# Higgs to 4-lepton Performance (11.0.41)

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# Outline

- ID vertexing performance for H4l
  - iPatRec/xKalman/newTracking
- First results on H→4-muon (CBNT)
  - Efficiencies eta/phi/pt (Muonboy,Staco,Staco+Mutag)
  - Resolutions
- Single Electron Performance (CBNT)
  - Linearity/Uniformity/Resolution
- First results H4-electron (EventView)
  - Egamma, ISEM bits, trk isolation efficiencies vs (eta, pt)
  - Z and Higgs masses
  - Cut flow

# 11.0.41 Samples

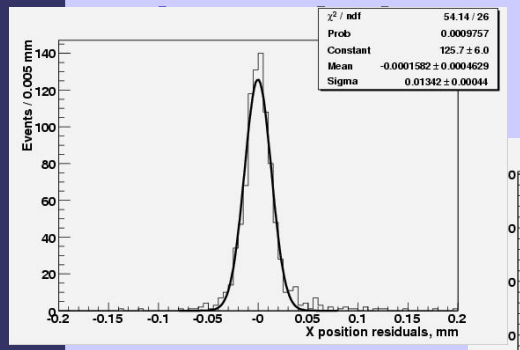
- Single Electrons
  - csc11.007072.singlepart_e_E25
  - csc11.007060.singlepart_e_E50
  - csc11.007073.singlepart_e_E75
  - csc11.007061.singlepart_e_E100
  - csc11.007074.singlepart_e_E200
  - mc11.004003.Electrons._e100
  - mc11.004022.Electron_Pt_25
- Higgs
  - csc11.005300.PythiaH130zz4l (19k)
  - csc11.005302.H150zz4mu
  - csc11.005303.H180zz4mu

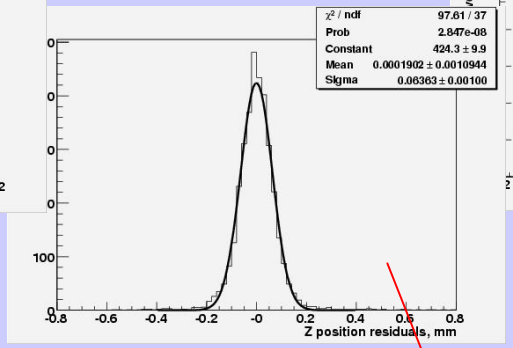
Kirill Prokofiev

# *Exclusive decay vertex test*

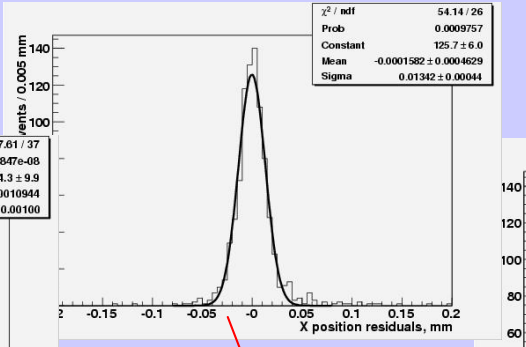
- Example results for the VxBilloir fast fit, *H(130)→4l, ATHENA 11.0.41, 4'000 events*

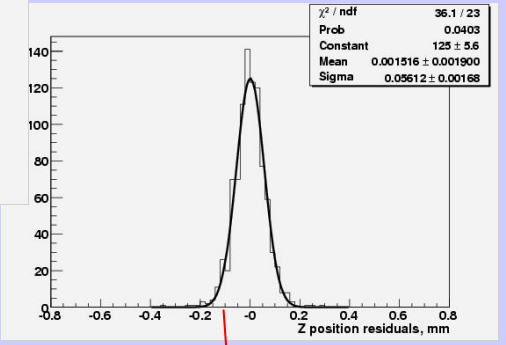
*4l Z residuals*




*4 μ Z residuals*




| | 4l | | 4μ | |
|---|---|---|---|---|
| | X [μm] | Z [μm] | X [μm] | Z [μm] |
| xKalman | 20.48+-0.46 | 63.63+-1.0 | 13.41+-0.44 | 56.12+-1.68 |
| iPatRec | 16.92+-0.37 | 58.85+-0.89 | 11.89+-0.38 | 54.23+-1.64 |
| newTracking | 25.02+-0.63 | 78.74+-1.48 | 14.63+-0.48 | 59.47+-1.85 |

Kirill Prokofiev

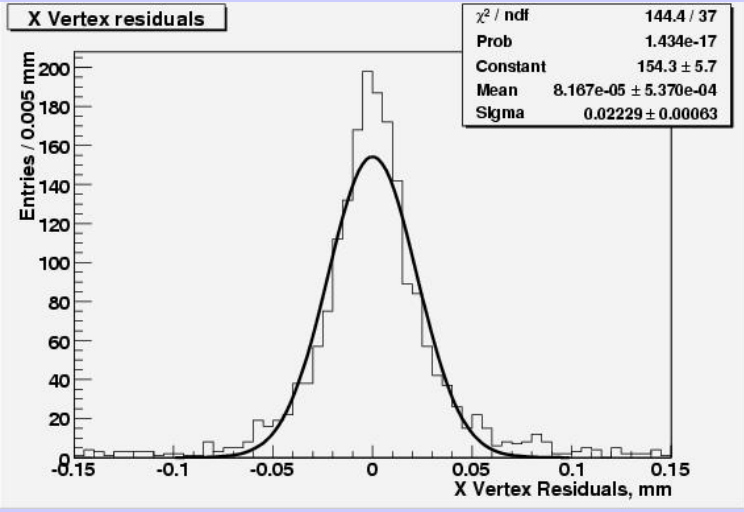
# *Primary Vertex Test*

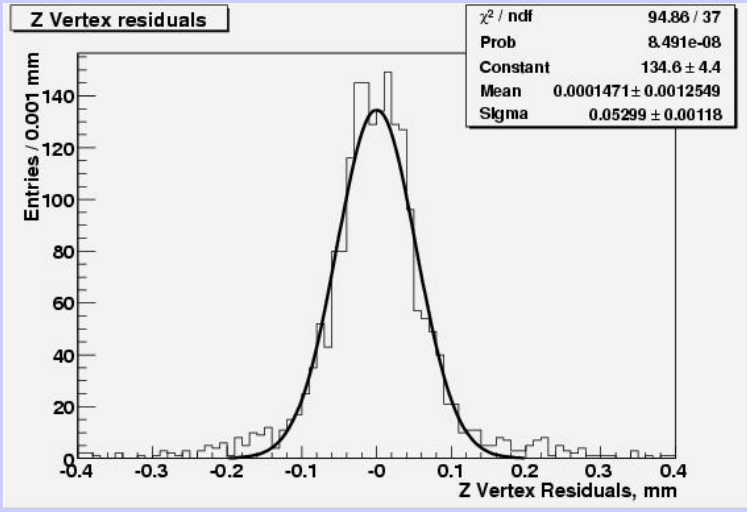
- Example results for the VxBilloir fast fit

