PROJECT FINAL REPORT

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Name, title and organisation of the scientific representative of the project's coordinator:

Centro SMAArt c/o Dipartimento di Chimica – Università di Perugia
Via Elce di Sotto 8, 06123 Perugia, Italy
Tel: +39.075.5855509
Fax: +39.075.5855606
E-mail: bruno@dyn.unipg.it

Project website address: http://www.charismaproject.eu

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FINAL PUBLISHABLE SUMMARY REPORT

1. Executive summary

The aim of CHARISMA was to build a new user-friendly platform of existing large-scale facilities or small/medium installations open to users and develop a set of the widest number of scientific methodologies and techniques, in order to enable the European heritage science community to gain improvement in the research for diagnostics, analysis and assessment of materials of cultural heritage, identification of artistic techniques, identification of the cause and effects of deterioration processes, and in situ monitoring during and after restoration.

Long term objectives were: improve the infrastructure relationships and counteract the fragmentation in scattered scientific communities of the wide range of activities, integrate the research capacities across Europe and beyond, capitalising on the resources and expertise to foster and enlarge the user community, diffuse awareness at the scientific and decision making level of the vision and results of CHARISMA.

Significant achieved results have been:

· The deployment of functioning *access nodes of the most advanced European facilities* customized to meet the particular heritage requirements for research and applications on composition and structure of works of art, the technology used to produce them, the alteration of their materials in specific environmental conditions - including museums – , the establishment of possible remedies against deterioration, etc.;

· The set up of high performance analytical equipment, for *in-situ* non-invasive measurements on artworks, *without any movement of the artefacts from their location*, permitting for a direct materials research on precious or immovable artworks, or monitoring innovative conservation methodologies during their application, even on the scaffolding at a restoration site;

· The development of structured scientific information, available in the archives and documentation departments of both *prestigious museums and conservation centres*, consisting of an unprecedented amount of analytical data to unlock their immensely valuable data collections, making them more widely available;

· The development of new *instrumentation* and *methodologies* for the study of artwork materials, at the surface (2D) and in depth (3D), both for *laboratory analyses* on microsamples and for *in-situ* non-contact investigations, overcoming technological barriers, improving the quality of the participating infrastructures and offering innovative technology solutions and competitive advantages for the production of *new instruments for diagnostics;*

· The set-up of new *advanced laser cleaning techniques*, exploiting high security methods that guarantee the artwork, being based on local control of the intervention through non-invasive in-situ real time monitoring;

· Establishing *best practices* for multi-technique analysis of samples, analytical data assessment or degradation issues;

· Providing international cooperation, education, training, users' awareness events, and technology transfer to research laboratories, memory institutions and industrial organizations;

· *Sharing knowledge* on large scale EC conservation projects, adopting a progressive compatibility of individual archives and registers, establishing common approaches to the interpretation and easy exchange of 2D and 3D analytical data.

2. Project context and objectives

- *The Context*

The project beneficiaries Ancient and historical masterpieces are often exposed to the harmful effects of a changing environment or inappropriate restoration or handling, so that tangible cultural heritage can be intrinsically unstable. Many risks can be mitigated so long as proper knowledge of materials and degradation processes has been acquired. In fact, the detailed knowledge of the composition or structure of an artwork or an archaeological artefact is a prerequisite condition for any research in art history or archaeology as well as any action of conservation-restoration. This is crucial for decisions on proper preservation actions and undeniably requires an assessment of the foreseeable evolution of the degradation. To gain the deepest insight into the artwork properties, museums curators, conservators and heritage scientists should benefit from access to research tools of the highest level and to the most skilled teams able to take advantage of the outstanding possibilities of the corresponding micro-analytical tools.

Due to their origin and ageing, heritage materials are generally mixtures of inorganic phases (crystalline or amorphous) and organic compounds (often at the micro- and nanoscale), which require powerful analytical tools to be identified. Mapping of constituents is now essential in view of the heterogeneous nature of heritage materials at all scales: it involves not only the distribution of elemental composition, but also of crystal structures, molecular signatures, etc. A large variety of advanced techniques – portable or microinvasive – is used nowadays, from laser to synchrotron and ion beams, from microfocussed spectroscopy to full-field imaging. Regarding conservation methodologies, laser technology has recently offered new solutions to the complex problems of cleaning dirt encrusted artefacts, this in spite of the complexity of the physicochemical risks associated with the ablation of photosensitive substrates and the limited opportunities for testing on real cases.

Within this general frame, the lack of a coherent powerful platform of access to the widest number of scientific methodologies and techniques available in large scale facilities and small/medium installations, as well as the difficulty of sustaining coherent combined experimental strategies, have been in the past significant limiting factors to a rapid development of the European research.

To close this gap, CHARISMA (Cultural Heritage Advanced Research Infrastructures: Synergy for a Multidisciplinary Approach to Conservation/ Restoration, http://www.charismaproject.eu) has been established as an FP7 EU-funded advanced Research Infrastructures consortium, which integrates conservation/restoration scientific activities and transnational access, whose activities, developed within the period from October 2009 to March 2014, are reported in this document.

- *The objectives*

The aim of CHARISMA was to build a new, user-friendly platform based on a combination of the most relevant existing instruments, knowledge and stored data collections. The results must be capable of performing the necessary applications enabling the heritage science community answer complex questions related to i) diagnostics; ii) analysis and

assessment of materials of artworks; iii) identification of artistic techniques; iv) identification of the cause and effects of deterioration processes; v) *in-situ* monitoring of conservation processes during and after treatments.

- *Main goals*

· Provide the best opportunity for developing research at the forefront of the field, combining advanced scientific research infrastructures with the high-level knowledge of leading technology institutes on cultural heritage.

· Couple cutting-edge research to intelligent delivery systems through interaction with end-users and experts in science applied to cultural heritage disciplines.

· Optimize the use of infrastructures through a coordinated program of transnational access, joint research, and networking activities.

· Overcome the lack of a coherent powerful platform of access to the widest number of scientific techniques available in large scale installations and small/medium facilities, sustaining combined experimental strategies.

- *At the EU heritage science scale*

· Develop a common accessible platform offering users the most advanced European facilities embedded in a complementary and multidisciplinary environment involving material science and artwork conservation/restoration.

· Create a solid base for outstanding innovation in the capacity-building policies of science and technology, with expert knowledge on the most significant advances for safeguarding and protecting cultural heritage, enhancing the project openness across Europe and beyond.

· Hold a program of open workshops and training to introduce curators, research-conservators and conservation scientists to the questions involved.

· Promote a joint reflection work and share the best practice for multi-technique analysis of samples, analytical data assessment or degradation issues as well as knowledge on large scale conservation projects.

- *Scientific and Technological Views*

· Design and set-up innovative instrumentations, for in-situ 2D and 3D examinations of artworks, and new cleaning techniques based on laser technology.

· Improve access to databases exploiting digitalization of data and their harmonization.

· Carry out research on dyestuff identification to further elucidate the composition and behaviour of organic colorants.

· Develop patterning and orientation techniques and new methodologies for the study of organic materials and their distribution in micro-samples or directly at the surface of the object.

The challenges facing CHARISMA embrace transnational access, joint research and networking activities.

2.1 Networking

The powerful advances in research over the last few years have coincided with a growth and spread of a culture of cooperation among European scientists, with an increase in the awareness of the crucial importance of sharing of knowledge, pooling of resources, and coordination of activities over the European area. Initiatives such as the Eu-ARTECH project, funded within the 6th FP, and others as European standardisation in cultural

heritage, CEN TC/346, strongly hinted at this cultural development. CHARISMA strongly contributed to improve interoperability among the institutions of the consortium and those external to it, diffusing best practices and, at a more fundamental level, knowledge of new instrumentation, methods and technologies.

During the projects years a progressive harmonization/compatibility was adopted of *best protocols for multi-technique analysis* of samples, following the type of object and material (stone, metal, paint, paper, polymers, etc.) or degradation issue (alterations, depositions) and in diagnosis and conservation methodology for monuments, historical buildings and sites. A uniform protocol for sharing analytical data of individual archives and registers (distributed data sets or database systems or different digital formats) was also completed.

A detailed training plan has been developed for *turn the assembled scientific excellence* to the advantage of the cultural heritage community with the organizing training events, seminars, "hands on" workshops to diffuse deep knowledge, expertise and well established methodologies to the users / professionals and to the public.

To coordinate the compatibility of CHARISMA with *related initiatives worldwide*, to disseminate information about the project, its objectives and results, spreading internal and external communication through the establishment of target audiences, have been all other goals successful accomplished, creating two-way communication channels with stakeholders carrying national responsibilities, academic, research and conservators' communities and users benefiting from project activities.

Coordination fruitful activities included:

- Share and compare the results obtained by European scientific community on focused priority areas, verify the impact of project work and grades through *focused technical meetings* and ensure the highest efficiency of the developed activities and verify that they correspond to the real users' needs.

- Implement the *CHARISMA web site* with a relevant dedicated Welcome access section, to apply for access, define and implement, in a coherent way, unified modality of access, the outreach of new users and the site review procedure. Brochures, project Logo, project Fliers etc. were also produced.

- Monitor the success and impact of the project activities through the *Extra-Mural Advisory Committee*, having external feedbacks regarding the project objectives, its technical goals, milestones and deliverables.

- The delivery of the 'Definition of quality control procedures', so-called project reference book, a common procedural document, designed and developed to ensure a ready reference mean for the quality project assurance and the dissemination activities, including publications and presentations. For optimal use, the reference book was produced at the beginning of the project, and shared among partners.

2.2 TA support

The CHARISMA engagement offered to European researchers and professionals, a full access service - using an easy single entry point on-line - to the most advanced infrastructures and technologies for investigations on cultural heritage.

For applying to techniques devoted to non-destructive examination of objects and samples (FIXLAB) the access was executed at two strongly integrated platforms, one in France (SOLEIL, CNRS) and the other in Hungary (ATOMKI-HAS, BNC), where Large Scale Facilities (LSF) were coupled to a set of medium scale instrumentations, completed when necessary with more conventional examination and analysis tools.

The access to the mobile equipment of MOLAB, a unique set of portable instruments and associated competences, allowed researchers to *carry out their work on-site, i.e. directly in a conservation laboratory, in a museum room or even on scaffolding in a restoration site*.

Basically, the equipment consisted of a new *high-resolution VIS-NIR multispectral imaging* device; a compact, *portable XRD-XRF device*, for in-situ XRD measurements on identification of crystalline solids; a miniaturised *fibre-optic micro-Raman spectrometer*, equipped with two lasers (532 and 785 nm) for the study of glasses and glazes, pigments and colorants; a *prototypical spectro-fluorimeter* for the in-situ measurements of fluorescence lifetimes in the scale of picoseconds, unique for its portability; as well as other additional compact portable advanced tools based on other chemical and physical techniques.

These services were integrated with ARCHLAB, a “facility” enabling access to the huge quantity of archived *knowledge and technical data* held in the most prestigious European museums or conservation institutes recognised from France, UK, Italy Spain and Netherlands (namely: British Museum, UK; C2RMF/Palais du Louvre, FR; Museo del Prado, ES; Opificio delle Pietre Dure, IT; Agency for Research in Cultural Heritage, NL, and National Gallery of London, UK.

These archives assemble analytical and technical data on paintings, sculptures, manuscripts, metals, etc., collected over many years of activities devoted to the analysis and studies for the scientific conservation and safeguard of cultural heritage. These archives have been through CHARISMA, for the first time, accessible to European scientists, engineers and technologists, together with art historian, archaeologists and conservator-restores, allowing the data held within them to be used in new ways.

ARCHLAB, MOLAB and FIXLAB therefore covered the whole range of needs from the in-situ studies on artworks, to the most advanced micro-analytical laboratory techniques for bulk, surface and stratigraphic investigations, to the access to stored knowledge and technical data. Their coupling allowed users to successfully combine a wide range of analytical facilities, for non-invasive and micro-invasive measurements, taking into account the particular issues of cultural heritage regarding security, insurance and transportation. The support to this novel investigation strategy was at the heart of CHARISMA transnational access activities (TNA).

2.3 Joint research

The activity was addressed to extend the novel instrumental areas and to push their capabilities to the cutting edge of research, following the users’ requirements and the current needs of the research community, aiming at the development of:

· Portable equipment for 3D in-situ examination of artworks, for integrated absorption-fluorescence-decay time measurements on fluorescing substances in the UV-Vis range and on novel cleaning methodologies;

· Chemically oriented research for emerging innovative lab methodologies for the study of organic material distributions in cross sections or in the identification of dyes and their deterioration products/pathways, possibly as a function of their nature and provenance. The application of multispectral imaging and spectroscopy to the study of the distribution of organic and inorganic materials in art objects was also explored;

· New methods to access and integrate existing heritage records and protocols should enable available data and knowledge to be made more readily available to cultural heritage professionals in a user-friendly, integrated and effective way, allowing direct exchange and comparison of data to be exploited.

2.4 Project's team combined efforts (Beneficiaries List)

- *The Consortium*

The project beneficiaries, 22 of the most internationally well-known European institutions in the field of cultural heritage, cooperated to provide cultural institutions, laboratories and researchers with new opportunities and technical developments with instruments, parameters and guidelines for carrying out their work, improving, at the same time their knowledge/proficiency/competencies.

Table 1 Consortium members

	Beneficiaries	Acronym	Country	Contacts
1	University of Perugia, Center SMAArt, Coordinator	UNIPG	Italy	Brunetto G. BRUNETTI
2	Centre National de la Recherche Scientifique	CNRS-LAMS	France	Philippe WALTER
3	Foundation for Research and Technology - Hellas	FORTH	Greece	Demetrios ANGLOS
4	The National Gallery London	NGL	United Kingdom	Ashok ROY
5	Société Civile Synchrotron Soleil	SOLEIL	France	Loic BERTRAND
6	Consiglio Nazionale delle Ricerche	CNR-ICVBC/ INO\IFAC	Italy	Susanna BRACCI
7	Nicolaus Copernicus University of Torun	NCU	Poland	Piotr TARGOWSKI
8	Aachen University	RWTH	Germany	Bernhard BLUEMICH
9	Institute of Nuclear Research of the Hungarian Academy of Science	ATOMKI	Hungary	Zita SZIKSAI
10	Cercle des Partenaires du Patrimoine - Laboratoire de Recherche des Monuments Historiques	CPP-LMRH	France	Isabelle PALLOT-FROSSARD
11	The British Museum	BM	United Kingdom	David SAUNDERS
12	Doerner Institut - Bayerische Staatsgemäldesammlungen	DI-BS	Germany	Heike STEGE
13	Idryma Ormylia - Art Diagnosis Centre	Of-ADC	Greece	Sophia SOTIROPOULOU
14	Opificio delle Pietre Dure	OPD	Italy	Daniela PINNA
15	Museo Nacional del Prado	PRADO	Spain	Maria Dolores GAYO
16	Cultural Heritage Agency of the Netherlands	OCW-RCE	The Netherlands	Maarten VAN BOMMEL
17	Royal Institute for Cultural Heritage	KIK-IRPA	Belgium	Ina VANDERBERGHE
18	Agenzia per la Promozione della Ricerca Europea	APRE	Italy	Diassina DI MAGGIO
19	Laboratorio Nacional de Engenharia Civil	LNEC	Portugal	Joao MIMOSO
20	Wigner Research Centre for Physics and the Centre for Energy Research of the Hungarian Academy of Sciences	BNC-Wigner	Hungary	Laszlo ROSZTA
21	Alma Mater Studiorum - University of Bologna	UNIBO	Italy	Rocco MAZZEO
22	Ministère de la Culture et de la Communication, Centre de Recherche et de Restauration des Musées de France	MCC-C2RMF	France	Michel MENU

3. Main S&T results/foregrounds

In the following pages, the main achievements of the project are reported with a brief description of concerned activities. For further details, see the referenced deliverable documents.

3.1 The management

Project Management (WP1)

[UNIPG WPL, CNRS/MCC-C2RMF, NGL CNR-IFAC, NCU, Of-ADC, OCW-RCE, APRE]

· *Project Bodies Functioning.* Two bodies were in charge of project management, helping the Coordinator: i) the CHARISMA Governing Board with all beneficiaries (GB) and ii) the Steering Committee (SC) with all the WP Leaders. All rules of governance were set out in the Consortium Agreement, regulating mutual relations and rights among participants and *vis-à-vis* the European Commission. The CA defined decision-making procedures, methods for reviewing the technical work, the settlement of internal disputes and the distribution of the EC grant.

A meetings' plan was agreed among partners to ensure that all partners took part to the program according to their role and responsibilities. A beneficiary in turn hosted the General or Interim meeting with a six-month cadence, taking care of the logistics and organisation. APRE supported the Coordinator in the definition of the agenda and in the collection of presentations by the partners. Minutes have been collected, distributed to partners and published in the Intranet website.

· *Communication with the European Commission.* UNIPG, Coordinator, has been the intermediary for any communication between the EC and partners during the project period.

· *Administration of the financial contribution*. The Community financial contribution was carefully managed regarding its allocation among partners, in accordance with the GA, the Consortium Agreement and the decisions taken by the consortium, informing the Commission. At the end of each period the Partners' Financial Reports have been collected, giving homogeneity to all the information provided by the partners both in terms of content and editing; ensuring consistency between the expenses claimed by the partners and the activity performed. FAQ, general provisions governing the role and responsibilities of the partners, financial and contractual aspects were also implemented.

· *Quality assurance.* The Steering Committee was in charge of evaluating technical progress, reviewing and assessing the project results, feedback of the results into redefinition of the project operational goals, and overall coherence. In this role, the SC was charged of project quality control and the status of each work package, ensuring the high quality of the data sets generated.

The so-called project reference book 'Definition of quality control procedures' was implemented during the first year of the project, as a common procedural document, for the quality project assurance and the dissemination activities, including publications and presentations.

· *Communication and Reporting.* During the project, the tasks of preparing, binding and sending the periodical Reports and the generated technical documentation have been exchanged in electronic format and made available to partners. To monitor the status of the planned project deliverables, internal reports have been prepared every four months. A mailing list service has been developed.

To enhance and facilitate the reporting process to the EC, a *Reporting Tool system*, especially produced, was stored in Intranet and rendered available to partners. Appropriate exchange of information with beneficiaries has been ensured through specific meetings. Evaluating, binding and sending the periodical Reports and Annexes was also ensured.

· *Knowledge management.* Matters related to confidentiality and intellectual property right issues handling have been defined in the Consortium Agreement and monitored by the Steering Committee along the project.

- *Main results achieved*

· The 'Quality project handbook', a comprehensive working tools escribing the processes in place for the CHARISMA consortium, addressed in particular the issue of how to manage and monitor the project quality to develop and implement a process baseline, on which the Steering Committee monitored the project progress, stage by stage.

· The 'Report template and guidance' was intended to help the project partners to prepare the project Periodic Reports, to be submitted to the Commission (M18,36,54), detailing the level of information required to WP Leaders/Beneficiaries for the description of the technical and scientific work carried out insofar. Furthermore, following the decision taken by the Steering Committee each beneficiary was required to submit to the Coordinator an Internal Intermediate Progress Reports.

· The survey on monitoring the project' Deliverables and Milestones status on a six months basis helped for the assessment of the work due in the period. This procedure was part of the Steering Committee responsibility together with the scientific quality check, the supervision and evaluation of the project technical progress and the revision of the project results. In this role, the SC has been in charge of the project global critical path, the scientific review of the work performed by the partners, including the degree of fulfilment of the objectives of the period, and the status of each work package outputs. Eight 'Periodic status checks reports' were provided during the project at M6, M11, M17 M24, M30, M36, M42 and M48, before the Steering Committee concerned meetings.

· The EU Mid-Term Review, Heraklion, GR, 30th September 2011 provided an external evaluation and feedback.

3.2 The coordination activity

Three different programs have been carried out in order to merge expertise and strengthen interoperability among the consortium institutions with the aim of establishing common best practices in studies of works of art and in analysis and assessment in conservation. Participation of all partners offered the possibility to take advantage of the different competences existing within the consortium on multidisciplinary investigation of materials, deterioration mechanisms, environmental monitoring, and conservation strategies.

Best practice and protocols towards common standards (WP2)

[UNIPG, CNRS, FORTH, NGL WPL, SOLEIL, CNR-ICVBC/IFAC, NCU, RWTH, ATOMKI-HAS, CPP-LMRH, BM, DI-BS, Of-ADC, OPD, PRADO, OCW-RCE, KIK-IRPA, LNEC, BNC-WIGNER, UNIBO, MCC-C2RMF]

WP2 had the overall objective of exchanging knowledge and expertise within and outside the consortium in certain key areas of mutual interest among the partners, to establish common protocols, and to increase awareness of current best practice and latest developments, with the ultimate aim of raising general standards in the field of science applied to cultural heritage over Europe as a whole.

The two tasks addressed targeted areas of current relevance and complementary to tasks in other CHARISMA joint research and access WPs.

The first task concentrated on best practices, principles and protocols, the two chosen areas of focus being firstly the methodology for technical examination of paintings and painted objects (especially sample preparation and methodology for use of multiple complementary techniques); and secondly evaluation of methodology and scientific techniques for monitoring and diagnosis directed towards conservation of historical buildings and sites.

Many different methods of technical examination are now used on works of art, depending on the questions being investigated and the type of object, but also on the facilities available in different laboratories. These are in a state of continuous development and improvement. Task 1a took advantage of the fact that CHARISMA included major laboratories in this field by carrying out a survey of practice in technical examination of paintings and painted objects across Europe.

Task 1b also addressed best practice in technical examination, but instead applied to problem-solving and decision-making during large-scale conservation projects across Europe for monuments, historical buildings and sites. Working groups were formed for four main categories– stone, stained glass, metals, and wall paintings. The main achievement was the formulation of an assessment of the current state of the field, new developments and guidelines on best practice in the diagnosis and monitoring of the various materials found in historic building and sites. This took the form of a series of flowcharts indicating appropriate methodology for different materials, with additional commentary, presented in the deliverable D2.4 Estimation principles for planning and implementation of conservation projects in selected categories of monuments and historical buildings. As with Task 1a, a parallel practical exercise was organised. The workshop held at the former Cistercian Abbey of Chaalis, near Paris (24-25 Nov 2013), served as a direct means of exchanging information and opinions on the capabilities and relevance of various diagnostic techniques, in order to form a consensus on their place in the methodological flowcharts. Some of the new techniques being developed in WP9 were included in this workshop, so that potential applications of these new instruments could be explored.

The second task in WP2 was focused on a different, but also very topical, area – exchange and integration of data generated during scientific examination. This is important to allow sharing as well as archiving, and is becoming increasingly relevant as initiatives develop for online databases that allow advances in searching and re-using the information, which in the future offer the prospect of more efficient use of the data as a research resource.

Subtask 2b was more general in approach, addressing integration of the wide range of data and images and related historical metadata generated during technical study of any cultural heritage object.

Importantly, it was demonstrated that although there is a common general strategy for the combination of different complementary techniques in the investigation of cultural heritage, there are neither common practices nor universal protocols for integration of the data, nor for organization of metadata. It is clear there is great potential for further development in this area, and a most significant outcome of this task was identification of actual needs and directions of common interest that could be used as a basis for formulating research priorities in this area in the future.

- *Main results achieved*

· The first main success of this task was a comprehensive review of current methods and new developments. Deliverable D2.1-1 was a substantial report on the results, made available on the project website. It included specifically:

a) A detailed summary of practice among project partners for sampling methodology and practice for all types of painting (canvas, panel, wall etc.) and painted objects.

b) A literature survey on general paint sample preparation, and needs for various FTIR techniques (synergistic with practical experiments in WP10) and promising new methods.

· The work for the second deliverable D2.1-2 in Task 2.1a built on the first deliverable by concentrating on complementary strategies for analysis of samples with multiple techniques, and on sample preparation, a subject of current interest since many newer chemical imaging methods are demanding in this respect. In addition, sampling from precious cultural heritage objects must be limited, so it is particularly valuable to establish effective methodologies, and yet this is a subject not often dealt with in the scientific literature. In the deliverable, guidelines for appropriate methodologies and the results of detailed comparisons of different mounting and polishing methods for samples were presented. The combined results form a valuable resource for describing best practice and considering future priorities.

· A highly successful complementary action was the event at SOLEIL synchrotron: Methodology in practice: hands-on workshop on sample preparation and methodology for FTIR analysis. This allowed practical knowledge exchange on sample preparation for FTIR, ultimately also useful for SOLEIL FTIR beamline users via FIXLAB (WP7). Samples were prepared in different ways and the effect on FTIR in various modes tested: transmission, reflectance, transflectance or ATR – in the lab or on SMIS synchrotron beamline.

· Analytical data are often generated in proprietary formats that do not allow easy interchange. The main achievement of Task 2a was a detailed review of current data standards aimed at constructing guidelines on suitable platform-independent file formats for a range of 2D and 3D data to allow sharing. The focus was on dyestuff analysis as a case study, since a practical need arose during WP10.2 for exchange of this data. The review outlined the need for software development to facilitate exchange of scientific cultural heritage data, and describes the functionality that would be required of such a tool

· The evaluation and survey of existing software tools for data integration and documentation (inside and outside CHARISMA), described in deliverable D2.2-2, constitutes an important assessment of the general approach and specific practices or tools that are adopted for effective documentation and integration of analytical and imaging data acquired on cultural heritage materials and objects. In addition, a practical exercise on documentation and integration of the results of the WP9 round robin exercise using MediaWiki, proved useful in considering the needs and format of digital online tools for presenting analyses from multiple techniques.

Both actions well served the aims of the task, which were to exchange information on specific digital documentation practices adopted by each CHARISMA partner, to raise awareness of good practice, and to bring together a review of the approaches and protocols in use in important European laboratories for integration, visualisation/presentation and interpretation of results from multiple analytical methods, as an example of best practice and to work towards adopting common protocols to allow more effective exchange of results.

Scientific excellence (WP3)

[UNIPG, CNRS, FORTH, NGL, SOLEIL, CNR-IFAC WPL/ICVBC, NCU, RWTH, ATOMKI-HAS, CPP-LMRH, BM, DI-BS, Of-ADC, OPD, PRADO, OCW-RCE, KIK-IRPA, LNEC, BNC-WIGNER, UNIBO, MCC-C2RMF]

Scientific excellence (WP3) was pursued through focused training actions and skills development in favour of CHARISMA end-user in focused priority areas, as well with

sharing in scientific and technical meetings the results obtained with the European scientific community, verifying the impact of CHARISMA. The deep knowledge on materials and their behaviour, as well as on best approaches in evaluating their conditions and the selection of the best conservation procedures, has been diffused through the organisation of training events, seminars or workshops. Aim of such events was to train and engage researcher(s) in discussion with professionals (conservator-restorers, conservation-scientists and museum curators) on the appropriate application of the most advanced and novel analytical techniques and conservation methodologies. The WP highlighted also the use of expert technical meetings to disseminate a large fraction of CHARISMA's principal findings.

Three tasks, articulated into subtasks were foreseen.

Task 1 "Sharing of resources and oriented-training on advanced instrumentation" (Resp.: NCU).

This task had the aim to offer researchers new opportunities to benefit from immediate and direct experience with new technological acquisitions and prototypes within the consortium, enhancing the possibilities for young scientists in establishing new research programmes. Trainings were also dedicated to professionals and new users external to the consortium on well established analytical/documentation techniques (NMR, laser-based techniques, OCT, etc.) or on the new investigation techniques and related technologies offered by prototypes.

Each training event was under the responsibility of one CHARISMA partner, however, each event include other partners interested in the theme and able to cover topics and/or co-finance the course.

Task 2 Sharing knowledge and oriented-training on advanced methodologies (Resp.: UNIBO).

With the aim to support a better comprehension of the potentialities of innovative advanced methodologies among researchers of institutions external to the consortium, training activities and/or exchange of visits on problem solving approaches in conservation of paintings, books, buildings, dyestuffs, organic materials, etc. using advanced analytical techniques have been carried out. As for the previous task, behind the CHARISMA partner responsible of the organisation, each event included the active participation of other interested consortium members, that actively cooperated in lecturing, preparing notes, and in other tasks, also co-financing the course, if necessary.

Task 3 Oriented-topics events (Resp.: NGL).

During the project, four technical meetings or thematic workshops on defined topics have been planned and/or organised. The objective was to verify the impact of CHARISMA work and grades. The workshops have been also an opportunity to share and compare the results obtained by European scientific community on focused priority areas in collaboration of the joint research programme. Main topics were: (i) Advances in a specific analytical field (technique applied on different materials and objects; sampling and sample preparation); (ii) Foresight studies for new instrumentation and technologies; (iii) A group of objects of one period / one style / one (painter) creator/ one (painting) technique. The events have been open to internal and external experts and to the professionals and users. Three of these events led to the publication of proceedings.

- *Main results achieved*

· Training courses, seminars, "hands on" workshops have been organised, to diffuse deep knowledge - expertise – and well established methodologies to the users / professionals and to the general public (see the following tables and the paragraph Dissemination activities in the Section Potential impact).

· The highest efficiency of the developed activities was ensured, verifying that they correspond to the real users' needs, in order to turn the assembled scientific excellence to the advantage of the cultural heritage community.
· The results obtained by European scientific community on focused priority areas were shared and compared, verifying the impact of the CHARISMA work and grades through technical meetings and workshop (see the concerned tables).

Table 2 CHARISMA Training Courses, Oriented-topics technical meetings and thematic workshops organised and held

Training Courses on advanced instrumentation

Task	Course	Date	City	Organising partner/s
T3.1a	Mobile NMR	28–29 April 2011	Aachen, DE	RWTH with UNIPG, NGL, BM.
T3.1b	Advanced laser-based techniques in art conservation, diagnostics and analysis	18–22 June 2012	Heraklion, GR	FORTH with CNR-IFAC/ICVBC, Of-ADC, NCU
T3.1c	Application of Optical Coherence Tomography (OCT) to structural analysis	27–28 June 2013	Torun, PL	NCU with NGL, FORTH, CNR-IFAC/INO, , KIK-IRPA

Training Courses on advanced methodologies

Task	Course	Date	City	Organising partner/s
T3.2a	Spectroscopic techniques (invasive and non-invasive).	27–29 June 2010	Ravenna, IT	UNIBO with UNIPG, C2RMF, FORTH, NGL, CNR-IFAC/ICVBC, RWTH, BM, DI-BS, Of-ADC, OPD
T3.2b	Technology of lakes preparation and dyeing textiles from botanical/animal source dyestuffs (2 events in two different countries)	22-23 March 2011 30 Nov. - 2 Dec. 2011	Munich, DE Brussels, BE	RCE and DI-BS, with UNIPG, C2RMF, NGL, BM, Of-ADC, KIK-IRPA RCE and KIK-IRPA, with UNIPG, C2RMF, NGL, BM, DI-BS, Of-ADC
T3.2c	Stone conservation. (3 separate events in three different countries)	7-18May 2012 10-21 Sept. 2012 27 May - 7 June 2013	Lisbon, PT Torun, PL Amsterdam, NL	LNEC with NCU, LRMH, OPD, KIK-IRPA, RCE, CNR-ICVBC

Oriented-topics technical meetings and thematic workshops

Task	Workshops	Date	City	Organising partner/s
T3.3a	Leonardo da Vinci's Technical Practice	13-14 January 2012	London, UK	NGL, BM, C2RMF
T3.3b	New techniques for the non-invasive investigation of the surface and subsurface structure of heritage objects	25–26 June 2013	Torun PL	NGL with NCU, RWTH, FORTH, UNIPG, OCW-RCE, Of-ADC
T3.3c	Caravaggio's Painting Technique	17 September 2010	Firenze, IT	OPD with NGL, UNIPG, CNR-INO

T3.3d	The Renaissance Workshop	10–11 May 2012	London, UK	BM with NGL, C2RMF, OPD, UNIPG, PRADO
T3.3e	Workshop on Diagnostics in Cultural Heritage (Foresight event I)	17-19 November 2011	Rome, IT	UNIPG with NGL, BM, OPD, CNR-INO/IFAC, C2RMF
T3.3f	Experience, Research and Innovation: A Research Infrastructure Platform for Cultural heritage Conservation and Restoration - CHARISMA Final Event. (Foresight event II)	5-6 March 2014	Firenze, IT	UNIPG, APRE, and CNR-IFAC hosted by OPD

Coordination of dissemination and communication efforts (WP4)

[UNIPG, CNRS, NGL, NCU, Of-ADC, OCW-RCE, APRE WPL, LNEC]

For the achievement of the objectives of the project, communication and dissemination, constitute an important and substantial domain, being fundamental to share the information basis, to extend the participatory process of stakeholders, to attract users and project associates, and to gain fruitful feedbacks about the ongoing developments of the project.

In the first year of the project a 'Dissemination Plan' handbook defined the Consortium strategy for communication and foreground dissemination, identifying the specific areas in which the project results can have influence, the different recipients and the related actions as well as the related initiatives/events to be performed throughout the duration of the project. In addition, an external evaluation and feedbacks accomplished through the Extra-Mural Advisory Committee, monitored the success, attainment and impact of the project objectives, technical goals, and milestones.

- *CHARISMA public web site http://www.charismaproject.eu/*

Following a content scheme discussed and approved by the SC members, the project web presence has been designed and developed by APRE in a user-friendly fashion and English language, during the first months of the project life. A specific domain name provided web-based access to project information, having a persistent URL.

The CHARISMA web site is largely described in the specific following Section 5.

