

Constellation Testbeam

DAQ Integration @ DESY

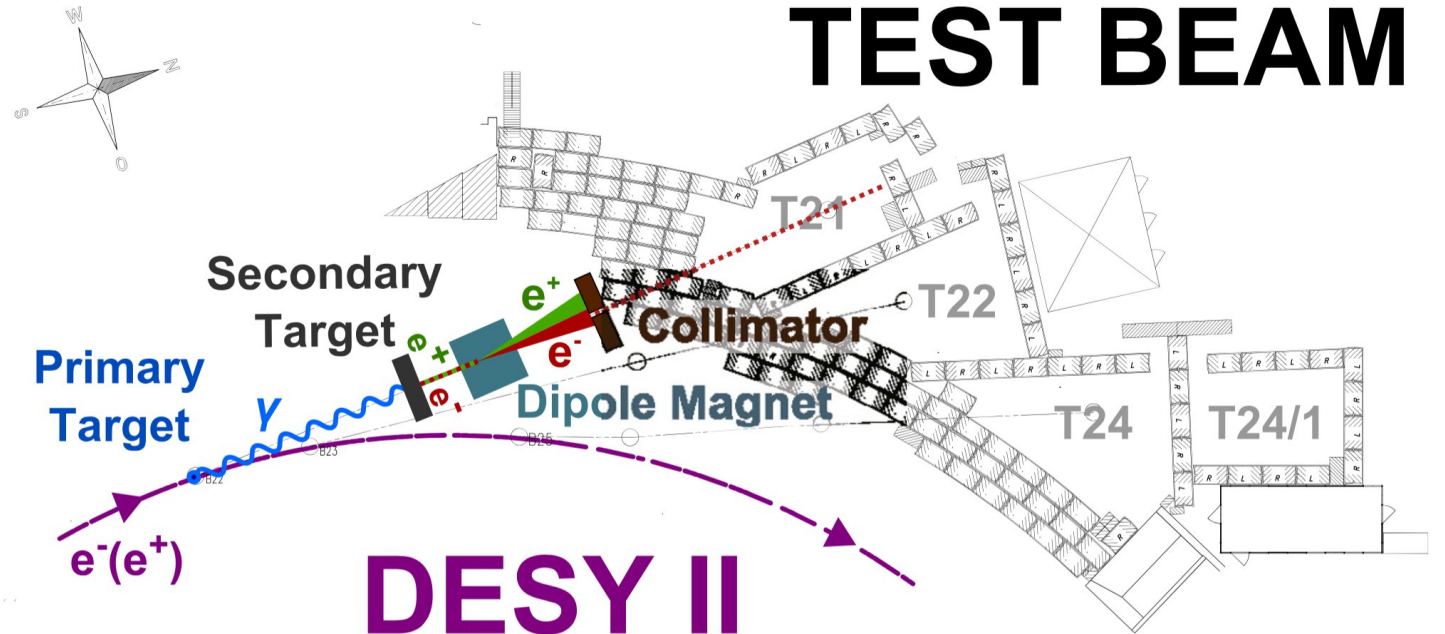
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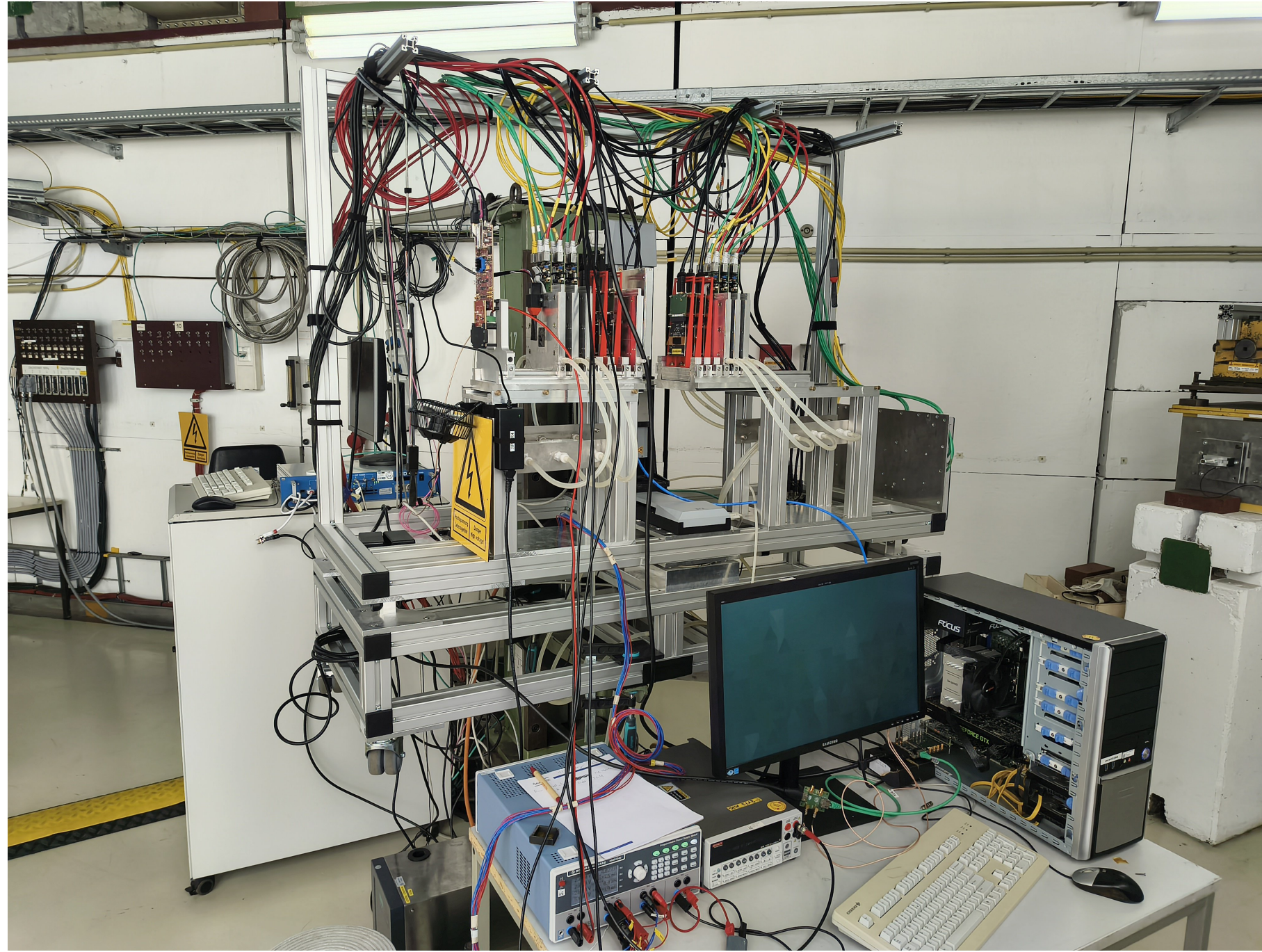
Testbeam @ DESY

