HRS rates comparison

Calculations

For hadron rate, wiser code is used.
For electronr rate, whitlow code is used.
Condition: 16 degrees, 2.35 GeV/c, Q2 is about 1
Target density: 10 atm @ 27 degrees.
Pion decay: 2.6*2.35/0.14*3 = 131 m, exp(-23.5/131) = 0.8357
Kaon decay: 2.35*1.24/0.49*3 = 17.8 m, exp(-23.5/17.8) = 0.267
Acceptance: 6.7 msr for solid angle , +-5% momentum acceptance
Target length: 33 cm

Data

For negative mode, we used run 4015.
For position mode, we used run 4223.
Cuts: Trigger 3, edtpl, trip, acceptance, ntrack == 1, vertex:33 cm, momentum +-5%,
PID cuts (electron): A1>150 && Cer > 300 && E/p > 0.6
PID cuts (Pion): A1>150 && Cer < 300 && E/p < 0.6
PID cuts (Proton/Kaon): A1<150 && Cer < 300 && E/p < 0.6
Correction: livetime

Results: Unit: events/uC

	Pi+	Pi-	e-	K-	Proton
Calulation	105	62.4	11.6	0.88	71
Data	54.8	34	12.4	1.34	49.6

Conclusion

electron rate, calculation is reasonable.
pion rate, calcultion overestimates by a factor of 2.
proton rate, calculation overestimates by 45%
kaon, hard due to dirty PID

BigBite rates Comparison

Caluclulations (This is the baseline before goes to MC)

For Hadron rates, wiser code is used.
For electron rates, whitlow code is used.
Codition: 30 +- 5 degree, 0.6-2.15 GeV/c.
Target density: 10 atm @ 27 degrees
Decay length assuming 3.5 m
Target length: 33 cm
Acceptance: 64 msr
Previous log
Units: events/uC

P (MeV)	electron	pip	pim	kp	km	proton
815	28.4	19285	5868	1223	121	10103
1246	19.7	3549	1412	428	42.7	3380
1612	13.2	664	299	115	10.1	859
1925	11.0	167	81	36.8	2.65	262

Data

Cuts: Trigger 1, edtpl trip, acceptance, vertex: 33 cm
Cuts: chi2/ndof<2.4, 2.15> (p or E) >0.6 and shower trigger acceptance cut
PID: electron: charge cut, momentum cut, preshower vs E/p, track match cut
PID: pion: charge cut, momentum cut, low preshower cut
PID: photon: no cluster cut, high preshower cut
Correction: livetime, tracking efficiency is assumed to be 0.85. No trigger efficiency cut
Units: events/uC

P (MeV)	electron	pim	pip	photon	photon induced electron, half energy assumption
815	58.6906	159.736	77.1651	2920.1	18.6
1246	28.4204	100.396	82.9068	901.132	0.12
1612	13.5736	33.9699	40.2162	166.181	0.
1925	9.15314	13.021	19.2672	36.818	0.

BigBite rates comparison

Motivation

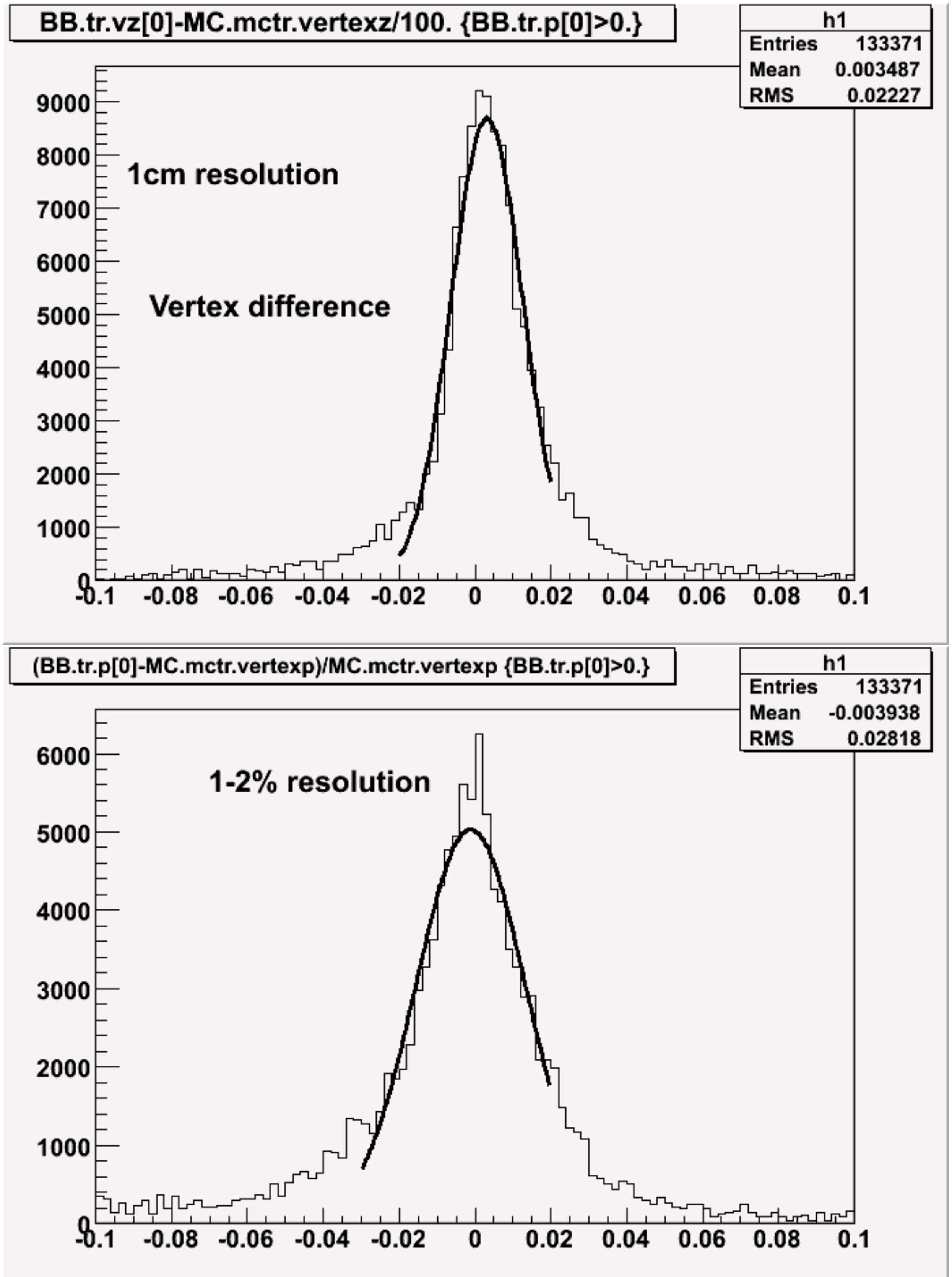
1. Understand Wire chamber Tracking
2. Understand Photon events
3. Understand Photon-induced electron events
4. Understand Pion- contamination to electron sample

