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, allowing 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

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