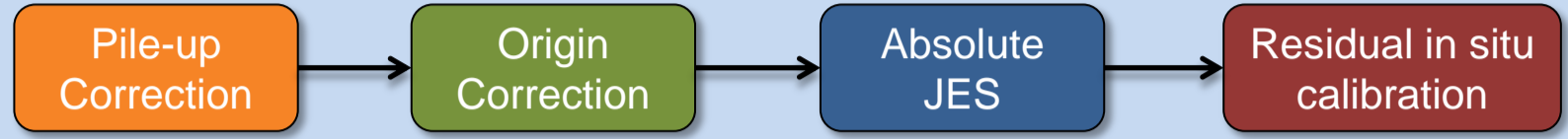




LHCC Poster Session - CERN, 21 March 2012

Probing the measurement of jet energies with ATLAS using Z+jet events

Jet calibration in ATLAS



Function of the number of primary vertices and of the average number of interactions per bunch crossings.

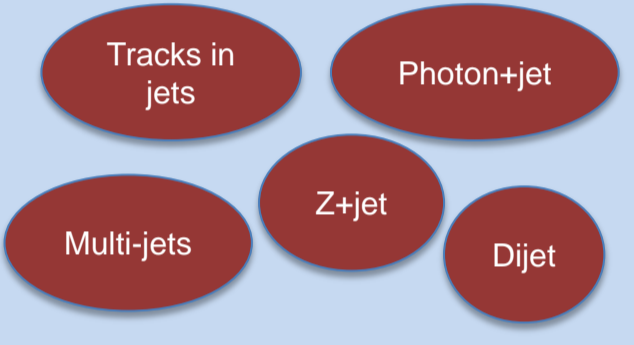
Changes the jet direction to point to the primary vertices.

Corrects the 4-vector to the particle level scale.

A residual calibration is derived using in situ measurements and is applied to data only.

In situ measurements

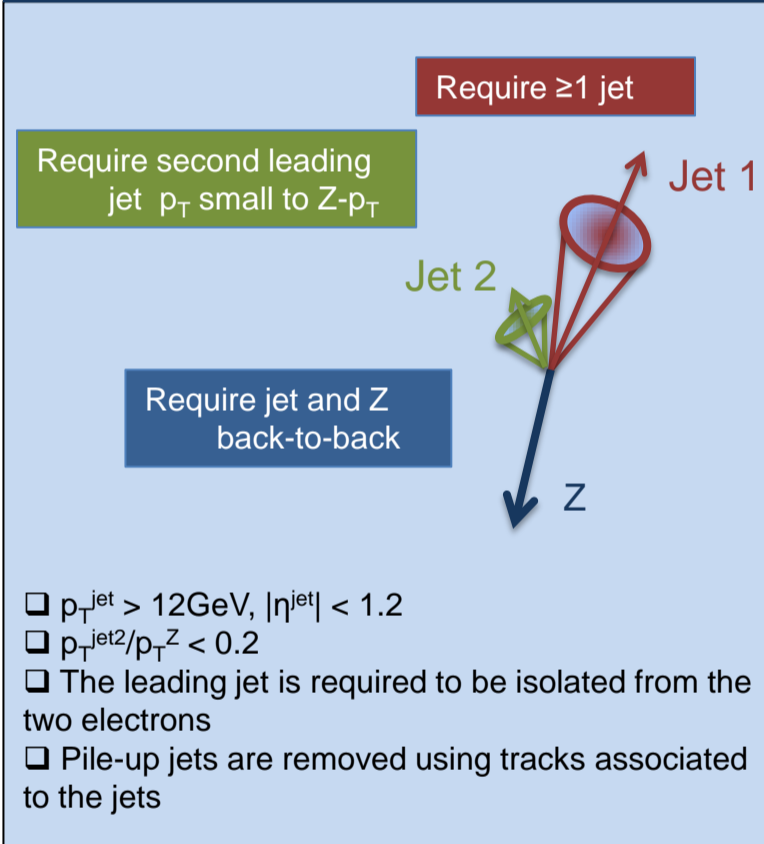
- Exploit the **transverse momentum (p_T) balance** between one jet and one reference object (or the ratio of the total p_T in tracks in jets to the calorimeter p_T) to assess the jet energy measurement.
- Compare data to simulation



