A Look at p14 Electrons

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Outline

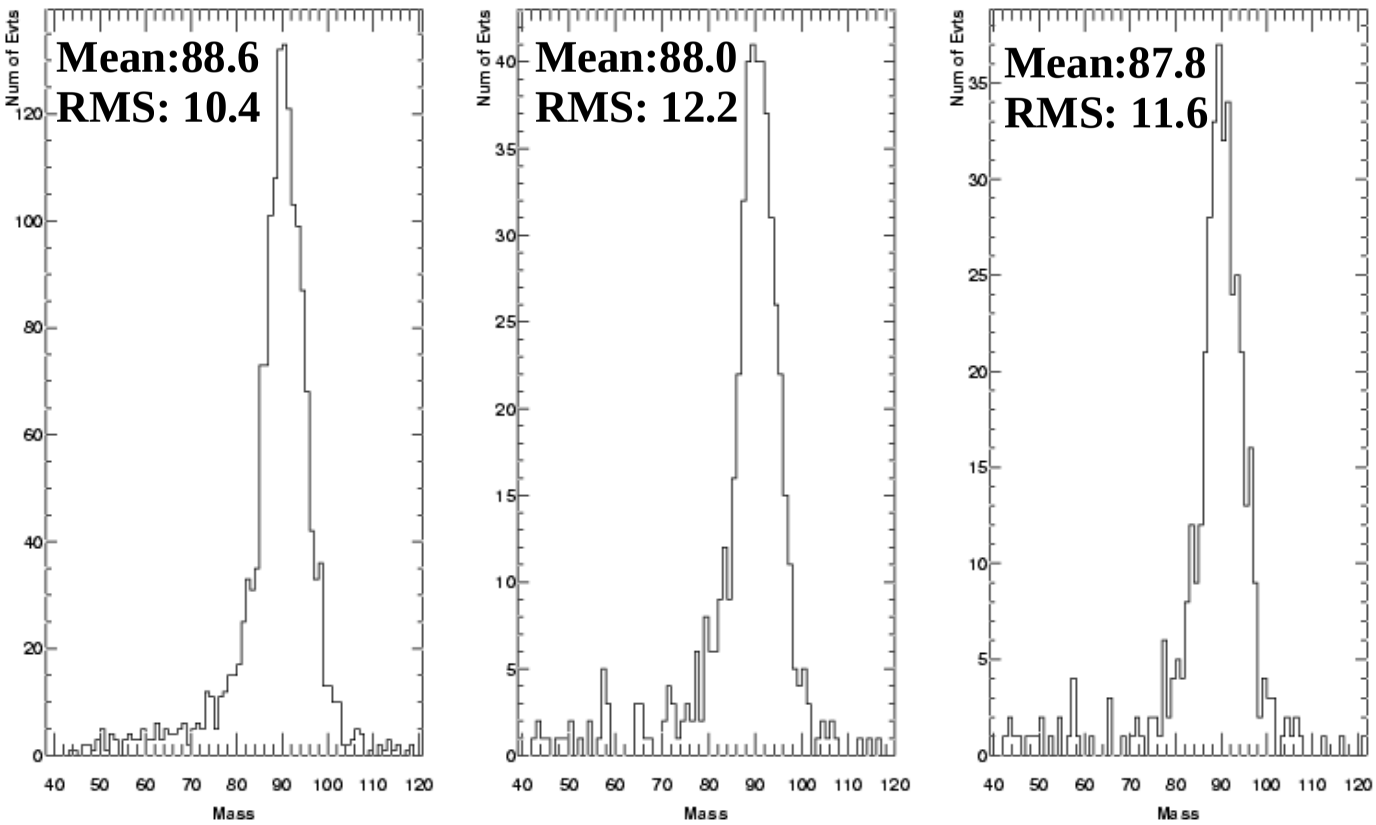
- **Dataset**
- **Z mass comparison**
- **Likelihood**
- **Tracking Efficiency**
- **Fake rates**

Dataset

- **p14.03.00 and p14.03.01 data**
- **DiEM triggers:**
  - **2EM_HI (<v12)**
  - **Ex_2L20, Ex_2L15_SH15 x=1,2,3**
    - **Level 1:**
      - **(x=1) CEM(1,11)**
      - **(x=2) CEM(2,6)**
      - **(x=3) CEM(2,3)CEM(1,9)**
    - **Level 3:**
      - **2L20: 2 ems pt > 20 GeV passing ELE_NLV.**
      - **2L15_SH15: 2 ems pt > 15 GeV passing ELE_NLV, 1 em pt > 15 GeV passing ELE_NLV_SH.**

