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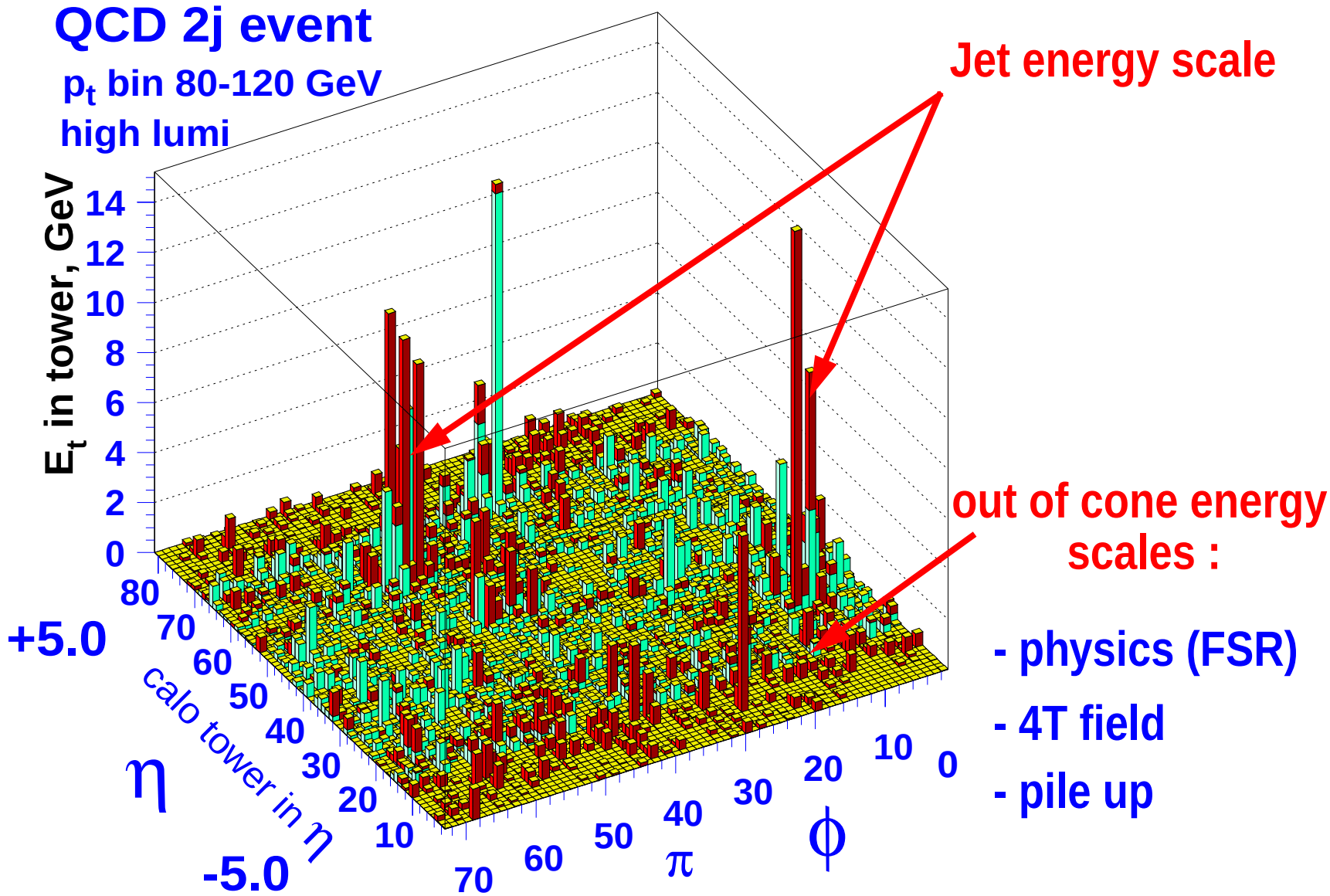
Jet and min.bias scale studies for MET

11.04.01 jetmet meeting

Preliminary plan of MET talk for CPT week. **please, comment**

1. known problems with current “towers” off-line MET reco.
   - $\Delta p_{x(y)}$=0.67(0.46)xΣE_t , CMS(ATLAS)
   - bad mass res. for A/H(500 GeV)->2τ->2j, qq->qqH(135GeV)->2τ->ej
   - less MET rejection power than expected
2. <MET> from pileup
   - part. -> field -> detector -> noise+threshold -> 17.3 min.bias
   - sources of tails in MET
3. scales for MET (today)
   - Jet scale
   - out of cone scale
4. MET with calo jet energy corrections - current status
   - L1 signal/bkg (Salavat’s plots), off-line plots (A.N. on Higgs/SUSY)
   - MET and thresholds
5. usage of tracker for MET (from Dan)

