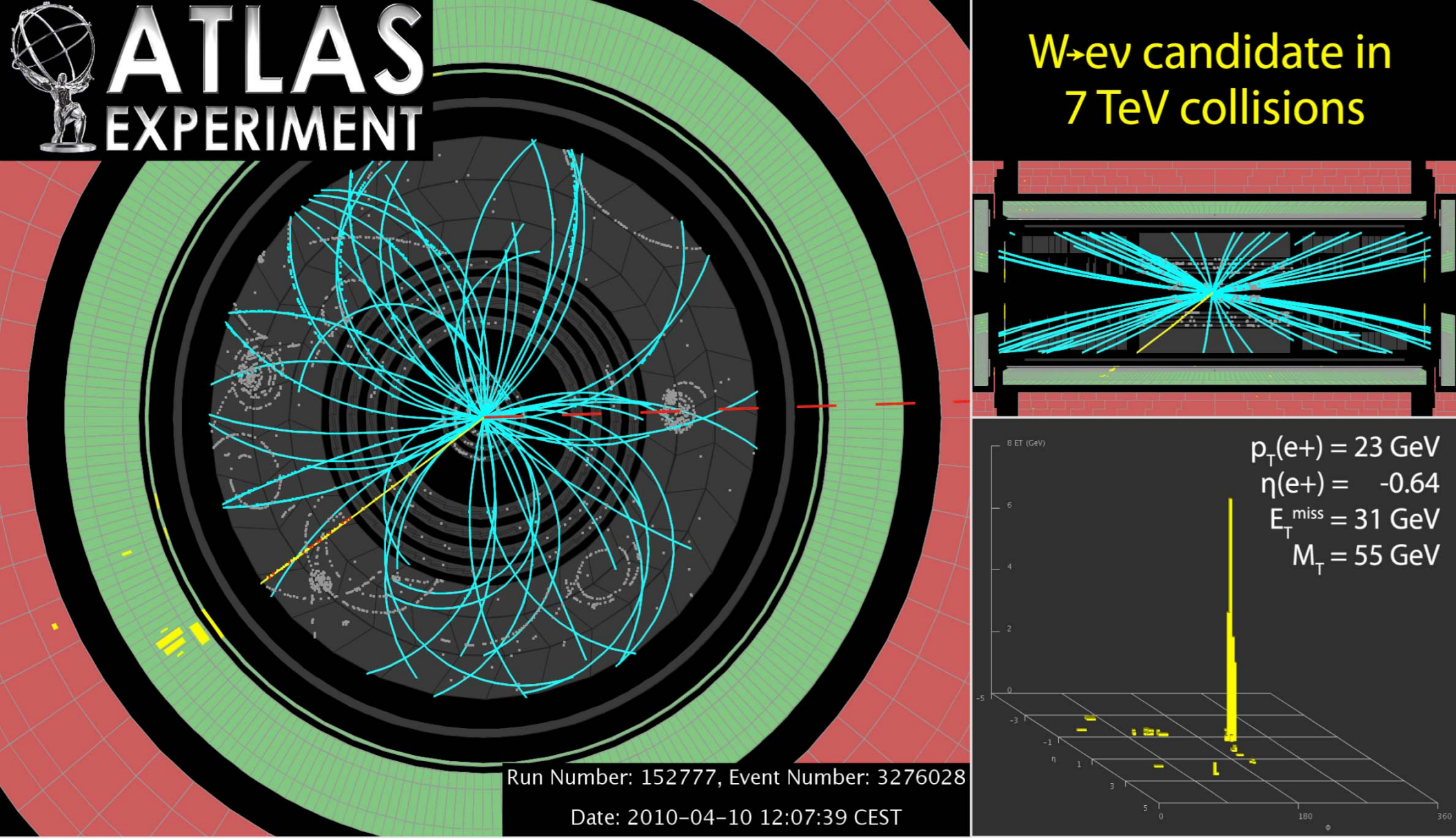

Performance of the Missing Transverse Energy Reconstruction in the first ATLAS Data at 7 TeV

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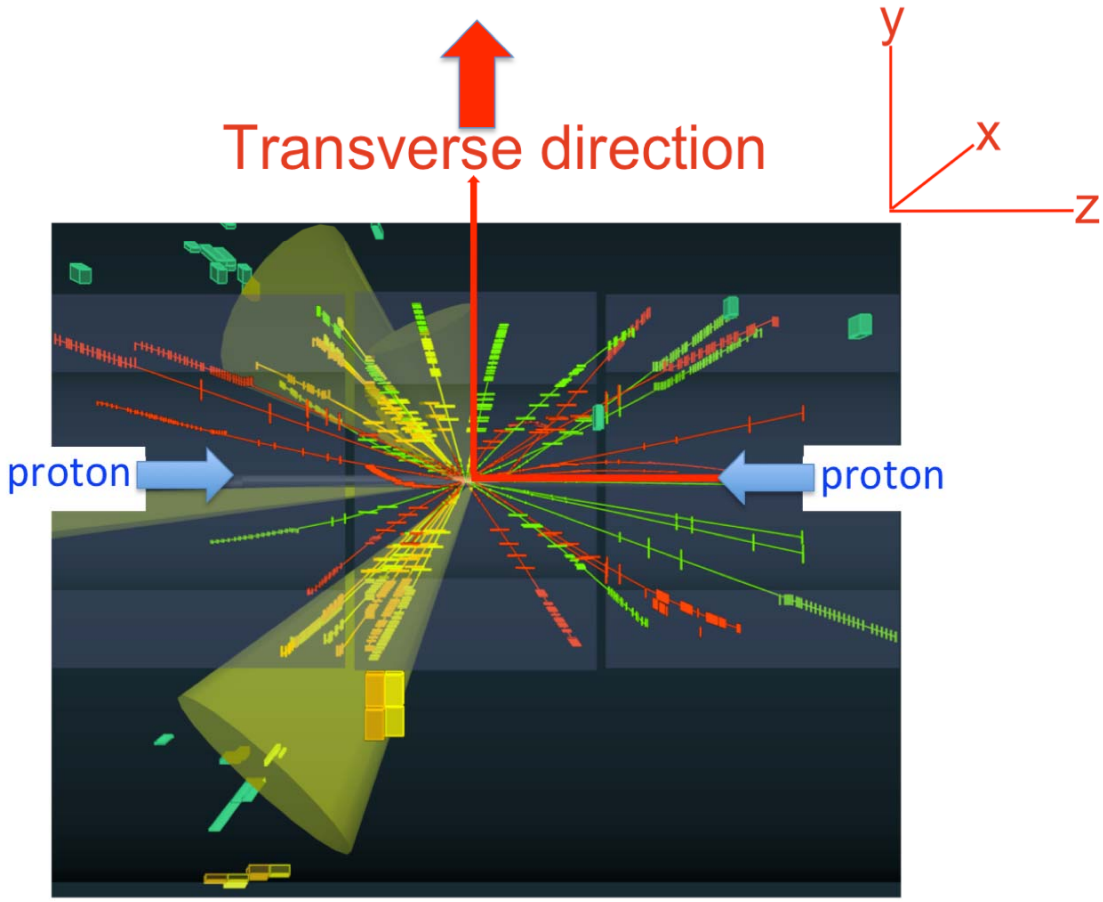
on behalf of the ATLAS Collaboration

