University of Athens

The IASA/UoA outreach team:
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Involving students in HEP research with the help of the "Inspiring Science Education" and "Go-lab" European outreach projects

The main challenge:

How can we provoke students' curiosity for HEP? (which in most countries is absent from the national curricula)

➤ Engage students in hands-on experimentation directly connected to **top-level research** and discoveries
➤ Attract their attention to **real-time** research
➤ Create material which is ready to be used in **the internal of a school lesson**
➤ Directly connect material to **Big ideas of science**
➤ Material has to be adapted to the **age of students**
➤ Identify **best practices**

The running EU outreach projects +CREATIONS

➢ **Go-Lab (Nov. 2012 - Nov.2016, 20 partners)**

❖**Online science laboratories for the large-scale use in schools**

http://www.go-lab-project.eu/

➢143 on-line labs
➢132 Inquiry Learning Spaces
➢34 Apps
In all STEM curricula subjects in 10 languages

➢ **Inspiring Science Education (ISE) (April 2013 + 40mo, 31 partners)**

❖**eLearning tools for 5,000 schools in 14 countries**

http://inspiring-science-education.org/

➢120 Demonstrators (in all STEM curricula subjects)
➢+Harvested existing repositories with 278,000 educational resources (mainly ODS and DtC)
➢**In two years has reached 2750 schools**

Example of **four HYPATIA lesson plans (ILSs)** developed for **Go-lab** using the full Inquiry Based path :
Orientation, Conceptualization, Investigation, Conclusion, Discussion

1) **Conservation of momentum**
http://www.golabz.eu/spaces/conservation-momentum-particle-colisions

2) **Measurement of the magnetic field using the giant ATLAS detector**
http://www.golabz.eu/spaces/measurement-magnetic-field

3) **Hunt for the Higgs boson**
   http://www.golabz.eu/spaces/discover-higgs-boson

4) **Discover the Z boson**
   http://www.golabz.eu/spaces/discover-z-boson

Direct relation with school curricula

HEP applications
The main tool: HYPATIA
Best practice

- **Offline version** used by IPPOG's **Z-path** http://hypatia.phys.uoa.gr/

- **Online version** http://hypatia.iasa.gr/

 has been used since 2010 in about 100 Greek schools across the country

Local Masterclasses, e-Masterclasses & Virtual Visits

Students learn "how actually science works" (half day)

➢ Listen to lectures

➢ Follow a virtual visit to ATLAS control room

➢ Analyse events with the HYPATIA on-line tool

Remark:

Both versions of HYPATIA now "enriched" to **handle large event files** for University students' analysis

Back-up

Content of Discover the COSMOS repository/Activities

Discover the COSMOS Repository

The Discover the COSMOS Repository contains educational material in the form of **educational content** (photos, videos, animations, exercises, graphs, links) and of **learning activities** (structured lesson plans organized according to specific pedagogical models such as inquiry based Learning and Guided Research). Users can search for the educational materials in the "Explore Discover the COSMOS" section or to upload their own materials to the Discover the COSMOS Repository, using the "Share your Content" section.

Explore Discover the COSMOS

Search for Educational Content (90205)
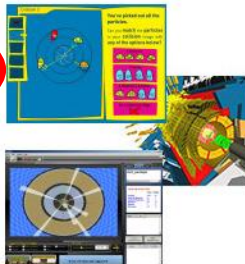
Search for Learning Activities (625)

Share your Content

Upload Educational Content

Upload Learning Activities

moCERN

The DISCOVER the COSMOS Repository goes mobile! Now, Discover the COSMOS Educational Content is available for mobile and handheld devices. Visit MoCERN and explore the HEP resources and MoCO and explore the Astronomy repository through your mobile phone.

Visit the DISCOVER the COSMOS Camp in Second Life! Explore the Universe, the ATLAS Detector and numerous other contents of the Repository through a unique immersive experience in a realistic context. From here you can download and install Second Life Viewer which is used for entering the Discover the COSMOS Camp in Second Life. Teleport to Discover the COSMOS Camp.

Discover the COSMOS Tutorials

The Discover the COSMOS consortium has produced a series of video tutorials astronomy, astrophysics and high energy physics subjects. To access these tuto click here.

