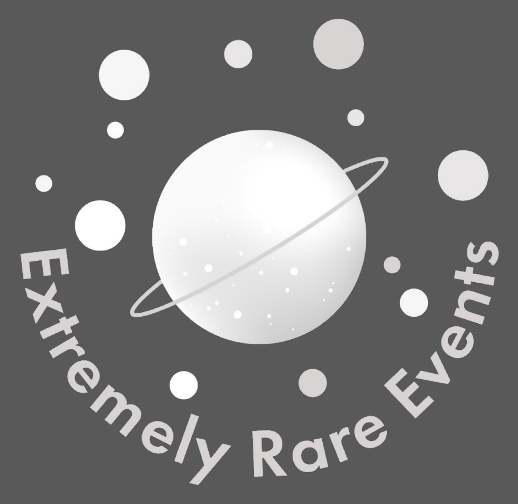




UGRP2026

Ryota Namai (Kobe Univ.)
on behalf of NEWAGE group

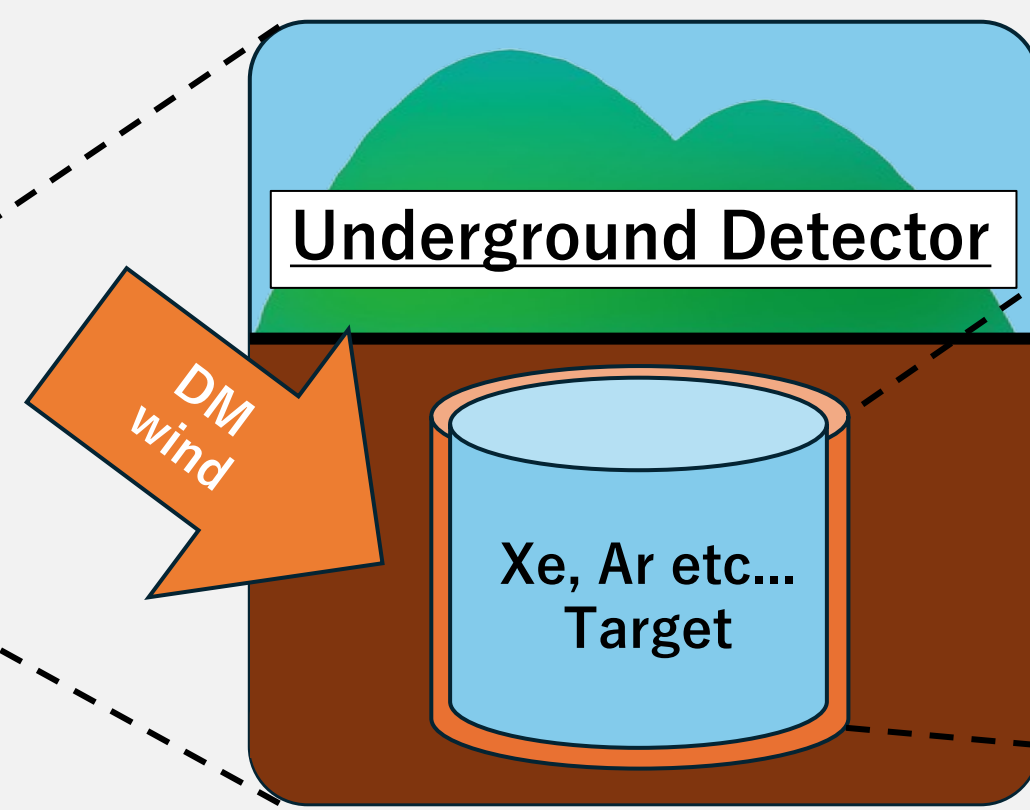
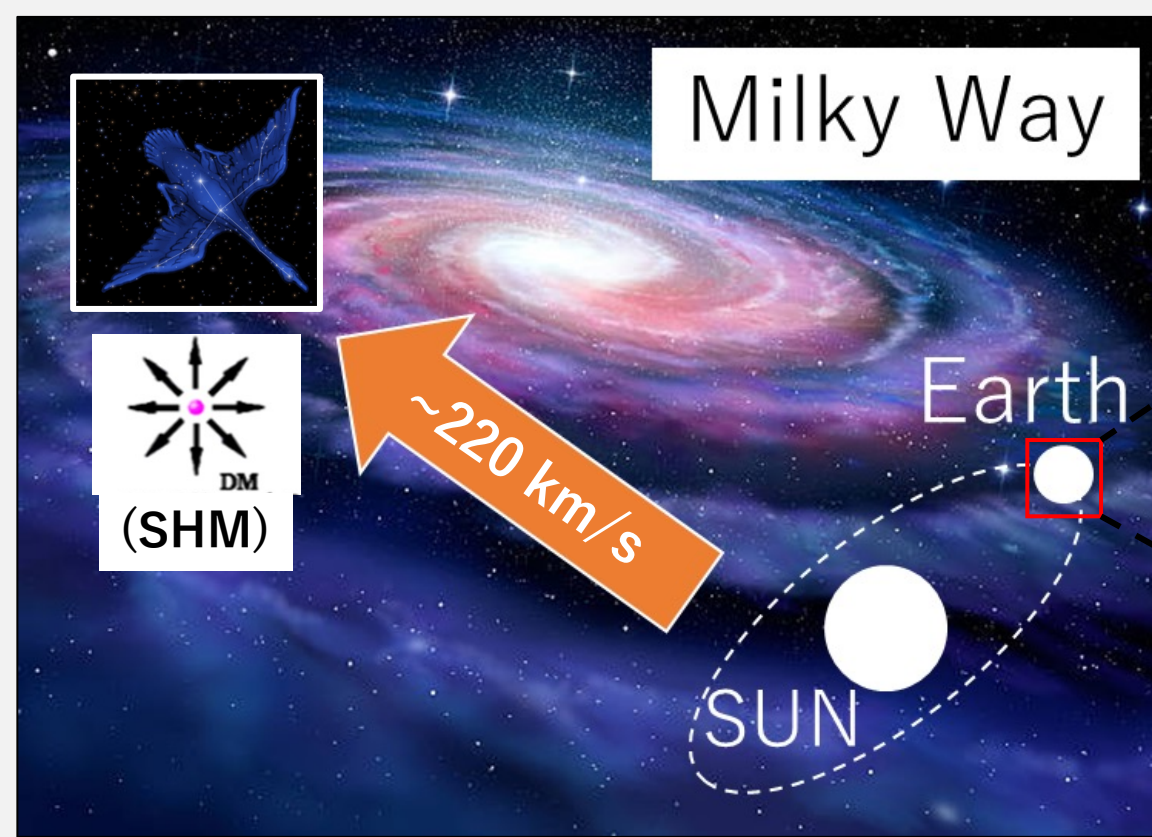
Institute of Science Tokyo 28/09/2026



