Preliminary Study on 2x2 Hot Pixels

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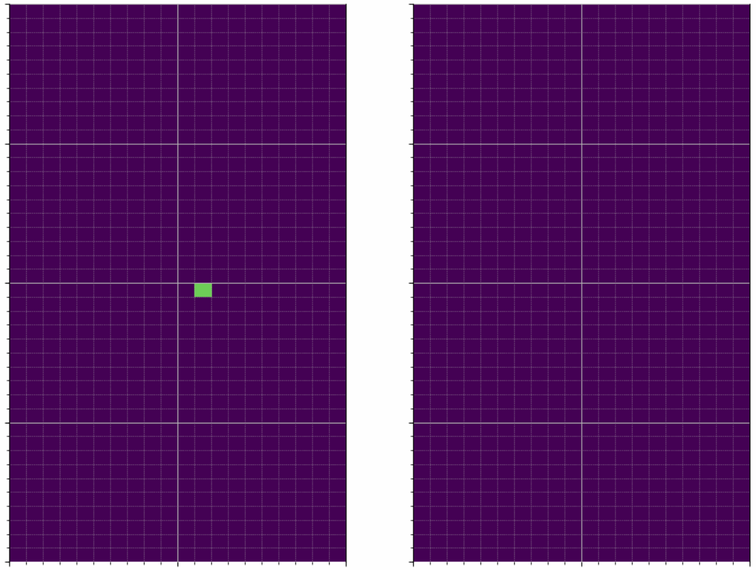
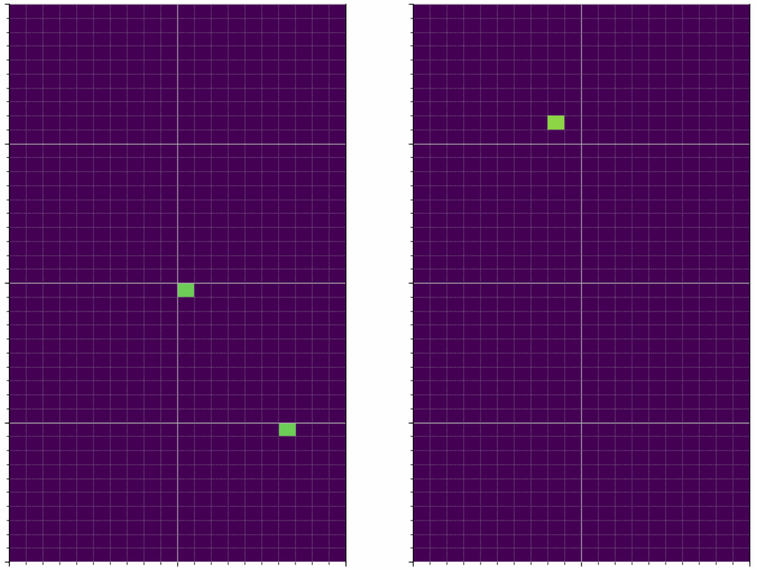
Searching for Charge Readout Hot Pixels in 2x2

- Characterizing chips triggering at high data rates can be valuable.
- Chip rates per spill are calculated using beam-only files.
- Threshold for labeling a chip as hot chip is adjusted spill by spill.
- Some chips are hot in more spills than other chips, which are closely looked at.

