Module 0 HV Run LArPix Noise & Stability

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ND-LAr Consortium Meeting

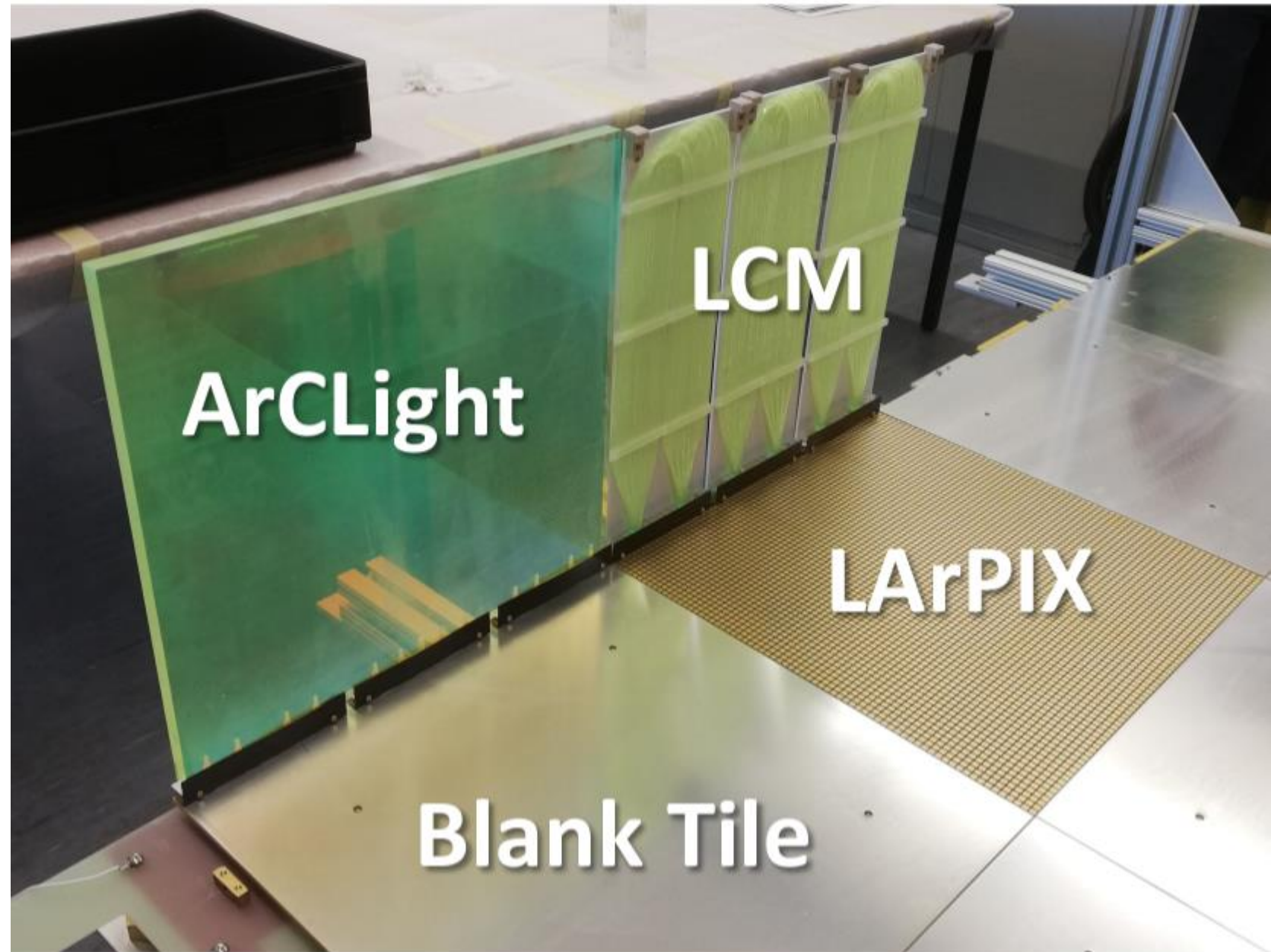December 10, 2020

Module 0 HV run at Bern

30 cm max drift distance

Operation of LAr purification and cooling for 2x2-scale module

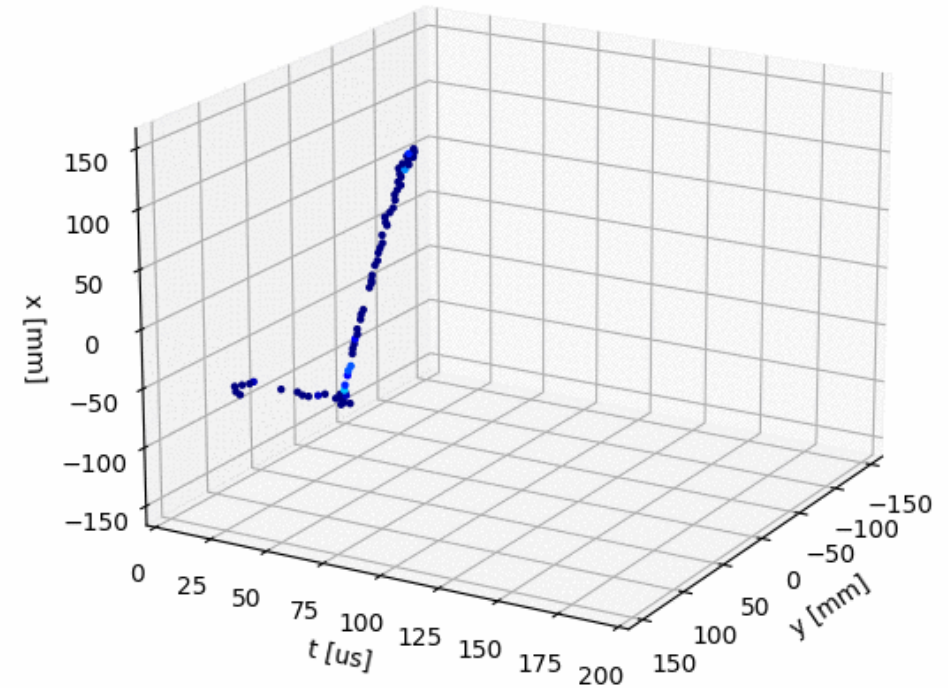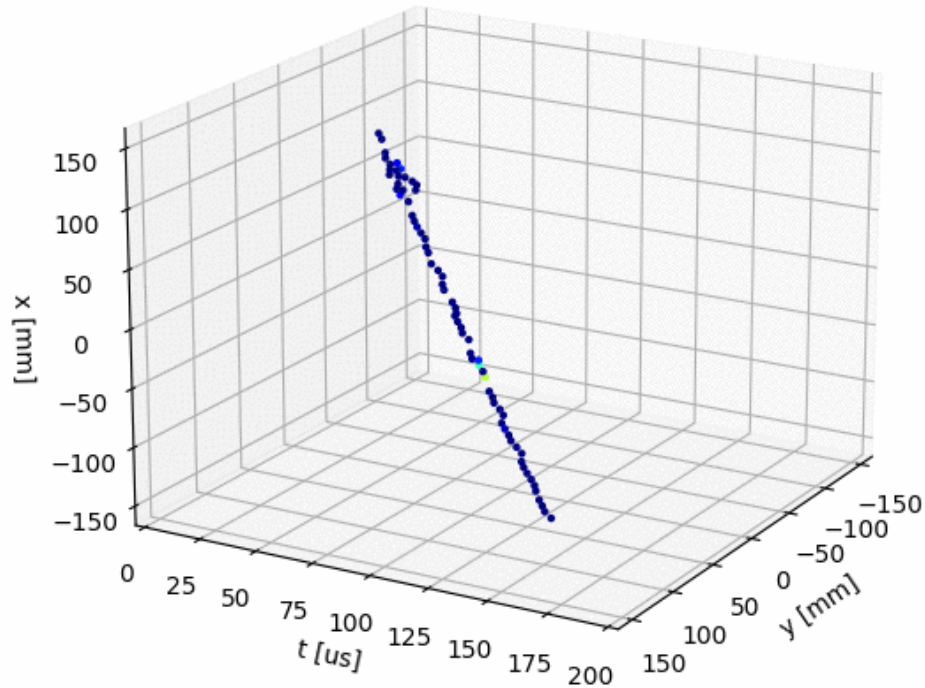First large-scale operation of low-profile resistive sheet field cage

