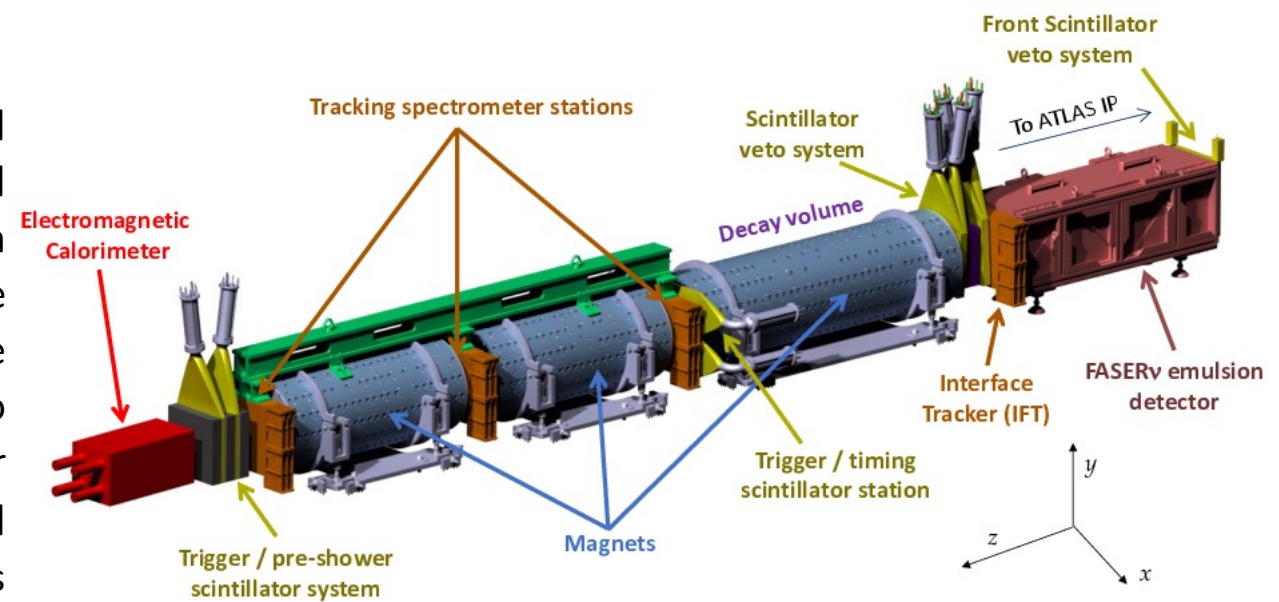


FASER Tracker Performance

VCI2025, 17-21 February

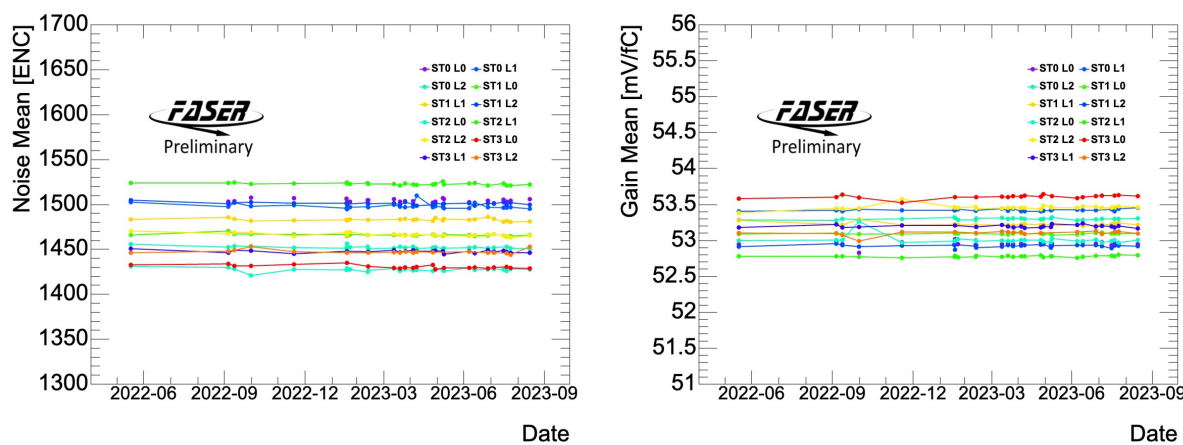
Introduction

FASER is designed to search for new long-lived particles and study neutrinos produced in high-energy collisions. It is located 480 meters from the ATLAS interaction point, along the collision axis, and started data taking in 2022. The tracking system of the FASER detector consists of four identical tracker stations made from silicon microstrip detectors. It's designed to be able to measure the trajectory of charged particles. The detector performance was studied in detail before physics data taking and documented in Ref. [1]. Now after three-year of data taking, it's time to re-assess the performance of the tracker detector.