Procedure

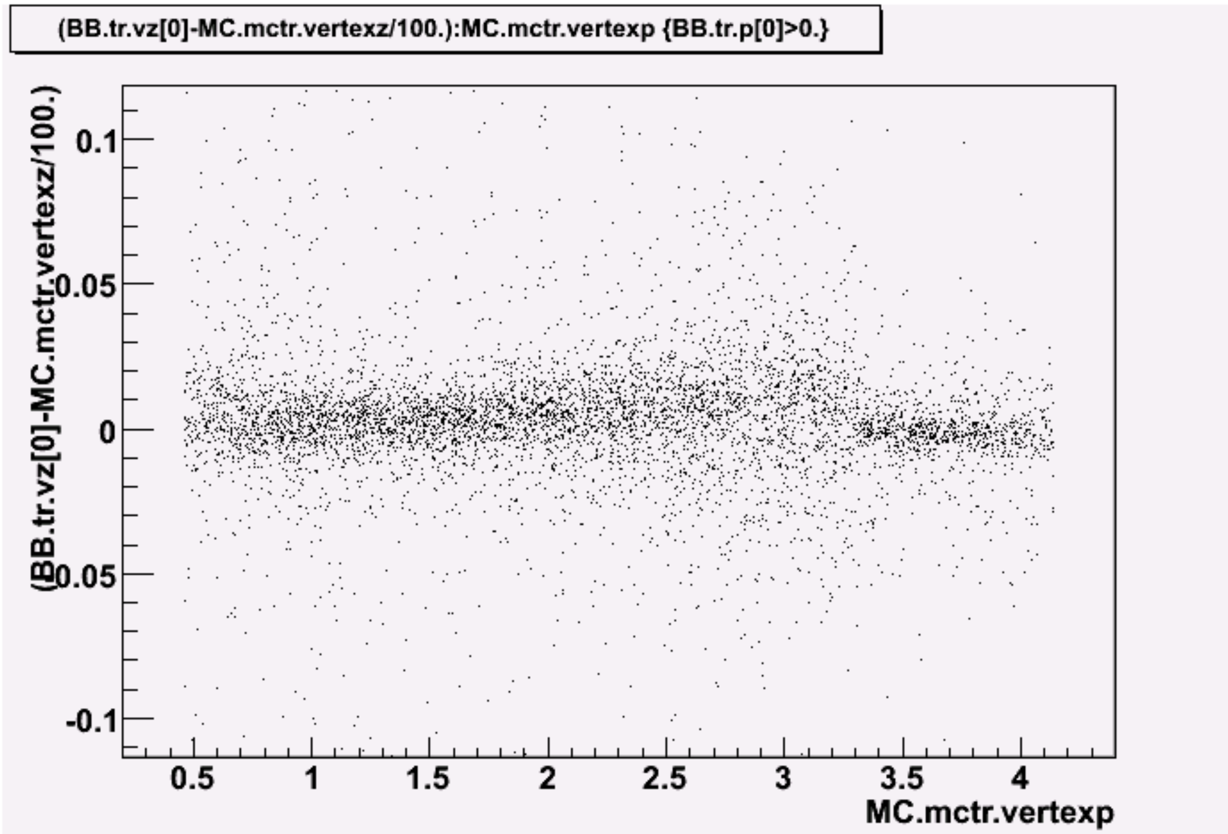
1. Monte-Carlo: GEANT3 simulation generate e-, pion (+,-,0), proton events.
2. Extract the digitization from the wire chamber and Calorimeter
3. Add in cross-section based on whitlow and wiser code
4. The "faked data" are analyzed using the standard BigBite analyzer software including: BigBite TreeSearch Tracking, BigBite optics, BigBite Shower software
5. The MC model is tuned slightly to obtain reasonable agreements in: Vertex, Momentum, Collimator position, Shower acceptance.
6. An energy resolution about 7.5% is added to get the shower energy resolution correction

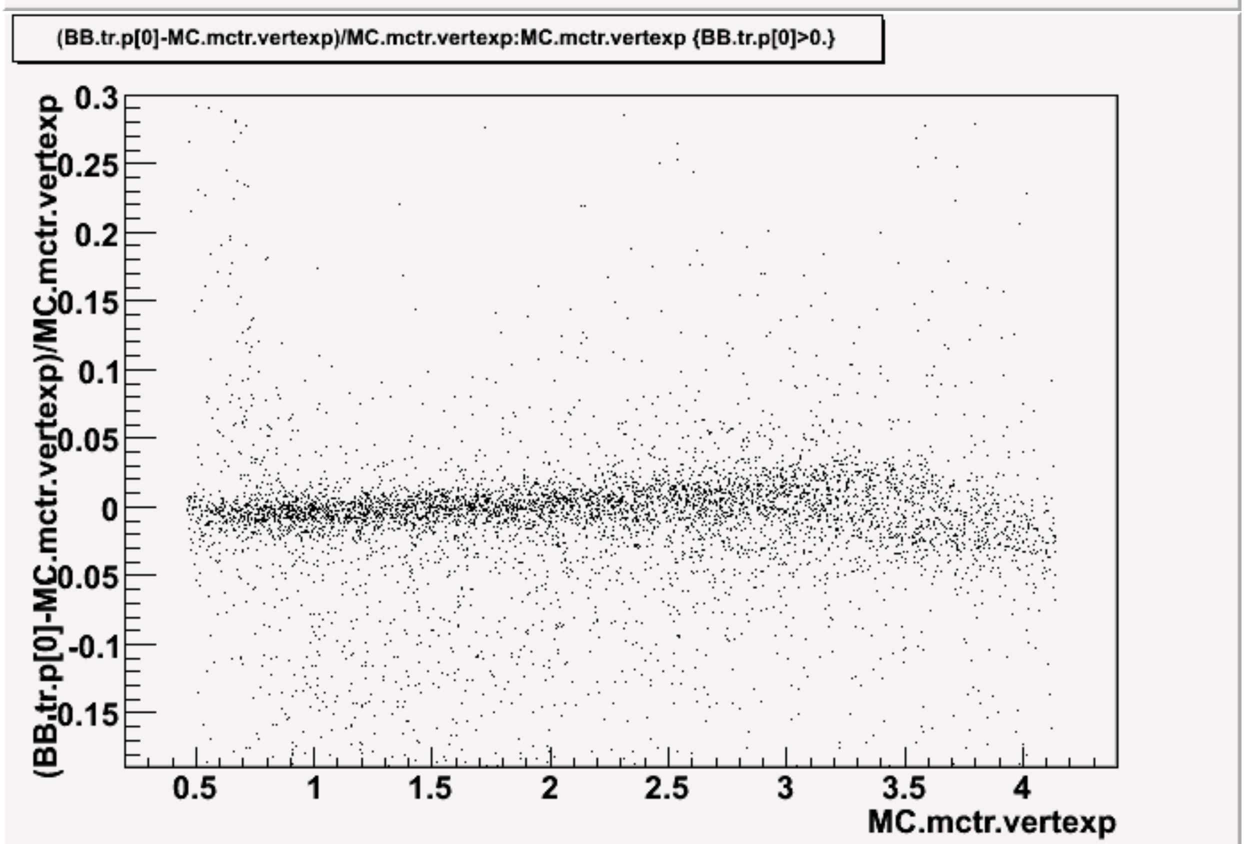
Optics Checks for MC faked data

Generated Vertex - Reconstructed Vertex (L/U); (Generated Momentum - Reconstructed Momentum)/(Generated Momentum) (R/D)



