Update on Z pT analysis

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Z event selection

- Two electrons each with:
- pT>25 GeV
- $|\eta|<1.1$ (CC)or $1.5<|\eta|<3.2$ (EC)
- In fiducial region of the Calorimeter
- |id|=10 or 11, emf>0.9, iso<0.15
- Hmx7<12 for CC, Hmx8<20 for EC
- Spatial track match(chi2prob>0.01) (≥2 for CCCC, ≥1 for CCEC,ECEC)
- Invmass in [70,110] GeV
- At least one of the electrons pass a single EM trigger

data correction

- Measured Z pT(bkg,smearing, selection)
- Data correction:
- Bkg subtraction(smear, selection)
- **Selection correction(smear)**
- Unfold: generator distribution to compare with theory calculation
-
- Selection correction:
- Acceptance cuts(pT(e), position(e), invmass) Z pT dependence got from pmcs
- $$acc(ZpT)=\frac{(ZpT(smeared+all\ acc\ cuts))}{(ZpT(smeared))}$$
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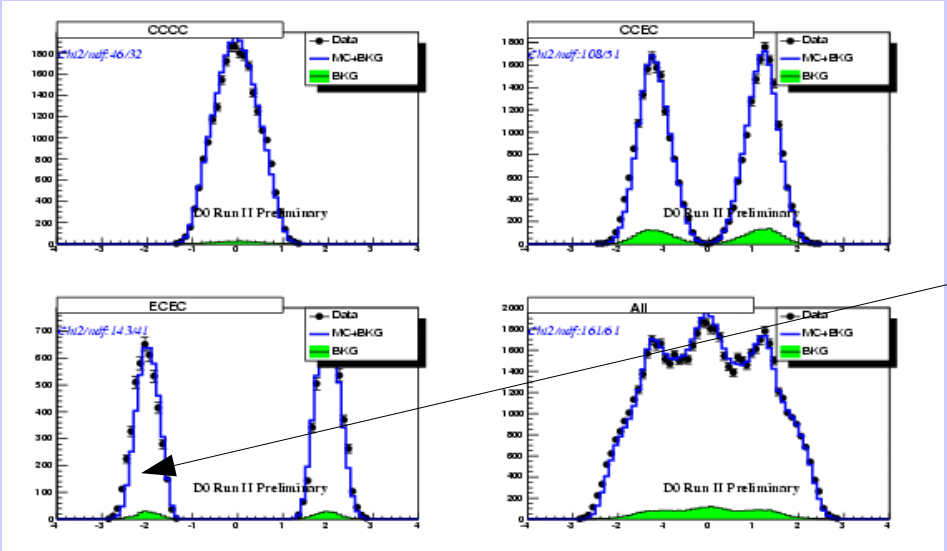
- Efficiency cuts(preselection(iso,emf,id), H-matrix, spatial track-match) Z pT dependence got from full MC

$$eff(ZpT)=\frac{(ZpT(smeared+all\ acc\ cuts+all\ eff\ cuts))}{(ZpT(smeared+all\ acc\ cuts))}$$

issues in previous note

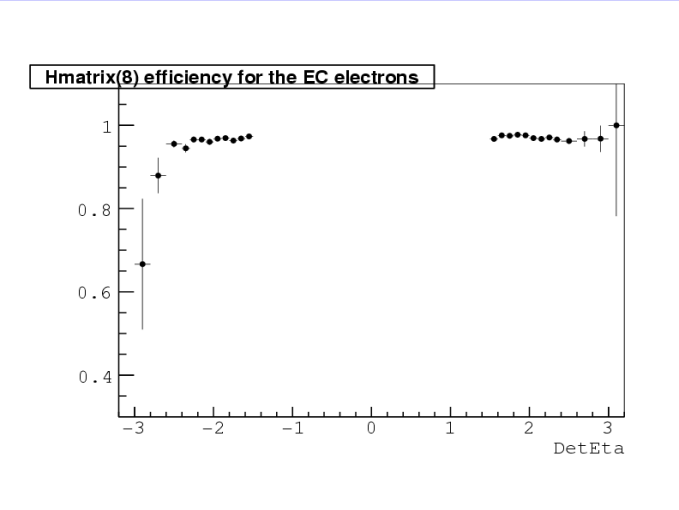
- Z rapidity discrepancy between data/pmcs

