

# Collider activities at Stockholm University



P. Mermod, 20 September 2007

- **ATLAS detectors**
  - TileCal commissioning
  - Level 1 trigger
  - Hadronic calibration
- **ATLAS/DO physics**
  - Top di-lepton cross section
  - Stable massive particles



# Our team



- Lecturers/professors

- Christian Bohm
- Christophe Clément
- Sten Hellman
- Sven-Olof Holmgren
- Erik Johansson
- Kerstin Jon-And
- David Milstead
- Torbjörn Moa
- Björn Selldén
- Sam Silverstein
- Barbro Åsman

- Research scientists

- Philippe Mermod
- Jörgen Sjölin

- PhD students

- Elin Bergeås
- Daniel Eriksson
- Attila Hidvegi
- Marianne Johansen

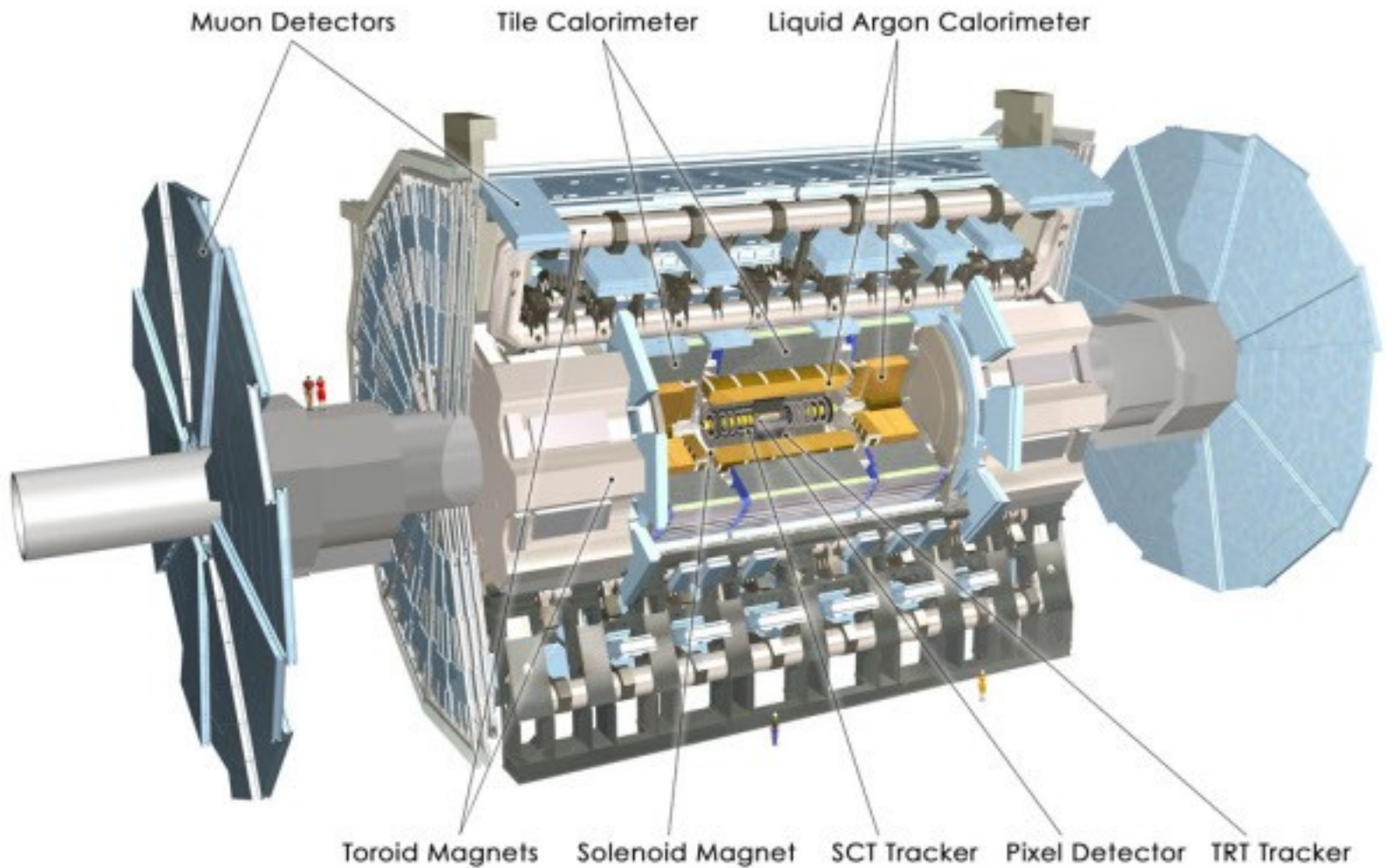
- Diploma students

- Björn Nordqvist
- Maja Rullgård
- Svante Winblad

# Large Hadron Collider

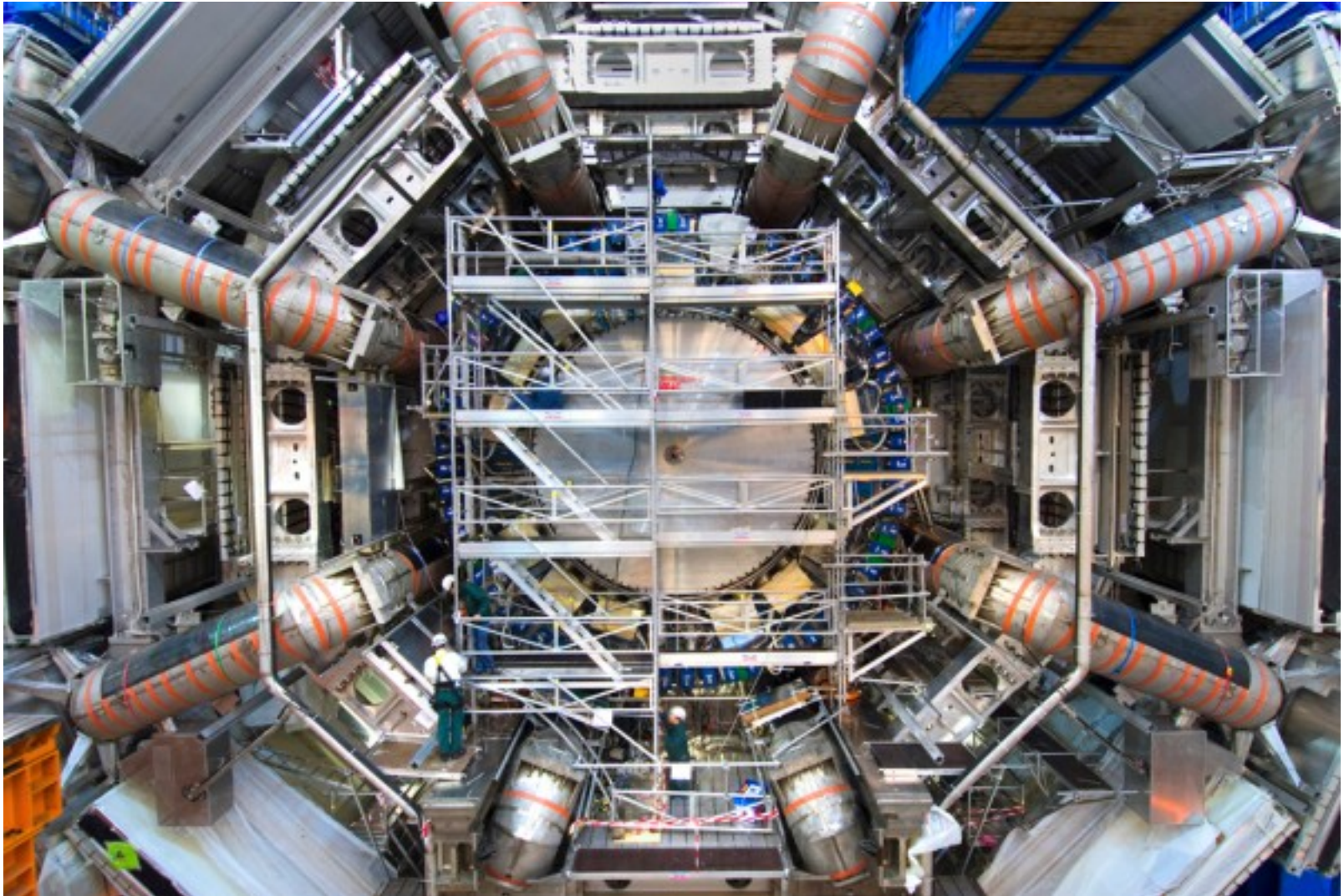


# The ATLAS experiment

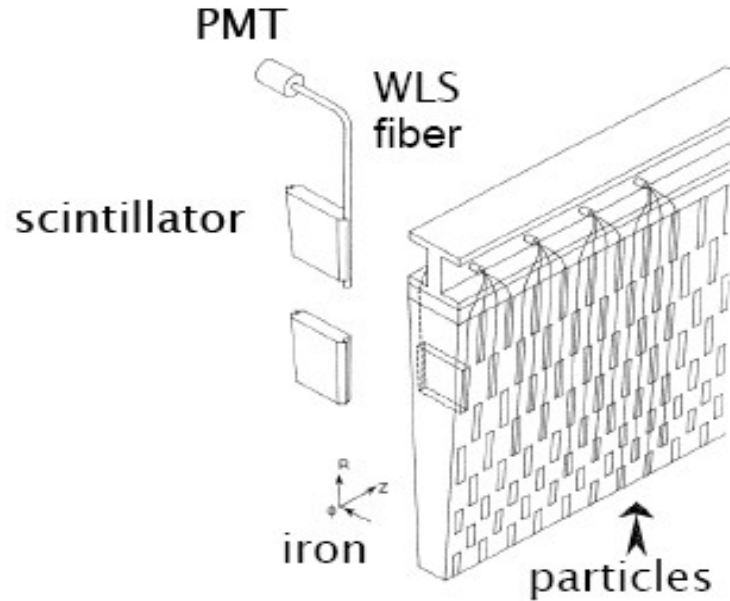
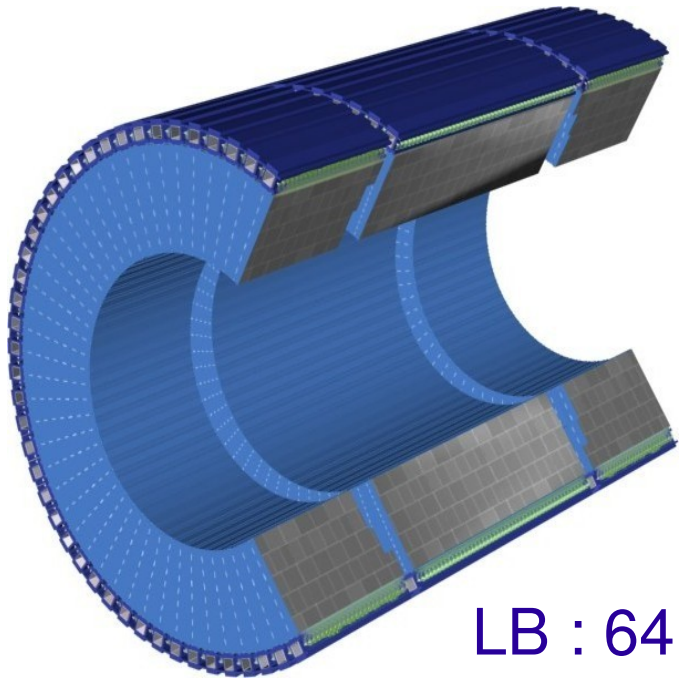




