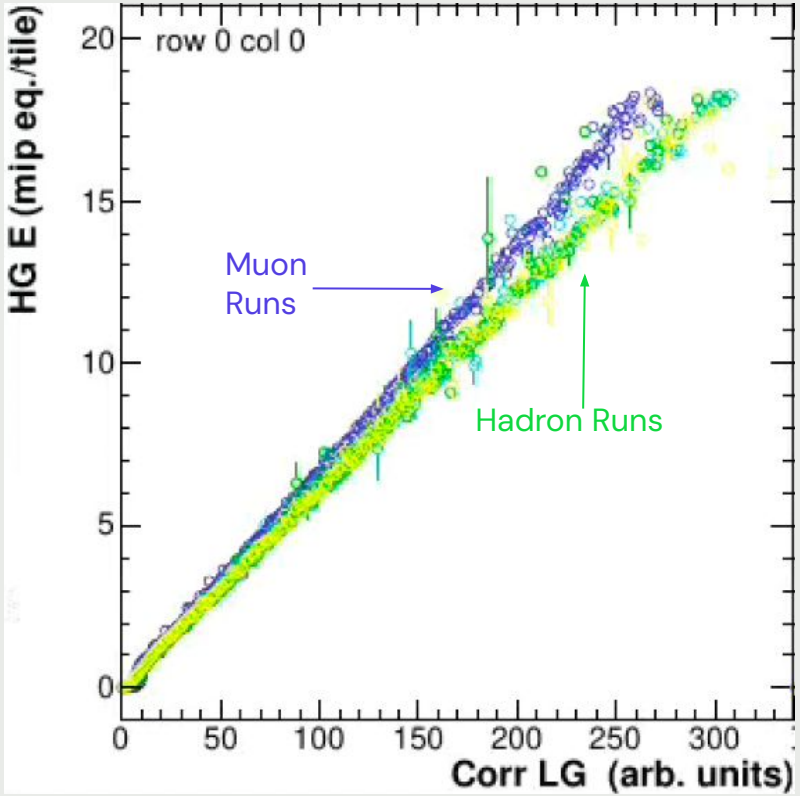
Investigating the High Gain vs Low Gain Discrepancy with MIP Plots

Leah Shafer 07/21/2025

Mentors: Adam Gibson-Even, Paul Nord

The HG vs LG Discrepancy

- All runs should have the same correlation between HG and LG
- Distinctly different slopes between different run types
- This plot is calibrated physics files plotted using the Compare code with all events



Method

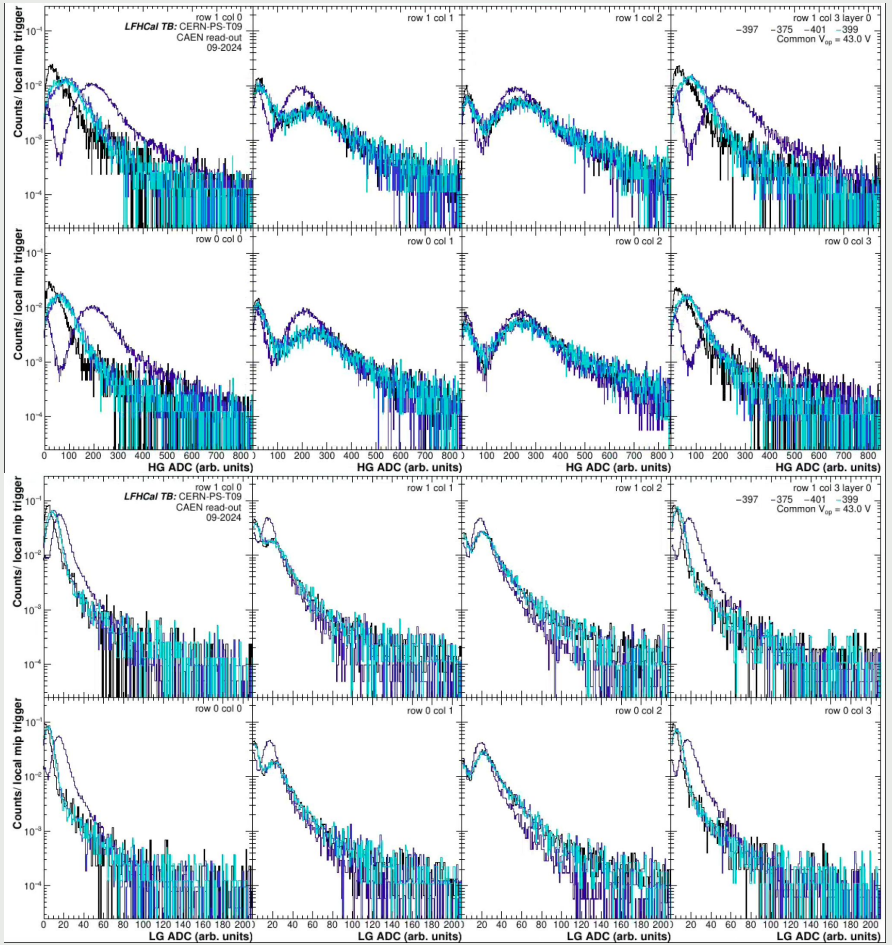
- Make plots to compare the different runs
  - Mainly done by finding how the MIP peak shifts between different runs and in different gain settings

