Trigger validation for 13.0.30.3

Many thanks to Julie Kirk, Patricia Conde Muiño, Allen Mincer, Valeria Perez Reale, Cibran Santamarina, Denis Damazio and Monika Wielers for slides, plots and information

Ricardo Gonçalo, RHUL

Physics Validation Meeting – 9 October 2007

TrigDecisionTool Troubles

- Nonsensical HLT results found with TrigDecisionTool
  - Reported in last validation meeting by Frank Paige and David Adams (many thanks!)
  - In some runs, result seemed to go wrong after a some 100s of events
- Due to silent failure to set up (non-existent) SLC4 libraries for pcache nightlies
  - 13.0.30 SLC4 libraries with bugs was being used instead
  - On the other hand, running on pcache (SLC3) was fine
  - Problem tracked down as side-effect of a pacman update
  - Fixed on Monday
- Setting up a wiki with a recipe and a clear example to use TrigDecisionTool in 13.0.30.2
  - Will post to Physics Validation HN

500 $H \rightarrow \gamma\gamma$ events

13.0.30.2

- EM Level 1 items show good efficiency
- Muon items reject most events
- Tau efficiency somewhere in between (harder to discriminate)

```
TrigDecChecker  INFO TrigDecisionTool summary:
TrigDecChecker  INFO ========================
TrigDecChecker  INFO   item L1_2EM13 accepted events=475
TrigDecChecker  INFO   item L1_2EM13I accepted events=455
TrigDecChecker  INFO   item L1_2EM13_MU6 accepted events=4
TrigDecChecker  INFO   item L1_2EM18 accepted events=467
TrigDecChecker  INFO   item L1_2EM18I accepted events=449
TrigDecChecker  INFO   item L1_2EM18_MU6 accepted events=3
TrigDecChecker  INFO   item L1_2EM23I accepted events=449
TrigDecChecker  INFO   item L1_2EM3 accepted events=489
TrigDecChecker  INFO   item L1_2EM3_EM7 accepted events=489
TrigDecChecker  INFO   item L1_2EM3_TAU6 accepted events=489
TrigDecChecker  INFO   item L1_2EM7 accepted events=480
TrigDecChecker  INFO   item L1_2EM7_MU6 accepted events=4
TrigDecChecker  INFO   item L1_TAU16I_XE30 accepted events=150
TrigDecChecker  INFO   item L1_TAU16I_XE40 accepted events=94
TrigDecChecker  INFO   item L1_TAU25 accepted events=500
```

500 $H \rightarrow \gamma\gamma$ events

13.0.30.2

- Forward jets active (but no HLT rejection)
- Muon has good rejection
- Tau efficiency somewhere in between (harder to discriminate)

```
TrigDecChecker  INFO TrigDecisionTool summary
TrigDecChecker  INFO ==========================
TrigDecChecker  INFO   chain EF_2FJ10 accepted events=29
TrigDecChecker  INFO   chain EF_2b10_3L1Jets accepted events=6
TrigDecChecker  INFO   chain EF_2b18_3L1Jets accepted events=3
TrigDecChecker  INFO   chain L2_mu10 accepted events=0
TrigDecChecker  INFO   chain L2_mu15 accepted events=0
TrigDecChecker  INFO   chain L2_e20_passL2 accepted events=500
TrigDecChecker  INFO   chain L2_e25i accepted events=112
TrigDecChecker  INFO   chain L2_g15i accepted events=493
TrigDecChecker  INFO   chain L2_g20 accepted events=493
TrigDecChecker  INFO   chain L2_g20_xe15 accepted events=310
TrigDecChecker  INFO   chain L2_g20i accepted events=492
TrigDecChecker  INFO   chain L2_g25 accepted events=489
```

500 $H \rightarrow \gamma\gamma$ events

13.0.30.2

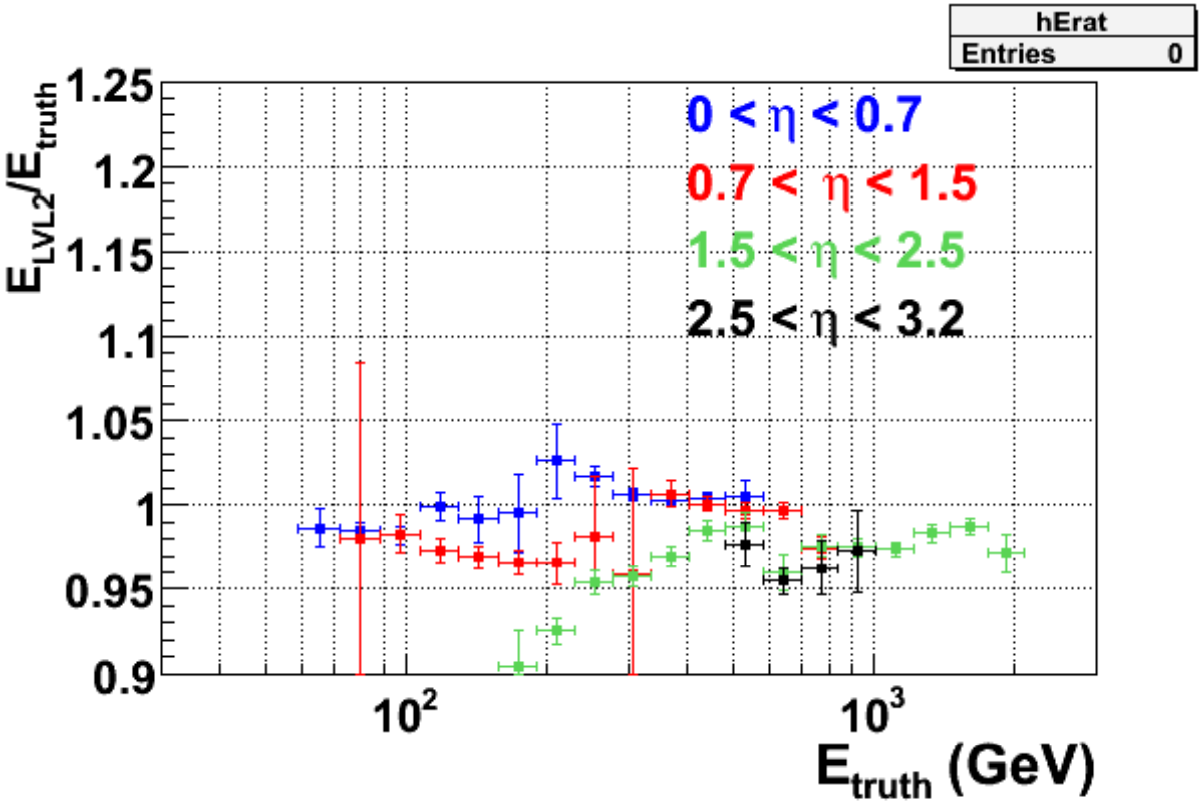
•Stability of a few signatures being checked in nightlies

```
TrigDecChecker  INFO TrigDecisionTool tests: efficiency in blocks of
   100 events
TrigDecChecker  INFO
   ================================================================
TrigDecChecker  INFO Event L2_J5 L2_J70 L2_3mu6 EF_J5 EF_J70 EF_3mu6
TrigDecChecker  INFO  100   100   67   0   100   67   0
TrigDecChecker  INFO  200   100   64   0   100   64   0
TrigDecChecker  INFO  300   100   65   0   100   65   0
TrigDecChecker  INFO  400   100   72   0   100   72   0
TrigDecChecker  INFO  500   100   69   0   100   69   0
```

