



ПИЯФ в эксперименте ATLAS

Научная сессия ученого совета ПИЯФ
22-24 декабря 2009 года
Олег Федин

Beam history from ATLAS perspective

Friday, November 20:

- ~ 20:53h: beam-1 threading → 6 beam splashes to ATLAS
- ~ 22:30h: beam-2 threading → 7 beam splashes to ATLAS

Saturday, 21 November:

- ~ 1h: beam-2 splashes to ATLAS → 27 events (side C)
- ~ 4h: beam-1 splashes to ATLAS → 26 events (side A)

Monday 23 November:

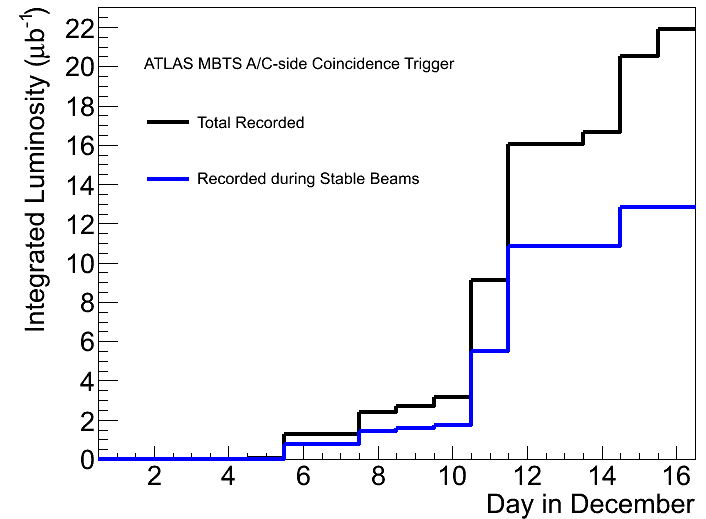
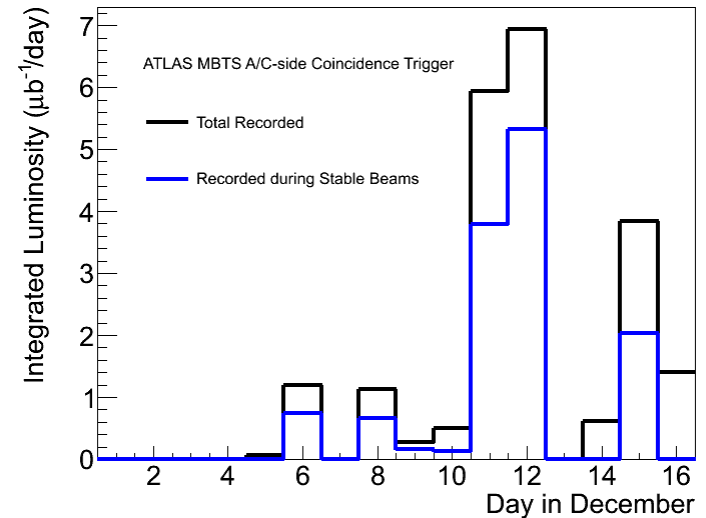
- ~ 6:30: last series of splashes to ATLAS → 25 events (side C)
- ~ 13:30: two beams injected for collisions at IP1 and IP5
- ~ 14:22: first ATLAS collision event seen 900 GeV

Tuesday 8 December:

- ~19:00 collision 2.36 TeV

Wednesday 16 December:

LHC stopped. No beam before middle of February 2010



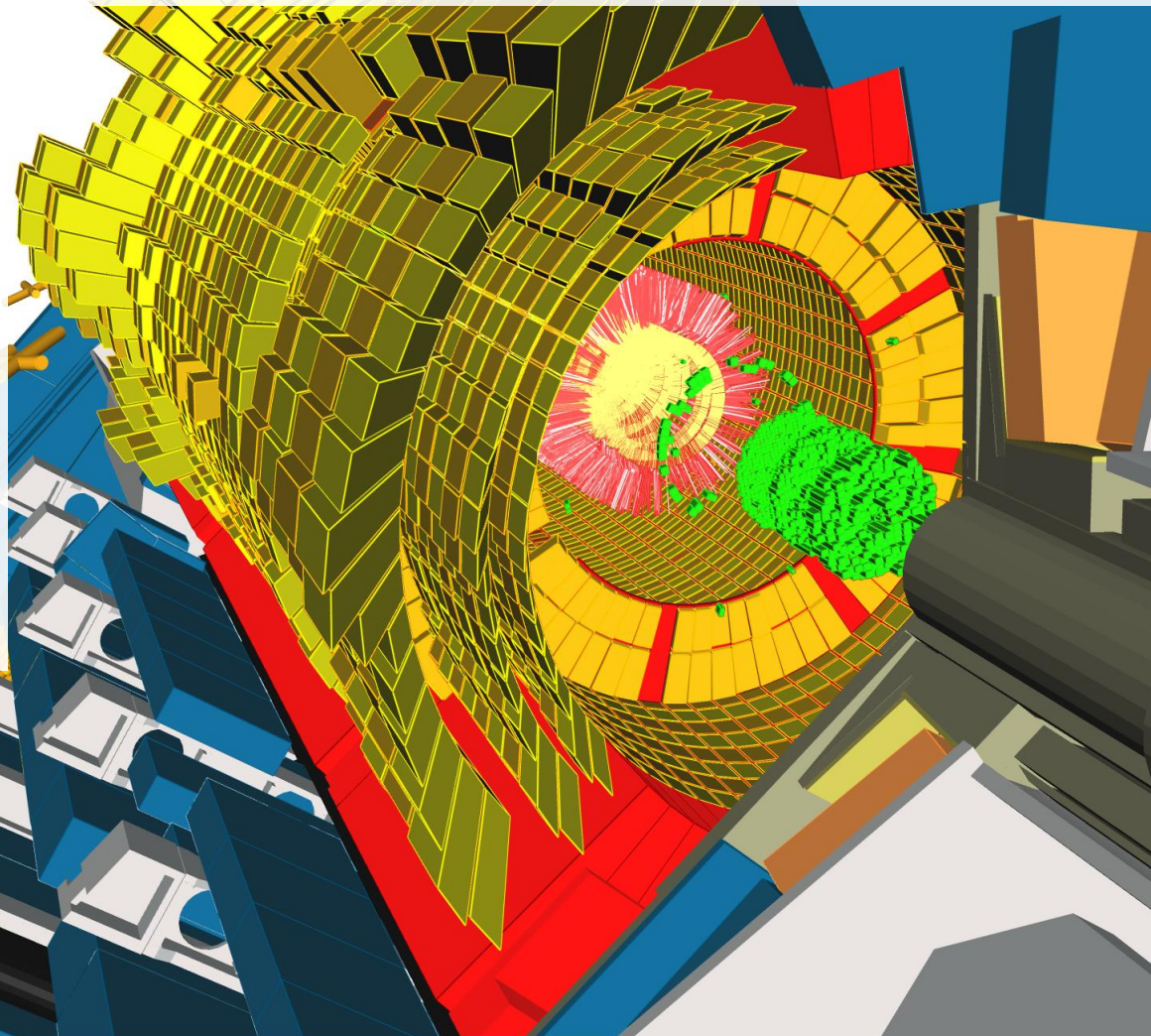
1st Beam Splash from Beam-2

Beam-splash events

Avalanche of scattered particles
from beam-on-collimator hits

Detectors fully lit, typically

- 300,000 SCT hits
- 350,000 TRT hits
(~all passing high-threshold)
- 3000 TeVcalo energy sum
- 490,000 MDT hits
- 320,000 RPC hits
- 65,000 TGC hits

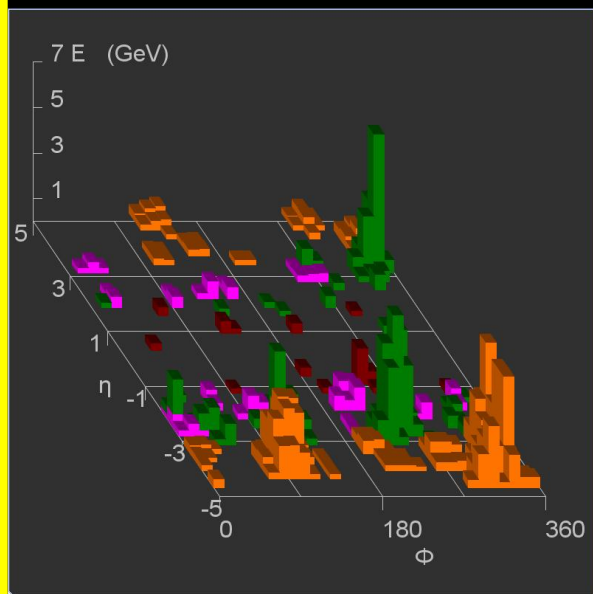
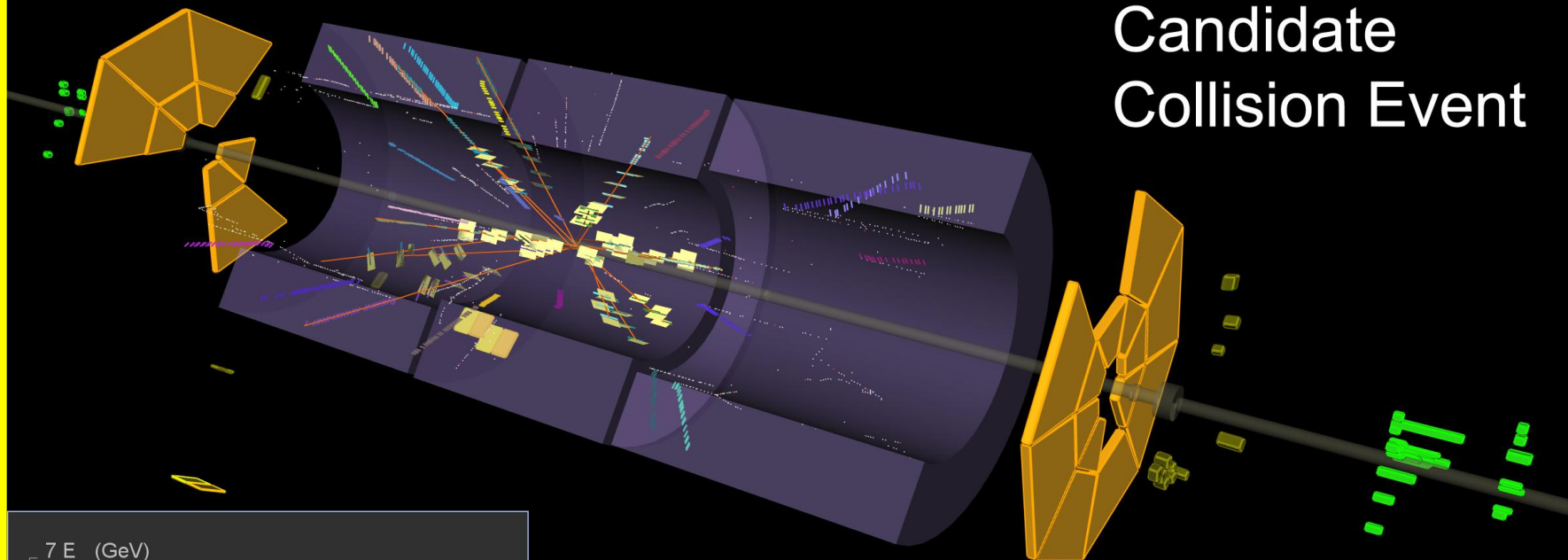