~ 95,000 items in Educational content
~ 630 educational scenaria (HEP/Astronomy)

HEP tool-box
- **HYPATIA**
- **MINERVA**
- **CAMELIA**
- **CERNland**
- **LHCgame**

5,000 teachers and
31,000 students reached
850 impl.activities in schools
2,000 schools continuing

Measurement of Magnetic Field

xxx ➡

Students will study the motion of a charged particle in a magnetic field, in order to determine the strength of the field of one of the ATLAS magnets, used to measure the momentum of the particles produced by particle collisions at the CERN LHC accelerator. The momentum of the tracks, as measured by the detector, is provided (since the magnetic field is known-but not given for this purpose of this exercise).

Orientation Conceptualisation Investigation Conclusion Discussion

Introduction

Let's have a look at the Sun's wild surface!

Analysis: Big Ideas of Science

the continuity

#1. All material in the Universe is made of very small particles
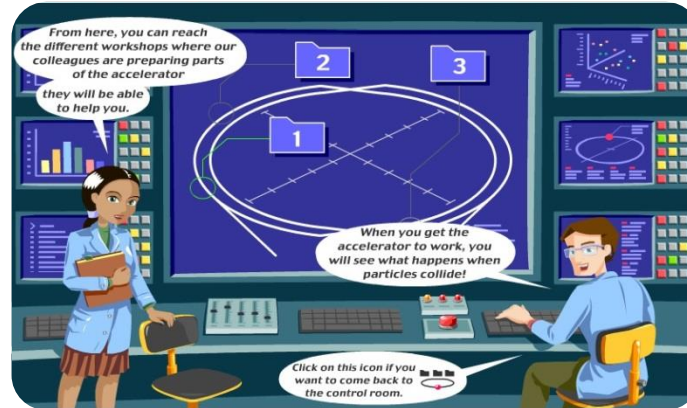
| CERN Land 6-9, 9-12 | LHC Game 12-15 | Hypatia 15-18 |
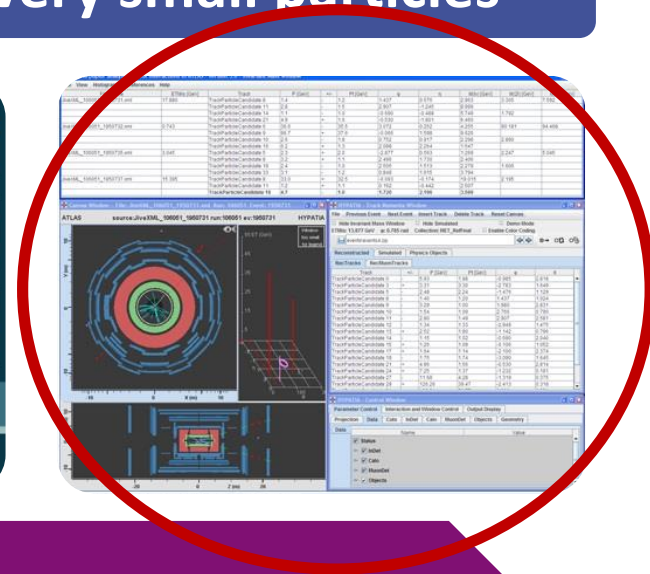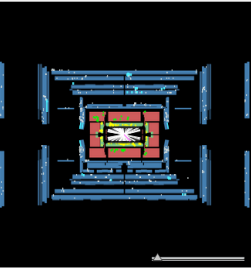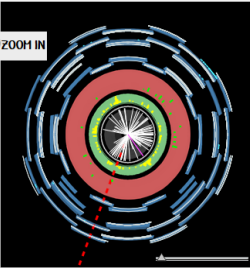
ISE HYPATIA demonstator +PISA assessment questions

Horizon 2020

Call: H2020-SEAC-2014-1

NEW

Topic: SEAC-1-2014

Proposal acronym: CREATIONS

Developing an Engaging Science Classroom

➤ 36 months
➤ 1,8ME
➤ 7 WPs
➤ Coordinator: University of Bayreuth

16 Partners (CERN, UoB, IASA, STFC etc) + Quarknet

Big Ideas of Science

scheme is to build in depth knowledge around basic concepts and scaffold to big and more complex concepts

First level
(kindergarten - around 10)

Second level
(11 -14)

