

# ATLAS ACC/CEA collaboration (on particle physics)

Eric Lançon (CEA-Saclay/Irfu)



**5th France China Particle Physics Laboratory Workshop**  
March 2012, 21-23 - Orsay-Saclay  
*Jointly organised by Irfu (CEA) and LAL (CNRS-IN2P3)*

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The bottom of the poster features a row of logos for the participating institutions: CEA, Irfu, CNRS-IN2P3, LAL, Université Paris Sud, and P210.

# ATLAS ACC/CEA collaboration since beginning of FCPPL

*Beijing Dec. 2006*



***Pr. H. Chen***

***Pr. F. Le Diberder***

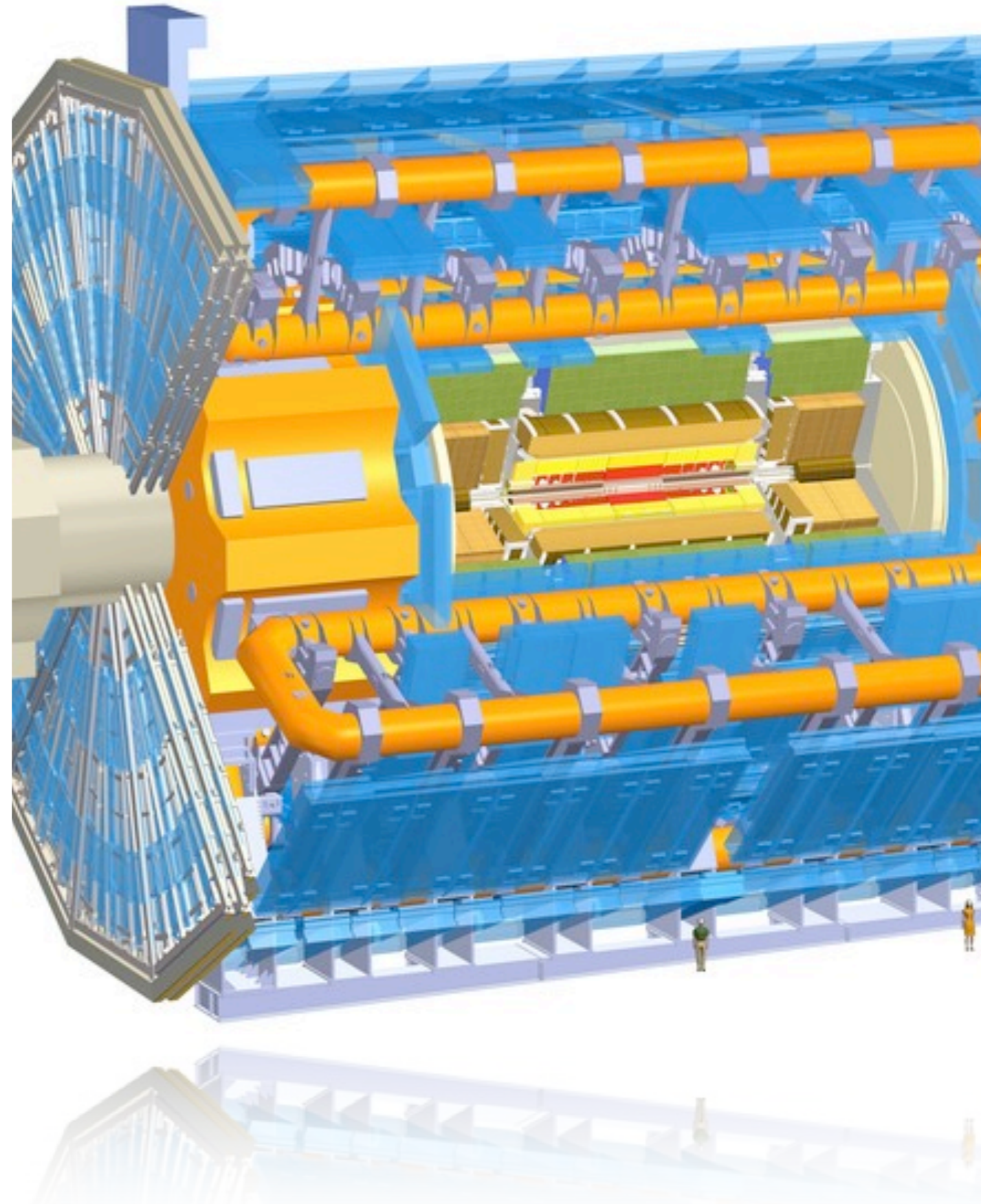
***B. Mansoulié***






# The ATLAS group of CEA-Saclay/Irfu

- ~40 people (physicists & post-docs)
- One of the founder institutes of ATLAS
- Involved in design and construction of
  - Electromagnetic calorimeter
  - Muon spectrometer
  - Torroidal magnet
- Physics with leptons



# ATLAS activities at CEA-Saclay/Irfu

- Electromagnetic calorimeter trigger
- Muon reconstruction software
- Magnetic field map
- Muon alignment
- Grid & computing 
- LHC upgrade

*Common tools for analysis*

- Standard Model



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

- B tagging

- Higgs searches



- 4-leptons

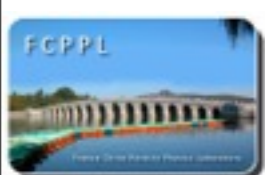
- WW

- Top quark physics



- t quark mass, ttbar cross-section

- Exotics ( $Z'$ ,  $I^*$ , ...)



