



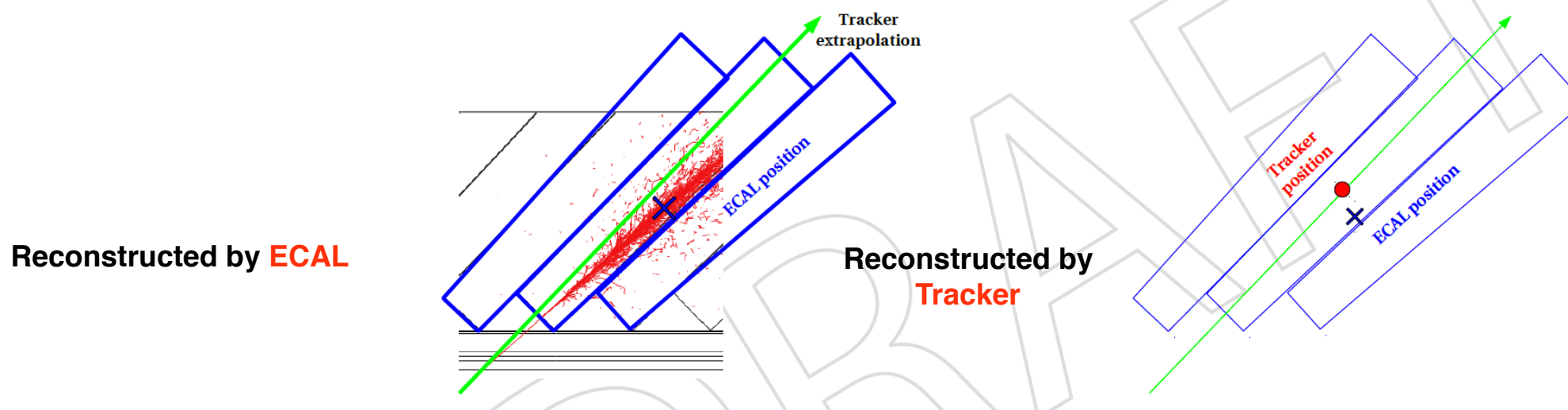
ECAL Alignment - Preliminary MC 2017 Studies

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Northeastern University



ECAL DPG Meeting

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

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

- 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



MC Studies

Procedure

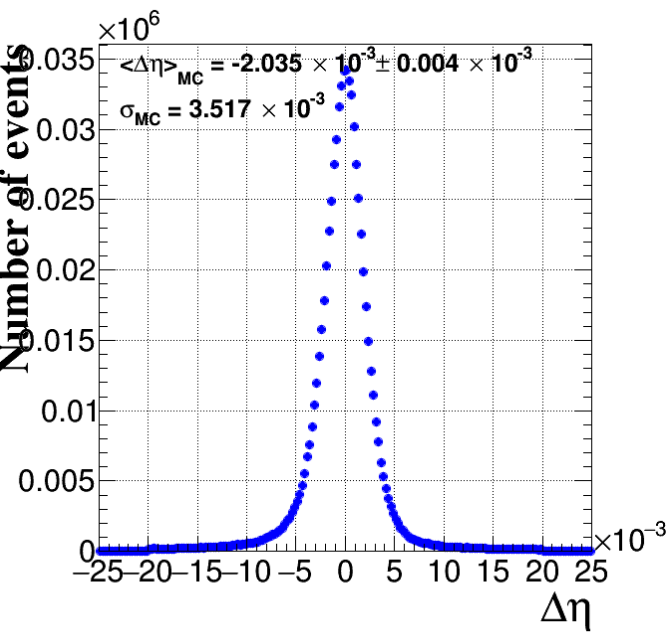
- Derive MC biases required for Alignment Procedure
 - Use new CMSSW release - CMSSW_9_0_2_patch1
 - Using dataset=`/DYJetsToLL_M-50_TuneCUETP8M1_13TeV-madgraphMLM-pythia8/PhaseISpring17MiniAOD-FlatPU28to62_90X_upgrade2017_realistic_v20_ext1-v1/`
MINIAODSIM
 - Used entire dataset

