Recent updates of C/N-1.0 chamber and its circular system

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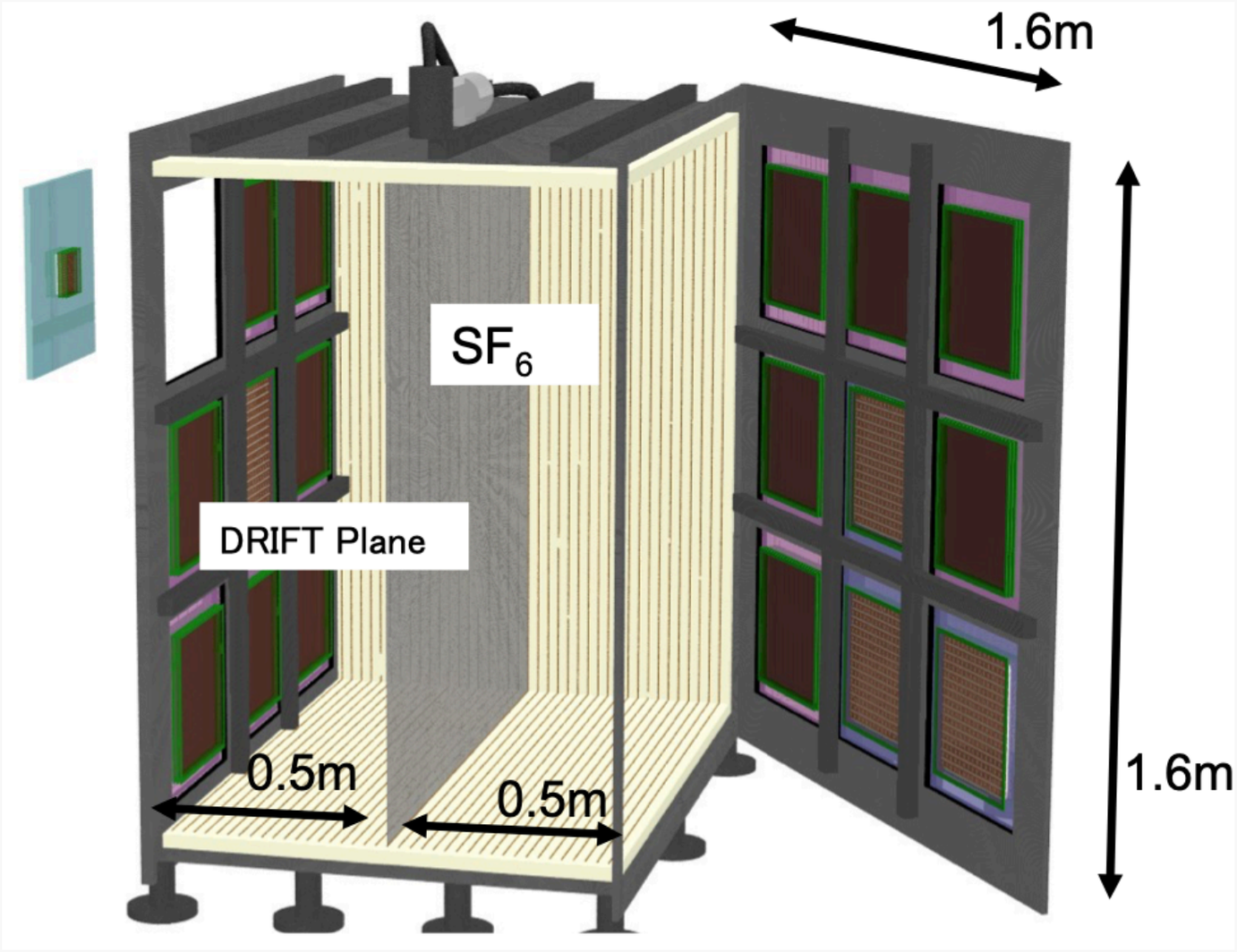
Introduction

(Kamioka)

CYGNUS-KM / NEWAGE (C/N-1.0)

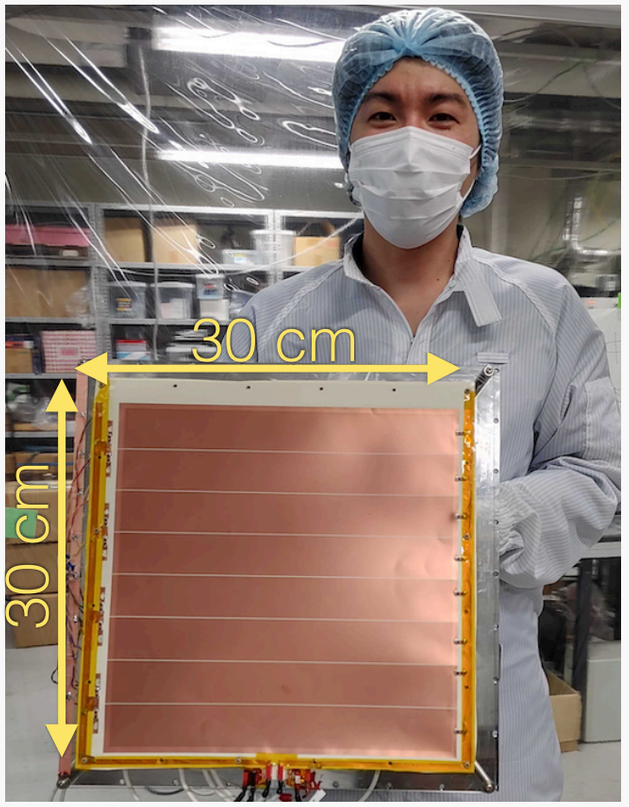
- 18 modules capable 1 m^3 chamber

➡ placed in Kobe University

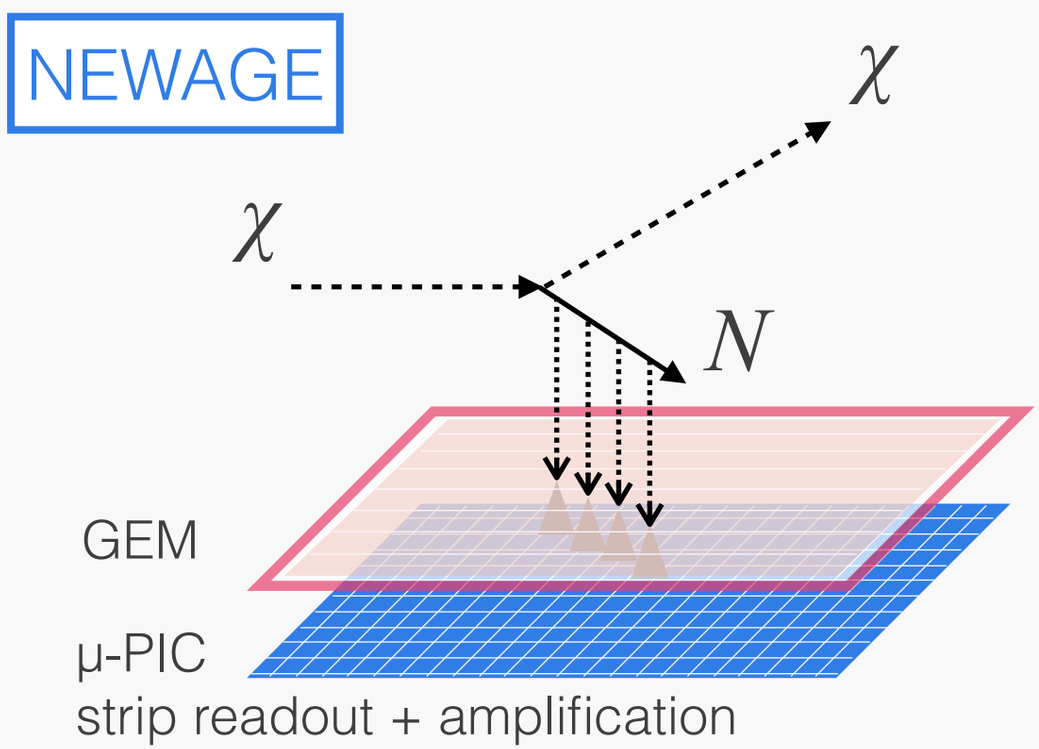


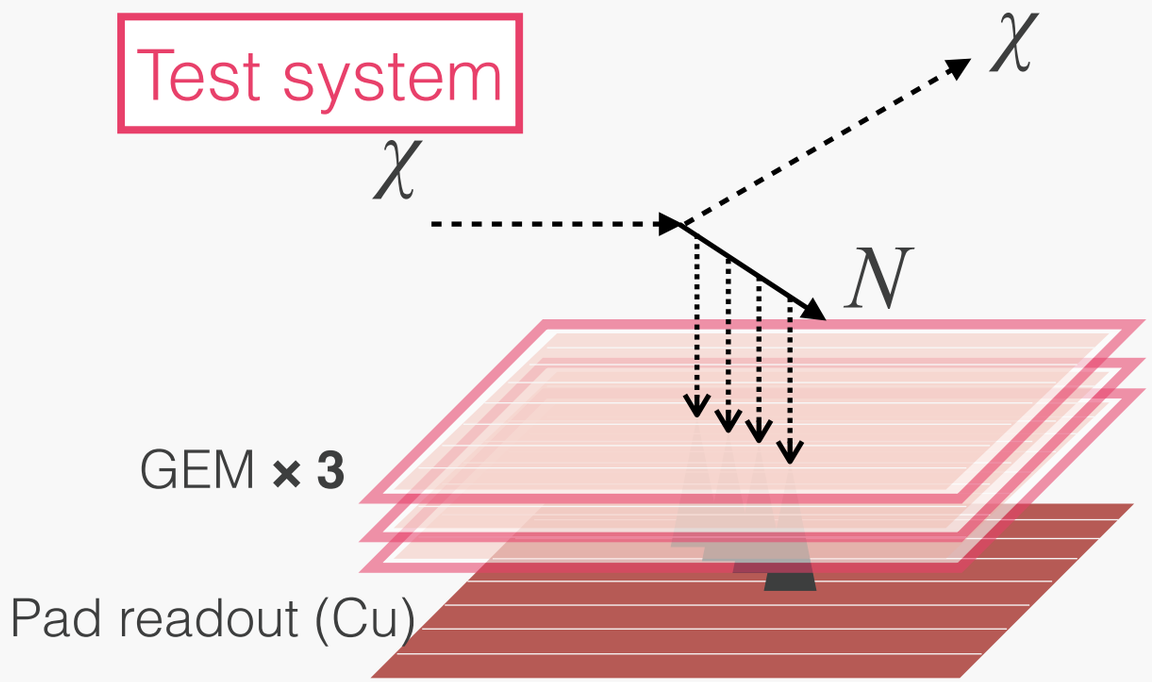
Detector: “Module 0”

