TB04 analysis current status – Oct 2005

Geneva meeting

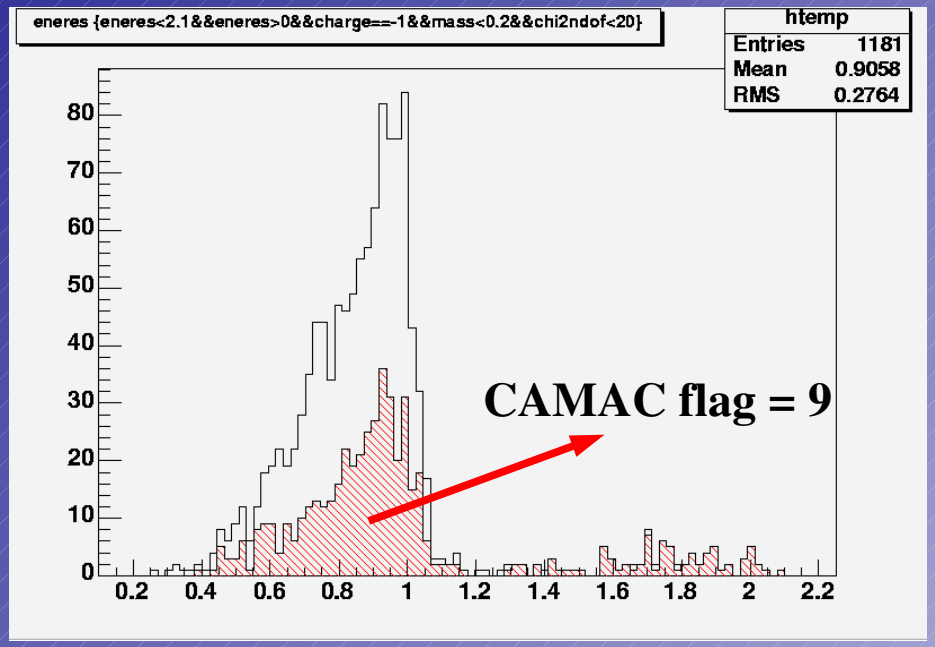
Juan Alcaraz Maestre; Nacho Sevilla Noarbe et al.

Outline

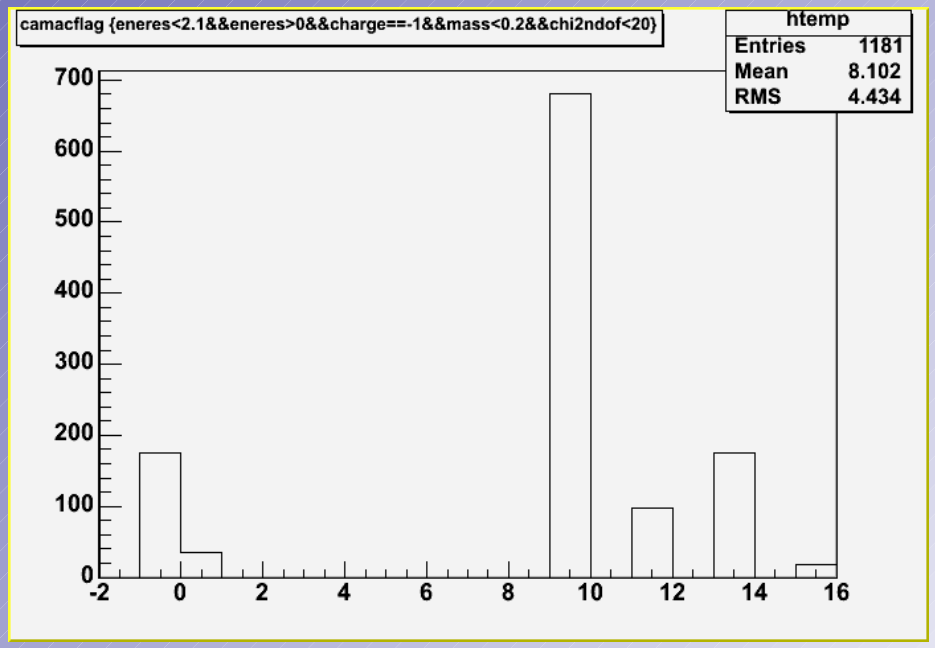
- CAMAC flag.
- Hit resolution.
- Momentum resolution + more on cuts.
- Photon energy resolution + hi/lo energy distributions.
- Photon angular resolution + current problems.

CAMAC flag

- Flag indicating early/late B_0 triggers in a ~10 usec time window (as far as I know). Flag==9 was used to select good events.
- High energy tails cleaned.
- However around ~>25% of events have a pile-up event detection (higher rate than expected?).



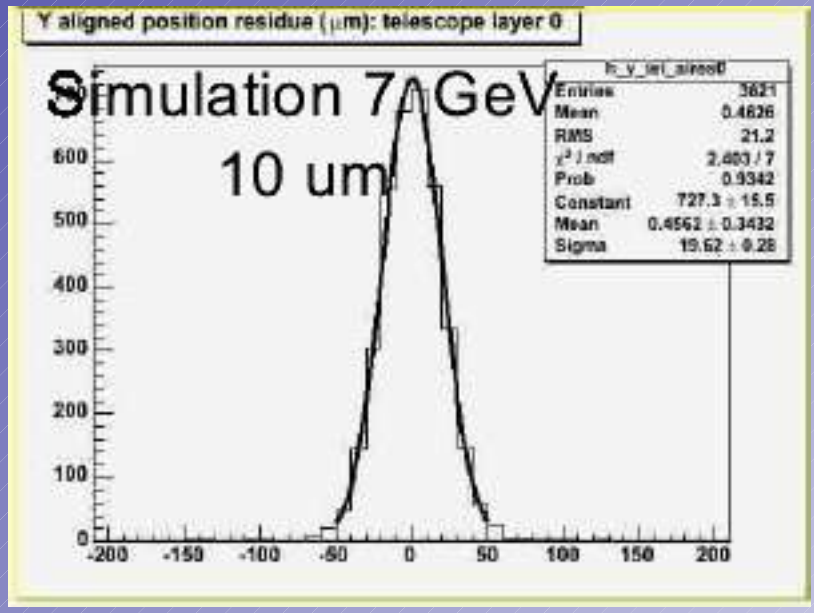
3-prong vertex energy / Beam energy
7 GeV runs

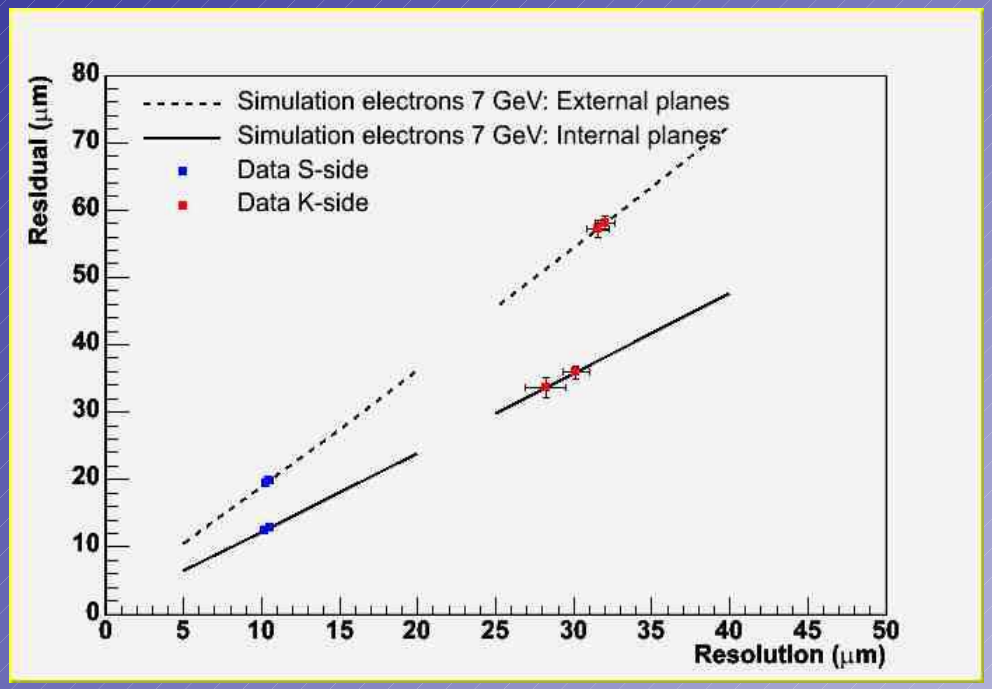


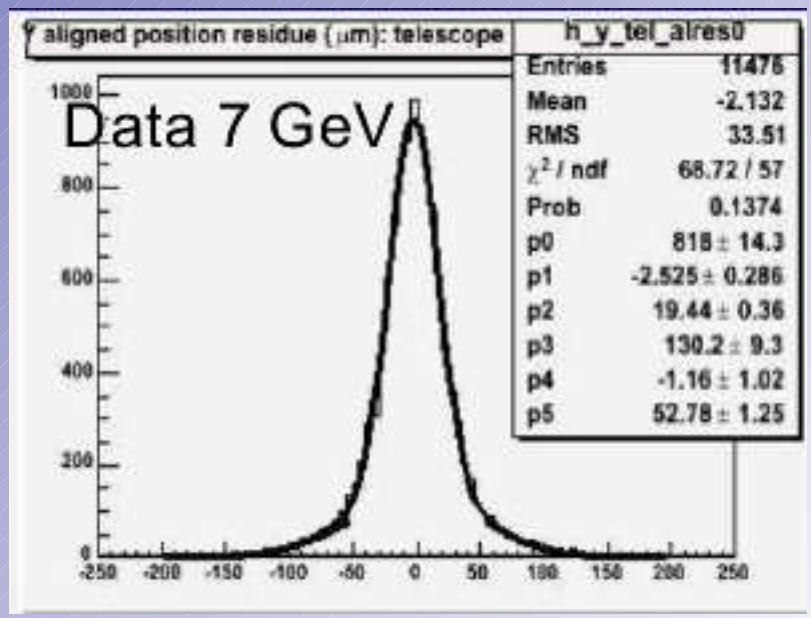
CAMAC flag = 9 => no early/late trigger
CAMAC flag = 0,-1 (reconstruction program coding) => camac info not read

Hit resolution

- Similar situation as in July, S-side 10.4 ± 0.2 um; K-side 30.4 ± 1.4 um for central Gaussian events (~90%).
- Using Bill,Paolo et al. approach for 2003 analysis, we performed similar simulations to compute resolution vs. residual relationships (with 7 GeV electrons).

