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ATLAS Upgrade and Background for Higgs

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The S-shape correction in the FCAL ATLAS Electromagnetic module "FCal1"

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Professor:

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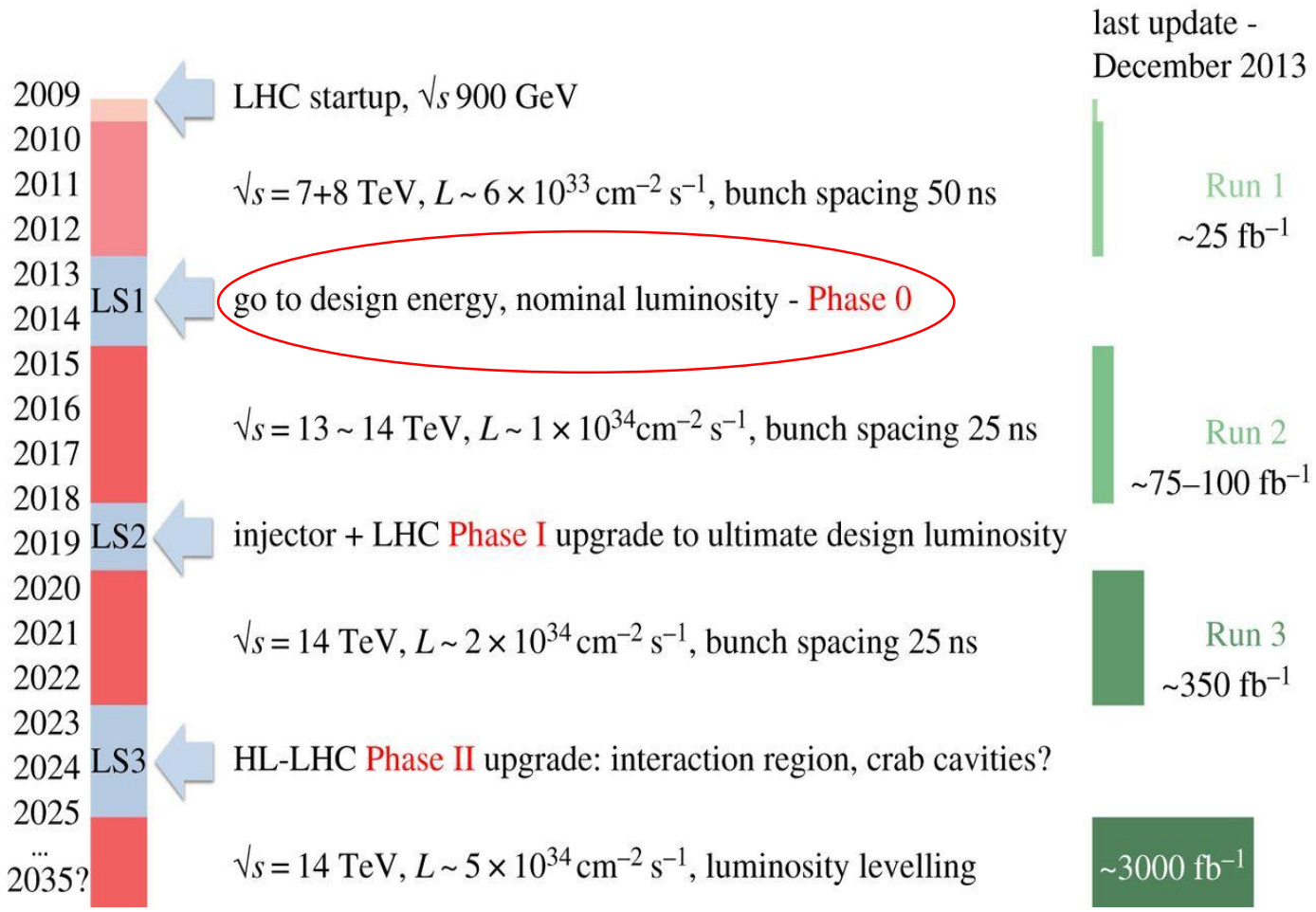
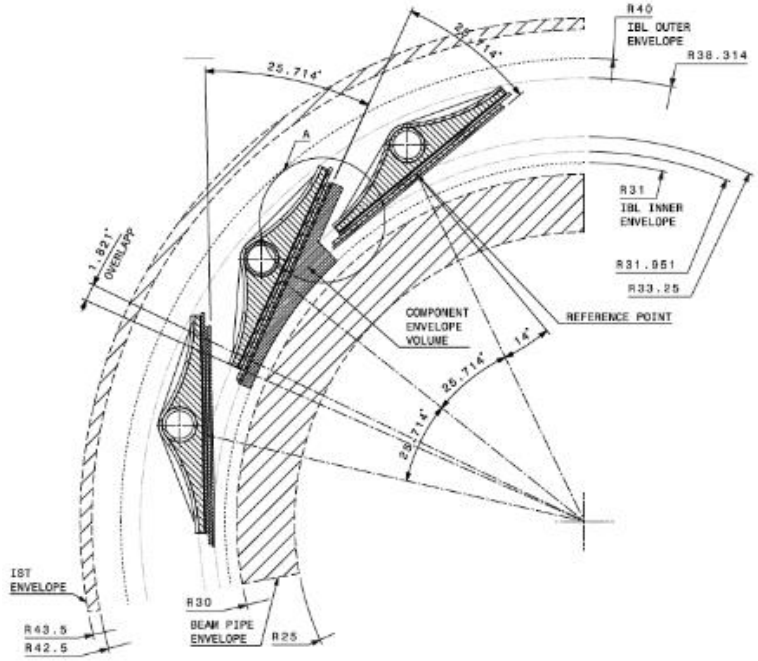
ATLAS Upgrade for HL-LHC Project



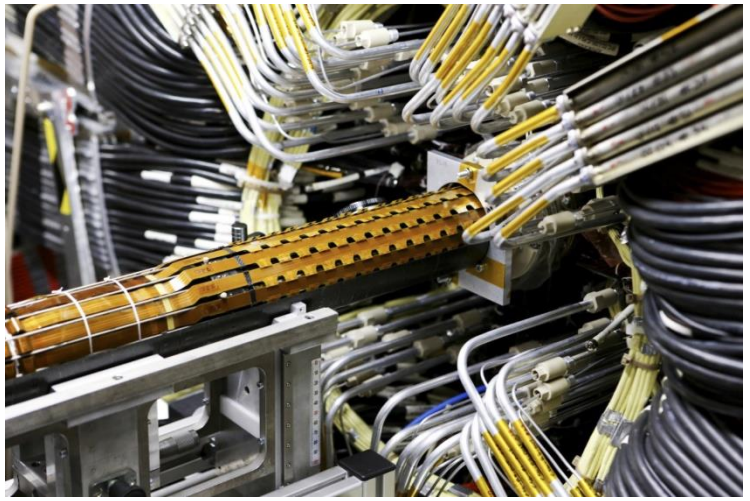
- In order to prepare for the proposed high luminosity upgrade of the LHC for the HL-LHC Project, ATLAS is investigating the necessary changes to the sub-detectors .The goal is to achieve a better performance (spatial resolution ,Energy resolution….) at the HL-LHC as at the LHC.
- I will focus so far on the Phase 0 or the first Long Shutdown (LS1).

ATLAS plans for LS1

- ✓ **Increase in centre of mass energy to $\sqrt{s}$ = 13 TeV .**
- ✓ **New Aluminum Beam pipes to prevent activation problem and reduce Muon Background.**
- ✓ **New insertable pixel b-layer (IBL) is now the new fourth layer in the inner detector region of ATLAS, an additional point for tracking particles. More points mean better precision which is always good for physics.**
- ✓ **Revisit the entire electricity supply network.**
- ✓ **New magnets cryogenics systems.**



IBL structure in r-ϕ plan



The IBL detector at the midpoint of its installation journey.

