

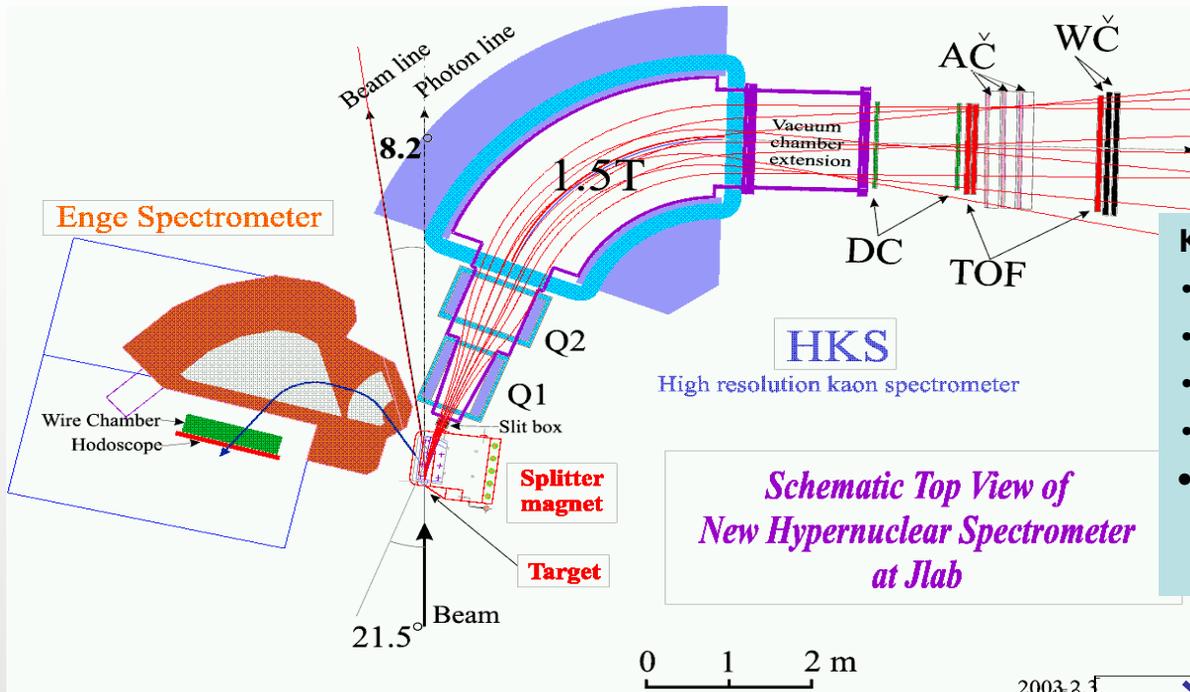
Analysis Status of HKS (E01-011)

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HKS Experimental Setup

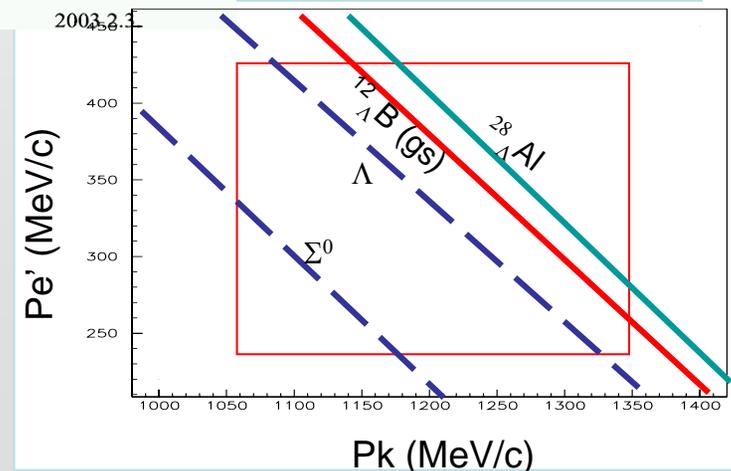


Kinematics:

- Beam energy ~ 1.83 GeV
- e' : 0.22 \sim 0.41 GeV
- K central 1.2 GeV/c
- K angle: 1-13 degree
- **Enge tilted ~ 7.75 degree off-plane (up)**