# ATLAS thesis at CEA-Saclay/Irfu

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- Since 2008, 3 Chinese students joined the group

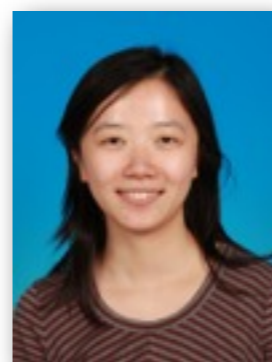
- **YU Jie/俞杰 : 2008 - 2011**



- **XU Chao/徐超 : 2009 - 2012**



- **XIAO Meng/肖朦 : 2010 - 2013**

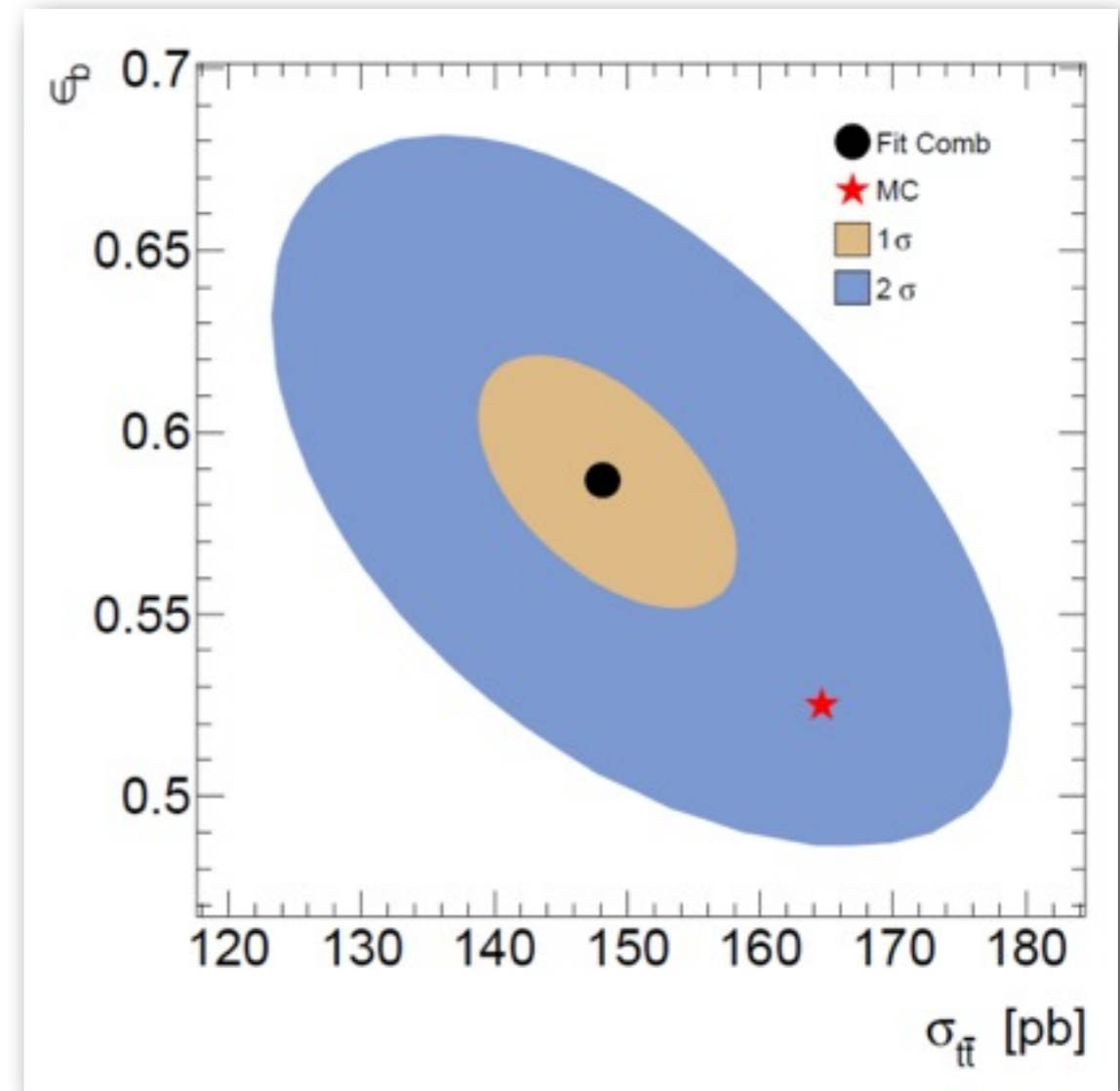




# Top quark pair production cross-section measurement



- Co-Thesis of **YU Jie/俞杰** (Nanjing University), Oct. 2008 - to May 2011
  - Supervisors : S. Chen (Nanjing), B. Mansoulié (CEA-Saclay)
  - Advisor : J. Schwindling (CEA-Saclay)
- **Subject:** Measurement of Top Pair Production Cross-Section in lepton + jets Channels in ATLAS at 7 TeV
- **Original work :** simultaneous **b-tagging efficiency** /  $\sigma_{t\bar{t}}$  measurement using 2010 data



