Jet/MET Comissioning

Ulla Blumenschein

- Impact of noise on Jet/MET reconstruction
- MET and bad channels
- High-energy muons
- Jet/METCleanup cuts

Introduction Jet/MET comissioning

Motivation:

- Global calorimeter comissioning, long-term stability
- Check detector simulation
- Test jet/MET performance
- Develop methods to reject cosmic background

Platforms:

- Jet/MET data preparation meeting
  http://indico.cern.ch/categoryDisplay.py?categId=492
- Calorimeter performance meetings:
  http://indico.cern.ch/conferenceDisplay.py?confId=47495
- Tile data preparation meeting
  http://indico.cern.ch/categoryDisplay.py?categId=1633

Data:

- Single beam runs and selected cosmic runs:
  https://twiki.cern.ch/twiki/bin/view/Atlas/InterestingRuns
- Dec 2008 reprocessing, athena 14.5.0.5: ESDs, DPDs
  (Second reprocessing with 14.5.2.4 ongoing)

Trigger:

- RNDM: noise
- L1Calo: Showering high-energy muons, noise

Jet and MET studies are related. Most issues have an impact on both MET and Jets

Calorimeter analysis with recent reco versions

In the previous years cosmics data analysis has contributed heavily to the discovery of features, e.g. bad channels, noise bursts, bad of noise in MC ...
  - Not part of this presentation -

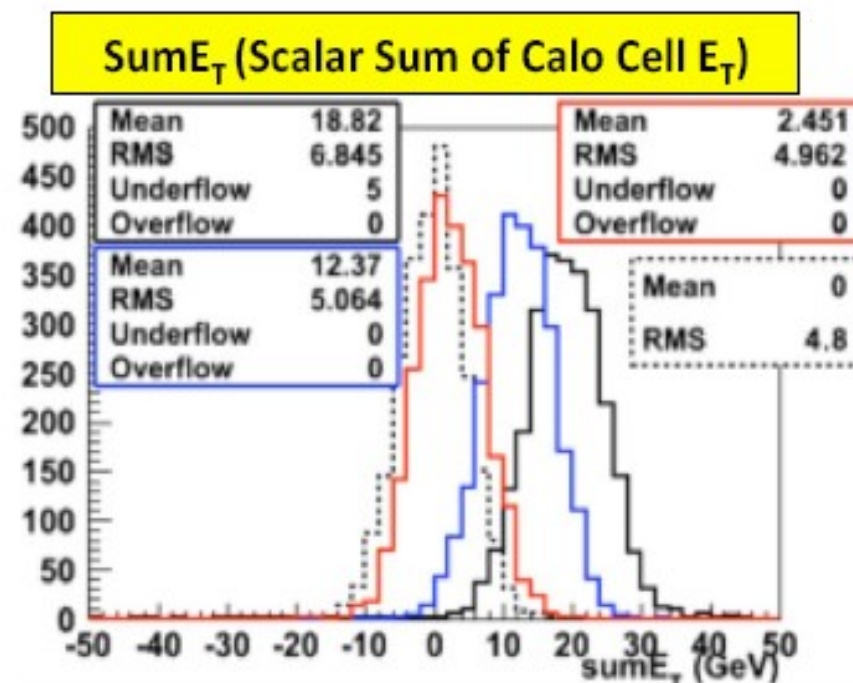Reprocessing of cosmics data in dec2008 (Athena 14.5.2):

- improved energy reconstruction (improved calibration, corrections for hardware issues, e.g. lower HV)
- improved noise description
- improved bad-channel data base on-the-fly masking of bad channels

Obtained much better agreement with Cosmics MC !

○ Old Reprocessing
○ Old Reproc. with offline correction
● New Reprocessing
⋯ expectation

MET_Base algorithm used
(All cells with $|E| > 2\sigma$ used in the calculation)

SumE$_T$ (Scalar Sum of Calo Cell E$_T$)

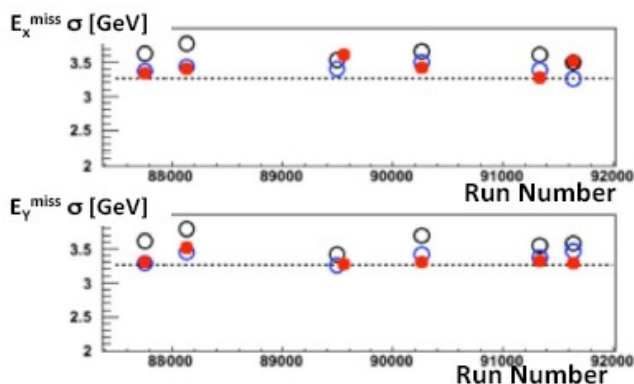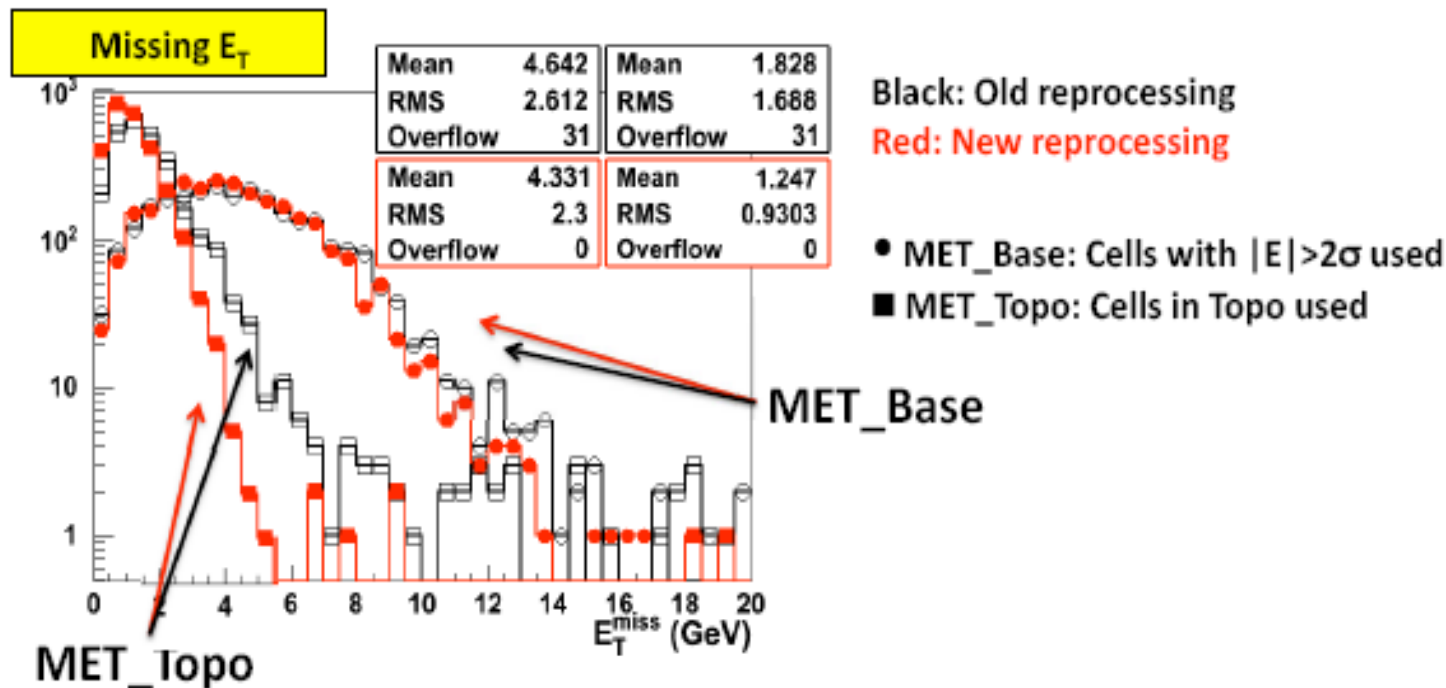|	
Mean 18.82	Mean 2.451
RMS 6.845	RMS 4.962
Underflow 5	Underflow 0
Overflow 0	Overflow 0
Mean 12.37	Mean 0
RMS 5.064	RMS 4.8
Underflow 0	
Overflow 0	

