

STUDIES OF THE ELECTRON CHARGE MISIDENTIFICATION RATE

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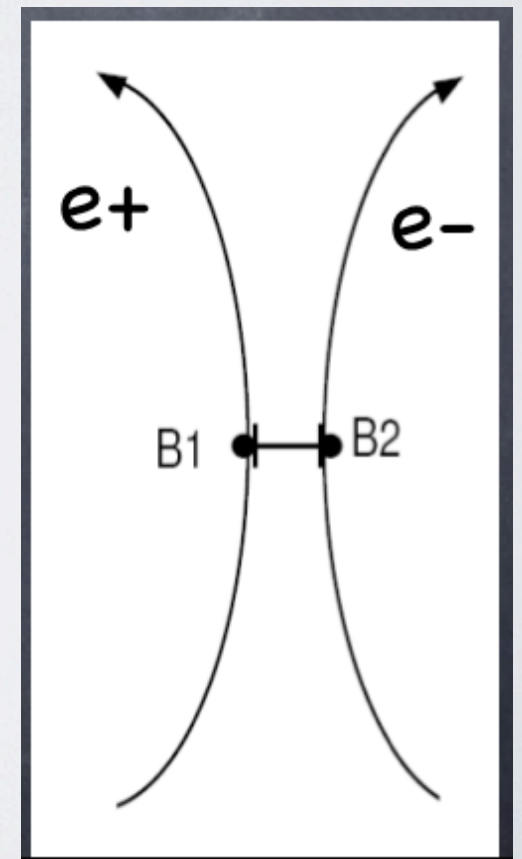
INTRODUCTION



- Control of the electron charge misidentification rate is important for leptonic final states, especially same sign dilepton studies
- This talk presents studies to reduce the charge misidentification rate with basic cuts without significantly reducing the reconstruction efficiency
 - Starting from our analysis selection of electrons

EVENT SELECTION

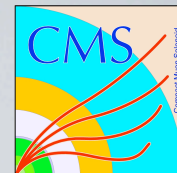
- Study misidentification rate in single electron particle gun events
 - 1 E6 events in $|\eta| < 2.5$, $5 \text{ GeV} \leq p_T \leq 100 \text{ GeV}$ produced in 227
- Event selection:
 - $p_T > 10 \text{ GeV}$
 - $|d_0| < 250 \text{ } \mu\text{m}$ – corrected for beam spot
 - **Tight Category based Electron ID**
 - Isolation: $p_T / (p_T + \text{SumEt}(\text{Calo\&Trk})) > 0.92$
 - Conversion veto by finding the conversion partner of an electron in the general track collection by requiring
 - $\Delta \cot \theta < 0.02$ (parallel to each other)
 - Distance $|B1 - B2| < 0.02 \text{ cm}$ (close to each other)
 - P. Kalavase: <http://indico.cern.ch/contributionDisplay.py?contribId=5&confId=49595>



