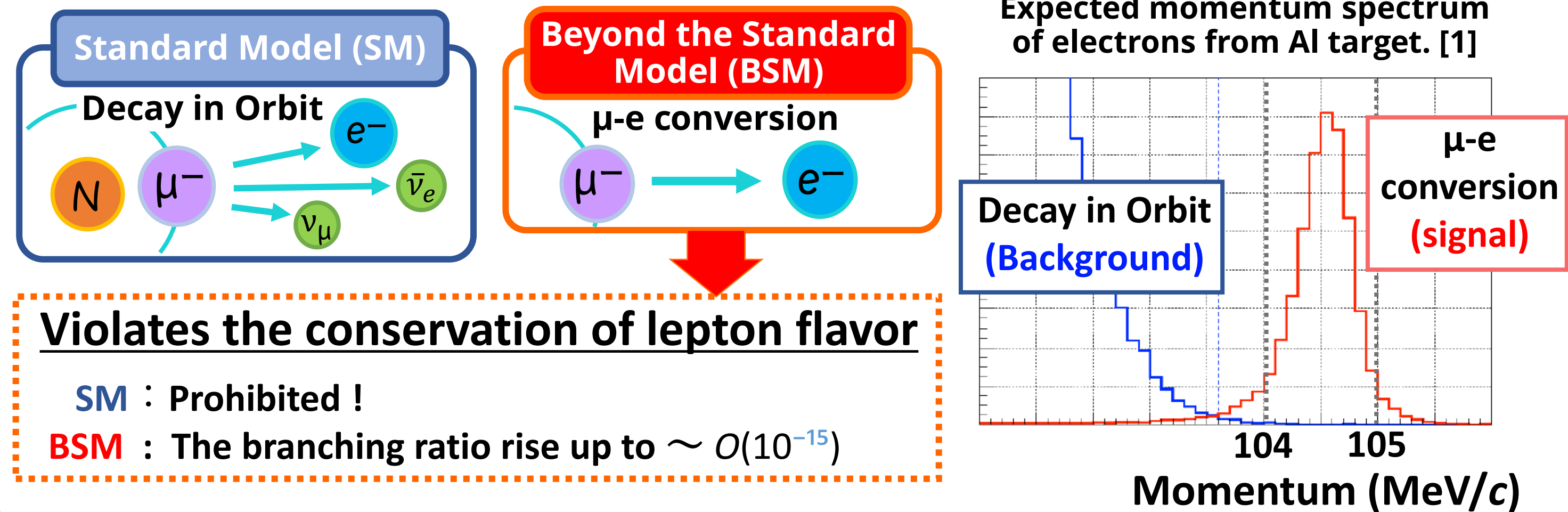


Muon to Electron Conversion

A muon captured by an atom will decay into ...