E. Petit, D. Varouchas

Overall performance in noise events

D. Varauchas, E. Petit

- MET performance improved
- MET_Topo has better noise supression

Black: Old reprocessing
Red: New reprocessing

- MET_Base: Cells with $|E|>2\sigma$ used
- MET_Topo: Cells in Topo used

Mean	4.642	Mean	1.828
RMS	2.612	RMS	1.688
Overflow	31	Overflow	31
Mean	4.331	Mean	1.247
RMS	2.3	RMS	0.9303
Overflow	0	Overflow	0

- MET resolution consistent with expectation for a long time range

Remaining noise issues: LArg presampler noise

Fluctuations in EM presampler create fake MET

→ METtopo: (4/2/0)   METbase: (Cells >2σ)
remove clusters seeded in PS   remove cells in PS

E. Petit:
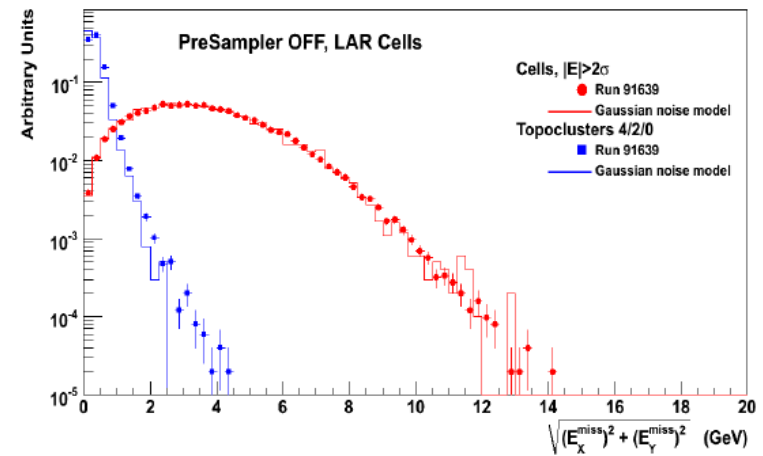*Study of events from*
RNDM trigger
Example: run 91639
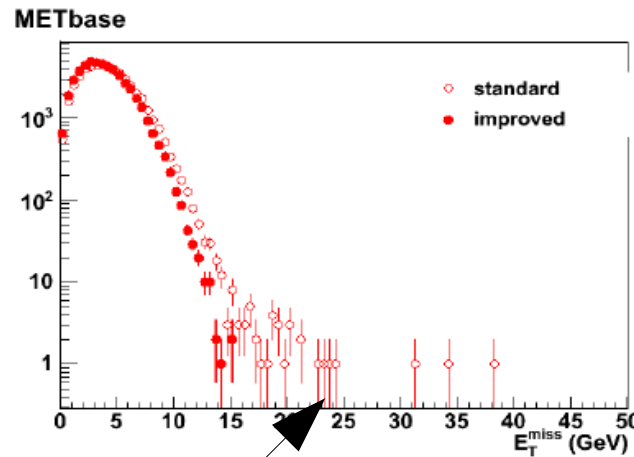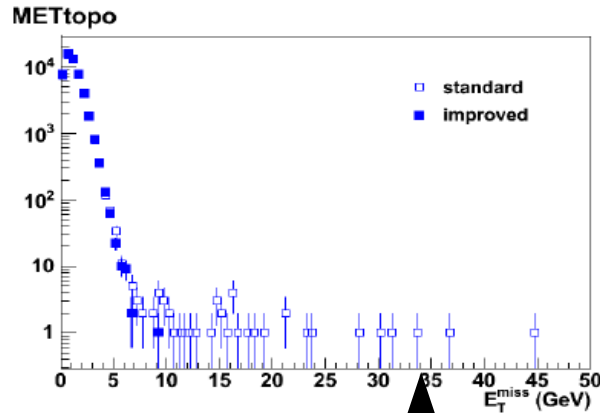
Jets and MET
Studies are
complementary
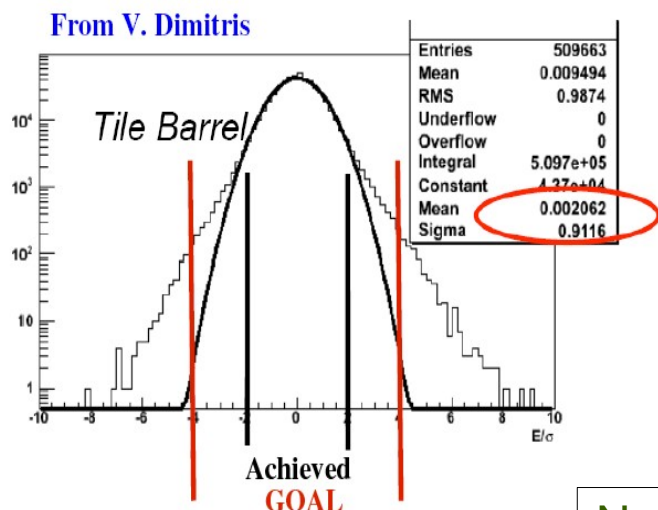
Additional jets created,
Seeded in presampler, EMF=1
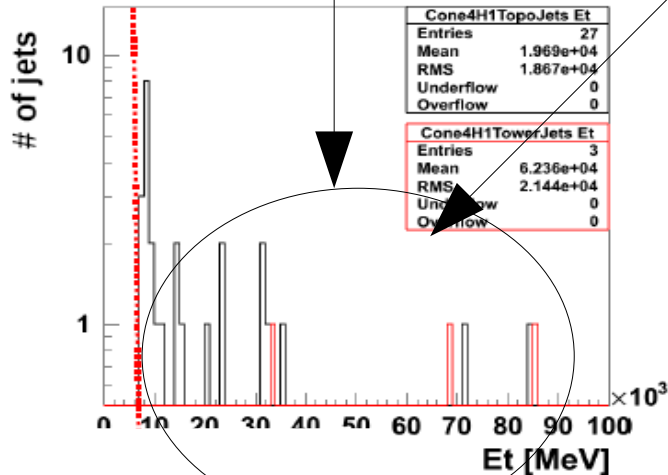