 **ATLAS**
EXPERIMENT

2009-11-20, 23:32 CET
Run 140370, Event 2666

Monday 23 November: first collisions at $\sqrt{s} = 900$ GeV !
→ ATLAS records ~ 200 events (first one observed at 14:22)

Candidate Collision Event

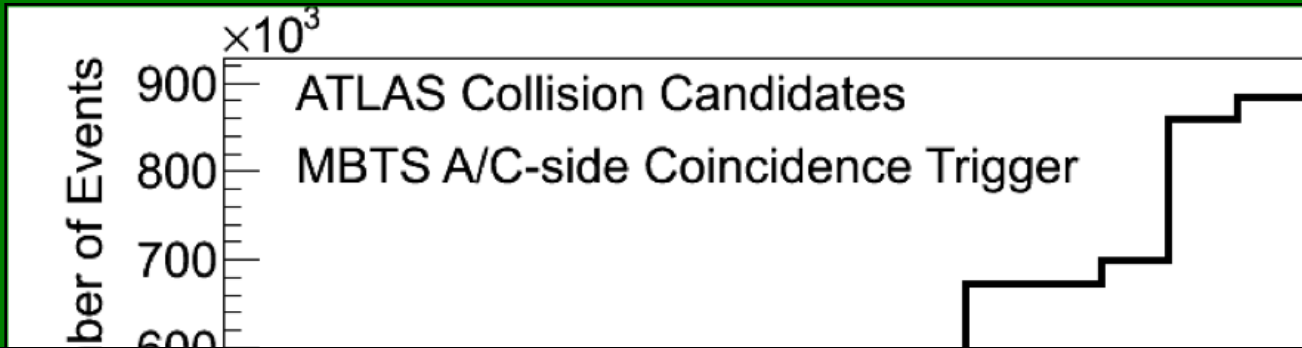


ATLAS
EXPERIMENT

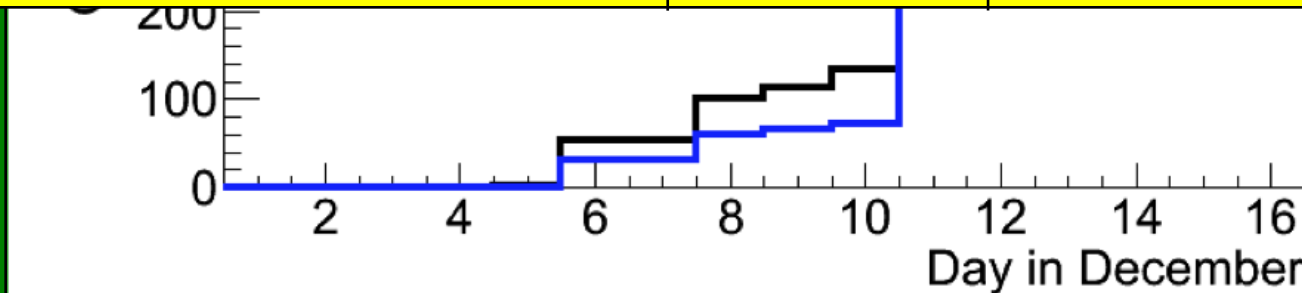
2009-11-23, 14:22 CET
Run 140541, Event 171897

<http://atlas.web.cern.ch/Atlas/public/EVTDISPLAY/events.html>

Average data-taking efficiency: ~ 90%



Recorded data samples	Number of events	Integrated luminosity (< 30% uncertainty)
Total	~ 920k	~ 20 μb^{-1}
With stable beams (\rightarrow tracker fully on)	~ 540k	~ 12 μb^{-1}
At $\sqrt{s}=2.36$ TeV (flat top)	~ 34k	≈ 1 μb^{-1}



Max peak luminosity seen by ATLAS : $\sim 7 \times 10^{26} \text{ cm}^{-2} \text{ s}^{-1}$

Detector fully operational

Subdetector	Number of Channels	Approximate Operational Fraction
Pixels	80 M	97.9%
SCT Silicon Strips	6.3 M	99.3%
TRT Transition Radiation Tracker	350 k	98.2%
LAr EM Calorimeter	170 k	98.8%
Tile calorimeter	9800	99.2%
Hadronic endcap LAr calorimeter	5600	99.9%
Forward LAr calorimeter	3500	100%
MDT Muon Drift Tubes	350 k	99.7%
CSC Cathode Strip Chambers	31 k	98.4%
RPC Barrel Muon Trigger	370 k	98.5%
TGC Endcap Muon Trigger	320 k	99.4%
LVL1 Calo trigger	7160	99.8%

- Pixels and Silicon strips (SCT) at nominal voltage only with stable beams
- Solenoid and/or toroids off in some periods
- Muon forward chambers (CSC) running in separate partition for rate tests

