

Το CERN

Χ.Κουρκουμέλη
Παν/μιο Αθηνών



- ▣ Ζητά απαντήσεις σε ερωτήσεις για το Σύμπαν.
- ▣ Προωθεί τα όρια της τεχνολογίας αιχμής.
- ▣ Εκπαιδεύει τους επιστήμονες του αύριο.
- ▣ Φέρνει τις χώρες πιά κοντά μέσω της επιστήμης.



<http://www.cern.ch>

120,000 επισκέπτες /χρόνο

Βασική Έρευνα

- 22 χώρες μέλη, 16000 ερευνητές, 800 Παν/μια, 110 Εθνικότητες
- Μοναδικές Εγκαταστάσεις στον κόσμο (Επιταχυντές και Ανιχνευτές)

Έρευνα

NOBEL PRICES

G. Charpak: Wire chamber

C. Rubbia: W, Z bosons

S. Van der Meer: Beam cooling

P. Higgs & F. Englert : Higgs boson

MAJOR DISCOVERIES AND INVENTIONS



900 peer reviewed research papers
600 PhD theses / year

2,400 Διδακτορικοί φοιτητές

Education

High school students and teachers

- 70 000 school children visit CERN every year
- 10 000 teachers have been trained at CERN since 2006 impacting more than a million students
- 4000 school students each year perform hands-on experiments on modern physics at CERN S'Cool LAB
- 200-300 teams from schools around the world engages in “Beamline for Schools” competition
- 15000 pupils in 46 countries analyse real LHC data through “International Masterclasses”



70,000 μαθητές/επισκέπτες/χρόνο

10,000 καθηγητές εκπαιδεύτηκαν σε 10 χρόνια

15,000 μαθητές από όλο τον κόσμο συμμετέχουν στα

Masterclasses

IPPOG's International Masterclasses

- High school students (15 – 19) are “scientists for one day”
- Get invited to a research institute or university
- Introductory talks
- 2 h measurement with LHC data (ATLAS, CMS, ALICE, LHCb) + New also with Icecube data
- International video conference (2 – 5 inst. + CERN/Fermilab)

From H.P. Beck



International Masterclasses 2017



1.3. - 11.4.2017

50 countries involved



Coord.: QuarkNet / TU Dresden



- 43 institutes (43)
- 50 Masterclasses (48)
 - 35 CMS (33)
 - 15 ATLAS (15)



- 173 institutes (169)
- 264 Masterclasses (227)
 - 45 ATLAS W (42)
 - **93 ATLAS Z (83)**
 - 52 CMS (49)
 - 45 LHCb (34)
 - 24 ALICE SP (15)
 - 5 ALICE R_AA (4)

Competition: a beam line for

schools



Country	schools				
Italy	85				
Spain	66				
United States	45	Netherlands	6	Egypt	3
United Kingdom	43	Singapore	5	Slovakia	3
India	28	South Africa	5	New Zealand	2
Greece	19	Indonesia	4	Czech Republic	2
Germany	17	Hungary	4	Brazil	2
Canada	13	Austria	4	Norway	2
Poland	10	Mexico	4	Serbia	2
Switzerland	8	Ireland	4	Slovenia	2
France	7	Iran	3	Bulgaria	2
Portugal	7	Colombia	3	Australia	2
Romania	6	Estonia	3	Afghanistan	2
Turkey	6	Thailand	3	Lebanon	1
				Jordan	1
				Mauritius	1
				China	1
				Kuwait	1
				Nigeria	1
				Malaysia	1
				Ethiopia	1
				Haiti	1
				Pakistan	1
				Guyana	1
				Peru	1
				Latvia	1
				Belgium	1
				Sri Lanka	1
				Cyprus	1
				Malta	1
				Qatar	1
				UAE	1
				Israel	1
				Chile	1
				Bangladesh	1
				Kenya	1
				Total	455

IPPOG acts as local contacts to schools in many countries.

IPPOG members take responsibilities for multiple countries to ensure that language barriers will not be a insurmountable hurdle.

The Beamline for Schools competition 2018 is now open!



First Competition 2014
(to celebrate 60th anniversary)
Winner a Greek team!!

