ECAL Alignment 2018: Monitoring

MoCa Meeting
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Tanvi Wamorkar
Northeastern University

Status of ECAL alignment

- Dataset used: **/EGamma/Run2018B-ZElectron-PromptReco-v1/RAW-RECO**
- CMSSW version : **CMSSW_10_1_2_patch2**
- Global Tag: **101X_dataRun2_Prompt_v10** (with new tracker alignment deployed on 4th of June)
- Performed re-alignment of EB and EE to monitor the alignment conditions
- In all the following plots, comparison of **Tracker(after 4th Jun) + ECAL(2018 conditions)** VS **Tracker(after 4th Jun) + ECAL (2018 re-alignment)** is shown

EE alignment values

		ΔΦ	Δϕ	ΔΨ	Δx	Δy	Δz
EE -	Dee 0	0.00039112	0	0.00039112	−0.10144	−0.63533	−0.63961
	Dee 1	0.00046148	0	0.00046148	−0.071571	−0.75355	−0.49267
EE +	Dee 2	−0.00026845	0	−0.00026845	0.066632	−0.78463	0.38257
	Dee 3	−0.00045037	0	−0.00045037	0.11935	−0.86755	0.39066

Before re-alignment

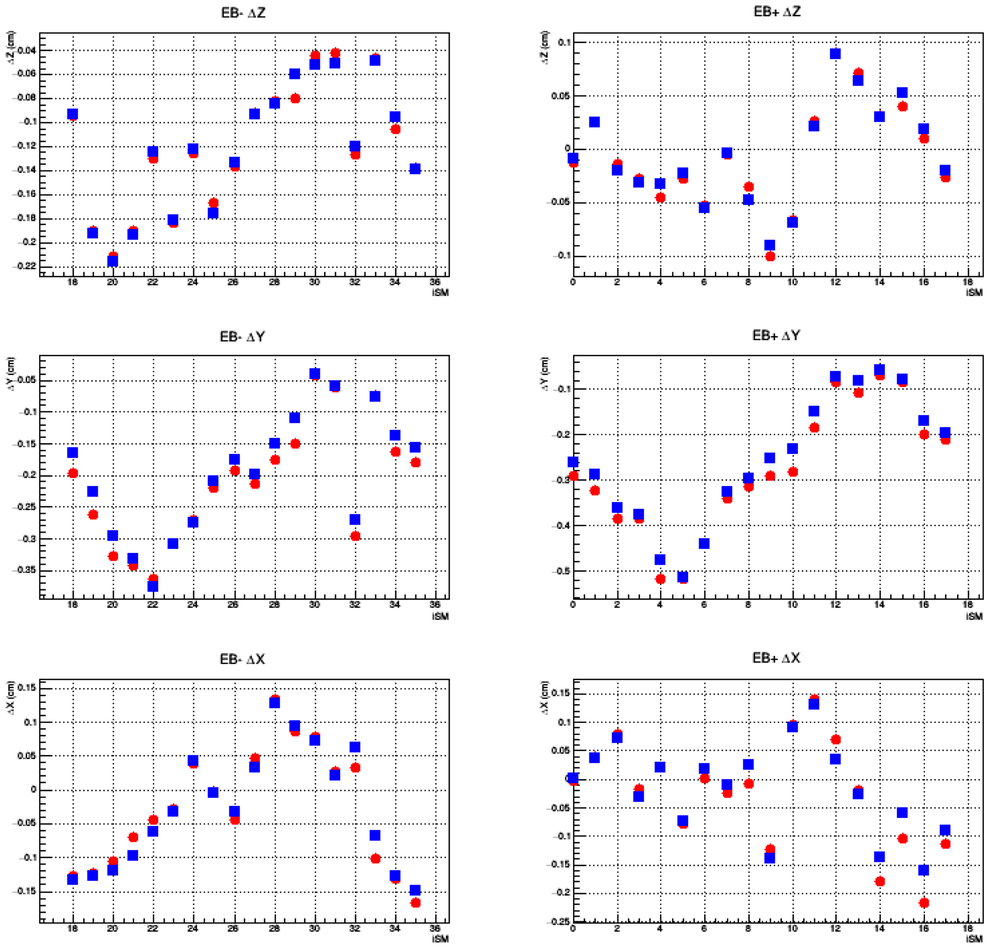
EE -	Dee 0	0.00039112	0	0.00039112	−0.1032	−0.63828	−0.64133
	Dee 1	0.00046148	0	0.00046148	−0.067387	−0.75517	−0.50865
EE +	Dee 2	−0.00026845	0	−0.00026845	0.073991	−0.77889	0.35724
	Dee 3	−0.00045037	0	−0.00045037	0.11076	−0.87008	0.37314

