Work Summary

Liverpool FASER Meeting

February 7, 2025

Pawan Johnson

My work thus far ...

- 2024 DQ Checks for Tracking Variables
  - Presented at Physics General Meeting on 17 December
  - Link to slides [Add Link]
- Followup to the 2024 DQ Checks
  - Almost finished up with the underlying work
  - Writing up the slides
  - Hoping to send out early next week
- Working on ALMA9 Efficiency Checks for DP
  - Almost finished up
  - Hoping to send around/present before Monday

2024 DQ Checks

- Look at all of 2024 Data and compare it to 2023
- Focus was on the Track Variables
- Expected good agreements?
- But agreements weren't straightforward
  - Variables like Positions were fine.
  - Momenta were not
  - Most variables were quite different
  - Attributed to the changed background and changed optics
  - Made one to one correspondence with 2023 data difficult

2024 DQ Checks – Some Plots

- We knew the beam crossing angle changed
- From -160 μrad in 2023 to +160 μrad in 2024

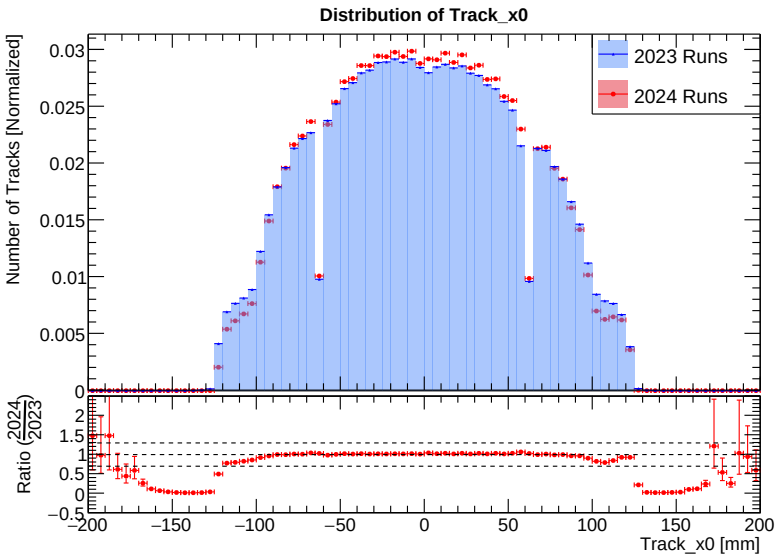

Figure: Track x0

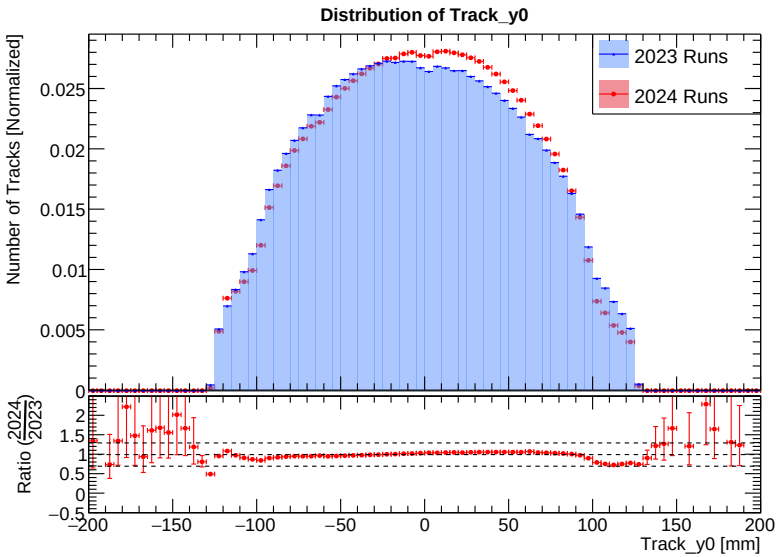

Figure: Track y0

- We observed the corresponding shift in the the track positions

2024 DQ Checks – Some Plots

- That had huge implications on the observed background

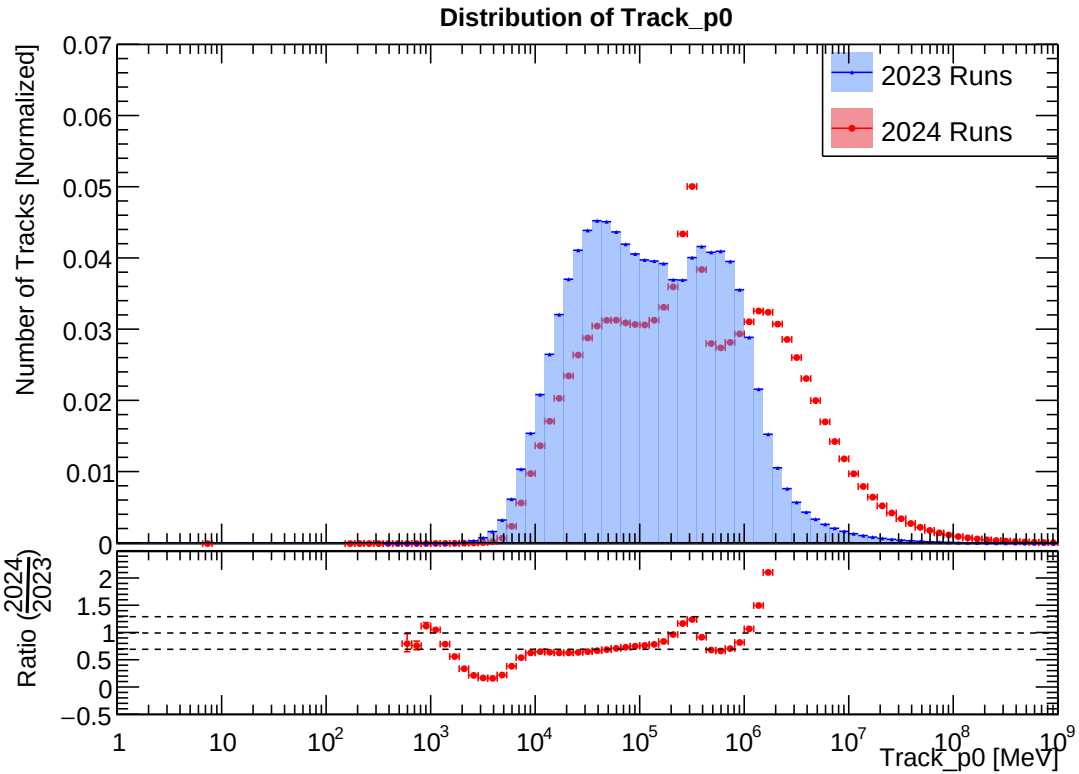

Figure: Track p0

- Lot more high-momenta-positively charged muons in 2024
- This had non-trivial effects on the other track parameters

Follow Up on 2024 DQ Checks

- Do a momentum binning to see if we can have a more equitable correspondence between 2023 and 2024
- Some new variables were introduced in the 2024 data
  - module_eta0, module_phi0
  - which describes the first tracking module hit by the track
- Start looking at the track parameters as a function of the starting module of the track
- Also needed updates to the 2024 runlist [Preliminary]
- Updates to the Yeild Plots
- Comparative analysis between four run periods in 2024
- Should be sent out early next week

