ECAL CUTS IMPACT ON JET/DIJET RESOLUTION

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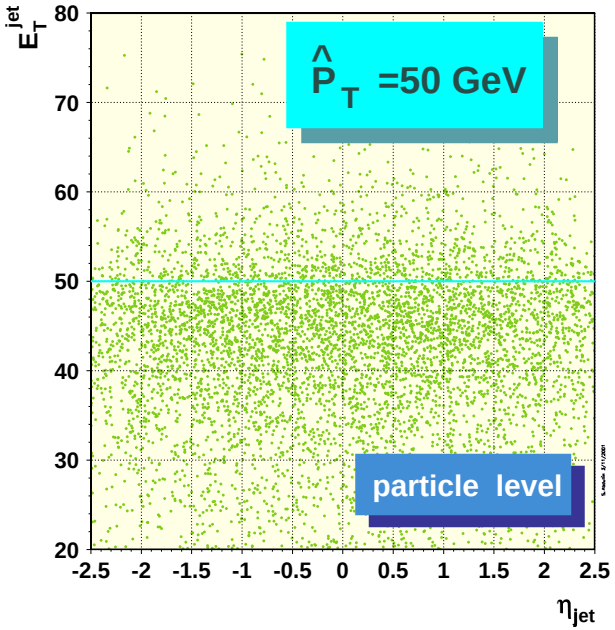
- What we are worrying about ?
- Data samples
- Z′(120) results
- QCD di-jet results

PREOCCUPATION

- ECAL selective readout assumes a significant reduction (factor ~ 20) of full data (10 frames) samples stored for the subsequent off-line analysis
  - Zero suppression above some cut (2.5 σ ?) out of "interesting" regions
  - All (or almost) preserved in specified (ECAL L1) "interesting" regions
- What about jet (di-jet) energy reslution and missing E_T measurement precision ?
- ECAL community : it's OK, not a main limiting factor ...
- HCAL community - probably so ...

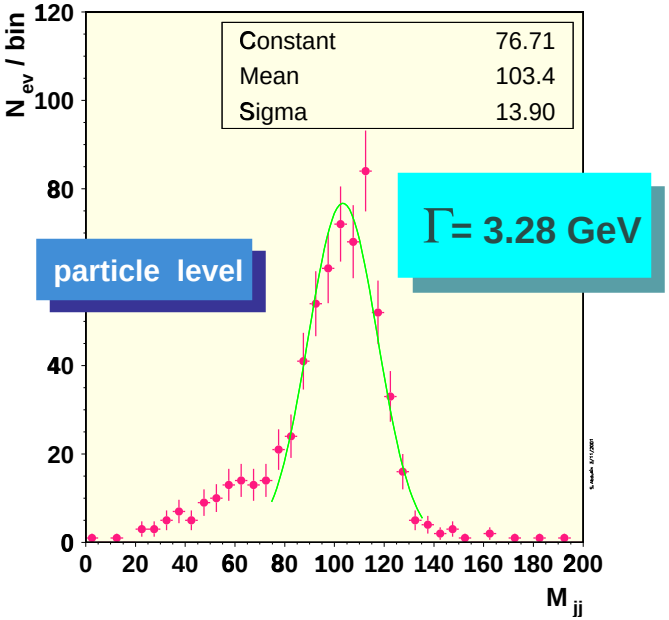
SAMPLES

- QCD di-jet (u,d)



- ISR / FSR
  multiple interaction } on
- Particle-level preselection :
  min. 2 jets with E_T > 30 GeV
  within η < 2.5

- $Z'(120) \rightarrow j\,j$ ($u\bar{u}$, $d\bar{d}$)



- $q\bar{q} \rightarrow Z' \rightarrow j\,j$ ($u\bar{u}$, $d\bar{d}$)
- Particle-level preselection :
  min. 2 jets with E_T > 30 GeV
  within η < 2.5

CALCULATIONAL DETAILS

Readout thresholds (RecHits)

Set No	HCAL threshold (MeV)	ECAL threshold (MeV) barrel	ECAL threshold (MeV) forward
1	$-\infty$	$-\infty$	$-\infty$
2	0	0	0
3	600**	$-\infty$	$-\infty$
4	600**	0	0
5	600**	30*	150*
6	600**	60**	300**

** $2\sigma_{noise}$ * $1\sigma_{noise}$

IterativeCone Jetfinder

- R = 0.5
- Seed = 3 GeV
- E_T^{min} = 25-30 GeV
- No jet energy corrections
- 2 hardest jets taken for mass

New HCAL prototype code

- 1 depth layer (HB/HE) + HO
- Layers 1 & 2 "re-weighted"
- Signal integration in 2 bkts
- ADC quantization
- Photo statistics effect
- Hit time jitter
- HF splitted from HB/HE

Objy database size : 15 Gb

- 3000 QCD dijets + 1000 Z'

BACK-OF-ENVELOPE ESTIMATES

"It's so simple, it might even work !"