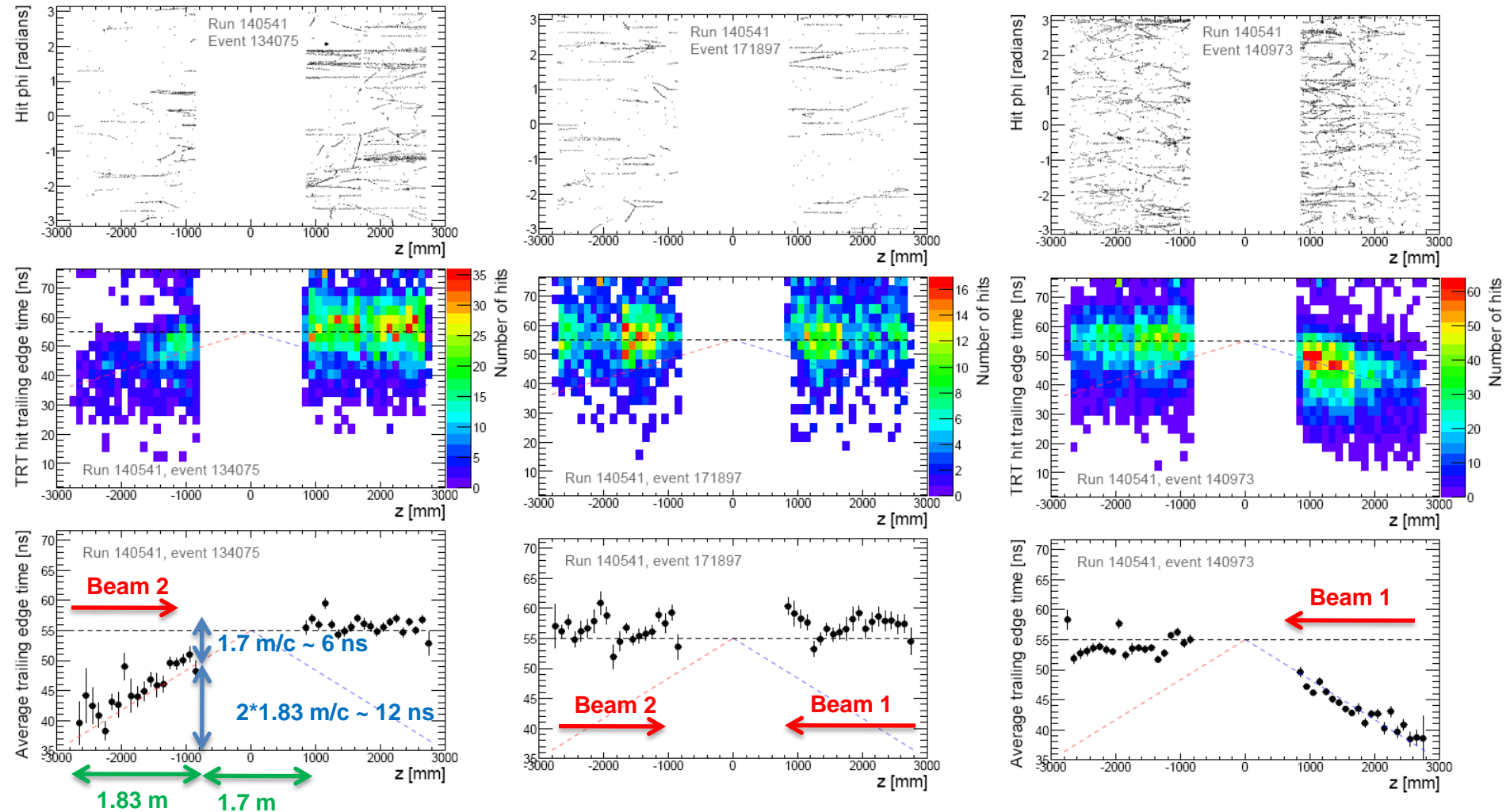
TRT timing to identify collision events

TRT end-cap boards T_0 were adjusted better than 2 ns

Beam 2 splash event

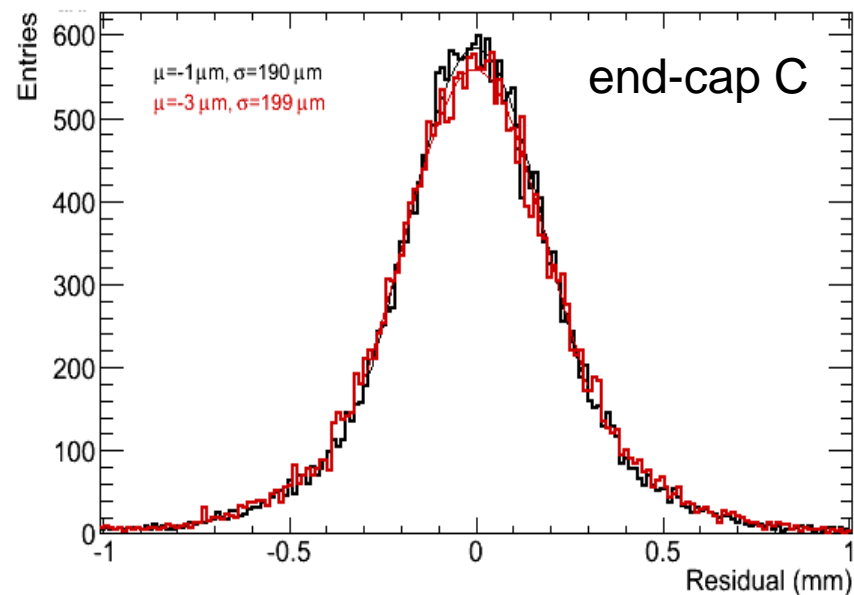
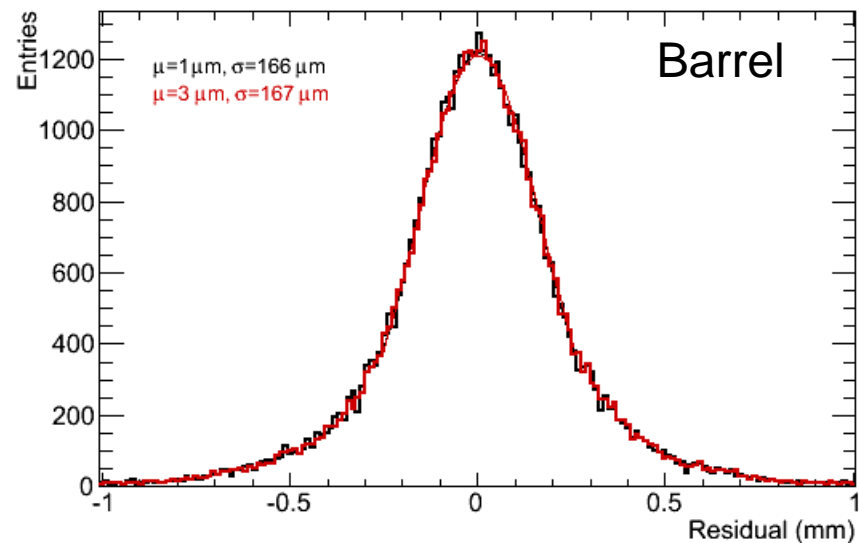
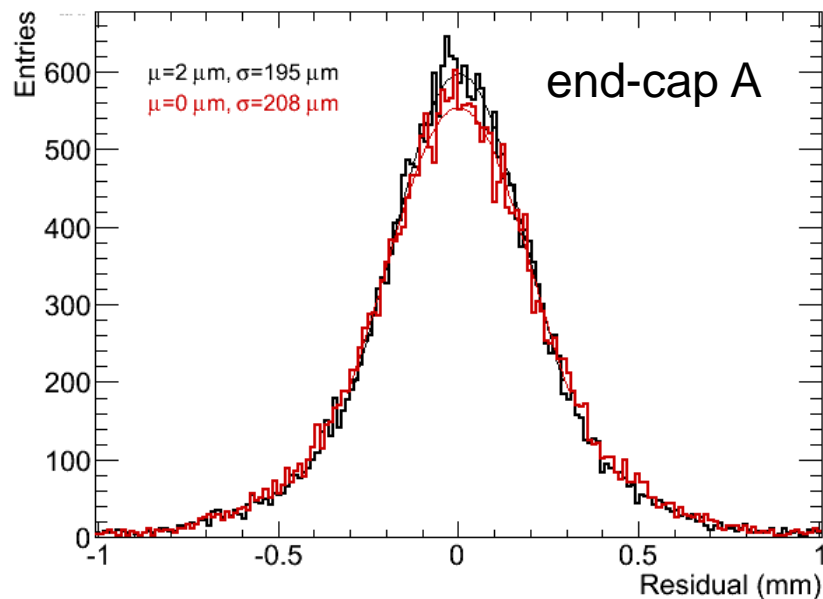
Beam collision event

Beam 1 splash event

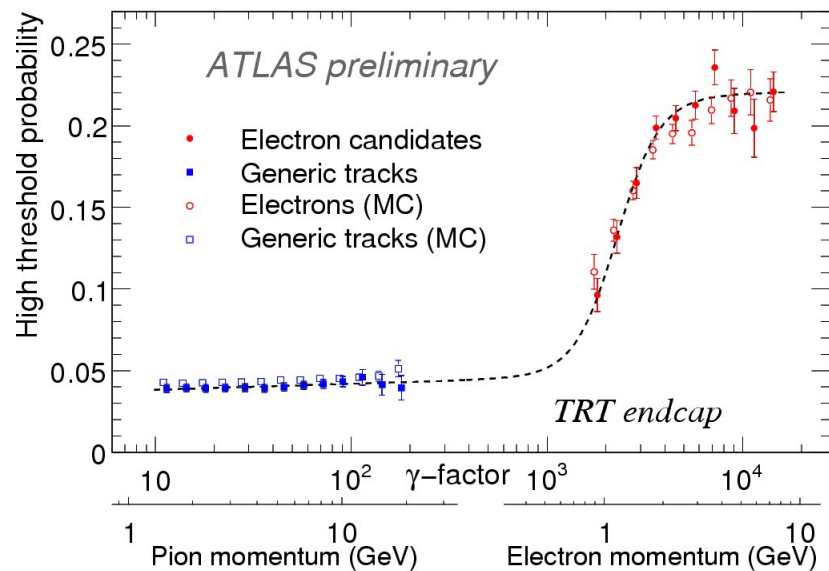


The residual distribution obtained with combined TRT only tracks ($p_T > 1$ GeV) for the TRT Barrel (top right) and for TRT end-caps (bottom left and right).