After re-alignment

Units are cm

- No significant shift observed in parameters

EB alignment values



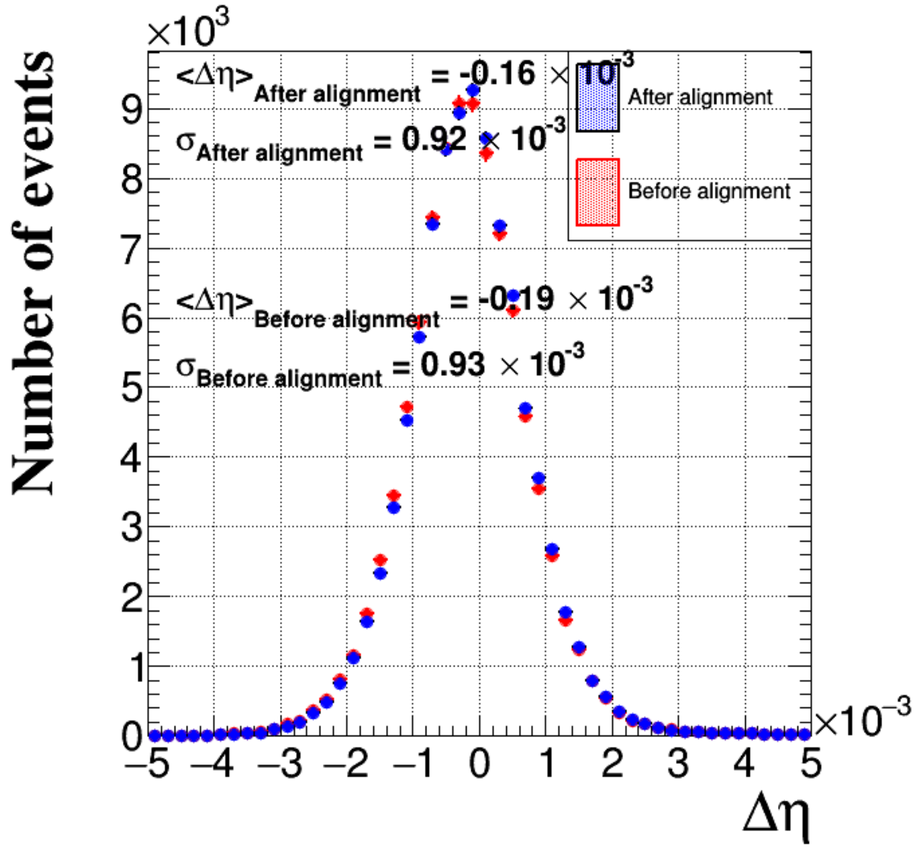
- Δx, Δy, Δz values for EB + and - compared for before and after re-alignment
- On y axis: Supermodule number

- Red circles : Before re-alignment values
- Blue squares : After re-alignment values
- No significant change observed

