Concluding Discussion: Day 1 Talks
(Test Beam, MC, Cell-Level Calibration)

Overview:

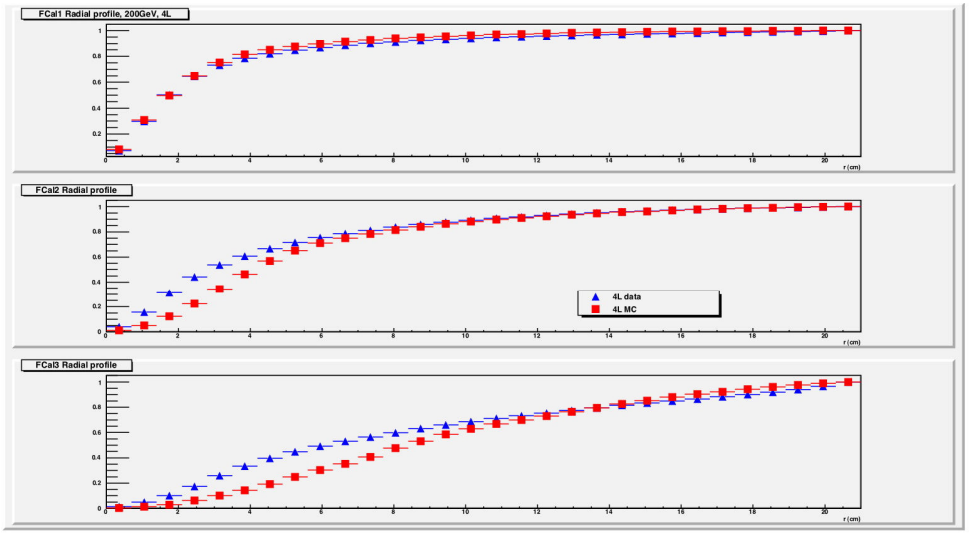
- Two kinds of calibration components currently under
- development:
  - Particle driven:
    - Jet response viewed as convolution of single particle momentum spectrum with hadron/photon response
    - Calibration weights determined from this response
    - MC used to correct for dead material and residual effects not handled by weights
  - Jet driven
    - Calibrations constants from jets obtained in-situ (photon-jet or dijet balance, W from top, etc)
- Both will be used by ATLAS. They provide complementary information
- Day 1 of workshop concentrated on issues relevant for particle driven methods. Jet driven methods on Day 2

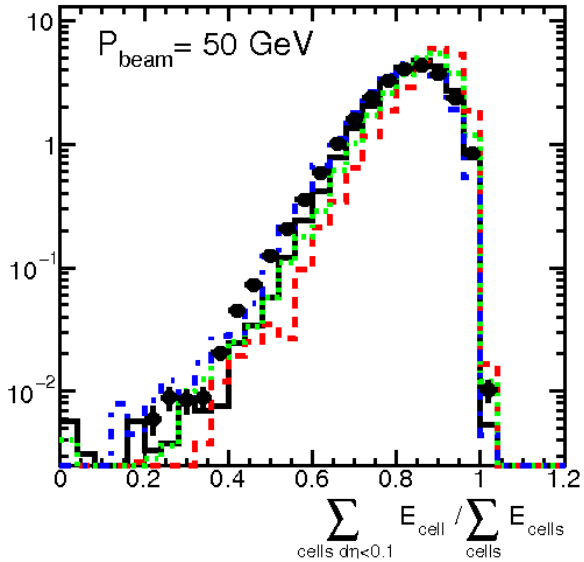
From Detector Response to Jet Response: General Observations

- Non-compensating calorimeter:
  - Jet energy resolution improved significantly if different calibration weights can be used for EM-like and hadron-like energy event-by-event
  - Calibration scheme requires knowledge of energy density for hadronic and EM showers
- Nonlinearities at low momentum
  - Jet response depends on spectrum of incident particles
- Noise Suppression: Topoclusters
  - Response depends on transverse shower shape
- Sophisticated calibration and noise suppression strategies significantly improve performance, but require *detailed* understanding of calorimeter response
- Jet response will (at few % level) be process dependent:

Predictions require tuning of MC generators to agree with observed particle spectra

Test Beam



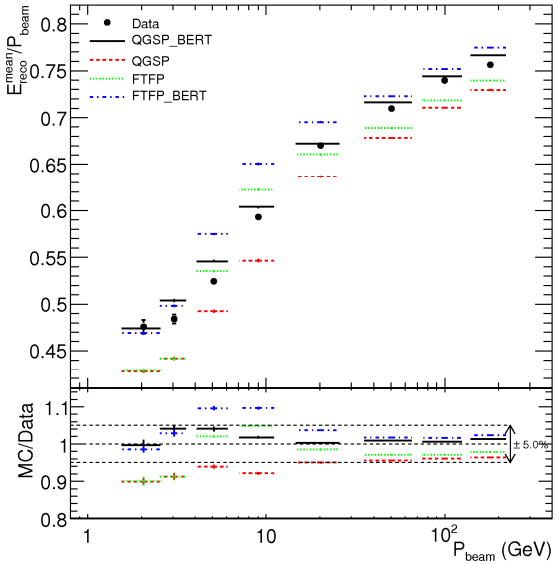


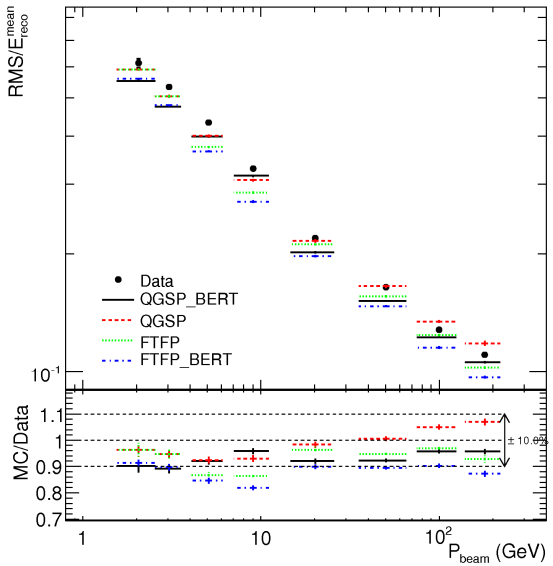
- Major effort for all calorimeters both standalone and CTB
- Impressive level of precision of large energy range
- Detailed studies of many distributions
- Touchstone for first-principle understanding of jet calibrations and a resource that must last the lifetime of ATLAS

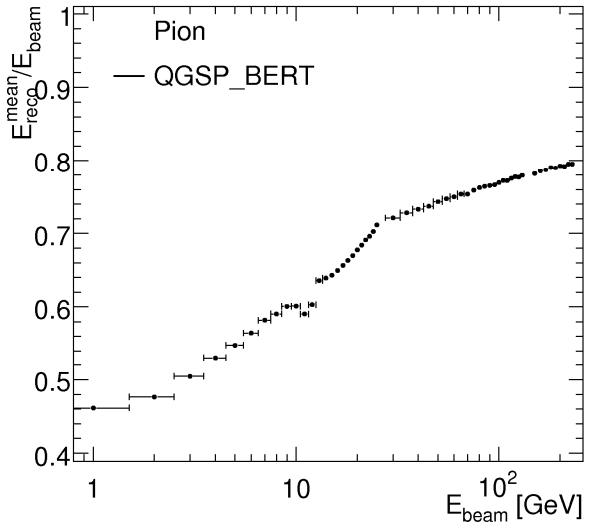
Recommendation:

- Storage of test beam data in ESD format very important
  - Should be an OTSMOU task to obtain support