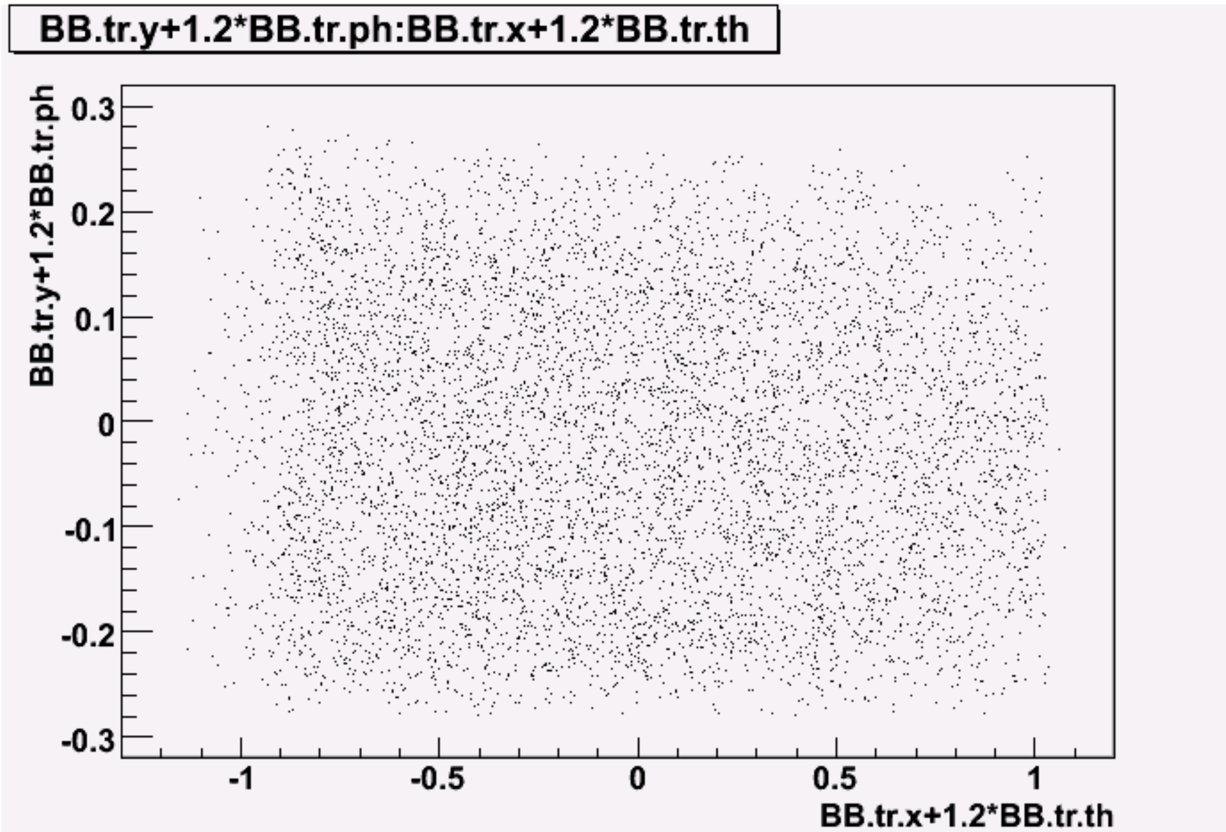
Generated Vertex - Reconstructed Vertex vs momentum (L/U); (Generated Momentum - Reconstructed Momentum)/(Generated Momentum) (R/D) vs momentum

