

A quick look at the laser data

DUNE IoLaser meeting

October 15 2024



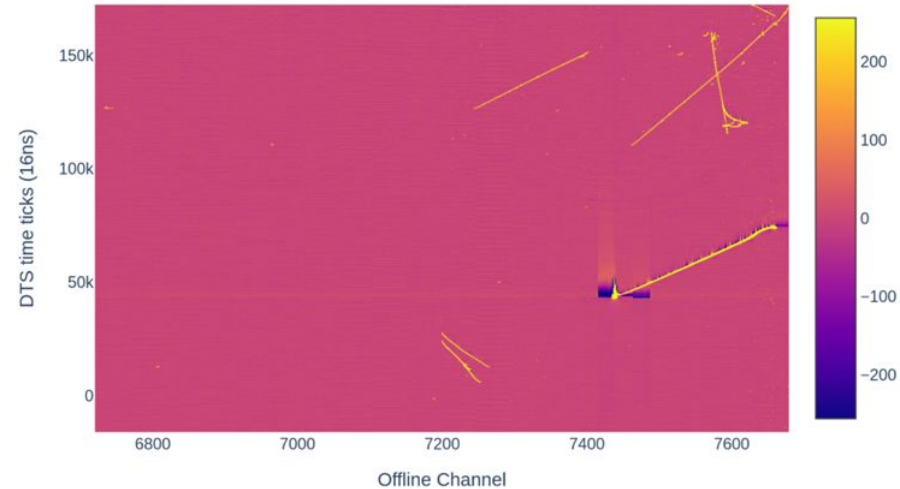
LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS
partículas e tecnologia

Cristóvão Vilela, for the LIP team

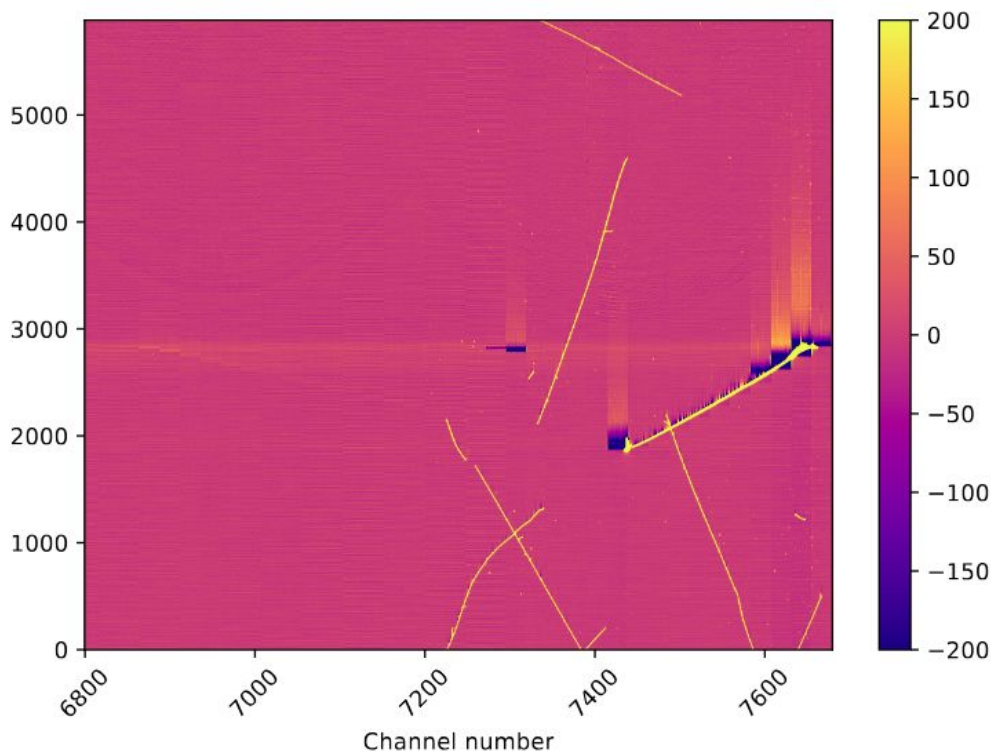
Data extraction

- `dqmtools` used to produce event displays.
- Hacked the code to dump all the information used to produce the event display into a pickle file.
- Inspect the data with standalone python script.
- This is clearly not a streamlined workflow and it's not suitable for large-scale analysis.
- The goal is just to start looking at the data in a way that compares apples-to-apples with the event displays we are used to.

