L2 Overview

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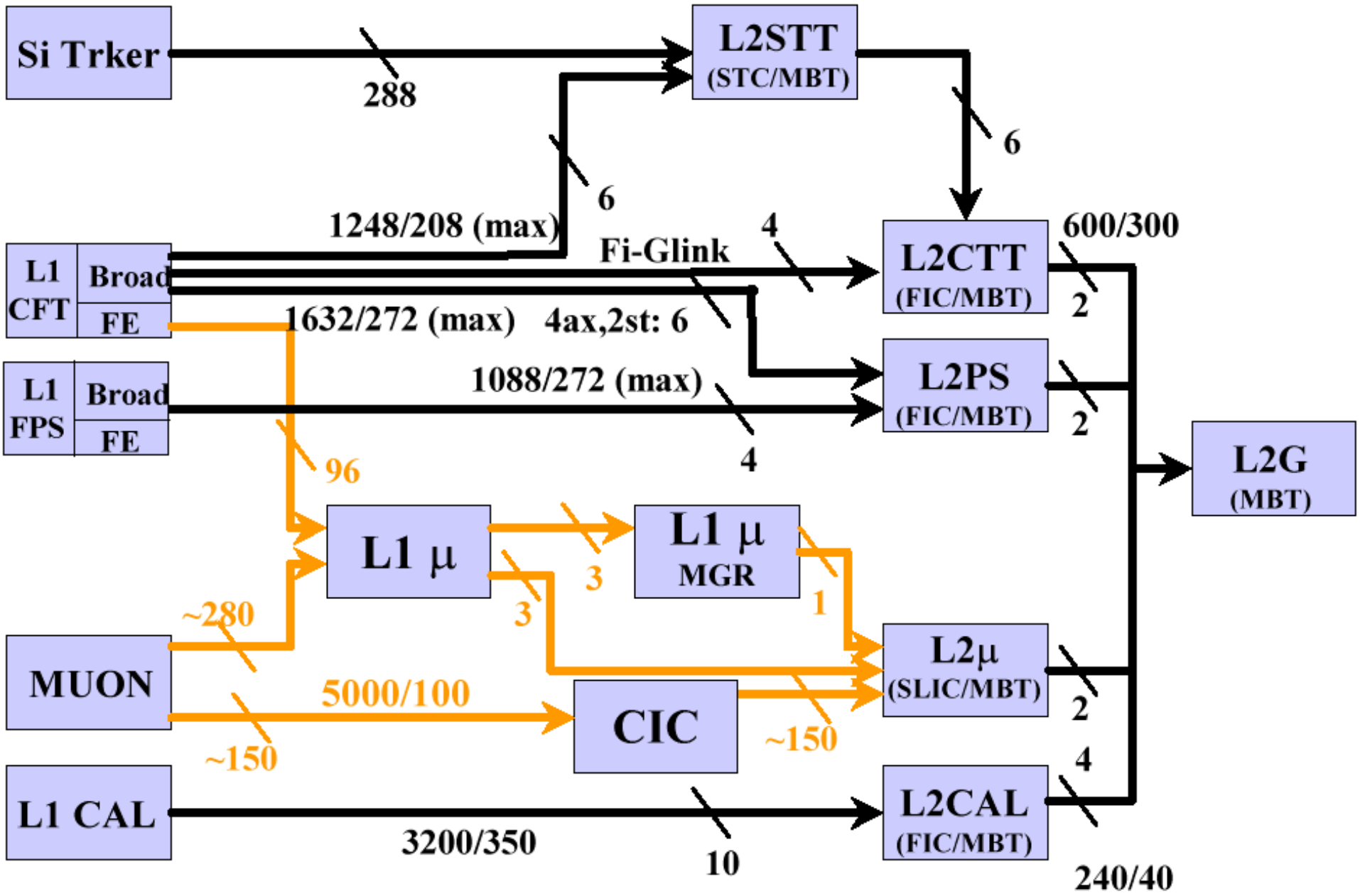
Trigger Workshop, 04/22/02

Outline

- Online
- Simulator
- L2 Algorithm performance
  - muon
  - calorimeter (em + jets)
  - global
- Issues
- Summary
- Outlook

L2 Connections



Inputs Availability

- Global (128-bit mask): from trigger framework
  - No header (event alignment?)
- Muon: ≈ 150 front-end muon channels
  - A few dead channels
- CAL:
  - 2 out of 10 fibers (-0.8<eta<0.8)
  - 1/4 GeV stepsize for total energy (rather than 1/2 GeV)
  - Software corrections for:
    - Missing L2 headers/trailers
    - seed mask
    - Pedestals
    - Gain
- CTT/PS:
  - Later this sprint/summer
  - See L1CTT/PS schedule

L2 Hardware

- 4 fully functional online crates
  - L2gbl, L2muc, L2muf, (L2cal)
  - Single Alpha system
    - Rate limit ≈ 200 Hz (in single-buffer VRBC mode)
- L2 test stand
  - Hardware/Algorithm/Software debugging
  - Copies of all L2 inputs, SCL
  - No COOR connection yet