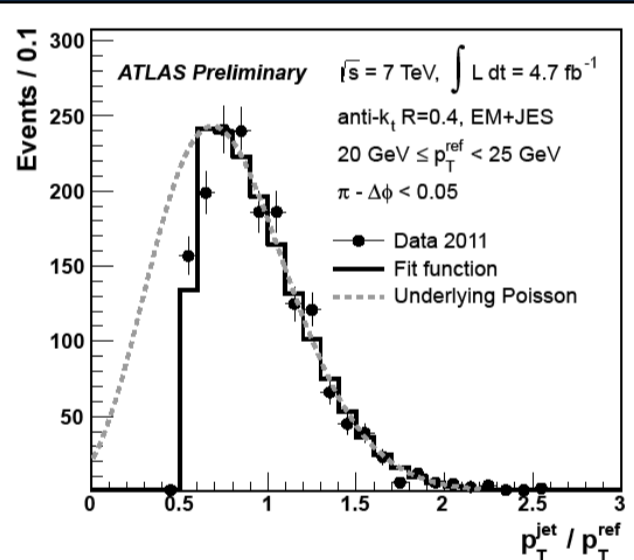
Z+jet balance measurement

- The **electron channel** is used.
- The mean p_T -balance $p_T^{\text{jet}}/p_T^{\text{ref}}$ is estimated using a **Poisson (+turn-on) fit** at low p_T (<35GeV).
- For higher p_T the arithmetic mean is taken.
- The reference p_T is the Z boson p_T projected on the jet axis: $p_T^{\text{ref}} = p_T^Z \cdot |\cos \Delta\Phi(Z, \text{jet})|$
- The mean balance is extrapolated to a topology where the Z boson and the jet are back-to-back.

