

## Neutron induced reactions at KLF

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Neutron and  $K_L$  momentum spectra from SLAC measurements

## **Neutrons and** $K_L$ 's as a function of $\beta$





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#### **Strangeness in NN collisions**





Phys. Rev. C 84, 055207 (2011)

#### **K<sup>+</sup>** in NN collisions



Phys. Rev. C 84, 055207 (2011)  $\frac{\sigma(pp \rightarrow pK^{+}\Lambda)}{\sigma(pn \rightarrow nK^{+}\Lambda)} \sim 2$ 

#### At $\beta = 0.95$ , $E_n^{kin} = 2.1 \text{ GeV}$ , $E_{K_L}^{kin} = 1.1 \text{ GeV}$

 $K^+$  x-section energy dependence from nucl-th/0512059 (EPJA 27(2006) 269)  $\sigma(K_L p \rightarrow K^+ n)$  assumed to be 10mb





## Other sources of n-induced background



- $np \rightarrow K^+X NOT A PROBLEM$ 
  - the x-section and a flux is too small to be a problem.
- $np \to \pi^+ X$  ?
- $\sigma(np \rightarrow \pi^+ X) \sim 10^3 \sigma(np \rightarrow K^+ X)$ 
  - If pions are misidentified as Kaons might become dangerous

## $\pi^+$ background





## Other sources of n-induced background



- $np \rightarrow K^+X \text{not a problem}!!$ 
  - the x-section and a flux is too small to be a problem.
- $np \rightarrow \pi^+ X$  ?
  - $np \rightarrow \pi^+ X$  with  $K \pi$  misidentification is not a problem either.



## Neutron induced reactions at KLF BEYOND BACKGROUND

### np-elastic scattering





NN091 Nucleon-Nucleon 05/09 Amdt[NIJM] 01/03/19

 $E_n = 1.5 \text{ GeV}$ 



## *np*-single pion production



#### Isoscalar contribution



 $\sigma(NN \to NN\pi)[I = 0] = 3\{2\sigma(np \to pp\pi^{-}) - \sigma(pp \to pp\pi^{0})\}$ 

# *n*-induced reaction countrate





X-sections from SAID database

## Total cross section pn $\rightarrow d\pi^0 \pi^0$





P. Adlarson et. al Phys. Rev. Lett. 106:242302, 2011

### d\*-at KLF





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### Conclusion



- Neutron-induced background is small to pollute K<sub>L</sub>
  physics
- Neutron induced reactions have sufficient countrate to become scientifically interesting
  - No spectators
  - Smooth flux with uniform systematics
  - -np elastic
  - Single pion production
  - Two-pion production