

ATLAS ACC/CEA collaboration (on particle physics)

Eric Lançon (CEA-Saclay/Irfu)



ATLAS China - CEA collaboration within FCPPL

ATLAS ACC/CEA collaboration
since beginning of FCPPL



Beijing Dec. 2006

Pr. H. Chen



Pr. F. Le Diberder

B. Mansoulié



CEA, Irfu & Saclay

CEA

Irfu

Saclay



CEA, Irfu & Saclay

CEA

**The French Alternative Energies
and Atomic Energy Commission**

(16 000 Employees, 3 900 M€ Budget)

Irfu

**The “Institute of research into the fundamental
laws of the universe”**

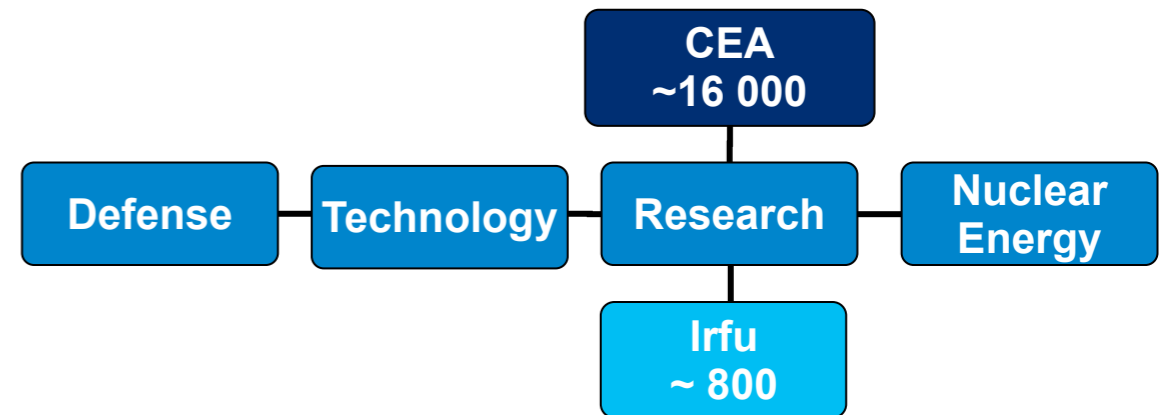
The largest institute of CEA

Saclay

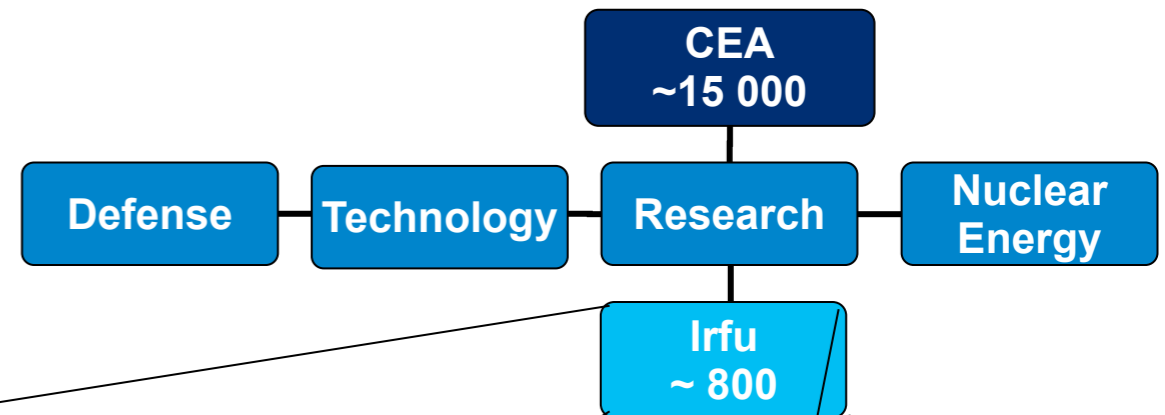
One of the 10 research centers of CEA



The largest institute of CEA



The largest institute of CEA : Research and technology



Institute of Research into the Fundamental laws of Universe



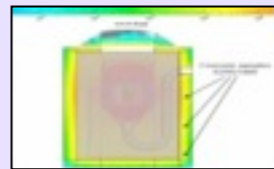
Astrophysics
Space technologies



Nuclear Physics



Particle Physics

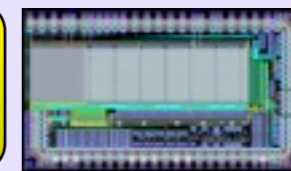


Nuclear expertise

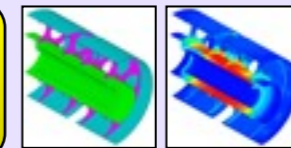
Accelerators,
Supra. Magnets



Detectors, electronic,
computing



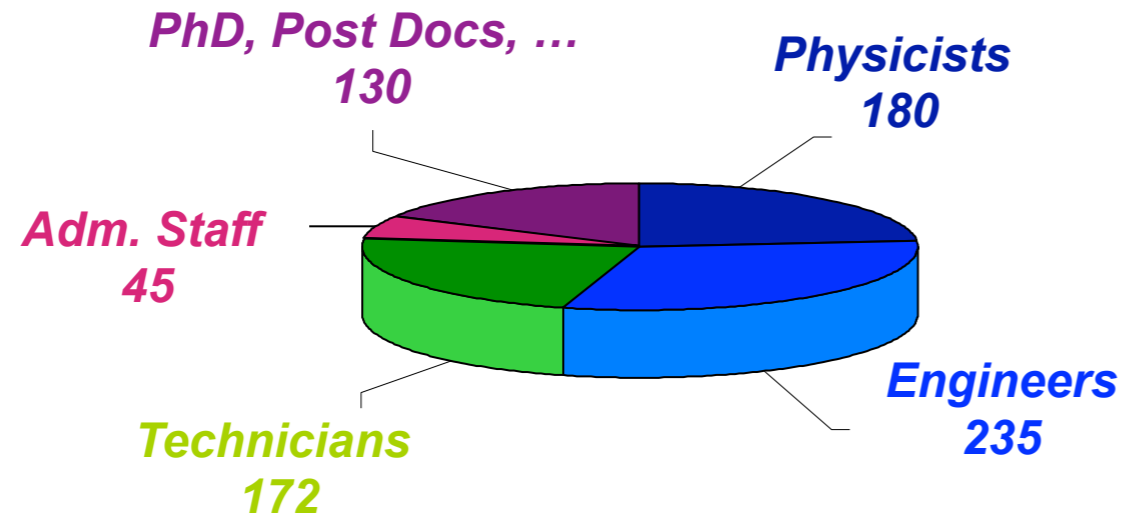
Systems engineering



IFMIF EVEDA



The largest institute of CEA



Research and technology

Institute of Research into the Fundamental laws of Universe



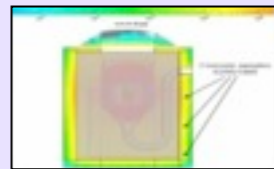
Astrophysics
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Nuclear Physics