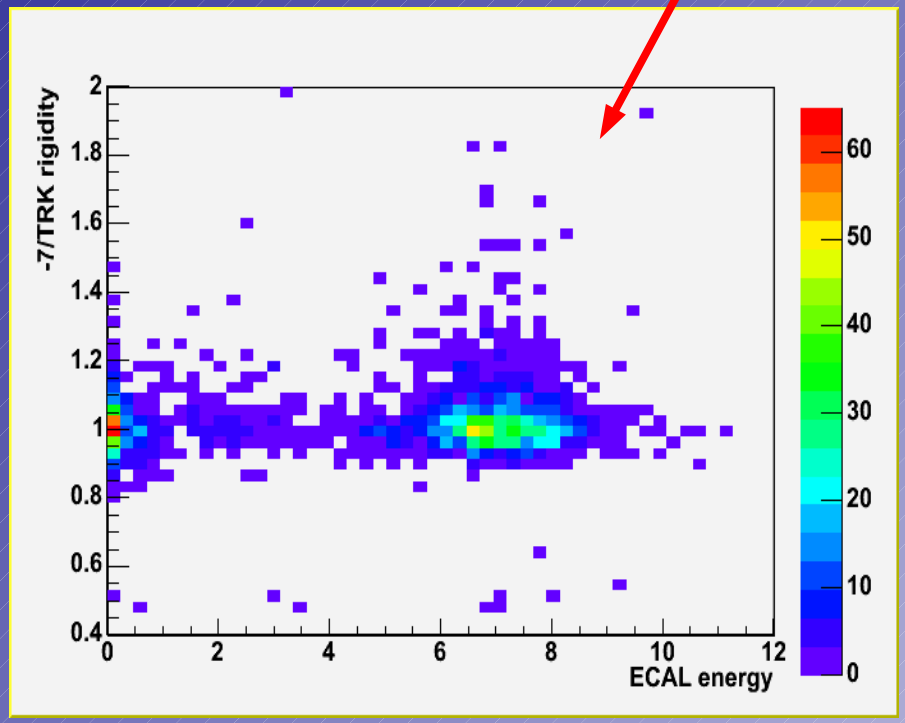


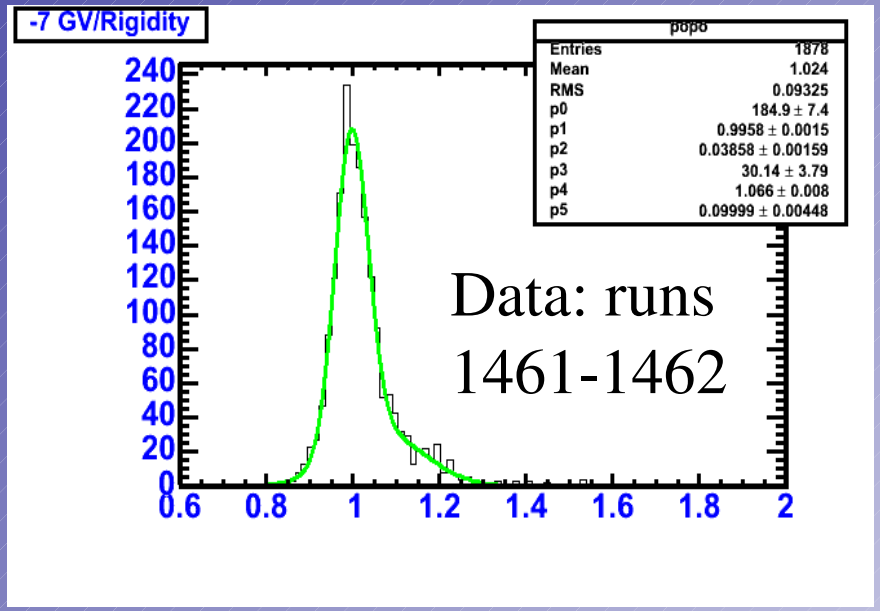


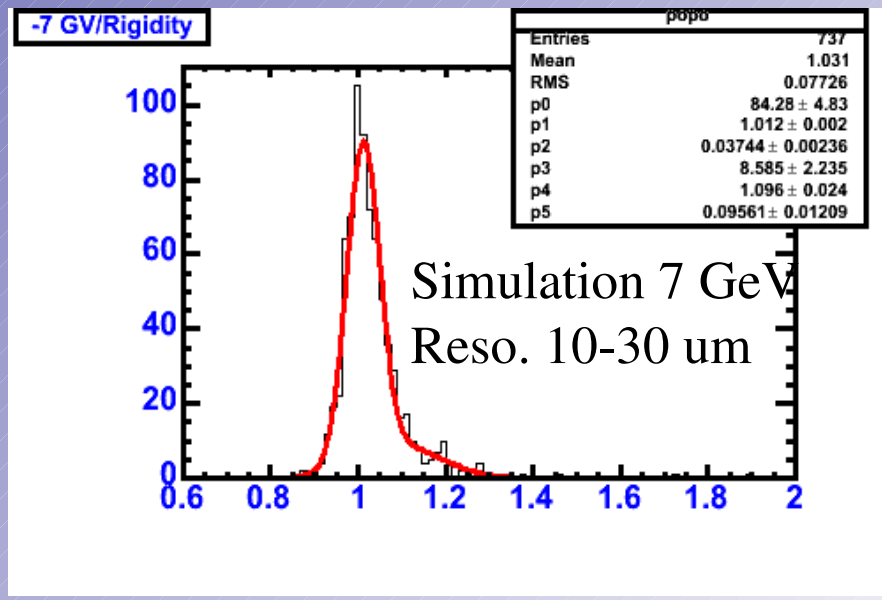


Momentum resolution

- Selection:
  - One track.
  - χ^2/ndof < 50
  - θ < 5 mrad
  - Close to beam (< 3 cm)
  - More than 6 hits
  - $|1/R_1 - 1/R_2| < 0.2$
  - Downstream hit required
  - ECAL energy more than ~ 4 GeV.
- Data: 3.8 ± 0.2 %; Sim: 3.7 ± 0.2 %