Energy scales for MET



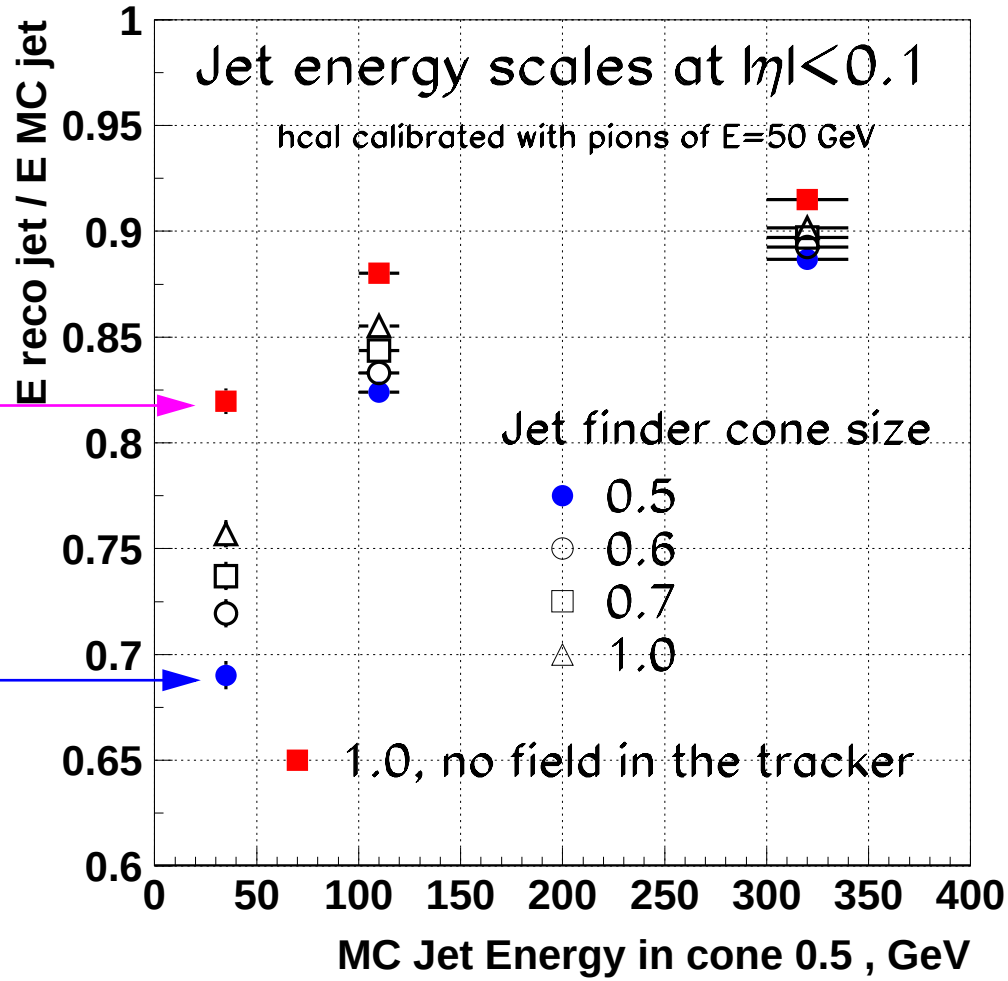
Jet energy scales

"D0's" Jet responce R

(to be found from γ + j events)

