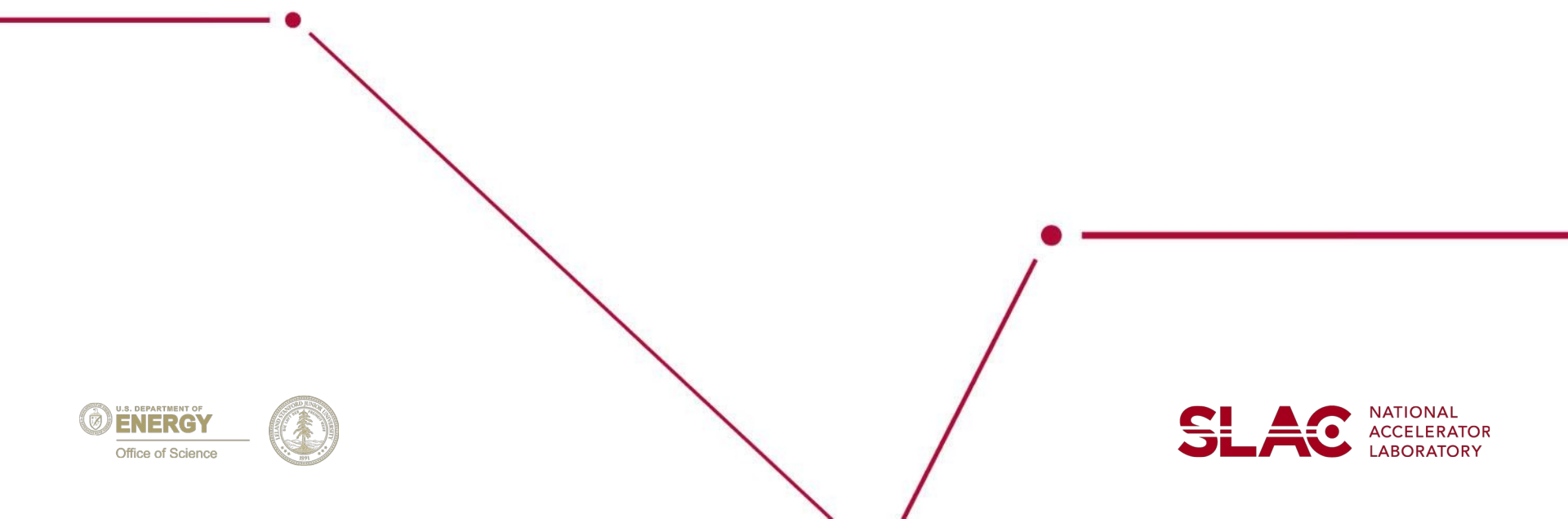# Taking a look at 2021 run-by-run
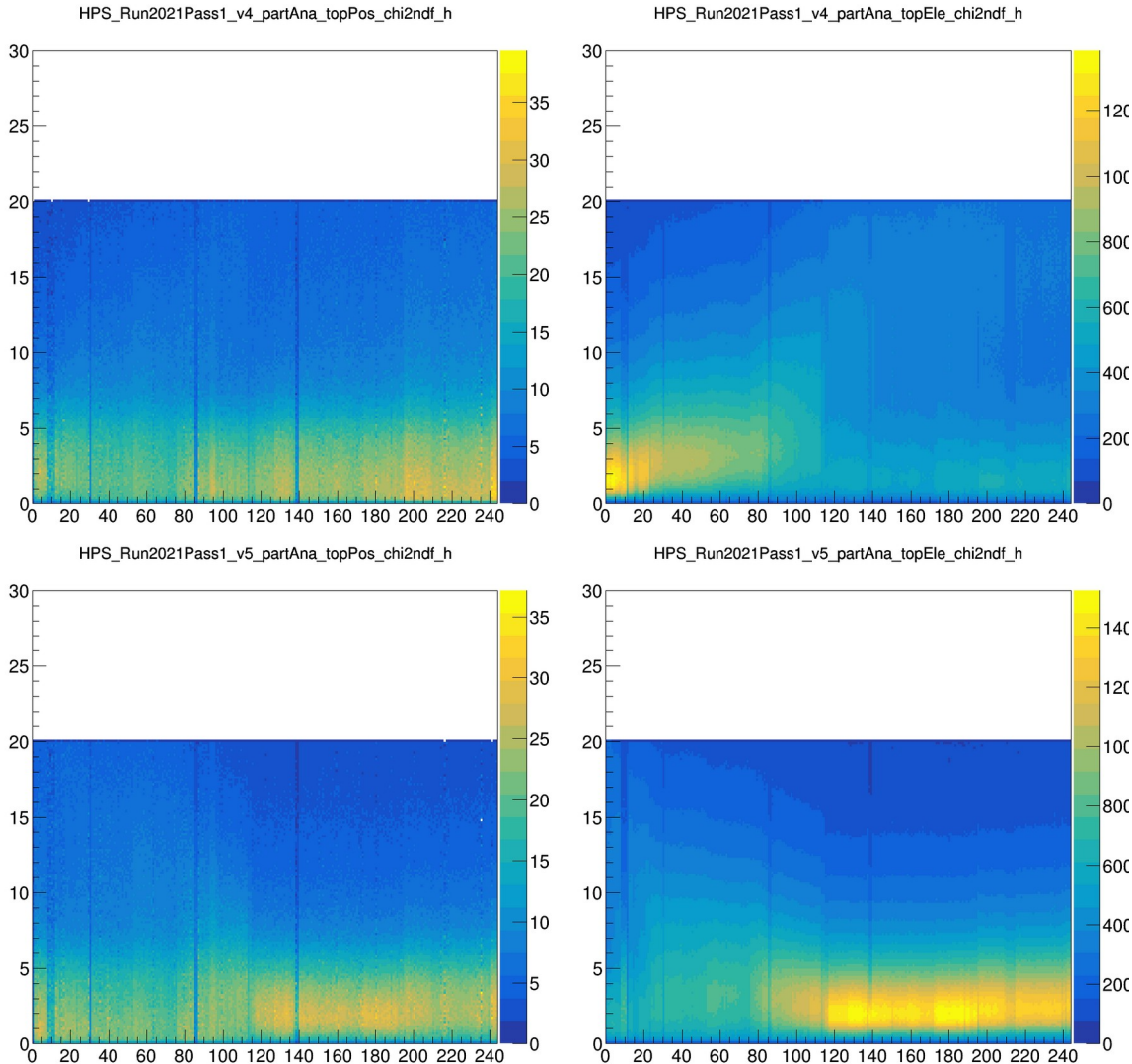
Cameron Bravo (SLAC)

