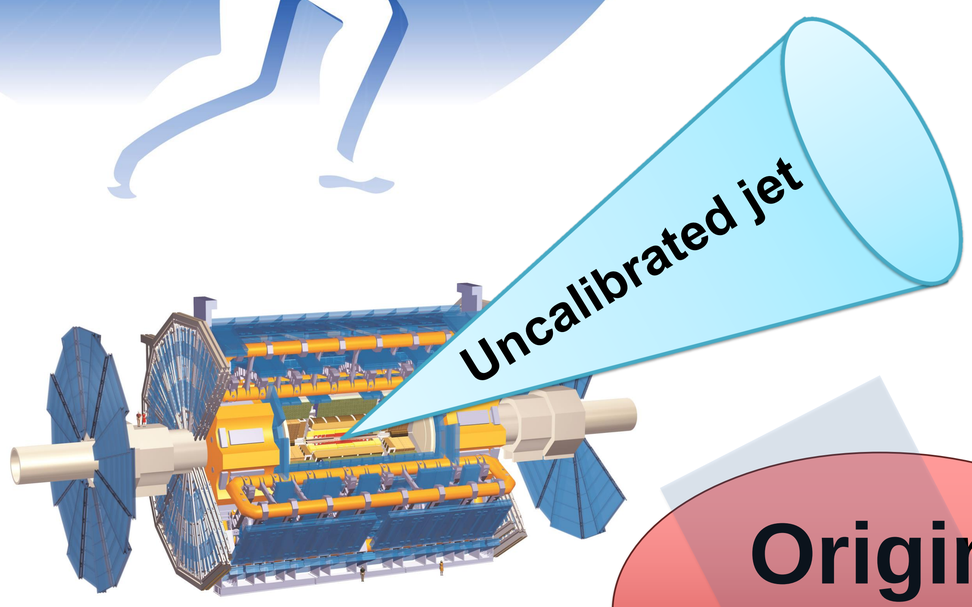
LHCC Poster Session - CERN, 2 March 2016

ATLAS JET ENERGY SCALE CALIBRATION AND UNCERTAINTIES WITH 13 TeV

Abstract

Run-2 at the LHC made a step to newer frontiers of proton-proton collisions at highest energies yet available. Collimated sprays of hadrons, called jets, remains the dominant feature at the collisions. Jets are playing a key role in many physics analyses and searches of new phenomena, e.g. ATLAS jets measurements are used to constrain the parton densities. This leads to the high priority role of jet energy scale (JES) calibration and getting valid knowledges on the uncertainties of the measurements.



Run-2 upgrades affecting JES

A number of changes between Run-1 and Run-2 are relevant for jets calibration in ATLAS. This includes **increase of the collision energies, upgrade of the tracker detector, LAr calorimeter energy and topoclusters reconstruction, updates in the hadronic shower simulation.** However the JES calibration flow is mostly left unchanged from Run-1.

Calibration flow

Jet calibration in ATLAS starts from Topologically connected cells, called clusters, calibrated at the EM or LCW scale. It is represented by a step by step correction procedure denoted in diagonal. Both MC simulation and in situ techniques are used to bring jet energy calibration to particle level.

ATLAS-PHYS-PUB-2015-015

Origin correction

Origin correction

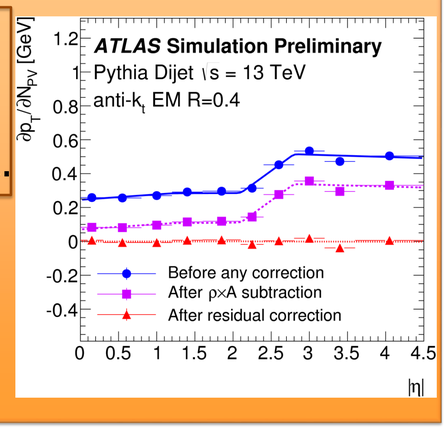
Corrects the jet to point to the primary vertex instead of the geometrical center of the ATLAS detector

Pile-up correction

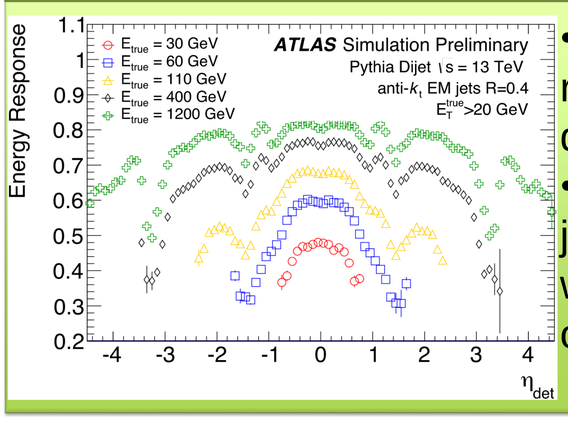
Pile-up correction

- Removes the effect of pile-up exploiting the average energy density ρ and the area of the jet A.
- Residual correction removes NPV and <μ> dependence

$$p_T^{corr} = p_T^{EM/LCW} - \rho A - \alpha(N_{PV} - 1) - \beta < \mu >$$



MC JES and η corrections



- MC JES correction exploits reco-truth relative difference in simulation.
- Corrects η direction of the jet in specific detector regions where the jet η bias is observed

