



Discover the Cosmos Deliverable

D4.8 Final Report on Implementation Activities (International Level)

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Editing:	Angelos Alexopoulos
Approved by:	<Review Committee>
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Short Description:

This report documents the implementation activities of Discover the COSMOS undertaken at international level throughout the second and final year of the project as they have been described in D4.1. This report is best read in conjunction with the interim report D4.7 and also with the final reports D4.4 and D4.6 on local and national implementation activities respectively.

List of Recipients: Discover the COSMOS participants



D4.8 Final Report on Implementation Activities (International Level)

Contents

1. Introduction	3
2. International Level Implementation Activities	4
2.1 International Masterclasses	4
2.1.1 The 9 th International Particle Physics Masterclasses.....	4
2.2 Summer Schools.....	7
2.2.1 The Discover the COSMOS Summer School	7
2.2.2 The High School Teachers Programme at CERN	16
2.3 Discover the COSMOS International Conference	21
2.4 Discover the COSMOS International Contest	24
2.5 International Training Sessions and Workshops.....	26
3. Conclusion	33
4. ANNEX	34



D4.8 Final Report on Implementation Activities (International Level)

1. Introduction

Discover the COSMOS (DtC) aims to address the declining interest of secondary school students in science and in following scientific careers by demonstrating innovative ways through which the educational potential of existing e-Infrastructures in the fields of particle physics and astronomy can be fully exploited by providing powerful applications and interactive tools for the effective uptake of eScience by secondary schools framed in an inquiry-based pedagogical approach to science education. To serve this aim, a wide array of local, national and international level activities have been implemented in the framework of the project. Collectively, these activities tap into the intellectual capital of the education and outreach groups that participate in the DtC project in order to help the educational communities to value and realise the potential of eScience initiatives by adopting and using tools and interfaces, the DtC Demonstrators, which in turn will enable students to get familiarised with the scientific methodology leading to higher levels of interest in and engagement with science.

This document details the international level implementation activities undertaken during the second and final year the project (September 2012 to August 2013). Where applicable, and consistent with Deliverable 4.1, these activities are presented under a common framework highlighting in a structured and integrated manner their learning objectives, participants' profiles, methodology and process, outcomes and follow up actions. Table 1 provides a summary of the international level implementation activities undertaken by the Consortium partners during the aforementioned period. All activities are listed in the [Annex](#).

Title of Activity	Type of Activity	Date(s) of Activity	Place of Activity	Organising Institute(s)
9th International Particle Physics Masterclasses	MC	25 Feb - 22 Mar 2012	Dresden, Geneva	CERN, IASA, TUD
Discover the COSMOS Summer School	SS	30 Jul - 04 Aug 2013	Volos (Greece)	EA
Discover the COSMOS International Conference	IC	02-04 Aug 2013	Volos (Greece)	EA
High School Teachers Programme at CERN	SS	30 Jun – 20 Jul 2013	Geneva	CERN
Training Sessions and Workshops (e.g. Comenius, GTTP, EU-HOU)	T	Sep 2012 – Aug 2013	Various countries (e.g., France, Chile, China, India, Spain, UK)	IAP/CNRS, LBL, NUCLIO, UB, UCM

MC=Masterclass; SS=Summer School; T= Training Seminar or Workshop; IC = International Conference

Table 1: International level activities implemented for Year Two of the DtC Project




D4.8 Final Report on Implementation Activities (International Level)

2. International Level Implementation Activities

2.1 International Masterclasses

2.1.1 The 9th International Particle Physics Masterclasses



Hands-On Particle Physics
International Masterclasses
25th February – 22nd March, 2013

Objectives

International Masterclasses provide a unique opportunity for high-school students to be "scientists for a day". 16- to 19-year-old students in 31 countries around the whole world are invited to one of about 120 nearby universities or research centres for one day in order to take part in an authentic research process. They hear lectures from active scientists and gain insight into topics and methods of basic research into the fundamentals of matter and the forces. Thus prepared, students perform measurements themselves on real data from particle physics experiments at the LHC (ALICE, ATLAS, CMS). At the end of each day, as in an international research collaboration, the participants join in a video conference for discussion and combination of their results. In summary, International Masterclasses offers students the chance to close their textbooks and experience modern science first-hand.

The International Masterclasses are a core activity of IPPOG, the International Particle Physics Outreach Group. The program is organized and run by Dr. Michael Kobel at the Technical University Dresden (TUD), Germany, and coordinated by Dr. Uta Bilow at TUD and CERN, both members of the DtC Consortium.

Preparation

There is no particle physics knowledge required for the students participating in the International Masterclasses.

Participants

The 9th International Masterclasses series, which took place from 25 February to 22 March 2013, comprised 161 Masterclasses (132 plus 29 in the US) organised by 101 institutes (plus 29 in the US), reaching more than 10,000 high-school students and ca. 500 teachers from 37 countries across the world. CERN, IASA, EA and TUD were among the DtC partners that organized Masterclasses in Switzerland, Greece and Germany. The full schedule of the 9th International Masterclasses is available at: <http://physicsmasterclasses.org/index.php?cat=schedule>

Methodology

The Masterclasses are a full-day activity that is structured into three main parts as follows:

- In the morning, students come to their respective university/institute where they are



D4.8 Final Report on Implementation Activities (International Level)

introduced to particle physics, experiments and detectors within lectures. Typically, two lectures, 45 min each, are scheduled for the morning session. Guided tours to the university's/institute's can also be scheduled, if appropriate.

- After having lunch with the lecturers and staff, including their tutors, students work on particle physics data on their own. For this afternoon activity a PC-pool is required as students work in pairs. One tutor per ten students is also present providing support and guidance to students.
- Having performed the measurements, students are then participating in an international video conference, together with three or four other institutes, according to the schedule, and moderators from CERN. The video conference goes from 4 pm to 5 pm CET. Students give their results and combine them with students from other countries. The video conference also includes discussion of results with the moderators, a Q&A session, and a quiz. Before students leave, they are handed out certificates of participation.

A short description of the International Masterclasses organised by CERN, IASA, EA and TUD is provided below.

Date of Event: 11 March, 2013

Place of Event: Technical University of Dresden, Germany

One hundred and thirteen German high-school students accompanied by thirteen teachers came to the Technical University of Dresden (TUD), Germany for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, the students were welcomed by ATLAS physicists and introduced to particle physics, the LHC and ATLAS and were prepared for the hands-on exercise. In the afternoon session, the students worked with ATLAS data to look for W bosons. This was followed by a discussion of their results over a videoconference with students in Wuppertal and Würzburg (Germany), Upsala (Sweden) and Bern (Switzerland).

Date of Event: 11 March, 2013

Place of Event: CERN, Switzerland

Twenty-five high-school students accompanied by three teachers from the neighboring French town of Annecy came to CERN for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, lectures were given by professors from ATLAS scientists and in the afternoon a laboratory was held where students used the HYPATIA event display to look for Z bosons. Finally the students compared their results in a videoconference with of students performing the same exercise in University of Geneva (Switzerland), Adam Mickiewicz University in Poznan (Poland), Laboratoire d'Annecy le Vieux de physique des particules in Annecy (France) and Radboud University in Nijmegen (Netherlands).

Date of Event: 12 March, 2013

Place of Event: CERN, Switzerland

Twenty-six high-school students accompanied by two teachers came to CERN for one day in order to learn about particle physics, CERN and become researchers for a day. In the morning, lectures were given by CMS scientists and in the afternoon a laboratory was held where students used the iSpy event analysis tool event display to look for Z and W bosons and a small number of Higgs candidates. Finally the students compared their results in a videoconference with those of students performing the same exercise at the Ruđer Bošković Institute (Croatia), Obuda University (Hungary) and Institut de physique nucléaire de Lyon (France).



D4.8 Final Report on Implementation Activities (International Level)

Date of Event: 2 September, 2013

Place of Event: Orthodox Conference, Center, Kolympari, Crete, Greece

During the International conference on New Frontiers in Physics in Kolympari, Chania, from 28 August to 05 September 2013, in the afternoon poster session on the 2nd September there has been a demonstration of the Masterclasses where HYPATIA and MINERVA were set-up for the 150 participants of the conference to get experience with it and three posters presenting the project were displayed. Consortium members from IASA and TUD led the effort and is estimated that about twenty scientists took active part in the session.

Outcomes and Follow Up

There are five core learning outcomes for students, teachers and scientists participating in the Masterclasses:

1. Learning about fundamental subatomic particles and interactions
2. Learning about particle accelerators and detectors
3. Getting acquainted with analyzing particle collisions
4. Performing a measurement with real data from the LHC experiments (ALICE, ATLAS, CMS)
5. Gaining insight into modern research in particle physics and scientific methods

Moments from the 9th International Particle Physics Masterclasses

A selection of pictures from the 2013 IPPOG Masterclasses at CERN and TUD are presented below.



CMS Masterclass at CERN, 12 March 2013 (© 2013 CERN)
For more images, see here: <http://cds.cern.ch/record/1527517?ln=en>



D4.8 Final Report on Implementation Activities (International Level)



ATLAS W Masterclass at Technical University of Dresden, 11 March 2013
(Photo: IKTP)

2.2 Summer Schools

There have been two Summer Schools conducted during the second year of the DtC project. These are:

1. The Discover the COSMOS Summer School
2. The High School Teachers Programme at CERN

A detailed description of each activity is provided below.