Particle Physics

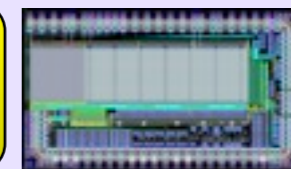


Nuclear expertise

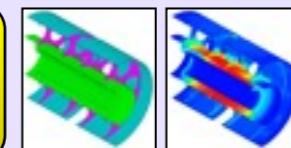
Accelerators,
Supra. Magnets



Detectors, electronic,
computing



Systems engineering



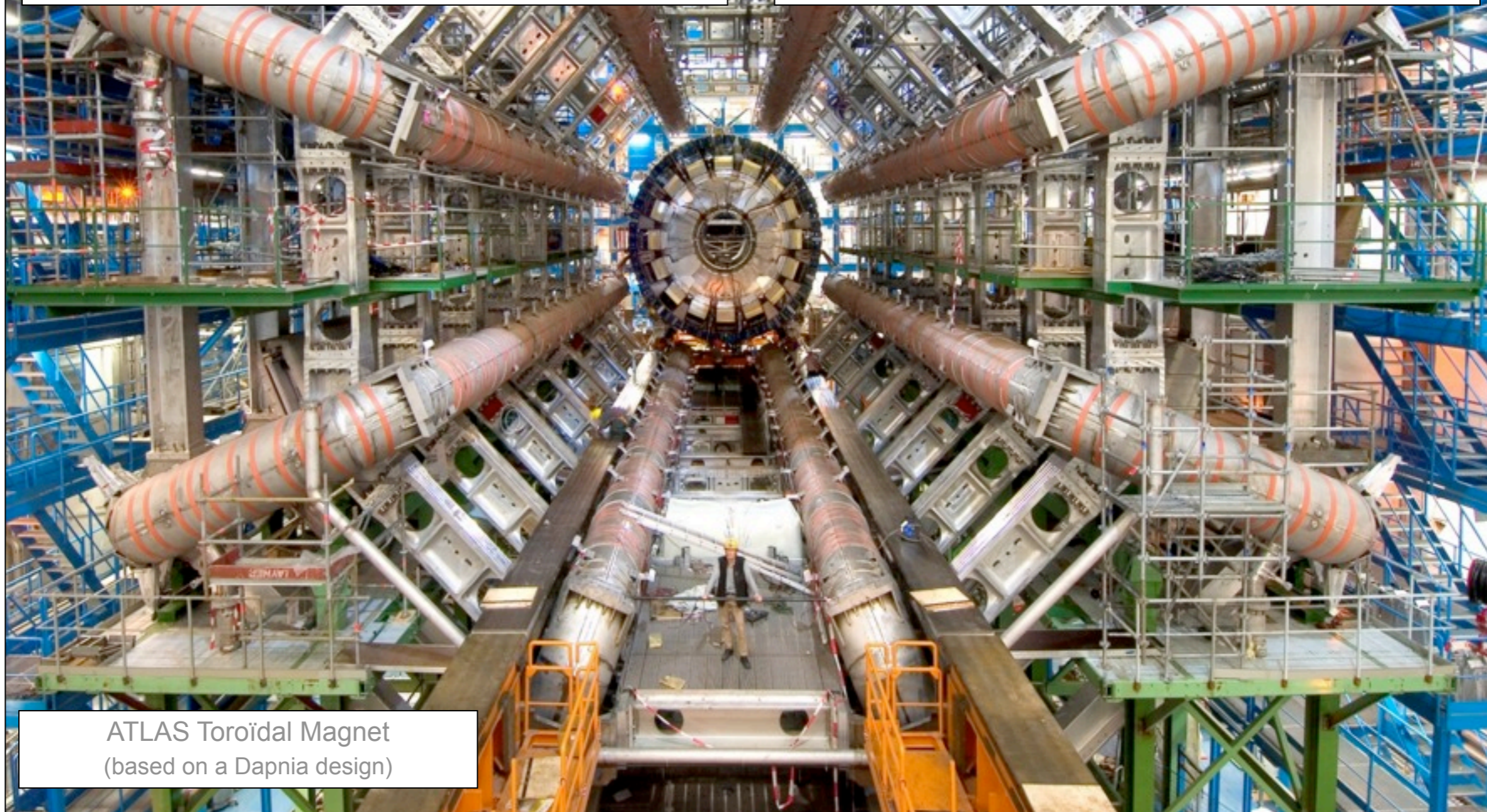
IFMIF EVEDA



Institute of research into the fundamental laws of the universe

Concentration of human Resources
Heavy equipment
Advanced technologies

Project oriented organization,
inside CEA, a technology
dominated institution



ATLAS Toroidal Magnet
(based on a Dapnia design)

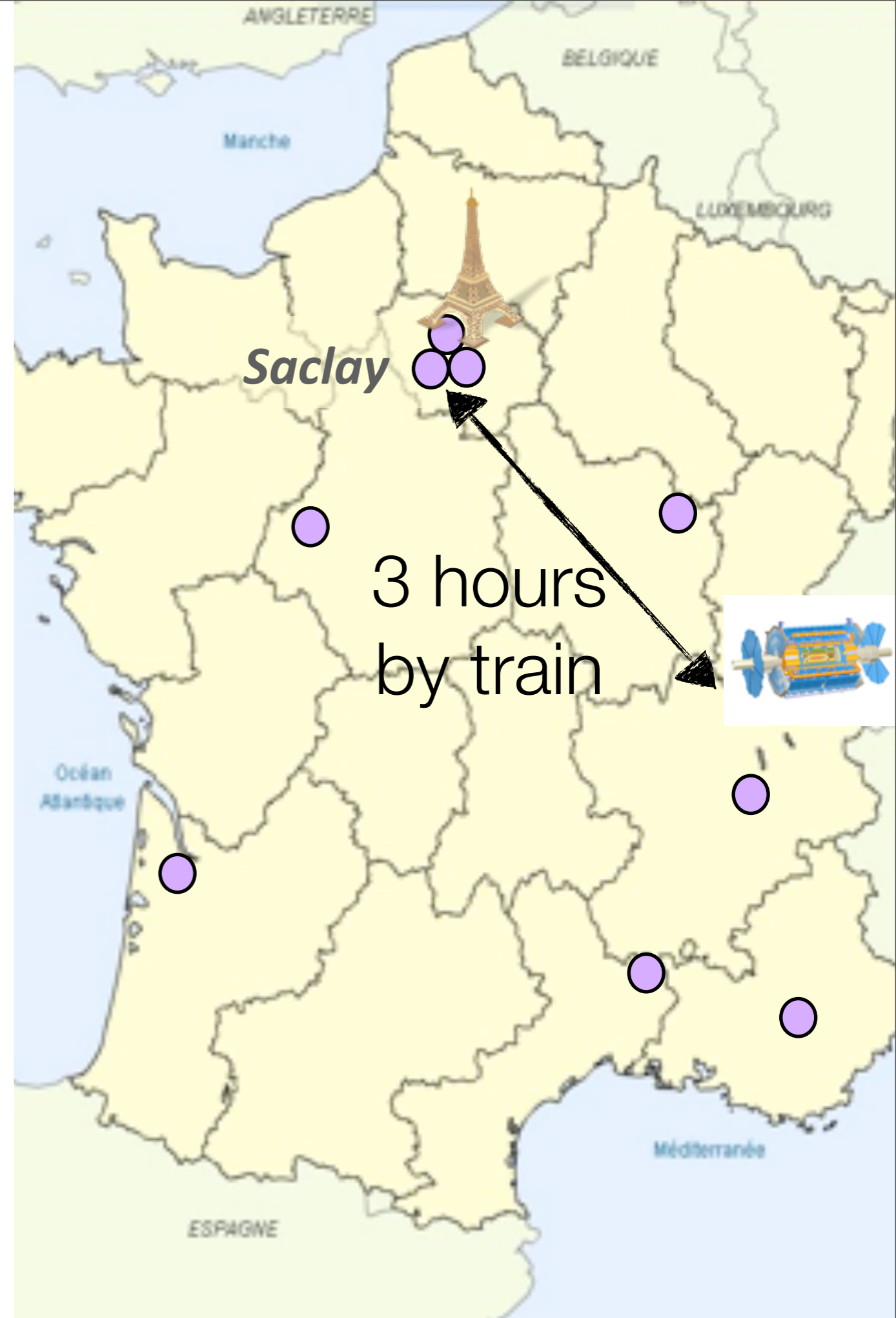
CEA : 10 research centers



CEA : 10 research centers

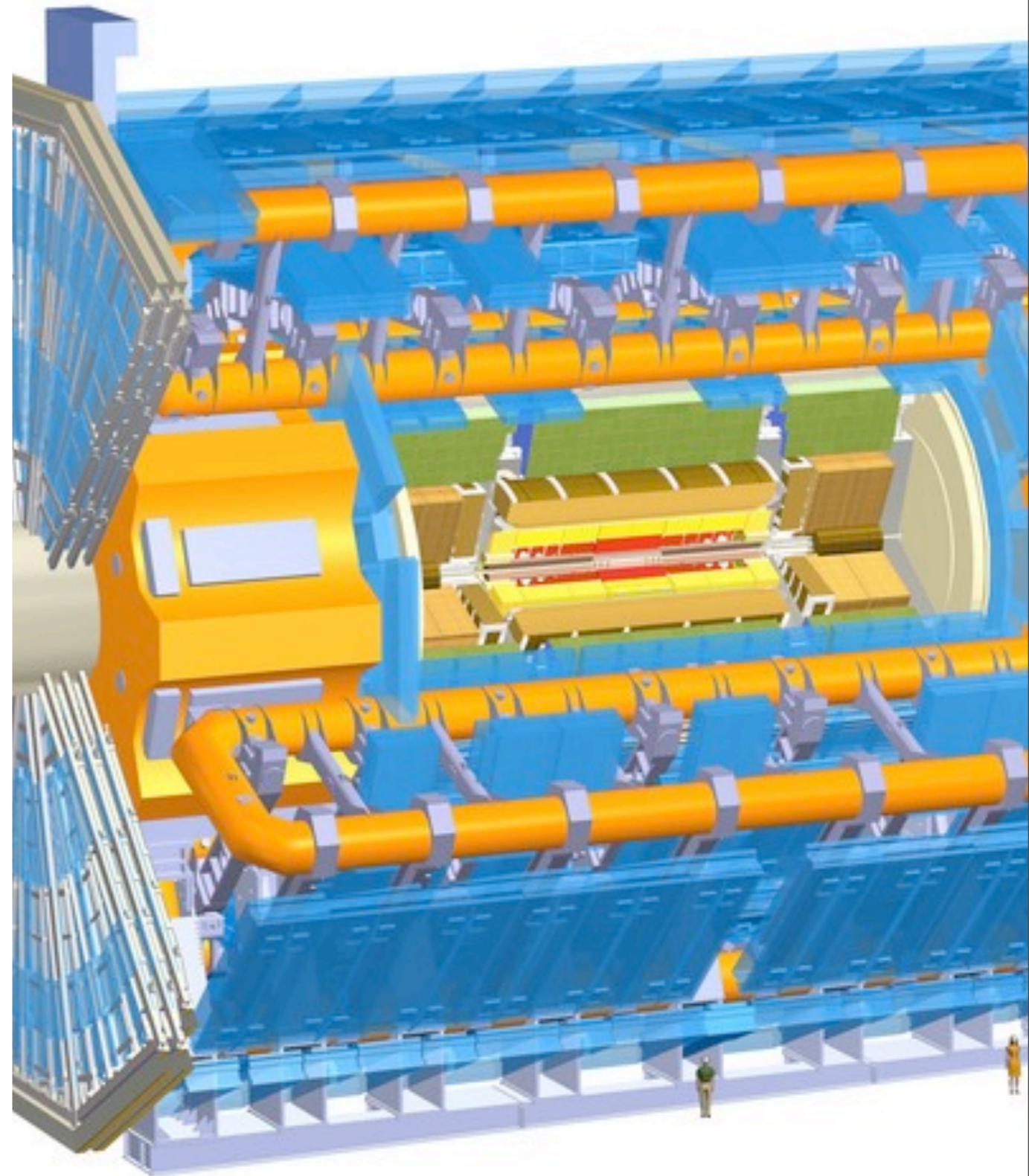
Saclay :

