

# Electron efficiency from Tag&Probemethod in Z events to semiElectronicttbar

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# Introduction

## Questions:

- Is it possible to use the result of Tag&Probe method on Z events, directly in ttbar or there is a difference should be considered in systematics?
- In case of difference, is it possible to go to some part of the phase space in which two type of events are similar?
- Regardless to the possibility above, is this difference affected by the luminosity?

## The idea :

- To compare electron Id/isolation efficiency in Z and ttbar(semiElectronic) when the electron is :
  - In Z: Probe in the TagProbepair
  - In ttbar: Matched with generated electron

## First step in Tag&Probe:

- No fit. Just a simple event counting around Z peak (*compared with fit results*)
  - Tag is a well-identified electron,
    - Isolated in tracker, Outer cone size: 0.3, Inner Cone Size: 0.015, Cut: 0.2
    - Tight identified
  - Probe is a candidate together with Tag, meet the criterion of  $80 < \text{Inv}M(T,P) < 100$

## Data sets (all are GEN-SIM-RECO ):

- /Zee/Summer08\_IDEAL\_V9\_v1/
- /TauolaTTbar/Summer08\_IDEAL\_V9\_v2/ (*Skimmed to semiElectronic using genInfo*)
- /ZeeJet\_Pt230to300/Summer08\_IDEAL\_V9\_v3/ (*see the possible effect of hard jets*<sup>3</sup>)

# Event Selection

### Electrons (*gsfElectrons*):

- $Pt > 20$ ,  $|\eta| < 2.4$ , excluding  $1.4442 < |\eta| < 1.560$
- Between two electrons with the same superCluster and different tracks, the one with the track pt closer to SC's energy is kept. (*DuplicationRemover*)
- At least one/two electron(s) in ttbar/Z event:
  - In ttbar, this electron should have a genMatch
  - In Z, two electrons should make a *Tag&Probe* pair

