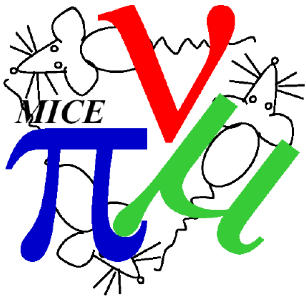


# Field On Scattering

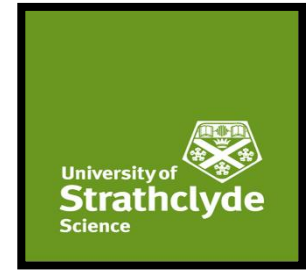
Alan Young

Department of Physics,  
University of Strathclyde

28<sup>th</sup> June 2019

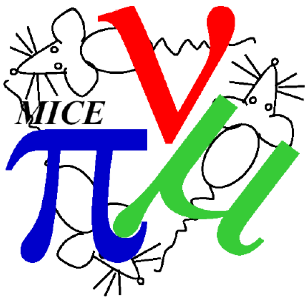


## Fiducial Cut Analysis

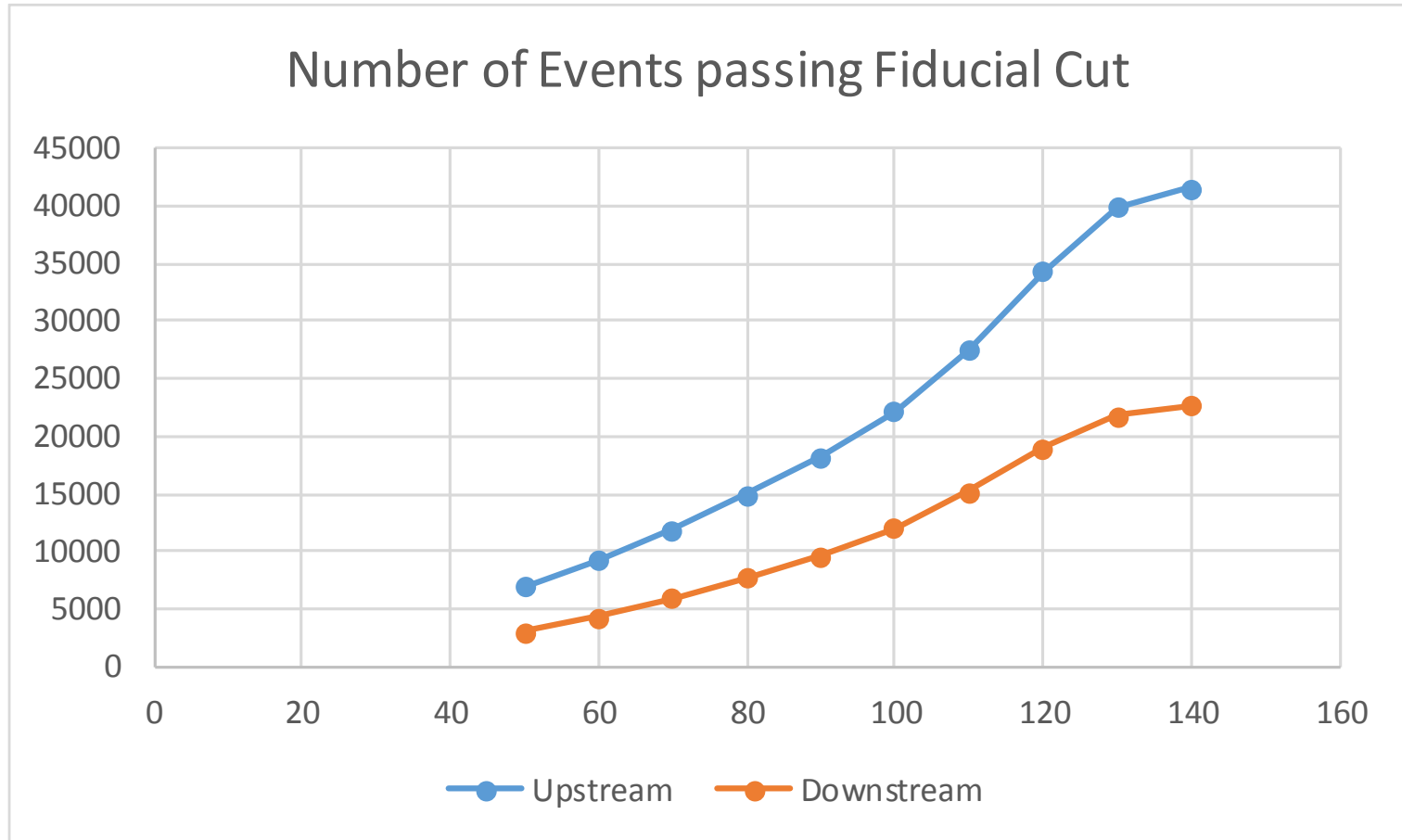
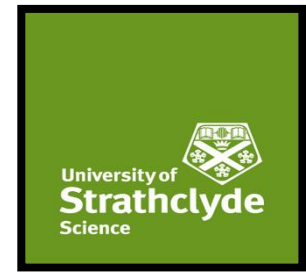