- DESY Testbeam provides single electrons to users
- Electron energy up to 6 GeV
- Useful to study e.g. performance of tracking sensors or calorimeters
- Beam telescopes provided by DESY
- Measurements last 1-2 weeks
- Ideal use-case for Constellation



Testbeam Setup

- Mupix11 (HV-MAPS)
- Eudet telescope
- New Alpile telescope
- Timepix4
- Aida2020 TLU
- Keithley 2410 SMU
- HAMEG PSU

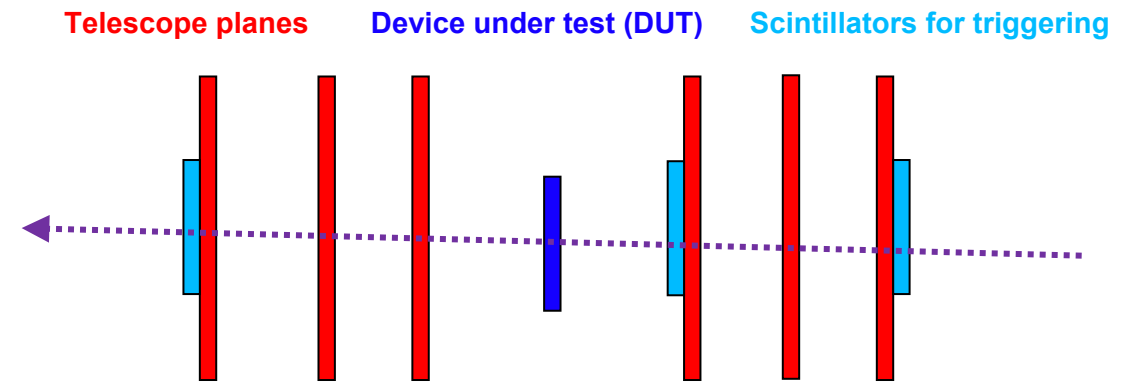


Goals

- Integrate the various DAQ systems into Constellation
- Test real-world usability
- Find bugs in core framework
- Prove we can do tracking with Constellation just like with EUDAQ (“predecessor framework”)

Tracking 101

- Electrons pass through sensors and scintillators
- Trigger Logic Unit (TLU) distributes the trigger to the DAQ systems of the telescope and DUT