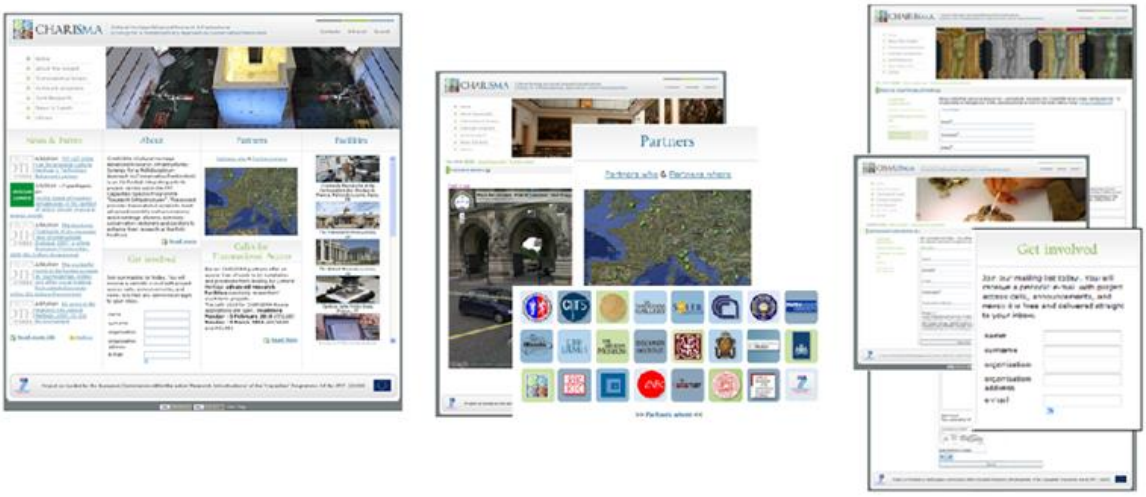


Fig. 3.2-1 Some snapshot of CHARISMA web (from the left): the home page, the Beneficiaries *who* and *where*, the 'Get involved' service

A dedicated Editor team following the suggestions of all partners updated the site regularly. It acted as the main information platform for the Consortium, external users and wider public.

- *CHARISMA Associates*

In order to extend the project scenario, significant attention to CHARISMA activities was registered from European countries external to the EU and overseas countries, including South America, United States, and Mexico, where numerous expressions of interest were given to exchange expertise and to collaborate with CHARISMA.

As part of the objectives for the project and following several requests coming from relevant European or worldwide organisations, the Steering Committee approved the *Associate Partners* by means of a Letter of Intent available on the CHARISMA web. Agreements have been established with Brazilian Associations and Institutes of Conservators-Restorers, as the Associação Brasileira de Conservadores e Restauradores de Bens Culturais (ABRACOR), and the Laboratorio de Ciencia da Conservação – Universidade Federal de Minas Gerais (LACICOR). The association process was successful completed also for the Italian universities of Pisa, Torino, and Verona, the University of Antwerp, BE, the Museum of Fine Arts of Boston, US, the Institute of Protection of Cultural Heritage of Slovenia, Lubljana, SL, the Universidad Autonoma de Mexico, Instituto de Fisica, Mexico City, MX, the Victoria and Albert Museum, London, UK, and the Academy of Fine Arts of Prague, CZ.

Associate Partners gave inputs (advice, best practices, statistical data, workshop organisation, etc.) contributing with their know-how to the project's specific workpackage targets. They benefited directly from the project's workshops, web-based information, training schools, and so on.

- *A Database Target Users*

An Address Database (AD) was available to the project, starting from the list coming from the previous infrastructures' EU-ARTECH project data. The AD implemented primarily involving the selected researchers/ professionals/ SMEs/ labs of the cultural heritage community with whom CHARISMA members previously collaborated and currently cooperate. A high number of data have been inserted (more than 1000 records).

- *Get Involved*

An open invitation to link to the project was implemented through the CHARISMA web site home page (Get Involved). It consisted of a user interest check page that invited on-line registration (name, organisation, e-mail). Registered motivated people, were included in the AD mailing list for specific dissemination activities. The section, (closed at the end of the project) allowed individuals showing interest toward the project, to receive proper information about the open access calls and CHARISMA issues (events, job announcements, breakthrough results, etc.) permitting them to propose information of news or events of interest to specialists.

- *Friends EC projects & initiatives*

Following suggestions of the CHARISMA EC Scientific Officer, a number of Coordinators of other EC-supported projects or initiatives in the field of cultural heritage have been contacted. Special efforts have been made to achieve active collaboration with 3D-COFORM, POPART, STACHEM, NET-HERITAGE, DC-NET, DASISH, EuNamus, ECTP FACH and DARIAH (CHARISMA became affiliate project of DARIAH).

In addition, a profitable collaboration with CEN TC/346 (developing European, EN standards for conservation) was established.

- *Scientific workshops and conferences*

Traditional channels of communication of the most advanced scientific achievements, such as presentations at scientific workshops and conferences, was also one of the pillars of the

consortium dissemination activity.
During the project, the dissemination activities have been the subject of Coordinator and WP Leaders' *invited* conferences, with the objective to distribute general information on CHARISMA - at the service of the project as a whole - raising the project awareness, diffusing its goals, and enhancing the interest of potential users. In addition, the project beneficiaries participated in many meetings and international conferences related with CHARISMA topics. At these meetings, the primary results of the project activities were presented, underlining the FP7 support of the European Commission.
Complementing this, papers were written and presentations at oriented seminars and conferences were carried out. (see the List of dissemination activities).

- *Periodic news, leaflets and blog*

During the period, some promotional materials as well dissemination products have been designed and made available to the partners and public through the project web site: some Institutional Poster, CHARISMA brochures (summarising the project activities and objectives to the general structure of the project) and leaflets (specifically referred to the three transnational access services: ARCHLAB, MOLAB and FIXLAB).

Periodic news have been published on the website, in collaboration with all consortium partners, such as CHARISMA related events, other events, and job opportunities.

A partners' blog designed and managed by OCW-RCE researchers, gave a glimpse into the project, as well as the experiences carried out throughout its development. The blog allowed the RCE CHARISMA group to record events, opinions, and ideas freely, as individual posts, with no need to define their scope.

- *Main results achieved*

· The 'Dissemination Plan' formulated in a draft form agreed among partners at the project start, identified the CHARISMA policy of dissemination actions, as well as the related initiatives/events to be performed throughout the whole duration of the project.

· The 'EMAC evaluation report' was a contribution of the Extra-Mural Advisory Committee to the project interim evaluation. It has been specifically constructed as an input to the Mid-Term Steering Committee evaluation with the aim of examining the rationale for the intervention, the programme implementation, and the first two years' products and achievements.

· The EU *Workshop on Research Infrastructures for Cultural Heritage and Global Change* Brussels, 14 March 2012 at KIK-IRPA, was organised by the European Commission, Directorate General for Research and Innovation, in collaboration with CHARISMA;

· A CHARISMA video was released, providing a general overview of the project's support, coordination and joint research activities, showing potential users, stakeholders and public the facilities involved and the Transnational Access opportunities. The movie is available on the Project web site (http://www.charismaproject.eu/) and also published on YouTube (https://www.youtube.com/watch?v=_MhAwxoi1zw).

· A stand managed by CNR-IFAC equipped with optical windows at the Science Festival (held in Genova, IT, on 27 Oct- 7 Nov. 2010), permitted to carry out demonstrations of the project laser cleaning research activities to the large public. A CHARISMA stand was also set up at the AR&PA Innovation initiative of the 8th Biennial of Heritage Restoration and Management (Valladolid, ES, May 24-27, 2012) organised by the Spanish Castilla & León Regional Authority, in liaison with the European Commission and Labein-Tecnalia Research Centre and with the support of UNESCO.

· The Project Final Event workshop entitled 'Experience, Research and Innovation: a Research Infrastructures Integrated Platform for Cultural Heritage Conservation/Restoration' was dedicated to the assessment of the project implementation through the intervention of external speakers, including a poster session and an open demonstration of the performances of the innovative instrumentations and methodologies developed.

3.3 The transnational access activity

The Transnational Access programme had the general mission to offer a portfolio of services and activities centred on the needs of the heritage science community in Europe and Associated Countries. The activity promoted the development of advanced research in the study and conservation of works of art, offering users the exploitation of unique European resources for in situ and laboratory investigations on artwork materials.

The support activities were planned to cover the needs of researchers in the different phases of research development, as: a) Information on previous studies and data (ARCHLAB);

b) *In-situ* non-invasive measurements for the acquisition of all the possible experimental data, avoiding any contact (and therefore any possible damage) with the investigated object (MOLAB);

c) Deepening of the study through micro-sampling exploiting all the most advanced state-of-the-art techniques presently available (FIXLAB).

The specific activity of the Welcome Desks, composed by representatives of the access providers, gave focused technical information to users or user groups on the experimental work to be carried out, (feasibility aspects and other concerns), and, if required, even suggested the most appropriate exploitation of the facilities (a unique or a group of facilities).

The CHARISMA TA plan represented a unique experimentation of a model of integration and cooperation among infrastructures open for transnational access, offering together an integrated service in favour of researchers in heritage science. Through the three programs of access the project delivered to the users (from experienced practitioners to primary users) not only experimental resources but also methodological approaches, compliant best practices, tools and technologies to allow researchers carry out their work in conditions otherwise impossible for them. The summary of the work developed for the whole duration by ARCHLAB, MOLAB and FIXLAB (users' projects, access days and number of users) is in following table.

Table 3 CHARISMA transnational access summary key data for the whole duration

	ARCHLAB	**MOLAB**	**FIXLAB**
	Executed / *Planned*	**Executed** / *Planned*	**Executed / *Planned***
USERS' PROJECTS	**85** / *72*	**50** / *46*	**138** / 132
ACCESS DAYS	**397** / *324*	**299** / *260*	**703** / 633
N. OF USERS	**131** / *108*	**239 /***150*	**275** / 217

ARCHLAB - The archives of conservation institutions laboratories (WP5)

[CNRS/MCC-C2RMF WPL, NGL, BM, OPD, PRADO, OCW-RCE]

ARCHLAB was a facility composed by the archives of laboratories of national museums, such as National Gallery of London, British Museum and *Museo del Prado*; or laboratories of conservation institutions such as the *Centre de Recherche et de Restauration des Musées de France*, FR, *Opificio delle Pietre Dure*, IT, and the Agency for Research in Cultural Heritage, NL.

These laboratories possess wide archives on analytical and technical data on paintings, sculptures, manuscripts, metals, and historic objects of various types, regions and periods etc., collected through years of "institutional" activities devoted to the study, conservation and safeguard of cultural heritage.

The data consists of documentation on the examination of constituent materials, technology, state of conservation, stratigraphy, etc. for each investigated object, including images and other technical and scientific data. Collections of samples are also available, taken from artworks and monuments during previous campaigns of study and conservation, carefully archived after investigations

The total number of proposals received by ARCHLAB were 154 of which around 50% were selected by the Peer Review Panel. The users were belonging to several different countries as: Austria, Denmark, France, Germany, Hungary, Ireland, Italy, Macedonia, Netherlands, Poland, Portugal, Serbia, Slovenia, Spain, United Kingdom.

The majority of projects (69%) were focused on artefacts execution techniques, 14% on history of conservation, 13% on specific conservation issues, and 4% on materials and chemical analysis. With respect to the types of artefacts, it was registered a predominance of projects focused on paintings.

Typical users were: (a) researchers that wanted to collect information concerning structure of support, materials, colours, stratigraphy, or composition of grounds in polychromies; (b) art-historians or archaeologists that wanted to carry out provenance studies or studies on ancient execution techniques, or wanted to compare collections; (c) conservators and scientists that wanted to inform cleaning and restoration data with other data collected in previous interventions on objects analogous to those on which they were working, (d) and others.

The ARCHLAB success is indicated by the scientific quality of the work developed by the users, the large number of access days offered (397 on 324 planned), the large number of users that exploited the open archives (131 on 102 planned) and by the large number of research projects that have been developed (85 on 72 planned).

- *Main results achieved (some examples)*

· A successful ARCHLAB access project (SANROMANO UGL M. Verdat, IT) regarded the execution technique of the famous painting *Battle of San Romano* by Paolo Uccello. The painting, originally composed by three panels, is today dismembered and panels are at the National Gallery of London, the Louvre Museum of Paris, and the Uffizi Gallery of Firenze. ARCHLAB permitted the access user group (restorers in charge of the restoration of the Uffizi panel) to compare the results of the technical examinations in the Uffizi (prior and during restoration) with those obtained in Paris (C2RMF Archives) on the panel of the Louvre and in London at the National Gallery (NGL Archives). The upcoming publication of a book on the restoration of the Battle of San Romano, includes a section regarding the study undertaken on the London and Paris panels exploiting the ARCHLAB facilities.

· The CHANGE GROUND LAYERS project explored scientific data stored in OPD Archives (UGL D. Hradil, CZ) comparing the measurements of ground layers of 16-18th century paintings in Czech collections to find reference localities of historical exploitation of clay-

based materials. The method of using the composition and technology of preparing grounds as an indicator of the provenance of the painting. For example: one of the last paintings by Caravaggio “Beheading of Saint John the Baptist” (1608) contains a red chalk with Globigerina fossils (so called “Globigerina limestone”) in the ground which is authentic local material from Malta island where the author spent last period of his life. This is in contrast with his other works, which contain the brown clay-based ground - probably the most typical ground of North-Italian authors of the end of 16th and the first half of 17th century. The same local Maltese material was also largely used by Mattia Preti who was acting in Malta in the last period of his life.

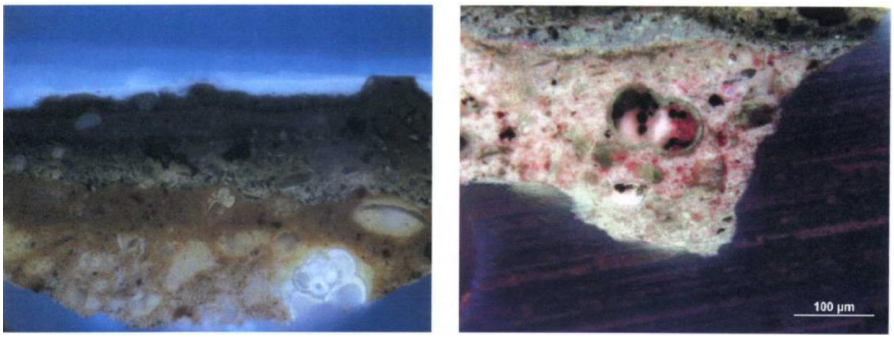


Fig. 3.3.1 (on the right) Globigerina-rich material from Malta used as ground on painting by Mattia Preti (1613-1699); cross-section in UV light magnification 20x, ph. by G. Lanterna; (on the left) Foraminifera shells in the Italian brown ground type D containing framboidal pyrite; cross-section in UV light, ph. J. Hradilová.CHANGE GROUND LAYERS access Project

· Another significant example of the work developed in ARCHLAB is related to the ongoing project of restoration and collection of new documentation on the van Eyck’s Ghent Altarpiece (Ghent, Belgium). The users requested visits to the archives of the National Gallery, Museo del Prado, and C2RMF. In London (NGL Archives), the users examined the scientific reports, conservation records, infrared reflectographies, photomicrographs and X-ray radiographs relating to the Van Eyck’s paintings in the National Gallery. In the archives of the Museo del Prado, the users had access to the conservation documentation, technical data, macrophotographs, infrared reflectography, X-ray radiographs and laboratory research reports on six important paintings by van Eyck or his contemporaries. Finally, at C2RMF, in Paris, the users examined the scientific reports, conservation records, photographs and X-radiographs carried out on the Van Eyck’s paintings located in French museums, achieving an excellent general overview of analytical results on the French panels, in a comparative approach.

The full set of projects and results obtained throughout the development of the ARCHLAB access programme, are listed and described in the deliverables D5.1, D5.3, and D5.5.

MOLAB - The mobile facilities for in situ non-invasive measurements (WP6)

[UNIPG WPL, CNRS- LAMS, CNR-INO]

A large proportion of the historical patrimony consists of immovable objects that cannot be moved from their usual location, e.g. monuments, sculptures, buildings, etc. and therefore the only way to carry out non-destructive measurements on their materials is to perform in-situ measurements. Even in the case of movable patrimony, including precious paintings, ceramics, gems, manuscripts, etc., curators normally avoid moving artworks to a laboratory, because of the high risk for the integrity of the artwork posed by transportation and of the high costs of insurance.

MOLAB (Mobile Laboratory) was a facility composed by a unique collection of advanced, integrated and portable equipment, moved to the site where the users were operating. The

moving experts accompanying the equipment were scientists (in a number depending on the number of different techniques involved in the work) with competences on materials and methods in conservation and technicians. At each intervention, any measurement preceded by teaching modules, where a presentation of the characteristics of the instrumental devices was given, to ensure their safe and correct use by the users.Operators concurred: a) to assemble *in-situ* the various part of the instrumentation(s); b) to help in carrying out the measurements; c) to discuss the first interpretation of results with the users.

During the whole project, 126 request of access have been submitted to MOLAB (through proposals mostly requiring access to more than one facility). Of these, 50 access to facilities were executed (46 planned) in 11 countries (FR, AT, CZ, ES, CH, NL, SL, BE, GB, PL, IE) corresponding to 299 days of work (260 planned) for 239 users (150 planned), a number often enlarged to other personnel of the entire hosting institution (museum, open air monuments, libraries, etc.).

Typical users of MOLAB were conservation scientists or conservators/restorers (individuals or group members of public or private institutions) who were developing research to deepen the knowledge on the nature and state of conservation of relevant artefacts and/or to determine the optimal modality/condition for a programmed conservation's intervention. Users were also scholars, conservators or scientists belonging to museums or other institutions operating in the field of artwork studies or heritage care, as well as restorers of public institutions or SMEs.

The results strongly contributed to a better knowledge of the structure and materials used by the artists, giving also specific information (alterations of materials and their locations) useful for their conservation.

- *Main results achieved (some examples)*

· Access projects were carried out on works of art of great masters of the European history of art. For instance: Caravaggio (National Gallery of Ireland, Dublin, IE), Van Gogh (Kroeller-Muller Musem of Otterlo,NK; Van Gogh Museum of Amsterdam, NL), Picasso (Musée Picasso in Antibes, FR; Museu Picasso of Barcelona, ES), Memling (National Museum of Gdansk, PL), Durer (National Gallery of Prague, CZ), Bosch (Academy of Fine Art, Vienna, AT), Van Eyck (St. Bavo Cathedral, Gent, BE) and others. European, Mesoamerican and Islamic illuminated manuscripts have been also studied, as well as stones, mural paintings and glazed ceramics in monuments, such as the Real Alcazar in Sevilla or the Roman Theatre in Merida, ES.

· The results of MOLAB access project at the Musée Picasso of Antibes, FR, permitted to record significant indications on the use of Picasso enamel paints (oleoresinous house and boat paints), in combination with other types of ready-mixed, commercial paints and define the palette of the paintings of the Picasso's Antibes period (1946), comparing these findings with receipts for painting materials available in the Museum archives. MOLAB also permitted to explore the connections amongst similar types of paints used on different works, helping to refine their chronology.

Picasso manifested continuous interest in this type of oleoresinous medium for its qualities of expediency, durability, and vivid colours, aesthetic and, in the coastal town of Antibes, superior resistance to the weathering assaults of the marine environment. The Antibes cycle represents a prime site for the exploration of the Picasso's pioneering use of enamel paints among which the paints of the French company Ripolin gained large popularity in Europe after the 2nd World War.

·Another exemplary access project exploiting the instrumentations offered by the three MOLAB providers, on identification of painting materials, regarded the study of pigments, binding media, and ground, commonly used by Van Gogh during the last months of his life, when he was in Saint-Rémy and Auvers-sur-Oise. Measurements were carried out at the

Kroeller Muller Museum of Otterlo, NL. Special aim was to attempt the identification of pigments particularly prone to fading and degradations.

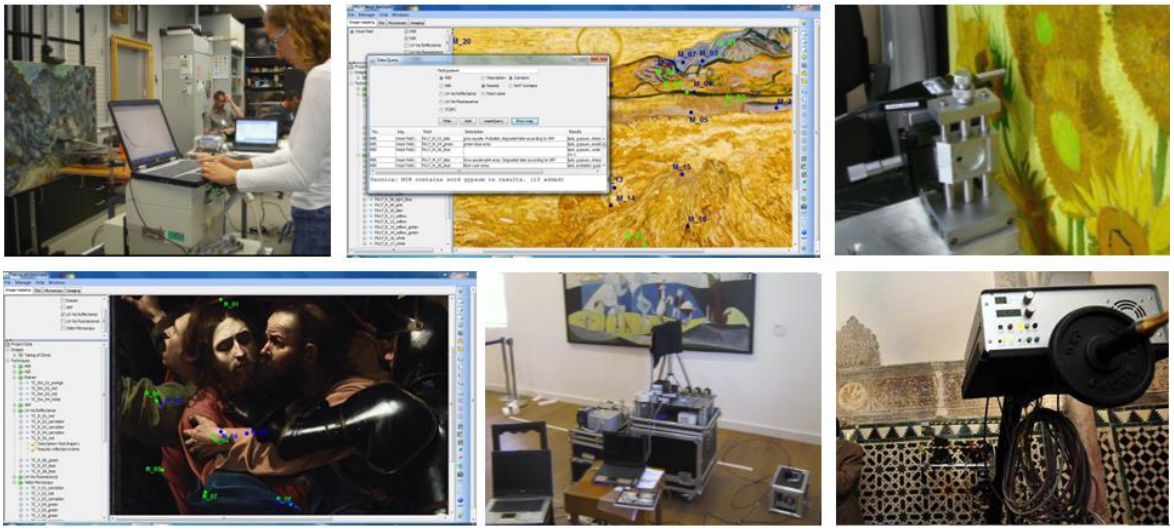


Fig. 3.3.2 MOLAB at work (some examples): access projects VANGOGH (UGL K. Janssens) at the Kroeller-Muller Museum of Otterlo, NL; YELLOW (UGL E. Hendricks) at the Van Gogh Museum of Amsterdam, NL; MIMECA (UGL S. Mancini) at the National Gallery of Ireland, IE ; HOPPA (UGL R.May) at the Musée Picasso of Antibes, FR; ALCAZART (UGL M.D. Robador) at the Seville Alcazar, ES

Specific highlight was the identification of both pure lead chromates and co-precipitates of chromates and sulphates, with convergence of results by FT-IR and XRD. These compounds -that correspond to chrome yellow pigments of different composition, structure, and chromatic hue - are difficult to be distinguished by non-invasive techniques. The use by Van Gogh of chrome yellows composed by chromate/sulphate co-precipitates deserves particular attention from the point of view of conservation, due to the fact these pigments are particularly subject to darkening.

The full set of projects and results, obtained through the MOLAB access all along the three periods of the project, are described in deliverables D6.1, D6.3, and D6.5.

FIXLAB - Medium and Large Scale Facilities (WP7)

[PA: CNRS NEW_AGLAE WPL, SOLEIL, PB: ATOMKI-HAS, BNC-WIGNER]

FIXLAB consisted of two access platforms, located in two European sites, offered by a joint group of four medium and large-scale installations, under a coherent management. The first one (*Platform A*) corresponding to the urban area of Paris, FR, was composed by NEW_AGLAE at the *Palais du Louvre*, and the Synchrotron SOLEIL in Saclay, while the second (*Platform B)*, was composed by the two Hungarian scientific centres of Budapest (Budapest Neutron Centre) and Debrecen (Ion Beam Accelerator ATOMKI).

Through FIXLAB, EU conservation scientists, conservators, curators, art-historians, and archaeologists, applied for transnational access to advanced state-of-the-art laboratories and large installations in order to deepen their studies through appropriate and advanced scientific techniques. These studies were carried out directly on objects (when movable) or on selected micro-samples or on mock samples prepared in the laboratory, exploiting the most advanced techniques presently available in large and medium scale facilities.

Users from different countries brought their objects and samples to carry out measurements of different nature as PIXE, PIGE, RBS, PGAA, Neutron Diffraction, Small Angle Neutron Scattering, X-ray Absorption Spectroscopy, and others. Most of the projects

dealt with studies of pottery, glazed ceramics, paintings, enamels, bronze sculptures, stones, jewels, glasses, coins, armours, tiles, obsidians, gildings, gold alloys, ivory artifacts, silver table pieces, garnets, and many others objects and materials.

The total number of projects executed by FIXLAB within CHARISMA were 138 (*Platform A*: 57 AGLAE + 18 SOLEIL; *Platform B*: 23 ATOMKI + 40 BNC-Wigner), a number higher than the 132 projects. Also satisfactory were the days of access: in total 703,5 (*Platform A*: AGLAE: 191 d; SOLEIL: 75 d; *Platform B*: 149,5 ATOMKI + 288 BNC-Wigner), higher than the 633 total days planned in Annex I. Finally, the total number of users who exploited the FIXLAB facility was 275, well above the minimum planned number of 192.

The service fully achieved all the planned objectives, as clearly demonstrated by the figures of the work developed and by the related numerous articles published in the international scientific literature.

Considering the high number of submitted proposals and the quality of the work developed, it appears how the opportunities offered by FIXLAB have become, more and more known, diffused and exploited among the heritage science community, leading to excellent results in characterising heritage materials, interpreting degradations, understanding provenances, attempting attributions, establishing execution techniques, and, more in general, supporting the study and conservation of artifacts, in a framework of multi-disciplinary approaches and solutions.

Fig. 3.3.3 The NIPS-NORMA station at BNC_Wigner and the investigated pottery of EP-NTOMO Access Project (UGL E. Abraham)

- *Main results achieved (some examples)*

· Typical case of a success application of Ion Beam Analytical facilities (New_AGLAE) by PIXE and PIGE measurements, was the analysis of the Renaissance Venetian glass artifacts, (RVEG-LM2 access Project, UGL M. Verita, IT) regarding the detailed determination of glass composition for provenance assessment, but also understanding execution techniques and alteration of materials. The establishment of an extended compositional database as a significant tool useful for comparison with the analyses of object of dubious origin in view to confirm (or reject) their Venetian origin and even establish the age of the examined object, was an important pursued result.

· Experiments carried out at the Synchrotron Soleil explored mostly the application of FTIR and X-ray absorption spectroscopy techniques. Example of this type of study is the search of structural information about lead soaps (reaction products of lead-containing pigments and fatty acids from the oil medium) and their spatial distribution in paint layers at the micro-scale (PAinT access Project, UGL A. van Loon, NL).

After selection of a coherent corpus of samples from traditional oil paintings, including a painting by Rembrandt van Rijn, *Homer*, 1663 (Mauritshuis) and an original painted ceiling dating from *c*.1650 (Johan de Witthuis, The Hague), the results of analyses were compared with data from 16 replica paint films constructed to simulate the lead soap aggregation processes. Samples from both cases showed comparable layer build-ups, composed of one or more medium-rich, overlying dark paint layers on top of a lead white-containing preparatory layer, that acts as the source of the lead to form lead soaps. The whole corpus

of results provided important clues about the mechanisms regarding formation and migration of lead soaps in aged oil paintings.

· An exemplary work has been carried out (BNC_Wigner) on the earliest known iron artefacts, dated to circa 3200 BC, found in Gerzeh, northern Egypt (Petrie's iron beds access Project, UGL T. Rehren, UK).

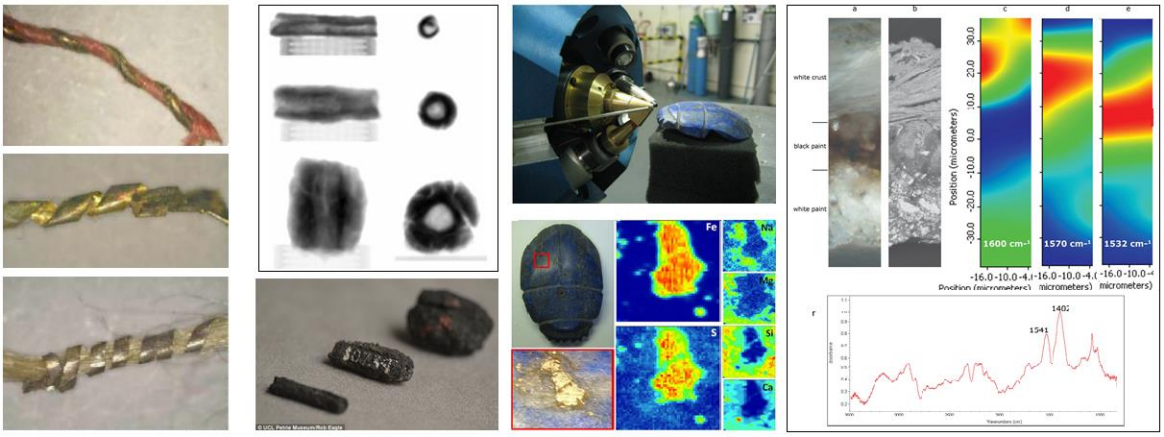


Fig. 3.3.4 FIXLAB Access Projects: from the left IBATEX, Petrie's iron beds, RVEG-LM2 and PAinT

The results through the neutron facility have shown that these beads were made from meteoritic iron, and shaped by careful hammering the metal into thin sheets before rolling them into tubes. They confirmed that already in the fourth millennium BC metalworkers had mastered the smiting of meteoritic iron, an iron nickel alloy much harder and more brittle than the more commonly worked copper. This is of wide significance in archaeology as it demonstrates that metalworkers had already nearly two millennia of experience to hot-work meteoritic iron when iron smelting was introduced.

· The research on detailed composition and technological characteristics of the gilded threads used in historical Romanian textiles (IBATEX and IBATEX 2 access Projects, UGL I.Z.Balta, RO) demonstrated the importance of the integration of advanced analytical methods with historical information. Since the date of manufacturing of the specific textiles of the examined collection was known quite precisely, the results obtained on the nature and technology of the gilded threads, besides the information acquired, represent an important set of reference data on historical textiles with metal threads that will be used for comparison in further studies.

3.4 The research: techniques, instrumentation and technologies

A portal to cultural heritage knowledge has been created, to facilitate the access to the data stored in the six open archives of ARCHLAB. Two main research tasks were developed: the first was dedicated to the integration of the technical metadata associated with different types of data and databases, with the aim of developing an open gate to the Infrastructures' archives on analytical and technical data. In the second, the processing, fusion and registration of 2D and 3D were analysed and tested and optimal methods of signal and imaging processing (WP8 Programme).

New portable instrumentation and methodologies have been designed and set up, with the goal of exploring the artwork in-situ, at and beneath the surface, in order to determine non invasively depth profiles or tomography of paint layers, to localise alterations, measure patinas or stratifications, or even determine penetration of organic consolidants into porous stones (WP9 Programme).

Among the portable instrumentation, four different innovative pieces of equipment are now disposable for the community of scientists to carry out tomographic measurements. Based on techniques of IR-Scanning Confocal Microscopy, Optical Coherence Tomography, Terahertz spectroscopy, and NMR depth profiling, these devices are able to obtain images of objects, probing regions below the surface reaching depths that cover a wide range of distances, from hundreds of microns to several millimetres. The application of Terahertz imaging opens up the possibility of revealing *in-situ* (i.e. in a church or in a room of a public or private building) hidden mural paintings even under millimetres of mortar. Another high performance portable device offers high sensitivity monitoring of the effect of the environment on the surface of museum objects. Finally, a compact new system for the in-situ non-invasive study of organic and inorganic fluorescent materials capable of producing, in a single, unique equipment, absorption spectra, fluorescence emission and emission decay-time (picosecond scale).

The application of laser cleaning methodologies to all material types, including cases where the use is considered “routine” has been also critically assessed. The innovations in cleaning procedures take advantage of the above-mentioned 3D diagnostic techniques. In particular, optical coherence tomography permits the monitoring of laser or traditional cleaning, in-situ, through immediate visualization of the in-depth effects of varnish removals.

A better characterization of multi-layered structures in polychromies has been pursued also by micro-invasive approaches, through advances in the examination of cross sections that allow for a link of the identification of organic materials to their location and spatial distribution within the stratigraphy, an information that is essential for the understanding of execution techniques or material alterations (WP10 Programme). The creation of a new database of analyses and properties of colorant materials has been also pursued and innovative instrumentation for a spectroscopic in-depth approach to the study of painting layers by infrared imaging was also developed.

The practice of frequent interchange of information and ideas among the three workpackages was particularly profitable in the work development, having all the planned research activities the common final objective of improvement of the services offered through the access programme, increase of the number of users, and the strengthening of the quality of the heritage science research.

A portal to cultural heritage knowledge (WP8)

[UNIPG, CNRS /MCC-C2RMF, NGL, BM, Of-ADC WPL, OPD, PRADO, OCW-RCE]

General objective was to strengthen, complement and integrate the physical access to ARCHLAB, the unique “facility” of CHARISMA open archives, containing a huge amount of scientific and technical data. The objective was pursued providing virtual access of professional users to information on such data, through the integration of metadata coming from the archives, streamlined via a web portal in a regular, standardised, and consistent way.

Main purpose of the *Web Portal* was to provide information to users on the rich content of the archives available through the ARCHLAB transnational access. The model was conceived to satisfy the following requirements: i) optimal management of the information and meta-information; ii) homogeneous representation of metadata to users of different profiles, guiding them in finding the information appropriate to their needs; iii) provide advanced search functionalities to the metadata related to objects identification, technical data and technical reports.

The activity encompassed: i) the *Integration of technical metadata*, consisting of the various steps leading to the opening of the portal toward the archive contents, and ii) the *processing*

of the acquired information (*ND techniques*), regarding the optimal handling and fusion of 2D and 3D analytical data provided by non-destructive (ND) methods.