Z Mass

- **Compare Z peaks using p13 with lhood (left), p14 with trk match (center), p14 with lhood(right) (CC and standard emf, iso, hmx cuts)**

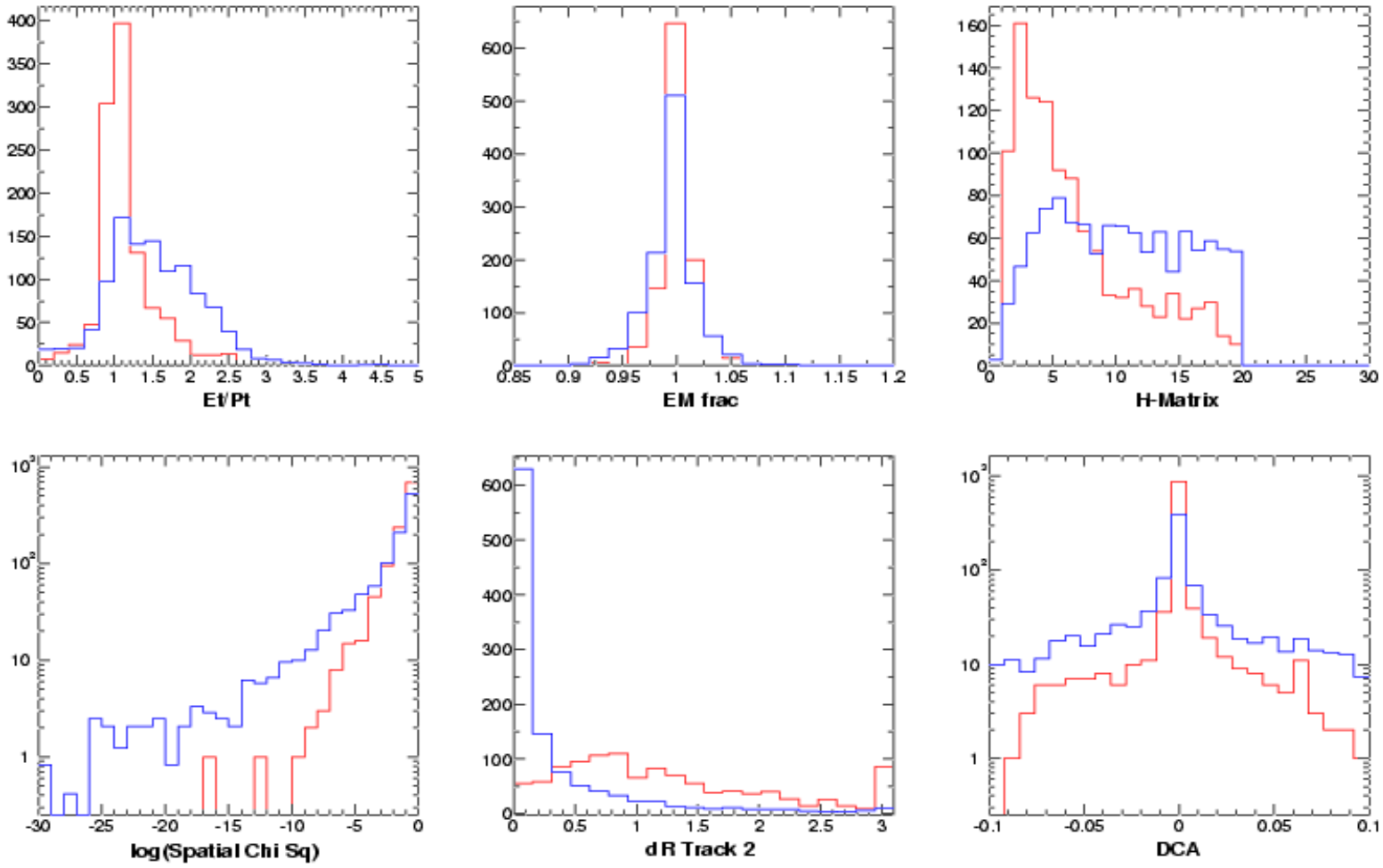


Likelihood Variables in p14

- **Signal and background defined as in the likelihood note (#4184) by Daniel and Lukas.**
  - **Signal:**
    - **2 EM clusters, each with pt>20 GeV, emf>0.9, iso<0.15, hmx8<20, 80<M_{ee}<100 GeV, assoc trk candidate.**
  - **Background:**
    - **Exactly 1 EM cluster with pt>20 GeV, emf>0.9, iso<0.15, hmx8<20, 80<M_{ee}<100 GeV, assoc trk candidate.**
    - **Exactly 1 good jet with pt>15 GeV.**
    - **ΔR(e,jet)>2.5**

