



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

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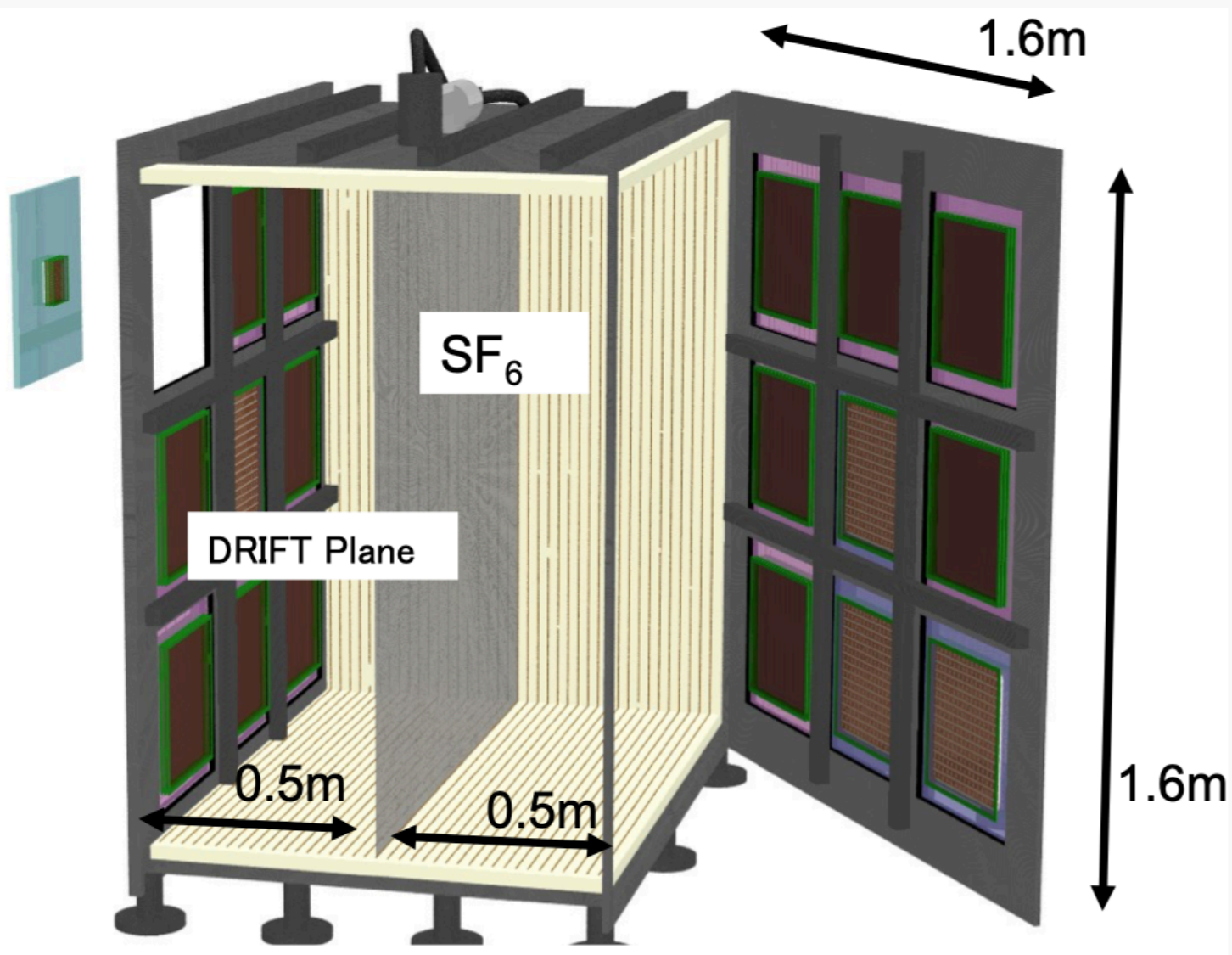
11 / 1 / 2022

Introduction

(Kamioka)

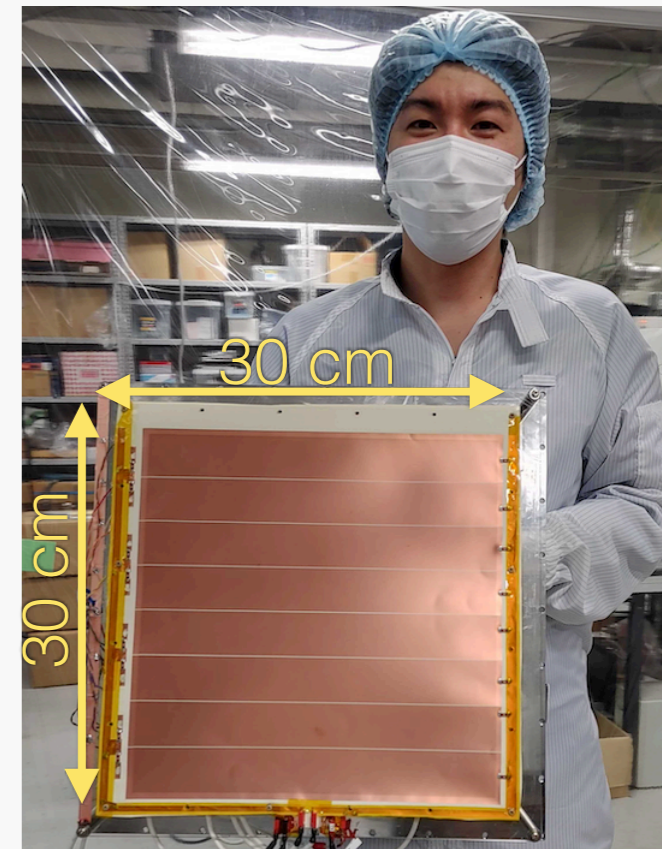
CYGNUS-KM / NEWAGE (C/N-1.0)

