

Hypernuclear spectroscopy with the $(e,e'K^+)$ reaction at JLab

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S N Nakamura, Tohoku Univ.
Hall C – HKS/HES Collaboration

The $(e,e'K^+)$ reaction vs. γ spectroscopy at J-Parc

JLab $(e,e'K^+)$

J-Parc $(K,\pi\gamma)$

$p \rightarrow \Lambda$

Mirror Hypernuclei

$n \rightarrow \Lambda$

Good resolution
for absolute BE
incl. nucleon unbound

Excellent resolution
for level differences
of bound states

Thin enriched targets

Complementary techniques to study hypernuclei

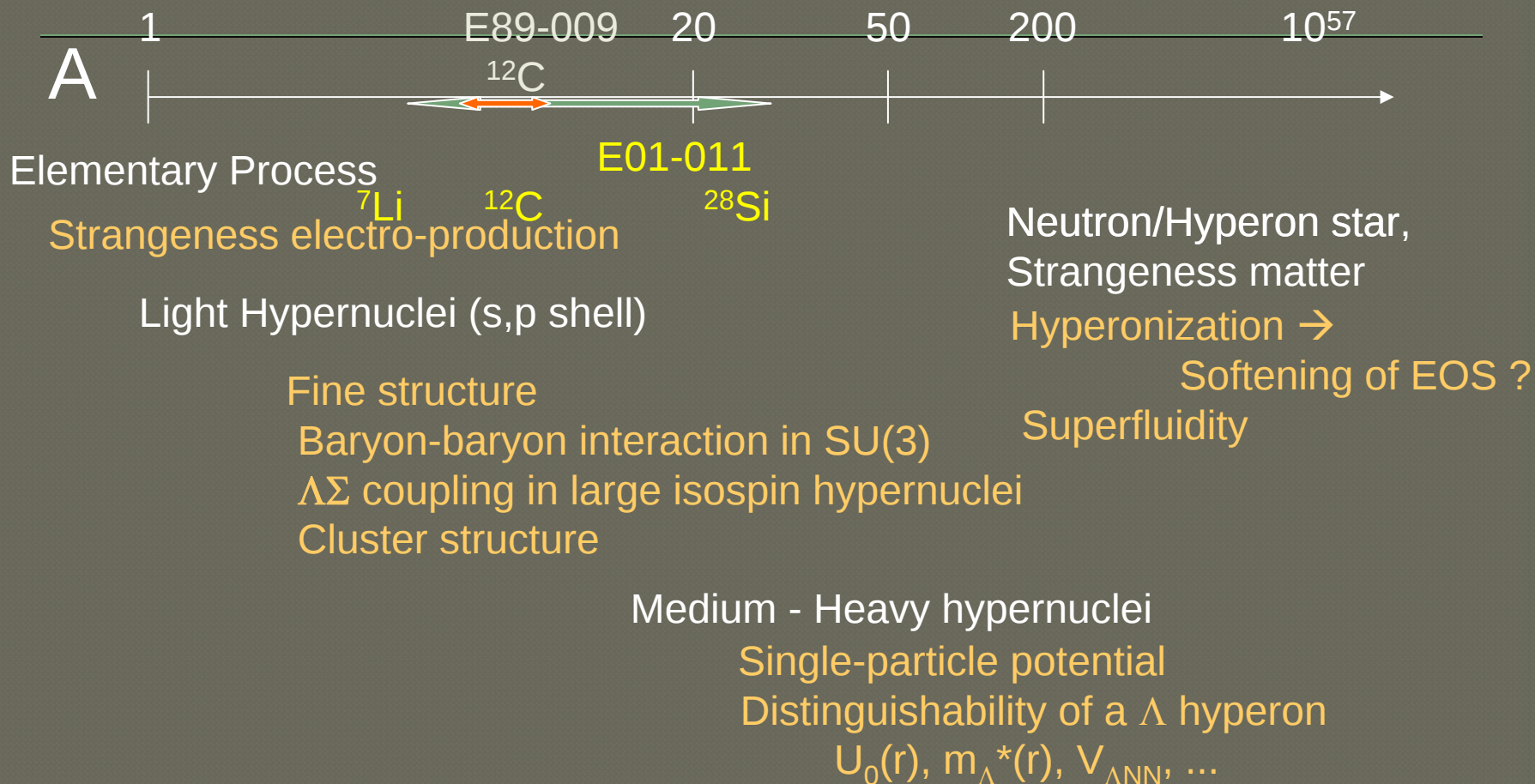
Challenge of (e,e'K) HY Study

- Large e' Background due to Bremsstrahlung and Møller scattering
Signal/Noise, Detector

