Status of Si tracker
&
Simulator, Hodoscope setup

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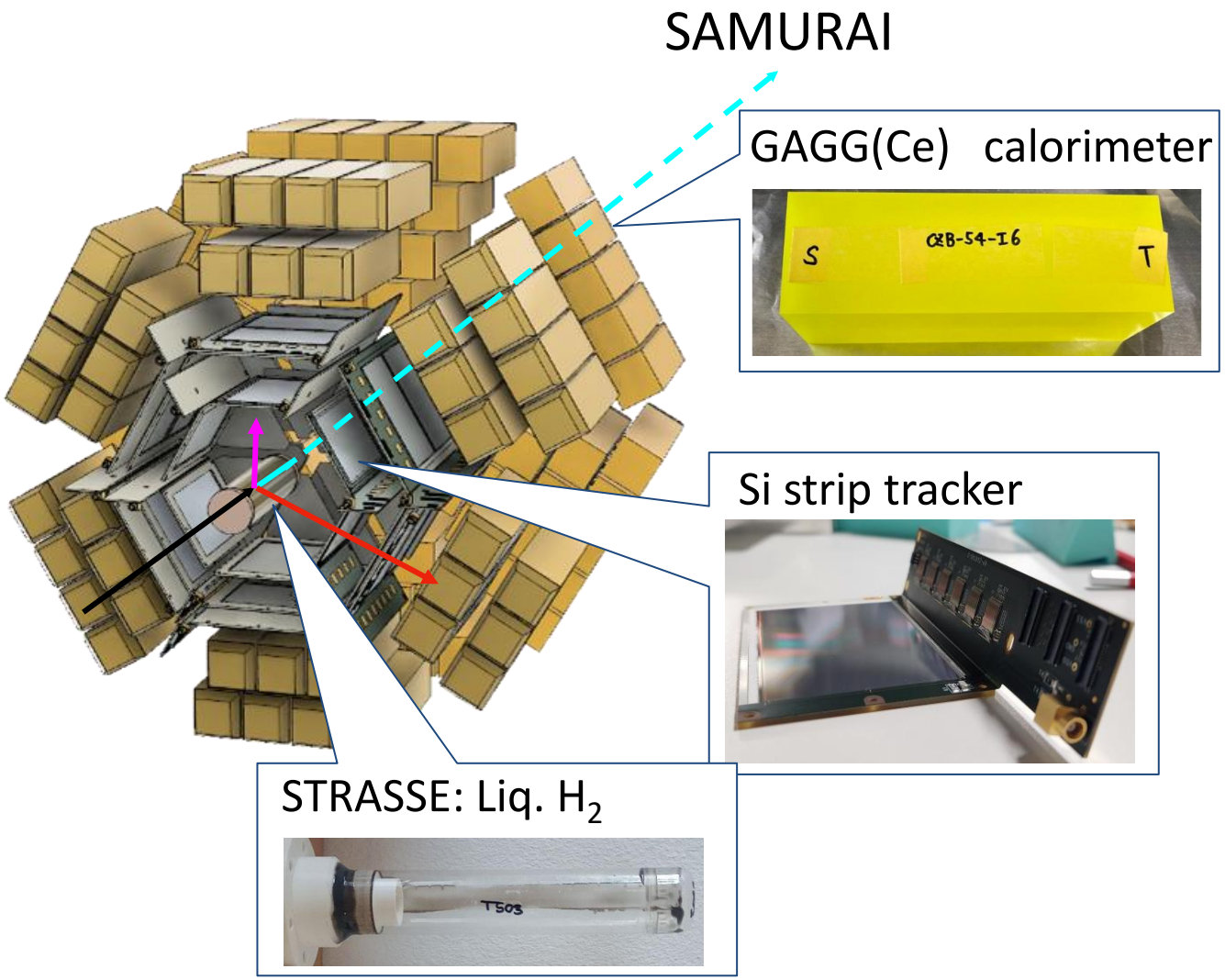
TOGAXSI