# ATLAS in year 2007



# TileCal



LB : 64 modules

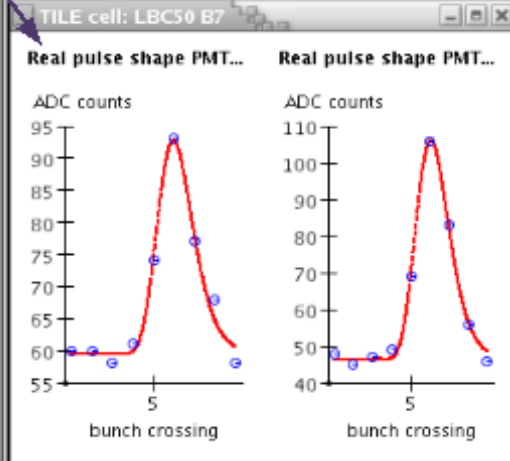
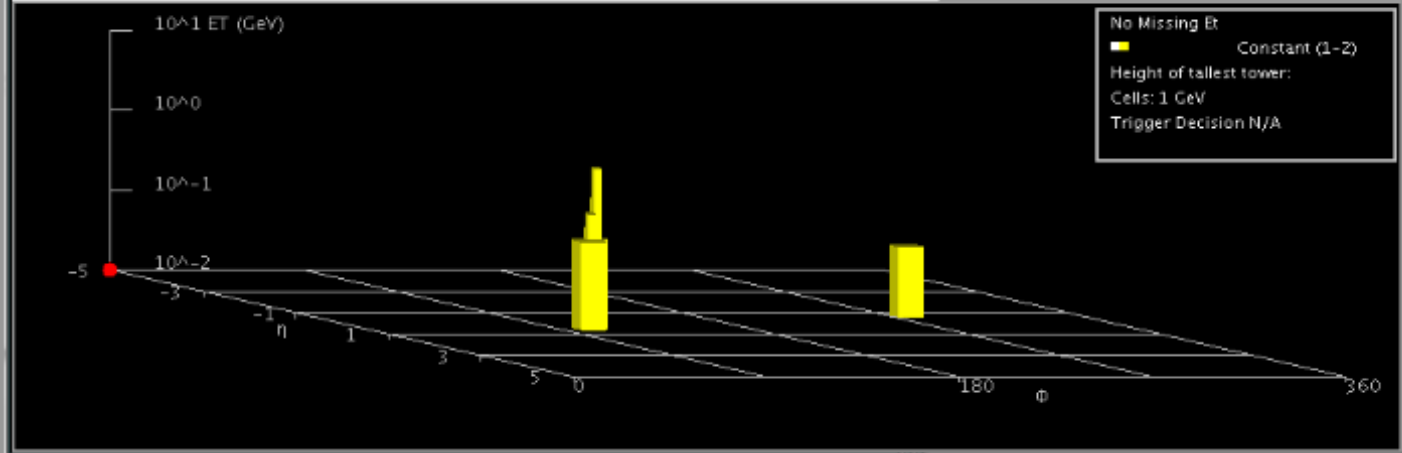
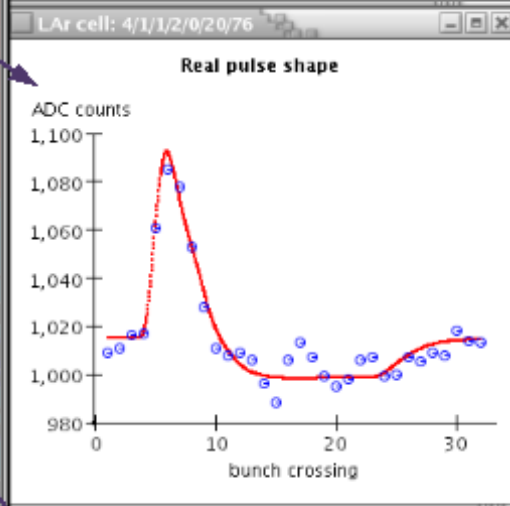
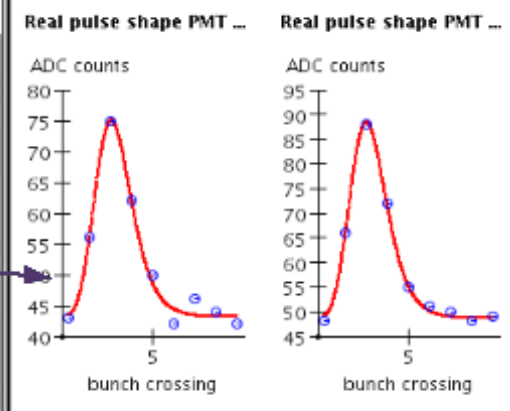
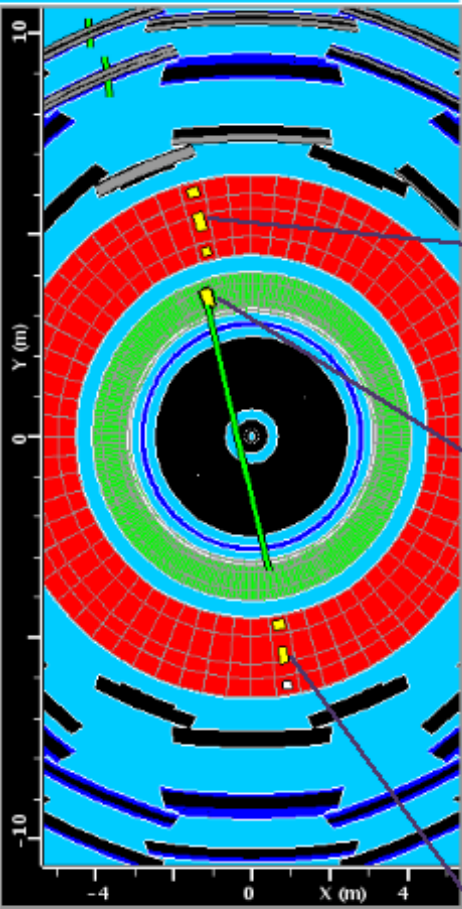
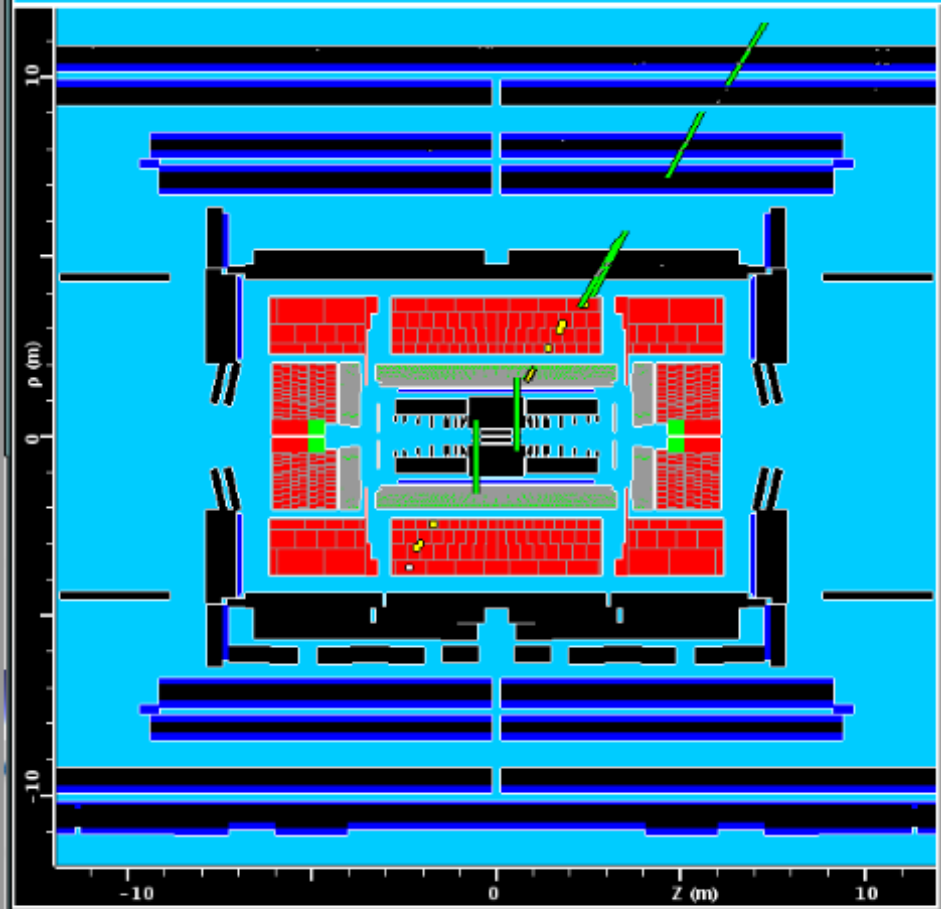
EB : 2x64 modules

**SU responsibility :**  
**2000 Digitizers**



# TileCal - Status

- All modules installed
- Taking data
  - source, laser, charge injection, cosmics
  - online monitoring
- Commissioning ongoing
  - stability/recovery, Detector Control System
  - timing equalization, synchronization
  - L1 Trigger
  - hadron and jet calibration
  - ...