2024 DQ Followup – Some Plots

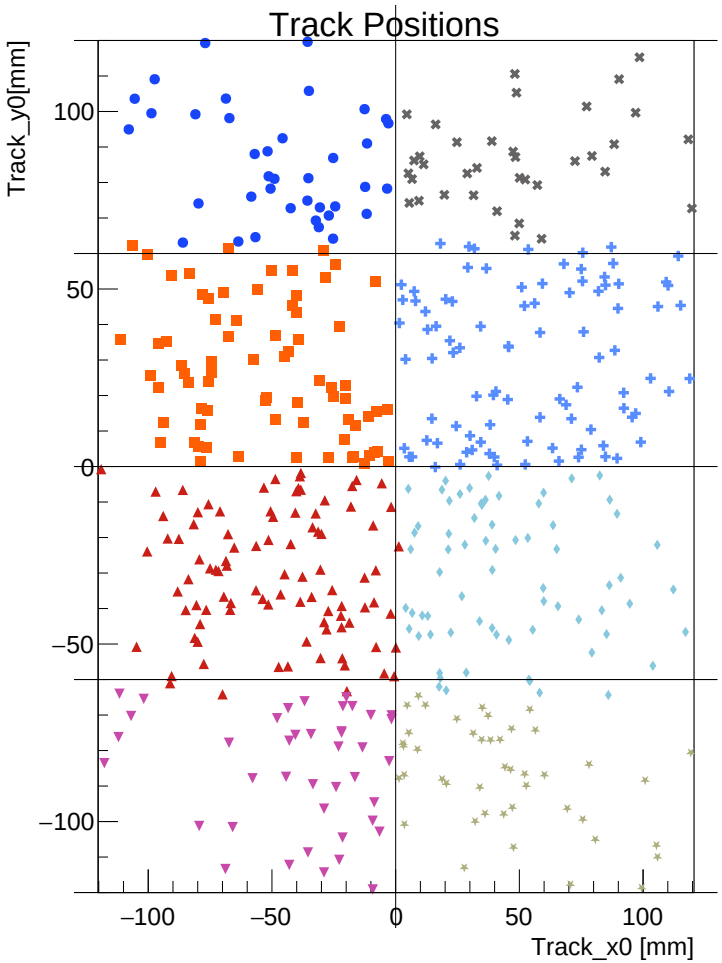

Figure: Track Points across Module

Module 1	Module 8
Module 2	Module 7
Module 3	Module 6
Module 4	Module 5

Figure: Module Numbering

- Four central modules : 2,7,3,6
- Four outer modules : 1,8,4,7

2024 DQ Followup – Some Plots

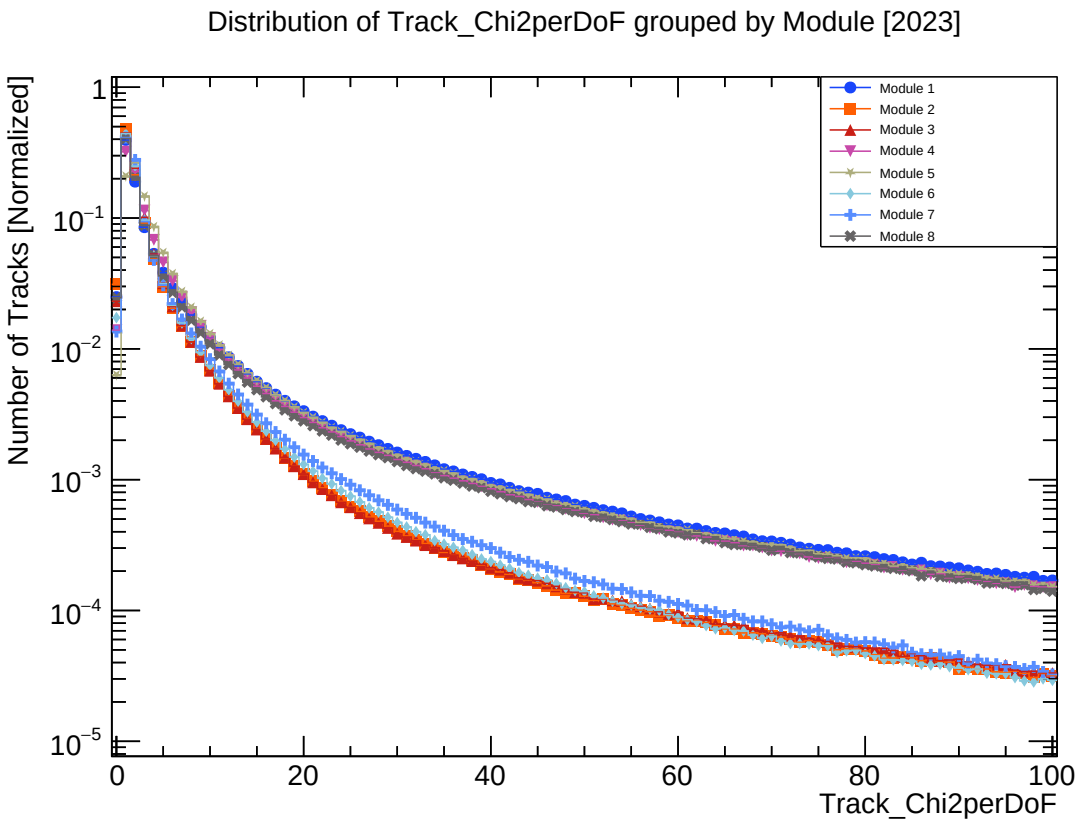

Figure: Track Points across Module

- Some of the parameters factor out nicely with the central/outer module definition

