G4numi Validation update

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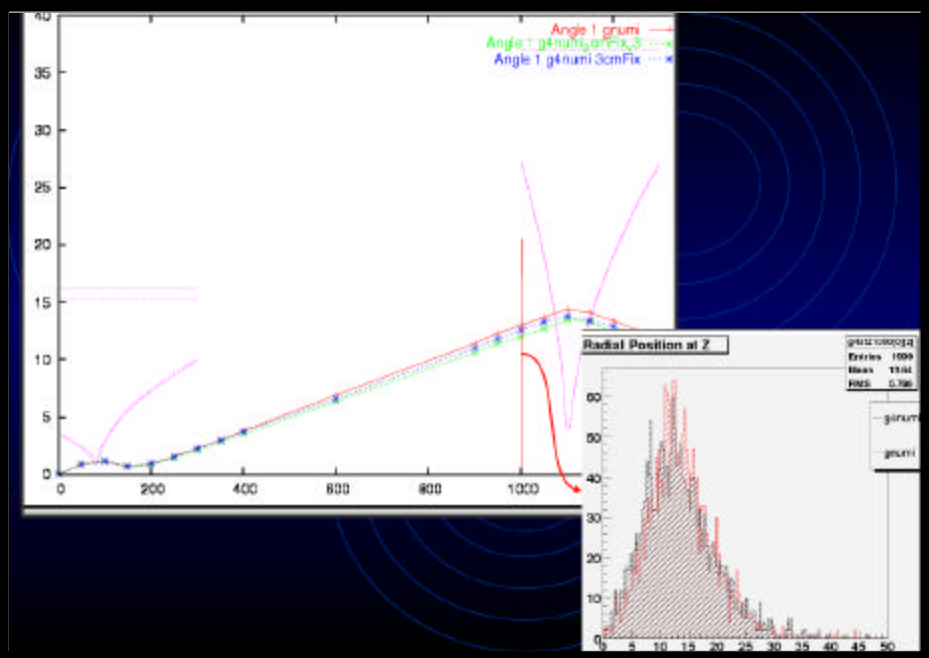
- Reminder on the ray tracing study and conclusion (doc 3652-v4)
- Initial fluxes from fixed g4numi v.s. gnumi
- Subtraction of horn material

Discovered discrepancies between g4numi and gnumi horns

- Z=0
  - The g4numi MC z=0 began at the beginning of the parabolic shape
  - The gnumi MC z=0 begins at 3cm before the parabolic shape
    - Difference in " MC 0" and beginning of the parabolic horn
- G4numi horn is longer
  - The g4numi horn is longer by about a foot
- Gnumi horn has more pieces



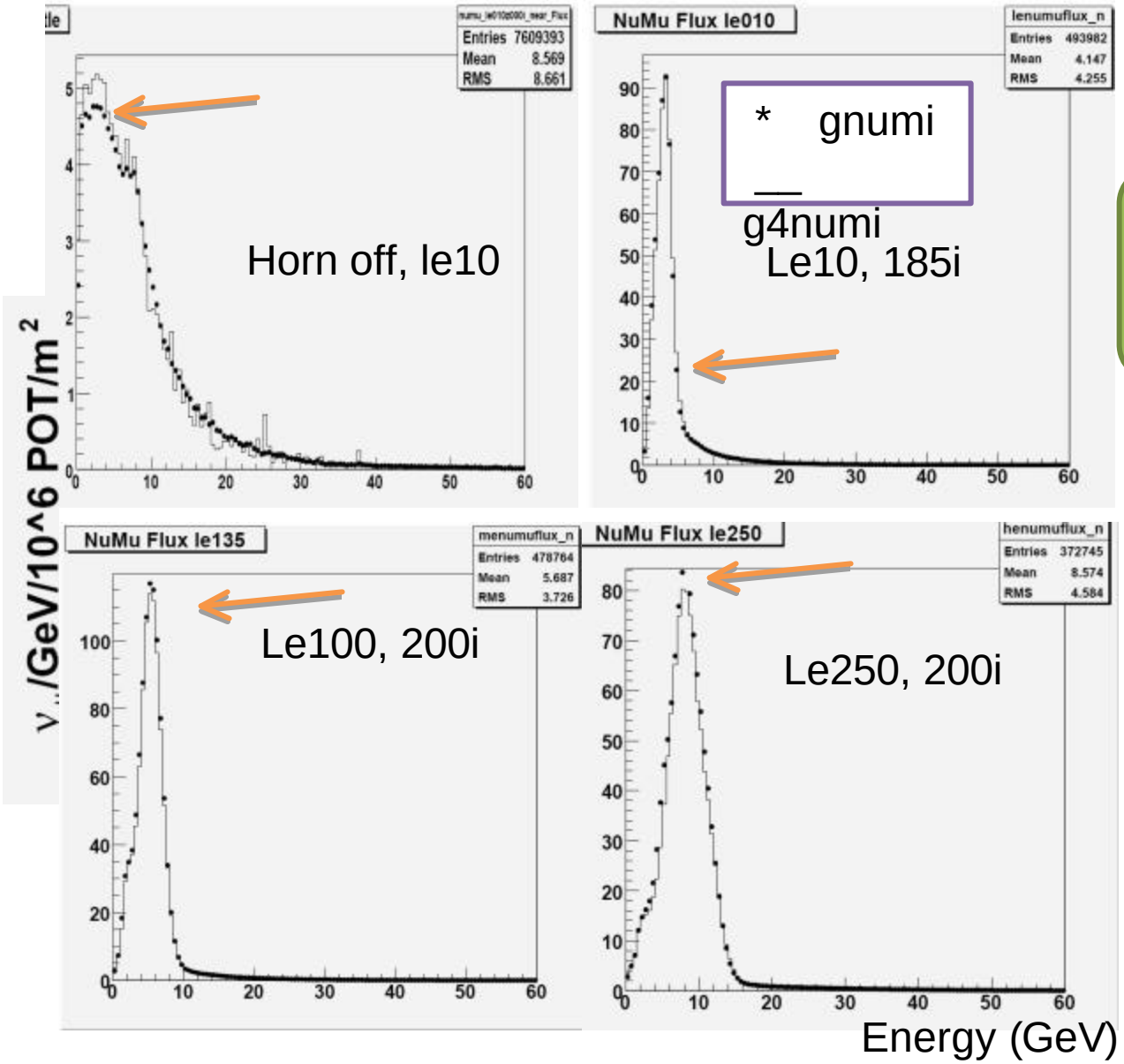
We traced 2000 pi+ at different angles and energies from MC Z=0