1D Energy Plots

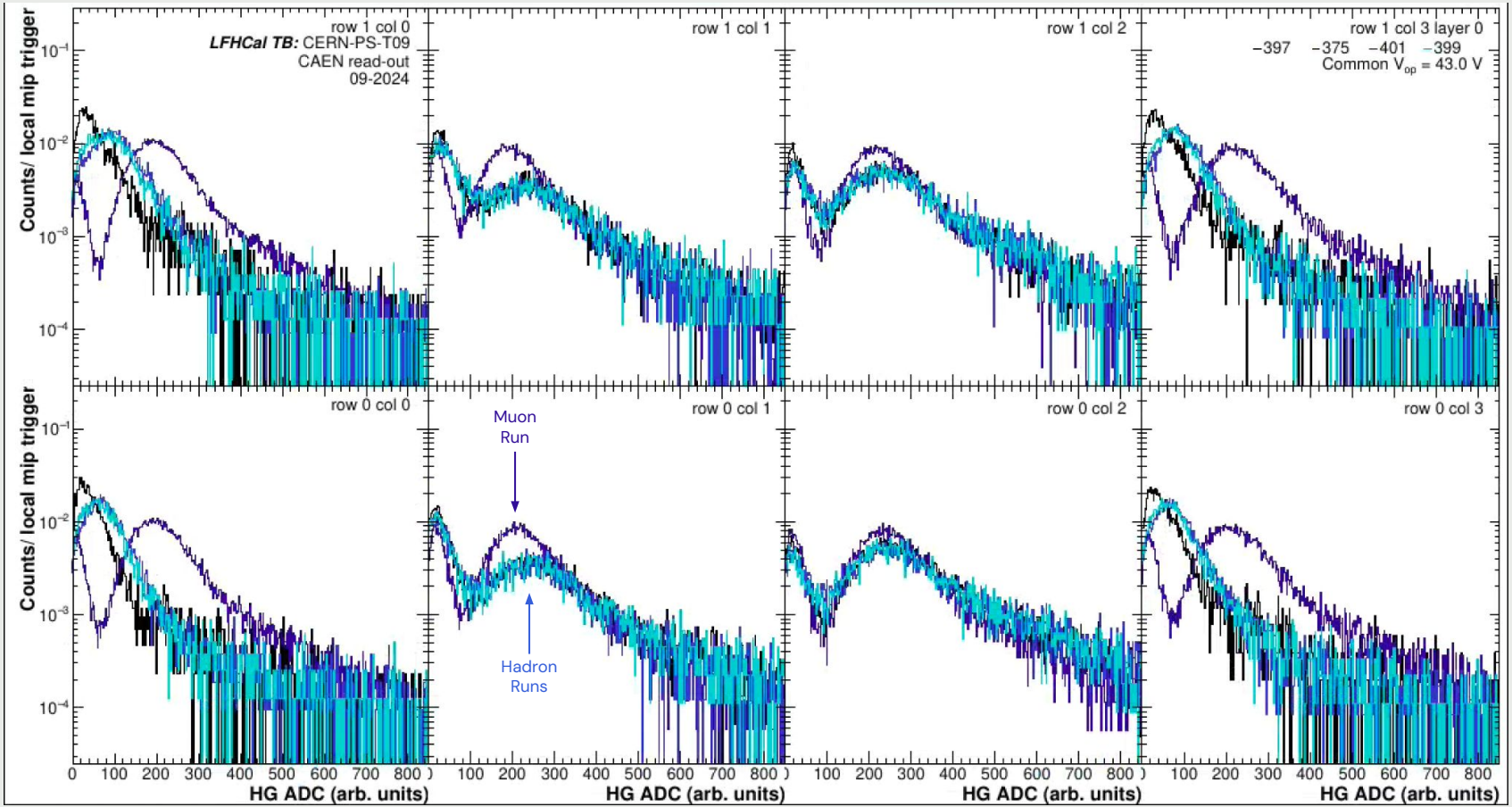
Originally we aimed to make the Compare code work with physics files which we had issues with