Connecting the Test Beam with G4





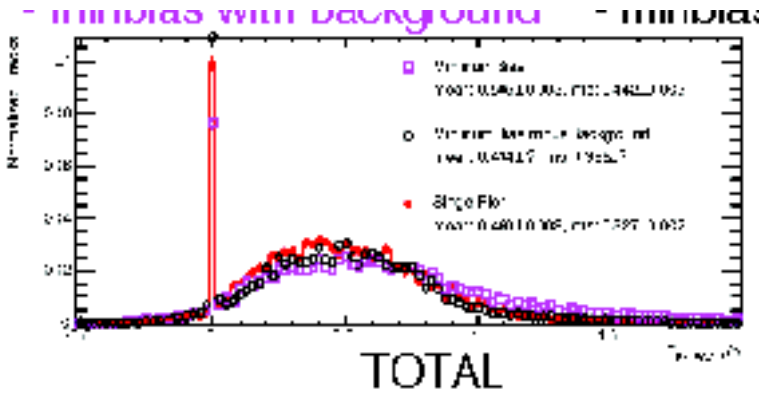


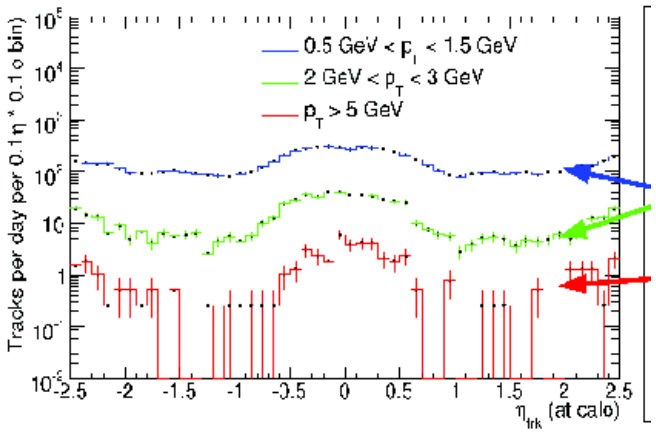
- Detailed comparisons with different G4 models
- None are perfect, but lists bracket the data

Recommendations:

- Continued interaction with G4 collaboration necessary
- Improvements in 9.5-25 GeV region necessary in future
- For current run, studies with different physics lists important for understanding systematic uncertainties

Connecting Test Beam with In Situ Response (E/p for isolated pions)





- Single pion E/p studies important to extend measurements of response below 2 GeV and to understand differences between test beam and in situ performance (geometry, time dependence)
- Procedure require detailed understanding of systematics due to background subtraction
- Existence of low energy test beam data insures large energy range where two techniques can be compared

Recommendations:

- These studies are important and require significant effort
- Use of HLT track trigger to extend energy range essential
- Must evaluate how much data is needed an insure the data is available on DPDs

In Situ Determination of EM Scale

- e/gamma group has primary responsibility for determining best energy calibration for electrons and photons
  - This calibration done with sliding window clusters
  - Some of the final corrections inappropriate for jets

- Recommendations:
  - Jet/Met group and e/gamma group should collaborate further to develop a strategy to propagate scale improvements to topoclusters
  - This is likely to require manpower from the jet group

Time-Dependent Conditions

- Expect conditions to vary with time, especially during first run (pileup, number of bunches, dead channels)

Recommendations:

- Common analysis tools necessary to handle such changes within jet calibration framework
- Strategy for handling these effects in simulation must be developed

Performance Comparisons

- Two calibration schemes global (H1) and local (LC) under development
  - Both use energy density to determine weights (cells forH1/clusters for LC)
  - LC classifies clusters as EM or Hadronic
- At first glance, performance appears similar for both, but comprehesive comparisons still in progress

- Recommendations
  - Must establish a set of benchmarks to compare performance of different calibration strategies
    - What are the metrics? (resolution, efficiency, robustness)
    - Common software and samples must be used for comparing the strategies

Local Hadron Calibration and Cell Energy Density Weighting

- Huge effort on both H1 and LC calibration schemes
  - Impressive level of understanding of how to transfer event-by-event energy density to calibration
- A major development of past year: Existence of debugged, easy to use tools:
  - ParticleID: Allows systematic studies of how individual particle energy depositions
  - JetPerformance, MetPerformance: Ability to compare algorithms on equal footing with common code
  - JetTools: Common tools to calculate quantities of interest to many people AND ability to easily switch between implementations

This is a major achievement and the authors and Jet/Met should be congratulated