FST Hardware and Alignment

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UIC

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Hardware

Cooling system

• EIT-D serial to Ethernet converter was replaced in the FST cooling system.

• Leak rate ~0.5%.

Leak from connection of TPC water to FST PPB (was fixed with copper connector).

FST

• No troubles with the FST modules or connected electronics.

• HV settings were unchanged from start to finish of Run 23.
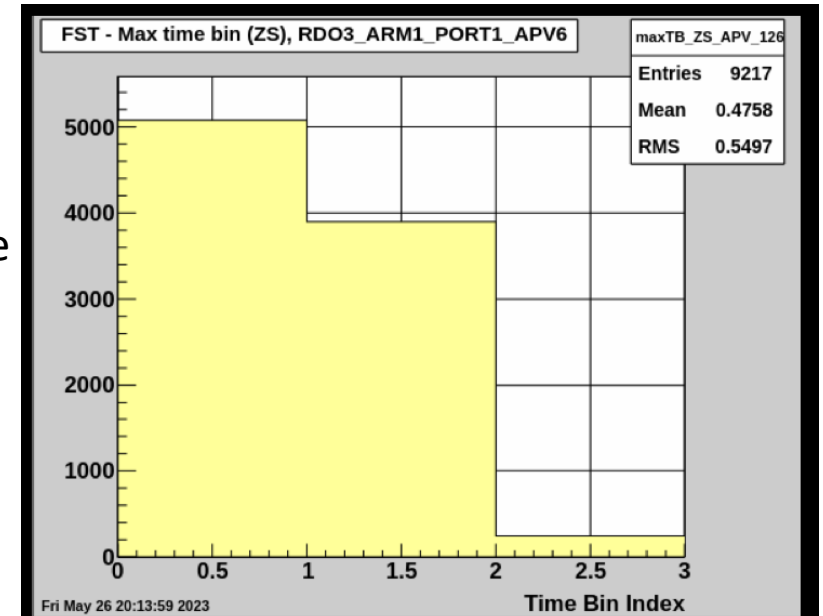
Calibration

Latency

- Ziyue developed code to scan over all APVs and find which ones are not peaked at the central timebin.

- Every 2 weeks, the latency was adjusted on APVs to ensure peak in central TB.

- Latency adjustment was needed directly after a failure to shut down FST before beam dump.
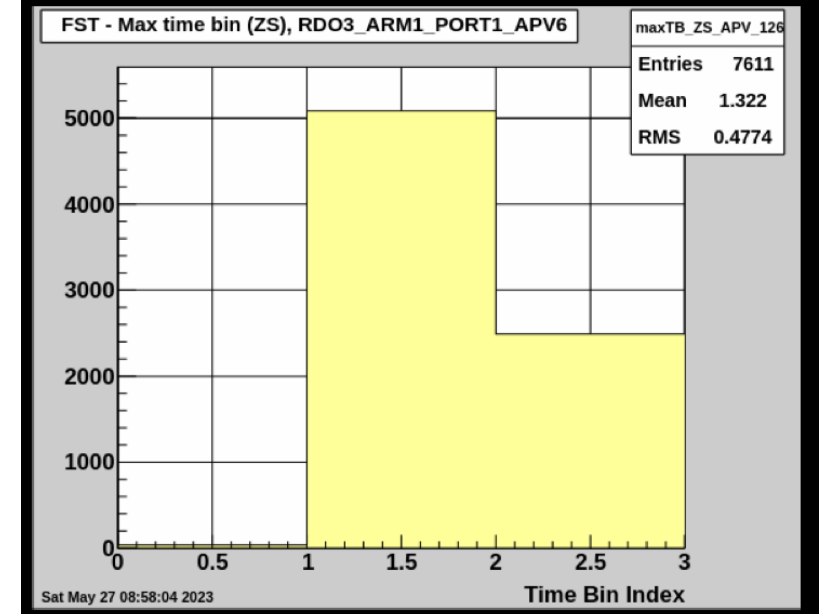
Other