New York 10

A Horizon 2020 European outreach project to Develop an Engaging Science Classroom

- 36 months (Oct 15->Oct 18), 1.8 ME, 16 partners
- Coordinator: University of Bayreuth
- Improve skills of youngsters in STEM subjects
- HEP partners are UoA/IASA, UoBirmingham, Art@CMS, STFC

Some partners focus on combining science and art and boost creativity in schools


Global Science Opera



You are cordially invited to

Cultural Collisions

An art exhibition, music and dance performance presented by Austrian and Genevese students



CERN Meyrin Bldg 40 **February 24th 2017**

In the presence of His Excellency Thomas Hajnoczi,
Permanent Representative of Austria to the international organizations in
Geneva / Switzerland

18h30 Opening
19h00 Welcome
19h15 art show & performance by Haydn Gym. Vienna,
Herz Jesu Gym. Salzburg, ECOLINT LGB Geneva;
20h00 Drinks
21h00 Close



We mainly focus on introducing HEP and CERN to 16-17 year old students

Μια τοπική Masterclass (μισή μέρα) σε ένα σχολείο:

➤ Εισαγωγή και εκτέλεση ενός από τα σενάρια μας:



1) Let's accelerate particles (LHC game)

<http://tools.inspiringscience.eu/delivery/view/index.html?id=c4e9fd501dce4f6290d35f8dcb9dcf1d&t=p>



2) All that MATTERs (make atoms, make nucleons)

<http://tools.inspiringscience.eu/delivery/view/index.html?id=02afe7b3264f4848bf59c42a6b07e3cf&t=p>

