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|---|--|---|
| Dissemination Level | | |
| PU | Public | X |
| RE | Restricted to a group specified by the partners of the ACTINET-6 | |
| CO | Confidential, only for partners of the ACTINET-6 project | |

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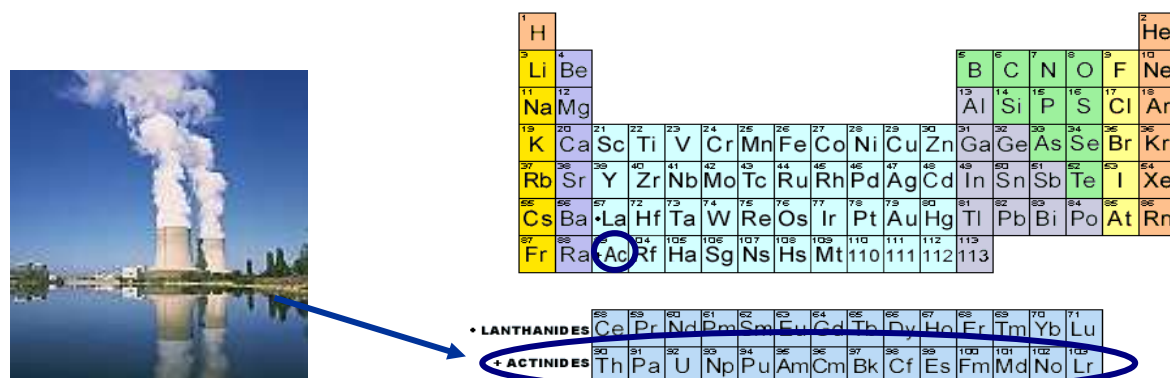
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1- GENERAL PROJECT OBJECTIVES

The European Union currently produces 35% of its electricity from nuclear fission. Furthermore, as stated by the Green Paper “Toward a European strategy for the security of energy supply” published in 2000 by the European Commission, the European Union should maintain a diversity of its sources of energy supply. Nuclear fission is therefore likely to contribute substantially to the energetic mix in the future, as an option to reduce the energy dependency of the European Union, while avoiding greenhouse gas emission. As mentioned in the Green Paper, “the European Union must retain its leading position in the field of civil nuclear technology”.

Research plays an important role in this context.

One major issue requiring intensive research and development programs remains a broadly agreed approach to waste management. Research and development is also needed to explore new concepts for nuclear energy generation that make better use of fissile material and generate less waste. All these issues require expertise and improved knowledge on processes involving actinides.



Actinides are elements of the same family as Uranium, produced within the nuclear fuel during its life in power plants. Actinides have a rich and specific physical and chemical behaviour.

However, research with actinides has stagnated in the past decades and has become less attractive for young scientists, particularly in European countries: the safety requirements for handling alpha-emitting compounds have gradually made researches very costly, so that many radiochemistry laboratories have restricted their activities in this field. Maintaining up-to-date experimental capacities for handling radioactive compounds has gradually made research very costly. This trend has dramatically reduced basic research on actinides in Europe, so that at present, only few research institutions are able to maintain the necessary research capacity, and none of them alone covers the full spectrum required, with the expertise, technical competence and tools at the scale required by the technical challenges faced today.

Because of its strategic importance, research on actinides must be revitalized. This can only be envisaged by networking at the European scale, by the development and strengthening of links between nuclear research institutes and academic radiochemistry laboratories: this networking will not only facilitate the coordination and utilization of the available facilities, but also consolidate and optimise research programming and training capacities in Europe.

The objective of ACTINET was to take some steps in order to bring both research infrastructures and human expertise in Europe at an adequate performance level, thus contributing to the creation of the European Research Area in the fields of physics and chemistry of actinides. The three directions of action were:

- Stimulating a global European **infrastructure policy** by pooling a set of facilities for a joint use within the network.
- Defining shared ambitious **research projects** through a selective and competitive procedure to select the best joint research projects taking advantage of the pooled facilities.
- Joining efforts for **training**. In particular a yearly ACTINET Summer School was to be established.