Jets

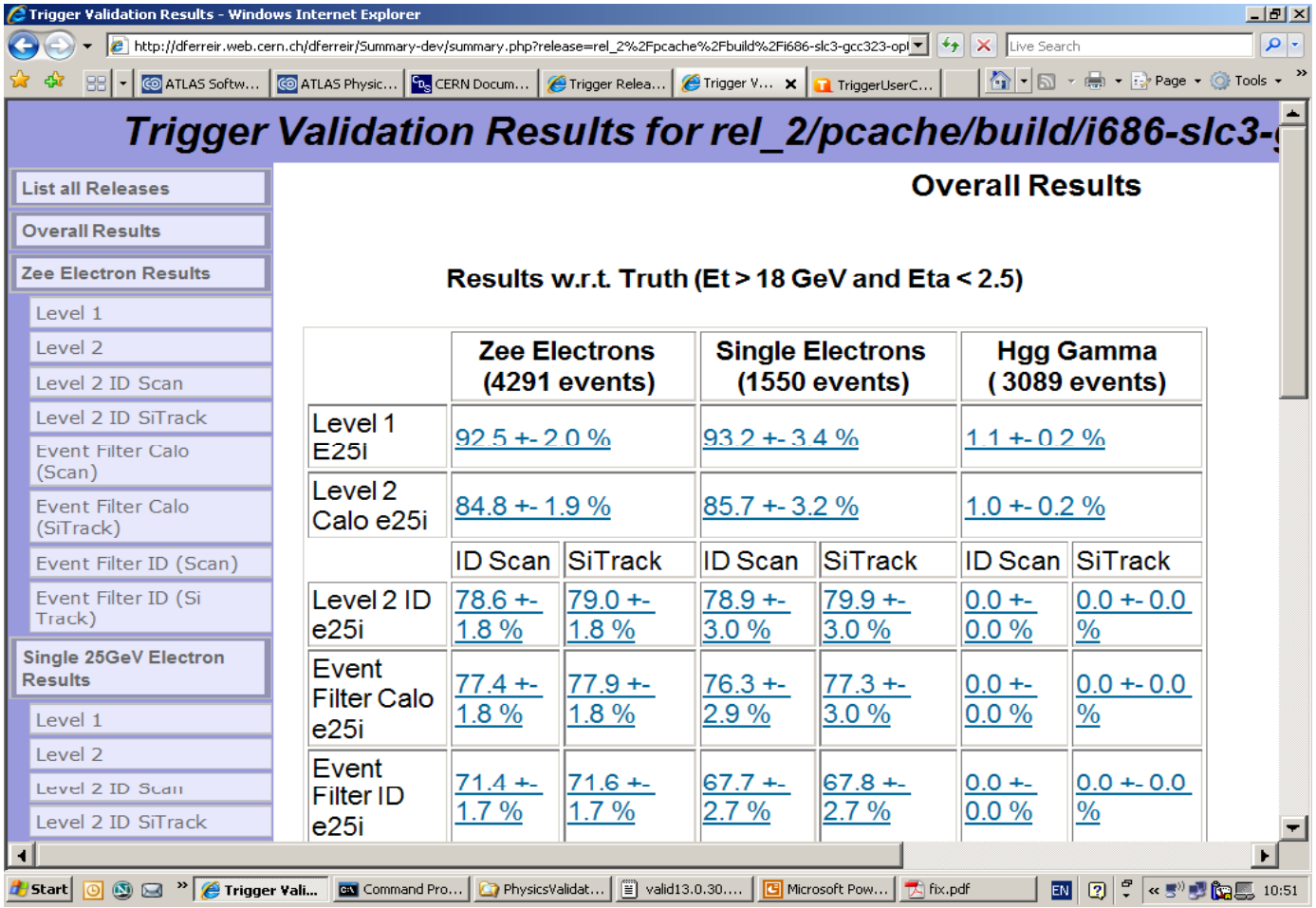
- Level 2 jet energy scale versus true jet energy
- Within ~5% except for:

  $1.5 < \eta < 2.5$



Electron Slice

- Problems retrieving Sample A data
- Only change since 13.0.30.1 was a tighter IsEM flag at EF
  - Efficiency for benchmark single electrons at 25GeV drops from 96.1% to 95.7%