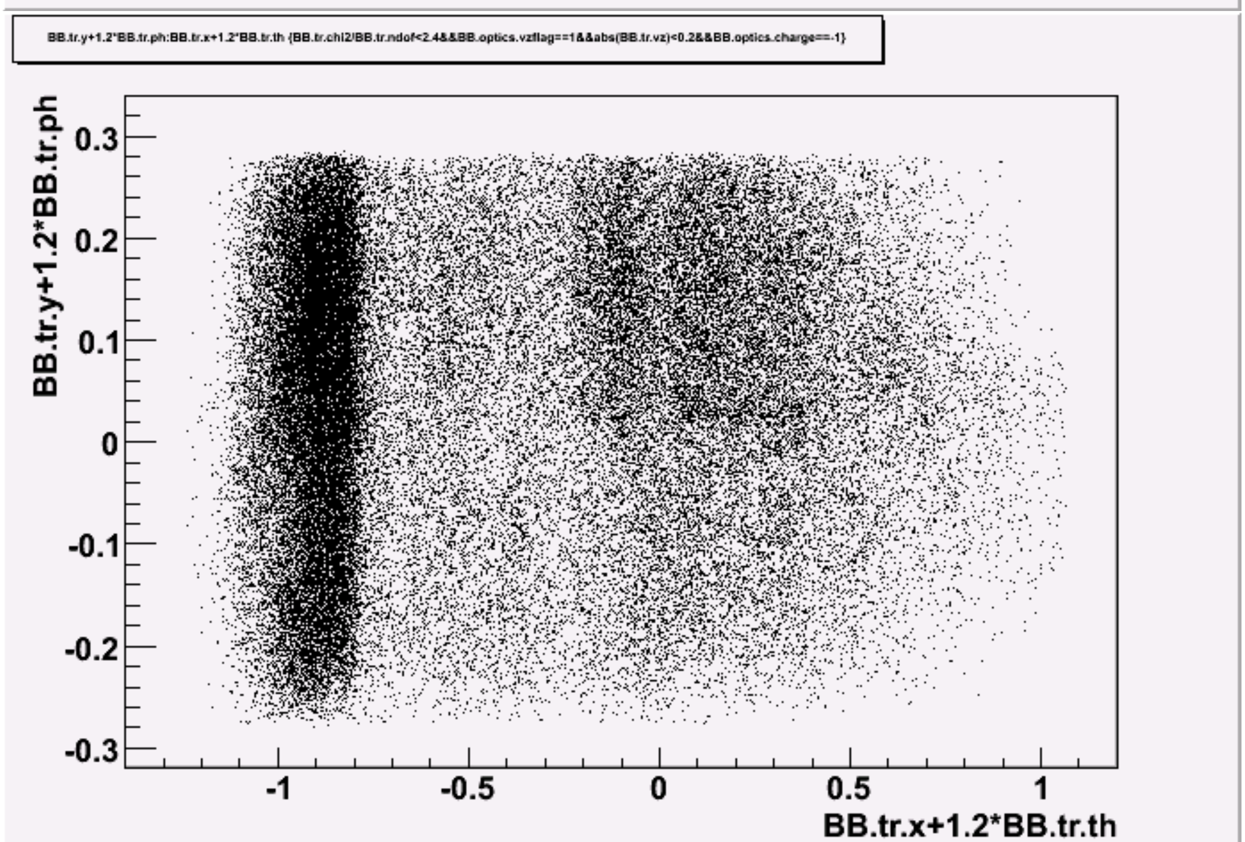




Shower Acceptance check

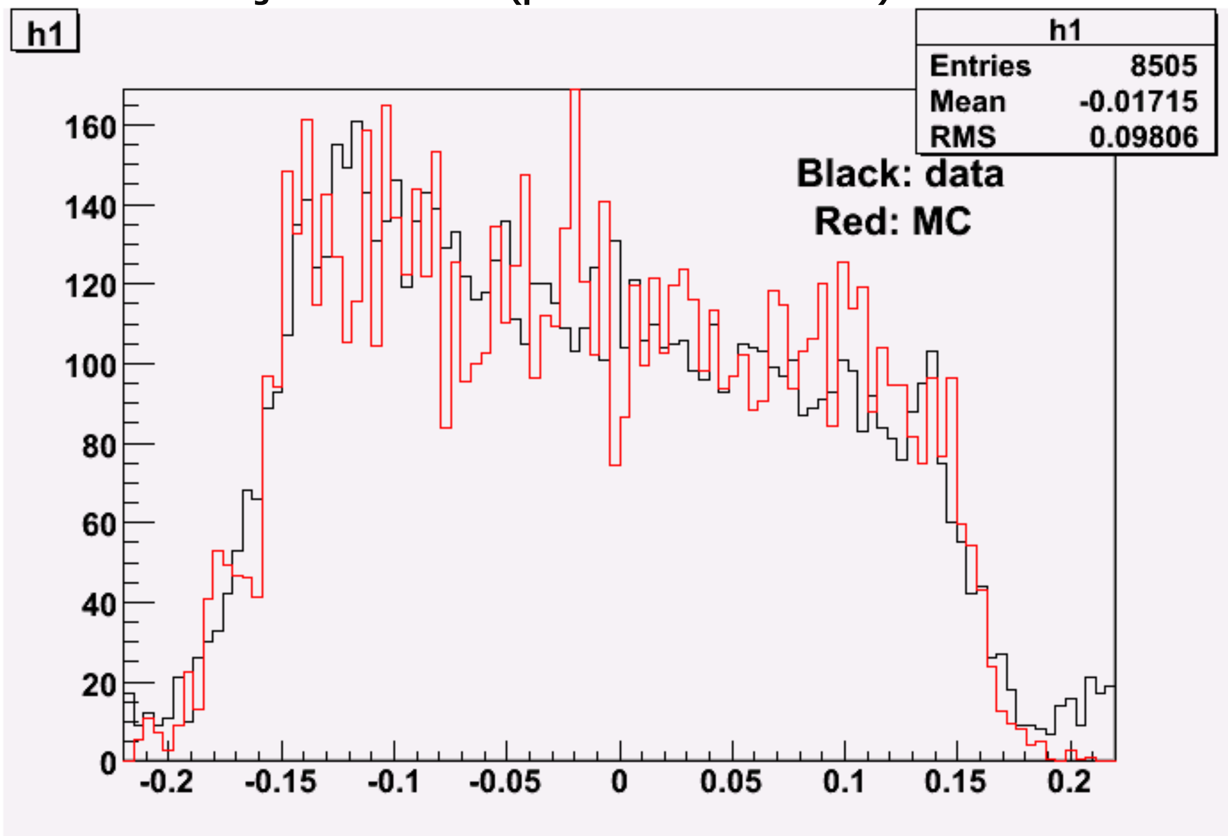
Faked data(L/U): Real data:(R/D)