Plots with XKal

*H(130)→4l, ATHENA 11.0.41, 2'000 events*

*PV X*

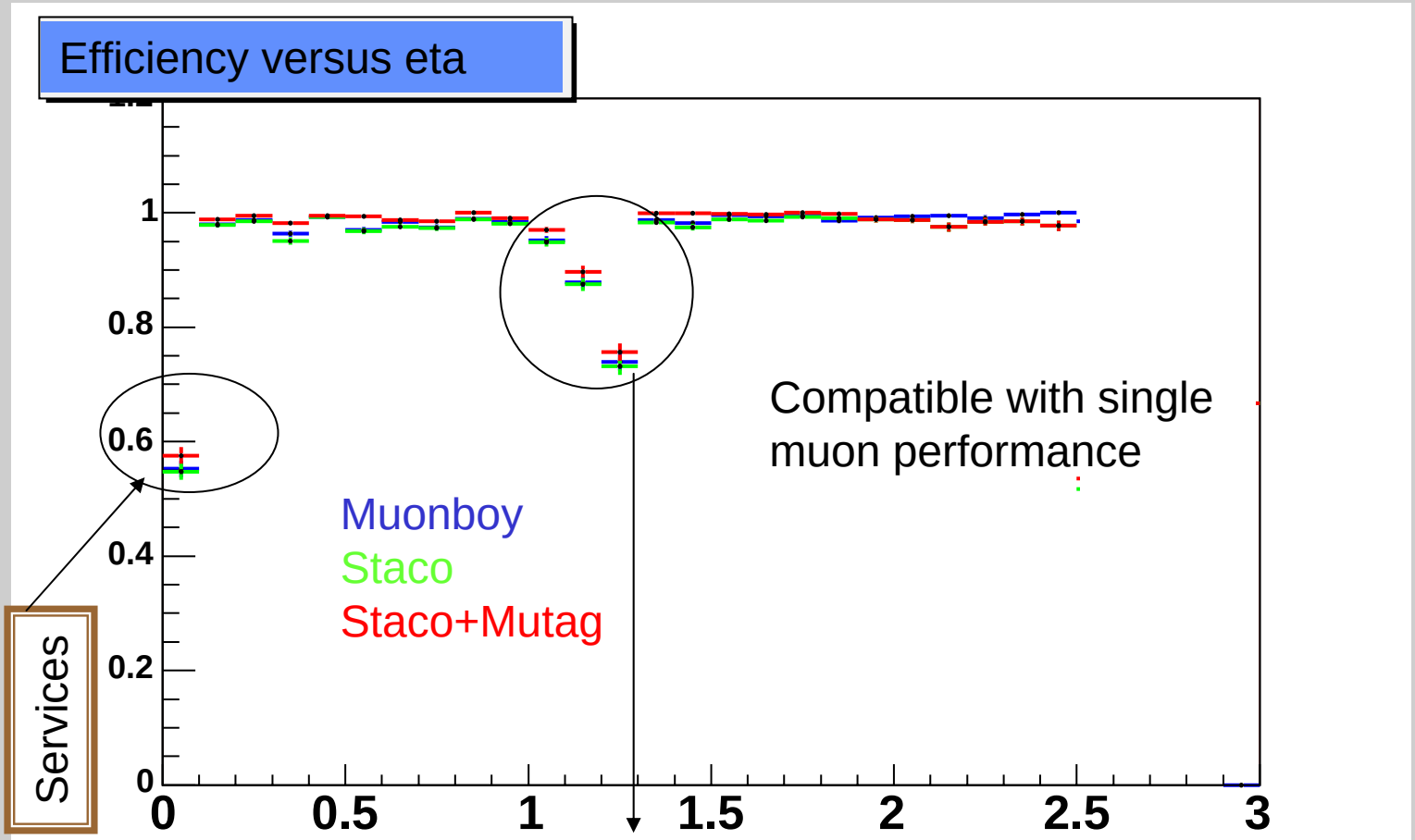



| | X[μm] | Z [μm] | Av. Trk. Mult. |
|---|---|---|---|
| xKalman | 22.29+-0.63 | 53.64+-1.20 | 19.23 |
| NewTracking | 34.19+-1.01 | 82.22+-1.84 | 22.35 |
| iPatRec | 16.77+-0.47 | 47.35+-1.11 | 18.63 |

# Efficiency per muon: H(180)→4μ (11.0.41)

Contribution from SaMuSoG (Saclay)
S. Hassani, J.F. Laporte, E. Lancon,
A. Ouraou, L. Chevallier, R. Nikolaidou

