OUTREACH ACTIVITIES IN GREECE

Christine Kourkoumelis/NKUA

RECFA Athens meeting
November 10th, 2023

HELLENIC REPUBLIC
National & Kapodistrian
University of Athens

Our main challenge

HEP institutions/labs besides performing cutting-edge research and development should :

- promote the accessibility of science (and possibly get support on fundamental publicly-funded research)
- share the excitement of scientific exploitation and discoveries
- actively engage audience (hands-on)
- inspire the next generation of scientists

OUTREACH AND COMMUNICATION

Target audience (outline)

- High schools
  - International masterclasses
  - Local mini-masterclasses
  - μNet
  - CERN Visit groups (in-person/virtual)
  - BL4S
- STEM teachers
  - Greek teacher programme
  - IBSEducational resources in the framework of EU projects
- Open data
  - Citizen scientist volunteers
  - University students

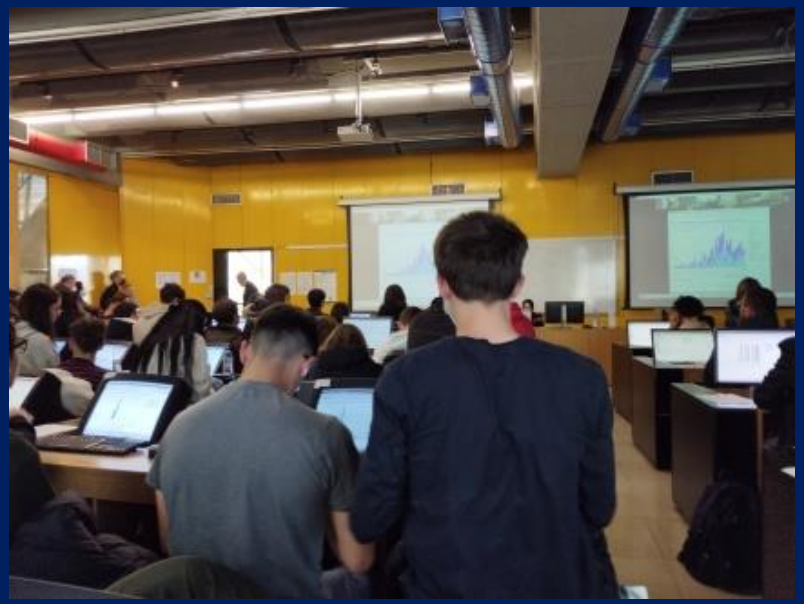
MASTERCLASSES FOR HIGH SCHOOL STUDENTS
(make students into scientists for a day)

Annual **IPPOG** program now in its 19th edition (13k students/year)

- **Greece participated since the beginning 2004 (LEP) and from 2011 (LHC)**
- **ATLAS (Z Path) , CMS and ALICE MasterClasses**
- Teachers select max 5 students/school
- More applications than can be accommodated (3/4)
- 2023 for 1st time **Particle Therapy Masterclass** 240 pers virtual +100 present in AUTh (Thessaloniki)
- **International day of Women and Girls in Science** February '23 @ Center of Physical Sciences (Thessaloniki) 25 pers.

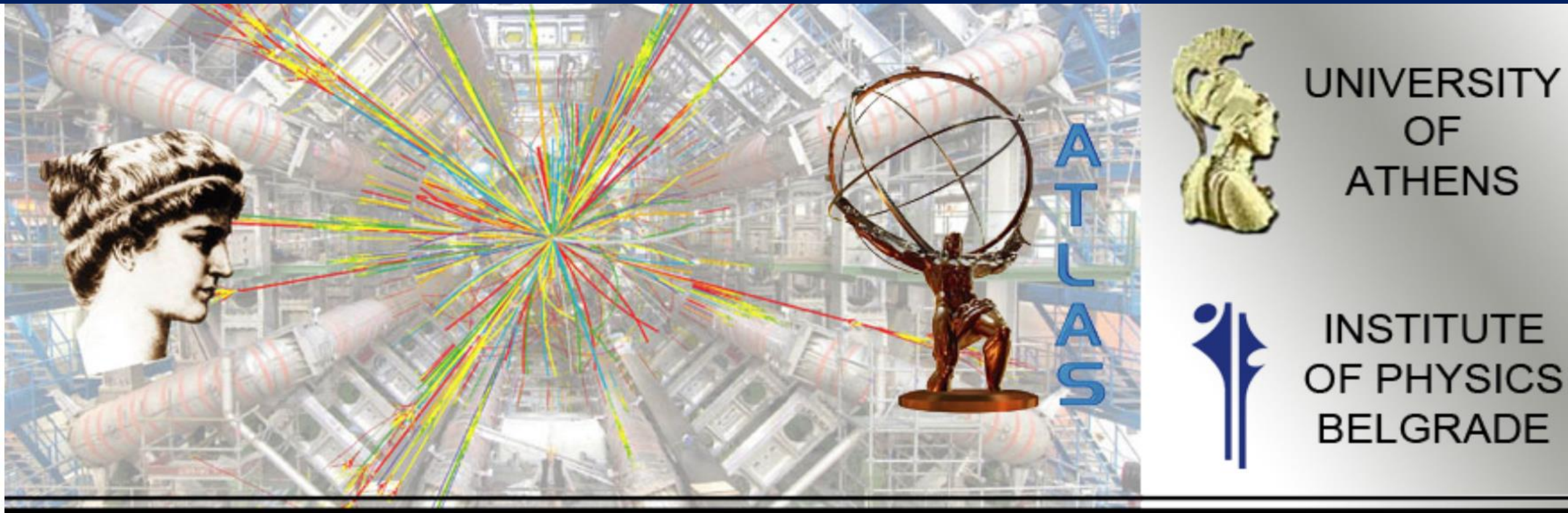
IPPOG MASTERCLASSES 2023 (Coordinated by Prof. N.Tracas/NTUA)

Institution (8 locations)	Students	STEM teachers
Center of Physical Sciences (Thessaloniki)	25	
Center of Physical Sciences (Crete and Thessaloniki)	140 (Virtual)	
NKUAthens	60	
AUTh (Thessaloniki)	100	
UoCrete	50	
NCSR Democritus	45	
NTUAthens	120	40
Hellenic Open University (Patras)*new	40	
Sum	**580**	**40**



HYbrid Pupil's Analysis Tool for Interactions in ATLAS

HYPATIA USED in "Z path" WRITTEN BY NKUA (50% of all LHC CERN masterclasses)

