# Update of CGEM Alignment and Preliminary Performance

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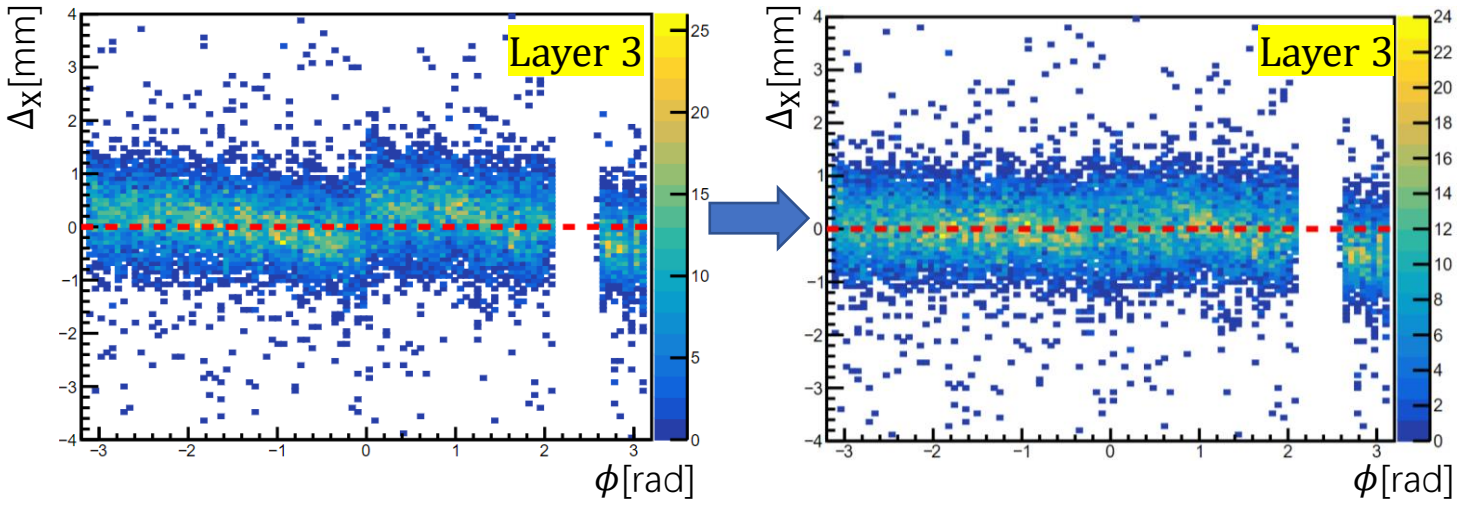
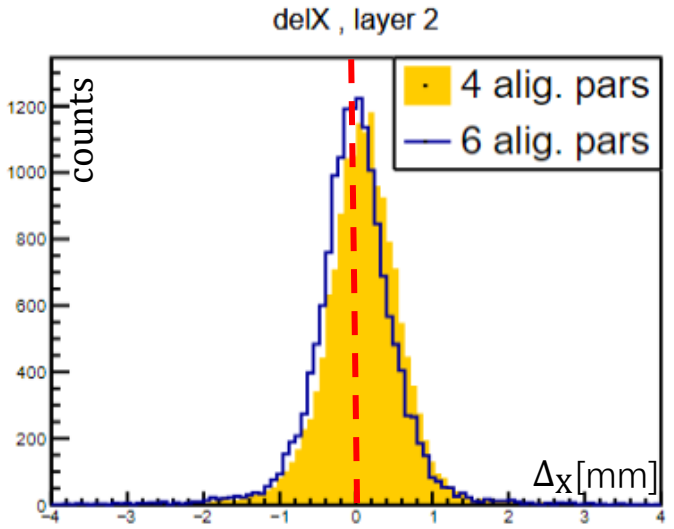
# Alignment Strategy & Progress

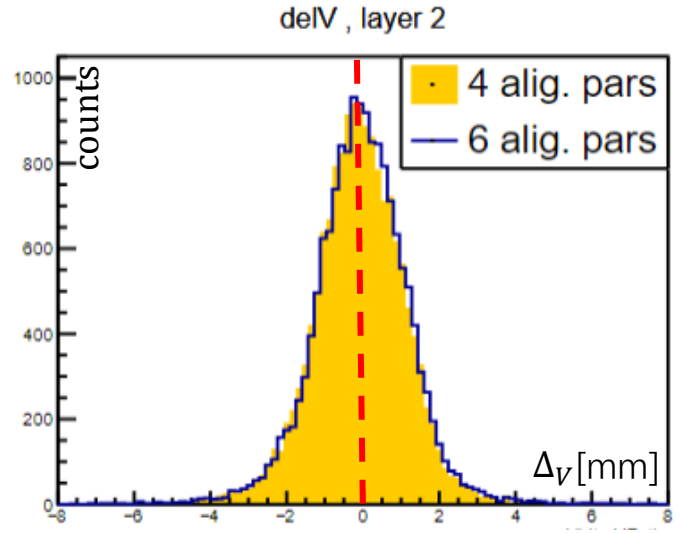
| Step | Data sample | Alignment method | Target parameters |
|---|---|---|---|
| 1 | cosmic-ray<br>without/with magnetic field | Residual<br>parameterization | **CGEM**: $\delta x, \delta y, \delta z, \theta_z$, Lorentz angle<br>(two sheets in the same layer as one part) |
| 2 | cosmic-ray<br>without/with magnetic field | Millepede | **CGEM**: $\delta x, \delta y, \delta z, \theta_z$, Lorentz angle<br>(two sheets in the same layer as one part)<br>**ODC:** $\delta x, \delta y, \theta_z$ |
| 3 | cosmic-ray<br>without/with magnetic field | Millepede | **CGEM**: $\delta x, \delta y, \delta z, \boldsymbol{\theta_x}, \boldsymbol{\theta_y}, \theta_z$, Lorentz angle<br>**(taking a single sheet as a part)**<br>**ODC:** $\delta x, \delta y, \theta_z$ |
| 4 | dimu | Millepede | **CGEM**: $\delta x, \delta y, \delta z, \theta_x, \theta_y, \theta_z$, Lorentz angle<br>(taking a single sheet as a part)<br>**ODC:** $\delta x, \delta y, \theta_z$ |

# Improvement of the Alignment

- Correct the relative misalignment between the two sheets in the same layer
- The peak shift is further corrected