$\sqrt{s}$ = 13 TeV pp Data Sample in 2015

In 2015 pp collision data at $\sqrt{s}$ = 13 TeV whith highest instantaneous luminosity 5.1 $10^{33}\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$ were taken with two bunch spacing configurations:

- **25 ns with integrated luminosity values are 0.13 fb^{-1}.**
- **50 ns with integrated luminosity values are 3.87 fb^{-1}.**

❖ **In Run 1, proton collisions were timed to take place every 50 nanoseconds. In Run 2, with higher energy and increased luminosity, the clock has doubled to collisions timed at every 25 nanoseconds.**

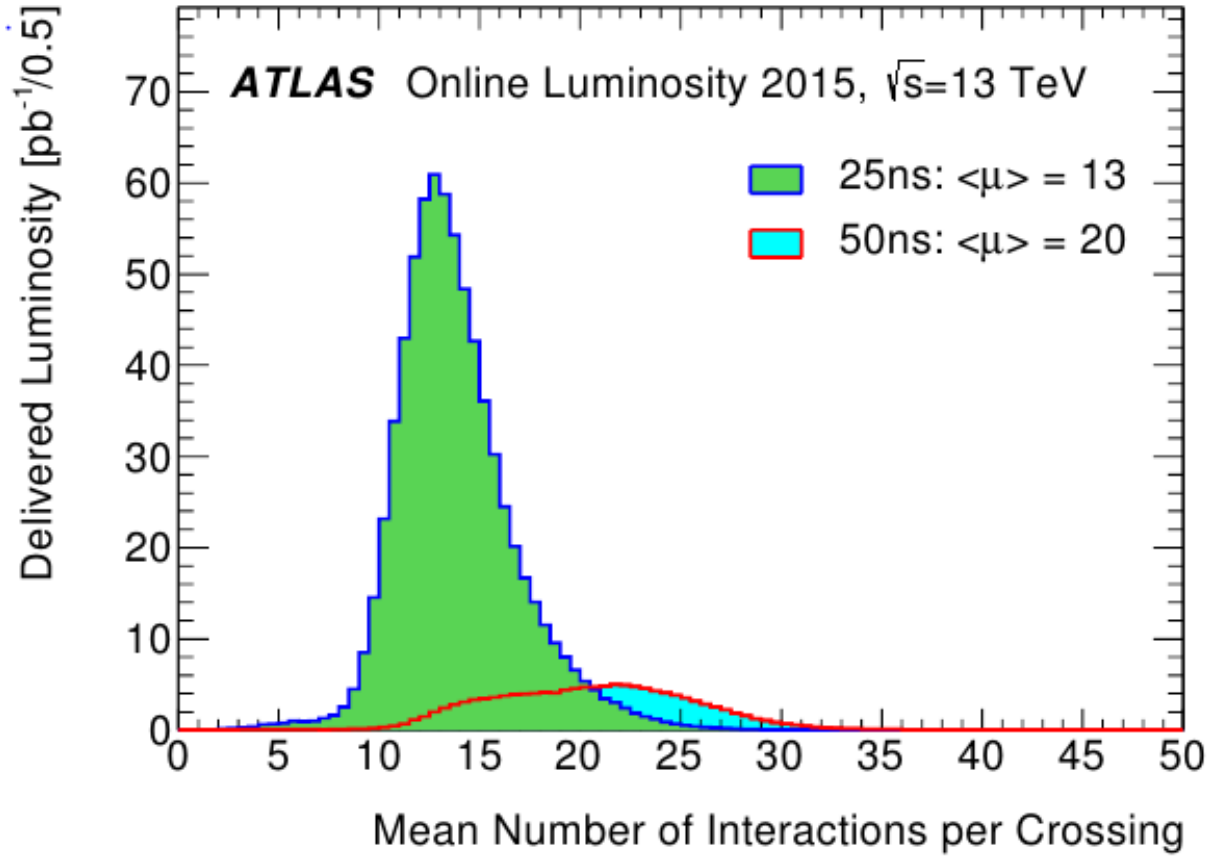
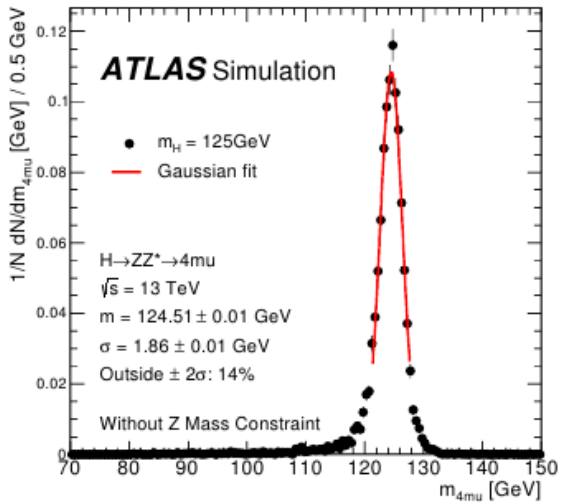


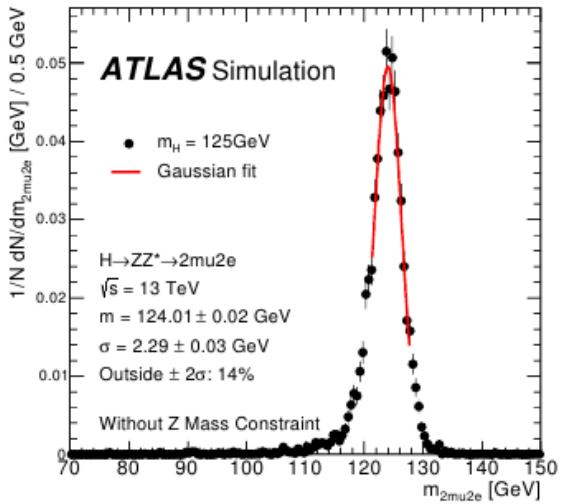
Figure: the luminosity-weighted distribution vs Mean number of interaction per crossing for 2015 pp colission data recordd from 3 June to 22 September.

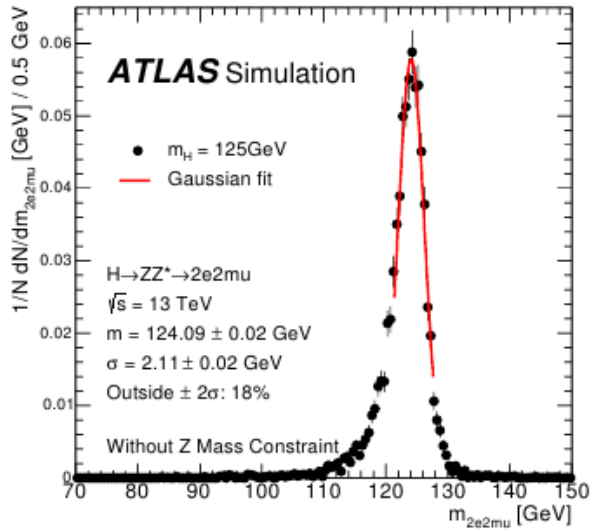
Measurement and search for Higgs bosons

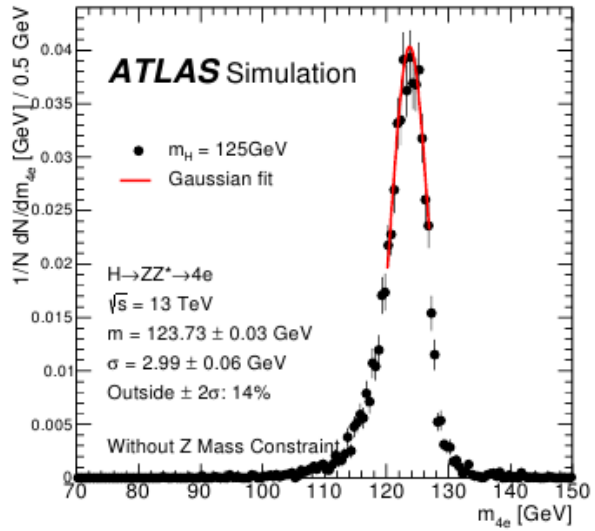
- **Higgs boson was discovered at mass of 125 GeV with pp colission data at $\sqrt{s}$ = 7 TeV and 8 TeV at the LHC at CERN in summer 2012.**