For both gnumi and g4numi in search for disagreements between the two MCs.

After the differences mentioned were fixed (except for the length of the horns) the ray traced pions agreed well for most cases

We figured the next step is to calculate the g4numi flux and compare it to gnumi flux histograms

G4numi vs Gnumi Fluxes

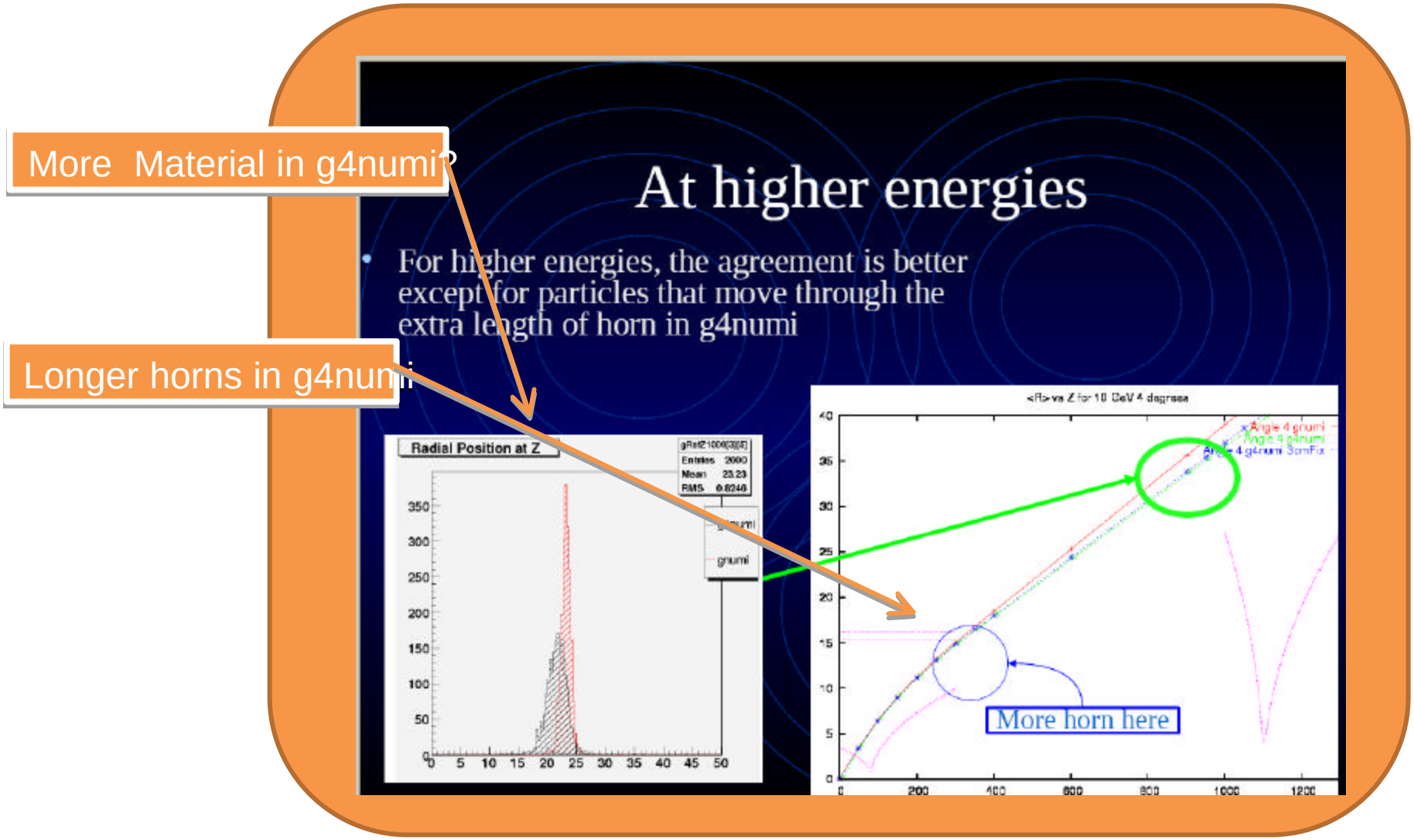