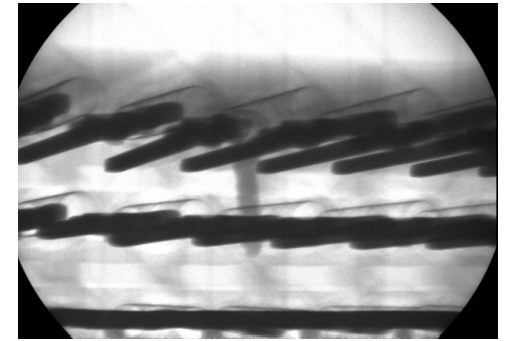
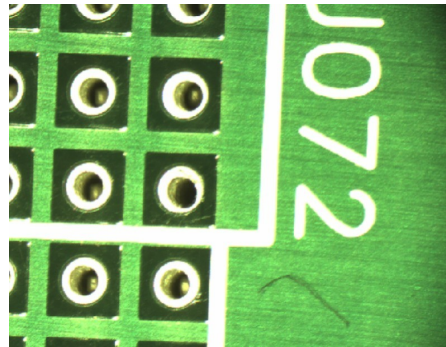




# Level 1 Calorimeter Trigger

- Hardware

- JEM processors
- processor backplanes :  
22000 pins
- Cables installed



- Monitoring

- Talk tomorrow by [Marianne Johansen](#)



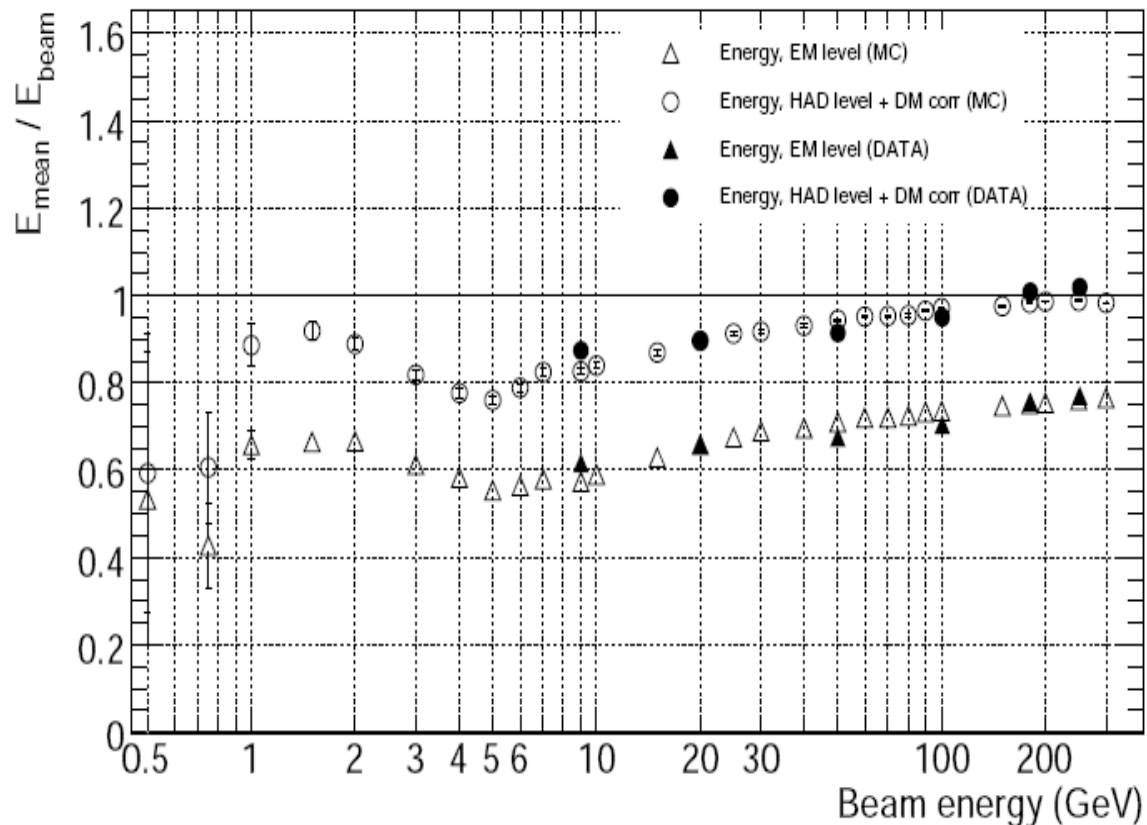
# Hadronic calibration

- **Local** method

- Apply weights at the **cell** level using cluster information
- Form larger objects
- Correct for global effects

- Test beam →

- Jet applications



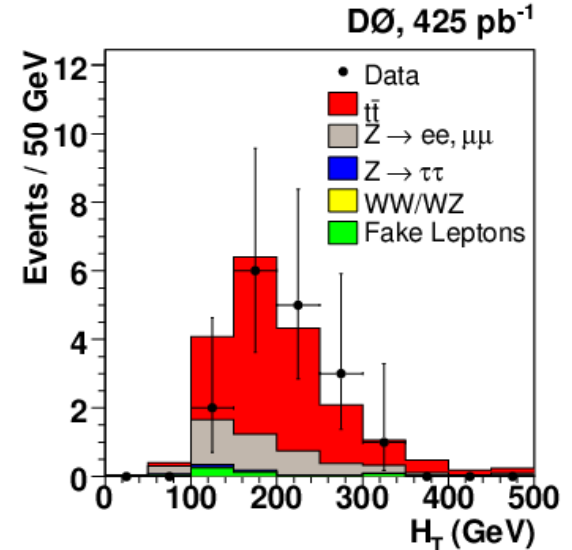
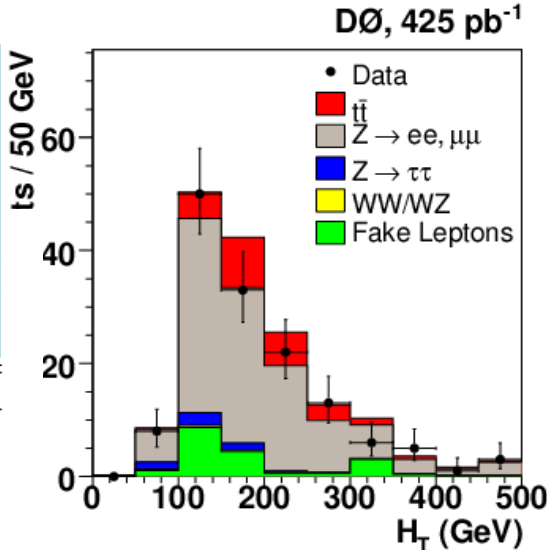
# top quark physics at Tevatron

