dE/d (Plane) Comparison of Monte Carlo to Real Data for 2 GeV Muons at CalDet

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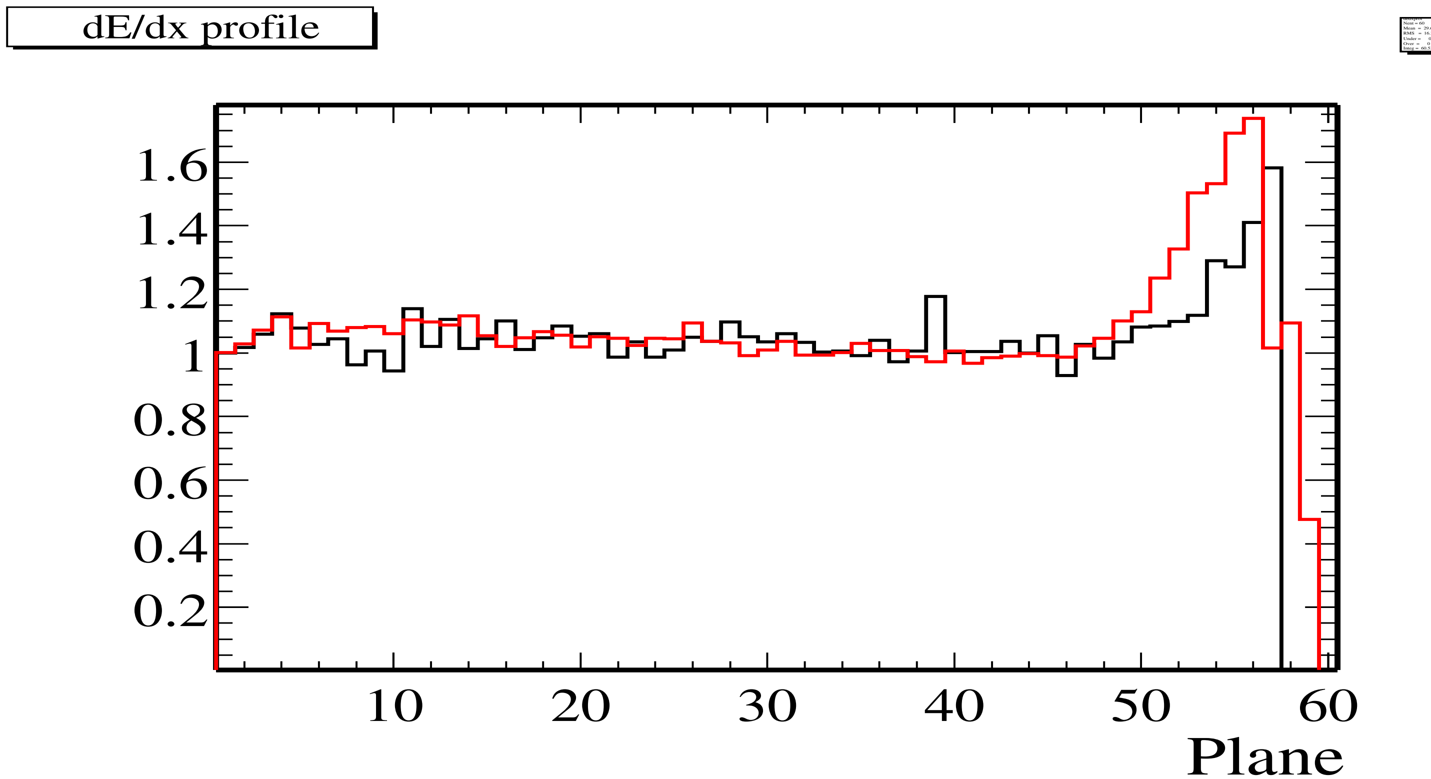
- Muons were generated using Geant 3.21. New code was used (thanks Ruben!) which simulated :
  - Birk's scintillator saturation
  - PMT response
  - 1% smearing of particle momentum
  - green and clear signal attenuation

- Chris's cuts were then applied to make a fair comparison:
  - always a green and clear readout for every hit in a track
  - at least 16 hits anywhere in the detector
  - the muons path has to make an angle of less than 10 degrees with the beamline
  - less than 3 hits in a given plane or 4 next to each other in two consecutive planes
  - sparsification threshold set to 1/3 of a p.e.

