1897-2007
SOCIETÀ ITALIANA DI FISICA
110 anni d'attività

International School of Physics "Enrico Fermi"
CLXVII Course
"Strangeness and Spin in Fundamental Physics"
Varenna sul Lago di Como, June 19-29, 2007

Strangeness Physics at FINUDA

Alessandro Feliciello

I.N.F.N. - Sezione di Torino

Outline

1) the experimental setup

   - the DAΦNE machine
   - the FINUDA apparatus

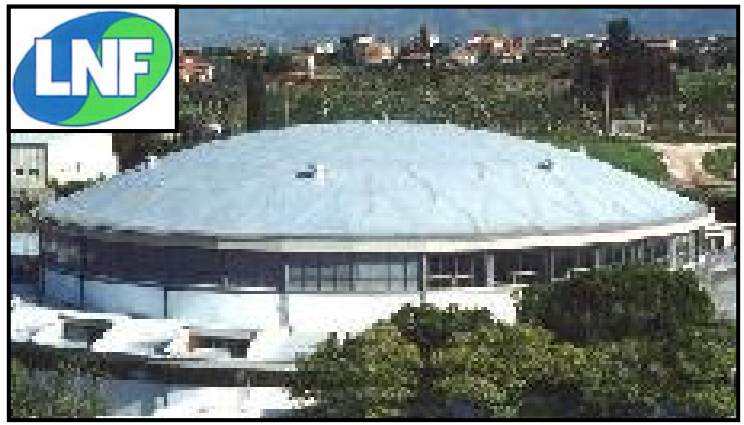
2) the strangeness nuclear physics program

   - high-resolution spectroscopy of Λ-hypernuclei
   - Λ-hypernucleus decay
   - neutron-rich Λ-hypernuclei
   - $K^+\mathcal{N}$ charge exchange reaction
   - (deeply) bound kaon-nuclear states

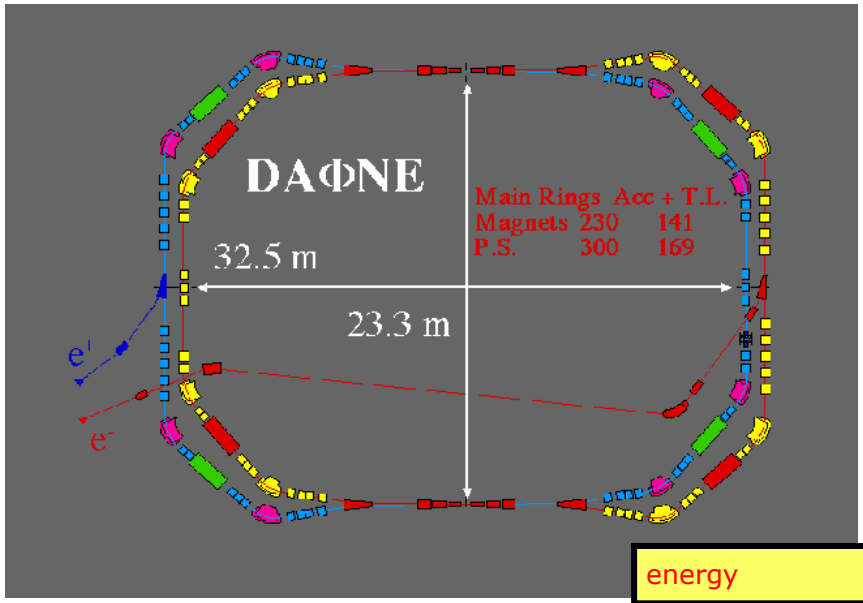
The DAΦNE machine

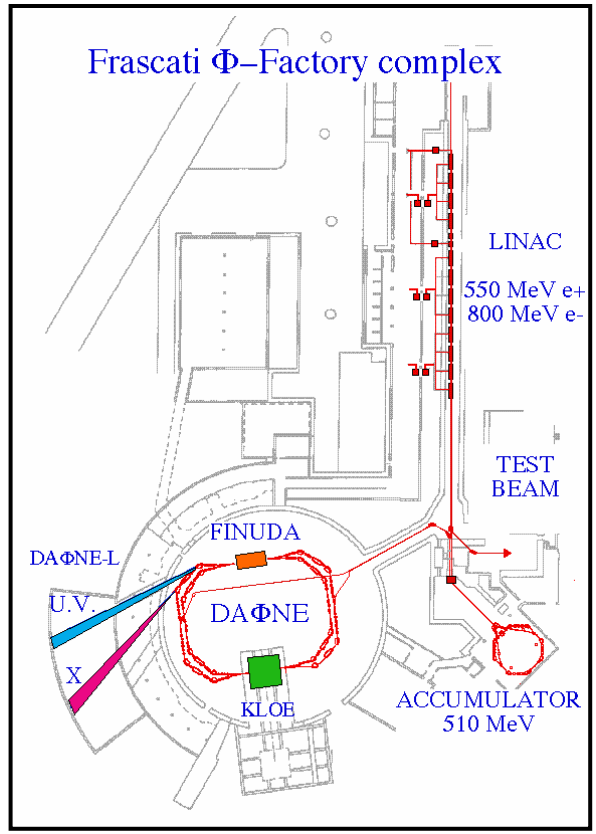
The DAΦNE Φ-factory

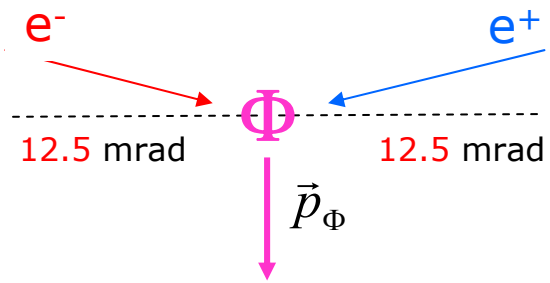
INFN
Istituto Nazionale
di Fisica Nucleare



The DAΦNE e^+e^- collider







energy	510 MeV
luminosity	≤ 5 x 10^{32} cm^{-2} s^{-1}
σ_x (rms)	2.11 mm
σ_y (rms)	0.021 mm
σ_z (rms)	35 mm
bunch length	30 mm
crossing angle	12.5 mrad
frequency (max)	368.25 MHz
bunch/ring	up to 120
part./bunch	8.9 10^{10}
current/ring	5.2 A (max)

What one can do with a Φ-factory?

(brilliant) source of monochromatic, collinear, background free, tagged neutral and charged kaons

KLOE
CP, CPT violation
chiral dynamics
and more...

FINUDA
hypernuclear physics

$K_S K_L$
(34%)

$\rho\pi$
(13%)

K^+K^-
(49%)

DEAR/SIDDHARTA
exotic atoms

Double
Annular
Φ-factory for
Nice
Experiments

The FINUDA way

$e^- + e^+ \rightarrow \phi$ σ = 3.26 μb $\mathscr{L} \approx 1 \times 10^{32}$ cm^{-2}s^{-1} ≈ 300 Hz

$K^- + K^+$ $T_{K^-} \approx 16.1$ MeV ≈ 150 Hz

$K^-_{stop} + {}^{A}Z \rightarrow {}^{A}_{\Lambda}Z + \pi^-$

$$\frac{\Delta T_\pi}{T_\pi} = \frac{\sqrt{p_\pi^2 + m_\pi^2} + m_\pi}{\sqrt{p_\pi^2 + m_\pi^2}} \cdot \frac{\Delta p_\pi}{p_\pi} \equiv f(p_\pi)\frac{\Delta p_\pi}{p_\pi}$$

coincidence measurement

$${}^{A}_{\Lambda}Z \rightarrow \begin{cases} {}^{A}(Z+1) + \pi^- \\ {}^{(A-2)}(Z-1) + p + n \\ {}^{(A-2)}Z + n + n \end{cases}$$