## Top pair production in l+track

submitted to Phys. Rev. D

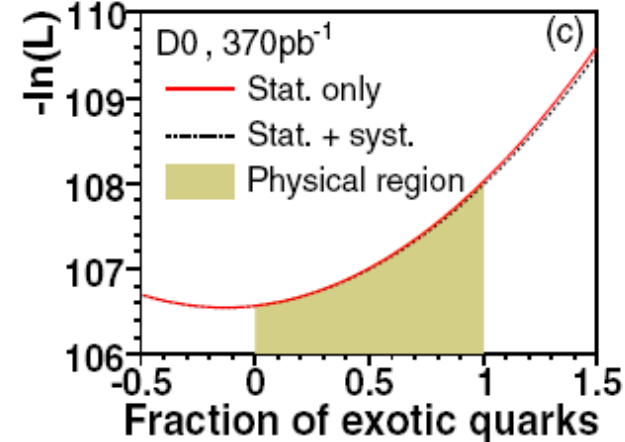
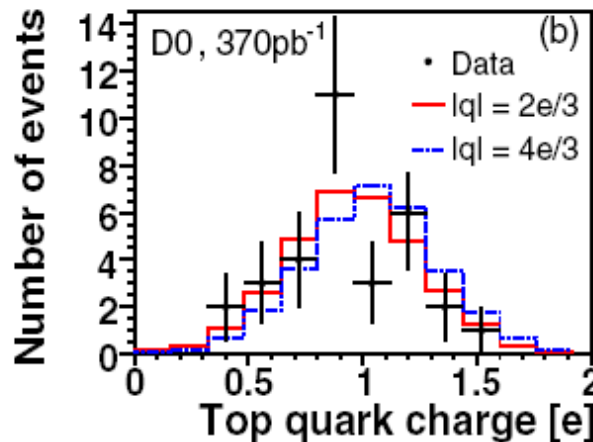
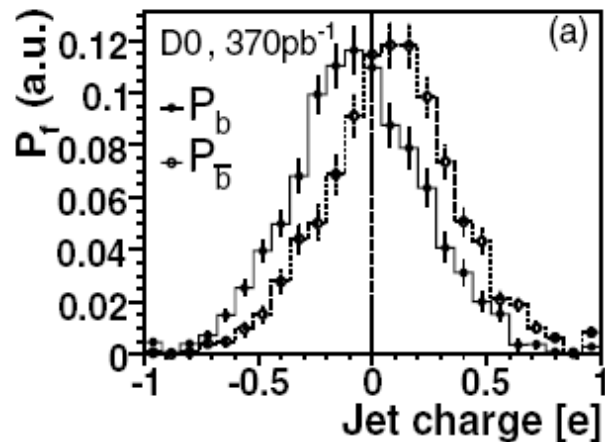
hep-ex/0706.0458v2 (2007)

Channel	$N_{\text{obs}}$	$N_{\text{bkg}}$	$\epsilon \times \mathcal{B}$ (%)	$\int \mathcal{L} dt$ ( $\text{pb}^{-1}$ )
$e\mu$	21	$4.58^{+2.56}_{-1.77}$	$0.44 \pm 0.04$	$427 \pm 26$
$ee$	5	$1.12^{+0.22}_{-0.27}$	$0.13 \pm 0.02$	$446 \pm 27$
$\mu\mu$	2	$0.67^{+0.24}_{-0.29}$	$0.10 \pm 0.02$	$421 \pm 26$
$e+\text{track}$	11	$2.85^{+0.33}_{-0.27}$	$0.27 \pm 0.02$	$425 \pm 26$
$\mu+\text{track}$	6	$2.00^{+0.29}_{-0.30}$	$0.21 \pm 0.02$	$422 \pm 26$



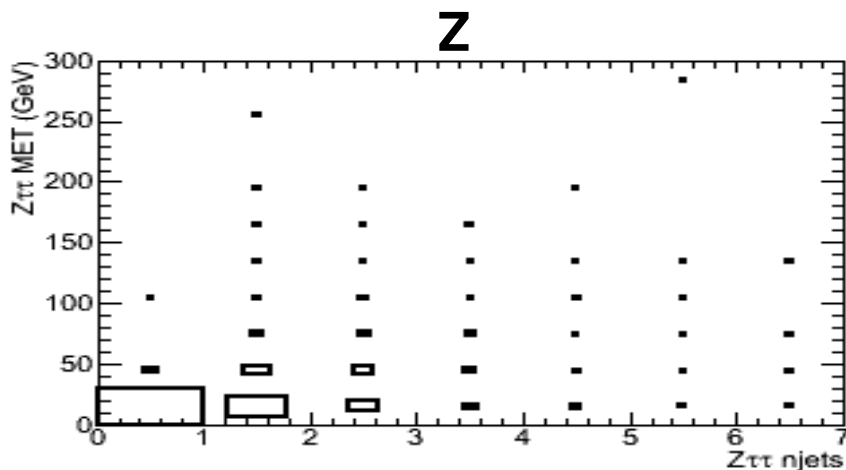
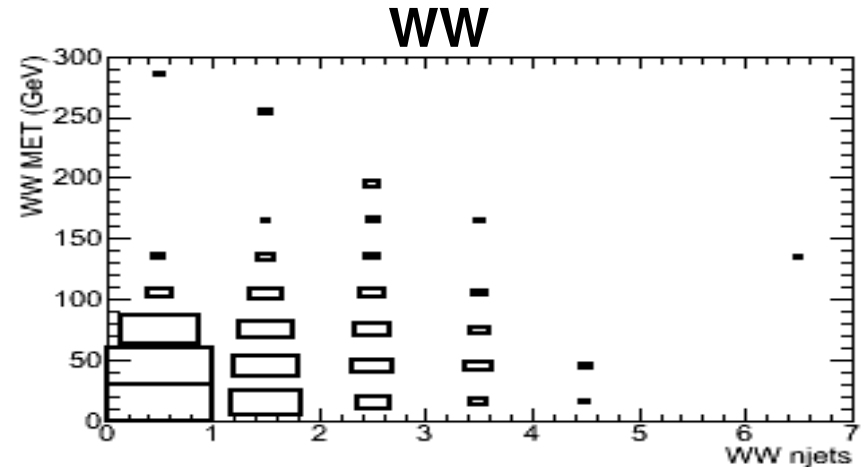
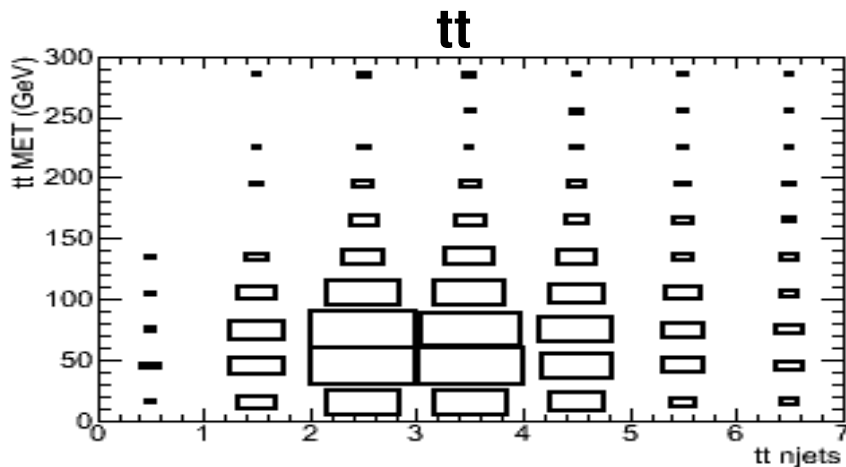
## First discrimination between Q=2/3 and 4/3 top/exotic quark

Phys. Rev. Let. 98, 041801 (2007)