- A simple but multi-channel readout detector is prepared for the test
  - ➡ 8 channel pad readout
  - ➡ Triple-GEM is used to compensate gas amplification
- Not only for the TPC test but for general purpose
  - ➡ e.g. BG monitor (for Rn, ambient gamma, …)



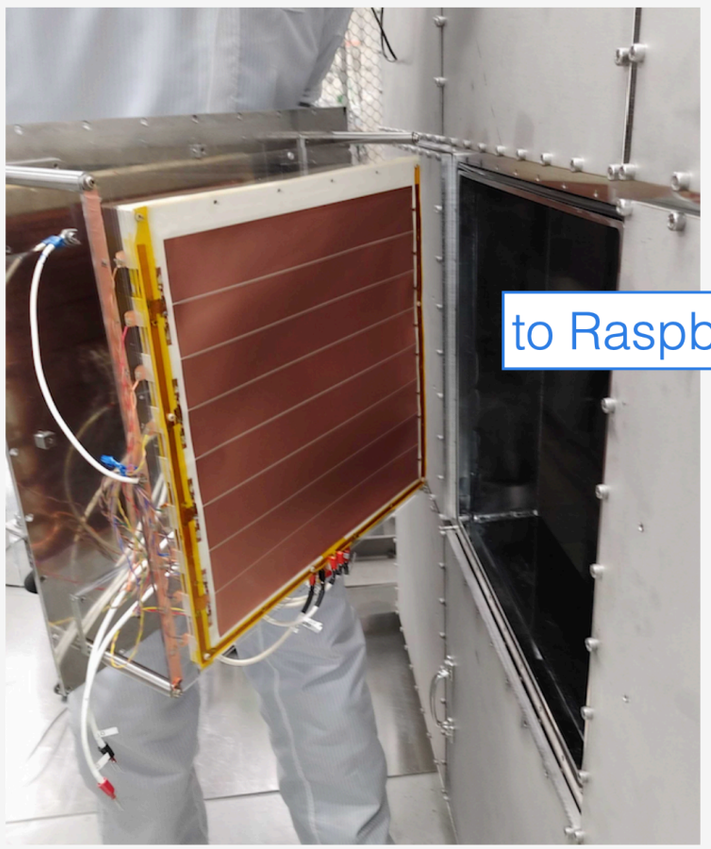
Amplification and detection system

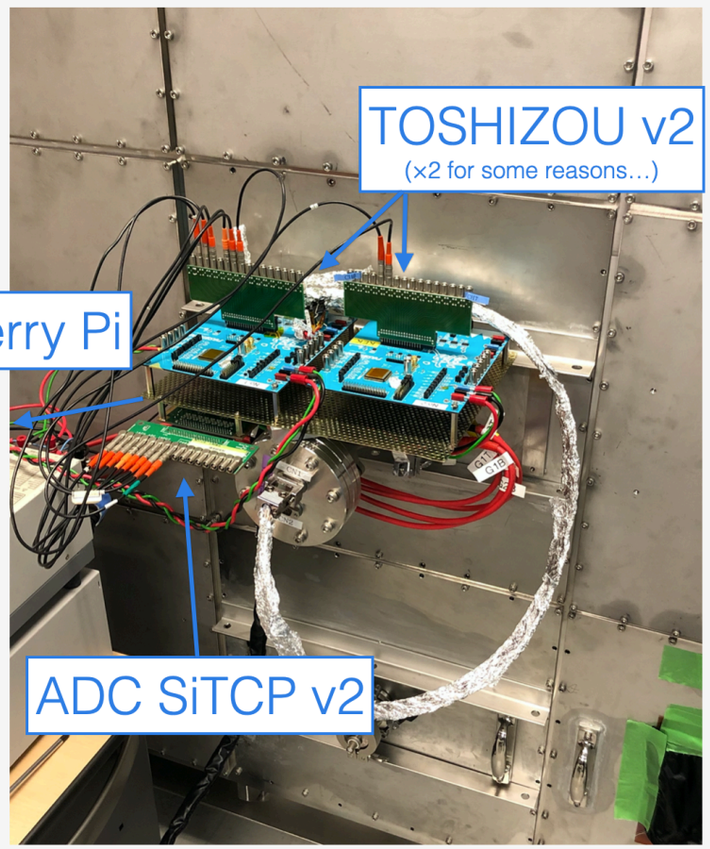




First commissioning with Module 0

- The first integration test was carried out on the last March.
  - ➡ First signal (^{252}Cf source induced) was obtained
- Several issues were remained in this test
  - ➡ non-uniform electrical field, severe gas leak, spark, …





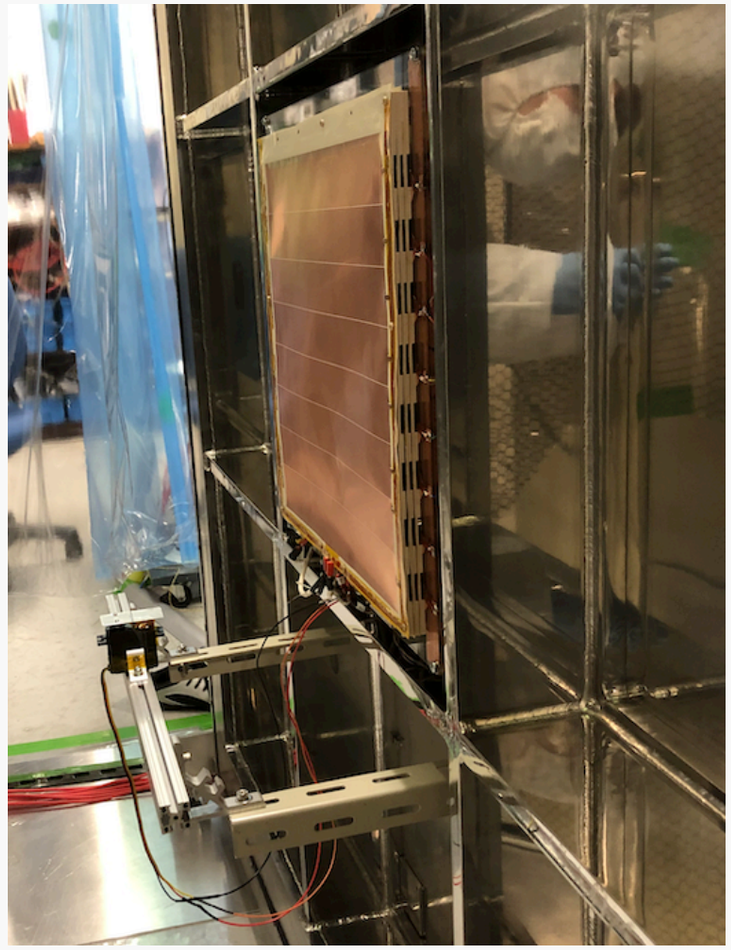
^{252}Cf (neutron source) test

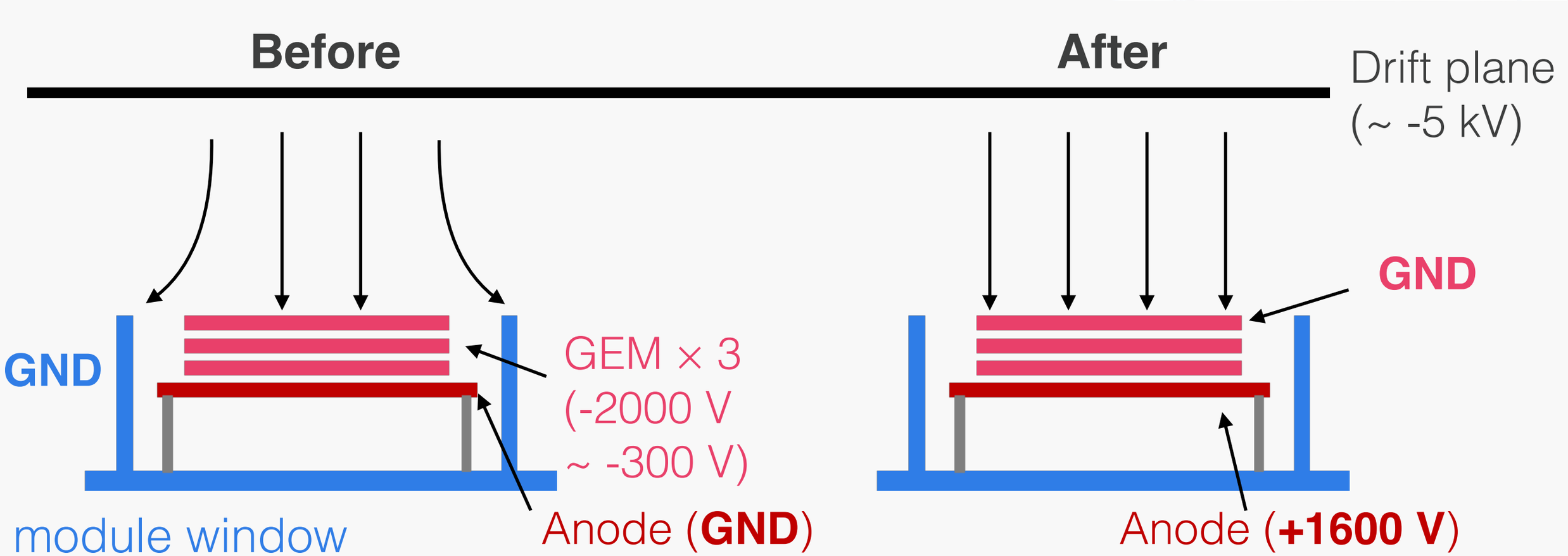
Updates

- Fixed non-uniform electrical field
- Fixed gas leak
- Improved spark issue

Detector update (1)

- Each module space has “box-like” structure
  - ➡ The GND level of detectors should be the top of the box
  - ➡ The top of the GEM surface should be aligned with the GND level
    - ‣ but the level of anode pad was connected to GND before