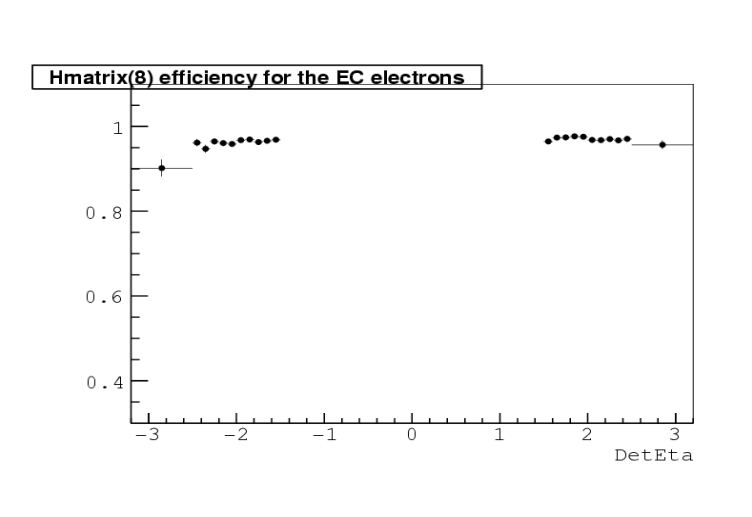


prevent us from looking at high rapidity Z pT

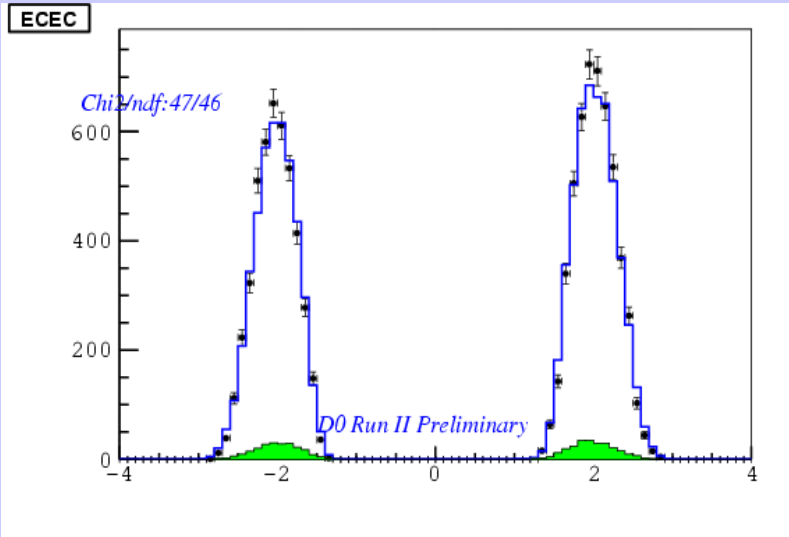
- Efficiency(Z pT) distribution, got from full MC. Big systematic error due to discrepancy between data/full MC. Conservatively assign the difference in absolute scale as the sys. error. 6%, which is the biggest sys error. But we are more interested in the shape rather than the absolute scale. Detailed study on full MC is necessary

Z rapidity in pmcs

- Z rapidity discrepancy between data/pmcs is due to efficiency implementation in pmcs
- 



New comparison shows good agreement



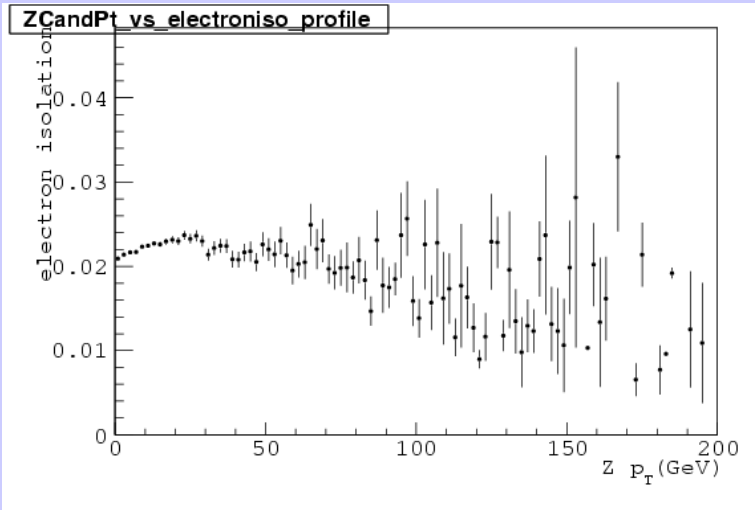
efficiency(ZpT)

