

Micro-vertex detection system for the WASA-FRS Experiments

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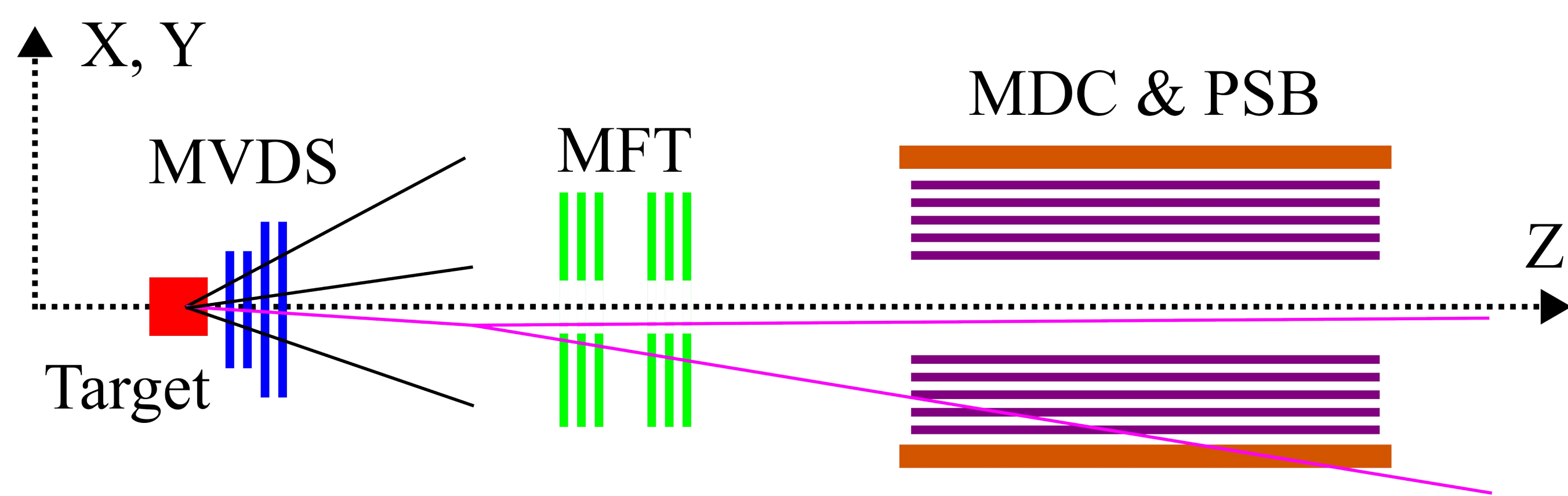
Introduction & Motivation

WASA-FRS Experiment [1] was held in 2022 at GSI-FAIR (Germany), aiming at the study of light hypernuclei induced by heavy ion beams. The production reaction generates high multiplicity of particles

↳ allows for Interaction Point (IP) measurement

Objectives of Micro-vertex detection system (MVDS)

1. Determine IP position
2. Obtain particle tracks from IP, including hypernucleus

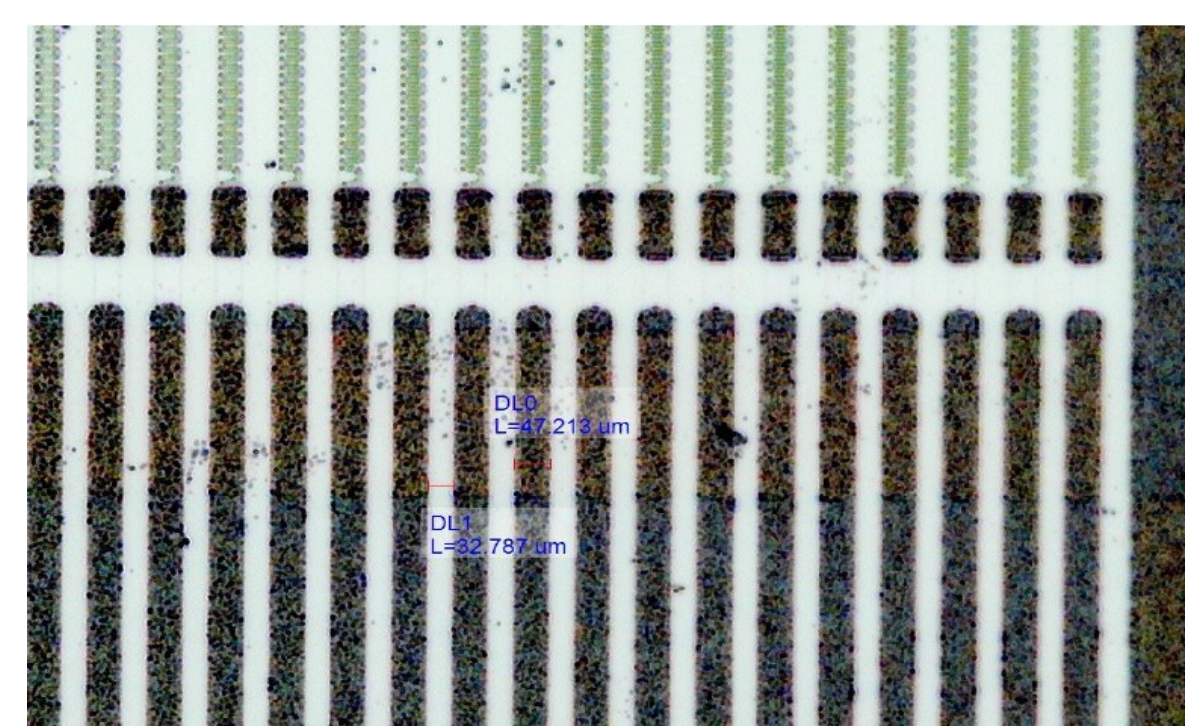


Detection System Description

The Micro-vertex detection system comprises 20 sensors, placed in pairs to cover x-y, and distributed in 4 stations

