Status of Monitoring in HLT ALgorithms

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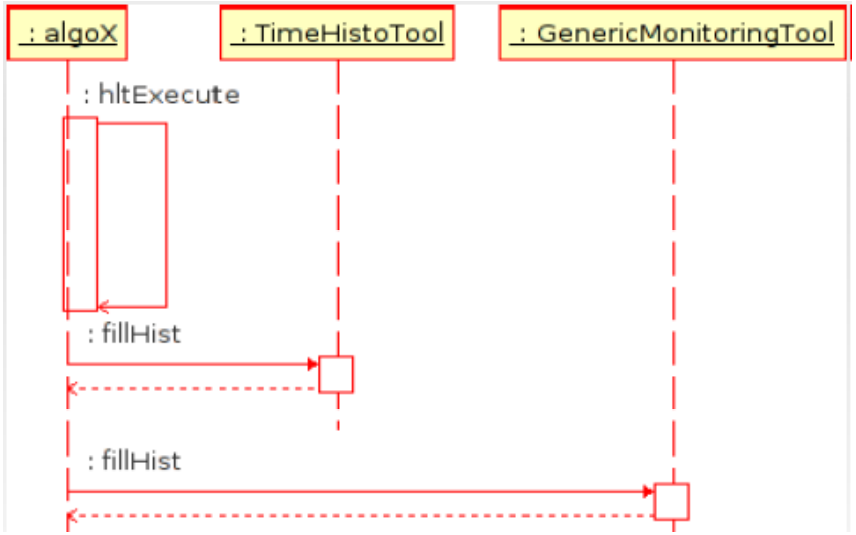
Monitoring infrastructure

- HLT algorithms (both FEX and Hypo) instrumented to produce histograms of internal variables
- Monitored variables exposed by the algorithms and collected after the AlgoX::execute() method
- Primitive type variables, objects (through accessor) and collections can be monitored
- Used both for online monitoring/data quality and offline software validation



See: Tomasz's talk in http://indico.cern.ch/conferenceDisplay.py?confId=13869

For instructions, see:
https://twiki.cern.ch/twiki/bin/view/Atlas/TriggerValidationHistograms

Monitoring infrastructure (cont.)

- Easy to add to algorithms
- Just declare variables to be monitored
  - Relevant methods in HLT algos base class
- Declare wanted histograms
  - No overhead if undeclared
- Advisable to reset variables every event with unphysical values

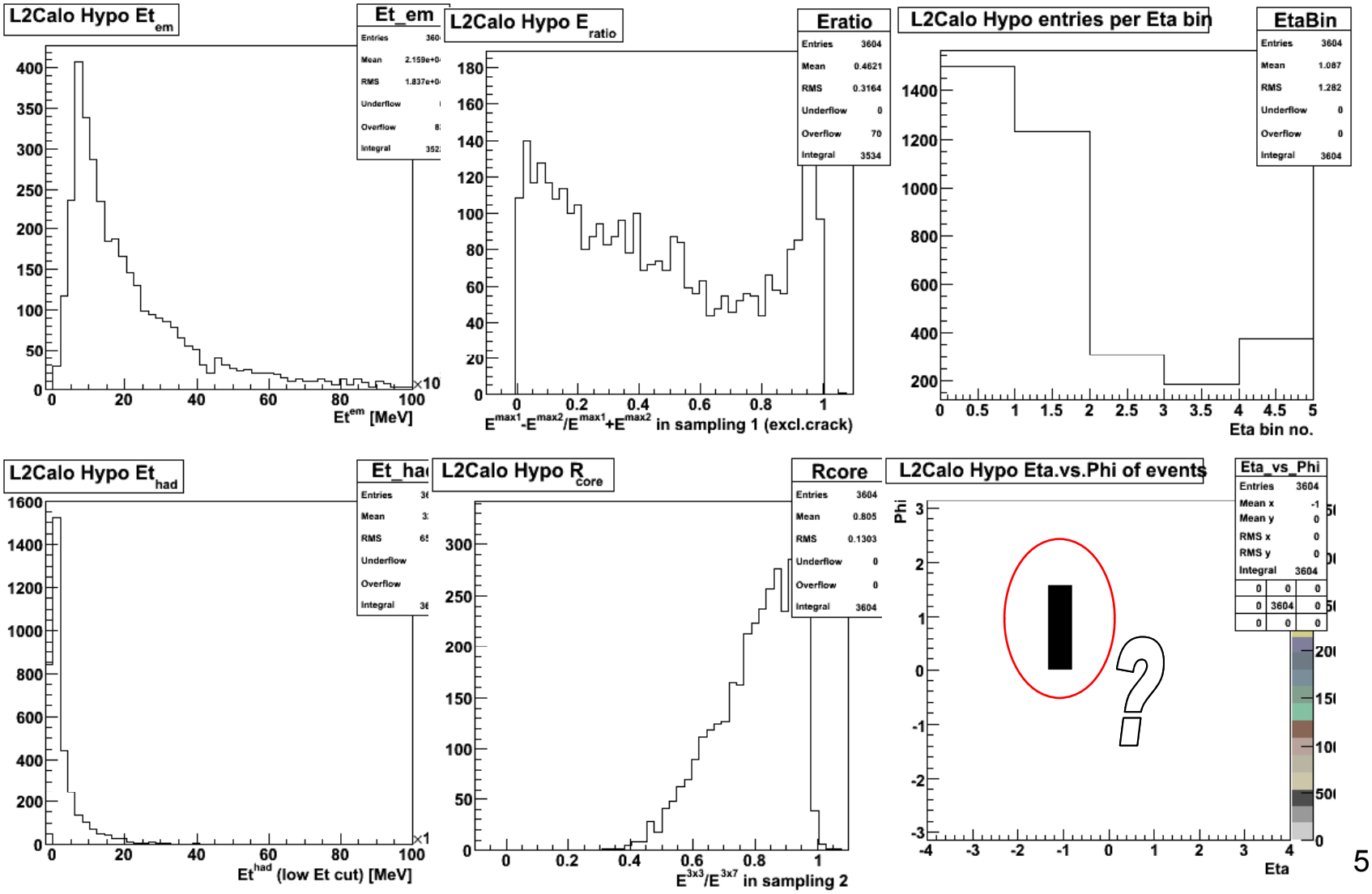
```
#include "TrigT2CaloTau/T2CaloTau.h"

#include <TH1F.h>
#include "AthenaKernel/errorcheck.h"

class ISvcLocator;
class AlgFactory;

T2CaloTau::T2CaloTau(const std::string & name, ISvcLocator* pSvcLocator):
  T2CaloNewBase(name, pSvcLocator){

  declareProperty("TrigTauClusterKey", m_trigTauClusterKey = "T2CaloTrigTauCluster");

  declareMonitoredVariable("Eta",m_Eta        );
  declareMonitoredVariable("Phi",m_Phi        );
  declareMonitoredVariable("EtaL2vsL1",m_EtaL2_L1   );
  declareMonitoredVariable("PhiL2vsL1",m_PhiL2_L1   );
  declareMonitoredVariable("EMRadius",m_EMRadius   );
  declareMonitoredVariable("IsoFrac",m_IsoFrac    );
  declareMonitoredVariable("StripWidth",m_StripWidth );
  declareMonitoredVariable("EtCalib",m_EtCalib    );
  declareMonitoredVariable("EME",m_EME        );
  declareMonitoredVariable("HadE",m_HadE       );
}

T2CaloTau::~T2CaloTau(){
}
```

```
#-----------------------------------------------------
#  T2CaloTau monitoring.
#-----------------------------------------------------
include.block("TrigT2CaloTau/jobOfragment_TrigT2CaloTau_mon.py")
theApp.Dlls += [ "TrigT2CaloTau" ]


Algorithm("T2CaloTau_g4_L2").AthenaMonTools +=  ["TrigTimeHistTool/TimeHisto" ]
Algorithm("T2CaloTau_g4_L2").AthenaMonTools +=  ["TrigGenericMonitoringTool/Mon" ]
Algorithm(  "T2CaloTau_g4_L2.Mon").Histograms = []
from TrigMonitorBase.TrigGenericMonitoringToolConfig import defineHistogram

Algorithm("T2CaloTau_g4_L2.Mon").Histograms = [ defineHistogram('Eta', type='TH1F', title="L2CaloTau FEX Eta; Eta; nevents", xbins=40, xmin=-4, xmax=4) ]
Algorithm("T2CaloTau_g4_L2.Mon").Histograms += [ defineHistogram('Phi', type='TH1F', title="L2CaloTau FEX Phi; Phi; nevents", xbins=50, xmin=-3.2, xmax=3.2) ]
Algorithm("T2CaloTau_g4_L2.Mon").Histograms += [ defineHistogram('EtaL2vsL1', type='TH1F', title="L2CaloTau FEX Eta_L2 - Eta_L1; dEta; nevents", xbins=50, xmi
Algorithm("T2CaloTau_g4_L2.Mon").Histograms += [ defineHistogram('PhiL2vsL1', type='TH1F', title="L2CaloTau FEX Phi_L2 - Phi_L1; dPhi; nevents", xbins=50, xmi
```