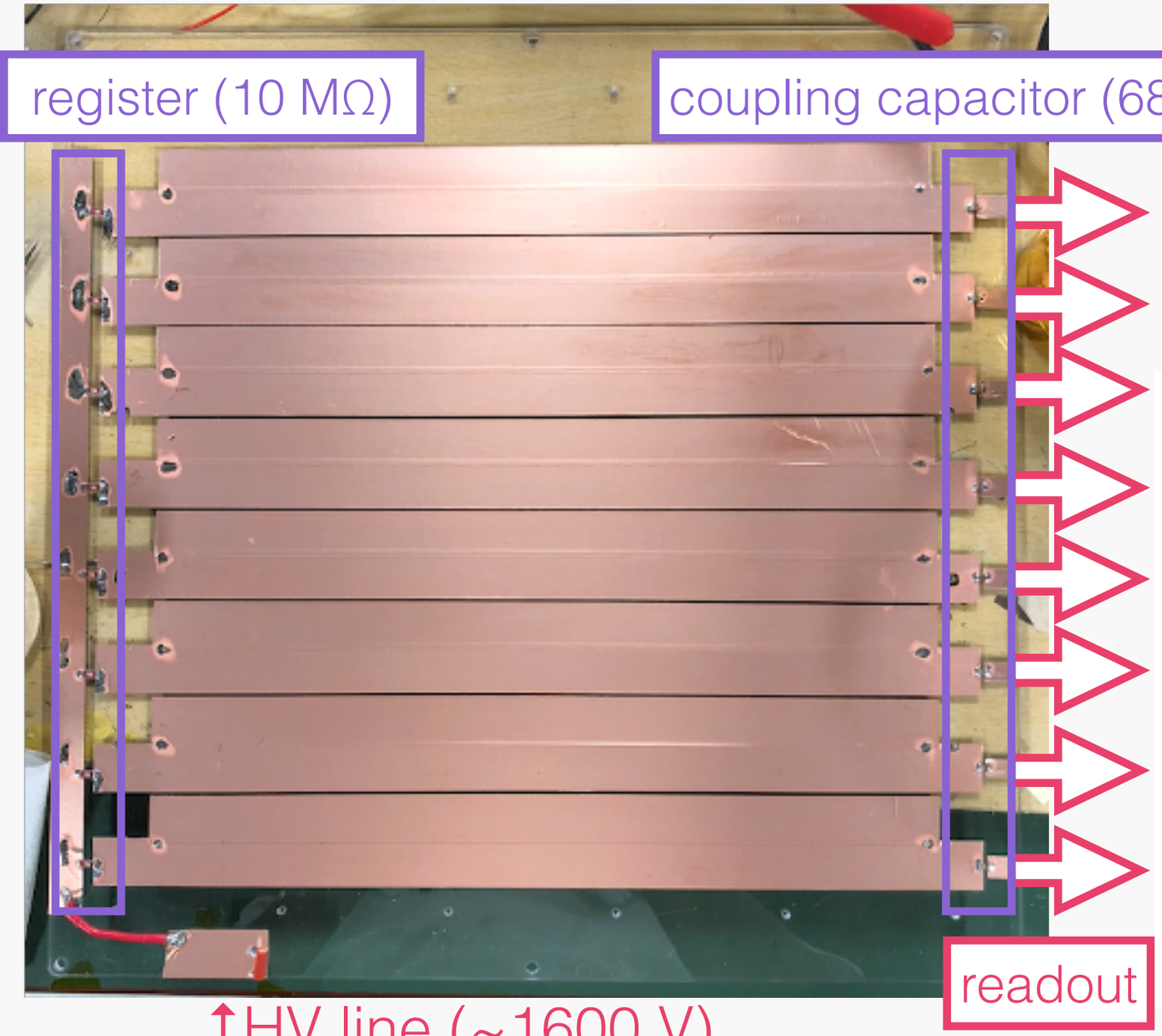




Detector update (2)

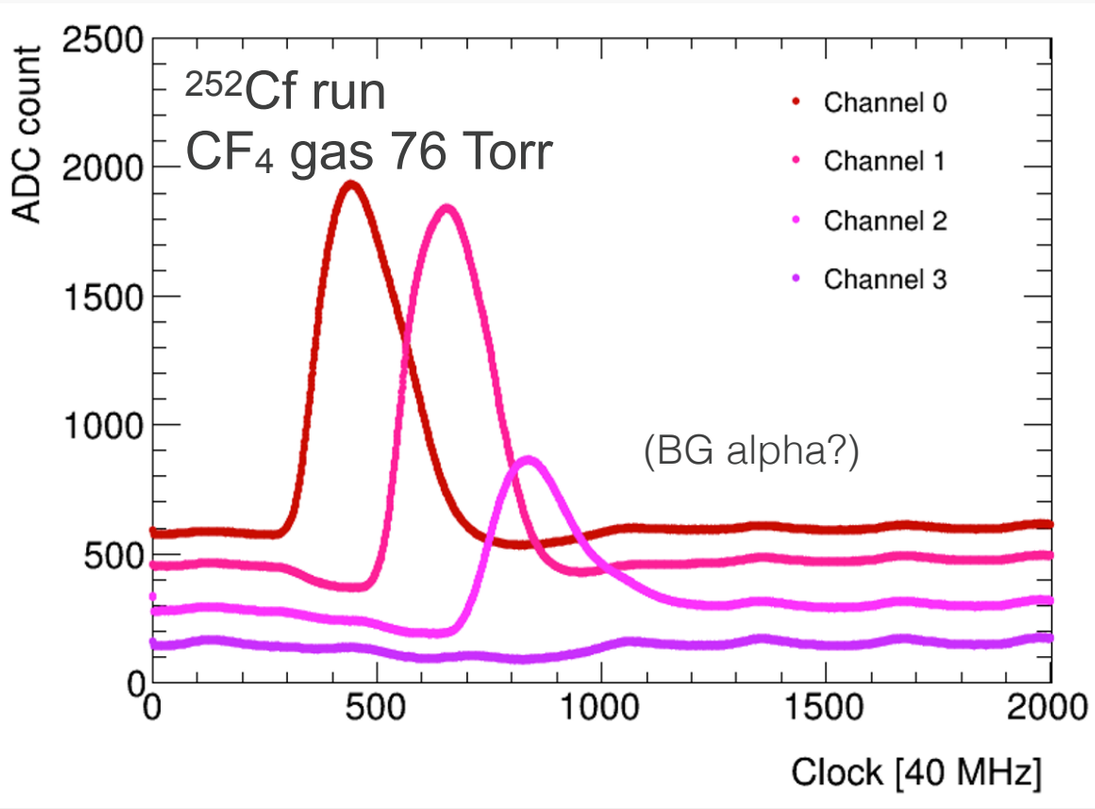
- Update from DC to AC coupling readout

  ➡ to make it possible to apply HV in anode pads



Succeed in working!

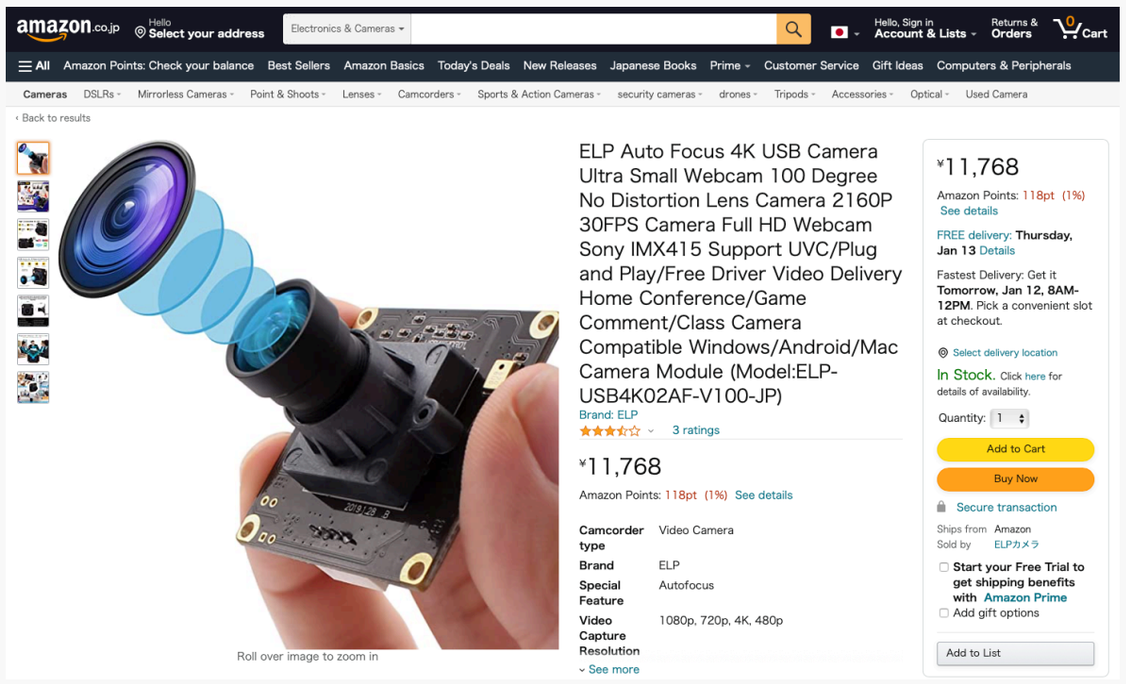
(only four channels are used for some reasons)

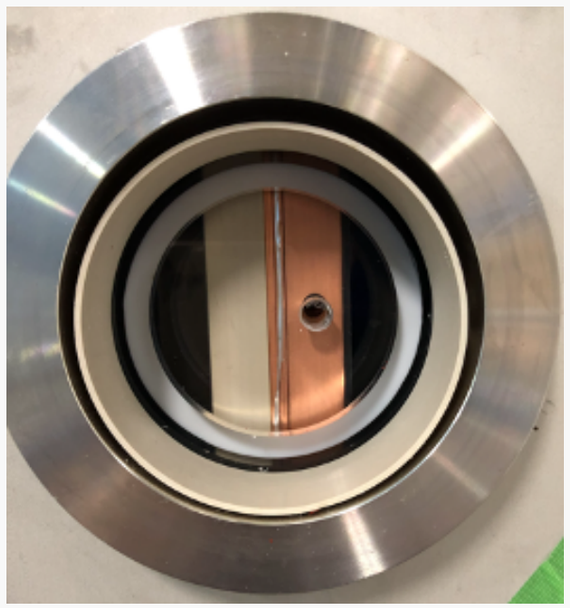


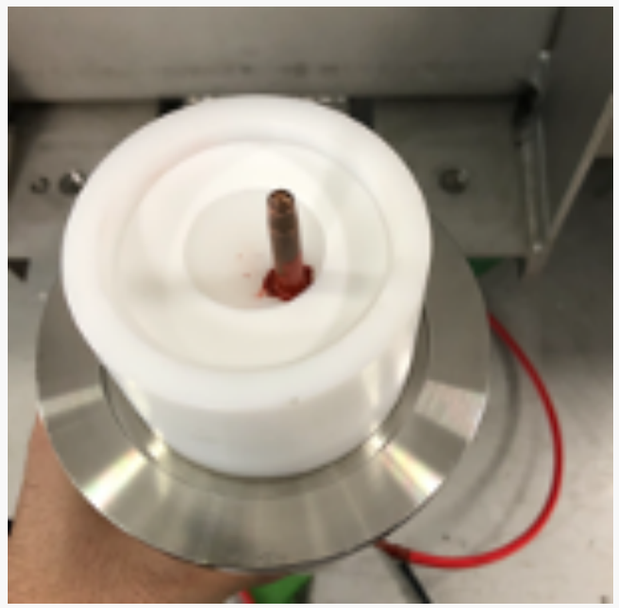
Gas leak and spark issues

- Both were caused in the HV feed-through
- Leak issue was fixed by using epoxy type glue (araldite) and liquid-gasket
- Spark was occurred when HV: **~13 kV** was applied to the drift plane (CF_4, 76 Torr)
  - ➡ Our goal is **50 kV** with SF_6, 20 Torr