"D0's" jet corrections C

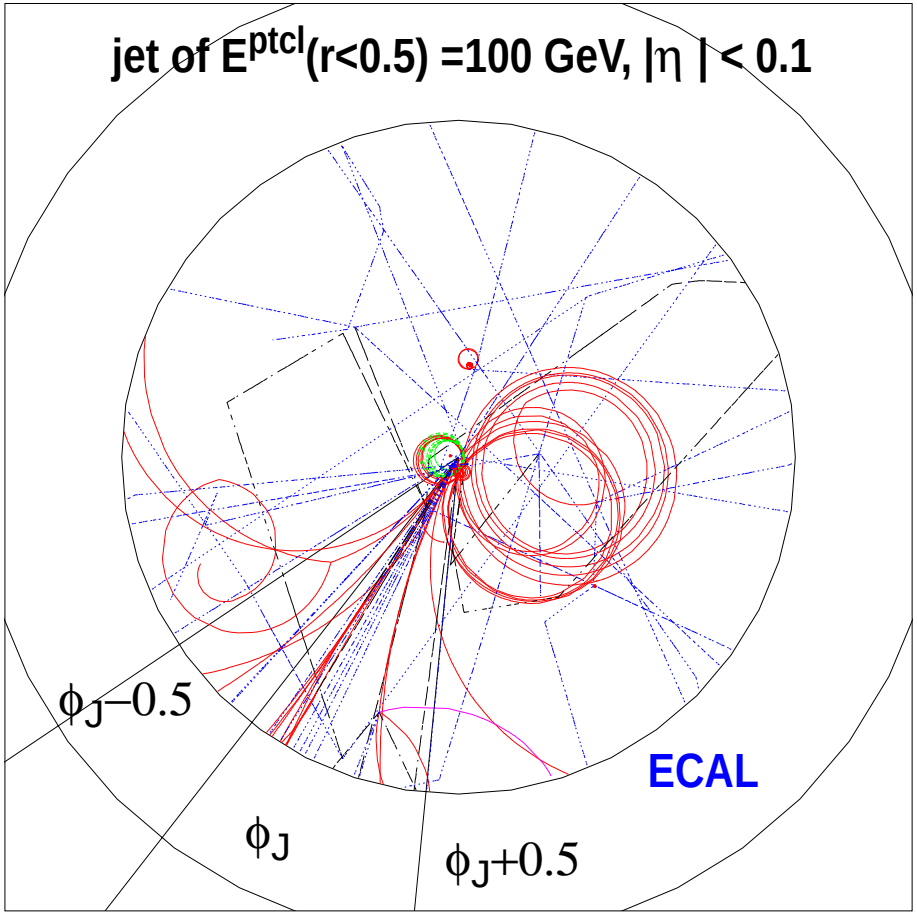
to evaluate $E_{jet}^{ptcl}(r<0.5)$

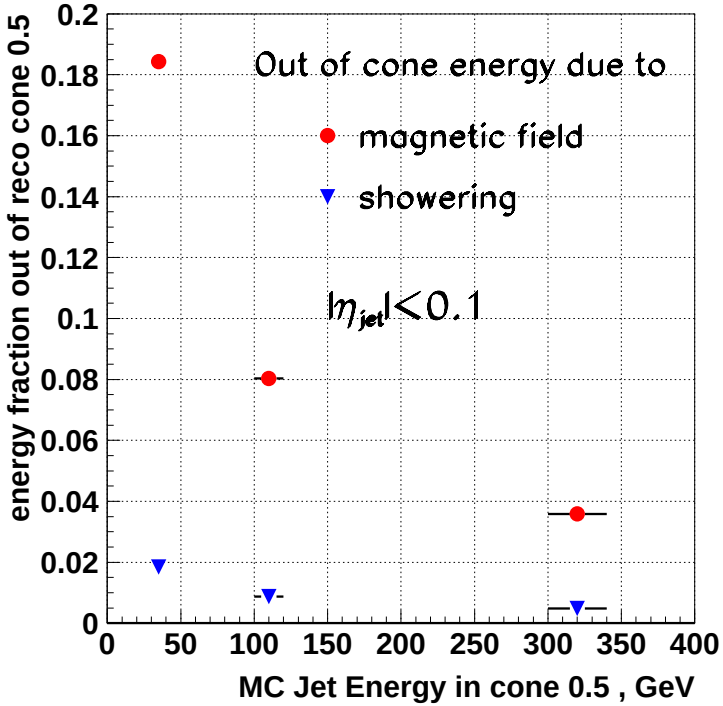


MET must use jet energy corrections, but C or R ?

usage of C may lead to double counting for low energy jets

Fraction of out of cone energy due to 4T field and showering





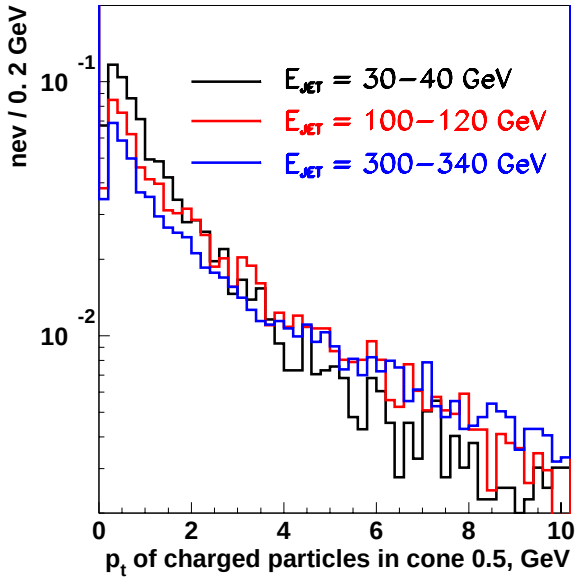
Usage of jet energy corrections (R) instead of jet responce (R) may lead to double counting for low energy jets

Particles out of reco cone due to 4T field (barrel):

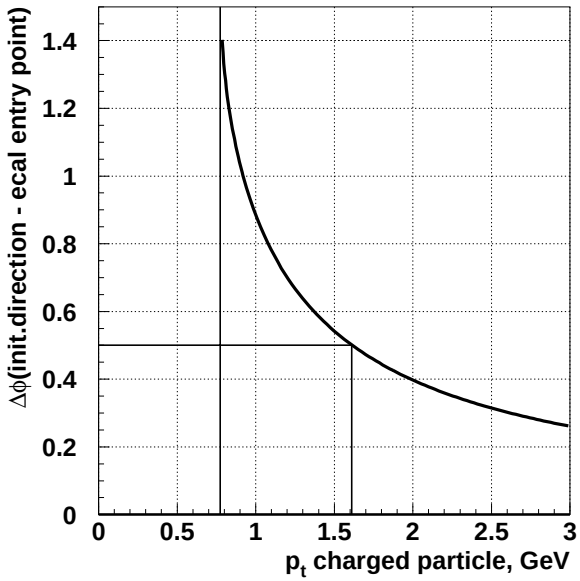
low p_t jet particls don't enter reconstruction cone

Jets with MC energy 30-40, 100-120, 300-340 GeV in cone 0.5 , η = 0.1

spectra of jet charged particles



$\Delta\phi$ deviation due to 4T field



E_J=30 - 40 GeV - $\langle p_t^{ch} \rangle$ = 2.4 GeV, $\langle n^{ch} \rangle$ = 8.4

