Validation of the TAU Triggers

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for *lepton-track trigger* group

2002/5/7 EtDt Meeting

Trigger Validation Module

Call

- **TauTriggerValidation:**
  - **CEM8Track5Validaiton**
  - **CMUP8Track5Validation**
  - **CMX8Track5Validation**
  - **TauMetValidation**
  - **DiTauValidation**

BaseTauTrigger Validation

Lepton+track trigger/dataset validation is a part of tau trigger/dataset validation.

- **Code validation with recent data was done.**
- **Deposited on ExoticMods/Validation.(v4.5.0)**

Written by ***lepton-track trigger*** group

Max Chertok, Teruki Kamon, Takashi Ogawa, Alexei Safonov

TAU_ELECTRON8_TRACK5_ISO Path

- **Level 1:**

  L1_CEM8_PT8

- **Level 2:**

  L2_CEM8_PT8

- **Level 3:**

  L3_ELECTRON8_TRACK5_ISO

Electron : Et > 8GeV, Pt > 8 GeV/c,

chi2_z < 20.0, |delta Z| < 8.0 cm

Iso Track : Pt > 5.0 GeV…

|Z0e – Z0trk| < 15.0 cm, Delta R(e,trk) > 0.175

Definition of efficiency

① **Select events with back-up path bit**

e.g. ELECTRON_CENTRAL_4 (CEL4)

② **Apply offline cuts relevant to**

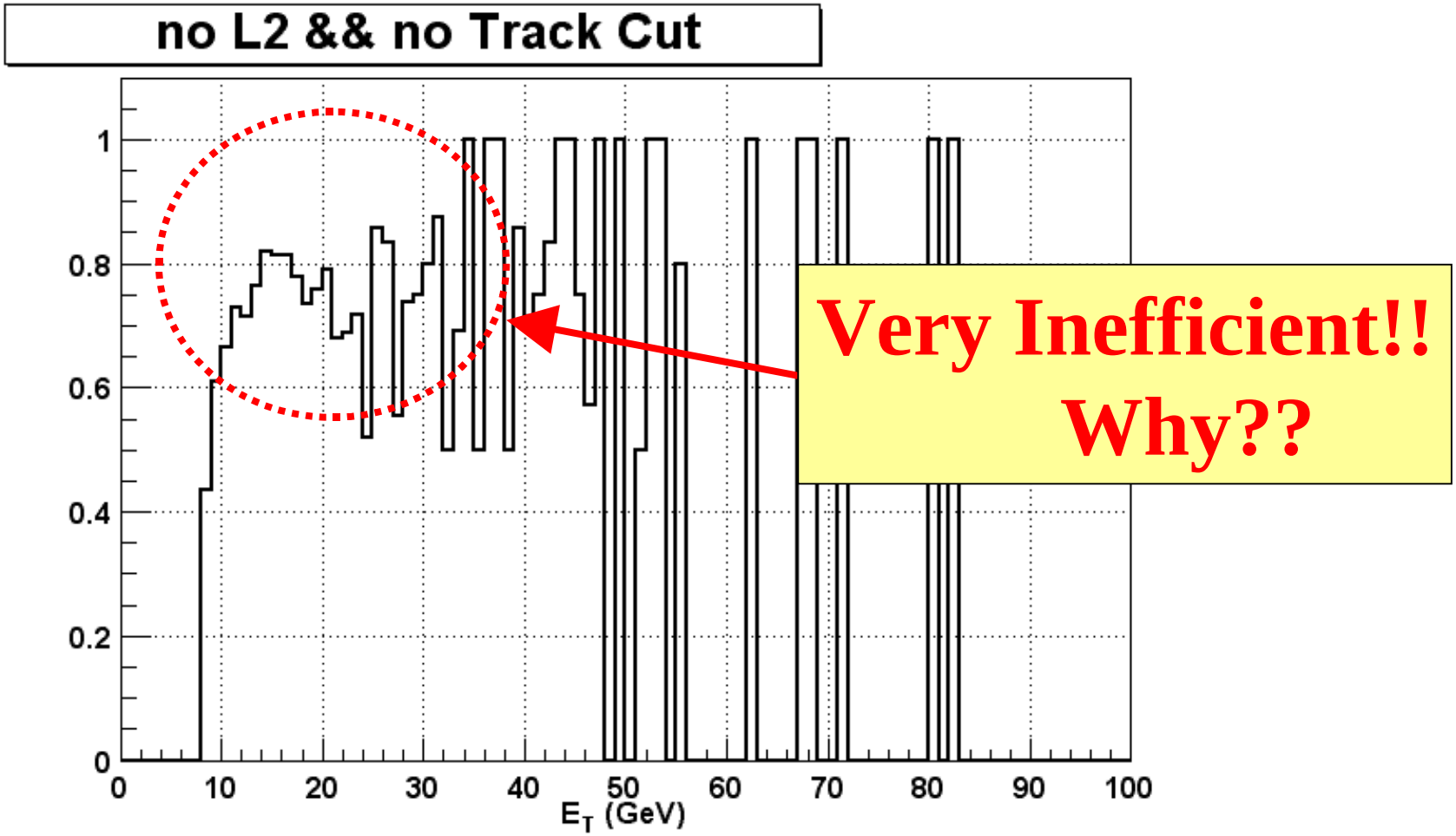
TAU_ELECTRON8_TRACK5_ISO (EL8TRK5)

