LHCC Poster Session - CERN, 4 March 2015

Pushing the limits by looking within: Jet Substructure with the **ATLAS** Detector

7+8 TeV and Beyond: the Era of Jet Substructure

ATLAS has collected a large number of hadronically decaying boosted top quarks and W bosons.

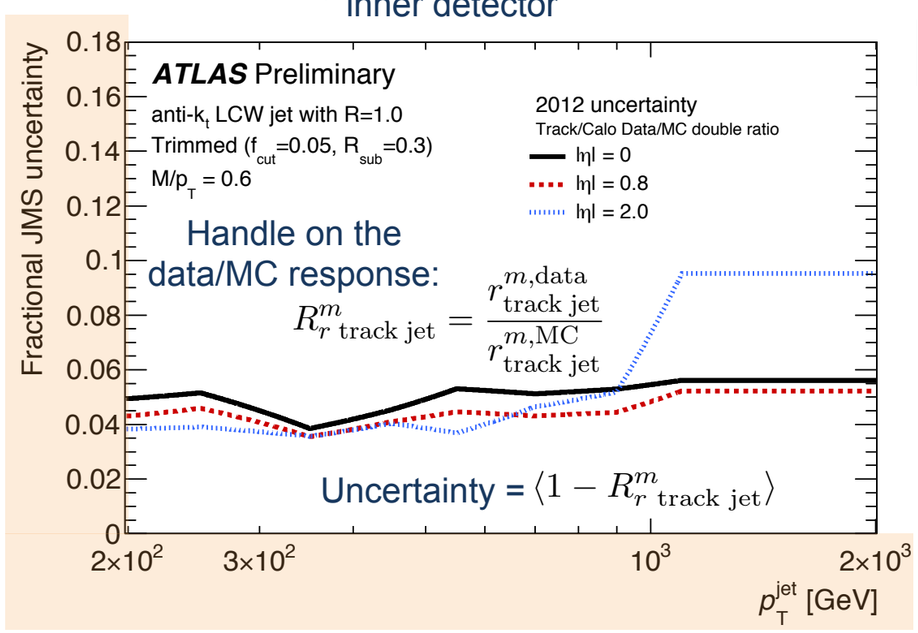
The orientations of their constituents, measured in the **calorimeter** or the **inner detector**, provide powerful tools for understanding their properties and discriminating them from background processes.

Orthogonal Measurements:

$$r^{m}_{\text{track jet}} = \frac{m^{\text{jet}}}{m^{\text{track jet}}}$$

m^{jet}: from the calorimeter

$m^{\text{track jet}}$: from the inner detector



Jet Sub/Superstructure Performance

The **jet pull vector** is a weighted radial (2nd) moment over jet constituents. Its **magnitude** describes the spread of energy in the jet and its **direction** with respect to other jets contains information about inter-jet radiation.

The angle is insensitive to the overall jet energy (uncertainty), but depends on cluster/track energy/angle resolutions.

