Validation of Iso Track plus di-jets response correction with single pions

Jordan Damgov
5 Dec 2008

Tested response correction: IsoTracks + di-jets

Validation samples: single pions**,** 10, 50, 100, 300 GeV (magnet on)

Validation region: up to ieta 22

Cluster definition: HCAL 3x3 towers (also in HE for 10deg in phi towers)
Cluster is centered at the tower with maximum deposited energy.

MIP in ECAL: Eecal<1.0 GeV in cone of 9cm (~0.07 in eta-phi space)

Selection cuts:

- $\Delta|\text{ieta}| \leq 1$ and $\Delta|\text{iphi}| \leq 1$between propagated track position to HCAL surface and the tower with maximum deposited energy
- E/p > 0.2 (HCAL)

List of Validation Plots

For each momentum: pi 10, 50, 100, 300
With and w/o HO

As a function of ieta:

- Energy in HCAL with MIP in ECAL
- Energy in ECAL+HCAL
- Resolution (RMS/E) for HCAL with MIP in ECAL

Energy in ECAL vs HCAL

Energy spectra for HB an HE

Material effect in HB as a function of iphi

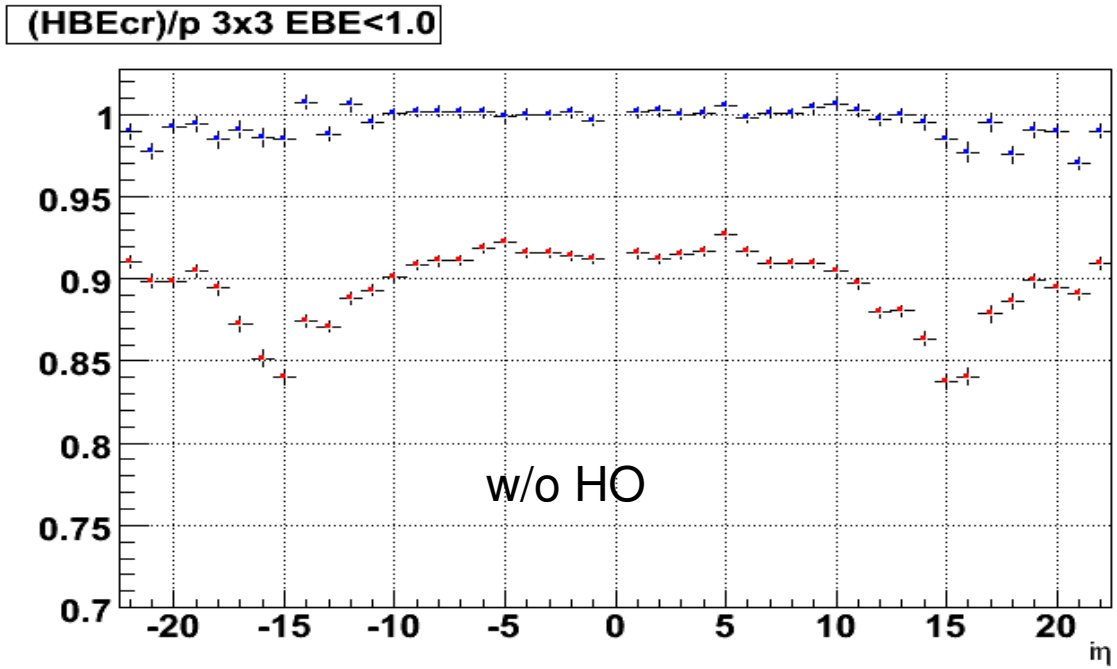
Common convention:

Red – w/o response correction

Blue – response correction applied

E/p for HCAL with MIP in ECAL (E<1. GeV)

E/p for 50 GeV pions - HCAL with MIP in ECAL

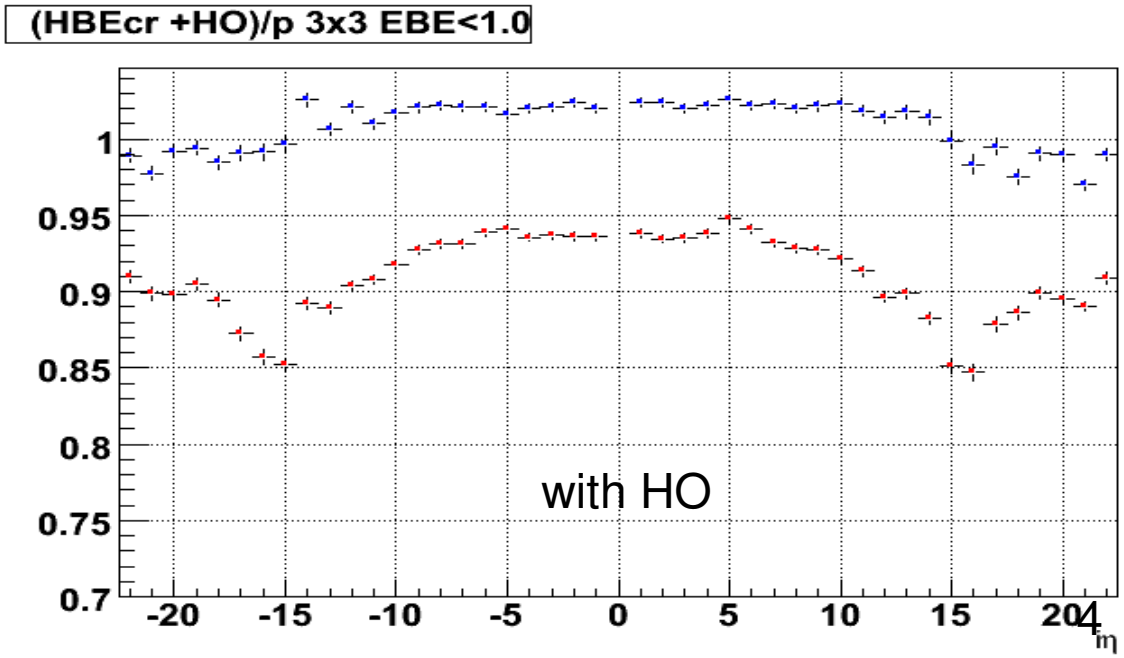


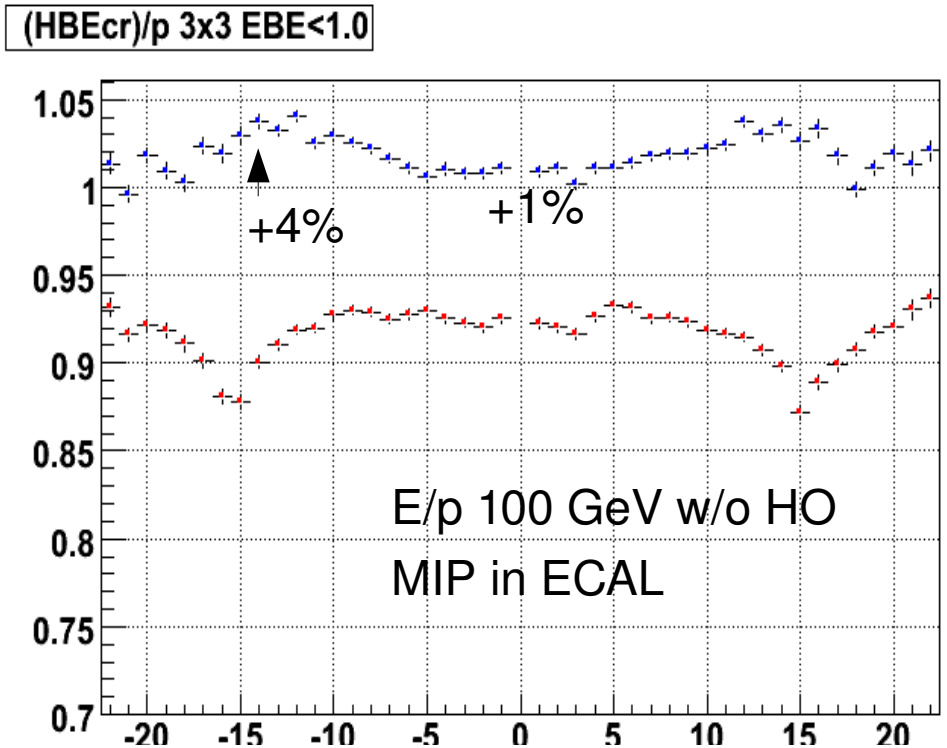
The calibration energy with IsoTracks

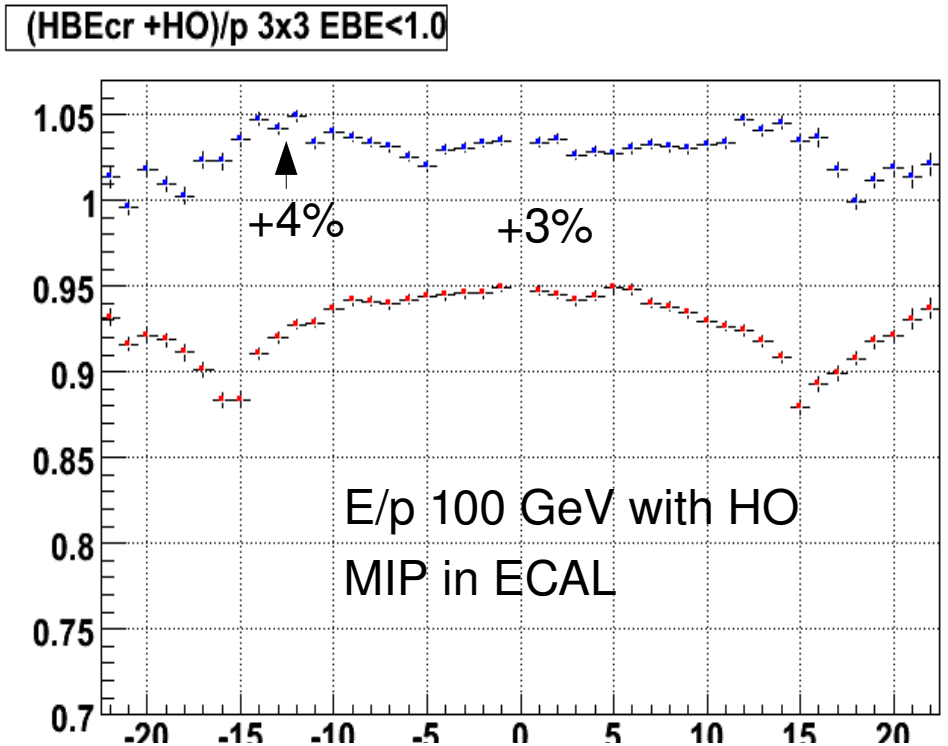
HB – flat at 1.