While the basic shape agrees, g4numi and gnumi differ on the few percent level

Used the gnumi fluxes already calculated

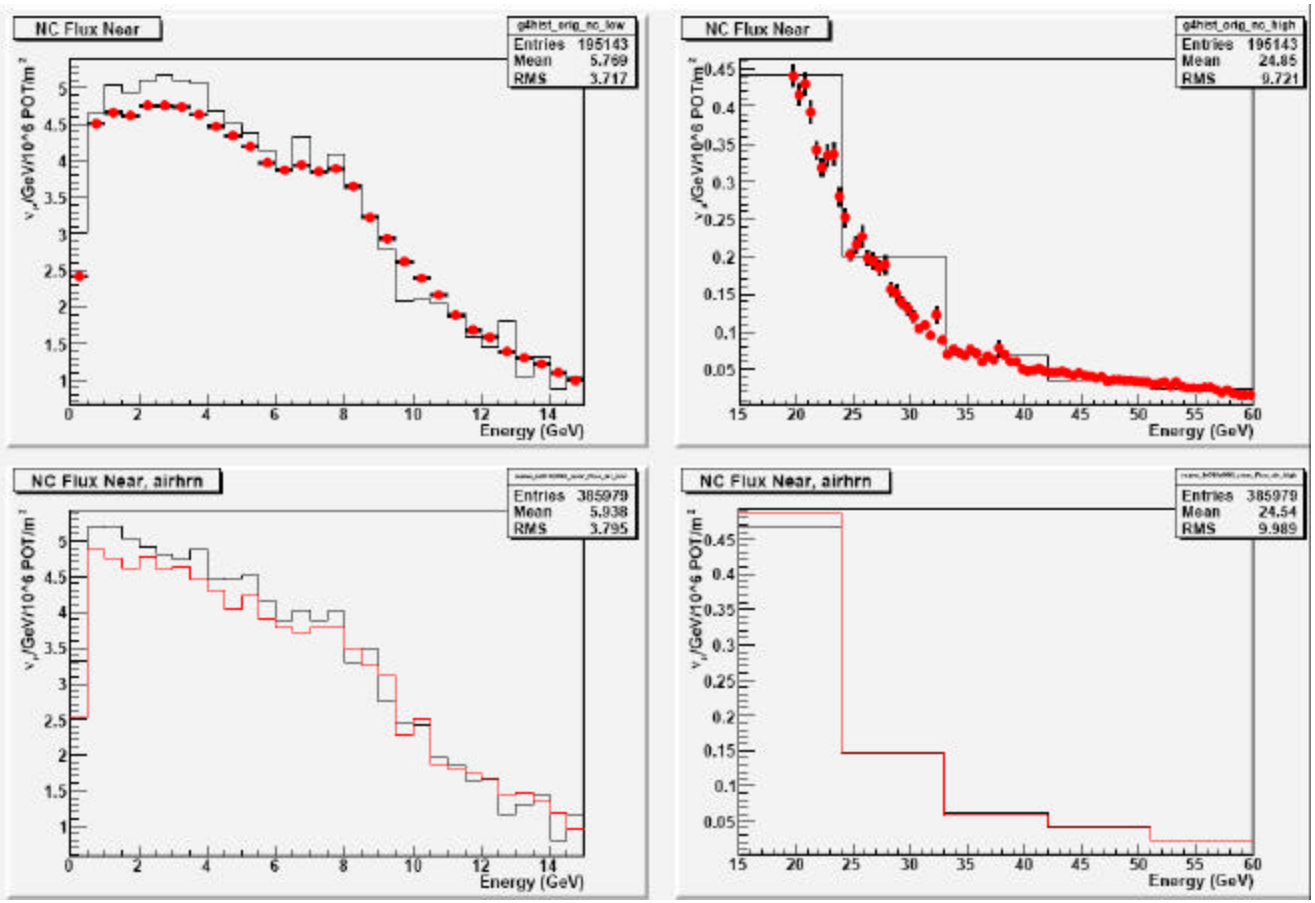
We ran 4 million events to create the g4numi flux

There was evidence that the length and material of the horns could be responsible for the differences seen for some angles and energies. Perhaps this is why?