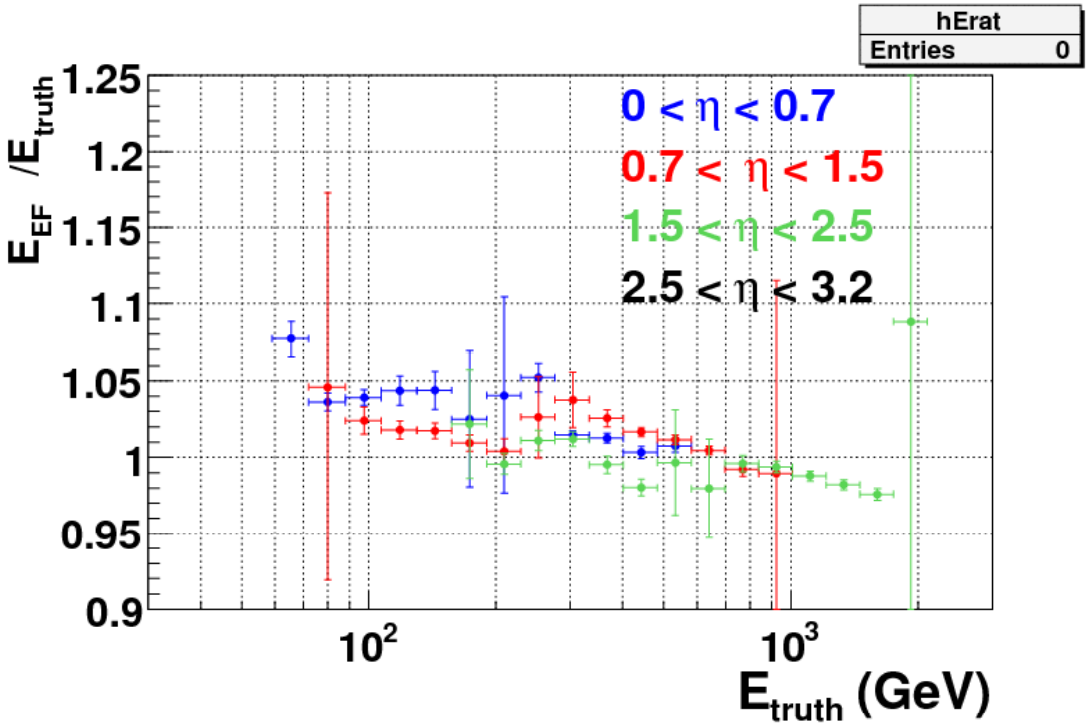


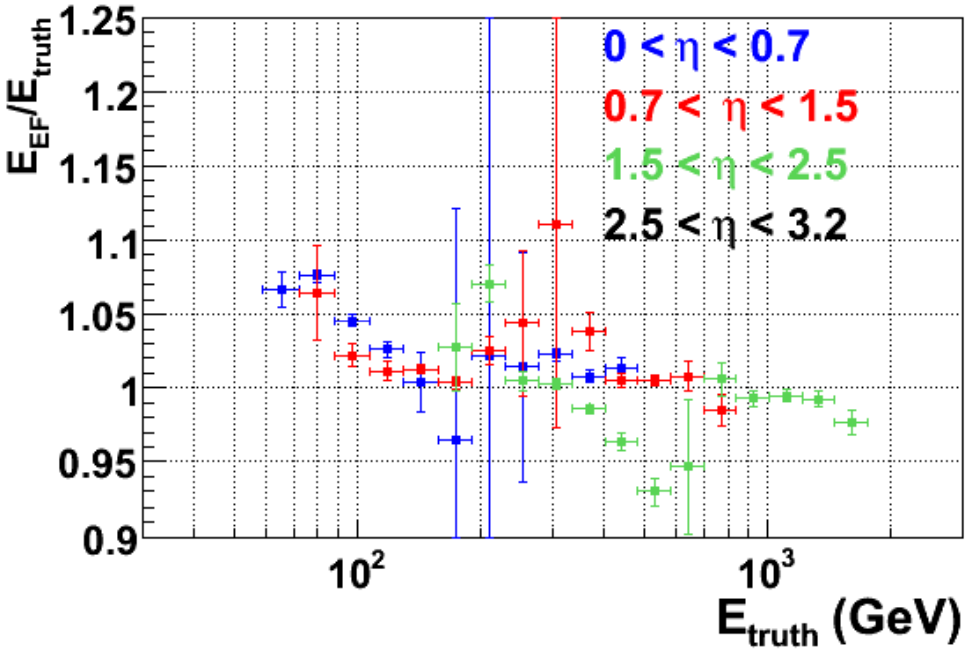
Top: 13.0.30.2

- EF energy scale variation ~5%

Bottom:13.0.30.1

- EF energy scale variation ~5%
- Large errors (low stats) in middle-ET sample



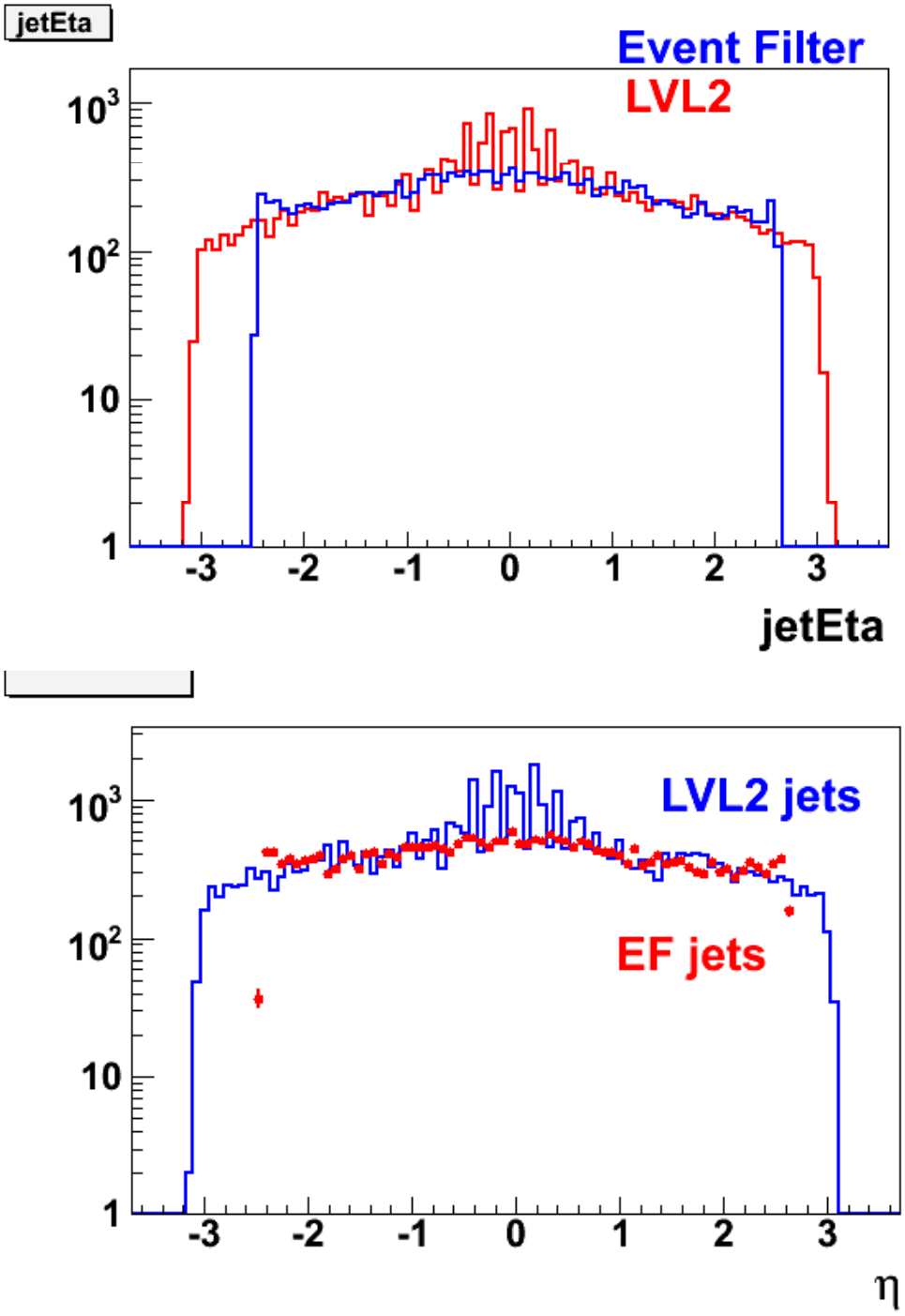


- Jet η at Level 2 and Event Filter

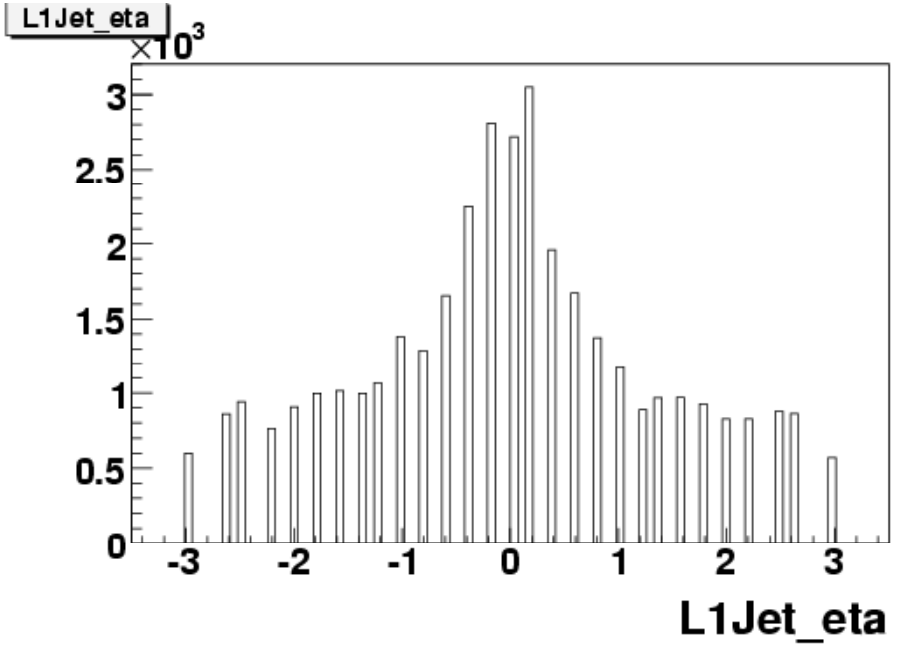
