STUDIES OF THE

ELECTRON CHARGE MISIDENTIFICATION RATE

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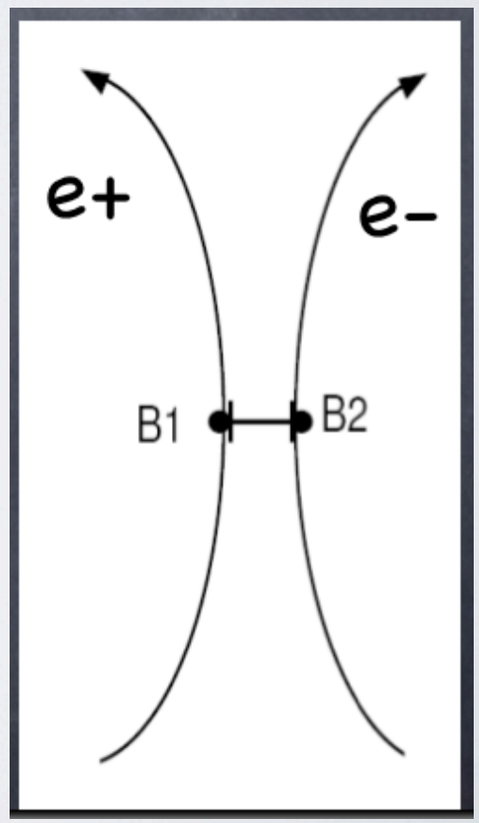
INTRODUCTION

- 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

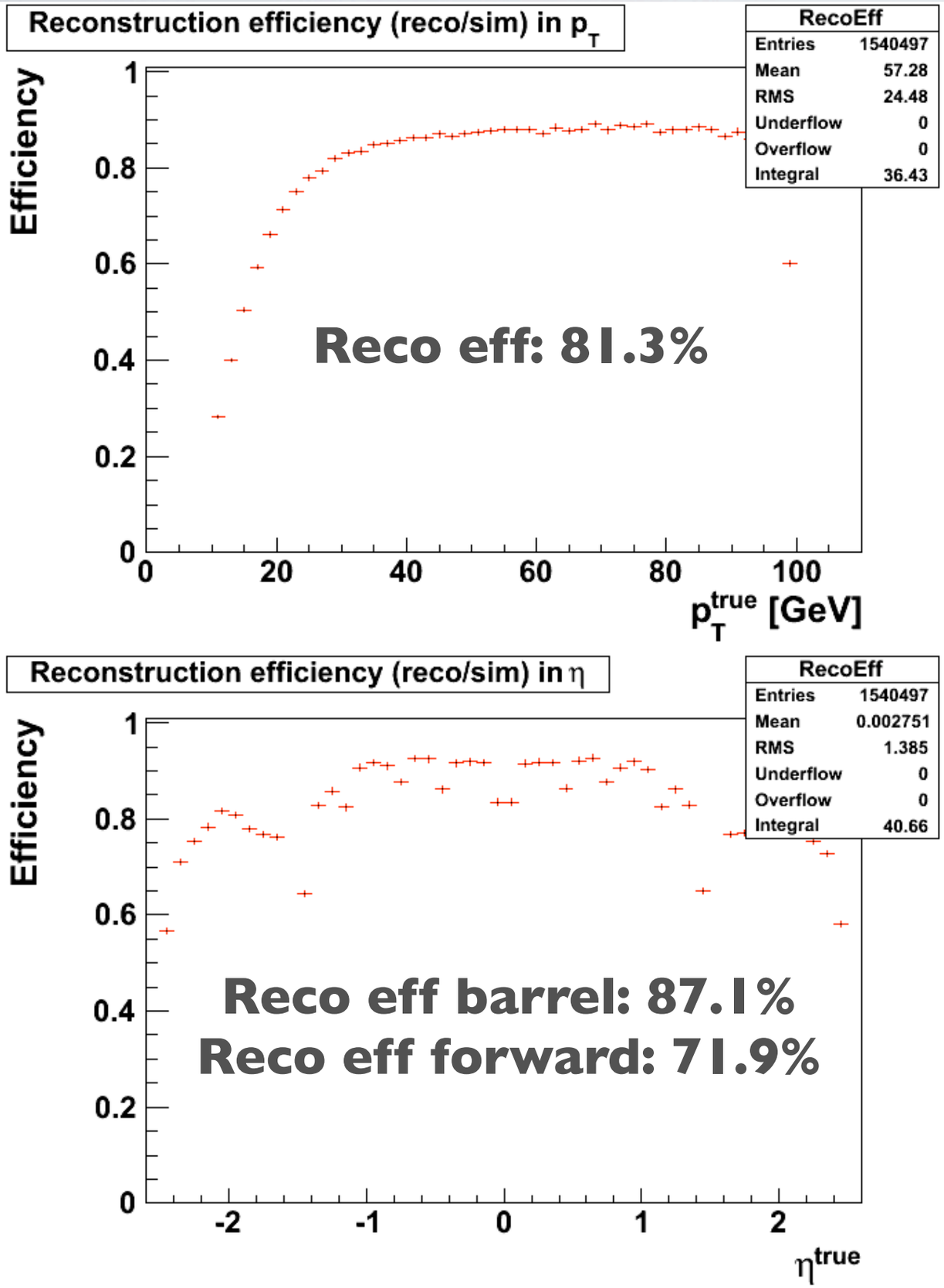
- Study misidentification rate in single electron particle gun events
  - 1E6 events in $|\eta|<2.5$, 5 GeV ≤ pT ≤ 100 GeV produced in 227
- Event selection:
  - p_T > 10 GeV
  - |d0| < 250 μm – corrected for beam spot
  - **Tight Category based Electron ID**
  - Isolation: $p_T/(p_T + \text{SumEt(Calo\&Trk)}) > 0.92$
  - 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 cm (close to each other)
  - P. Kalavase: http://indico.cern.ch/contributionDisplay.py?contribId=5&confId=49595

