Update on H2 TB2007 data analysis

Outline

- Test Beam 2007 set up and beam cleaning conditions
- Study of beam profile.
- Noise and MIP studies in EE.
- Study of MIP-fraction
- Response and resolution for HE+EE+ES

CaloTaskForce Meeting , December 12, 2008

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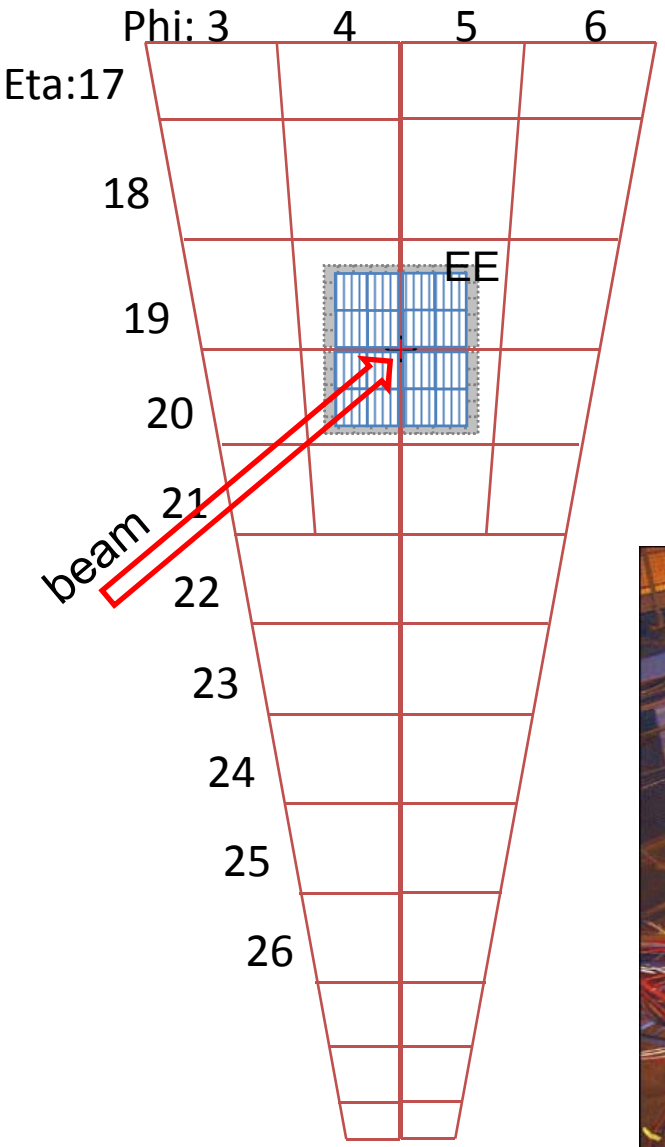
TestBeam 2007 calorimeter set up



HE Preproduction Megatile

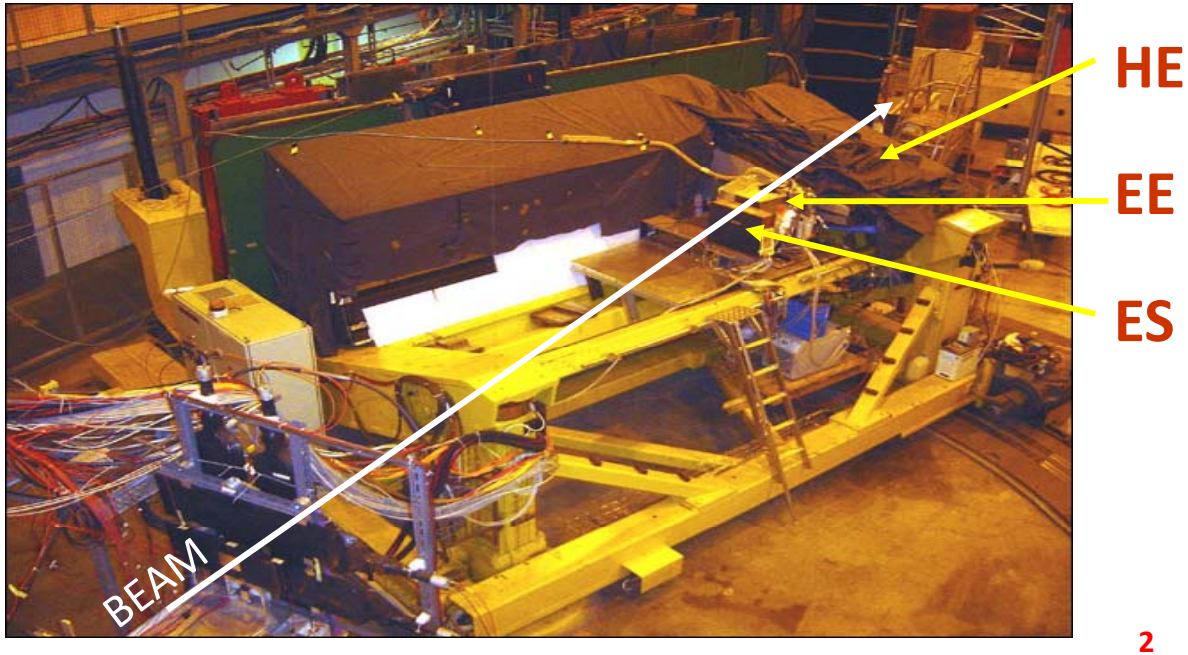
Depth segmentation

η = 16 1 depth seg.
η = 17-23: 2 depth seg.
η = 24-25: 3 depth seg.
η = 26-29: no tile

