

Research Result Report

ICRR Inter-University Research Program 2022

Research Subject: Towards a multiphysics liquid Xe TPC with scintillation and charge multiplication readouts

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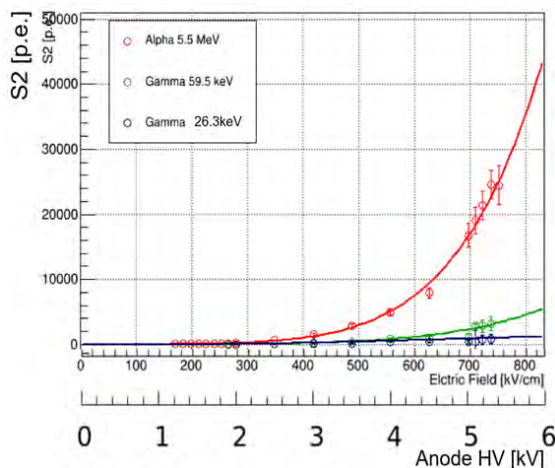
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Summary of Research Result :

The setup for this project is already prepared in Kamioka Observatory. First tests using a 10 μm wire as the multiplication electrode, operated stably at 700 kV/cm, demonstrated the S2 signal measurement for 13.9 keV X-rays. The S2 photoelectrons yield as a function of the applied voltage is shown in the Figure.



Preliminary investigations of particle identification performance were also undertaken. The design of a 10 cm in-diameter prototype spherical detector is ongoing. The project has been affected due to the limitations imposed by the COVID-19 pandemic. Nonetheless, regular meetings were held, and progress was achieved. In 2022 first tests were conducted using a high-voltage

feedthrough. It was demonstrated that it could sustain the voltages required. This was achieved with the addition of an insulator to isolate the recessed pin. Then the needle electrode structure was developed and is shown in the Figure below, building on previous experience with resistive materials. Tests were



performed with the needle electrode in Ar:CH₄ (2%) with pressures of up to 2 bar. Initially, sparking was observed at about 4kV. Following thorough cleaning/baking of the electrode surface high voltages up to 6kV (power supply limit). A uniform glow discharge was observed. In the next steps, a power supply that can

provide high voltage will be used to identify the limit of the sensor.
Strategies to suppress the glow will be pursued. Subsequently, the setup will be used in the liquid phase to confirm stability and to investigate whether contamination is kept to sufficiently low levels since purity is a crucial factor for liquid phase operation.

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