



# Update on $Z \rightarrow e^+e^-$ analysis

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*on behalf of **Z Signal Extraction** team*

A quick look at  $35 \text{ pb}^{-1}$  data

*VBTF meeting*  
(November 12, 2010)

# Data sample and trigger



	<u>Run-range</u>	<u>Data sample</u>	<u>Trigger path</u>
Run 2010 A	132440–137028	/EG/Run2010A-Sep17ReReco_v2/RECO	HLT_Photon10_L1R
	138564–140401	”	HLT_Photon15_Cleaned_L1R
	141956–144114	”	HLT_Ele15_SW_CaloEleId_L1R
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Run 2010 B	146428–147116	/Electron/Run2010B-PromptReco-v2/RECO	HLT_Ele17_SW_CaloEleId_L1R
	147196–148058	”	HLT_Ele17_SW_TightEleId_L1R
	148819–149064	”	HLT_Ele17_SW_TighterEleIdIsol_L1R_v2
	149181–149442	”	HLT_Ele17_SW_TighterEleIdIsol_L1R_v3

## ◆ Used release for analysis:

CMSSW\_3\_8\_5\_patch3

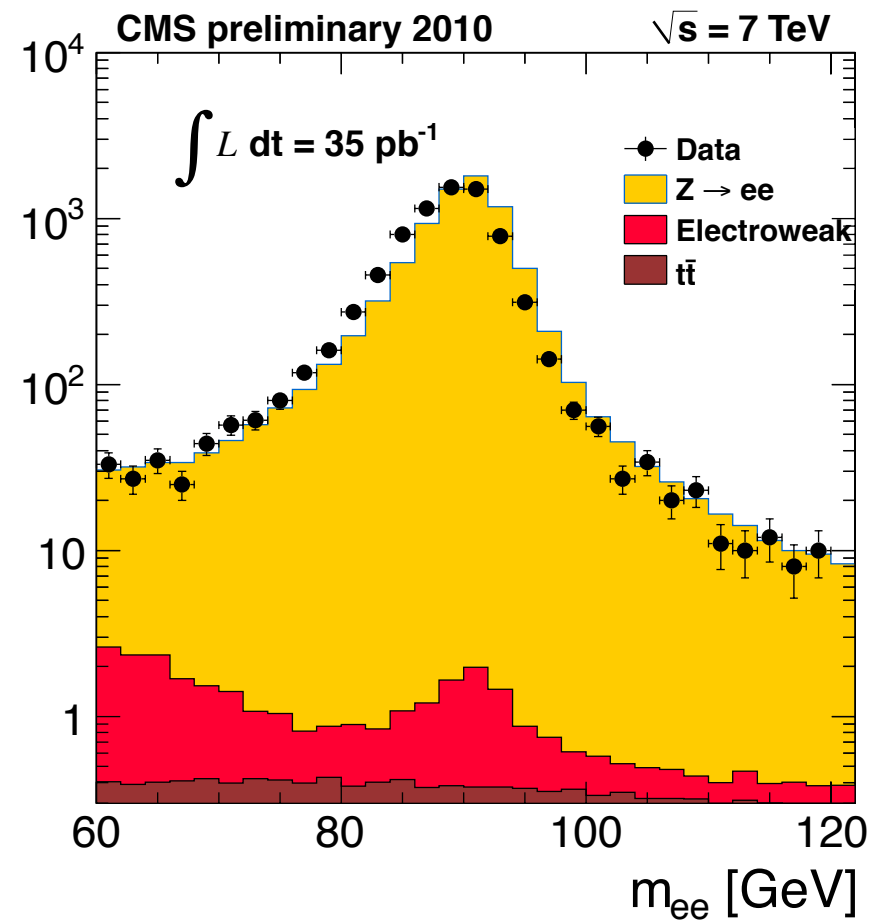
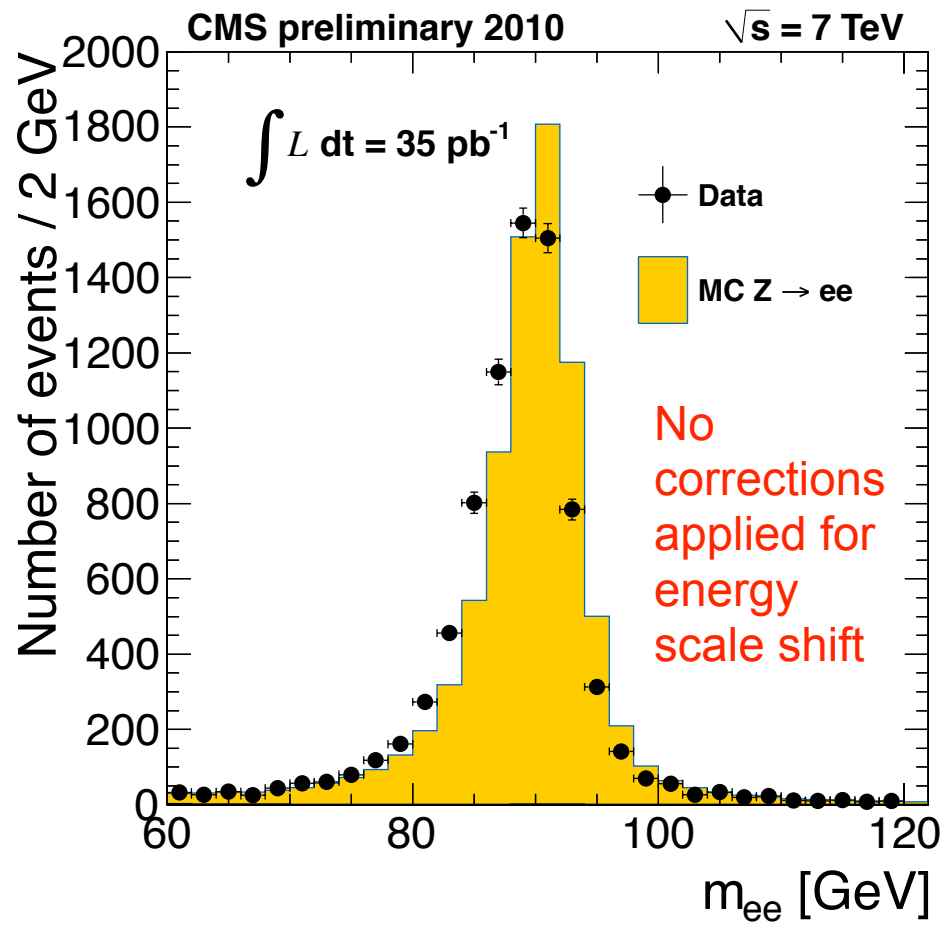
## ◆ JSON file:

Cert\_132440-149442\_7TeV\_StreamExpress\_Collisions10\_JSON.txt

# Using 34.7 pb<sup>-1</sup> of Run-2010B data

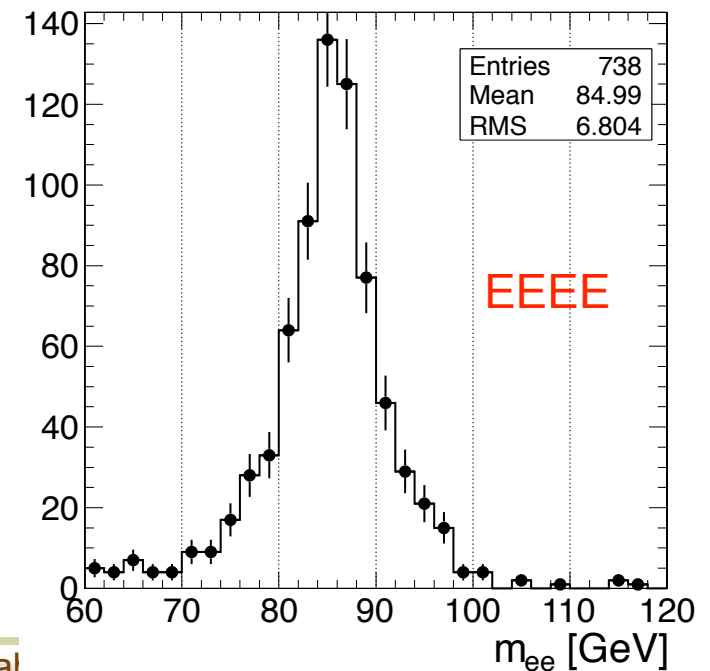
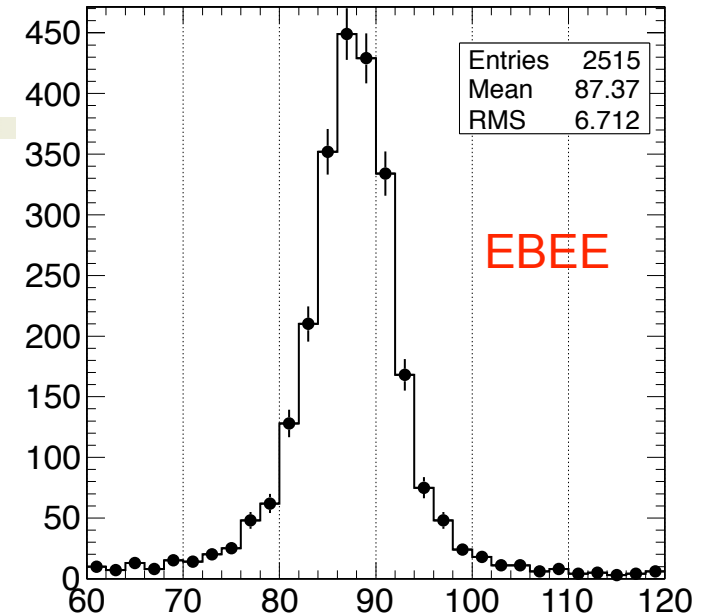
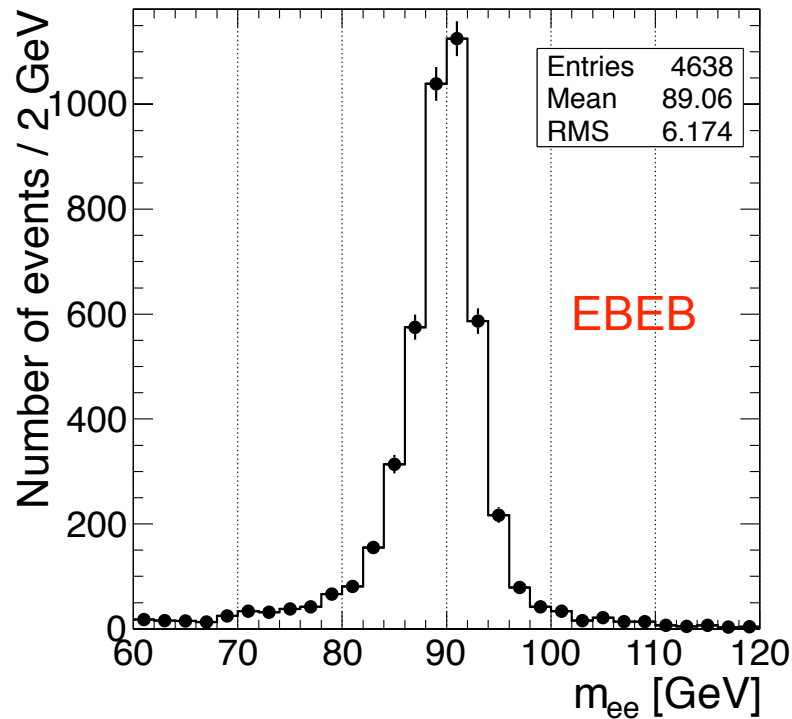


