Measurement of the π^- Decay Width of $^5_\Lambda$He

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It has been theoretically discussed that Λ-Nucleus potential has a repulsive core in s-shell hypernuclei [1]. Non-mesonic decay has much larger momentum transfer($\sim$ 400 MeV/c) than that of mesonic decay($\sim$ 100 MeV/c). If the central repulsion exits, the overlap of Λ wave function and nucleon becomes reduced and mesonic decay width is expected to be enhanced, while non-mesonic decay width is suppressed. However experimental data has too large statistical error to distinguish the potential shape. In year2000-2001, we produced $^5_\Lambda$He hypernuclei via ^{6}Li(π^+,K$^+$)$^6_\Lambda$Li, $^6_\Lambda$Li $\rightarrow$ $^5_\Lambda$He+p reaction and measured decay products including charged pion, proton and neutron at KEK-12 GeV PS. Up to now, about 30% of whole data were analyzed. As shown in Figure 1, hypernuclear formation was clearly identified even with coincident pions detected at the decay counter, which is not the case in the previous experiment [2]. The π^--mesonic decay width is given as $\Gamma_{\pi^-} = b_{\pi^-}/\tau$, where b_{π^-} and τ denote the branching ratio and lifetime, respectively. Preliminary analysis of the lifetime already achieved as same order of accuracy(282^{+21}_{-19} ps) as existing data(Figure 2). Non-mesonic decay width is obtained as $\Gamma_{\mathrm{nm}} = 1/\tau - 3/2 \times \Gamma_{\pi^-}$ since π^--mesonic decay width can be assumed twice as large as π^0-mesonic decay width in case of $^5_\Lambda$He. $^5_\Lambda$He yield will finally reach 52,000 counts and results with drastically updated accuracy will be reported.

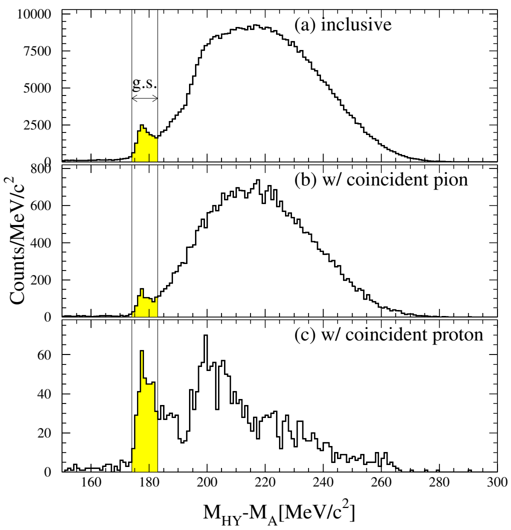

Figure 1: Excitation spectrum of ^{6}Li(π^+,K$^+$)$^6_\Lambda$Li reaction.

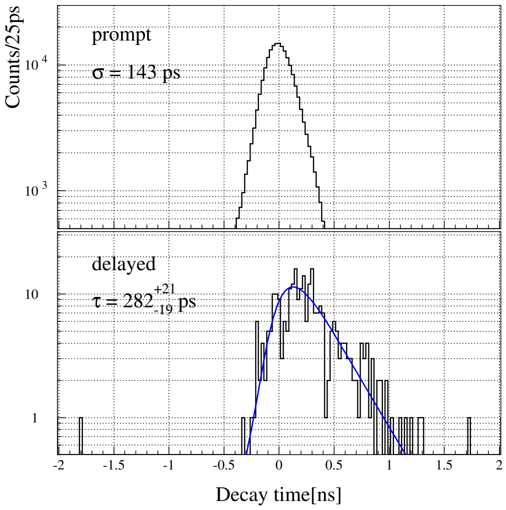

Figure 2: Prompt time spectrum(top) and decay time spectrum(bottom) of $^5_\Lambda$He.

References

[1] T. Motoba and K. Itonaga, Nucl. Phys. **A577** (1994) 293c.
[2] J. J. Szymanski *et al.*, Phys. Rev. Lett. **C43** (1991) 849.