Run 29058, Trigger 2434, APA2 Plane 2
Trigger Type (CIBLaserTriggerP1), 2024-09-03 11:20:37+02:00 (CERN)



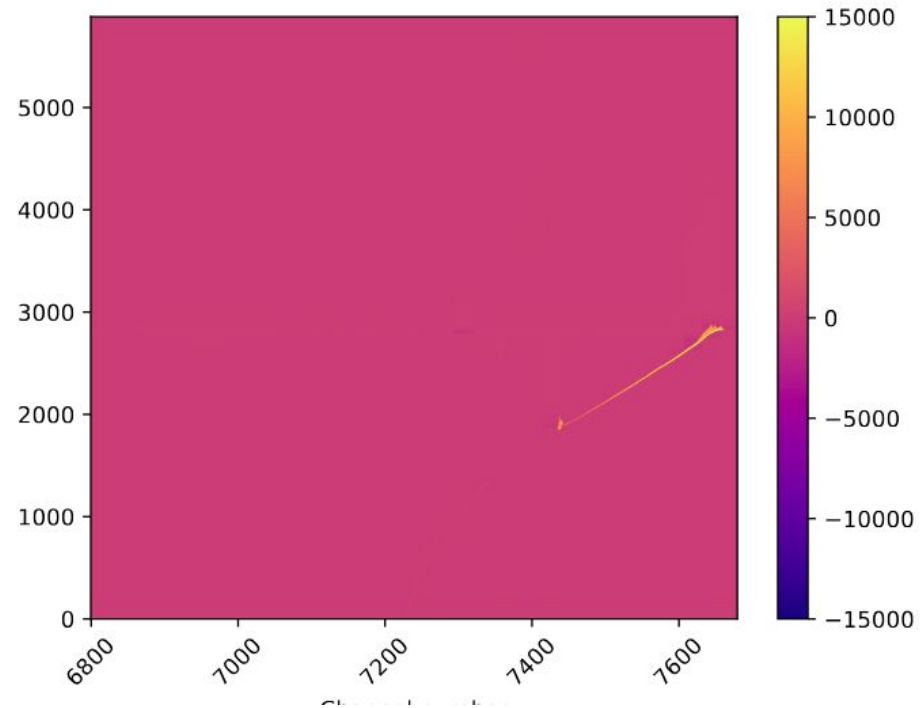
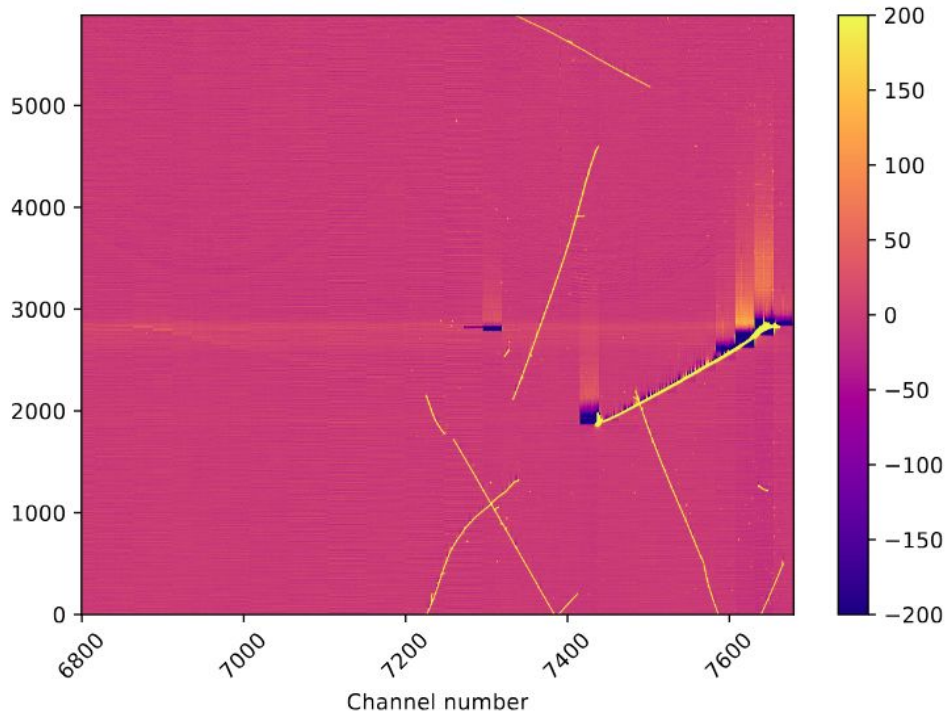
Reproducing event display



