

Study of $S=-2$ Hypernuclei with Hybrid Emulsion Method

“New Hadrons with Various Flavors”

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Room C517, Department of Physics

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KEKPS-E373 Group

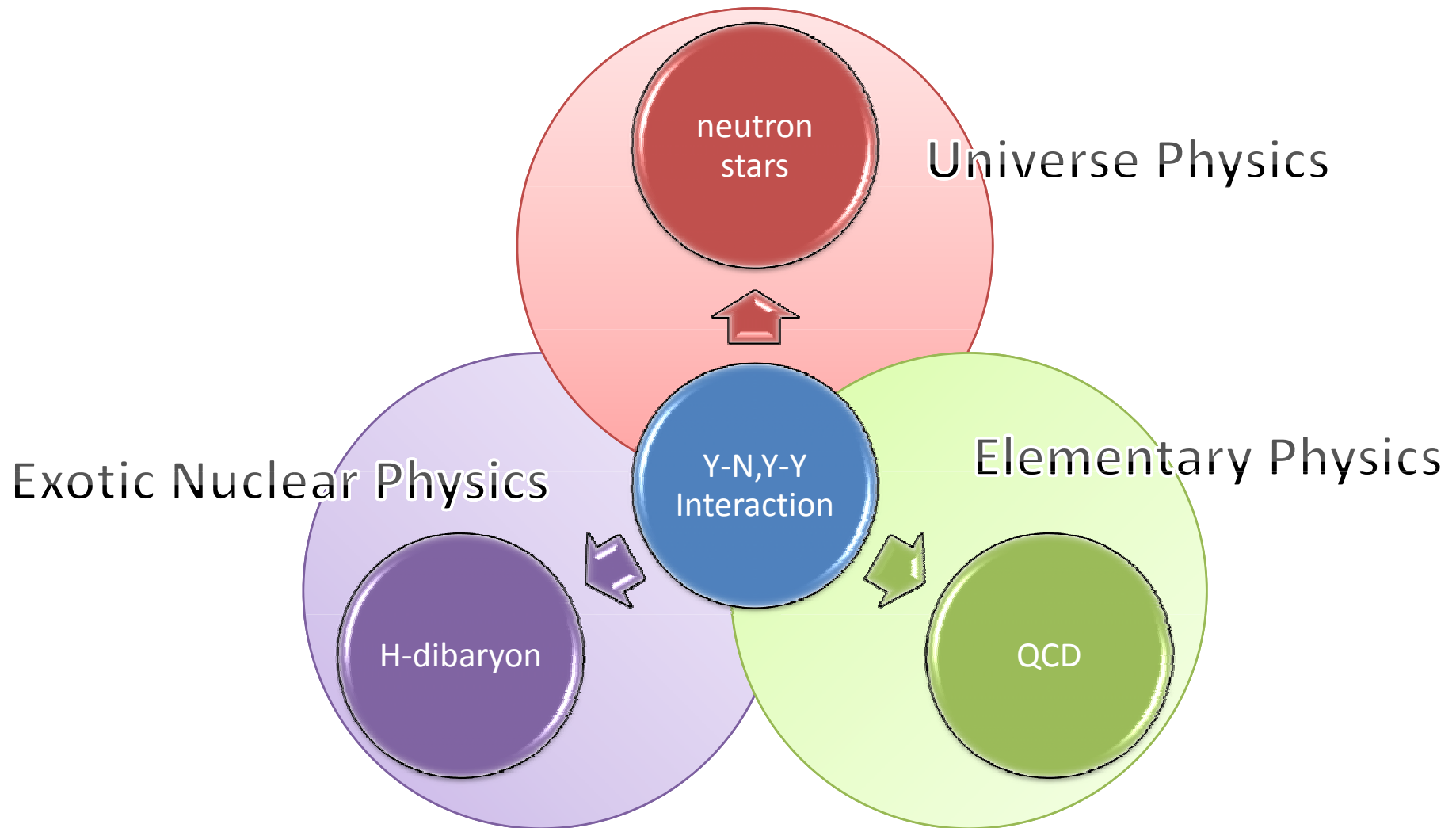
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Motivation