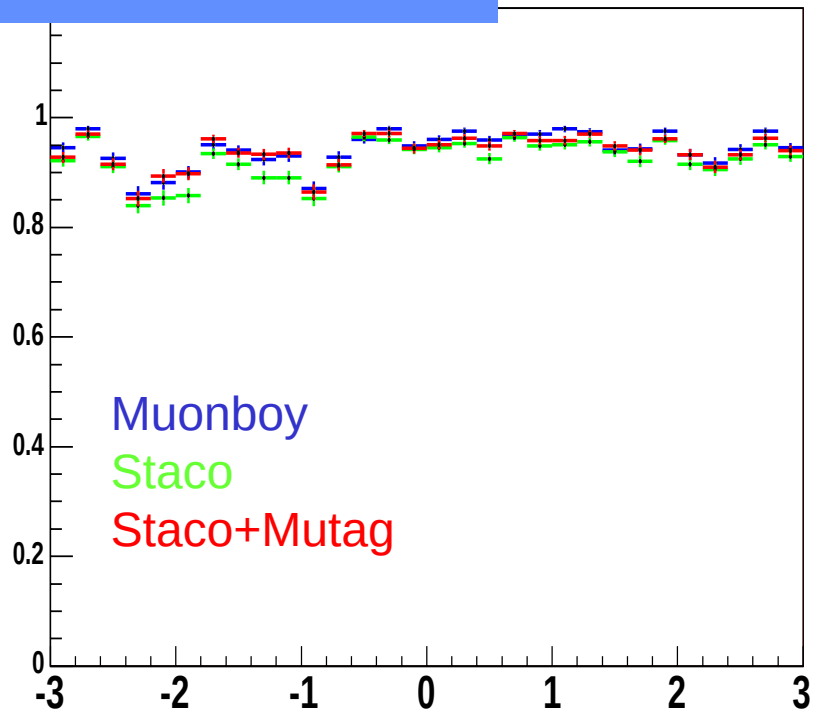



EES and EEL chambers (final layout only) cover eta range 1.0 <|η|< 1.4

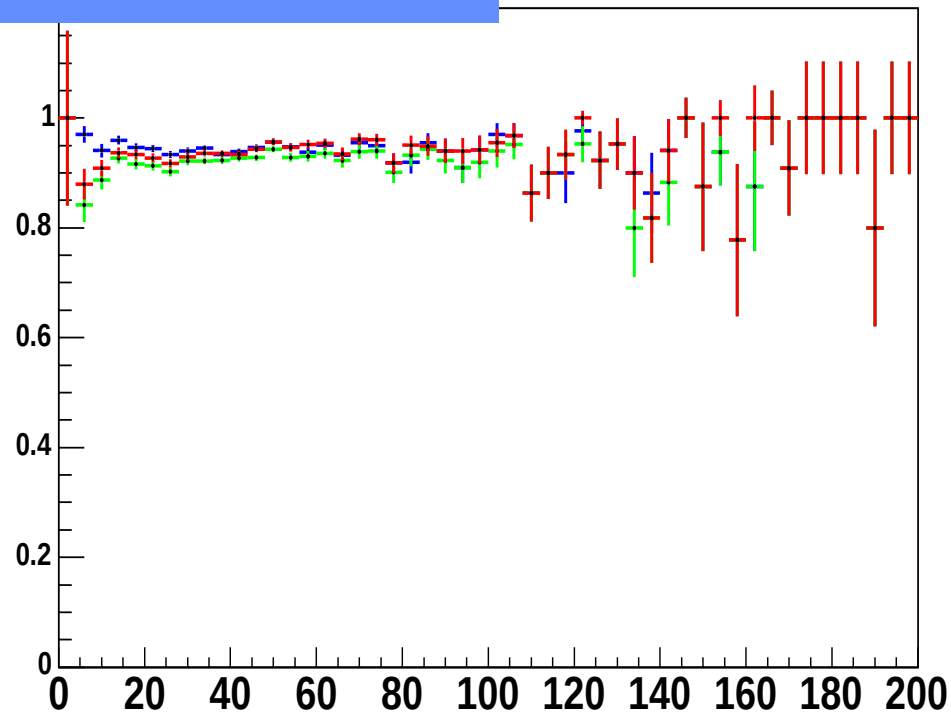
→ absence of these chambers in initial layout creates inefficiency around |η|=1.2

# Efficiencies per muon: H(180)→4μ (11.0.41)

Efficiency versus phi

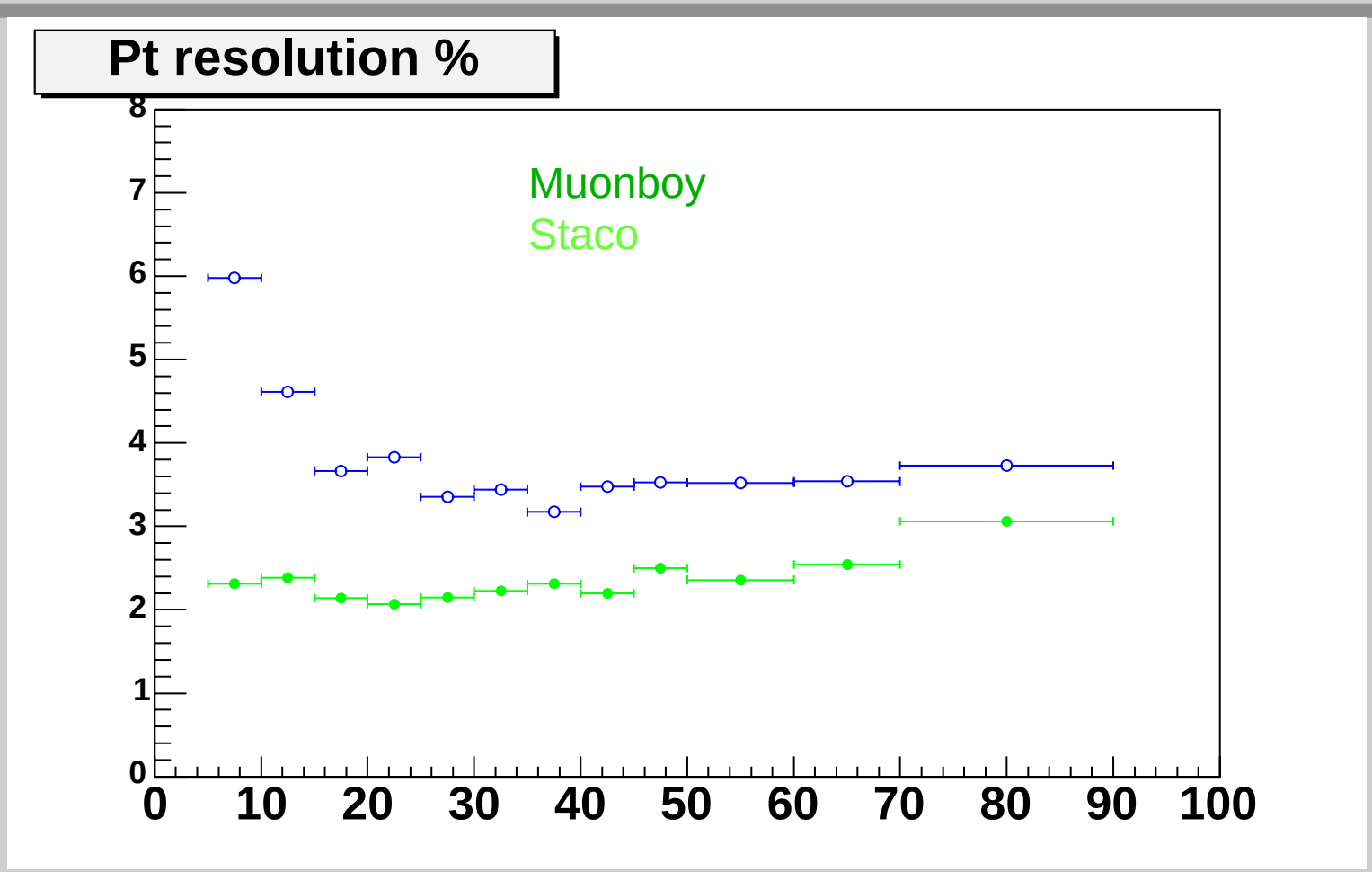



Efficiency versus pt




**Contribution from SaMuSoG (Saclay)**
**S. Hassani, J.F. Laporte, E. Lancon,**
**A. Ouraou, L. Chevallier, R. Nikolaidou**