③ **Check EL8TRK5 bit after cut**

We define

Eff. = (①&②&③)/(①&②)

Inefficiency of EL8TRK5

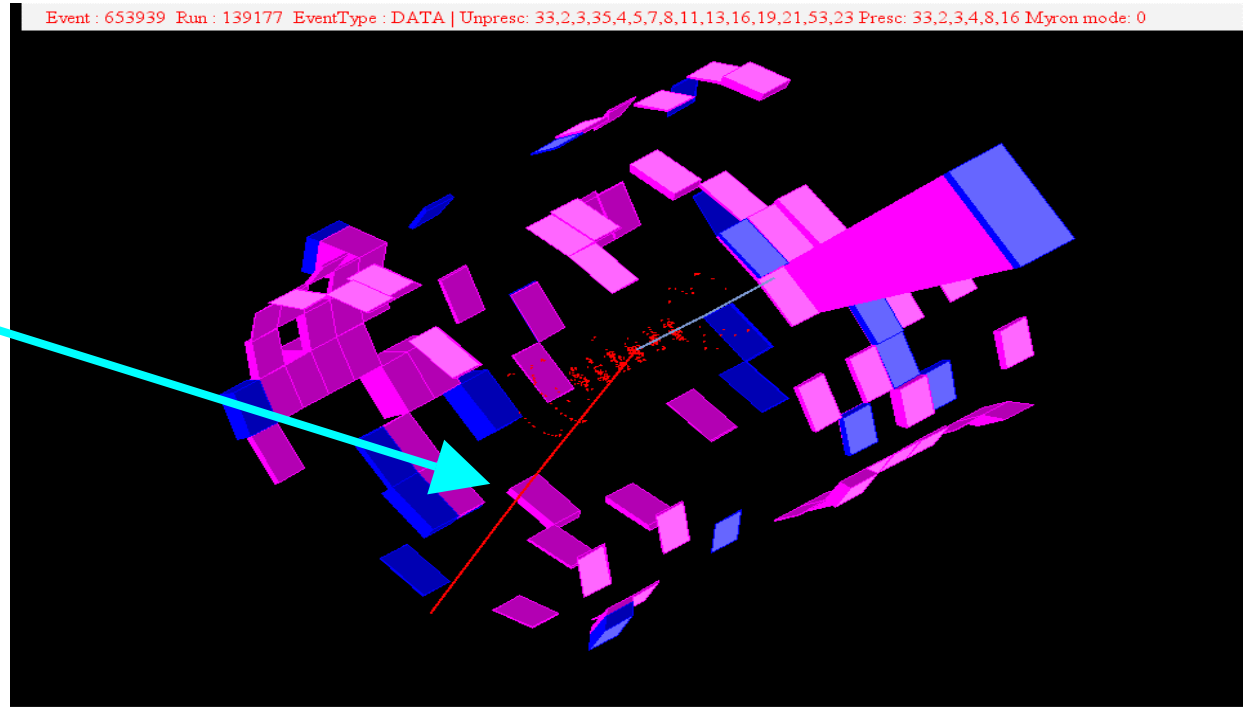


What' causing deficiency?