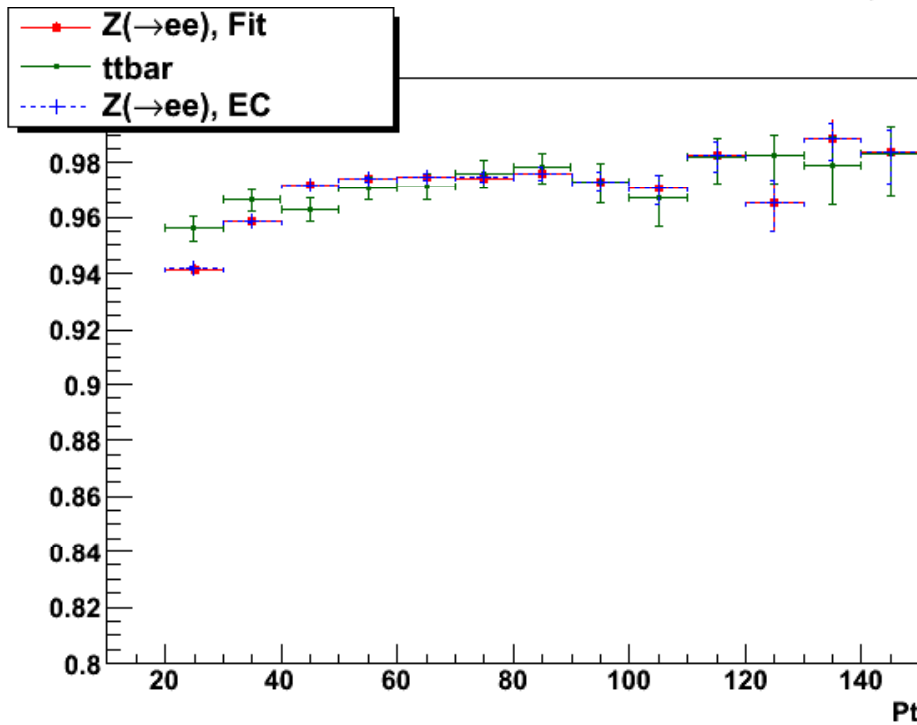
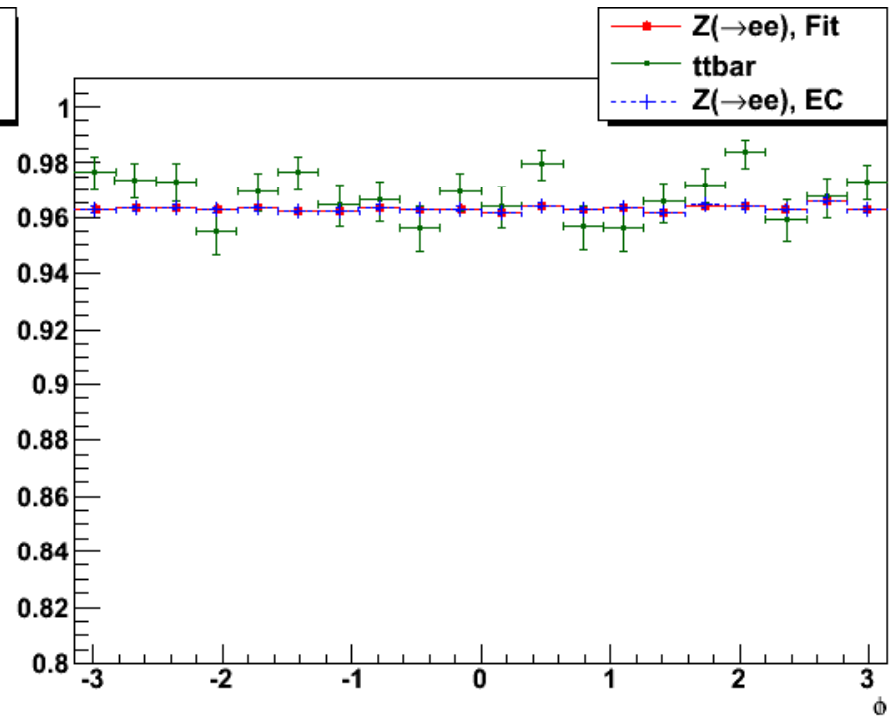