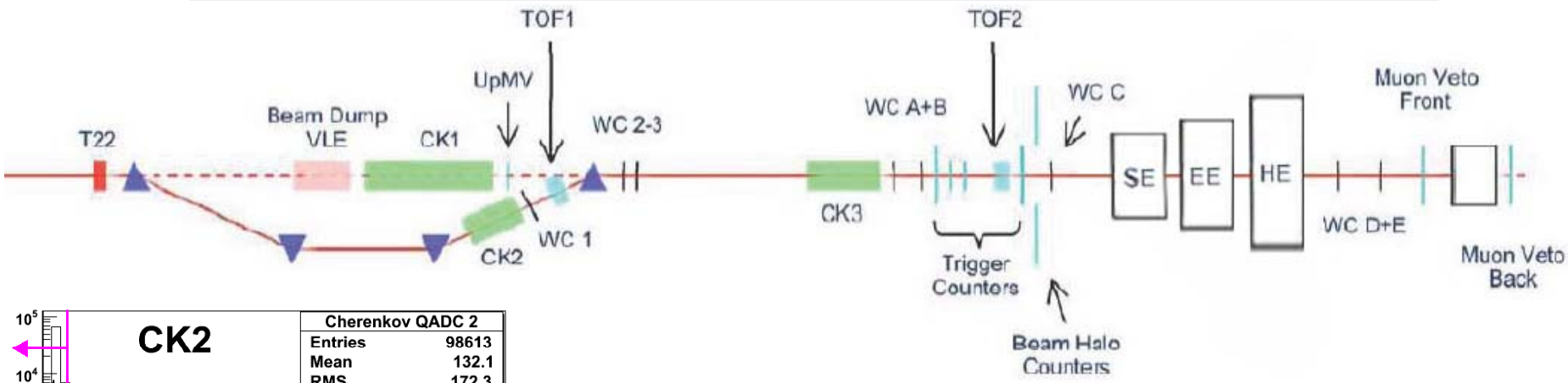
Phi segmentation

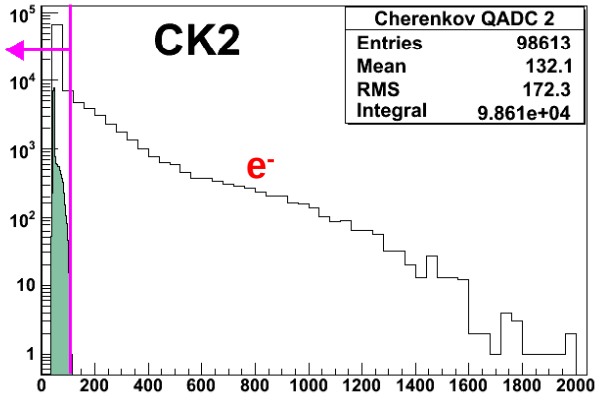
η = 21: $\Delta\phi$ 5 degrees.
(production megatile- 10 deg)

Test beam set-up at H2



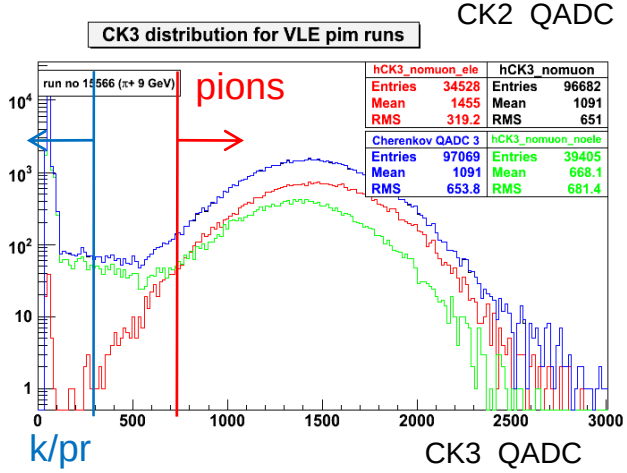
TestBeam 2007 beam line and Particle ID



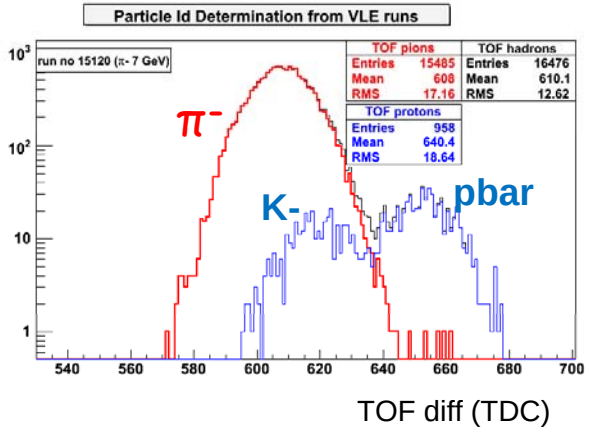


CK2 QADC

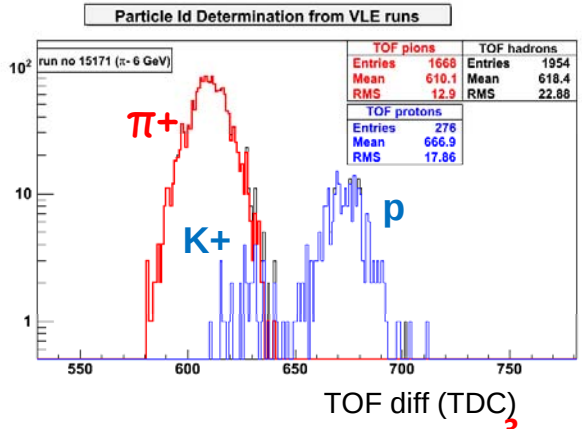
- CK2 is used for removing electrons.
- CK3 is used to distinguish pions from proton+kaon.
- Further Kaon/Proton separation was done using TOF information.