The FINUDA apparatus

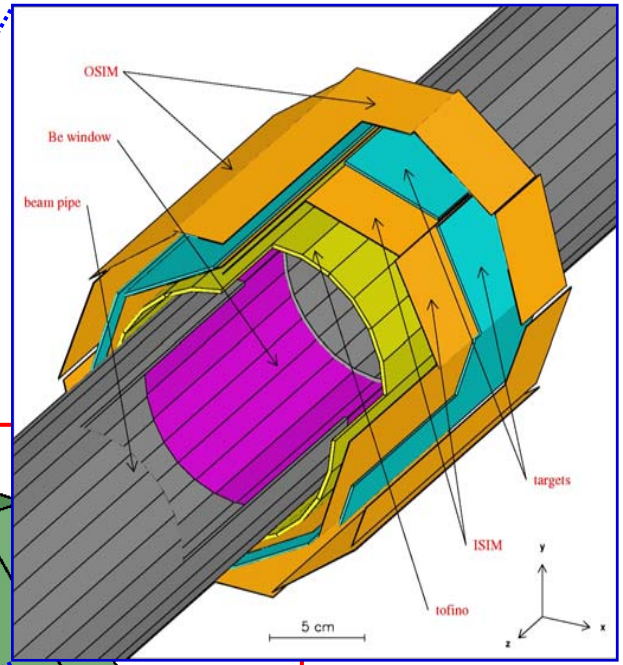
… nothing by chance

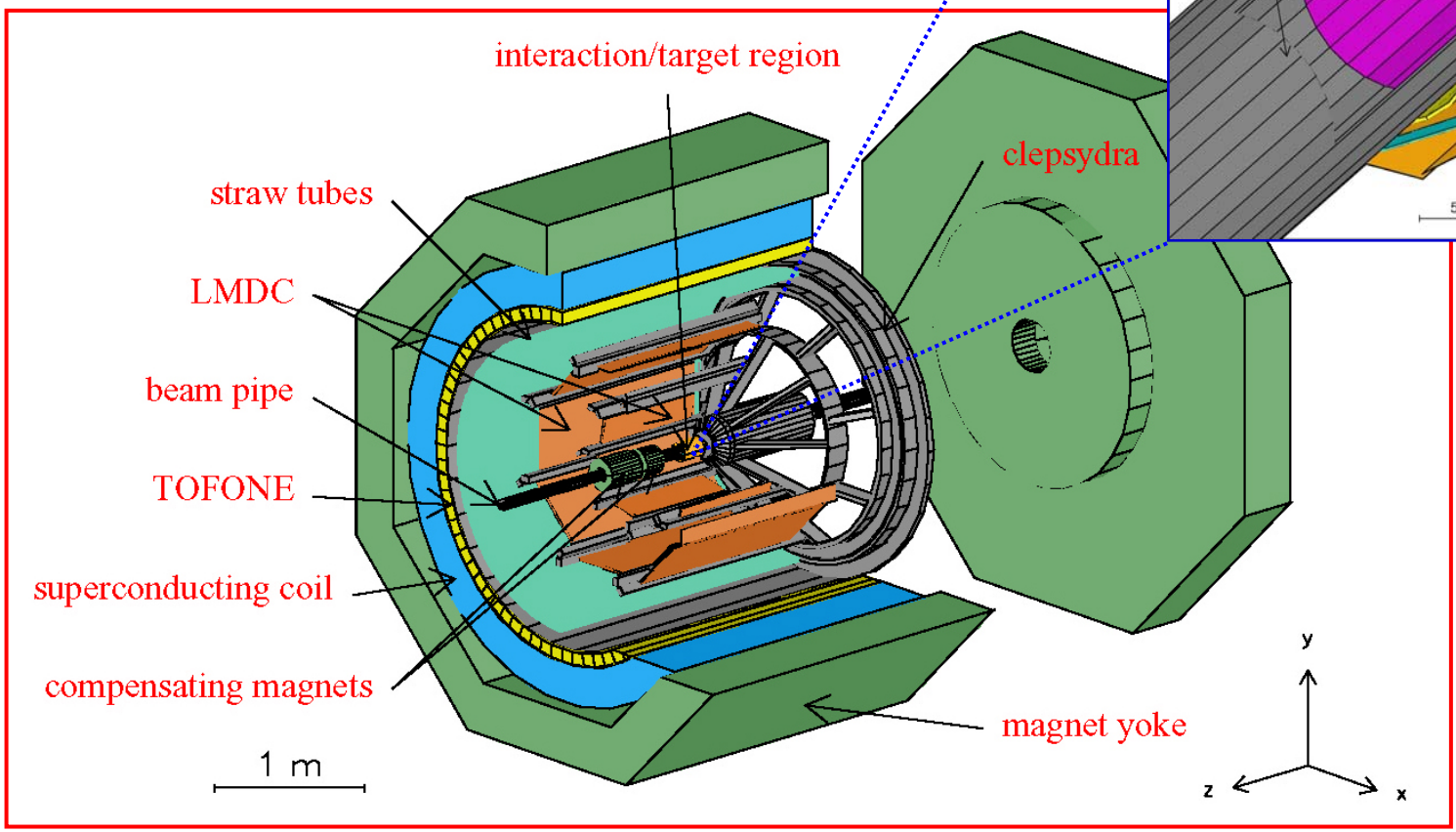
The FINUDA apparatus

- high resolution
- high acceptance

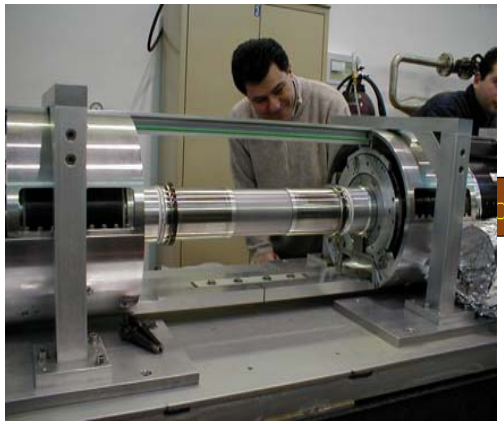
} magnetic spectrometer

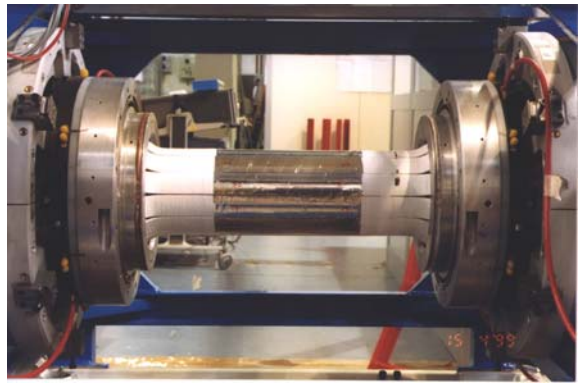
- realistic (feasible)
- reasonable cost





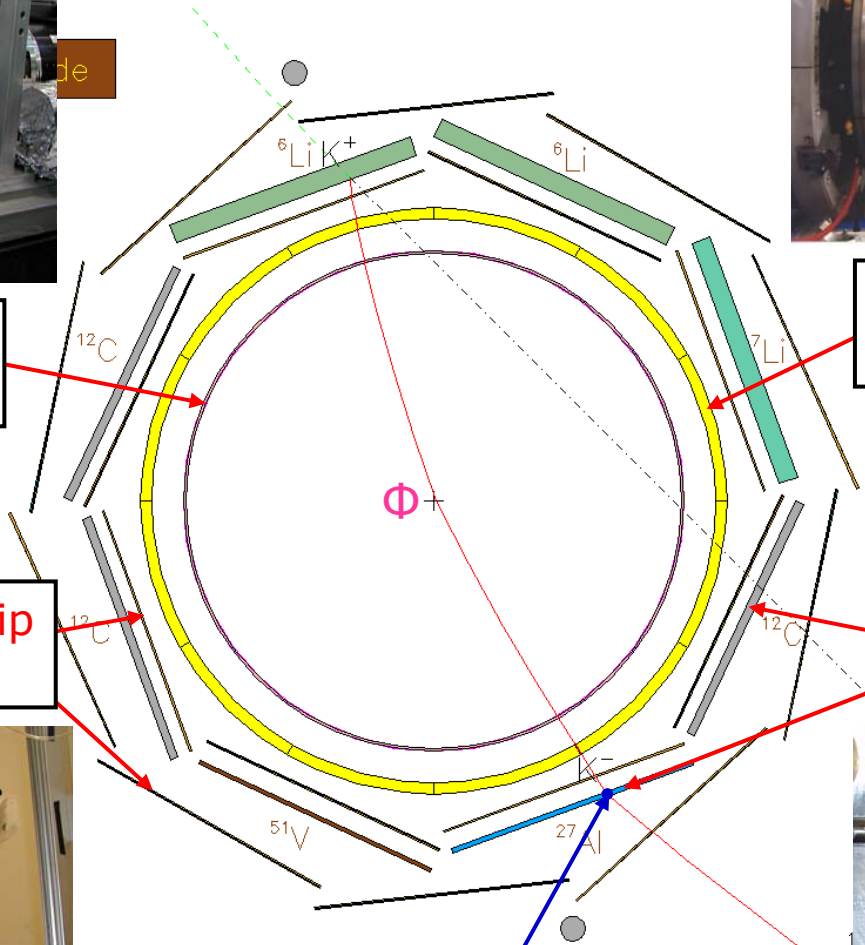
Interaction-target region





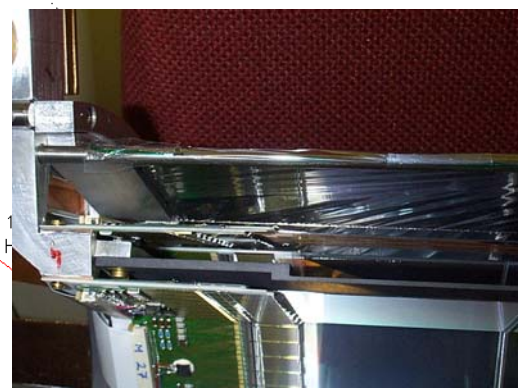
beam pipe
500 μm Be tube

internal scintillator
barrel (2.3 mm)



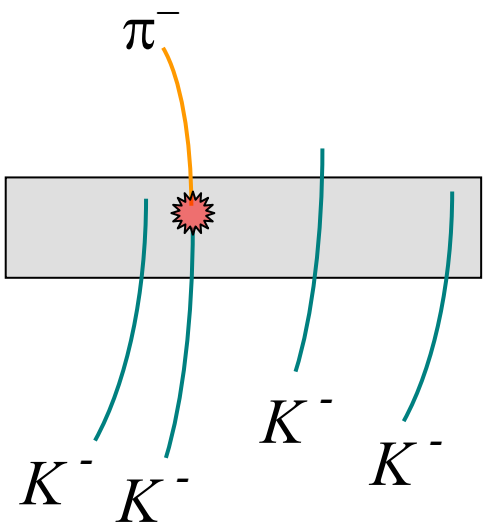
double Si microstrip
array (400 μm)

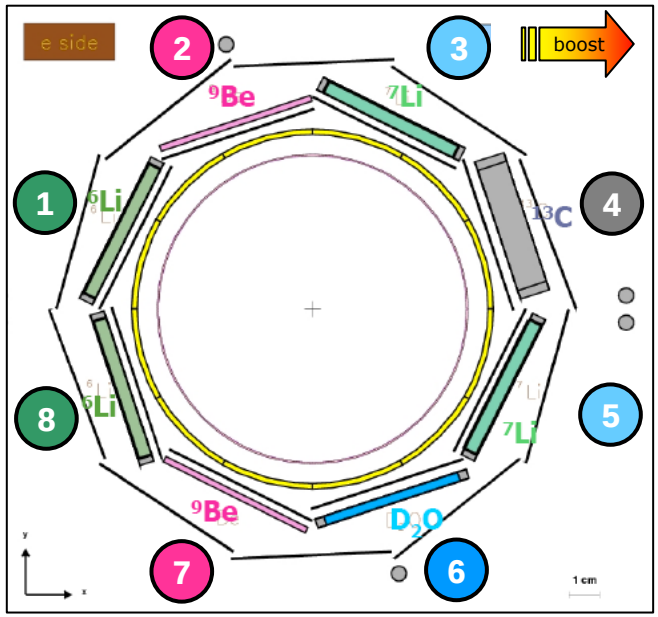
target modules
(0.1 – 0.3 g/cm^2)