- ❑ ***E01-011: Hypernuclear spectroscopy up to medium-heavy mass region by $(e, e'K)$***
- ❑ Data taking: June, 2005 – Sept. 2005
- ❑ Targets: CH₂, ¹²C, ²⁸Si, ⁶Li, ⁷Li, ⁹Be *et al.*

HKS kinematics Acceptance

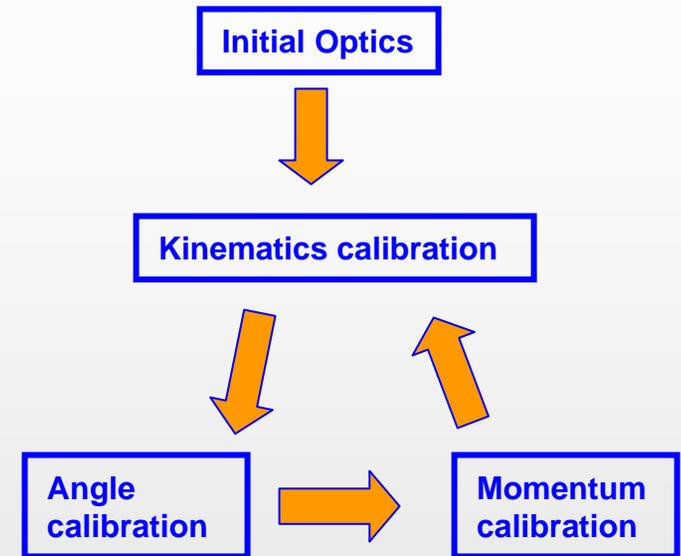


Calibration Strategy: Iterative Procedure

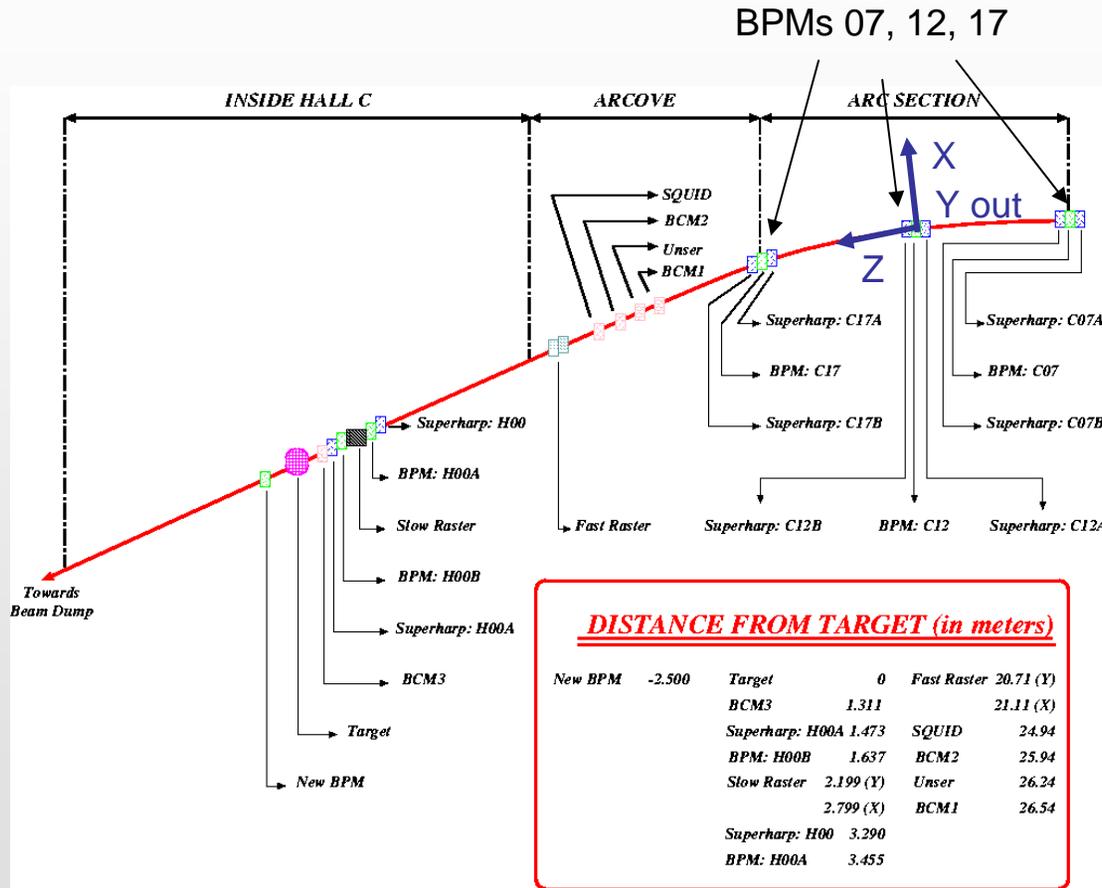
- ❑ 2-arm coupled momentum calibration by nonlinear Least Square method, using known masses of Λ, Σ^0 from CH2 target and $^{12}_{\Lambda}\text{B}$ ground state
- ❑ To reduce the effect of background events:
 - Events weighted depending on reconstructed MM
 - Background shape used to check consistency
- ❑ Kinematics calibration: Using reconstructed Λ, Σ^0 peak positions and width
- ❑ **Iteration** of kinematics, angle and momentum calibrations

