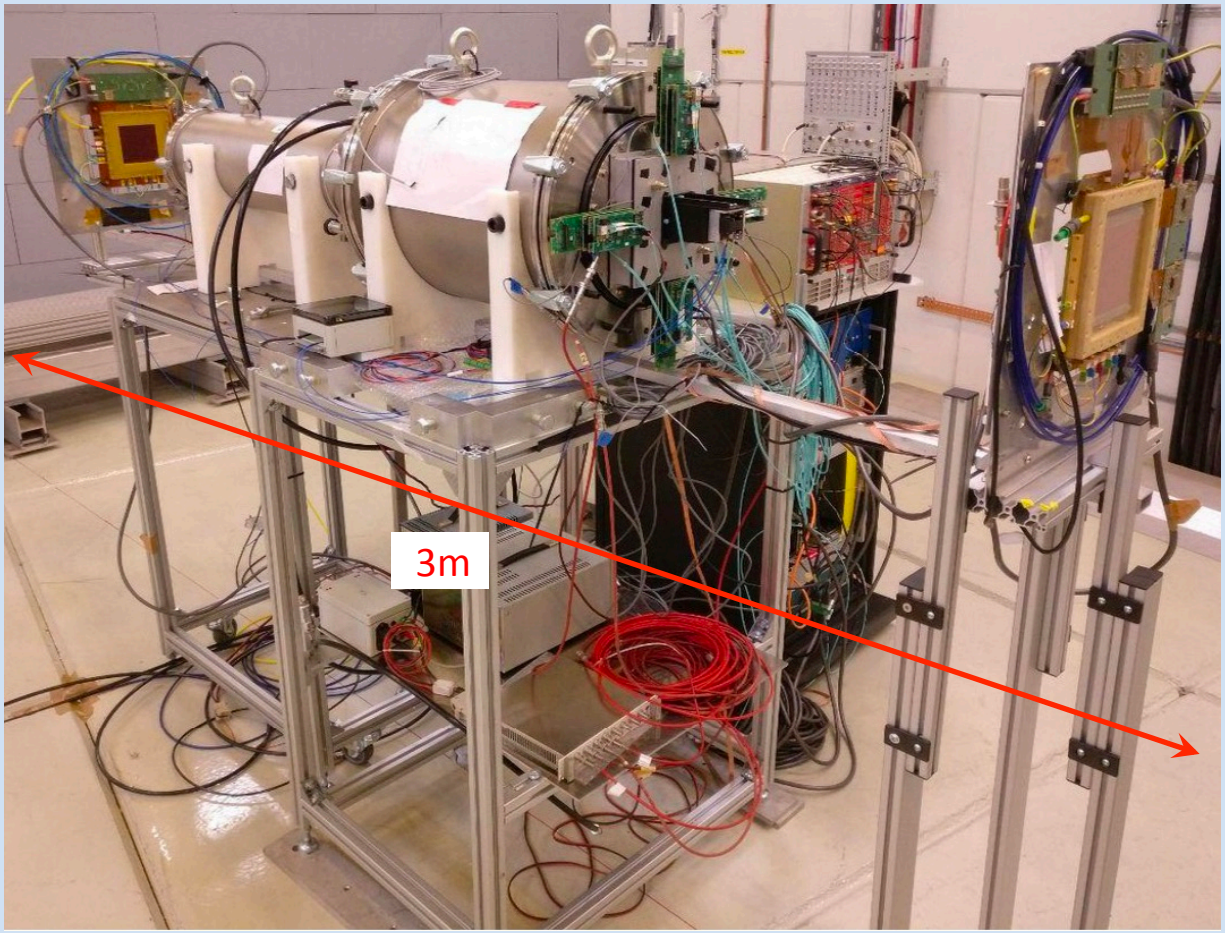
# dRICH Prototype




**Goals:**

- Study dual radiator performance and interplay
- Study specifications and alternatives for optical components
- Test alternate single-photon detection systems
- Design parameters and optimization