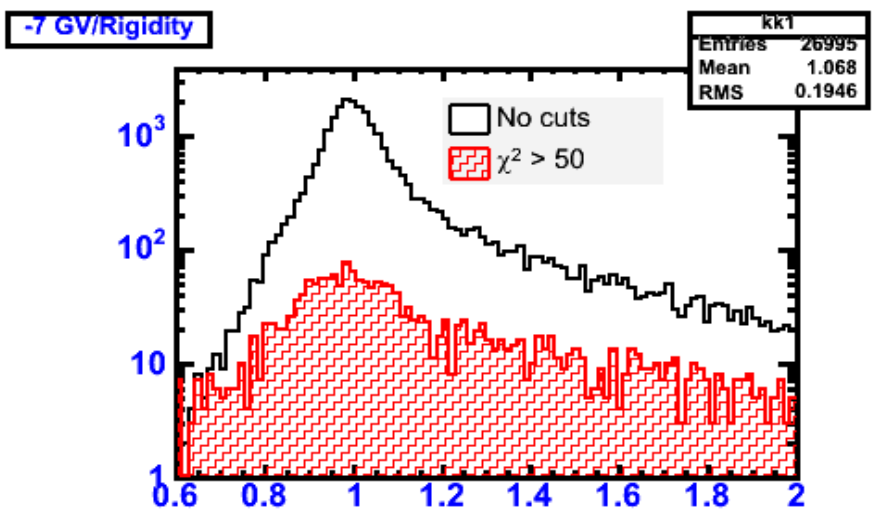


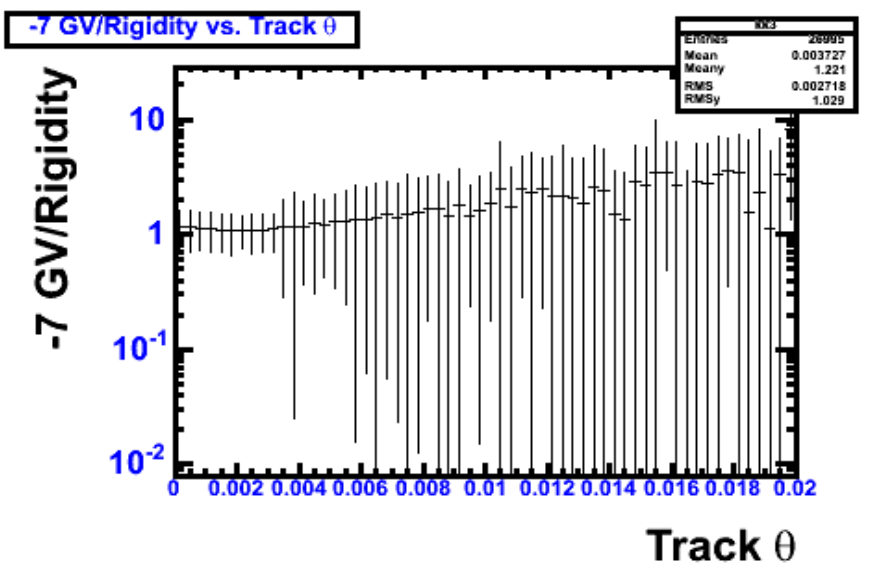


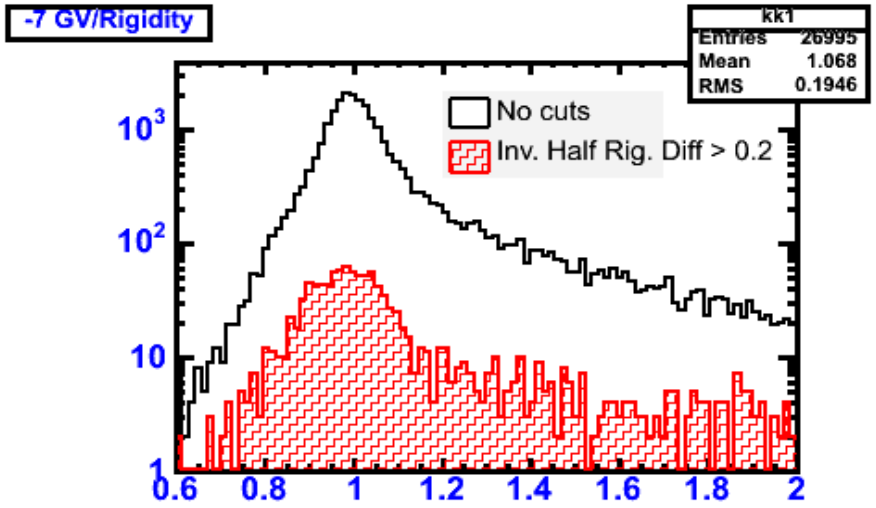


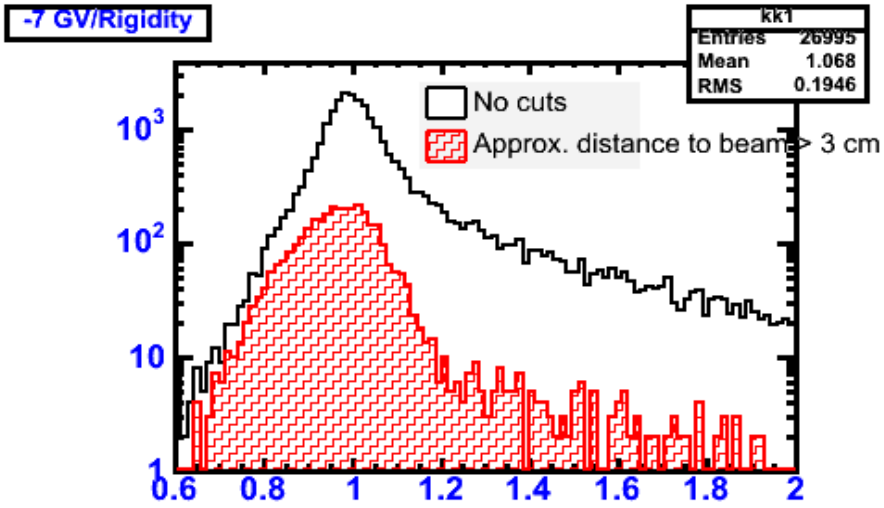
$\Delta(1/p) \sim 1/B$

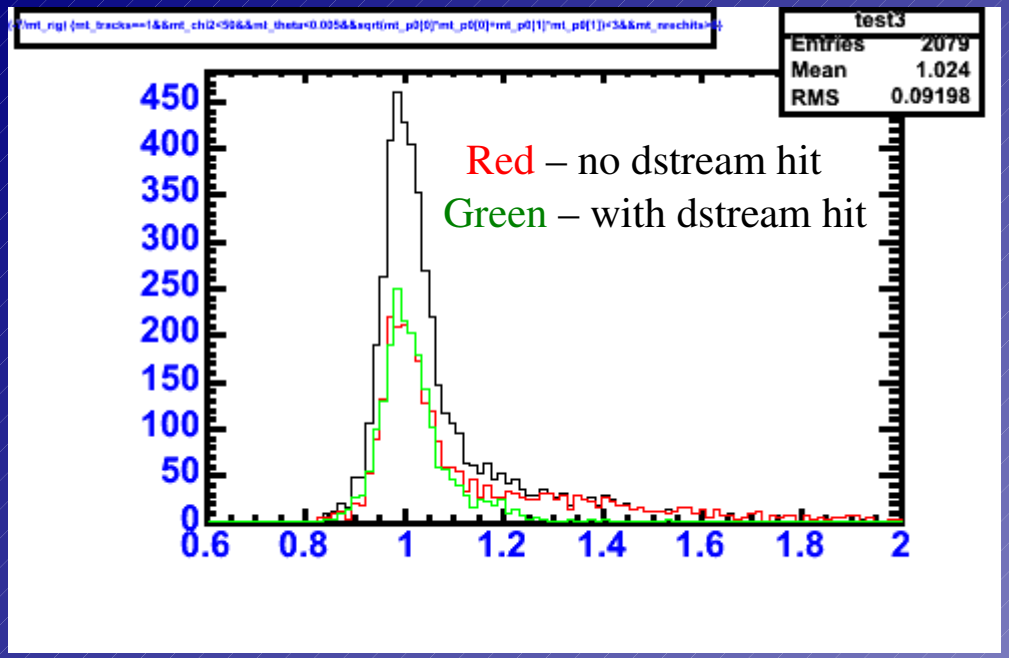
Momentum resolution



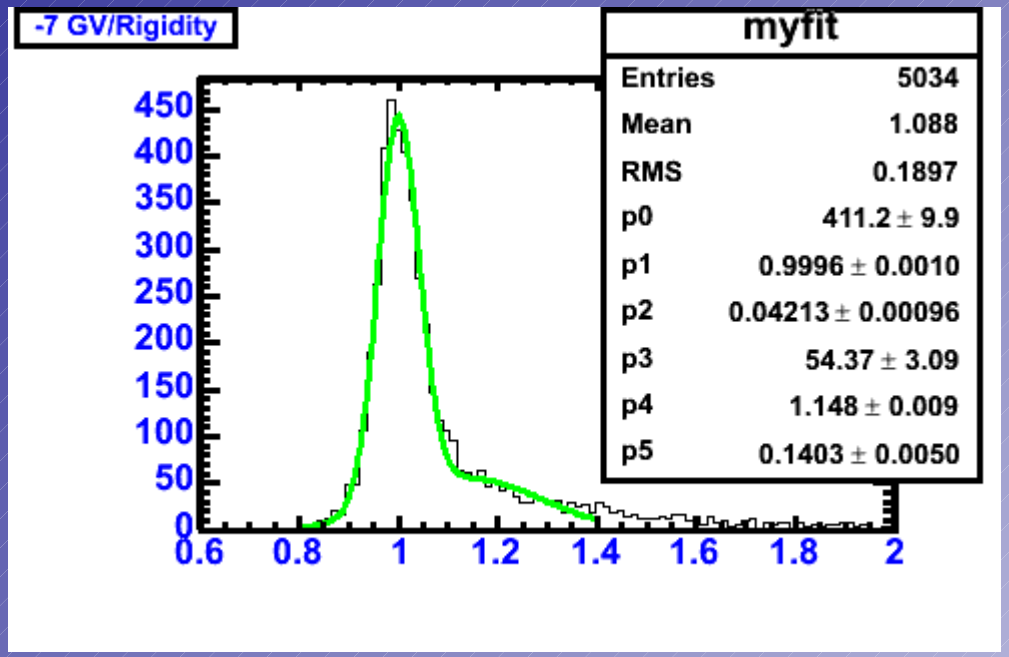




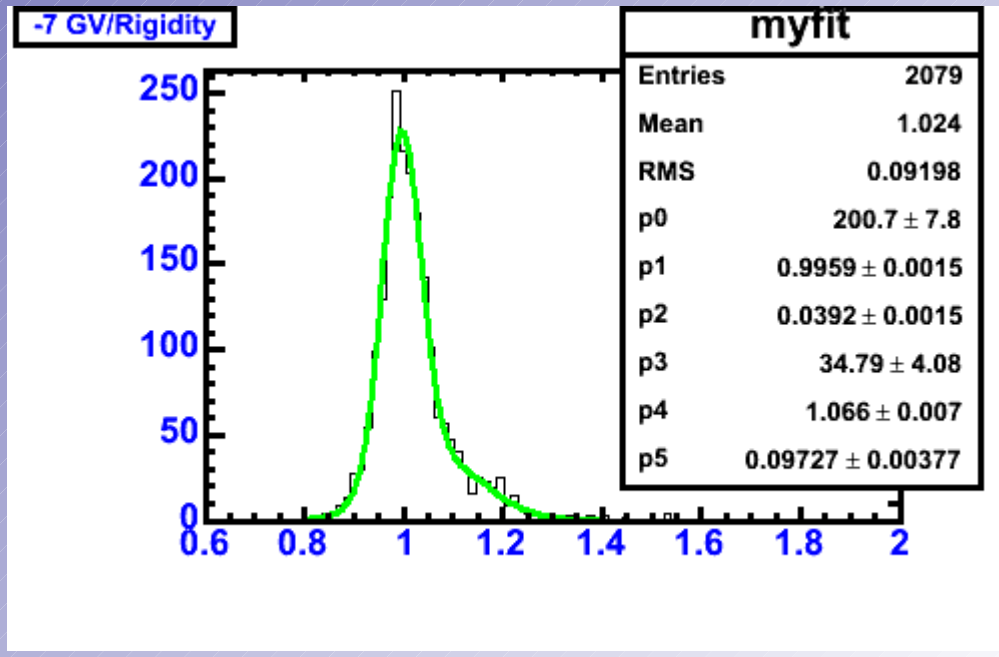




Previous cuts without ECAL or dstream cut

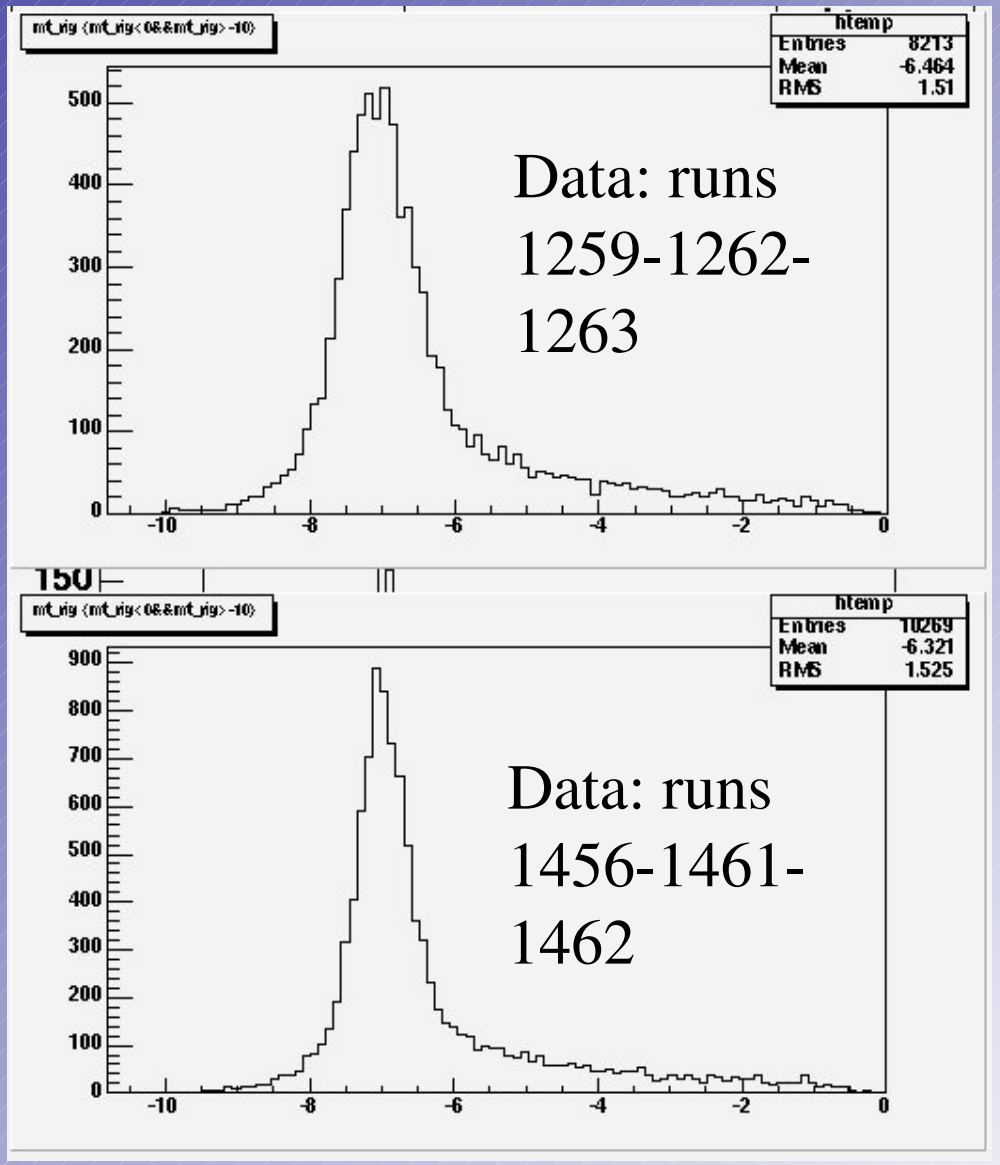


Previous cuts without ECAL cut

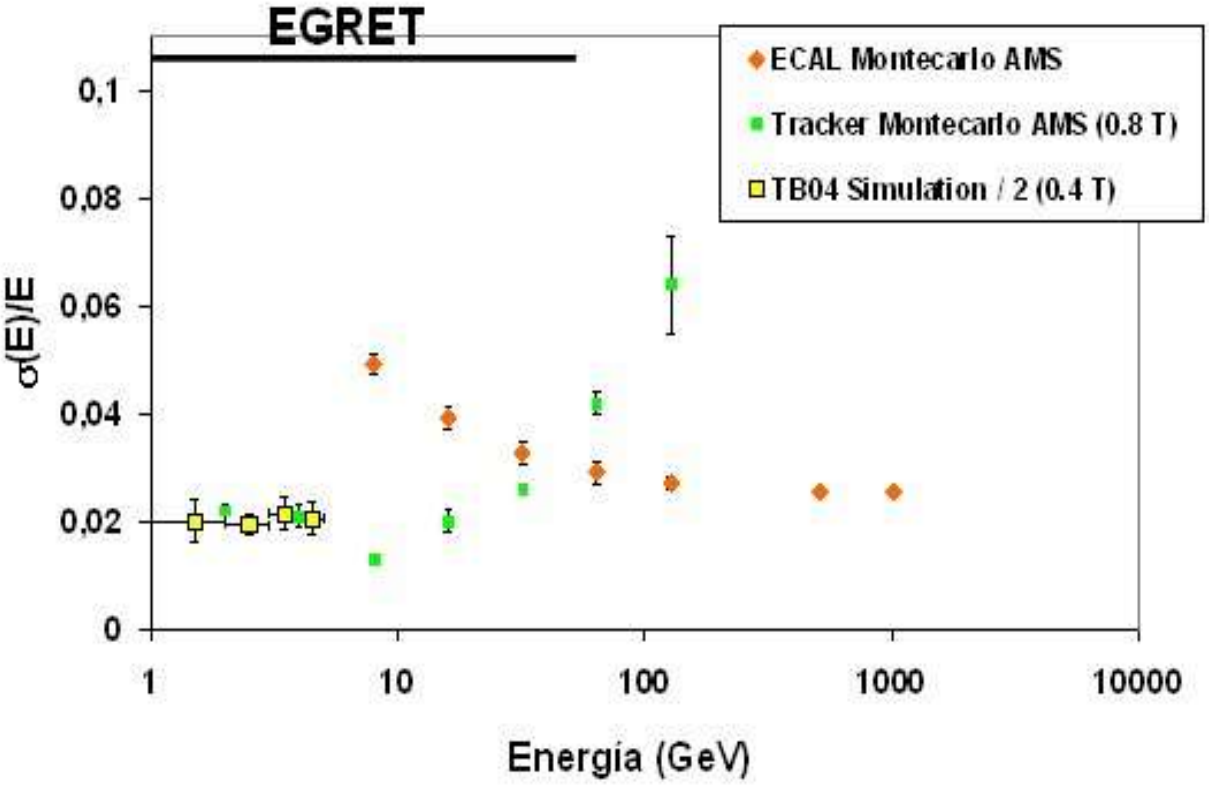


Momentum resolution

- Some 'dirty' details:
  - Plots in the left with no cuts
  - Runs 126X have worse quality than runs 146X.
  - According to logbook, conditions are the same (no convertor, 4 sigma cuts).
  - Some problems in quadrupole magnets in previous runs: 1257-1258 (?)



Energy resolution



- Photon info not available in the data.
- In order to compare with AMS Montecarlo, use testbeam MC with the knowledge of good momentum resolution agreement.
- Compare alternative energy resolution between data and MC to confirm (next slide, some ideas).

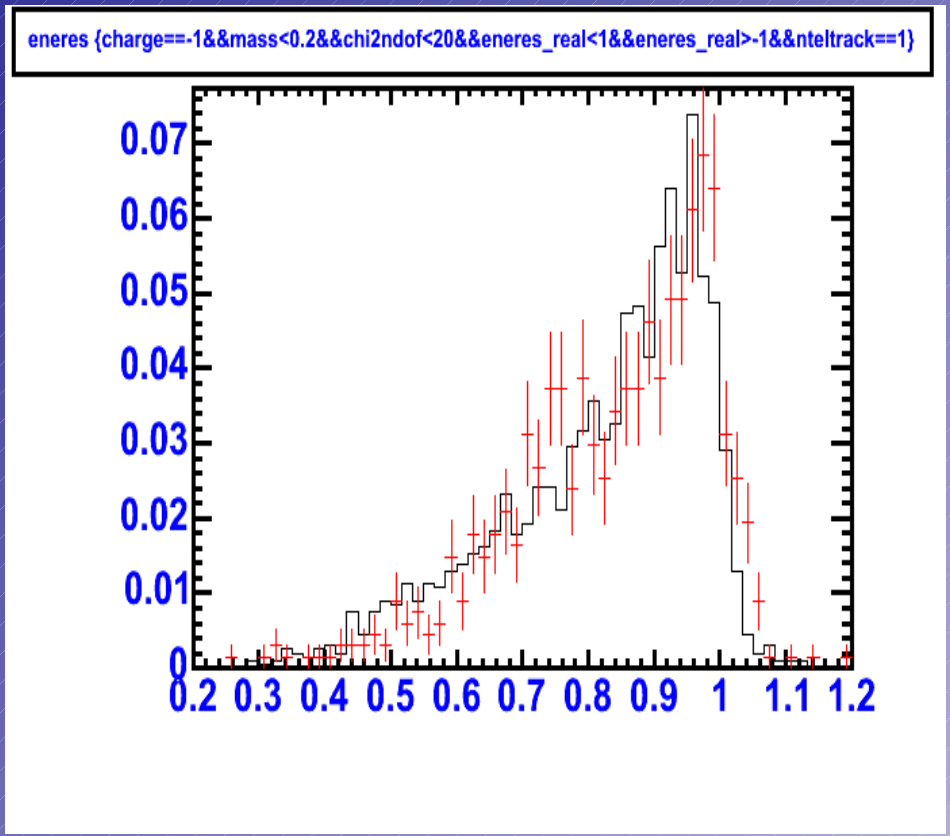
$$\sigma(E)/E = [(E[e^+]+E[e^-])-E[\gamma]]/E[\gamma]$$

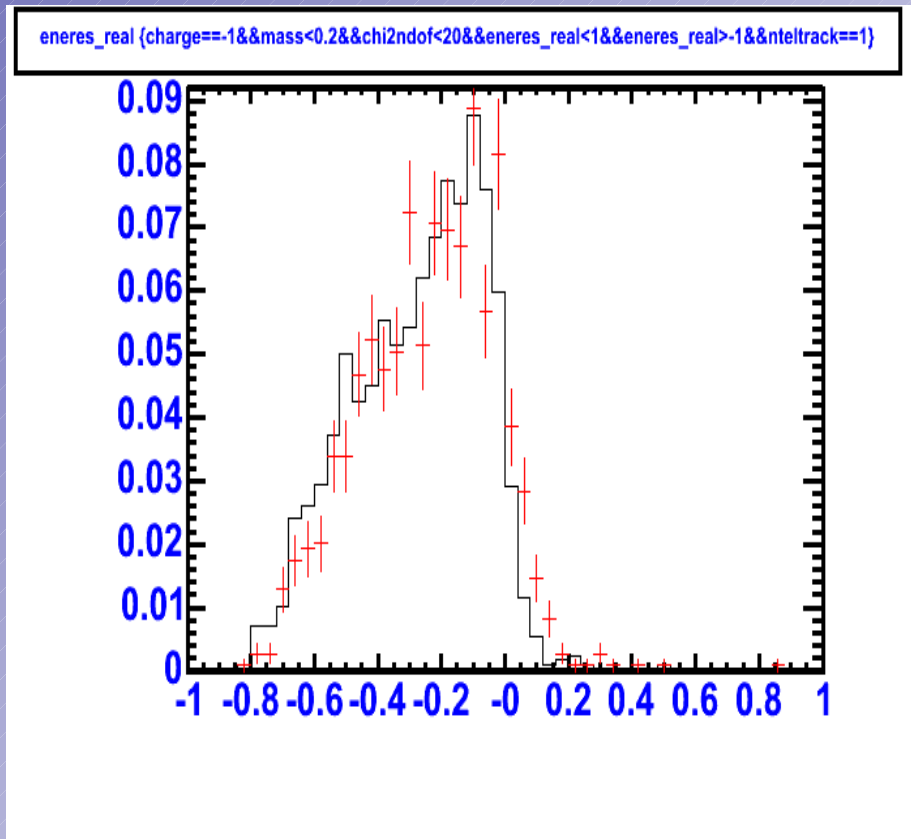
Energy resolution

- On the left plot, we compute Vertex energy/Beam energy (7 GeV, standard cuts of vertex charge=-1, invariant mass<0.2, Chi2ndof<20). Vertex momentum is the sum of the track rigidities in absolute value.
- On the right plot, we use the "realistic" definition from Bill's presentation (July 04):

$$\sigma'(E)/E = [(E[e^+]+E[e^-])-(E[\mathbf{beam}]-E[e^-_{\mathbf{beam}}])]/(E[\mathbf{beam}]-E[e^-_{\mathbf{beam}}])$$

- A shift is seen, maybe slightly too much bremsstrahlung on simulation (excess in material upstream).