- 20 south of Paris
- ~500 Km from CERN
- ~5,000 people



The ATLAS group of CEA-Saclay

- Over 35 people (physicists & post-docs)
- One of the founder institutes of ATLAS
- Involved in design and construction of
 - Electromagnetic calorimeter (LArg)
 - Muon spectrometer
 - Torroidal magnet
- Physics with leptons



ATLAS activities at CEA-Saclay

- LArg Trigger
- Muon reconstruction software
- Magnetic field map
- Muon alignment
- Grid & computing 
- LHC upgrade 

- Standard Model



- W,Z bosons : mass, cross-section
- Di-boson couplings

- B tagging & B physics
- Higgs searches

- 4-leptons



- WW

- Top quark physics



- t quark mass, ttbar cross-section

- Exotics (Z')



Common tools for analysis

Top quark pair production cross-section measurement



- Co-Thesis of **YU Jie/俞杰** (Nanjing University), Started Oct. 2008
 - Thesis supervisors : S.Chen (Nanjing), B. Mansoulié (CEA-Saclay)
 - Advisor : J. Schwindling (CEA-Saclay)
- Thesis defense : May 15, 2011, first PhD thesis of China-CEA cooperation
- Detailed presentation at 2010 FCPPL workshop
- Contributions to 3 internal and 2 conference ATLAS notes
- Numerous presentations in ATLAS meetings

THESIS

presented by

Jie YU

to obtain the degree of

Doctor of Sciences of the University of Nanjing and
University Paris Sud 11 Orsay (Particle, Noyaux, Cosmos (ED 517))

**Measurement of Top Pair Production
in $1 + \text{jets}$ Channels in ATLAS at $\sqrt{s} = 7$ TeV**

Under the direction of:

Pr. Shenjian Chen

Dr. Bruno Mansoulié

Defend on May 15, 2011. Committee members:

Pr. Shan Jin Chair person

Pr. Xueyao Zhang

Pr. Liang Han

Pr. Etienne Augé

Dr. Didier Vilanova

Dr. Jérôme Schwindling

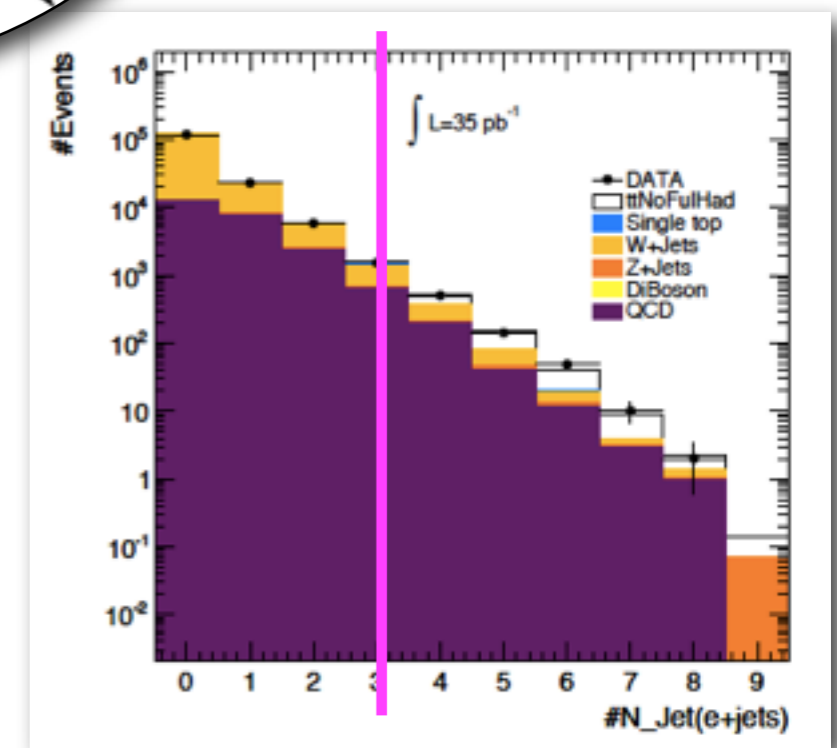
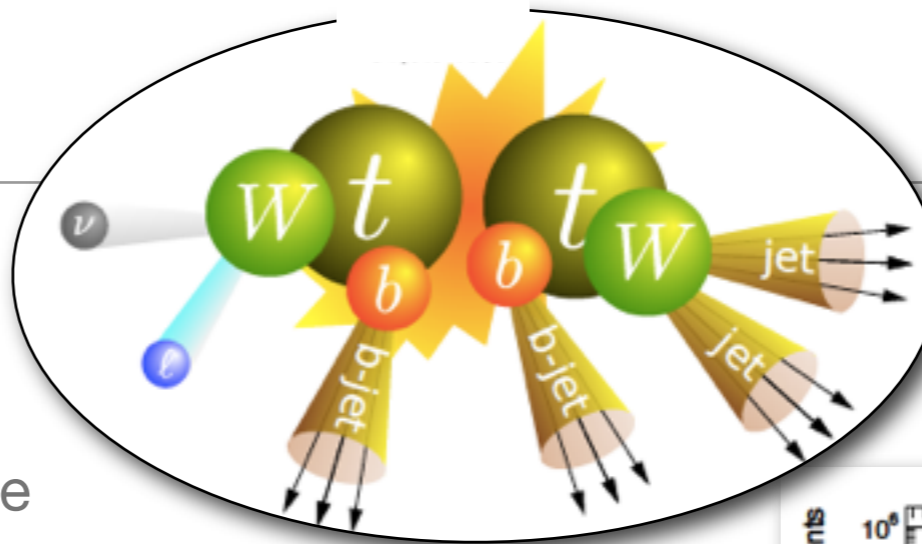
Thesis prepared at IRFU / SPP / CEA-Saclay and
the department of physics in University of Nanjing



Top quark pair production cross-section measurement



- ‘semi-leptonic’ decay
 - lepton (e,μ), missing transverse E, 4 jets (2 b-jet)
 - backgrounds : W+Jets, QCD
- W+Jets background determined by either
 - Extrapolating of W+2 jets yield to W+4 jets region
 - Using MC W charged asymmetry prediction (Bckg. charged symmetric)