Pooled Facilities: A global European infrastructure policy is necessary, in a context where the available tools are scarce resources. Currently, facilities are scattered among several institutes, some of them are redundant, while others are either missing or difficult to gain access to by academic researchers. A research infrastructure policy at the European level will be a cornerstone for structuring the European Research Area in the field of nuclear fission energy, and in particular for actinide sciences. This policy proceeds step-by-step to improve the accessibility of the major actinide facilities to the European scientific community, to optimise at the European scale the utilisation of existing experimental facilities, and to coordinate the deployment of future facilities and new instruments.

The objective within the network was to select parts of the major facilities allowing handling radioactive material under specific controlled conditions with access to analytical techniques and specific characterization methods, for the benefit of joint research projects potentially involving all members of the network.

Joint Research Projects: Offering the access to up-to-date major experimental tools must be accompanied by the definition of shared ambitious research programmes, and by improved mobility between the involved institutions, in particular between academic institutions and national laboratories, in order to reduce the fragmentation of the European community of actinide sciences and strengthen scientific excellence.

The objective was there to establish a common unified procedure of competitive calls for projects in order to provide access to the pooled facilities for the best projects.

Training and Education: Enhanced mobility and enhanced infrastructure availability for joint research programmes allows the next generation of actinide scientists and engineers to gain hands-on experience as part of their training.

It was also an objective of the network to support a stronger participation of national laboratories in training at the universities, as well as a stronger use of facilities for teaching and training. Furthermore a new yearly European school on actinides was to be established.

2- ORGANISATION OF THE NETWORK

ACTINET has started in March 2004 by the establishment of a consortium of 27 organisations ranging from large national laboratories to university departments, thus bringing together major experimental facilities, academic and applied research expertise and capacities, and training experience. Other members joined the network at later stages.

| ACTINET Member Organisations (initial members: 01 to 27) | | |
|--|--|-------------|
| 01 | Commissariat à l'Energie Atomique (CEA) | France |
| 02 | JRC – Institute for Transuranian Elements (ITU) | EU |
| 03 | Forschungszentrum Karlsruhe (FZK) | Germany |
| 04 | Studie Centr. voor Kemenerg. – Centre d'Etude de l'En. Nucl. (SCK-CEN) | Belgium |
| 05 | Chalmers University of Technology | Sweden |
| 06 | CIEMAT | Spain |
| 07 | Centre National de la Recherche Scientifique (CNRS) | France |
| 08 | Czech Technical University in Prague | Czech Rep. |
| 09 | Forschungszentrum Jülich GmbH | Germany |
| 10 | Forschungszentrum Dresden-Rossendorf (FZD) | Germany |
| 11 | Johannes Gutenberg Universität | Germany |
| 12 | Royal Institut of Technology (KTH) | Sweden |
| 13 | University of Copenhagen | Denmark |
| 14 | Nuclear Research Institute Rez | Czech Rep. |
| 15 | Inst. of Low Temp. Struct. Res., Polish Acad. of Sciences | Poland |
| 16 | Paul Scherrer Institut (PSI) | Switzerland |
| 17 | University of Stockholm | Sweden |
| 18 | Universiteit Antwerpen | Belgium |
| 19 | University of Cambridge | UK |
| 20 | University of Cyprus | Cyprus |
| 21 | University of Helsinki | Finland |
| 22 | University of Liège | Belgium |
| 23 | University of Manchester | UK |
| 24 | Universitat Politècnica de Catalunya | Spain |
| 25 | Nuclear Research and consultancy Group (NRG) | Nederland |
| 26 | Imperial College | UK |
| 27 | Ecole Nationale Supérieure Chimie Paris | France |
| 28 | University of Potsdam | Germany |
| 30 | Charles University of Prague | Czech Rep. |
| 32 | University of Barcelona | Spain |
| 33 | University of Sheffield | UK |
| 34 | University of Wrocław | Poland |

ACTINET was supported during four years by the European Commission as a network of Excellence under the 6th Framework Programme Euratom.

