



ENIGMASS

- Higher-Education
- Outreach
- Valorization

ENIGMASS



Higher-Education : main actions

- ESIPAP
- GraSPA
- Subatomic lab Plateform
- AHEAD
- GIF School 2013 & 2016
- Physics at TeV colliders 2013, 2015 & 2017

European School of Instrumentation in Particle and Astroparticle Physics

esi
European Scientific Institute

esipap...
European School of Instrumentation
in Particle & Astroparticle Physics

- Mid-term objective :
 - to become the reference European school of instrumentation in the discipline within 3-5 years
 - train 32 master and PhD students per year
2 modules of 4 weeks each



lab sessions at CERN



2016 - 2017 status :

Attendance keeps increasing

2 independent 4-week modules ; 210 hours of lectures in all ; ~50 lecturers and lab session tutors.

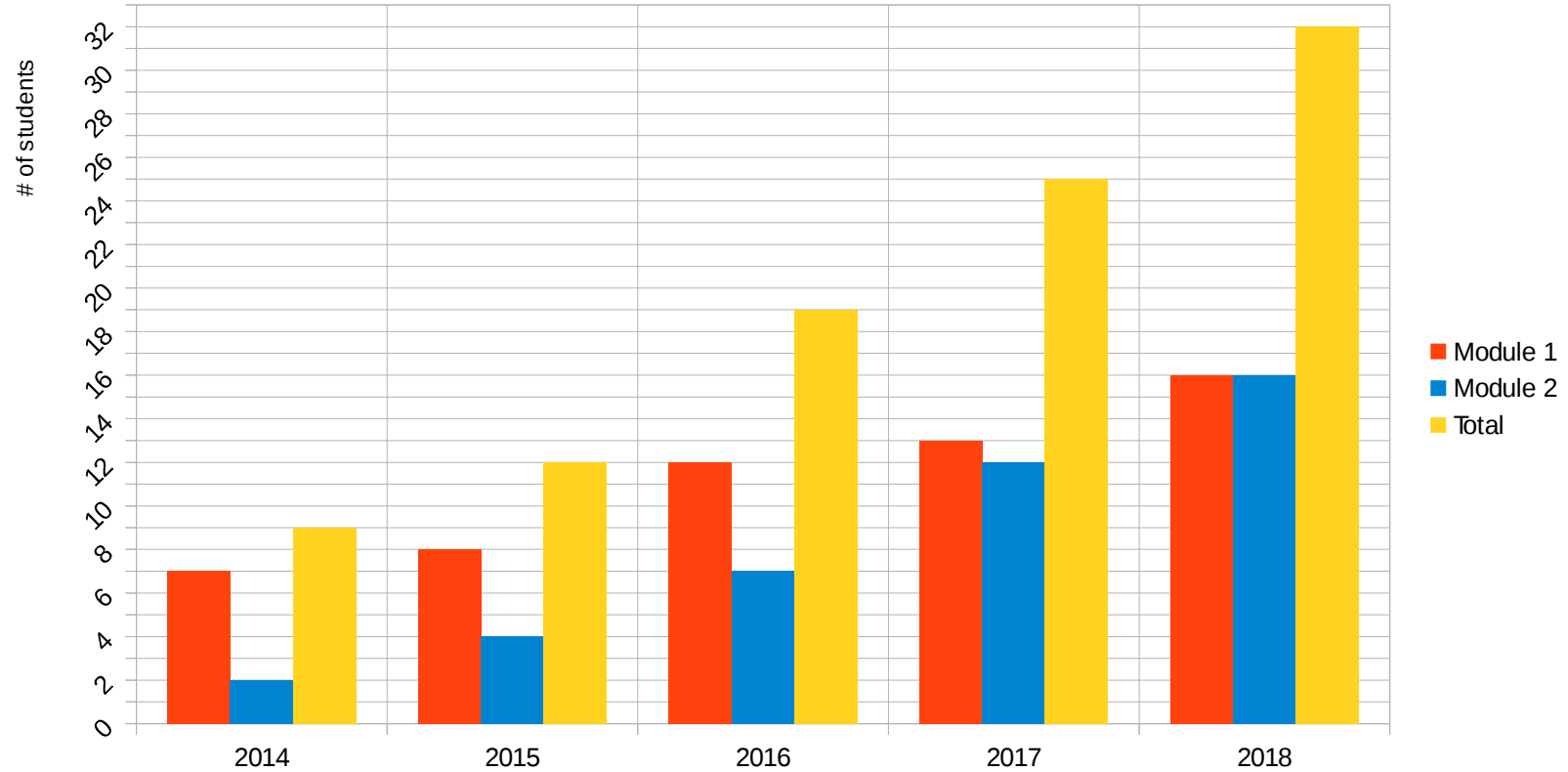
budget 80 k€ (1/2 ENIGMASS, 1/2 ESI + Technopole Archamps)

