Scanning systems for double strangeness nuclei in nuclear emulsion

J. Yoshida, H. Ito, S. Kinbara, H. Kobayashi, D. Nakashima, K. Nakazawa, A. Mishina, M. K. Soe, A. M. M. Theint, K. T. Tint, and J-PARC E07 Collaboration

Physics Department, Gifu University, Gifu 501-1193, Japan

We will introduce two kinds of scanning systems to obtain larger statistics for double strangeness nuclei in nuclear emulsion shown in Fig.1. Double strangeness nuclei, such as double Λ hypernuclei and Ξ hypernuclei, are important subjects to study Λ-Λ and Ξ-N interaction respectively. Nuclear emulsion is the best detector for double strangeness nuclei. Fast scanning systems are therefore essential to obtain more information on Λ-Λ and Ξ-N interaction.

One of the systems is for fully automated Ξ^- hyperon tracking for the hybrid emulsion method. This system follows the tracks of Ξ^- hyperons in stacked emulsion plates. Then it locates double strangeness nuclei at some of the rest points of the Ξ^- hyperons. The system is an essential instrument for the coming experiment named E07 at J-PARC K1.8 beam line[1]. We will finish the location work within a few years with this system.

The other is a system for "Overall scanning"[2]. The system directly detects double strangeness nuclei with image recognition from microscopic images of nuclear emulsion. We have developed a dedicated microscope for a high-speed image taking and algorithms of image recognition. So far, a typical twin single-hypernuclear event[3] and several candidates of double Λ hypernuclei are detected during the operation of this system.

The both systems are in operation with emulsion plates of KEK-PS E373. Basic technologies are almost established. R&D for faster, robust and highly reliable operations is ongoing.

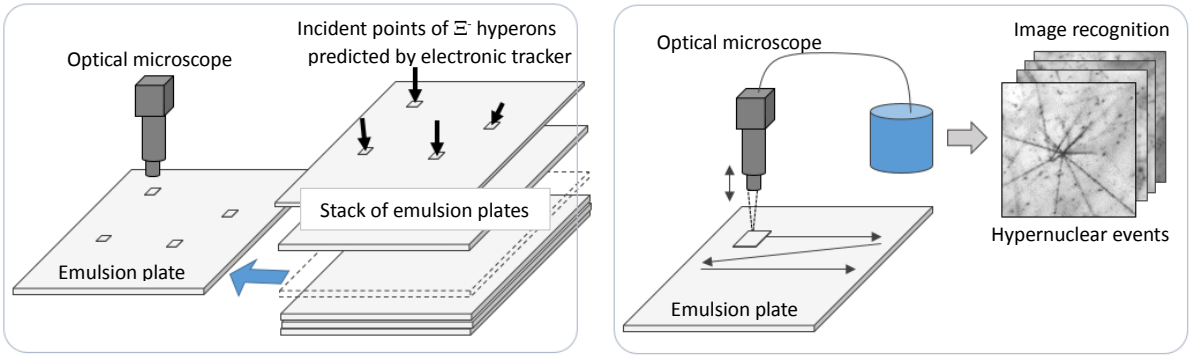

Figure 1: Two kinds of scanning systems for double strangeness nuclei in nuclear emulsion. Left one is for fully automated Ξ^- hyperon tracking. Right one is for "Overall scanning".

[1] Imai, K., Nakazawa, K., Tamura, H., Proposal for K1.8 beam line at J-PARC
[2] Junya Yoshida, Kazuma Nakazawa, Kaori Umehara, JPS Conf. Proc., 013070 (2014)
[3] K.Nakazawa et al., Prog. Theor. Exp. Phys. 2015, 033D02 (2015)