Validation on HO response for upgrade simulation

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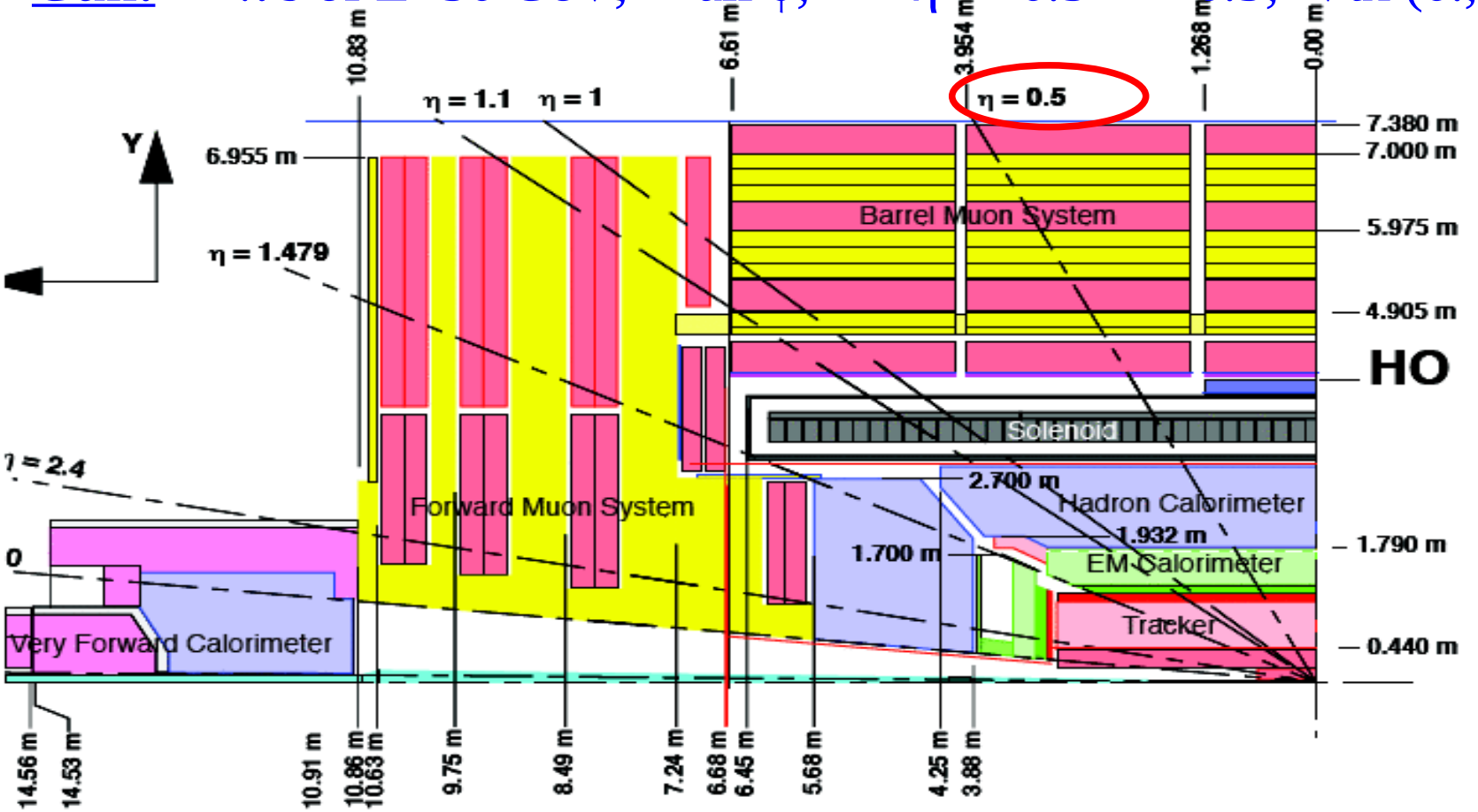
Gun: π's of E=50 GeV, all ϕ, η = -0.5 ÷ +0.5; Vtx (0.,0.,0.)



in use:

- CMSSW_4_2_8_SLHChcal2
- ...SLHCUpgradeSimulations.Geometry.Phase1_R34F16...
- SIM-DIGI-RECO

Details of Simulation

Collections:

- in analysis with digis, use the simHcalUnsuppressedDigis for HBHEHO;

- in analysis with rechits, use hcalupgradereco for HBHE and horeco for HO;

- to take into account ECAL energy contribution, use ecalRecHit for EB, EE and ecalPreshowerRecHit for Preshower;

- other collections were booked as well: simHcalDigis, ecalDigis, towerMakerWithHO;

- for digis: summarize energy over 4 TS's, 4+5+6+7;

DIGI+RECO Processes:

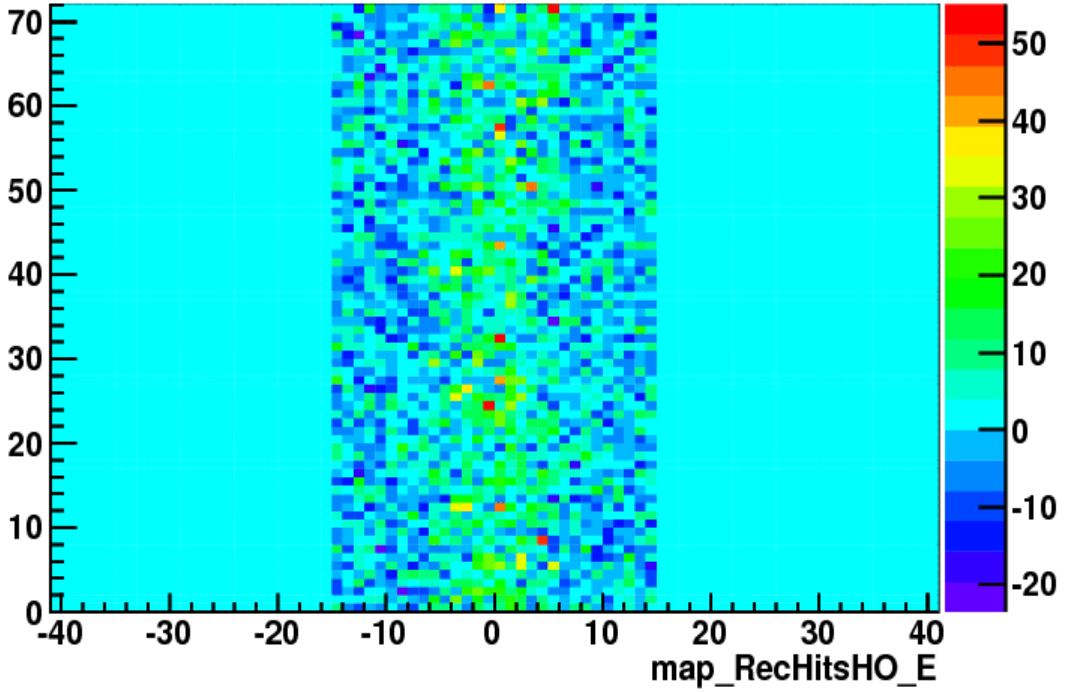
process.randomEngineStateProducer + mix +ecalDigiSequence + simHcalUnsuppressedDigis + simHcalDigis + ecalPacker + esDigiToRaw + rawDataCollector + ecalDigis + ecalPreshowerDigis + ecalGlobalUncalibRecHit + ecalDetIdToBeRecovered + ecalRecHit + hcalupgradereco + horeco)

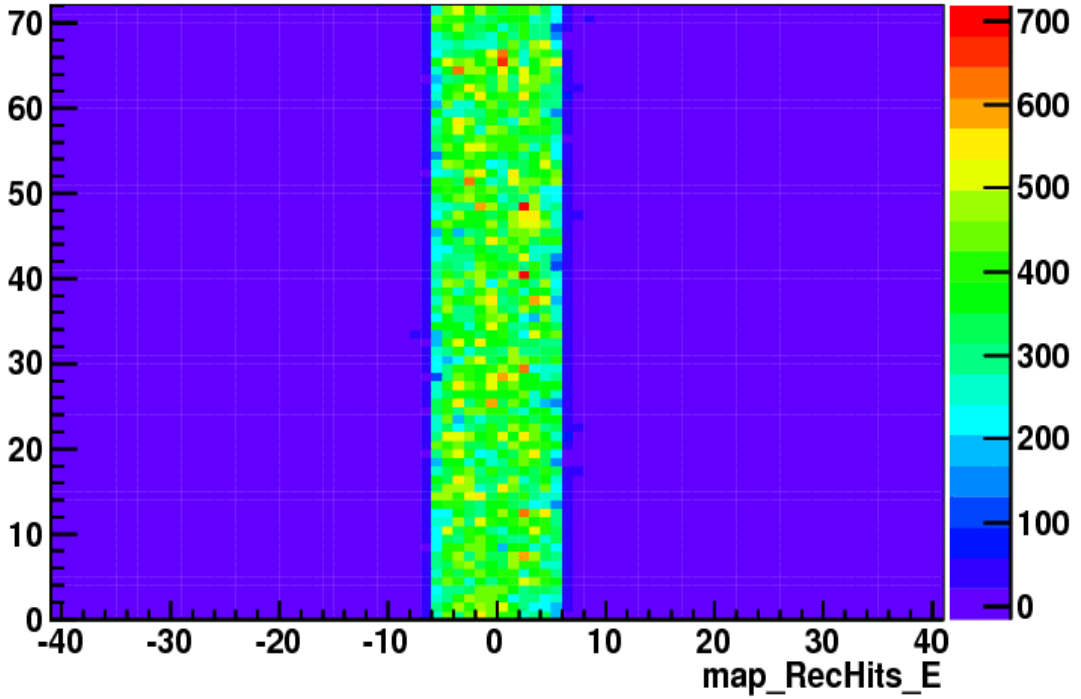
process.load("RecoLocalCalo.HcalRecProducers.HcalUpgradeReconstructor_cff")