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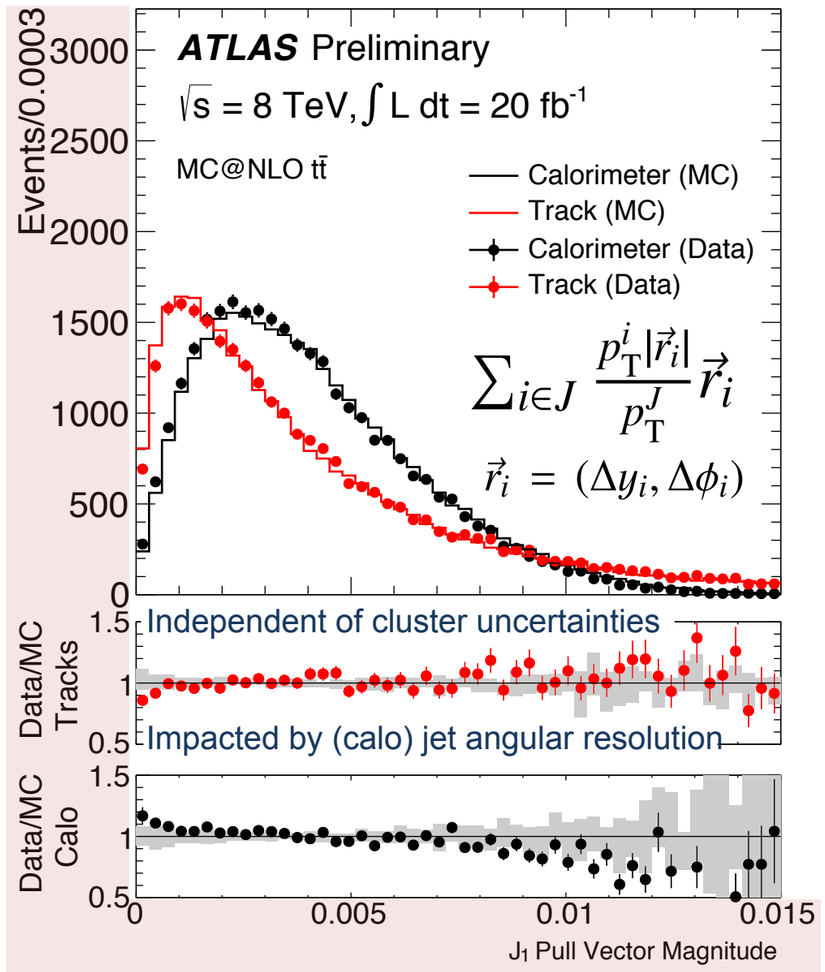

Determining the Jet Mass Performance *In Situ*

Since the inner detector and calorimeter measurements are independent, one can be used as a handle on the response (reco jet / truth jet) of the other.

For jet mass, this is the **only** handle on the inclusive response *in situ*. For p_T, we now also have γ+jet; for a few topologies, can use hadronic (W/top) resonances.