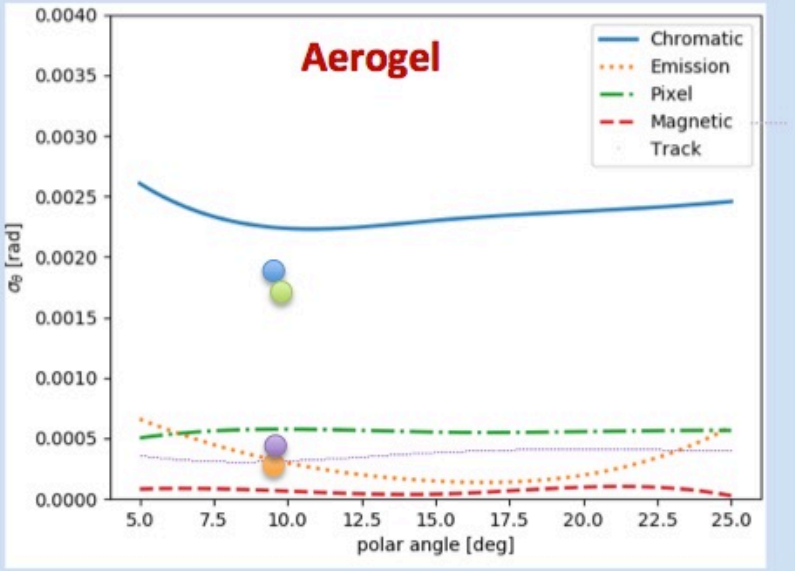
Basic system commissioned in 2021 runs

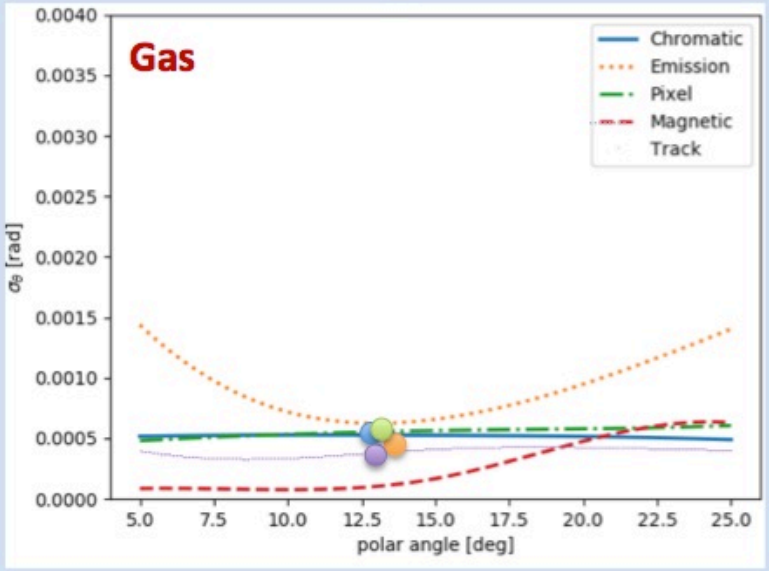
# dRICH Resolution

| 1 p.e. error (mrad) | | Aerogel Demo | Aerogel dRICH | Gas Demo | Gas dRICH |
|---|---|---|---|---|---|
| Pixel | ( 3mm pixel) | 1.9 | (0.6) | 0.6 | (0.5) |
| Chromatic | (300 nm filter) | 1.8 | (2.2) | 0.6 | (0.5) |
| Emission | (1 cm out of focus) | 0.3 | (0.3) | 0.4 | (0.6) |
| Tracking | (0.5 mrad) | 0.4 | (0.3) | 0.4 | (0.4) |
| Total | | 3.0 | (2.3) | 1.1 | (1.0) |

5

1.2




Preparing the prototype for the next test beam campaign (fall 2022)