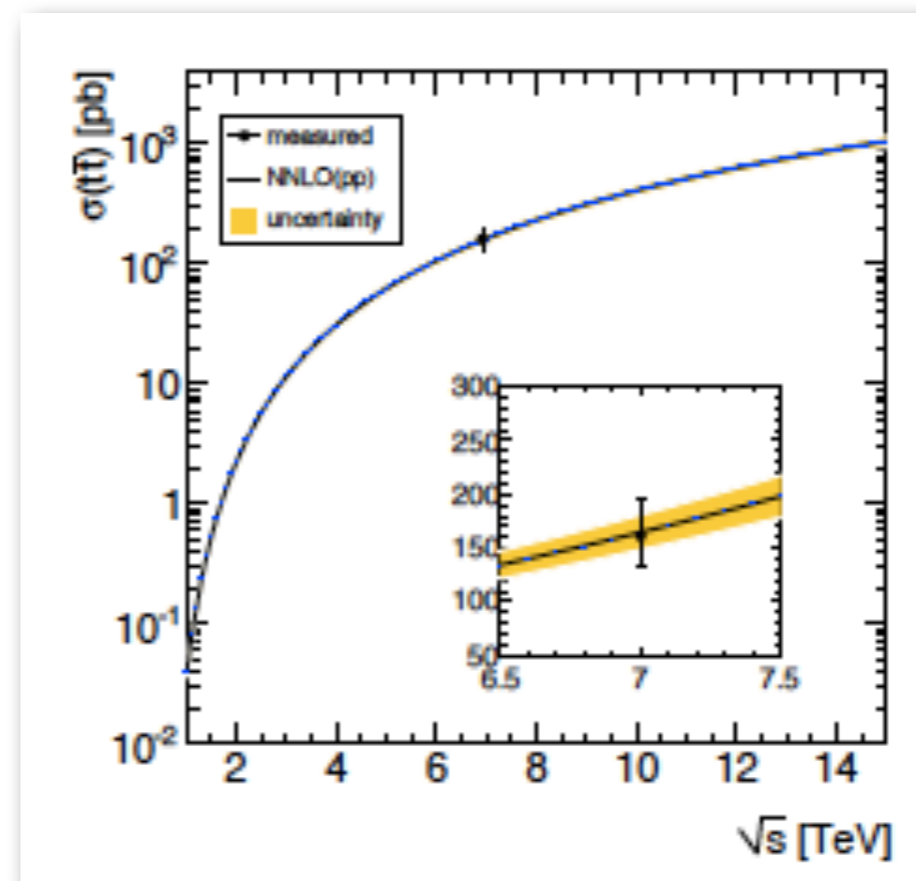
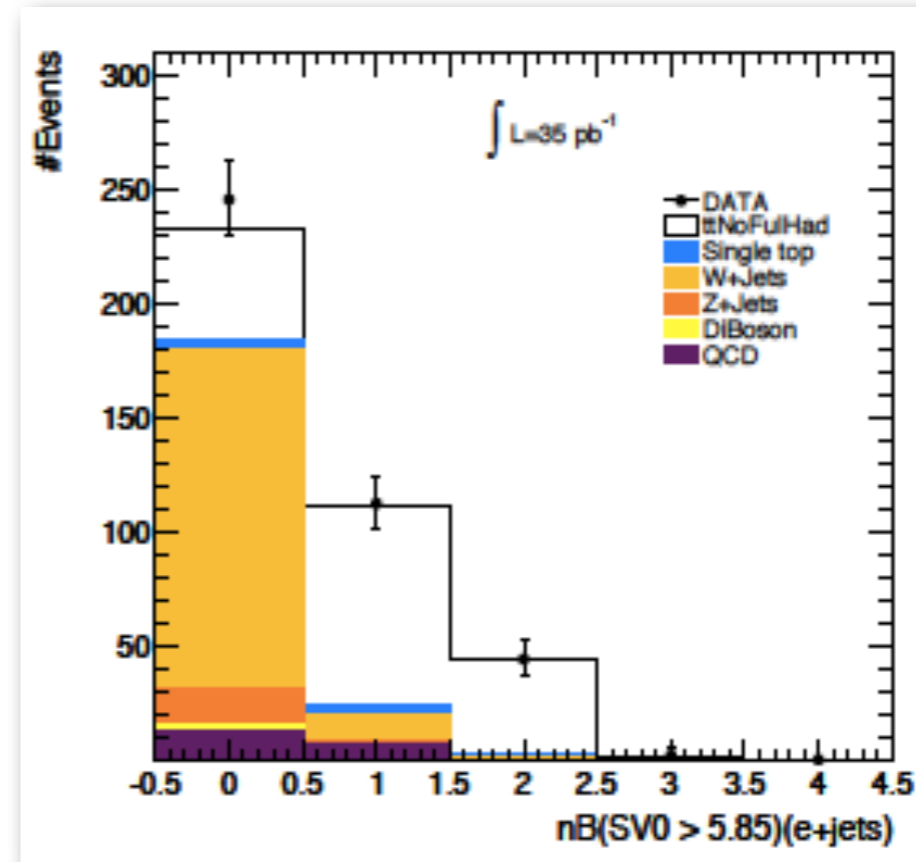


N_{evt} selected	e+jets	μ +jets
Data Obs.	408 ± 20.2	655 ± 25.6
diboson (MC)	2.6 ± 0.5	4.3 ± 0.8
single top (MC)	10.8 ± 3.1	15.9 ± 4.2
Z+Jets (MC)	17.9 ± 3.8	14.0 ± 5.8
W+Jets (DD)	160.7 ± 40.2	301.9 ± 60.4
QCD (DD)	27.7 ± 7.4	49.2 ± 6.6
Data - Bkg	171.9 ± 49.6	247.3 ± 67.5
$t\bar{t}$ (MC)	183.9 ± 0.1	269.3 ± 0.2



Top quark pair production cross-section measurement with B tagging

- B-jet tagging used to improve on $t\bar{t}$ separation from backgrounds
- Original work : simultaneous fit of Jet B tagging efficiency and $t\bar{t}$ production cross-section as a function of jet multiplicity