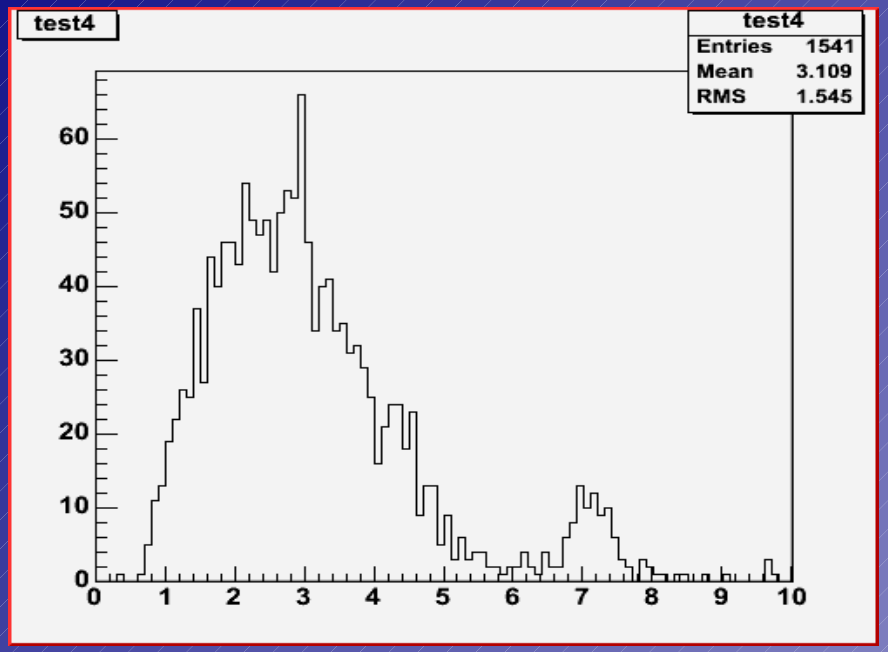


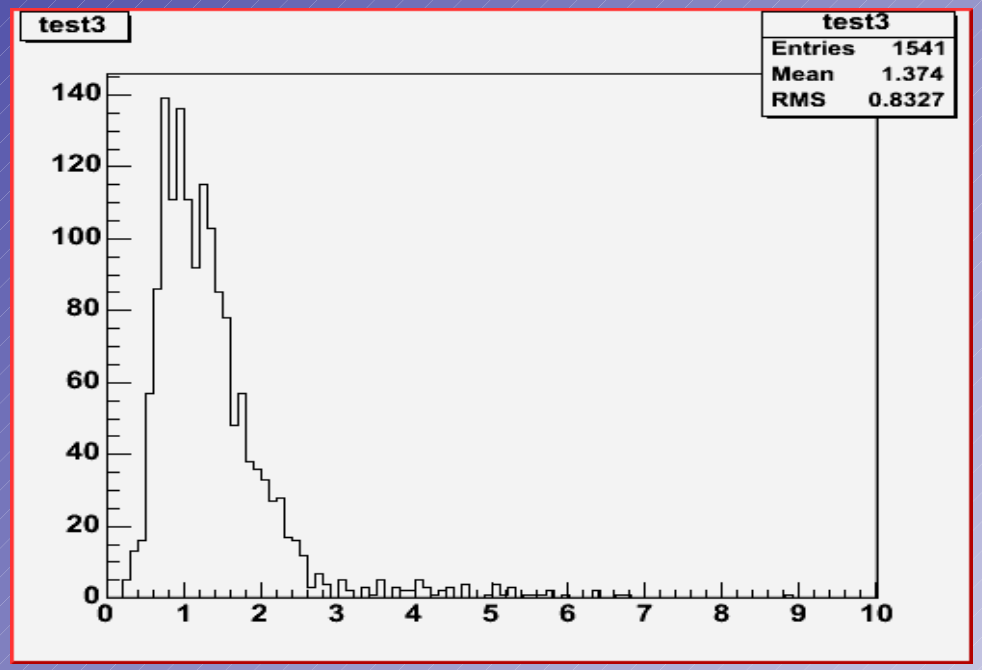


High energy electron

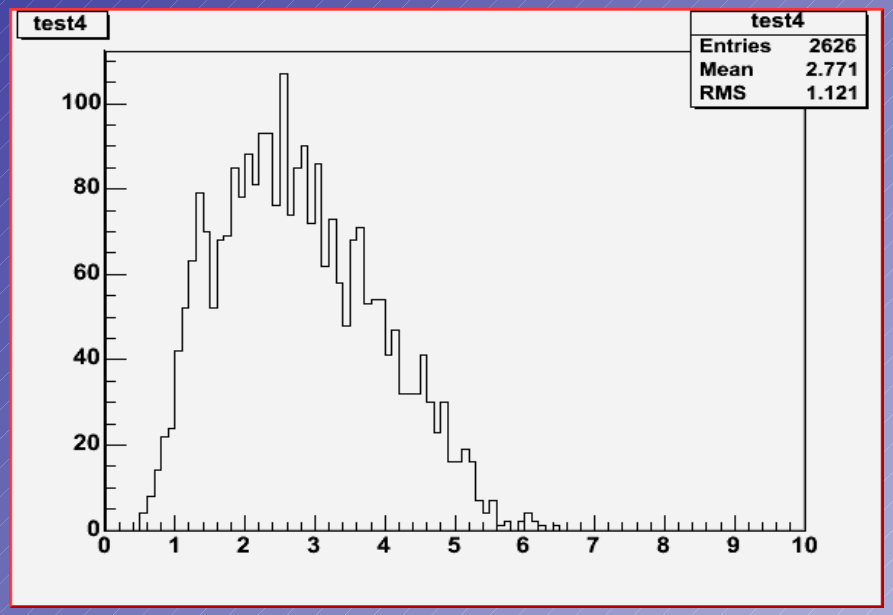
Low energy electron

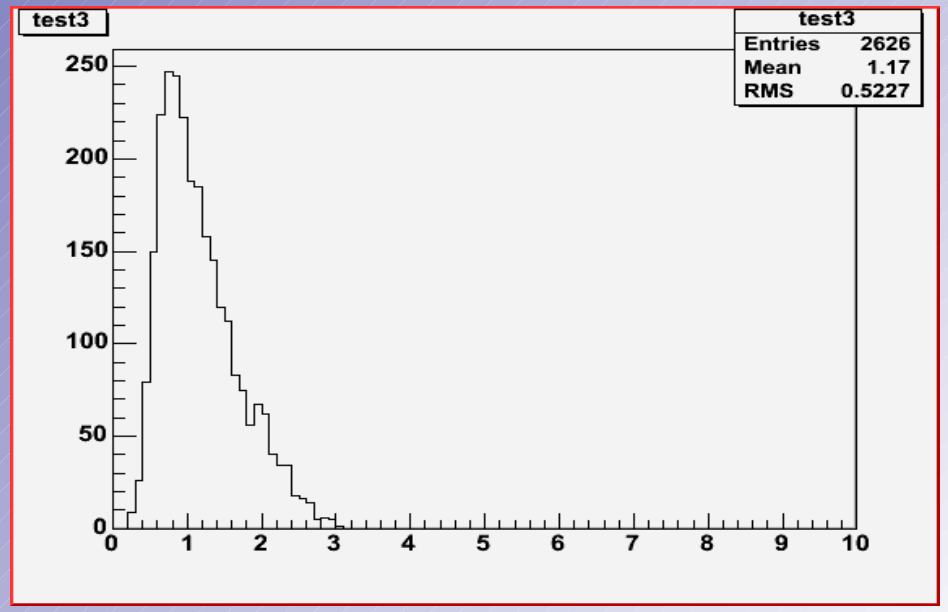
Data



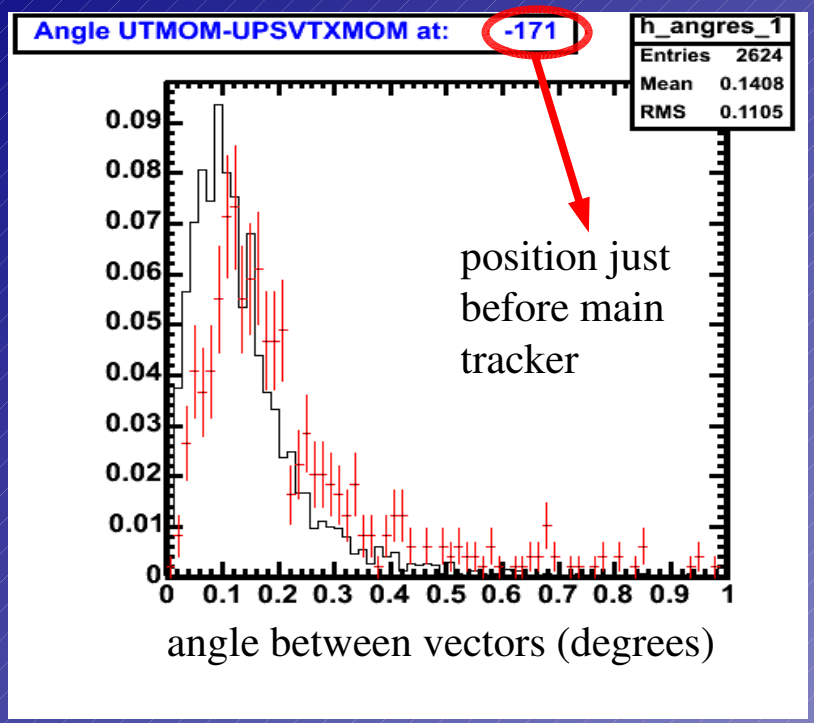


Sim

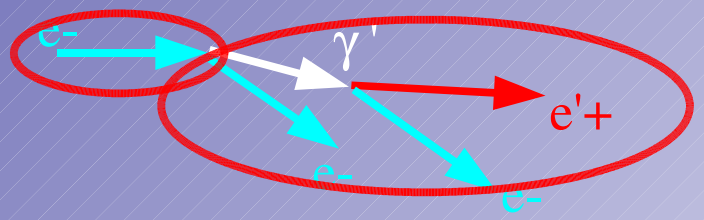


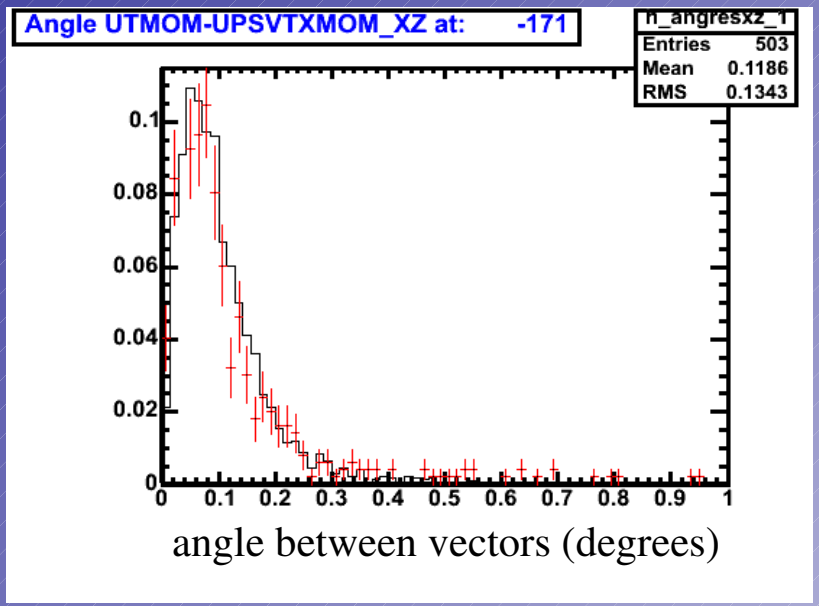


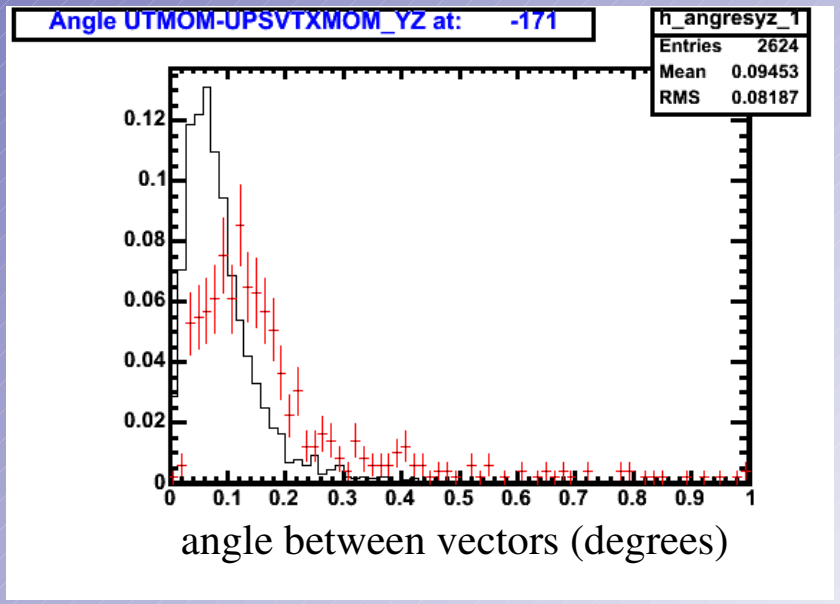
Angular resolution



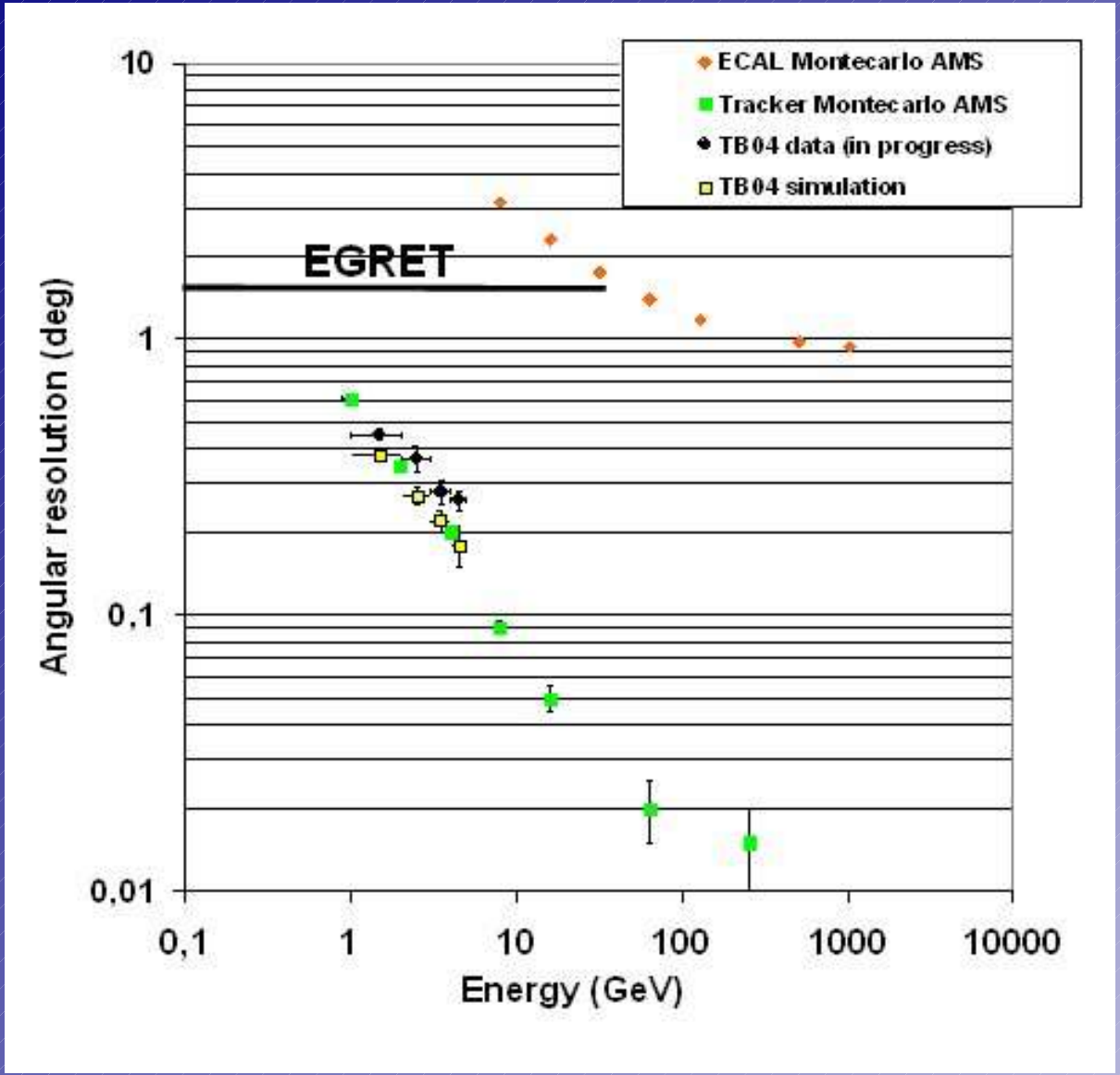
- We compare the beam vector (measured at the upstream telescope) with the vertex momentum vector (3-prong).
- Differences seen in YZ plane, maybe due to usage of virtual hits in K-side (which are necessary to have enough statistics).
- Under study, upstream extrapolation of vertex where B field data not available. Results not yet understood.



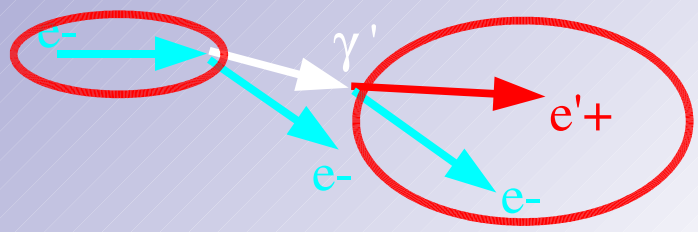