One active anode (LArPix) + 15 dummy anodes (blank)

One ArCLight + one LCM

Charge readout

- imaging of cosmic rays
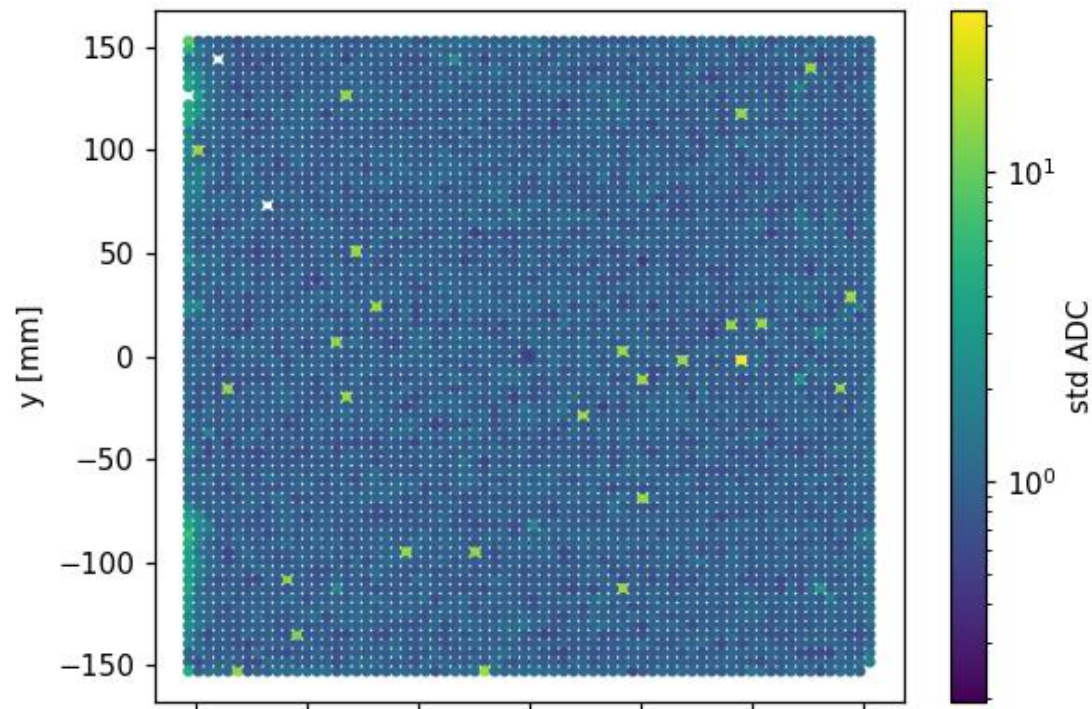- integration of light readout triggers to LArPix

Gaps in tracks - channel thresholds not optimized
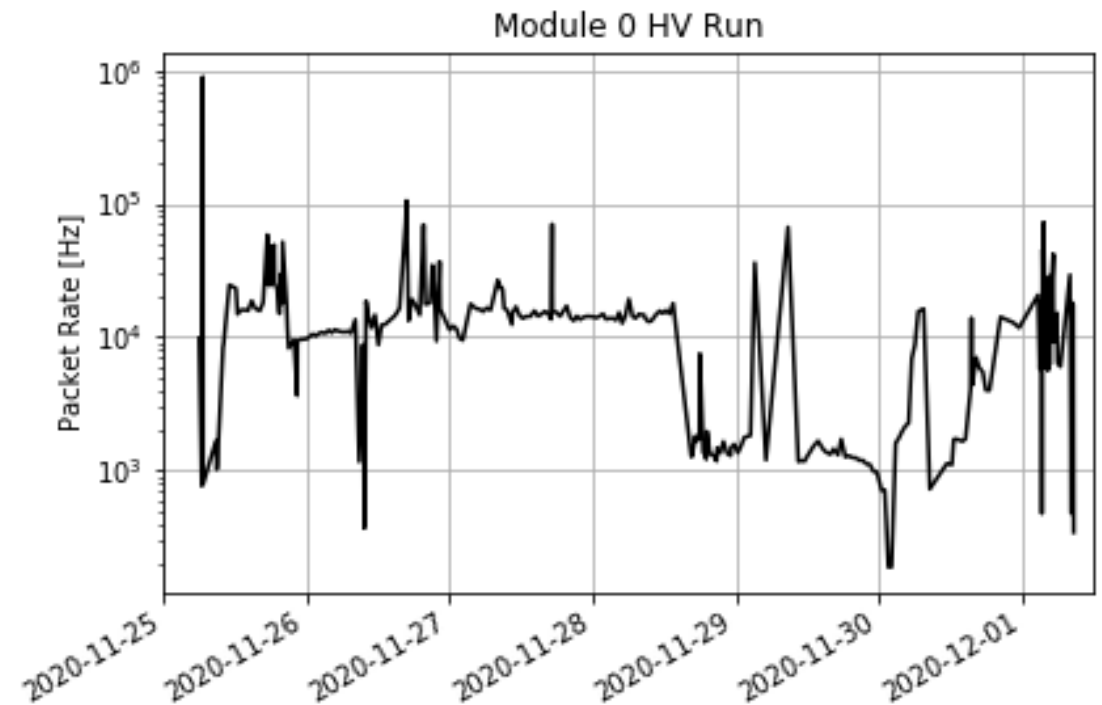
LArPix Noise & Instability

