LHCP Poster Session - Columbia University, 6 June 2014

9. Determination of the Jet Energy Scale and Jet Energy Resolution in the 20 fb^{-1} collected by the ATLAS detector in 2012

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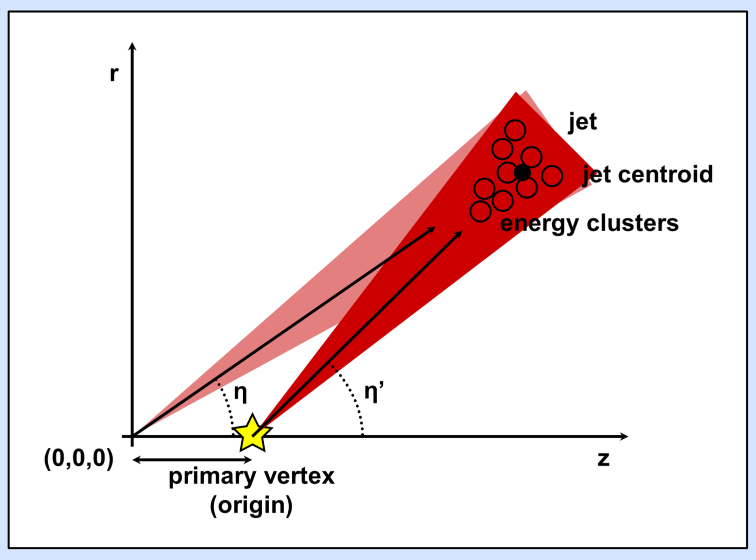
ATLAS Jet calibration chain

Pile-up Suppression → Origin Correction → MC JES Calibration → Global Sequential Calibration → In-situ Correction

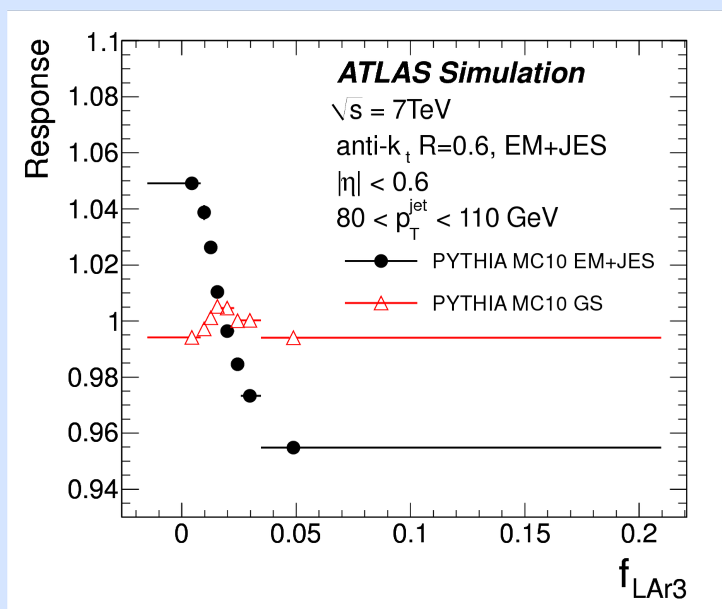
Origin correction

The jet origin correction reconstructs jets such that their constituents point toward the event primary vertex, rather than the nominal vertex at the detector center. The jet angular resolution is improved by the origin correction.