E_J=100 -120 GeV - $\langle p_t^{ch} \rangle$ = 5.1 GeV, $\langle n^{ch} \rangle$=12.7

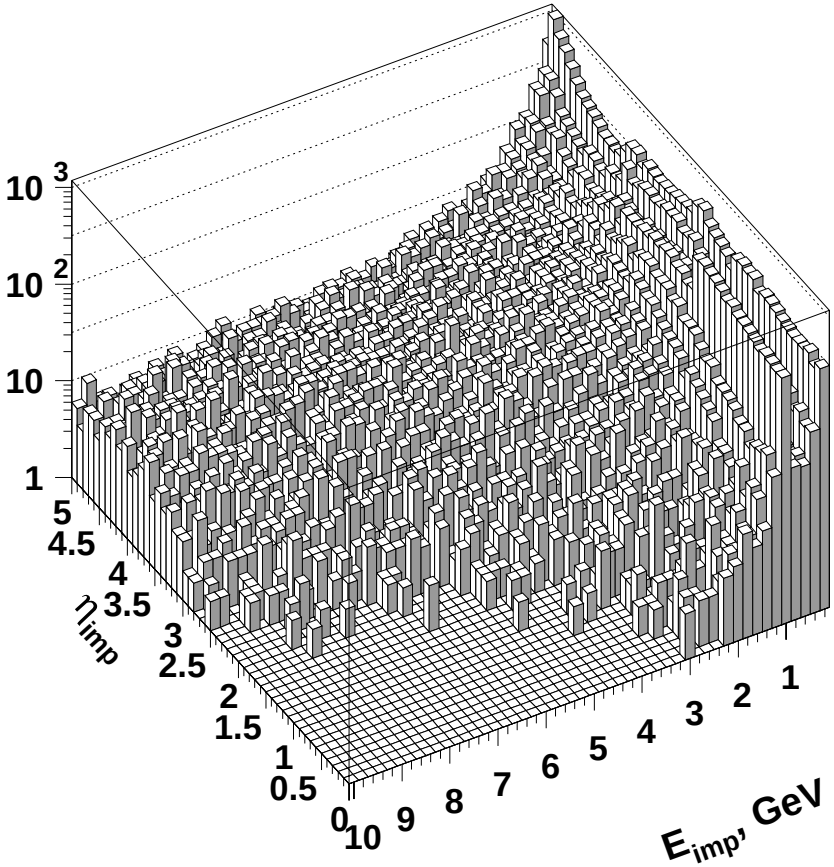
E_J=300 -340 GeV - $\langle p_t^{ch} \rangle$ = 9.6 GeV, $\langle n^{ch} \rangle$=17.0

charged particles of p^{ch}_t < 1.5 GeV do not enter reco cone 0.5

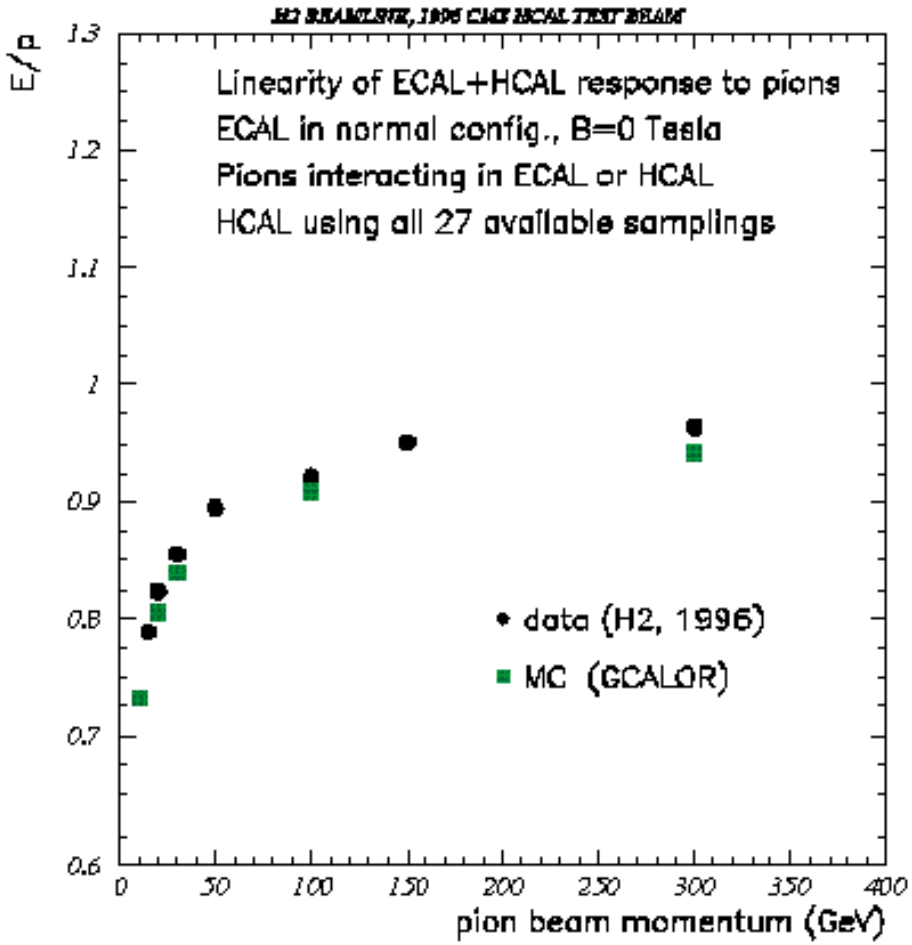
Out of cone scale due to pile up :