L2 Alpha/Beta

- 13 working Alphas
  - Up to 15 possible
  - 2 have TTL arbitration modifications
    - Required for multi-Alpha crates
    - Rick Kwarciany working on PIO firmware
  - Enough to put 3 Alphas in L2cal
- Beta prototype available
  - Testing in progress
    - Successful Mbus transaction
  - Firmware in progress
  - Production during the summer
  - Installation later this year

L2 Online Framework Software

- State Loop design
  - Input - processing - output - readout
  - Reset states for SCL init and TCC commands
- L2 parser
  - Disk-resident configuration file
  - COOR - TCC downloads - *being implemented*
- Trigger framework interaction
  - L1 trigger bits input from trigger framework
  - L2 bits output to trigger framework
  - L2 bits also in L3 readout block
- Running from release (l2p11.05.00)
- Monitoring

L2 Offline Software

- Simulator
  - MC processing
  - Raw data re-processing
    - Comparison online-offline
  - Analysis (ntuple output)
  - p11.05.00
- Trigger bit information (Run Database)
- Reco/L3/L2/L1 comparison tool
  - SEED based
  - Implementation phase

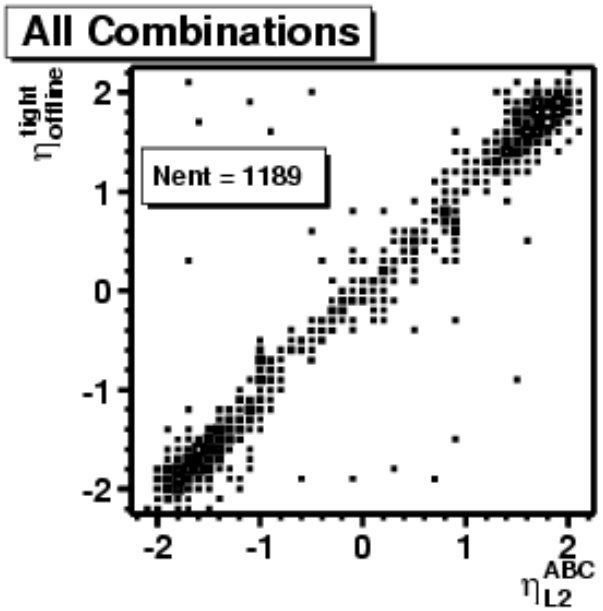
Analysis Tools

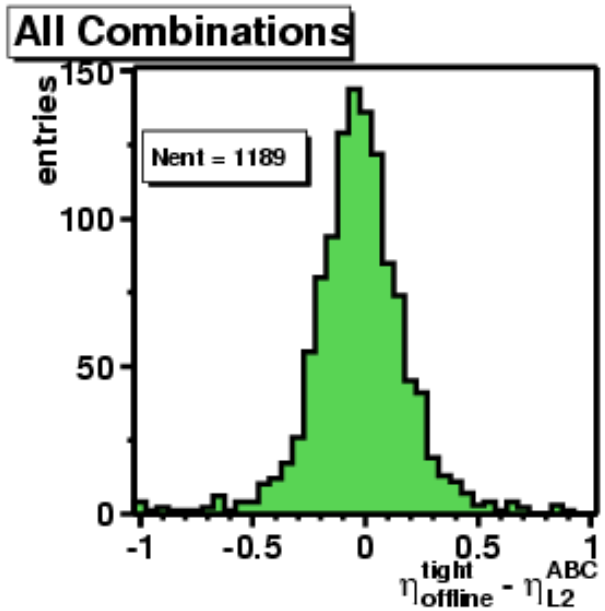
- Trigsim
  - Run over MC data → ntuple
  - Run over raw data → ntuple
  - Add trigger bit name information
- Analyze with ROOT macros
  - Combine with reco ntuple
  - Example macros available

L2 Algorithms

- L2 muon
  - SLIC + Alpha algorithms
  - ≈150 front-end muon input channels
    - Some break
  - TB presentation last Wednesday → ready to trigger
- L2 cal EM, L2 cal jet
  - Online as a combined worker
  - Ready for TB presentation
    - Waiting for more data (VRC1A replacement)
- L2PS, L2CTT
  - Running in the simulator

