



# Update on $Z \rightarrow e^+e^-$ analysis in 3.9.X

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*on behalf of Z Signal Extraction team*

*VBTF meeting  
(January 20, 2011)*

# Data sample and trigger



	<u>Run-range</u>	<u>Data sample</u>	<u>Trigger path</u>
Run 2010 A	132440–137028	/EG/Run2010A-Dec22ReReco_v1/RECO	HLT_Photon10_L1R
	138564–140401	”	HLT_Photon15_Cleaned_L1R
	141956–144114	”	HLT_Ele15_SW_CaloEleId_L1R
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Run 2010 B	144115–147145	/Electron/Run2010B-Dec22ReReco_v1/RECO	HLT_Ele17_SW_CaloEleId_L1R
	147146–148058	”	HLT_Ele17_SW_TightEleId_L1R
	148103–149065	”	HLT_Ele17_SW_TighterEleIdIso_L1R_v2
	149180–149442	”	HLT_Ele17_SW_TighterEleIdIso_L1R_v3

## ◆ Used release for analysis:

CMSSW\_3\_9\_7

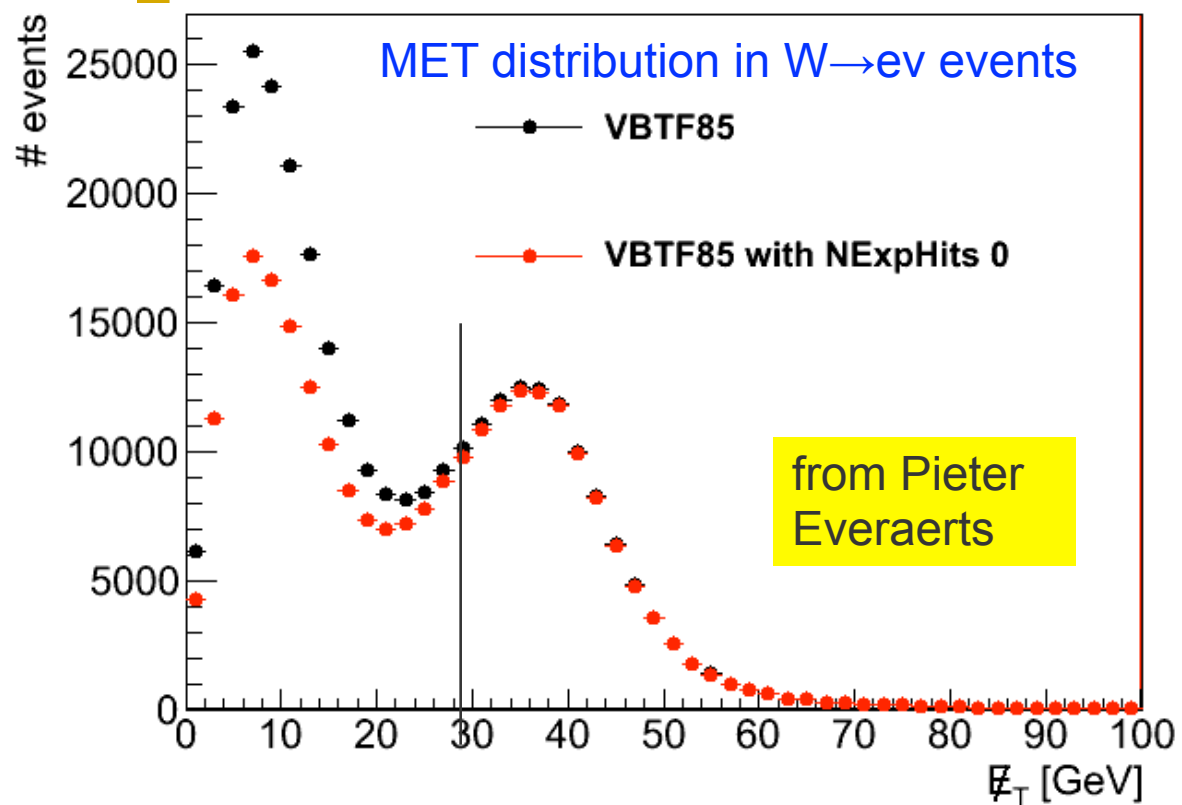
## ◆ JSON file:

Cert\_136033-149442\_7TeV\_Nov4ReReco\_Collisions10\_JSON.txt

Move to “WP85” selection and  $E_T > 25$  GeV threshold



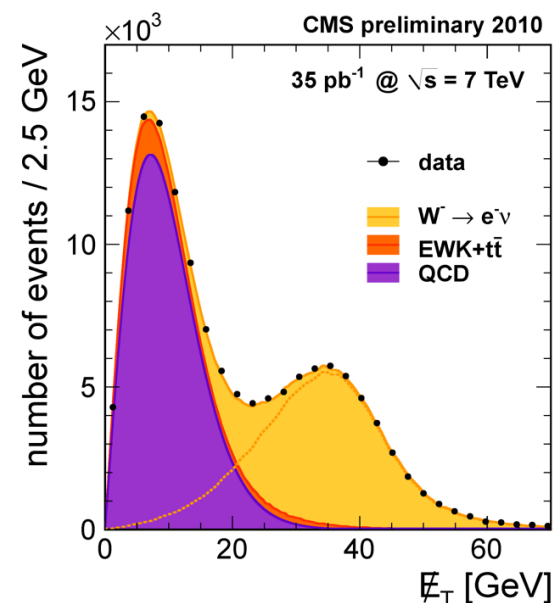
# Improvement in WP85 performance



In CMSSW 3.9 reconstruction  $N_{\text{ExpectedHits}}=0$  is more optimal for WP85.

In the following slides all plots are made using this new definition of WP85 and with  $E_T > 25$  GeV threshold

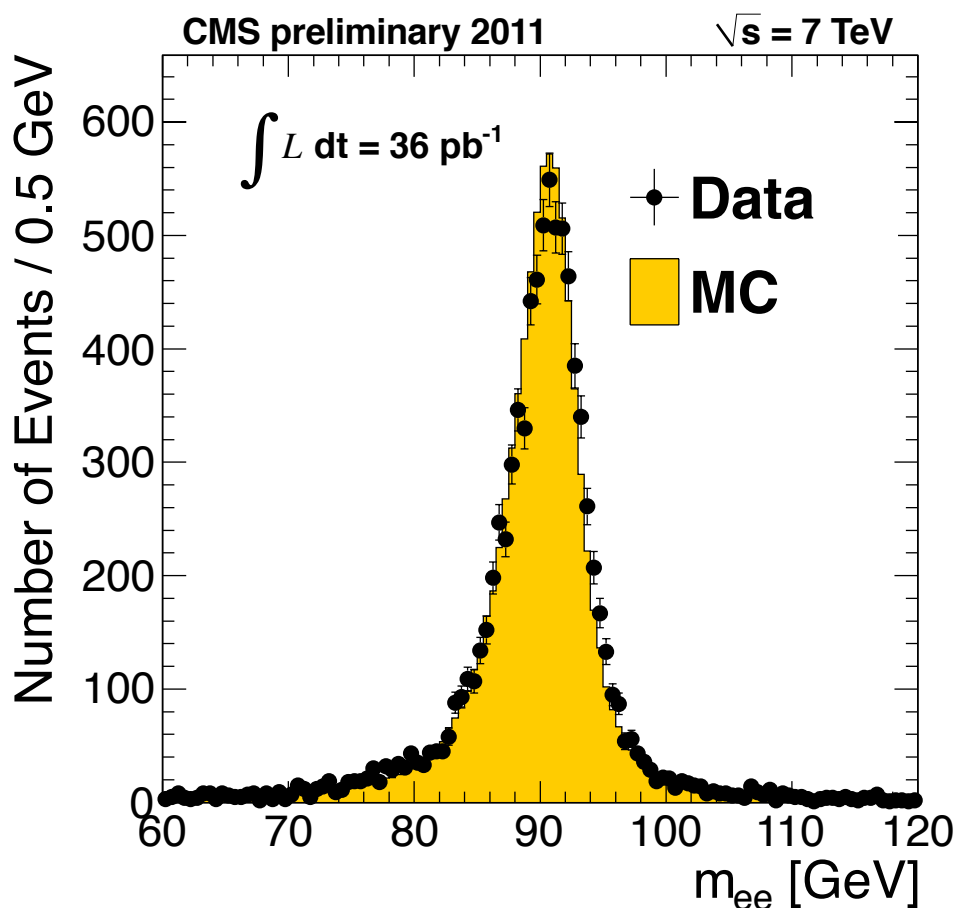
- ◆ Currently WP85 requires  $N_{\text{ExpectedHits}}=1$ .
- ◆ Just changing this one requirement (i.e., w/o touching other cuts) will improve the background rejection rate substantially while signal efficiency will remain same.