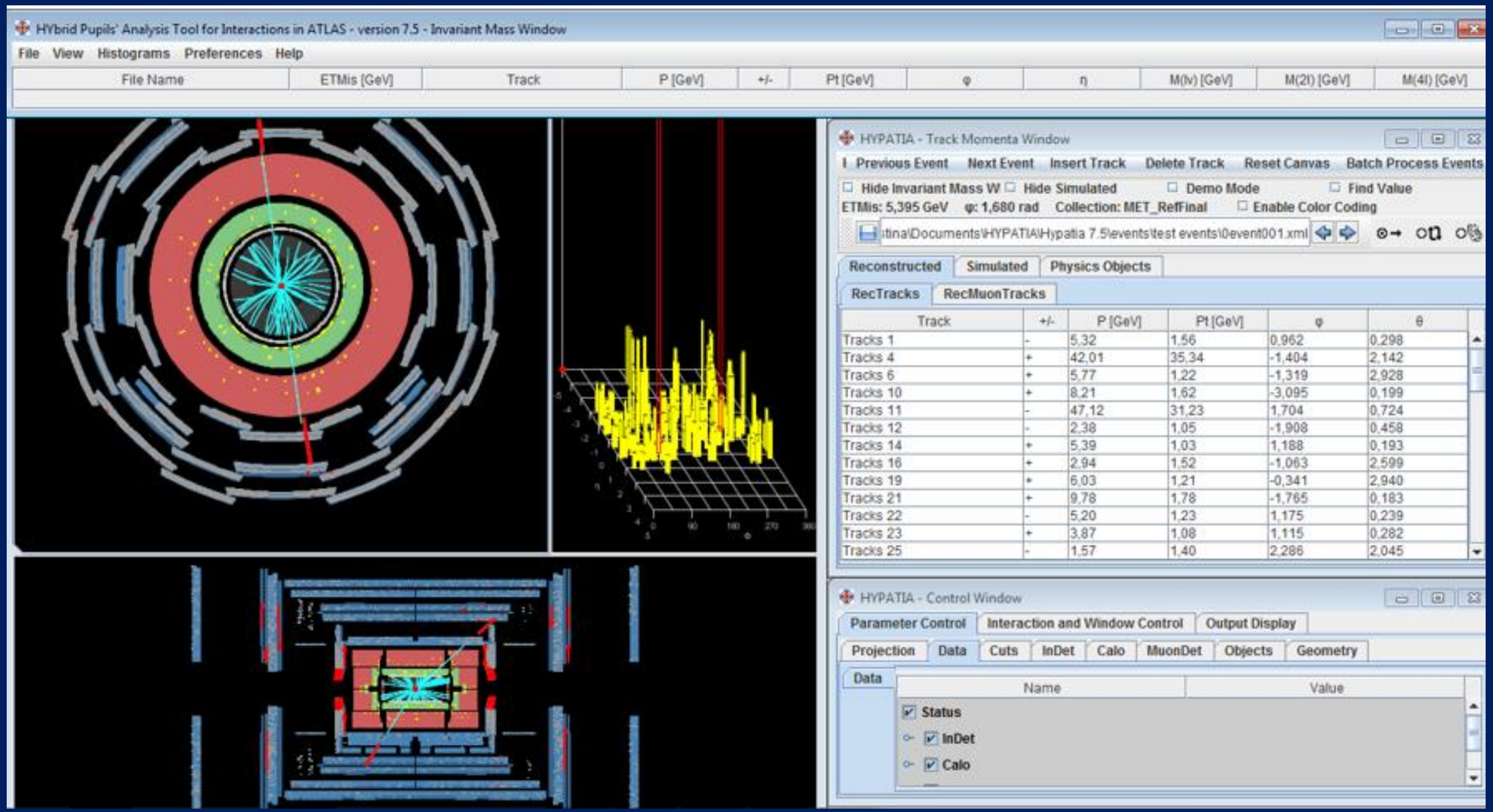


UNIVERSITY OF ATHENS

INSTITUTE OF PHYSICS BELGRADE

H Y P A T I A

HYPATIA OFFLINE VERSION (FOR IMC)



HYPATIA ONLINE VERSION (IN 4 LANGUAGES)
Used in mini-masterclasses (visits in schools)

HY.P.A.T.I.A
HYbrid Pupil's Analysis Tool for Interactions in ATLAS

Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών
National and Kapodistrian University of Athens

Christine Kourkoumelis
Stelios Vourakis

Η ΥΠΑΤΙΑ
μελετήσου
γραφικής α
είναι «γεγο
σωματιδίων
Σωματιδίων

The HYPAT
fundamenta
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detected by
in the Euro

Le projet H
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sont des «é
puissant du
Genève.