######process.load("RecoLocalCalo.HcalRecProducers.HcalSimpleReconstructor_hbhe_cfi")

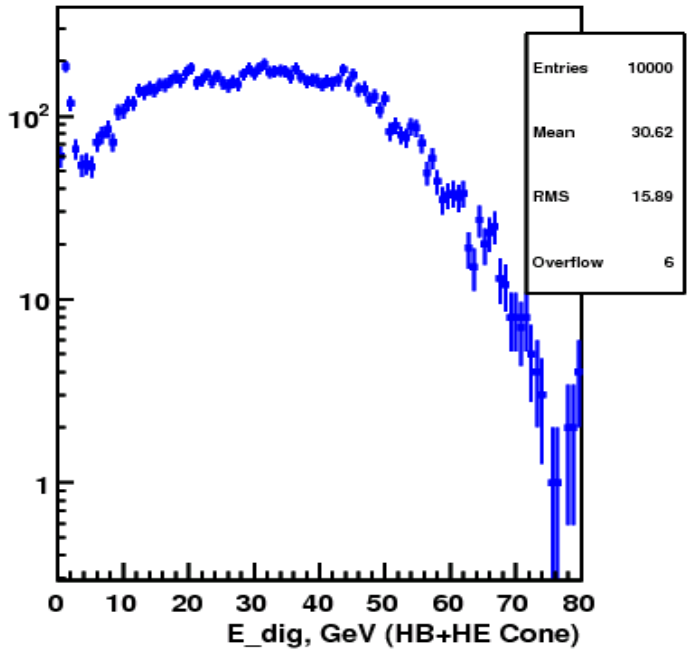
process.load("RecoLocalCalo.HcalRecProducers.HcalSimpleReconstructor_ho_cfi")

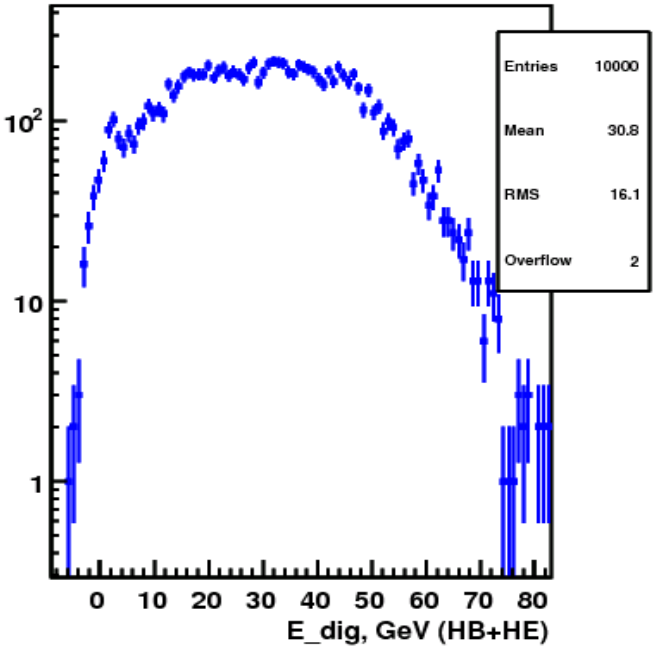
η−ϕ Energy deposition in HO and HB+HE



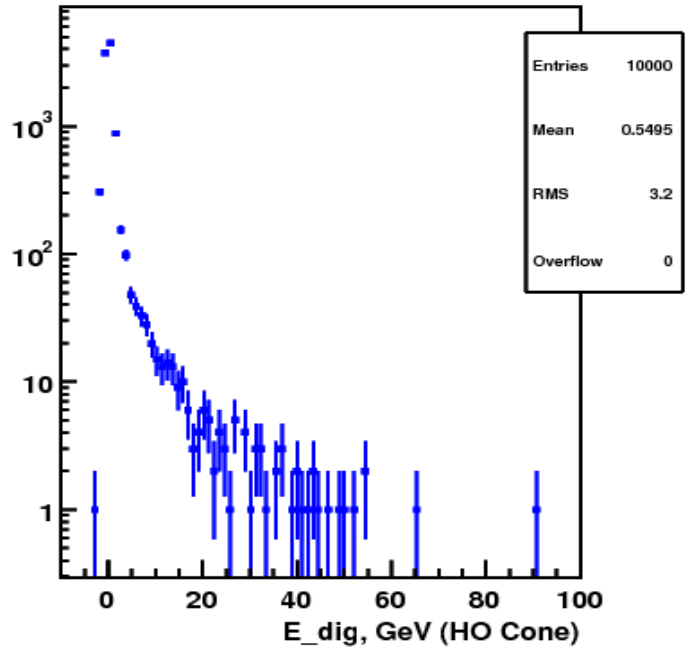


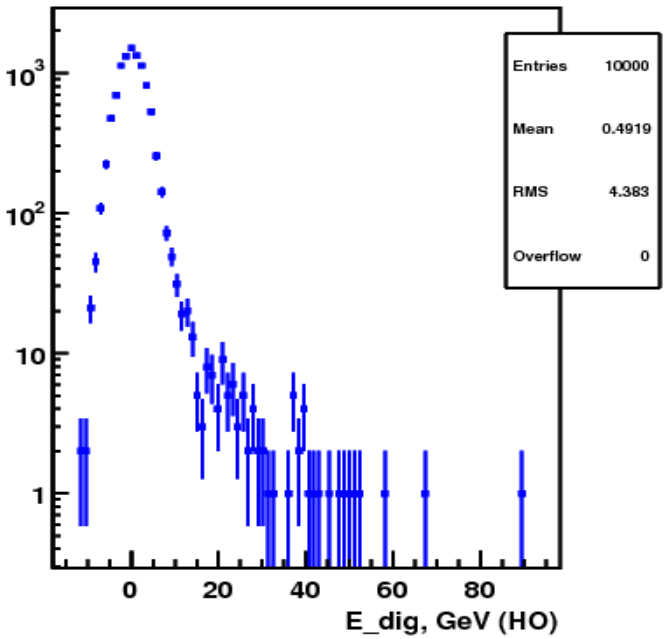
digiEnergy deposited in HB+HE and HO





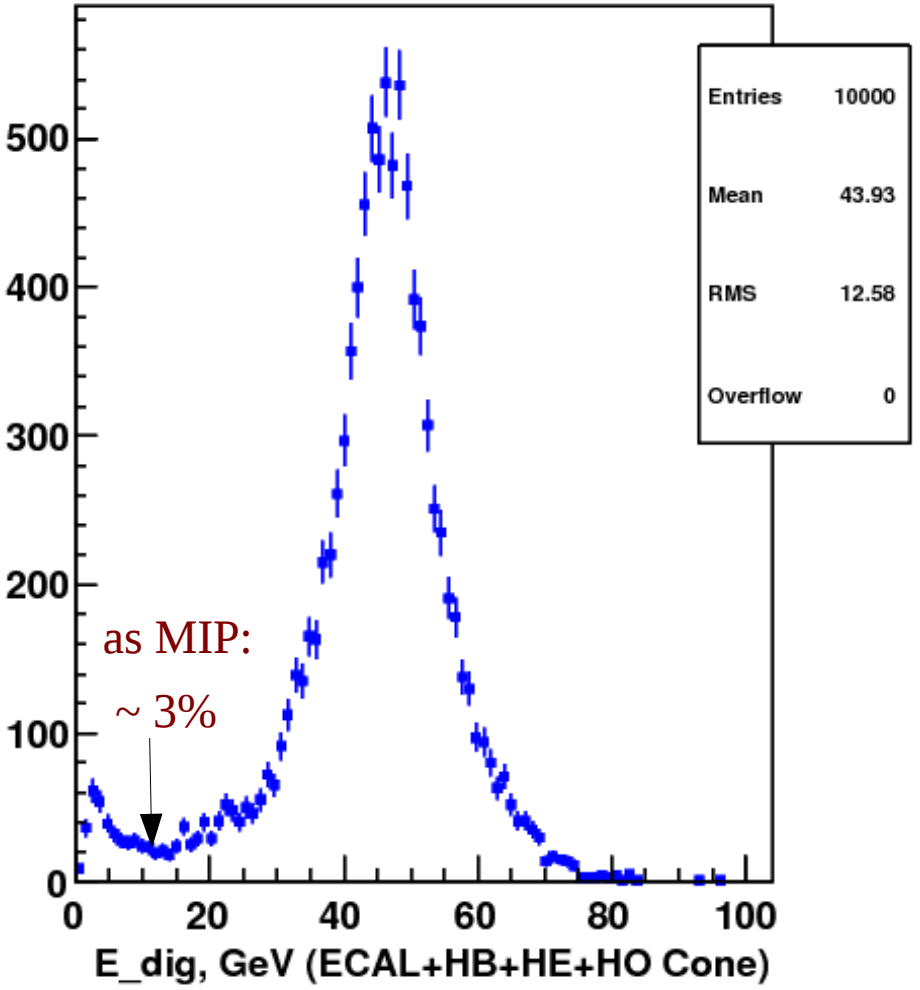
gen-digi matching: dR(η,ϕ) < 0.5 (=Cone)