participating institutions : UGA, GINP, USMB, U of Strasbourg, CERN, CPPM, IRFU, U. of Tsukuba, LPSC, LAPP

ENIGMASS product

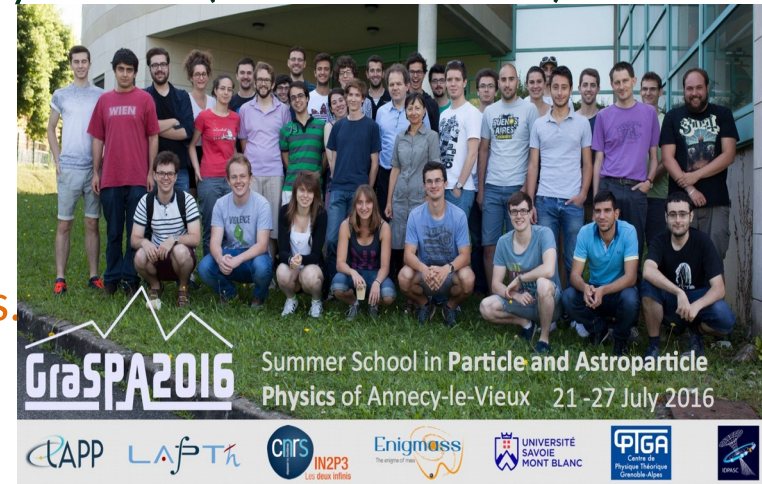
<http://www.esi-archamps.eu/Thematic-Schools/ESIPAP>

Growth of ESIPAP student attendance



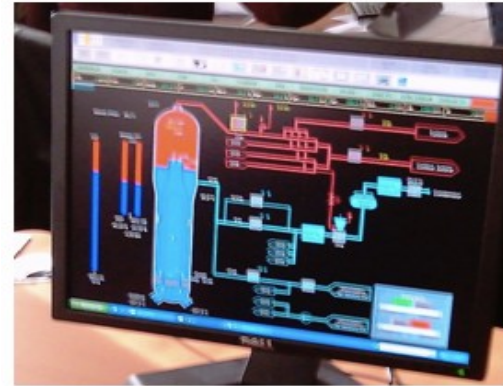
GraSPA Summer School

- Why? Decrease in number of Physics students at university $\Rightarrow$ Inspire and help 3rd and 4th year physics students to pursue a career in Particle Physics/Astro/Cosmo $\Rightarrow$ Summer School!
- How? 30 students, 1 week-long School, theoretical & experimental introductory courses on few topics: LHC physics, neutrinos, heavy flavours, astroparticles, gravitational waves, computational tools (ROOT), cosmology. Mostly local lecturers, a few high-profile guests. Highly subsidized: accommodation and lunches paid by School (~420 €/student). Would not happen without ENIGMASS support.
- When : 20-26 juillet 2017
- Outcome Huge success in applications (114 for 27 countries in 2016), very good feedback from students.
- budget : ~14000 € , 8000 € from ENIGMASS



Subatomic lab platform in Grenoble

- 20 lab setups :
 - nuclear, particle physics and medical applications
 - 500 master students per year
- 2 computing rooms :
 - data analysis
 - pressurized nuclear reactor simulator
- Annual investment :
 - 50 k€ from UGA and Grenoble INP
 - 10-20 k€ from ENIGMASS