- 18 modules capable 1 m³ chamber
 - ➔ placed in Kobe University

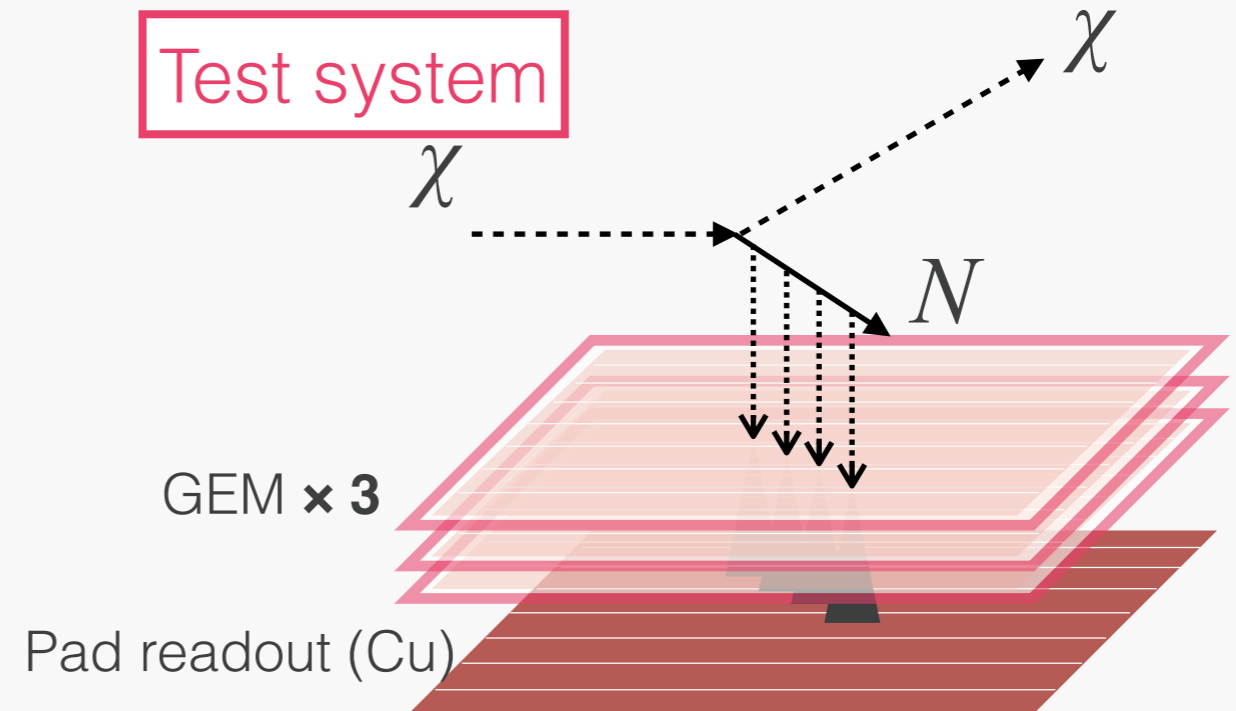
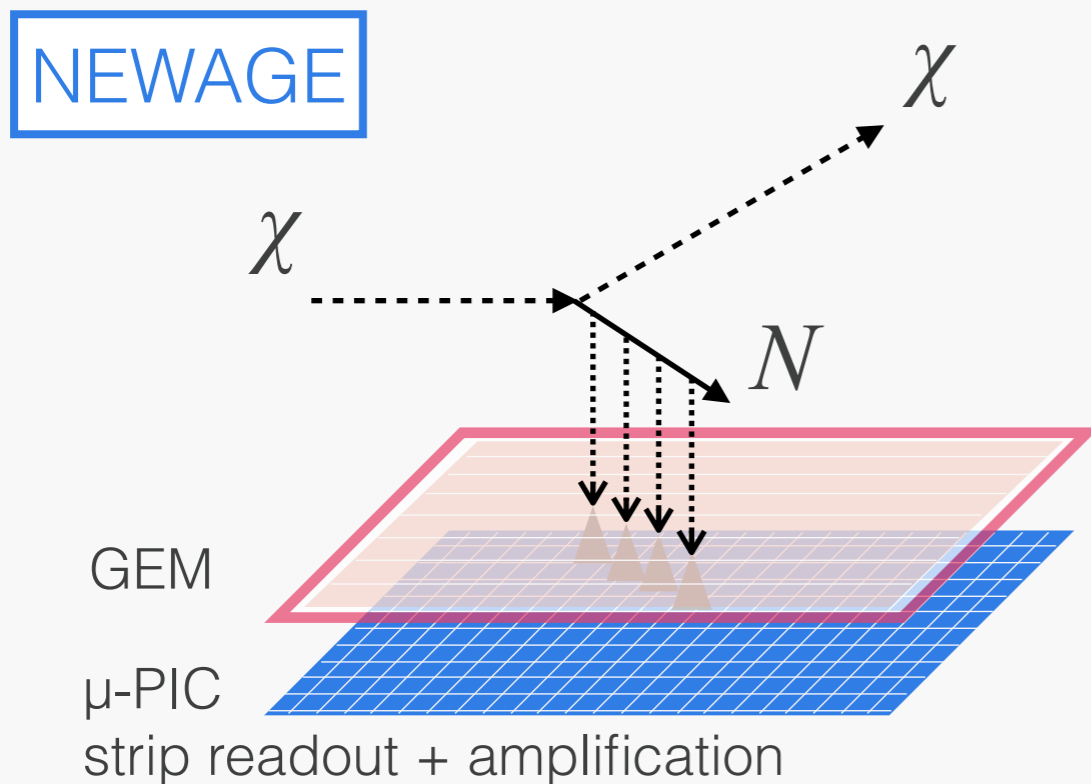


Detector: “Module 0”

- 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, ...)

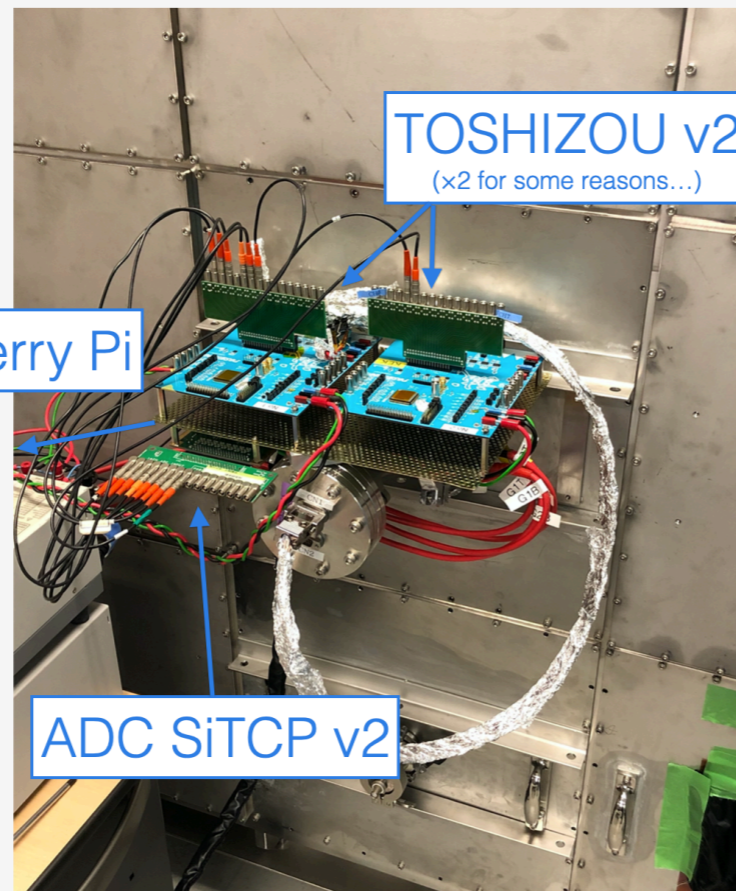
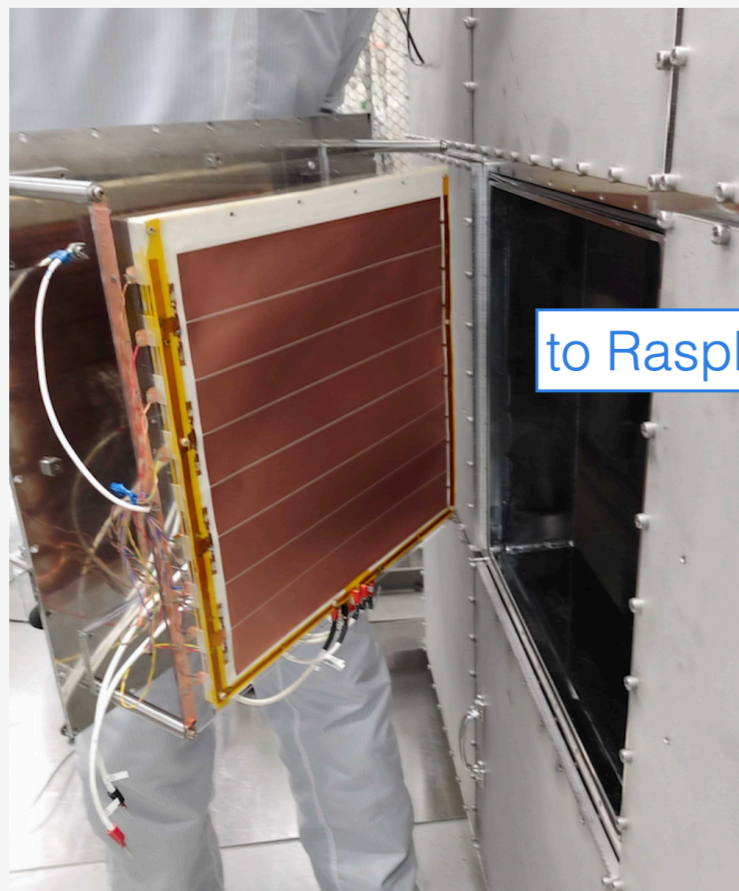