Excess noise
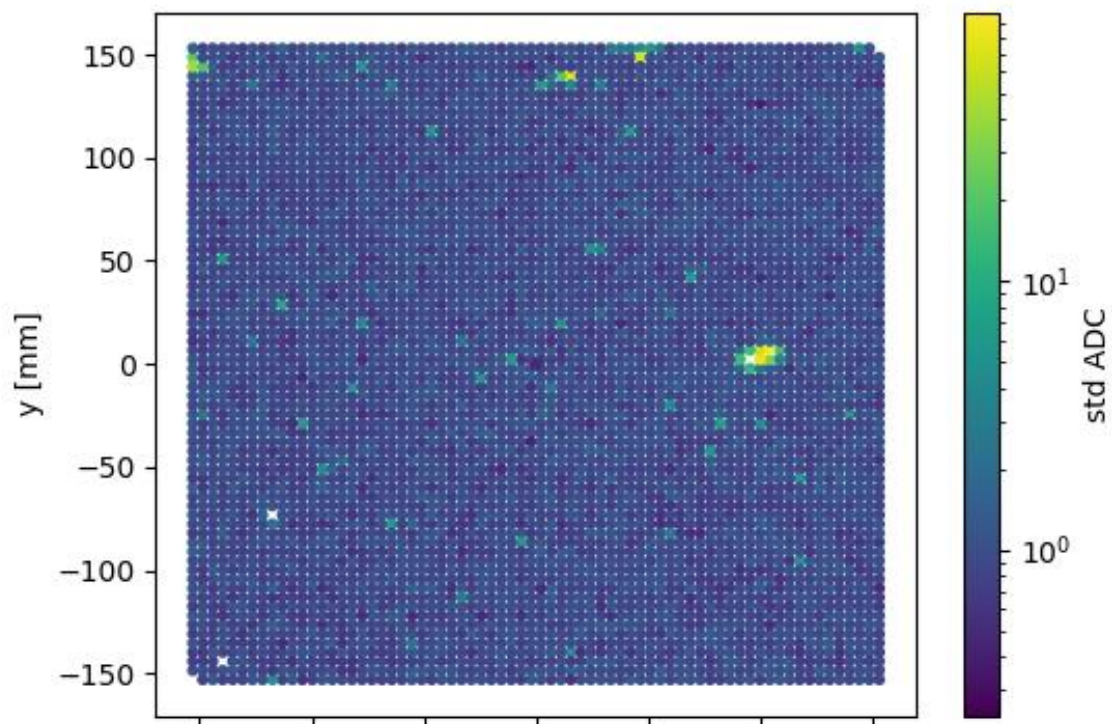
– in region of E-board attachment to tile

Excess hits
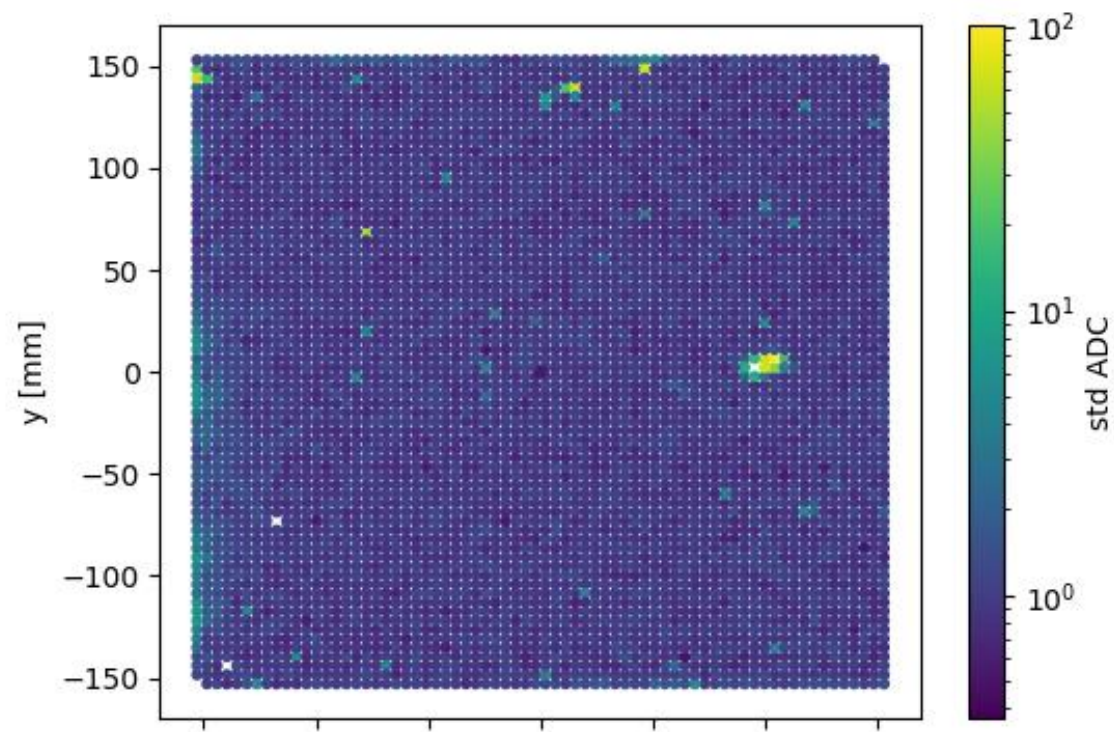
- intermittent non-physical hits