Introduction

Direct dark matter search

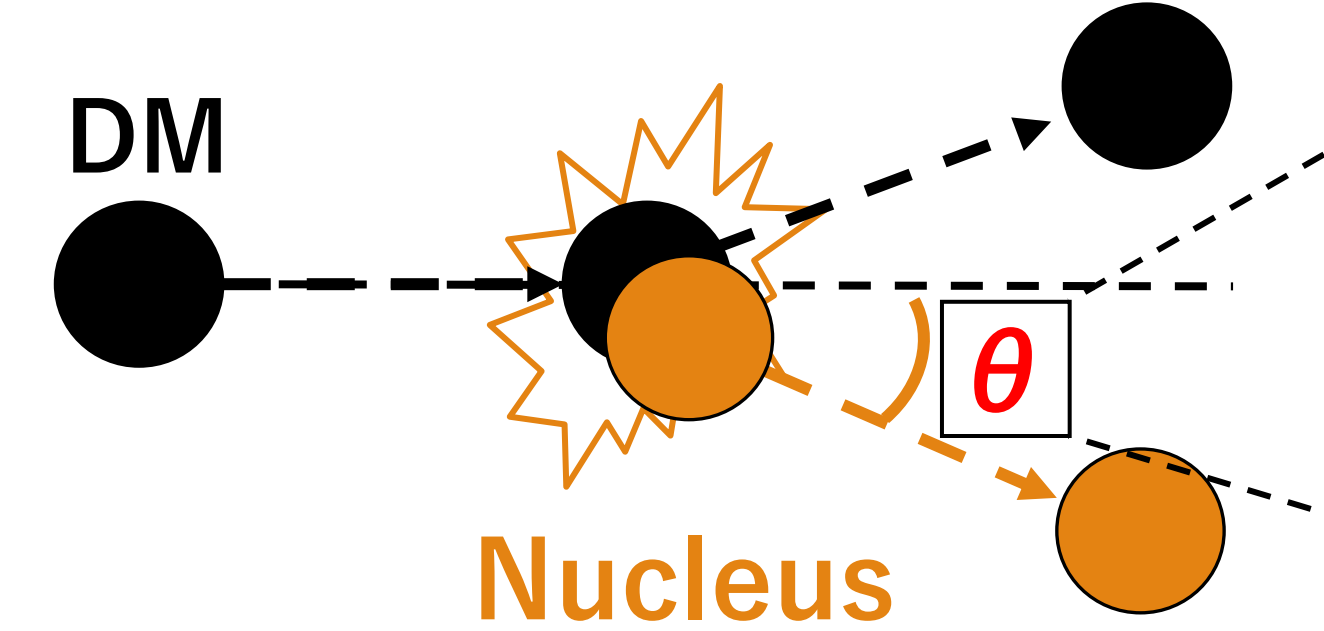
- Although numerous experiments around the world are searching for dark matter (DM), no experiment has yet reported a detection.
- Direct detection aims to observe dark matter-SM particle interactions, with searches at large target masses underway (XENON-nT, LZ, PandaX-4T ...).



