



# ECAL ALIGNMENT 2017 - Monitoring

6<sup>th</sup> September 2017

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Northeastern University

**MoCa Meeting**

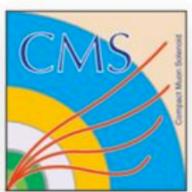


# Alignment monitoring

- EB/EE alignment done with Prompt GT and Prompt reco datasets

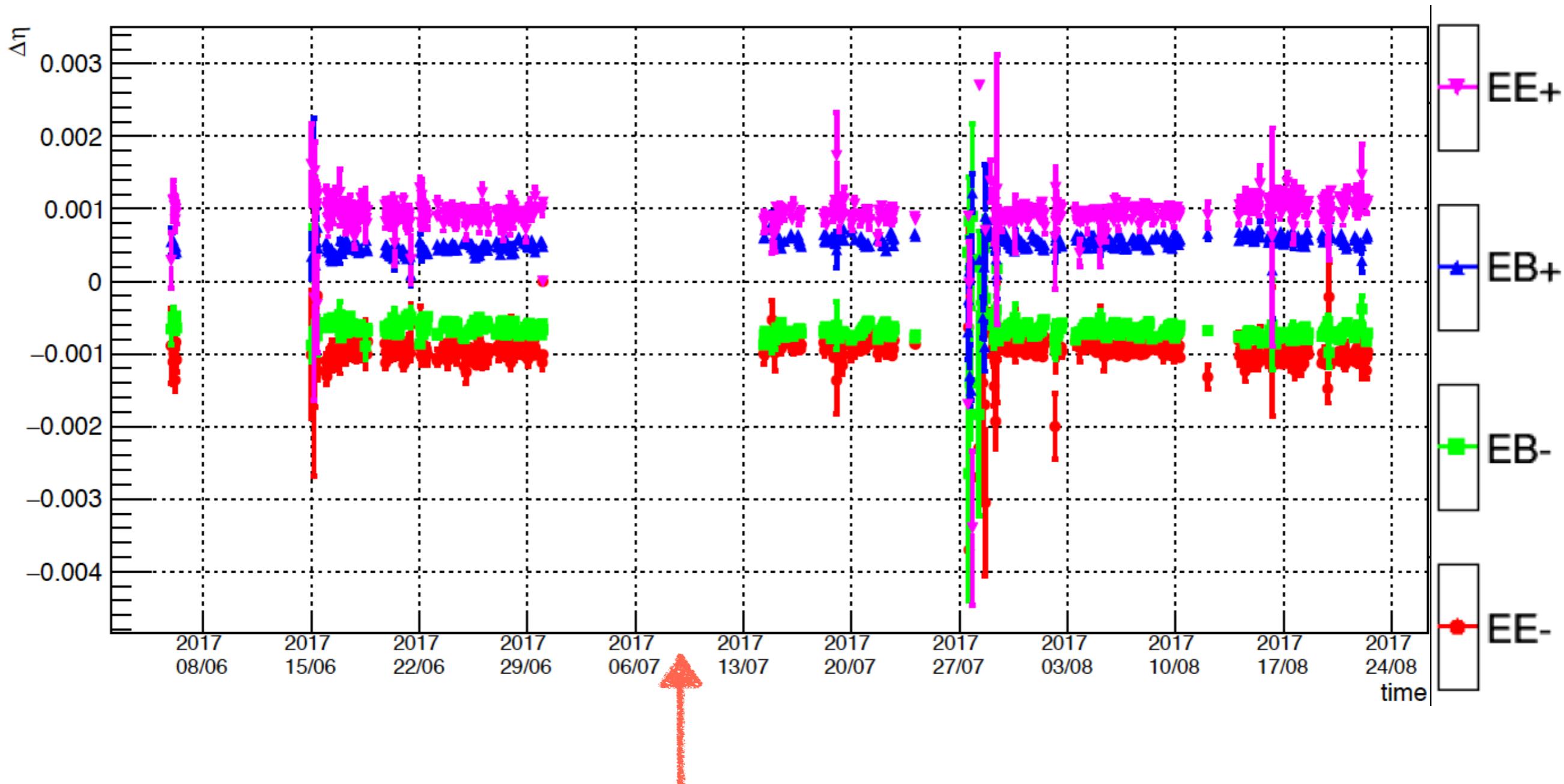
[https://indico.cern.ch/event/651242/contributions/2650401/attachments/1488150/2312173/twamorkar\\_mocajul5.pdf](https://indico.cern.ch/event/651242/contributions/2650401/attachments/1488150/2312173/twamorkar_mocajul5.pdf)

- Alignment measurement with datasets:
  - **/DoubleEG/Run2017C-PromptReco-v3/MINIAOD**
  - **/DoubleEG/Run2017C-PromptReco-v2/MINIAOD**
  - **/DoubleEG/Run2017C-PromptReco-v1/MINIAOD**
  - **/DoubleEG/Run2017B-PromptReco-v2/MINIAOD**
  - **/DoubleEG/Run2017B-PromptReco-v1/MINIAOD**
  - **/DoubleEG/Run2017A-PromptReco-v3/MINIAOD**
  - **/DoubleEG/Run2017A-PromptReco-v2/MINIAOD**
- Check if the alignment values provided for EE+/- and EB+/- are stable and keep track of any changes



# $\Delta\eta$ Supercluster

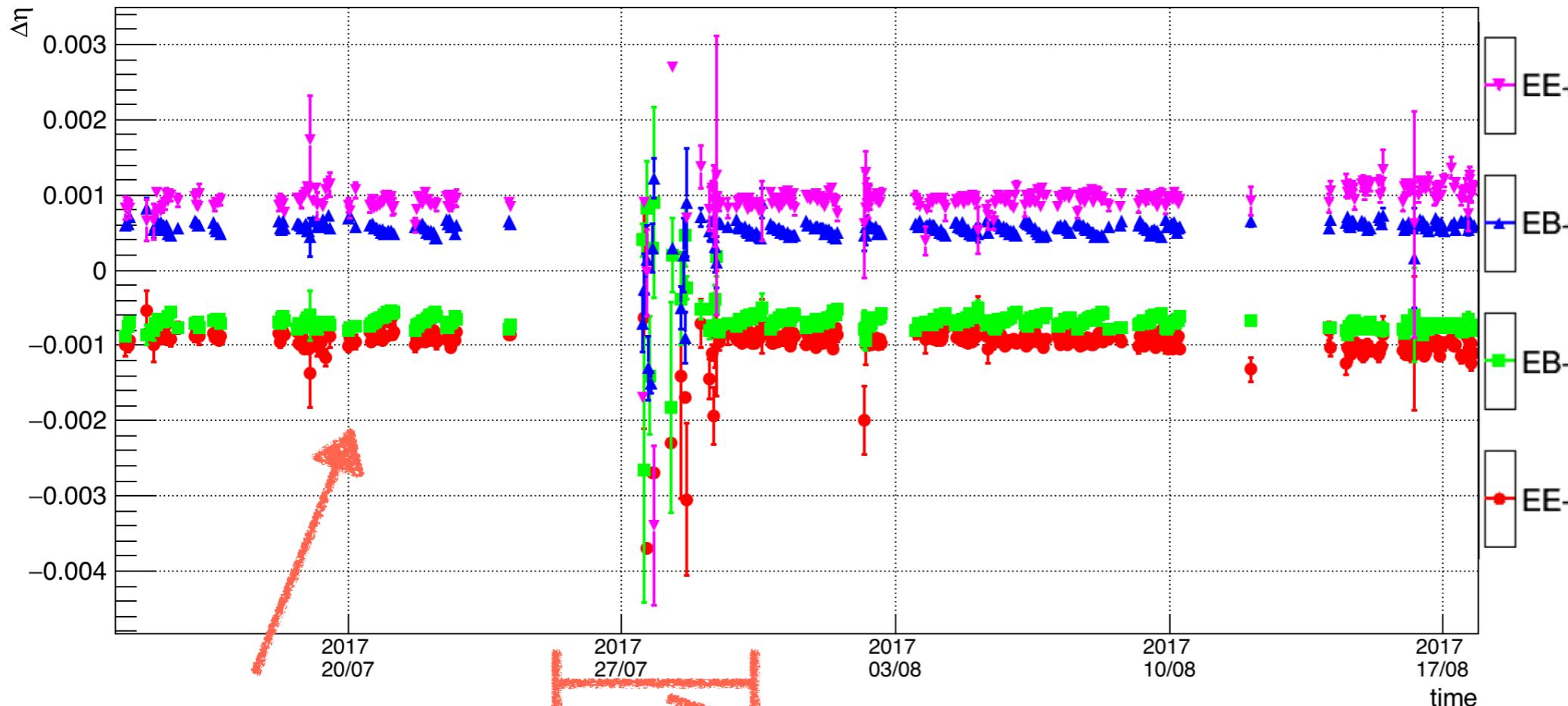
- Track and monitor ECAL alignment by looking at  $\Delta\eta$  Vs time



