FCal 2003 Test Beam: Data and MC Comparison Inner Edge

FCal Group

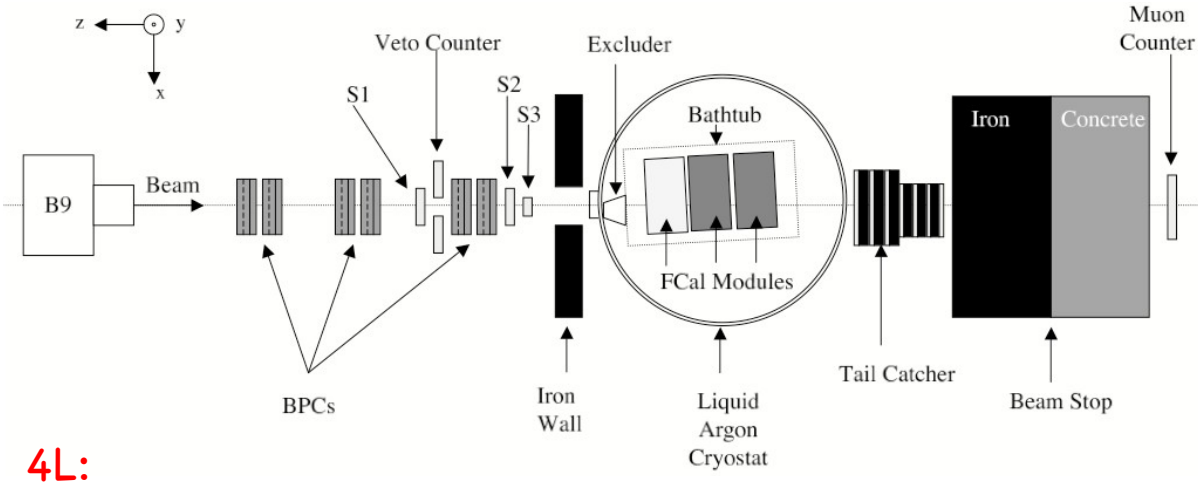
ATLAS Hadronic Calibration Workshop

Lisbon, Portugal

June 2009

Carleton UNIVERSITY
Canada's Capital University

FCal 2003 Test Beam Data



- three FCal modules tested at CERN in H6 beam line
- wide beam spot
- ~1000 active readout channels

4L:

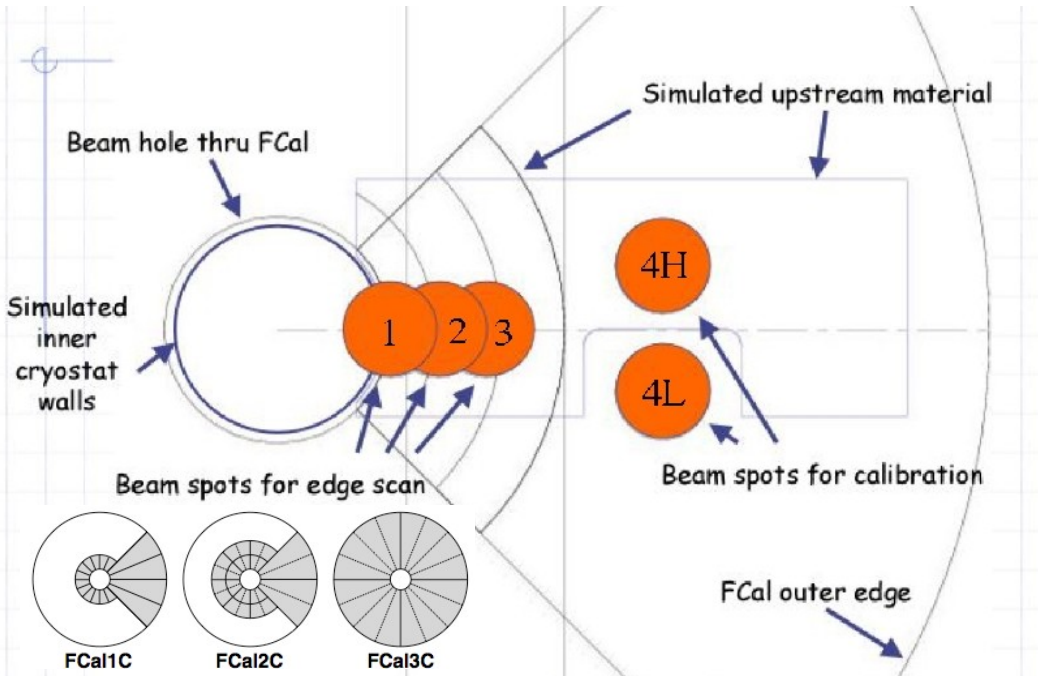
- intrinsic response Fcal
- electrons, hadrons 10 – 200 GeV
- (2008 JINST 3 P02002)