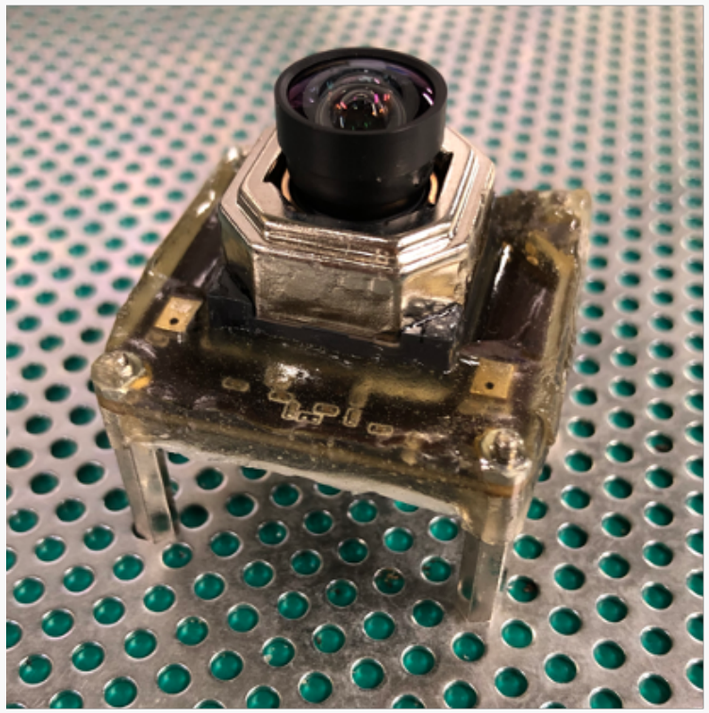
- Camera-module was prepared to find sources of spark
  - ➡ with commercially available USB camera (not CCD!)
  - ➡ Camera was put into the chamber



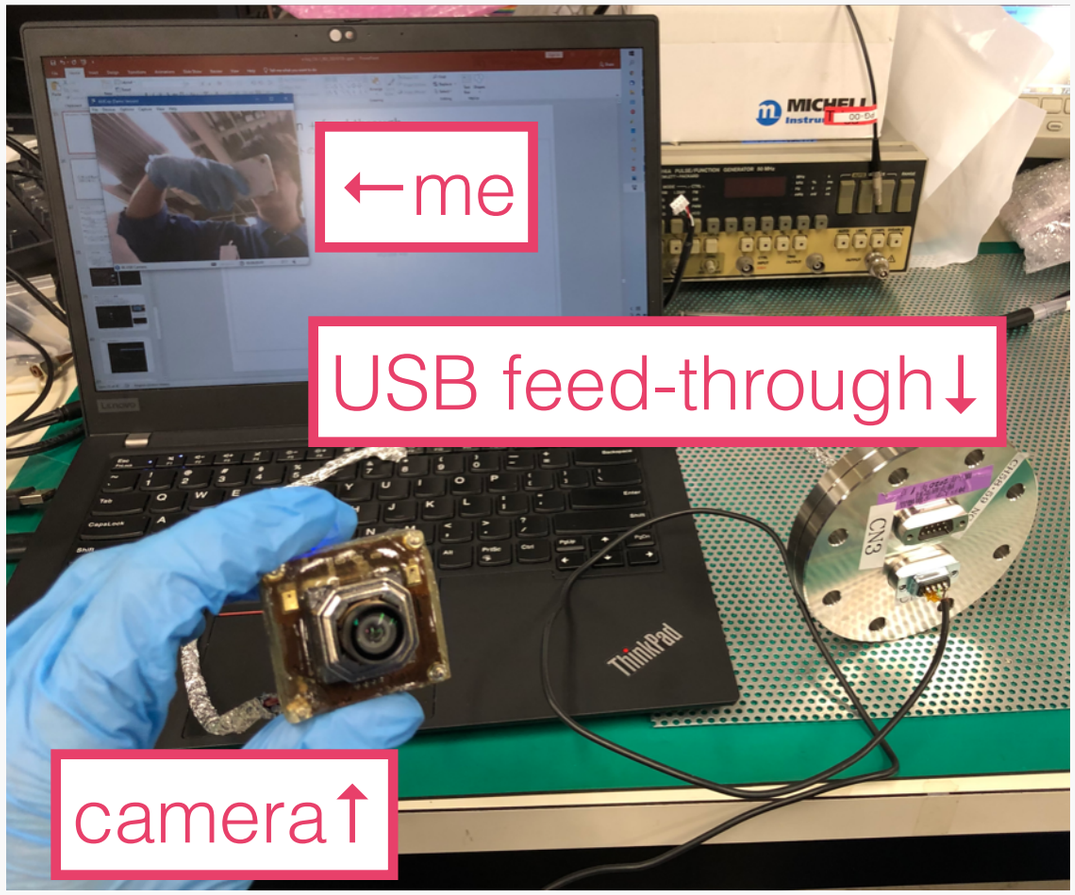


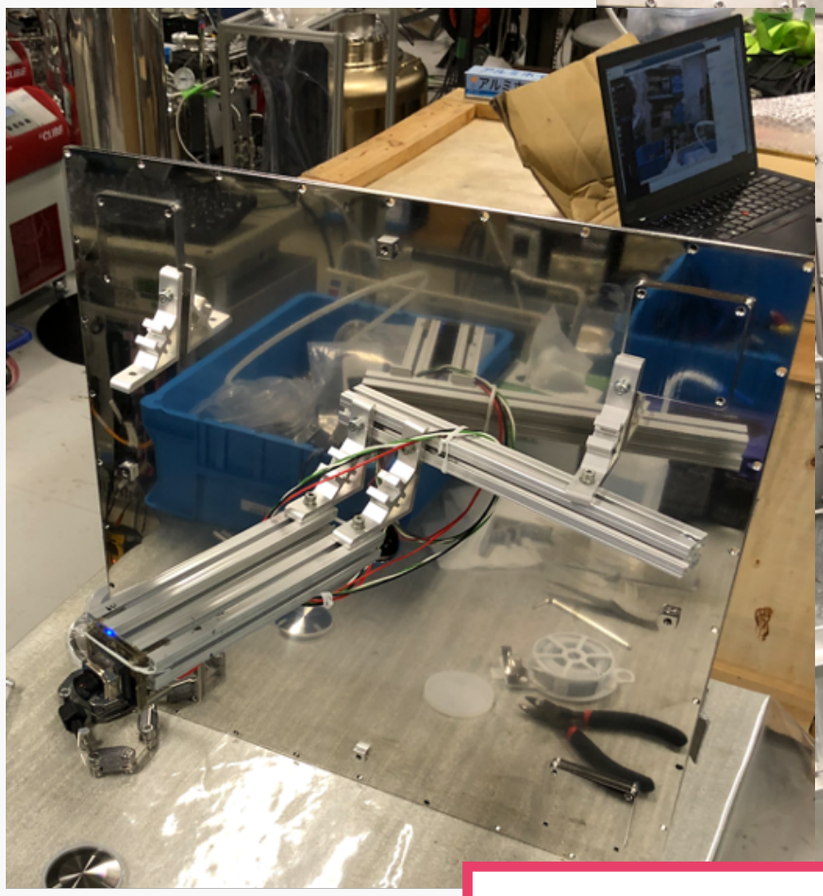


Camera module

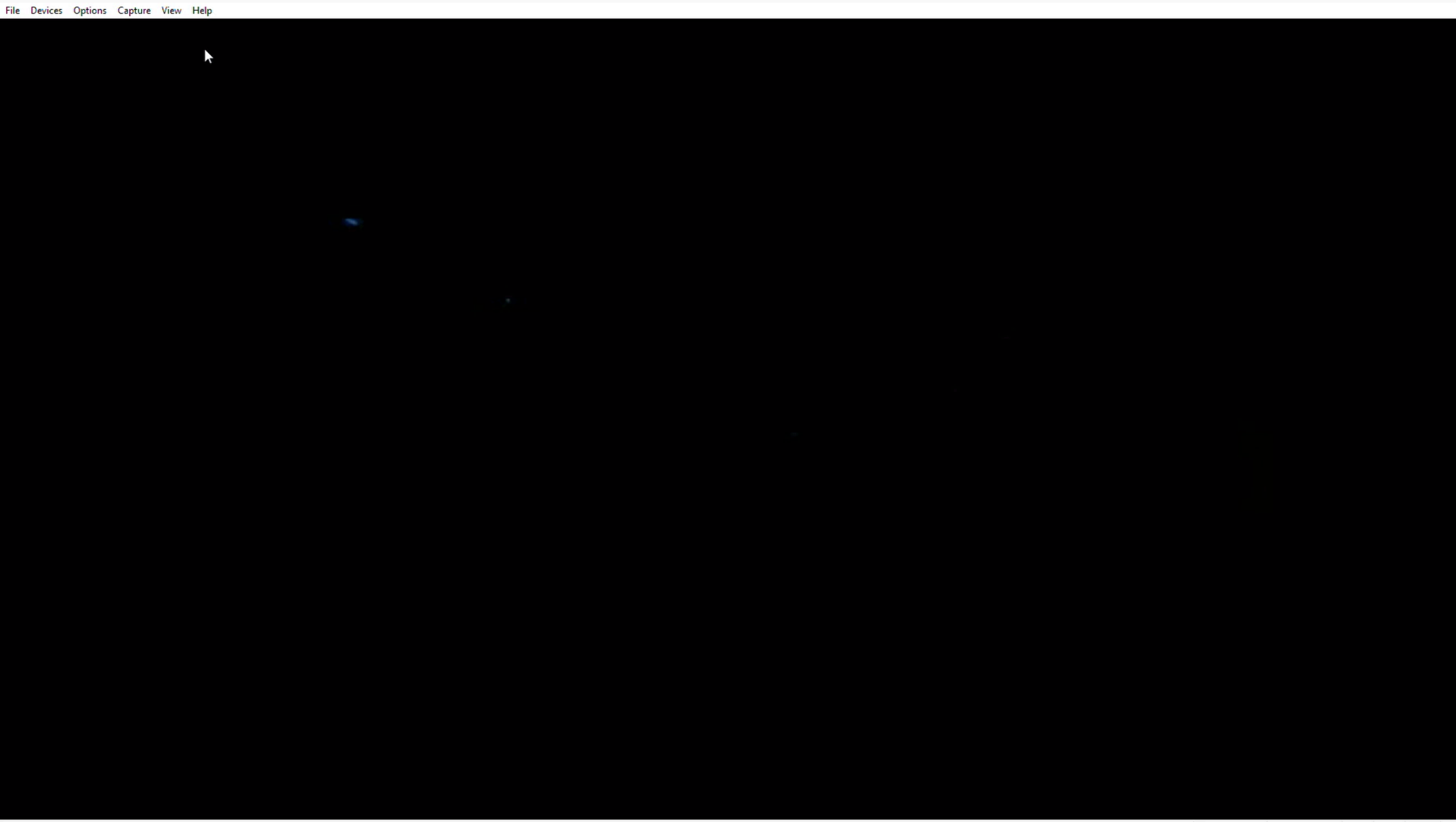


- Encapsulated by epoxy to protect device from vacuum environment
- USB feed-through was prepared
- Camera module was installed near the HV feed-through