Building restoration & refurbishing

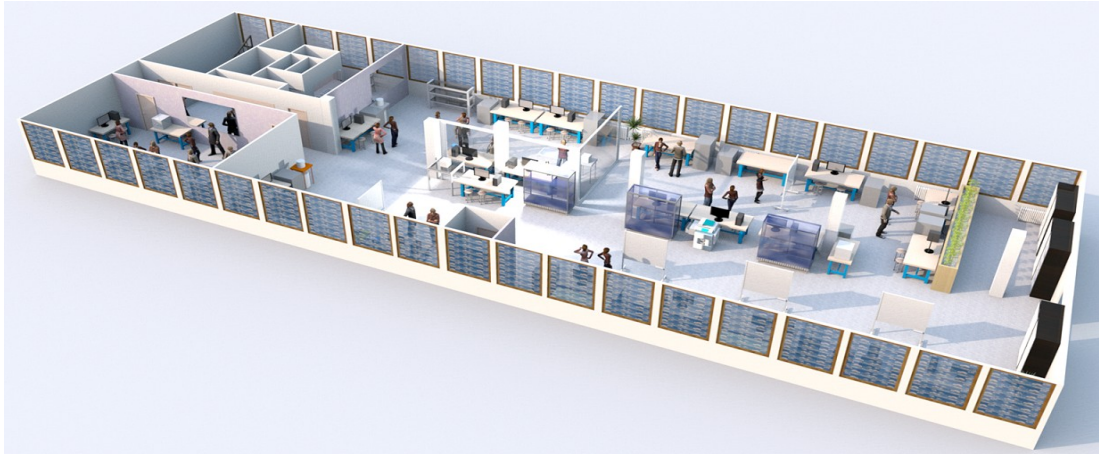
20 lab experimental setups + 2 computing room of 240 m²

Budget : 305 k€ of which 150 k€ from LABEX ENIGMASS

ENIGMASS coproduct

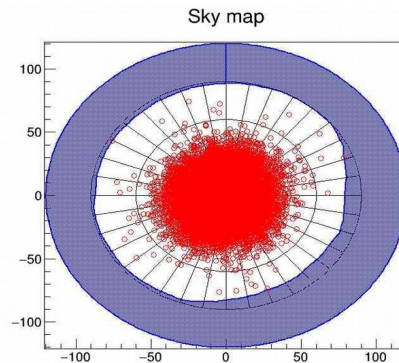
Inauguration 14/11/2016

One of the most important subatomic lab platforms in France



AHEAD

- UHE neutrino air shower detector prototype decommissioned and moved to ESI in Archamps
- set of 5 cosmic stations
- was decommissioned by helicopter thanks to ESI
- will be used as a lab setup for ESIPAP and in outreach programs
- MoU signed between ESI and LPSC
- Budget : ~ 16 k€ paid by ESI
- New 8-channel fast digital sampler bought in 2016 by ESI