References at warm before run
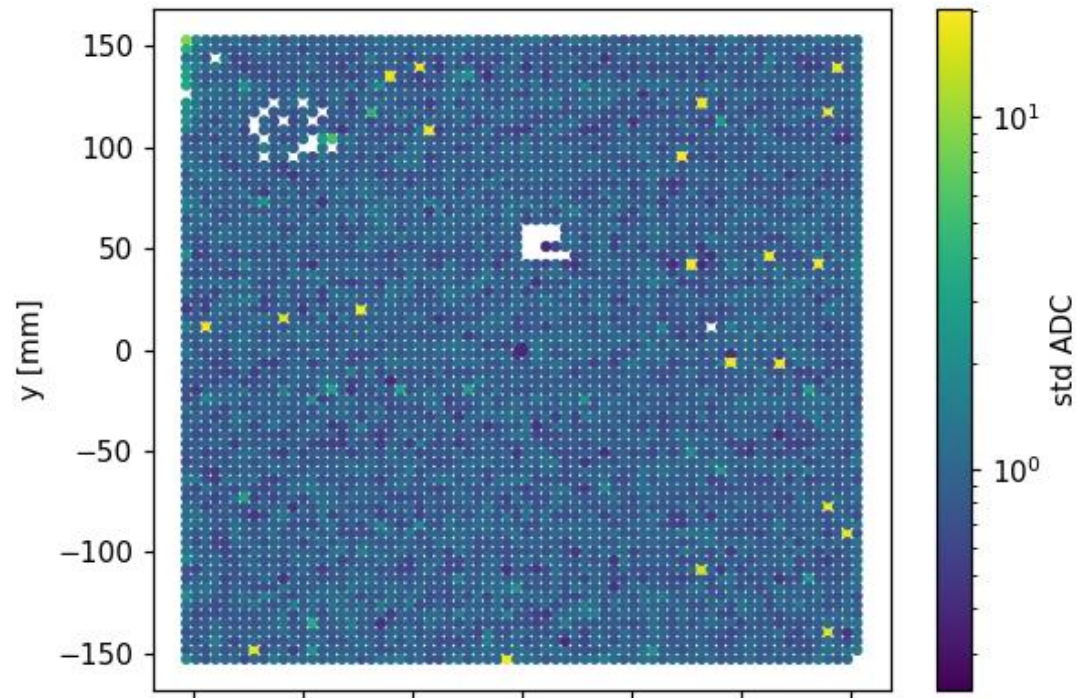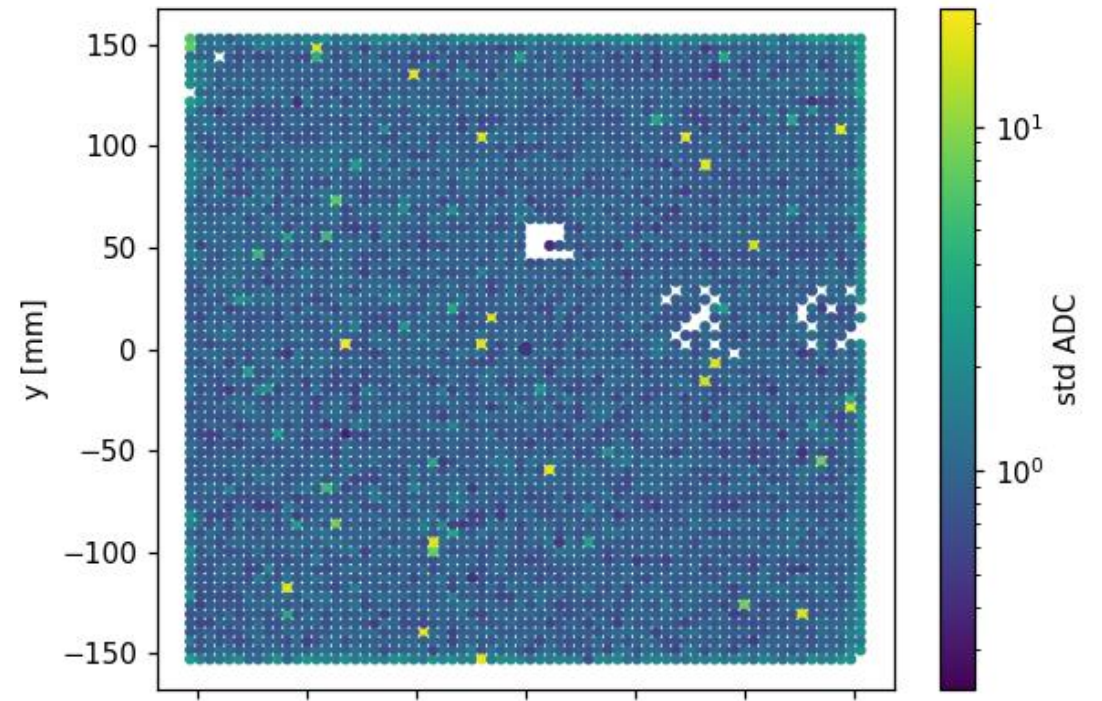

11-20-2020

11-22-2020

References at cold before/after HV initially ramped up

11-25-2020

Before HV turned on

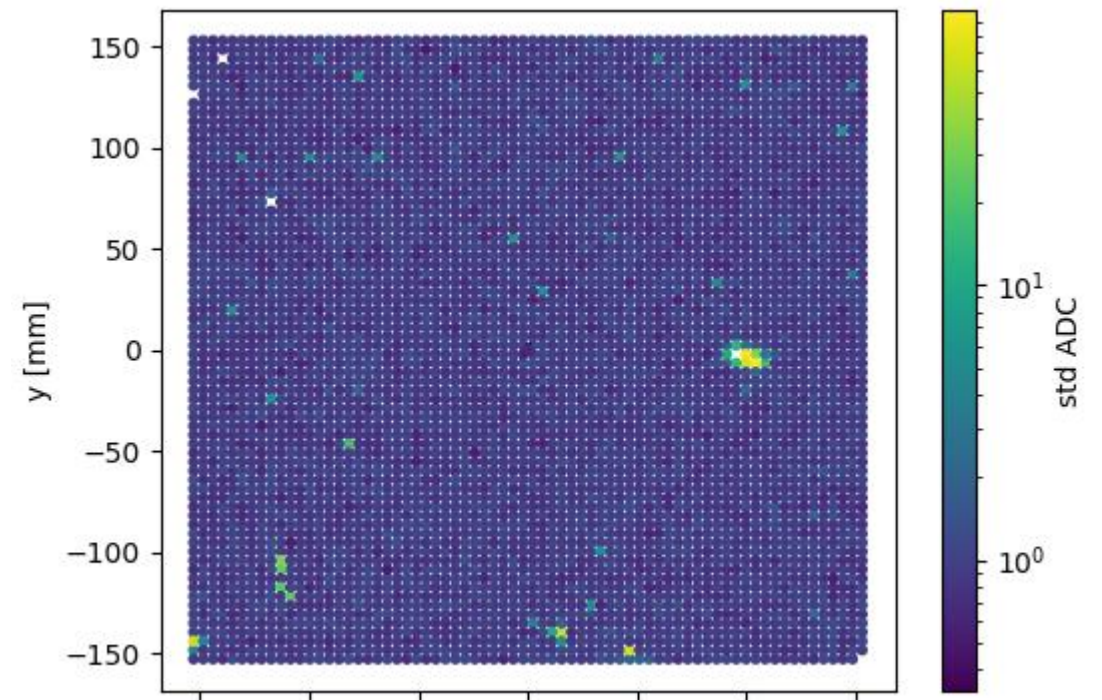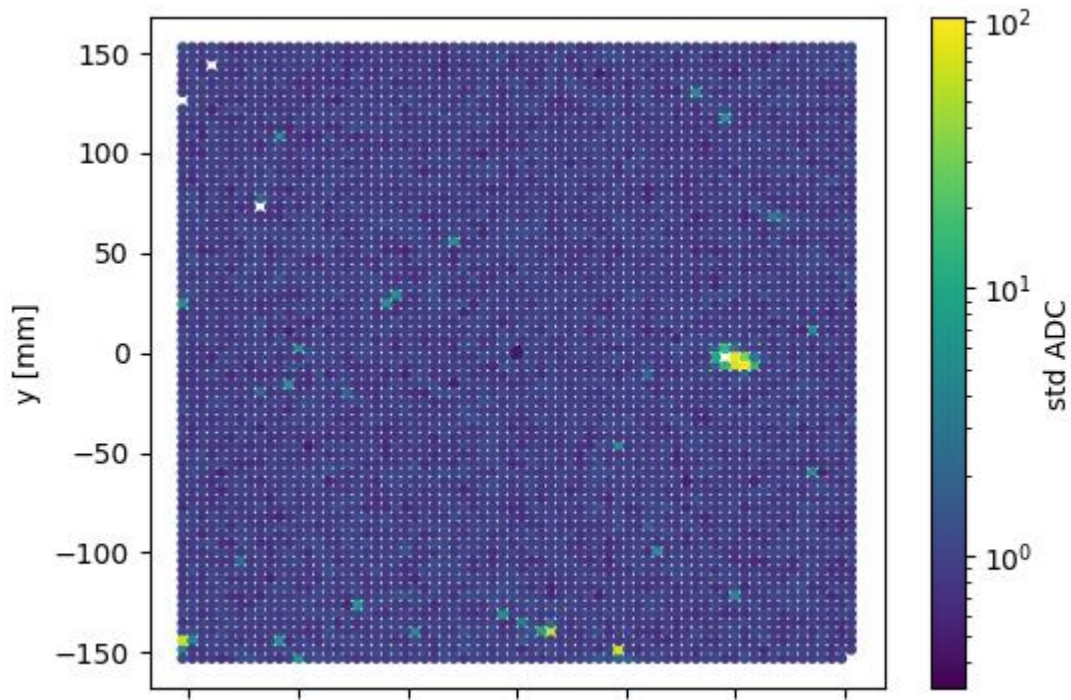Immediately after HV ramped up
(500 V/cm electric field)