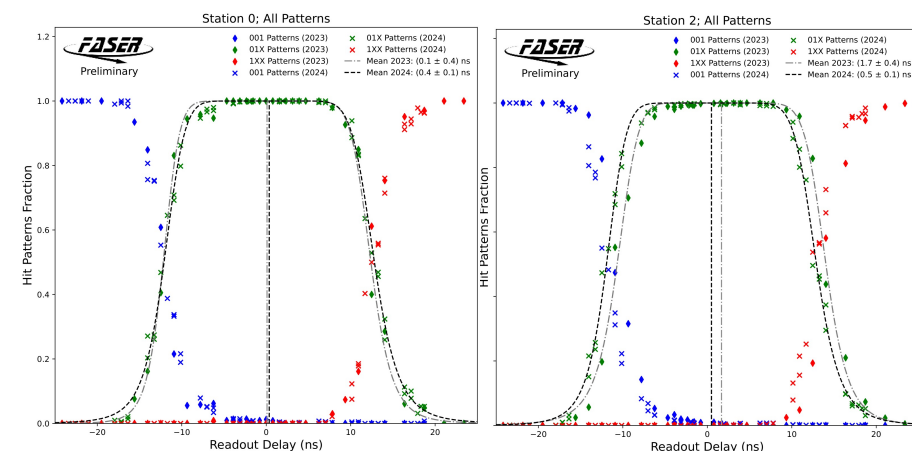
Noise and Gain measurements

Regular calibration runs were performed during LHC beam downtime to measure the gain and noise. Defective strips are removed from the measurements.



Fine Time Scan

Fine time scans performance (time offset adjustment from the nominal physics data taking setting during the scan period) for binary hit patterns in each station was studied. Consistent between 2023 and 2024.