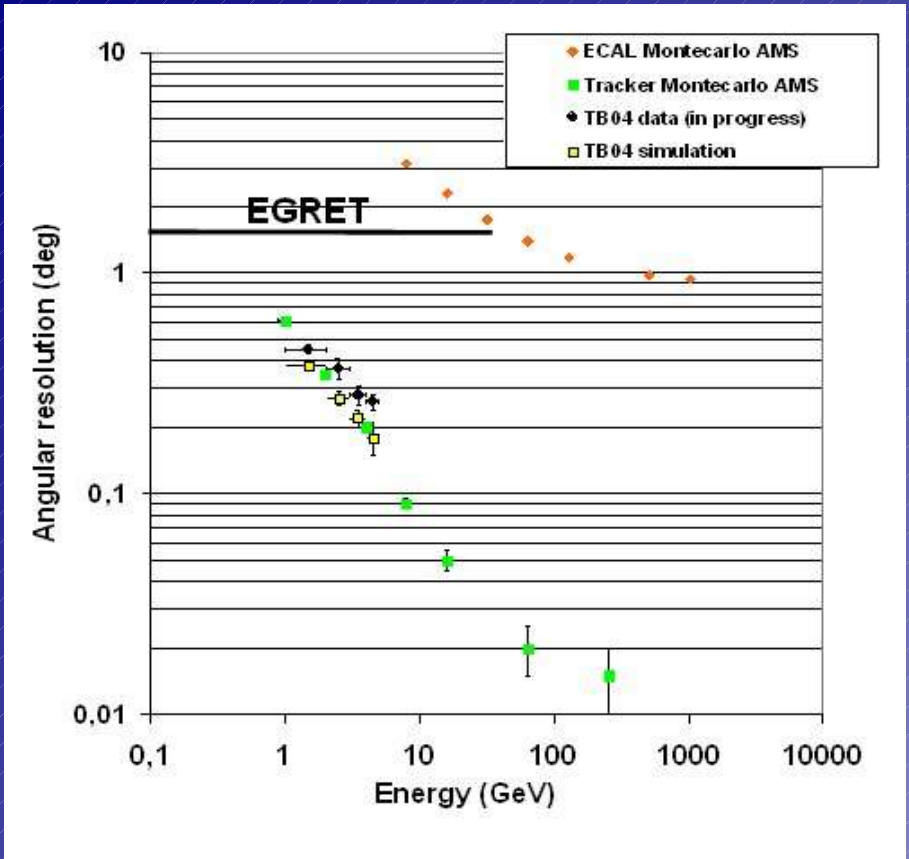


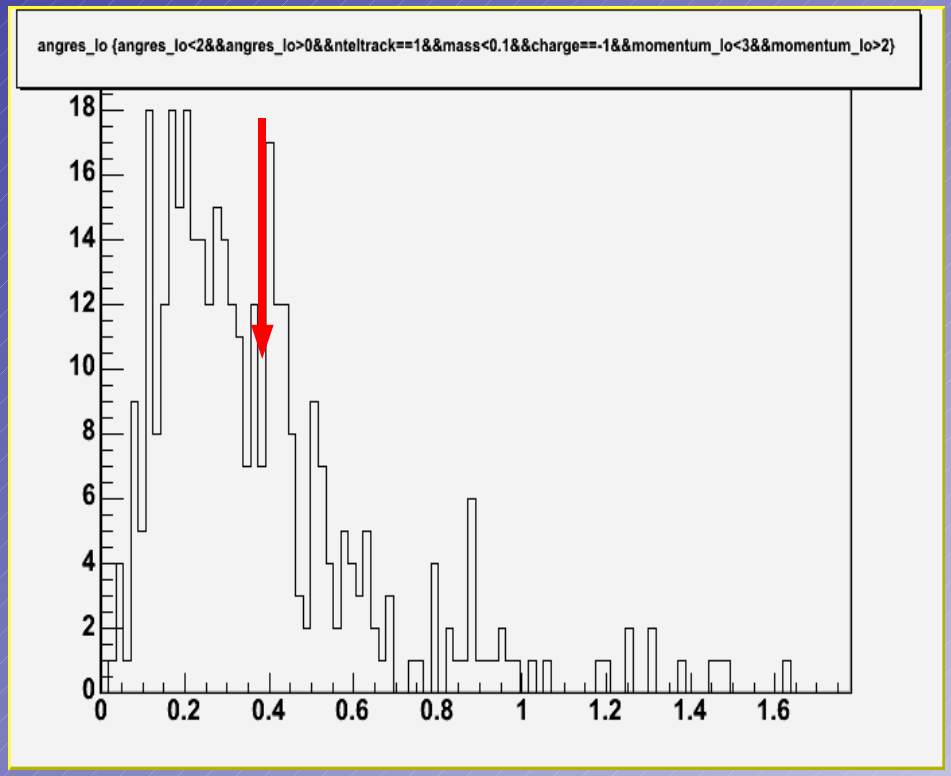
Angular resolution

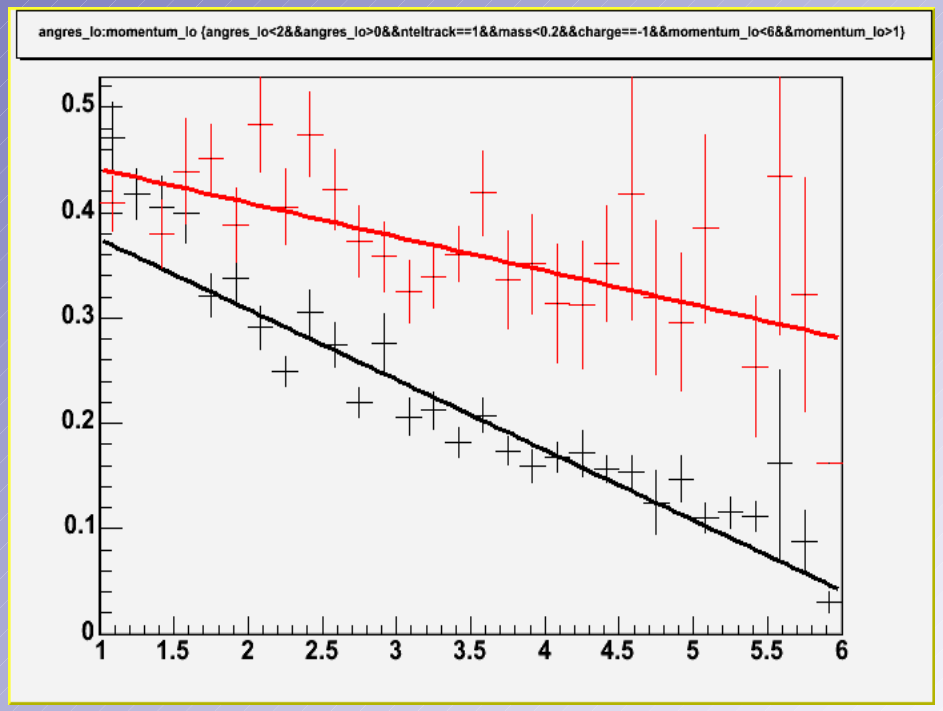


- Angular resolution is the 68% containment angle of the reconstructed photons.
- To compare with AMS-02 Montecarlo, we compare the beam vector (measured at the upstream telescope), with the 2-prong, positron + lowest energy electron momentum, extrapolated to the convertor.
- This electron choice seems to be correct for 90% of the cases, according to MC (deeper study needed?). We are also assuming that the gamma is nearly parallel to the original electron (good approximation).

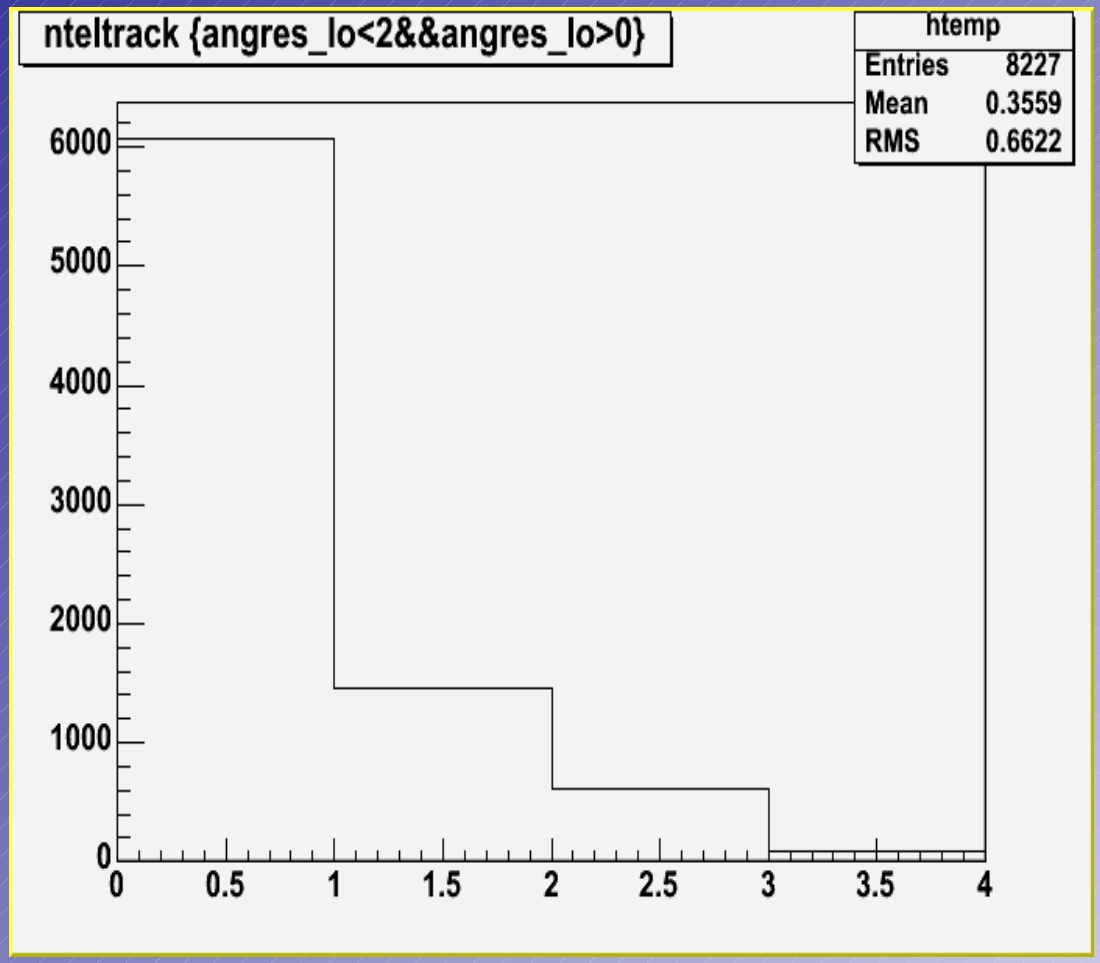


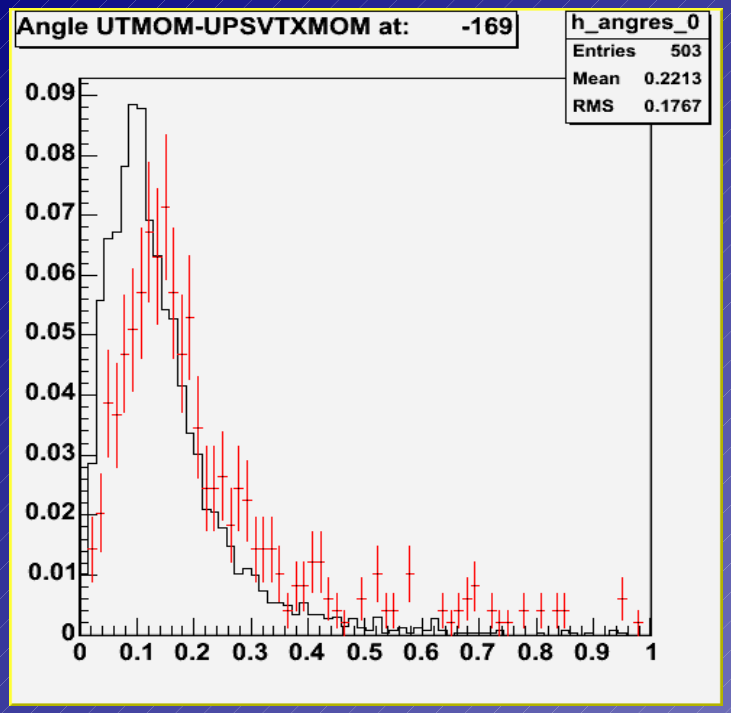

ECAL Montecarlo AMS
Tracker Montecarlo AMS
TB04 data (in progress)
TB04 simulation
EGRET
Angular resolution (deg)
Energy (GeV)
10
1
0,1
0,01
0,1
1
10
100
1000
10000

