Performance of EtMiss reconstruction in first ATLAS data at a center-of-mass energy of 7 TeV

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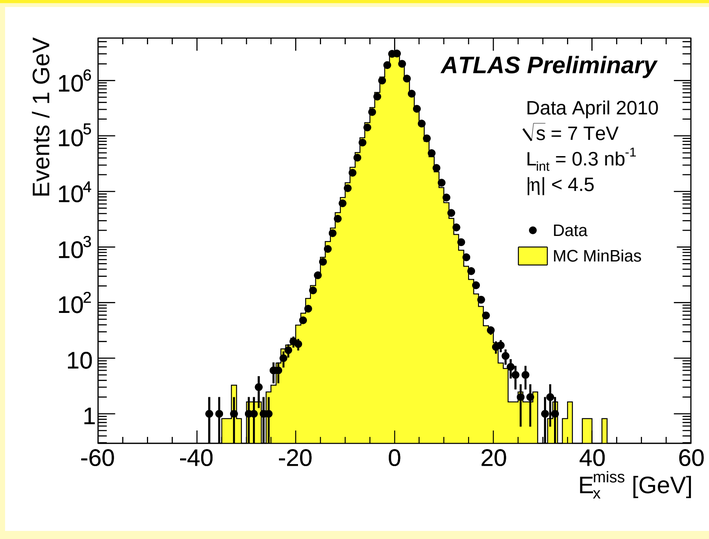
Introduction

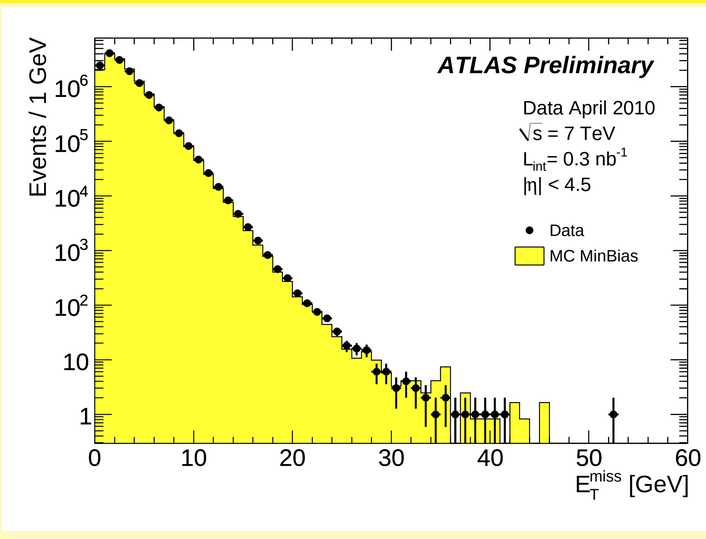
The performance of the reconstruction and calibration of the missing transverse energy is tested using a sample of minimum bias events collected by the ATLAS experiment in April and May 2010, with up to 300 GeV total transverse energy and with reconstructed objects at large transverse momentum. The integrated luminosity of the sample after all data quality criteria are applied is 0.3 nb^{-1}.

$E_{\text{T}}^{\text{miss}}$ reconstruction

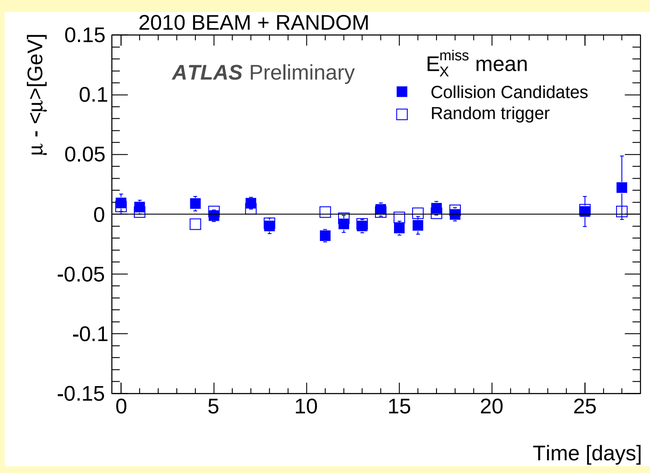
$E_{\text{T}}^{\text{miss}}$ reconstruction : contributions from the calorimeter, corrections for energy loss in the cryostat, and measured muons: $E_{x(y)}^{\text{miss}} = E_{x(y)}^{\text{miss, calo}} + E_{x(y)}^{\text{miss, cryo}} + E_{x(y)}^{\text{miss, muon}}$ [1].

