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Representing Misalignments of the STAR Geometry Model using AgML

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The STAR Heavy Flavor Tracker (HFT) was designed to provide high-precision tracking for the identification of charmed hadron decays in heavy ion collisions at RHIC. It consists of three independently mounted subsystems, providing four precision measurements along the track trajectory, with the goal of pointing decay daughters back to vertices displaced by <100 microns from the primary event vertex. The ultimate efficiency and resolution of the physics analysis will be driven by the quality of the simulation and reconstruction of events in heavy ion collisions. In particular, it is important that the geometry model properly accounts for the relative misalignments of the HFT subsystems, along with the alignment of the HFT relative to STAR's primary tracking detector, the Time Projection Chamber (TPC).

The Abstract Geometry Modeling Language (AgML) provides the single description of the STAR geometry, generating both our simulation (GEANT 3) and reconstruction geometries (ROOT). AgML implements an ideal detector model. Misalignments are stored separately in database tables, and have historically been applied at the hit level – detector hits, whether simulated or real, are moved from their ideal position described in AgML to their misaligned position according to the database. This scheme has worked well as hit errors have been negligible compared with the size of sensitive volumes. The precision and complexity of the HFT detector require us to apply misalignments to the detector volumes themselves. In this paper we summarize the extension of the AgML language and support libraries to enable the static misalignment of our reconstruction and simulation geometries, discussing the design goals, limitations and path to full misalignment support in ROOT/VMC based simulation.

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