Signal to Background Comparison

- **Signal: Red. Background: Blue.**



Comments on the Likelihood

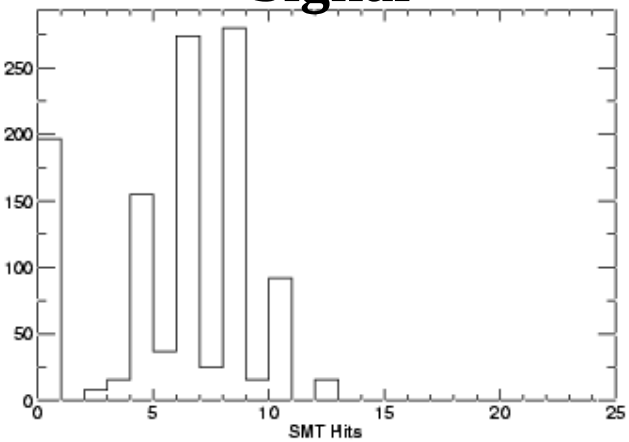
- **Shapes look very similar to the shapes in p13. (See D0 Note referenced earlier.)**
  - **Probably wouldn't expect too much to change?**
- **Need to talk to Daniel and figure out how to tune the likelihood for p14.**
- **Start thinking about other variables to add to the likelihood for even better performance-- # SMT hits, #CFT hits, preshowers (being looked at by Shabnam), ...**
- **Try loosening the hmx8 preselection cut.**
- **Maybe put track and cal isolation into a separtate likelihood.**