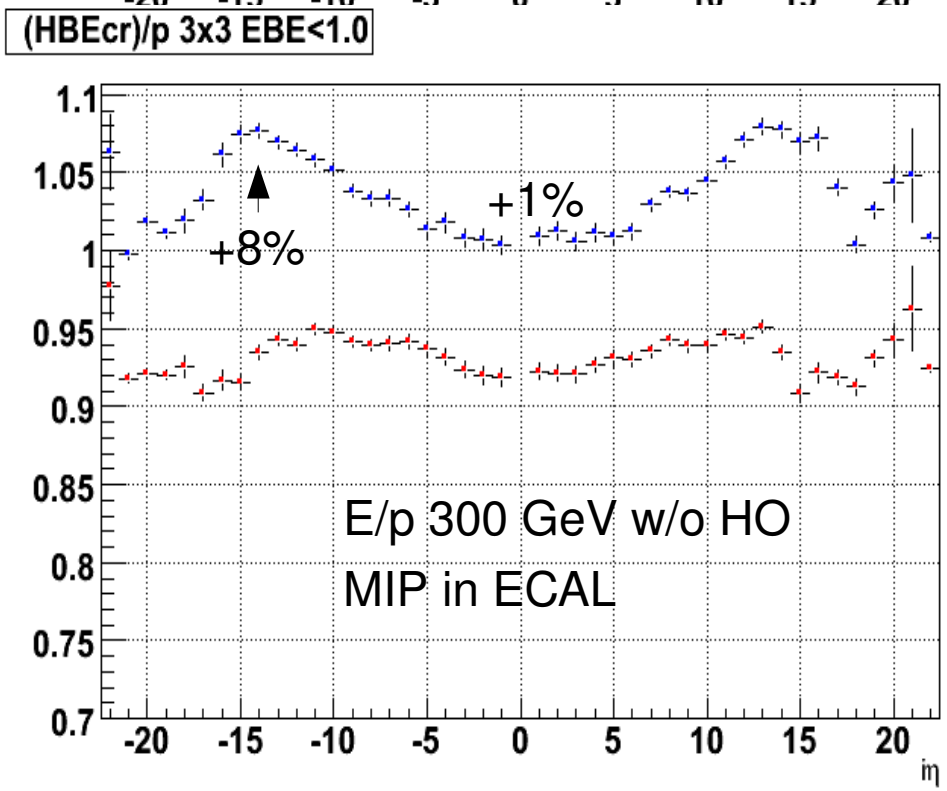
HE ~ 1% lower

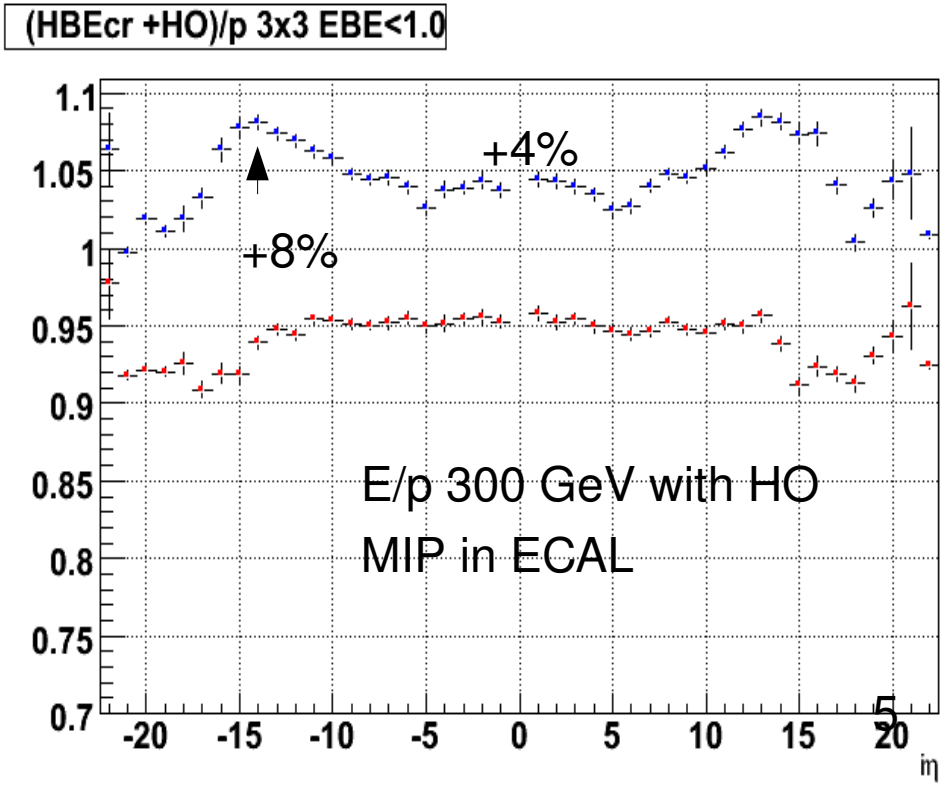
HO adds ~ 2%

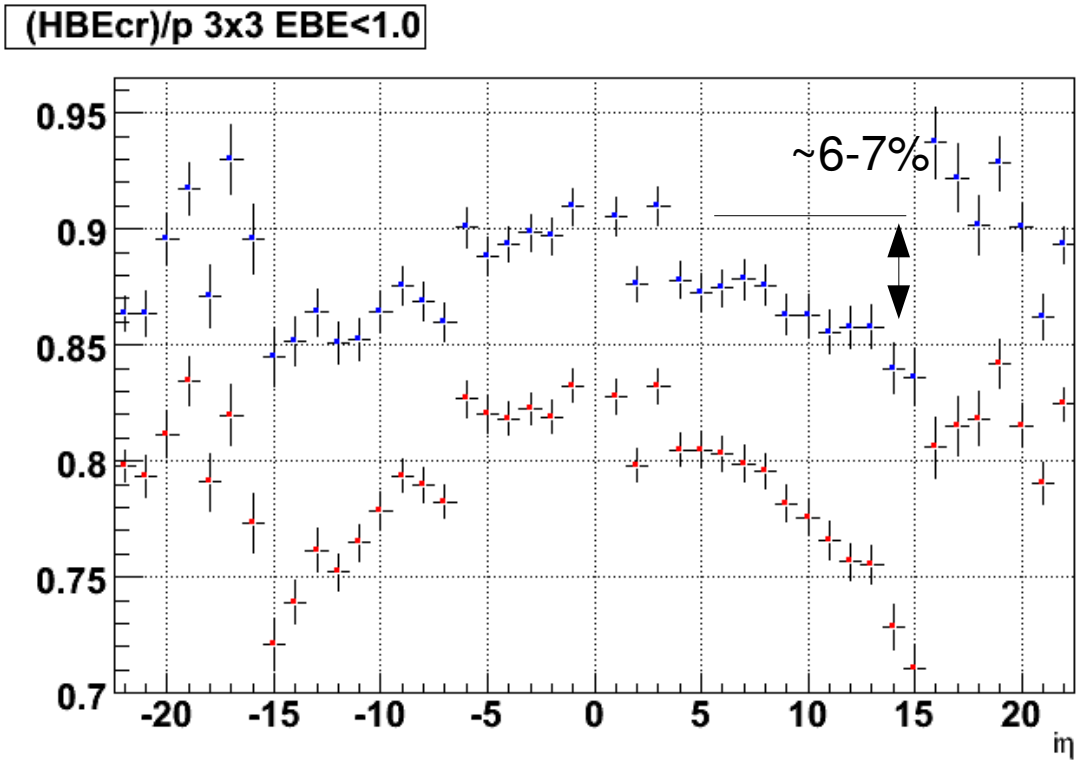



(HBEcr)/p 3x3 EBE<1.0
+4%
+1%
E/p 100 GeV w/o HO
MIP in ECAL


(HBEcr +HO)/p 3x3 EBE<1.0
+4%
+3%
E/p 100 GeV with HO
MIP in ECAL

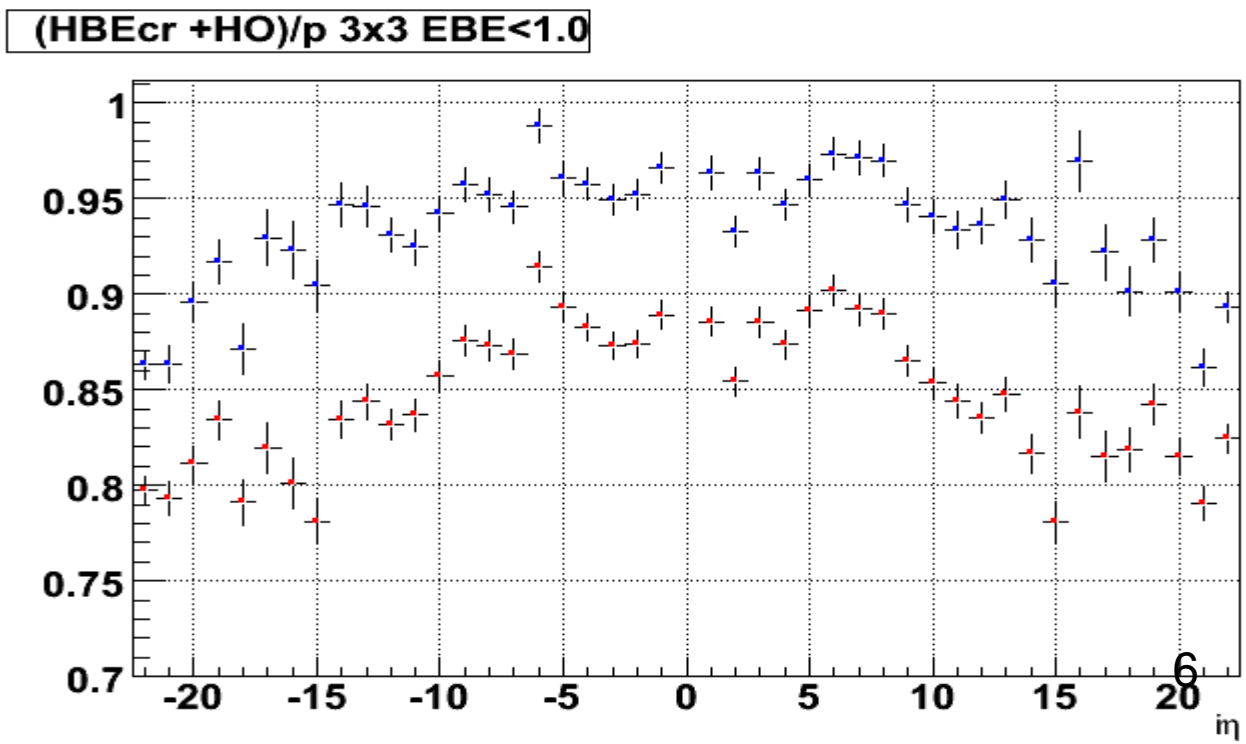

(HBEcr)/p 3x3 EBE<1.0
+8%
+1%
E/p 300 GeV w/o HO
MIP in ECAL
iη


(HBEcr +HO)/p 3x3 EBE<1.0
+4%
+8%
E/p 300 GeV with HO
MIP in ECAL
iη

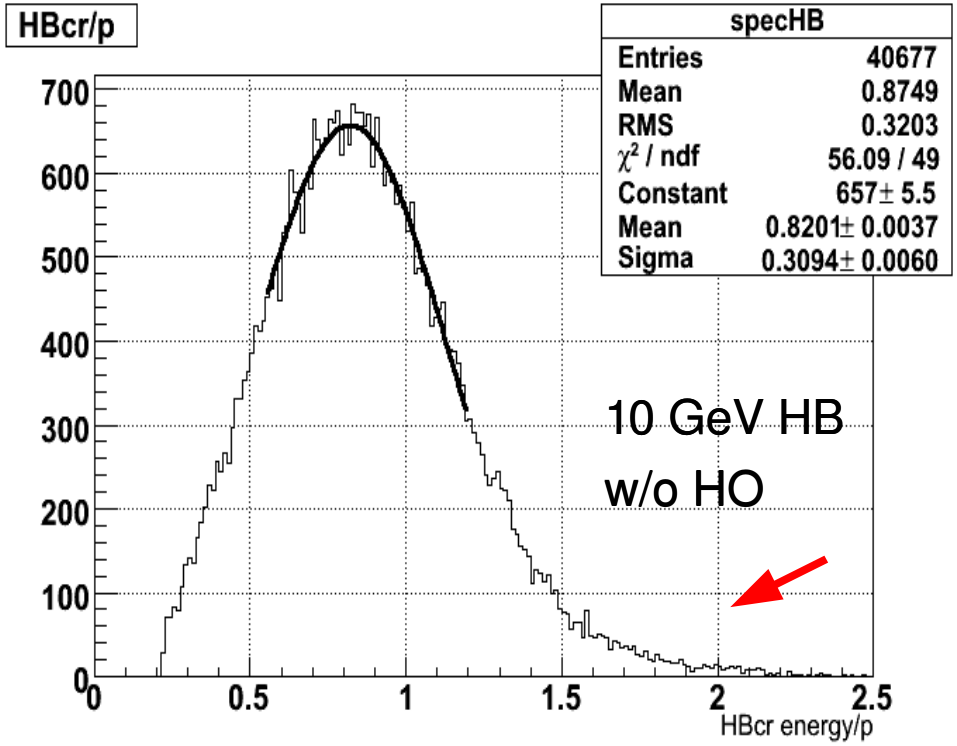


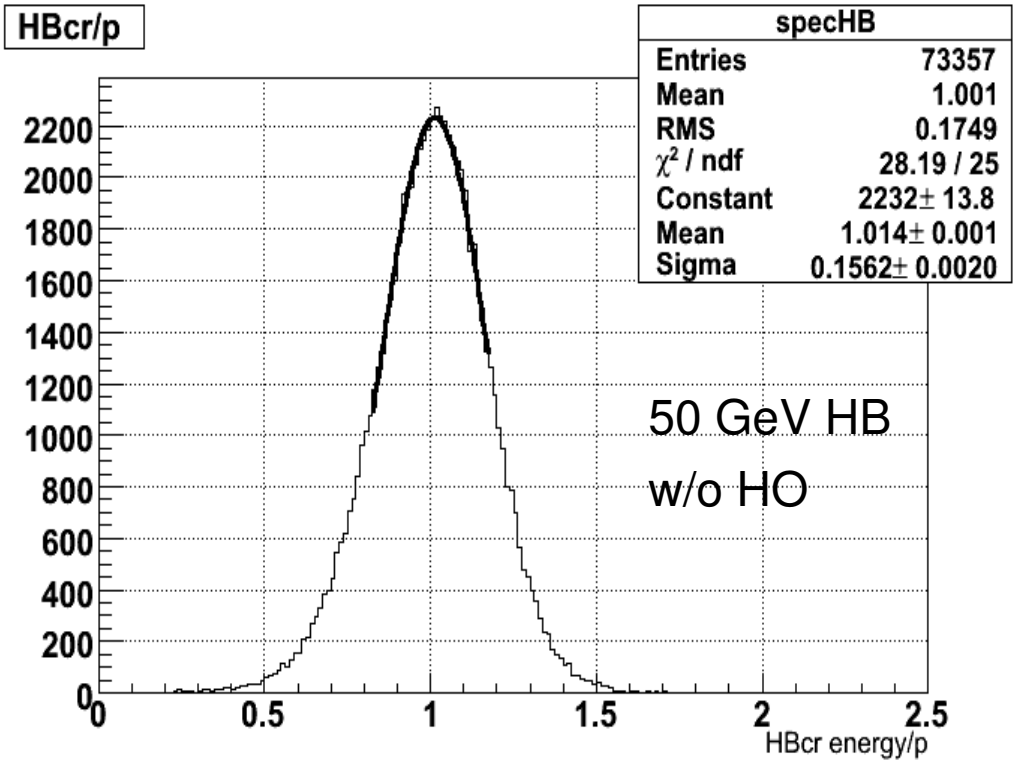
E/p 10 GeV w/o HO
MIP in ECAL

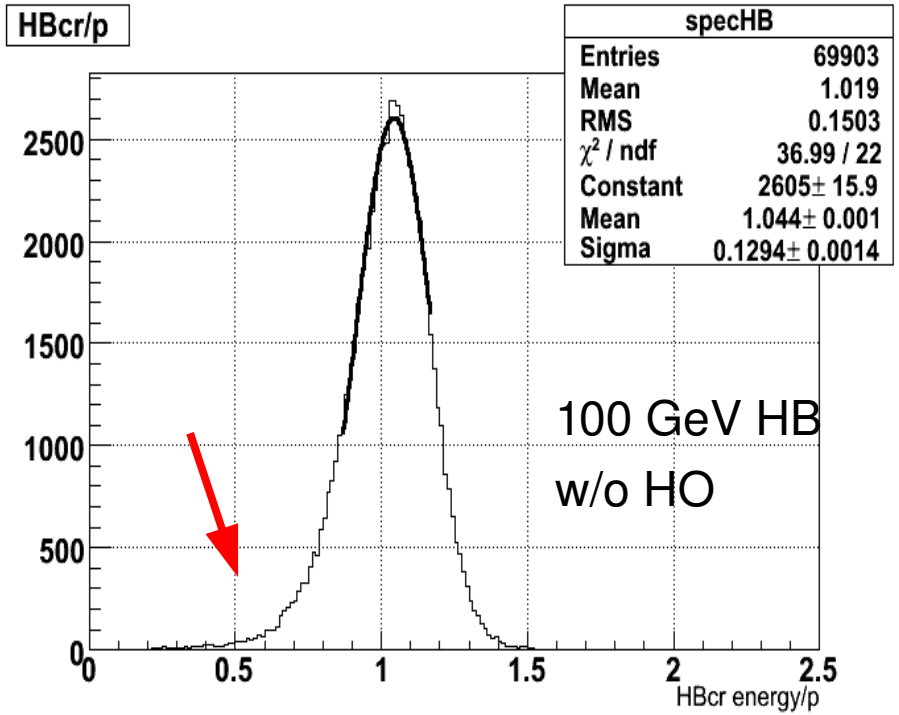
E/p 10 GeV with HO
MIP in ECAL

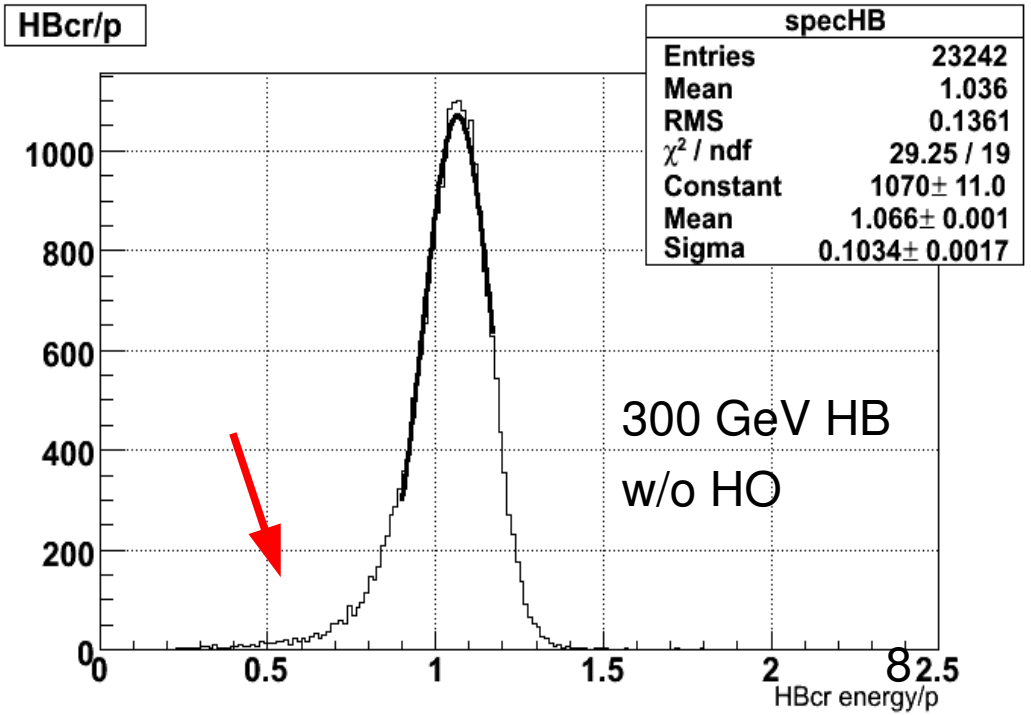


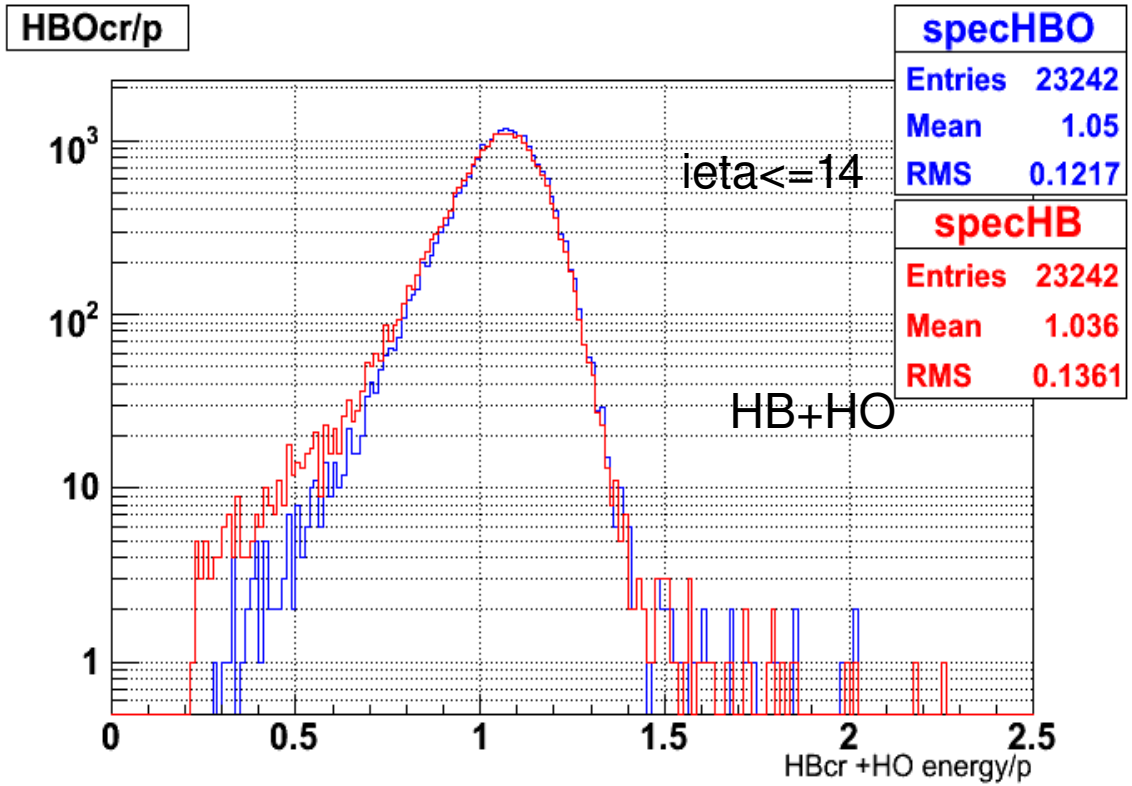