Missing Transverse Energy (E_T^{miss})

- In pp collisions at the LHC, a significant, unmeasured amount of energy escapes in z direction
- Total initial and final momentum is zero in transverse direction
- Imbalance of energy in transverse direction signals presence of weakly or non-interacting particles such as neutrinos



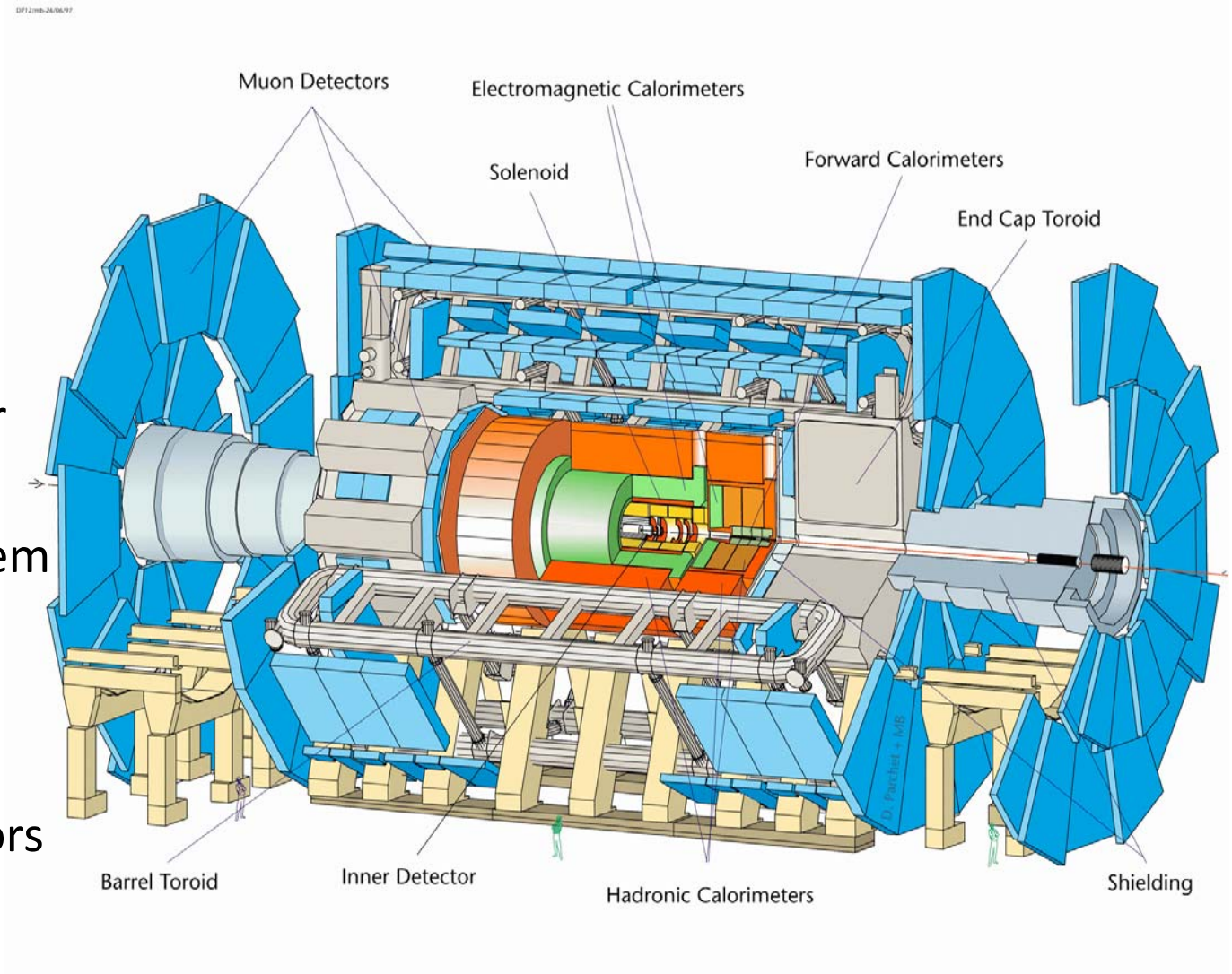
$$E_T^{miss} = \sqrt{(E_x^{miss})^2 + (E_y^{miss})^2}$$

$$E_{x(y)}^{miss} = -\sum_{particles} E_{x(y)}$$

$$\sum E_T = \sum_{particles} E_T$$

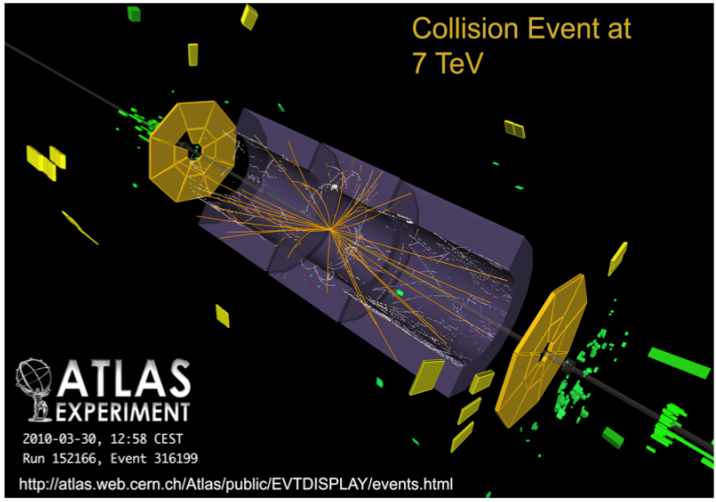
ATLAS Detector

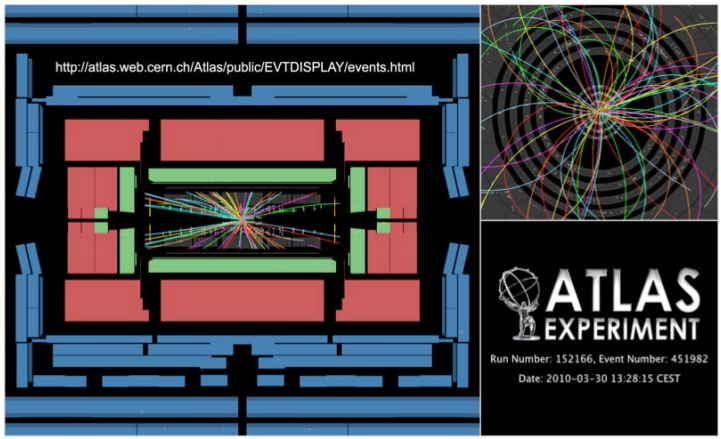
- Precision inner tracker in magnetic field for charged particle momentum measurement
- Calorimeters for precise energy measurement over large energy range
- Air-core toroid muon system
- Excellent data quality monitoring
- Good E_T^{miss} reconstruction depends on all subdetectors and data quality control