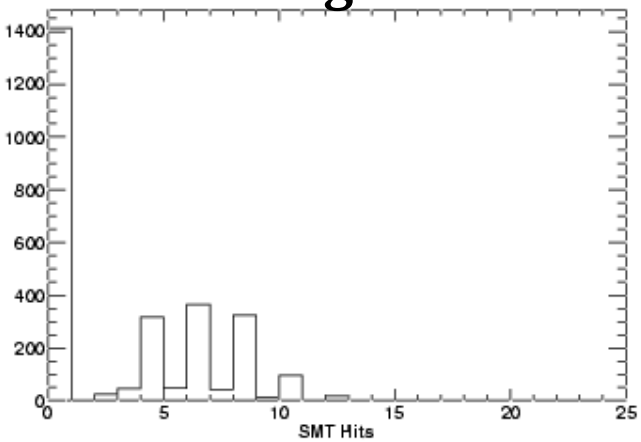
Number of Hits

- **Nhits distributions for signal and background.**

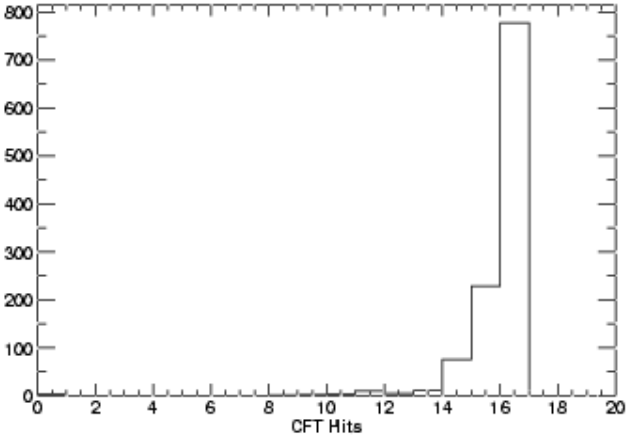
Signal **Background**

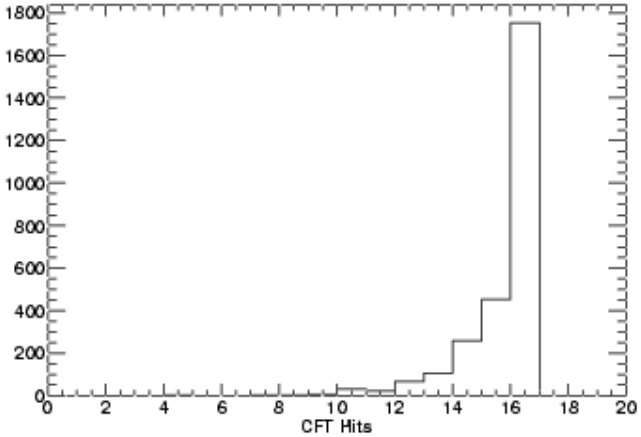
SMT





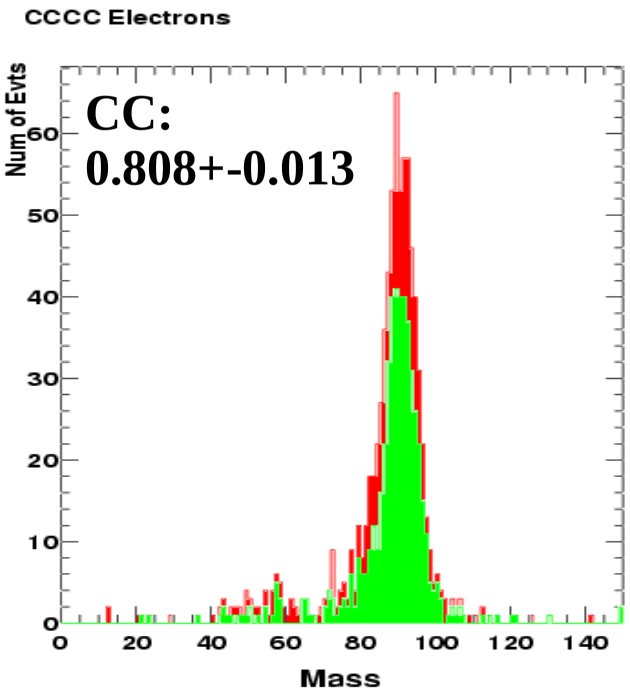
CFT

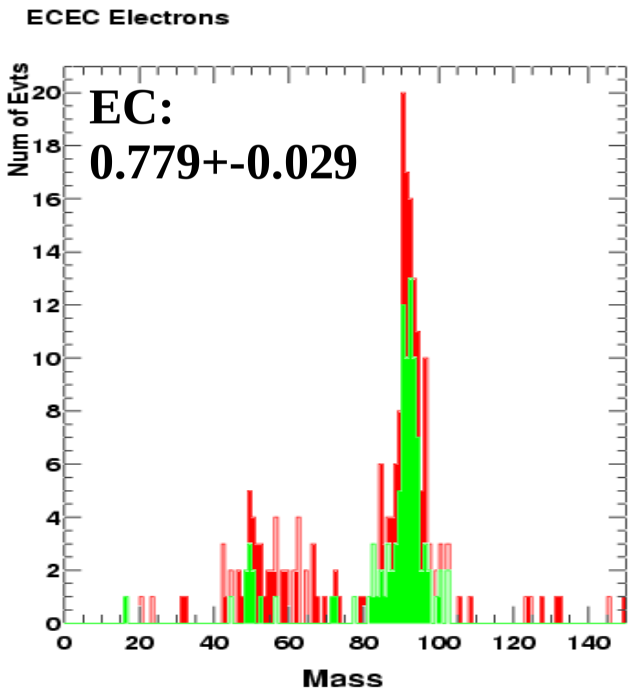