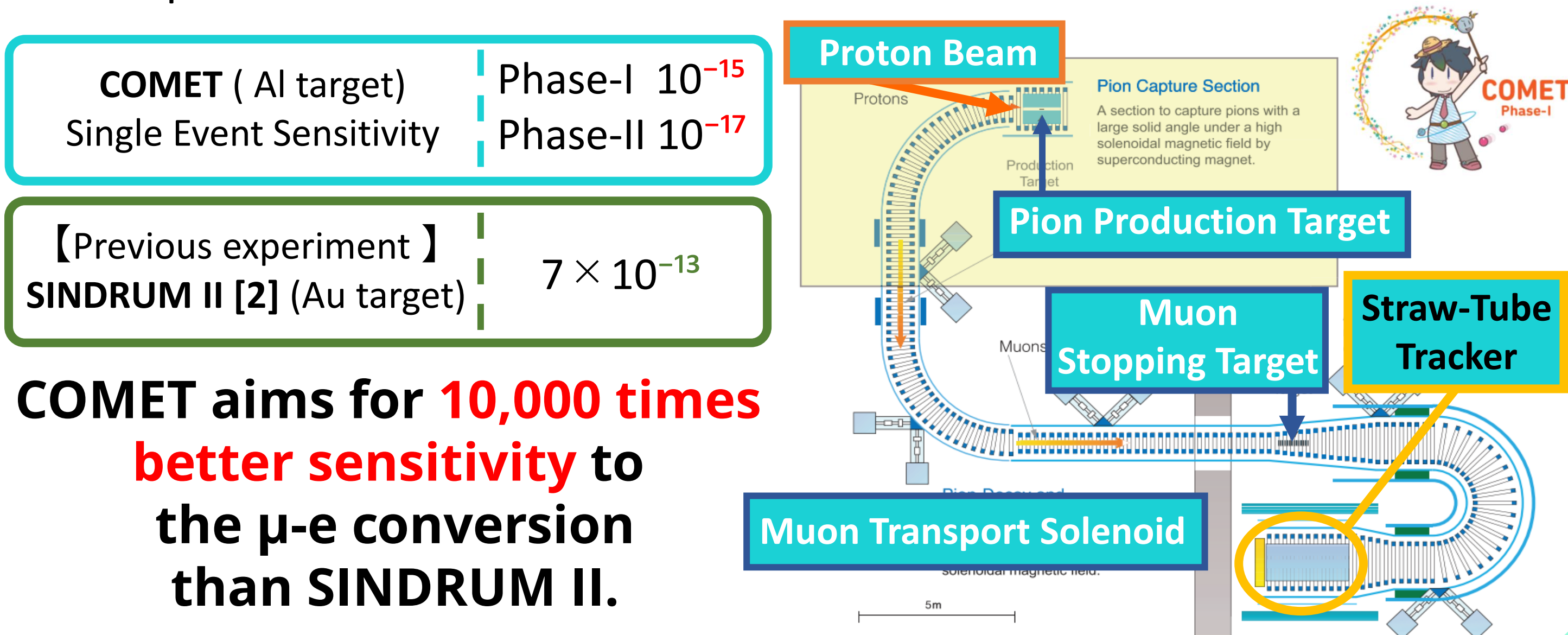


COMET Experiment

COherent **M**uon to **E**lectron **T**ransition

The Main Mission : Search for the μ -e conversion.
(charged Lepton Flavour Violation process.)