Das HYPAT
der Materie
Zerfallsproc
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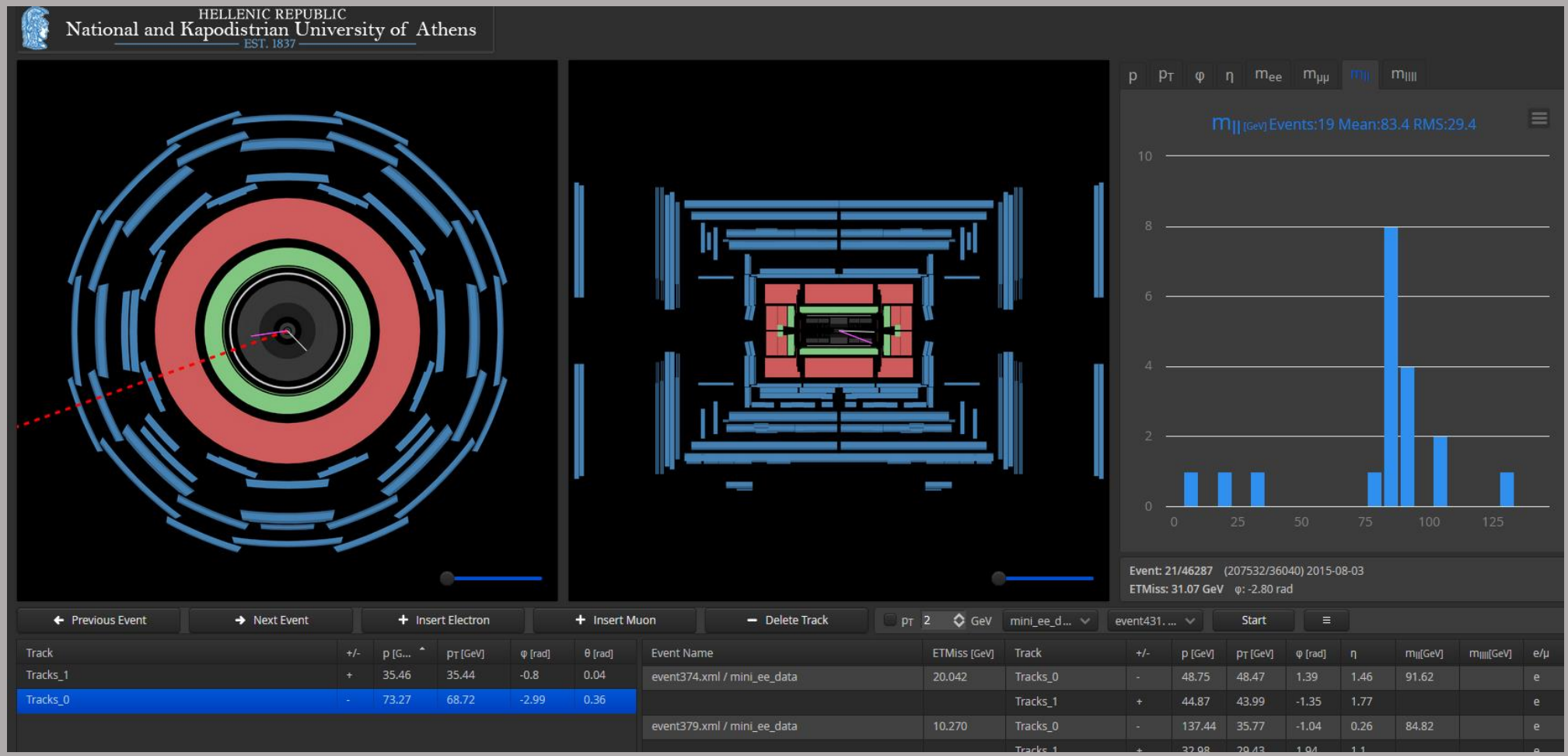
am europäi

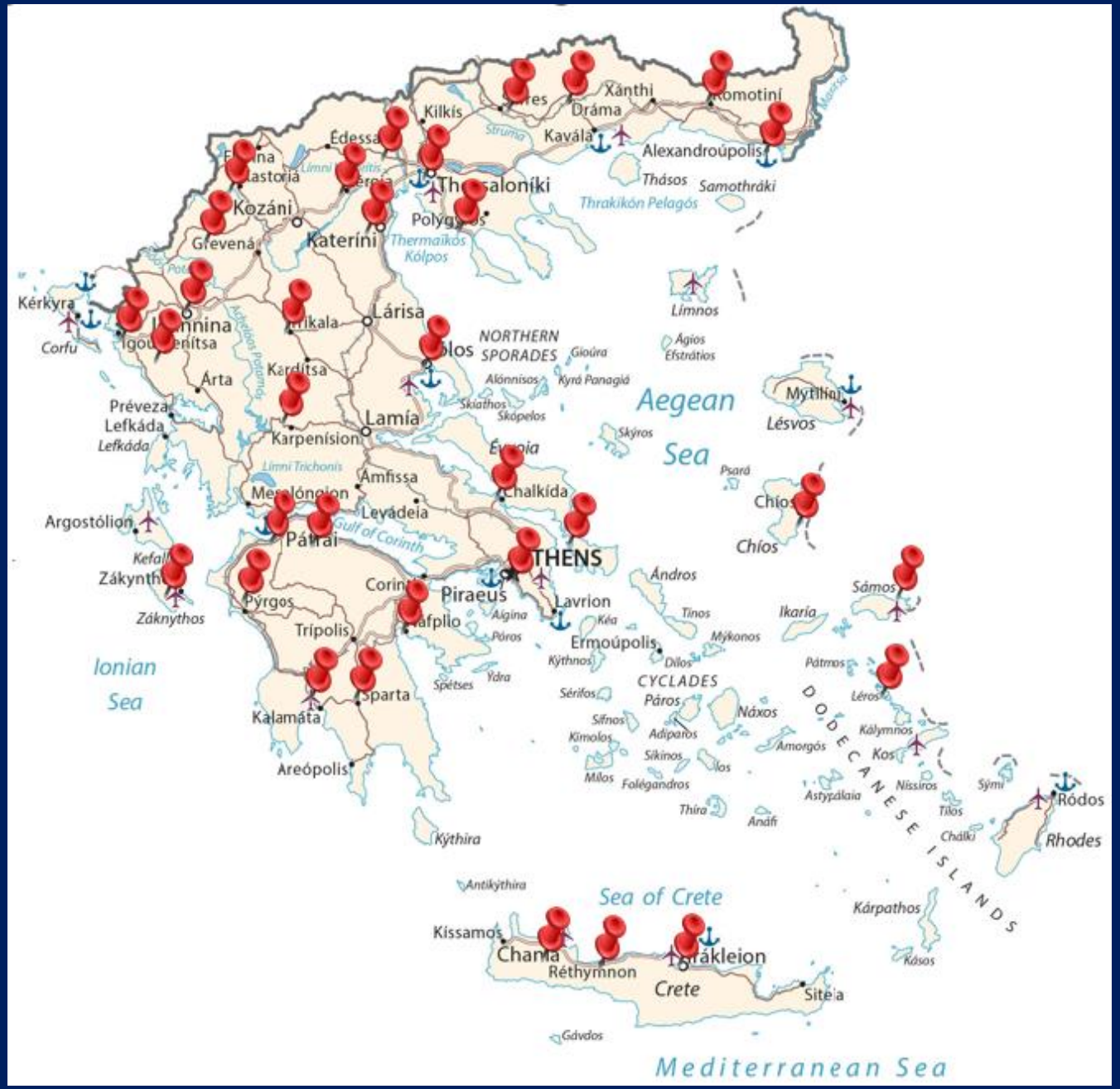


ATLAS Mini-Masterclasses in Greek schools

During the class hours 9:00-14:00

- Lectures
- Hands-on measurements at school's Computer Lab with HYPATIA
- At the end, a Virtual Visit + Q&A
- About 30 stud + 5 teachers/event
- 15-17 years old students prepared beforehand by their teachers
- Guided by the presence of at least two HEP physicists

Invited by the schools, visited more than **100 schools all over Greece** during the last few years



