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

Kalanand Mishra

Fermilab

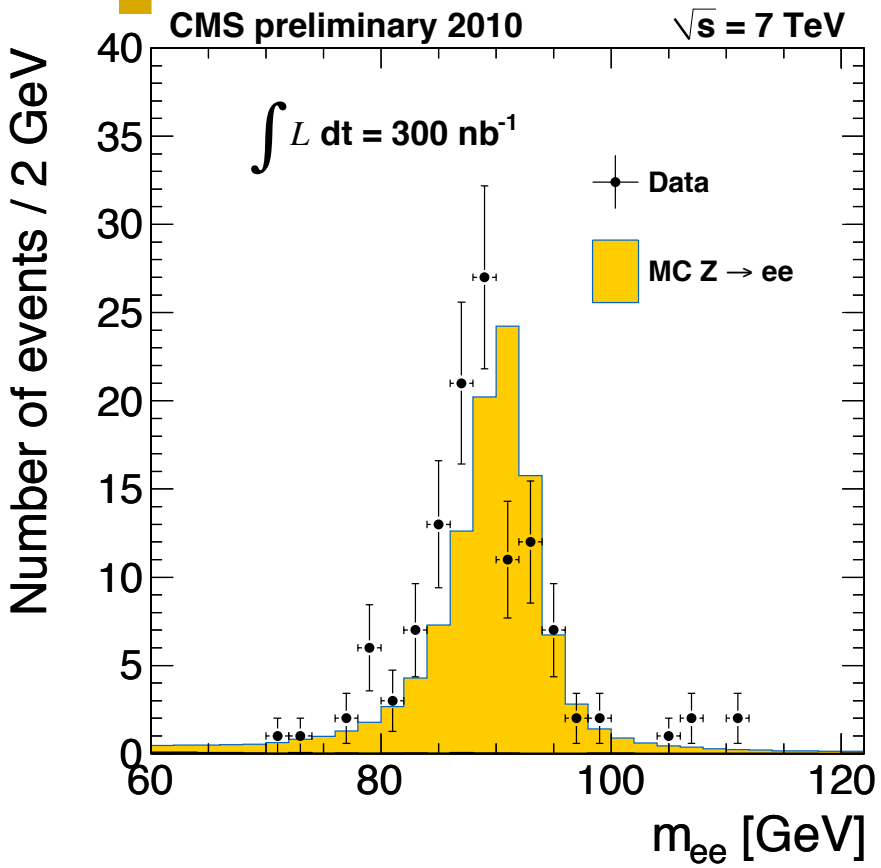
*on behalf of **Z Signal Extraction** team*:

D Bandurin, J Berger, C Broutin, Y Chung, A De Cosa, F Fabozzi, M De Gruttola, V Halyo, J Han, N Heracleous, O Hindrichs, I Kravchenko, C Lazaridis, L Lista, M Makouski, K Mishra, P Paganini, D Piccolo, D Piparo, R Rodrigues, Y Roh, A Schorlemmer, E Sudano, K Sung, J Werner, S Xie, A Zabi, M Zeise

VBTF meeting

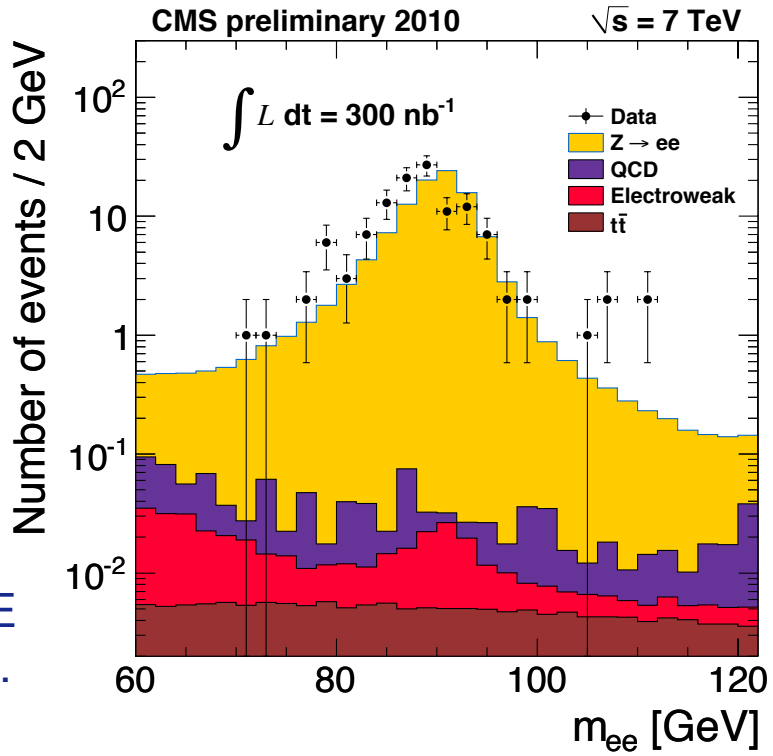
(August 6, 2010)

Z→ee snapshot at 300 nb^{-1}



Overall count:

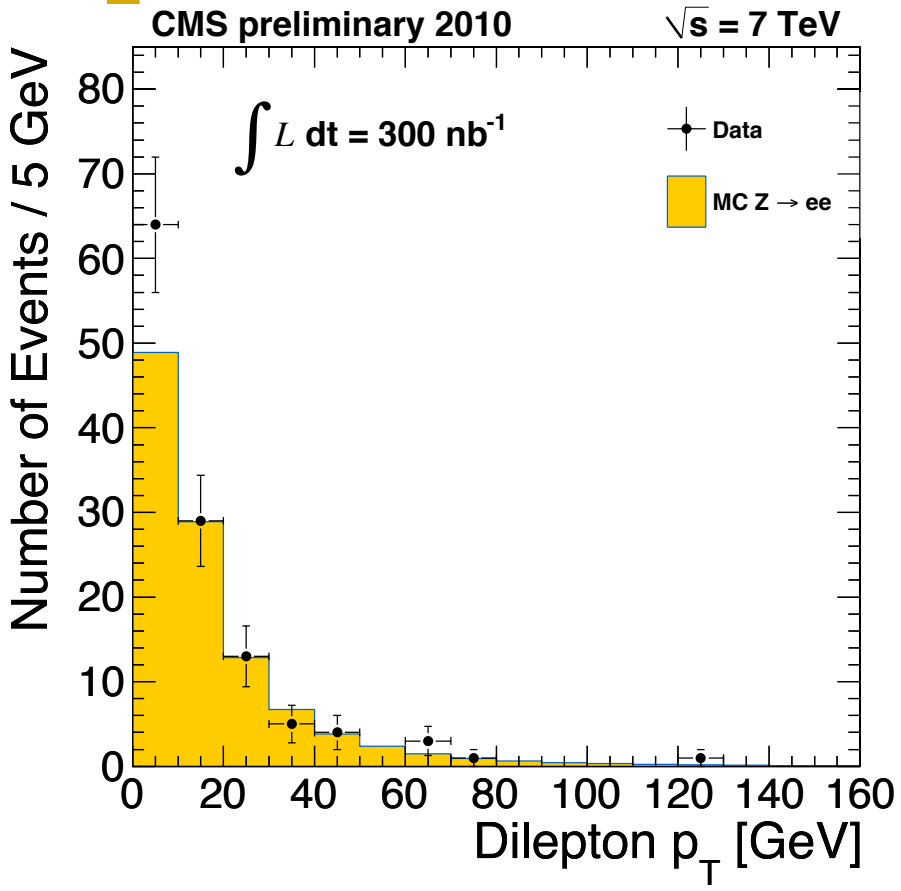
- Using latest JSON good run list of Aug 4.
- We have 121 golden Z→ee candidates.
- 64 BB, 49 BE, 8 EE combinations.

