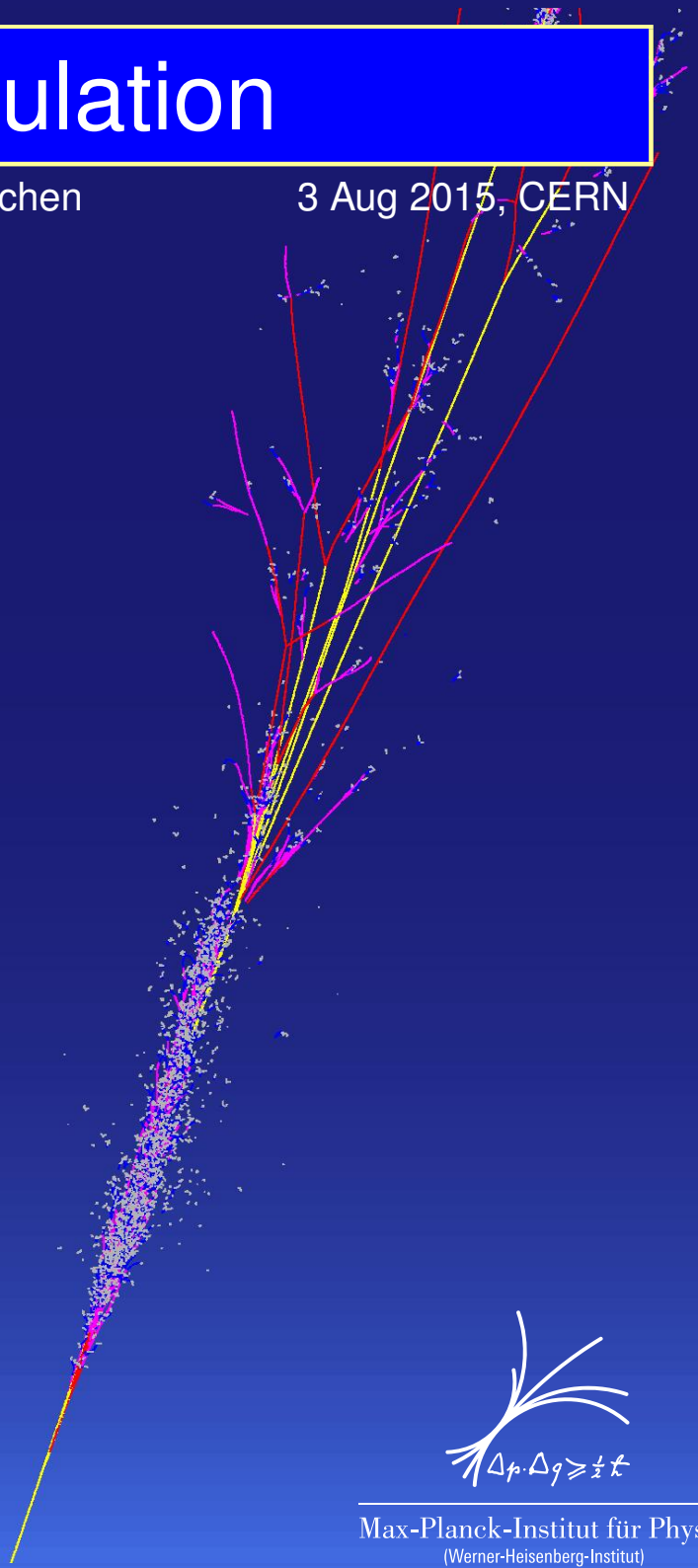
Status of sFCal Simulation

LAr Upgrade Simulation Meeting Sven Menke, MPP München 3 Aug 2015, CERN



- Simulation
  - MinBias & single pion samples in prodsys
  - Standard samples for Scoping Document
- Digitization
  - Noise and other conditions folders
- Reconstruction
  - All in place
    - BCID correction and Local Hadron Calibration (LCW) were latest additions
    - Pavol upload 5-sample LCW today (4-sample based LCW for $\mu = 200$ was produced before)
    - GlobalTags can now be created/updated
  - Some example results
- Next Steps

ATLAS EXPERIMENT

Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)