- Pedestal values have been sent to the FST db up until end of July.
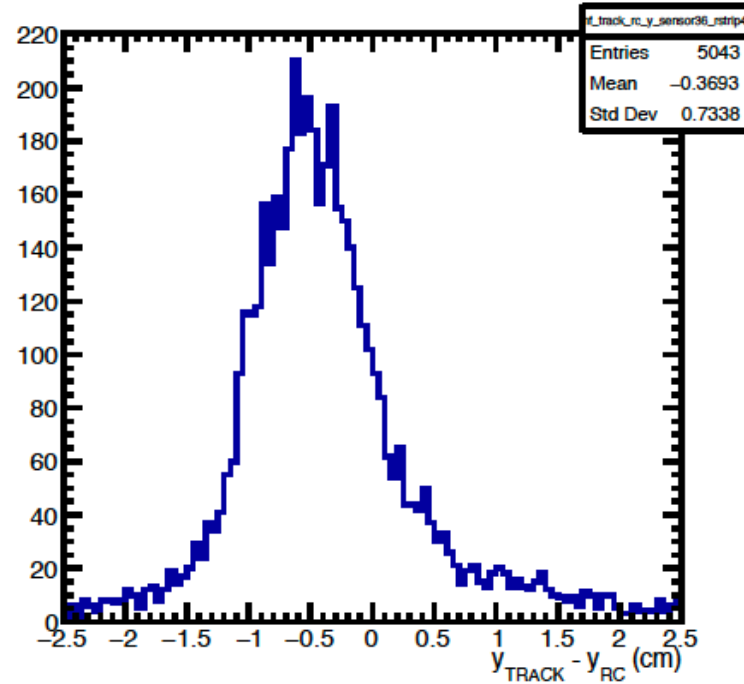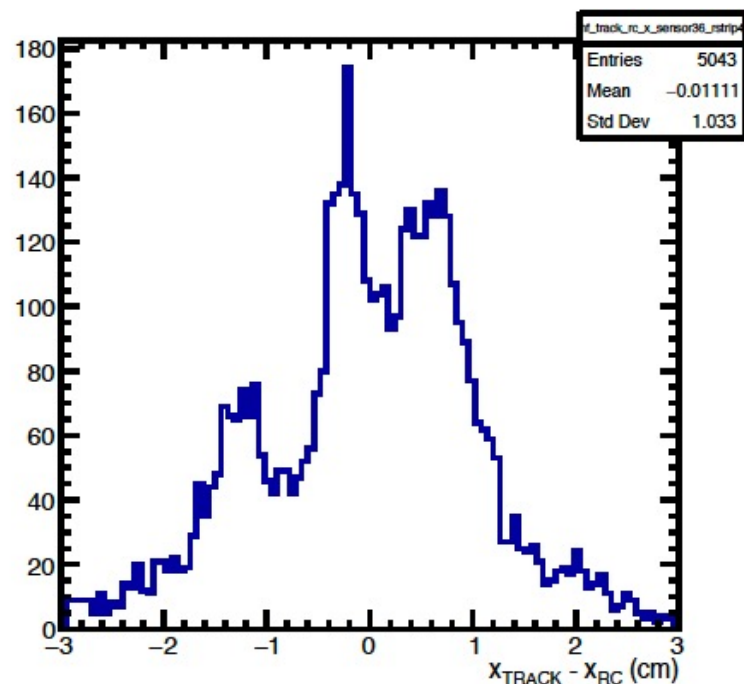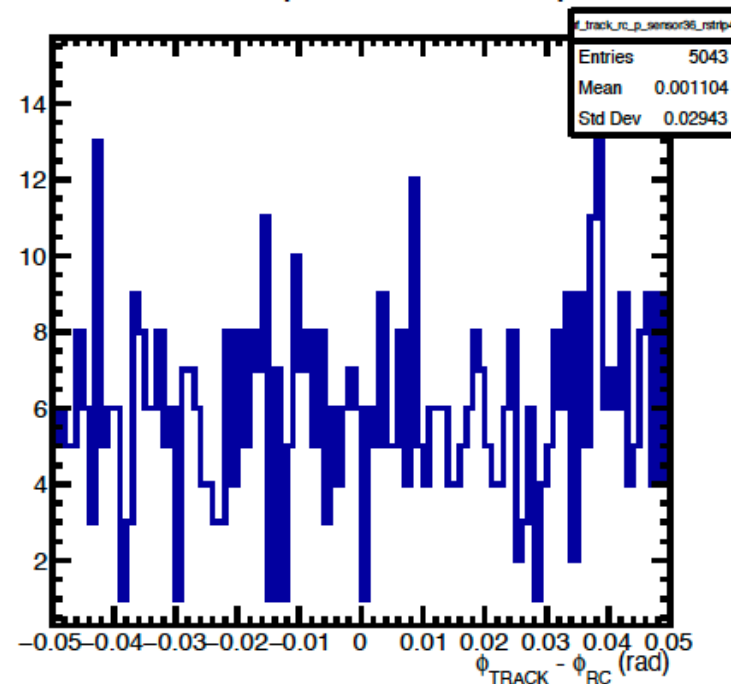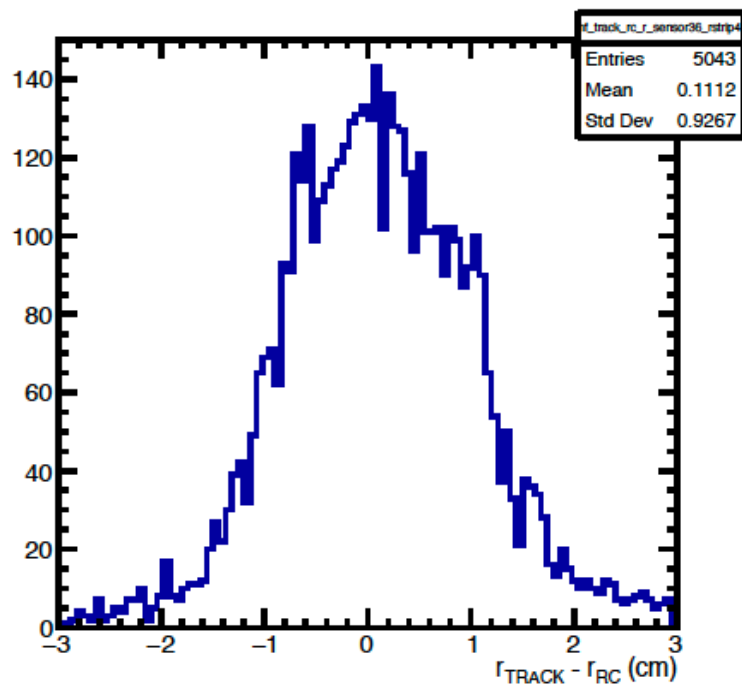
Before