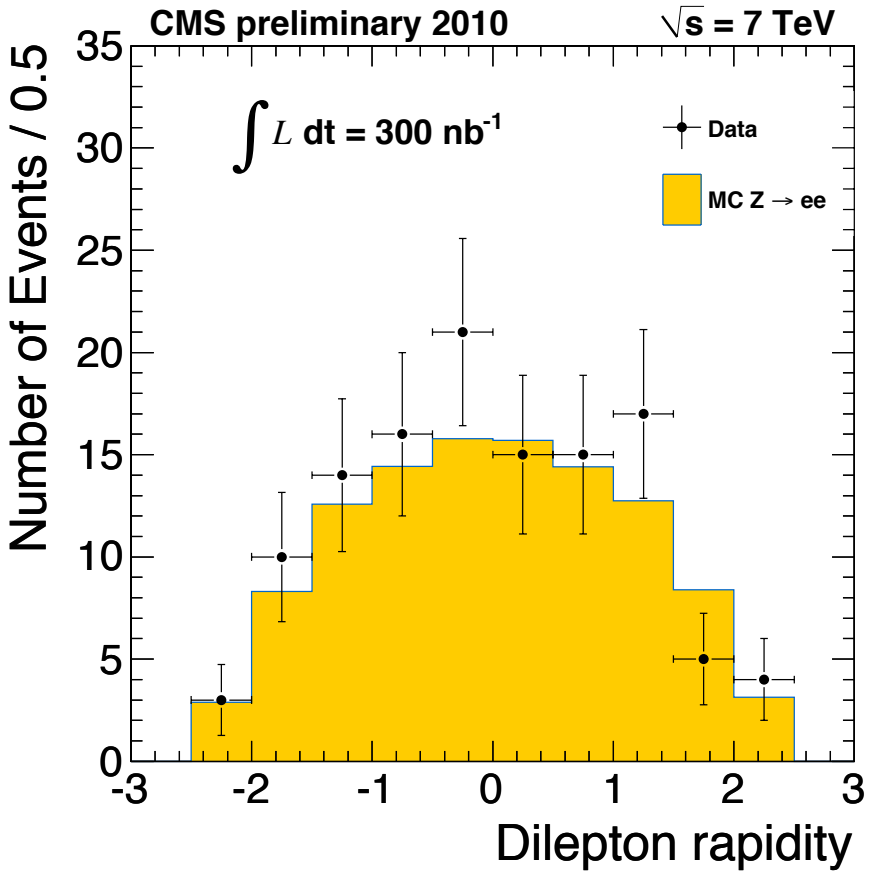


✦Expect about 52% BB, 40% BE, and 8% EE events. So far consistent with the expectation.

✦Consistently observe about 2% downward shift in Z peak position.