Experimental(1)

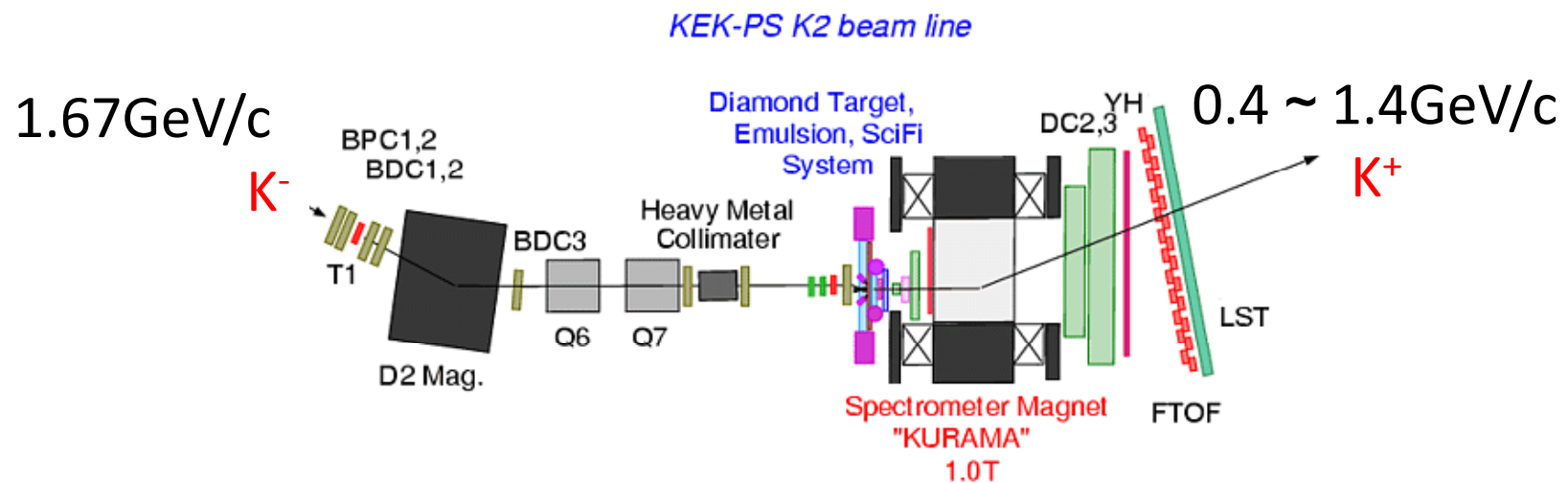
KEKPS-E373

- K⁻ beam intensity
 - 1.1 x 10⁴/spill in '98 run
 - 1.3 x 10⁴/spill in '99, 2000 runs
 - total : 1.3 x 10⁷ events