# Prototype Signals

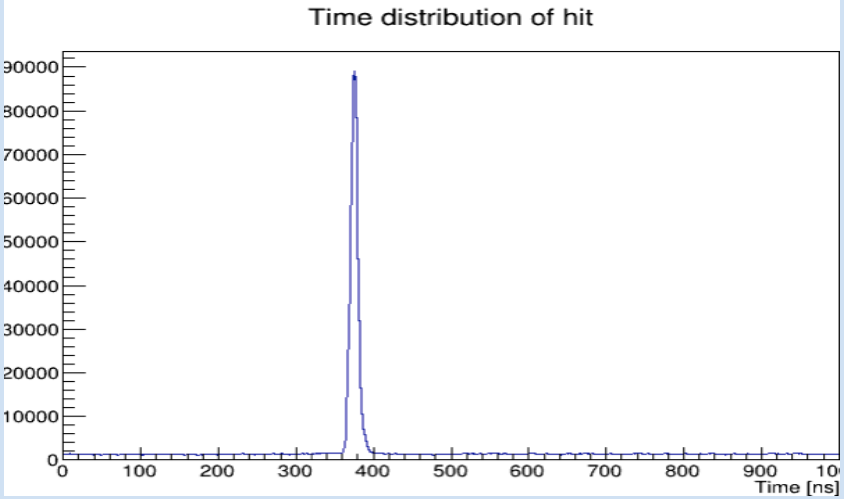
2021 beam time:

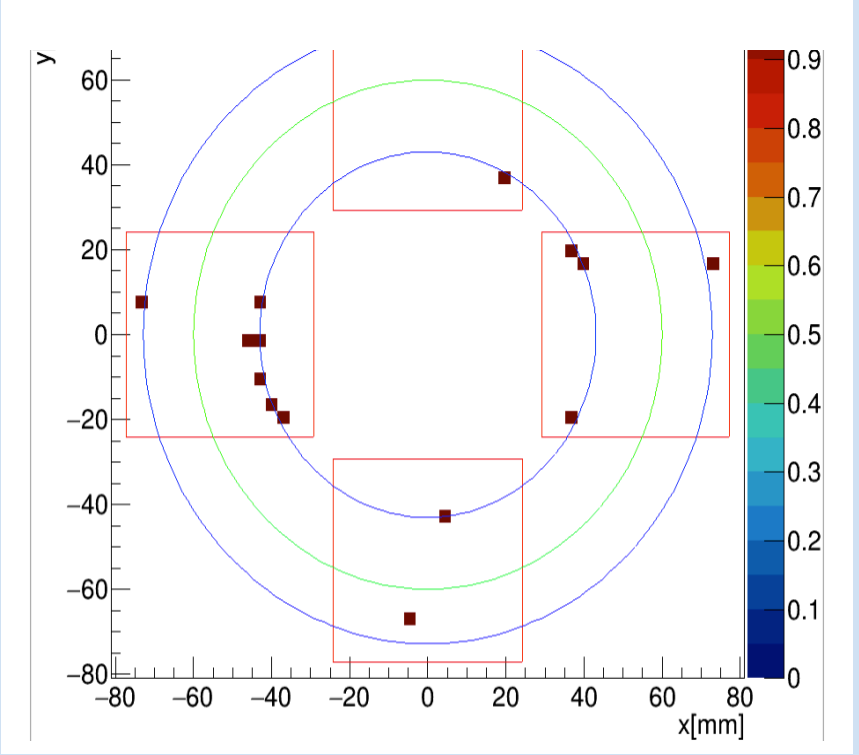
- Most of the time was parassitic
- Sensors + readout shared with eRD101
- Beam line still under commissioning

Prevented a detailed systematic study
Nevertheless preliminary performance study was possible