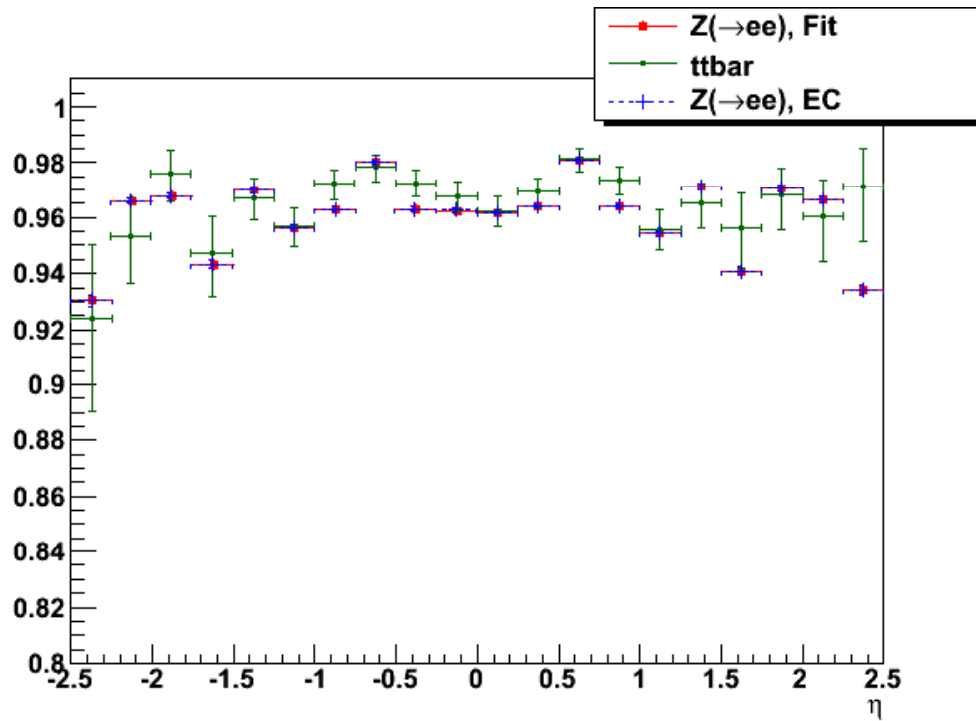
### Jets (*itrCone5*):

