ATLAS status and recent results

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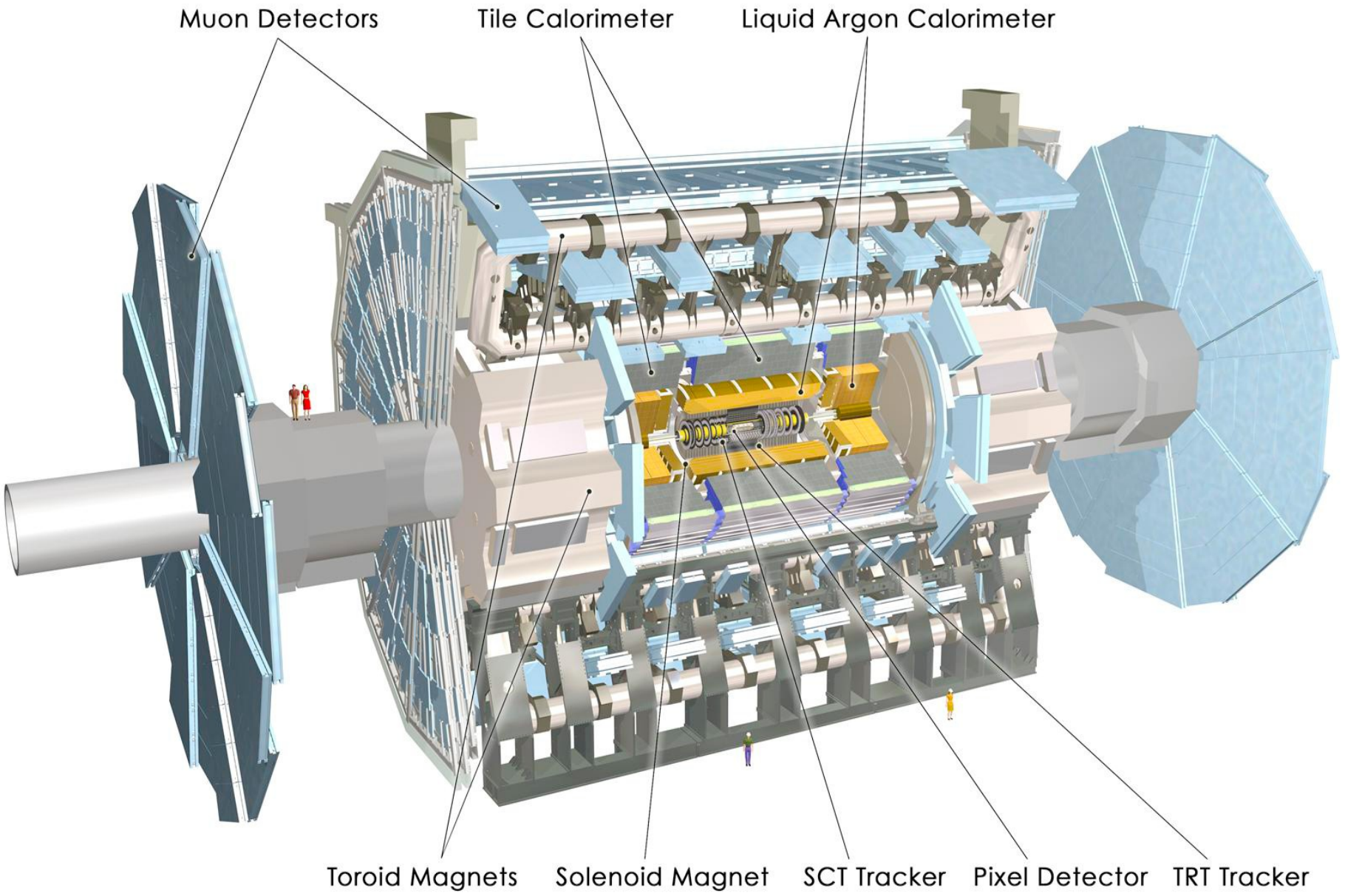
For the ATLAS collaboration

Outline

- Current status of the ATLAS detector and data taking
- Some of the most significant physics results 2009/2010
  - Tracking
  - Calorimetry
  - Muon spectrometer
- First W and Z candidates

The ATLAS detector



Status of the detector

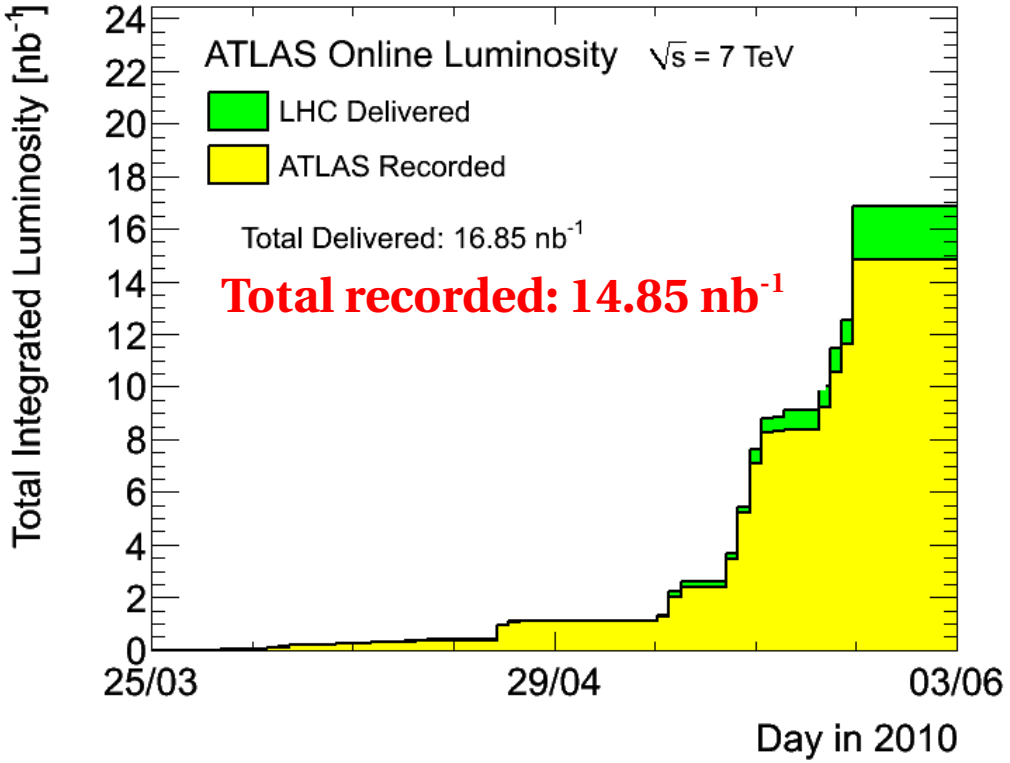
Subdetector	Number of Channels	Approximate Operational Fraction
Pixels	80 M	97.5%
SCT Silicon Strips	6.3 M	99.3%
TRT Transition Radiation Tracker	350 k	98.0%
LAr EM Calorimeter	170 k	98.5%
Tile calorimeter	9800	97.3%
Hadronic endcap LAr calorimeter	5600	99.9%
Forward LAr calorimeter	3500	100%
LVL1 Calo trigger	7160	99.8%
LVL1 Muon RPC trigger	370 k	99.7%
LVL1 Muon TGC trigger	320 k	100%
MDT Muon Drift Tubes	350 k	99.7%
CSC Cathode Strip Chambers	31 k	98.5%
RPC Barrel Muon Chambers	370 k	97.3%
TGC Endcap Muon Chambers	320 k	98.8%