2.2.1 The Discover the COSMOS Summer School



DtC Summer School

Volos, Greece

30 July - 04 August 2013

Objectives

The overall objective of the DtC Summer School was to enhance science education by presenting the fabric of the cosmos as was shaped by scientific evidence and explanations through 400 years of scientific advancement. In particular, the Summer School included presentations followed by practical sessions (workshops) focusing on:

- a) Introduction to the concepts and skills of learning-design, inquiry processes and scaffolding.
- b) Introduction to preparing, uploading and sharing digital learning resources and scenarios.
- c) Presentation of inquiry-based learning activities for use in the science classroom



D4.8 Final Report on Implementation Activities (International Level)

- d) Familiarization with on-line labs portals and educational digital repositories.
- e) Presentation of popular social tools and science outreach websites.
- f) Hands-on sessions working on on-line labs and resources related to science.

The tools and techniques presented facilitated the teachers to actively engage their students into science topics, acquire scientific inquiry skills and experience the culture of doing science, under motivating circumstances, by undertaking active, guided, experimentation, carried out at both basic and top-level scientific facilities. The course also strengthened its social cohesive and pan-European dimension by inviting participants to be part of a community of practice that will allow them to exchange ideas and materials with fellow teachers across Europe and introduce them to social tagging, educational metadata and on-line learning repositories.

The repertoire of online labs and experimentations, and the social tools that was presented in combination with the hands-on activities facilitated the participants in learning how to deploy the vast collection of existing eLearning tools and educational resources and also how to integrate their own work into educational repositories and share it within a European community of practice.

Preparation

All information relative to the summer school was available to everyone through the summer school's website (<http://dte.ea.gr/>). Information about how to register to the summer school, the programme and the location was among the information included.

A month before the beginning of the training course, all participants were sent detailed information, about the course and the activities that would be carried out as well as what they are expected to do before coming to the summer school. Participants were asked to prepare an educational activity in PowerPoint that connects in-class teaching with an eScience application from the area of High Energy Physics (HEP) or Astronomy and that allows for communicating science either by using real data that has been collected from large scientific infrastructures like CERN, robotic telescopes etc. or through online labs, virtual demonstrations and simulations of nature. Participants were asked to use for their activity, a template they were provided with which follows the Inquiry Based Science Education (IBSE) teaching approach. Along with the template participants were also provided with 2 example activities as well as a series of digital materials to support the creation of their scenarios. The "Discover the Cosmos: digital repository" was used as the main reference point for access to digital material. All the relative material was also available to the participants through the BSCW server (Figure 1). All participants also had a private folder where they could upload and store their materials and their educational activities.



D4.8 Final Report on Implementation Activities (International Level)

The screenshot shows the BSCW (BSCW 5.0.5) internal server interface. The breadcrumb path is: :eleftheria > Summer Schools > Summer School 2013 > International Teachers' Training Course - Volos 2013. The file list is as follows:

Name	Action	Size	Share	Creator	Priority	Last Modified	Events
02. Educational Scenario Template	▼	3		angelos		2013-07-08 05:02	🔍 🗑️
03. Examples of Educational Scenarios	▼	2		angelos		2013-07-08 05:02	🔍 🗑️
04. Inquiry-based Science Education References	▼	5		angelos		2013-07-08 05:02	🔍 🗑️
05. Participants' Material	▼	34		angelos		2013-08-03 17:38	🔍 🗑️
06. Training Manuals	▼	2		angelos		2013-07-08 05:03	🔍 🗑️
07. Summer School Program	▼	1		angelos		2013-07-26 21:41	🔍 🗑️
01. Preparatory phase	▼	5.3 K		angelos	→	2013-07-08 05:13	🔍 🗑️

The BSCW internal server

By the time the summer school began, all participants had prepared an educational activity, and had uploaded it in PowerPoint format to the BSCW internal server along with all its supporting materials. According to participants' comments, after the completion of the summer school the guidance during the preparation phase was sufficient and straightforward although they would have preferred to have some more time for preparation.

When arriving in Volos, each participant received a summer school bag which included all the necessary materials:

1. Training course program
2. Go-Lab brochure
3. Discover the Cosmos portal guide
4. Learning Astronomy through Inquiry and by means of self-constructions book
5. Discover the Cosmos conference program
6. Discover the Cosmos conference book of proceedings.

Participants

Thirty science teachers from various European countries attended the DtC Summer School. The geographical distribution of participants is shown below:

Country	Number of Participants
Greenland	2
Norway	1
Estonia	1
United Kingdom	4
Germany	2
Switzerland	1
Austria	1
Hungary	1



D4.8 Final Report on Implementation Activities (International Level)

Portugal	8
Greece	7
Spain	2

Workshops and Activities

The program of the training course had four main branches:

- a) Workshops
- b) Plenary Sessions
- c) Extra Activities
- d) Participants' presentations and reflection.

During the workshops, participants worked on the activity they had prepared with the aim to refine it and add some more digital material with the aim to make it more interactive and interesting for the students. To achieve that, they were introduced to repositories of digital educational material and online labs. The tutors worked with each of the participants in person, discussing their activity and proposing improvements and extra material. During the workshops, participants also had the opportunity to use some online labs and perform small tasks. Throughout the course teachers had hands-on activities with four eScience applications; the Faulkes network of robotic telescopes, the SalsaJ image analysis tool, the Crashing Galaxies applet and the HYPATIA analysis tool. During the last workshop, all participants uploaded their activities to the "Discover the Cosmos" educational repository.

The plenary sessions that took place aimed at introducing to the participants past and future initiatives that aim at improving science education, like the "Science Created by You" and the "Inspiring Science Education" projects.

Field trips and extra activities were also carried out during the realization of the course. These initiatives included an observation of the night sky at the mountain Pelion, a science café event at the village of Milies, a virtual visit to the control room of the ATLAS experiments at CERN and visit to the archaeological Museum of Volos. The detailed programme of the course as well as descriptions of the events are presented below.



D4.8 Final Report on Implementation Activities (International Level)

INTERNATIONAL SCIENCE TEACHERS' TRAINING COURSE							
PROGRAMME							
Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday		
30 July 2013	31 July 2013	1 August 2013	2 August 2013	3 August 2013	4 August 2013		
Arrivals	<p>09.00 - 11.00 Introductory Session (Xenia A)</p> <p>Large e-Infrastructures and on-line labs Dr. Angelos Lazoudis <i>Ellinogermaniki Agogi</i></p>	<p>09.00 - 11.00 Workshop 2 (Xenia A)</p> <p>Crashing Galaxies in the classroom Eleftheria Tsourlidaki <i>Ellinogermaniki Agogi</i></p>	<p>09.45 - 17.00 Visit to Milies Traditional Village (Science Café Practices and Science Education)</p>	<p>09.00 - 11.00 Workshop 3 (Xenia A)</p> <p>Hunting the Higgs particle with HYPATIA data analysis tool Prof. Christine Kourkoumelis <i>National Kapodistrian University of Athens</i></p> <p>Stelios Vourakis <i>National Kapodistrian University of Athens</i></p>	<p>10.00 - 12.00 Participants' Presentations, Reflection & Certificates (Xenia A)</p>		
	<p>11.15 - 13.00 Interactive Session with all participants (Xenia A)</p> <p>The Calendar of Centaurus Chiron Dr. Serafeim Spanos <i>Society of Astronomy and Space</i></p>	<p>11.15 - 13.00</p> <p>Visit to the Archaeological Museum of Volos</p>		<p>11.15 - 13.00 Plenary Session (Xenia A)</p> <p>Go-Lab: Listening to Teachers' Voice and designing an on-line Lab Federation Dr. Denis Gillet <i>EPFL</i></p> <p>Dr. Effie Law <i>University of Leicester</i></p>	<p>12.15 - 13.00 Plenary Session (Xenia A)</p> <p>Inspiring Science Education Dr. Sofoklis Sotiriou <i>Ellinogermaniki Agogi</i></p>		
<p>17.00 - 19.00 Opening Session (Xenia A)</p> <p>Chair Dr. Angelos Lazoudis <i>Ellinogermaniki Agogi</i></p> <p>Science Created by You Prof. Ton de Jong <i>University of Twente</i></p> <p>Global Hands on Universe Dr. Rosa Doran <i>NUCLIO</i></p> <p>Discover the COSMOS: From Telescopes to Accelerators Dr. Sofoklis Sotiriou <i>Ellinogermaniki Agogi</i></p>	<p>14.00 - 15.15 Virtual visit @ CERN (Xenia A)</p> <p>Dr. Angelos Alexopoulos <i>CERN</i></p> <p>17.00 - 19.00 Workshop 1 (Xenia A)</p> <p>The Discover the COSMOS portal: educational material enriched with metadata Dr. Angelos Lazoudis <i>Ellinogermaniki Agogi</i></p> <p>22.00 - 00.30 Observing the night sky from mountain Pelion</p>	<p>15.00 - 18.00 Plenary Session (Xenia A)</p> <p>Using the Faulkes Robotic Telescopes Dr. Rosa Doran <i>NUCLIO</i></p>	<p>18.00 - 19.00 Stereo photos exhibition</p>	<p>19.00 - 20.30 Plenary Session (Xenia B)</p> <p>Discover the COSMOS Conference Opening Prof. Christine Kourkoumelis <i>National Kapodistrian University of Athens</i></p> <p>Inquiry Learning with on-line labs Prof. Ton de Jong <i>University of Twente</i></p> <p>Designing Effective Outreach Programmes for Teachers Dr. Mick Storr <i>CERN</i></p>	<p>17.00 - 19.00 Workshop 4 (Xenia A)</p> <p>Finalization of Participants' educational scenarios Dr. Angelos Lazoudis <i>Ellinogermaniki Agogi</i></p>	Departures	

The Programme of the DtC Summer School (also available at: www.dtc.ea.gr)



D4.8 Final Report on Implementation Activities (International Level)

Virtual visit @ CERN

(July 31st, 14:00 - 15:15, Hotel Xenia)



The CMS (Compact Muon Selenoid) experiment, a part of the LHC (Large Hadron Collider) uses a general-purpose detector to investigate a wide range of physics, including the search for the Higgs boson, extra dimensions, and particles that could make up dark matter. Although it has the same scientific goals as the ATLAS experiment, it uses different technical solutions and design of its detector/magnet system to achieve these. Summer school participants will have the opportunity through a live connection to receive a tour of the CMS underground facilities, talk with a CMS scientist and get answers to their questions.