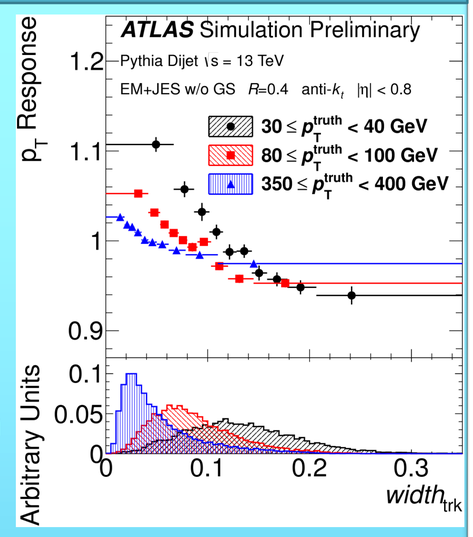
MC JES

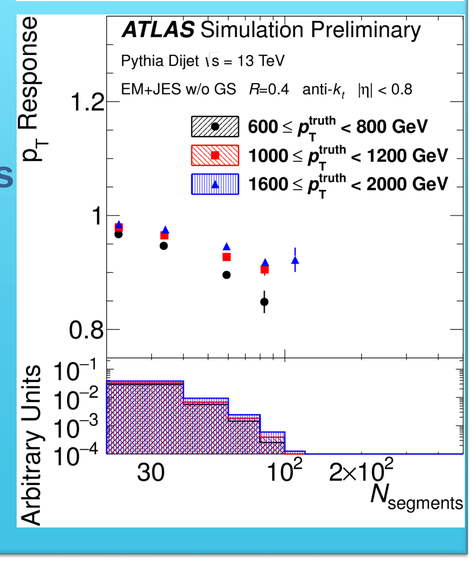
Global sequential correction

A set of corrections applied sequentially to reduce JES dependence on initial parton flavor.

Corrects the response dependence on:

- number of tracks
- track width
- energy fraction in the last electromagnetic and first hadronic calorimeter layers
- number of muon segments behind jet





GSC

In situ residual correction

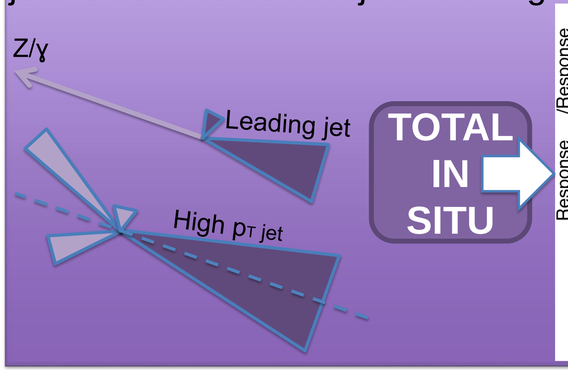
Corrects the jet pT in data using a well calibrated reference object in dijet, Z/γ and multijet events

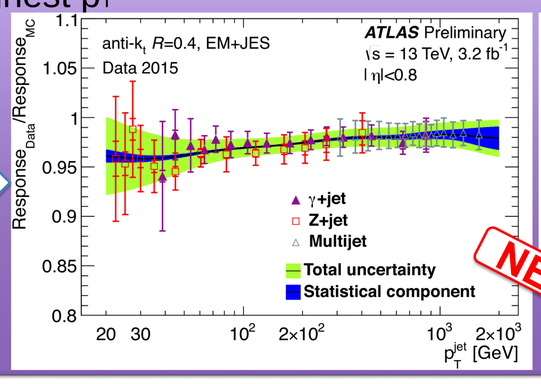
Absolute in situ

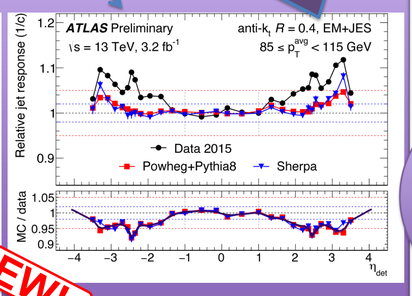
- **Z/γ** transverse momentum **balance** is used to correct jets with p_T < 800 GeV
- **Multijet balance** w.r.t. calibrated low p_T jets is used to correct jets with highest p_T

Relative in situ

- **η-intercalibration** exploits central jets to calibrate forward jets





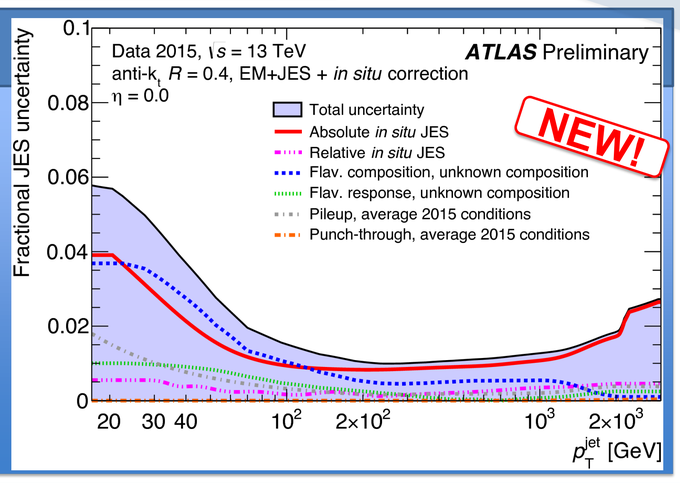


NEW!

In situ

Systematic uncertainties

Calibration described above is provided with a set of total 77 independent sources of systematic uncertainties to correctly account for all correlations in jet calibration. A reduced set of systematic uncertainties is produced to simplify physics analyses while keeping the loss of correlation information to a minimum. **The total 2015 JES uncertainty is found to be at the same level as 2012 final uncertainty.**



NEW!

Calibrated jet

Ready for physics

Aliaksei Hrynevich (INP BSU), for the ATLAS Collaboration

ATLAS EXPERIMENT