Introduction

- Taking a look at various track parameters from reconstructed data over full 2021 run period

  - New plotting tool to compare 1D distributions for each run

- Focusing here on FEE skims of all runs

  - Thanks to Nathan for making the FEE skims

  - Using simple track selection to study changes run-by-run

  - Using detector aligned for beginning of ran and one for the end of the run

  - Removed 1-pass runs that were at 1.92 GeV

- Current goal is to prepare for a final push in aligning 2021

  - Identify the number of alignment states we want and determine run numbers for data to be used to do the alignment of each state

  - Prepare data to be used for alignment from the selected run numbers

Simple FinalStateParticle Selection
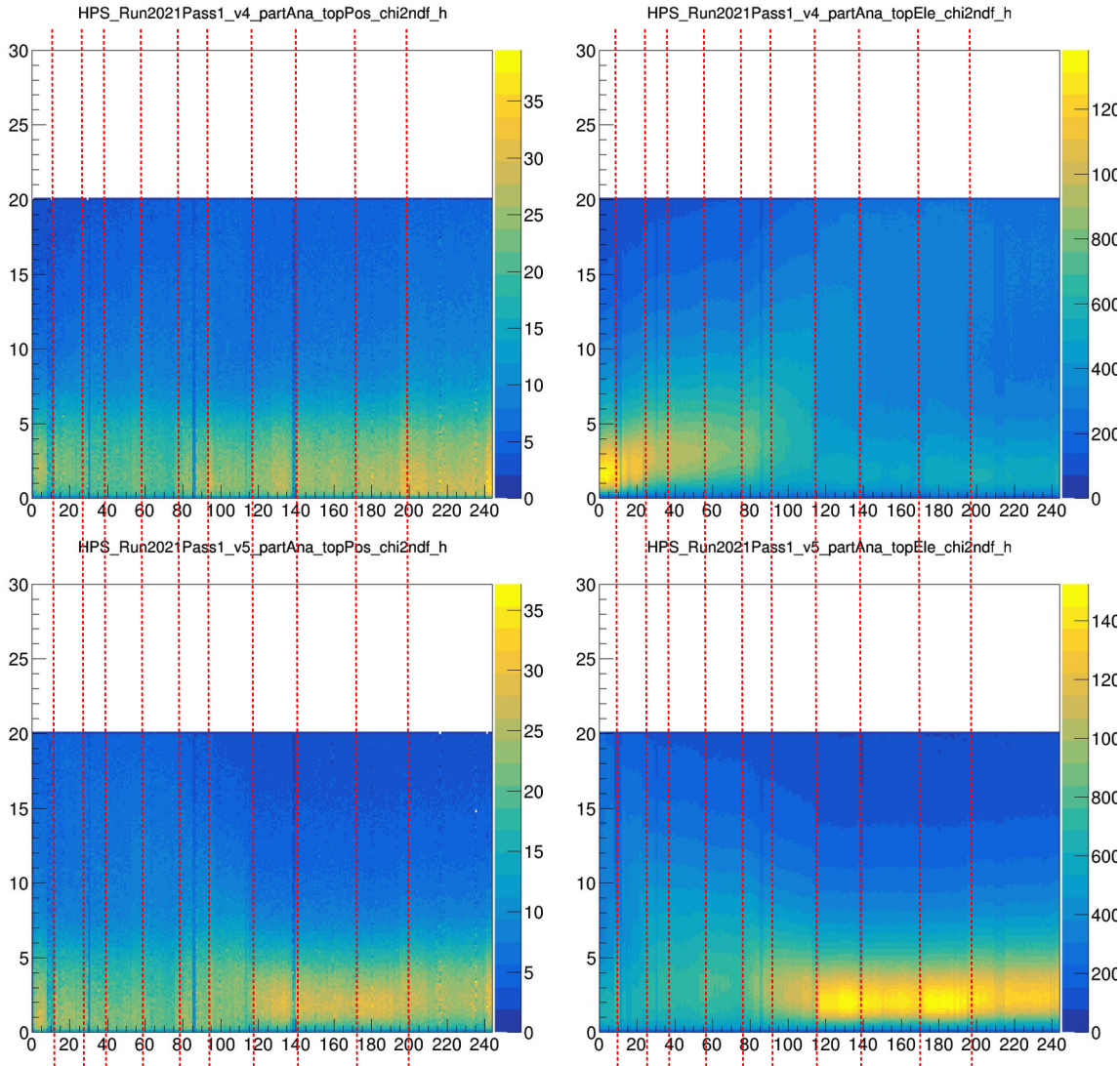
anaParts_trkSelector_cutflow
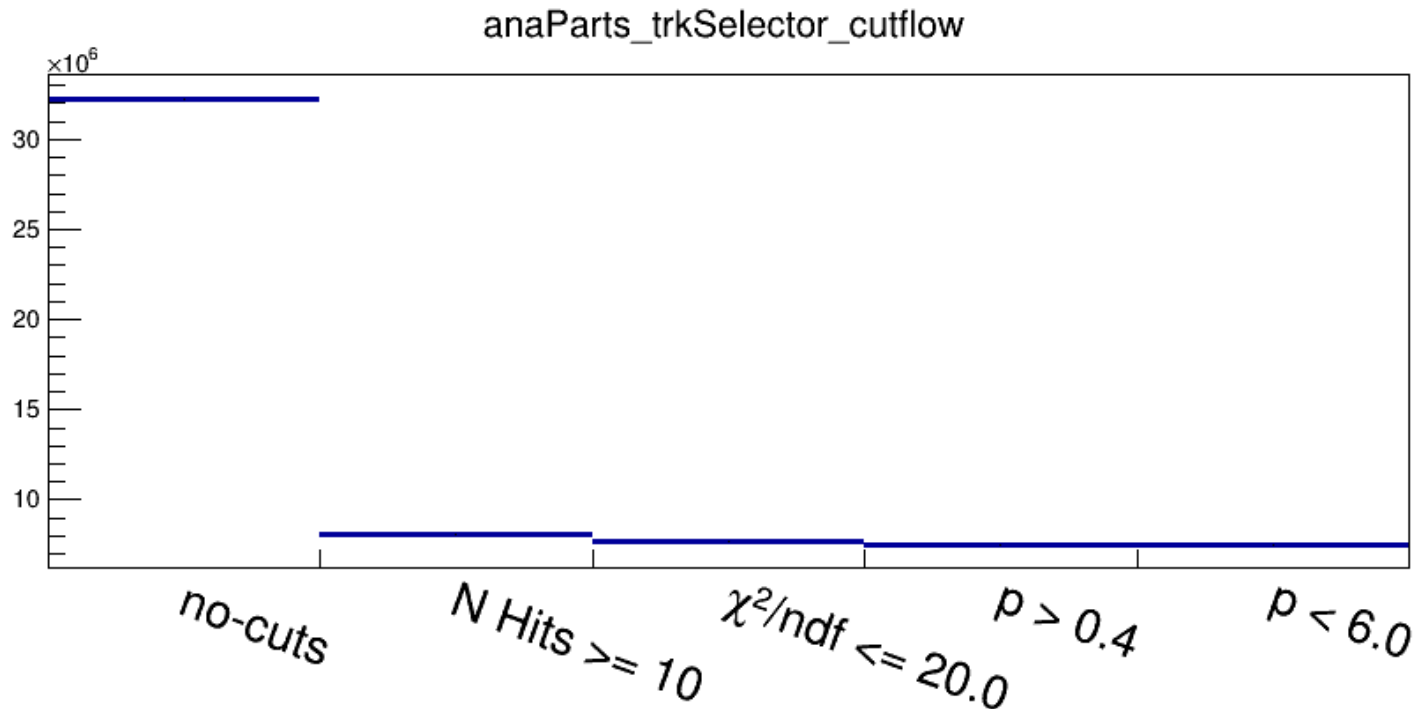
- Simple selection used (reminder that these from FEE skims)

- This is just to show you the selection being used, cuts are the same for all the runs