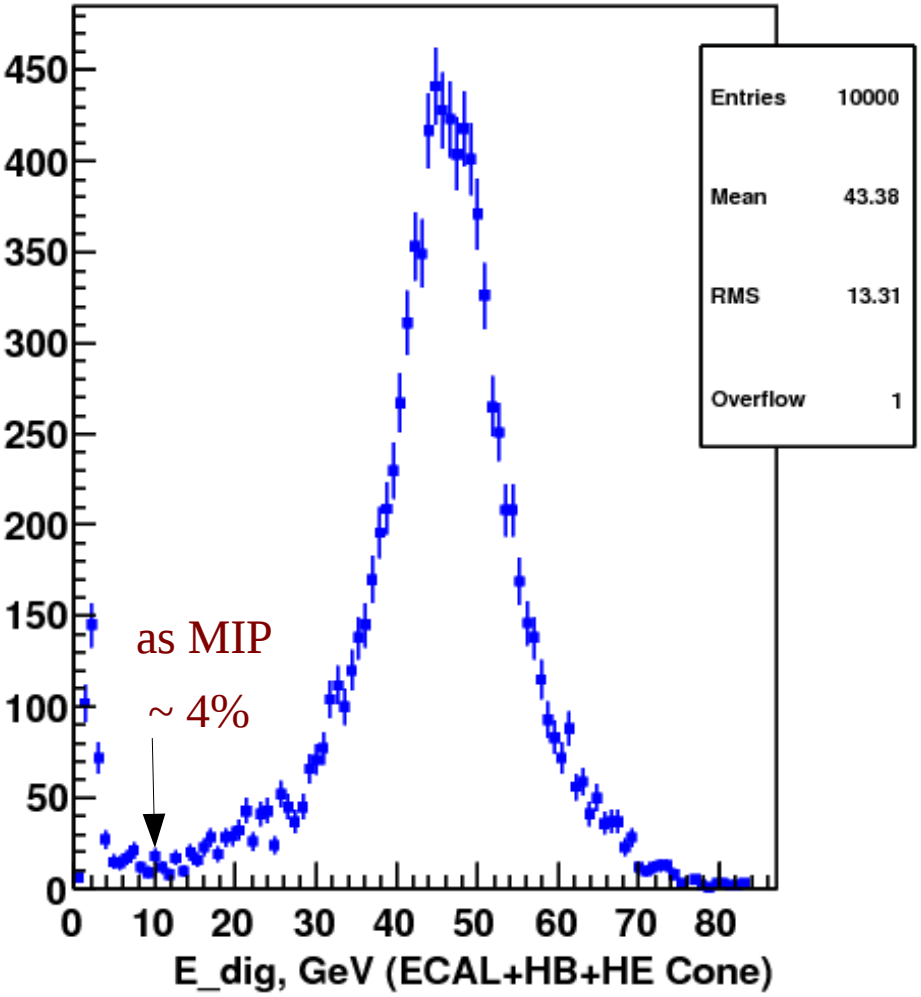


digiEnergy deposited in

ECAL+HB+HE+HO



ECAL+HB+HE



For 50 GeV π's:

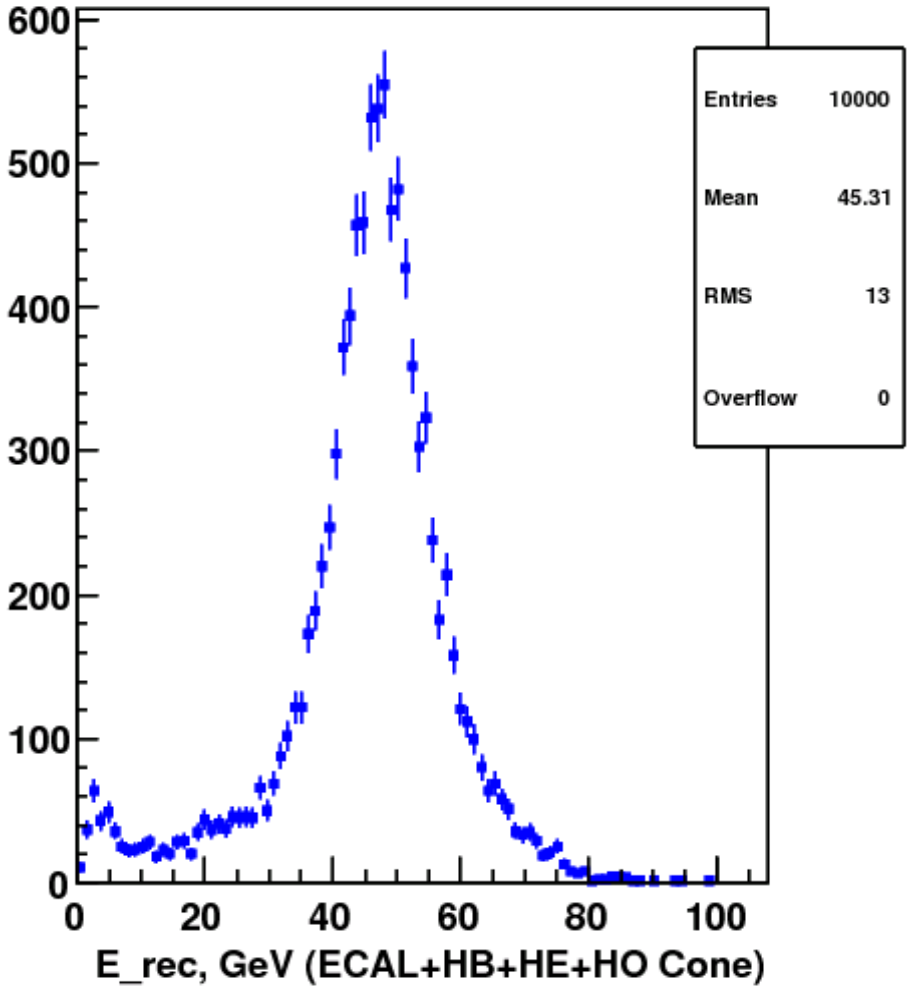
σ/E ~ 28.6 %

σ/E ~ 30.7 %

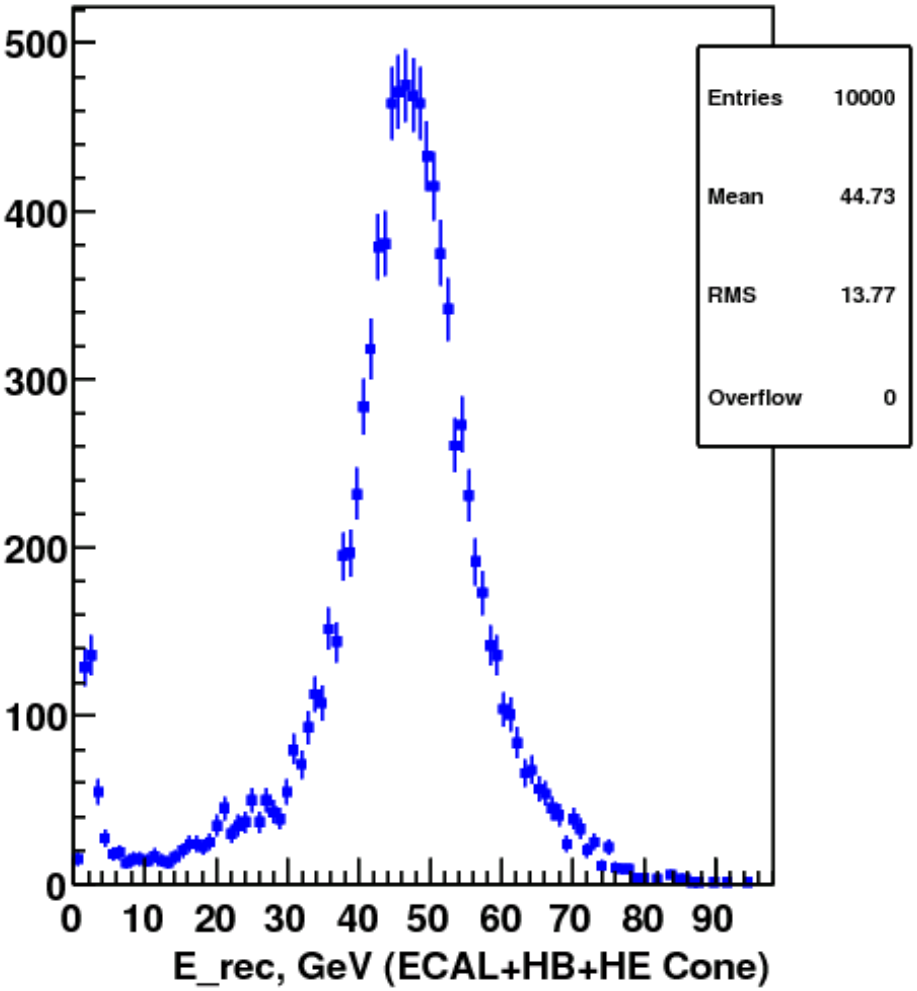
(precision ~ 1%)

rechitEnergy deposited in

ECAL+HB+HE+HO



ECAL+HB+HE



gen-rechit matching: dR(η,ϕ) < 0.5 (=Cone)

For 50 GeV π's:

σ/E ~ 28.7 %

σ/E ~ 30.8 %

(precision ~ 1%)

Summary

- the MC validation on Digi and Rec Hits collections with 50 GeV pions in framework of SLHC upgrade CMSSW shows reasonable contribution of HO in improving of hadronic energy resolution.