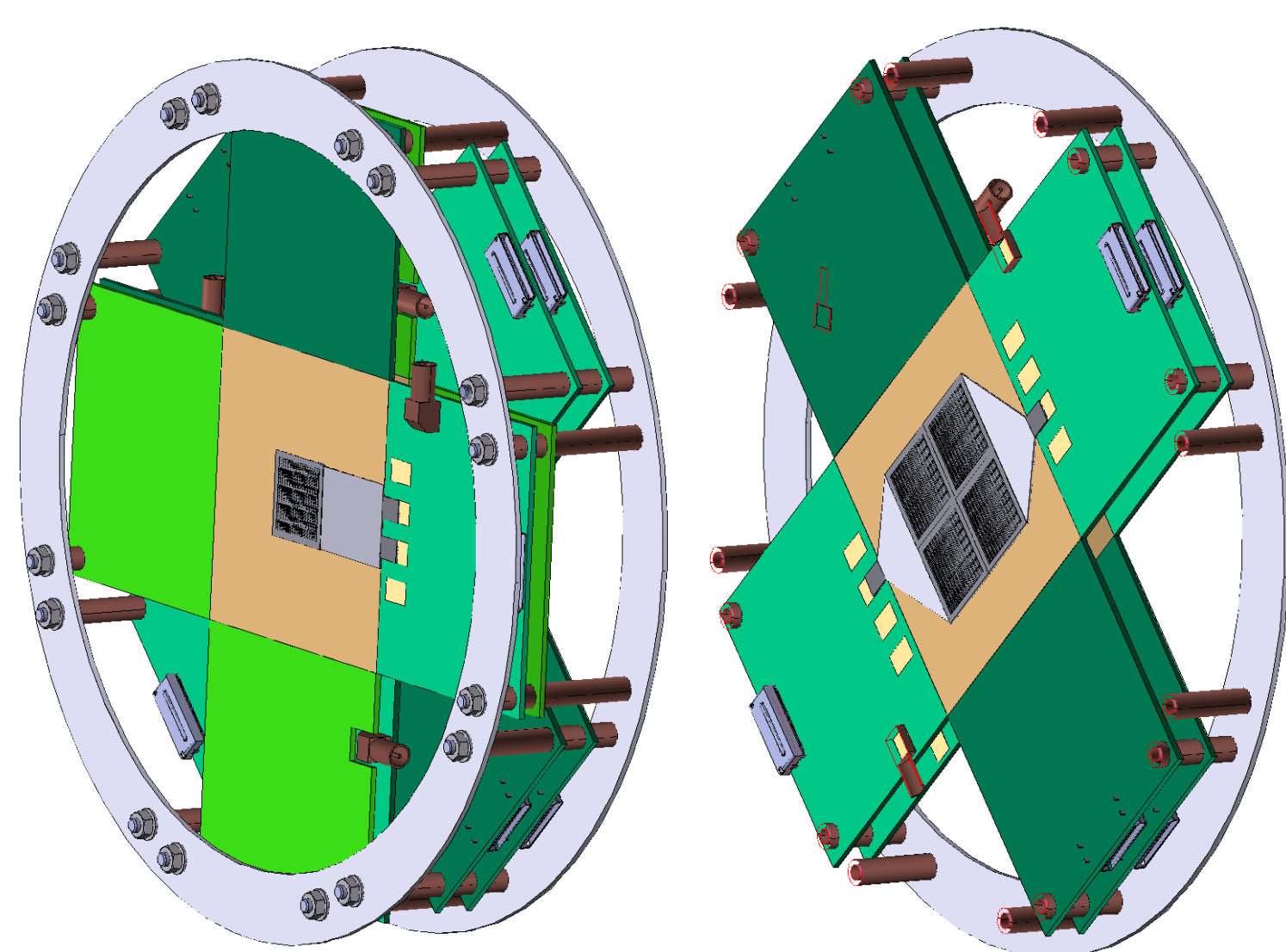
Sensor details

- ▶ Single-sided micro-strip silicon
- ▶ Side length: 2,06 cm
- ▶ Thickness: 300 μm
- ▶ AC coupled