Top Track chi2/ndf

HPS_Run2021Pass1_v4_partAna_topPos_chi2ndf_h

HPS_Run2021Pass1_v4_partAna_topEle_chi2ndf_h

HPS_Run2021Pass1_v5_partAna_topPos_chi2ndf_h

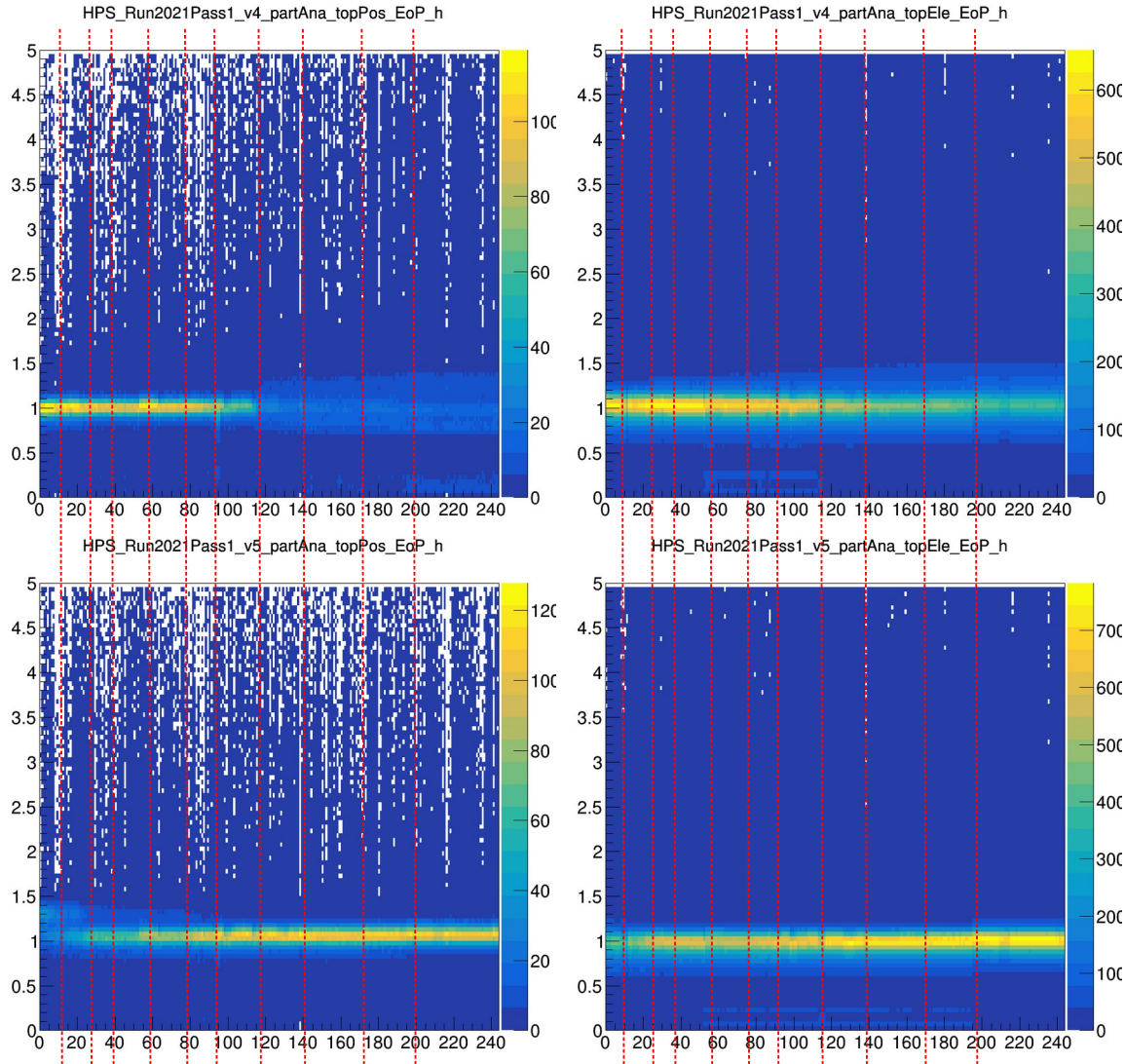HPS_Run2021Pass1_v5_partAna_topEle_chi2ndf_h

- X-axis is run id which is a count of the golden run numbers starting at zero

  - Removed the 1-pass runs that were at 1.92 GeV

- These are normalized to equal number of FEE triggers per run

- v4 detector clearly better for early runs, very inefficient for later runs

- v5 detector clearly better for later runs

- Where do we want to draw the boundaries in run ID to delineate the alignment states?

4

Top Track chi2/ndf

- X-axis is run id which is a count of the golden run numbers starting at zero

  - Removed the 1-pass runs that were at 1.92 GeV

- These are normalized to equal number of FEE triggers per run

- v4 detector clearly better for early runs, very inefficient for later runs

- v5 detector clearly better for later runs

- Where do we want to draw the boundaries in run ID to delineate the alignment states?