The μNet Outreach Project
An Extended School Network of Air Shower Detectors in Greece

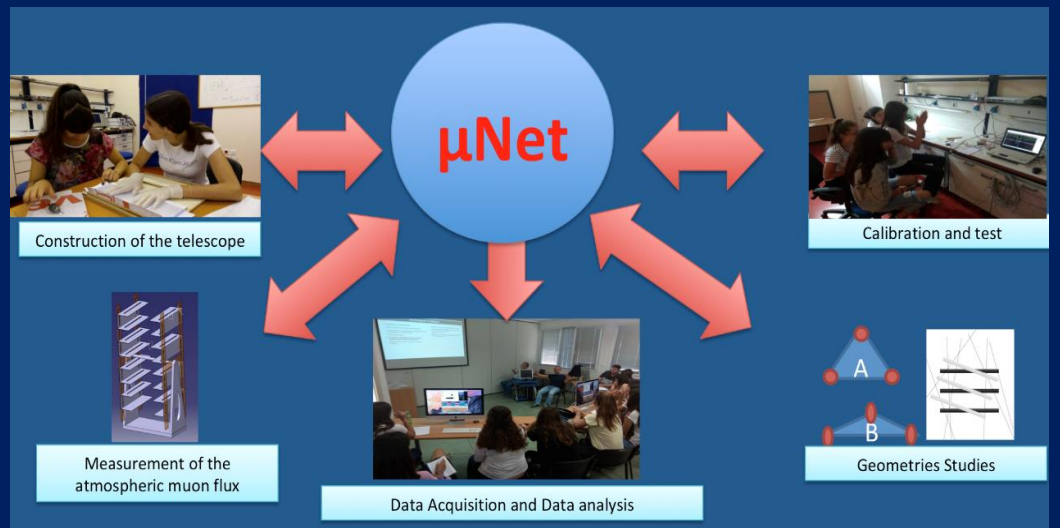
HELLENIC OPEN UNIVERSITY

School of Science & Technology

A.Leisios/HOUPatras

The μCosmics telescope

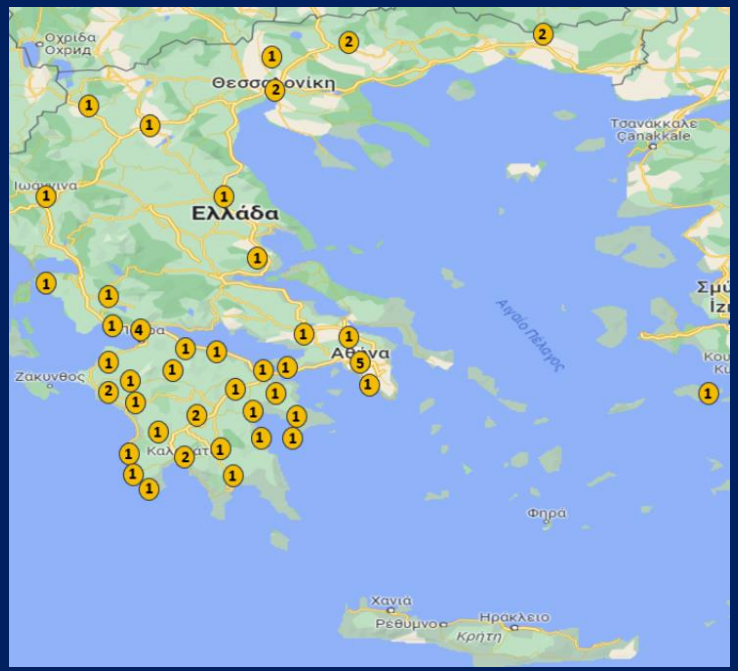
The μNet educational activities



μNet in action

1st year of operation 2022-2023

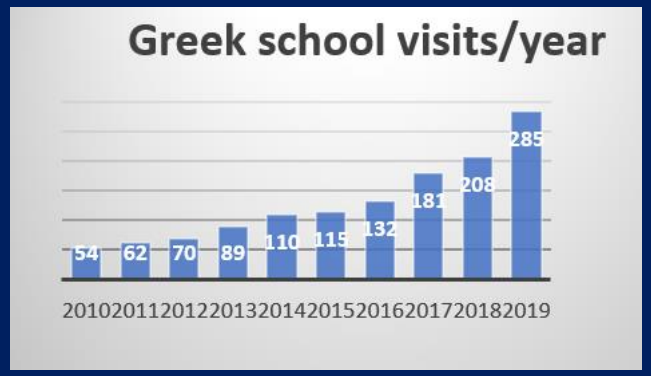
- **20 school units from Peloponnese hosting a μCosmic detector in their laboratory.**
- **40 school units from all over Greece operating telescopes located at the Physics Laboratory of HOU.**
- **500 students participated**



The **only outreach HFRI Greek funded** project ~100k

School visits @ CERN

- On-site high school guided tours group visits are very popular
- In 2019:
  - 1500 requests!!!
  - 285 visits/8312 visitors
  - **5.5%** of all CERN visits are from Greek schools