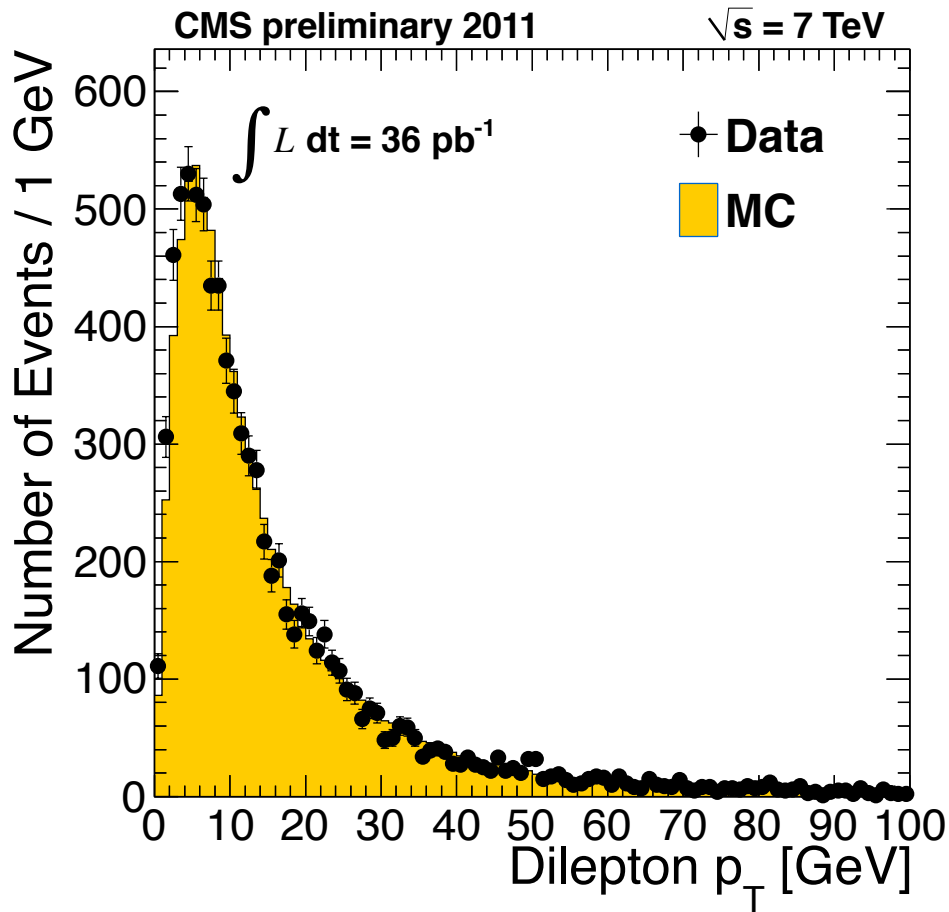
# Using 36 pb<sup>-1</sup> of 2010 data

- ◆ Have 8743 golden Z→ee events using “WP85” electron selection
  - EBEB = 5198, EBEE = 2652, EEEE = 893 (using E<sub>T</sub>>25 GeV)
  - Simple scale up of the EWK-10-002 paper is: 36\*677/2.88 = 8462 (which used E<sub>T</sub>>20 GeV)

