

Precise magnetic field measurement of electron spectrometer for the electron scattering off unstable nuclei experiment

There are two types of atomic nuclei: “stable nuclei” and “unstable nuclei”. The unstable nuclei make up about 97% of all nuclides, including those expected to theoretically exist. It has become clear that many of their characteristics such as shape and structure cannot be explained by the standard nuclear structure models. So far, the internal structure of the atomic nuclei have been elucidated mainly by electron scattering experiments using the stable nuclear targets. However, the electron scattering experiments using short-lived unstable nuclear targets have not been realized yet.

We have built the SCRIT (Self-Confining Radioactive-isotope Ion Target)^[1] electron scattering facility^[2] at RIKEN RI Beam Factory in order to determine the charge density distribution of short-lived unstable nuclei by electron scattering. WiSES (Window-frame Spectrometer for Electron Scattering) is an electron spectrometer for the SCRIT experiment. WiSES consists of a dipole magnet, two drift chambers at the entrance and the exit of the magnet, two scintillation counters for trigger generation, and a helium-gas filled bag installed between the two drift chambers. The momentum of the scattered electrons is determined by reconstructing the trajectories from the magnetic field distribution of the magnet and information of the position and the angle of the scattered electrons obtained from two drift chambers. In order to determine the charge density distribution by elastic scattering, we need to identify the elastic and the inelastic scattering events by WiSES. The momentum resolution of WiSES is necessary to be at least 10^{-3} in the energy range of 150 to 300 MeV to be used for the SCRIT experiment. But the past studies show that it has not been reached yet. One of the possible causes is the incomplete knowledge of the magnetic field distribution. The calculated magnetic field map has been used so far. I will measure the magnetic fields instead of the calculated fieldmap in order to improve the momentum resolution of the spectrometer. Since three components of magnetic field are needed, I am developing a 3D Hall device.

In this talk, I will report the current status and future prospects of the WiSES magnetic field measurement.

1. M.Wakasugi et al: Nucl. Instr. Meth. A532, (2004), 216-223
2. T.Suda et al : Prog. Theor. Exp. Phys. 03C008, (2012)

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