- **Fraction of events have track with large eta (>1.2), large d0 and/or no COT hits.**

Pt = 5.5 GeV

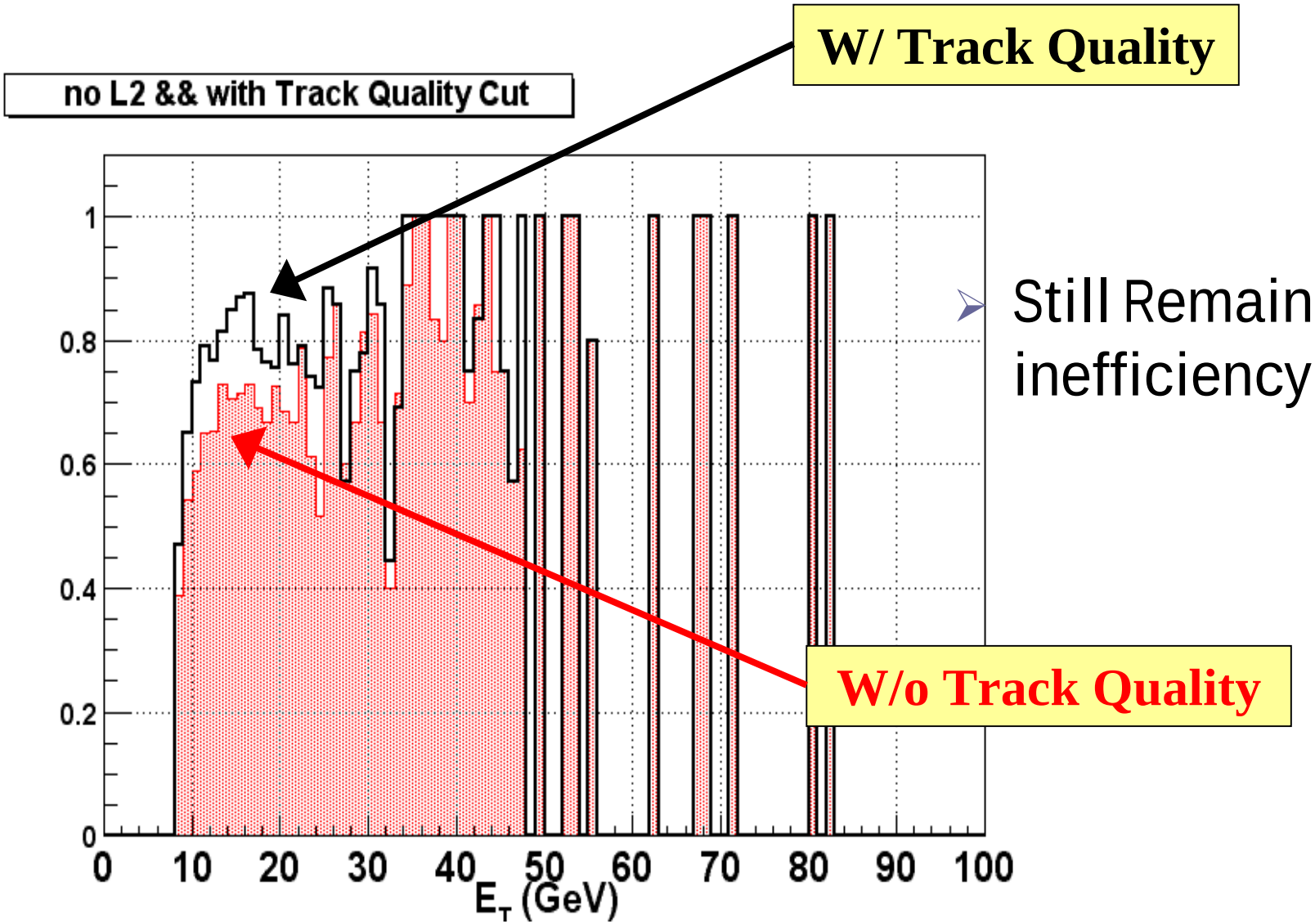
Eta = -1.21



We apply track quality cuts **:**