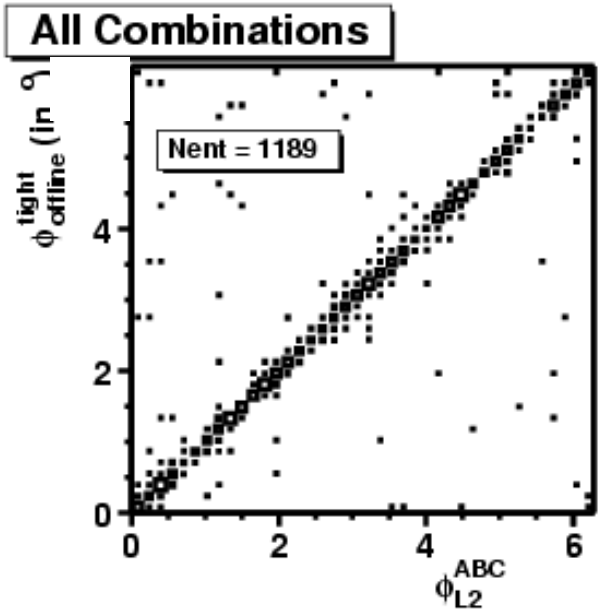
L2MU vs. reco: η, φ

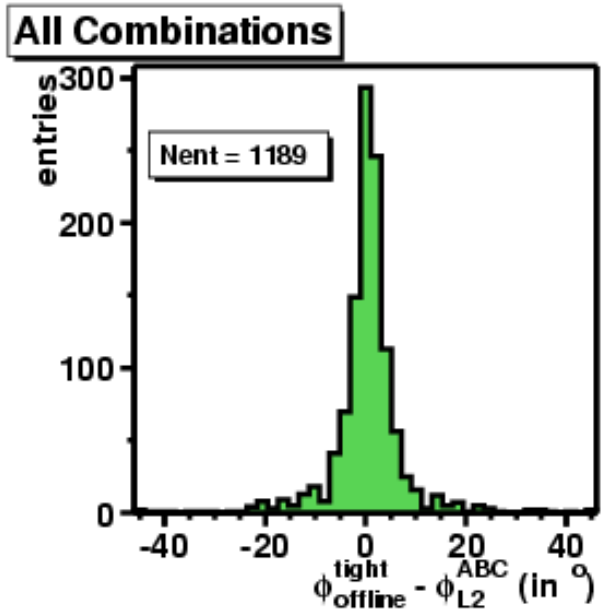




Run # 149852
9335 events
missing: PDT 0x25, 0x35

L2MU: **p11.05.00**
reco: **p10.15.01**





(η, φ) correlation for tight off-line muons and medium L2MU (matched A&BC stubs)

From Christos' TB talk

L2 Muon Performance

- Efficiency wrt reco

muc and muf	Loose reco μ	Medium reco μ	Tight reco μ
Loose L2MU	98%	99%	99%
Medium L2MU	82%	84%	88%
Tight L2MU	78%	81%	87%