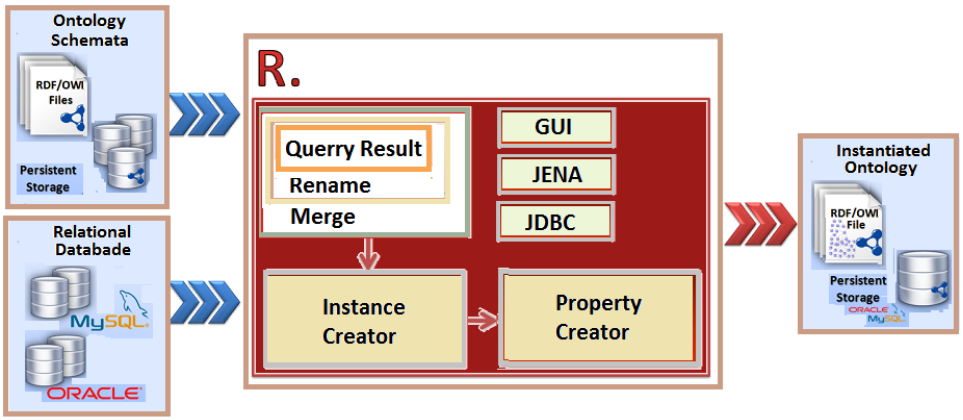


Fig. 3.4.1 RDOTE architecture

Special reference was done to data provided by the methods developed in the other joint research work-packages of the project.

- *Main results achieved*

· From the home page, the users can browse artworks, artists, institutes, techniques, places, and periods or perform queries by combining selection criteria. The portal is accessible through the site http://archives-charisma-portal.eu/

· At the project end, a portal has been developed whose web interface introduces the user to existing metadata, on the data maintained and being actively advanced in the partners' infrastructures, consisting of the content of the wide archives of analytical and technical knowledge acquired in previous studies on paintings, sculptures, manuscripts, metals, etc.

· The information provided comprised: i) identification information, consisting of basic information regarding the object, such as title, creator, creation date etc.; ii) available technical reports on the examined object; iii) data information, which describes the data available about the examined object. · The web portal was open to users of the cultural heritage community from different disciplinary backgrounds; the achievement of this goal was supported by semantic web technologies and intelligent web services (semantic web, social network analysis, intelligent software agents) aiming at providing the user with data according to his (her) needs.

· As second task final output, the handbook provided an overview (from a unified perspective) of NTD techniques, that can be used for analysis of art objects, presenting simulations and models, in the perspective to better tackle the problem of convergence and fusion of 2D and 3D analytical data. In the handbook, selected works that apply scientific and technological advances (in electrical and computer engineering, mathematics, informatics, etc.) for the analysis and documentation of artworks are put under focus and soft computing algorithms are described in a treatment rich of technical details.

New portable instrumentation and innovative methodologies for in-situ diagnostics and conservation (WP9)

[UNIPG, CNRS /MCC-C2RMF, NGL, FORTH, CNR- ICVBC/INOA/IFAC, NCU WPL, RWTH, OPD, LNEC]

In-situ measurements have a high impact on the field of study and conservation of artworks.

This impact goes beyond the simple technical aspects, because the introduction of portable analytical tools in the conservation practice has led to a progressive modification of the way of thinking about the best approach for the scientific examination of an art objects and even to a modification of the relationships between scientists and the other professionals in conservation (conservator/restorers and art-historians):

- the movement of the laboratory to the artwork, instead of the contrary, avoids any risk (and costs) connected with the transportation of a high-value and fragile object into a lab, opening the way to the scientific examinations of a very large number of artworks, as was never done before;
- the ability to get valuable information without touching the surface of the object makes it possible to analyse in a virtually infinite number of points all over the surface of the object, ultimately obtaining a more thorough description than in case of sampling;
- the results are obtained practically in real time, creating a new form of relationship between scientists and conservators (or curators), based on immediate group-discussion of the results; this fact does not simply reduce the time of work, but significantly improve the quality of the examination;
- the possible "non-confidence" on scientific examinations by professionals from other fields than science is vanished in front of the absolute non-invasivity of the measurements and the possibility to view and discuss immediate and evident results.

In total six new portable tools and methodologies for in situ non invasive measurements have been designed and set-up in this workpackage. Innovative methodologies for laser cleaning have been also set up and validated.

In the following, a brief description follows of each tool and methodology. The innovative equipment and the laser cleaning methodology have been the subject of a demonstration offered to the invited authorities, stakeholders, and public, in occasion of the Final Event of CHARISMA in Firenze, hosted by OPD.

1 - Confocal Laser Scanner near-IR Microscope.

A prototype of confocal laser scanning microscope (CLSM) has been set up for in situ non-invasive measurements on paintings. The goal was to make optical sectioning of paint layers without any sampling, with a very compact, low-cost and easy-to-use device based on confocal microscopy in the IR range.

In the first part of the project a prototype has been designed, assembled and validated by means of laboratory tests. However, this first experimentations revealed margins of improvement of the depth resolution. To this purpose, although not originally foreseen, the CLSM has been modified into a system able to work also as a time-domain confocal OCT.

- *Main results achieved*

· Substantially, the finally developed prototype can work both as a confocal CLSM, as originally planned, and as an OCT device, integrating that developed in another task of this workpackage. The whole system is computer controlled: after the selection of the modality of operation and acquisition parameters (sampling step in the X, Y directions, acquisition rate, source amplification) the measurements are driven by means of a specifically developed software.

· The device has been tested on several cases in collaboration with OPD, leading to positive results for the non contact 3D visualization and measurement of varnish thicknesses.

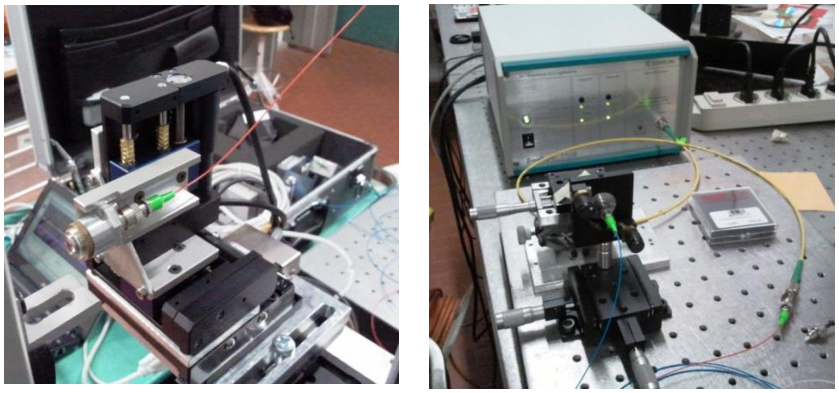


Fig. 3.4.2 Third version of the instrument, now capable to work also as a time-domain confocal OCT(see text). (a) Optical head with the new 2x2 coupler (sample arm); (b) broad-band SLED source and reference arm.

· The system is very compact and easy to be transported, therefore is also fully responding to the needs of a portable and flexible tool suitable for the in situ monitoring of cleaning during restoration.

2 - Terahertz Spectroscopy and Imaging

Terahertz techniques are able to combine material characterization (spectroscopic mode) and time of flight imaging with penetration of optically opaque materials (non-polar, non metallic) suitable for subsurface imaging of several objects.

The Terahertz system developed in this task is able to provide images from tens of micrometers to approximately one centimeter into the inspected object and therefore is suitable to provide mesoscopic details of an object, without the need of any sampling, either in situ or in the laboratory.

After the assembling of the components, the system has been experimented for various applications and in particular for examination of paintings.

- *Main results achieved*

· The optical components are contained within a box of an easy to transport size and weight, and the fibre-coupled antennas permit rapid modification of the measurement geometry to be carried out. This is particularly advantageous because facilitates in situ examinations.

· Among the various tests, particularly representative is the in situ test carried out on the mural Doom Painting at St Thomas' Church, Salisbury, UK, where the system was experimented to reveal possible under-paintings under a thick layer of mortar. The examined medieval painting is representing Christ in Majesty, dominating a scene of judgement. During the examination, below the gilded geometrical figures of the halo of Jesus, a previous gilding was found.

A photograph of the scanned halo of Christ is shown below, together with the THz image superimposed on the photograph. The lily form, made of gold is easily recognizable, while the line highlighted in blue indicates a very strong sub-surface reflection layer in the painting, clearly suggesting the presence of a hidden sub-surface metal layer.

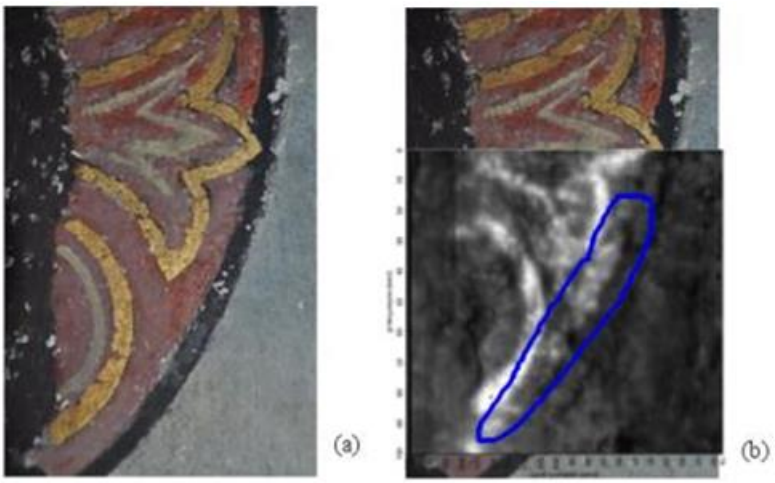


Fig. 3.4.3 (a) shows a photograph of the section of Jesus' halo that was scanned using THz imaging, while (b) shows the superposition of the THz image on the painted section, the area highlighted in blue shows a strong reflection possibly as a consequence of a metallic under layer of paint

A cross section, examined via a microsampling carried out in the same area for validation of the experiment, confirmed the presence of another layer of golden leaf below the surface of the mortar.

· The performances of the developed THz system were positively tested also for the detection of wood-rings for dendrochronology and for in situ identification of pigments via spectroscopic measurements.

· All the experimental tests, both in the laboratory and in the field, demonstrated the high potential of the developed real-time, high resolution, portable THz imaging system, a device complementary to the other tools for non-invasive in situ measurements, developed in other tasks of this workpackage.

3 - Optical Coherence Tomography

Major concept of the design of this new instrument was to dispose of an effective device capable to produce well resolved tomograms of varnishes and paint layers, that can be easily dismantled and easily transported for *on-site* examinations of objects of art in place of their storage or exhibition.

In parallel with the designing, assembling and testing of the instrument, a data acquisition and processing software was developed, to ensure: i) high operation speed for high resolution real time imaging, ii) massive parallel processing of data with a Graphic Processor Unit (GPU) with use of CUDA technology.

- *Main results achieved*

· After the assembling of the system, several field and laboratory test have been carried out to improve the performances of the developed instrument.

The list includes in-situ tests at the *Opficio delle Pietre Dure*, Firenze, Italy on the 'Adoration of the Magi by Leonardo da Vinci, at the Museum of Fine Arts, Gent, Belgium, on the outstanding Adoration of the Mystic Lamb by Hubert and Jan van Eyck, in cooperation with KIK-IRPA in Bussels, and on La Muta by Raphael in cooperation with OPD in Firenze.

Several laboratory tests were also carried out on *Azulejos* (in co-operation with LNEC), various paintings of the 18th and 19th century, stained glass from National Museum in Wroclaw and other materials.

· All test were very positive, as in the case of the Adoration of the Mystic Lamb where the experimentation was concentrated on thickness and number of vanish layers on ten different panels and two frames, leading to detailed information on varnish stratifications.

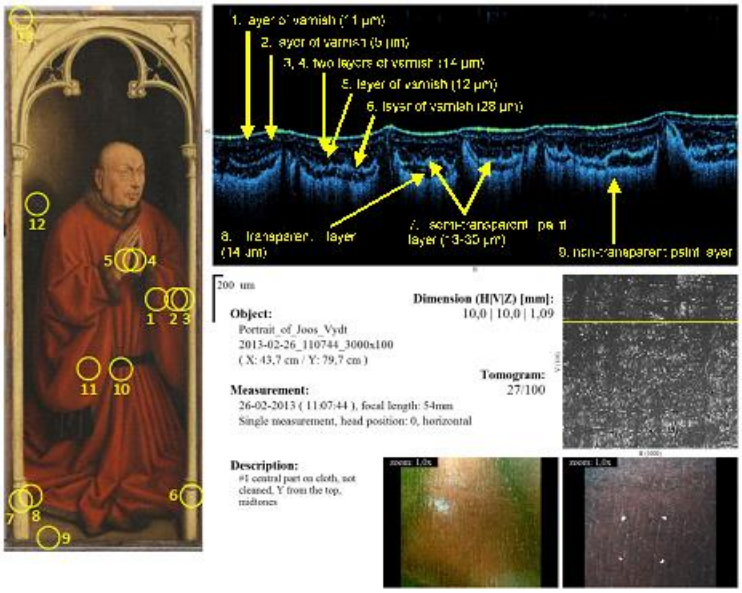


Fig. 3.4.4 Adoration of the Mystic Lamb: Portrait of Joos Vijdt – locations of the OCT examinations and exemplary result in standard output format (photo: KIK-IRPA)

· Satisfactory OCT examinations were also carried out on stained glass. In this case OCT can be exploited mostly for revealing corrosion and presence of internal cracks and delaminations. In the case of the collection of medieval glass from Grodziec Palace (now in National Museum in Wrocław, PL) in addition to the surface gel layer, internal delaminations have been clearly detected.

· A the end of the project, the planned objective of the research has been fully achieved and the newly set up system is working with very high performances.

4 - Mobile Single-Sided NMR-MOUSE Depth Profiler

The NMR-MOUSE (Nuclear Magnetic Resonance - Mobile Universal Surface Explorer) is a portable device that provides single-sided non invasive depth profiling of hydrogen-containing materials (organic and inorganic) in situ. Today the NMR-MOUSE® is a registered trademark and is available off the shelf. Starting from a prototype device, the system has gone through major improvements within CHARISMA and new models developed.

- *Main results achieved*

· The NMR-MOUSE® measures ^{1}H nuclei and its different models may be employed for profiling at different depths. The maximum achievable depth in the last model is 20 mm. The maximum depth resolution of 2.3 µm may be achieved, depending on the sensor.

In addition to the detection of ^{1}H nuclei, a new sensor was developed suitable for the detection of ^{27}Al and ^{23}Na. The detection of ^{23}Na is particularly relevant in heritage investigations due to the relevance of sodium salts in the deterioration of stones.

· The NMR-MOUSE system based on the measurement of relaxation time of ^{1}H nuclei works quite well and can be successfully employed for the non invasive study of water or organic substance penetration into different stones up to a depth of 200 mm. The new sensor for $^{27}Al/^{23}Na$ is working appropriately for sodium containing salts. However, the decay of crystalline sodium chloride is shorter than the dead time of the sensor, leading to

the limitation that the signal from ^{23}Na in the solid state cannot be measured. To reduce the relaxation rate, ^{23}Na atoms need to be mobilized by dissolution in water.

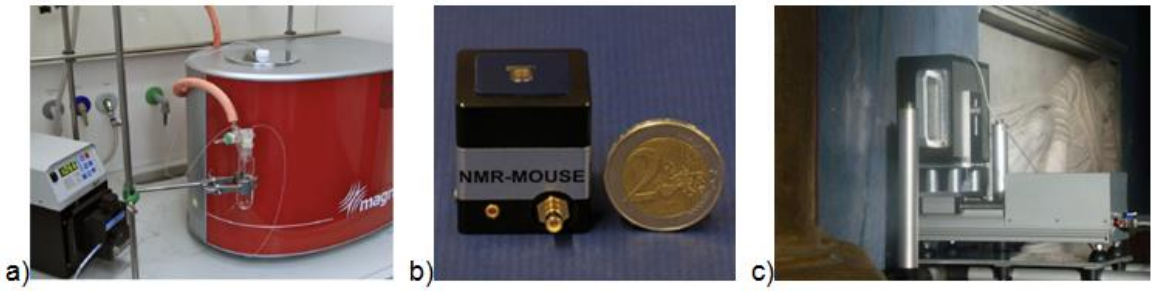


Fig. 3.4.5: a) Spinsolve NMR spectrometer for chemical analysis developed by Magritek GmbH Germany, by advancing technology originally developed for the NMR-MOUSE. b) Micro NMR-MOUSE developed by ITMC. c) Setup of the NMR-MOUSE with 25 mm depth range in Chaalis, France, November 2013.

· Experiments using the new sensor were performed on tuff stone of the type used for building the ancient walls in the archaeological area of Herculaneum in Italy. Non-invasive determination of the amount of mobile ^{23}Na was carried out and Inverse Laplace Transform (ILT) has been exploited to determine the distribution of ^{23}Na relaxation times inside the stone. The experimentation demonstrated that the system is able to record multimodal relaxation components corresponding to sodium dissolved in pores of different dimensions.

5 - METROTECH

METROTECH is a system that is able to monitor the surface of the work of art offering the possibility of a continuous or periodic control of its morphology, establishing topographic maps of defects, indicating location of endangered areas with local estimates from high to low deterioration risks.

METROTECH measurements are based on the principles of digital holography and speckle pattern interferometry, which require strict boundary conditions to maximize stability of the system and minimize errors due to extraneous noise effects.

Fig. 3.4.6 On-field defect mapping of wall paintings in Museum church with real time raw data visualizing highly structured subsurface interconnection among crack and lateral detachments

- *Main results achieved*

· The hardware and software development led to a final system, that is set for direct or remote operation, fully portable, pc driven, and equipped with user-friendly interface. Custom developed post-processing tools for expert analysis is also available.

· The protocol for defect detection is fast and effective with topographic maps adding lots of valuable information to the conventional maps of the conservator. The improved automation and FT and FFT analyses are now able to provide excellent results on ceramic, masonry, stones, mortars, and wall paintings.

· A considerable number of indoor sites were successfully examined either for environmental impact or defect detection, as Byzantine churches in Crete, the Dominikanon historical building, Valsamonero monasteries, St Peter Church, Eisodia Theotokou Church, Avignon monastery, and Chaalis. Museums may share similar indoor climate with climate controlled historical buildings.

6 - An integrated System for Absorption/Fluorescence Spectroscopy

This prototype is composed by a steady-state spectrometer, working both in absorption and emission mode, integrated with a single photon counting device for the measurement of the emission decay time. The system has been conceived to permit users to work either in the time-domain or in the frequency-domain and to collect spectra on the same point using different excitation wavelengths, by means of a set of several sources/detectors.

The variability of the set up and the possibility to carry out different spectroscopic measurements on the same point is the main property of the system, relevant for the non-invasive in situ identification of luminescent materials used in works of art (mainly organic dyes and lakes and some inorganic pigments).

- *Main results achieved*

· Material identification obtained through comparison of the recorded data with *ad hoc* databases set up in the laboratory, enriched during the project development with the response of dyes and pigments provided by the project partnership.

· Several spectra of absorption, emission and decay time of emission of dyes and colorants have been recorded and are available for comparative identification. A relevant family of luminescent inorganic pigments of different colours can be also profitably studied by the new system, as zinc oxide and sulfide, and cadmium sulpho-selenides. All these pigments are largely used in modern and contemporary art.

· The prototype, in its last version, has been successfully experimented for in situ studies of ancient and modern paintings in restoration laboratories or in museums. In particular, it has been also positively experimented in the last MOLAB intervention at the Picasso Museum of Antibes, demonstrating to be ready for effective applications.

7 - Innovative Laser Cleaning Methodologies: Biodeteriorations, encrusted granite and paintings

To provide advances on the state-of-the-art of laser cleaning, an approach was followed based on: i) understanding which wavelength (including UV and mid-IR) and pulse-widths (including ultra-short pulses) optimize the laser-interaction for effective ablation, ii) operating in condition of absolute safety for the object employing on-line monitoring and diagnostics for material characterization.

Following these principles, a set of advanced laser systems and application methodologies have been set-up along the project, allowing hand-held delivery of laser radiation with direct control of spot dimension and laser fluence suitable for safe applications on several types of cleaning problems. Optimal parameters and methodologies have been optimised in accurate experimental trials in the laboratory and then applied on-site, according to the specific needs.

- *Main results achieved*

· After the numerous experimentations: i) the safe removal of the lichen *Verrucaria nigrescens* and biofilms from Carrara marble sculptures has been demonstrated; ii) biodeterioration and foxing of paper artefacts has been validated; iii) laser ablation of iron-rich black films from exposed granite surfaces has been optimized; iv) laser induced phase changes and stabilisation of corroded iron surfaces were thoroughly characterized.

· Removal of overpaintings from modern easel paintings has been also experimented and validated; LQS Nd:YAG(1064 nm, 120 ns) laser ablation has been successfully exploited for removing overpaintings disguising a portrait of a woman by anonymous (dated around 1930).

Fig. 3.4.7 Laser removal of overpaintings from a modern painting. Restorer: A. Pavia

After a vain attempt of removal the overpainting using traditional solvents, which resulted to be very aggressive because of the significant content of carboxylates (metal soaps), a laser ablation validation study was successfully carried out. Raman spectroscopy, reflectance spectroscopy, optical microscopy, ESEM-EDX, and FTIR were used for characterizing the laser interaction effects on prepared samples and, subsequently, the uncovering tests directly on the artworks. The overpaintings on the portrait by anonymous were executed using chlorinated copper phthalocyanine green and Ba, Zn (Ca) based pigments in linseed oil. The presence of traces of Cr and Pb also suggested the presence of some chrome yellow. Traditional inorganic pigments such as lead white, red lead, and carbon black, and modern organic dyes (red synthetic azo pigment) in linseed oil were also identified before removal.

· An integrated validation was also achieved on a further modern painting, which was found beneath overpaintings on the backside of the canvas of a signed painting by Giacomo Balla, one of the founding members of the Italian Futurist Painters.

Innovative methodologies and instrumentation for laboratory research (WP10)

[UNIPG, NGL, CNR-ICVBC, BM, DI-BS, Of-ADC, OCW-RCE WPL, KIK-IRPA, UNIBO]

New methodologies and research strategies were developed for i) the characterisation and study of deterioration of a range of organic and inorganic materials, via non-invasive and/or micro-destructive approaches; ii) improving basic understanding of dyes and lakes by systematic optimal application of existing or new emerging analytical techniques. Specific tasks of this work-package were:

Task 10.1 “Organic material identification in micro-stratigraphies” (Resp. UNIBO) devoted to the optimal application of the new chemical imaging methods, which can characterise organic materials and determine their distribution at high resolution within the stratigraphy of a paint. Task 10.2 “Organic colorants in ancient and contemporary art” (Resp. OCW-

RCE), to overcome the problems that currently hamper accurate identification of dyestuffs, producing new methodologies and knowledge useful for the study and conservation of organic colorants in art with new analytical approaches. Task 10.3 “Multispectral imaging and spectroscopy in diffuse reflectance mode and fluorescence” (Resp. Of-ADC), for acquisition and processing of images for 2D and 3D distribution of organic and inorganic materials in artifacts. The task included image-processing techniques for the non-invasive identification of inorganic and organic substances and their spatial distribution.

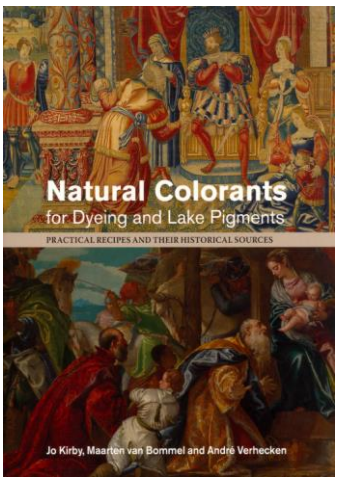
- *Main results achieved*

· Suitable methodologies (sample preparation, instrument configuration, etc.) were defined for selective characterisation and localisation of organic components (binder, varnishes, colorants, etc) in paints or coatings characterised by a complex stratigraphy.

· Surface Enhanced Raman Spectroscopy (SERS) was successfully experimented. for the identification and localization of organic materials (dyes and lakes) in cross-sections. Surface Enhanced Infrared Absorption (SEIRA) was also tested with success on micro extracts, in the effort to overcome the limitation of FTIR microscopy when organic colorants are present in mixture with other organic and/or inorganic compounds.

· Immunological approaches for the characterization of proteins in paint cross-sections have been set up, to determine the distributions of proteins within the various layers of the paint when a proteinaceous binder or varnish is used. While enzyme linked immunosorbent assay (ELISA) methods have been developed for the ready and specific identification of all the main proteins commonly used by painters, as egg, milk, and animal glue, a really powerful immunochemical probe has been successfully experimented and set up, composed by gold nanoparticles (AuNPs) functionalised with a dye for Surface Enhanced Raman Scattering (SERS) detection.

· To determine the factors that affect the overall colour obtained in preparing organic pigments from anthraquinone and flavonoid plant sources and/or in dyeing textiles, important parameters influencing the final colour in dyeing textiles were established. The large quantity of data gathered, their ordering and their final discussion, have been the subject of a booklet, entitled *Natural Colorants for Dyeing and Lake Pigments*, whose cover is shown in the picture aside.



· A semi-Preparative Liquid Chromatographic system was developed (Prep-LC) coupled to fraction collector for isolate individual components from madder and weld, which were subsequently characterised by ESI-MS. Some of these compounds are not commercially available and not characterised previously. The availability of these standards strongly enhances the possibility of a correct and precise identification of these colorants.

· Extraction protocols were reviewed (http://research.ng-london.org.uk/scientific/colourant/) and a selection was then optimised for both dyed textiles and paint samples for a better identification of colorant present in textiles and pigments. In fact, mild extraction well preserves the colorant’s molecules and therefore improves diagnostics. The dyes investigated were indigo, annatto, safflower red, redwood, madder, weld, unmordanted tannins and tannins on iron mordant and for the pigments, were selected: indigo, redwood, buckthorn, madder, weld and cochineal.

· To achieve a better understanding of structural and spectroscopic properties of metal-dye complexes, in both textile dyeing and pigment preparation, significant spectral differences were emerged for the fluorescence emission of alizarin and purpurin forming complexes with Al(III). Of particular interest was the finding that the experiments in solution and powder

showed strong similarities, so they can be used as model for both cases. Theoretical quantum mechanical calculations have been also carried out. This activity opened the way for a more effective exploitation of computational tools in understanding nature and spectroscopic behaviour of the complex chemical systems that characterise heritage objects.

· 30 synthetic dyes and 30 synthetic pigments (pure materials) were selected for the research on early synthetic colorants, based on their more common use in art objects and including all dye classes. For the experimentations, wool was dyed following historical recipes and mock paint samples created. Of the techniques used (including FTIR, fluorescence spectroscopy, UV-VIS colorimetry) micro-Raman spectroscopy and HPLC-PDA were the most effective. Excellent HPLC-PDA results were also obtained for the dyes, while for pigment in some samples no response was obtained due to poor solubility.

· Working from an existing system based on the cube corner technology of the IR-CUBE platform, an IR spectrophotometer system was developed using monochromatic illumination from 200 to 5000 nm, a Michelson interferometer and a Focal Plane Array detector (FPA- InSb camera) operating in the 1000-5000 nm range. The system allows images to be recorded of areas of a few cm^2. The images obtained are in accordance with those acquired using another system, but the time needed for a single measurement is of few seconds, while the previous system acquisition times amounted of around half an hour.

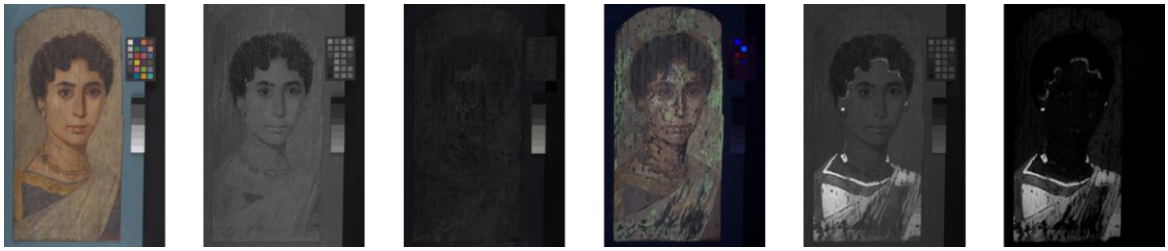


Fig. 3.4.8 (from left) Visible- (VIS), IR- (IRR) and UV-reflected (UVR), UV-induced visible luminescence (UVL) and two visible-induced IR luminescence (VIL) images of a Fayum portrait from the British Museum.

· A methodology for producing device-independent, standardised, comparable and reproducible images has been developed to allow the necessary correction/calibration transformations to be consistently applied, with the aim to facilitate the comparison and interpretation of the resulting images. Traditionally, the acquisition of multispectral images has been highly set-up dependent, making cross-comparison between different laboratories and researchers very difficult.

· A series of standardised experimental setups and acquisition protocols for both luminescence imaging methods and a range of related broadband reflectance imaging techniques have been developed and presented in the form of a user manual (see https://www.britishmuseum.org/pdf/charisma-multispectral-imaging-manual-2013.pdf).

· New versions of user-friendly software tools/workspaces were also created. See: https://www.britishmuseum.org/files/charisma-bm-workspace.ws and https://www.britishmuseum.org/research/research_projects/all_current_projects/charisma/technical_imaging.aspx.

4. Potential impact and the main dissemination activities and exploitation of results

4.1 General impact

Cultural Heritage represents a fundamental bond in Europe, due to its uniqueness relative to other regions of the world. Actions for its conservation and preservation are crucial in shaping the European Research Area and undeniably require an assessment of the foreseeable evolution of its degradation.

The social dimension of the Heritage Sciences field has not been fully explored, nor has its position in the European strategic technological area. Moreover, the conservation and preservation of our heritage imposes important socio-economic burdens on the European science & technology system. National and regional funding remains largely uncoordinated leading to lacks of efficiency and lowering of the competitive position of the European heritage researcher.

High-level advanced CH research infrastructures, integrated, networked and accessible to research teams from across Europe, pillars of an ambitious ERA-vision, can play an essential role in this framework as fundamental tools for improving the quality of the scientific and technological research undertaken in the EU.

The contribution of research infrastructures to European competitiveness is universally acknowledged, and the I3 instrument play a fundamental role in the involvement of users in the operation of research facilities provided that some conditions are verified, as:

· The setting-up of a highly experienced trans-facility board to coordinate access and interactions with the participating infrastructures.

· Provision of services by experts with a strong experience in the field.

· The full guarantee that the usual selection process of proposals are compatible with the specific needs of the user communities involved.

The strong involvement of the large-scale facilities participating in the CHARISMA project, integrate all these new approaches within the organisation and obviates the need for the end-user and the requirements for the heritage sciences community. The new instruments developed for the CH field, are certainly a good model for communities with similar constraints and instrumental needs, such as environmental sciences, on a longer-term basis.

The CHARISMA consortium presents itself as a unique distributed and high-performance infrastructure facilitating complex analyses as required for academic and industrial research, while providing access to the latest technologies necessary to conduct advanced research for users, independently of the user location and of the resources.

Its distribution amongst 11 European countries reflects its European scale, if not larger as the initiative takes into consideration European associate states along with extra-European countries. As an example, the success in jointly operating the two FIXLAB platforms, one in Western Europe and the other in Eastern, should be of great importance for European Heritage Sciences, especially regarding the door this approach may open towards the Eastern Europe cultures, including Russia, Central Asia and Middle-Eastern countries. In this way, CHARISMA played an important role in extending the CH vision towards countries of exceptional culture in line with the pre-figuration of the future EU political challenges.

4.2 Impact on heritage sciences

The Consortium created a bridge between the Humanities and specialists in advanced material analysis, turning challenging experiences into creative encounters. The cross-disciplinary sharing of scientific approaches with knowledge of culture is of great benefit to both fields. The setting-up of European Distributed Facilities within CHARISMA, recognised by the users community as one unit, structured by a common dissemination policy and a strongly enhanced exchange of technical expertise, is a key requirement for a continuous strengthening of the awareness of the importance of the interdisciplinary encounters between the world of art history and archaeology and that of science.

During its implementation, CHARISMA has pioneered the use of

- The coupling of “hard” and “soft” infrastructures through the implementation of an ambitious e-portal which prefigures a concept of “mixed-access”, truly adapted to ARCHLAB approach. This approach associates real and virtual access to the large quantity of data present in the archives of prestigious European institutions (museum and academic institutions devoted to research and safeguard of cultural heritage) completing the offer made by CHARISMA to users;

- The platform concept, grouping “fixed” facilities with an in-depth practice of heritage research conducted by partners, and proposing a highly experienced service in order to take the best benefit from the joint use of such sophisticated investigation techniques, and optimise the usage of the European medium and large scale facilities;

- The MOLAB “portable tools” with their success story, related to the novelty to bring a scientific laboratory inside the museums and conservation institutions, that has achieved a very high visibility in the international research and application communities working in Cultural Heritage. The EC recognized the need to stimulate the creation of an integrated European heritage research community and to promote the building up of extended expertise in cultural heritage, in order to maintain the European research in this important area at a global competitive level.

A relevant scientific and structuring impact of CHARISMA regards the activation of new user groups, as well as of associated partners, followers of the implementation of the CHARISMA activities. Enhanced support for access to a wide range of advanced analytical techniques offered by a unified set of distributed infrastructures opens new interests and extends new fields for research. In this context, the research activity was clearly geared towards the improvement of the quality of the services that can be offered through access.

The access to the equipment offered by CHARISMA includes both access to large-scale facilities and, as deemed necessary for the study of artwork materials, access to a unique set of portable high-performance instrumentations, many of which are prototypes, that allow measurements to be carried out otherwise impossible without sampling from the object or its transportation to a laboratory. Coupling of mobile instrumentation and large-scale facilities is then the best option for extending to the entire work of art the localised interpretation arising from micro-samples which, although giving in-depth characterisation of materials, unavoidably give information with a limited statistical relevance. The combination allows minimum invasive intervention on the work with maximum extraction of material information.