- Tag inclusive of 2017 alignment values released around 07/07/2017
- Corresponds to Run 298475 , Record **EBAccignmentRcd** and **EEAlignmentRcd**

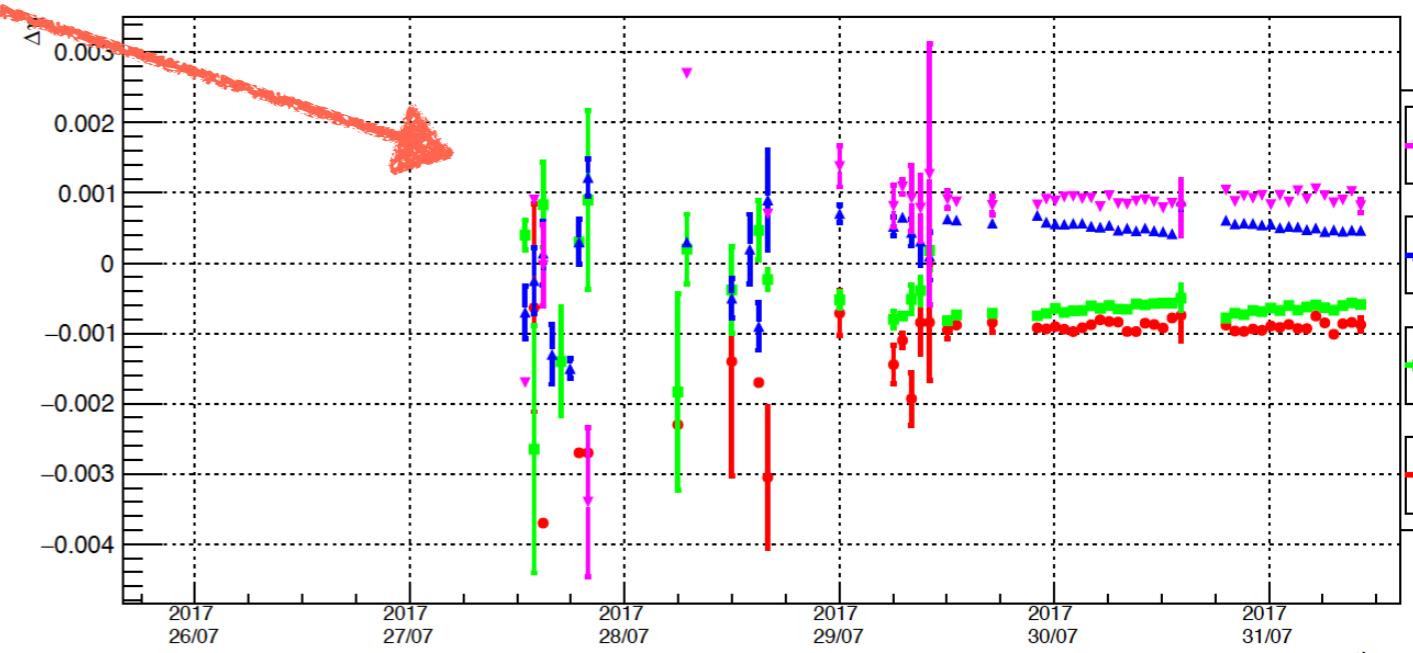


# $\Delta\eta$ Supercluster



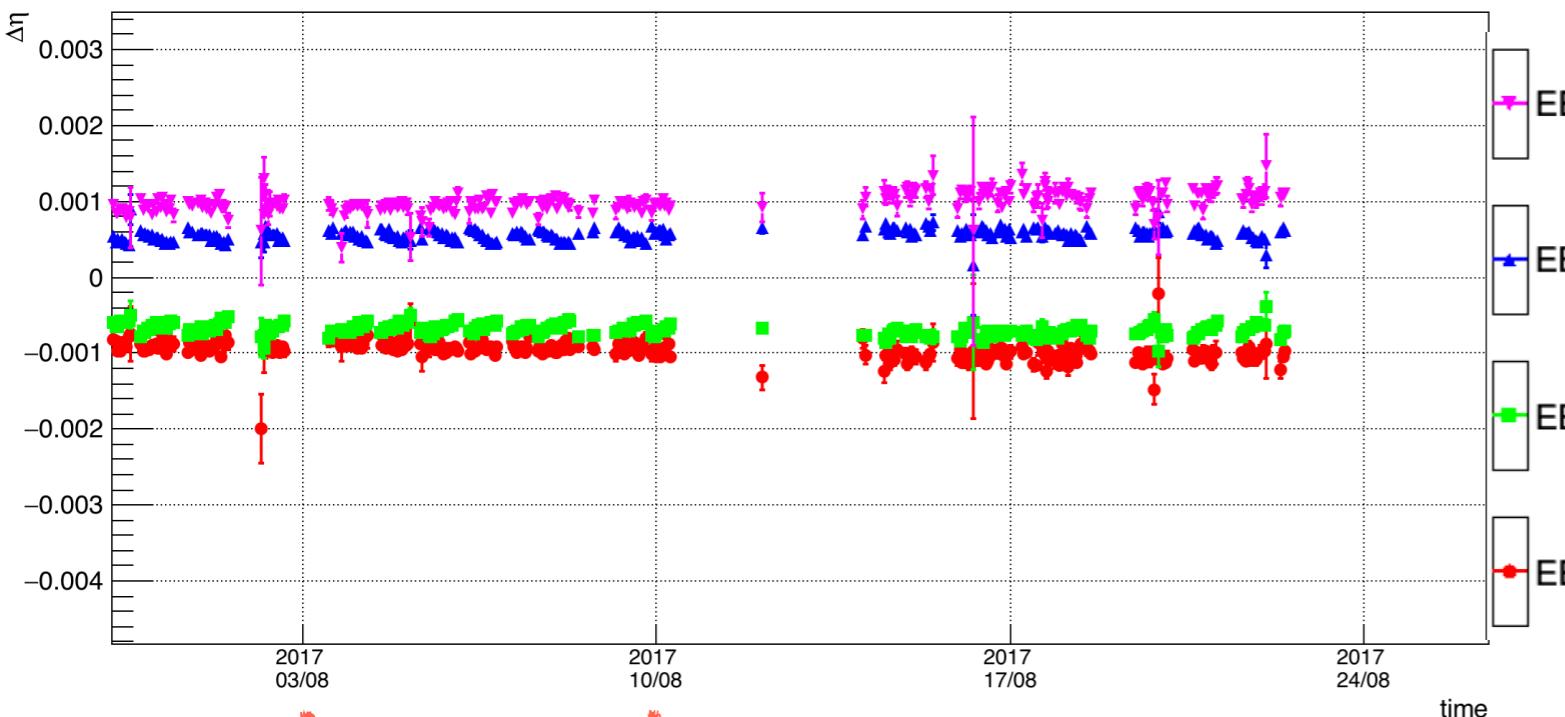
- Manifestation of low statistics
- Corresponding to Run 298653, 298678, 298996, 298997, 298998

