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Geant4 Parameter Tuning Using Professor

The Geant4 toolkit is used extensively in high energy physics to simulate the passage of particles through matter and to estimate effects such as detector responses, efficiencies and smearing. Geant4 uses many underlying models to predict particle interaction kinematics, and uncertainty in these models leads to uncertainty in the interpretation of experiment measurements. The Geant4 collaboration recently made some parameters in physics models accessible for uncertainty studies. We present a study of the impact of varying parameters in three Geant4 hadronic physics models on agreement with thin target data sets and describe fits to these data sets using the Professor model tuning framework. We find that varying parameters produces substantially better agreement with some data sets, but that more degrees of freedom are required for full agreement. This work is a first step towards a common framework for propagating uncertainties on Geant4 models to high energy physics measurements, and we outline future work required to complete that goal.

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