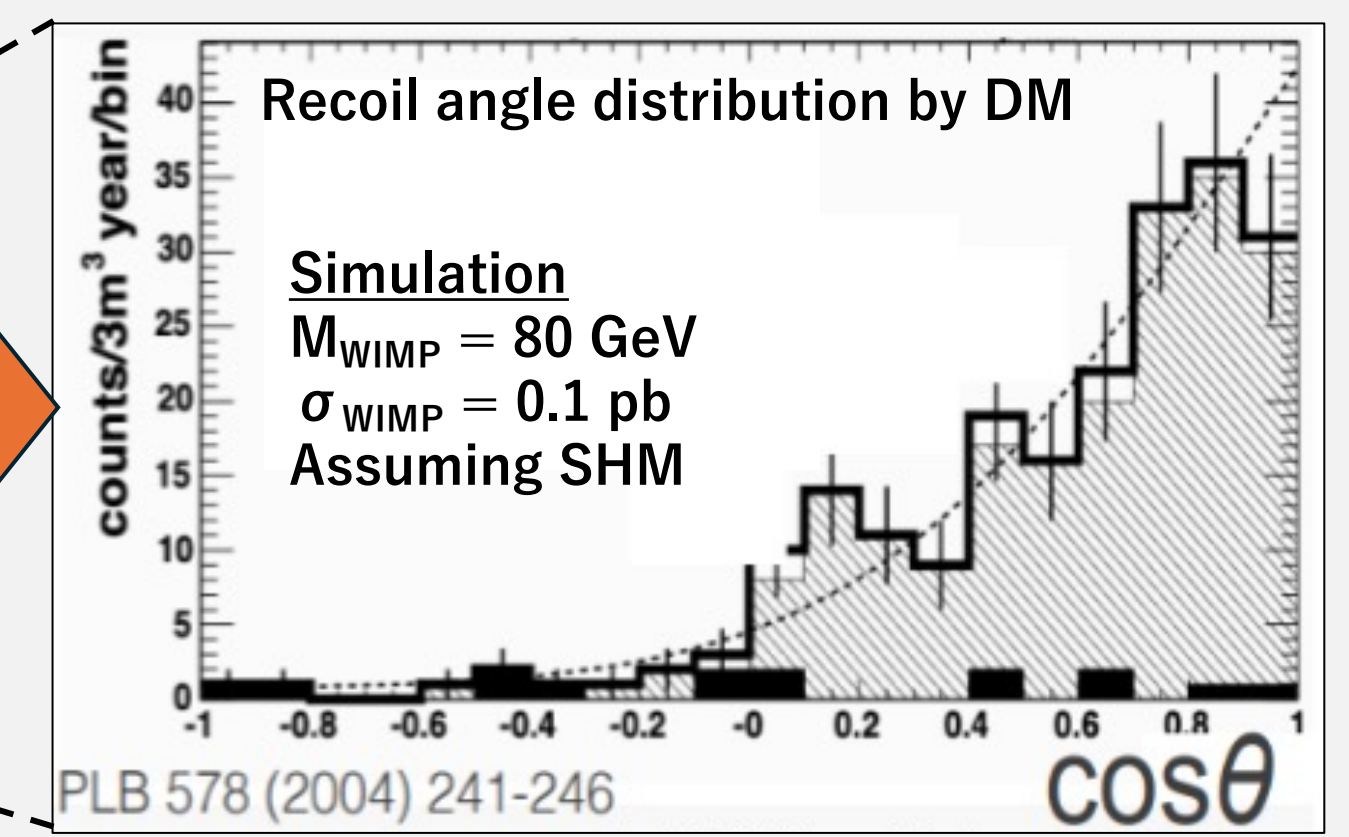
Directional darkmatter search

- Standard Halo Model (SHM) predicts an enhanced DM flux from the direction of the Solar System's motion, reflected in the DM distribution.
- DM recoils are analyzed via their direction distribution to determine DM's kinematic profile.
- Strong discrimination against neutrino background events (neutrino fog) from the Sun is also achievable using directional information.

Elastic scattering

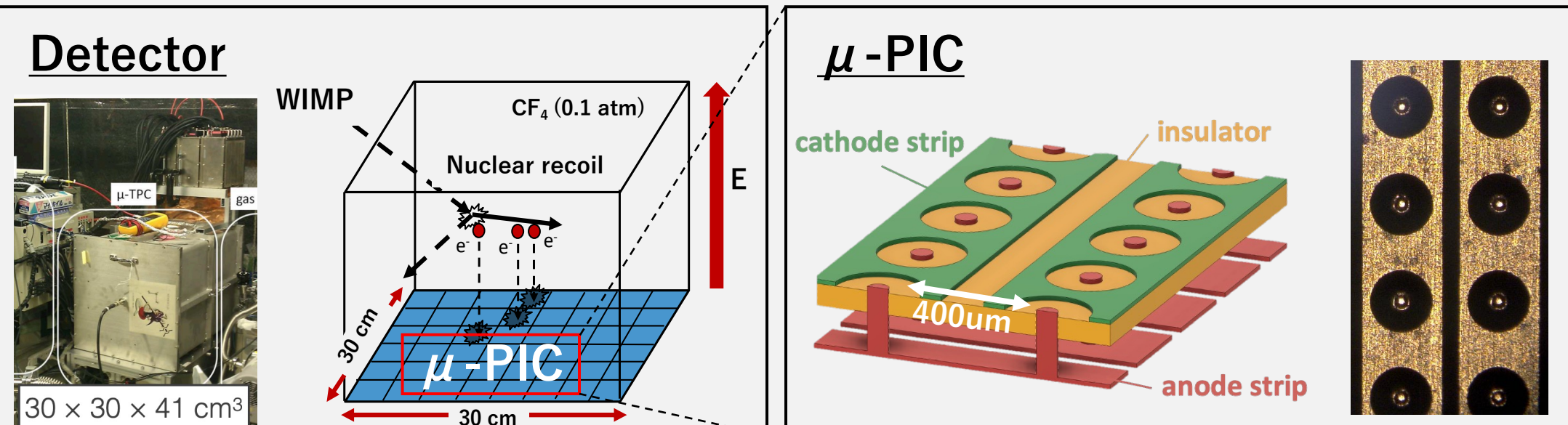


Statistical analysis



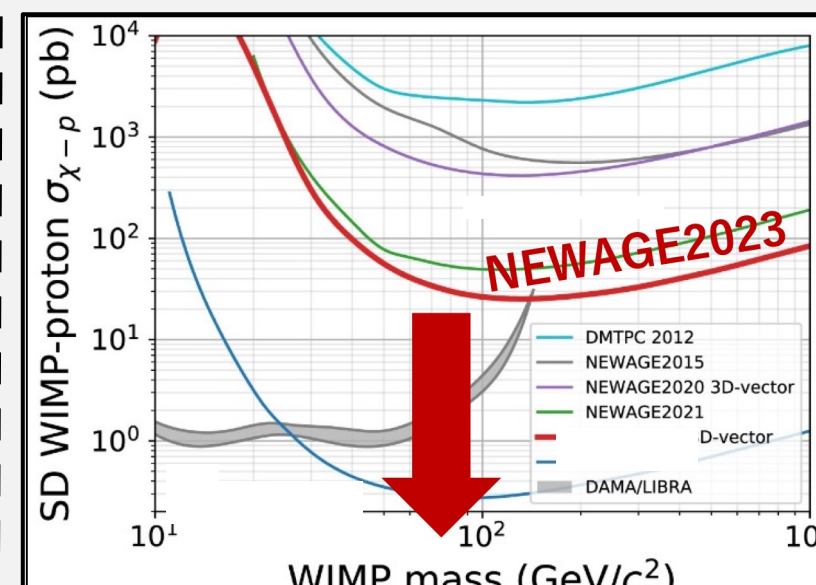
NEWAGE

Experiment



- Operation ongoing at the Kamioka underground laboratory.
- 3D reconstruction of particle tracks is required: μ -PIC detector is used in a low-pressure gas Time Projection Chamber (μ -TPC).
- Anode and cathode strips are aligned orthogonally with 400 μ m pitch.
- 2D position and timing information allow full 3D track reconstruction.
- Drift electrons are amplified by a high electric field formed around the pixels.