$E_{\text{T}}^{\text{miss}}$ from calorimeter only

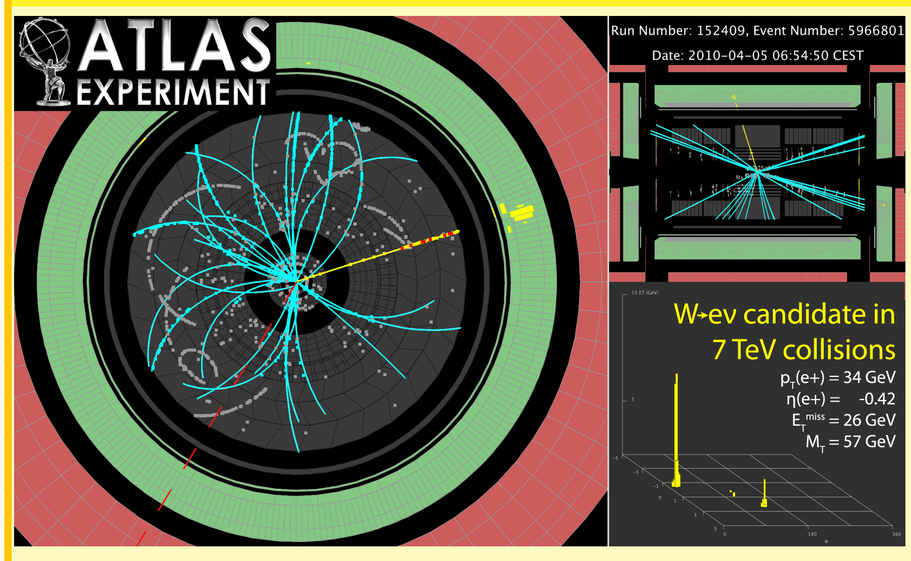


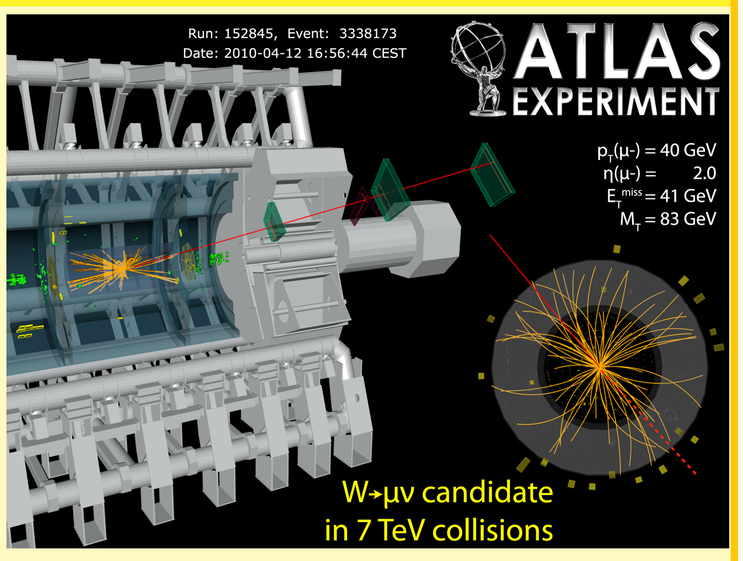


- the calorimeter term is dominant in minbias events.
- noise suppresion is done by considering only the cells in topological clusters.
- average values of E_x^{miss} and E_y^{miss} are compatible with zero. RMS of the distribution is 2.4 GeV.
- $E_{\text{T}}^{\text{miss}}$: overall good agreement with MC, some discrepancies for $E_{\text{T}}^{\text{miss}} > 10$ GeV more pronounced in events with jets with high transverse momentum. An outlier event in the data with $E_{\text{T}}^{\text{miss}}$=52 GeV is due to a mis-measured jet pointing to a crack.
- stable detector over one month of data taking.



First W→eν and W→ μν candidates





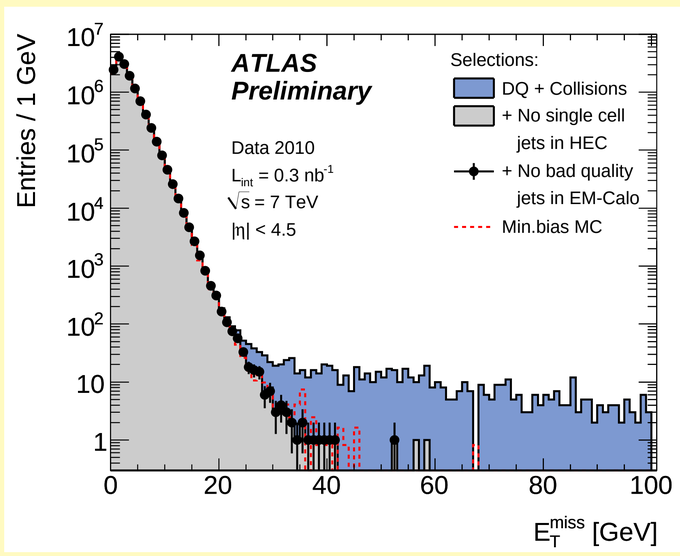
- for the first observation of W-bosons in ATLAS the $E_{\text{T}}^{\text{miss}}$ reconstructed at electromagnetic scale was used for the electron channel; for the muon channel, the $E_{\text{T}}^{\text{miss}}$ muon term was also considered.