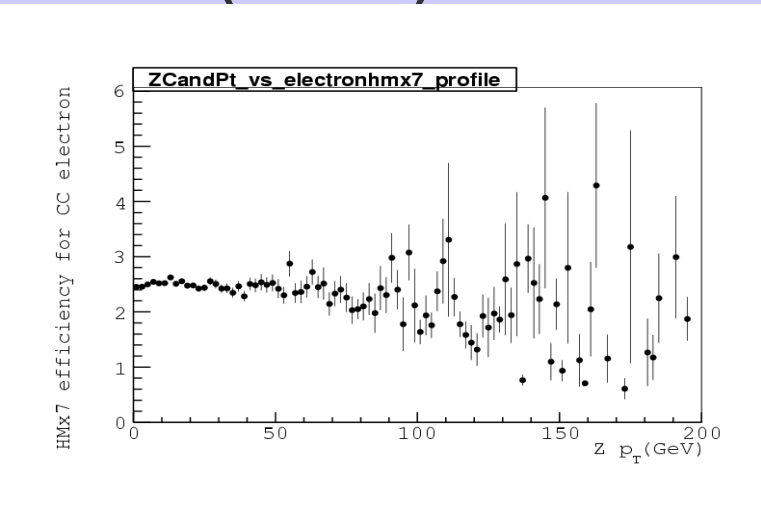
$$eff\,(ZpT) = \frac{(ZpT\,(smeared + all\ acc\ cuts + all\ eff\ cuts))}{(ZpT\,(smeared + all\ acc\ cuts))}$$

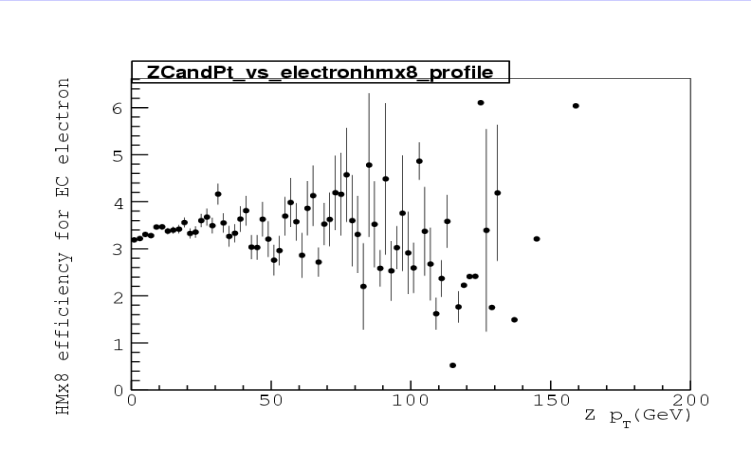
- All eff cuts(preslection(iso,emd,id),H-matrix,spatial track match)
- Jet activity(mostly the recoil against the Z) spoils the electron qualities of these variables, and they strongly depend on Z pT. The bigger the Z pT, the bigger the recoil. The angle between the recoil and the electron also changes as Z pT changes.