Its general organisation was as follows:

- A Governing Board as the network's uppermost decision-making and arbitration body, responsible for the general policy and strategic orientations of the network (each member organisation had one institutional representative to the Governing Board, the Core Group – CEA, ITU, FZK, SCK-CEN – had 50% of the voting rights).
- An Executive Committee of nine members appointed by the Governing Board was responsible for preparing and implementing the policy decided on by the Governing Board.
- A Scientific Advisory Committee of eight or nine members appointed by the Governing Board for their personal expertise, advised on the fields of research to be encouraged, and assessed all joint research proposals prior to selection by the Executive Committee.
- A Coordinator appointed by CEA for the overall coordination and monitoring of the project, and for reporting to the European Commission.

3 ACTIVITIES OF THE NETWORK

In line with the major objectives described above, the main activities of the network were related to:

- pooled facilities
- joint research projects
- training and education

3.1- POOLING FACILITIES

ACTINET pooled facilities are laboratories and facilities dedicated to actinide research, provided by CEA, ITU, FZK, SCK-CEN, FZR, and PSI (details on the pooled facilities are available on the website at www.actinet-network.org/pooled_facilities).

Information on the status of the individual laboratories was exchanged, specific requirements were identified for the access to the individual facilities, and the difficult question of homogenisation of access requirements was addressed by an adhoc working group.

Stays of visiting scientists in ACTINET pooled facilities in the frame of joint research projects amounted to approximately 330 person weeks up to March 2008 (86.6 person weeks in total up to the end of 2005, and to 65.5 person weeks in 2006). The pooled facilities are also involved in training activities. An example is the workshop on actinide speciation using XAFS organised by FZK, PSI and FZR in Karlsruhe and Villigen.



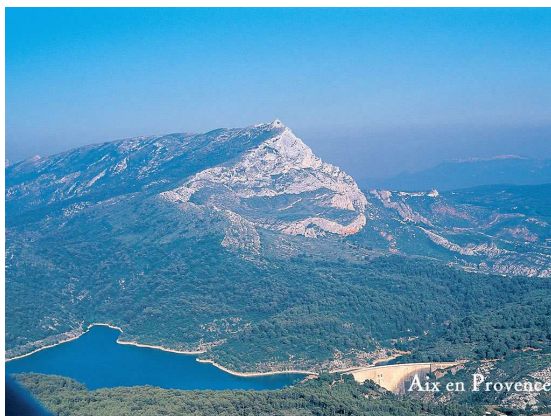
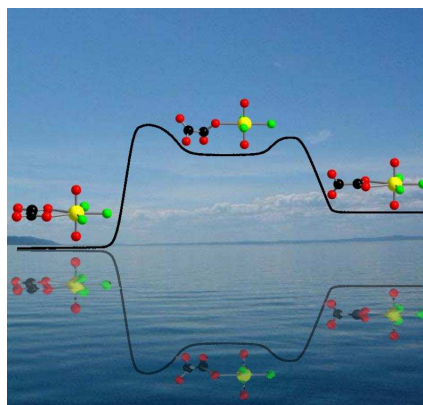
In the same spirit as the pooling of experimental facilities, a virtual Theoretical User Laboratory (ThUL) was established to bring together in a long lasting structure the tools and expertise available in European actinide modelling and simulation, and to make them available to the whole European community of actinide scientists.

The ThUL also organised two schools designed to contribute bridging the gap between theoreticians and experimentalists: how to perform relevant experiments that can be modelled, and to orient calculations to be relevant for the interpretation of experiments.

The first ThUL School took place in May 2006 in Lille, the second in November 2007 in Cadarache.