After

Alignment
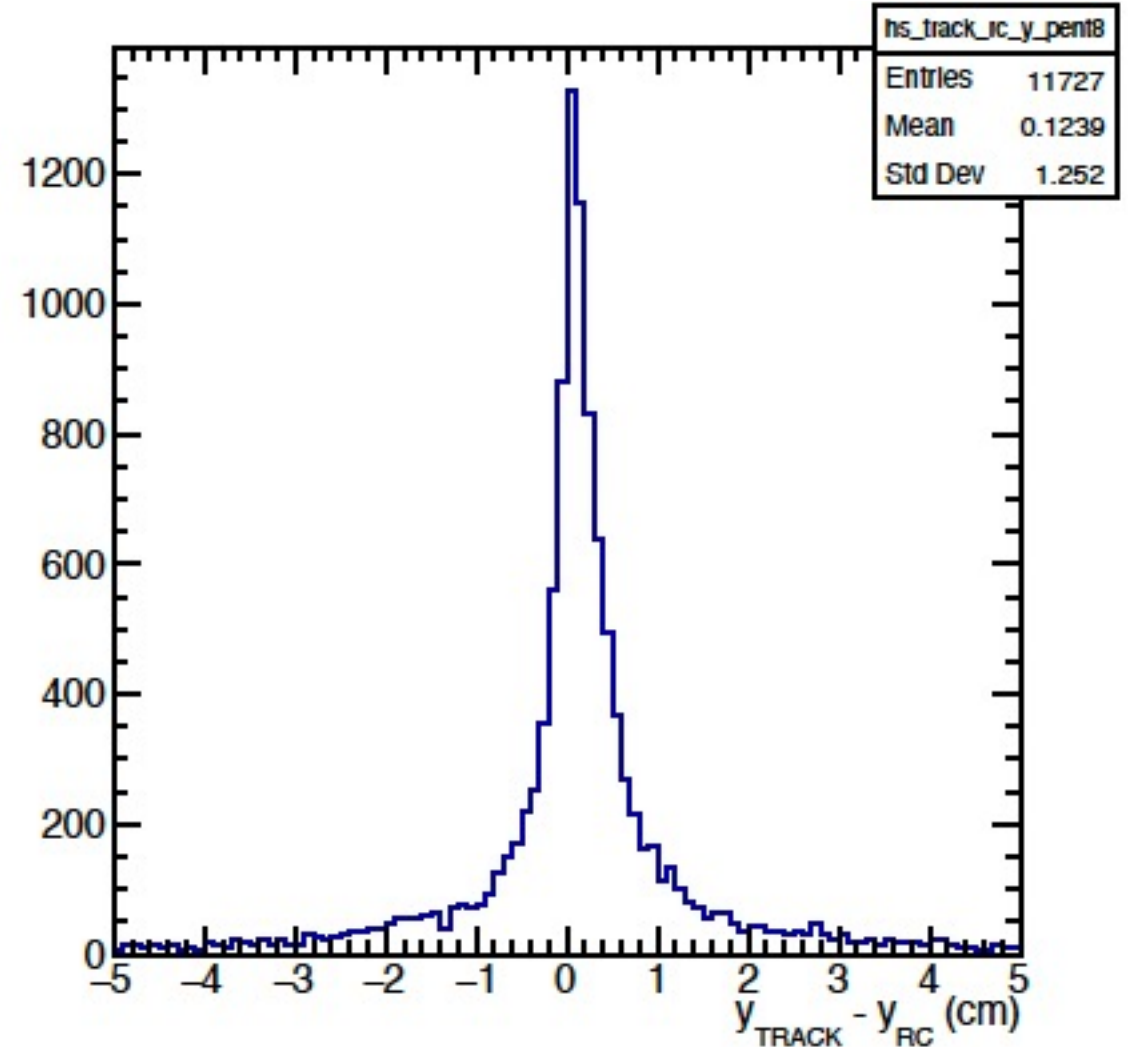