DCS JSON : [/afs/cern.ch/cms/CAF/CMSCOMM/COMM\\_DQM/certification/Collisions17/13TeV/DCSOnjson/DCSONLY.txt](https://afs/cern.ch/cms/CAF/CMSCOMM/COMM_DQM/certification/Collisions17/13TeV/DCSOnjson/DCSONLY.txt)





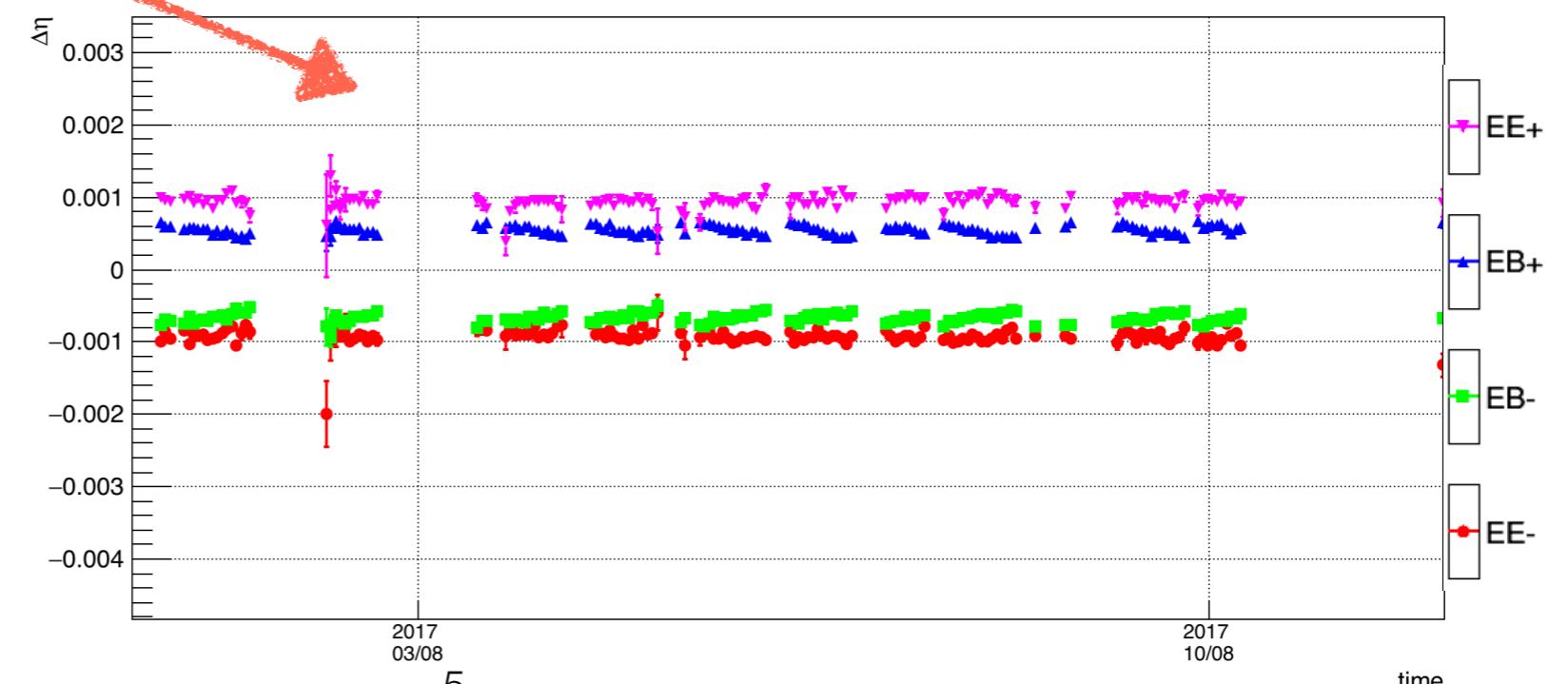
# Taking a closer look

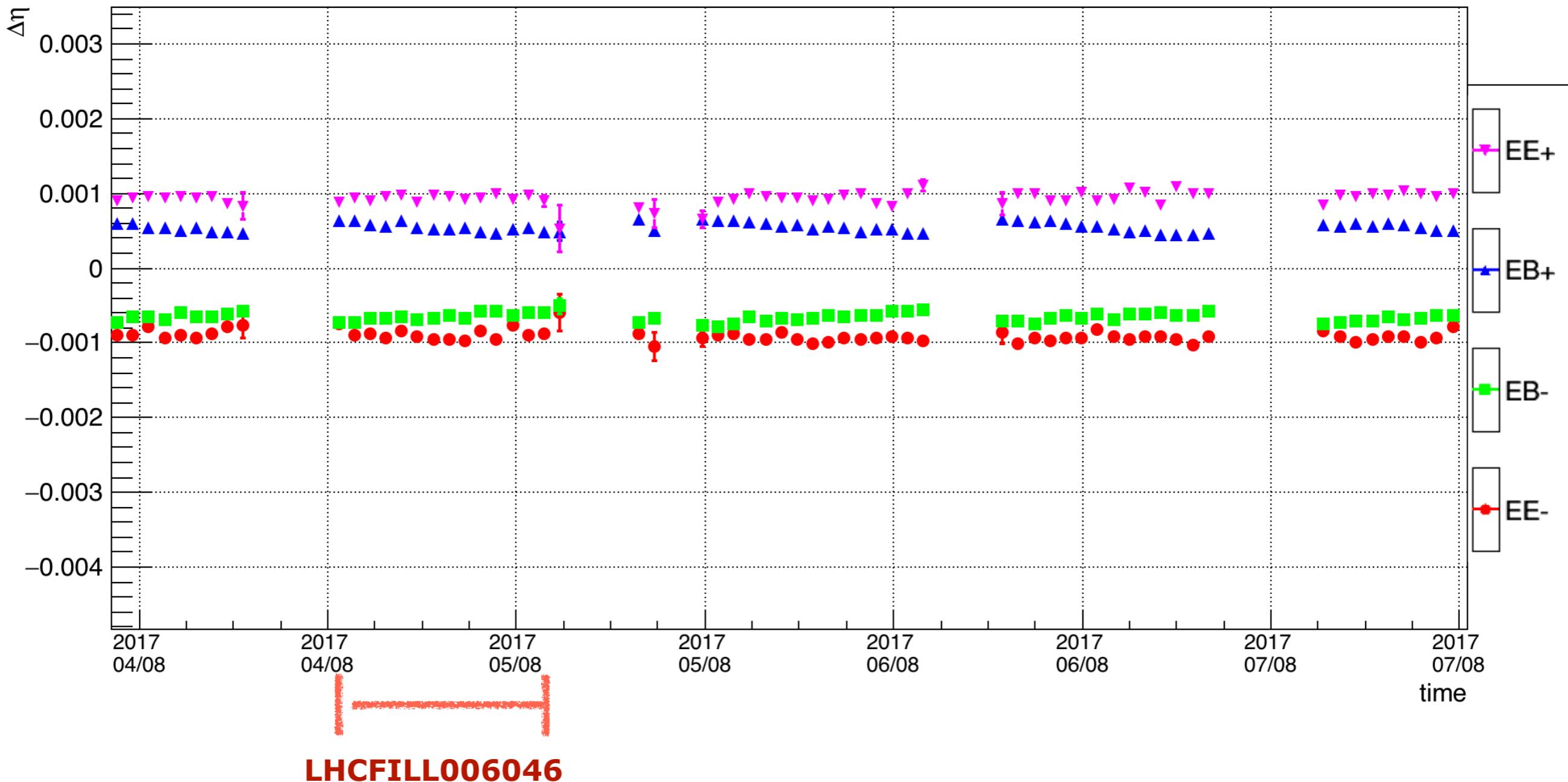
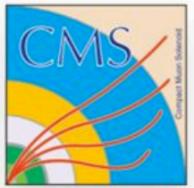