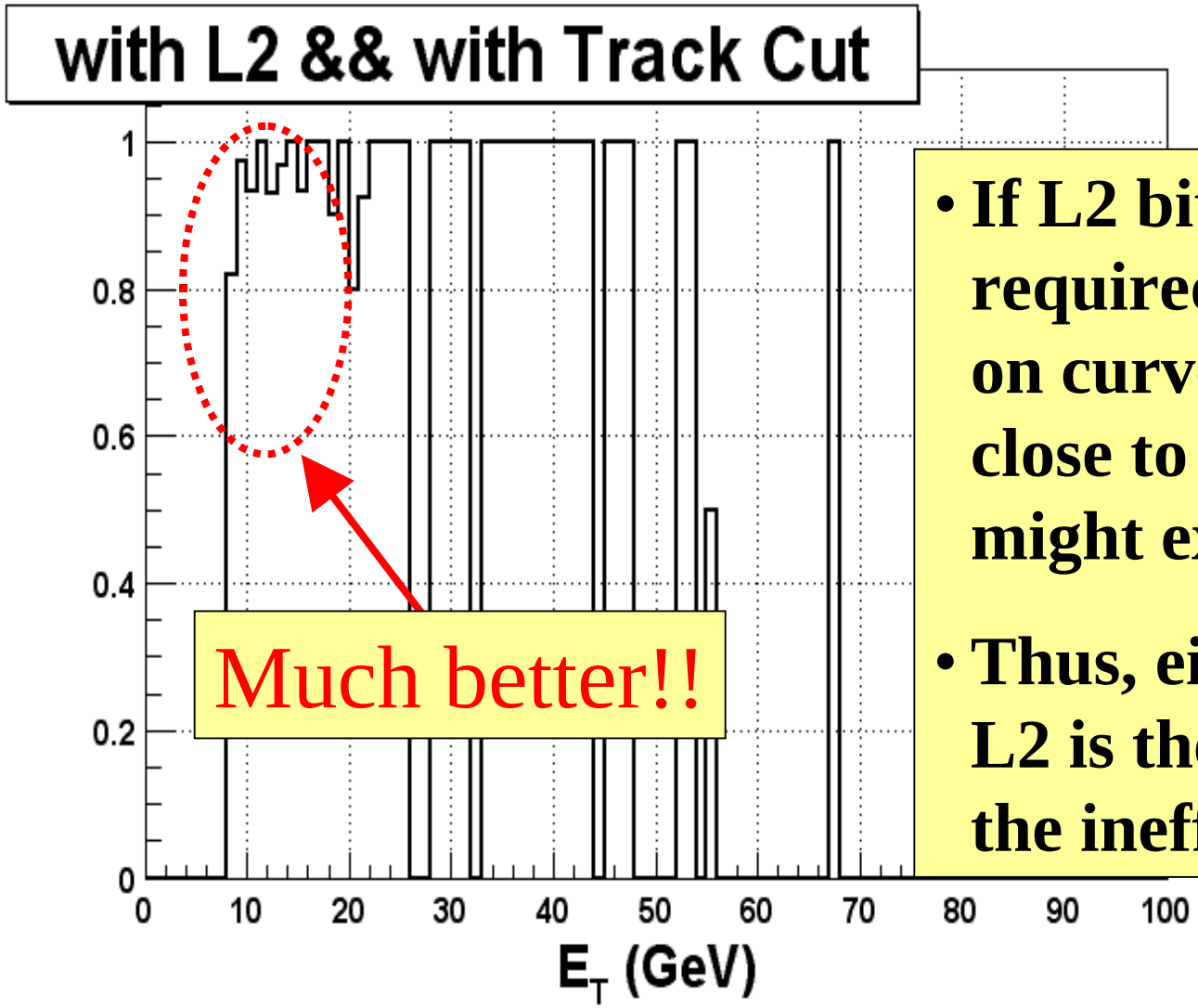
|eta| < 1.0, |d0| < 2.0 COT hits > 50

After track quality cuts



- Still Remaining inefficiency

Is L3 to blame? No.

