

ECAL ALIGNMENT 2017 - First Results

28 June 2017

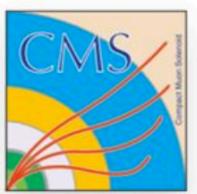
Tanvi Wamorkar
Northeastern University

MONitoring and CALibration meeting



Datasets

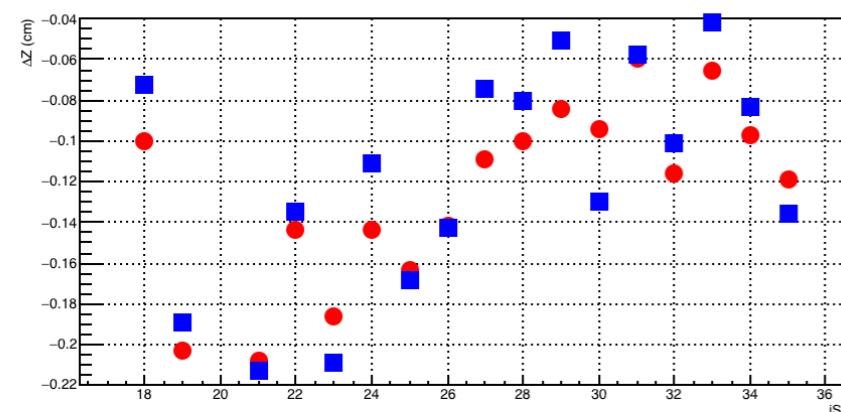
- CMSSW release used - **CMSSW_9_2_1**
- Dataset used for getting MC bias values:
`dataset=/DYJetsToLL_M-50_TuneCUETP8M1_13TeV-madgraphMLM-pythia8/
PhaseIISpring17MiniAOD-FlatPU28to62_902_90X_upgrade2017_realistic_v20_ext1-v1/
MINIAODSIM`
- Prompt GT used: **92X_dataRun2_Prompt_v4**
- `/DoubleEG/Run2017A-ZElectron-PromptReco-v2/RAW-RECO`
`/DoubleEG/Run2017A-ZElectron-PromptReco-v3/RAW-RECO`
`/DoubleEG/Run2017B-ZElectron-PromptReco-v1/RAW-RECO`
- The datasets correspond to 2.7 fb^{-1} integrated luminosity
- Only DCS JSON used