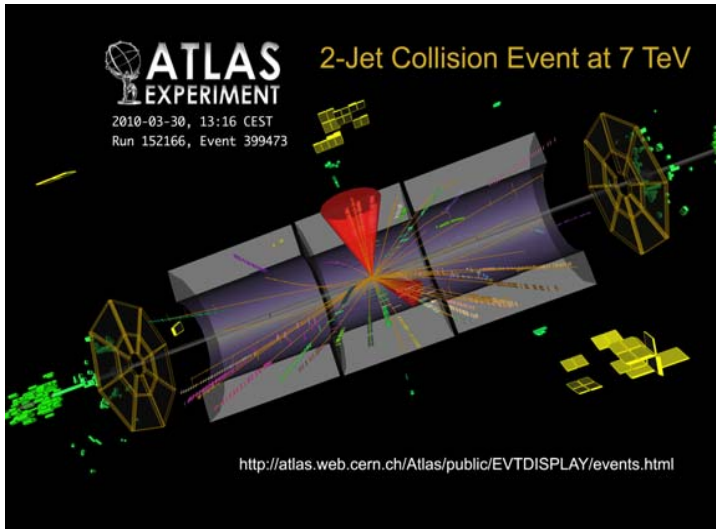


Dataset

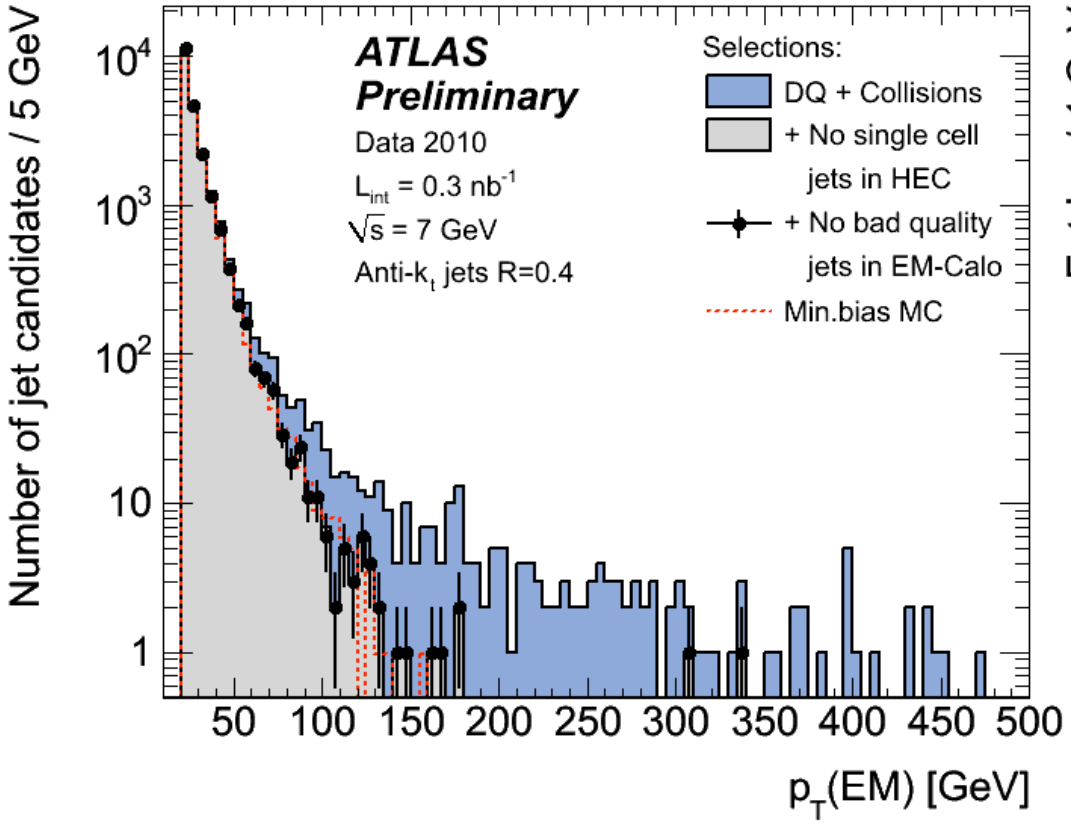
- 14.5 million events selected from 7 TeV data (0.3 nb^{-1})
- All plots at electromagnetic scale
- Events triggered by Minimum Bias Trigger Scintillators
- Require reconstructed primary vertex, apply calorimeter + offline timing cuts to reduce non-collision backgrounds
- Simulated data made with PYTHIA (non-diffractive and single- and double-diffractive processes)