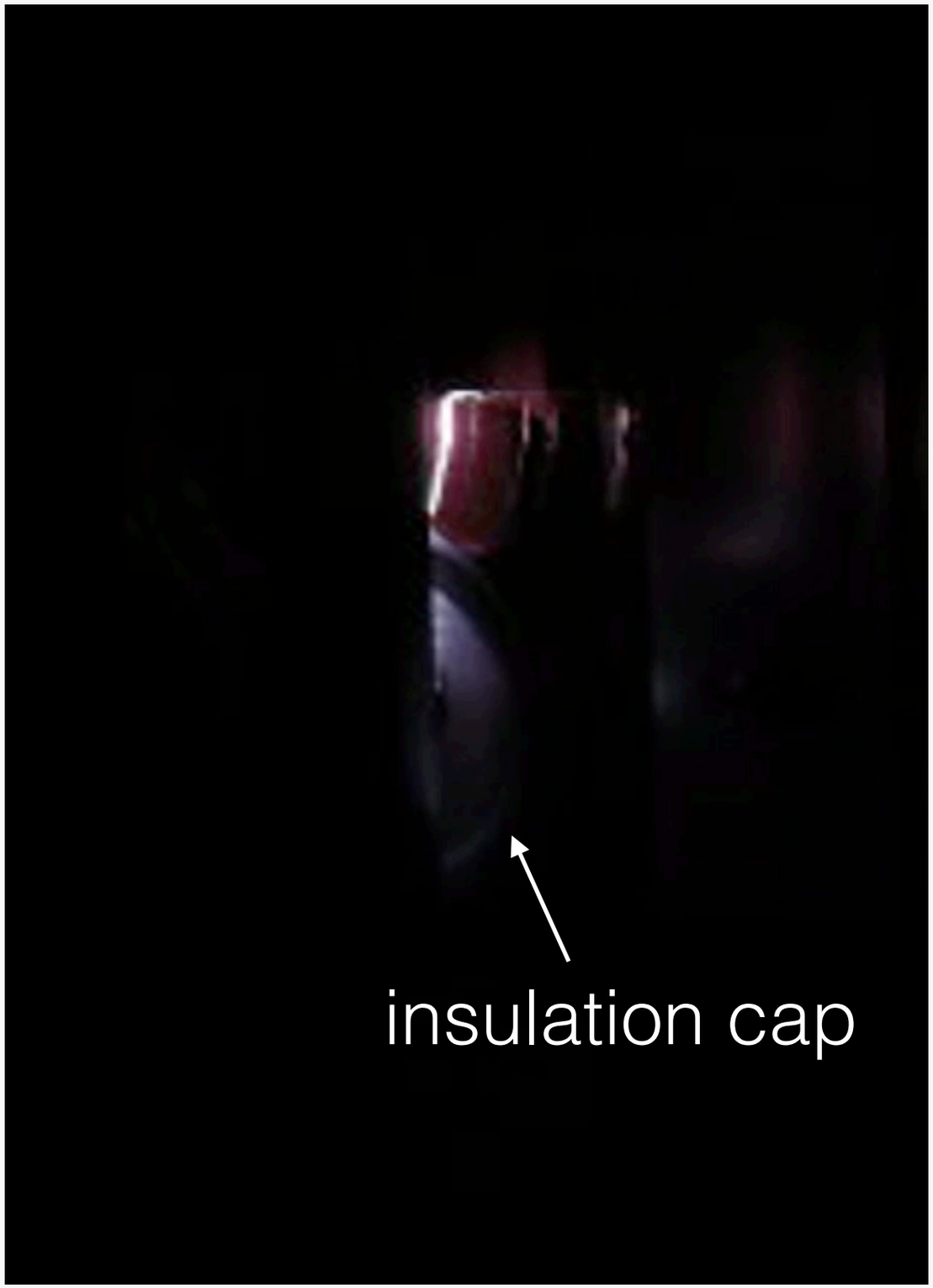




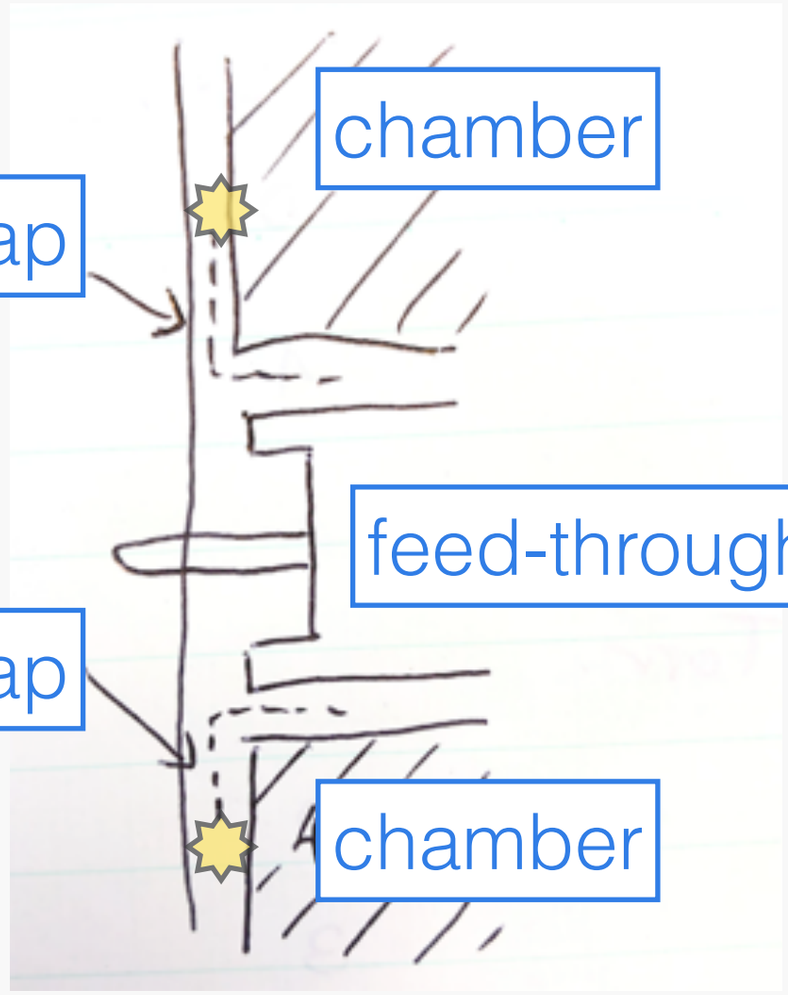
Spark (movie)



Source of spark

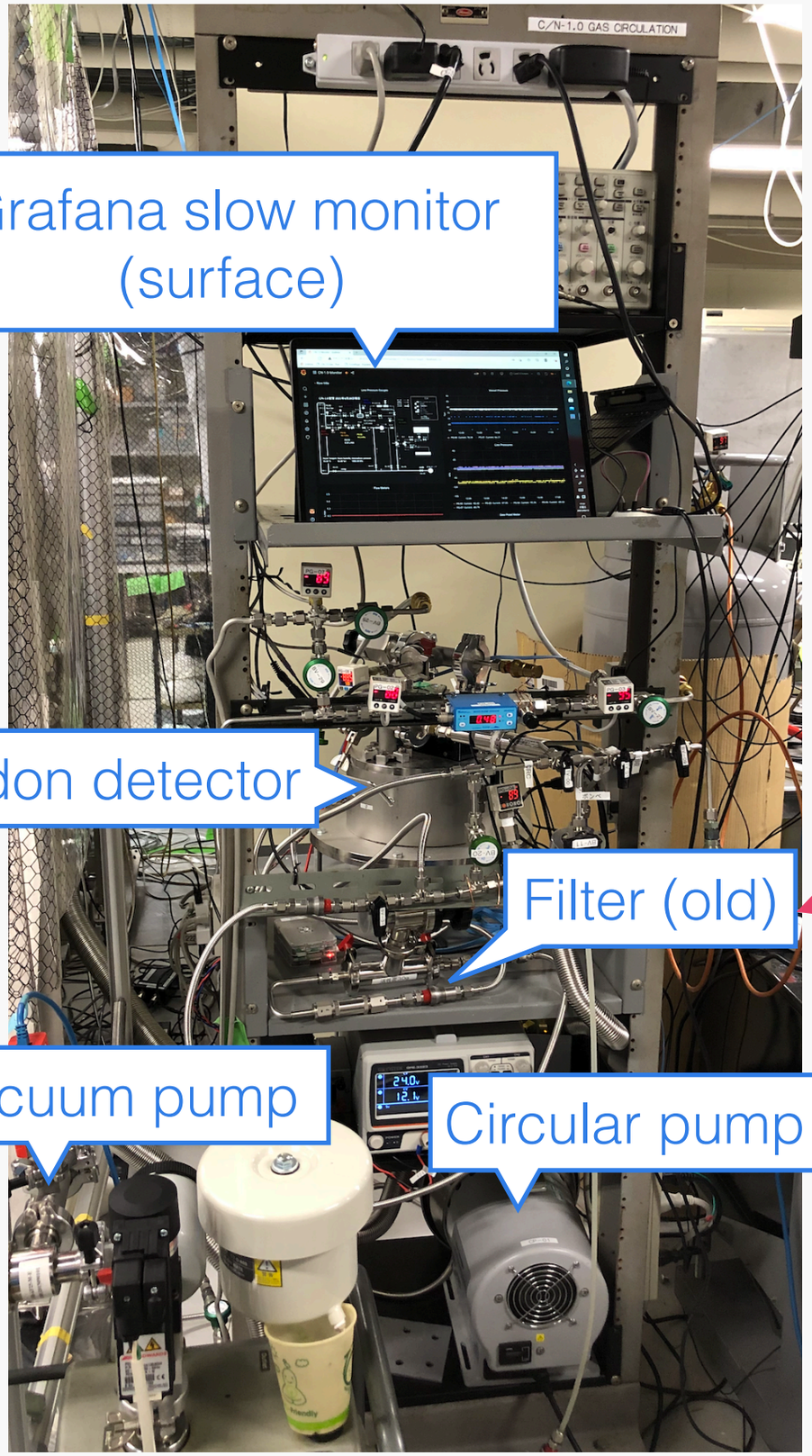


- Sparks are very clearly seen!
- Insulation cap doesn't work effectively
- Feed-through issue was already solved but other source were found…
  - ➡ This work is still ongoing