HB energy spectra (MIP in ECAL)


HBcr/p
specHB
Entries 40677
Mean 0.8749
RMS 0.3203
χ² / ndf 56.09 / 49
Constant 657± 5.5
Mean 0.8201± 0.0037
Sigma 0.3094± 0.0060
10 GeV HB
w/o HO
HBcr energy/p


HBcr/p
specHB
Entries 73357
Mean 1.001
RMS 0.1749
χ² / ndf 28.19 / 25
Constant 2232± 13.8
Mean 1.014± 0.001
Sigma 0.1562± 0.0020
50 GeV HB
w/o HO
HBcr energy/p

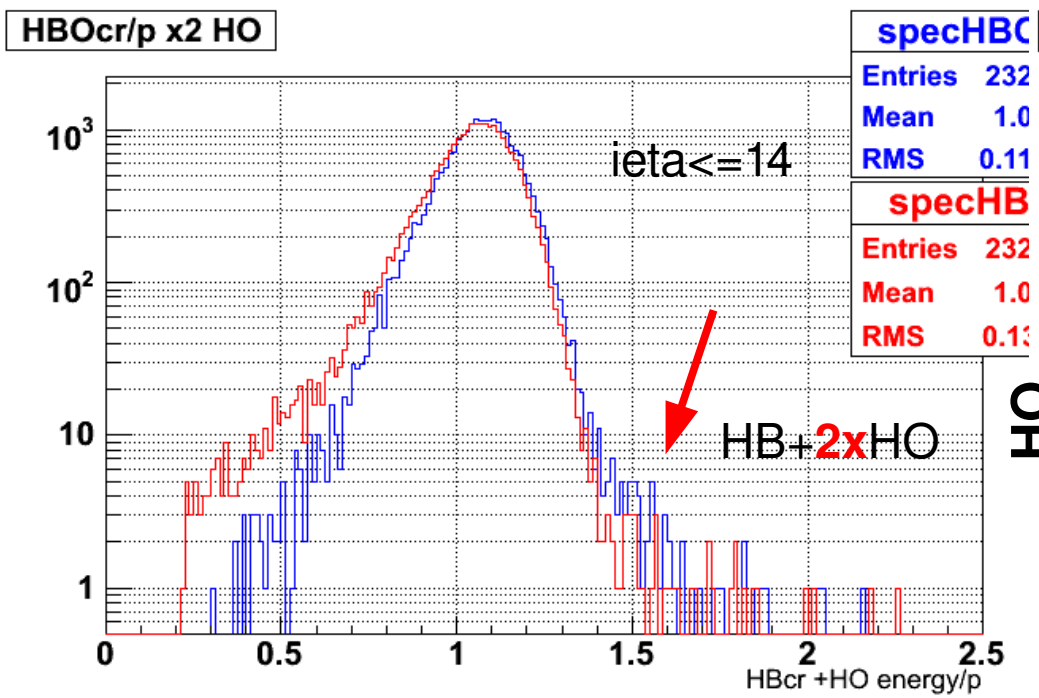

HBcr/p
specHB
Entries 69903
Mean 1.019
RMS 0.1503
χ² / ndf 36.99 / 22
Constant 2605± 15.9
Mean 1.044± 0.001
Sigma 0.1294± 0.0014
100 GeV HB
w/o HO
HBcr energy/p


HBcr/p
specHB
Entries 23242
Mean 1.036
RMS 0.1361
χ² / ndf 29.25 / 19
Constant 1070± 11.0
Mean 1.066± 0.001
Sigma 0.1034± 0.0017
300 GeV HB
w/o HO
HBcr energy/p