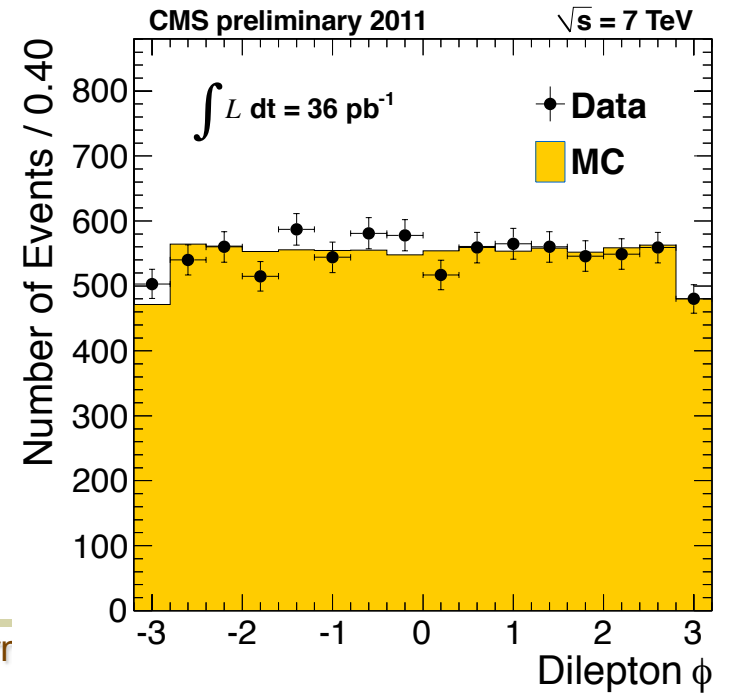
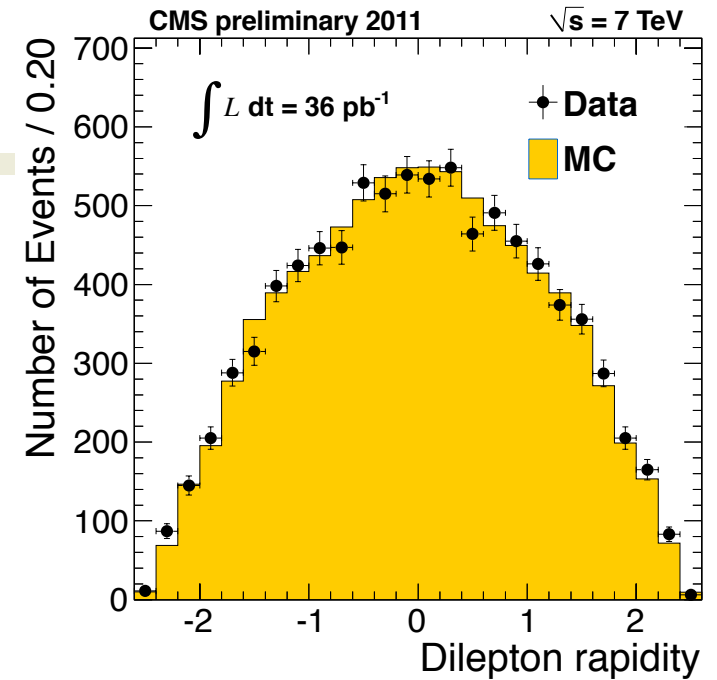


In 3.9 re-Reco the Z mass is peaked at right place (perhaps very slightly overestimated). The resolution in data looks almost as good as in MC.