Latest result



- Sets the most stringent limit among direction-sensitive dark matter searches.
- A larger detector is planned to further improve sensitivity.

C/N-1.0 & Modular detector

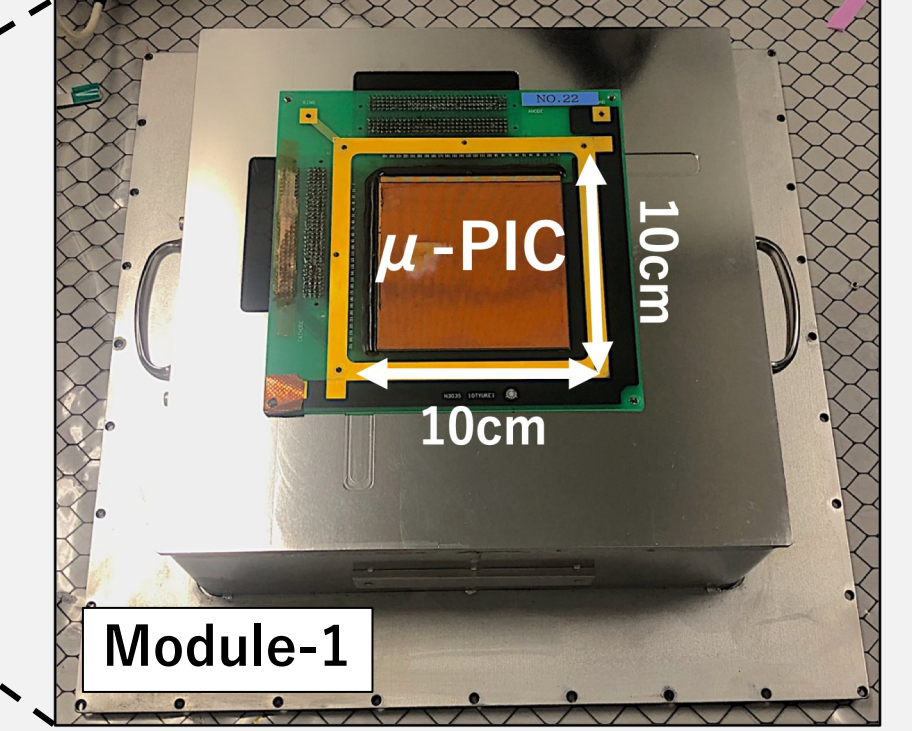
C/N-1.0



Features

- Has a maximum effective volume of about 1 m³ (approximately 30 times larger than NEWAGE).
- Has slots for up to 18 modular detectors.
- A uniform electric field is formed by applying voltage to the conductive film at the center.

Modular detector



Features

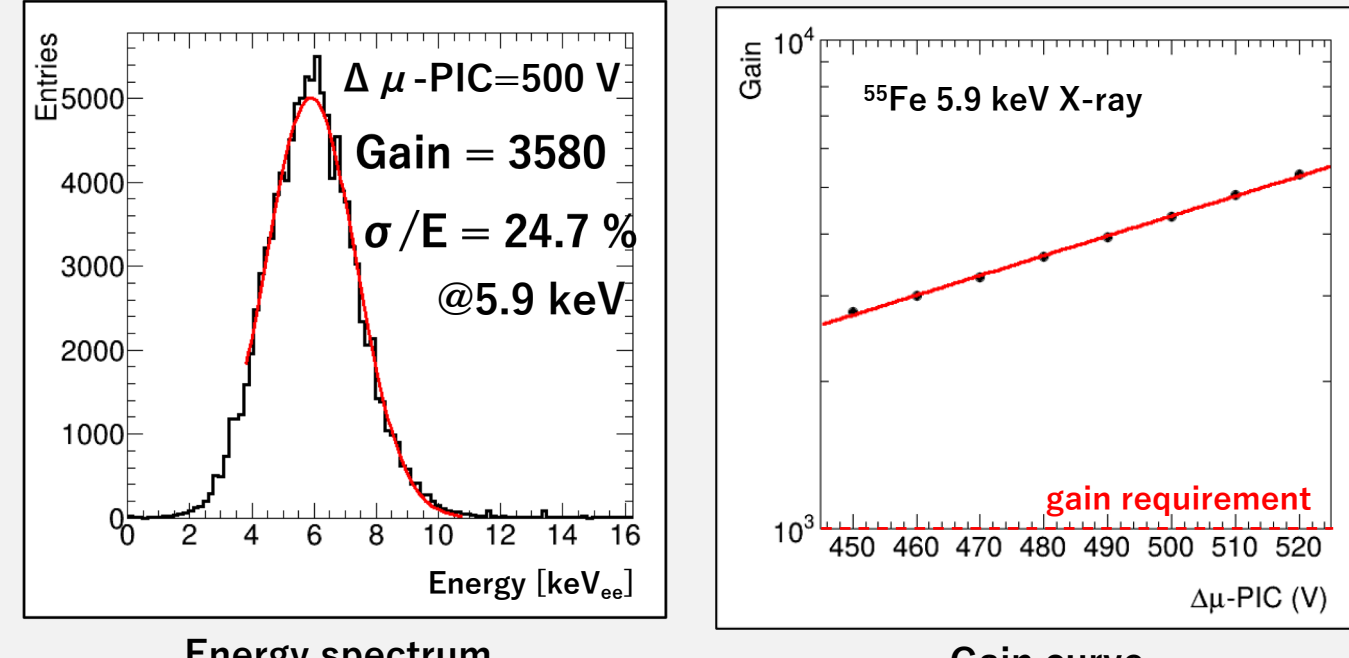
- Direction-sensitive (μ -PIC)
- 10 $\times$ 10 cm² detection area
- 800 μ m readout pitch
- 128 $\times$ 2 channels readout