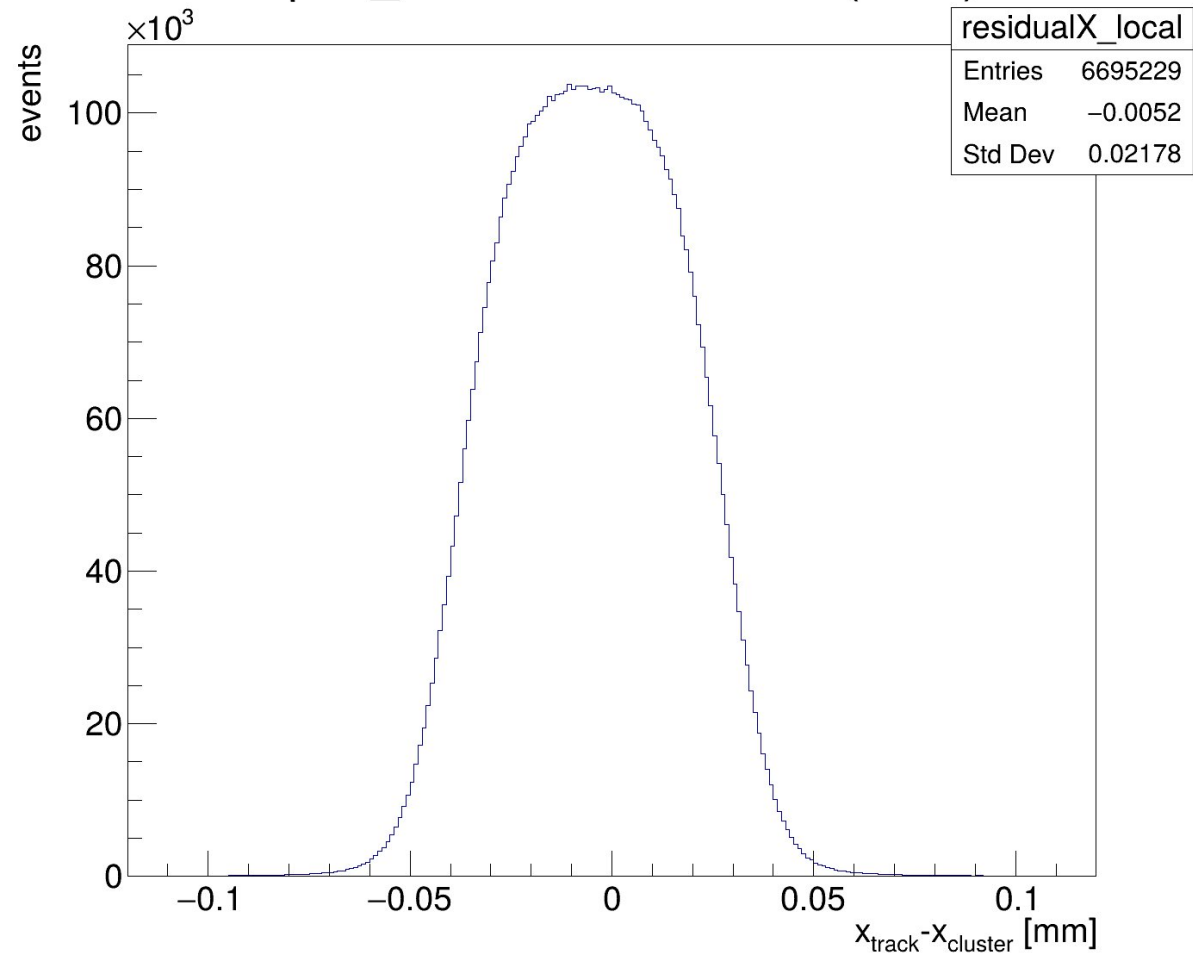


- Algorithm takes hit clusters on a plane and searches for a match in the next one given some spatial and timing constraints
- Track can be reconstructed from hits on telescope planes
