



Welcome in the Paris Sud Campus Welcome to LAL

Achille Stocchi

LAL director

Professor at the Paris-Sud University

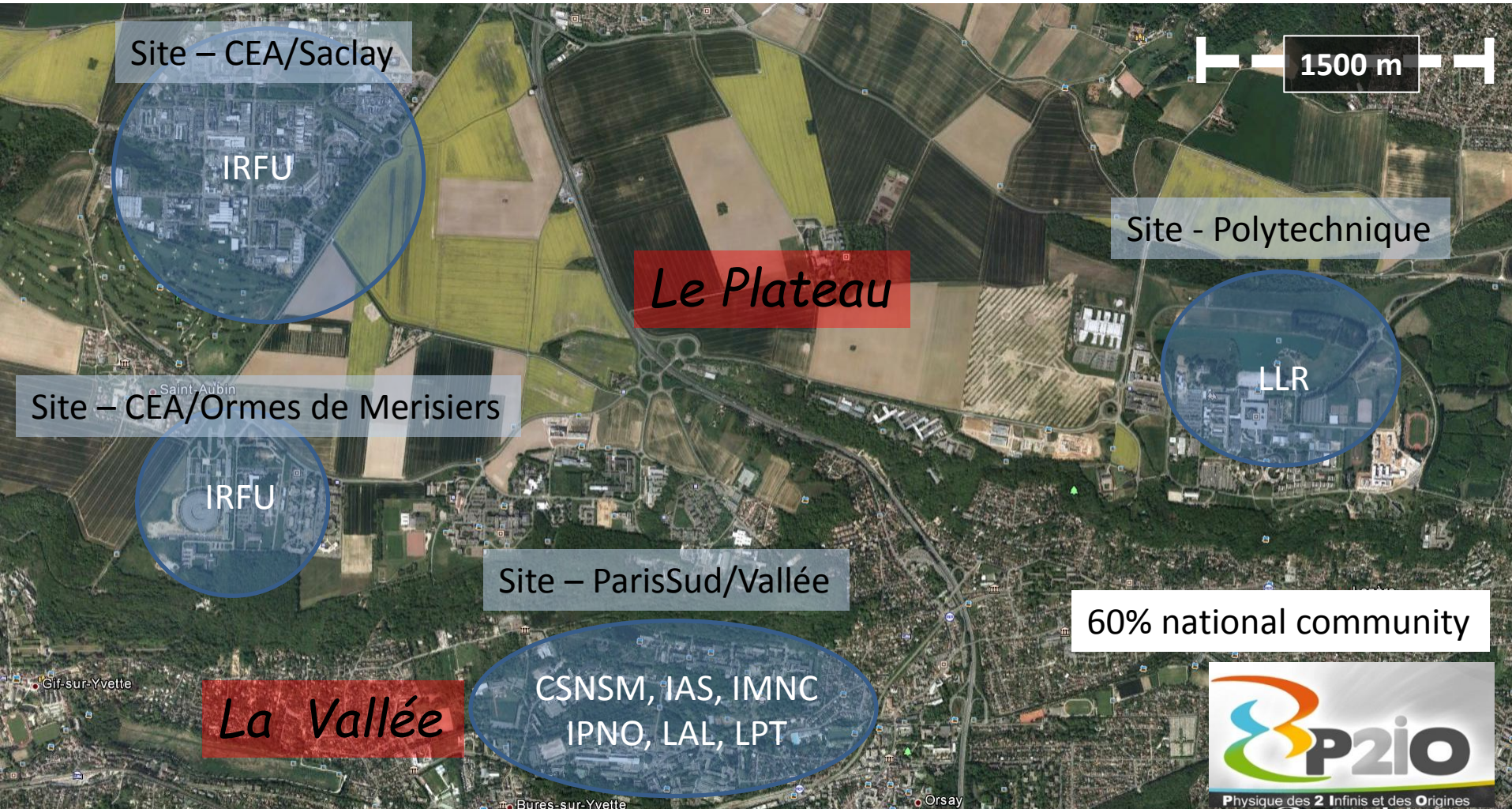


15th May 2014

The Site where you are

Personnel ~ 2000
Superficies ~ 100000m²

The Labs : CSNSM, IAS, IMNC, IPNO, IRFU, LAL, LLR, LPT



Labs grouped under P2IO label and belonging to 4 agencies : Paris Sud, CNRS, CEA and Ecole Polytechnique

Laboratoire de l'Accélérateur Linéaire (LAL) (IN2P3/CNRS and Paris Sud University)



www.lal.in2p3.fr

Located at the Paris Sud University campus between Orsay and Bures-sur-Yvette

Historical name: big linear e⁺e⁻ accelerator was stopped in 2004.