1st School of the ThUL. Lille. May 2006

| Time | Sunday 14-May | Monday 15-May | Tuesday 16-May | Wednesday 17-May | Thursday 18-May | Friday 19-May | Saturday 20-May |
|-------------|------------------|--|--|--|--|--|------------------------|
| 9:00-9:15 | | Opening Ingmar Grenthe | Jean-François Desreux | Maurizio Cossi | Robert Denning | Melissa Denecke | Computer exercise |
| 9:15-10:45 | | Coordination chemistry in solution | NMR spectroscopy | Solvation models | Spectroscopy | EXAFS spectroscopy | Do your own project |
| 10:45-11:00 | | Coffee break | Coffee break | Coffee break | Coffee break | Coffee break | Coffee break |
| 11:00-12:15 | | Ingmar Grenthe | Jean-François Desreux | Maurizio Cossi | Robert Denning | Melissa Denecke | Computer exercise |
| 12:30-14:00 | | Coordination chemistry in solution | NMR spectroscopy | Solvation models | Spectroscopy | EXAFS spectroscopy | Do your own project |
| 14:00-15:45 | | Lunch | Lunch | Lunch | Lunch | Lunch | Lunch |
| 15:45-16:00 | | Luuk Visscher | Luuk Visscher | Luuk Visscher | Per-Ake Malmqvist | Melissa Denecke | Free time |
| 16:00-18:00 | Arrival in Lille | Computer exercise ADF / test runs | Computer exercise ADF / Relativistic effects | Computer exercise ADF / Actinides | Computer exercise Molcas / introduction | Computer exercise Molcas / spectroscopy | |
| 18:00-18:30 | | Flash presentation | Flash presentation | | | | |
| 21:00-22:00 | | | Poster session | Poster session | | School dinner | |



2nd School of the ThUL. Cadarache. Nov 2007

| Time | Monday 12-Nov | Tuesday 13-Nov | Wednesday 14-Nov | Thursday 15-Nov | Friday 16-Nov |
|-------------|--|---|--|---|--------------------------------|
| 9:00-10:30 | General Introduction : | X-ray spectroscopy: | Photoemission: | Empirical potentials: | Thermodynamical properties: |
| 10:30-11:00 | Coffee break | Coffee break | Coffee break | Coffee break | Coffee break |
| 11:00-12:30 | General Introduction : | Relativistic aspects: | Beyond LDA: SIC | Classical Molecular dynamics: | Questions session |
| 12:30-14:00 | Lunch | Lunch | Lunch | Lunch | Lunch |
| 14:00-15:30 | DFT-pseudos : | DFT +Applic ations : | Beyond LDA: LDA-U | Phonons: | Magnetism |
| 15:30-16:00 | Coffee break | Coffee break | Coffee break | Coffee break | Coffee break |
| 16:00-17:30 | Computer exercise : Pseudopotenti al generation | Computer exercise : DFT Calculations on UO2 | Computer exercise : LDA-U calculation on UO2 | Computer exercise : Calculations on classical molecular dynamics | |

The Theoretical User Lab was also strongly involved in other events, both for co-funding and co-organisation, including contribution to the programme; e.g. the “Very Heavy Metal Conference” VHM 2006 (March 2006), the “Relativistic Effects in Heavy Elements” REHE 2007 conference where the ACTINET ThUL chaired the specific session on actinides, and the Helsinki Winter school 2007 with the topic “Radiochemistry and Actinides”.

3.2- JOINT RESEARCH

The rhythm of two calls for joint research projects every year has been well established within the research teams of the member organisations.

On the whole duration of the project, more than 150 proposals have been received, and reviewed by the Scientific Advisory Committee. Approximately half of them have been selected by the Executive Committee, ranging from instrumentation to quantum chemistry, from solution chemistry to the physics of irradiated actinide materials. For these projects, access was given to the requested pooled facilities, and support was provided for mobility, accommodation, sample transports. A list of approved projects and more information on each project may be found on the internet (http://www.actinet-network.org/joint_projects).

A new instrument to enhance integration and mobility has been available since the 5th call for proposals mid-2006: specific funding of excellent young scientists by grants when this was significantly supporting the use of the pooled facilities for joint research projects with high scientific added value. 13 fellowships have been granted during the project, and this gave a renewed impetus for academic partners to propose more ambitious projects demanding a strong involvement.