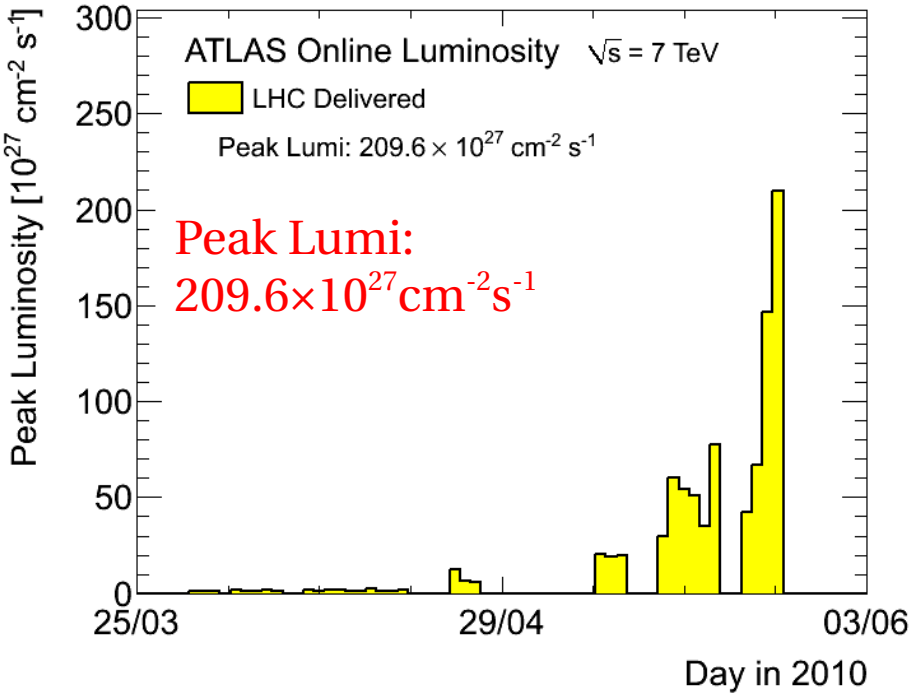
Luminosity in 2010

	Today	nominal
Beam energy	3.5 TeV	7 TeV
N. of bunches n_b	1-8	2808
p/bunch N_b	~2×10^{10}	10^{11}
$\mathscr{L}$ [$cm^{-2}s^{-1}$]	2×10^{29} (max)	10^{34}

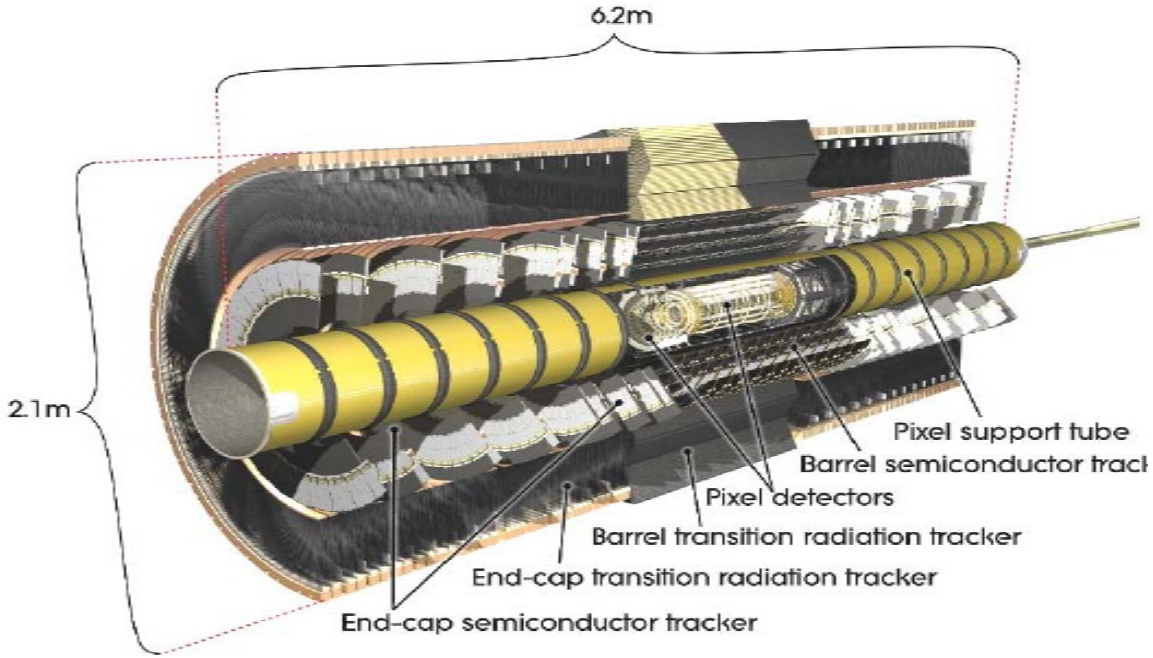
$$\mathscr{L} \propto \frac{N_b^2 n_b f_{revolution}}{4\pi\sigma^2}$$

- Goal :
  - 1 pb^{-1} end of June
  - 1 fb^{-1} end of 2011





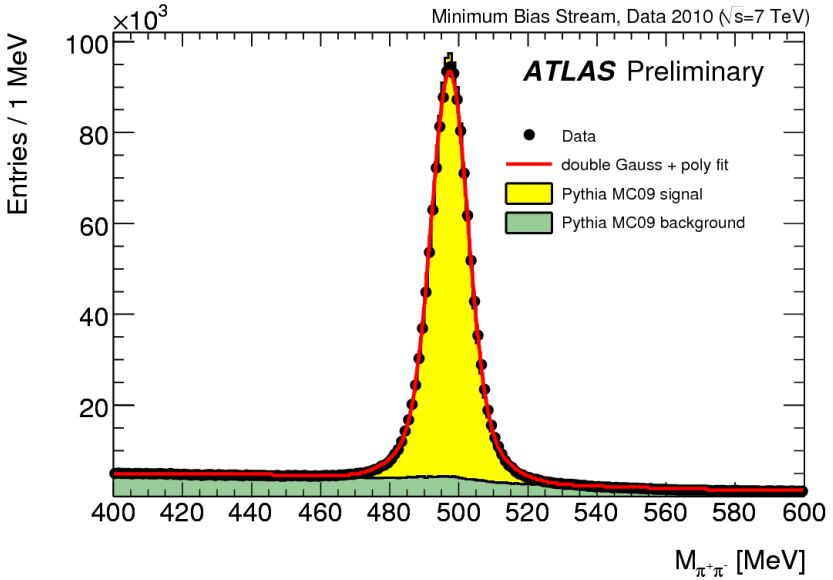
Inner detector

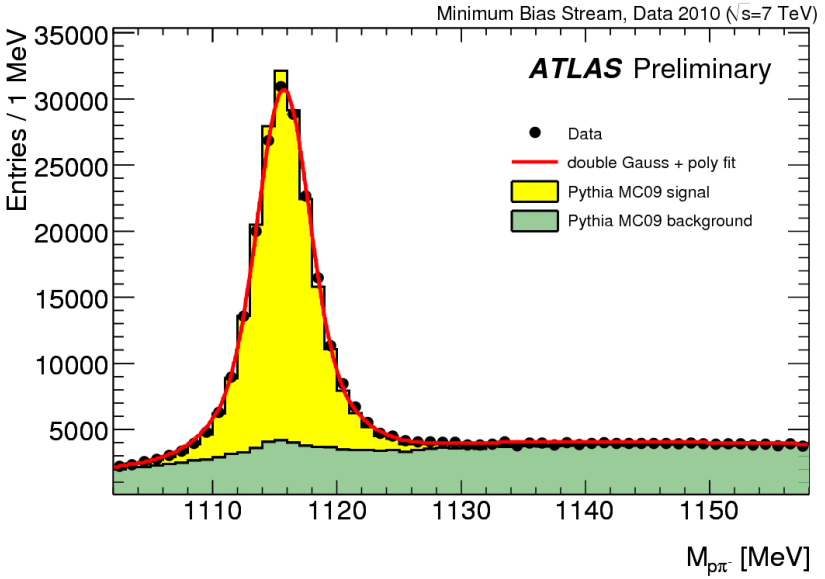


- Coverage : $|\eta|<2.5$

- First collisions sqrt(s) = 900 GeV and 7 TeV
- Single charged particle reconstruction
  - Validate the simulation of the dead material simulation
  - Validation of the particle identification
- Minimum bias studies (tuning of MC)