9 GeV pi+ run

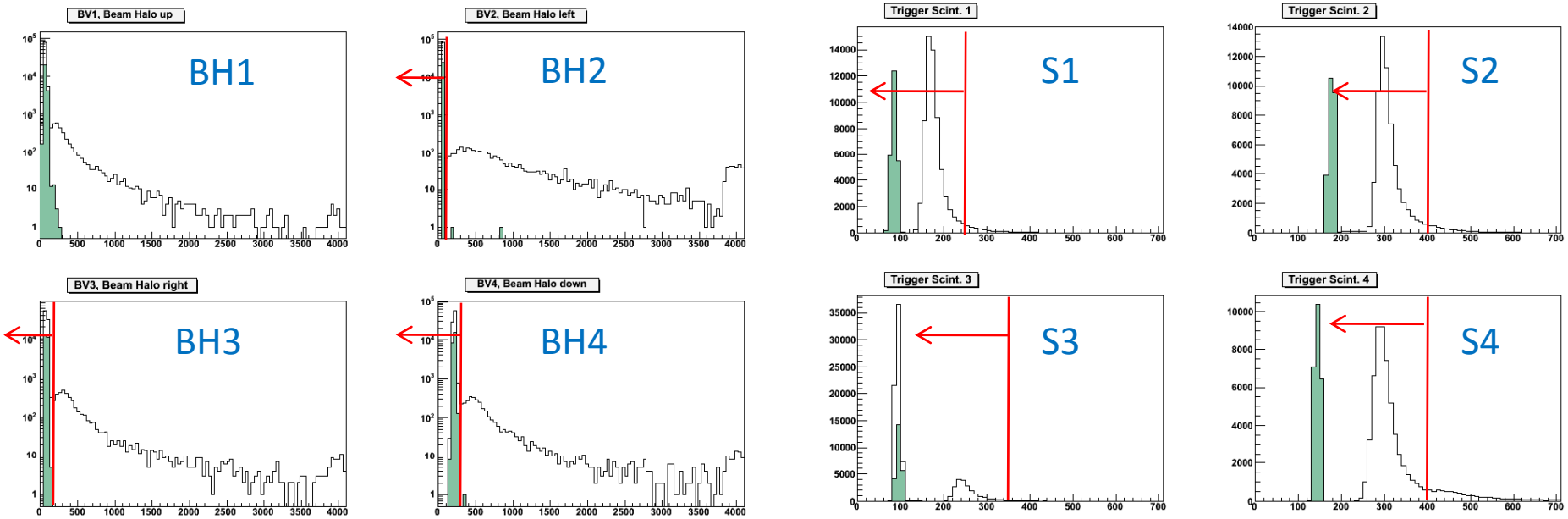


6GeV pi- run



6 GeV pi+ run

Various beam cleanings used for analysis of data



Definitions used :

singleHit : if(S1>210 || S2>340 || S3>280 || S4>340)

beamHalo : if(BH1>50 || BH2>80 || BH3>120 || BH4>280)

muon : if ((VMB>400 || VMF>400))

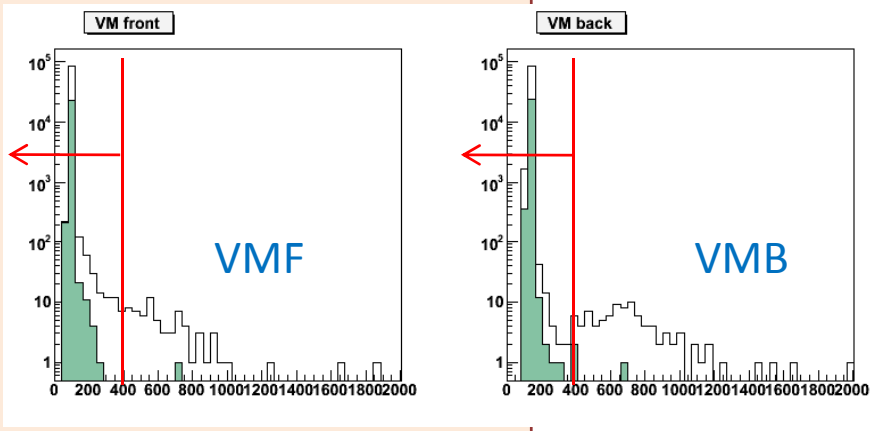
Cleanbeam: if(! singleHit AND ! beamHalo AND ! muon)

electron: if (Cleanbeam) AND CK2>100)

hadrons : if (Cleanbeam AND CK2<100)

pions : if(hadron AND CK3>ck3_cut)