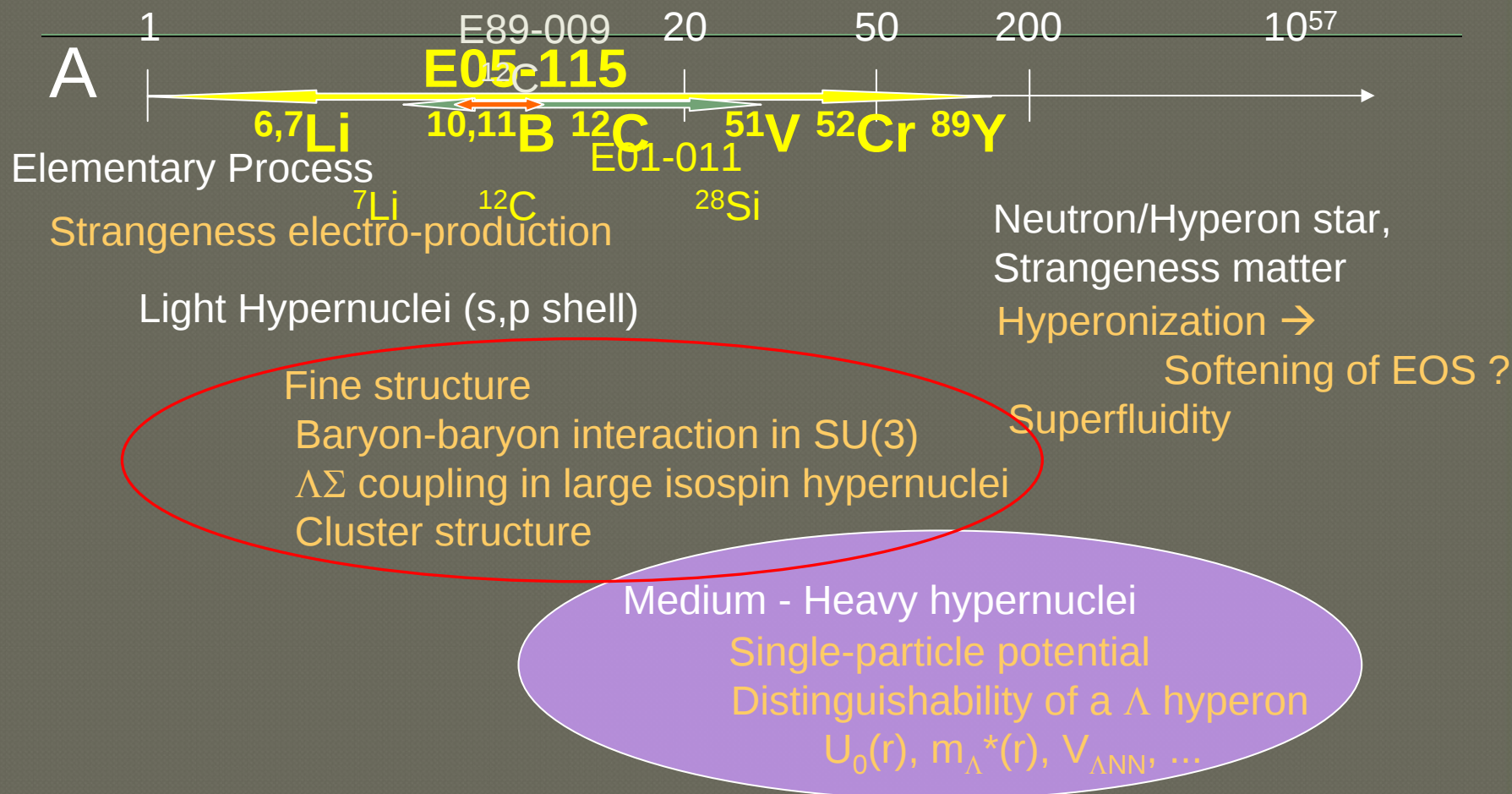
High Quality Electron Beam is Essential !