Commisioning

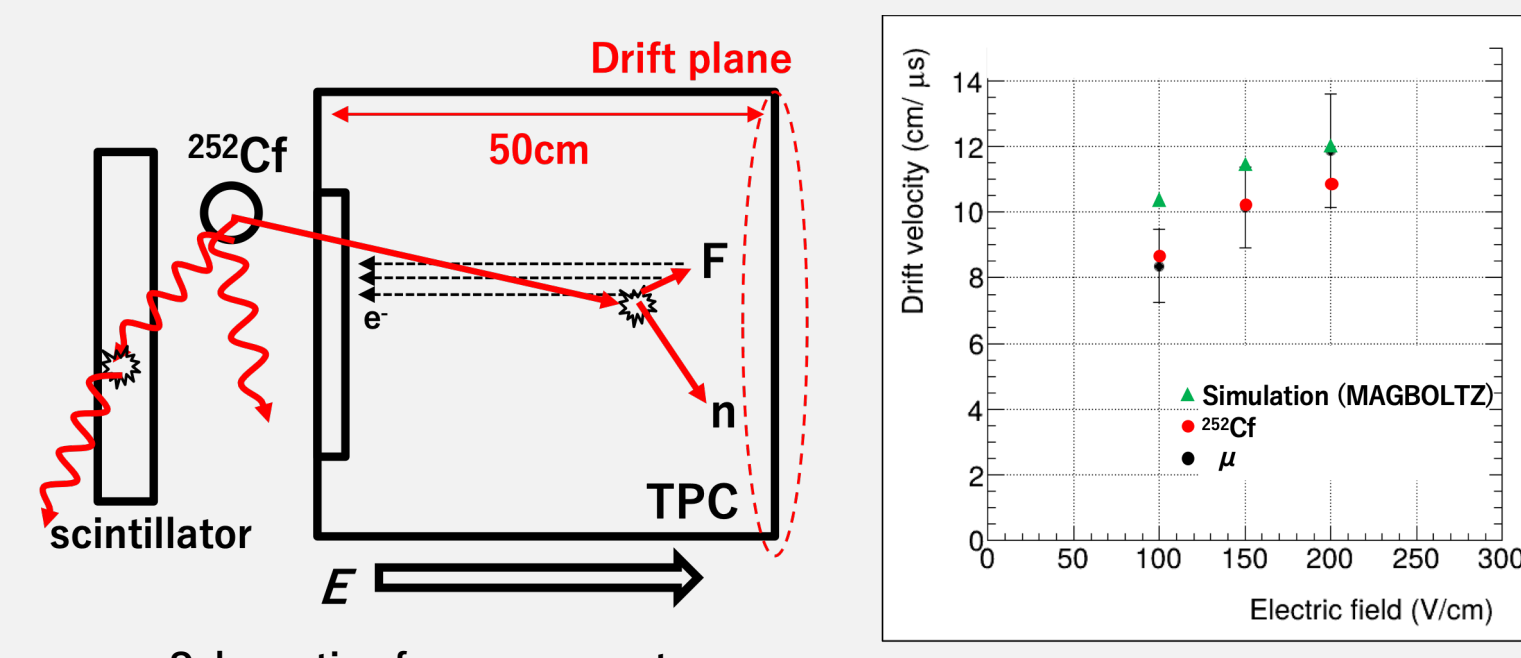
C/N-1.0 operation test with Module-1

Calibration • Gas: CF₄ (0.1 atm)

