ICHEP 2016 Chicago Poster Session, 8 August 2016

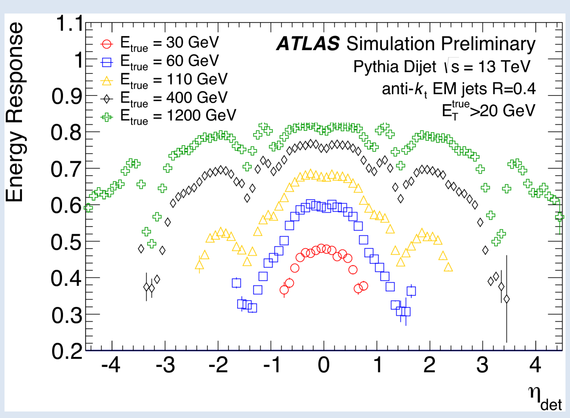
ATLAS Jet and Missing E_T Reconstruction, Calibration & Performance

David A. DeMarco (University of Toronto), for the ATLAS Collaboration

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

MC JES calibration

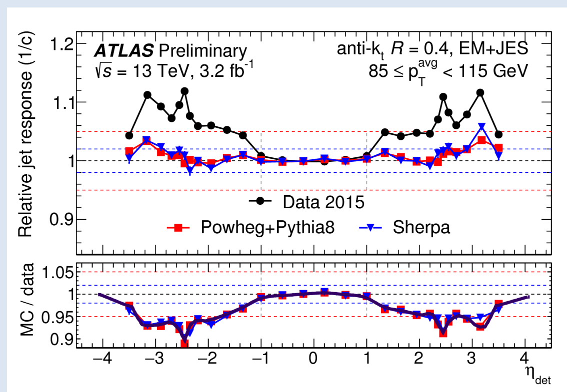
MC calibrations are applied to jet energy and η to account for considerations such as leakage, dead material and non-compensation.



ATL-PHYS-PUB-2015-015

η-Intercalibration

For uniform p_T response across the full detector η coverage, forward jets with $|\eta| > 0.8$ are calibrated to the same scale as central jets using dijet events. Calibration is applied to data.



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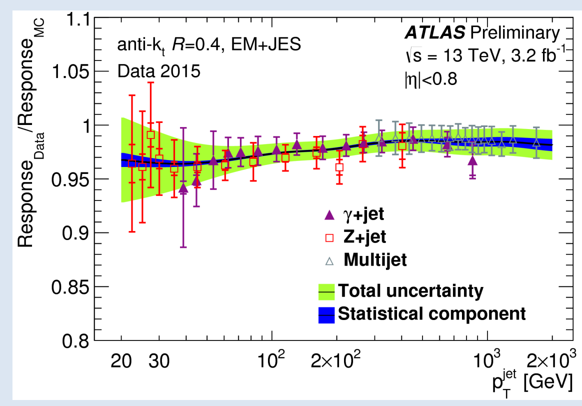
In-situ combination

A residual data correction is derived from jet p_T balanced against a reference system in Z/γ+jet and multijet events. These calibrations are combined to cover a large phase space.



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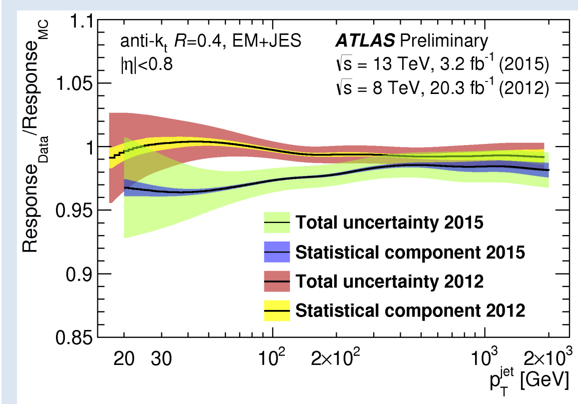
Combined response

Condition changes between 2012 and 2015, particularly in the hadronic shower simulation within GEANT4, account for difference in the central value of the jet response between runs.



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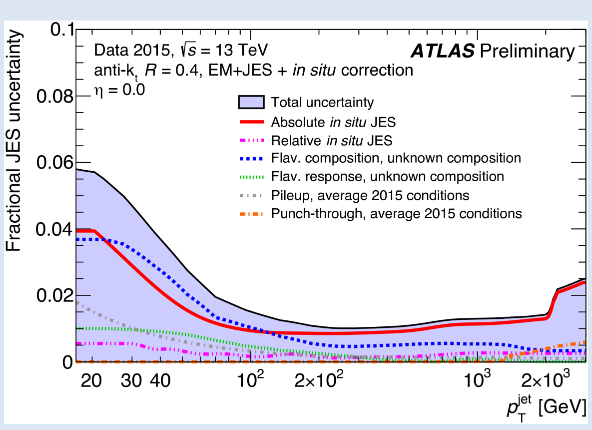
Jet systematic uncertainties



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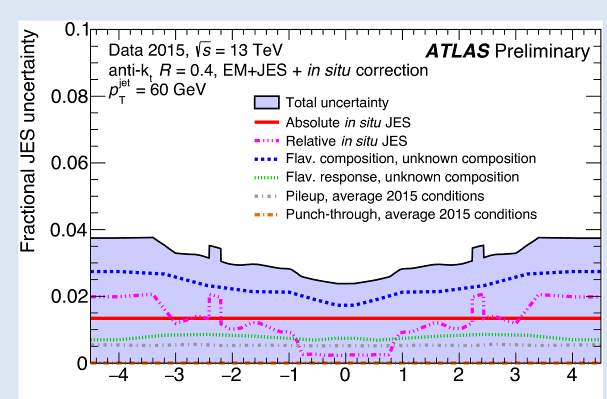
The full set of jet systematics contains O(70) components. Among other sources, it includes terms for pile-up, MC modelling, statistics and reference object systematics. For pT > 100 GeV jets, the total uncertainty is approximately 2%.