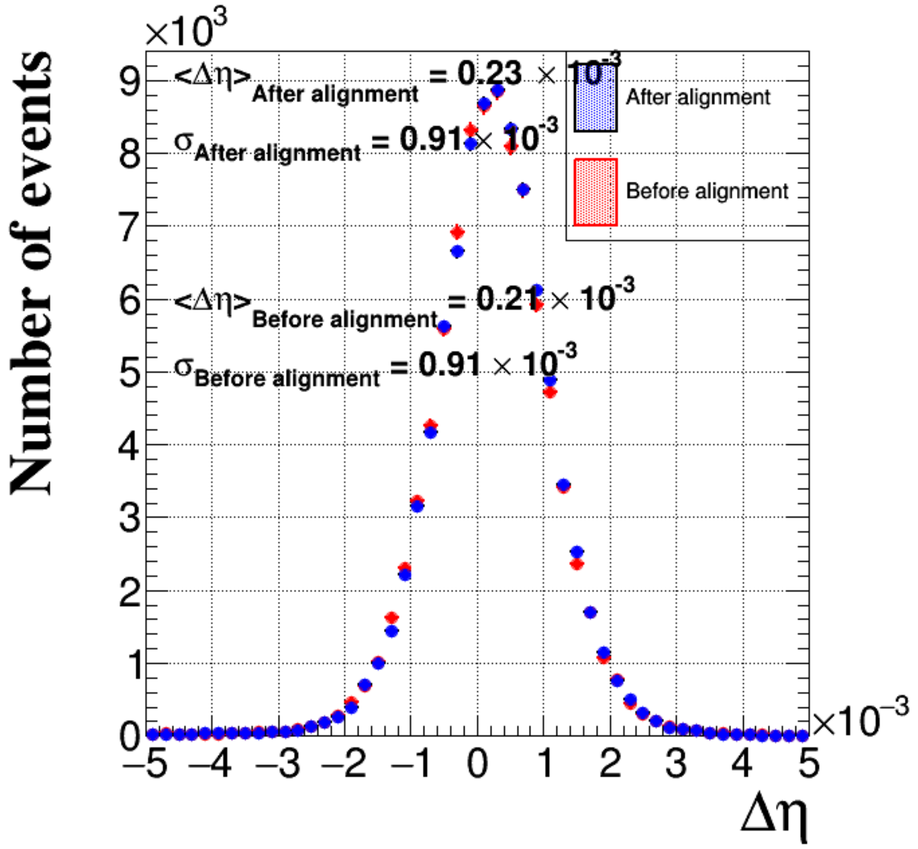
Δη Distributions : ECAL barrel

Data after re-alignment

Data before re-alignment



EB +

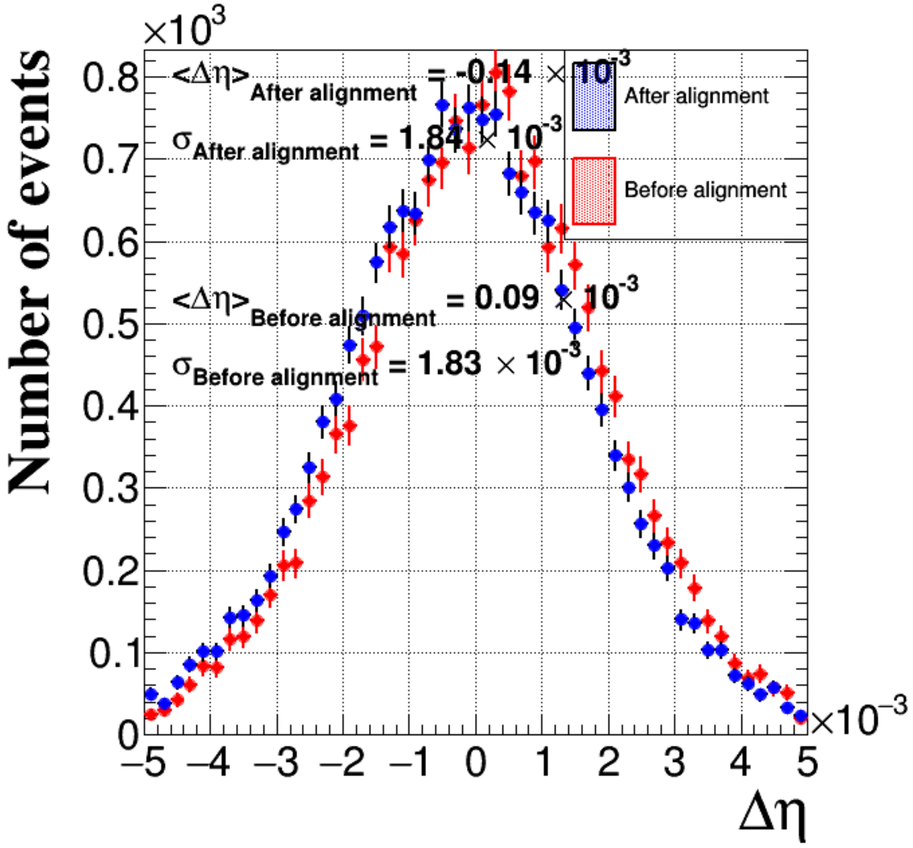


EB -

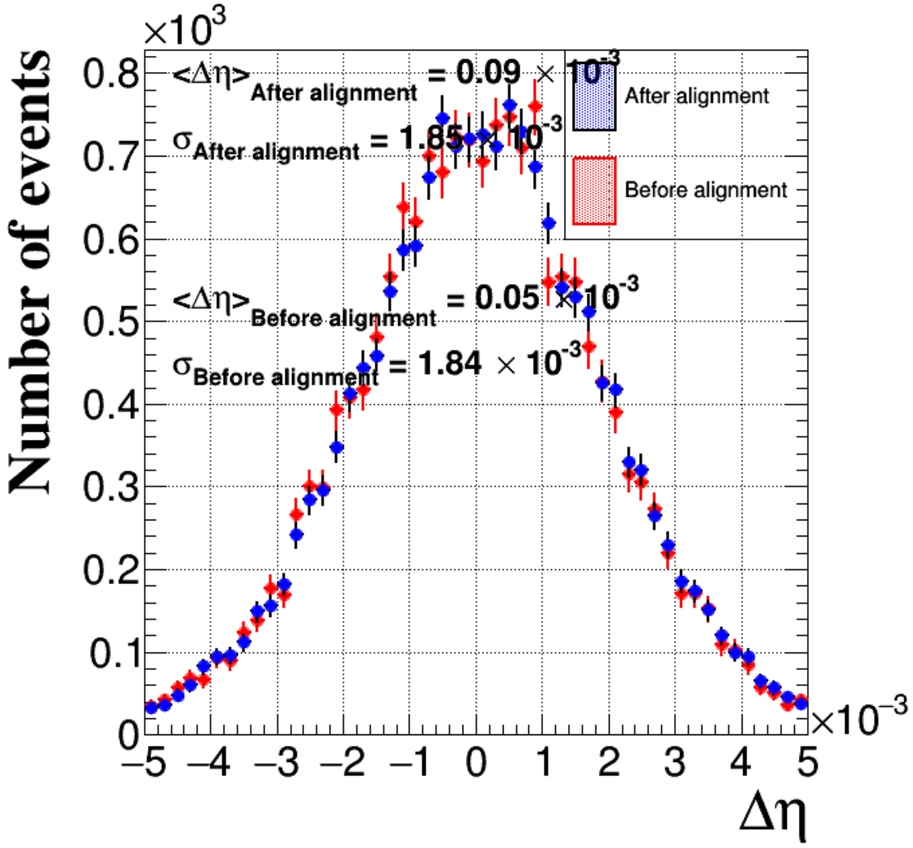
Δη Distributions : ECAL endcap

Data after re-alignment

Data before re-alignment



EE +

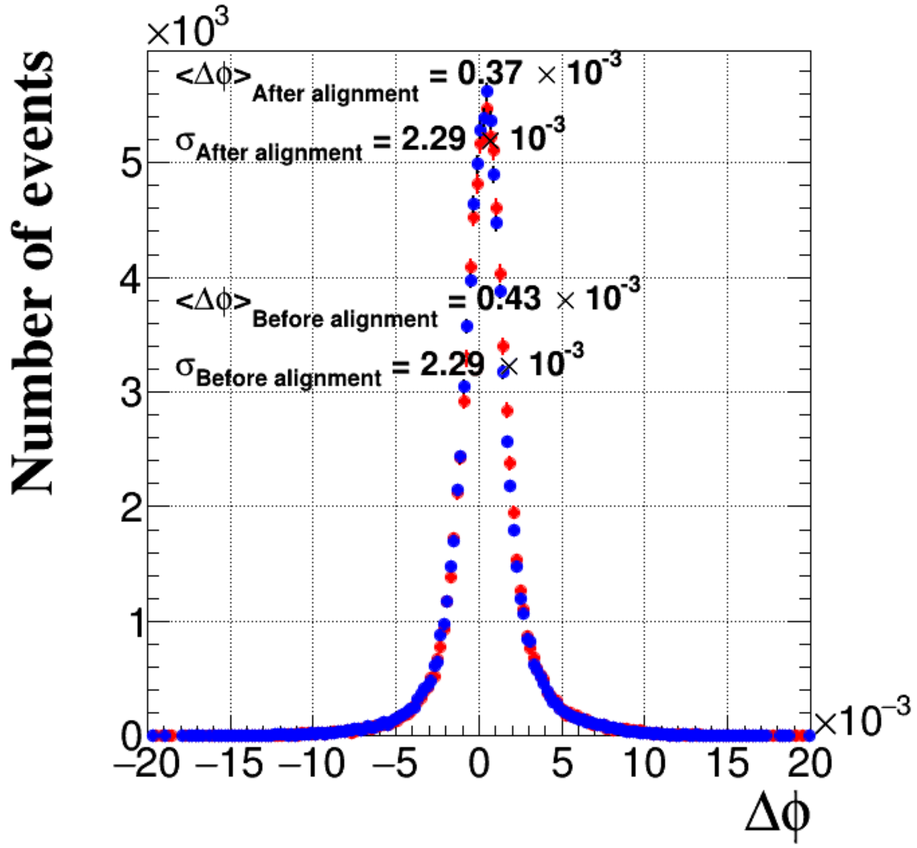


EE -

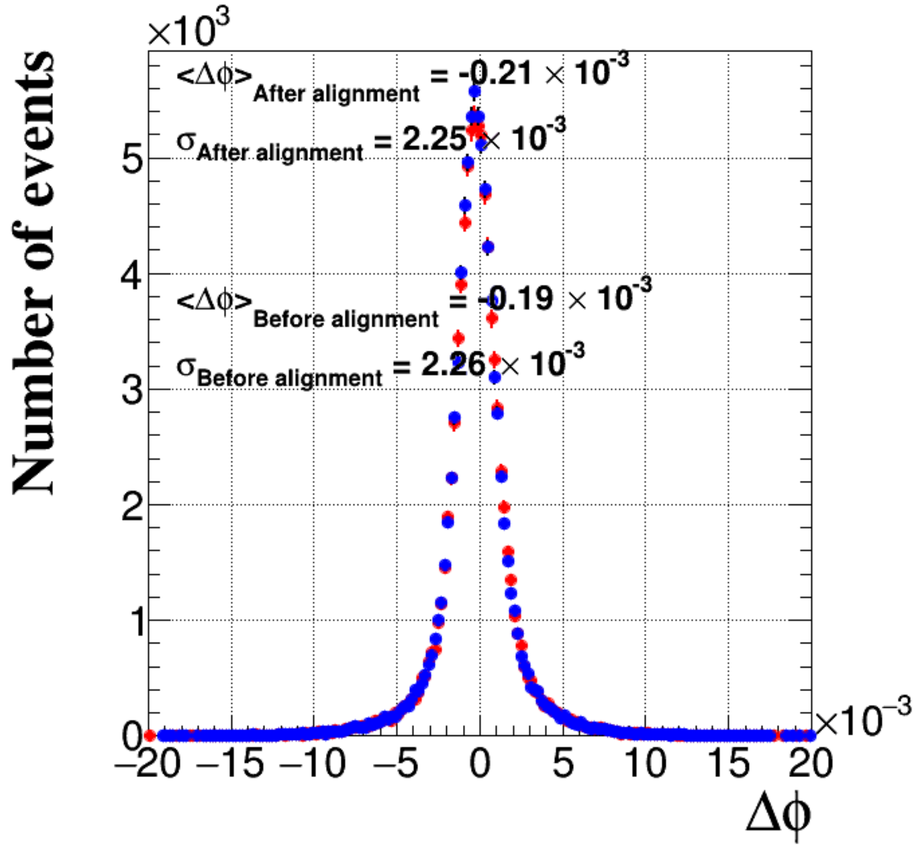