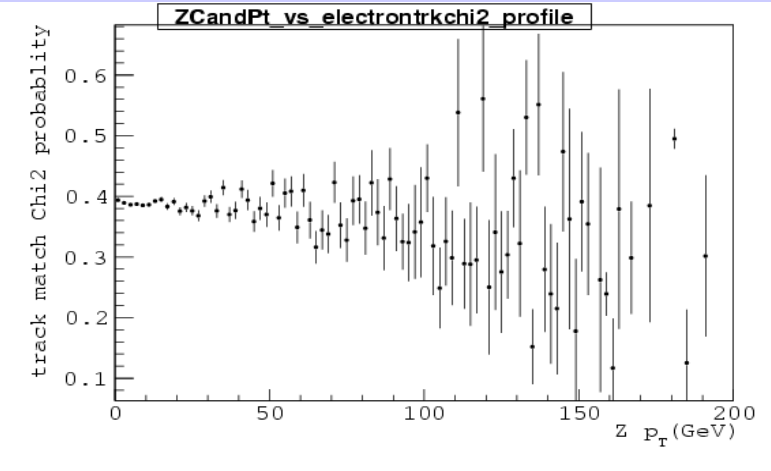
how do the variables depend on Z pT

- electrons after Z selection(data)





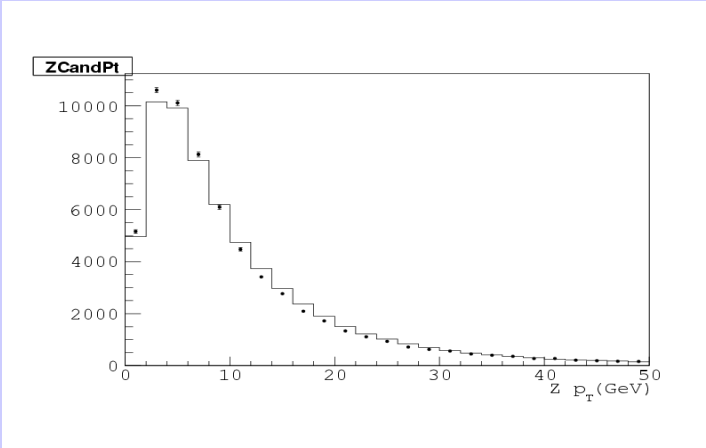




strong dependence in isolation and H-matrix and small depen-dence in trk match probability

New approach

- Get the eff(ZpT) shape from the full MC, get the absolute scale from the data
- Make comparison plot between data and full MC to study systematic uncertainty.
- full MC:Generator is PYTHIA
- Reweight generator Z pT to ResBos prediction



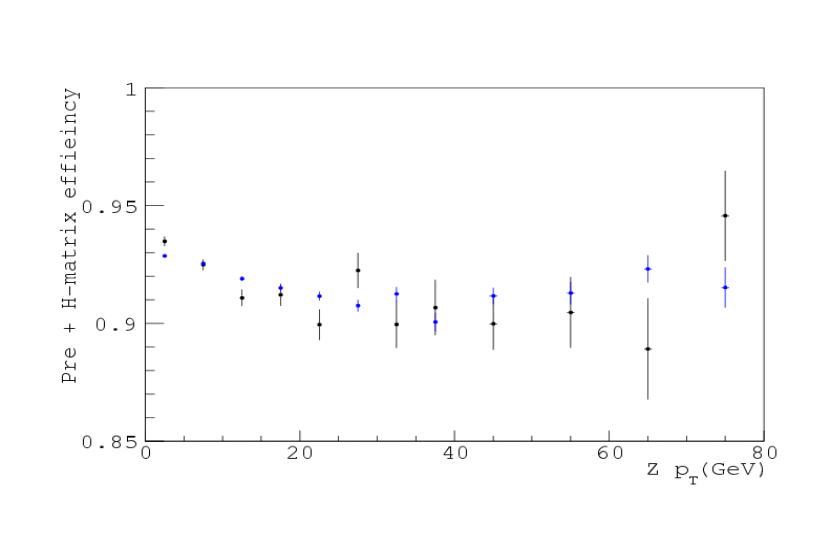
data/full MC comparison

$$eff(ZpT) = \frac{(ZpT(smeared + all\ acc\ cuts + all\ eff\ cuts))}{(ZpT(smeared + all\ acc\ cuts))}$$

- From data, we can not get the denominator(or numerator) directly, we need to do bkg subtraction. But the QCD background will dominate the signal if we do not apply any efficiency cuts.
- Instead, we require track match in the denominator sample, this will reduce a lot of background, and as we saw before, the Z pT spectrum are not sensitive to the track match requirement.