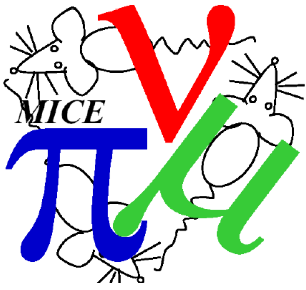
### Fiducial cut

- Aim is to answer if a track in the Upstream tracker is likely to produce a track in the Downstream tracker
- Achieved by propagating track from Upstream tracker to final station of the downstream tracker and checking that that track is within a given radius.
- An initial value of 140mm was used based on the geometry of the tracker.
- Field off analysis was improved by reducing the radius of the fiducial cut to 90mm



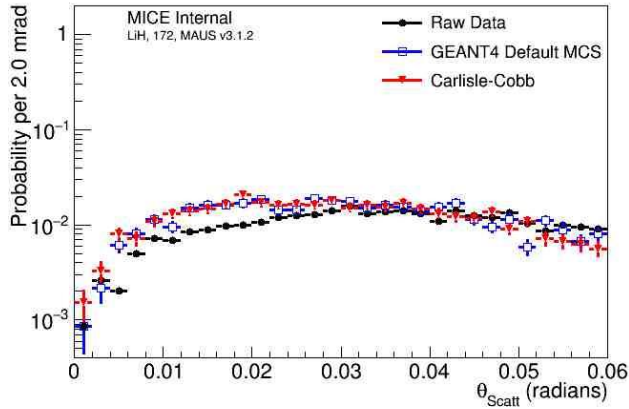
## Number of events passing fiducial Cut



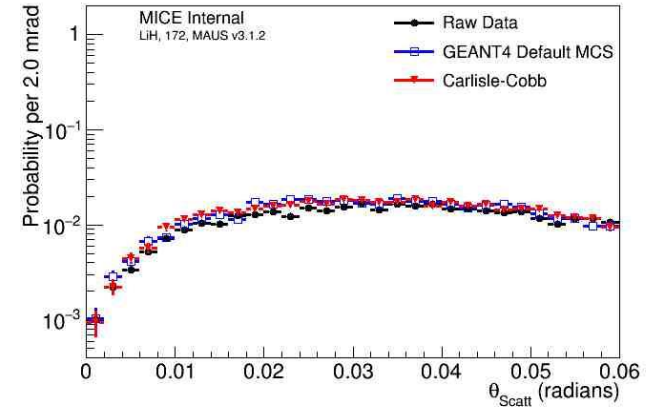


# Fiducial Analysis

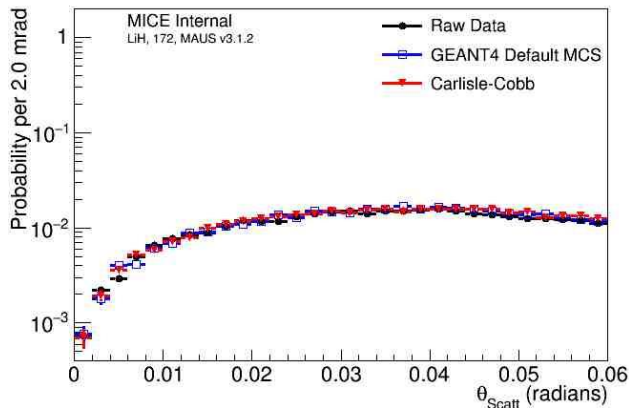
## Scattering Angle Plot 172 MeV/c Momentum