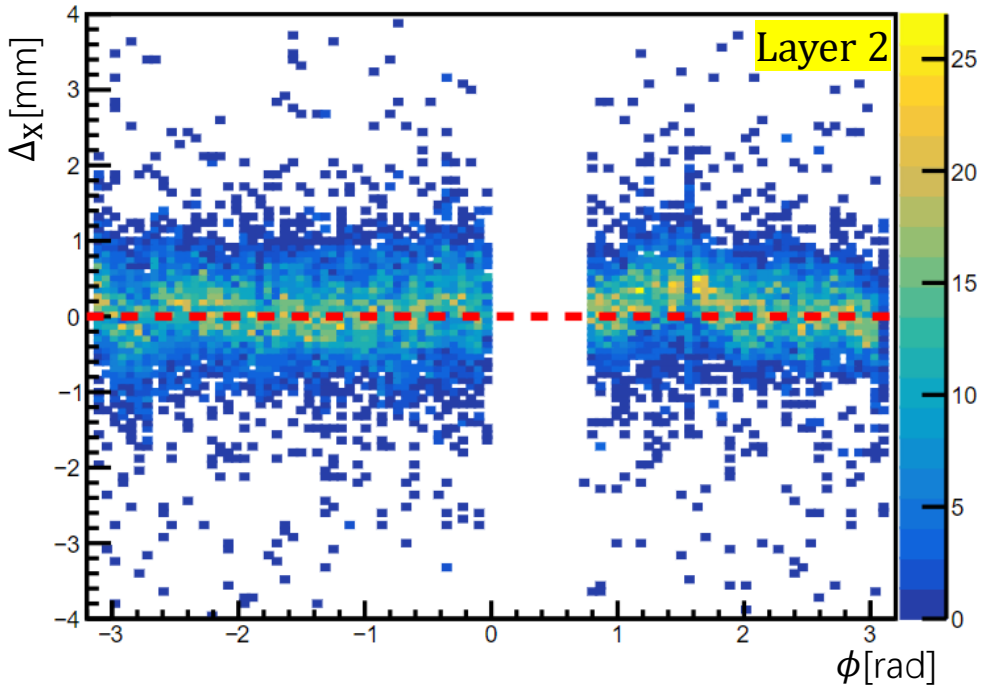


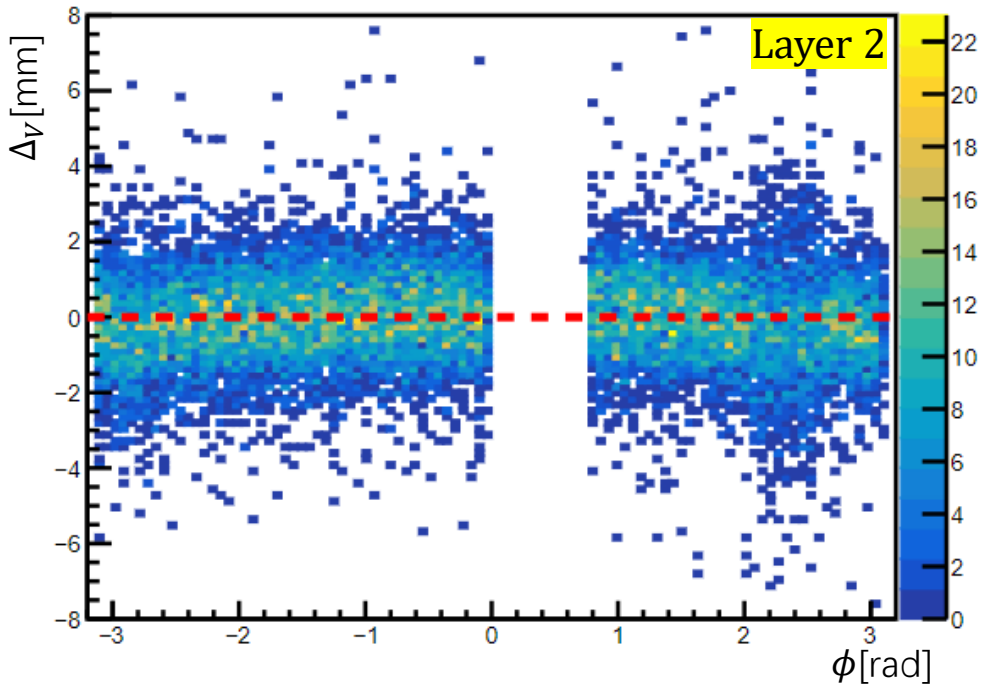



# Remaining Misalignment

$\Delta_X \sim \phi$




$\Delta_V \sim \phi$




The remaining distortion within an alignment element is under study

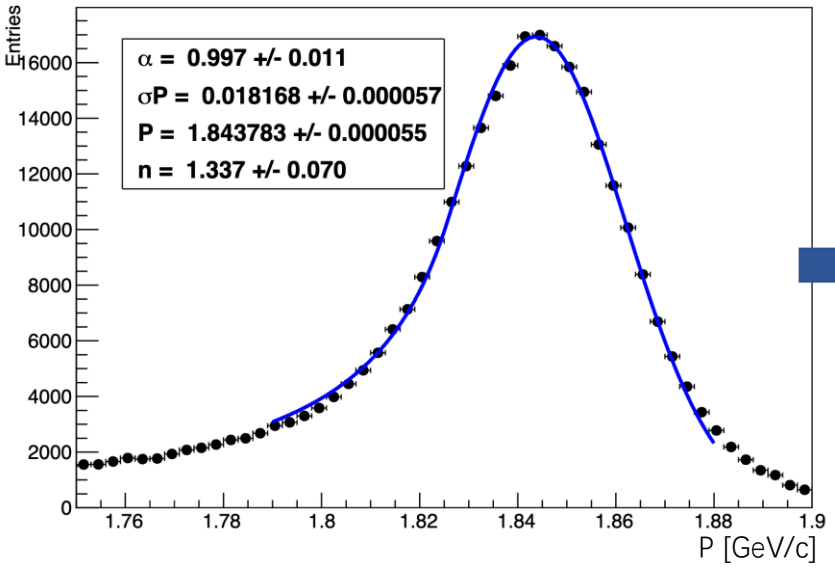
# Spatial Resolution

| | Layer1 | Layer2 | Layer3 |
|---|---|---|---|
| $\sigma_X$ [mm] | 0.5594 | 0.4106(top) | 0.5375(top) |
| | | 0.4988(bottom) | 0.4897(bottom) |
| $\sigma_V$ [mm] | 1.1646 | 0.8932(top) | 0.8267(top) |
| | | 0.9487(bottom) | 0.7895(bottom) |