$\langle p_t^{ch} \rangle \sim 0.6$ GeV, $\langle n_{ch} \rangle / \Delta\eta \sim 7.2$ at $\eta=0$

min.bias particle energy at the entry face of calorimetry



ECAL+HCAL non linearity from test beam

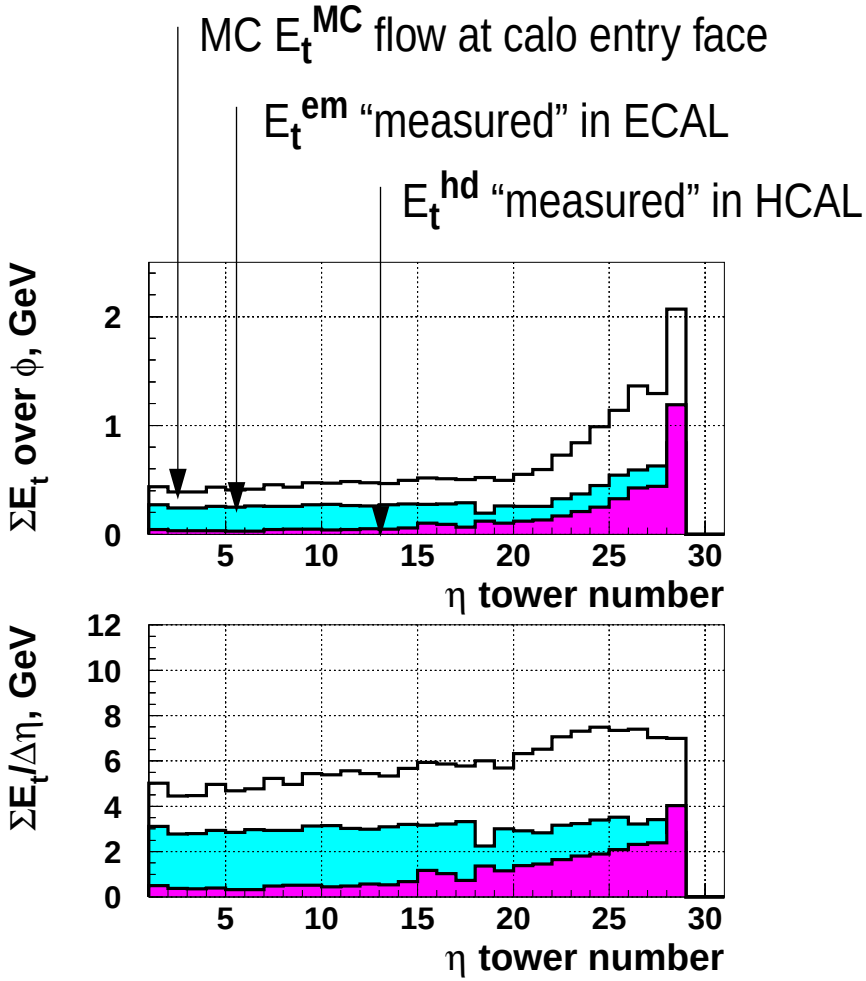


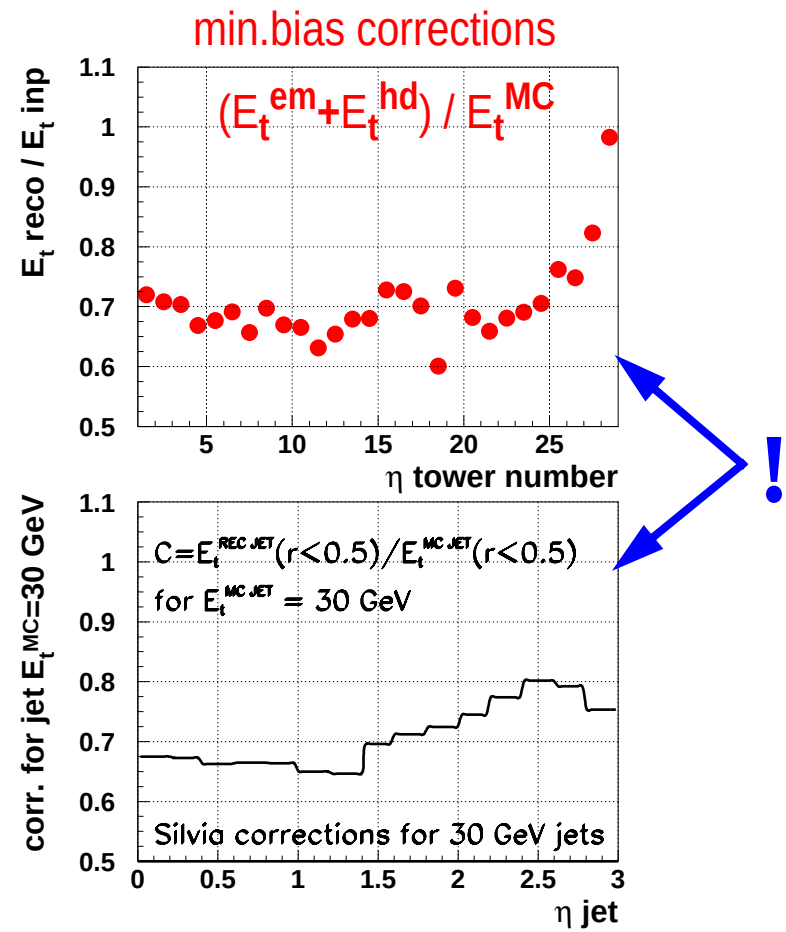
no data for $E_\pi < 10$ GeV

“calo response” to min.bias from geisha MC