# Top cross section

- Important background to SUSY/exotics  
→ must be measured early at **LHC**

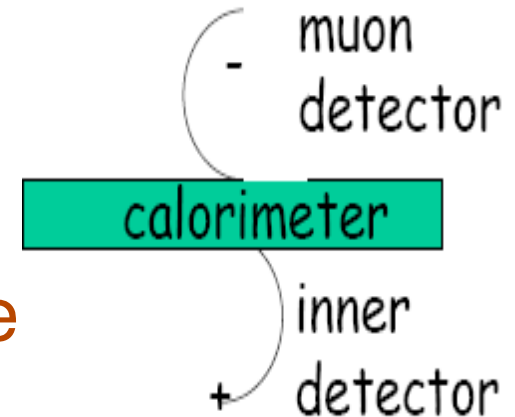


- One pair of high-pt leptons
- Inclusive measurement  
(high statistics)



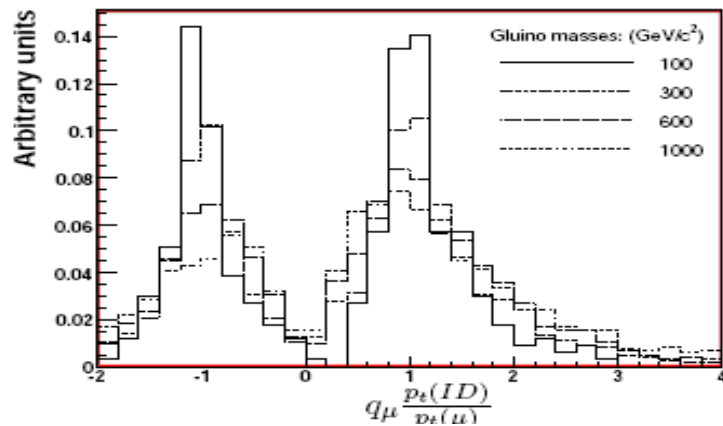
# Stable massive particles

- Stable sleptons, R-hadrons, KK-hadrons, etc.
- Look like **slow** muons with **high pt**
- Study cases : **gluinos and stops in ATLAS**
  - Pair-produced
  - Hadronize
  - Nuclear scattering
  - Gluino R-hadrons can **flip charge**
- Pythia + Geant4 (full scale)

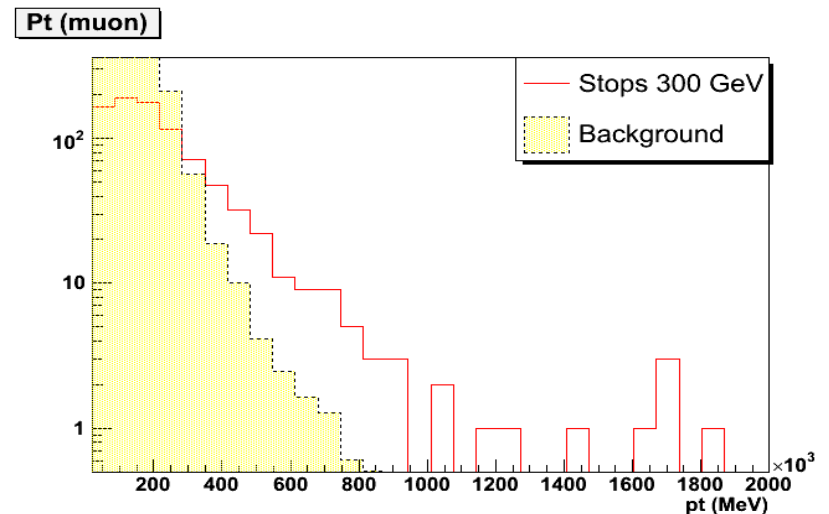
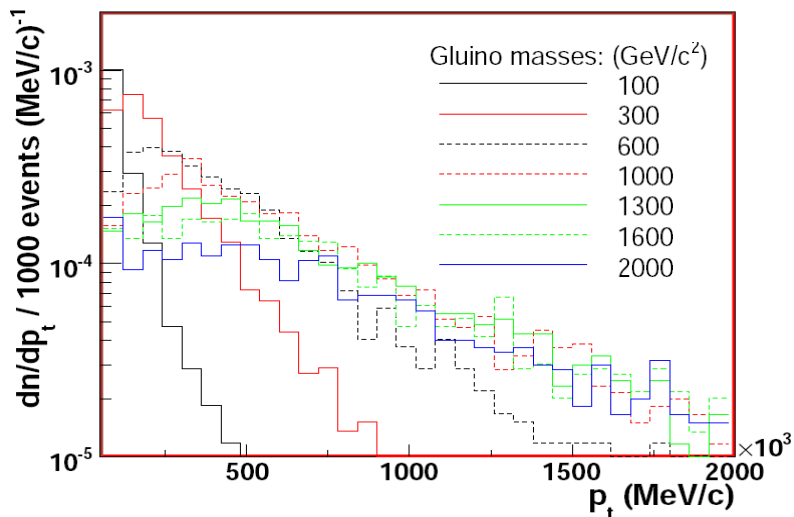
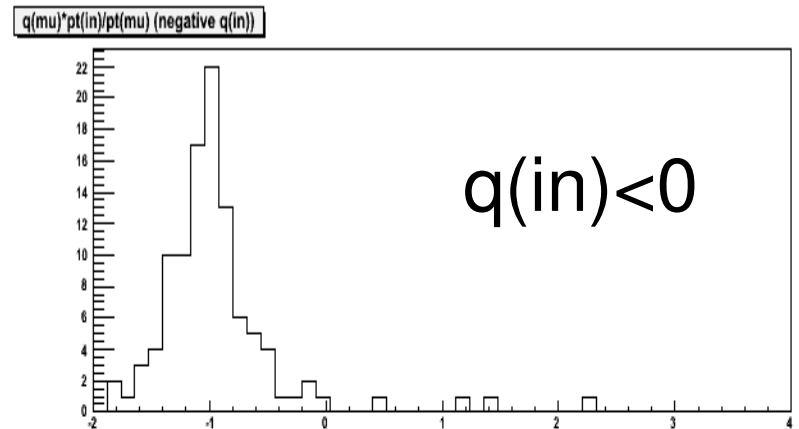