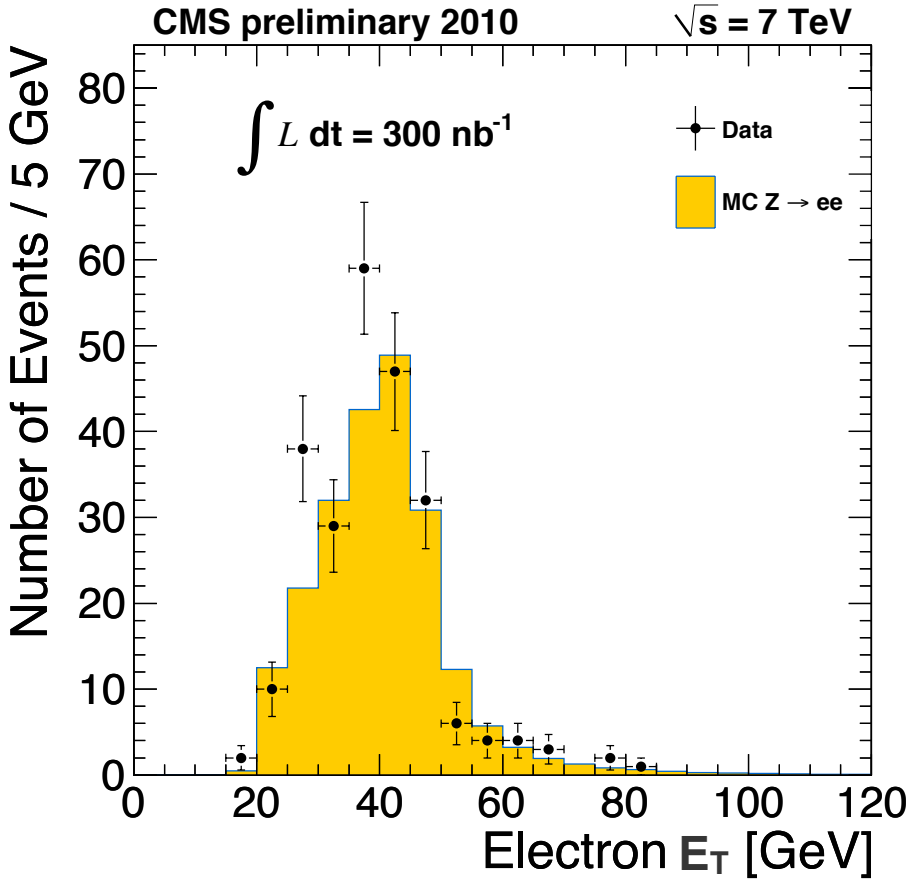
Z p_T and rapidity

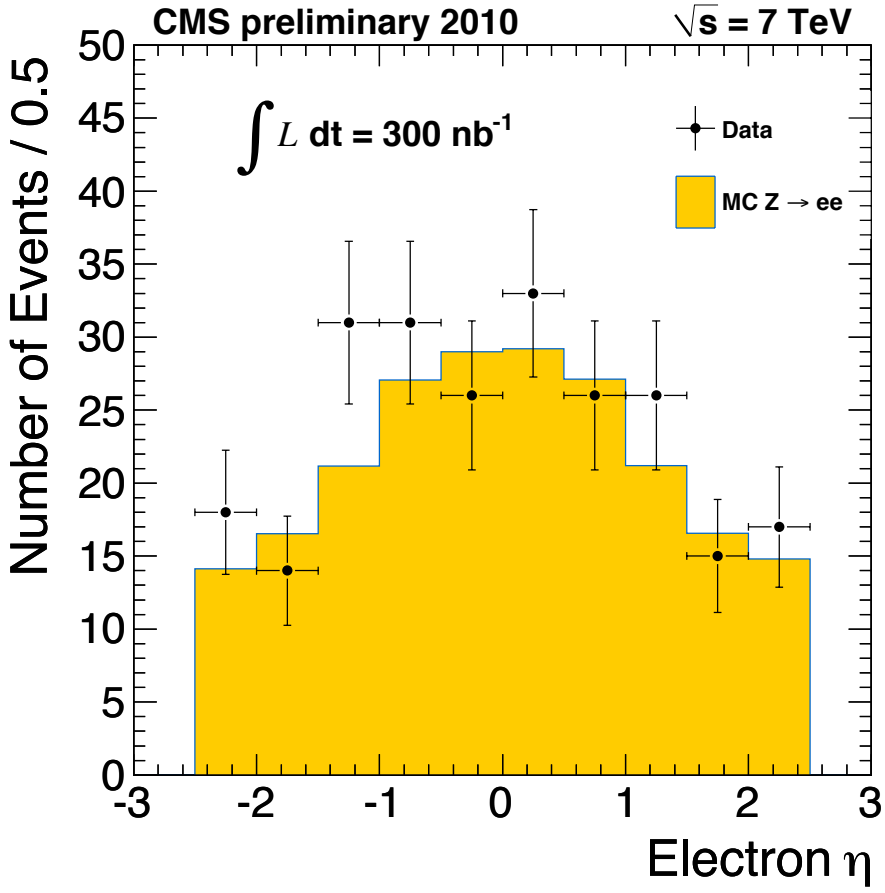




- Distributions look very similar to NLO prediction.
- Some disagreement in the lowest diboson p_T bin: need to compare with MC that does proper resummation at low x.

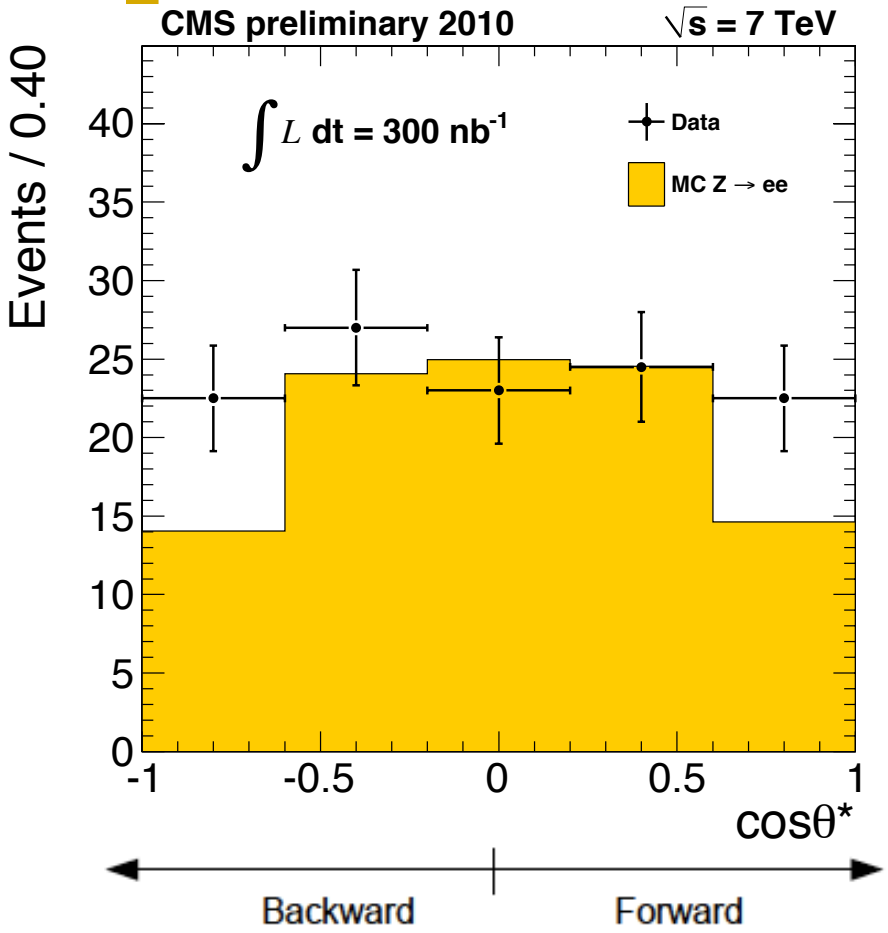
Electron P_T and rapidity



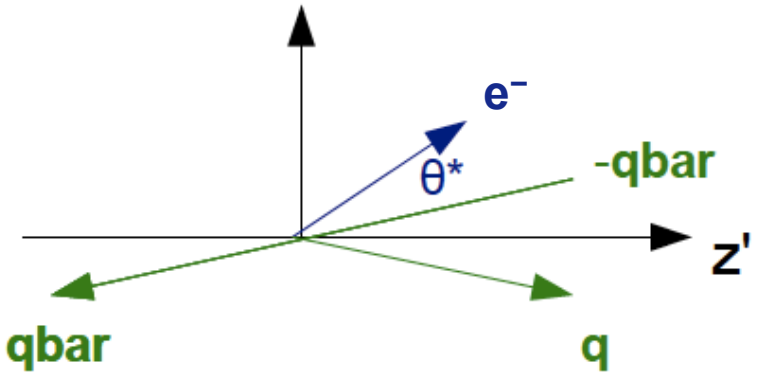


Perhaps indication of a small shift in electron E_T as well.