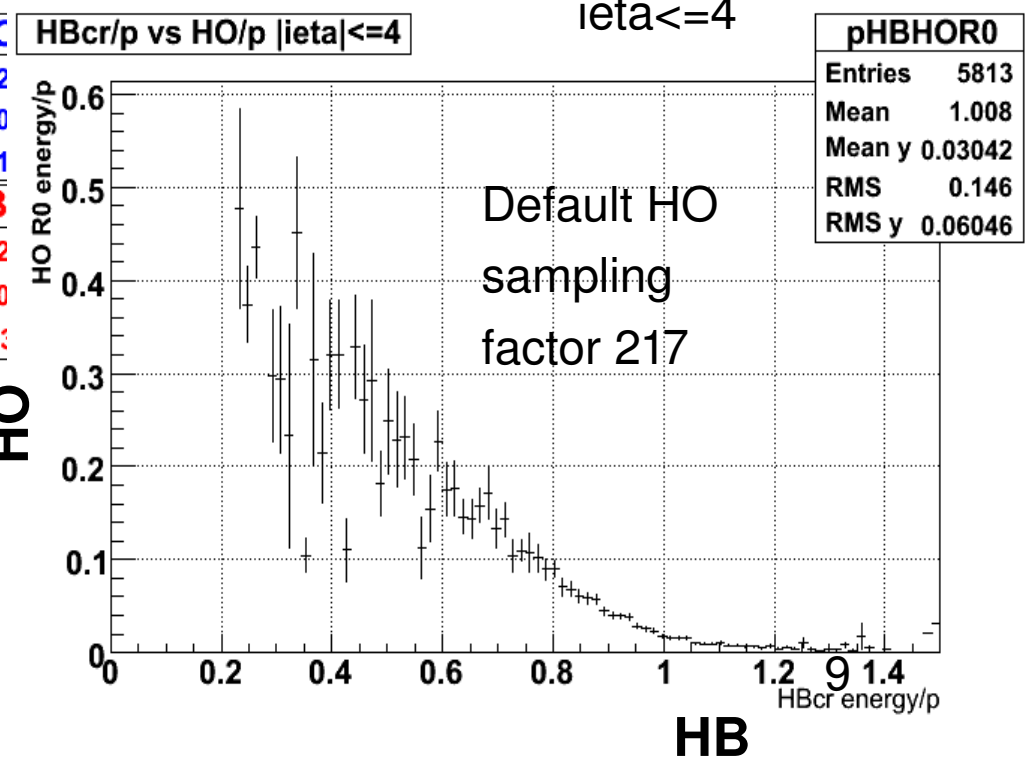


Pi 300 GeV with HO

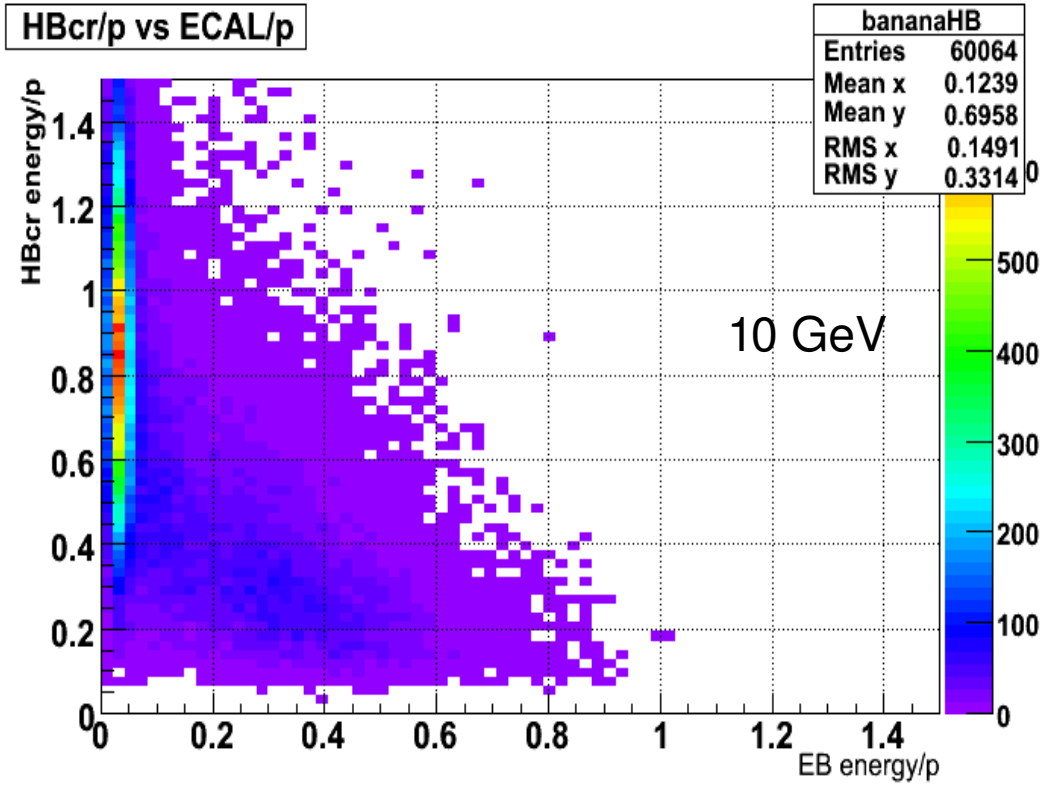
HO effect on the leakage

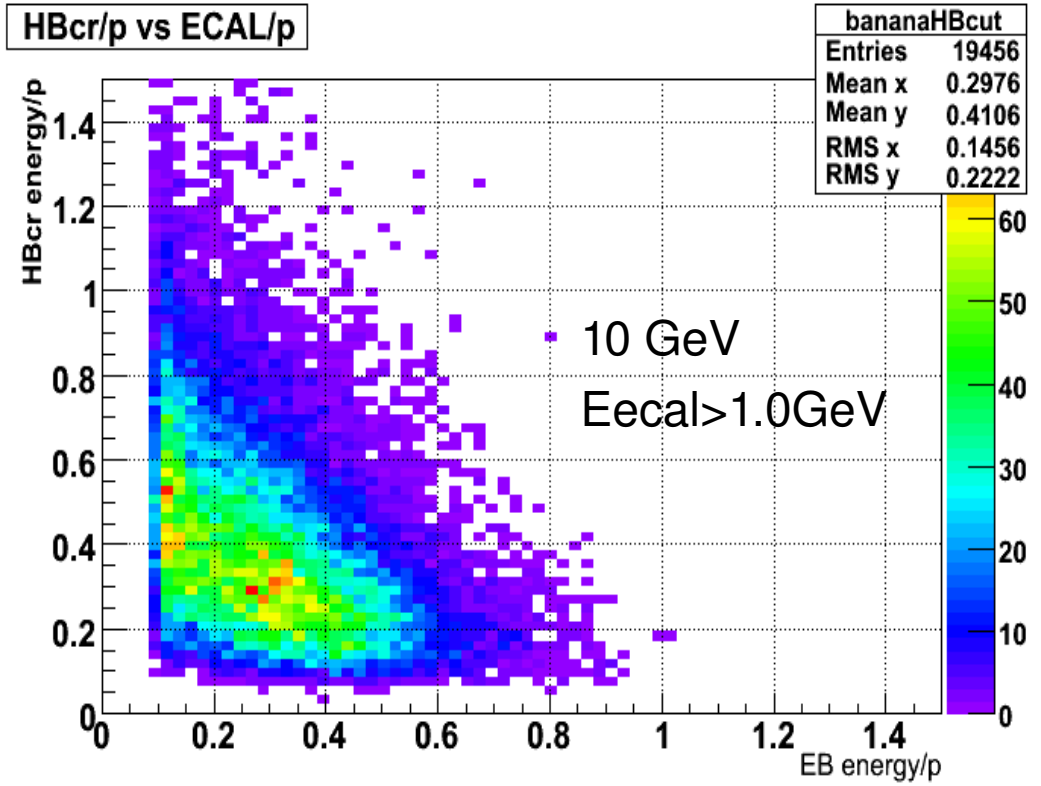


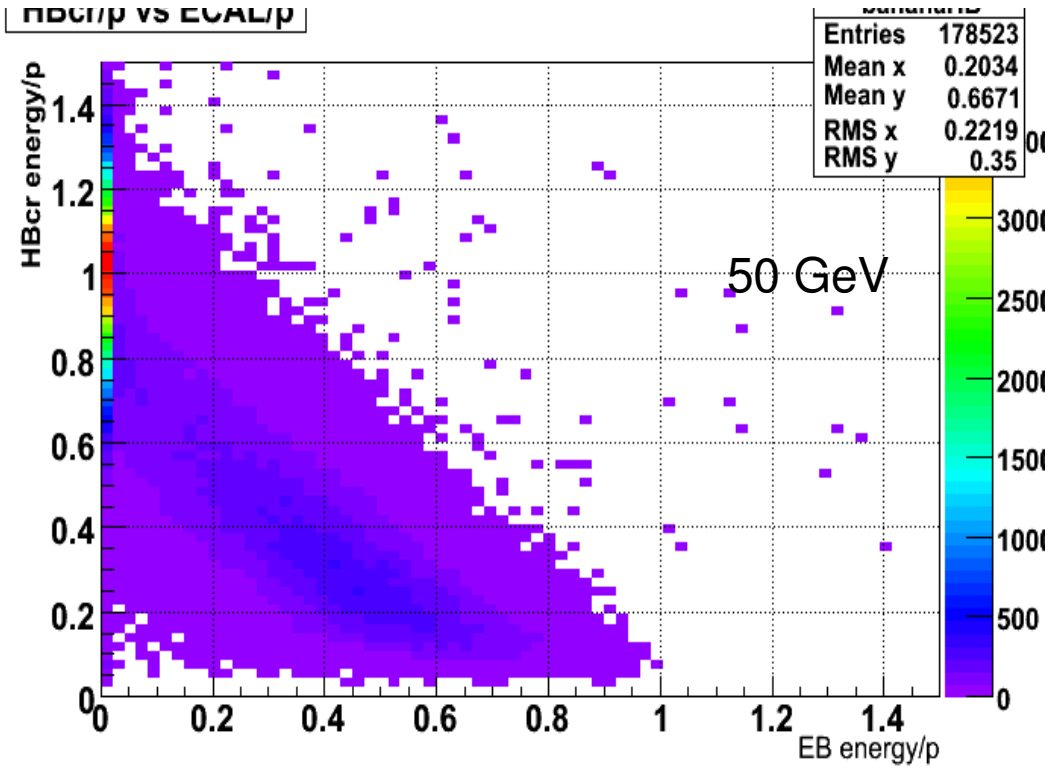
ieta<=4

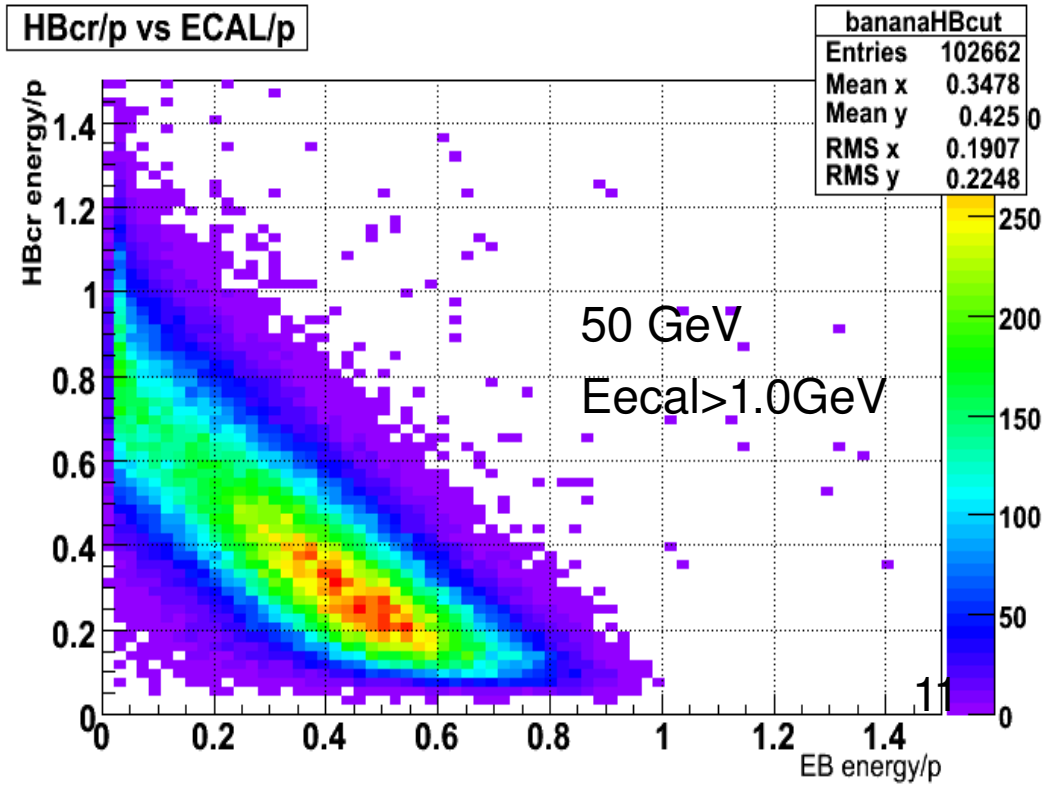


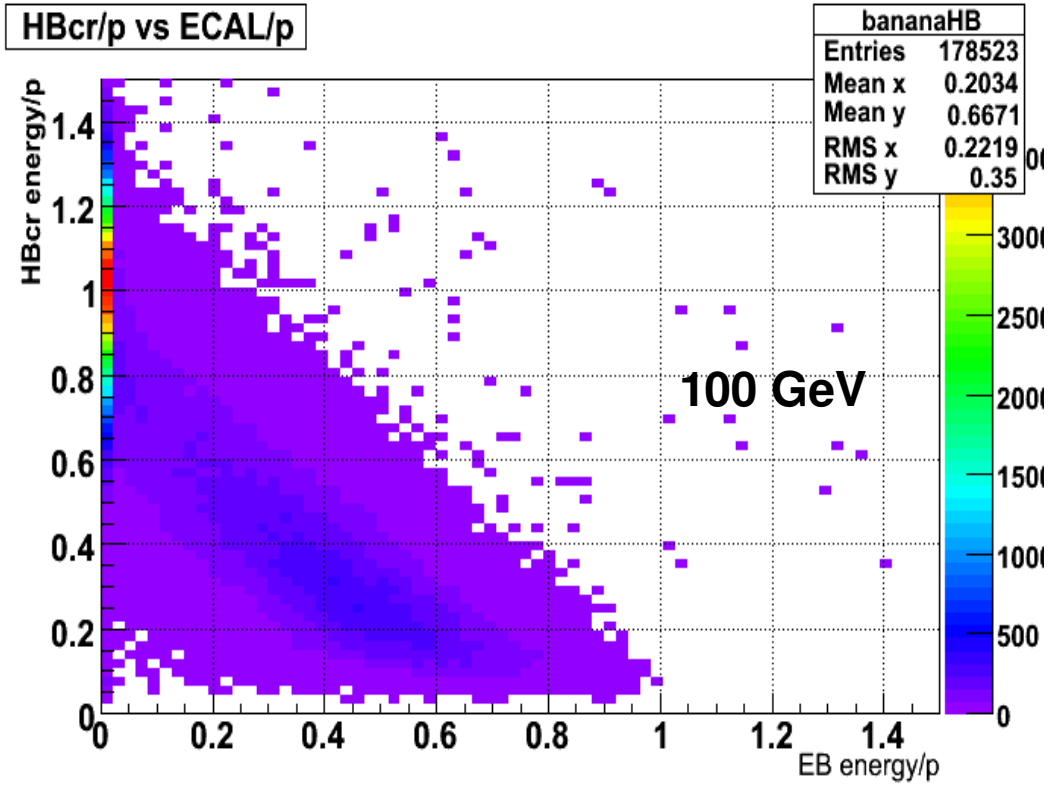
ECAL vs HCAL energy distribution

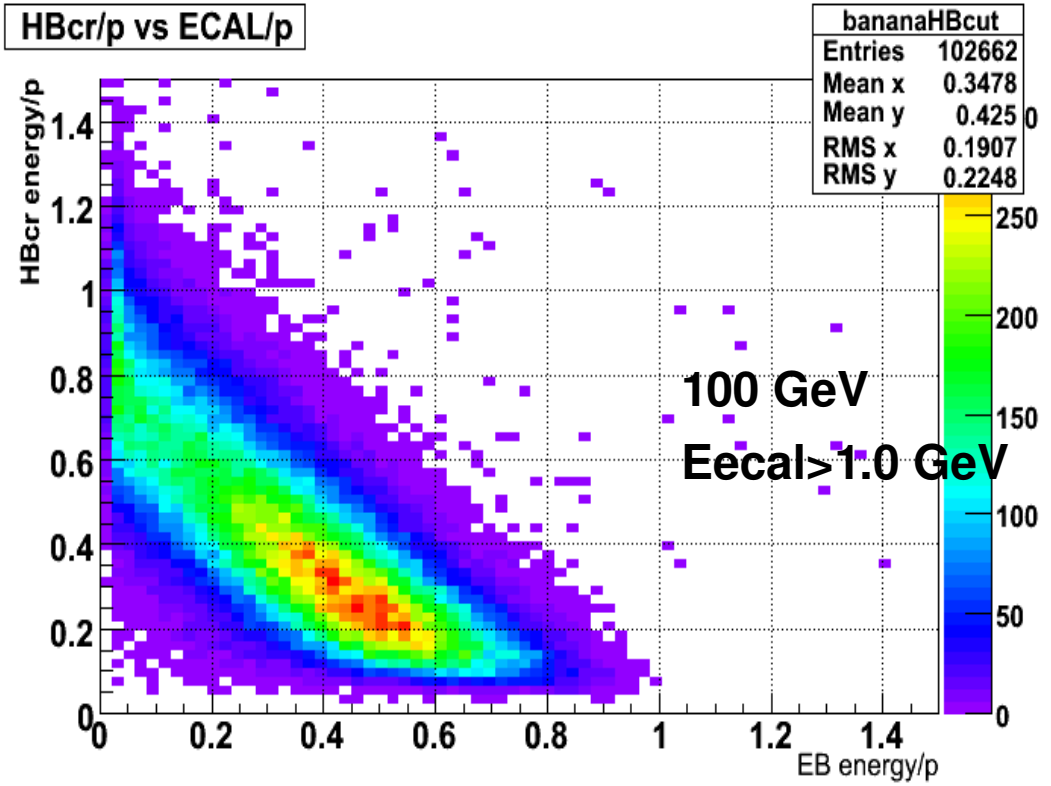

HBcr/p vs ECAL/p
bananaHB
Entries 60064
Mean x 0.1239
Mean y 0.6958
RMS x 0.1491
RMS y 0.3314
10 GeV
HBcr energy/p
EB energy/p

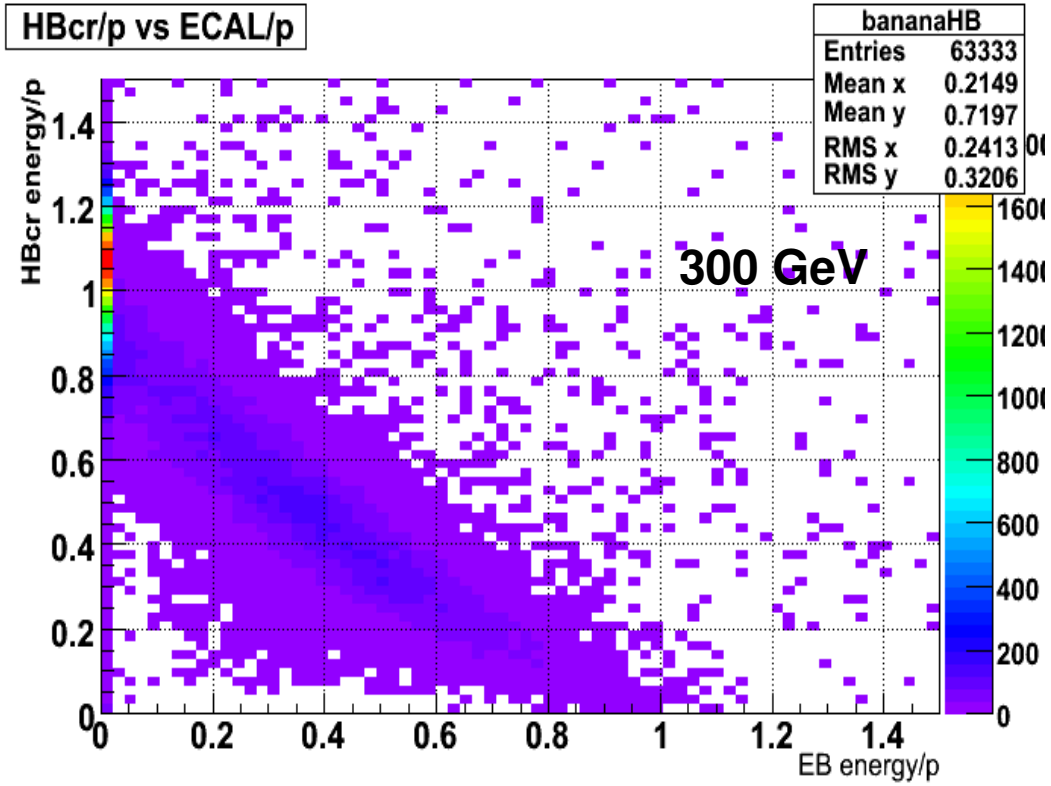

HBcr/p vs ECAL/p
bananaHBcut
Entries 19456
Mean x 0.2976
Mean y 0.4106
RMS x 0.1456
RMS y 0.2222
10 GeV
Eecal>1.0GeV
HBcr energy/p
EB energy/p

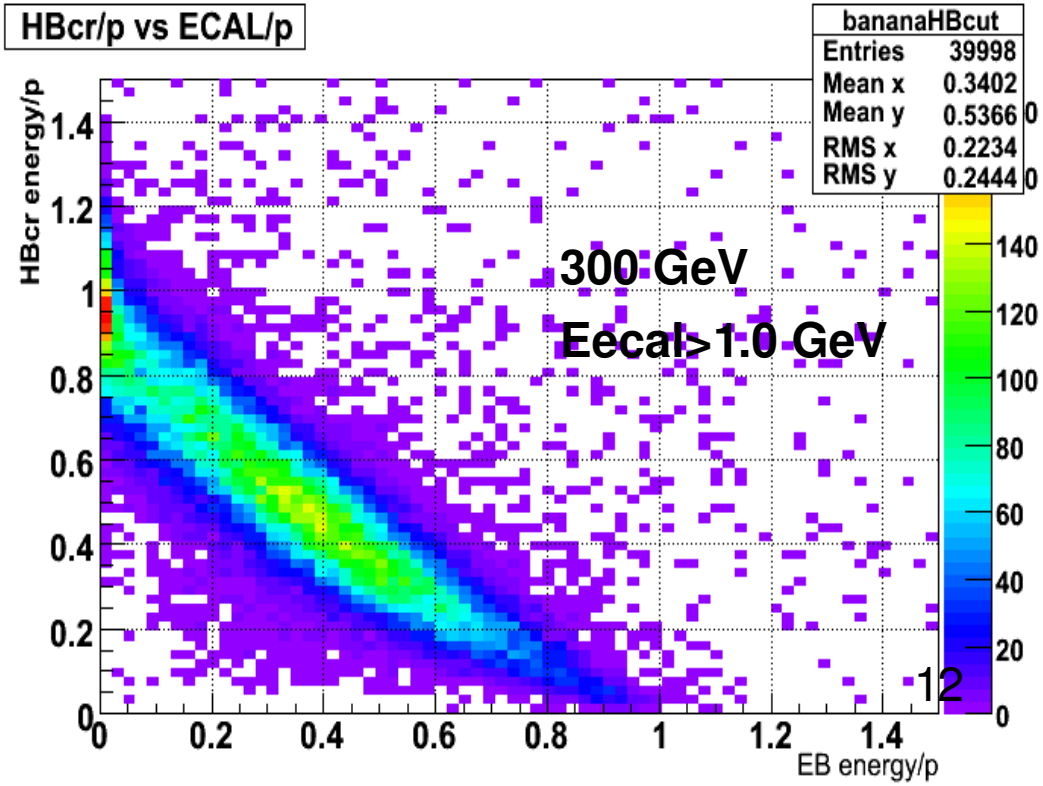

Entries 178523
Mean x 0.2034
Mean y 0.6671
RMS x 0.2219
RMS y 0.35
50 GeV
HBcr energy/p
EB energy/p


HBcr/p vs ECAL/p
bananaHBcut
Entries 102662
Mean x 0.3478
Mean y 0.425
RMS x 0.1907
RMS y 0.2248
50 GeV
Eecal>1.0GeV
HBcr energy/p
EB energy/p