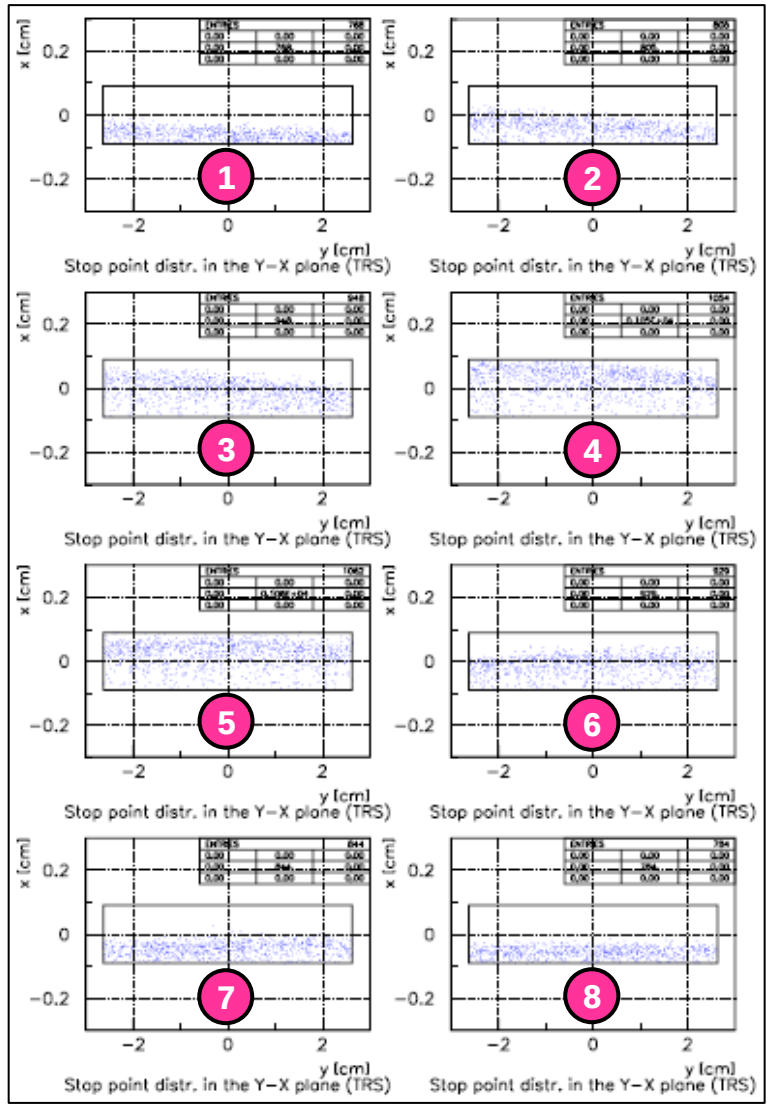
kaon stop point
in the target

Target design study

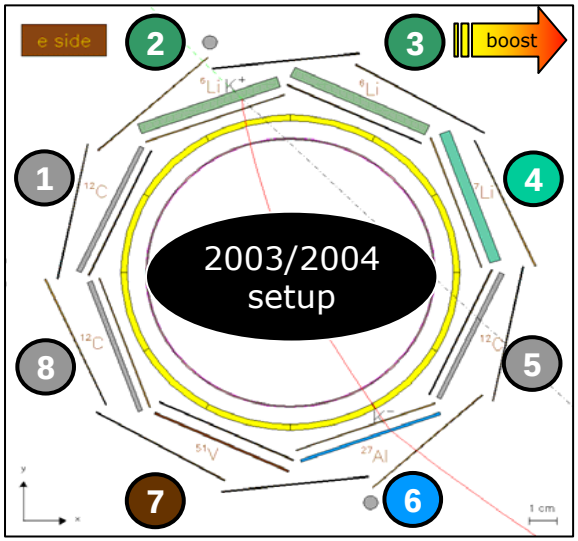


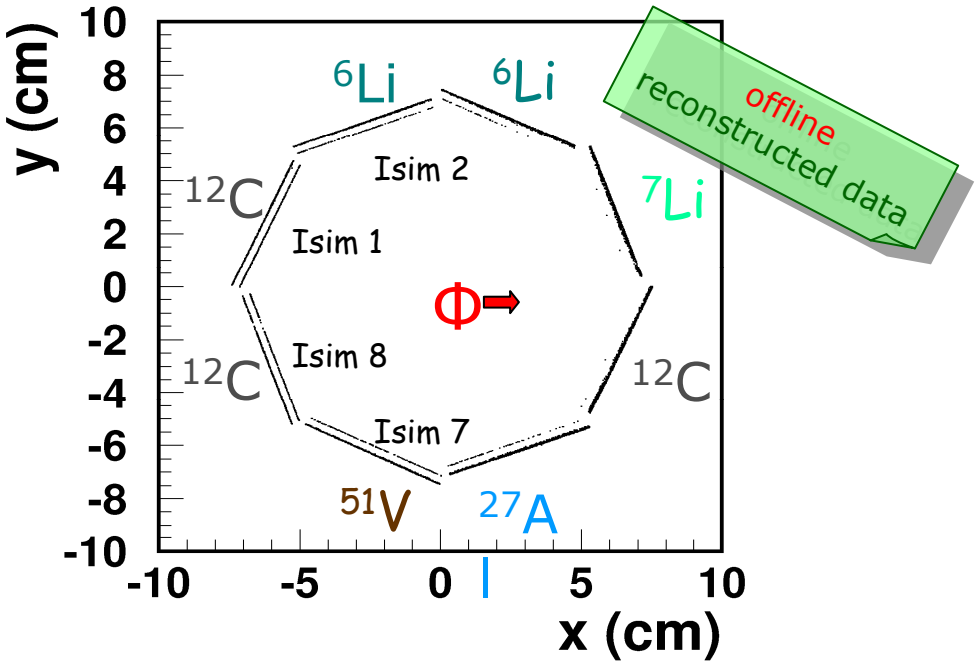


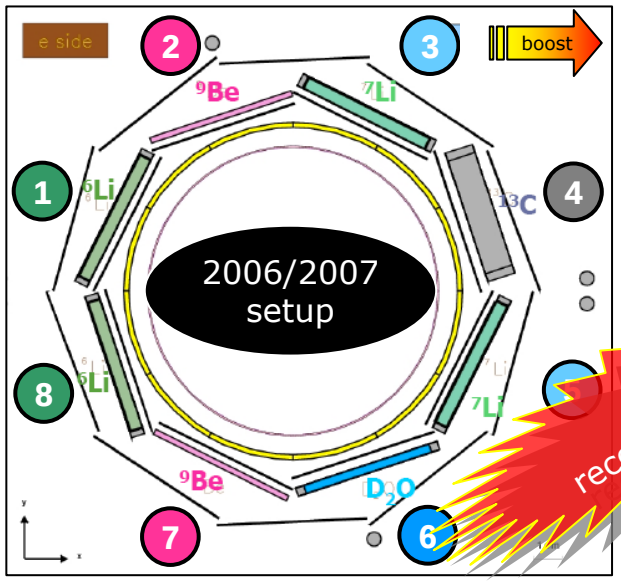
^{9}Be target thickness: 1.8 mm

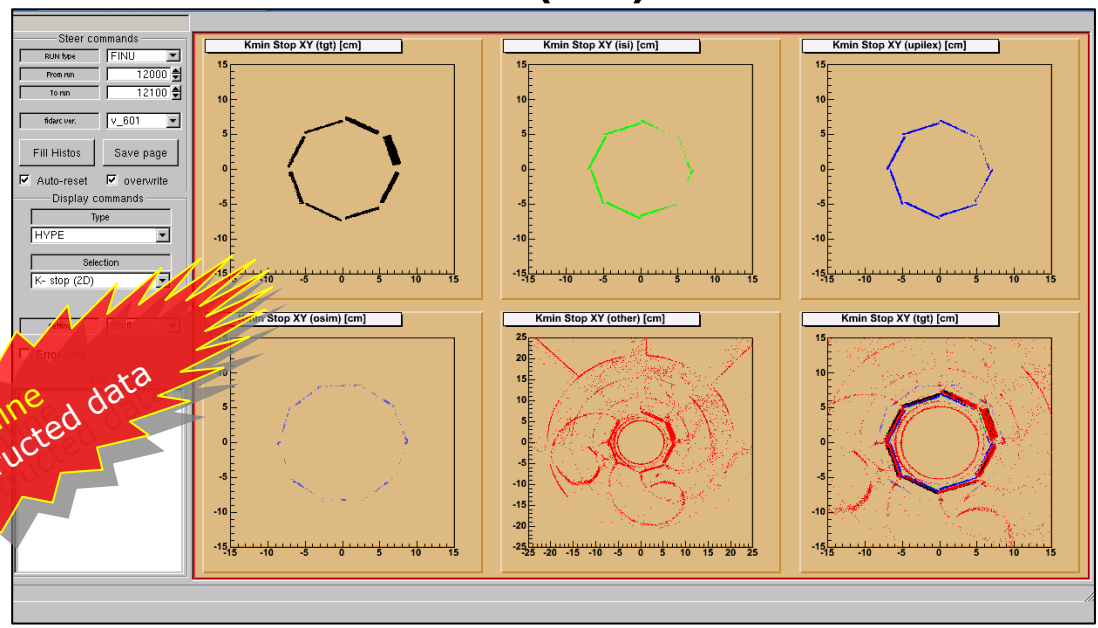


Target envelope by K^- stopping points

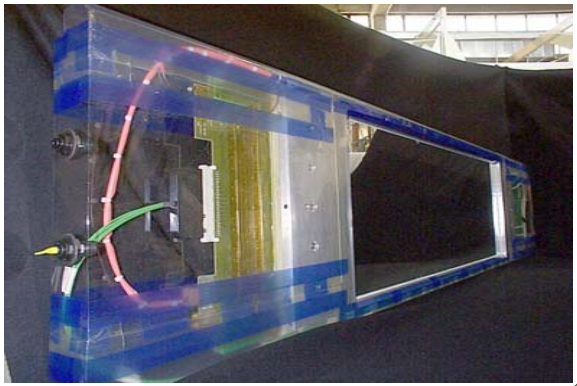








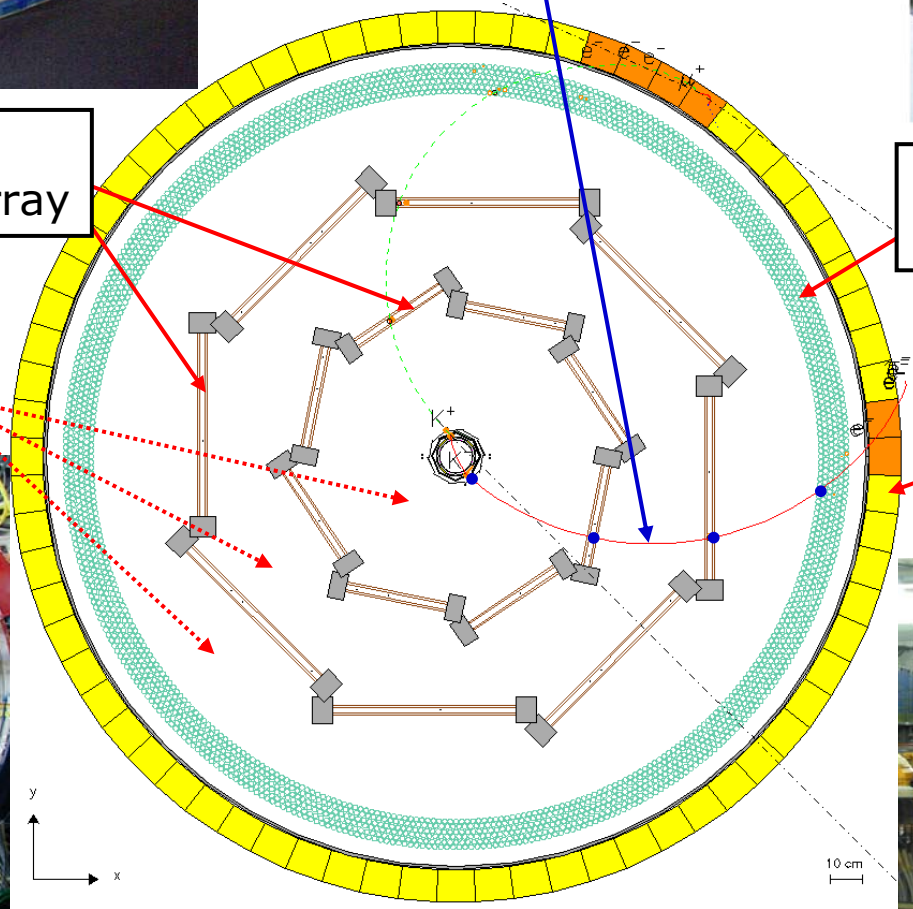
Tracking system + neutron detector



trajectories are measured in 4 points

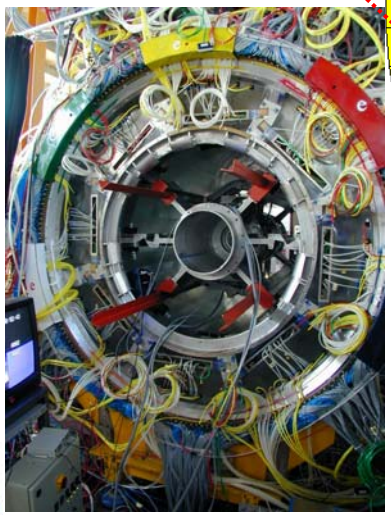
2 low-mass drift chamber array

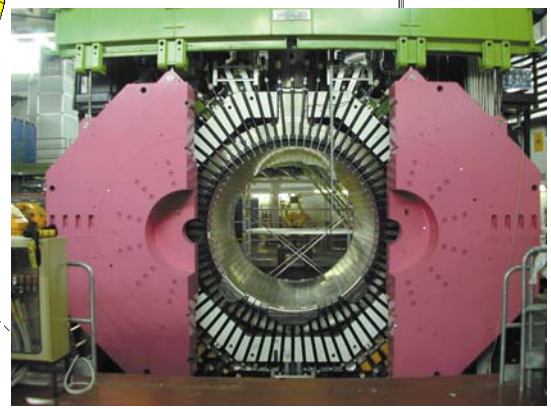
longitudinal and stereo straw tube arrays



8 m^3 He bag

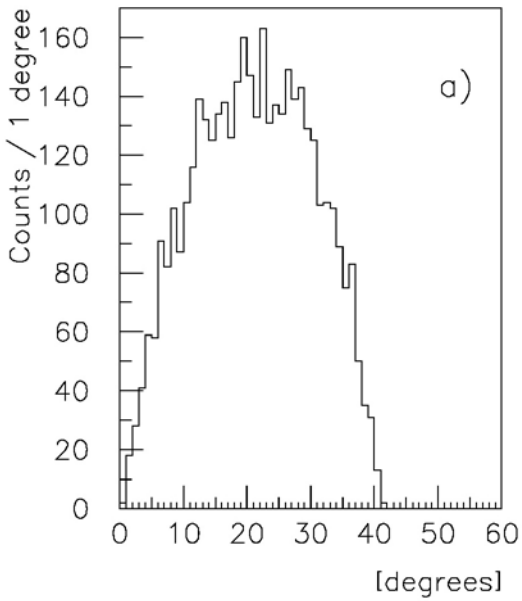
outer scintillator barrel (10.0 cm) neutron counter



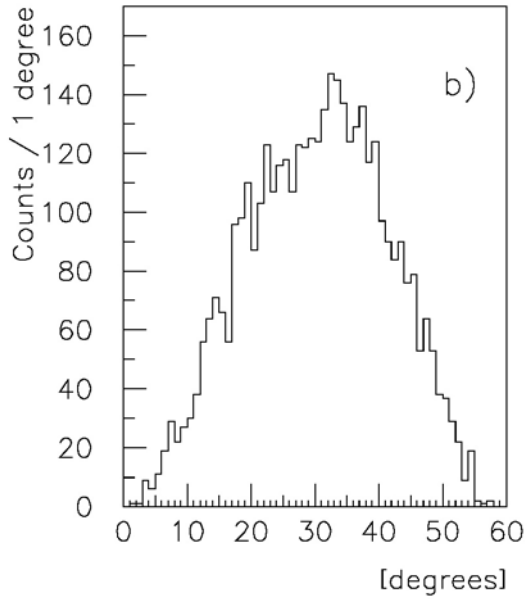


Why so many different technologies?