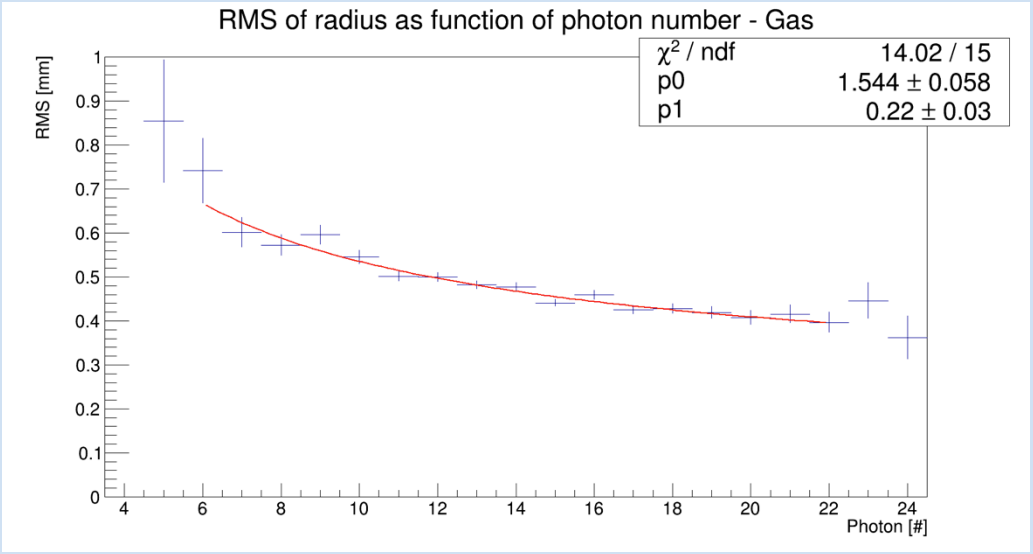
Example of event display

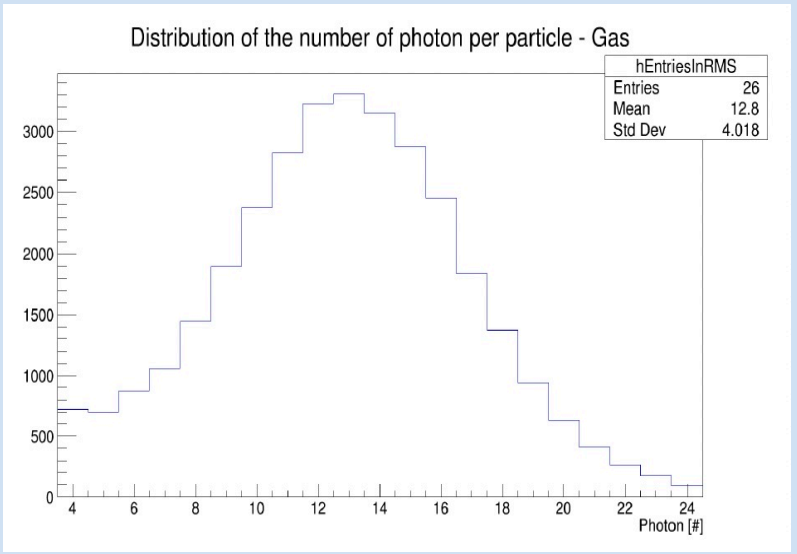
- Recorded hit
- Sensor
- Geometrical selection
- Gas and aerogel reconstructed rings



# Preliminary Performance: Gas




Fitting function: $y=\sqrt{p\downarrow 0 \uparrow 2 /x+p\downarrow 1 \uparrow 2}$