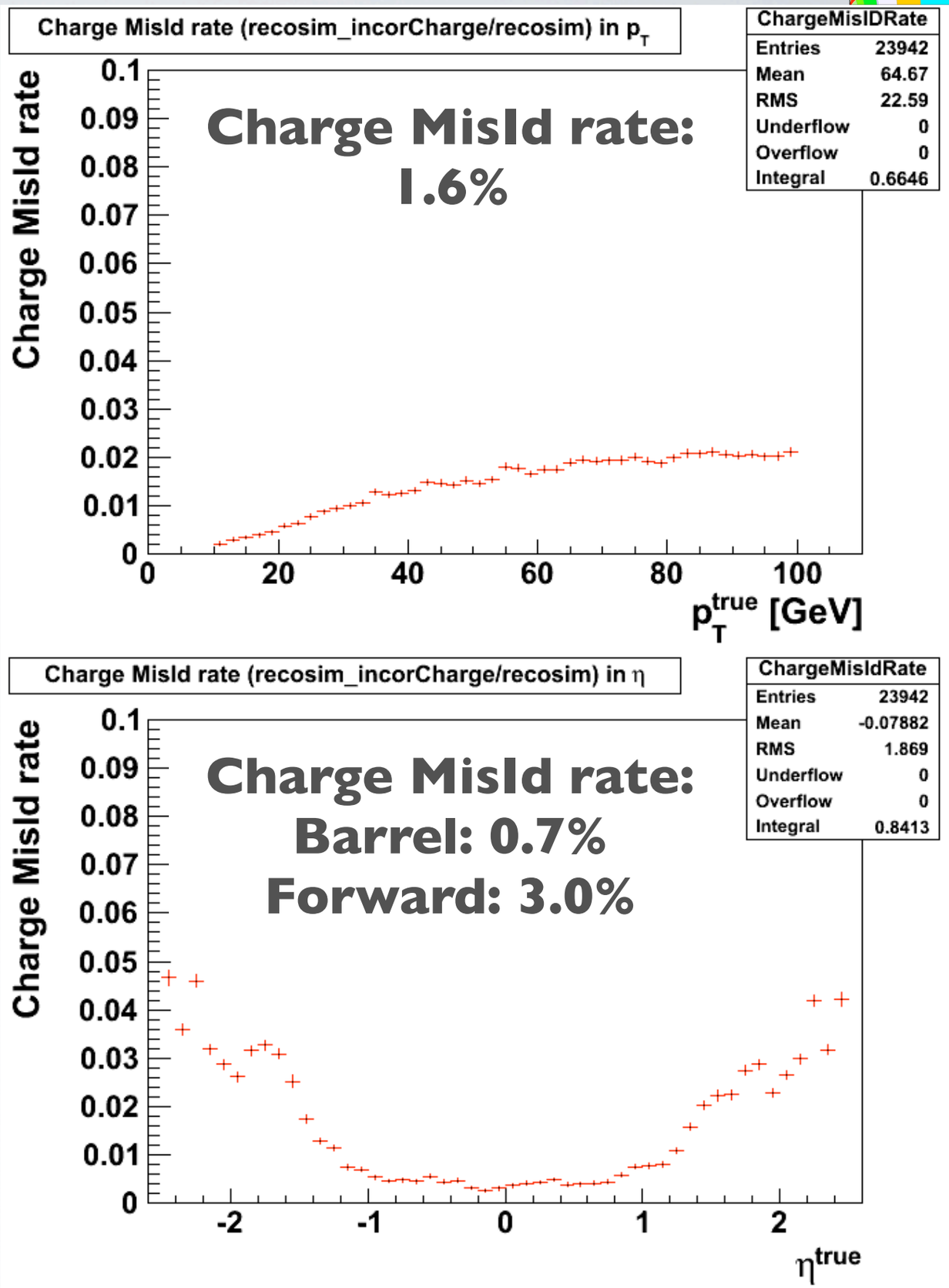


CHARGE MISIDENTIFICATION RATE

- 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

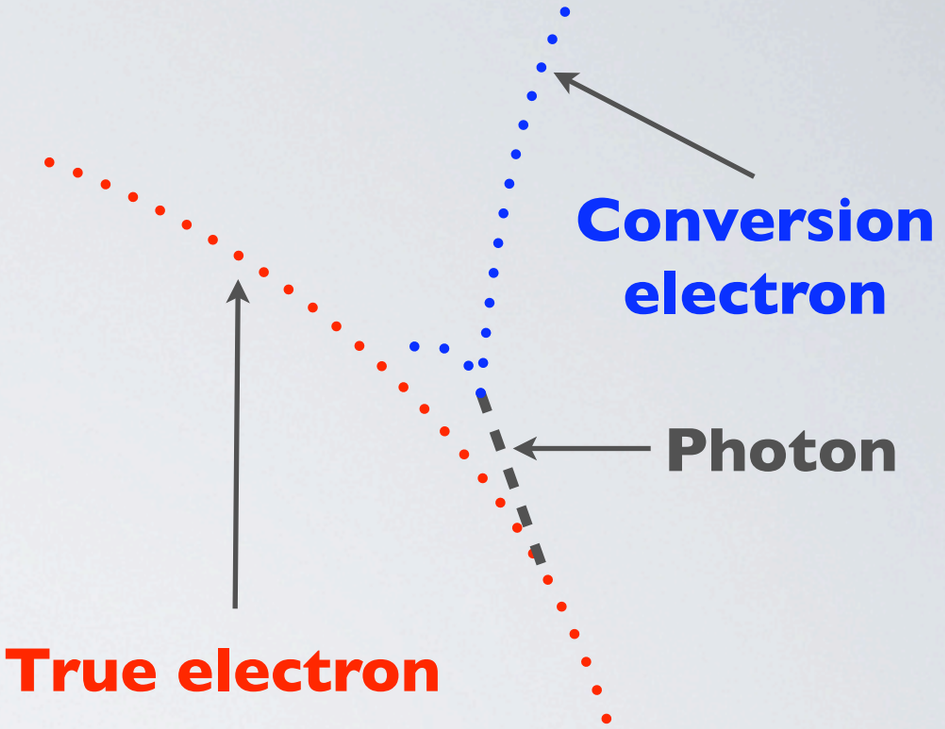
STATUS BEFORE IMPROVEMENT



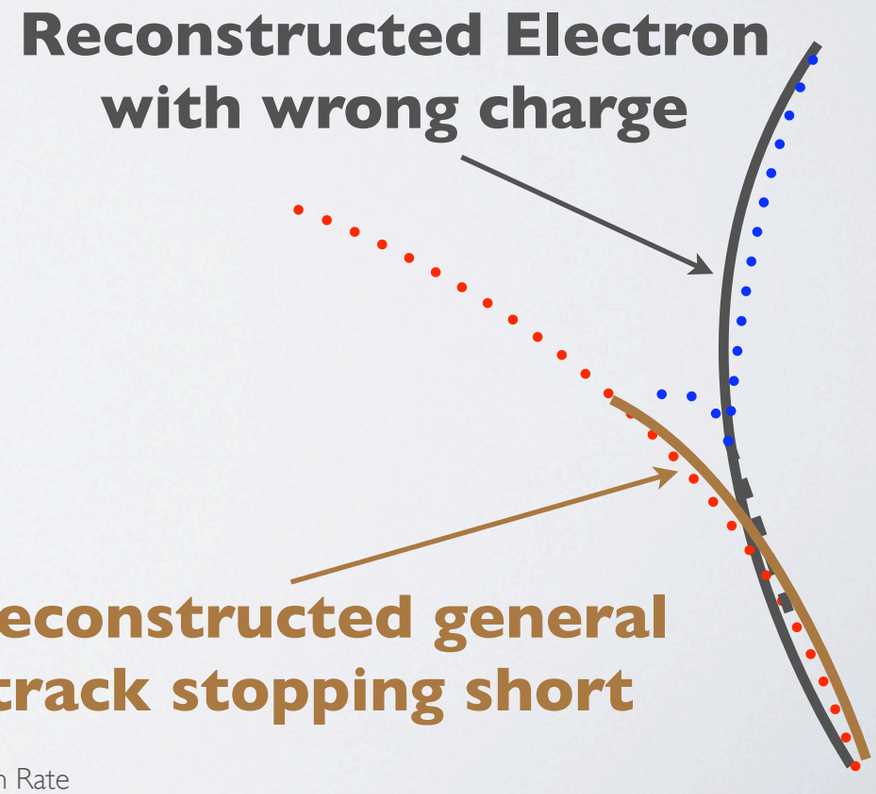


REDUCE CHARGE MISIDENTIFICATION RATE

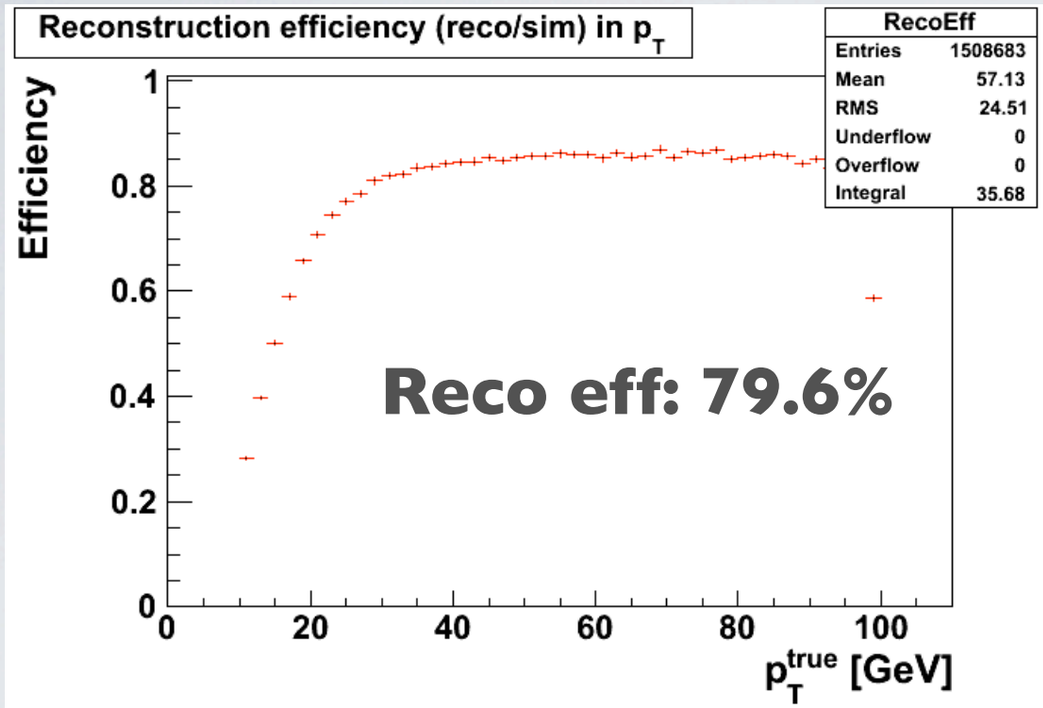
- Working hypothesis
  - Charge misidentification triggered by radiating a bremsstrahlung photon which converts (asymmetrically) in e^+e^-
  - General track follows true electron due to narrower road to pick up hits and stops short
  - GSF track picks up hits from the conversion electron due to wider road and reconstructs wrong charge