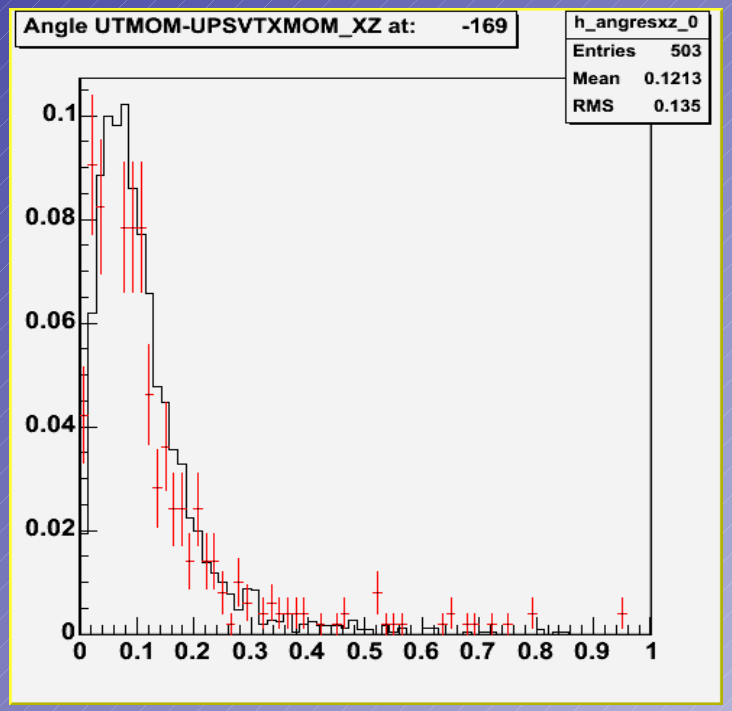

angres_lo {angres_lo<2&&angres_lo>0&&nteltrack==1&&mass<0.1&&charge==-1&&momentum_lo<3&&momentum_lo>2}
0
2
4
6
8
10
12
14
16
18
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6


angres_lo:momentum_lo {angres_lo<2&&angres_lo>0&&nteltrack==1&&mass<0.2&&charge==-1&&momentum_lo<6&&momentum_lo>1}
0
0.1
0.2
0.3
0.4
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6

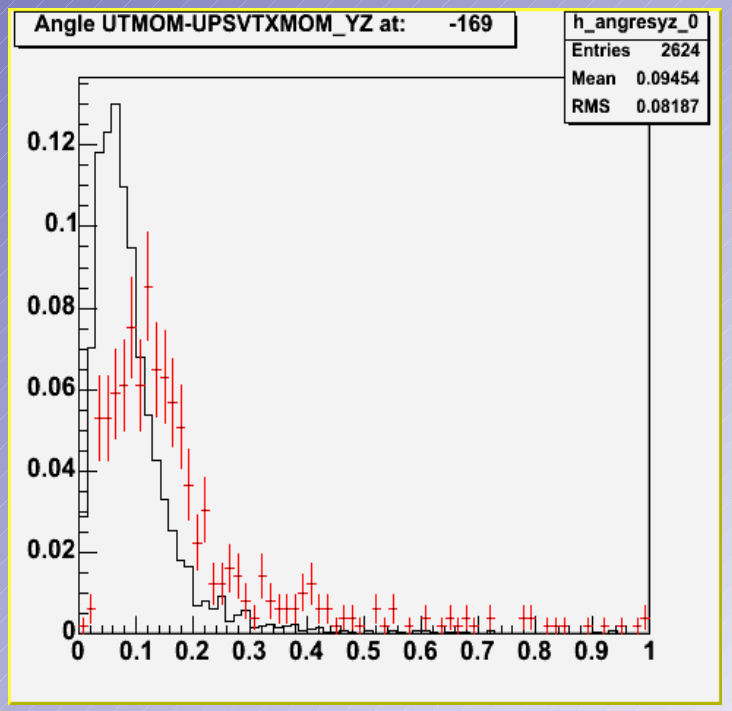
- **Efficiency bad, also apparent at the upstream telescope**