We decided to run the hadron runs through the calibration steps to make a calib file out of them and use those in compare

This gave us these 1D energy plots of locally muon triggered events



Purple = muon run
Black, Blue, Teal = hadron runs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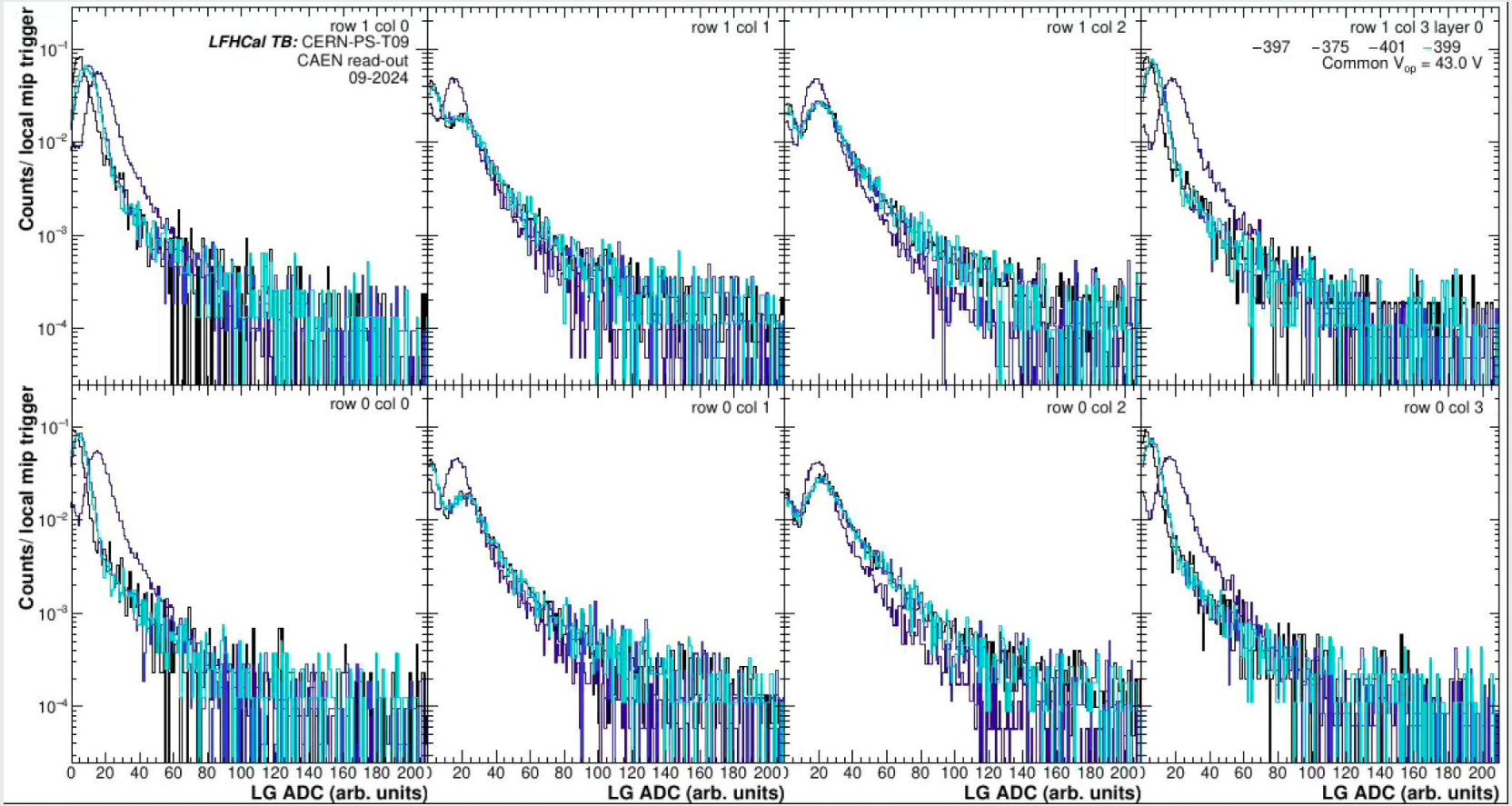