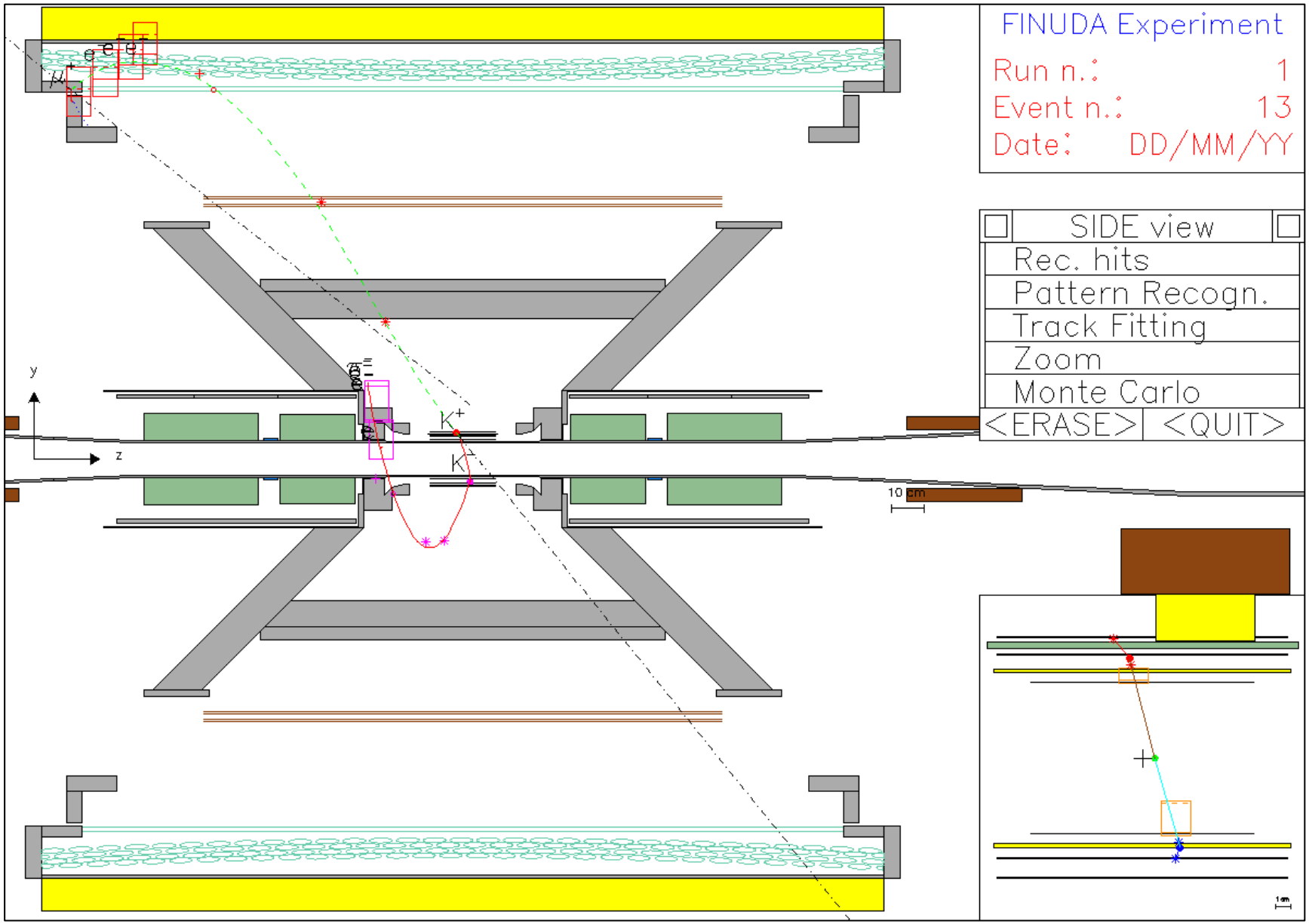
π^- incident angle on inner chambers



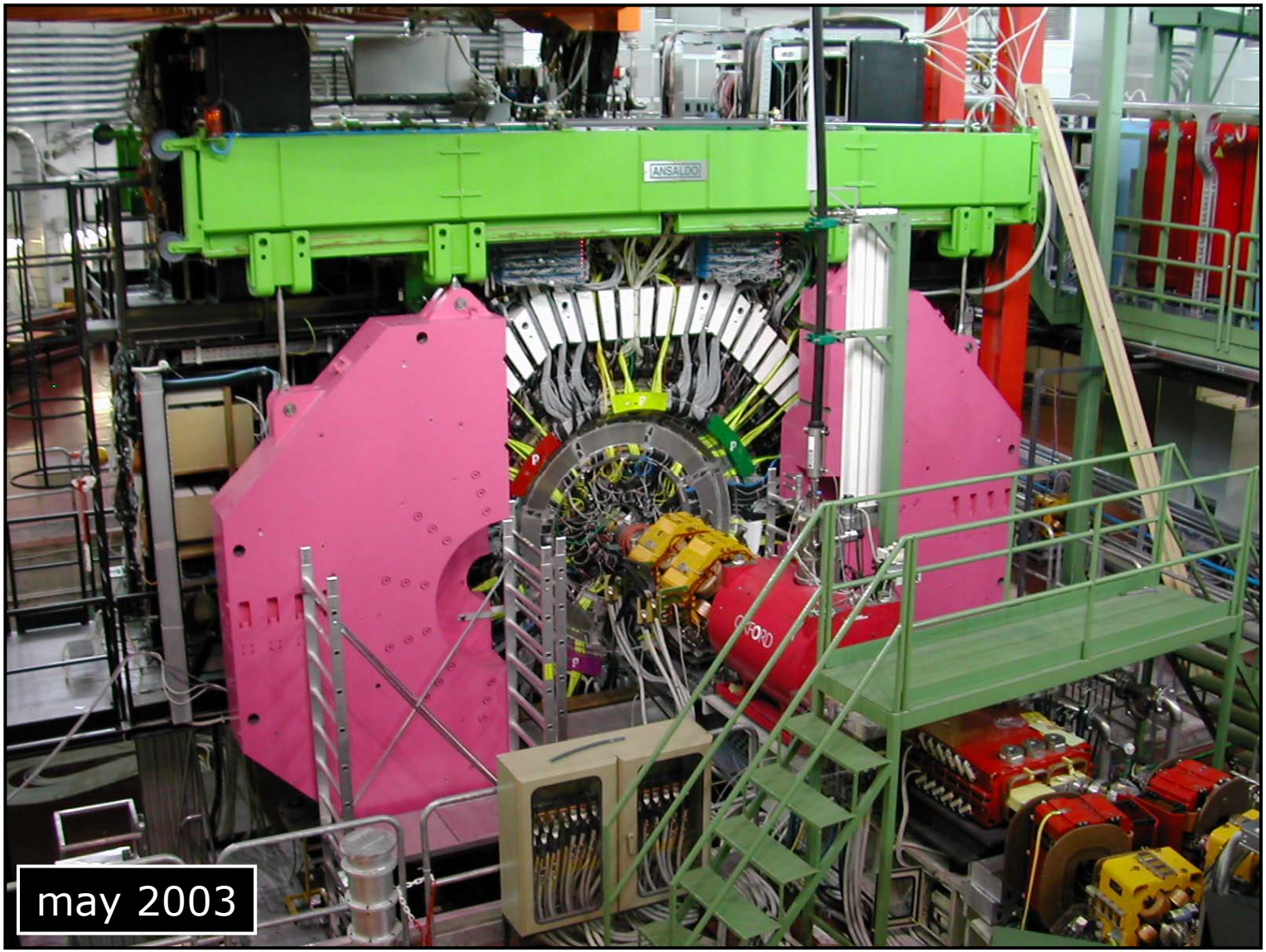
π^- incident angle on outer chambers



Tracking system + neutron detector



Concept becomes reality



FINUDA sub-detectors performances

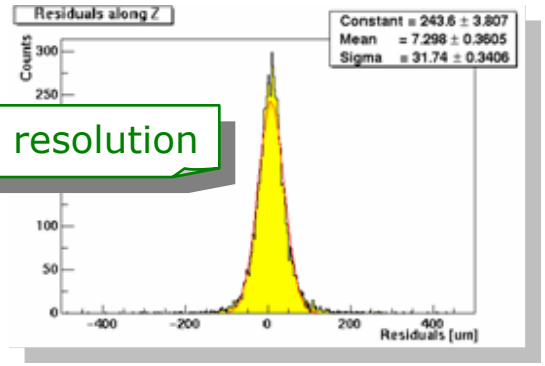
- s.c. solenoid: B = 1.0 T; field homogeneity within 2%
- interaction/target region: K^+/K^- identification, hypernucleus production and detection

  ISIM/OSIM: σ_z = 30 μm; ΔE = 20% FWHM
  TOF_{in}: $\sigma_t \approx$ 300 ps
- tracking devices: measurement of trajectories and momenta of charged particles (Δp/p 3.5‰)

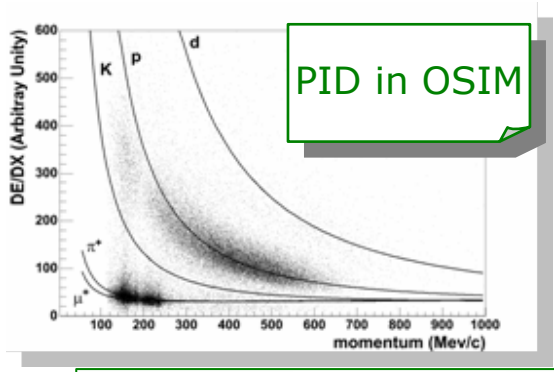
  LMDC: σ(ρ, φ) = 150 μm; $\sigma_z \leq$ 1% wire length
  STB: σ(ρ, φ) = 150 μm; σ_z 500 μm
- external scintillator barrel: trigger and neutron detection

  TOF_{out}: $\sigma_t \leq$ 500 ps FWHM
  efficiency ≥ 10%; ΔE = 8 MeV
- He chamber: minimization of particle multiple scattering

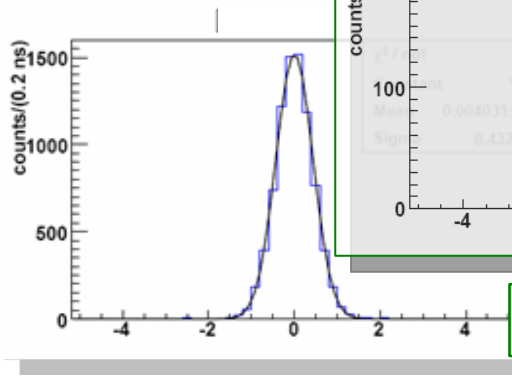
  Δp/p: He atmosphere = 3.5‰
  air = 2%

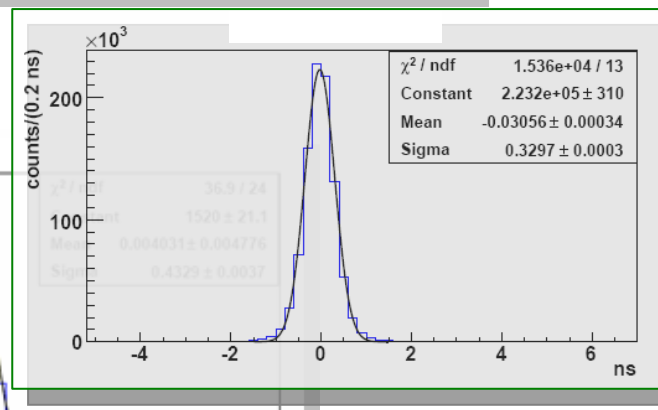


VDET z resolution



PID in OSIM





TOF time resolution

FINUDA key features

- very thin nuclear targets (0.1 ÷ 0.3 g/cm^2)

  → high resolution spectroscopy

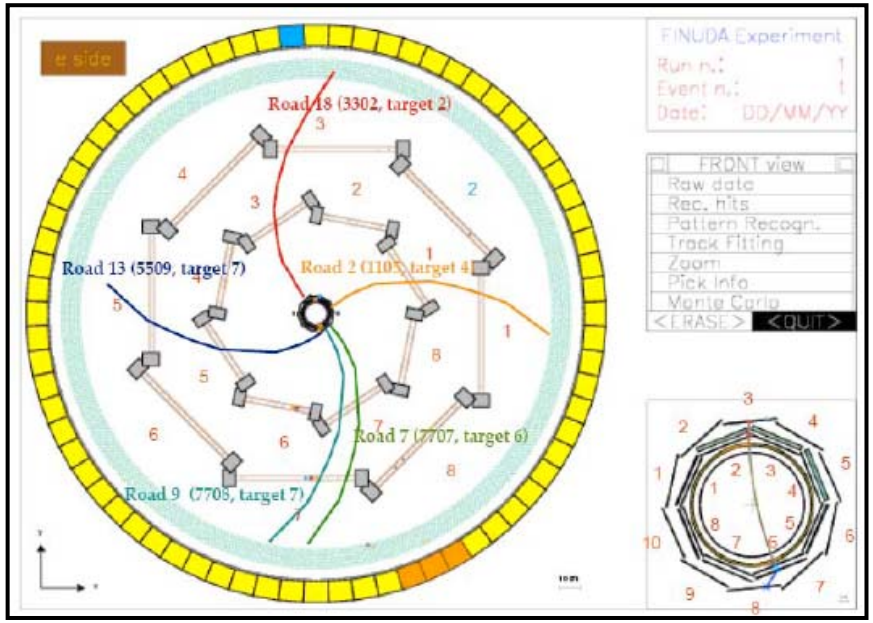
- coincidence measurement with large acceptance

  → decay mode study

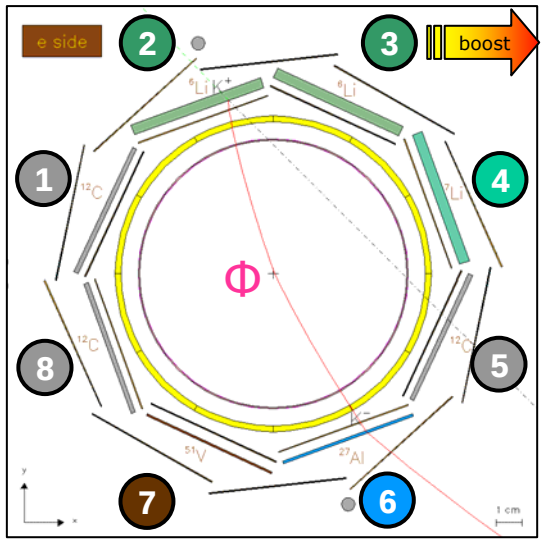
- irradiation of different targets in the same run

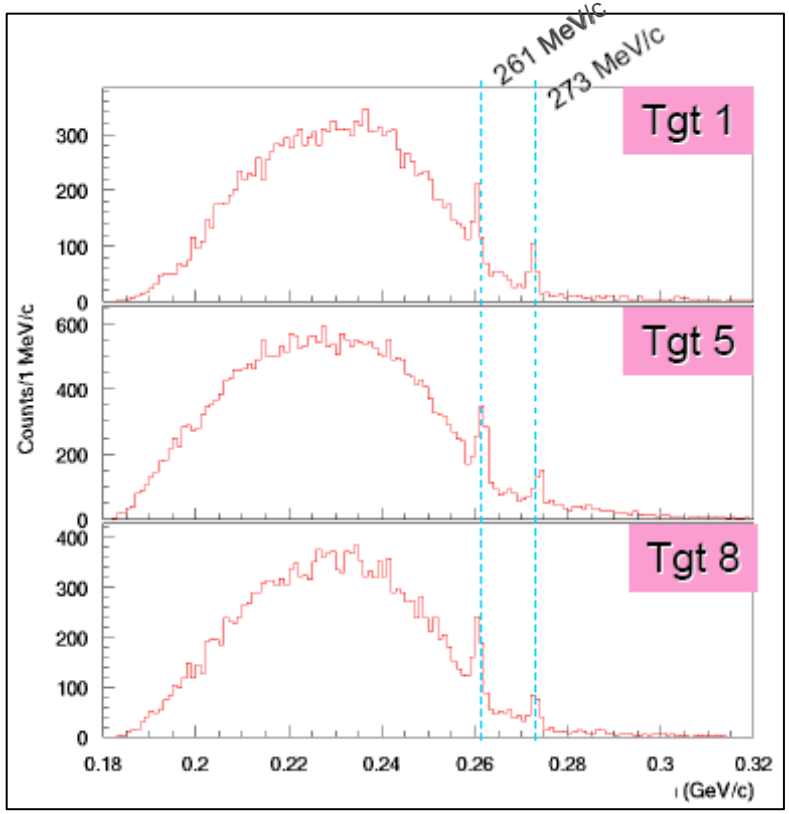
  → systematic error reduction

FINUDA drawbacks



- ✓ long and painful alignment procedure
- ✓ careful treatment of systematic effects