Before / After Alignment

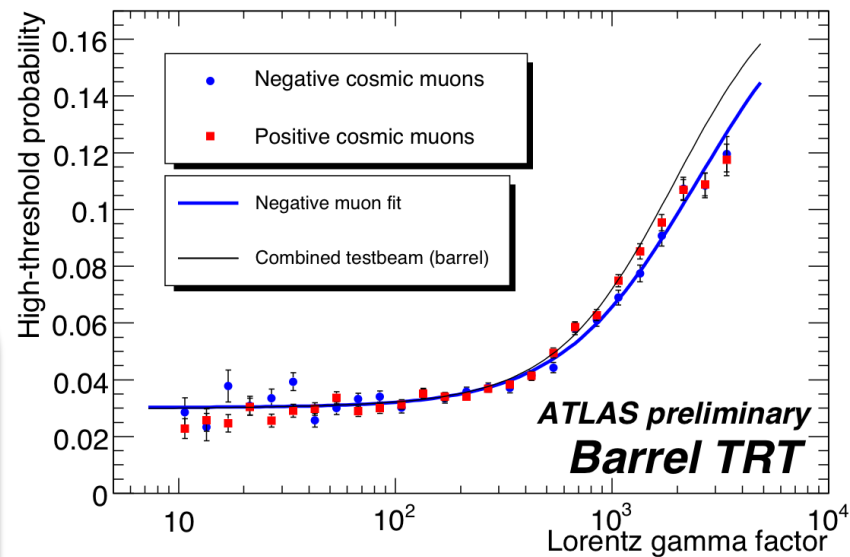


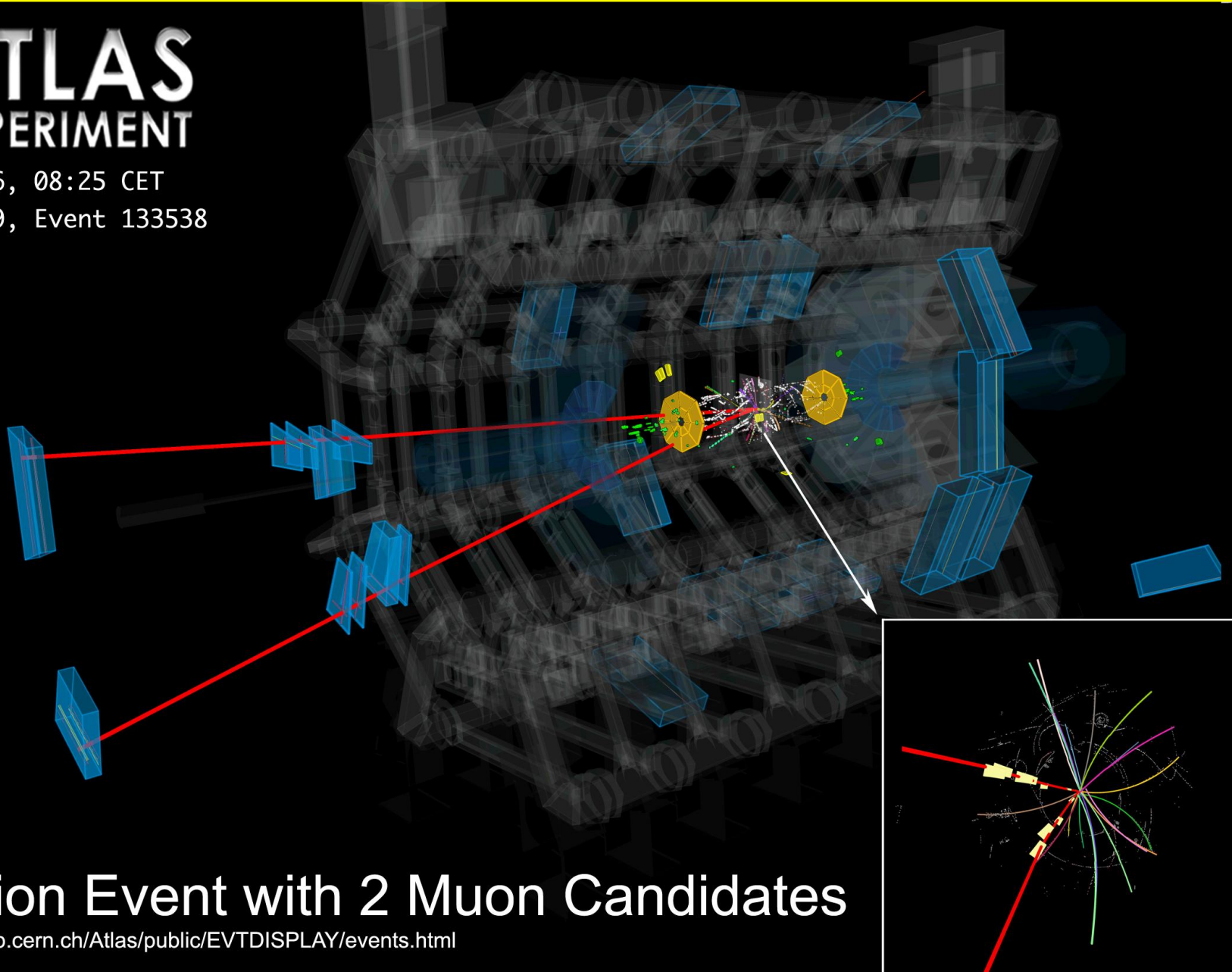
e/π identification in TRT detector



The probability of a TRT High Threshold (HT) hit as a function of the Lorentz Factor γ for the TRT end-caps as measured in LHC collision events.

The onset of the Transition radiation is measured for the first time using data with electron candidates from photon conversions. It shows that the TRT has an excellent starting point to study and optimize its particle identification properties.

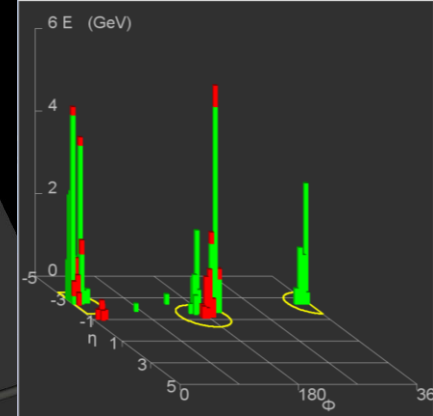




Collision Event with 2 Muon Candidates

<http://atlas.web.cern.ch/Atlas/public/EVTDISPLAY/events.html>

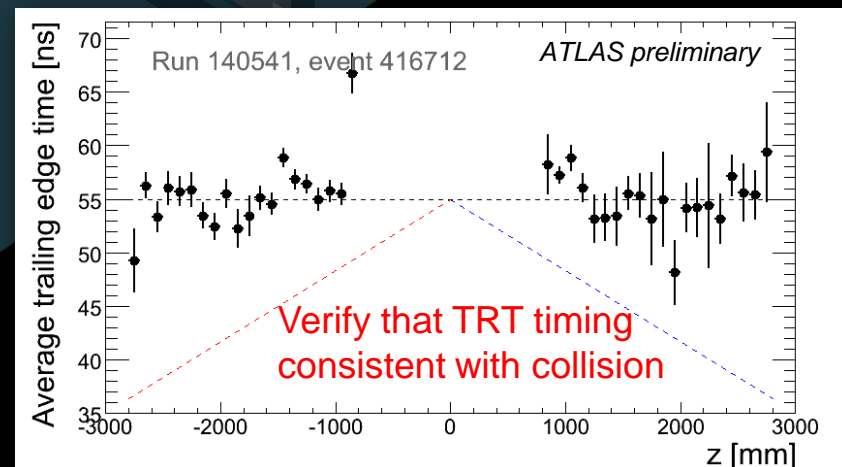
A di-jet candidate



Run 140541
Event 416712

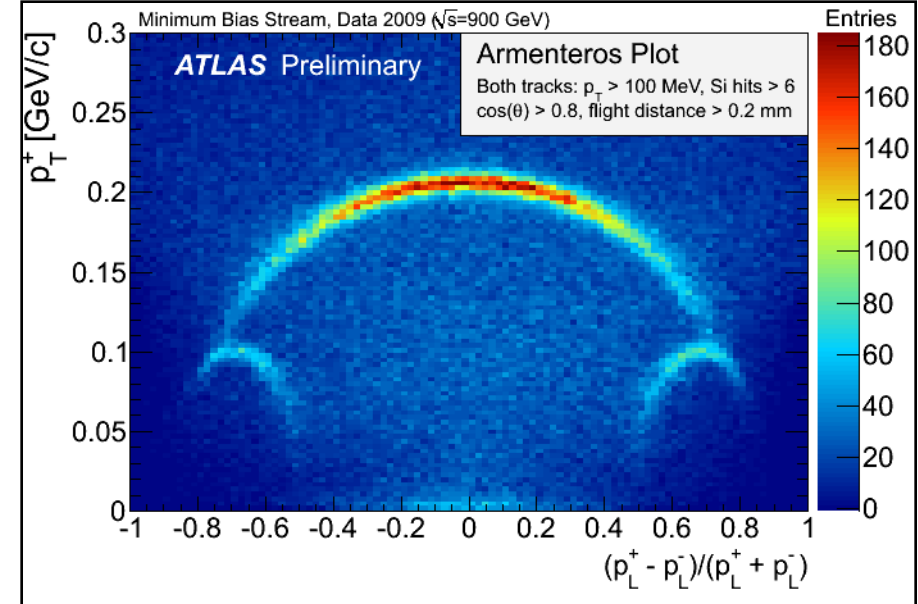
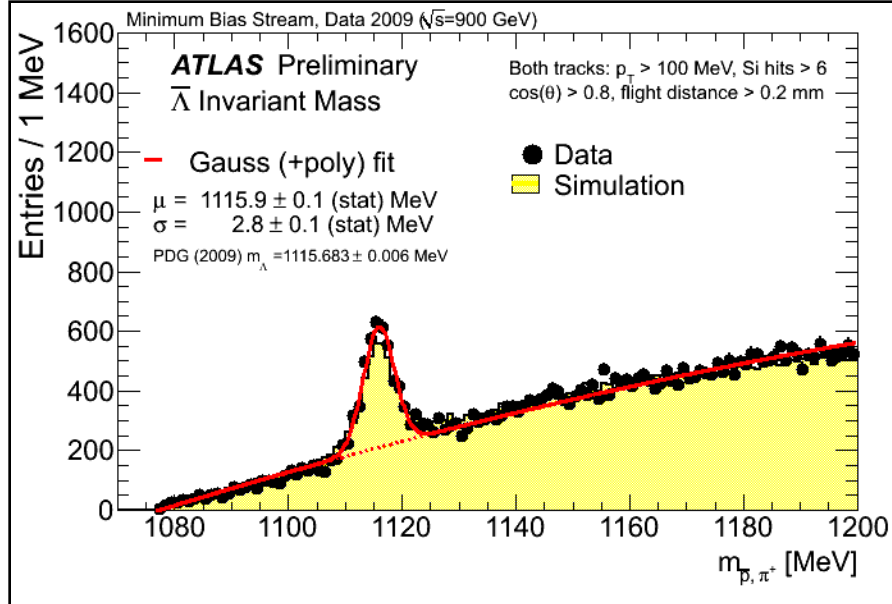
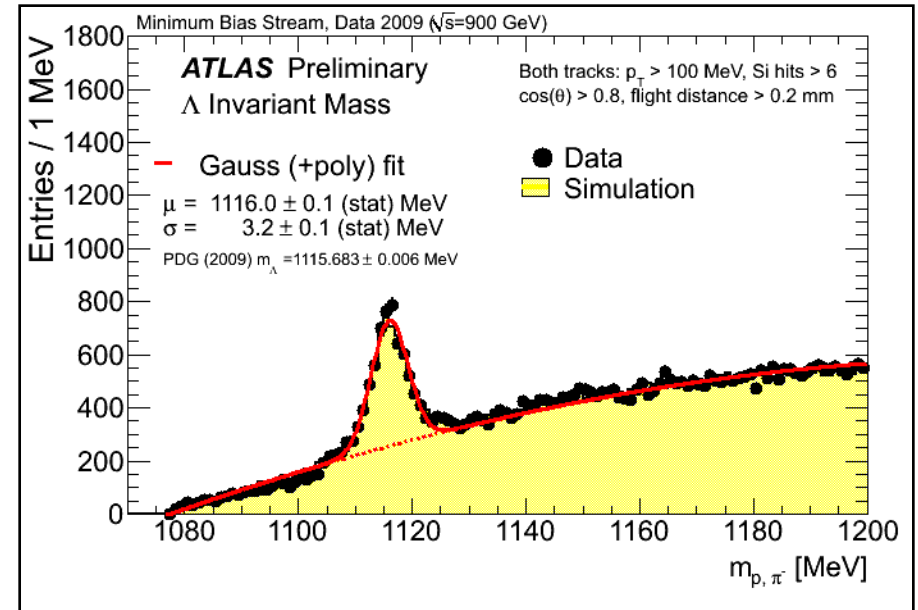
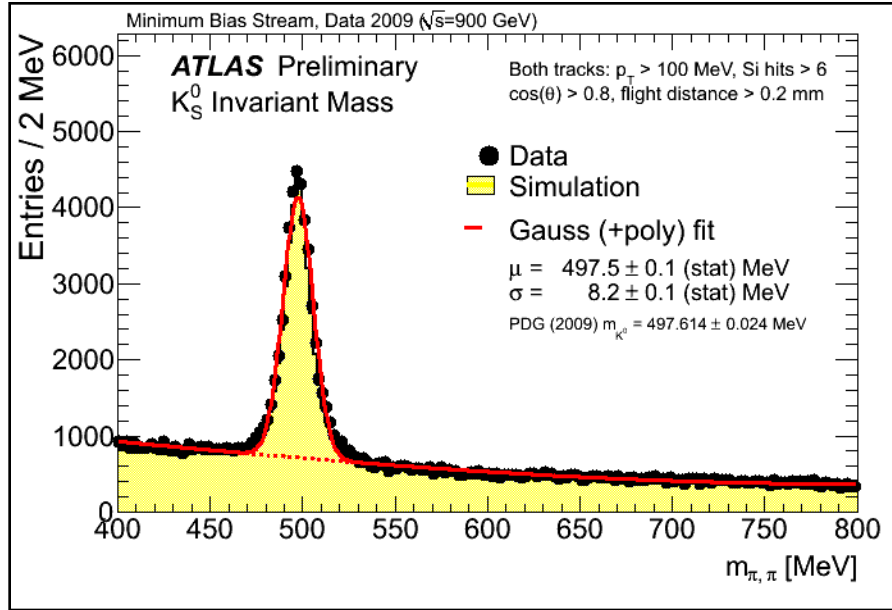
Two jets back-to-back in ϕ , both with (uncalibrated) $E_T \sim 10$ GeV, η of -1.3 and -2.5 , \sim no missing E_T

