



The  
University  
Of  
Sheffield.



# Status Report

Dimitris Kyriazopoulos

“Diboson”-Thalis meeting  
Chios, 27/4/2013



European Union  
European Social Fund



MINISTRY OF EDUCATION, LIFELONG LEARNING AND RELIGIOUS AFFAIRS  
MANAGING AUTHORITY



EUROPEAN SOCIAL FUND

Co-financed by Greece and the European Union



# Profile

- 1<sup>st</sup> year PhD student
- Joint PhD, University of Sheffield & ATh
- ATLAS
- Supervisors:  
Stathes Paganis & Chara Petridou



# Activities

- Participated in ATLAS diboson analyses towards Moriond 2013
  - Standard Model  $ZZ \rightarrow 4$  leptons (talk by S. Chouridou)
  - Standard Model  $WZ \rightarrow 3$  leptons + 1 neutrino (talk by K. Bachas)
- Currently working:
  - Investigation of  $ZZ$  High Mass events (probe for New Physics)  
( $pp \rightarrow ZZ \rightarrow 4l$  &  $H \rightarrow ZZ \rightarrow 4l$ )
  - Final State Radiation corrections in  $ZZ \rightarrow 4l$
  - Scale Factors for High Eta Muons (service task)



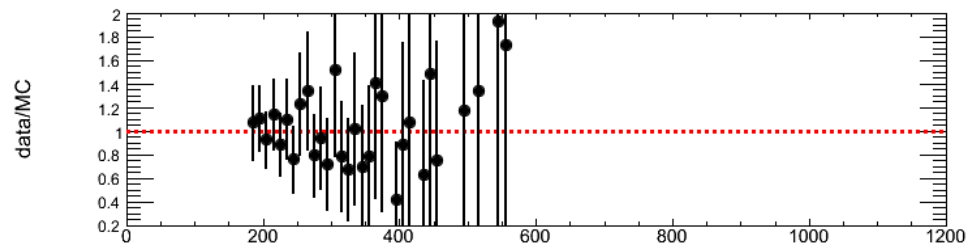
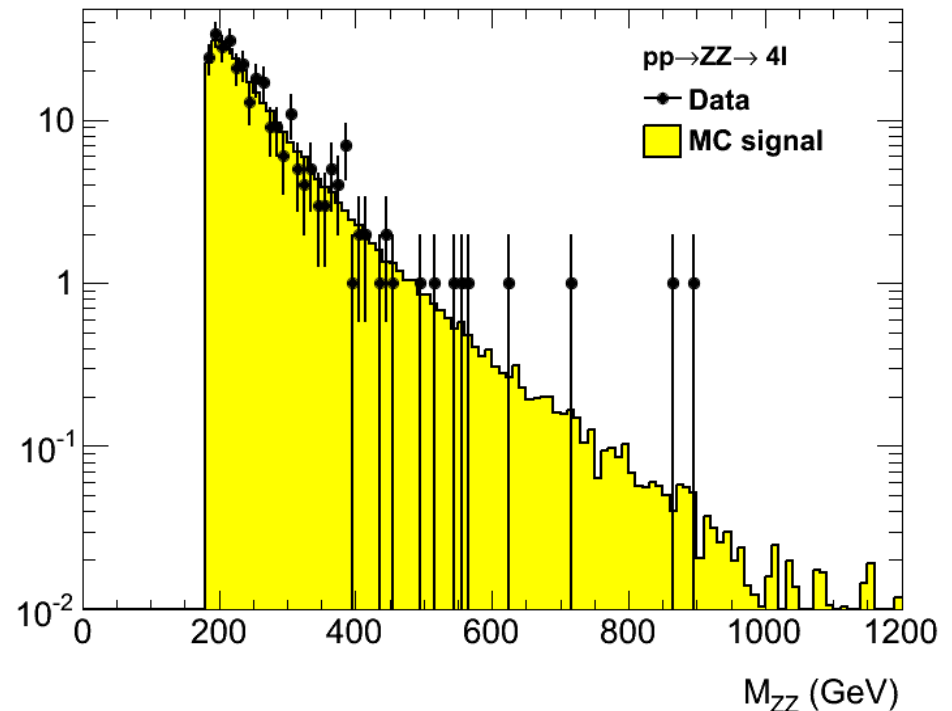
# Status – High Mass ZZ