Instead new facilities have been built (see later)



- ☐ **Biggest CNRS HEP laboratory in France:**
 - ~120 physicists**
 - ~220 engineers/technicians**
 - Annual budget ~10 Meuros**
 - + ~20MEuros (salary)**
- ☐ **Hosting ~10-15 PhD thesis / year**

- ☐ **Surface of 18 000 m², including 7 000 m² of halls, workshops and clean rooms**

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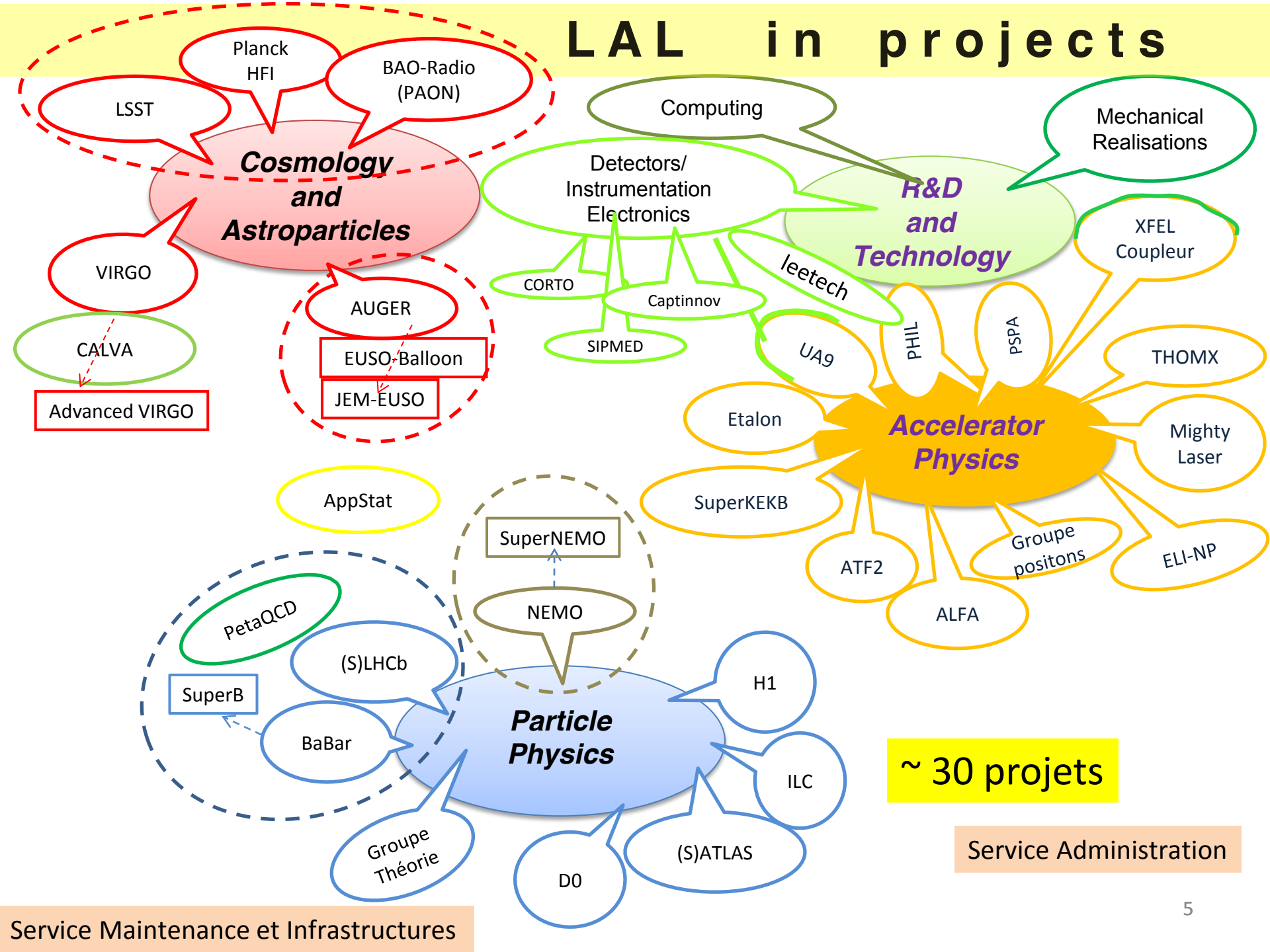
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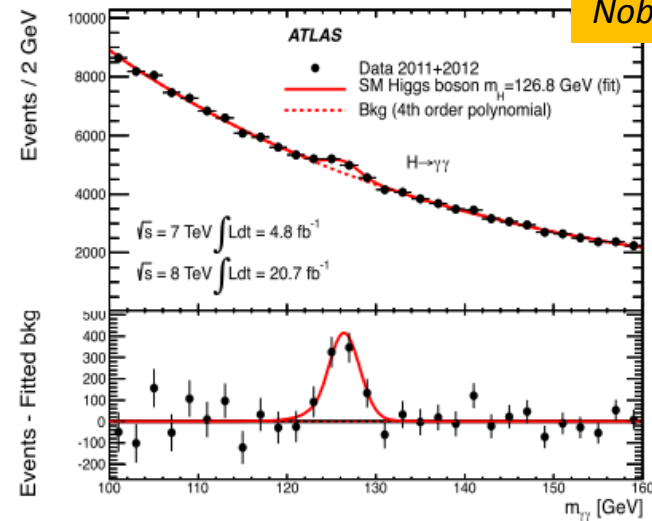
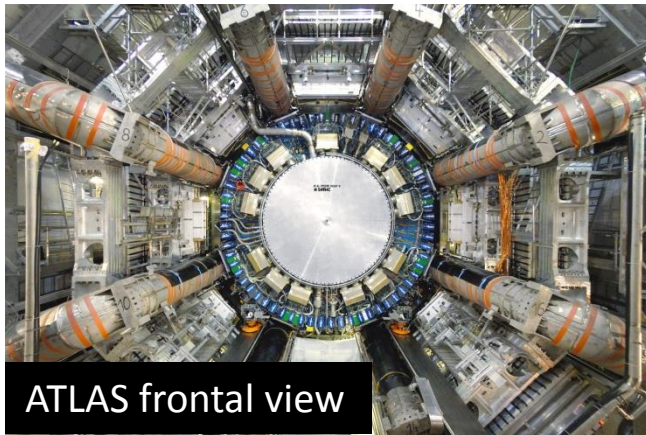
The LAL is member of the 8 “Large European National Laboratories in particle physics” and thus is part of the «Strategy Group » and has participated to the elaboration of the Strategy