Smaller sets of effective components are also provided. For each release, a global reduction and a category reduction which combines components by source are produced. For 2015, strongly-reduced 4-term sets have been prepared for use primarily by analyses unaffected by uncertainty correlations.



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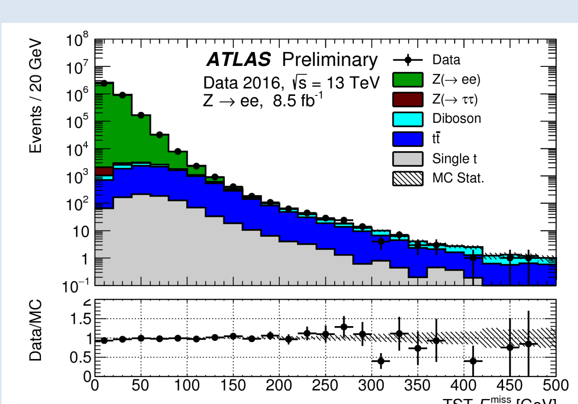
Missing transverse energy

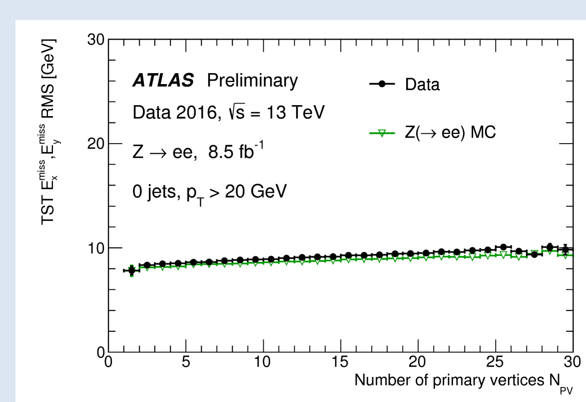


JETM-2016-008

$$E_{x,y}^{miss} = E_{x,y}^{miss,e} + E_{x,y}^{miss,\gamma} + E_{x,y}^{miss,\tau} + E_{x,y}^{miss,jet} + E_{x,y}^{miss,\mu} + E_{x,y}^{miss,soft}$$

E_T^{miss} is reconstructed from all calibrated hard objects with a soft term constructed from tracks associated to the hard-scatter vertex but not to a hard object. Integrating calorimeter and tracker information in this way greatly improves pile-up stability.

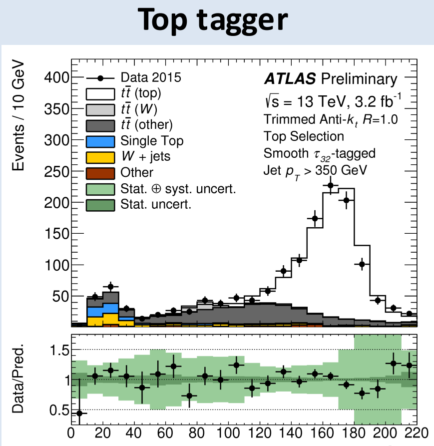
Systematics from hard objects are propagated through calculation with the soft term estimated by comparing MC generators.



JETM-2016-008

Jet substructure techniques

Top tagger

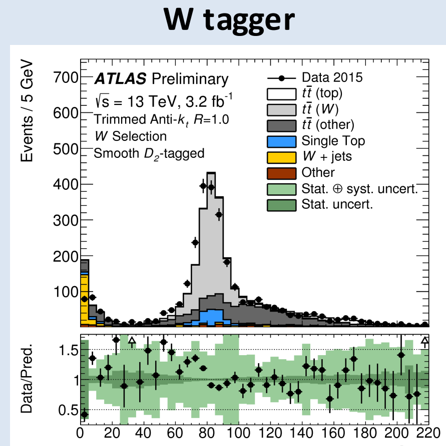


JETM-2016-005

Jet substructure observables are used to discriminate between decay products for use in quark and boson taggers.

Large-R jet mass is used in both displayed taggers, while τ_{32}^{wta} and D_2 are utilized in tagging top quarks and W bosons respectively.

W tagger



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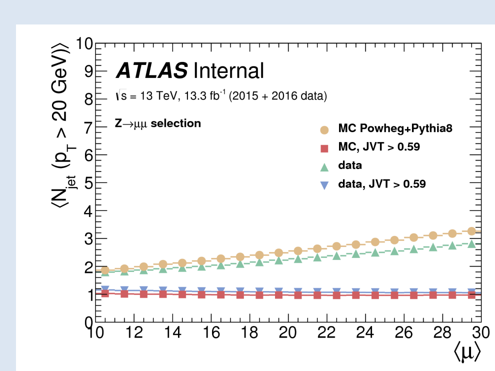
Jet vertex tagger performance

The jet vertex tagger uses tracker information to suppress selection of pile up jets, independent of the number of primary vertices.



JETM-2016-011

David A. DeMarco (University of Toronto), for the ATLAS Collaboration