The requirements for studying these heterogeneous materials involve the coupling of many distinct approaches (ion beam analysis techniques, synchrotron X-ray spectroscopy, neutron sources, lasers, chromatography techniques, etc.). This is in line with the current major development of micro-imaging techniques, using microprobe, near-field or full-field approaches. The integration of data coming from different sources was a major issue at the distinct participating facilities, which strongly benefit from approaches, where the need to couple elemental, chemical, structural and morphological data lies at the heart of many

research activities such as, for example, the distribution of distinct organic substances in cross sections or the assessment of the nature, and state of conservation of a dye on the basis of its chemical composition.

On the other hand, through the various TNAs worked in CHARISMA and the development of joint research, the partners intended to make available to users efficient access to new frontier performance instrumentation, destined to increase the diagnostic capabilities of the distributed infrastructure in particular with reference to in-situ analyses. The monitoring of the structural modifications of works of art in response to environmental conditions is a key-step in programming preventive conservation measures (METROTECH). The in-situ non-invasive identification of organic colorants with fluorescence methodologies (triple measurements of absorption, emission, and decay time of fluorescence) represents a significant advance in technologies offered to researchers for diagnostic analyses. Outstanding advances are offered also by the development of portable equipment for CLS, OCT, NMR, THz. All these techniques are capable of creating 3D images corresponding to the layers beneath the surface of the object under study, reaching variable depth from micrometers to millimetres. These results are expected to open the way to unprecedented performances, such as the imaging of a painting materials beneath several millimetres of plaster or the control of the execution of conservation treatments, such as laser cleaning, monitoring their effect on-line, at the same moment that they are carried out.

4.3 Impact on society

Learning the particular history of an artwork and how it was made, knowing how the potential degradation through exhibition to the public may threaten its durability, discovering how much society could lose in neglecting an artwork, are new exploratory ways for revitalising public interest in visiting museums. In particular long-term alteration issues are directly interconnected with environmental research activities, therefore promoting a novel way to disseminate these key scientific questions within European Society.

In addition, this domain is of great interest at the economical level, first of all for the cultural market, which is mainly sustained by basic confidence in the durability of artworks. Secondly, many famous places in Europe attract visitors, a fact that implies long-lasting benefits for the European economy and international visibility.

CHARISMA could reinforce the confidence of cultural charities and foundations in investing in the preservation of artworks. Coupling research and conservation on well-known artworks with a scientific contribution may be of great interest for appropriate support programs and guarantee their input to the work carried out within the European project. Finally, the international attractiveness for young researchers and new users from overseas countries constitutes a leading aspect for our heritage sciences community.

CHARISMA contributes to enhancing a political culture in Europe based on mutual respect and high-level competencies. Associating Heritage sciences experts from cultural institutions (conservation scientists, conservators, restorers) with specialists from Physics, Chemistry and Environmental sciences, in a fast moving scientific context, is a key aspect for CH Research.

4.4 CHARISMA spread character

In addition to the support activities and the joint research plans, an important feature of CHARISMA will be its *openness*. A main ambition will be to provide an open setting, where

an heritage science international forum, impacting on policy and practice, can be developed and updated.

The activities generated by the project (e.g., professional technical events, training preparation, link with associated partners, conference and workshop organisation, presentations for a general audiences etc.) will not be mirrored by the project himself, but they will be enlarged. To establish lasting connections and cooperation among interested research institutions in Europe and beyond, enhancing the interest and visibility of the European heritage research out of the borders of Europe will open new ground for international cooperation.

At project level, foresight information and communication concern collecting and presenting project activities, experiences, results to potentially interested users: they have been all aimed at increasing an effective knowledge-sharing with the public at large. In this process, detailed in the networking WPs, various tools were used, the website, and besides, publications, presentations in international events, press and news releases, documentation, expositions, conferences, videos, etc.

4.5 Main dissemination activities

In order to develop a helpful dissemination plan – a WP4 Steering Committee task - the CHARISMA Plan was drafted at the very beginning of a project, containing the activities to be continuously carried out until the project's end (and possibly afterwards).

The Plan indicated those activities to be devoted to ensure that the developed goal and results could be externally spread and exploited, both during the completion of the project and after its conclusion, through the dissemination of the final outcomes in the most suitable environments. The results and impact of the project efforts rest not only in the effectiveness of dissemination activities, but also in the possibility of their use. In fact, while the first is essential in order to attain the objective of making the project understandable and visible, the latter aims at assuring the conditions to take advantage of it.

The Evaluation report of the Extra-Mural Advisory Committee, envisaged at the middle of the project duration and providing information and feedback, helped the discussion to adapt and focus the dissemination plan or devise alternative strategies.

The three networking WPs were devoted to these issues. The structure of dissemination and communication effort, planned in WP4, provided a wide range of activities sustained by WP2 and WP3, such as international cooperation, education, training, users' awareness and technology transfer events to research laboratories, memory institutions and industrial organizations in the heritage field, based on the main objective of the action, the contents and the targeted recipients.

- *Technical training events*

A series of trainings sessions have been carried out, primarily destined to advanced CHARISMA users.

· Training on *Mobile Nuclear Magnetic Resonance* (28–29 April 2011, Aachen, DE) Dedicated to learn and practice the basic steps for art conservators that enabled the course participant to perform NMR analyses for investigating canvas paintings, violin bows, mummies, wall paintings etc. with the most advanced mobile NMR equipment. Technical insights on the practical use of the NMR-MOUSE (MObile Universal Surface Explore) device and related data processing were provided. Training materials have been produced for use in the educational course.

· Training on *advanced laser-based techniques* in art conservation, diagnostics and analysis (Heraklion, GR 18–22 June 2012). To provide an intensive, high-level training

course to scientists and technicians on the fundamentals and applications of laser-based technologies used in art conservation, diagnostics and analysis. The following topics were identified: analytical laser spectroscopy (LIBS, LIF, Raman, THz); laser restoration: methodologies and real-case interventions; optical coherence metrology in structural diagnosis; and imaging and mapping: spectral and non-linear microscopy imaging.

· Training on *application of Optical Coherence Tomography* (OCT) to structural analysis. (27–28 June 2013, Torun, PL). The course was structured as lectures combined with hands-on sessions. Topics regarded traditional and innovative applications of OCT in archaeometry and conservation such as easel paintings, Chinese glaze, faience, historic wood, historic glass and reverse painting of glass. Hands-on training was carried out on easel paintings, jade and porcelain, and stained glass.

· Training on *spectroscopic techniques (invasive and non invasive)* (27–29 June 2010, Ravenna, IT). Lectures combined with hands-on sessions on the role of spectroscopic techniques (XPS-SIMS, portable NMR, XRF-XRD, LIBS, μ-FTIR, μ-Raman, and others), concerning paintings, metal artefacts, mosaics, ceramics, and glasses. A methodology of use of a sequence of different analytical techniques was applied to a real case study (series of paper painted mosaic replicas).

· Training on the *technology of lakes preparation and dyeing textiles* from botanical/animal source dyestuffs. (22-23 March 2011 Munich, DE; 30 November – 2 December, 2011, Brussels, BE). The first course “Back to the Roots - Preparation of Historical Lake Pigments” to better understanding of the nature, preparation, and use of historical lake pigments, relevant for paintings and polychromies. Participants learned to prepare lake pigments from selected red and yellow dyestuffs (madder, brazilwood, cochineal, lac dye, weld and Persian berries) according to historical recipes. Practical experiments were accompanied by theoretical presentations on the historical background of lake pigments, case studies, as well as chemistry and analytical identification of these pigments. In the second event “Dyeing with Natural Organic Colorants” the type and use of natural organic dyes for textile dyeing in preindustrial times, as well to provide a deep knowledge about the interpretation of historical recipes and practical dyeing technology was discussed.

· Training on *stone conservation* (7-18 May 2012, Lisbon, PT; 10-21 September 2012, Torun, PL; 27 May - 7 June 2013, Amsterdam, NL). The training scheme of lecture’s main topics was stone artifact’s characterisation, their deterioration phenomena devising also suitable conservation methodologies, according to the modern conservation concepts based on diagnostics and innovative materials. Special insights were dedicated to the role of water and acid rains in the deterioration mechanisms of outdoor stone artifacts, as well as to the various aspects of biodeterioration. Restoration and maintenance strategies using the most advanced intervention techniques were extensively treated. Besides the presentations, visits to case studies were also organized.

- *Oriented topic events*

The events were an opportunity to share and compare the results obtained by the European scientific community on focused priority areas, such as the advances in a specific analytical field (techniques applied on different materials and objects). Novel methods for sampling/sample preparation; foresight studies for new instrumentation and technologies; approaches to studies of groups of objects relating to one period / one style / one (painter) artist/ one (painting) technique.

· *Caravaggio’s Painting Technique* at OPD (17 September 2010, Firenze, IT) on the fourth centenary of the death of Caravaggio and coinciding with the exhibition "Caravaggio e caravaggeschi a Firenze" (22 May – 17 October 2010). The latest scientific studies of paintings by Caravaggio were presented to a wide international audience. Relevant aspects of recent restorations, new findings on materials and techniques, and general observations on the applied scientific methodologies were discussed.

Proceedings published: M. Ciatti, B.G. Brunetti (Eds.) Caravaggio's painting technique, Nardini Editore. ISSN: 2036-1122. ISBN: 978-88-404-4344-7.

· *Leonardo da Vinci's Technical Practice* at NGL (13-14 January 2012 London, UK). Coinciding with the exhibition "Leonardo da Vinci. Painter at the Court of Milan" at the National Gallery and organised by NGL, C2RMF and BM.

Over 300 specialists in conservation science, technical imaging, art history and curatorship, as well as invited students, attended the presentations over 2 days by world experts in Leonardo technical studies.

The cross-disciplinary audience heard comprehensive studies of materials/techniques, integrated with art-historical research, including new outstanding discoveries on the practice of painters in the workshops of the Italian Renaissance. It was also an opportunity to assess latest practice in examination of paintings and drawings.

Proceedings published M. Menu (Ed), Leonardo da Vinci's Technical Practice, Hermann. ISBN: 9782705684556.

'Fig. 4.5.1 The Proceeding covers or posters of CHARISMA Workshops: 'Caravaggio's Painting Technique'; 'Leonardo da Vinci's Technical Practice'; 'The Renaissance Workshop'; 'New techniques for the non-invasive investigation of the surface and subsurface structure'; 'Experience, Research and Innovation, A Research Infrastructure Platform for Cultural heritage Conservation and Restoration'

· *New techniques for the non-invasive investigation of the surface and subsurface structure of heritage objects* at NCU (25–26 June 2013, Torun PL).

The core topic was the latest developments and practical applications of non-invasive techniques to investigate the surface and sub-surface structures of cultural heritage objects. The lectures focused on the application of optical coherence tomography, terahertz spectroscopy and imaging, combined time-resolved and steady-state fluorimetry, single-sided NMR tomography and IR scanning confocal microscopy.

The workshop gathered 81 participants (researchers, scientists, conservator-restorers, art historians, and archaeologists).

· T*he Renaissance Workshop: Material and Techniques of Renaissance Art* at BM (10–11 May 2012, London, UK). The workshop aimed at exploring how technical examination of Renaissance artefacts can shed light on their materials and manufacturing techniques, as well as on the prevailing European workshop practice in the fourteenth to sixteenth centuries.

260 participants included art historians, curators, conservators and scientists from universities, national research agencies, museums and private companies attended the workshop.

Proceedings published D. Saunders, M. Spring, A. Meek (Eds), The Renaissance Workshop: The Materials and Techniques of Renaissance Art, Archetype. ISBN: 9781904982937.

- *Foresight events*

Two other public events on foresight heritage sciences on “new instrumentation/ technologies” for conservation and on advanced studies of “materials and techniques” along the history of art (paintings, sculptures, ceramics, glasses, etc.) for the identification of future trends, and to promote the new applications of innovative instrumentation and methodologies studies, were also planned and held. The choice of the most promising topics were originated by proposals related to the technologies and their applications to CHARISMA activities and results.

· Workshop on ‘*Diagnostics in Cultural Heritage*’ at the Accademia dei Lincei (17-19 November 2011, Rome, IT) dedicated to the presentation and discussion of the most advanced experimental devices and methodologies for the study and monitoring of artworks. The event was also part of the initiatives of the International Year of Chemistry 2011 (IYC 2011) and was co-organised with the Accademia dei Lincei. The programme included diagnostics in ancient, modern and contemporary art, diagnostics in conservation of books and diagnostics for the study and conservation of archaeological heritage. A final session was devoted to the demonstration of applications of the portable non-invasive tools used within MOLAB, with open discussion on their performances.

The workshop registered 91 participants, mostly from universities, national research agencies, institutions of the ministry of culture, and private companies of diagnostics and restoration, including art-historians, conservators-restorers, scientists, journalists, and also public.

· ‘*Experience, Research and Innovation: A Research Infrastructure Platform for Cultural heritage Conservation and Restoration*’ - CHARISMA Final Event. (4-5 March 2014, Firenze, IT)

The organisation of the CHARISMA Final Event, led by UNIPG, APRE, and CNR-IFAC, was developed in collaboration with all partners. The event was hosted by OPD, while all the WP Leaders were involved in presenting results and chairing the various sessions, as well as in the preparation of 20 posters illustrating the activities and the main results of the project. Demonstration stands were also organised by Task Leaders.

Main aim was the presentation of the activities and results of CHARISMA by emphasising the achievement of significant innovation in the heritage study and conservation, along with the disclosure of new research perspectives.

Fig. 4.5.2 Lecture’ sessions and Demonstration stands at the CHARISMA Final event (© OPD, Photos by P. Zicarelli).

The program included presentations in the Sant’Apollonia Auditorium, along with posters, bookstands, and videos’ exhibitions in the adjacent rooms, open during the whole event. Furthermore, visits to a series of stands set up at the OPD laboratories in Fortezza da Basso were also foreseen.

These stands were specifically dedicated to the demonstration of performances of the instrumentations and methodologies developed within the joint research programme of the project, as: THz imaging, portable Optical Coherent Tomography, NMR-MOUSE depth-profiling, Optical Fiber Fluorescence/Absorption triple spectrometry, Optical Coherent Interferometry, FT-IR Imaging, and Laser Cleaning.

The persons in charge of the research introduced the instruments, then demonstrations were carried out on the outstanding artworks currently in restoration at the Opificio delle Pietre Dure.

- *Trade Events & Exhibitions*

Following specific invitations, CHARISMA presented the first WP9 prototypes and other project results in a comprehensive way at public events, increasing the potential for the uptake of the results.

Fig. 4.5.3 The CHARISMA Stand at the 8th Biennial of Heritage Restoration and Management, Valladolid, ES (2012)

A professional stand equipped with optical windows at the *Science Festival*, held in Genova, IT, on 27 Oct- 7 Nov. 2010, was dedicated to the public demonstration of project laser cleaning activities managed by CNR-IFAC

A CHARISMA stand was also arranged by UNIPG, NCU and APRE, at the *AR&PA Innovation* initiative of the 8th Biennial of Heritage Restoration and Management (AR&PA Biennial), held in Valladolid, ES, on May 24-27, 2012. The exhibition was organised by the Spanish Castilla & León Regional Authority, in close liaison with the European Commission and Labein-Tecnalia Research Centre and with the support of UNESCO.

All these initiatives were substantial occasions to give positive hints to the research of young and senior scientists and to the diffusion of good analytical practices and common strategies. In addition, exchange of visits among consortium partners and permanence of researchers in participating institutions have been put in action under the supervision of the SC, for variable periods.

Summarising, the main activities of the networking WPs were:

· Defining the term dissemination, within the project context, stressing out the significant importance of this activity particularly to reach the project aims;

· Producing and defining the most effective works and materials for the dissemination that are best suited for the planned goals, target groups and deliverables;

· Defining the term exploitation, within the project context, to take full advantage of the consortium at the whole;

· Identifying the project purposes, the internal and external available results, both from the project context, and from the single work-packages in order to make clear to internal members and potential interested parties and collaborators what can be exploited and in which way;

· Defining the potential external stakeholders of the project in terms of target communities, giving a clear vision of the audience for dissemination and exploitation activities;

· Capitalizing on existing collaborations and liaisons with established networks of higher cultural institutions or professional renamed associations as well as wider Cultural Heritage environment.

4.6 CHARISMA visual identity

- *The project logo*

The project logo has been designed by UNIPG with the support of the APRE graphics group exploiting a fresco of Piero della Francesca. To create a strong CHARISMA community identity and brand, all dissemination material, web, video, leaflets, deliverables doc, etc. was designed to be consistent with the adopted CHARISMA logo.

It has been used the slides model, that was exploited in the material distributed during scientific meeting and conferences at national, European and international level.

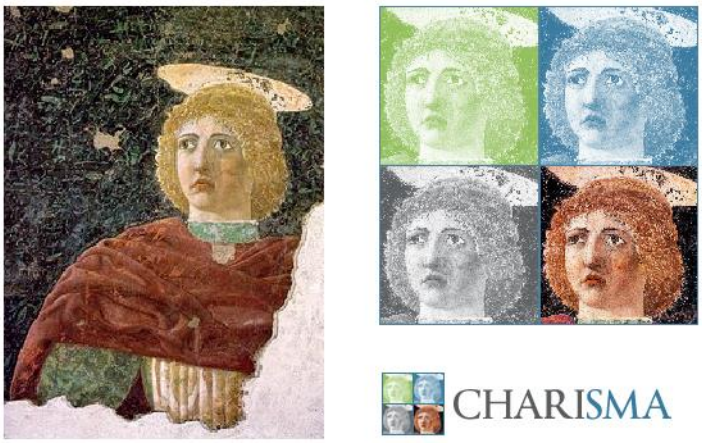


Fig. 4.6.1 The fresco shows a young haloed figure, identified as San Giuliano. The fresco found on 23rd December 1954 in Sansepolcro near the old Church of Sant'Agostino. (Sansepolcro, IT, Civic Museum).

The 'CHARISMA style' was then adopted by the Editor-Working Group (Editor-WG) for flyers, presentations etc., and published on line through the web (Intranet) to help consortium members in giving the project a stable image.

- *Diffusion materials*

Fig. 4.6.2 CHARISMA Leaflet and Communication materials; CHARISMA Final event Agenda.

Fig. 4.6.3 From the left, the 1st Users' meeting program, the folder of EU Workshop on Research Infrastructures for Cultural Heritage and Global Change, Brussels and one project' poster.

Fig. 4.6.4 CHARISMA Final event leaflet and Roll-up, Firenze, It

- *CHARISMA videos*

For the occasion of EU Workshop on Research Infrastructures (March 2012) a CHARISMA dissemination video produced by APRE and UNIPG examining the material received by project's partners, was appreciated and presented for the first time.

Fig. 4.6.5 The CHARISMA video (2012)

The movie, available on the Project web site (http://www.charismaproject.eu/), also published on YouTube (https://www.youtube.com/watch?v=_MhAwxoi1zw), provides a general overview of the project's support, coordination and joint research activities, and focuses the Transnational Access opportunities and the facilities involved.

The TV magazine of the European Commission, FUTURIS, introducing EU Research Projects, broadcast in seven languages and available to European and International audiences for 20 times a week (102 countries worldwide – including Japan), has dedicated (04/11/2013) a specific movie to CHARISMA activities, entitled 'Art detectives team up'.

The video included short interviews with the Coordinator, the WP7 Leader, and some transnational access user's group leaders.

The project coordinator, explained how the technology helps artists: "New advanced technology allows us to dig really deep into the nature of art objects. We can understand its structure, the evolution of the creative process used by the artist. We can also get new information about when the work of art was created. And all this with an accuracy we couldn't even begin to imagine before now." Fixed research facilities are often too big to relocate. When they are, it is up to the art to go on the move.

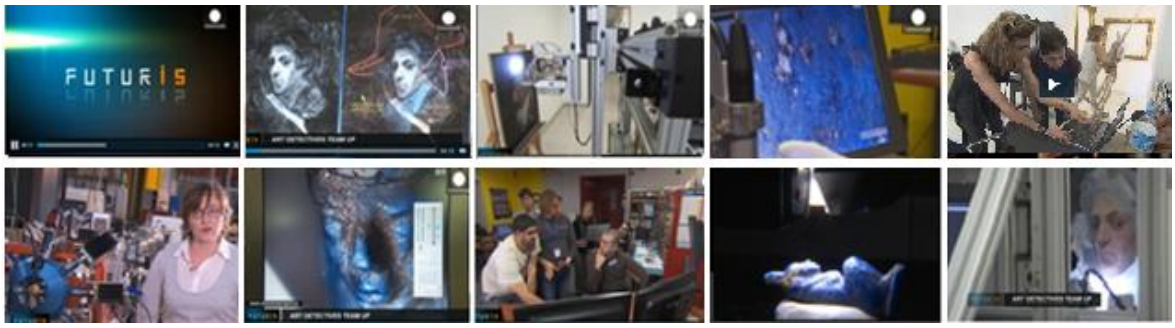


Fig. 4.6-6 The FUTURIS CHARISMA video (2013)

The WP7 Leader scientist at C2RMF, emphasised the importance of host institutions getting everything right: "Hosting European researchers means that they travel here with their works of art. Sometimes the transportation prices and cost of insurance are breath-taking. So we, as host institutions, can't let anything go wrong. We can't afford to start organising such a huge effort and not deliver because of a technical failure." The objects are placed on an unique particle accelerator, devoted exclusively to the study of works of art. The French hosts need to make sure everything is ready for their European colleagues.

The movie is visible at the following link: http://www.euronews.com/2013/11/04/art-detectives-team-up/ .

- *Press and broadcasting*

During the project life press and TV most significant interests were the following:

DE VOLKSRANT

The newspaper offers daily, national, and world news in The Nederlands, as well as weather, sports, entertainment, business, and travel coverage. http://www.volkskrant.nl/
Issue of September 26th 2009: an article/interview of M. van Bommel (OCW-RCE, former ICN).


Page trois

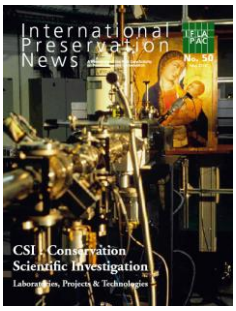
Une partie d'un butin d'or et d'argent du VII^e siècle découvert dans un champ anglais est actuellement analysée dans les sous-sols du Louvre. Visite privée

Le trésor des « âges sombres »

LE MONDE

The most diffused newspaper in France.
Issue of December 4th 2010: an article was dedicated to the excellent results obtained through the FIXLAB (AGLAE) transnational access on gold and garnet objects of the Staffordshire Treasure, a regal treasure the VII century, outstanding British archaeological discovery of 2009.

INTERNATIONAL PRESERVATION NEWS



The review (ISSN 0890 - 4960) is a publication of the International Federation of Library Associations and Institutions (IFLA) Core Activity on Preservation and Conservation (PAC) that reports on the preservation activities and events that support efforts to preserve materials in the world's libraries and archives. The Editor is IFLA-PAC, at the Bibliothèque Nationale de France, Paris, FR.
An article dedicated to CHARISMA and MOLAB activities has been published in the issue n. 50 of May 2010; in the article *New Synergies for a Multidisciplinary Approach to Conservation: MOLAB Activities within CHARISMA* the Coordinator presented the project and MOLAB activities as initiatives aiming to create a solid base for outstanding innovation in the capacity-building policies of science and technology for the safeguard and protection of the European cultural heritage.
http://www.ifla.org/files/pac/ipn/50-may-2010.pdf . An image of the AGLAE laboratory is in the cover of the special issue.

CHEMICAL & ENGINEERING NEWS

A weekly magazine published and diffused allover the world by the American Chemical Society, with large diffusion in Europe, U.S., and Asia. C&EN editors and reporters cover science and technology, business and industry, government and policy, education, and employment aspects of the chemistry field.
In the Vol. 88, Issue 38, of 20 September 2010, a full article entitled "*Drive-by Conservation*" was dedicated to the scientific non-invasive examination during the HOPPA Access Project carried out by a French users' group (UGL: Roland May) through MOLAB-UNIPG at the Picasso Museum in Antibes, FR.

WIRED IT

The Italian edition of the US review that deals with technology and how it influences the culture, economy, politics and daily-life.
Issue of February 8th 2011: an article entitled "*Micro-restauri per grandi capolavori*" describes the activity of MOLAB in Italy and Europe.

KERMES

A popular Italian quarterly review dedicated to conservation and restoration, largely diffused in the world among conservator-restorers.
Issue of October 2010: a chronicle is given on the MOLAB intervention at the Picasso Museum of Antibes, FR

TV SLOVENIJA 1

The most important domestic public service broadcast channel of Slovenian TV.
Two TV reports were given within the transmission "Kultura ob 22h" on the MOLAB interventions in Ljubljana, SL, by UNIPG and CNRS-LC2RMF (Project CARPACCIO-II) for the study of paintings of Carpaccio : 1- http://tvslo.si/#ava2.88954754 (UNIPG) [third report in the news]; 2- http://tvslo.si/#ava2.97150655 (CNRS-LC2RMF) [first report].

THE NATIONAL GEOGRAPHIC CHANNEL

The channel produced three documentaries relating to the discovery and conservation, together with the research on the Staffordshire Hoard, undertaken at AGLAE through FIXLAB (Project STASH1 and STASH2),

E-CONSERVATION MAGAZINE

In the on-line conservation journal, Issue No. 19 (2011) pp. 21-24, the article *'Back to the Roots' - Workshop on the Preparation of Historical Lake Pigments'* by M. Griesser described the CHARISMA "'Back to the Roots' last Workshop. Available at http://www.e-conservationline.com/content/view/993.

C&EN CHEMICAL & ENGINEERING NEWS

The weekly magazine published by the American Chemical Society, with diffusion in Europe, U.S., and Asia (covering science and technology, business and industry, government and policy, education, and employment aspects of the chemistry field).
http://pubs.acs.org/cen/about/ ,
The magazine published news on 4 of the MOLAB interventions of the period in the C&EN Blog (News, notes, and musings from C&EN) C&ENtral Science – Artful Science.
Titles of the articles and related projects are:
Vincent Van Gogh's Last Months, July 6th 2011 (Project VANGOGH)
Rare Aztec Document Gets A Check-Up , March 15th, 2012 (Project FEJERVARY)
http://cenblog.org/artful-science/2012/03/15/rare-aztec-document-gets-a-check-up/
Finding The Culprit For Van Gogh's Darkening Yellows, March 15th, 2012 (Project YELLOW)
Think You Can Identify A Van Eyck?, February 15th, 2012 (Project VAN EYCK)
http://cenblog.org/artful-science/2012/02/15/think-you-can-identify-a-van-eyck/

E-CONSERVATION MAGAZINE

In the on-line Issue n.23 (2012) Anna Karatzani, wrote a review of *Back to the Roots - Workshop on Textile Dyeing with Natural Dyes*, organised by KIK-IRPA. Downloadable at http://www.e-conservationline.com/content/view/1051/
In the on-line conservation journal, issue n.24 (2012) pp. 9-14, the article *The Renaissance Workshop: The Materials and Techniques of Renaissance Art'* by H. Glanville described the CHARISMA last workshop. Available at http://www.e-conservationline.com/content/view/1087 .

EL PAIS, Andalucía

The most diffused newspaper in Spain.

Issue of May 30th 2012: an article was dedicated to the excellent first findings obtained through the MOLAB transnational access (ALCÁZART project) measurements in different parts of the Alcazar Palace including wall paintings and ceramic tiles from various epochs:
"Investigadores del Louvre trabajan en el Real Alcazar analizando azulejos y frescos

RTVE RADIO Y TELEVISIÓN ESPAÑOLA, S.A.

Interest was manifested by the RTVE that broadcasted a national report on the MOLAB intervention in Merida in occasion of the study of the effects of conservation and restoration treatments on the porous lapideous materials of the Roman Theatre and House of Mitreo in the city of Merida, ES. RTVE is the largest audiovisual group in Spain broadcasting in the Spanish language. The service is visible at the following link:
http://www.rtve.es/alacarta/videos/telediario/tecnologia-valioso-aliado-restauracion/2494132/

EUROPE IN THE UK

The on-line magazine that provides a gateway to European information for the UK regions (covering culture, science and technology, government and policy and education).
The magazine published on 17 January 2013, an article 'The CHARISMA Project' by Michael Prodger with the D. David Saunders (BM) interview about the objectives and the significance of most promising activities.
http://www.europe.org.uk/2013/01/17/the-charisma-project/ ,

TVN (TV NOWA) POLISH TELEVISION NETWORK POLAND

The nationwide commercial Polish television network produced a short program on visit of NCU CHARISMA team to OPD in 2102 for examination with the OCT instrument of famous Adoration of the Magi panel painting by Leonardo da Vinci. The production includes interviews with some OPD scientists', including the Soprintendente, http://dziendobry.tvn.pl/wideo,2064,n/leonardo-da-vinci-pod-lupa-polakow,38132.html, HU

INDEX Magazine

The on-line magazine covering culture, science and technology, policy and sport, published on 20 June 2013 the article *Ancient secrets have been revealed by Hungarian scientists* on the BNC CHARISMA activities. The article is available at:
http://index.hu/tudomany/2013/06/20/magyar_kutatok_oldjak_meg_az_okori_rejtelyeket/

KOSSUTH RÁDIÓ, HUNGARY

The national radio station of Hungary produced some radio-interviews (2013) about the project with the staff of the Nuclear Analysis and Radiography Department, HU.

5. The project website

One of the first achievements of CHARISMA was the establishment of a website (http://www.charismaproject.eu) with both a public as well as a restricted section. In order to maximize the effectiveness of the communication flow, to the CHARISMA Website has been given a flexible, networked structure.

The website was based on a freely available content management system (CMS), Umbraco open-source, in full compliance with the W3C web standards. It allowed the coordinator and WP Leaders (i.e. the Steering Committee) to edit and update directly the content.

The project participants suggested how to adjourn it with up-to-date information about ongoing activities and results (deliverables, publications, relevant events, news, etc.). The website URL was connected to the main search engines and directories on the web (i.e. Google, AltaVista, Yahoo, and so on). All beneficiries contributed by providing images (big images) for the development of the home and following pages.

5.1 Public web pages

The public part, with open access from the home page through specific tool buttons, included an overview of the project; the list of the facilities giving access; the consortium partners with contact information; the composition of the Steering Committee (Contacts) providing name, address and email address; the announcement the access calls; the relevant public news and events, such as scientific conferences, and the press releases, which may have been of interest for project participants.

Fig. 5.1.1 CHARISMA public web: the Joint research activities pages (left) and the Transnational programs welcome desk pages

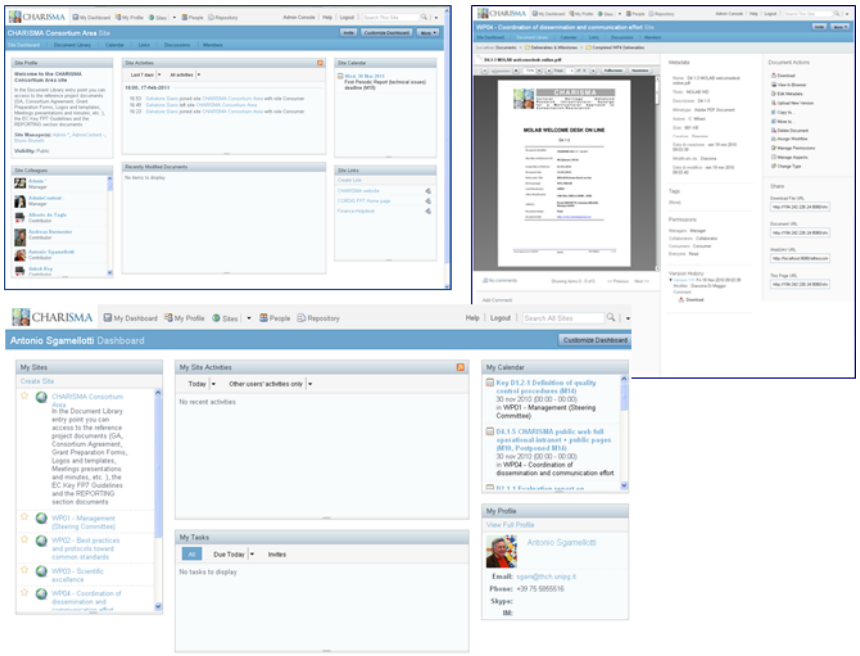
All web pages and documents provided within the public website used the agreed *corporate identity* of the project. Within this scheme, each WP Leader was allowed to develop an individual web page describing the project activities on her/his WP web pages.

5.2 Restricted sections

A protected Consortium´s area was used (limited login) for internal, confidential communication enabling interaction between CHARISMA members on the activities of the project. A document sharing application has been developed, offering a useful platform to partners to share documents and files. Useful documents will be stored as well (templates, EC guidelines, reporting tools and guidance, etc.) on Document Library. An ad hoc access has been provided by using usernames and passwords. The Intranet was structured on different interlinked sites:

· The principal one, the CHARISMA Consortium Area Site, mainly used as documents archive and managed by the Coordinator and accessible by all participants (the Governing Board and Steering Committee members and Team Leaders). Not only official documents of the project like Grant Agreement, Consortium Agreement, GPF etc. but also relevant material as Guidelines, Project Logos and Templates, CHARISMA Meetings (Agenda, Minute, Presentations, etc.), were available.