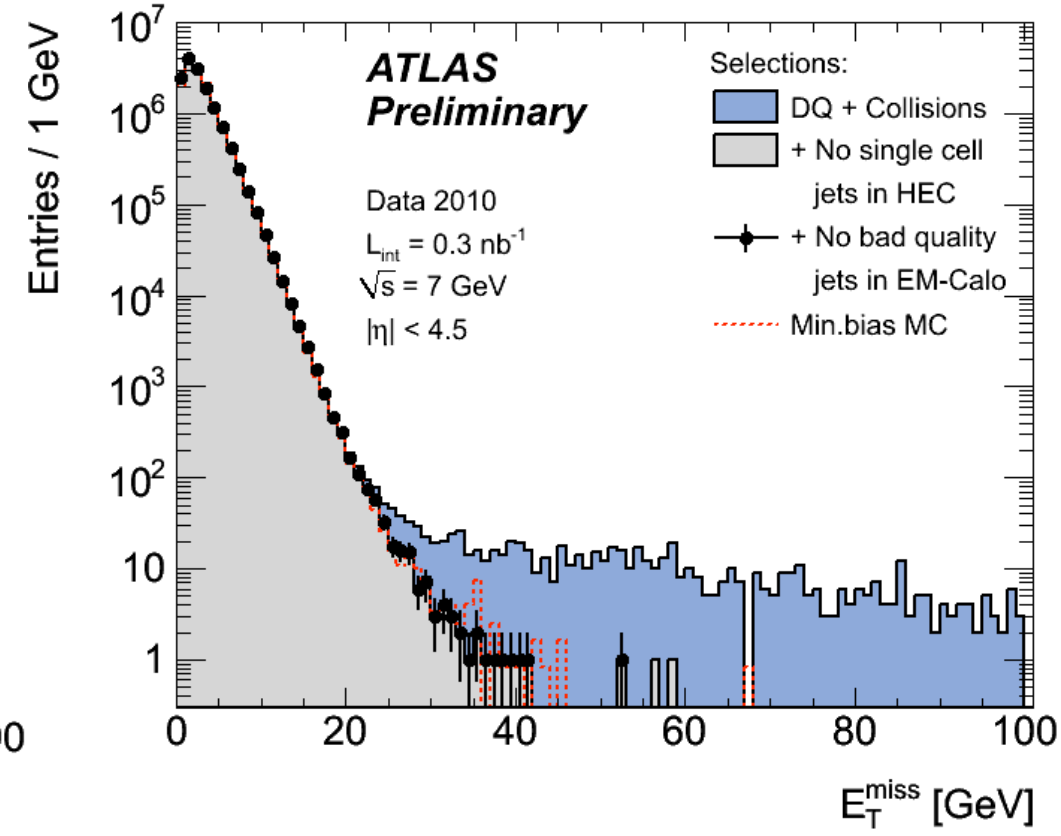






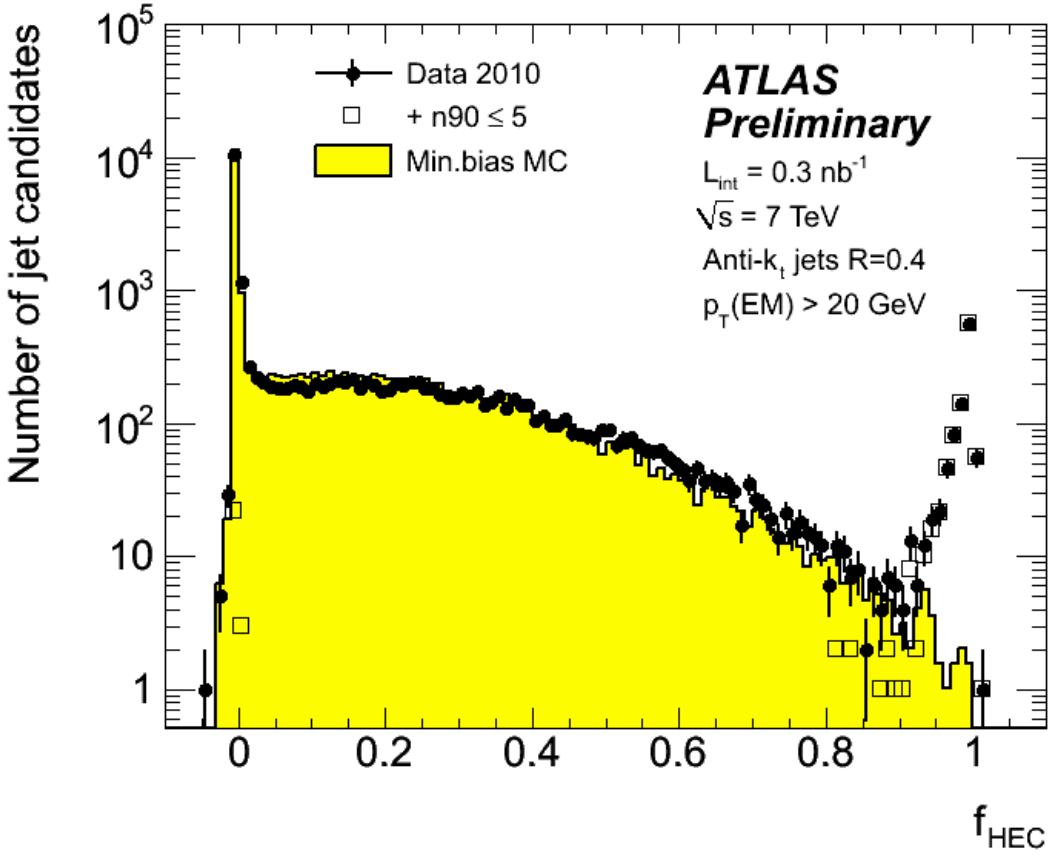
Data Cleaning

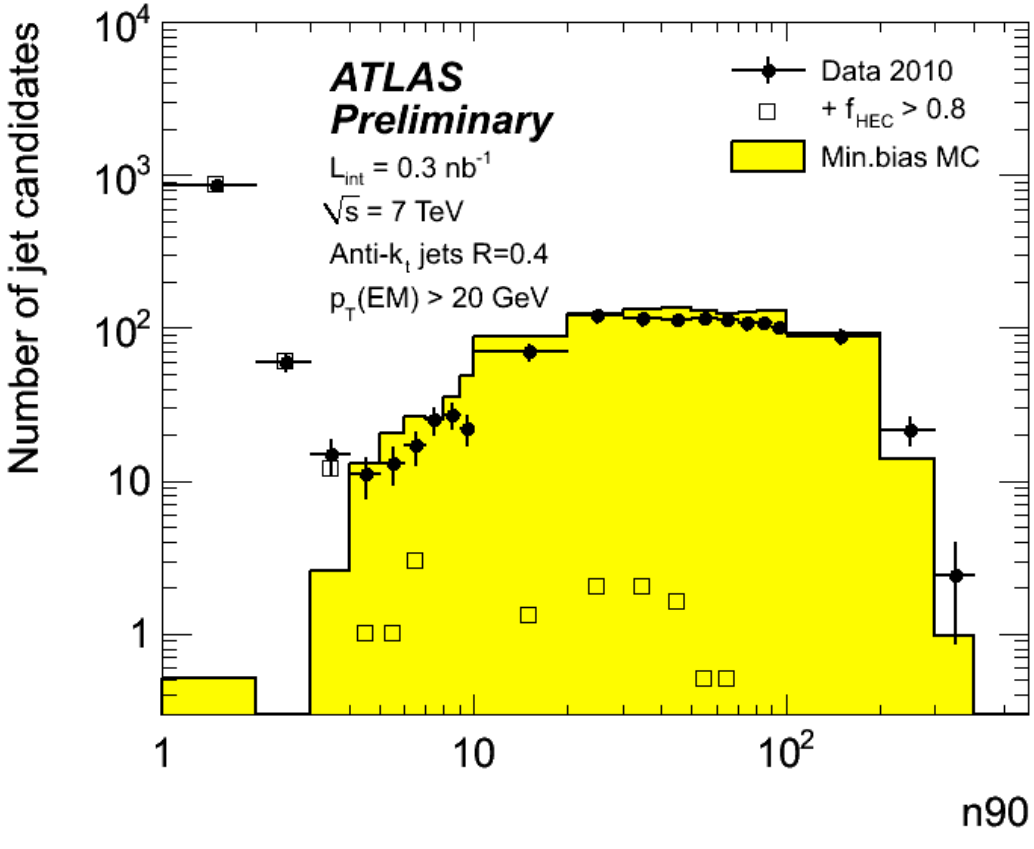




- E_T^{miss} very sensitive to any detector problems
- Exclude bad events by using jets as probe