(Dan Green ?)

- ECAL : ~ 2500 Xtals in R=0.5, σ = 30 MeV in EB

- HCAL : ~ 100 towers,

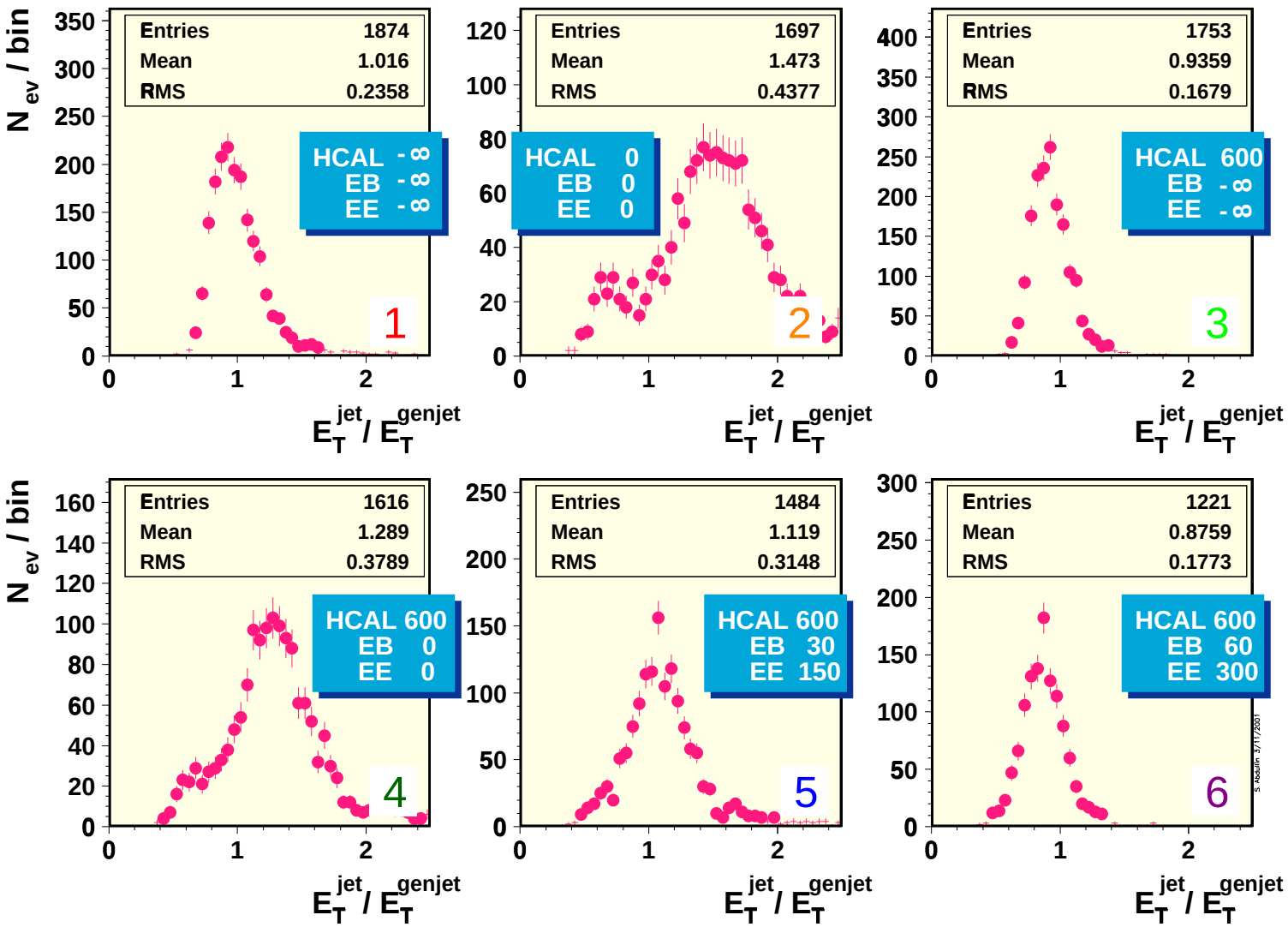
$$\sigma = 200\ \text{MeV} * \text{corr} * \sqrt{2\ \text{readouts} * 2\ \text{layers}} \sim 450\ \text{MeV}$$