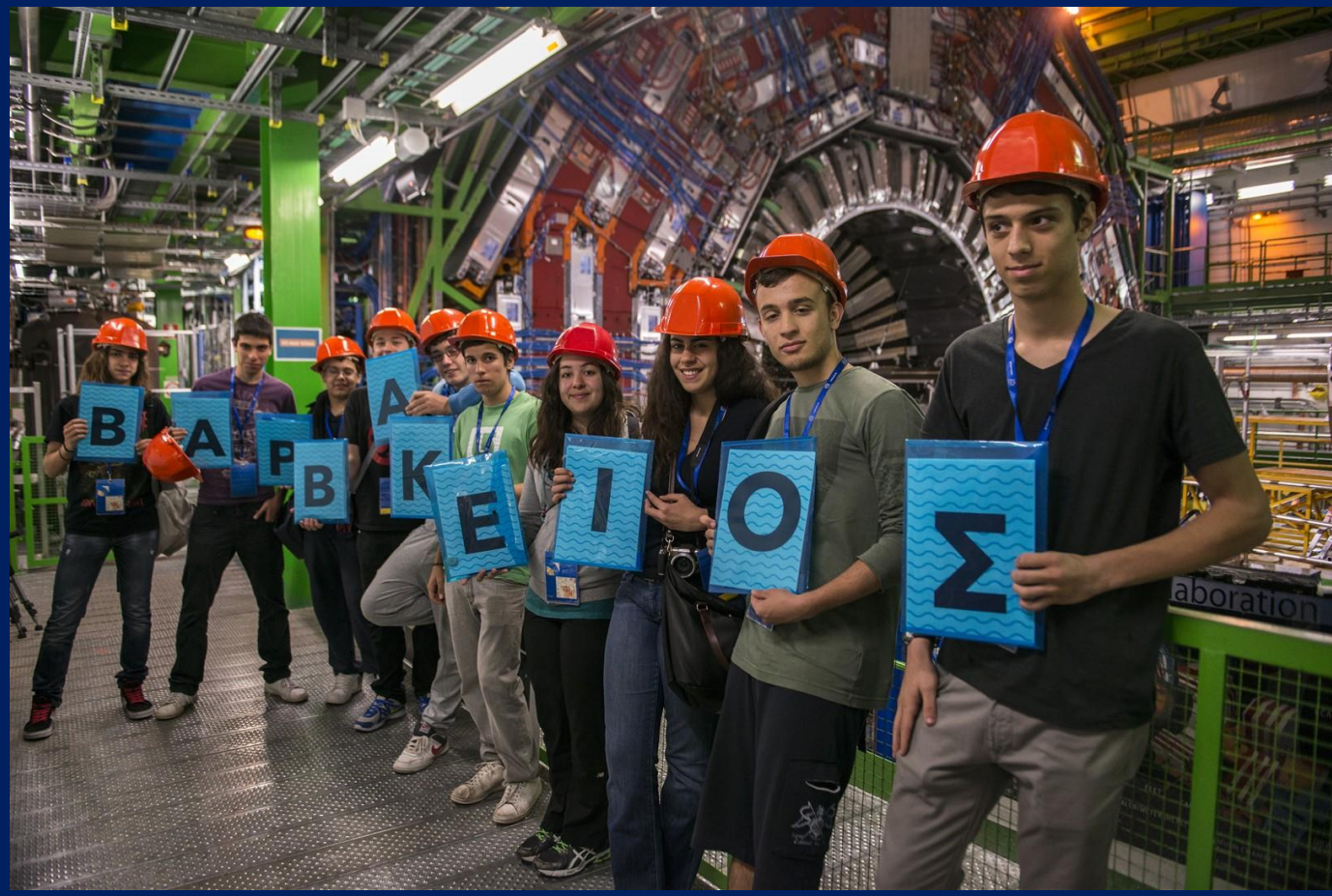
- Many Virtual Visits as well

Thanks to F. Briard

Beamline for Schools

The BL4S is a competition for high school students all round the world organized at CERN and DESY

- Started in 2014 (7 editions)
- 1905 teams from 92 countries **(62 Greek teams)**
- Its **first edition** won by jointly by a Greek **(Varvakios Pilot School in Athens)** and a Dutch team



GREEK TEACHER PROGRAM @ CERN (1/2)

John S. Latsis
Public Benefit Foundation

Greek Teacher Programme

- Nationally Coordinated by E. Tsesmelis
- Since 2008, yearly event (end August)
- Two 3-full day sessions for 36+36 STEM teachers
- Algorithm selection of teachers from all prefectures of Greece
- Lectures+ visits+ hands-on (help from Perimeter Institute)
- In Greek-> no language barrier
- 46% female teachers
- Supported by the J.S. Latsis foundation (teachers only pay for travel)

IMPACT of GREEK TEACHER PROGRAM @ CERN (2/2)

- Enthusiastic feedback from teachers who return as ambassadors of CERN
- “Lifetime experience”-> Organize school visits, lectures, exhibits, student clubs
- Hopefully in 2024 edition +1 day to the program to visit Science Gateway

2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2022	2023	Sum
80	40	44	76	80	80	74	40	60	38	36	72	70	**791**

EU outreach projects-> support, educational content (since 2008)

Coordinated by NKUA/IASA

- Learning with ATLAS@CERN, http://www.learningwithatlas-portal.eu/
- Discover the COSMOS, http://portal.discoverthecosmos.eu/

Partner

- PATHWAY IBSE **Project**, http://www.pathway-project.eu/
- Go-lab, http://www.go-lab-project.eu/
- Inspiring Science education, http://inspiring-science-education.org/
- CREATIONS project, http://creations-project.eu/
- The Frontiers Project (Erasmus+), http://www.frontiers-project.eu/
- REINFORCE, http://www.reinforceeu.eu/->citizen science

OPEN DATA FROM LHC EXPERIMENTS

An educational platform providing easy access to the **REAL ATLAS data**, software and tools with documentation in the form of step-by-step instructions for users

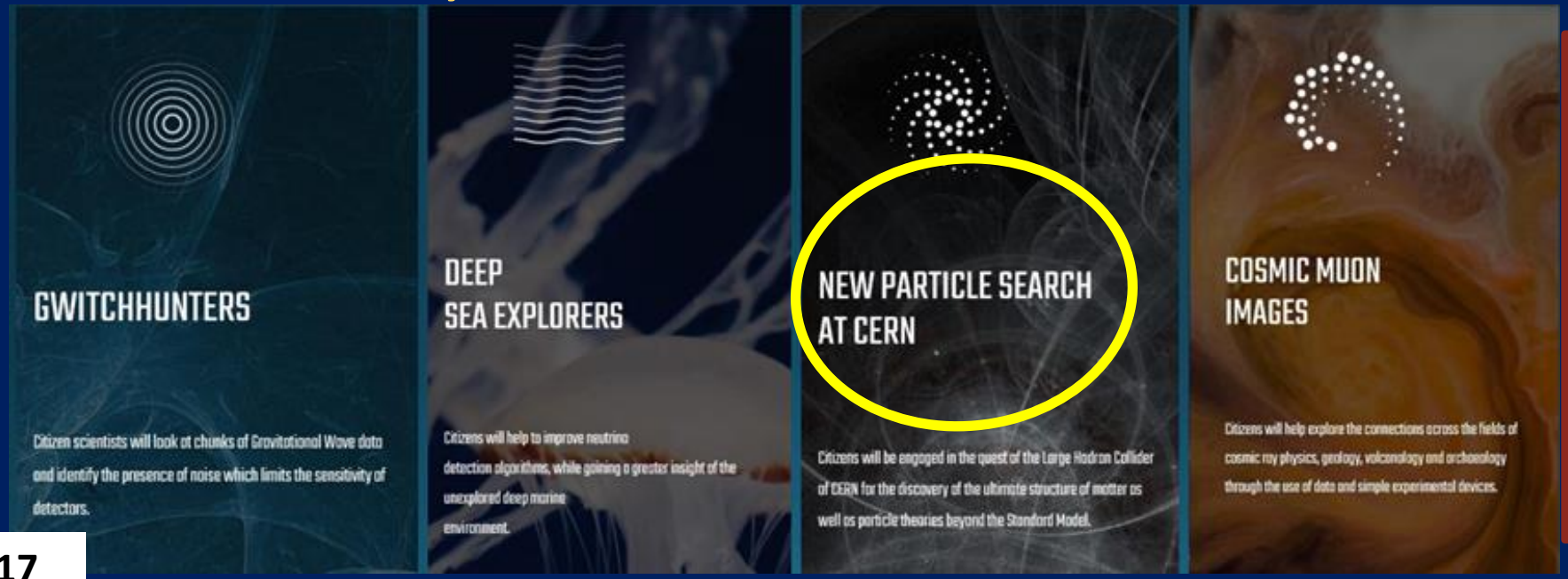
- Used in REINFORCE "New Particle search at CERN" demonstrator
- Designed and used since 2016 a 4th year undergraduate particle physics lab at NKUA. The students use HYPATIA in batch mode (large samples) and try to optimize the selection criteria (signal/background) for Z and Higgs boson searches