4H:

- effect of upstream material
- electrons, hadrons 10 – 200 GeV

3, 2, 1:

- effect of energy loss and shower shapes at high eta (at beam pipe)
- electrons, hadrons 200 GeV



Analysis Details

Data

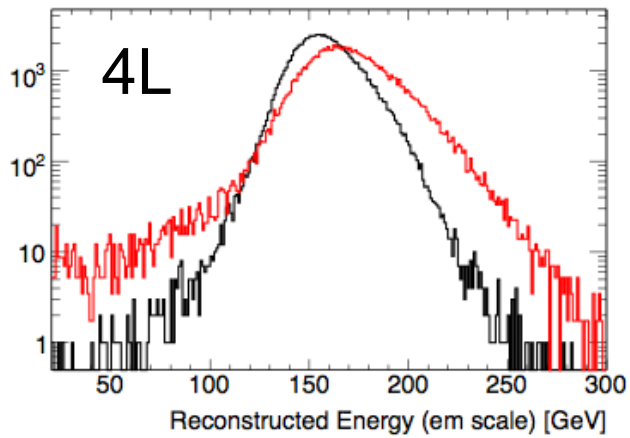
- Athena 13.0.40
- cuts: S1&S2&S3 coincidence, time quality cuts, veto wall cut, beam cleaning (beam envelope 4L)
- 200 GeV runs all five positions (em scale)
- clustering with topological clustering algorithm 4/2/0 (summing energy in Fcal1+2+3)
- noise run-by-run and channel-by-channel

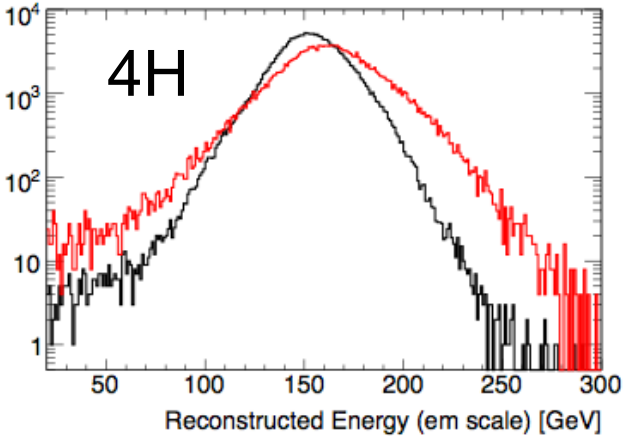
MC

- Athena 13.0.30
- hardcode FCal23Absorber density (default in 13.0.30 incorrect at 15.366, correct at 14.39)
- simulated, digitized, reconstructed using real beam profile 1000 events per data run
- simulated with real beam profile
- QGSP_EMV physics list used
- clustering with topological clustering algorithm 4/2/0 (summing energy in Fcal1+2+3)
- used default noise in database (incorrect for some unsummed channels, factor of two too high for summed channels) for digitization and reconstruction (topo)

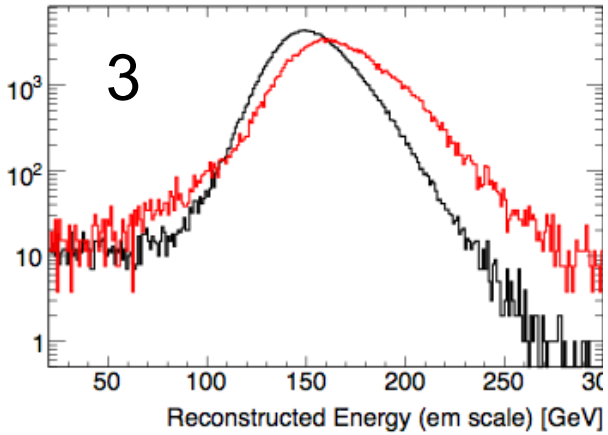
only pions...