- Cross Section
Coincidence Measurement (e', K⁺)
Limited Statistics

Hypernuclei in wide mass range



Hypernuclei in wide mass range

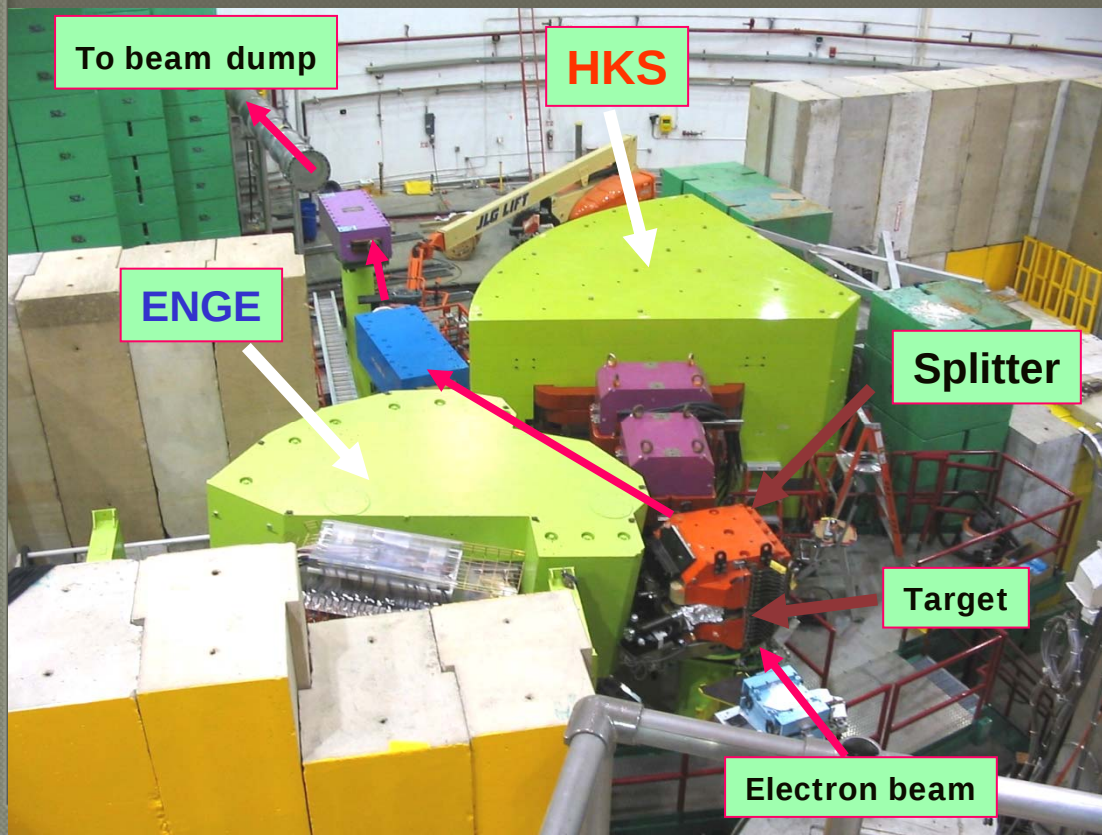


3rd Generation Experiment

Second Generation Exp. at JLab

2005 E01-011 (Hall C)

First step to midium heavy hypernuclei (^{28}Si , ^{12}C , ^7Li)



Two Major Improvements

New HKS

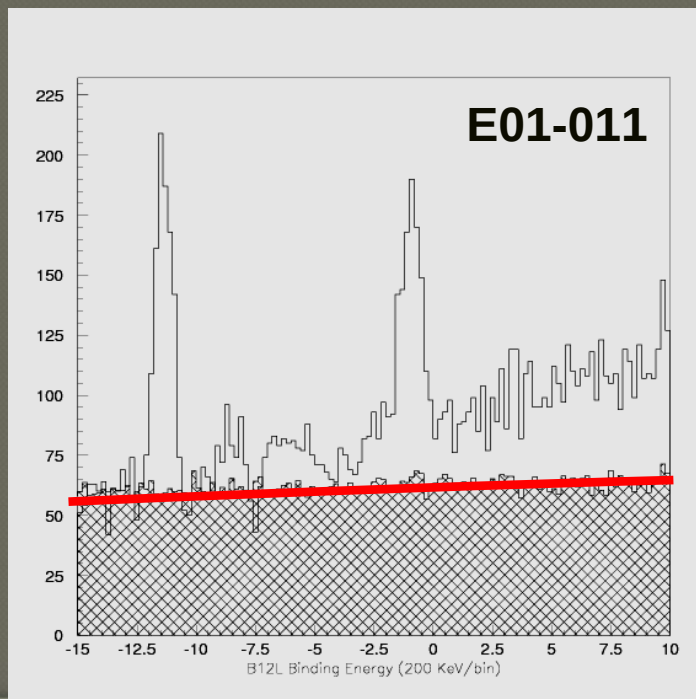
Tilt Method

Beam: $30 \mu\text{A}$, 1.8GeV
HKS: $\Delta p/p = 2 \times 10^{-4}$ [FWHM]
Solid angle 16msr (w/ splitter)