Simulation

- Central Simulation uses `AtlasProduction-19.2.3.8`
- Single pions are finished in prodsys (AMI tags `s2641, s2639`) including `CalibrationHits`
- MinBias samples are finished in prodsys (AMI tags `s2640, s2638`) without `CalibrationHits`
- sFCal simulations are discussed in several JIRA threads:
  - ATLMCPROD-1779: Scoping document samples in rel19/20
    - has the latest news about the scoping document samples
    - So far simulated are (also same samples with `s2630` instead (i.e. without sFCal)):

`mc15_14TeV.147911.Pythia8_AU2CT10_jetjet_JZ1W.simul.HITS.e1996_s2640/`
`mc15_14TeV.147914.Pythia8_AU2CT10_jetjet_JZ4W.simul.HITS.e1996_s2640/`
`mc15_14TeV.147912.Pythia8_AU2CT10_jetjet_JZ2W.simul.HITS.e1996_s2640/`
`mc15_14TeV.147807.PowhegPythia8_AU2CT10_Zmumu.simul.HITS.e1564_s2640/`
`mc15_14TeV.147915.Pythia8_AU2CT10_jetjet_JZ5W.simul.HITS.e1996_s2640/`
`mc15_14TeV.147917.Pythia8_AU2CT10_jetjet_JZ7W.simul.HITS.e1996_s2640/`
`mc15_14TeV.160024.PowhegPythia8_AU2CT10_VBFH125_gamgam.simul.HITS.e1337_s2640/`
`mc15_14TeV.117050.PowhegPythia_P2011C_ttbar.simul.HITS.e2176_s2640/`
`mc15_14TeV.147910.Pythia8_AU2CT10_jetjet_JZ0W.simul.HITS.e1995_s2640/`
`mc15_14TeV.147913.Pythia8_AU2CT10_jetjet_JZ3W.simul.HITS.e1996_s2640/`
`mc15_14TeV.147806.PowhegPythia8_AU2CT10_Zee.simul.HITS.e1564_s2640/`

Simulation

- JIRA threads, continued:
  - ATLSWUPGR-12 NaN in sFCal detector description when running ITk and sFCal together
    - the underlying problem here was conditions for the LAr saved in `IdentifierHash`
    - fixed with new conditions
  - ATLMCPROD-1374 Simulation only samples with release 19
    - the initial MinBias simulations needed for the noise folders
    - for both small and large gap versions of the sFCal

    small:

    `mc15_14TeV.119995.Pythia8_A2MSTW2008LO_minbias_inelastic_low.simul.HITS.e1133_s2638/`

    `mc15_14TeV.119996.Pythia8_A2MSTW2008LO_minbias_inelastic_high.simul.HITS.e1133_s2638/`

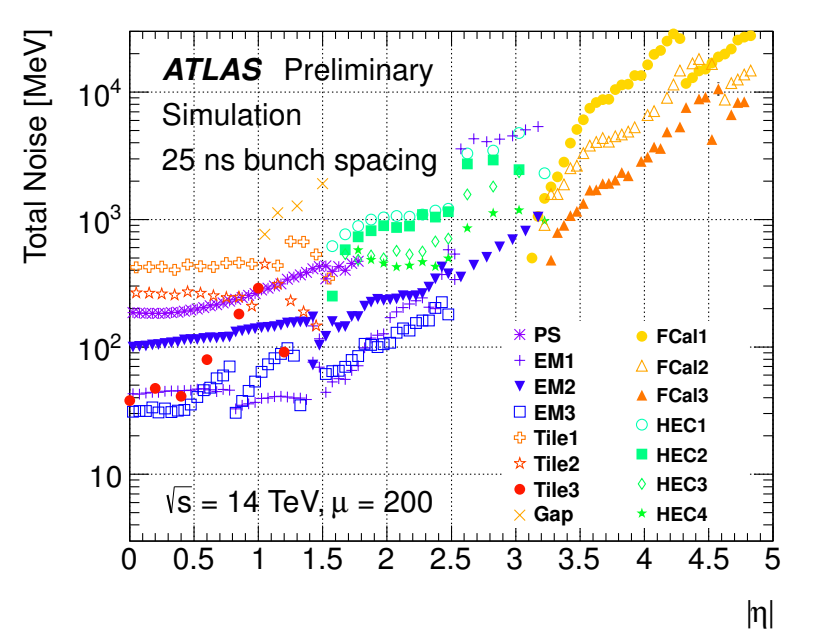
    large:

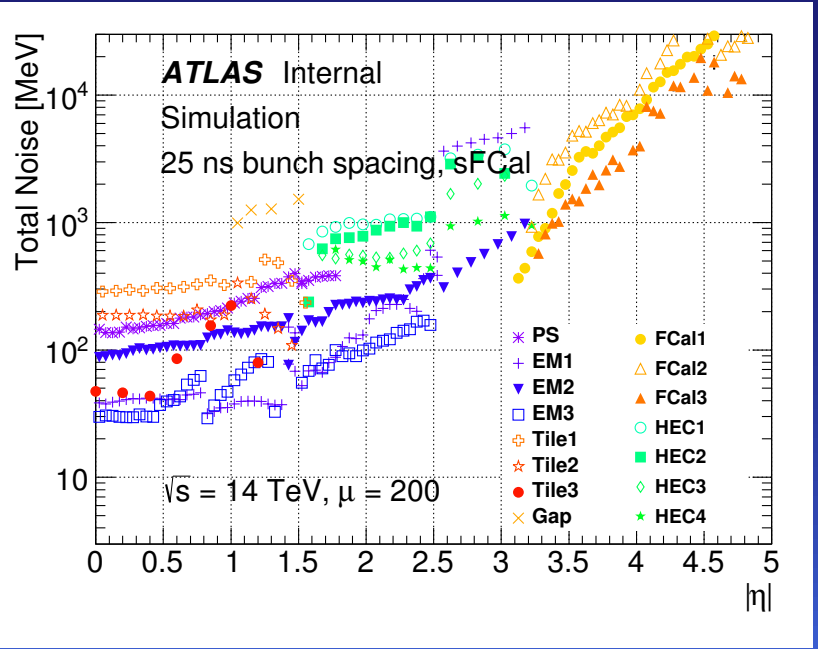
    `mc15_14TeV.119995.Pythia8_A2MSTW2008LO_minbias_inelastic_low.simul.HITS.e1133_s2640/`

    `mc15_14TeV.119996.Pythia8_A2MSTW2008LO_minbias_inelastic_high.simul.HITS.e1133_s2640/`
    - done since beginning of July
  - ATLMCPROD-1436 Single pion samples in rel 19
    - simulation done

Digitization

- Digitization currently uses `AtlasProduction-20.3.0.3`
- Pavol Strizenec made noise tags for LAr including sFCal with large gaps and small gaps
  - for both Run1 and Run2 electronics for LAr
  - based on 4-sample digitization (Run2) or 5-sample digitization (Run1)
  - for $\mu = 80, 140, 200$ and $\Delta t = 25$ ns
- Sasha Solodkov provided Tile noise for both Run1 and Run2
- prodsys uses the Run1 condtions now
- plots below compare old mc12 based Phase-II estimate with FCal (left) with new mc15 based Phase-II estimate with sFCal (right) for $\mu = 200$

