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Readout system of pixelated silicon detector for compact AMS

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^{14}C is one of the most useful isotopes and has been widely utilized for radiocarbon dating in various fields, such as archaeology, environmental science, geology, and space and earth sciences. Yamagata University (YU) installed a compact accelerator mass spectrometry (YU-AMS, Fig. 1) system in March 2009 [1]. Two automated graphitization lines, AGL-I and AGL-II, were also installed in YU dedicated to ^{14}C measurement [2,3]. The AMS system is based on a 0.5 MV Pelletron accelerator (CAMS) developed by National Electrostatics Corporation. This is the first CAMS system to be installed in a university in Japan.

Recently, we have developed a pixelated silicon detector (PSD) for the position-sensitive detector on a focal plane of YU-AMS system as shown in Fig. 2 [4]. The active area and thickness are $16 \times 16 \text{ mm}^2$ and $320 \mu\text{m}$, respectively. The active area is segmented into 64 channels (8×8) each with an electrode pad of $2 \times 2 \text{ mm}^2$. The characteristics of the PSD were investigated by irradiating α particles from an ^{241}Am source. The energy resolution of 22.4 keV (FWHM) is obtained for 5.486 MeV α particles. The PSD was installed at the focal plane of the beamline of the YU-AMS system and its performance was investigated using ^{14}C beam. The two-dimensional count map of the ^{14}C beam was successfully obtained by the PSD. The PSD can be utilized for not only the tuning of the optimal parameters of the AMS system such as low- and high- energy bending magnets but also for the monitoring of the ^{14}C beam during ^{14}C measurements. We are currently developing the new low-noise preamplifier and data acquisition system of the PSD. It is expected that the performance of the newly developed PSD and the readout system enable effective beam diagnostics, and hence, the precise isotope measurements in other AMS facilities including the positive ion mass spectrometry (PIMS) systems. In this conference, we will present the recent development of the PSD.

References

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Student Submission

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