Second Generation Exp. at JLab

2005 E01-011 (Hall C)

First step to midium heavy hypernuclei (^{28}Si , ^{12}C , ^7Li)



**Newly introduced HKS
worked fine**

**Introduction of Tilt ENGE
e' rate surpression**

Goals of the E05-115 experiment

E01-011 :

The **tilt method** applied to the electron spectrometer

New **HKS** spectrometer

Open door to the heavier hypernuclear study with (e,e'K) reaction

- $^{51}\text{V}(e,e'K^+)^{51}_{\Lambda}\text{Ti}$, $^{52}\text{Cr}(e,e'K^+)^{52}_{\Lambda}\text{V}$ reactions
 - Λ binding energies for s,p,d orbits determined
 - Λ hypernuclear structure investigated
 - $1s$ splitting in $l=2,3$ orbits to be derived if the splitting is sizable
- $^{89}\text{Y}(e,e'K^+)^{89}_{\Lambda}\text{Sr}$ reaction
 - Exploratory run to examine feasibility of (e,e'K+) spectroscopy in heavier hypernuclei
- $^{6,7}\text{Li}(e,e'K^+)^{6,7}_{\Lambda}\text{He}$ and $^{10,11}\text{B}(e,e'K^+)^{10,11}_{\Lambda}\text{Be}$
 - Precision hypernuclear structure in neutron-rich Λ hypernuclei
 - $\Lambda\Sigma$ coupling effect changing isospins with neutron number

Introduction of the new electron spectrometer (HES)

Improve the Experiment

Improved
VP tagging
efficiency

Reduce Background
(Brems, Møller e^-)

HES

Larger
Acceptance of
Spectrometers

Better
Energy
Resolution

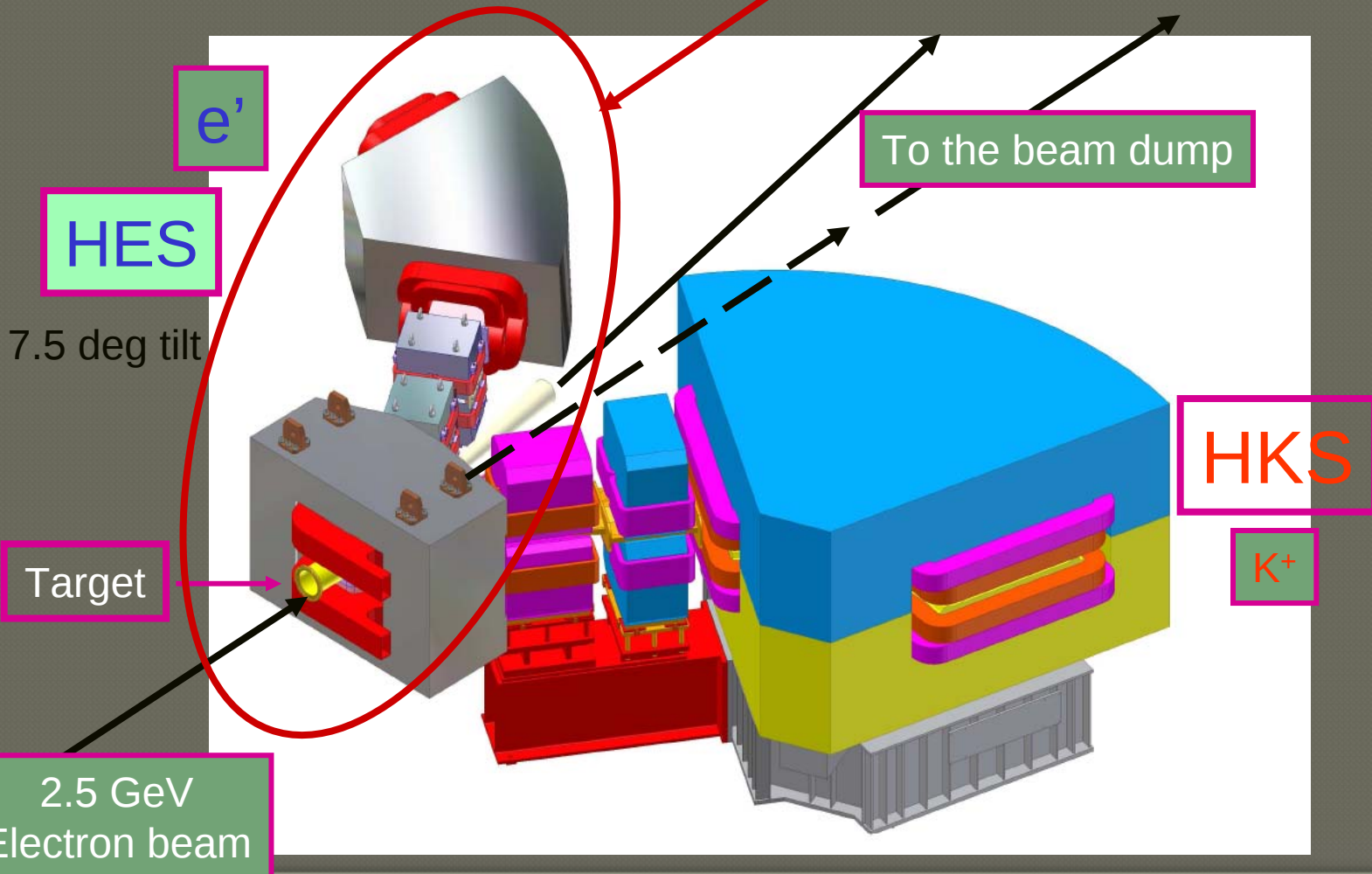
Better Understanding of
Spectrometer Optics