How about the stability of beam energy ? Is there beam energy shift?

Beam energy calibration by Hall C Arc BPM information



Beam energy calibration by Hall C Arc BPM Info



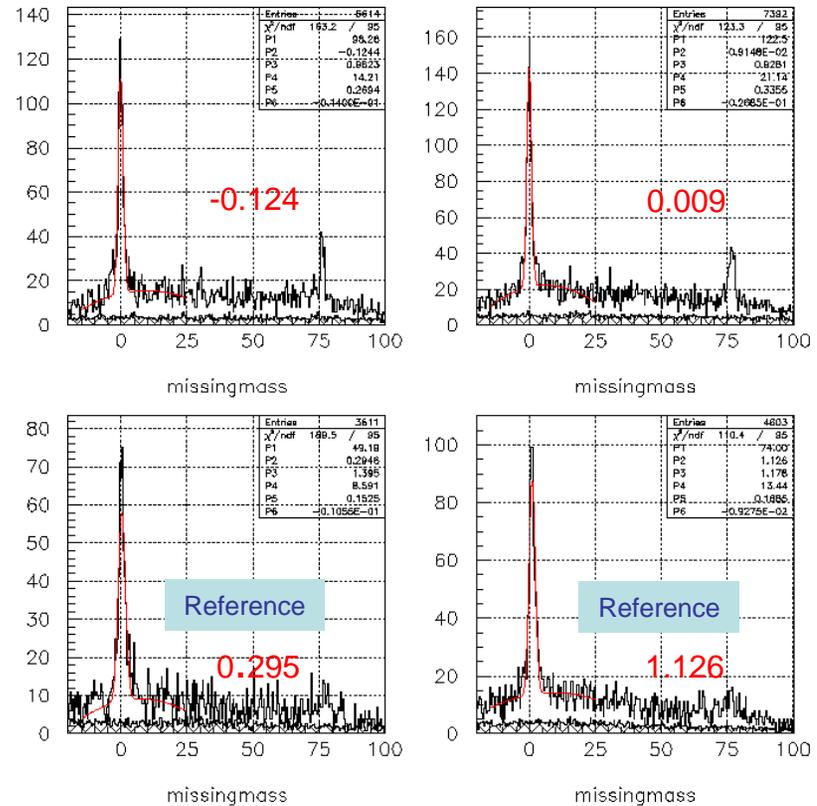
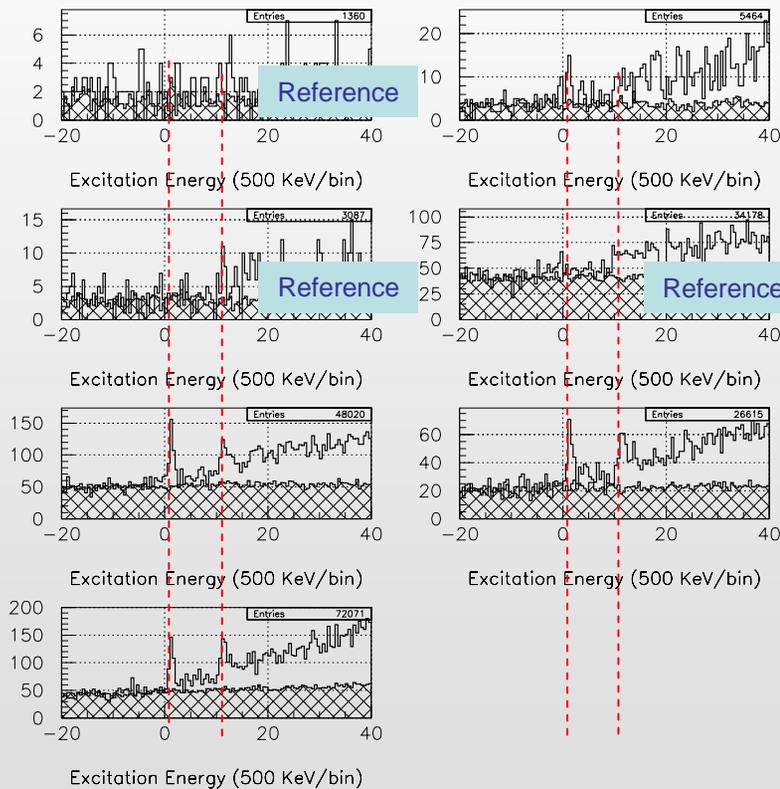
- ARC radius: 40.09 m
- Total deflection: 34.3 degree
- Achromatic mode: fixed BPM17X position