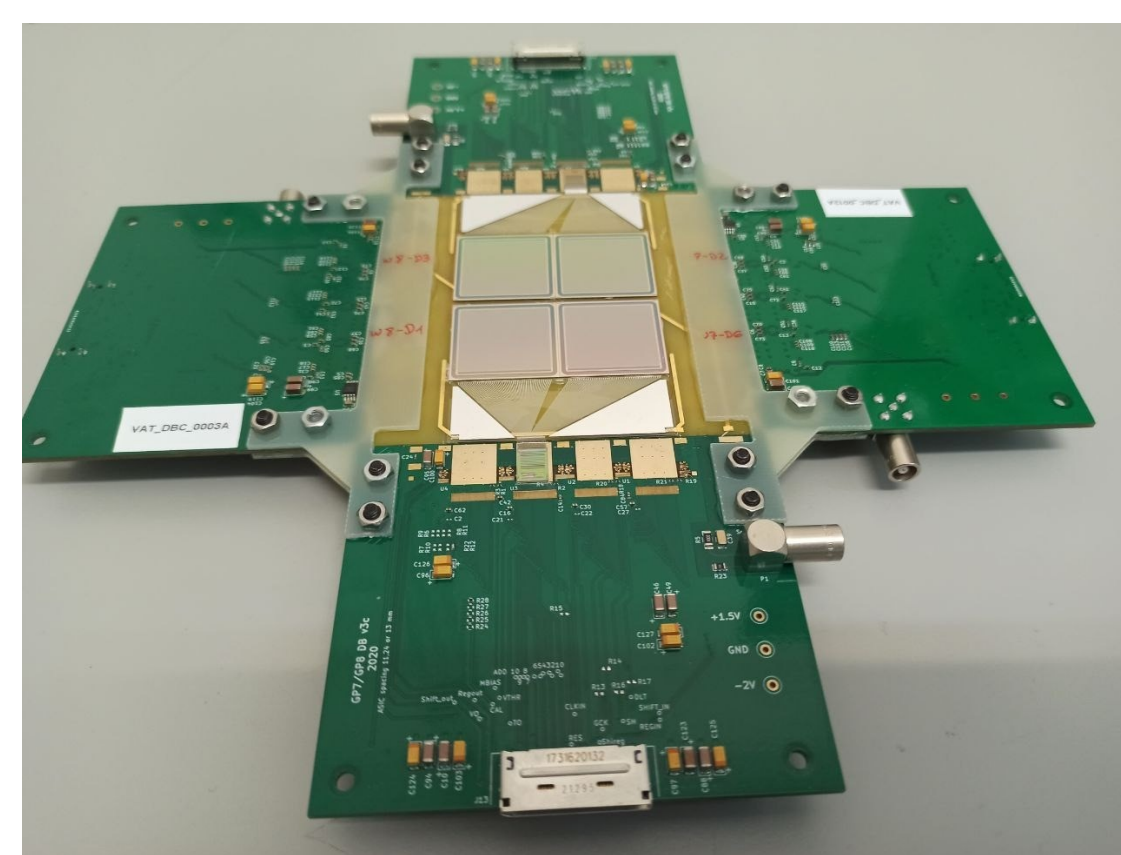
Station 1 & 2

- ▶ X-Y measurement
- ▶ Strip width: 80 μm



Station 3 & 4

- ▶ U-V measurement (45°)
- ▶ Strip width: 160 μm (combined in pairs in FE)
- ▶ PAD distance: 4 mm