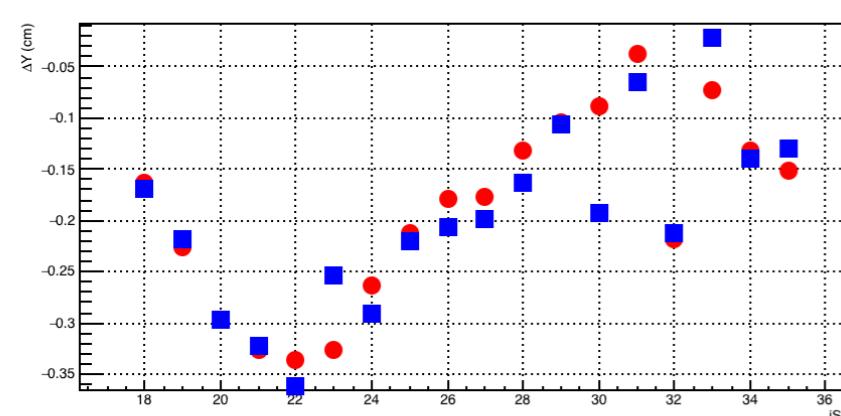
Alignment Values EB

2016 values

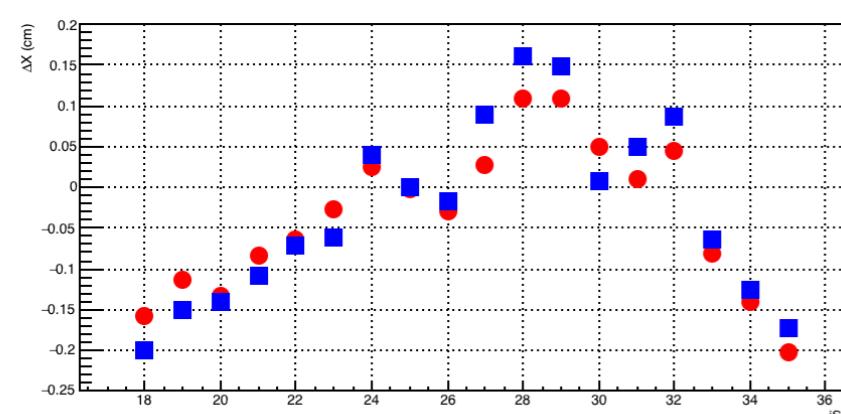
EB- ΔZ



EB- ΔY

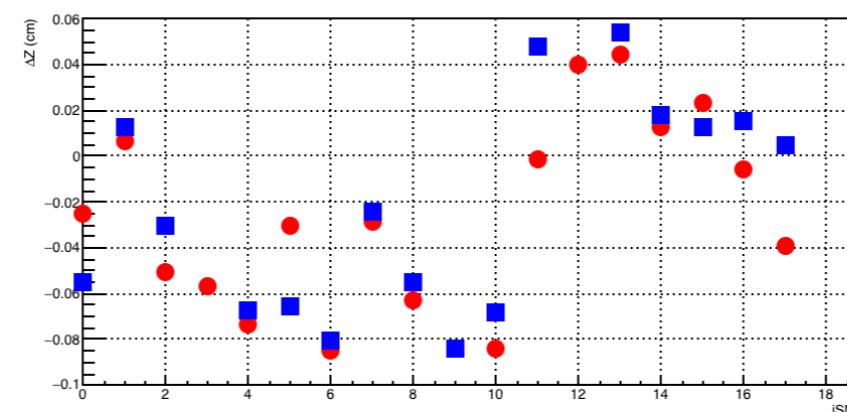


EB- ΔX

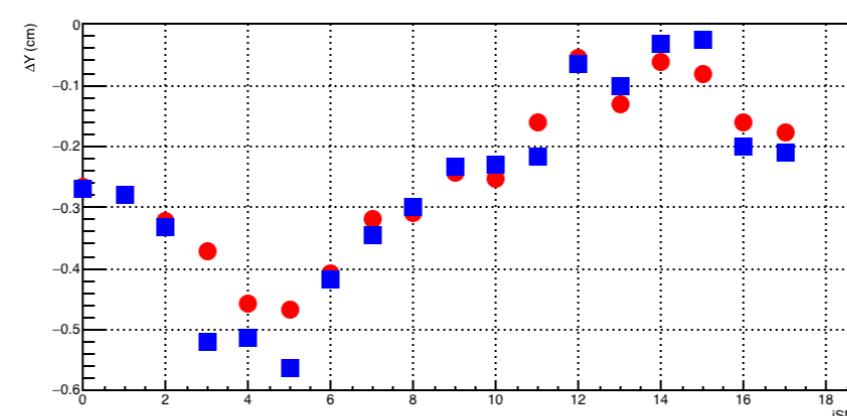


2017 values

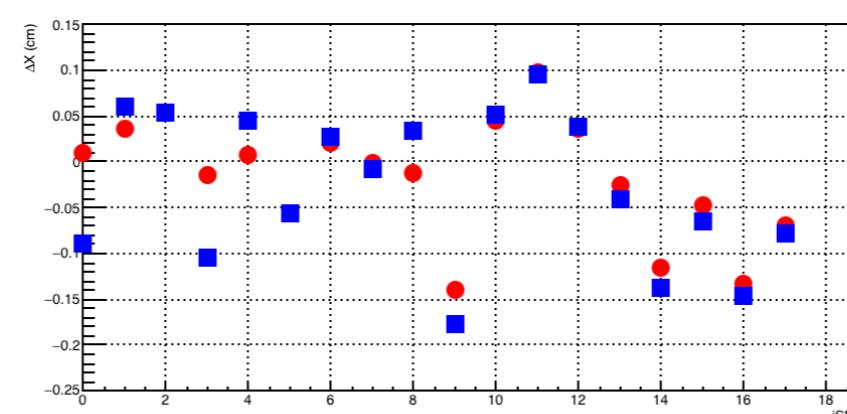
EB+ ΔZ



EB+ ΔY



EB+ ΔX



Δx (cm) Δy (cm) Δz (cm)

-0.088169	-0.26833	-0.055234
0.060606	-0.27906	0.012702
0.054138	-0.33231	-0.030223
-0.10481	-0.51952	-0.10745
0.046077	-0.51249	-0.067163
-0.055743	-0.5617	-0.065283
0.027476	-0.41894	-0.080729
-0.0083739	-0.34418	-0.024267
0.035091	-0.29902	-0.055326
-0.1772	-0.23299	-0.083676
0.050944	-0.23109	-0.067959
0.095427	-0.21642	0.048225
0.038706	-0.066055	0.071572
-0.03969	-0.10063	0.054317
-0.13801	-0.032513	0.017595
-0.065653	-0.02466	0.012972
-0.14526	-0.19993	0.015392
-0.07739	-0.21165	0.004881
-0.19874	-0.16911	-0.072402
-0.15086	-0.21742	-0.18925
-0.14175	-0.29742	-0.22003
-0.1082	-0.3215	-0.21238
-0.07074	-0.36176	-0.13519
-0.062037	-0.25425	-0.20919
0.04103	-0.29043	-0.11099
0.0011471	-0.22097	-0.168
-0.017628	-0.20633	-0.14248
0.088202	-0.19938	-0.074815
0.16031	-0.16384	-0.079963
0.14779	-0.10545	-0.050666
0.007887	-0.19342	-0.12931
0.048543	-0.065578	-0.057634
0.08683	-0.21185	-0.10117
-0.064301	-0.021634	-0.041786
-0.12544	-0.13874	-0.083155
-0.17221	-0.12924	-0.13594



Alignment Values EE

$\Delta\Phi$

$\Delta\phi$

$\Delta\Psi$

Δx

Δy

Δz

0.00078224	0	0	-0.14669	-0.53892	-0.67354
0.00092297	0	0	-0.14529	-0.64954	-0.53502
-0.00053689	0	0	0.40036	-0.74396	0.44456
-0.00090074	0	0	0.41034	-0.82334	0.41698

2016 values

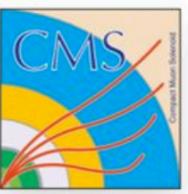
0.00039112	0	0.00039112	-0.064943	-0.54488	-0.65778
0.00046148	0	0.00046148	-0.01668	-0.65543	-0.5094
-0.00026845	0	-0.00026845	0.2852	-0.75506	0.40194
-0.00045037	0	-0.00045037	0.33484	-0.83266	0.4104

2017 values

- With rotation in Phi turned off
- Can see shift in both EE and EB

Alignment values stored :

- /afs/cern.ch/user/t/twamorka/public/ECALalignment_2017/myEBAlignment_2017_jun26_combined.txt
- /afs/cern.ch/user/t/twamorka/public/ECALalignment_2017/myEEAlignment_2017_jun26_combined.txt