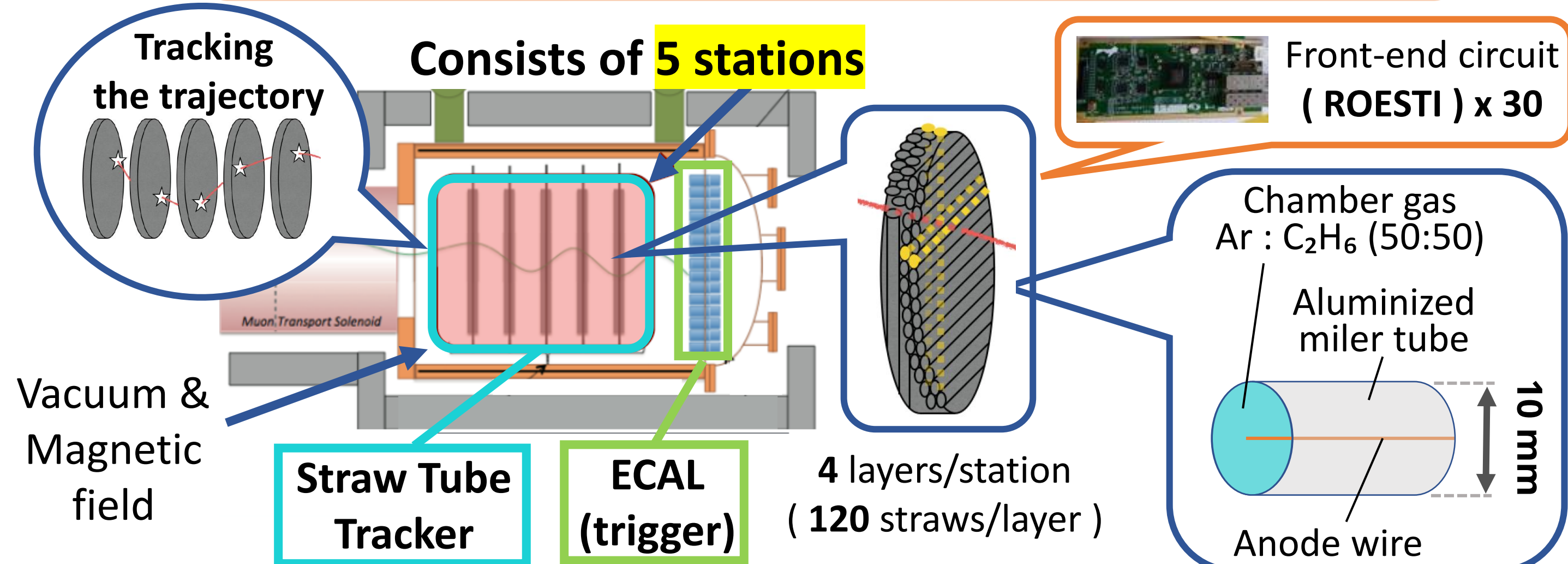
- ◆ @ J-PARC accelerator, Hadron experimental hall.
- ◆ Apply high intensity pulse muon beam (COMET beamline).
- ◆ Experiment will be conducted in Phase-I & II



Straw Tube Tracker

→ The detector for momentum measurement.

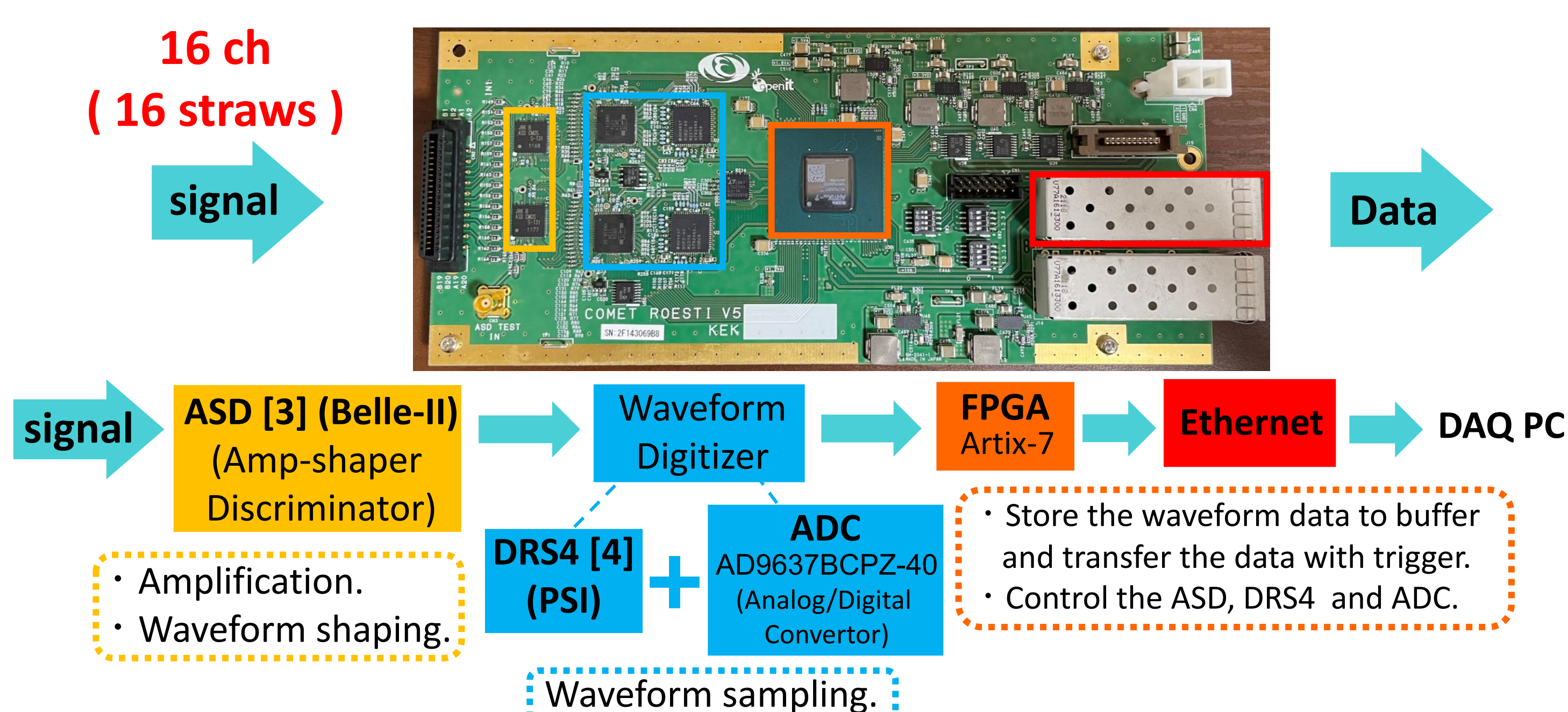
Mission Phase-I : Beam Measurement.
Phase-II : Search for μ -e conversion.