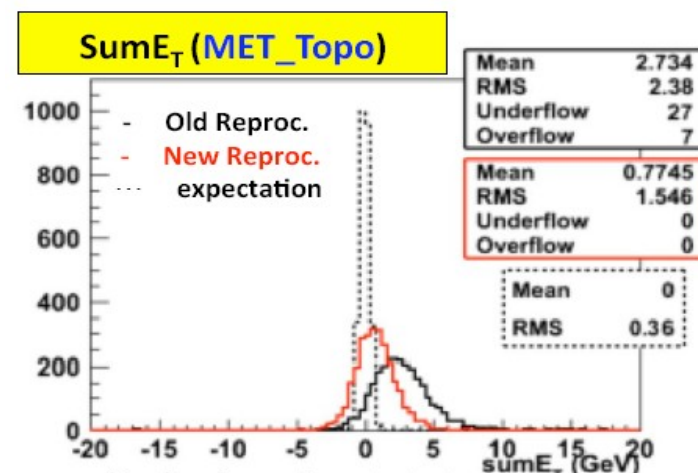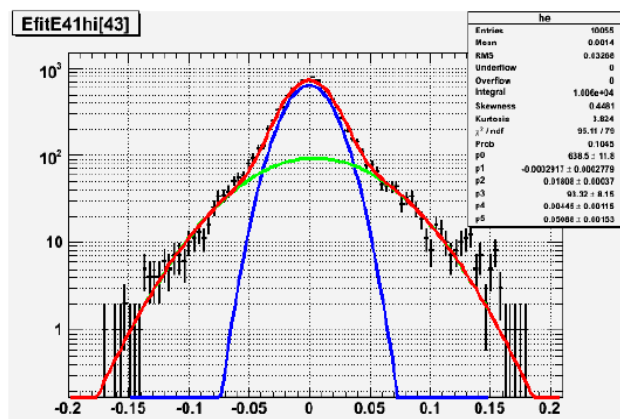After presampler corrections:
Good agreement of MET with MC

Remaining noise issues: Tile non-gaussian noise

Dimitris Varouchas, Luca Fiorini, Brian Martin:

- Tile noise is not exacly gaussian
- Since octuber 2008 description at 2σ in Calo DB
- Mostly ok, but 4/2/0 topo cluster seed requires 4σ

- Very visible in cosmics but probably only limited impact on physics

- Possible solution: Double-gaussian fits

New noise PDFs in 15.2.0:
 3-Param double gaussian
 or 2 separate PDFs (2σ,4σ)
  - CaloNoiseDB
  - CaloClusterMaker:
    New thresholds for
    seeds and cells:
    2σ/4σ-equivalent values
will also be useful for
pile-up noise

- No further hardware improvements
- Some improvement with final Optimal Filtering

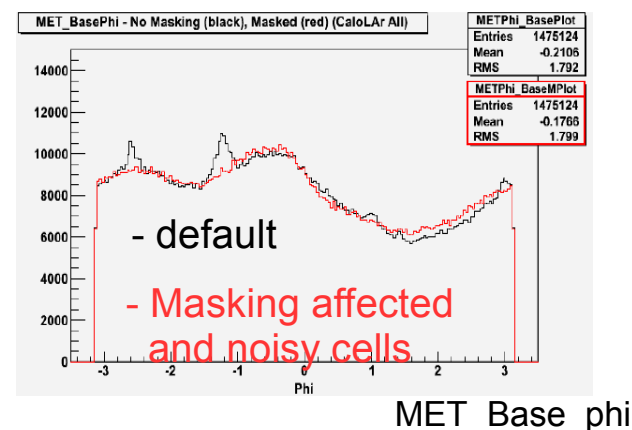# Bad channels: Improving MET reconstruction

- LarBadChanTool/Masker, TileBadChanTool → combined in CaloBadChanTool:
  Access channel quality and mask channels