# R-Hadrons – ATLAS simulation

## Gluginos



## Stops



# Summary

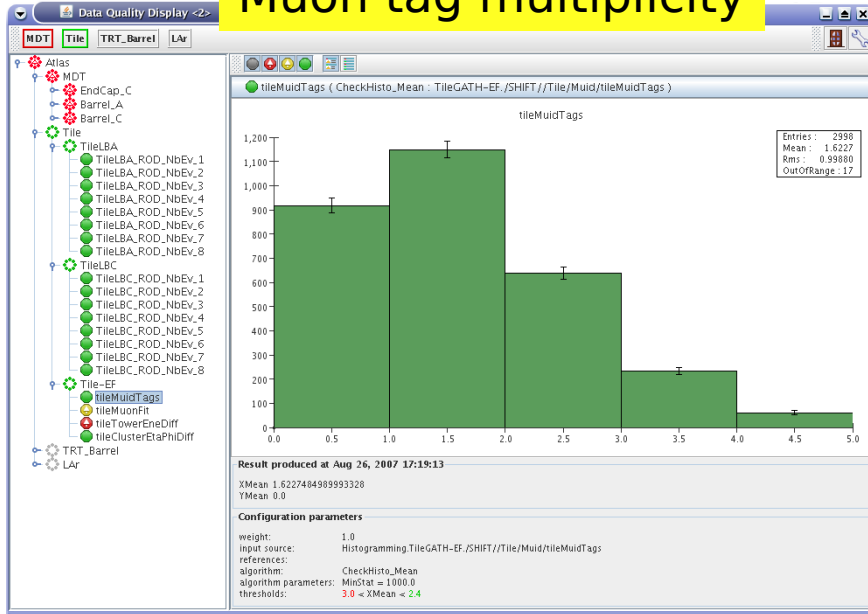
- **TileCal** is working fine
- **L1 calorimeter trigger** 75% complete
- **ATLAS** components are tested together
- **Top dilepton cross section** will be measured early at LHC
- **Stable massive particles** will be discovered up to 1 TeV if they exist