5

HPS_Run2021Pass1_v4_partAna_topPos_EoP_h

HPS_Run2021Pass1_v4_partAna_topEle_EoP_h

HPS_Run2021Pass1_v5_partAna_topPos_EoP_h

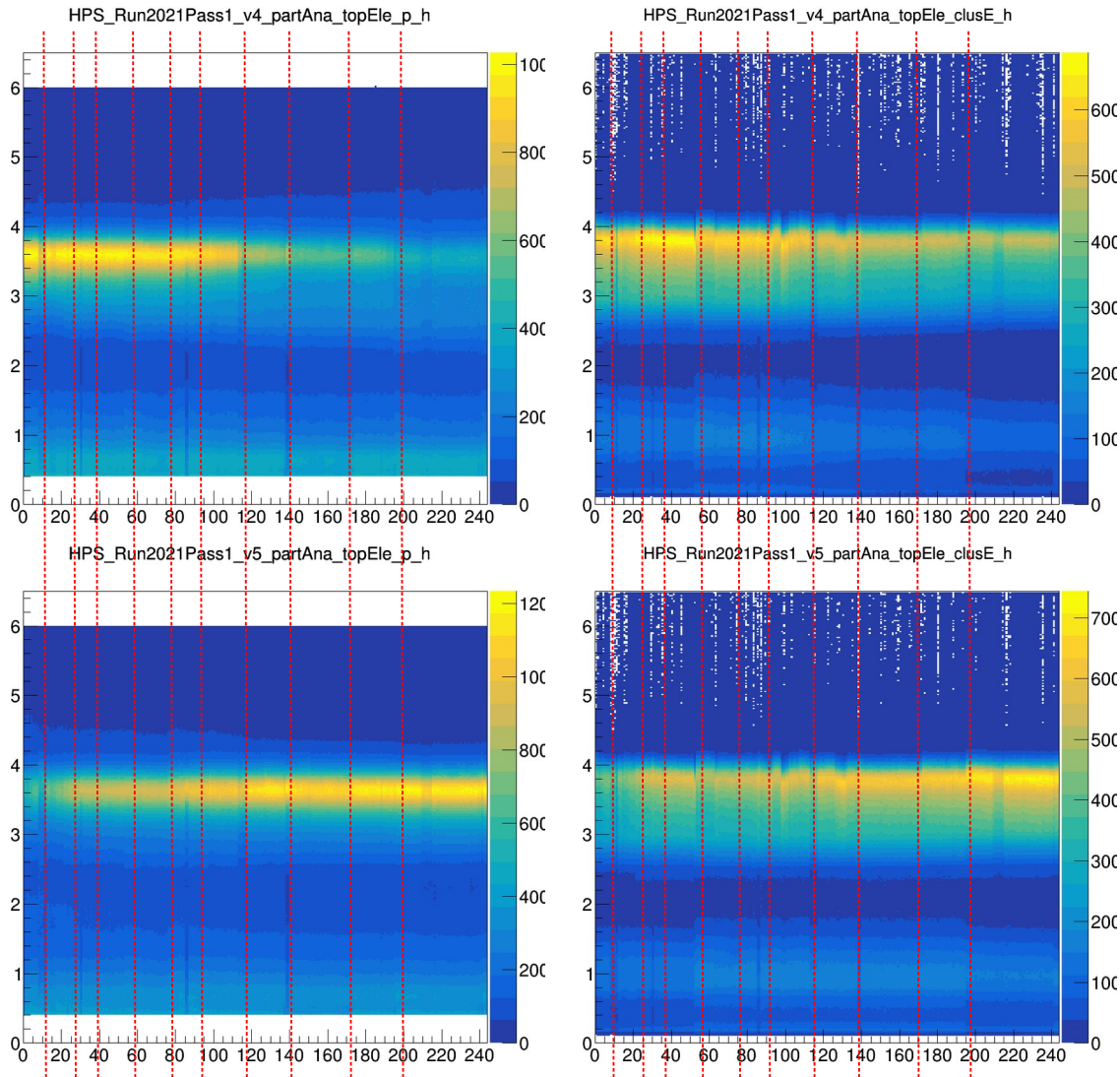HPS_Run2021Pass1_v5_partAna_topEle_EoP_h

- Positron E/p bifurcates for early runs using the detector aligned using a later run