+ HO !

cut (σ)	fraction	mean (σ)	jet content (GeV)	
			ECAL	HCAL
0	0.5	0.8	30.0	18.0
1	0.15850	1.524	18.3	10.9
2	0.02875	2.372	5.0	3.0
3	0.00135	3.276	0.3	0.2

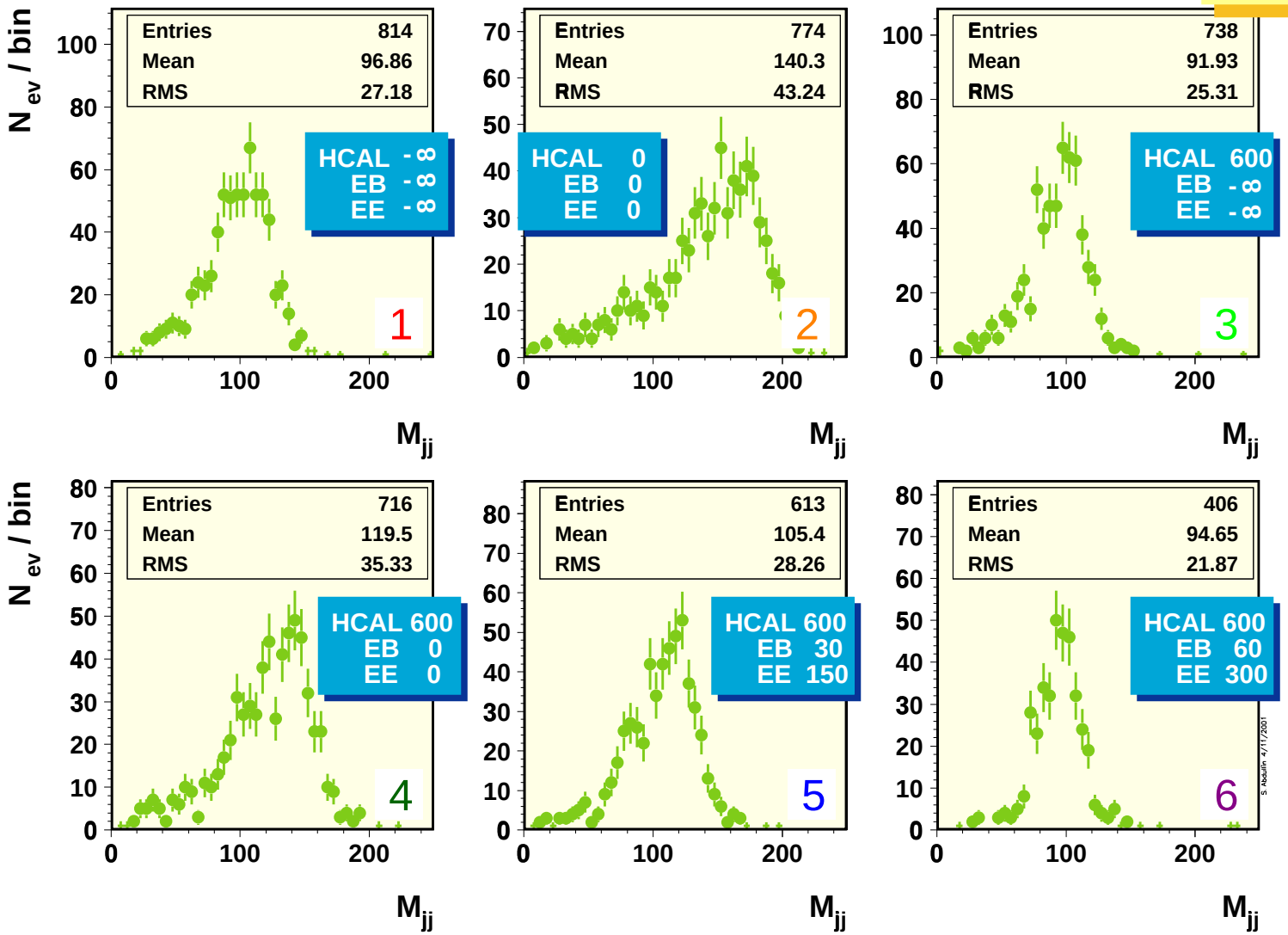
$Z'(120)$ JETS

$E_T^{jet} > 30$ GeV