Evidences of beam energy shift

□ Λ peak position shift during 4 CH2 running periods; Λ ^{12}B GS peak position shift

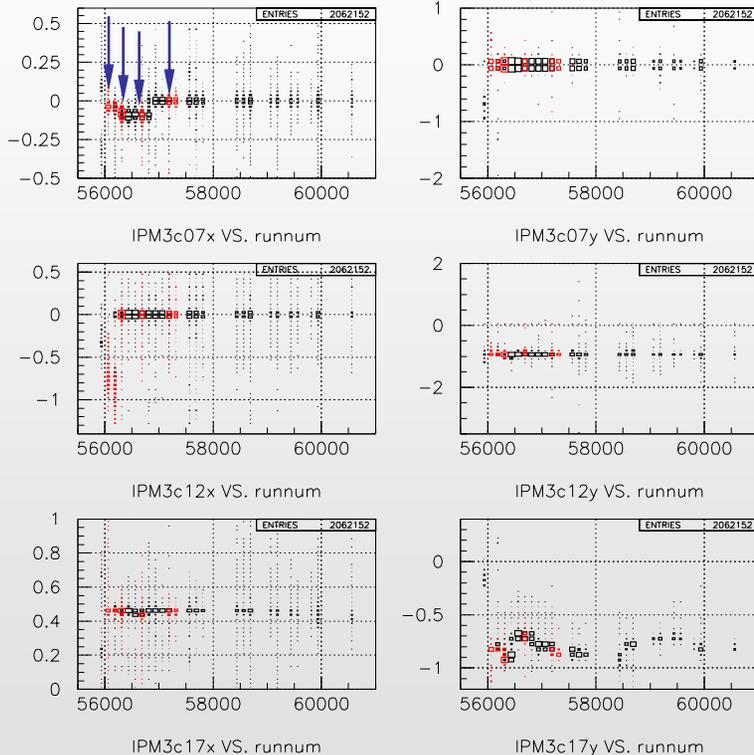
C12 run periods

Λ Position Shift



Beam energy shift vs. Arc BPM position

BPM 07, 12, 17 vs. Run number



□ Arc BPMs vs. Δ Center

CH2 Runs	1	2	3	4
BPM 07X(cm)	-0.034	-0.082	-0.093	0.0
BPM 12X(cm)	-0.813	0.0	0.0	0.0
BPM 17X(cm)	0.456	0.454	0.434	0.453
BPM 17Y(cm)	-0.82	-0.94	-0.70	-0.85
L Center(MeV)	-0.124	0.009	0.295	1.126

- Beam energy change fitted as linear function of Arc Beam position shifts (07X: dX_1 , 12X: dX_2 , 17Y: dY_3):