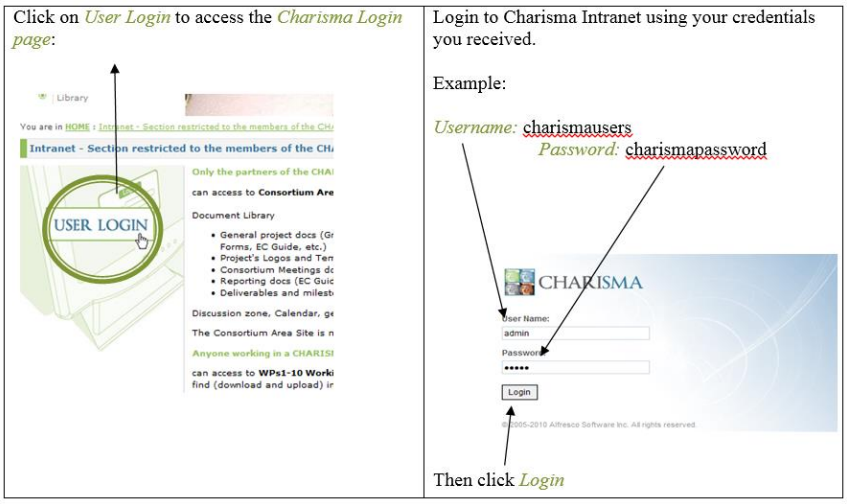
The specific Section called *Reporting* was used by all participants, permitting everyone to contribute to the preparation of Periodic Reports avoiding e-mail exchange and overloading. It was a general principle that documents should rather be uploaded and then announced by e-mail.



5.2.1 CHARISMA Intranet applications: Consortium area, the Personal Dashboard, the Consortium shared docs, etc.)

· The *WP1-10 Sites* were used as autonomous working areas; each WP site was managed by the respective WP Leader and restricted to the specific WP participants, although the WP Leader had the possibility to invite additional members. The *My Sites* personal box, listed all sites of which the user was member, providing quick access to each of them.

· A short guide also produced intends help the CHARISMA People to facilitate a quick *Start for easy* internal Sites navigation.



5.2.2 CHARISMA Intranet Short - guide:

5.3 Address and contact details

- *Address*

The CHARISMA website can be found at the following link:

http://www.charismaproject.eu/

- *Contacts*

The website, as a dissemination and communication efforts activity (WP4), is co-ordinated by APRE.

WP4 Leader:

Diassina Di Maggio APRE Director Agenzia per la promozione della Ricerca Europea Via Cavour, 71 - 00184 Roma, Italy - www.apre.it Phone +39 06) 489 399 93 /Fax +39 (0) 06 489 025 50 E-Mail e-mail: segreteria@apre.it ; charisma@apre.it

USE AND DISSEMINATION OF FOREGROUND

6. Measures for use and dissemination of results

6.1 Project Consortium agreement rules and Confidentiality

At the time where museums everywhere are grappling with what is culturally appropriate for data sharing, access to collections and reciprocal agreements, intellectual property (IP) appears as a guarantee of success for the scientific knowledge management. Despite the fact that IP claims surrounding CH issues can engender exclusionary practices, or unjustifiable restrictions or knowledge flows, concerns over sharing the benefits of research and unauthorised or commercial exploitation of knowledge, images, stories and designs will persist and fuel debates.

The vast implication and repercussions of increased flows of ideas and information in our increasingly global and digital knowledge economy is of concern to the CHARISMA partners especially because IP issues arise between researchers and institutions or among stakeholders and information gatekeepers at the intersection of public domain, cultural knowledge and research.

There is clearly much at stake regarding: i) open scientific knowledge vs ownership of knowledge; ii) restrictive vs inclusive modes of resolution; iii) rights of knowledge holders vs knowledge users; iv) legal definition vs customary definition of IP as well as the legal challenges of new technologies such as digital repositories.

In this context CHARISMA partners are particularly concerned with the practical implications of flows, restrictions and appropriations of knowledge about the data handling, how these affect their access to researchers and other stakeholders, how they are defined and used and how fair and appropriate use and access can be achieved to benefit of all stakeholders.

In addition to this awareness solicitation, the CHARISMA IP rules that have been prepared down within the Consortium Agreement, retained fundamental procedures associated to specific ones regarding confidentiality, ownership and exploitation of knowledge, as well as results and exploitation of results and copyrights.

In developing and executing the WP8, WP9 and WP10 joint research activities, it is critical to understand the role of intellectual property and its possible impact on research and technology obtained, for a subsequent adaptation and/or further development. The principal quandary is to ensure that research innovations are issued in a timely manner and that promising directions for use are identified swiftly.

In this context, the publication of scientific results originating from the joint actions of the consortium have been made as per the usual custom and practice of the CH scientific community, with the prior consent of all laboratories having contributed to results. All publications borne the statement: “The research leading to these results is partly funded by the EU Community's FP7 Research Infrastructures programme under the CHARISMA Project (Grant Agreement 228330)”.

WP9 and WP10 research plan was the most sensitive, considering the expected new technology instrumentations. In Plan of use and dissemination the possibility to transfer the technology (‘Products’, ‘Methods’ and ‘Experiences’) to ultimate users, i.e. to instrument’ producers, has been considered following the guidance IP rules set out in the Consortium Agreement.

The users benefiting of access activities were also subject to IPs local rules of the partnership holder of the CHARISMA open facilities. In planning and conducting WP5 access activities - in which a massive pre-existing knowledge data owned and often not

protected by the host Institution were open to CH professional communities - several well-known IP key points were examined and taken into account, including, among others, the confidentiality of information, the proprietary nature of materials, the property issues associated with the collaborations processes (user/host institution), and/or the research tools.

The Consortium Agreement rules prevented the confidential information and data and a specific NDA (Non-Disclosure Agreement) was envisaged for the visits' scientist analysing scientific data not already published.

6.2 Project output and outreach

- *Scientific publications relating to the activity of the project*

The following cumulative tables show all publications and dissemination actions from the beginning until after the end of the project, thus demonstrating the added-value and positive impact of the project.

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6.2.1 Peer reviewed publications

Table 4 Scientific (peer reviewed) publications, starting with the most important ones (2009-2014)

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
01	*Recent Studies of Laser Science in Paintings Conservation and Research 10.1021/ar900 224n*	*P.Pouli et al.*	*Accounts of Chemical Research*	*Vol. 43 Issue 6*	*ACS Publishing*	*United States*	*15/06/2010*	*771-781*		*Peer reviewed*
02	*Scanning Multispectra l IR Reflectograph y SMIRR: An Advanced Tool for Art Di agnostics 10.1021/ar900 268t*	*C.Daffara et al.*	*Accounts of Chemical Research*	*Vol. 43 Issue 6*	*ACS Publishing*	*United States*	*01/06/2010*	*847–856*	Yes	*Peer reviewed*
03	*Development and trends in synchrotron studies of ancient and historical materials 10.1016/j.phy srep.2012.03.003*	*L. Bertrand et al.*	*Physics Reports*	*Vol. 519/I ssu e 2*	*Elsevier BV*	*Netherlands*	*01/10/2012*	*51-96*		*Peer reviewed*
04	*In Situ Non-invasive Study of Artworks: The MOLAB Multitechniq ue Approach 10.1021/ar100 010t*	*C.Miliani et al.*	*Accounts of Chemical Research*	*Vol. 43 Issue 6*	*American Chemical Society Publications*	*United States*	*01/06/2010*	*728–738*	Yes	*Peer reviewed*
05	*5,000 years old Egyptian iron beads made from hammered meteoritic iron 10.1016/j.jas .2013.06.002*	*Thi.Rehren et al.*	*Journal of Archaeological Science*	*Vol. 40 Issue 12*	*Academic Press Inc.*	*United States*	*01/12/2013*	*4785-4792*		*Peer reviewed*
06	*Optical Coherence Tomography: its role in the non-invasive structural examination and conservation of cultural heritage objects—a review 10.1007/s0033 9-011-6687-3*	*P. Targowski et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 106*	*Springer*	*Germany*	*26/10/2011*	*265–277*	Yes	*Peer reviewed*
07	*Terahertz deconvolution 10.1364/OE.20 .027230*	*G.C. Walker et al.*	*Optics Express*	*Vol. 20 Issue 25*	*Optical Society of America*	*United States*	*01/01/2012*	*27230*		*Peer reviewed*
08	*Noninvasive Testing of Art and Cultural Heritage by Mobile NMR 10.1021/ar900 277h*	*B.Blumich et al.*	*Accounts of Chemical Research*	*Vol. 43 Issue 6*	*ACS Publishing*	*United States*	*01/06/2010*	*761–770*	Yes	*Peer reviewed*
09	*Advances in Laser Cleaning of Artwork an d Objects of Historical Interest: The Optimized Pulse Duration Approach 10.1021/ar900 190f*	*S.Siano, et al.*	*Accounts of Chemical Research*	*Vol. 43 Issue 6*	*ACS Publishing*	*United States*	*15/06/2010*	*739-750*	No	*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
10	*Analytical investigation on Renaissance Venetian enamelled glasses from the Louvre collections 10.1016/j.jas .2012.03.014*	*I.Biron et al.*	*Journal of Archaeological Science*	*Vol. 39 Issue 8*	*Academic Press Inc.*	*United States*	*01/08/2012*	*2706-2713*		*Peer reviewed*
11	*Micro-PIXE Geochemical Fingerprinting of Nephrite Neolithic Artifacts from South west Bulgaria 10.1002/gea.2 1417*	*R.I. Kostov et al.*	*Geoarchaeology an International Journal*	*Vol. 27*	*Wiley-Blackwell Publishing*	*United Kingdom*	*16/07/2012*	*457–469*	Yes	*Peer reviewed*
12	*Fluorescence Spectroscopy: A Powerful Technique for the Noninvasive Characterization of Artwork 10.1021/ar900 291y*	*A. Romani, et al.*	*Accounts of Chemical Research*	*Vol. 43, Issue 6*	*ACS Publishing*	*United States*	*15/06/2010*	*837-846*		*Peer reviewed*
13	*Portuguese tin-glazed earthenware from the 16th century: A spectroscopic characterization of pigments, glazes and pastes 10.1016/j.aps usc.2013.08.016*	*L.F. Vieira Ferreira*	*Applied Surface Science*	*Vol. 285*	*Elsevier BV*	*Netherlands*	*01/11/2013*	*144-152*		*Peer reviewed*
14	*New Advances in the Application of FTIR Microscopy and Spectroscopy for the Characterization of Artistic Materials 10.1021/ar900 274f*	*S. Prati et al.*	*Accounts of Chemical Research*	*Vol. 43, Issue 6*	*ACS Publishing*	*United States*	*15/06/2010*	*792-801*		*Peer reviewed*
15	*Material Aspects of Icons. A Review on Physicochemical Studies of Greek Icons 10.1021/ar100 0082*	*S.Sotiropoulo et al.*	*Accounts of Chemical Research*	*Vol. 43, Issue 6*	*ACS Publishing*	*United States*	*15/06/2010*	*877-887*		*Peer reviewed*
16	*From Greek Boar's-Tusk Helmets to the First European Metal Helmets: New App roaches on Development and Chronology 10.1111/ojoa. 12021*	*M. Mödlinger et al.*	*Oxford Journal of Archaeology*	*Vol. 32/Is sue 4*	*Wiley-Blackwell Publishing*	*United Kingdom*	*01/11/2013*	*391-412*		*Peer reviewed*
17	*Immunodetection of Proteins in Ancient Paint Media 10.1021/ar900 279d*	*L. Cartechini et al.*	*Accounts of Chemical Research*	*Vol. 43, Issue 6*	*ACS Publishing*	*United States*	*15/06/2010*	*867-876*		*Peer reviewed*
18	*Degradation Process of Lead Chromate in Paintings by Vincent van Gogh Studied by Means of Spectromicroscopic Methods. Part III Synthesis, Characterization, and Detection of Different Crystal Forms of the Chrome Yellow Pigment*	*L. Monico et al.*	*Analytical Chemistry*	*Vol. 85, Issue 2,*	*ACS Publishing*	*United States*	*10/10/2012*	*851–859*	Yes	*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
	dx.doi.org/10 .1021/ac302158b									
19	*Computational Chemistry Meets Cultural Heritage: Challenges and Perspectives 10.1021/ar100 012b*	*S. Fantacci et al.*	*Accounts of Chemical Research*	*Vol. 43 Issue 6*	*American Chemical Society*	*United States*	*15/06/2010*	*802-813*		*Peer reviewed*
20	*Application of Microfocus X-Ray Beams from Synchrotrons in Heritage Conservation 10.1080/15583 058.2010.528825*	*A.V. Chadwick et al.*	*International Journal of Architectural Heritage*	*Vol. 6 Issue 2*	*Routledge*	*United Kingdom*	*01/03/2012*	*228-258*		*Peer reviewed*
21	*Alternative SERRS probes for the immunochemical localization of ovalbumin in paintings: an approach 10.1039/C3AN0 0057E advanced mapping detection*	*G. Sciutto et al.*	*Analyst Publishing*	*Vol. 138 Issue 16*	*Royal Society of Chemistry*	*United Kingdom*	*01/01/2013*	*4532*		*Peer reviewed*
22	*The Degradation Process of Lead Chromate in paintings by Vincent van Gogh studied by means of Spectromicroscopic methods. Part IV: Artificial Aging of Model Samples of Co-Precipitates of Lead Chromate and Lead Sulfate dx.doi.org/10 .1021/ac3021592*	*L. Monico et al..*	*Analytical Chemistry*	*Vol. 85, Issue 2,*	*ACS Publishing*	*United States*	*10/10/2012*	*860–867*	Yes	*Peer reviewed*
23	*An advanced multivariate approach for processing XRF spectral and hyperspectral data from non-invasive in situ analyses on painted surfaces 10.1016/j.aca.2012.09.03*	*G. Sciutto et al.*	*Analytica Chimica Acta*	*Vol. 752*	*Elsevier Science BV*	*Netherlands*	*02/10/2012*	*30-38*	Yes	*Peer reviewed*
24	*Why does Prussian blue fade? Understanding the role(s) of the substrate 10.1039/C3JA5 0025J*	*C.Gervais et al.*	*Journal of Analytical Atomic Spectrometry*	*Vol. 28 Issue 10*	*Royal Society of Chemistry*	*United Kingdom*	*01/01/2013*	*1600*		*Peer reviewed*
25	*Localization of proteins in paint cross-sections by scanning electrochemical microscopy as an alternative immunochemical detection technique 10.1016/j.aca .2014.04.058*	*G.Sciutto et al.*	*Analytica Chimica Acta*	*Vol. 831*	*Elsevier BV*	*Netherlands*	*01/06/2014*	*31-37*		*Peer reviewed*
26	*Sub-surface terahertz imaging through un even surfaces: visualizing Neolithic wall paintings in Çatalhöyük*	*G.C. Walker et al.*	*Optics Express*	*Vol. 21 Issue 7*	*Optical Society of America*	*United States*	*01/01/2013*	*8126*		*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
	10.1364/OE.21 .008126									
27	*Application of ATR-far-infrared spectroscopy to the analysis of natural resins http://link.s pringer.com/article/ 10.10 07/s00216-010-4388-y*	*S. Prati et al.*	*Analytical and Bioanalytical Chemistry*	*Vol. 399 Issue 9*	*Springer*	*Germany*	*01/03/2011*	*3081-3091*		*Peer reviewed*
28	*Small-scale instrumentation for nuclear magnetic resonance of porous media 10. 1088/1367-26 30/13/1/01500 3*	*B. Blümich et al.*	*New Journal of Physics*	*Vol. 13*	*IOP Science Publishing*	*United Kingdom*	*28/01/2011*	*015003-*	Yes	*Peer reviewed*
29	*Analysis of paint cross-sections: a combined multivariate approach for the interpretation of μATR-FTIR hyperspectral data arrays 10.1007/s0021 6-011-5680-1*	*G. Sciutto et al.*	*Analytical and Bioanalytical Chemistry*	*08/01/201 2*	*Springer*	*Germany*	*08/01/2012*	*XX-XX*	Yes	*Peer reviewed*
30	*European research platform IPANEMA at the SOLEIL synchrotron for ancient and historical materials 10.1107/S0909 04951102334X*	*L. Bertrand at al.*	*Journal of Synchrotron Radiation*	*Vol. 18*	*Wiley-Blackwell Publishing*	*United Kingdom*	*01/09/2011*	*765?772*		
31	*Development of innovative embedding procedures for the analyses of paint cross sections in ATR FTIR microscopy 10.1007/s0021 6-012-6435-3*	*S. Prati et al.*	*Analytical and Bioanalytical Chemistry*	*Vol. 405 Issue 2-3*	*Springer*	*Germany*	*06/10/2012*	*895-905*	Yes	*Peer reviewed*
32	*Eutectic epsilon-near -zero metamaterial terahertz waveguides 10.1364/OL.38 .001140*	*M. Massaouti. et al.*	*Optics Letters*	*Vol. 38 Issue 7*	*Optical Society of America*	*United States*	*01/01/2013*	*1140*		*Peer reviewed*
33	*Single and multiplexed immunoassays for the chemiluminescent imaging detection of animal glues in historical paint cross-sections 10.1007/s0021 6-012-6463-z*	*G.Sciutto et al .*	*Analytical and Bioanalytical Chemistry*	*Vol. 405 Issue 2-3*	*Springer*	*Germany*	*12/10/2012*	*933-940*	Yes	*Peer reviewed*
34	*In-situ identification of copper-based green pigments on paintings and manuscripts by reflection FTIR 10.1007/s0021 6-013-6707-6*	*D. Buti et al.*	*Analytical and Bioanalytical Chemistry*	*Vol. 405 Issu e 8*	*Springer*	*Germany*	*01/03/2013*	*2699-2711*		*Peer reviewed*
35	*Evaluation of the effect of six different paint cross section preparation methods on the*	*S. Prati et al.*	*Microchemical Journal*	*Vol. 103*	*Elsevier Science BV*	*Netherland*	*21/01/2012*	*79-89*	Yes	*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
	performances of FT-IR microscopy in attenuated total reflection mode 10.1016/j.mic roc.2012.01.007.									
36	*Portuguese tin-glazed earthenware from the 17th century. Part 1: Pigments and glazes characterization 10.1016/j.saa .2012.11.069*	*L.F. Vieira Ferreira et al.*	*Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy*	*Vol. 104*	*Elsevier BV*	*Netherlands*	*01/03/2013*	*437-444*		*Peer reviewed*
37	*Archaeometallurgical characterization of the earliest European metal helmets 10.1016/j.matchar.2013.02.007*	*M. Mödlinger et al.*	*Materials Characterization*	*Vol. 79*	*Elsevier Inc.*	*United States*	*01/05/2013*	*22-36*		*Peer reviewed*
38	*FT-NIR microscopy: An advanced spectroscopic approach for the characterisation of paint cross-sections 10.1016/j.microc.2013 .09.021*	*G.Sciutto et al.*	*Microchemical Journal*	*Vol. 112*	*Elsevier Science BV*	*Netherland*	*01/01/2014*	*87-96*		*Peer reviewed*
39	*Nonlinear microscopy techniques for assessing the UV laser polymer interactions*	*A. Selimis et al.*	*Optics Express*	*Vol. 20*	*Optical Society of America*	*United States*	*02/02/2012*	*3990-3996*	Yes	*Peer reviewed*
40	*Non-invasive investigation of a pre-Hispanic Maya screenfold book: the Madrid Codex 10.1016/j.jas .2013.08.008*	*D. Buti et al.*	*Journal of Archaeological Science*	*Vol. 42*	*Academic Press Inc.*	*United States*	*01/02/2014*	*166-178*		*Peer reviewed*
41	*Wavelength and pulse duration effects on laser induced changes on raw pigments used in paintings 10.1016/j.saa .2012.10.001*	*M. Oujja et al.*	*Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy*	*Vol. 102*	*Elsevier BV*	*Netherlands*	*01/02/2013*	*7-14*		*Peer reviewed*
42	*The Book of Kells: A non-invasive MOLAB investigation by complementary spectroscopic techniques 10.1016/j.saa .2013.06.020*	*B. Doherty et al.*	*Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy*	*Vol. 115*	*Elsevier BV*	*Netherlands*	*01/11/2013*	*330-336*		*Peer reviewed*
43	*Terahertz pulse imaging for tree-ring analysis: a preliminary study for dendrochronology applications*	*B Jackson et al.*	*Measurement Science and Technology*	*Vol. 20 / Issue 7*	*Institute of Physics Publishing*	*United Kingdom*	*1/07/2009*	*075502*		*Peer reviewed*
44	*Non-invasive identification of metal-oxa late complexes on polychrome artwork*	*L. Monico et al.*	*Spectrochimic a Acta - Part A:*	*Vol. 116*	*Elsevier BV*	*Netherlands*	*01/12/2013*	*270-280*		*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
	surfaces by reflection mid-infrared spectroscopy 10.1016/j.saa .2013.06.084		*Molecular and Biomolecular Spectroscopy*							
45	*Nondestructive Characterization and Enzyme Cleaning of Painted Surfaces: Assessment from the Macro to Nano Level 10.1017/S1431 927613013196*	*C. Pereira et al.*	*Microscopy and Microanalysis*	*Vol. 19 Issue 06*	*Cambridge University Press*	*United Kingdom*	*01/12/2013*	*1632-1644*		*Peer reviewed*
46	*Papyrus imaging with terahertz time domain spectroscopy 10.1007/s0033 9-010-5693-1*	*J. Labaune et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 100 Issue 3*	*Springer*	*Germany*	*01/09/2010*	*607-612*		*Peer reviewed*
47	*Laser cleaning in conservation of stone, metal, and painted artifacts: state of the art and new insights on the use of the Nd:YAG lasers 10.1007/s0033 9-011-6690-8*	*S.Siano et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 106*	*Springer*	*Germany*	*24/11/2011*	*419–446*	Yes	*Peer reviewed*
48	*Cultural heritage and archaeology materials studied by synchrotron spectroscopy and imaging 10.1007/s0033 9-011-6686-4*	*L. Bertrand et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 106*	*Springer*	*Germany*	*26/11/2011*	*377–396*	Yes	*Peer reviewed*
49	*Reflection infrared spectroscopy for the non-invasive in situ study of artists' pigments 10.1007/s0033 9-011-6708-2*	*C. Miliani et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 106*	*Springer*	*Germany*	*21/12/2011*	*295-307*	Yes	*Peer reviewed*
50	*SR XRF and μ-PIXE studies on ancient metallurgy of thirteen Dacian gold bracelet s 0.1007/s00339 -012-7306-7*	*B. Constantinescu et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 109*	*Springer*	*Germany*	*06/10/2012*	*395-402*	Yes	*Peer reviewed*
51	*Colorando Auro: contribution to the understanding of a medieval recipe to colour gilded silver plates 10.1007/s0033 9-012-7532-z*	*A. Crabbé et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 111 Issue 1*	*Springer*	*Germany*	*01/04/2013*	*39-46*		*Peer reviewed*
52	*"Live" Prussian blue fading by time-resolved X-ray absorption spectroscopy 10.1007/s0033 9-013-7581-y*	*Cl. Gervais et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 111 Issue 1*	*Springer*	*Germany*	*01/04/2013*	*15-22*		*Peer reviewed*
53	*Efficiency of applying ammonium oxalate for protection of monumental limestone by poultice, immersion and brushing methods*	*D. Mudronja et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 111 Issue 1*	*Springer*	*Germany*	*01/04/2013*	*109-119*		*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
	10.1007/s0033 9-012-7365-9									
54	*Investigation of Terra Cotta artefacts with Terahertz DOI 10.1007/s003 39-011-6567-x*	*J. Labaune et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 105*	*Springer*	*Germany*	*31/08/2012*	*5-9*	Yes	*Peer reviewed*
55	*SR XRF and micro-PIXE studies on ancient metallurgy of thirteen Dacian gold bracelets 10.1007/s0033 9-012-7306-7*	*B. Constantinescu et al.*	*Applied Physics A: Materials Science and Processing*	*Vol. 109 Issue 2*	*Springer*	*Germany*	*01/11/2012*	*395-402*		*Peer reviewed*
56	*Photoluminescence Properties of Zinc Oxide in Paints: A Study of the Effect of S elf-Absorption and Passivation 10.1366/12-06 643*	*C.Clementi et al.*	*Applied Spectroscopy*	*Vol. 66 Issue 10*	*Society for Applied Spectroscopy*	*United States*	*01/10/2012*	*1233-1241*		*Peer reviewed*
57	*Depth-Resolved Multilayer Pigment Identification in Paintings: Combined Use of Laser-Induce d Breakdown Spectroscopy (LIBS) and Optical Coherence Tomography (OCT) 10.1366/12-06 703*	*E. A. Kaszewska et al.*	*Applied Spectroscopy*	*Vol. 66 Issue 10*	*Society for Applied Spectroscopy*	*United States*	*01/08/2013*	*960-972*		*Peer reviewed*
58	*Detection of Harmful Residues in Honey U sing Terahertz Time-Domain Spectroscopy 10.1366/13-07 111*	*M. Massaouti et al.*	*Applied Spectroscopy*	*Vol. 66 Issue 10*	*Society for Applied Spectroscopy*	*United States*	*01/11/2013*	*1264-1269*		*Peer reviewed*
59	*Comparative study of laser induced break down spectroscopy and mass spectrometry for the analysis of cultural heritage materials 10.1016/j.mol struc.2013.01.069*	*O. Kokkinaki et al.*	*Journal of Molecular Structure*	*Vol. 1044*	*Elsevier BV*	*Netherlands*	*01/07/2013*	*160-166*		*Peer reviewed*
60	*Adapting and testing a portable Raman spectrometer for SERS analysis of aminoacids and small peptides 10.1016/j.mol struc.2012.12.060*	*A. Brambilla et al.*	*Journal of Molecular Structure*	*Vol. 1044*	*Elsevier BV*	*Netherlands*	*01/07/2013*	*121-127*		*Peer reviewed*
61	*Discrimination of prehistoric polished s tone tools from Hungary with non-destructive chemical Prompt Gamma Activation Analyses (PGAA) 10.1127/0935- 1221/2011/0023-2148*	*G.Sazakmány et al.*	*European Journal of Mineralogy*	*Vol. 23*	*Schweizerbart Science Publisher*	*Germany*	*12/01/2011*	*883-893*	Yes	*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
62	*Non-invasive PGAA, PIXE and ToF-ND analyses on Hungarian Bronze Age defensive armour 10.1007/s1096 7-014-3064-7*	*M. Mödlinger et al.*	*Journal of Radioanalytical and Nuclear Chemistry*	*Vol. 300 Issue 2*	*Springer*	*Germany*	*01/05/2014*	*787-799*		*Peer reviewed*
63	*Atomic Force Microscopy as a Valuable Tool in an Innovative Multi-scale and Multi-technique Non-invasive Approach to Sur face Cleaning Monitoring 10.1016/j.pro che.2013.03.032*	*C. Pereira et al.*	*Procedia Chemistry*	*Vol. 8*	*Elsevier BV*	*Netherlands*	*01/01/2013*	*258-268*		*Peer reviewed*
64	*The role of nuclear microprobes in the study of technology, provenance and corrosion of cultural heritage: The case of gold and silver items 10.1016/j.nim b.2012.11.053*	*M.F. Guerra et al.*	*Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms*	*Vol. 306*	*Elsevier Science BV*	*Netherland*	*01/07/2013*	*227-231*		*Peer reviewed*
65	*PIXE analyses over a long period: The case of Neolithic variscite jewels from Western Europe (5th–3th millennium BC) 10.1016/j.nim b.2013.07.033*	*G. Querré et al.*	*Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms*	*Vol. 306*	*Elsevier Science BV*	*Netherland*	*01/01/2014*	*149-156*		*Peer reviewed*
66	*Provenance studies of Central European N eolithic obsidians using external beam milli-PIXE spectroscopy 10.1016/j.nim b.2013.06.054*	*B. Constantinescu et al.*	*Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms*	*Vol. 306*	*Elsevier Science BV*	*Netherland*	*01/01/2014*	*145-148*		*Peer reviewed*
67	*Analysis of lustred ceramics of the Galleria Regionale di Palazzo Bellomo di Siracusa, Italy 10.1016/j.nim b.2013.11.032*	*G. Politi et al.*	*Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms*	*Vol. 306*	*Elsevier Science BV*	*Netherland*	*01/07/2014*	*82-88*		*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
68	*The Use of Neutron Analysis Techniques f or Detecting The Concentration And Distribution of Chloride Ions in Archaeological Iron 10.1111/arcm. 12058*	*D. Watkinson et al.*	*Archaeometry*	*54*	*Wiley-Blackwell Publishing*	*United Kingdom*	*01/11/2013*	*n/a-n/a*	Yes	*Peer reviewed*
69	*Mineralogical and Chemical Constraints on the Provenance of Copper Age Polished Stone Axes of 'Ljubljana Type' from Caput Adriae 10.1111/arcm. 12004*	*F. Bernardini, et al.*	*Archaeometry*	*Vol. 56/Is*	*Wiley-Blackwell Publishing*	*United Kingdom*	*01/04/2014*	*175-202*		*Peer reviewed*
70	*PIXE analysis of Middle European 18th an d 19th century glass seals 10.1002/xrs.1 328*	*A.Simon, et al.*	*X-Ray Spectrometry*	*Vol. 40, Issue 3*	*John Wiley and Sons Ltd*	*United Kingdom*	*01/05/2011*	*224-228*		*Peer reviewed*
71	*Semi-quantitative analysis of the format ion of a calcium oxalate protective layer for monumental limestone using combined micro-XRF and micro-XRPD 10.1002/xrs.2 486*	*F. Vanmeert et al.*	*X-Ray Spectrometry*	*Vol. 42 Issue 4*	*John Wiley and Sons Ltd*	*United Kingdom*	*01/07/2013*	*256-261*		*Peer reviewed*
72	*A Survey of Terahertz Applications in Cultural Heritage Conservation Science 10.1109/TTHZ. 2011.2159538*	*J. B. Jackson et al.*	*IEEE Transactions on Terahertz Science and Technology*	*Vol. 1 Issue 1*	*Institute of Electrical and Electronics Engineers Inc.*	*United States*	*01/09/2011*	*220-231*		*Peer reviewed*
73	*How Can Neutrons Contribute to Cultural Heritage Research? 10.1080/10448 632.2012.645689*	*Zs. Kasztovszky et al.*	*Neutron News*	*Vol. 23 Issue 1*	*Gordon and Breach Science Publishers*	*China*	*01/01/2012*	*25-28*		*Peer reviewed*
74	*Analysis of the restoration of an historical organ: The case study of the Cavaillé-Col l organ of La Merced Church in Burgos, Spain 10.1179/20470 58411Y.0000000001*	*A.Justo-Estebaranz et al.*	*Studies in Conservation*	*Vol. 57 Issue 1*	*International Inst. for Conservation of Historic and Artistic Works*	*United Kingdom*	*01/03/2012*	*21-28*		*Peer reviewed*
75	*Scientific Investigation of an Important Corpus of Picasso Paintings in Antibes: New Insights into Technique, Condition, and Chronologica l Sequence 10.1179/19452 33013Y.0000000013*	*F.Casadio et al.*	*Journal of The American Institute for Conservation*	*Vol. 52/Is sue 3*	*American Institute for Conservation of Historic and Artistic Works*	*United States*	*01/08/2013*	*184-204*		*Peer reviewed*

NO	Title / DOI	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
76	*Three-Dimensional Nondestructive "Sampling" of Art Objects Using Acoustic Microscopy and Time-Frequency Analysis 10.1109/TIM.2 011.2124730*	*G.T. Karagiannis et al.*	*IEEE Transactions on Terahertz Science and Technology*	*Vol.60*	*Institute of Electrical and Electronics Engineers Inc.*	*United States*	*19/04/2011*	*3082-3109*	Yes	*Peer reviewed*
77.	*Terahertz, X-ray and neutron computed tomography of an Eighteenth Dynasty Egyptian sealed pottery*	*E. Abraham et al.*	*Appl. Phys. A*	*117*	*Springer*	*Germany*	*01/2014*	*963-972*	Yess	*Peer reviewed*

6.2.2 Other publications

Table 5 Other scientific publications, articles, conferences proceeding, monographs and thesis (2009-2014)

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
1.	*Elemental characterization of Bronze Age copper objects by micro-beam measurements*	*A. Vasilescu et al.*	*Romanian Reports in Physics*	*Vol. 65, Issue 4*	*Editura Academiei Romane*	*Romania*	*01/01/2013*	*1222-1233*	Yes	*Article*
2.	*Non-destructive analysis of altered gold leaf glass tesserae from the mosaics of the Daphni Monastery*	*P. Loukopoulou et al.*	*Recent Advances in Glass, Stained Glass, and Ceramics Conservation*	*ICOM-CC Glass and Ceramics Working Group*	*Spa Uitgevers*	*Netherlands*	*01/01/2013*	*31-39*	Yes	*Article*
3.	*Elemental Composition of Metal Artefacts from the 10th c. Metal Art Centre near the Village of Zlatar, Preslav Region, NE, Bulgaria.*	*S. Doncheva et al.*	*Archaeologia Bulgarica*	*Vol. 17*	*NOUS Publishers LTD*	*Bulgaria*	*01/01/2013*	*71-85*	No	*Article*
4.	*Analysis of golden threads from Romanian medieval textiles by IBA techniques*	*Balta Z et al.*	*Restitutio*	*Vol. 7*	*Dimitrie Gusti National Village Museum*	*Romania*	*10/06/2013*	*162-170*	No	*Article*