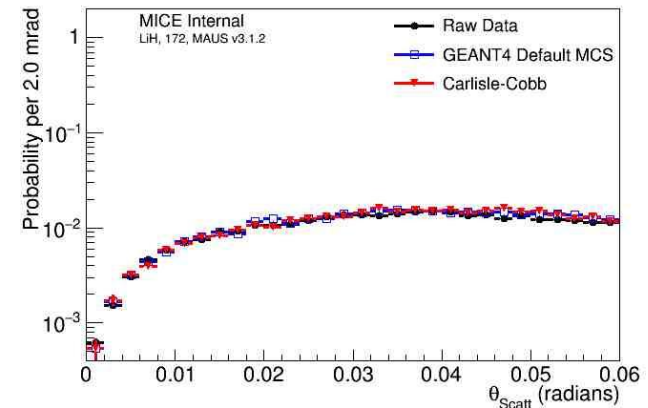
50mm



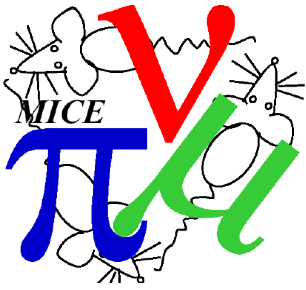
80mm



110mm

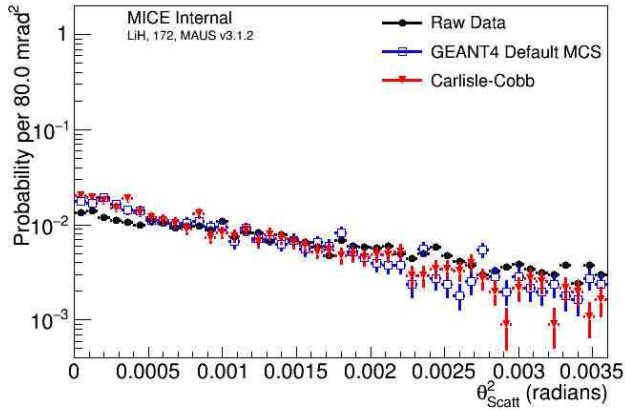
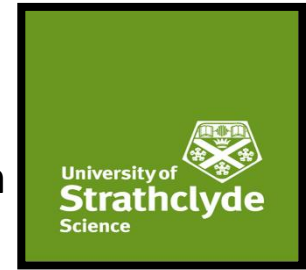


140mm

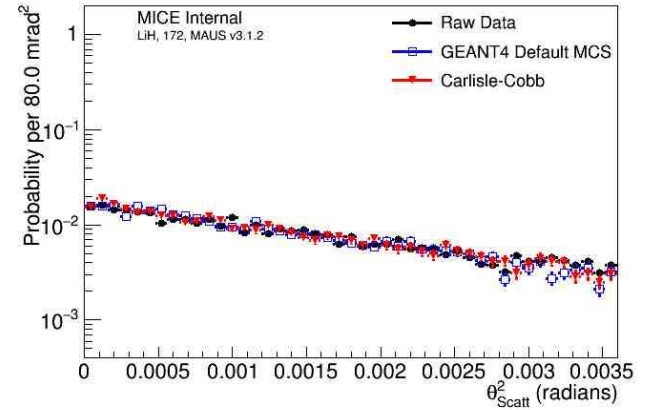


# Fiducial Analysis

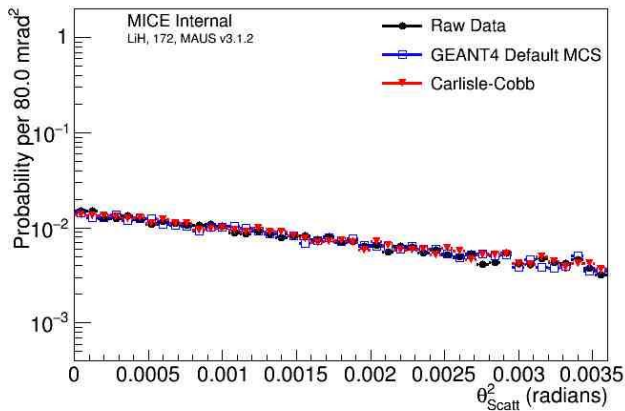
## Scattering Angle Squared Plot 172 MeV/c Momentum