ENIGMASS coproduct

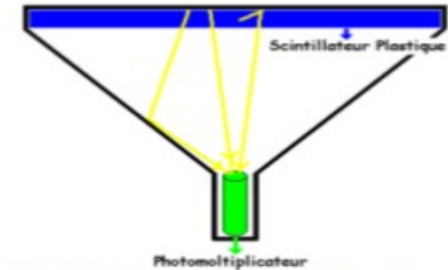


Figure 2 : Principe de fonctionnement d'un détecteur



GIF summer School



La physique souterraine

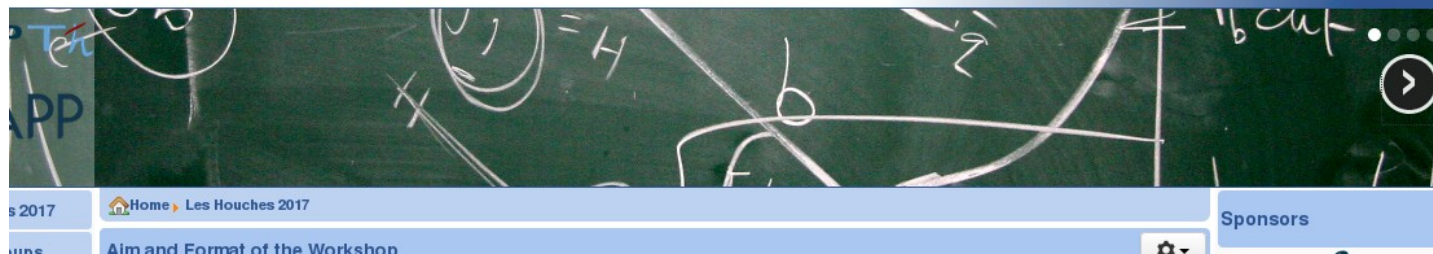
CAES du CNRS
Centre Paul Langevin
73500 AUSSOIS

48^e École de GIF
19 - 23 septembre 2016

ENIGMASS coproduct

Physics at TeV Colliders

Les Houches Workshop Series
"Physics at TeV Colliders"
2017 Session: 5 to 23 June



2013, 2015 & 2017

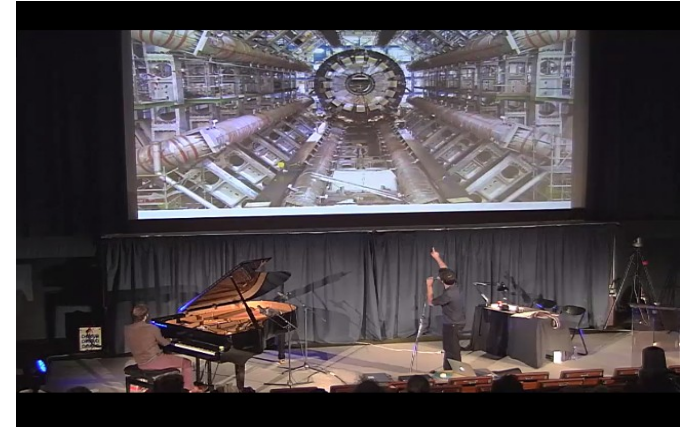
ENIGMASS coproduct

Summary of outreach activities

- The Night of the two infinities : annual event in multiplex. Science, music & art event, 400-600 attendees each year in Grenoble , 2017 in Annecy
- Annual National Science Festival : lab visits, conferences, stands...
- General public books : Big-Bang et au-delà , Des univers multiples... Aurélien Barrau (Dunod)
- Permanent exhibition : Carré des Sciences in Modane (LSM)
- International masterclasses : hands on particle physics
- many grand public conferences
- webdoc on dark matter



- many conferences, lectures and actions in elementary, secondary schools and high schools



<http://podcast.grenet.fr/episode/nuit-des-2-infinis-partie-13/>

<http://podcast.grenet.fr/episode/nuit-des-2-infinis-partie-23/>

<http://podcast.grenet.fr/episode/nuit-des-2-infinis-partie-33/>



Nuit des Ondes Gravitationnelles 2017



14 locations in France & in Italy and in particular Annecy

Conferences

Art and technical competitions

Online Quizz

Entertainment

300 attendees in Annecy



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Penzias and Wilson project

- remake of P&W experiment with high-school students (Marie Reynoard high-school)
- 2015-2016 physics Olympiades project in Paris - Won first prize