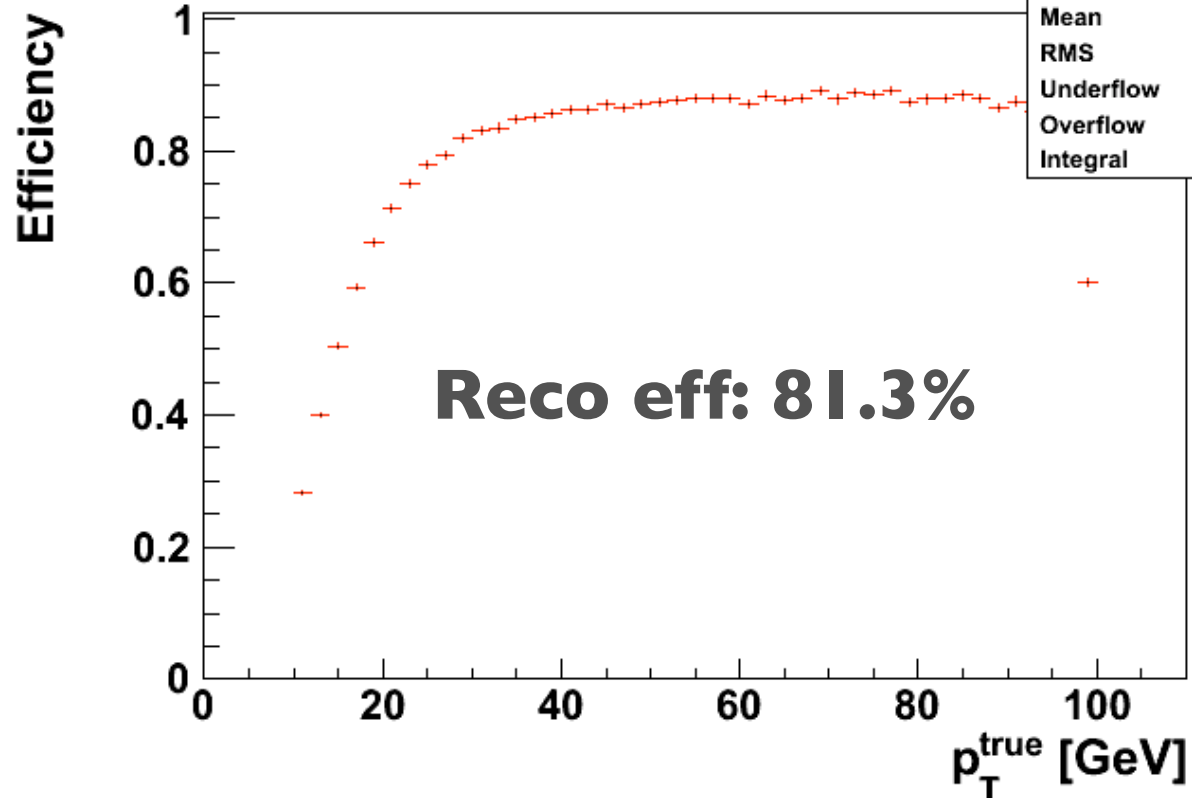
CHARGE MISIDENTIFICATION RATE

- Definition of variables for single electron sample:
 - **Reconstruction efficiency:** ratio of *reconstructed electrons* over *generated electrons*
 - **Charge misidentification rate:**
 - select reconstructed electrons matched to a true electron
 - Misidentification rate is ratio of *electrons with wrong reconstructed charge compared to true charge* over *all reconstructed and truth matched electrons*