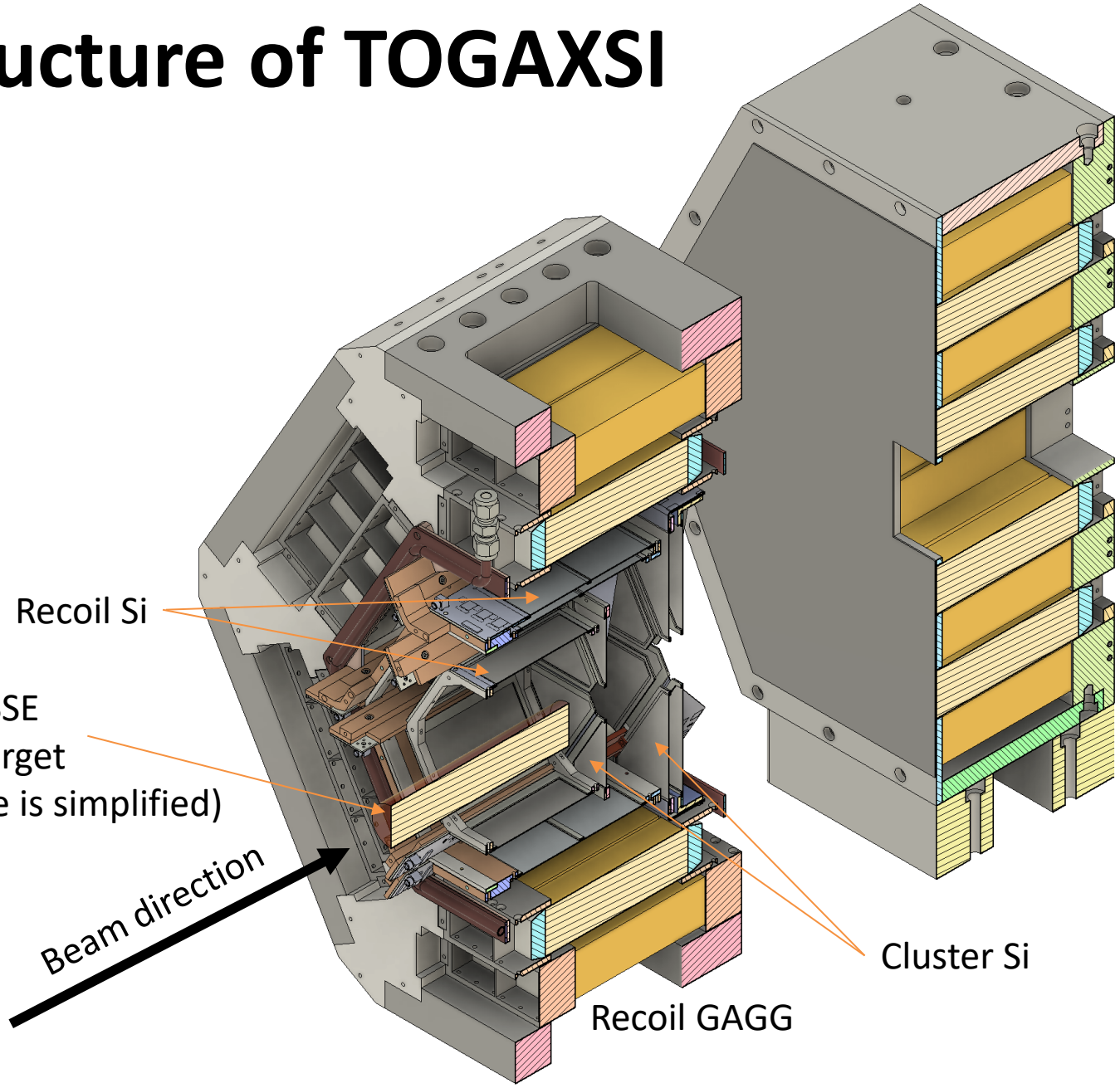
J. Tanaka et al., Nucl. Instr. Meth. B **542**, 4 (2023).