- **In 2015 a measurement and search for Higgs bosons through the decay $H \longrightarrow ZZ^{(*)} \longrightarrow l^+l^-l'^+l'^-$ at $\sqrt{s}$ = 13 TeV where $l, l' = e \; or \; \mu$.**





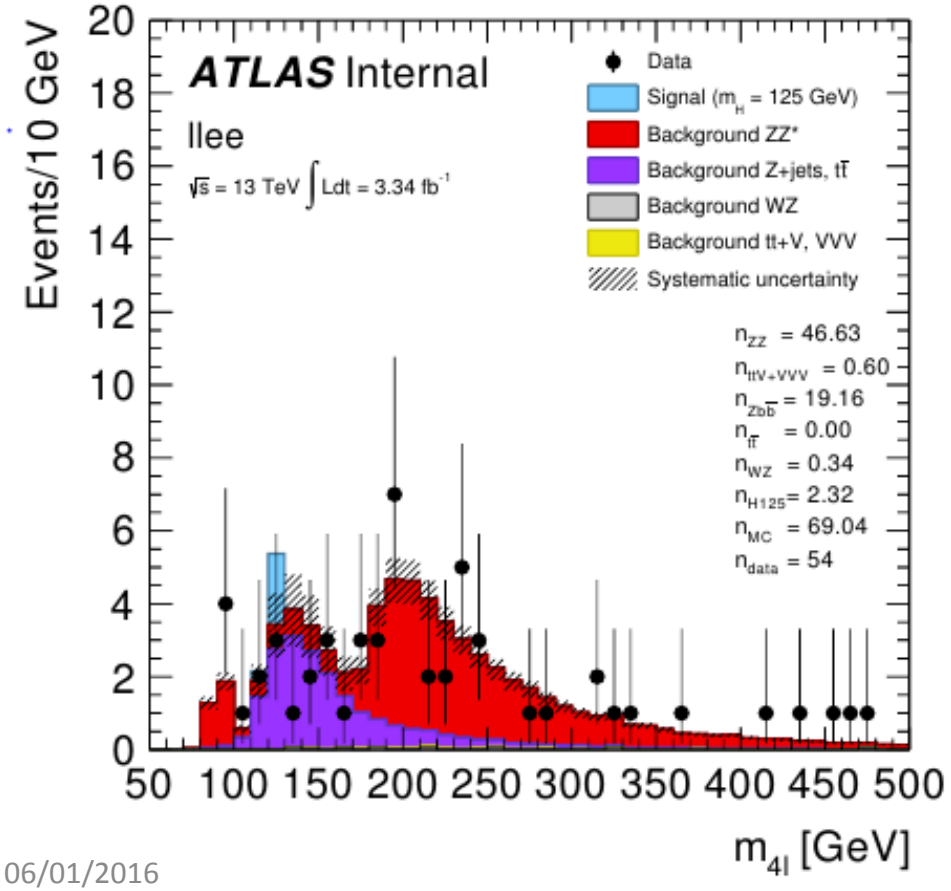


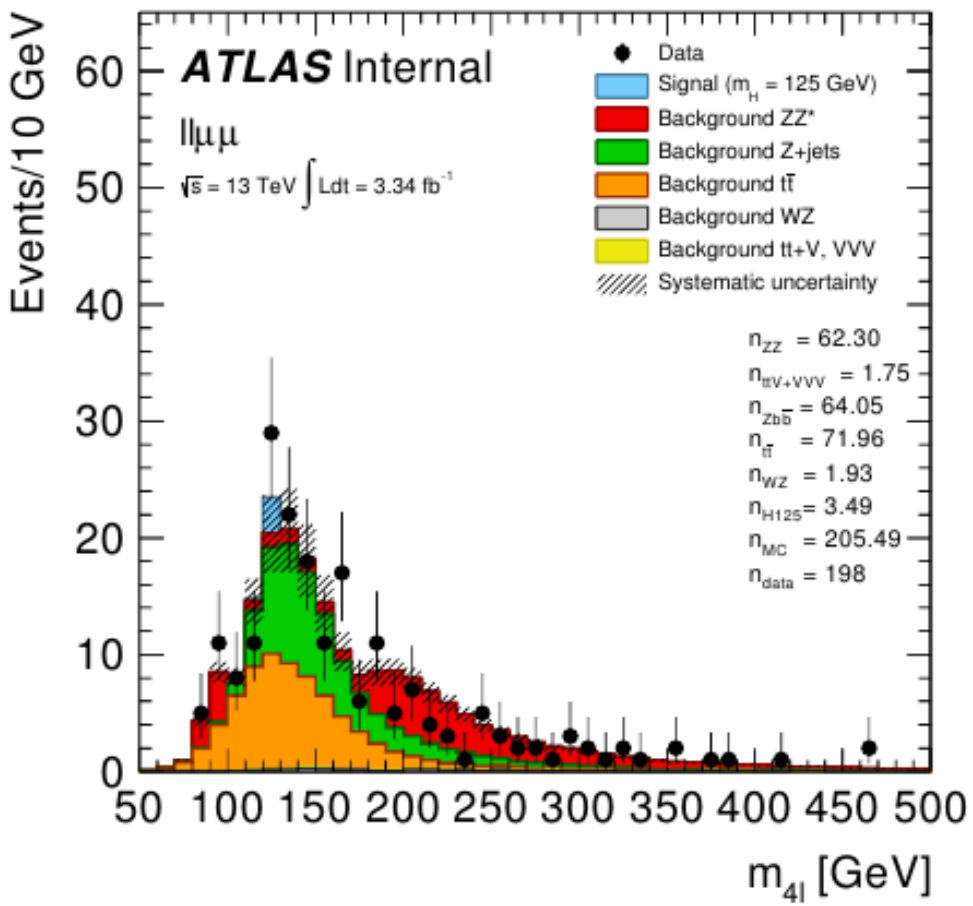


Background for *Higgs bosons*

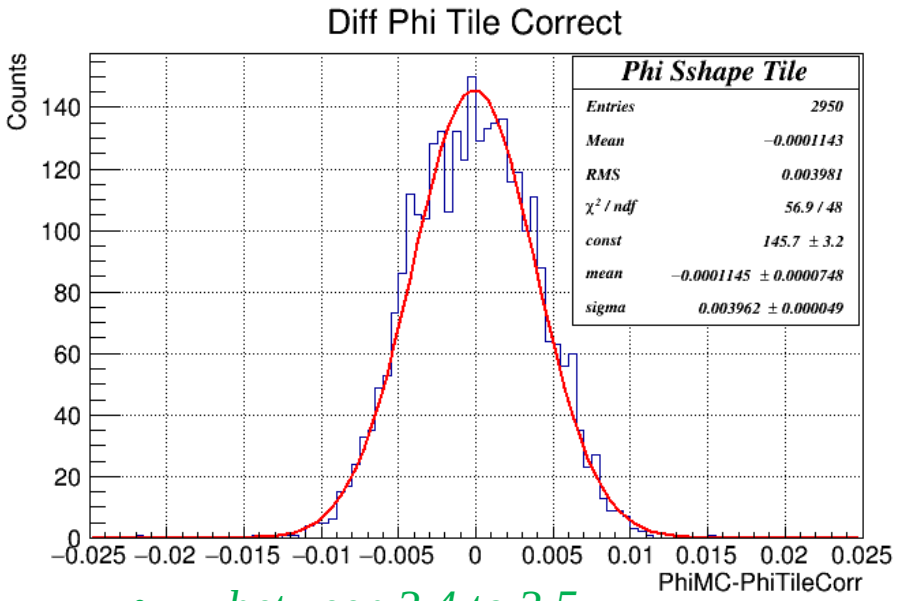
The backgrunds to be considered in this decay are the ZZ* production,wich has exactly the same topology as the signal (irreducible background).The reducible comes from Z+jets (heavy and light jets),top-quark pair, and WZ production.