LAL in projects

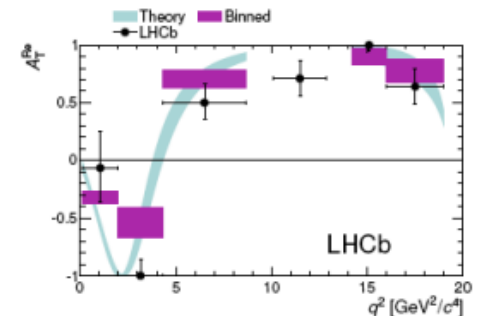
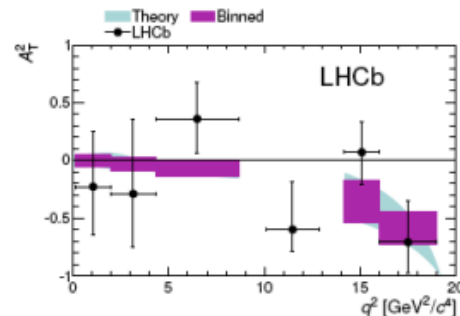
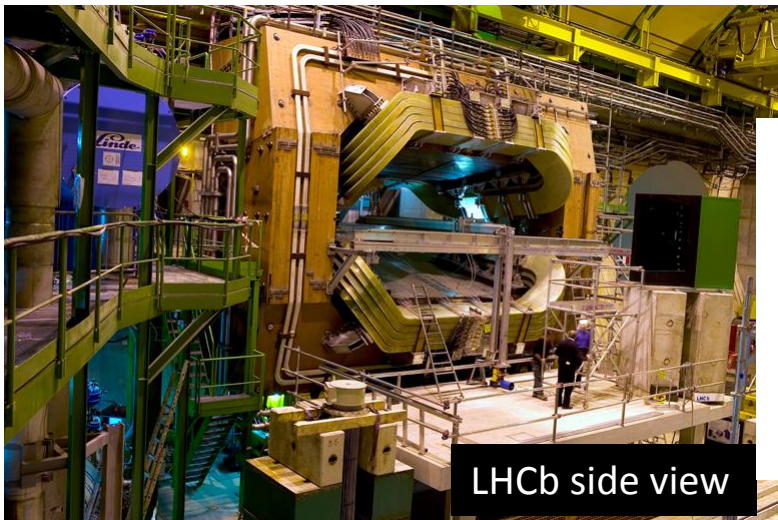


Few example of experimental Program at LAL

- Main projet: LHC at **CERN**
 - ~40% of physicists implied in two experiements **ATLAS** and **LHCb**
 - Important technical contribution for detectors et l'accelerator