# Muon Pt resoluton vs Pt (11.0.41)




**Contribution from SaMuSoG (Saclay)**
**S. Hassani, J.F. Laporte, E. Lancon,**
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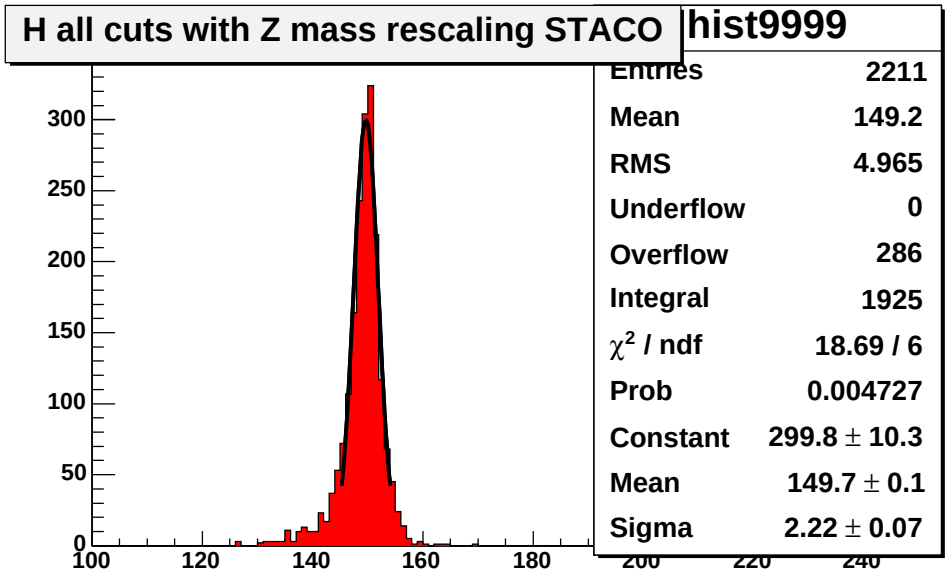
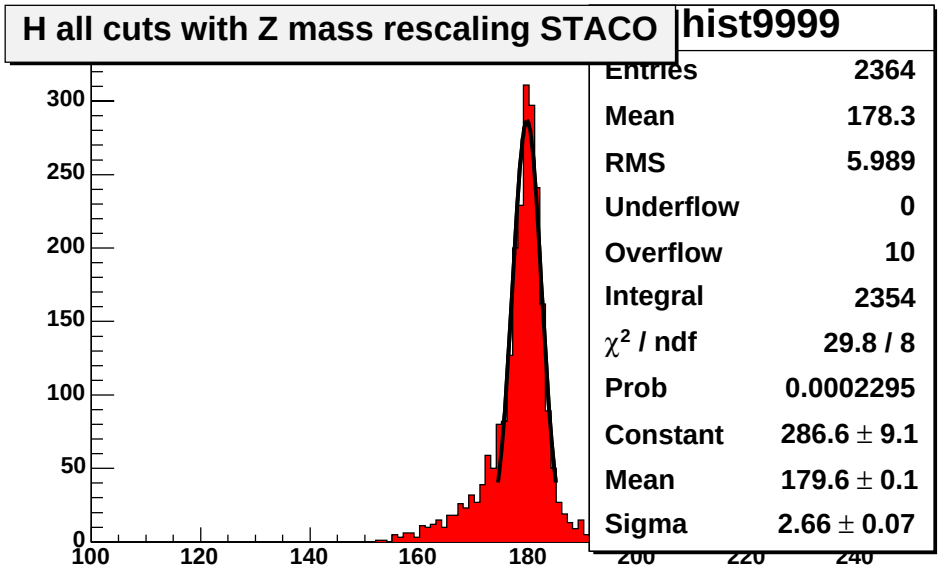
# Higgs→4μ mass resolutions

mH=150 GeV




Combined
<> 149.7 ± 0.1
σ 2.22 ± 0.07

mH=180 GeV

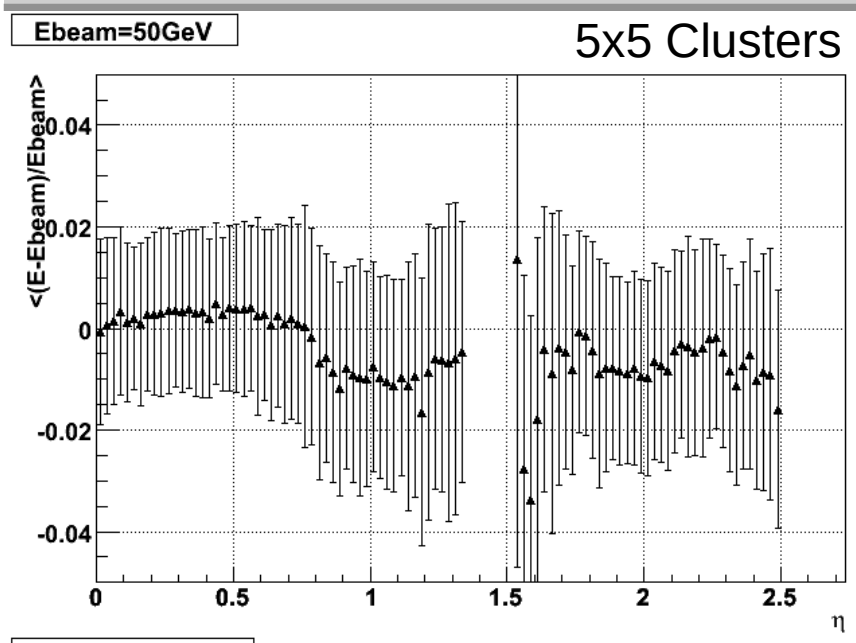


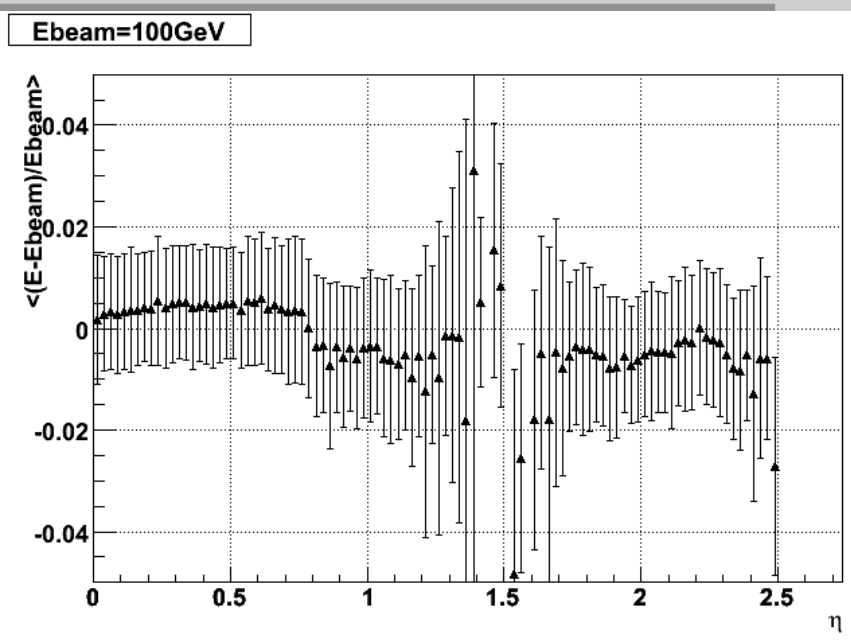

Combined
<> 179.9 ± 0.1
σ 2.66 ± 0.07

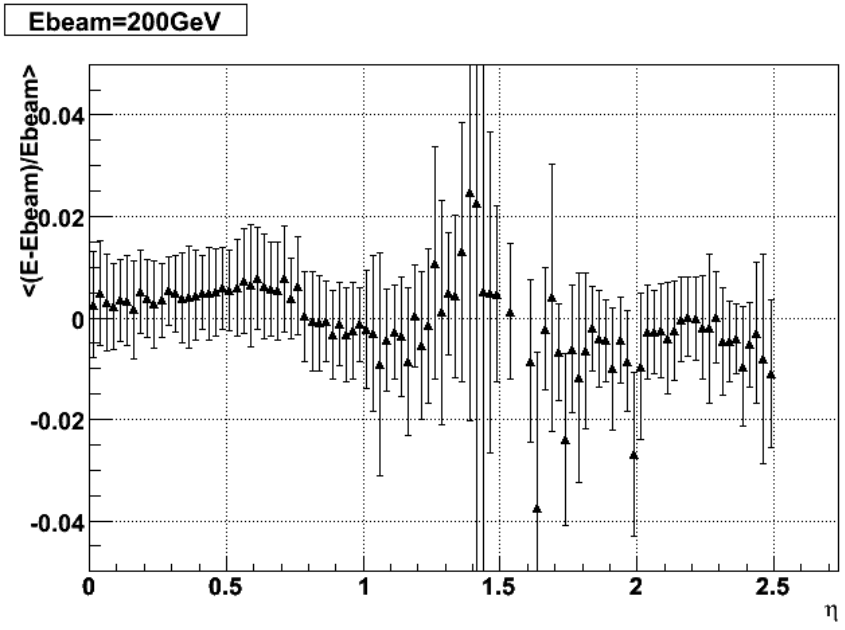
# Single electrons and H→4e

For details see 21/3/06 egamma talk:
http://agenda.cern.ch/fullAgenda.php?ida=a058230