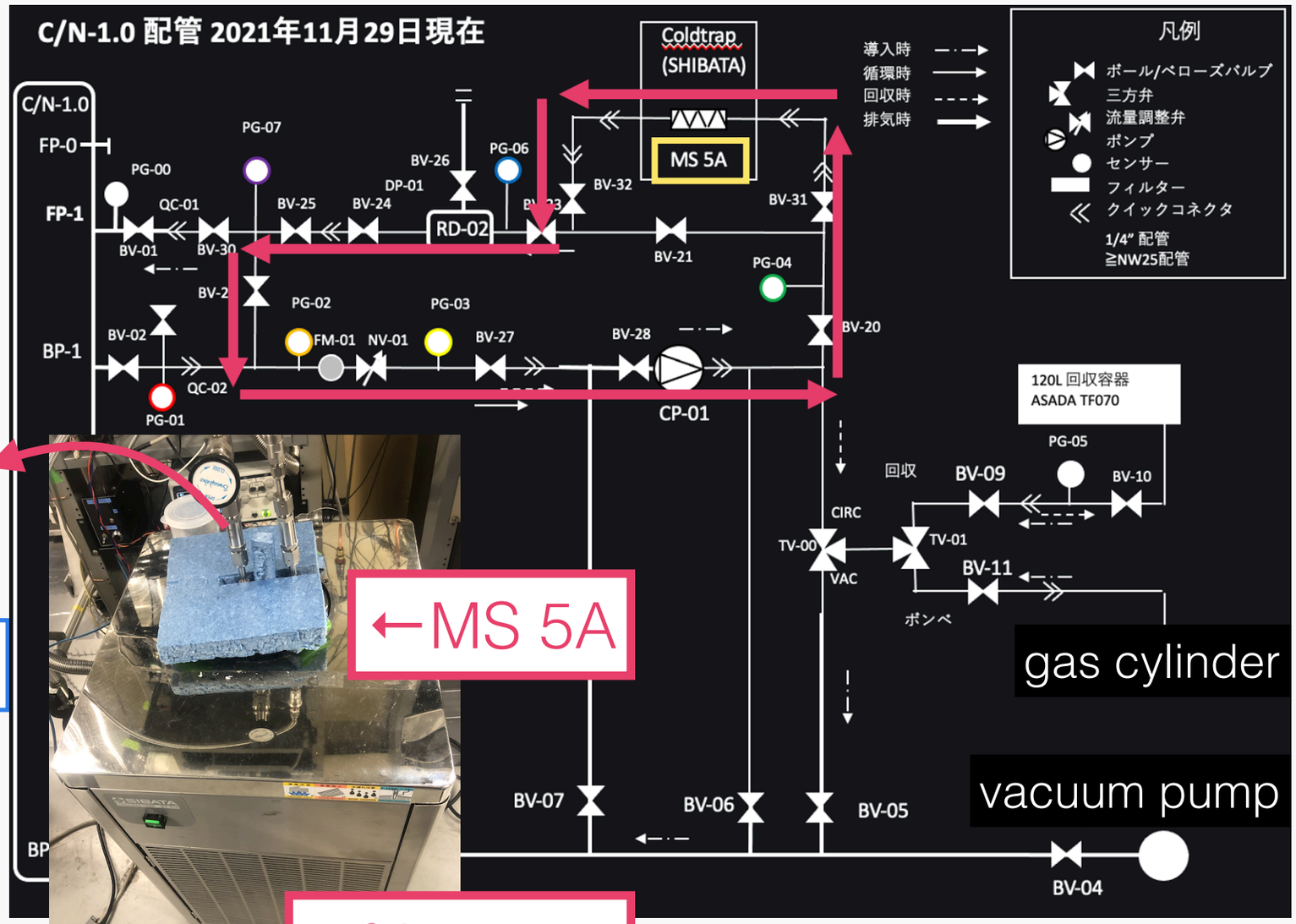


Circular system and Slow monitor

Circular system

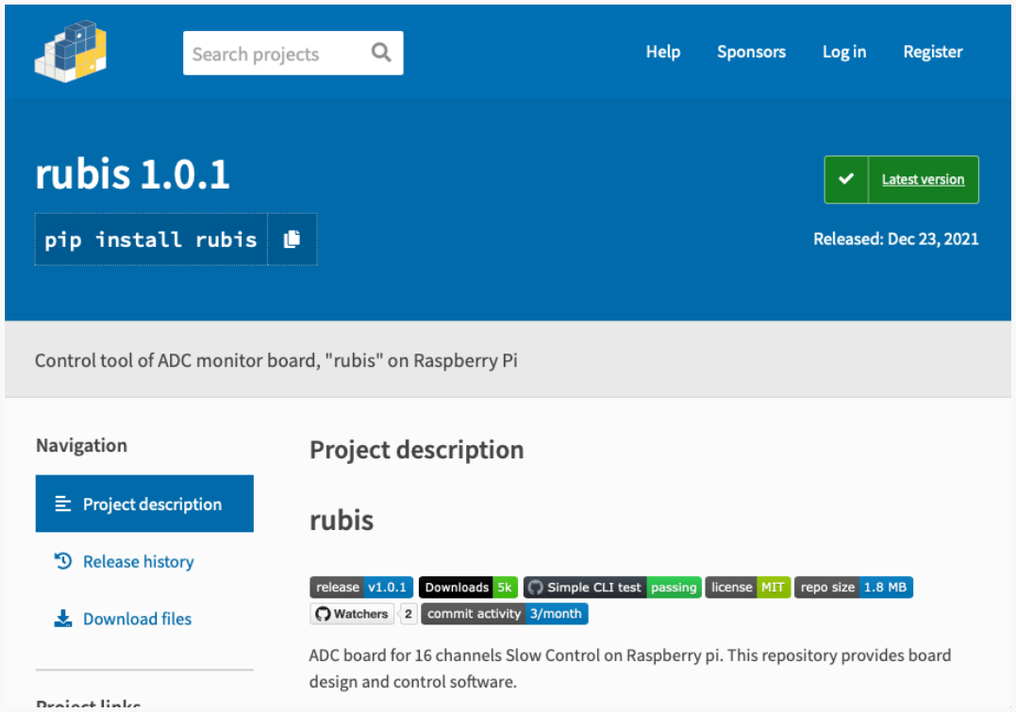


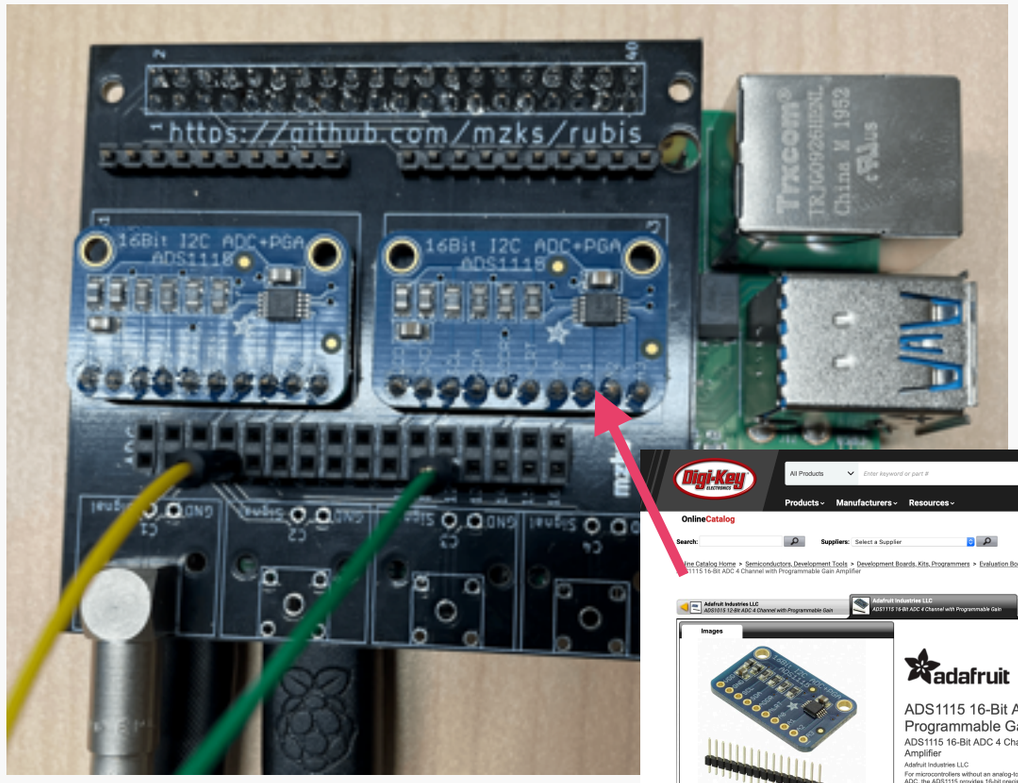
- MS 5A (received from Hiroshi) was included with cooling system
  - ➡ circulation just started!
- The system can be replaced to (or put together with) others
  - ➡ e.g. sheffield circulation system