References at warm after run
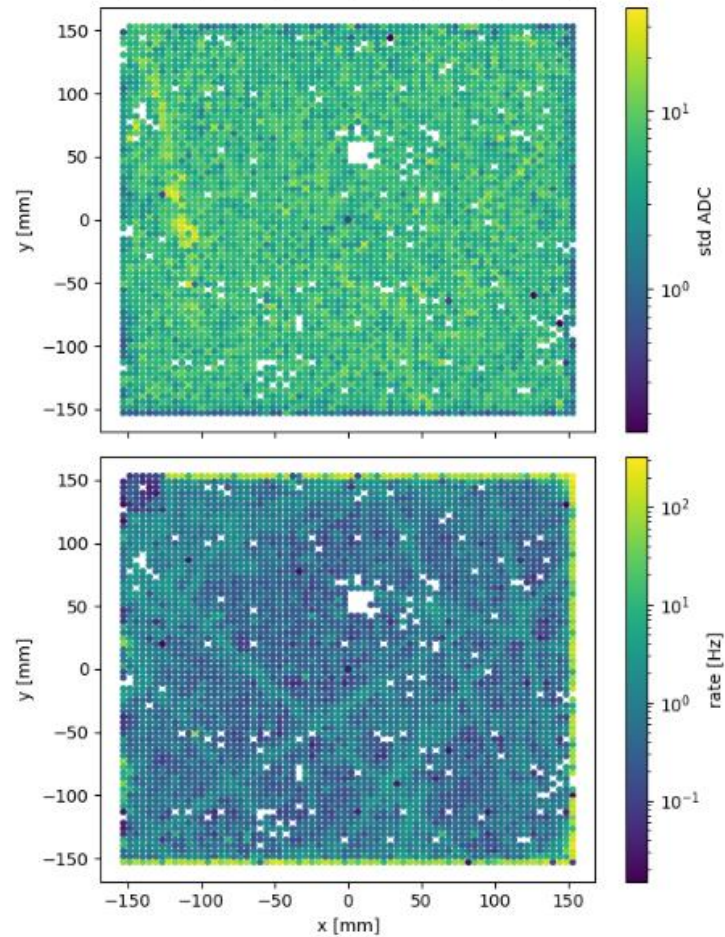
12-3-2020

Successive pedestal runs

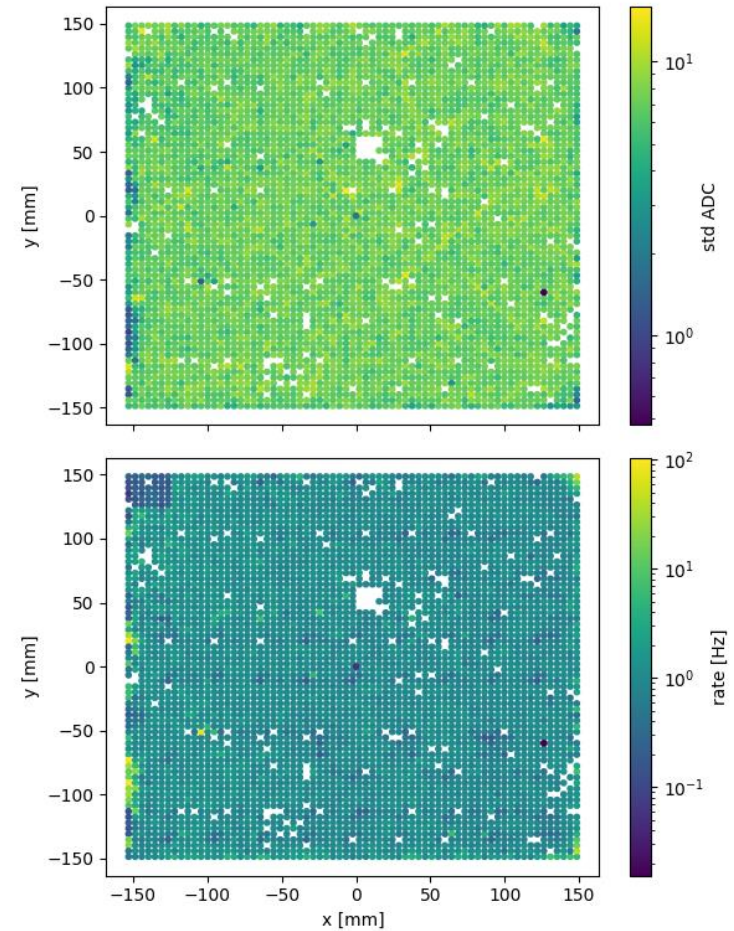– cryostat sealed, presumably the same electrical connections as operation

