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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**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.

\[ p_{T,\text{corr}} = p_T - \rho \cdot A_T - \alpha \cdot (N_{PV} - 1) - \beta \cdot \langle \mu \rangle \]

**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 jet energy resolution.

**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 $\gamma$+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.

**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.