Larger
Hypernuclear Yield



HKS+HES+New SPL

Under construction at SENDAI



HKS is now stored at SA in Hall C.



To be developed

- HES magnets (EQ1, EQ2, ED and SPL)
- Electron hodoscope
- Electron Drift Chamber
 - EDC used for E01-011 + HDC (spare chamber)
- HKS detectors upgrade
 - Water Cerenkov, new Lucite C, TOF counters, AC magnetic shield
- Target (CH_2 target, Water cell, enriched)

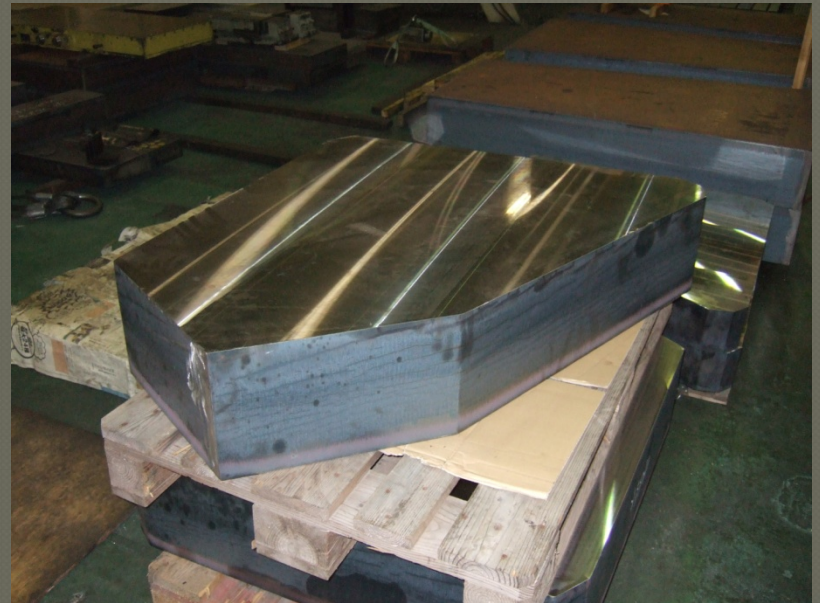
HES magnets status

- EQ1, EQ2, ED, SPL will be ready in Aug.