Triggered by MBTS A/B in time, several hits
Also triggered by L1Calo EM3



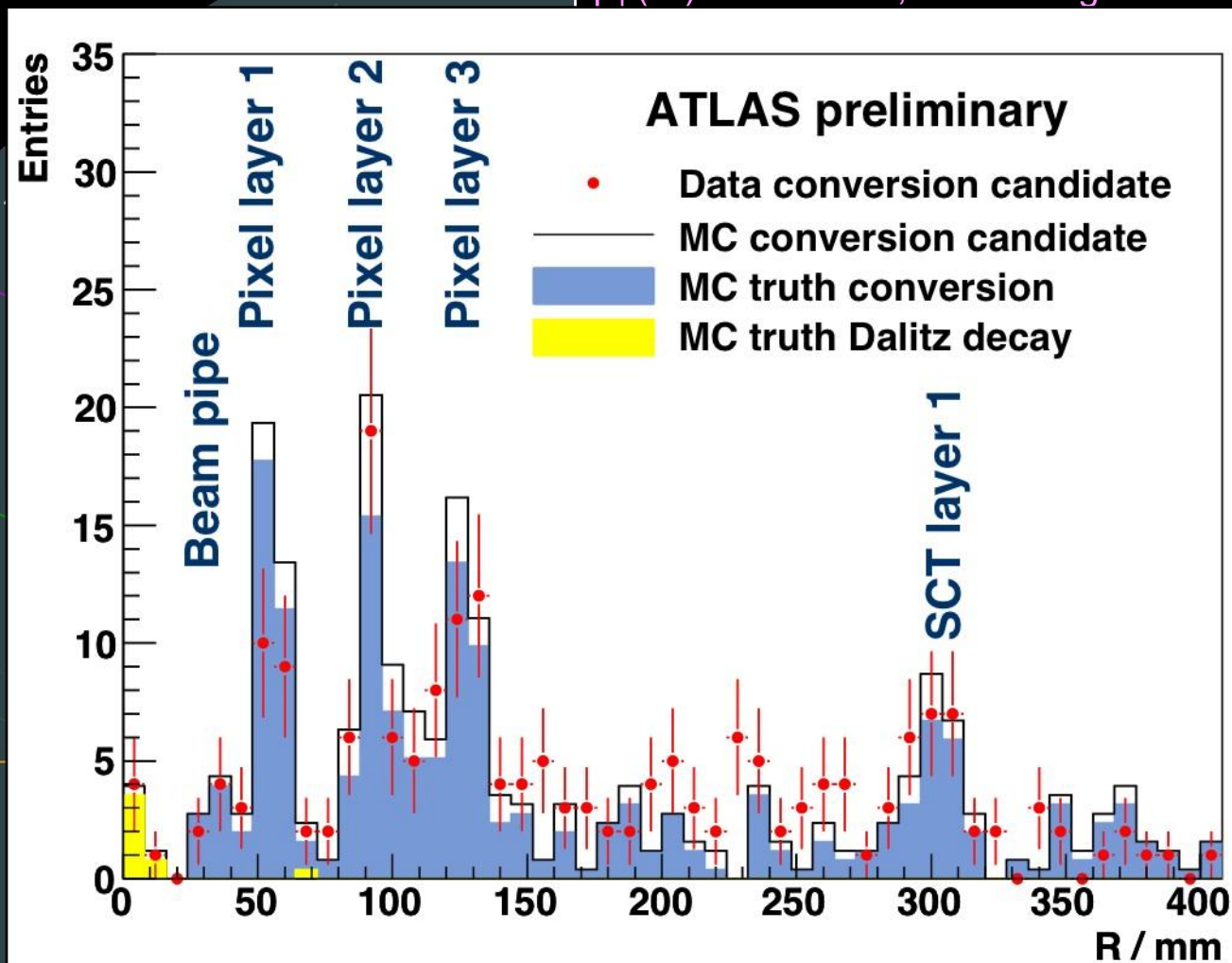
$$K_S^0 \rightarrow \pi^+ \pi^-, \Lambda \rightarrow p \pi^-, \bar{\Lambda} \rightarrow \bar{p} \pi^+$$

p_T (track) > 100 MeV
MC signal and background normalized independently



$p_T(e^+) = 1.75$ GeV, 11 TRT high-threshold hits

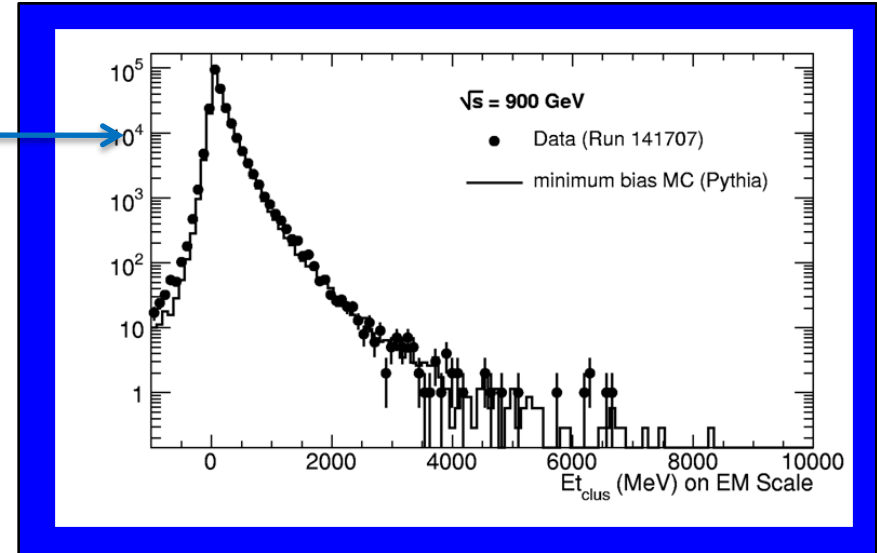
hits



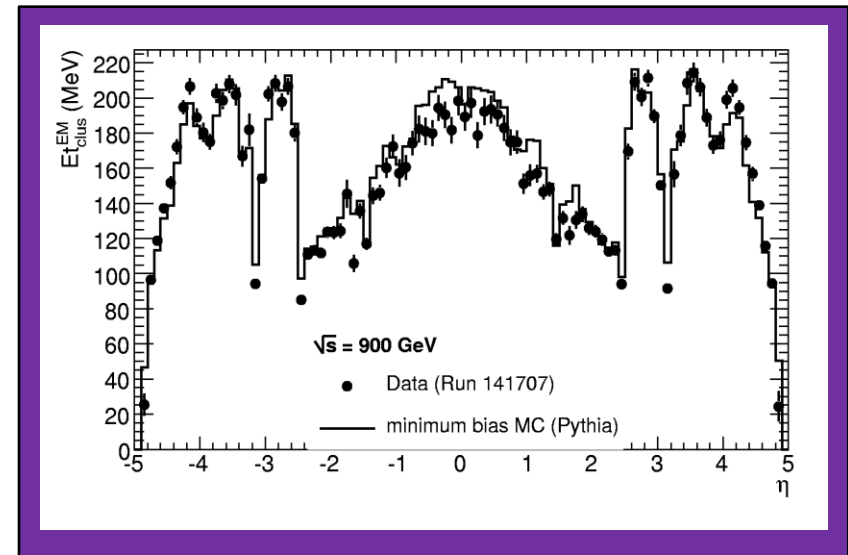
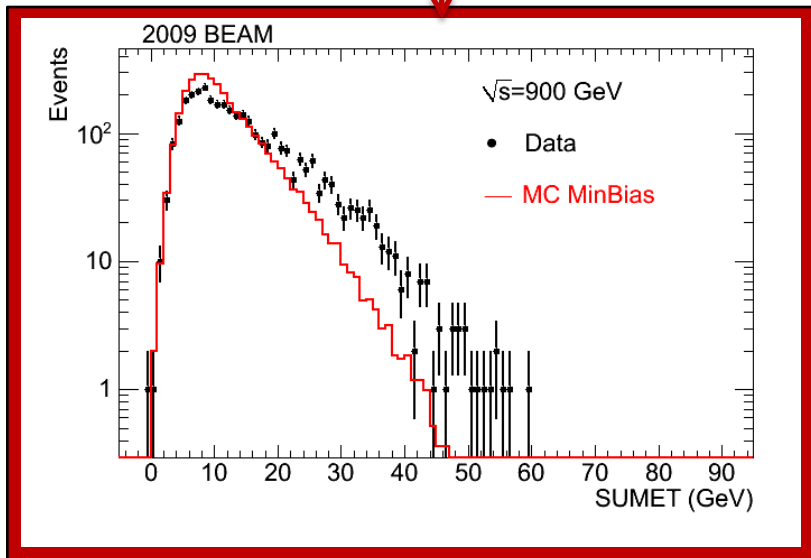
Topoclusters in collision events