Other EM Things: Track Efficiency

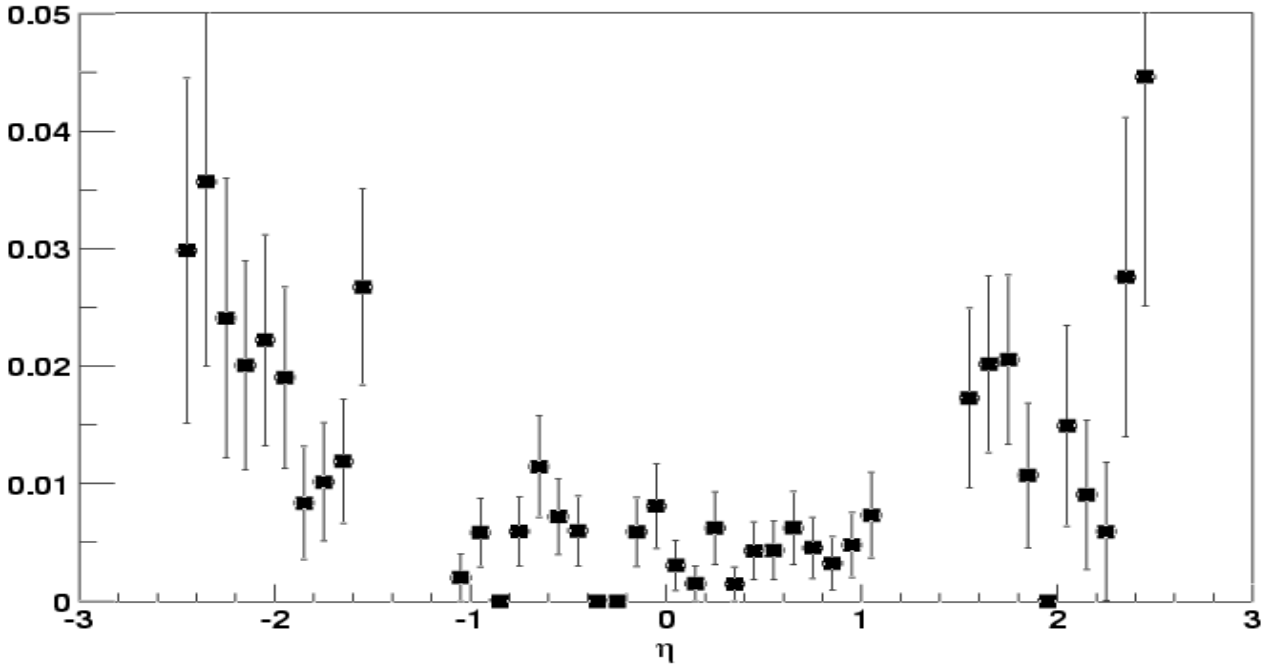
- **p14 supposed to have great improvements in tracking so I tried to get a track-matching efficiency forelectrons.**
- **Used $\varepsilon=2N_2/(N_1+2N_2)$**
- **Seems lower than some numbers I have heard.**





