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Implementation of a Riemann Helical Fit for GlueX track reconstruction

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The future GlueX detector in Hall D at Jefferson Lab is a large acceptance (almost 4pi) spectrometer designed to facilitate the study of the excitation of the gluonic field binding quark–anti-quark pairs into mesons.
A large solenoidal magnet will provide a 2.2-Tesla field that will be used to momentum-analyze the charged particles emerging from a liquid hydrogen target. The trajectories of forward-going particles will be measured with a set of four planar cathode strip drift chamber packages with six layers per package.
The design naturally separates the track into segments where the magnetic field is relatively constant, thereby opening up the possibility of performing local helical fits to the data within individual packages. We have implemented the Riemann Helical Fit algorithm to fit the track segments.
The Riemann Helical Fit is a fast and elegant algorithm combining a circle fit for determining the transverse momentum and a line fit for determining the dip angle and initial z value that does not require computation of any derivative matrices.
The track segments are then linked together by swimming through the field from one package to the next to form track candidates. A comparison between the Riemann Circle Fit and a simple linear regression method that assumes that the origin is on the circle will be presented. A comparison between the Riemann Helical Fit and a full least-squares fit with a non-uniform magnetic field will also be presented.

Primary author: TAYLOR, Simon (Jefferson Lab)

Presenter: TAYLOR, Simon (Jefferson Lab)

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