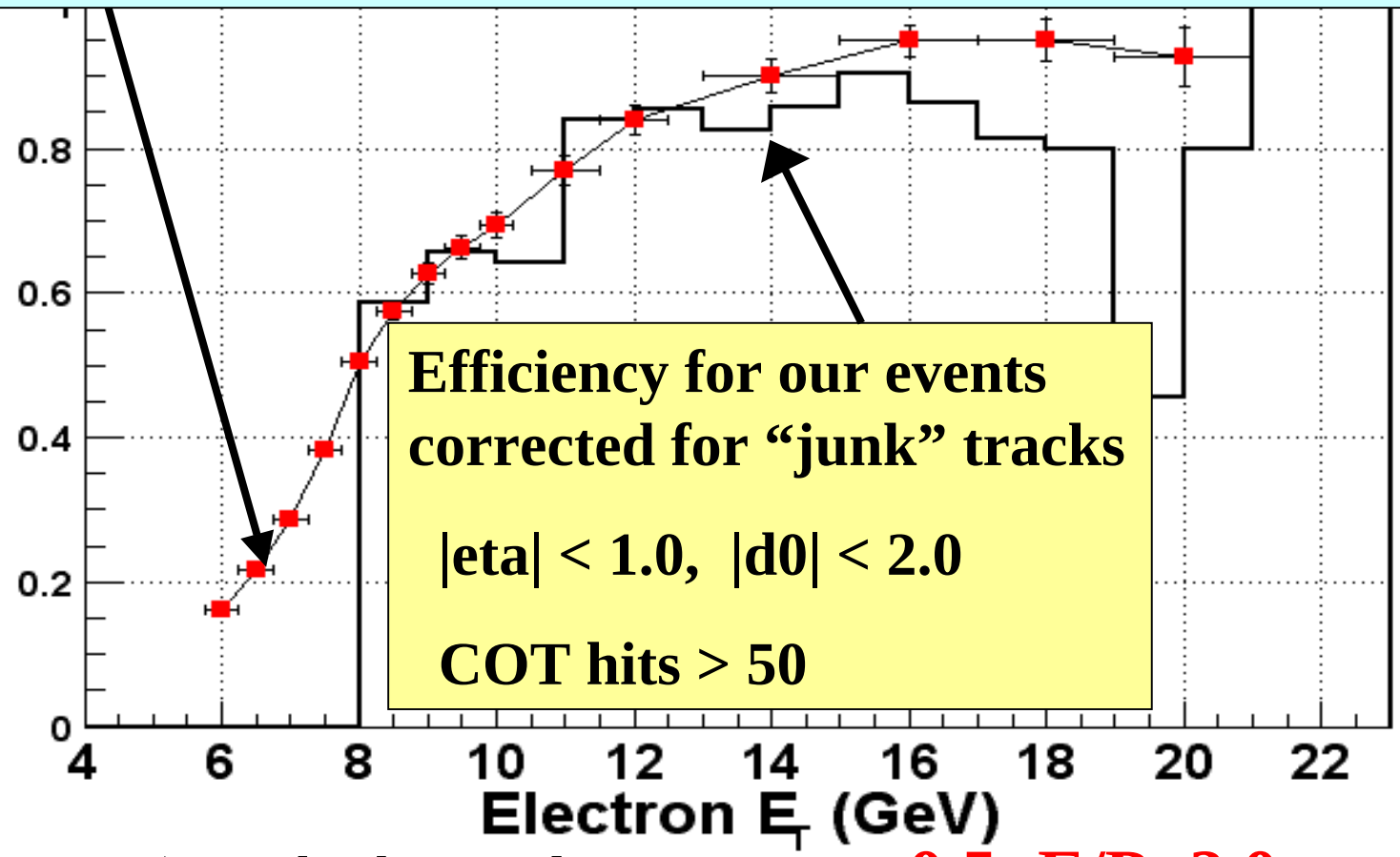


- **If L2 bit is required, the turn-on curve looks close to what one might expect.**
- **Thus, either L1or L2 is the source of the inefficiency.**

Smth wrong with L1/L2?

(L1+L2) Eff for "electron candidates" (as defined by our trigger reqs):

(**ELE4** & offline cut & L2_CEM8_PT8) / (**ELE4** & offline cut)



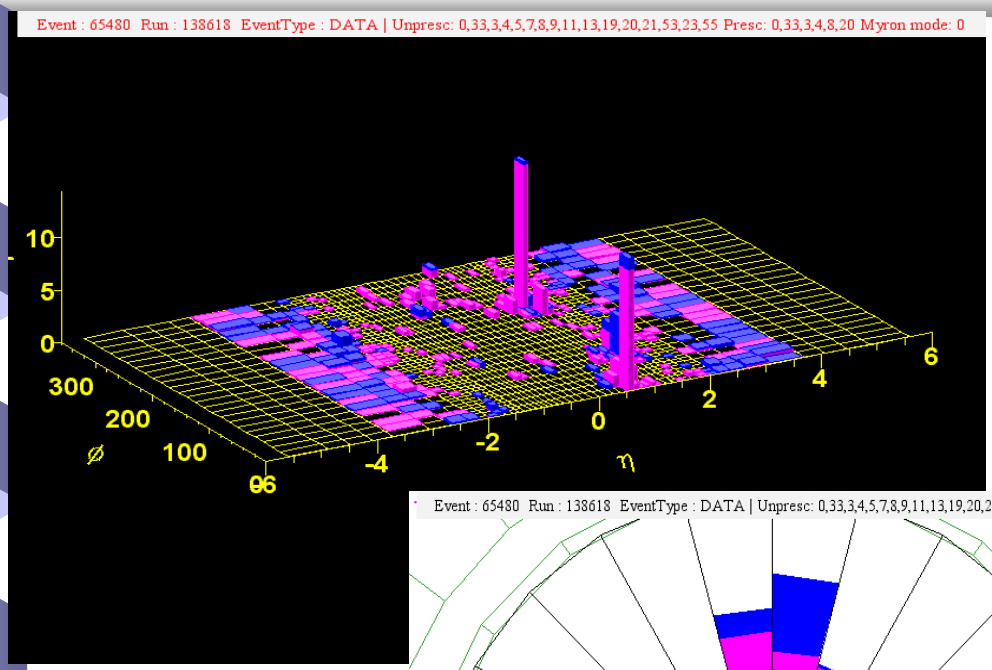
Efficiency for our events corrected for "junk" tracks