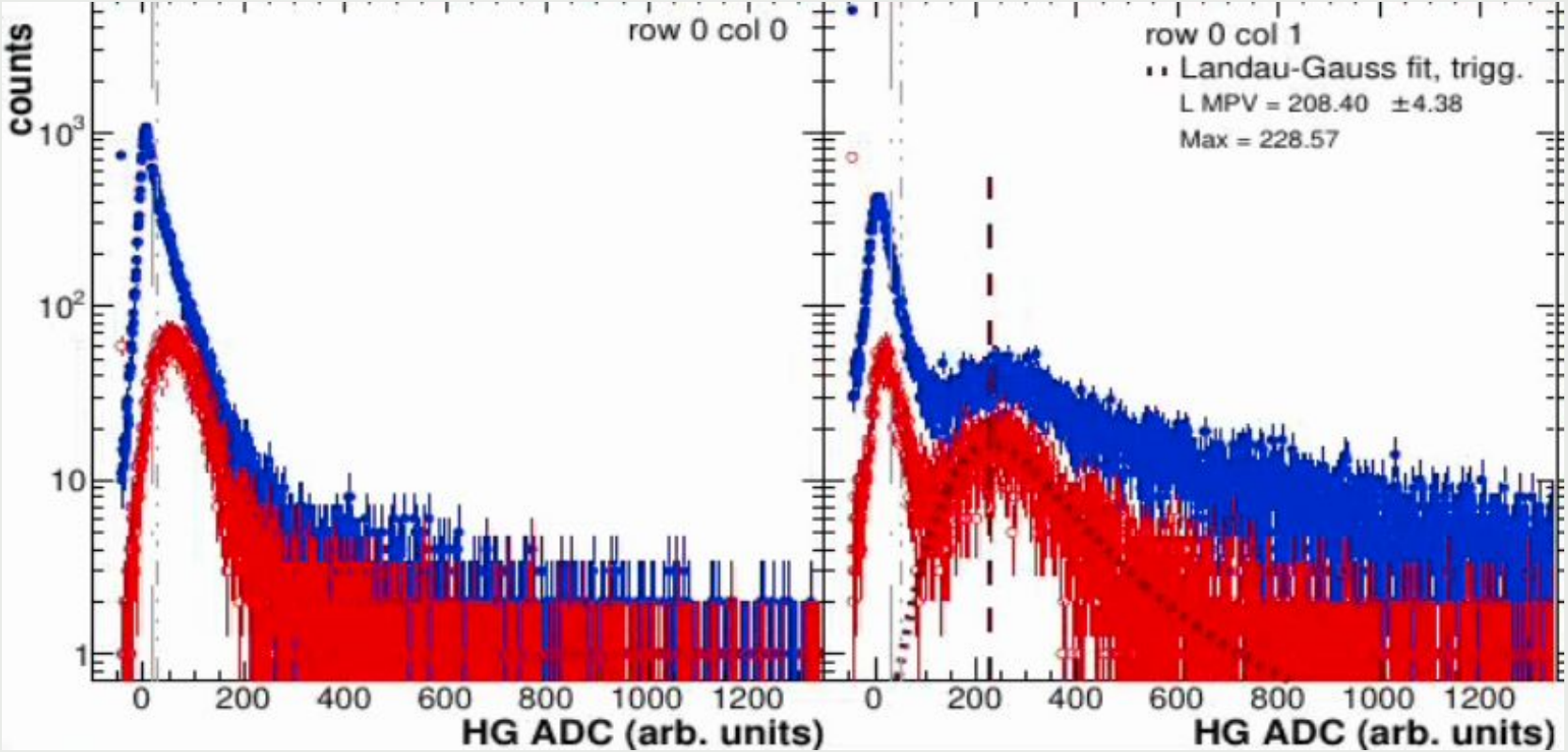
CAEN read-out
09-2024
row 1 col 1
row 1 col 2
row 1 col 3 layer 0
−397 −375 −401 −399
Common V_op = 43.0 V
row 0 col 0
row 0 col 1
row 0 col 2
row 0 col 3
Muon Run
Hadron Runs
Counts/ local mip trigger
HG ADC (arb. units)

