

# ENIGMASS HIGHER EDUCATION ACTIVITIES

*Pablo DEL AMO SANCHEZ (LAPP)*

on behalf of

GraSPA team (PdAS, Lucia DI CIACCIO, Gilles MAURIN, Loïc  
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Laurent DEROME

Johann COLLOT

# ENIGMASS HIGHER EDUCATION ACTIVITIES

- GraSPA 2014
- LPSC's Nuclear Physics Experiments Platform  
(Laurent DEROME from LPSC)
- ESIPAP (Johann COLLOT from LPSC)



# Summer School in Particle and Astroparticle physics of Annecy-le-Vieux

21-25 July 2014

## GRASPA 2014

Lucia DI CIACCIO, Pablo DEL AMO SANCHEZ,  
Loïc ROLLAND, Pasquale SERPICO,  
Gilles MAURIN

LAPP & LAPTh  
Université de Savoie

Registration  
deadline: May 18<sup>th</sup>

<http://lapp.in2p3.fr/GraSPA2014>

Introductory courses aimed at  
advanced 3<sup>rd</sup> year and 4<sup>th</sup> year physics students

Topics: LHC Physics, Neutrinos, Heavy Flavors,  
Astroparticle Physics, Gravitational Waves and Computational Tools



# WHY GRASPA?

- **Decrease in number of students** enrolling in Physics at university  
⇒ less and less students dream of doing a career in Physics!
- **Inspire and help 3rd and 4th year physics students** (before they choose a field) to pursue a career in Particle Physics/Astro/  
Cosmo ⇒ **Summer School!**
- Limited offer of schools addressing this audience (CERN, DESY, GSI...)

# HOW?

- 1 week-long School, 4h (theoretical & experimental) introductory courses on few topics: LHC physics, neutrinos, heavy flavours, astroparticles, gravitational waves, computational tools (ROOT), (cosmology)
- Highly subsidised: accommodation and lunches paid by School, travel funded by students or their institutions (travel grants for 2 students, a few paid by IDPASC institutes).
- Mostly local lecturers (see below)

# NEW IN 2014

- Larger Organizing Committee: 4 LAPP + 1 LAPTh (LPSC anyone?)
- **1 day longer** (shorter days, lectures less exhausting for students)
- **CERN visit**
- Brief (1h long) introduction to Cosmology
- Two travel grants

# BUDGET

INCOME	
ENIGMASS Excellence Lab	7000
LAPP	3000
IN2P3	1500
CPTGA	1000
<b>TOTAL</b>	<b>12 500 €</b>

EXPENSES	
Student accommodation	5261
Lunches, social dinner, coffee breaks	4955
CERN visit, transport from airport	786
Travel grants	400
Other	206
<b>TOTAL</b>	<b>11 608 €</b>