REINFORCE
REsearch INfrastructures FOR Citizens in Europe

Citizen scientist activities

- **RE**search **IN**frastructures **FOR C**itizens in **E**urope,supported by Swarfs
- 3 years long (2019 – 2022) **12 partners** from 7 different countries across two continents

Four "discovery" demonstrators **built on the Zooniverse platform**



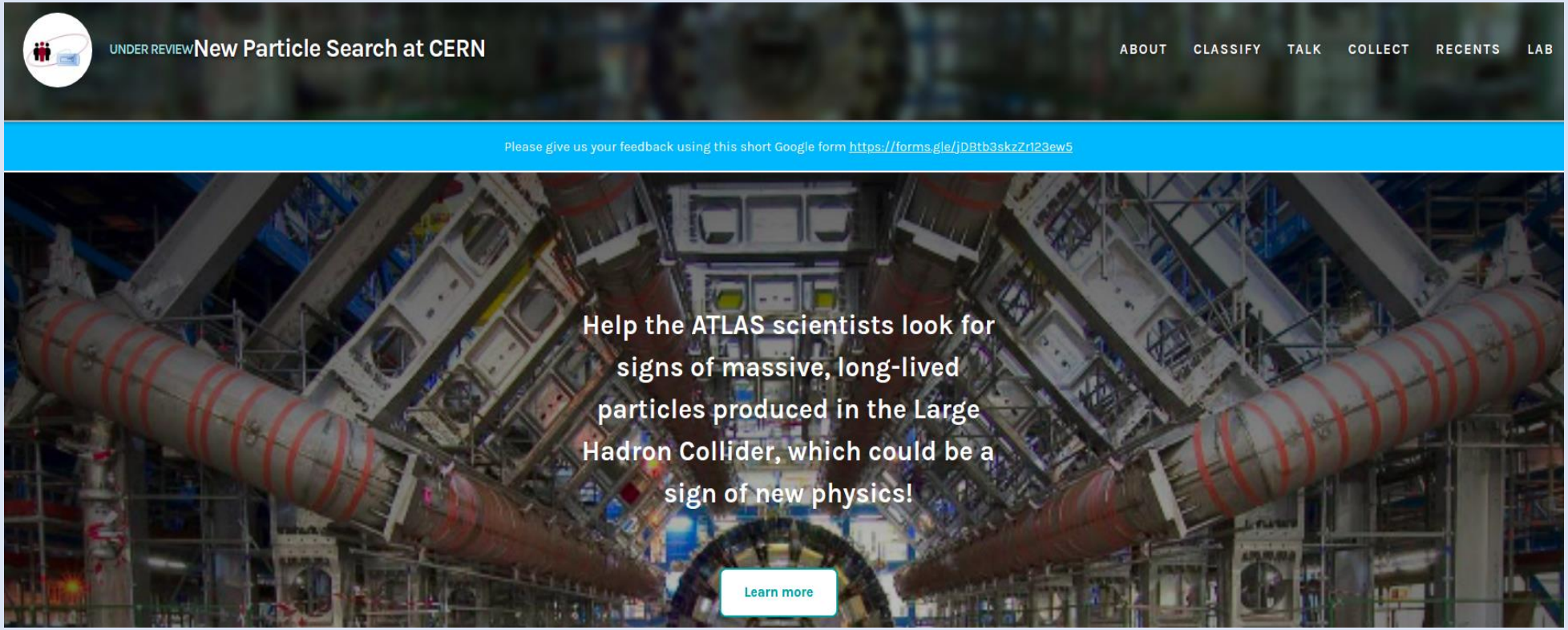
PLUS:

Explore the potential
of frontier citizen science
for inclusion and diversity.

REINFORCE CITIZEN SCIENCIST VOLUNTEERS (1/2)

New Particle Search at CERN demonstrator developed by NKUA

https://www.zooniverse.org/projects/reinforce/new-particle-search-at-cern



In EN, GR, SP

Using ATLAS Open Data

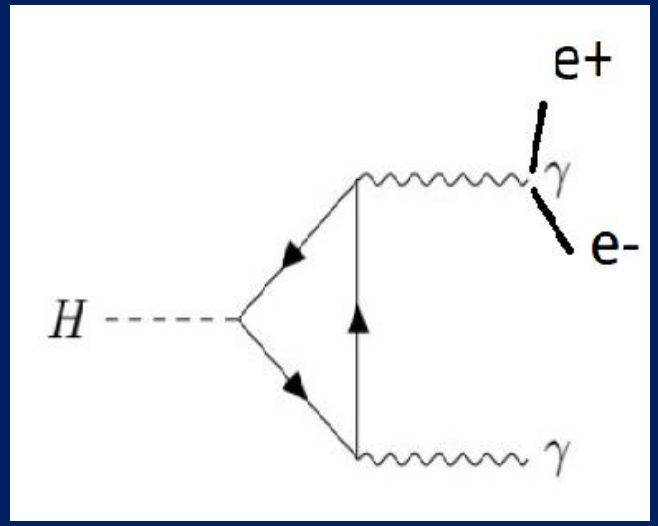
365,000 Event Classifications since Oct ’21, 2800 volunteers

CITIZEN SCIENCIST VOLUNTEERS (2/2)