Detailed presentation at 2010 & 2011 FCPPL workshops  
Contributions to 3 internal and 2 conference ATLAS notes



# YU Jie's PhD thesis

Now postdoc position with Oklahoma State University



- Thesis defended on May 15th, 2011, at Nanjing University, first PhD thesis of China-CEA cooperation



**THESIS**  
presented by  
**Jie YU**  
to obtain the degree of  
  
Doctor of Philosophy of Nanjing University and  
University of Paris Sud 11 Orsay (Particle, Noyaux, Cosmos (ED 517))  
  
**Measurement of Top Pair Production  
in 1 + jets Channels in ATLAS at  $\sqrt{s} = 7$  TeV**  
  
Under the direction of:  
  
Pr. Shenjian Chen  
Dr. Bruno Mansoulié  
  
Defense 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  
  
With an external report by: Dr. Arnaud Lucotte  
  
Thesis prepared at IRFU / SPP / CEA-Saclay and  
the department of physics in Nanjing University

Available at: <https://cdsweb.cern.ch/record/1357896>



# W/Z + Jets production



- Co-Thesis of **XU Chao/徐超** (USTC), Started Feb., 2009
  - Advisers : Z. Zhao (USTC), E. Lançon (CEA-Saclay)
- Measurement of W/Z production ratio ( $R_{\text{Jets}}$ ) as a function of Jet transverse energy
  - Analysis of  $\mu$ -decay channel
- **Thesis defense** : beg. June 2012 at USTC

## *Chao's presentation at FCPPL 2011*

### Introduction of $R_{\text{jets}}$

#### I. What is $R_{\text{jets}}$

$$R_{\text{jets}} = \frac{\sigma_{W+1\text{-jet}}}{\sigma_{Z+1\text{-jet}}}$$

#### II. Why $R_{\text{jets}}$ interesting

- ✓ By measuring  $R_{\text{jets}}$  many systematic uncertainties present in the V+jets analyses cancel or are significantly reduced, small errors allow precise comparison with theoretical predictions
- ✓ Measurement of  $R_{\text{jets}}$  in various kinematics and topological regimes, such as jet  $p_T$  is also sensitive to new physics

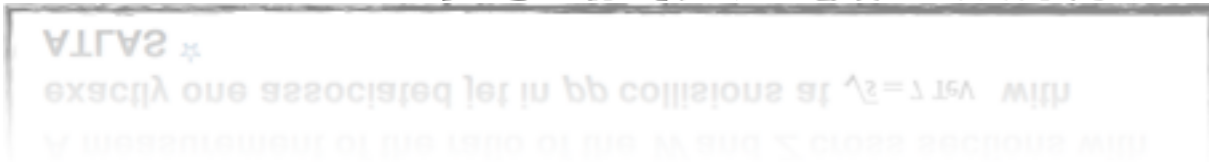
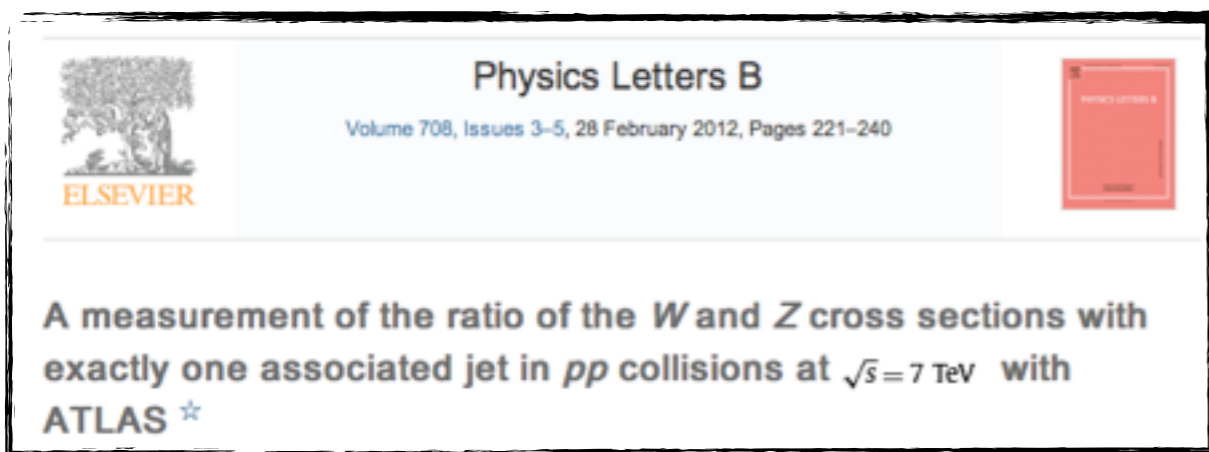