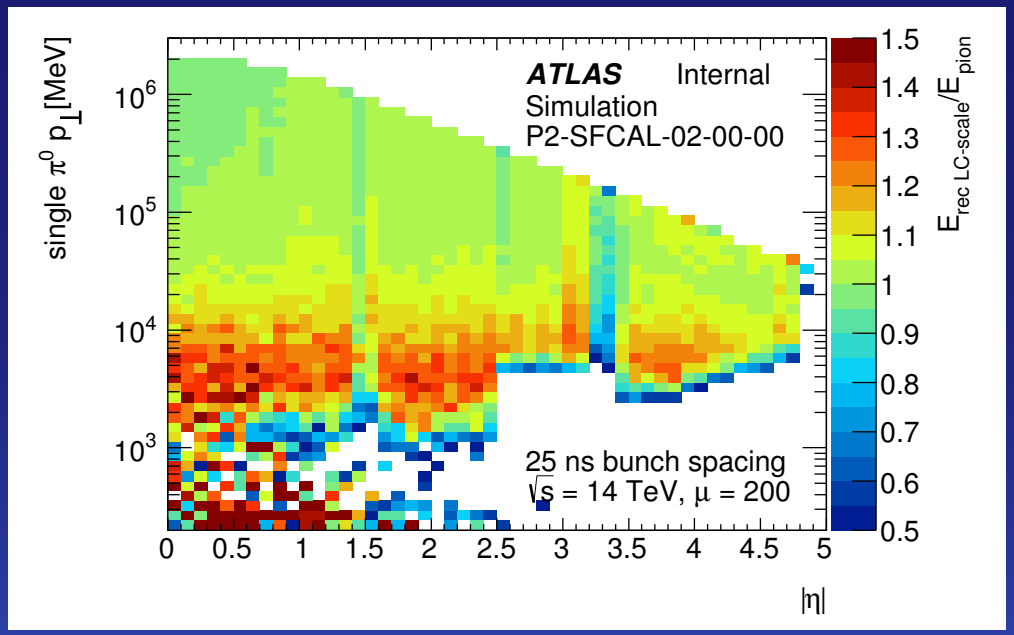


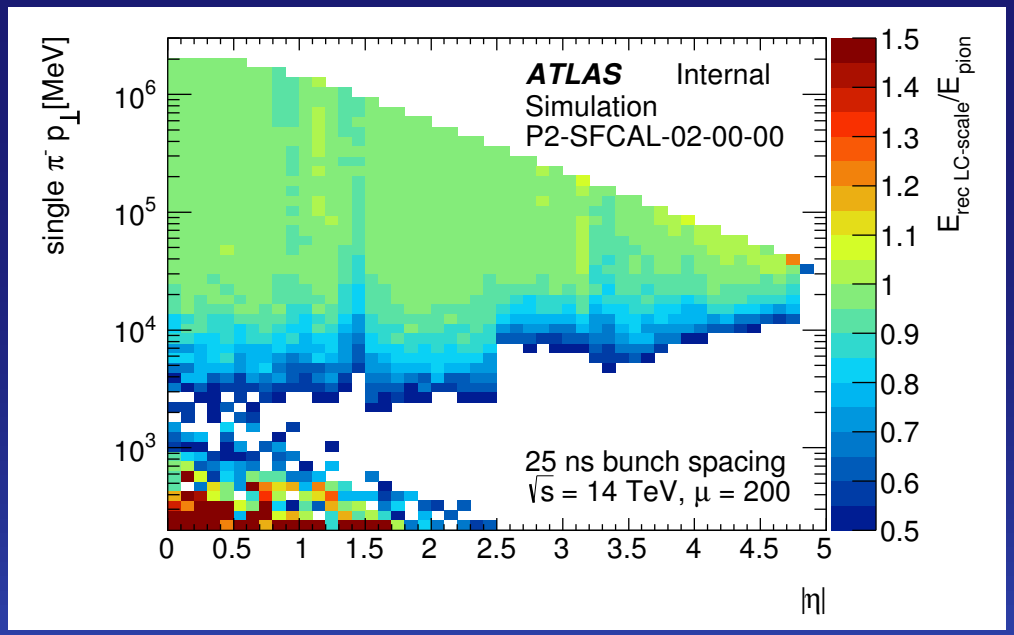


- note improvement by $\times 2$ for sFCal1 for $|\eta| < 4, 3$

Reconstruction

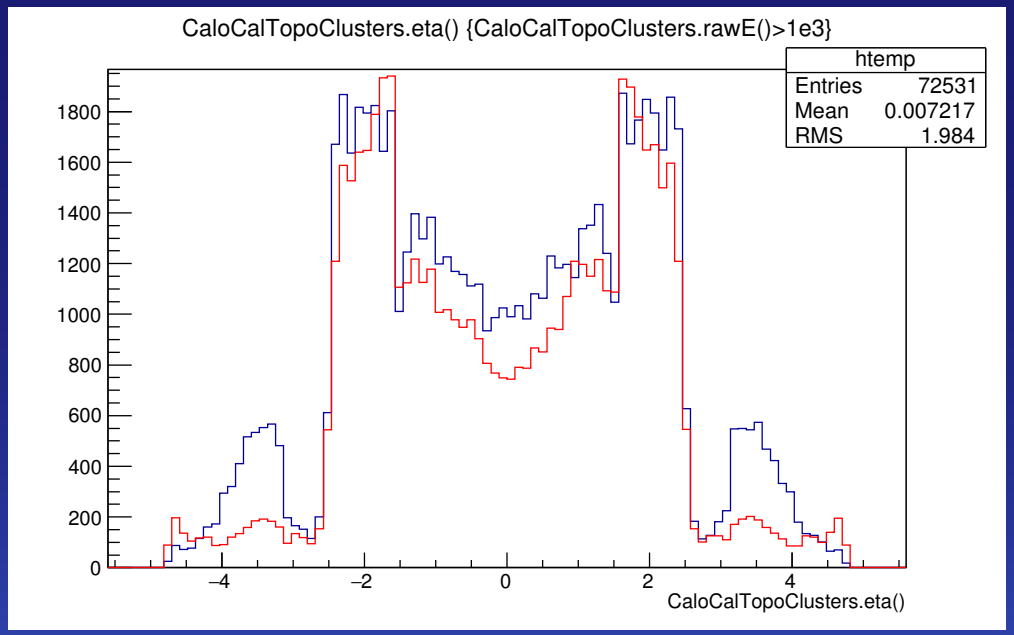
- Some example distributions from LCW production and private JZ5W, Zee
- Plots below show single π^0 (left) and π^- (right) samples
- Reconstructed Energy after LCW over truth energy vs. $p_\perp$ and $|\eta|$
- Prooves clustering/moments/calibration chain is working for sFCal region
- These plots (and the ones on the next slides) are for the large gap sFCal with $\mu = 200$ PileUp assumed/added