Z production topology: cosine θ*



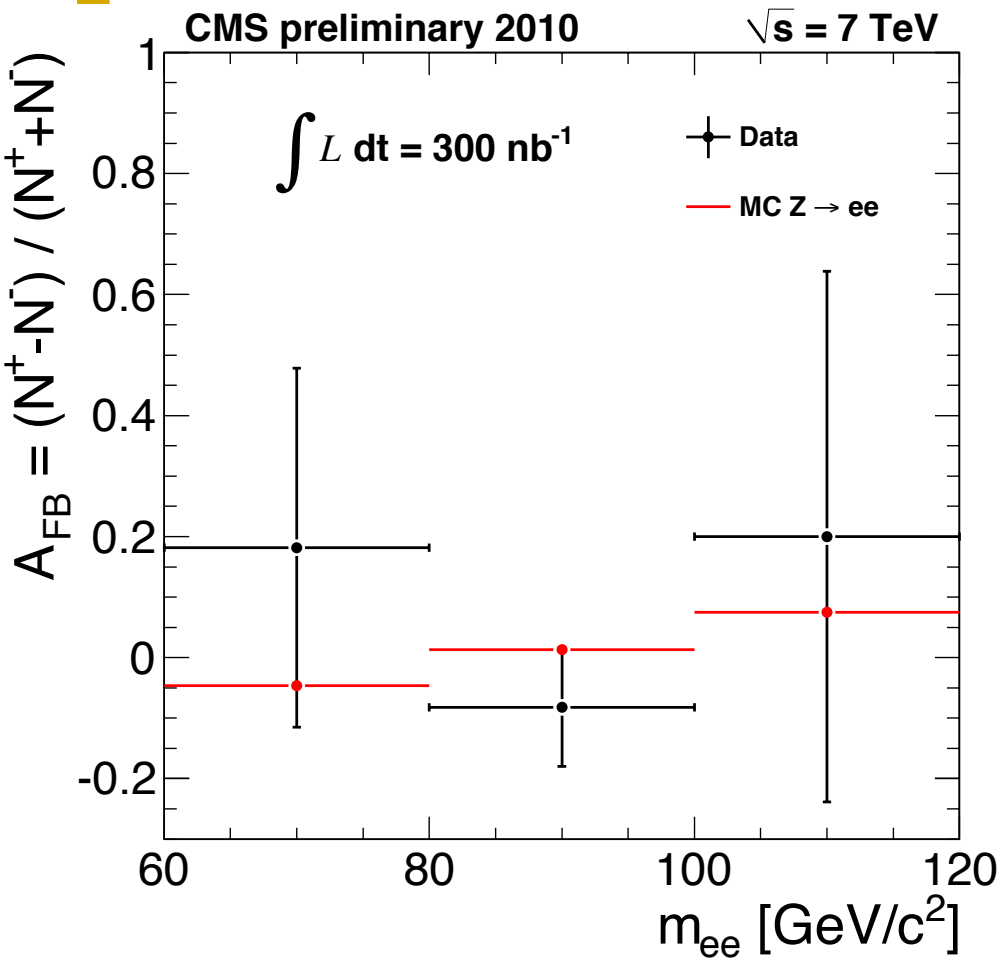
Collins–Soper frame



θ* 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 (cosΘ*>0)
- **Backward** events (cosΘ*<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.

Z→ee cross section using ∫L = 300 nb^{-1}

$N_{selected}$	121 ± 11
N_{bkgd}	1.1 ± 0.2 (from MC)
ε Acceptance Integrated Luminosity	0.8671 ± 0.0023 (MC stat.) ± 0.0867 (syst.) 0.4357 ± 0.0010 (MC stat.) ± 0.0131 (syst.) 0.300 ± 0.033 pb^{-1} (syst.)
$\sigma_{\gamma^*Z} \times BR(\gamma^*Z \to e^+e^-)$	1057.8 ± 97.0 (stat.) + 61.4 (syst.) + 116.6 (lumi.)
Theoretical prediction	LO: 740 pb, NLO: 911 pb ($60 < m_Z < 120$ GeV) LO: 1300 pb ($m_Z > 20$ GeV), NLO: 1607 pb ($m_Z > 20$ GeV)

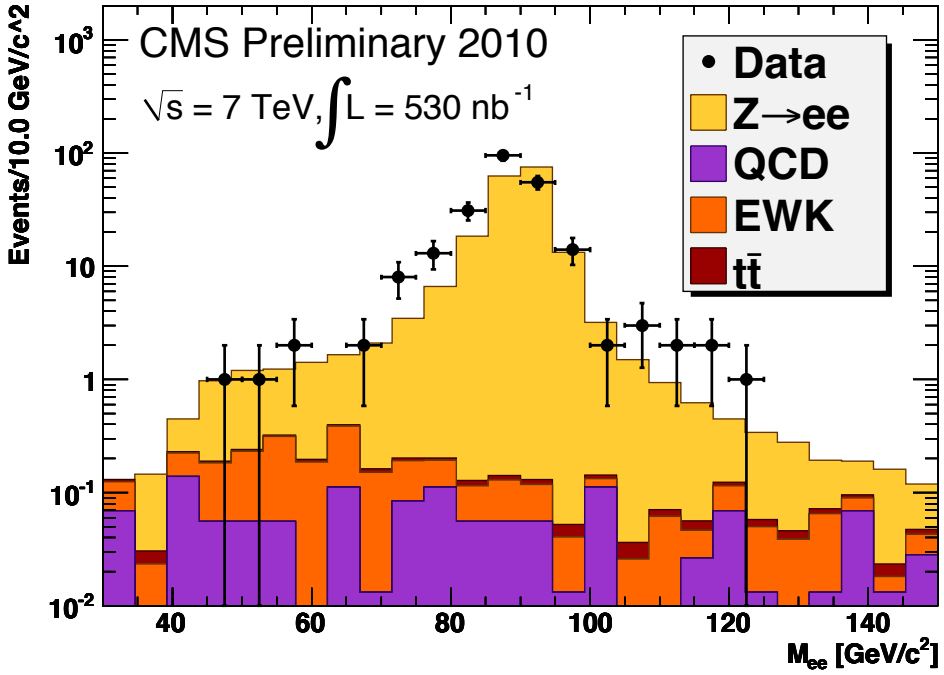
Acceptance = 44%
Efficiency = 87 %
Cross section = 1058 ± 97 pb
NLO prediction = 911 pb

from MC

our result

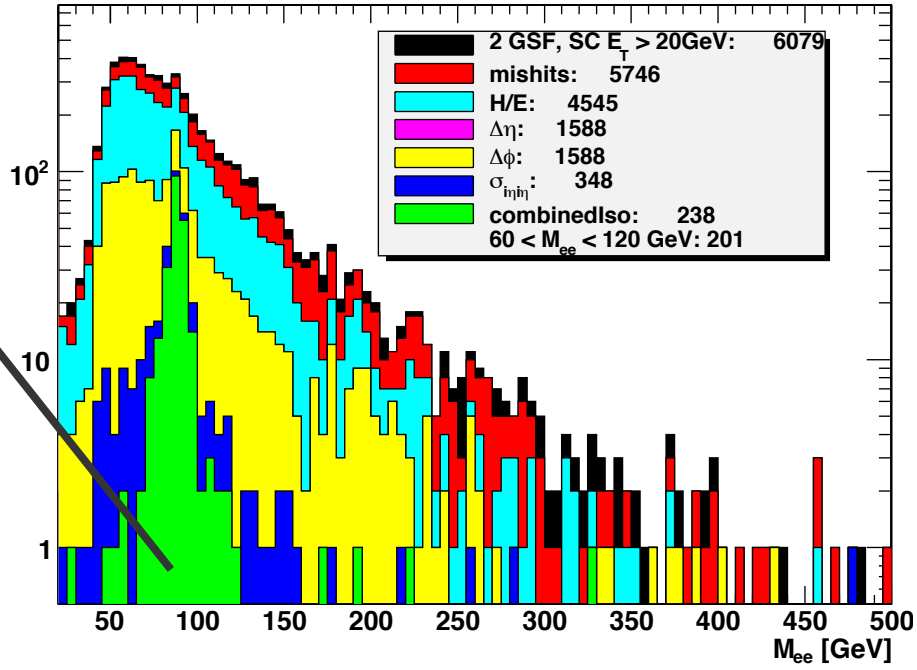
We have been working on several data-driven background methods. Jeremy Werner will give an update today on two such methods.