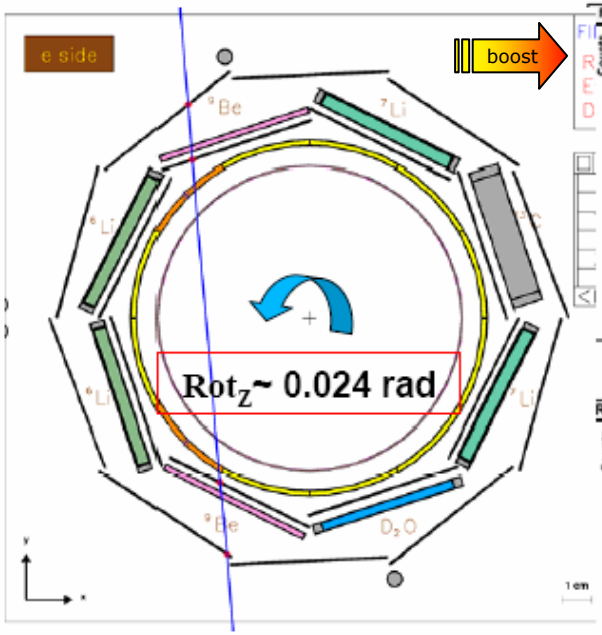




FINUDA drawbacks

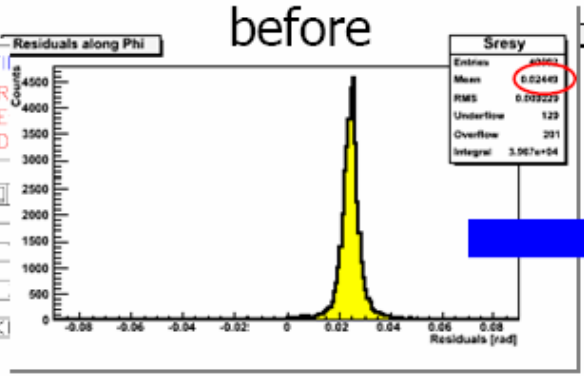
ISIM/OSIM residuals with respect to the straw tube system