Observing the night sky from mountain Pelion

(July 31st, 22:00 - 00:30, Chania)

Come discover the wonders of the Universe with us in our field trip to Chania on top of mountain Pelion. By naked eye and with telescopes you will have the opportunity to join astronomers on this journey to rediscover some fascinating objects like Saturn and its beautiful rings, the Milkyway with its billions of stars, globular clusters, planetary nebula and much more. The trip is organized by the Society of Astronomy and Space that will also provide participants with a number of telescopes allowing observation time per visitor as much as possible. Departure is expected shortly after 21:30 from Hotel Xenia, Volos.



Visit to the Archaeological Museum of Volos

(August 1st, 11:15 - 13:00, Volos)



The Archaeological Museum of Volos, houses many exquisite finds from early 20th century and modern archaeological excavations in Thessaly. Exhibits on display include jewelry, household utensils and agricultural tools, originating from the Neolithic settlements of Dimini and Sesklo, as well as clay statuettes and a wide variety of items from the Geometric period, a time of great heroic events, such as the Argonaut Expedition and the Trojan War. Other fascinating exhibits include tombs transported in their entirety from the archaeological sites where they were discovered, along with the human skeleton and the offerings placed around it. Just outside the museum there are some interesting reconstructions of the Neolithic houses at Dimini and Sesklo.

Science Café Practices and Science Education

(August 2nd, 14:00 - 15:00, Milies traditional village)

Science cafés are informal events of various formats, which all share a common feature: they are relaxed social gatherings focused on promoting the public understanding of science. In the framework of the SciCafé 2013 Events, organized by SciCafé - Europe's Network of Science Cafés (<http://www.scicafe.eu>), summer school participants can explore the science café concept and share relevant views and experiences with researchers and practitioners from diverse fields and contexts. Participants will have the chance to participate in lively discussions on the opportunities and challenges linked to science café practices in science education, on the one hand, and science communication in science museums and centres, on the other.



Stereo photos exhibition

(August 2nd, 18:00 - 19:00)



Mr. Zafrantzas Efstathios, an amateur astronomer, member of the Society of Astronomy and Space, Volos-Greece, will guide us through his private collections of

- stereo photos- slides of the starry Sky that were taken by him
- rare stereo diagrams created by Mr Ph. Fauth (Germany) in 1916, that were used as educational tools for teaching astronomy in the early 1900's

The stereo photos and the stereo diagrams can be seen in stereo at the exhibition with the appropriate optical devices that will be given to visitors.

Description of events during the DtC Summer School



D4.8 Final Report on Implementation Activities (International Level)

Outcomes and Assessment

Participants worked either in groups of two or on their own and produced educational activities mostly focusing on astronomy and particle physics. The participants had made an initial preparation following the preparation guidelines that were presented above. During the workshops they had the opportunity to work further on their activities and improve them based on the presentation of different e-Infrastructures and e-Science applications like the Faulkes telescopes, SalsaJ and HYPATIA as well as based on the discussions with the tutors. Based on participants' comments, the majority of them have found the face-to-face discussion with the tutors on their work to be very helpful and useful. By the end of the course all participants had finalized their activities and the majority of them also uploaded the activity on the "Discover the Cosmos" repository. The total number of activities produced is 31. The activities of the participants are presented in the table below.

Participant's Name	Name of the activity	eScience application used	Link to the online version
Gunter Bachman	Projekt kosmische Höhenstrahlung		Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41035041
Otmar Winkler	The Great CERN-Game of Particles	Hands-on	http://portal.discoverthecosmos.eu/en/node/196165
Nikolaj Jensen Jaakunnguaq Skade	The moon	Hands-on	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41035056
Ogbuagu Bettina	Colours in astronomical imaging	Faulkes, SalsaJ	http://portal.discoverthecosmos.eu/en/node/196181
Abdul Salom	Earth-like exoplanets	Hands-on	http://portal.discoverthecosmos.eu/en/node/196164
Rosalind Jack	The Life Cycle of a Star Plotting a Hertzsprung-Russell Diagram.	SalsaJ	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41035071)
David Waterman	Eclipsing binary stars	Faulkes	http://portal.discoverthecosmos.eu/en/node/196177
Janet Hilton	Types of stars using NSO spectra	NSO	http://portal.discoverthecosmos.eu/en/node/196183
Elena Poncela Blanco	1. El CERN y los detectores de partículas 2. Solar system measurements	1. HYPATIA 2. Faulkes, Cosmoquest	1. http://portal.discoverthecosmos.eu/en/node/196185 2. http://portal.discoverthecosmos.eu/en/node/196178



D4.8 Final Report on Implementation Activities (International Level)

José Gonçalves	Bosemon Spiel	Hands-on	http://portal.discoverthecosmos.eu/en/node/196182
Philippe Kobel	Why sunlight energy varies	SalsaJ	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41064221
Nuno Mendes	The Sun also has spots!	SOHO Data set	http://portal.discoverthecosmos.eu/en/node/196179
João Sousa Ana Tavares Sousa	Where do stars come from? Where do they go?	Hubble Data Set	http://portal.discoverthecosmos.eu/en/node/196169
Cristina Pinho	Cosmic Rays - Pierre Auger Observatory	Pierre Auger Observatory public data	http://portal.discoverthecosmos.eu/en/node/196160
Ludovic Martins	Lens beginning	Hands-on	http://portal.discoverthecosmos.eu/en/node/196184
Oded Ben Horin	Potentials of the Arts in educational settings inspired by the ATLAS experiment and The Higgs Boson discovery	Hands-on	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41082733
Telma Esperança	Sun's movement	SalsaJ, Sun4all	http://portal.discoverthecosmos.eu/en/node/196175
Rita Guerra	Shapes of Galaxies	Faulkes	http://portal.discoverthecosmos.eu/en/node/196176
Mikel Etxaniz Añorga	1. Why do buoys float, while an eraser sinks? 2. Roemer and the speed of light	1. Aquarium 2. Java Simulations	1. http://portal.discoverthecosmos.eu/en/node/196170 2. http://portal.discoverthecosmos.eu/en/node/196168
Kristel Uiboupin	Why is it hotter in summer and colder in winter?	Astronomy Data set Weather Data set	http://portal.discoverthecosmos.eu/en/node/196180
Isabel Borja Pallarés	Cryopreservation	Hands-on	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41035136
Nagy Tibor	Detectors	HYPATIA	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41035141
Christos Ifantis	Phases of the Moon - Lunar Eclipse	Java Simulations	http://portal.discoverthecosmos.eu/en/node/196162



D4.8 Final Report on Implementation Activities (International Level)

Nikos Makris	From the Outer of the Universe to the Inner of the Atom	Solar System simulator , Colorado simulations , Google Earth	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41035151
Maria Theodoropoulou	Sunspots! Let us introduce ourselves	Sun4all	http://portal.discoverthecosmos.eu/en/node/196158
Ioannis Chiotelis	What color would plants have on another planet?	Hands-on	http://portal.discoverthecosmos.eu/en/node/196134
Mavrommatis Dimitrios	Sea level during a day with a full Moon	Stellarium	http://portal.discoverthecosmos.eu/en/node/196171
Veis Nikolaos	Constituents of Atoms	Colorado simulations	Available at the BSCW: http://fit-bscw.fit.fraunhofer.de/bscw/bscw.cgi/41035177
Vergos Ioannis	S/n remnants expansion	SalsaJ	http://portal.discoverthecosmos.eu/en/node/196172

Moments from the DtC Summer School

A selection of pictures from the DtC Summer School is presented below.