- ZZ High Mass ( $M_{4l} > 180$ ) is a region of very high purity
  - No background contribution (small bkg from Z+jets around 180-200 GeV)
  - Very clear, well reconstructed events
  - Any outliers from the MC prediction are direct probe for New Physics
- ZZ + jets production could be associated with Vector Boson Fusion exotic resonance
- Effect of Double Parton Scattering in ZZ production



# ZZ high Mass events

- Clear events above 600 GeV
- Probable outliers around 350 GeV (limited statistics)
- MC Normalization → M4I control region

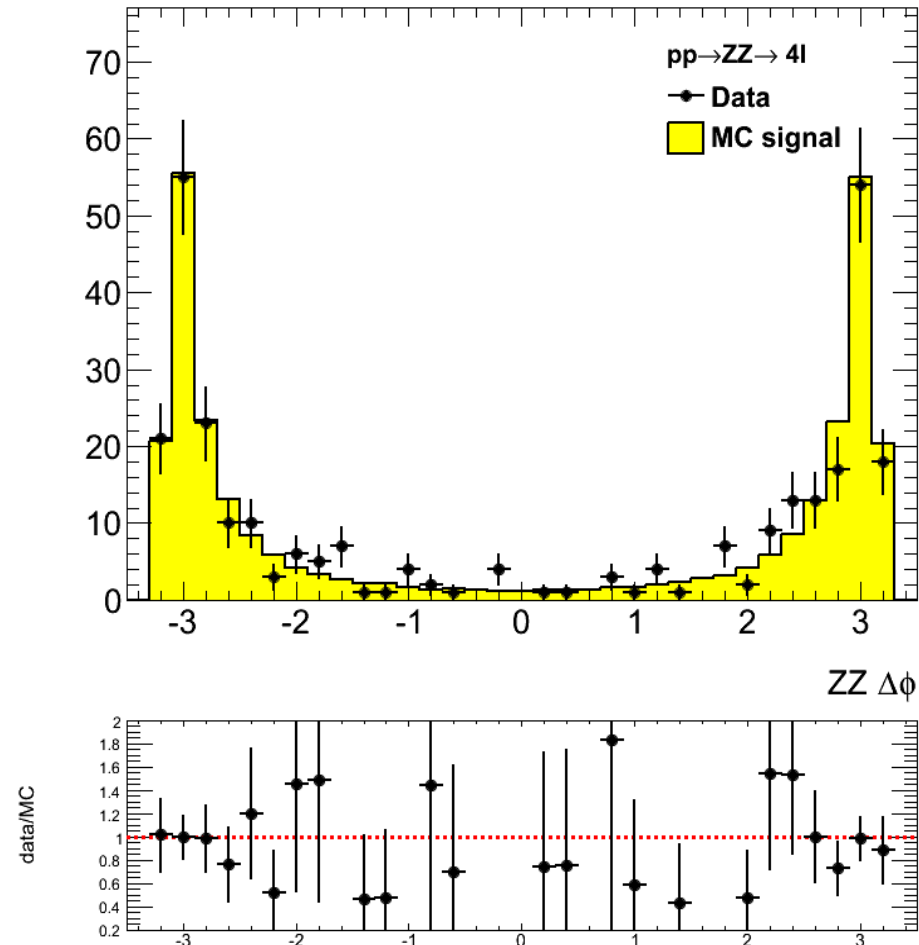




# ZZ high Mass events

- Topology of ZZ events indicates clearly their origin
- DATA/MC agreement → ZZ back-to-back
- DPS predicts flat distribution of ZZ system
- Note for  $20 \text{ fb}^{-1}$  0.4 DPS ZZ events expected