$p_1$ = single particle resolution constant term

$p_0$ = single photon resolution

1.5 mm in radius

**~ 1.2 mrad in angle (1.1 expected)**

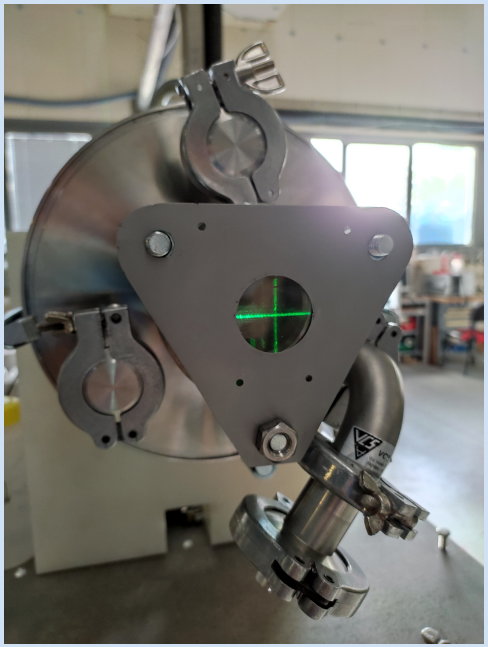
$\sigma_{20}$ ~ 0.45 mrad

| Gas | Data | Simulation |
|---|---|---|
| $p_0$ [mm] | 1.5 | 1.1 |
| $p_1$ [mm] | 0.22 | 0.07 |
| Avg photon | 12.8 | 11.3 |

# Next Steps: Prototype

Prepare for the next test-beam campaign (fall 2022)

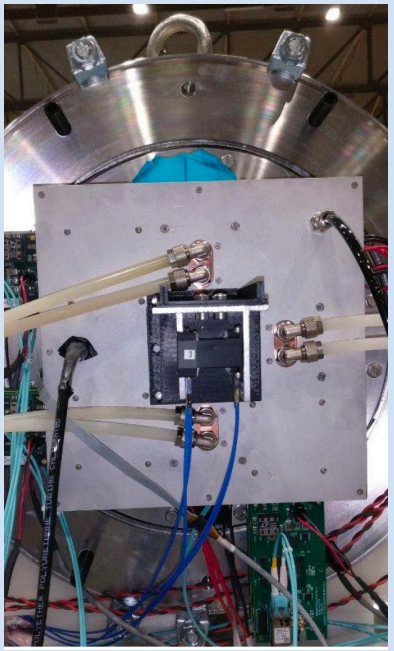
Improved tools for alignment



Upgrade support structure

Time and gain calibration

Improved trigger



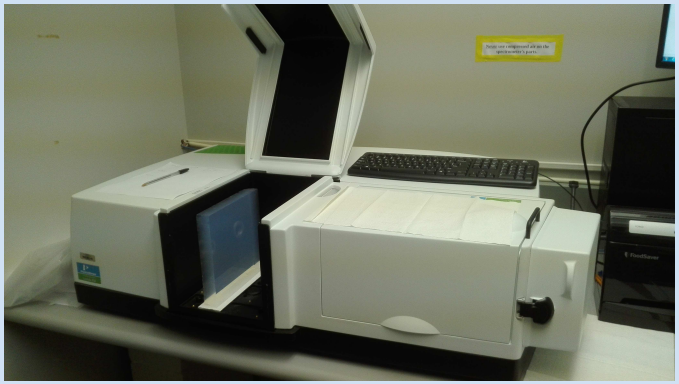
Study alignment and focusing
Study radiator interplay: Distinguish gas and aerogel photons by space and time
Direct comparison between reference (MA-PMTs) and EIC-driven (SiPM)
Tagging time and PID of the beam particle

