Interplane alignment of SiT detector in ATLAS Forward Proton detectors

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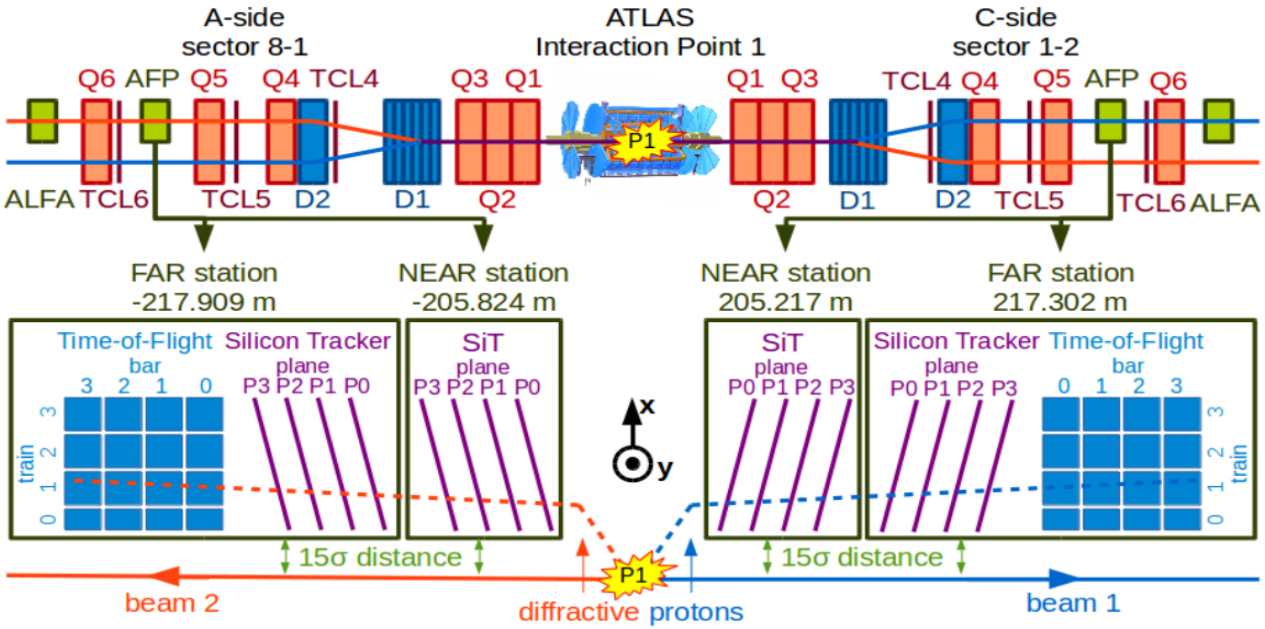
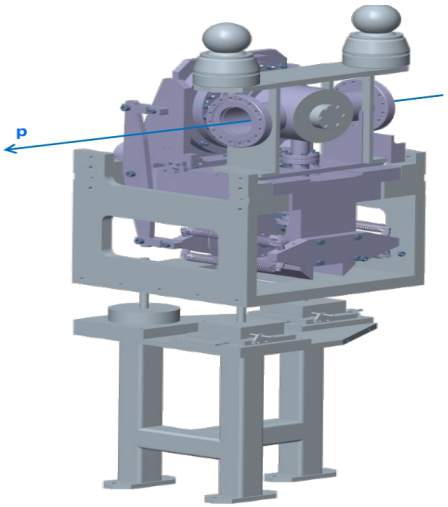
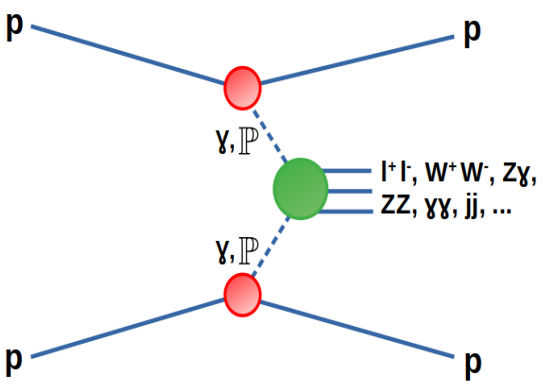
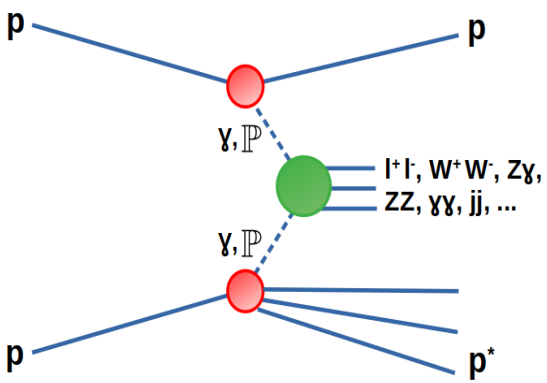
ATLAS Forward Proton Detector