- See-saw like pattern observed

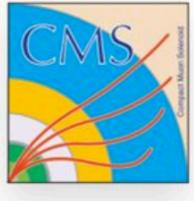
$\Delta\eta$  values appear to waver  
Change in  $\Delta\eta \sim 10^{-5}$

03/08/2017 - 10/08/2017



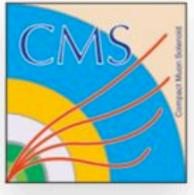


- The eta value recovers once a new fill starts
- Overall, the alignment values provided are stable (as expected)



# Summary

- Monitoring of  $\Delta\eta$  SC as a means of keeping track of the alignment conditions
- The  $\Delta\eta$  value is stable within a  $10^{-5}$  order -> Good ECAL alignment stability :)

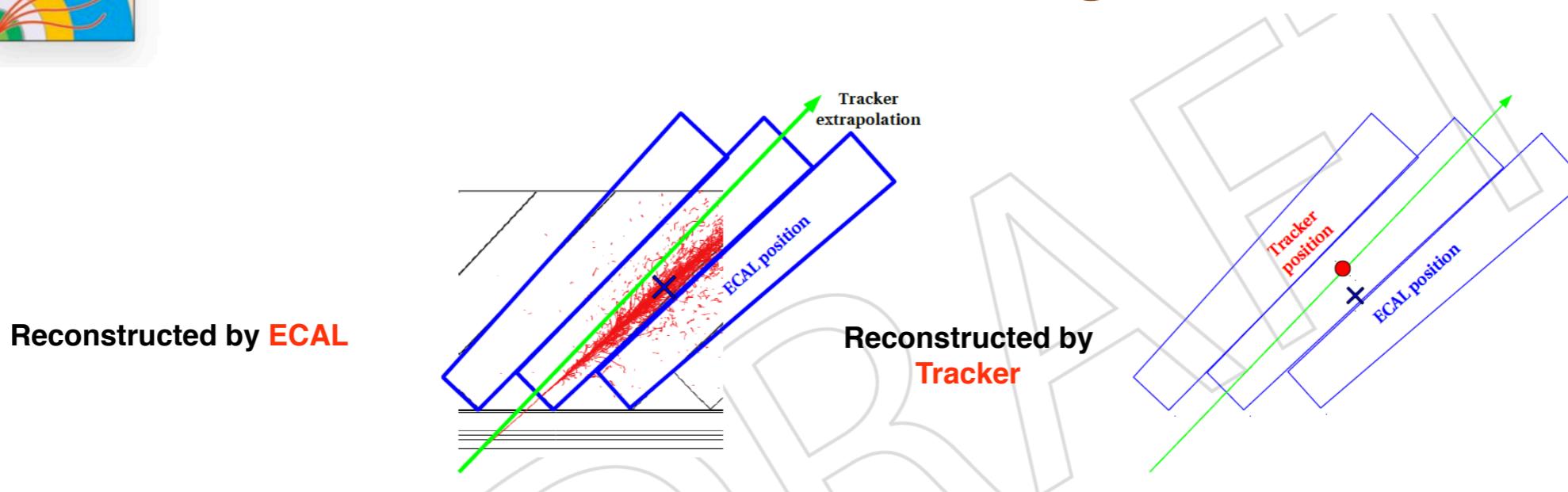


# **BACK UP**

## **(Quick Review of the Alignment Procedure)**



# Quick Review of the Alignment Procedure



- Distance along  $\Phi$  and  $\eta$  directions are used to construct  $\chi^2$

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

↑  
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  $\chi^2$

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

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

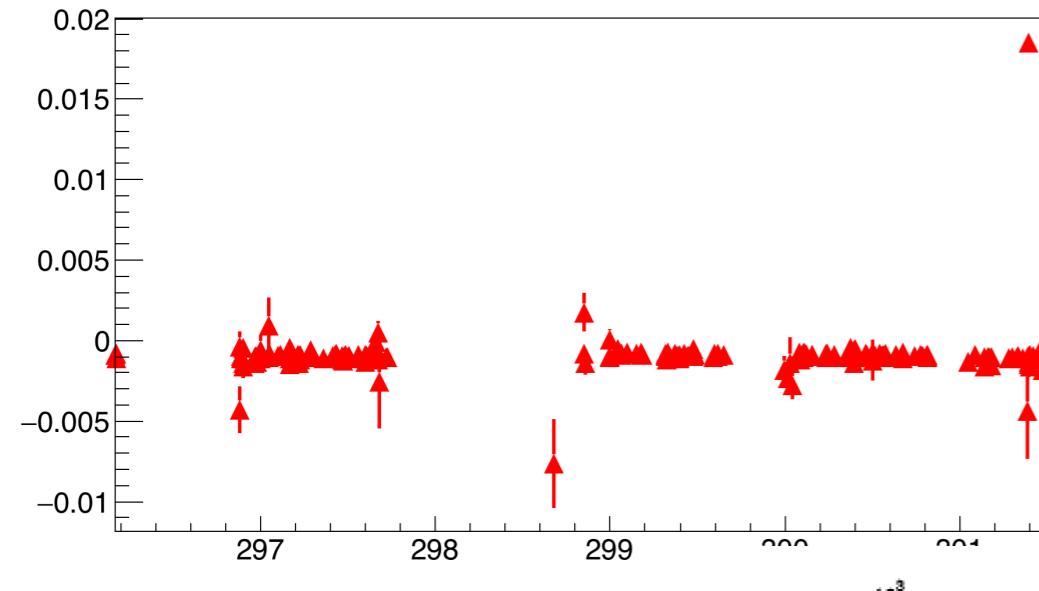
- $\Delta\Phi$  and  $\Delta\eta$  are used to construct  $\chi^2$  and the difference between these variables for Data and MC is minimized in order to effectively align the ECAL with the tracker