Event Cleaning Cuts



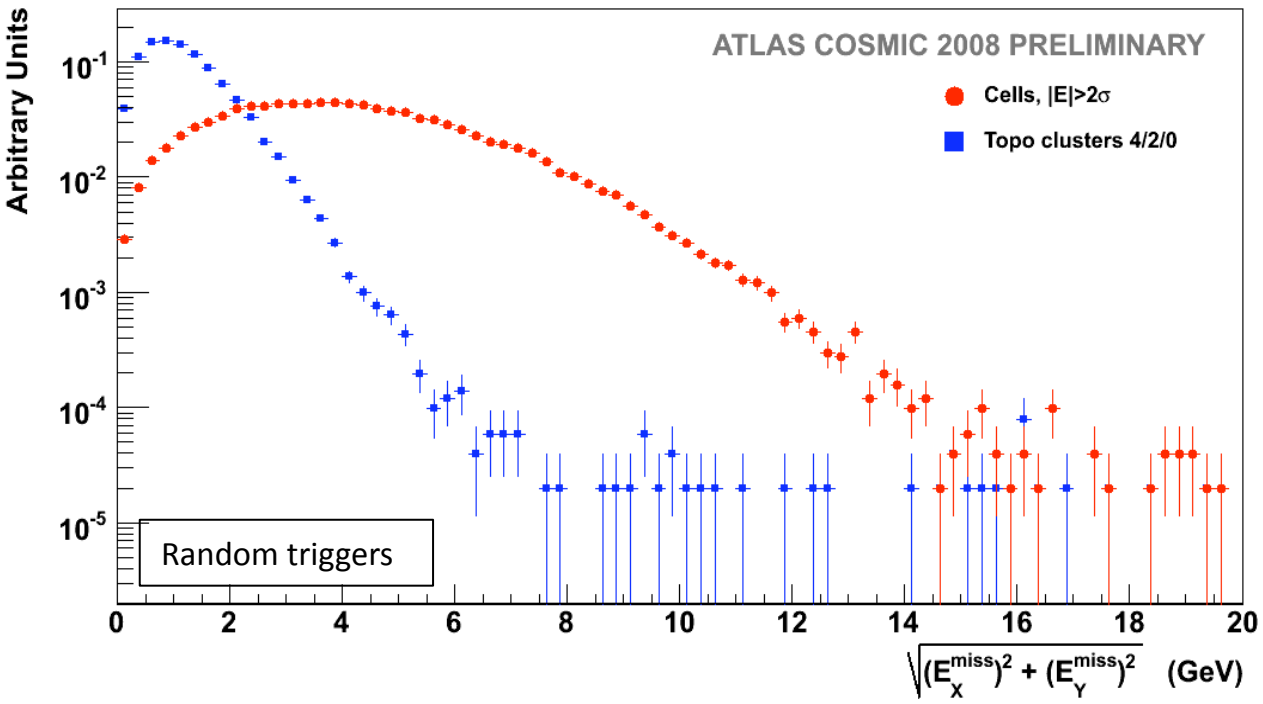


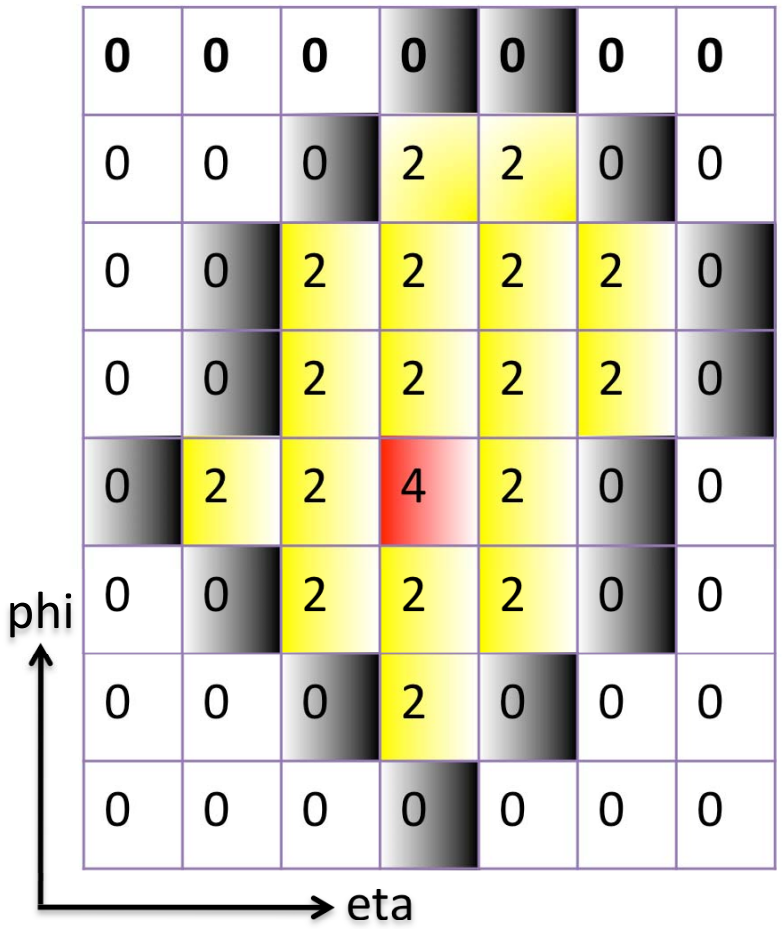
f_{HEC} = fraction of jet energy in hadronic endcap calorimeter
n90 = number of calorimeter cells in jet carrying 90% of the jet energy

- Rare single-event detector problems are identified and removed
- ~1/10000 single events removed