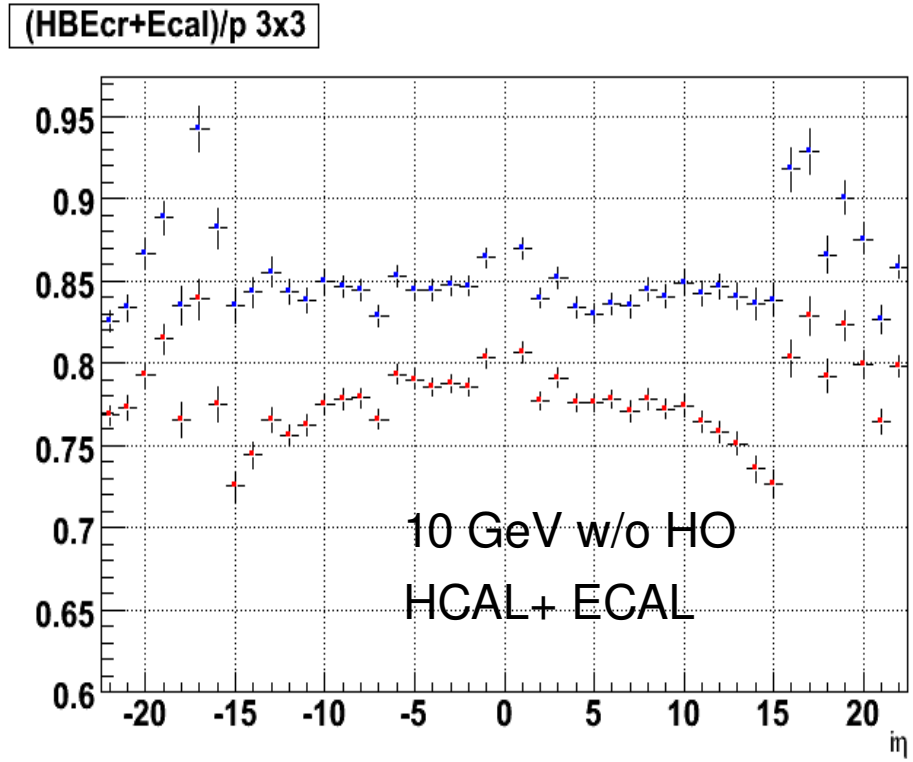

HBcr/p vs ECAL/p
bananaHB
Entries 178523
Mean x 0.2034
Mean y 0.6671
RMS x 0.2219
RMS y 0.35
100 GeV
HBcr energy/p
EB energy/p

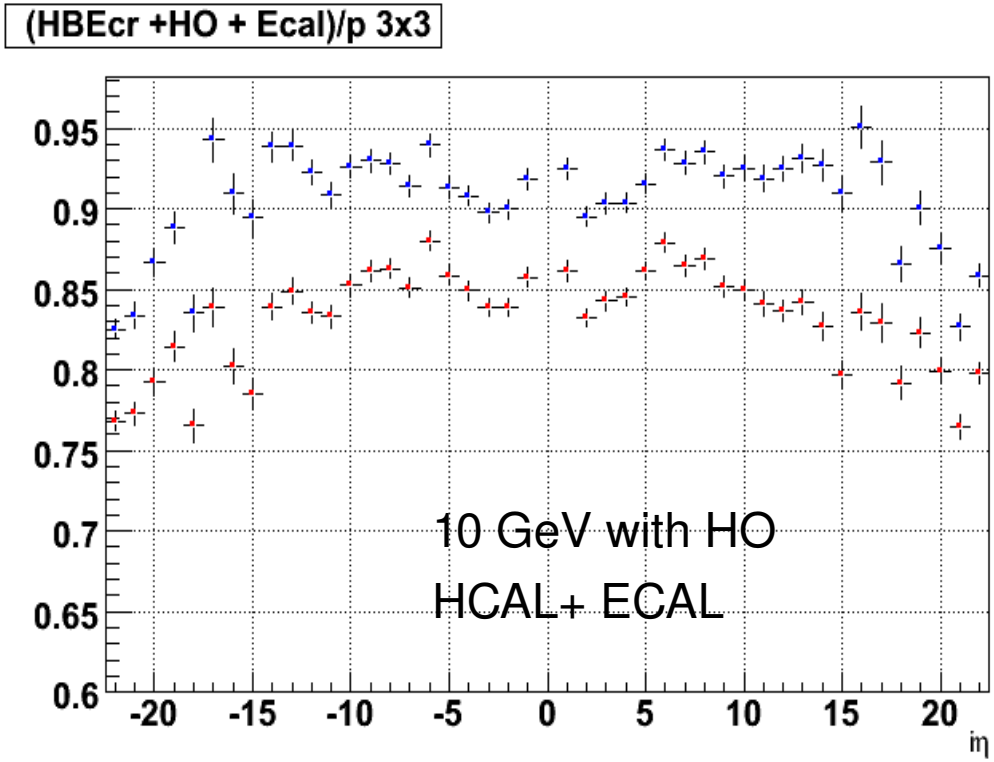

HBcr/p vs ECAL/p
bananaHBcut
Entries 102662
Mean x 0.3478
Mean y 0.425
RMS x 0.1907
RMS y 0.2248
100 GeV
Eecal>1.0 GeV
HBcr energy/p
EB energy/p

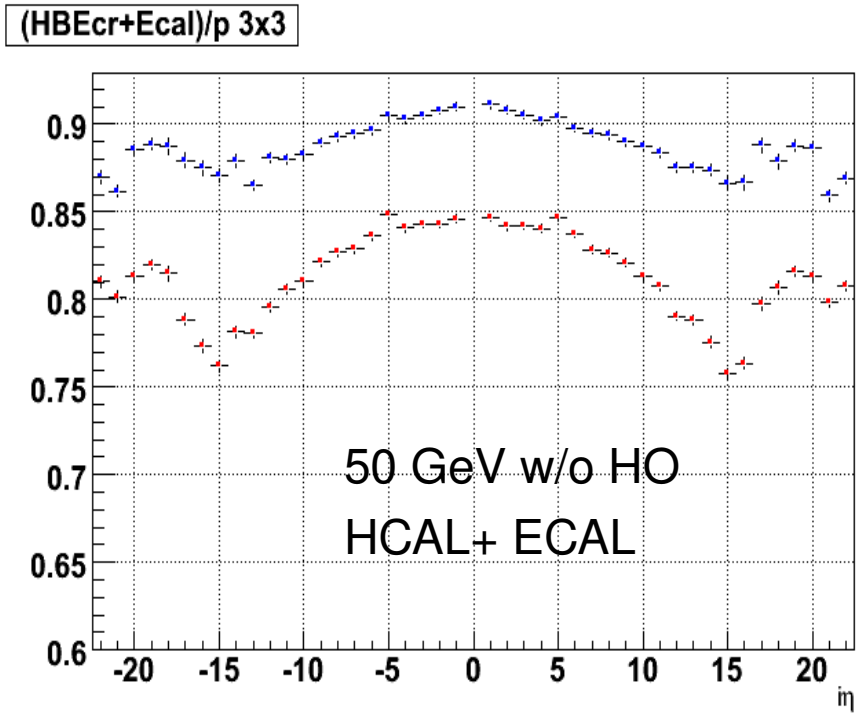

HBcr/p vs ECAL/p
bananaHB
Entries 63333
Mean x 0.2149
Mean y 0.7197
RMS x 0.2413
RMS y 0.3206
300 GeV
HBcr energy/p
EB energy/p

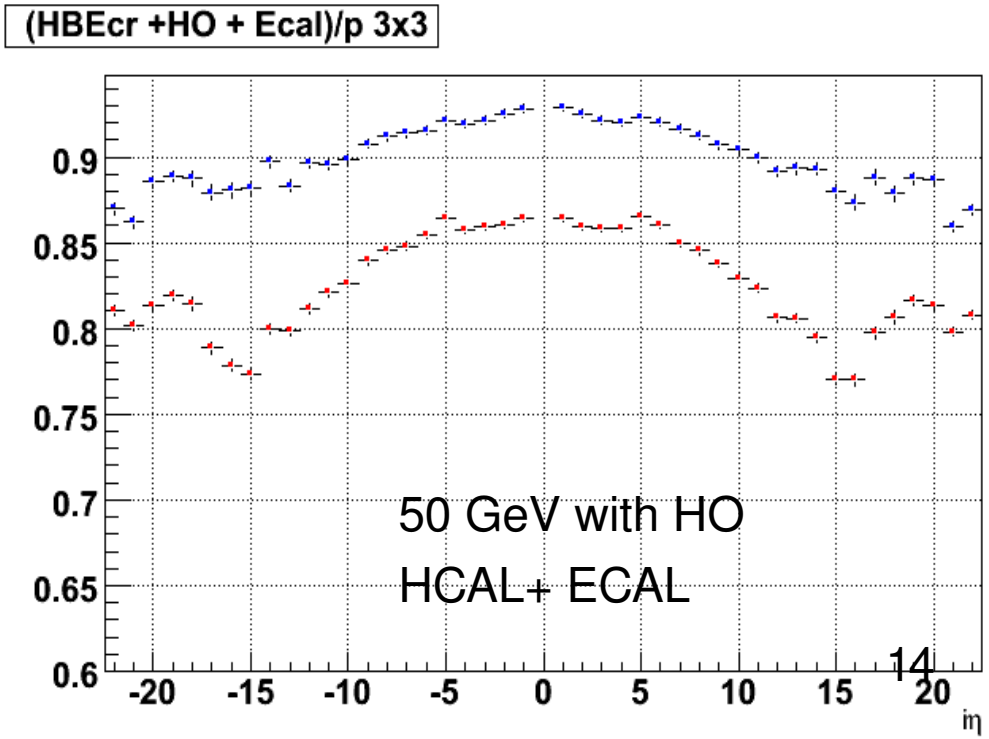

HBcr/p vs ECAL/p
bananaHBcut
Entries 39998
Mean x 0.3402
Mean y 0.5366
RMS x 0.2234
RMS y 0.2444
300 GeV
Eecal>1.0 GeV
HBcr energy/p
EB energy/p