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

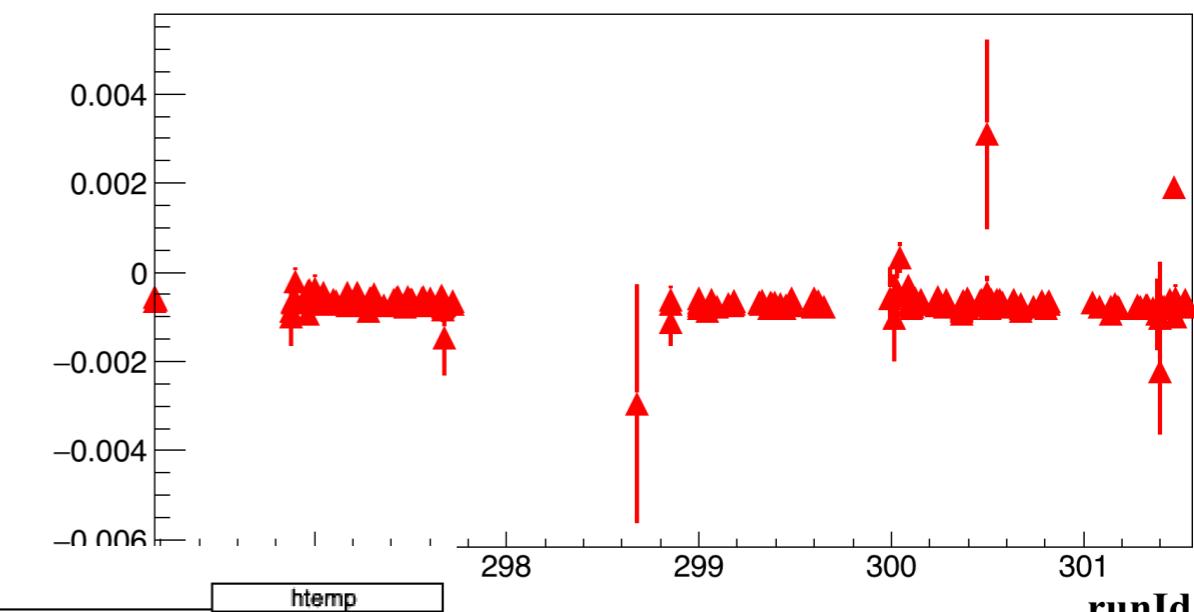


runId X 1000

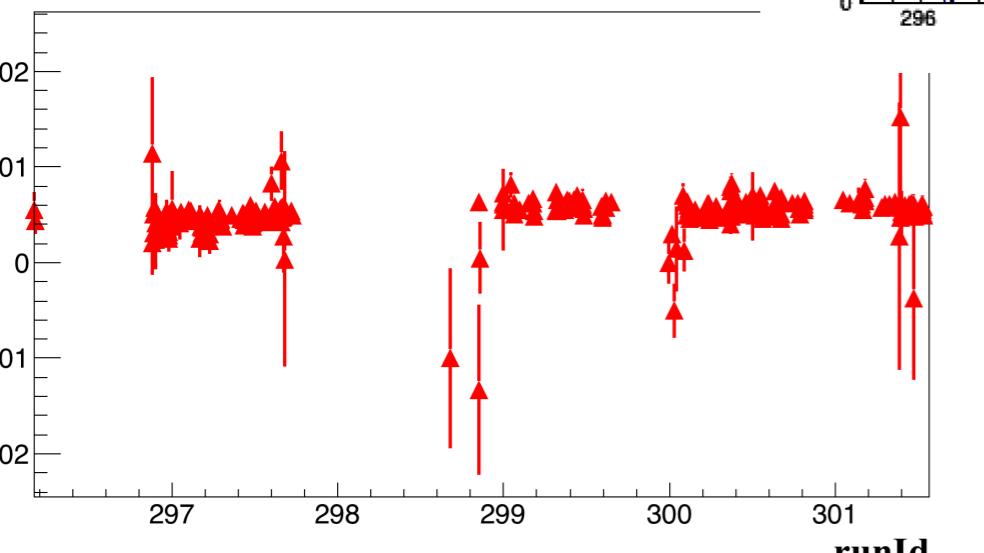
EE -



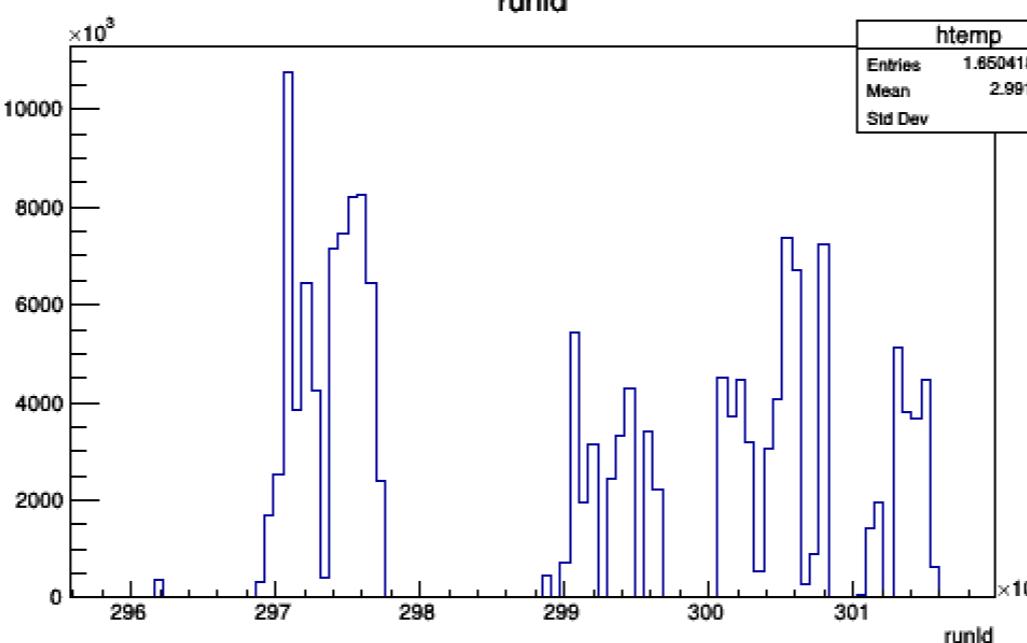
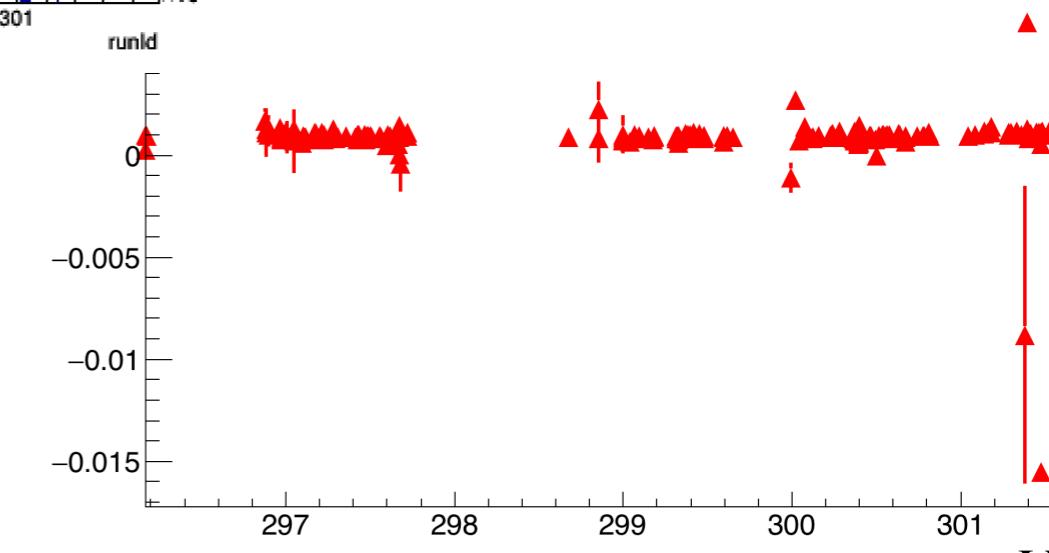
EB -