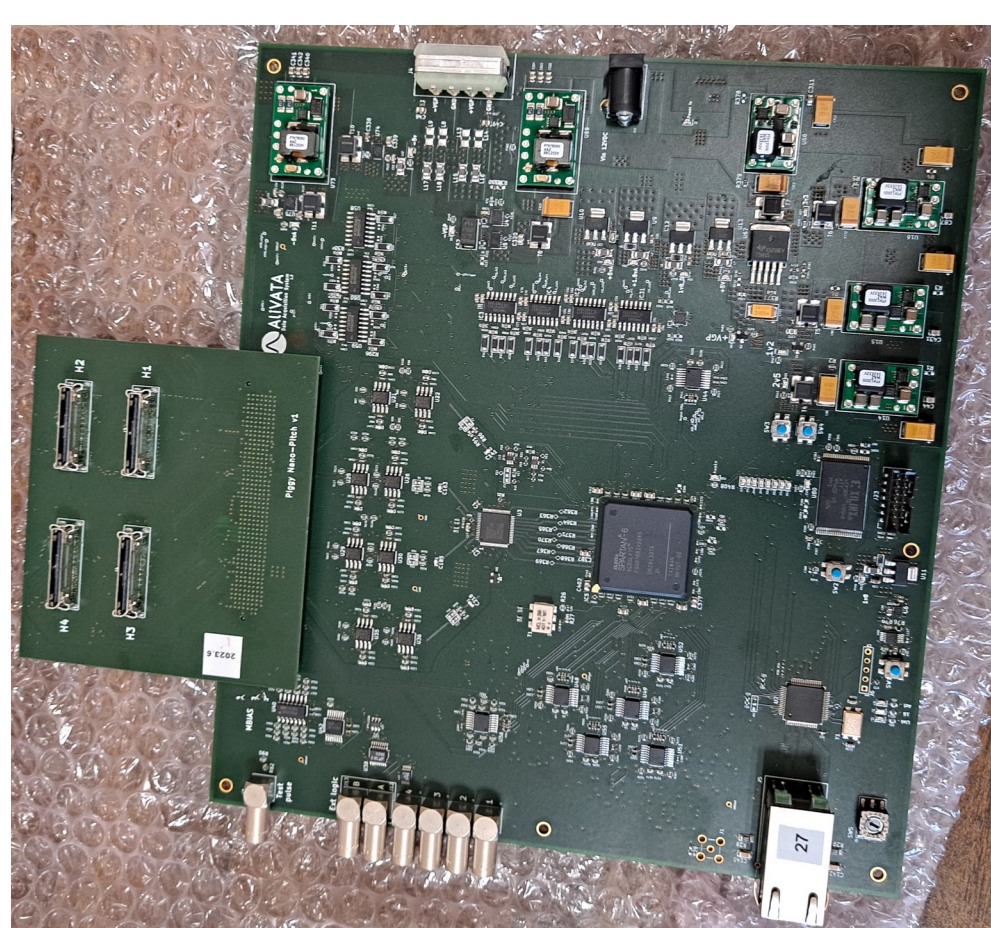
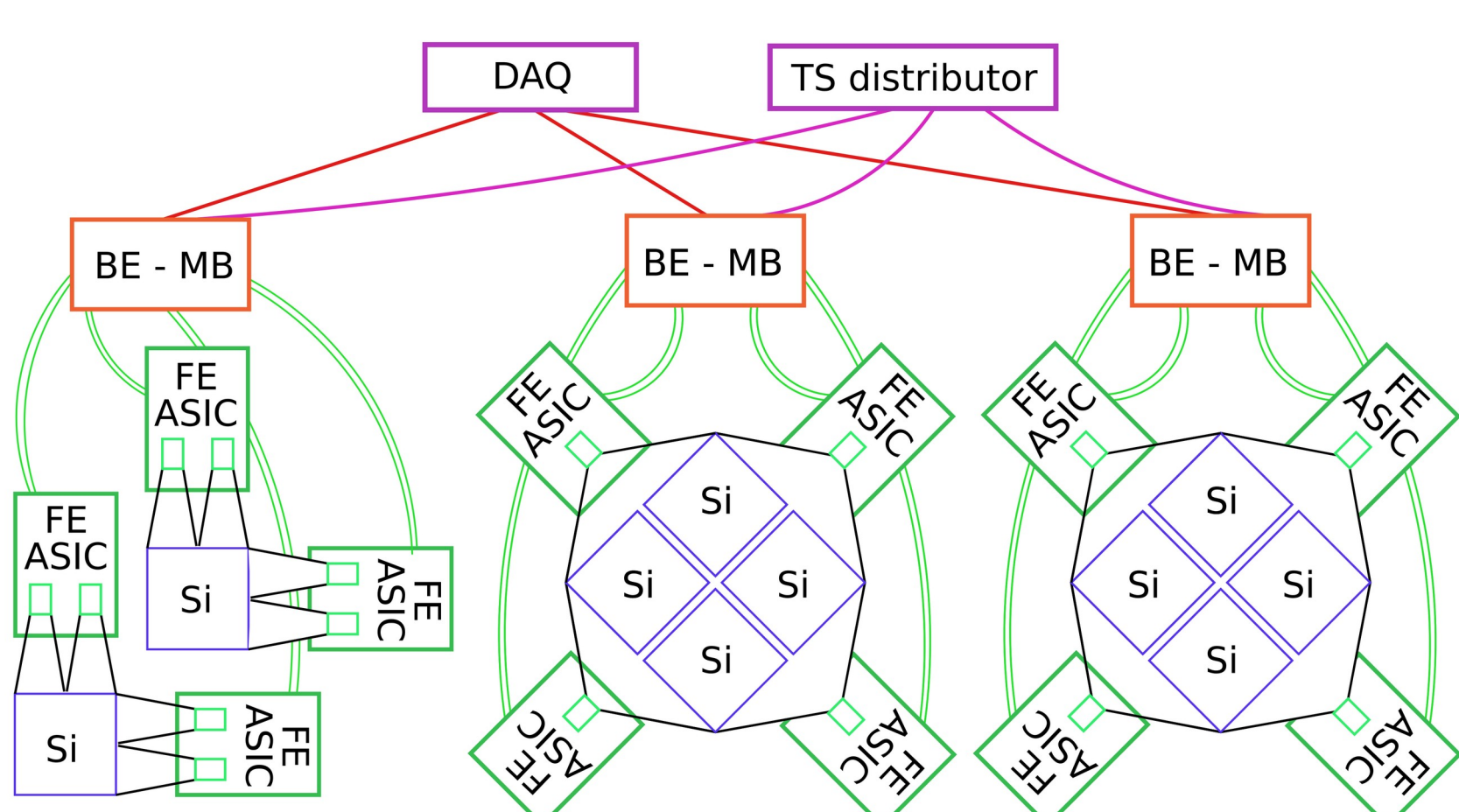


Front-end electronics

- ▶ 16 ASICs (VATAGP8 from IDEAS)
- ▶ Pre-amplifiers and shapers
- ▶ Shaping time: 50 ns / 500 ns
- ▶ Readout modes: serial / sparse
- ▶ Multiplexed output

