

Strategy meeting
JLab hypernuclear experiment
Expected spectra for ${}^3_{\Lambda}\text{H}$

T. Gogami (Kyoto Univ.)

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GRADUATE
SCHOOL OF
FACULTY OF **SCIENCE**
KYOTO UNIVERSITY

Used a rate estimator made by Sho

<https://docs.google.com/spreadsheets/d/18GEnIWgMTDtWNbbDInGvp9WjeGrG-XeFp1jVcL0nBys/edit#gid=1373519431>

| 1 | Inputs | | | | | | | | Results | | | | | | | | | | |
|----|-------------------------|---------|--------------|-------|-----------------|--------------|------------|-------|--------------|--------------|-------------|-------------|------------------|----------------|-------------|-------|--------------|-----------------------|--|
| 2 | Beam | | Target | | e' | K | Efficiency | | | | | | | | | | | | |
| 3 | Title | Setting | Current (μA) | Name | Spectrometer | Spectrometer | Efficiency | day | e' rate (Hz) | pi rate (Hz) | K rate (Hz) | p rate (Hz) | K trig rate (Hz) | Coin rate (Hz) | Hyper Yield | S/N | Significance | Mass Resolution (MeV) | |
| 25 | Gas target cell (0.3mm) | 1-pass | 20 | Al27 | PCS+HES(H) 8deg | PCS+HKS(H) | Setting 1 | 10.00 | 1,500,000 | 23,000 | 270 | 29,000 | 4,800 | 530 | 350 | 0.13 | 4.4 | 0.51 | |
| 26 | 4H_Lambda | 1-pass | 20 | He4 | PCS+HES(H) 8deg | PCS+HKS(H) | Setting 1 | 10.00 | 140,000 | 22,000 | 260 | 28,000 | 3,700 | 38 | 990 | 4.3 | 22 | 0.51 | |
| 27 | 3H_Lambda | 1-pass | 20 | He3 | PCS+HES(H) 8deg | PCS+HKS(H) | Setting 1 | 10.00 | 140,000 | 16,000 | 200 | 21,000 | 2,800 | 28 | 240 | 1.4 | 8.9 | 0.51 | |
| 28 | 40K_Lambda | 1-pass | 20 | Ca40 | PCS+HES(H) 8deg | PCS+HKS(H) | Setting 1 | 20.00 | 380,000 | 6,000 | 73 | 7,600 | 1,300 | 35 | 190 | 0.52 | 5.8 | 0.51 | |
| 29 | 48K_Lambda | 1-pass | 20 | Ca48 | PCS+HES(H) 8deg | PCS+HKS(H) | Setting 1 | 20.00 | 310,000 | 5,900 | 71 | 7,400 | 1,200 | 27 | 160 | 0.54 | 5.4 | 0.51 | |
| 30 | 208TI_Lambda | 1-pass | 20 | Pb208 | PCS+HES(H) 8deg | PCS+HKS(H) | Setting 1 | 10.00 | 1,100,000 | 4,800 | 58 | 6,000 | 1,700 | 140 | 36 | 0.069 | 1.1 | 0.51 | |
| 31 | | | | | | | | | | | | | | | | | | | |

PCS + HES (5 msr) + HKS (7 msr)
 VPF ~ 1×10^{-5} /electron

Additional conditions for gas targets

- Gas density reduction $\rightarrow 0.5$
- Vertex
 - z vertex resolution $\rightarrow 2$ cm FWHM
 - z vertex cut $\rightarrow 2$ sigma

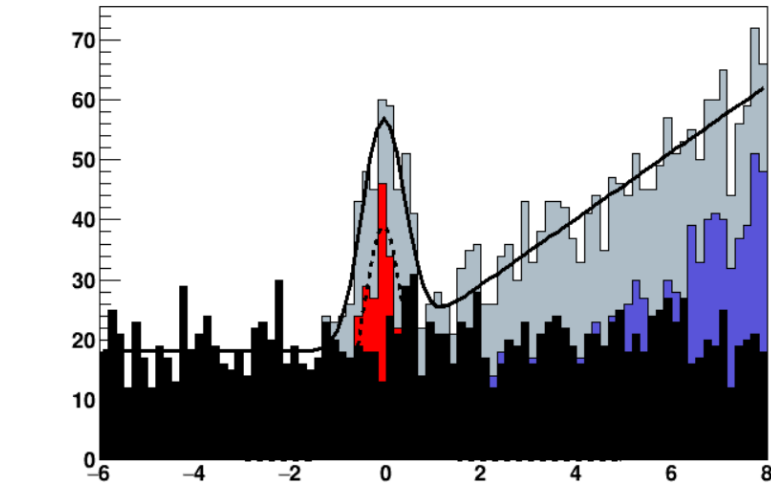
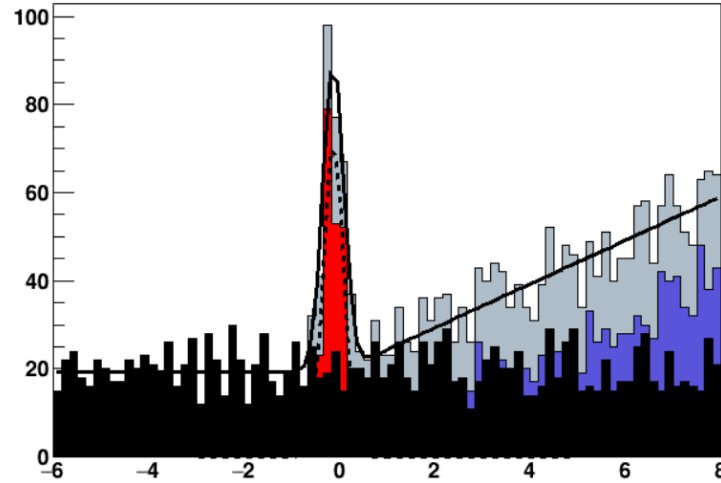
Estimation