- Top: 13.0.30.2
- Bottom: 13.0.30.1
  - Look very compatible

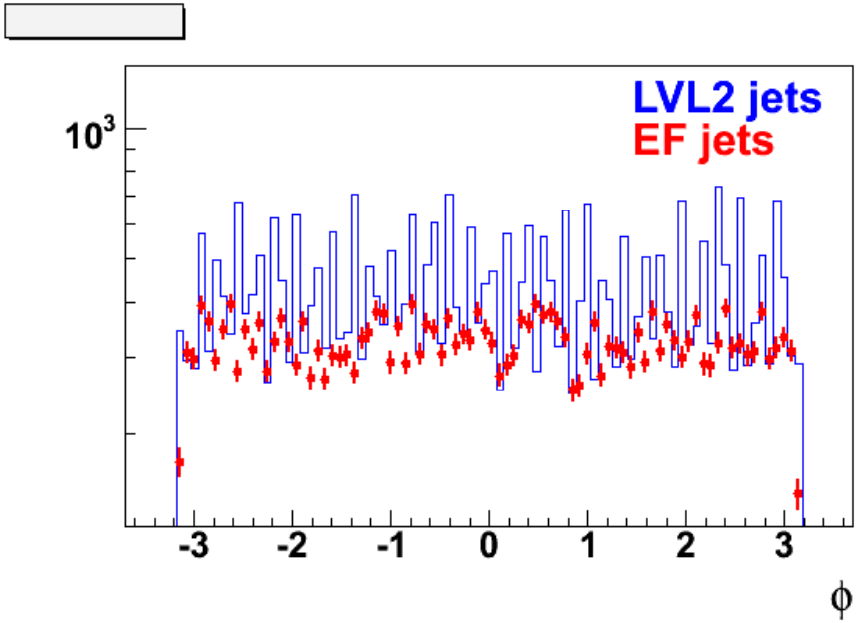
- EF doesn't reconstruct jets between η=2.5 and η=3.2 (?!!!)
  - Under investigation

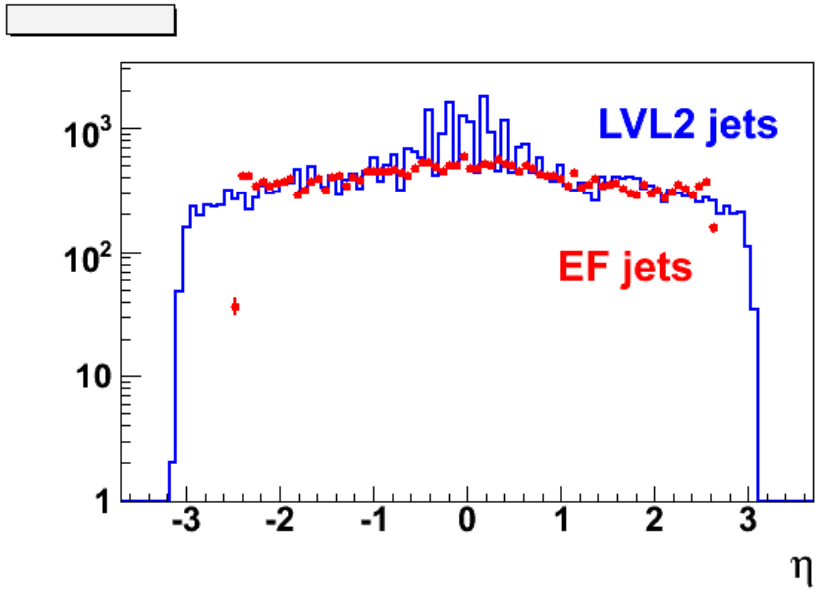
- Periodic structure at L2 (0.2 in eta and also phi) probably due to L1 bias (L1 ROIs, see next page)