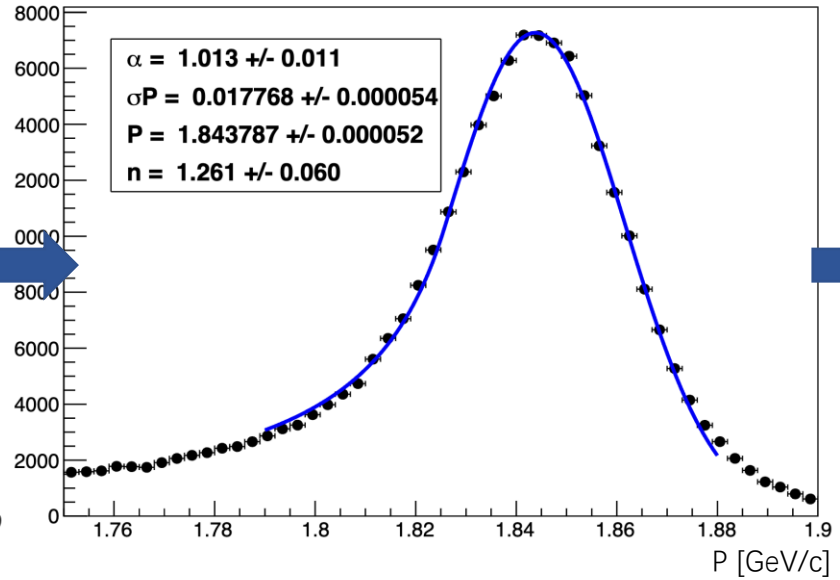
# Momentum Resolution

Data sample:
Bhabha on 2025.07.25

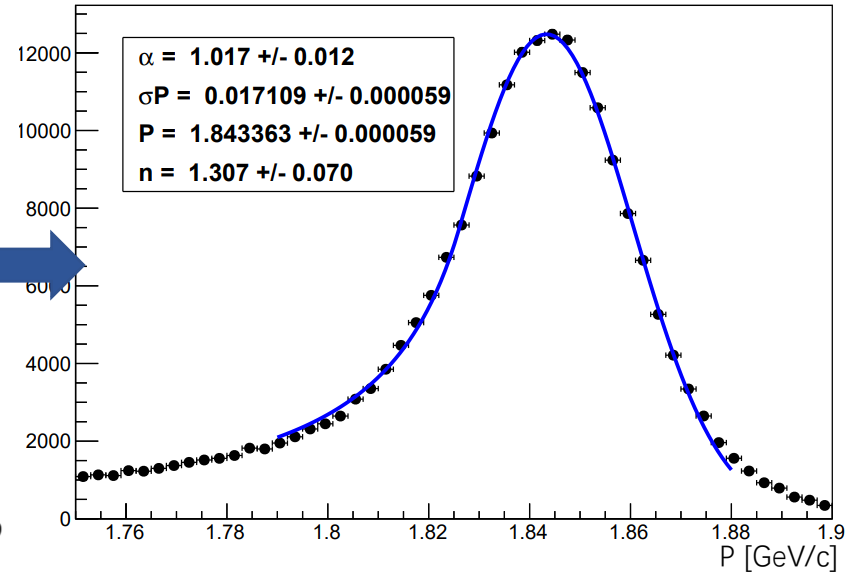
Only ODC
$\sigma P = 18.2$ MeV




ODC + CGEM
$\sigma P = 17.7$ MeV




**ODC + CGEM**
**$\sigma P = 17.1$ MeV**




- Momentum resolution improved significantly
- To be improved after further optimization of the alignment, reconstruction and calibration

