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Development of a New Particle Identification Method by Pulse-shape Analysis of GAGG:Ce Calorimeter

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We have launched ESPRI⁺ and ONOKORO projects to investigate uniform and nonuniform properties in nuclei and nuclear matter.
Under these projects, we plan to perform the experiments to measure proton elastic scattering and proton induced cluster knockout reaction in inverse kinematics at RIBF, Riken.
For these experiments, we are developing the new telescopes named DELTA and TOGAXSI.
These telescopes consist of Si micro strip detectors (100 um thick, 100 um pitch) and large GAGG:Ce calorimeters (35 mm $\times$ 35 mm $\times$ 120 mm).
Although the performance of each detector was already checked and design of the telescopes has been completed, it is still difficult to identify particles by the conventional ΔE - E method because of the small energy deposits in the thin Si detectors.
Thus, we have developed a novel particle identification (PID) method focuing on the pulse-shape of the GAGG:Ce calorimeter.
We performed the test experiment at RCNP, Osaka University.
The various energies of protons and deuterons were injected to the GAGG:Ce calorimeter and the response was obtained by the waveform digitizer.
We analyzed the data sets and found that the good separation between protons and deuterons were achieved by utilizing the difference in pulse-shape.
In this presentation, we will report the result of the test experiment and the performance of this new PID method.

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