Good agreement between data and Monte-Carlo

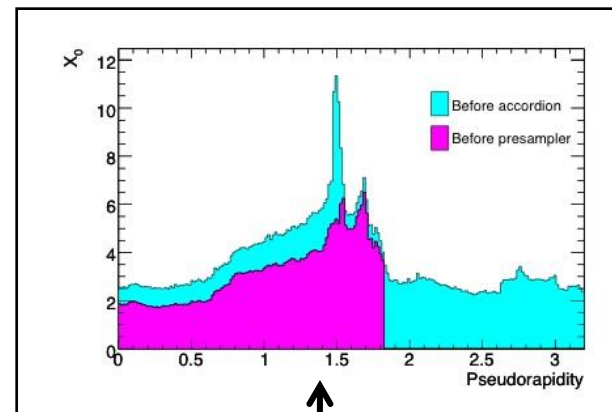
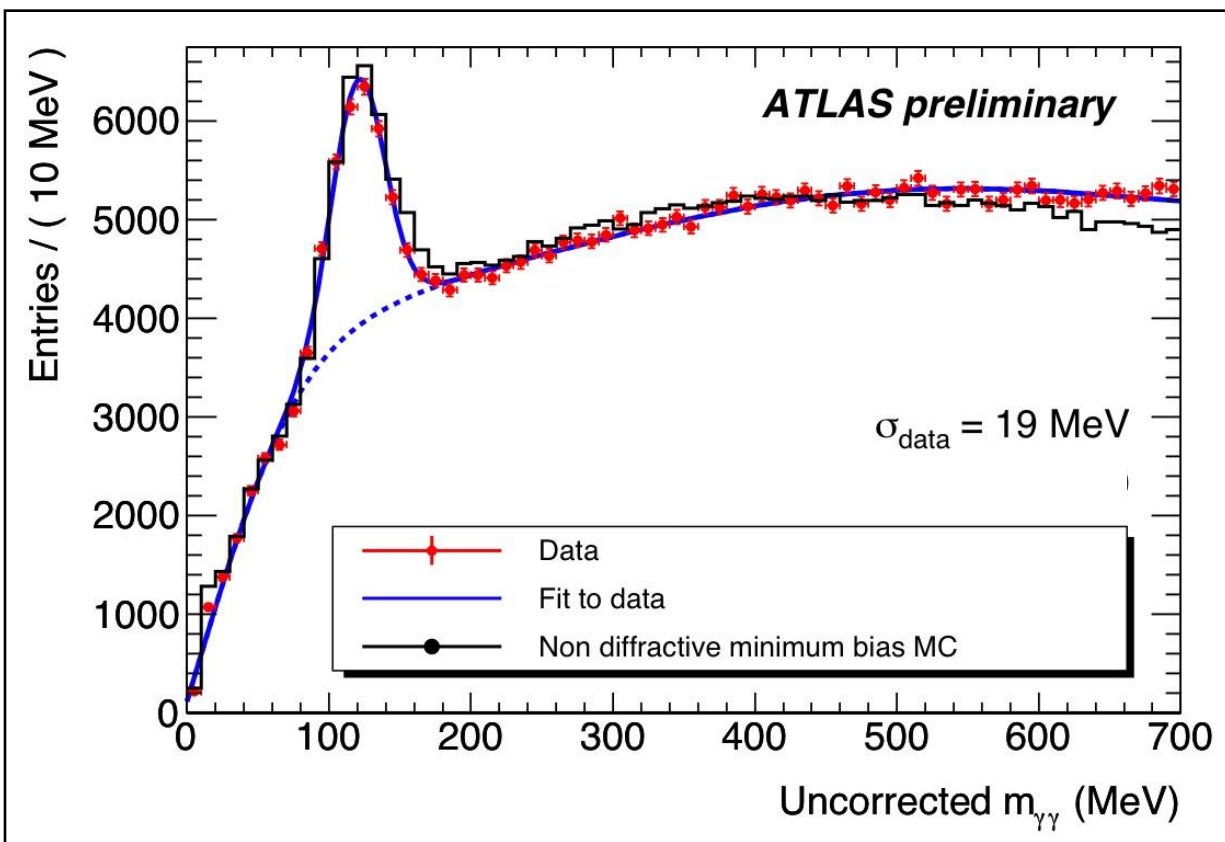
Total transverse energy with topoclusters cells: Poor agreement of ΣE_T with simulation, due to MC tuning / trigger bias ?



E_T distribution as a function of η .
Structure of the calorimeter visible

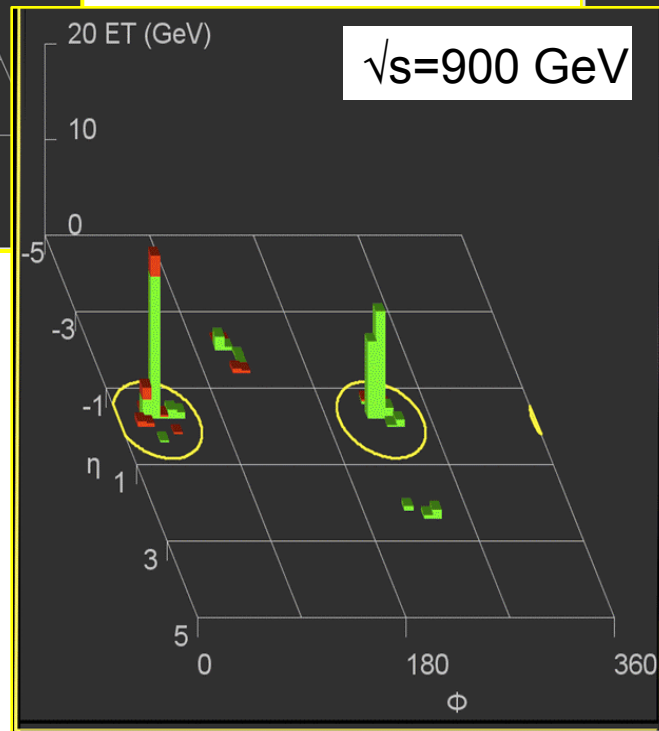
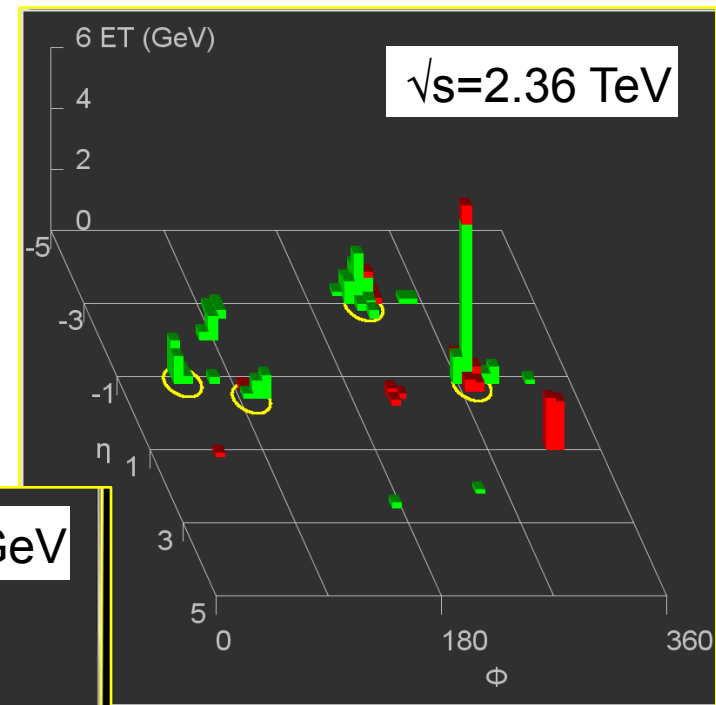
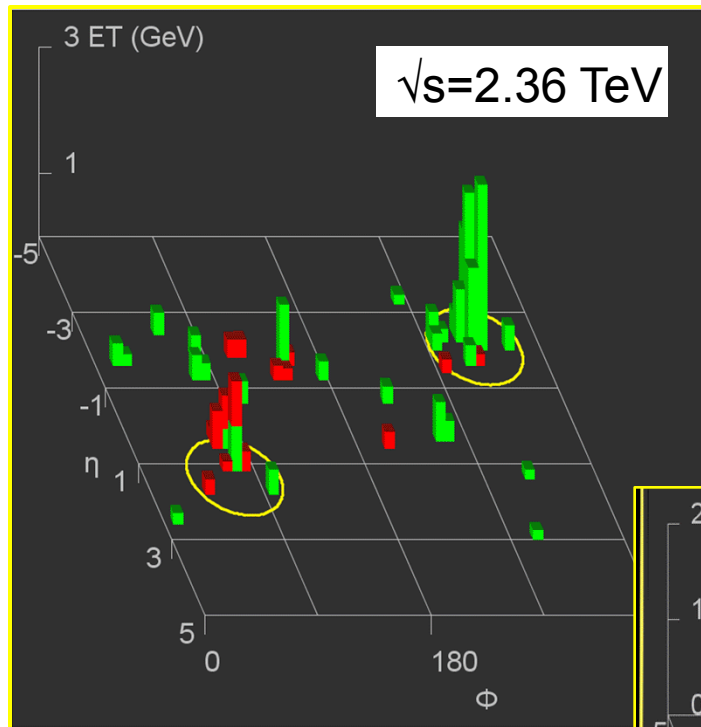


- 2 photon candidates with $E_T(\gamma) > 300$ MeV
- $E_T(\gamma\gamma) > 900$ MeV
- Shower shapes compatible with photons
- No corrections for upstream material