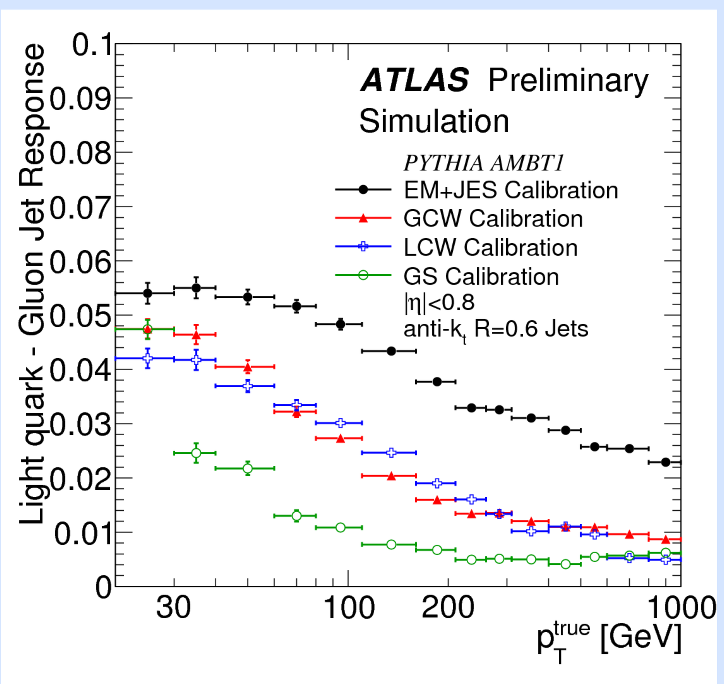


Global Sequential

The global sequential calibration (GSC) takes advantage of tracking and calorimeter observables to reduce the dependence of the JES on jet showering fragmentation. The GSC also reduces the JES dependence on the flavor of the initiating parton, and improves the the jet energy resolution.



Eur. Phys. J. C72 (2012)



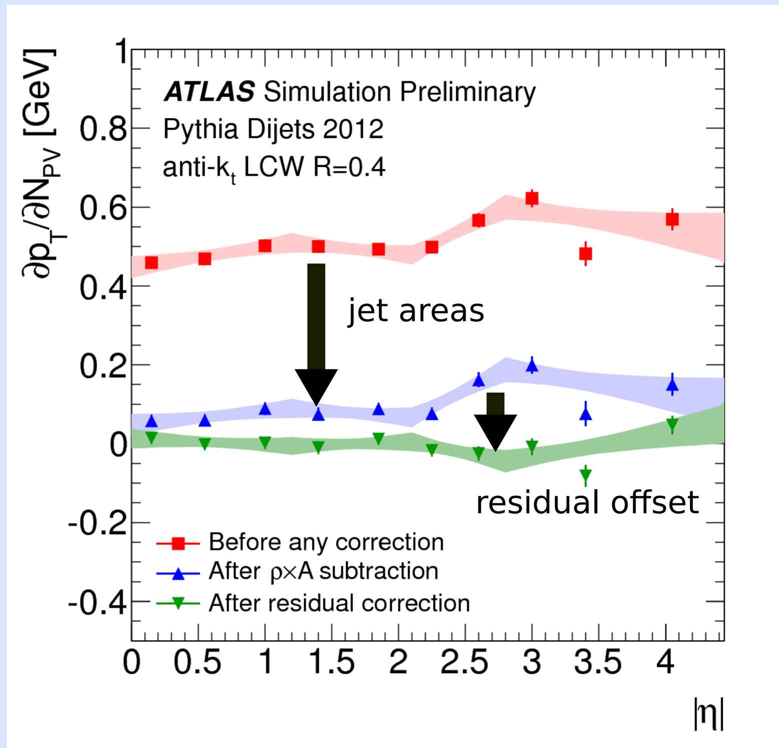
ATLAS-CONF-2011-053

Jet pile-up suppression techniques

The unprecedented pileup conditions (exceeding 30 interactions per bunch crossing) of the 2012 LHC run present challenges to jet reconstruction, significantly degrading the energy resolution. The Jet Areas correction estimates the pile-up p_T density event-by-event, and corrects the jet p_T according to its area, significantly reducing the effect of pile-up fluctuations and improving the jet energy resolution. A residual correction is applied after the Jet Area correction to subtract any remaining jet p_T dependence on pileup.

$$p_T^{corr} = p_T - \rho \cdot A_T - \alpha \cdot (N_{PV} - 1) - \beta \cdot \langle\mu\rangle$$