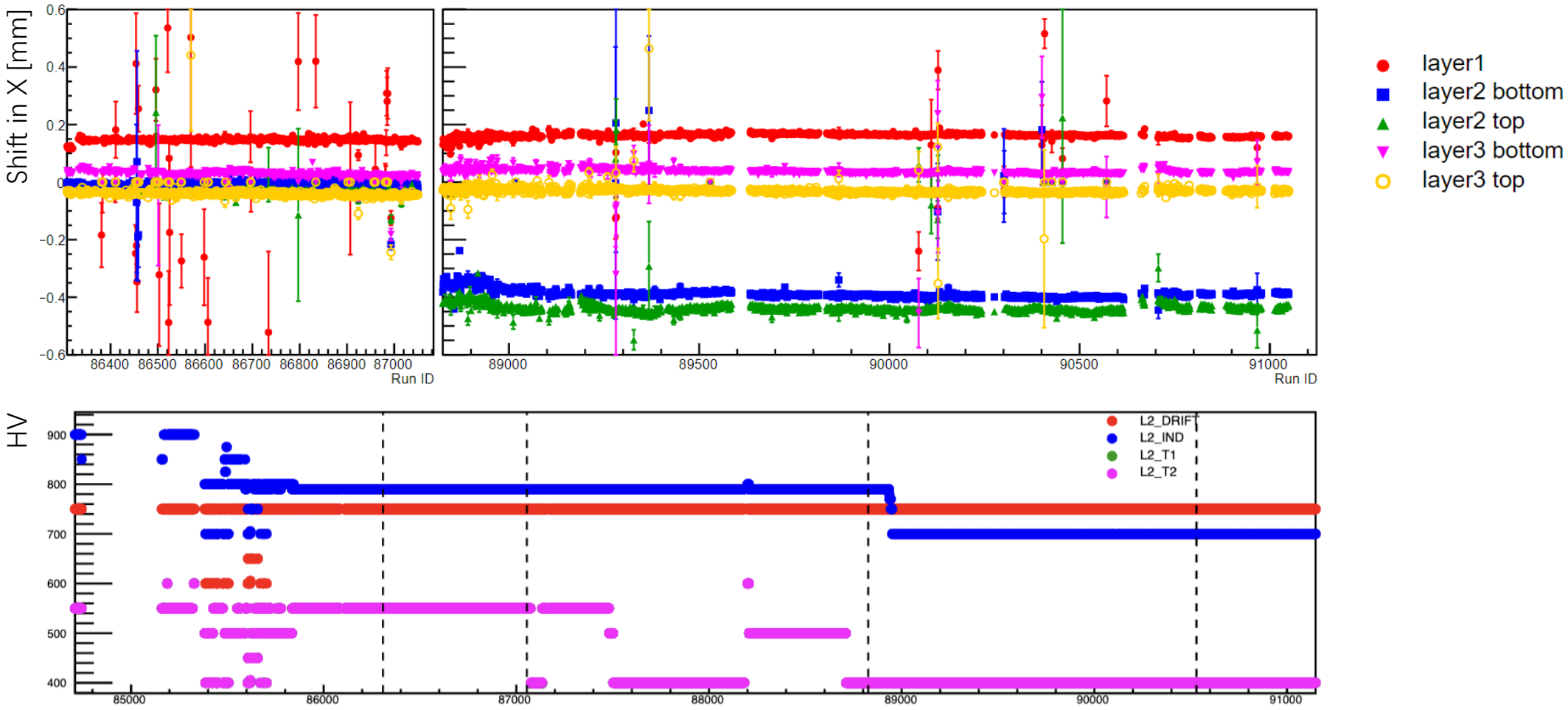
# Run-by-run Results

# Peak Shift ~ Run

Bhabha

Round 18, 2025.07

Round 19,  2025.12.25~2026.03.15



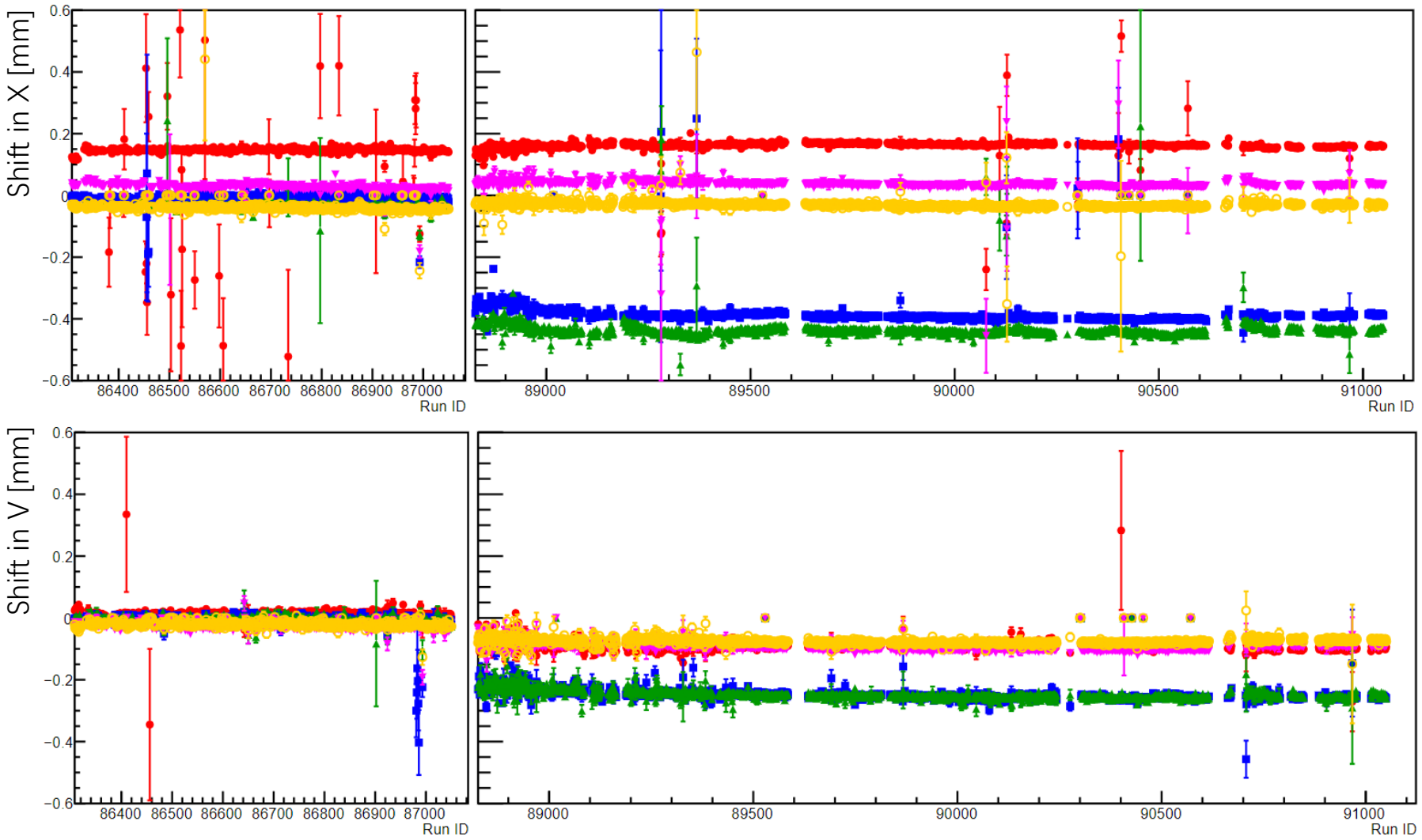

Lorentz angle changed due to high voltage change