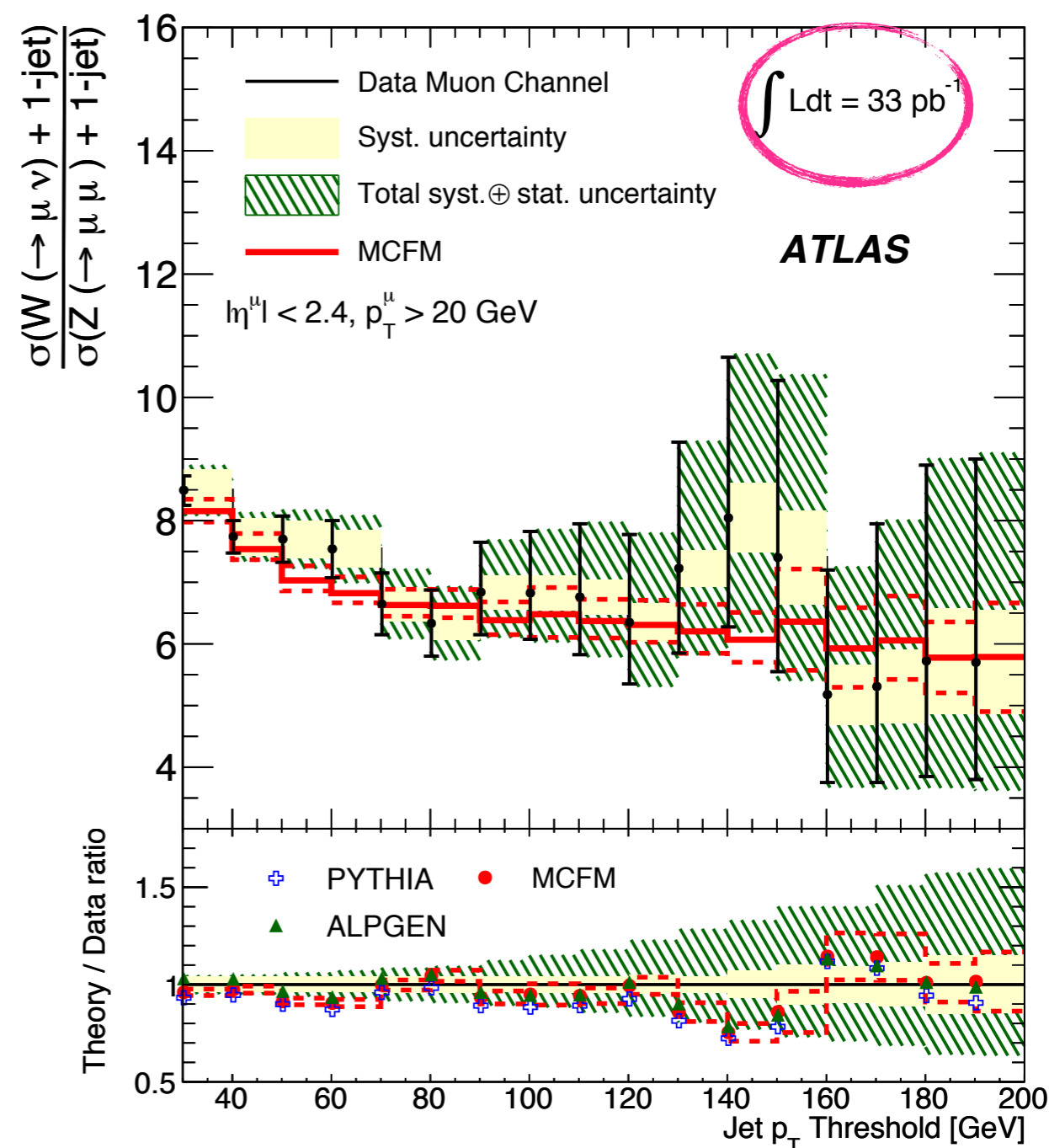


# R<sub>Jets</sub> analysis status

- XU Chao key player of the analysis based on 2010 data
- One conference note
- Paper published