- Rejection wrt L1

L1 trigger	cen	fwd
Loose L2MU	1.8	1.6
Medium L2MU	4.7	2.3

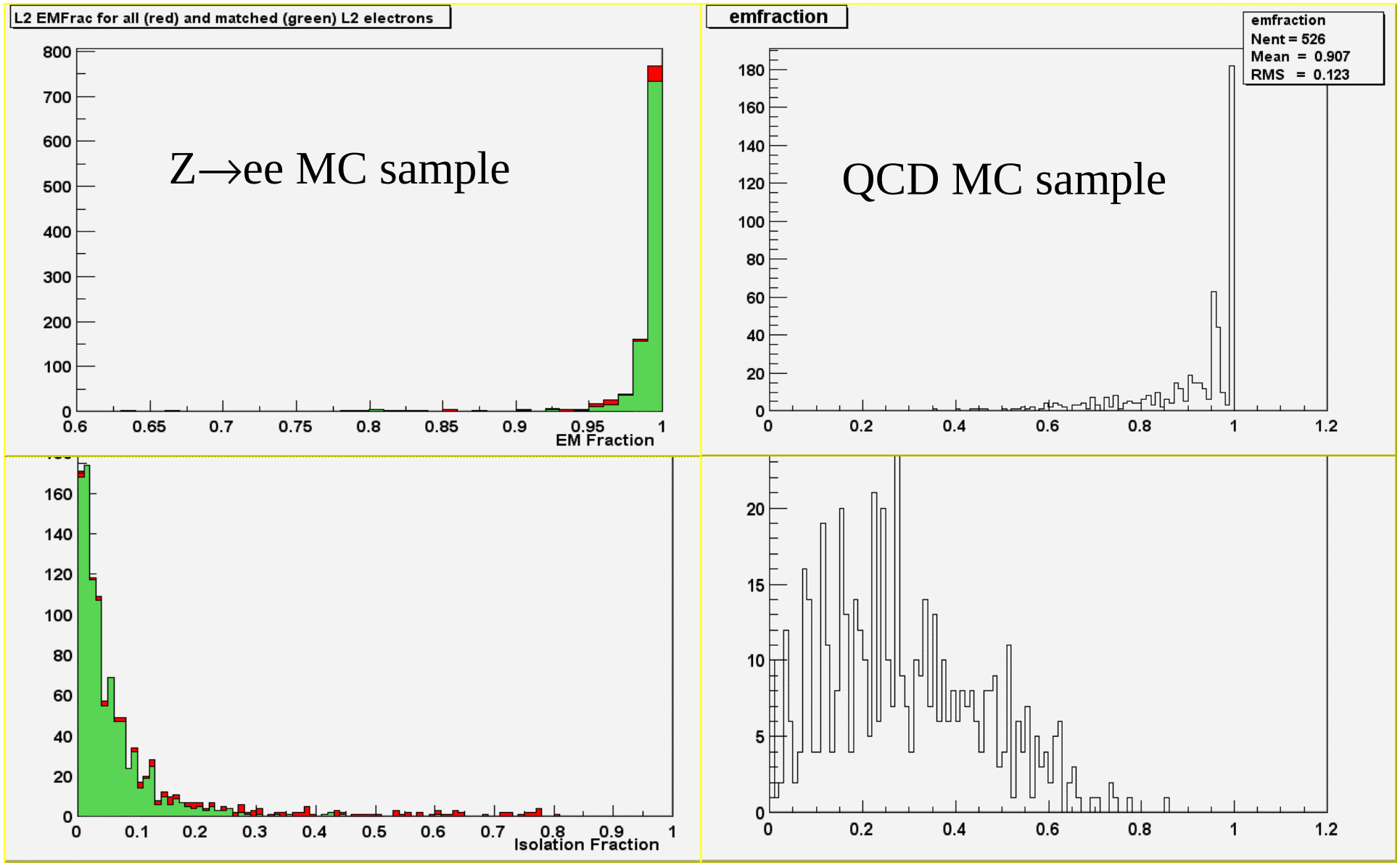
- Online rejection test: loose L2 muons

L1 bit name	Rejection (L1/L2)	comment
mu1ptxctxx_fz	1.8	9/10 cen SLICs
mu1ptxbtxx_fz	3.2	3/4 fwd SLICs