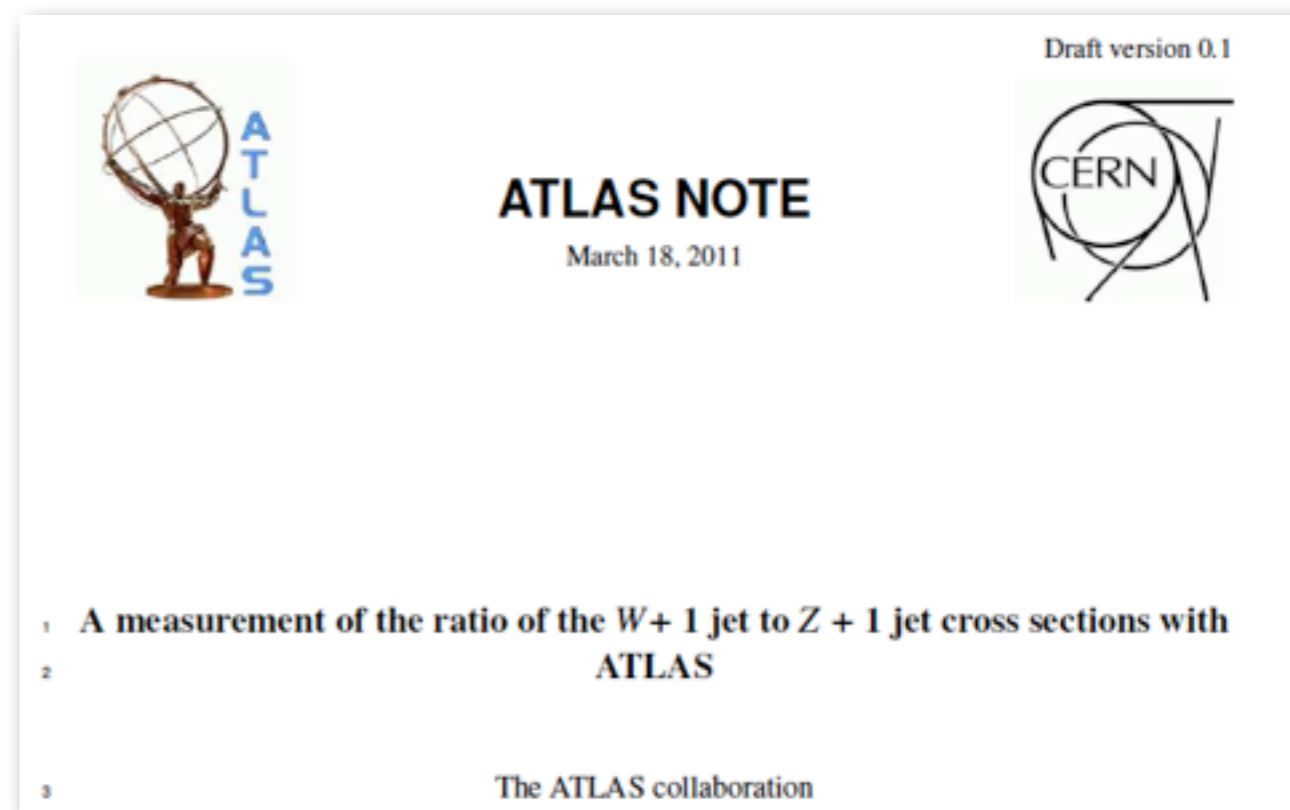




W/Z + Jets production

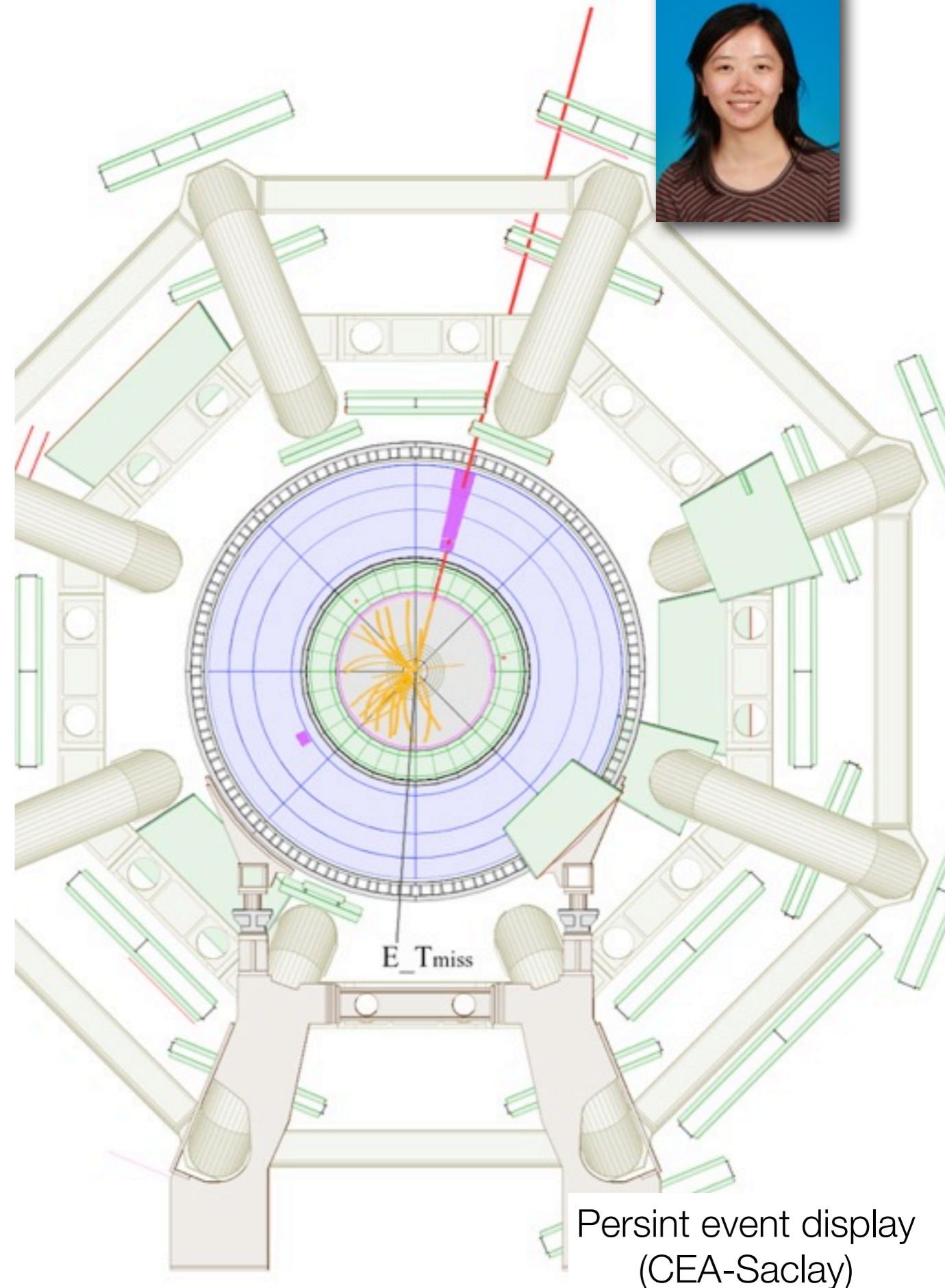
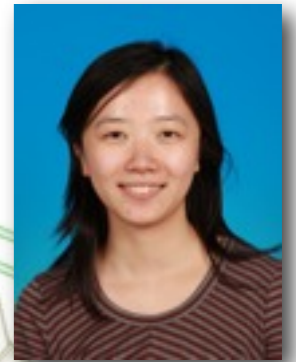
- Co-Thesis of **XU Chao/徐超** (USTC),
Started Feb., 2009
 - Thesis advisers : Z. Zhao (USTC), E. Lançon (CEA-Saclay)
- Measurement of W/Z production ratio as a function of Jet transverse energy
- Most of experimental systematics cancel in ratio
- Analysis of μ channel
- ATLAS conference note in approval phase
- Numerous presentations in ATLAS meetings

$$R_{jets} = \frac{\sigma(W + 1\text{-jet})}{\sigma(Z + 1\text{-jet})}$$



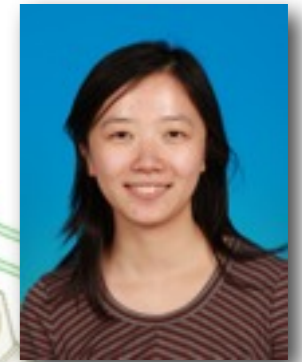
Muon detector description & Higgs search

- Thesis of **XIAO Meng/肖朦**
(Nanjing University), CEA grant,
started Oct. 2010
 - Thesis adviser : S. Hassani
(CEA-Saclay)
- X-ray tomatography data
measurements implementation
in muon spectrometer
geometry description
- Higgs boson search in the WW
fully leptonic channel

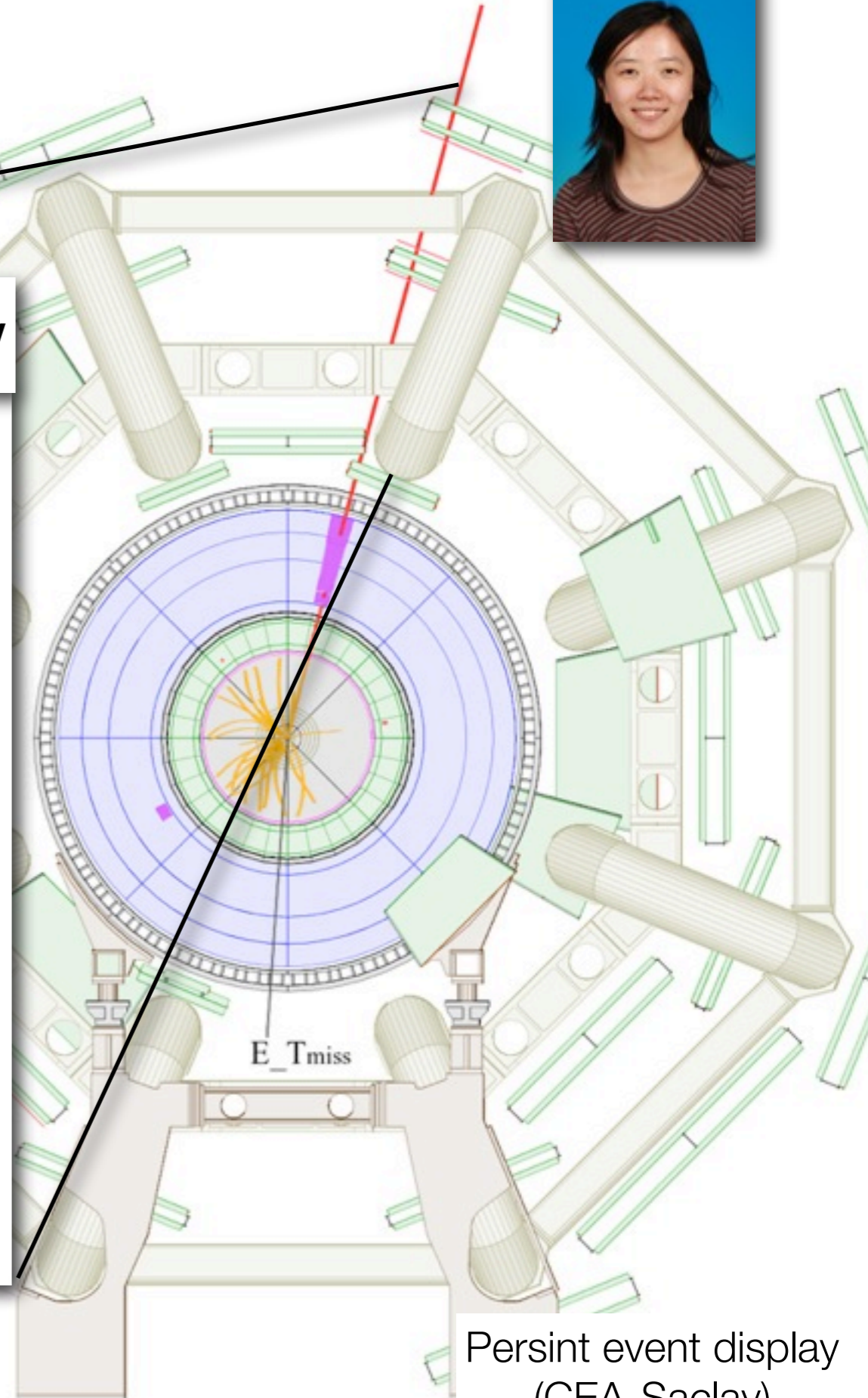
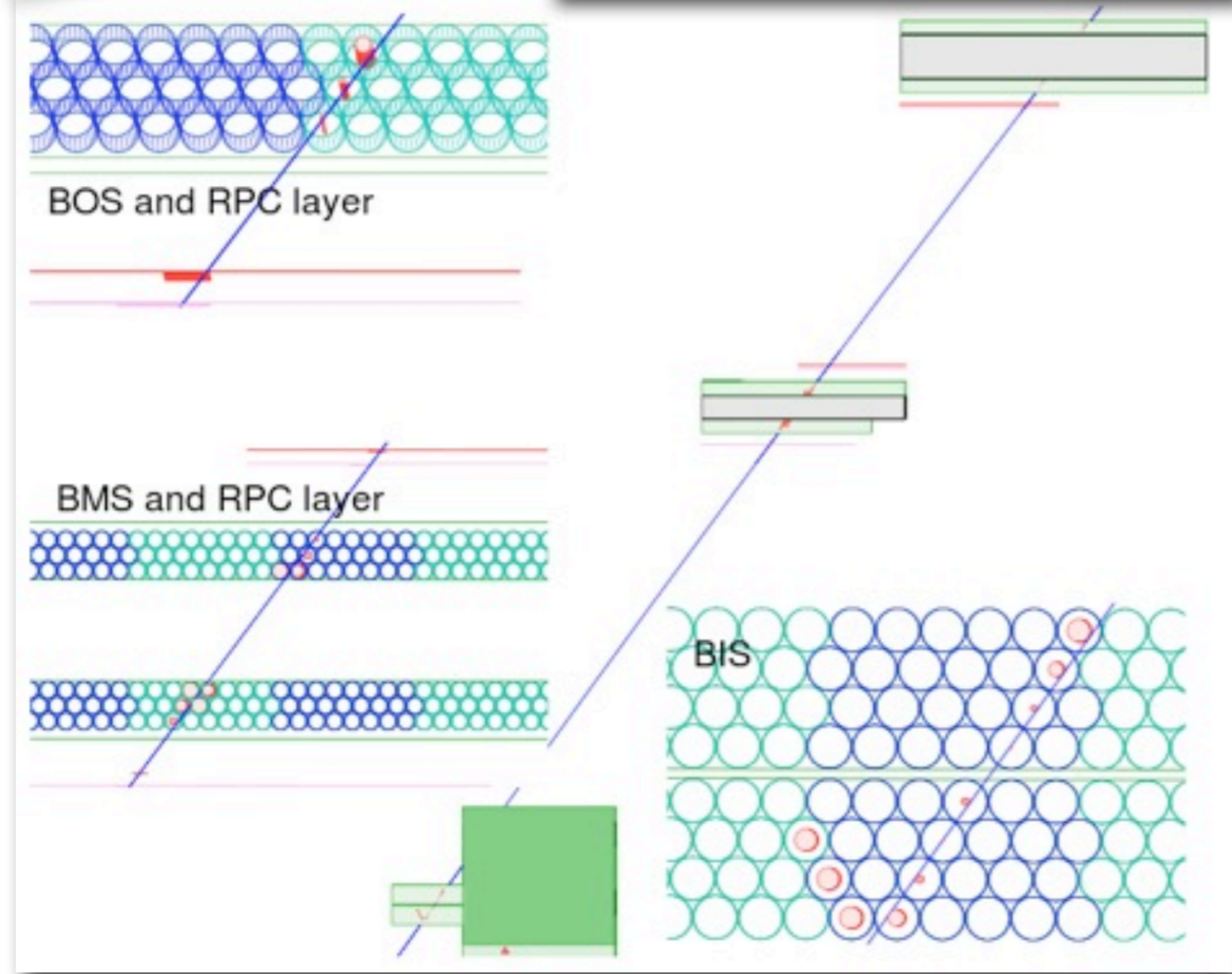