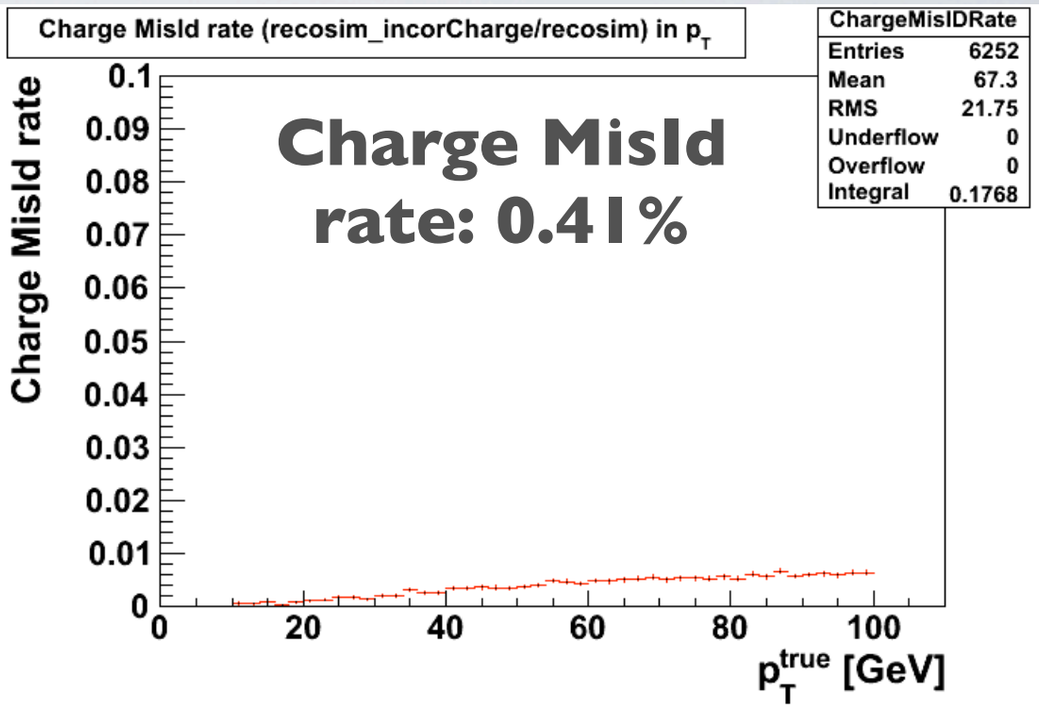


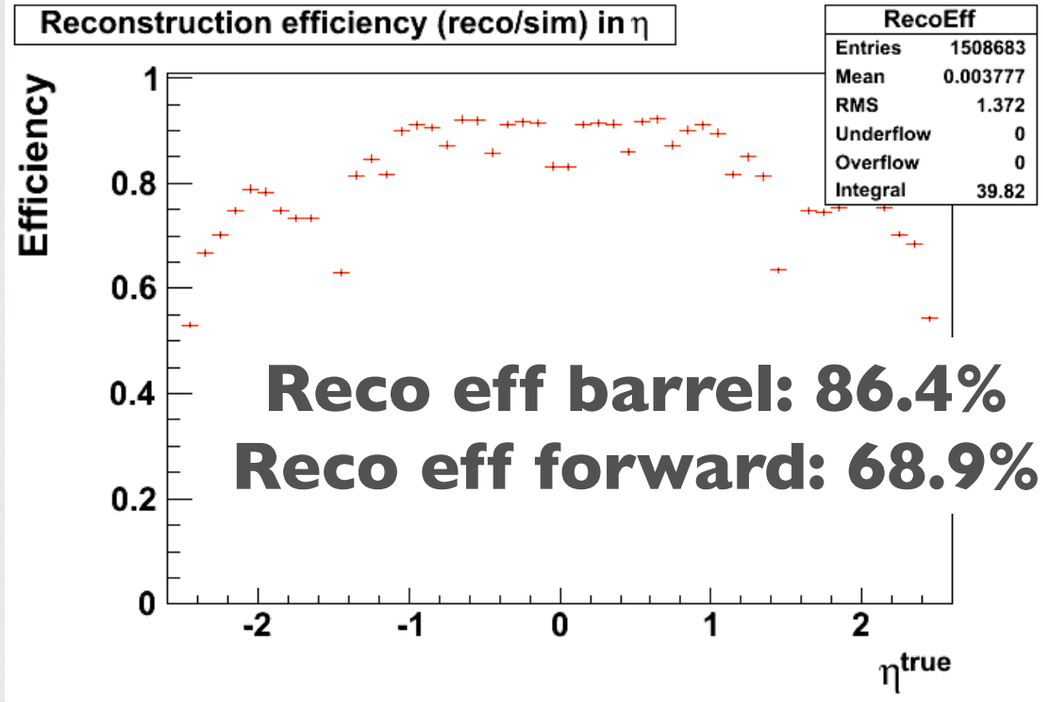
- Approach:
  - **Veto electrons where charge of GSF track ≠ charge of associated general track**
  - Electron-track match by hit sharing
    - **2.7%** of GSF electrons without matched track
    - Keep those electrons without matched track