- ◆ Have 7891 golden Z → ee events using “WP80” electron selection
  - EBEB = 4638, EBEE = 2515, EEEE = 738 (w/o escale correction)
  - Simple scale up of the EWK-10-002 paper is: 34.7\*677/2.9 = 8100



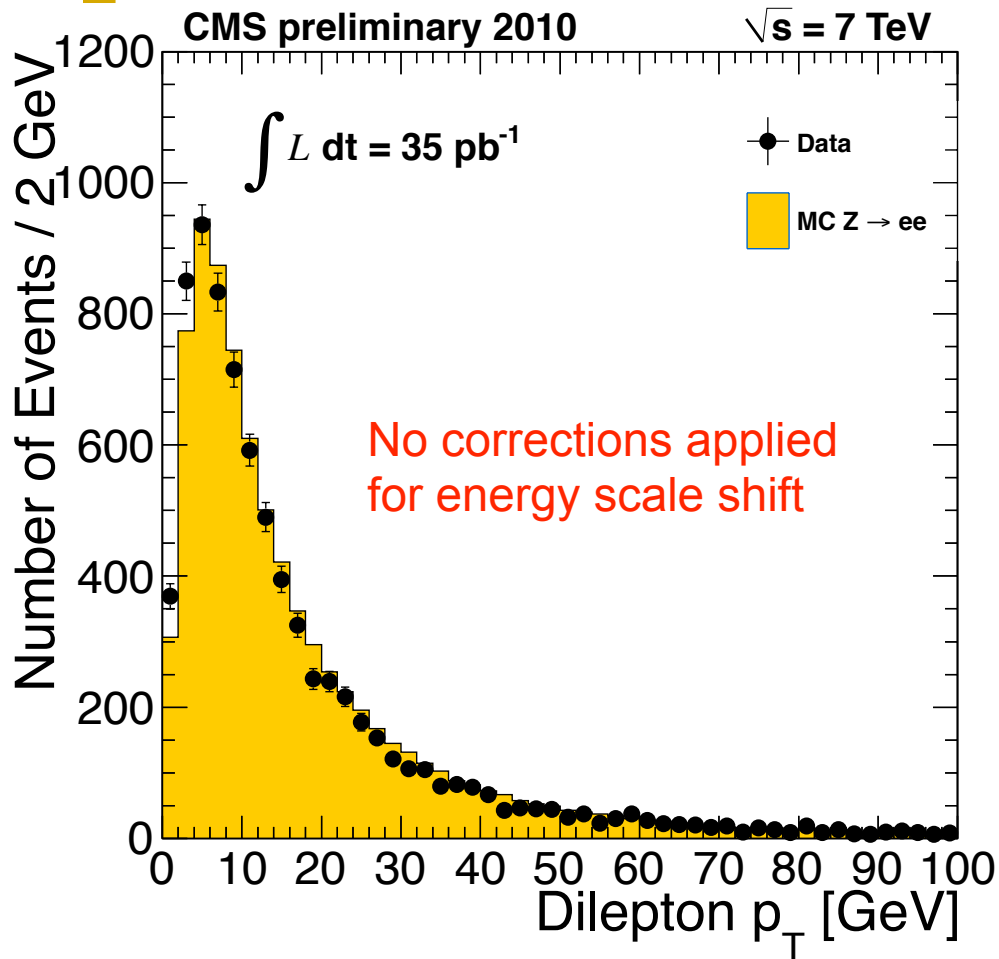
# Electrons in EB and EE

- Escale from  $\pi^0$  is already there in EB, not in EE
- ECAL transparency loss causes additional energy loss, mostly in EE