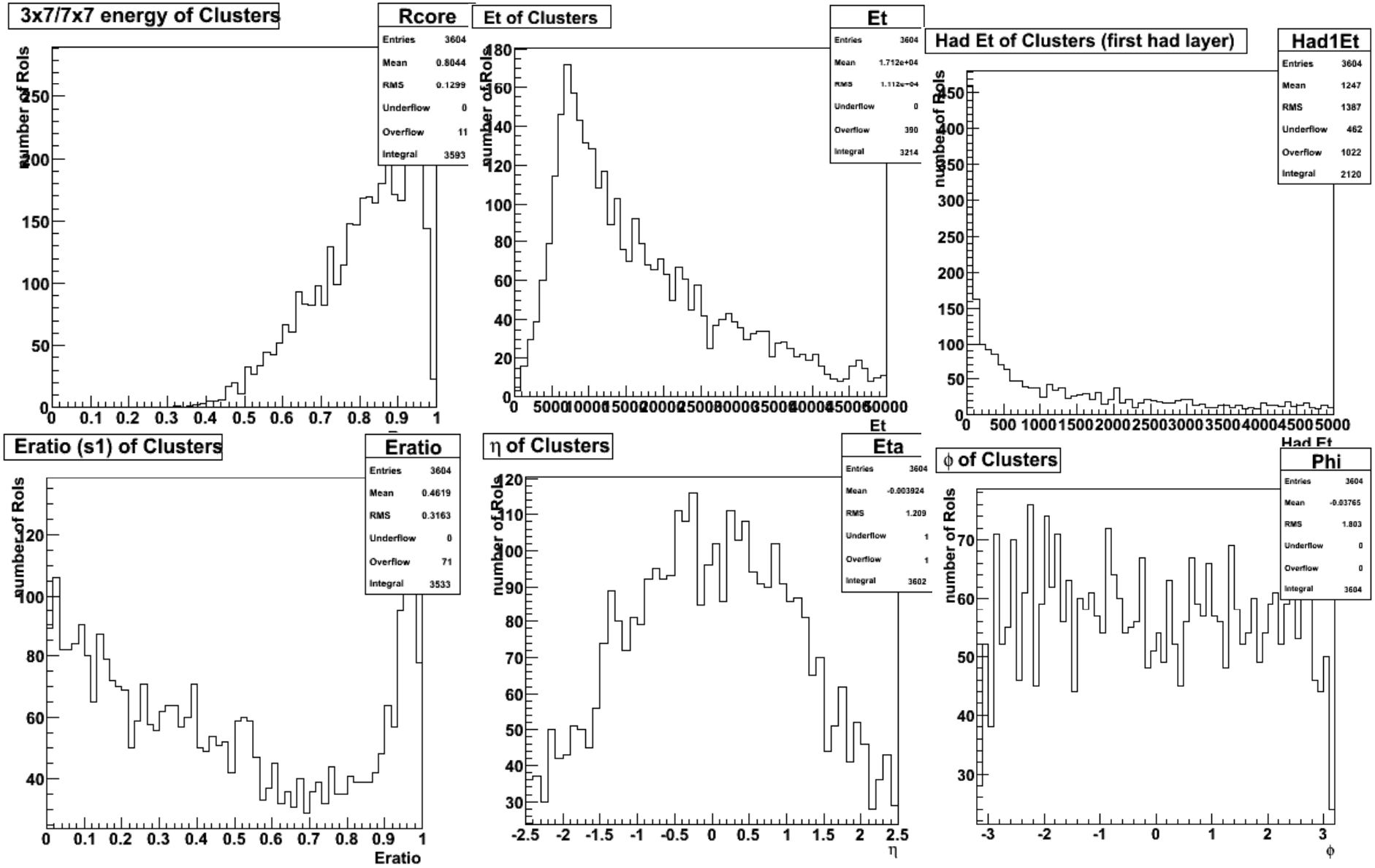
Trigger	p_T threshold(*)	Obs
Electron	5,10,15,	Prescale
Electron	20,25,100	No presc
Di-electron	5,10	Prescale
Di-electron	15	No presc
Photon	10,15,20	Prescale
Photon	20	No presc
Di-photon	10	Prescale
Di-photon	20	No presc
Jets	5,10,18,23,35,42,70	Prescale
Jets	100	No presc
3 Jets	10,18	B-tag
4 Jets	10, 18	B-tag
4 Jets	23	Express
τ	10, 15, 20, 35	
Di- τ	10+15,10+20,10+25	
Muon	4, 6, 10, 11, 15, 20, 40	Muon spectr.
Muon	4, 6, 10, 11, 15, 20, 40	ID+Muon
Di-muon	4, 6, 10, 15, 20	Passtthr.
ΣE_T	100, 200, 304	prescale
ΣE_T	380	No presc

Trigger	p_T threshold(*)	Obs
ΣE_T (jets)	?	?
E_T^{miss}	12, 20, 24, 32, 36, 44	Prescale
E_T^{miss}	52, 72	No presc
$J/\Psi \rightarrow ee$	Topological	B-phys
$\mu\ \mu$	4	B-phys
$J/\Psi \rightarrow \mu\ \mu$	Topological	B-phys
BsDsPhiPi	Topological	B-phys
BγX		B-phys
e + E_T^{miss}	18+12	Prescale
μ + E_T^{miss}	15+12	No presc
Jet + E_T^{miss}	20+30	No presc
2 Jets + E_T^{miss}	42+30	No presc
Jet+ E_T^{miss} +e	42+32+15	No presc
Jet+ E_T^{miss} + μ	42+32+15	No presc
4 Jet + e	23+15	No presc
4 Jet + μ	23+15	No presc
τ + E_T^{miss}	15+32,25+32, 35+20,35+32	
τ + e	10+10	Express
τ + μ	10+6	Express
2 τ + e	10+10	Express

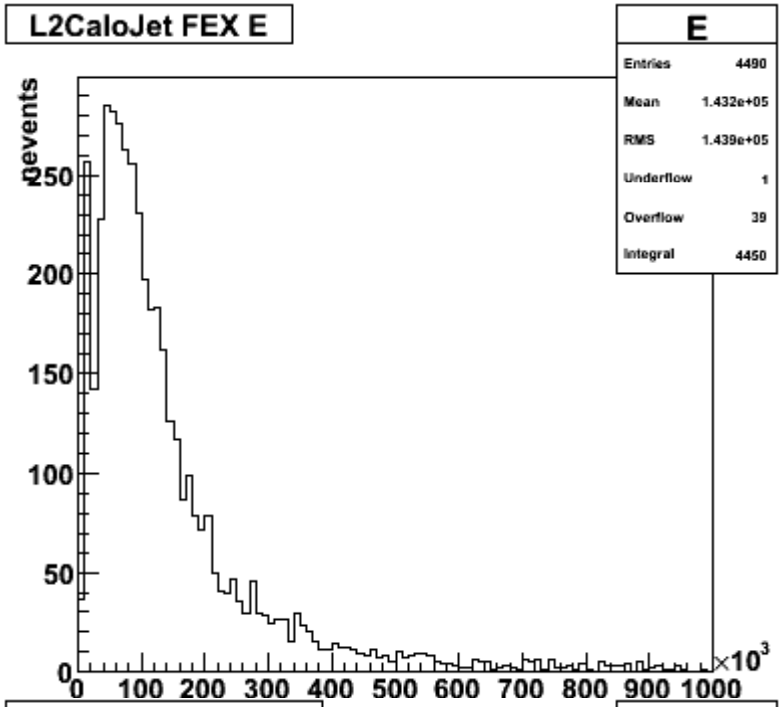
L2 electron slice: e10 calo hypo plots on 1k ttbar events
Other hypotheses identical (but less events)

