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On-the-fly measurement calibration with ACTS

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Kalman Filter (KF)-based tracking algorithms are used by many collider experiments to reconstruct charged-particle trajectories with great performance. The input to such algorithms are usually point estimates of a particle's crossing on a detector's sensitive elements, known as measurements. For instance, in a pixel detector, connected component analysis is typically used to yield two-dimensional pixel clusters on which shape analysis is performed to obtain a position estimate. Such estimates can usually be made more precise if some information about the the fitted track's direction is available. Kalman Filter-based pipelines can thus readily benefit from on-the-fly measurement calibration, since the KF always makes a prediction of the current track state, which includes track angles, before incorporating each measurement. Measurement calibration can also be used to correct for detector effects such as wire sagging or module deformation, and may also be used to improve convergence when performing track finding and fitting with misaligned detector geometries. All of these calibrations are well suited to machine learning applications.

ACTS is an experiment-independent toolkit for charge particle tracking which includes implementations of Kalman Filter track finding and fitting algorithms. This contribution will focus on the measurement calibration infrastructure implemented in ACTS and will present results from actual applications of realistic measurement calibration methods, from simple scale-and-offset schemes to sophisticated neural network-based techniques.

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