The ATLAS Forward Proton (AFP) detectors open up new possibilities to expand the ATLAS physics reach and probe unique physics processes by measuring intact protons produced in diffractive and photon-induced processes.







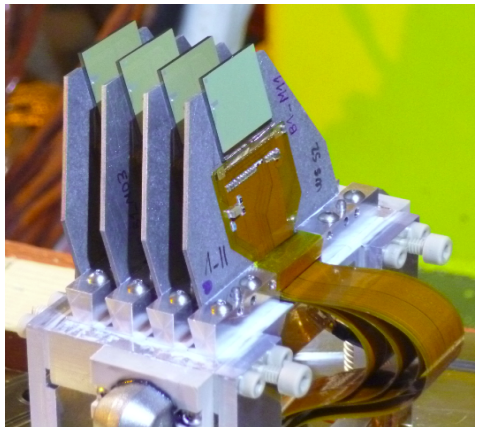


AFP + ATLAS provides:

- enhanced kinematic control of final states
- significant background reduction
- various tests of the QED processes

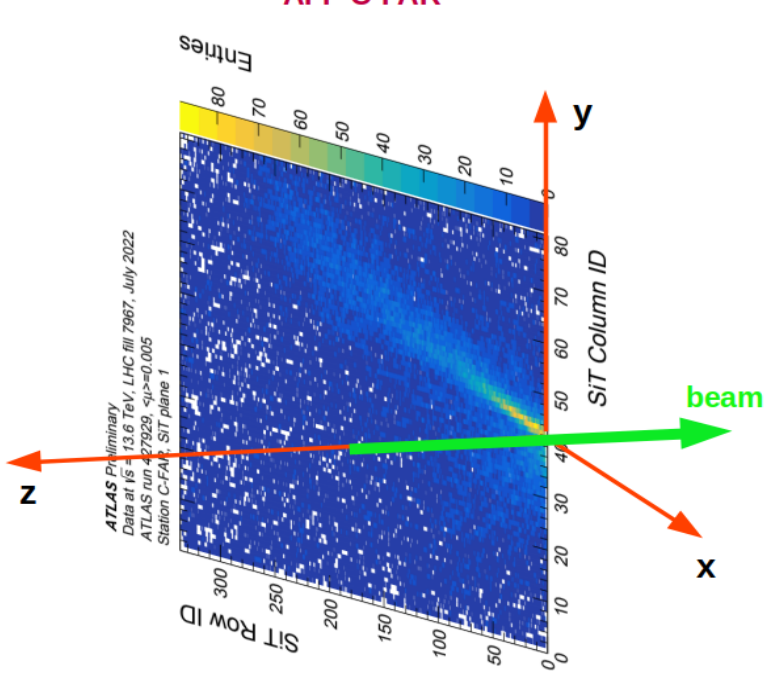
AFP Reconstruction

Silicon Tracker (SiT) planes

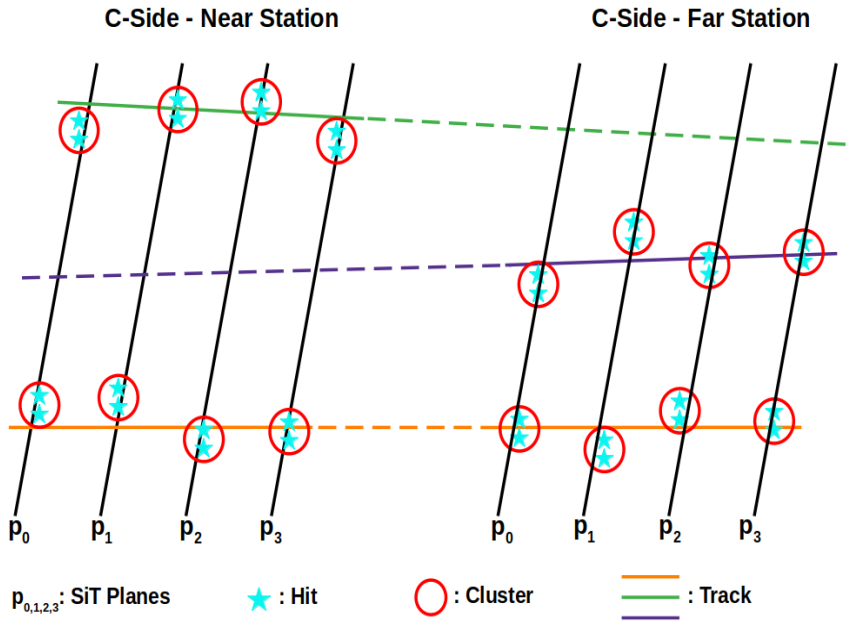


- 3D silicon pixel sensors
- 336×80 pixels (row $\times$ column)
- $50\,\mu m \times 250\,\mu m$ and 230 µm thick
- $\sigma_x = 6\,\mu m$ and $\sigma_y = 30\,\mu m$ at 14° tilt
- FE-I4 readout chips (ATLAS IBL)

Hits recorded in a SiT plane

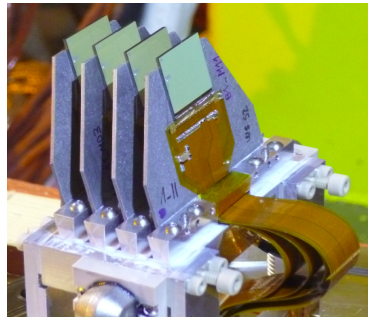