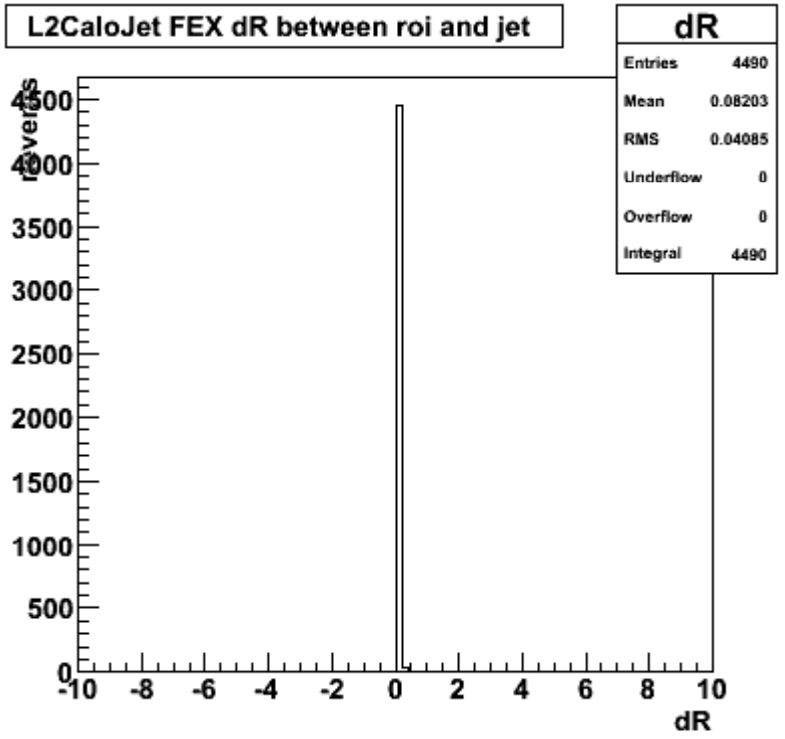


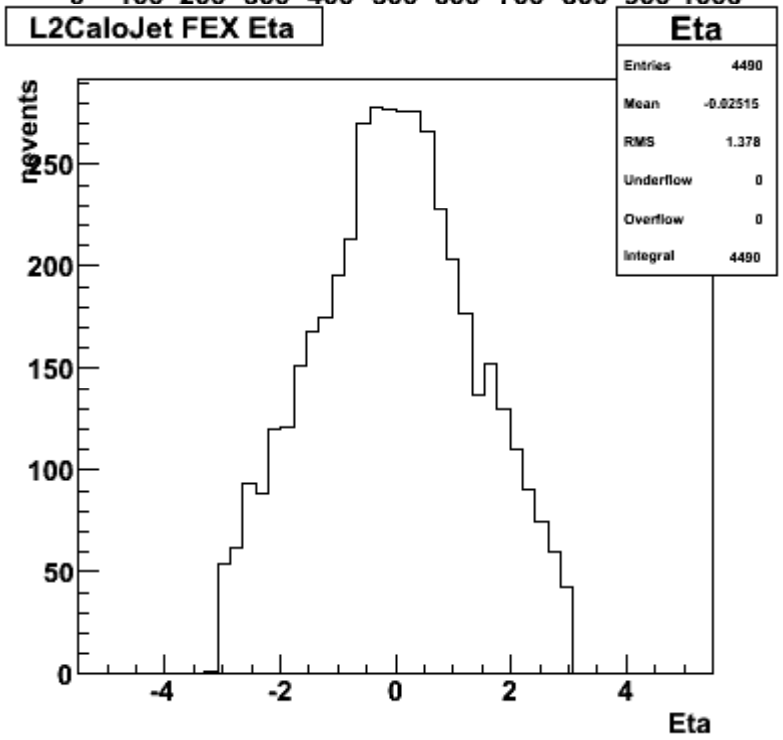
L2 electron slice: T2Calo_egamma

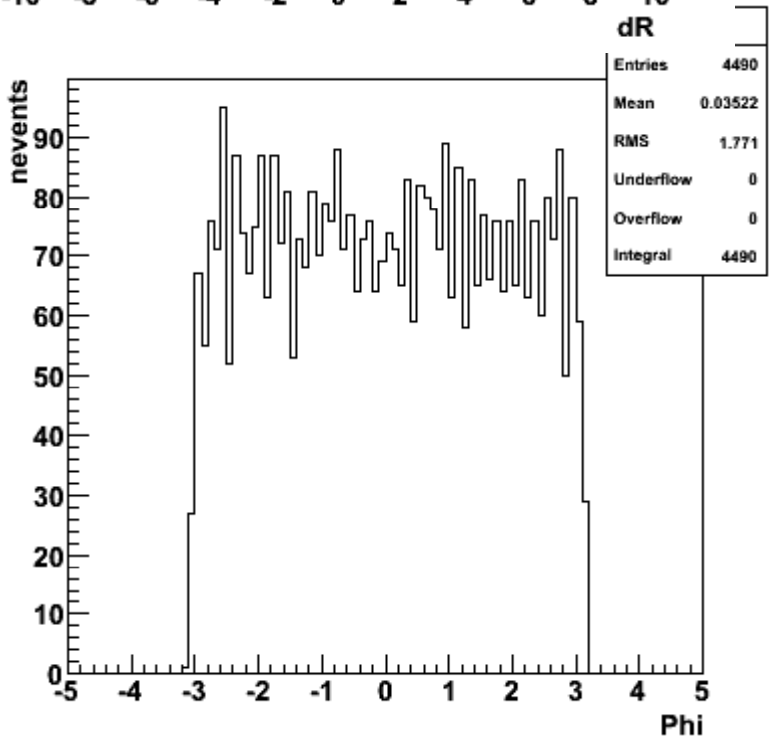


T2Calo_Jets

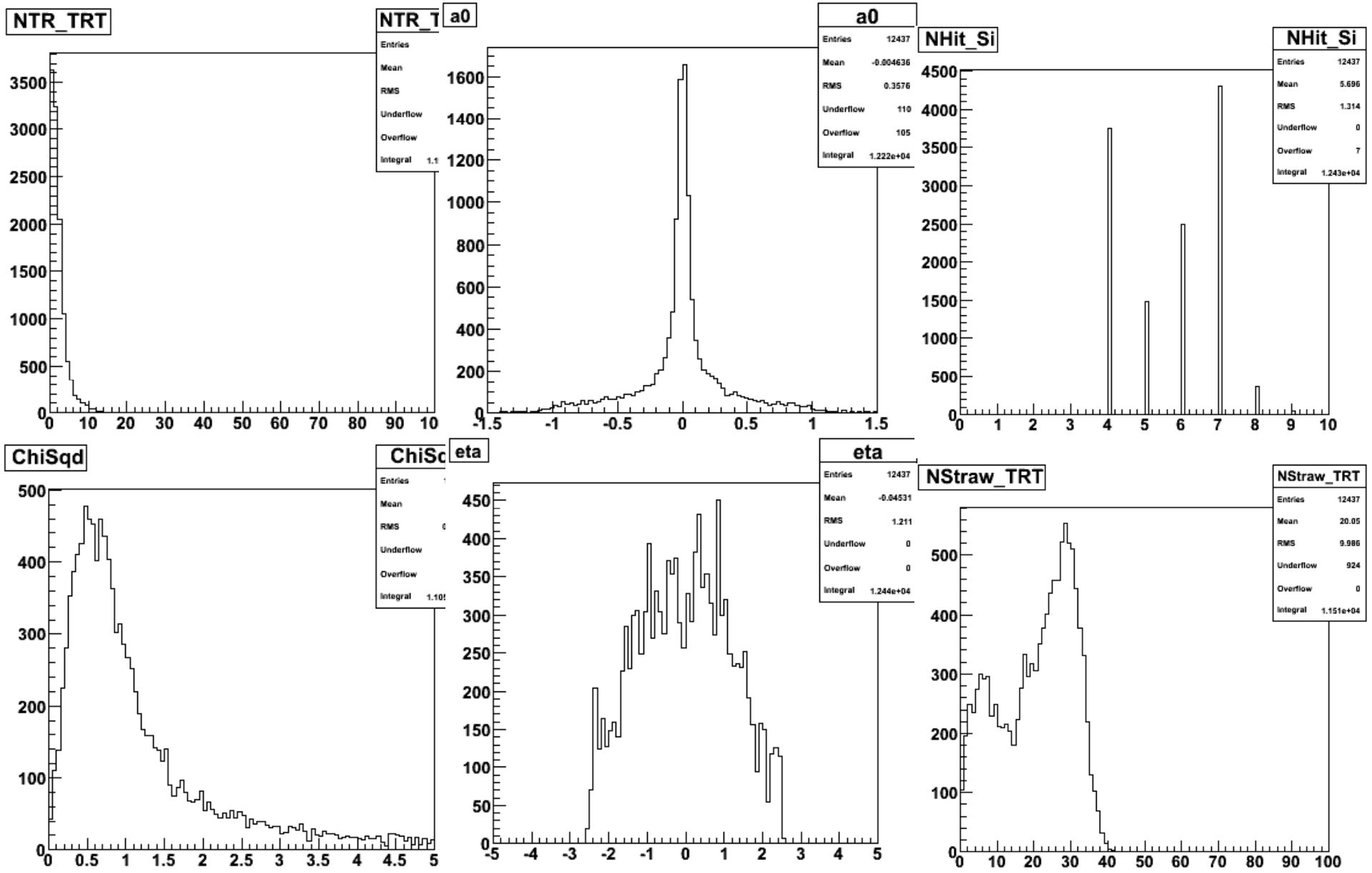

L2CaloJet FEX E
E
Entries 4490
Mean 1.432e+05
RMS 1.439e+05
Underflow 1
Overflow 39
Integral 4450
nevents
0 100 200 300 400 500 600 700 800 900 1000
×10^3


L2CaloJet FEX dR between roi and jet
dR
Entries 4490
Mean 0.08203
RMS 0.04085
Underflow 0
Overflow 0