Other smaller background with four or more leptons,namely VVV and $t\bar{t}$ + V where V= Z or W

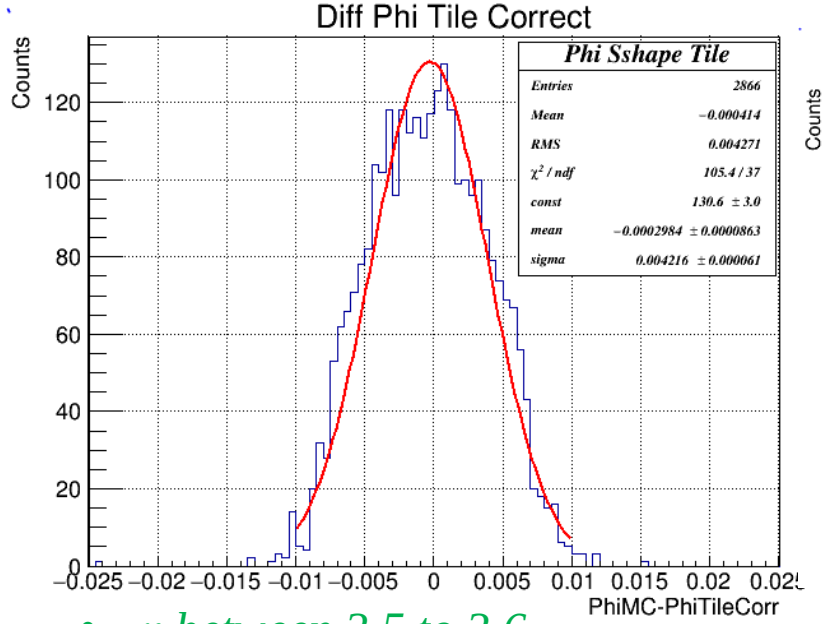




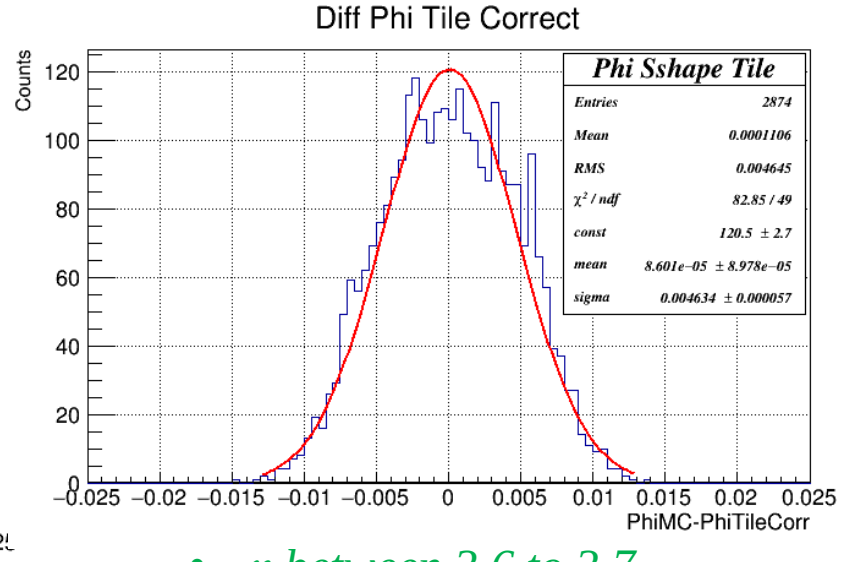
The S-shape correction in the FCAL ATLAS Electromagnetic module "FCal1"