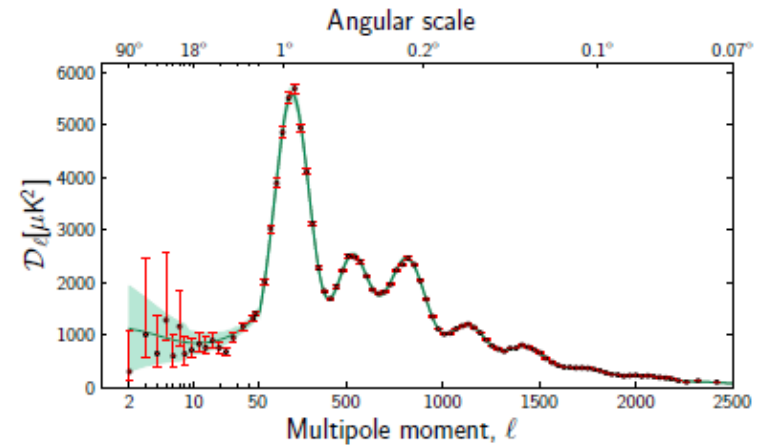
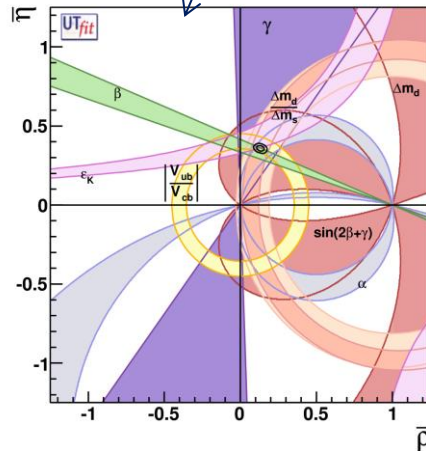
Nobel Prize 2013



Example of other projects

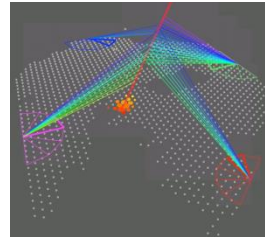
- Experiments on accelerators : BaBar, DØ, H1

Prix Nobel 2008



- Planck satellite

- Auger Observatory and JEM/EUSO for cosmic rays at ultra high energy



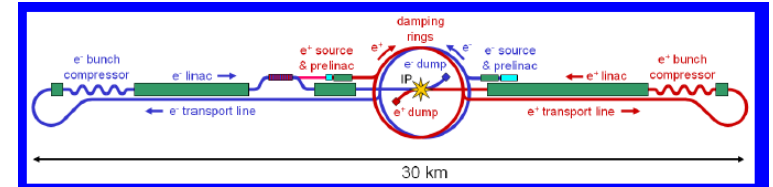
- Studies of neutrino physics with the NEMO detectors.

- Direct search for gravitational wave using the interferometer Virgo

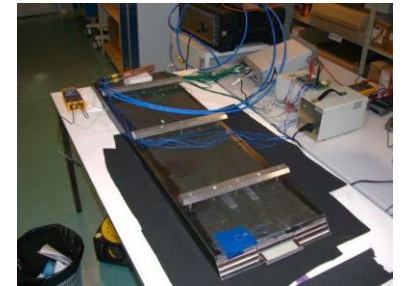
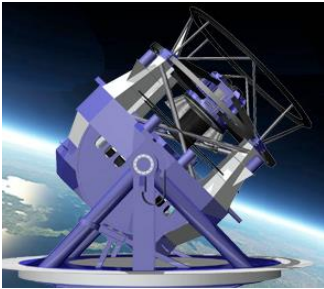
- Accelerators : XFEL in Germany, PHIL at LAL, ATF/ATF2 in Japon, UA9 (LHC).. (see later)

Implications in future projects

- Next generation of electron-positron linear colliders
→ Projects **ILC** (Japan) and **CliC**



- Futur telescopes **LSST**



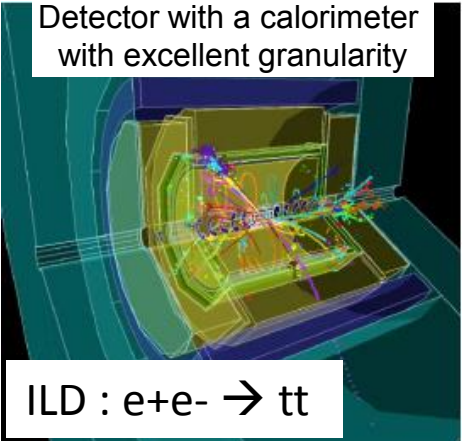
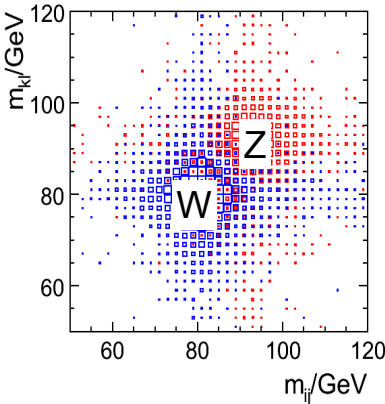
- LHC upgrades !