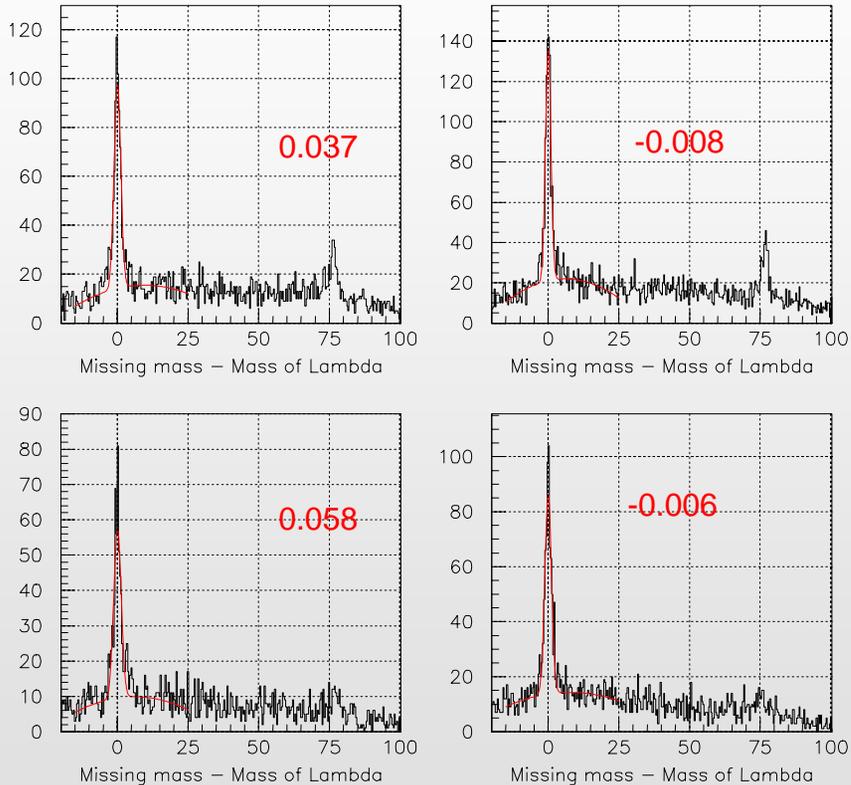
$$\Delta E/E = C1 \cdot dXr_1 + C2 \cdot dXr_2 + C3 \cdot dYr_3 + C0$$