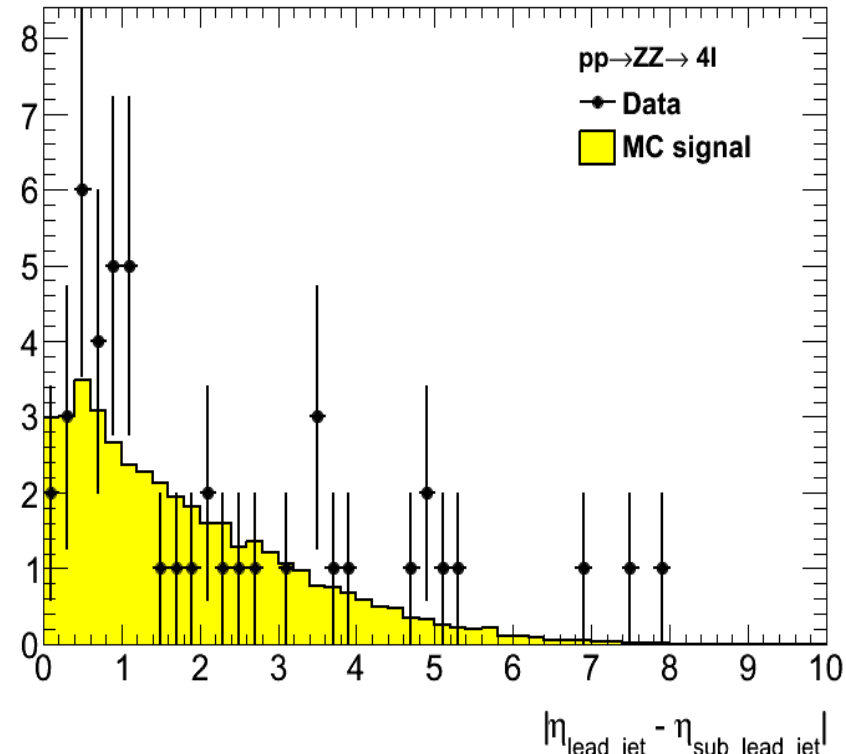
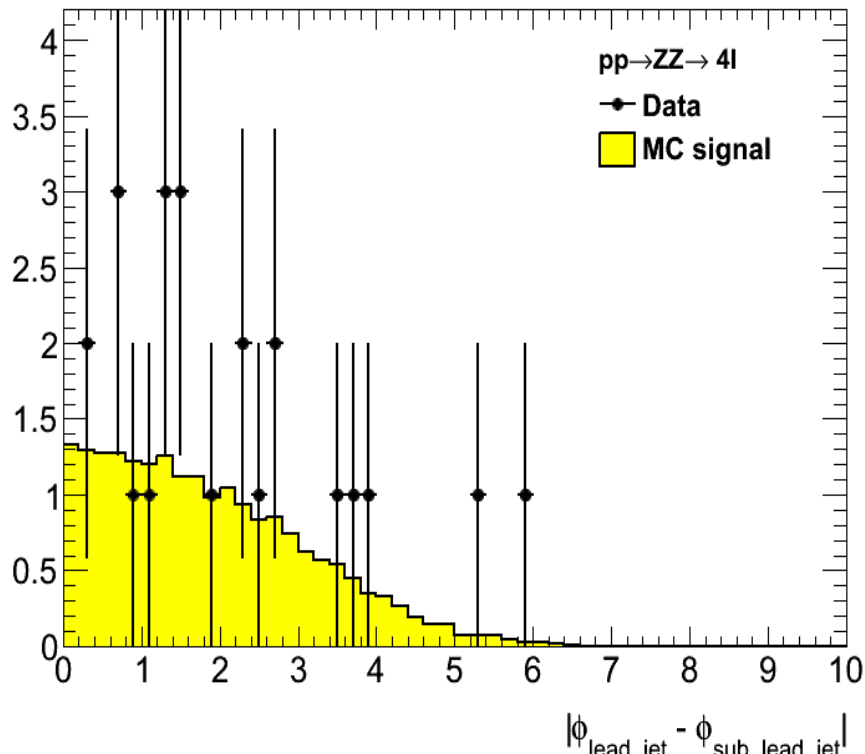
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# Studies for VBF