Δφ Distributions: ECAL barrel

Data after re-alignment

Data before re-alignment



EB +

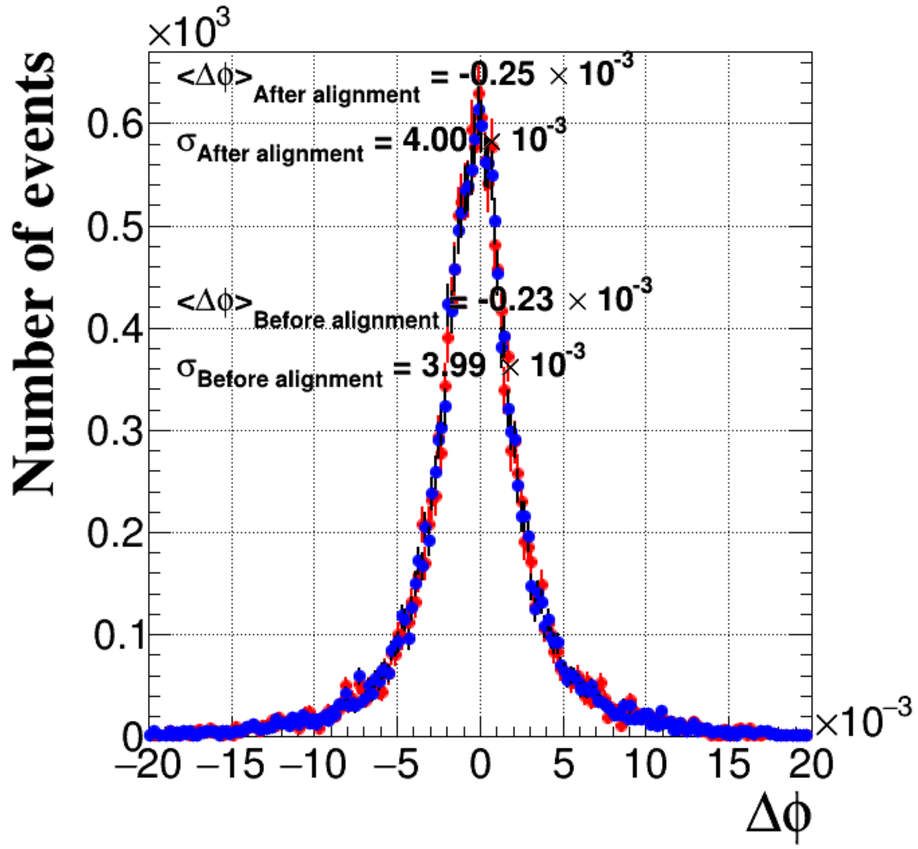


EB -

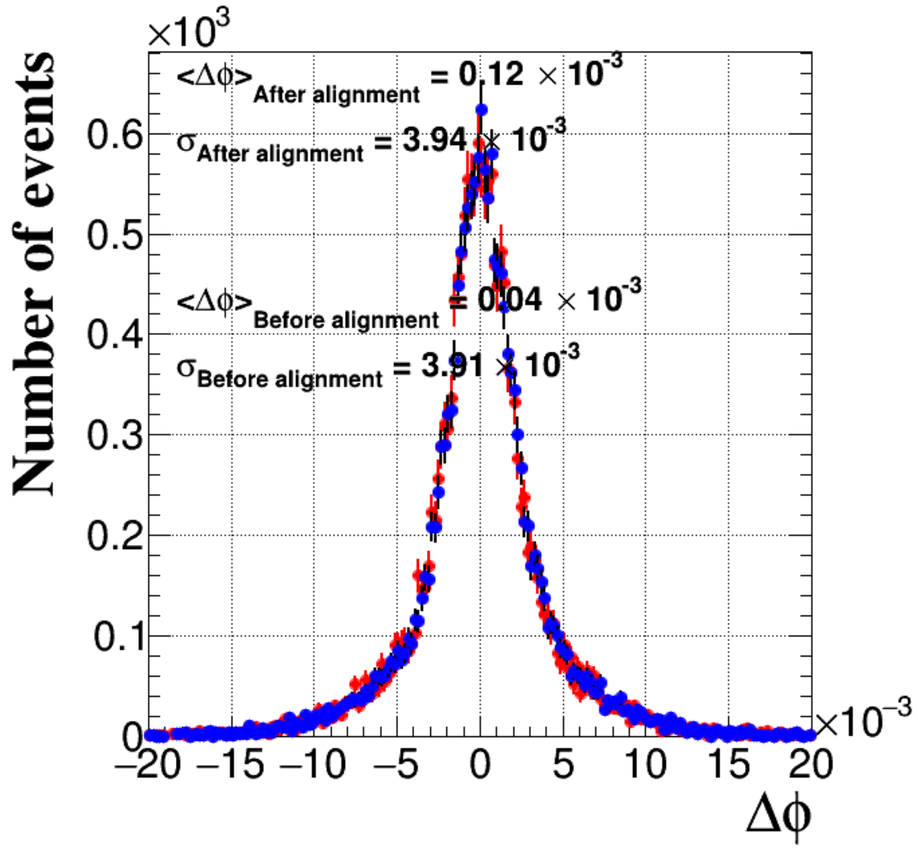
Δφ Distributions: ECAL endcap

Data after re-alignment

Data before re-alignment



EE +



EE -

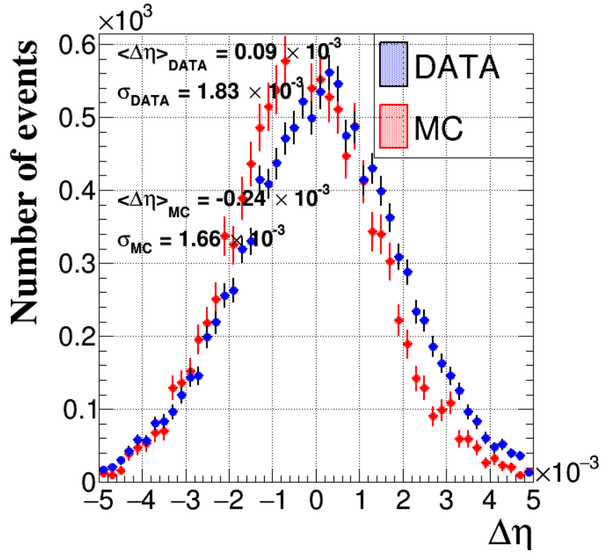
Conclusion