Third level
(15 -18)
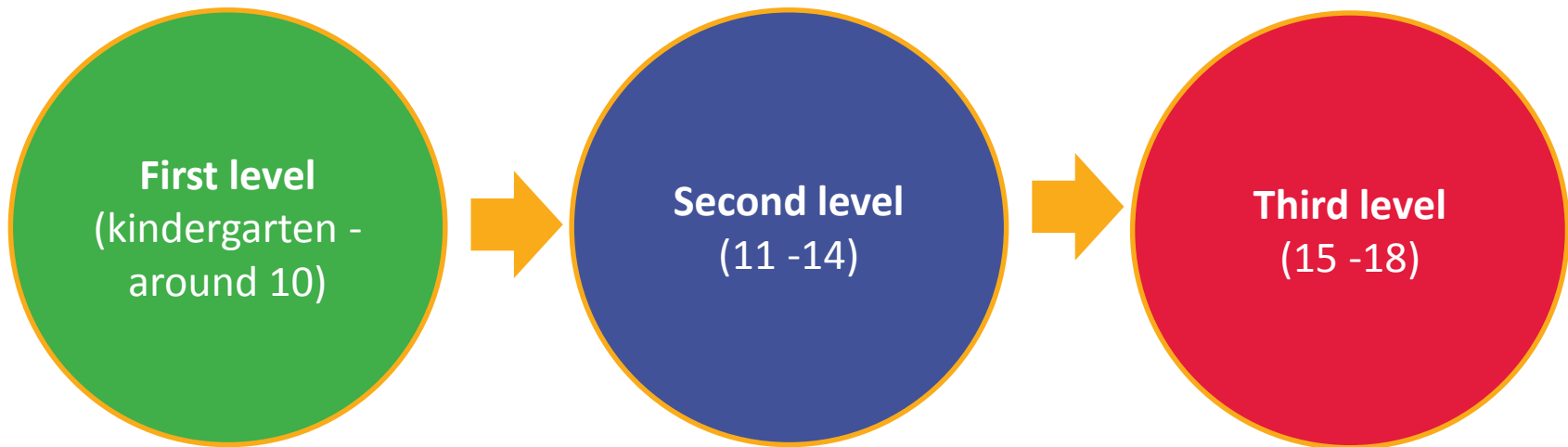
from small to big ideas in science, from simple experiences to complex and abstract phenomena in the natural World
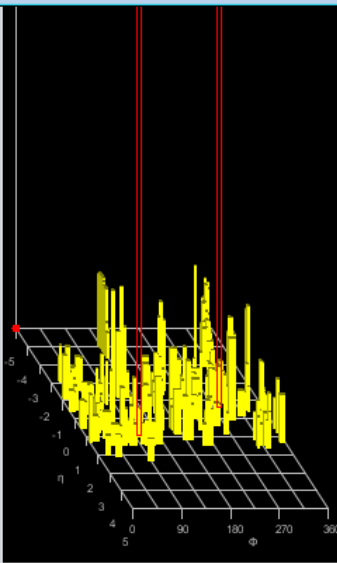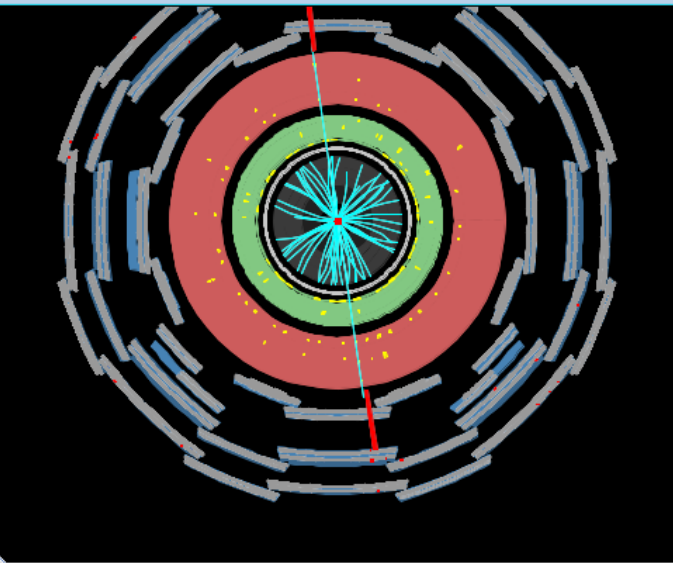
1) "Standard" version of offline HYPATIA

