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Comparison of various techniques for correcting the non-linearities of BPMs

The current LHC orbit system relies on accurate beam position measurement. The beam position is extracted from Beam Position Monitor (BPM) pickups and corrected by a 5th order correction polynomial with a set of pre-calculated coefficients. In this study, a family of 4-button BPMs with various beampipe diameters and buttons is simulated in CST Particle Studio and mapped with beam positions in both planes. The measured beam positions are then corrected with several different position correction methods. The accuracy and performance of a correction polynomial obtained with classic 2D and 3D linear regression fits, is compared to polynomials obtained with probabilistic (genetic algorithm) and deterministic (gradient-based Newton minimization) optimization methods.

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