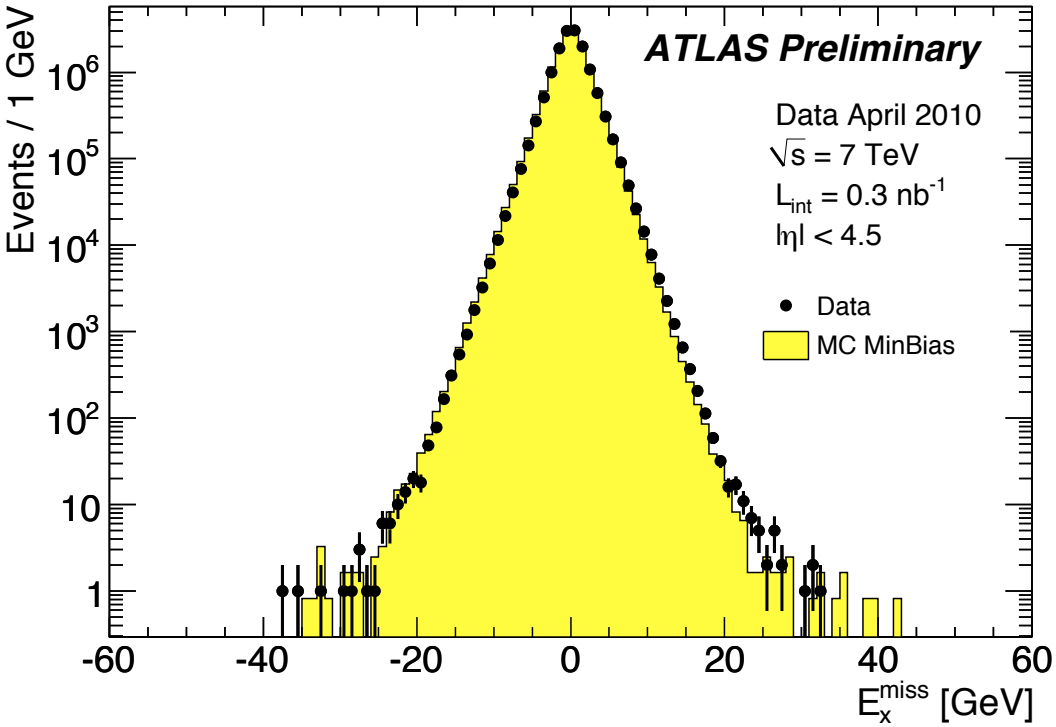
Topological Clusters

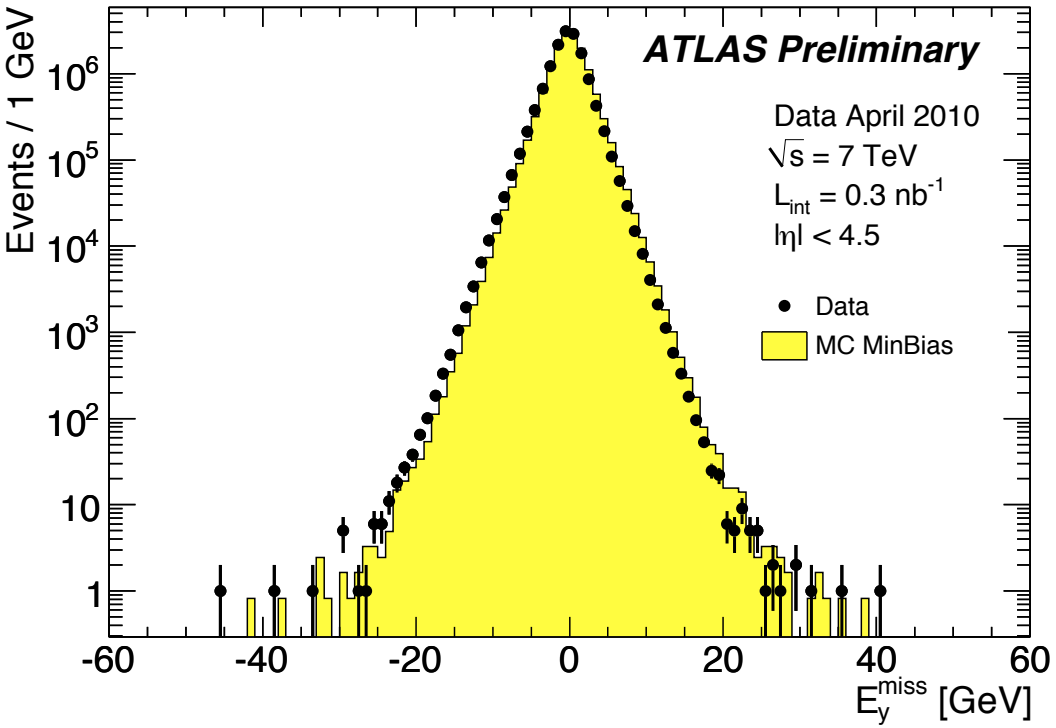
- Significant noise contribution when summing all calorimeter cells with simple noise cut
- Topological clustering algorithm creates clusters seeded by cells with $|E| > 4*\sigma_{noise}$
- All neighboring cells with $|E| > 2*\sigma_{noise}$ are added and final shell of cells (no cut)