Elevated rate on tile-edge pixels

self-triggered data @ 500 V/cm

Edge pixels enabled

Edge pixels disabled

Differential study at cold

1. LCM bias on (not sending triggers) – drift HV off & LAr re-circulation on

2. LCM bias off (E-board remains powered)

3. E-board powered off

4. E-board disconnected

5. LCM on & biased (immediately after ramping up HV) – drift HV on (E-field 500 V/cm)

6. LCM on & biased (20 min. after ramping up HV)

7. LAr re-circulation off

8. LAr pump disconnected

9. LCM on & biased (5 min. after ramping down HV)

10. LCM disconnected

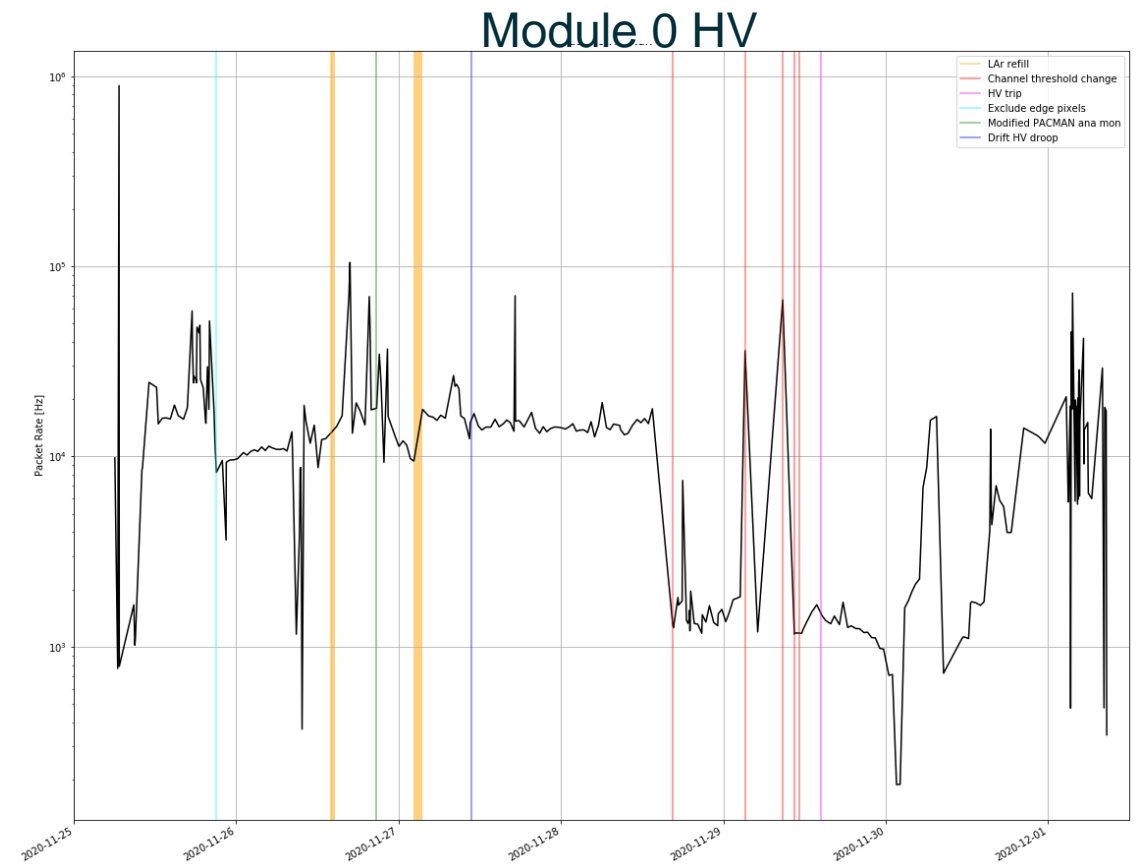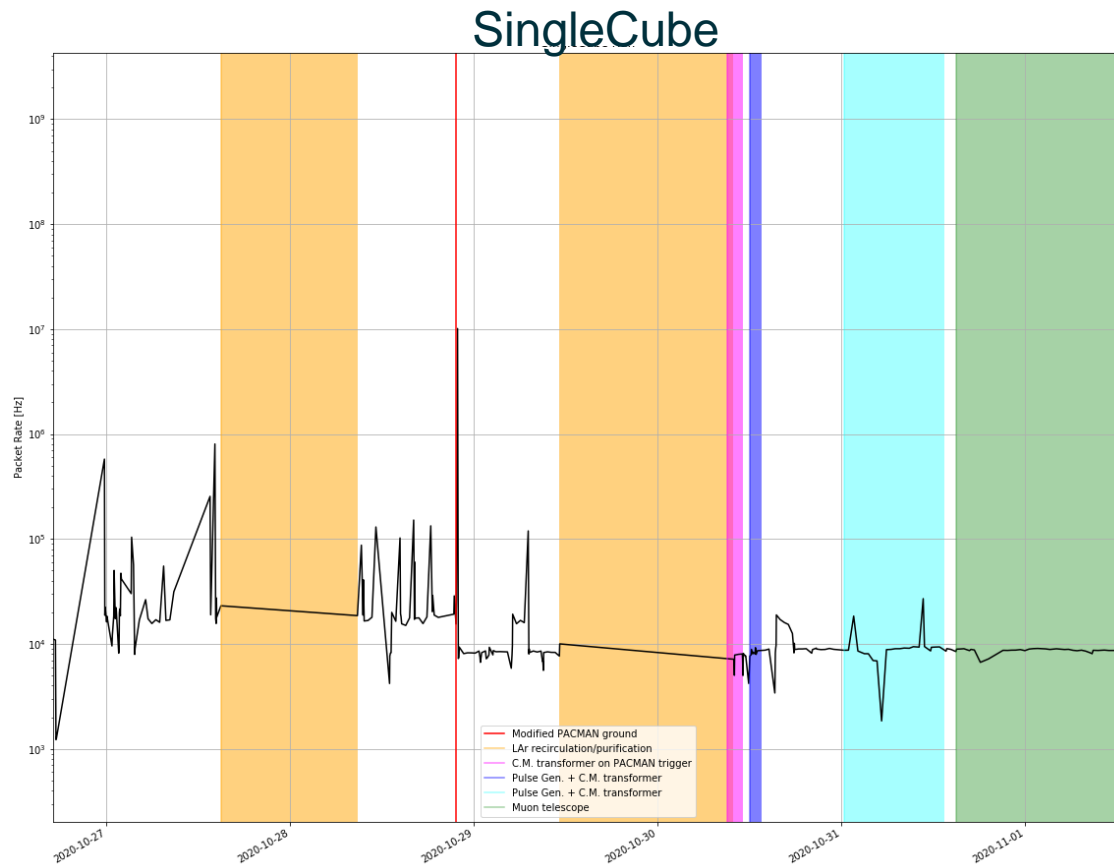Source of excess hist unchanging - associated with E-board attachment on pixel tile
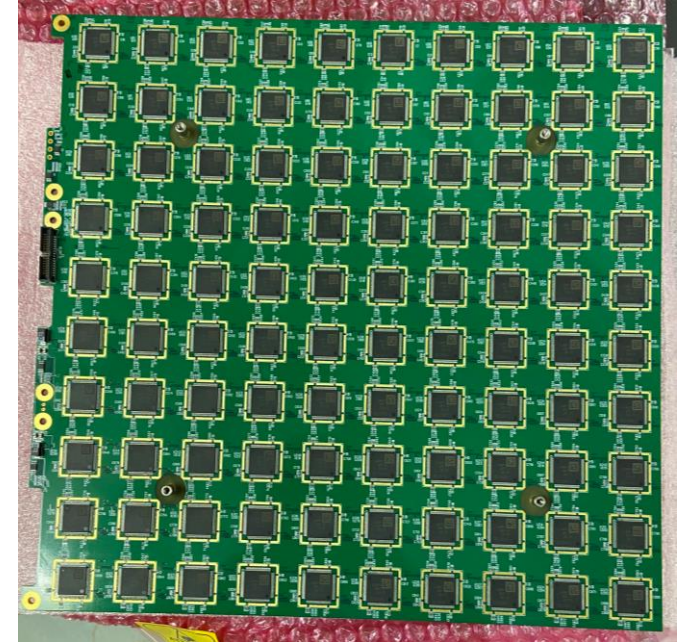
5 hours with LCM disconnected & HV off
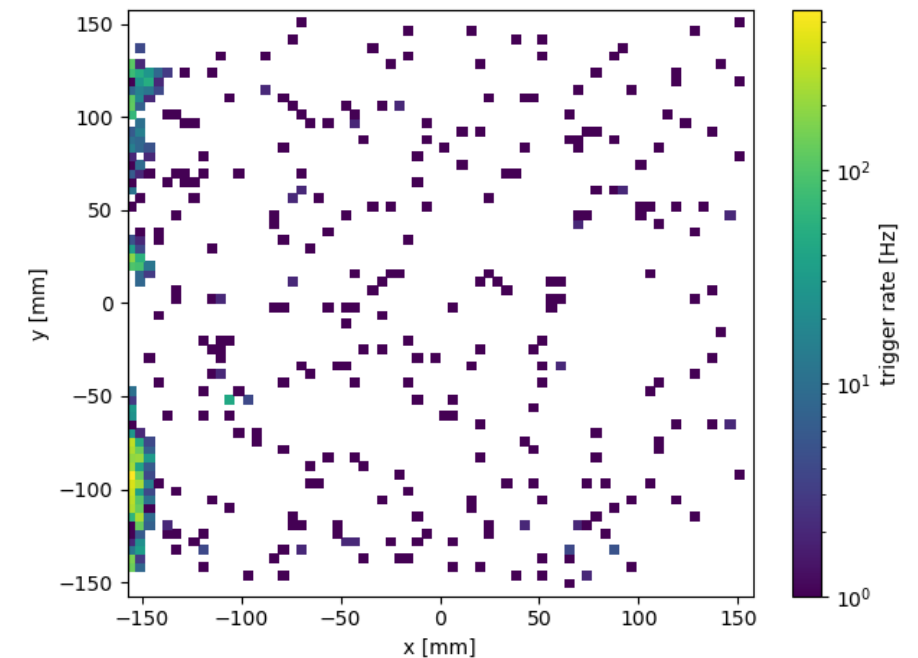
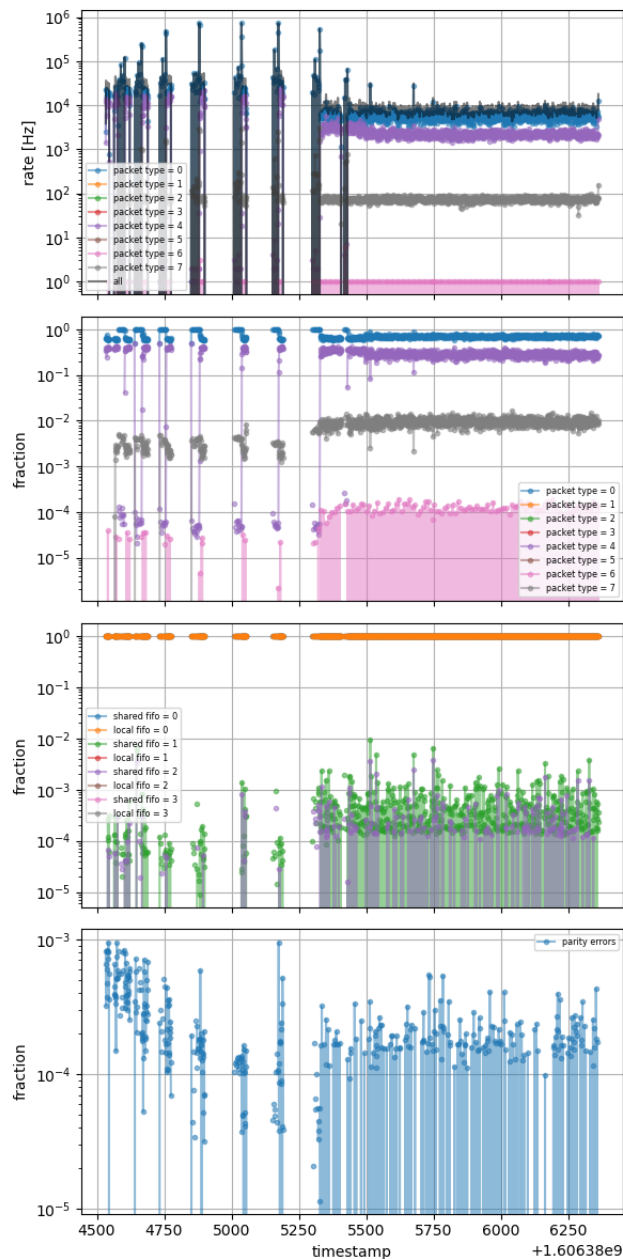# Packet Rate Instability