❖ Energy

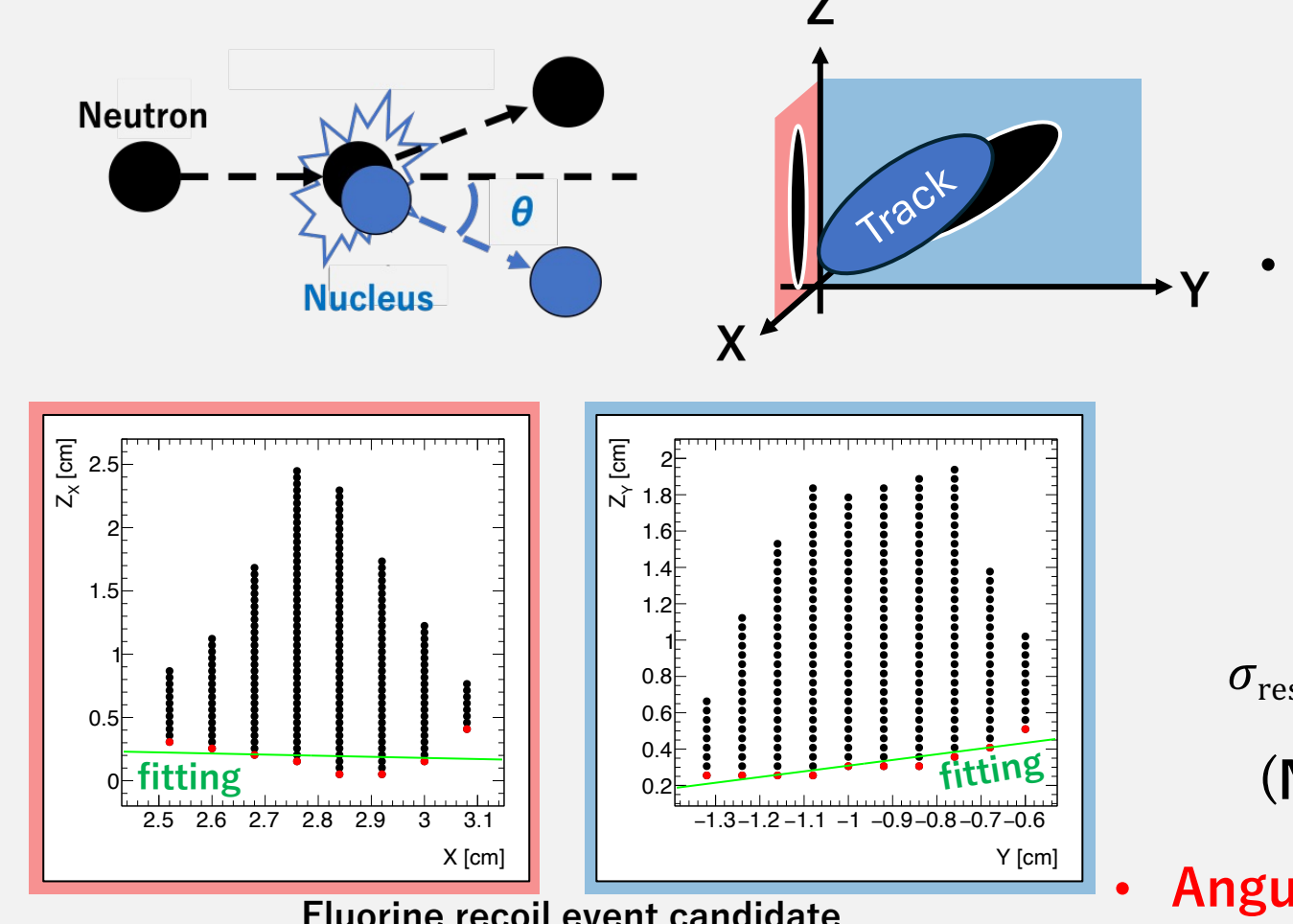


- An ⁵⁵Fe 5.9 keV X-ray source was used for energy calibration.
- An energy resolution comparable to or better than that of NEWAGE was measured.
- We confirmed that the required gas gain was achieved at an applied voltage with no discharge.

❖ Drift velocity ($\equiv$ Track length)

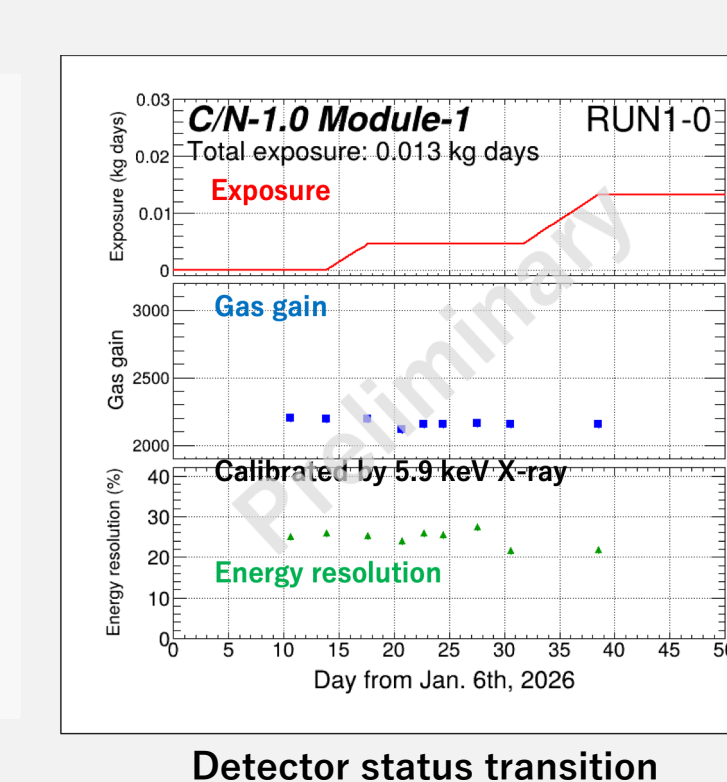
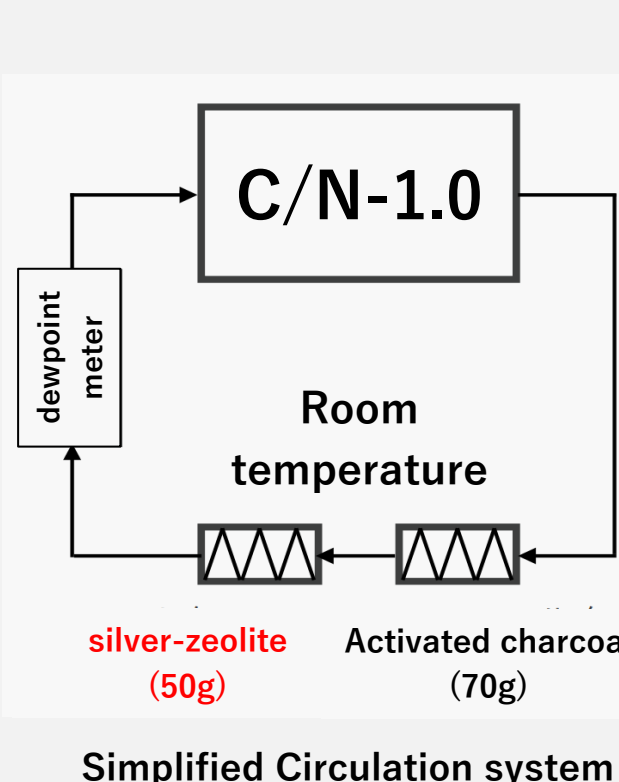
- Gamma rays and neutrons from a ²⁵²Cf source were used.
- Events were triggered by a scintillator.
- The drift velocity was calculated from the time difference between the scintillator signal and the TPC signal.
- The measured drift velocity as a function of the electric field strength is consistent with the simulation.
- The electric field is properly formed.