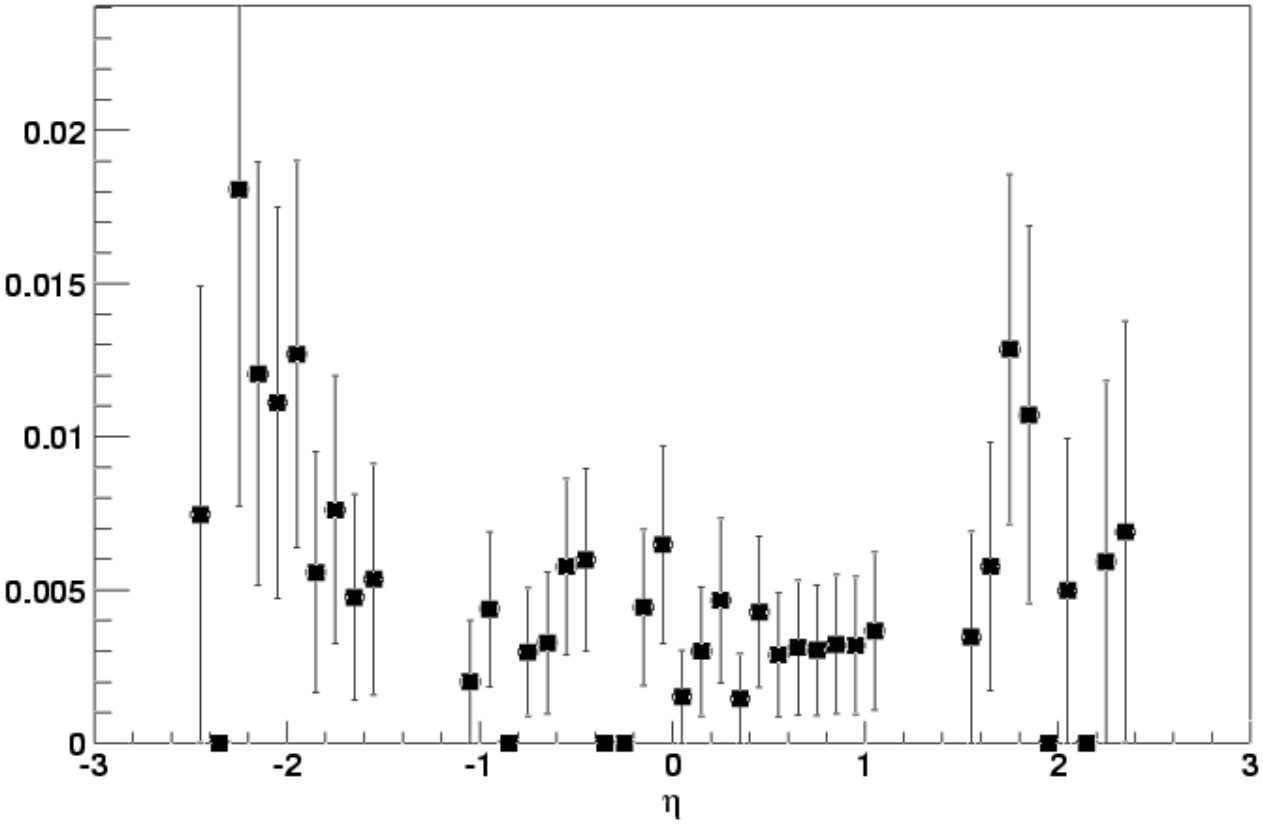
EM Fake Rate

- **Plot of EM fake rate vs η. Fake rate in each eta bin = # tight ems / # loose ems.**
  - **Loose: id 10 or 11.**
  - **Tight: emf>0.9, iso<0.15, hmx8<20, has_track_match**



EM Fake Rate with Lhood

- **Same plot with has_track_match replaced with lhood_iso>0.4.**

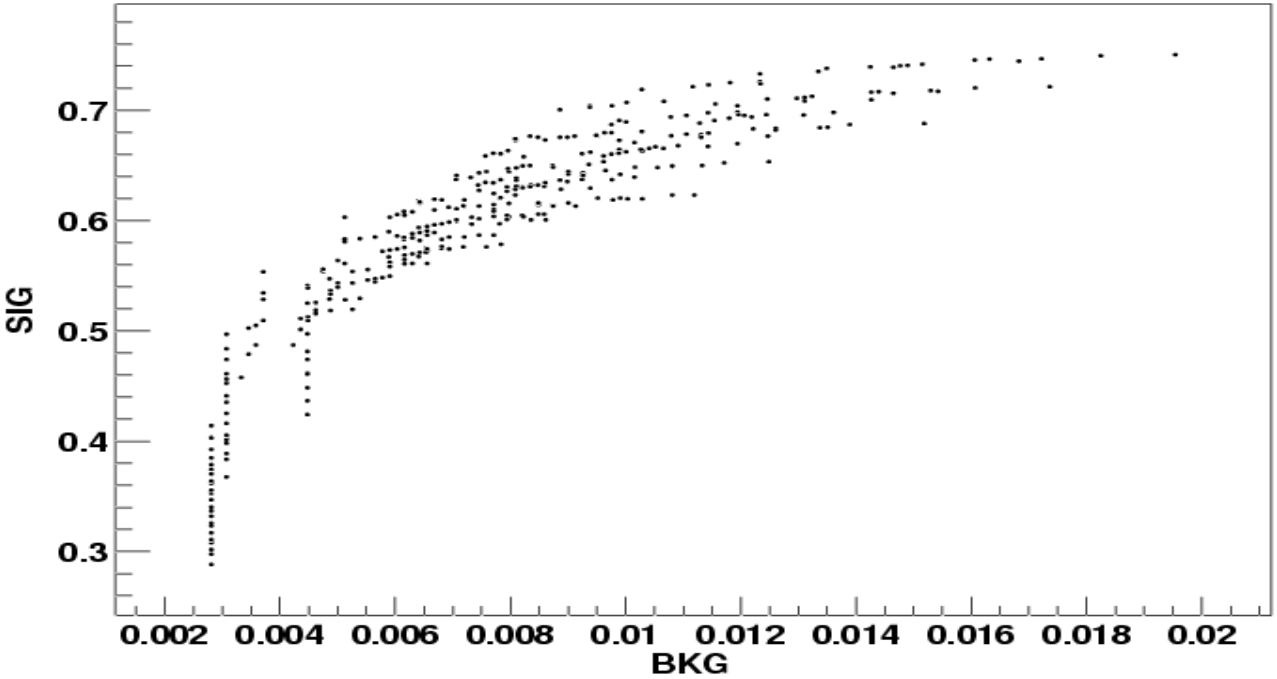


Random Grid Search

- **Try varying MET, p_T^{j1}, p_T^{j2}, and hts in order to optimize cuts using Sqrt(S+B)/S as a figure of merit (FOM). (Recall: Want to minimize FOM.)**
  - **MET**
    - **Using an infinite Z window cut right now.**
    - **Test 15, 20, 25, 30, 35 GeV cuts**
  - **Jet pTs**
    - **Vary independently with second leading jet cut <= leading jet cut.**
    - **Test 15, 20, 25 GeV cuts**
  - **Hts**
    - **Ht = p_T^{j1}+ p_T^{j2}: Test 90, 100, 110, 120, 130 GeV**
    - **Hte = p_T^{j1}+ p_T^{j2}+ p_T^{e1}: Test 100, 110, 120, 130, 140 GeV**
    - **Ht2e = p_T^{j1}+ p_T^{j2}+ p_T^{e1}+ p_T^{e2}: Test 120, 130, 140, 150, 160 GeV**