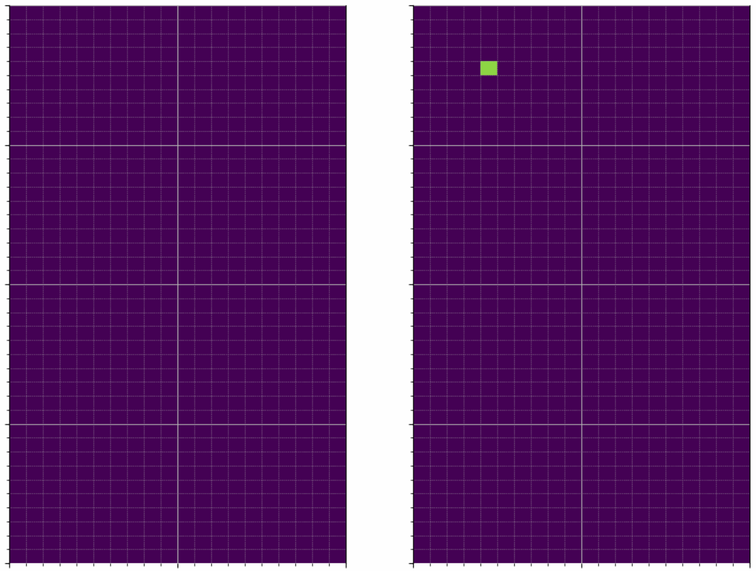
Module 0



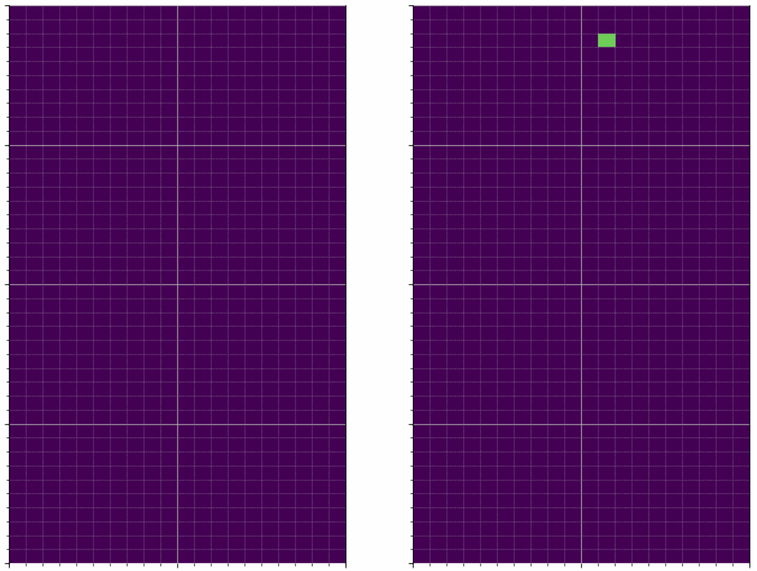
Module 1



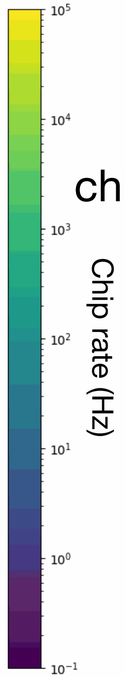
Module 2



Module 3



Chip rate per spill:
reflow v5 beam-only nominal



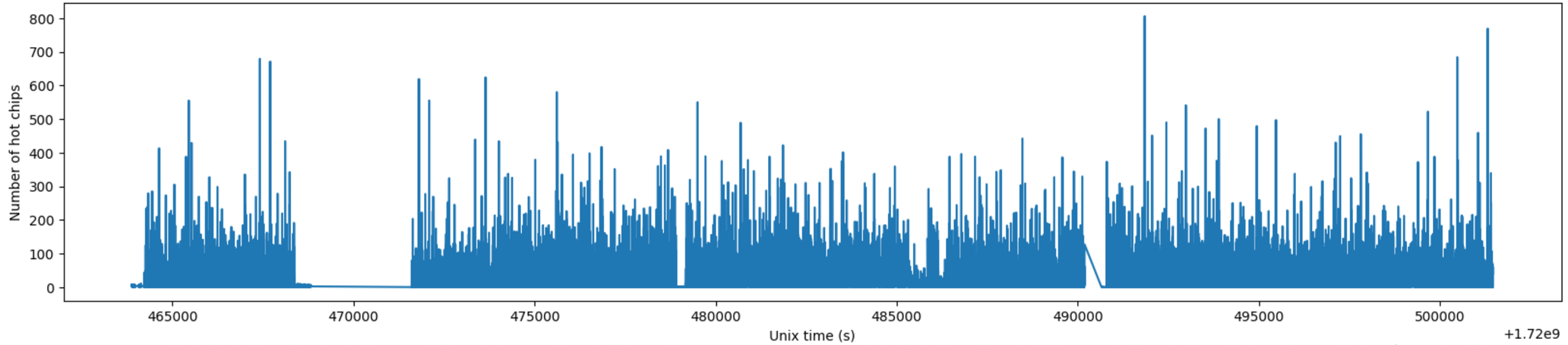
One event corresponds to one spill

$$\text{chip rate} = \frac{\text{chip id count per event}}{\text{event ts end - event ts start}}$$