Update with 500 nb^{-1} data



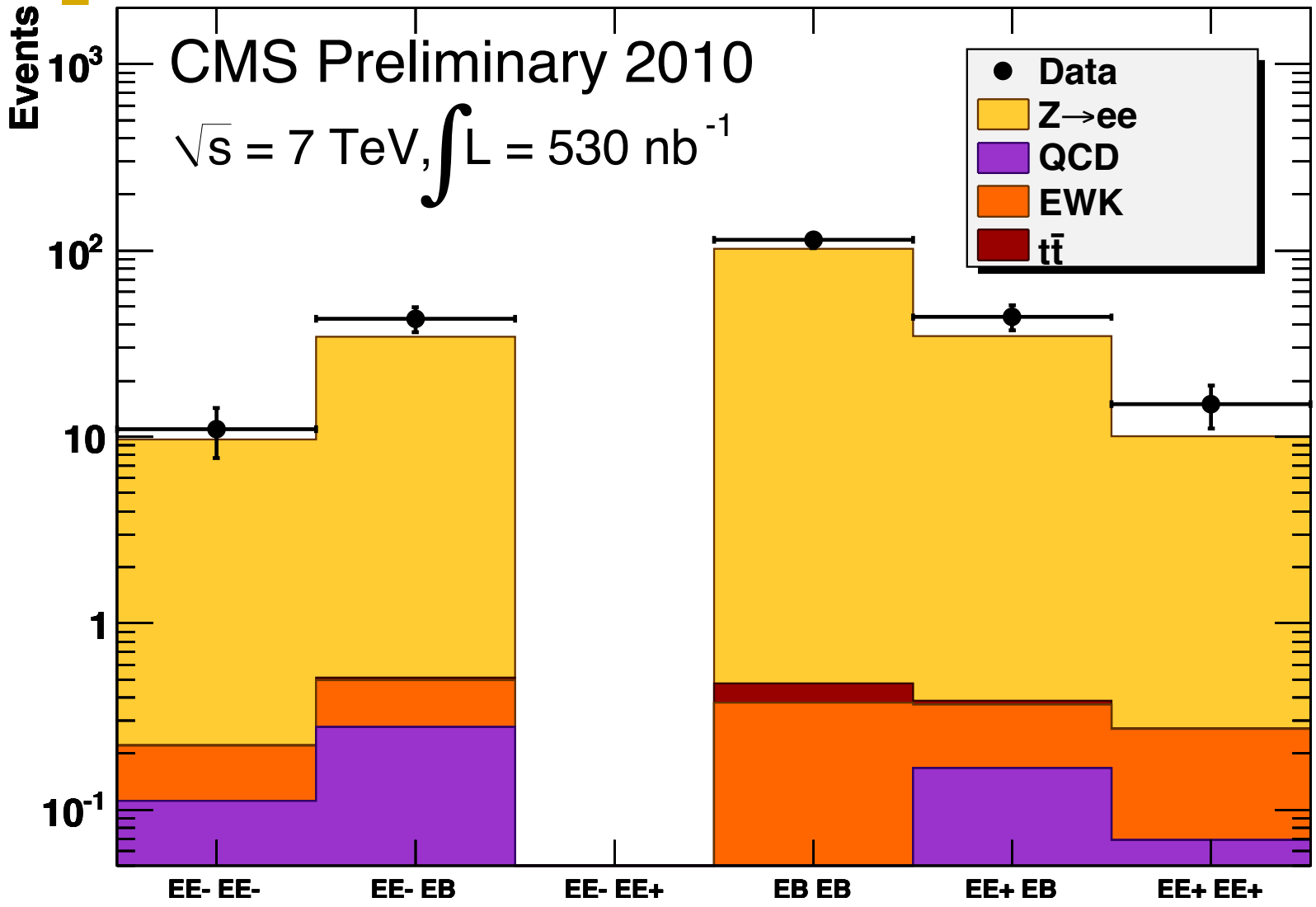
•About 200 golden Z→ee candidates.