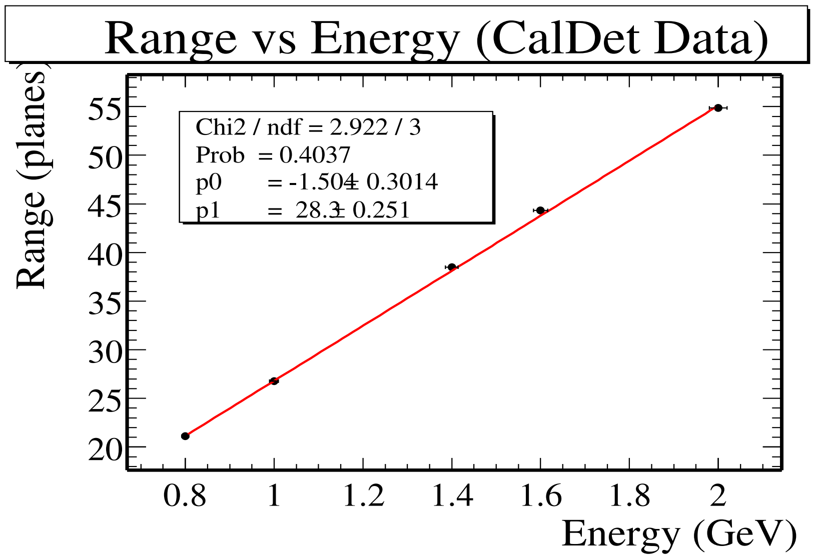


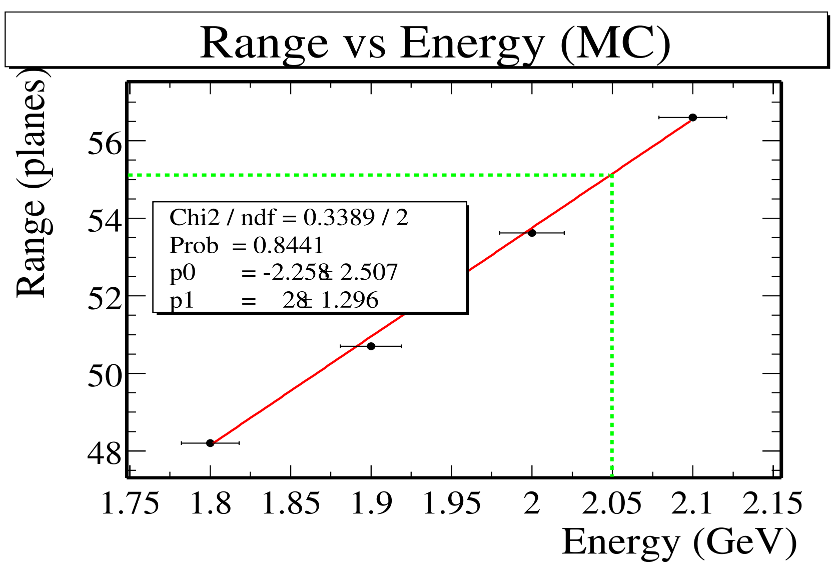
- Monte Carlo is shown in red and Chris's real data is shown in black.

- There is pretty good agreement for the first forty planes or so.

- The discrepancy towards the end is due to the fact that Chris only looks at muons that stop in planes 54, 55 and 56 whereas I look at all MC muons.

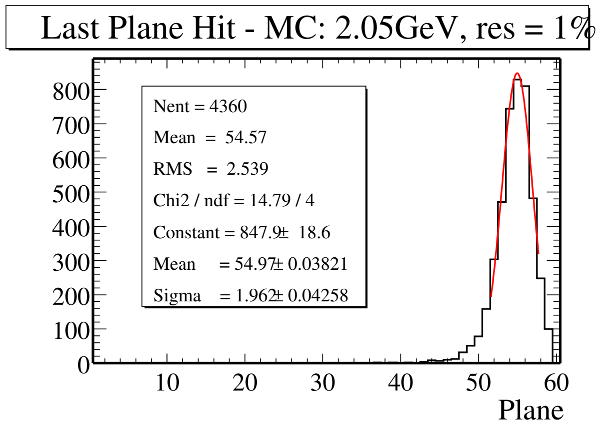
- This plot highlighted an apparent difference between the last plane hit seen in MC and Data.