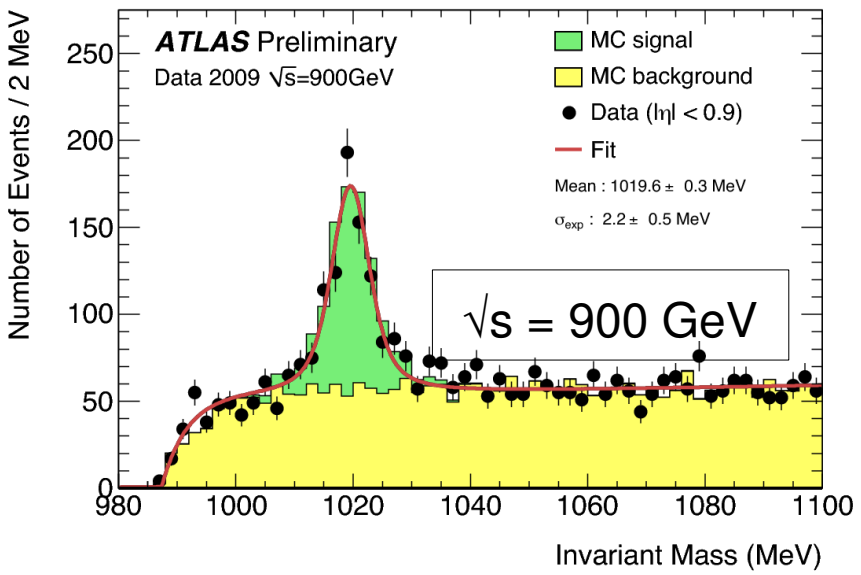
Particle reconstruction in tracker



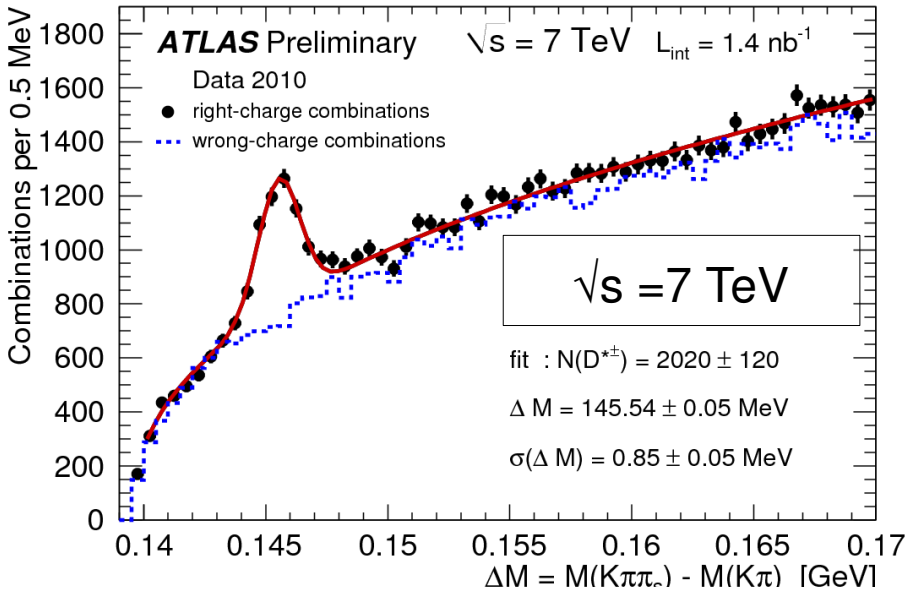


- $K^0_S \rightarrow \pi^+\pi^-$
  - m = 497.427 ± 0.006 MeV
  - PDG : 497.614 ± 0.024 MeV
- $\Lambda \rightarrow p\pi^-$
  - m = 1115.73 ± 0.01 MeV
  - PDG : 1115.683 ± 0.006 MeV
- Peak position is sensitive to the dead material in ID : validation of the material simulation

Particle reconstruction in tracker

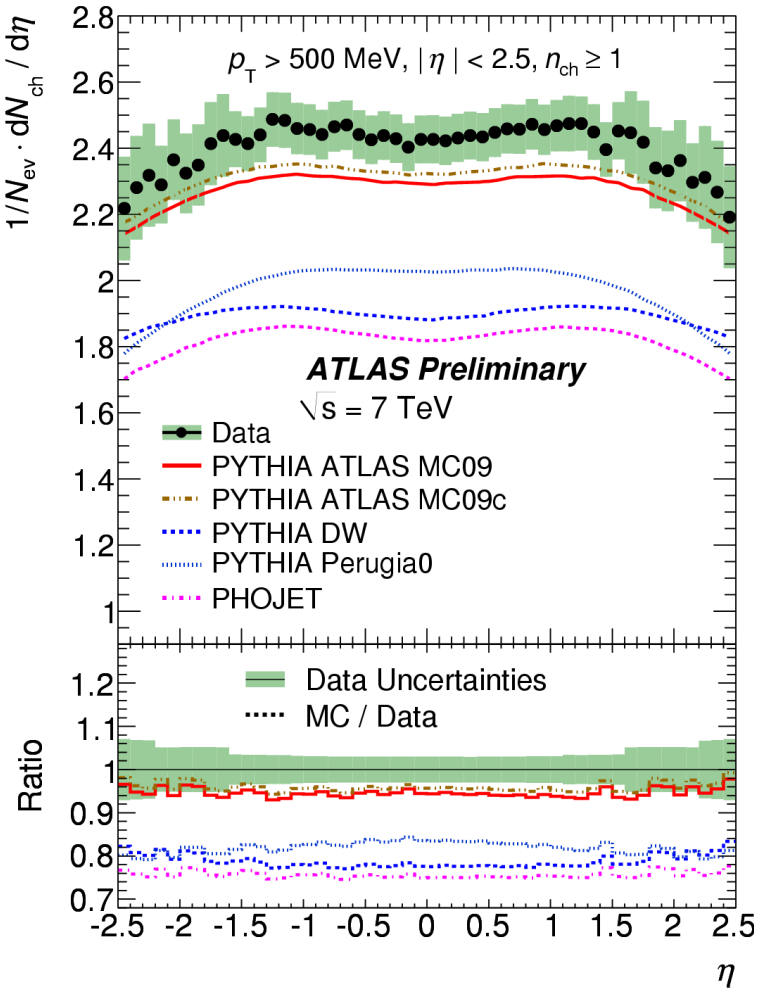


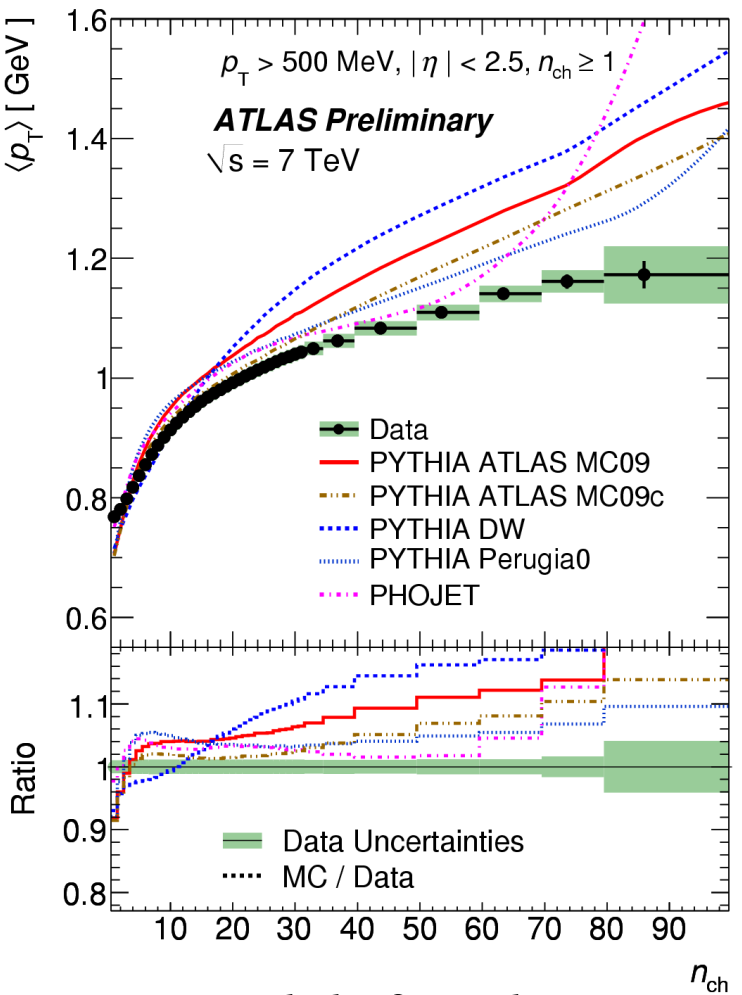
- $\Phi(1020) \rightarrow K^+K^-$
  - m = 1019.6 ± 0.3 MeV
  - PDG : 1019.455 ± 0.020 MeV



- $D^*(2010)^{\pm} \rightarrow D^0 \pi^{\pm}$; $D^0 \rightarrow K^{\pm}\pi^{\pm}$
  - $m(D^{*\pm})$-$m(D^0)$ = 145.54 ± 0.05 MeV
  - PDG : 145.421 ± 0.010 MeV

Charged particles multiplicity in MB





ATLAS MC09

pythia 6.4.21 with pT-ordered showers, MRST LO* PDFs

ATLAS MC09c

improved tuning of color-recombination term

Pythia DW

virtuality-ordered showers tuned from CDF run II.