Gnumi vs G4numi with “air” horns

*gnumi originally
_ gnumi air horns
_ g4numi, original, air horns respectively



We can compare the original fluxes to
Fluxes without horns (note that there is significantly less statistics for the gnumi flux (5 million events))

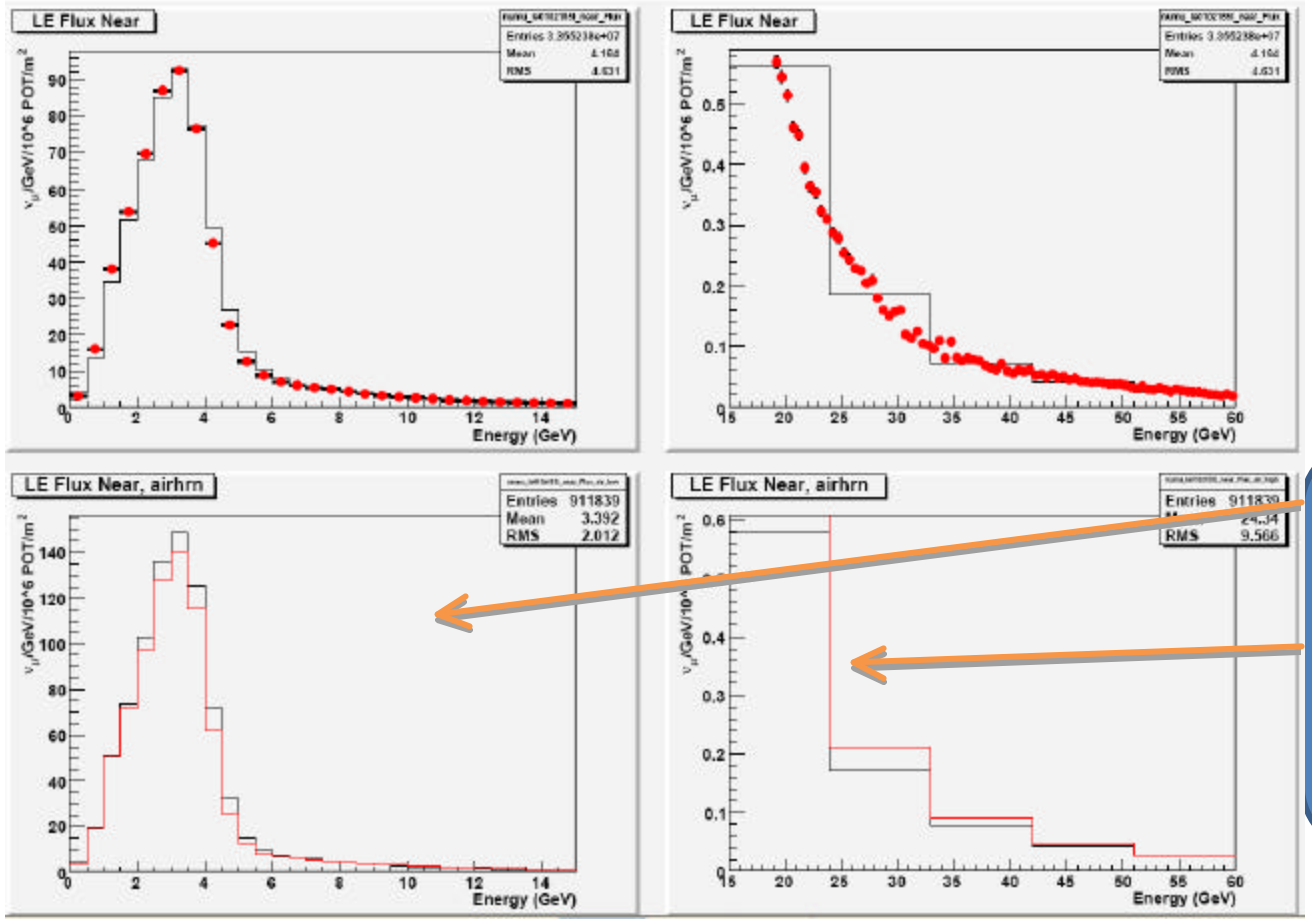
The graphs left are split by energy (< or > 15 GeV)