- Updated tracker alignment conditions do not create any significant changes in 2018 ECAL alignment conditions
- Near future: Tracker will release new alignment around 20th August; Will perform re-alignment soon after this
- ECAL is ready to provide new alignment conditions!

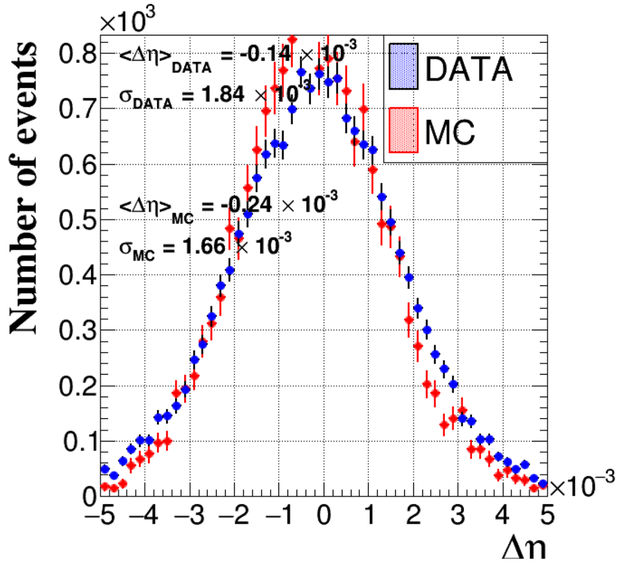
Backup

Δη Distributions : ECAL endcap

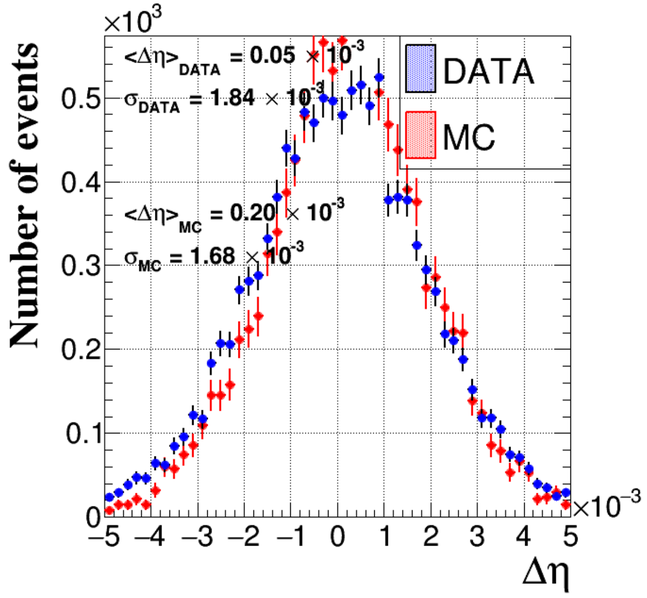
Old tracker(pre Jun4) + new ECAL Alignment