Amplification and detection system



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

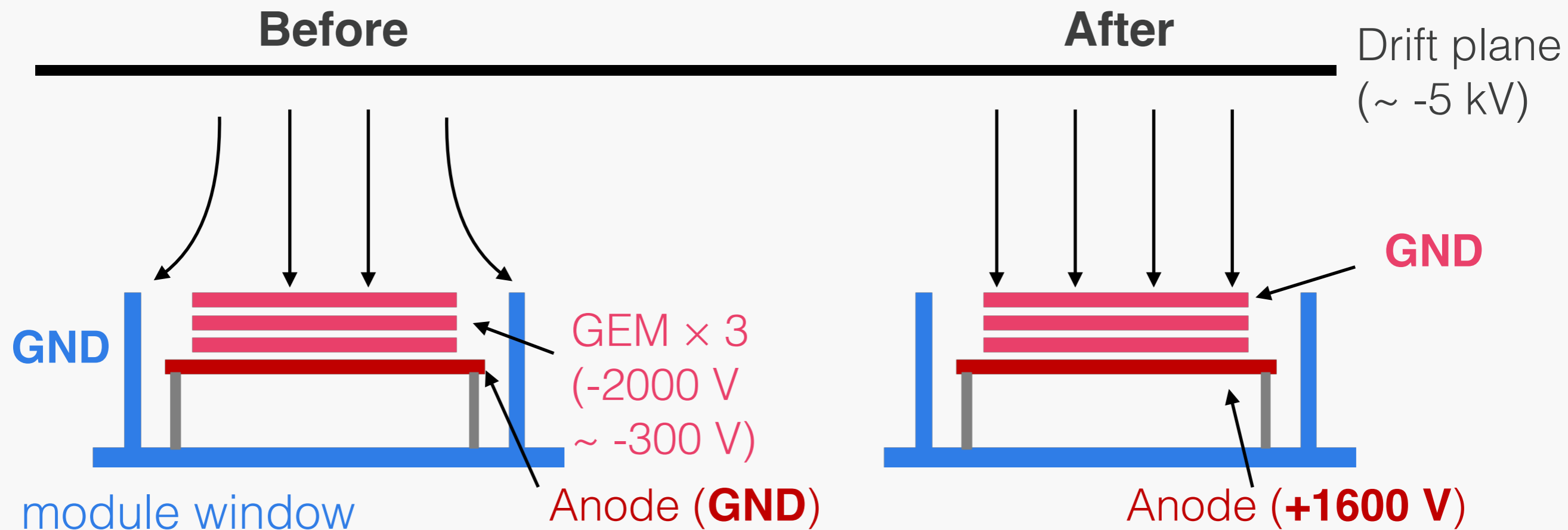
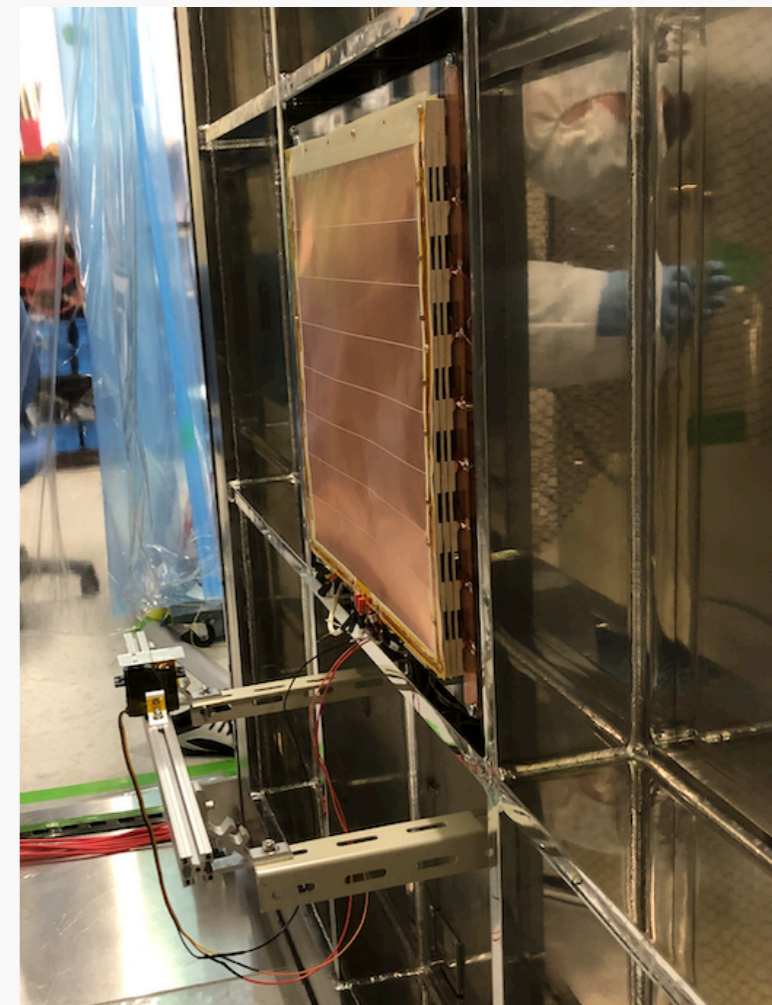


Updates

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

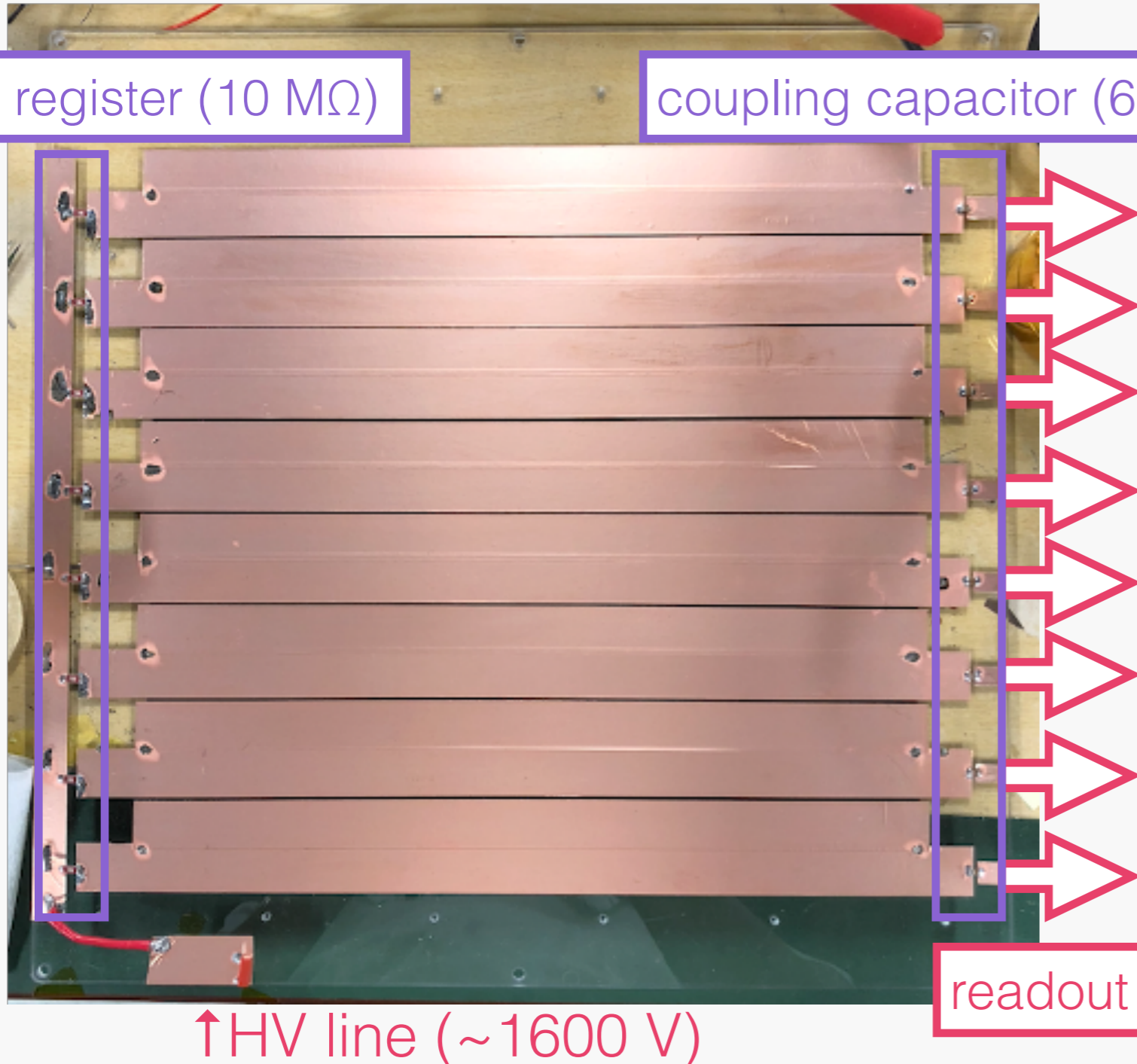
Detector update (1)