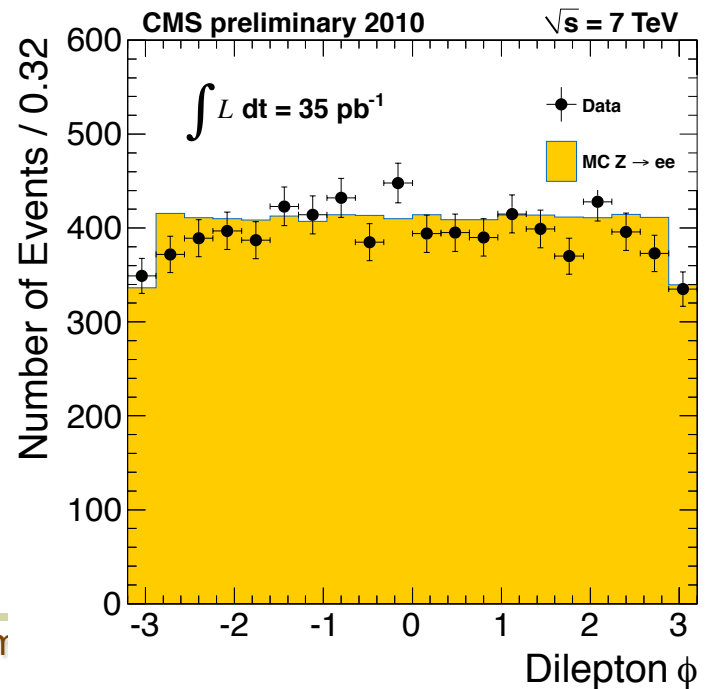
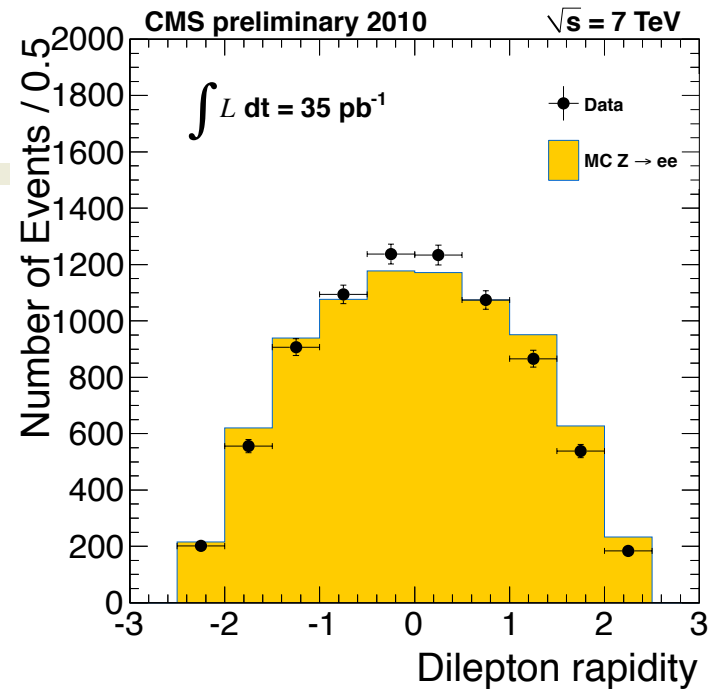
Most of the energy loss in endcaps is still from energy scale.