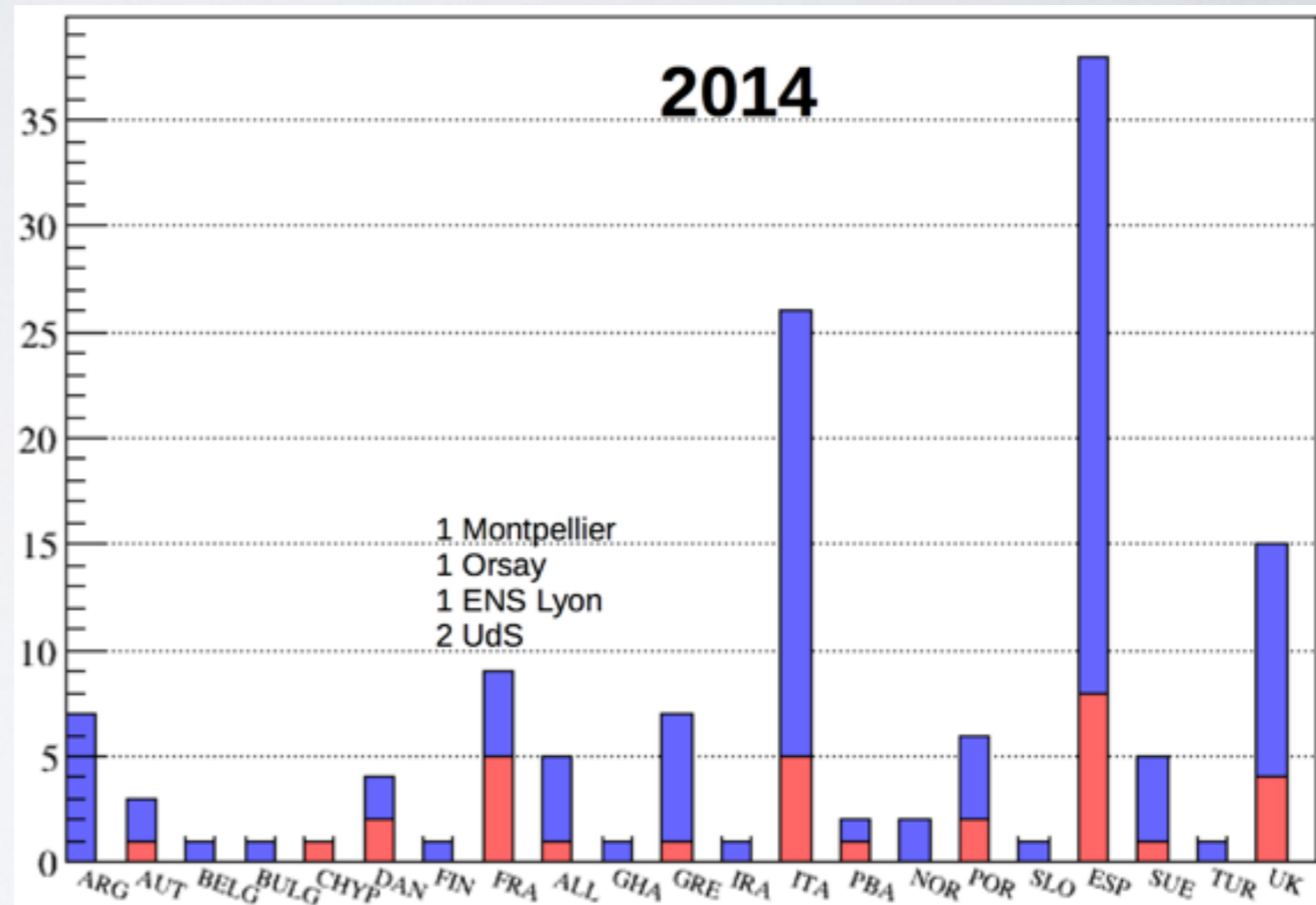
Great support from ENIGMASS

- Need to diversify sources!!!

363 €/student

# APPLICATIONS

- 137 candidates from 21 countries
- 28 applications from IDPASC institutes
- 32 students kept (budgetary reasons, but good size for informal discussions)



- Half (15/32) of accepted students had applied to CERN School



# LECTURERS

- Mostly local lecturers  
(4 external lecturers/13)
- Dates a problem to get external lecturers (end of July: conferences, Schools, holidays)

## Lecturers :

Cédric DELAUNAY	LHC Physics (Th.)
Marco DELMASTRO	LHC Physics (Exp.)
Pasquale SERPICO	Neutrinos (Th.)
Karol LANG	Neutrinos (Exp.)
Fabrice PIQUEMAL	Neutrinos (Exp.)
Diego GUADAGNOLI	Heavy Flavours
Andreas GOUDELIS	Astroparticle Physics (Th.)
Julien MASBOU	Astroparticle Physics (Exp.)
Thomas TRAM	Cosmology
Damir BUSKULIC	Gravitational Waves
Loïc ROLLAND	Gravitational Waves
Lucia DI CIACCIO	Computational Tools
Pablo DEL AMO SANCHEZ	Introduction to Particle Physics