- 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



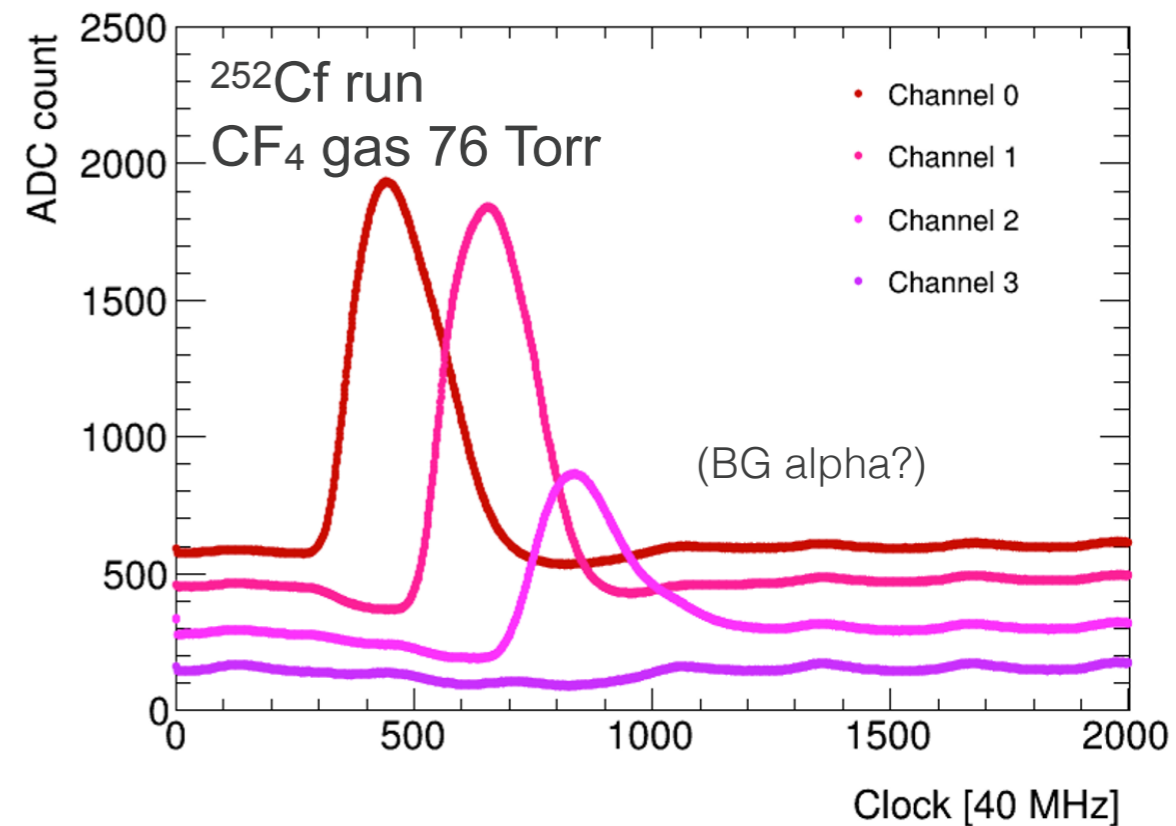
Detector update (2)

- 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 (CF₄, 76 Torr)
 - Our goal is **50 kV** with SF₆, 20 Torr
- Camera-module was prepared to find sources of spark
 - with commercially available USB camera (not CCD!)
 - Camera was put into the chamber

A screenshot of an Amazon Japan product page for an "ELP Auto Focus 4K USB Camera". The product is described as an "Ultra Small Webcam 100 Degree No Distortion Lens Camera 2160P 30FPS Camera Full HD Webcam Sony IMX415 Support UVC/Plug and Play/Free Driver Video Delivery Home Conference/Game Comment/Class Camera Compatible Windows/Android/Mac Camera Module (Model:ELP-USB4K02AF-V100-JP)". The price is listed as ¥11,768. The page includes navigation links, a search bar, and a "Buy Now" button.

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Electronics & Cameras

Cameras DSLRs Mirrorless Cameras Point & Shoots Lenses Camcorders Sports & Action Cameras security cameras drones Tripods Accessories Optical Used Camera

ELP Auto Focus 4K USB Camera Ultra Small Webcam 100 Degree No Distortion Lens Camera 2160P 30FPS Camera Full HD Webcam Sony IMX415 Support UVC/Plug and Play/Free Driver Video Delivery Home Conference/Game Comment/Class Camera Compatible Windows/Android/Mac Camera Module (Model:ELP-USB4K02AF-V100-JP)

Brand: ELP

3 ratings

¥11,768

Amazon Points: 118pt (1%) See details

Camcorder type Video Camera

Brand ELP

Special Feature Autofocus

Video Capture Resolution 1080p, 720p, 4K, 480p

See more

¥11,768

Amazon Points: 118pt (1%) See details

FREE delivery: Thursday, Jan 13 Details

Fastest Delivery: Get it Tomorrow, Jan 12, 8AM-12PM. Pick a convenient slot at checkout.

Select delivery location

In Stock. Click here for details of availability.