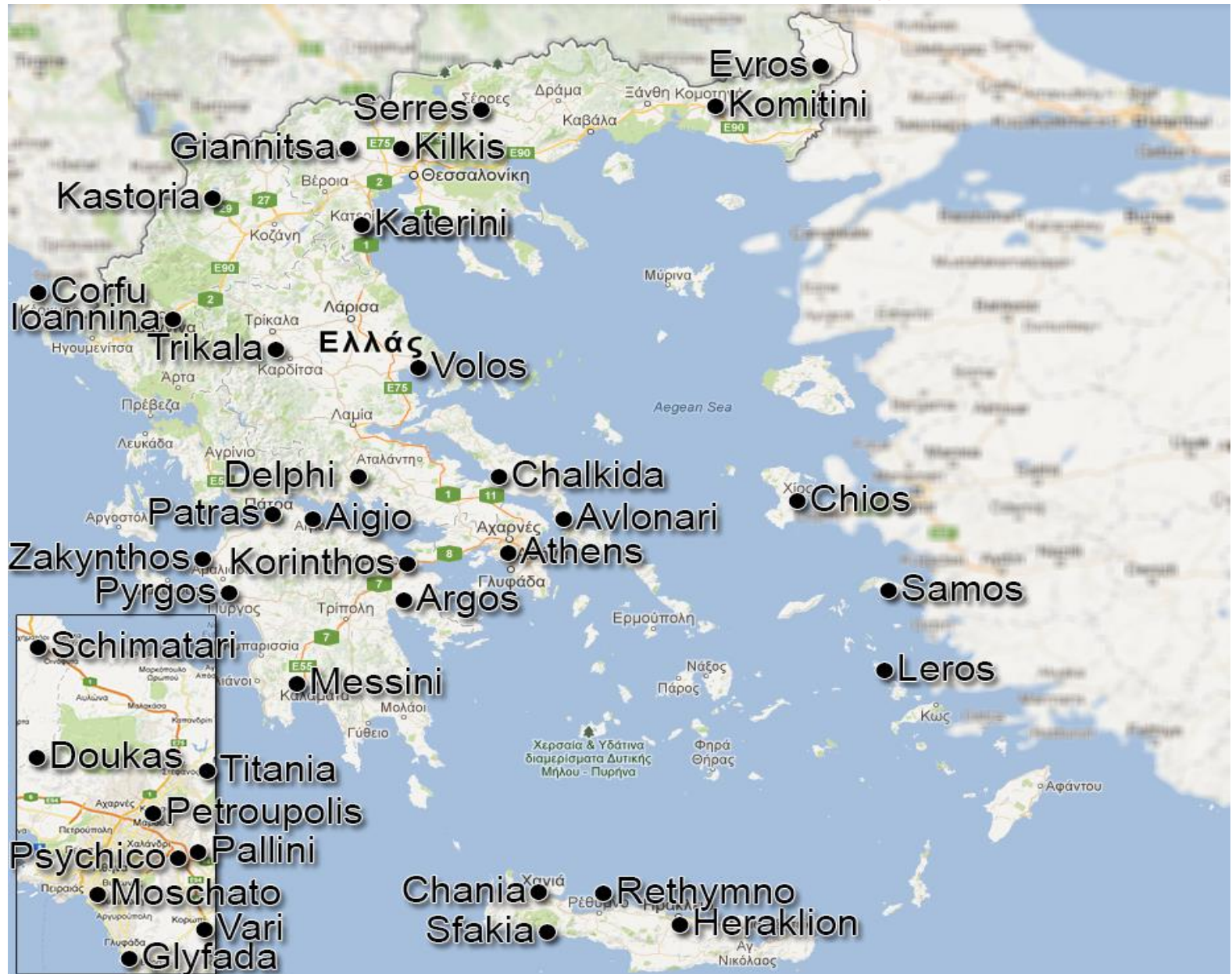


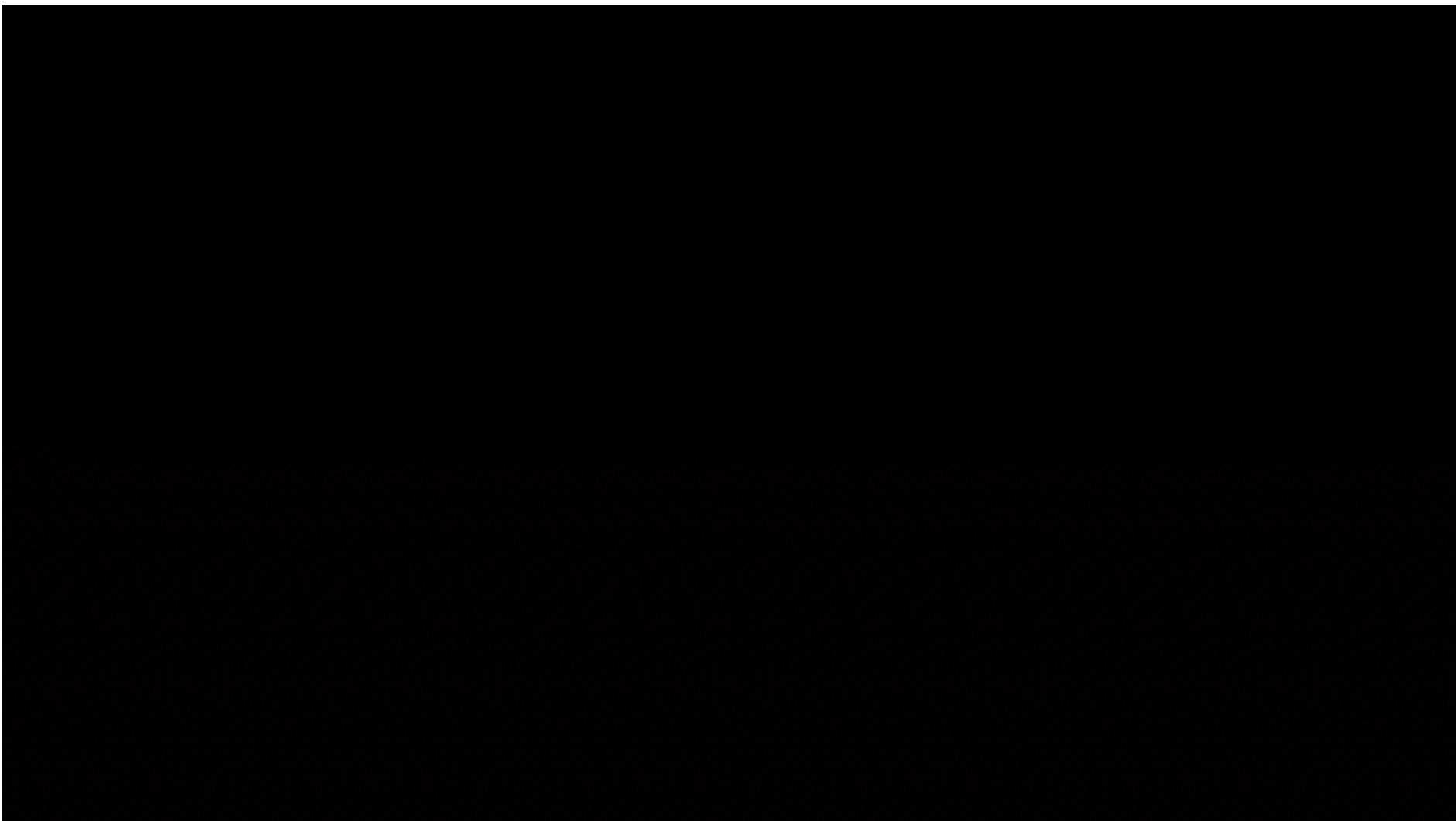
C.Kourkoumens, GSA

37

➤ Συνδιάζεται με VV στο CERN και Q&A

Τοπικά masterclasses τα τελευταία χρόνια

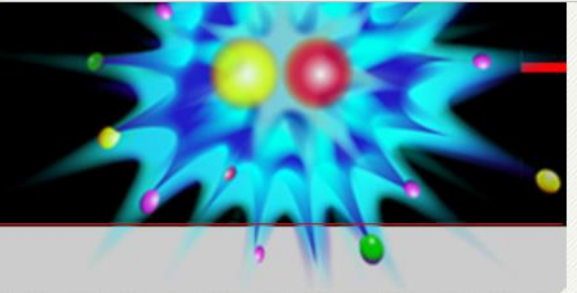




Quarknet@Fermilab

QuarkNet

Helping Develop America's Technological Workforce



Home

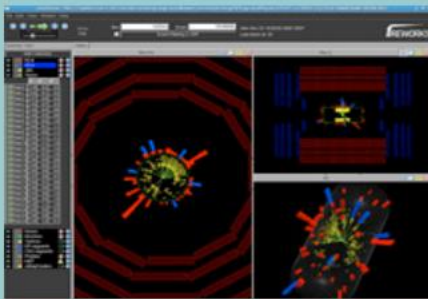
Data Portfolio

The Opportunity: "Your program rejuvenates my soul. It connects me with a cadre of intelligent and excited educators. It reinvigorates my teaching and provides me avenues to extend and enliven the projects that I can offer my students. Without the Quarknet program I am sure that I would have left teaching years ago."

