Study of Lifetimes and Binding Energies of Light Single Hypernuclei with Nuclear Emulsion

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It is not doubtful the nuclear emulsion is good detector to study hypernuclei. World data for binding energies of light single hypernuclei were described with high statistics events by the combination data from only emulsion experiments [1].

So far, lifetime estimation for light hypernuclei by various experiments have large interval estimations. For ${}^{3}_{\Lambda}$H, its lifetime can equal to that of free lambda (263.2 ps) because its binding energy is loosely bound (0.13 ± 0.05MeV). It was surprised that previous different experiments estimated the lifetime for ${}^{3}_{\Lambda}$H to be 95^{+19}_{-15} ps [2], 128^{+35}_{-26} ps [3], 183^{+42}_{-32} ps [4], and so on. Recently, C. Rappold *et al.*, reported the lifetimes of ${}^{3}_{\Lambda}$H to be 216^{+19}_{-16} ps by combination of estimations [5]. If the lifetime of ${}^{3}_{\Lambda}$H is significantly shorter than that of free lambda, it may need to reconsider B_{Λ} of ${}^{3}_{\Lambda}$H. In order to measure precisely the lifetime of ${}^{3}_{\Lambda}$H, high statistic events are required.

We search light hypernuclei ${}^{3}_{\Lambda}$H, ${}^{4}_{\Lambda}$H, ${}^{4}_{\Lambda}$He, ${}^{5}_{\Lambda}$He by use of emulsion plates of E176 experiment detected with overall scanning method [6] to measure their lifetimes precisely. In the E176 experiment, emulsion stacks consisting of 43 emulsion plates were exposed to 1.66 GeV/c K- beam at KEK-PS [7]. The thickness of a stack (~5 cm) is proper to detect completely the ranges of all decayed particles form single hypernuclei.

Overall scanning method can detect full volume of emulsion plate and pick up the K- beam interaction stars shown in Figure 1. The forward black tracks from beam star are followed to find the single hypernucleus decay vertex. This work will be performed by automatic track following system. In this presentation, it will be discussed for the event detection system, analysis system and hypernuclei events in detail.

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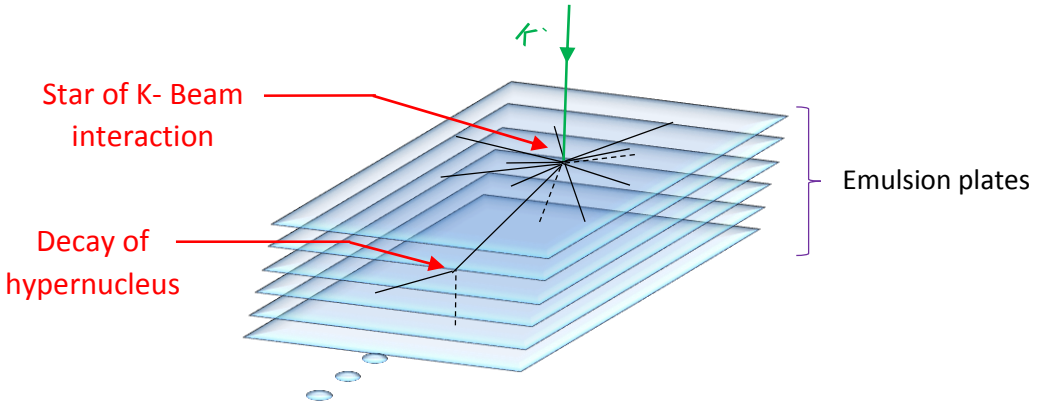

Figure 1: Schematic diagram of K- Beam star and hypernucleus decay in nuclear emulsion.

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