This is for “horn off” le10

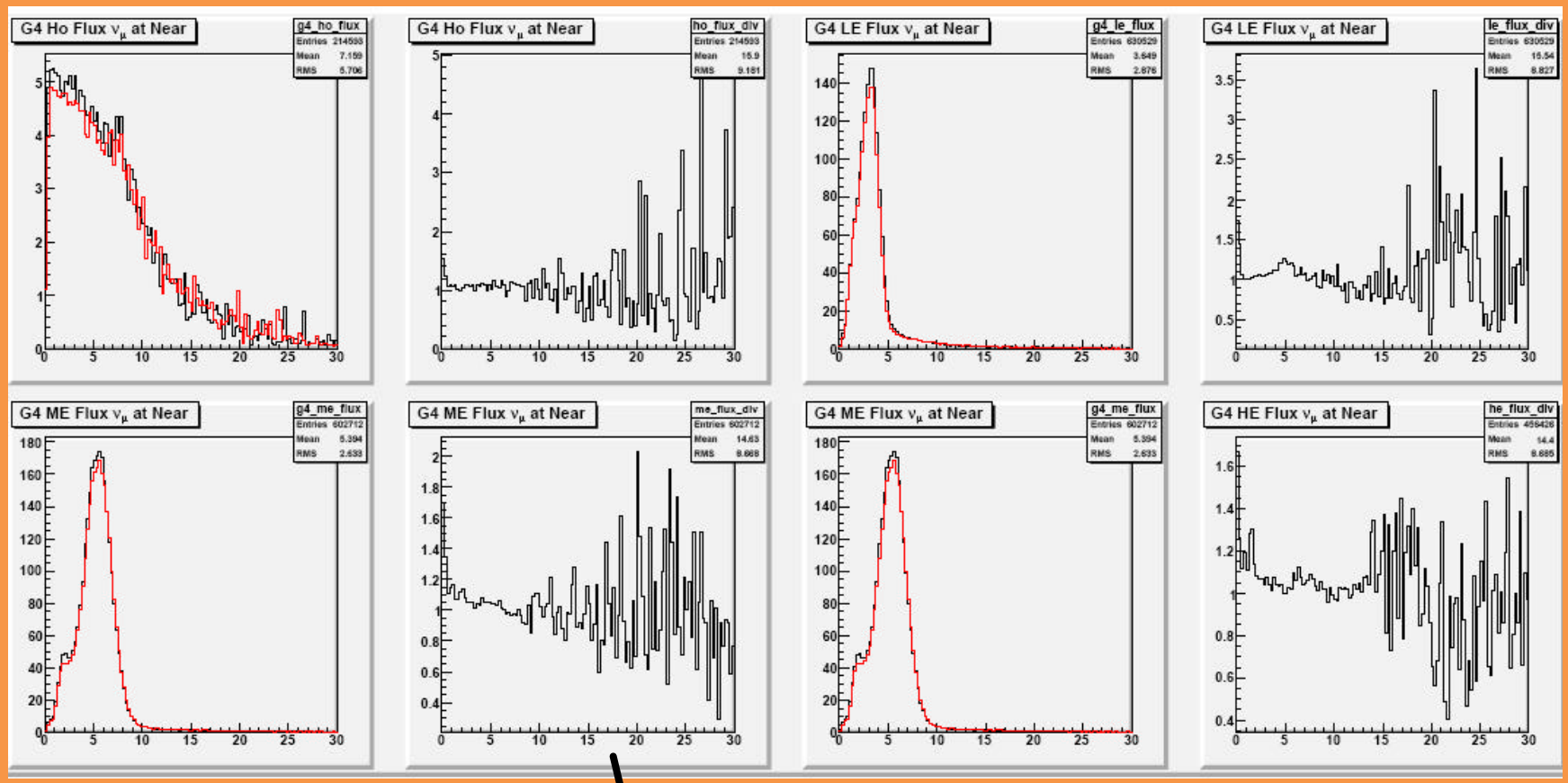
G4numi vs Gnumi fluxes

*gnumi originally
_ gnumi air horns
_ g4numi, original, air horns respectively

This is for le10z185i

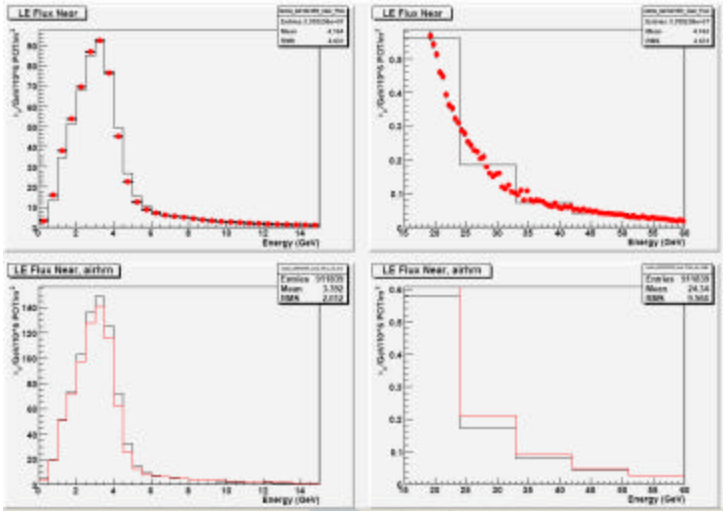


For the air horns there is an even larger difference than for the original flux--!!??
You can also see it at higher energies!