# Electron Uniformity/Linearity (11.0.41)

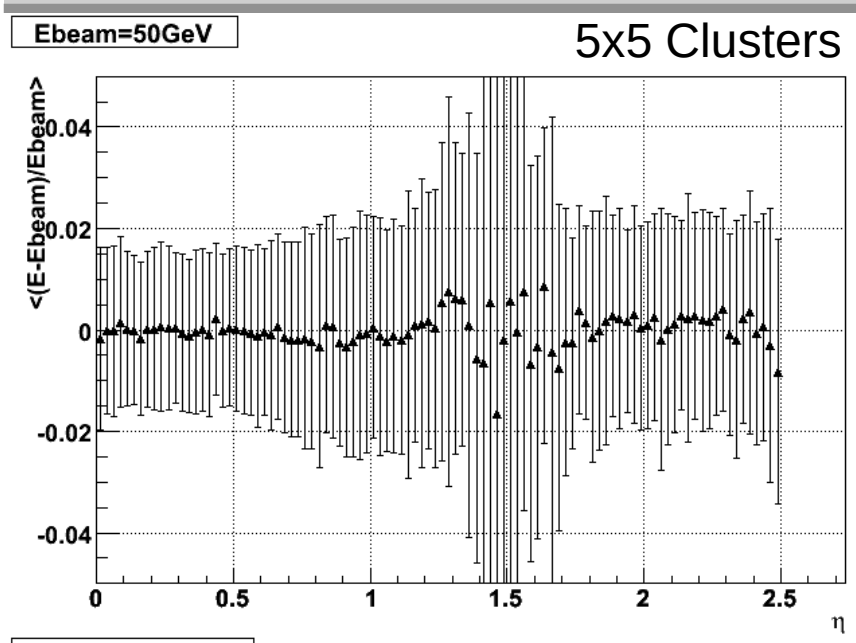


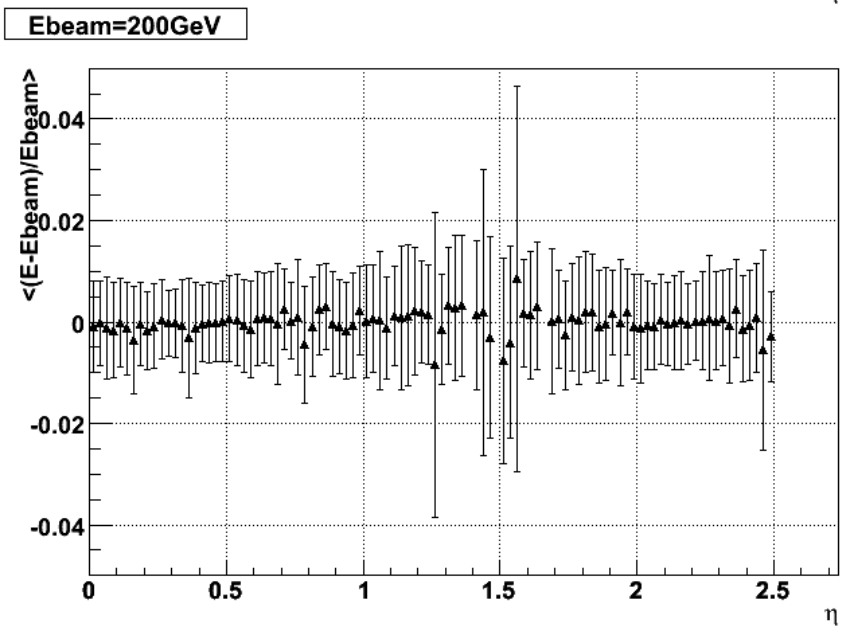



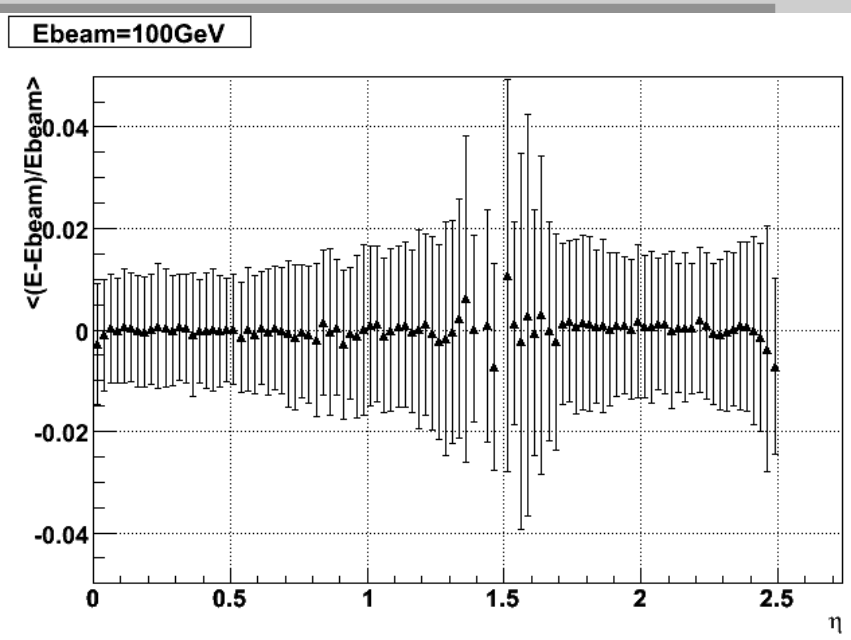




Changes in the layout require recalculation of the layer weights.

