Post-Shutdown EM Triggering

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Goals:

- maintain stable thresholds for at least a few months
- avoid prescaling main single- and di-EM trigger
- plan for L1Cal η-coverage up to 2.4
- plan for luminosities up to 4×10^{31}
- increase trigger efficiency for J/Psi and Upsilon (calibration)

Level 1

Need to pick 4 EM thresholds: LO<ML<MH<HI

Trigger	L1 Prescale	Purpose
CEM(1,HI)	1	single EM
CEM(2,ML)	1	di-EM, sharpen single EM
CEM(2,LO)CEM(1,MH)	1	di-EM, sharpen single EM
CEM(3,LO)CEM(1,ML)	1	tri-EM
CEM(2,LO)	N	J/Psi, Upsilon

Proposal:

- HI=10.0
  - goal: run CEM(1,HI) unprescaled
  - CEM(1,10) extrapolates to 250Hz (out of L1) at 4×10^{31}
  - increased L2/L3 input rates should allow to run this unprescaled
- LO=2.5 (?)
  - goal: maximize L1 efficiency for J/Psi:

Trigger	presc. at 2×10^{31}	$\epsilon_{J/\Psi}$ (direct)	$\epsilon_{J/\Psi}$ ($b\bar{b}$)
CEM(2,1.5)	2800	20%	20%
CEM(2,2.0)	?	8.9%	9.8%
CEM(2,2.5)	?	3.3%	5.6%
CEM(2,3.0)	?	1.5%	3.8%

Efficiencies from MC (Sergey), prescales under investigation (Rick)

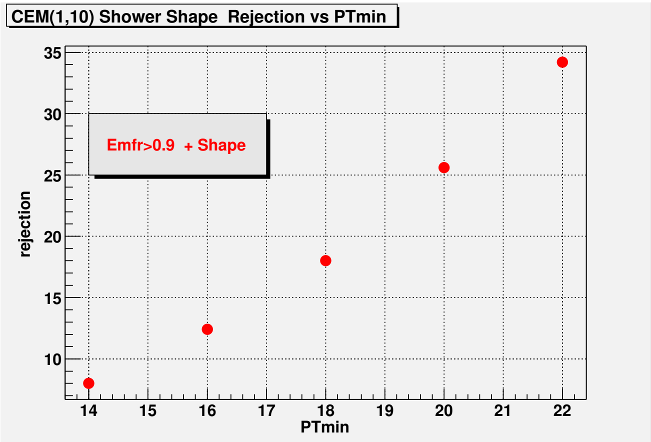
  - note: L1CTT should allow to lower threshold again
- ML=5.0
  - goal: run CEM(2,ML) unprescaled
  - rate estimate uncertain, but 5 GeV should be OK
- MH=8.0
  - goal: run CEM(2,LO)CEM(1,MH) unprescaled
  - rates for various combinations are under investigation

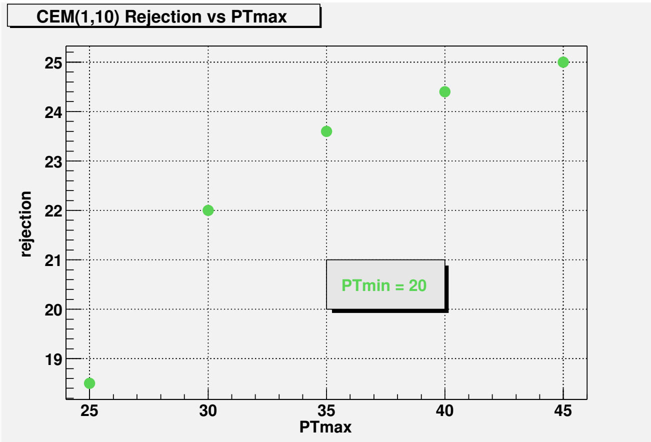
Level 3

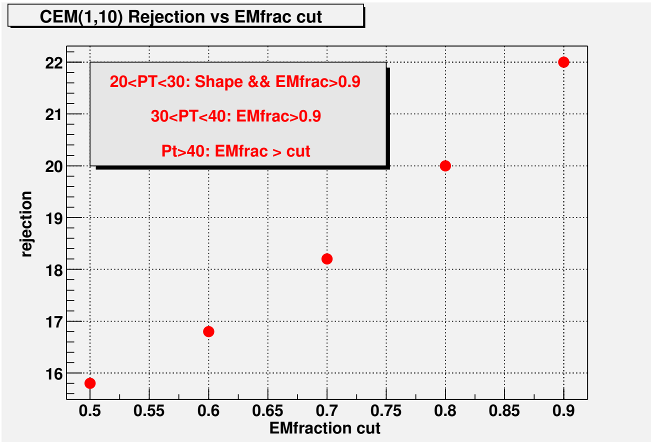
Single EM Filters:

- hanging off CEM(1,HI), CEM(2,ML), CEM(2,LO)CEM(1,MH)
- need to reduce 250Hz out of L1 to about 10Hz
- use OR of several filters:

  L3EM(1,pt>40, emfr_loose) with emfr_loose=0.8
  L3EM(1,pt>30, emfr) with emfr=0.9
  L3EM(1,pt>20, emfr+sh) with sh=(0.09, 0.08, 0.045)
  L3EM(1,pt>12, emfr+sh+track) with track_pt>10
  L3Track(1,pt>x)





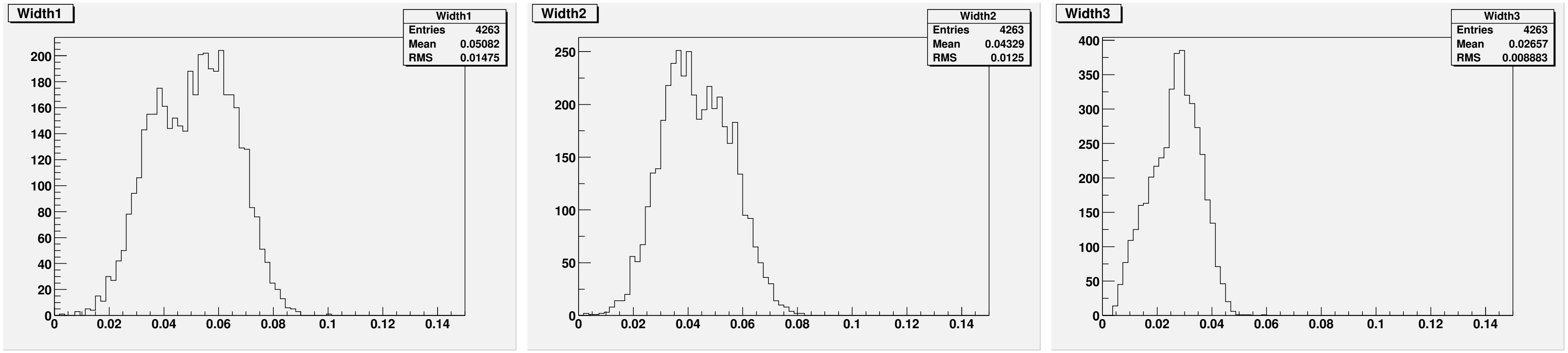


- test rejection power of adding a jet filter:

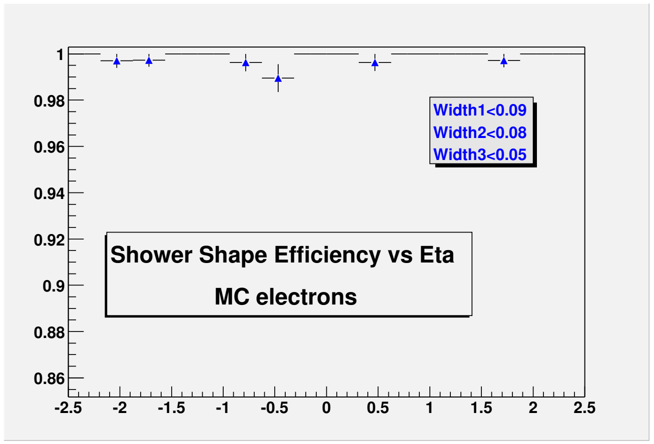
  L3EM(1,pt>20, emfr+sh) L3MP(1 out of 1) L3JET(2,20)