Eta Distributions

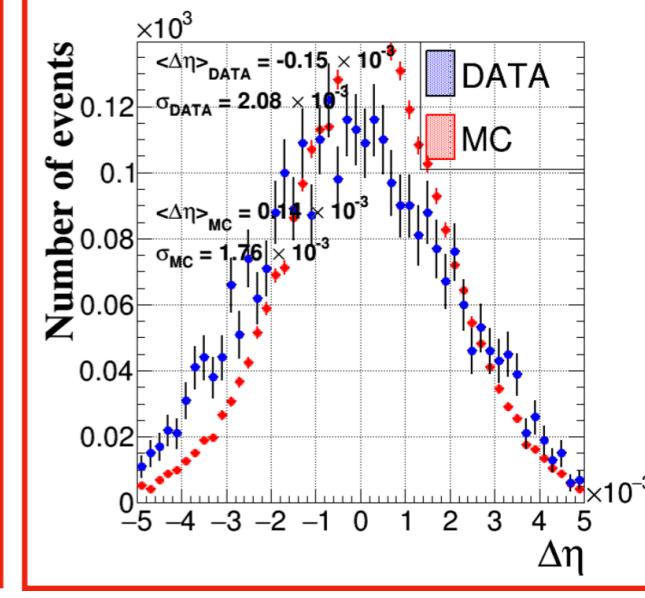
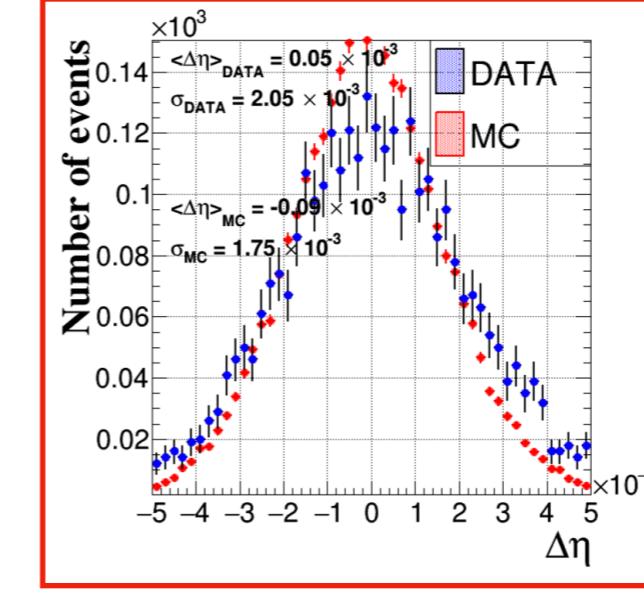
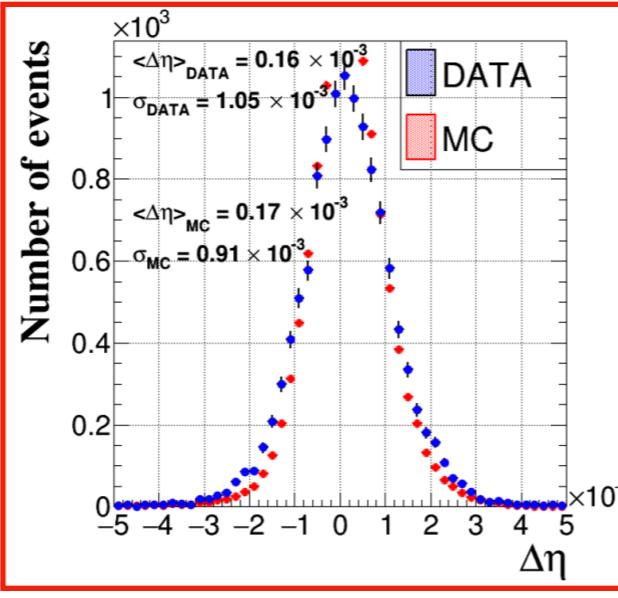
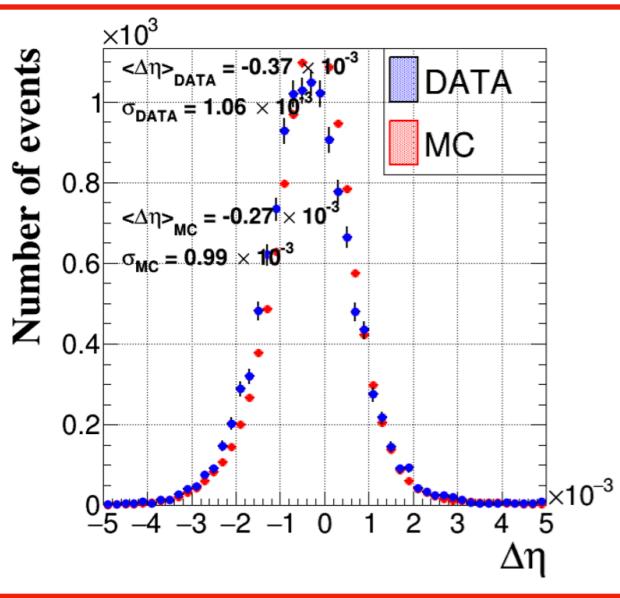
EB +