- METCellMaskTool: uses these tools to mask cells in the MET reconstruction
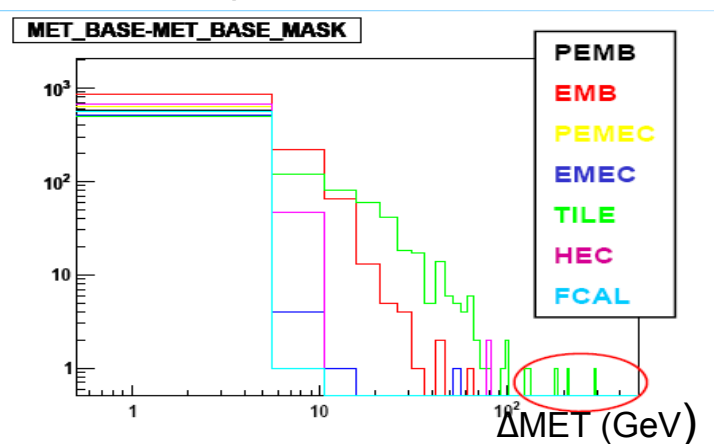 Runs with cells from MET_Base or MET_Topo (*D. Cavalli, S.Resconi*)
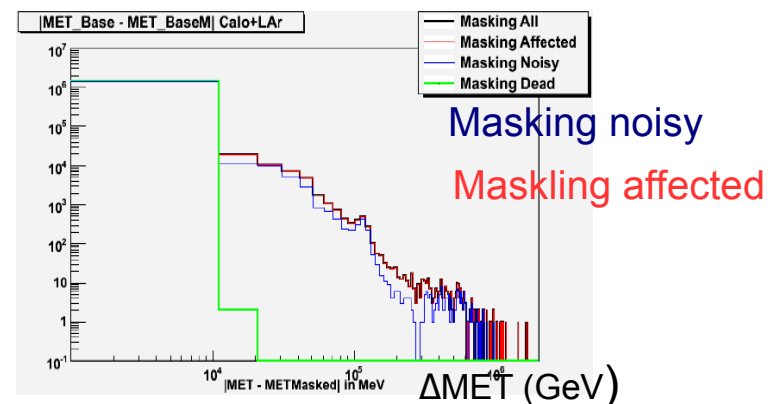
S. Resconi

B. Fatholahzadeh

Φi-spikes removed

MET_Base_phi
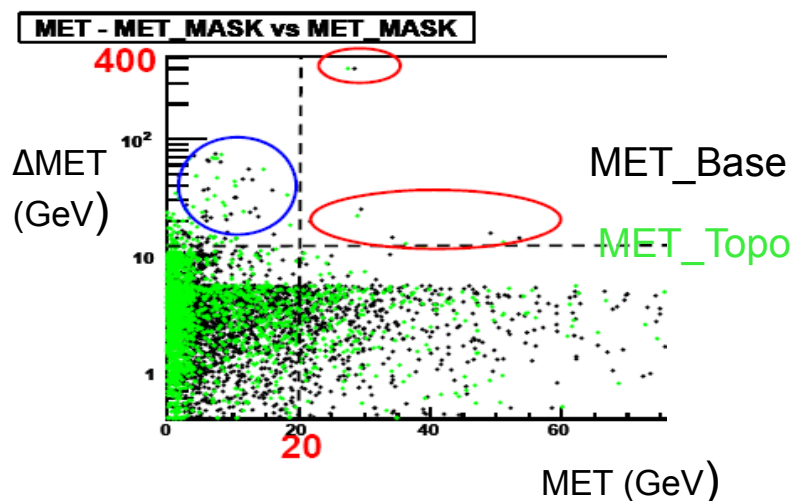
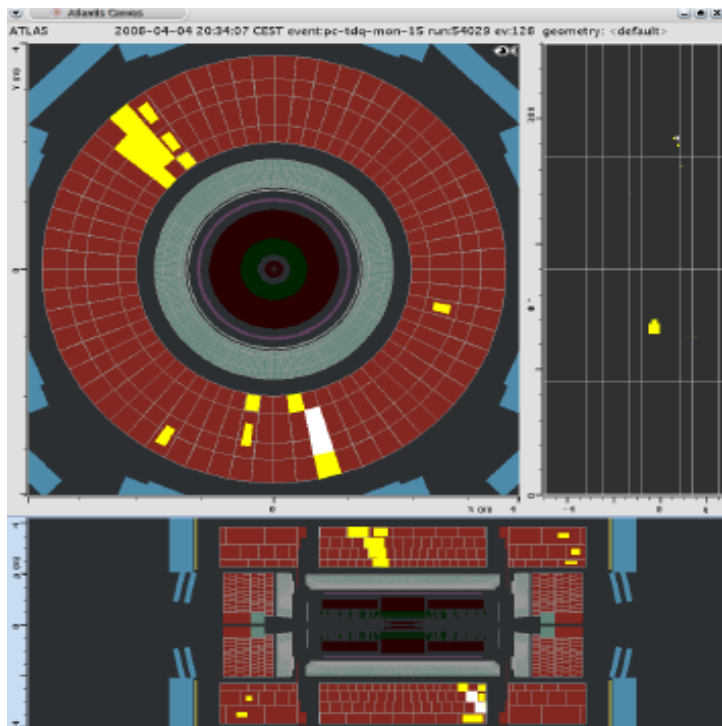Hardware components involved