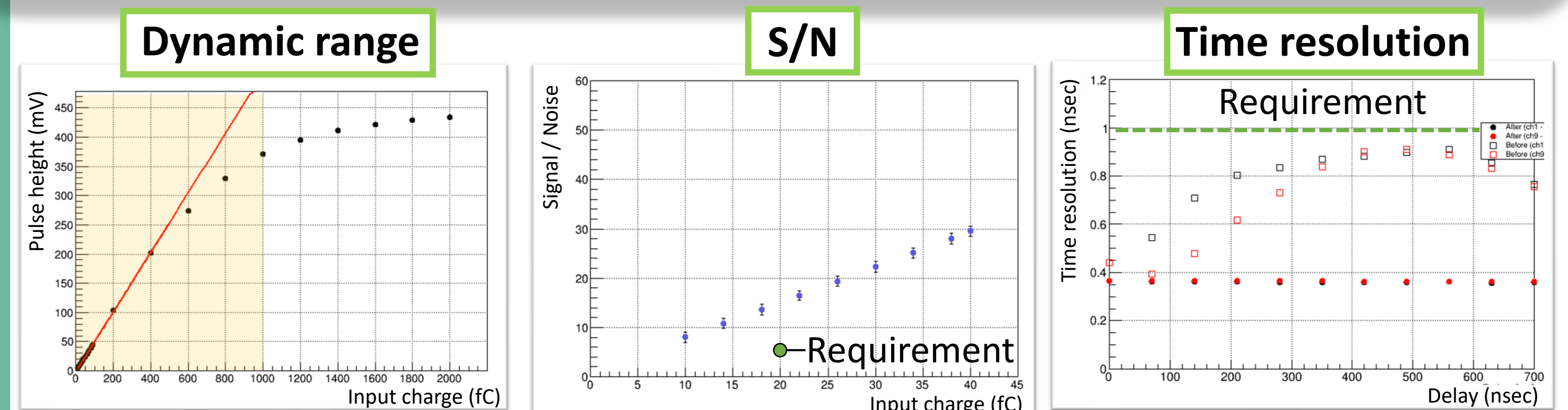
- ◆ Detect the track of charged particle in spiral motion due to magnetic field (~ 1 T)
→ **Momentum measurement.** : Resolution (**< 200 keV/c**) @105 MeV/c
 - ◆ Obtain energy & time information by **Electromagnetic CALorimeter (ECAL)**
→ **Trigger & Energy measurement**
- ★ Low-material design.
★ Suppression of Multiple scattering.
★ High momentum resolution!