Estimation on RMS/meanE:

with DigiHits:

28.6% w/ HO w.r.t 30.7% w/o HO

with RecoHits:

28.7% w/ HO w.r.t 30.8% w/o HO

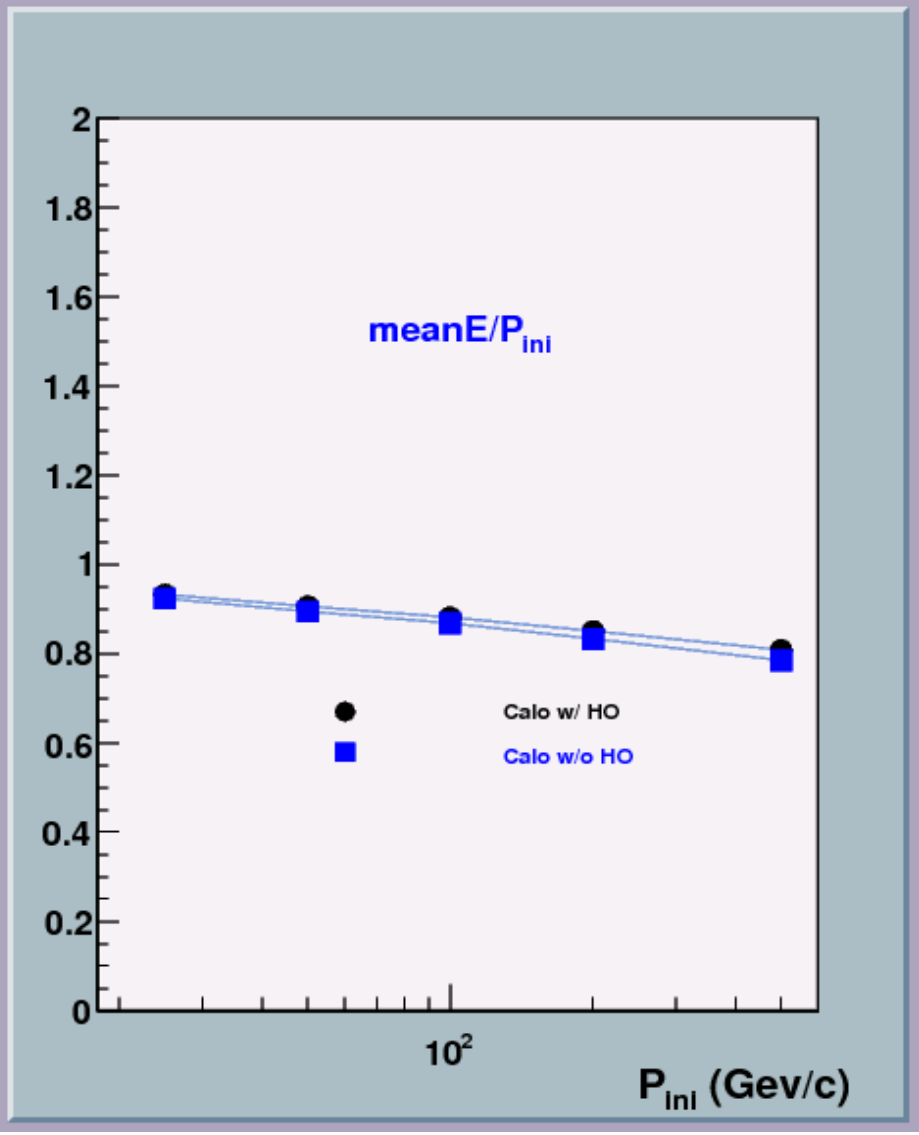
Acknowledgments:

I would like to thank Salavat Abdoulline for the help in reconstruction of digi and reco hits.

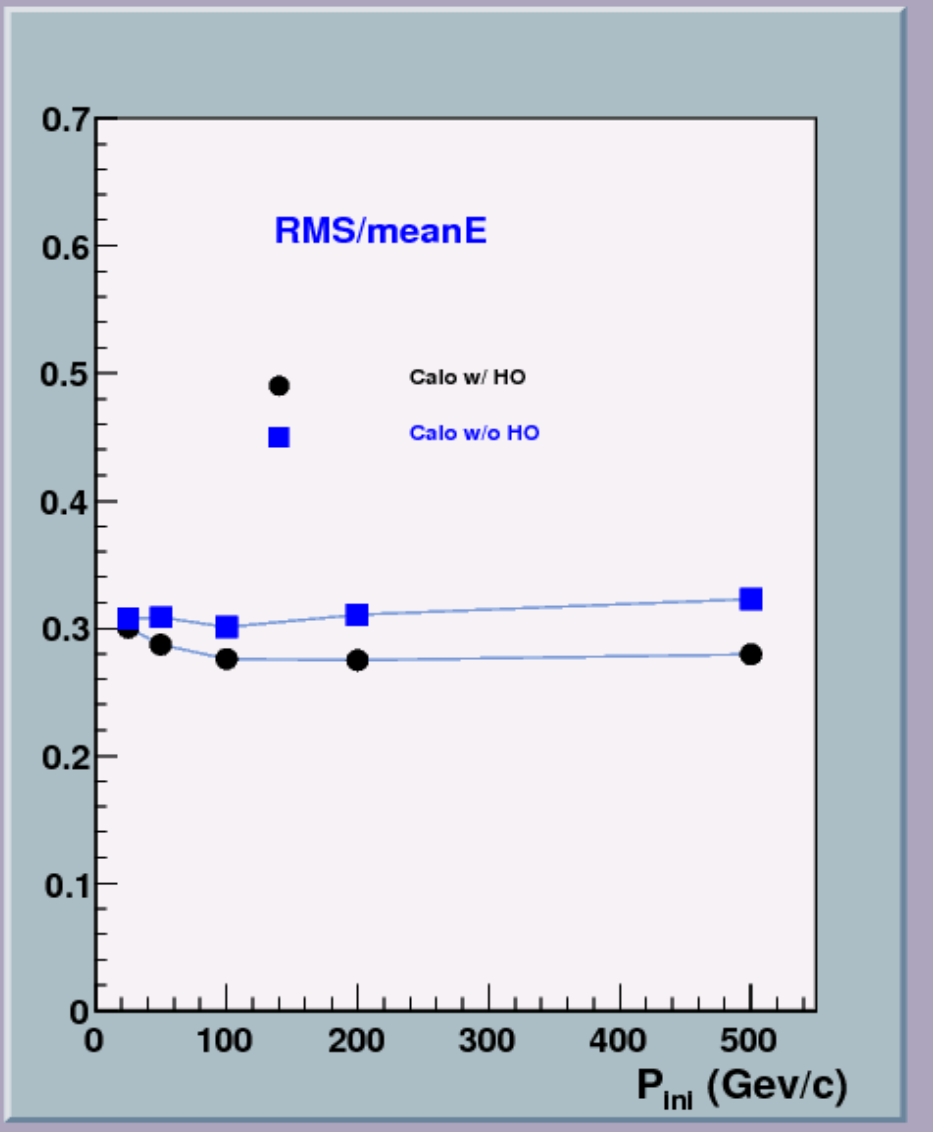
Some more study on hadronic resolution using RecHits with pions of energy: 25, 50, 100, 200, 500 (GeV)

MC Study of HO-upgrade response with RecHits(noZS)

Linearity



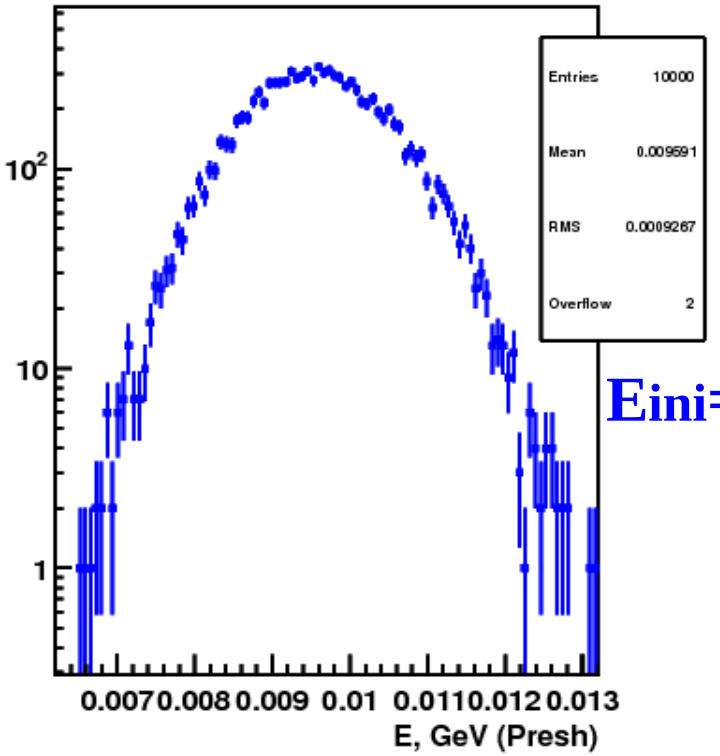
Energy resolution



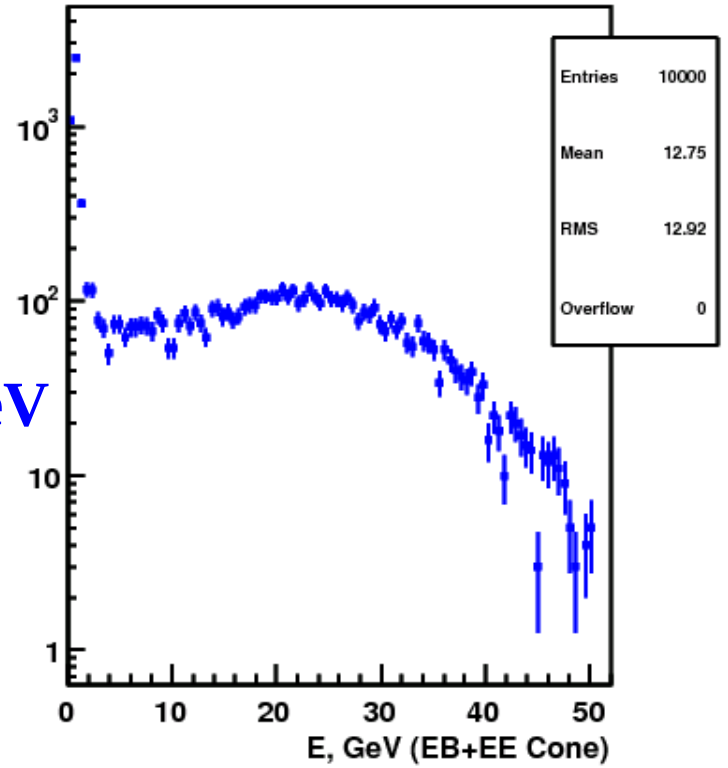
- with HO, the leakage is a bit smaller and resolution is improving as well.
- no sense to extract parameters of energy resolution, once ZS and other cuts not applied
-> just wanted to demonstrate that HO contribution with use of RecHits is reasonable