STATUS BEFORE IMPROVEMENT

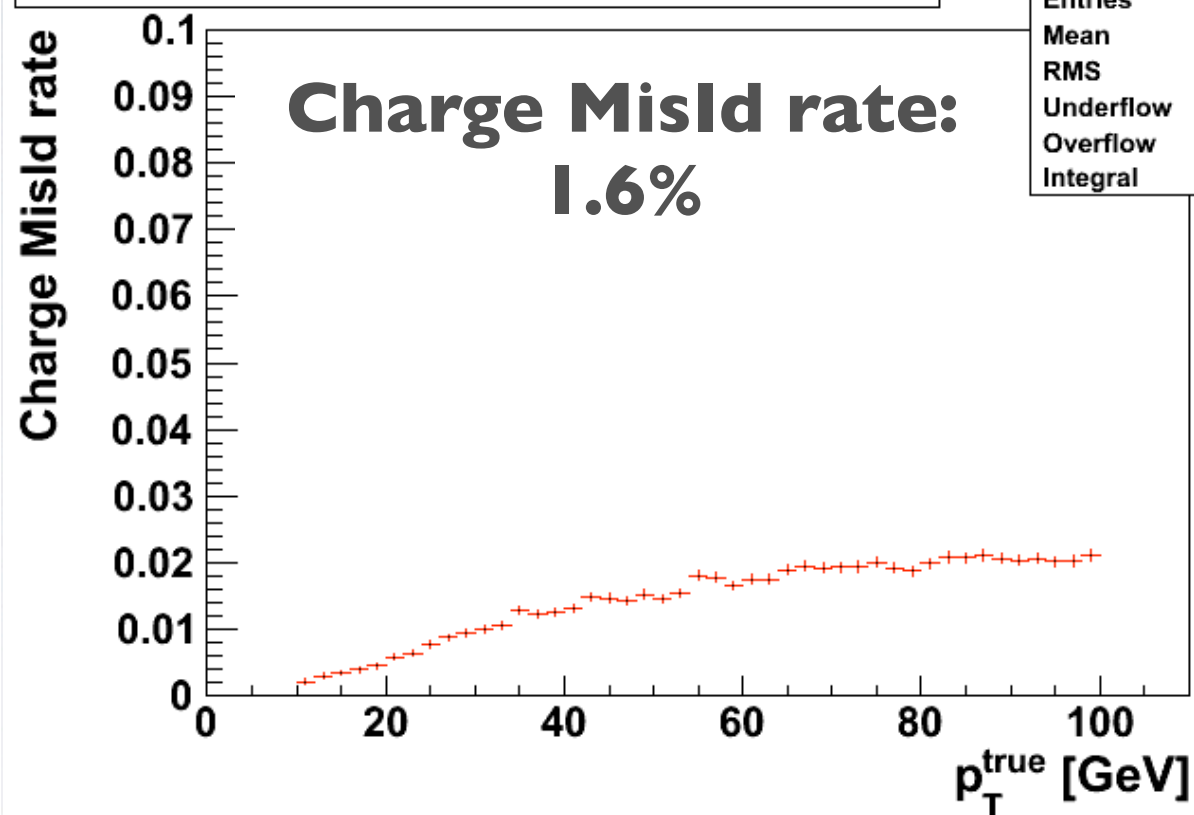


Reconstruction efficiency (reco/sim) in p_T



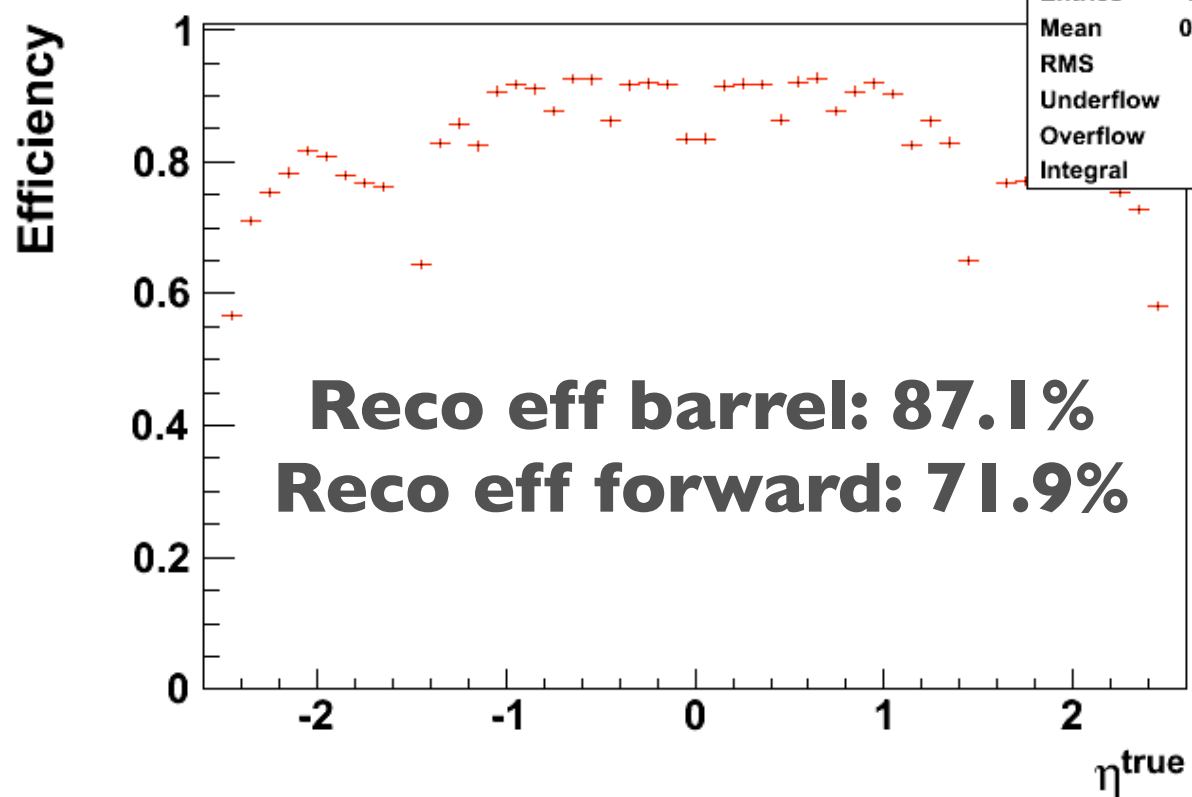
RecoEff	
Entries	1540497
Mean	57.28
RMS	24.48
Underflow	0
Overflow	0
Integral	36.43

Charge Misld rate (reco/sim_incorCharge/reco/sim) in p_T



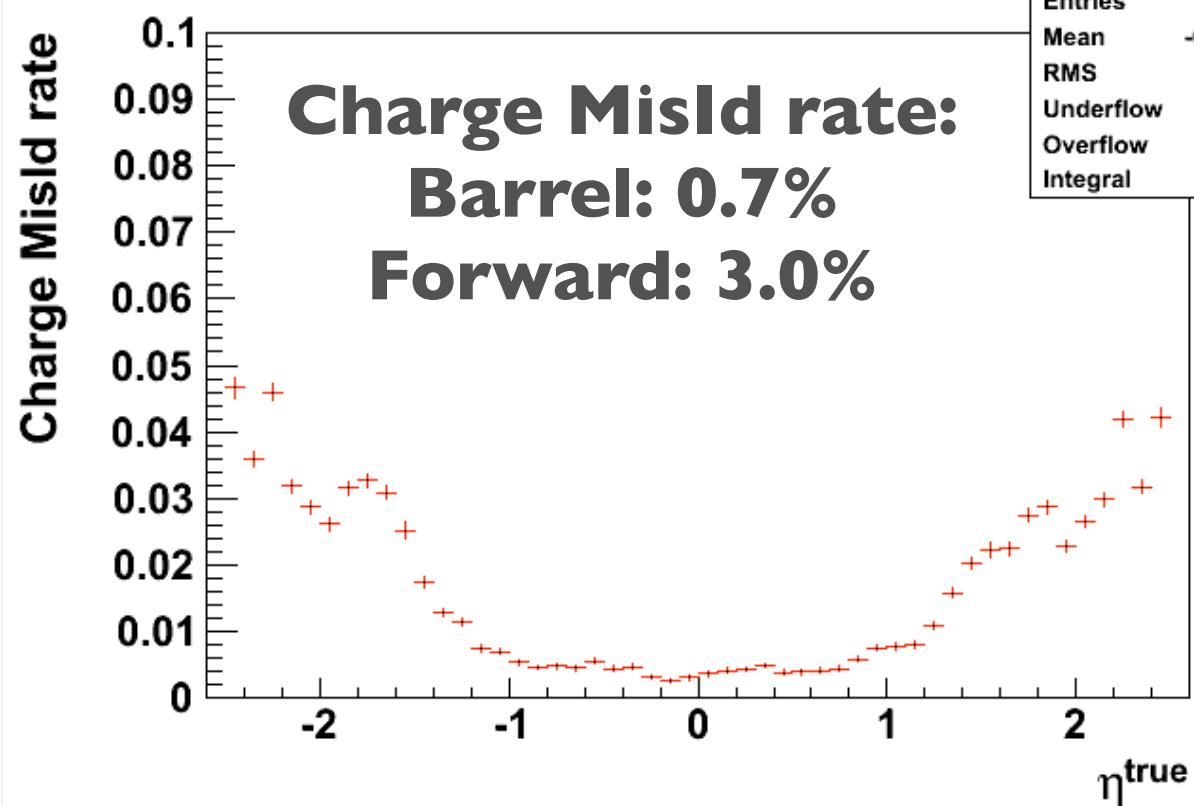
ChargeMisldRate	
Entries	23942
Mean	64.67
RMS	22.59
Underflow	0
Overflow	0
Integral	0.6646