- Recoil proton array
  - Wide angle 35–70°
  - Wide energy 80–250 MeV

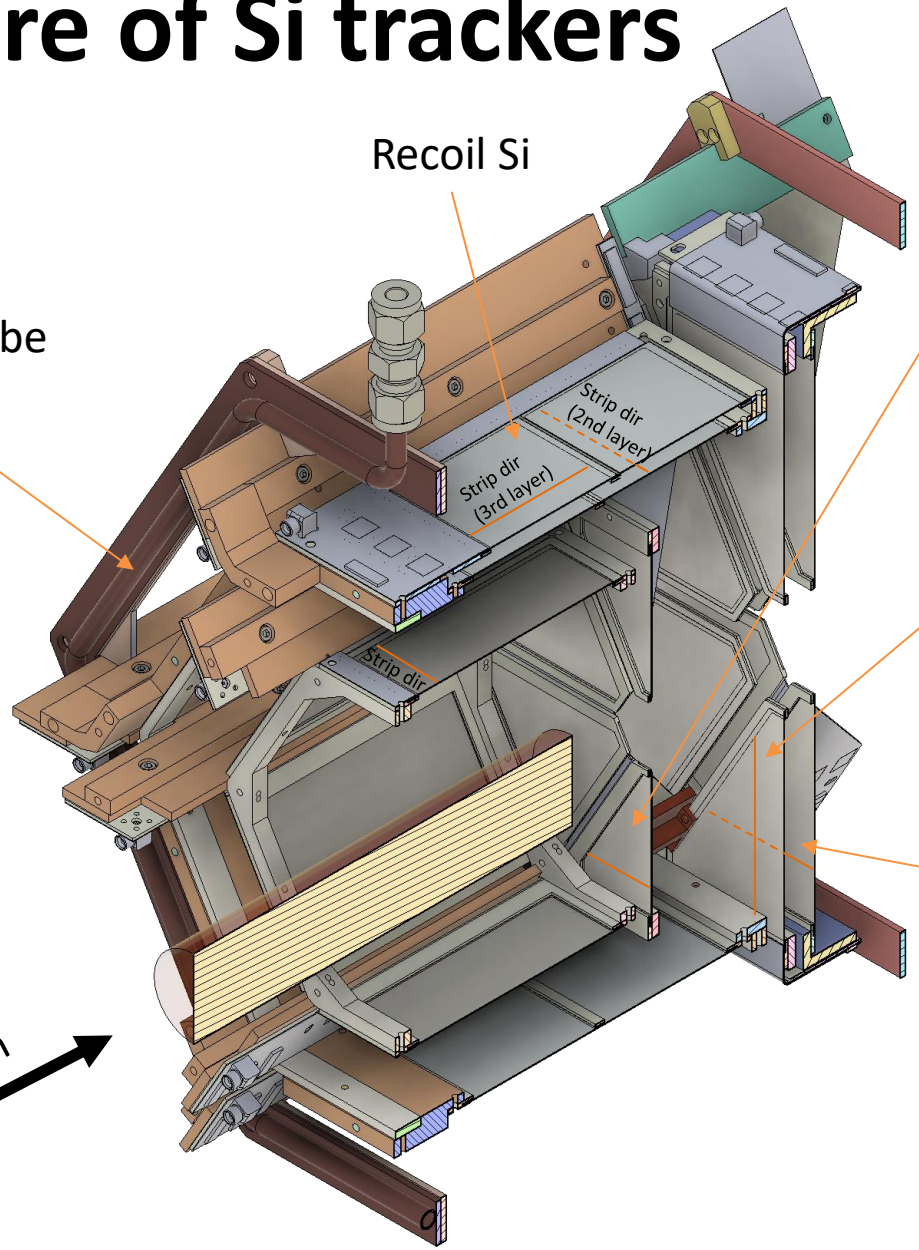
- Knock-out cluster array
  - Forward angle 8–30°
  - High energy ~250A MeV
  - Particle identification: *p, d*, *t*, ^{3}He, *α*
  - High rate ~10^{4} cps