- Tracking performance checks: residuals (hit cluster position – track position) and track χ^2
- Analysis performed using Corryvreckan (<https://doi.org/10.1088/1748-0221/16/03/P03008>)

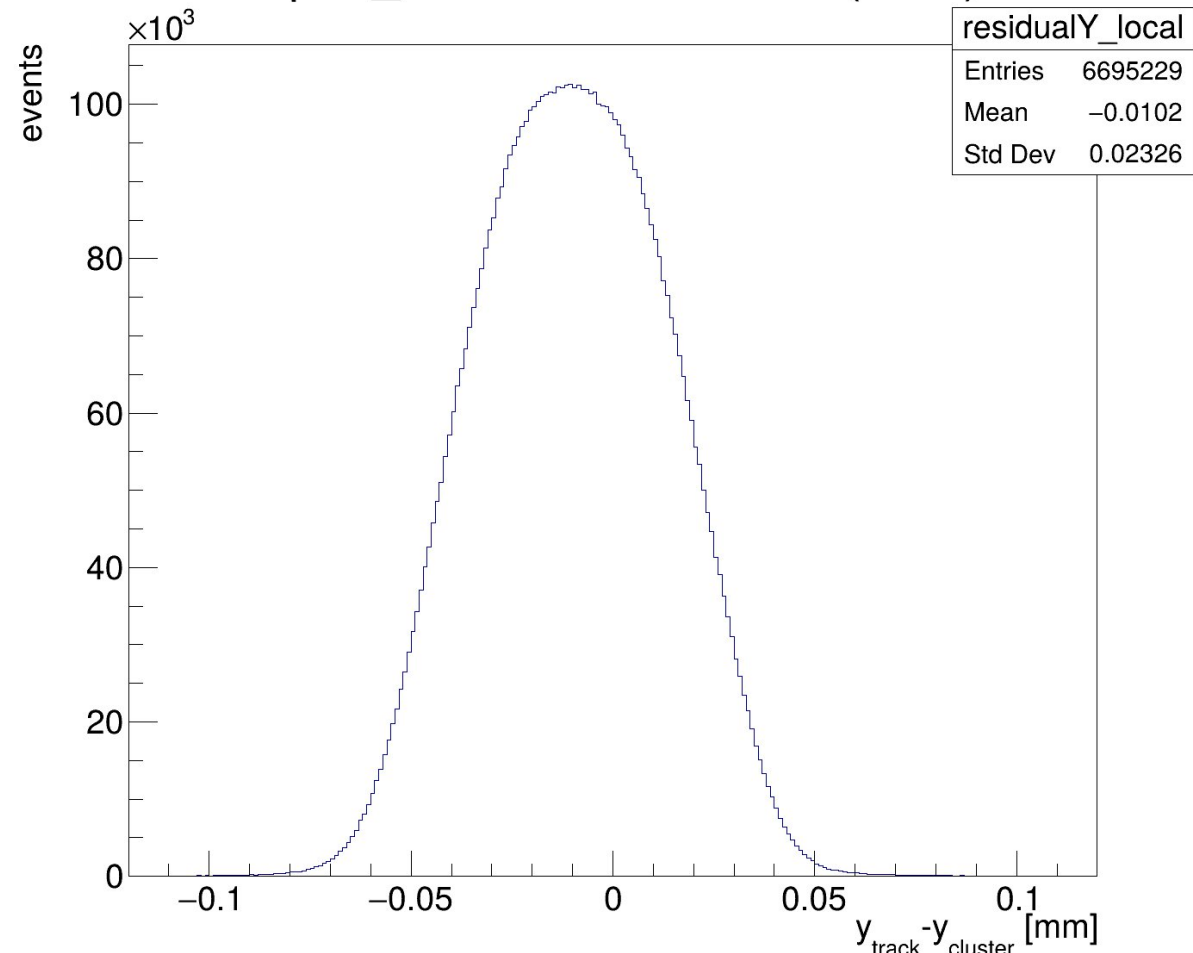
Mupix11 Residuals

80um x 80um

mp10_0 Biased residual X (local)