# TIMETABLE

Time	21nd July	22 nd July	23 nd July	24nd July	25nd July
8h30 - 9h30	Welcome/Intro	Neutrino th 1	Heavy Flavours 2	Astroparticles th 1	Astroparticles exp 1
9h30 - 10h00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
10h00 - 11h00	LHC physics th 1	Gravitational waves 4	Cosmology	Neutrino exp 1	Neutrino exp 2
11h00 - 12h00	Gravitational waves 1	Neutrino th 2	Heavy Flavours 3	Astroparticles th 2	Astroparticles exp 2
Lunch					
14h00 - 15h00	LHC physics th 2	LHC exp 1	Computing	CERN	Computing
15h00 - 16h00	Gravitational waves 2	Heavy Flavours 1			
16h00 - 16h30	Coffee break	Coffee break	Coffee break		Coffee break
16h30 - 17h30	Gravitational waves 3	LHC exp 2			Closing speech
17h30-18h30	Laboratory visit				
18h30	Reception				
20h				Social dinner	

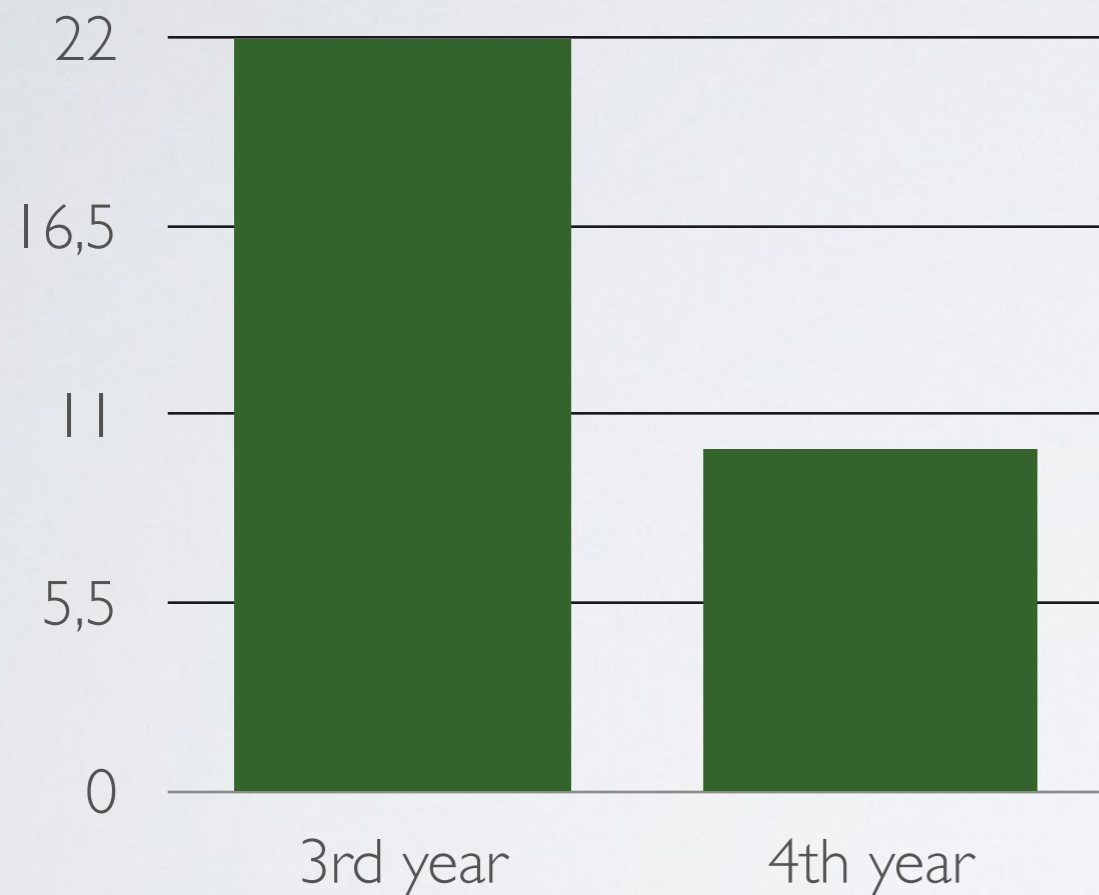
- 4h (theoretical & experimental) [introductory courses](#) on few topics: LHC physics, neutrinos, heavy flavours, astroparticles, gravitational waves, computational tools (ROOT), very brief intro to cosmology
- CERN visit