cms120, hcal calibration on p_t^{π} = 50 GeV, no noise, no threshold

1 min.bias event per crossing



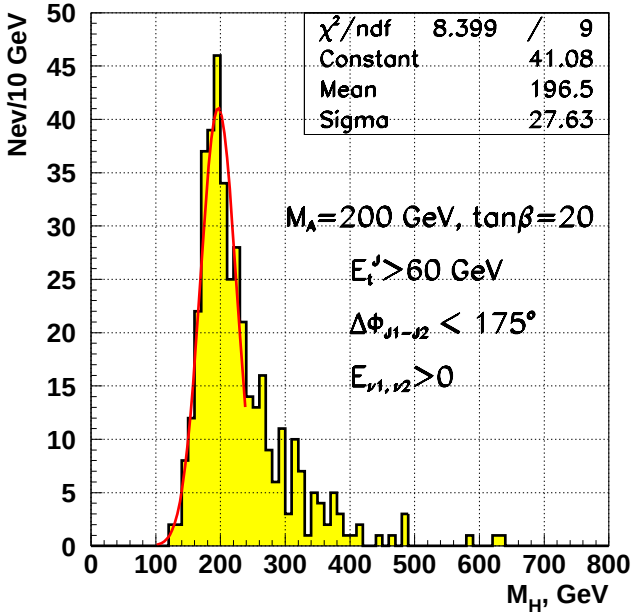


plot MET for signals and qcd with Silvia's Jet corrections for towers in jets and with 30 GeV jet corrections for out of cone towers

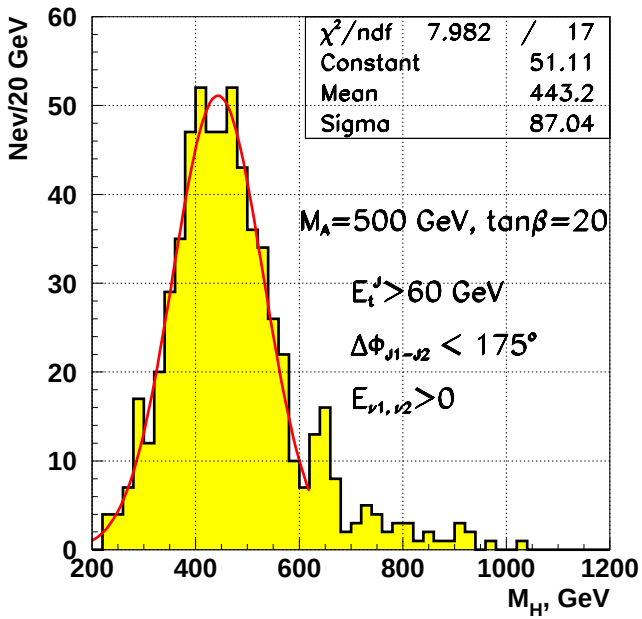
Problem with mass resolution for A/H(500 GeV)->2τ->2j