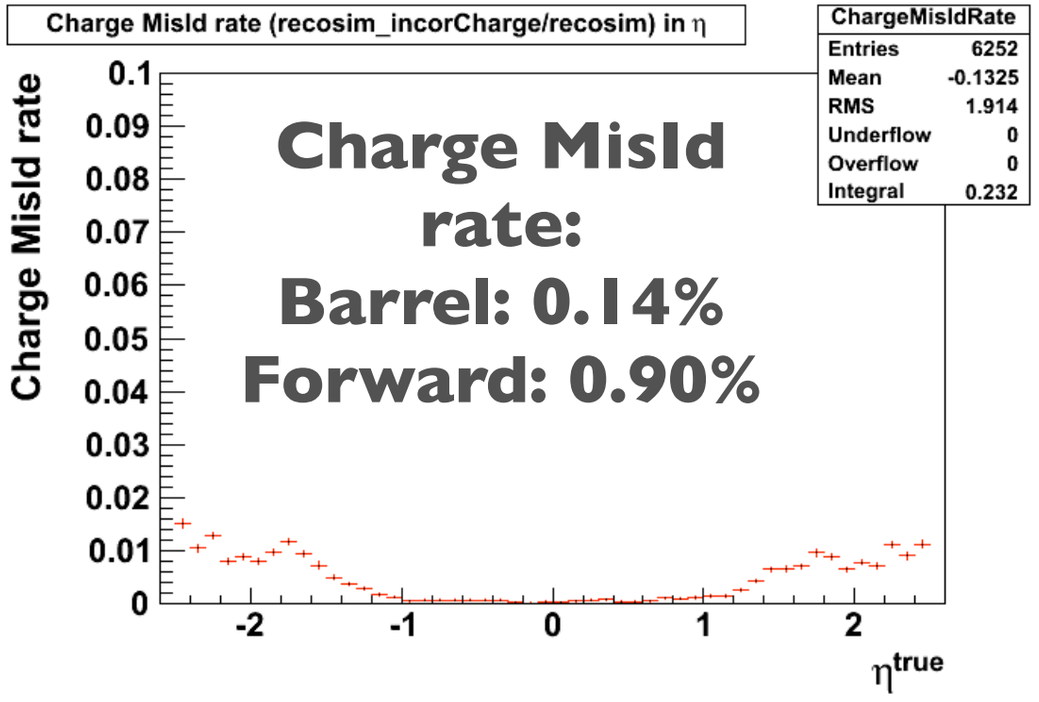


STATUS AFTER VETO









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

SUMMARY

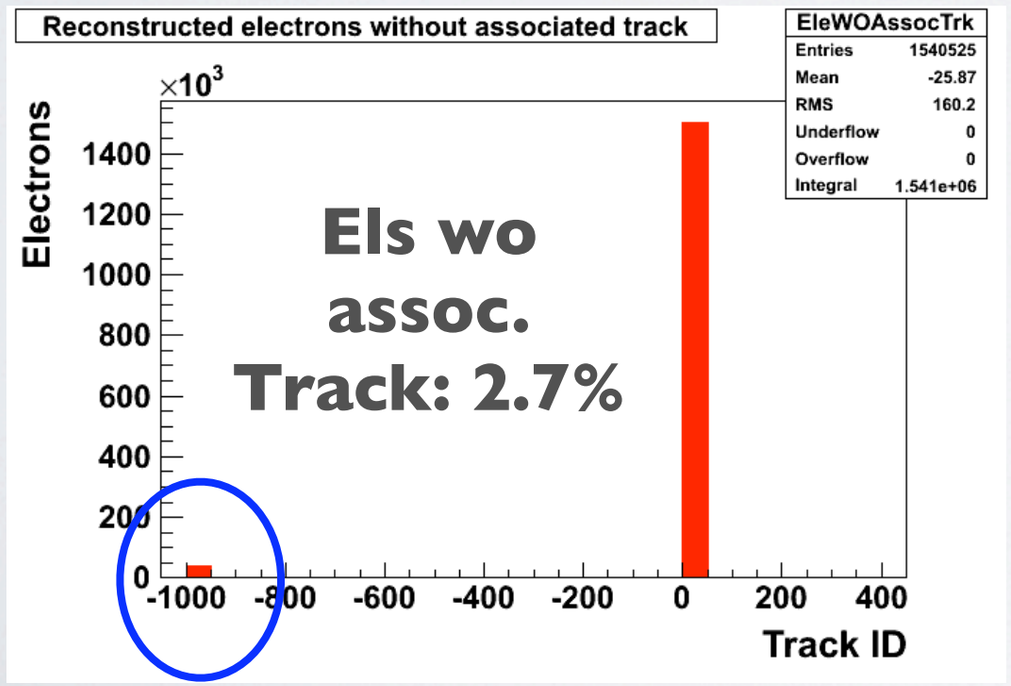
- Reduction of charge misidentification rate
  - Can be achieved by vetoing electrons whose charge do not agree with the charge of the associated general track
- Applying veto in single electron events
  - Reduces overall charge misidentification rate by factor 3.9
  - Without reducing the reconstruction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

