Background

Tom Eichlersmith is an advanced grad student on LDMX at UMN under Jeremy Mans

- Jeremy works on LDMX and CMS: Tom strongly prefers to do physics on HPS to CMS
- Tom has been the de facto leader of the LDMX software group during the ~year that Omar was busy with the HPS 2021 Run. Tom is a gifted developer and an excellent physics student.

Pre-proposal is that Tom performs a first search for iDM with 2016 data, which has some synergy with Alic's SIMPs search.

- Offers HPS an opportunity to expand its physics portfolio
- Offers HPS an opportunity to refine our understanding of the apparatus with the well-understood 2016 dataset and make improvements to efficiencies and resolutions for (hit reconstruction, alignment, track reconstruction, event reconstruction/selection).

We want to select service work for Tom that serves the needs of the experiment while maximizing the leverage provided by his thesis topic and takes good advantage of his skills.

- In the past, service work for students has usually been somewhat generically defined by the involvement of their institution in the construction and operation of the HPS apparatus and work on reconstruction that is required for their physics analysis.
  - Since Tom will not be involved in construction and operations, we have agreed that we should define some "pure" service work that is defined solely by what the experiment requires for reconstruction and analysis.
  - We recognize that Tom will also perform important service work that is motivated by and synergistic with his dissertation analysis

Input was collected from Norman, Matt, Cameron, Tongtong, PF and Omar. Detailed discussion with Matt and Cameron ensued, where we sharpened a list of tasks required for data analysis to allocate to the students (also Alic, Emrys, Rory, and Sarah!)

Proposed Service Work

Pure service work (required to take the lead role with supervision):

- *Debug/test Kalman-based Millipede alignment tools on 2016 data (PF)*

- Develop standardized alignment plots (PF, Cameron, Norman)

- *Assist with 2019/2021 alignment with KF tracks (PF, Cameron, Norman)*

Synergistic with analysis (expect contributions these areas in collaboration with others)

- *Revisit MC tools used for background (Omar, Cam, other students)*

- Improve standard set of monitoring plots for changes in the reconstruction code (Norman, PF, Cameron, other students)

- *Relieve discrepancy between data and MC (tracking chisq, efficiency, momentum and time resolution) through improvements in data and/or better modeling in MC. (Matt, Cameron, other students)*

- Revisit Miriam's standard cuts and define a tool that can be loaded in various parts of the data reconstruction workflow for standard physics objets. (Matt, Cameron, PF, other students)