

RIBF experimental program in TRIP project 2024

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The TRIP¹⁾ use case “Nuclear Transmutation,”²⁾ was launched in FY2023 to promote at the social implementation of unstable nuclear physics, particularly in medical RI and nuclear waste, through the acquisition of RI-Beam Factory (RIBF) experimental data and theoretical development. This use case comprises three main tasks: automation of accelerator experiments, acquisition and sharing of experimental data, and development of unstable nuclear theory. There are three experimental programs: measurement of elastic scattering anytime anywhere any-beam (MESA), symbiotic systematic and simultaneous cross-section measurements across the nuclear chart (S³CAN), and gamma-ray tracking in R5 using the germanium clusters array (GT-5). These experimental programs are complementary, and by conducting each measurement on the same nucleus, researchers can extract information such as optical potentials and nuclear radii. This report outlines the progress of these experimental programs.

As the first TRIP experiment, TRIP23-01-01 was performed in March at the E6 course, and proton elastic scattering of ⁸⁶Kr³⁾ was measured under the MESA program. A new detector system for recoil particles,

named DELTA,⁴⁾ was successfully introduced. The second experiment was carried out in May (TRIP24-01-01). For the MESA program, proton elastic scattering of the unstable nuclei ⁴⁴Ti⁵⁾ and ⁵⁰Ca⁶⁾ was measured using DELTA and ESPRI⁷⁾ setups at the F12 area. For the S³CAN program, interaction and charge-changing cross sections were measured for nuclei in the Si-Co region using carbon and CH₂ targets. A new ionization chamber was installed in the F3 chamber. In November, TRIP24-01-02 experiment was conducted, and proton elastic scattering of ¹³⁶Xe⁸⁾ and interaction cross section of Zr isotopes were measured. In addition, automated systems of high voltage control⁹⁾ and gas handling¹⁰⁾ were successfully commissioned. A new cryogenic target system is now available for upcoming TRIP programs.¹¹⁾ Development is also underway to automate the surveying analysis of experimental setups using a photogrammetry system.¹²⁾

In summary, a significant amount of nuclear reaction data was successfully obtained under the 2024 TRIP use case. From 2025, an in-beam gamma-ray spectroscopy experiment will be conducted under the GT-5 program using a segmented germanium detector.

References

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