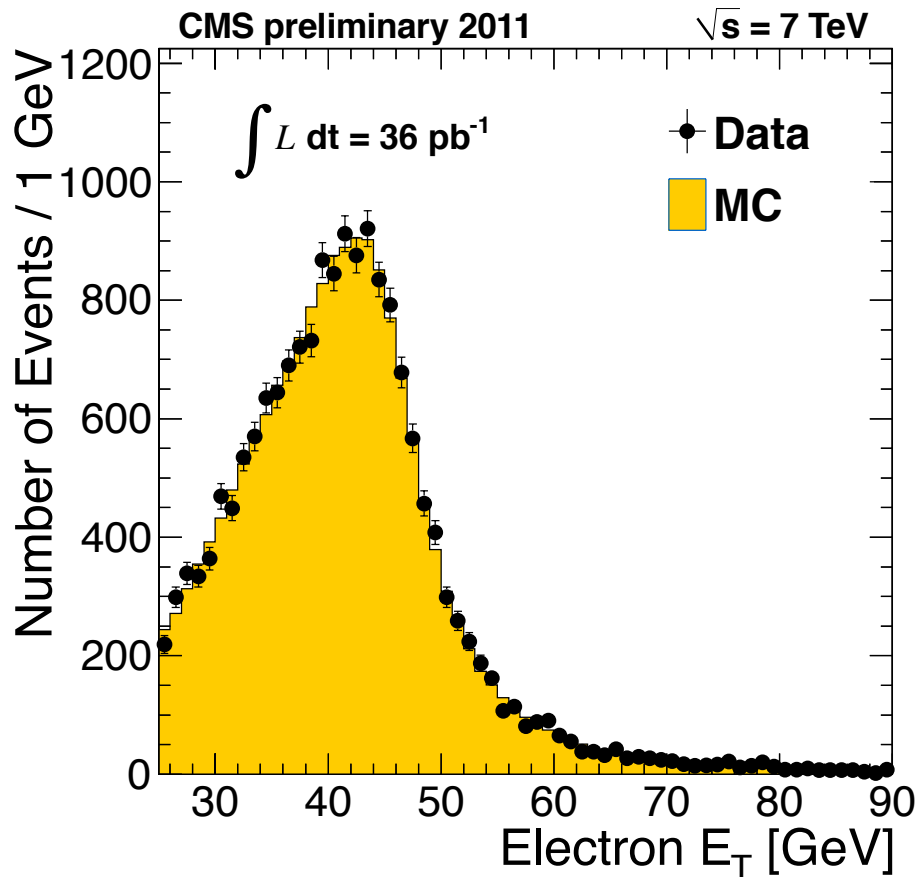
# Z p<sub>T</sub>, rapidity, azimuth



◆ Distributions are in agreement with NLO predictions.

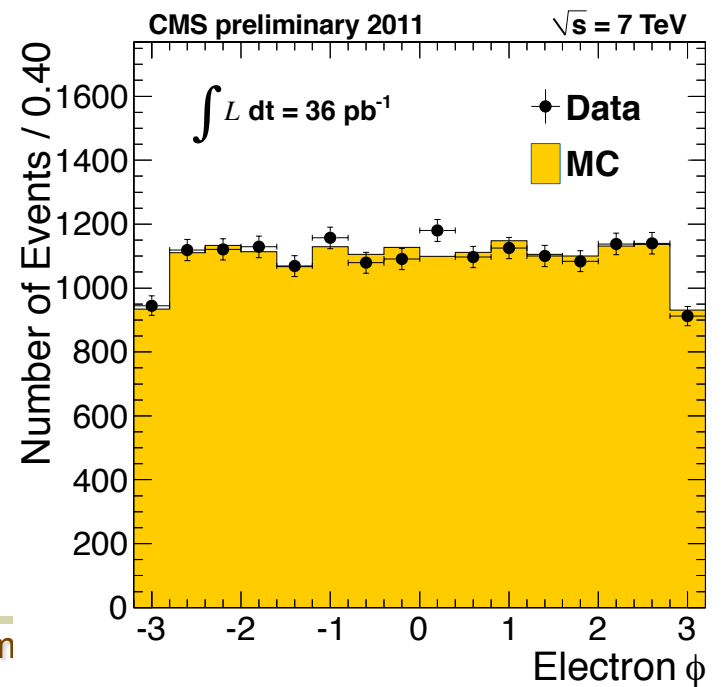
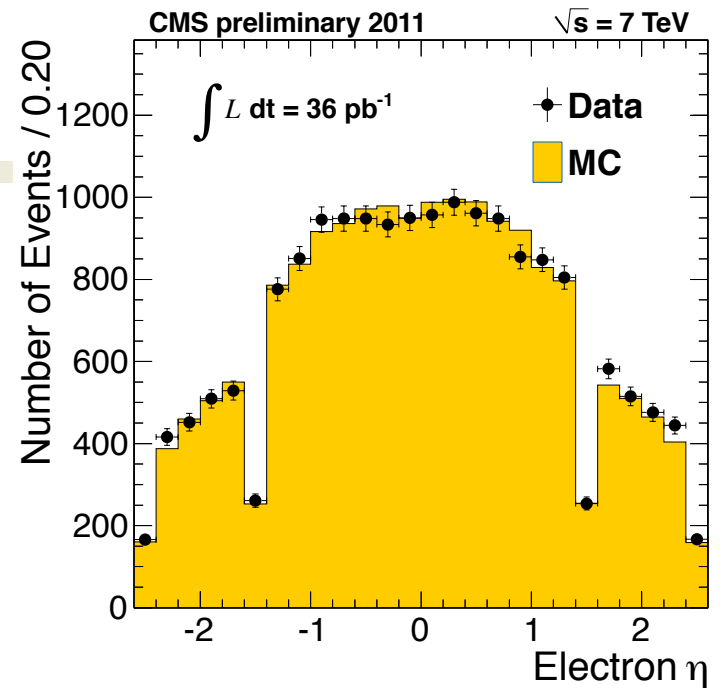