Integral 4490
nevents
-10 -8 -6 -4 -2 0 2 4 6 8 10
dR


L2CaloJet FEX Eta
Eta
Entries 4490
Mean -0.02515
RMS 1.378
Underflow 0
Overflow 0
Integral 4490
nevents
-4 -2 0 2 4
Eta

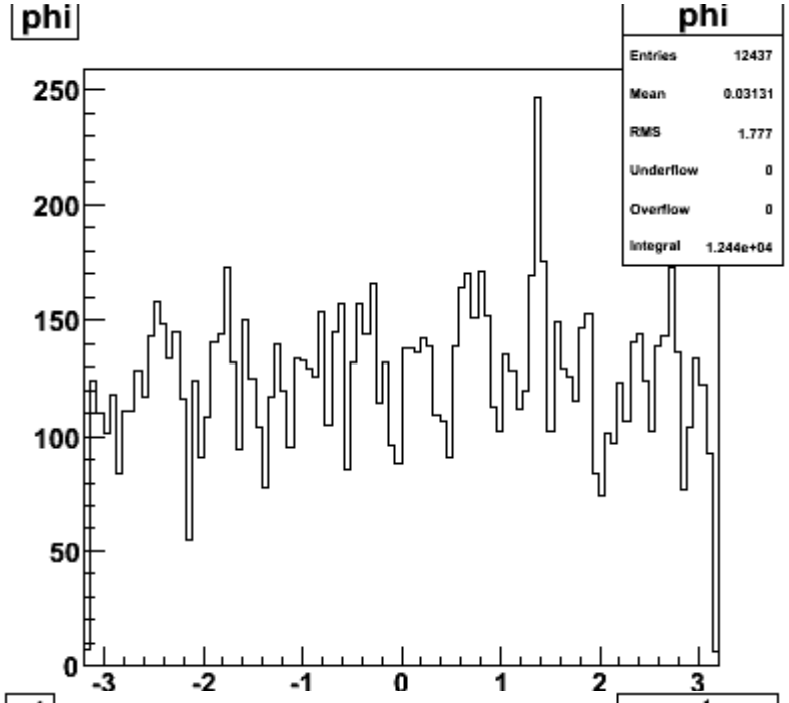

Entries 4490
Mean 0.03522
RMS 1.771
Underflow 0
Overflow 0
Integral 4490
nevents
-5 -4 -3 -2 -1 0 1 2 3 4 5
Phi

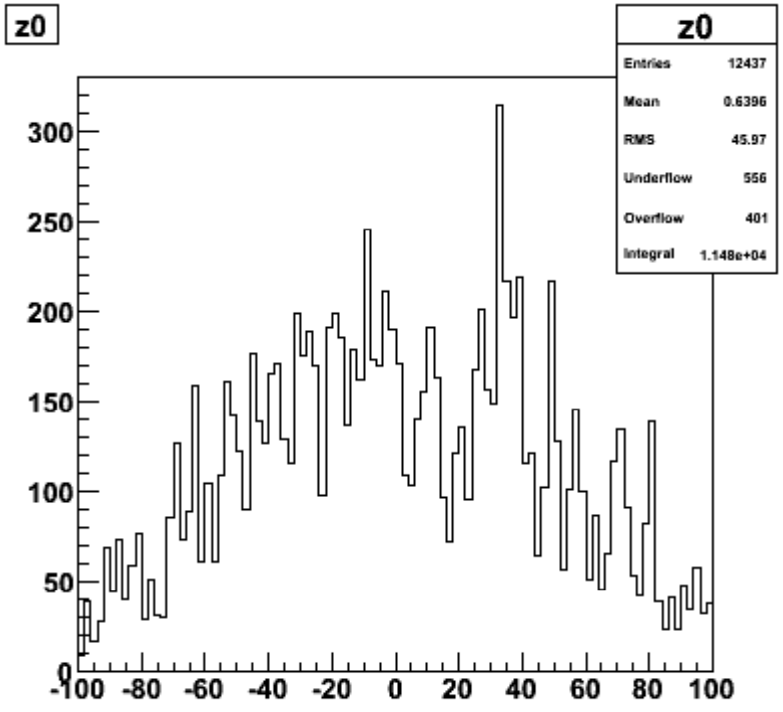
L2 tracking for e/gamma (IDScan)

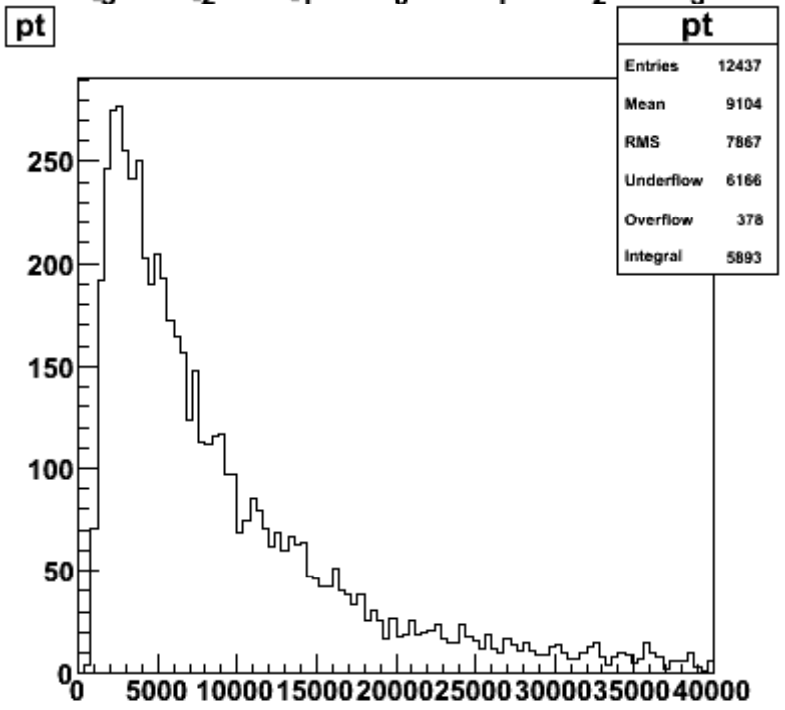


IDScan (cont.)