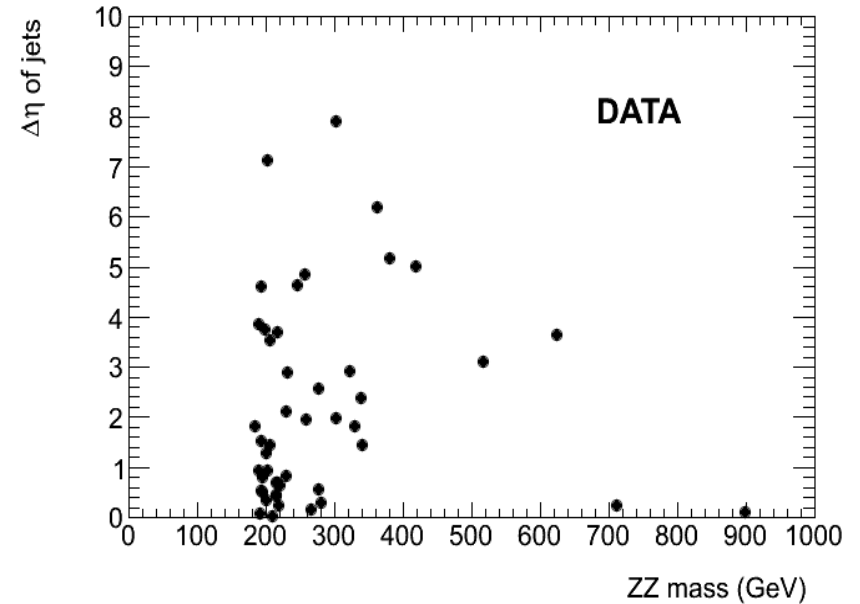
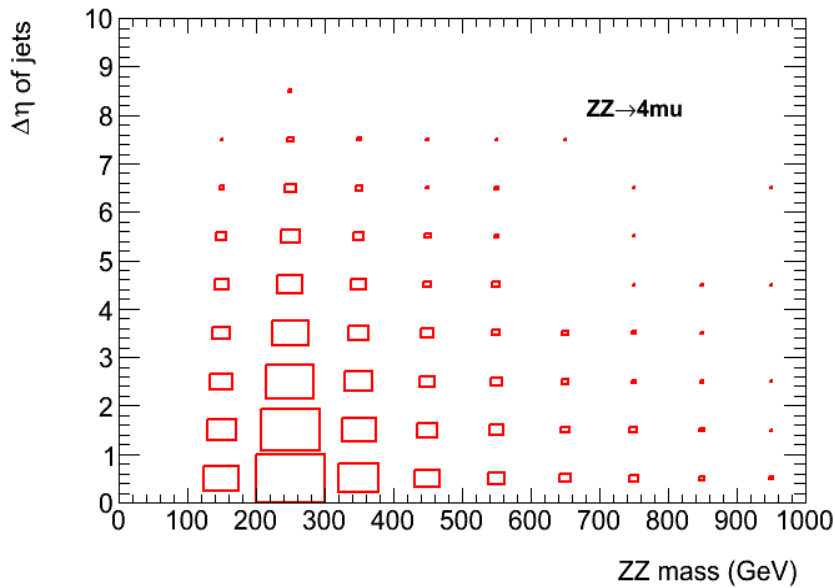
- An associated jets production (ZZ+jets) through VBF, implies separation among jets ( $\eta, \phi$ )
- Selection on Jets  $\rightarrow P_t > 25 \text{ GeV}$  &  $dR_{\text{lep\_jet}} > 0.3$
- No significant outliers observed