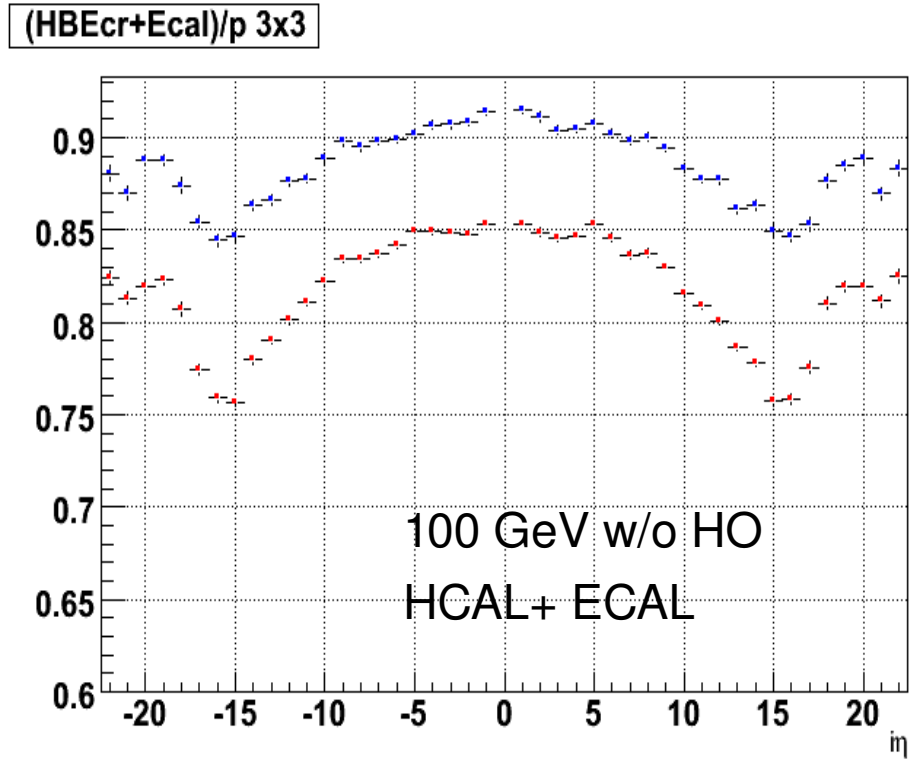
E/p for ECAL + HCAL

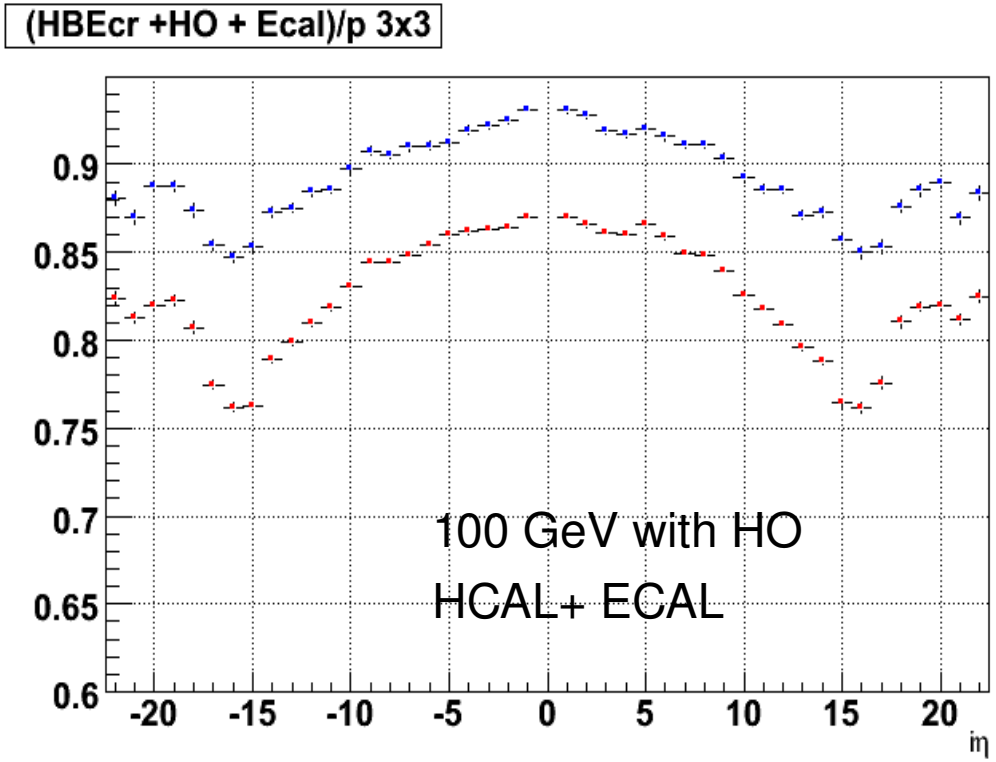

(HBEcr+Ecal)/p 3x3
10 GeV w/o HO
HCAL+ ECAL
iη

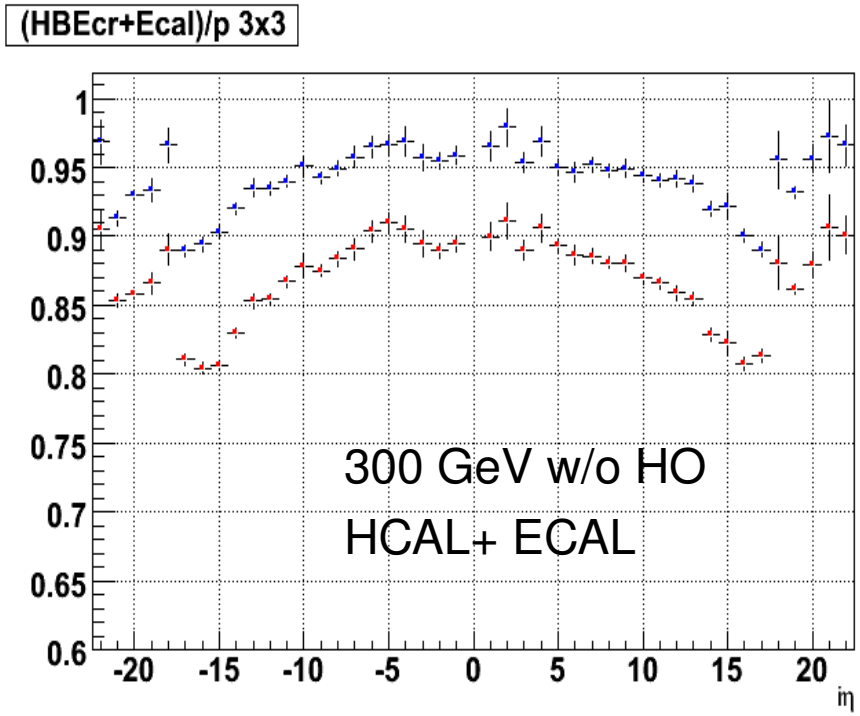

(HBEcr +HO + Ecal)/p 3x3
10 GeV with HO
HCAL+ ECAL
iη

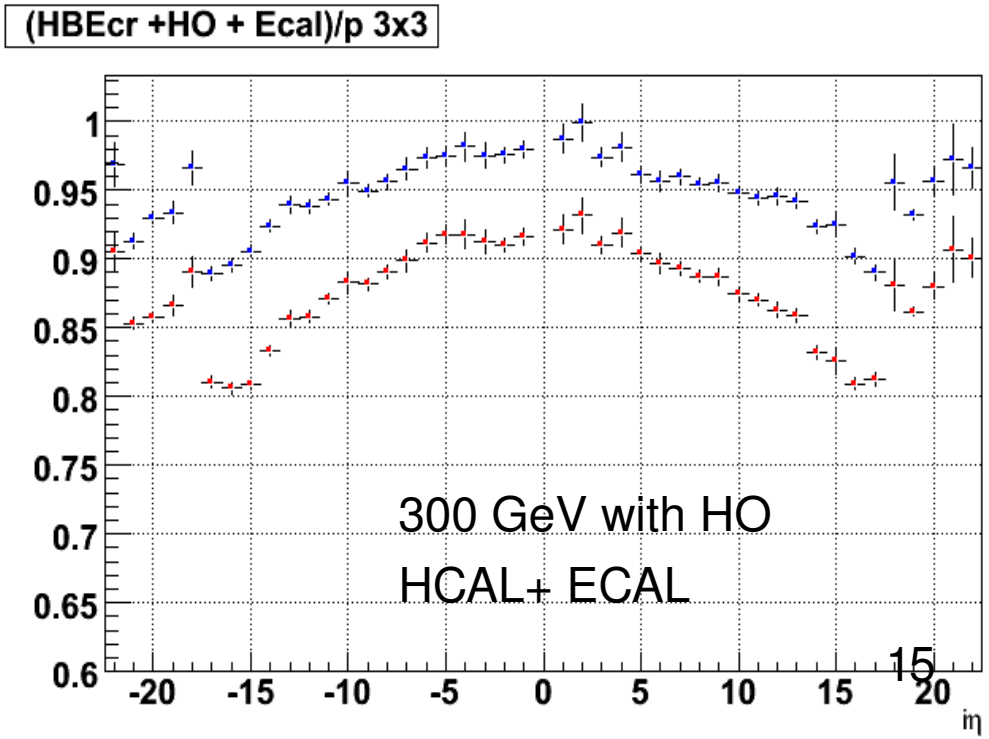

(HBEcr+Ecal)/p 3x3
50 GeV w/o HO
HCAL+ ECAL
iη


(HBEcr +HO + Ecal)/p 3x3
50 GeV with HO
HCAL+ ECAL
iη

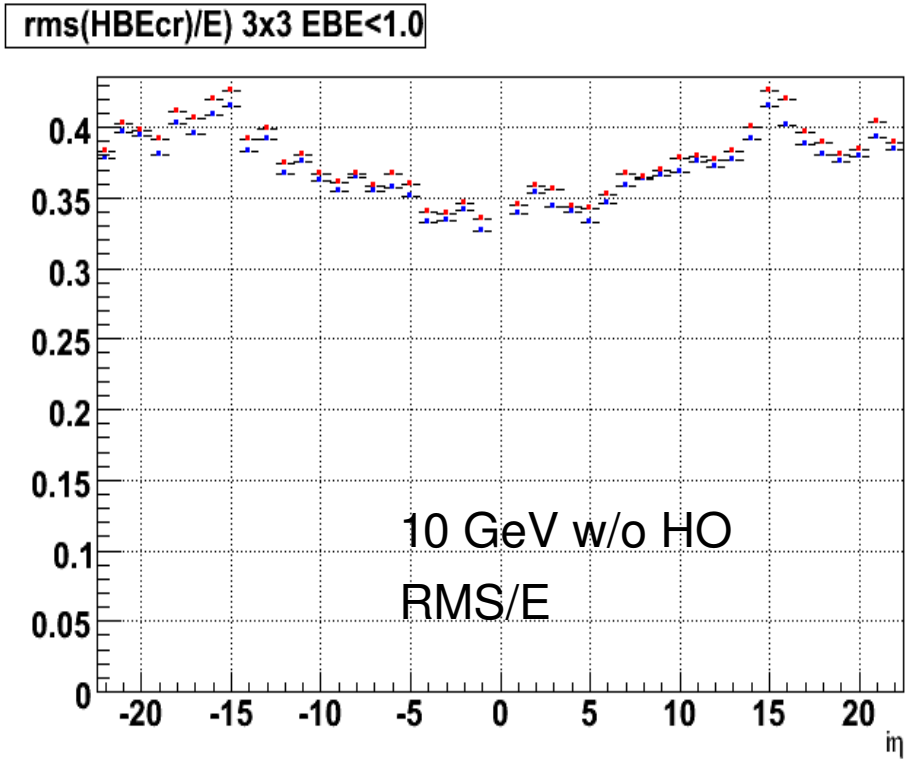

(HBEcr+Ecal)/p 3x3
100 GeV w/o HO
HCAL+ ECAL
iη

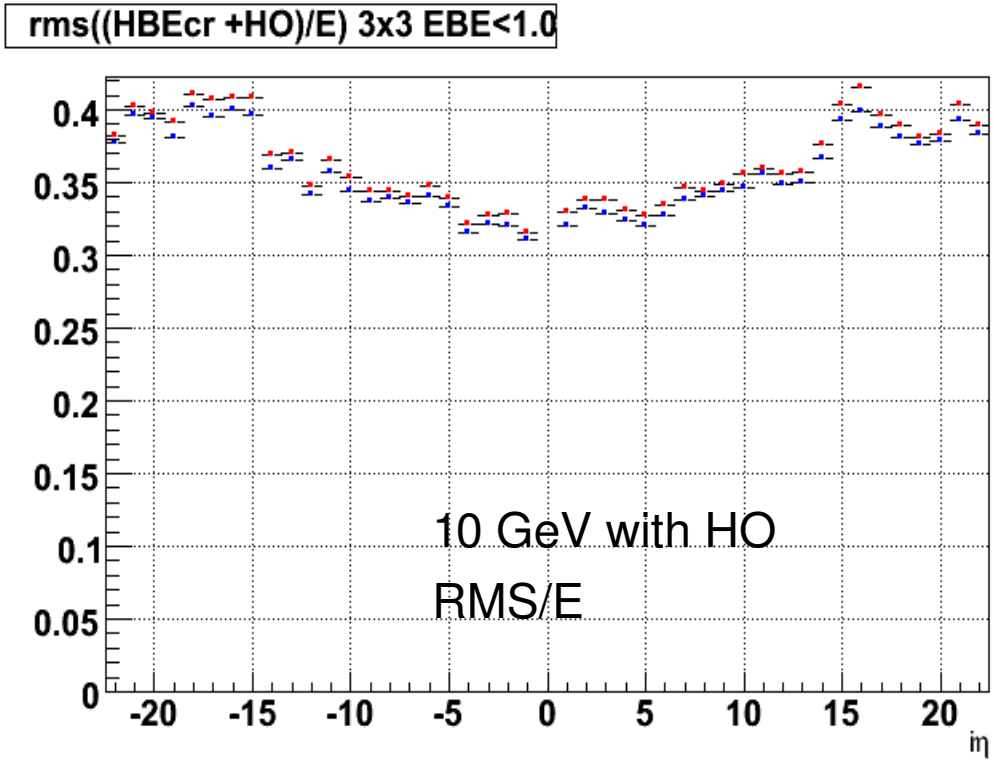

(HBEcr +HO + Ecal)/p 3x3
100 GeV with HO
HCAL+ ECAL
iη

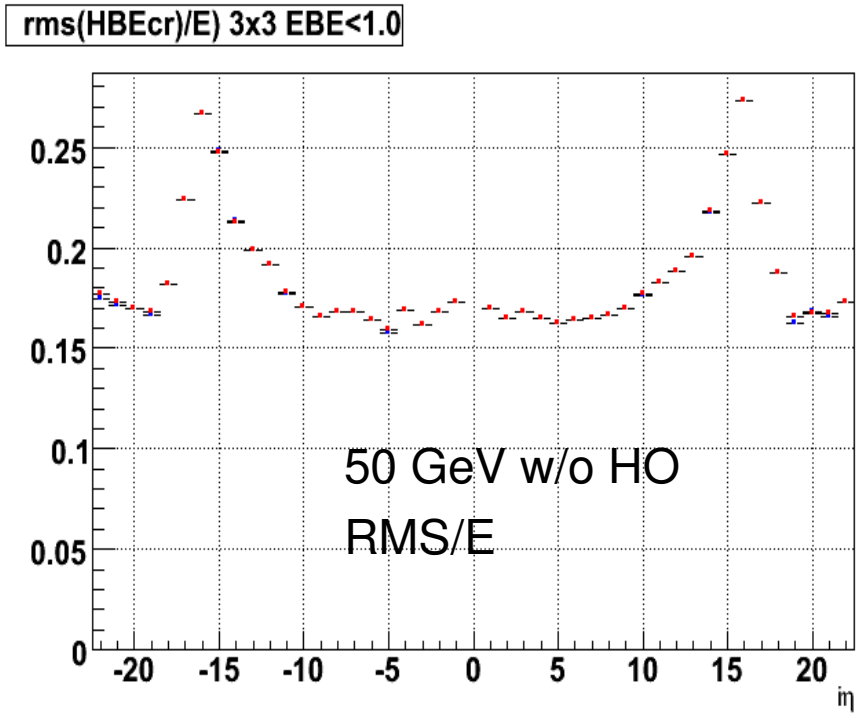

(HBEcr+Ecal)/p 3x3
300 GeV w/o HO
HCAL+ ECAL
iη

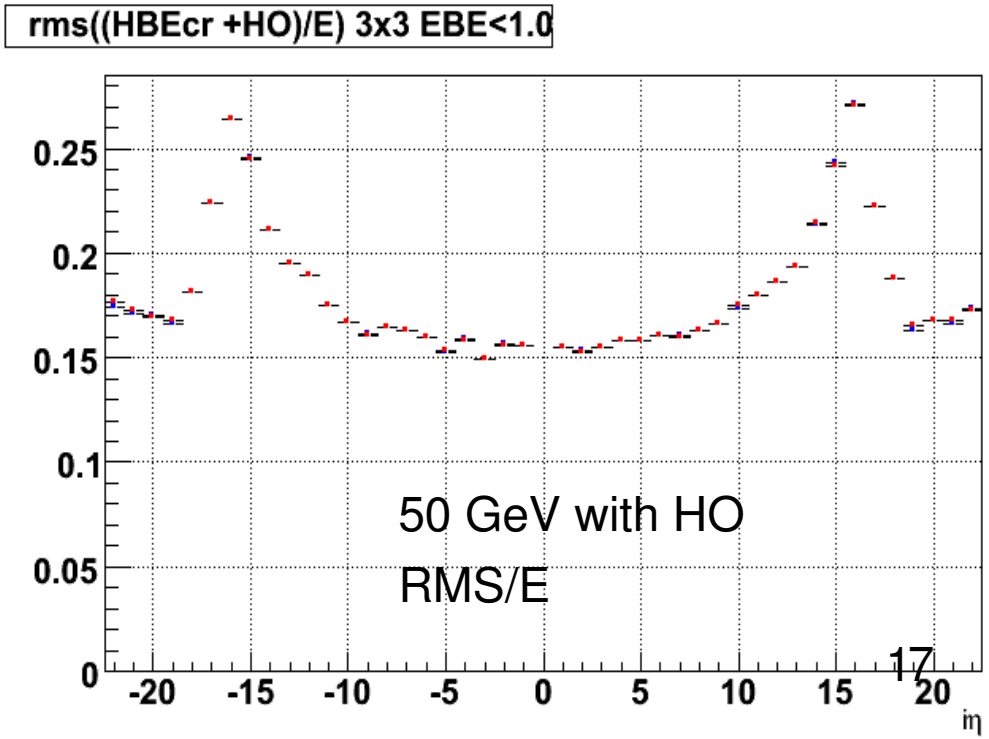

(HBEcr +HO + Ecal)/p 3x3
300 GeV with HO
HCAL+ ECAL
iη

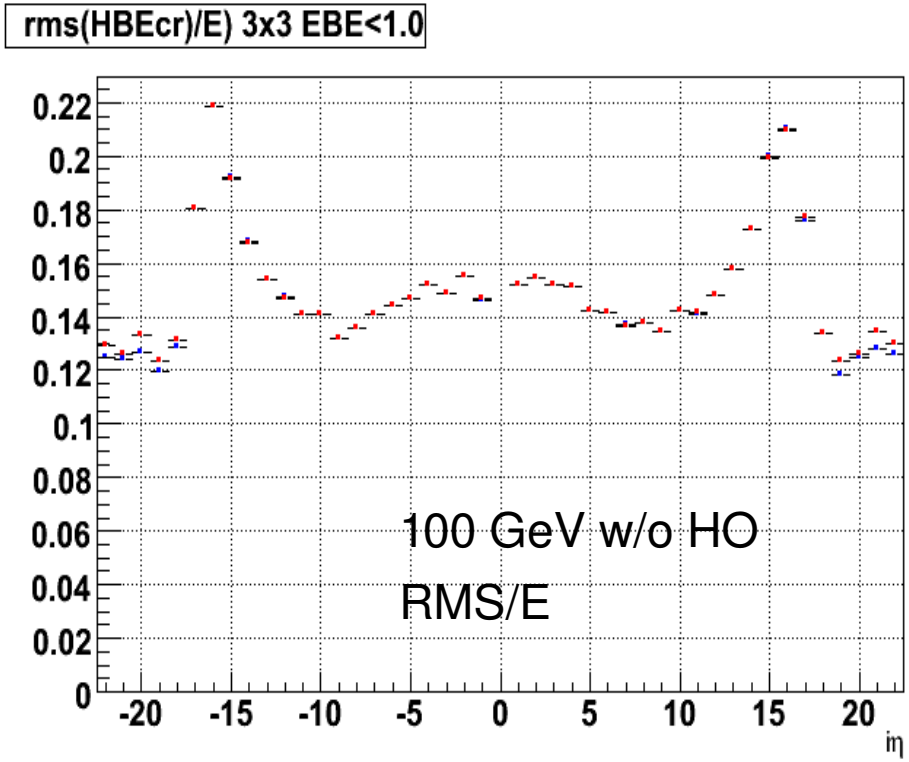