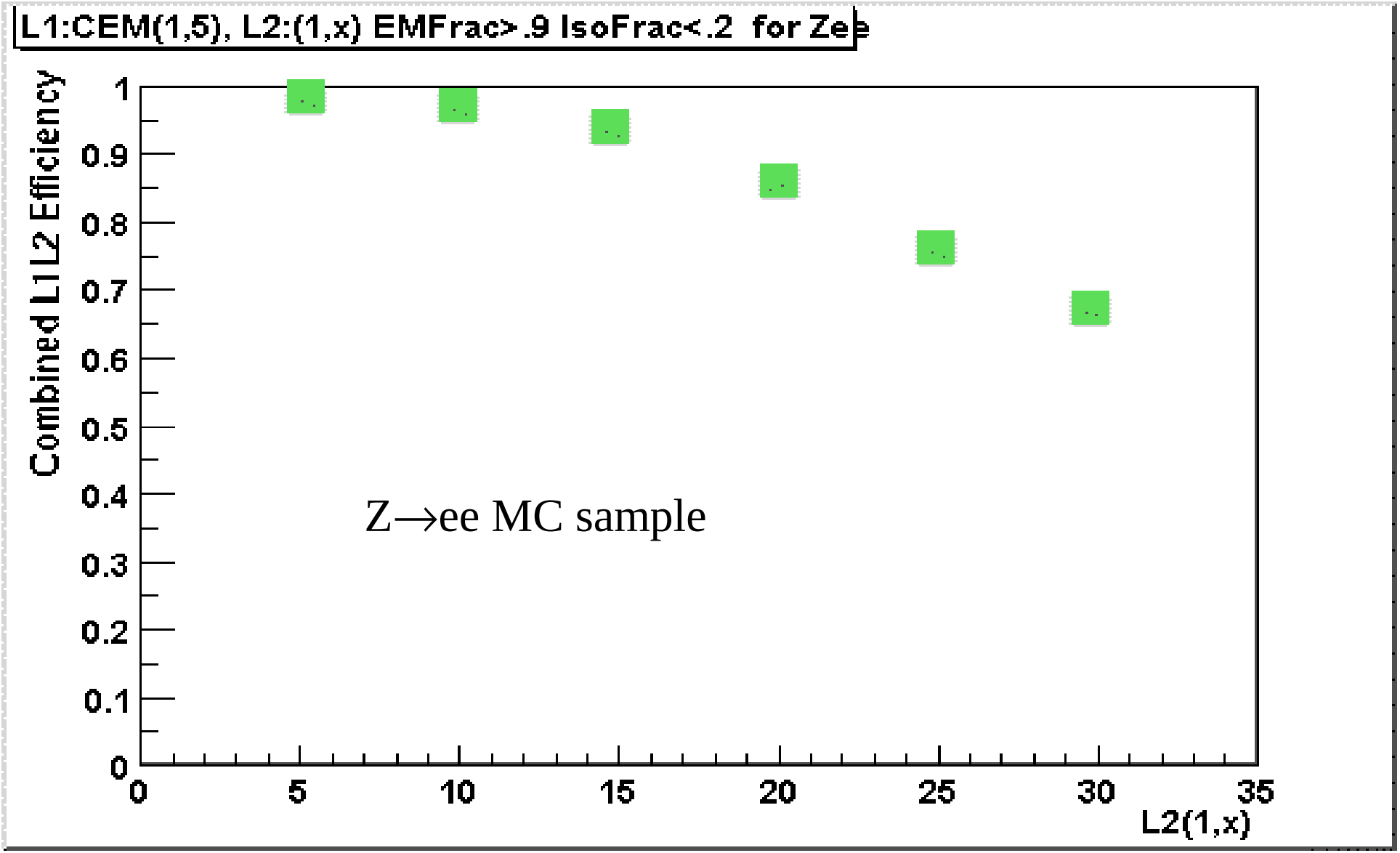
From Christos' TB talk

L2CalEM - MC particle matching

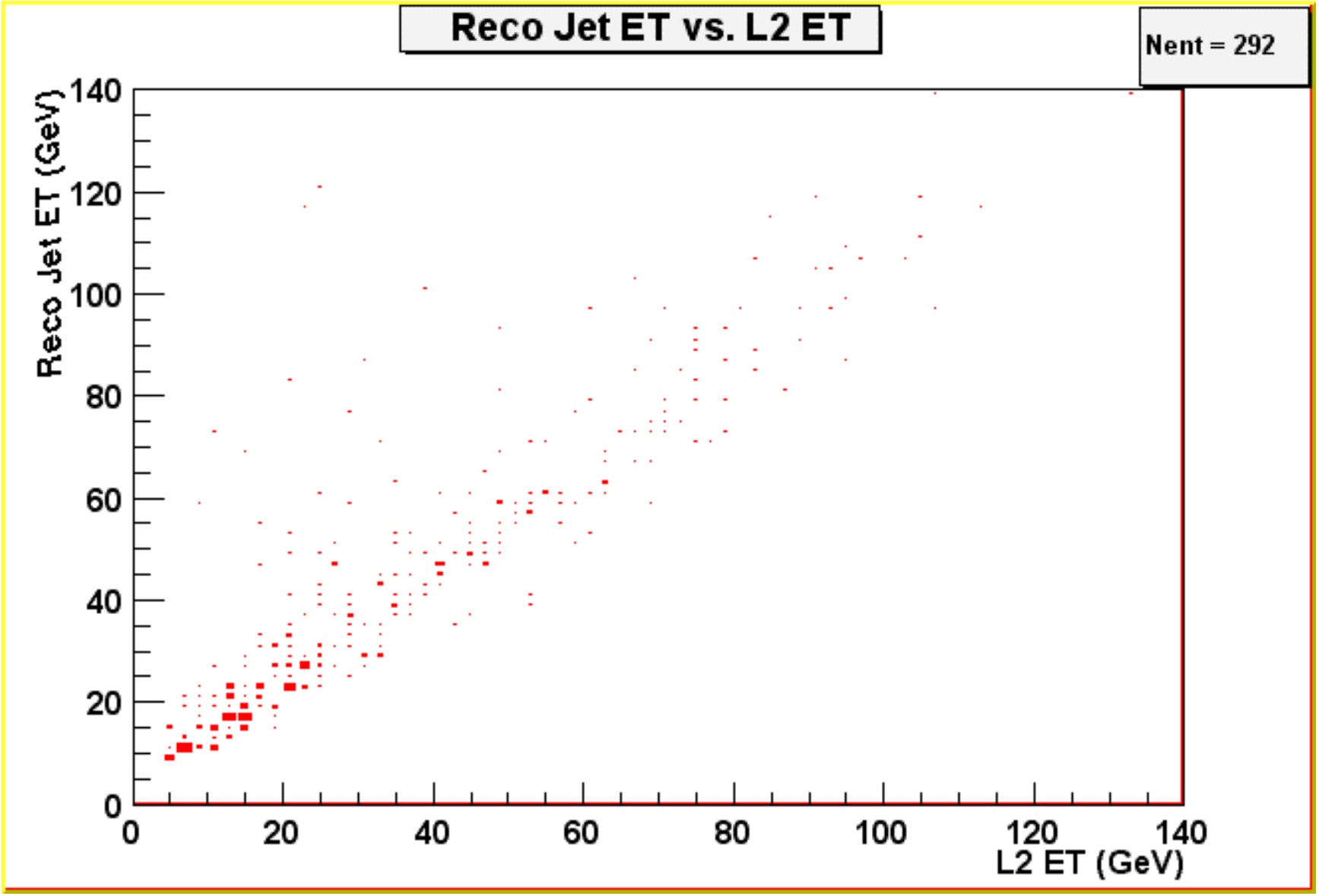
5GeV L2 ET cut