Workshop on the "Crashing Galaxies activity"



Science Café at Milies Village



D4.8 Final Report on Implementation Activities (International Level)

2.2.2 The High School Teachers Programme at CERN



High School Teachers (HST) Programme

CERN, Geneva, Switzerland, 30 June - 20 July 2013

Objectives

Established in 1998, the High School Teachers (HST) Programme is a 3-week residential training summer course addressed to physics teachers from CERN member, observer and non-members states, with the ultimate objective to bring modern science, physics, particle physics and CERN closer to schools. Structured around a combination of lectures, visits to experimental facilities, hands-on workshops, working group activities and team building initiatives, the programme aims to infuse inspiration, motivation and confidence to teachers, who in turn can motivate and inspire their students and communicate science to their colleagues and the general public, thereby acting as ambassadors for science, physics, particle physics and CERN. Specifically, the goals of the HST Programme are:

- To promote the teaching of physics and, in particular of particle physics, in high schools
- To promote the exchange of knowledge and experience among teachers of different nationalities
- To expose teachers to the world of research
- To stimulate activities related to the popularization of physics within and beyond the classroom
- To help CERN establish closer links with schools from Europe and beyond
- To encourage the cooperation between CERN and existing programs sponsored by the European Union in the area of science education

The 16th edition of the HST Programme, which took place from June 30th to July 20nd 2013, was characterised by an emphasis on targeted training designed and implemented in line with the principal aim of Discover the COSMOS' implementation activities, that is, to overcome the limitations of science classroom instruction by helping teachers to appreciate the inquiry-based science methodology; to learn about and experiment with eScience tools and applications; and to co-create inquiry-based educational scenarios for pilot testing, further development and online sharing across an international community of science teachers through the Discover the COSMOS Portal.

Participants

Fifty-one physics teachers from twenty-nine countries across Europe (57%), Africa (12%), America (16%), Asia (12%) and Oceania (3%) participated in the HST 2013 Programme. Of these participants, 60% were males and 40% females. 15 percent between 19 and 30 years old, 43 percent of the participants were between 31 and 40 years old, 38 percent between 41 and 55 years old, and the remaining 4 percent were more than 55 years old.



D4.8 Final Report on Implementation Activities (International Level)

Preparation

Four weeks prior to their arrival at CERN, participants were contacted by email and were informed about the IBSE training activity in the context of the HST Programme. Educational material was also provided to participants in order to help them familiarise with IBSE and its application to ICT-enhanced learning with the use of specific eScience applications (i.e. HYPATIA) in the area of particle physics. In particular, this material included: a brief overview of Inquiry-based Learning (University of Birmingham, 2010); an introductory chapter in Inquiry Learning (Minstrell & van Zee, 2000); a recent report on perspectives on Inquiry-based Learning (The Wellcome Trust, 2011); the "Conservation of Momentum" Demonstrator developed by Ellinogermaniki Agogi; and a PowerPoint template serving as a guide for building educational pathways scenarios during the HST Programme. Participants were invited to review this material and were assured that they would also have opportunities to review and reflect on the IBSE activity throughout the duration of HST Programme.

Methodology

Overall, the HST 2013 Programme included:

- More than 25 hours of lectures from CERN scientists covering topics such as particle physics, dark matter and anti-matter, neutrinos and quantum fluctuations, cosmic rays and the concept of mass, particle detectors and accelerators, medical applications in particle physics, cosmology, the history of scientific ideas and Nobel stories
- Numerous visits to experimental facilities and CERN's permanent public exhibitions, including the CMS experiment, the Super Conducting Magnet Test Facility, the CERN Computer Centre and AMS, and the Globe and Microcosm exhibitions
- Hands-on practical sessions, including the "How to Build a Cloud Chamber" workshop and the "Hands-on HYPATIA" training session
- Dedicated sessions on: IBSE, creating links between schools and the research community, bringing CERN closer to the classroom, and the Discover the COSMOS Portal
- Working group activities focused on the construction of educational pathways scenarios
- Special events, including meeting Nobel Laureate Prof. Jack Steinberger and also a Q&A Session with Prof. Rolf-Dieter Heuer, Director General of CERN (see photographs)
- Social events and team building activities, including the "Discover Geneva Treasure Hunt" and the International Evening

The complete agenda of the HST 2013 Programme, which includes all material covered in lectures along with the videos from the presentations of the educational pathways scenarios, can be found at: <http://indico.cern.ch/conferenceDisplay.py?confId=257353>

While the IBSE activity was viewed as embedded in the goals and objectives of the HST 2013 Programme, targeted and systematic efforts were made to optimise its process and expected outcomes. These are described in a sequential order below:

- On the third day of the programme, an hour-and-a-quarter session was held in which participants were introduced to the objectives of the HST 2013 Programme, and the "what", "why" and "how" of IBSE. Examples of educational scenarios drawn from the Discover the



D4.8 Final Report on Implementation Activities (International Level)

COSMOS portal structured around the IBSE methodology were presented and participants' questions on the IBSE activity were answered. The Discover the COSMOS project was also presented with emphasis on eScience tools and resources on Particle Physics. This was followed by an interactive session during which participants exchanged their experiences with IBSE and discussed challenges and opportunities for applying the IBSE methodology to their teaching practice.

- During Week 2, a series of dedicated DtC workshops took place focusing on the use of the online version of HYPATIA eScience application (www.hypatia.iasa.gr) and associated resources available at the DtC portal. On July 8th, participants attended a 2-hour seminar "Introduction to HYPATIA", preceded by an hour presentation on International Masterclasses. Two hands-on workshops (8th and 9th July 2013) were also organised by CERN and IASA during the same week.

- During Week 2, and following the DtC workshop, participants were divided into seven working groups and invited to propose topics for the educational scenarios or activities inspired by their participation in the HST Programme. One group of 8 participants proposed "Particles with HYPATIA" as the title of their project.

- At the end of Week 3 (19th July), all seven working groups presented their educational scenarios to members of CERN Education at a half-day session. This was followed by customised feedback provided to each of the seven working groups.

Outcomes and Follow Up

Participants' quantitative and qualitative feedback was used to evaluate the HST 2013 Programme in terms of: (1) learning outcomes, (2) attitudinal and motivational outcomes, and (3) programme satisfaction outcomes.

Based on participants' responses on a 5-point Likert scale (1=disagree, 5=agree), the results of quantitative analysis indicated:

- Better insight into particle physics (mean: 4.71)
- Increased motivation (mean: 4.66) and confidence (mean: 4.34)
- Satisfaction with the organisation (mean: 4.56) and usefulness (mean: 4.66) of the programme

The highest score was for the item "I will recommend this programme to others" (mean: 4.74).

Besides its overall positive evaluation, the HST 2013 Programme produced some tangible outcomes which are of value and relevance to participants, their science education communities and the Discover the COSMOS Consortium. Seven educational pathways scenarios structured around the inquiry-based approach to science learning were created by respective groups of physics teachers and are ready to be pilot tested in high-schools in 29 countries. The titles of these scenarios and activities are:

1. Elevator Explanations



D4.8 Final Report on Implementation Activities (International Level)

2. How to Build an Electrostatic Generator
3. Lagrangians
4. Antimatter matters
5. Introduction to Particle Physics with Cards
6. CERN through my Eyes
7. Particles with HYPATIA

Notably, a HYPATIA Masterclass is planned to take place in Melbourne, Australia in October 2013 co-organised by a HST 2013 participant and member of the "Particles with HYPATIA" working group. In addition, the same group will be working with the HYPATIA team at IASA to improve further this eScience tool by providing feedback on planned content and interface upgrades.

As a follow up to the HST 2012 Programme, regular communication has been established with participants through email and their social media (i.e. Google Plus) page with the aim to:

- Track and provide them with feedback on the pilot-testing of their educational pathways scenarios
- Help them participate actively in the Discover the COSMOS user group by uploading and sharing their scenarios
- Inform them on forthcoming training activities in the context of Discover the COSMOS and related EU projects (e.g. Go-Lab)
- Support them in the organisation of e-Masterclasses and participation in related activities and especially education and outreach activities planned for 2014 in member states for the celebration of the 60th anniversary of CERN.

Moments from the HST 2013 Programme

A selection of pictures from the HST 2013 Programme is presented below.



HST 2013 Participants after meeting CERN Director General, Prof. Rolf Heuer (© 2013 CERN)



D4.8 Final Report on Implementation Activities (International Level)



HST 2013 Participants meeting Nobel Laureate Prof. Jack Steinberger



HYPATIA Workshop on 9th July 2013 by Dr. Dimitrios Fasoulitis (University of Athens)



The "Particles with HYPATIA" working group presenting its educational plan on 19th July 2013.



D4.8 Final Report on Implementation Activities (International Level)

2.3 Discover the COSMOS International Conference



Aims and Objectives

Jointly organized by the DtC Consortium and the Global Hands-On Universe (GHO�) Network, a 3-day long international conference on "e-Infrastructures for an Engaging Science Classroom" took place in Volos, Greece during the 2nd and 4th August, 2013. The aim of the conference was to highlight and promote exemplary science education and outreach activities for schools. Such a process is considered vital to chart the course into the future. By building on the best of current practice, the conference themes aimed to take us beyond the constraints of present structures of schooling (pedagogical, organizational and technical barriers) toward a shared vision of excellence. The conference presented a series of exemplary practices, resources and applications (analysis tools, data repositories, simulations and advanced visualizations) providing students with experiences that enable them to achieve scientific literacy, criteria for assessing and analyzing students' attainments in science and learning opportunities that school programmes afford. It thus aimed to offer a window onto live scientific experiments and phenomena, ongoing research, and the personalities and stories of working scientists across the globe.