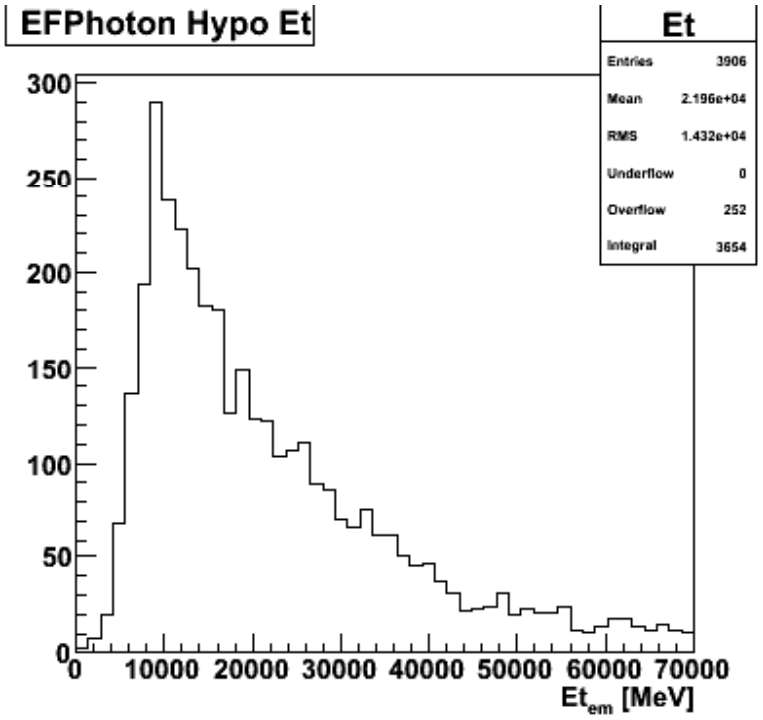
Missing histograms in IDCaloHypo (track-cluster matching)