- The lines line up with features we see in E/p as a function of run ID

Hits on Top Tracks
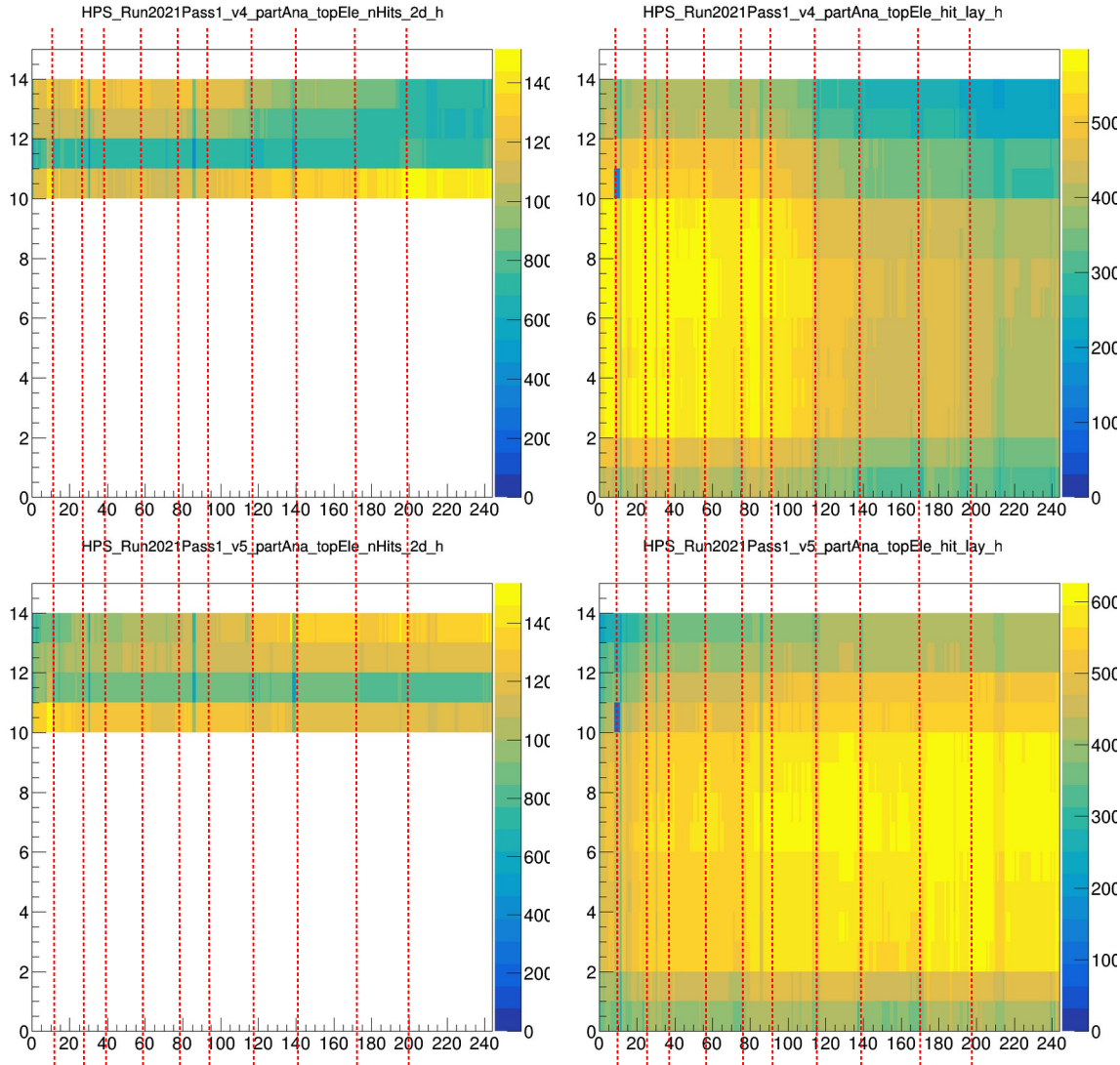
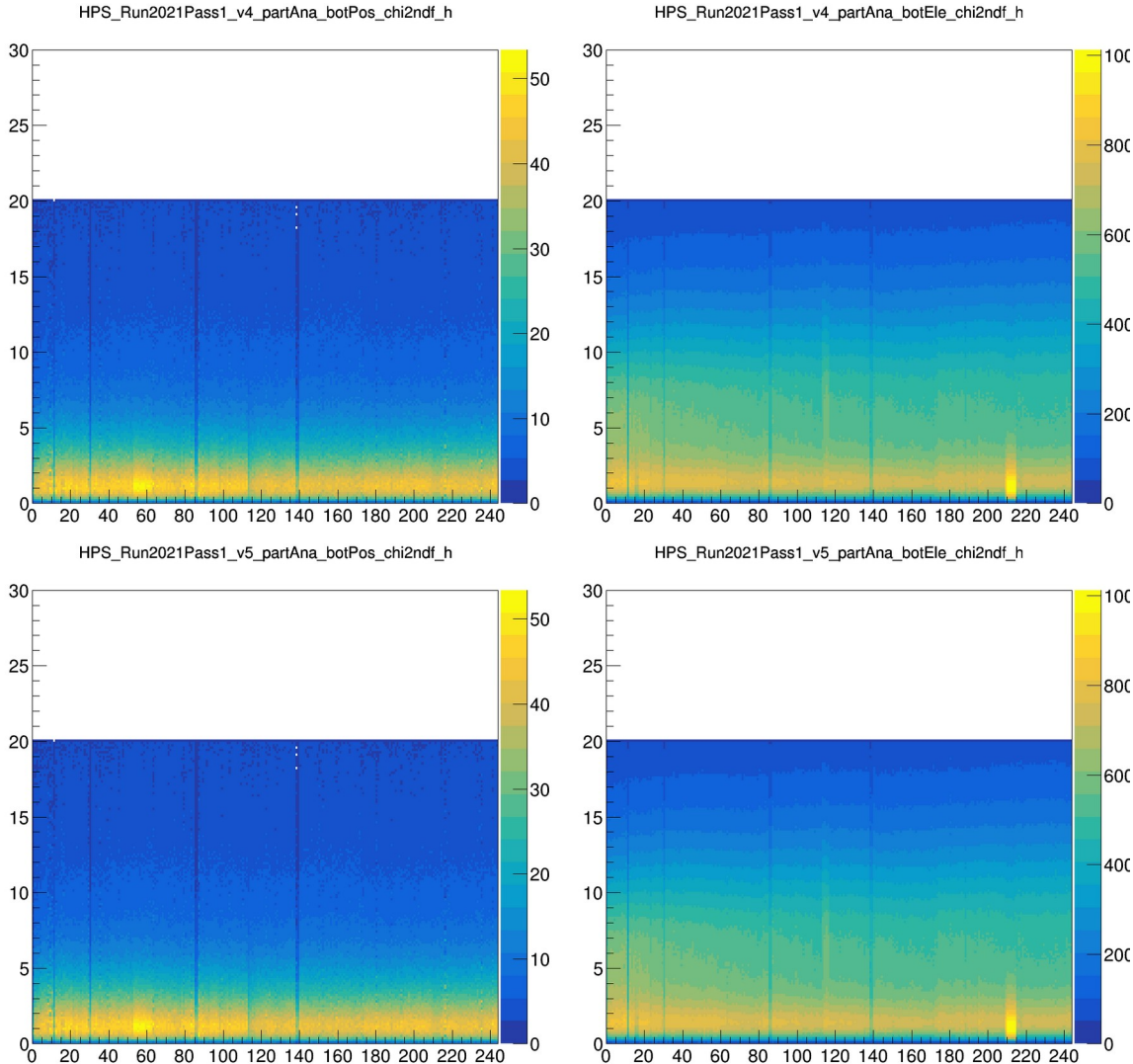- We can also see the movements in the track hit multiplicity lays of the hits