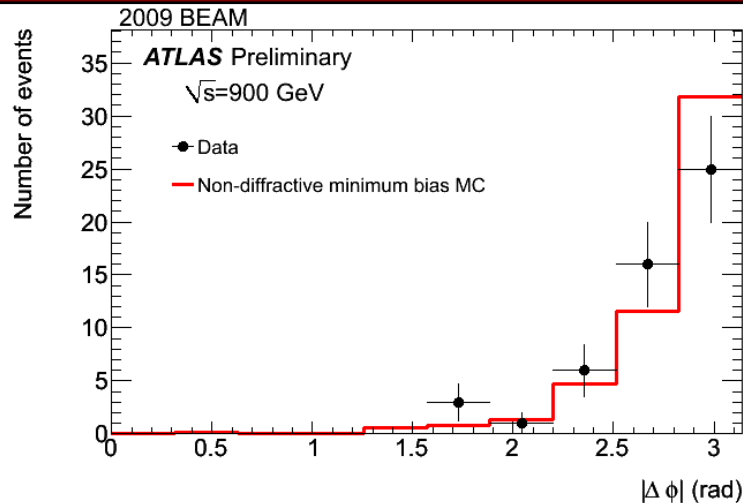
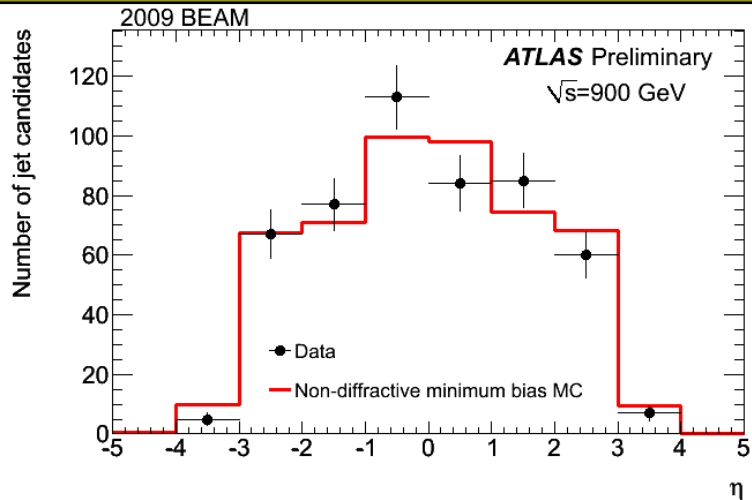
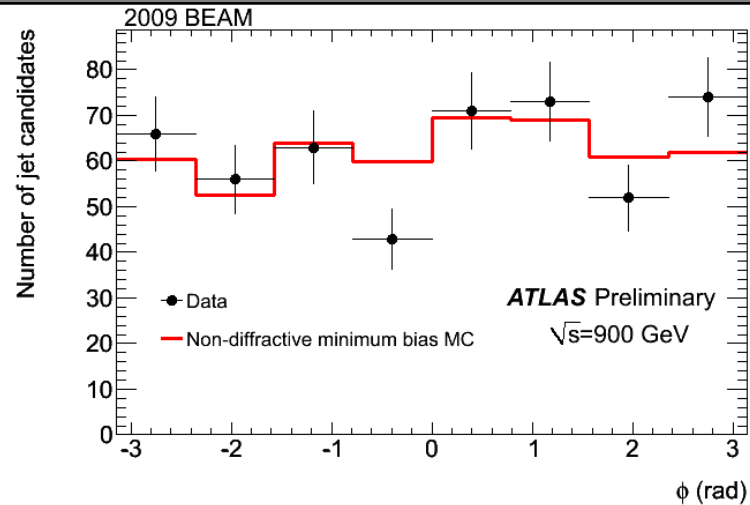
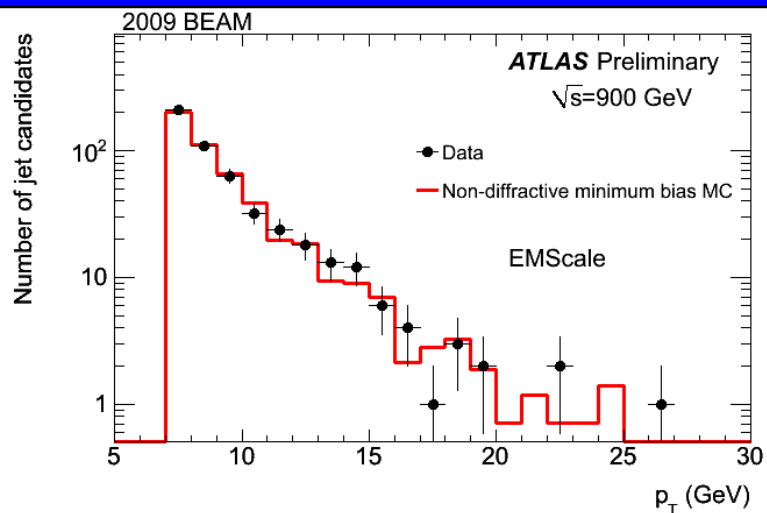


Note: soft photons are challenging because of material in front of EM calorimeter (cryostat, coil):
 $\sim 2.5 X_0$ at $\eta=0$

Data and MC normalised to the same area

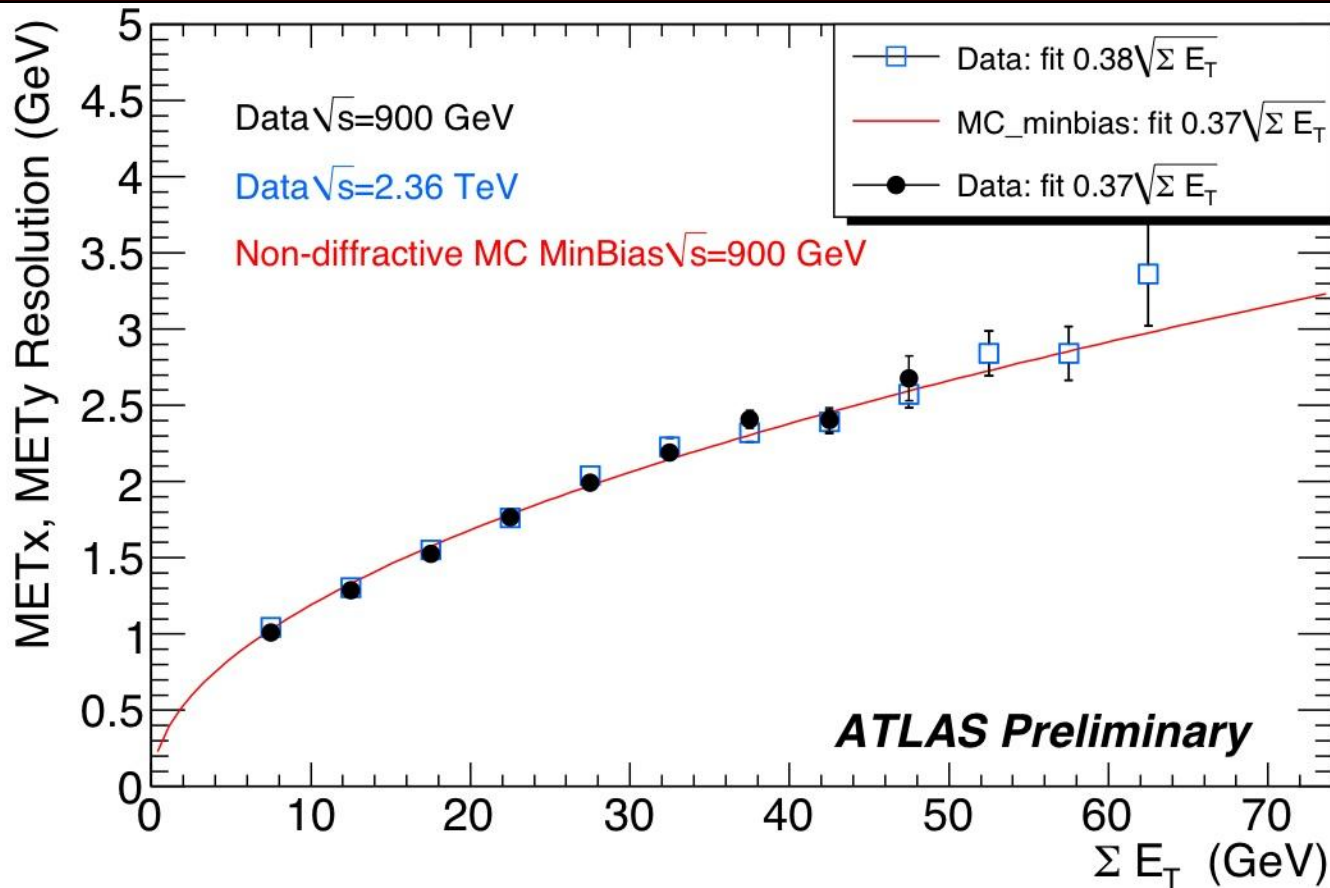


Uncalibrated EM scale Monte Carlo normalized to number of events in data

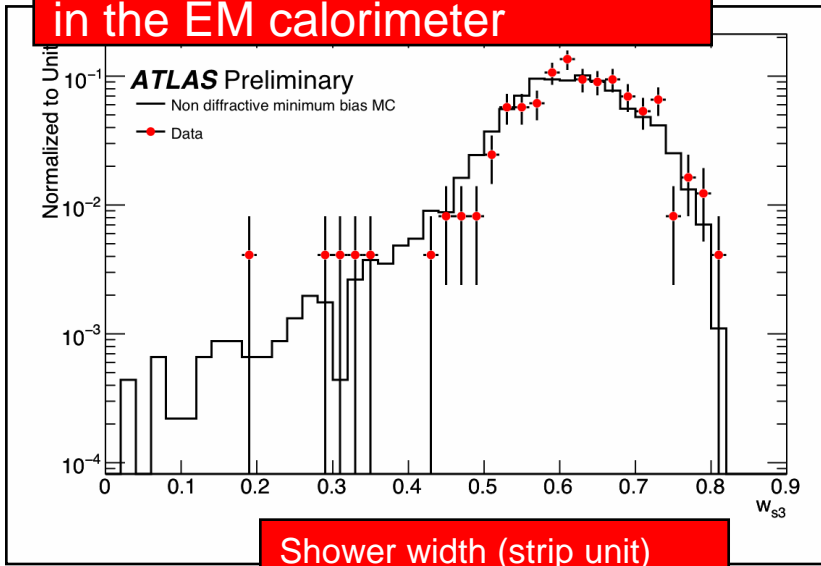


Missing E_T resolution

- Sensitive to calorimeter performance (noise, coherent noise, dead cells, mis-calibrations, cracks, etc.) and backgrounds from cosmics, beams, ...
- Measurement