# THE RESULT...



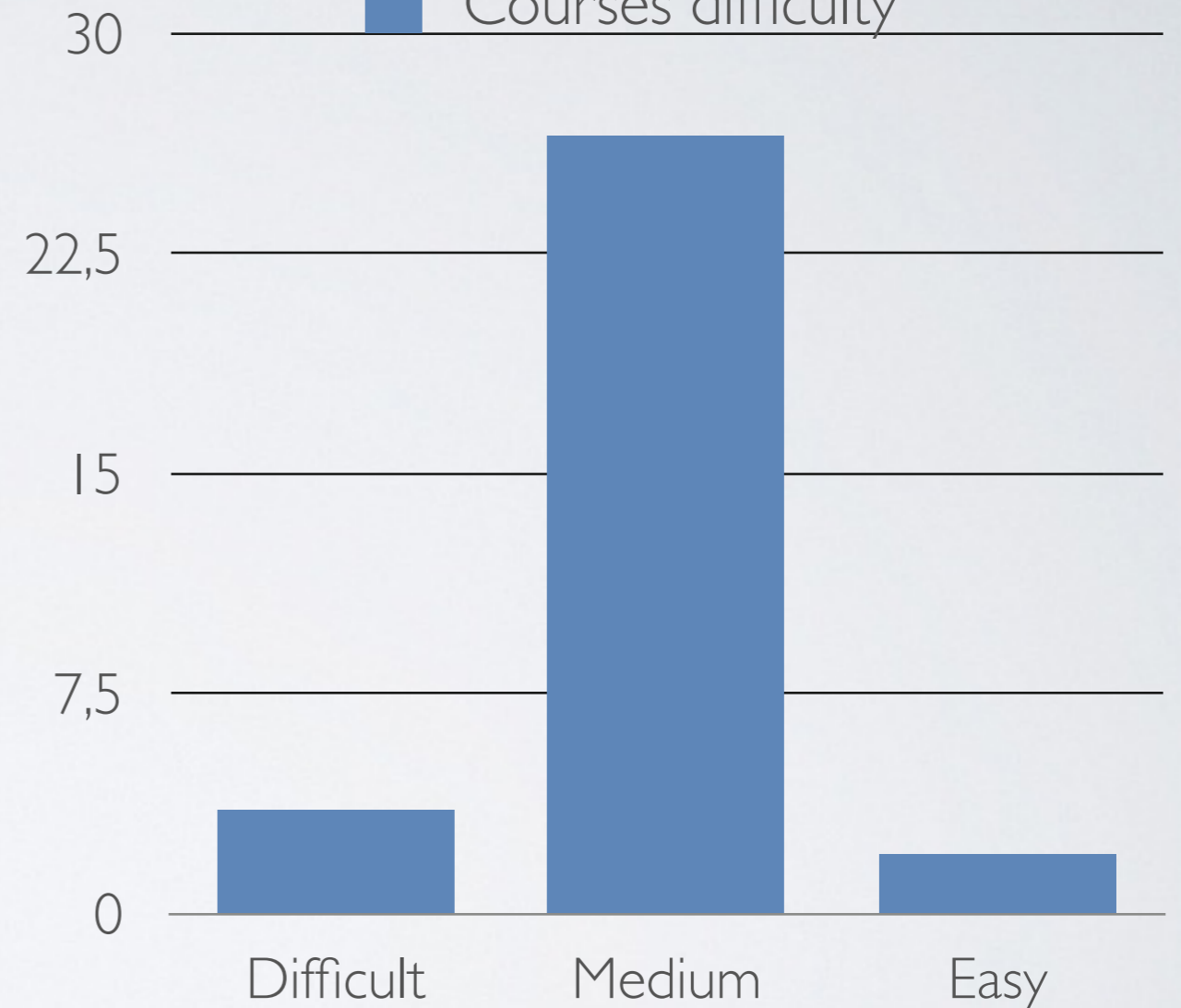
# FEEDBACK

■ Age

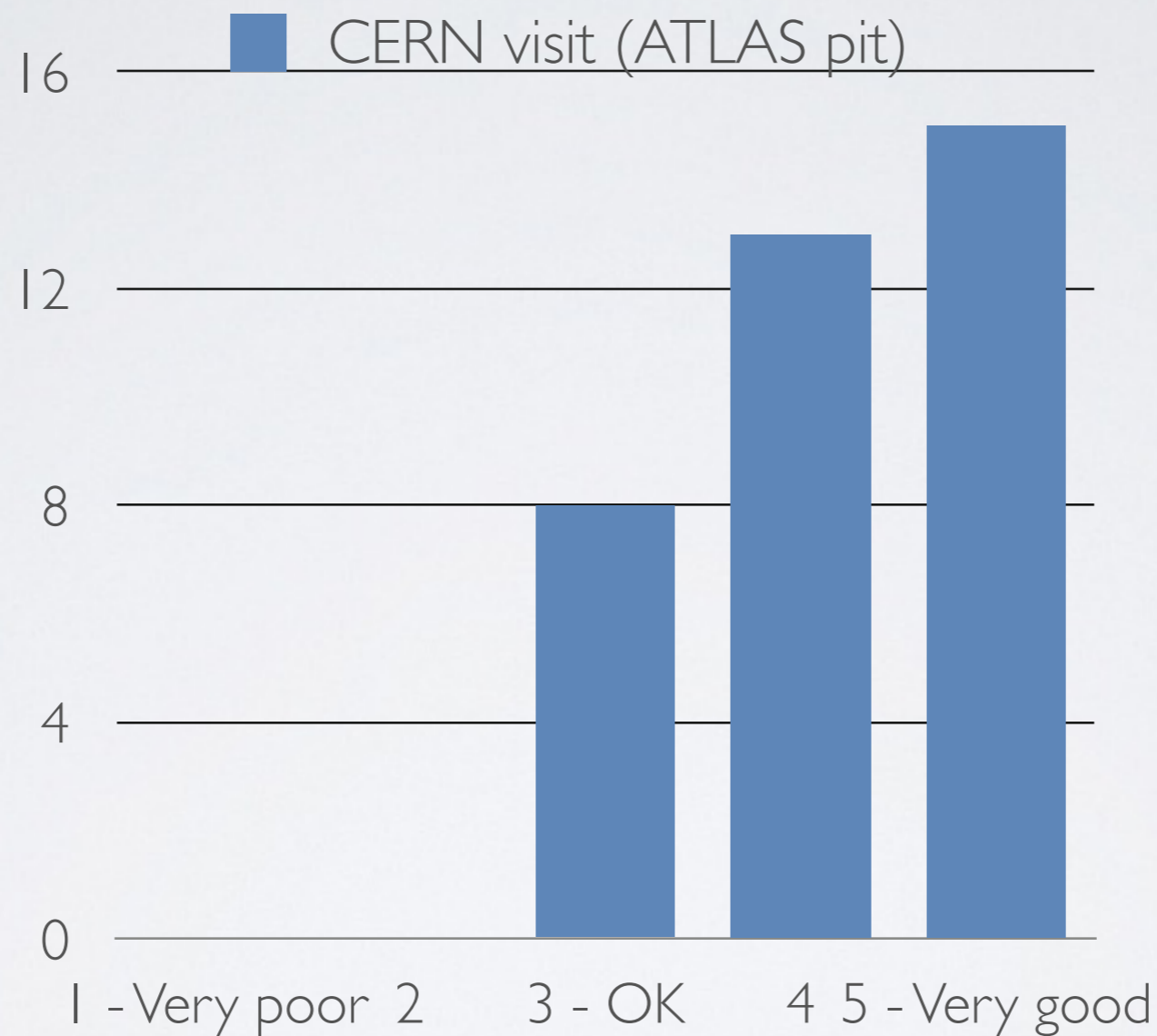


- 2/3rds 3rd year students (choice!)
- Courses difficulty ~well gauged

■ Courses difficulty



# FEEDBACK



- CERN visit, a great success and one of highlights

# FEEDBACK

“5 out of 5”

“Keep it like this!”