Backup

Energy deposited in ECAL

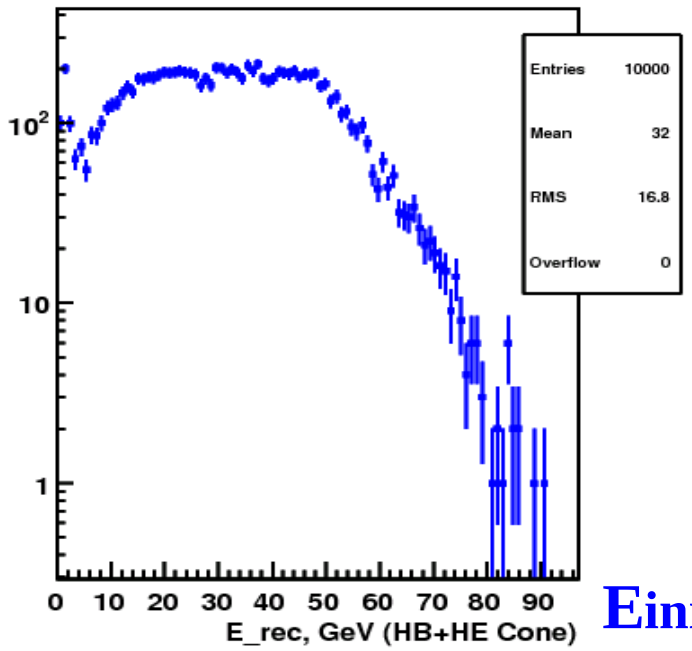


Eini=50 GeV

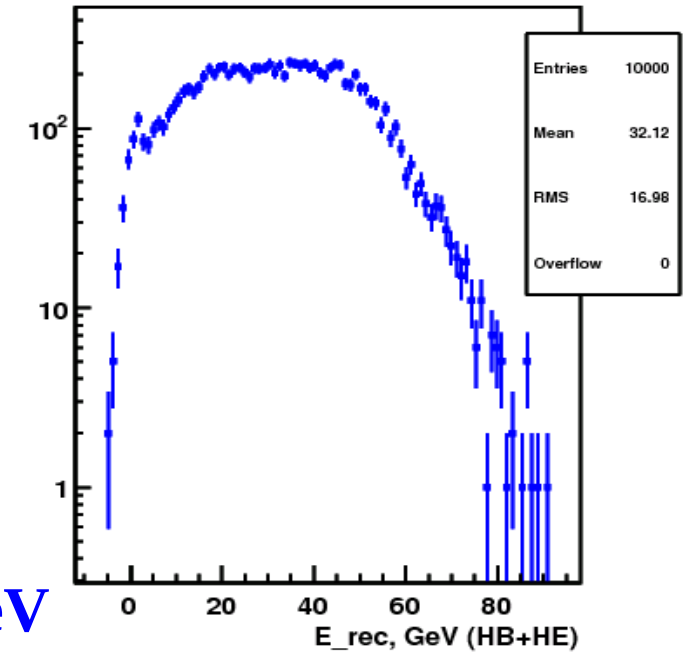


gen-rechits matching: dR(η,ϕ) < 0.2 (=Cone)

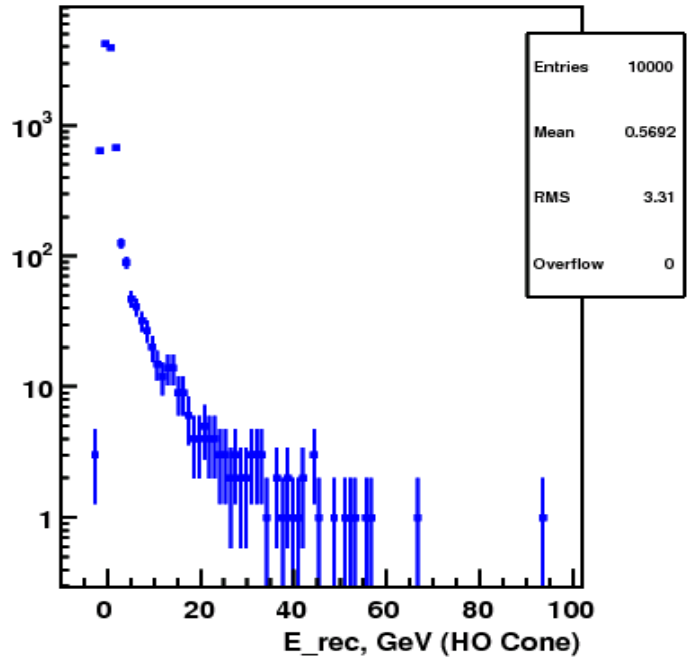
rechitEnergy deposited in HB+HE and HO

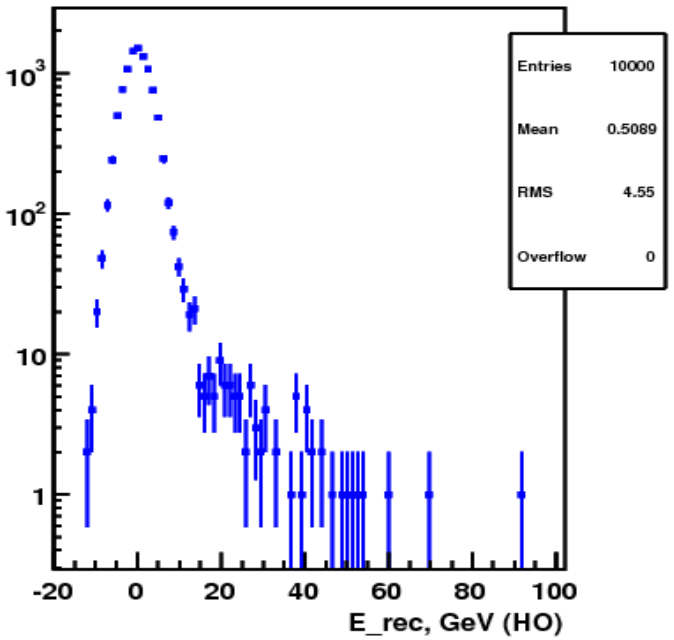


Eini=50 GeV

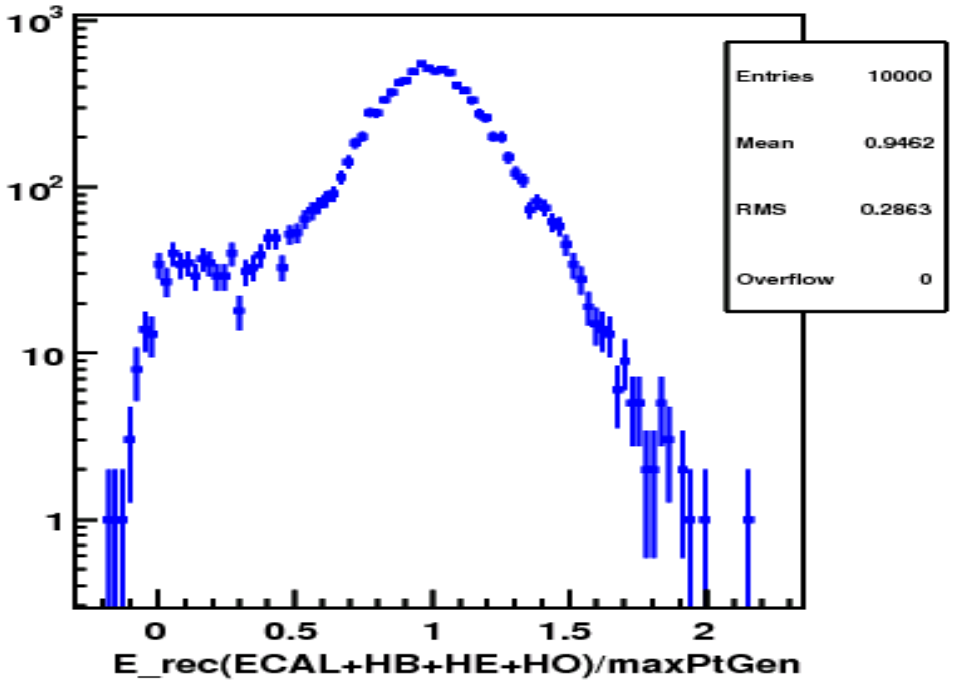


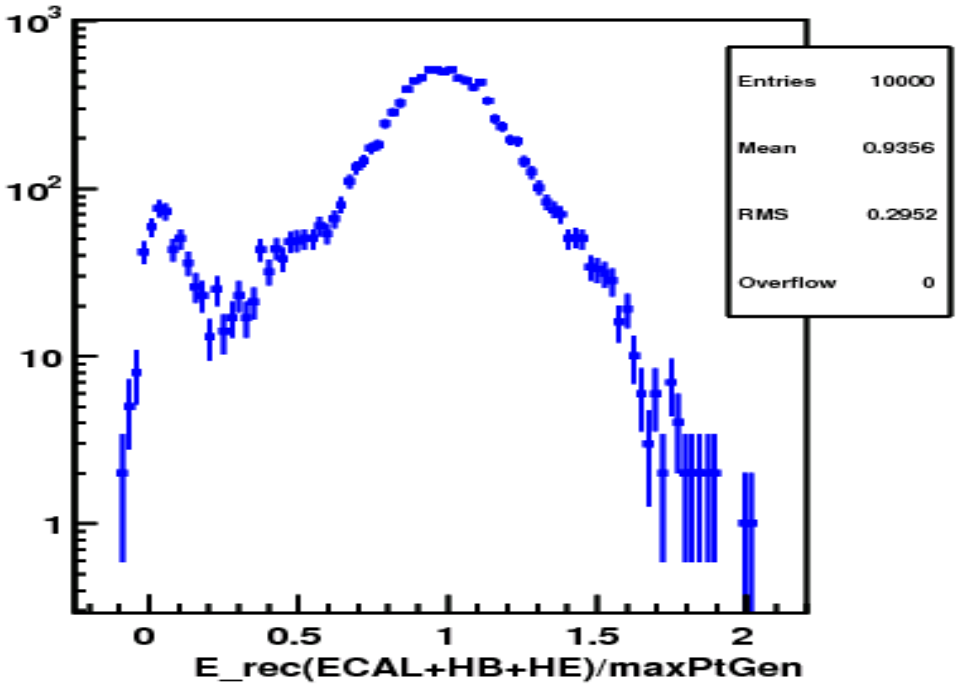
gen-rechit matching: dR(η,ϕ) < 0.5 (=Cone)