# Studies for VBF

- Discriminant variables  $\rightarrow$   $d\eta_{\text{jets}}$  vs  $M_{ZZ}$

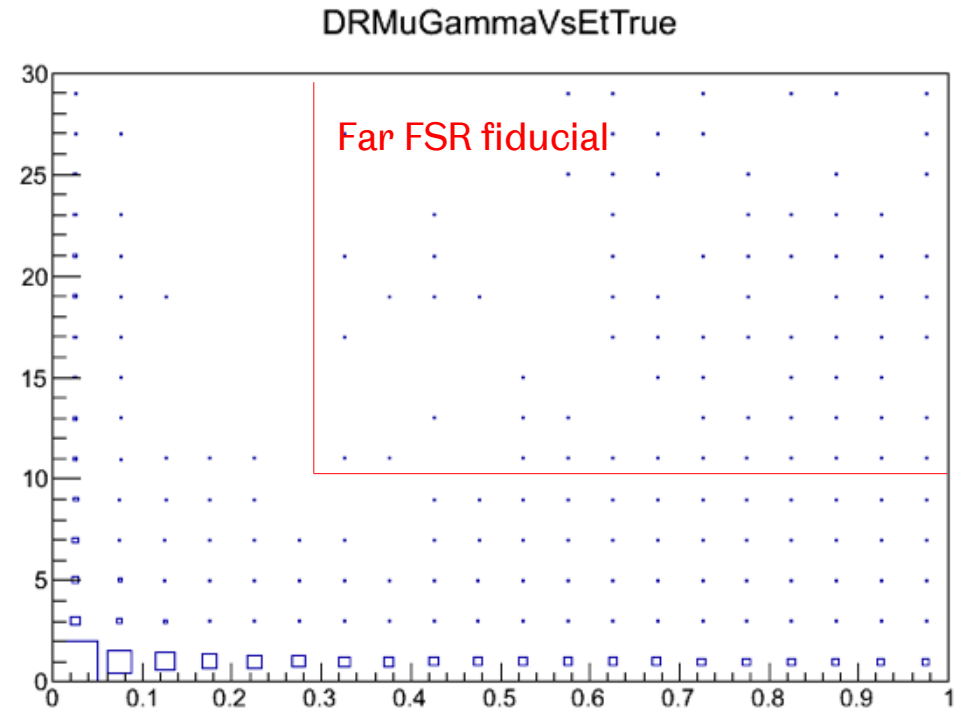






# Final State Radiation

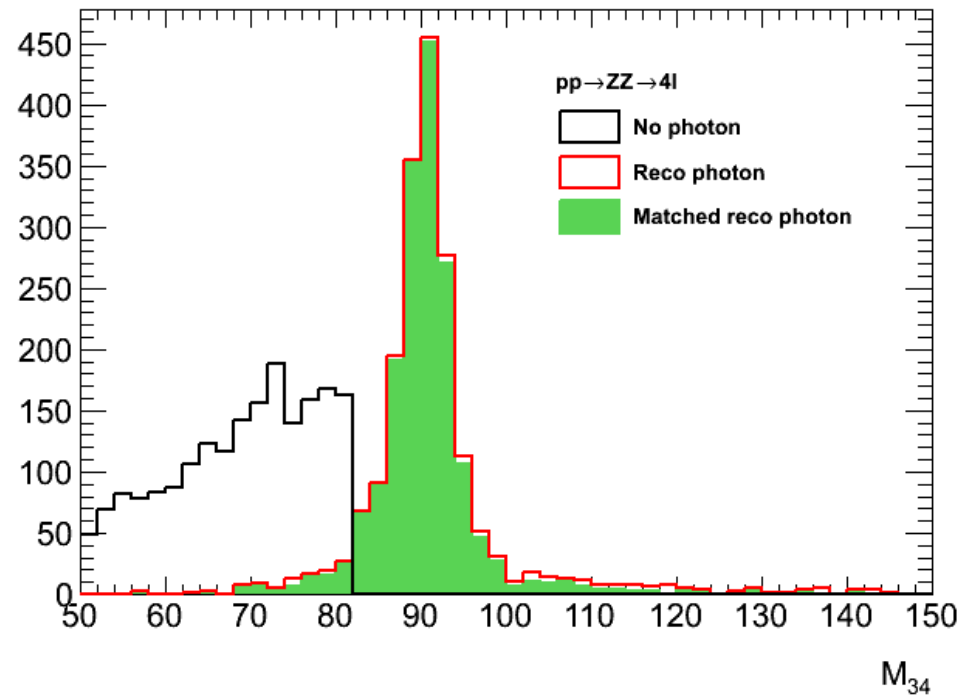
- Extending FSR correction in Z mass by exploiting far FSRs
- Tight cuts on photons may decrease FSR yield
- Towards a “universal” FSR reconstruction procedure-tool