The Players: High school students, teachers and physicists working together on physics research projects exploring the hidden nature of matter, energy, space and time.

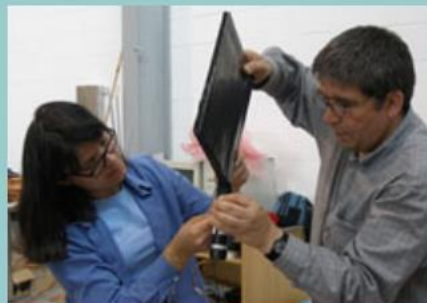
The Questions: What are the origins of mass? Can the basic forces of nature be unified? How did the universe begin? How will it evolve?

Project Overview



LHC & Fermilab Links

QuarkNet Stories



For Teachers



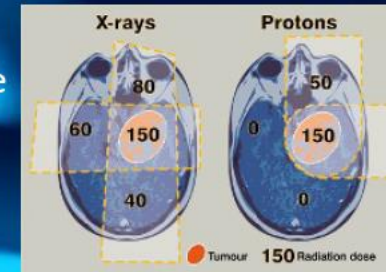
For Students

Innovation, Knowledge transfer, Economy

“CERN contributes to medical applications, with the goal of providing solutions to societal health challenges.” Fabiola Gianotti, CERN Director-General

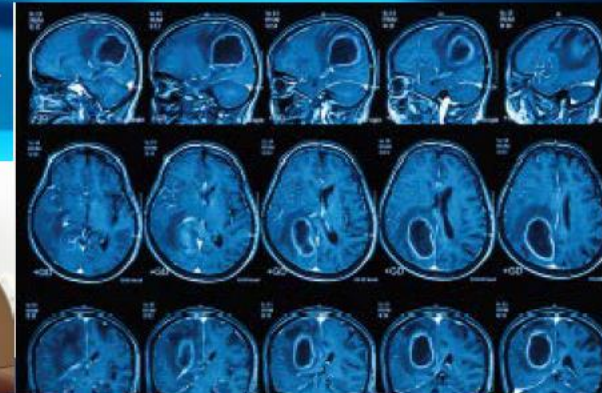
❖ Hadron therapy (HT)