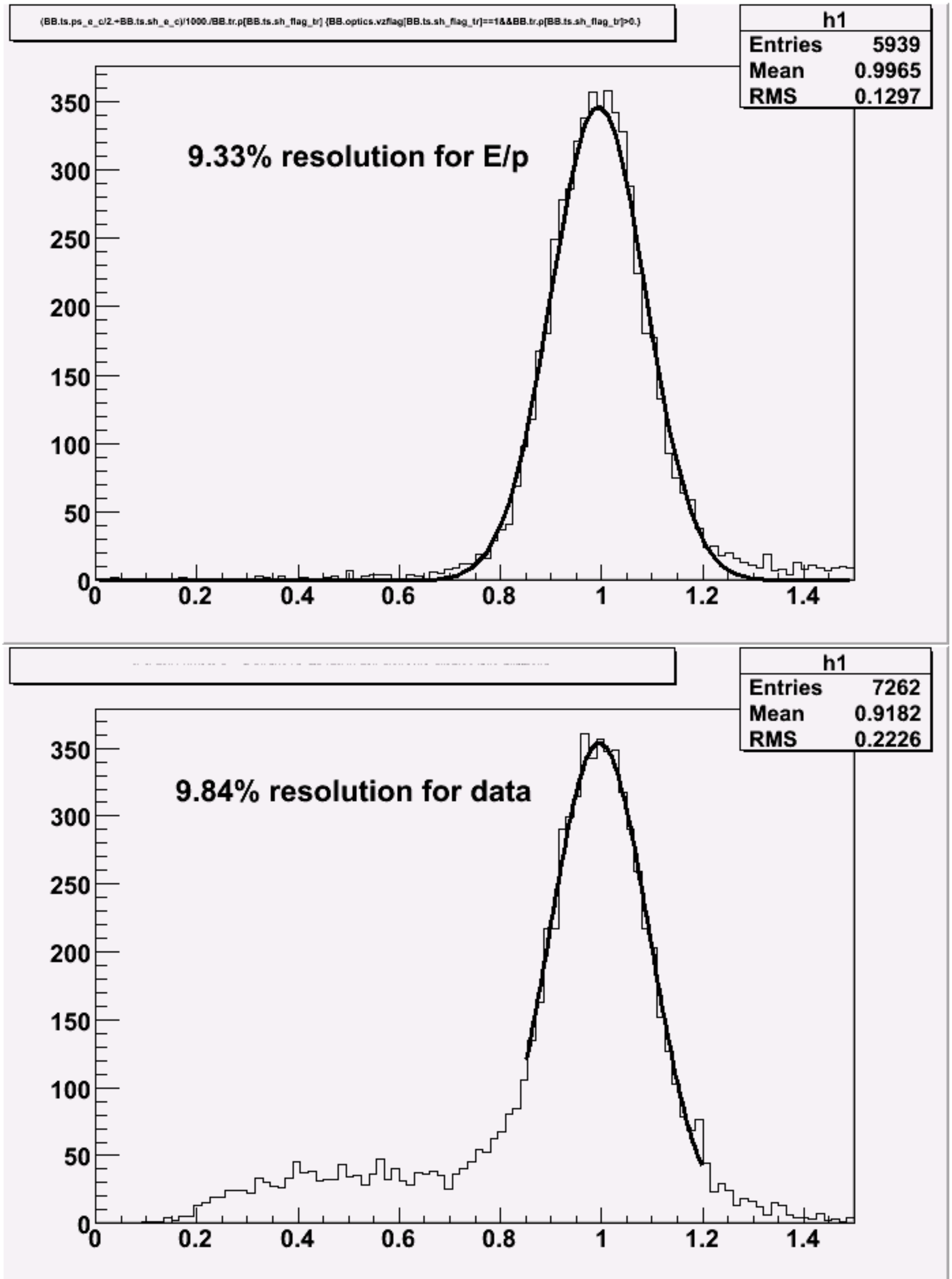
Collimator Position Check

Cross-section weighted for the MC. (pure DIS electron for MC)



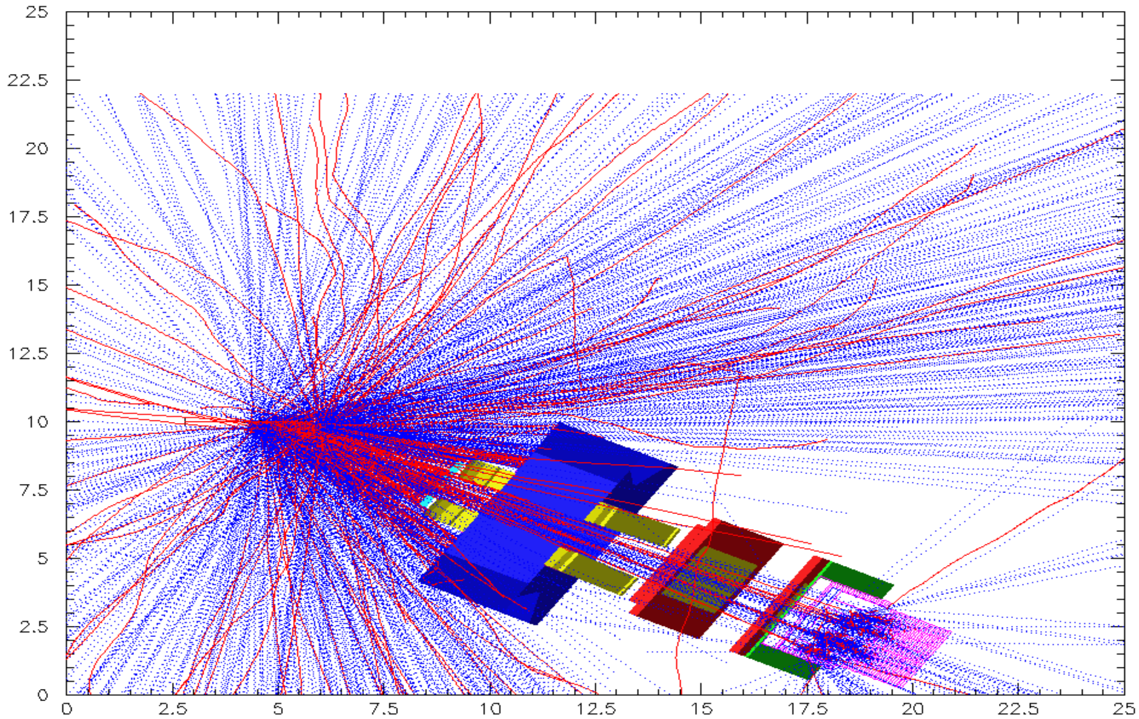
Calorimeter energy resolution check

Faked data (electron only) E/p(L/U): Real data:(R/D)

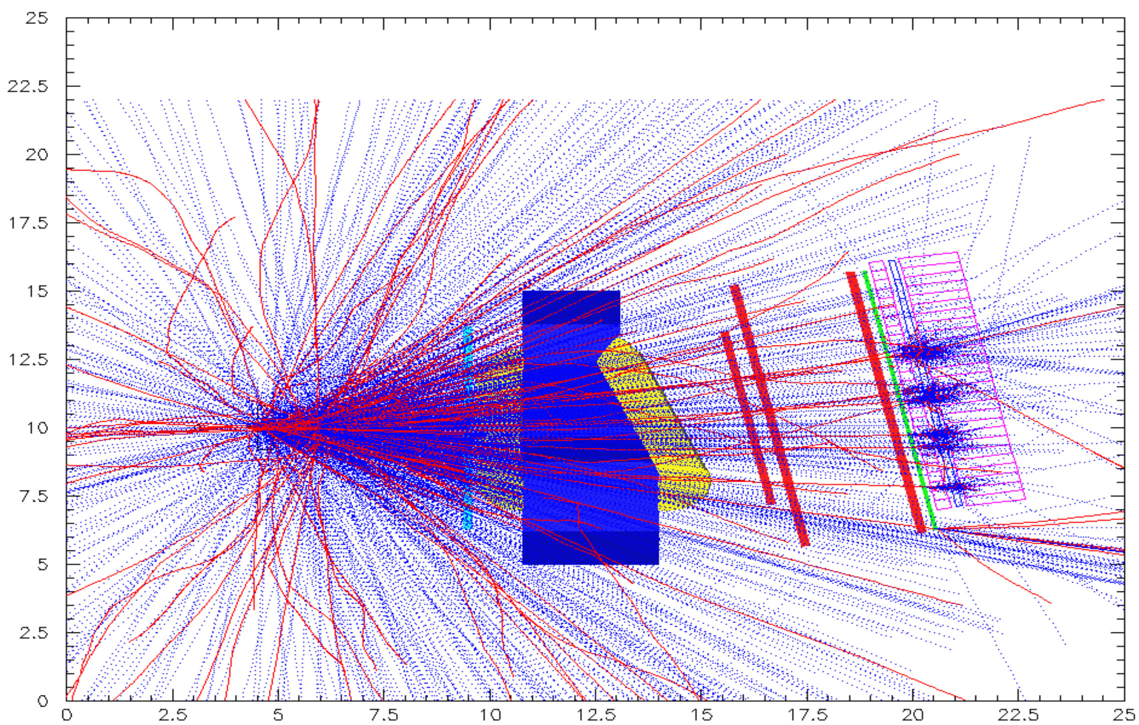

(BB.ts.ps_e_c/2.+BB.ts.sh_e_c)/1000./BB.tr.p[BB.ts.sh_flag_tr] {BB.optics.vzflag[BB.ts.sh_flag_tr]==1&&BB.tr.p[BB.ts.sh_flag_tr]>0.}
h1
Entries 5939
Mean 0.9965
RMS 0.1297
9.33% resolution for E/p
0 50 100 150 200 250 300 350
0 0.2 0.4 0.6 0.8 1 1.2 1.4
h1
Entries 7262
Mean 0.9182
RMS 0.2226
9.84% resolution for data
0 50 100 150 200 250 300 350
0 0.2 0.4 0.6 0.8 1 1.2 1.4