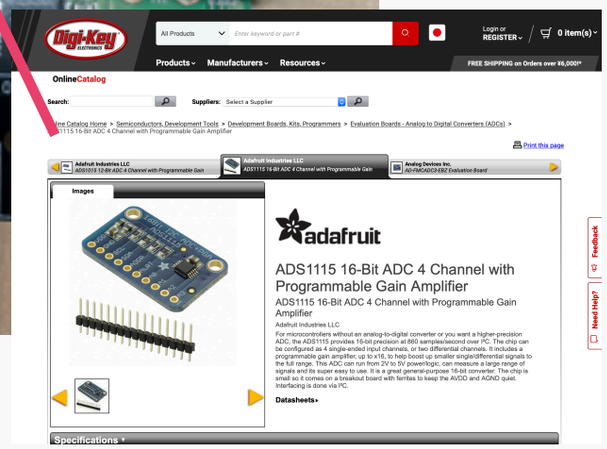


Slow monitor

- Raspberry-Pi + 16 bit ADC (16 ch. in total)
  - ➡ adafruit ADS1115 4 ch ADC ×4 are mounted
    - develop intermediate PCB
  - ➡ python script is available via pypi
- Compact and portable slow monitor system
  - ➡ In case of Kobe: rack mounting & LEMO interface







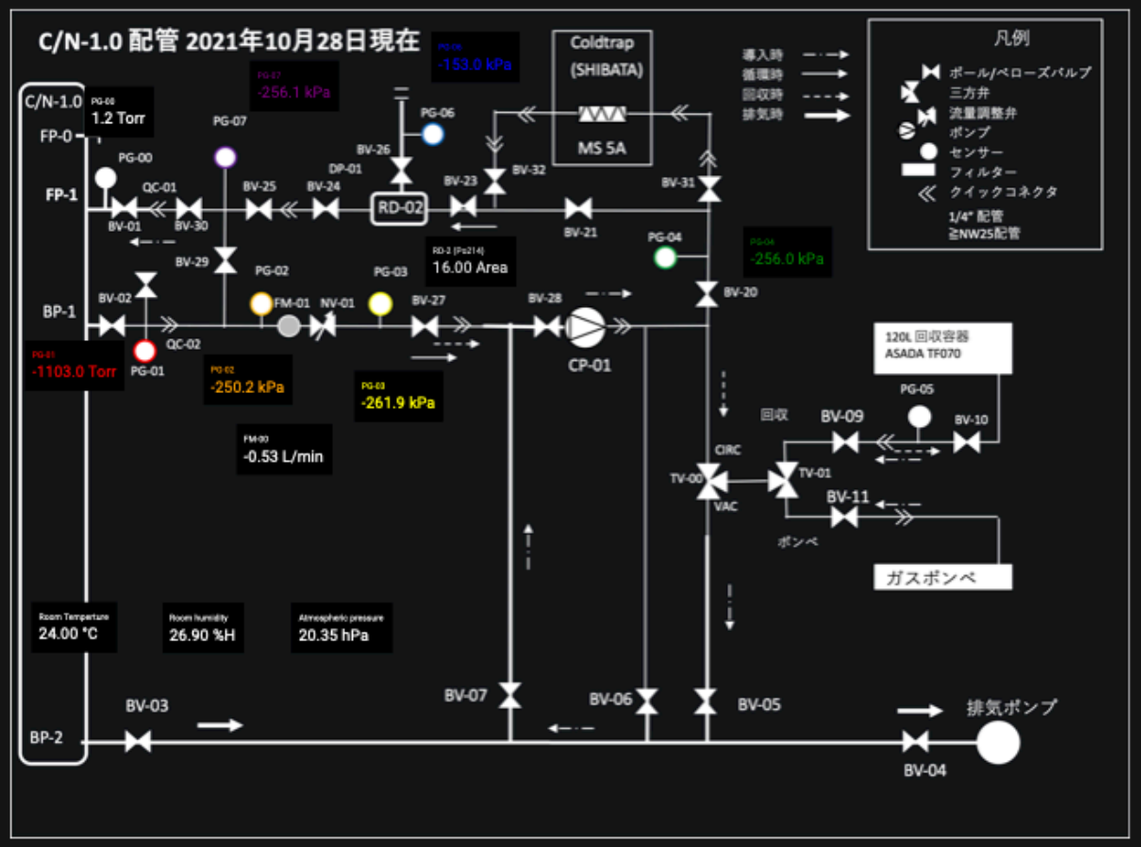
Raspberry Pi slow monitor + Grafana

CN-1.0 Monitor

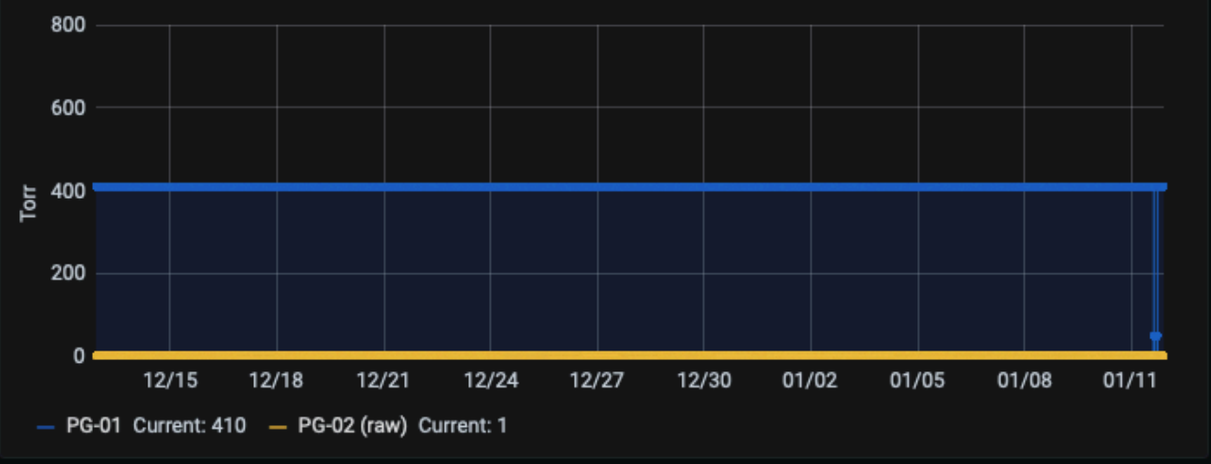
Last 30 days | 5s

Row title

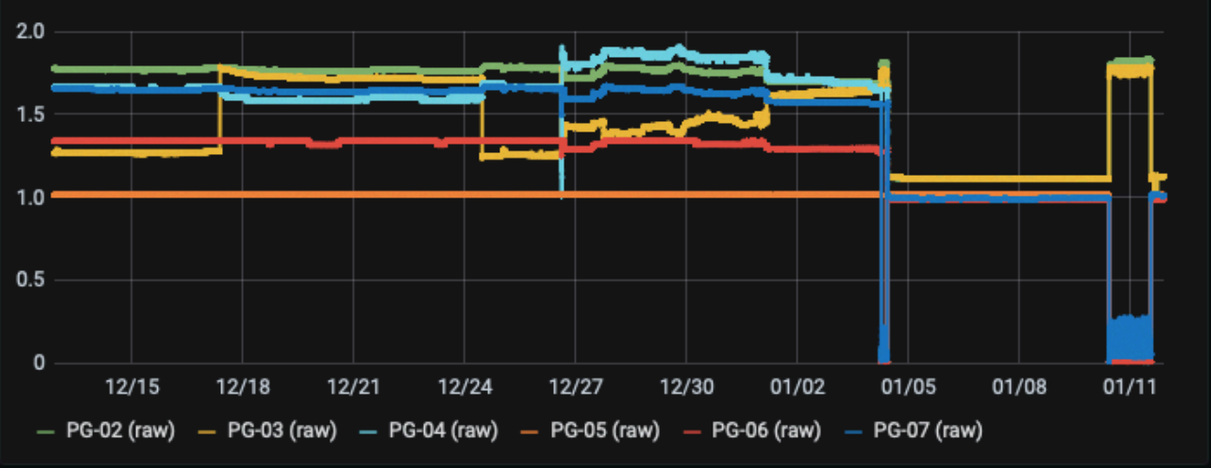
Line Pressure Gauges



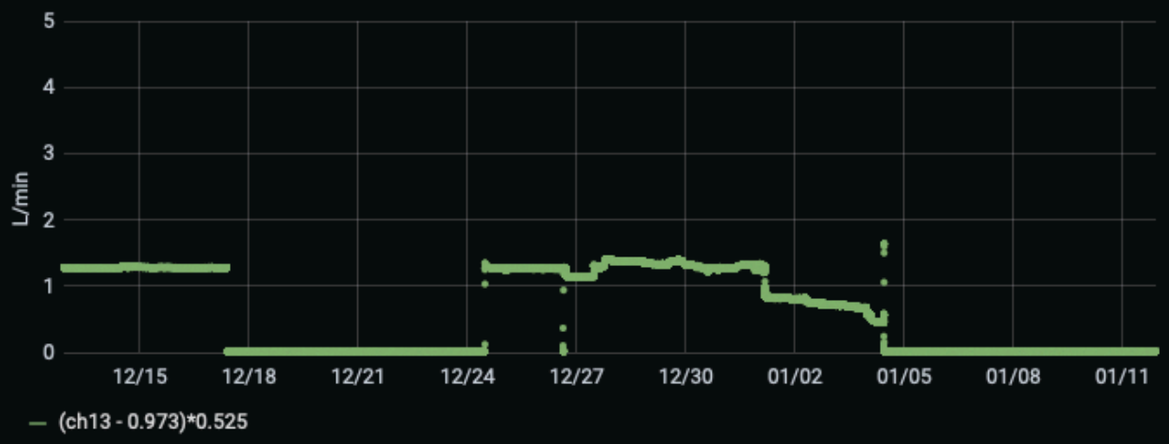
Vessel Pressure



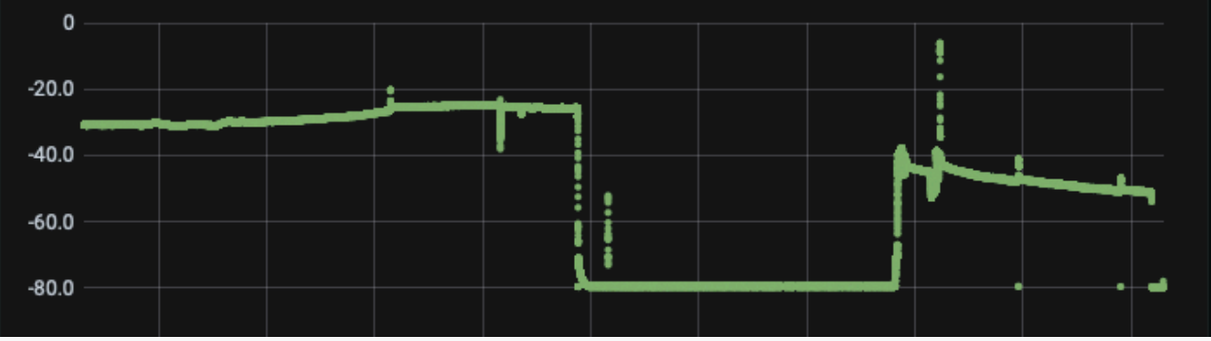
Line pressure (RubiS MySQL)