TDR published

- **Activities on Physics / theory**
- **Activities on Detectors**

Detector R&D for SiW ECAL

Development of the front end electronics, design of the Detector and assembly + data analysis of the test beam



Physics Prototype
Test beams
2005 – 2009 + 2011)

• Number of channels : 9720 ($10 \times 10 \text{ mm}^2$)
• Weight : ~ 200 Kg

Technological Prototype
Test beams 2011 – 2014)

• Number of channels : 45360 ($5 \times 5 \text{ mm}^2$)
• Weight : ~ 700 Kg

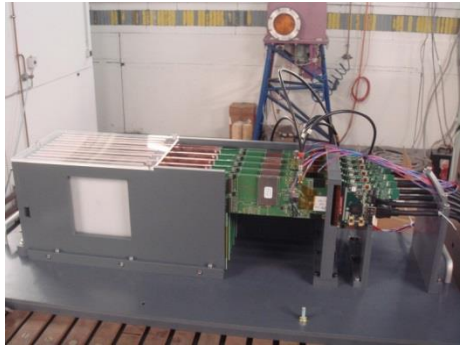


LC Detector

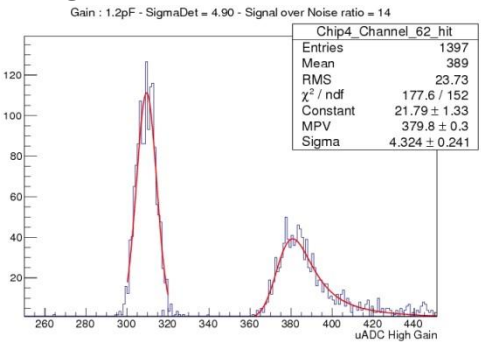
Electromagnetic Calorimeter :

- Cells : 110 10^6
- Total Weight : ~130 t

Tests with the first layers of the 2nd generation Ecal

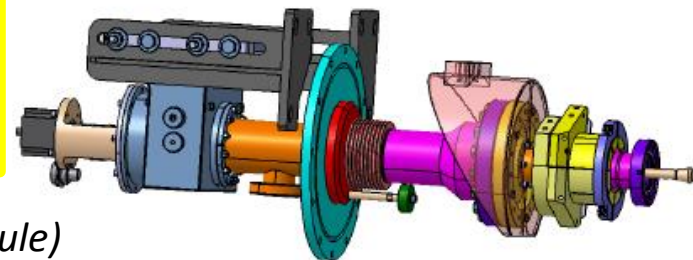


Signal/noise > 10



XFEL

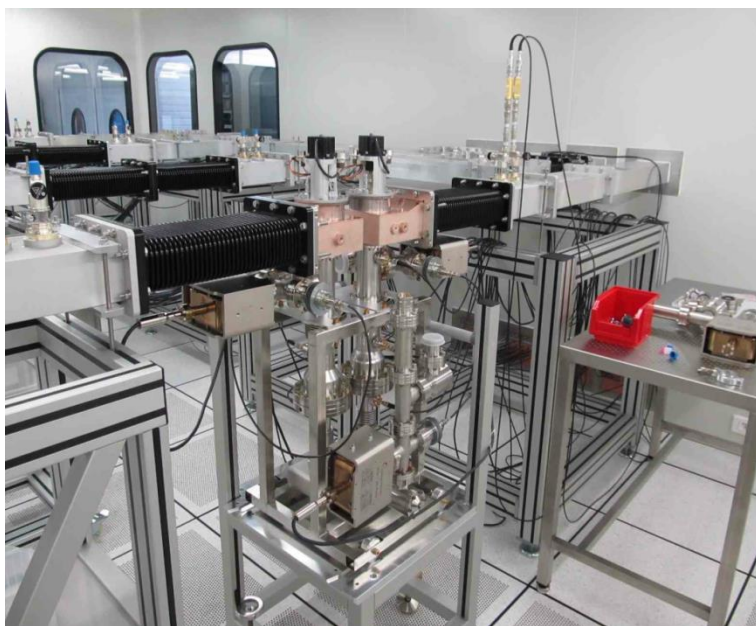
Very high flux of X-rays produced from accelerated electrons sent on undulators. XFEL is installed at DESY-Hambourg



Projet – Couplers at LAL (IRFU responsible of the cryomodule)