Dielectron mass after successive cuts

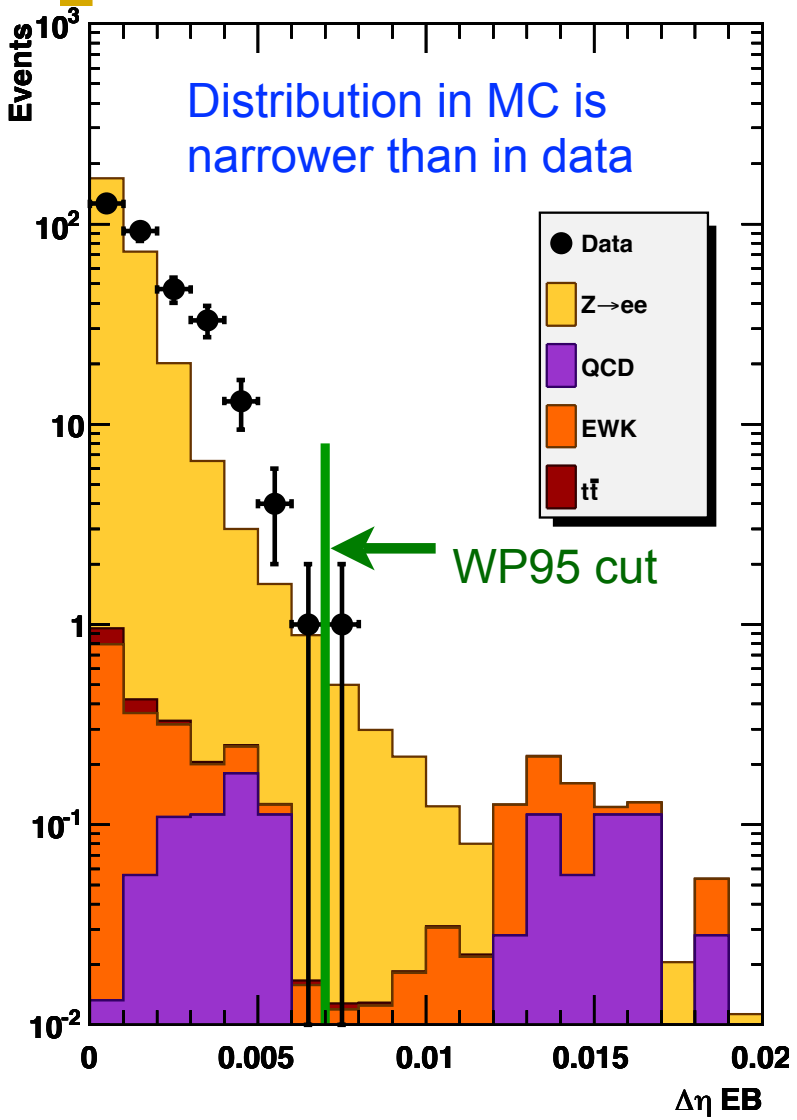


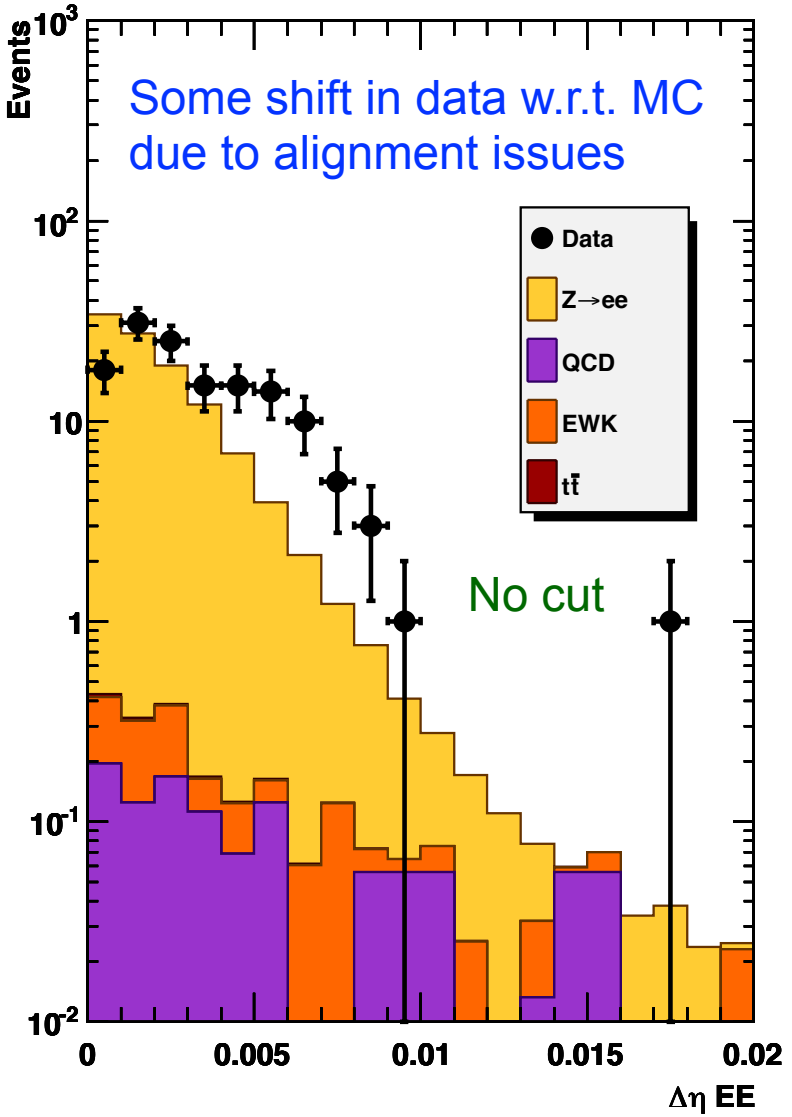
So far, we have got 4 high mass dielectron events with m_{ee}>150 GeV and both electrons passing WP95 selection. The highest mass dielectron candidate has m_{ee}=330 GeV.