0.5 MeV

1 MeV

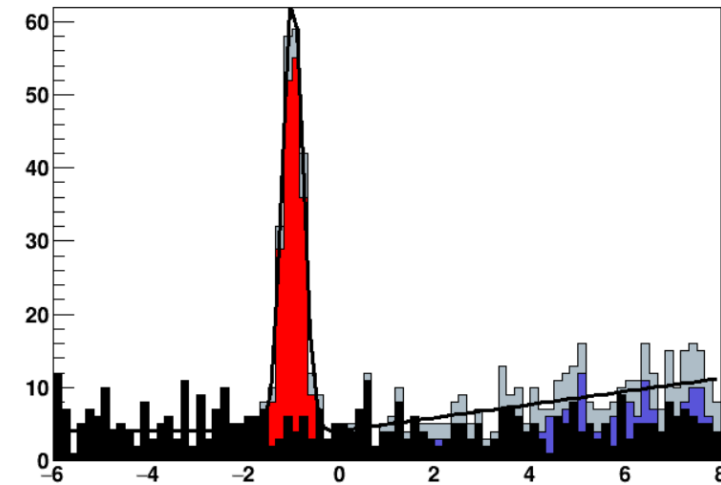
20 μ A,
20 days

3H_Λ



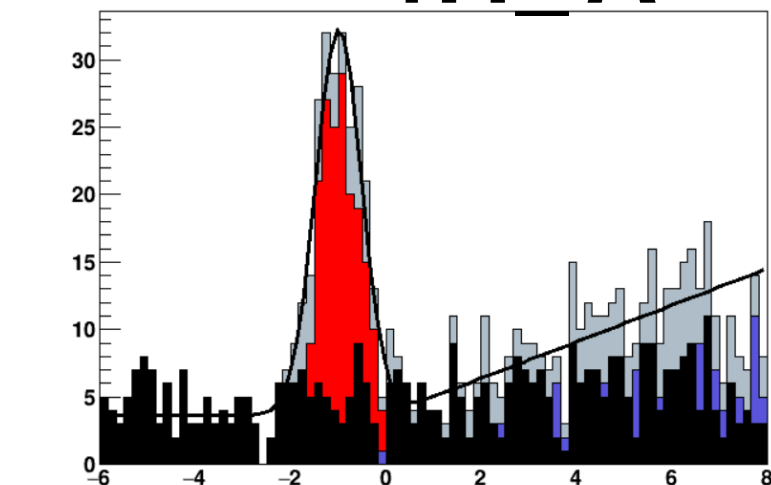
20 μ A,
4 days

4H_Λ



$\Delta B \sim 20$ keV

4H_Λ



$\Delta B \sim 50$ keV

Summary for helium targets

- PCS + HES + HKS
 - (50 μ A (Hall A) \rightarrow) 20 μ A (Hall C)
- At least, two times longer beam time is needed
 - 10 (2) \rightarrow 20 (4) days for ^3He (^4He)

Backup

Accidental backgrounds estimated by scaling the prev. Li data

The number of events in a range of -10 to 10 MeV -->

| | |
|-------------------------------------------------|-----------|
| [3 2: 20uA, 190 mg/cm ² , 10days] | : 2435.91 |
| [4 2: 20uA, 262 mg/cm ² , 2days] | : 665.799 |
| [27 13: 20uA, 324 mg/cm ² , 10days] | : 8477.27 |
| [40 20: 20uA, 100 mg/cm ² , 20days] | : 215.562 |
| [48 20: 20uA, 100 mg/cm ² , 20days] | : 162.383 |
| [208 82: 20uA, 100 mg/cm ² , 30days] | : 264.632 |

Accidental backgrounds estimated by scaling the prev. Li data

The number of events in a range of -10 to 10 MeV -->

[3 2: 20uA, 190 mg/cm², 10days] : 1011.07

[4 2: 20uA, 262 mg/cm², 2days] : 276.352

[27 13: 20uA, 324 mg/cm², 10days] : 193.282

[40 20: 20uA, 100 mg/cm², 20days] : 215.562

[48 20: 20uA, 100 mg/cm², 20days] : 162.383

[208 82: 20uA, 100 mg/cm², 30days] : 264.632

Gas density reduction → 0.5

z vertex resolution → 2 cm FWHM

z vertex cut → 2 sigma