Serie production COUPLERS 1.3GHz

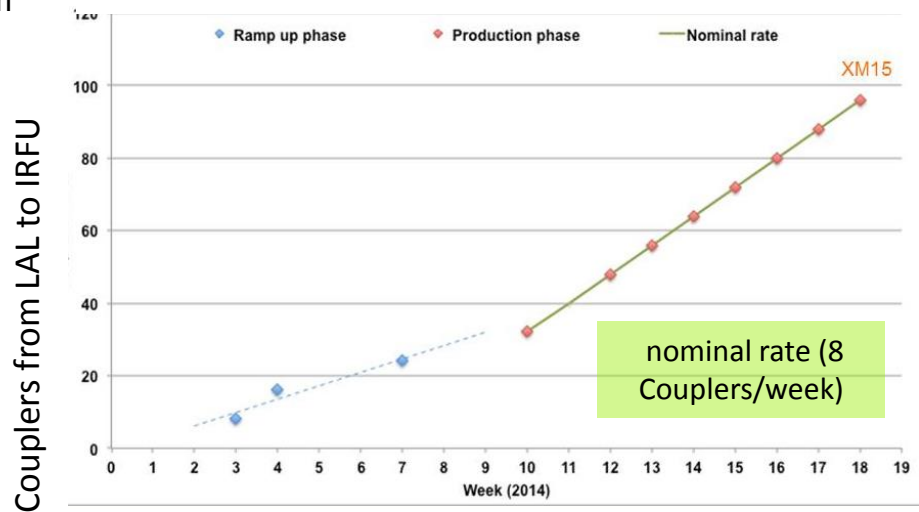
Couplers : assure the transmission of the HF-waves from (klystrons) to supraconductives cavities



Production is now lunched !
(visit after this session)

Projet of ~ 20 MEuros (Thales)

Coupleurs conditionnés et envoyés à IRFU en 2014





Compact Source of X-rays(50-90 KeV)
At high flux($\sim 10^{12}$ ph/s)

Compton back-scattering

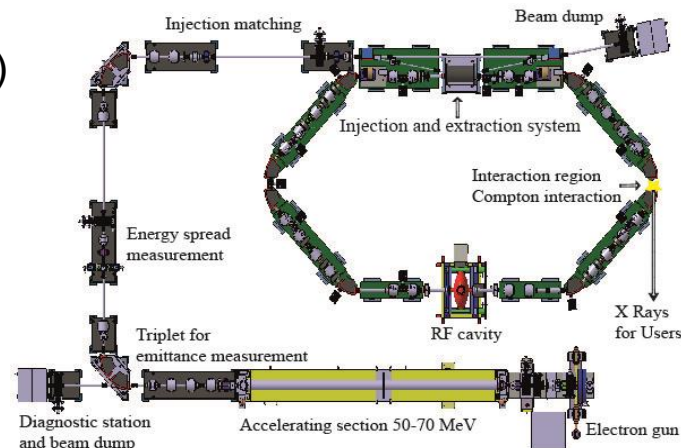
Electron beam of 50 MeV

laser amplified with a Fabry-Perot cavity

Collaboration : CELIA, C2RMF,LAL, NEEL,
SOLEIL,THALES, ESRF, INSERM, UPS,UB1.