Angular resolution measurement

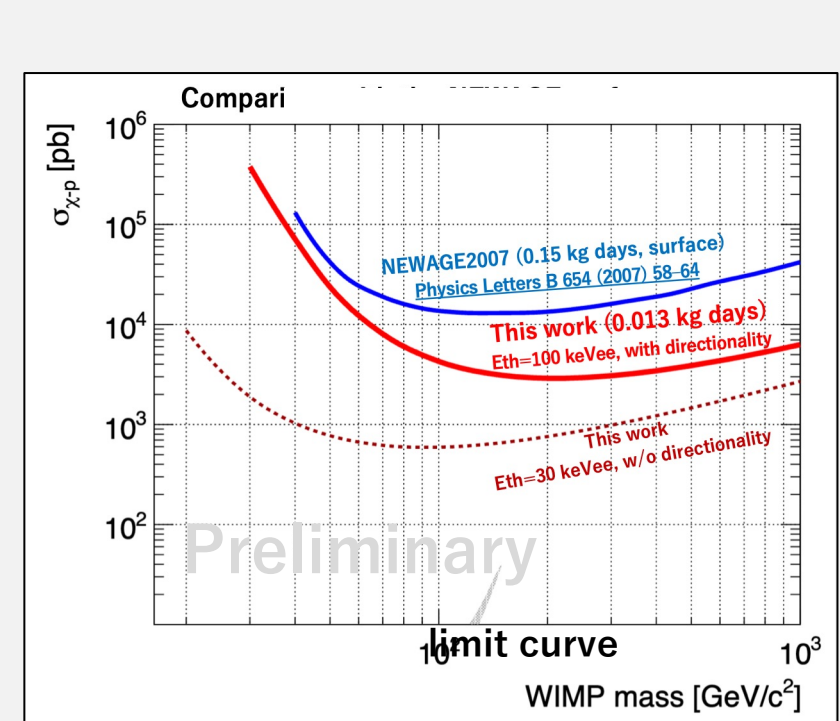


- The angular resolution was evaluated using a ²⁵²Cf neutron source.
- The tracks were fitted with a linear function for each ToT rising point, and the expected angular distribution was obtained from Monte Carlo simulations.
- $\sigma_{\text{reso}} = 48.5^{+2.8}_{-5.6}$ (stat.) (> 100 keV_{ee}) (NEWAGE: $\sigma_{\text{reso}} = 44.5^{+2.5}_{-3.1}$)
- Angular information was obtained successfully.

Long term measurement

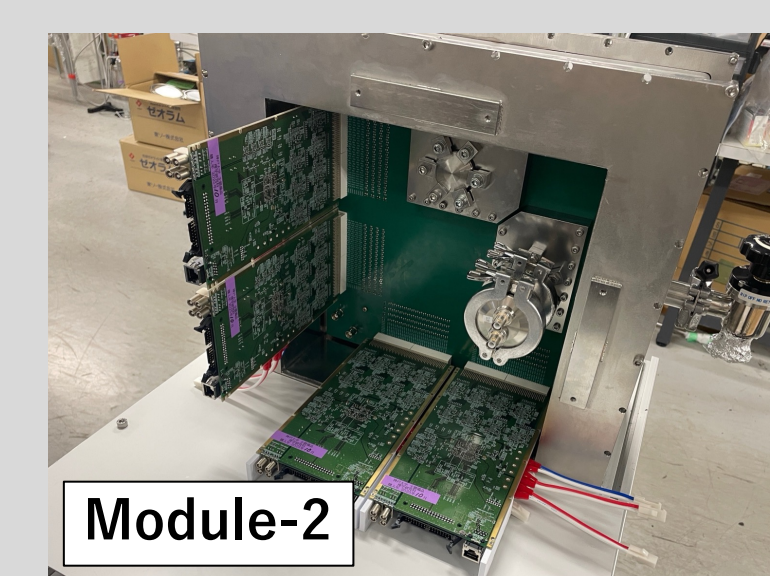


- Stable data acquisition for over 50 days was confirmed.
- CF₄ 0.1 atm
- 0.013 kg days exposure
- Obtained a comparable limit to the NEWAGE surface run.



- The results with Module-1 demonstrate that C/N-1.0 is ready.

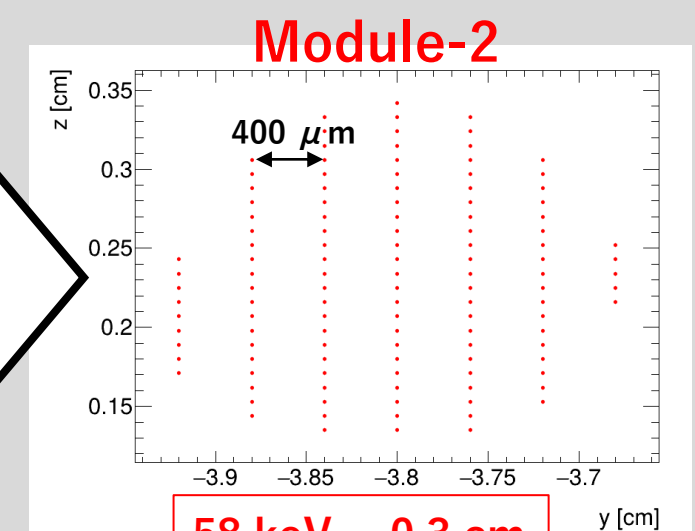
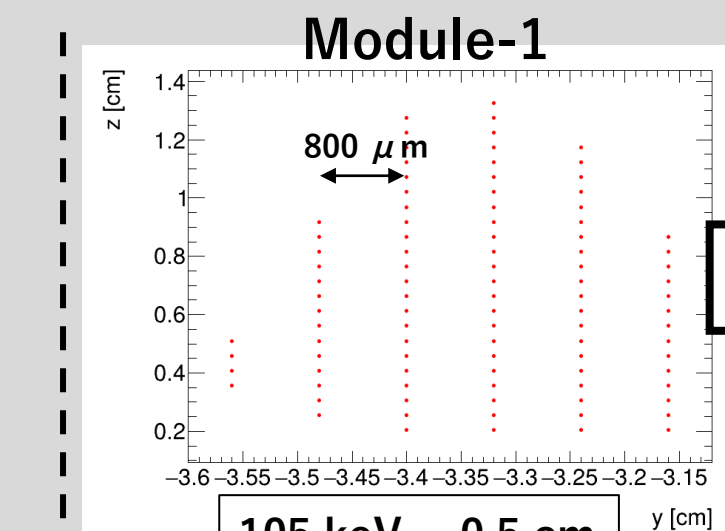
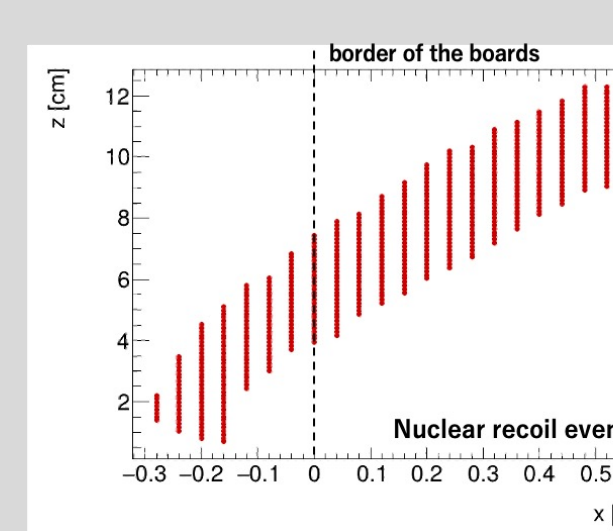
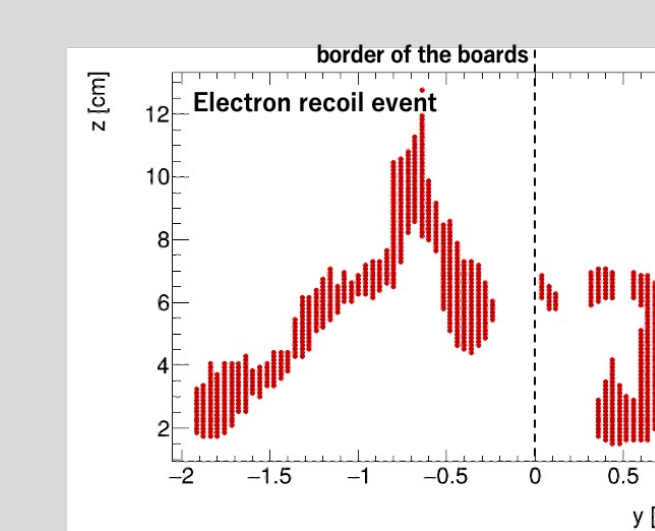
Development of new modular detector