# Final State Radiation

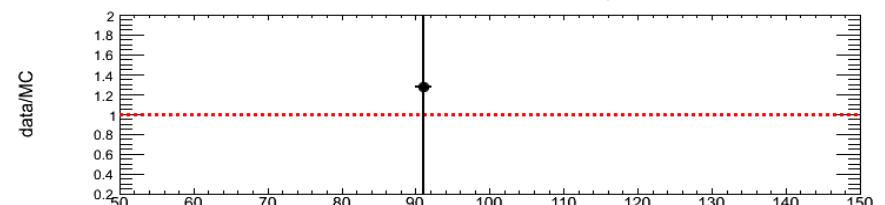
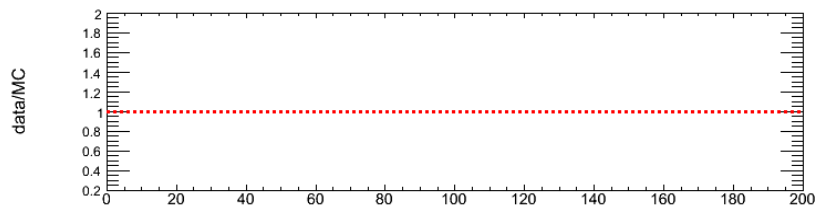
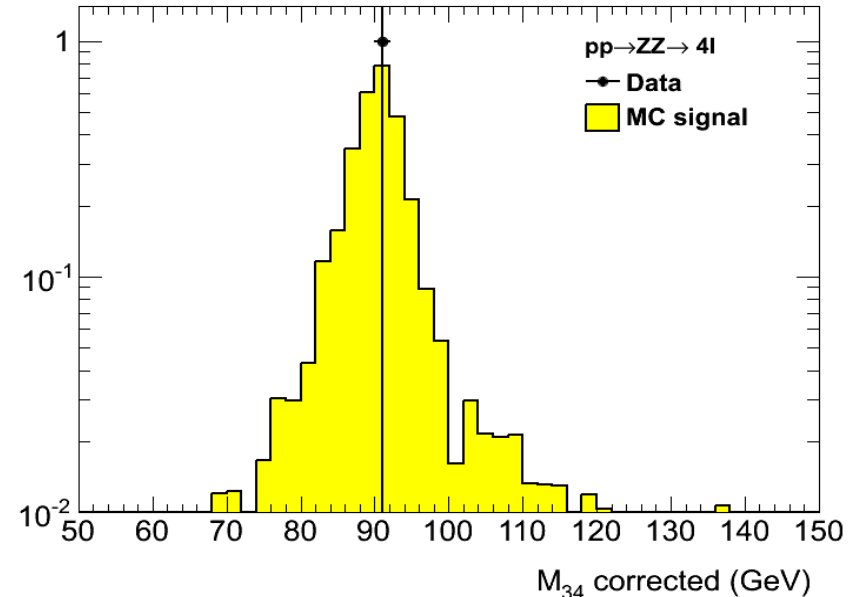
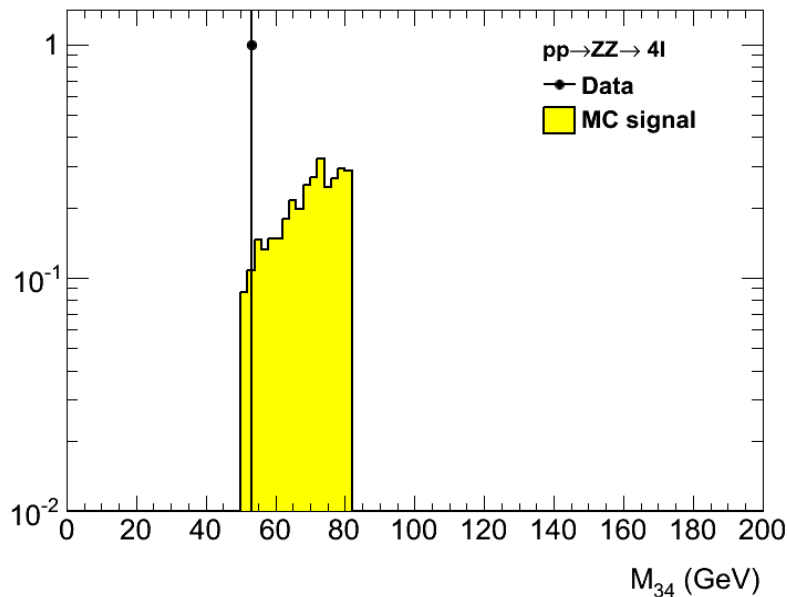
- Selecting far FSRs with  $E_t > 8$  GeV &  $\Delta R(l, \gamma) > 0.3$  and matching them with true FSR (mc\_block) & (mc\_truth\_classifier)
- Final Purity > 90%
- Optimization of cuts under progress ( $E_t / \Delta R$  cut, TightPhoton selection vs NeutralNet selection)





# Final State Radiation

- One event on 2012 data with far FSR found and properly corrected
- Modification on selection/cuts would give higher yields





# Scale Factors for High eta muons

- Extend technique in 2012 data used by Muon Combined Performance group on 2011
- Expect similar muon behaviour between  $2.2 < |\eta| < 2.5$  and  $|\eta| > 2.5$   
Correlate muon behaviour in those areas to extract SFs
- Using “tag and probe” method
  - “Tag” → “good” Combined Muon in central region
  - “Probe” → muon in  $|\eta| > 2.2$
- Results to presented within MCP soon



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Thank you!