LAL leads the project

EQUIPEX Project =12MEuros



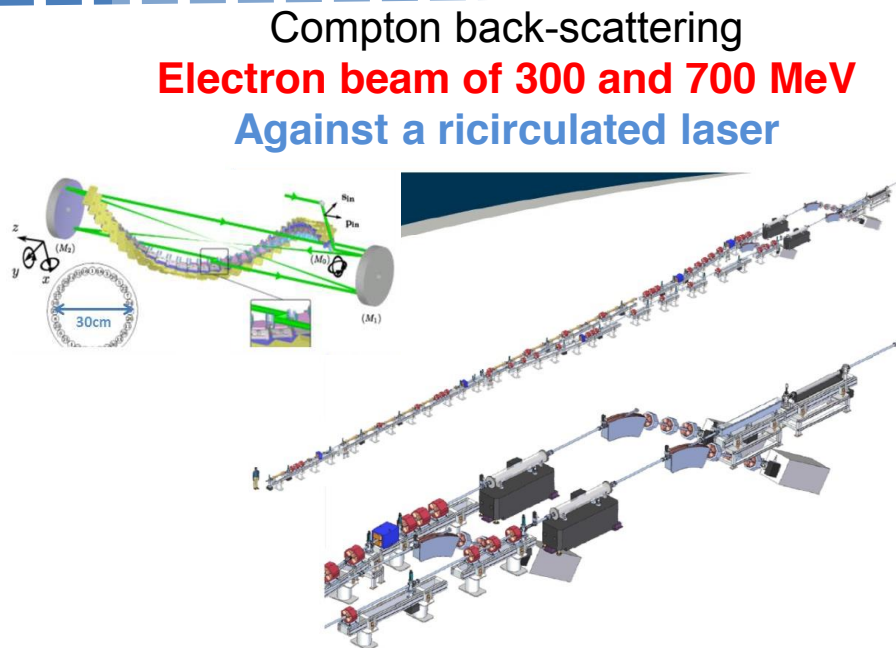
~2016 first interactions

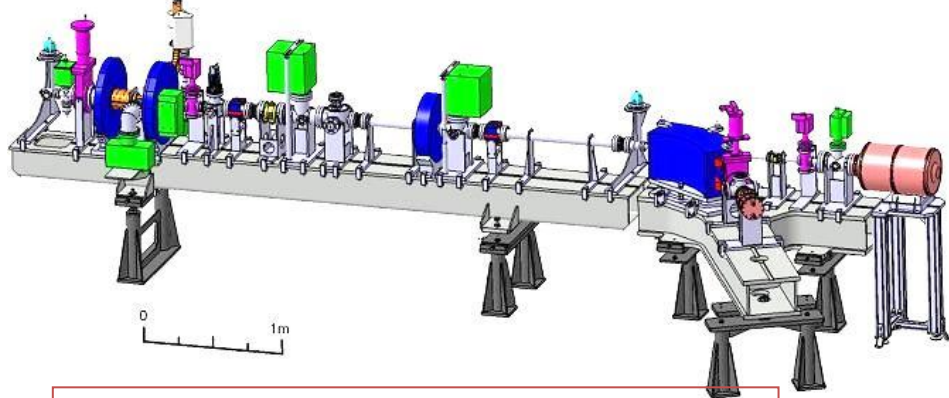


LAL participates to the
e/ γ facility
in Romania ELI-NP.

Project ~ 66 MEuros (our part ~ 15 MEuros)
(French industry Amplitude, Alsyom...).
Collaboration Italy-France-UK

Leaded by : INFN and University Roma Sapienza





- **canon RF**
gradient ~ 90 MV/m - 2011
- **Photocathode**
-cathode Mg – 2011 – for THOMX
-transfert arm +valise Cs_2Te – 2013
- **Beam Diagnostics**
ps pulse, emittance $5 \mu\text{m}.\text{rad}$ – 2013
BPM strip line – 2013 – for THOMX
- **Influence of laser**
top Hat spatial – 2013
laser 100 fs - ?
- **Energy Upgrade 9 MeV** (2013)

Today
électrons at 3 MeV@5Hz, $Q \sim 100$ pC

Ambitious program for using PHIL as a
detector facility. Work in progress



News : transfert arm to change photocathode.
collaboration CTF (CLIC-CTF)

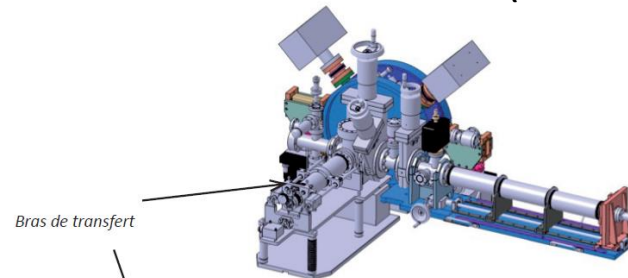
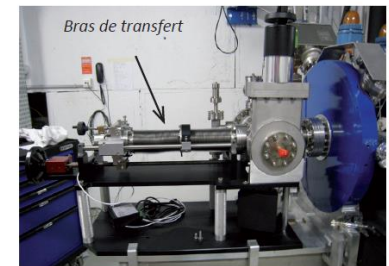


Schéma du bras de transfert de PHIL.