* *Cut slightly vary for high energy and very low energy runs.*



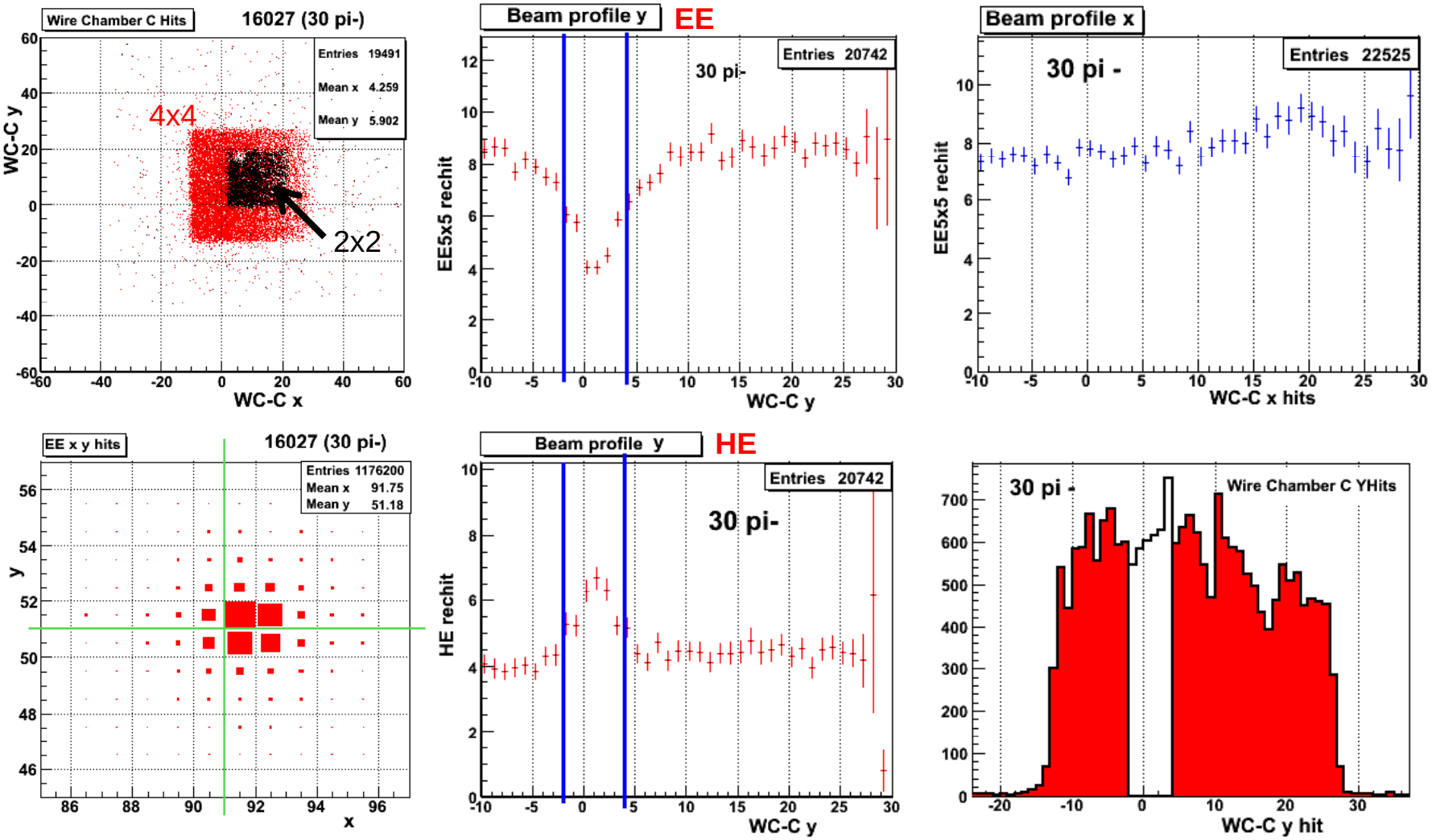
Fraction of pion/ kaon/proton for VLE runs

- Beam	No of hadr	No of Pion	No of (k+pbar)	%pion	%k	%pbar	# of k	# of pbar
2	303	51	248	-	-	-		
3	1636	1562	56	95	3.4	1.6	37	19
4	1988	1929	49	97	1.35	1.65	22	27
5	2696	2607	85	96	1.08	3.92	23	62
6	4627	4415	204	95	1.8	3.2	74	130
7	16476	15485	958	93	2.52	4.48	345	613
8	45279	41889	3273	92	3.2	4.8	1448	2173
9	36372	32513	2827	89	1.87	9.13	846	3320

+ Beam	No of hadr	No of Pion	No of(k+p)	% pion	%k	%proton	# of k	# of proton
2	167	32	133	-	-	-		
4	2057	1770	269	86	.98	13.02	19	67
6	1954	1668	276	85	1.95	13.05	36	240
7	13879	11700	2137	84	2.72	13.28	363	1774
9	77187	51443	21975	67	3.63	29.37	2417	19548

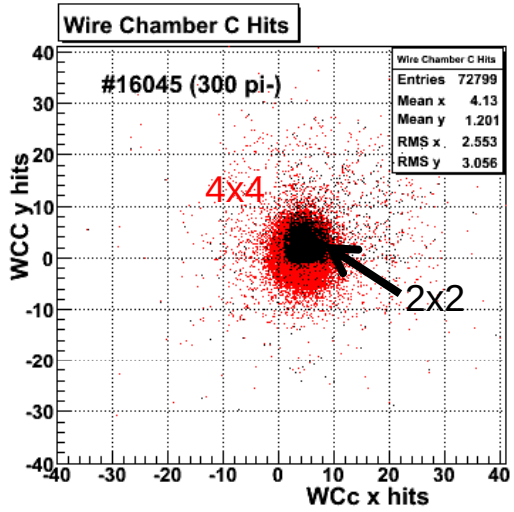
* For details see http://indico.cern.ch/getFile.py/access?contribId=3&resId=3&materialId=slides&confId=40226

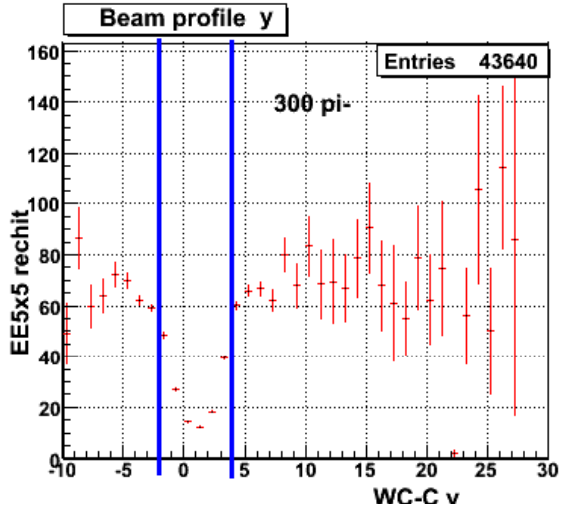
Beam Profile of HE and EE w.r.t. WireChamber C