Jet Area Correction — Residual correction

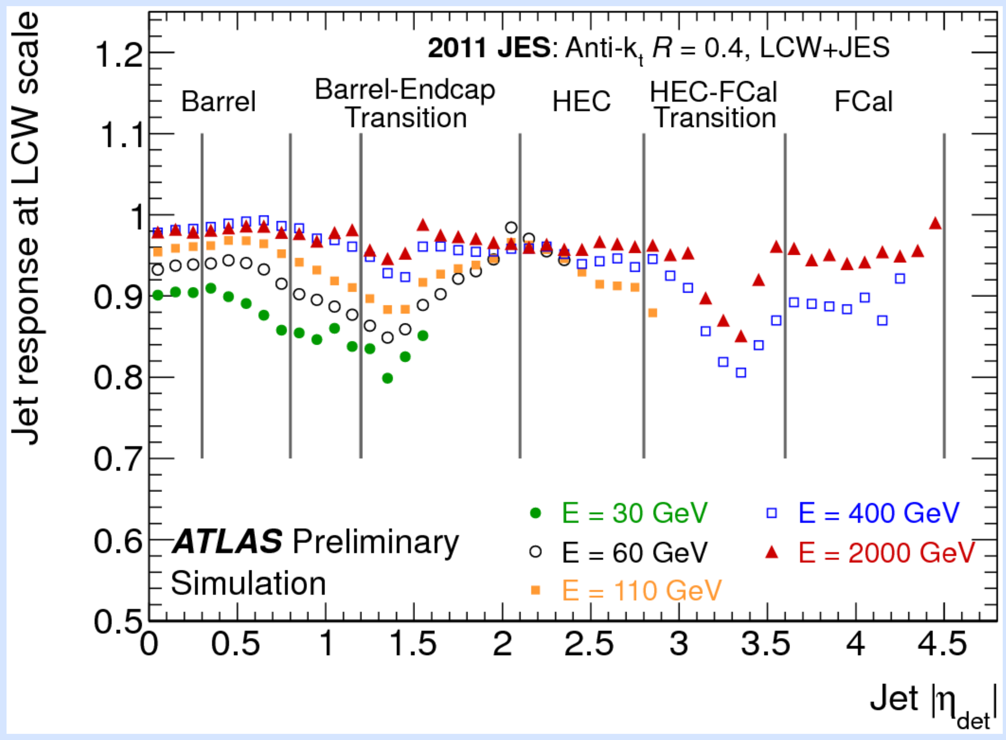


ATLAS-CONF-2013-083

Monte Carlo Jet Energy Scale calibration

The jet energy scale (JES) calibration corrects for detector effects that affect the jet energy measurement, such as non-compensation, leakage, and dead material.

The calibration is determined by taking the mean of the jet response distribution in bins of jet energy and η, where the response is defined as the quotient of the reconstructed jet energy and the energy of the same jet reconstructed from stable simulated particles.

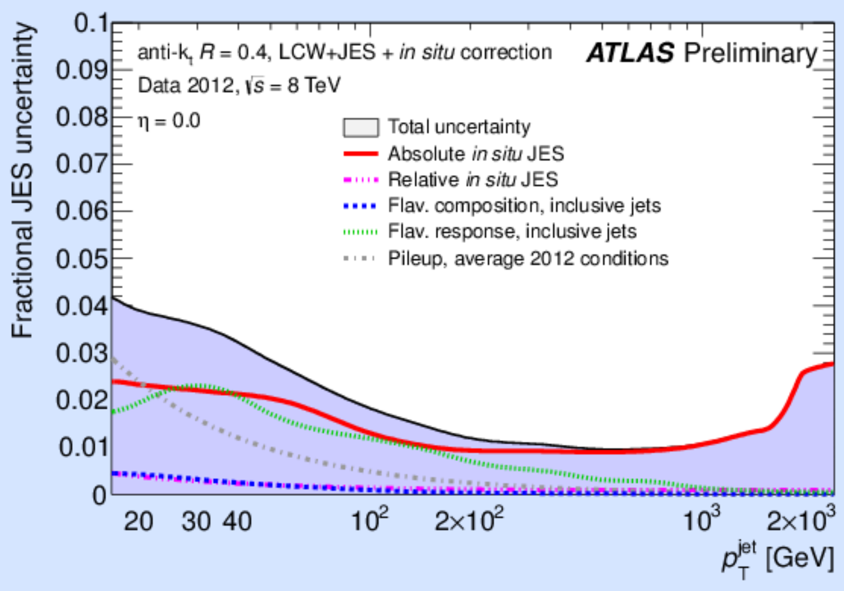


ATLAS-CONF-2013-004

Residual in-situ correction and uncertainties

Residual corrections to the JES and are derived in-situ from p_T balance in dijet, multijet, Z+jet and γ+jet events in the 2012 data sample.

Many of the JES uncertainties are also derived at this stage. The total JES uncertainty is less than 3% for jets with p_T > 100 GeV.