Noisy vs. Affected Channels
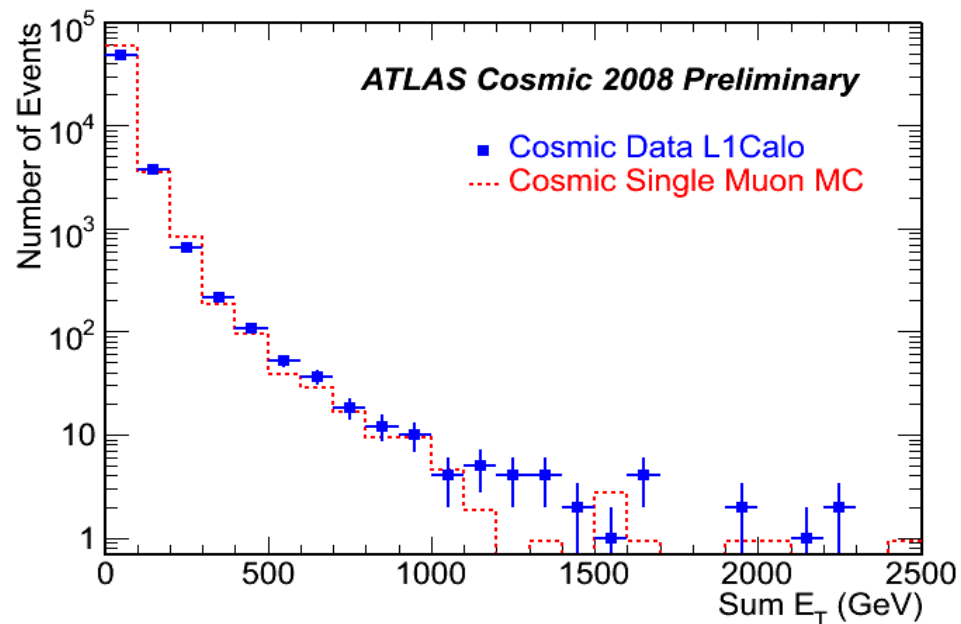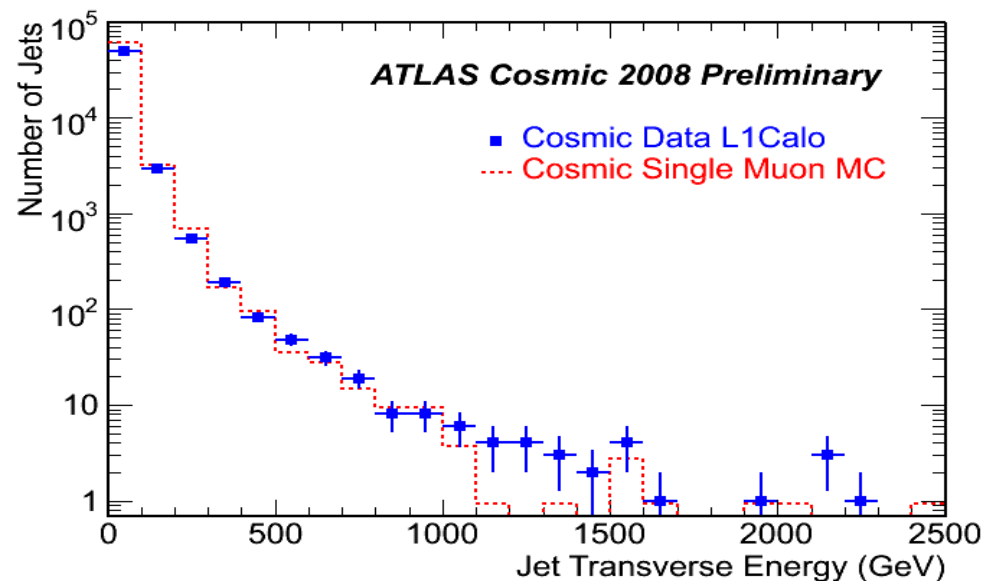
High-energy events

H. Okawa

L1Calo enriches high-energy muons
(real shower in the calorimeter)

L1Calo event, 04/2008
Run 54029, evt 126

Good agreement between data and MC!
Cosmics constitute a background source
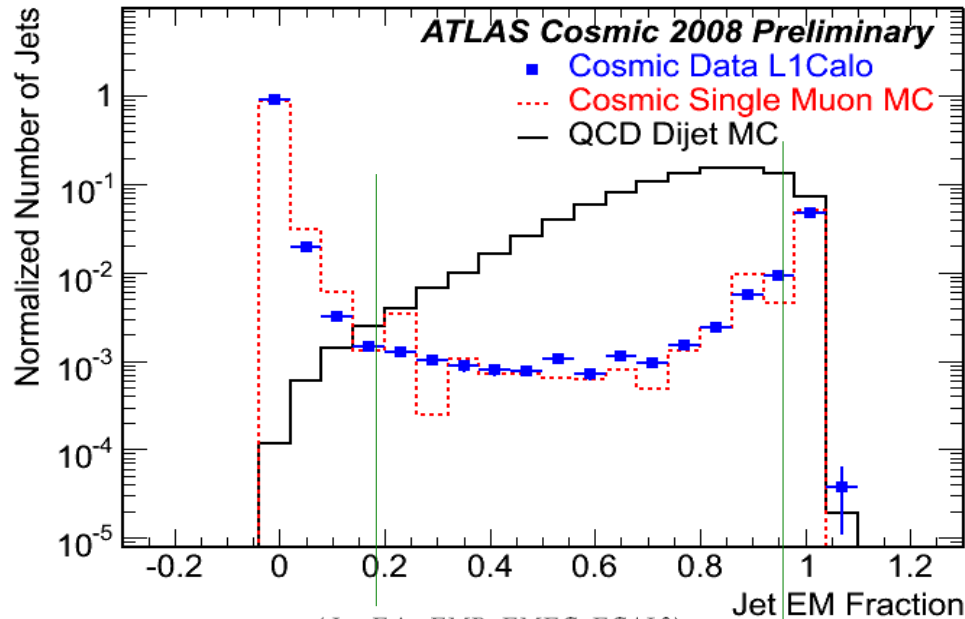 which we have to reject
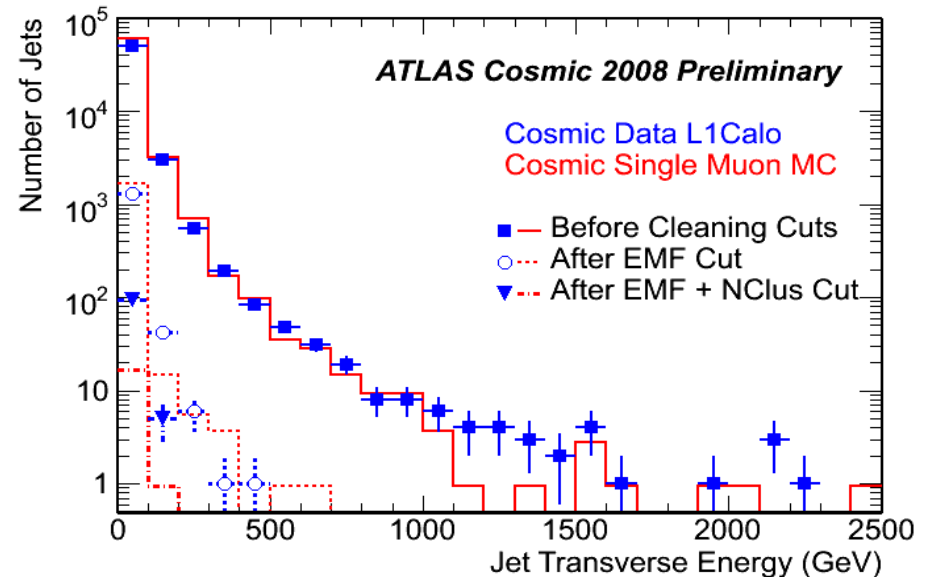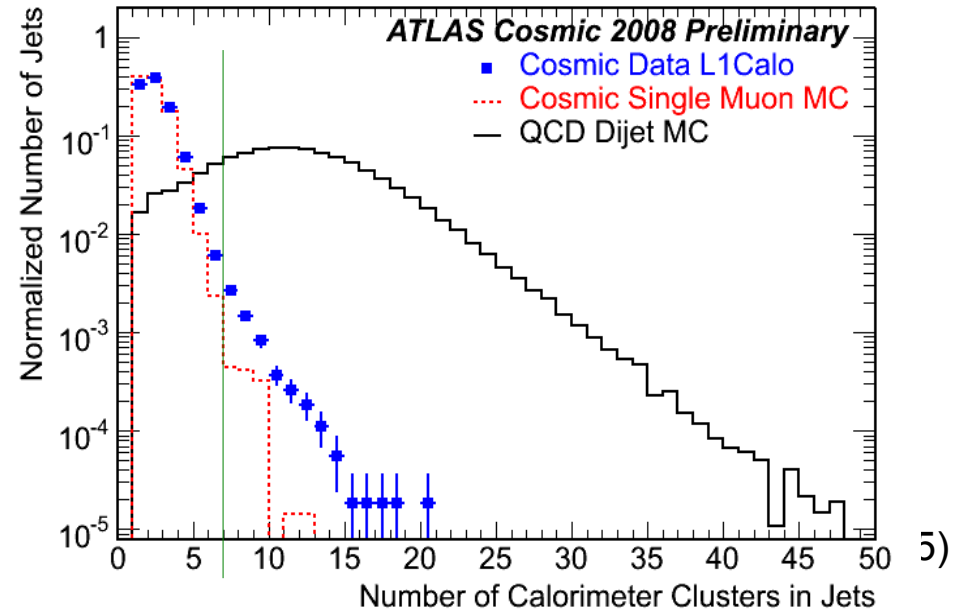(standard task in collider experiments)