Global Tag used

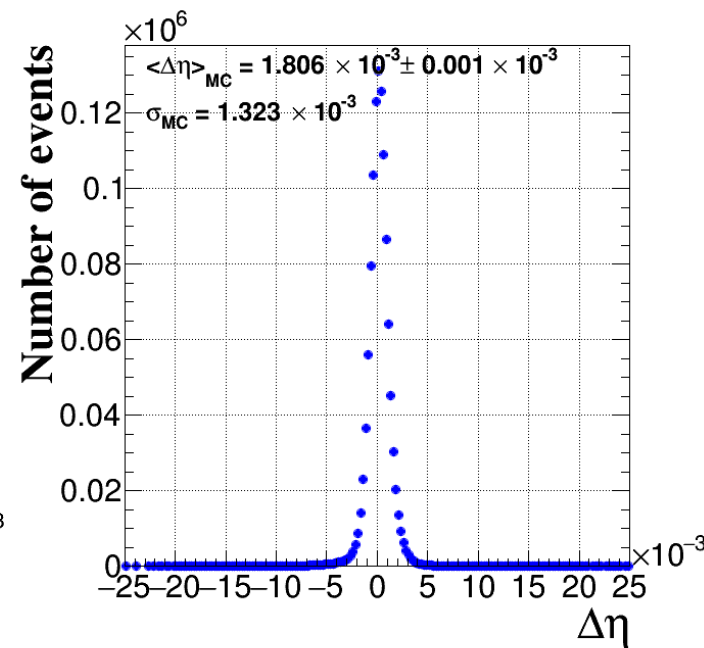
MC Bias - $\Delta\eta$

The bias values in EB +/- and EE +/-

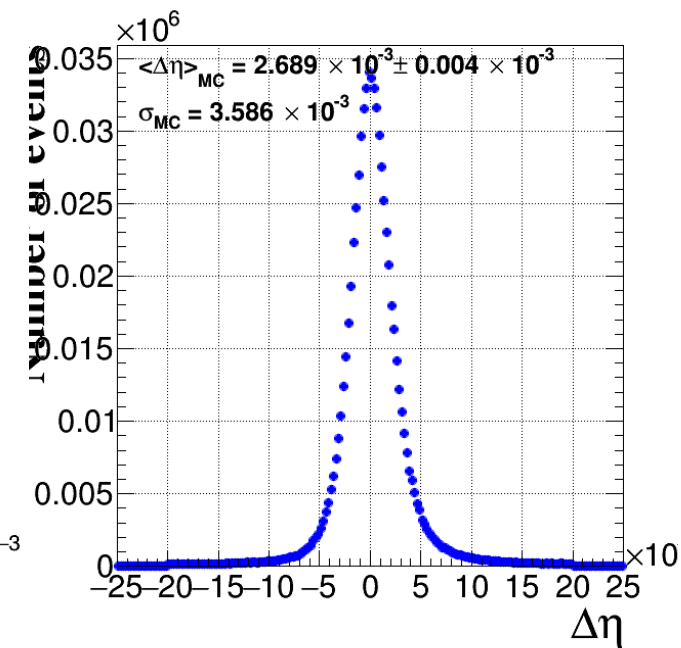
EE -



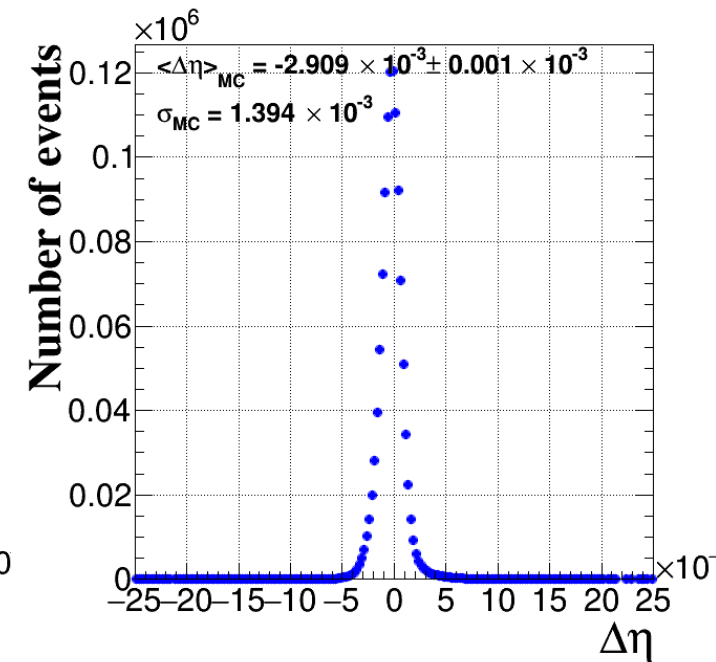
EB -



EE +



EB +



MC Bias - $\Delta\Phi$