C1: 34.32, **C2:** 3.25, **C2:** 5.06, **C0:** 0.00207

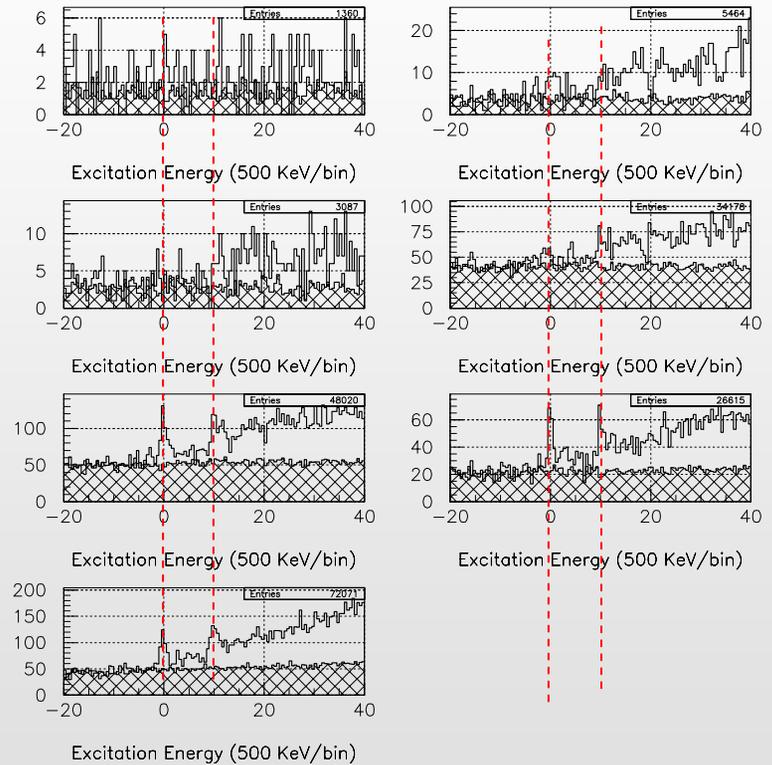
$$dXr_i = dX_i/R0$$

CH2 and C12 Spectra after Beam Energy correction