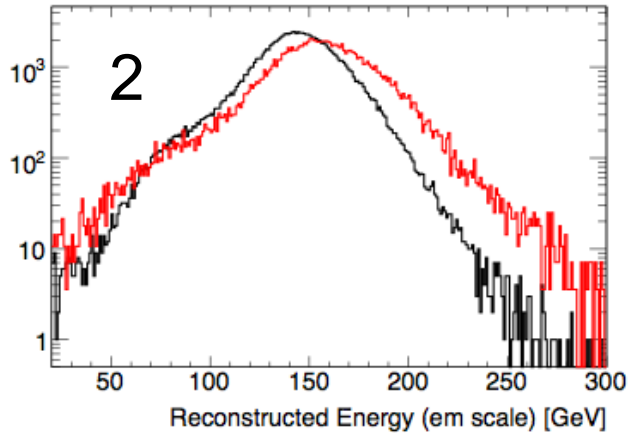
Total Clustered Energy

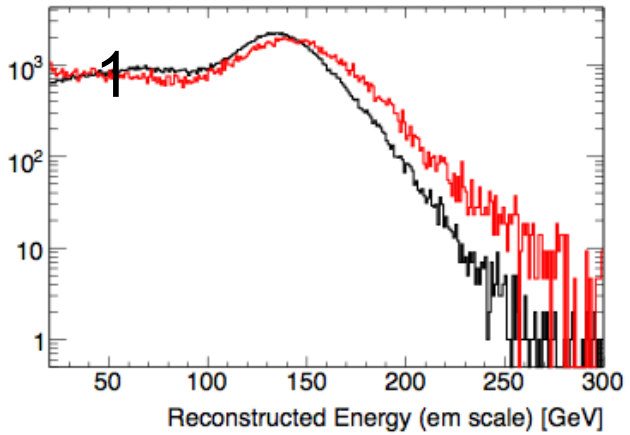




Data
MC

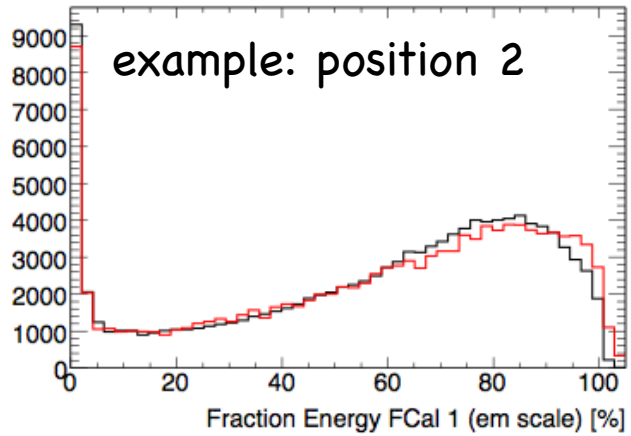


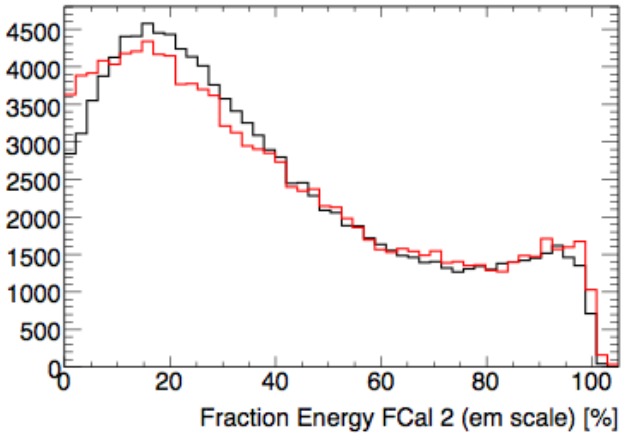


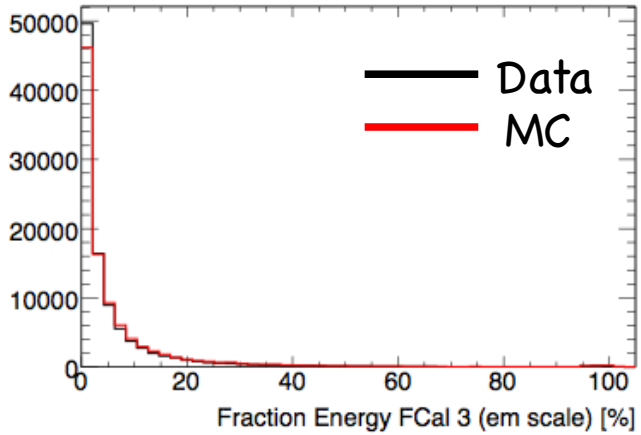


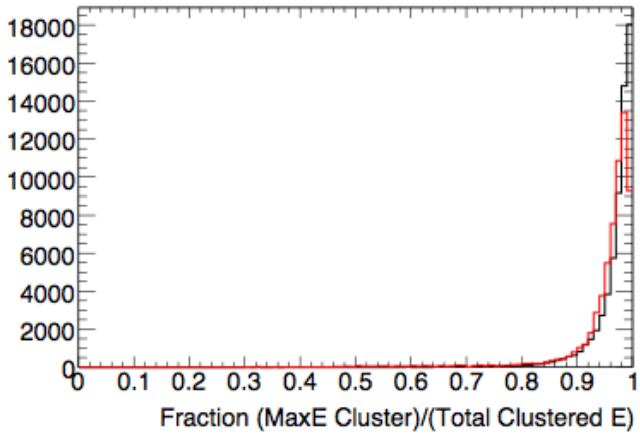
- overall poor agreement in quantitative values between data and MC
- MC reconstructs more energy (em scale)
- similar qualitative features: shapes, poor resolution as reconstruct closer to beam pipe