# Z p<sub>T</sub>, rapidity, azimuth

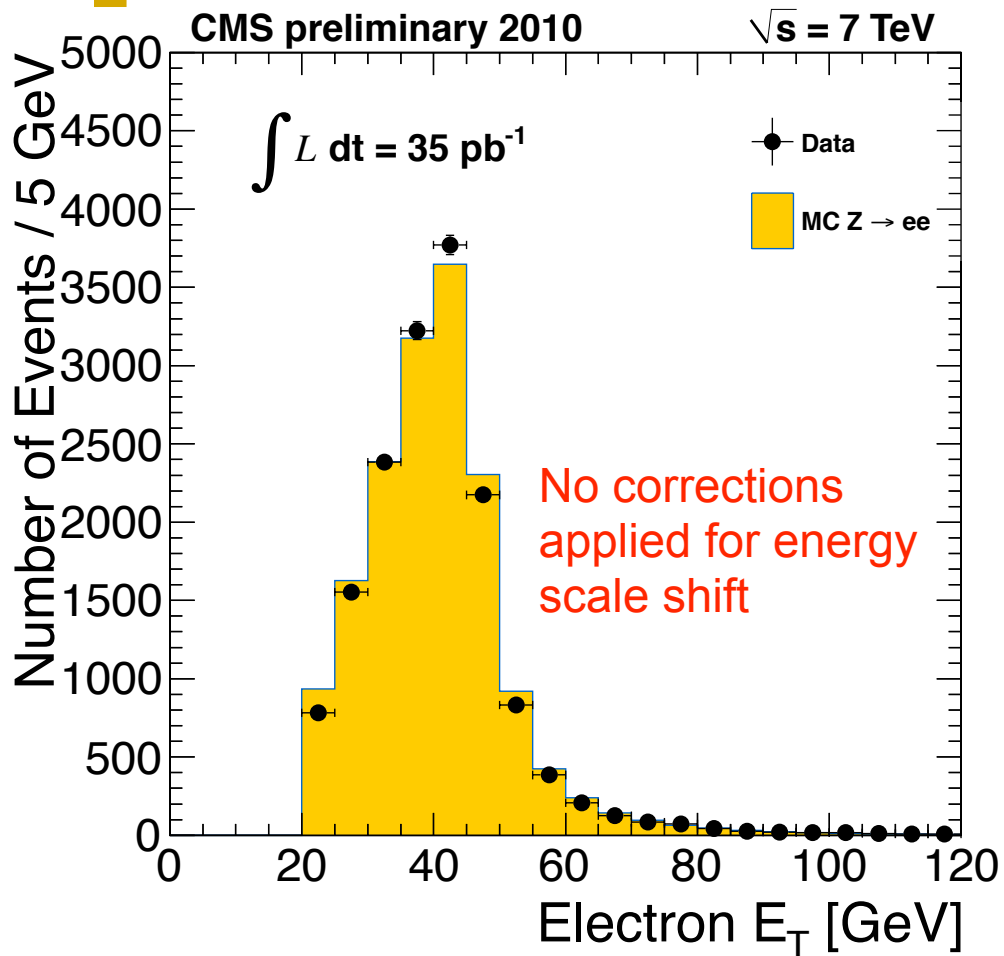


◆ Distributions are in agreement with NLO predictions.

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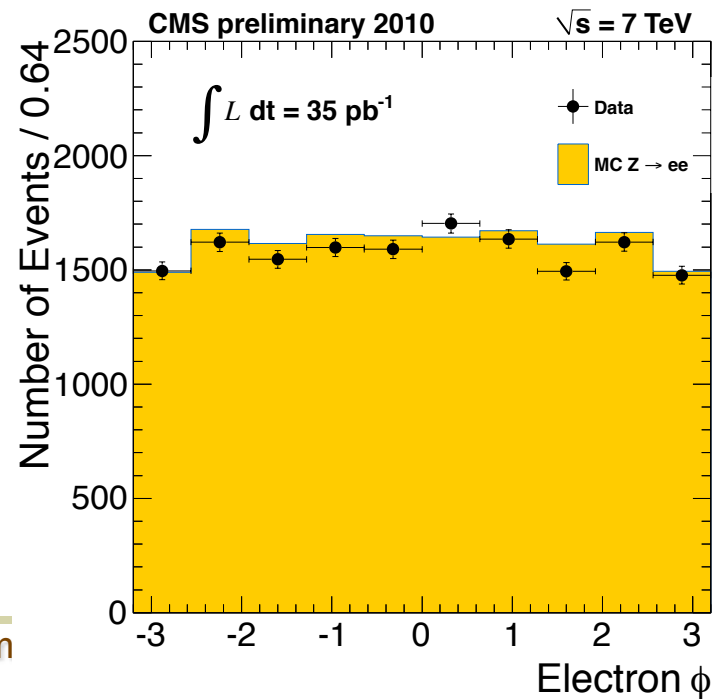
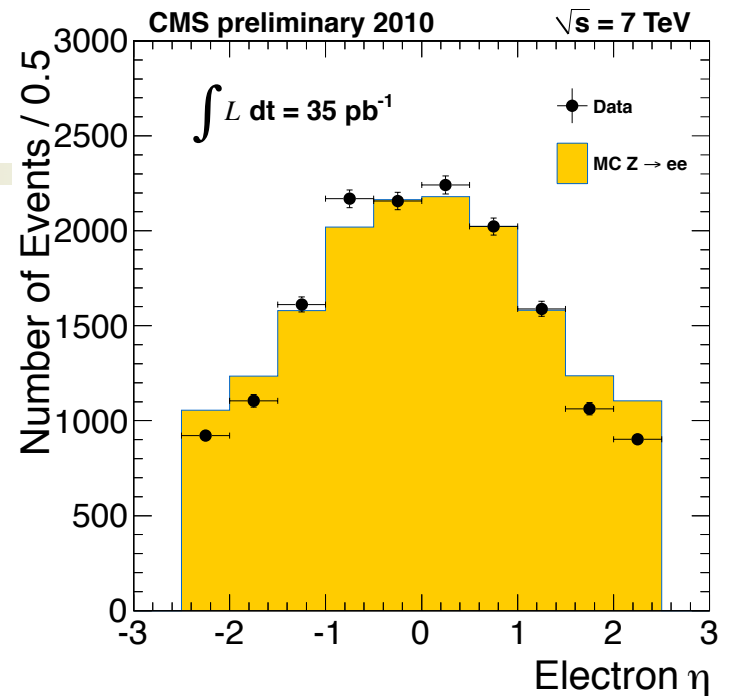