Flow Meters

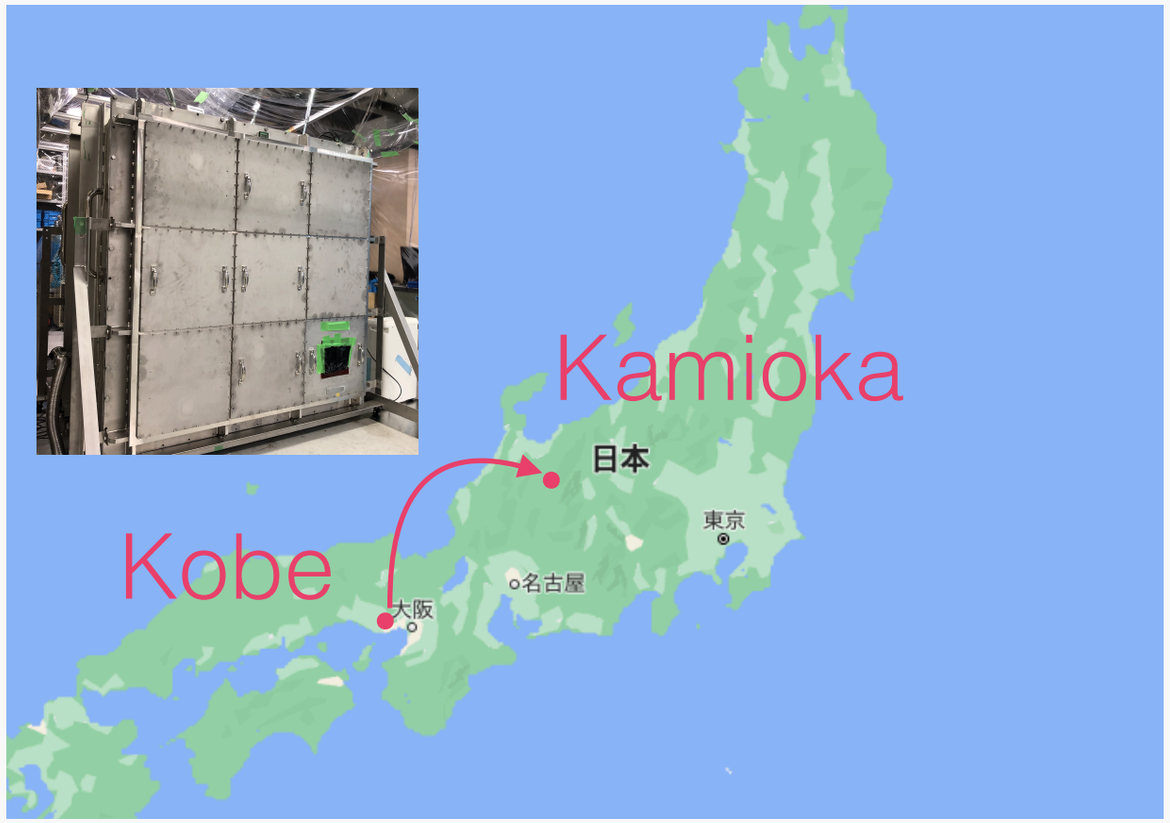


Dew Point Meter



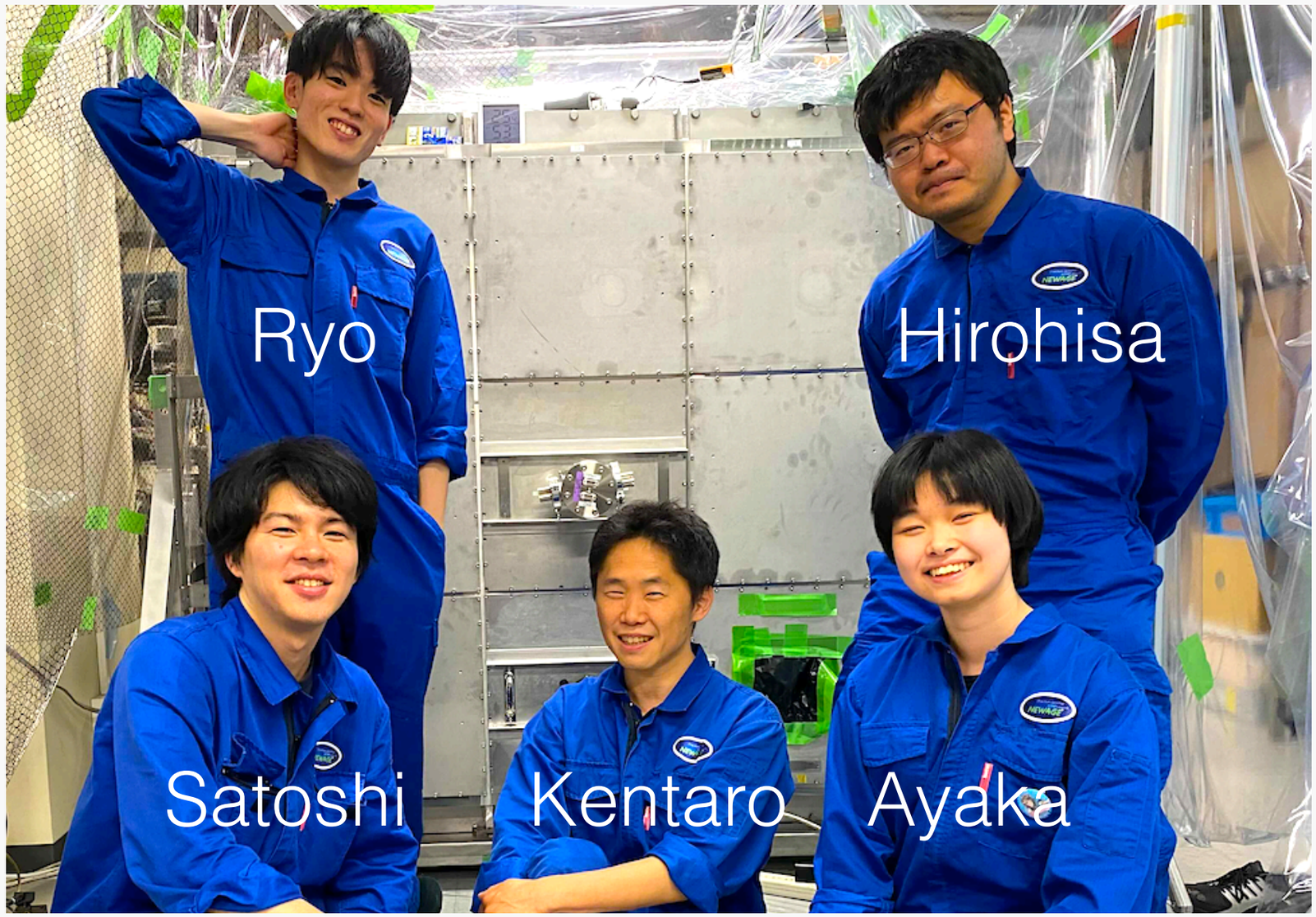
Schedule

- C/N-1.0 commissioning will be finished on March.
  - ➡ CF_4 (76 Torr) gas will be replaced to SF_6 (20 Torr) gas soon
- Goal of the commissioning is to detect main and minority peaks by SF_6^- and SF_5^-, respectively
- After the commissioning, C/N-1.0 will be moved to Kamioka mine
  - ➡ The move will be carried out on the end of March.



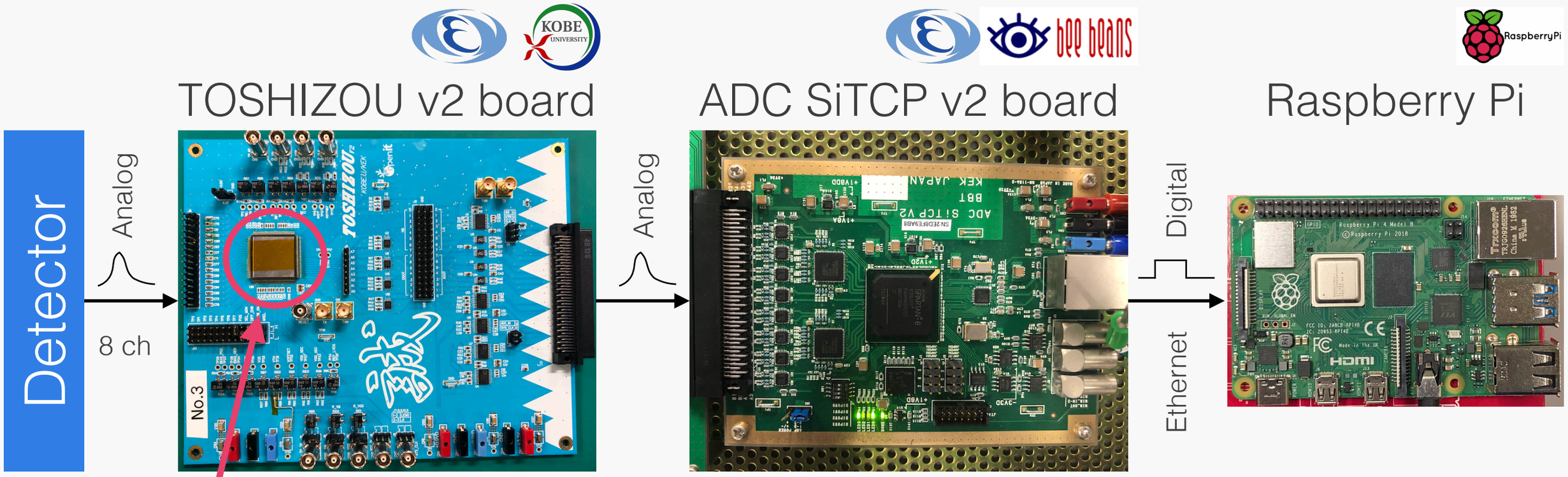
Summary

- C/N-1.0 commissioning is ongoing with only five active persons!
- After solving HV spark issue, final commissioning will be taken place with SF_6 gas
- Gas circulation with MS 5A was constructed and started to test
- C/N-1.0 will be moved to the underground on the end of March.



Backup

Readout system



- Compact DAQ system with multi-channel waveform acquisition is created to avoid to interfere neighbouring modules
  - ➡ TOSHIZOU: 10.0 or 0.5 [mV / fC] selectable amplifiers (used lower gain amp.) in each channel
    - Proto-type of SF_6 readout board
  - ➡ ADC SiTCP: 5~40 MHz sampling ADC (waveform digitizer): max depth = 2048