New HPS Simulation Framework

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Introduction

- HPS is in need of a new detector simulation software framework

  - Slic is not flexible enough for 2019 production needs

  - Jeremy McCormick started the hps-sim project as a replacement

- Hps-sim has yet to be validated much against slic

  - Still need to do some development of features to achieve 2019 goals

  - This framework was a fork from ldmx-sim, since then it has diverged

- What are our needs?

  - Biasing of specific processes to study new potential backgrounds

 - Flexibility to make on-the-fly changes to improve our understanding

Comparison of Frameworks

	slic	hps-sim	ldmx-sim
Flexibility	2	10	7
Biasing/Filtering?	no	no	yes
Existing user base?	yes	no	yes
Validation Level	9	5	8
Documentation	little	little	Wiki in progress
Public code?	yes	yes	no

- How to determine weights for each row?
- Produced a sample with a single electron source (2 GeV) and a pulser trigger

Simulation Level Multiplicities

- This original "issue" that Jeremy McCormick was chasing before he stop working on hps-sim is still there
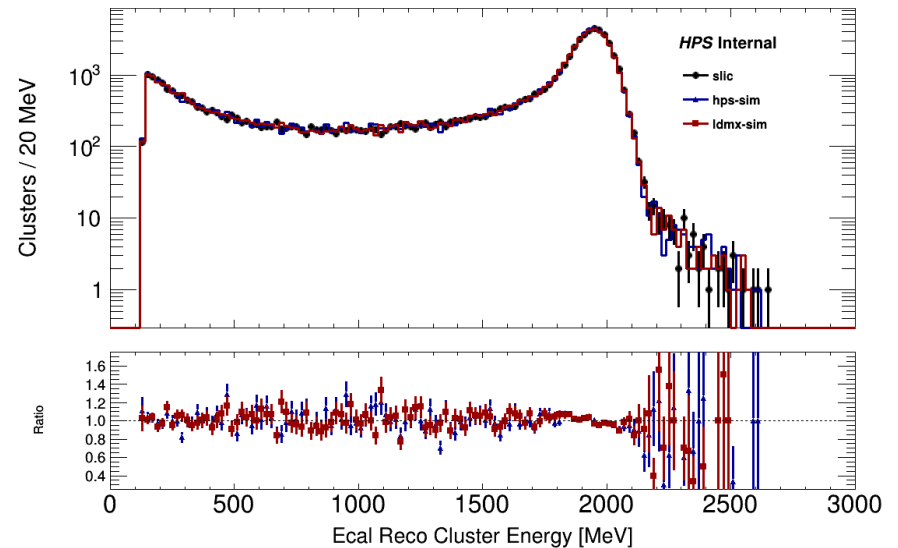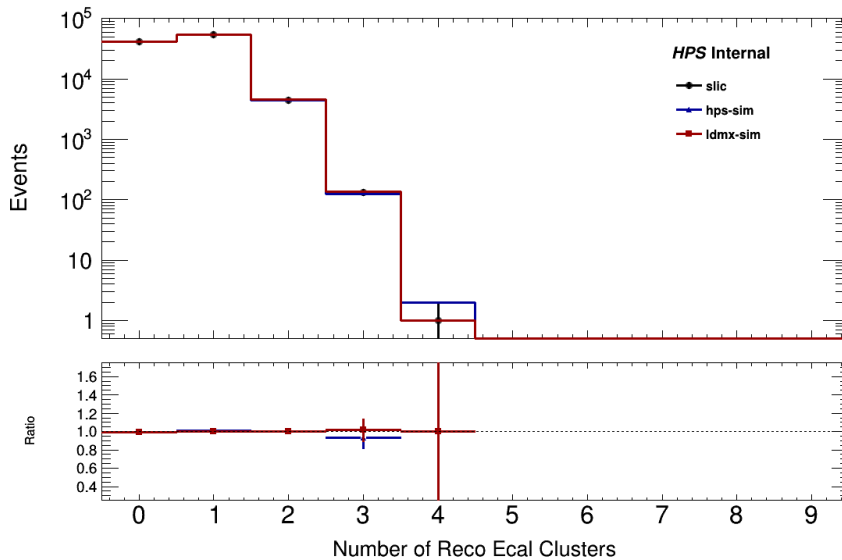- The hit multiplicities look great
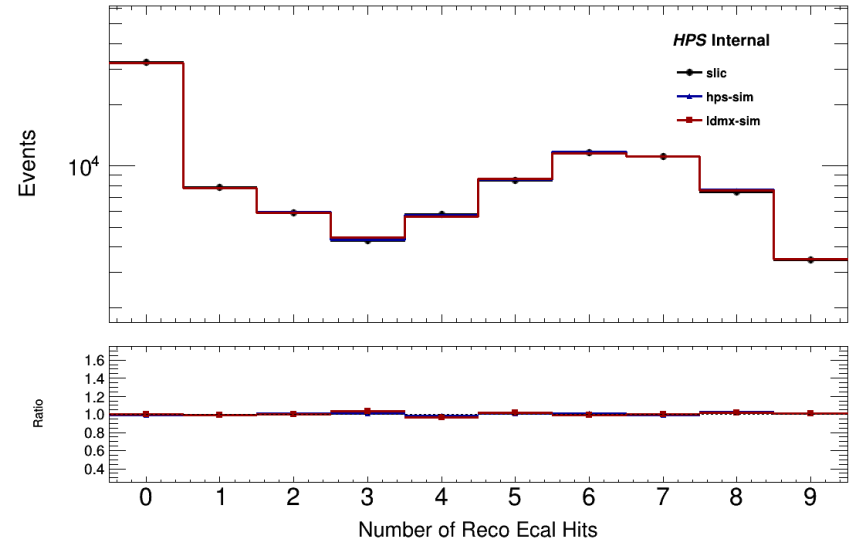- How do the energies look?
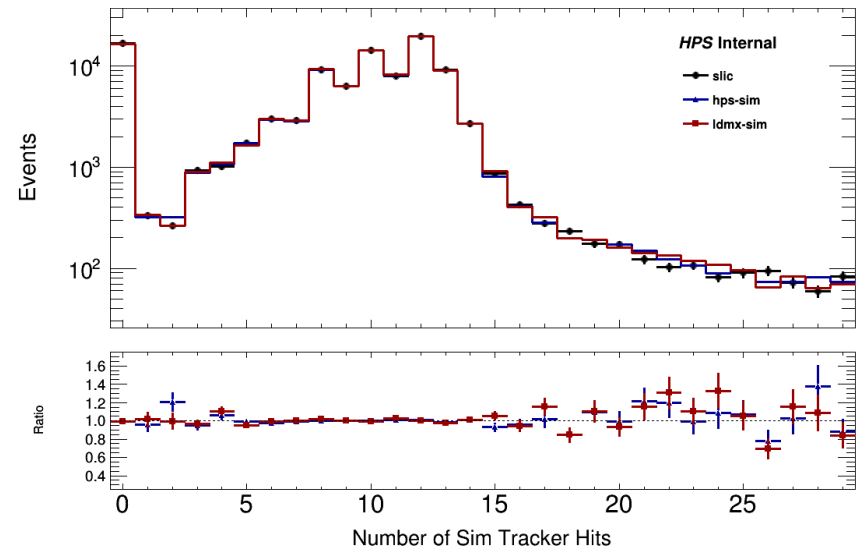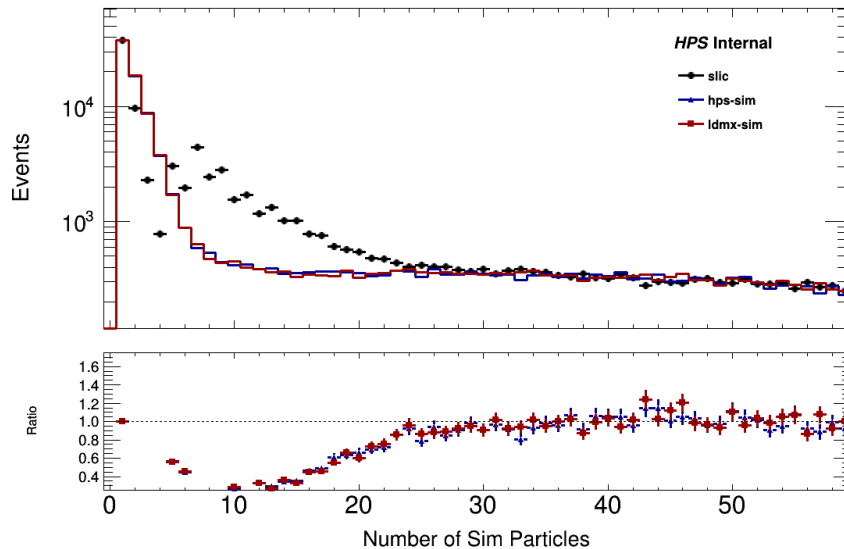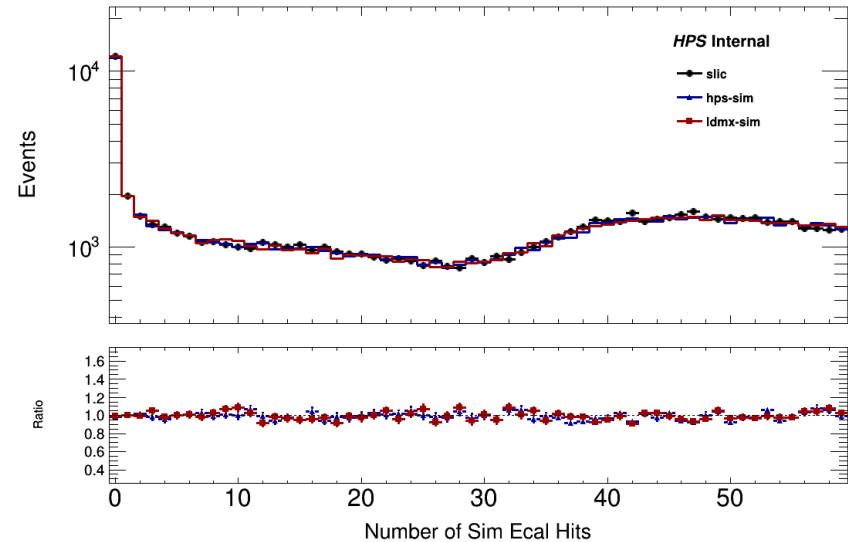
Simulation Level Energies