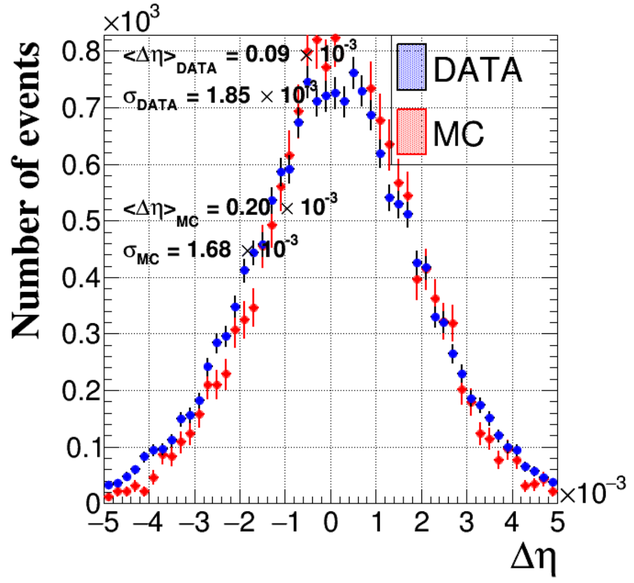
EE +



New tracker (post Jun4) + new ECAL Alignment

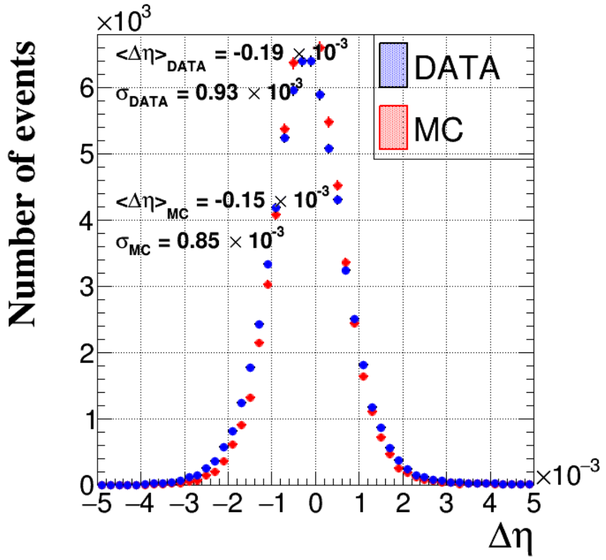


EE -

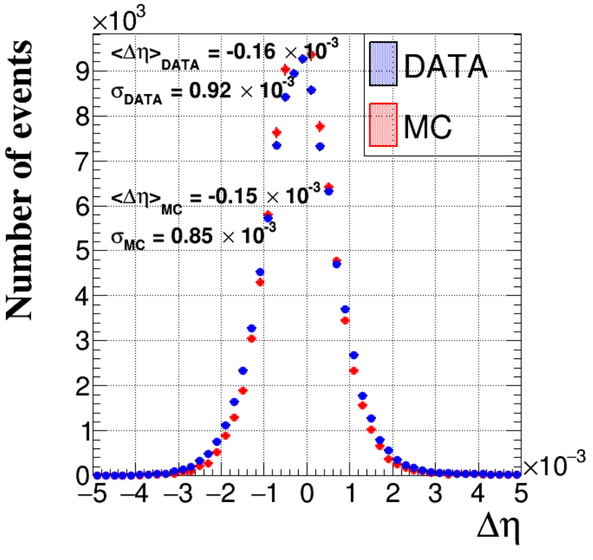


Δη Distributions : ECAL barrel

Old tracker(pre Jun4) + new ECAL Alignment



EB +



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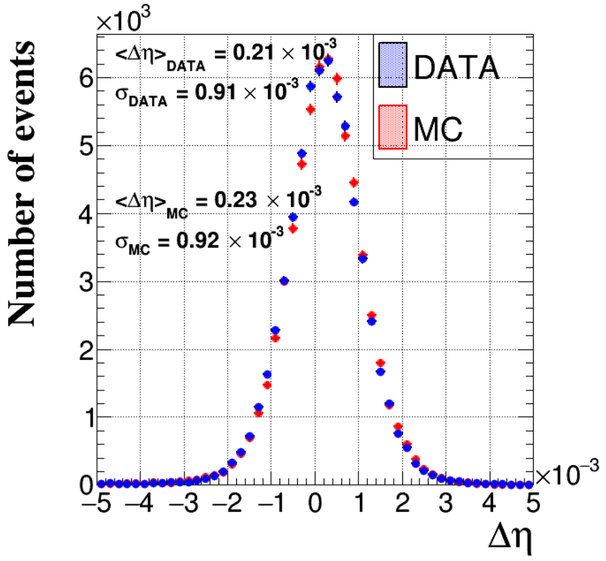
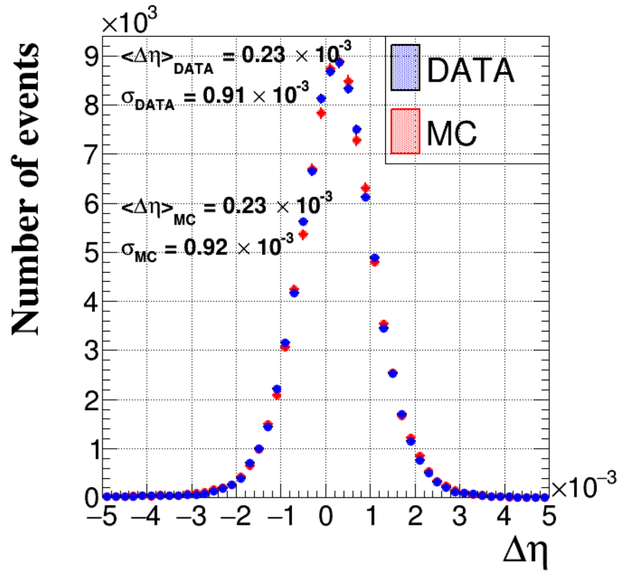
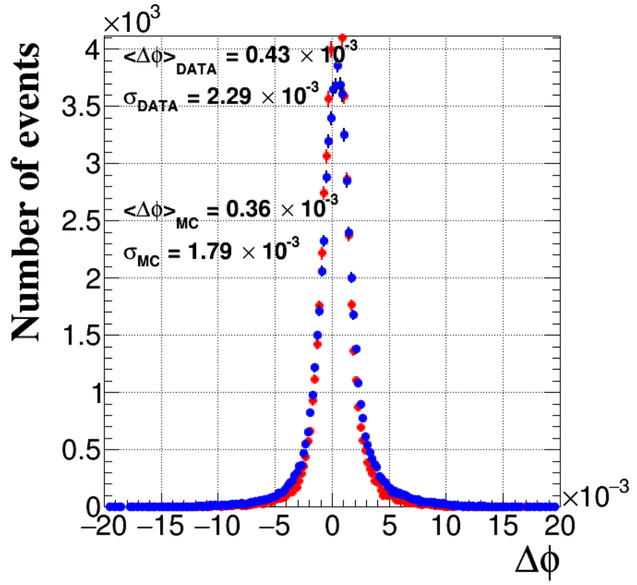