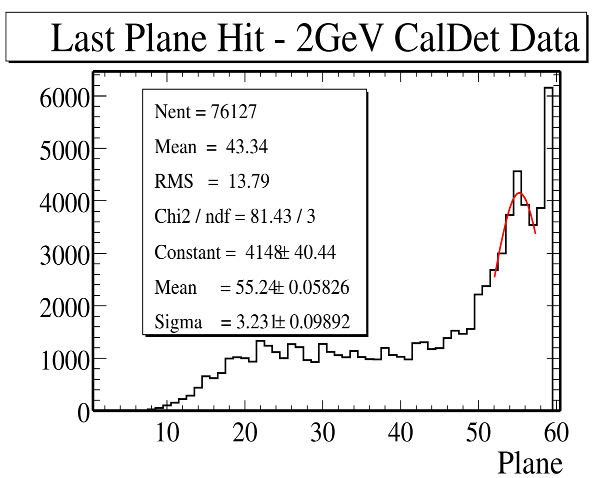


- The range implies the T11 beam energy may in fact be slightly higher than expected at 2.05 GeV when we expect 2 GeV

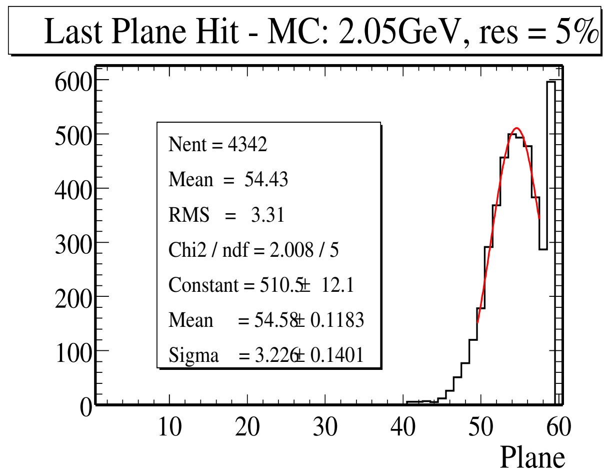
- This could be due to a slight deviation of the focussing magnet settings from nominal



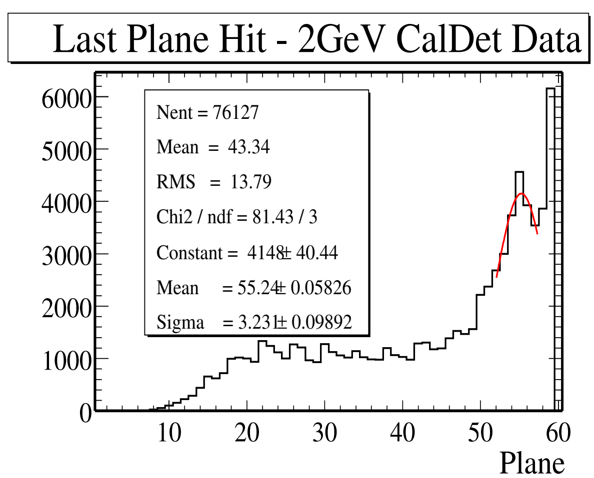
- A 1% spread of particle momenta shows nothing passing all the way through the detector at 2 GeV in Monte Carlo...



- ...unlike the real data



- A 5% spread looks much closer to what is observed



Summary

- The beam appears to have a slightly higher energy than expected at 2 GeV

- The spread of particle momenta is also higher than expected

- Next:
  - Better dE/d (Plane) comparison by using running MC and Data through same code
  - Adjust to true dE/dx
  - Higher statistics and better fits to find best approximation of observed energy and momentum spreading