Conference Themes

There were eight themes covered in the conference including:

- Designing the Science Classroom of the future
- Remote and Virtual Labs for inquiry learning
- Scientific Repositories and Data Archives for school use
- Scientific Simulations in education
- Communicating science via online applications & tools
- Developing effective collaborations between schools and research centers
- Advanced Research Infrastructures and Outreach programs
- Education and eScience practice

Participants

160 participants, including educators, teacher trainers and trainees, scientists, education and outreach groups, education policy makers and other interested stakeholders, from Europe, USA



D4.8 Final Report on Implementation Activities (International Level)

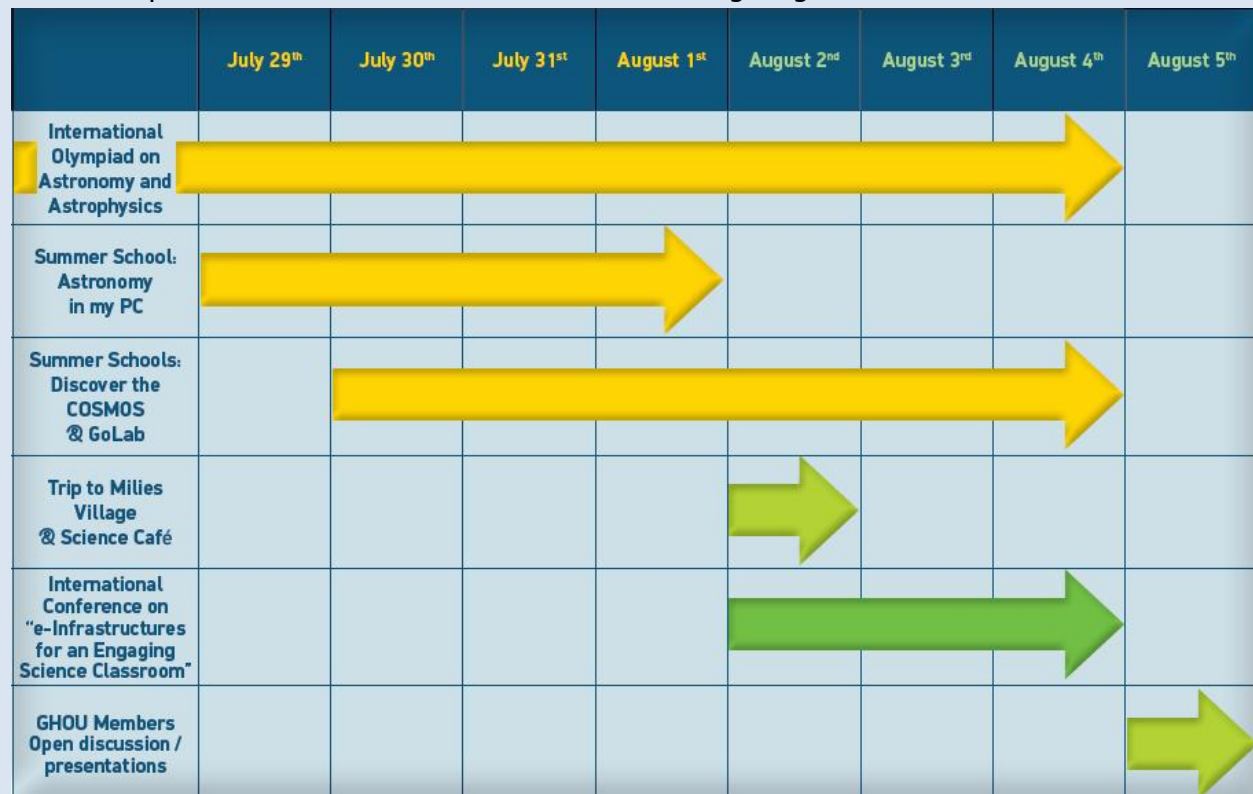
and beyond participated in the conference.

Conference Programme and Parallel Activities

The joined DtC-GHOU International Conference took place in parallel with the following events hosted in the city of Volos:

- The International Olympiad in Astronomy and Astrophysics (<http://www.ioaa2013.gr>)
- The "Astronomy in my PC" Summer school for educators
- The "Discover the COSMOS" Summer school (<http://dte.ea.gr>) for science teachers
- The "Go-Lab" Summer School (<http://golab.ea.gr>) for science teachers

The overlap of these events can be seen in the following diagram.



Therefore, conference participants had the opportunity to follow closely the Olympiad and take part in the many educational activities that were planned in the city of Volos in the framework of this event. Moreover, conference participants were free to attend the DtC Summer School's plenary sessions open to the public (30th July – 4th August). Sessions included talks about using research infrastructures in education, building scientific instruments for astronomical observations and much more.



D4.8 Final Report on Implementation Activities (International Level)

The conference's programme is shown below (an online version is also available at the Conference's website (<http://dte-conference.ea.gr/en>)).

DISCOVER THE COSMOS CONFERENCE

PROGRAMME

Friday 2 August 2013

09:00-16:30
Visit to Miles Traditional Village (Science Cafe Practices and Science Education)

08:00
Depart from Hotel Xenia by bus

10:00-11:30
Pelion steam train: Aioi Lechaio-Miles

11:30-12:45
Visit Miles Traditional Village

12:45-13:45
Lunch @ Miles

13:45-15:15
Science Cafe Practice and Science Education

15:30
Depart from Miles by bus

16:30
Arrive to Hotel Xenia

18:00-19:00
STEREO-PHOTOS EXHIBITION

19:00-20:30
Discover the COSMOS Conference Opening
Chair: Christine Kourkoumelis, IASA

19:00-19:10
Welcome
Prof. Christine Kourkoumelis
Coordinator of Discover the COSMOS project

19:10-19:50
Inquiry learning with on-line labs
Prof. Ton De Jong
University of Twente

19:50-20:30
Designing Effective Outreach Programmes for Teachers
Dr. Mick Starr
Coordinator of High School Teacher Programmes and Visits Services @ CERN

Saturday 3 August 2013

09:00-10:00
Keynote Talk:
A Universe of Discoveries, Learning, and Inspiration
Carl Pennypacker
University of California at Berkeley, USA

10:00-11:20
10:00-11:20 SESSION
Online tools & apps, Scientific Repositories and Data Archives for school use
Chair: Rosa Soares, NICLID

10:00-10:20
Educational projects with the Faulkes Telescopes
Sarah Roberts
Faulkes Telescope Project, UK

10:20-10:40
Utilising the Bulgarian National Observatory Spectral Repository in Astronomy Education for Schools and Amateur Clubs
Petar Goulev
Astronomical Association Sofia, Bulgaria

10:40-11:00
Using Geogebra to teach analemma
Aniket Sule
Homi Bhabha Centre for Science Education, Mumbai, India

11:00-11:20
"SunMail" – Scientific tool for classroom helping students to discover the cosmos
Telma Espiranca
Universidade do Coimbra, Portugal

11:20-11:40 Coffee Break

11:40-13:00
11:40-13:00 SESSION
Developing effective collaborations between schools and research centers
Chair: Barbara Dillman, EUSIA

11:40-12:10
Science in the Schools:
The Extreme Energy Events project
Despina Hatzifotiadou
Physics Department, CERN, Switzerland

12:10-12:35
Network Telescopes – Hands On (Astro-) Particle Physics Masterclasses in Germany Best Practice in Sharing Authentic Science with the Public
Michael Rocketroh
Institute of Nuclear and Particle Physics, TU Dresden, Germany

12:35-13:00
Bringing astronomy research into the schools
Wolfgang Vleser
Christoph-Probst-Gymnasium, Götting, Germany

13:00-14:00 Lunch Break

14:00-15:40
14:00-15:40 SESSION
Remote and Virtual Labs for Inquiry Learning
Chair: Wolfgang Goede, EUSIA

14:00-14:20
EDOU-MK: A Small Radio Telescope Network for schools
Anne-Laure Melchior
Université Pierre et Marie Curie, France

14:20-14:40
The CosmoQuest Virtual Research Facility: Motivating Everyday Scientists
Pamela L. Gay
STEM Center, Southern Illinois University, USA

14:40-15:00
The HYPPATI particle physics on-line event analysis tool for students
Stelios Vourakis
Physics Department, University of Athens, Greece

15:00-15:20
Universe Awareness: online and physical infrastructures for science education
Sarah Eve Roberts
Ei Universe Awareness Project, The Netherlands

15:20-15:40
SkyNet and Other HOU Partners for Cue-based and Real Time Use of Telescopes
Vivian Hoette
Kenos Observatory @ University of Chicago, USA [VIRTUAL Presentation]

15:40-16:00 Coffee Break

16:00-17:30
16:00-17:30 SESSION
Education and eScience practice
Chair: Patrick Miller, Hardin-Simmons Univ.