“I would definitely recommend the School”

“Great to chat to academics and postdocs over lunch, breaks!”

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“Keep it like this!”

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“Great to chat to academics and postdocs over lunch, breaks!”

“More hands-on sessions”

“What I liked the least: lectures with too many plots and too few equations”

# GRASPA CONCLUSIONS & OUTLOOK

- **Huge success!** (number of applications, level of students, student satisfaction)
- And can improve: more hands-on sessions, more non-local, high-profile lecturers
- ENIGMASS key part in supporting and short-term sustainability of School
- Great opportunity for ENIGMASS:  
punching above our weight (CERN, DESY, GSI)!
- **TRY AND SECURE LONG-TERM FUNDING**



# LPSC'S NUCLEAR PHYSICS EXPERIMENTS PLATFORM

Laurent DEROME

# NUCLEAR PHYSICS EXPERIMENTAL PLATFORM

Laurent DEROME

- Common platform for INPG and UJF from 2005 at LPSC.
- 7 rooms,  $\sim 200 \text{ m}^2$ .
- 19 experiments



**Usual lab experiments** ( $\gamma$  and  $\alpha$  interaction with matter, cosmic rays...)

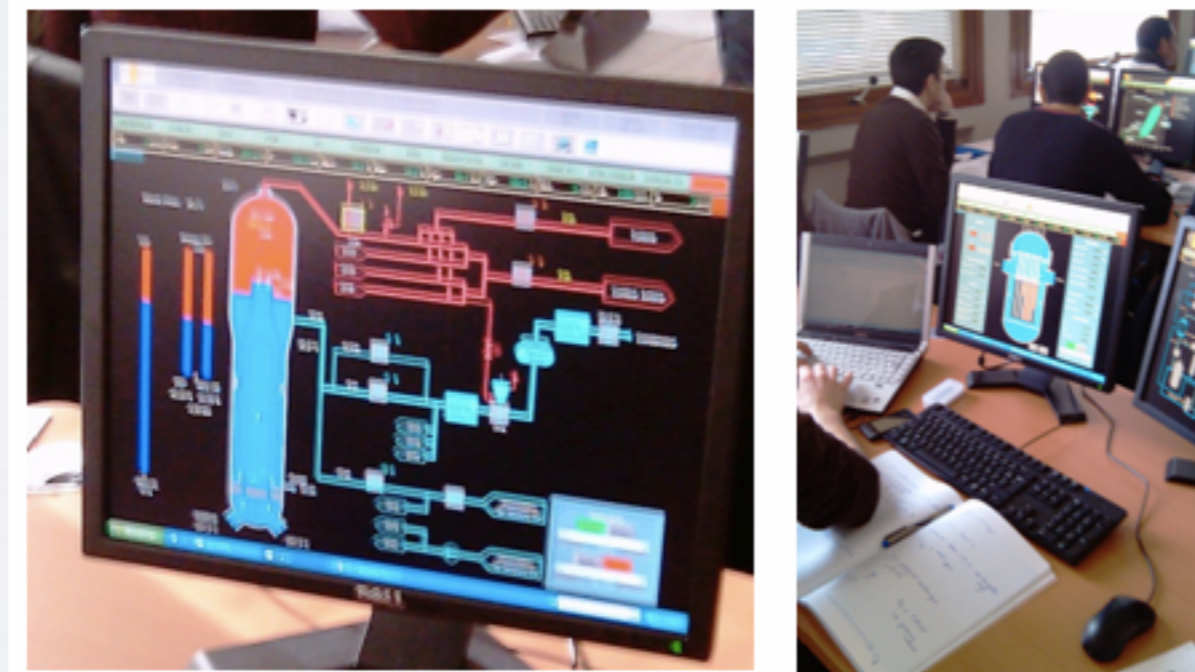
**More specialized topics** (Neutronics, Activation, Medical Applications, Muon lifetime measurement...)