Frontend Circuit : ROESTI

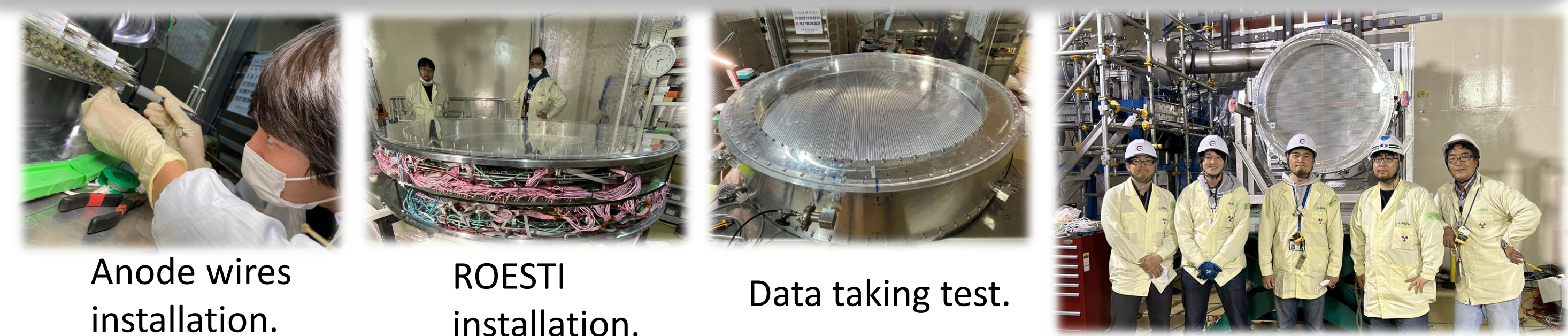
Read Out Electronics of Straw Tube Instruments



Quality Check of the ROESTIs



Construction of the Stations



Construction of the 1st - 4th stations have been completed.

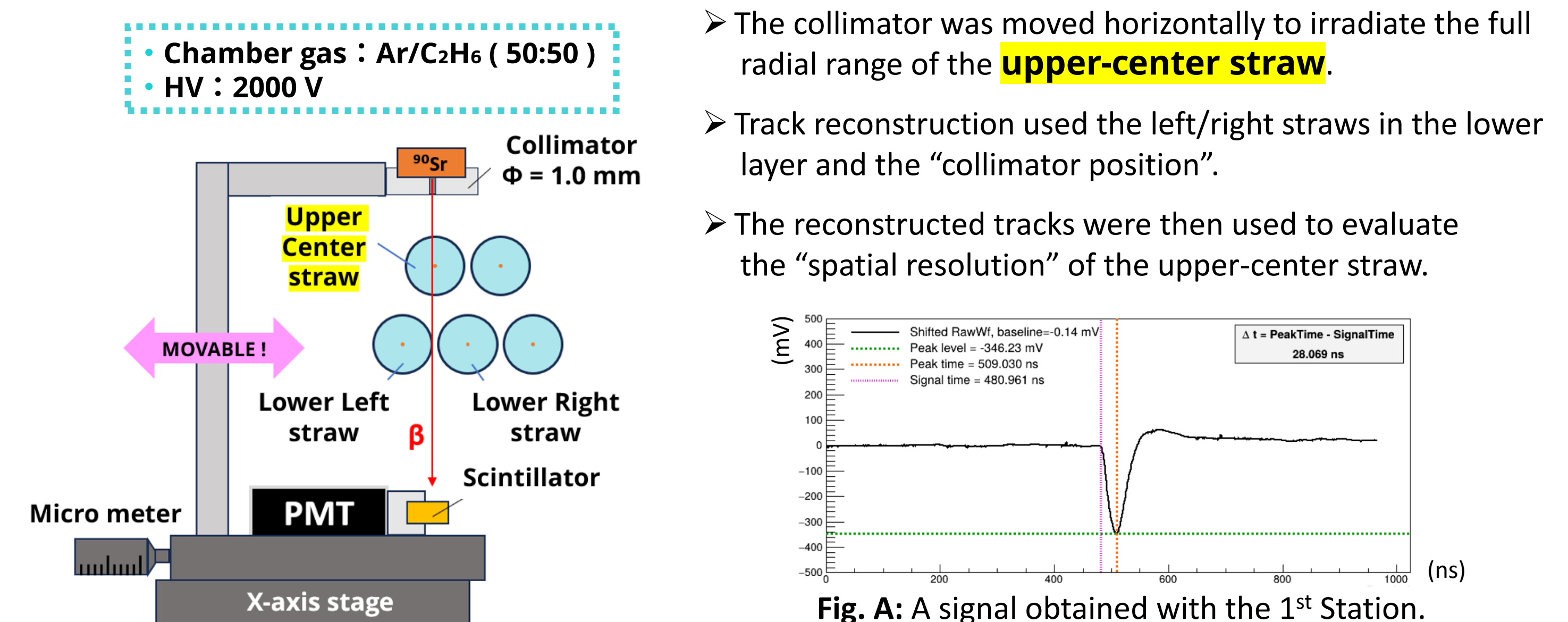
⇒ Successful signal acquisition with ROESTI has been achieved for the 1st and 2nd stations.