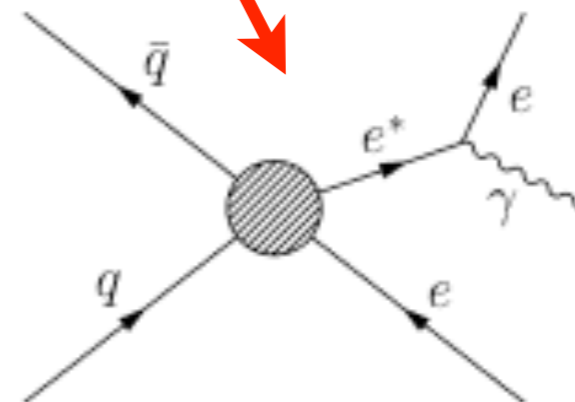
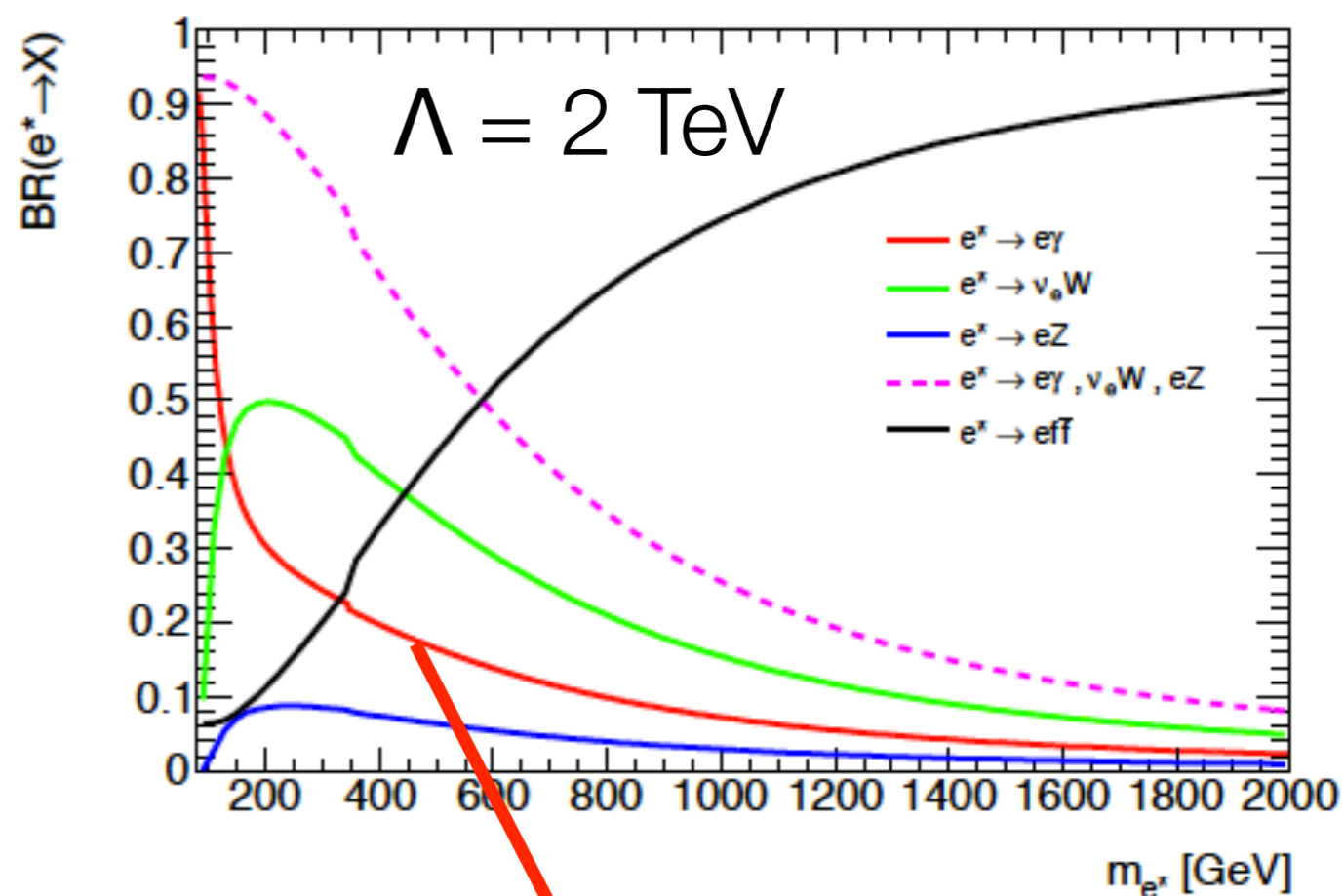
2010 data only...





# Search for excited leptons - I

- For excited lepton masses below compositeness scale,
  - production dominated by contact interaction
  - followed by subsequent electroweak decay of excited lepton into an ordinary lepton and a photon
- Production Cross section depends on compositeness scale  $\Lambda$  and  $M_{l^*}$
- Signature: 2 leptons + 1 photon