7

Top Track P and Cluster E

HPS_Run2021Pass1_v4_partAna_topEle_p_h

HPS_Run2021Pass1_v4_partAna_topEle_clusE_h

HPS_Run2021Pass1_v5_partAna_topEle_p_h

HPS_Run2021Pass1_v5_partAna_topEle_clusE_h

- Cluster energy peak seems to be less stable than track momentum

  - Reminder that these are from FEE trigger skims

8

Track chi2/ndf in the Bottom
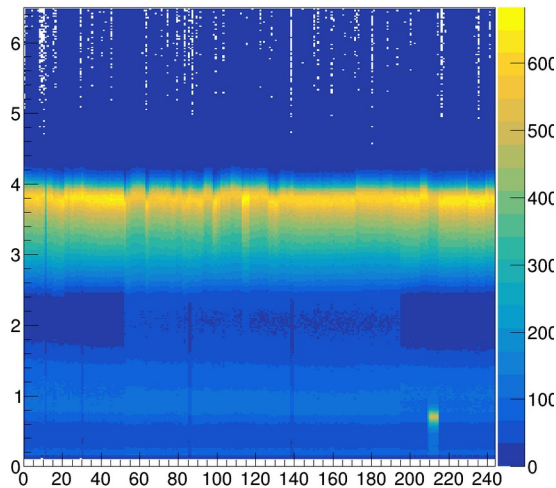
HPS_Run2021Pass1_v4_partAna_botPos_chi2ndf_h

HPS_Run2021Pass1_v4_partAna_botEle_chi2ndf_h

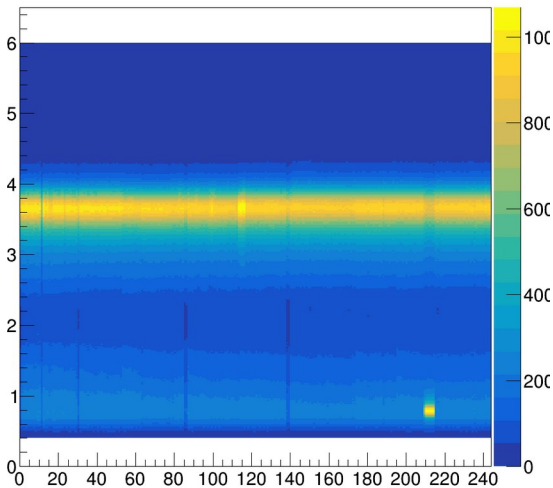HPS_Run2021Pass1_v5_partAna_botPos_chi2ndf_h

HPS_Run2021Pass1_v5_partAna_botEle_chi2ndf_h

- Looks pretty stable, but why do we have so many more low chi2/ndf tracks in run IDs ~210-215?

- There is potentially some room to have a few different alignment states for the bottom

9

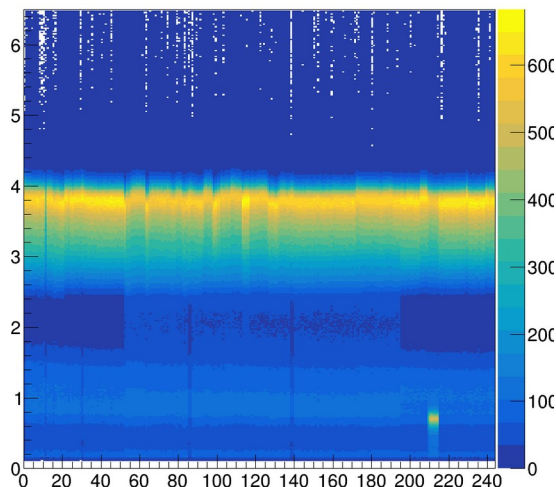# Track P and Cluster E for Bottom Electrons
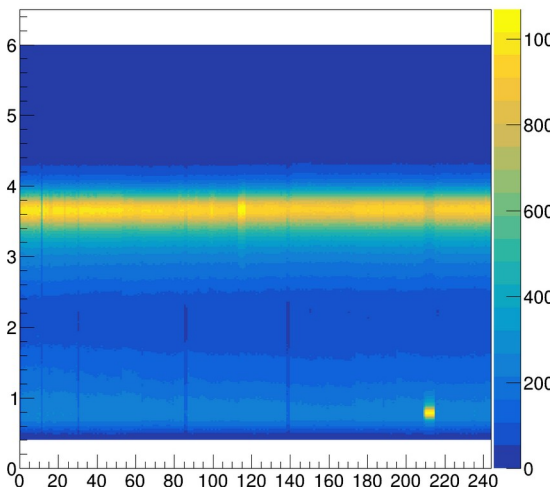
HPS_Run2021Pass1_v4_partAna_botEle_clusE_h