$$eff(ZpT) = \frac{(ZpT(smeared + all\ acc\ cuts + all\ eff\ cuts))}{(ZpT(smeared + all\ acc\ cuts + track\ match\ cut))}$$

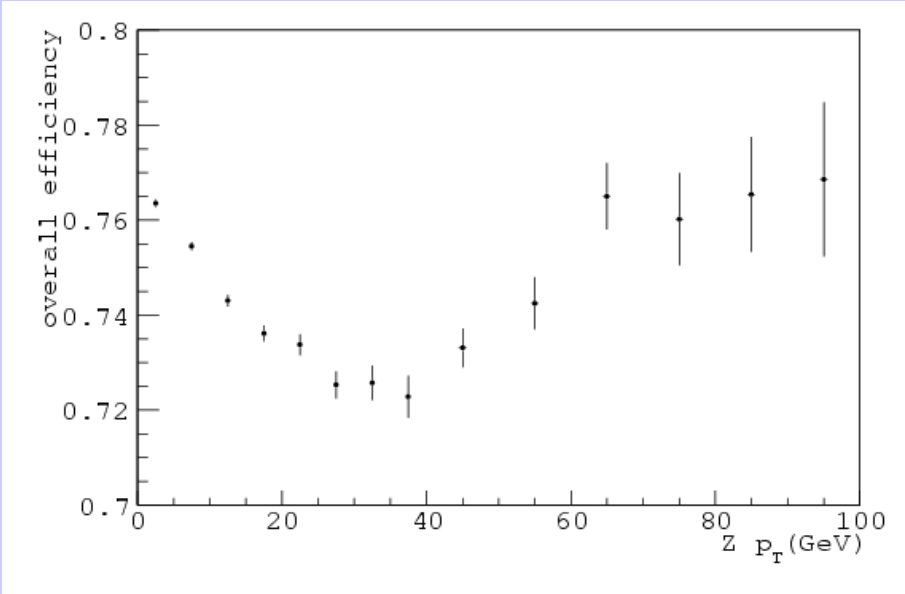
blue: full MC; black:data
good agreement between data and full MC



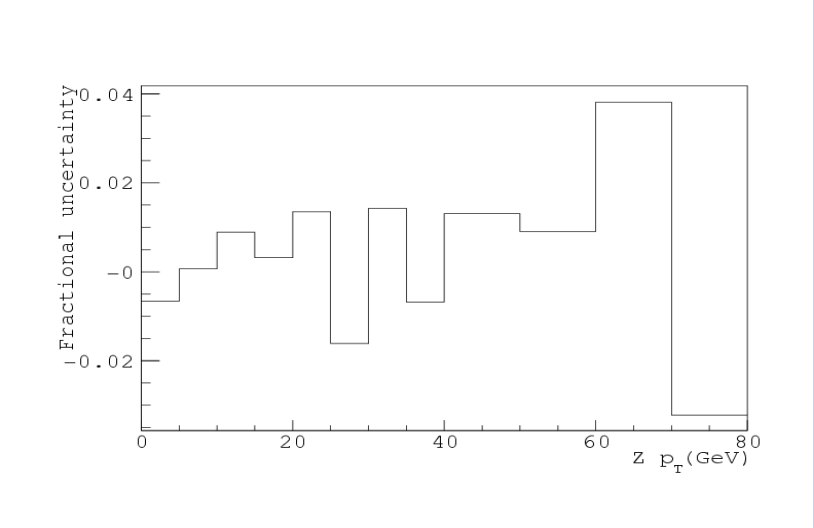
eff(ZpT) from full MC

$$eff\,(ZpT) = \frac{(ZpT\,(smeared + all\ acc\ cuts + all\ eff\ cuts))}{(ZpT\,(smeared + all\ acc\ cuts))}$$

- after scale to overall data efficiency(75.1%):



systematic uncertainty



Next to do

- Update the result with the new measured eff(ZpT)
- Look at the pT of the forward Zs
- Tuning of ResBos parameter g2
- Update the note