Z→ee events by their location in the detector

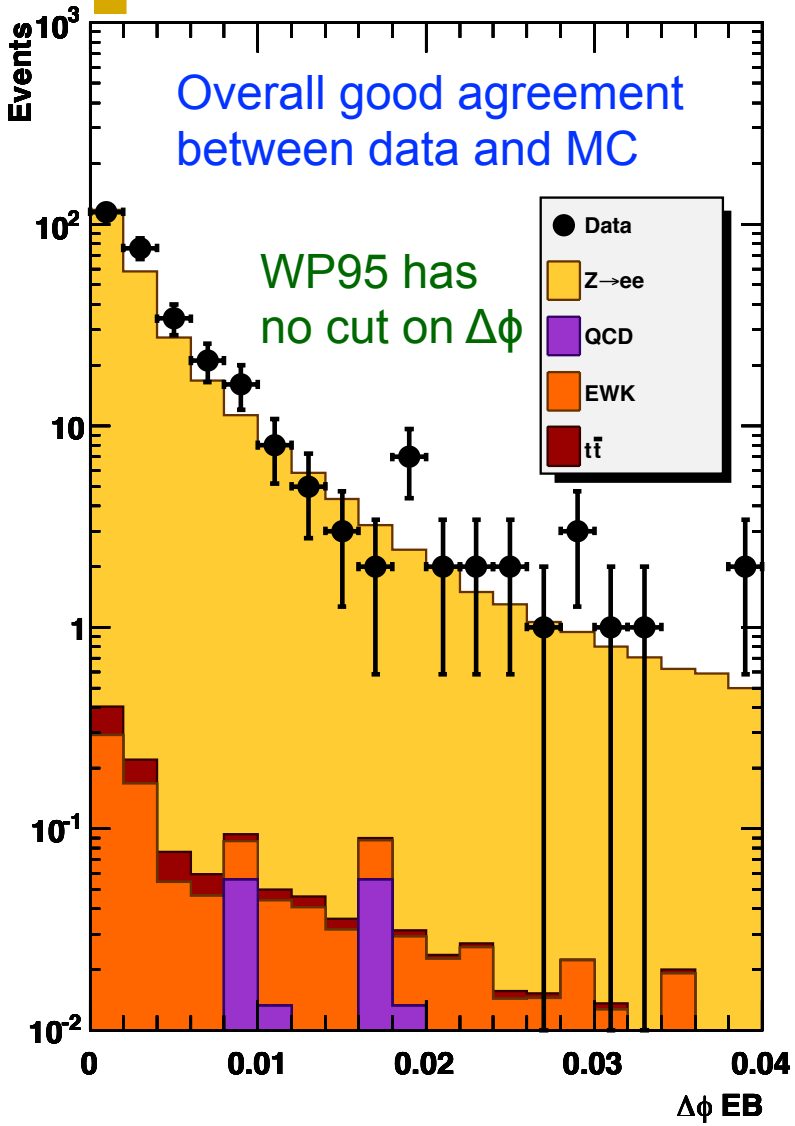


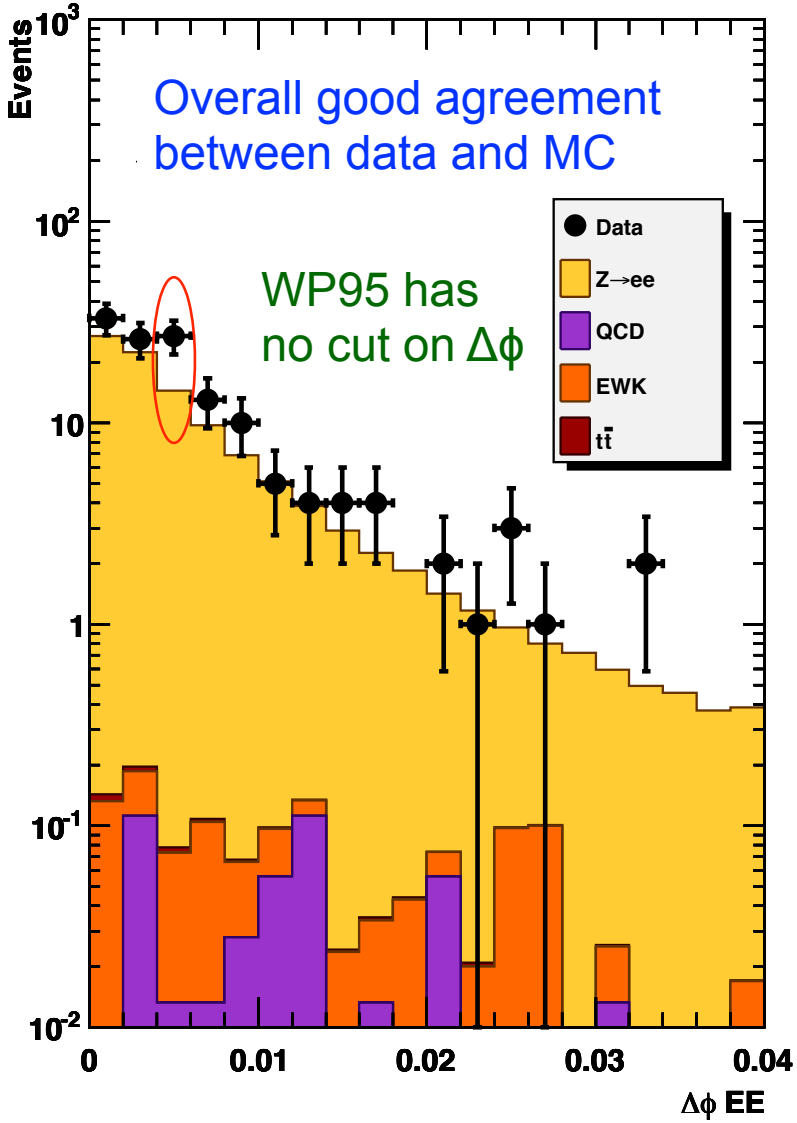
Electron performance plots: Id : Δη



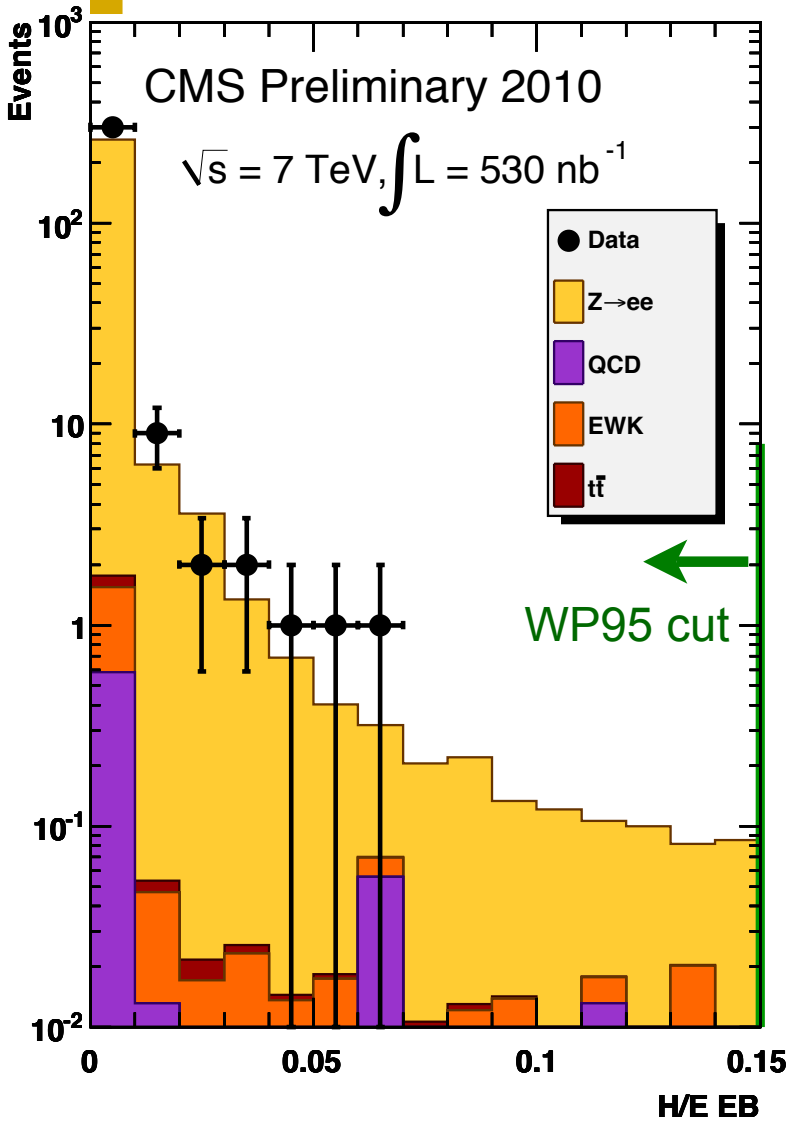


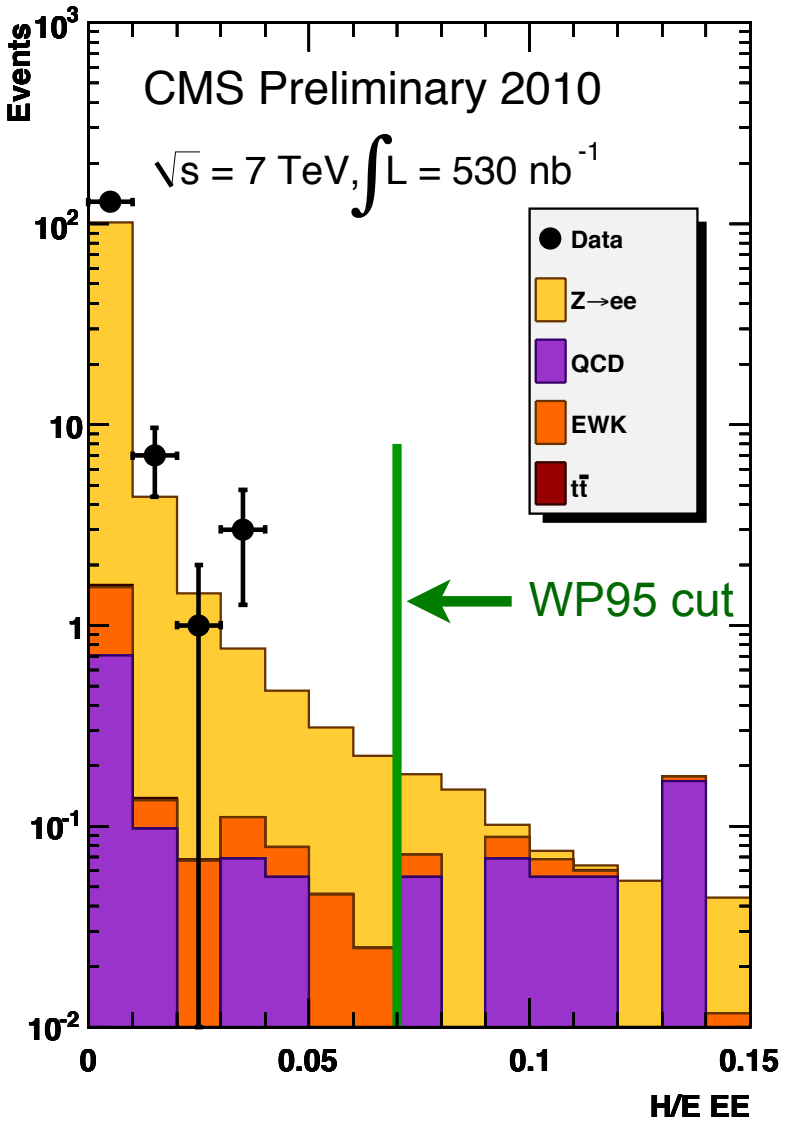
Electron performance plots: Id : Δϕ