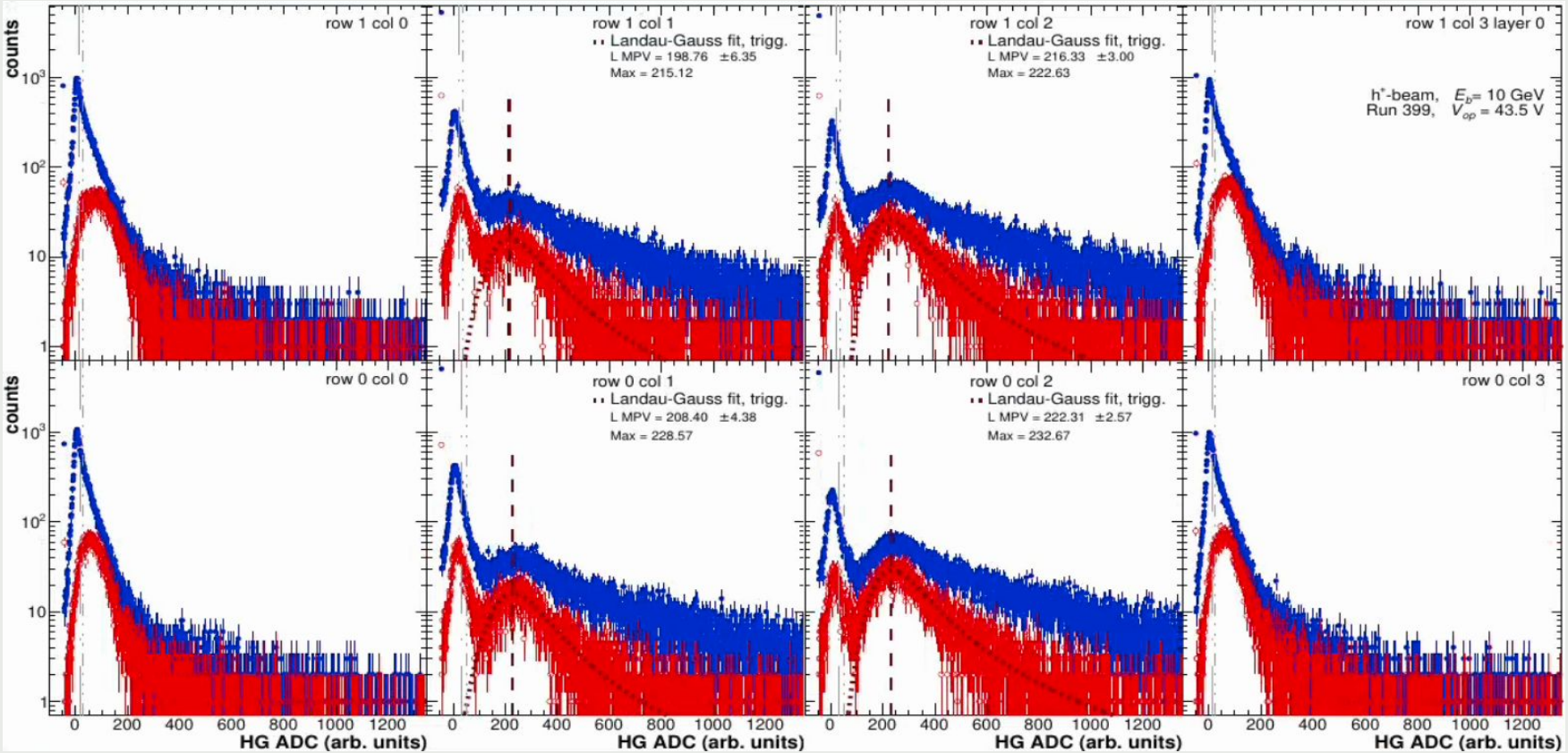

row 1 col 0
LFHCal TB: CERN-PS-T09
CAEN read-out
09-2024
row 1 col 1
row 1 col 2
row 1 col 3 layer 0
−397 −375 −401 −399
Common V_op = 43.0 V
row 0 col 0
row 0 col 1
row 0 col 2
row 0 col 3
Counts/ local mip trigger
LG ADC (arb. units)