- treating tumours with beams of protons and light ions reducing the radiation exposure of healthy issue
- 3 HT centres in Europe built in collaboration with CERN
- CERN supports development of miniature linear accelerators for proton therapy



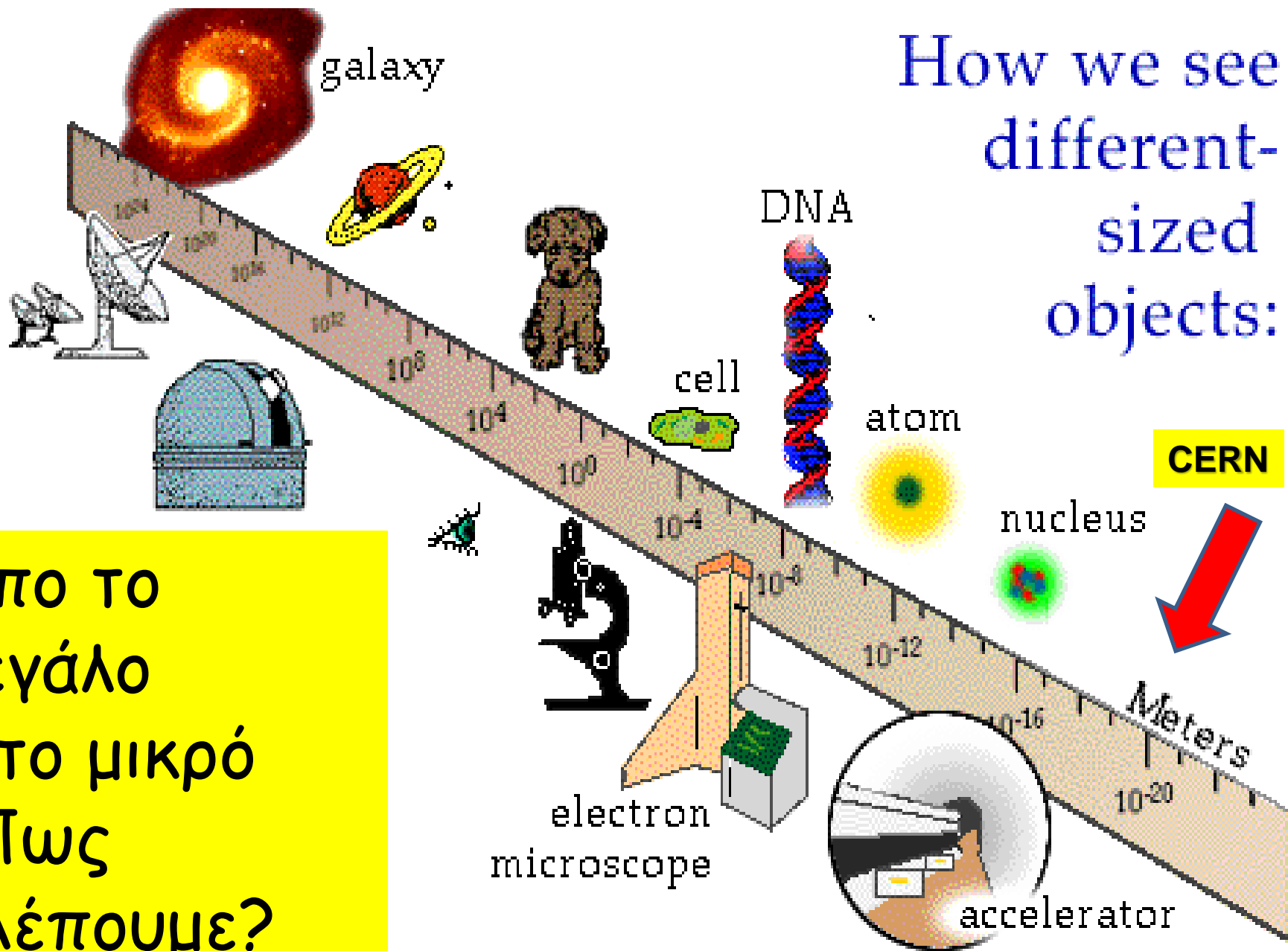
❖ Medical imaging: PET, MRI and others...