# Electron Linearity/Uniformity (new weights)

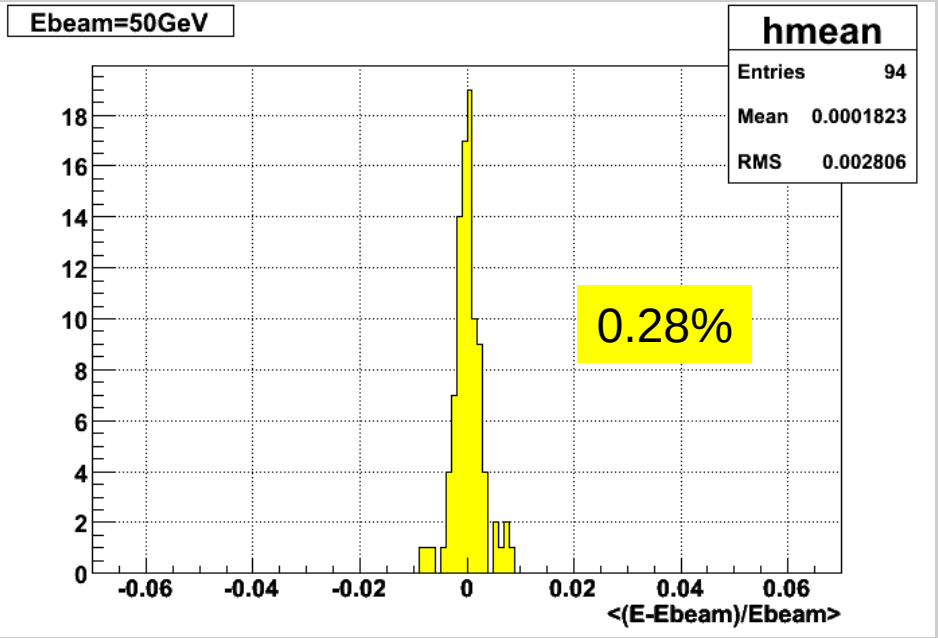


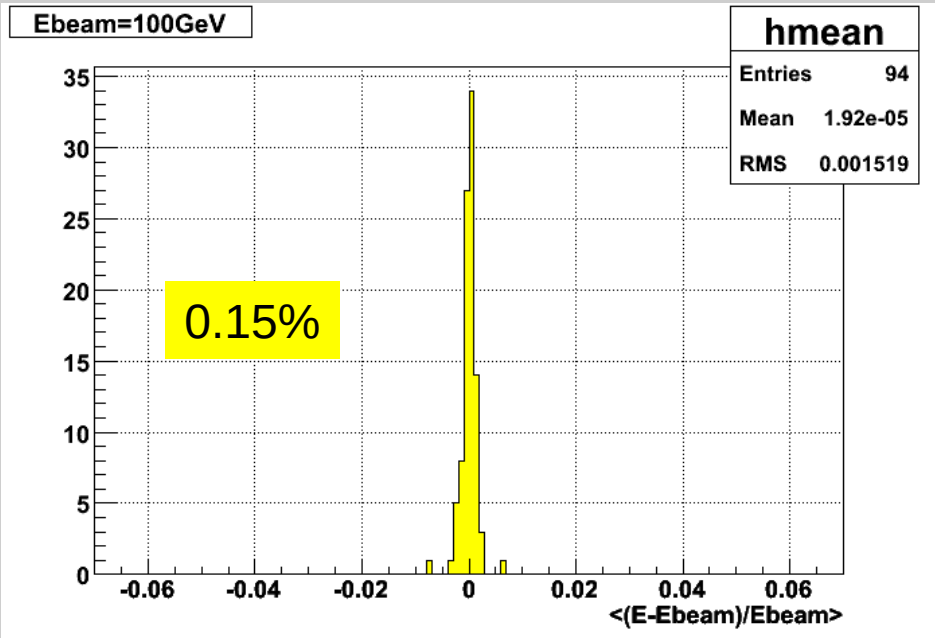




Comment: full statistics of various samples is not available yet except for the 100GeV point.

# Summary of Uniformity RMS (away from crack)



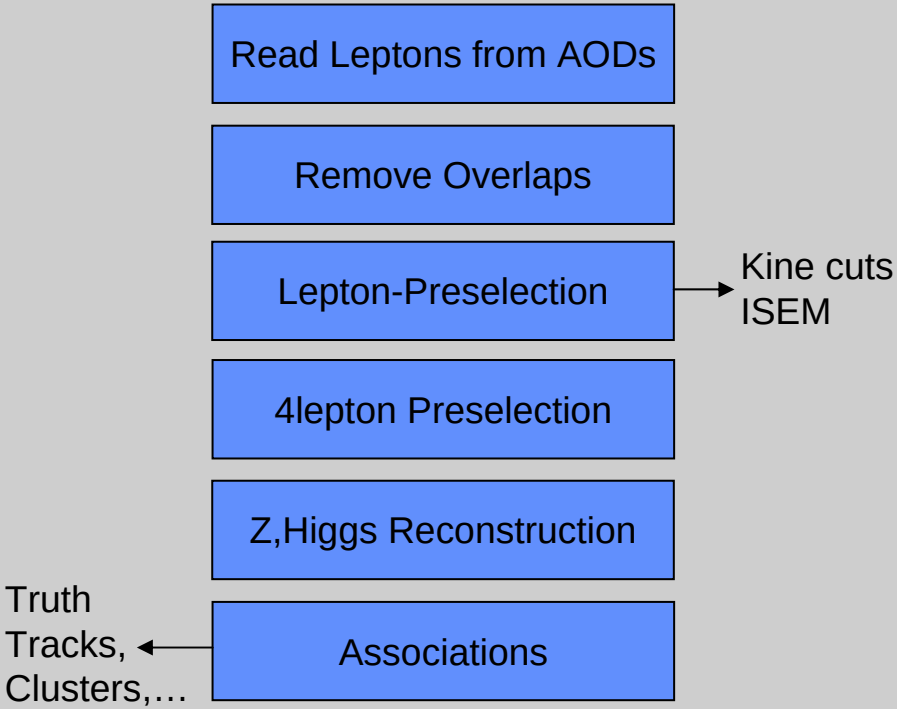




New weights are already satisfactory even with the low statistics (2k events per bin).
Checked with 25,50,75,100,200GeV beams.

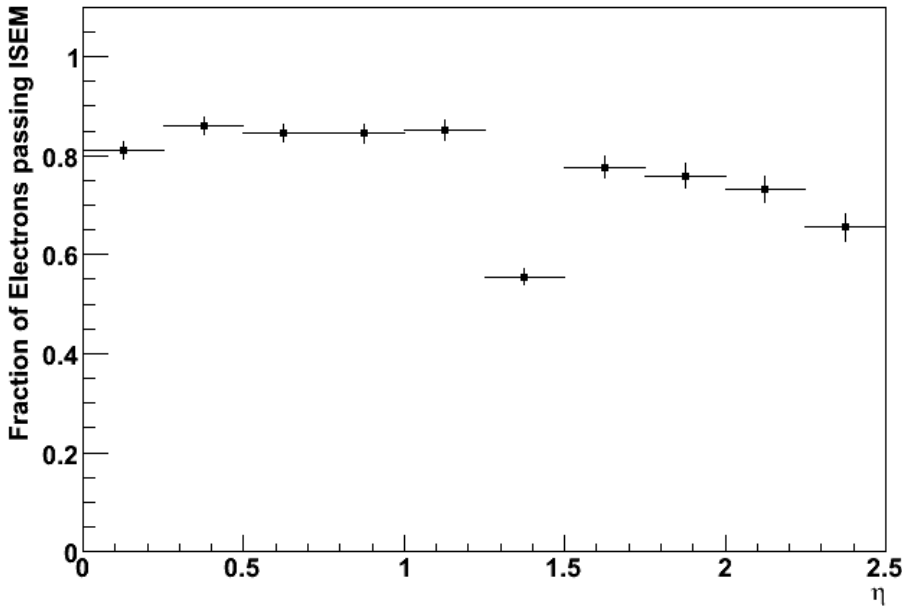
# Higgs to 4-electrons (11.0.41)