Hadron MIP Peak Fits

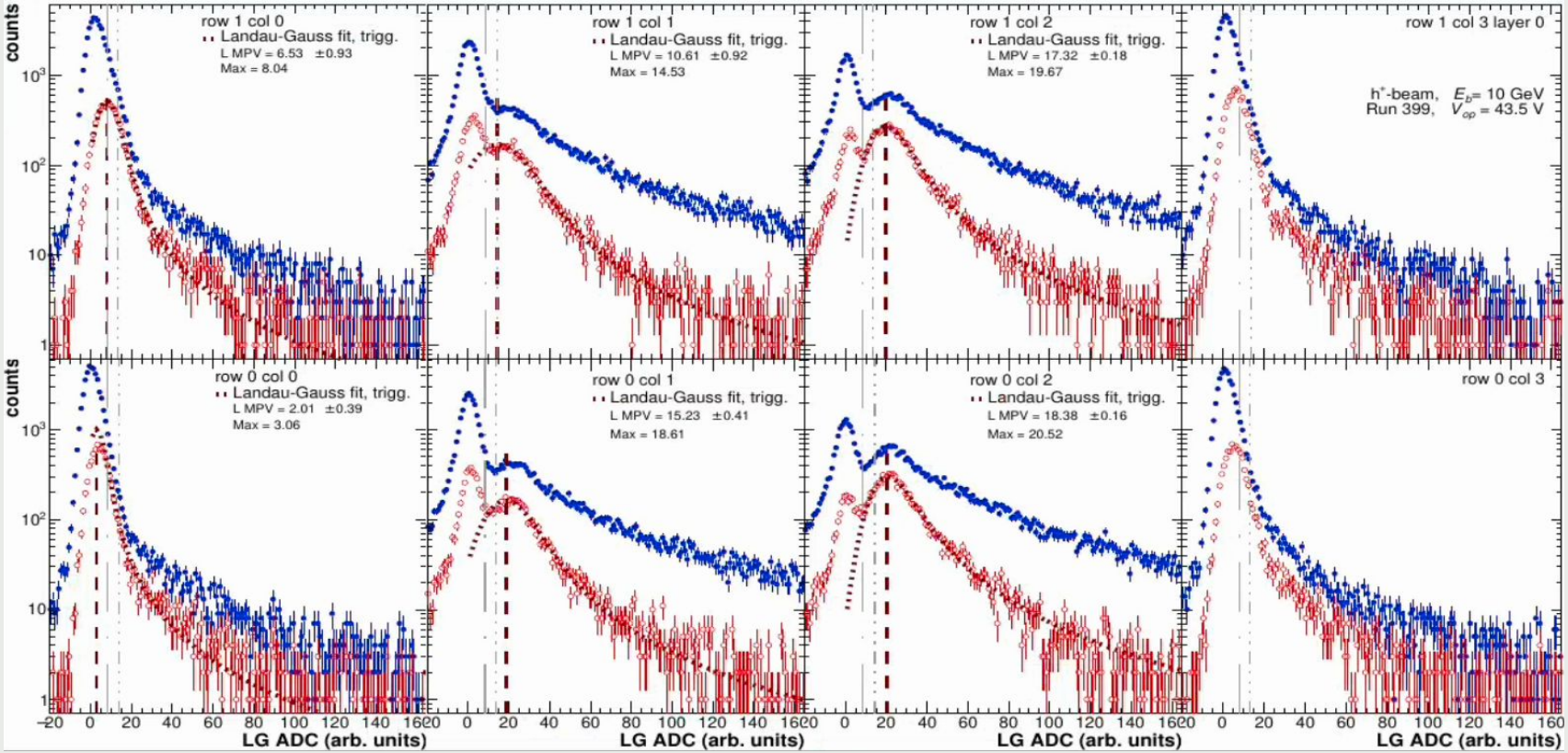
Blue = total events
Red = locally muon triggered events