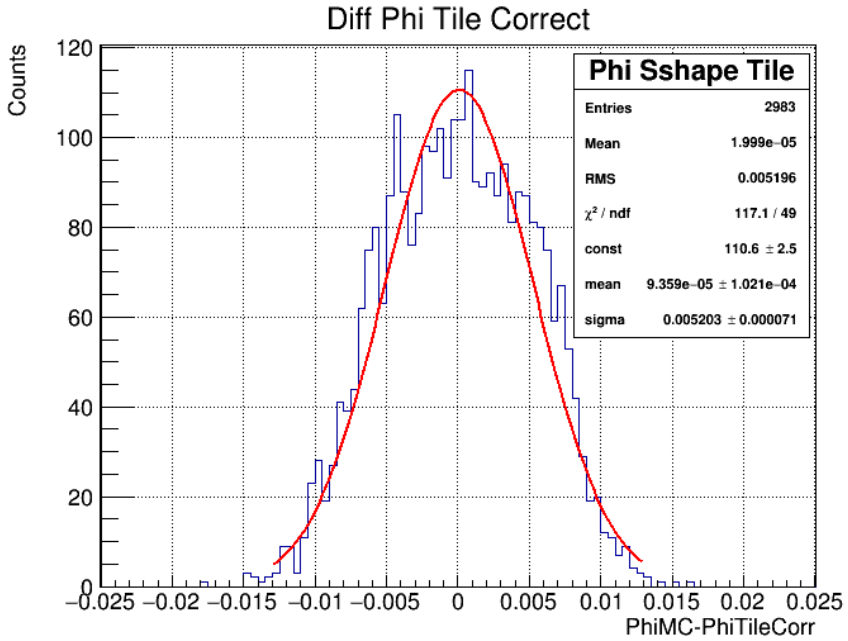
- *η between 3.4 to 3.5 .*



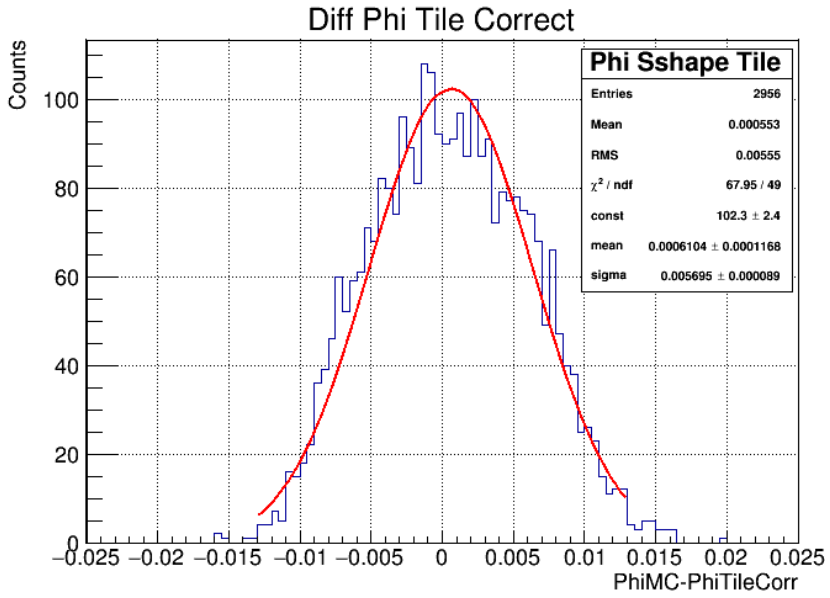
- *η between 3.5 to 3.6 .*



- *η between 3.6 to 3.7 .*



- *η between 3.7 to 3.8 .*



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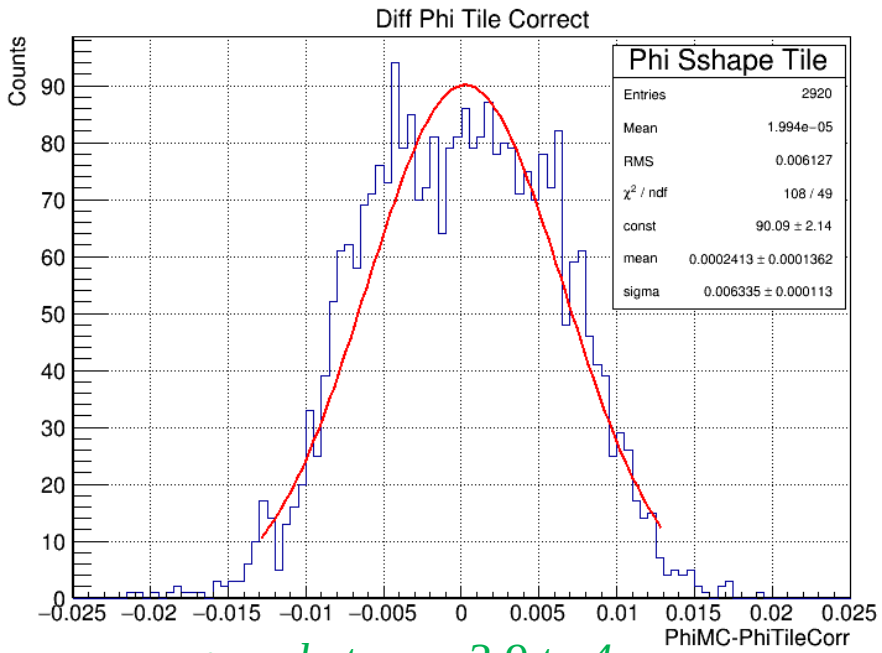

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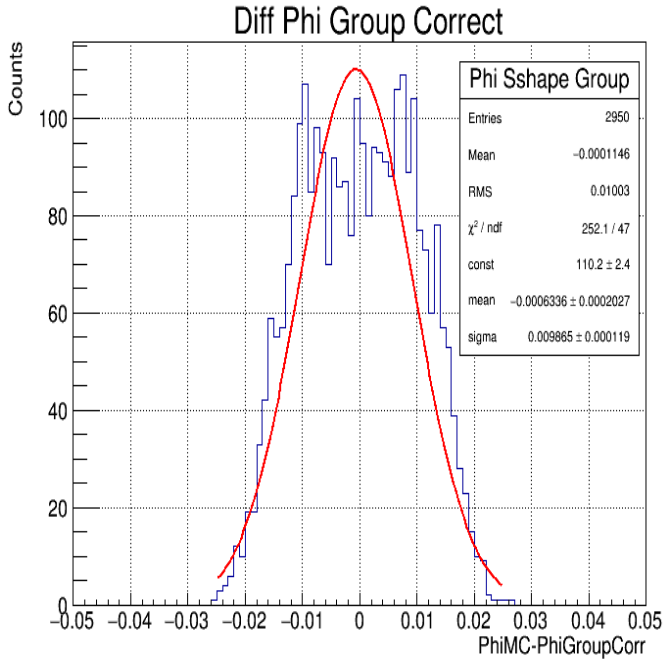

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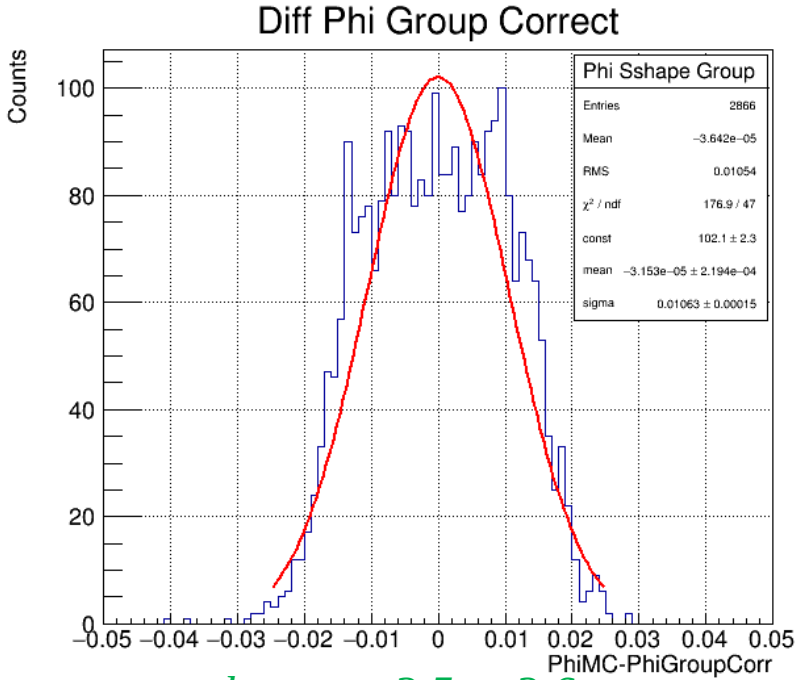

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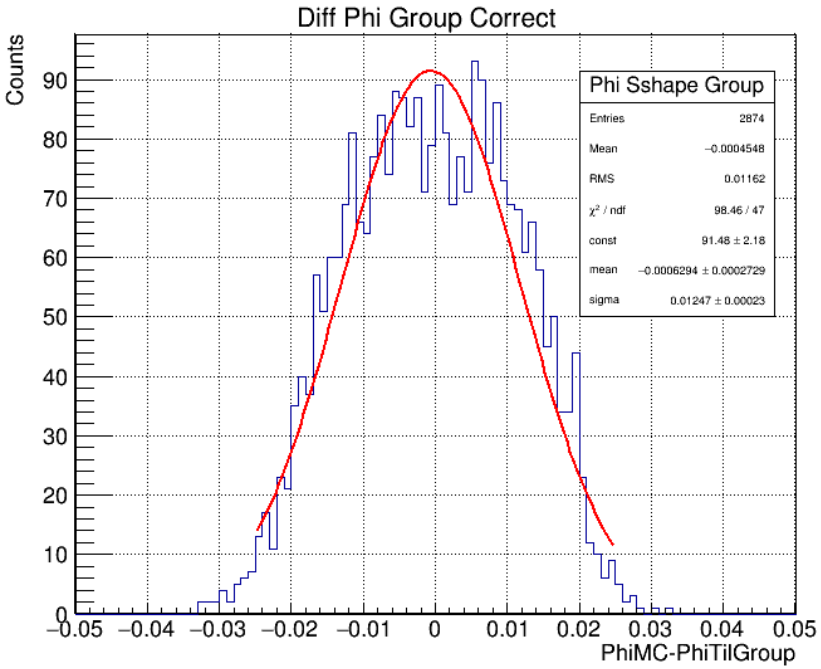

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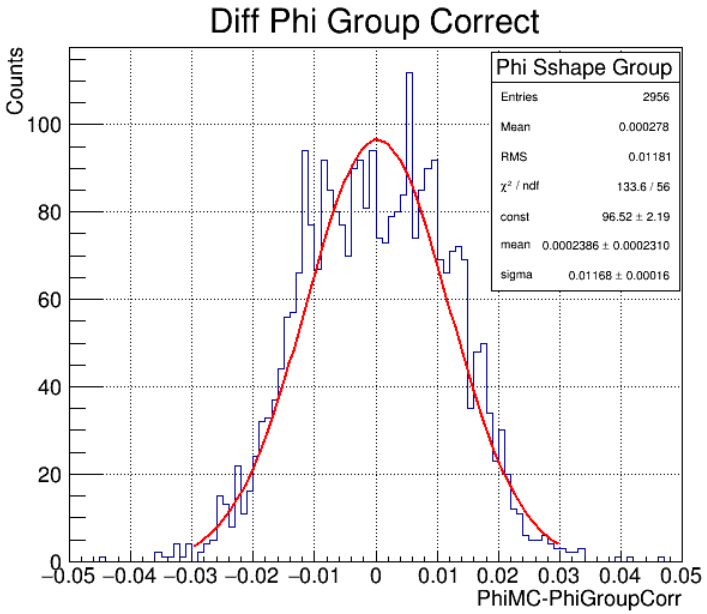