Global translational & rotational offsets

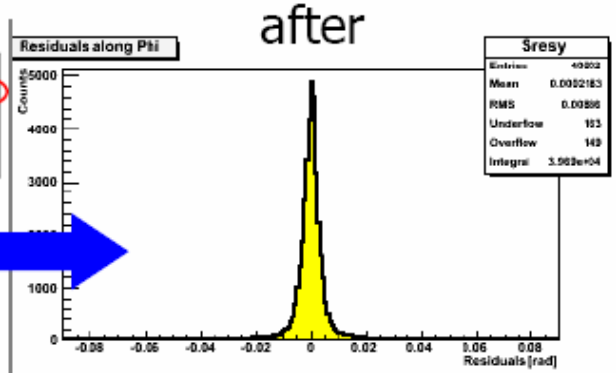


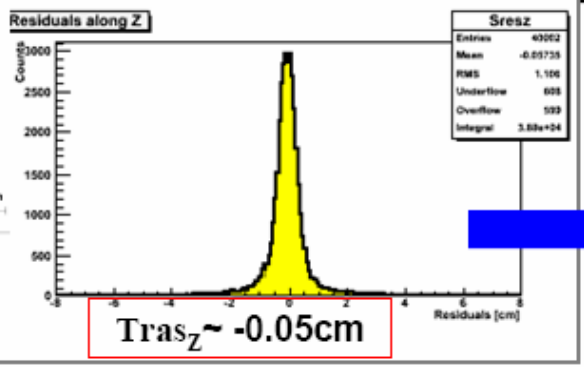
boost

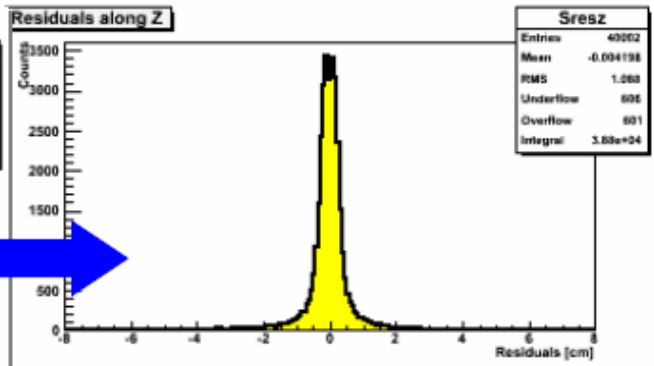
before



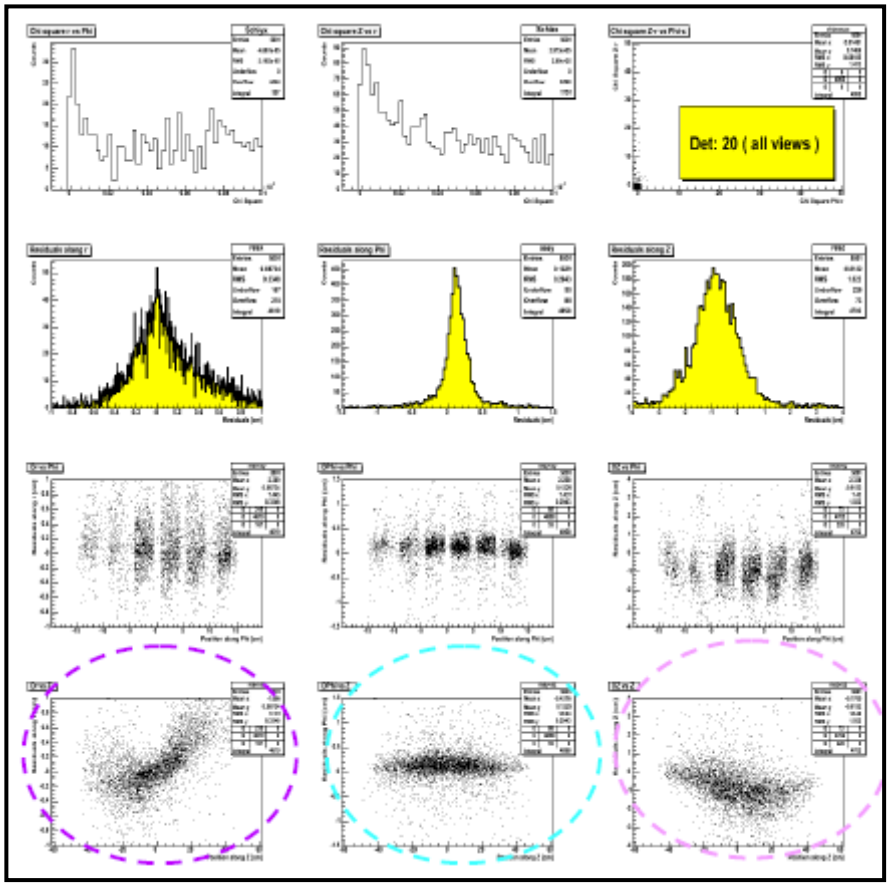
after

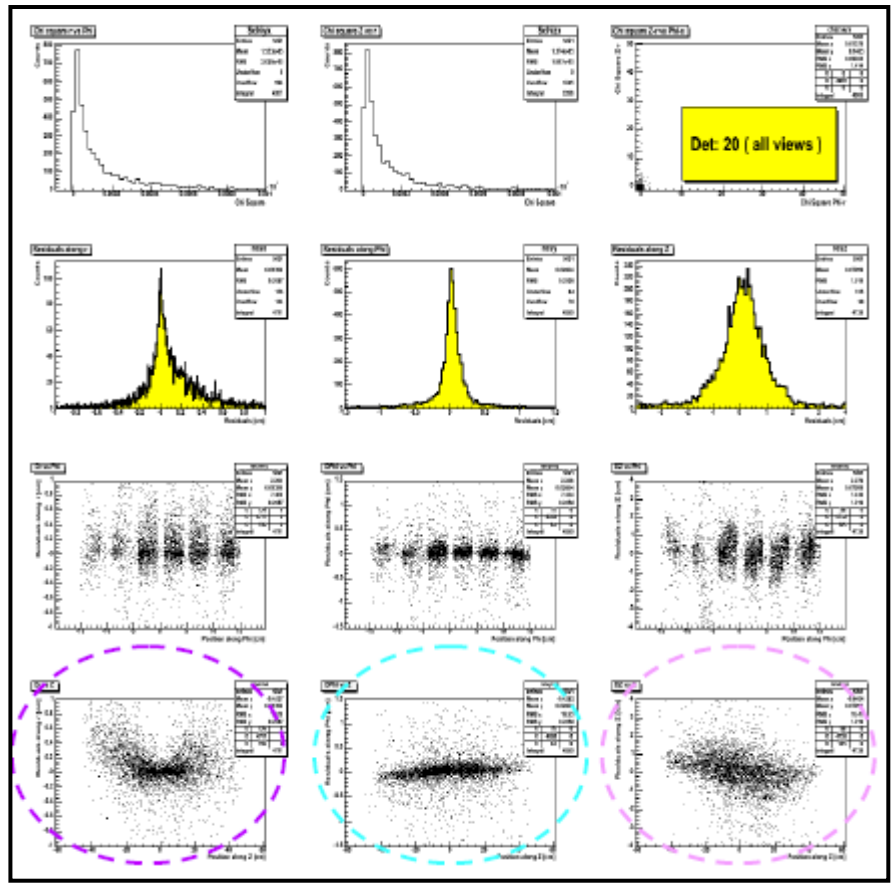






Inner drift chamber alignment

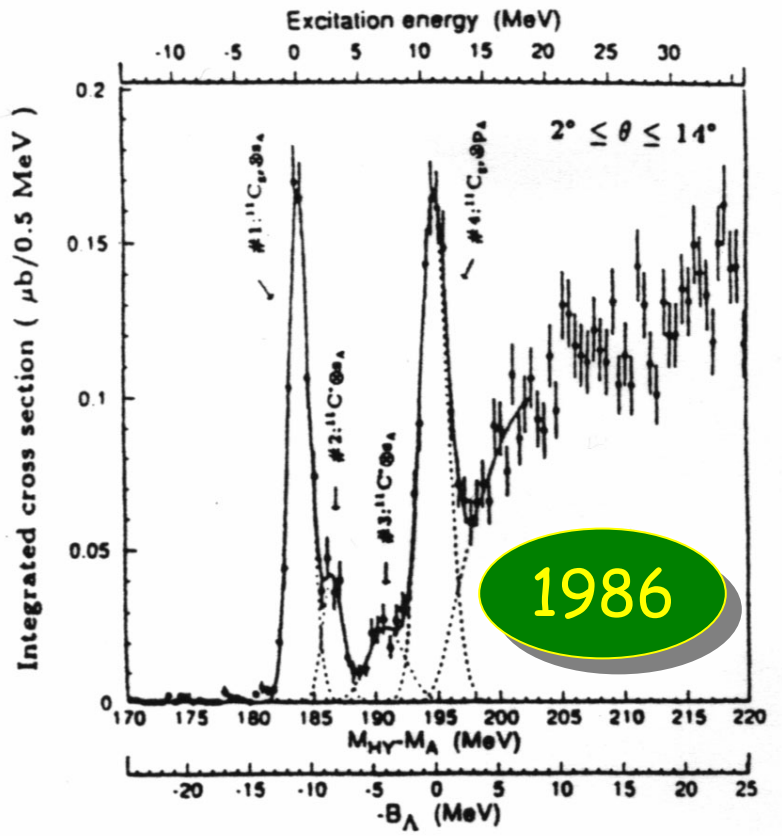




starting condition

after fine alignments

Mission accomplished



$^{12}C(\pi^+,K^+)^{12}_{\Lambda}C$

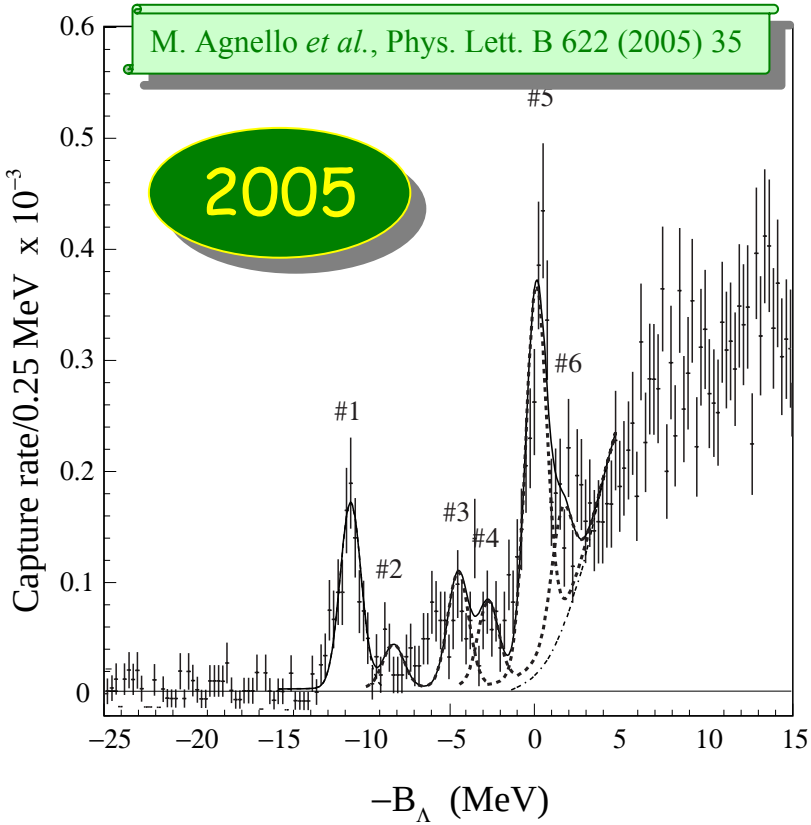