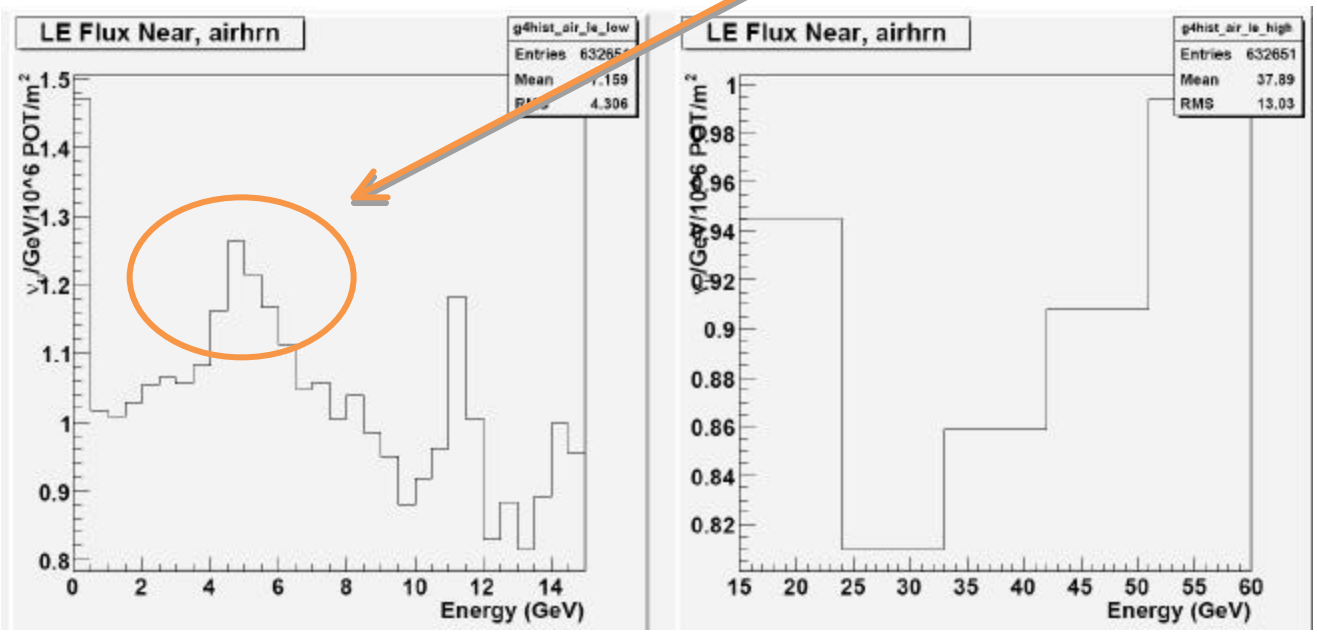


G4numi/g3numi

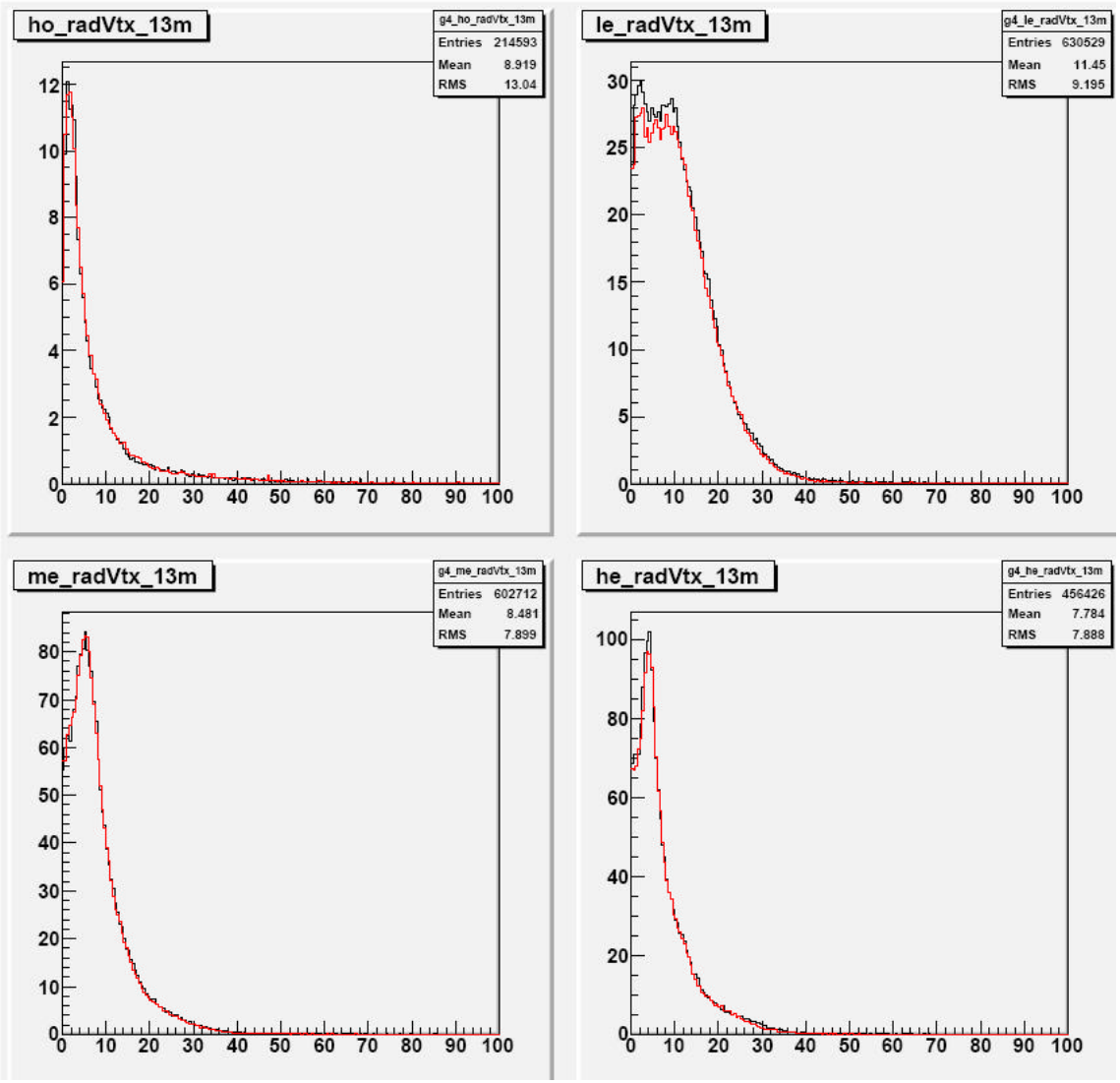