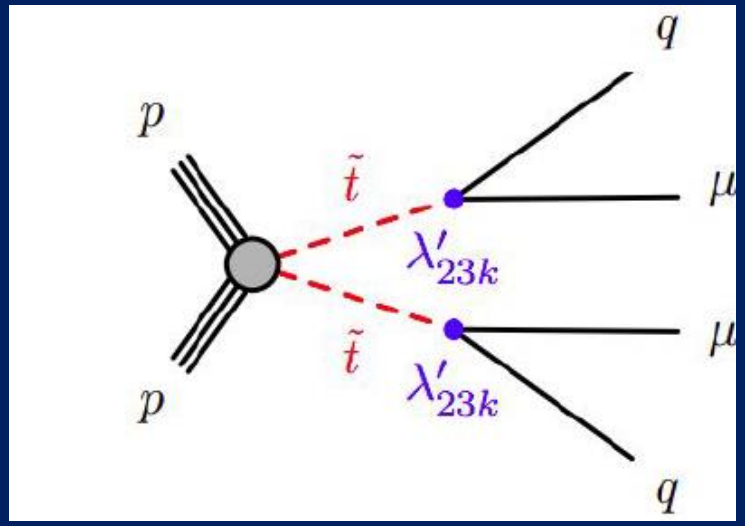
Citizens focus on **visual** inspection of events using the online HYPATIA event display

- We train them to locate **displaced vertices** (MC samples)
- We train them to recognize to **characteristic signatures** of electrons, muons, photons and converted photons (MC samples)
- Combine the above: to let them to study decays of **REAL** events (**ATLAS Open Data**)

Study of Higgs->γγ decays

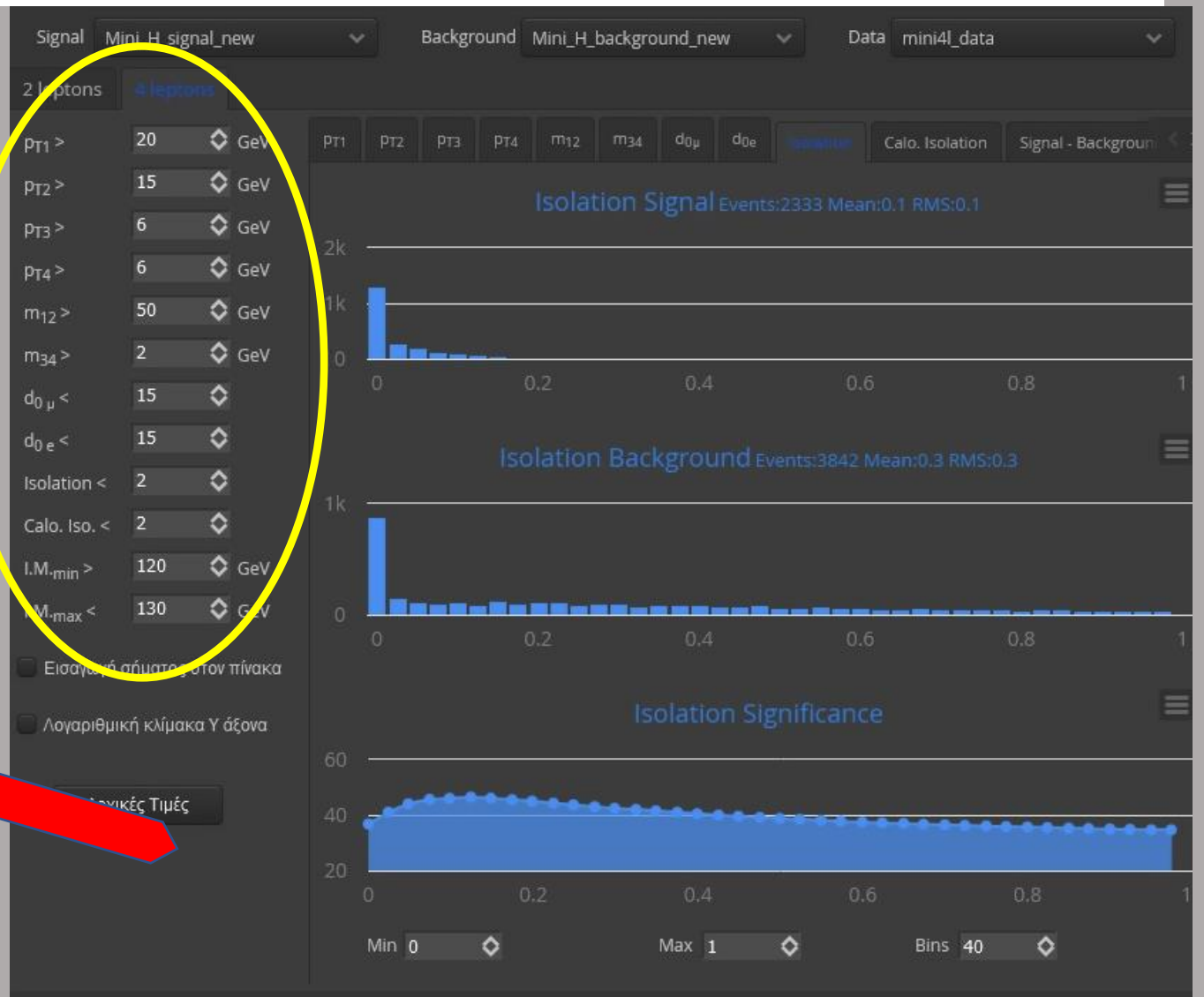


Hunt for new Long-Lived neutral particles



HYPATIA IN BATCH MODE (Process large samples of ATLAS Open Data) TO OPTIMIZE CUTS for Z AND Higgs Boson "discovery" University lab for 4th year physics undergraduates

