

Development of the telescope array for MESA in the TRIP project

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In the TRIP project,¹⁾ one of the experimental programs involves the measurement of elastic scattering of protons, neutrons, and α -particles with radioactive ion (RI) beams via inverse kinematics (MESA). We have been developing a ΔE - ΔE - E type telescope array for measuring recoil particles in proton and deuteron elastic scattering. The array comprises three telescopes. Each telescope consists of a microstrip silicon detector, a strip silicon detector, and either 4 CsI (Tl) crystals or 3 GAGG:Ce crystals, all mounted on a Cu base (Fig. 1).

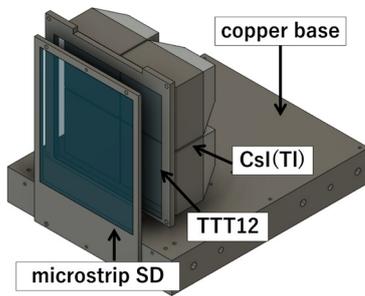


Fig. 1. Telescope design: Illustration of a telescope, featuring a microstrip SSD type B as the first layer and CsI(Tl) as the third layer.

Table 1 lists the specifications of each detector. The first layer consists of a microstrip silicon detector for x position and ΔE measurements similar to the silicon detectors used in the ONOKORO project.²⁾ Two types, Type A and B, are available depending on size. The second layer comprises a strip silicon detector (Micron TTT12³⁾) for y position and ΔE measurements. The third layer consists of CsI(Tl) or GAGG:Ce crystals serving as a total E counter. The telescope array is used in a vacuum, with APV-s1 and CR-110 used for readout integrated into the telescope. Therefore, the base of the telescope is cooled by water.

The setup of the telescopes array is shown in Fig. 2. Each telescope will be installed at a distance of 14 cm from the beam center. In addition, the telescope, the upper and lower telescopes, will be tilted at an angle of 55° . These telescopes cover angles in the range of 60 – 90° in the laboratory system. This setup enables the measurement of recoil protons in the range of 60 – 87° in the $^{86}\text{Kr}(p,p)^{86}\text{Kr}$ reaction. This corresponds to a range of 5.3 – 56.7° in the center-of-mass system.

The proton elastic scattering on ^{86}Kr at 66 MeV/nucleon will be measured in March 2024 in the E6 experimental room.

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Table 1. Detector specifications: Detailed specifications of the detectors used in the experiment

Detector	Item	Value
Microstrip silicon detector	Thickness	100 μm
	Pitch	100 μm
	Size	83.5 mm \times 108.8 mm (A) 107.36 mm \times 85.1 mm (B)
	Ch	988 (A) 768 (B)
	Readout	APV25-s1 ⁴⁾ 128 ch/chip
Strip silicon detector TTT12	Thickness	300 μm
	Pitch	5.0 mm
	Size	98.4 mm \times 98.4 mm
	Ch	20
CsI(Tl)	Readout	Cremat CR-110 ⁵⁾
	Thickness	25 mm
	Size	50 mm \times 50 mm
GAGG:Ce	Readout	Cremat CR-110 ⁵⁾
	Thickness	35 mm
	Size	35 mm \times 120 mm
	Readout	R11265U-300 S3584-08

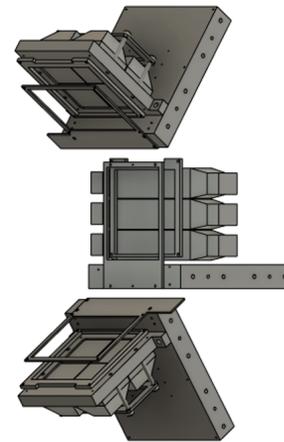


Fig. 2. Setup of the telescope array.

References

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