16:00-16:20
Building Blocks of our Future
Rosa Doran
Núcleo Interactivo de Astronomia, Portugal

16:20-16:40
Helping US students of Age 10 to 14 Love Algebra through Astronomy
Carl Pennypacker
University of California at Berkeley, USA

16:40-17:00
Building a teacher's community in Portugal
Carlos Santos
Núcleo Interactivo de Astronomia, Portugal

17:00-17:30
Application of the Internet in the promotion and popularization of astronomy
Zoran Tomić
Astronomical Society „Zvezda“, Serbia [VIRTUAL Presentation]

Sunday 4 August 2013

09:00-10:00
Keynote Talk:
Quarknet, a research-based teacher professional development program
Dan Karmgard
University of Notre Dame, USA

10:00-11:20
10:00-11:20 SESSION
Education and eScience practice
Chair: Carl Pennypacker, UC Berkeley

10:00-10:20
Moon Over Us: USA, China, Brazil, Austria, Nepal
Online Student Exchange
Bonnie Thuber
Northwestern University, USA

10:20-10:40
Astronomical activities for all
Amelia Ortiz Gil
Observatorio Astronómico de Valencia, Spain [VIRTUAL Presentation]

10:40-11:00
Project MAST: A Route to Quality Teacher Professional Development
Mehri Fadavi
Jackson State University, USA

11:00-11:20
Tackling the decline: shaping the future of Physics through a collaborative curriculum
Christopher Ince
University of Sheffield

11:20-11:40 Coffee Break

11:40-13:00
11:40-13:00 SESSION
The Galileo Teachers Training Programme's impact on science education
Chair: Rosa Doran, NICLID

11:40-12:00
Importance of Teachers Training and impact of Galileo Teachers Training Programme in Nepal
Manisha Dwa
Department of Physics, Pabitra Kanyan Campus, Nepal

12:00-12:20
Training teachers for Astronomy teaching in Southern Brazil
Maia de Fátima D. Saraiva
Federal University of Rio Grande do Sul, Brazil

12:20-12:40
The GalileoMobile Handbook: Interactive astronomy activities with low-cost materials
Philippe Nobel
Galileo Mobile Project, Switzerland

12:40-13:00
GTP/Planetary de Medellín Parque Explora/Universidad de San Buenaventura
Luz Angélica Céspedes González
Planatorio de Medellín, Colombia [VIRTUAL Presentation]

13:00-14:00 Lunch Break

14:00-15:40
14:00-15:40 SESSION
Remote and Virtual Labs for Inquiry Learning
Chair: Angelos Lazoukis, Ellinogermaniki Aggy.

14:00-14:20
Internet Educational Solar Radio Telescope
Cezar Edward Lesanu
Stefan cel Mare University of Suceava, Romania

14:20-14:40
Observation of the Annular Eclipse using a BS antenna radio telescope
Hideo Shinohara
Saitama prefectural Washi High School, Japan

14:40-15:00
Analysis of Asteroid Light Curves including the Near-Earth Object 2012 DA14
Matthew Davis
Hardin-Simmons University, USA

15:00-15:20
Analysis of Delta Scuti Light Curves
Tom Caruso
State University of New York at Albany, USA

15:20-15:40
The International Astronomical Search Collaboration: An Online Astronomy Discovery Program for High Schools and Colleges
Patrick Miller
Hardin-Simmons University, USA

15:40-16:00 Coffee Break

16:00-18:00
16:00-18:00 SESSION
Advanced Research Infrastructures and Outreach programs
Chair: Pamela L. Gay, Southern Illinois Univ.

16:00-16:20
Introduction to Astronomical Education on National Astronomical Observatory of Japan
Hidehiko Agata
National Astronomical Observatory of Japan, Japan

16:20-16:40
Earth and Sky Images for Astronomy Communication
Bobak A. Tafreshi
The World of Night Project, Germany

16:40-17:00
Scheduling and Reservation Website for Telescopes
Rada Azis
Lawrence Berkeley National Laboratory, USA

17:00-17:30
Access Time and Space: Creating a Community of Practice for Teachers Using Virtual Tools
Nancy Alma Hill
University of California at Berkeley, USA [VIRTUAL Presentation]

17:30-18:00
NASA Kepler Activities and Remote Astronomy Meeting Techniques
Alan Gould
University of California at Berkeley, USA [VIRTUAL Presentation]

17:30-19:30
POSTER SESSION

17:30-19:30

•• Poster #1 ••
Inquiry Teaching in Science - Problem Based Learning in Astronomy
Rosa Soares

•• Poster #2 ••
Learning about the Galaxy by constructing a Galactic Garden at school
Margarita Metzias

•• Poster #3 ••
Network Telescopes Alumni - Proceeding with the Project
Flora Brückmann

•• Poster #4 ••
International Masterclasses - Hands on Particle Physics
Uta Blöchl

•• Poster #5 ••
Social media with Galileo Teacher Training Program and Discover the Cosmos: Impact of a Joint effort
Lina Canas

•• Poster #6 ••
How Community Building could Initiate Common Activities in the Educational Field? A case in Austria
Christian Reimers

•• Poster #7 ••
The challenges of Teaching Astronomy Off the Grid
Chuck Ruelhe

•• Poster #8 ••
Project "Astronomy from an armchair" in Niš
Zoran Tomić

•• Poster #9 ••
Diagram of our Universe
Hidehiko Agata

•• Poster #10 ••
Teaching children about astronomy through the game as a method of education
Zoran Tomić

•• Poster #11 ••
The challenge of research and education: a Spanish experience
Ana Gómez de Castro

•• Poster #12 ••
Success Story from an Outreach Programme
Yasuharu Hanaoka

•• Poster #13 ••
The 4-dimensional Digital Universe Project
Hidehiko Agata

19:00
GALA DINNER

A snapshot of DtC-GHOU International Conference's Programme



D4.8 Final Report on Implementation Activities (International Level)

Moments from the DtC-GHOU Conference

A selection of pictures from the DtC-GHOU Conference is presented below.



2.4 Discover the COSMOS International Contest



Aims and Objectives

Open to teachers and students from all over the world, the DtC International Contest aimed at encouraging collaborative work between teachers, trainers, scientists and students, with a view to promoting the exploration of online scientific resources in the classroom, that is e-Science tools, resources and e-Infrastructures.

The main objective of the educational activities created during the contest, and enriched by the use of Discover the COSMOS tools and resources, was to promote the introduction of the scientific method into the classroom. As a result, participants were encouraged to think of themselves in terms of scientific researchers and their infrastructures, so that students could adopt a scientific rationale and approach towards the activities they intended to develop.



D4.8 Final Report on Implementation Activities (International Level)

The sharing of good practices and ideas was a major goal of this contest. Therefore, the clarity of instructions, the completeness of information and the methodology to be used in classroom were seen as crucial factors for those participating in this challenge.

The Challenge and Rules

The educational activities created during the DtC Contest were supported by the following e-Infrastructures that provided the astronomical images to be used for the contest:

- Astronomical Observatory of Coimbra
- National Schools Observatory
- The Faulkes Telescope Project

The contribution of each of the above e-Infrastructures related to astronomy can be seen in the following thematic campaigns:

Astronomical Observatory of Coimbra

<http://portal.discoverthecosmos.eu/en/view/observationweeks?filter0=2>

<http://portal.discoverthecosmos.eu/en/search/repository/educon/results/Espectroheliograma>

National Schools Observatory

<http://portal.discoverthecosmos.eu/en/view/observationweeks?filter0=3>

<http://portal.discoverthecosmos.eu/en/search/repository/educon/results/moon>

<http://portal.discoverthecosmos.eu/en/view/observationweeks?filter0=4>

<http://portal.discoverthecosmos.eu/en/view/observationweeks?filter0=5>

<http://portal.discoverthecosmos.eu/en/view/observationweeks?filter0=8>

Faulkes Telescope Project

<http://portal.discoverthecosmos.eu/en/search/repository/educon/results/orion>

In addition, the following thematic campaigns were provided in collaboration with international initiatives – *TWAN, AWB and Dark Skies Alqueva in Portugal*:

<http://portal.discoverthecosmos.eu/en/view/observationweeks?filter0=9>

<http://portal.discoverthecosmos.eu/en/search/repository/educon/results/DSR>

All educational activities submitted ought to involve the application, manipulation or reproduction of astronomical images made available during April 2013, the Global Astronomy Month, through a dedicated website at the DtC Portal:



D4.8 Final Report on Implementation Activities (International Level)

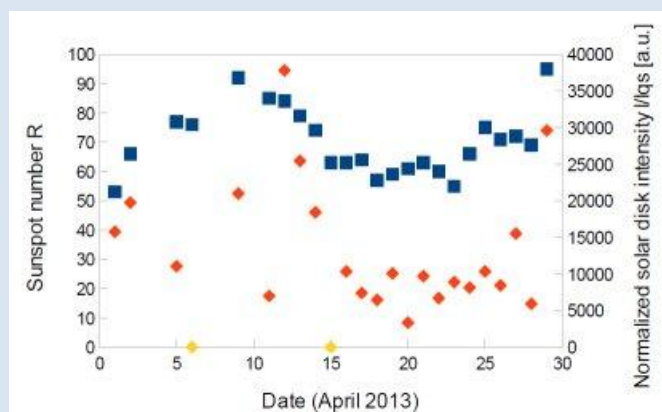
<http://portal.discoverthecosmos.eu/en/panel/observationweeks>

Further information on the DtC Contest's rules can be found on the relevant website that was created at the DtC Portal (<http://portal.discoverthecosmos.eu/en/node/191795>)

Winning Scenario

Philippe Kobel, member of the DtC Community for 18 weeks, was the winner of the DtC Contest with his scenario, entitled "*Why does the sunlight energy vary? Explaining solar irradiance variations with SalsaJ*". A short description of the scenario (available at the DtC Portal <http://portal.discoverthecosmos.eu/en/node/194978>) is provided below:

We owe every living form on Earth to sunlight, more precisely to the radiant energy transported by sunlight. In this activity, we'll see that the energy that the Earth receives from the Sun (measured by the solar irradiance) varies in the course of time. By analyzing very recent (April 2013) solar images from the Astronomical Observatory of the University of Coimbra, the student task will be to identify the solar surface phenomena responsible for this irradiance variability.



