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Advances in the ATLAS Forward Proton Detector and Global Alignment Studies

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This presentation offers a comprehensive overview of the ATLAS Forward Proton (AFP) detector within the ATLAS experiment at CERN. Positioned some millimeters from the proton-proton collision point at the LHC, the AFP detector comprises silicon-based trackers and a time-of-flight system strategically placed 210 meters away from the ATLAS interaction point. The silicon tracker facilitates precise momentum measurements, while the time-of-flight system effectively mitigates background interference from multiple proton-proton collisions. The AFP physics program focuses on probing soft and hard diffractive events at low luminosities ($\mu \approx 1$). Furthermore, we present systematic uncertainty results for global alignment using data from 2017 (Run 2), comparing it with the latest data from 2022 (Run 3). Global alignment, defined as the distance between the AFP edge and the beamline, serves as a crucial metric for ensuring the precision and reliability of the detector's performance.

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