- All of these look great!
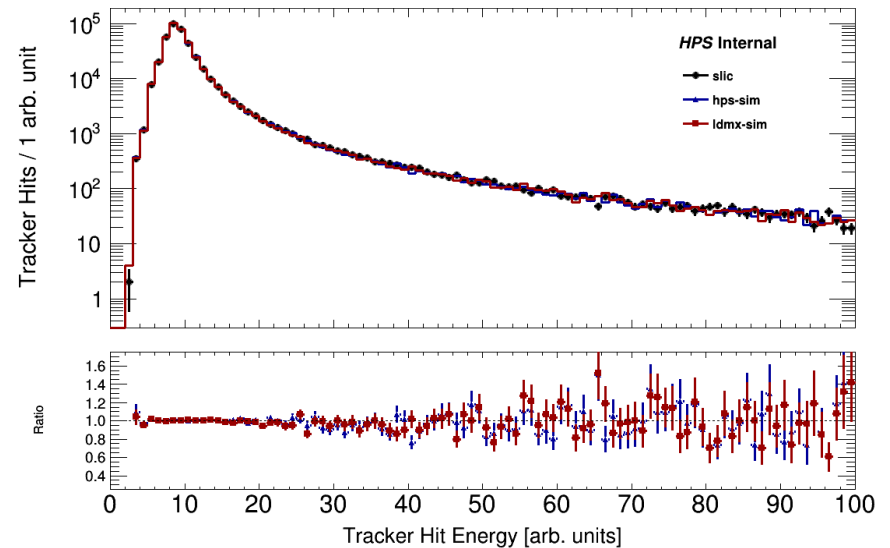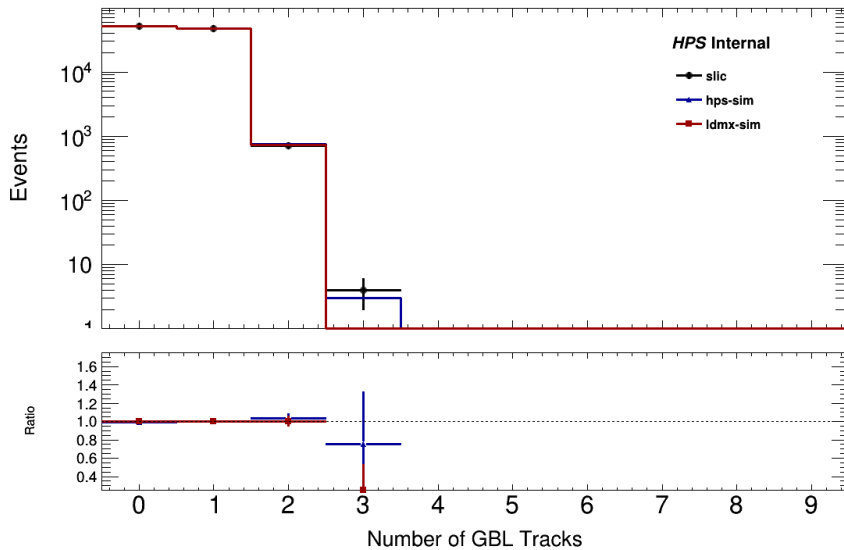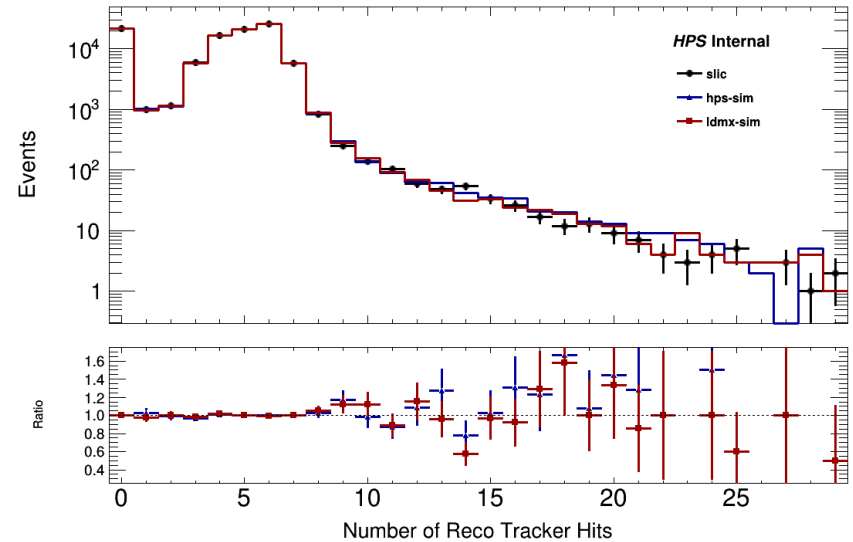- Next let us look at the reconstruction level of the hits