cmsim116/orca4 data at $L=10^{33}cm^{-2}s^{-1}$

σ / M = 14 %



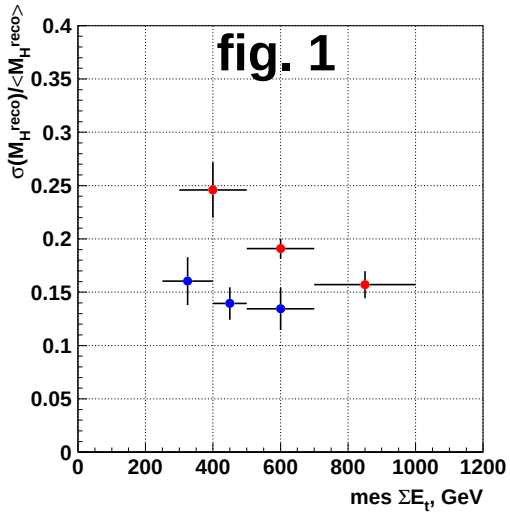
σ / M = 20 %

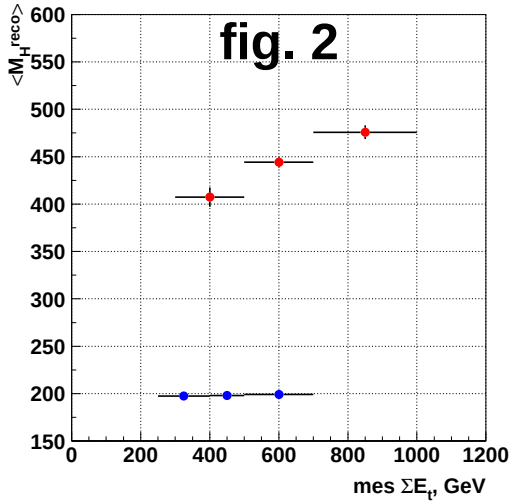


cmsjet : 13 % **13.4 %**

why 500 GeV Higgs has a worse resolution ?

Higgs mass resolution improves with increasing of ΣE_t (fig. 1), however $\langle M_H^{reco} \rangle$ varies with ΣE_t (fig. 2)





this variation of $\langle M_H^{reco} \rangle$ with ΣE_t spoils mass resolution for 500 GeV Higgs

variation of τ-jet energy scale is less than 4 %, so the major contribution spoiling resolution are not tau's

next slides : "event display" of events H(500 GeV) with low and high ΣE_t,

A/H(500 GeV)->2τ->2j. Low Σ E_t, M_H = 393 GeV

green - ecal tower E_t

grey - hcal tower E_t

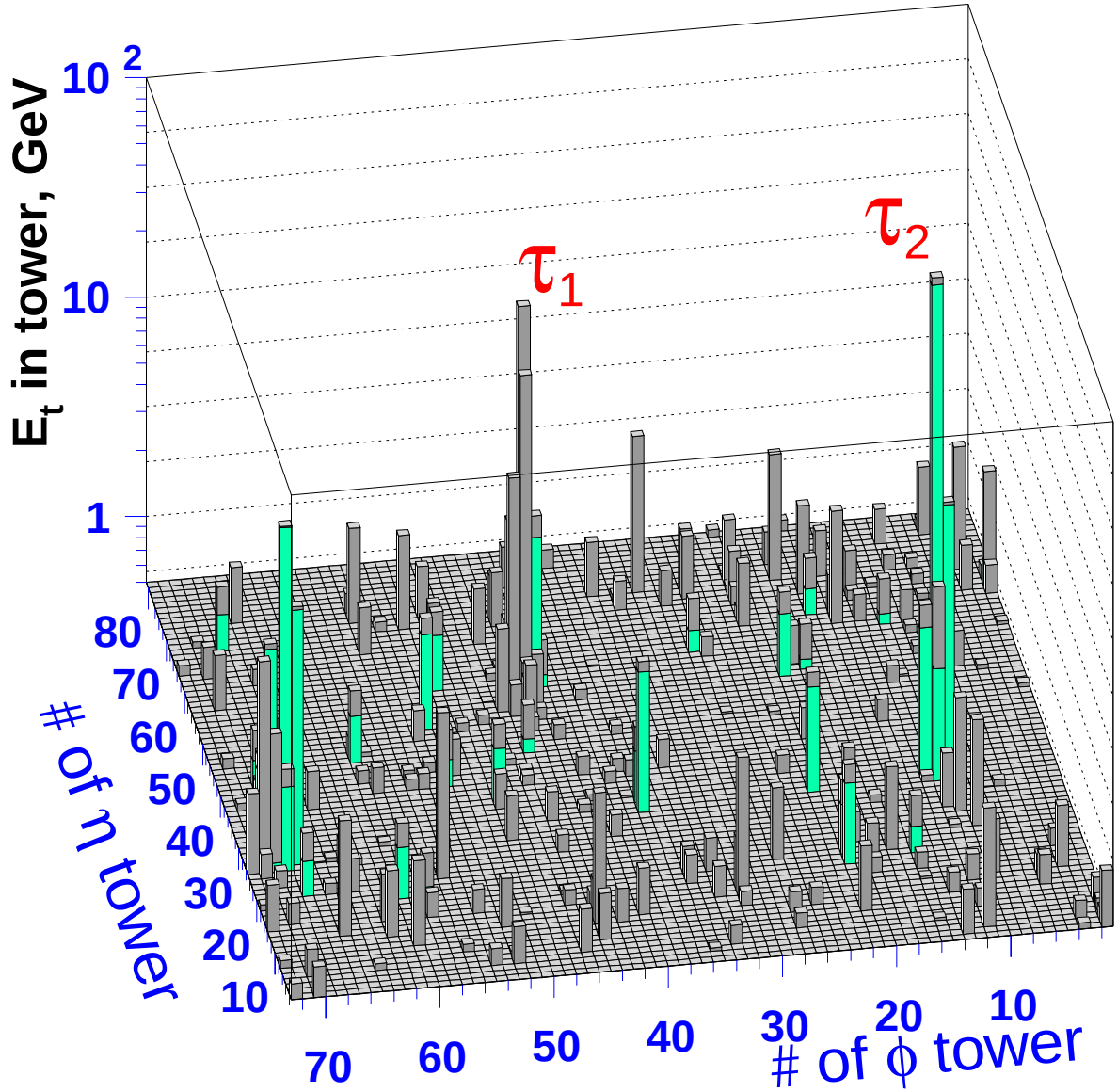
M_H, GeV	393
ΣE_t, GeV	450
$\Sigma E_t - \Sigma E_t^{\tau\text{-jets}}$, GeV	264
$E_t^{\tau\text{-j1}}$ mes/mc,GeV	74/76
$E_t^{\tau\text{-j2}}$mes/mc, GeV	112/120
MET MC, GeV	74
MET mes	84