2 leptons (J/ψ, Υ, Z, Z')   4 leptons (Higgs)

➢Needs xml files (big)
➢Can process any .xml file
➢ATLANTIS is slow in loading events
➢Takes about 15min for 4000 events

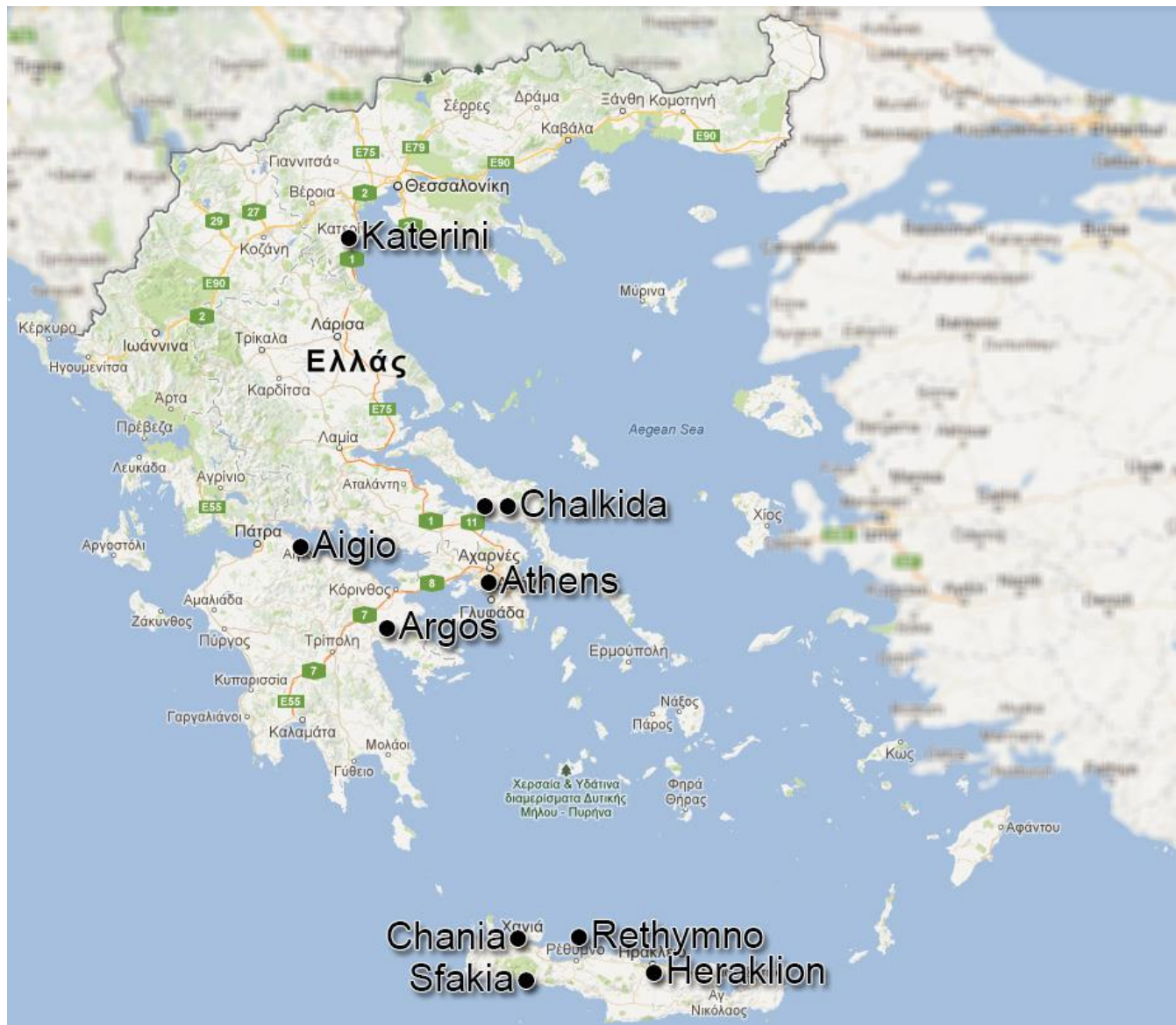C. Kourkoumelis, UoA   14

2)Implemented in the online HYPATIA

Same GUI for 2 and 4 leptons

➢Event files are built-in (converted from xml) but much smaller
➢Only works with the built-in event files
➢Runs VERY fast