3.3- TRAINING & EDUCATION

At each call for project (starting from Call#2 in October 2004), it was also possible to propose “education and training projects”, finally resulting in a total of 18 approved events (see http://www.actinet-network.org/joint_projects for details).

The network also established a yearly summer school, alternately organised by CEA and ITU (the pedagogical material produced for these school is available on the ACTINET website):
 The first ACTINET Summer School (AnSS'04) was organised by CEA from 17 to 19 June 2004 in Avignon, and focused on "Thermodynamics and Kinetics of Liquid-Liquid Extraction".
 The second ACTINET Summer School (AnSS'05) was organised by ITU from 15 to 18 June 2005 in Karlsruhe. This was actually a new issue of the former “summer school on actinide science and applications”.
 The third ACTINET Summer School (AnSS'06) was organised by CEA from 3 to 6 July 2006 in Saclay (France) on “Geochemistry and migration of Actinides”.
 The fourth ACTINET Summer School (AnSS'07) was organised by ITU in Karlsruhe from 12 to 15 June 2007, following the standard scheme of the “Actinide Science and Applications”.
 The fifth ACTINET Summer School (AnSS'08) was organised by CEA in Cadarache and Marcoule from 2 to 5 July 2008, focused on plutonium and actinide nuclear fuels. The school was associated to the international conference “Plutonium Futures – the Science 2008” taking place the following week in Dijon.



ANNEXES

Major dates along the project.

| | |
|----------------------|--|
| December 2002 | Plenary preparation meeting # 1 (Karlsruhe) |
| March 2003 | Plenary preparation meeting # 2 (Avignon) |
| March 2004 | Start of the FP6 ACTINET-6 contract |
| April 2004 | Governing Board # 1 (Paris) |
| May 2004 | Executive Committee # 1 (Karlsruhe) |
| May 2004 | Call for projects # 1 (deadline: July 2004) |
| June 2004 | ACTINET Summer School # 1 (Marcoule) |
| July 2004 | Scientific Advisory Committee # 1 (Paris, evaluation Call 1) |
| September 2004 | Executive Committee # 2 (Marcoule, selection Call 1) |
| October 2004 | Governing Board # 2 (Karlsruhe) |
| October 2004 | Call for projects # 2 (deadline: December 2004) |
| January 2005 | Scientific Advisory Committee # 2 (Karlsruhe, evaluation Call 2) |
| January 2005 | Executive Committee # 3 (Barcelona, selection Call 2) |
| March 2005 | Call for projects # 3 (deadline May 2005) |
| March 2005 | Governing Board # 3 (Mol) |
| June 2005 | ACTINET Summer School # 2 (Karlsruhe) |
| June 2005 | Scientific Advisory Committee # 3 (Karlsruhe, evaluation Call 3) |
| June 2005 | Executive Committee # 4 (Copenhagen, selection Call 3) |
| August 2005 | Call for projects # 4 (deadline December 2005) |
| January 2006 | Scientific Advisory Committee # 4 (Paris, evaluation Call 4) |
| January 2006 | Executive Committee # 5 (Brussels, selection Call 4) |
| April 2006 | Governing Board # 4 (Karlsruhe) |
| April 2006 | Call for projects # 5 (deadline May 2006) |
| June 2006 | Scientific Advisory Committee # 5 (Karlsruhe, evaluation Call 5) |
| June 2006 | Executive Committee # 6 (Villigen, selection Call 5) |
| July 2006 | ACTINET Summer School # 3 (Saclay) |
| October 2006 | Call for projects # 6 (deadline December 2006) |
| January 2007 | Scientific Advisory Committee # 6 (Karlsruhe, evaluation Call 6) |
| February 2007 | Executive Committee # 7 (Dresden, selection Call 6) |
| March 2007 | Governing Board # 5 (Paris) |
| April 2007 | Call for projects # 7 (deadline May 2007) |
| June 2007 | ACTINET Summer School # 4 (Karlsruhe) |
| July 2007 | Scientific Advisory Committee # 7 (Karlsruhe, evaluation Call 7) |
| July 2007 | Executive Committee # 8 (Paris, selection Call 7) |
| October 2007 | ACTINET Stakeholders Information Day (Brussels) |
| November 2007 | Call for projects # 8 (deadline December 2007) |
| January 2008 | Scientific Advisory Committee # 8 (Karlsruhe, evaluation Call 8) |
| February 2008 | Executive Committee # 9 (Karlsruhe, selection Call 8) |
| March 2008 | Governing Board # 6 (Avignon) |
| March 2008 | ACTINET Plenary Meeting (Avignon) |
| July 2008 | ACTINET Summer School # 5 (Cadarache) |
| December 2008 | Termination of the FP6 ACTINET-6 contract |
| February 2009 | Governing Board # 7 (Karlsruhe) |