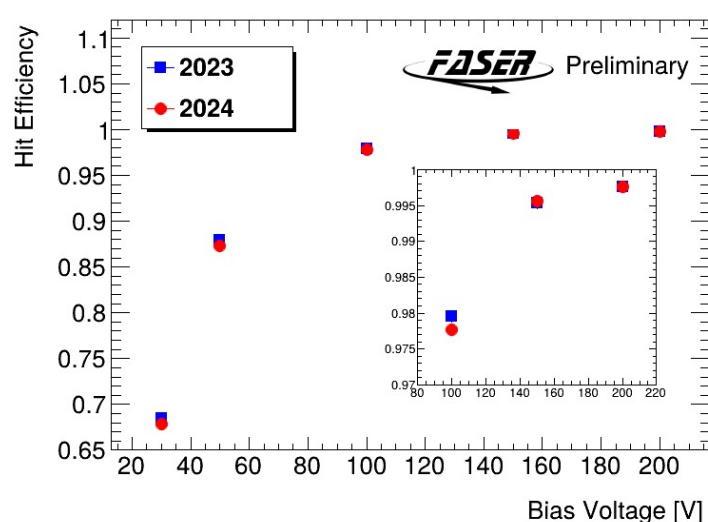
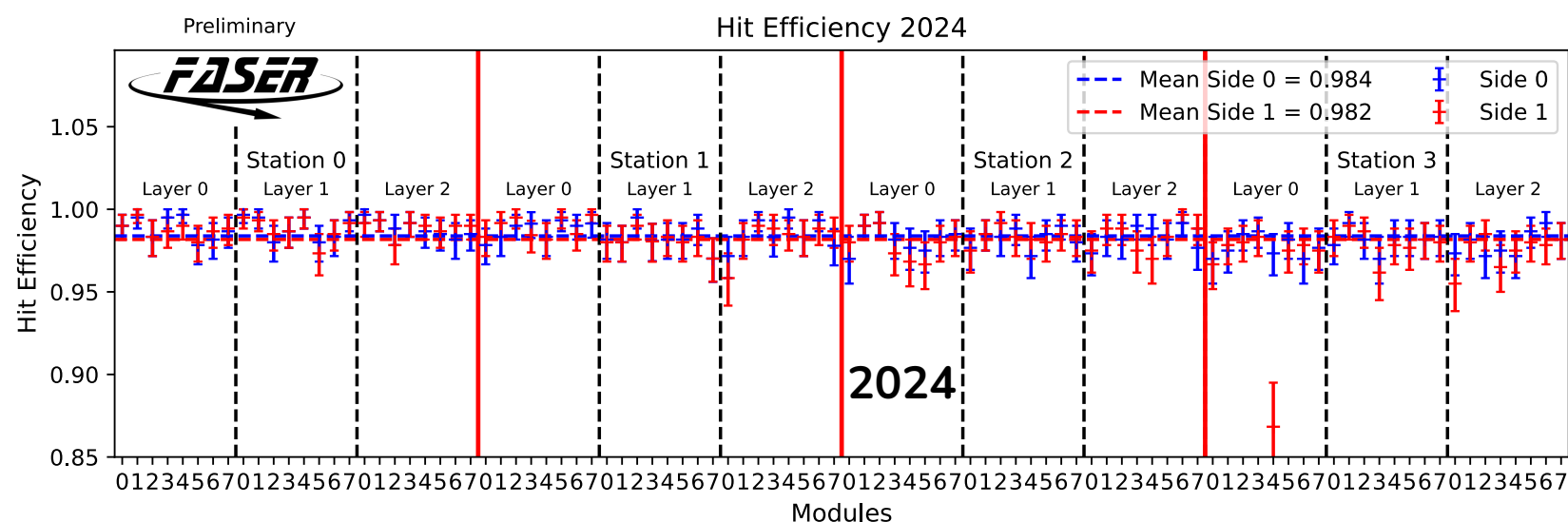


- Hit patterns:
- 1XX: positive delay offset (events processed early)
 - 01X: in-time
 - 001: negative time shift (events processed late)

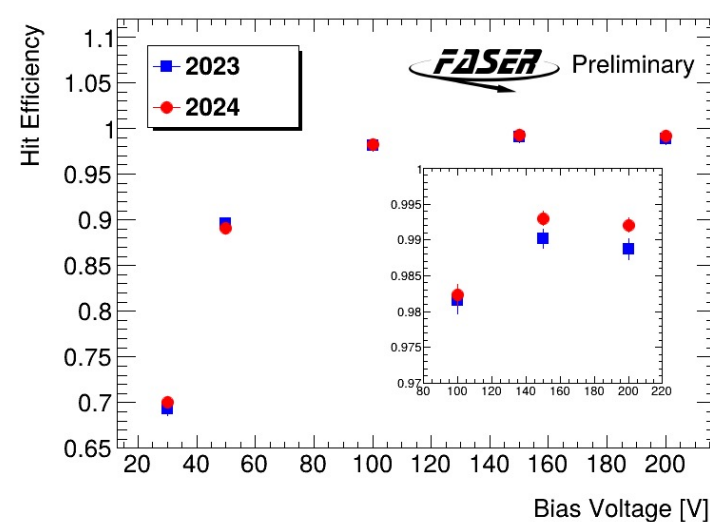
Hit efficiency and HV scans

Hit efficiency is defined as the ratio of good tracks with residual lower than 0.5 mm and all good tracks.

- The good tracks are selected with the cuts on $\chi^2 < 15$, radius < 90 mm, $\tan \theta < 0.12$, momentum > 10 GeV and 5 clusters in each station (one cluster is always masked in the reconstruction).
- The drop in station 3 layer 0 is due to one chip with many defective strips.



Station 0



Station 2

Special runs were performed to determine operation bias voltage, by changing the bias voltage to 30 V, 50 V, 100 V, 150 V and 200 V, individually. The hit efficiency reaches a plateau after increasing bias voltage to 150 V, so it's taken as the nominal setting.

Conclusion

After almost three-year of operation, the FASER tracker detector is performing well within its design specification. The performance is stable and consistent over stations and years.