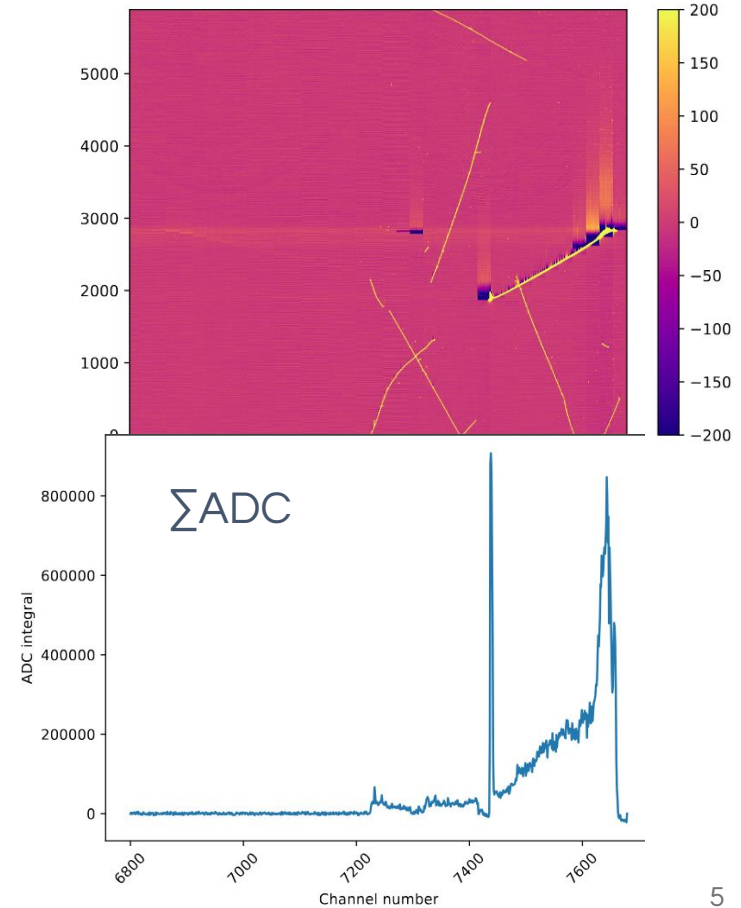
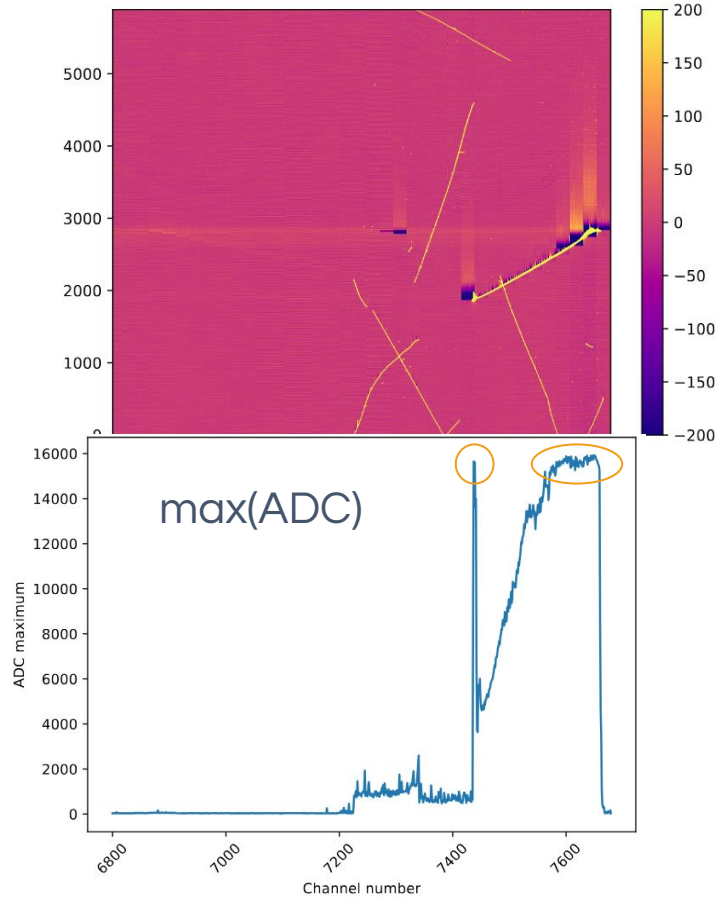
- Draw ADC counts as a function of channel number and clock tick.
- Subtract the median of each wire to normalise the baseline.
 - The median is pre-calculated in `dqmtools` and saved to our pickle file.

