Vertex reconstruction

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STAR Collaboration

Introduction

- STAR needs several approaches
  - Heavy Ion / High luminocity p-p
    - Small pile-up vs Huge pile-up
  - High / Low multiplicity
    - Au+Au vs ‘no-touching’

Heavy Ion Program

- Vertex finder is based on a ‘seed’ finder plus an analytical LSM method combined with iterative outlier removal in each step (3 steps)

- No simultaneous vertex/track fit
  - Quick/Simple but w/out sacrificing accuracy

Seed finder

- Tracks are propagated to the beam-line
- A density array is build in z steps (0.5cm)
- The maximum is determined
- The vertex ‘seed’ is put at (0, 0, z_max)

LSM/outlier removal

- Tracks are moved to dca (perigee or 3D) from seed or iteration vertex. This can be recalculated in every step
- (Some) MCS is taken into account
- Track model is linearized for short distances
- A dca cut removes outliers from the fit
  - Weighted dca removal of single tracks in peripheral
- A vertex and full error matrix is calculated based on a global minimization of track's dca
- Repeat three times

- Primary tracks selection is based on a (relaxed) dca criterion (3cm)
- FTPC and/or SVT can determine and store a vertex which is determined by them
- Finder is ran on TPC only tracks to define a vertex for FTPC use
- Track refit is performed in an independent fitting step

Performance

- For central Au+Au and TPC only vertex resolutions in x,y,z are about 200 microns
- For TPC+SVT drop to 50 microns
- Relatively stable operation (lately!)

Plans

- Merge low/high multiplicity finders
- Upgrade outlier removal method
  - Take errors into account
- Replace propagation routines with universal routines in a certain framework (Geane, Kalman …)
- For fun only, we might use the ‘full’ fitting at some point