# Electron $P_T$ , rapidity, azimuth

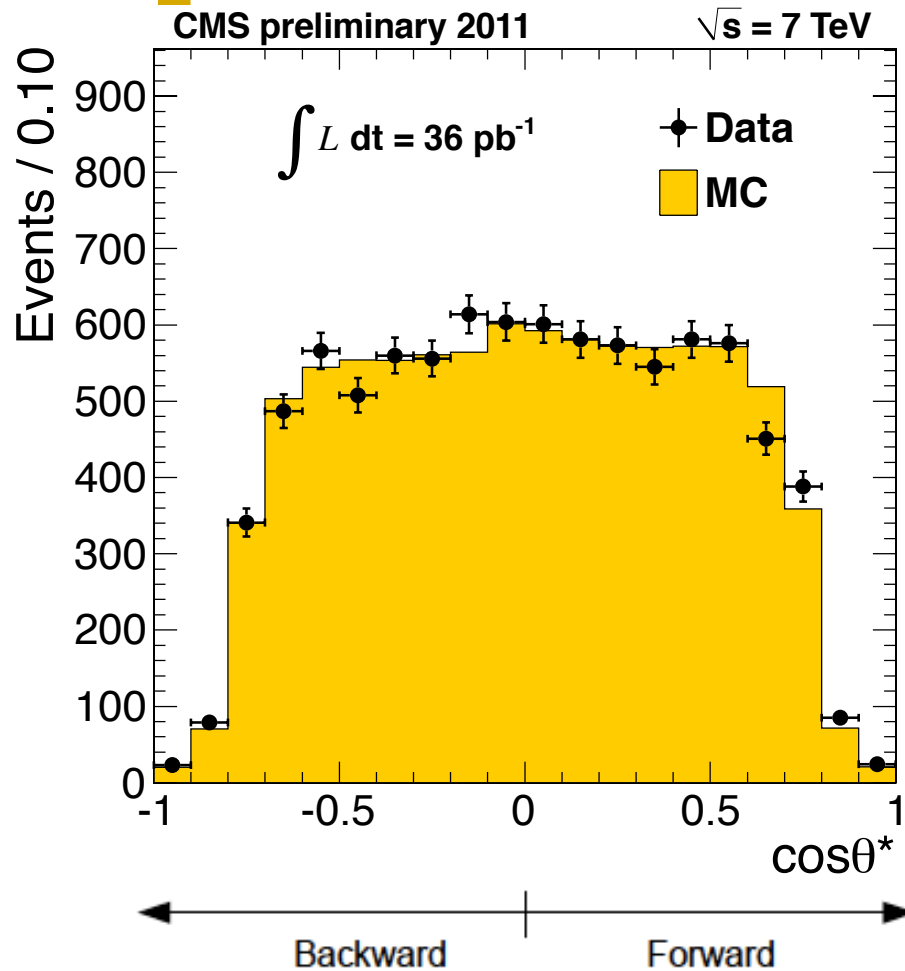


◆ Distributions are in agreement with NLO predictions.