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
5.	*Chemical composition of metal artefacts from the Early Medieval centre for artistic metal finds near the village of Novosel, Shumen region, Bulgaria*	*St. Doncheva et al.,*	*Archaeologia Bulgarica*	*Vol. 16, Issue 1*	*NOUS Publishers LTD*	*Bulgaria*	*01/01/2012*	*67-82*	No	*Article*
6	*Elemental characterization of Bronze Age copper objects by micro-beam measurements.*	*Vasilescu A., et al.*	*Romanian Reports in Physics*	*Vol. 65, Issue 4*	*Editura Academiei Ro mane*	*Romania*	*01/01/2013*	*1222-1233*	No	*Article*
7	*External Milli-beam PIXE Analysis of the Mineral Pigments of Glazed Iznik (Turkey) Ceramics*	*B. Constantinescu, et al.*	*Periodico di Mineralogia*	*Special Is sue*	*Edizioni Nuova Cultura*	*Italy*	*01/09/2013*	*141-162*	No	*Article*
8	*Gemstones at Qatna Royal Tomb: Preliminary Report*	*J.Zöldföldi et al.*	*P. Pfälzner (ed.): Interdisziplinäre Studien zur Königsgruft von Qatna*	*Quatna Studien Vol. 1*		*Germany*	*01/01/2011*	*235-248*	No	*Article*
9.	*Non-destructive analysis of altered gold leaf glass tesserae from the mosaics of the Daphni Monastery*	*P. Loukopoulou et al.*	*H. Roemich and K. Van Lookeren Campagne (ed.) Recent Advances in Glass, Stained Glass, and Ceramics Conservation 2013*		*Spa Uitgevers*	*Netherland*	*01/01/2013*	*31-39*	No	*Article*
10.	*Optical Imaging Applications for the Study of Cultural Heritage Artefacts*	*I. Crina et al.*	*A. Tanaka, B. Nakamura (Eds) Optical Im aging : Technology, Methods and Applications*		*Nova Science Publishers, Inc.*	*United States*	*01/04/2012*	*34-41*	No	*Article*
11.	*The role of the Budapest Neutron Centre in the Research of the European Cultural Heritage – CHARISMA (in Hungarian)*	*Z. Kasztovszky*	*Magyar Tudomány (Hungarian Science)*		*Hungarian Academy of Sciences*	*Hungary*	*01/01/2011*	*1238-1246*	No	*Article*
12.	*Neutron Investigations of an Exceptional Zinc Lamp from the Academia Georgica Treiensis Archaeological Collection (Italy)*	*E.Horvath, M.Rogante*	*Restaurierung und Archäologie*		*Römisch-Germanisches Zentralmuseum, Forschungsinstitute für Archäologie*	*Austria*	*01/12/2012*	*1-5*	No	*Article*

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
13.	*Proof of the Meteoritic Origin of Mankinds Earliest Iron Artefacts through Neutron and X-ray Analysis*	*László Rosta et al.*	*Hungarian Archaeology E-Journal*		*Archaeolingua Foundation and Publisher House*	*Hungary*	*01/01/2013*	*1-5*	Yes	*Article*
14.	*Geological Sources for Archaeological Obsidian Found in Romania*	*D.Cristea-Stan, B.Constantinescu et al.*	*Romanian Journal of Mineral Deposits*	*Vol 86*	*Geological Institute of Romania*	*Romania*	*10/01/2012*	*10-15*		*Article*
15.	*„VASGYÖNGYÖK AZ ÉGBŐL" A legősibb ember által készített vastárgyak meteorit eredetének igazolása röntgen- és neutronanalízissel*	*Rosta et. al*	*Magyar Régészet*	*2013 winter*	*Archaeolingua*	*Hungary*	*12/2013*	*1–5*	yes	*Article*
16.	*The use of non-linear microscopy techniques to assess the affected region in the laser cleaning of polymeric coatings*	*S. Kogou, et al.*	*D. Saunders,, M. Strlic, C. Korenberg, N. Luxford and K. Birkholzer (Eds) Lasers in the Conservation of Artworks - LACONA IX proceedings*		*Archetype publications Ltd,*	*United Kingdom*	*15/01/2013*	*103-107*		*Conference*
17.	*A new portable digital holographic speckle pattern interferometr y (DHSPI) system for structural documentation of artworks*	*K. Haztigiannakis, et al.*	*D. Saunders,, M. Strlic, C. Korenberg, N. Luxford and K. Birkholzer (Eds) Lasers in the Conservation of Artworks - LACONA IX proceedings*		*Archetype publicatio ns Ltd.*	*United Kingdom*	*15/01/2013*	*67-74*		*Conference*
18.	*Potential of Chlorophyll Fluorescence imaging for assessing viability changes of biodeteriogen growths on stone monuments*	*Osticioli I et al.*	*Optical Metrology*	*Vol. 8790*	*SPIE*	*Germany*	*01/11/2013*	*1-7*		*Conference*
19.	*Application of optical coherence tomography for monitoring some conservation treatments*	*M. Iwanicka et al.*	*D. Saunders,, M. Strlic, C. Korenberg, N. Luxford and K. Birkholzer (Eds) Lasers in the Conservation of*		*Archetype publications Ltd*	*United Kingdom*	*15/01/2013*	*19-25*		*Conference*

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
			Artworks - LACONA IX proceedings							
20.	*Early altarpieces in Transylvania: materials and technologica l characteristics*	*S. Hradil, et al.*	*Saunders D., Spring M. & Meek, A. (Eds.)The Renaissance Work-shop: Materials and Techniques of Renaissance Art*		*Archetype publications Ltd*	*United Kingdom*	*16/09/2013*	*199*		*Conference*
21.	*OCT structural examination of Madonna dei Fusi by Leonardo da Vinci 10.1117/12.20 21607*	*P. Targowski , et al.*	*L. Pezzati, Piotr Targowski (Eds) Optics for Arts, Architecture, and Archaeology IV*	*Vol. 8790*	*SPIE*	*Germany*	*30/05/2013*	*87900N*		*Conference*
22.	*Optical coherence tomography for high-re solution real-time varnish ablation monitoring*	*P. Targowski, et al.*	*Lasers in the Conservation of Artworks - LACONA IX proceedings, eds D. Saunders, M. Strlic, C. Korenberg, N. Luxford and K. Birkholzer*		*Archetype publications Ltd*	*United Kingdom*	*15/01/2013*	*26-31*		*Conference*
23.	*Real time 3D structural and Doppler OCT imaging on graphics processing units 10.1117/12.20 02511*	*M. Sylwestrzak et al.*	*Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XVII*		*SPIE*	*Germany*	*20/03/2013*	*85710Y*		*Conference*
24.	*The altarpiece of Saint Dominic of Silos by Bartolomé Bermejo: an example of painting practices during the early Spanish Renaissance*	*D. Gayo et al.*	*The Renaissance Work-shop: The Materials and Techniques of Renaissance Art, Saunders D., Spring M. & Meek, A. (eds.)*		*Archetype publications Ltd*	*United Kingdom*	*16/09/1913*	*71-78*		*Conference*
25.	*New hypotheses on the Madonna of the Yarnwinder series*	*C Acidini*	*Workshop Leonardo da Vinci's Technical*		*Hermann Edition Sciences Et Arts*	*France*	*01/02/2014*	*114-125*		*Conference*

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
			Practice: paintings, drawings and influence, M. Menu (Ed)							
26.	*Leonardo's Adoration of the Magi at the Uffizi: preliminary technical study at OPD*	*R.Bellucci et al.*	*Workshop Leonardo da Vinci's Technical Practice: paintings, drawings and influence, M. Menu (Ed)*		*Hermann*	*France*	*01/02/2014*	*32-39*		*Conference*
27.	*Leonardo's charisma: Leonardo as subject for scientific study applied to cultural heritage*	*C.Frosinini*	*Workshop Leonardo da Vinci's Technical Practice: paintings, drawings and influence, M. Menu (Ed)*		*Hermann*	*France*	*01/02/2014*	*27-31*		*Conference*
28.	*The Paris Virgin of the Rocks: a new approach based on scientific analysis*	*V.Delieuvin et al.*	*Workshop Leonardo da Vinci's Technical Practice: paintings, drawings and influence, M. Menu (Ed)*		*Hermann*	*France*	*01/02/2014*	*72-100*		*Conference*
29.	*La belle Ferronnière: a non invasive technical examination*	*E.Ravaud, M.Eveno*	*Workshop Leonardo da Vinci's Technical Practice: paintings, drawings and influence, M. Menu (Ed)*		*Hermann*	*France*	*01/02/2014*	*126-138*		*Conference*
30.	*The copy of the Gioconda*	*A.Gonzalez Mozo*	*Workshop Leonardo da Vinci's Technical Practice: paintings, drawings and influence, M. Menu (Ed)*		*Hermann*	*France*	*01/02/2014*	*194-199*		*Conference*
31.	*Leonardo's Monna Lisa at the light of the Madrid copy*	*B.Mottin*	*Workshop Leonardo da Vinci's Technical Practice: paintings,*		*Hermann*	*France*	*01/02/2014*	*203-222*		*Conference*

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
			drawings and influence, M. Menu (Ed)							
32.	*Caravaggio's The Beheading of Saint John the Baptist in Malta*	*M.Ciatti, C.Lalli*	*Caravaggio's Painting Technique - Proceedings of the CHARISMA Workshop*		*Nardini Editore*	*Italy*	*1/3/2012*	*11-22*		*Conference*
33.	*Caravaggio's Painting Technique: a brief survey based on paintings at The National Gallery*	*L.Keith*	*Caravaggio's Painting Technique - Proceedings of the CHARISMA Workshop*		*Nardini Editore*	*Italy*	*1/3/2012*	*23-30*		*Conference*
34.	*Optical diagnostics on Caravaggio's paintings with a new IR multispectral scanner for reflectography*	*R.Fontana et al.*	*Caravaggio's Painting Technique - Proceedings of the CHARISMA Workshop*		*Nardini Editore*	*Italy*	*1/3/2012*	*41-50*		*Conference*
35.	*Caravaggio's influence in the North*	*A.Roy*	*Caravaggio's Painting Technique - Proceedings of the CHARISMA Workshop*		*Nardini Editore*	*Italy*	*1/3/2012*	*85-94*		*Conference*
36.	*The San Giovanni altar from the Baptistery of Florence: the goldsmith's workshop though the fourteenth and fifteenth centuries*	*P.Bonanni et al.*	*The Renaissance Work-shop: The Materials and Techniques of Renaissance Art, Saunders D., Spring M. & Meek, A. (eds.)*		*Archetype publications Ltd*	*United Kingdom*	*16/09/1913*		90-97	*Conference*
37.	*Compact NMR*	*B. Blümich, et al.*	*Compact NMR*	*Vol. 1*	*Walter De Gruyter Inc.*	*United States*	*29/01/2014*			*Monograph*
38.	*Natural Colorants for Dyeing and Lake Pigments: Practical Recipes and their Historical Sources*	*J. Kirby, et al.*	*Natural Colorants for Dyeing and Lake Pigments: Practical*	*Vol. 1*	*Archetype Publications Ltd*	*United Kingdom*	*31/03/2014*			*Monograph*

NO	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date	Relevant pages	Is/Will open access	Type
			Recipes and their Historical Source							
39.	*Artificially created calcium oxalate for surf ace protection of stone monuments*	*D. Mudronja*			*University of Zagreb*	*Croatia*	*28/11/2012*			*Thesis*
40.	*Obsidian Least Destructive Analysis Provenancing System: an Application Study.*	*F. Eder*			*Technische Universität Wien, Atominstitut*	*Austria*	*27/03/2014*			*Thesis*

6.2.3 Dissemination list

Table 6 Main Dissemination activities

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
01	P16	*OCW-RCE*	*WP10 Leader interview on CHARISMA project*	*DE VOLKSRANTa widely diffused daily newspaper http://www.volkskrant.nl*	*26/09/2009*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*The Netherland*		*Articles published in the popular press*
02	P20	*BNC-WIGNER*	*CHARISMA Joint research activity: From botanical source to analytical result*	*DHA28 Dyes in History and Archaeology, Poznan, PL*	*21/10/2009*	*Scientific community (higher education, Research)*	*Europe*	*40*	*Posters*
03	P01	*UNIPG*	*Photophysics of ancient anthraquinone-Al complexes: from the laboratory to the artwork*	*FISPHOTON: 2nd France-Italy Symposium on Photosciences, Marseille, FR*	*07/12/2009*	*Scientific community (higher education, Research)*	*France-Italy*	*50*	*Oral presentation to a scientific event*
04	P18	*APRE*	*Different project posters available for presentation at conferences or workshops, which you may download.*	*http://charismaproject.eu/media/79006/poster_def_2012_v3.pdf*	*03/01/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Posters*
05	P18	*APRE*	*CHARISMA website*	*http://charismaproject.eu/*	*03/01/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*	*45000*	*Web sites/Applications*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
06	P18	*APRE*	*The flyer gives an overview of CHARISMA project's aims and activities. You may download and print the CHARISMA flyer to use in promoting CHARISMA activities.*	*http://charismaproject.eu/media/79043/charisma-flyer-def-may2012_v2.pdf*	*03/01/2010*	*Scientific community (higher education, Research) - Civil society - Policy makers - Medias*	*International*		*Flyers*
07	P18	*APRE*	*CHARISMA (Cultural Heritage Advanced Research Infrastructures: Synergy for a Multidisciplinary Approach to conservation/restoration)*	*APRE Newsletter*	*04/02/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers*	*Europe*	*200*	*Press releases*
08	P01	*UNIPG*	*Chemistry and Art: Recent Developments for the Study and Conservation of Artworks*	*PITTCON 2010 - 61st Pittsburgh Conf. on Analytical Chemistry and Appl. Spectroscopy, Orlando, US*	*02/03/2010*	*Scientific community (higher education, Research)*	*International*	*500*	*Oral presentation to a scientific event*
09	P20	*BNC-WIGNER*	*Cultural Heritage European Advanced Research Infrastructures*	*University of Philadelphia, US*	*10/02/2010*	*Scientific community (higher education, Research)*	*United States*	*35*	*Oral presentation to a scientific event*
10	P01	*UNIPG*	*Towards non-destructive surface enhanced Raman spectroscopy for cultural heritage*	*IRUG 09 - 9th Biennial Conference on IR and Raman Users Group, Buenos Aires, AG*	*03/03/2010*	*Scientific community (higher education, Research)*	*International*	*80*	*Oral presentation to a scientific event*
11	P06	*CNR*	*Characterization of painting techniques by multispectral IR reflectography*	*9th EMAS Regional Workshop on Electron Probe Micro-analysis, Amsterdam, NL*	*26/04/2010*	*Scientific community (higher education, Research)*	*Europe*	*40*	*Oral presentation to a scientific event*
12	P01	*UNIPG*	*New Synergies for a Multidisciplinary Approach to Conservation: MOLAB Activities within CHARISMA*	*INT. PRESERVATION NEWS- Int. Fed. of Library Ass.http://www.ifla.org/files/pac/ipn/50-may-2010.pdf*	*05/05/2010*	*Scientific community (higher education, Research) - Civil society - Policy makers*	*France and Europe*	*10000*	*Articles published in the popular press*
13	P02	*CNRS*	*Gold jewellery in Ancient Egypt: alloys, polychromy and joining techniques*	*38th International Symposium On Archaeometry, ISA 2010 Tampa, US*	*14/05/2010*	*Scientific community (higher education, Research)*	*International*	*150*	*Oral presentation to a scientific event*
14	P06	*CNR*	*On the identification of organic materials in painting cross sections by means of ToF-SIMS*	*YOCOCU Conference (Youth in The Conservation of Cultural Heritage), Palermo, IT*	*24/05/2010*	*Scientific community (higher education, Research)*	*International*	*100*	*Oral presentation to a scientific event*
15	P09	*ATOMKI-HAS*	*Non-destructive analysis of Attic pottery by micro-beam techniques (FIXLAB access project)*	*19TH SYMPOSIUM OF THE HELLENIC NUCLEAR PHYSICS SOCIETY, Thessaloniki, GR*	*28/05/2010*	*Scientific community (higher education, Research)*	*Greece and Europe*	*60*	*Oral presentation to a scientific event*
16	P09	*ATOMKI-HAS*	*Study of old European forest glass by ion beam analytical techniques (FIXLAB access project:CUPAG)*	*PIXE2010: 12TH Conference on Pixe (Particle Induced X-Ray Emission), Guilford, UK*	*28/06/2010*	*Scientific community (higher education, Research)*	*UK and Europe*	*70*	*Presentations*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
17	P01	*UNIPG*	*Access and innovation in Europe for the study and conservation of artworks: the CHARISMA project*	*L'ICONA 2010, Laser Optics for the Conservation of Artworks, St. Petersburg, RU*	*29/06/2010*	*Scientific community (higher education, Research)*	*Europe*	*40*	*Oral presentation to a scientific event*
18	P01	*UNIPG*	*CHARISMA and evaluation of cleaning and conservation materials (and other CHARISMA presentations)*	*CHEMCH 2010 1st International Congress on Chemistry and Cultural Heritage, Ravenna, IT*	*01/07/2010*	*Scientific community (higher education, Research)*	*International*	*130*	*Oral presentation to a scientific event*
19	P09	*ATOMKI-HAS*	*Analysis of old European forest glass (FIXLAB access project:CUPAG)*	*ICNMTA 2010-12th International Conference On Nuclear Microprobe Technology and Applic., Leipzig, DE*	*26/07/2010*	*Scientific community (higher education, Research)*	*Germany and Europe*	*35*	*Presentations*
20	P03	*FORTH*	*Laser spectroscopies for cultural heritage (and other presentations related to CHARISMA work)*	*EUCMOS 2010 - 30TH EUROPEAN CONGRESS OF MOLECULAR SPECTROSCOPY, Firenze, IT*	*30/08/2010*	*Scientific community (higher education, Research)*	*Italy and Europe*	*80*	*Presentations*
21	P02	*CNRS*	*Terahertz Investigation of Egyptian Artifacts*	*35th International Conference Infrared Millimeter and Terahertz Waves (IRMMW-THz), Rome, IT*	*05/09/2010*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
22	P08	*RWTH*	*Advances on portable NMR for cultural heritage*	*MRPM10 - 10TH Bologna Conference on Magnetic Resonance in Porous Media, Leipzig, DE*	*14/09/2010*	*Scientific community (higher education, Research)*	*Germany and Europe*	*40*	*Articles published in the popular press*
23	P01	*UNIPG*	*Drive-by Conservation*	*C&EN - Chemical and Engineering News*	*20/09/2010*	*Industry - Civil society - Policy makers*	*World diffusion*	*10000*	*Articles published in the popular press*
24	P01	*UNIPG*	*Coordinators invited talk: CHARISMA - Cultural heritage advanced research infrastructures*	*ICRI International Conference on Research Infrastructures, Rome, IT*	*30/09/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers*	*Europe*	*130*	*Oral presentation to a wider public*
25	P01	*UNIPG*	*Studi MOLAB al Museo Picasso di Antibes*	*KERMES - popular Italian quarterly review dedicated to conservation*	*01/10/2010*	*Civil society - Policy makers - Medias*	*Italy and Europe*	*10000*	*Articles published in the popular press*
26	P01	*UNIPG*	*The Coordinator presents the project.*	*Eastern Mediterranean countries initiative, Cyprus Institute, Nicosia, CY*	*08/10/2010*	*Scientific community (higher education, Research) - Policy makers*	*Europe*	*50*	*Oral presentation to a wider public*
27	P20	*BNC-WIGNER*	*The invited talks presentation described the CHARISMA activities in Europe (including the involvement of BNC)*	*Day of science in Hungary, Budapest, HU*	*16/11/2010*	*Scientific community (higher education, Research)*	*Hungary*	*70*	*Oral presentation to a scientific event*
28	P17	*KIK-IRPA*	*Opening and Enhancing the Use of the Archives of European Cultural Heritage Institutions*	*DC-NET International Conference on E-infrastructures for Cultural Heritage, Bruxelles, BE*	*29/10/2010*	*Scientific community (higher education, Research)*	*International*	*60*	*Presentations*
29	P05	*SOLEIL*	*Progress state of the European platform IPANEMA for ancient materials at SOLEIL (and other present.)*	*SR2A-2010 Conference, Fourth Edition of Synchrotron Radiation in Art & Archaeology, Amsterdam. NL*	*09/11/2010*	*Scientific community (higher education, Research)*	*Europe*	*120*	*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
30	P16	*OCW-RCE*	*Creating colours: the making of dyed textiles and organic pigments (and other posters)*	*DHA29 Dyes in History And Archaeology, Lisbon, PT*	*11/11/2010*	*Scientific community (higher education, Research)*	*Europe*	*30*	*Posters*
31	P20	*BNC-WIGNER*	*CHARISMA Egy új pályázati lehet Qség európai kutatóintézetekhez a kulturális örökség kutatói számára (in Hungarian)*	*Annual Radiochemistry Workshop, Keszthely, HU*	*12/10/2010*	*Scientific community (higher education, Research)*	*Hungary*	*30*	*Oral presentation to a scientific event*
32	P11	*BM*	*Analysis of natural colorants at the British Museum*	*Early Textiles Study Group 13th Biannual Conference Colours, London, UK*	*19/11/2010*	*Scientific community (higher education, Research)*	*International*	*40*	*Presentations*
33	P07	*NCU*	*Optical Coherence Tomography (OCT) a novel tool for non-invasive examination of artwork*	*International Conference Technology and Technique In Research on the Works of Art, Torun, PL*	*25/11/2010*	*Scientific community (higher education, Research)*	*Poland*	*30*	*Presentations*
34	P01	*UNIPG*	*The TV report on the MOLAB interventions by UNIPG (Access Project CARPACCIO-II, was given within the transmission "Kultura ob 22h"*	*TV SLOVENIJA 1 The most important public service broadcast channel of Slovenian http://tvslo.si/#ava 2.88954754*	*26/11/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*National*		*Media briefings*
35	P02	*CNRS*	*Le tresor des "ages sombres' (FIXLAB access project)*	*LE MONDE: the most diffused newspaper in France*	*04/12/2010*	*Civil society - Policy makers - Medias*	*France*	*10000*	*Articles published in the popular press*
36	P07	*NCU*	*CHARISMA: a project on Cultural Heritage Advanced Research Infrastructures*	*International Conference Technology and Technique In Research on the Works of Art, Torun, PL*	*25/11/2010*	*Scientific community (higher education, Research)*	*International*	*30*	*Posters*
37	P16	*OCW-RCE*	*Identification of early synthetic organic dyestuffs using micro-Raman spectroscopy*	*9th EMAS Regional Workshop on Electron Probe Micro-analysis, Amsterdam, NL*	*26/04/2010*	*Scientific community (higher education, Research)*	*Europe*	*40*	*Posters*
38	P13	*Of-ADC*	*Non-destructive identification of art objects using multispectral mapping images and acoustic micros*	*9th EMAS Regional Workshop on Electron Probe Micro-analysis, Amsterdam, NL*	*26/04/2010*	*Scientific community (higher education, Research)*	*Europe*	*40*	*Posters*
39	P06	*CNR*	*ToF-SIMS characterization of inorganic and organic compounds ina Sienese painting*	*CHEMCH 2010 1st International Congress on Chemistry and Cultural Heritage, Ravenna, IT*	*01/07/2010*	*Scientific community (higher education, Research)*	*International*	*130*	*Posters*
40	P01	*UNIPG*	*Multitechnique spectroscopic study of natural ultramarine*	*CHEMCH 2010 1st International Congress on Chemistry and Cultural Heritage, Ravenna, IT*	*01/07/2010*	*Scientific community (higher education, Research)*	*International*	*130*	*Posters*
41	P05	*SOLEIL*	*Developments in the multi-technique analyses of the varnish of historical musical instruments*	*CHEMCH 2010 1st International Congress on Chemistry and Cultural Heritage, Ravenna, IT*	*01/07/2010*	*Scientific community (higher education, Research)*	*International*	*130*	*Posters*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
42	P09	*ATOMKI-HAS*	*Proton induced X-ray emission analysis of bottle signets from old European glass factories*	*CHEMCH 2010 1st International Congress on Chemistry and Cultural Heritage, Ravenna, IT*	*01/07/2010*	*Scientific community (higher education, Research)*	*International*	*130*	*Posters*
43	P02	*CNRS*	*Synchrotron-based FTIR microscopy for the analysis of ancient artistic materials*	*IR Workshop on Spectro-Microscopy, Basel, CH*	*01/02/2011*	*Scientific community (higher education, Research)*	*CH and Europe*	*30*	*Presentations*
44	P21	*UNIBO*	*Development of alternative immunological imaging techniques for the detection of proteins in paint c*	*ART'11 International Conference, Firenze, IT*	*14/04/2011*	*Scientific community (higher education, Research)*	*Europe*	*180*	*Oral presentation to a scientific event*
45	P01	*UNIPG*	*Vincent Van Goghs Last Months (A MOLAB intervention in Otterllo, NL)*	*C&ENtral Science Artful Science, on-line Jounal of the American Chemical Society*	*06/07/2011*	*Scientific community (higher education, Research) - Civil society - Medias*	*International*	*10000*	*Articles published in the popular press*
46	P01	*UNIPG*	*Innovation in Europe for the study and conservation of artworks: the MOLAB approach*	*XX International Materials Research Congress, IMRC Cancun, MX,*	*15/08/2011*	*Scientific community (higher education, Research)*	*International*	*100*	*Oral presentation to a scientific event*
47	P01	*UNIPG*	*Open European facilities for the study and conservation of artworks: the CHARISMA access program.*	*International Conference on Matter And Materials for Heritage Conservation, MATCONS 11 Craiova, RO*	*23/08/2011*	*Scientific community (higher education, Research)*	*Europe*	*120*	*Oral presentation to a scientific event*
48	P01	*UNIPG*	*Micro-spectroscopy for art conservation: the CHARISMA approach*	*X Multinational Congress on Microscopy, MCM 2011 Urbino, IT*	*06/09/2011*	*Scientific community (higher education, Research)*	*Europe*	*130*	*Oral presentation to a wider public*
49	P01	*UNIPG*	*CHARISMA per la conservazione delle opere d'arte. A service of the Scientific TV Programme TG "Leonardo"*	*RAI3 the television channel of the Italian national public broadcasting*	*19/11/2011*	*Scientific community (higher education, Research) - Civil society - Medias*	*Italy*	*10000*	*Interviews*
50	P01	*UNIPG*	*Innovation in Europe for the study and conservation of artworks: the MOLAB approach*	*5th International Congress "Science and Technology for the Safeguard of. Cultural Heritage in the Mediterranean Basin" Istanbul, Turkey*	*22/11/2011*	*Scientific community (higher education, Research)*	*Europe*	*200*	*Oral presentation to a scientific event*
51	P01	*UNIPG*	*Think You Can Identify A Van Eyck? (Chronicle of a MOLAB intervention in Rotterdam, NL)*	*C&ENtral Science Artful Science, on-line Jounal of the American Chemical Society*	*15/02/2012*	*Scientific community (higher education, Research) - Civil society - Medias*	*International*	*10000*	*Articles published in the popular press*
52	P01	*UNIPG*	*EU Workshop Research Infrastructures for Cultural Heritage and Global Change co-organised by CHARISMA (KIK-IRPA, UNIPG, APRE)*	*EU Workshop on Research Infrastructures for Cultural Heritage and Global Change, Brussels, BE*	*14/03/2012*	*Scientific community (higher education, Research) - Policy makers*	*Europe*	*100*	*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
53	P01	*UNIPG*	*CHARISMA video: content and objectives of the consortium (by APRE and UNIPG)*	*http://www.youtube.com/watch?v=_MhAwxoi1zw*	*14/03/2012*	*Scientific community (higher education, Research) - Civil society - Policy makers - Medias*	*Europe*	*20000*	*Videos*
54	P01	*UNIPG*	*Rare Aztec Document Gets A Check-Up (Chronicle of a MOLAB intervetion in Liverpool, UK)*	*C&ENtral Science Artful Science, on-line Jounal of the American Chemical Society*	*15/03/2012*	*Scientific community (higher education, Research) - Civil society - Medias*	*International*	*10000*	*Articles published in the popular press*
55	P01	*UNIPG*	*Finding The Culprit For Van Goghs Darkening Yellows (Chronicle of a MOLAB intervention)*	*C&ENtral Science Artful Science, on-line Jounal of the American Chemical Society*	*15/03/2012*	*Scientific community (higher education, Research) - Civil society - Medias*	*International*	*10000*	*Articles published in the popular press*
56	P11	*BM*	*The Renaissance CHARISMA Workshop: The Materials and Techniques of Renaissance Art*	*E-CONSERVATION MAGAZINE, an on-line Journal on conservation*	*30/04/2012*	*Scientific community (higher education, Research) - Medias*	*International*	*1000*	*Publication*
57	P01	*UNIPG*	*A CHARISMA stand with presentations, videos,posters and flyers (in cooperation with APRE and NCU)*	*8th Biennial Fair on Heritage Restoration and Management (AR&PA Biennial), Valladolid, ES*	*24/05/2012*	*Scientific community (higher education, Research) - Civil society - Policy makers*	*Europe*	*3000*	*Exhibitions*
58	P01	*UNIPG*	*The Coordinator presents the CHARISMA development of new instruments, no n-invasive technologies and innovative solutions for analysis, protection and conservation of cultural heritage*	*TechnoHeritage 2012 - Int Congress on S &T for Cultural Heritage, Santiago de Compostela. ES*	*02/10/2012*	*Scientific community (higher education, Research)*	*Europe*	*200*	*Oral presentation to a scientific event*
59	P18	*APRE*	*The video providing a general overview of the project's support, coordination and joint research activities, showing the facilities involved and the Transnational Access opportunities (by APRE and UNIPG)*	*http://www.youtube.com/watch?v=_MhAwxoi1zw*	*01/03/2012*	*Scientific community (higher education, Research) - Civil society - Policy makers - Medias*	*International*	*20000*	*Videos*
60	P18	*APRE*	*Stand equipped with specific posters of each project's device, the video, the leaflets and flyers (APRE, UNIPG, NCU)*	*8th Biennial of Heritage Restoration and Management, AR&PA 2012, Valladolid (ES)*	*24/05/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Europe*	*10000*	*Exhibitions*
61	P18	*APRE*	*Corner equipped with project's dissemination material*	*EuroScience Open Forum - ESOF, Dublin (IE)*	*11/07/2012*	*Scientific community (higher education, Research) - Industry - Civil*	*Europe*	*1000*	*Exhibitions*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
						society - Policy makers - Medias			
62	P10	*CPP-LMRH*	*Terahertz applications in cultural heritage: case studies*	*Fundamentals of Laser-Assisted Micro- and Nanotechnologies (FLAMN-13), St Petersburg, RU*	*25/06/2013*	*Scientific community (higher education, Research)*	*Europe*	*150*	*Oral presentation to a scientific event*
63	P01	*UNIPG*	*Che Charisma!*	*Il Giornale dell'ARTE*	*02/12/2013*	*Scientific community (higher education, Research) - Civil society - Policy makers*	*Italy*	*3000*	*Articles published in the popular press*
64	P18	*APRE*	*Beni culturali: invito a presentare proposte nellambito del progetto CHARISMA*	*APRE news*	*18/04/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Italy*	*1000*	*Press releases*
65	P18	*APRE*	*Beni culturali: invito a presentare proposte nellambito del progetto CHARISMA*	*APRE news*	*05/12/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Italy*	*1000*	*Press releases*
66	P18	*APRE*	*Ricerca scientifica e beni culturali: il video di CHARISMA ci racconta le più importanti novità*	*APRE news*	*26/04/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Italy*	*1000*	*Press releases*
67	P18	*APRE*	*Beni culturali, scienza e innovazione: alcune news dal progetto CHARISMA*	*APRE news*	*10/05/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Italy*	*1000*	*Press releases*
68	P18	*APRE*	*CHARISMA ALLA 8° EDIZIONE DELLA BIENNALE DELLA FIERA DEL RESTAURO E DELLA GESTIONE DEL PATRIMONIO STORICO*	*APRE Newsletter*	*05/06/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Europe*	*200*	*Press releases*
69	P18	*APRE*	*EU Workshop Research Infrastructures for Cultural Heritage and Global Change in collaboration with CHARISMA*	*http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=workshop_march_2012*	*14/02/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*All*		*Press releases*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
70	P01	*UNIPG*	*MOLAB Infrastructure*	*-*	*31/12/2012*	*Scientific community (higher education, Research) - Industry - Civil society*	*Europe*	*300*	*Flyers*
71	P01	*UNIPG*	*MOLAB Infrastructures (II ver)*	*-*	*31/12/2013*	*Scientific community (higher education, Research) - Industry - Civil society*	*Europe*		*Flyers*
72	P01	*UNIPG*	*The article 'Micro-restauri per grandi capolavori' describes the activity of MOLAB in Italy and Europe.*	*WIRED IT The Italian edition of the US review. http://mag.wired.it/rivista/start/mo-lab-micro-restauri-per-grandi-capolavori.html*	*08/02/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers*	*Italy*		*Articles published in the popular press*
73	P01	*UNIPG*	*The WP6 Leader presents the CHARISMA progress.*	*iPoCh2, Italian Platform For Cultural Heritage, Rome, IT*	*04/10/2012*	*Scientific community (higher education, Research) - Industry - Policy makers*	*National*	*60*	*Oral presentation to a wider public*
74	P01	*UNIPG*	*The Coordinator presents CHARISMA advanced tools for in-situ monitoring*	*IN-ART 2013 1st International conference on innovation in art research and technology, Evora, PT*	*10/07/2013*	*Scientific community (higher education, Research) - Industry - Civil society*	*International*	*100*	*Oral presentation to a wider public*
75	P01	*UNIPG*	*Enhancing the communication between FP7 SSH projects*	*DASISH SSH Workshop, Gothenburg, SE*	*04/10/2013*	*Scientific community (higher education, Research) - Policy makers*	*Europe*	*70*	*Oral presentation to a wider public*
76	P01	*UNIPG*	*ICCROM Forum on Conservation Science*	*Rome, IT*	*16/10/2013*	*Scientific community (higher education, Research)*	*International*	*80*	*Oral presentation to a wider public*
77	P01	*UNIPG*	*The TV magazine of the European Commission has dedicated a specific movie to CHARISMA activities, entitled 'Art detectives team up' including short interviews with the Coordinator, the WP7 Leader, and some transnational access users.*	*FUTURIS http://www.euronews.com/2013/11/04/art-detectives-team-up/*	*04/11/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*	*100000*	*Media briefings*
78	P02	*CNRS*	*The TV report on the MOLAB interventions by CNRS (Access Project CARPACCIO-II, was given within the transmission "Kultura ob 22h"*	*TV SLOVENIJA 1 The most important public service broadcast channel of Slovenian http://tvslo.si/#ava2.97150655*	*17/02/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Slovenia*		*Media briefings*