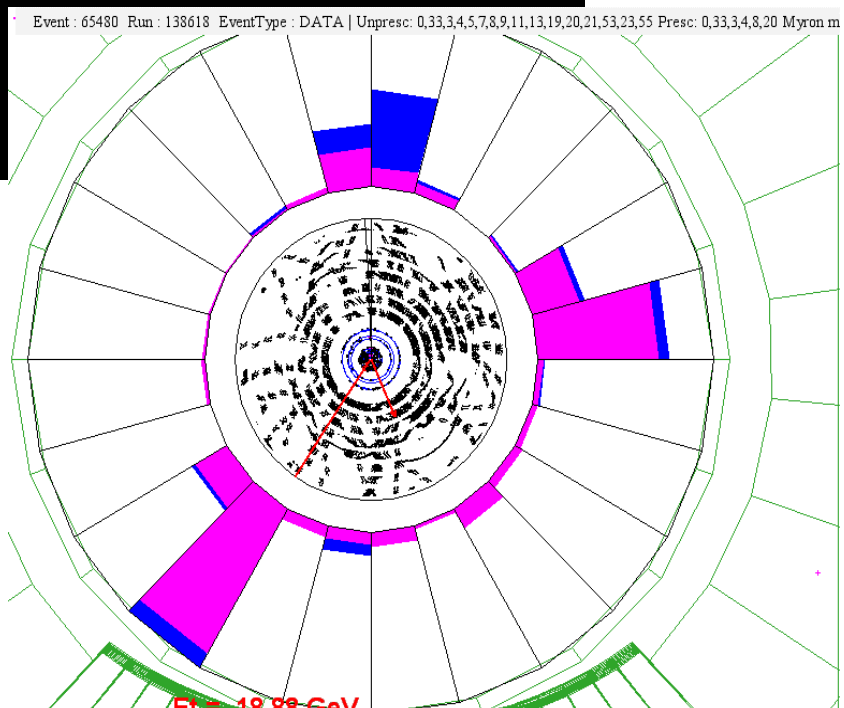
|eta| < 1.0, |d0| < 2.0

COT hits > 50

*) For both samples we require **0.5<E/P<2.0** to remove background.

What are these events?