Reconstruction efficiency (reco/sim) in η



RecoEff	
Entries	1540497
Mean	0.002751
RMS	1.385
Underflow	0
Overflow	0
Integral	40.66

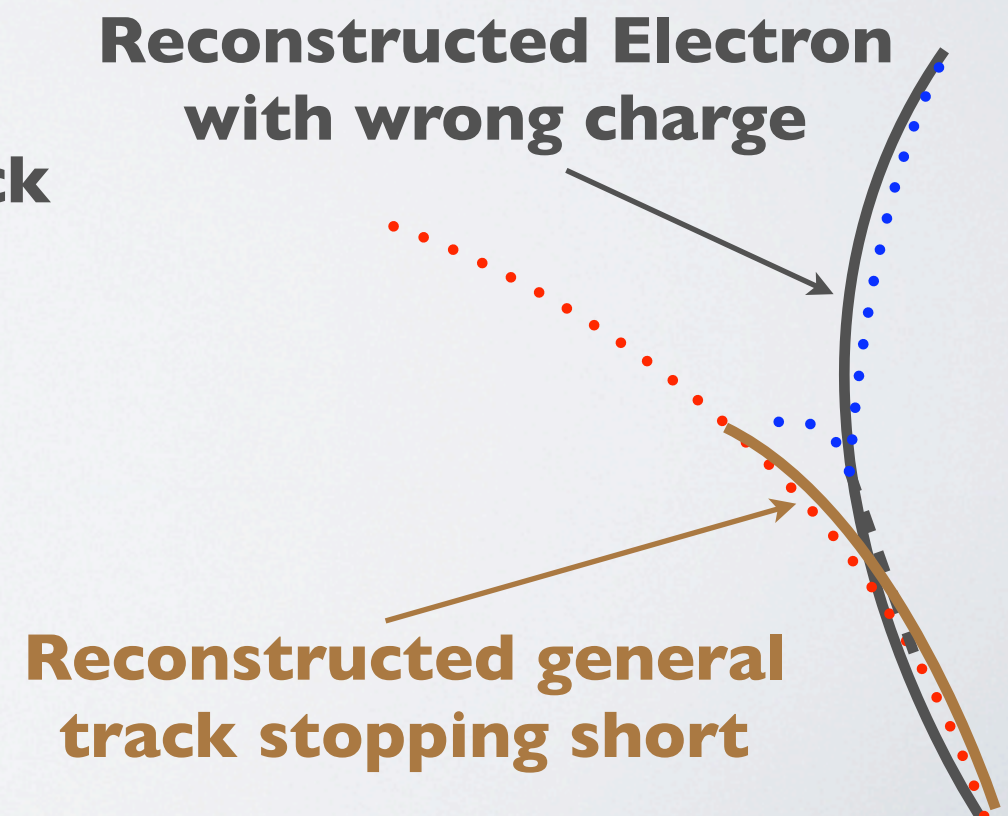
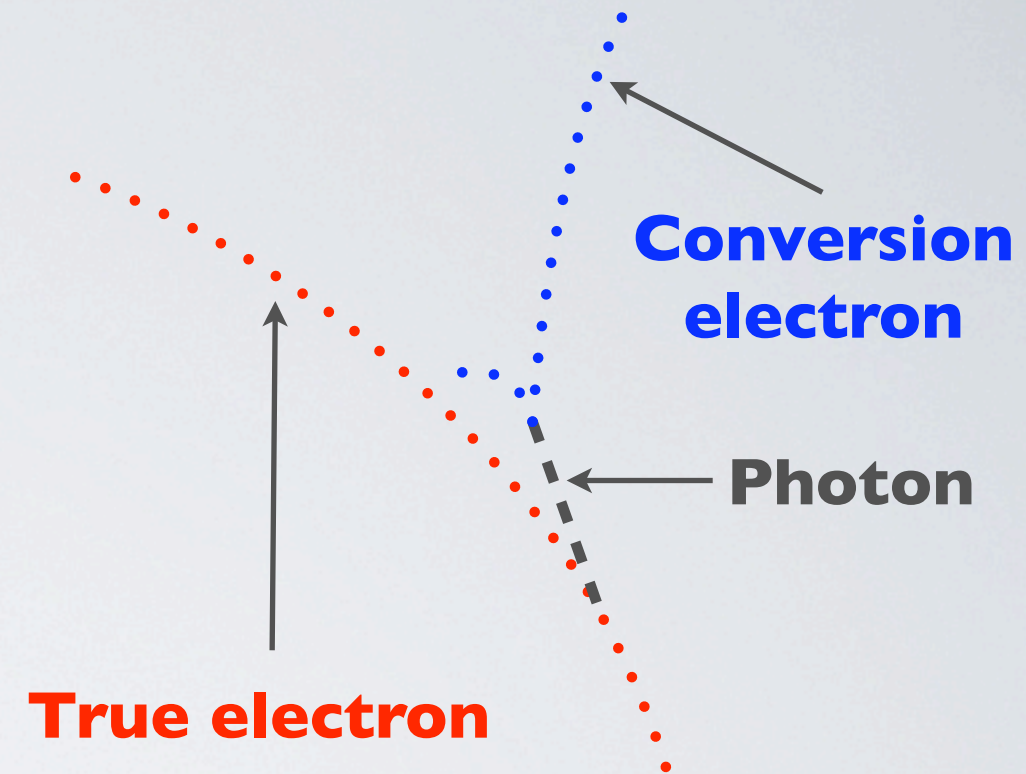
Charge Misld rate (reco/sim_incorCharge/reco/sim) in η