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79	P02	*CNRS*	*The most diffused newspaper in Spain The article was dedicated to the first findings obtained through the MOLAB transnational access at the Alcazar Palace*	*EL PAIS http://ccaa.elpais.com/ccaa/2012/05/29/andalucia/1338316990_260806.html*	*30/05/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Spain*		*Articles published in the popular press*
80	P04	*NGL*	*Presentation on all the activities of CHARISMA made by WP2 leader*	*AHRC conference Sustaining the impact of UK Science and Heritage Research, London, UK*	*29/10/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers*	*National*	*150*	*Oral presentation to a wider public*
81	P06	*CNR*	*At the national reference point for the divulgation of science. A professional equipped box show in situ the effectiveness of laser cleaning on a set of prepared samples including wall paintings, stones and metals.*	*Science Festival, Genoa, IT*	*27/10/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*National*	*200000*	*Exhibitions*
82	P06	*CNR*	*The WP3 Leader, invited as keynote speaker, highlighted the CHARISMA methods and objectives.*	*EuroMed 2012 the European conference dedicated to Cultural Heritage, Lemesos, CY*	*29/10/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Europe*	*5000*	*Oral presentation to a wider public*
83	P07	*NCU*	*Presented poster: CHARISMA Cultural Heritage Advanced Research Infrastructures*	*International Conference Technology and Technique In Research on the Works of Art, Torun, PL*	*25/11/2010*	*Scientific community (higher education, Research) - Industry*	*International*	*150*	*Posters*
84	P09	*ATOMKI-HAS*	*Article on PIXE method in the archaeology analysis of metal artefacts, for the first time in Bulgaria- Related to CHARISMA PAMOMB access project.*	*NAUKA (= Science) newspaper www.nauka.bg*	*01/11/2011*	*Scientific community (higher education, Research) - Civil society*	*Bulgaria*		*Articles published in the popular press*
85	P09	*ATOMKI-HAS*	*Article Related to: EAAACSMB access project*	*SHUMENSKA ZARYA*	*13/12/2011*	*Scientific community (higher education, Research) - Civil society*	*Bulgaria*		*Articles published in the popular press*
86	P09	*ATOMKI-HAS*	*General presentation of the CHARISMA project*	*Workshop on Archaeometry, Debrecen, HU*	*02/04/2012*	*Scientific community (higher education, Research)*	*Hungary*	*50*	*Posters*
87	P09	*ATOMKI-HAS*	*Article 'The mysterious axe stone in Hung' (= A rejtélyes baltakQ) related to CHARISMA NENEART access project*	*-A TERMÉSZET VILÁGA (= The World of Nature) Journal of Hungarian science*	*31/05/2012*	*Scientific community (higher education, Research) - Civil society*	*Bulgaria*		*Articles published in the popular press*
88	P09	*ATOMKI-HAS*	*In the Sunday newspaper Interview with The UGL of - PGCAP1&2 Access project*	*TO VIMA - Latest breaking news from Greece*	*15/07/2012*	*Scientific community (higher education,*	*Greece*		*Articles published in the popular press*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
						Research) - Civil society - Medias			
89	P09	*ATOMKI-HAS*	*Article related to CHARISMA Access Project IBATEX1&2: Ion Beam Analysis Methods in Advanced Historical Textiles Research- Technical Study of Metal Threads from Romanian Historical Textiles (15th18th century) http://nuclculther.eu/wp-content/uploads/2014/01/Science-for-Heritage-Newsletter-December-2013.pdf*	*IAEA Newsletter, Issue 1 Science for Heritage*	*31/12/2013*	*Scientific community (higher education, Research)*	*International*		*Media briefings*
90	P11	*BM*	*Article on the CHARISMA Renaissance Workshop: The Materials and Techniques of Renaissance Art*	*E-CONSERVATION MAGAZINE, Issue No. 24 http://www.e-conservationline.com/content/view/1087*	*31/12/2012*	*Scientific community (higher education, Research) - Civil society - Medias*	*International*		*Media briefings*
91	P11	*BM*	*CHARISMA dedicated web pages*	*http://www.britishmuseum.org/charisma*	*31/12/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Web sites/Applications*
92	P11	*BM*	*The on-line magazine that provides a gateway to European information for the UK regions Article on the CHARISMA Project*	*EUROPE IN THE UK http://www.europe.org.uk/2013/01/17/the-charisma-project/*	*17/01/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*United Kingdom*		*Media briefings*
93	P16	*OCW-RCE*	*Partnersblog a publically broadcasted message, that tries to evoke direct feedback from the audience.*	*http://www.collectiewijzer.nl/tag/charisma/*	*31/12/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Web sites/Applications*
94	P16	*OCW-RCE*	*CHARISMA dedicated web pages*	*http://www.kennisvoorcollecties.nl/en/projects/objects-in-context/charisma-european-collaboration/*	*31/12/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Web sites/Applications*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
95	P17	*KIK-IRPA*	*Article Back to the Roots: CHARISMA Workshop on textile dyeing with natural organic dyes*	*E-CONSERVATION MAGAZINE, Issue No. 19 - http://www.e-conservationline.com/content/view/1051*	*31/03/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Media briefings*
96	P20	*BNC-WIGNER*	*CHARISMA access activity*	*Budapest, HU*	*31/12/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Flyers*
97	P20	*BNC-WIGNER*	*CHARISMA dedicated web pages*	*http://www.bnc.hu/?q=node/66*	*31/12/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Web sites/Applications*
98	P20	*BNC-WIGNER*	*Radio interviews about the project with the Staff of the Nuclear Analysis and Radiography Department (ATOMKI and Wigner)*	*KOSSUTH Radio, Hungary*	*19/03/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Hungary*		*Media briefings*
99	P09	*ATOMKI-HAS*	*5000 Years Old Iron Beads from the Heaven (Wigner and ATOMKI)*	*NOL News -online Journal http://nol.hu/tud-tech/20130813-_otezer_eves_vasgyongyok_az_egbol-1406195*	*13/06/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Hungary*		*Articles published in the popular press*
100	P20	*BNC-WIGNER*	*Article on CHARISMA project: Ancient secrets have been revealed by Hungarian scientists (Hungarian language)*	*INDEX MAGAZINE http://index.hu/tudomany/2013/06/20/magyar_kutatok_oldjak_meg_az_okori_rejtelyeket/*	*20/06/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Hungary*		*Media briefings*
101	P18	*APRE*	*Experience, Research and Innovation: a Research Infrastructures integrated platform for Cultural Heritage Conservation/Restoration (UNIPG, CNR, APRE, OPD)*	*CHARISMA Final event, Firenze, IT*	*05/03/2014*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*	*200*	*Organisation of Conference*
102	P20	*BNC-WIGNER*	*BNC-WIGNER CHARISMA access activity*	*Budapest, HU*	*01/01/2010*	*Scientific community (higher education, Research) - Industry - Policy makers - Medias*	*International*		*Flyers*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
103	P20	*BNC-WIGNER*	*CHARISMA dedicated web pages*	*http://www.bnc.hu/?q=node/66*	*01/01/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*		*Web sites/Applications*
104	P20	*BNC-WIGNER*	*Hungary Radio interviews about the project with the Staff of the Nuclear Analysis and Radiography Department*	*KOSSUTH Radio, Budapest, HU*	*19/03/2012*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Hungary*		*Media briefings*
105	P20	*BNC-WIGNER*	*5000 Years Old Iron Beads from the Heaven (Wigner and ATOMKI)*	*NOL News -online Journal http://nol.hu/tud-tech/20130813-_otezer_eves_vasgyongyok_az_egbol-1406195*	*13/06/2013*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Hungary*		*Media briefings*
106	P01	*UNIPG*	*The Coordinator and the WP6 Leader, invited by ESFRI, presented the project.*	*ESFRI-Working Group on Social Science and Humanities, Brussels, BE*	*15/06/2010*	*Policy makers*	*European Countries*	*20*	*Oral presentation to a wider public*
107	P01	*UNIPG*	*Coordinators invited talk: CHARISMA - Cultural heritage advanced research infrastructures.*	*ICRI International Conference on Research Infrastructures, Rome, IT*	*30/09/2010*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers*	*European Countries*	*250*	*Oral presentation to a wider public*
108	P02	*CNRS*	*Variscites dans la Préhistoire de lOuest de lEurope (AGLAE: CALLAIS Users Access project)*	*RSP-RENNES-2010 Roches et sociétés de la préhistoire entre massifs cristallins et bassins sédimenta, FR*	*28/04/2010*	*Scientific community (higher education, Research)*	*France*	*25*	*Oral presentation to a scientific event*
109	P06	*CNR*	*Advances in laser cleaning of artworks*	*L'ICONA 2010, Laser Optics for the Conservation of Artworks, St. Petersburg, RU*	*29/06/2010*	*Scientific community (higher education, Research)*	*European Countries*	*40*	*Oral presentation to a scientific event*
110	P01	*UNIPG*	*A detachable SERS active polymer film: a minimally invasive approach to the study of painting lakes*	*EUCMOS 2010 - 30TH European Congress of Molecular Spectroscopy, Firenze, IT*	*30/08/2010*	*Scientific community (higher education, Research)*	*Italy and Europe*	*80*	*Oral presentation to a scientific event*
111	P01	*UNIPG*	*Computational spectroscopy in cultural heritage*	*EUCMOS 2010 - 30TH European Congress of Molecular Spectroscopy, Firenze, IT*	*30/08/2010*	*Scientific community (higher education, Research)*	*Italy and Europe*	*80*	*Oral presentation to a wider public*
112	P01	*UNIPG*	*Evidence of the role of Zn and Fe cations as dopants in lead antimonate yellow by X-ray absorption spectroscopy (XAS)*	*SR2A-2010 Conference, Fourth Edition of Synchrotron Radiation in Art & Archaeology, Amsterdam. NL*	*09/11/2010*	*Scientific community (higher education, Research)*	*European Countries*	*120*	*Posters*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
113	P16	*OCW-RCE*	*Collecting botanical sources: Joint research on organic pigments and dyestuffs*	*DHA29 Dyes in History and Archaeology, Lisbon, PT*	*11/11/2010*	*Scientific community (higher education, Research)*	*European Countries*	*30*	*Posters*
114	P11	*BM*	*Review of extraction methods for the characterisation by HPLC of organic colorants in textiles and pigments in cultural heritage objects*	*DHA29 Dyes in History and Archaeology, Lisbon, PT*	*11/11/2010*	*Scientific community (higher education, Research)*	*European Countries*	*30*	*Posters*
115	P20	*BNC-WIGNER*	*Comprehensive database on Lapis Lazuli by PGAA, ¼-PIXE, external-beam PIXE, FTIR and TOF-ND methods*	*TECHNART 2011 Non-destructive and microanalytical techniques in art and cultural heritage,Berlin, DE*	*26/04/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
116	P20	*BNC-WIGNER*	*Gemstones in the royal tomb of Qatna (Syria)*	*TECHNART 2011 Non-destructive and microanalytical techniques in art and cultural heritage,Berlin, DE*	*26/04/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
117	P20	*BNC-WIGNER*	*Comprehensive database on Variscite by ¼-PIXE, external-beam PIXE and PGAA methods*	*TECHNART 2011 Non-destructive and microanalytical techniques in art and cultural heritage, Berlin, DE*	*26/04/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
118	P14	*OPD*	*Combining non-destructive techniques and microsamples analysis to study a stone giant: the case of Nettuno in Piazza della Signoria (Firenze, Italy)*	*ART'11 International Conference, Firenze, IT*	*14/04/2011*	*Scientific community (higher education, Research)*	*European Countries*	*180*	*Oral presentation to a scientific event*
119	P01	*UNIPG*	*The Coordinator highlighted the project objectives within the international scenario.*	*iPoCh2, Italian Platform For Cultural Heritage, Rome, IT*	*19/05/2011*	*Industry - Civil society - Policy makers - Medias*	*Italy*		*Oral presentation to a wider public*
120	P01	*UNIPG*	*A new portable system for integrated non-invasive in-situ measurements of absorbance , steady state fluorescence and emission decay time in dyes and colorants*	*XX International Materials Research Congress, IMRC Cancun, MX*	*15/08/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
121	P01	*UNIPG*	*Spectroscopic characterisation of natural dyes for their non-invasive identification in European and Mesoamerican manuscripts*	*XX International Materials Research Congress, IMRC Cancun, MX*	*15/08/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
122	P03	*FORTH*	*Cultural Heritage Materials Analysis by LIBS*	*International Conference on Matter and Materials for Heritage Conservation, MATCONS 11 Craiova, RO*	*23/08/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
123	P03	*FORTH*	*LIBS in Art and Archaeology. Achievements and Challenges*	*TECHNART 2011 Non-destructive and microanalytical techniques in art and cultural heritage,Berlin, DE*	*26/04/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
124	P03	*FORTH*	*Studying pigments on painted plaster in Minoan, Roman and Byzantine Crete*	*TECHNART 2011 Non-destructive and microanalytical techniques in art and cultural heritage,Berlin, DE*	*26/04/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
125	P03	*FORTH*	*Combined Laser-Induced Breakdown Spectroscopy, and Mass Spectrometry for the Analysis of Cultural Heritage Materials*	*TECHNART 2011 Non-destructive and microanalytical techniques in art and cultural heritage,Berlin, DE*	*26/04/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
126	P03	*FORTH*	*Preliminary investigation on monitoring transportation effects by full field methods: a digital holographic speckle pattern interferometry study on canvas paintings*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
127	P01	*UNIPG*	*New portable instrument for combined reflectance, time-resolved and steady-state luminescence measurements on works of ar*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
128	P06	*CNR*	*Autofocus laser system for multi-NIR scanning imaging of painting surfaces*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
129	P06	*CNR*	*Wide-band IR imaging in the NIR-MIR-FIR regions for in situ analysis of frescoes*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
130	P02	*CNRS*	*Terahertz pulse imaging of stratified architectural materials for cultural heritage studies*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
131	P07	*NCU*	*Application of optical coherence tomography (OCT) for real time monitoring of consolidation of the paint layer in Hinterglasmalerei objects*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
132	P07	*NCU*	*Application of digital image correlation (DIC) for tracking deformations of paintings on canvas*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
133	P03	*FORTH*	*IRIS: a novel spectral imaging system for the analysis of cultural heritage objects*	*SPIE (O3A) Optical Metrology conference on Optics for Arts,*	*23/05/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
				Architecture, and Archaeology, Munich, DE					
134	P07	*NCU*	*Application of optical coherence tomography (OCT) for monitoring of conservation treatment*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
135	P07	*NCU*	*Optical coherence tomography for high-resolution real time varnish ablation monitoring*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
136	P03	*FORTH*	*tudies of the affected region in the laser cleaning of polymeric coatings*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
137	P03	*FORTH*	*Real-time monitoring of laser cleaning using Digital Holographic Speckle Pattern Interferometry*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
138	P03	*FORTH*	*Removal of hard burial encrustation from ceramic sherds using Er:YAG and Nd:YAG laser irradiation*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
139	P20	*BNC-WIGNER*	*Wavelength and pulse duration effects on laser induced changes on raw pigments used in painting practices*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
140	P03	*FORTH*	*A high spatial and spectral resolution imaging system for the analysis of Cultural Heritage objects*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
141	P03	*FORTH*	*A new portable Digital Holographic Speckle Pattern Interferometry system for artworks structural documentation*	*LACONA IX Lasers in the Conservation Of Artworks, London, UK*	*07/09/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
142	P17	*KIK-IRPA*	*Shellfish purple in pre-Roman Italy: new evidence from Strozzacapponi (Perugia/Corciano)*	*DHA30 - 30th Annual Meeting of Dyes in Hystory and Archeaology Derby, UK*	*12/10/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
143	P13	*Of-ADC*	*Identification of Tyrian Purple in Aegean Bronze Age pigments*	*DHA30 - 30th Annual Meeting of Dyes in Hystory and Archeaology Derby, UK*	*12/10/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
144	P11	*BM*	*Analysis of organic colorants at the British Museum and preliminary results from study of the Andean textile collection*	*DHA30 - 30th Annual Meeting of Dyes in Hystory and Archeaology Derby, UK*	*12/10/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
145	P11	*BM*	*The preparation of madder-based pigments in antiquity*	*DHA30 - 30th Annual Meeting of Dyes in Hystory and Archeaology Derby, UK*	*12/10/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
146	P04	*NGL*	*Extraction methods for the HPLC characterisation of organic colorants in cultural heritage objects: creations of an online searchable bibliographic reference database*	*DHA30 - 30th Annual Meeting of Dyes in Hystory and Archeaology Derby, UK*	*12/10/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
147	P20	*BNC-WIGNER*	*Ore, slag and inclusion: measuring variability in the direct process and assessing its implications for provenancing iron using the SI method*	*39th International Symposium on Archaeometry: 50 years of ISA Leuven, BE*	*28/05/2012*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
148	P20	*BNC-WIGNER*	*A Technological and Provenance Study of Two Mycenaean Glass Collections Using X-Rays and Ion-Beam Analyses*	*39th International Symposium on Archaeometry: 50 years of ISA Leuven, BE*	*28/05/2012*	*Scientific community (higher education, Research)*	*International*		*Posters*
149	P20	*BNC-WIGNER*	*Mankinds earliest iron - really meteoritic?*	*39th International Symposium on Archaeometry: 50 years of ISA Leuven, BE*	*28/05/2012*	*Scientific community (higher education, Research)*	*International*		*Posters*
150	P20	*BNC-WIGNER*	*Using PGAA to determine the composition of experimental iron smelting residues: strengths and limitations of a non-destructive analytical technique*	*39th International Symposium on Archaeometry: 50 years of ISA Leuven, BE*	*28/05/2012*	*Scientific community (higher education, Research)*	*International*		*Posters*
151	P20	*BNC-WIGNER*	*Recent Provenance Study of Obsidian Artefacts found in Central Europe*	*39th International Symposium on Archaeometry: 50 years of ISA Leuven, BE*	*28/05/2012*	*Scientific community (higher education, Research)*	*International*		*Posters*
152	P09	*ATOMKI-HAS*	*PIXE Analysis of Decoration Pixels in Classical Attic Pottery*	*39th International Symposium on Archaeometry: 50 years of ISA Leuven, BE*	*28/05/2012*	*Scientific community (higher education, Research)*	*International*		*Posters*
153	P01	*UNIPG*	*X-ray Fluorescence Integrate by Molecular Spectroscopies for the Non Invasive Studies of Paintings*	*61st Annual Conference on Applications of X-RAY Analysis Denver, Co, US*	*06/08/2012*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
154	P01	*UNIPG*	*Photoluminescence properties of painting materials: from the laboratory to the museum*	*GORDON conference on scientific methods in cultural heritage research, West Dover, VT, US*	*29/07/2012*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
155	P08	*RWTH*	*Portable MRI for Nondestructive Testing of Cultural Heritage*	*GORDON conference on scientific methods in cultural heritage research, West Dover, VT, US*	*29/07/2012*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
156	P07	*NCU*	*Optical Coherence Tomography*	*GORDON conference on scientific methods in cultural heritage research, West Dover, VT, US*	*29/07/2012*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a wider public*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
157	P16	*OCW-RCE*	*Conservation and Valuation of Plaster casts*	*5th International Congress "Science and Technology for the Safeguard of. Cultural Heritage in the Mediterranean Basin" Istanbul, Turkey*	*22/11/2011*	*Scientific community (higher education, Research)*	*International*		*Posters*
158	P07	*NCU*	*Nondestructive Testing of Paintings by Optical Coherence Tomography*	*Analyses of paintings, new advances in the development of micro-destructive and non-destructive technique, Bologna, IT*	*14/06/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
159	P08	*RWTH*	*Nondestructive Testing of Paintings by Mobile Magnetic Resonance Imaging (MRI)*	*Analyses of paintings, new advances in the development of micro-destructive and non-destructive technique, Bologna, IT*	*14/06/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
160	P02	*CNRS*	*Terahertz application to reveal hidden faces on fresco*	*Analyses of paintings, new advances in the development of micro-destructive and non-destructive technique, Bologna, IT*	*14/06/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
161	P21	*UNIBO*	*Evaluation of the effects of sample preparation on the results achievable by means of FTIR spectroscopy in ATR mode*	*Analyses of paintings, new advances in the development of micro-destructive and non-destructive technique, Bologna, IT*	*14/06/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
162	P21	*UNIBO*	*Analysis of paint cross-sections: a combined multivariate approach for the interpretation of ¼ATR-FTIR hyperspectral data arrays*	*Analyses of paintings, new advances in the development of micro-destructive and non-destructive technique, Bologna, IT*	*14/06/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
163	P01	*UNIPG*	*Micro-infrared reflection spectroscopy for the study of paint-cross section*	*Analyses of paintings, new advances in the development of micro-destructive and non-destructive technique, Bologna, IT*	*14/06/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
164	P02	*CNRS*	*Terahertz application in cultural heritage: the case study of Villeneuve-lès-Avignon*	*FLAMN-13 Symposium Fundamentals of Laser Assisted Microand Nano-Technologies, St Petersburg, RU*	*23/06/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
165	P01	*UNIPG*	*Conservation and science in Europe: towards a transnational infrastructure*	*Conservation-Science & Science-Conservation Day Firenze, IT*	*07/05/2013*	*Scientific community (higher education, Research)*	*Italy and Europe*		*Oral presentation to a scientific event*
166	P01	*UNIPG*	*Non-invasive in situ investigations on modern and contemporary art*	*Conservation-Science & Science-Conservation Day Firenze, IT*	*07/05/2013*	*Scientific community (higher education, Research)*	*Italy and Europe*		*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
167	P06	*CNR*	*Optical metrology for Cultural Heritage*	*Conservation-Science & Science-Conservation Day Firenze, IT*	*07/05/2013*	*Scientific community (higher education, Research)*	*Italy and Europe*		*Oral presentation to a scientific event*
168	P06	*CNR*	*Laser treatments in the restoration: state of the art and perspectives of a methodological revolution*	*Conservation-Science & Science-Conservation Day Firenze, IT*	*07/05/2013*	*Scientific community (higher education, Research)*	*Italy and Europe*		*Oral presentation to a scientific event*
169	P06	*CNR*	*Potential of Chlorophyll Fluorescence imaging for assessing bio-viability changes of biodeteriogen growths on stone monuments*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*13/05/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
170	P02	*CNRS*	*Terahertz analysis of stratified wall plaster at buildings of cultural importance across Europe*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*13/05/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
171	P07	*NCU*	*OCT structural examination of Madonna dei Fusi by Leonardo da Vinci*	*SPIE (O3A) Optical Metrology conference on Optics for Arts, Architecture, and Archaeology, Munich, DE*	*13/05/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
172	P01	*UNIPG*	*MOLAB non invasive in situ study of Edvard Munch's painting materials*	*MUNCH150 Conference Public paintings by E. Munch and his contemporaries. Change and conservation challenges, Oslo, NO*	*28/06/2013*	*Scientific community (higher education, Research) - Civil society - Medias*	*Norway and Europe*		*Oral presentation to a wider public*
173	P06	*CNR*	*Analysis of the Munch paintings by scanning multispectral infrared reflectography: Anxiety (1894), Puberty (1894) and Vampire (1895)*	*MUNCH150 Conference Public paintings by E. Munch and his contemporaries. Change and conservation challenges, Oslo, NO*	*28/06/2013*	*Scientific community (higher education, Research) - Civil society - Medias*	*Norway and Europe*		*Oral presentation to a scientific event*
174	P02	*CNRS*	*Image retrieval techniques for THz applications in cultural heritage*	*38th International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz), Mainz , DE*	*01/09/2013*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
175	P18	*APRE*	*CHARISMA corner, posters and flyers*	*ICRI (EuroRIs-Net) International Conference on Research Infrastructures - FP7 Capacities, Rome, IT*	*30/09/2010*	*Scientific community (higher education, Research) - Policy makers*	*International*	*130*	*Organisation of Conference*
176	P02	*CNRS*	*Seeing through Walls: Çatalhöyük*	*UK Archaeological Science Biennial Conference UKAS 2011, Reading, UK*	*15/09/2011*	*Scientific community (higher education, Research)*	*National*		*Posters*
177	P02	*CNRS*	*Pulsed Terahertz Investigation of Corroded and Mineralized Copper Alloy Historical Artifacts*	*36th International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz), Houston, USA*	*02/10/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
178	P02	*CNRS*	*Deconvolution: Imaging the Unturned Page*	*36th International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz), Houston, USA*	*02/10/2011*	*Scientific community (higher education, Research)*	*International*		*Oral presentation to a scientific event*
179	P02	*CNRS*	*Issues with Surface and Sub-surface Measurements in the Terahertz Pulse Imaging of Heritage Objects*	*Annecy, FR*	*21/03/2012*	*Scientific community (higher education, Research)*	*International*		*Posters*
180	P02	*CNRS*	*Terahertz imaging of graffiti*	*AES 2012, Advanced Electromagnetics Symposium Paris, FR*	*16/04/2012*	*Scientific community (higher education, Research)*	*National*		*Posters*
181	P02	*CNRS*	*Terahertz Pulse Imaging of Egyptian and Near Eastern Artifacts*	*AES 2012, Advanced Electromagnetics Symposium, Paris, FR*	*16/04/2012*	*Scientific community (higher education, Research)*	*National*		*Posters*
182	P20	*BNC-WIGNER*	*Ion microprobe analysis of decorated classical pottery (FIXLAB access projects PGCAP1&2)*	*11th International Conference on Applications of Nuclear Techniques (CRETE 11) Rethymnon, GR*	*12/06/2011*	*Scientific community (higher education, Research) - Industry*	*International*	*100*	*Oral presentation to a scientific event*
183	P20	*BNC-WIGNER*	*Looking into the gold-leaf glass tesserae from the mosaics of the Daphni Monastery, Athens, GR (FIXLAB Access project NUTEBYTES)*	*6th Symposium of the Hellenic Society for Archaeometry, Athens, GR*	*16/05/2013*	*Scientific community (higher education, Research) - Industry*	*European Countries*	*200*	*Oral presentation to a scientific event*
184	P20	*BNC-WIGNER*	*In-vacuum micro-PIXE and micro-PIGE study of natural limestone compared with Kufu and Kafré pyramid material (FIXLAN Access project NUTEBYTES)*	*ECAART 11 European Conference on Accelerators in Applied Research and Technology, Namur, BE*	*08/09/2013*	*Scientific community (higher education, Research)*	*International*	*150*	*Posters*
185	P16	*OCW-RCE*	*Back to the Roots - A CHARISMA Workshop on Textile Dyeing with Natural Dyes,*	*E-CONSERVATION MAGAZINE, an on-line journal on conservation*	*02/04/2012*	*Scientific community (higher education, Research) - Medias*	*Europe*	*1000*	*Media briefings*
186	P20	*BNC-WIGNER*	*Micro-Pixe studies on copper provenance of some Romanian bronze age (FIXLAB access project: MICROBRONZE)*	*TECHNART 2011 Non-destructive and microanalytical techniques in art and cultural heritage,Berlin, DE*	*26/04/2011*	*Scientific community (higher education, Research)*	*International*	*300*	*Oral presentation to a scientific event*
187	P20	*BNC-WIGNER*	*Non-destructive analysis of altered gold leaf glass tesserae from the mosaics of the Daphni Monastery, Greece*	*ICOM-CC Glass and Ceramics WG Interim Meeting and Forum , Amsterdam NL*	*07/10/2013*	*Scientific community (higher education, Research)*	*International*	*200*	*Oral presentation to a scientific event*
188	P18	*APRE*	*The TA opportunity of CHARISMA project*	*Information Day on European Funding Opportunities for Research Infrastructures, Nicosia (CY)*	*15/09/2011*	*Scientific community (higher education, Research) - Civil society - Policy makers - Medias*	*International*	*100*	*Oral presentation to a wider public*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
189	P18	*APRE*	*EU Workshop Research Infrastructures for Cultural Heritage and Global Change co-organised by CHARISMA (KIK-IRPA, UNIPG, APRE)*	*EU Workshop on Research Infrastructures for Cultural Heritage and Global Change, Brussels, BE*	*14/03/2012*	*Scientific community (higher education, Research) - Civil society - Policy makers*	*International*	*100*	*Organisation of Workshops*
190	P18	*APRE*	*CHARISMA corner with dissemination material*	*EuroMed 2012 the European conference dedicated to Cultural Heritage. Limassol, CY*	*30/11/2012*	*Scientific community (higher education, Research) - Civil society - Policy makers - Medias*	*International*	*300*	*Exhibitions*
191	P18	*APRE*	*Experience, Research and Innovation the integrated Research Infrastructures for Cultural Heritage Conservation and Restoration celebrates its results.*	*CHARISMA Final event, Firenze. http://www.apre.it/notizie/2014/i-semestre/charisma-final-event/*	*20/02/2014*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*All*		*Press releases*
192	P01	*UNIPG*	*The Non-Invasive Analysis of Painted Surfaces: Scientific Impact and Conservation Practice The Coordinator presents the CHARISMA In situ non-invasive studies of paintings*	*ICOM-CC Joint Working Group Meeting - The Non-Invasive Analysis of Painted Surfaces, Washington, US*	*20/02/2014*	*Scientific community (higher education, Research) - Policy makers*	*International*	*200*	*Oral presentation to a wider public*
193	P07	*NCU*	*CHARISMA WP9: New portable instrumentation - Optical Coherence Tomography Poster*	*CHARISMA final event, Firenze, IT*	*05/03/2014*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers*	*International*		*Posters*
194	P11	*BM*	*Strategies for analysis: balancing the desirability of non-invasive methods with the advantages of sampling*	*ICOM-CC Joint Working Group Meeting - The Non-Invasive Analysis of Painted Surfaces, Washington, US*	*20/02/2014*	*Scientific community (higher education, Research) - Medias*	*International*	*200*	*Oral presentation to a wider public*
195	P06	*CNR*	*Experience, Research and Innovation: a Research Infrastructures integrated platform for Cultural Heritage Conservation/Restoration (UNIPG, CNR, APRE, OPD)*	*CHARISMA Final event, Firenze, IT*	*05/03/2014*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*	*200*	*Organisation of Conference*
196	P14	*OPD*	*Experience, Research and Innovation: a Research Infrastructures integrated platform for Cultural Heritage Conservation/Restoration (UNIPG, CNR, APRE, OPD)*	*CHARISMA Final event , Firenze, IT*	*05/03/2014*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*	*200*	*Organisation of Conference*
197	P04	*NGL*	*CHARISMA after four years: a participant's perspective*	*CHARISMA Final event , Firenze, IT*	*05/03/2014*	*Scientific community (higher education, Research) - Industry - Civil*	*International*	*200*	*Oral presentation to a wider public*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
						society - Policy makers - Medias			
198	P06	*CNR*	*IPERION-CH: a view towards a future common work*	*CHARISMA Final event , Florence, IT*	*05/03/2014*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*	*200*	*Oral presentation to a wider public*
199	P01	*UNIPG*	*Experience, Research and Innovation: a Research Infrastructures integrated platform for Cultural Heritage Conservation/Restoration (UNIPG, CNR, APRE, OPD)*	*CHARISMA Final event, Florence, IT*	*05/03/2014*	*Scientific community (higher education, Research)*	*International*	*200*	*Organisation of Conference*
200	P14	*OPD*	*Modern technology and the conservation of artworks*	*CHRISMA Final Event, Firenze, IT*	*05/03/2014*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*International*	*200*	*Oral presentation to a wider public*
201	P04	*NGL*	*London and Amsterdam Sunflower paintings: Comparison of the painting materials and techniques used in the two pictures*	*http://www.nationalgallery.org.uk/the-sunflowers-feature London, UK*	*14/03/2014*	*Scientific community (higher education, Research)*	*European Countries*		*Oral presentation to a scientific event*
202	P16	*OCW-RCE*	*Dissemination Booklet - Natural Colorants for Dyeing and Lake Pigments: Practical Recipes and their Historical Sources*	*-*	*31/03/2014*	*Scientific community (higher education, Research) - Civil society*	*International*		*Media briefings*
203	P10	*CPP-LMRH*	*Lettre d'information du LRMH n°3 Article related to the Terahertz Time-Domain reflectometrometry System, a new portable instrumentation developed by CHARISMA*	*http://www.lrmh.fr/lrmh/html/lettre3.htm*	*31/03/2014*	*Scientific community (higher education, Research) - Civil society*	*National*		*Media briefings*
204	P03	*FORTH*	*Prepared for the 2nd International Conference on Research Infrastructures, 2-4 April 2014, Athens Lasers in the service of the future ¿f our past: the laser cleaning of the Athens Acropolis sculptures*	*http://www.icri2014.gr/*	*31/03/2014*	*Scientific community (higher education, Research) - Policy makers*	*International*		*Flyers*
205	P01	*UNIPG*	*RTVE RADIO Y TELEVISIÓN ESPAÑOLA, S.A. The largest audiovisual group in Spain broadcasted*	*http://www.rtve.es/alacarta/videos/telediario/tecnologia-valioso-aliado-restauracion/2494132/*	*07/04/2014*	*Scientific community (higher education, Research) - Industry - Civil*	*Spain*		*Media briefings*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
			La tecnologia un valioso aliado a la restauracion on the MOLAB access intervention in Merida (Spanish language)			*society - Policy makers - Medias*			
206	P01	*UNIPG*	*The Coordinator presents the CHARISMA transnational access program: a profitable tool for the study and conservation of cultural heritage in Europe*	*eCult 2nd DIALOGUE DAY Creating the Magic: Matching Culture and ICT eCult Dialogue Day Tallinn, EE*	*14/05/2014*	*Scientific community (higher education, Research) - Industry*	*International*	*100*	*Oral presentation to a wider public*
207	P04	*NGL*	*From botanical source to analytical result: the influence of recipe and plant source on appearance and composition of anthraquinone and flavonoid dyes and pigments*	*DHA32 Dyes in History and Archaeology,La Rochelle FR*	*02/10/2013*	*Scientific community (higher education, Research)*	*Europe*	*40*	*Oral presentation to a scientific event*
208	P14	*OPD*	*Analysis of metal artworks by SEM-EDS*	*9th EMAS Region al Workshop on Electron Probe Micro-analysis, Amsterdam, NL*	*26/04/2010*	*Scientific community (higher education, Research)*	*Europe*	*40*	*Oral presentation to a scientific event*
209	P14	*OPD*	*Coping with past conservative interventions and biological growth on stone statues located in Boboli garden, Florence (Italy)*	*International conference Jardins de Pierres. Conservation of stone in parks, gardens and cemeteries, Paris, FR*	*22/06/2011*	*Scientific community (higher education, Research)*	*International*	*40*	*Oral presentation to a scientific event*
210	P14	*OPD*	*The San Giovanni Altar from the Baptistery of Florence: the goldsmith workshop through fourteenth and fifteenth centuries*	*Symposium The Renaissance Workshop: The Materials and Techniques of Renaissance Art, London, UK*	*10/05/2012*	*Scientific community (higher education, Research)*	*International*	*350*	*Oral presentation to a scientific event*
211	P14	*OPD*	*The Workshops of Benedetto and Giuliano da Maiano, Giuliano and Antonio da Sangallo and Baccio da Montelupo*	*Symposium The Renaissance Workshop: The Materials and Techniques of Renaissance Art, London, UK*	*10/05/2012*	*Scientific community (higher education, Research)*	*International*	*350*	*Oral presentation to a scientific event*
212	P14	*OPD*	*Striptease and dressing-up in Titians Workshop: a technical comparison of the Young Ladies in the Galleria Palatina, the Hermitage, the Kunsthistoriches Museum*	*Symposium The Renaissance Workshop: The Materials and Techniques of Renaissance Art, London, UK*	*10/05/2012*	*Scientific community (higher education, Research)*	*International*	*350*	*Oral presentation to a scientific event*
213	P14	*OPD*	*Underdrawings in paintings*	*Symposium Science and Innovation for the Study and Conservation of Works of Art, Washington, US*	*07/10/2013*	*Scientific community (higher education, Research) - Civil society - Policy makers*	*International*	*150*	*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
214	P14	*OPD*	*Conservation projects at the Florentine Opificio delle Pietre Dure*	*Symposium Science and Innovation for the Study and Conservation of Works of Art, Washington, US.*	*07/10/2013*	*Scientific community (higher education, Research) - Civil society - Policy makers*	*International*	*150*	*Oral presentation to a scientific event*
215	P20	*BNC-WIGNER*	*Non-destructive Neutron Analytical Methods for Material Studies and their Archaeometric Applications at the Budapest Research Reacto (in Hungarian) http://www.mkenk2011.mke.org.hu/*	*1st National Chemistry Conference, Sopron, HU*	*22/05/2011*	*Scientific community (higher education, Research)*	*Hungary*	*30*	*Oral presentation to a scientific event*
216	P20	*BNC-WIGNER*	*Bronze Age Defensive Armour in Hungary: New Aspects of Manufacture http://aie3.bergbaumuseum.de/*	*3rd International Conference on Archaeometallurgy in Europe 2011, Bochum, DE*	*29/06/2011*	*Scientific community (higher education, Research)*	*International*	*100*	*Posters*
217	P20	*BNC-WIGNER*	*Corrosion monitoring of archaeological iron QADCAI Access Project*	*6th Central European Training School on Neutron Scattering, Budapest, HU*	*14/05/2012*	*Scientific community (higher education, Research)*	*Europe*	*50*	*Oral presentation to a scientific event*
218	P20	*BNC-WIGNER*	*High Resolution Neutron Diffraction in Archaeological Studies*	*6th Central European Training School on Neutron Scattering, Budapest, HU*	*14/05/2012*	*Scientific community (higher education, Research)*	*Europe*	*50*	*Oral presentation to a scientific event*
219	P20	*BNC-WIGNER*	*Non-destructive elemental analysis and imaging of Cultural Heritage objects with cold neutrons*	*6th Central European Training School on Neutron Scattering, Budapest, HU*	*14/05/2012*	*Scientific community (higher education, Research)*	*Europe*	*50*	*Oral presentation to a scientific event*
220	P20	*BNC-WIGNER*	*PIXE, a Complementary Tool for Elemental Analysis in Cultural Heritage Research*	*6th Central European Training School on Neutron Scattering, Budapest, HU*	*14/05/2012*	*Scientific community (higher education, Research)*	*Europe*	*50*	*Oral presentation to a scientific event*
221	P20	*BNC-WIGNER*	*Non-destructive Neutron Analytical Methods for Material Studies and their Applications at the Budapest Research Reactor - (in Hungarian) http://www.diamond-congress.hu/rakk2011/*	*7th Annual Meeting on Non-destructive Material Studies, Eger, HU*	*12/04/2011*	*Scientific community (higher education, Research)*	*Hungary*	*50*	*Oral presentation to a scientific event*
222	P20	*BNC-WIGNER*	*Provenance Study of Obsidian Artefacts from the Carpathian Basin (in Hungarian) http://www.ace.hu/ametry/GKKIProgram%20-%202011-11-17.pdf*	*Annual Meeting of the Committee on Geochemistry, Mineralogy and Petrology of the HAS, Budapest, HU*	*17/11/2011*	*Scientific community (higher education, Research)*	*Hungary*	*50*	*Oral presentation to a scientific event*
223	P20	*BNC-WIGNER*	*Neutrons in the Archaeology, http://www.atomki.mta.hu/Magyar_Fizikus_Vandorgyules_2013/*	*Annual Meeting of the Hungarian Association of Physicists, Debrecen, HU*	*21/08/2013*	*Scientific community (higher education, Research)*	*Hungary*	*120*	*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
224	P20	*BNC-WIGNER*	*Mankinds Earliest Iron Artefacts Made of Meteoritic Iron Indeed? (in Hungarian) - http://www.radiokemia.mke.org.hu/*	*Annual Radiochemistry Workshop, Eger, HU*	*16/10/2013*	*Scientific community (higher education, Research)*	*Hungary*	*30*	*Oral presentation to a scientific event*
225	P20	*BNC-WIGNER*	*A Non-Invasive Method for the Identification of Hidden Patterns on the Blades of Indo-Persian Swords in the Wallace Collection, London GNASH Access Project - http://buma8.wiki.fc2.com/*	*BUMA 2013. 8th International Conference on the Beginning of the Use of Metals and Alloys, Nara, Japa*	*10/09/2013*	*Scientific community (higher education, Research)*	*International*	*100*	*Oral presentation to a scientific event*
226	P20	*BNC-WIGNER*	*External Milli-Beam PIXE Analysis of the Mineral Pigments of Glazed Iznik (Turkey) Ceramics - http://emac2013.geoscienze.unipd.it/*	*EMAC 2013. 12th European Meeting on Ancient Ceramics, Padova, IT*	*19/09/2013*	*Scientific community (higher education, Research)*	*Europe*	*250*	*Posters*
227	P20	*BNC-WIGNER*	*Neutron Scattering to Reveal Nano-Scale Structures in Functional Materials http://www.euronanoforum2011.eu/*	*EuroNanoForum 2011, Budapest, HU*	*30/05/2011*	*Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias*	*Europe*	*1200*	*Oral presentation to a scientific event*
228	P20	*BNC-WIGNER*	*Production of Bronze Age defensive armour in Eastern Europe: analyses and archaeological studies AHAB_ACT Access project - http://www.unicaen.fr/archeometrie2013/*	*GMPCA 2013. 19th Symposium of Group for Multidisciplinary Methods Contributing to Archaeology, Caen,*	*22/04/2013*	*Scientific community (higher education, Research)*	*France*	*70*	*Oral presentation to a scientific event*
229	P20	*BNC-WIGNER*	*Characterization of Archaeological and Museological Metal-Related Artefacts by TOF-ND at Budapest Neutron Centre - http://www.icns2013.org/*	*ICNS 2013. 10th International Conference on Neutron Scattering Edinburgh, UK*	*08/07/2013*	*Scientific community (higher education, Research) - Industry*	*International*	*800*	*Oral presentation to a scientific event*
230	P20	*BNC-WIGNER*	*Multipurpose Utilisation of a Medium Flux Research Reactor Benefit for the Society http://www-pub.iaea.org/iaeameetings/38299/International-Conference-on-Research-Reactors-Safe-Management-and-Effective-Utilization*	*International Conference on Research Reactors: Safe Management and Effective Utilization, Rabat, MO*	*14/11/2011*	*Scientific community (higher education, Research)*	*International*	*150*	*Oral presentation to a scientific event*
231	P20	*BNC-WIGNER*	*Lithics from the Tell Site HódmezQvásárhely-Gorzsa: Typology, Technology, Use and Raw Material*	*International Conference, Chronologies, Lithics and Metals Late Neolithic and Copper Age in the*	*30/03/2012*	*Scientific community (higher education, Research)*	*International*	*70*	*Oral presentation to a scientific event*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
			Strategies during the Late Neolithic DRAGA Access Project http://www.elte.hu/file/regeszet_konf_2012_program.pdf	*Eastern Part of the Carpathian Basin and in the Balkans, Budapest, HU*					
232	P20	*BNC-WIGNER*	*Archaeological Glass Weathering and Resulting Implications for Analytical Studies TECH-PRO OF PELOP-GLASS Access Project http://www.ssaette.gr/node/621*	*History, Techn. Conserv. Ancient Metal, Glasses, Athen, GR*	*16/11/2011*	*Scientific community (higher education, Research)*	*International*	*70*	*Oral presentation to a scientific event*
233	P20	*BNC-WIGNER*	*3D Neutron Imaging of a XVIIIth Dynasty Egyptian Sealed Pottery http://www.frm2.tum.de/indico/conferenceDisplay.py?confId=3*	*NINMACH 2013. 1st International Conference on Neutron Imaging and Neutron Methods in Archaeology and Cultural Heritage Research, Garching, DE*	*09/09/2013*	*Scientific community (higher education, Research)*	*International*	*80*	*Posters*
234	P20	*BNC-WIGNER*	*Della Robbia Sculptures in Portugal: Neutron Techniques Applied to Provenance Issues TIGLAZEAccess project - http://www.frm2.tum.de/indico/conferenceDisplay.py?confId=3*	*NINMACH 2013. 1st International Conference on Neutron Imaging and Neutron Methods in Archaeology and Cultural Heritage Research, Garching, DE*	*09/09/2013*	*Scientific community (higher education, Research)*	*International*	*80*	*Oral presentation to a scientific event*
235	P20	*BNC-WIGNER*	*Fifteen Years of Archaeometry Research at the Prompt Gamma Activation Analysis Facility of the Budapest Neutron Centre, http://www.frm2.tum.de/indico/conferenceDisplay.py?confId=3*	*NINMACH 2013. 1st International Conference on Neutron Imaging and Neutron Methods in Archaeology and Cultural Heritage Research, Garching, DE*	*09/09/2013*	*Scientific community (higher education, Research)*	*International*	*80*	*Oral presentation to a scientific event*
236	P20	*BNC-WIGNER*	*Lapis Lazuli: The Stone of the Antiquity and their Origin LAPIS LAZULI Access project - http://www.frm2.tum.de/indico/conferenceDisplay.py?confId=3*	*NINMACH 2013. 1st International Conference on Neutron Imaging and Neutron Methods in Archaeology and Cultural Heritage Research, Garching, DE*	*09/09/2013*	*Scientific community (higher education, Research)*	*International*	*80*	*Oral presentation to a scientific event*
237	P20	*BNC-WIGNER*	*Neutron Investigation of an Exceptional Zinc Lamp from the Academia Georgica Treiensis Archaeological Collection (Italy) IRPAG Access project http://www.frm2.tum.de/indico/conferenceDisplay.py?confId=3*	*NINMACH 2013. 1st International Conference on Neutron Imaging and Neutron Methods in Archaeology and Cultural Heritage Research, Garching, DE*	*09/09/2013*	*Scientific community (higher education, Research)*	*International*	*80*	*Posters*