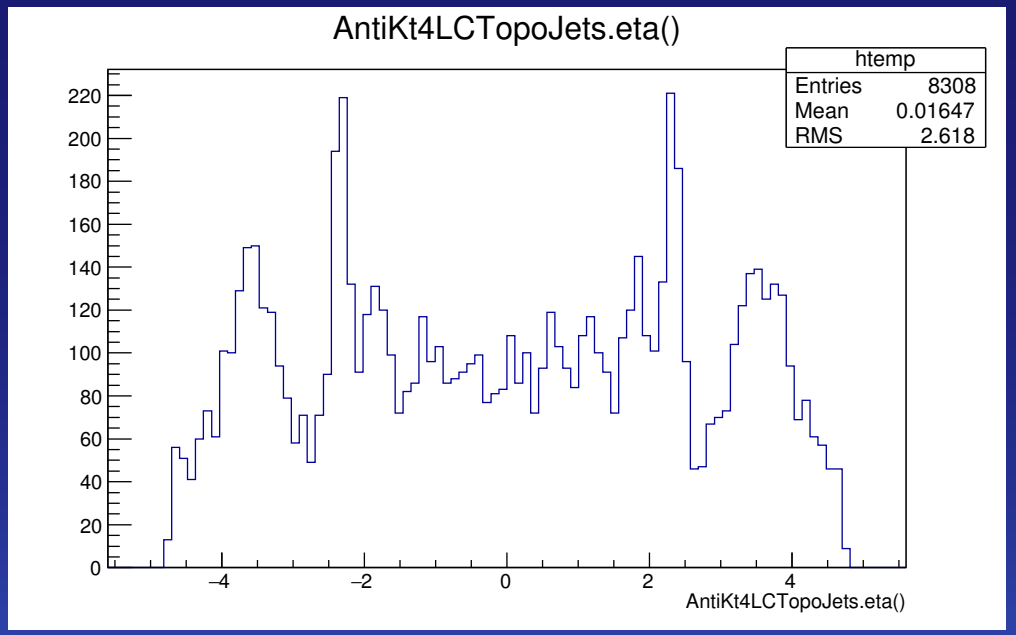




Reconstruction

- η distribution of `CaloCalTopoClusters` on EM-scale for JZ5W (left) for mc15 ITK+sFCal (blue) and mc12 ITK+FCal (red)
  - PileUp is Pythia6 in mc12 and Pythia8 in mc15
  - 20% level differences likely due to noise conditions
  - increase in sFCal region for $|\eta| < 4.3$ demosntrates effect of 4-times higher granularity in sFCal1
- η distribution of `AntiKt4LCTopoJets` for JZ5W (right)
  - jet-reco works find in sFCal region