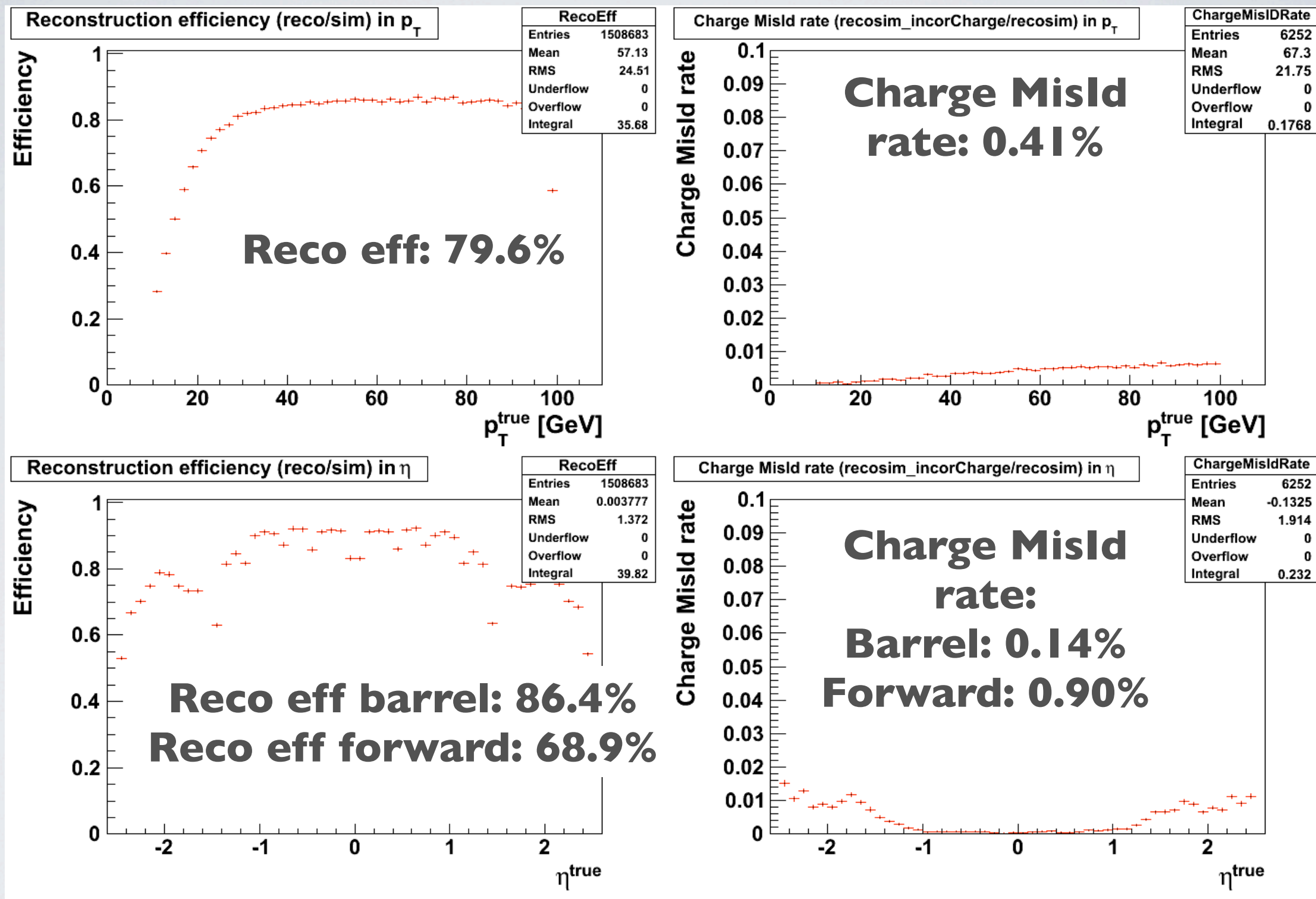
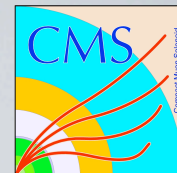
ChargeMisldRate	
Entries	23942
Mean	-0.07882
RMS	1.869
Underflow	0
Overflow	0
Integral	0.8413

REDUCE CHARGE MISIDENTIFICATION RATE

- Working hypothesis
 - Charge misidentification triggered by radiating a bremsstrahlung photon which converts (asymmetrically) in e^+e^-
 - General track follows true electron due to narrower road to pick up hits and stops short
 - GSF track picks up hits from the conversion electron due to wider road and reconstructs wrong charge
- Approach:
 - **Veto electrons where charge of GSF track \neq charge of associated general track**
 - Electron-track match by hit sharing
 - **2.7%** of GSF electrons without matched track
 - Keep those electrons without matched track



STATUS AFTER VETO



- **Reduce charge misidentification rate by factor 3.9**
while **reducing reconstruction efficiency by 2.1%**

SUMMARY



- Reduction of charge misidentification rate
 - Can be achieved by vetoing electrons whose charge do not agree with the charge of the associated general track
- Applying veto in single electron events
 - Reduces overall charge misidentification rate by factor 3.9
 - Without reducing the reconstruction efficiency significantly
- Studies ongoing and continuing in 31X
 - See next slides ...