PYTHIA Perugia0

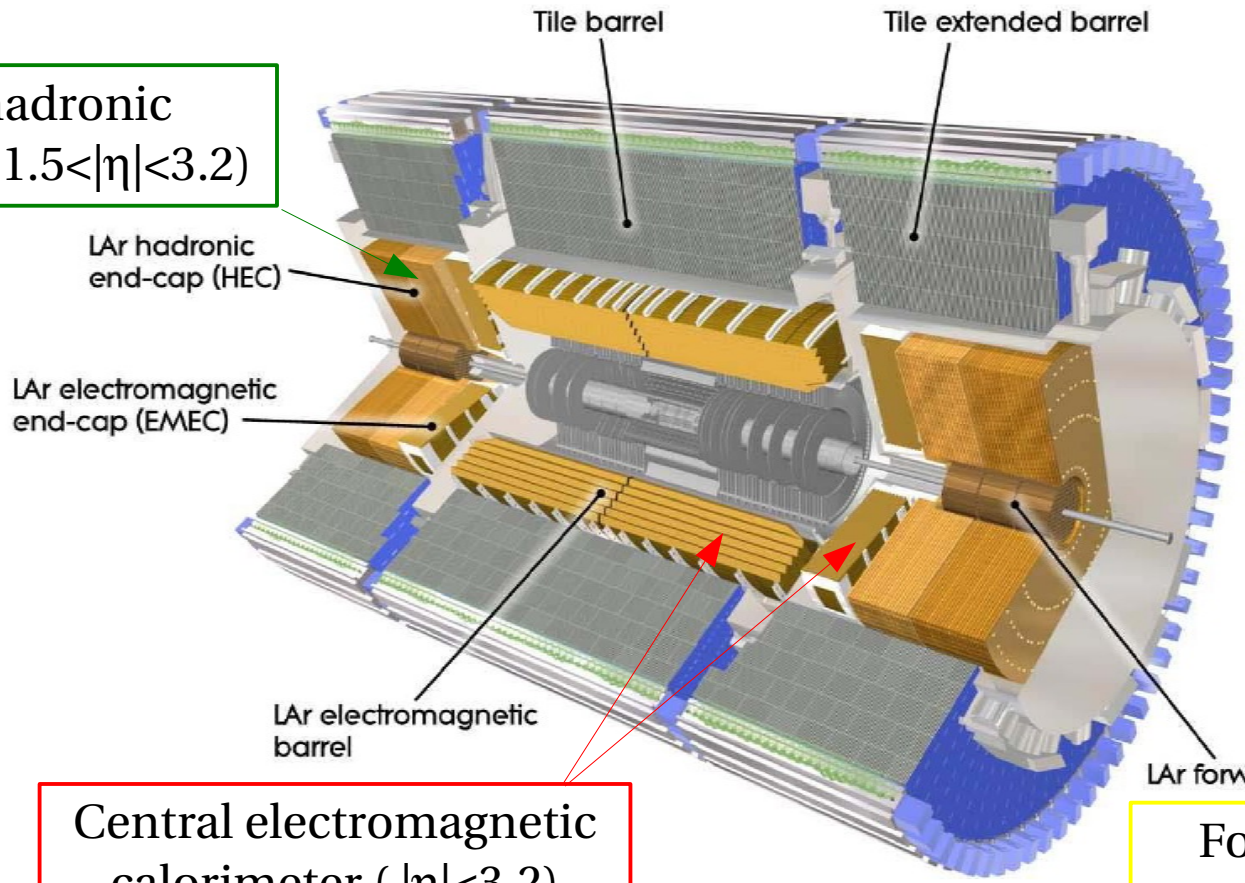
Alternative tune based on TeVatron and SPS data only

- Data compared with current models fitted to previous experiments
  - Average multiplicity : reasonable description (Pythia MC09/09c) at 7 TeV
  - Charge multiplicity : some refitting using the data will be needed to improve the description

Calorimetry in ATLAS

Central hadronic calorimeter (|η|<1.7)

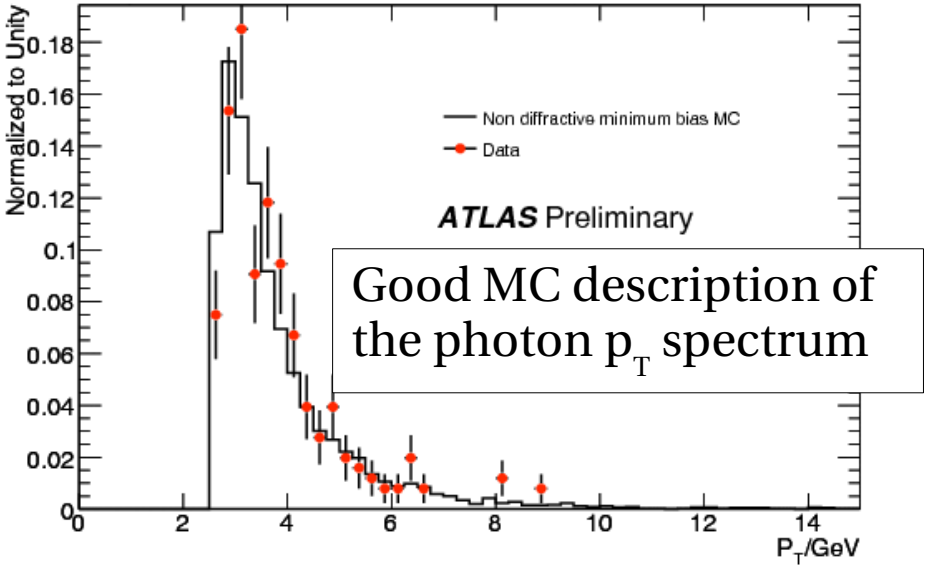
End-cap hadronic calorimeter (1.5<|η|<3.2)



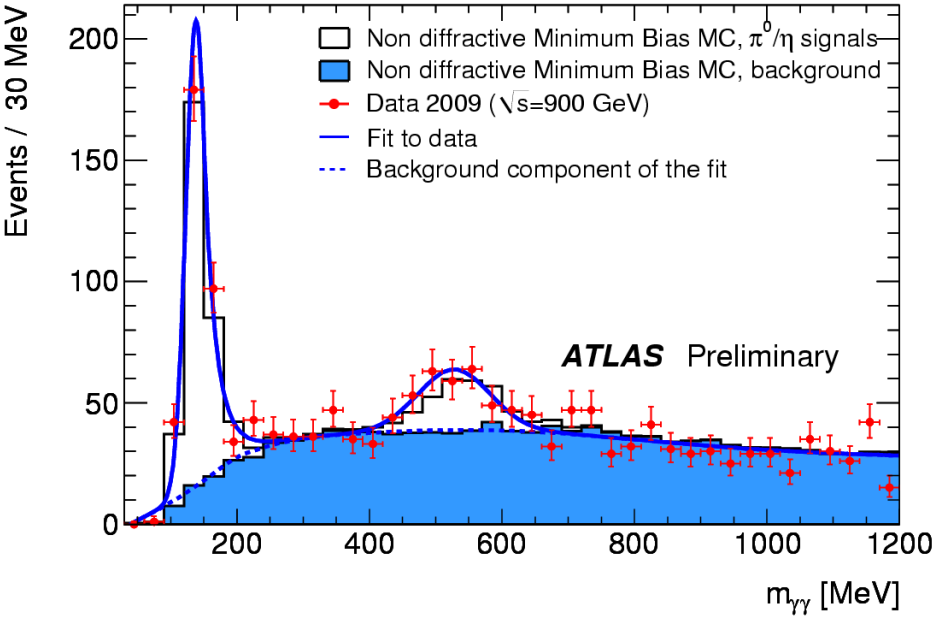
Central electromagnetic calorimeter (|η|<3.2)