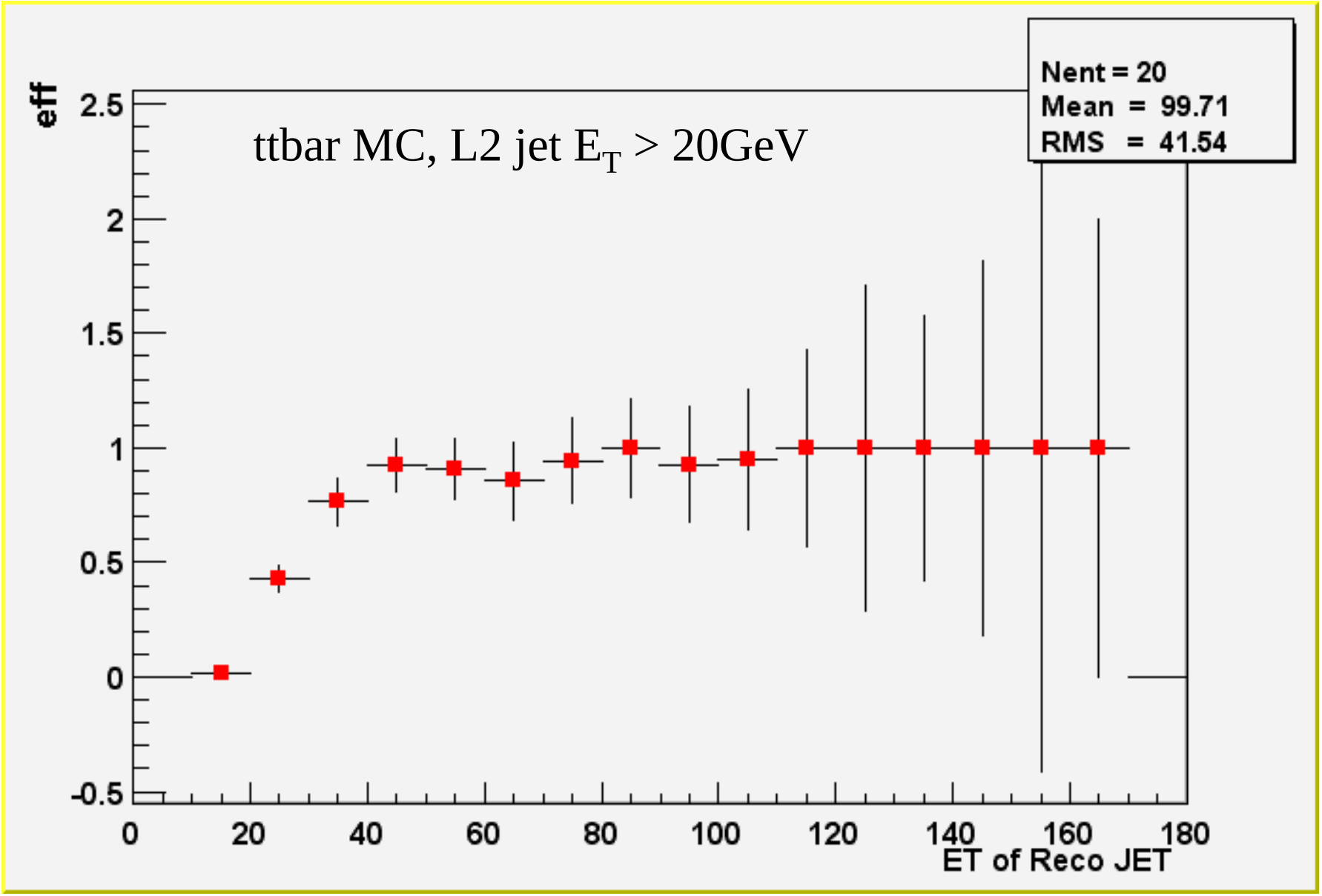
L2 EM Efficiency



L2Cal Jet Matching



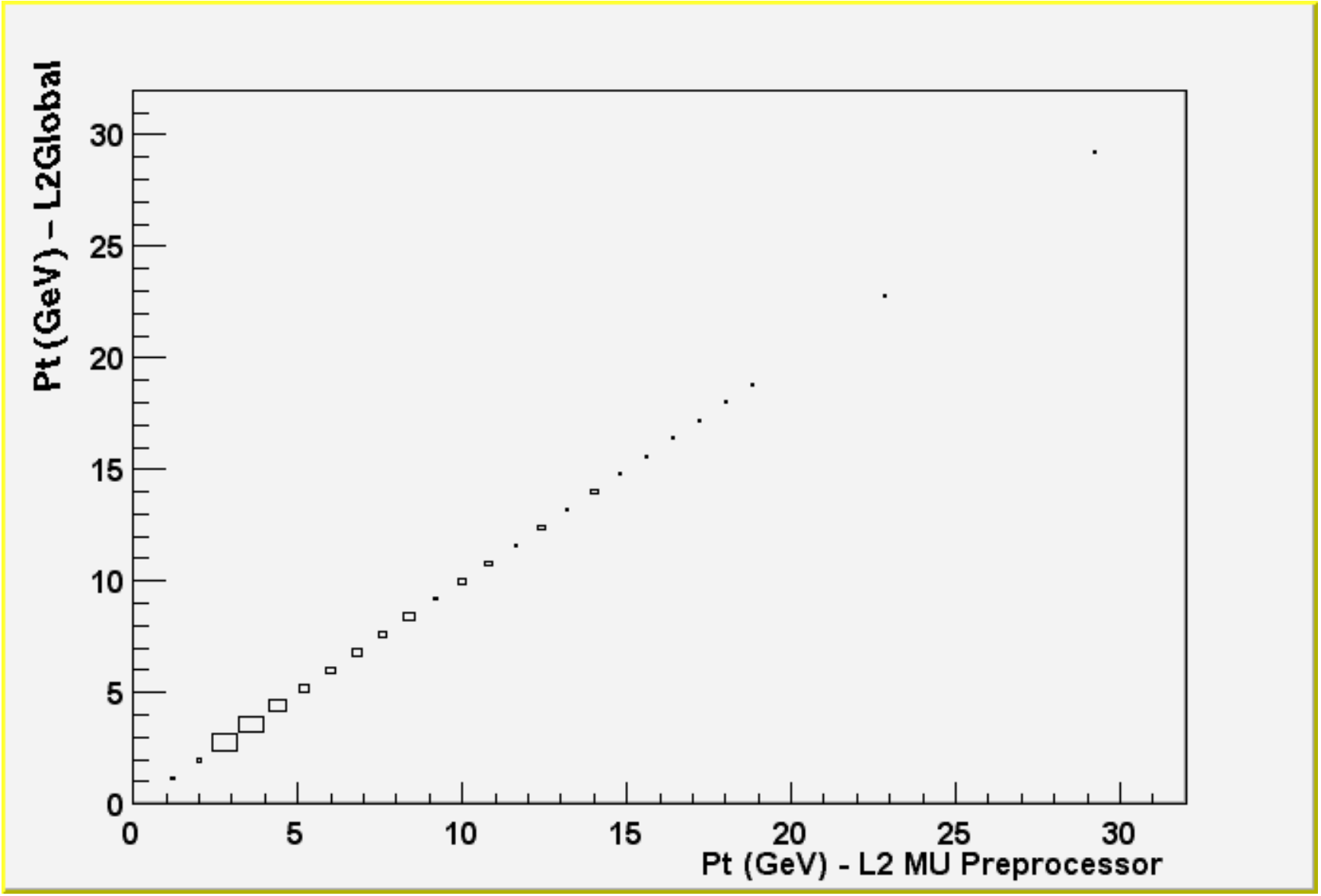
L2Cal Single Jet Efficiency



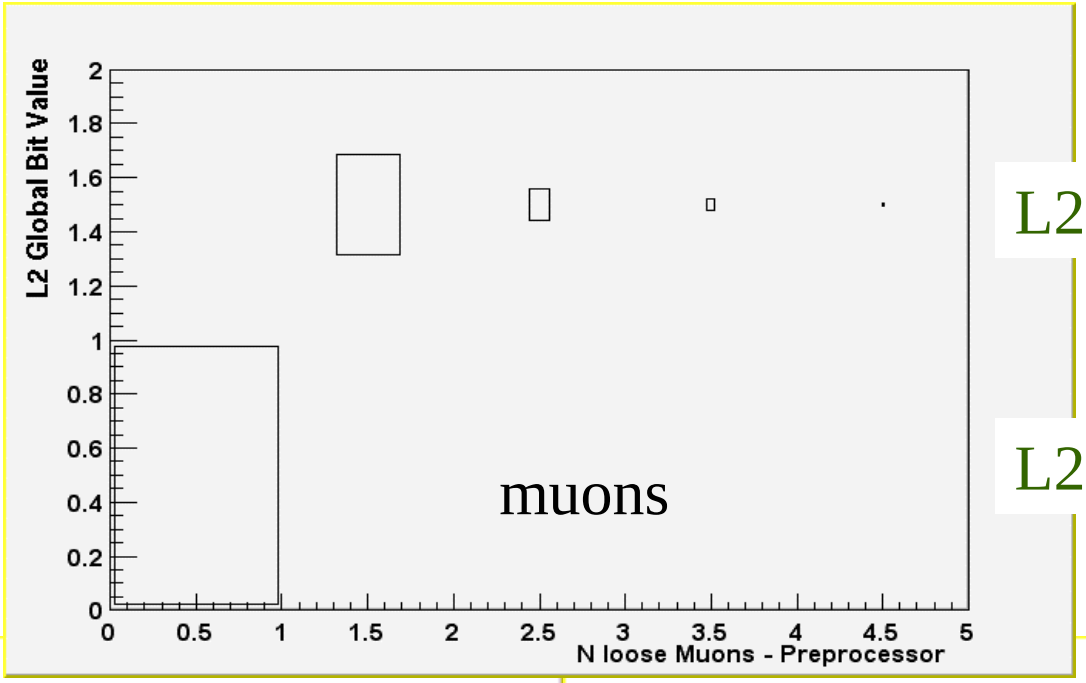
L2 Cut Parameters (L2gbl)

- Muons
  - Quality mask
  - P_T
  - *Track match*
- CAL EM
  - E_T
  - EM fraction
  - Isolation fraction
  - *Track match*
- CAL jets
  - E_T