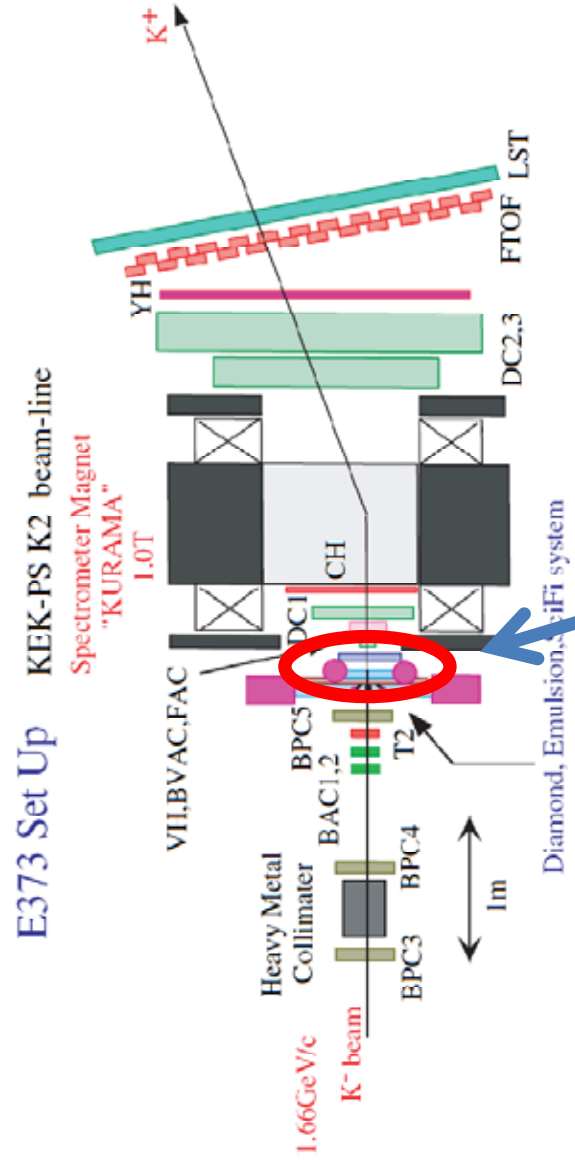


- Off line selection

- 9.0 x 10⁴ events of (K⁻,K⁺)