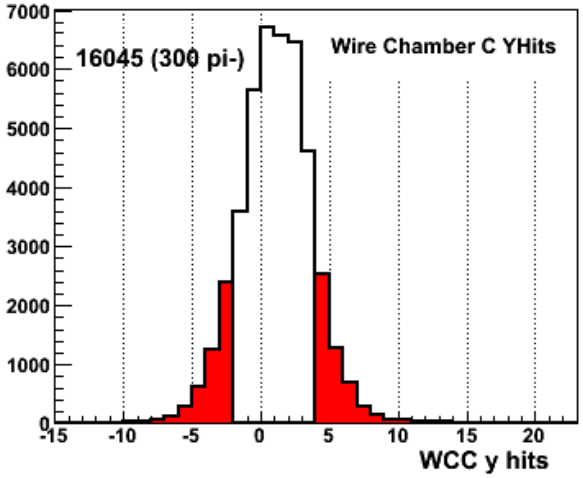


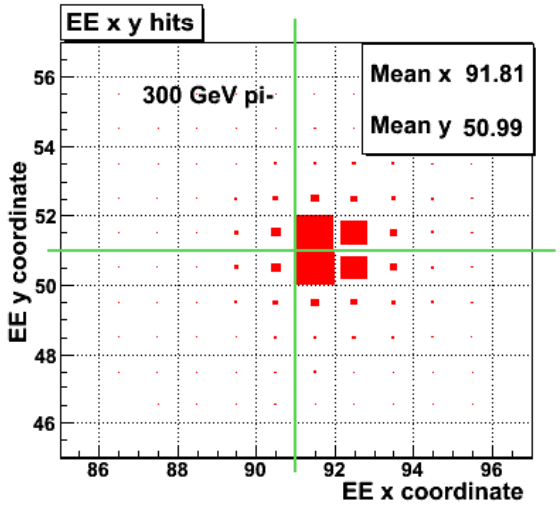
- For a 30 GeV pi- run we study the beam profiles in x and y direction in WC-C. We see a dip in the EE rechits profile when plotted as a function of WC-C y hits. Also a peak in the HE beam profile at the same position strengthens this observation that there was a gap in EE supermodule boundary along y. EE rechits profile as a function of WC-C x hits does not show any such dip. We decide to cut out events (from y=-2 –to y=4) in WC-C.

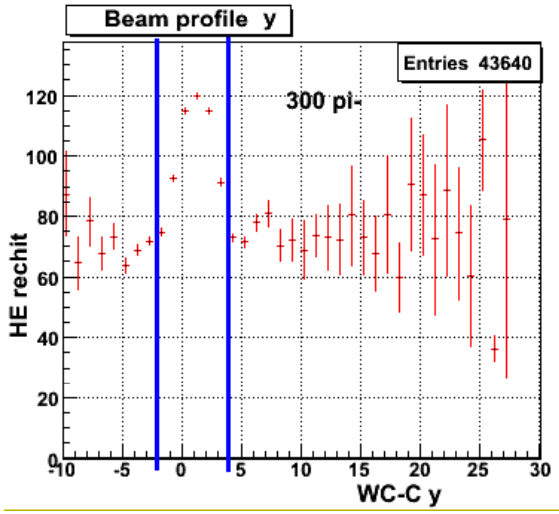
Beam Profile of HE and EE w.r.t. WireChamber C











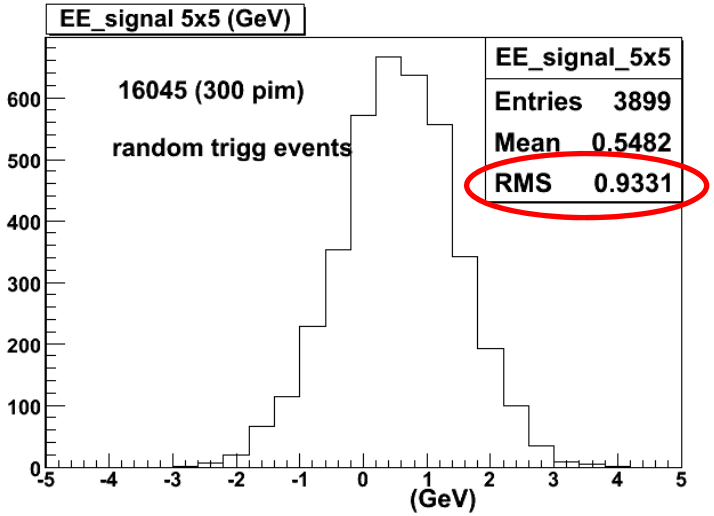
- A similar study was carried out for a 300 GeV pi- run where the <u>beam is more focussed</u>.
- Similar behavior sin beam profiles are observed.
- Events were cut out in the same region of the WC-C as before.

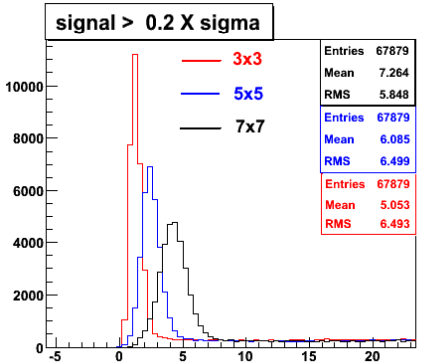
Issue with EE noise

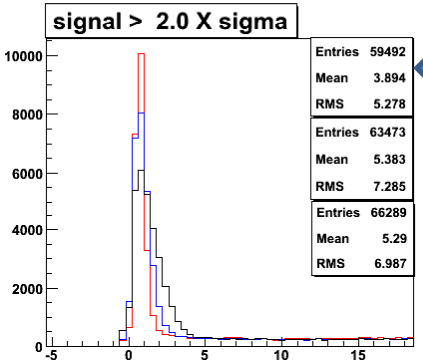
In TestBeam 06 we had EB where noise/crystal was 40 MeV.
In TestBeam 07 we have EE, which has noise/cry = 180 MeV.

✓ We establish that from the EE5x5 distribution for random trigger events. Noise/cry = 0.933/sqrt(25) = 0.180 GeV(approx).