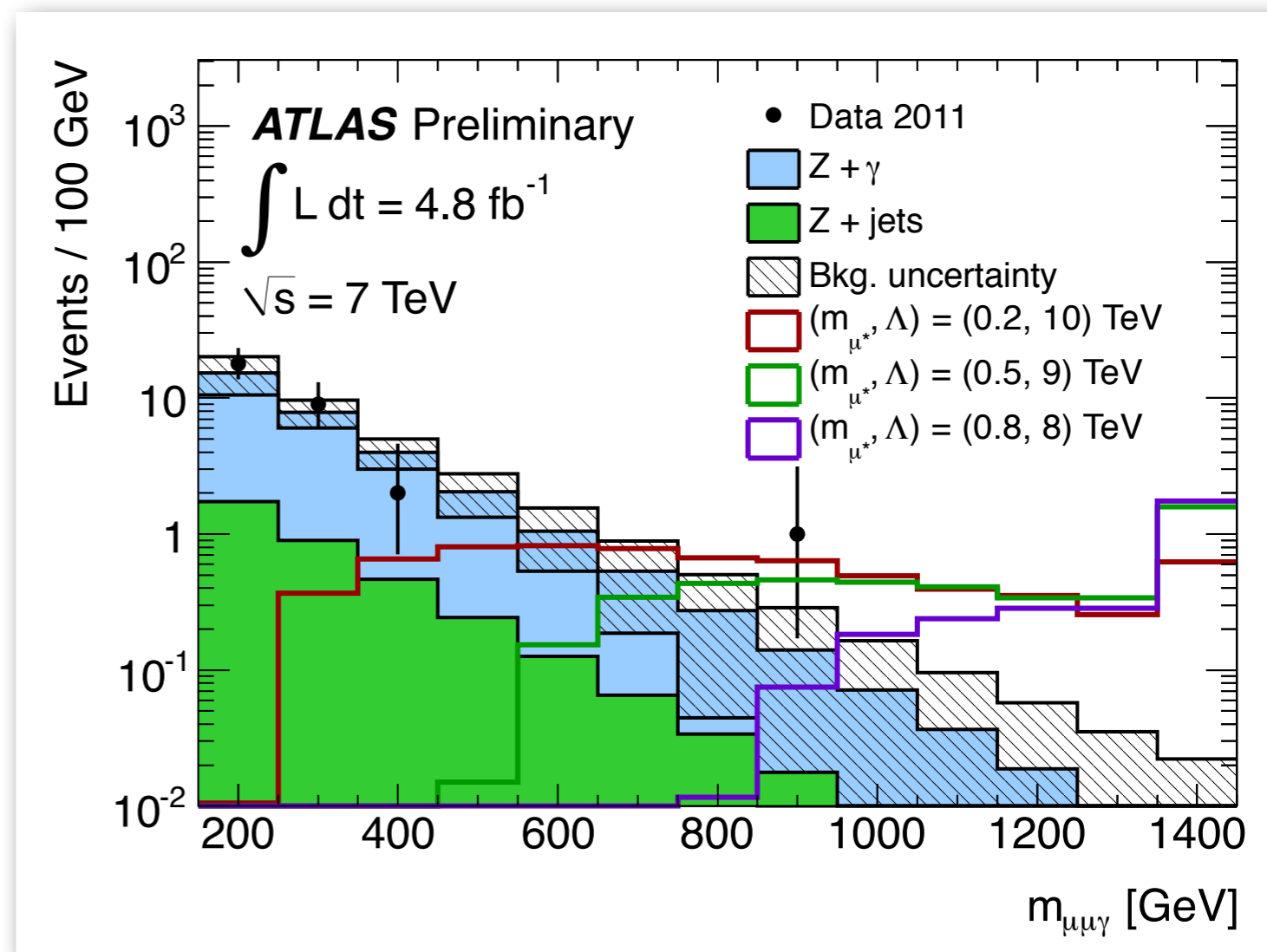






# Search for excited leptons - II

- Analysis strategy :
  - 2-body mass (lepton+photon) narrow signal width
  - 3-body mass (leptons+photon) excess if signal exist
- Distribution used: **3-body mass** to set limit
  - avoid deciding which lepton to be paired with the photon
  - still efficient to set limit when  $Ml^*$  is close to  $\Lambda$  in which case the signal width method is more significant