Jet cleaning

Hideki Okawa

Jet EM fraction
(Cone 04 Topojets, ET > 20GeV)

Jet Size
(# topo clusters in jet))

$$Jet\ EMF = \frac{(Jet\ E\ in\ EMB, EMEC, FCAL0)}{(Total\ Jet\ E)}$$

- Cuts are complementary
- Cosmic muons and noise jets
  sucessfully rejected
- Not even all options exhausted,
  e.g. additional timing cuts
- These variables or combinations
  can be used for MET cleaning

Overlay events

- What is the impact on physics of the issues observed with cosmics?
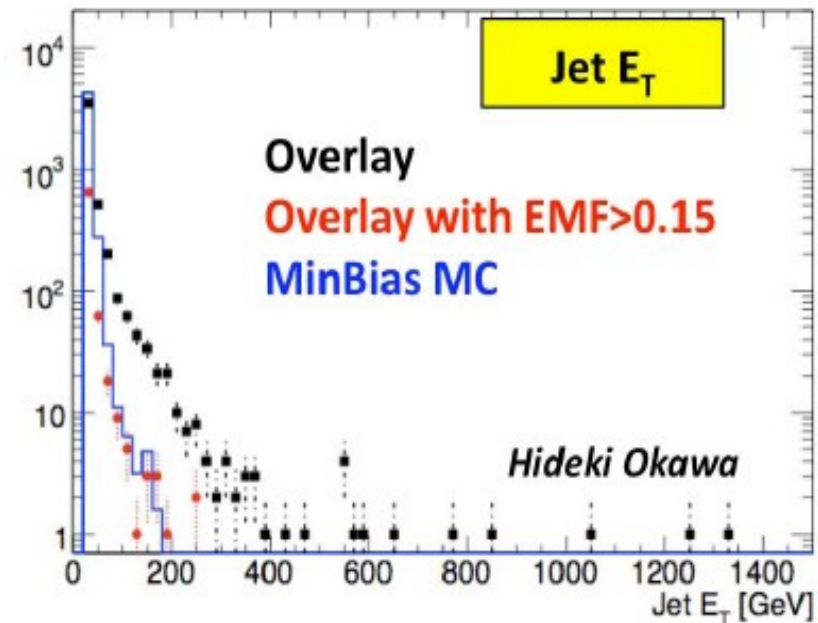- Are cuts developed on cosmics still efficient in colission runs ?

→ embedding simulated G4 signals on real data event by event
  during digitization (MinBias, Di-jets)
Status: after a few iterations, athena 14.2.25.9 seems to work correctly,
  currently beeing validated, first results