<u>Calorimeter tower:</u>

Et = 14.4GeV

HadEm = 0.015

Eta = 0.96

Phi = 232.5deg

<u>Track:</u>

Pt = 13.1GeV/c

Nhits = 88

Eta = 0.94

Phi = 235.0deg

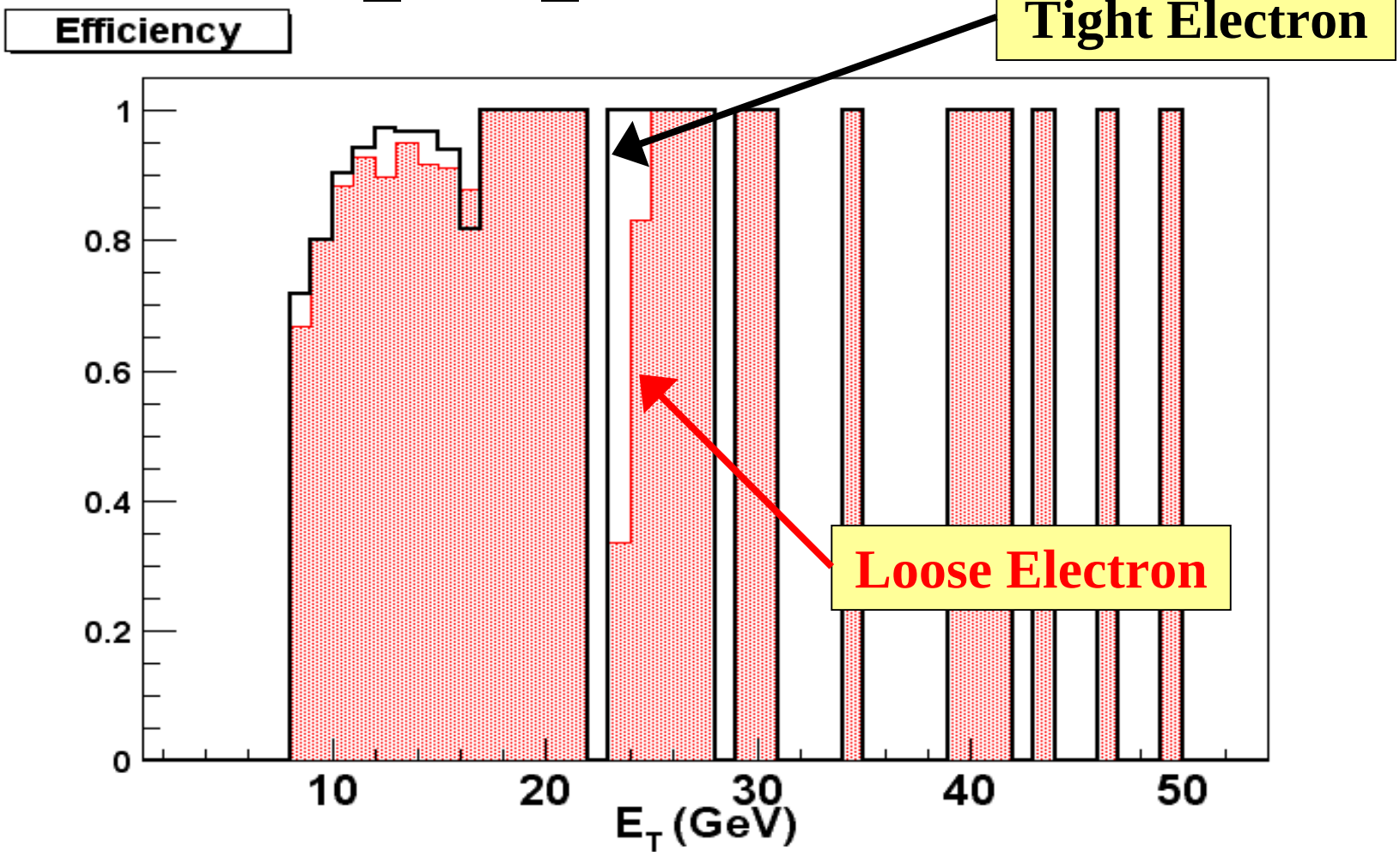
Study of Electron Eff. of L2_CEM8_PT8

- *Tight electron*
  - Et > 8 GeV
  - Pt > 8GeV/c
  - |Eta| < 1.0
  - Had/EM < 0.05
  - 0.5 < E/P < 2.0
  - |Delta Z| < 3.0cm
  - |Delta X| < 1.5cm
  - |PrimVtx| < 60cm

- *Loose electron*
  - Et > 8GeV
  - Pt > 8GeV/c
  - |Eta| < 1.0
  - Had/EM < 0.1
  - 0.5 < E/P < 2.0
  - |Delta Z| < 5.0cm
  - |Delta X| < 3.0cm
  - |PrimVtx| < 60cm

Tight/Loose electron eff for L2

- Select events with “standard” tight/loose electrons.
- Check if L2_CEM8_PT8 bit is set.



Conclusions

- L1 + L2 CEM8_PT8 trigger seem to have some strange features (slow turn-on, holes in loose electron efficiency at higher ET).
- There are events that fail L1/L2 while they should not. Why?
- Still not clear what is causing deficiency (e.g. if the isolation is to blame, this can be bad news for us).
- More careful studies are needed.