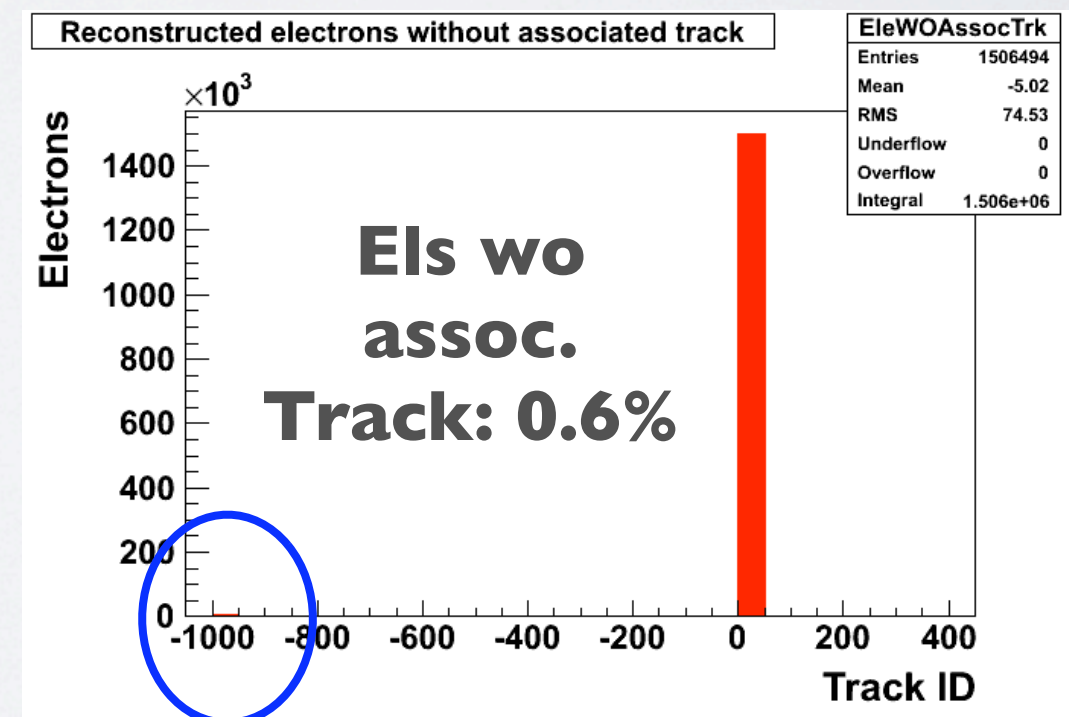
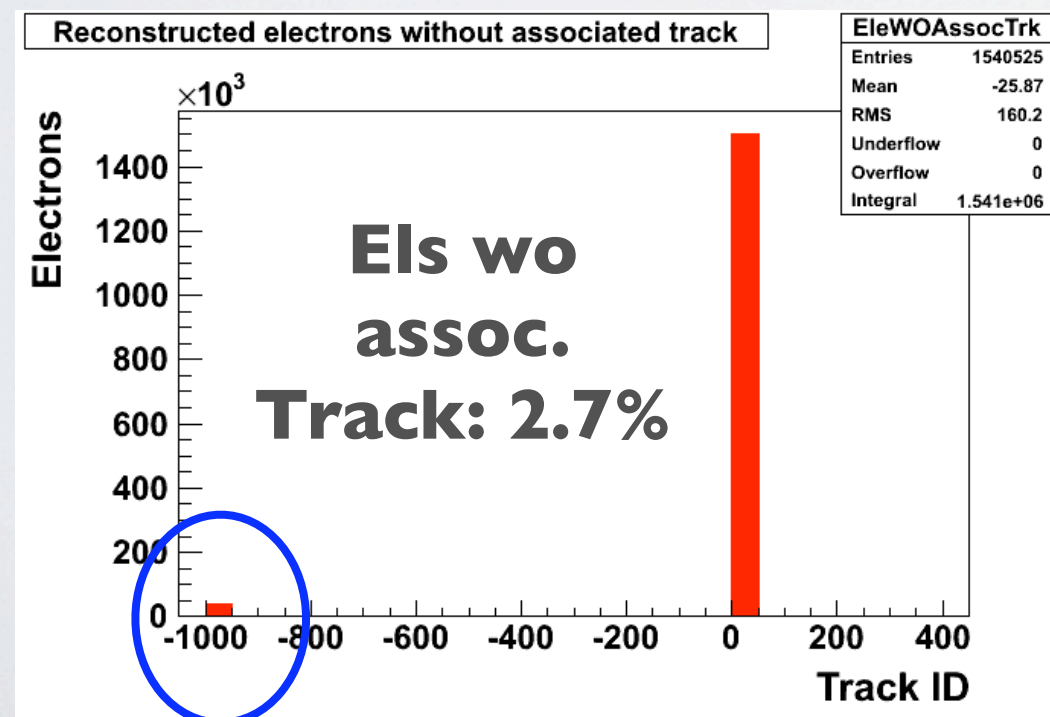
COMPARISON TO 31X WITHOUT VETO