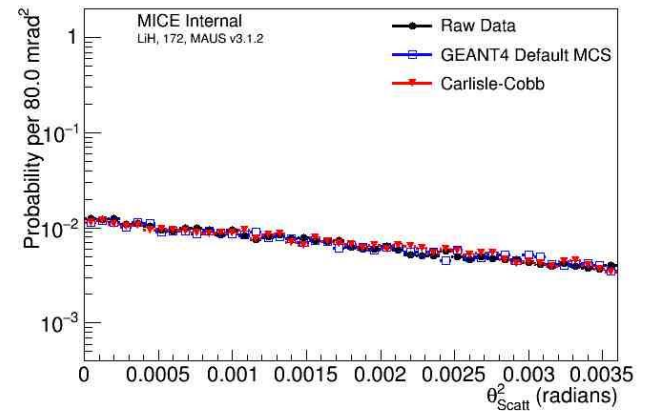
50mm



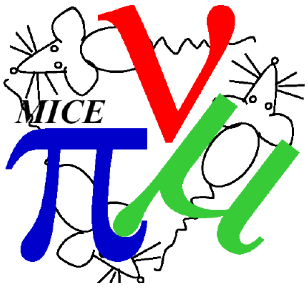
80mm



110mm



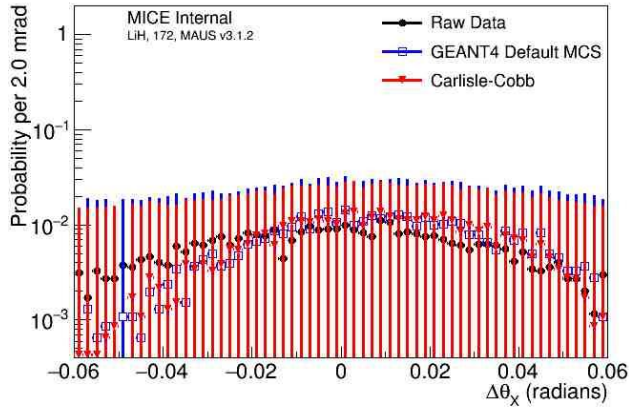
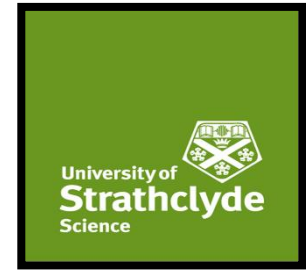
140mm