Y.Zhu
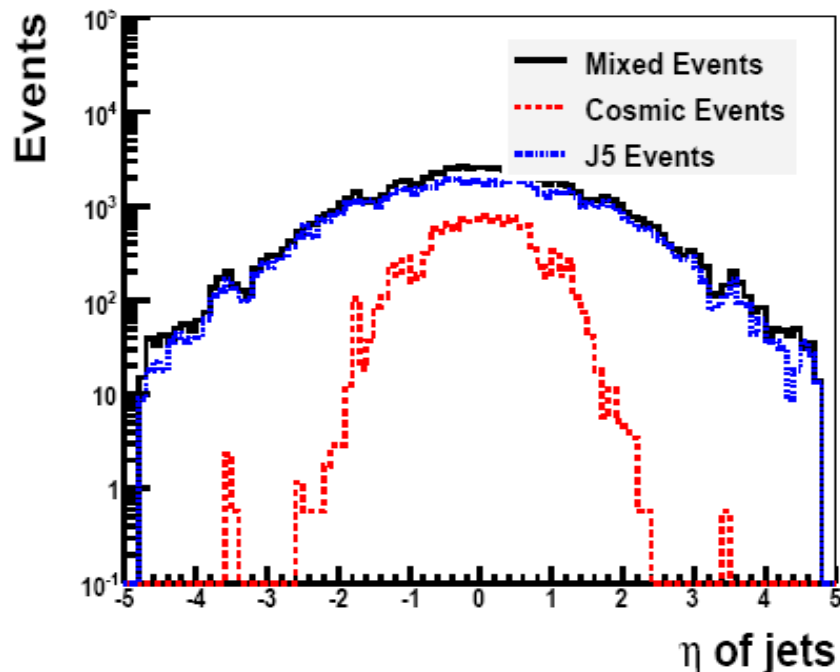
H. Okawa

Summary

- MET performance and data-MC comparison with clusters/jets/MET has improved much with the recent reprocessing (Dec 2008)
  A few issues left, most prominent: non-Gaussian Tile noise → fix iin rel. 15

- MET_Topo performs better than MET_Base, even with non-optimal noise-PDFs

- Still room for improving MET reconstruction: Exclude bad cells, cleanup cuts developed for cosmic jet- rejection, timing ...

- High-energy jets /large-MET expected from cosmics and enriched by L1Calo
  Strategies to reject cosmics and noise jets /correct MET for cosmics and noise

- Overlay of cosmics with simulated events (MinBias, Di-jets) are validated
  Important to evaluate impact on physics of features and cuts from cosmics

- Jets and MET studies can be complementary in solving problems

- Good cooperation between calorimeter and Jet/ETmiss working groups

Backup

Calorimeter Maintenance

A-side maintainance completed in march, C-side ongoing till beginning of May

LiquidArgon:

- 1(+2) FE crate LVPS failed → repaired
- 1 HEC LVPS failed → inspect all
- a few FE boards inoperable: replacement during next l ong shutdown ?
- a few L1 receivers fail
(• few single-channel problems <<permille level)
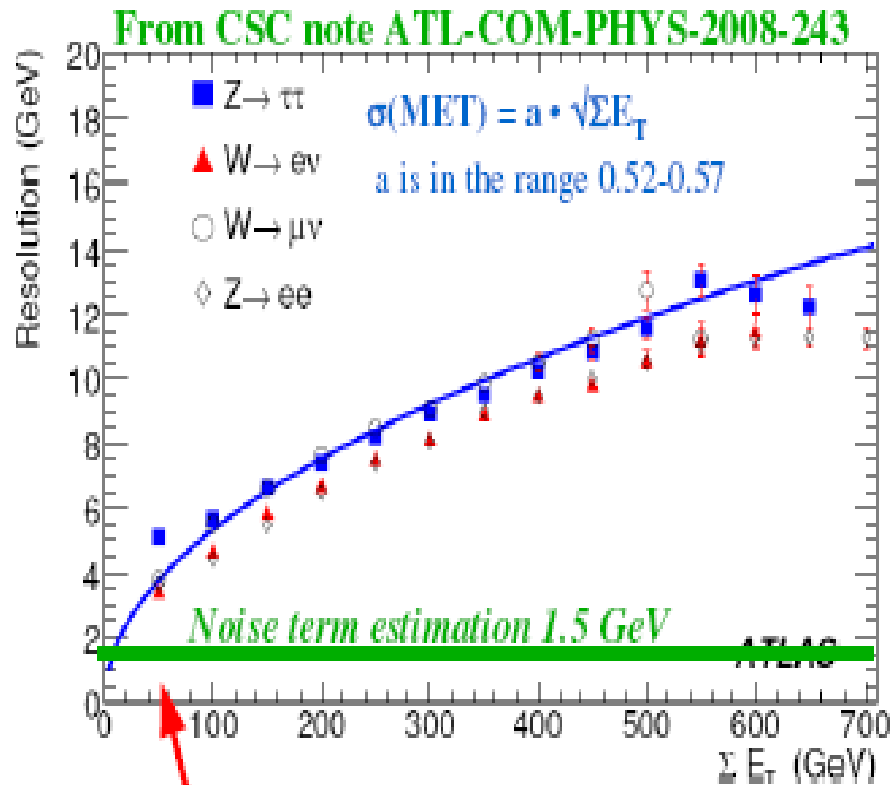 → Expect full-functioning calorimeter by may 2009
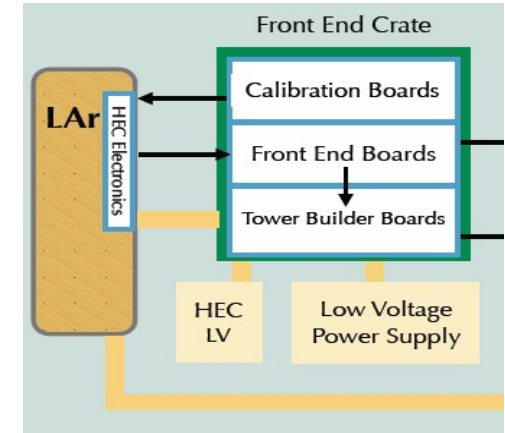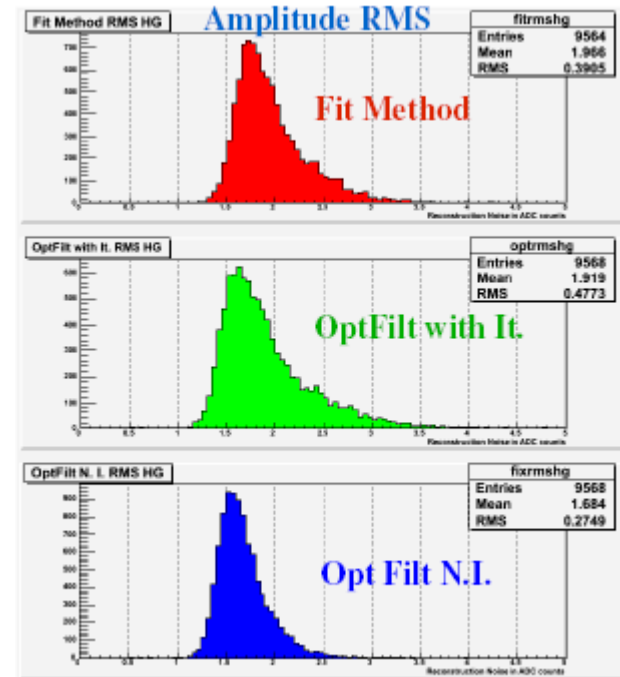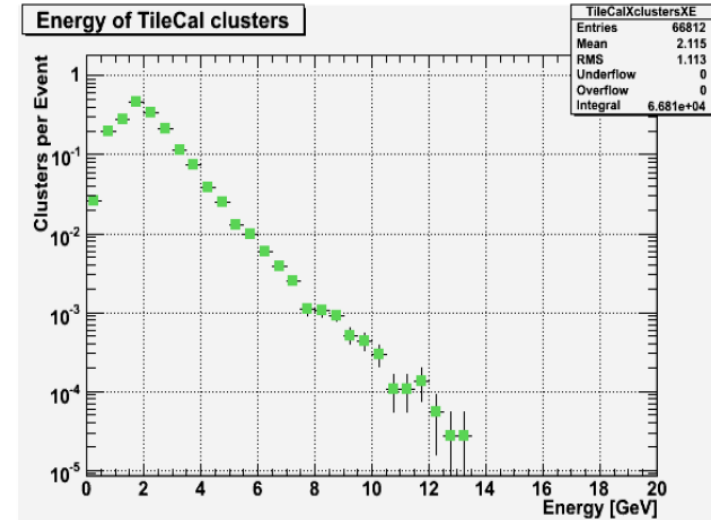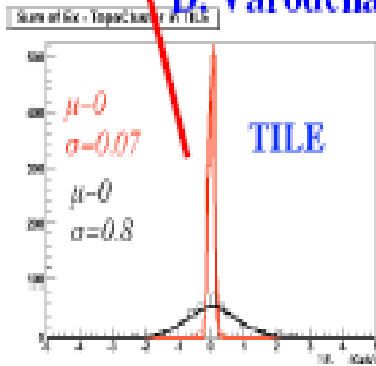