Bras de transfert



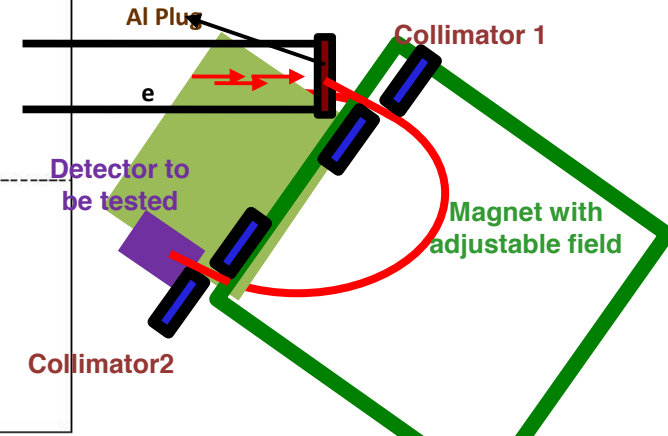
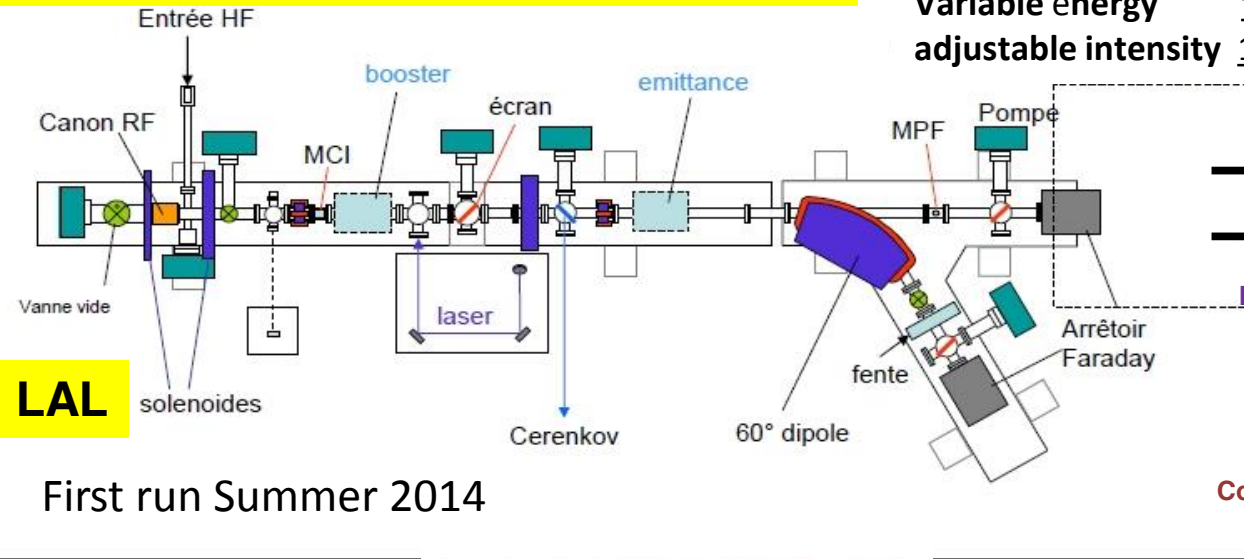
Le bras de transfert en salle de montage.



Le bras de transfert monté sur PHIL.

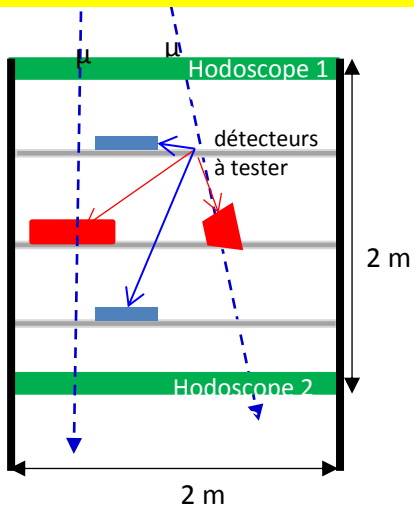
Three “common” PLATEFORMES to test detectors are in preparation

LEETECH :– Platform for testing detector @PHIL



First run Summer 2014

CORTO: COsmic Ray Telescope @ Orsay



LAL, IPNO



First run beginning 2014 CORTO en cours de développement

Captinnov : platform P210 for innovative captors



@ LAL



@ IRFU
Bonding Machine

- ✓ To characterize the circuits and the detectors in prototyping or pre-production phases
- ✓ Integrating hybrids systems (det/PCB/electronics) with large density of channels and/or large dimensions

CSNSM, IAS, IMNC, IPNO, IRFU, LAL, LLR, LPT

« Virtual Data » CENTER

New DATA Center of about 300m² in construction grouping 8 laboratories :

- 7000 cores, 3 PB of disk, 1 tier2 HPC, 1 important net infrastructure
- An important expertise (130 people) covering operation, development, instrument controls).

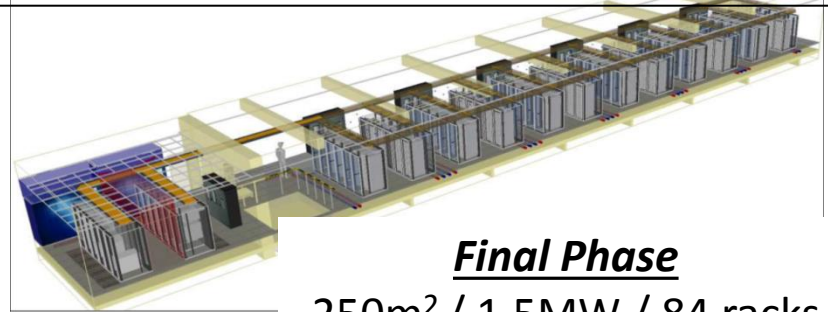
With :

- Cloud technology
- very good PUE (Power Usage Efficiency) of 1,3

Actual situation

650 m² of informatics room within 8 labs fragmented in more than 10 rooms (from 25 à 100 m²) hosting 900 KW

Very inefficient and expensive (1 M€/an)



Final Phase

250m² / 1,5MW / 84 racks

Total Cost : 3M€

Preliminary phase concluded !

100m² / 400KW IT / 30 racks,

cost ~ 1M€

with a new room here close by



CSNSM, IAS, IMNC, IPNO, IRFU, LAL, LLR, LPT