# Peak Shift ~ Run

Bhabha

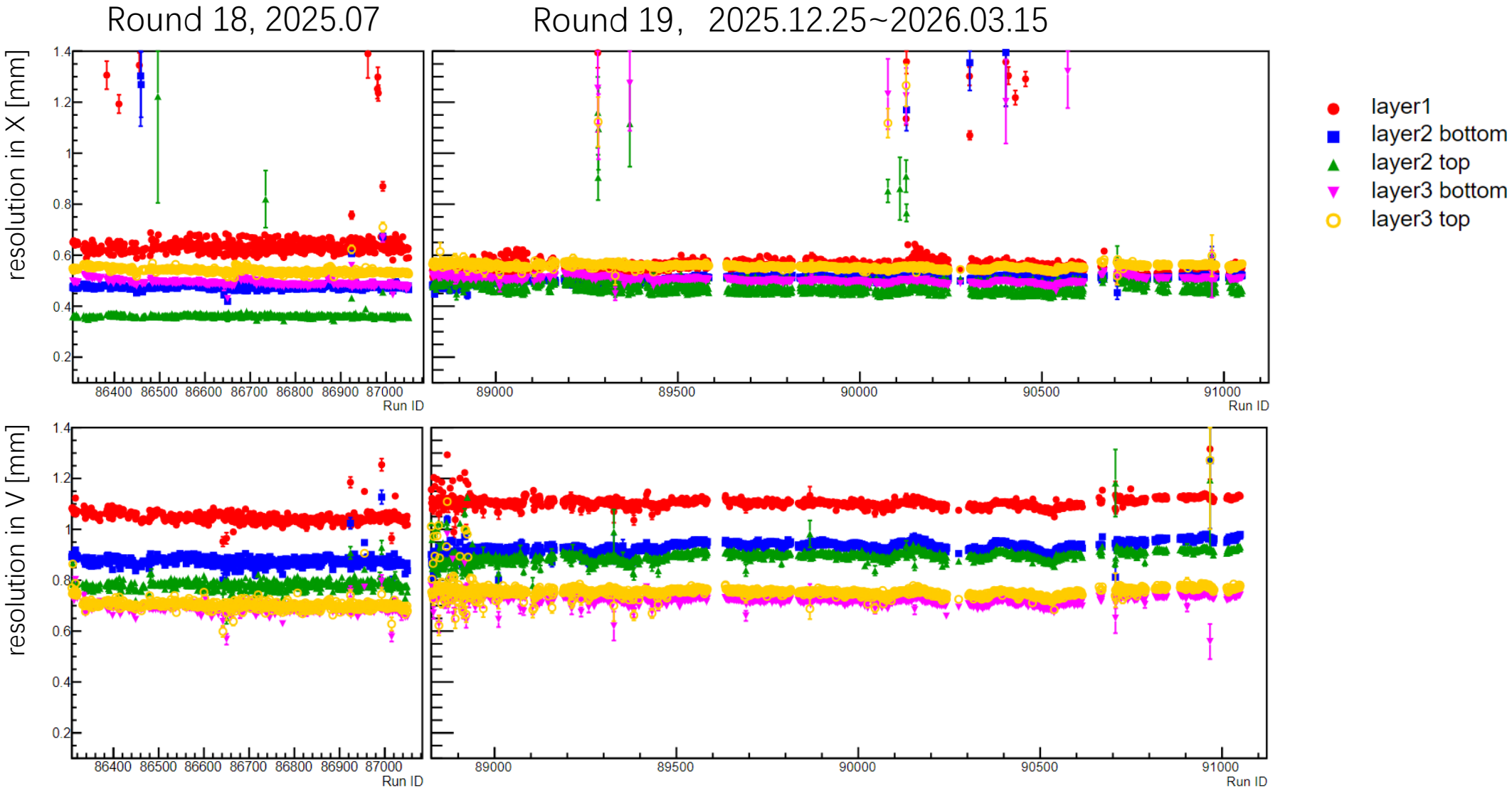
Round 18, 2025.07

Round 19,  2025.12.25~2026.03.15

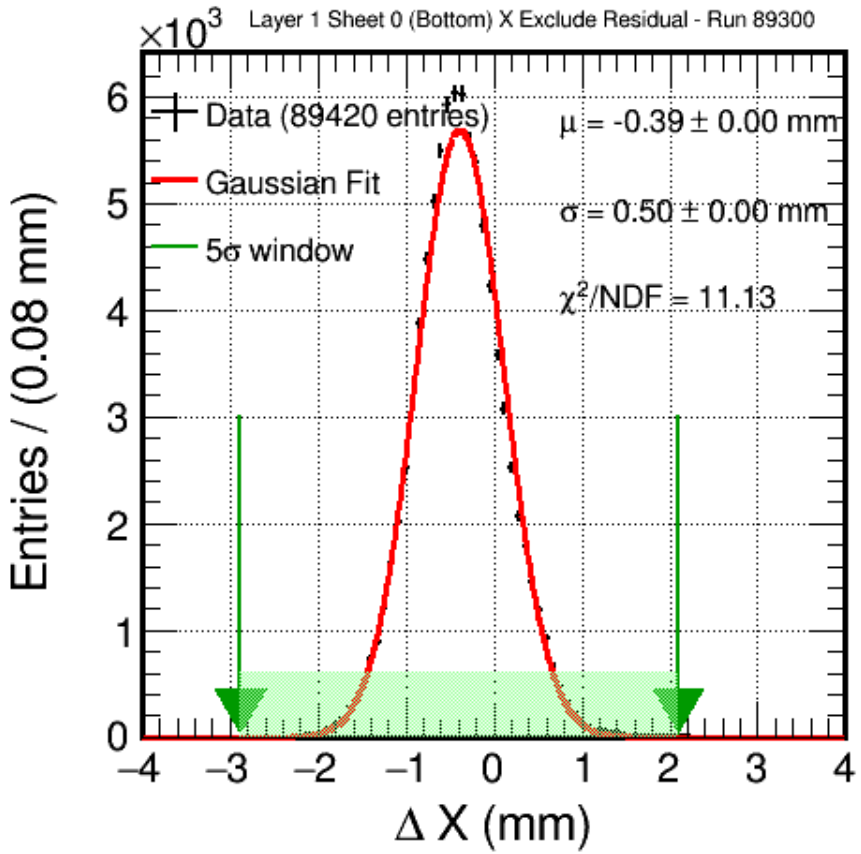


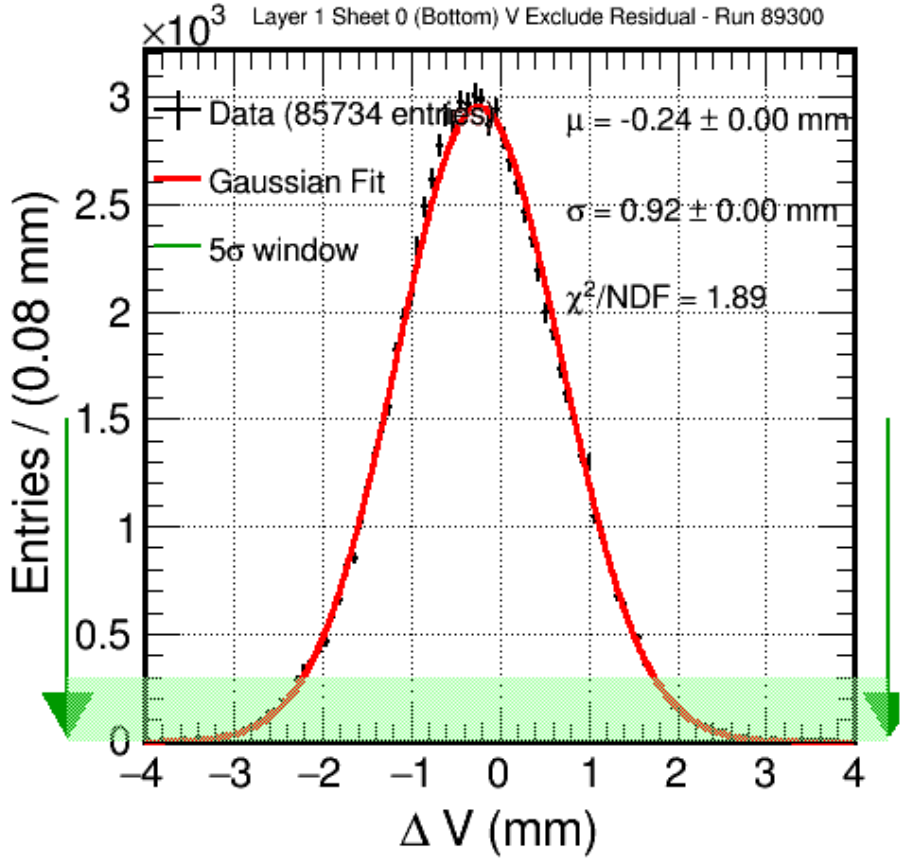
# Spatial Resolution ~ Run

Bhabha