Persint event display
(CEA-Saclay)

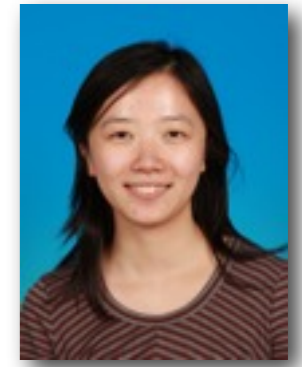
Muon detector description & Higgs search



Longitudinal view

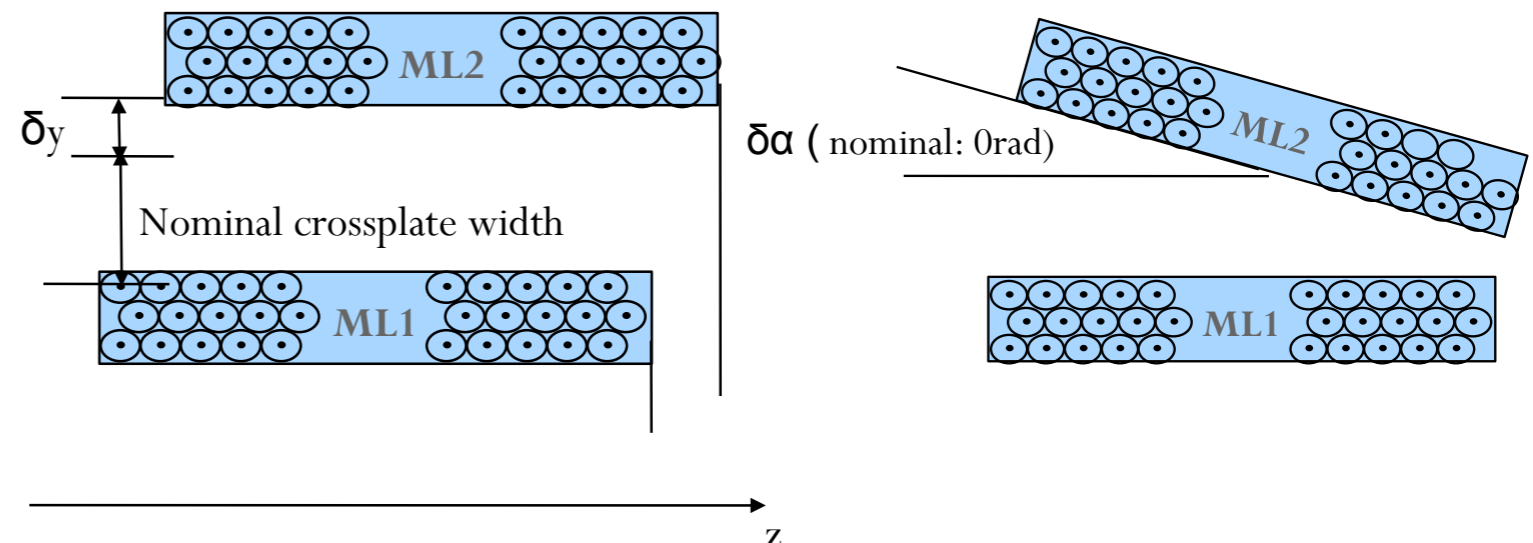
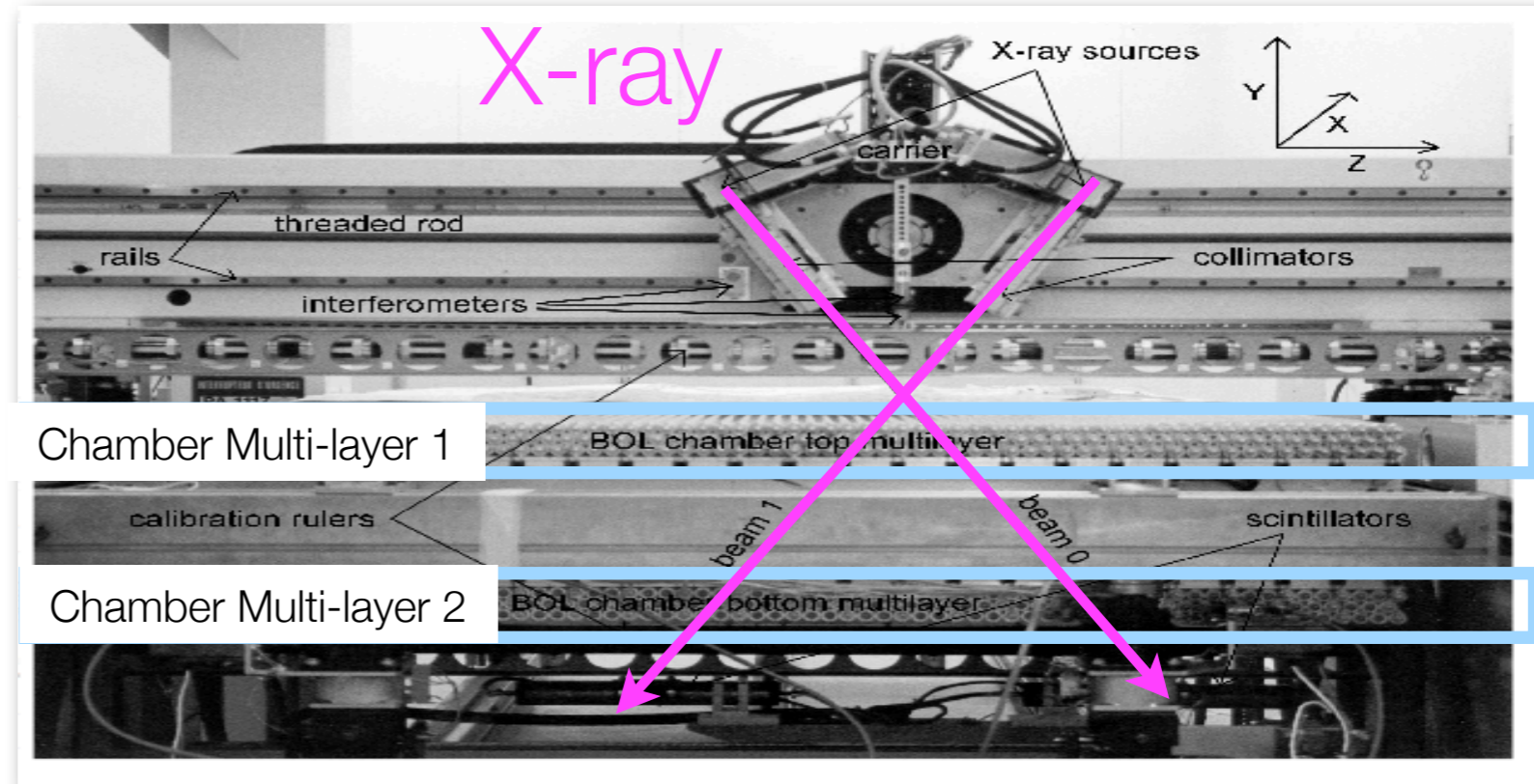