MC Higgs 495 GeV

mes->mc

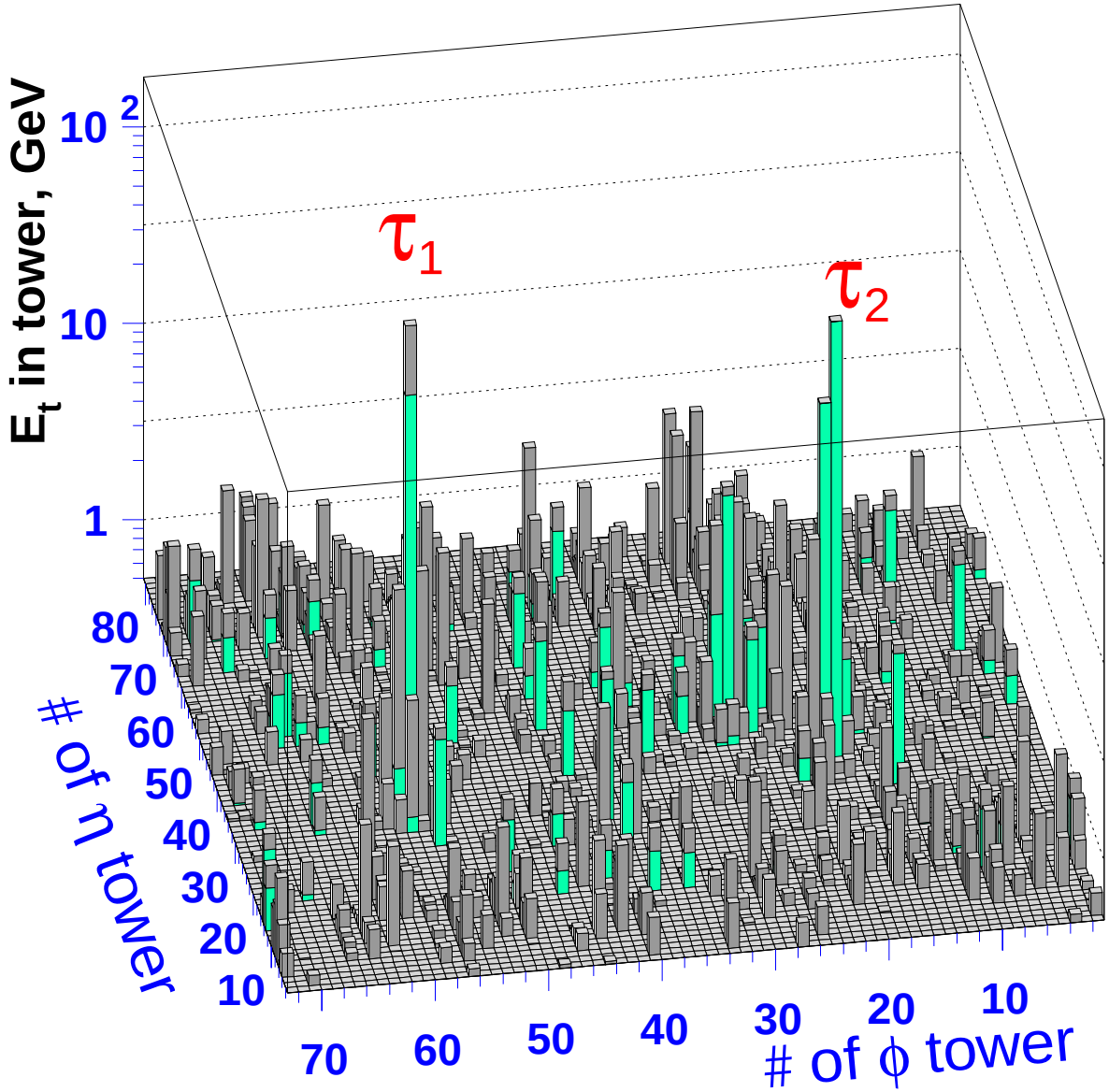
$E_t^{\tau\text{-j}}$ 470 GeV

$E_t^{\tau\text{-j}}$& missE_t 393 GeV



A/H(500 GeV)->2τ->2j. High Σ E_t, M_H = 546 GeV

green - ecal tower E_t

grey - hcal tower E_t

M_H, GeV	546
ΣE_t, GeV	967
$\Sigma E_t - \Sigma E_t^{\tau\text{-jets}}$, GeV	552
$E_t^{\tau\text{-j1}}$mes/mc, GeV	240/252
$E_t^{\tau\text{-j2}}$mes/mc, GeV	175/166
MET MC, GeV	14
MET mes, GeV	25