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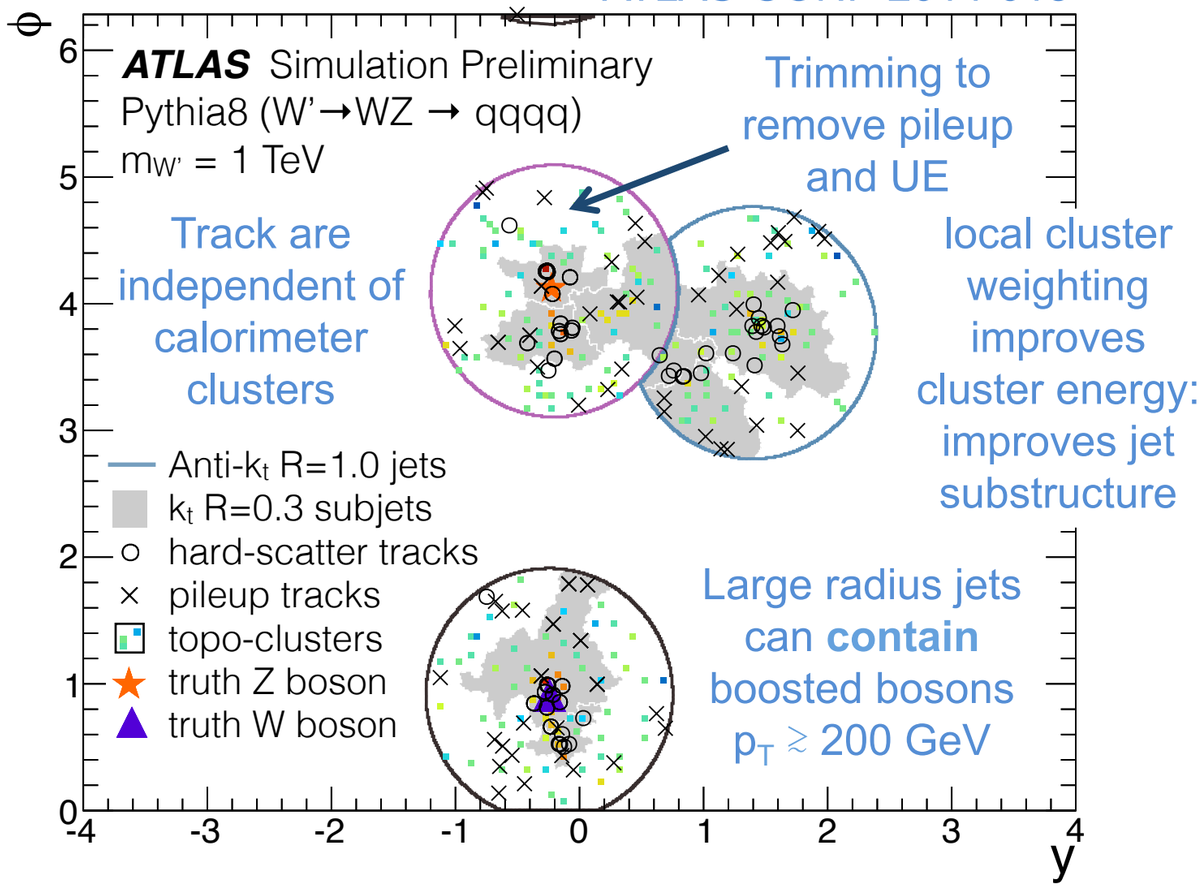
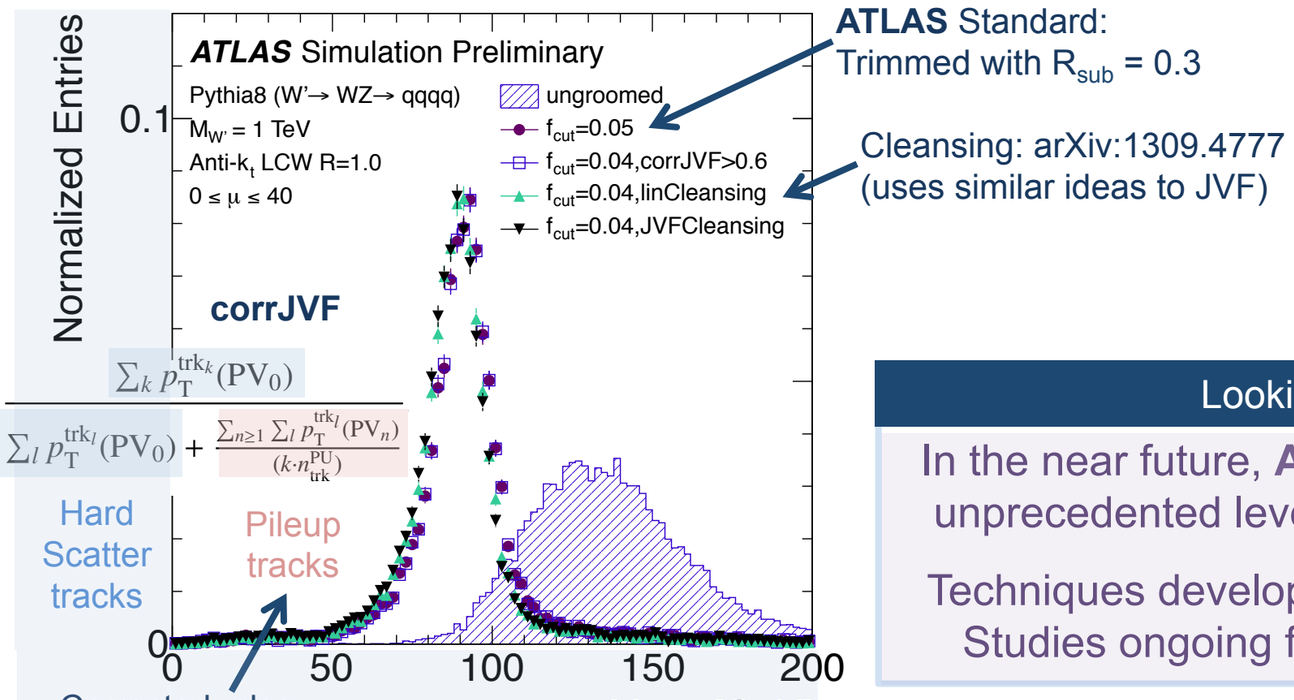