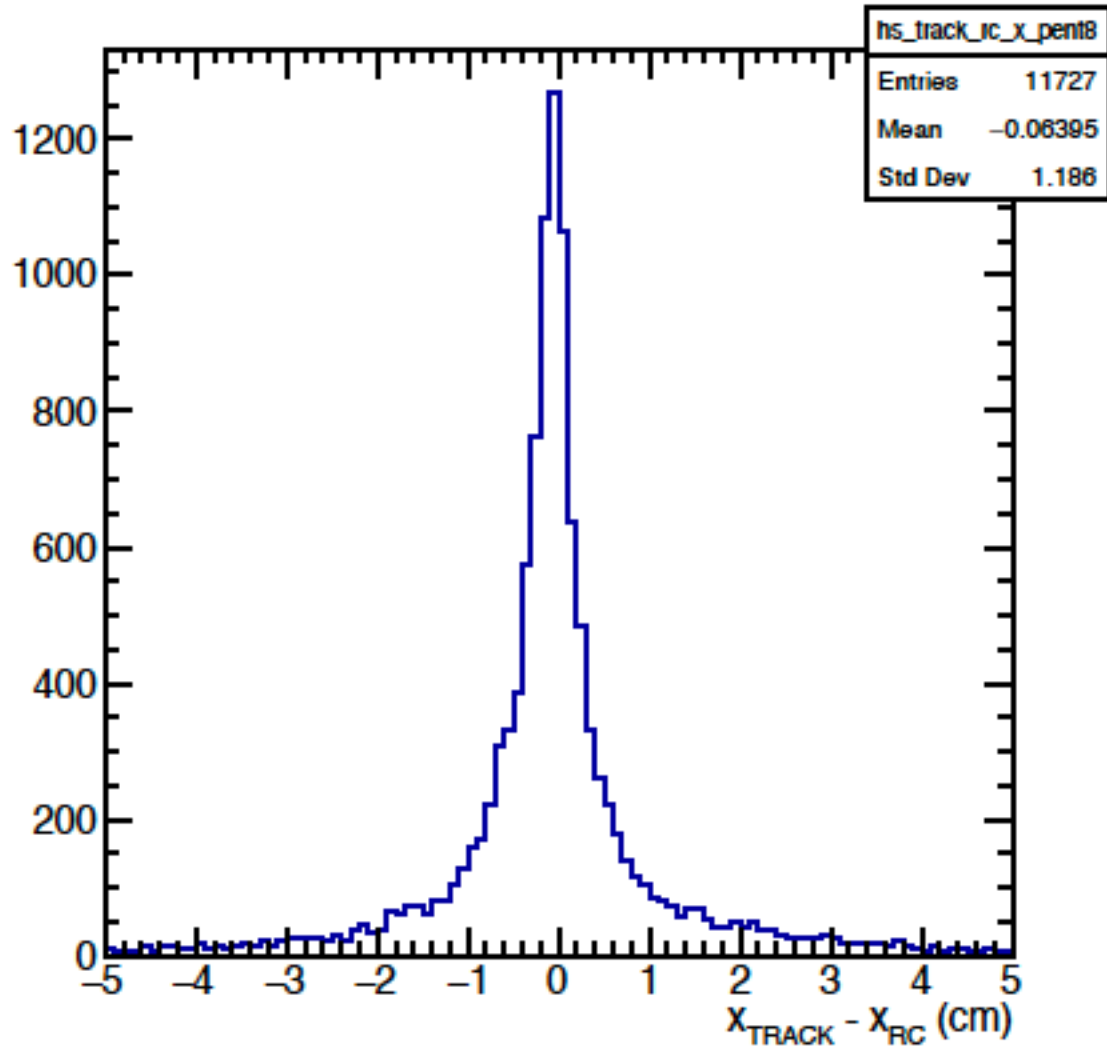
FST Inner Sensor Residuals