Break…

Look at $Z \rightarrow e + tau_h$

Luminosity

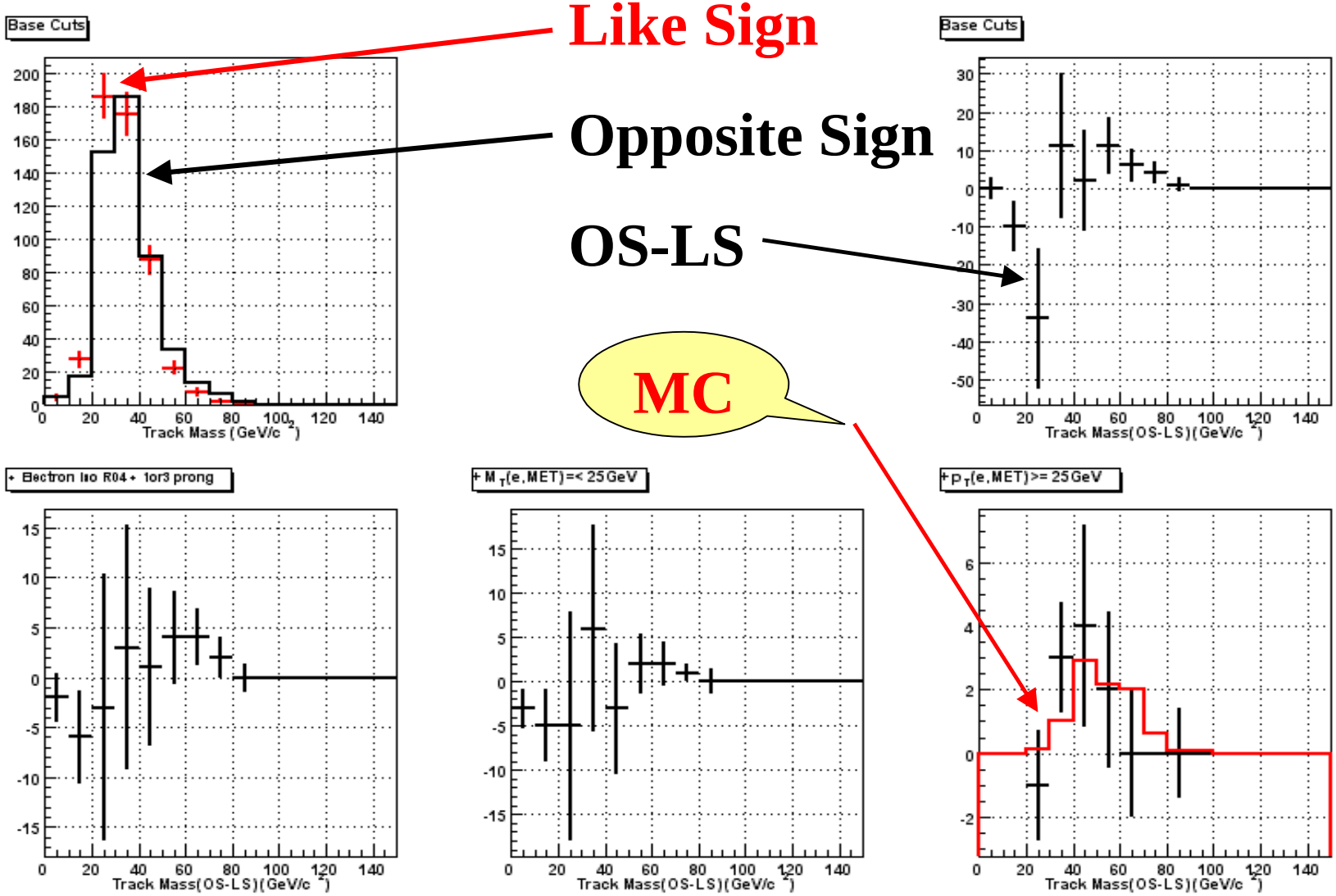
Dec.-Jan. : 2.7 pb^-1

Feb.4- Apr.26 : 11.8 pb^-1 (online luminosity)

Cf.) CDF Note 5251

- **|PrimVtx| < 60cm**
- **(M_T(e,MET) < 25 GeV/c2)**
- **(p_T(e,MET) > 25 GeV/c2)**

Base Cuts for e and tau_h

Electron	Tau
Et > 10 GeV	Cluster Et > 10 GeV
Pt > 8GeV/c	Track Pt > 8 GeV/c
|Eta| < 1.1	|Eta| < 1.0
|Z0 – Z0vtx| < 10.0	|Z0 – Z0vtx| < 10.0
0.5 <E/P < 1.8	Track Mass < 2.0 GeV/c2
Lshr < 0.2	Calo Mass < 4.0 GeV/c2
Had/Em < 0.055+0.00045 x E	EM frac. < 0.95
Chi2strip < 10.0	If 1 prong && Et/Pt < 4,
Δ Z < 3.0	EM frac. < 0.9
Δ X < 1.5	Track Iso. < 1.0 GeV, no 10~30deg
(Iso R0.4 < 4GeV)	(1or3 prong)

Track Mass of Z→e+tau_h