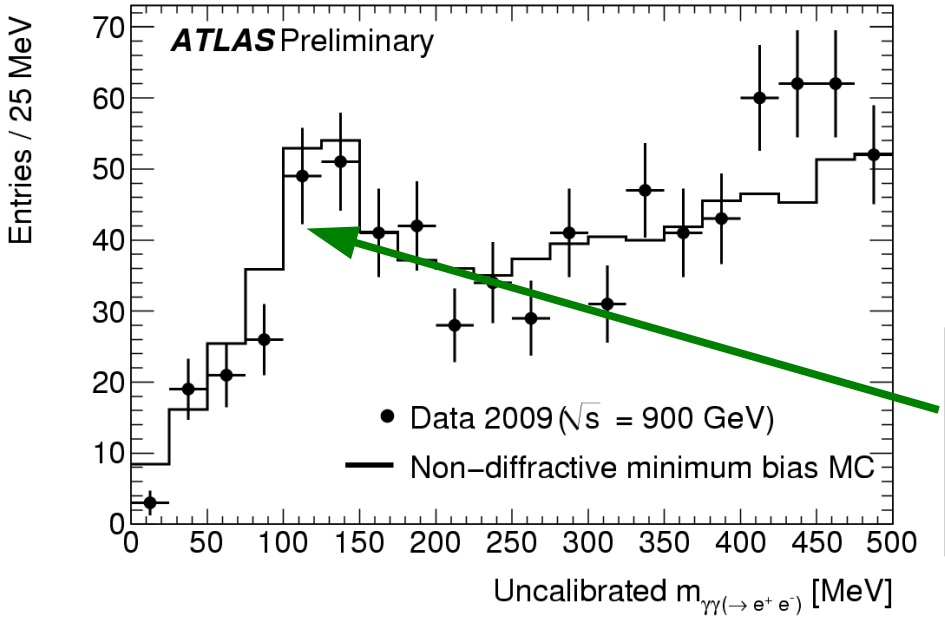
Forward calorimeter (3.1<|η|<4.9)

Reconstruction of γ, π^0,η



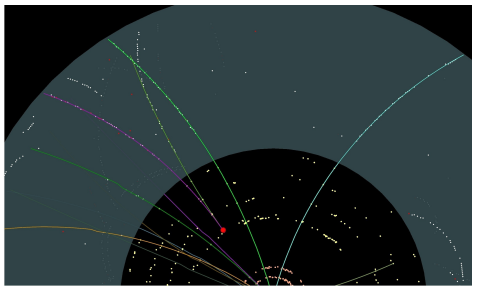
Good MC description of the photon p_T spectrum



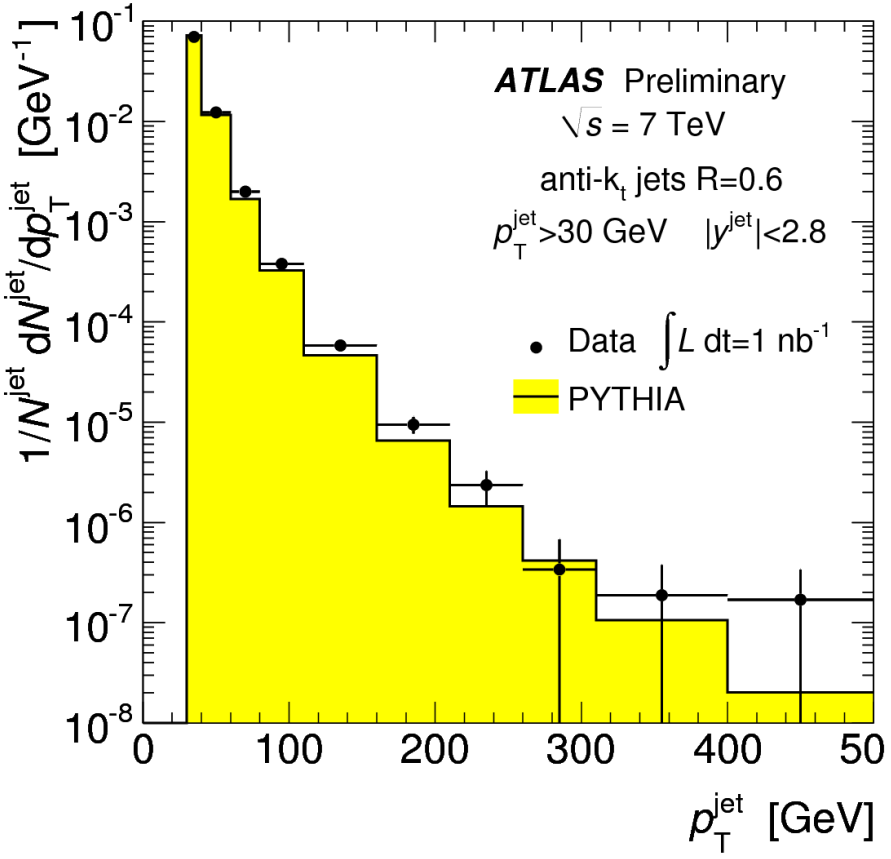


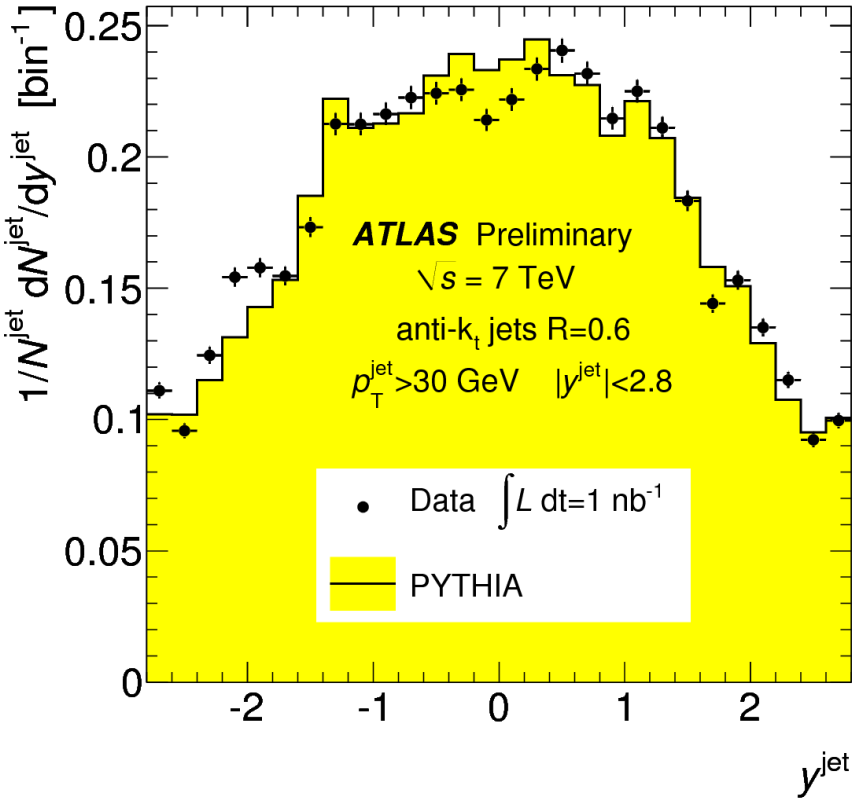
- $\pi^0 \rightarrow \gamma\gamma$: m = 134.0 ± 0.8 MeV
- $\eta \rightarrow \gamma\gamma$: m = 527 ± 11 MeV

Reconstructed from converted photons ($\gamma \rightarrow e^+e^-$)