Ratio of g4numi/ gnumi fluxes



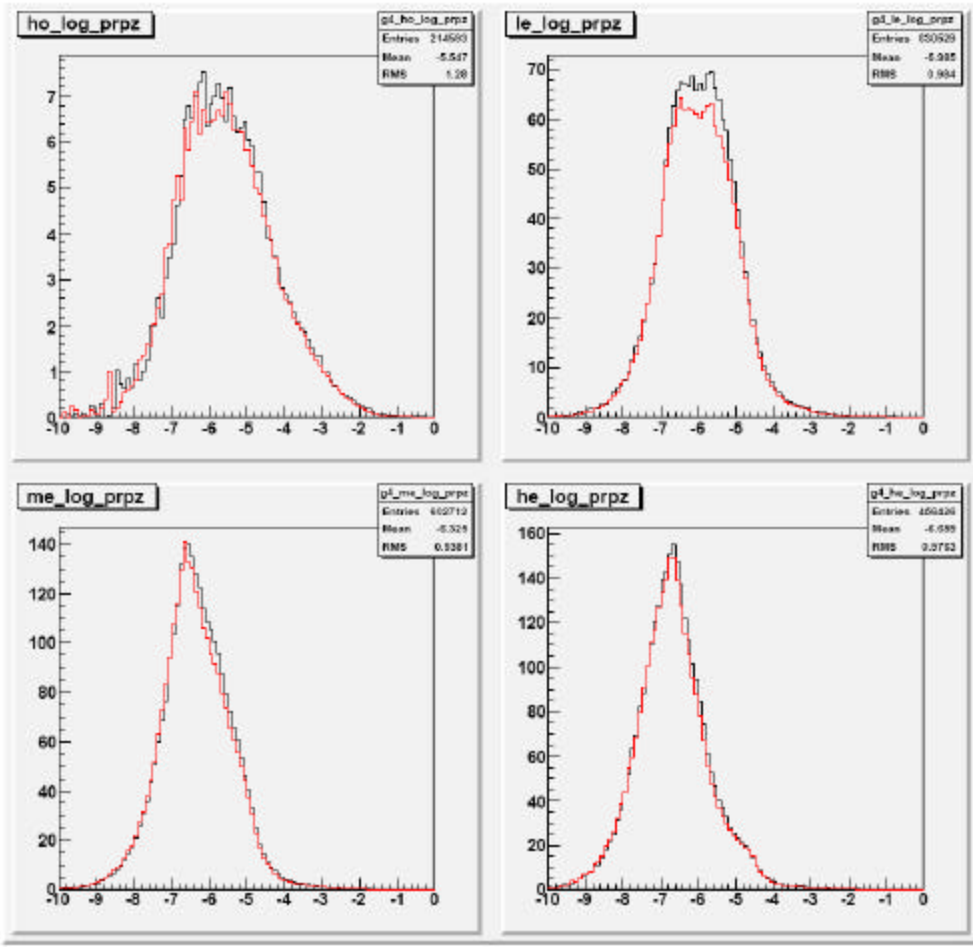
Here again you can see the significant differen