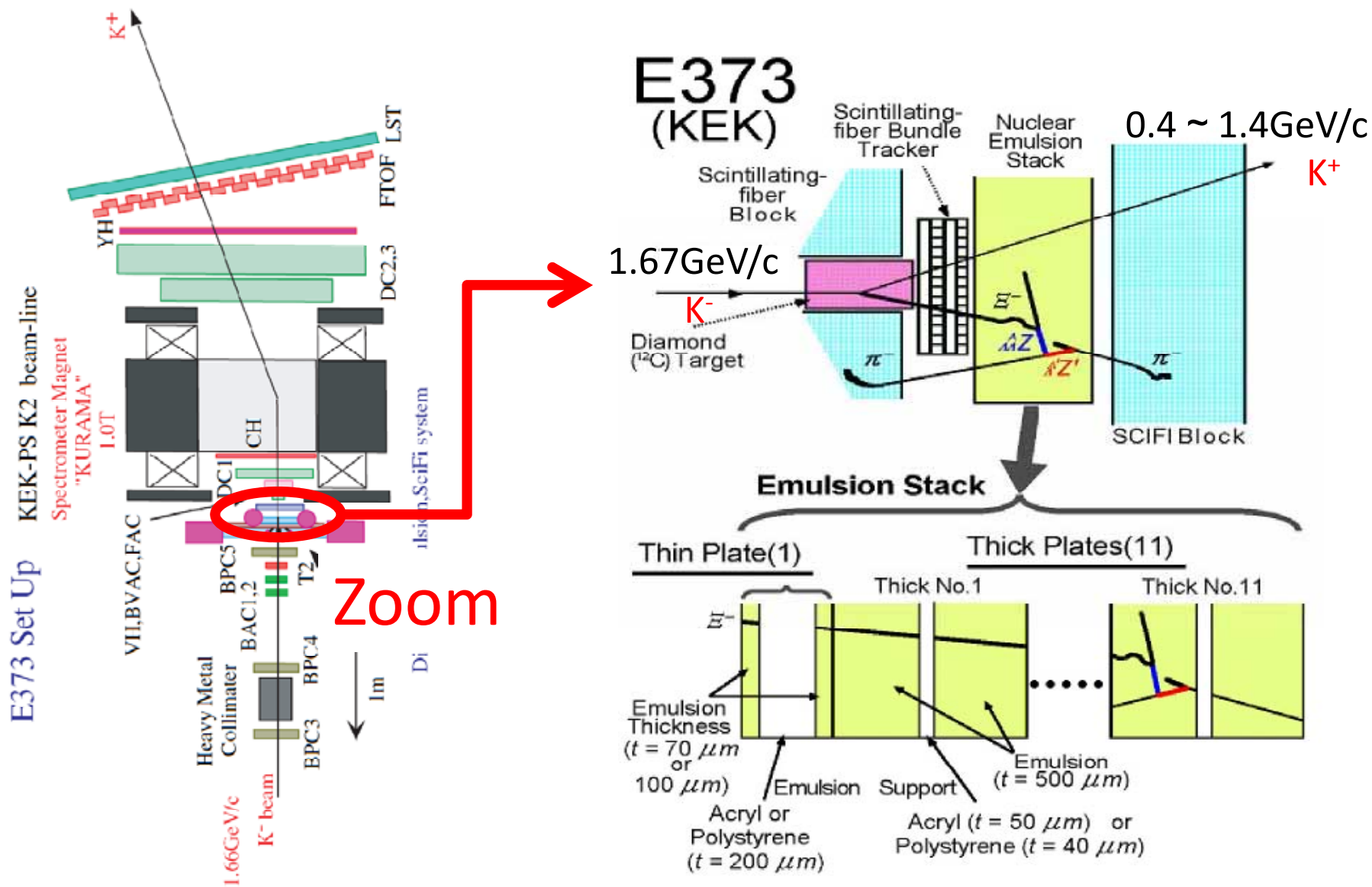


Experimental(2)



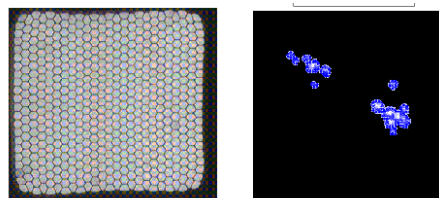
Install the emulsion

Experimental(3)



Experimental(4)

Fiber-bundle



E373
(KEK)

1.67 GeV/c

K^-

Diamond
(^{12}C) Target

Scintillating-
fiber Bundle
Tracker

Nuclear
Emulsion
Stack

0.4 ~ 1.4 GeV/c

K^+

SCIFI Block

Emulsion Stack

Thin Plate(1)

Thick Plates(11)

Thick No.1

Thick No.11

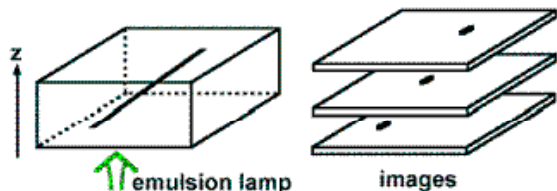
Emulsion
thickness
70 μm
or
100 μm

Acryl or
Polystyrene
($t = 200 \mu m$)

Emulsion
Support
Acryl ($t = 50 \mu m$) or
Polystyrene ($t = 40 \mu m$)

Emulsion
($t = 500 \mu m$)

1) Take pictures at different z(focusing) position.

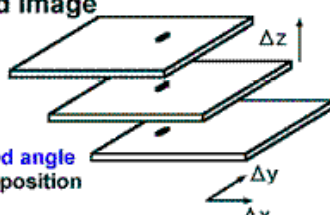


2) Make overlapped image
shift each image
by $(-\Delta x, -\Delta y)$

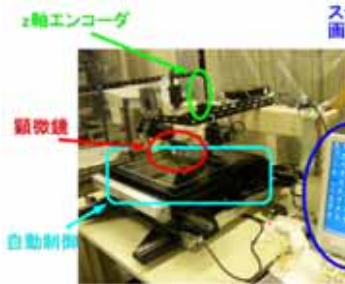
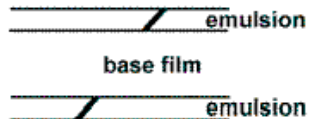
$$\Delta x = dx/dz \times \Delta z$$

$$\Delta y = dy/dz \times \Delta z$$

$dx/dz, dy/dz$: predicted angle
 Δz : step size of z-position



3) Search for the peak on both sides of the base.
[calculate x, y, $dx/dz, dy/dz$]