MC Plot

2009/11/02 16.56



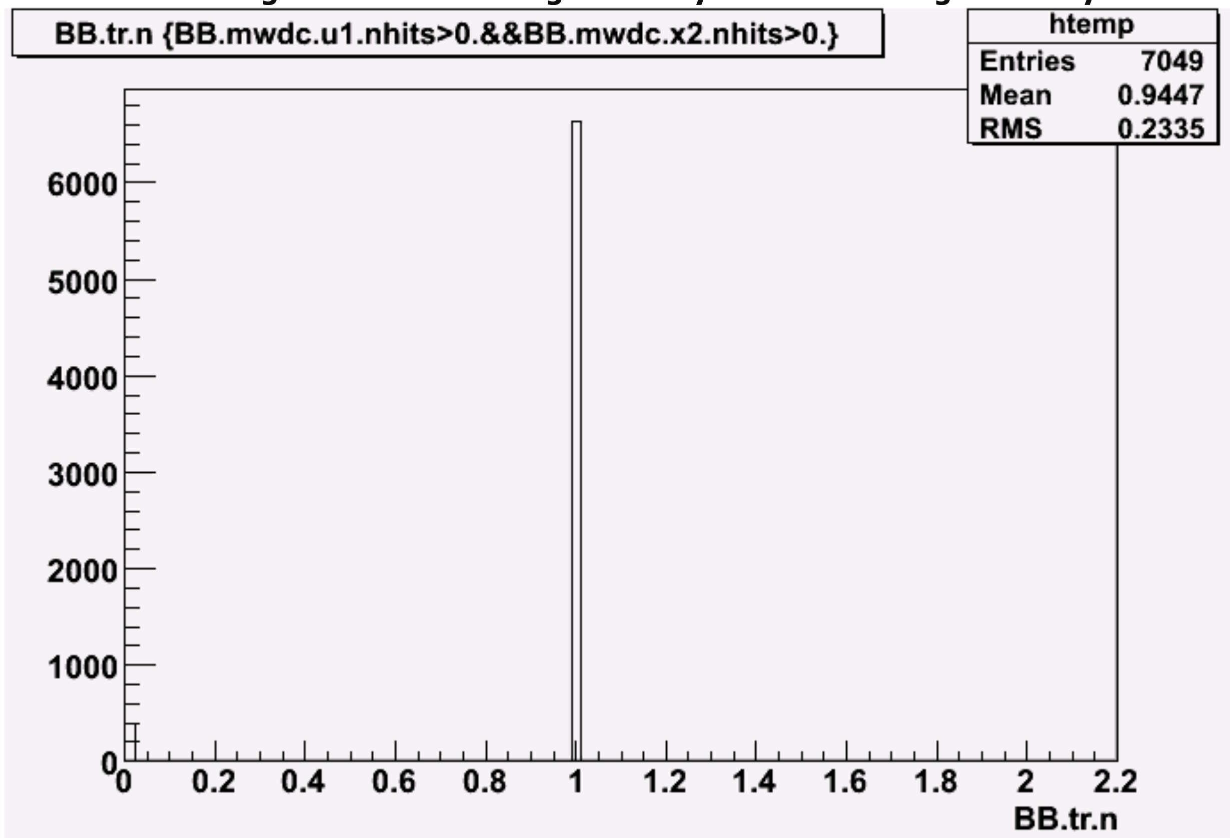
2009/11/02 16.59



First Results

Question 1: Is tracking good?