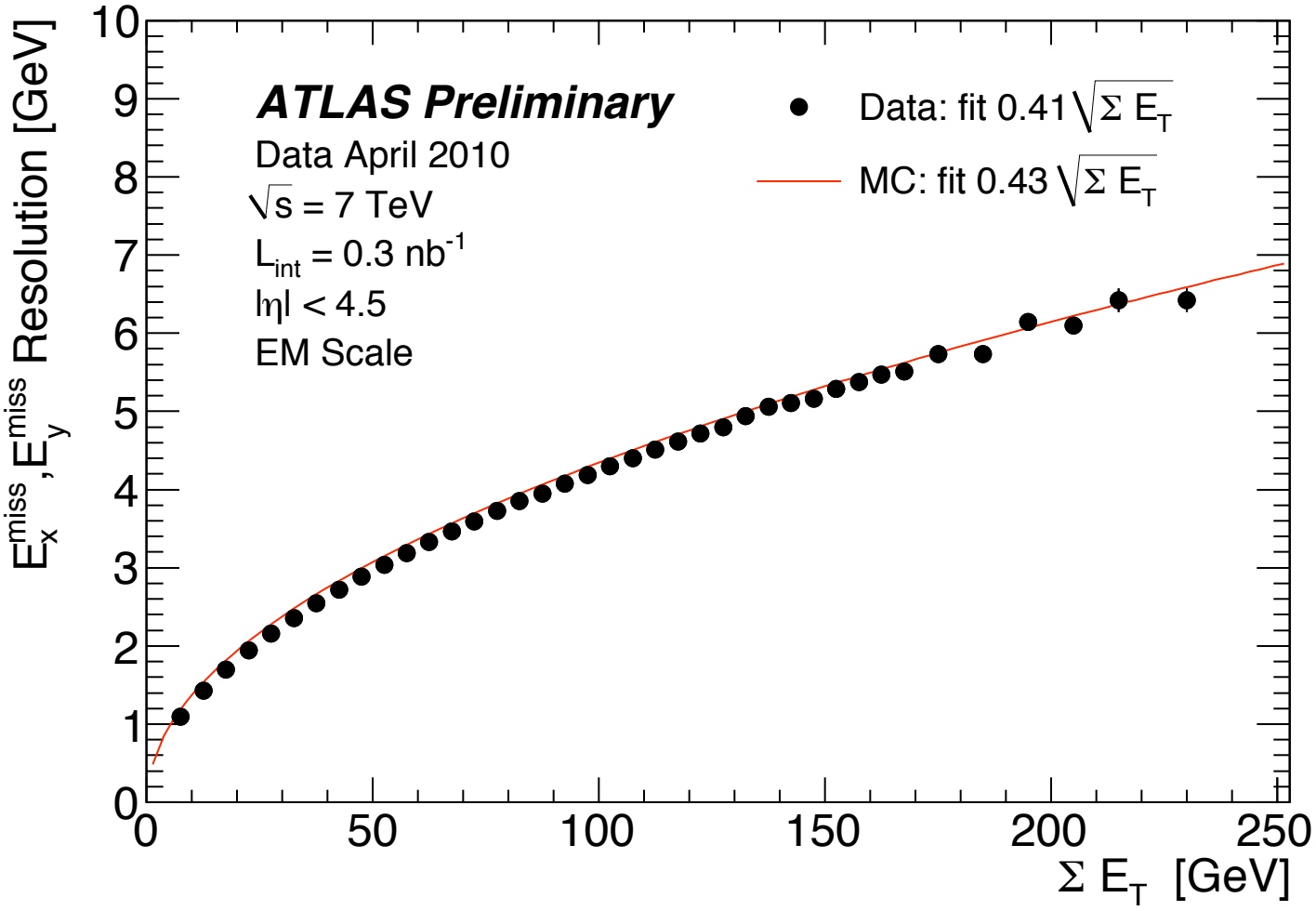
E_x^{miss} and E_y^{miss}





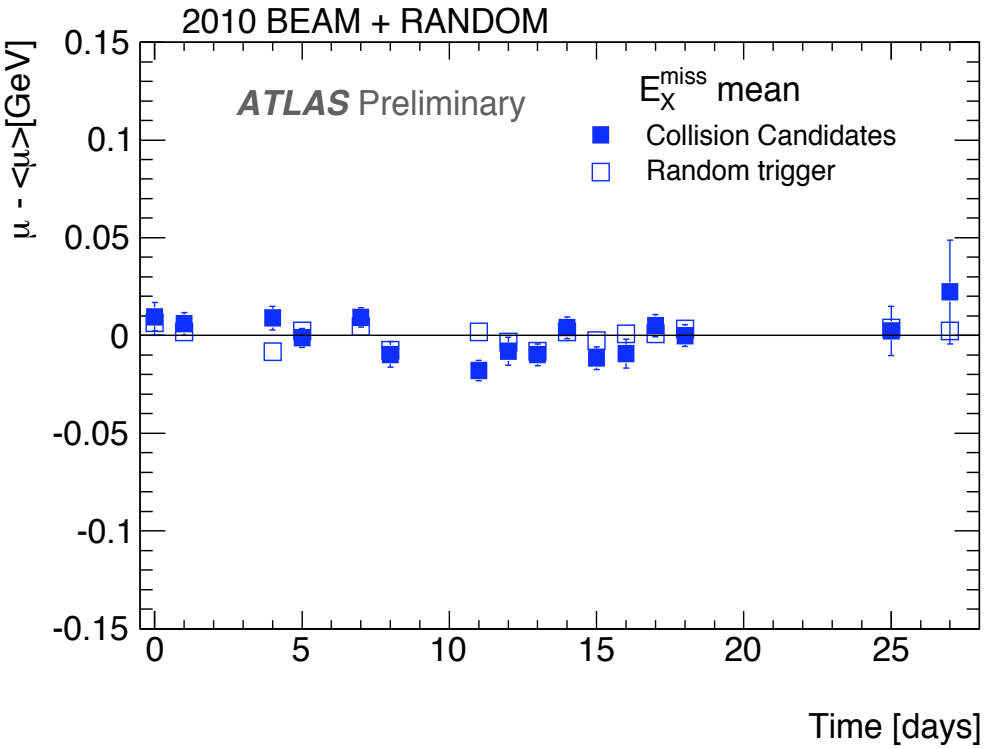
- Decompose E_T^{miss} vector along x- and y- axes
- No significant bias (deviation from zero) or large tails observed

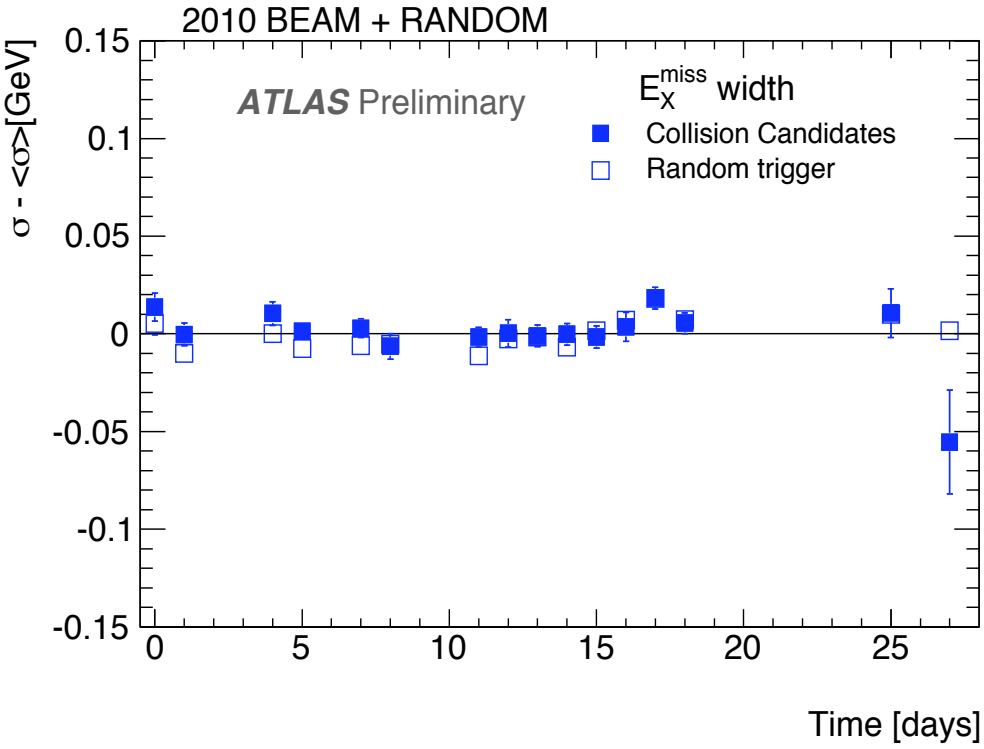
$E_{x(y)}^{miss}$ Resolution



- Resolution measured as a Gaussian fit to the $E_{x(y)}^{miss}$ distributions
- Resolution in bins of the scalar sum of transverse energy