Quantity: 1

Add to Cart

Buy Now

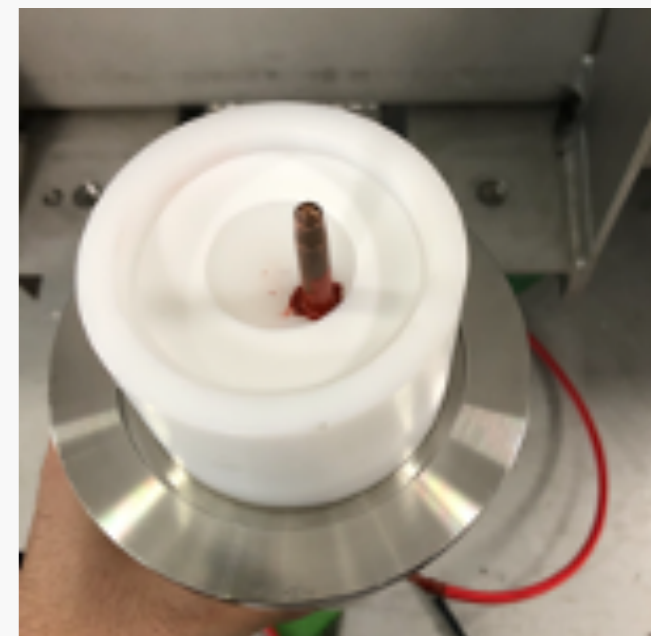
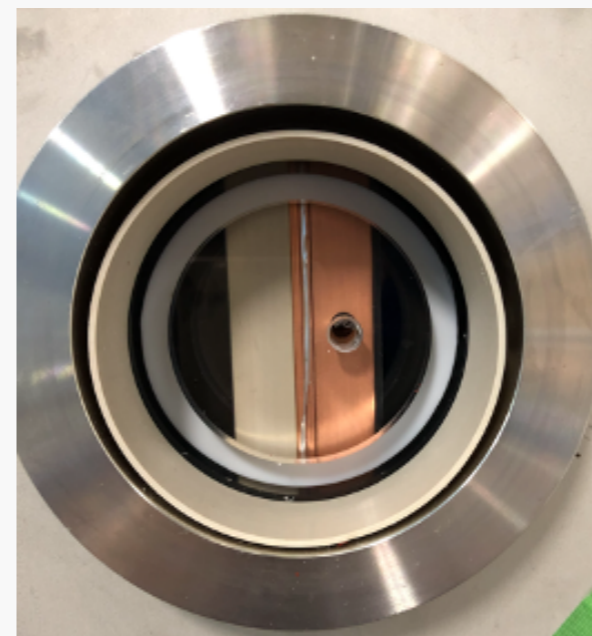
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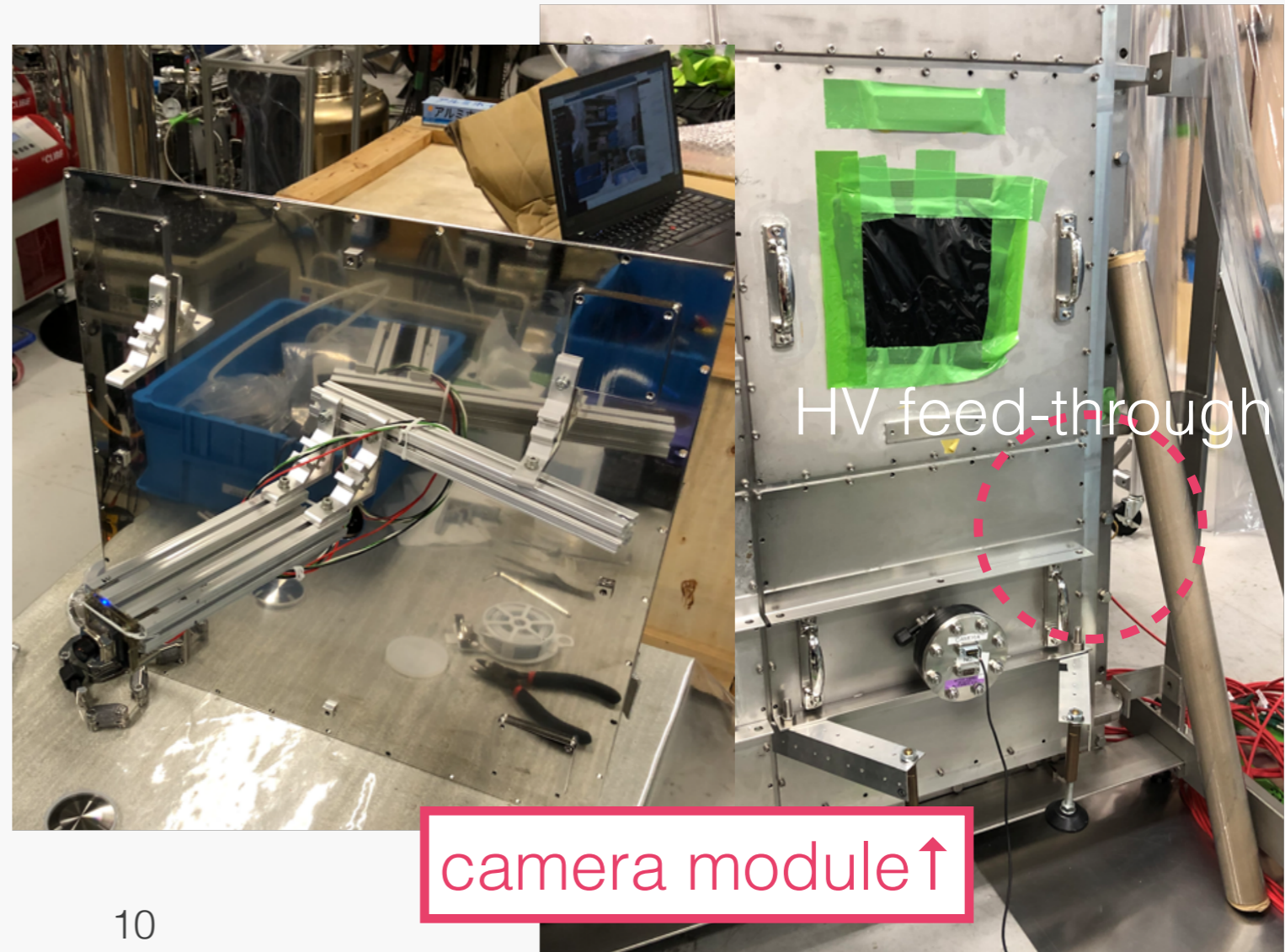
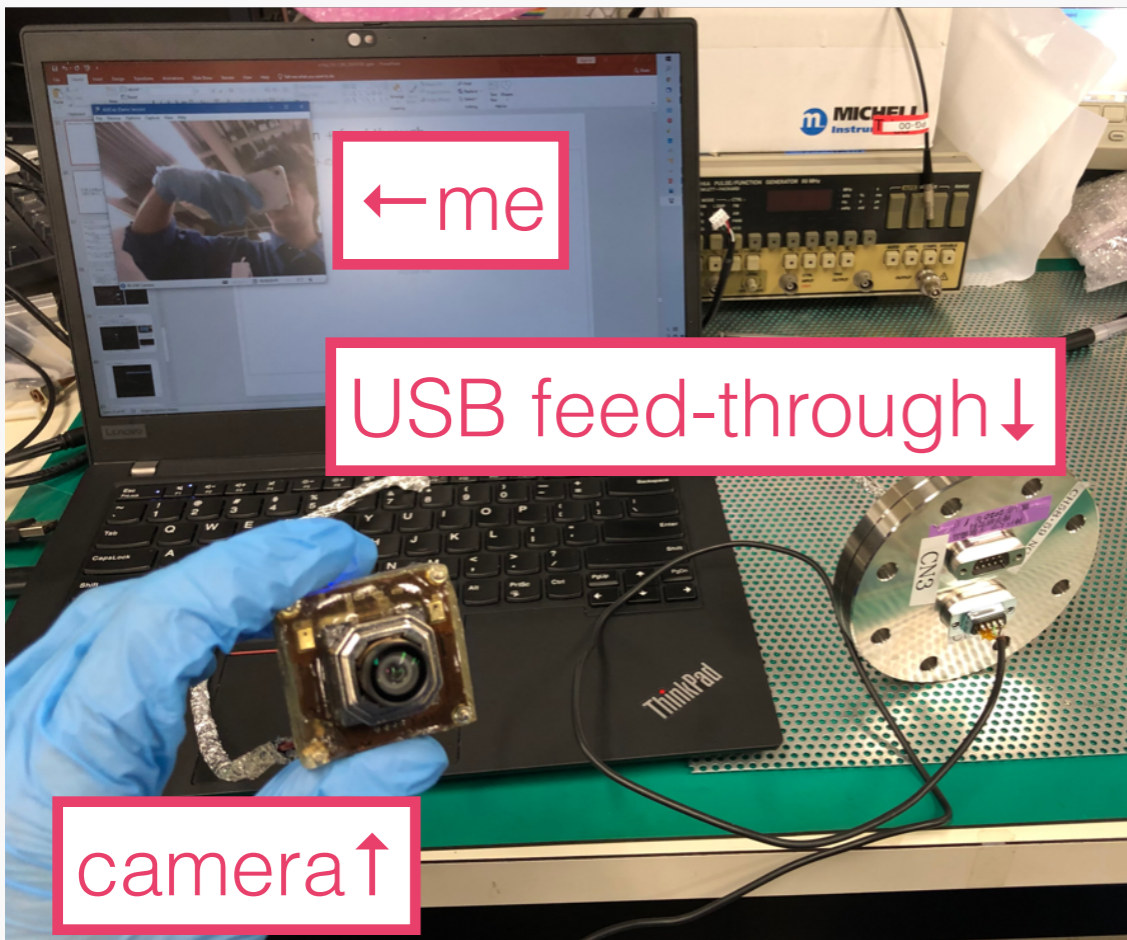
Add to List



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



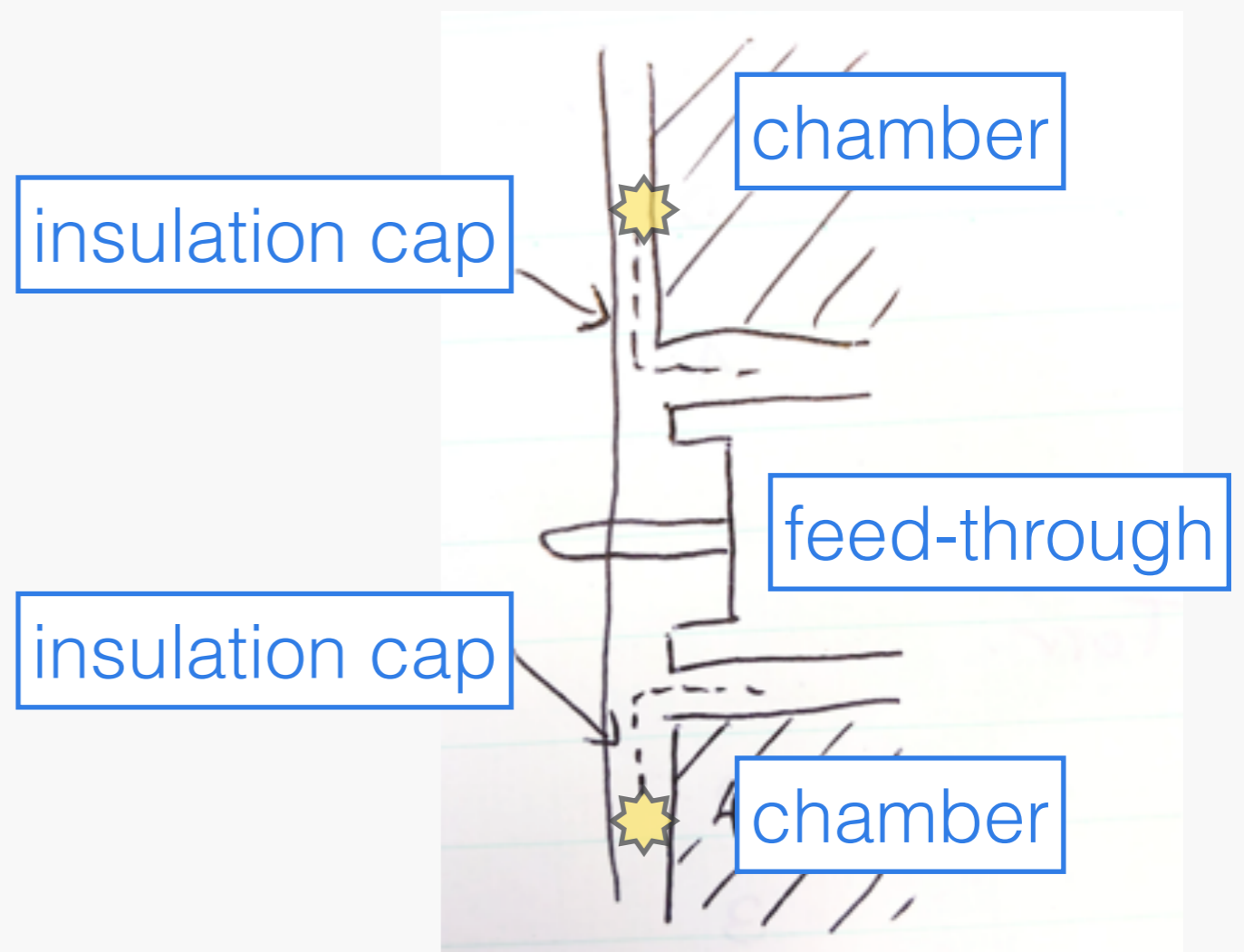
Spark (movie)