Result quick analysis

The number of event

	Total number of event
K ⁺ event(after selection)	13099
prediction	22419

The structures of the emulsion

- Candidate of nuclei
 - Light nuclei
 - C, N, O
 - Heavy nuclei
 - Ag, Br

Character

- Have **three vertex**

Result quick analysis

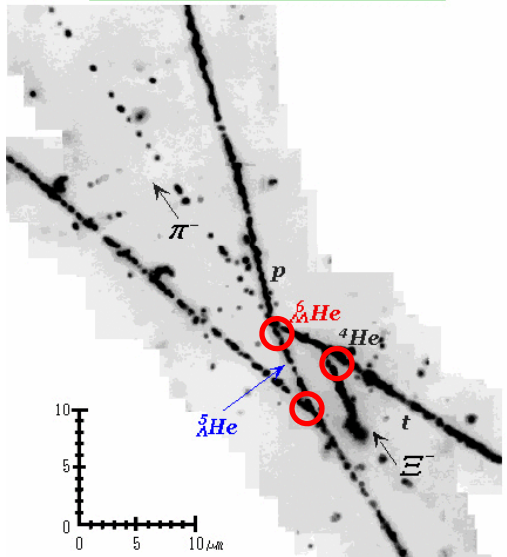
The number of event

	Total number of event
K ⁺ event(after selection)	13099
prediction	22419

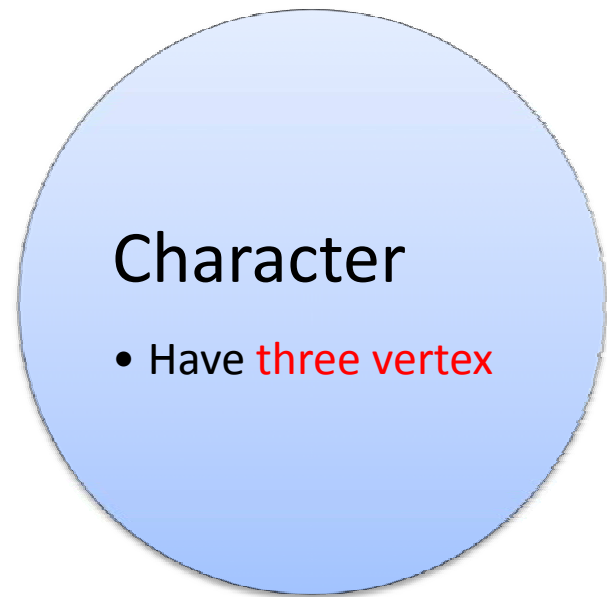
The structures of the emulsion

- Candidate of nuclei
 - Light nuclei
 - C, N, O
 - Heavy nuclei
 - Ag, Br

Oct. 20, 2001
 ${}^6_{\Lambda\Lambda}\text{He}$ double-hypernucleus
 Unique interpretation!!
 $\Xi^- + {}^{12}\text{C} \rightarrow {}^6_{\Lambda\Lambda}\text{He} + {}^4\text{He} + t$
 ${}^6_{\Lambda\Lambda}\text{He} \rightarrow {}^5_{\Lambda}\text{He} + p + \pi^-$