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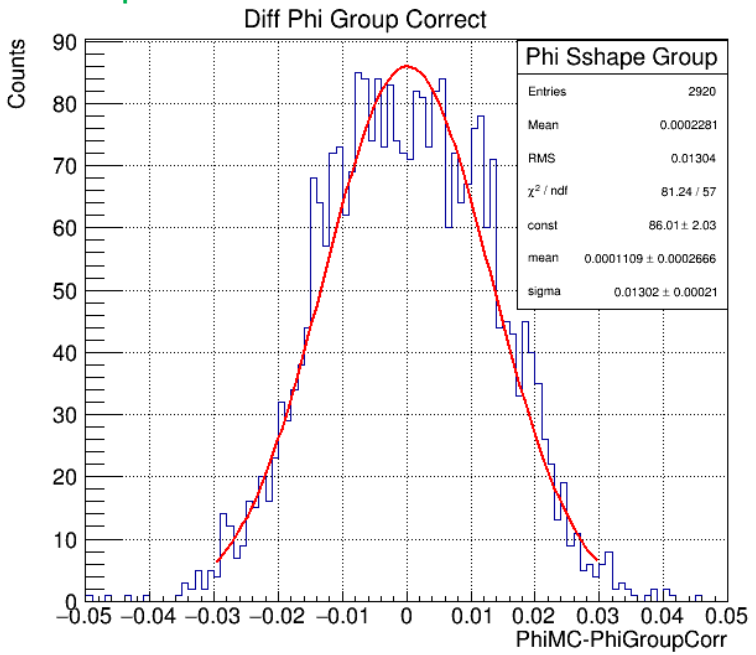

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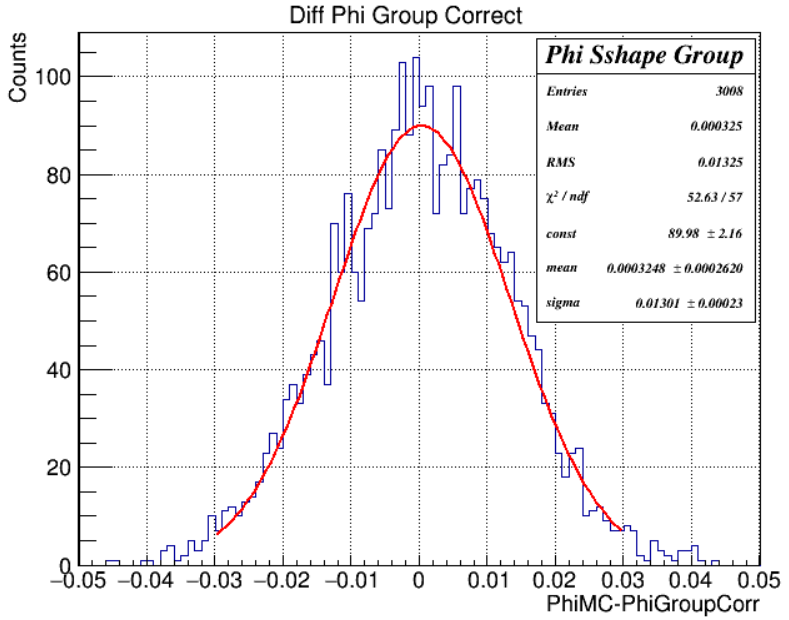