Back-end electronics

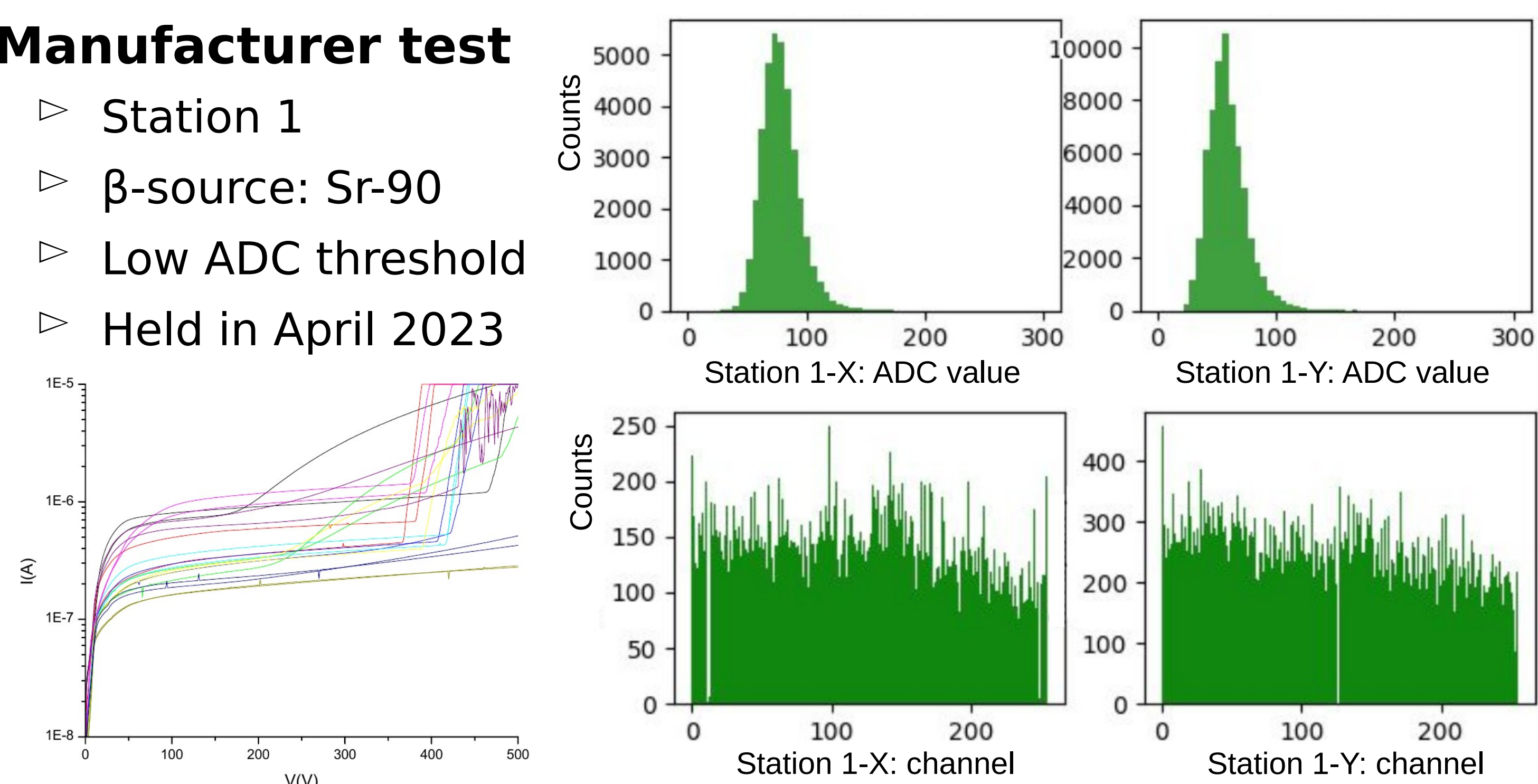
- ▶ 3 motherboards
- ▶ Synchronization: trigger & timestamp distributor
- ▶ ADC: 12 bits (~8 keV)
- ▶ TS: 48 bits (25 ns)