# Electron $P_T$ , rapidity, azimuth

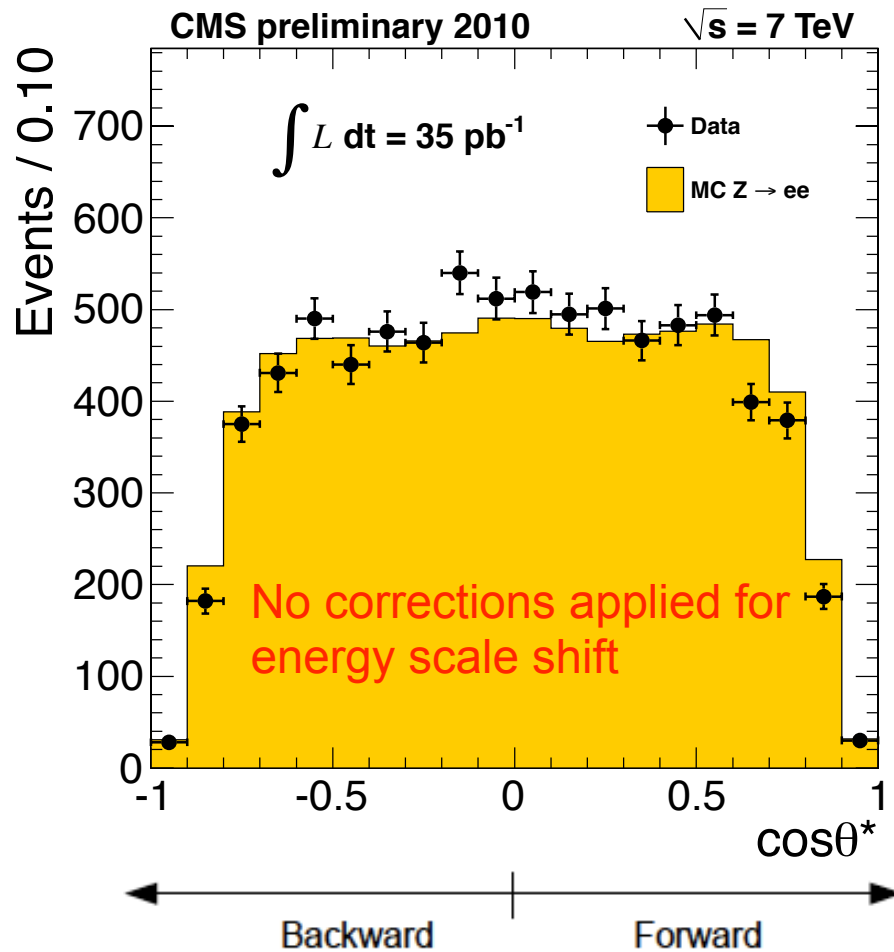


◆ Distributions are in agreement with NLO predictions.

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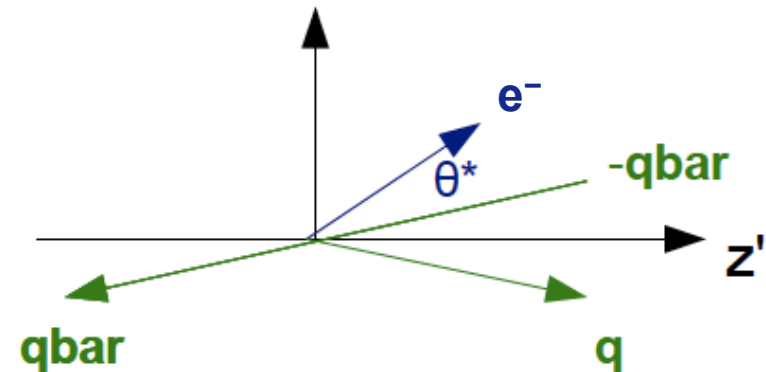


# Z production topology: cosine $\theta^*$



◆ Good agreement with NLO prediction.