evidence of instabilities in SingleCube run as well (see after modification to PACMAN ground)
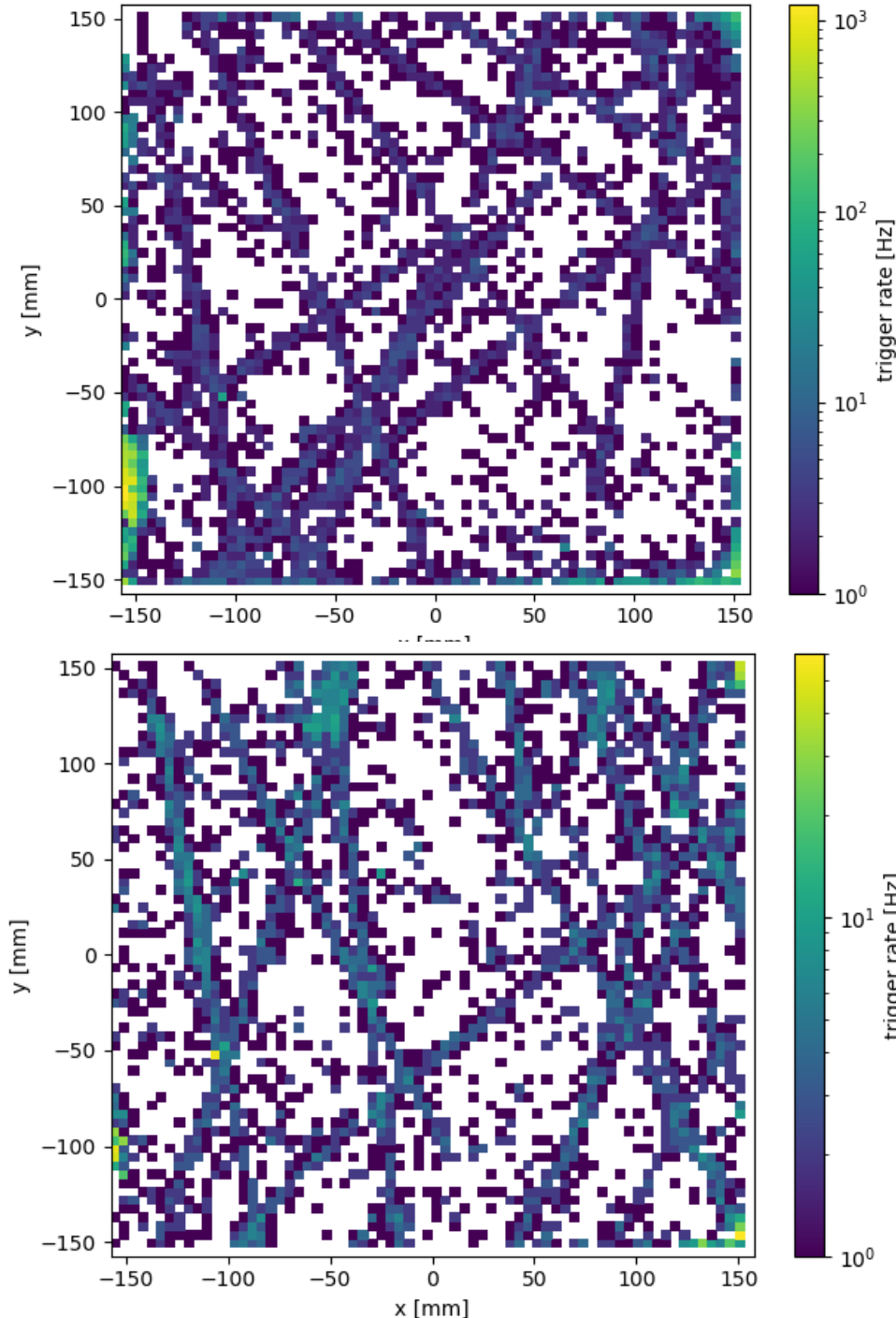