anti-Z selection but main backgrounds  
 $Z + \gamma$  and  $Z + \text{jets}$

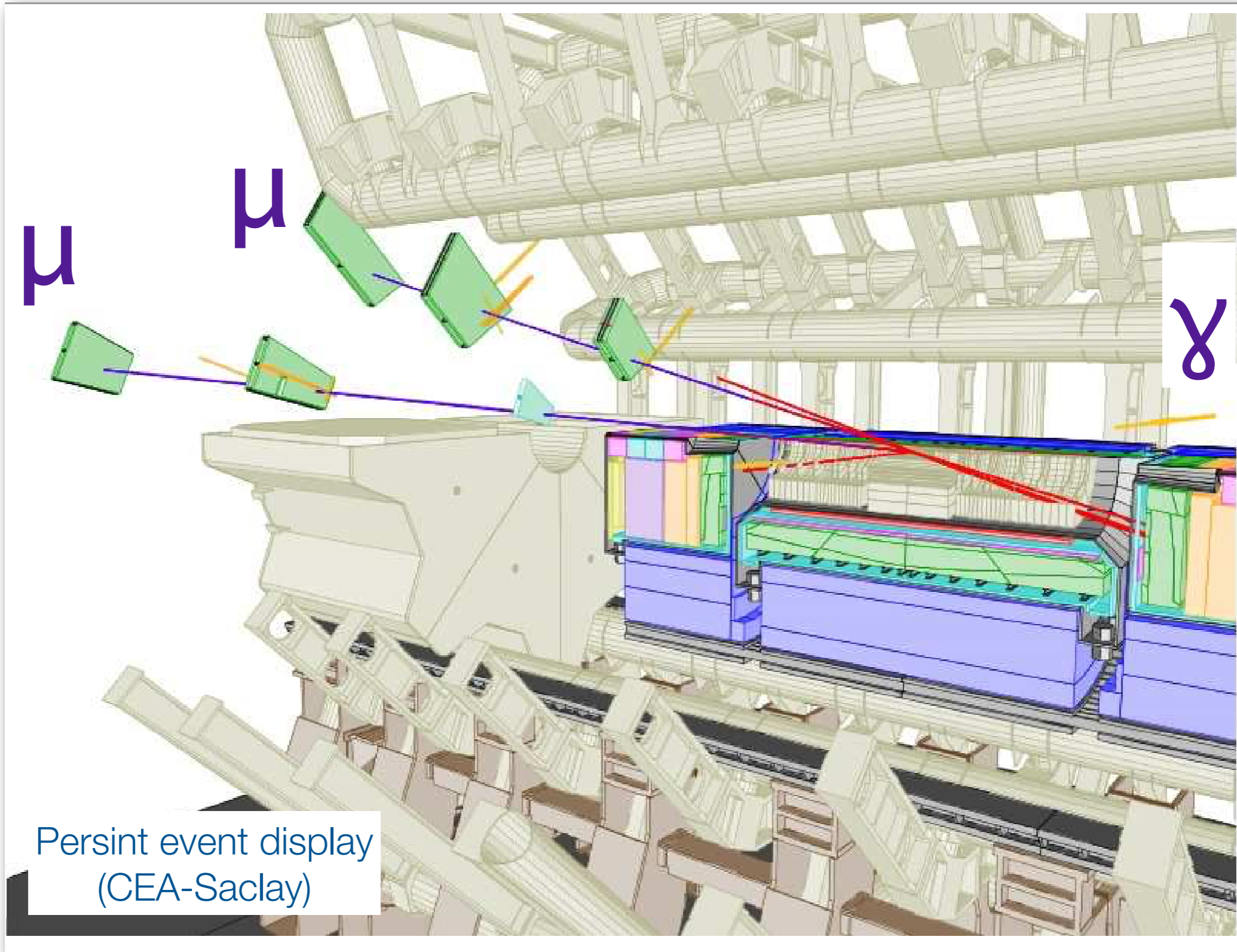


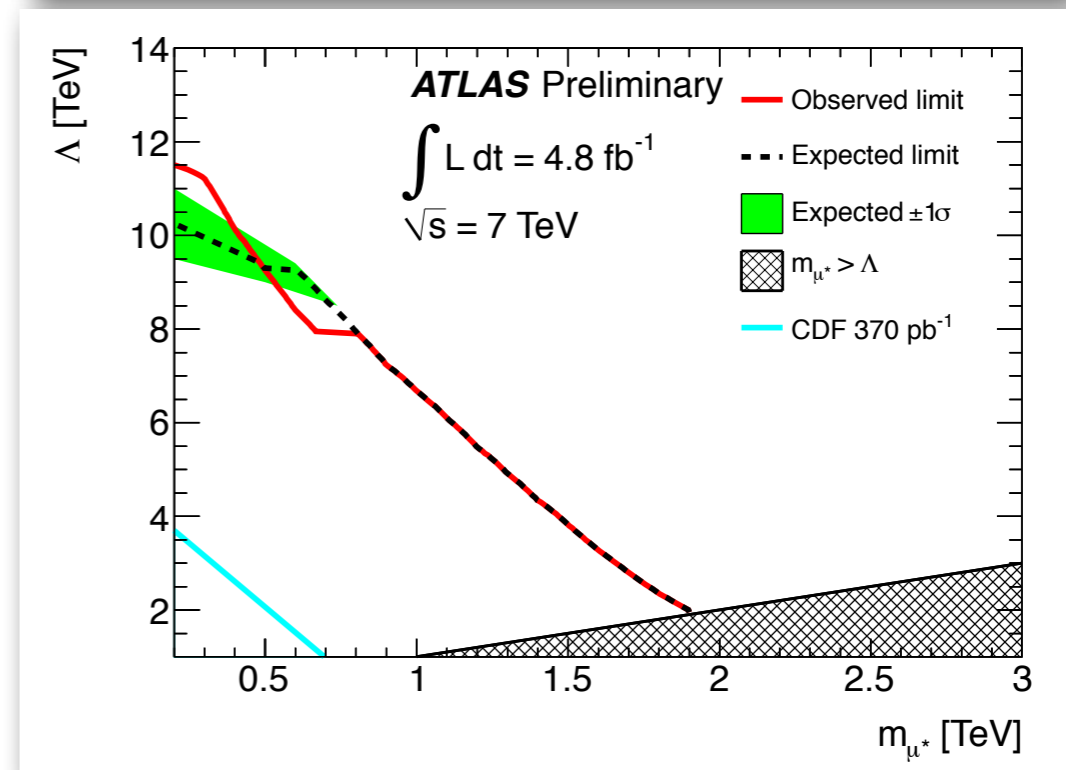
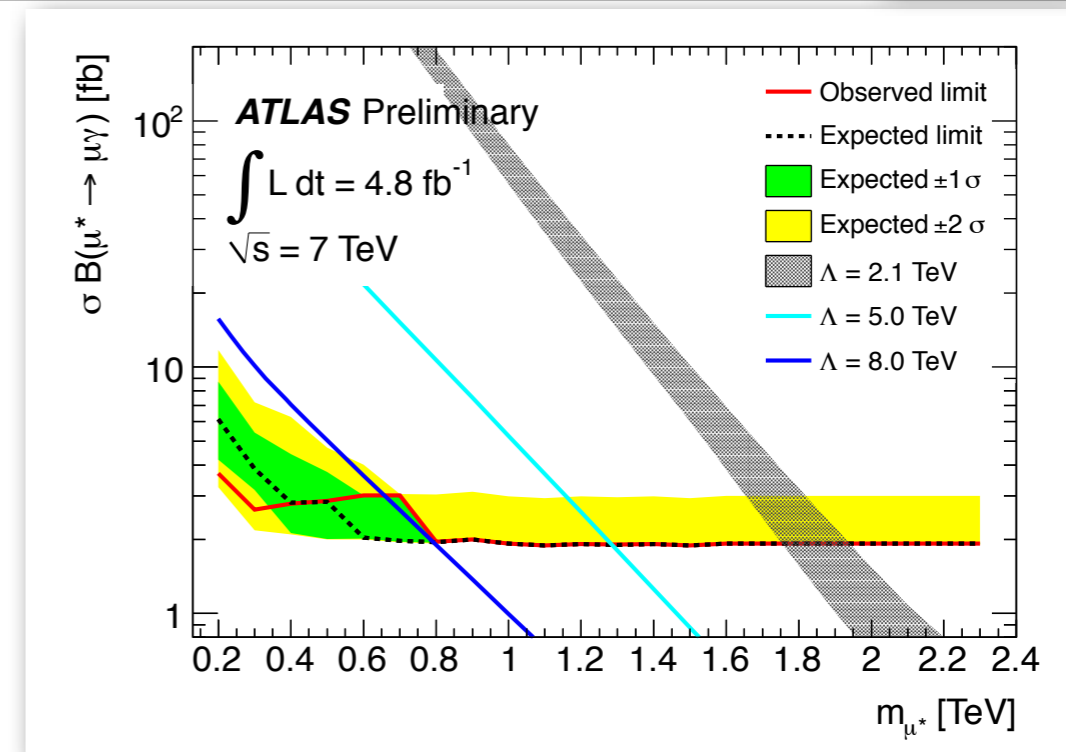
Figure 4: Display of the event containing the highest  $\mu^+\mu^-\gamma$  invariant mass: 890 GeV. The  $p_T$  of the muons and photon are: 91, 84 and 165 GeV, respectively. The dimuon mass is 165 GeV,  $m_{\mu_1\gamma} = 721$  GeV, and  $m_{\mu_2\gamma} = 491$  GeV.