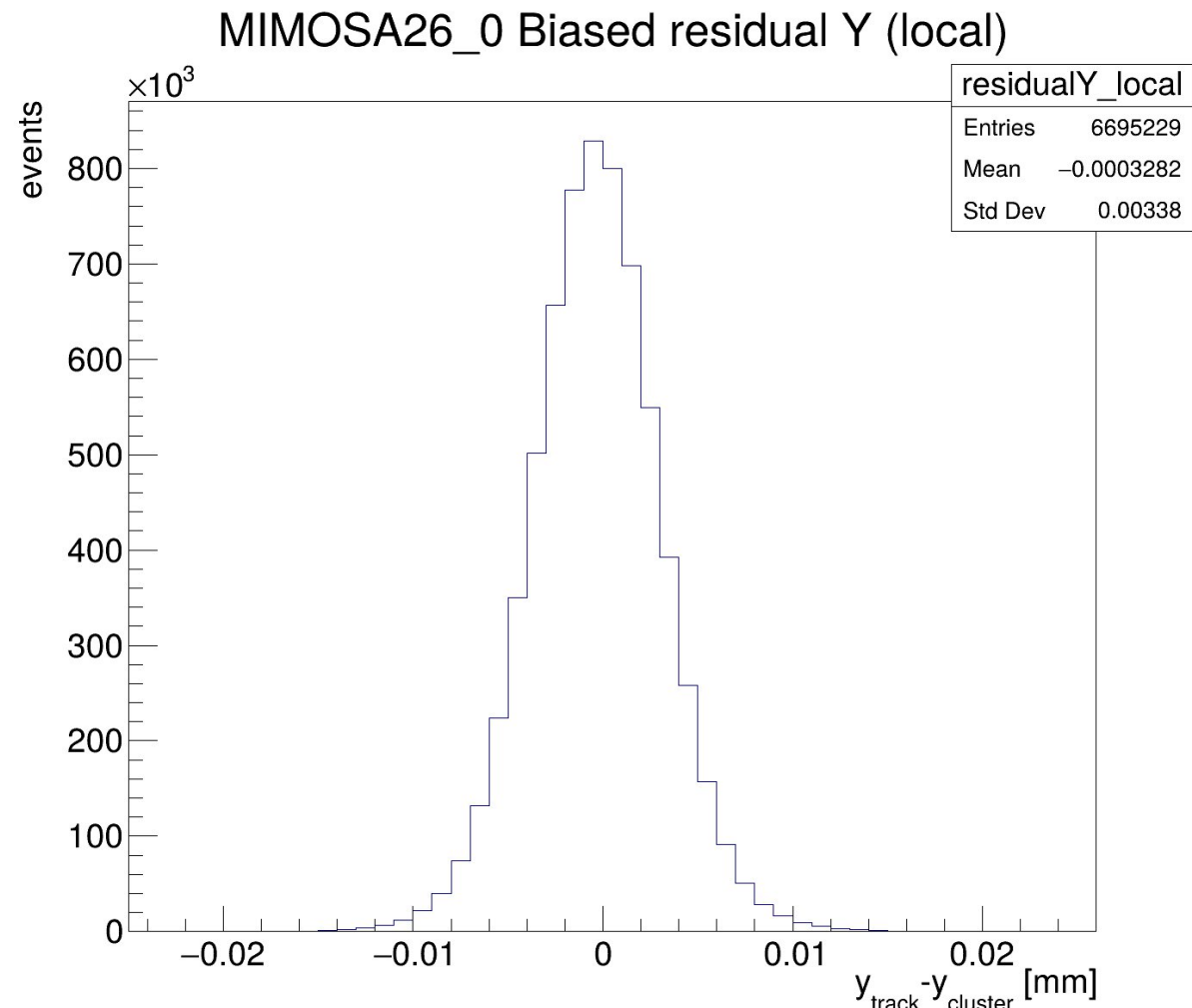