ENIGMASS product



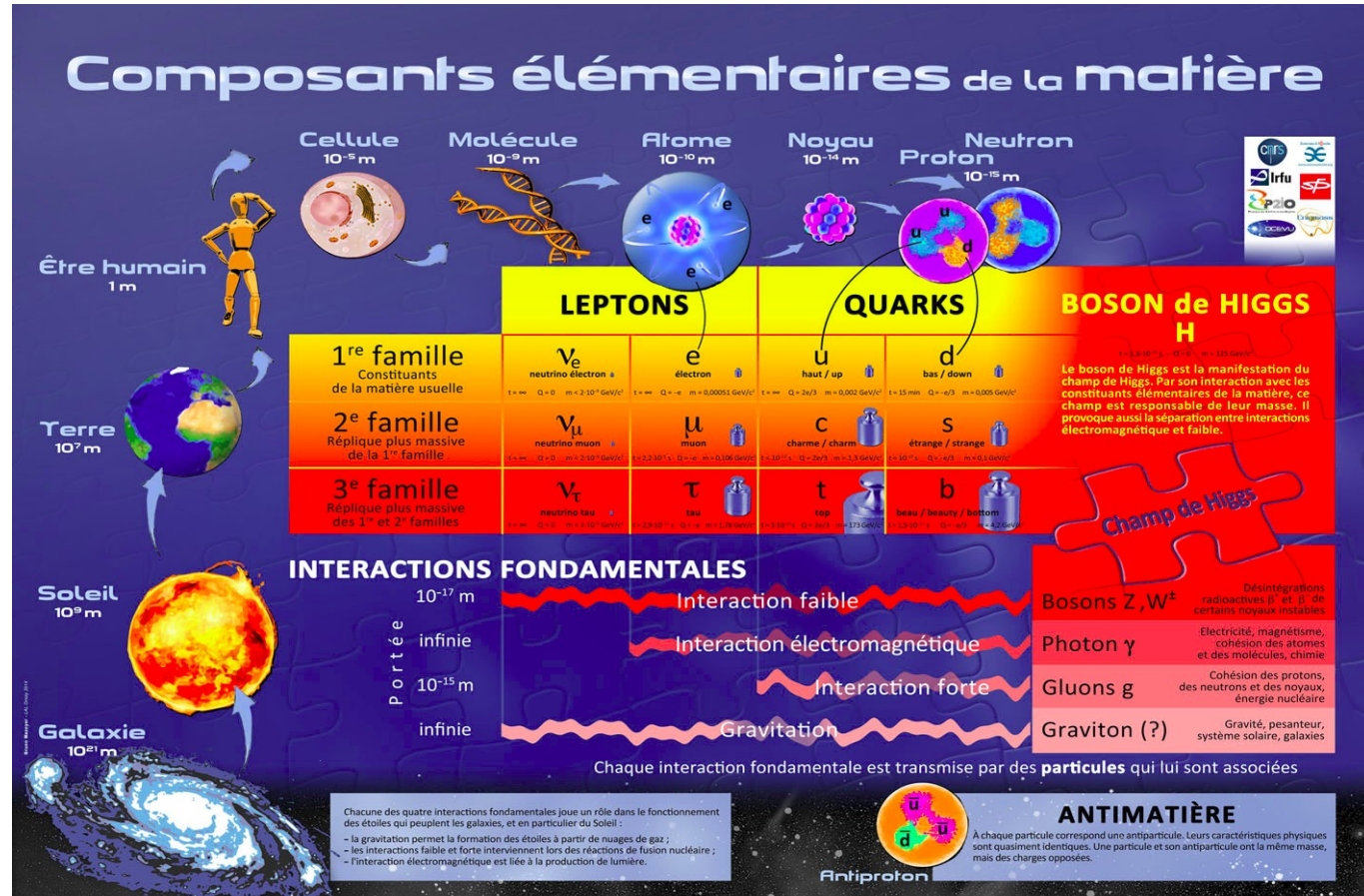
Poster of particles

Common action with other LABEX ,
IN2P3 and a few labs.

