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A novel method for ATLAS FSI alignment based on rapid, direct phase monitoring

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Frequency Scanning Interferometry is a precise, multiple distance measurement technique, originally developed for ATLAS, which is suited to a variety of applications in the survey and alignment of future accelerators and particle detectors. The ATLAS inner detector is instrumented with an automated FSI alignment system, capable of simultaneously measuring hundreds of interferometers within the operational particle tracker. The alignment system began data taking in 2008 and we present the latest results from the on-detector system during LHC running. A new method has been developed based on rapid, direct monitoring of the interferometer phase, which allows the measurement of short term motions with improved precision, at a fraction of the wavelength of light (typically sensitive to < 50nm). We outline the theory behind this novel technique and demonstrate precise measurements from ATLAS, which reveal interesting micron-level movements of the inner detector, correlated with thermal cycles and magnetic field changes of the detector environment.

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