Track Reconstruction Efficiency for ALMA9

- Objective was to validate the track reconstruction for Dark Photon samples in ALMA9.
- Dark Photon samples have closely separated tracking making reconstruction difficult.
- Idea was to see if ALMA9 "performs" better than CENTOS7
- Hoping to present on Monday in the Offline Software Meeting

Track Efficiency for ALMA9 – Some Plots

- Had an existing overlay study on Track Reconstruction

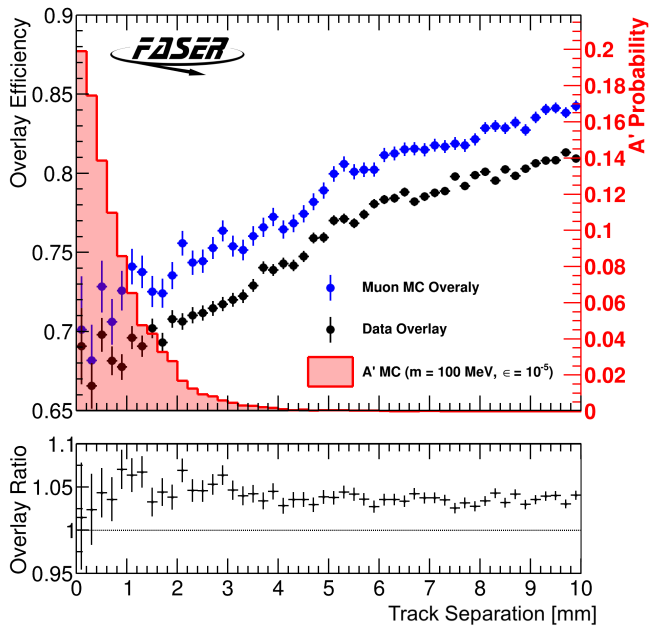

Figure: Overlay plot from Dark Photon Analysis

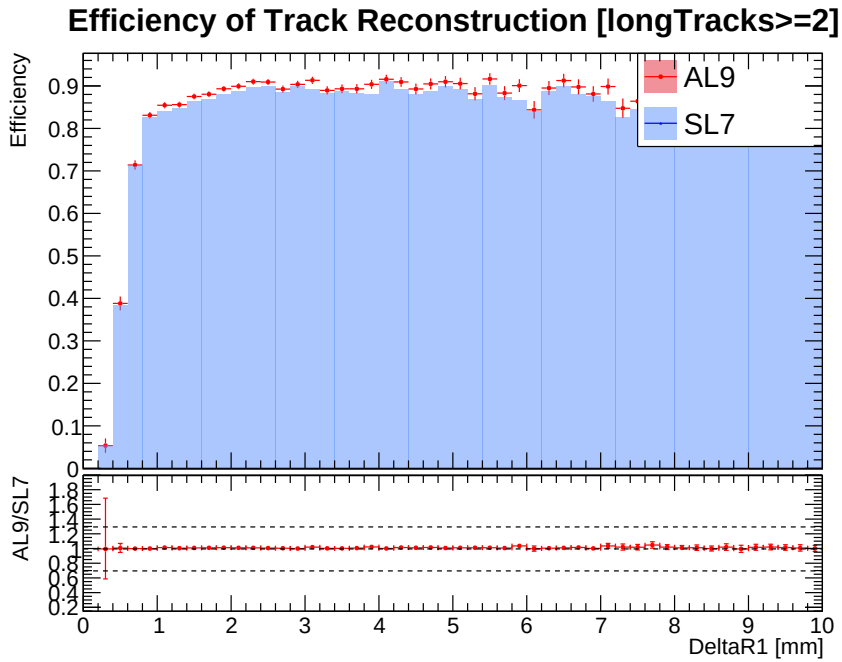

Figure: Track Efficiency ($\geq$2) as a function of distance between the tracks at the final station

- Not looking great for us . . .
- But atleast good agreement between ALMA9 and CENTOS7

Work to start on

- Start on FASER Monte Carlo Production
  - Read up on Twiki [Add Link]
  - Possibly get involved with John?
- Extended Dark Photon Search
  - Develop selection for $\mu^+\mu^-$
  - Develop selection for $\pi^+\pi^-$
  - Waiting on the samples from Eric
  - Can be done as an exercise for earlier work.

Thank you!