J-PARC K1.8BRにおける <sup>3</sup>He(K<sup>-</sup>,∧pn)反応を用いての K<sup>-</sup>多核子吸収の研究

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# E15 experiment

in-flight <sup>3</sup>He(K<sup>-</sup>, n) reaction & its exclusive measurement

=> Search for KNN bound states both via formation & Decay



#### What can we learn from $\Lambda p$ invariant mass

- If Kpp decays to Λp final state, Kpp can be derived Kpp bound state from Λp invariant mass (FINUDA exp)
- FINUDA applied stopped K<sup>-</sup> reaction
   =>tagged back-to-back Λp

E15 exp in-flight K<sup>-</sup> on <sup>3</sup>He target
Does 2/3 nucleon absorption exists?
Λpn π multi-body?

 =>it is important to identify all particles in final state



- FINUDA Exp. @ DA $\Phi$ NE
- <sup>6</sup>Li, <sup>7</sup>Li, <sup>12</sup>C target stop *K*-
- $\Lambda p$  invariant mass

#### Multi-Nucleon absorption@<sup>3</sup>He target Measurement In-flight K- multi-nucleon absorption is NEW!!

- $\pi^{-}$  stopped [1]
  - Clearly seen 2nucleon absorption &FSI (50%/π <sub>stopped</sub>)
  - **3n**ucleon absorption <3%  $/\pi_{stopped}$
- $\pi^{-}$  in-flight [2],[3]
- 2nucleon absorption 0.85  $\pm$  0.17mb (266 MeV/c)
- 3nucleon absorption 3.7  $\pm$  0.6 mb(220 MeV/c)
- 2NA/3NA ~25%

[1] D. Gotta, etal., Phys. Rev. C 51. 2 (1995)
[2] P. Weber etal., Nucl. Phys A501 (1989) 765-800
[3] G. Backenstoss etal., Phys. Rev. Lett 55. 25(1985)





CDC (15 layers, 1816ch) + CDH (36 seg) + 0.7T solid angle: 60% of  $4\pi$ 



# 1<sup>st</sup> Stage Physics Run

| Jun.2006       | proposed and approved @<br>1 <sup>st</sup> PAC                            |  |                       |
|----------------|---|--|-----------------------|
| Feb 2009       | first beam transportation to K1.8BR                                       |  |                       |
| Mar.11<br>2011 | the earthquake  | 1 <sup>st</sup> physics run (May 2013)   |                       |
| May 2012       | completion of<br>spectrometer construction<br>1 <sup>st</sup> physics run | duration   | Kaon on target        |
| March &        |   | 88 hours   | 5.0 x 10 <sup>9</sup> |
| May 2013       | 8   |  | lata in tha 1st       |
| May.23<br>2013 | the accident<br>(run was stopped)   | <ul> <li>Accumulated data in the 1<sup>st</sup><br/>stage physics run</li> <li>~1% of approved proposal</li> </ul> |                       |
|                |   |  |                       |
|                |   |  |                       |



### $\Lambda p$ event selection



Event tagged by  $pp\pi$ - @CDS

- 2. Requested no forward charged particle
- 3. Define  $\Lambda$  decay pair from the distance of closest approach (DCA) between  $\pi$  and p

=>All DCA<1cm (DCA(Λp)<2cm)



## **Decomposition of "missing neutron"** region









## Summary

#### We accumulated the data of 1<sup>st</sup> physics run of the J-PARC E15 experiment

~5x10<sup>9</sup> kaons on <sup>3</sup>He

#### Preliminary results has been presented

Exclusive  ${}^{3}\text{He}(K^{-},\Lambda p)n_{\text{missing}}$ 

=>indicates that 3 nucleon absorption reaction is dominant?

- 2 nucleon absorption reaction is not seen clearly
- With assumption all events come from  $\Lambda pn\,$  phase space uniformly , cross section is evaluated to be ~210  $\mu b$
- indicates structure around K+p+p threshold

#### Further analyses are under way

Detailed analysis of exclusive  $\Lambda pn$  events

- Finalize  $\Lambda/\Sigma$  rate in selected n missing
- Finalize 3 nucleon absorption reaction cross section
- 2NA reaction upper limit











There remains a statistically significant excess !!





c2dalitzIM

# M.M & I.M of ${}^{3}$ He(K<sup>-</sup>, $\Lambda$ p)X



- Fitting 3NA/2NA +  $\pi$  events produced MC
- =>2NA events are very few

# cosOA(CM) of $\Lambda p {}^{3}He(K^{-},\Lambda p)n_{missing}$



# Momentum(CM) of $\Lambda p {}^{3}He(K^{-},\Lambda p)n_{missing}$