Performance Studies

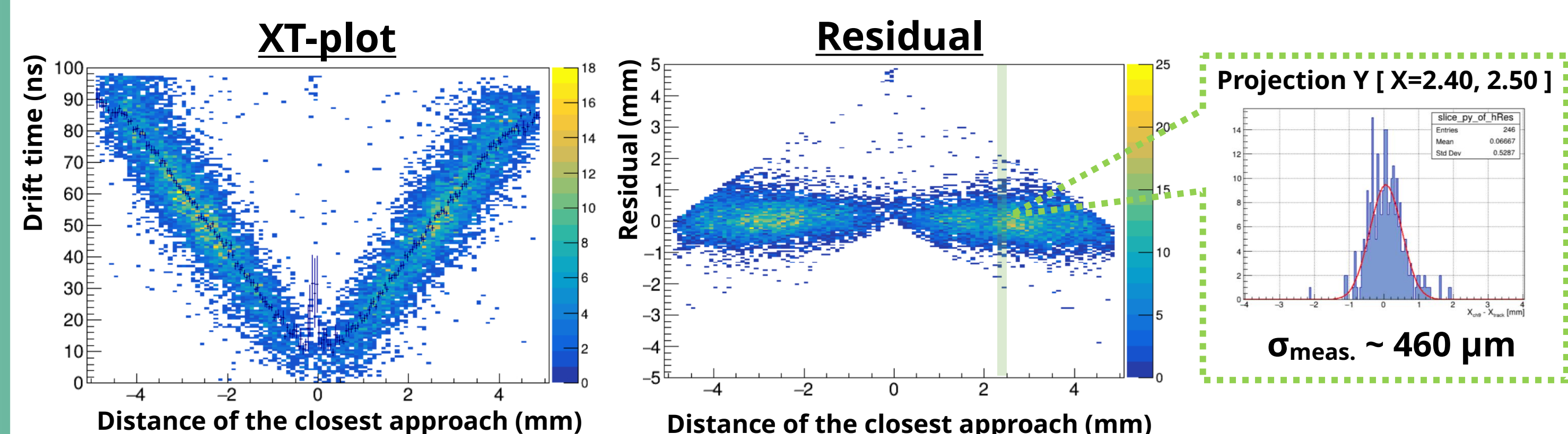
... A spatial-resolution study was performed using the 1st Station.