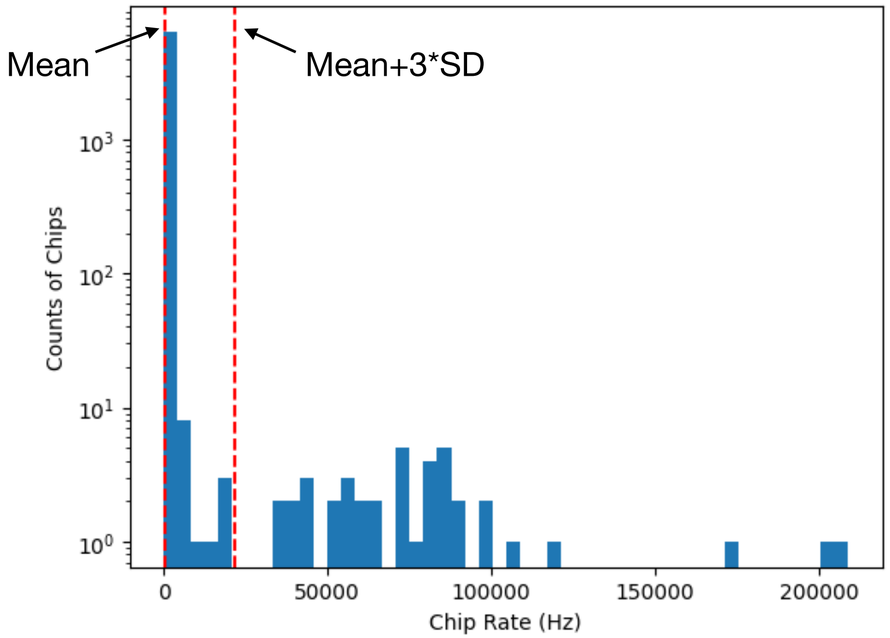
Found some chip_ids out of normal range (11~110)

packet-0050015-2024_07_08_13_37_49
to
packet-0050017-2024_07_08_14_03_28
(event 339)
~25 min