- FST First Tracking in Data

FROM DATA

sTGC Pentagon Residuals

FROM DATA

Hierarchical Alignment

- Change in residuals w.r.t. larger structure parameters

$$\frac{\mathrm{d}f_{u/v}}{\mathrm{d}\Delta\mathbf{p}_l} = \frac{\mathrm{d}\Delta\mathbf{p}_s}{\mathrm{d}\Delta\mathbf{p}_l} \cdot \frac{\mathrm{d}f_{u/v}}{\mathrm{d}\Delta\mathbf{p}_s},$$

- Constraints given to solution program for larger structures. For each parameter of larger structure, the effects from all smaller structures should sum to 0.

$$\sum_i^{\mathrm{components}} \left[\frac{\mathrm{d}\Delta\mathbf{p}_{s,i}}{\mathrm{d}\Delta\mathbf{p}_l}\right]^{-1} \cdot \Delta\mathbf{p}_i = \mathbf{0},$$

Hierarchical Alignment

- I have derived Matrices for change in smaller structure parameters w.r.t. larger structure parameters.

- Testing if we can recover shifts in large structures (FST halves)

- Currently testing with ideal simulation.

  - mcSeed momentum and perfect track finding.

- Problem is at the actual alignment stage, there is a rank defect reported in matrix equation.

  - Looking into this issue.

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Warning: the rank defect of the symmetric        372 -by-        372  matrix is        6  (should be zero).
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Outlook

- Pinpoint issue in last stage where alignment is calculated.
- Hopefully, resolve shifts in larger component parameters using ideal conditions soon.
- We should be ready to apply alignment to data once I confirm this is working.
- We will probably need TPC vertex and survey measurement input to properly apply to data.