File Devices Options Capture View Help



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

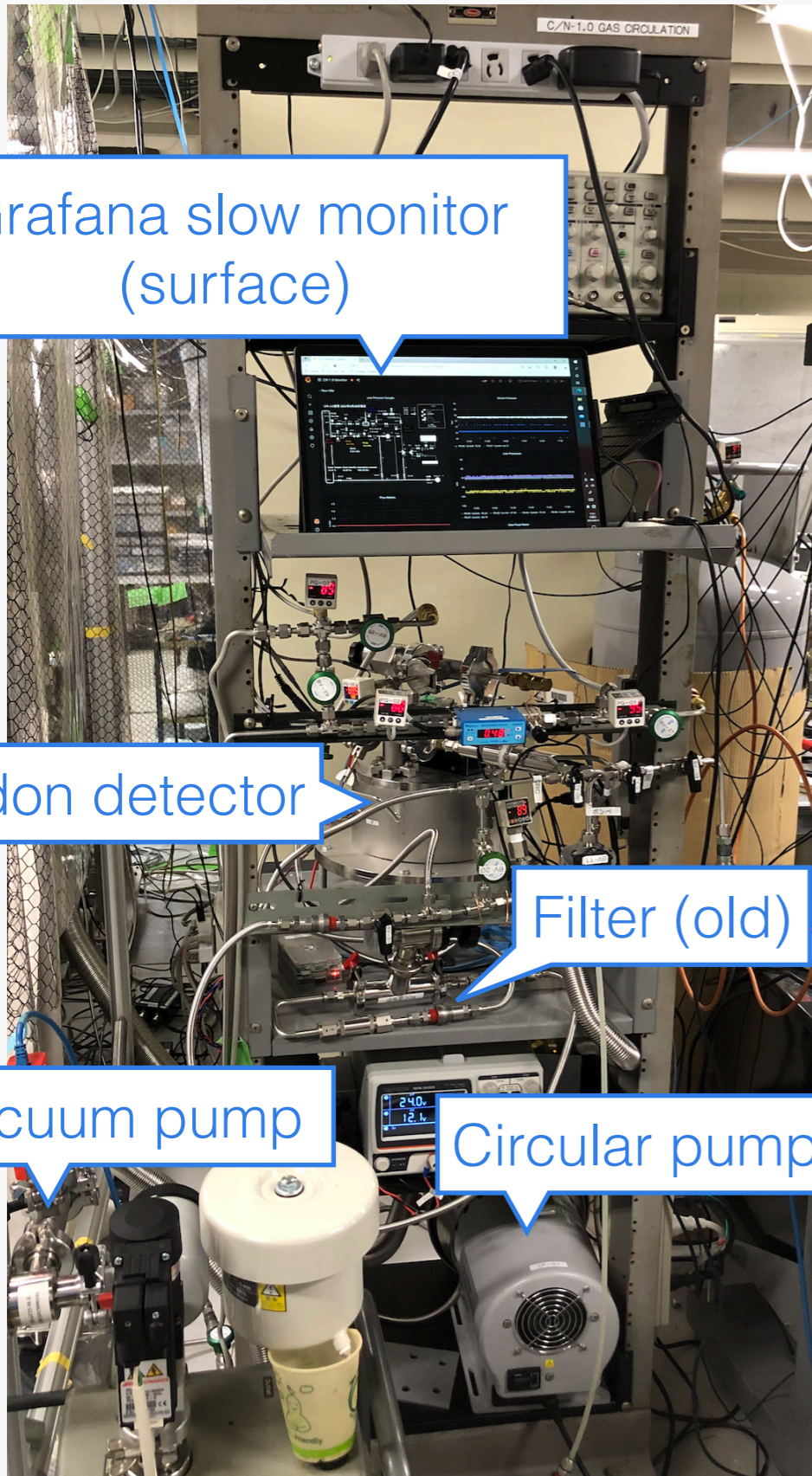


Circular system and Slow monitor

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

Grafana slow monitor (surface)

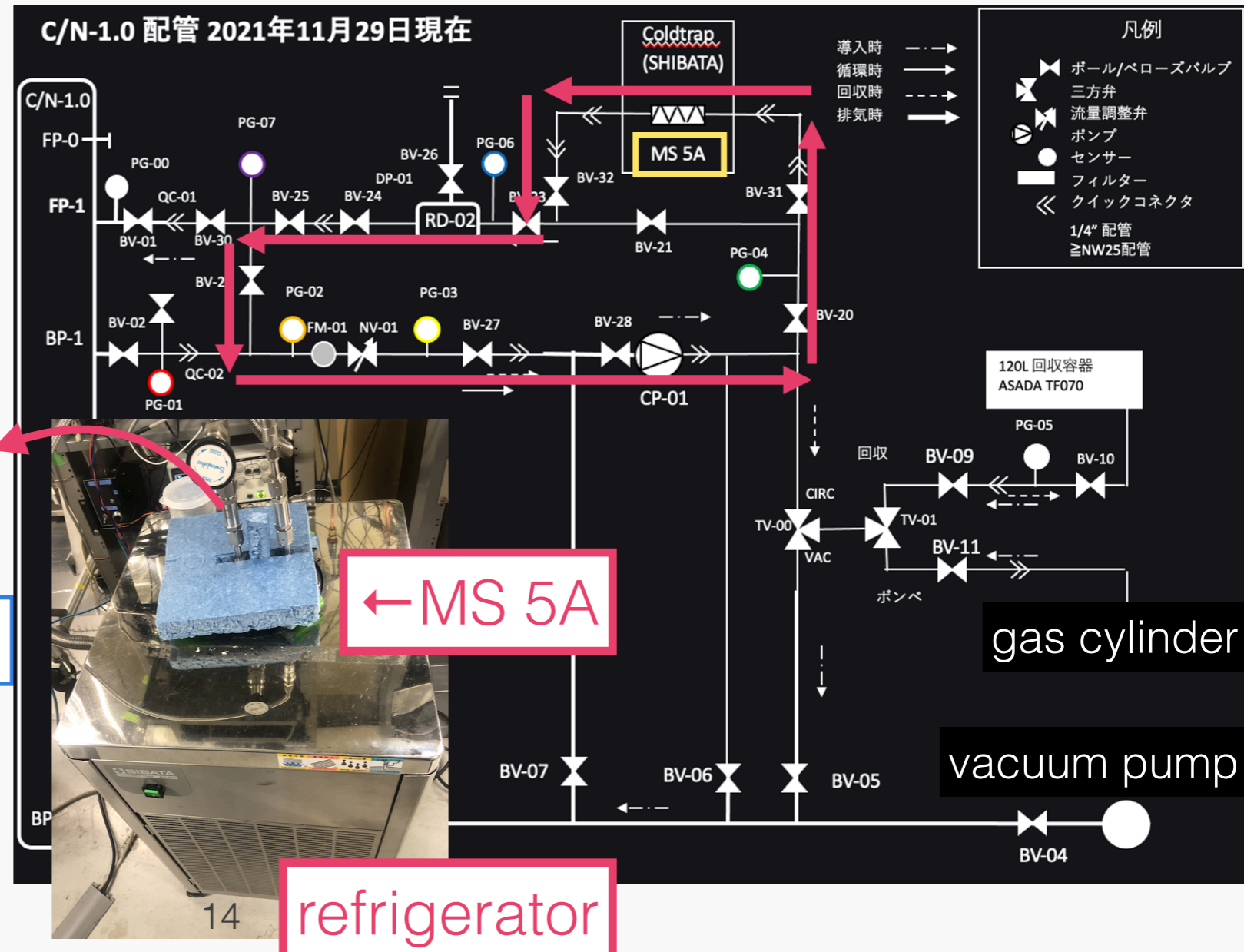


Radon detector

Filter (old)