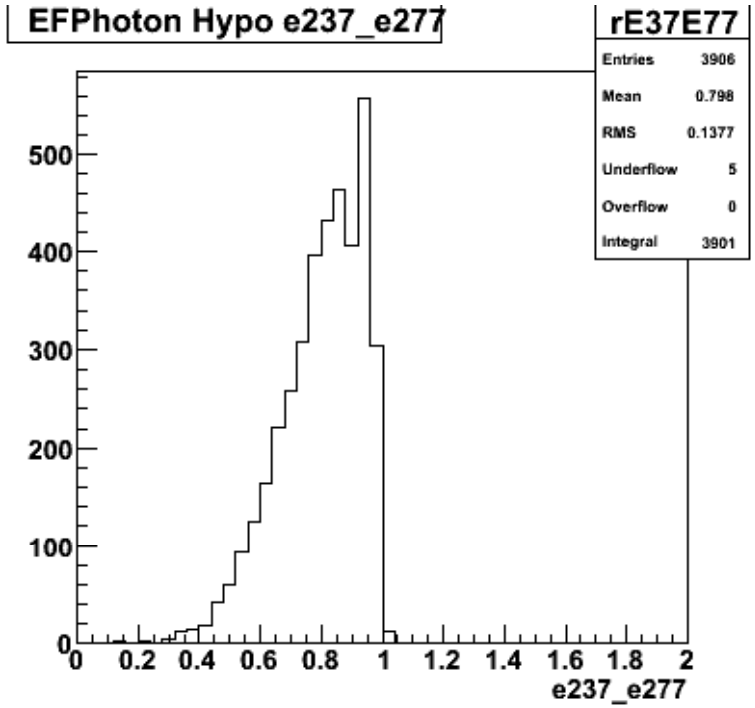


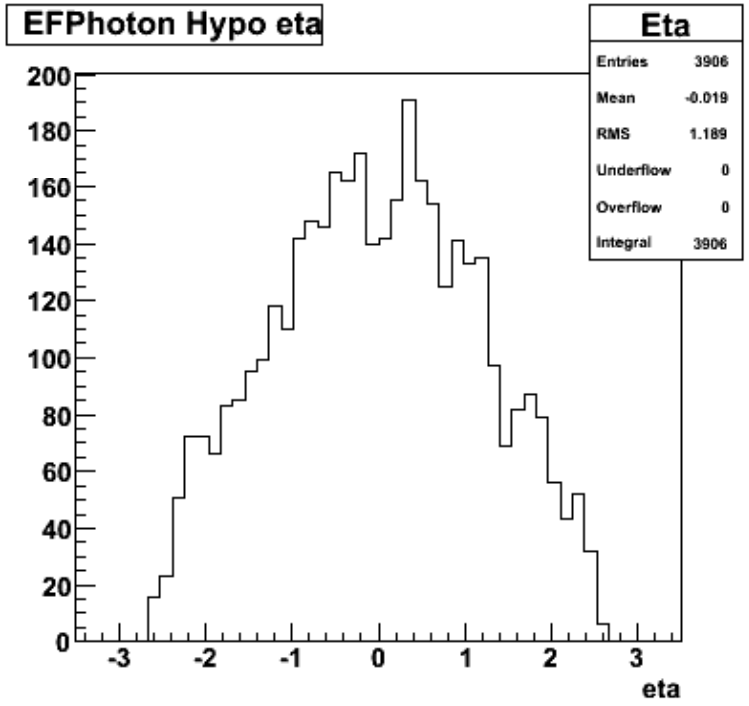


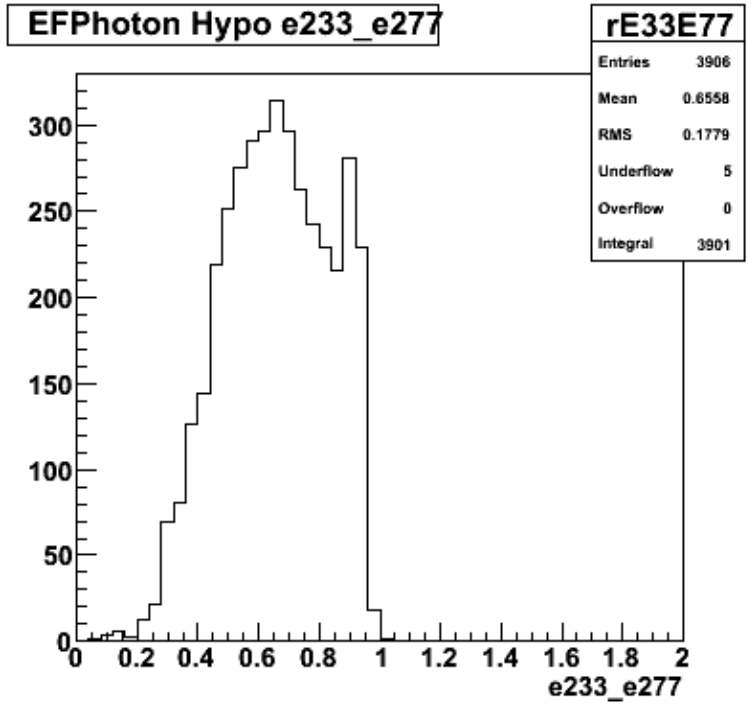


EF Photon Hypo









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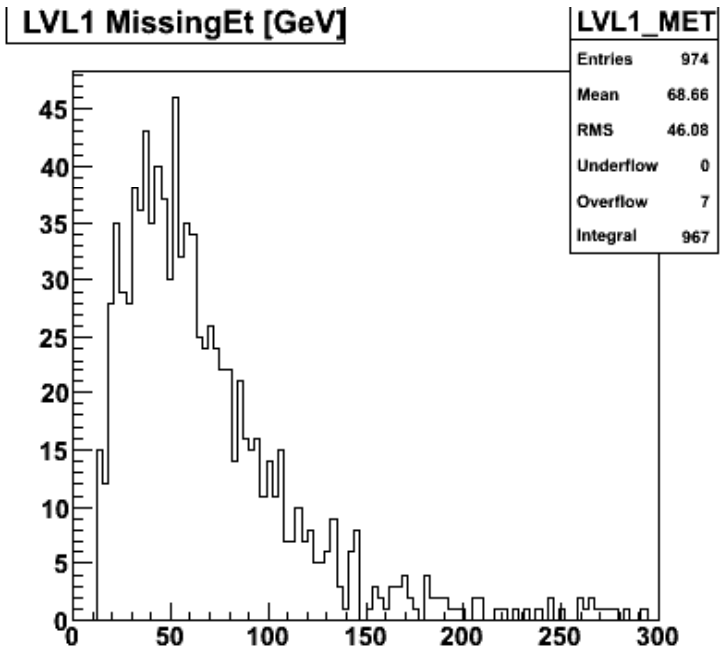
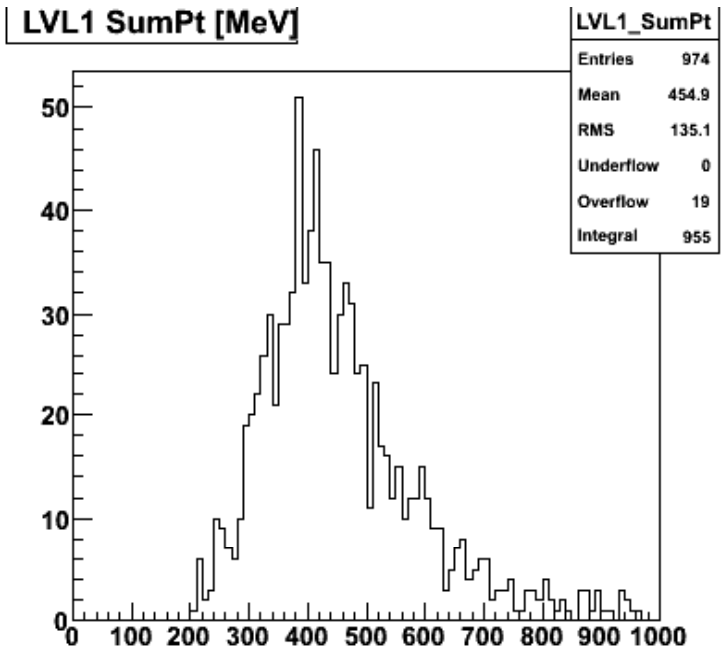
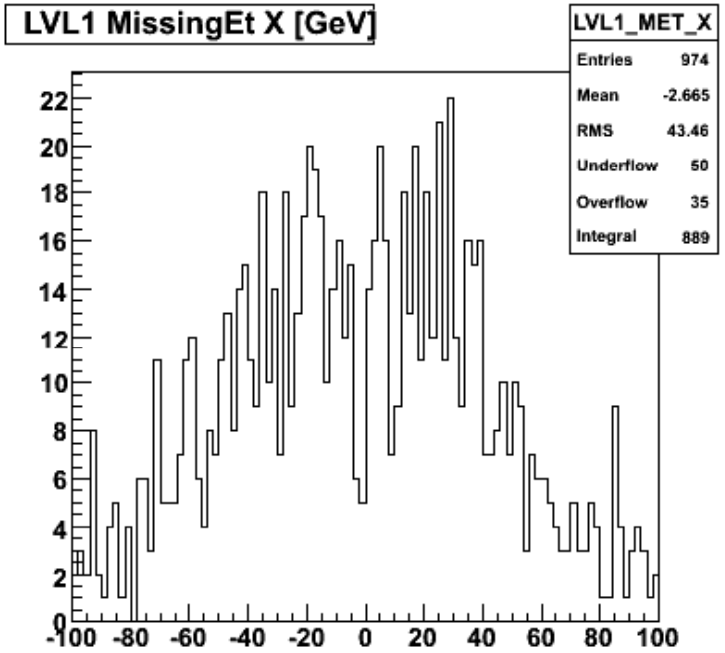
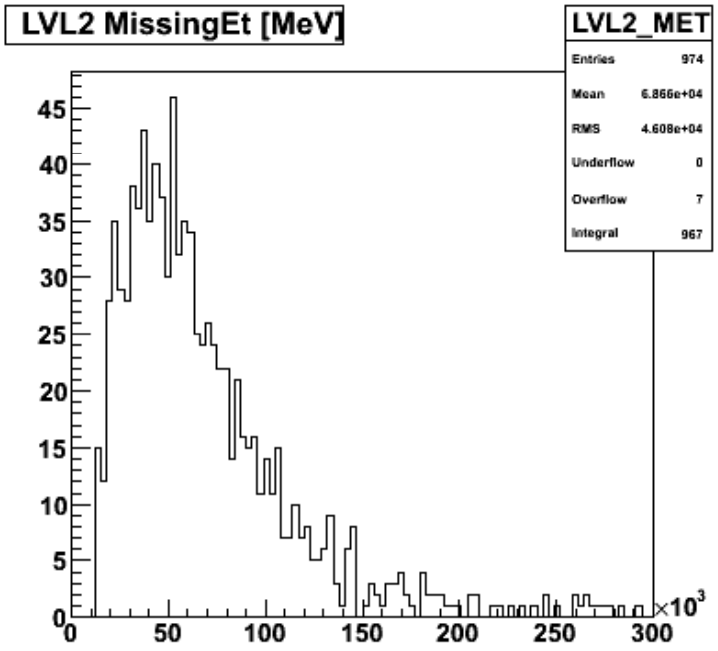
Missing ET

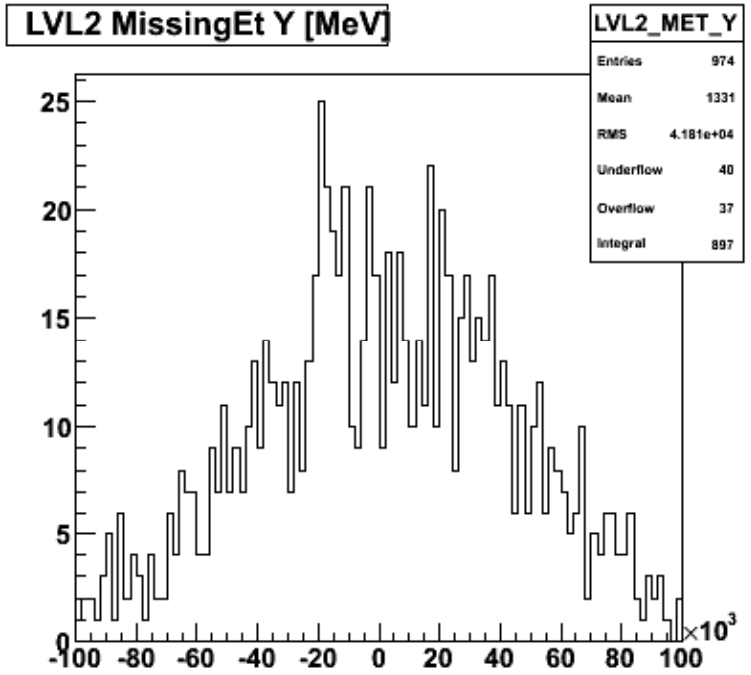

LVL1 MissingEt [GeV]
LVL1_MET
Entries 974
Mean 68.66
RMS 46.08
Underflow 0
Overflow 7
Integral 967

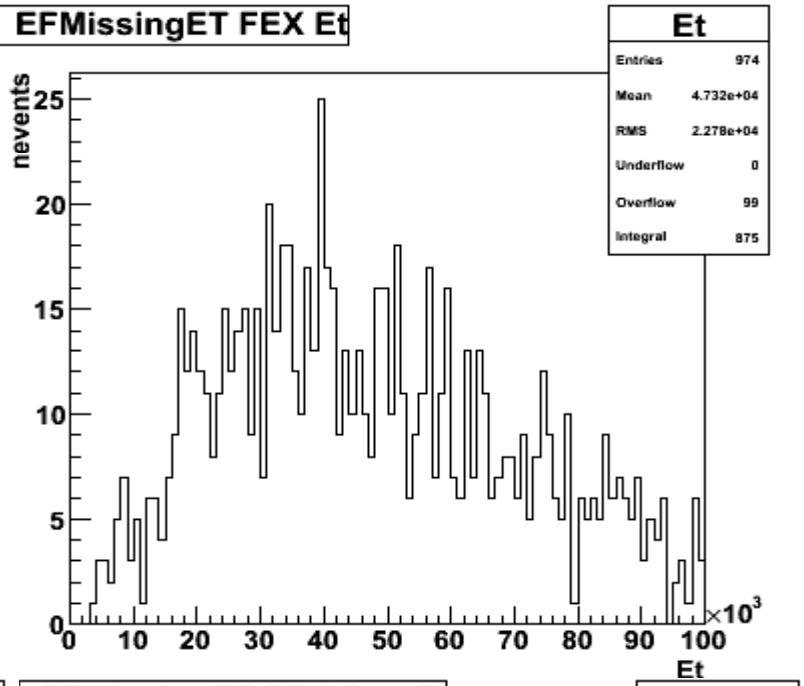

LVL1 SumPt [MeV]
LVL1_SumPt
Entries 974
Mean 454.9
RMS 135.1
Underflow 0
Overflow 19
Integral 955

