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Improvement of the β -ion correlation efficiency in decay spectroscopy

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β -decay spectroscopy is a useful method for understanding physics of nuclear structure. In decay spectroscopy experiments, Double-Sided Silicon Strip Detectors (DSSSDs) have often been used because of their detection capability on ions and β -rays. In order to identify β -ray events in the DSSSDs, it is necessary to correlate a β -ray and a corresponding, implanted ion using time and position information.

This process of the β -ion correlation should be carried out carefully, because the correlation efficiency depends on the positions and the energy losses of the implanted ions and the emitted β -rays in the DSSSDs. In this analysis, a new algorithm has been introduced to improve the β -ion correlation efficiency with the DSSSD, WAS3ABi [1]. In the new approach, hit patterns of β -rays recorded in the WAS3ABi are categorized to determine the initial position of the β -rays. When the β -rays were detected by the plastic scintillators installed at upstream/downstream of the WAS3ABi, the directions of the β -rays were also deduced. Furthermore, some ions stopped at the surface of the DSSSD layers have also been analyzed [2], finally improving the β -ion correlation efficiency. We demonstrate that this method can successfully reduce the background from random β -ion correlations while collecting more correlated β -ion events, thus improving signal to background ratio.

[1] P. -A. Söderström et al., Nucl. Instrum. Methods Phys. Res. B 317, 649 (2013)

[2] I. Nishizuka et al., JPS Conf. Proc. 6, 030062 (2015)

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