Structure of TOGAXSI

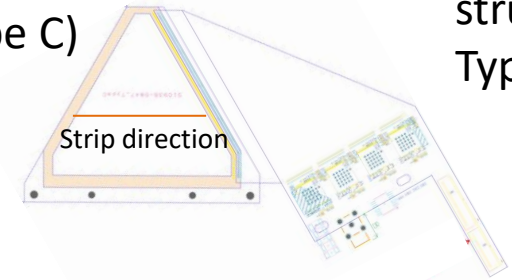


Structure of Si trackers



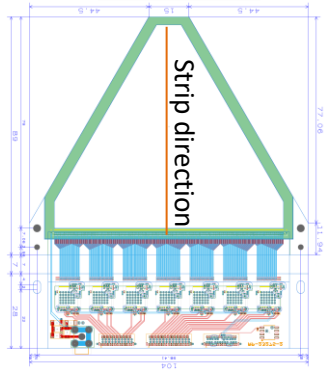
CLUster

Cluster Si 1st layer
(type C)



NOTE:
Design of support structure of cluster Si and Type-C PCB is not finalized

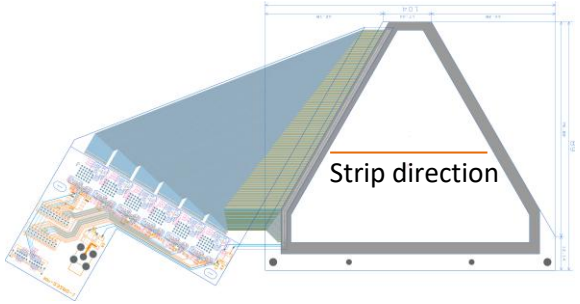
Cluster Si 2nd layer
(type L)



Si sensor (Hamamatsu)

- 100μm thick
- 100μm pitch

Cluster Si 3rd layer
(type U)



Flexible PCB is bent by 90 deg

Current Status of Si trackers

- Recoil Si
  - All the detectors will be ready when the demonstrator construction is completed
  - 4/6 will be completed in demonstrator construction

- Cluster Si
  - Type-L, U (2nd, 3rd layers)
    - Flexible PCBs for will be manufactured soon
      - Including implementation of APV(ASIC) chip, Si sensor, and wire bonding
  - Type-C (1st layer)
    - Si sensors and their APV(ASIC) chips have been purchased
    - Designing of Flexible PCB is ongoing

Remaining tasks (after demonstrator construction)

- Recoil Si
  - Arrangement of cables for 4/6 → 6/6 setup (space in chamber is very limited)

- Cluster Si Type-L, U (2nd, 3rd layers)
  - Bend flexible PCB by 90 deg
  - Check signals
  - → ready by 2025 Autum beam time

- Cluster Si Type-C (1st layer)
  - Finalize flexible PCB design
  - Production (takes ~6 months(?) for trial and error)
  - Bend flexible PCB
  - Check signals