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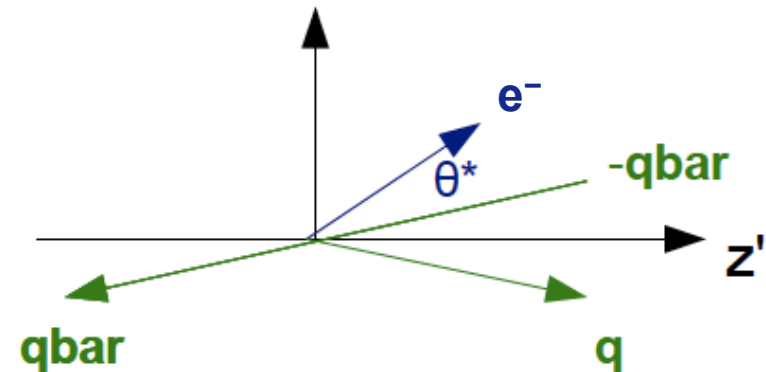


# Z production topology: cosine $\theta^*$



◆ Good agreement with NLO prediction.

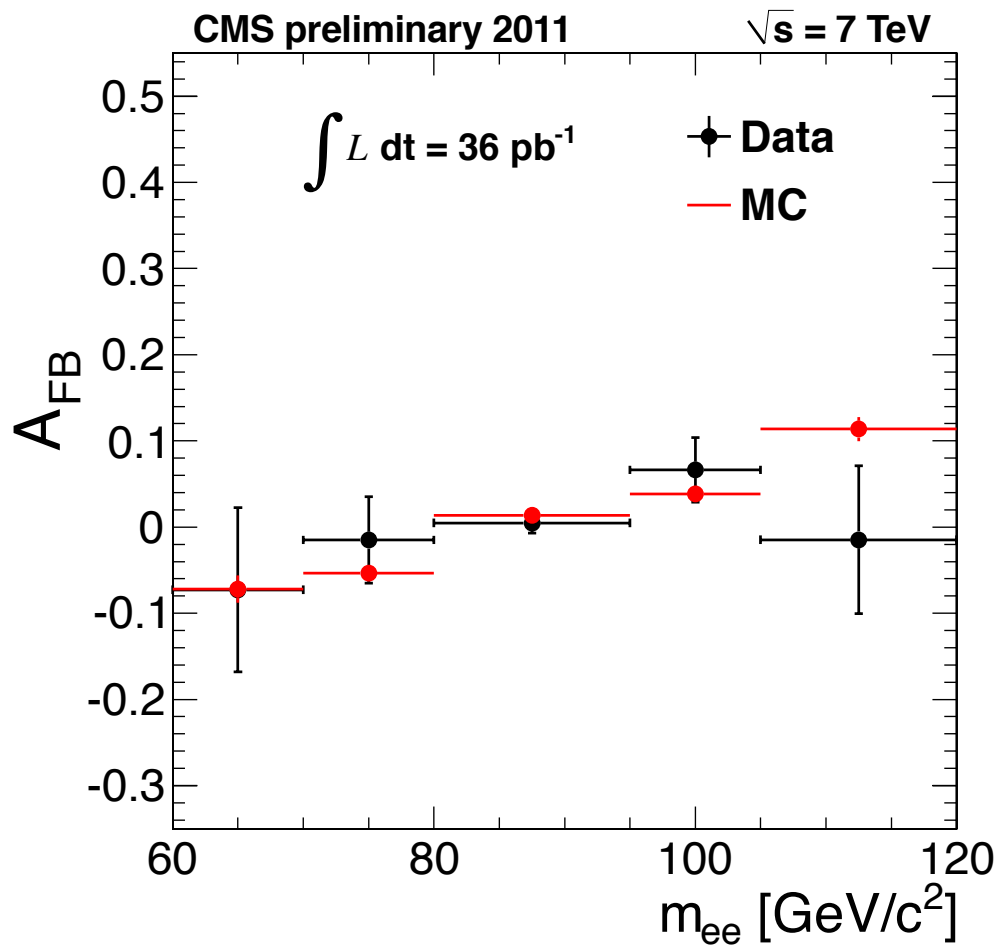
## Collins-Soper frame



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

*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.