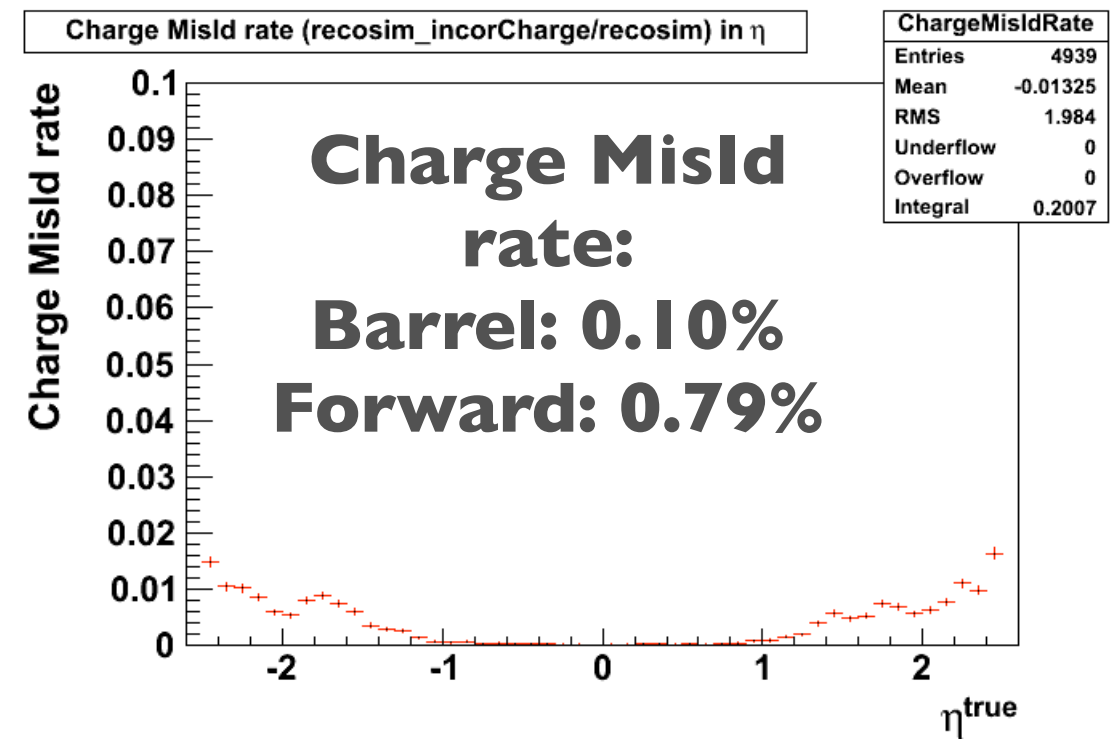
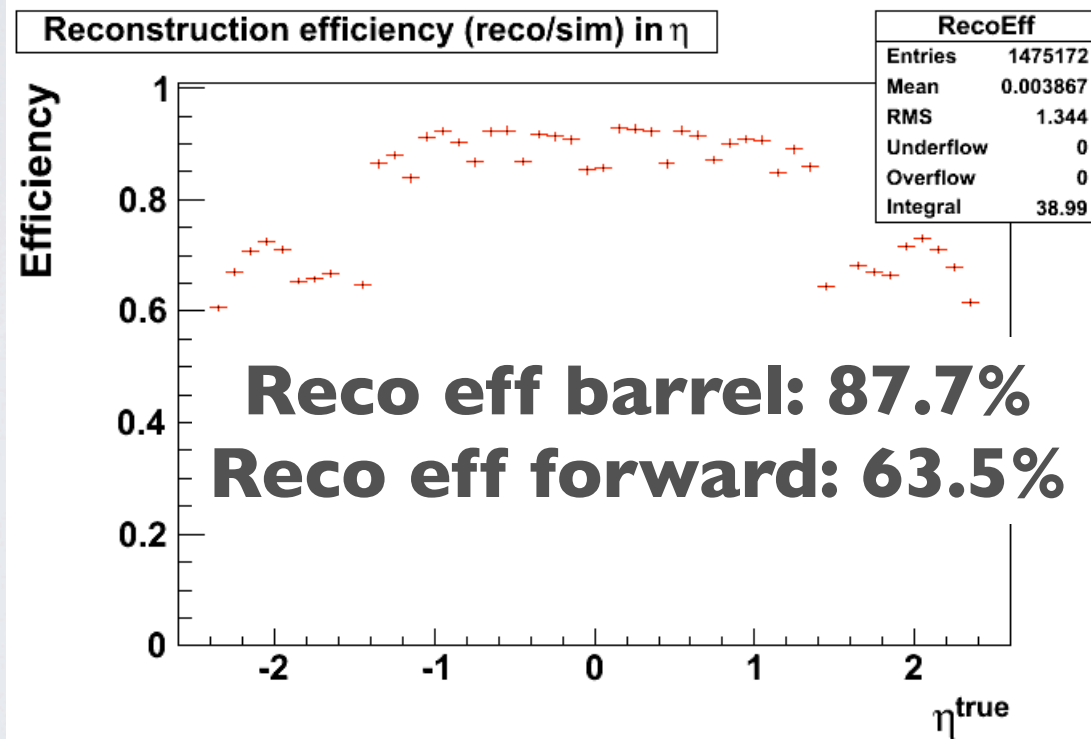
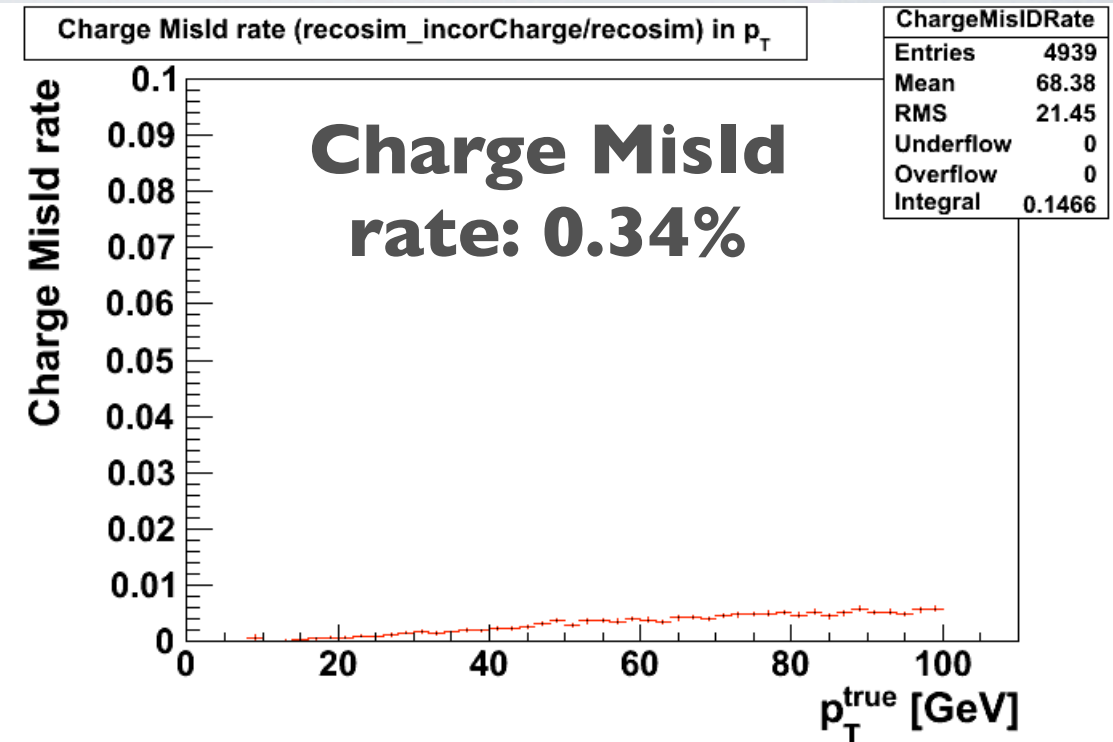
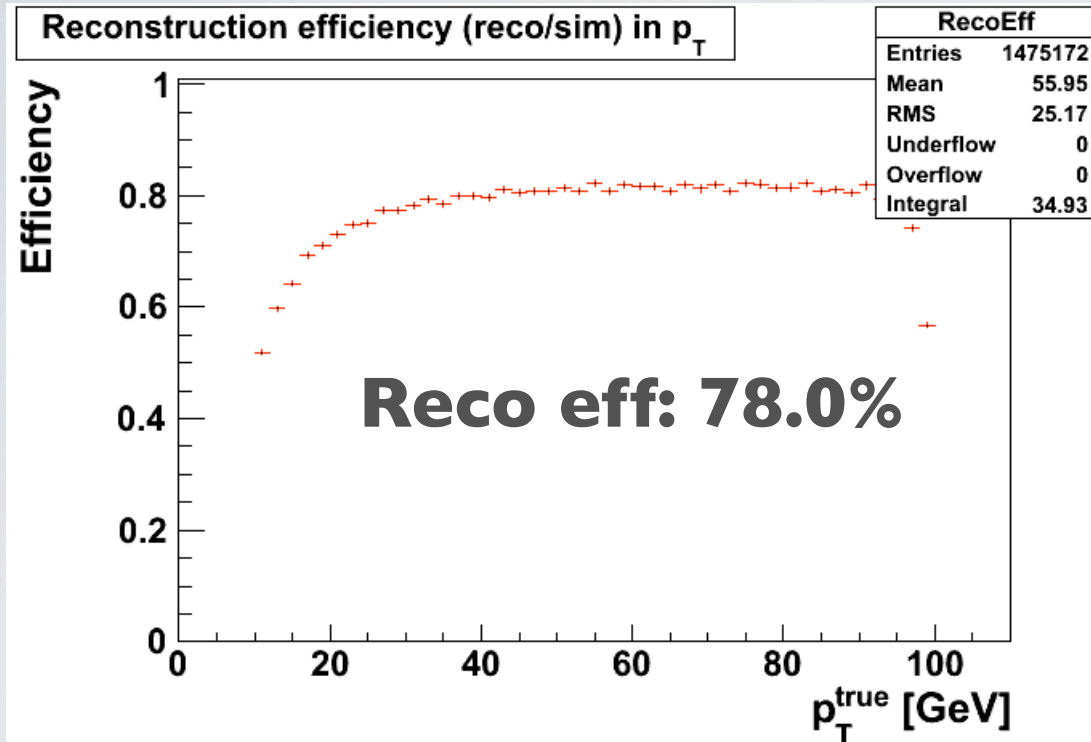
- Use same event selection and 1E6 single electron events in 3_1_0
 - Only buggy electron ECAL isolation could not be used and was excluded from isolation definition
- **Important:** electron identification has not been retuned and is used like in 22X

Release	Reco efficiency [%]	Barrel reco efficiency [%]	Forward reco efficiency [%]
22X	81.3	87.1	71.9
310	78.6	87.9	64.6

- First observation: fraction of electrons without associated tracks reduced from 2.7% to **0.6%**



RATE AFTER VETO IN 3IX



- Efficiency reduced esp. in forward → need to retune electron selection

- With not retuned electron selection: charge misidentification rate slightly lower
- Needs more studies!