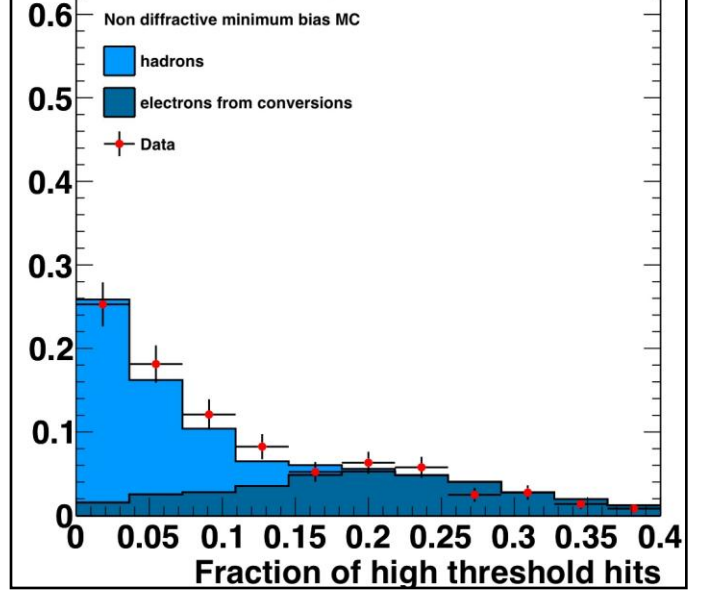
Photon candidate: shower shape in the EM calorimeter



Shower width (strip unit)

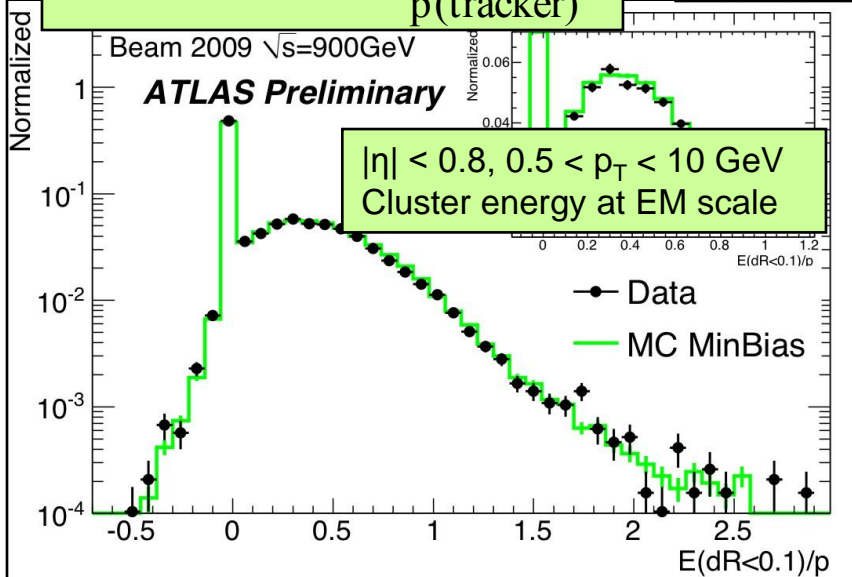
More comparisons data – simulation: fundamental milestone for undertaking solid physics measurements !

Electron candidates: transition radiation signal in TRT



Isolated hadrons : $\frac{E(\text{calorimeter})}{p(\text{tracker})}$

Monte Carlo and data normalized to same area



Good agreement in the (challenging) low-E region indicates good description of material and shower physics in G4 simulation (thanks also to years of test-beam ...)

Worldwide data distribution and analysis

MB/s per day

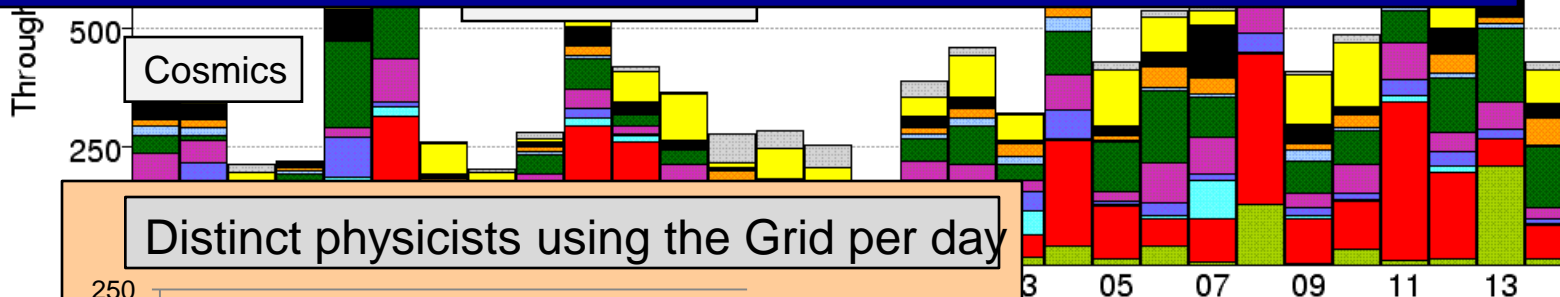
Total data throughput through the Grid (Tier0, Tier-1s, Tier-2s)

1000

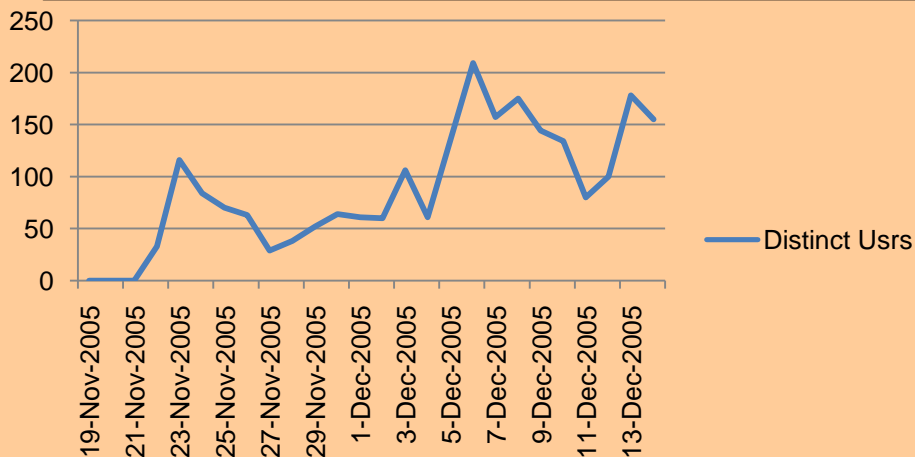
Nov.

Dec.

~ 0.2 PB of data stored since 20th November
 ~ 8h between Data Acquisition at the pit and data arrival at Tier2
 (including reconstruction at Tier0)



Distinct physicists using the Grid per day



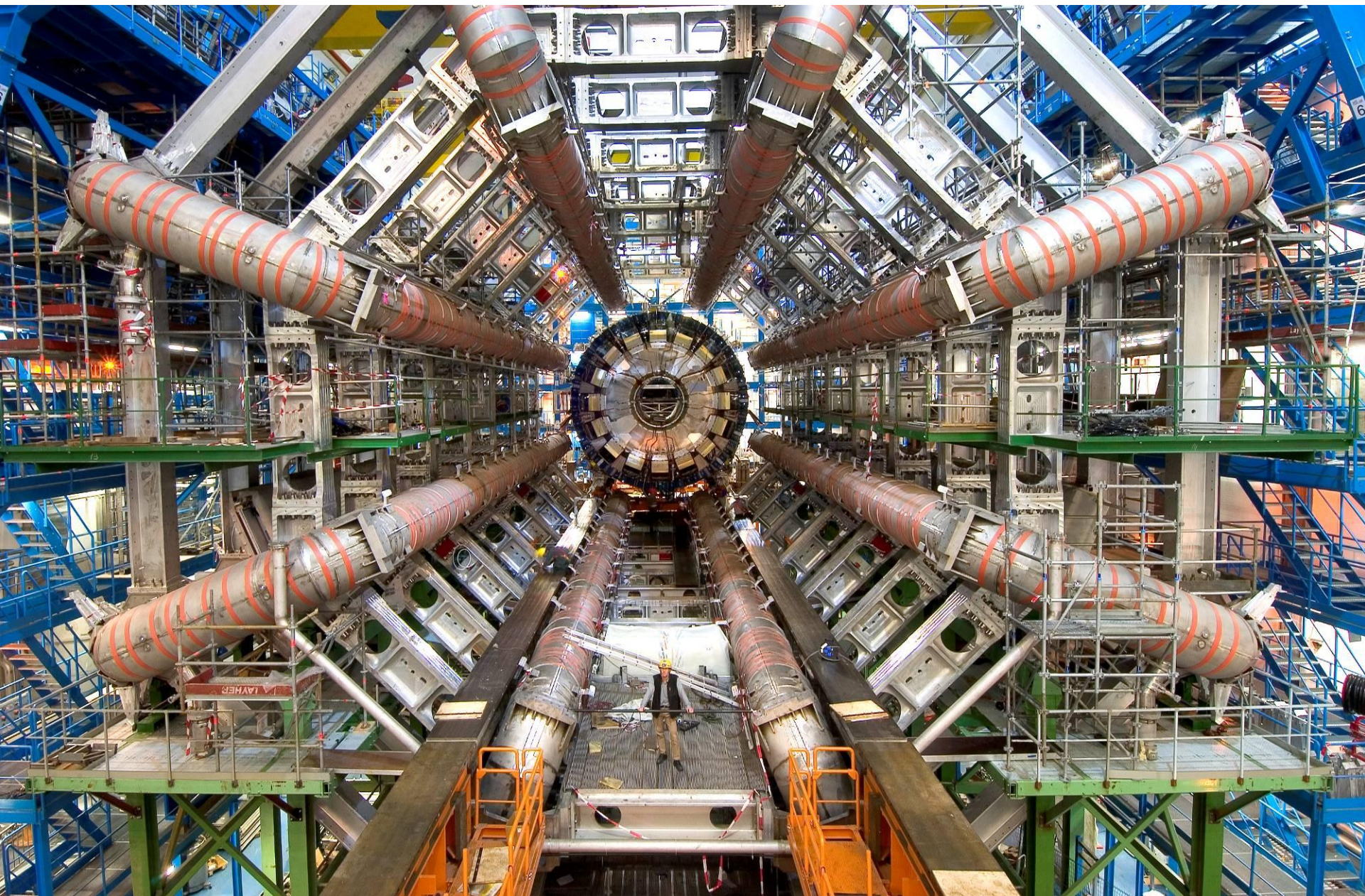
Many more people doing analysis locally after copying samples from the Grid

CA

TW-ASGC

WLCG

ATLAS cavern, October 2005



Hector Berlioz, “Les Troyens”, opera in five acts

Valencia, Palau de les Arts Reina Sofia, 31 October -12 November 2009