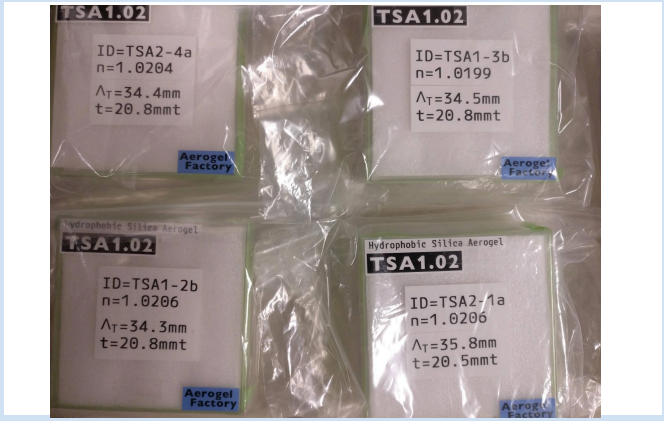
# Components

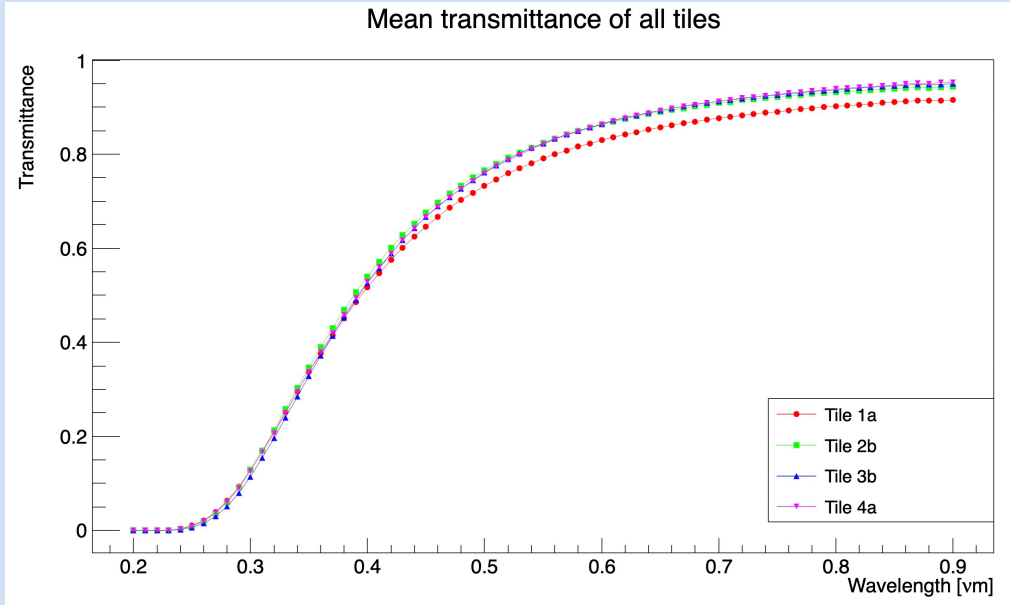
Aerogel: Budker Institute - Russia: not accessible
Aerogel Factory - Japan: good quality, working on dimensions (in collaboration with ALICE3)
ASPEN – USA: promising quality for n=1.02, awaiting validation (in collaboration with CUA)