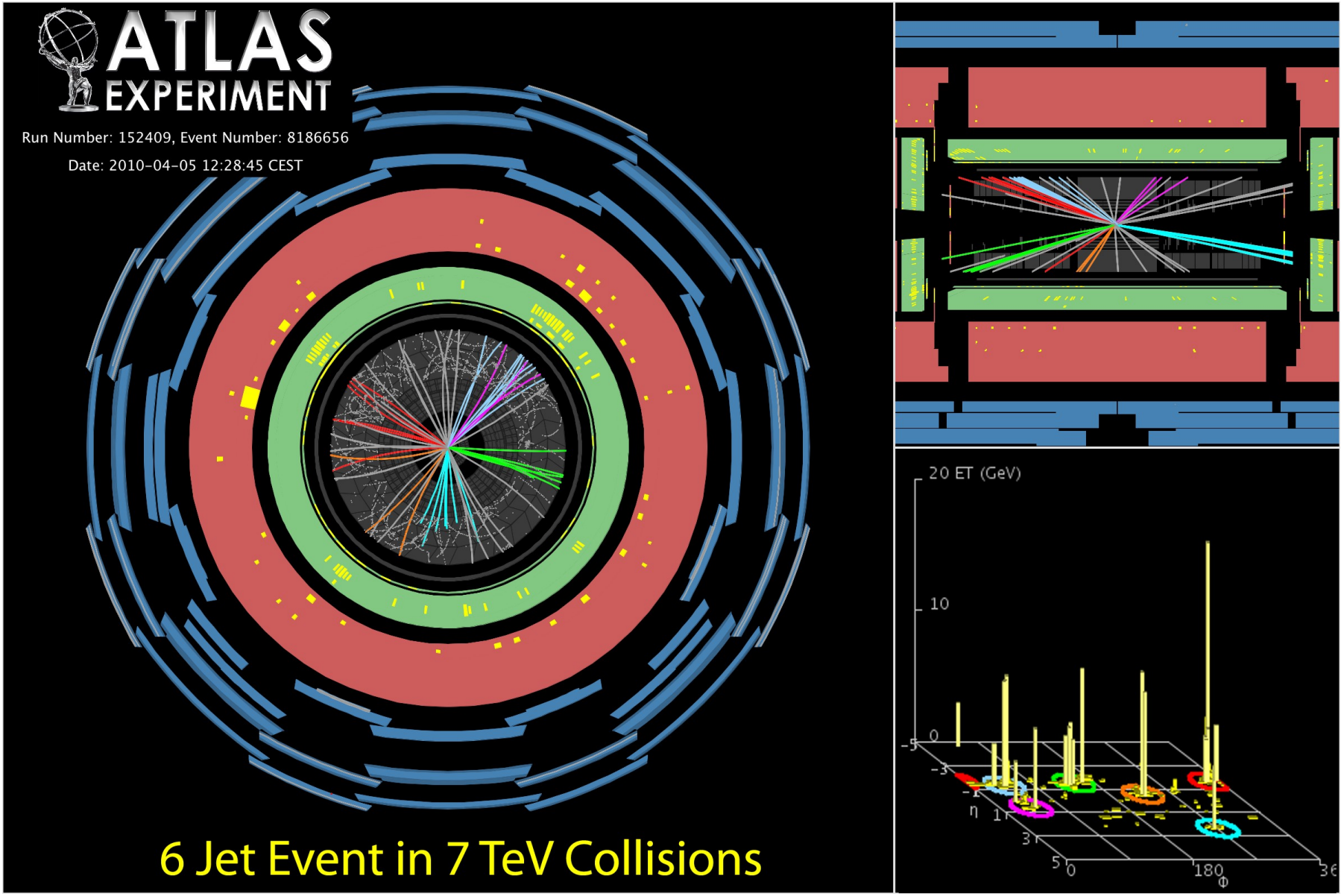
Inclusive jets p_T and y distribution



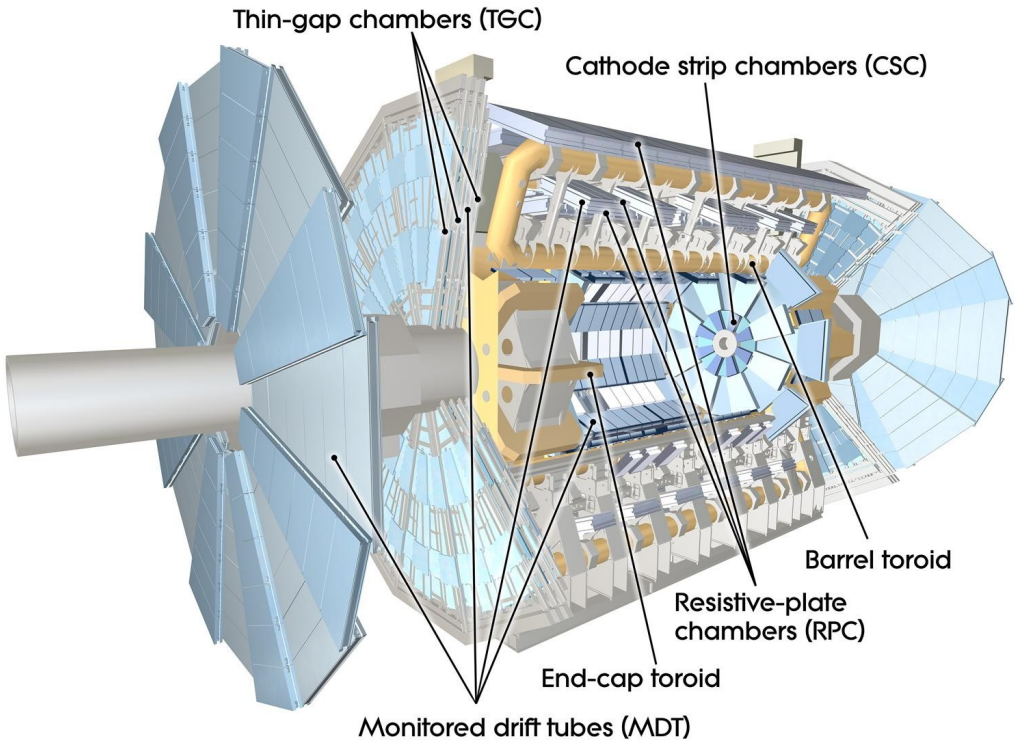


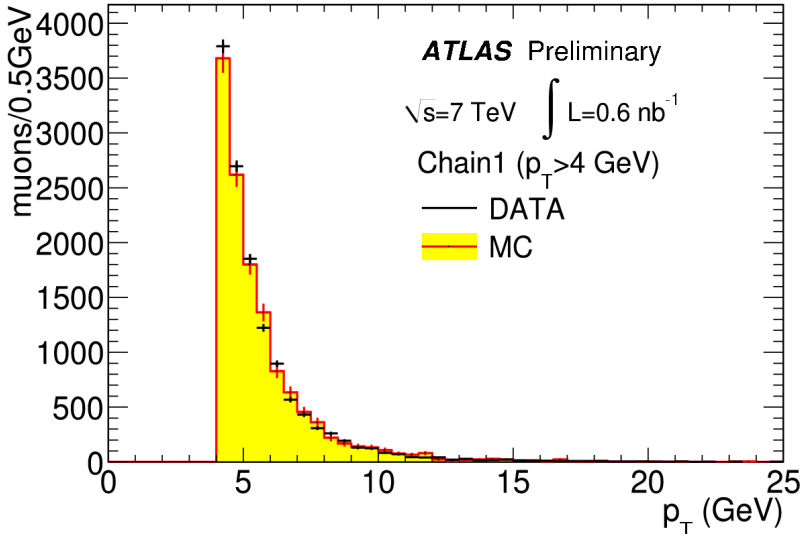
- Normalization to the total # of jets
- Simple p_T-dependent calibration
- Preliminary estimation of the absolute energy scale ~ ±7%
- Good description with Pythia

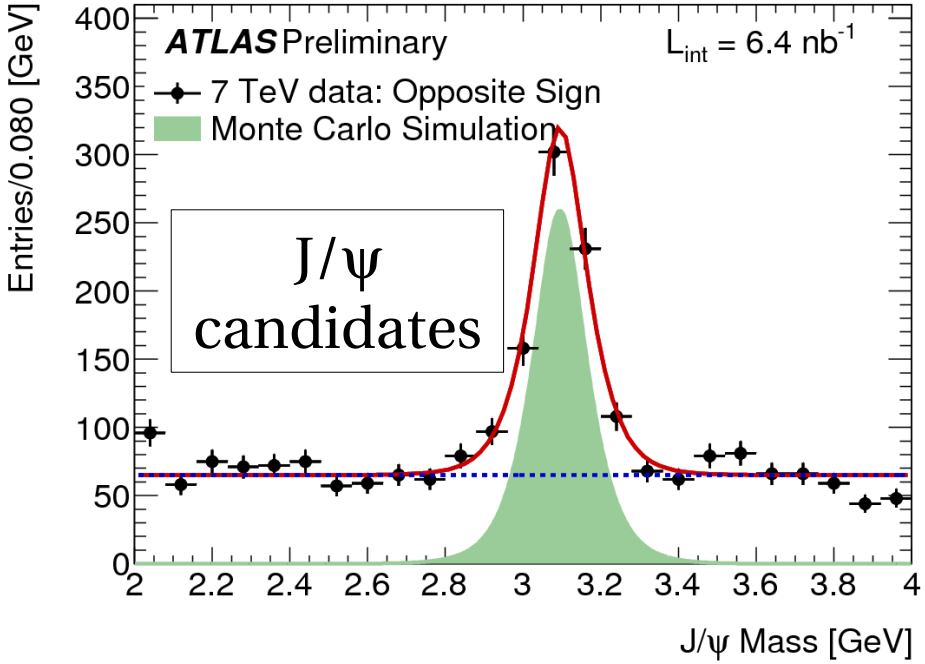
Jets multiplicity



Reconstruction of muons







- Coverage : $|\eta|<2.7$
- Resolution (combined with inner detector) : $\sigma(p)/p \approx 2\%$ (<50 GeV)
- Measurement of $\mu^+\mu^-$ invariant mass
- $m(J/\Psi) = 3.095 \pm 0.004$ GeV

