GRAMS (Gamma Ray and AntiMatter Survey) is a joint Japanese–U.S. project that uses a liquid argon time projection chamber to pursue high-sensitivity spectroscopic imaging of cosmic MeV gamma rays and indirect searches for dark matter. At Osaka University, we are developing NanoGRAMS, a compact detector with an active volume of 5 × 5 × 10 cm^3, to demonstrate the operating principle of a liquid argon Compton camera. Ionization electrons are read out using a 16 × 16 array of pixel electrodes coupled to the low-noise VATA-SGD ASIC (180 e^- at 6 pF), while scintillation light is detected using a SiPM array (Hamamatsu Photonics S13360-6075). An FPGA synchronizes the acquisition of the charge and scintillation signals. The XY coordinates are determined from the hit pixel positions, and the Z coordinate is obtained from the time difference between the two signals.

The recorded charge signals exhibit a variety of spatial patterns, including point-like signals and many signals extending across multiple pixels. These patterns have not yet been fully characterized, and their relationship to gamma-ray events remains unclear. In this study, we analyzed the spatial patterns and charge distributions of individual events recorded during a liquid argon experiment in October 2026. We evaluated their dependence on scattering position and measured charge, and compared the data with simulations reproducing the experimental conditions to investigate the physical processes underlying the observed patterns.

This talk will present the analysis methods and results.