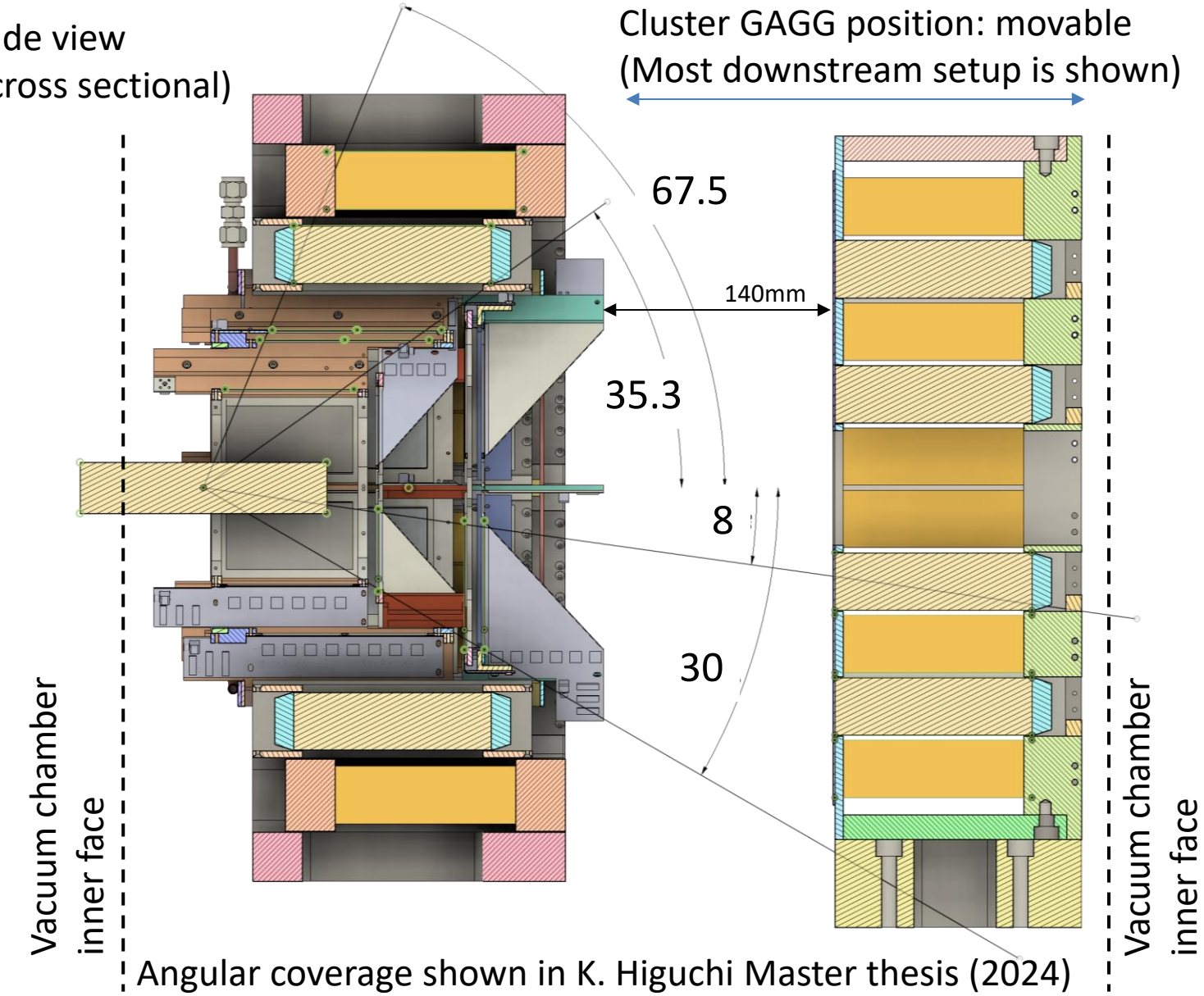
  → not ready by 2025 Autumn, ready by 2026 Spring

- Support structure
  - Finalize support structure
  - Design of cooling water tube
  - Determine how to organize cables (space is quite limited, compared with demonstrator setup)

- Feedthrough (also necessary for demonstrator)

Angular coverage

Side view
(cross sectional)



Angular coverage shown in K. Higuchi Master thesis (2024)

Angular coverage from the center of target:
(almost) consistent with values in documents

Angular coverage depends on the reaction point
Range of recoil/knocked-out particles

What is the best setup for your experiment?