Spatial Resolution Requirement : < 200 μ m

< Measurement Setup >

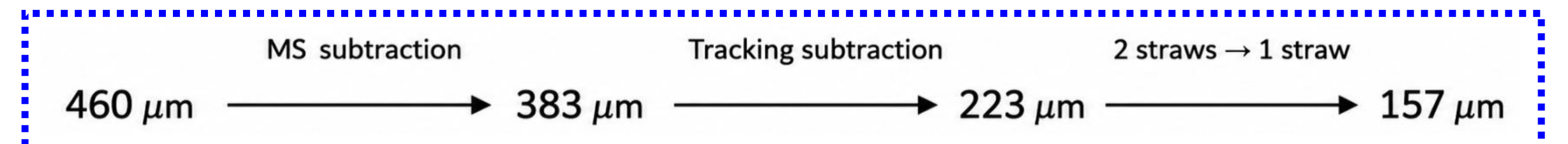


< Results >



... This “measured spatial resolution” mainly includes two sources of resolution degradation:
⇒ Evaluated the contributions of these effect with Geant4 based simulation toll “ICEDUST”.

- Multiple Coulomb scattering ⇒ (Simulated value : $\sigma_{\text{MS}} \sim 256 \mu\text{m}$)
- Tracking resolution arising from the finite collimator aperture ⇒ (Simulated value : $\sigma_{\text{MS}} \sim 311 \mu\text{m}$)



...The measured spatial resolution is consistent after accounting for multiple scattering and tracking resolution.

< Ongoing Works >

- ◆ Further improvement is expected through “collimator position calibration” and “iterative XT calibration”.
- ◆ The position dependence and breakdown of the resolution.

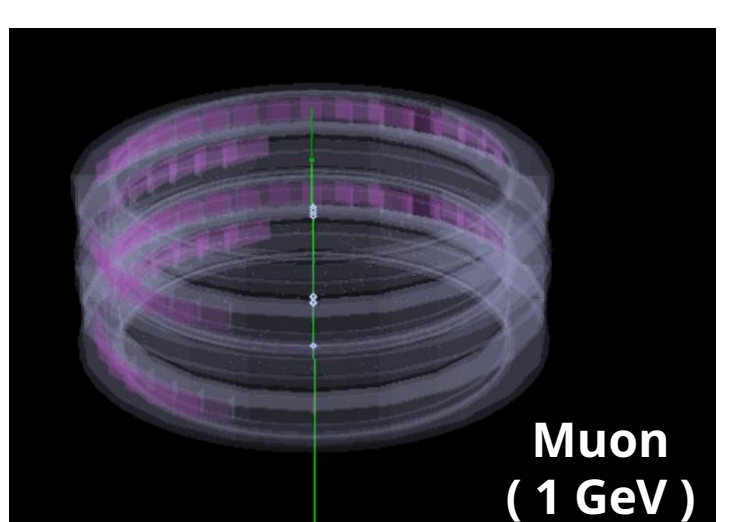
Future Works

1st Station

... Improve the spatial-resolution evaluation through analysis updates.

1st + 2nd Stations

... Operate the 1st and 2nd Stations in a **stacked configuration**.
⇒ Perform **cosmic-ray tracking** and evaluate the spatial resolution, alignment, and overall detector performance.
Preparation of the analysis tools are underway with simulation.



References

- [1] COMET collaboration (2020). COMET Phase-I technical design report. Progress of Theoretical and Experimental Physics, 2020(3), [033C01].
- [2] The SINDRUM II Collaboration, W. Bertl et al., “A search for $\mu - e$ conversion in muonic gold”, Eur. Phys. J. C 47 (2006) 337-346.
- [3] S. Shimazaki. Front-end electronics of the Belle II drift chamber, (2013).
- [4] Stefan Ritt. Development of high speed waveform sampling asics, (2010).