Persint event display
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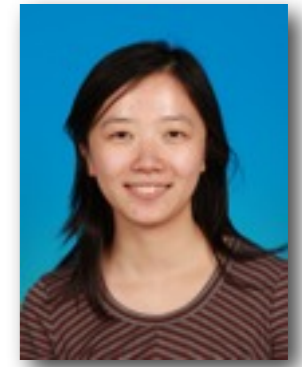


Muon detector geometry description

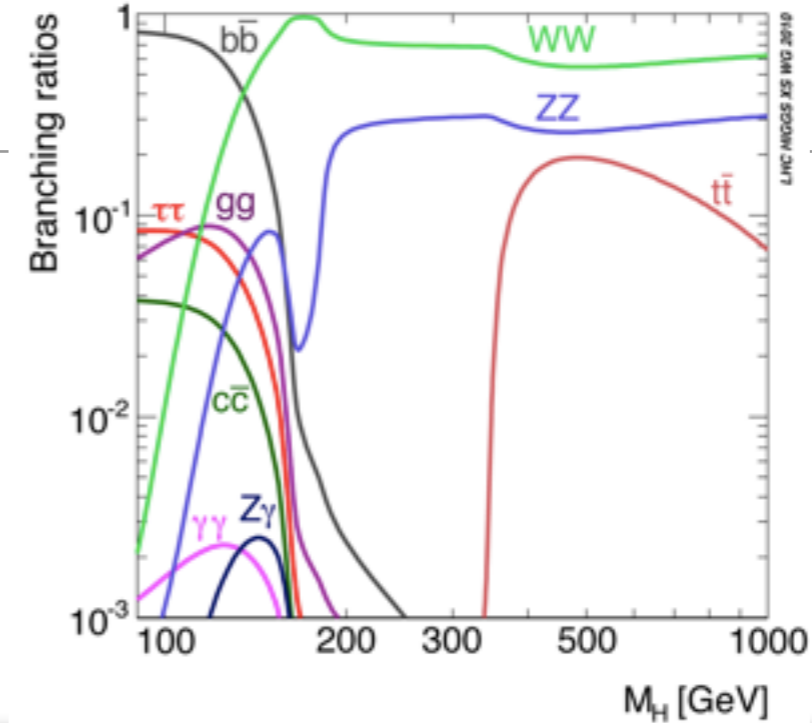
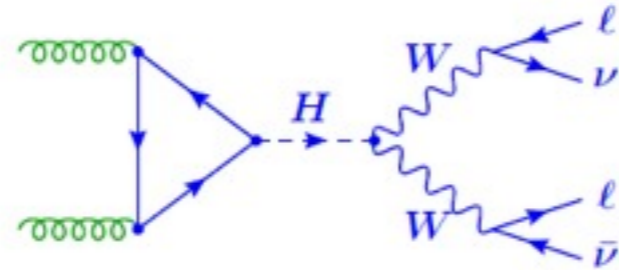
- Tube positions measured in local (y,z) system by X-ray spectroscopy before ATLAS installation, never fully analyzed due to lack of time/manpower
- Determination of translations and rotations of multilayers within chambers to be entered into detector geometry description
- Improvements in momentum resolution for high P_T tracks



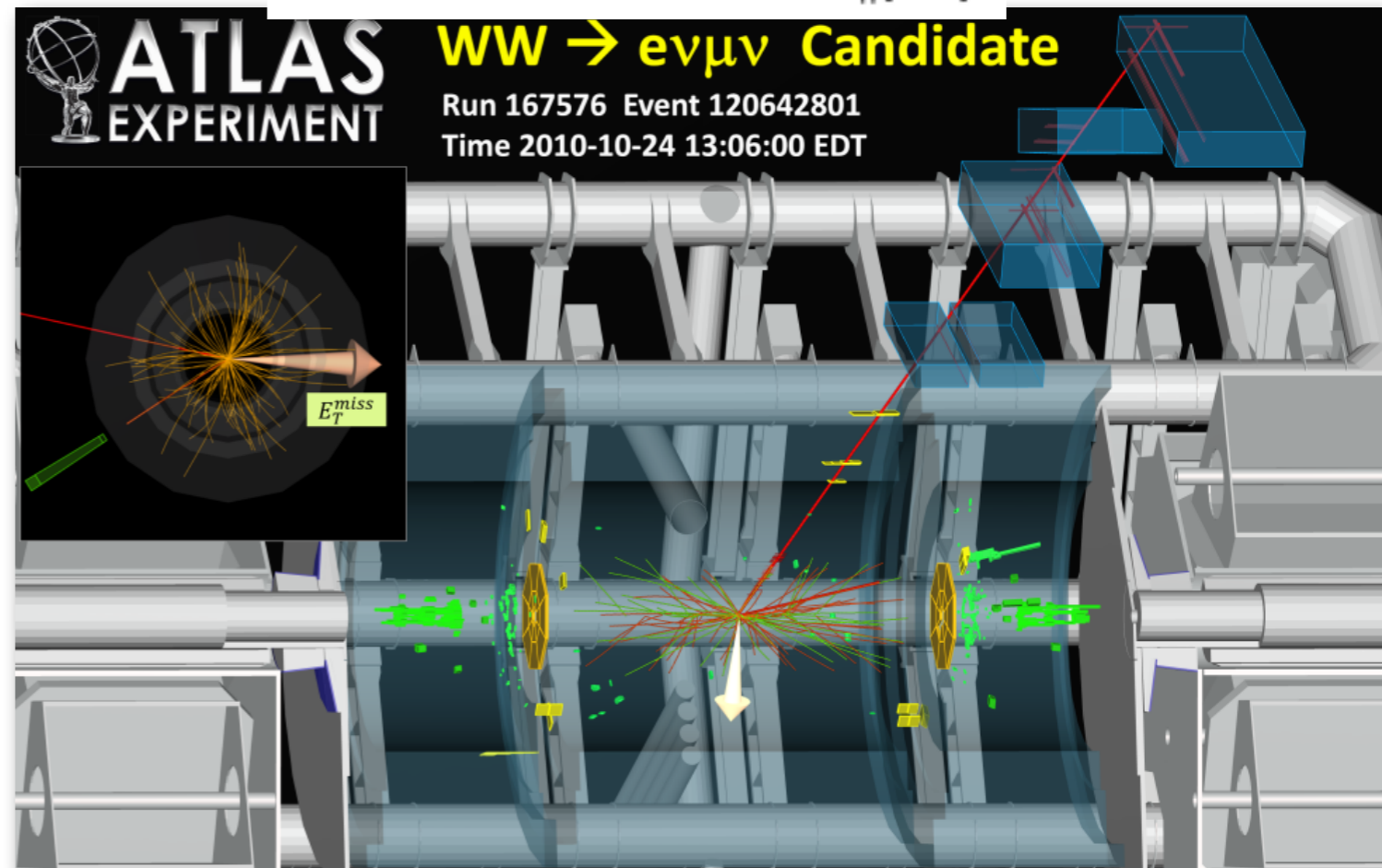
Higgs search



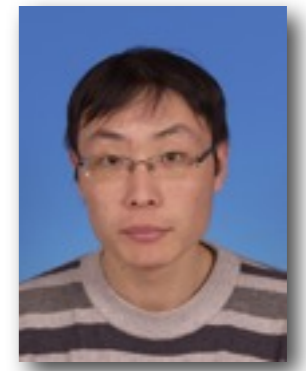
$$gg \rightarrow H \rightarrow WW \rightarrow l\bar{\nu}l\nu$$



