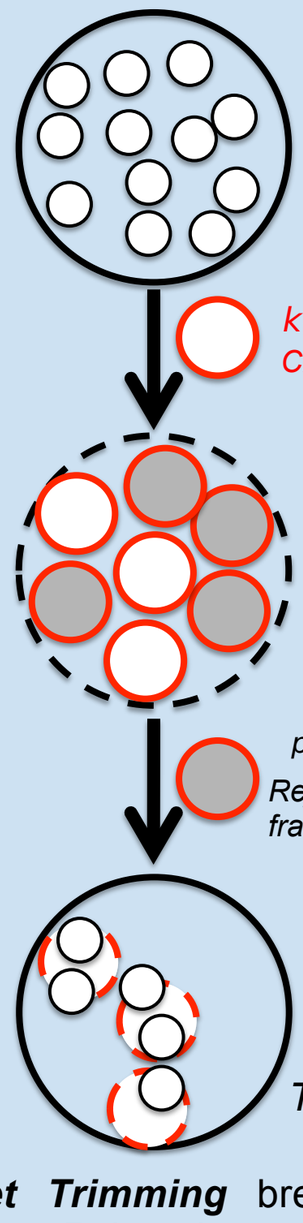
LHCC Poster Session - CERN, 13 March 2013

Jet, Missing ET, and Jet Substructure Performance in ATLAS

Abstract

ATLAS has implemented and commissioned several new techniques for the analysis and interpretation of hadronic final states at the LHC. The excellent ATLAS detector capabilities, in particular its high resolution longitudinally segmented calorimeter and inner detector, have enabled the development of complex clustering and reconstruction algorithms, and the large 2012 data sample allows for their validation and calibration in data. These include event-by-event pile-up subtraction algorithms for jets and E_T^{miss}, jet substructure techniques, quark-gluon discrimination, and jet tagging tools for the identification of boosted heavy particles. A summary of the most modern jet, E_T^{miss}, and jet substructure and tagging tools developed in ATLAS, and their calibrations are presented.

Jet Substructure



Jet Trimming breaks apart large-*R* jets into subjets and discards soft components, improving identification of heavy boosted particles. Data/MC agreement is verified using hadronic *W* decays from top events.