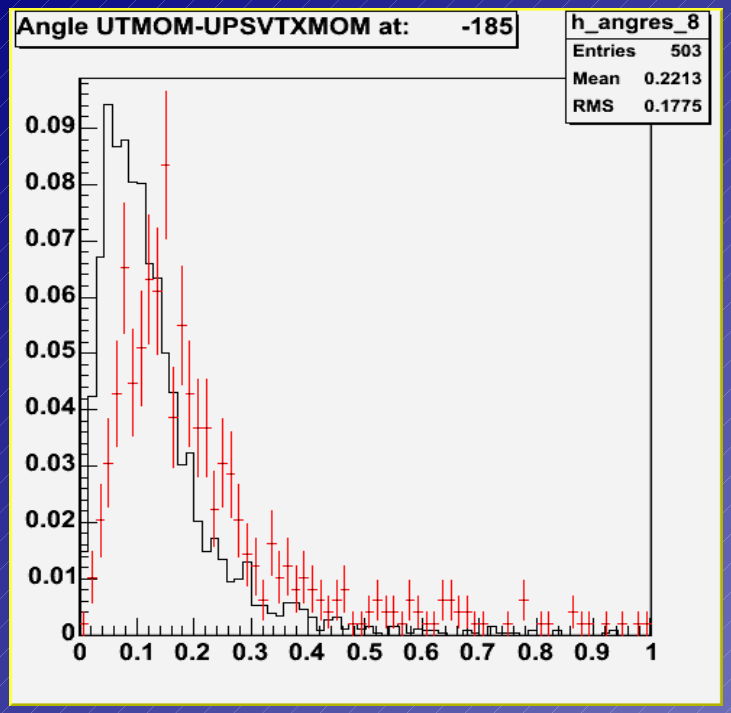


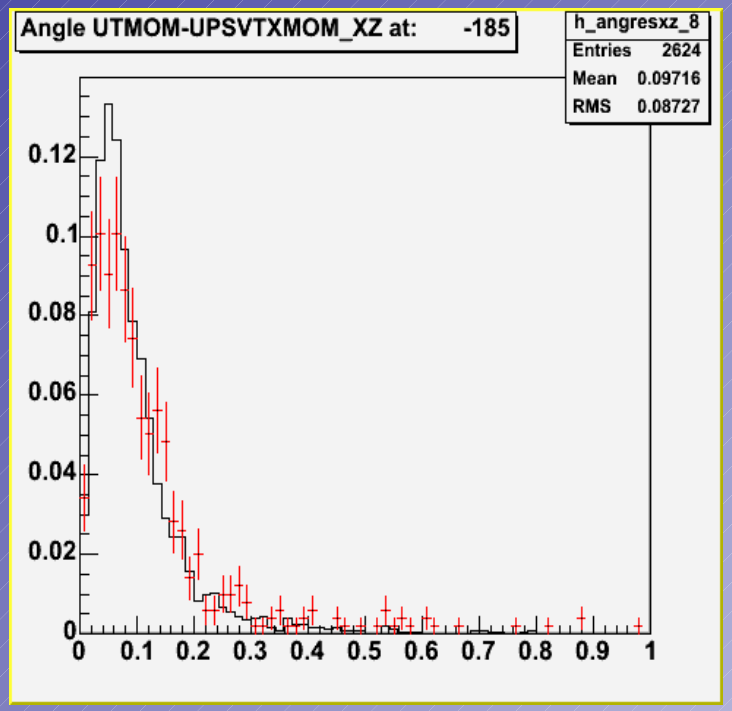


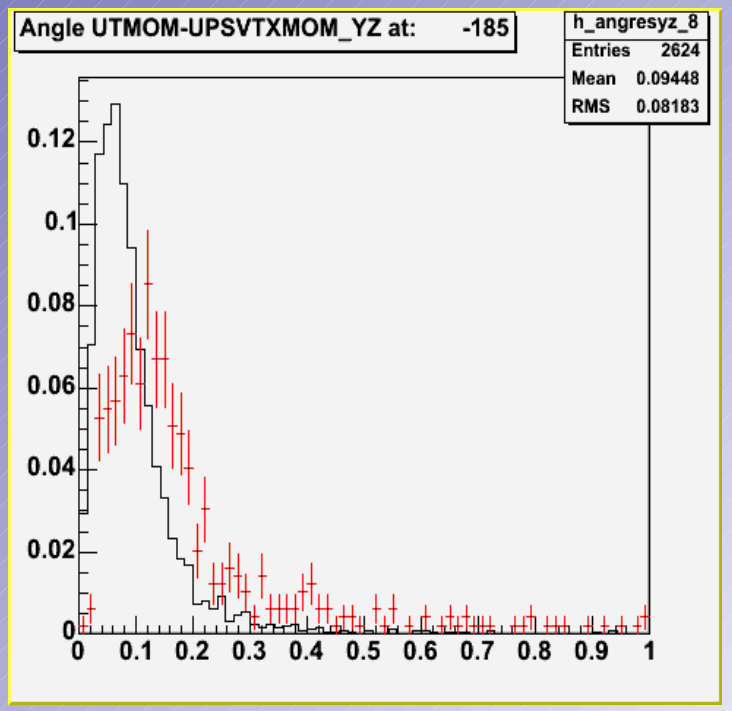


- **Compare upstream vector with 3-prong vector at beginning of tracker.**



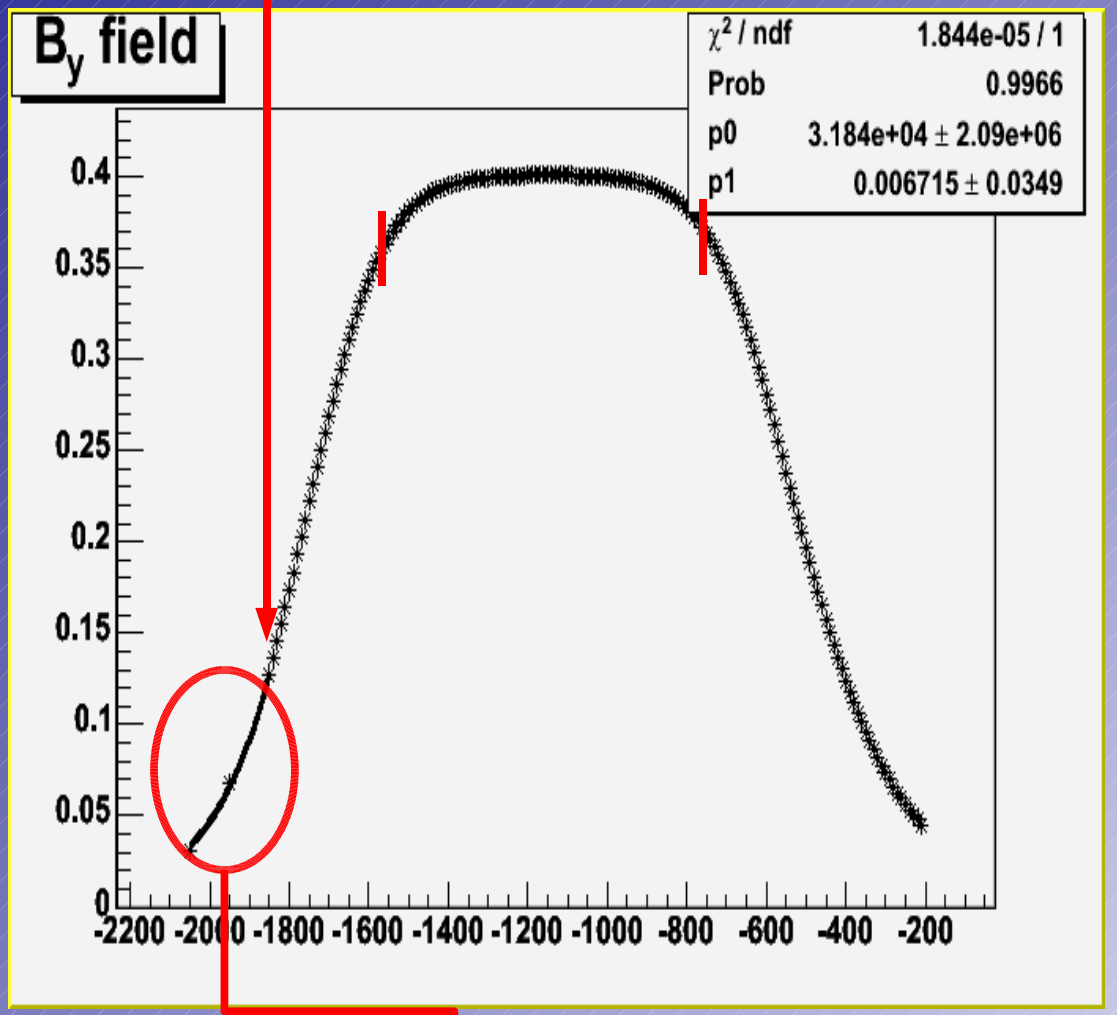




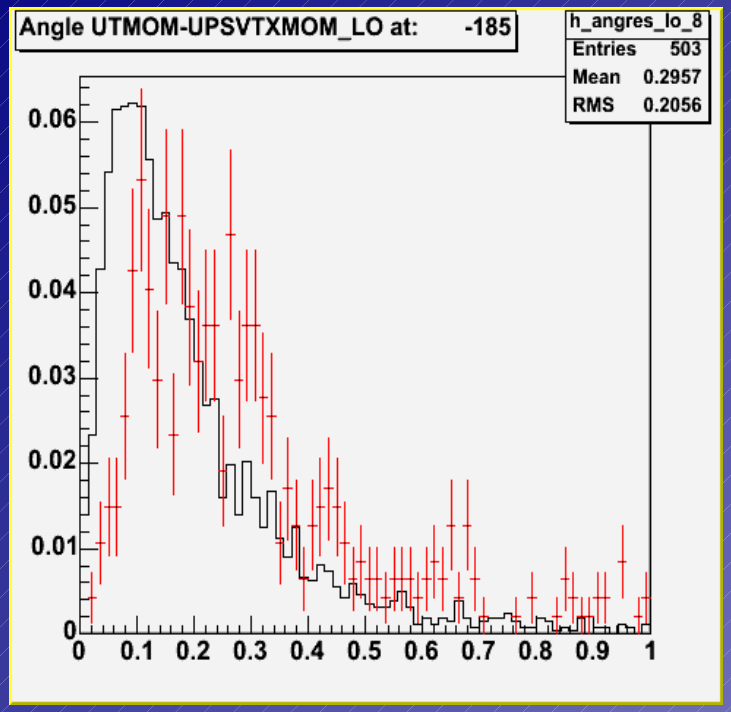


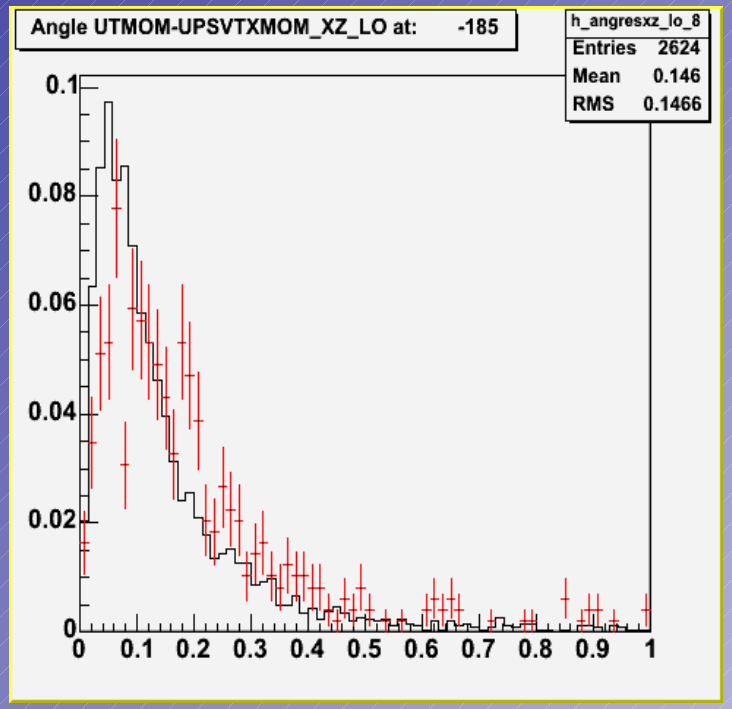
- **Compare upstream vector with 3-prong vector at beginning of B field (where data is available).**

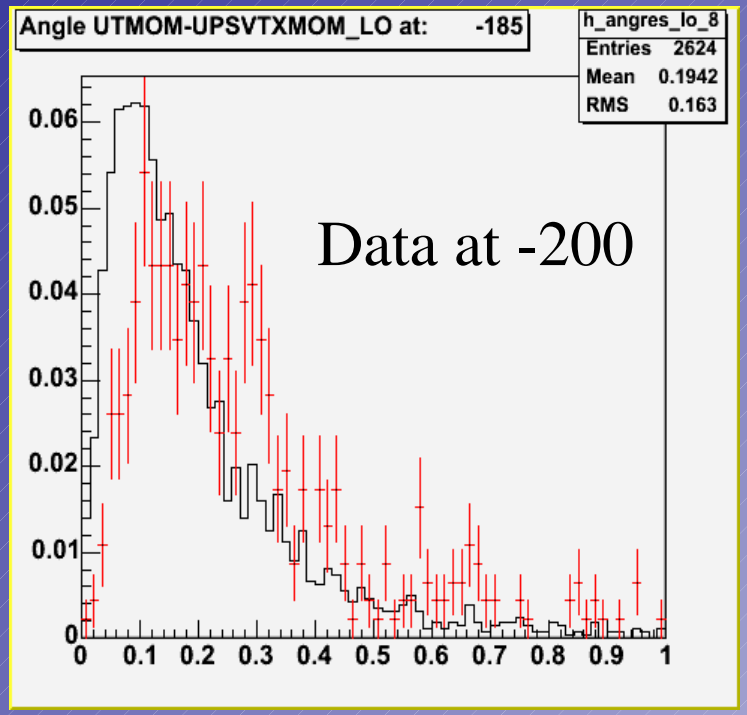
beginning of available data

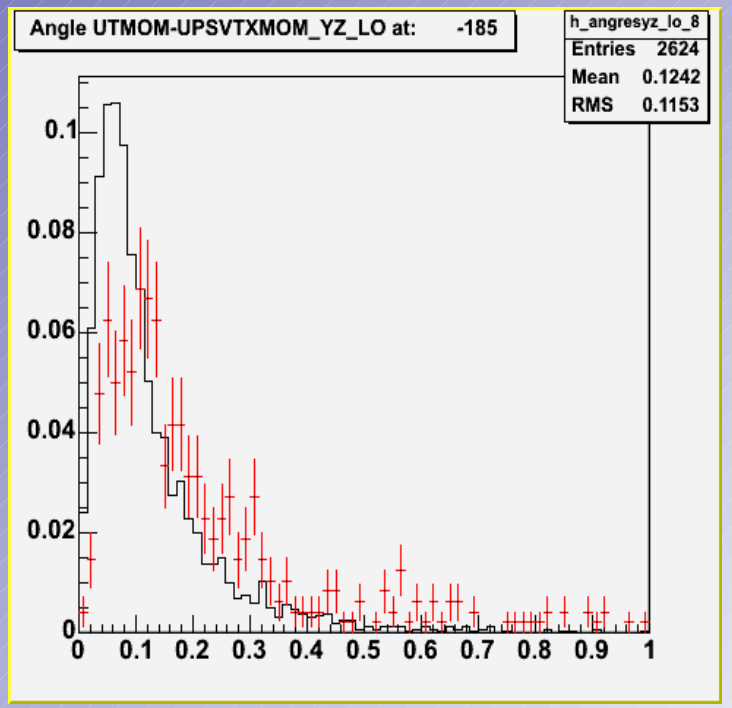


$B_y = p0 \cdot \exp(p1 \cdot x)$

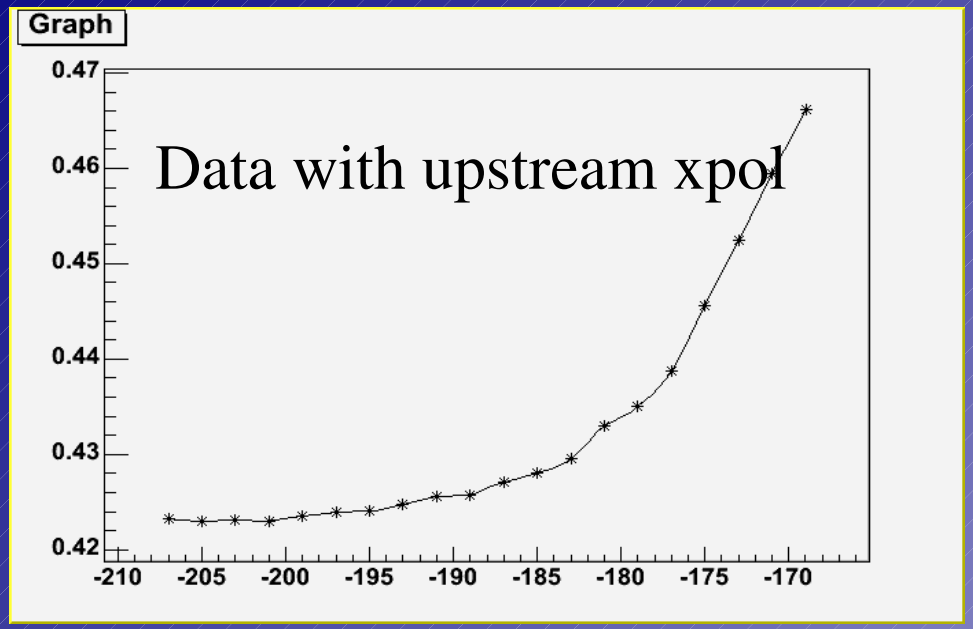

Angle UTMOM-UPSVTXMOM_LO at: -185
h_angres_lo_8
Entries 503
Mean 0.2957
RMS 0.2056

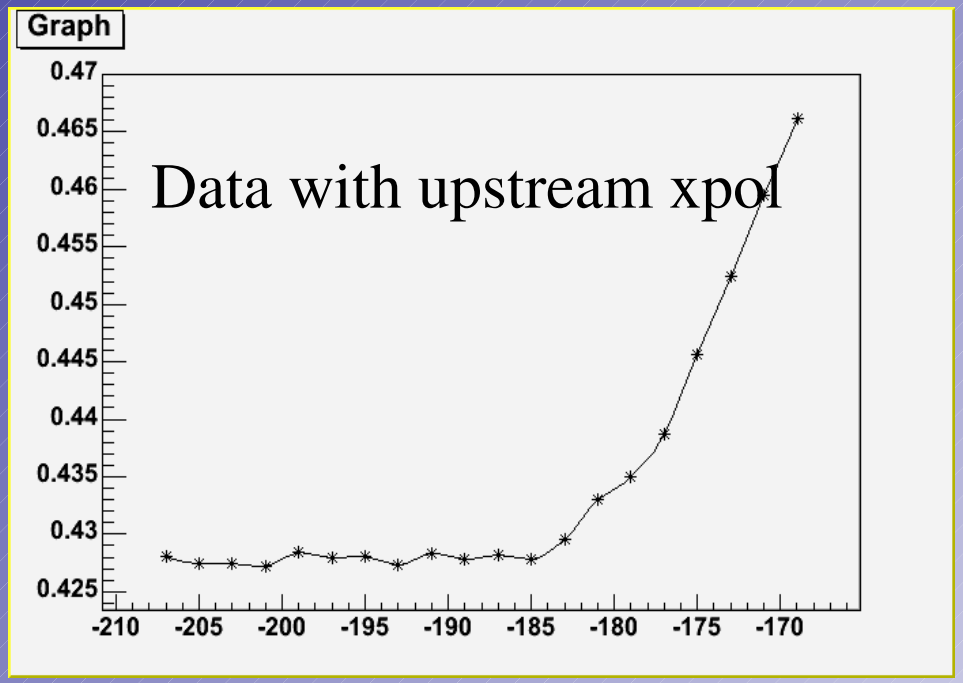

Angle UTMOM-UPSVTXMOM_XZ_LO at: -185
h_angresxz_lo_8
Entries 2624
Mean 0.146
RMS 0.1466

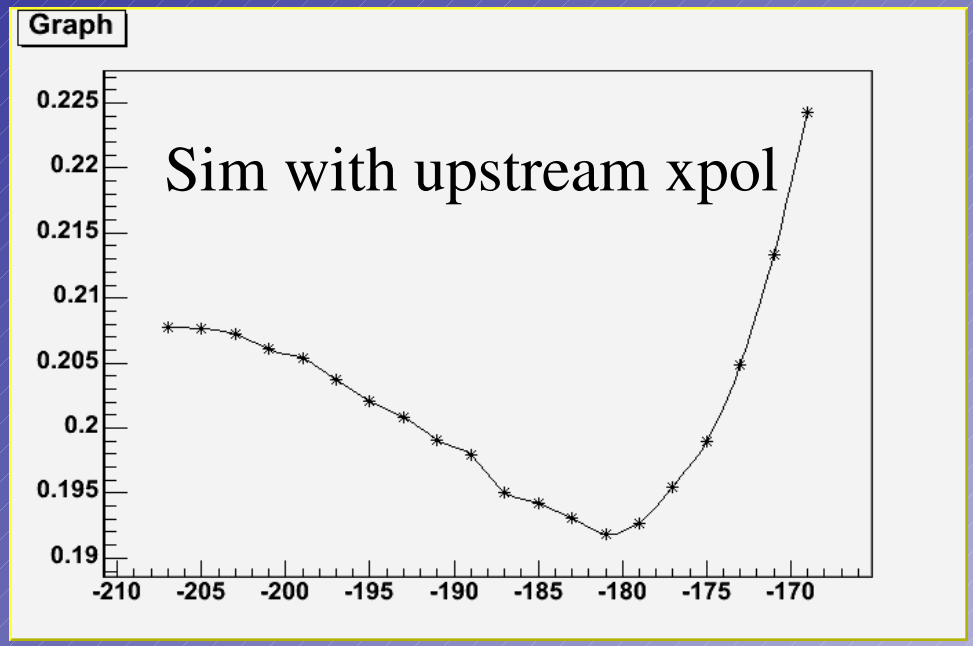

Angle UTMOM-UPSVTXMOM_LO at: -185
h_angres_lo_8
Entries 2624
Mean 0.1942
RMS 0.163
Data at -200