Laser track intensity

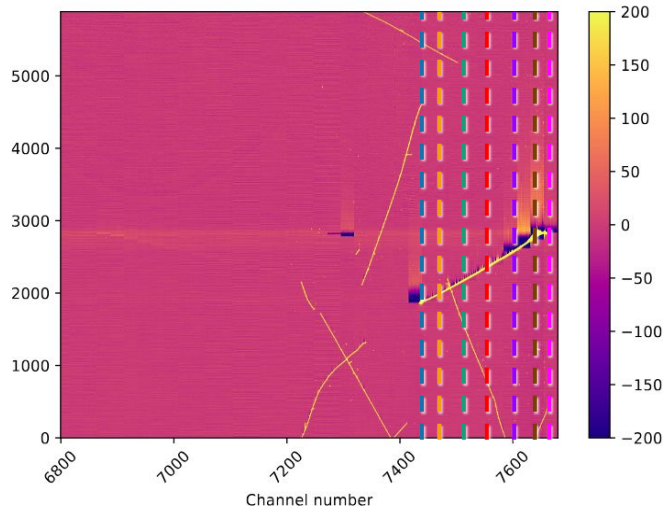
- Same event left and right – colour scale range increased by a factor of 75 on the right!
- At 15 mJ the laser track is much more intense than a MIP.
- Amount of ionisation seems to increase along the laser track (?)



