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Silicon pad detector with large effective area for SHE experiments

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A silicon pad detector (SPD) with one of the largest effective areas has been developed for the charged particle detector on a focal plane of a gas-filled recoil ion separator (GARIS-II and GARIS-III) at RIKEN. The main objective of research using the GARIS system is to discover new elements with atomic numbers Z = 119. The element Z = 119 is synthesized through a fusion reaction of ^{51}V + ^{248}Cm and successively decay through alpha decay or spontaneous fission. The SPD is installed in the GARIS to detect alpha particles or fission fragments through the decay chain of element Z=119. The SPD is newly developed in collaboration with Hamamatsu Photonics. The active area and thickness are 123 × 60 mm^2 and 320 μm, respectively. The active area is segmented into 32 channels (8 × 4) each with an electrode pad of 15 × 15 mm^2. The characteristics of the SPD were investigated by irradiating α particles with automatically moving and rotating the ^{241}Am source for each segmented portion of the SPD. A Monte Carlo simulation was also performed to estimate the dead layer thickness of the SPD. The deduced dead layer thickness of the SPD was less than 120 nm. In addition, the energy resolution of 26 keV (FWHM) was obtained for 5.486 MeV α particles. The performance meets the requirements for the new element search of Z = 119 with GARIS-II and GARIS-III.

Primary experiment

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