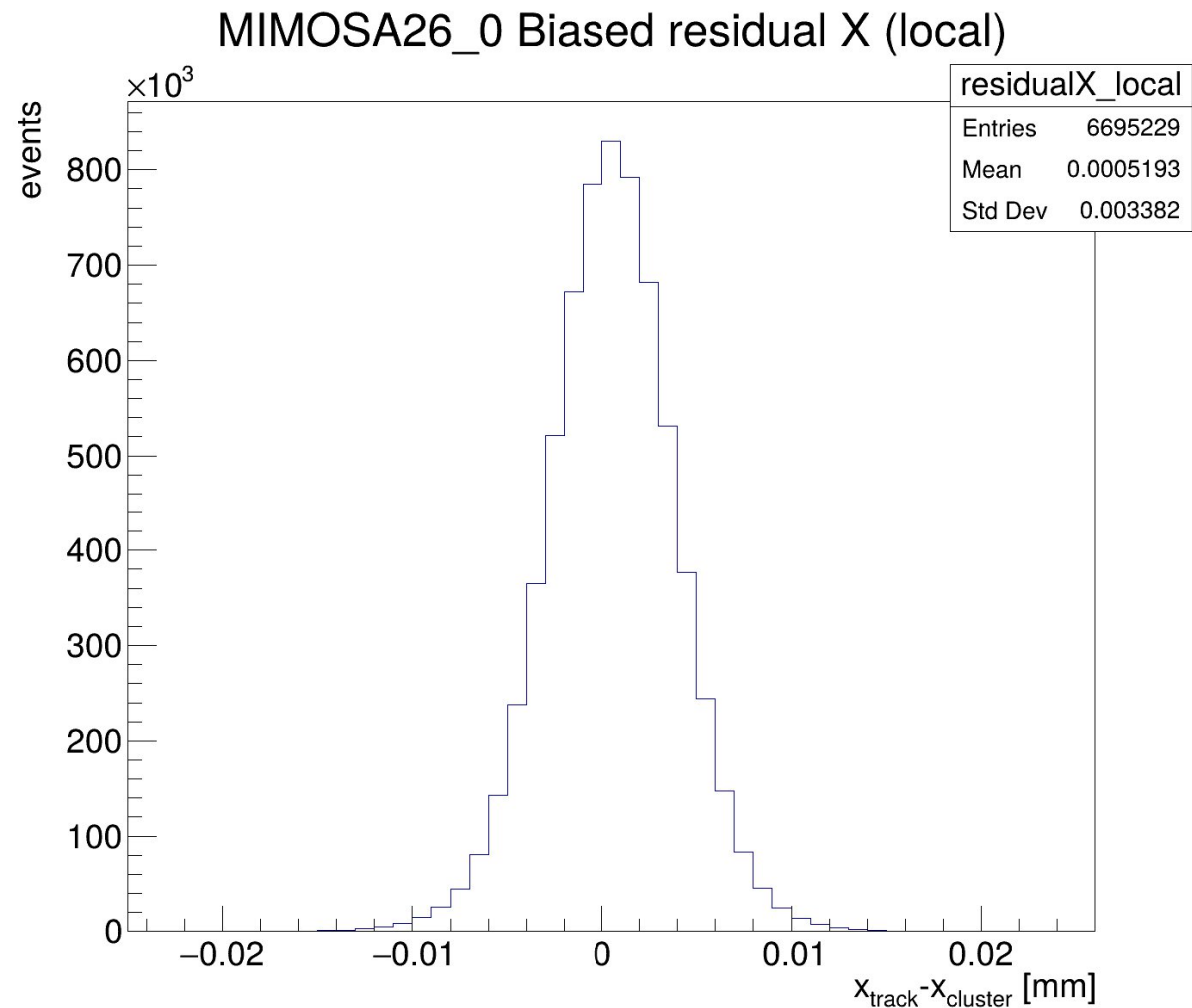