SingleCube

Module 0 HV

- High-rate pixels associated with lower LCM attachment to E-board and bar corner edges of pixel tile

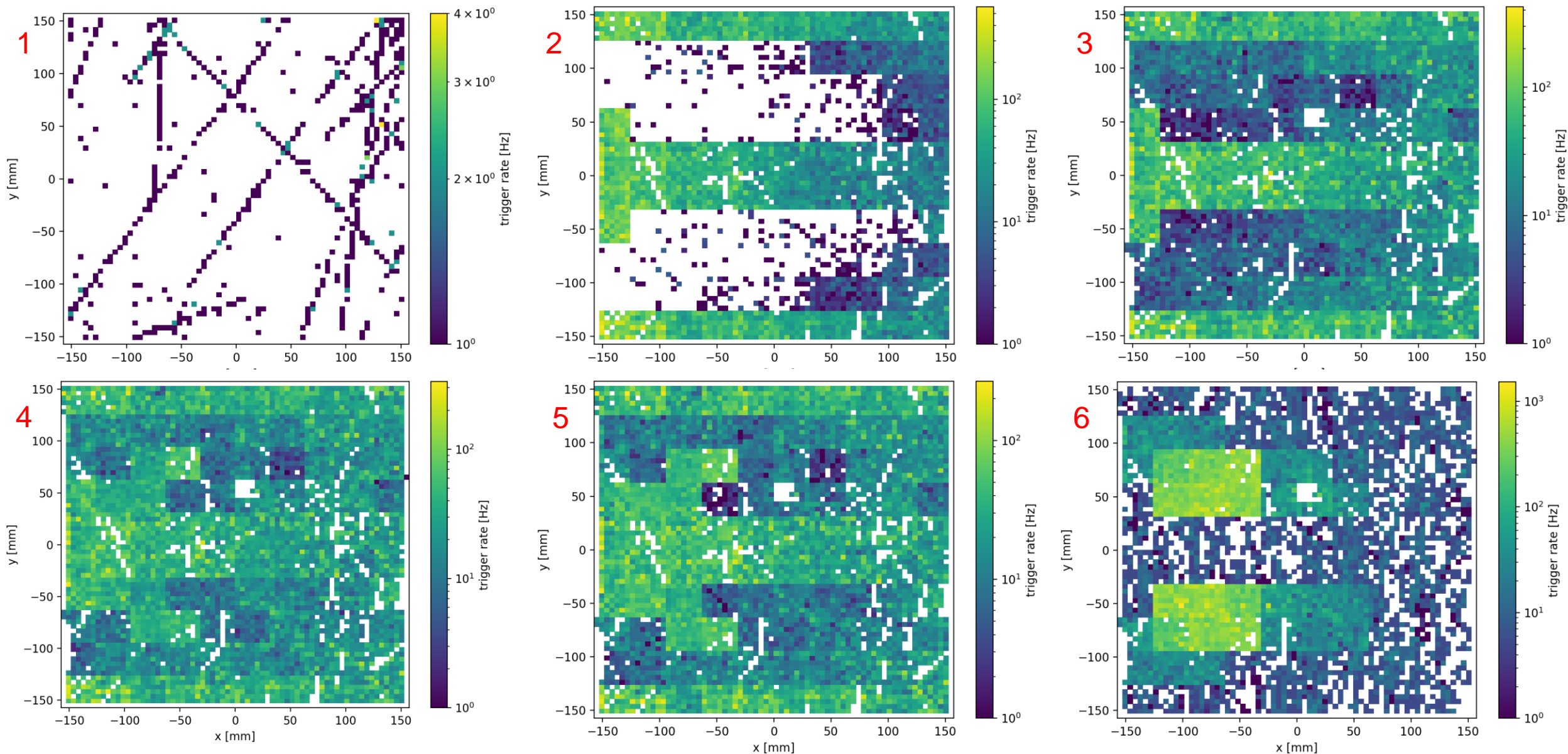- DAQ incapable of dealing with high rate

First full second in run

Last full second in run

Successive recorded seconds in self-triggered readout

Dummy tiles connected in series and grounded to pixel tile through mechanical post in E-board

E-board grounded through LArPix ground (cable)

Issues identified & actions to remedy

- System-level noise
  - Packet rate instabilities localized to pixel tile corners and E-board attachment
  - Excess noise originating from E-board attachment
  - Longitudinal study of noise evaluation with sealed, idle setup at warm
  - Documented electrical checkout pre- and post-sealing of cryostat
  - Re-assess pixel tile grounding scheme?

- DAQ unstable with packet rate exceeding ~10 kHz
  - High rate logging: output a more raw data file, packet parsing at a later stage downstream
  - From initial raw file, event building and online-data monitoring