EB -

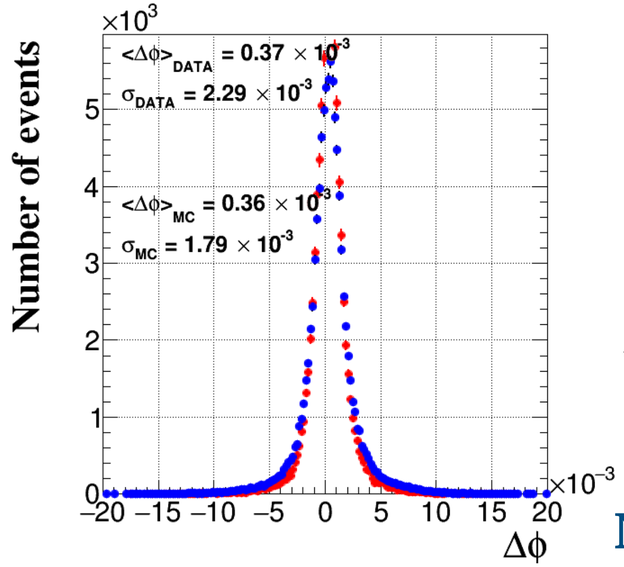


Δφ Distributions: ECAL barrel

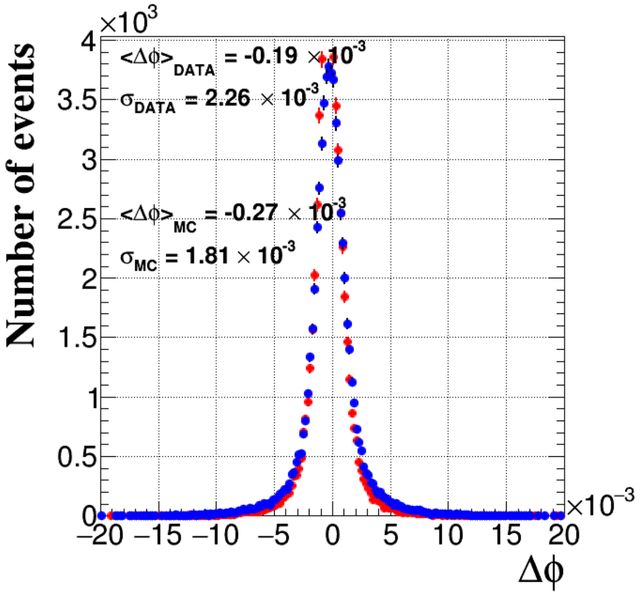
Old tracker(pre Jun4) + new ECAL Alignment