EB -

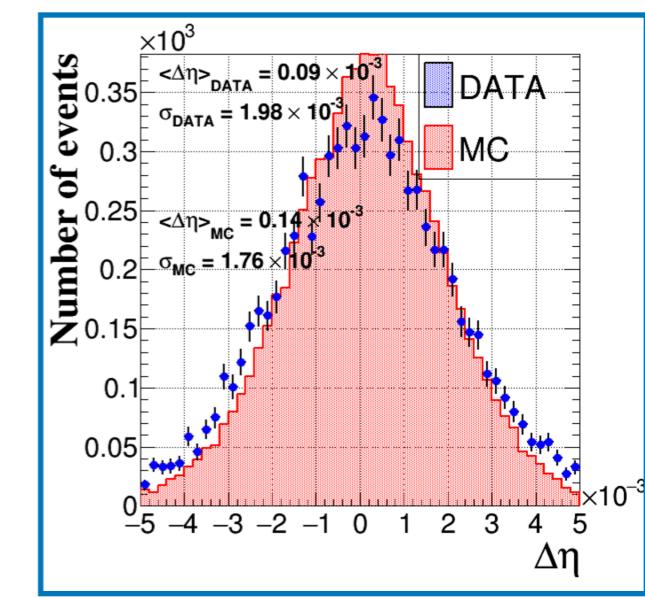
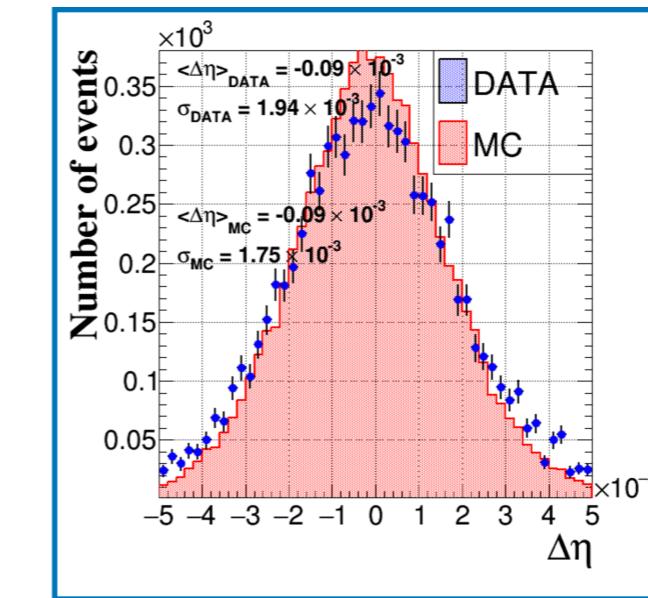
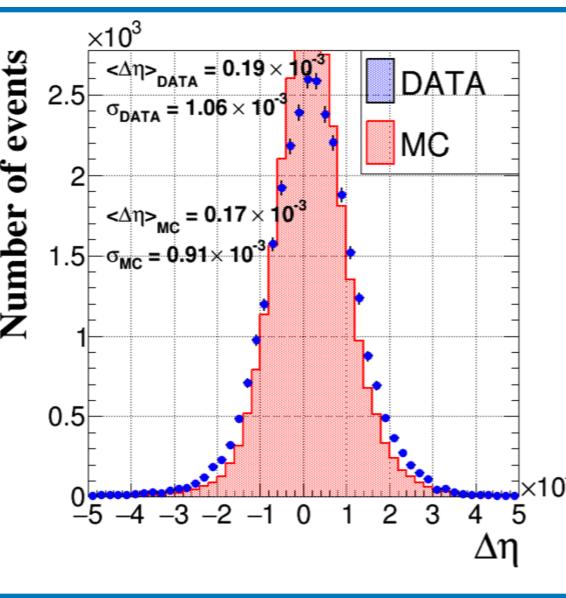
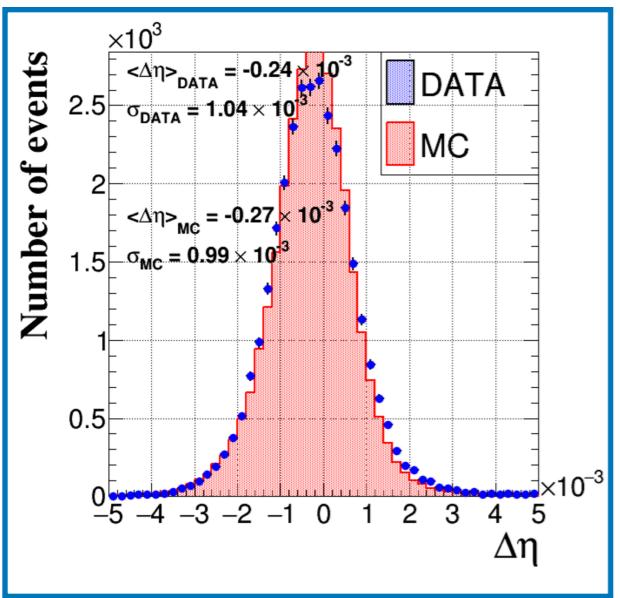
EE +