# EXTRA SLIDES

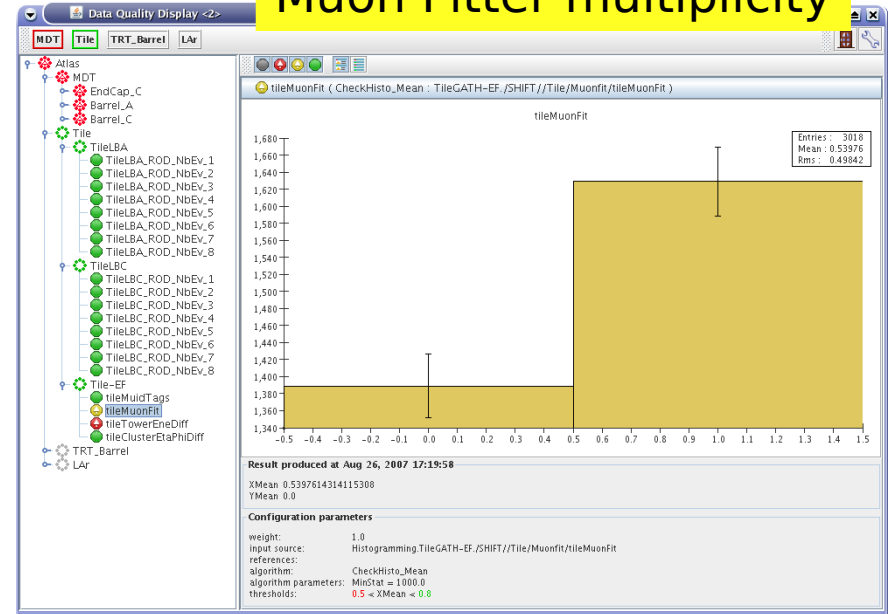


# Tile monitoring

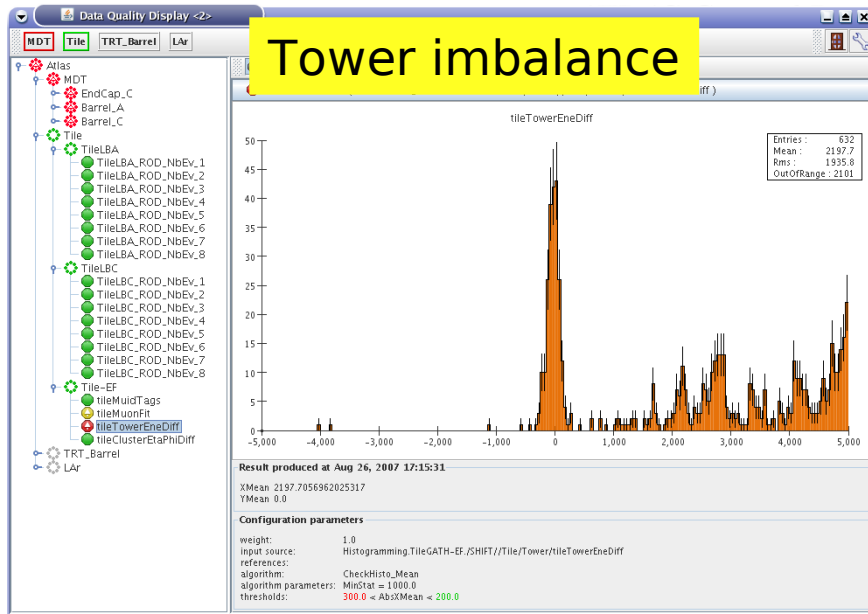
## Muon tag multiplicity



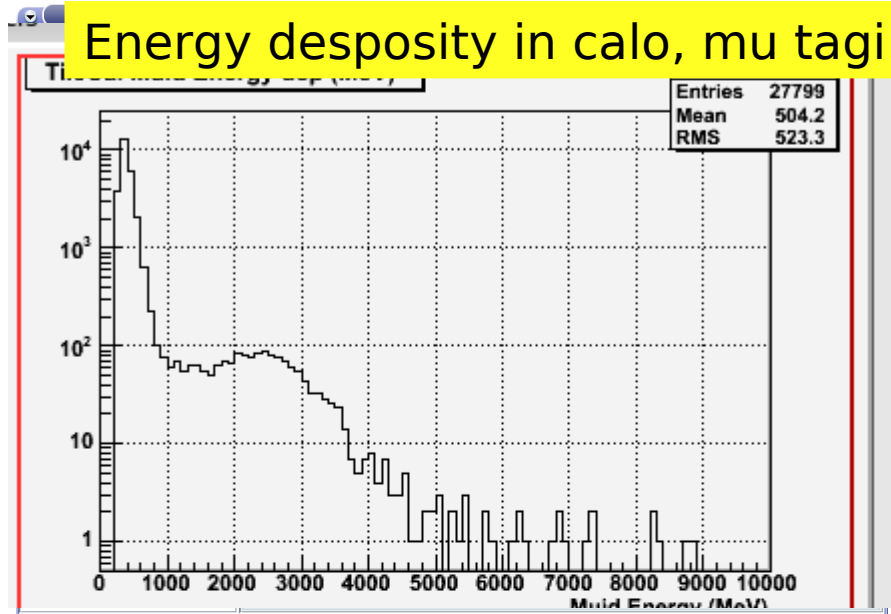
## Muon Fitter multiplicity



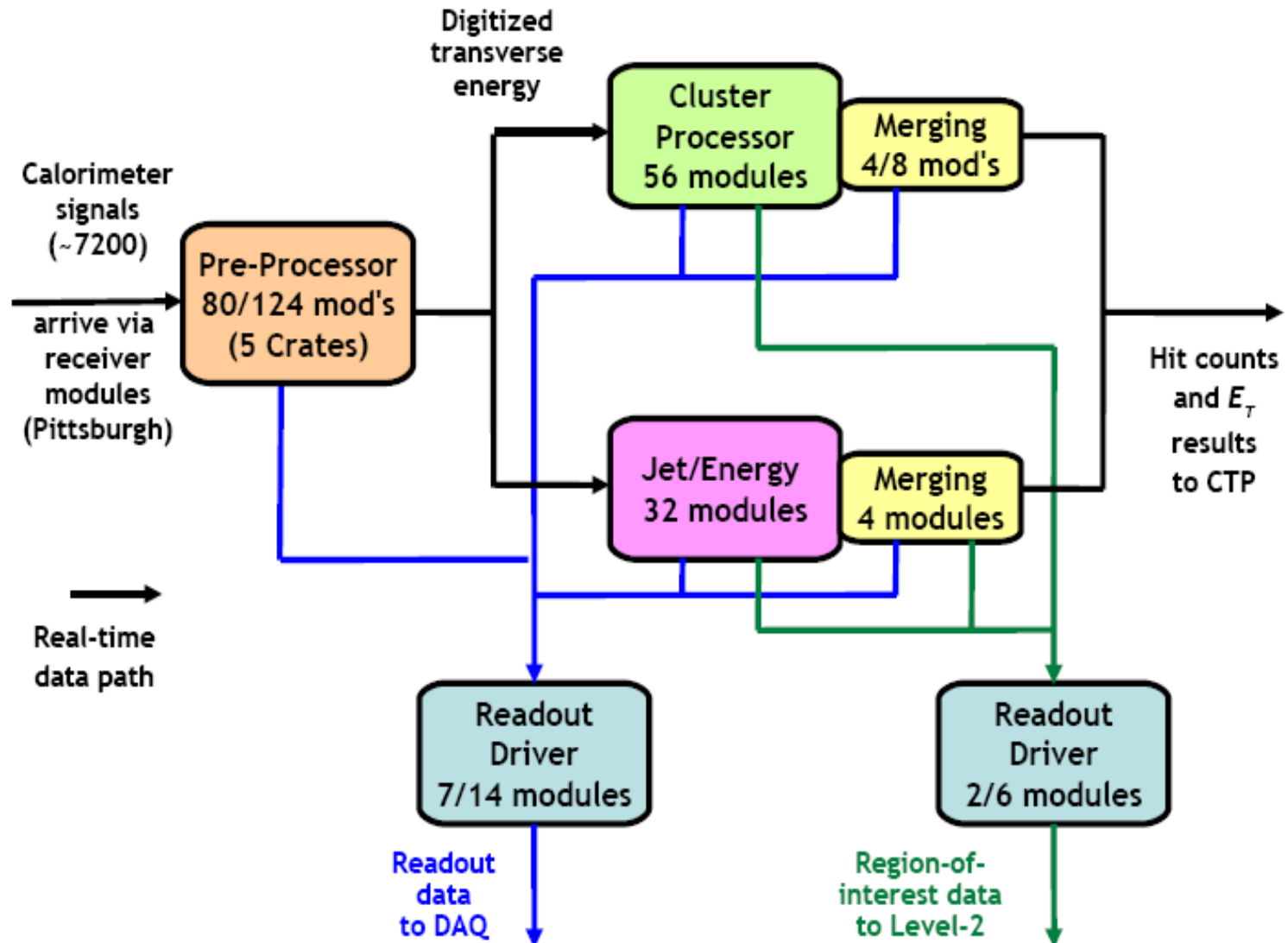
## Tower imbalance



## Energy desposity in calo, mu tagi

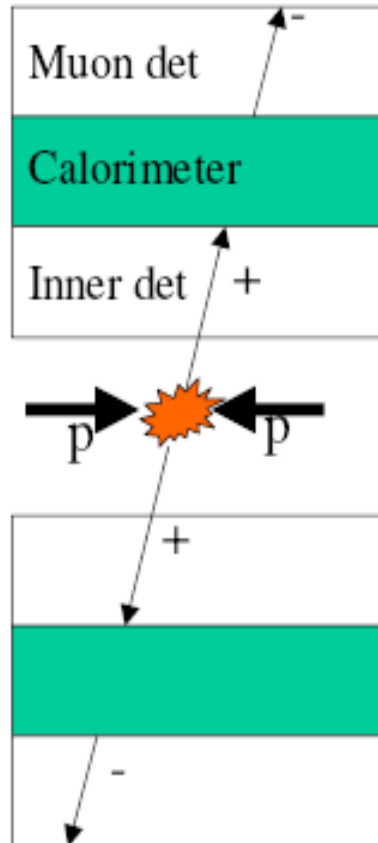


# L1Calo for M4



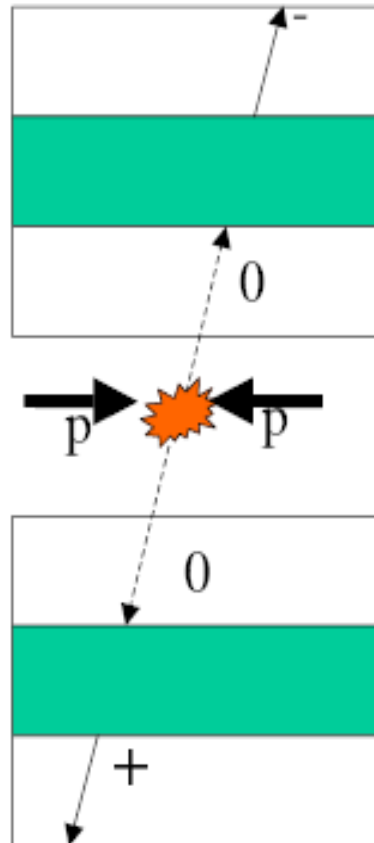