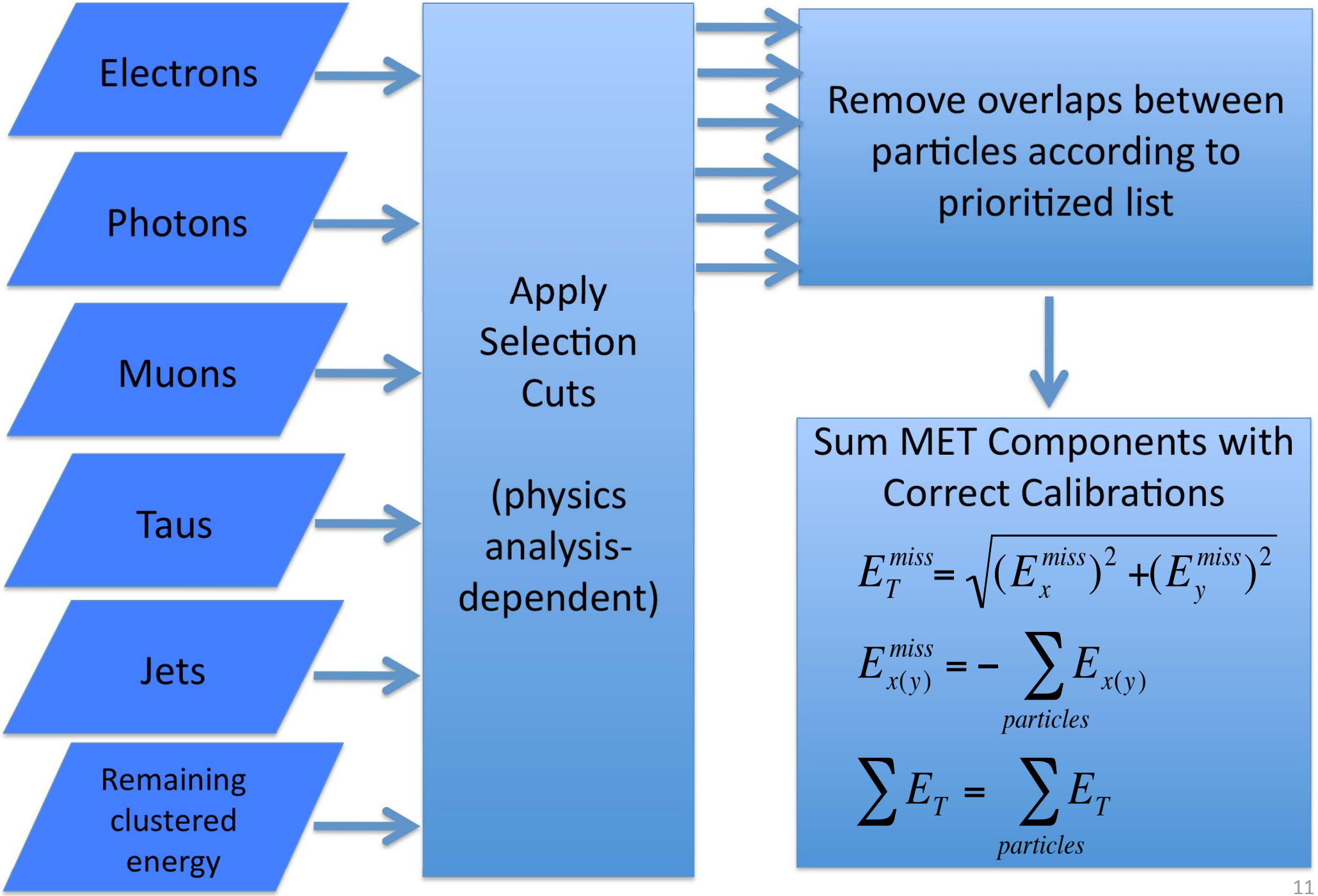
Stability Over Time



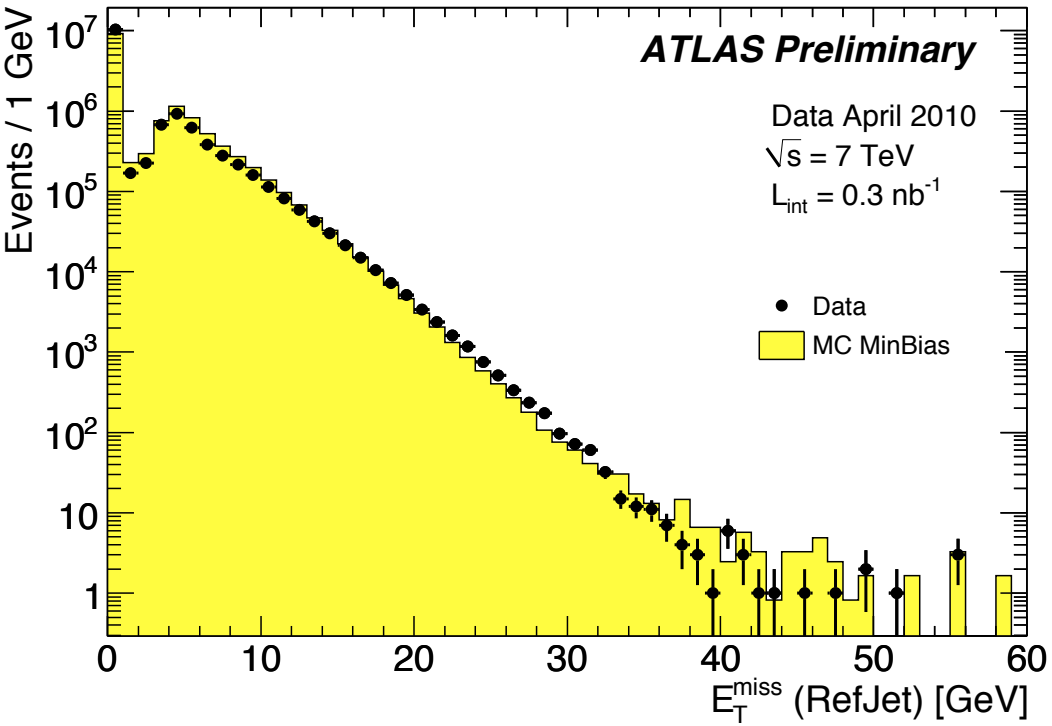


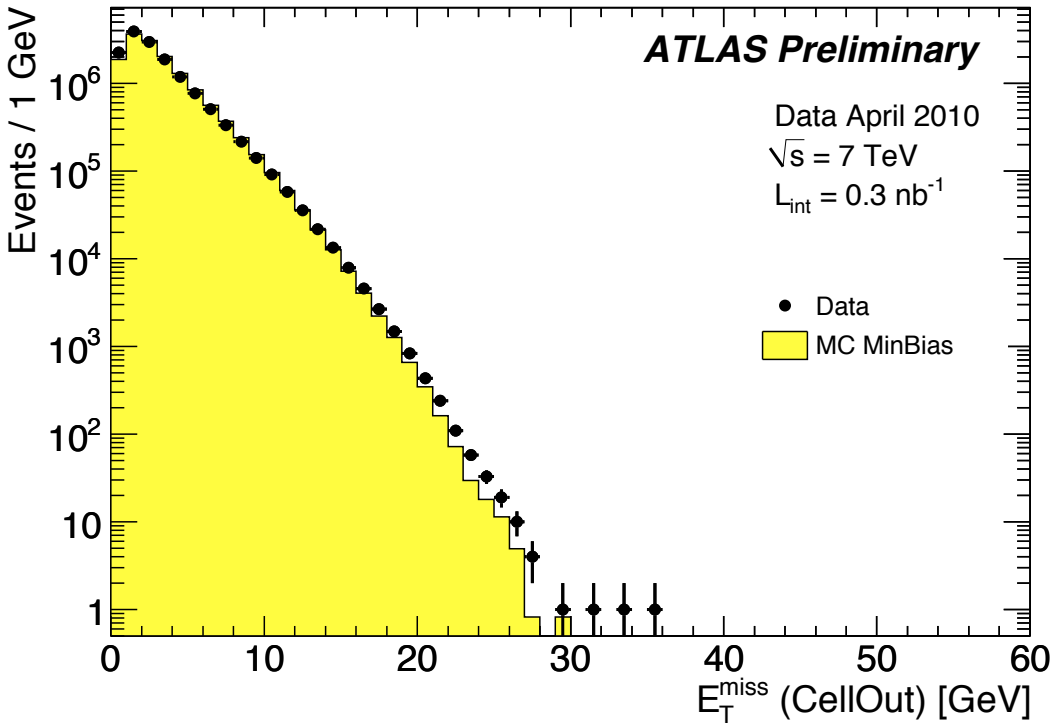
- Mean and width of the E_T^{miss} distribution shows a stable detector over several weeks of data taking

Towards "Refined" E_T^{miss} Calculation



E_T^{miss} from Energy Inside and Outside of Jets





- Commissioning of calibration of E_T^{miss} by reconstructed object type is under way

Conclusions

- E_T^{miss} in ATLAS is well-behaved in minimum bias sample due to excellent detector performance
- Commissioning ongoing in jet, W, and Z samples
- Calibrating electromagnetic and hadronic terms is important next step