Vacuum pump

Circular pump



← MS 5A

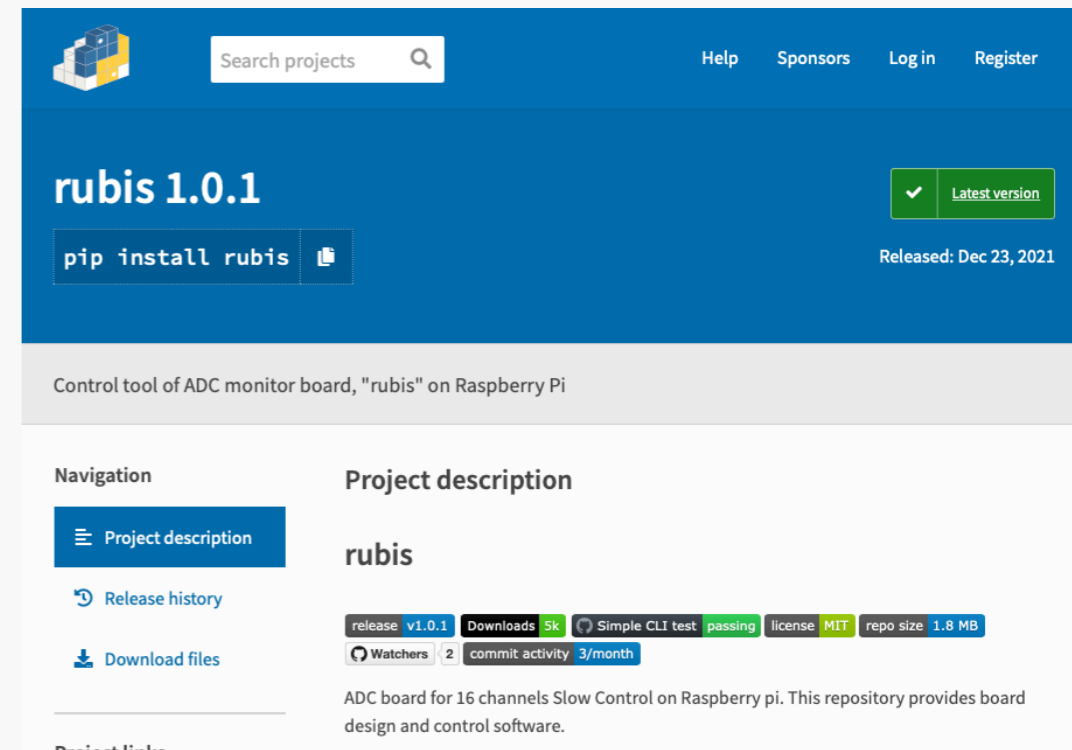
refrigerator

gas cylinder

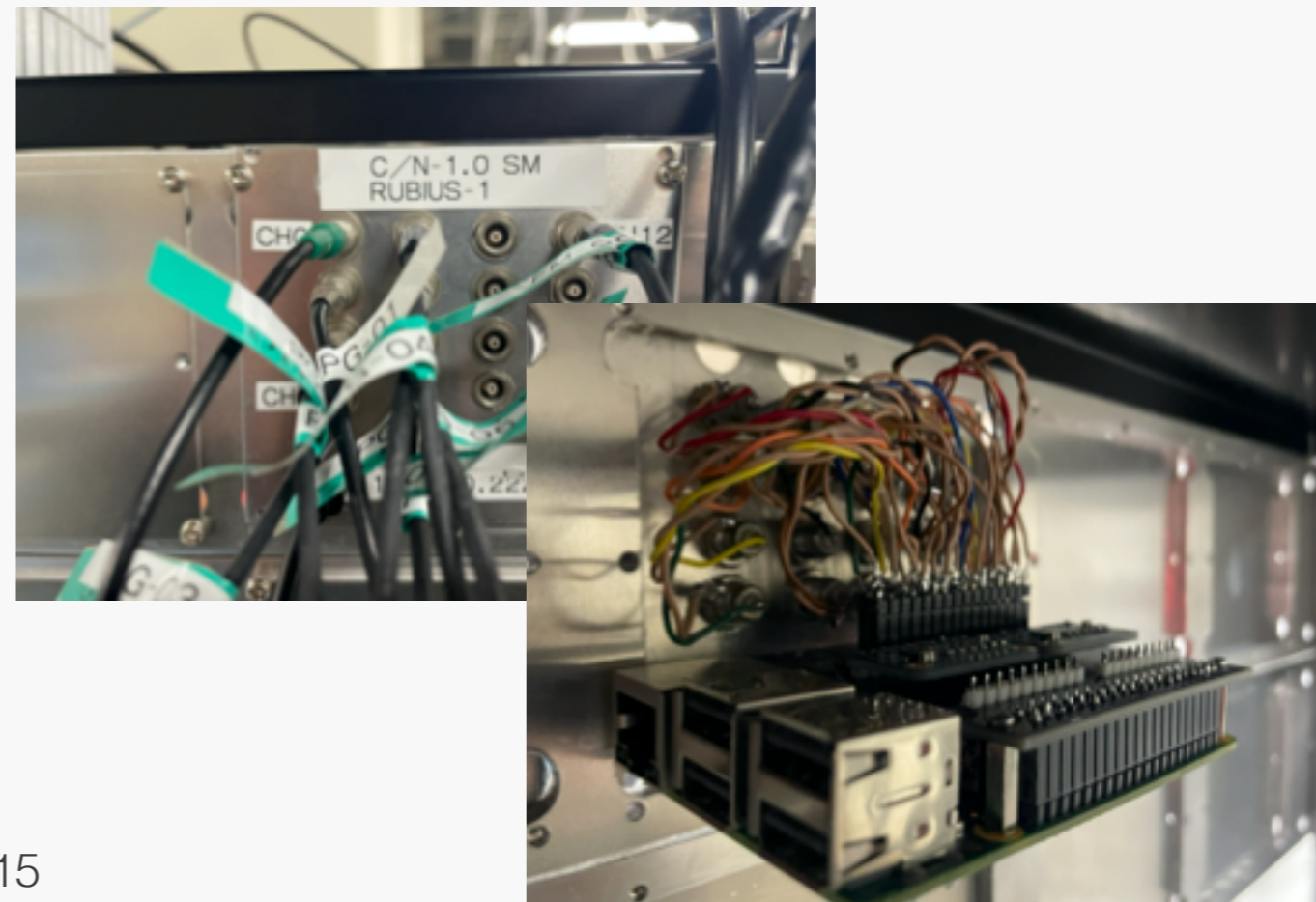
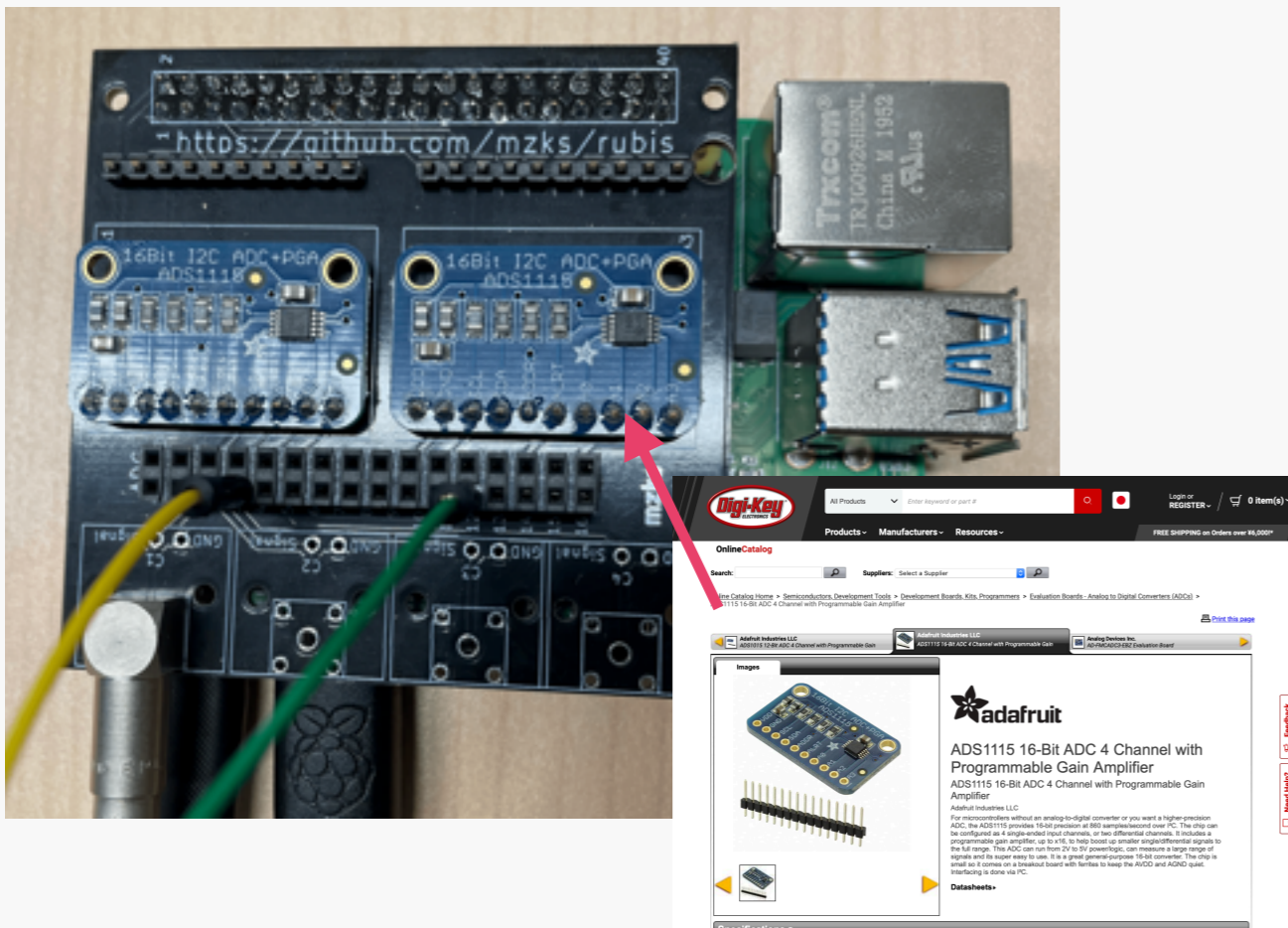
vacuum pump