Lucite: UV filter at 250 nm and 300 nm

Gas: new $C_2F_6$ bottle (RD51) to be verified: pressure reducer

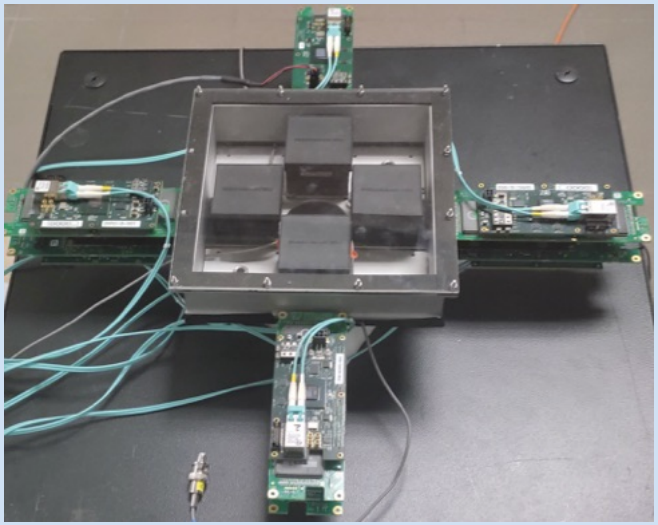




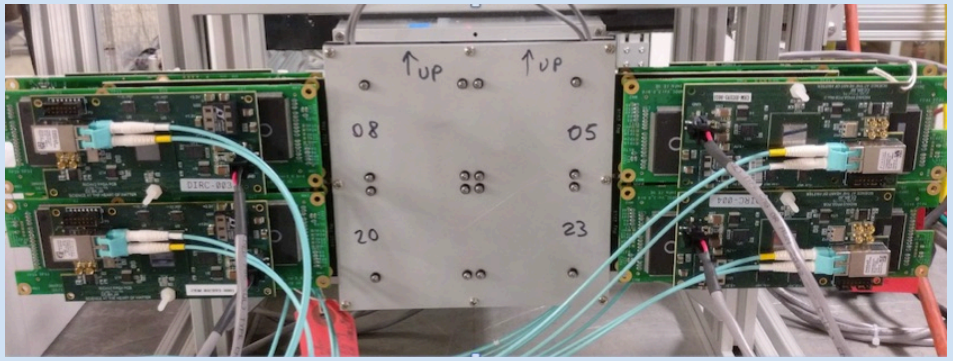



# Readout

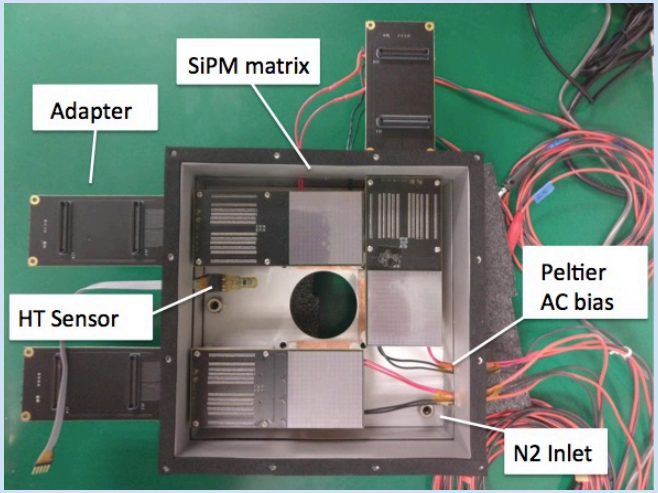
H13700 multi-anode PMTs



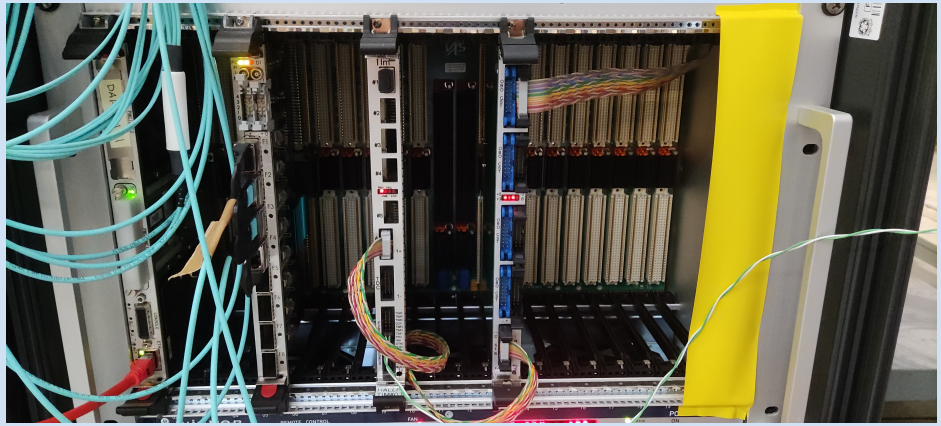
CLAS12 reference readout
MAROC3 front-end chip




H12671 SiPM Matrices




SSP/VME DAQ (~1k channels)



# Personnel

Limited availability: not sure to be able to run 24 h

| | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marco C. | FE | | | | | | | | | | | | | | | | | |
| Luca B. | FE | | | | | | | | | | | | | | | | | |
| Simone V. | FE | | | | | | | | | | | | | | | | | |
| Federico S. | FE | | | | | | | | | | | | | | | | | |
| Marco M. | LNF | | | | | | | | | | | | | | | | | |
| Francesco N. | LNS | | | | | | | | | | | | | | | | | |
| Francesco M. | LNS | | | | | | | | | | | | | | | | | |
| Marta | TO | | | | | | | | | | | | | | | | | |
| Michela | TO | | | | | | | | | | | | | | | | | |