	Module-1	Module-2
detection area	10 $\times$ 10 cm ²	10 $\times$ 10 cm ²
readout pitch	800 μ m	400 μ m
energy threshold with directionality	100 keV _{ee}	50 keV _{ee}

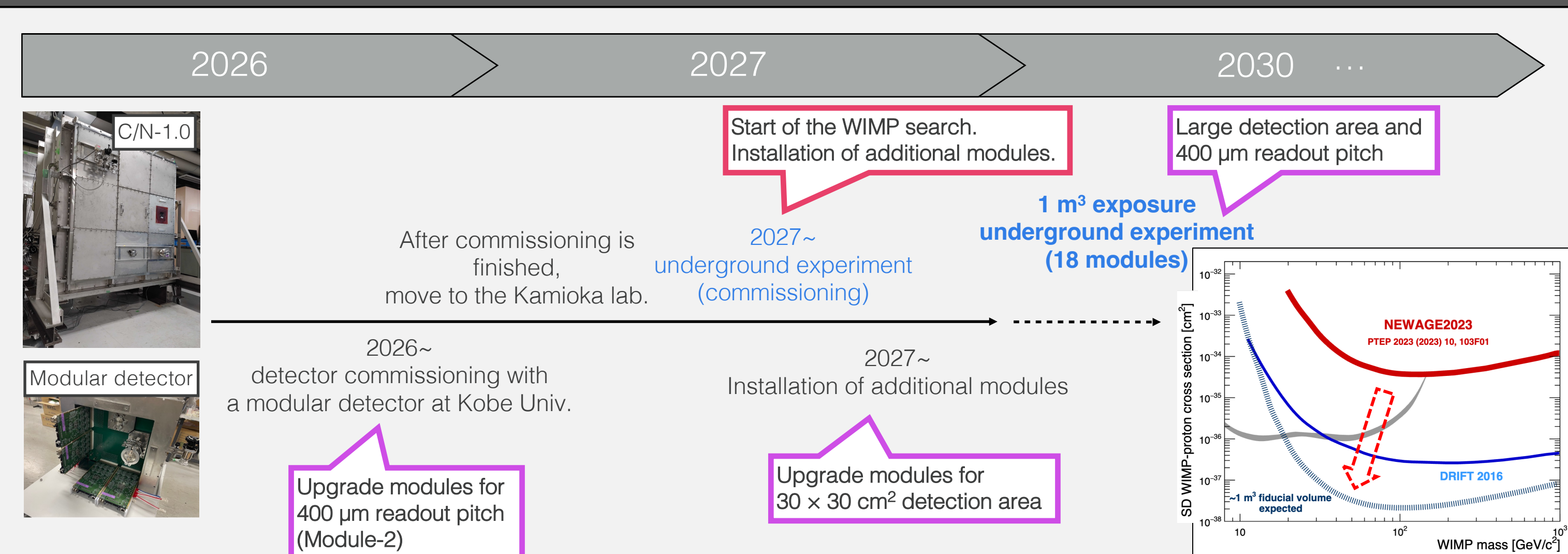
- Module-2 has 400 μ m readout pitch.
- This detector aims to search for WIMPs above 50 keV_{ee}.
- Detector structure is same as Module-1 (μ -PIC + GEM).

- Track reconstruction has already been performed.
- Successful reconstruction of events crossing the board's boundaries.
- Successfully reconstructed a track shorter than that of Module-1.



Currently preparing for installation on C/N-1.0. Once performance evaluation at CN1 is complete, the system will be ready.

Prospects



Conclusion

- NEWAGE is a direction-sensitive WIMP search experiment.
- A large volume detector is needed for greater sensitivity.
- 1m³ scale chamber "C/N-1.0" was tested with the Module-1 detector.
- ~ 50 days of operation was demonstrated.
- C/N-1.0 can be used for WIMP searches with directionality.
- Prospects
- The implementation of C/N-1.0 for Module-2 is now ready. Once performance evaluation of C/N-1.0 is complete, the system will be ready.
- Commissioning is underway to begin the WIMP search.