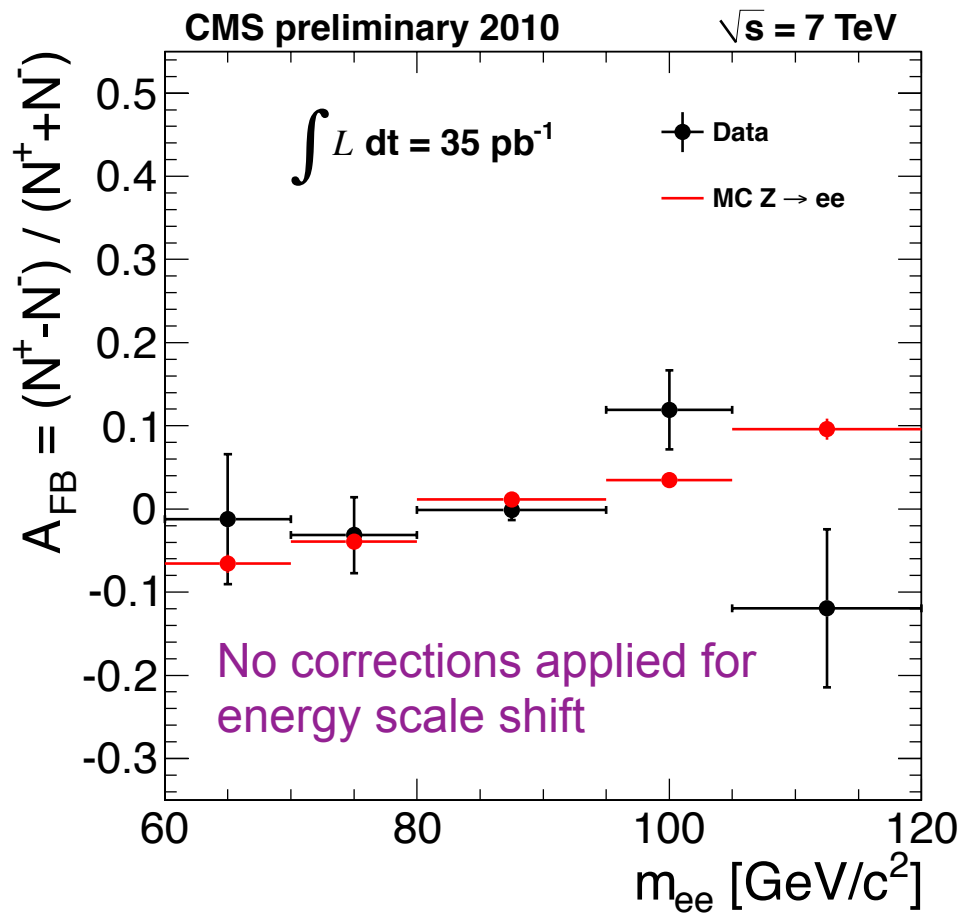
## Collins-Soper frame



$\theta^*$  is the angle between the electron momenta and the  $z'$  axis that bisects the angle between  $q$  and  $-qbar$ .

*J.C. Collins and D.E. Soper, Phys. Rev. D 16, 2219 (1977)*

# Z forward-backward asymmetry



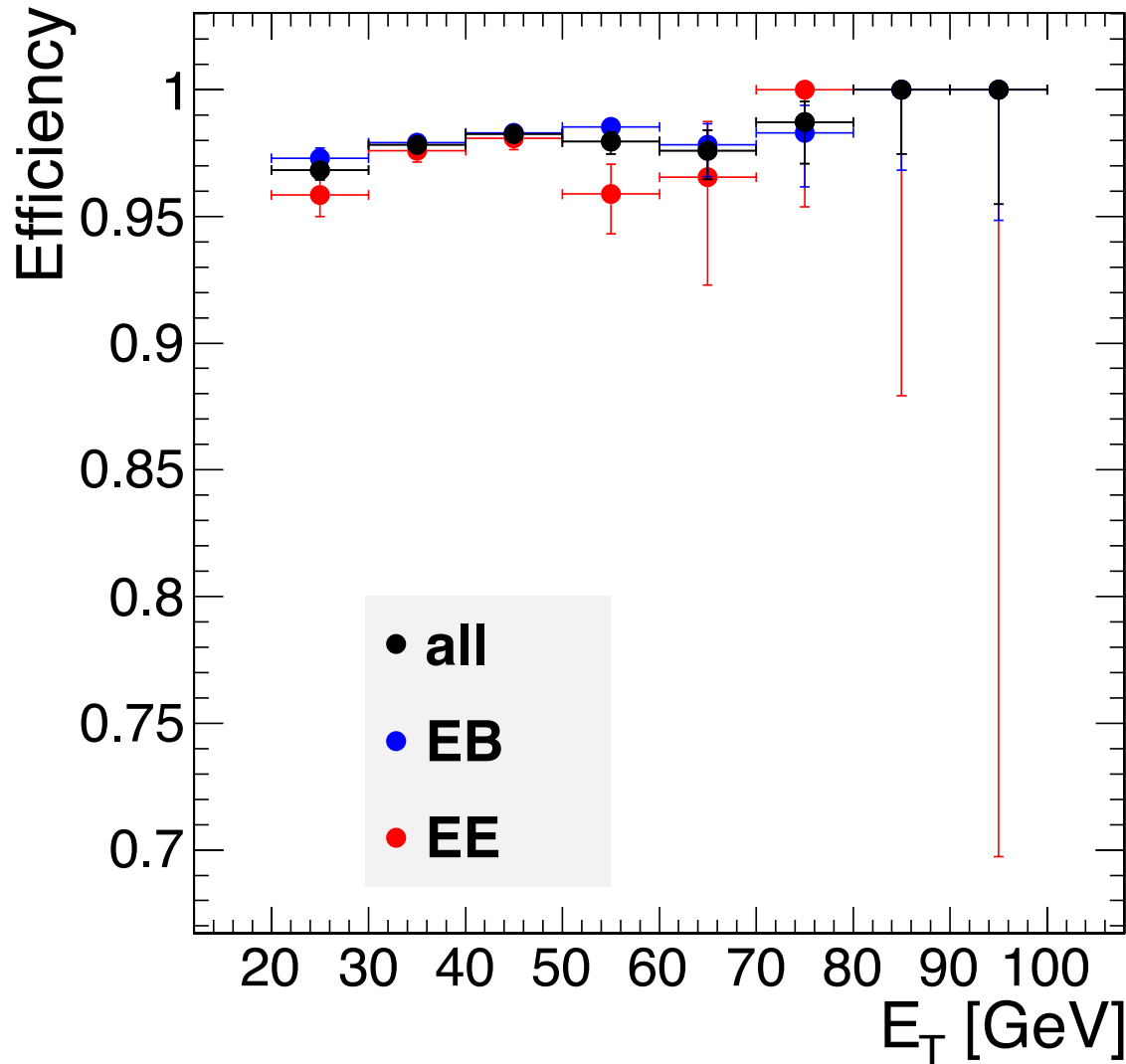
- Forward events ( $\cos\Theta^* > 0$ )
- Backward events ( $\cos\Theta^* < 0$ )

For each Z mass bin, we compute the asymmetry given by

$$A_{fb} = \frac{(N_f - N_b)}{(N_f + N_b)}$$

Observed asymmetry is consistent with NLO predictions.