The prize for Philippe Kobel was an invitation to participate in the DtC Summer School in Volos, Greece with all expenses of the trip, lodging, meals and course fees covered by the DtC project.

2.5 International Training Sessions and Workshops

In addition to the implementation activities presented above, numerous international training sessions, workshops and e-Masterclasses took place throughout the second year of the project. The majority of those activities were astronomy related and implemented by IAP/CNRS and NUCLIO in Europe and beyond in the context of the Galileo Teacher Training Program (GTTP) and the EU/Global-Hands on Universe (EU/G-HOU) as COMENIUS training events. Other astronomy and particle physics related training was implemented by IASA, UB and UCM in the framework of international conferences, workshops and scientific meetings. A more detailed description of selected training sessions and workshops is provided below.



D4.8 Final Report on Implementation Activities (International Level)

Title of Event: **GTTP/DtC in Beijing**

Date of Event: 01-02 September 2012

Place of Event: National Astronomical Observatory of Beijing, China

A teacher training session organized by the China Hands-On Universe took place at the National Astronomical Observatory of Beijing (NAOB) with the participation of 25 lower and senior high school teachers and science centre staff, and 5 scientists from the NAOB. Participants were introduced to the DtC tool and resources and had the opportunity to use them – especially the Faulkes Telescope and SalsaJ. More photographs available at



<https://www.facebook.com/photo.php?fbid=522176014463159&set=a.522174174463343.132933.128063420541089&type=3&permPage=1>

Title of Event: **Astronomy@myBackPack**

Date of Event: 10-15 September 2012

Place of Event: Cascais, Portugal

A COMENIUS training event in parallel with a local certified training course for Portuguese teachers took place in Cascais, Portugal, with the participation of 27 teachers and 3 trainers/scientists from several European countries. More photographs available at <https://www.facebook.com/media/set/?set=a.535329769817375.146032.130639500286406&type=3>





D4.8 Final Report on Implementation Activities (International Level)

Title of Event: **GTTP in India**

Date of Event: 17-18 October 2012

Place of Event: Gujarat, India

The Manthan than Educational Programme Society in India conducted a GTTP on 17-18 October 2012 in Kavedia Colony, Narmada district in Gujarat state for 30 science teachers. One of the main aspects on which Manthan focused was to communicate astronomy using low-cost methods and hands-on methods. The two days were full of brightness of the Sun and Stars and worked to spread the brightness in the entire district of Narmada. DTC tools and resources were introduced as a powerful ally to be used in schools with computer labs.



Title of Event: **International Occultation Timing Association – Middle East**

Date of Event: 04-08 November 2012

Place of Event: Tehran and Shiraz, Iran



A 4-days event, organized by the Middle-East branch of the International Occultation Timing Association, took place in Tehran and Shiraz from 04 to 08 November 2012. Roger Ferlet (IAP/CNRS.) gave a series of lectures on astronomy. On the last day at the Biruni Observatory of the University of Shiraz, a workshop dedicated to educational activities for 50 high school students and three teachers took place. Participants were trained to use SalsaJ with the use of HOU/DtC Demonstrators.

Title of Event: **HYPATIA e-Masterclasses**

Date of Event: 08 and 22 November 2012

Place of Event: CERN, Switzerland

Two e-Masterclasses with the participation of 9 Dutch and 43 Polish high school students took place at CERN on the 08th and 22nd November 2012, respectively.



D4.8 Final Report on Implementation Activities (International Level)

HYPATIA e-Masterclass with Dutch Students

The first HYPATIA e-Masterclass with nine senior high school students of the [Kandinsky College](#) in Nijmegen (Netherlands) was held at CERN. The students and their teacher, Paul de Haas (a participant of the [High School Teachers 2012 Programme at CERN](#)) were connected with Prof. Christine Kourkouvelis and George Vasileiadis at the University of Athens and learned hands-on how to analyse real physics events, including Higgs-like ones, from the ATLAS experiment at the LHC using the [HYPATIA Applet](#).



The HYPATIA e-Masterclass was an integral part of Kandinsky College's five-day trip to CERN, during which the students visited many of CERN's experimental facilities, took part in a Cloud Chamber workshop, attended talks and roundtable discussions of [SpacePart12](#) and worked on the evaluation of the [Microcosm exhibition](#) as part of their master research project. This HYPATIA e-Masterclass was recorded and can be watched at <https://cdsweb.cern.ch/record/1492961>

HYPATIA e-Masterclass with Polish Students

The second HYPATIA e-Masterclass with the participation of 43 Polish students from the [Mikotaz Kopernik High School](#) in Kalisz and the XIV Liceum Ogólnokształcące im. Kazimierza Wielkiego was held on 22 November 2012 in CERN. The students and their teachers, including [Malgorzata Maslowska](#) (a participant of the [High School Teachers 2012 Programme at CERN](#)), were connected with Prof. Christine Kourkouvelis and George Vasileiadis at the [University of Athens](#) and learned hands-on how to analyse real physics events, including Higgs-like ones, from the [ATLAS experiment](#) at the LHC using the [HYPATIA e-science tool](#). The e-Masterclass was combined with a live connection to the [CERN Hangout "Higgs, the unanswered questions"](#), during which the students had the opportunity to ask CERN physicists questions about the recent discovery of the Higgs boson and its impact on science and society.





D4.8 Final Report on Implementation Activities (International Level)

Title of Event: **Teacher Training Workshop**

Date of Event: 04 January 2013

Place of Event: University of Reading, Berkshire, UK

A teacher training workshop with the participation of 18 UK school teachers along with the 9 Norwegian school teachers, 2 Korean school teachers, 2 UK University teachers and 3 UK postgraduate students took place at the University of Reading on 04 January 2013 in the framework of the ASE Conference. This 2-hour workshop included an introduction to particle physics and research at the LHC at CERN, followed by a hands-on exercise with the use of MINERVA applet on detecting W and Z boson decays and measurements of the mass of the Z boson. The UK teacher and student competitions were also introduced to the participants. At the end of the workshop, participants were given a resource pack, including a memory stick with all talks, worksheets and software.



Title of Event: **COMENIUS 5-Day Teacher Training Workshop**

Date of Event: 28 January – 01 February 2013

Place of Event: University Pierre and Marie Curie, Paris, France

Twenty science teachers from various European countries took part in this 5-day workshop aimed at bringing frontline interactive astronomy to the school classroom. The workshop included lectures and numerous hands-on activities utilizing DtC eScience tools including SalsaJ and the Faulkes robotic telescopes.





D4.8 Final Report on Implementation Activities (International Level)

Title of Event: **GTPP at the Dominican Republic**

Date of Event: 18 April 2013

Place of Event: Santo Domingo, Dominican Republic

Astrophysicist Breezy Ocana participated in a DtC training event attended by 30 science teachers and one scientist/trainer that took place in Santo Domingo on 18 April 2013, bringing the DtC eScience tools and resources closer to the school classroom.



Title of Event: **COMENIUS 5-Day Teacher Training Workshop**

Date of Event: 27-31 May 2013

Place of Event: University Pierre and Marie Curie, Paris, France



Eighteen science teachers from various European countries took part in this 5-day workshop aimed at bringing frontline interactive astronomy to the school classroom. The workshop included lectures and numerous hands-on activities utilizing DtC eScience tools including SalsaJ and the Faulkes robotic telescopes.

Title of Event: **DtC International Training Event – Astronomy@myPC**

Date of Event: 08 – 12 July 2013

Place of Event: Turku, Finland

In parallel with the European Week of Astronomy and Space Science (EWASS) 2013, a COMENIUS training event with the participation of 15 teachers and 3 scientists/trainers took place in Turku, Finland on 08-12 July 2013. Participants had the opportunity to visit the observatory and learn about the place where mirrors for some of the most important space crafts are built.





D4.8 Final Report on Implementation Activities (International Level)

Title of Event: **Astronomy@myPC & Astronomy@myBackPack**

Date of Event: 29 July – 02 August 2013

Place of Event: Volos, Greece

NUCLIO organized a COMENIUS training for 22 teachers from Europe (Portugal, Poland, Romania, Switzerland), USA and Sri Lanka in the framework of the DtC Summer School in Volos, Greece (29 July – 02 August 2013). Participants were introduced to the astronomy related tools offered by the DtC and to the IBSE methodology. The training event was complete with a science café in Milies village while several participants continued their training by attending the DtC-GHOU International Conference.