- $unCorrectedPt > 15$ ,  $|\eta| < 2.5$ 
  - $\eta$  range is wider than electron's, regarding the possible jet effect on the isolation of electrons with  $\eta_e \approx 2.4$
- Electrons are removed from the jet collection
  - $RelTrkIso$  of electron  $< 0.2$
  - Electron-Jet separation  $< 0.3$
- To see the effect of the Jet multiplicity, for the moment, there is no cut on the number of jets.

### Special criteria for Z event:

- Remove event with  $nPair \geq 3$  ( $\sim 0.9\%$ )
- Remove events in which two probes are associated with the same tag ( $< 0.05\%$ )

# First Results about Tight Identification



**Tight identification efficiency is in agreement in Z and ttbar**

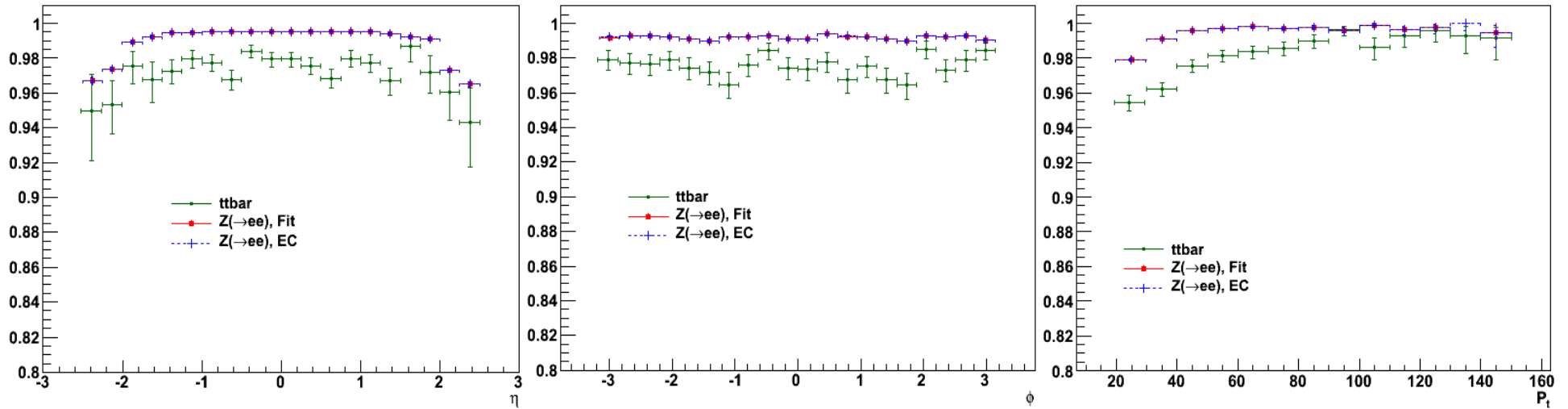
★ EC: Event Counting

# First Results about Relative Tracker Isolation

Outer cone size: 0.3

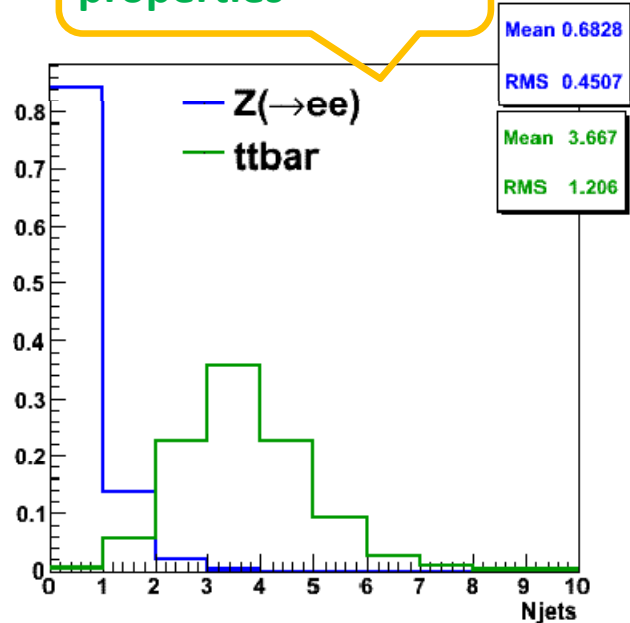
Inner cone size: 0.015

Isolation cut: 0.2

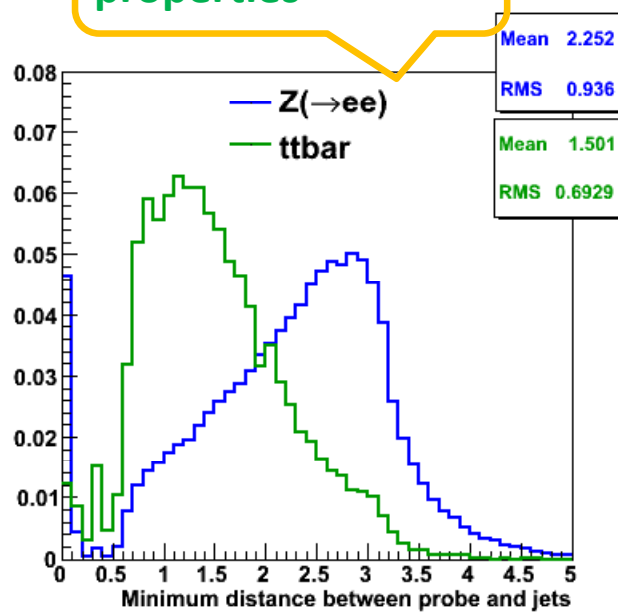


- Without backgrounds, **fit** and **event counting** are in good agreement in Tag&Probe method
- $\epsilon_Z - \epsilon_{tt} \approx 1.7\%$