# Electron trigger efficiency: WP80 → HLT



From AN-10/349 table-8  
(using  $2.9 \text{ pb}^{-1}$  data)

$$\epsilon_{EB} = 98.9 \pm 0.3 \%$$

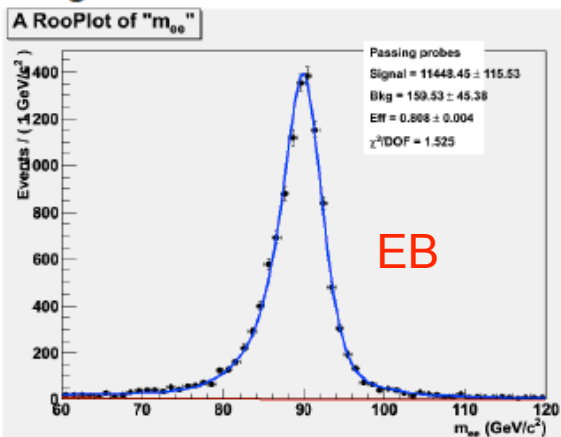
$$\epsilon_{EE} = 99.2 \pm 0.5 \%$$

The electron trigger efficiency is 1–2% lower than in initial data, as expected. However this will not affect the Z signal efficiency.

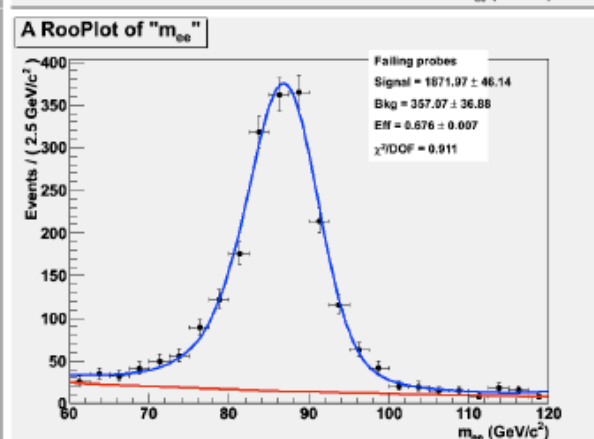
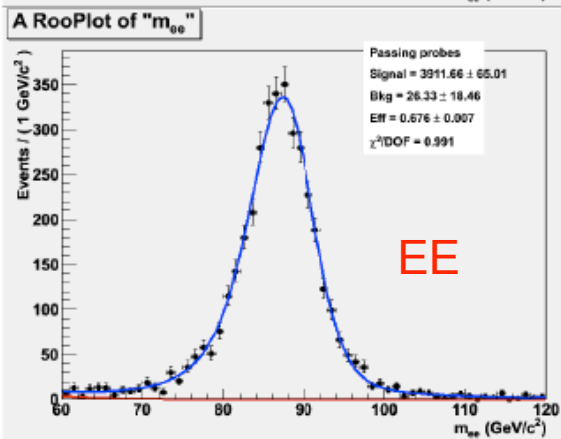
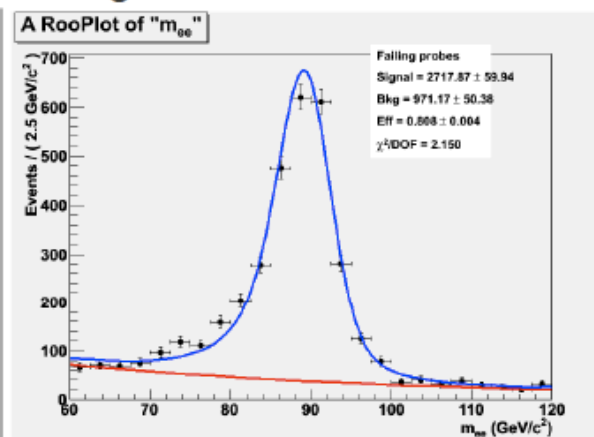
# Electron selection efficiency: reco $\rightarrow$ WP80



Tag + Pass



Tag + Fail



These numbers/plots are *\*very preliminary\** and represent our rough estimate at this point.

From AN-10/349 table-8  
(using 2.9 pb<sup>-1</sup> data)

$$\epsilon_{EB} = 79.1 \pm 1.8 \%$$

$$\epsilon_{EE} = 69.2 \pm 2.0 \%$$

Current preliminary  
estimate:

$$\epsilon_{EB} = 80.8 \pm 0.4 \%$$

$$\epsilon_{EE} = 67.6 \pm 0.7 \%$$

The electron selection  
efficiency is similar to  
the one in initial data.

# Summary



- ◆ A quick look at almost the entire 2010 data
- ◆ No big problem observed, data quality is good
  - other than “transparency loss” and energy scale in EE
- ◆ Z signal yield compares well to EWK-10-002  $\otimes$  lumi factor
  - Efficiency for electron selection & triggering look reasonable
- ◆ Need to:
  - Add remaining  $\sim 0.5 \text{ pb}^{-1}$  data which became available in today's JSON file
  - Apply correction for energy loss, then recompute signal yield and efficiency, and data/MC scale factors
- ◆ Now is the time to start work on improving systematic uncertainty for the second paper, especially the SC  $\rightarrow$  reco efficiency and signal estimation in “Tag+Fail” sample.