Number of hot chips in spills vs. Event unix timestamp

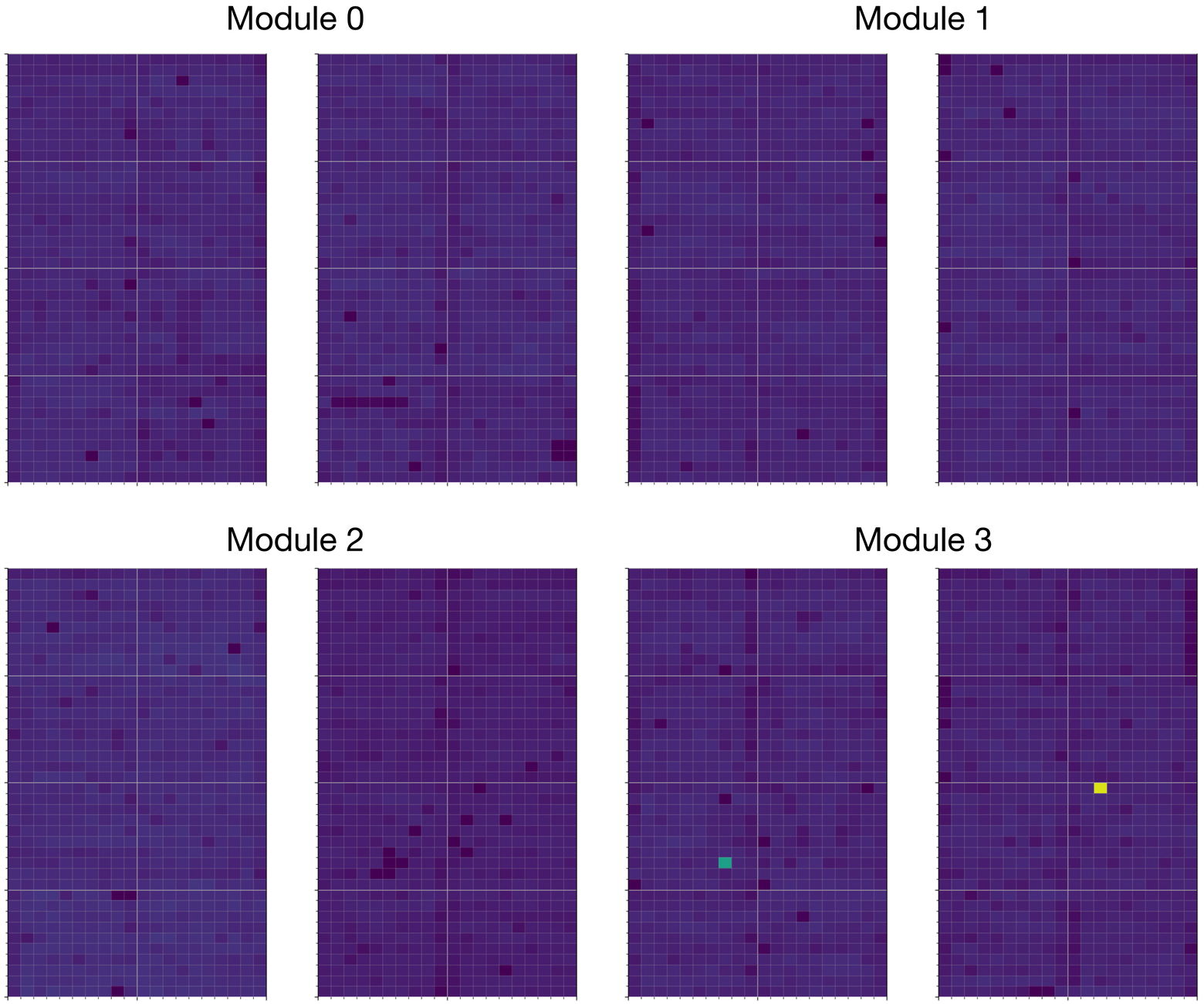


packet-0050015-2024_07_08_13_37_49 to packet-0050017-2024_07_08_23_54_32 (~10.5 hours)



Definition of hot chip: chip rate > mean +3*SD
Mean: mean over all chip rates per spill in 2x2
SD: standard deviation over all chip rates per spill in 2x2

Lower plot shows the distribution of chip rates of the first spill (event) in:
packet-0050017-2024_07_08_17_43_52

