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Measurement of residual nuclei with active-target TPCs and Si detectors/アクティブ標的 TPC および Si 半導体検出器を用いた残留核の測定

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Time Projection Chambers (TPCs) and silicon (Si) semiconductor detectors are useful to examine residual nuclei in nuclear reaction.
We developed MAIKo and MAIKo+, which are TPC-based active target systems [1]. They enable tracking of low-energy charged particles over a large solid angle by using gas as both the detection medium and target. We utilize them to study triple-alpha reaction, which is one of the most important in nucleosynthesis in the universe. We inject a neutron beam into the MAIKo(+) active targets filled with a detection gas containing carbon, and measure 3 alpha particles emitted from excited states of residual carbon nuclei. A test measurement was conducted at the OKTAVIAN neutron beam facility in Osaka University, and it showed significant potential to measure residual nuclei in nuclear reactions [2].
We also developed a Si detector array SAKRA to detect decay particles from residual nuclei. It has particle-identification capabilities via pulse shape analysis. We demonstrated that SAKRA is capable to distinguish protons from alpha particles at E > 2 MeV and alpha particles from carbon nuclei at E > 5 MeV, and useful to examine decay processes of residual nuclei and to clarify their internal structures. We employed SAKRA to search for alpha cluster states in ^{24}Mg [3].
In this talk, we will report the performance of MAIKo(+) and SAKRA, and present their application in our recent experimental works.

References
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