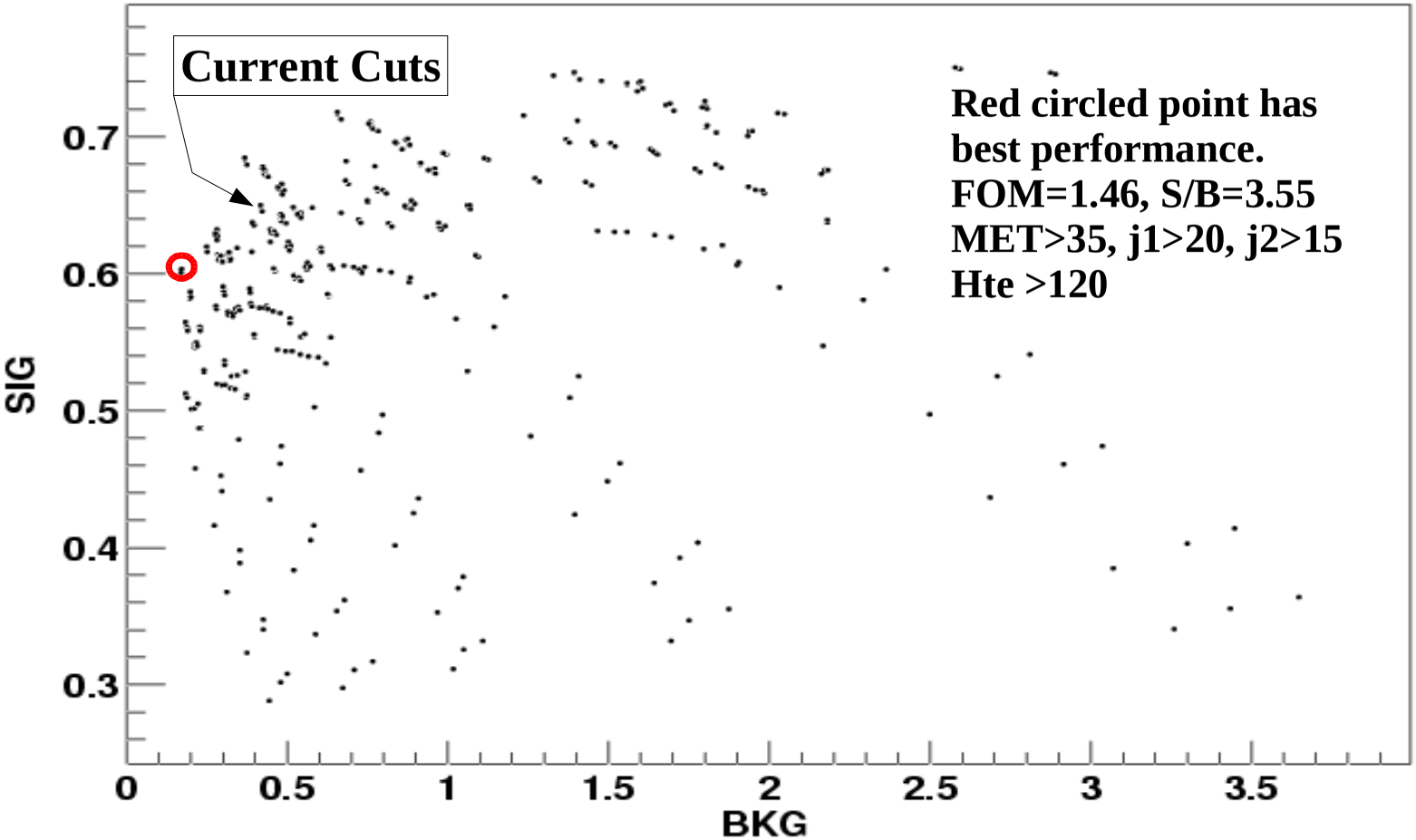
RGS Plot

- **# Signal Evts vs # Background evts for ttbar MC signal and WW and Z->ττ MC backgrounds (in 107 pb^{-1} of data).**
- **These backgrounds are so low that this exercise is almost silly, but it was a good starting point.**