- Budget :
  - ▣ Investment :  $\sim 50-100 \text{ k€ /year}$  (UJF + INPG on a project basis).
  - ▣ Operating costs:  $5 \text{ k€ /year}$

# NUCLEAR PHYSICS EXPERIMENTAL PLATFORM

Laurent DEROME

- 1 Computer room – Data analysis (8 PCs)
- Pressurized Water Reactor Simulator Platform
  - ▣ 10 PCs – SIREP CORYS-TESS licence
  - ▣ Sub-critical approach and divergence, search for nuclear heating threshold, physics trials at zero power, start and connection to electrical network.



# NUCLEAR PHYSICS EXPERIMENTAL PLATFORM

- 15 different degrees/specializations profit from platform. Mainly:
  - ▣ Engineering School: Phelma and E3
  - ▣ Masters : ITDD / Physics / Physical Energetics / Medical

	Students	Student hours	Lecturer hours
INP students	299	5392	836
UJF students	223	4224	712
Total	522	9616	1616



- Almost 8 full time lecturers!
- Equipement crucial for all degrees concerned
- Platform in use ~ 80 % of time
- Often a bottleneck when increasing student numbers in degrees

# ENIGMASS INVOLVEMENT IN THE PLATFORM

Laurent DEROME

- Use Labex money for long term investment in platform:
  - ▣ Create new experiments
  - ▣ Improve current experimental / instrumentation / radiation-matter interaction courses
  
- Items paid by ENIGMASS currently:
  - ▣ Modular and mobile experiments + lecture room equipment (video/screen)
  - ▣ New experiment: Measurement of orthopositronium lifetime in the vacuum (M2)
  - ▣ New experiment: 2x Beta radioactivity (M1, INPG)

esipap

European School of Instrumentation  
in Particle & Astroparticle Physics

Johann COLLOT

# ESIPAP MODEL

Johann COLLOT

- Hard for a single university to have sufficient students for a sustainable training programme in the very specific subject of particle and astroparticle physics instrumentation: TRY AND DO IT ON A EUROPEAN LEVEL
- Organization and management subcontracted to ESI, that already organizes JUAS & ESMP
- 1 director + Steering + Organizing committees
- 2 independent modules : 20 January to 15 March : 8 weeks (4 each)
- ~100 h / module
- Master students, Ph.D. students and continuing education trainees
- 15-20 students per year at European level (9 the first year)
- Students are evaluated - 16 ECTS (2 x 8)
- Accommodation of students organized by ESI
- lab sessions organized at CERN (with the support of CERN)
- progressive involvement of European universities
- benefit of other European schools

# PROGRAMME

Johann COLLOT

## ● Module 1:

### Physics of particle & astroparticle detectors

- Introduction to experimental particle physics
- Introduction to experimental astroparticle physics and cosmology
- Interaction of particles with matter
- Probability, statistics and MV analysis
- Detector Simulation
- Calorimetry
- Tracking
- Muon detection
- Particle Identification
- Imaging & Cherenkov detectors
- Radioprotection
- Lab sessions at CERN
- Computing sessions at ESI

## ● Module 2:

### Technologies and applications

- Detector Technologies
- Advanced Electronics and signal processing
- Composite materials
- 3D printing and innovation.
- Magnets for particle detectors
- Triggering and Data acquisition
- Advanced computing : C++, python, GRID, data technologies
- Ultra cold neutron production and detection
- Medical applications
- Project management
- Specific aspects of space projects
- Lab sessions/exercices at CERN
- Computing sessions at ESI