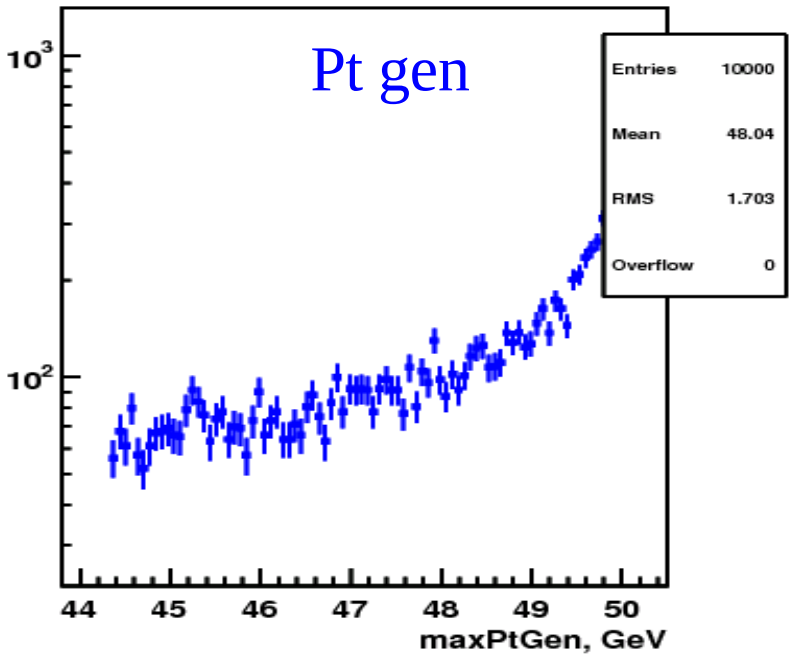


Relative rechitEnergy for ECAL+HB+HE+HO and for all calo w/o HO

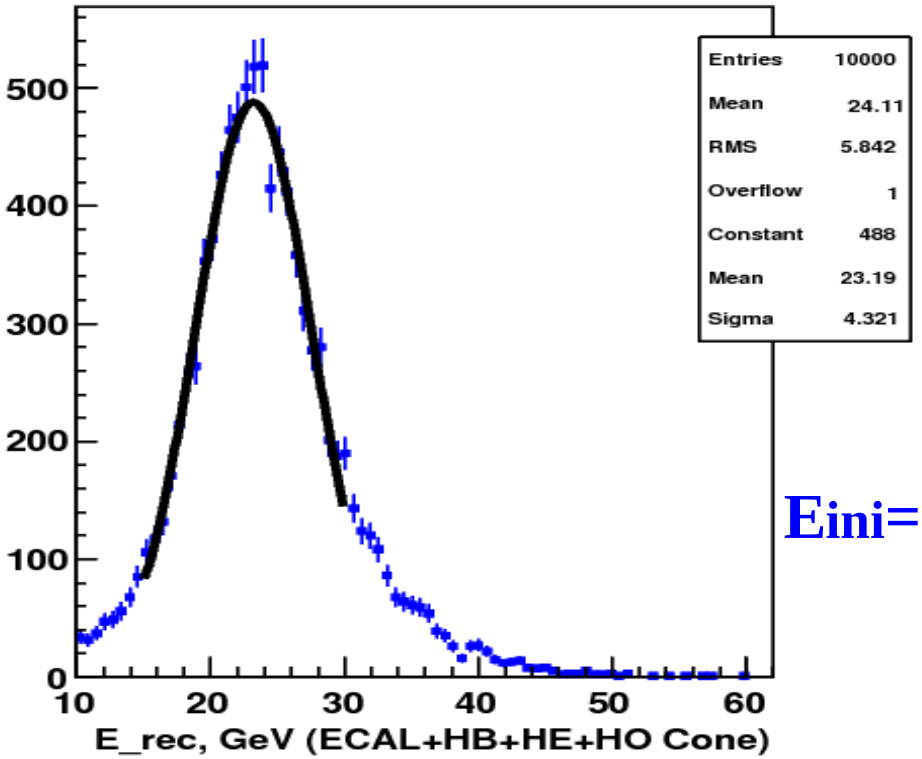




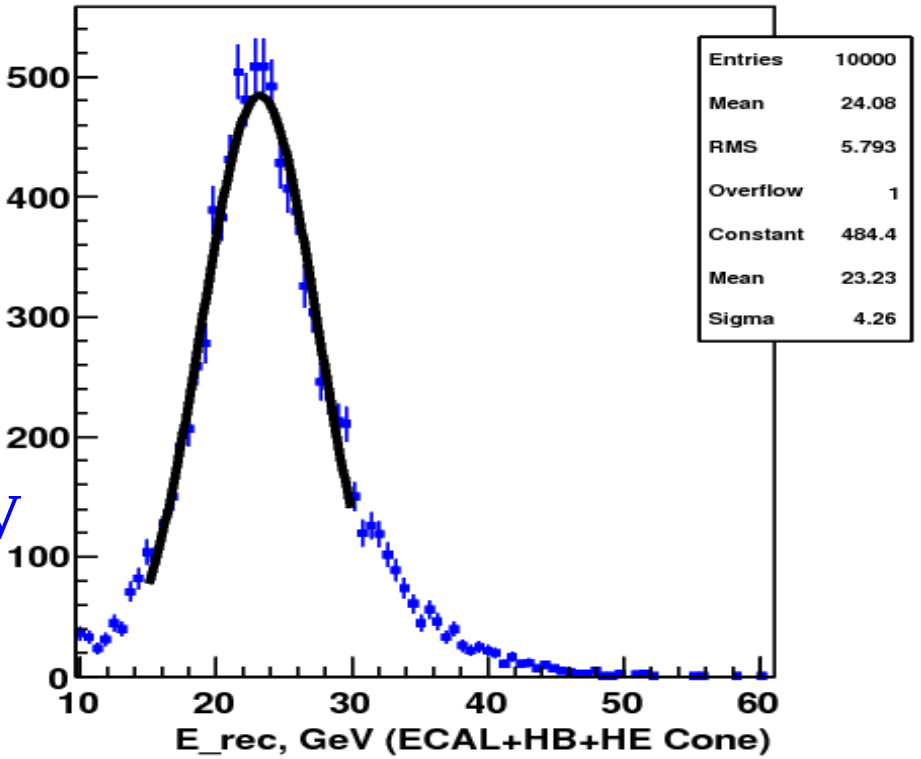
Eini=50 GeV

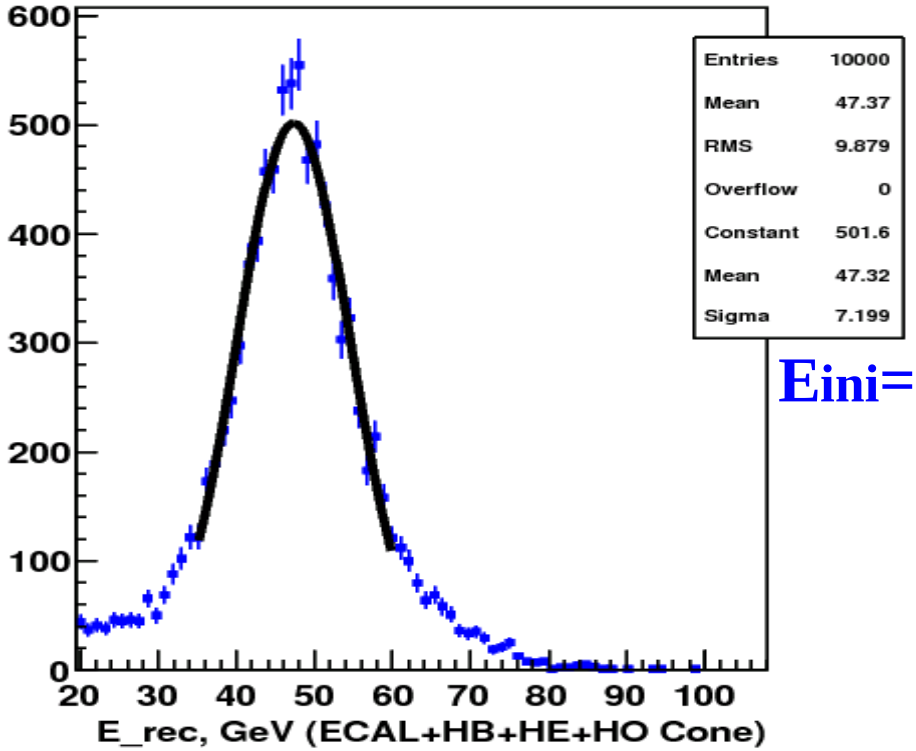


Reasonable improvement
of relative energy resolution
with use of HO rechits

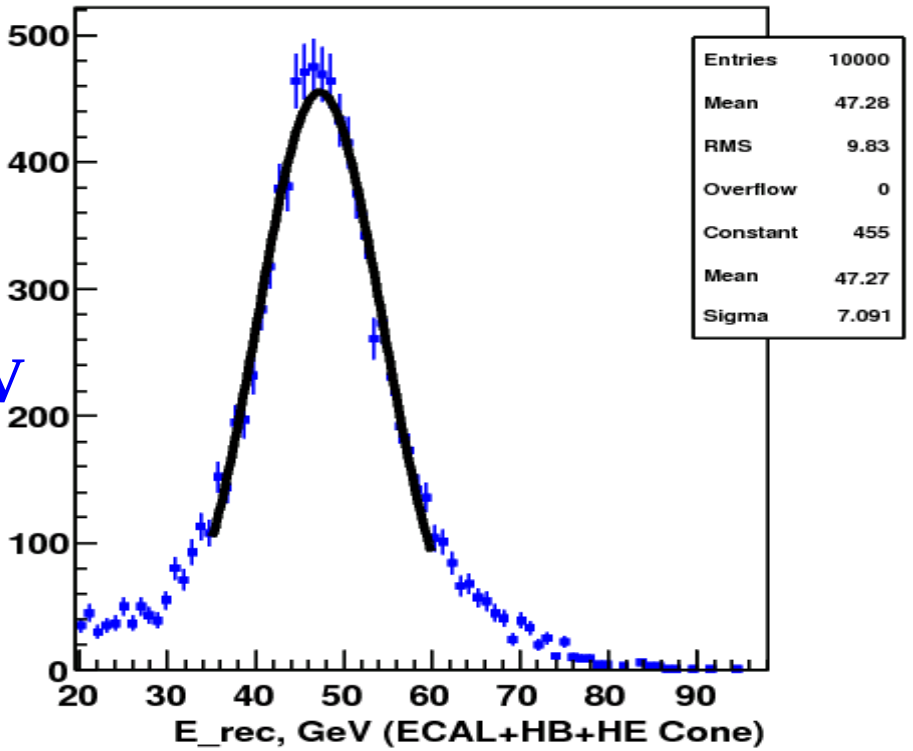