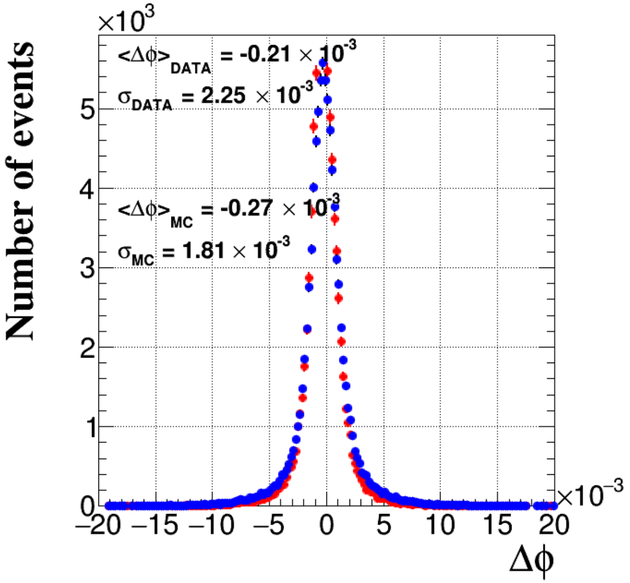
EB +



New tracker (post Jun4) + new ECAL Alignment

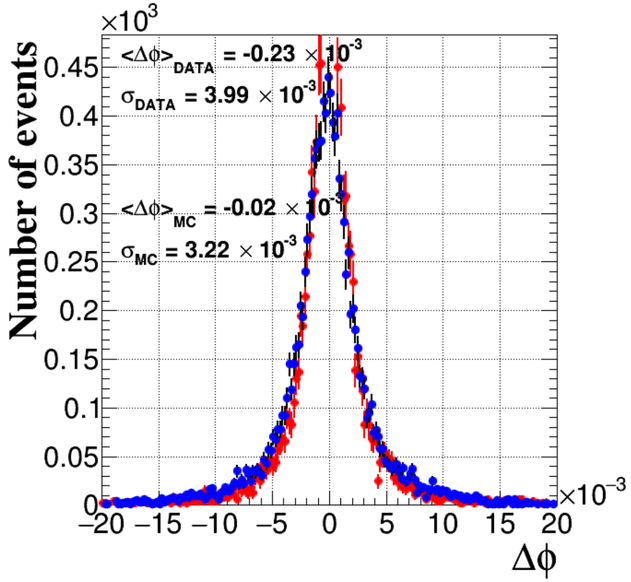


EB -

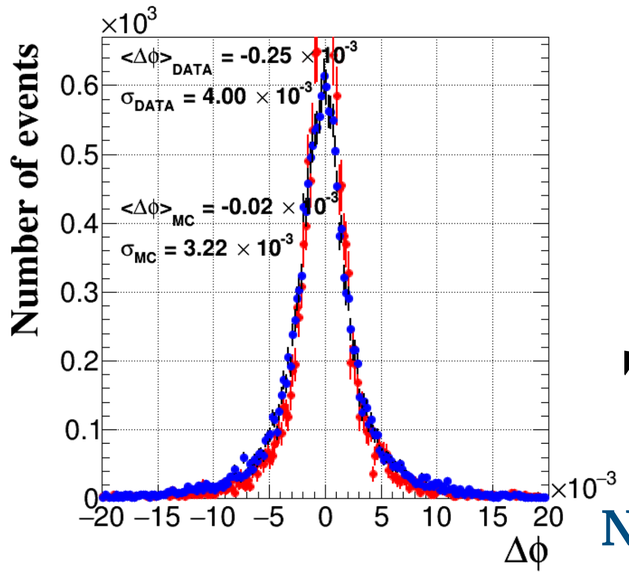


Δφ Distributions: ECAL endcap

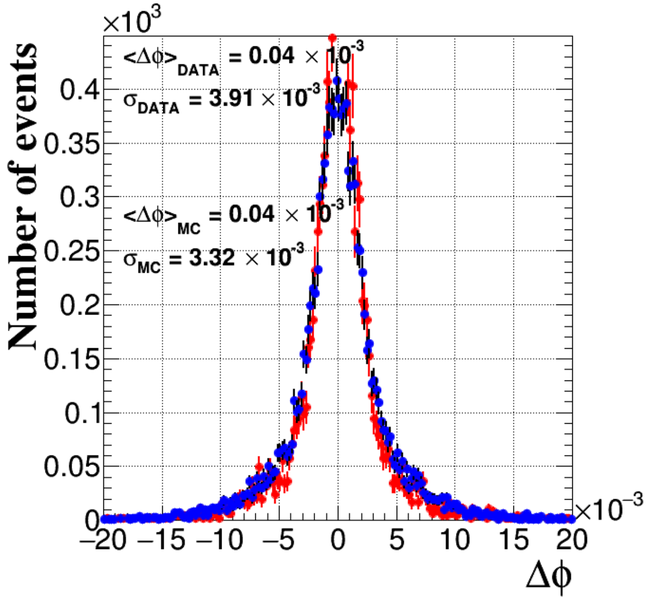
Old tracker(pre Jun4) + new ECAL Alignment



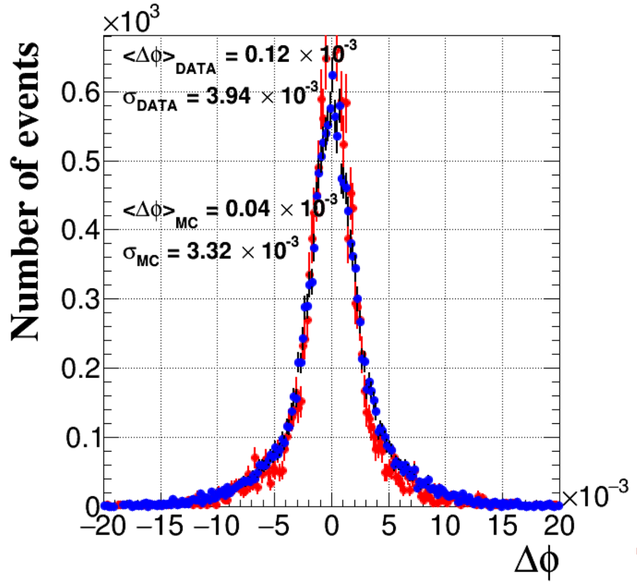
EE +



New tracker (post Jun4) + new ECAL Alignment



EE -



ECAL Alignment : Quick Review

- Alignment of ECAL barrel and endcap with respect to tracking system.
- Measured using electrons from Z→ee events.
- The alignment procedure is based on a minimization of χ^2 (sum of χ_+^2 for positrons and χ_-^2 for electrons). $\chi^2 = \chi^2_+ + \chi^2_-$
- The is based on Δη and Δφ and it minimizes the differences b/w MC and Data for these variables. Under the assumption that in a perfectly aligned system MC and data should agree in these variables, by means of minimization we are effectively aligning ECAL.

$$\chi^2_\pm = \sum_{lepton} \frac{(\Delta\varphi - \langle \Delta\varphi^{MC}_\pm \rangle)^2}{\varepsilon^2_\varphi} + \frac{(\Delta\eta - \langle \Delta\eta^{MC} \rangle)^2}{\varepsilon^2_\eta}$$

- More details on the alignment procedure can be found here:
  - CMS AN-2013/328 - CMS ECAL alignment in the LHC RUN1
  - CMS DN-2015/026 - CMS ECAL alignment in the LHC RUN II