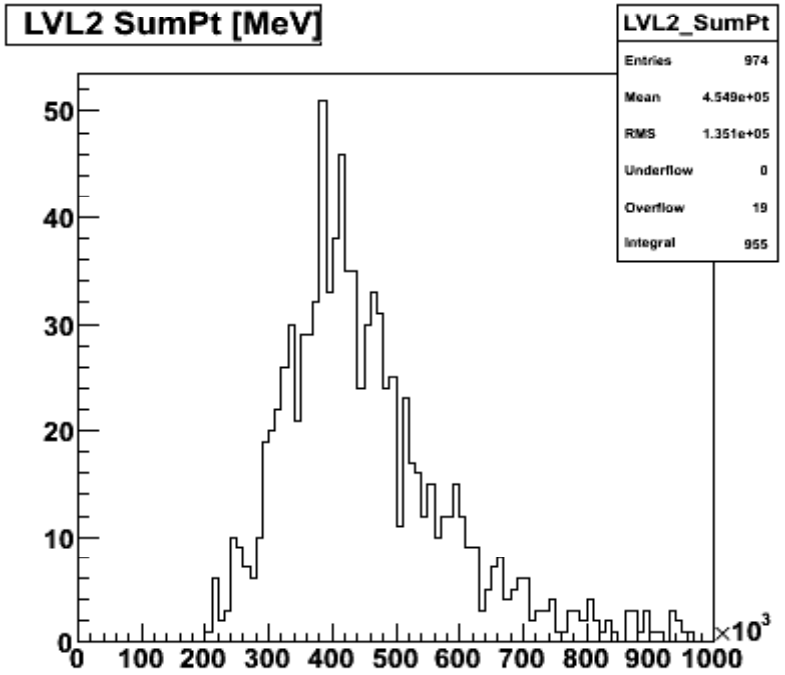

LVL1 MissingEt X [GeV]
LVL1_MET_X
Entries 974
Mean -2.665
RMS 43.46
Underflow 50
Overflow 35
Integral 889

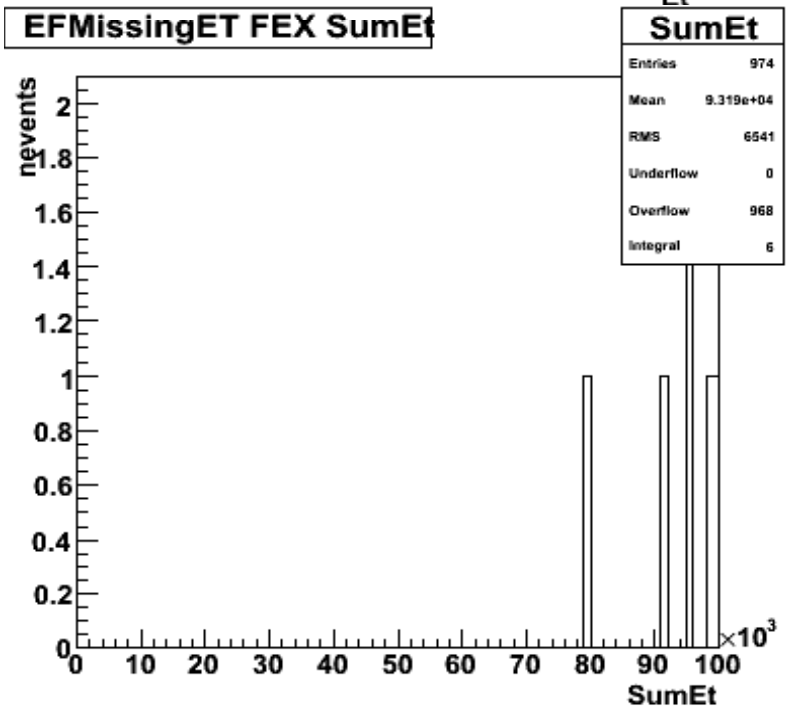

LVL2 MissingEt [MeV]
LVL2_MET
Entries 974
Mean 6.866e+04
RMS 4.608e+04
Underflow 0
Overflow 7
Integral 967
×10³

Missing ET


LVL2 MissingEt Y [MeV]
LVL2_MET_Y
Entries 974
Mean 1331
RMS 4.181e+04
Underflow 40
Overflow 37
Integral 897
×10^3

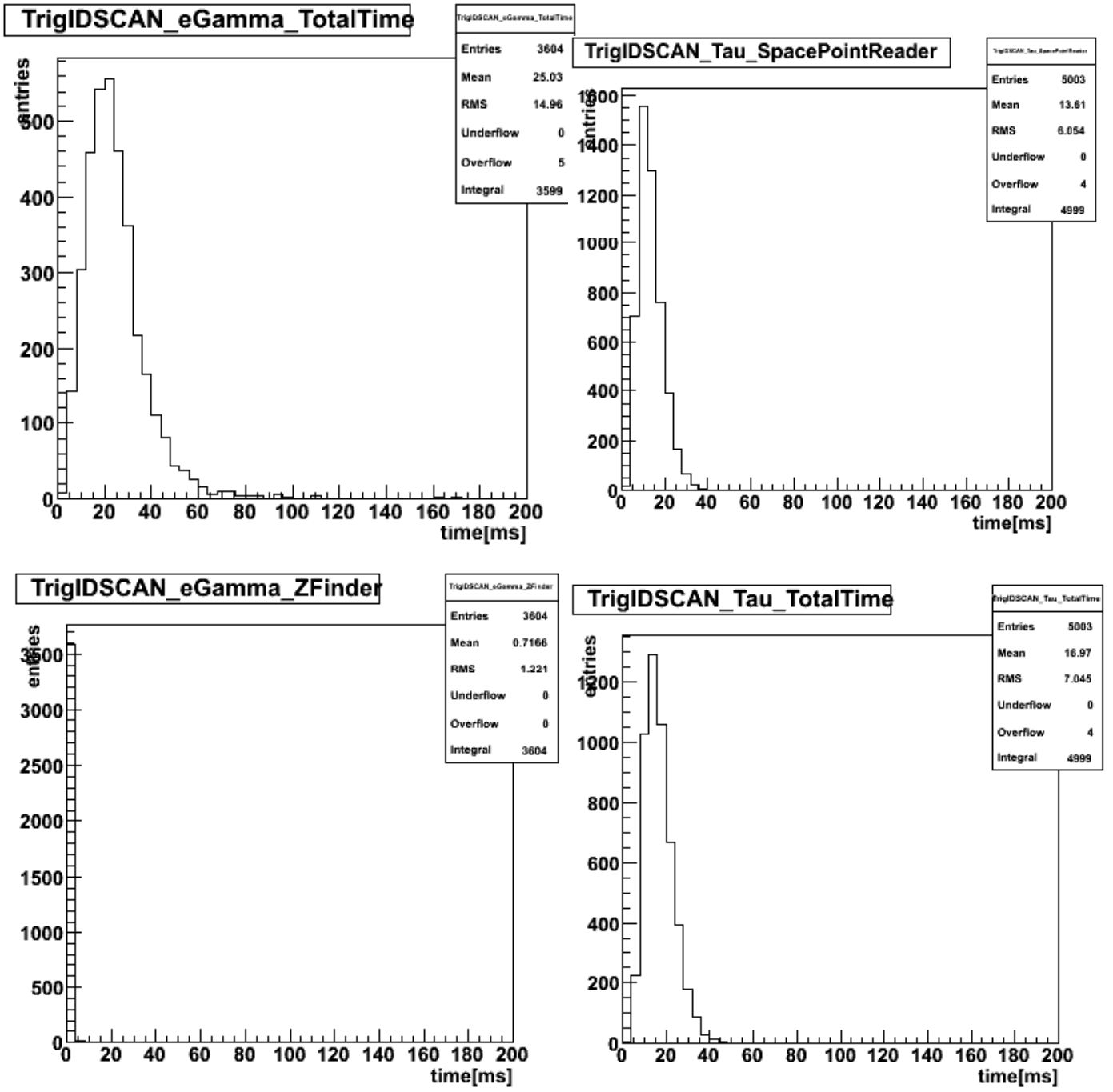

EFMissingET FEX Et
Et
Entries 974
Mean 4.732e+04
RMS 2.278e+04
Underflow 0
Overflow 99
Integral 875
nevents
Et
×10^3


LVL2 SumPt [MeV]
LVL2_SumPt
Entries 974
Mean 4.549e+05
RMS 1.351e+05
Underflow 0
Overflow 19
Integral 955
×10^3


EFMissingET FEX SumEt
SumEt
Entries 974
Mean 9.319e+04
RMS 6541
Underflow 0
Overflow 968
Integral 6
nevents
SumEt
×10^3