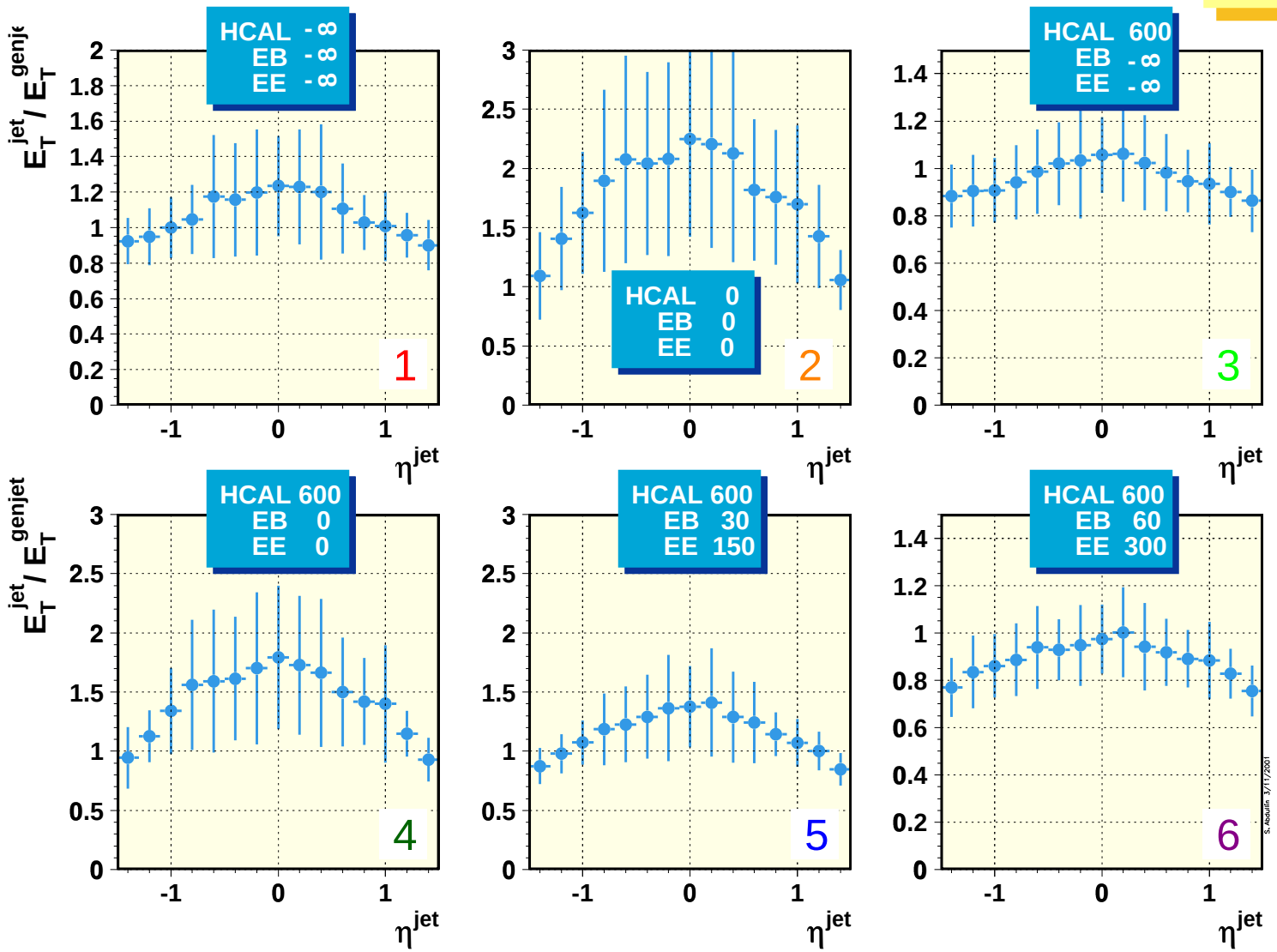
$Z'(120)$ MASS

$E_T^{jet\,1} > 40$ GeV
$E_T^{jet\,2} > 25$ GeV

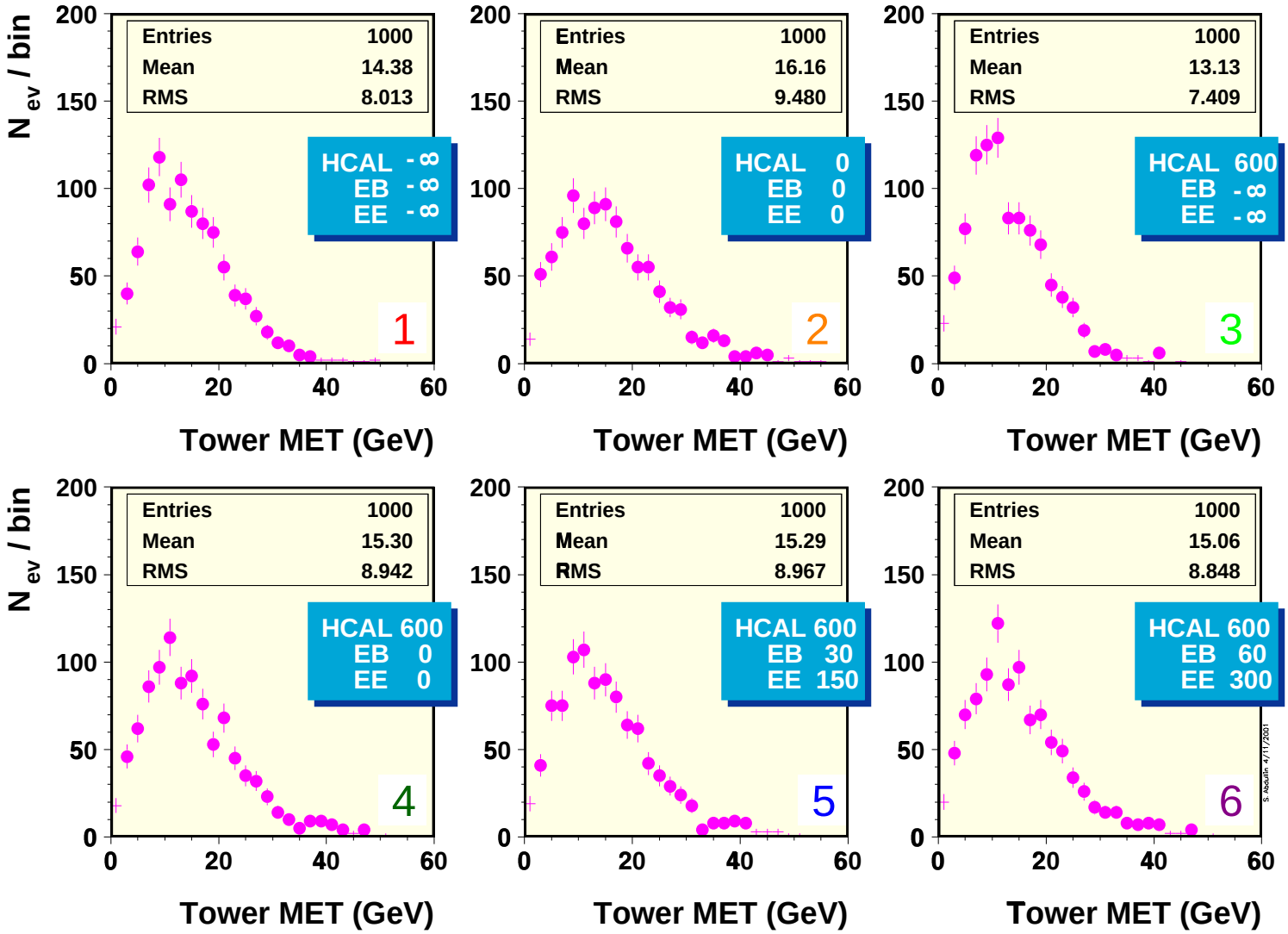


$Z'(120)$ JET/GENJET RATIO VS η

$E_T^{jet} > 30$ GeV



$Z'(120)$ MET