# MODULE 1: 106.5

## HOURS OF LECTURES

Johann COLLOT

- Experimental particle physics (15 h)** : Marco Delmastro LAPP (ATLAS)
- Experimental cosmology (9 h)** : Juan Macias-Perez LPSC (Planck)
- Experimental astoparticle physics (6 h)** : François Montanet LPSC (Auger)
- Interaction of particles with matter (6 h)** : Johann Collot LPSC (ATLAS)
- C++ programming (6 h)** : Éric Chabert IPHC (CMS)
- Reminder on probability and statistics (3 h)** : Benoît Clément LPSC (GRANIT)
- MVA Analysis & boosted decision trees (6 h)** : Yann Coadou CPPM (ATLAS)
- Tracking (6 h)** : Jérôme Baudot IPHC (CMOS & ILC)
- Calorimetry (6 h)** : Isabelle Wingerter LAPP (ATLAS)
- Muon detection (6 h)** : Joerg Wotschack CERN (ATLAS)
- Radioprotection (3 h)** : Helmut Vincke CERN (radioprotection group)
- Imaging & Cerencov detectors (4.5 h)** : François Montanet LPSC (Auger)
- Detector simulation (6 h)** : Alberto Ribon & Witold Pokorski CERN (G4 collab)
- Particle identification (3 h)** : Guillaume Unal CERN (ATLAS)
- Computing sessions (12 h)** : Éric Chabert & Éric Conte IPHC (CMS)
- Lab sessions (9 h)** : 12 people from CERN ! can't list them all, my apologies !
- Exams (10 h)** !

<https://indico.cern.ch/event/294651>

More than 30 lecturers !

Many thanks to all  
lecturers and lab tutors!

# MODULE 2: 102.5 HOURS OF LECTURES

Johann COLLOT

**Detector technologies (7.5 h):** Jean-Marie Brom IPHC (CMS)

-Working principles, gaseous detectors, semiconductor detectors, scintillation, cerenkov and transition radiation detectors

**Noble liquid detectors (3 h):** Johann Collot LPSC (ATLAS)

**Low temperature detectors (1.5 h) :** Alain Benoît Néel Institute (PLANCK)

**Electronics and signal processing (9 h) :** Daniel Dzahini LPSC (ATLAS)

**Project management (6 h) :** Pierre Bonnal CERN (CERN project office)

**C++ programming (9 h) :** Sébastien Ponce CERN

**TDAQ (9 h):**

-VME bus : Markus Joos CERN

-Modular Electronics : Markus Joos CERN

-TDAQ software : Enrico Pascalucci (INFN Roma)

-FPGAs : Hannes Sakulin CERN

-Triggering : Francesca Pastore (Royal Holloway London)

**Data technologies (6 h) :** Roberto Pace (CERN)

**Composite materials (9 h) :** Jérôme Senmartin (Compositec)

**Magnets for particle detectors (4.5 h) :** Herman Ten Kate CERN (ATLAS)

**3D/additive printing (1.5 h) :** Marc Krauth IPHC

**Python programming (3 h) :** Jérôme Odier LPSC

**Grid computing (3 h) :** Catherine Biscarat LPSC

**Ultra cold neutron production and detection (6 h) :** Guillaume Pignol LPSC (Granit)

**Medical applications (7.5 h) :** Ziad El Bitar IPHC

**Space projects (5 h) :** Jan Droz CNES (Ariane project manager for CNES)

**Lab sessions (12 h) :** people from CERN (can't list them all, apologies)

**Exams (8 h)**

<https://indico.cern.ch/event/301339>

Many thanks to all  
lecturers and lab tutors!

# MODULE I

## OPENING CEREMONY



7 students  
(France, Sweden and Algeria)



## ATLAS VISIT

# MODULE 2

Johann COLLOT

2 students  
(France and Germany)



# ESIPAP SUMMARY

Johann COLLOT

- **ESIPAP initially foreseen for 5 years** (hopefully more!)
- Annual budget : 70 k€ (50% ENIGMASS and 50% from ESI, Technopole of Archamps and Haute-Savoie council) ; (less in 2014)
- At the moment, participants are: Universities Grenoble-Alpes and Strasbourg, LPSC, LAPP, IPHC, CPPM and CERN
- **Very positive feedback from students (9) and professors (>50)**
- **Increase student recruitment by proper/massive/alumni advertisement this year**
- Seek partnership with more European universities, labs and other topical instrumentation schools (already the case with ISOTDAQ, CSC...)
- **Hope ESIPAP will become a standard ref. in instrumentation training**
- **[www.cern.ch/esipap](http://www.cern.ch/esipap)**

# ENIGMASS HIGHER EDUCATION ACTIVITIES

**ENIGMASS has given the opportunity to start Education activities that really leave a mark on the next generation of physicists through Education:**

- GraSPA
- LPSC's Nuclear Physics Experiments Platform
- ESIPAP