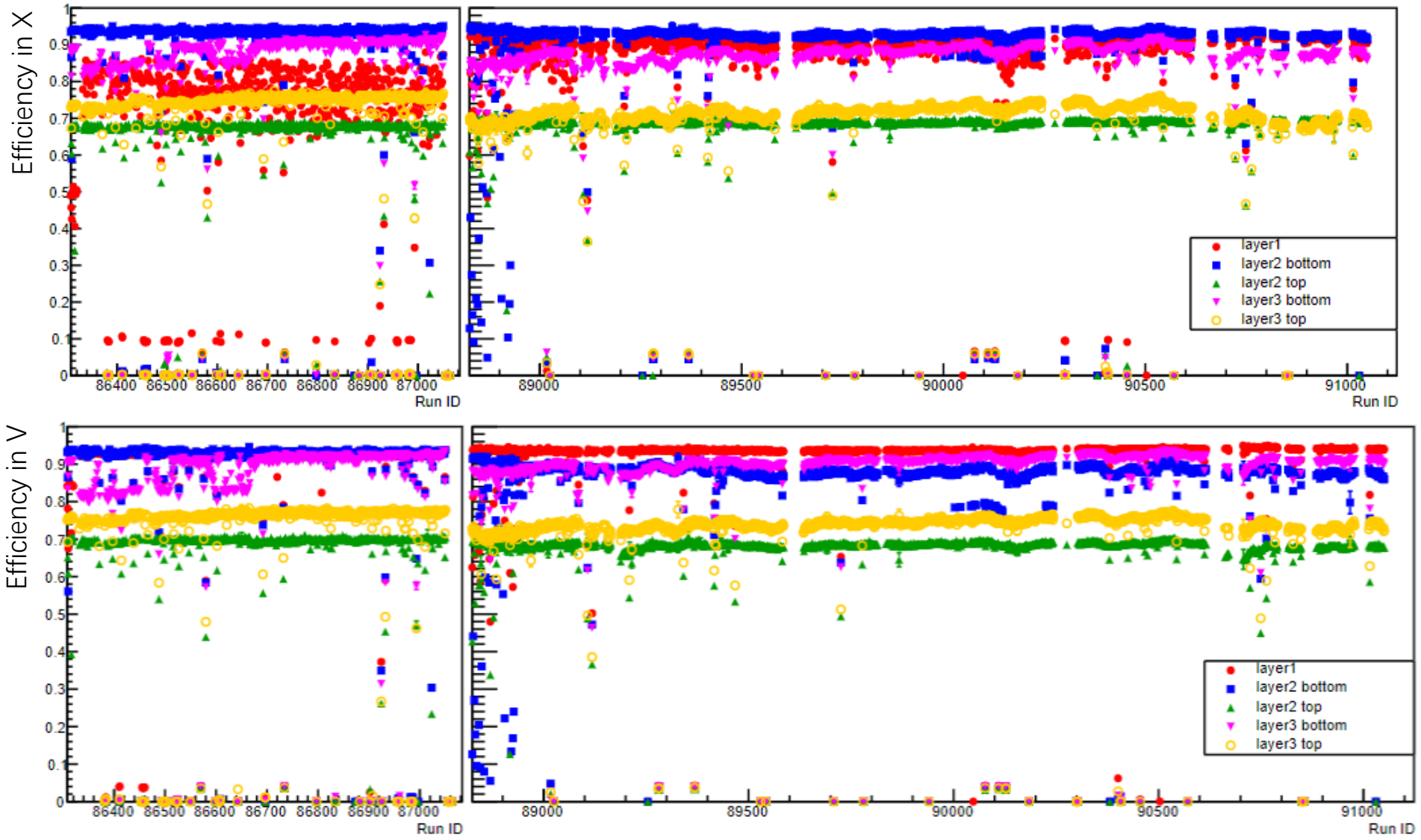
# Hit Efficiency



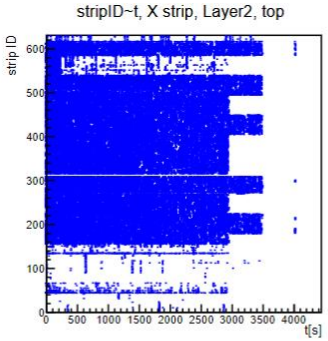



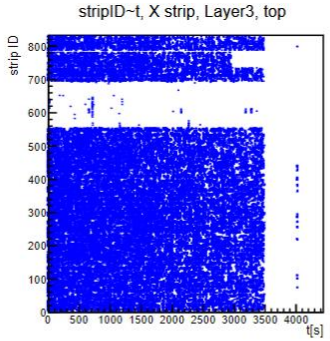
# Hit Efficiency~ Run

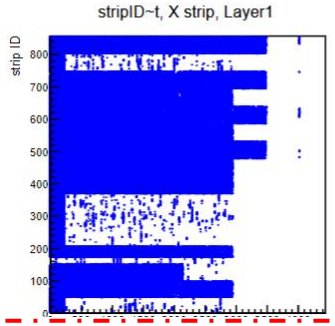
Round 18, 2025.07 Round 19, 2025.12.25~2026.03.15