- 13.0.30.1
- Top: η of Level 1 Jet RoIs
- Bottom: φ (left) and η (right) of Level 2 and EF jets
- Periodic structure at L2 (0.2 in eta and also phi) caused by L1



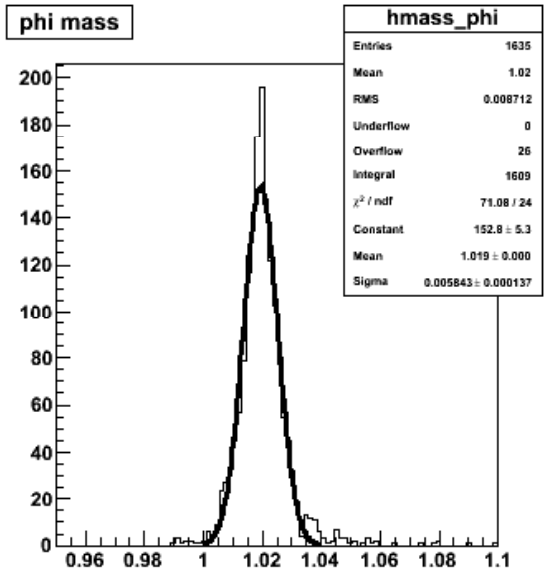


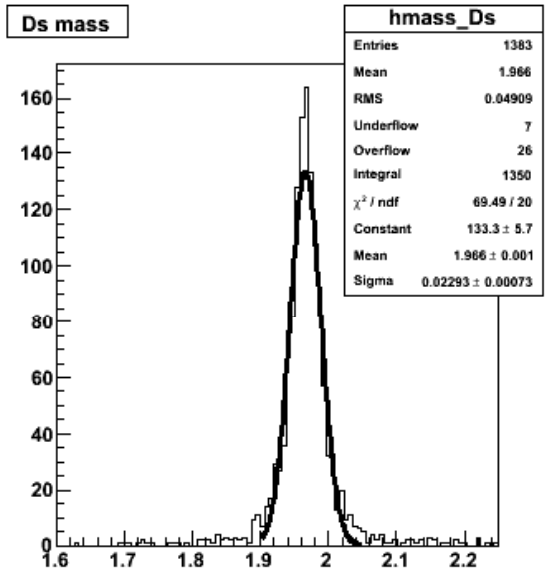


$B_s \rightarrow D_s(\Phi(KK)\pi)\pi$

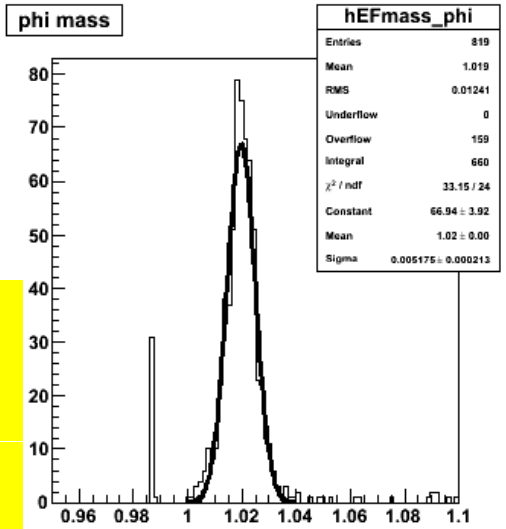
Top: L2
Φ mass 1019 +/- 6 MeV
Ds mass 1966 +/- 23 MeV

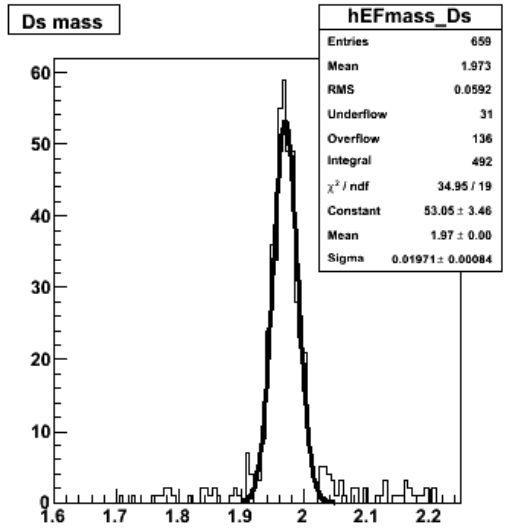
Widths in 12.0.6:
5 MeV and 22 MeV





Bottom: EF
Φ mass 1020 +/- 5 MeV
Ds mass 1970 +/- 20 MeV





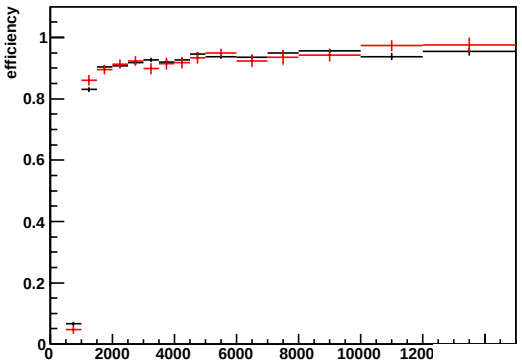
PDG:

$\Phi_{(1020)}$ mass = 1019.460±0.019 MeV

Γ=4.26 MeV

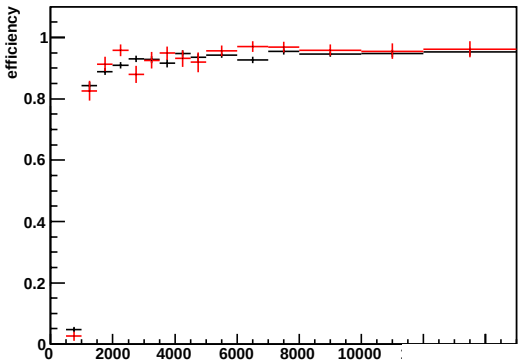
$D_s^{\pm}$ mass = 1968.2±0.5 MeV

kaons

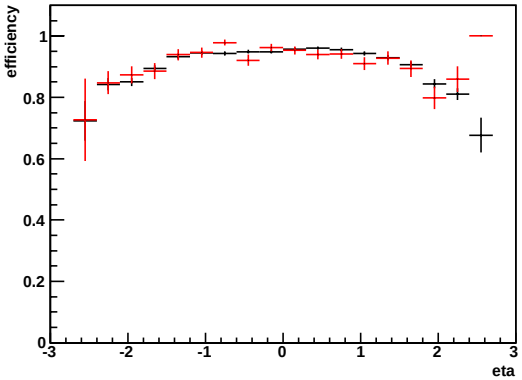


pT 15 GeV

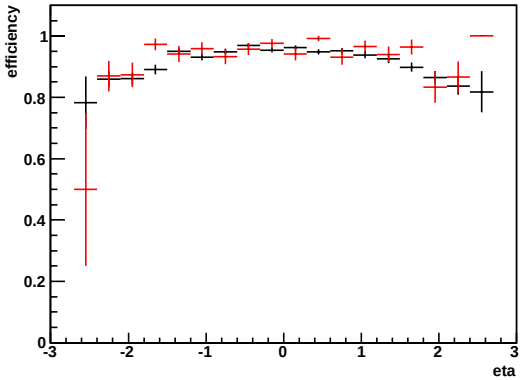
pions



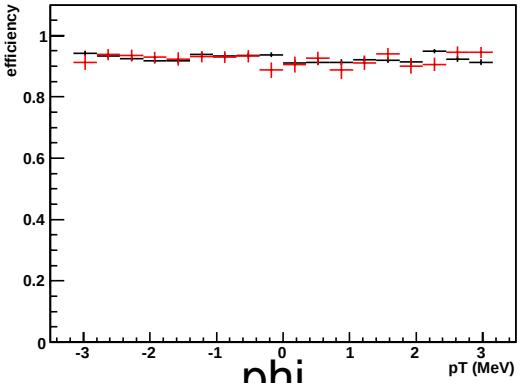
pT 15 GeV



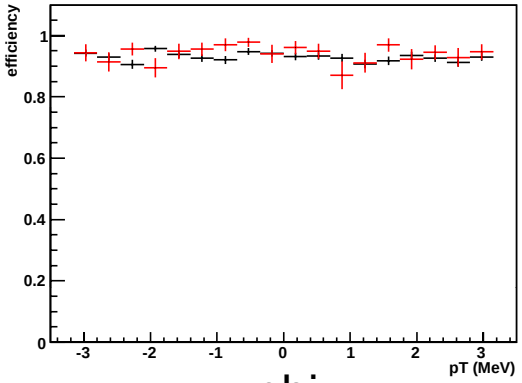
eta



eta



phi



phi

Tracking efficiencies
For kaons and pions

12.0.6 V 13.0.30.1

ALL LOOKS OK

Photon Trigger Status in Release 13.0.30.Y

Valeria Perez Reale (CERN)

Outline:

- **13.0.30.1 vs. 13.0.30.2 comparison**
- **Trigger Decision: L2 & EF selection efficiencies**
- **L2 and EF Selection Variables**
- **Summary**

Release 13 Validation

- *Release 13.0.30.1:*
  - Includes 10^31 photon menus (g25 & g25i photon triggers empty)
  - Includes fix in EF Photon hypothesis iSem flag
- *Release 13.0.30.2:*
  - Includes 10^31 photon menus (fixes for g25 & g25i photon triggers)
  - Includes 10^32 photon menus
- *No change in photon trigger performance expected between 13.0.30.1 and 13.0.30.2*

Validation sample: 1k events

- *trig1_misal1_valid1.006384.PythiaH120gamgam.recon.v13003001 (tid 0014940)*
- *trig1_misal1_valid1.006384.PythiaH120gamgam.recon.v13003002 (tid 0015353)*