Looking Ahead: Prospects for Jet mass with High Pileup

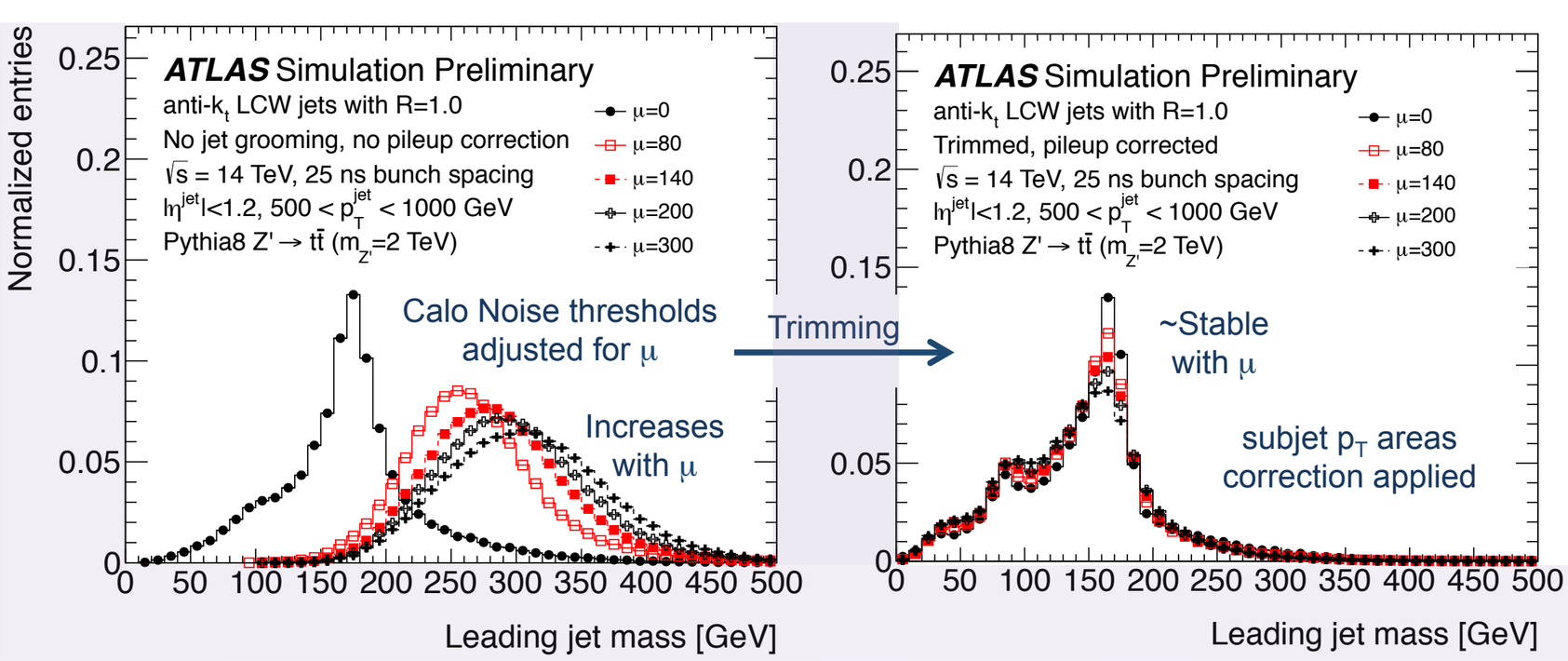
In the near future, **ATLAS** will face 10 x more collisions per bunch crossing – an unprecedented level of noise in the calorimeter, detrimental to jet substructure.

Techniques developed at low μ can **still work at high** μ, e.g. trimmed jet mass. Studies ongoing for the preservation of soft-radiation sensitive observables.

Subjet Pileup Jet Discrimination

In addition to developing **pileup jet** taggers (crucial for jet vetoes in e.g. VBF Higgs), we have used tracks to commission **pileup subjet taggers**.

Similar performance to trimming, even though orthogonal information (tracks vs calo) is used in the selection of subjets to remove.



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