ΔE ~ 1.9 MeV FWHM

T. Hasegawa *et al.*, Phys. Rev. C 53 (1996) 1210

$^{12}C(K^-_{stop},\pi^-)^{12}_{\Lambda}C$

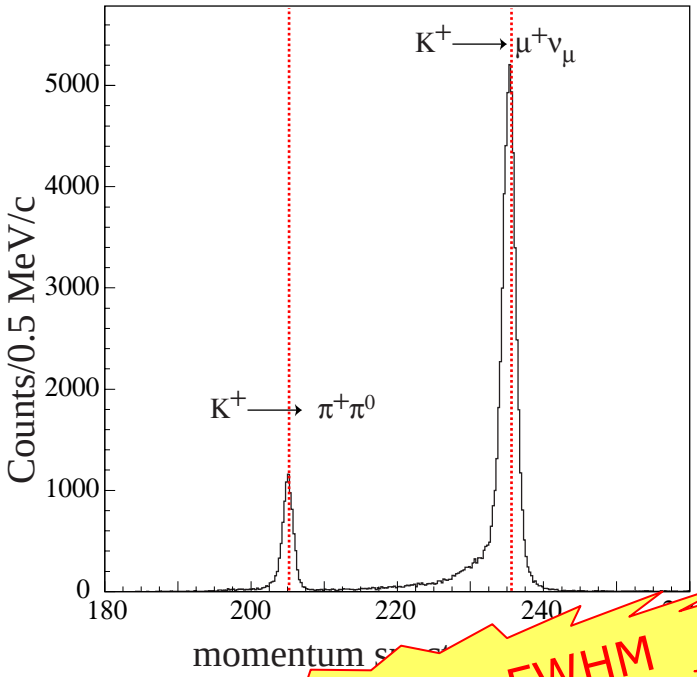
ΔE ~ 1.3 MeV FWHM

M. Agnello *et al.*, Phys. Lett. B 622 (2005) 35



Mission accomplished

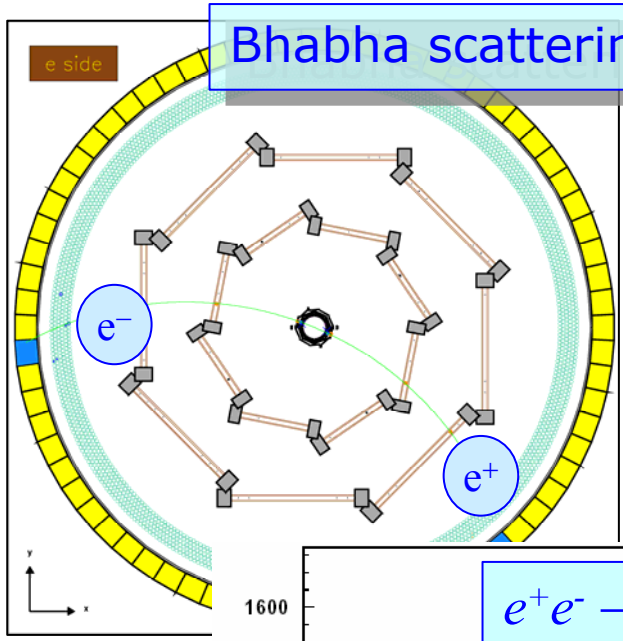
K^+ two body decays: benchmark for spectrometer calibration

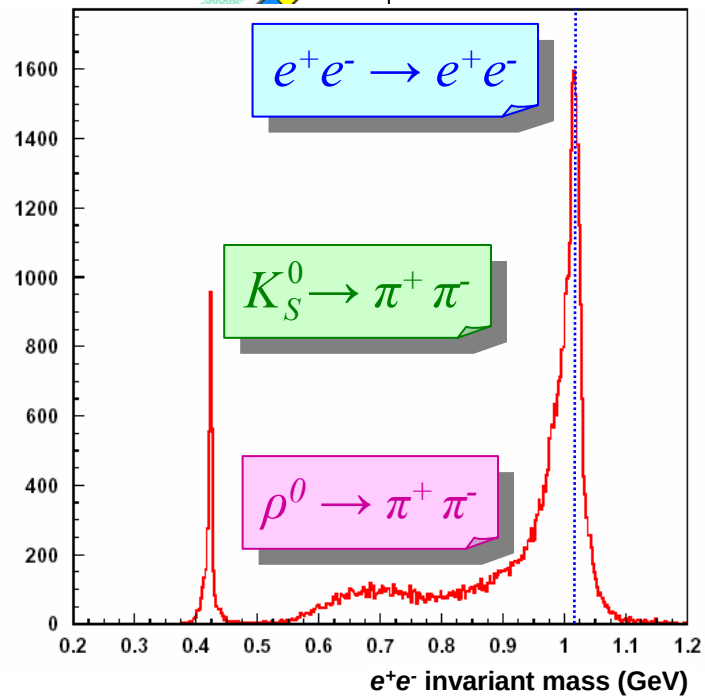


$\Delta p/p \sim 0.6\%$ FWHM

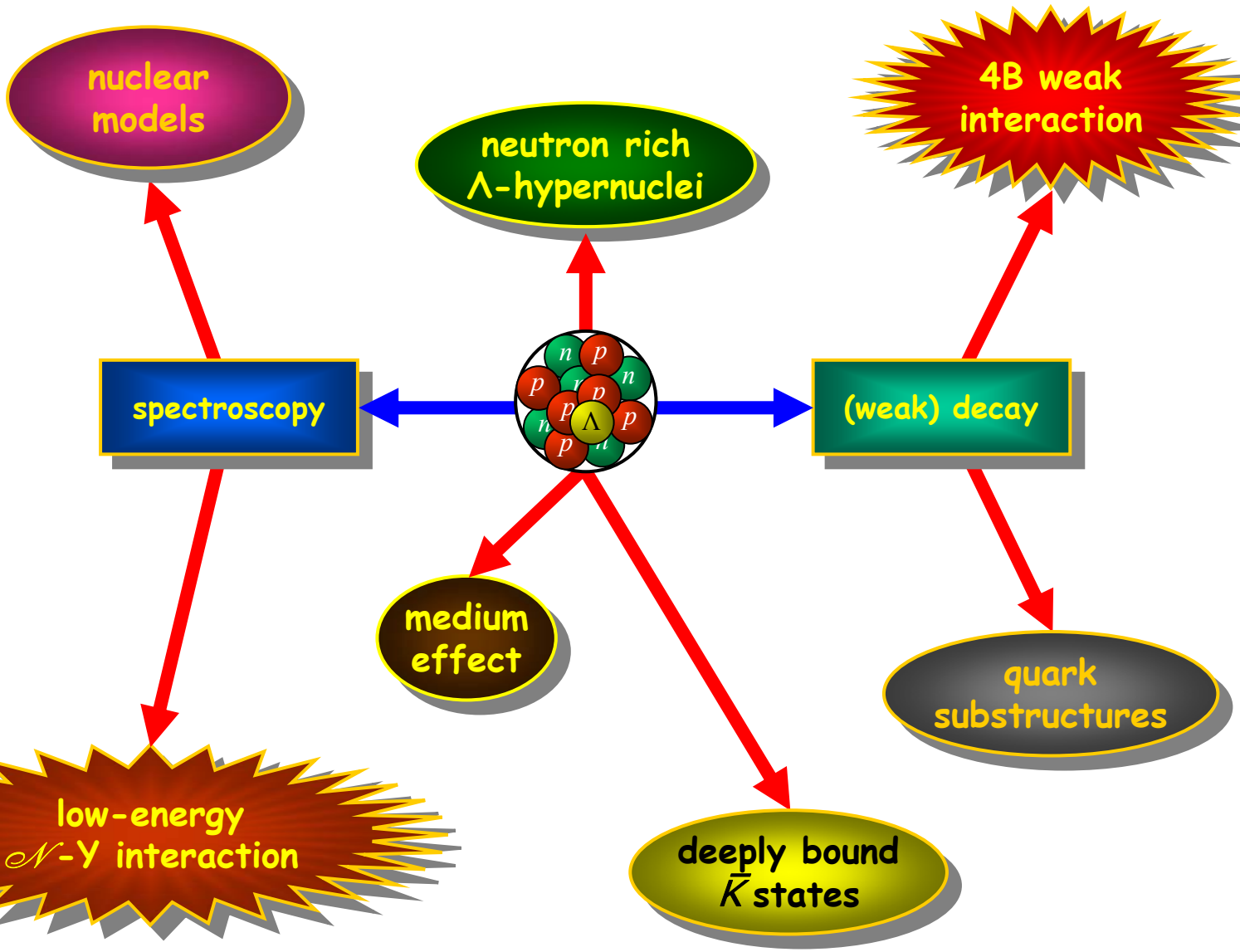
$\Delta T_\pi = \Delta M_H \approx 1.25$ MeV FWHM

