UNIVERSITY OF BIRMINGHAM | SCHOOL OF PHYSICS AND ASTRONOMY

University of Birmingham new simulation framework update

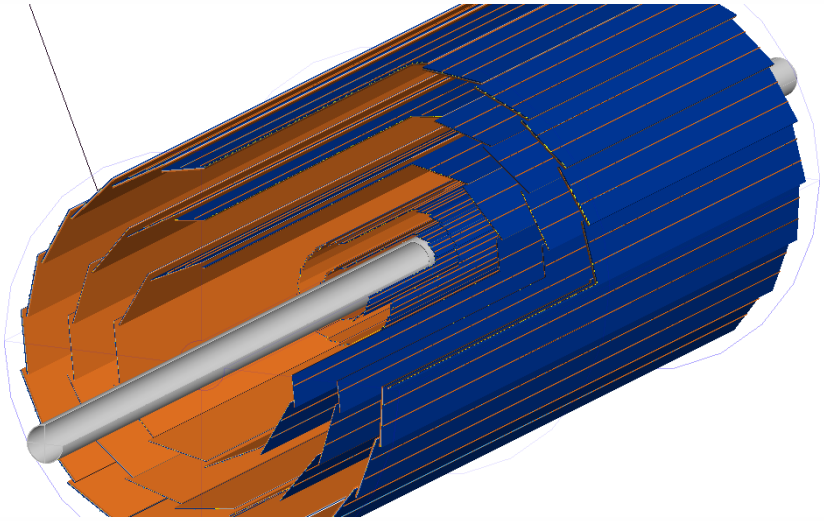
P.P. Allport, L. Gonella, P. Ilten, P.G. Jones, P.R. Newman, H. Wennlöf

7th of May 2020

h.wennlof@cern.ch

ESCalate framework (G4E+eJANA)

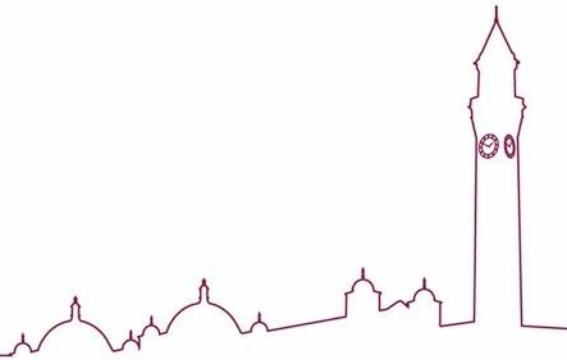
- Current working status:
  - G4E+eJANA (ESCalate) set up locally.
  - Can change geometry and active detector parts in G4E.
    - SVT implemented analogously to previous EICROOT studies (http://cern.ch/go/xKk6).
  - Stave construction set up based on EICROOT staves in a parameterised way, where it is easy to vary material thicknesses. Material scans made to create three stave types; inner (0.3% X_0), outer (0.8% X_0), and time-stamping (1.6% X_0). Staves made to level of ”simple structure”.



- Staves consist of
  - Kapton
  - Aluminium
  - Silicon (active volume)
  - Carbon fiber
  - Water cooling pipes

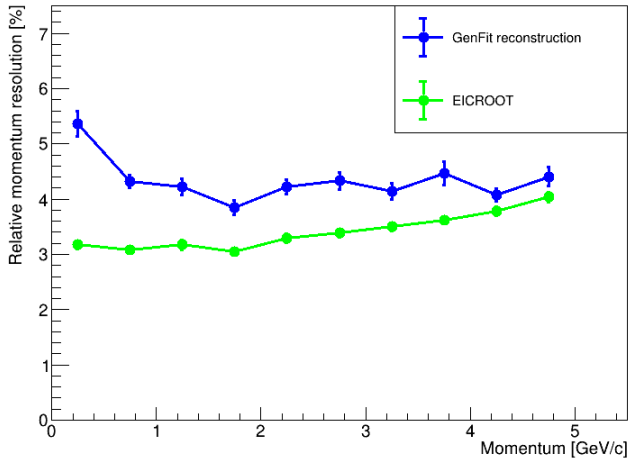
ESCalate framework (G4E+eJANA)

- Current working status:
  - Particle gun constructed, generating same distributions as used in previous EICROOT simulations.
  - Can write analysis code using eJANA plugin system.
    - Plugin written to create ROOT tree with the same structure as was done in EICROOT, so same final analysis tools can be used (making comparison straightforward).
  - Have set up Pythia generator. Can generate events, and propagate them through G4E geometry. Hit positions can be extracted.
- Vertex reconstruction currently **not** working
  - ACTS implementation underway, will reconstruct both tracks and vertices. ESCalate developers working with ACTS developers to get it functioning

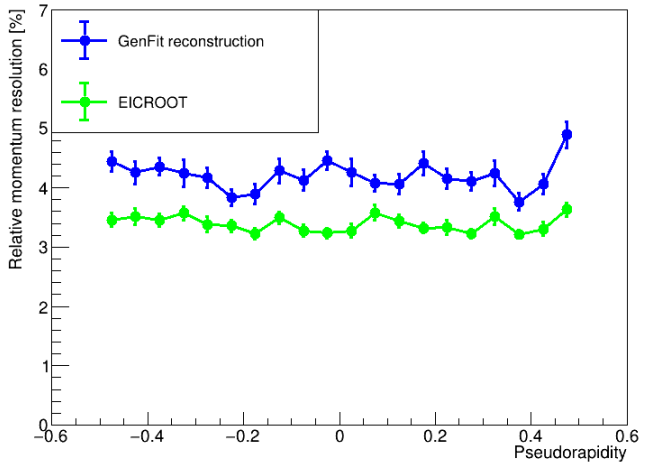


Preliminary results – GenFit momentum reconstruction vs EICROOT

- Parameters used:
  - Particle: π+
  - Transverse momentum range: 0 to 5 GeV/c
  - Pseudorapidity range: -0.5 ≤ η ≤ 0.5
  - Default pixel size: 20x20 μm^2
  - Magnetic field: uniform 1.5 T
- Relative momentum resolution can be extracted (at innermost layer)
  - G4E/GenFit values correct order of magnitude.
  - No TPC/extra silicon layers present, which degrades the resolution compared to previously presented studies.



Relative momentum resolution vs momentum



Relative momentum resolution vs η

Planned work - ESCalate

- Benchmarking against EICROOT results once vertex reconstruction is in place.
  - Analysis chain set up
  - Once reconstruction works, everything is ready to get results for Pavia workshop
- Physics simulations, once basic simulations yield reliable and consistent results.

Planned work - EICROOT

- Simulate best layouts with
  - New beampipe configuration (i.e. 31 mm radius)
  - 1.5 T and 3 T magnetic field comparison in barrel region
  - More realistic TPC, as simulated by eRD6
    - If approximate EIC parameters are decided on, please let me know; h.wennlof@cern.ch
- Study impact of adding a third inner layer, to be able to reconstruct even if a layer is missed
- Study impact of thinner inner layers, more ITS3-like