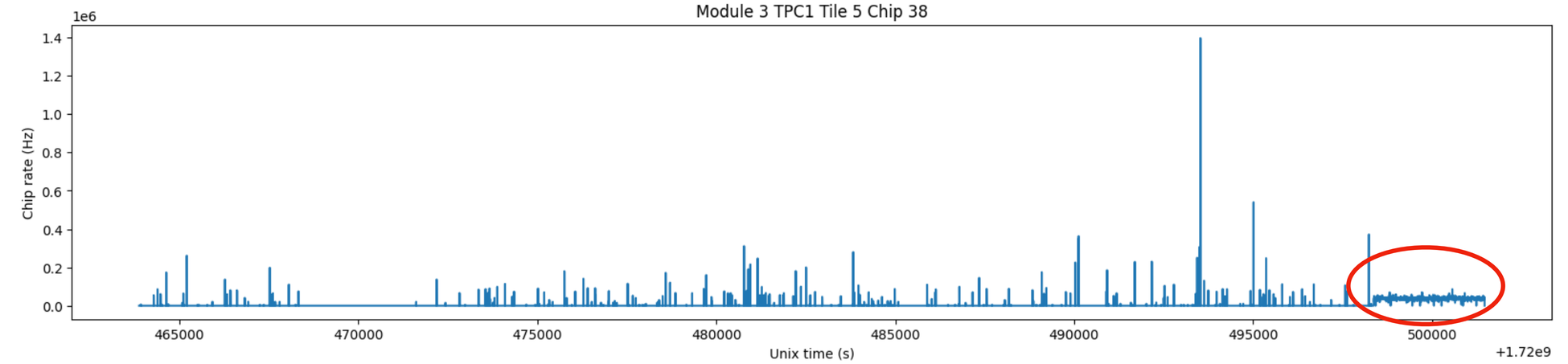


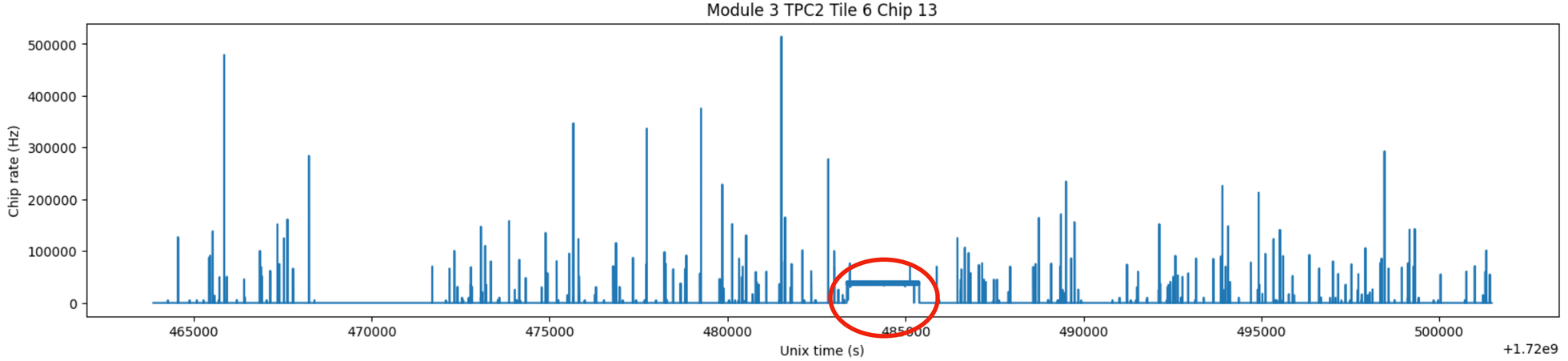
In how many spills a chip being hot during the runtime?

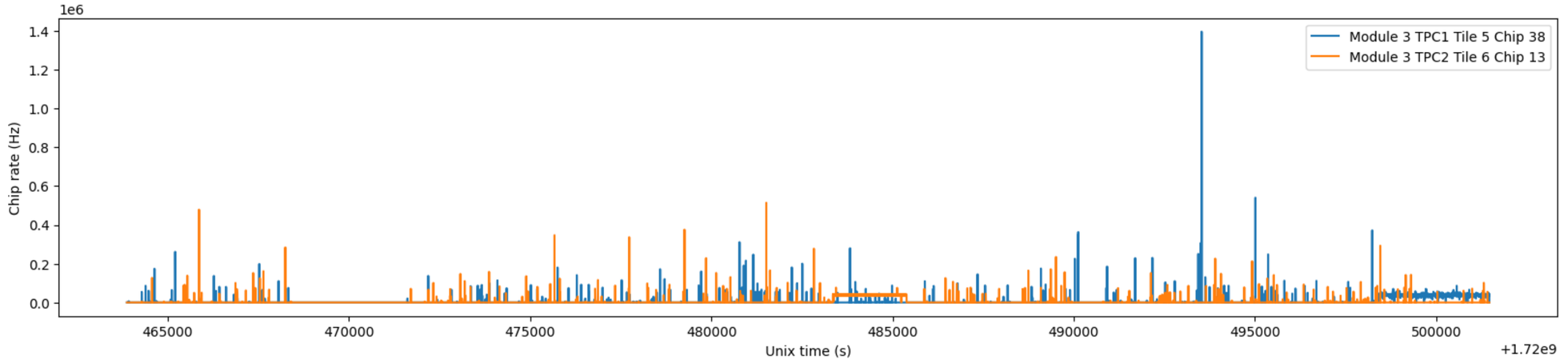
- Module 3 TPC1 Tile 5 Chip 38 (counts = 789)
- Module 3 TPC 2 Tile 6 Chip 13 (counts = 1324)

No chip is observed to be constantly on during this runtime

packet-0050015-2024_07_08_13_37_49 to packet-0050017-2024_07_08_23_54_32 (~10.5 hours, ~37800 spills total)


Module 3 TPC1 Tile 5 Chip 38
1e6
Chip rate (Hz)
Unix time (s)
+1.72e9


Module 3 TPC2 Tile 6 Chip 13
Chip rate (Hz)
Unix time (s)
+1.72e9


1e6
Module 3 TPC1 Tile 5 Chip 38
Module 3 TPC2 Tile 6 Chip 13
Chip rate (Hz)
Unix time (s)
+1.72e9

Next Steps

- Dig into the time periods when the two “hotter” chips in the previous page seem to have constant chip rates and see if similar pattern occurs in other time periods.
- Compare the “hotter” chip IDs with the hot chip list we have.
- Calculate and plot channel rate per spill for the “hotter” chips.
- Give a look at ADC distribution in spills.