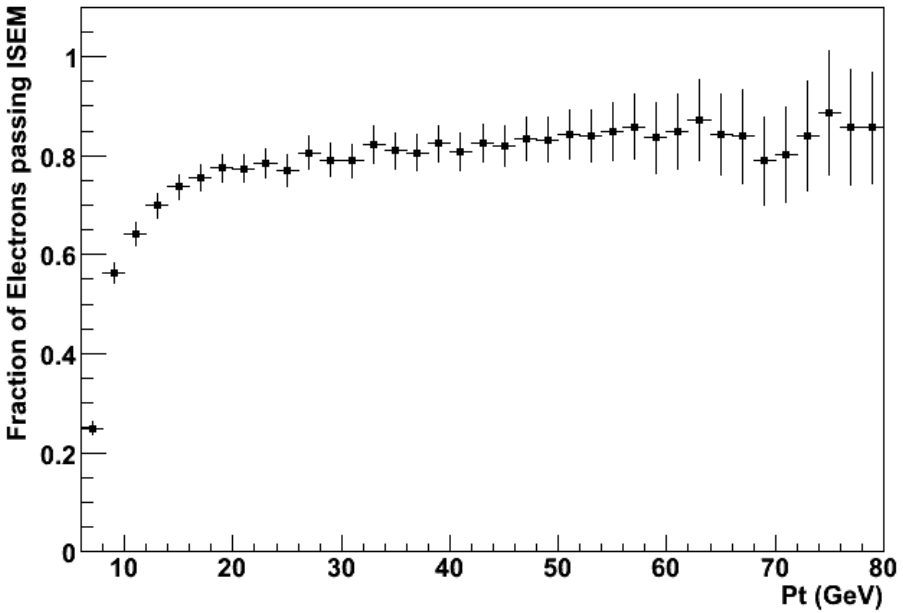
- We ported the analysis to the latest EventView:
  - Most analysis steps are done with Athena tools (EV)
  - AANtuple is produced for final processing (see Higgs talk)
  - Checked in CVS:

http://atlas-sw.cern.ch/cgi-bin/viewcvs-atlas.cgi/offline/PhysicsAnalysis/HiggsPhys/HiggsToFourLeptons/src/