Level 3

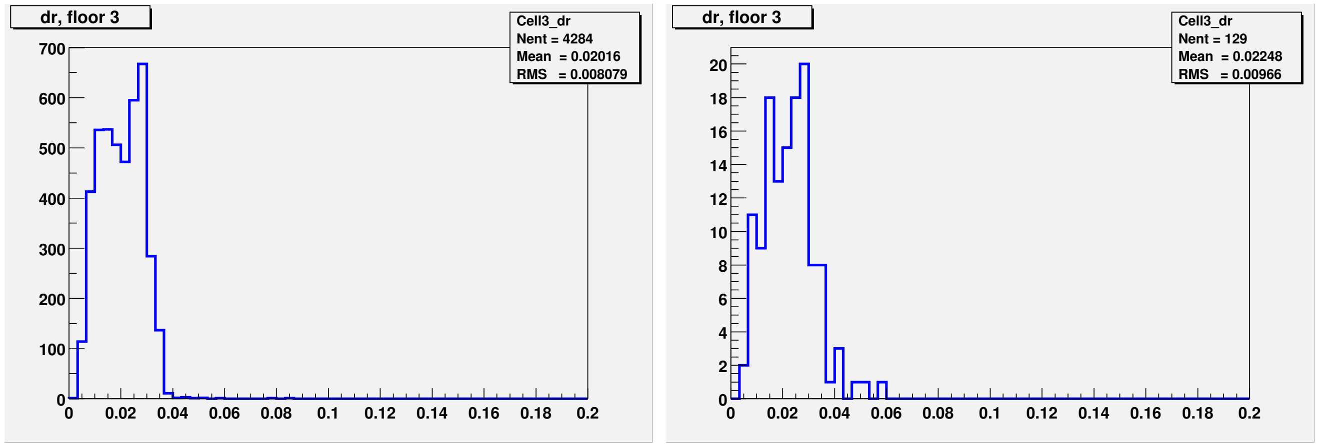
Shower Shape Cuts



Cluster Width in EM1 (left), EM2 (middle) and EM3 (right) for single e MC (flat in -2.4$<\eta<$2.4)



Efficiency of shower shape cuts vs. eta



Cluster Width in EM3 for Zee MC (left) and Zee data (right)

Level 3

Di-EM Filters:

– L3 threshold slightly above L1 threshold is sufficient:

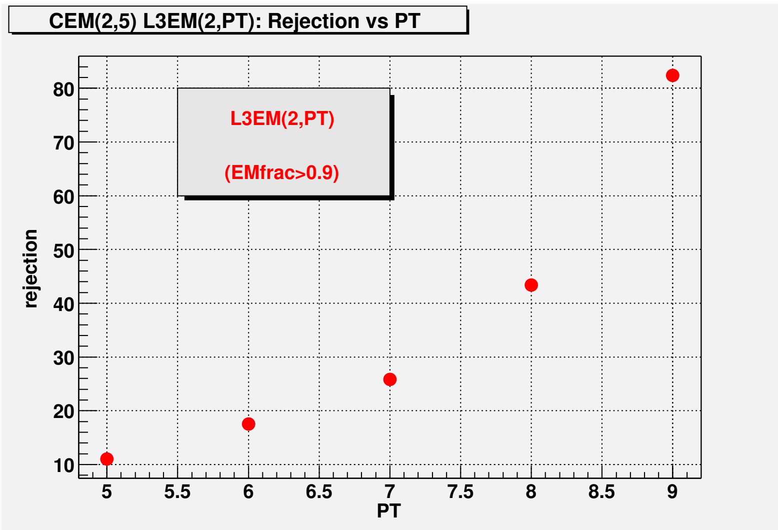
CEM(2,LO)CEM(1,MH)

L3EM(2,pt>LO+2,emfr)L3EM(1,pt>MH+2,emfr)

CEM(2,ML) L3EM(2,pt>ML+2,emfr)

CEM(3,LO)CEM(1,ML)

L3EM(2,pt>LO+2,emfr)L3EM(1,pt>ML+2,emfr)



J/Psi Filters:

– cal-based: L3EM(2,LO+x,emfr) with conesize=0.25

– track-based: L3Track(2,pt>y)

rejection is unknown

→ run as test trigger first:

L3Prescale(100)

L3MarkPass(1 out of 1)

L3Track(2,pt>2.0)

→ remove prescale after adjusting pt cut

Level 2

- L3 input rate currently at 500Hz, expected to increase
  - $\rightarrow$ initially should be able to get by without rejecting at L2
  - $\rightarrow$ will have to switch on emfr cut and clean up turnon curve as luminosity increases

$\rightarrow$ To measure turnon, run L2 in "pass-mode":

- L2 should be run to have L2 information in the data
- possible without duplicating trigger bits(?):
  CEM(n,X) L2EM(n,X-dx)
  (adjusting dx to account for differences in pedestal)

Level 3

Track-based Primary Vertexing

- L3 Primary Vertex will improve L3 Et resolution

  → sharper turnons

  → higher rejection

- L3 Vertex tool has passed offline tests

→ add it to triggerlist for commissioning online:

The general Idea:

- run existing, unprescaled filter (using NullVertex) with Et threshold reduced by 25%
- run Mark+Pass filter (1 out of 1)
- run filter (using L3 Vertex) with nominal Et threshold

The Proposal:

L1 Trigger	L3 Scripts
CJT(3,5)	JT_65TT JT_50TT_mp1_JT_65PV
CJT(4,5)	JT_95TT JT_70TT_mp1_JT_95PV
CJT(4,7)	JT_125TT JT_94TT_mp1_JT_94PV
CEM(1,10)	EM_HI EM_HI_SH EM_HI_SH_mp1_EM_HIPV