Slow monitor

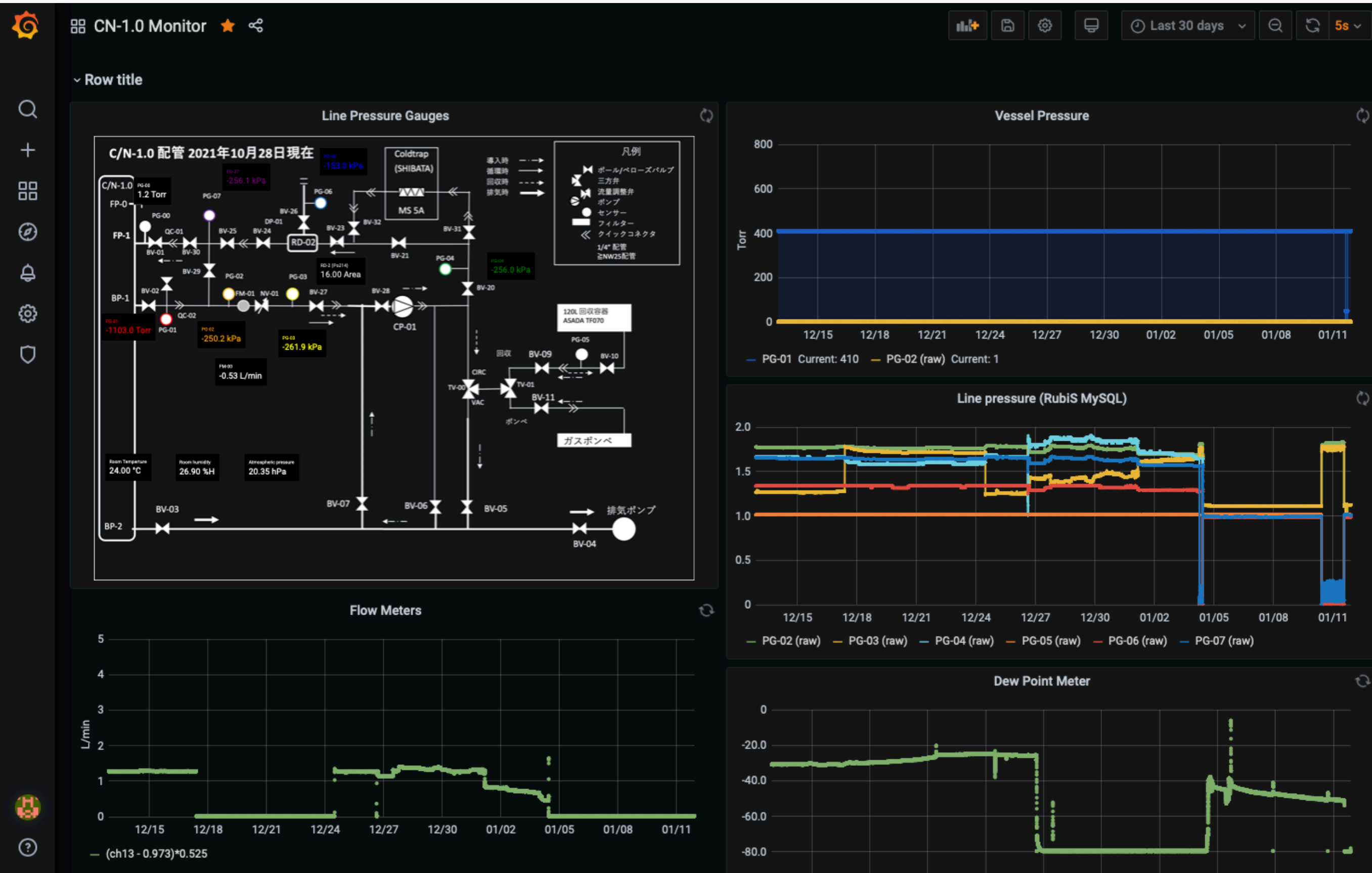
- Raspberry-Pi + 16 bit ADC (16 ch. in total)
 - adafruit ADS1115 4 ch ADC ×4 are mounted
 - develop intermediate PCB
 - python script is available via pypi
- Compact and portable slow monitor system
 - In case of Kobe: rack mounting & LEMO interface



The screenshot shows the PyPI project page for 'rubis'. At the top, there is a search bar and navigation links for 'Help', 'Sponsors', 'Log in', and 'Register'. The project name 'rubis 1.0.1' is prominently displayed, along with a 'Latest version' badge and a 'pip install rubis' button. Below this, the project description reads: 'Control tool of ADC monitor board, "rubis" on Raspberry Pi'. A navigation menu on the left includes 'Project description', 'Release history', and 'Download files'. The 'Project description' section shows 'rubis' with a release of 'v1.0.1', 5k downloads, a 'Simple CLI test' that is 'passing', an 'MIT' license, and a '1.8 MB' repo size. It also indicates 2 watchers and 3 commits per month. The description states: 'ADC board for 16 channels Slow Control on Raspberry pi. This repository provides board design and control software.'



Raspberry Pi slow monitor + Grafana



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 SF₆ 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

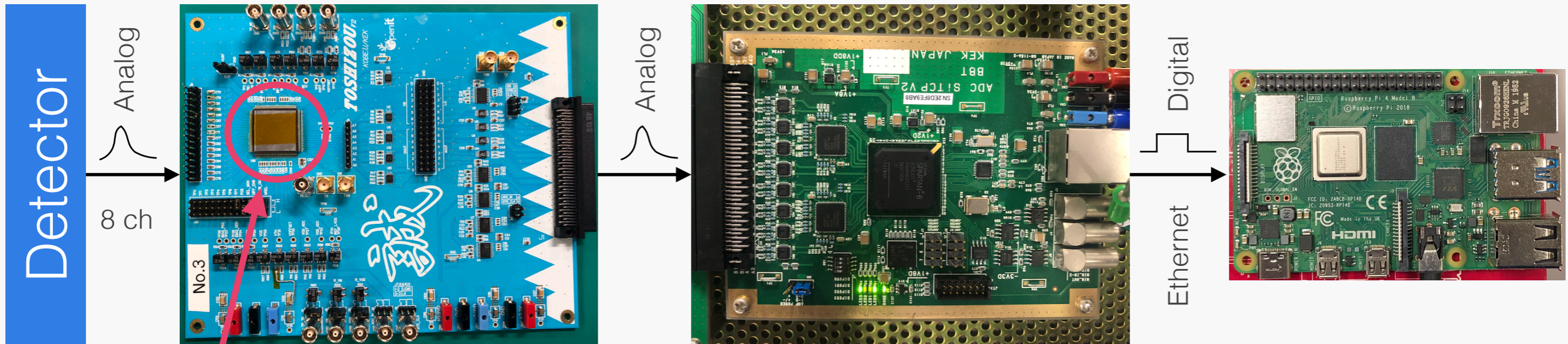
Readout system



TOSHIZOU v2 board

ADC SiTCP v2 board

Raspberry Pi



LTARS2016
(8 ch Preamp ASIC)

5~40 MHz FADC × 16 ch

- 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 SF₆ readout board
 - ➔ ADC SiTCP: 5~40 MHz sampling ADC (waveform digitizer): max depth = 2048