- Average pedestal rms for EE is 2 ADC counts (while in EB is 1.2 ADC counts)
- In EE matrix (at H2) is roughly 90 MeV per ADC counts (while it is on average 37 for EB)



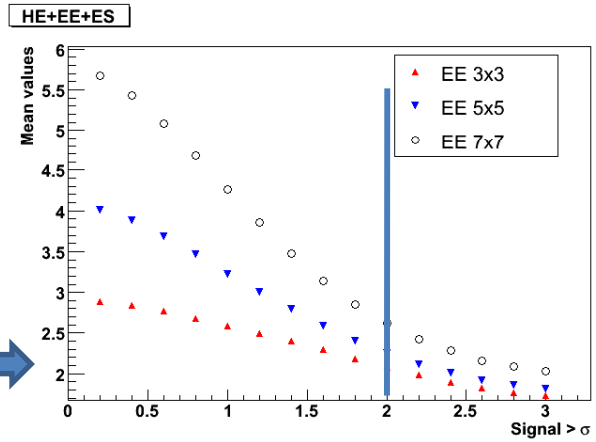




Due to this *high noise in EE* we need the consider signals only above a certain threshold.

We varied this thershold and studied the effect for different cluster sizes, namely 3x3, 5x5, 7x7.

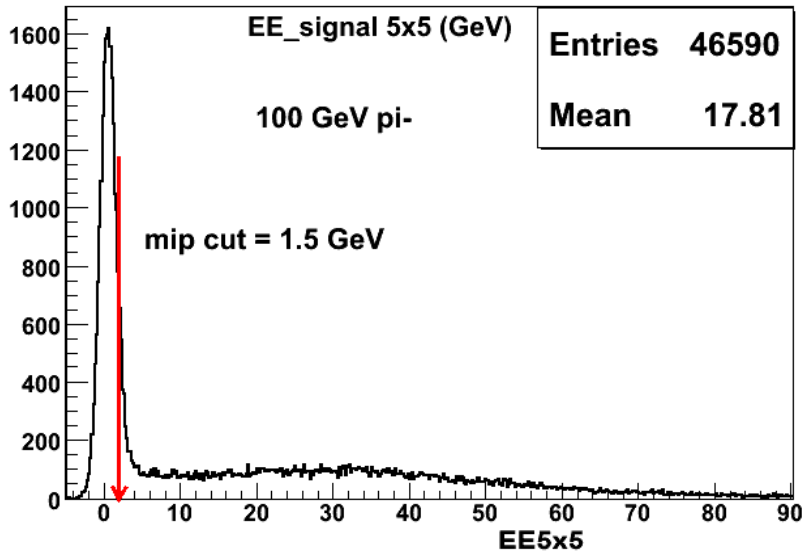
We see that around 2 sigma the signals for various clusters are coming close.

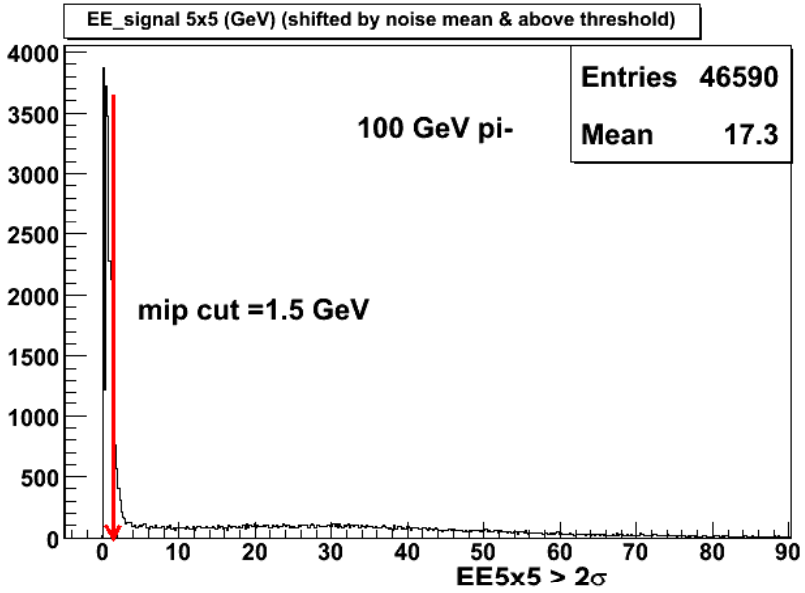


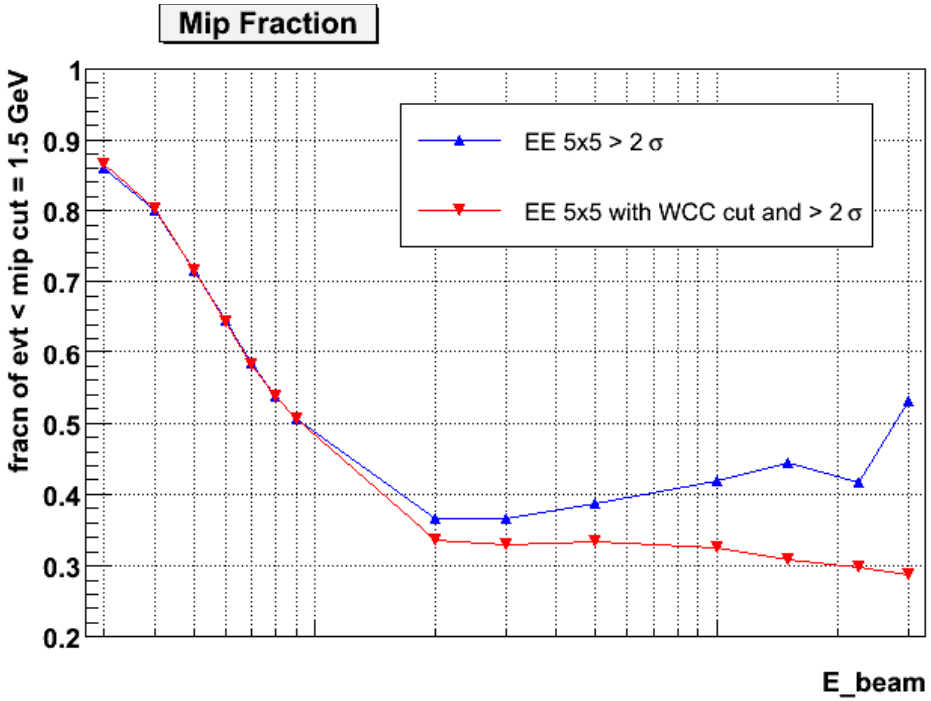
So we take the signal only when it is more than 2 sigma of the pedestal rms.