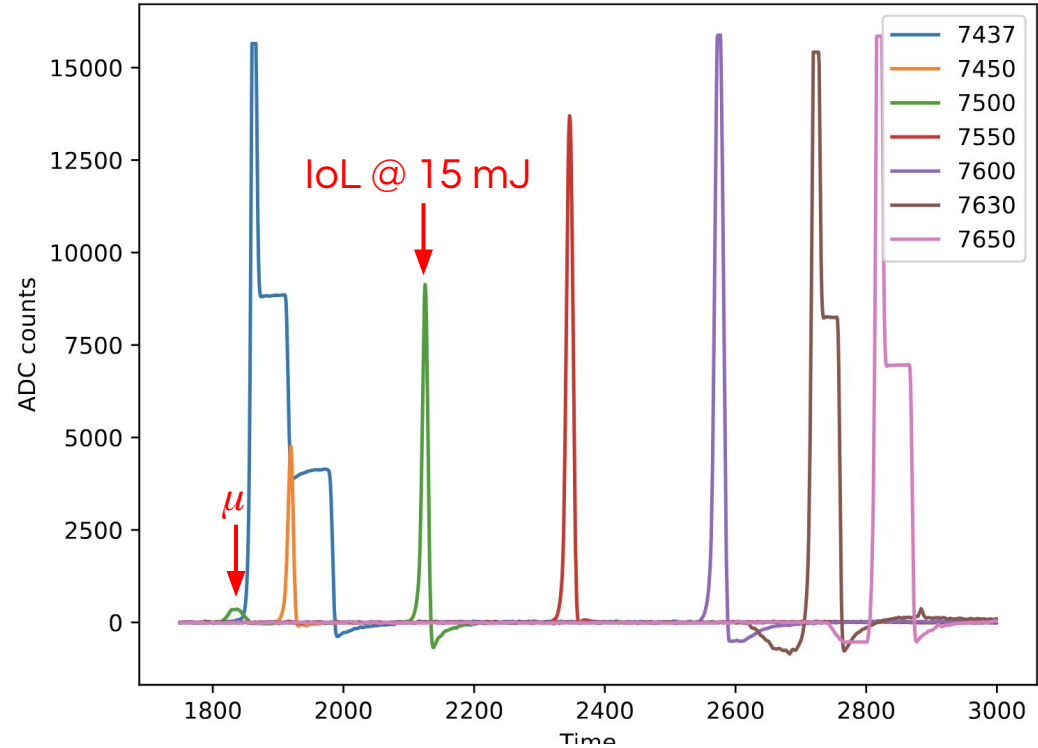
TPC saturation



Wire traces

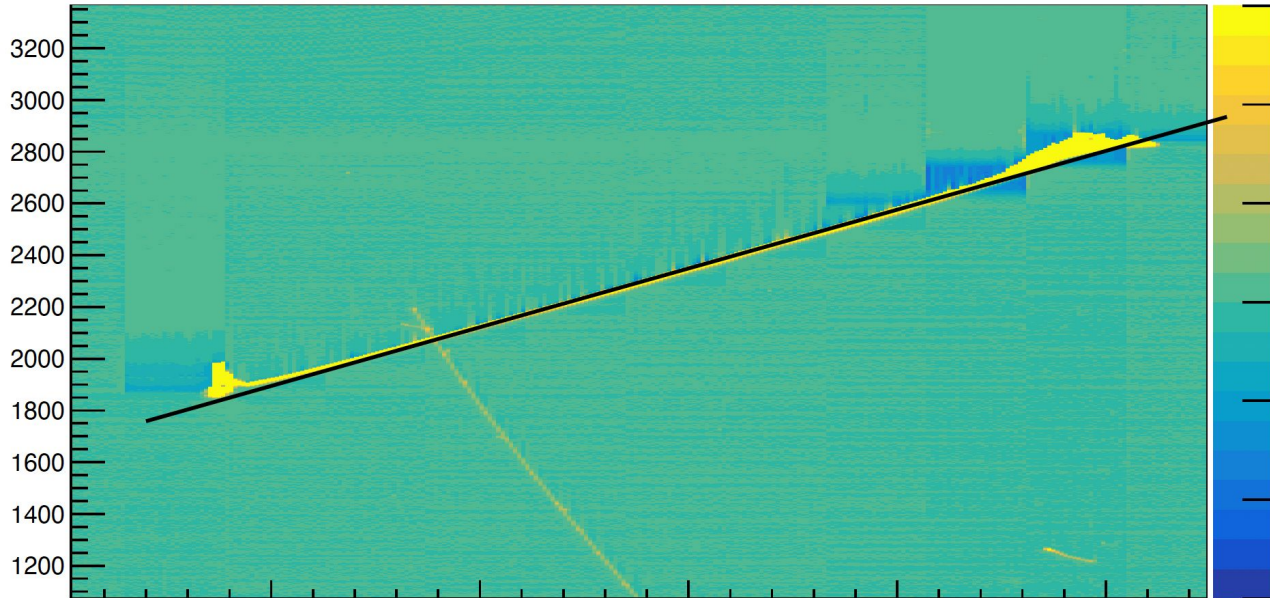


- IoL to muon peak height ratio:
 $9135 / 354 = 26$



Laser track reconstruction

- Hough transform pattern-matching algorithm used to successfully reconstruct laser track.
 - At this intensity, there is no ambiguity with muon tracks.
 - Algorithm is capable of iteratively identifying several tracks.
 - Muons or laser reflections.



Summary

- Hacked `qdmtools` for an initial quick look at the laser data.
- At 15 mJ, laser ionises much more than a MIP.
 - The amount of ionisation seems to increase along the laser track.
 - At the very beginning and towards the end of the track, the TPC signals saturate.
 - Discontinuities seen in wire traces when the signals saturate.
- Fast track reconstruction algorithm based on Hough transform successfully reconstructs high-intensity laser track.