Resolution (RMS/E) for MIP in ECAL

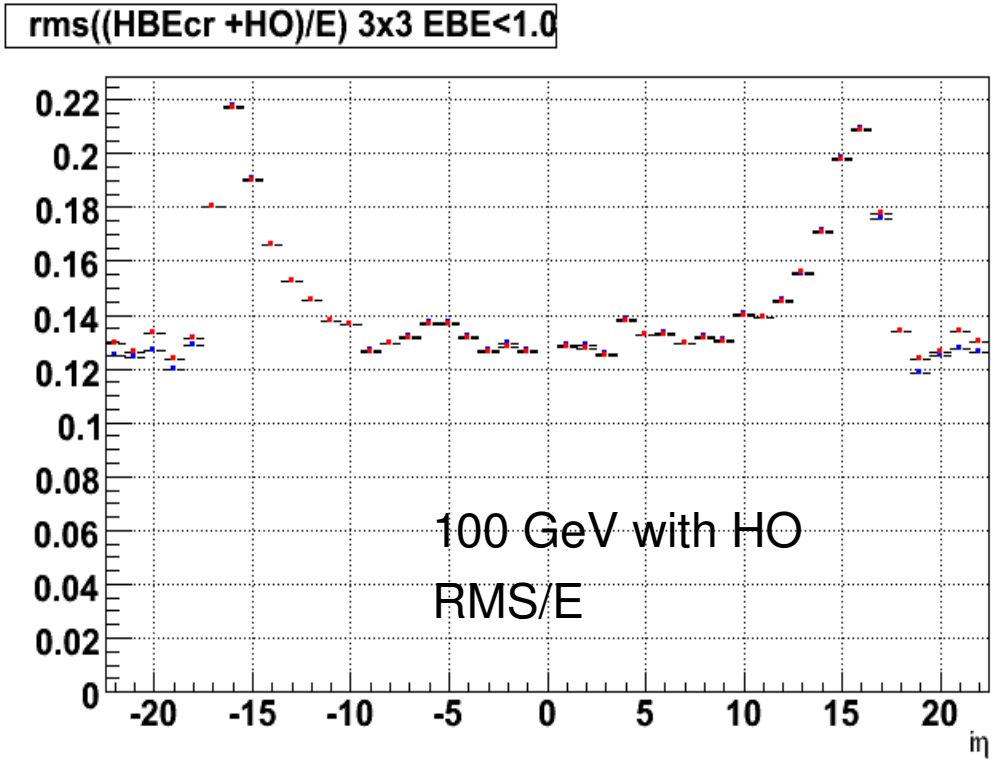

rms(HBEcr)/E) 3x3 EBE<1.0
10 GeV w/o HO
RMS/E
iη

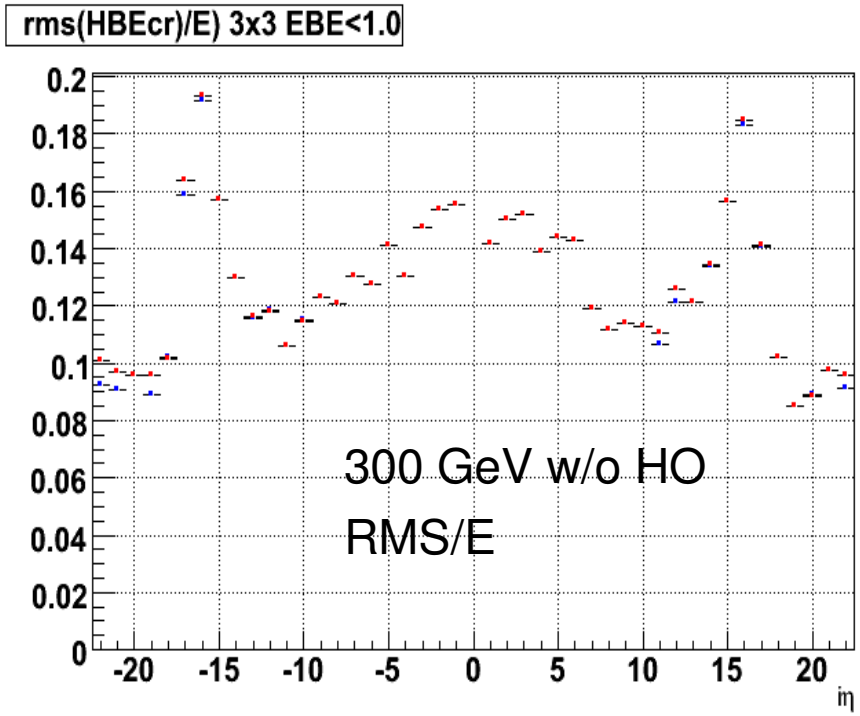

rms((HBEcr +HO)/E) 3x3 EBE<1.0
10 GeV with HO
RMS/E
iη

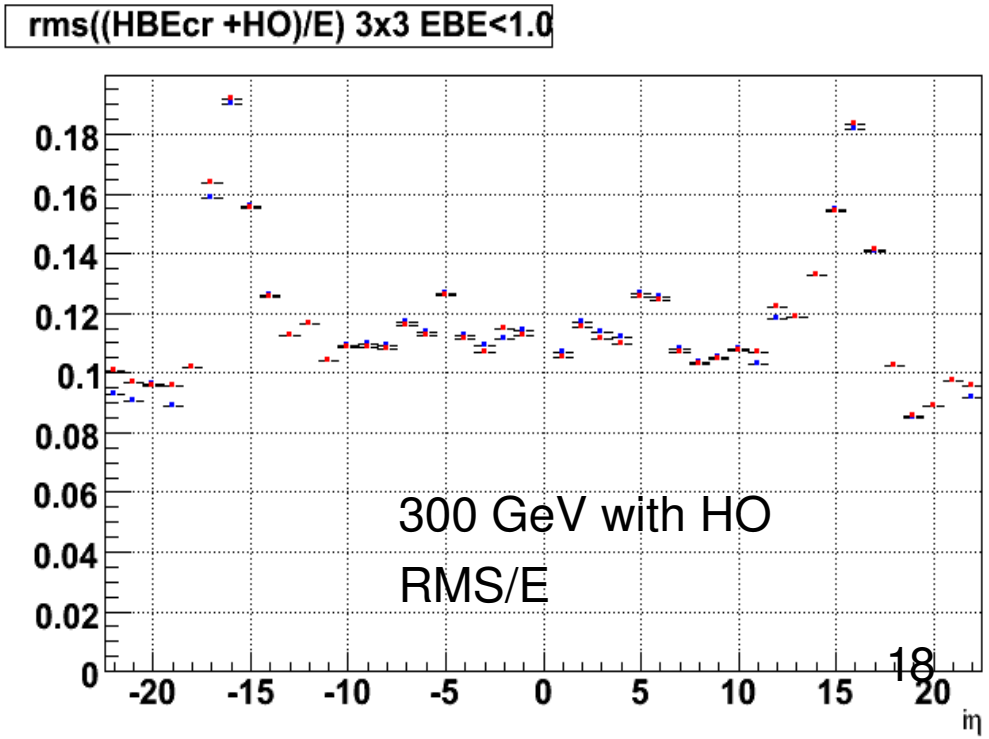

rms(HBEcr)/E) 3x3 EBE<1.0
50 GeV w/o HO
RMS/E
iη


rms((HBEcr +HO)/E) 3x3 EBE<1.0
50 GeV with HO
RMS/E
iη

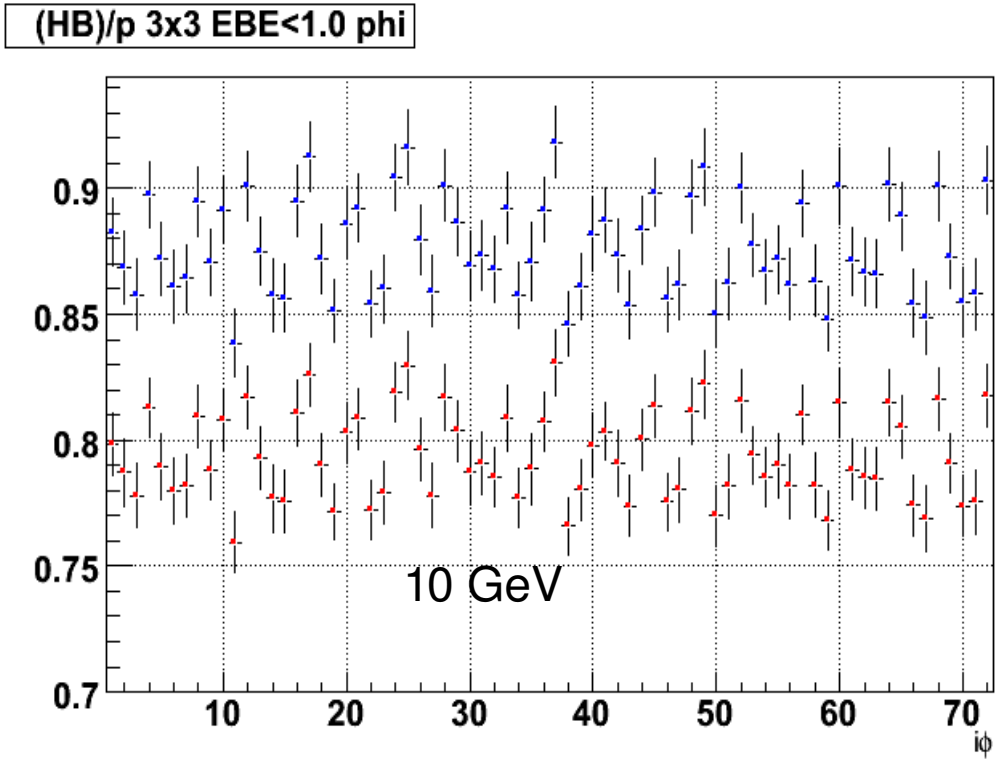

rms(HBEcr)/E) 3x3 EBE<1.0
100 GeV w/o HO
RMS/E
iη

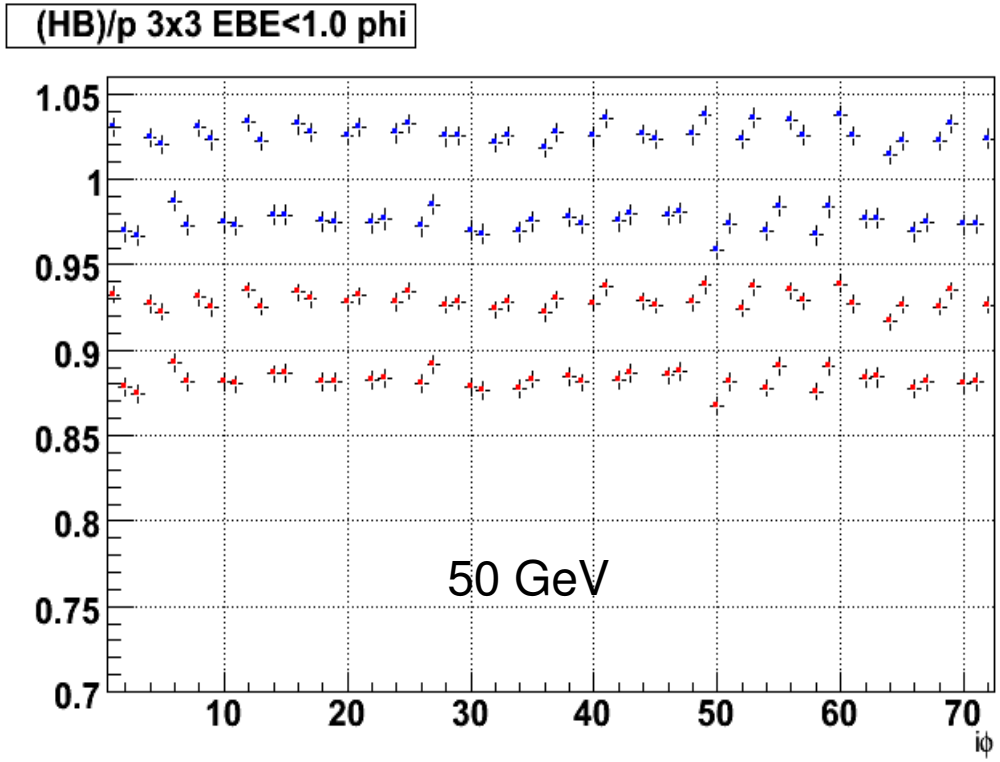

rms((HBEcr +HO)/E) 3x3 EBE<1.0
100 GeV with HO
RMS/E
iη

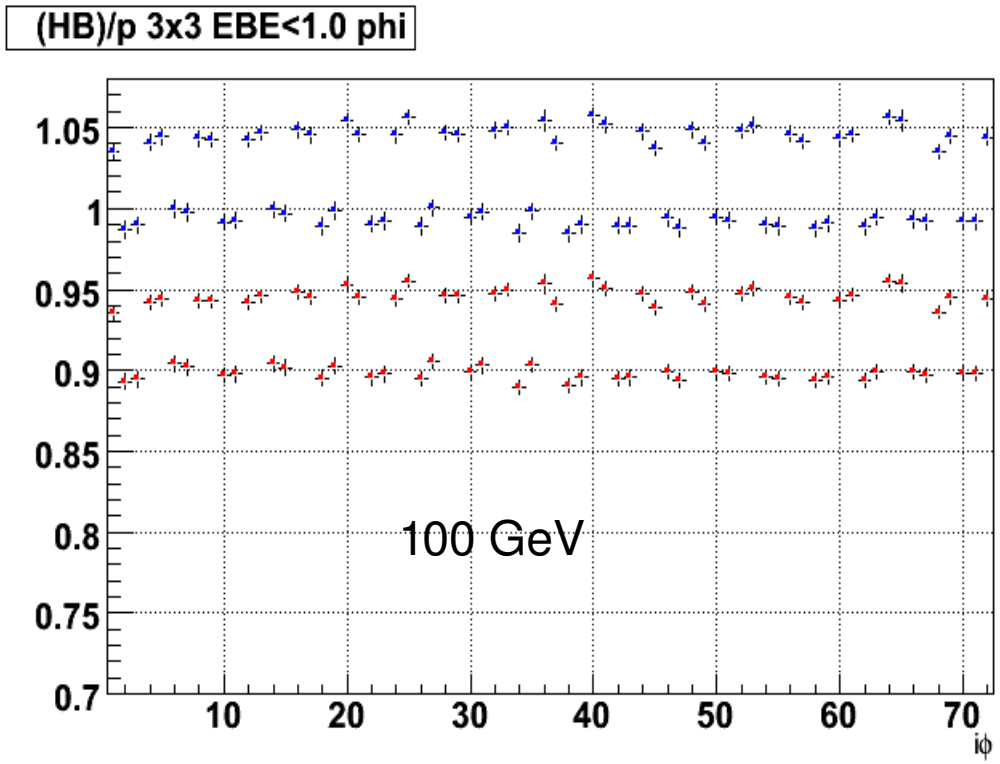

rms(HBEcr)/E) 3x3 EBE<1.0
300 GeV w/o HO
RMS/E
iη

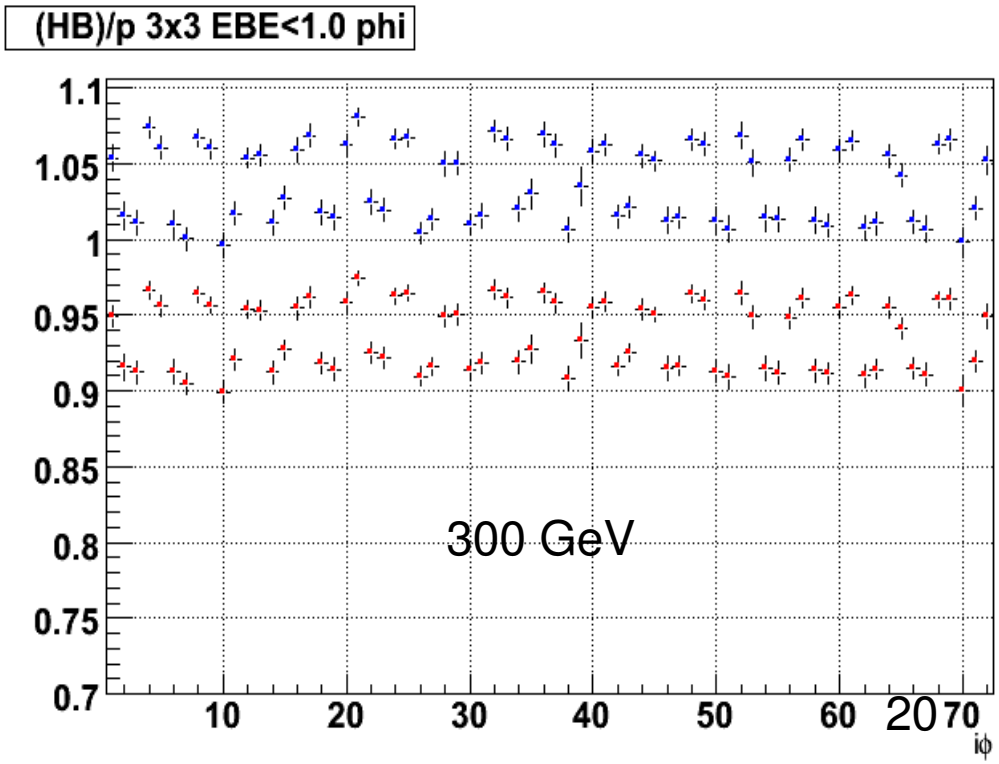

rms((HBEcr +HO)/E) 3x3 EBE<1.0
300 GeV with HO
RMS/E
iη

Material effect in HB (MIP in ECAL)