$W \to \nu \ell$ and $Z \to \ell \ell$ candidate

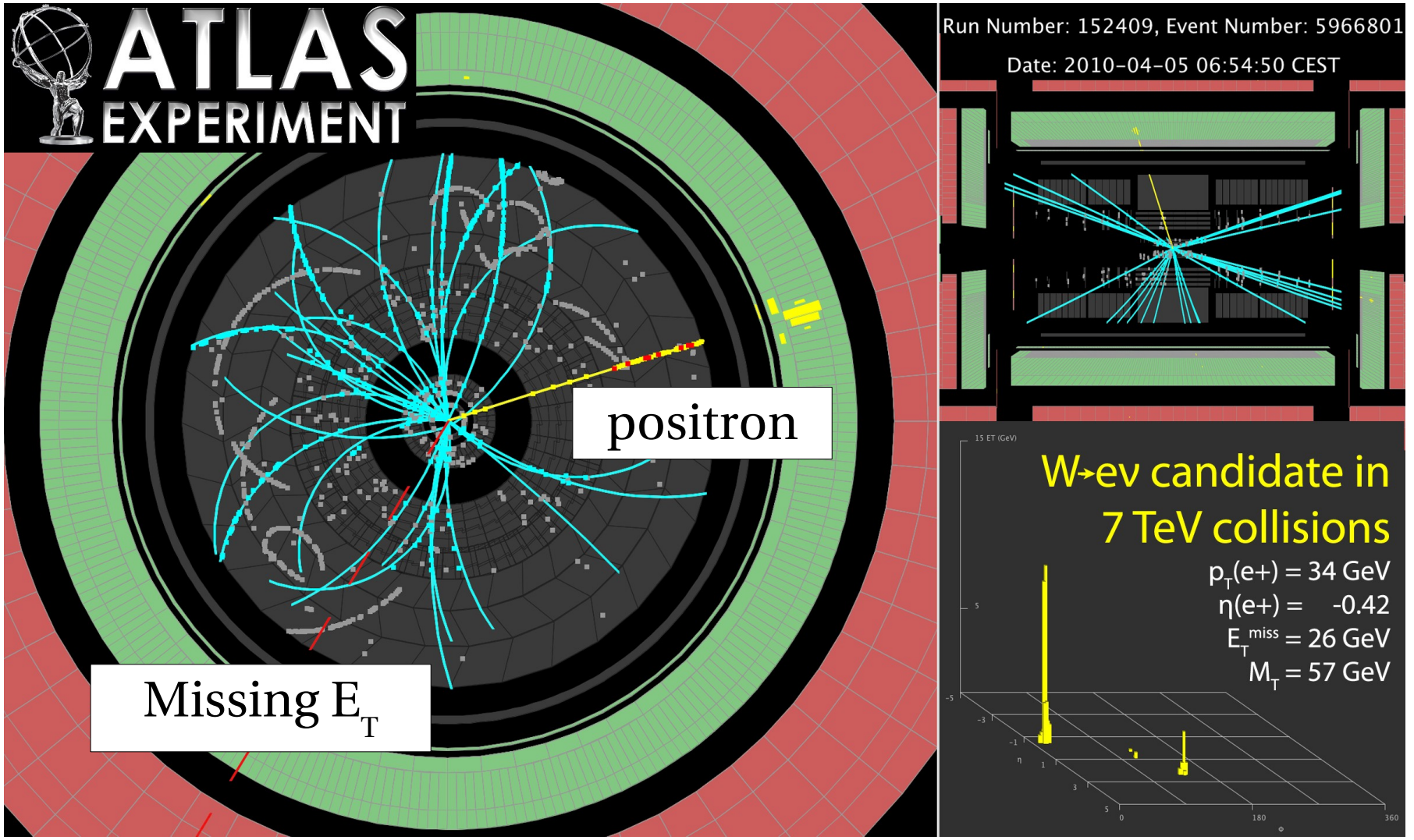
- A fundamental milestone in the rediscovery of the standard model

	$W \to \nu e$	$W \to \nu \mu$	$W \to \ell \ell$
σ(NNLO)	10.45 nb	10.45 nb	0.989 nb
$\int \mathcal{L} dt$	6.7 nb^{-1}	6.4 nb^{-1}	14.6 nb^{-1}
Observed	17	40	3
Tot. expected*	23.1 ± 5.0	28.7 ± 6.9	4.8 ± 0.95

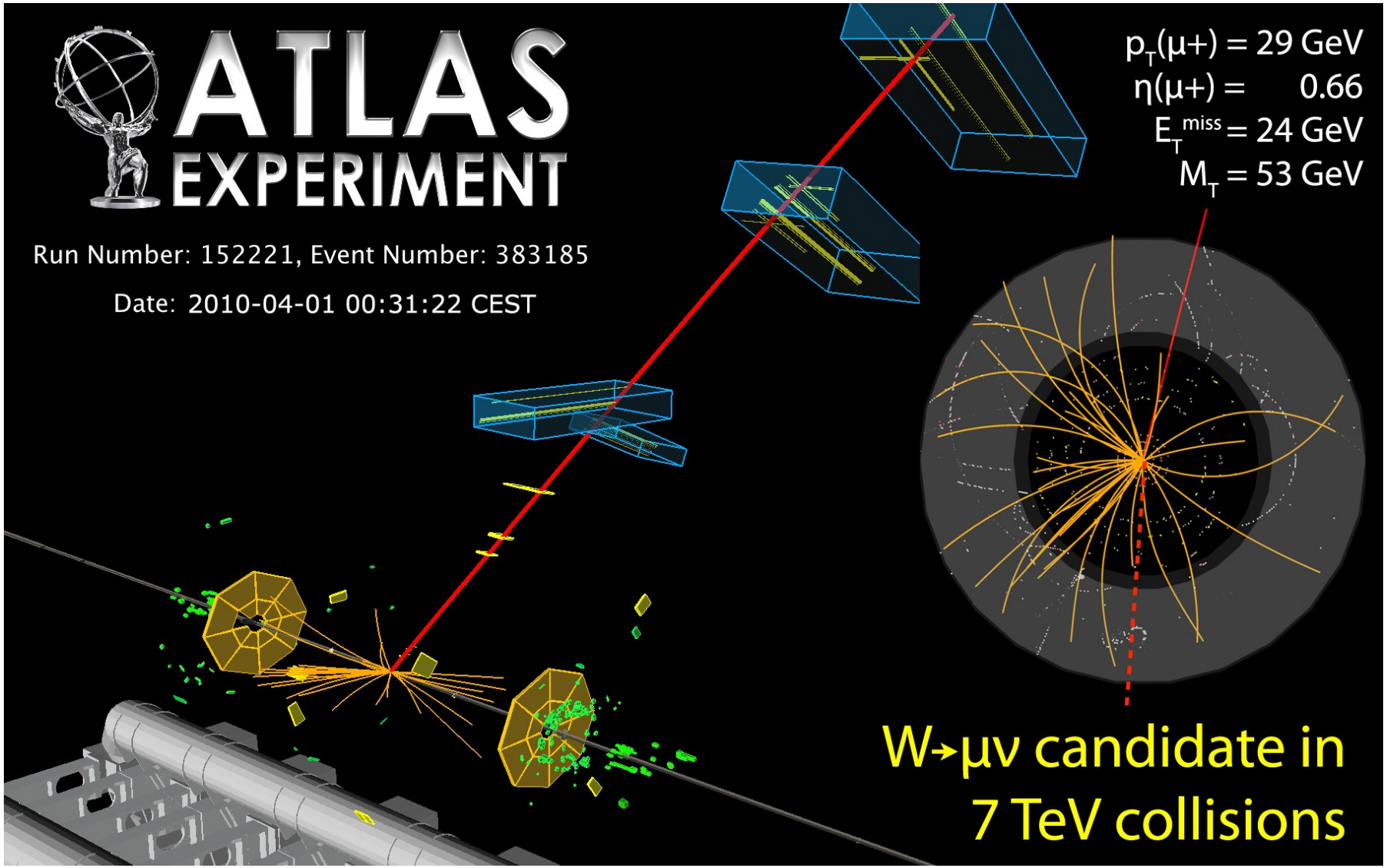
* : signal + background

- Results collected over a 7 week period
- Good agreement with the number of expected events