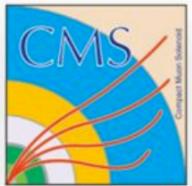


EB +



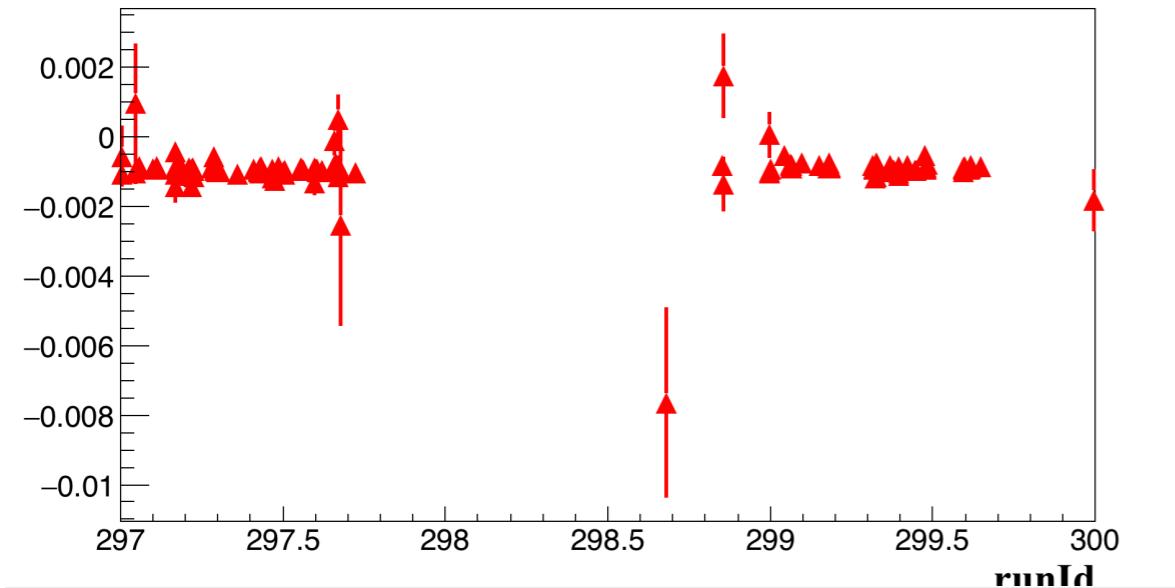
EE +



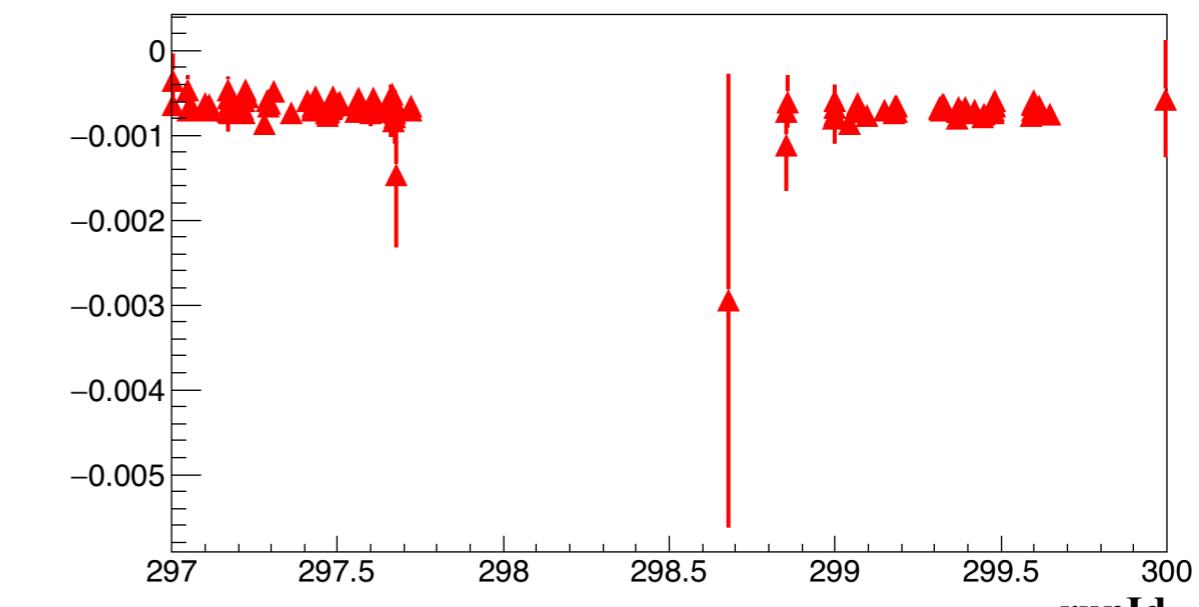


runId X 1000

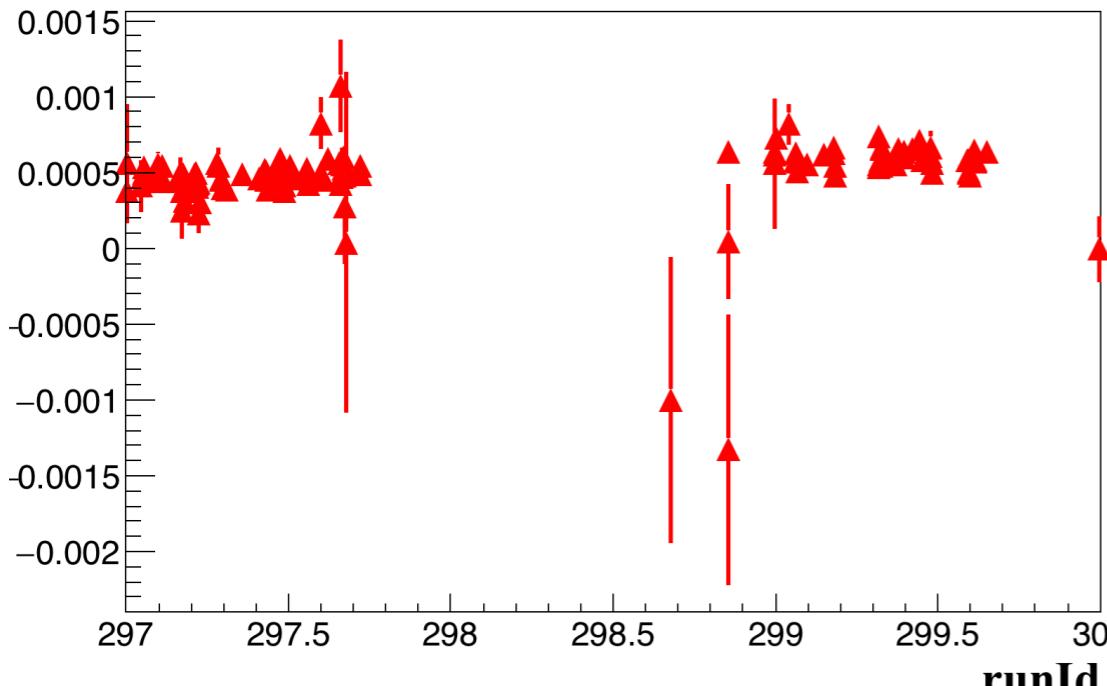
EE -



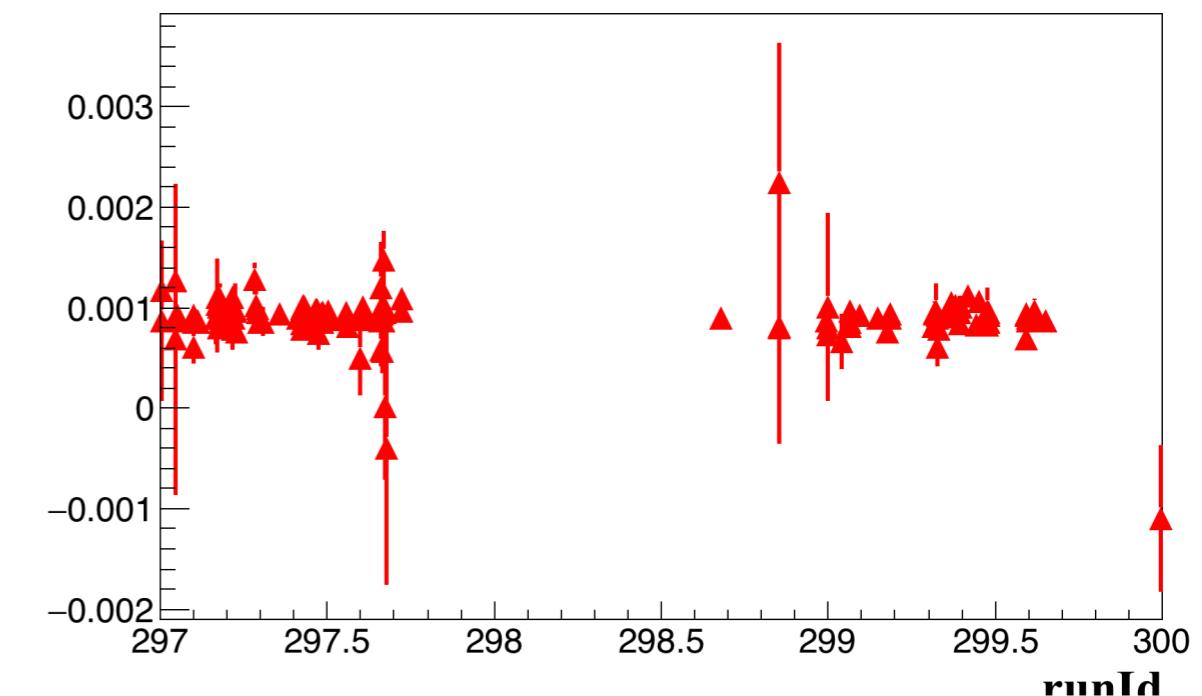
EB -

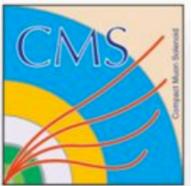