Coordinator:
Pascal CHAIX (CEA)

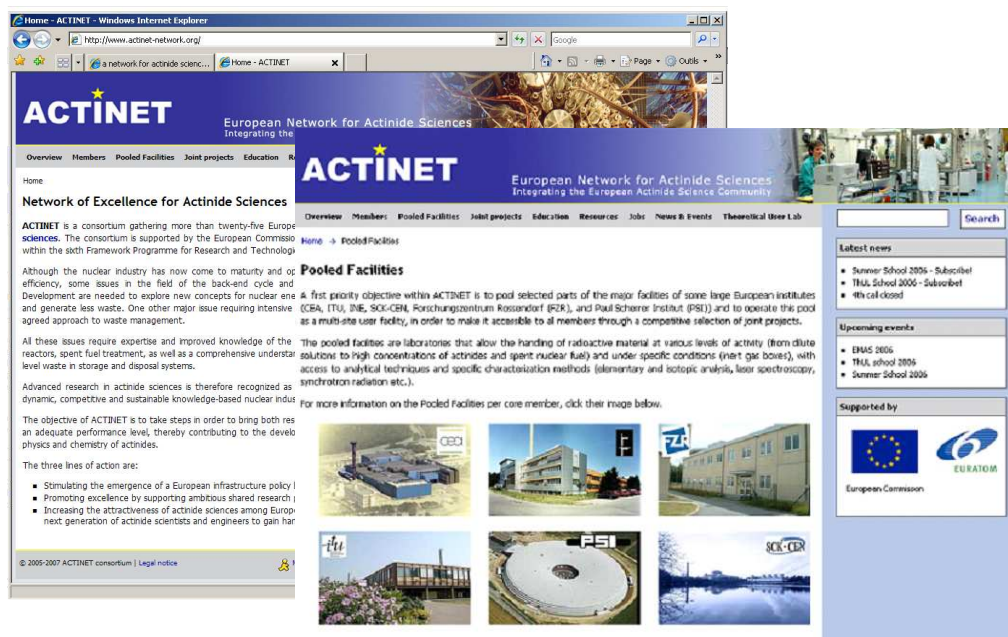
Members of the Executive Committee:

Bernard BOULLIS, Head of the Executive Committee (CEA)
Jean-Paul GLATZ (ITU)
Klaus GOMPPER (FZK)
Aimé BRUGGEMAN (SCK-CEN), repl. by Mireille GYSEMANS (SCK-CEN) in March 2008
Vinzenn BRENDLER (FZR)
Jörg HADERMANN (PSI), repl. by Mike BRADBURY (PSI) in March 2007
Suzan STIPP (KU)
Jordi BRUNO (UPC) until April 2006
Jean-Pierre COUTURE (CNRS), repl. by Gilbert BLONDIAUX in March 2005 (CNRS)

Members of the Scientific Advisory Committee:

Jean FUGER
Ingmar GRENTHE
Yannick GUERIN
Robert GUILLAUMONT
Jong Il KIM
Rudy KONINGS
Maurice LEROY
Francis LIVENS
Charles MADIC (since April 2006)

website: <http://www.actinet-network.org>.



All public pedagogical material used for the various training and education activities within the network are available on the platform and the website.