- PET using new type of dense scintillating crystals
- CERN has pioneer contribution to forerunner of PET
- PET and MRI imaging combined in single device thanks to new generation of CERN detectors



Back up

How we see different-sized objects:



Απο το
μεγάλο
στο μικρό
Πως
βλέπουμε?

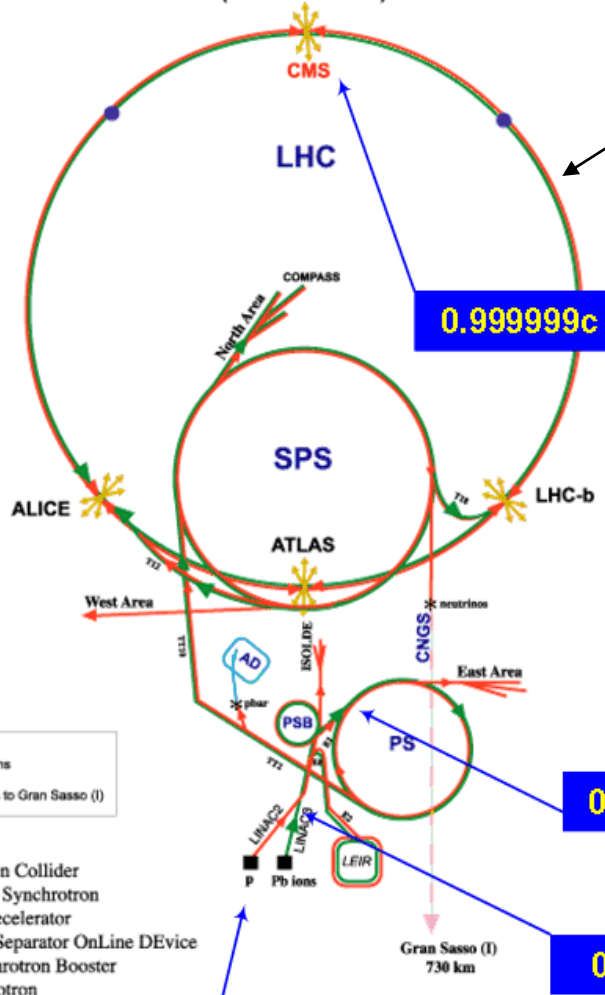
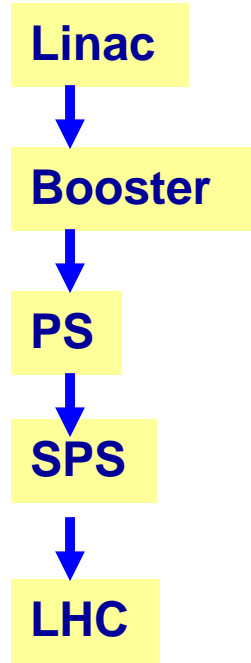
29/11/2017

Χ.Κουρκουμέλη, Παν/μιο Αθηνών
Χ.Κουρκουμέλη, Παν/μιο Αθηνών

16

The full LHC accelerator complex

CERN Accelerators
(not to scale)