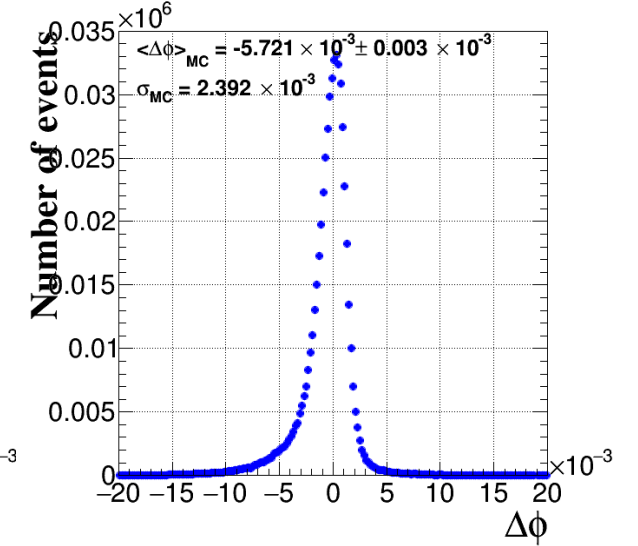
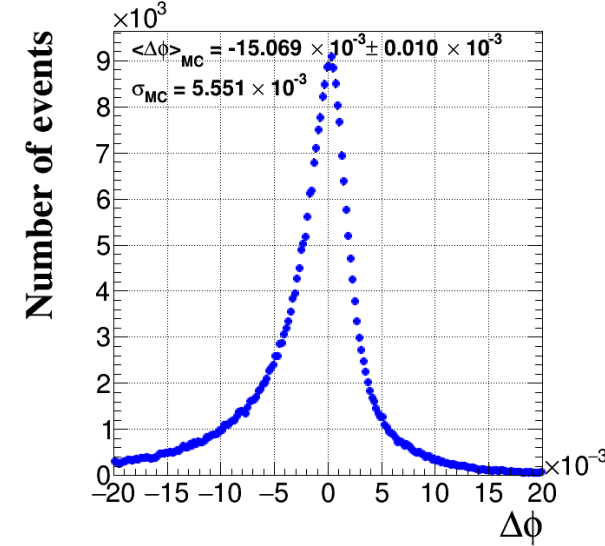
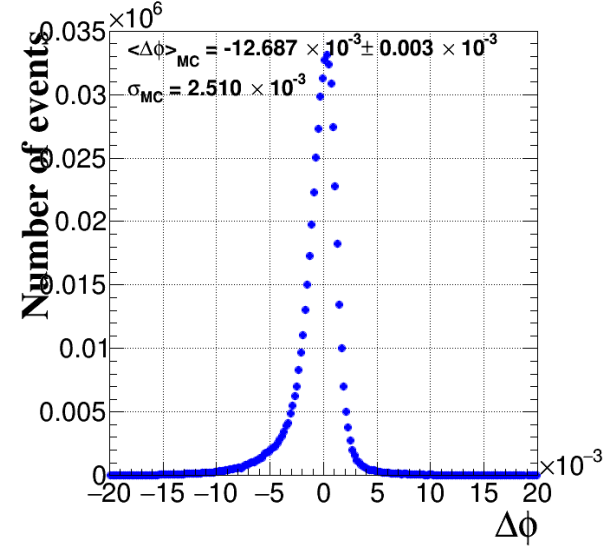
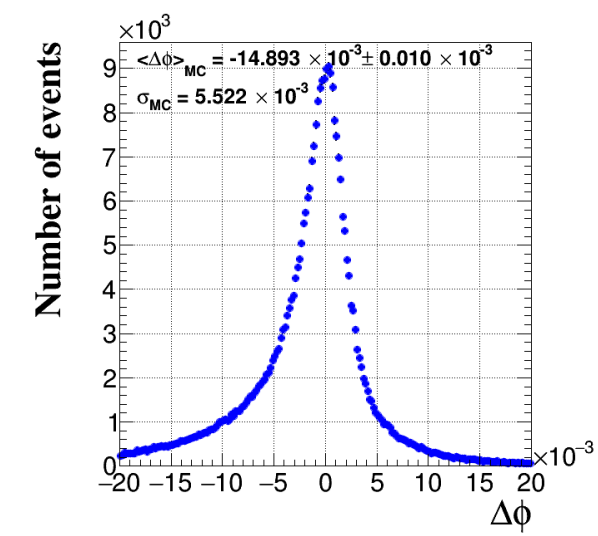
$\Delta\Phi$ is different for electrons and positrons because of their opposite Φ bending in the magnetic field