Managed by Nicolas Arnaud
from LAL

<http://www.particuleselementaires.fr/>

ENIGMASS coproduct



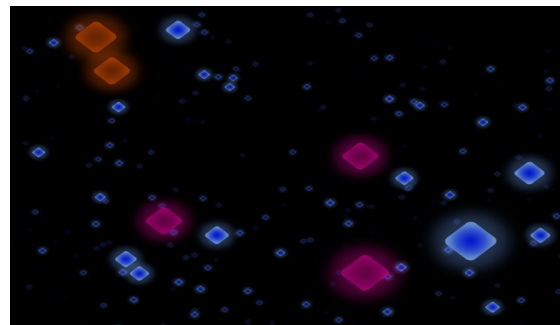
Web-documentary on Dark Matter

Inter-lab collaboration leaded by ENIGMASS :

- ENIGMASS : 2 LPSC researchers, 1 LAPP researcher, 1 LAPTh researcher + **50 k€**
 - P2IO : 1 SPP researcher + 5 k€ (in progress)
 - OCEVU : “in-kind” contribution with participation of their outreach officer
- +
- université Savoie Mont Blanc : student project in the Multimedia Internet master
 - support from the CNRS Com’Lab plan for contents production & diffusion (in progress)

ENIGMASS product

Project accepted in 16/09 by ENIGMASS
Work with the Canopée communication agency
Delivery 17/12
Meetings in Grenoble : “brainstroming” in 16/11+
decision contents in 17/09 + regular tcfs



Today :
concept of navigation, website structure, style
of narration, chapters defined.
3D realisation on the way
Conception adaptable to virtual reality, easy
evolution.

3D navigation in the cosmic web for computers, tables,
smartphones.
“Squares” = links to content (text, voice, movie, animation ...)
Narrator = the dark matter itself is watching us and enjoys
seeing how we try to understand and find it.

Valorization

- Neutron spherical detector, application derived from SPHERE project for LSM
- MIMAC-FastN, directional detector of fast neutrons, application derived from MIMAC project
- Seismic sensors from CLIC final focusing R&D (discontinued as industrial demand seems to low)

Development of a spherical neutron detector

Goal : Measurement of fast neutron spectrum for EDF (including thermal neutrons)

Joint project : LSM, Carmelec, Thessalonique, ENIGMASS

ENIGMASS Support : 2-year fixed-term valorization engineer

LabCOM P2R (Particle physics for radioprotection, CENBG, LSM, CPPM, Carmelec))

Principle of detection

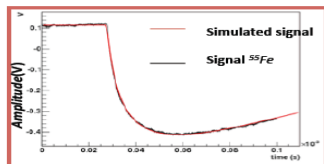
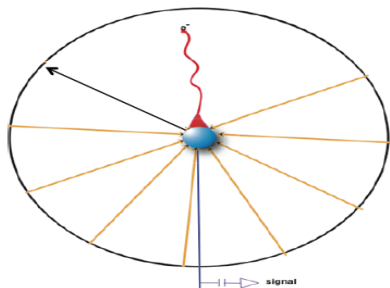
Radial Electric field
Ball radius = 0.5-16 mm
Spherical radius = 7.5 - 70 cm

$$E(r) = \rho V_0 / r^2$$

where

$$1/\rho = (1/r_2 - 1/r_1)$$

r_1 = ball radius
 r_2 = sphere radius



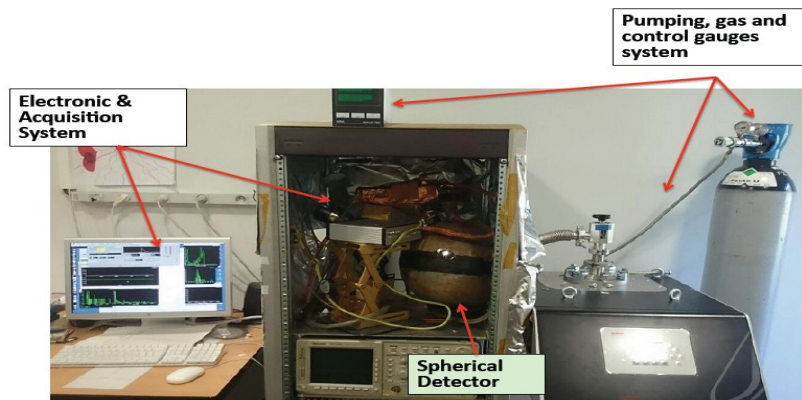
A Novel large-volume Spherical Detector with Proportional Amplification read-out, I. Giomataris et al., JINST :P09007,2008