EB +



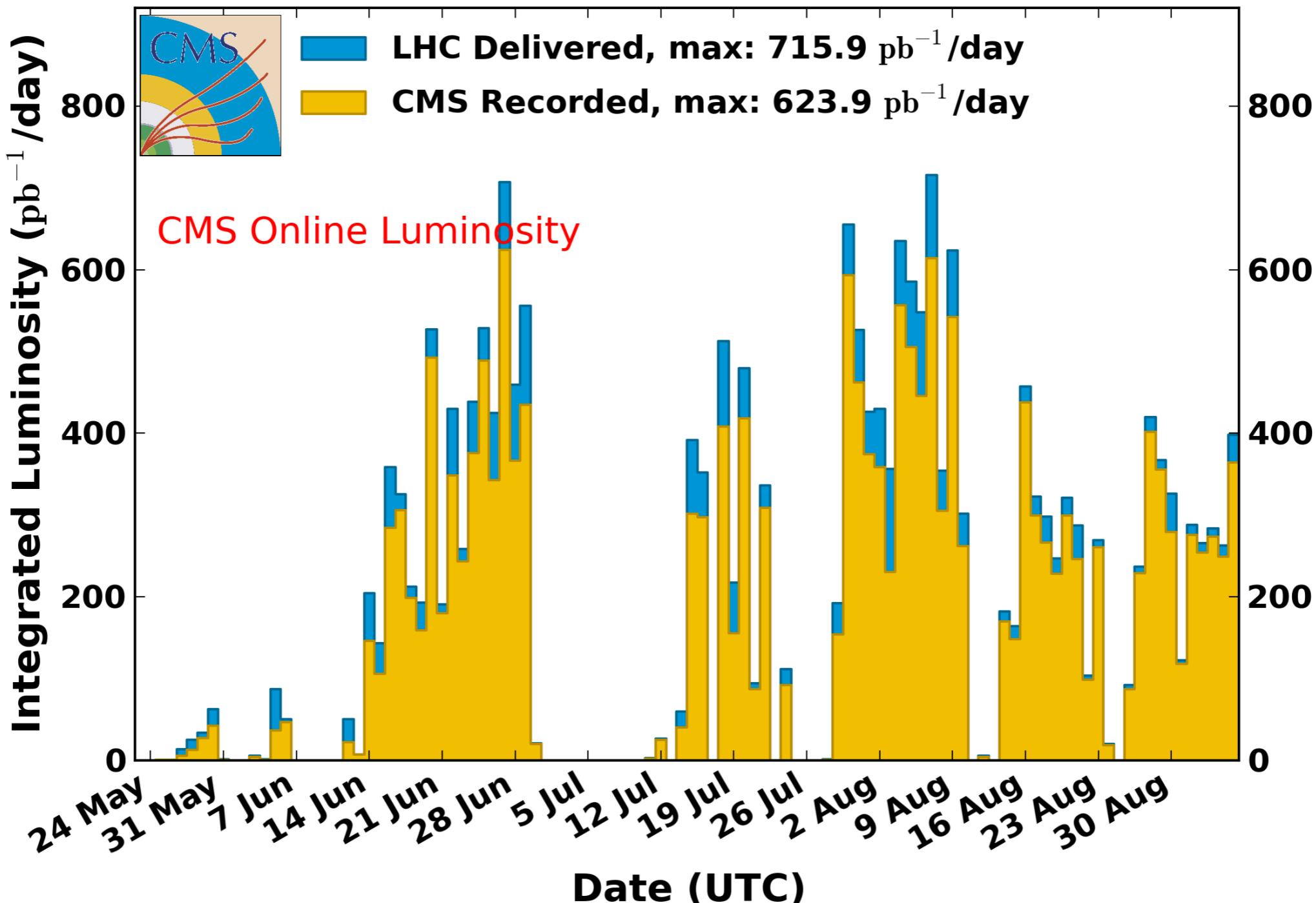
EE +





## CMS Integrated Luminosity Per Day, pp, 2017, $\sqrt{s} = 13$ TeV

Data included from 2017-05-23 14:32 to 2017-09-05 23:17 UTC





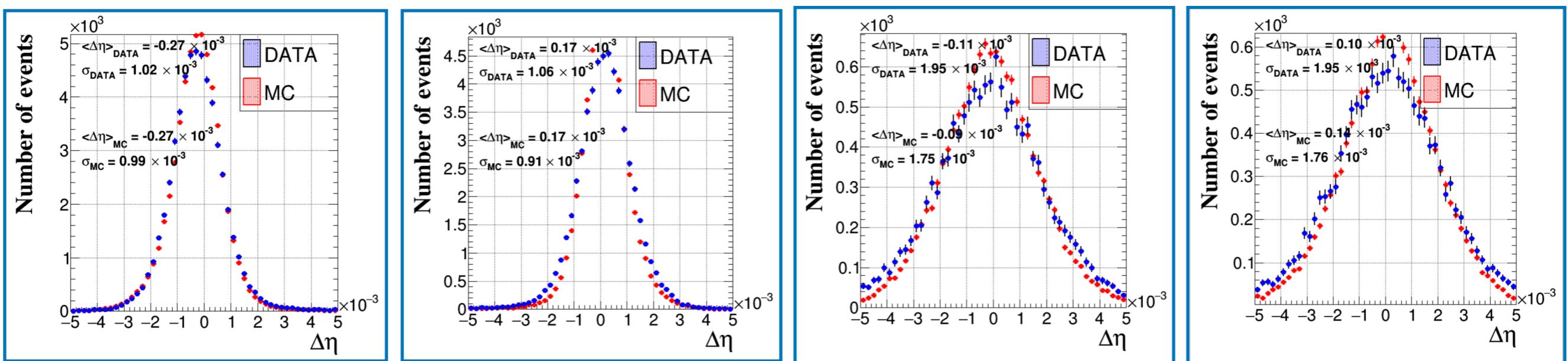
# Eta Distributions

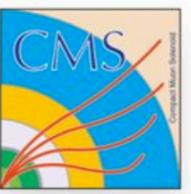