- Target position
- Target thickness (5, 10, 15 cm)
- Cluster GAGG position

→ Needs simulations

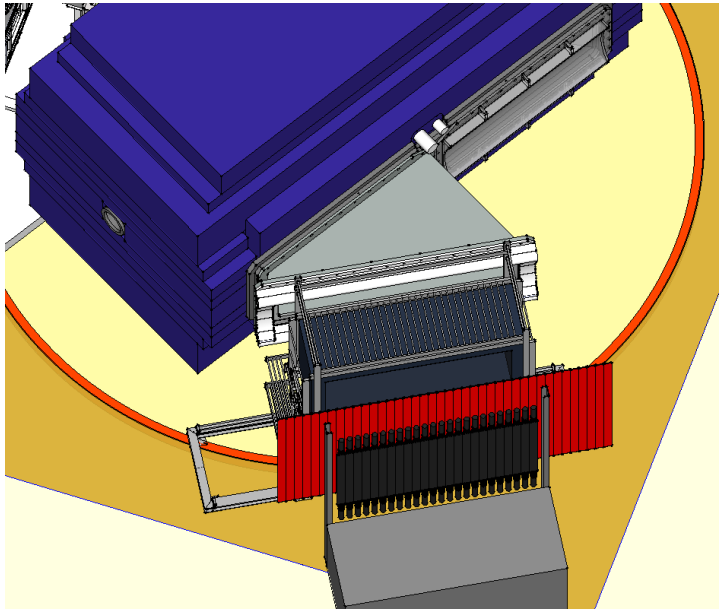
Development of TOGAXSI Simulator/Analysis

- Not available now…
- To be done
  - TOGAXSI simulator
  - Development of analysis software for experimental data
  - Establish analysis method
    - How to reconstruct vertex and so on
    - Correction of miss alignment
  - How to define/organize analysis parameters
- I and Miki-san are working on it, but don’t have enough time at this moment…
  - smsimulator6 (to be released, compatible with ROOT v6)
- If you can contribute to the development, please let me know

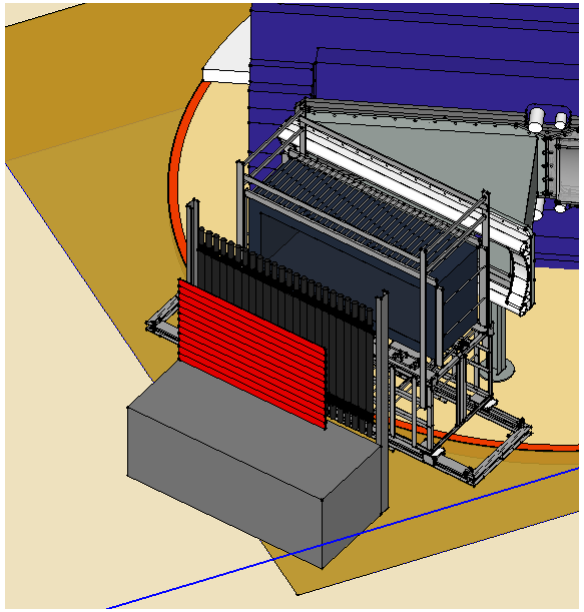
Hodoscope setup of LAMPS NDA detectors

- LAMPS NDA is planned to be shipped to SAMURAI
  - Transport schedule is not fixed

- Possibility of hodoscope of VETO detectors
  - 1 VETO: 10 x 1 x 200 cm^3
  - 40 detectors → 4m x 2m coverage
    - Can fully cover the exit window (2940 mm x 800 mm)



- Single HOD (HODF or HODP) cannot detect Z=1 particle in coincidence with a heavy ion
- Two hodoscope with different gain → enables Heavy ion + Z=1 coincidence



- Design is not fixed
- Please give me your idea if you'd like to use it

Summary

- Recoil Si
  - 4/6 will be ready soon
  - Several tasks for 6/6 configurations
- Cluster Si
  - Type-L, U detectors will be available soon
  - Designing Type-C and supports is ongoing, should be ready by 2026 Spring
- Simulator
  - Not available now
  - your contribution is very welcome
- Hodoscope setup with LAMPS NDA VETO detectors
  - Enables coin. det. of Z=1 and heavy ions with same A/Z
  - Further considerations are necessary