# Search for excited leptons - Status

- Full 2011 data set analyzed ( $\mu$  channel)
  - 2 conference notes
  - 1 paper



Cornell University Library

arXiv.org > hep-ex > arXiv:1201.3293

High Energy Physics - Experiment

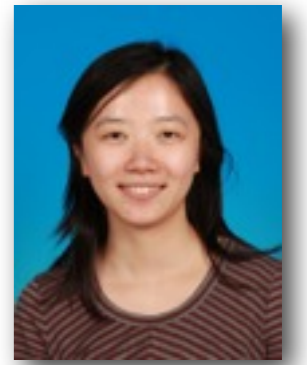
**Search for excited leptons in proton-proton collisions at  $\sqrt{s} = 7$  TeV with the ATLAS detector**

ATLAS Collaboration  
 (Submitted on 16 Jan 2012)

The ATLAS detector is used to search for excited leptons in the electromagnetic radiative decay channel  $l^* \rightarrow l + \gamma$ . Results are presented based on the analysis of pp collisions at a center-of-mass energy of 7 TeV corresponding to an integrated luminosity of 2.05/fb. No evidence for excited leptons is found, and limits are set on the compositeness scale  $\Lambda$  as a function of the excited lepton mass  $m_{l^*}$ . In the special case where  $\Lambda = m_{l^*}$ , excited electron and muon masses below 1.87 TeV and 1.75 TeV are excluded at 95% C.L., respectively.

Comments: 10 pages plus author list (22 pages total), 8 figures, 2 tables, submitted to Physical Review D  
 Subjects: High Energy Physics - Experiment (hep-ex)  
 Report number: CERN-PH-EP-2011-224  
 Cite as: arXiv:1201.3293v1 [hep-ex]

5th workshop of the France China Particle Physics Laboratory



# Muon detector description & Higgs search

- Thesis of **XIAO Meng/肖朦** (Nanjing University), CEA grant, started Oct. 2010
  - Thesis adviser : S. Hassani (CEA-Saclay)
- **Detailed** presentation on Muon Final State radiation in Drell-Yann process by Meng **next talk**



# Summary

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- Very healthy 5 years collaboration : visits, post-docs., PhD thesis
- First common thesis submitted spring 2011, another to come in spring 2012
- Wish to expand the collaboration through more integrated cooperations at group level

謝謝