Missing Et cleaning

Jets are reconstructed using the anti-k_t algorithm with distance parameter $R = 0.4$.

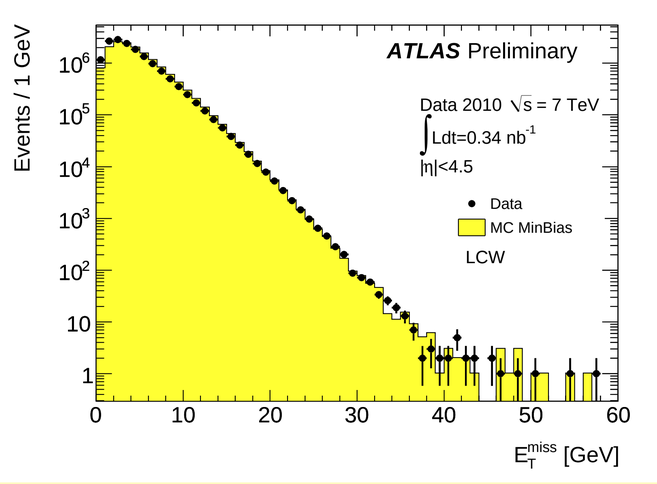
Three main sources of fake jets :
- sporadic noise in the HEC
- few noise bursts in the em calorimeter
- out-of-time energy deposits in the calorimeter.

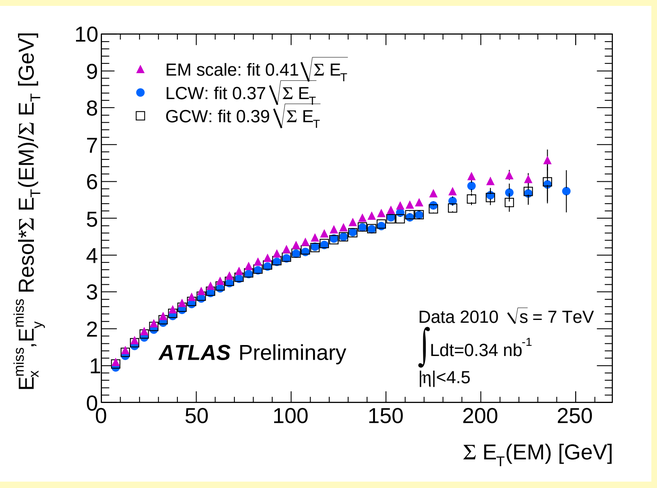
Events containing at least one fake jet with p_{T}>10 GeV are rejected.
The fraction of the rejected events is $\sim 1 \times 10^{-4}$.



Calibrated $E_{\text{T}}^{\text{miss}}$

Two calibration schemes: Global calibration and Local hadronic calibration [2].





- $E_{\text{T}}^{\text{miss}}$ distribution: no additional tails created by the calibration.
- calibrated resolution is improved with respect to the resolution at the em scale; reasonable agreement data/MC, with observed differences in the scale factors of up to 5%.

Refined $E_{\text{T}}^{\text{miss}}$

- computed with calorimeter cells calibrated on the base of the objects they belong to :

$$E_{x(y)}^{\text{miss,calo,calib}} = E_{x(y)}^{\text{miss,e}} + E_{x(y)}^{\text{miss,}\gamma} + E_{x(y)}^{\text{miss,}\tau} + E_{x(y)}^{\text{miss,jets}} + E_{x(y)}^{\text{miss,calo,}\mu} + E_{x(y)}^{\text{miss,CellOut}}.$$

- the contributions from the cells in topoclusters not associated to any reconstructed object and from cells belonging to jets are dominant.
- similar $E_{\text{T}}^{\text{miss}}$ to the one at the LCW scale, but it has slightly larger tails due to the addition of the muon term.

Conclusions

The missing transverse energy is computed from topological clusters and different calibration schemes are applied. The results demonstrate that the $E_{\text{T}}^{\text{miss}}$ reconstruction and calibration are well under control and reach the expected performance.

Bibliography

[1] ATLAS Collaboration, Internal Note, ATLAS-COM-CONF-2010-039

[2] ATLAS Collaboration, Internal Note, ATLAS-COM-PHYS-2010-365