1. Case 1: no background 100% hitting efficiency: 99.5% tracking efficiency



2. Case 2: 45 MHz random background 100% hitting efficiency (about 14 uA production situation)L 93.5% about 6% degration

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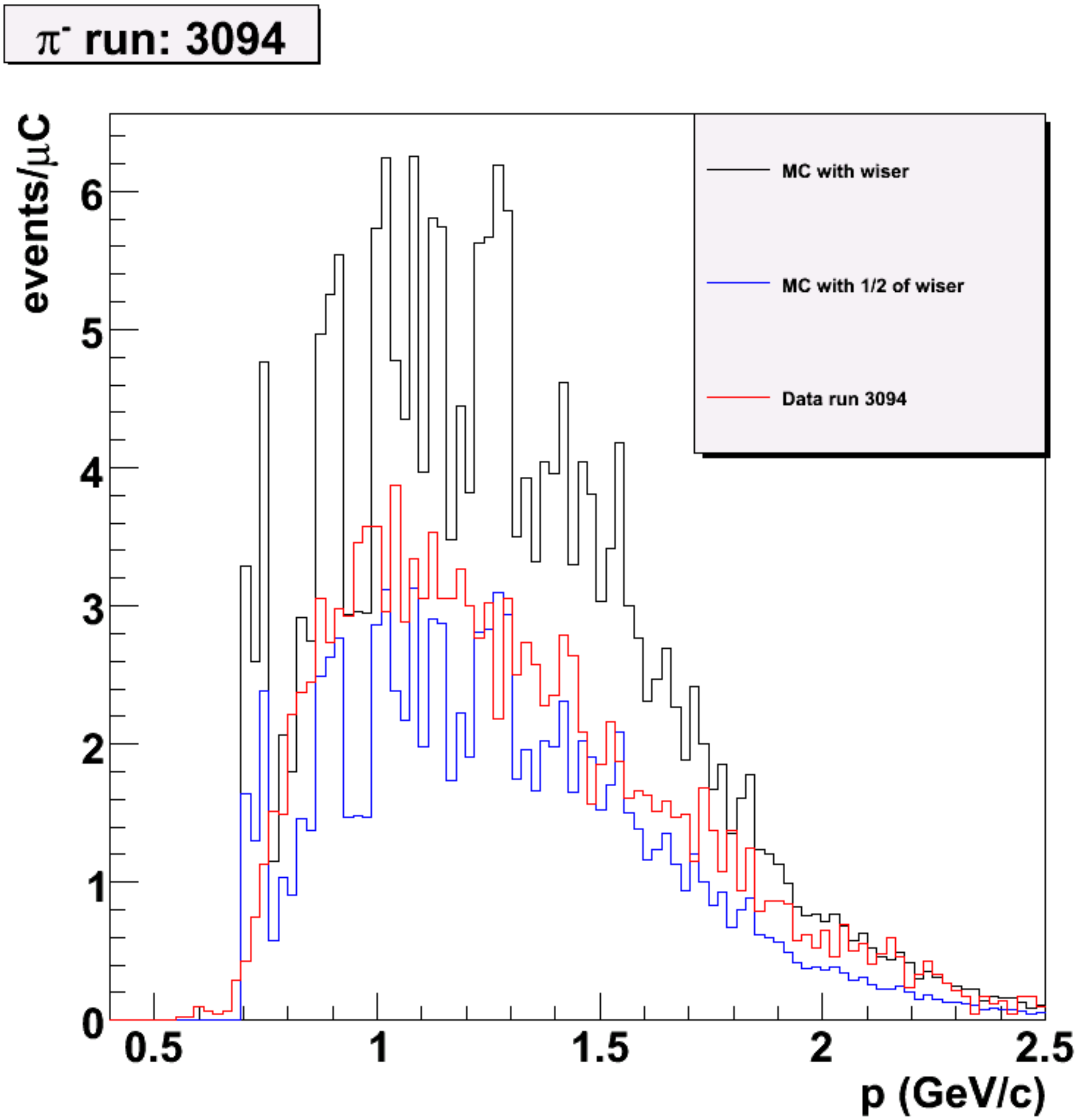
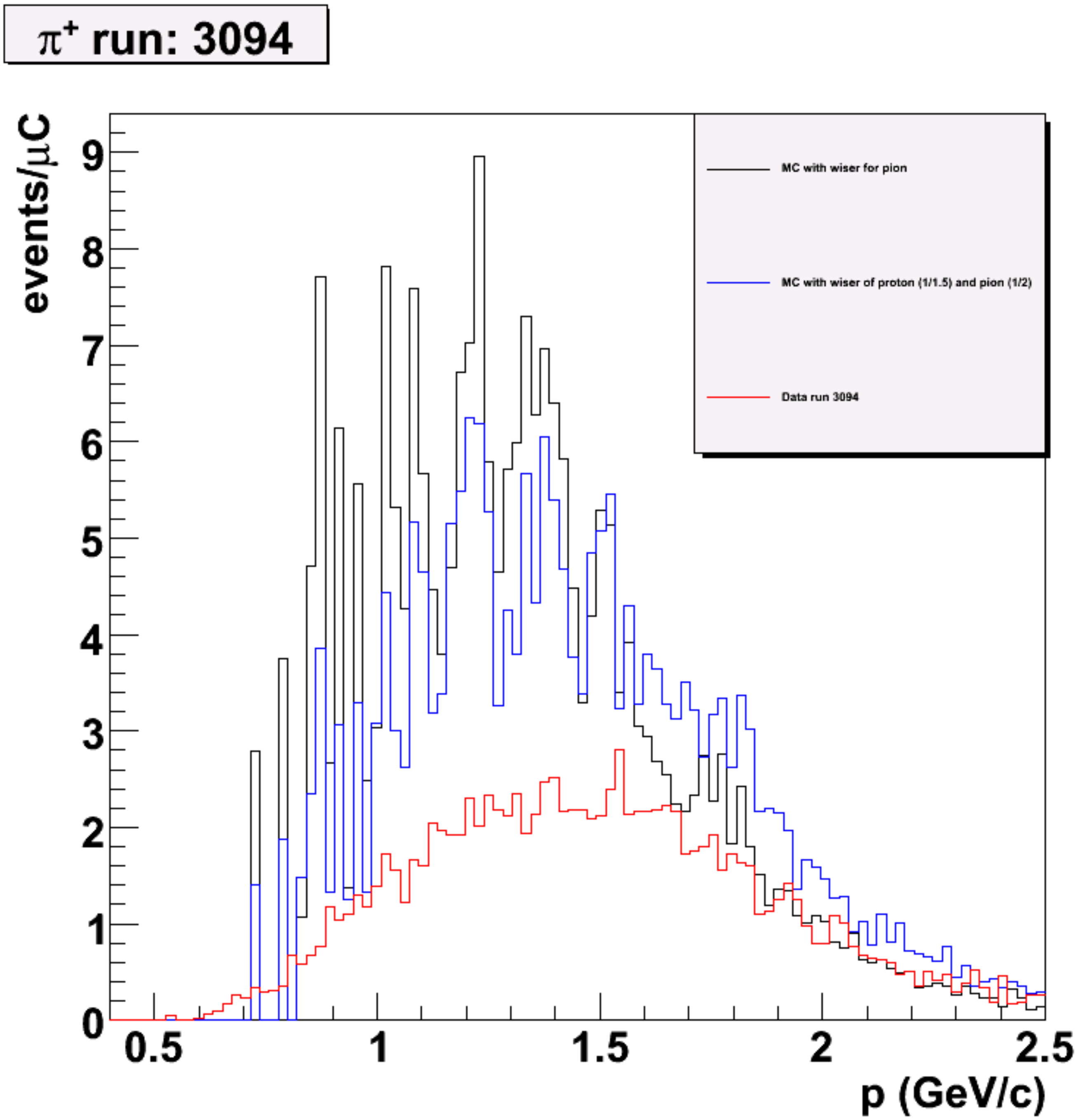
Question 2: Rates comparison for pions

For pim, wiser code is accurate to 0.5-1.0 level. Spectrum can be described.