mp10_0 Biased residual Y (local)

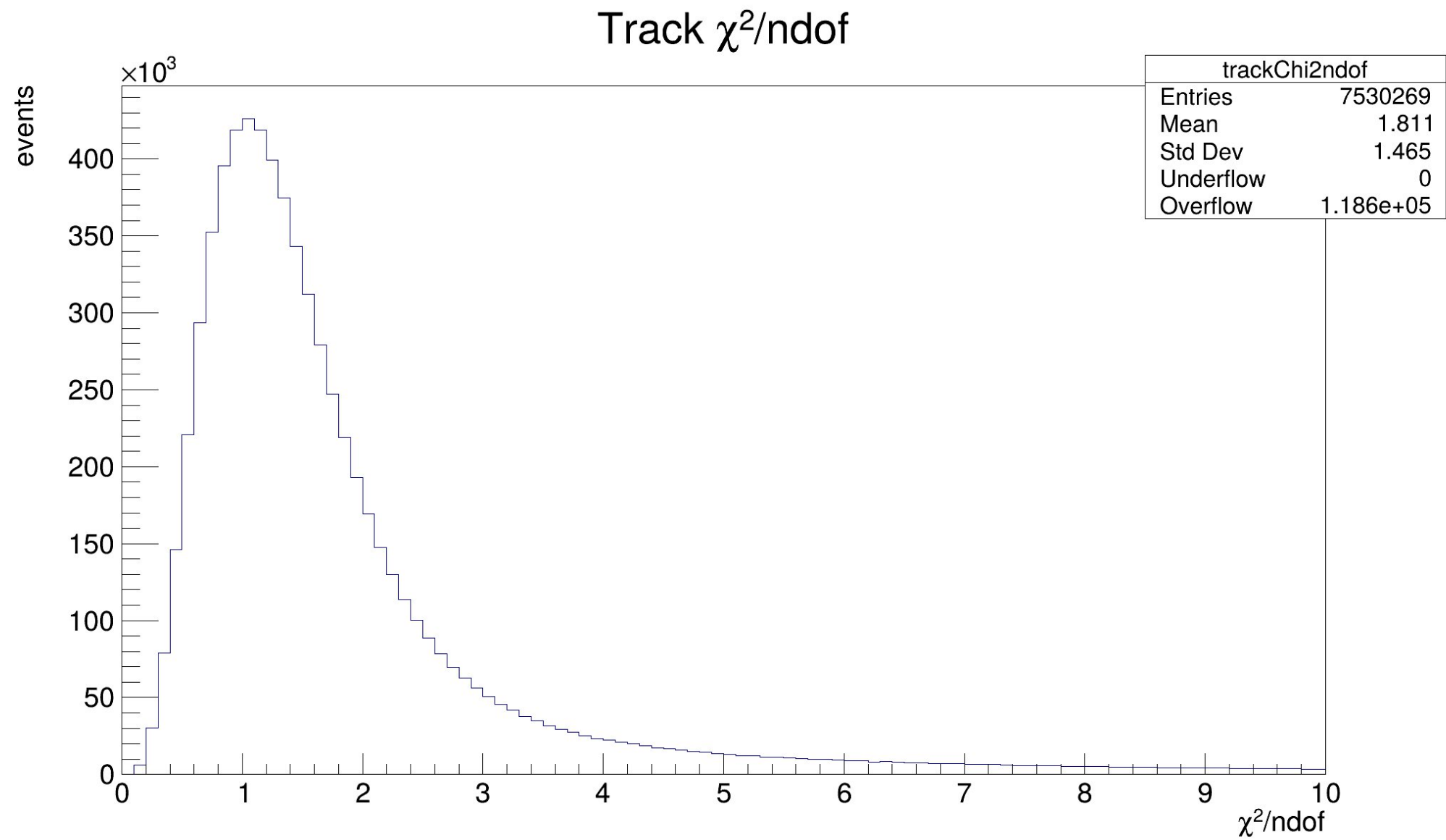


Mimosa26 Residuals (First Plane)