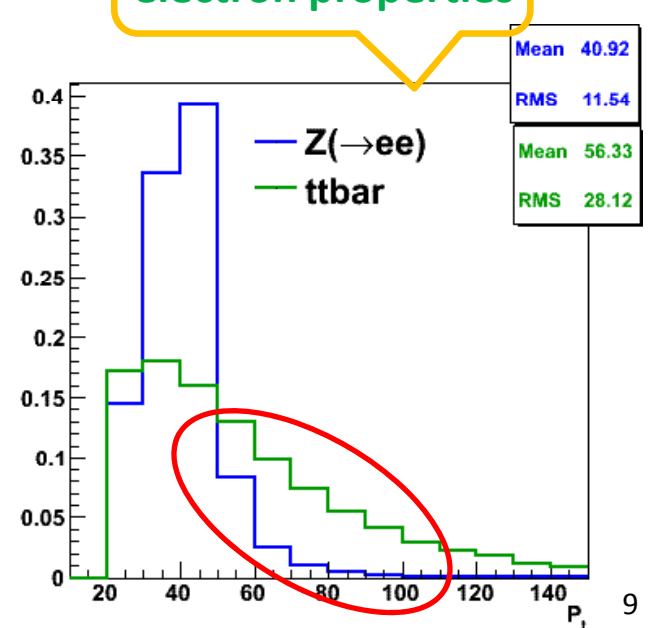
Difference in events properties



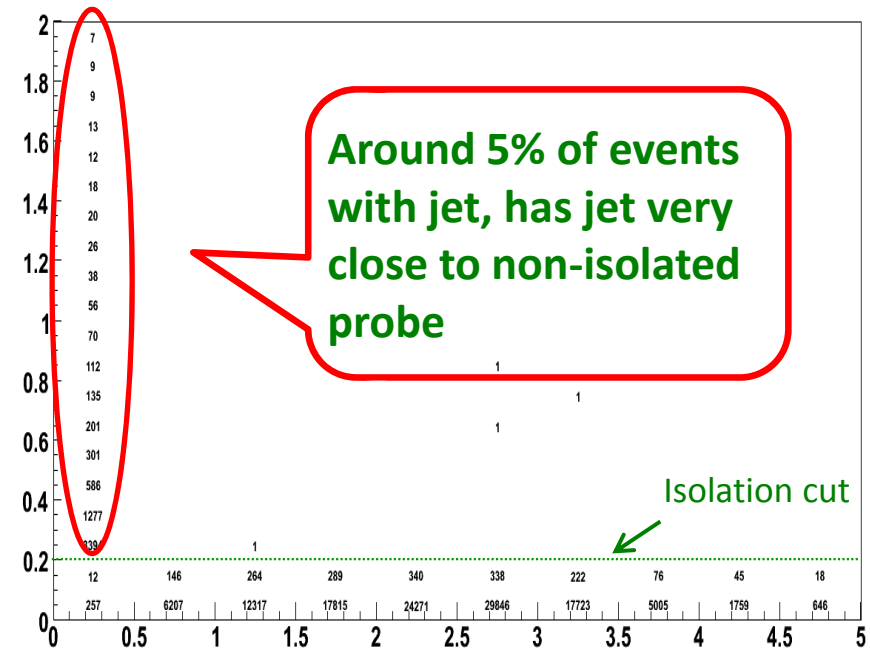
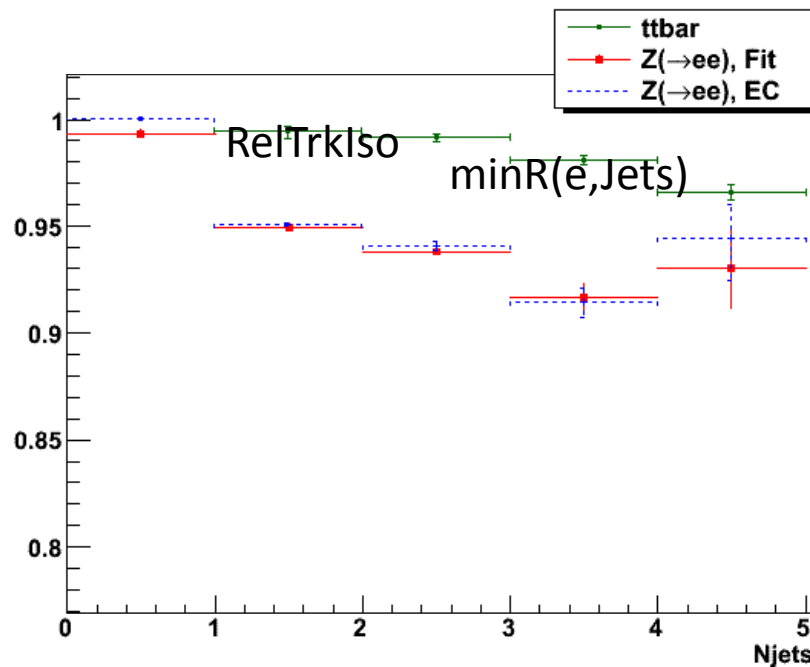
Difference in events properties



Difference in electron properties



A basic criteria in e+jet channel : at least 4 jets → Investigate the efficiency vs. nrJets



- Jets cause a dramatic drop in isolation efficiency in Z events. The reason can be the less separation between jets and the probes.
- In tracker, the electron is basically a clean object while with several tracks, jets are not as clean.
- In ttbar, the number of jets, active objects in tracker, are at least 4.
- To have the similar situation in Z event, ignoring the electrons, #jet>=4 is a good choice from the physics aspect.
- In 4'th jet bin, the number of Z events is too small and the uncertainty on the efficiency value is large.
- The efficiency difference, in 4'th jet bin would be at least the same as 3'rd bin, ~6%

# Conclusion and Outlook

- Electron 'Tight' Identification efficiency is in agreement between Z and  $t\bar{t}$ .
- The same study is ongoing for loose and robust Id.
- Top event is different from Z in different aspects like jet multiplicity,  $\min R(e, \text{jet})$ , etc.
- Tracker isolation efficiency is different in two kind of events.
  - To have similar tracker occupancy in both events, events should be investigated in the same jet bin.
  - The efficiency difference in 4'th jets bin is about 6% with large statistical errors.
  - For higher statistics in 4'th jet bin, Z+4jet Alpgen sample is under study
- Isolation efficiency in ECAL and HCAL is ongoing.