EE -

Pre-Alignment

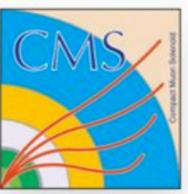


Post-Alignment



<http://twamorka.web.cern.ch/twamorka/prealignment/>

<http://twamorka.web.cern.ch/twamorka/postalignment/>



Phi Distributions

Electron

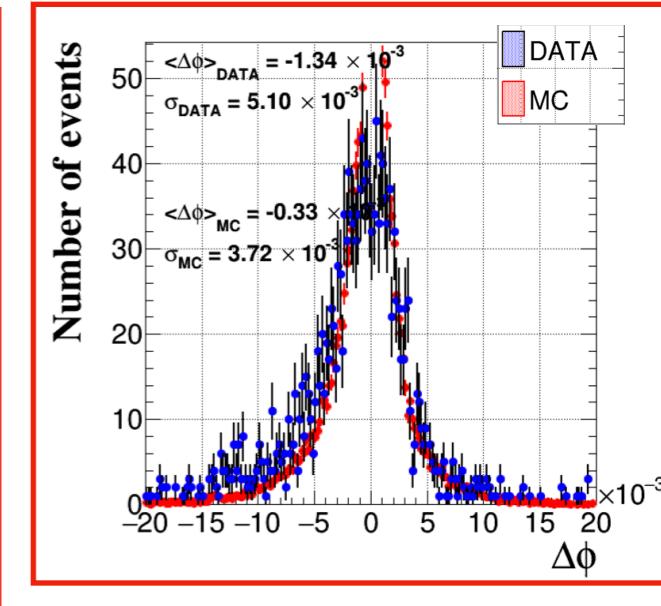
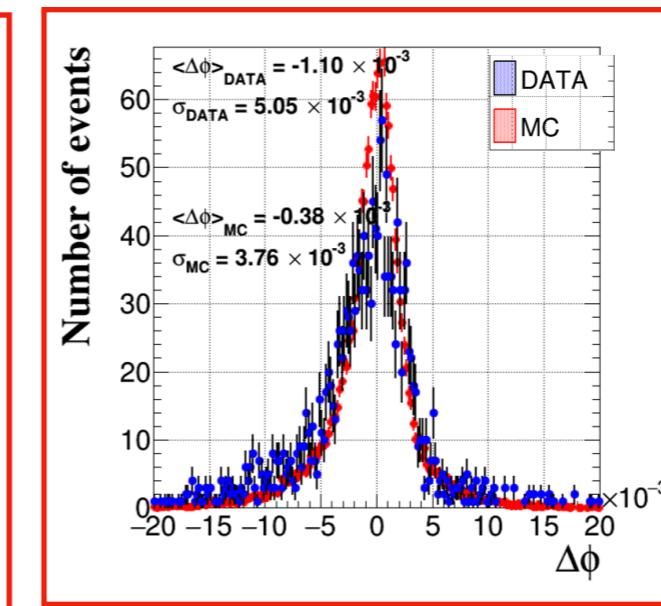
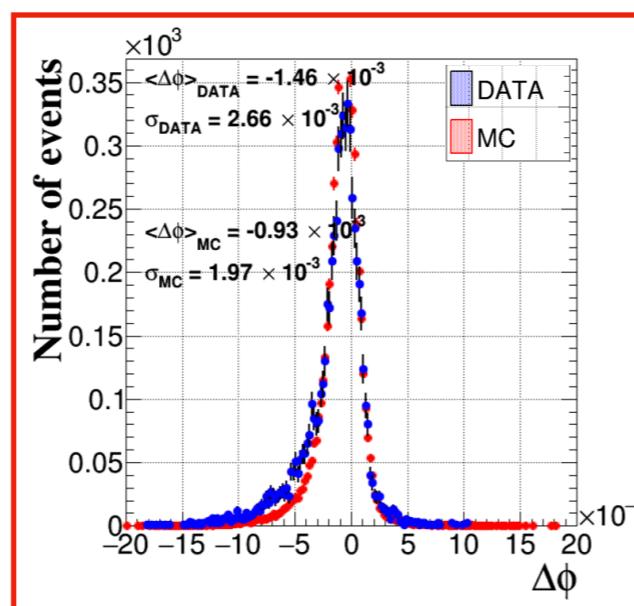
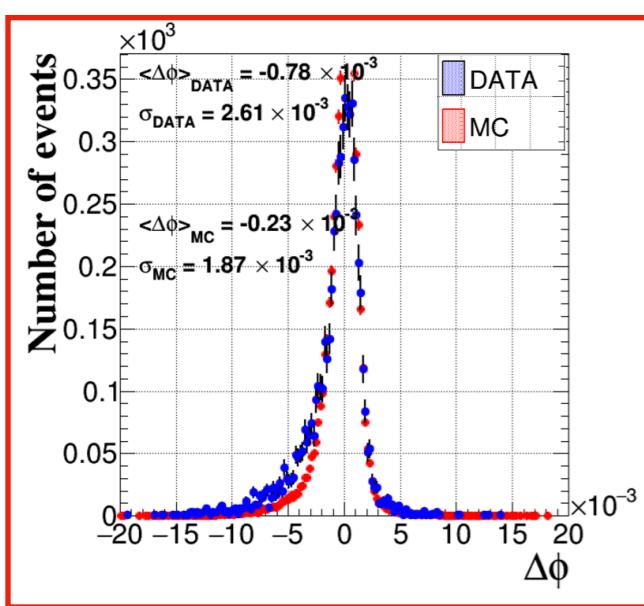
EB +

EB -

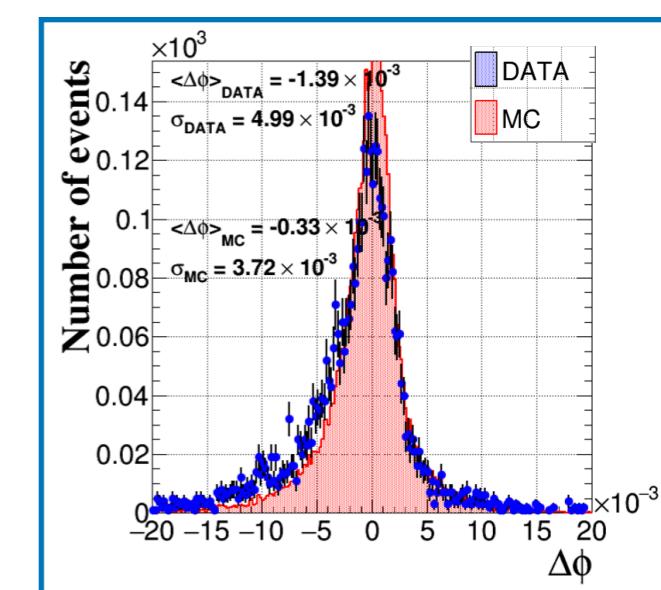
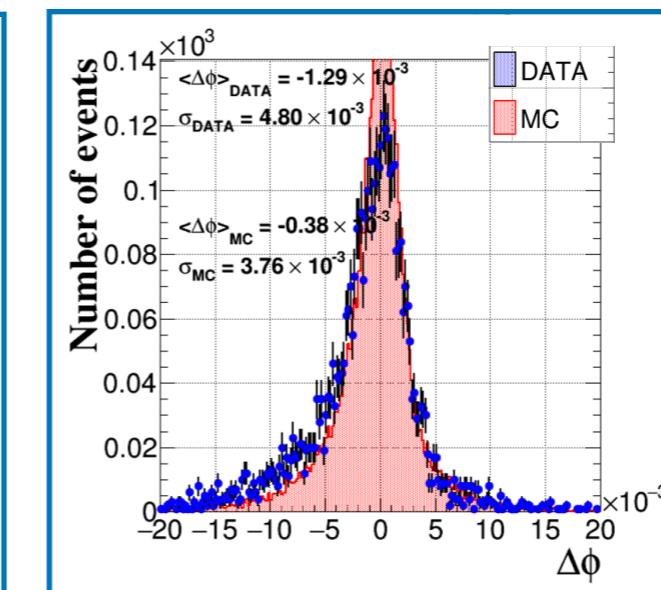
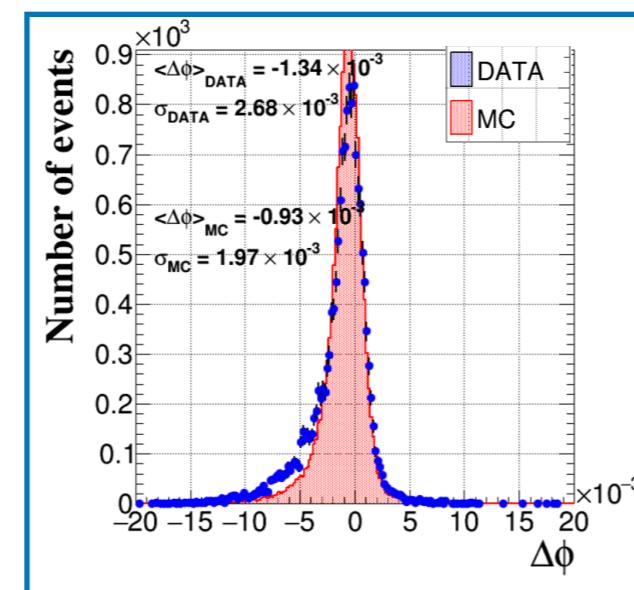
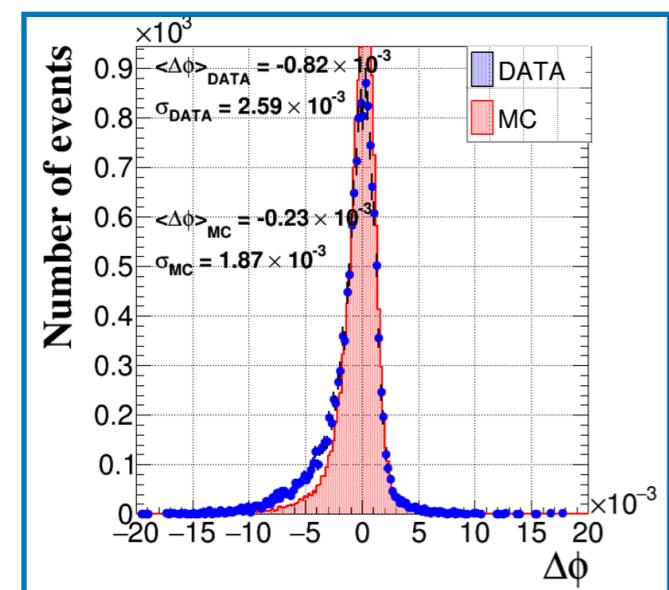
Pre-Alignment