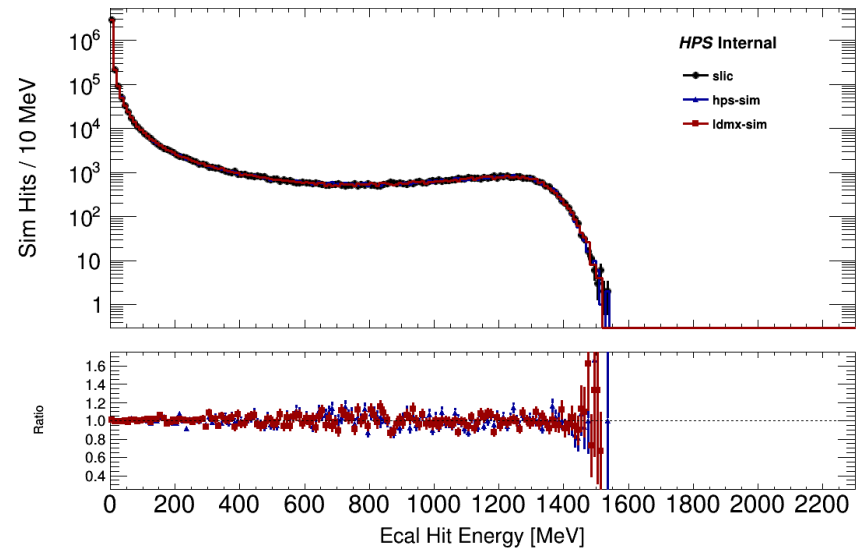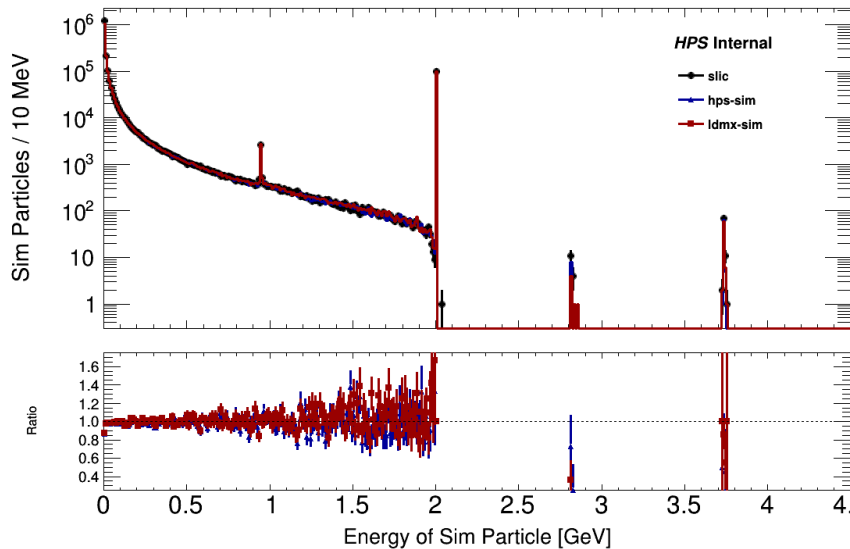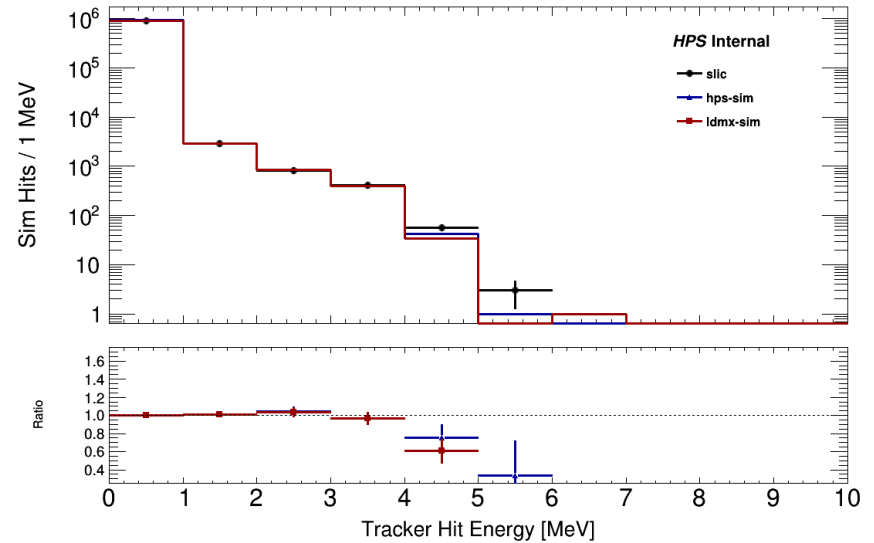
Reconstructed ECal Hits and Clusters