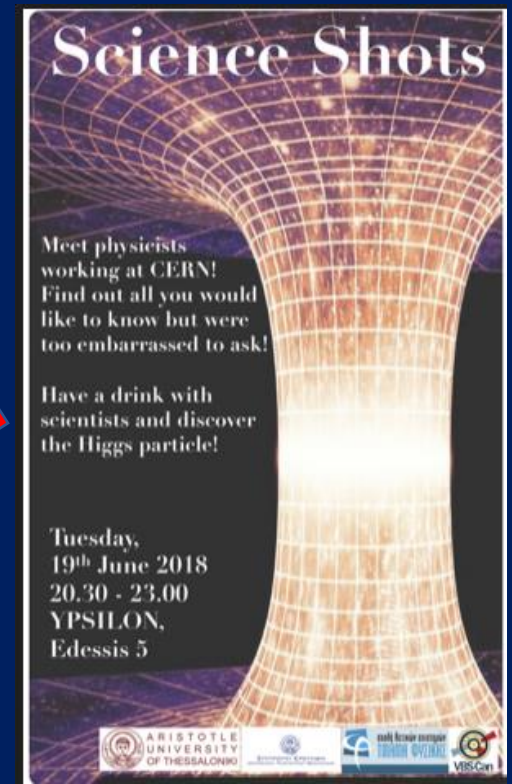
Path to study of 2 leptons and/or 4 leptons samples (data+MC bkg)
Vary values of cuts on:
p_T's, d_0 , isolation, etc
Aim: Maximize Significance



CONCLUSIONS

- Large effort to make available Open Data from Large Research Infrastructures for education and citizen research
- Actively engage students and teachers in “custom” built hands-on resources -> visible impact on increased interest

- Strive to reach a wider community through lectures, YouTube, science fairs, webinars, public events, science cafes etc



THANK YOU

Back up

New Particle Search at CERN has been selected to be one of the four featured projects at **the top landing Zooniverse page.**

Projects

Active | Paused | Finished

WELCOME! WE'RE SO GLAD YOU'RE HERE

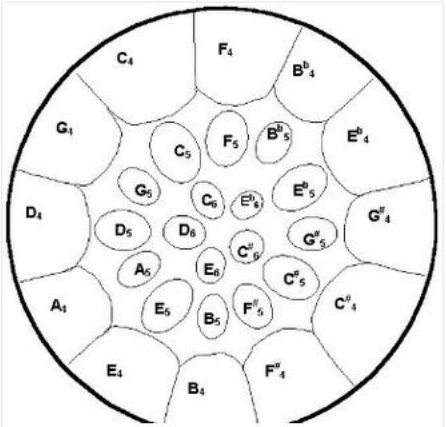
Thank you for your interest in helping real research. Here we've gathered a few projects we could really use your help on right now. For more options just scroll down to browse all of our active projects.

Make sure to also check out Talk where you can chat to other like-minded volunteers.

NEW PARTICLE SEARCH AT CERN

NOTES FROM NATURE - LABS

CORRESPONDING WITH QUAKERS



STEELPAN VIBRATIONS

Visual inspection of displaced vertices

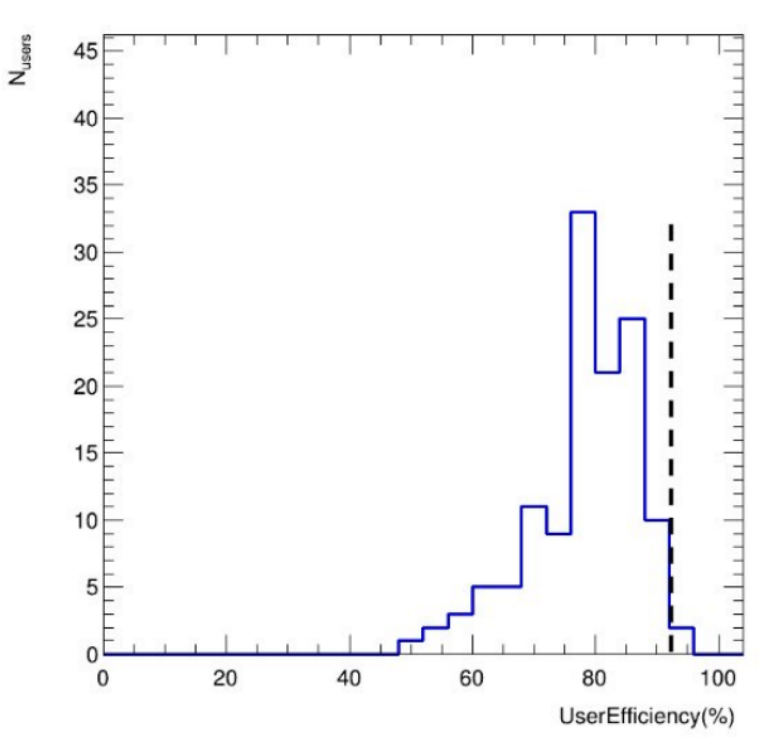
The workflow is split in 3 stages

simulated data
human Vs machine-based algorithms

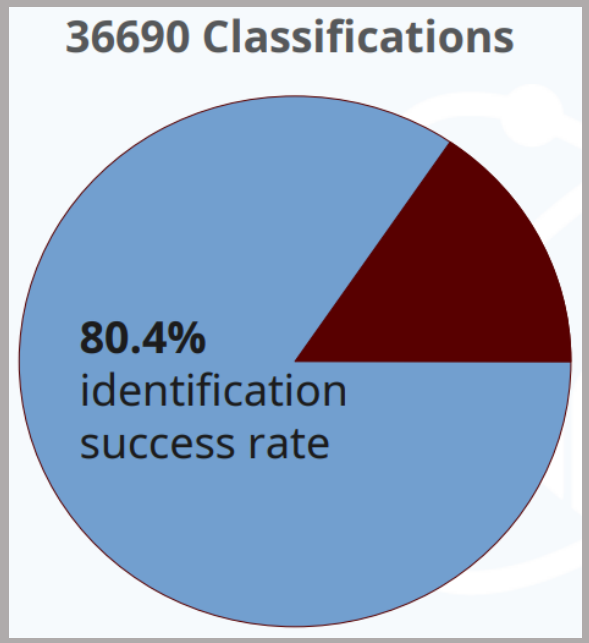
Stage 1
Displaced Vertex Identification

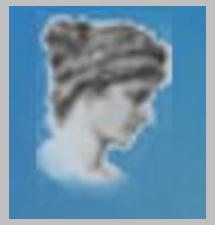
Stage 2
Particle Identification

Dashed line->consensus efficiency 93%
Automated algorithms 94%



Particle type	User efficiency (%)	ML efficiency (%)	User purity (%)	ML purity (%)
Electron	90	97	88	78
Photon	96	97	80	78
Conv. photon	62	95	35	81





The main tool: HYPATIA

(HYbrid Pupil's Analysis Tool for Interactions in ATLAS)

- Offline version used by International Masterclasses yearly by about 5,000 students in all five continents **http://hypatia.phys.uoa.gr/**
- Online version **https://hypatia.iasa.gr/**

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