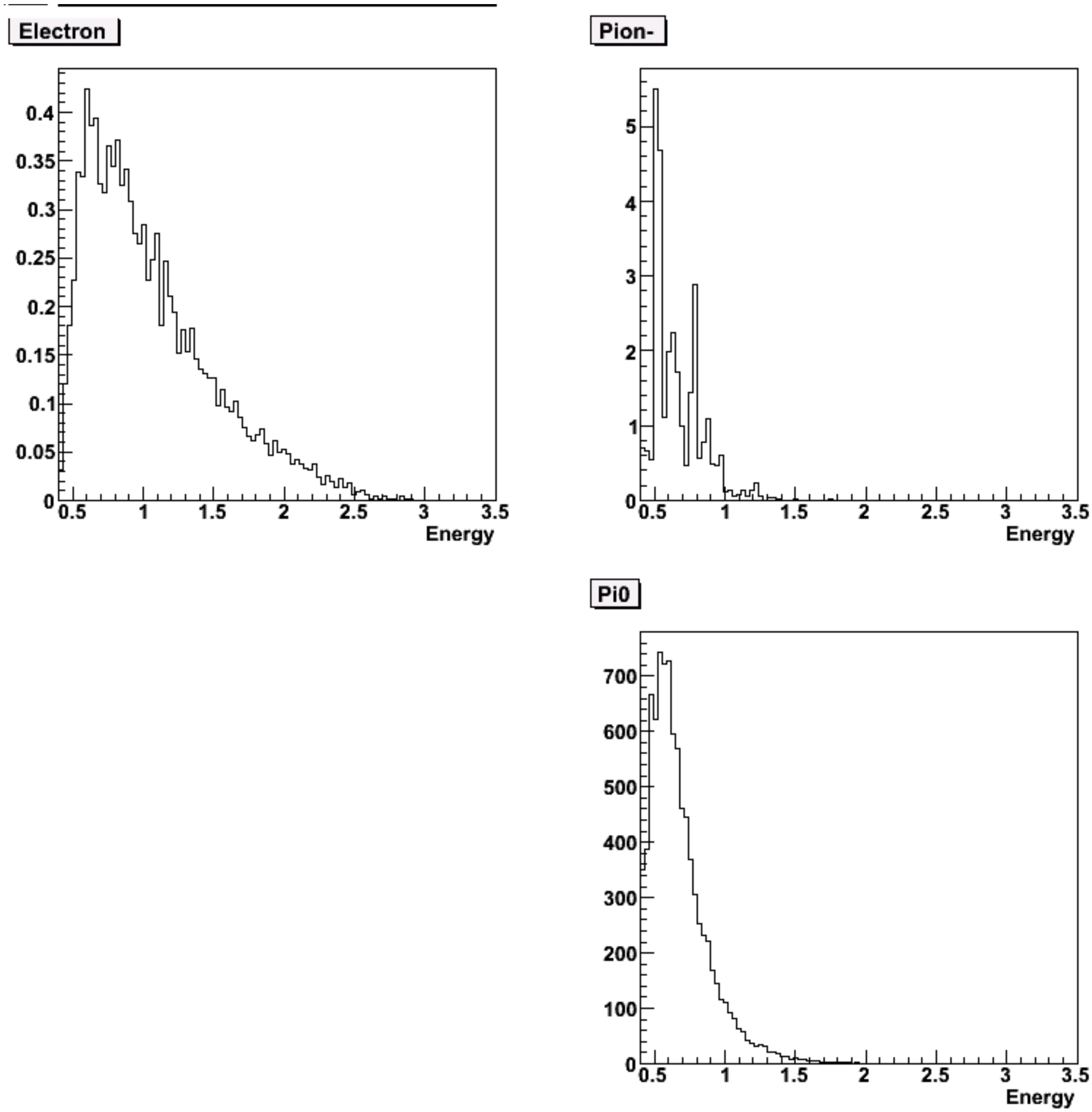


For pip, wiser code seems to overestimate the data. Data seems to has less low energy stuff. Seems to be related to trigger setup or acceptance



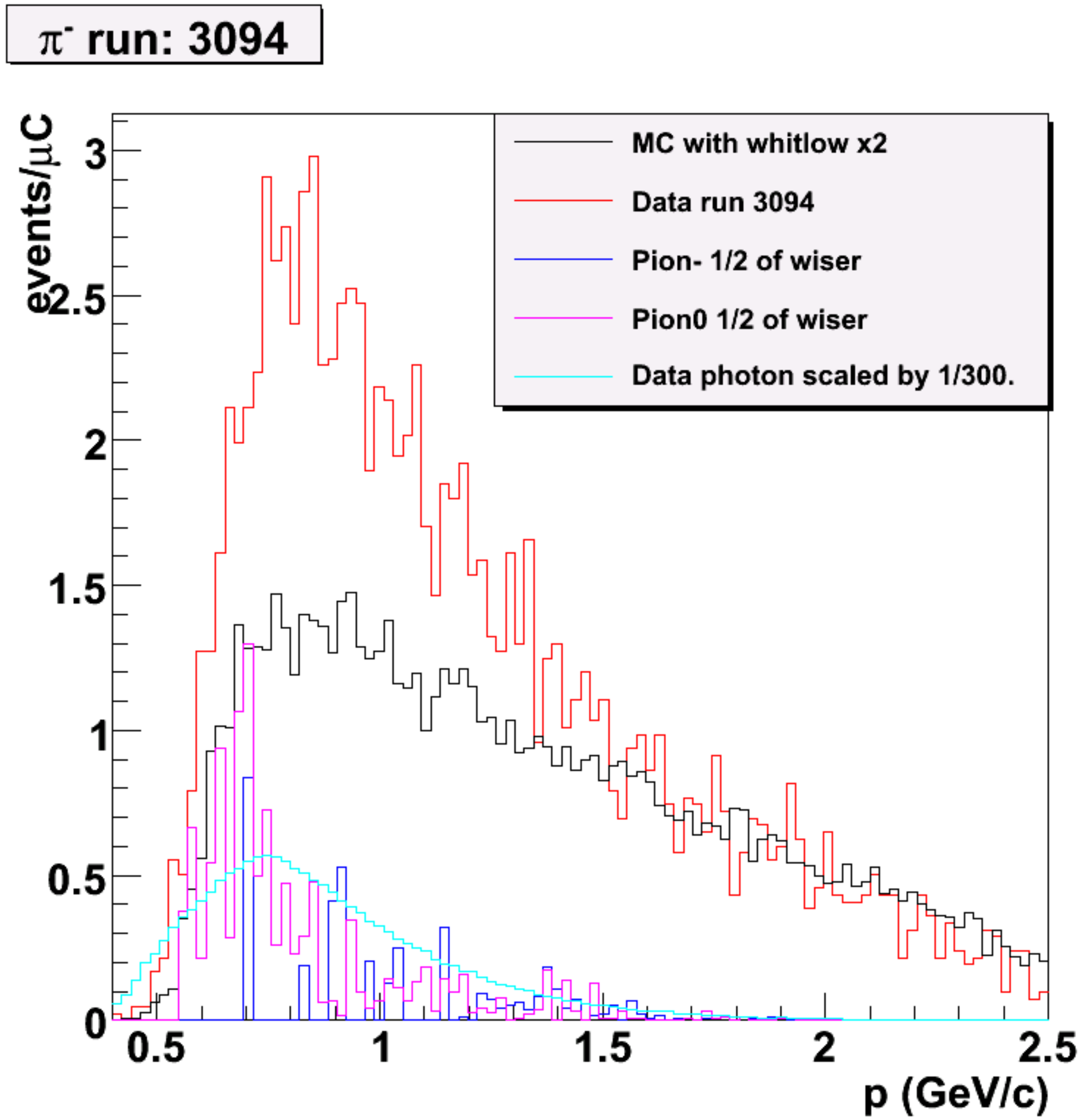
Question 3: Rates comparison for photons

The total rates seems to agree with half of wiser code. However, there is a clearly change of the spectrum.
More high energy photon and less low energy photon



Question 4: Rates comparison for electrons

We have to scale the whitlow code by a factor of 2 to take care the radiative correction part. The naive calculation gives about twice the rates.
Compare the MC photon-induced electron with the MC photon spectrum, we obtain an scale factor about 1/300. Thus, we scale our photon spectrum to show the contamination from photon-induced electron.



Question 6: Pion contamination (T1)

For T1 the pion contamination seems to be smaller than 4-8%. The coincidence trigger will lead to at least another factor of 3-4 reduction of pion contamination.