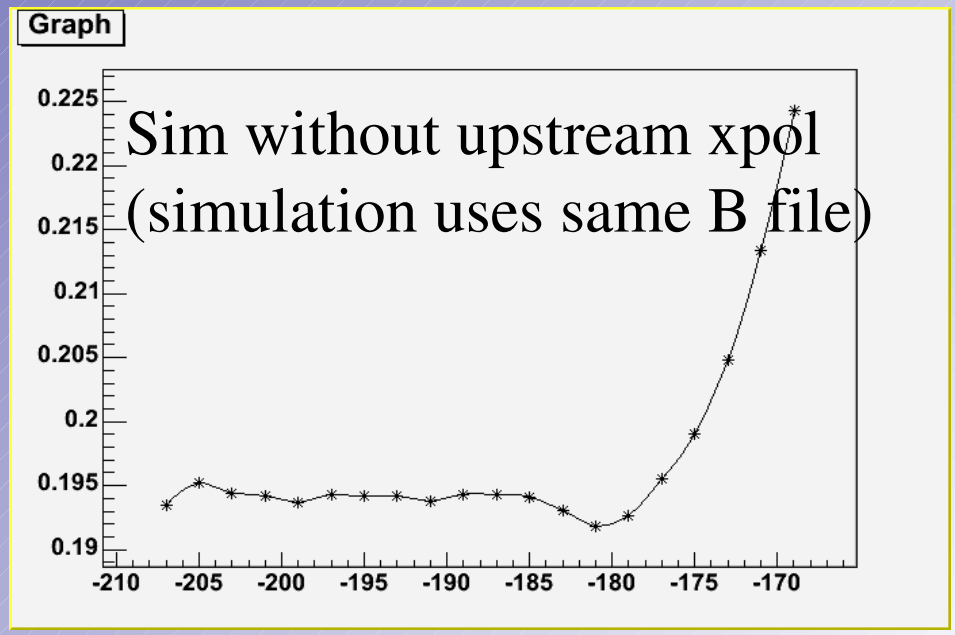

Angle UTMOM-UPSVTXMOM_YZ_LO at: -185
h_angresyz_lo_8
Entries 2624
Mean 0.1242
RMS 0.1153

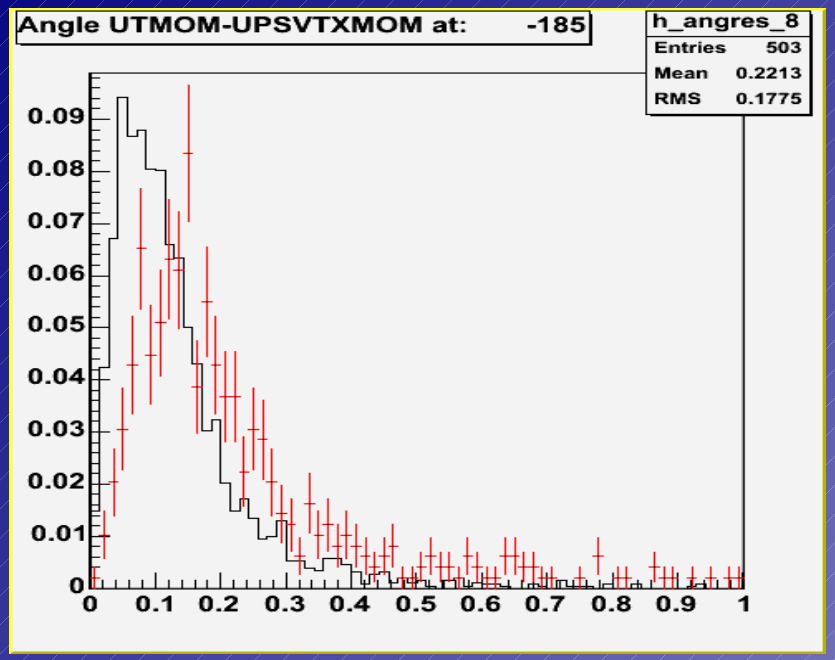
Mean of distribution as a function of Z position



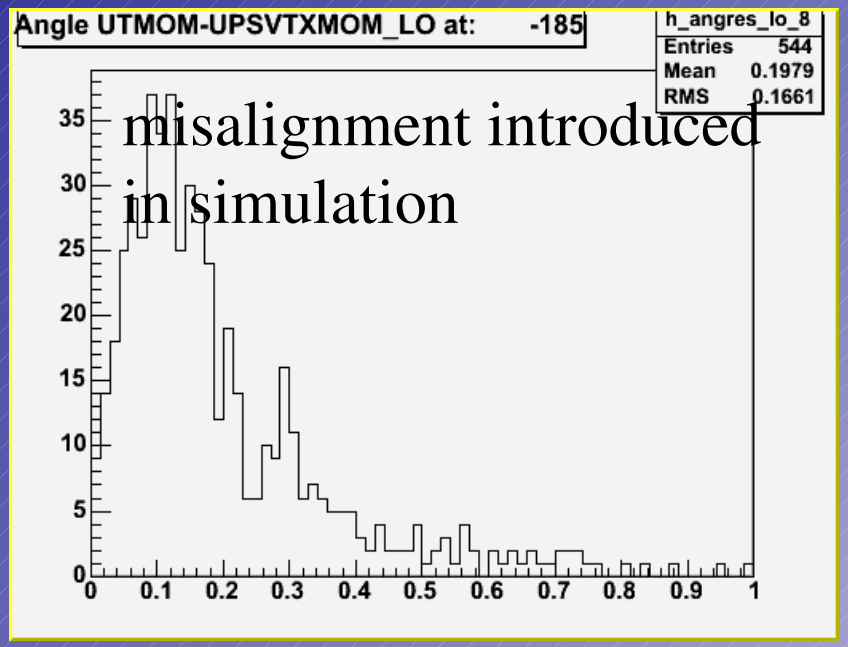


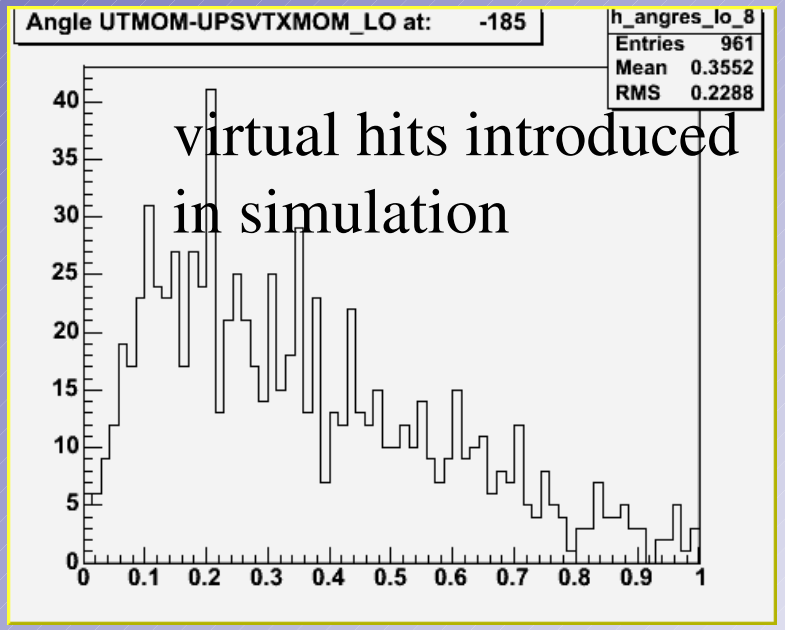






(this morning work...)

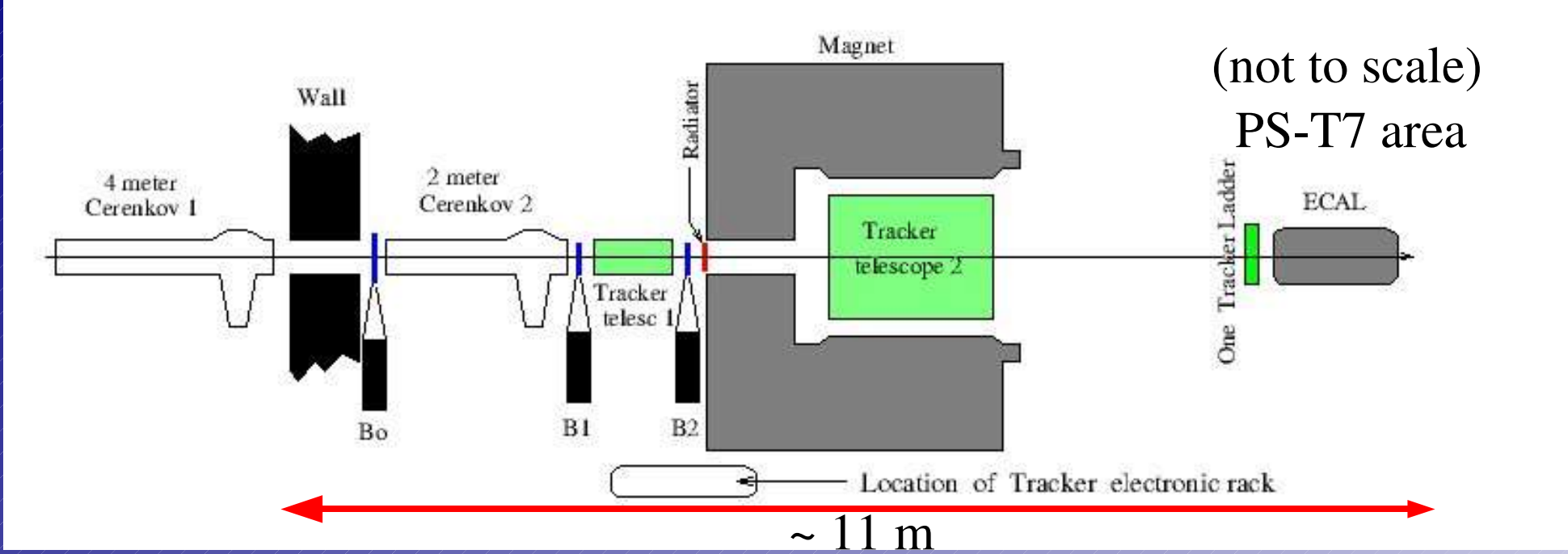


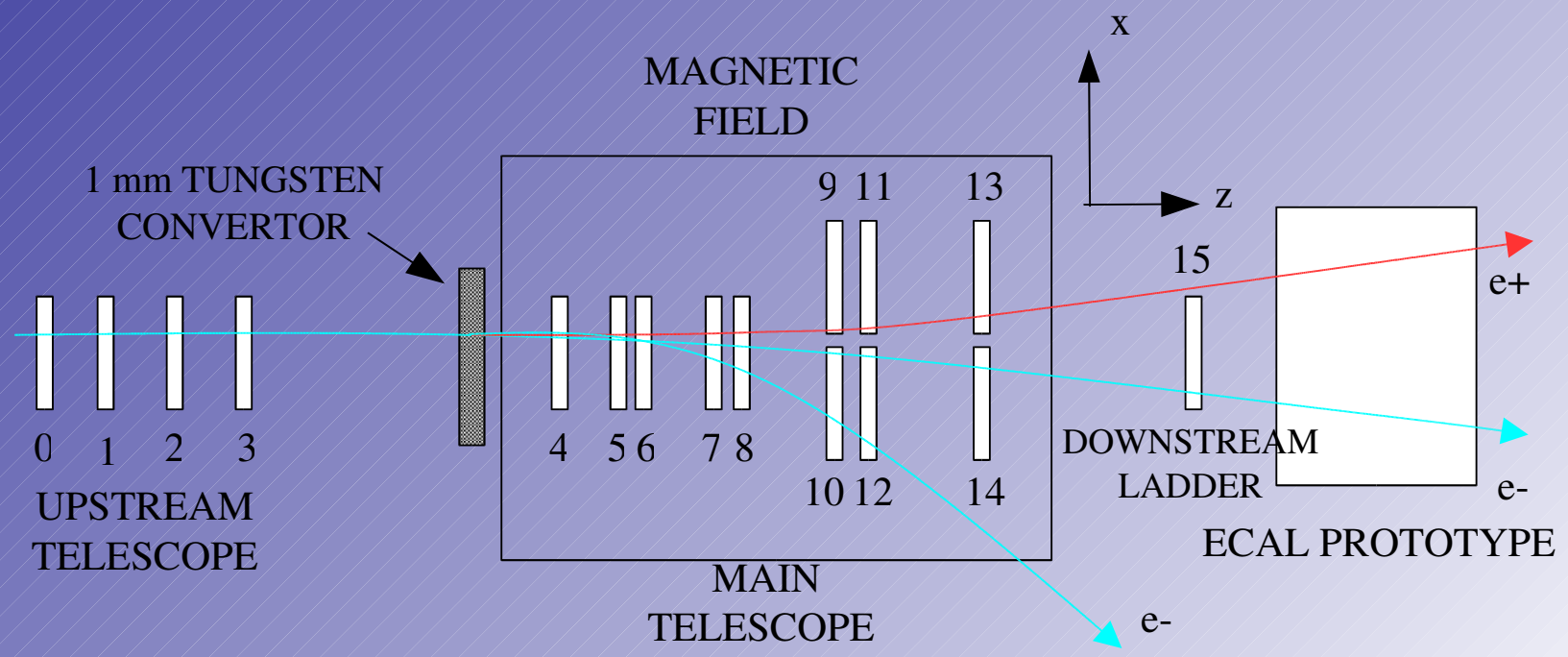


Conclusions

- Electron hit resolution and momentum resolution measured in this test-beam are as expected from simulations.
- Photon energy resolution OK if we believe in MC-data agreement in momentum. Other comparisons and checks to be added.
- Photon angular resolution is proving to be tougher. Still worse than simulation by a factor ~1.5.
  - YZ plane projection wider than MC, maybe virtual hits are worsening performance? On the other hand, virtual hits are essential to obtain reasonable statistics.
- AMS and TB04 simulations fully agree for both magnitudes.

Setup


Magnet
Wall
Radiator
(not to scale)
PS-T7 area
4 meter
Cerenkov 1
2 meter
Cerenkov 2
Tracker
telescope 2
ECAL
One Tracker Ladder
Tracker
telesc 1
Bo
B1
B2
Location of Tracker electronic rack
~ 11 m


x
MAGNETIC
FIELD
z
1 mm TUNGSTEN
CONVERTOR
9 11
13
15
e+
0 1 2 3
4 5 6 7 8
10 12
14
DOWNSTREAM
LADDER
e-
UPSTREAM
TELESCOPE
MAIN
TELESCOPE
ECAL PROTOTYPE
e-