N ev / bin
Tower MET (GeV)
Entries 1000
Mean 14.38
RMS 8.013
HCAL -∞
EB -∞
EE -∞
1
Entries 1000
Mean 16.16
RMS 9.480
HCAL 0
EB 0
EE 0
2
Entries 1000
Mean 13.13
RMS 7.409
HCAL 600
EB -∞
EE -∞
3
Entries 1000
Mean 15.30
RMS 8.942
HCAL 600
EB 0
EE 0
4
Entries 1000
Mean 15.29
RMS 8.967
HCAL 600
EB 30
EE 150
5
Entries 1000
Mean 15.06
RMS 8.848
HCAL 600
EB 60
EE 300
6
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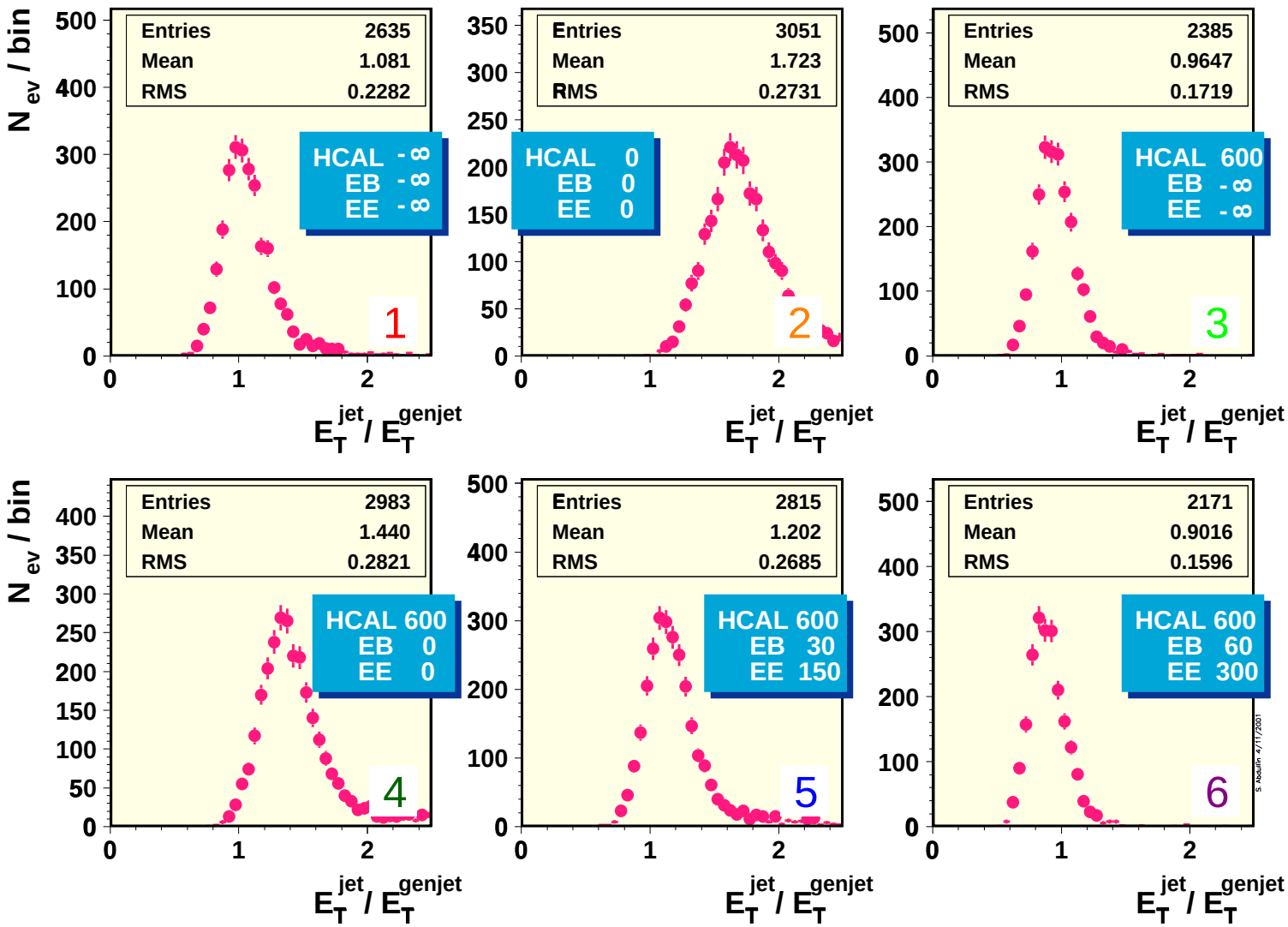
QCD JETS (I)