Proton reconstruction

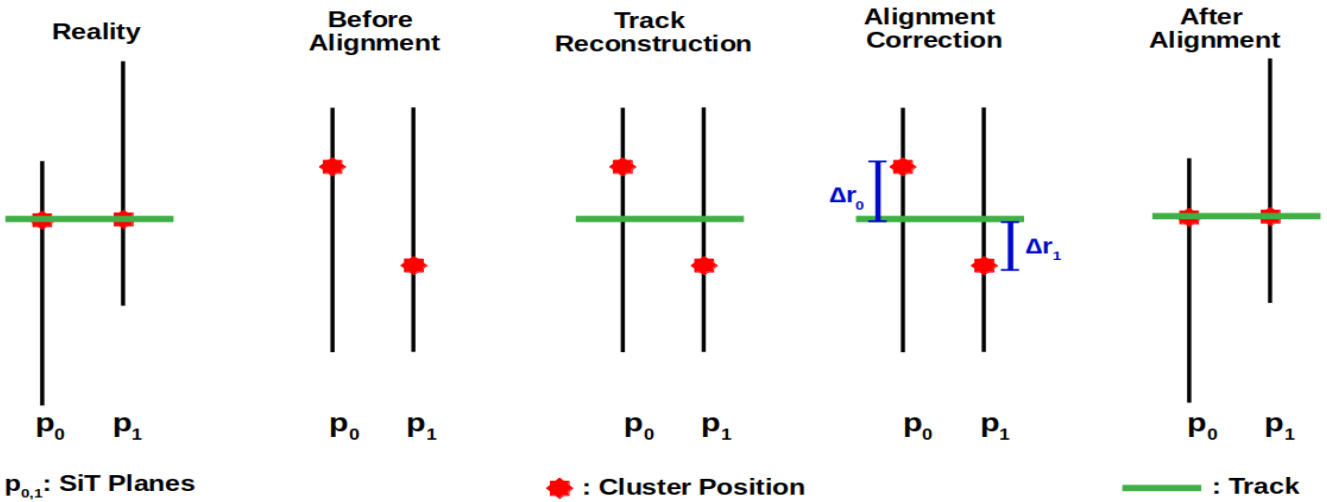


Interplane alignment

The aim of the interplane alignment is a precise understanding of the relative positions of the SiT planes in order to ensure the best accuracy of the measurements. In total, 24 parameters must be determined for the interplane alignment.



- The method applied in this study uses differences between the cluster positions measured in each plane and the position of the track reconstructed from the measurement in all planes.



- Event cleaning and reconstruction
- Obtaning corrections to the alignment parameters where only the shifts in the x and y directions and the rotations around the z-axis are considered.
- Iteratively, a correction is applied to the alignment parameters until convergence is reached.

Thank You