EE +

EE -



Post-Alignment



<http://twamorka.web.cern.ch/twamorka/prealignment/>

<http://twamorka.web.cern.ch/twamorka/postalignment/>



Positron

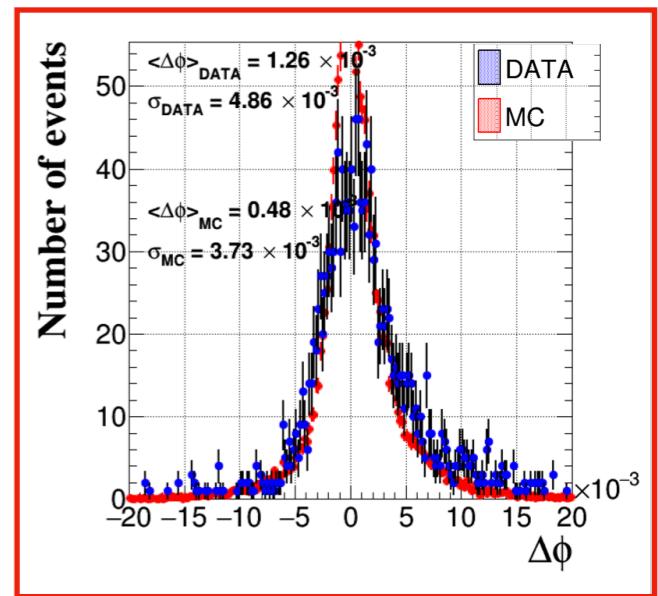
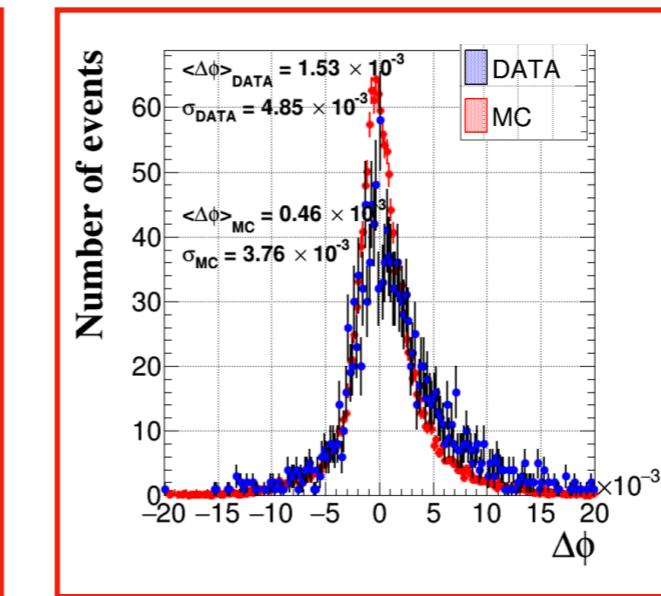
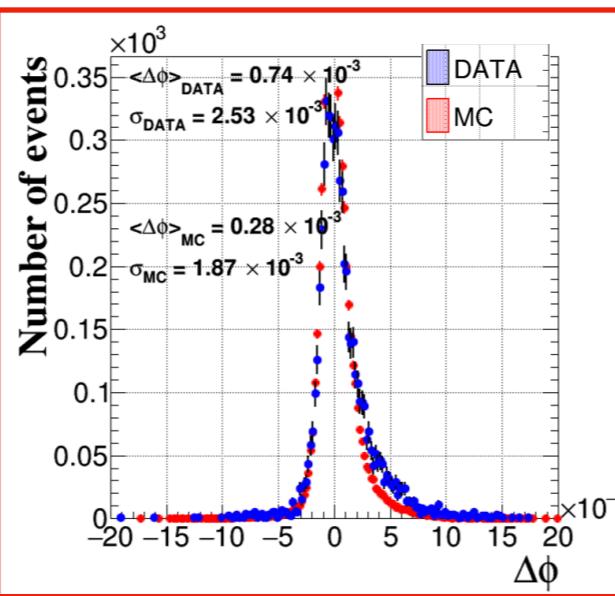
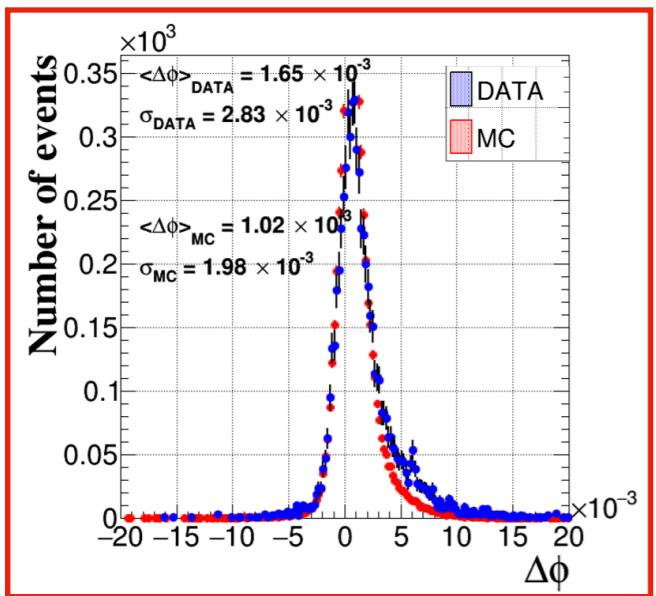
Pre-Alignment