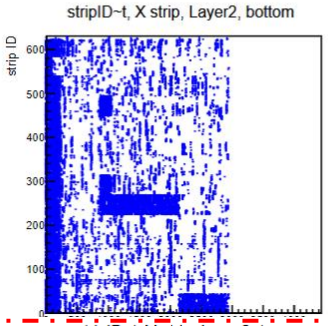


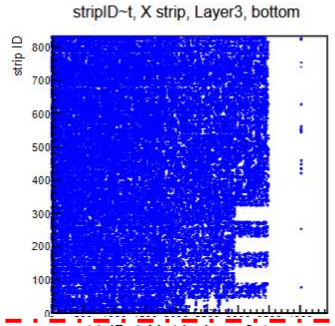
run88826
Low efficiency

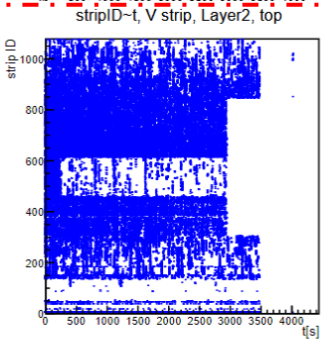


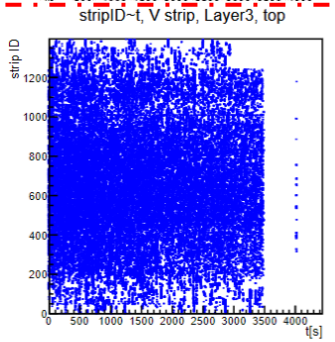



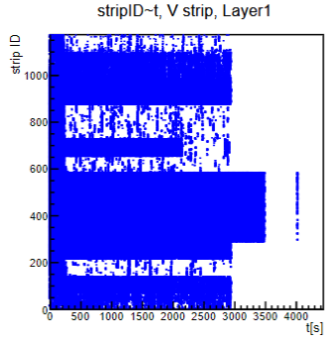



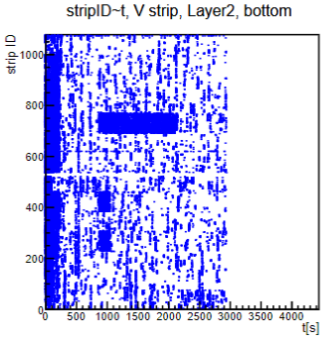



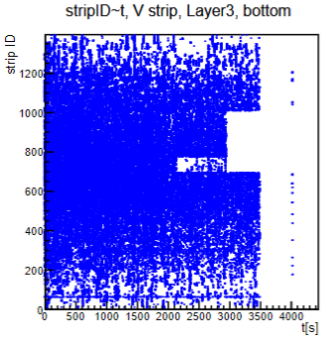



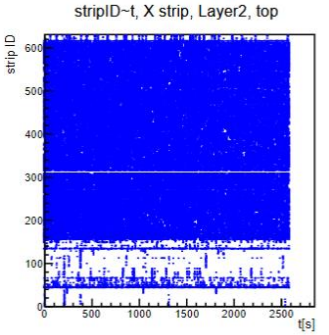



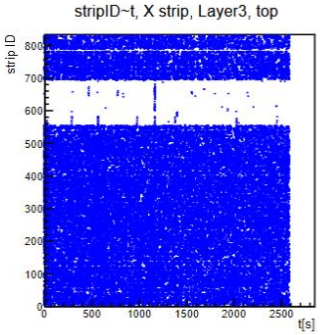



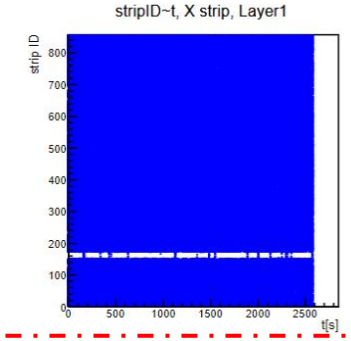



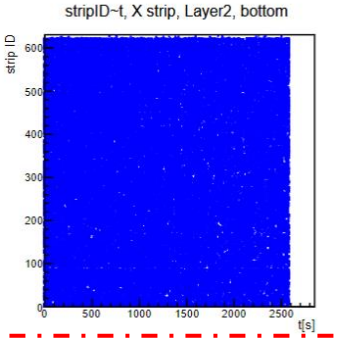



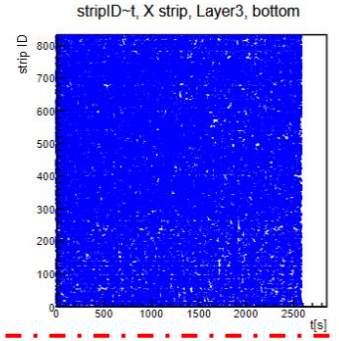

run88834

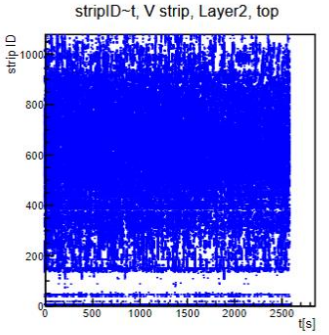