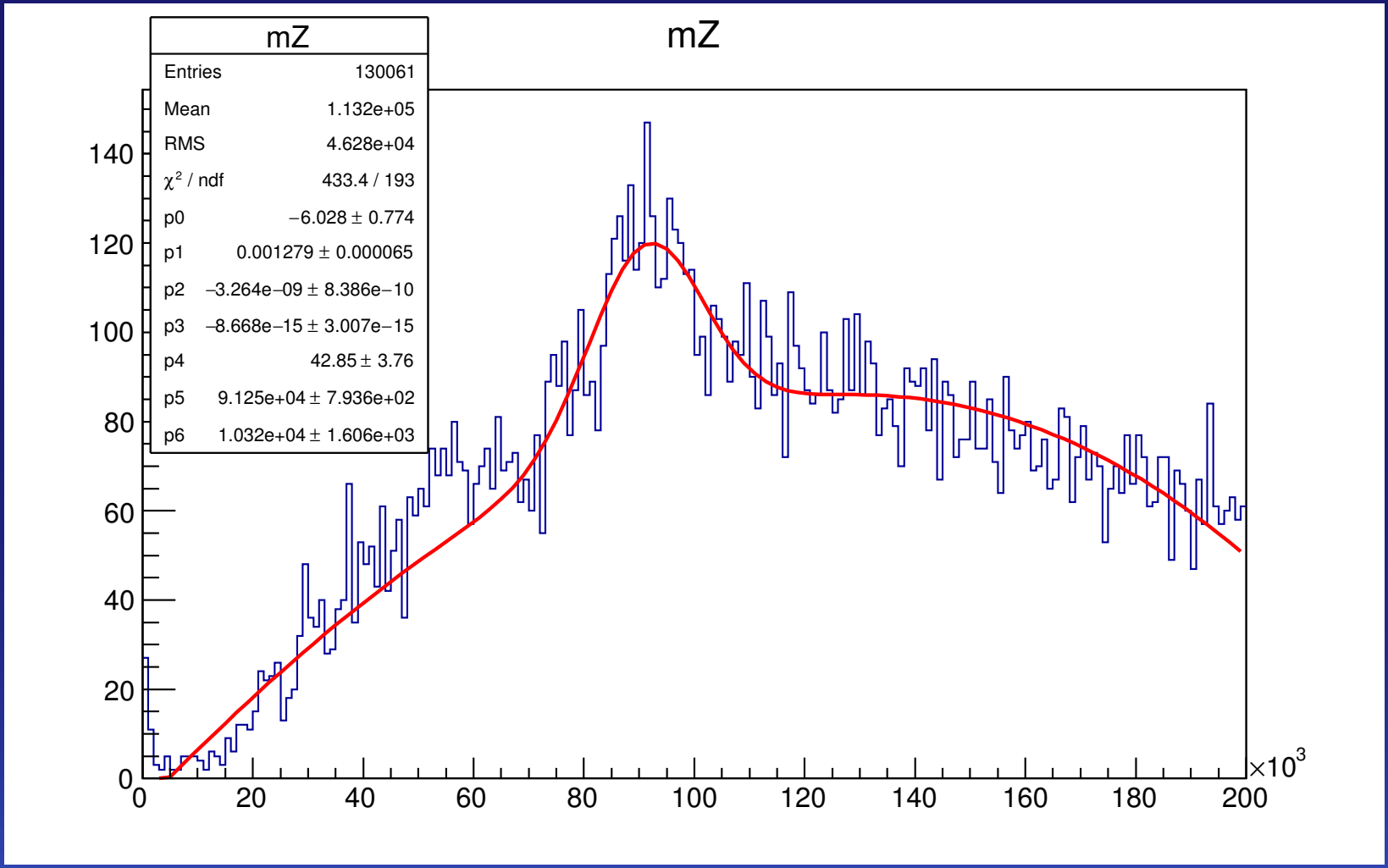
- samples compared:

`mc12_14TeV.147915.Pythia8_AU2CT10_jetjet_JZ5W.merge.AOD.e1996_s1729_s1720_r5388_r4732/`

`user.menke.mc15_14TeV.147915.Pythia8_AU2CT10_jetjet_JZ5W.simul.HITS.e1996_s2640_reco_v7_EXT1/`

Reconstruction

- Reconstructed di-electron mass from $Z \rightarrow e^+e^-$ sample using one central standard Electron and one ForwardElectron ► can be used to check em-scale reco in sFCal1



- samples used:

`user.menke.mc15_14TeV.147806.PowhegPythia8_AU2CT10_Zee.simul.HITS.e1564_s2640_reco_v7_EXT1/`

Next Steps

- Ariel Schwartzman and Steve Alkire to look into JES for sFCal+ITK
  - Ariel points out that also PileUp strategies can be improved (ρ calculation also in the forward)
- Digitization + reconstruction of scoping samples started in prodsys
  - Oana Boeriu and Susumu Oda are taking care of the production
- Biggest improvement is expected for the sFCal in:
  - PileUp reduction (already visible in noise plots)
  - Signal discrimination (substructure of jets, q/g separation)
  - Position resolution (track matching of ITK-VF with sFCal clusters)
- We will use the full reco samples for the sFCal review end of 2015
- Help is welcome to look into the performance comparison FCal/sFCal