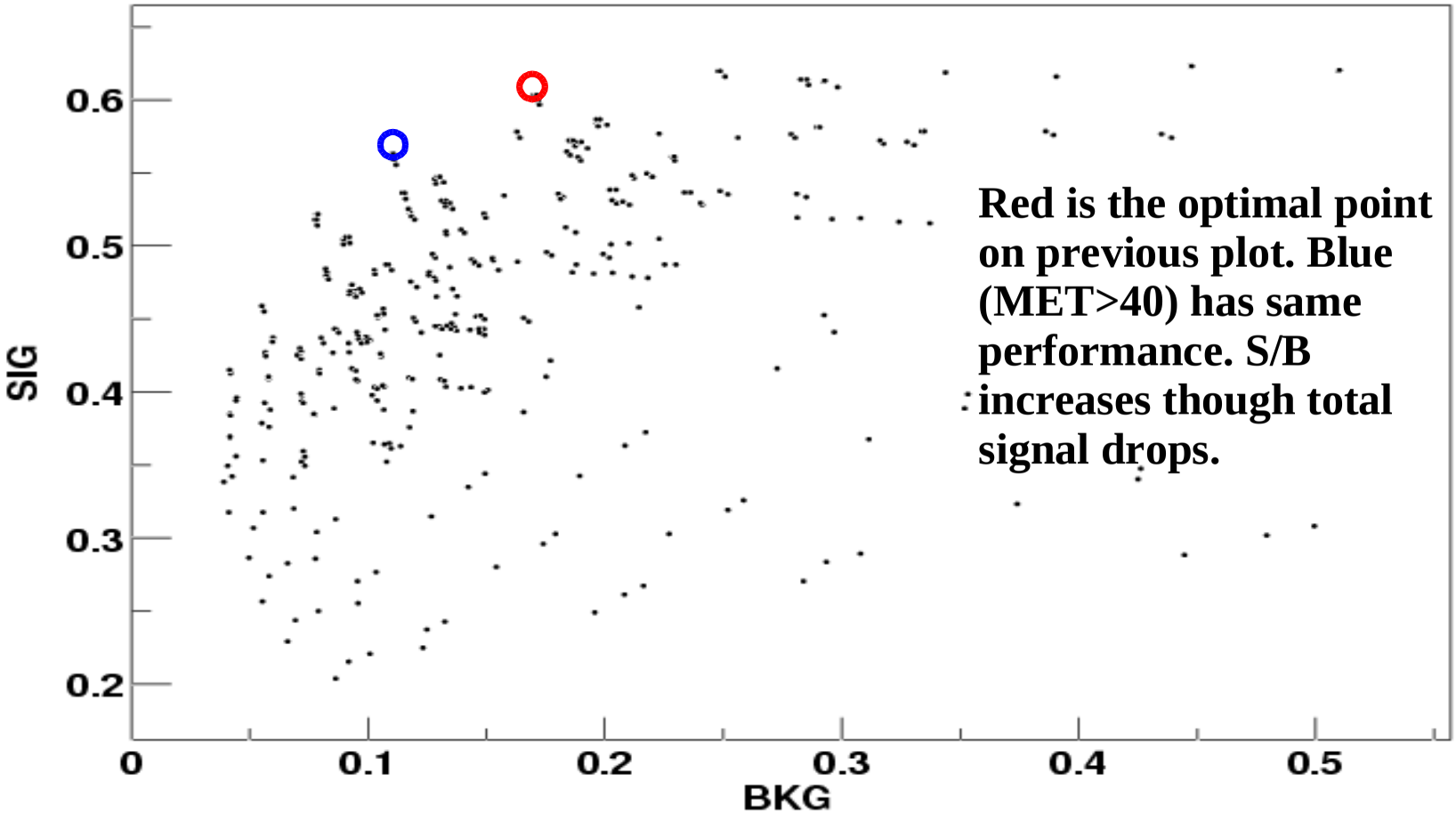
More Realistic RGS

- **Include EM and MET fake contributions using the Lepton-Photon Data. (Note: FOM for current cuts = 1.70, S/B=1.24)**



RGS (part 2)

- Since 35 GeV was the max MET variation, tried another set of 5 MET cuts -- 35, 40, 45, 50, 55 GeV -- to see if the optimal cut is higher.



Red is the optimal point on previous plot. Blue (MET>40) has same performance. S/B increases though total signal drops.

Conclusions

- **Electrons in p14 look quite similar to electrons in p13.**
- **Tracking seems to have improved since p13, but my track-matching efficiency still seems considerably lower than other numbers I have heard.**
- **p14 likelihood study is beginning to ramp up.**
- **RGS shows optimal analysis cuts to be MET>35 GeV (or 40 GeV), pt(j1)>20 GeV, pt(j2)>15 GeV, Hte>120 GeV.**
- **Currently adding the Z window back in.**