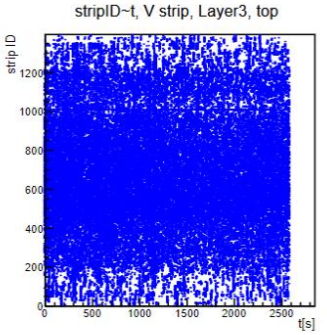



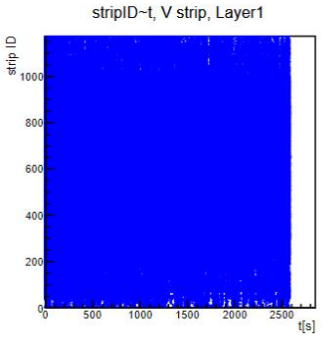



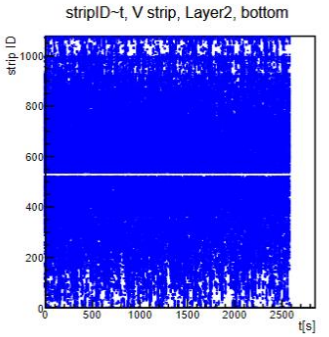



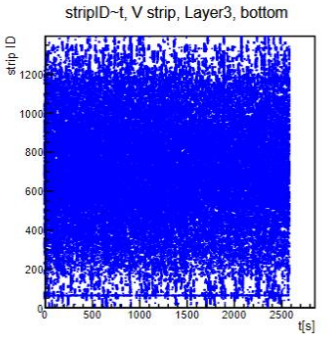



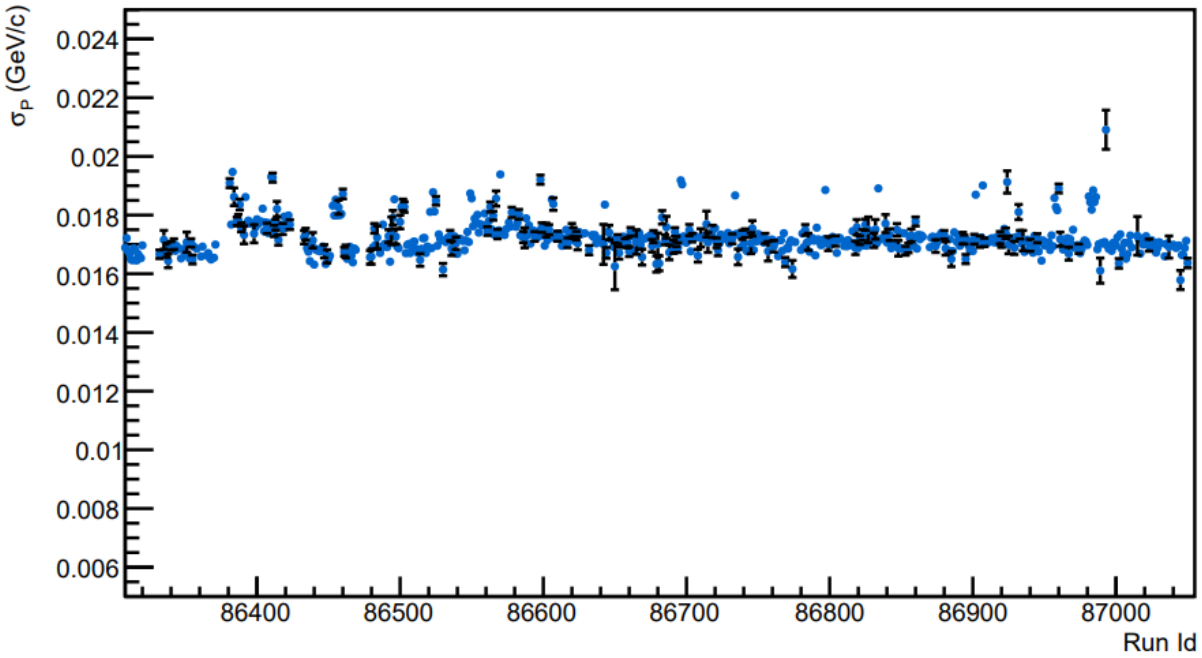



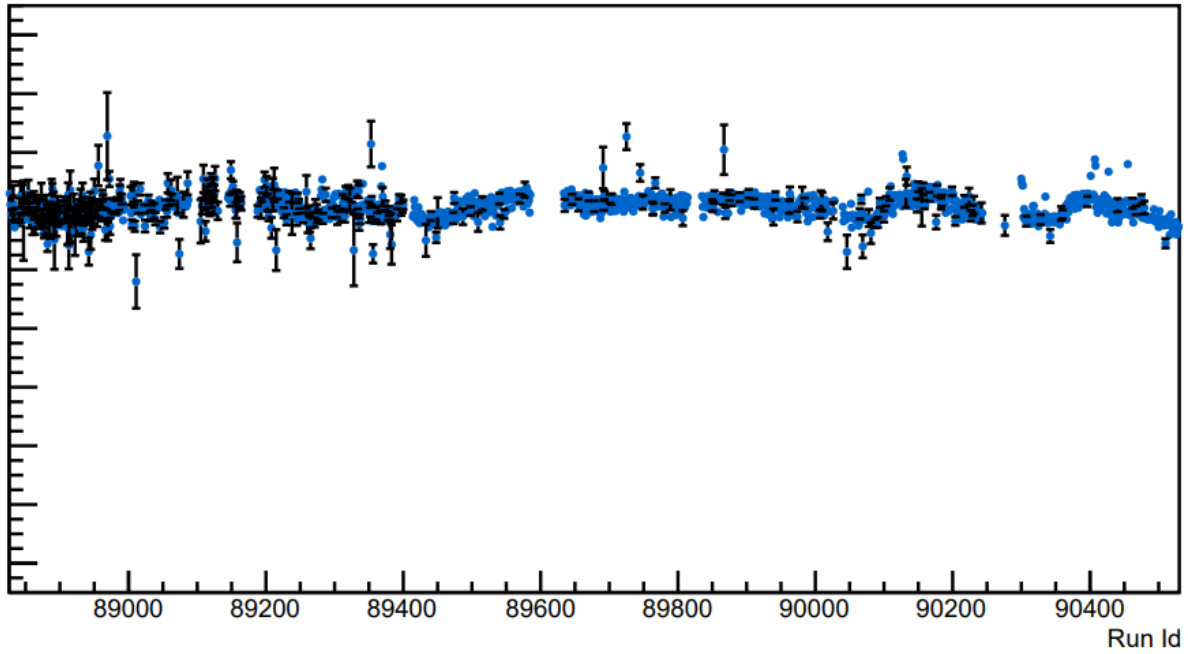



# Momentum Resolution ~ Run

Round 18, 2025.07

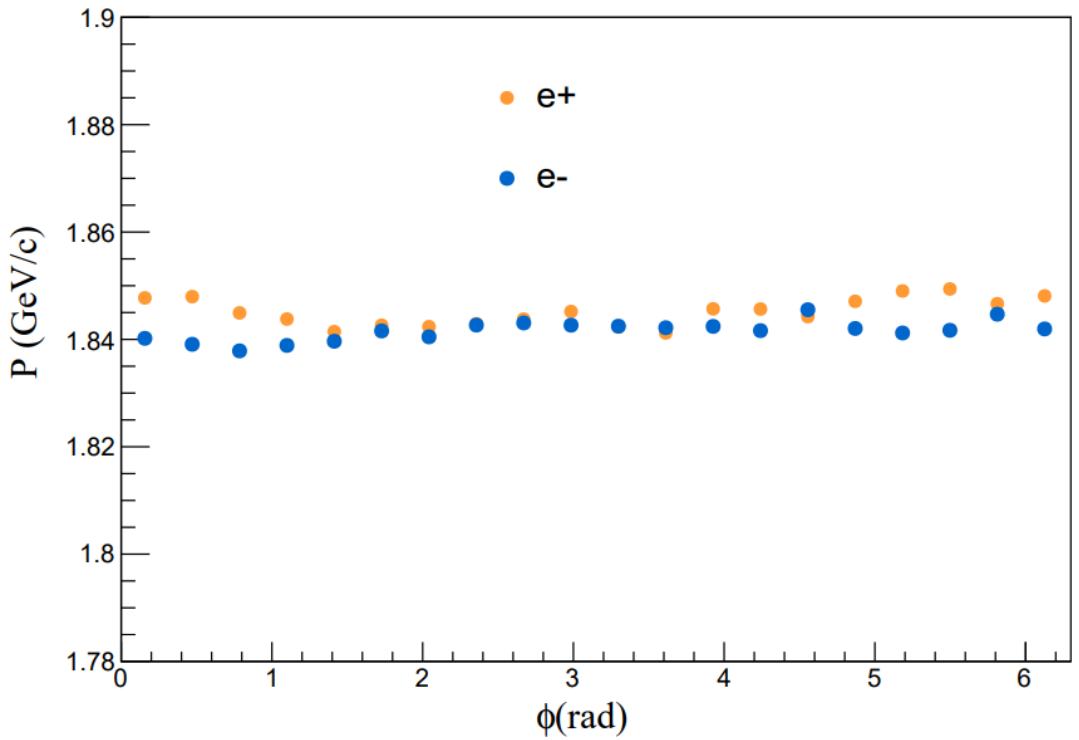



Round 19，  2025.12.25~2026.03.15

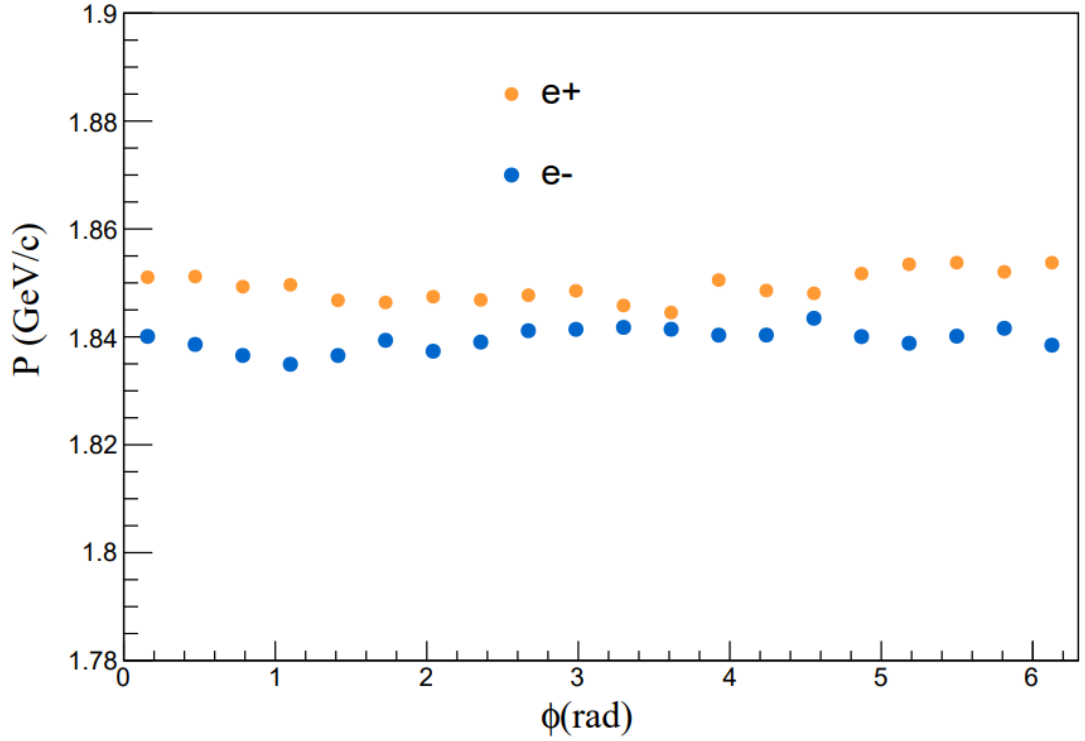


# Momentum resolution

Bhabha on 2025.07.25




Bhabha on 2026.01.11




Misalignment due to Lorentz angle shift caused by high voltage changed