We decided to consider signal events only above 2 sigma.

Study of Minimum Ionising Particle (MIP) in EE

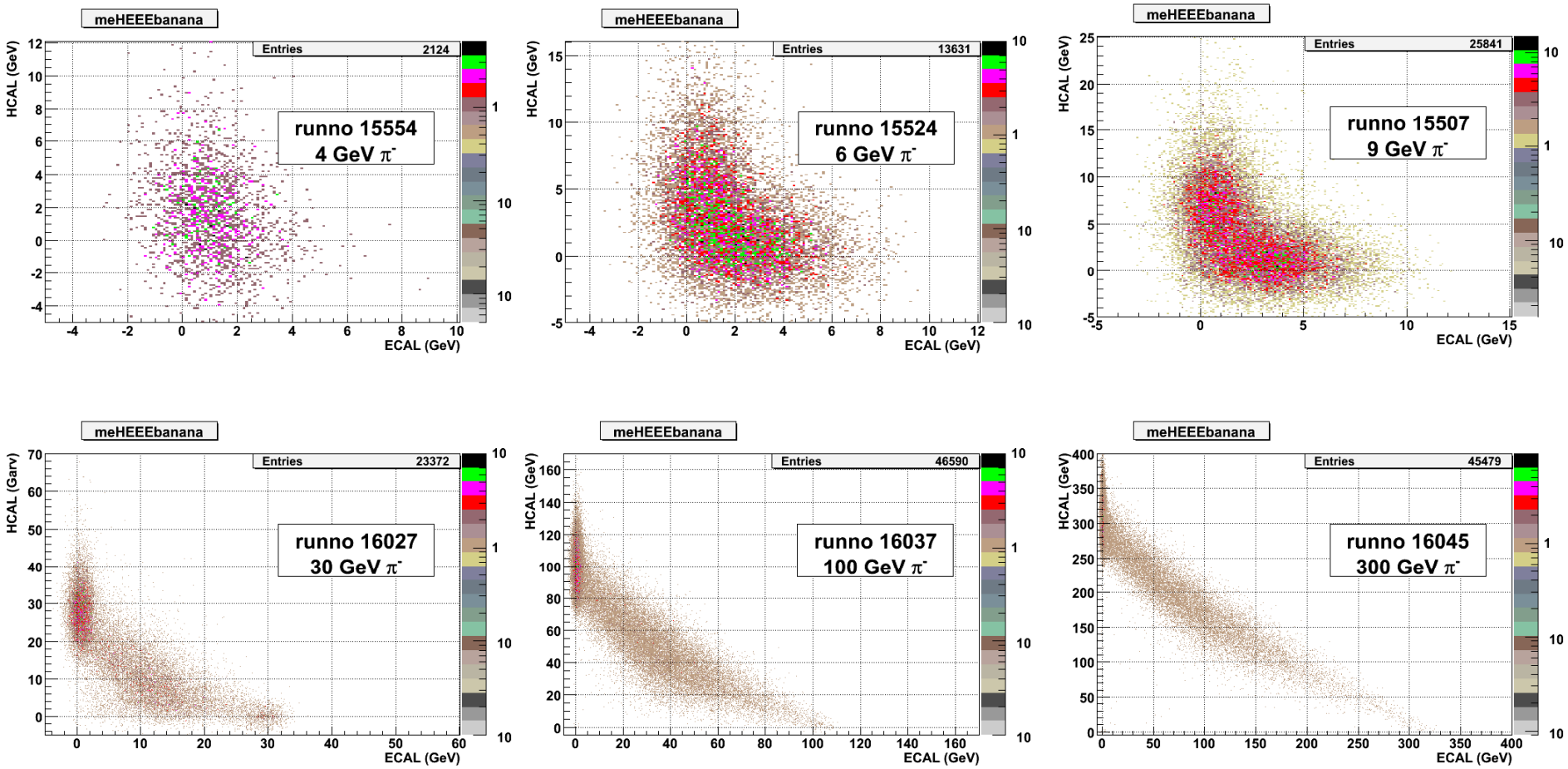






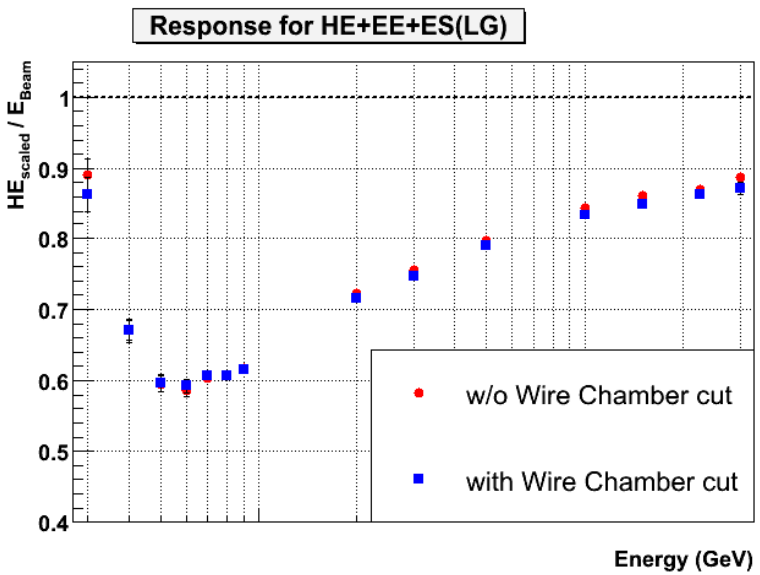
- Top two plots show EE5x5 energy and after it is required to be greater than 2 sigma of the pedestal RMS.
- We notice a sharp cut in the right plot as a result of the requirement.
- We take the mip signal to be less than 1.5 GeV.
- In the mip fraction plot (left) we observe a clear effect of wire chamber cut in the high energy points. Without the cut the beam was passing through the gap in the EE and was appearing as false mip signal.