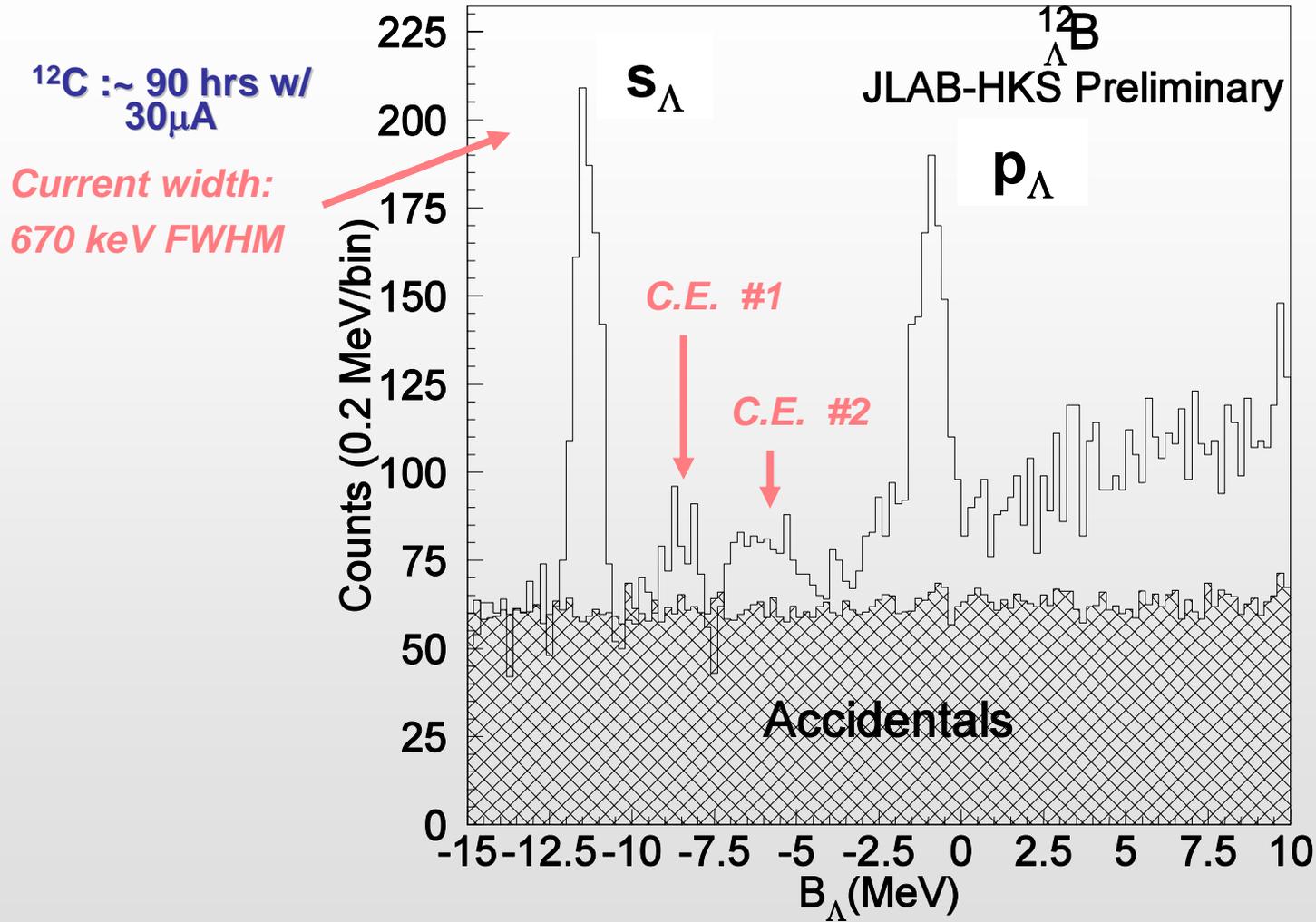
CH2



C12

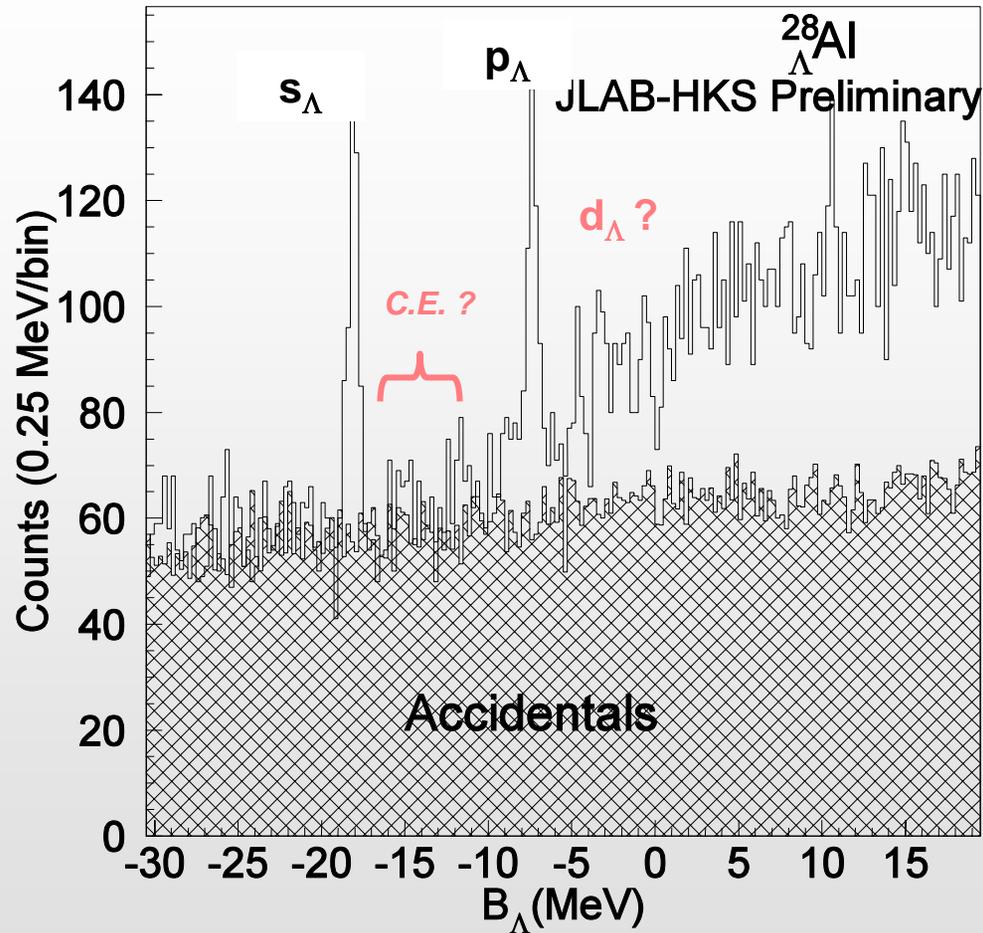


$^{12}\text{C}(e,e'\text{K}^+)^{12}_{\Lambda}\text{B}$ used for kinematics and optics calibration