- All of these look great!
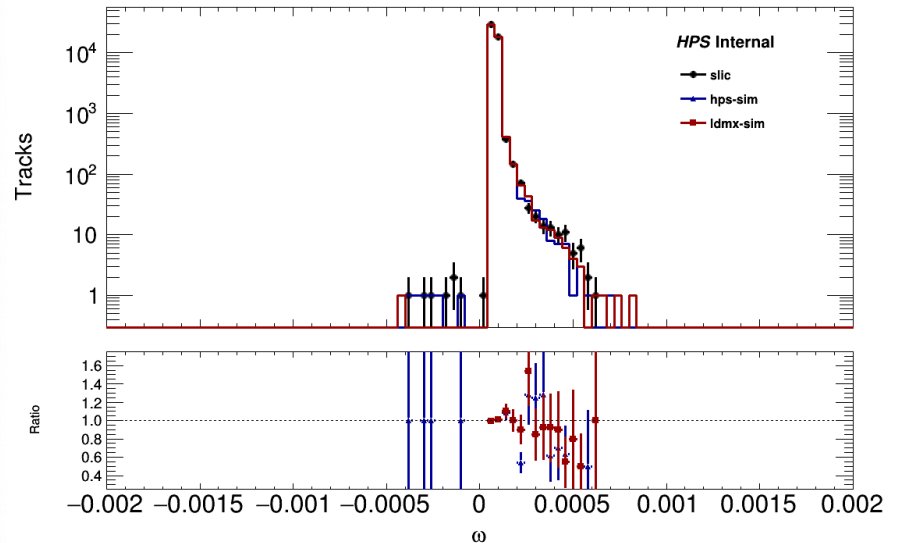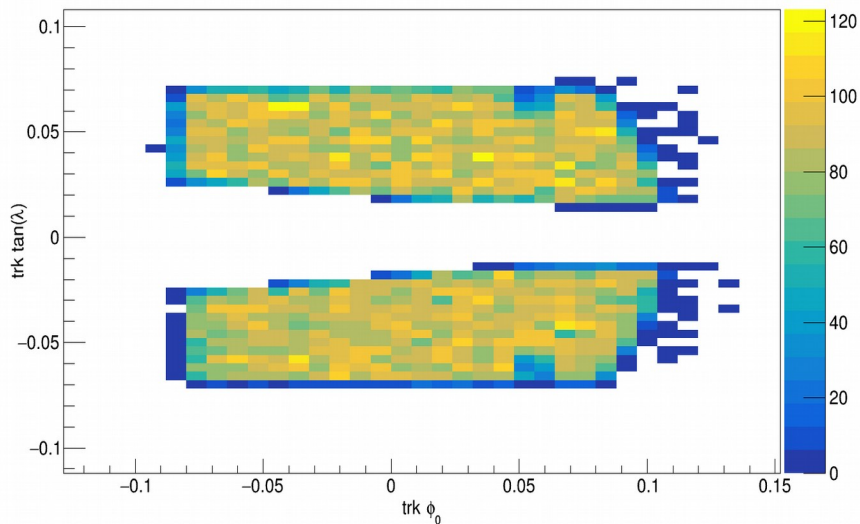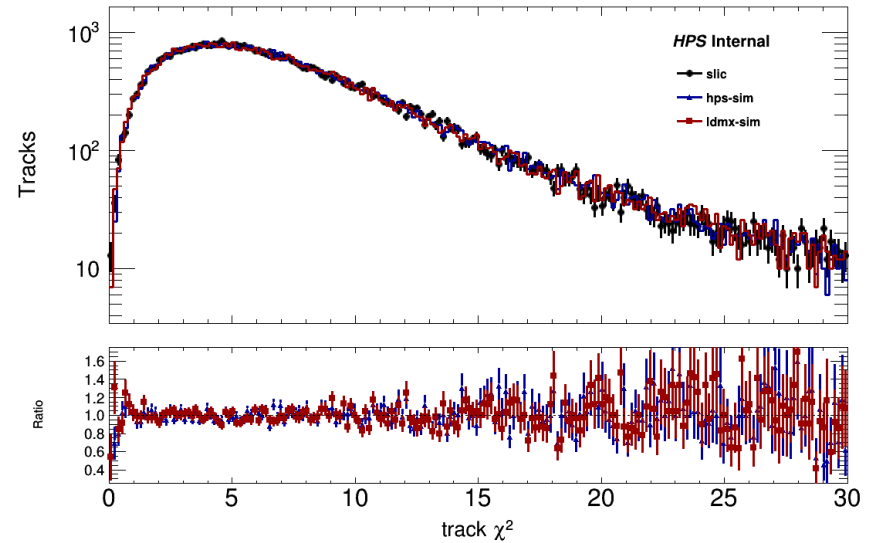- Moving now to the tracker