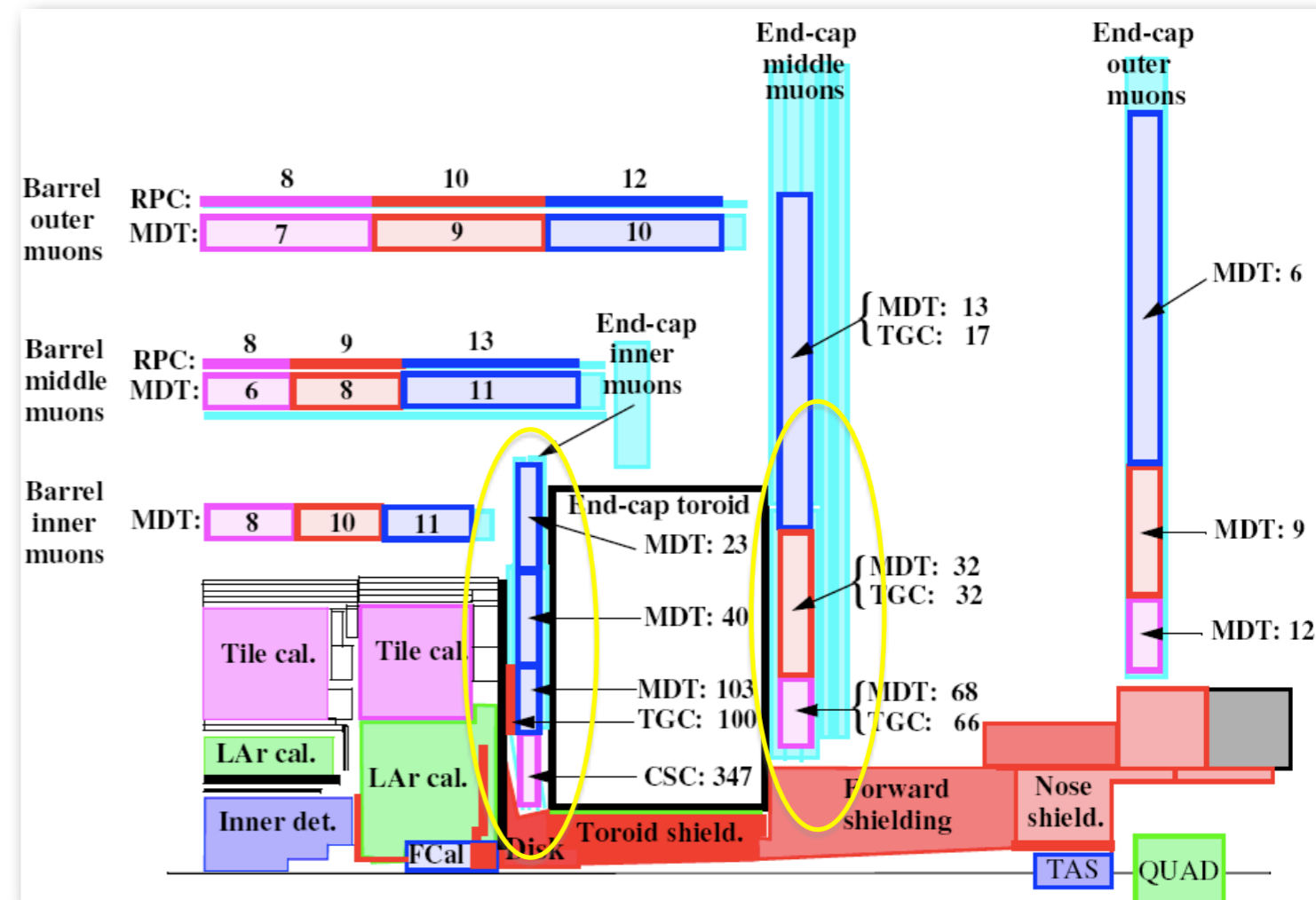
- $H \rightarrow WW \rightarrow ll \nu\nu$
- Precise missing E_T measurement required
- Thesis work :
 - Improvement on E_T resolution : contribution to missing E_T from muon energy loss
 - Improvement on lepton selection efficiency and isolation (pileup)



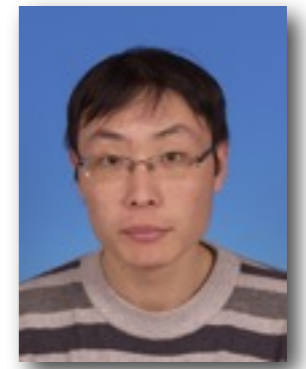
LHC upgrade - micromegas



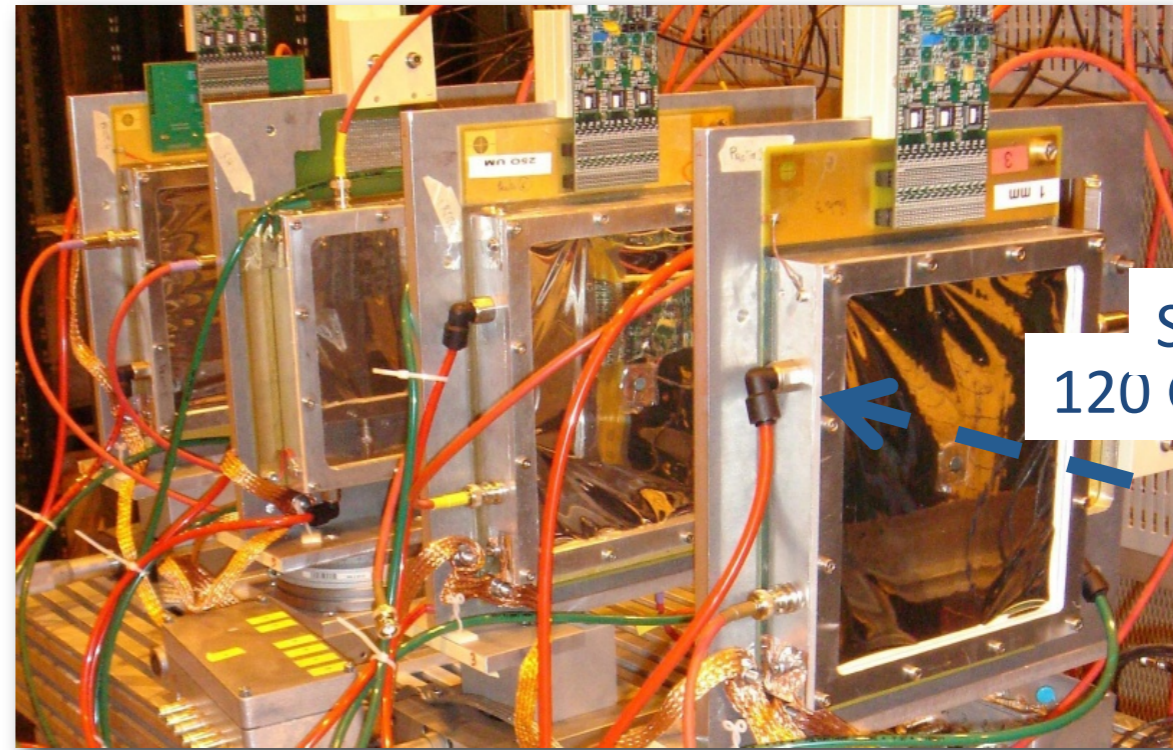
- **WU ShuoXing/吴硕星** (USTC student), spend 6 months at Saclay in 2010
 - Work done in collaboration with P. Colas (CEA-Saclay)
- LHC Upgrade program at high luminosity
 - Replacement of low angle TGC chambers by micromegas chambers
 - Within MAMA collaboration
- Detailed presentation of the project at 2010 FCPPL workshop



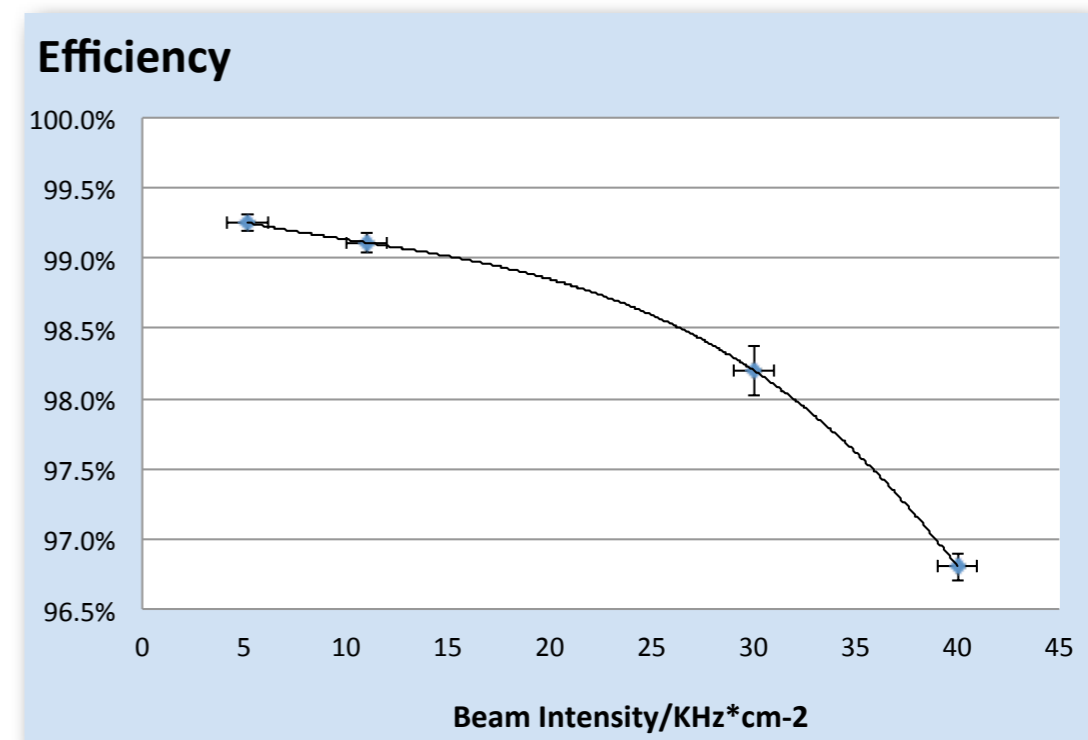
Micromegas Autumn 2010 test beam



- Improvement of telescope resolution
- Results :
 - Resolution about 100 μm and
 - Drop in efficiency $< 3\%$ for 0.4 $\text{M}\Omega/\text{square}$ resistive strip chambers even at very high beam intensity
- New project leader for ATLAS upgrade at Saclay, new phase of collaboration



SPS-H6
120 GeV π^+



Summary

- Very healthy 4 years collaboration : visits, post-docs., PhD co-thesis
- First common thesis submitted this spring, another to come in 2012
- Wish to expand the collaboration through more integrated cooperations at group level :
 - Common technical projects (LHC upgrade)
 - Common analyses

Summary

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謝謝