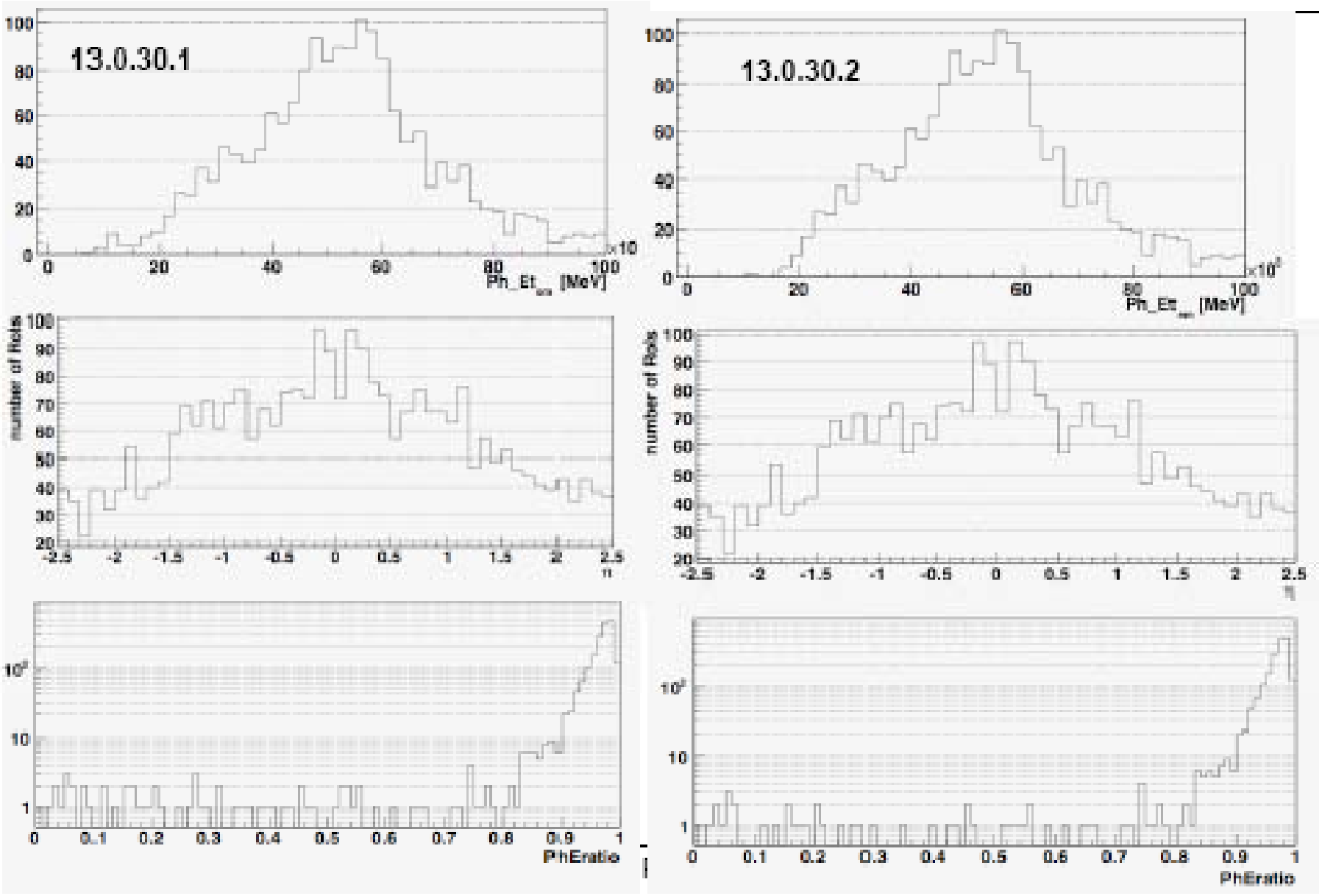
Trigger Decision for Photon Menus

- Compared Trigger Decision for 1k Hgg events (note: not same events reconstructed, no offline cuts applied for efficiency normalization)
  - Efficiency= number of accepted L2 events/number of accepted EF events

Trigger Menu/Release	13.0.30.1	13.0.30.2
2g10	81.7 %	81.5 %
2g15	81.9 %	82.7 %
2g20i_tight	88.5 %	89 %
2g20	83.5 %	83.6 %
g3	100 %	100 %
g60	94.3 %	93.6 %
e20_g20	80.3 %	80.2 %
g105	91.7 %	93.5 %
g20_x15	77.1 %	77.7 %
g25	empty	97.2 %
g25i	empty	96.8 %

- 13.0.30.1 and 13.0.30.2 give same photon trigger performance

L2 Photon Selection Variables



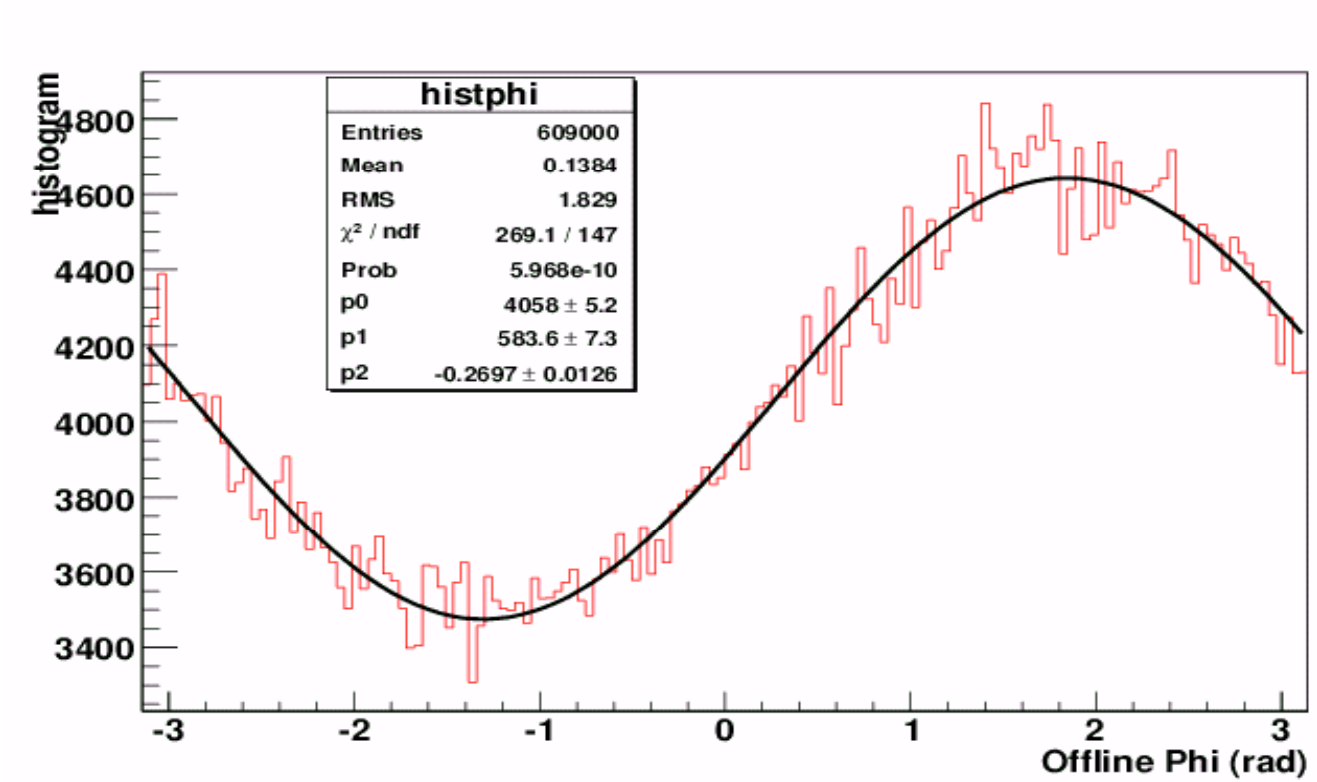
Summary

- Validation of the photon trigger slice yields same photon trigger performance results for 13.0.30.1 and 13.0.30.2:
  - In principal both 13.0.30.1 and 13.0.30.2 can be used for photon trigger Detector performance plots
  - Trigger can be switched ON for egamma samples (for photons) reconstructed with both releases
- Trigger Photon detector performance plots will be redone with release 13.0.30.2 by end of this week
  - 12.0.6 plots performed with EvenView AAN ntuple from AOD
  - For release 13 plots have to be performed with NTUP. Delay due to adapting framework to work from NTUP until EventView Framework works in rel13