L2 muon - global objects

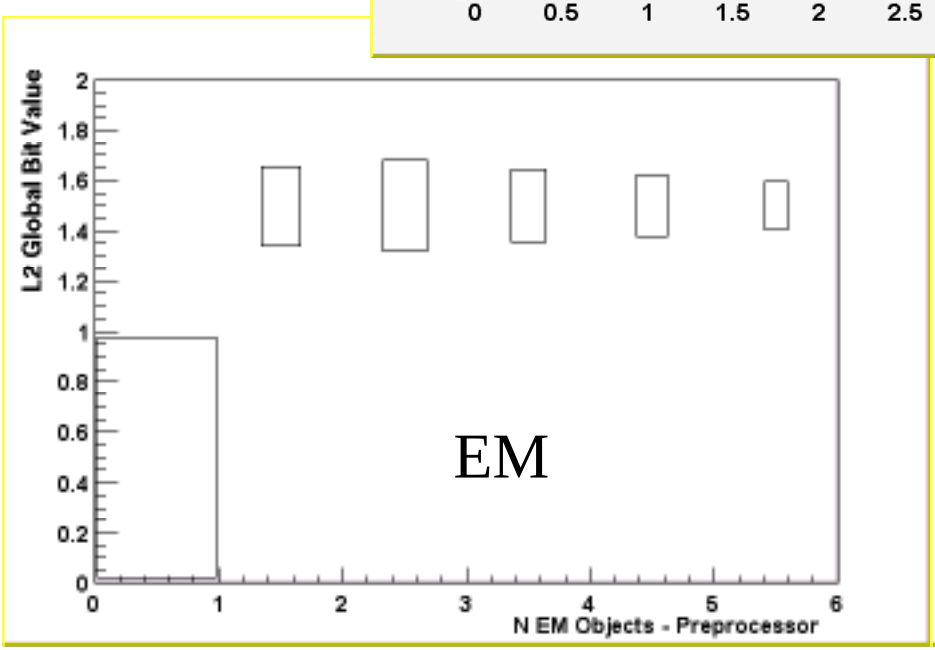


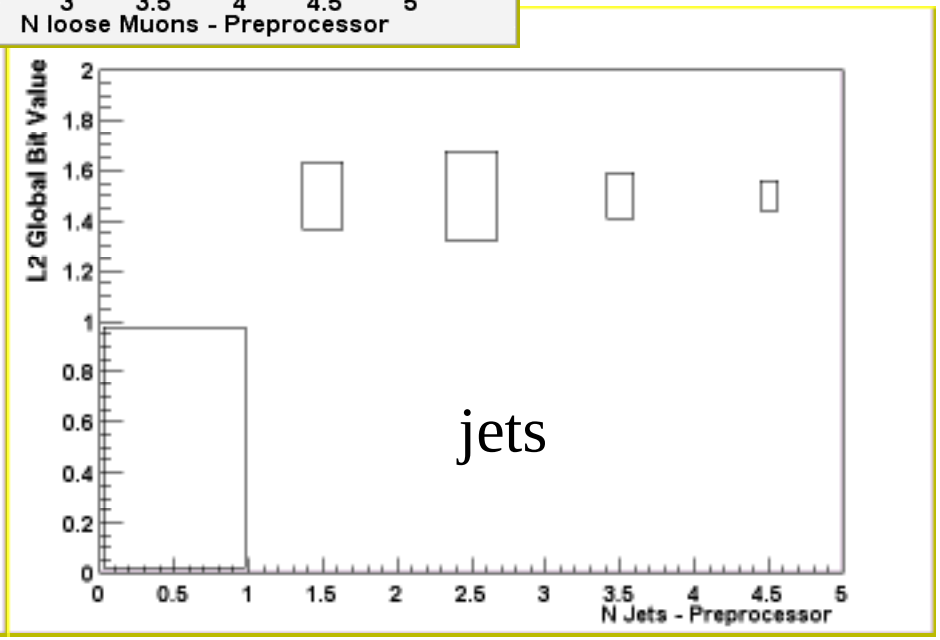
L2 global algorithm - PP



L2 accept (bit=1)

L2 reject (bit=0)





Issues

- COOR downloading
  - Assign trigger bits, enable L2 inputs
  - Implementation phase
- Algorithm fine tuning in progress
- Readout of L2cal (L2gbl)
  - Connected to VRC1A together with l1cal
    - Software VRC
    - Drops events at high rates (10% at 100Hz)
  - Just received SBC for L2gbl
  - SBC for L2cal when available

L2 Latency

- Single-buffer VRBC mode + L2 latency
  - Time from L1 accept to L2 accept: ≈300 μsecs
    - If running only L2mu + L2gbl
    - Increases to ≈400 μsecs if including L2cal
  - CAL asserts front-end busy between L1 accept and event readout

  ➔ Causes 8% dead time at 200Hz
- Multi-buffer VRBC mode
  - Rate limit ≈3 kHz

External Issues connected to L2

- SDAQ runs
  - L2 must have all its inputs for every event
  - L2 makes decisions for all runs or no runs

  ➔ all runs must include all L2 crates and all their inputs

  ➔ rate limit applies to sum of SDAQ and PDAQ runs
- Scriptrunner
  - L2 bits in the ITC header
- Luminosity information
  - L2 mask from L2gbl (for cross-checking)
  - L2UBS information
  - Will be available once UBS is functional

Summary

- L2 is ready to turn on
  - Muons, global ready
  - EM, jets to be approved
  - Probably want COOR downloading first
  - Start by duplicating existing L1 bits
    - Pass original
    - Cut on copy
- Also need the experiment to be ready
  - ITC header in Scriptrunner
  - SDAQ runs

Outlook

- L2 is ready to turn on
  - <200Hz input now
  - <3 kHz input in multi-buffer mode
- Future L2 improvements
  - Online-offline comparison
  - verification
- More Inputs
  - Start L2CTT commissioning in June
  - Start L2PS comissioning when inputs become available
  - STT comissioning this summer