"NAGARA" event
 presented by E373(KEK-PS) on Jan.2001



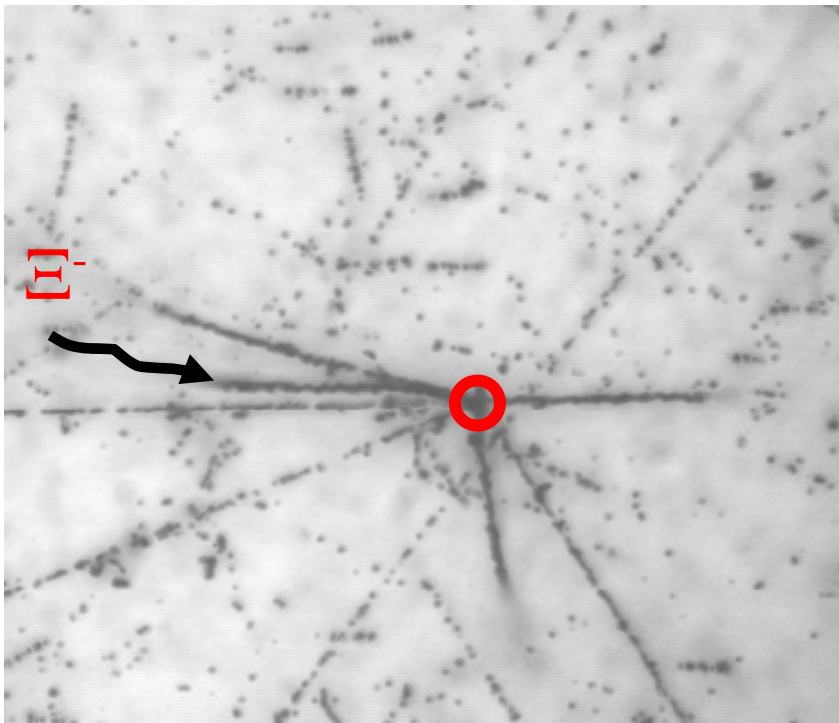
Heavy hypernuclei analysis

The number of event

	Total number of event
K ⁺ event(after selection)	13099
prediction	22419

The structures of the emulsion

- Candidate of nuclei
 - Light nuclei
 - C, N, O