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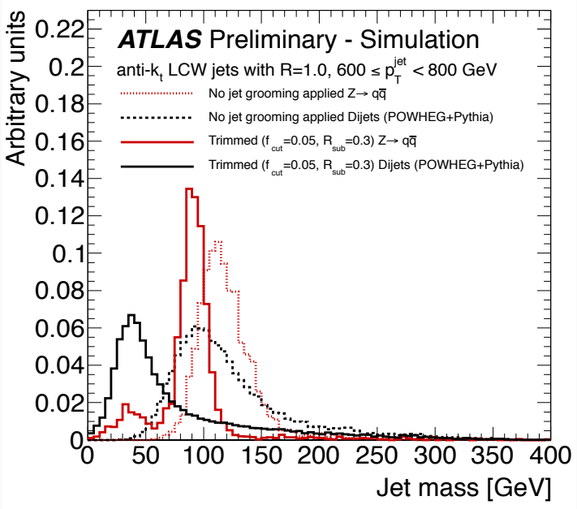
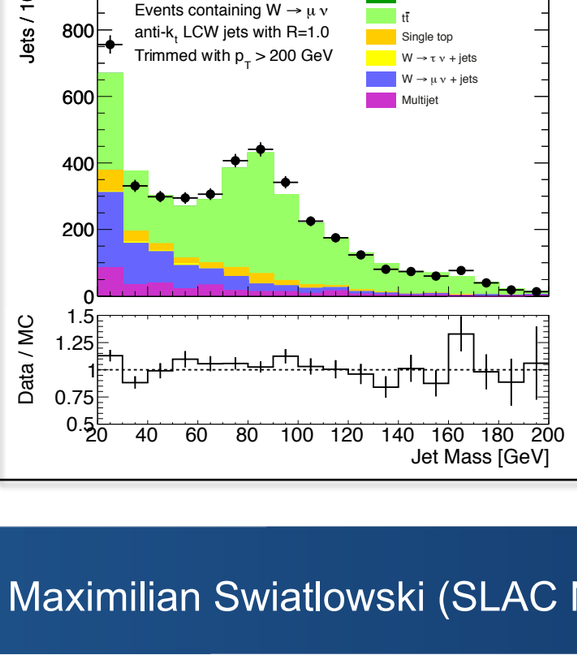
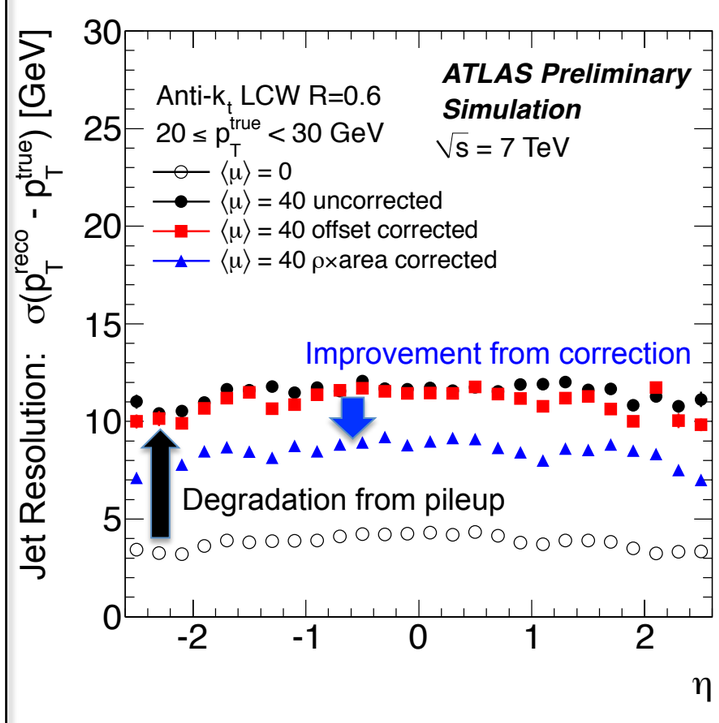
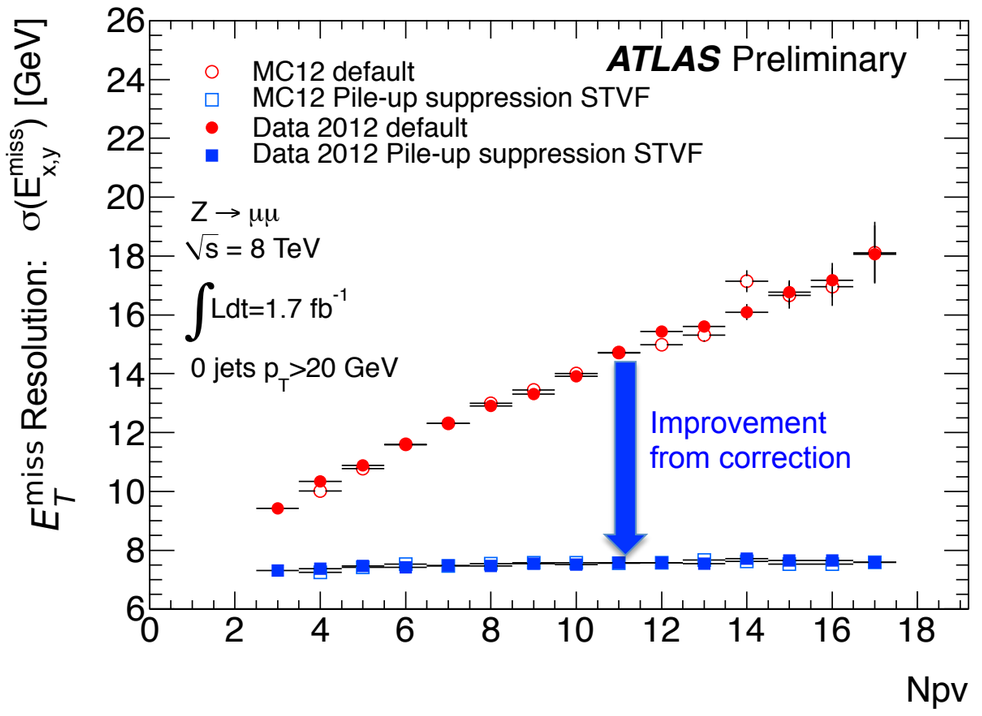




Pileup Suppression Techniques for Jets and E_T^{miss}





The unprecedented pileup conditions (exceeding 30 interactions per bunch crossing) of the 2012 LHC run present challenges to jet and E_T^{miss} reconstruction, significantly degrading the energy resolution in both cases. 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. The ***Soft Track Vertex Fraction*** uses tracking measurements to scale the soft term contribution to E_T^{miss}, recovering independence of resolution *vs.* NPV.

Quark/Gluon Initiated Jets

Commissioning of a ***Quark-Gluon Tagger*** using tracking information in jets is ongoing. In-situ measurements combining dijet and γ+jet samples enable extraction of pure quark/gluon templates from data. Disagreement with MC is observed.