Radial position at 13 m

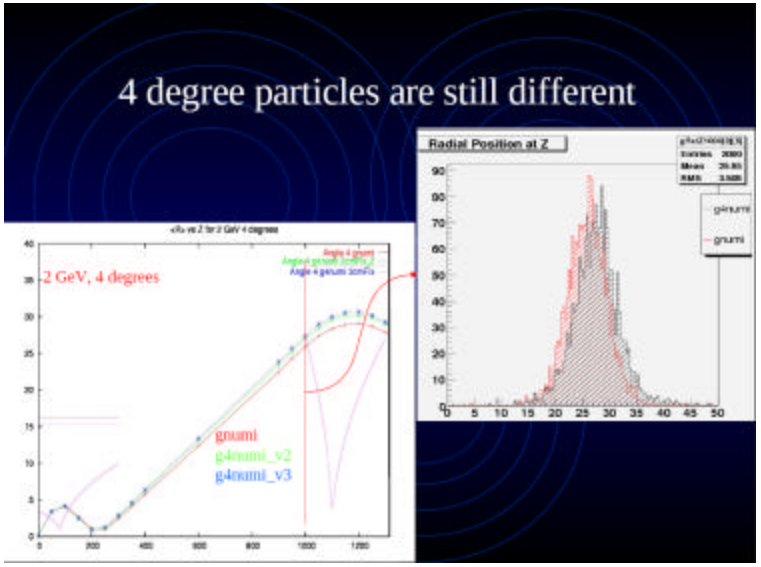


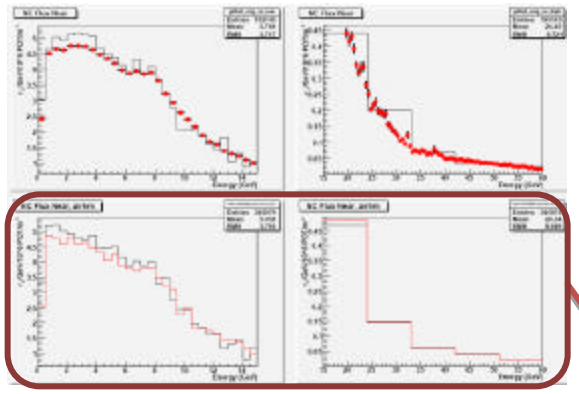
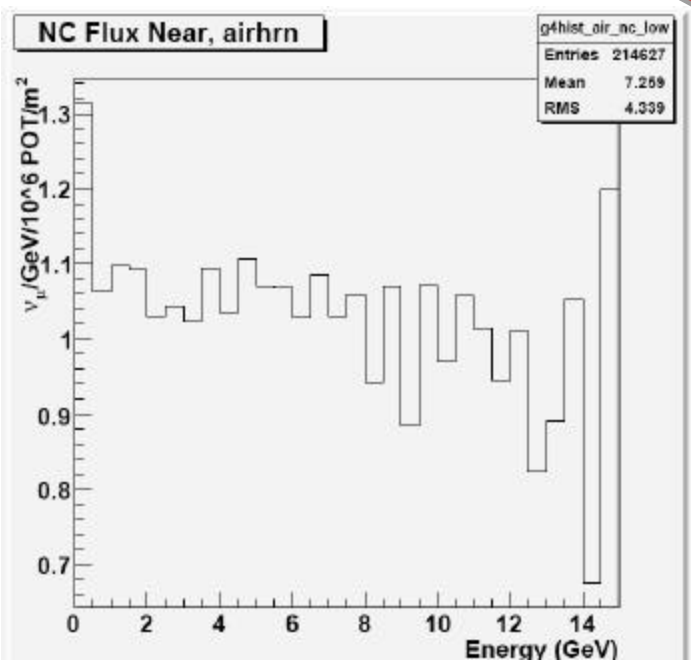
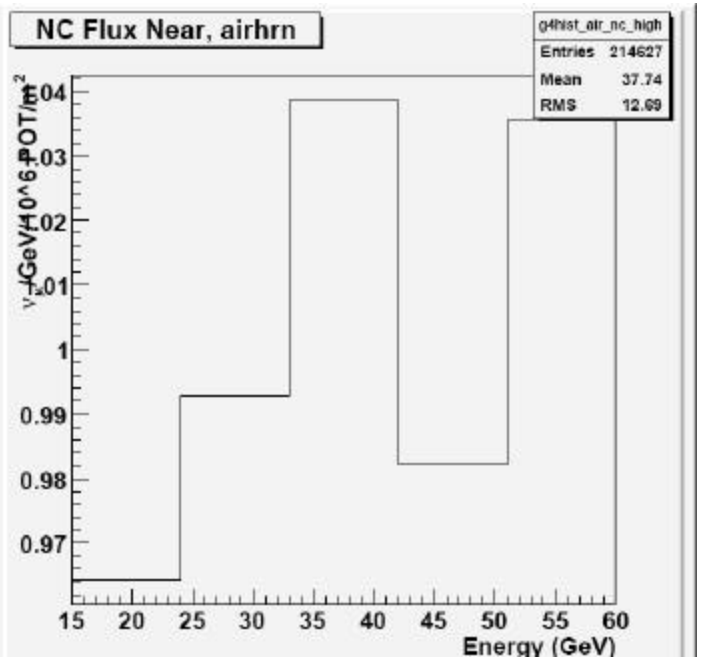
Log (tan(???



Summary

- Removing material seems to have made the discrepancy larger
- Still need to understand differences in fluxes, which could be related to differences in the ray tracing that are not understood
  - Possibilities include horn lengths? Other materials?
    fields near the neck of the horn?





You can make a ratio of the air horn fluxes. Though limited by statistics, they differ by ~ 10 %