Fractional Energy Each Module





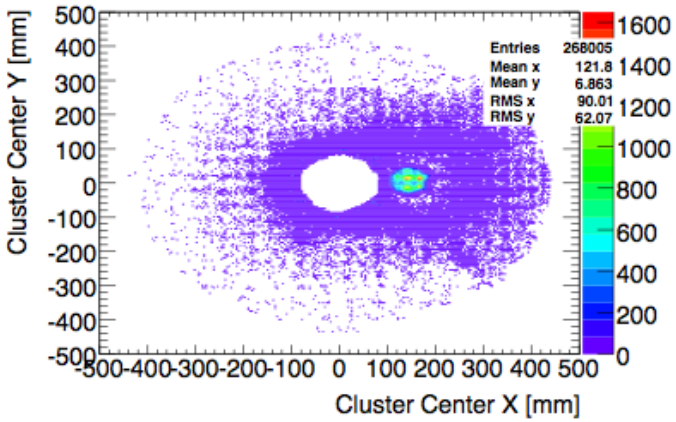


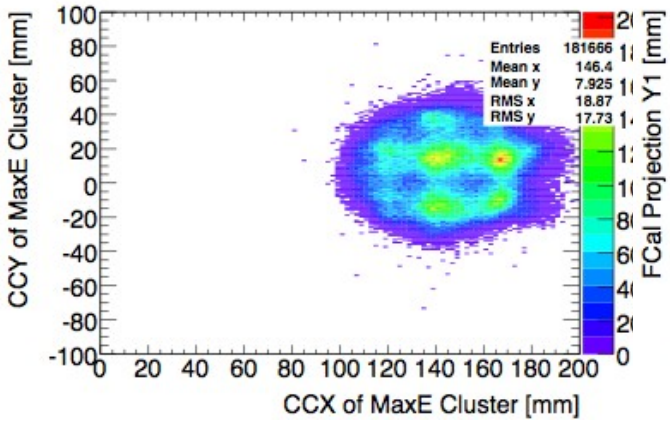


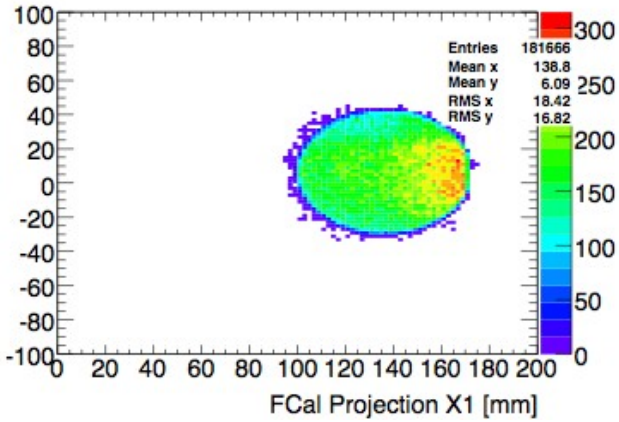
pos	<frac 1>	<frac 2>	<frac 3>	<frac max e>
1	47.9 (55.2)	38.8 (38.7)	17.3 (12.7)	91.9 (88.4)
2	58.2 (59.1)	38.2 (38.7)	6.2 (13.3)	97.0 (95.2)
3	59.1 (58.6)	37.6 (39.3)	5.9 (7.2)	98.4 (95.9)
4H	61.5 (62.6)	35.6 (35.9)	5.5 (6.6)	98.1 (95.1)
4L	56.7 (56.6)	39.7 (41.0)	6.3 (7.7)	98.7 (95.8)