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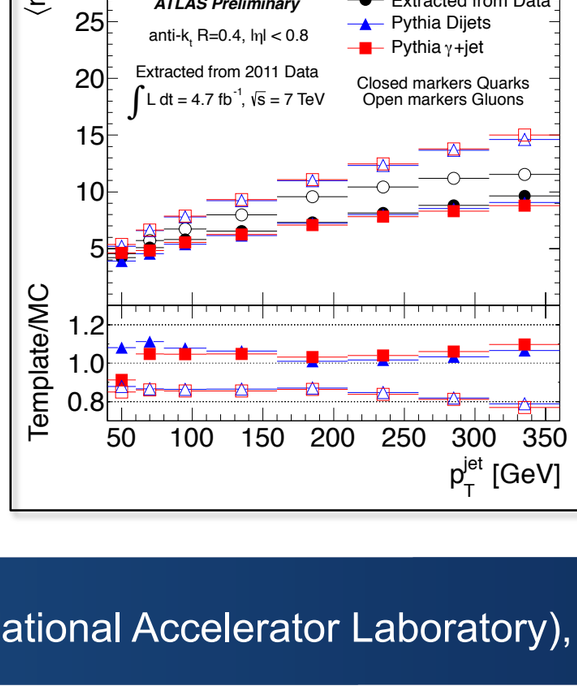
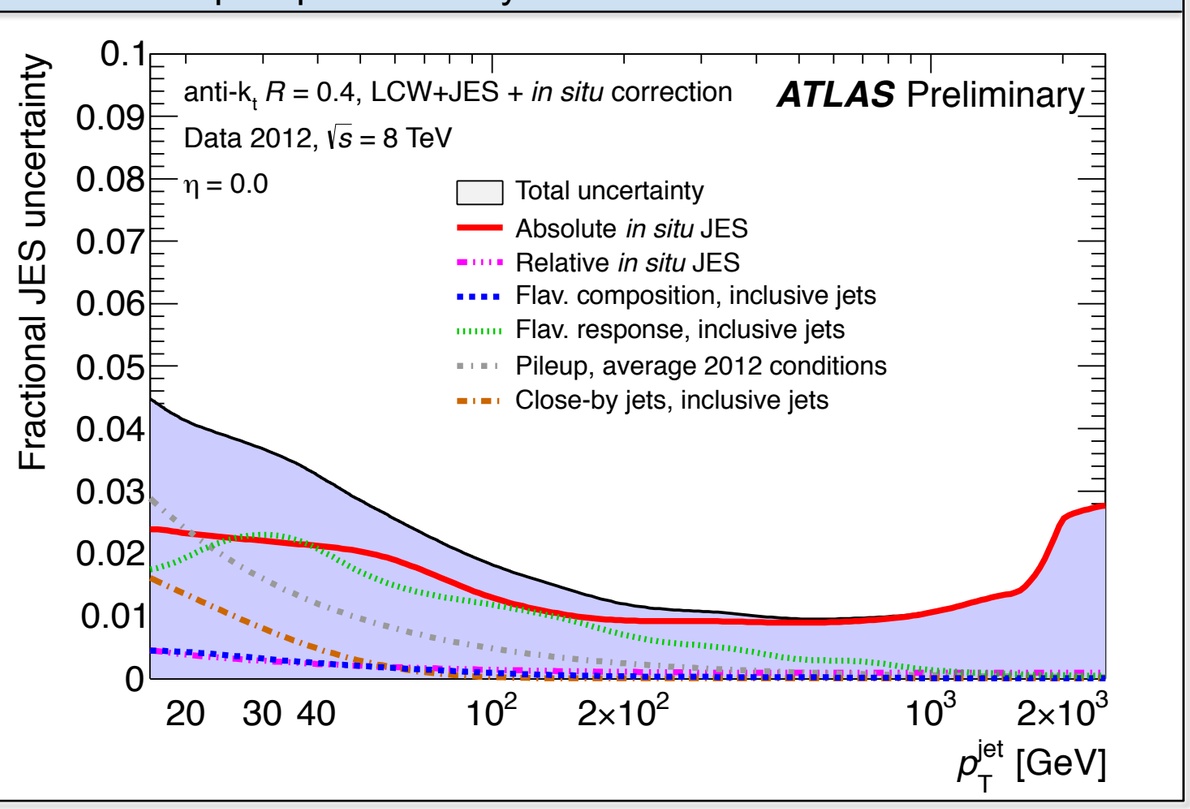


In-situ JES Derivation and Uncertainties

Jets are calibrated to the particle level using Monte-Carlo. Dijet, *Z* +jet, and γ+ jet events from the large 2012 data sample are used to derive an in-situ residual correction and set the jet energy scale uncertainty. The absolute JES uncertainty is **smaller than 1.5%** for jets above 100 GeV, and the new pileup subtraction technique reduces the pileup uncertainty to less than 3%.



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