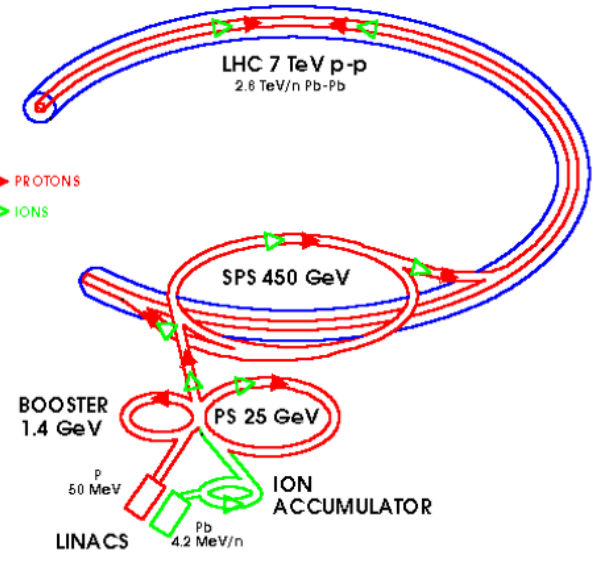


LHC ring is divided into 8 sectors

0.999999c by here

0.87c by here

0.3c by here



- LHC: Large Hadron Collider
- SPS: Super Proton Synchrotron
- AD: Antiproton Decelerator
- ISOLDE: Isotope Separator OnLine DEvice
- PSB: Proton Synchrotron Booster
- PS: Proton Synchrotron
- LINAC: LINear ACcelerator
- LEIR: Low Energy Ion Ring
- CNGS: Cern Neutrinos to Gran Sasso

Rudolf LEV, PS Division, CERN, 02.09.96
Revised and adapted by Antonella Dal Ross, EFT Div,
in collaboration with B. Destogbes, SL Div, and
D. Manglani, PS Div, CERN, 23.05.01

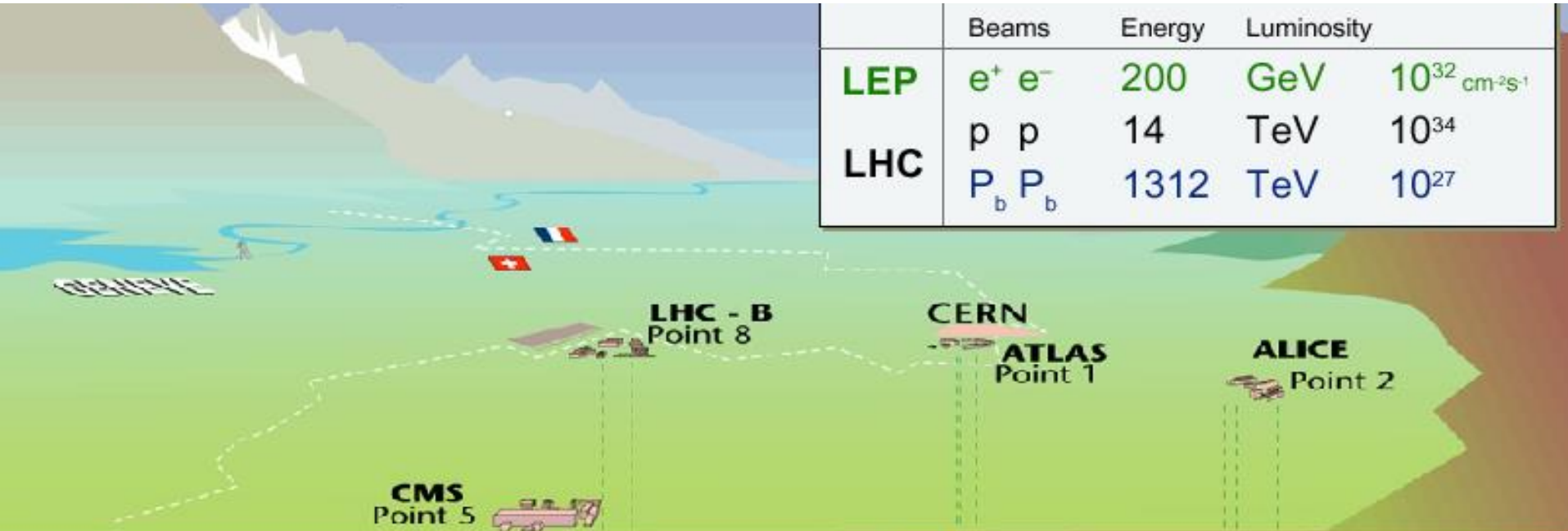
> 50 years of CERN history still alive and operational

Start the protons out here

Η πρόκληση:

η ανακάλυψη του Higgs στο LHC και νέας φυσικής

	Beams	Energy	Luminosity
LEP	$e^+ e^-$	200 GeV	$10^{32} \text{ cm}^{-2}\text{s}^{-1}$
LHC	$p p$	14 TeV	10^{34}
	$P_b P_b$	1312 TeV	10^{27}



Two superconducting magnet rings in the LEP tunnel.