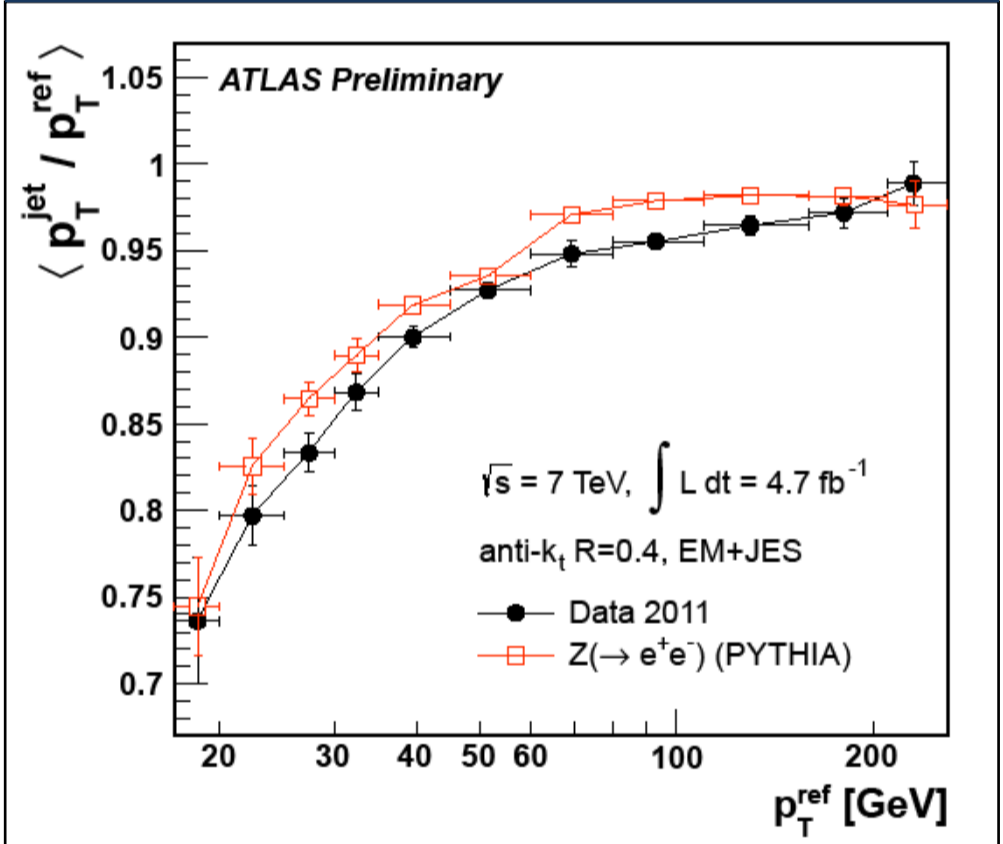
Z+jet event topology & selection



Z-jet p_T -balance distribution



p_T -balance as a function of p_T



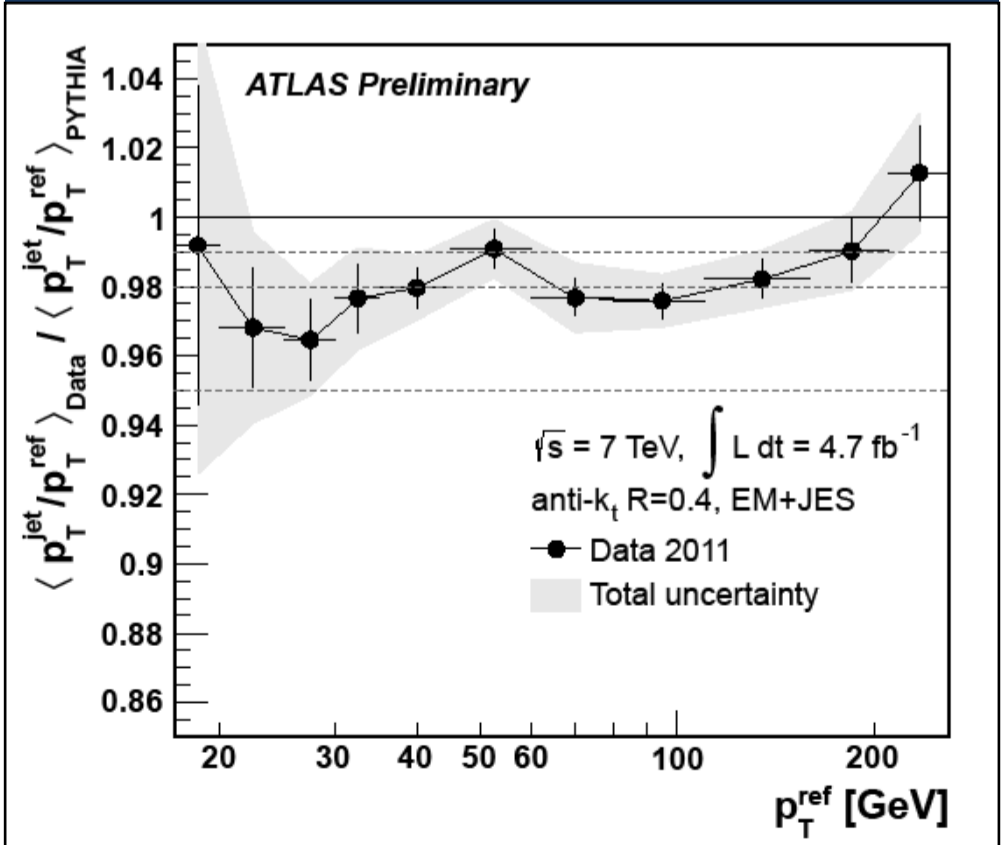
Systematic uncertainties

- Electron energy measurement:** The uncertainty is propagated through the analysis.
- Mean estimation and fit procedure:**
 - The uncertainty is increased according to the residuals of the fit.
 - The widths of the Poisson are varied according to their uncertainties
- Radiation out of the jet cone:** The impact on the balance is measured using the transverse momentum of charged tracks in annuli around the leading jet axis
- Additional high- p_T radiation:** The cut on the second leading jets is varied.
- Pile-up rejection:** The pile-up rejection cut on the leading jet is varied.
- Monte Carlo simulation:** The analysis is done with PYTHIA and Alpgen+Herwig

Results

- The p_T -balance between a Z boson and a jet is measured using 4.7fb^{-1} of pp collisions recorded in 2011, as well as in the simulation.
- The analysis is carried out for Z boson p_T between 17GeV and 260GeV.
- The p_T -balance is smaller in the data compared to MC by at most 4% and typically by 2%
- Uncertainties are **between 1% and 3%** for $30\text{ GeV} < p_T < 260\text{ GeV}$.
- This method will be used to correct the jet energies in the data, jointly with other in situ methods.
- It gives reduced uncertainties for very low p_T jets that are difficult to probe with the gamma+jet method.

Data-to-MC ratio



Further readings

- Validating the measurement of jet energies with the ATLAS detector using Z+jet events from pp collisions at $\sqrt{s}=7\text{TeV}$ - ATLAS-CONF-2011-159
- Jet energy measurement with the ATLAS detector in pp collisions at $\sqrt{s}=7\text{TeV}$ - arxiv:1112.6426 [hep-ex]