# R-hadrons – Three scenarios

Flippers and  $\mu^- \mu^- , \mu^+ \mu^+$



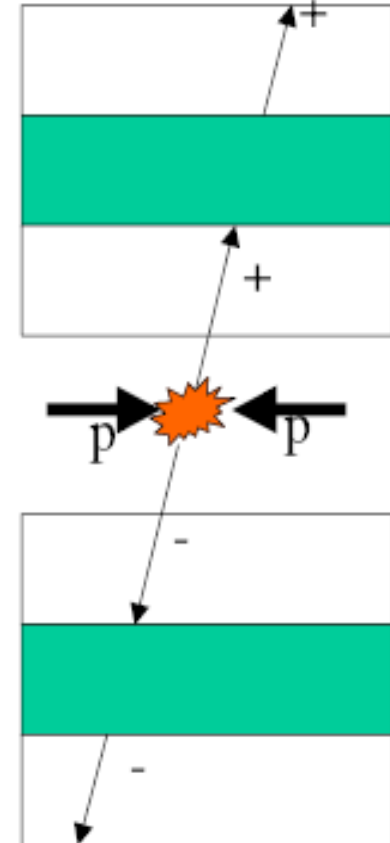
- gluino-gluino ✓
- stop-antistop ✗
- stau-antistau ✗

No ID track and  $\mu^+ \mu^-$



- gluino-gluino ✓
- stop-antistop ✓
- stau-antistau ✗

No flippers and  $\mu^+ \mu^-$



- gluino-gluino ✓
- stop-antistop ✓
- stau-antistau ✓

# R-hadrons – discovery potential

- For masses below 1 TeV : **easy discovery**
- For higher masses :