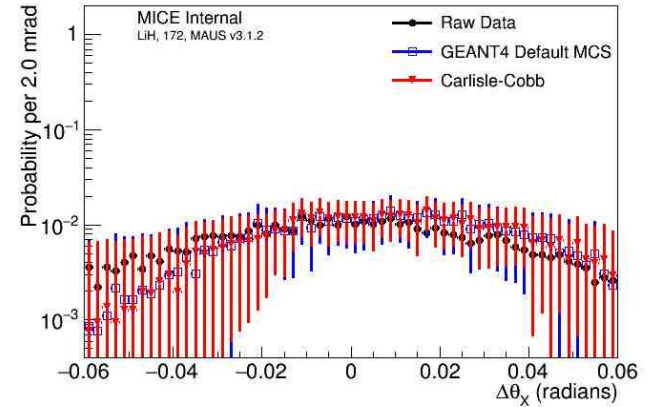
# Fiducial Analysis

## X-component of Scattering Angle Plot

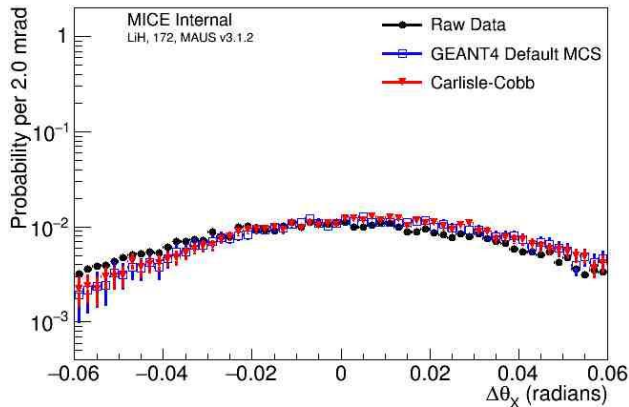
### 172 MeV/c Momentum



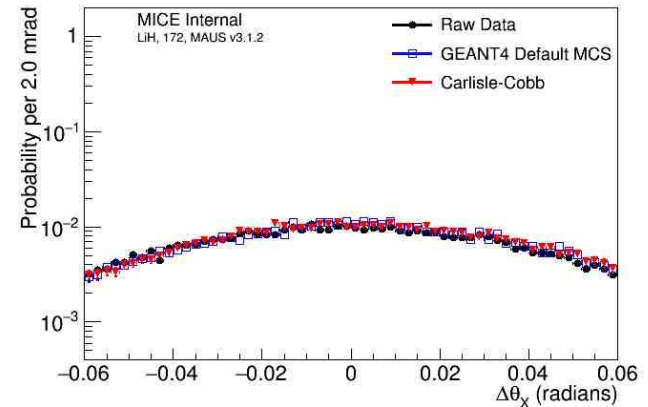
50mm



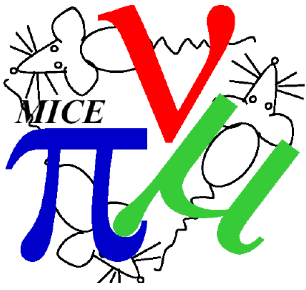
80mm



110mm



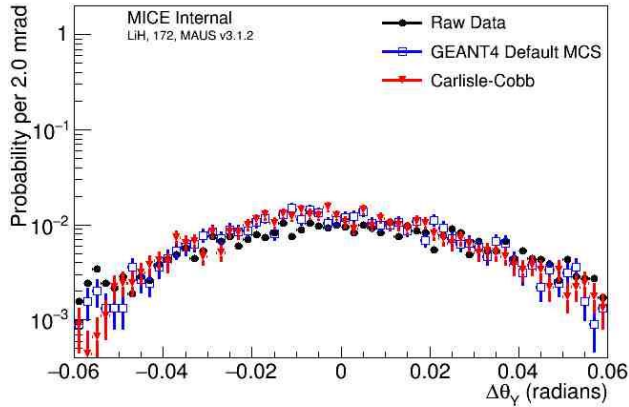
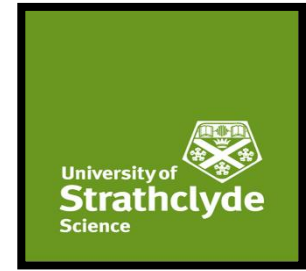
140mm