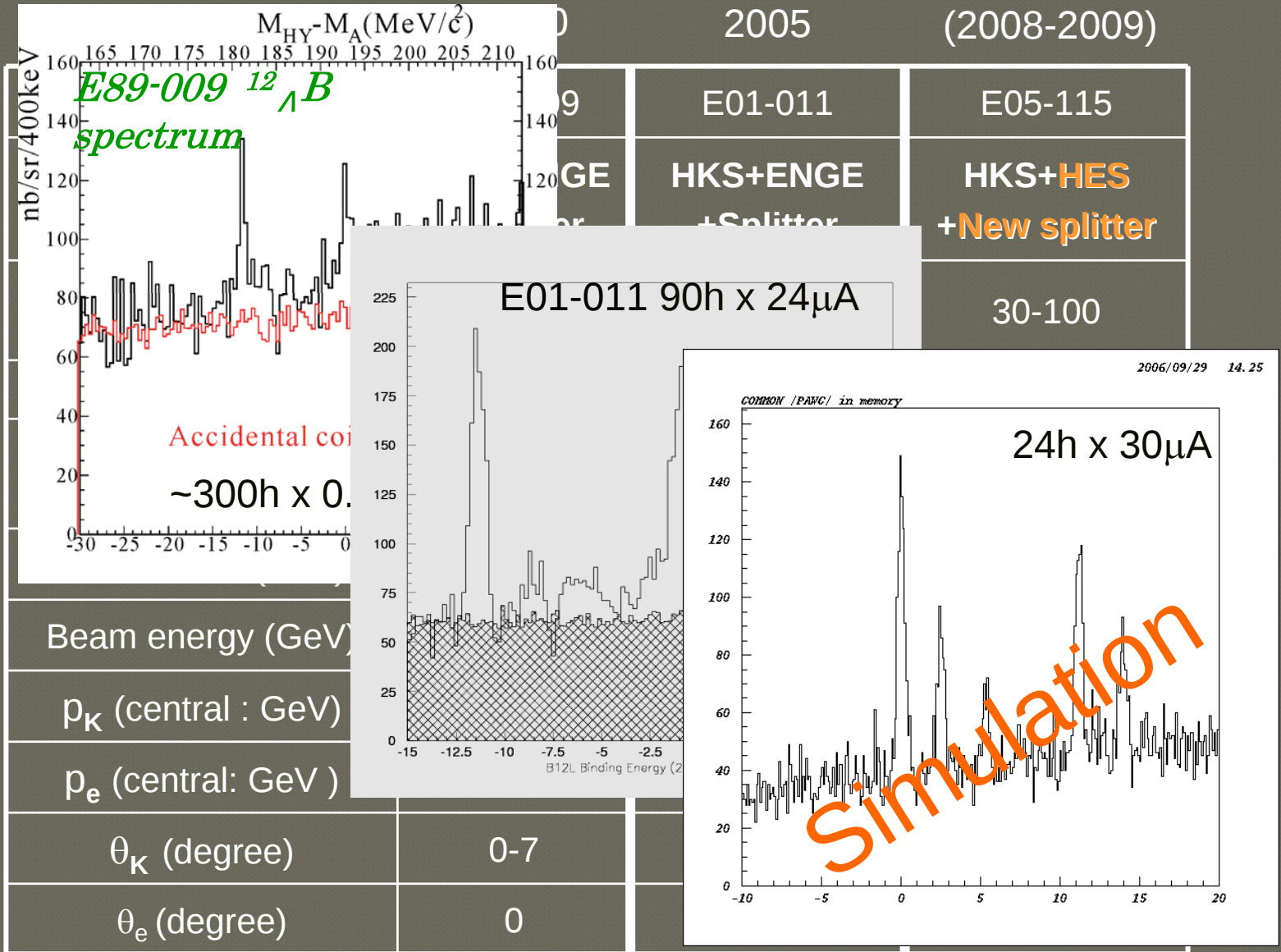


SPL yoke

SPL coil



Evolution of (e,e'K⁺) HY spectroscopy



() expected * select one angle

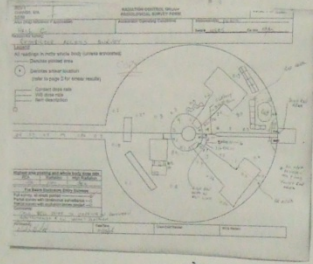
HKS+Tilt

HKS+Tilt+HES

HES schedule

- EQ1, EQ2, ED, SPL will be ready in Aug.
- In 2007 summer-autumn,
field map in Japan
- Winter 2007, ship HES to JLab

Collaboration will be ready for beam in 2008.



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Heel

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成力

نجاع

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hugnnu-pm

ycnex

uspjeh

Erfolg

Basta!

Success

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welshagen

Succès

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In 2009, we can expect new data from JLab as well as from J-Parc.