18.4um x 18.4um



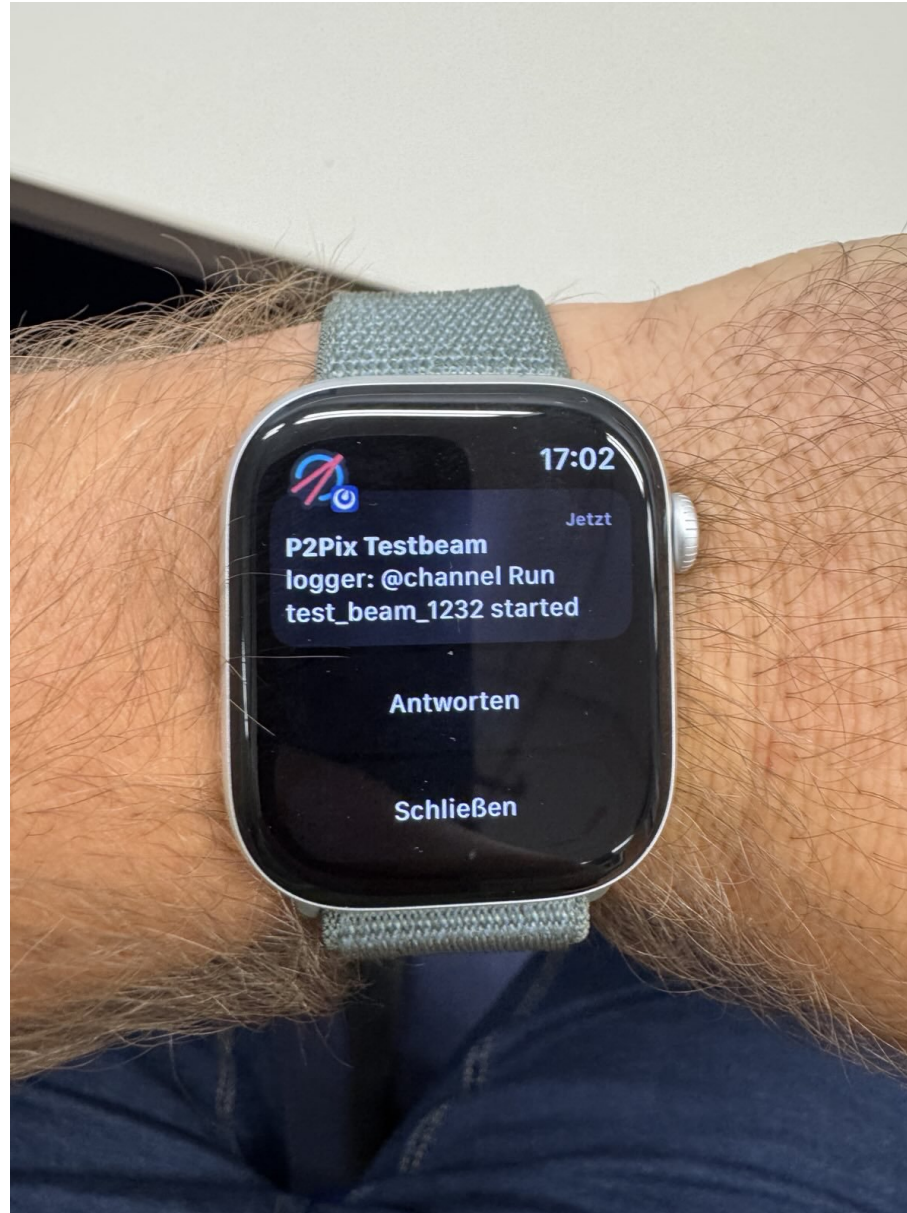
Track Chi2



Grafana Dashboard



Mattermost Notifications



Discovered Bugs

Fixed in patch release 0.5.1 (released today)

- Network interface selection more tedious than necessary (manually requires adding loopback)
- Some Python data sending bugs (BOR dictionary, send timeouts)
- Deadlock during interrupt while in conditional transition
- EudaqNativeWriter segfault when interrupting from ORBIT
- Logging using Mattermost satellite a bit too spammy
- Various interface problems for external satellites like e.g. Madaq
- Observatory not displaying message time in local time
- Python FSM issue related to SAFE state

Another note

- Please star the Constellation repository on GitHub! <https://github.com/constellation-daq/Constellation>
- Required to get Constellation into homebrew for easier installation on MacOS