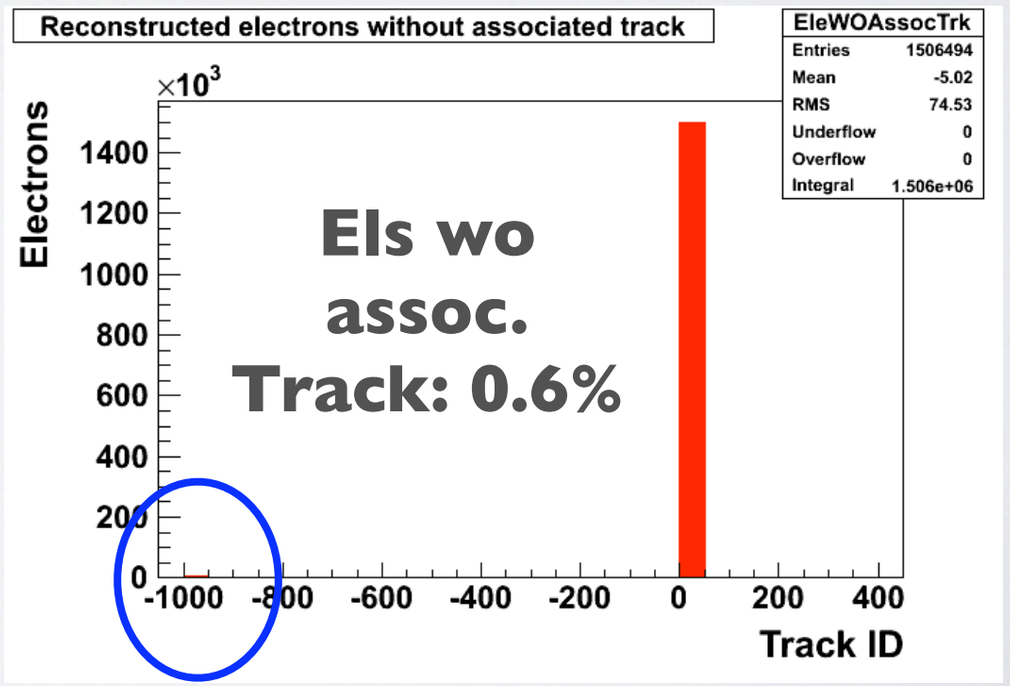
COMPARISON TO 31X WITHOUT VETO

- 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

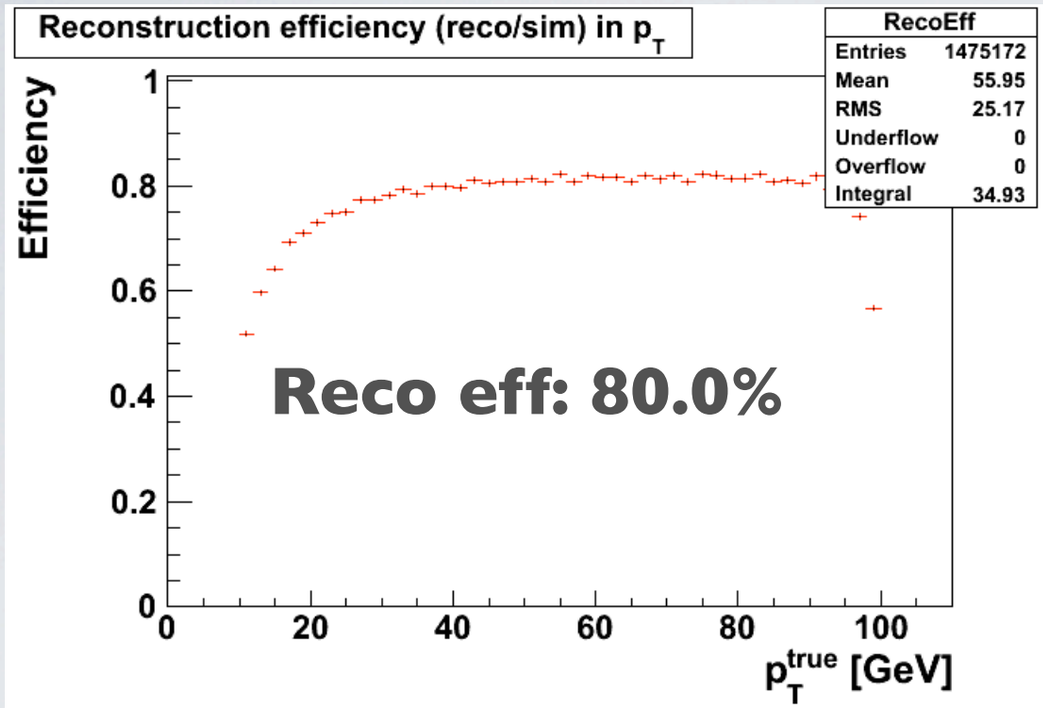
Release	Reco efficiency [%]	Barrel reco efficiency [%]	Forward reco efficiency [%]
22X	81.3	87.1	71.9
310	78.6	87.9	64.6

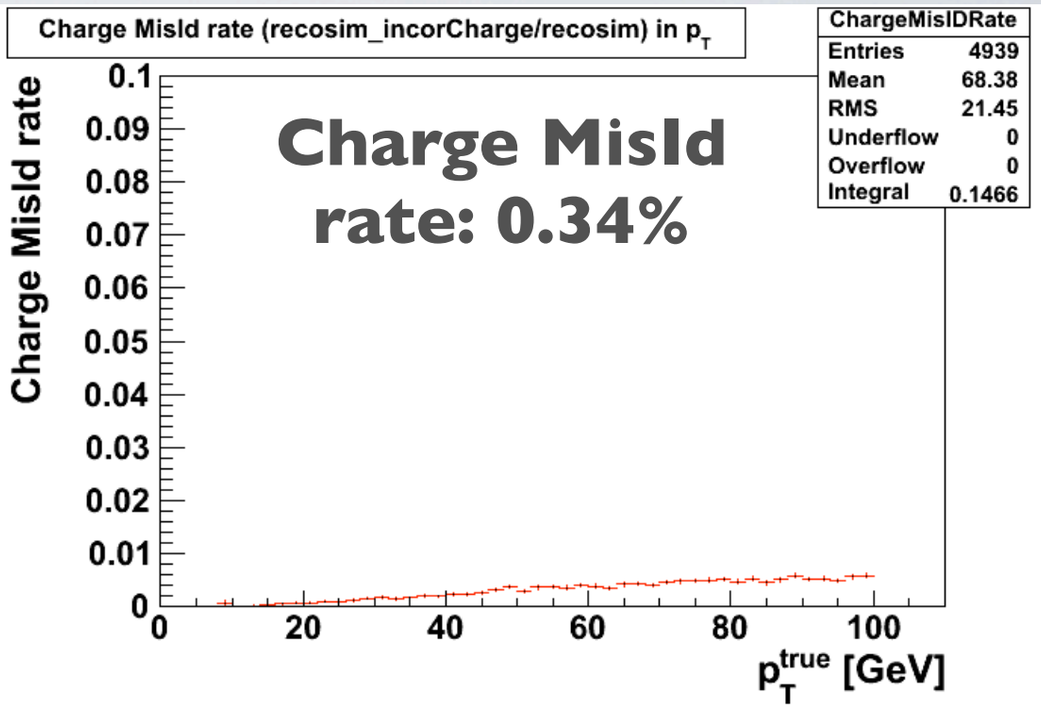
- First observation: fraction of electrons without associated tracks reduced from 2.7% to **0.6%**