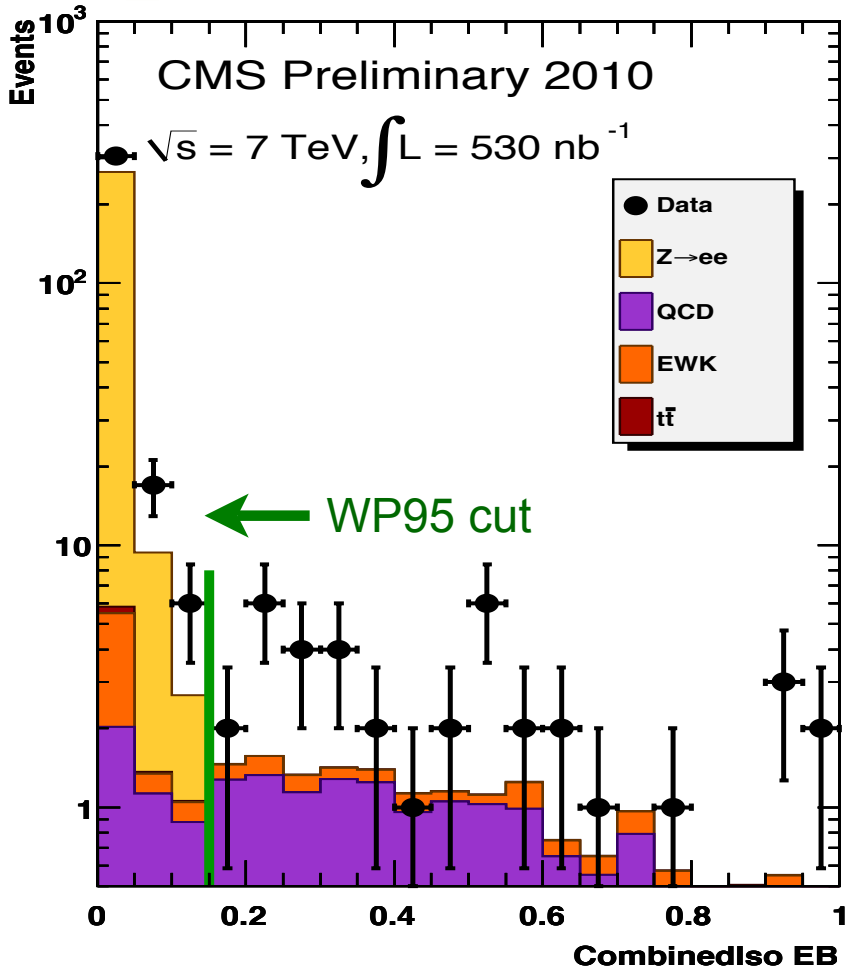


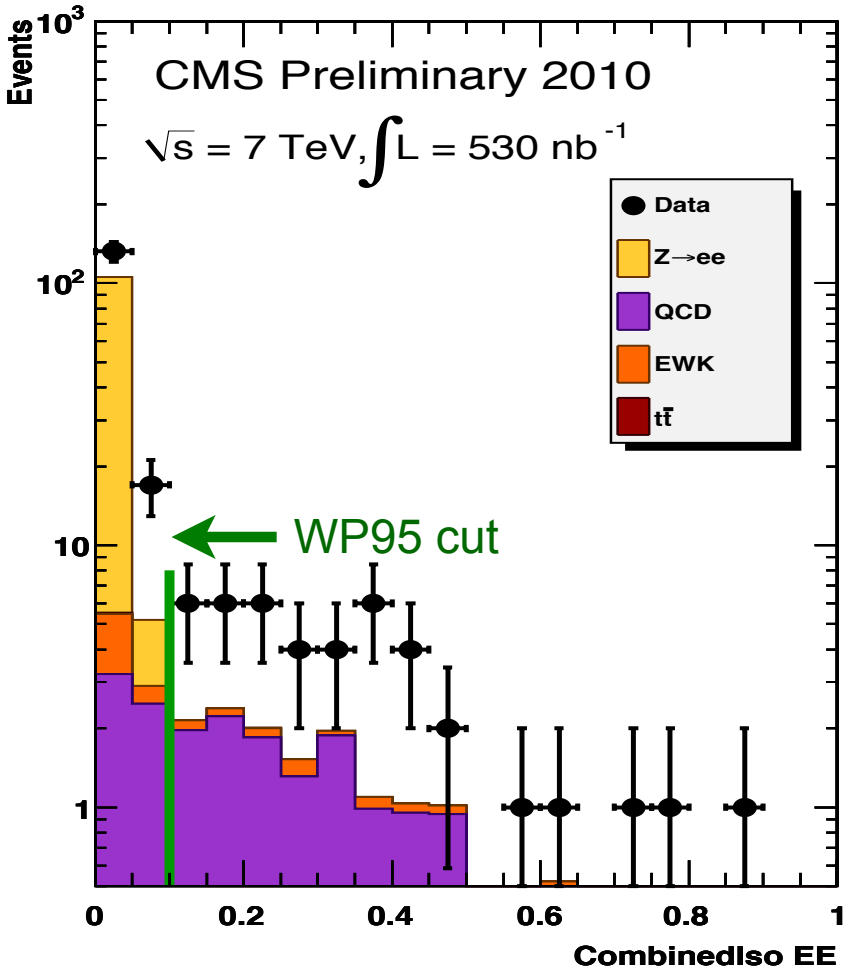
Electron performance plots: Id : H/E





Electron performance plots: isolation





WP95 cuts still look reasonable; perhaps they can be optimized using data now.

Electron performance plots: shower shape