Hadron MIP Peak Fits - HG

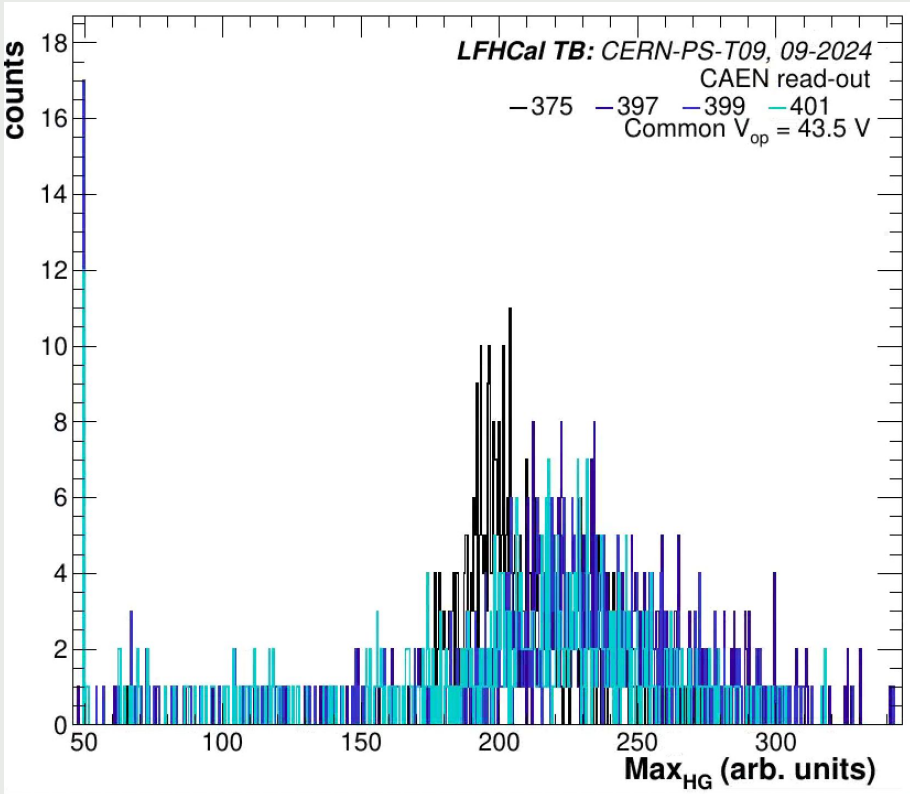


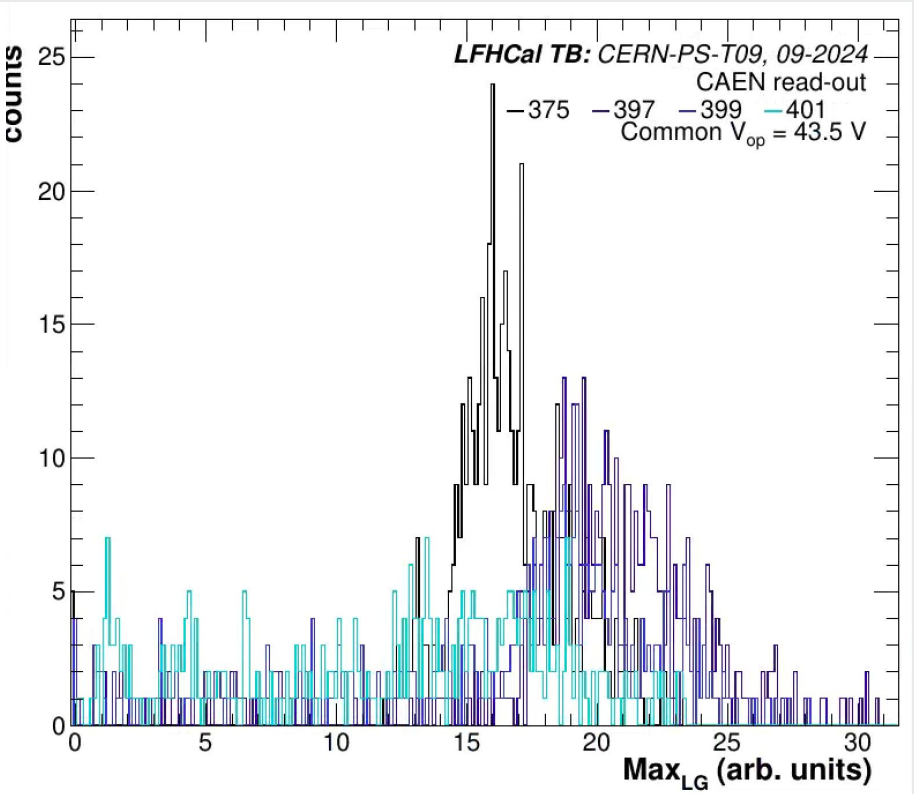
Hadron MIP Peak Fits - LG



MIP Peak Max Comparison Graphs

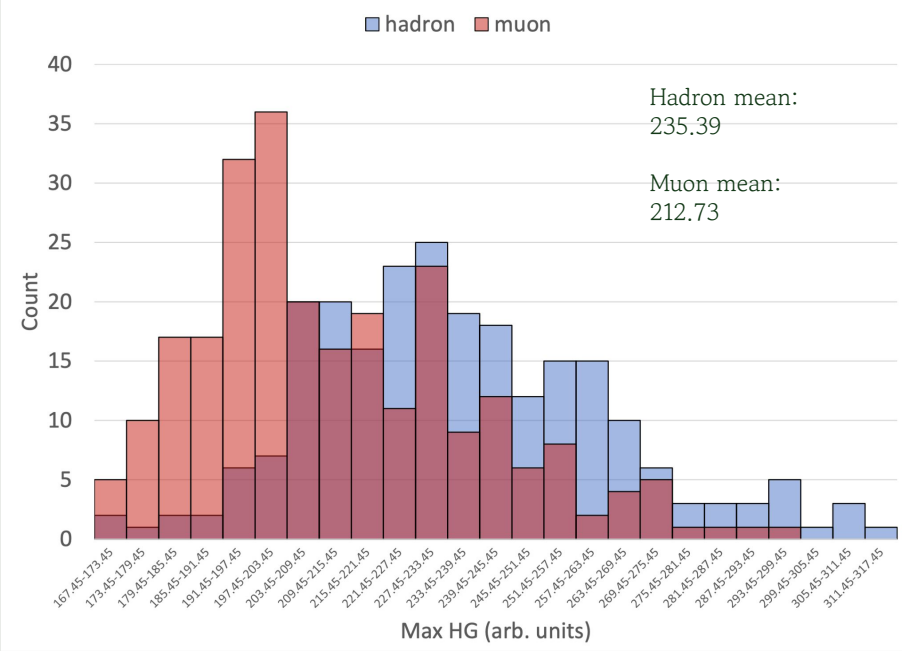
Black = muon run
Purple, Blue, Teal = hadron runs

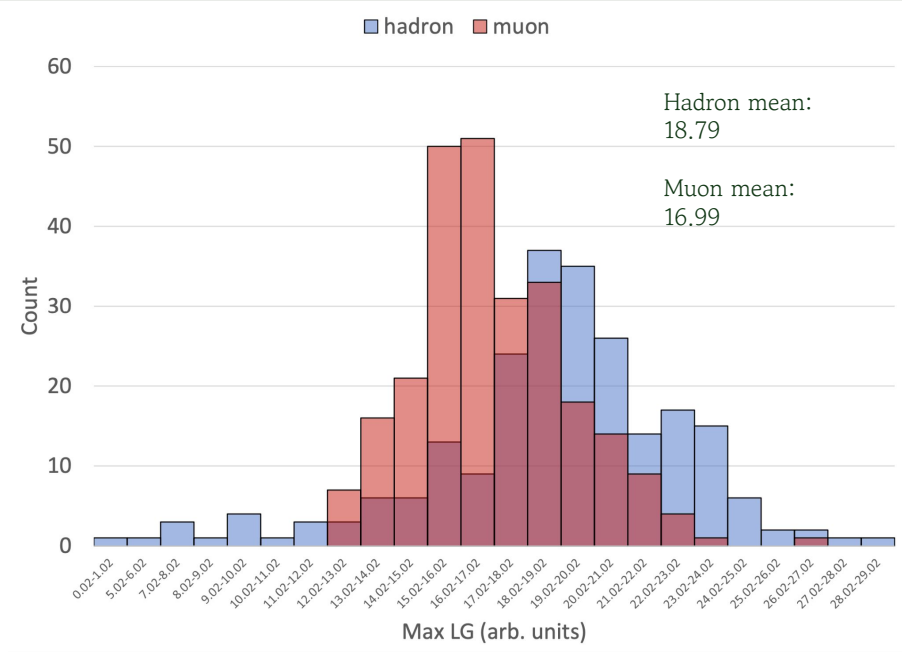




Cleaned Max Comparison Graphs

We took out just the maxes from the center 4 tiles which are the most consistent of the 8





The difference between the means of the two runs are significantly different

The ratio of the LG over HG means are nearly the same (hadron: 0.0798 and muon: 0.0799)

Summary

We have created 1D energy graphs of muon and hadron runs to aid in the investigation of the HG/LG discrepancy

These plots are from the calibration code and compare code and are locally muon triggered events

They have shown us that there is a shift in the MIP peaks between muon and hadron runs in both LG and HG

Next Steps

Make diagonal plots for the four center tiles (i.e. for trusted MIPs) and see whether they have the discrepancy between muon and hadron runs

Further investigate when we see this discrepancy in the HG/LG (e.g. muon tagged or not; which cells; for plausible MIPs; for shifted pedestals; for which energy ranges; etc.)

Questions