Title of Event: **GTTP in Chile**

Date of Event: September 2012 – August 2013

Place of Event: Chile

We continue to support workshops in Chile. Chile is a particularly interesting nation, as it is basically the "Stardeck" for spaceship Earth. Approximately 70% (estimate) of the high quality telescopes in the world are in Chile, and if Chilean people cannot benefit by this and by astrophysics education, we assert there is some big failure in the global educational and science system. Hence to help correct this, we have held workshops for the last year in Chile, reaching



more and more teachers (more than 100 over the last year), and are preparing to build learning communities around major urban centers so teachers can regularly meet and share their work, their activities, and their teaching methodology. This all seems to be going forward quite well, and we look forward to reaching 1000 teachers in Chile within a few years.



D4.8 Final Report on Implementation Activities (International Level)

3. Conclusion

In this report the international level implementations activities for the second year of the DtC project's life cycle have been documented in a structured manner by describing their learning objectives, participants' profile, process and methodology applied, outcomes, assessment and follow up actions. In particular, two Summer Schools, four International Masterclasses, one International Conference, one International Contest and numerous international training sessions and workshops were implemented. Table 2 provides a summary of all international-level implementation activities for the second year of the project classified per country of organising institute and categories of involved actors (i.e. teachers, students, others). In the same table, the total number of activities for the first year are also provided along with the indicator as specified in the Description of Work.

Country	International level Activities (2 nd year)			
	Events	Teachers	Students	Other
France	4	66	50	13
Germany	1	13	117	0
Greece	1	0	0	20
Portugal	7	162	0	23
Switzerland	6	86	103	1
UK	2	29	50	5
Spain	0	0	0	0
Austria	0	0	0	0
US	1	103	0	0
Total 1st Year	23	464	531	62
Total 2nd Year	22	459	320	102
Total (M24)	55	923	851	164
Indicator (M24)	10			

Table 2: International-Level Implementation Activities (Year Two)



Discover the Cosmos Deliverable

4. ANNEX

Table 1 and 2 list all international level implementation activities conducted during the project's first twelve months (September 2011 – August 2012). The type of the event is marked according to the following table:

Type	Event	Classification	Coverage
V	Visionary Workshop	Participatory Engagement	
PR	Practice Reflection Workshop	Participatory Engagement	Local/National
S	Summative Workshop	Participatory Engagement	
T	Training and demonstration activities: workshop or seminar	Training / Implementation	Local/National/International
MC	MasterClasses	Implementation	National/International
SS	Summer School	Implementation	International
IC	International Conference	Implementation	International



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	Nº part. per category	Partner
September 2012							
T	GTTP in Chile	09/2012 – 08/2013 (M13-M24)	Chile	Teacher training	Teachers	103	LBL
T	GTTP/Discover the COSMOS National Astronomical Observatories of China	01-012/09/2012 (M13)	Beijing, China	Teacher training session organized by China Hands-on Universe. Teachers and science centre staff were introduced to Discover the COSMOS tools and resources and had the opportunity to use them, in particular Faulkes Telescope and Salsa J	High school and middle school teachers and science centre staff Scientists	25 5	NUCLIO
T	Discover the COSMOS International Training Event – Astronomy@myBackPack	10-15/09/2012 (M13)	Cascais - Portugal	Comenius Training event in parallel with a local certified training for Portuguese teachers. Teachers from several European Countries were present	Middle school and high School Teachers from Europe Scientists	27 3	NUCLIO
October 2012							



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	Nº part. per category	Partner
T	GTPP in Narmada – India	17-18/10/2102 (M14)	Gujarat – India	Manthan Educational Programme Society, India conducted a Galileo Teacher Training Programme on 17th and 18th October 2012 in Kavedia Colony, Narmada district in Gujarat state for 30 science teachers. One of the main aspects Manthan focused was to communicate astronomy using low-cost methods and hands-on methods. The two days were full of brightness of the Sun and Stars and worked to spread the brightness in the entire district of Narmada. Discover the COSMOS tools and resources were introduced as a powerful allie to be used in schools with computer labs.	Teachers Teacher Trainers	30 3	NUCLIO
T	Discover the COSMOS International Training Event – Universe Quest	29/10-02/11/2012	Cascais - Portugal	Comenius Training event in parallel with a local certified training for	Middle School and High School Teachers from Europe	15	NUCLIO



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	N° part. per category	Partner
		(M14-M15)		Portuguese teachers. Teachers from several European Countries were present	Scientists	3	
November 2012							
T	International Occultation Timing Association – Middle East	03/11/2012 (M15)	Shiraz, Iran	Training on HOU and Discover the COSMOS exercises	Students Teachers	50 3	CNRS
MC	HYPATIA e-Masterclass	08/11/2012 (M15)	CERN, Switzerland	http://discoverthecosmos.eu/news/167	Dutch high school students Teachers	9 2	CERN, IASA
MC	HYPATIA e-Masterclass	22/11/2012 (M15)	CERN, Switzerland	http://discoverthecosmos.eu/news/168	Polish high school students Teachers	43 3	CERN, IASA
December 2012							
T MC	Geneva and Academie de Grenoble Teachers Programme at CERN	05-07/12/2012 (M16)	CERN, Switzerland	http://indico.cern.ch/conferenceDisplay.py?confId=218450	Swiss teachers French teachers Teacher trainers	16 9 1	CERN, IASA
January 2013							
T	Particle Physics workshop at ASE Teacher conference	04/01/2013	University of Reading	Talk and workshop using the MINERVA eScience	Teachers from UK schools	18	UB



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	N° part. per category	Partner
				application	Teachers from Norway Teachers/visitors from Korea University teachers PGCE students	9 2 2 3	
T	Comenius 5-day teacher training	28/01/2013 (M17)	UPMC, Paris		Teachers from various European countries	20	IAP/CNRS
March 2013							
MC	International ATLAS_W masterclass	11/03/2013 (M19)	Dresden, Germany	International masterclass Details here: http://www.physicsmasterclasses.org/index.php?cat=schedule	German high school students Teachers	117 13	TUD
MC	International ATLAS_Z masterclass	11/03/2013 (M19)	CERN, Switzerland	International masterclass. Details here: http://www.physicsmasterclasses.org/index.php?cat=schedule	French high school students Teachers	25 3	CERN, IASA



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	N° part. per category	Partner
MC	International CMS masterclass	12/03/2013 (M19)	CERN, Switzerland	International masterclass Details here: http://www.physicsmasterclasses.org/index.php?cat=schedule	French high school students Teachers	26 2	CERN
April 2013							
T	GTPP at Dominican Republic	18/04/2013 (M20)	Santo Domingo – Dominican Republic	Breezy Ocana (astrophysicist) participated in our Discover the Cosmos training and brought the tools and resources to a training at Dominican Republic	Teachers Trainers	30 1	NUCLIO
T	Robotic Telescope Demonstration	26/04/2013	Athens, Greece		Students	50	LJMU
May 2013							
T	Comenius Teacher Training Workshop	27 -31/05/2013 (M21)	UPMC, Paris	5-days training (Skype talk by UoG)	Teachers from Europe Trainers	18 5	CNRS UoG



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	N° part. per category	Partner
June 2013							
SS	High School Teacher Programme at CERN	30/06 – 20/07/2013 (M22-M23)	CERN, Switzerland	<p>Seminar on Discover the COSMOS eScience tools, portal and activities took place on 2 July.</p> <p>A HYPATIA masterclass preceded by lecture was organized on 8-9 July.</p> <p>Details of CERN Summer School's agenda here: https://indico.cern.ch/conferenceDisplay.py?confId=257353</p>	High school teachers from 29 countries across the world	51	CERN, IASA
July 2013							
T	Discover the COSMOS International Training Event – Astronomy@myPC	08-12/07/2013 (M23)	Turky - Finland	Comenius training event promoting Discover the COSMOS tools and resources and the IBSE methodology	Middle School and High School Teachers from Europe Scientists	15 3	NUCLIO
T	Workshop	13-15/07/2013	Chile	Workshop for teachers	Teachers	150	GHO, UC, LBL



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	N° part. per category	Partner
T	DtC International Training Event – Astronomy@myBackPack and Astronomy@myPC	29/07-02/08/2013	Volos, Greece	Comenius Training event in parallel with a local certified training for Portuguese teachers. Teachers from several European countries were present.	Middle School and High School Teachers from Europe Scientists	20 5	NUCLIO
SS	Discover the COSMOS Summer School	30/07 – 04/08/2013 (M23-24)	Volos, Greece	Discover the COSMOS Summer School website: http://dtc-conference.ea.gr/content/welcome	Teachers	30	EA
August 2013							
IC	Discover the COSMOS International Conference	02-04/08/2013	Volos, Greece	Discover the COSMOS International Conference website: http://dtc-conference.ea.gr	Teachers	160	EA
T	Teacher training workshop (GTTP/F-HOU)	30/08-01/09/2013 (M24)	Al Akhawayn University, Ifrane – Morocco		Teachers Trainers	25 3	CNRS
September 2013							
T	International Conference on	02/09/2013	Kolympari,	Hands-on workshop	Physicists	20	IASA



D4.8 Final Report on Implementation Activities (International Level)

Type	Event	Date (Project Month)	Location	Purpose	Participants	N° part. per category	Partner
	New frontiers in Physics		Chania, Greece	during poster session Conference website: http://indico.cern.ch/conferenceDisplay.py?confId=198153			

Table 1: International level activities implemented from September 2012 to August 2013