EB +

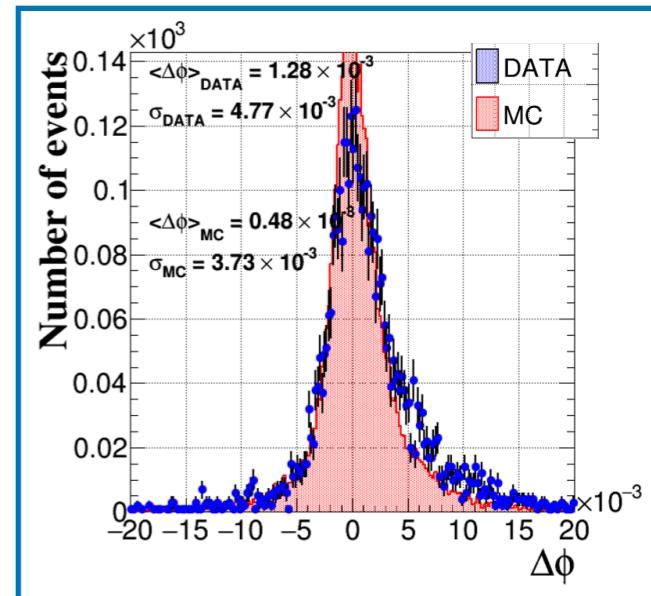
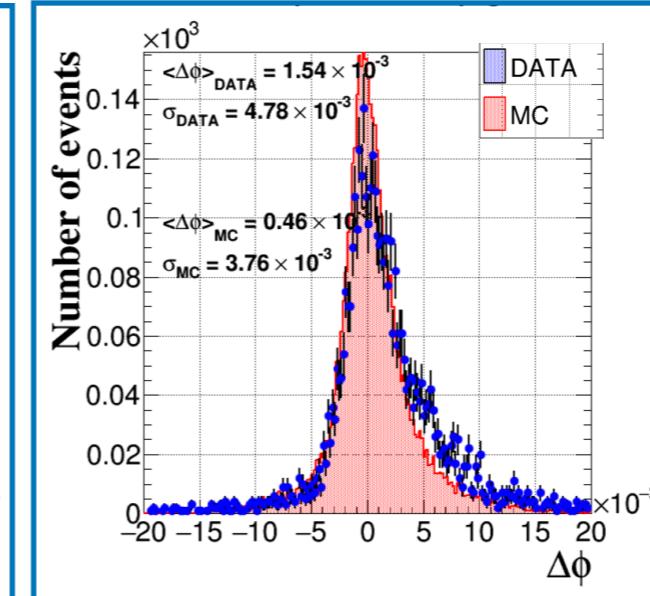
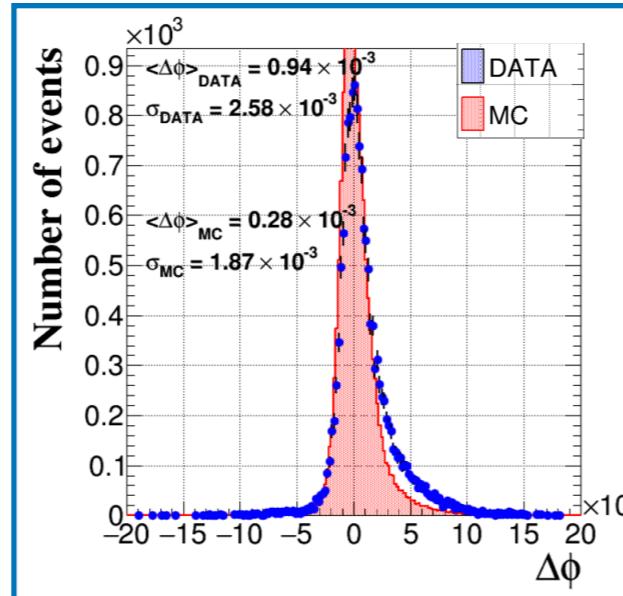
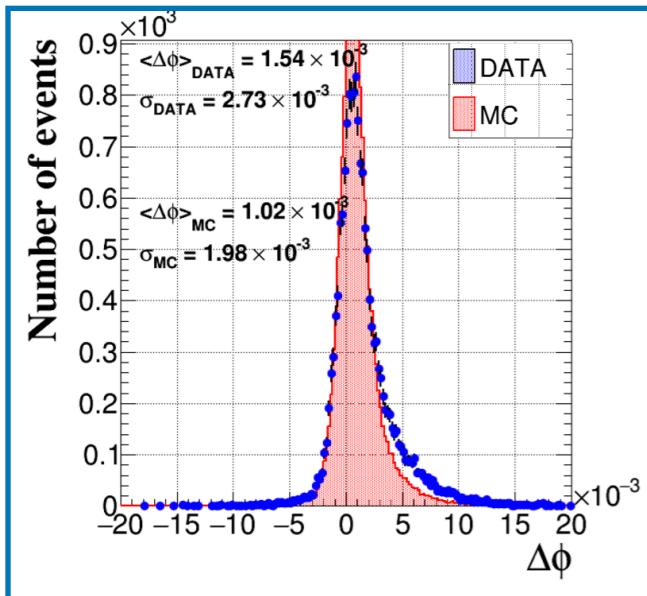
EB -