(HB)/p 3x3 EBE<1.0 phi
10 GeV
iϕ


(HB)/p 3x3 EBE<1.0 phi
50 GeV
iϕ

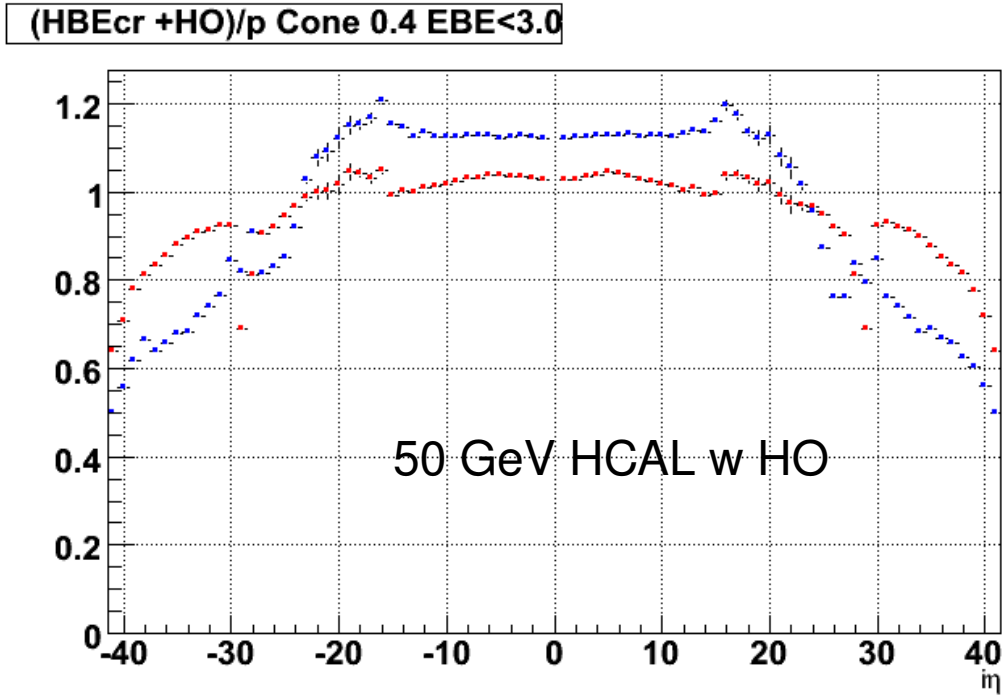

(HB)/p 3x3 EBE<1.0 phi
100 GeV
iϕ


(HB)/p 3x3 EBE<1.0 phi
300 GeV
iϕ

Performance check at full eta

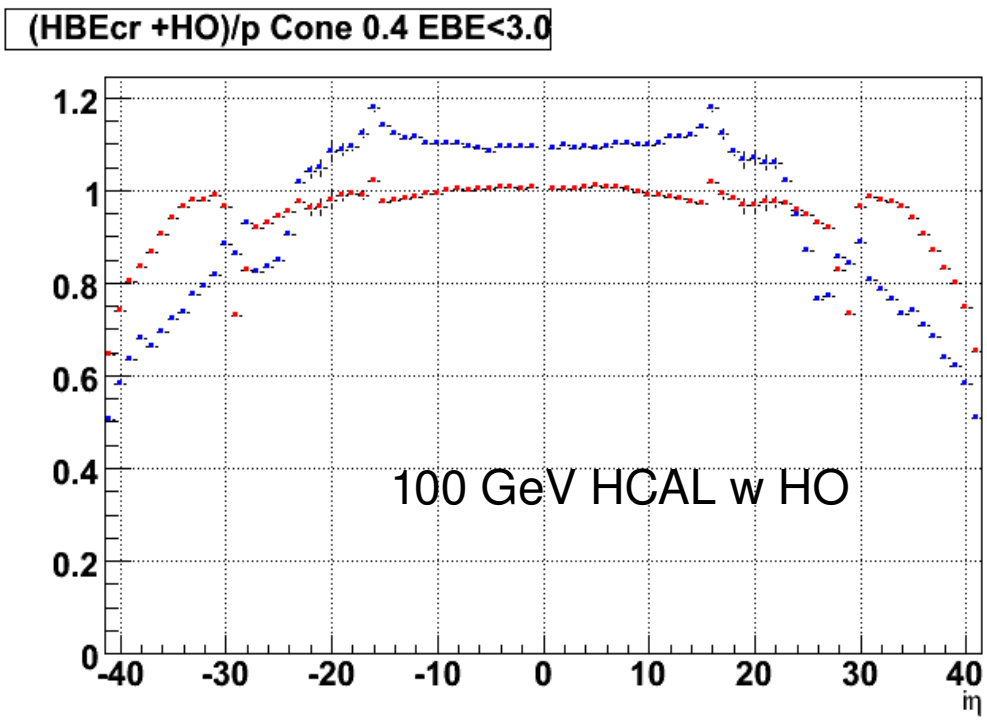
- Samples with magnetic field.
- Straight line propagation of the generated level pion
- Wide Cone 0.4 (in eta-phi space) to collect the energy
- No HF 0.7 factor in the response corrections.

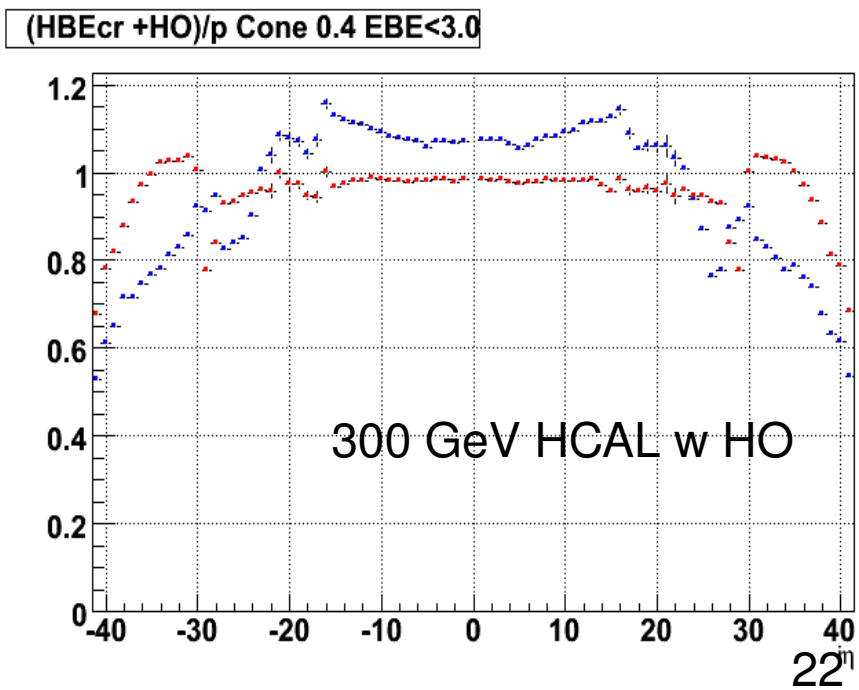
HCAL with HO, MIP in ECAL

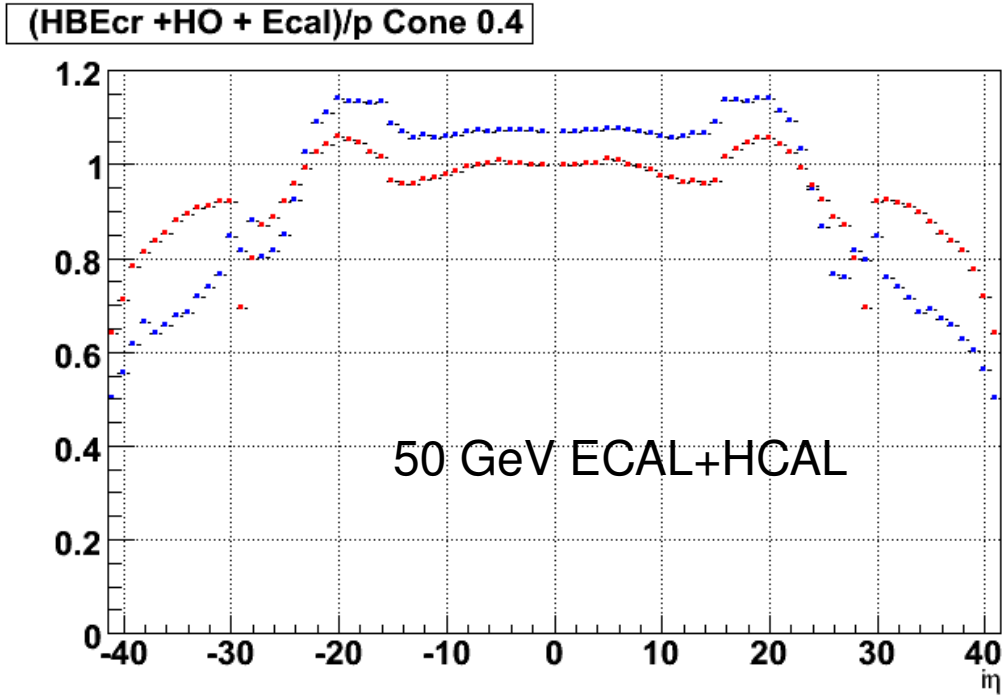


Wide cone – collect more noise
Order of 60 towers in it.

HF (uncorrected) scale is set at
100 GeV e, there HF e/pi ~ 1.

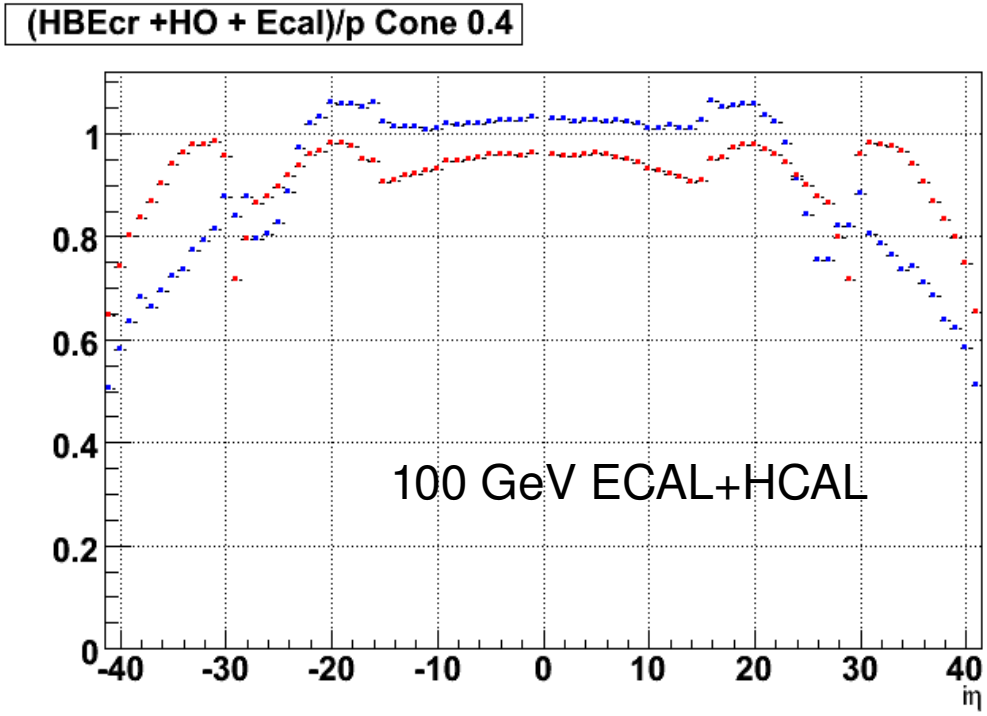


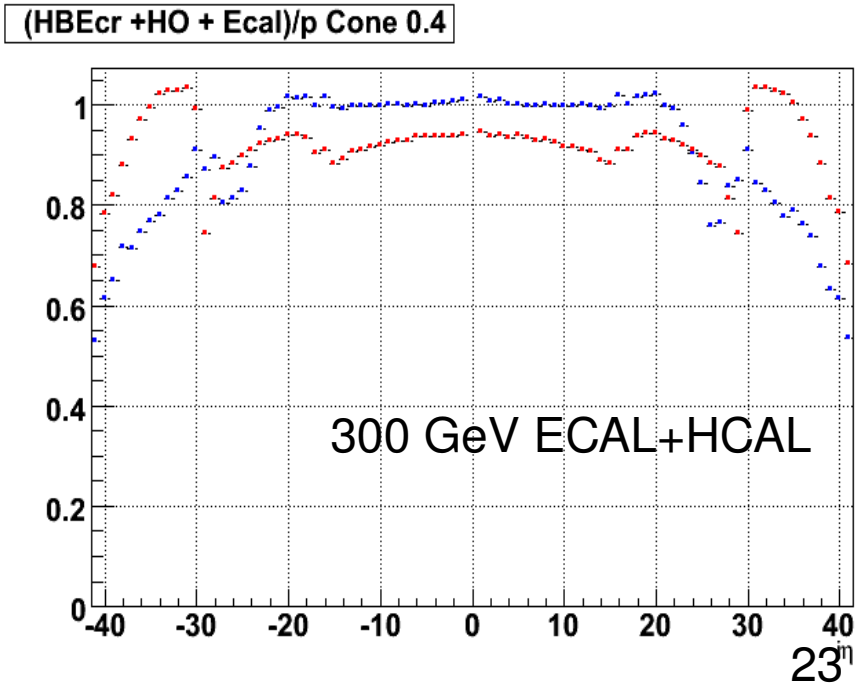




ECAL + HCAL+HO

For ECAL is used the same Cone 0.4





Summary

- Response correction from Iso Tracks and di-jets is validated with single pion samples at different energies
- At 50 GeV response is flat in the tracker calibration region
- At different momenta,eta dependence is observed

- We performed a test of the calorimeter response with single pions, including the region not covered by tracker to test the eta dependence
  - We observed eta dependence with and without the response corrections.
  - Response is smoother with the corrections in HE/HF