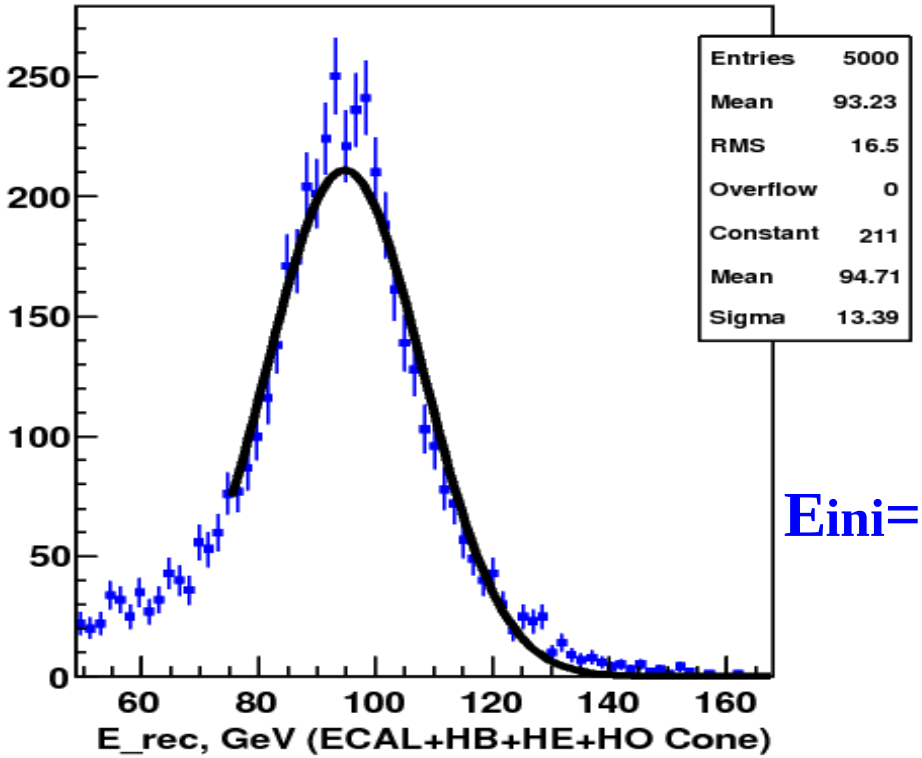
Eini=25 GeV

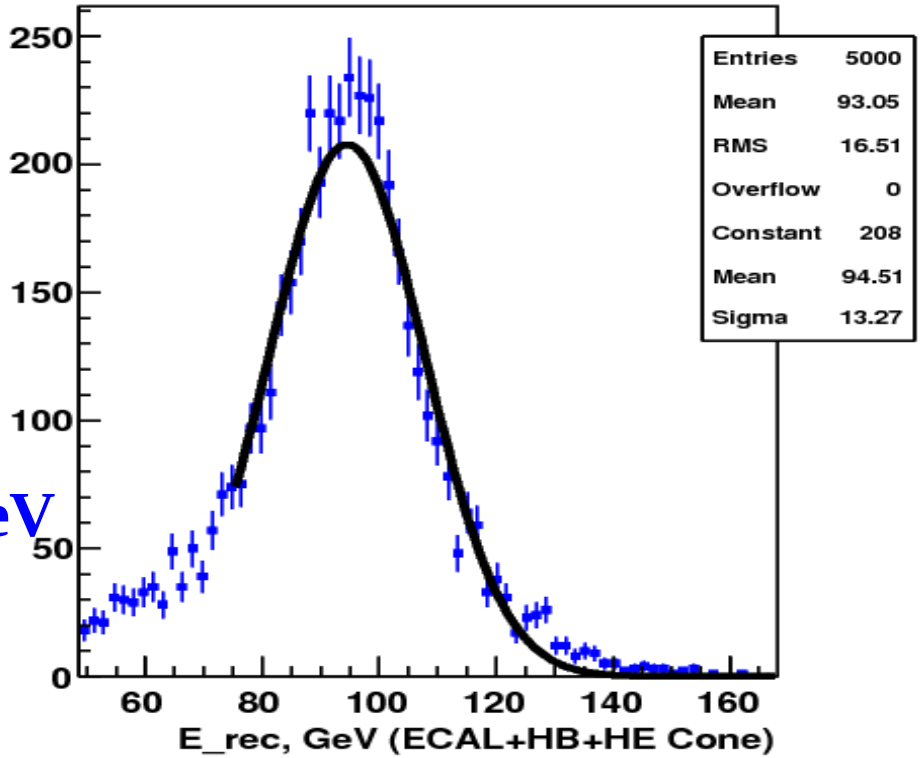




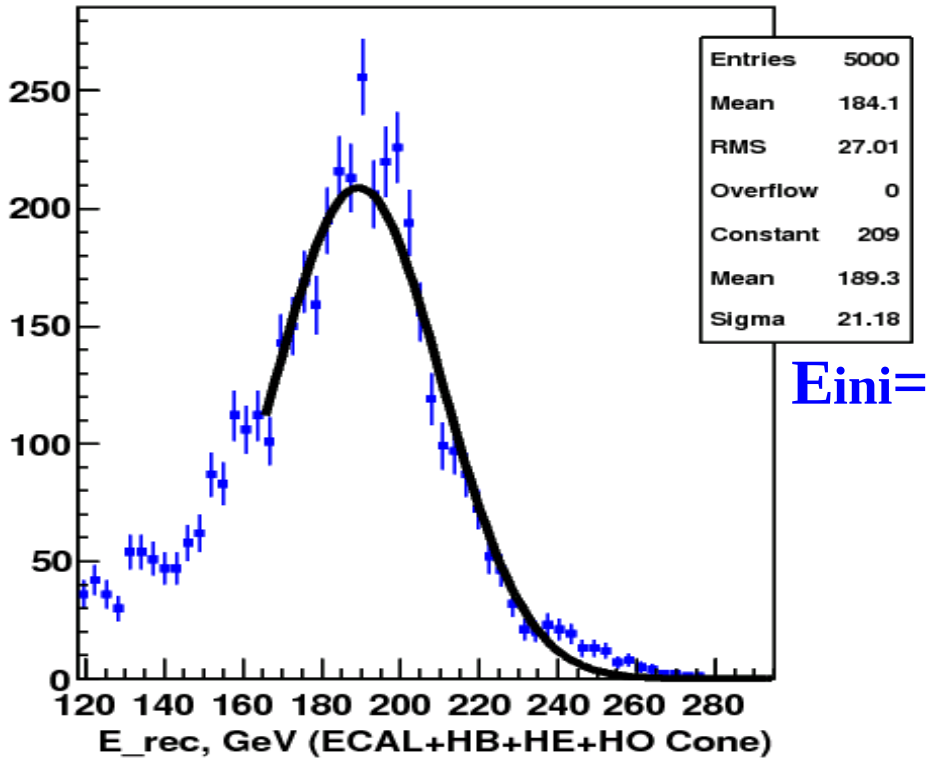
Eini=50 GeV

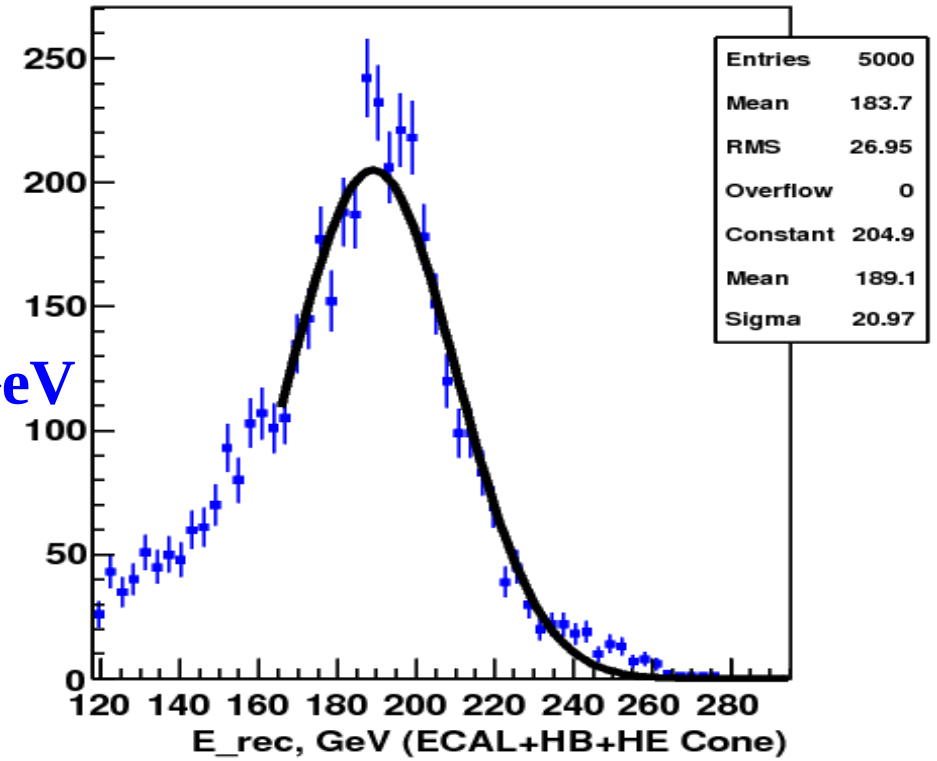




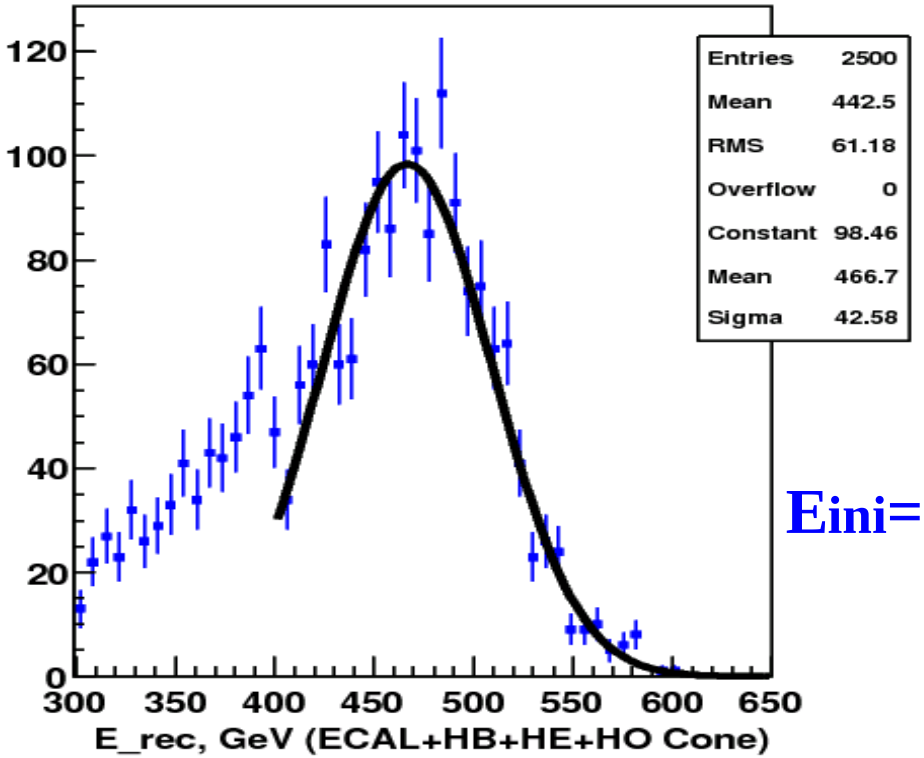


Eini=100 GeV

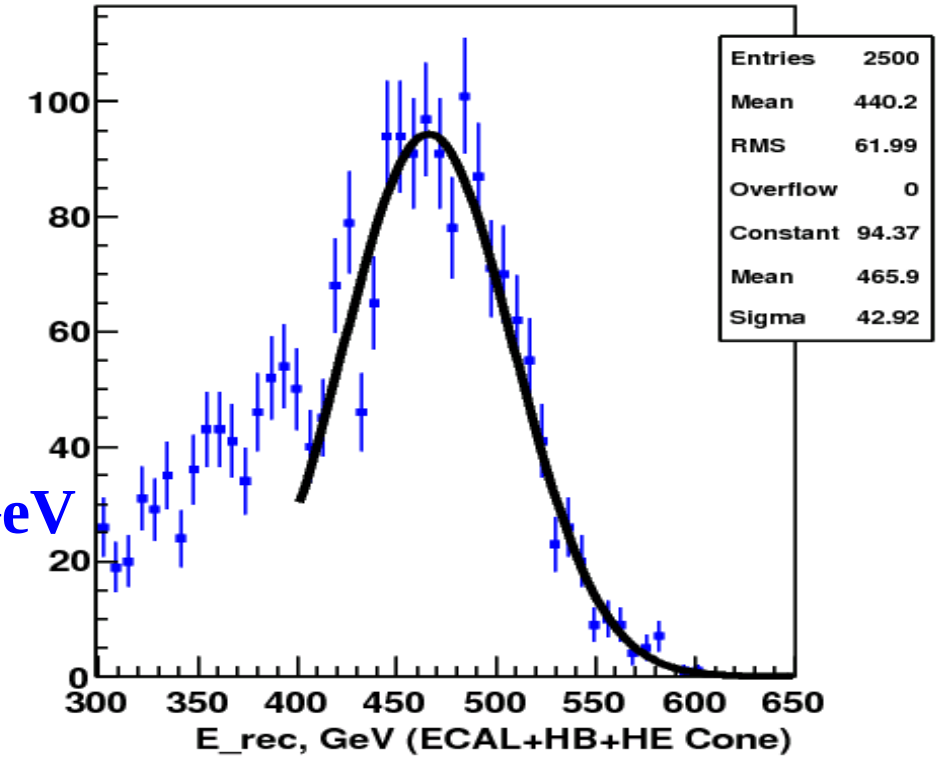




Eini=200 GeV

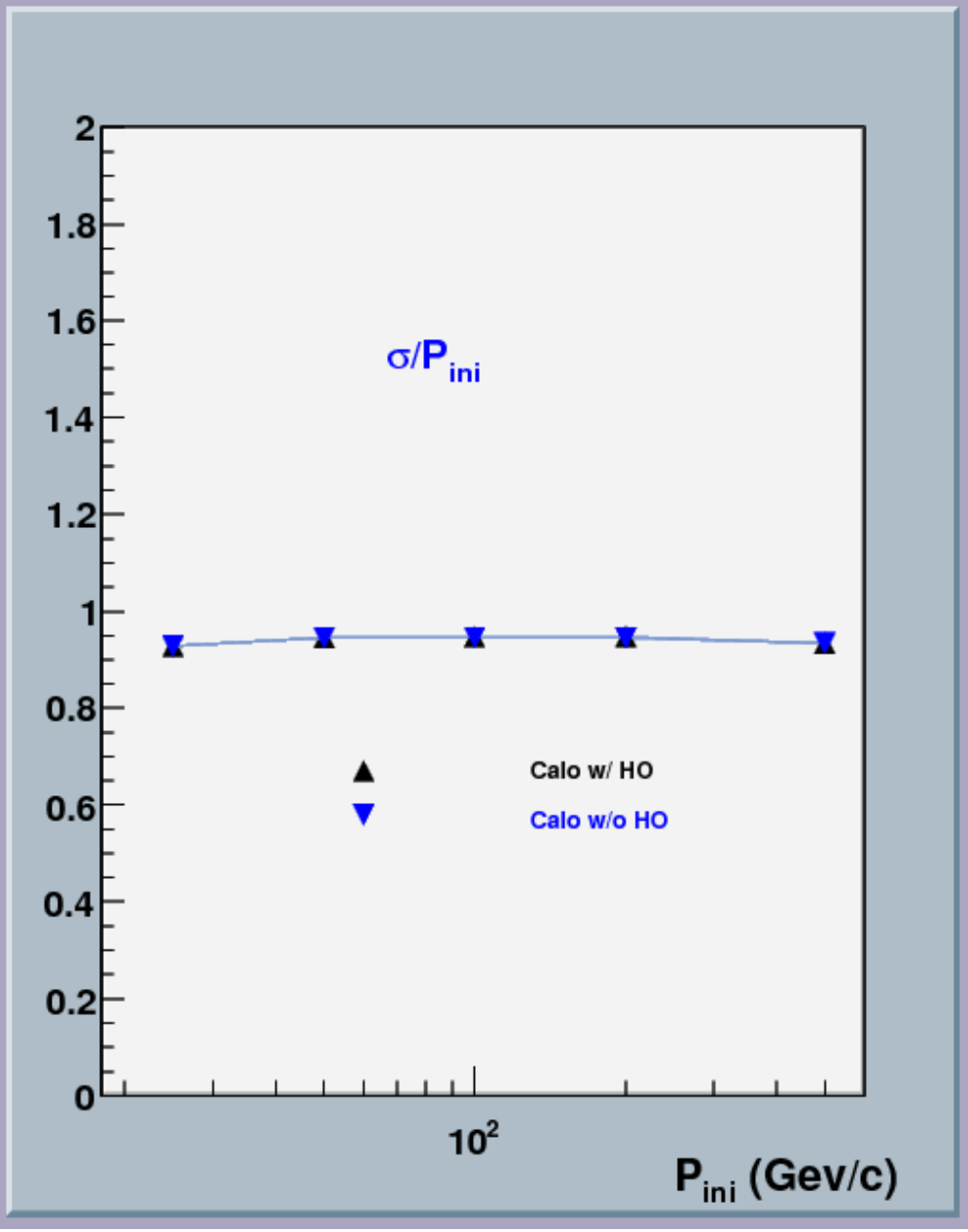

Entries 2500
Mean 442.5
RMS 61.18
Overflow 0
Constant 98.46
Mean 466.7
Sigma 42.58
E_rec, GeV (ECAL+HB+HE+HO Cone)

Eini=500 GeV


Entries 2500
Mean 440.2
RMS 61.99
Overflow 0
Constant 94.37
Mean 465.9
Sigma 42.92
E_rec, GeV (ECAL+HB+HE Cone)

MC Study of HO-upgrade response with RecHits(noZS,Gauss)

Linearity



Energy resolution