HPS_Run2021Pass1_v4_partAna_botEle_p_h
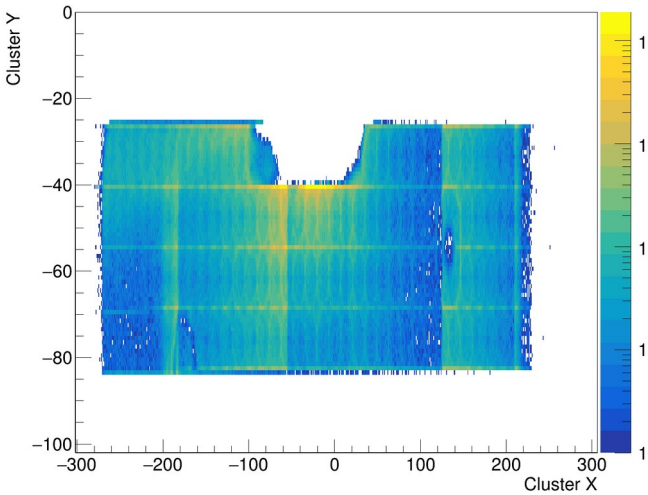
HPS_Run2021Pass1_v5_partAna_botEle_clusE_h
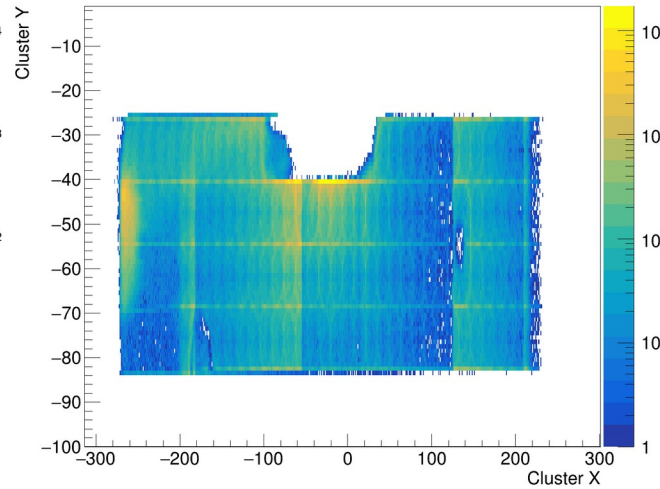
HPS_Run2021Pass1_v5_partAna_botEle_p_h

- We see some low momentum electrons in the bottom around run IDs 210-215

- FEE cluster energy peak in bottom seems less stable than track momentum peak

- Where are these low momentum clusters and energies in the FEE triggers coming from?
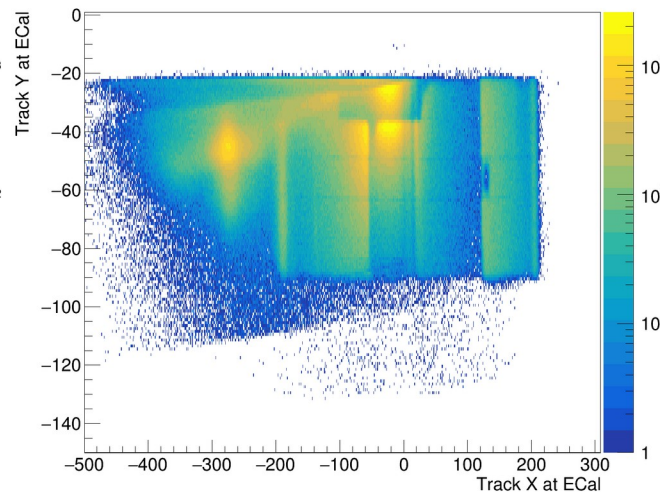
Bottom Track and Ecal Cluster Positions

- Left is not in 210-215, and right is

- Looks like Ecal has some fake FEE triggers on low momentum electrons that point to a specific crystal on the low x edge

- Note that Ecal and track projection plots have slightly different ranges in x

11

Discussion
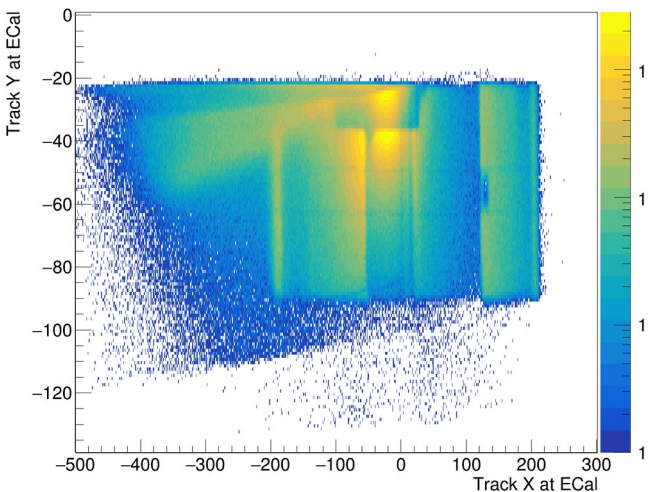
- Starting to dig into looking at plots summarizing the change of reconstructed parameters over all the runs

- Helps understand state of alignment through the entire 2021 run

  - Starting to get a picture of how many alignment states we need

  - There are a lot of states shown in this talk, do we need this many? Could we get away with less? Don't think we need more

- There are a lot of features in many other variable for us to dig into and understand, we have some software now to start really digging in deep

  - This stuff takes a while, so much stuff to look through and digest

- Overall the bottom doesn't seem to move as much, but it does show some evidence of a little drift throughout 2021, but this is a topic for another talk