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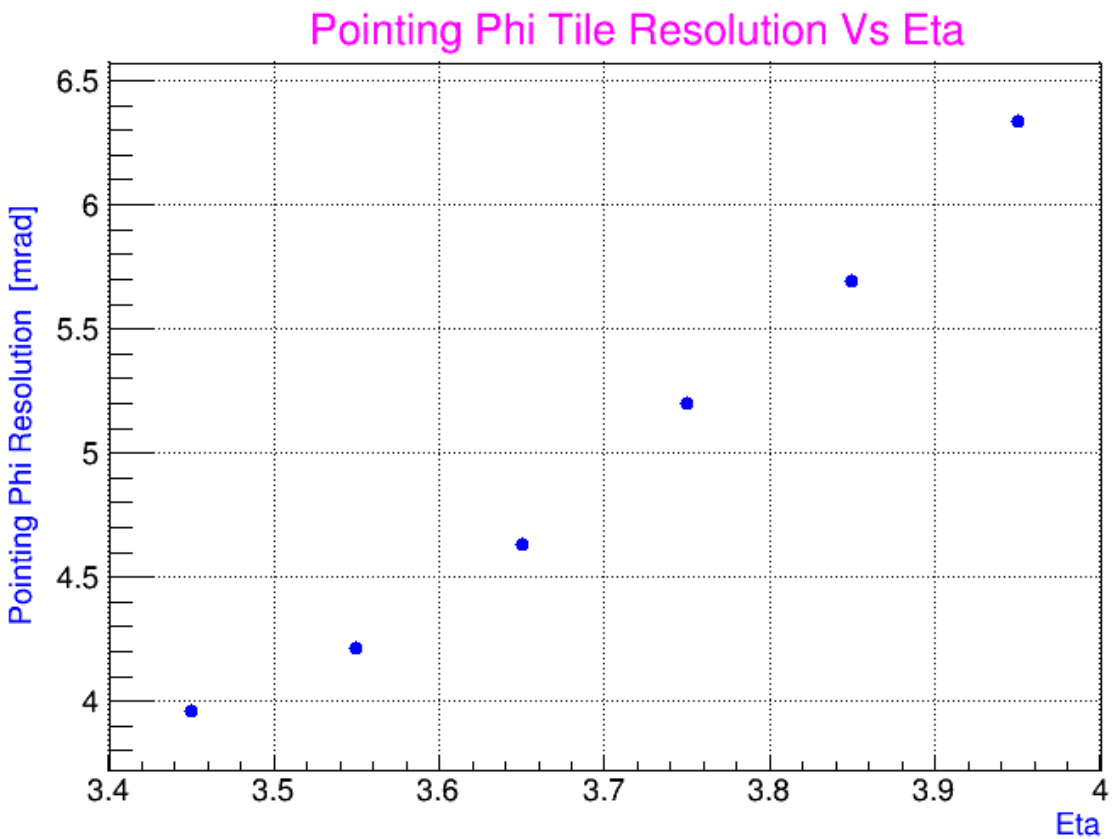
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Pointing Phi Resolution [mrad]
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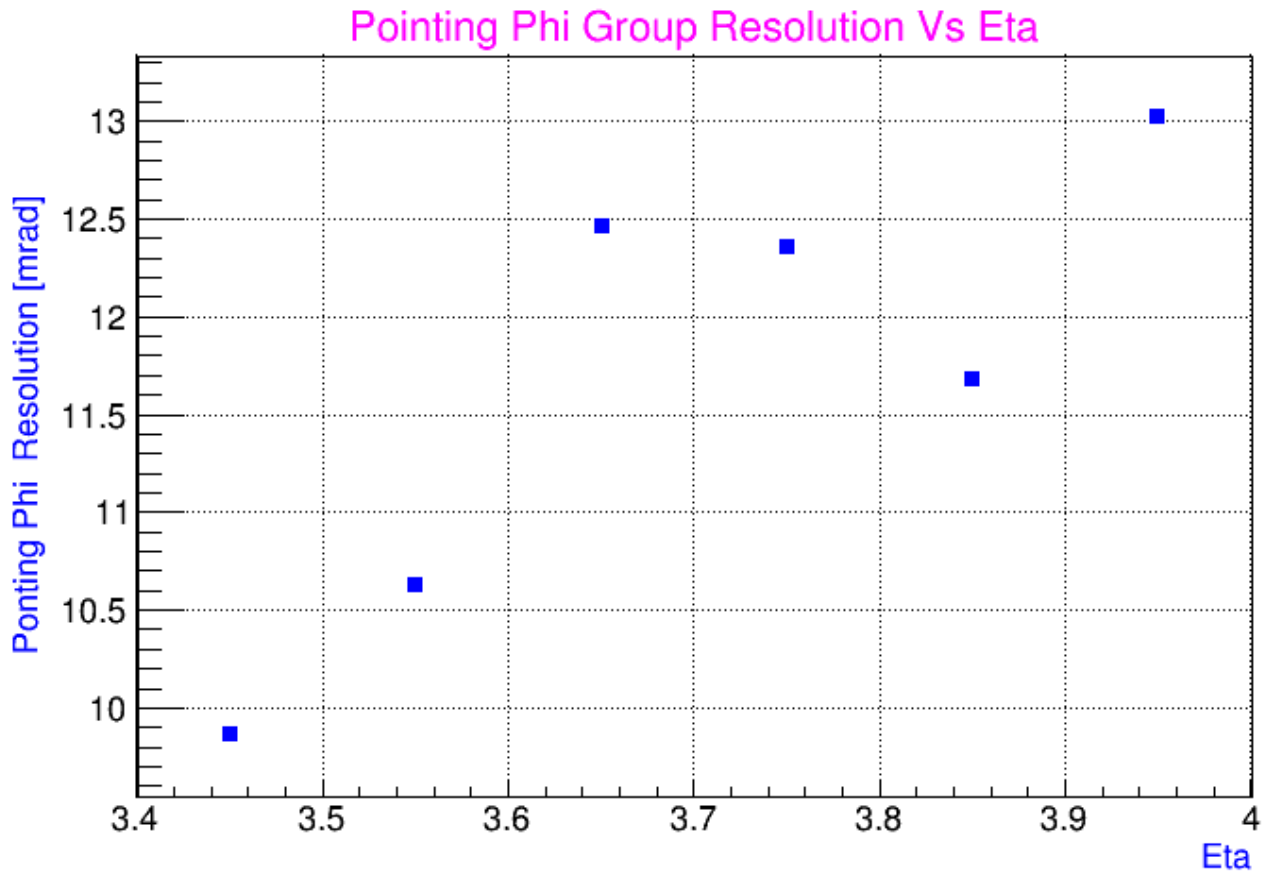
6
5.5
5
4.5
4
3.4
3.5
3.6
3.7
3.8
3.9
4
Eta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Ponting Phi Resolution [mrad]
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12.5
12
11.5
11
10.5
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3.4
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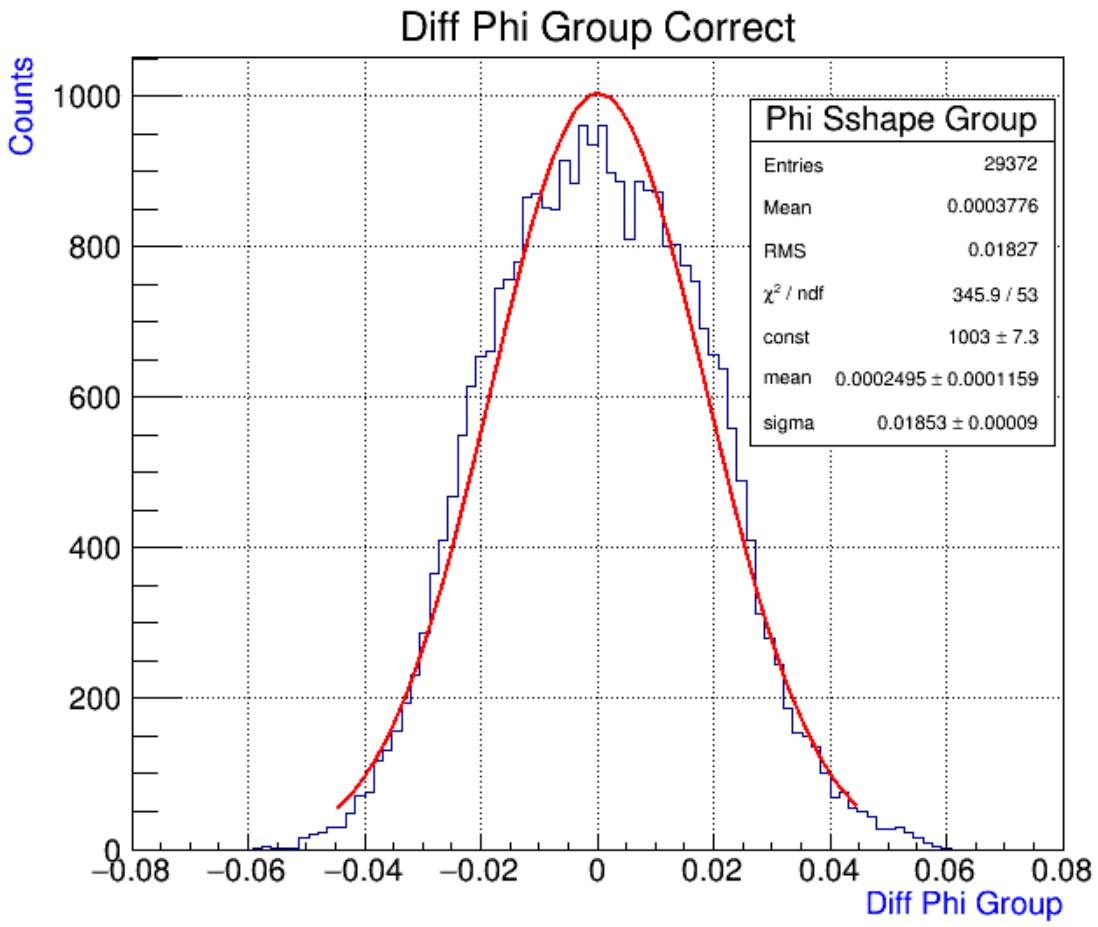
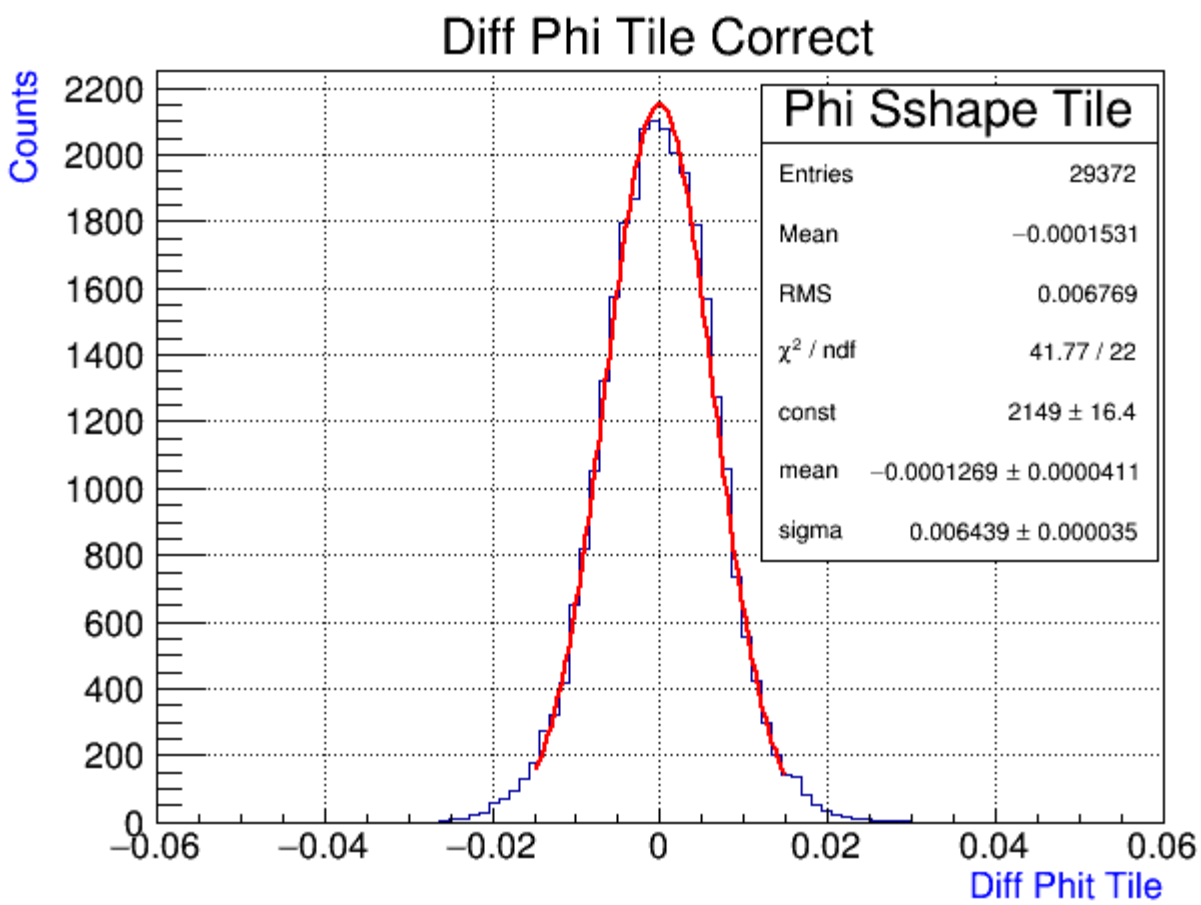
3.6
3.7
3.8
3.9
4
Eta