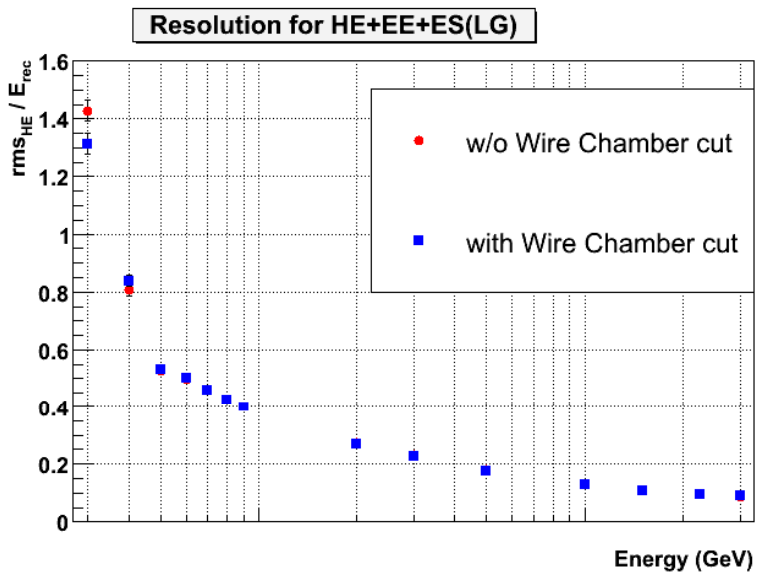
Banana plots for combined HE+EE+ES system



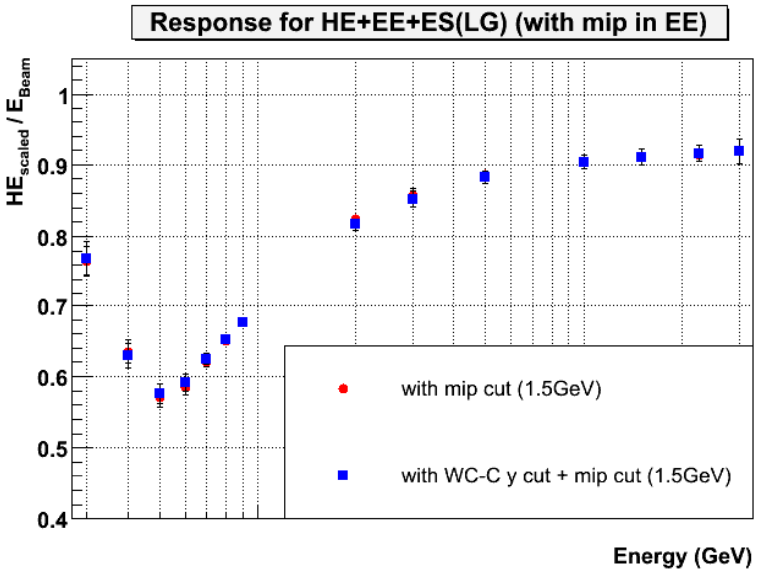
- Total energy is obtained by calibrating with 50 GeV e^-.

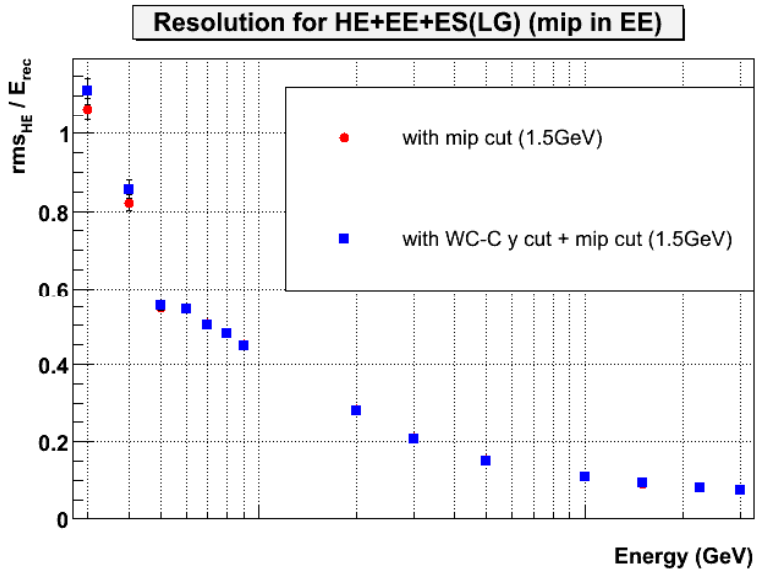
Response and Resolution for HE+EE+ES





- **Plots with events which are only from MIP in EE :**





- **We do not see any effect of wire chamber cut in response and resolution.**

Conclusions and Outlook

- We decide on the beam cleaning cuts as well as the cuts on Cerenkov counters and Time Of Flight counters for good particle identification.

- Due to high noise in EE crystals (4 times that in EB) we consider signals only above a Threshold of 2Xrms of the pedestal in EE.

- We observe a dip in the beam profile for EE which is possible caused by the crack in the EE supercrystals. We put a cut in the Wire Chamber C (y hits) to avoid that effect.

- The mip-fraction gets significantly affected by the cut in the wire chamber y-coordinate.

- The response and resoltuion of the combined calorimeter system is investigated.

- The response for very low energy points (3,4,5) is higher. The cause needs to be studied.

- The wire chamber cut does not seem to have much effect in the response and resolution plots.

- The response and resolution for events with mip in EE (2GeV) shows a little higher response for the high energy data points and lower response for the very low energy data points.