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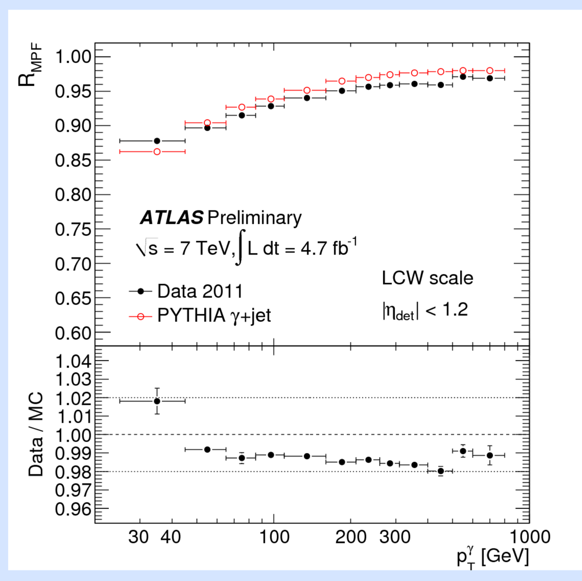
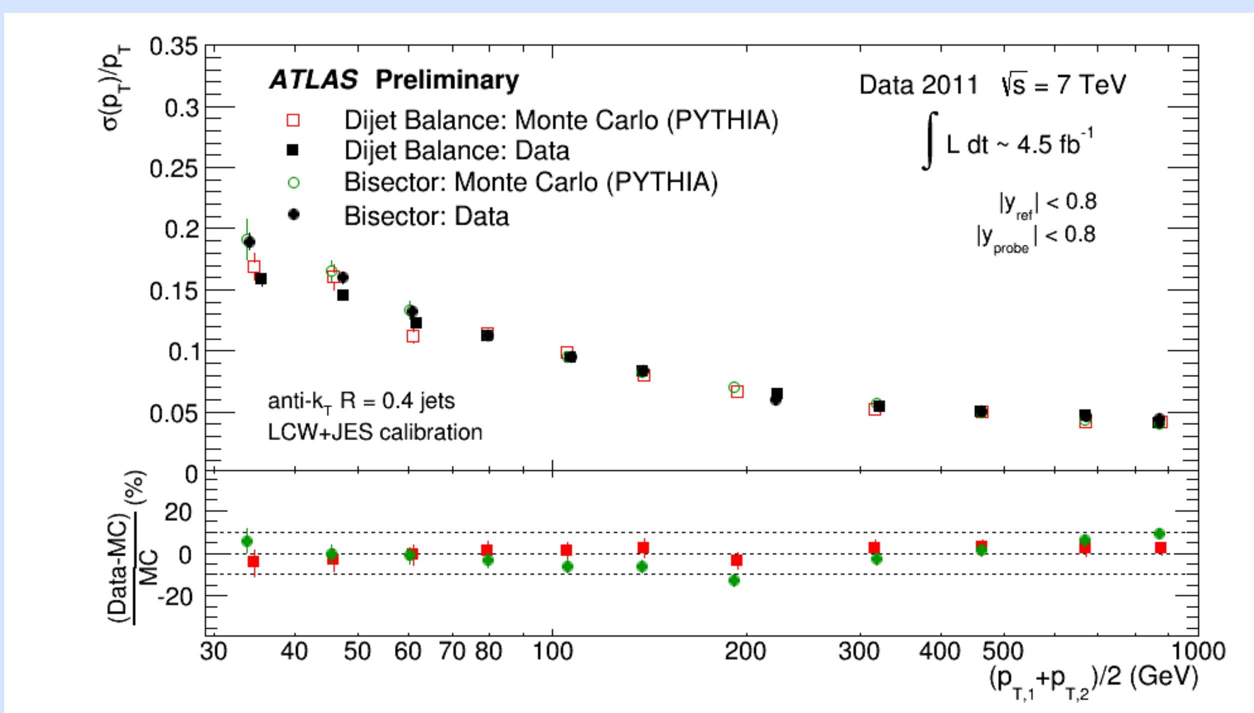


ATLAS-CONF-2012-063

Jet Energy Resolution

The jet energy resolution (JER) is measured in-situ from QCD multijet events using two techniques: the dijet balance method and the bisector method.

Both methods agree within their uncertainties, and also with measurements of the JER from Monte Carlo simulated events. The fraction JER is below 10% for jets with p_T > 100 GeV.



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