Timers

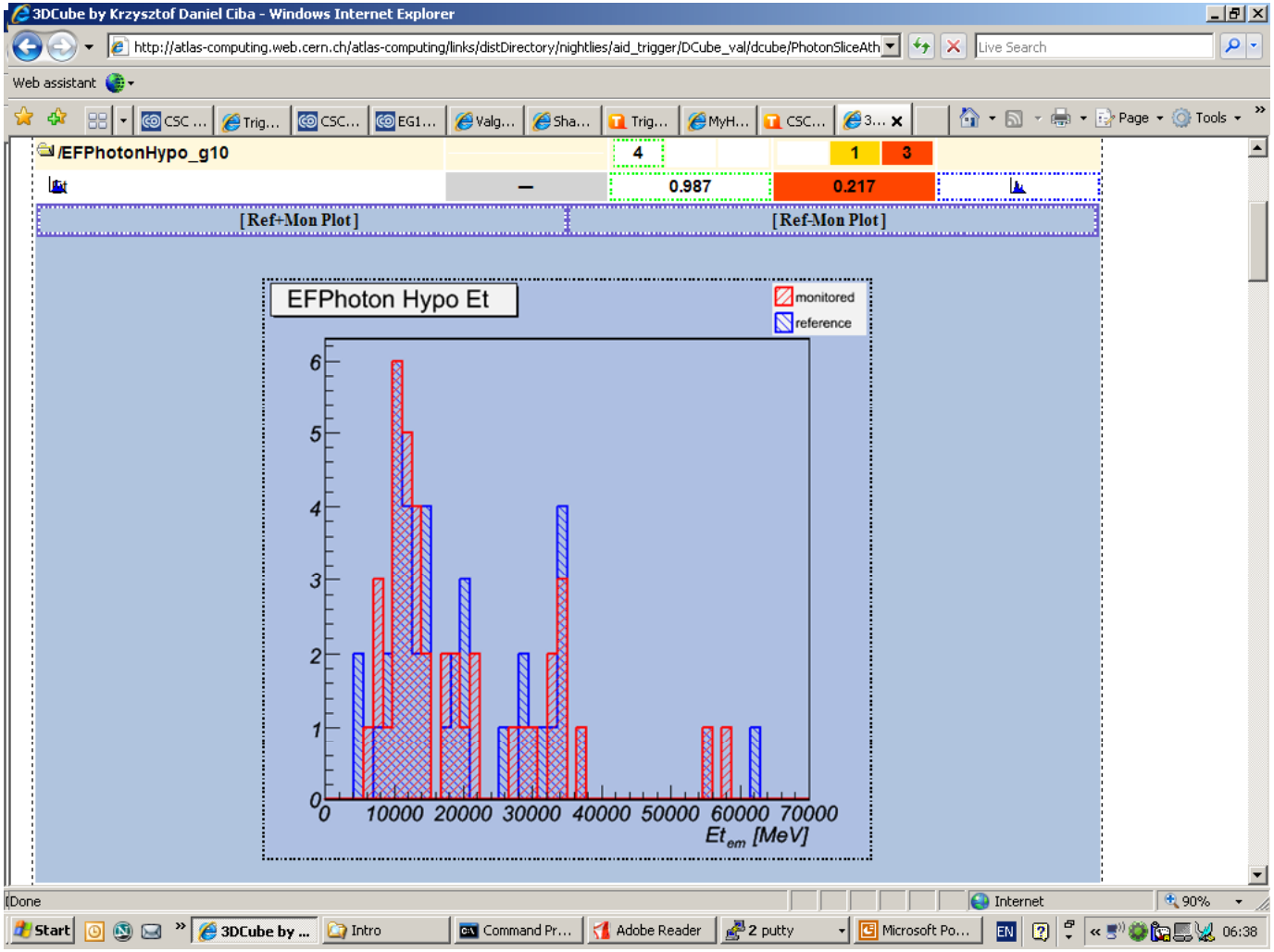
- Many histograms of algorithm execution time produced
- Numbers from RTT give only ball-park estimate, but still useful
- Many still need tuning



Viewing results: AID and DCube

See Alex's and Krzysztof Ciba's talk in: http://indico.cern.ch/conferenceDisplay.py?confId=13869

- Analysis Interpretation & Display (A.Undrus, Brookhaven)
- Shows monitoring plots (algorithms, timers, steering)
- Shows statistical comparison with reference (DCube, K.Ciba)
- Linked from the NICOS nightlies pages
- ATN results for now, RTT to follow

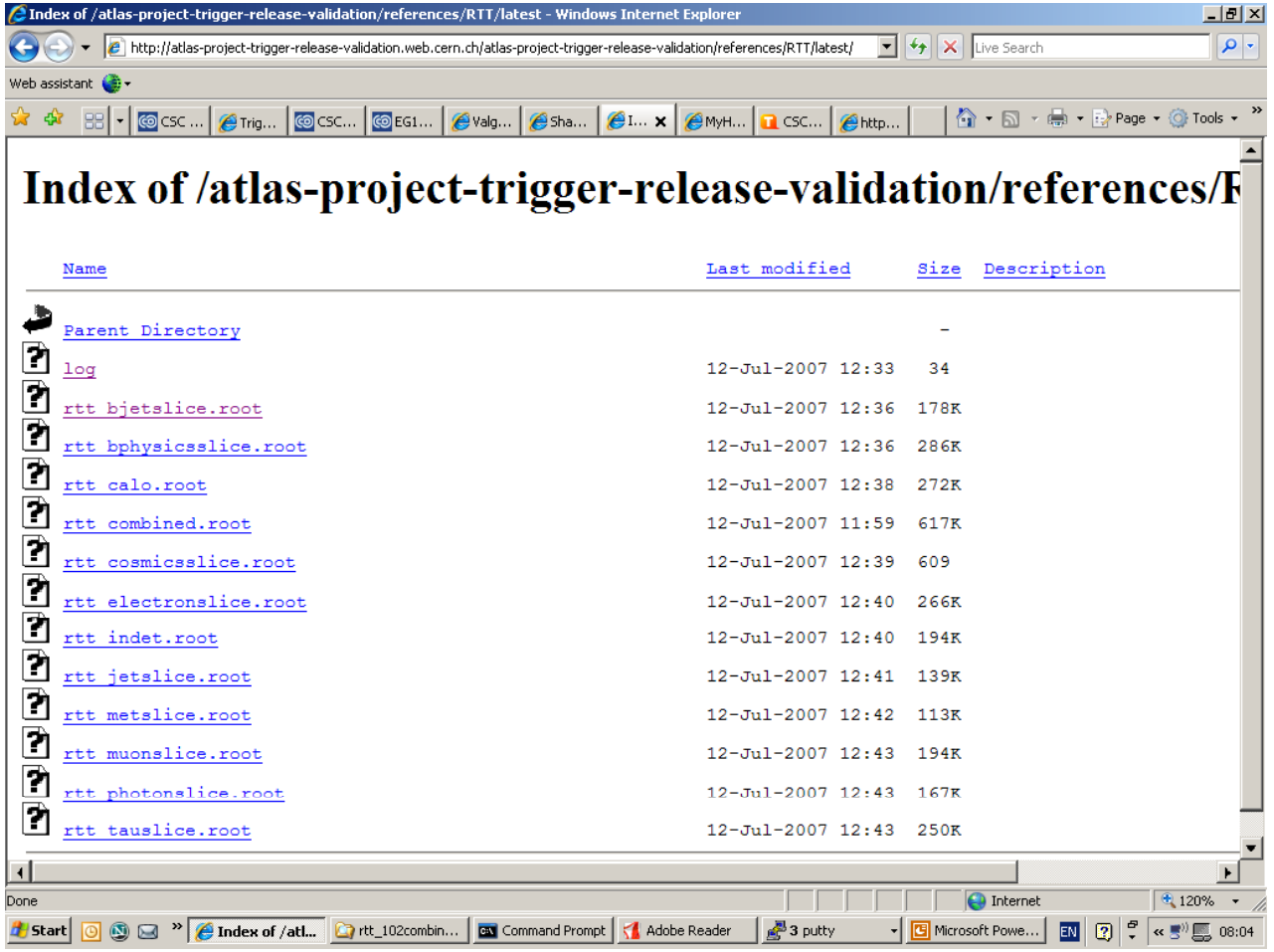


Conclusions

- The algorithm and timing Monitoring histograms are used for software validation
- Produced every night by RTT for 1000 top events
- Not fine tuned in many cases, but very useful

Backup slides

Use in Trigger Software Validation



Trigger / DAQ architecture