First Test Results

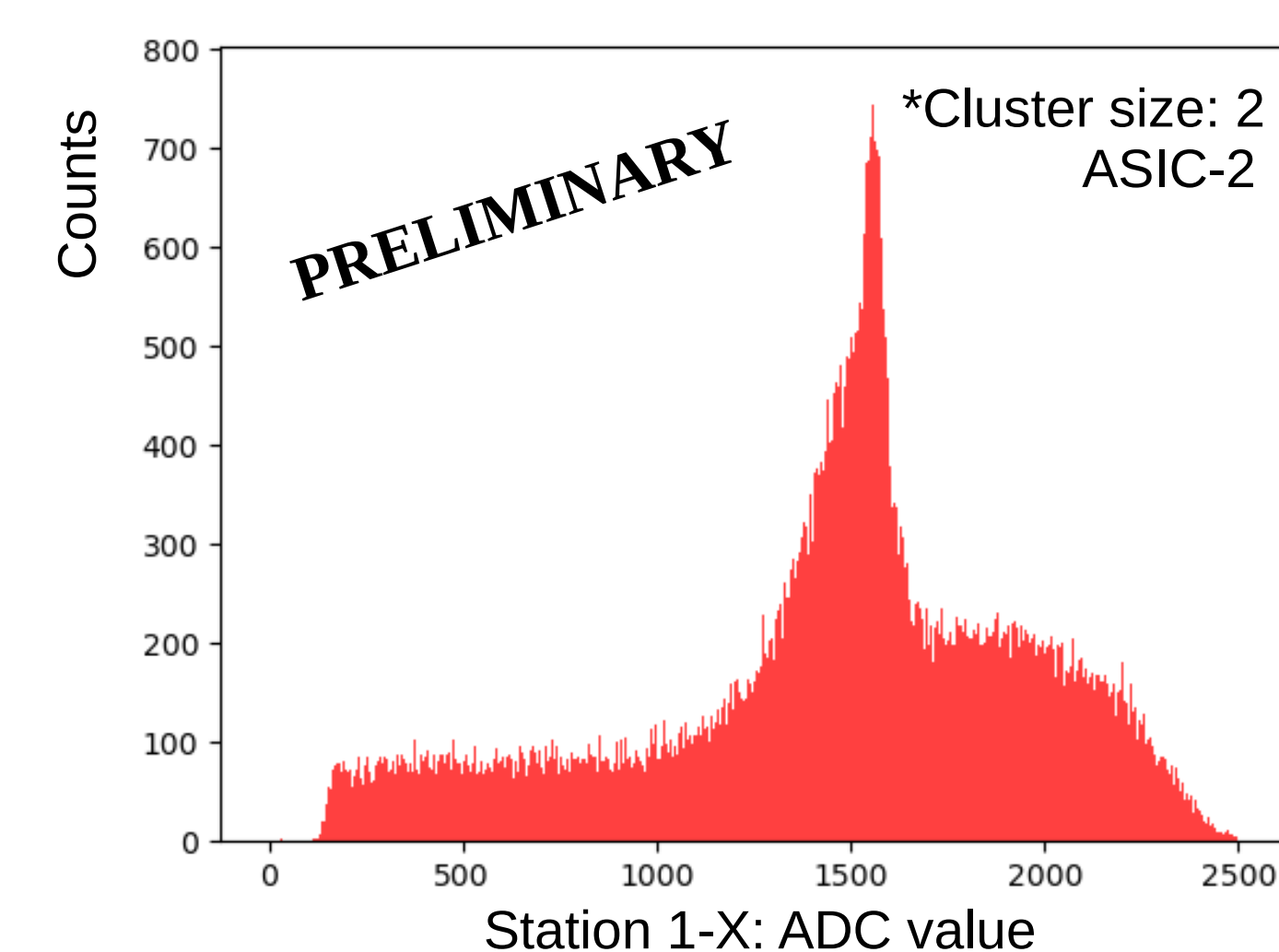
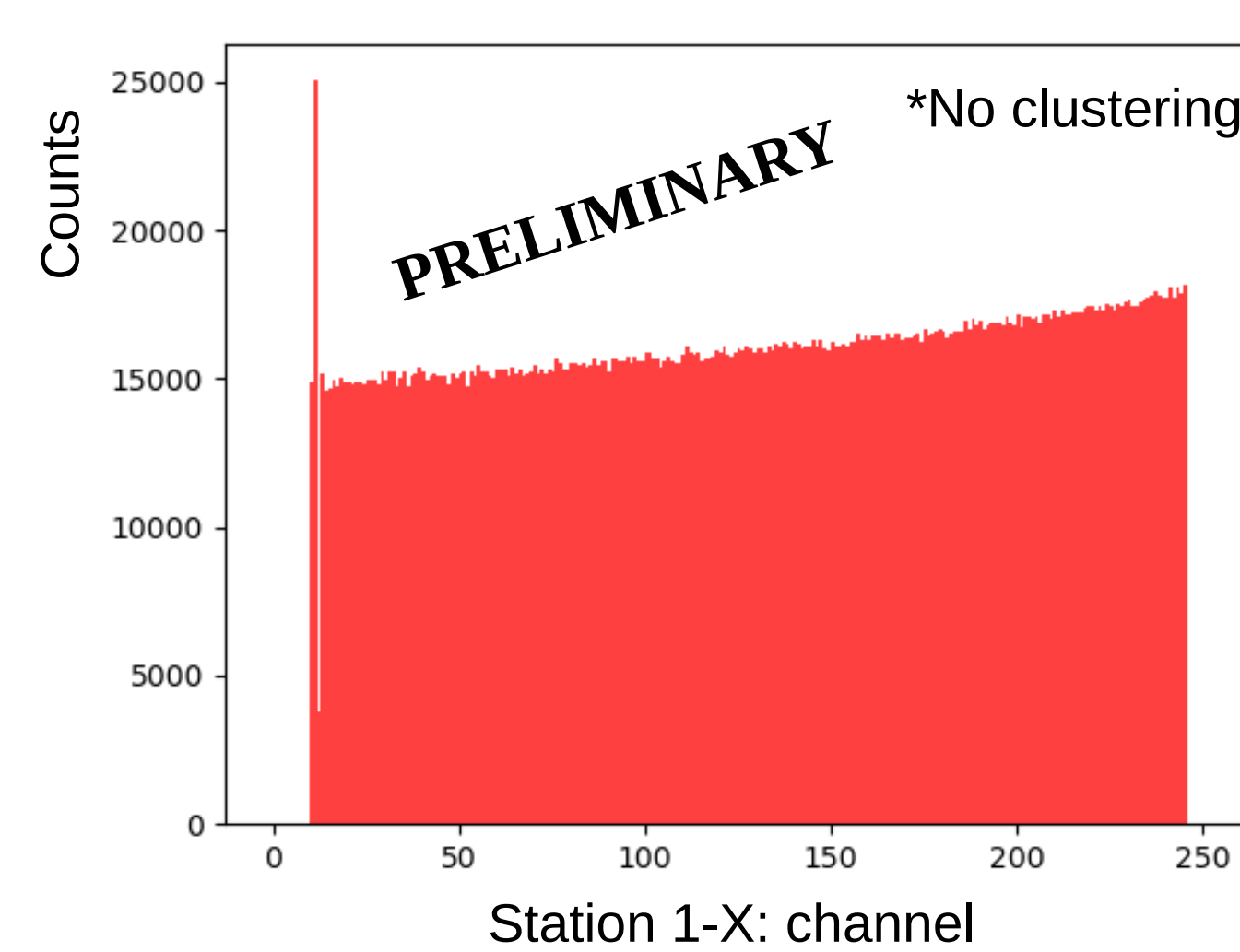
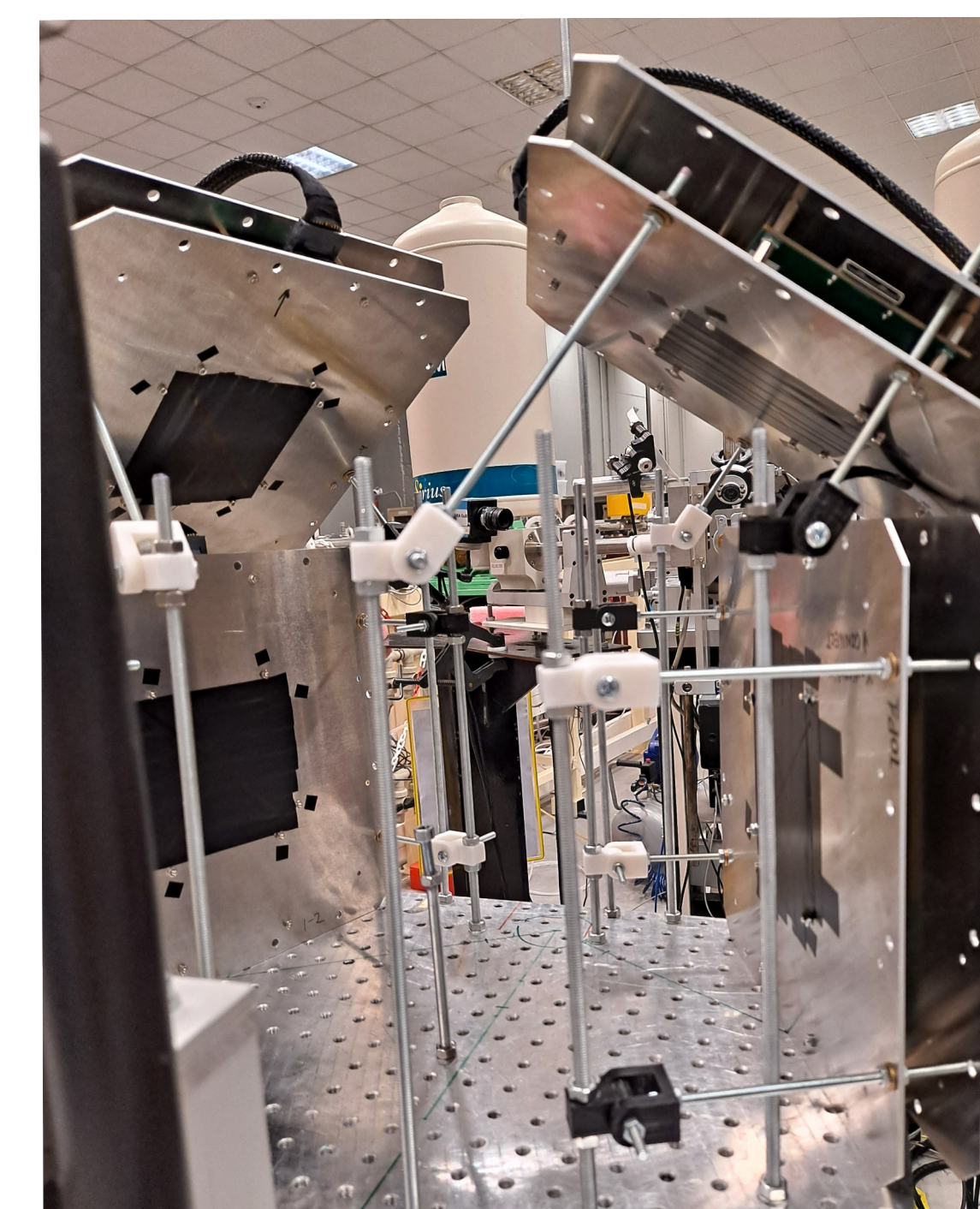
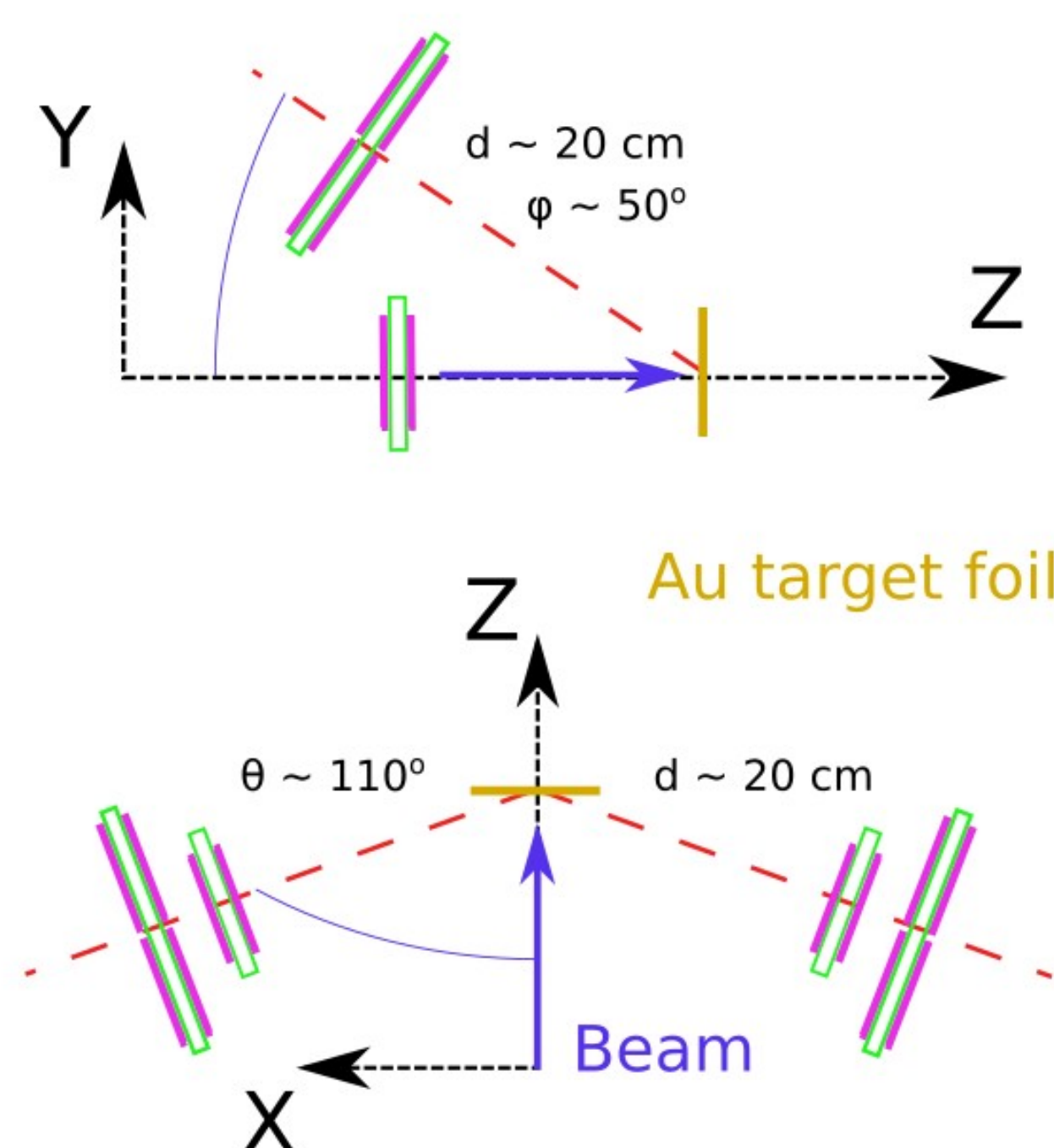
Manufacturer test

- ▶ Station 1
- ▶ β -source: Sr-90
- ▶ Low ADC threshold
- ▶ Held in April 2023



Experimental test with beam at CMAM

- ▶ All stations in detached configuration
- ▶ 10-MeV protons from Rutherford scattering on Au target
- ▶ Carried out at Centro de Micro-Análisis de Materiales (CMAM-UAM) in Madrid (Spain) in July 2023



Conclusions

- ✓ The Micro-vertex detection system has been developed by IEM, Alibava Systems, IFIC, INAIA and the WASA-FRS/SuperFRS EC
- ✓ First tests of the system have been successfully carried out by the manufacturer and at CMAM (UAM, Spain)
- ✓ Further tests in tracking configuration are to come in facilities providing high-energy beams

References

[1] T.R. Saito *et al.*, Nat. Rev. Phys. **3** (2021) 803-813

Acknowledgements

The work is supported by the grant 2019-T1/TIC-13194 of the program 'Atracción de Talento Investigador' of the Comunidad de Madrid, and 'Proyectos I+D+i 2020' PID2020-118009GA-I00