 - Heavy nuclei
 - Ag, Br

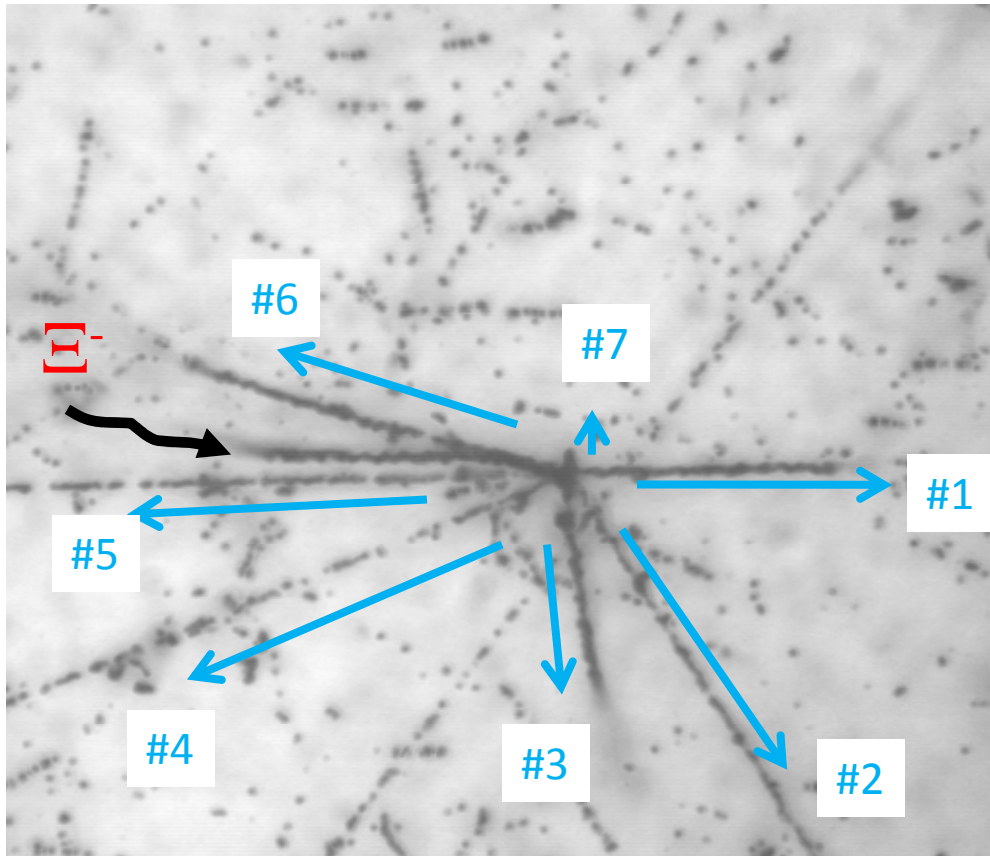


Character

- Have **one vertex only**

Heavy hypernuclei analysis

x100



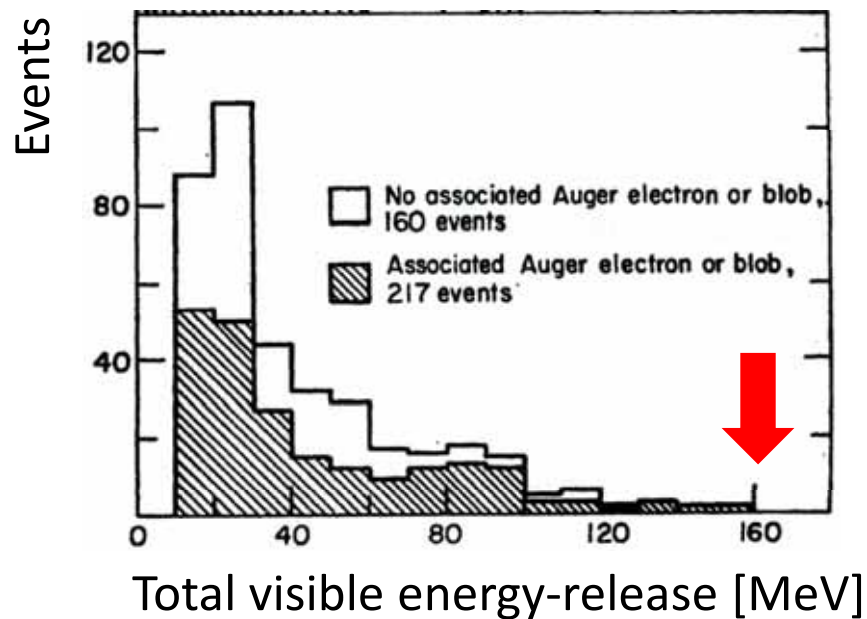
track#	range[μm]	kinetic energy[MeV]
1	198	5.3
2	>19407	>74.4
3	499	9.1
4	>3389	>27.6
5	898	12.8
6	333	7.2
7	1.5	0.2

