

The alignment method of the emulsion plates for Xi- hyperon tracking on J-PARC E07

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In the J-PARC E07 experiment, it is expected to detect many double Λ hypernuclei with 10 times higher statistics than the previous experiment, KEK-PS E373. Then we will get information to understand the A-number (nuclear mass) dependence of Λ - Λ interaction energy via those hypernuclei independent of the NAGARA event. Such hypernuclei are produced through capture reaction of Ξ^- hyperons by nuclei in nuclear emulsion, where the Ξ^- hyperons are made quasi-free 'p'(K $^-$, K $^+$) Ξ^- reaction in a diamond target located upstream of the emulsion. To avoid time-consuming job by human, candidate tracks of Ξ^- hyperons can be followed with newly developed automated tracking system.

An emulsion stack consists of 12 emulsion plates with 0.5mm thick emulsion coated on both sides of a thin polystyrene film. The total number of plate-by-plate location of the candidate tracks is about 10^5 times for all Ξ^- hyperon tracks. For the success for automated tracking of Ξ^- hyperons, accurate alignment of plate-by-plate is the essential task to prevent mis location.

A technique of precise position alignment has been developed with pattern matching of beams recorded perpendicular to the emulsion, as follows. Beam position pattern is extracted from tomographic images in the emulsion with image processing. The offset value of plate-by-plate is examined by comparing beam position patterns located on adjacent plates as shown in Fig.1. In the current techniques, matching efficiency was achieved at 99.2%. The position accuracy of alignment is less than $1\mu\text{m}$ in full area of the emulsion plate with the size of $23 \times 23 \text{ cm}^2$. This result is quite enough for automatic tracking of Ξ^- hyperons.

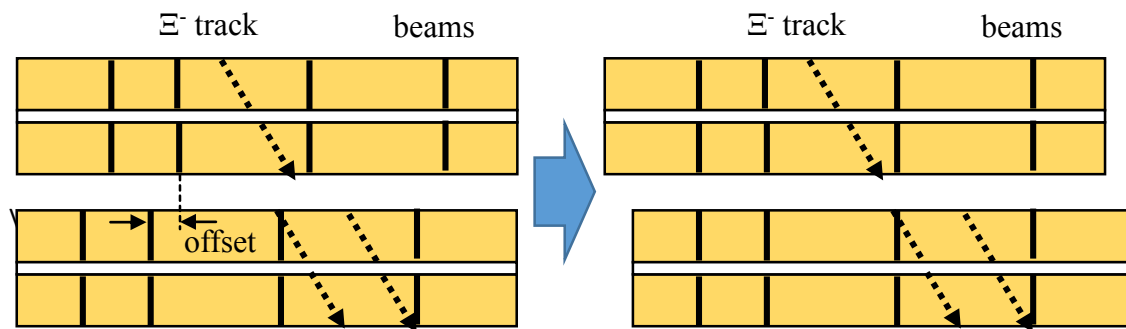


Figure 1: A schematic view of plate-by-plate alignment