- *η between 3.4 to 4.4*





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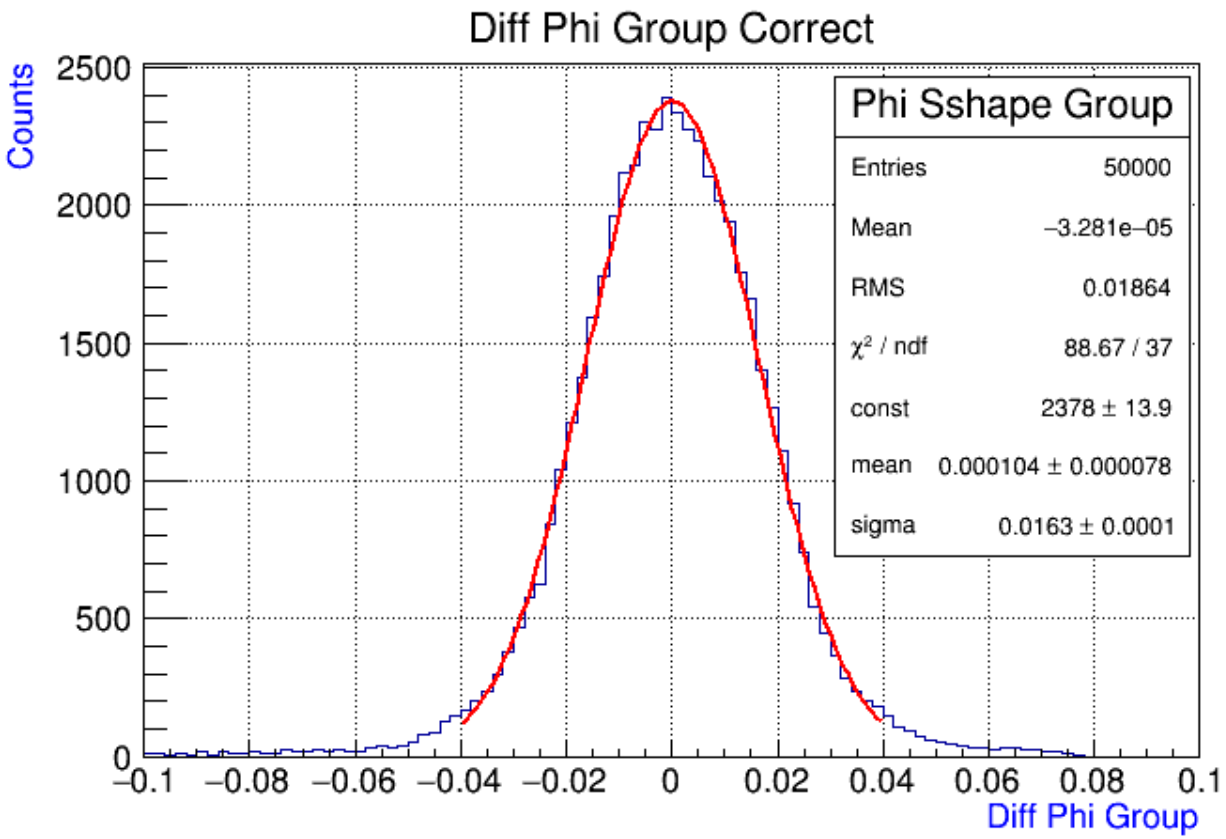
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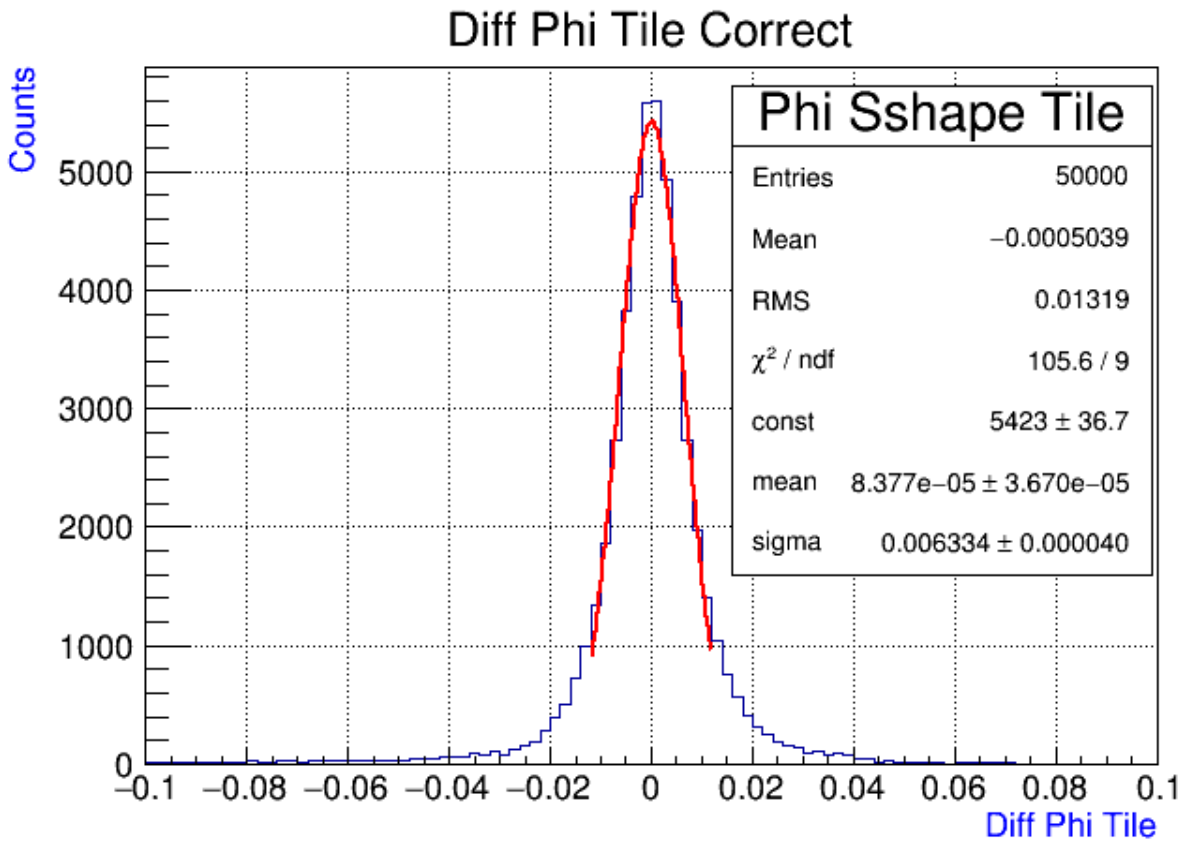
mean 0.000104 ± 0.000078
sigma 0.0163 ± 0.0001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Phi Sshape Tile
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sigma 0.006334 ± 0.000040

Thank you!