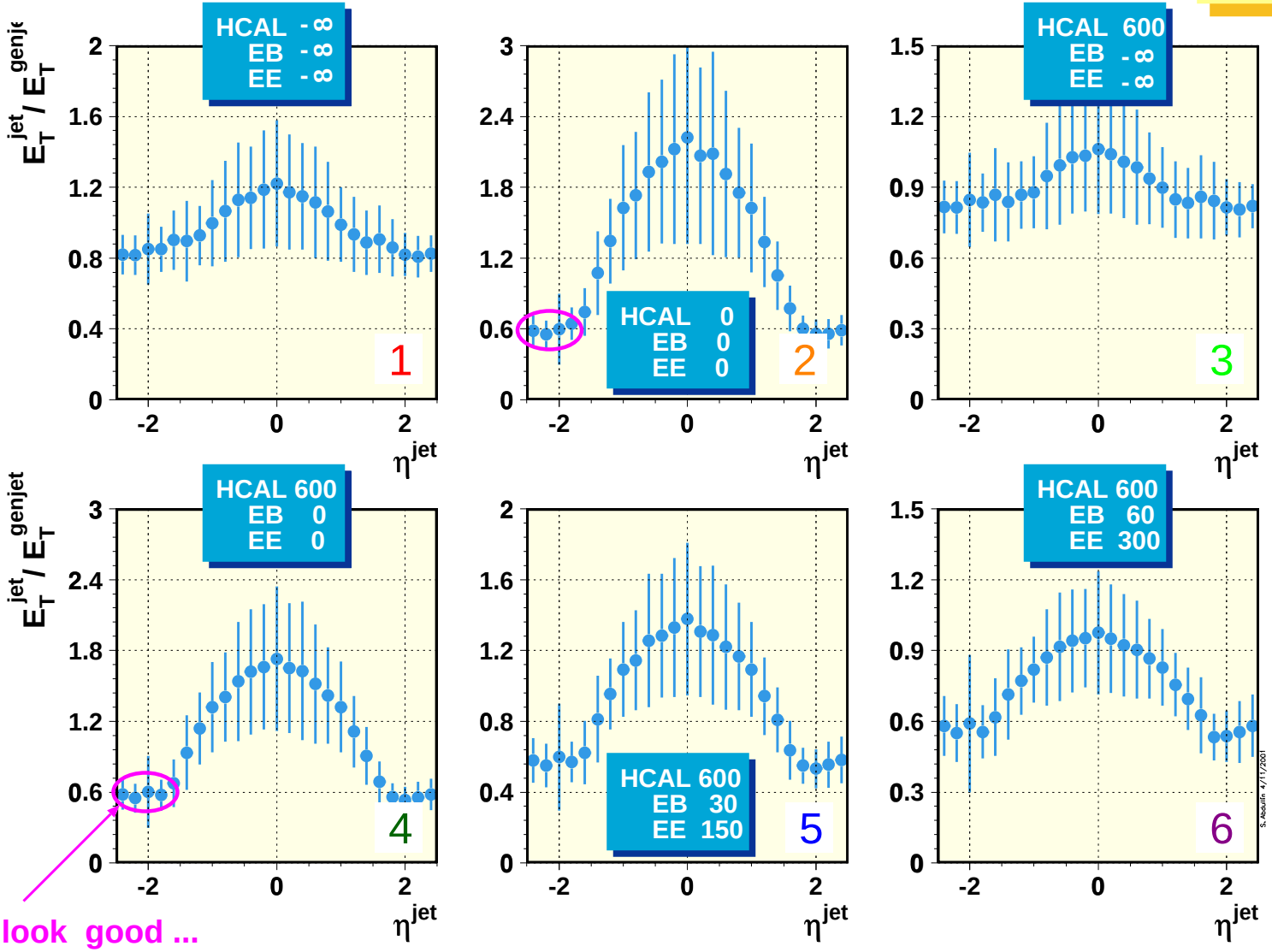
- $|\eta| < 1.0$

$E_T^{jet} > 30$ GeV



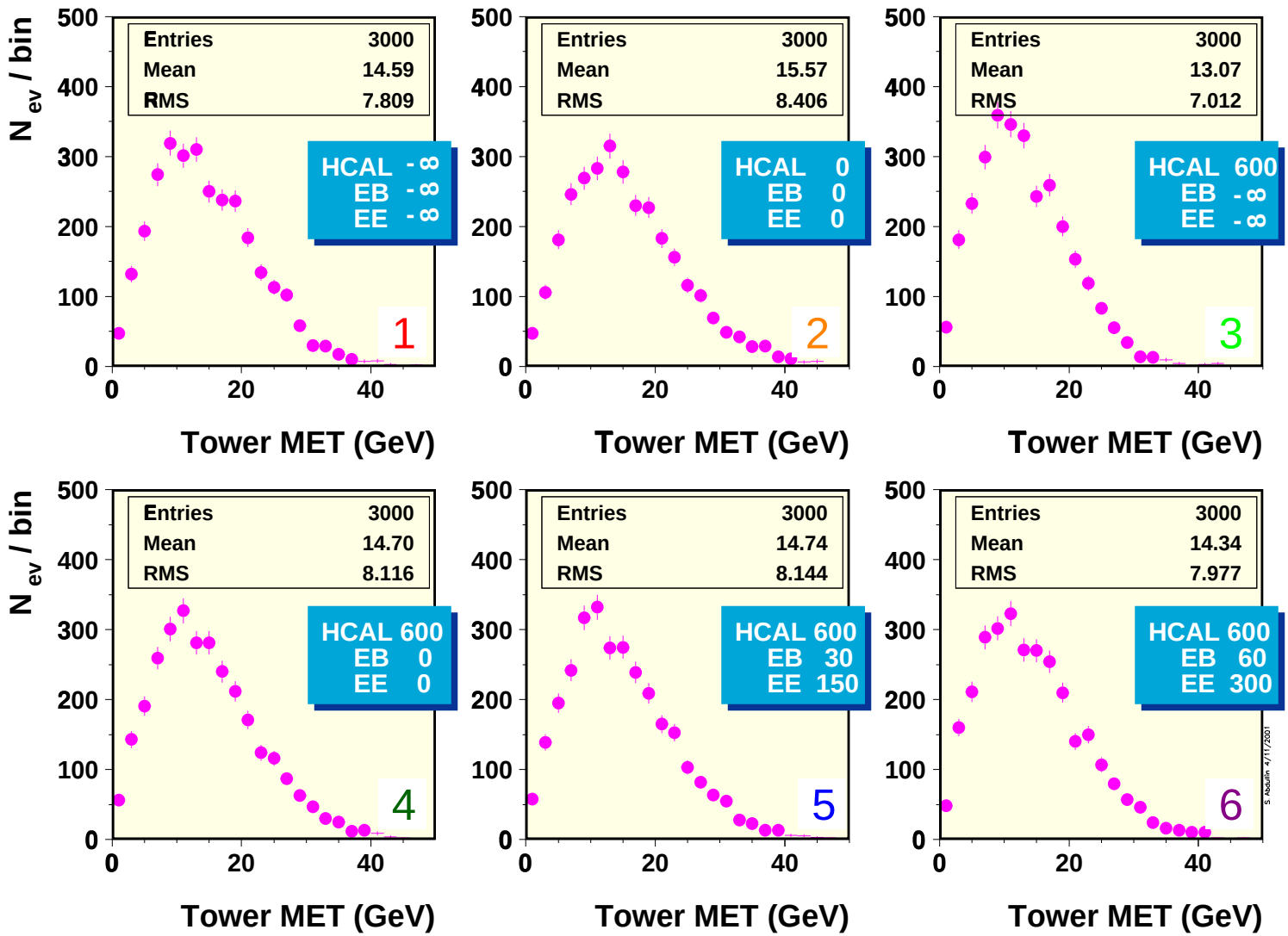
QCD JET/GENJET RATIO VS η

$E_T^{jet} > 30$ GeV



doesn't look good ...

QCD MET


N ev / bin
Tower MET (GeV)
Entries 3000
Mean 14.59
RMS 7.809
HCAL -∞
EB -∞
EE -∞
1
Entries 3000
Mean 15.57
RMS 8.406
HCAL 0
EB 0
EE 0
2
Entries 3000
Mean 13.07
RMS 7.012
HCAL 600
EB -∞
EE -∞
3
Entries 3000
Mean 14.70
RMS 8.116
HCAL 600
EB 0
EE 0
4
Entries 3000
Mean 14.74
RMS 8.144
HCAL 600
EB 30
EE 150
5
Entries 3000
Mean 14.34
RMS 7.977
HCAL 600
EB 60
EE 300
6
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CONCLUSION

- Effect on MET to be better investigated ...
- 2 σ thresholds look appropriate
- Probably even higher ...
- Jet physics affected by "physical issues" more than by 2σ → 3σ cut variation (I guess)
- 2-3 σ cut seems to be useful to get rid of the noise ...