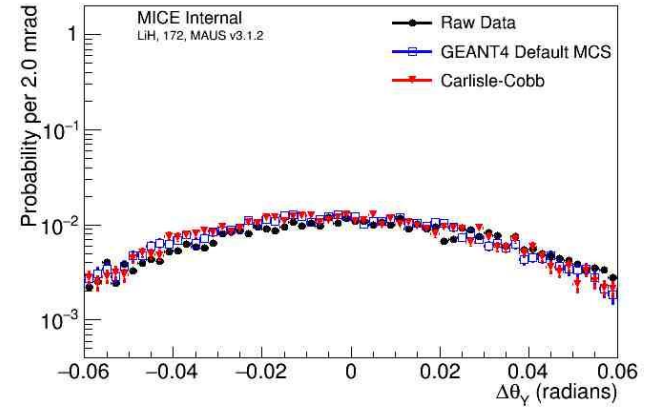
# Fiducial Analysis

## Y-component of Scattering Angle Plot

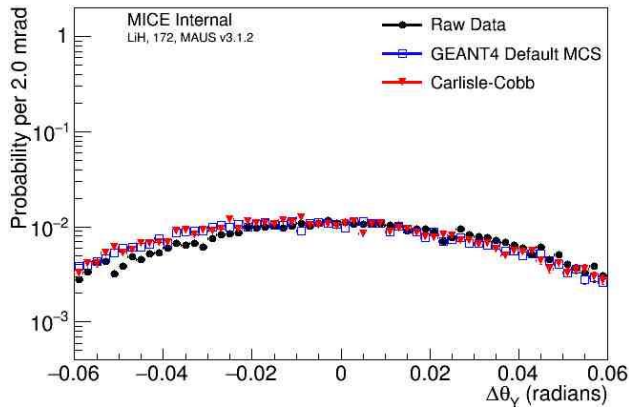
### 172 MeV/c Momentum



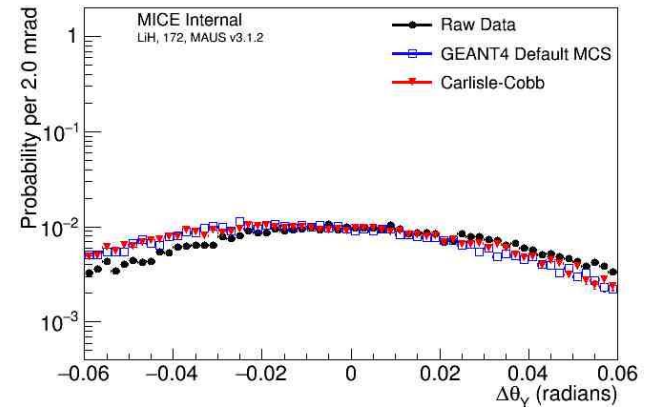
50mm



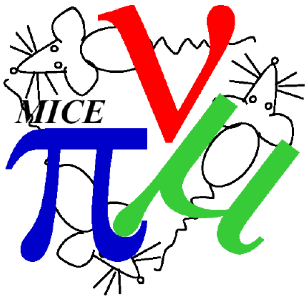
80mm



110mm

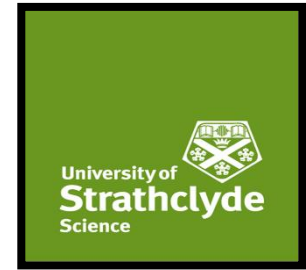


140mm



# Field On Scattering

## Summary

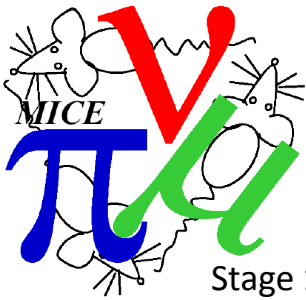


- Completed integrating improvements to Multiple Coulomb Scattering code to field on analysis
- Started studying effect of cuts on analysis
  - Fiducial radius varied from 50mm to 140mm

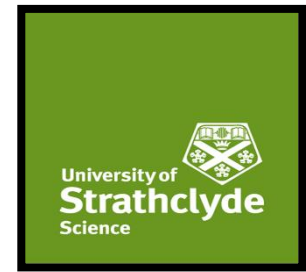
## Future Work

- Understand large error in convolved models in x-component of scattering angle
- Check analysis using Monte Carlo data
  - Monte Carlo data produced
  - Selection study
- Create a new cut on ratio of transverse to axial momentum
  - Study effect this has on asymmetry





# Data Selection



Stage 1 – Preliminary stage where data is prepared for analysis

- Stage 1a - Data read from root file and following cuts applied.
  - Require exactly 1 TOF1 space point
  - Require exactly 1 TOF0 space point
  - Require exactly 1 track in Upstream Tracker
  - Upstream tracker  $\text{Chi}^2/\text{dof} < 10$
- Stage 1b - Properties of particles that pass the above cuts are determined at key axial positions that are used in the next stage of cuts. If available this is taken from Globals, otherwise calculated using `globals::propagate`.
  - Upstream tracker max radius < 150mm
  - Diffuser max radius < 100mm
  - TOF01 consistent with Muon Peak
  - Extrapolated TOF01 consistent with muon hypothesis
  - Successfully extrude track from Upstream tracker back to TOF0
- Properties of Muon at centre of absorber as predicted by upstream and downstream trackers and at end of DS tracker are saved.

Stage 2 – Main analysis stage where final cuts are made and scattering analysis code run

- Fiducial cut - require the track from the upstream tracker, when projected downstream to be within 140mm radius at station 5 of downstream tracker
- Select narrow range of muon momentum to allow study of scattering as a function of momentum