Implementation in Greek schools 2012-2013
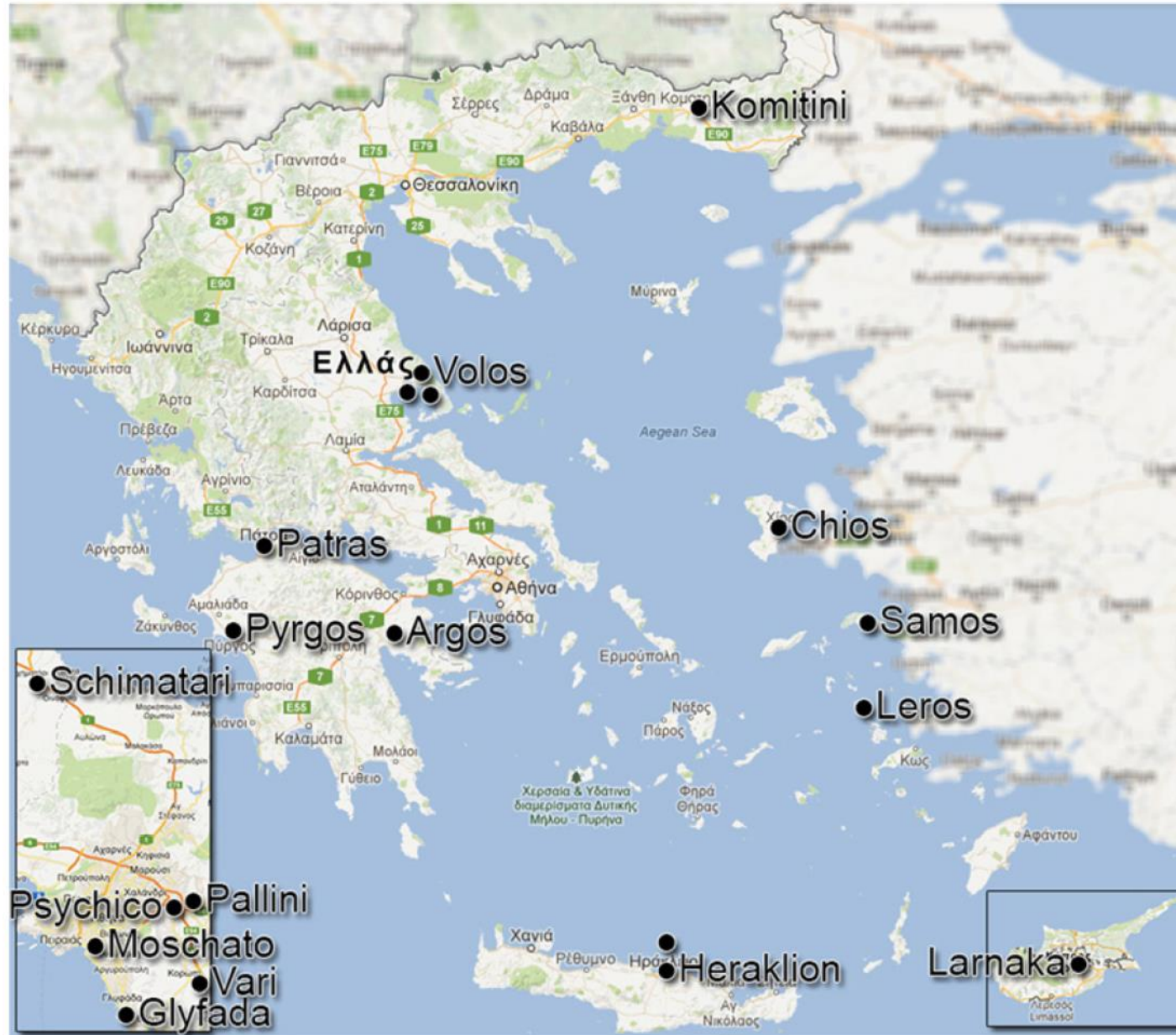
Implementation in Greek schools 2013-2014

Implementation in Greek schools 2014-2015