- 4H vs 4L: shower starts earlier in upstream material
- 1: lower fraction in Fcal1 much larger Fcal3, also more clusters, less fraction of energy in maximum energy cluster

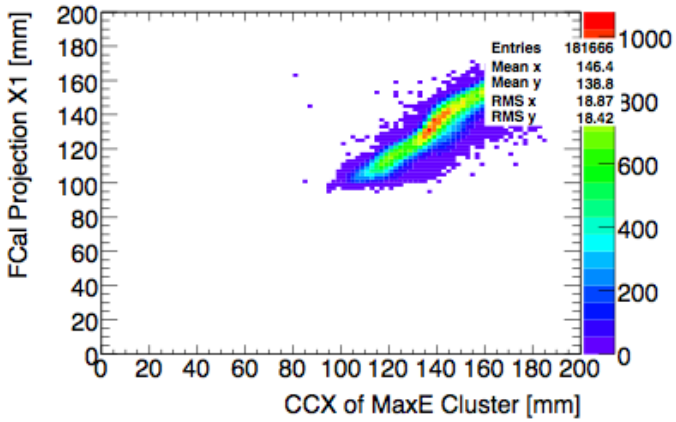
Cluster Center

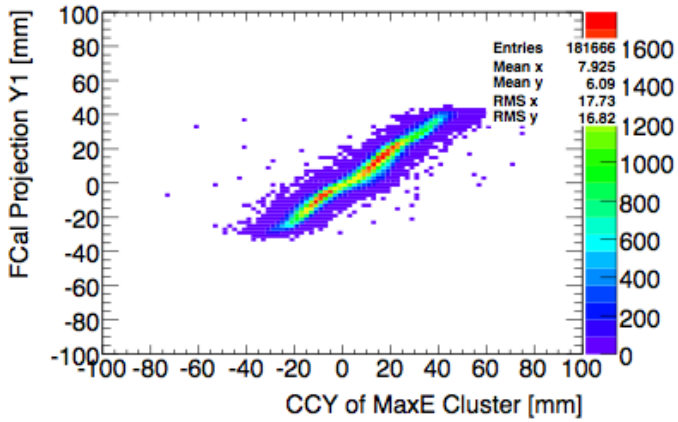






EXAMPLE position 3 Data





- bias towards cell centers
- CCX, CCY from topocluster (positive energy avg over all modules)
- "truth" FCal projection from BPC projections

Response Vs. Radius from Beam Pipe