Status of HLT MET

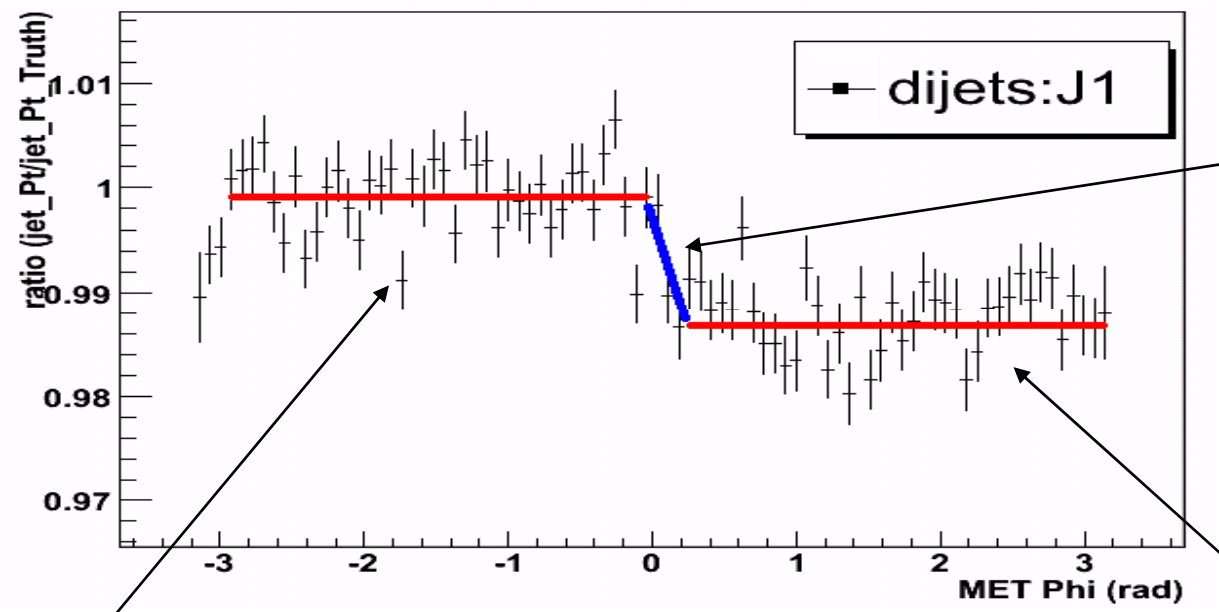
- Current algorithms stable:
  - LVL2 uses LVL1 output + LVL2 muons
  - EF uses sum over calorimeter cells + EF muons
- But still discussing whether muons should be added to MET/SumET
- Current timing studies appear OK.
- Work in progress on incorporating some calibration.
- Work not yet begun on rejecting fake MET sources

Plotting MET Phi distribution reveals asymmetry



Sinusoidal fit: p0+p1*sin(phi+p2)

Effect of distorted material on Jet Pt measurement



turn on curve consistent with the size of jet

with additional material

without additional material

Delta(ratio) ~= 1.2% (J1)
~= 1.0% (J4)
~= 0.7% (J7)

Trigger menus: 10^{31} luminosity

- **10^{32} and 10^{33} menus under discussion**
- **Chain L1_name prescale (HLT with same thr, pres=1)**

xe15 : L1_XE15 30000
xe20 : L1_XE20 7000
xe25 : L1_XE25 1500
xe30 : L1_XE30 200
xe40 : L1_XE40 20
xe50 : L1_XE50 2
xe70 : L1_XE70 1
xe80 : L1_XE80 1
te150 : L1_TE150 28500
te250 : L1_TE250 1100
te360 : L1_TE360 120
te650 : L1_TE650 1

HLT thresholds not correct in 13.0.30.2 (fixed in the latest tag):

te150 : HLT cut at 100 GeV
te250 : HLT cut at 200 GeV
te360 : HLT cut at 304 GeV
te650 : HLT cut at 380 GeV

From Jet/ETMiss phone conf. 19-0-07

Pending issues for 13.0.30.3

- Bytestream writing: needs a few new tags
- TauJet cannot be serialized
- Adding HLT info doubles the size of the BS. Can be reduced to 25% increase by changing the way serialization works
- ERROR messages when EF tries to de-serialize some objects created at L2 and which are still in StoreGate
  - Possible solutions:
    i. Don't record at the EF when running in this mode
    ii. Split the job into RDO->BS (L2)->BS (EF)->ESD/AOD steps
- Bytestream reading: should be ok but needs testing
- Minimum Bias: needed for FDR - some new tags needed
- Running from XML or Python trigger configuration

BACKUP

Event Size

- Andrew Hamilton https://twiki.cern.ch/twiki/bin/view/Main/TriggerAODSizeInRel13
- Measured in sample A events:
  - 1000 events per sample
  - Numbers in kB/event (~5% uncertainty)
- Note trigger size for top events:
  - This grows mostly with size of menu and event complexity
  - Top events satisfy almost every signature
  - Trigger EDM actually much more optimised ("smaller") in rel.13, but menu much larger (~190 chains per level in 13.0.30.1, as opposed to ~40 in 12.0.7)
    - In 13.0.20, reduction from ~100kB/ev to ~50kB/ev for top events and for same menu
  - ~35% reduction can be achieved for top events with separate B-physics menu

Dataset (AOD)	total	event	truth	calo	indet	muon	met	jet	tau	eg	trig ger
5011.J2_pythia_jetjet	187	6.0	31.3	25.7	26.2	3.7	3.3	36.1	1.2	6.5	42.1
5144.PythiaZee	175	6.4	25.6	20.7	19.0	3.9	3.3	33.8	1.4	5.6	49.7
5702.PythiaB_BsJpsiphi	220	6.0	29.0	23.9	26.3	32.0	3.4	37.9	0.8	3.4	51.2
6384.PythiaH120gamgam	179	6.4	26.6	22.3	20.2	3.5	3.4	32.9	1.3	5.0	51.5
5200.T1_McAtNlo_Jimmy	418	8.1	53.7	36.8	45.8	17.6	3.8	65.6	3.4	18.2	158.0