Reconstructed Tracker Hits and Tracks

- All of these look great!
- The tracker hits are 3D hits
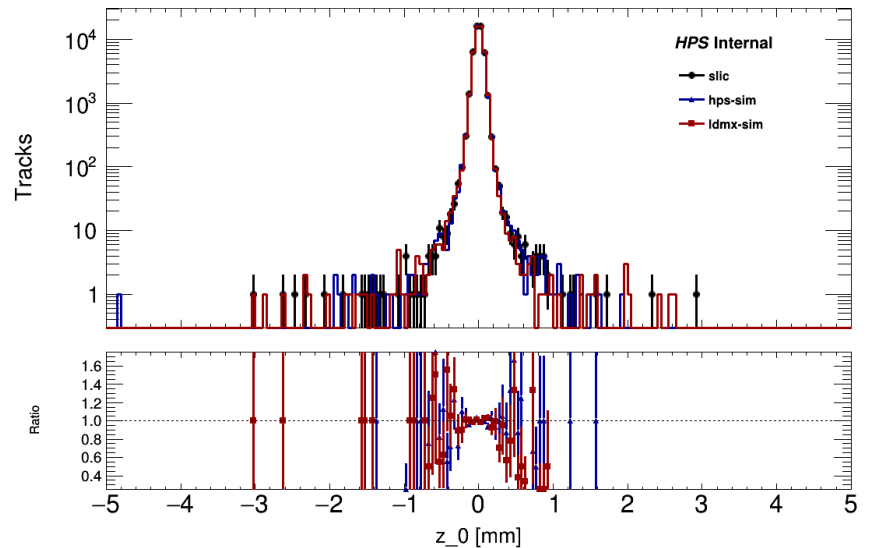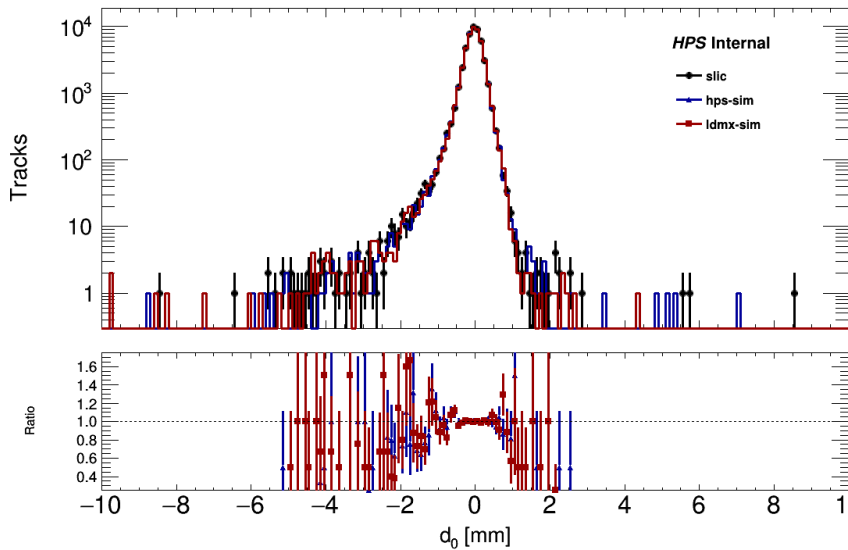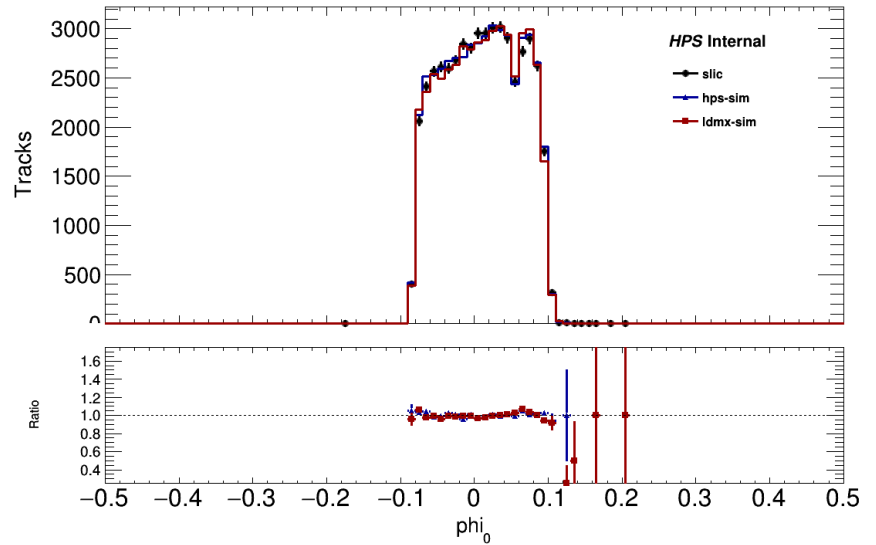- Moving now to more detailed track plots

Reconstructed Tracks

- All of these look great!
- Not all directions in the cone hit something in the detector
- Next more track plots

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Reconstructed Tracker Hits and Tracks

- All of these look great!
- No significant difference seen in tracks comparing all three frameworks

What is Next?

- Decide on which framework to move forward with

    - The two frameworks appear identical in what they are generating

    - The LDMX collaboration had a positive response towards the idea

    - Ultimately, the plan would be to break out the Core of ldmx-sim and then keep HPS specific code separate and public

- Readout code

    - Use random triggers as beam background

    - Updates needed for 2019 upgrades

- Producing small samples for reconstruction studies

- Start looking into SIMP production using MadGraph