EE +

EE -



Post-Alignment



<http://twamorka.web.cern.ch/twamorka/prealignment/>

<http://twamorka.web.cern.ch/twamorka/postalignment/>



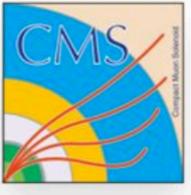
CONCLUSIONS

- For reference - Details of the Alignment procedure:

CMS AN-2013/328 - CMS ECAL alignment in the LHC RUN1

CMS DN-2015/026 - CMS ECAL alignment in the LHC RUN II

- New ECAL DB shows agreement between Data and MC
- New ECAL alignment values available:
 - [/afs/cern.ch/user/t/twamorka/public/ECALalignment_2017/myEBAlignment_2017_jun26_combined.txt](https://afs.cern.ch/user/t/twamorka/public/ECALalignment_2017/myEBAlignment_2017_jun26_combined.txt)
 - [/afs/cern.ch/user/t/twamorka/public/ECALalignment_2017/myEEAlignment_2017_jun26_combined.txt](https://afs.cern.ch/user/t/twamorka/public/ECALalignment_2017/myEEAlignment_2017_jun26_combined.txt)
- **Work in Progress** - As a final check, EE alignment values also being tested with rotation in Phi turned on
 - New DB being created
 - To be used for checking agreement between Data and MC

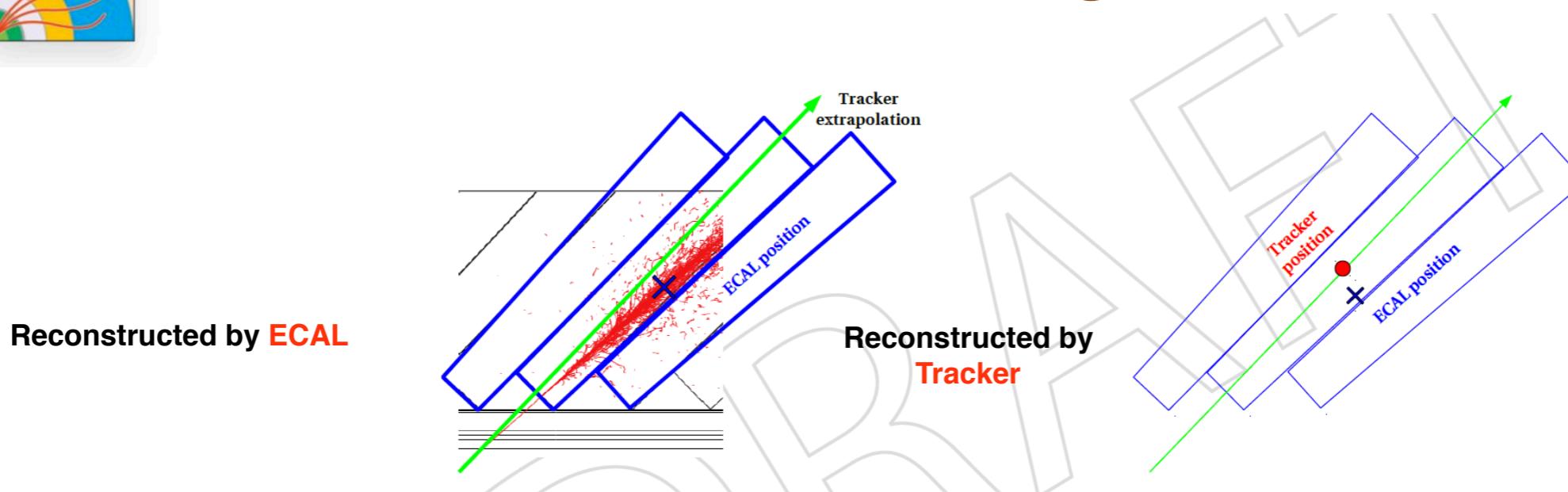


BACK UP

(Quick Review of the Alignment Procedure)



Quick Review of the Alignment Procedure



- Distance along Φ and η directions are used to construct χ^2

$$\chi^2 = \chi_+^2 + \chi_-^2$$

↑
Positrons ↑
Electrons

$$\chi_{\pm}^2 = \sum_{lepton} \frac{(\Delta\varphi - \langle \Delta\varphi_{\pm}^{MC} \rangle)^2}{\varepsilon_{\varphi}^2} + \frac{(\Delta\eta - \langle \Delta\eta^{MC} \rangle)^2}{\varepsilon_{\eta}^2}$$

- The alignment procedure is based on minimization of χ^2

Measure (for every SM in EB and Dee in EE)

- 3 Translations $\Delta x, \Delta y, \Delta z$
- 3 Rotations(Euler angles) $\Delta\Phi, \Delta\theta, \Delta\psi$

All alignment related variables are required to be same in MC and Data

- $\Delta\Phi$ and $\Delta\eta$ are used to construct χ^2 and the difference between these variables for Data and MC is minimized in order to effectively align the ECAL with the tracker