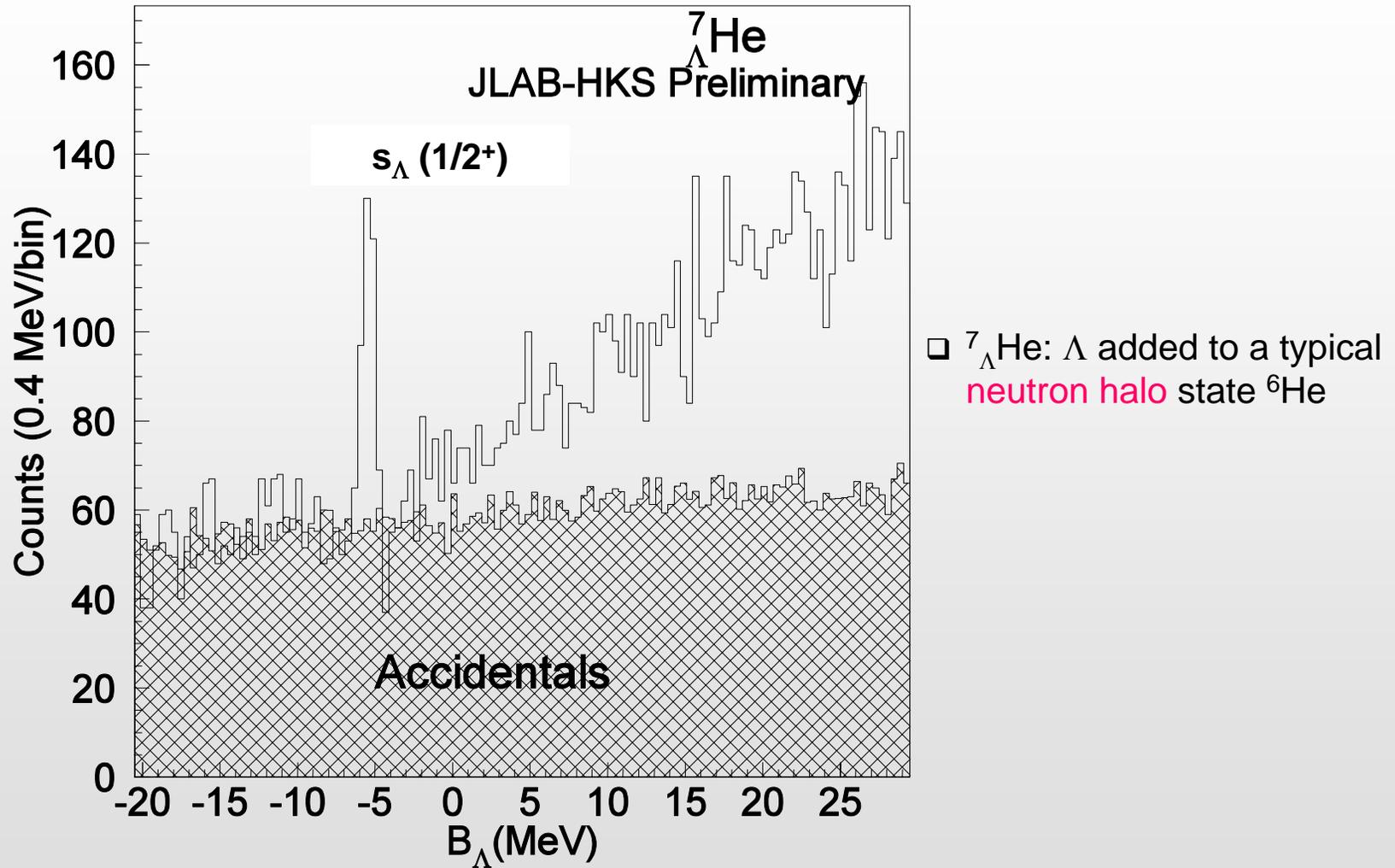
$^{28}\text{Si}(e,e'K^+)^{28}_{\Lambda}\text{Al}$ – First Spectroscopy of $^{28}_{\Lambda}\text{Al}$

^{28}Si : ~ 140 hrs w/ $13\mu\text{A}$



- Major shell structures formed by $(d_{5/2})_p^{-1} \otimes l_{\Lambda}$ are seen

${}^7\text{Li}(e,e'K^+){}^7_{\Lambda}\text{He}$ – First Observation of $1/2^+$ G.S. of ${}^7_{\Lambda}\text{He}$



Summary

- ❑ Special calibration procedure for HKS spectrometer with on-target magnetic field has been carried out to optimize missing mass resolution
- ❑ Proper kinematics calibration, multiple iterations are required to reach a global optimization
- ❑ Beam energy shift was identified and Hall C Arc BPM information was used to correct the shift
- ❑ Preliminary spectra obtained with resolution of ~ 700 keV (FWHM) for $^{12}_{\Lambda}\text{B}$ ground state