No.	P	Main Leader	Title	Place	Date	Type of audience	Countries addressed	Size of audience	Type of activities
238	P20	*BNC-WIGNER*	*PGAA Analysis of Some Neolithic Obsidian Samples from Romanian Regions - http://www.frm2.tum.de/indico/conferenceDisplay.py?confId=3*	*NINMACH 2013. 1st International Conference on Neutron Imaging and Neutron Methods in Archaeology and Cultural Heritage Research, Garching, DE*	*09/09/2013*	*Scientific community (higher education, Research)*	*International*	*80*	*Posters*
239	P20	*BNC-WIGNER*	*Nuclear techniques in research for cultural heritage http://www.nupecc.org/*	*NuPECC 2011. Nuclear Physics in Hungary, Budapest, HU*	*07/10/2011*	*Scientific community (higher education, Research)*	*Europe*	*50*	*Oral presentation to a scientific event*
240	P20	*BNC-WIGNER*	*Provenance Studies of Central European Neolithic Obsidians Using External Beam Milli-PIXE Spectroscopy ARCHAEO-OBSIDIAN access project - http://www.ufrgs.br/pixe/2013/*	*PIXE 2013. 13th International Conference on Particle Induced X-ray Emission, Garmado, Brazil*	*03/03/2013*	*Scientific community (higher education, Research)*	*International*	*250*	*Oral presentation to a scientific event*
241	P20	*BNC-WIGNER*	*Best Practice: Access to Large Scale Facilities for Cultural Heritage research within CHARISMA http://www4.ffg.at/veranstaltungen/Downloads/190974A5.pdf*	*Research Infrastructures - Crossing Borders, Budapest, HU*	*20/09/2011*	*Policy makers - Medias*	*Hungary*	*30*	*Oral presentation to a scientific event*
242	P20	*BNC-WIGNER*	*Combining Neutron and Proton Beam Techniques: a Unique Science Tool Kit in Archaeometric Analysis - http://wigner.mta.hu/wigner111/*	*Wigner 111 International Scientific Symposium, Budapest, HU*	*11/11/2013*	*Scientific community (higher education, Research)*	*Hungary*	*150*	*Posters*
243	P20	*BNC-WIGNER*	*Bronze Age Usage and Development of Defensive Armour in Hungary BUDDAH Access Project http://www.ace.hu/ametry/am111123/Program.html*	*Workshop on Archaeometry - Metals and Society, Budapest, HU*	*23/11/2011*	*Scientific community (higher education, Research)*	*Hungary*	*30*	*Posters*

6.3 Exploitation of Foreground

Table 7 Description of foreground

EXPLOITABLE FOREGROUND						
Exploitable foreground (Description)	**Type of Foreground**	**Exploitable product(s) or measure(s)**	**Sector(s) of application (NACE Code)**	**Timetable**	**Patents or other IPR exploitation (licences)**	**Owner & Other Beneficiary(s) involved**
1. *New portable system of Confocal Laser Scanning IR Microscopy*	*Commercial exploitation of R&D results*	*In situ non invasive 3D study of painting layers (varnish an d retouches).*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*CNR-INO & UNIPG, OPD, NCU*
2 *New portable system for in-situ applications of Optical Coherence Tomography*	*Commercial exploitation of R&D results*	*3D non invasive in-situ studies of painting layers, glasses, glazes, etc.*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*NCU & OPD, CNR-INO, RWTH, CNRS, FORTH*
3. *Innovations in single sided NMR-MOUSE relaxation measurements.*	*Commercial exploitation of R&D results*	*Non invasive in situ depth profiling for 1H or 23Na containing materials.*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*RWTH & UNIPG, NCU, CNR-INO, CNRS, OPD*
4. *Methodology of application of THz spectroscopy and imaging to heritage objects*	*General advancement of knowledge*	*THz spectroscopy and imaging for the characterisation of materials and of h idden images.*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*CNRS-LAMS & MCC-C2RMF, CPP-LMRH, F ORTH*
5. *Portable system for absorption and fluorescence spectroscopy (wavelength and time resolved)*	*Commercial exploitation of R&D results*	*In situ non invasive identification of fluorescing materials.*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*UNIPG & CNR-INO, FORTH, Of-ADC, OCW-RCE* .

EXPLOITABLE FOREGROUND						
Exploitable foreground (Description)	**Type of Foreground**	**Exploitable product(s) or measure(s)**	**Sector(s) of application (NACE Code)**	**Timetable**	**Patents or other IPR exploitation (licences)**	**Owner & Other Beneficiary(s) involved**
6. *New compact system for digital holographic speckle pattern interferometry*	*Commercial exploitation of R&D results*	*In situ non invasive recording of cracks or detachment risk maps in paintings or monuments.*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*FORTH & CPP-LMRH, CNRS, MCC-C2RMF, NCU*
7. *New laser cleaning methodologies for applications on different substrates*	*General advancement of knowledge*	*Improved methodologies for a secure and effective laser cleaning*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*CNR-IFAC & CNRS, MCC-C2RMF, FORTH, OPD, LNEC, NCU*
8. *Rare standards for analytical applications on colorants*	*Exploitation of R&D results via standards*	*Production and characterisation of rare standards*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*n.a.*	*OCW-RCE & KIK-IRPA,UNIPG, BM, NGL, Of-ADC, DI-BS, CNR-ICVBC*
9. *Early synthetic dyes*	*Exploitation of R&D results via standards*	*Collection of early synthetic dyes and definition of analytical strategies.*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*n.a.*	*DI-BS & NGL, UNIPG, BM, OCW-RCE, KIK-IRPA, CNR-ICVBC*
10. *High resolution multispectral spectroscopic mapping imaging system*	*Commercial exploitation of R&D results*	*Spectroscopic mapping images in different e/m wavelength bands.*	**M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*Of-ADC & UNIPG*
11. *ARCHLAB web Portal*	*Commercial exploitation of R&D results*	*Information on the content of the archives (metadata)*	***J63.1.2*** - *Web Portals* **M72.20** - *R & Exp, D on social science and humanities.* **M72.19** - *R & Exp, D on natural sciences* **R90.03** - *Art and creation*	*2014*	*not foreseen*	*Of-ADC & NGL, BM, OPD, PRADO, OCW-RCE, MCC-C2RMF*

- *Explanations of described foreground*

1. *New portable system of Confocal Laser Scanning IR Microscopy* The new system offers the advantage to be exploited for non-invasive and no-contact measurements in-situ (in museum rooms or any other site where the artwork to be examined is located, without any sampling). Purpose of the system is to record 3D non-invasive images of paint stratifications, based on the principles of the near-IR confocal laser scanning microscopy (CLMS), with particular reference to varnish and retouches. During the set up, modifications to increase the acquisition rate and depth resolution were introduced, that lead to a final "double" instrument capable to work as CLSM and time-domain confocal OCT prototype, obtaining in both cases satisfactory 3D representations of the layers under examination. ? CNR-INO was responsible of the development and is owner of the system. The prototype is ready for applications. It can be exploited by researchers (heritage scientists, art historians and archaeologists) and by restorer.
2. *New portable system for in-situ applications of Optical Coherence Tomography* Spectral-domain OCT is an ideal technique for the examination of stratigraphy of easel-paintings, including investigation of varnish layer thickness, sequence of layers, and presence of underdrawings. The technique can be also useful for revealing the authenticity of over-paintings or false signatures. In addition, the ability of the spectral domain modality to image internal structures at high resolution and in real time, makes it suitable for monitoring conservation processes, like laser ablation of varnish. Other applications in cultural heritage regard examination of stained and other historical glass, jade, porcelain, and parchment.

   Specific features are: i) the high portability (all the components can be packed in boxes easy to be transported and reassembled); ii) the device can operate in two different modes: with 8 µm and 15 µm mean spot size. The former satisfies the high transversal resolution requirement, although it allows imaging of a relatively small area. The latter permits for imaging of larger areas from longer distance, but at the cost of lower transversal resolution. To avoid the necessity of changing the reference arm to match the chosen telecentric objective, a double reference arm is available.

   The system is complete and is currently exploited with success at the eservice of users as art-historians, archaeologists, conservator-restorers, and scientists who want to integrate their surface measurements with 3D examinations.

   NCU is the institution responsible of the development and is owner of the prototype. The equipment gained attraction not only from museum curators and researchers working in restoration projects (e.g. National Museum in Gdansk, Poland and Ghent Altarpiece Conservation Project - Royal Institute for Cultural Heritage/KIK-IRPA, Brussels, Belgium) where the instrument has been used for examination of word-class objects, but also from SME active in field of restoration ("RESTAURO" company - http://www.restauro.pl/en/). The manufacturer of light sources for OCT ("SUPERLUM", Ireland) is using (with permission) results obtained within CHARISMA project instrument for demonstration purposes. Beyond the CH application the instrument was used on demand of "BITLUX" srl, Firenze, Italy for examination of delaminations in plastic soldering. Results obtained within the CHARISMA project pointed attention of THORLABS, the leading manufacture of non-medical OCT systems, towards cultural heritage.

   The system is ready for exploitation in research programmes and access plans.

3. *Innovations in single sided NM R-MOUSE relaxation measurement*. The Profile NMR-MOUSE (Mobile Universal Surface Explorer) developed by RWTH (University of Aachen, DE), consists of a portable open NMR sensor equipped with an innovative permanent magnet geometry that generates a flat sensitive volume parallel to the scanner surface.

   Purpose and ability of the de vice is to measure: proton density as a function of depth, T2 and T1 relaxation times; and self-diffusion coefficient of liquids. In various versions, the system is having substantial impact in several fields, from the industrial control of multilayer cement materials or solvent ingress into matrixes, to the medical profiling of human skin in vivo, to the applications in cultural heritage.

   Owner of the developed system is RWTH and technology transfer is currently active. In 2007, from RWTH Aachen University a spin-off ACT GmbH was generated, which merged into Magritek Ltd. in 2012. Magritek is producing several models of the NMR-MOUSE and a line of desktop NMR spectrometers with magnet technology that could find interesting development from the results achieved in CHARISMA. The company today has offices in Aachen, Germany, Wellington, New Zealand, and San Diego, US and is reporting consider able growth. Currently employs more than 8 persons in Germany. The system is ready for exploitation in research programmes and access plans.

4. *Methodology of application of THz spectroscopy and imaging to heritage objects*. The system has been assembled and experimented with the objective to dispose of an instrument able to retrieve information from different layers of a pain ting using terahertz pulsed reflection imaging. Besides the possible additional use as a spectrometer, relevant feature of the system is that the optical components are contained within a box of easy transportation size and weight, and the fiber-coupled antennas permit rapid modification of the measurement geometry to be carried out. This allows the instrument to be profitably applied for on-site examinations.

   The system is validated and is exploitable by heritage researchers to reveal, in situ and with no-contact measurements, the presence of reflective materials below thick layers of mortars, as in the cases of gildings, mosaics, and others. Besides researchers, it can be exploited by restorers for diagnostics previous to interventions.

5. *Portable system for absorption and fluorescence spectroscopy (wavelength and time resolved)*. One of the most relevant advantages of this system stays in the fact that more than one technique can be exploited to give answer to the same analytical question on the same identical point of the examined surface. The setup “triple” spectrometer, for integrated absorption-fluorescence-decay time measurements on fluorescing substances, registered large interest among researchers and conservation companies because of the high versatility in the examination of fluorescing materials (different techniques in the same identical point).

   This solution offers a unique possibility of effective non invasive diagnostics for organic materials, otherwise difficult without sampling.

   The good performances shown by the prototype opened the door to profitable applications at the level of research through services of access to mobile instrumentation. In fact, the prototype, in its last version, is also largely and successfully applied to in situ studies of ancient and modern paintings in restoration laboratories or in museums. Owner of the developed system is UNIPG. The system is currently used in the Italian MOLAB national access programme.

6. *New compact system for digital holographic speckle pattern interferometry*. The Metrotech instrument and overall monitoring concept, as developed in the

framework of the CHARISMA project, has attracted the attention of users as a tool that enables reliable assessment of the state of preservation of an object/monument overtime and the study of it as a function of environmental and climatic factors. Most importantly the lightweight and the mobility of the instrument, together with a straight forward operability, make it quite attractive for a vast number of field applications.

This was demonstrated in campaigns carried out within CHARISMA and currently several users (both state organizations and research institutes) have expressed their interest in making use of the instrument for field campaigns.

Owner of the developed system is FORTH. The new system is exploitable for application in research and access programmes.

7. *New laser cleaning methodologies for applications on different substrates*. The technological and methodological advances achieved within the Project on open cleaning problems has significantly grew the impact of the laser app roach in conservation of artworks. This has been achieved through the interaction with conservation institutions, restoration enterprises, and laser companies. In particular, the demonstration of the high versatility of the multiple pulse duration in laboratory tests and concrete case studies stimulated the company El.En. S.p.A (Calenzano, Italy) to develop and put on the market in 2012 a novel Nd:YAG(1064 nm) system, which combines different temporal emission regimes.

   To date, several units of this device were marketed, and used in many conservation-restoration yards. Similarly, the results showing the effectiveness of the Nd:YAG laser's second harmonic (532 nm) for removing biodeteriogens from stone and paper artefacts are under exploitation at both the industrial and service levels. Thus for example Quanta Systems S.p.A. (Milan, Italy) has marketed a multiwavelenght laser system for medical and cleaning applications since several years ago but before CHARISMA this laser source has been rarely used in conservation because of the lack of convincing validation studies, which are now available.

   The present results can provide benefits also for other companies producing very compact and advanced multiwavelenght Nd:YAG lasers, such as Quantel Group (Les Ulis Cedex, France, Big Sky Group).

8. *Rare standards for analytical applications on colorants*. Rare standards for analytical applications on organic colorants were isolated from madder and weld by a special developed extraction protocol and using preparative LC and subsequently characterised by ESI-MS. The methodology developed is of particular interest to the scientific community involved in dyestuff analysis since most of the natural organic colorants normally detected in cultural heritage cannot be obtained in a pure form. In fact, the development of an analytical method is in general done using mixtures of dyes, a modality which is not efficient. The isolated and characterised organic colorants, from madder, weld or any relevant biological source, are therefore highly relevant.

9. *Early synthetic dyes*. Early synthetic dyes and organic pigments were investigated in a systematic way. The methodology of preparing dyed wool and mock up paints following historical recipes are described in such way that they easily can be reproduced.

   The reference materials can be used to evaluate analytical techniques and the same set of materials is available for further study either for analytical purposes or for degradation studies.

10. *High-resolution multispectral spectroscopic mapping imaging system*. Diffuse reflectance spectra from 1 to 5 μm are acquired providing materials mapping images at different wavelength, using a Focal Plane Array as a detector. The

irradiation of the examined sample is performed using a source and an interferometer which is part of an existing FTIR system (Spectrum TWO or ALPHA).

The reflectance from the illuminated object is recorded by the FPA and Fourier transform carried out. The resolution achieved using the interferometer is of sub nanometer order and thus cube images every nanometer wavelengths are acquired. The time that the interferometer makes a scan is 0.7~1sec for the illuminated area (ROI).

Of-ADC, responsible of the work, is the owner.

The system is already used in missions of the mobile Lab of OR MYLIA Foundation as well as in other research actions. The system can be also applied in other scientific fields, as medicine (i.e. results on melanoma detection are appearing in conferences).

11. *ARCHLAB web Portal*. Main purpose of the ARCHLAB Portal is to provide information on the content of the archives available through CHARISMA. Data (high resolution images, spectra etc.) are not published. Published information includes metadata (identification information) about the objects one can find visiting each provider and data available.

    Of-ADC, as responsible of the work, is the owner of the portal. The data presented are property of the providing partner.

REPORT ON SOCIETAL IMPLICATIONS

A General Information

Grant Agreement Number: 228330

Title of Project: Cultural heritage Advanced Research Infrastructures: Synergy for a Multidisciplinary Approach to Conservation/Restoration

Name and Title of Coordinator: Prof. Brunetto Giovanni Brunetti

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)?

- If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? ***No***

Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*

2. Please indicate whether your project involved any of the following issues (tick box) :

RESEARCH ON HUMANS

- Did the project involve children? ***No***
- Did the project involve patients? ***No***
- Did the project involve persons not able to give consent? ***No***
- Did the project involve adult healthy volunteers? ***No***
- Did the project involve Human genetic material? ***No***
- Did the project involve Human biological samples? ***No***
- Did the project involve Human data collection? ***No***

RESEARCH ON HUMAN EMBRYO/FOETUS

- Did the project involve Human Embryos? ***No***
- Did the project involve Human Foetal Tissue / Cells? ***No***
- Did the project involve Human Embryonic Stem Cells (hESCs)? ***No***
- Did the project on human Embryonic Stem Cells involve cells in culture? ***No***
- Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos? ***No***

PRIVACY

- Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)? ***No***
- Did the project involve tracking the location or observation of people? ***No***

RESEARCH ON ANIMALS

- Did the project involve research on animals? ***No***
- Were those animals transgenic small laboratory animals? ***No***
- Were those animals transgenic farm animals? ***No***
- Were those animals cloned farm animals? ***No***
- Were those animals non-human primates? ***No***

RESEARCH INVOLVING DEVELOPING COUNTRIES

- Did the project involve the use of local resources (genetic, animal, plant etc)? ***No***
- Was the project of benefit to local community (capacity building, access to healthcare, education etc)?

DUAL USE

- Research having direct military use — ***No***
- Research having the potential for terrorist abuse — ***No***

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	0	1
Work package leaders	4	6
Experienced researchers (i.e. PhD holders)	32	21
PhD Students	12	6
Other	12	4

4. How many additional researchers (in companies and universities) were recruited specifically for this project? **12**

Of which, indicate the number of men: 4

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project?

◎ Yes
○ No

6. Which of the following actions did you carry out and how effective were they?

		Not at all effective				Very effective
☑	Design and implement an equal opportunity policy	○	○	○	○	◎
❑	Set targets to achieve a gender balance in the workforce	○	○	○	○	○
❑	Organise conferences and workshops on gender	○	○	○	○	○
❑	Actions to improve work-life balance	○	○	○	○	○
○	Other:					

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify

◎ No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

◎ Yes- please specify

PHD students involved in the project, training courses addressed to students, 'open lab event' open to school pupils

○ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

◎ Yes- please specify kits, websites, explanatory booklets, DVDs, etc.

○ No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

◎ Main discipline[1]: 1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

◎ Associated discipline[1]:
6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group] .

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)*

◎ Yes
○ No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

◎ Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?

○ Yes
◎ No

12. Did you engage with government / public bodies or policy makers (including international organisations)

○ No
○ Yes- in framing the research agenda
○ Yes - in implementing the research agenda
◎ Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

○ Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
◎ Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
○ No

13b If Yes, in which fields?

Agriculture		Energy		Human rights	
Audiovisual and Media		Enlargement		Information Society	
Budget		Enterprise		Institutional affairs	
Competition		Environment		Internal Market	
Consumers		External Relations		Justice, freedom and security	
Culture	✓	External Trade	✓	Public Health	
Customs		Fisheries and Maritime Affairs		Regional Policy	
Development Economic and Monetary Affairs		Food Safety		Research and Innovation	✓
Education, Training, Youth		Foreign and Security Policy		Space	
Employment and Social Affairs		Fraud		Taxation	
		Humanitarian aid		Transport	

[1] Insert number from list below (Frascati Manual).

13c If Yes, at which level?

- ○ Local / regional levels
- ○ National level
- ○ European level
- ◎ International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals? **76**

To how many of these is open access[2] provided? **25**

How many of these are published in open access journals? **6**

How many of these are published in open repositories? **0**

To how many of these is open access not provided? **16**

Please check all applicable reasons for not providing open access:

- ☑ publisher's licensing agreement would not permit publishing in a repository
- ❑ no suitable repository available
- ❑ no suitable open access journal available
- ❑ no funds available to publish in an open access journal
- ❑ lack of time and resources
- ❑ lack of information on open access
- ❑ other[3]: ……

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).* **0**

16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).

Trademark	**0**
Registered design	**0**
Other	**0**

17. How many spin-off companies were created / are planned as a direct result of the project?

Indicate the approximate number of additional jobs in these companies:

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

- ❑ Increase in employment, or
- ❑ Safeguard employment, or
- ❑ Decrease in employment,
- ☑ Difficult to estimate / not possible to quantify
- ❑ In small & medium-sized enterprises
- ❑ In large companies
- ☑ None of the above / not relevant to the project

[2] Open Access is defined as free of charge access for anyone via Internet.
[3] For instance, classification for security project.

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs: *Indicate figure:*

Difficult to estimate / not possible to quantify ❑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

○ Yes ◎ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Yes ◎ No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

- ☑ Press Release
- ☑ Media briefing
- ☑ TV coverage / report
- ☑ Radio coverage / report
- ☑ Brochures /posters / flyers
- ☑ DVD /Film /Multimedia
- ☑ Coverage in specialist press
- ☑ Coverage in general (non-specialist) press
- ☑ Coverage in national press
- ☑ Coverage in international press
- ☑ Website for the general public / internet
- ☑ Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

- ☑ Language of the coordinator
- ☑ Other language(s)
- ☑ English