EB +

EB -

EE +

EE -

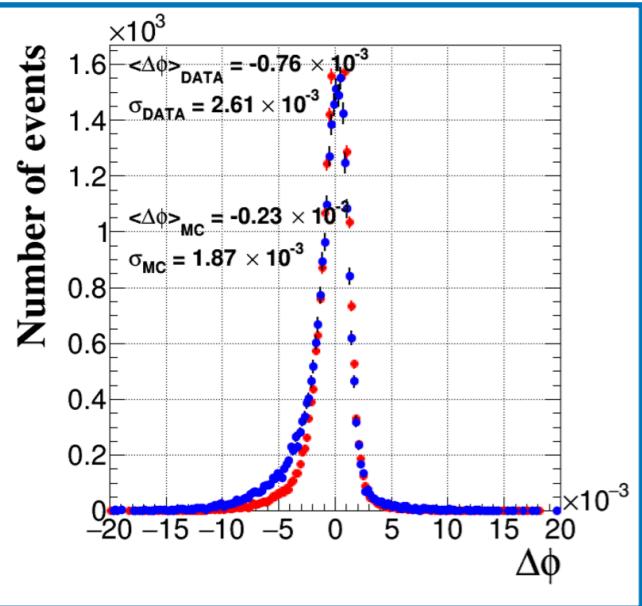




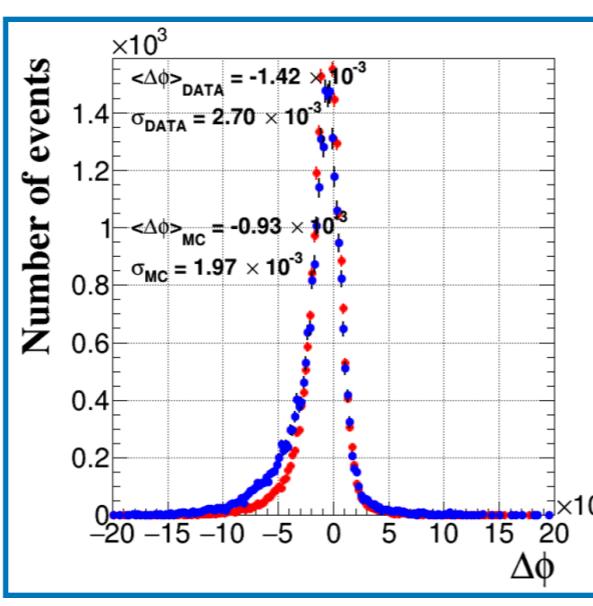
# Phi Distributions

## Electron

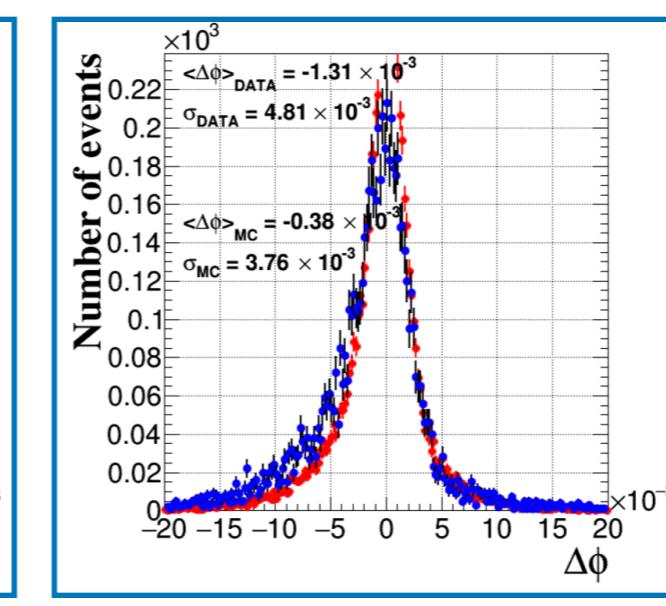
EB +



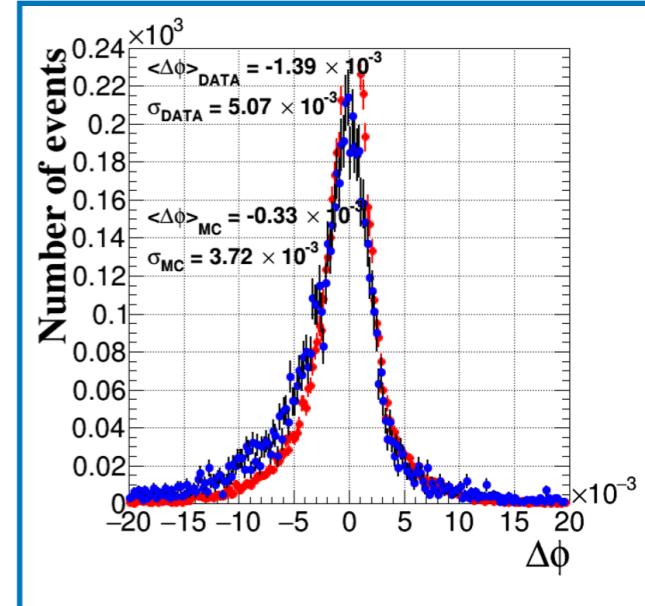
EB -



EE +



EE -



## Positron