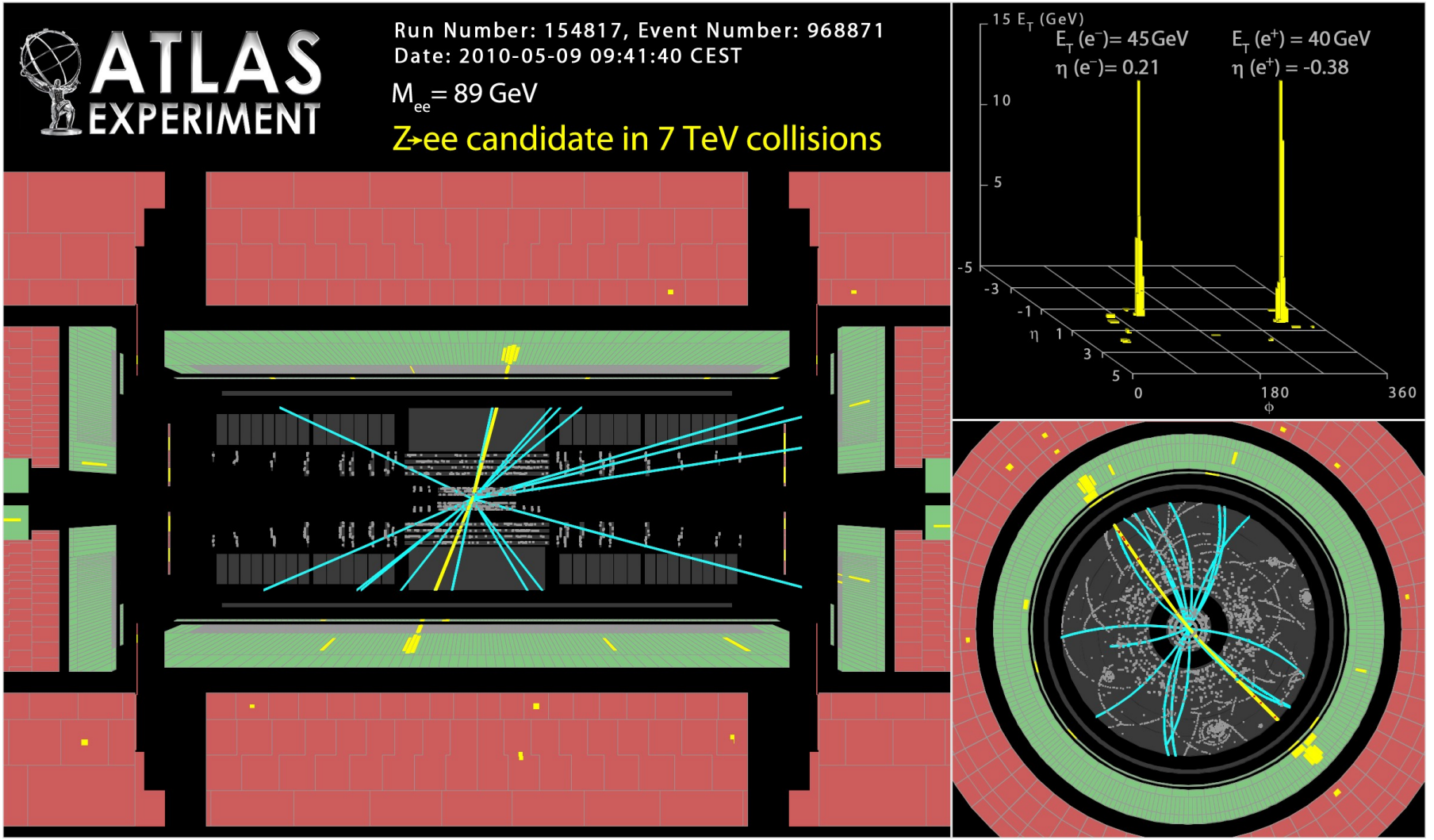
W→νe candidate



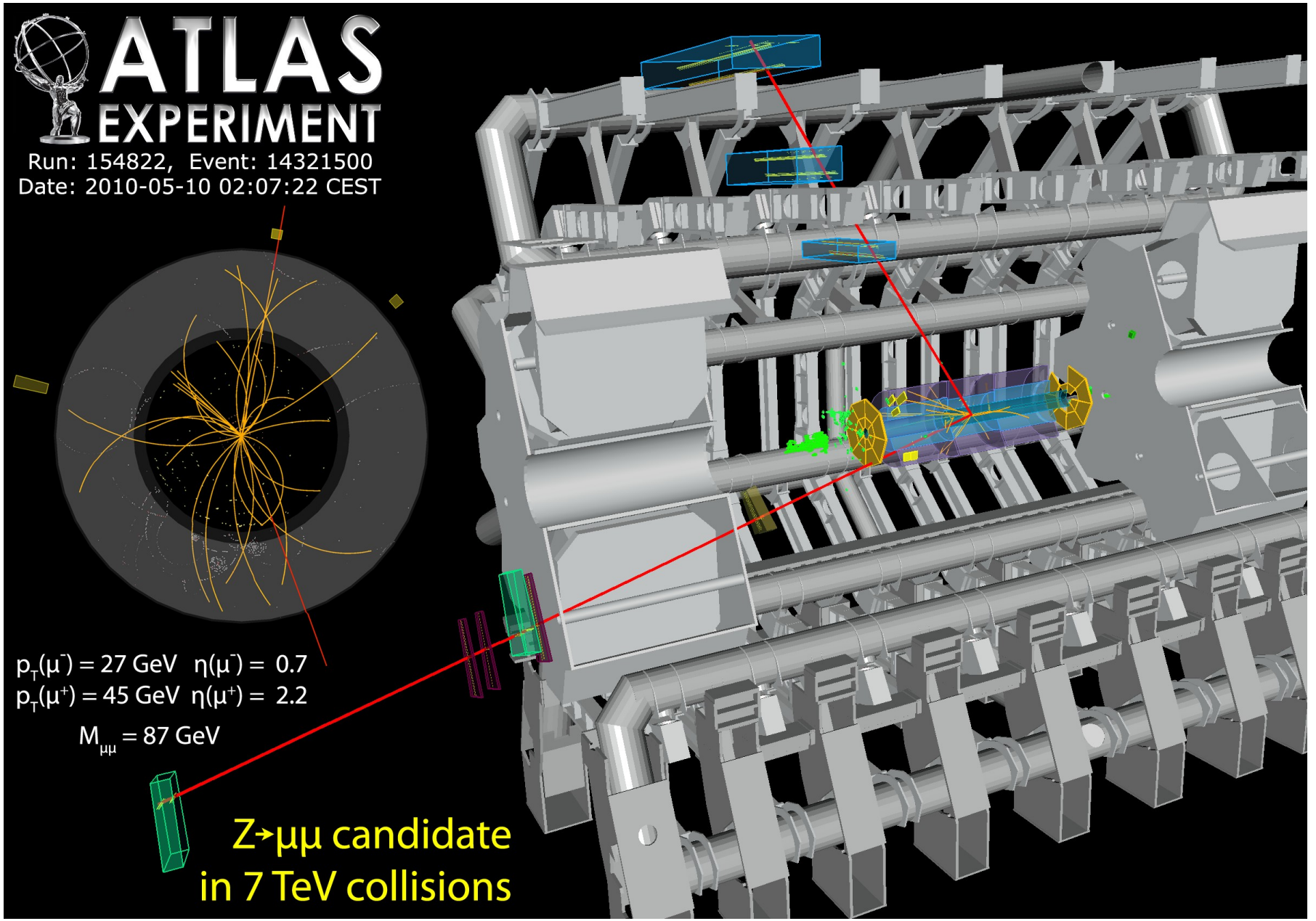
W→νμ candidate



Z→ee candidate



Z→μμ candidate



Conclusions

- ATLAS detector is operational (all sub-detectors >97% operational)
- Data taking is going-on : ~15 nb^{-1} collected so far
  - Goal is 1 fb^{-1} for the end of 2011
- Sub detectors performances checked using benchmark physics channels
- Many physics results have been produced
- First W, Z events have been observed
- Exciting physics program expected for 2010-2011