

Simulations and Analysis Software for the STAR TPC

P.M. Jacobs, M.A. Lisa, I.M. Sakrejda, N.T.B. Stone and the STAR Collaboration

A set of programs to simulate and analyze data from the STAR Time Projection Chamber has been developed. This package includes the detector simulations, reconstruction of the particle tracks in the detector, and the particle identification software. The simulations and reconstruction modules are accompanied by the calibrations and geometry packages.

The first step in the simulation chain is to track particles produced in a 100GeV/nucleon Au+Au collision through the STAR detector. This task is performed by GSTAR [1], a module based on the CERN simulations package GEANT. It accounts for the hadronic interactions of the particles produced during the collision with the detector material, multiple scattering, decays in flight, and many other effects. The next step is designed to study impact of the detector performance on the ionization deposited in the volume of the TPC by charged products of the collision. Two packages were provided to perform this task. First, the TPC Slow Simulator (tss) [2] includes effects of the charge drifting in the electric and magnetic field and the signal processing by the Front-End Electronics (FEE). The Slow Simulator writes output in the raw data format. This simulated data then serves as an input to the cluster finder and hit reconstruction software [3]. The other option is to forgo detailed simulations of the detector and use a parametrization of the reconstructed position resolution and the hit finding efficiency to directly create reconstructed hits. The second option is implemented in the form of the TPC Fast Simulator, (tfs) [4]. After the hits are reconstructed or simulated, the next step in data analysis is the track reconstruction. This task is performed by the TPC tracking module - tpt [5]. High tracking efficiency (>95%) and good momentum resolution provide input for the particle identification based on the dE/dx analysis.

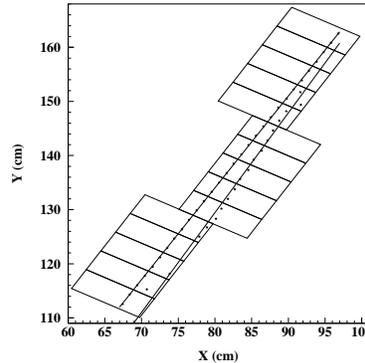


Figure 1: Reconstructed laser tracks in a test module. The rectangles outline parts of the detector that have been instrumented so far.

Recently parts of the TPC software chain were tested (Fig. 1) during the STAR TPC System Test. Data taken in the fall of 1996 agreed with the simulated detector parameters. The simulation and reconstruction software chain is used to develop physics analysis software so that, when the experiment starts taking data in the year 1999, a prompt and reliable analysis will be possible.

References

- [1] P.M. Jacobs GSTAR: A GEANT-based Detector Simulation Chain for STAR, STAR Note SN0235.
- [2] Wen Gong; The STAR-TPC Slow Simulator, Star Note SN0197
- [3] M.A. Lisa; The STAR TPC Cluster finder Hit finder, Star Note SN0238.
- [4] P.G. Jones; The STAR Fast TPC Simulation (A User's Guide), STAR Note SN0056
- [5] I.M. Sakrejda; Tracking for the STAR TPC, STAR Note SN0190