# Efficiency per e: Higgs→4e ISEM cut (no TRT)

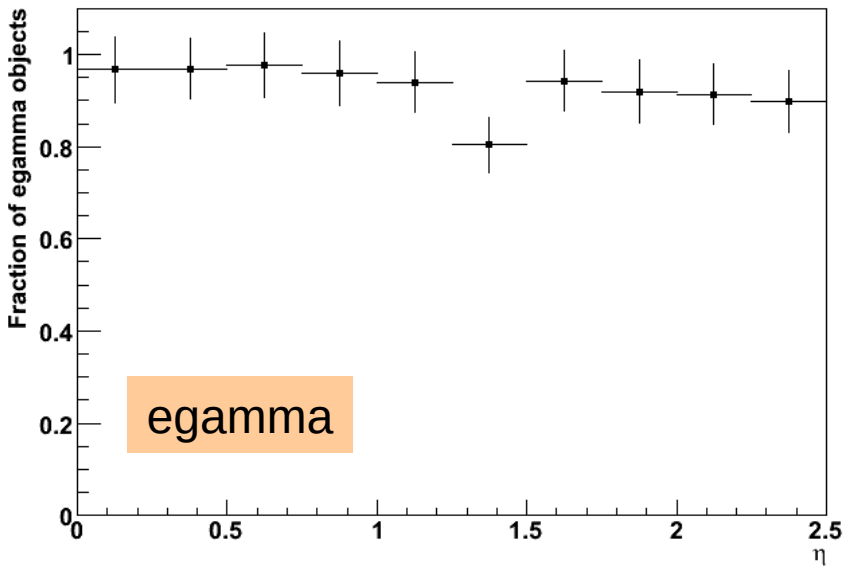


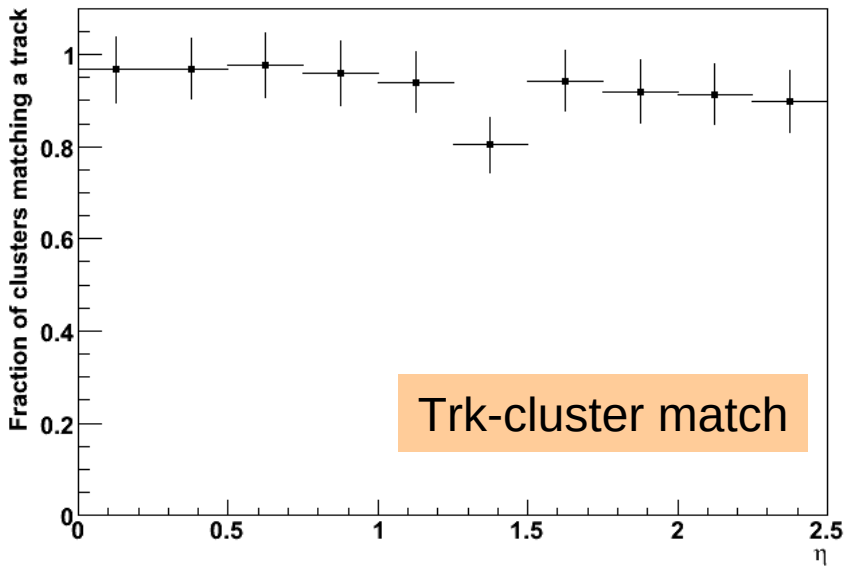



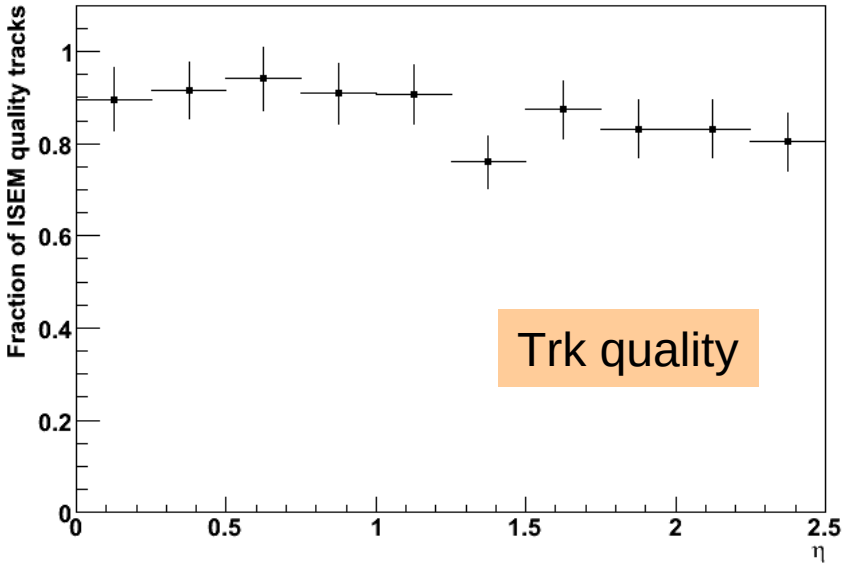

**However:**
**H->4e Trigger: 1e25 or 2e15 using ISEM: 99.6% (see last slide)**

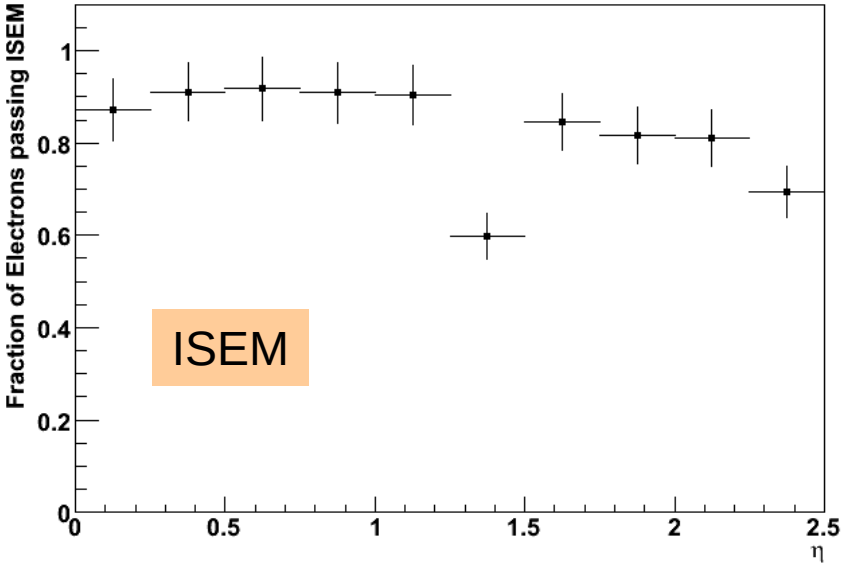
# Single electron efficiency (Pt=25GeV sample)

Cone match dR<0.1

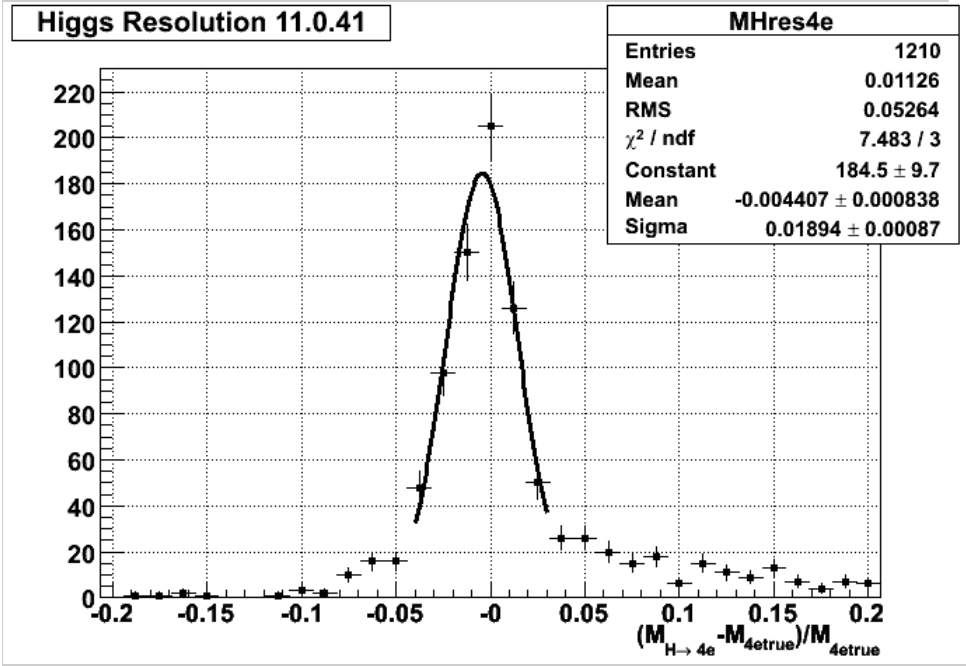


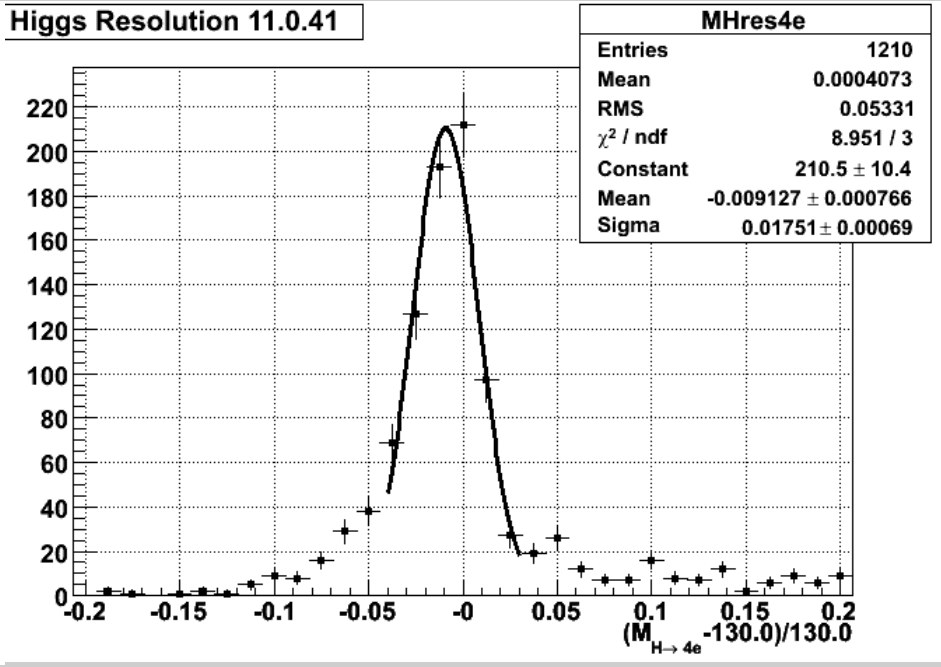



# Higgs masses




Using true matched electrons (they could have radiated)

Assume nominal Higgs mass

Reminder: new weights will improve mean and resolution

# 4e cut flow including trigger:

| CutName | In | Out | Efficiency |
|---|---|---|---|
| trigger2e15i_e25Cuts | 2720 | 2710 | 0.9963 |
| fourEgammaClusters | 2710 | 2710 | 1.0000 |
| fourEgamma7_7Clusters | 2710 | 2426 | 0.8952 |
| fourEgamma7_20Clusters | 2426 | 2301 | 0.9485 |
| fourIsoEMLArClusters | 2301 | 1260 | 0.5476 |
| fourTrkIsoClusters | 1260 | 1207 | 0.9579 |
| fourIsoImpParElecs | 1207 | 1097 | 0.9089 |
| ZeeReconstruction | 1097 | 1097 | 1.0000 |
| H4eReconstruction | 1097 | 822 | 0.7493 |
| nHiggsInsideWindow | 822 | 683 | 0.8309 |

Numbers very preliminary

# Summary

- First look on H→4e and H→4μ with 11.0.41 samples
  - First checks on lepton performances
  - Imported the 4e analysis in the eventView framework
  - To be done next: 4μ and 2e2μ analyses in the eventView
- Future Plans:
  - Detailed studies on lepton performances within the performances groups.
  - Full analysis including background samples.