Tile:

- Sept 09: 5/256 drawers with Single point failures
    2: LVPS failures, 3 FE failures
    + FE problems restricted to individual cells
    → dead cells: 0.8% LVPS
                1. 4% FE
  additional cells with reduced performance
- all but a few minor problems (e.g. less precise calibration) have been/are being repaired

Reliability analysis: We have to expect new failures (% level)
to accumulate during 2009/2010 operation, rate will diminish in time

Physics impact of Tile non-gaussian noise

From CSC note ATL-COM-PHYS-2008-243

$\sigma(MET) = a \cdot \sqrt{\Sigma E_T}$

a is in the range 0.52-0.57

Noise term estimation 1.5 GeV

D. Varouchas

Energy of TileCal clusters

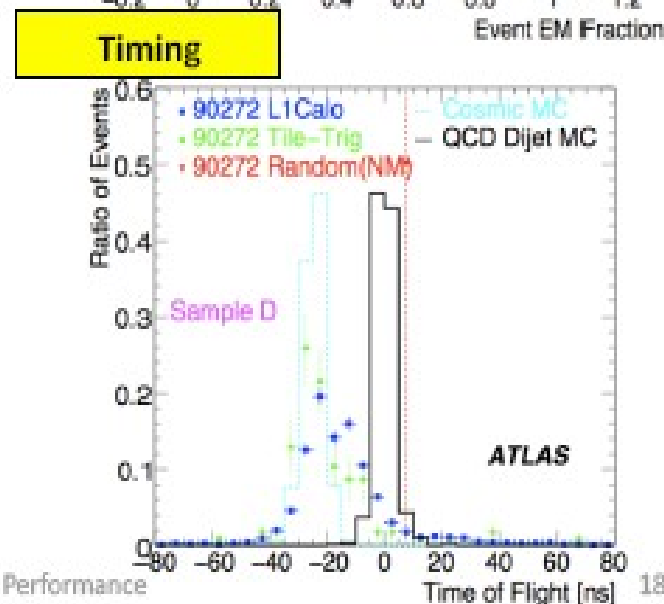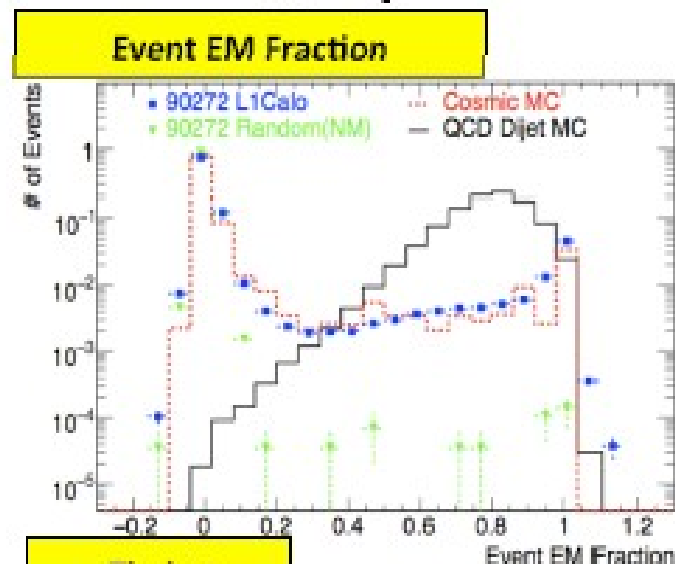last year

now

later

MET cleaning

Hideki Okawa et al.

Event-level Quality for Missing E$_T$ Cleaning

- Many variables from jets can also be used for event (Missing E$_T$) cleaning
- Weighted-average of jet cleaning variables by jet E$_T$ is useful

$$ex. \quad EMF_{event} = \frac{\sum_{jet} EMF_{jet} \times E_{T\,jet}}{\sum_{jet} E_{T\,jet}}$$

- Timing information provide additional cleaning

Event EM Fraction

Timing