Main characteristics

- Low capacitance < 0.1 pF
- Low energy threshold (< 1 keV)
- Good energy resolution
- A single measurement channel for a large volume
- Flexibility : gas, pressure
- Robust, simple and cheap

E. Bougamond et al., arXiv:1010.4132 [physics.ins-det] & E. Bougamont et al., J.Phys.Conf.Ser.:309:012023,2011.

SPC_ Neutron detector @ LSM



Proof of feasibility : demonstrated

test on neutron beams of GENEPI 2 at LPSC

Industrial prototype to be tested on EDF site in fall this year

ENIGMASS coproduct

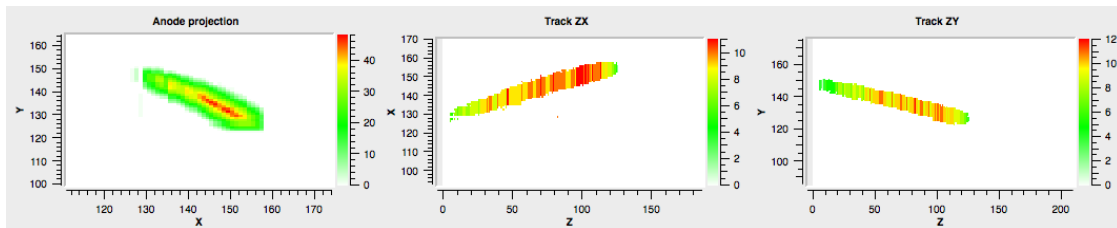
MIMAC FastN : Development of a directional fast neutron detector



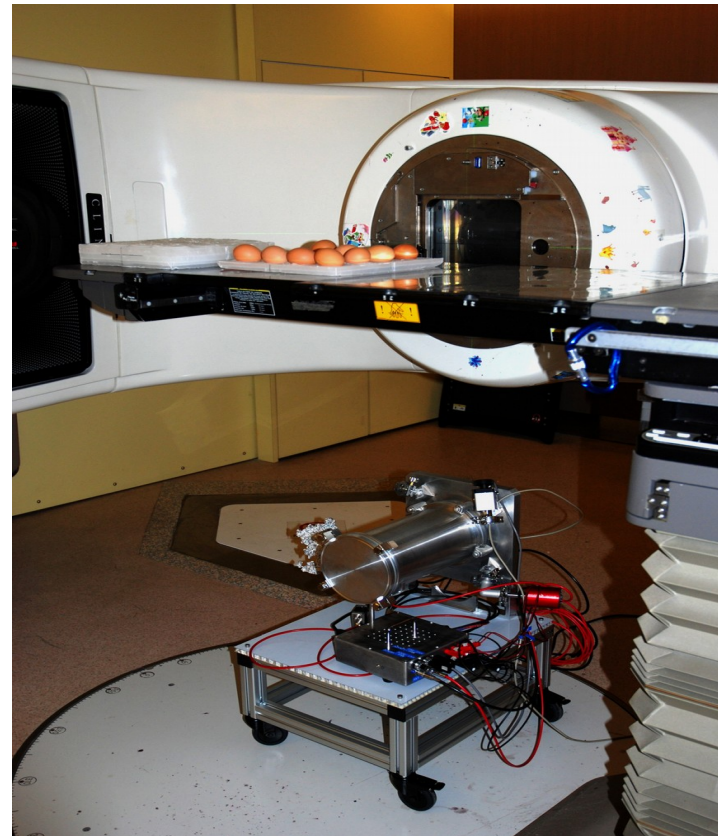
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Neutron spectrum : 10 keV - 200 MeV

Principle : 3D reconstruction of recoiling nucleus after neutron elastic scattering



Pre-industrialization phase & start-up creation



Conclusion and outlook

- Higher-Education : local & international actions - significant contributions to HEP community
- Outreach : many actions (art-science events, books, conferences, webdoc, high-schools...) - increased public visibility
- valorization : In progress but not the main mission of our labs mostly focused on fundamental science
- all these actions will be continued in EUR PAGE (next to come)