EE -

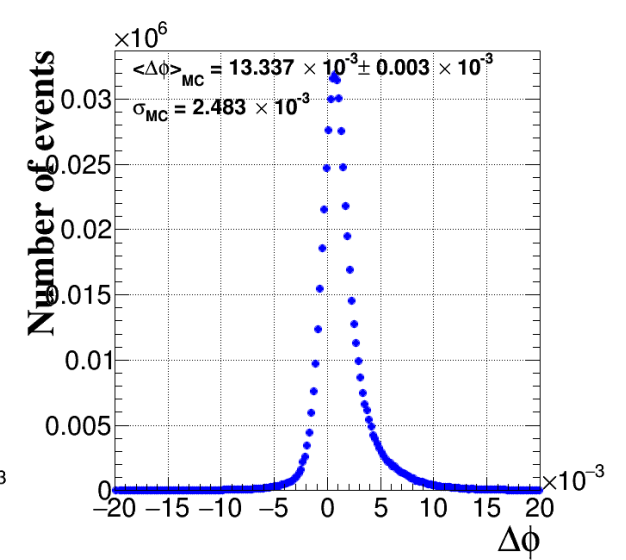
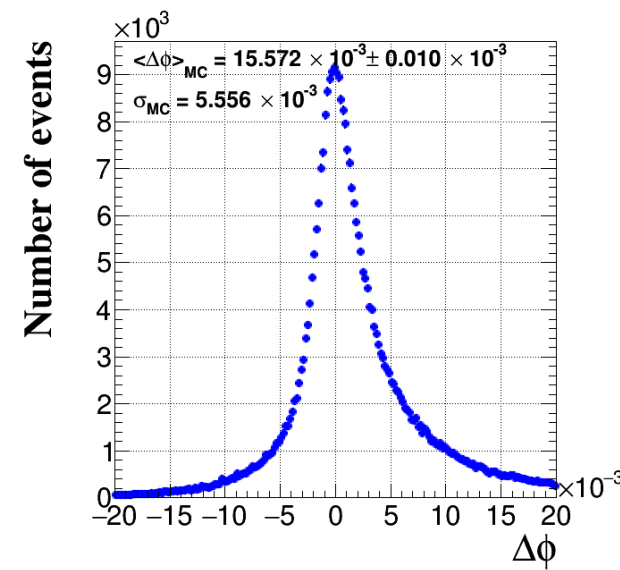
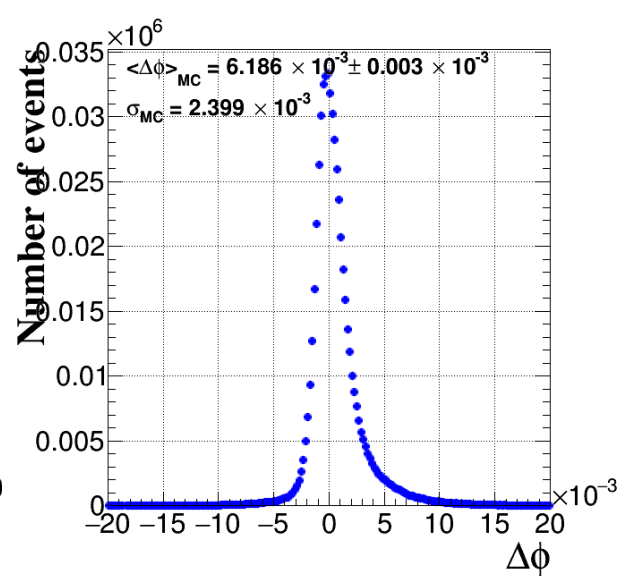
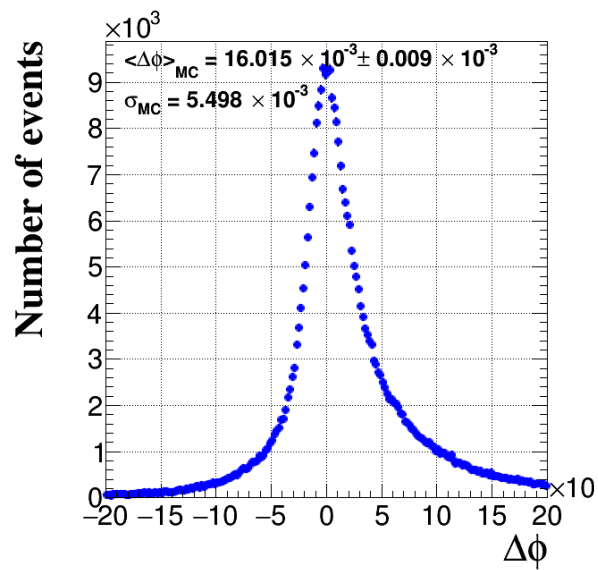
EB - Electron

EE +

EB +

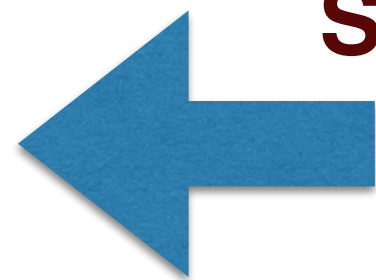


Positron





		$\Delta\Phi \text{ (X } 10^{-3})$	$\Delta\eta \text{ (X } 10^{-3})$
EE+	e+	15.572 ± 0.010	2.689 ± 0.004
	e-	-15.069 ± 0.010	
EE-	e+	16.015 ± 0.009	-2.035 ± 0.004
	e-	-14.893 ± 0.010	
EB+	e+	13.337 ± 0.003	-2.909 ± 0.001
	e-	-5.721 ± 0.003	
EB-	e+	6.186 ± 0.003	1.806 ± 0.001
	e-	-12.687 ± 0.003	



**Summary
of Bias
Values**



Next Steps

- ECAL Alignment Code has been updated!
- Wait for new data and look at the same variables in Data after ECAL alignment procedure is performed (bias values obtained from MC will be fed into the alignment code to “align” new data)