Total visible energy-release : 192.6 MeV

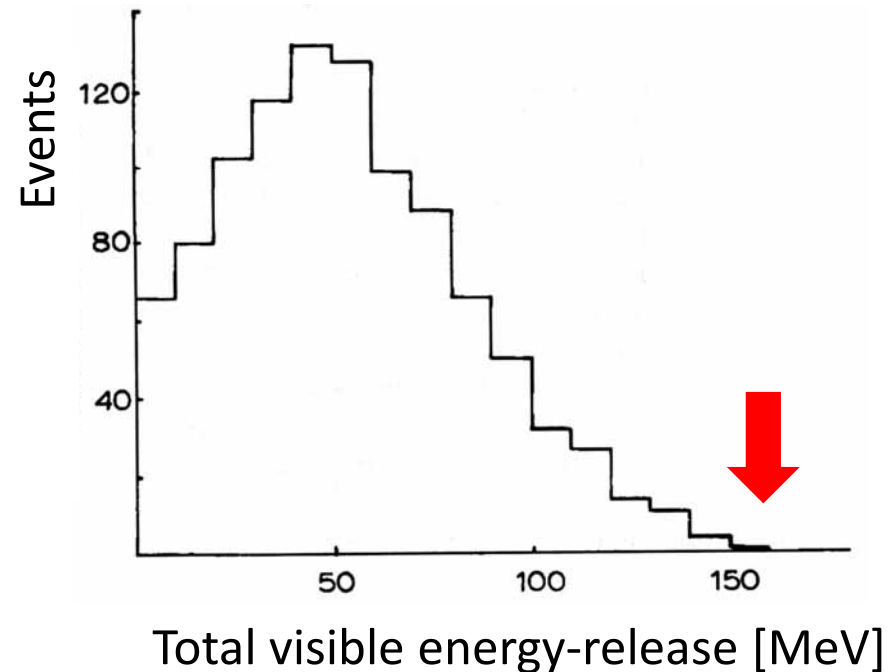
Past experimental data

S=-1 nuclear system

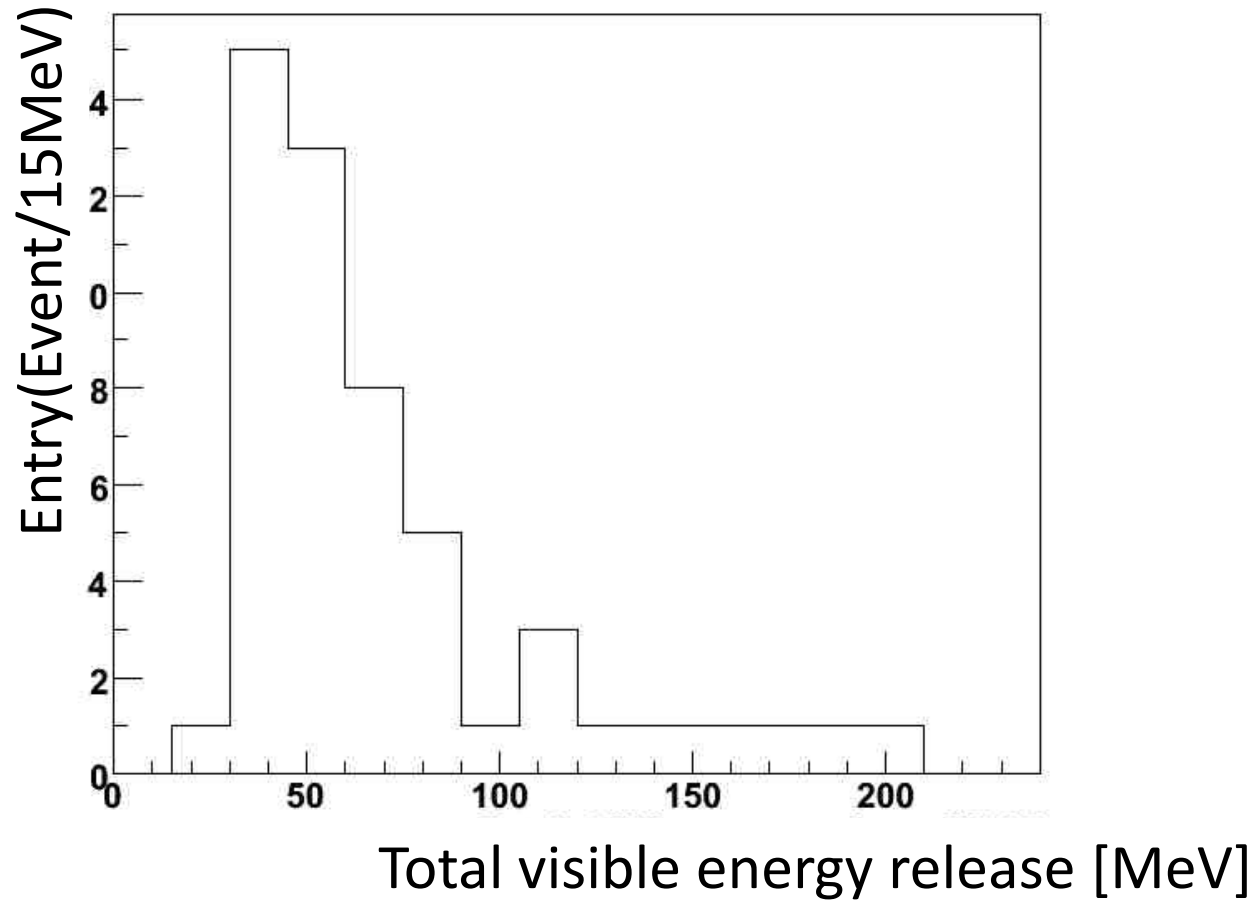
Absorption of Σ Hyperons in Photographic Emulsion Nuclei



The decay of heavy hypernuclei



The present data of E373



Summary and future plans

- We have surely detected $s=-2$ nuclear system
- Future plans
 - We will analyze the rest of event to increase statistics within one year

E07 FOLLOWS E373 IN J-PARC

END