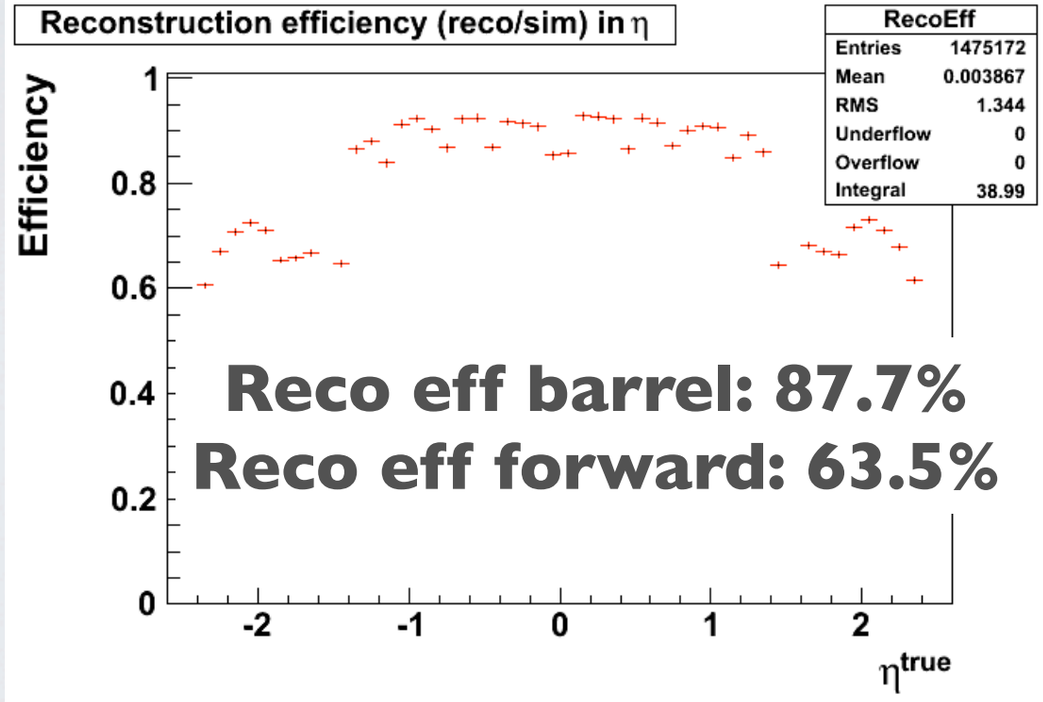


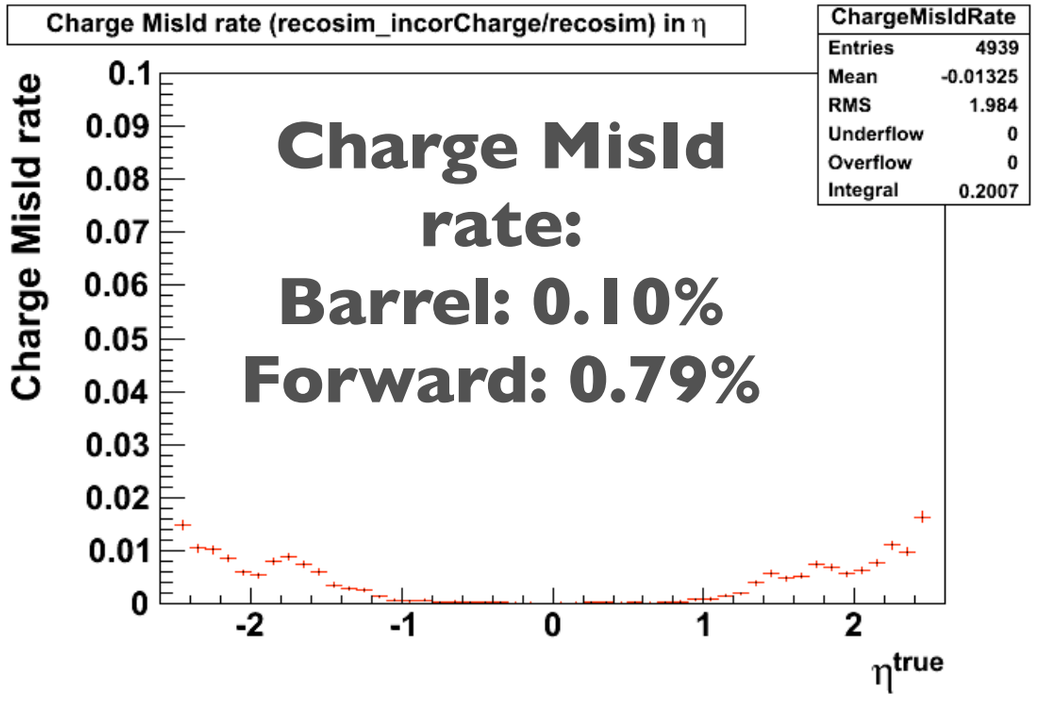


RATE AFTER VETO IN 31X









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

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