Bhabha scattering



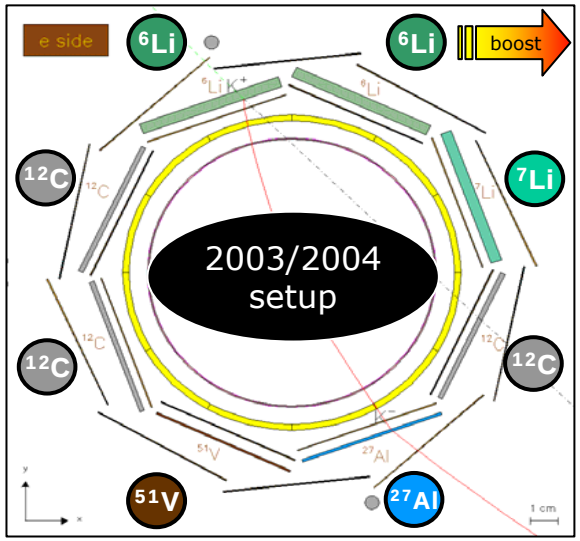


Physics output (S = -1)

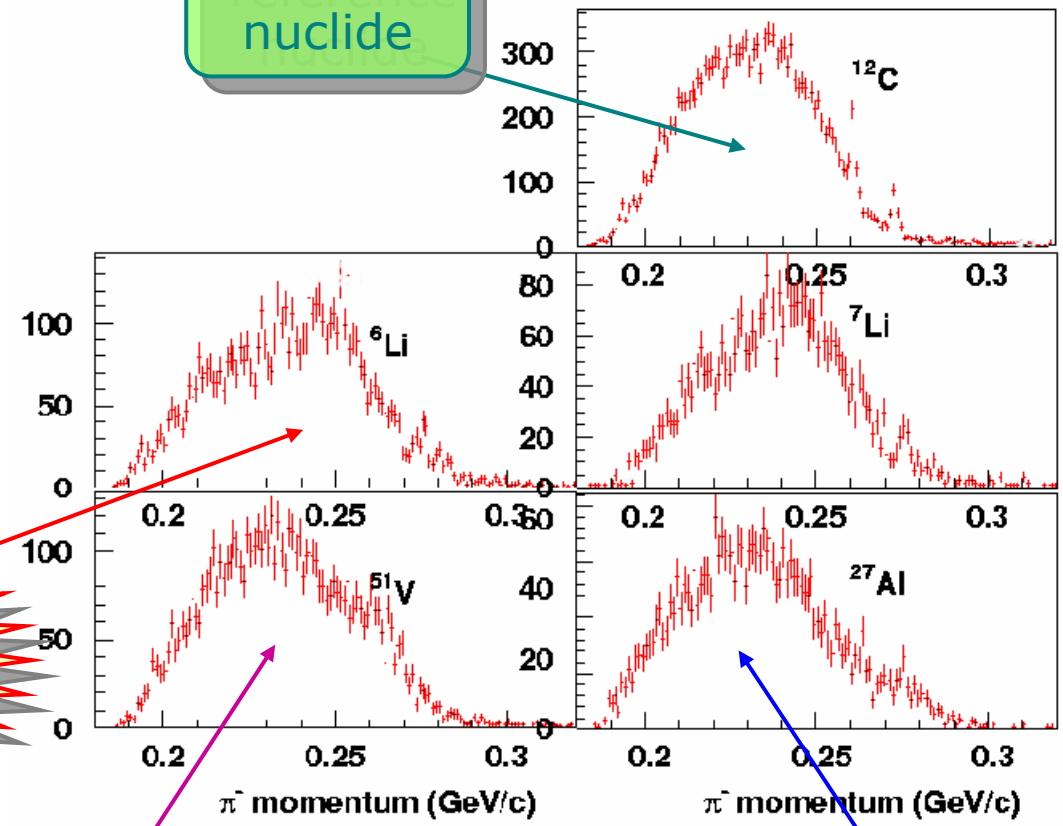


Spectroscopy of Λ-hypernuclei

FINUDA 1st round



reference nuclide



doorway for light systems

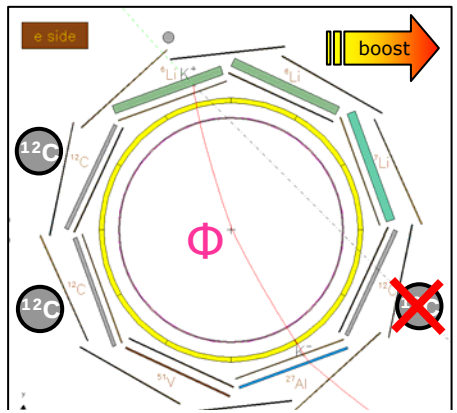
$({}^{4}_{\Lambda}H, {}^{4}_{\Lambda}He, {}^{5}_{\Lambda}He)$

medium-A systems (~ terra incognita)

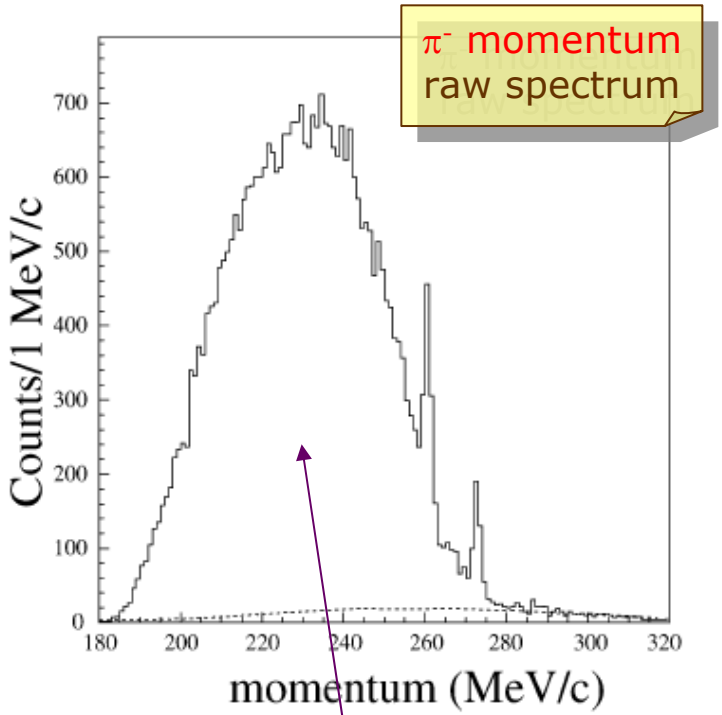
never studied before

FINUDA results on ^{12}C

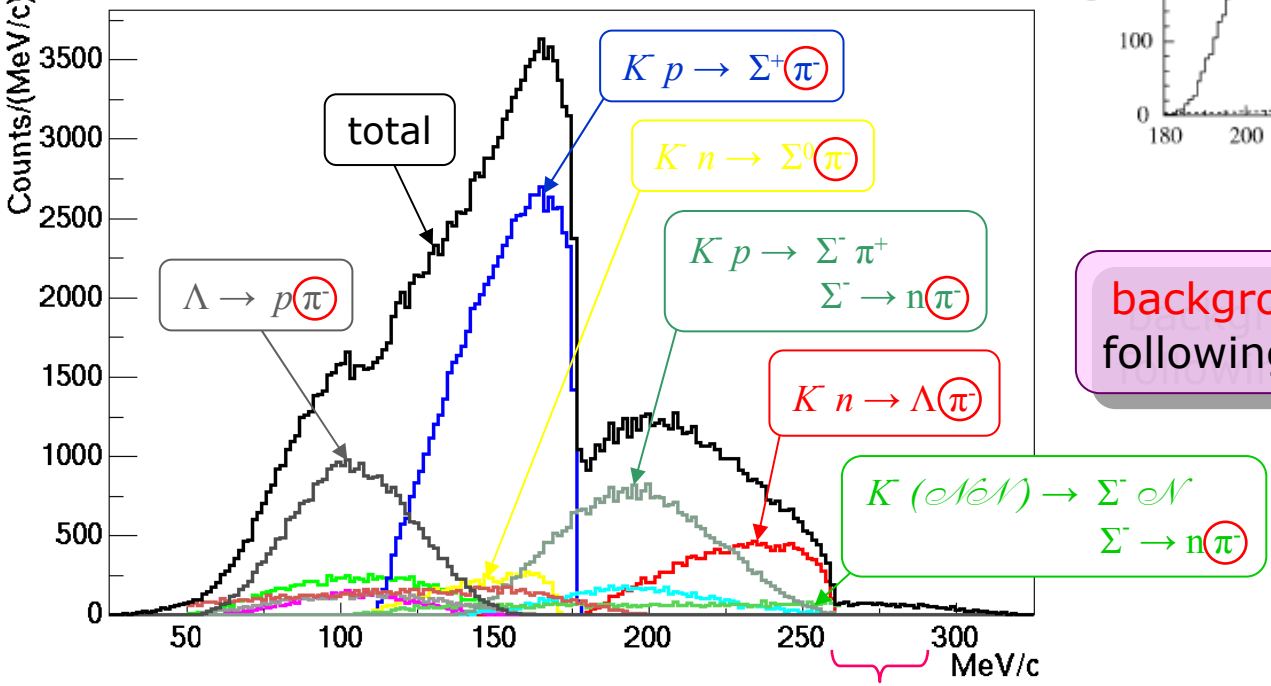
$^{12}C(K^-_{stop},\pi^-)^{12}_{\Lambda}C$



background processes simulated in the FINUDA Monte Carlo



π⁻ momentum distribution



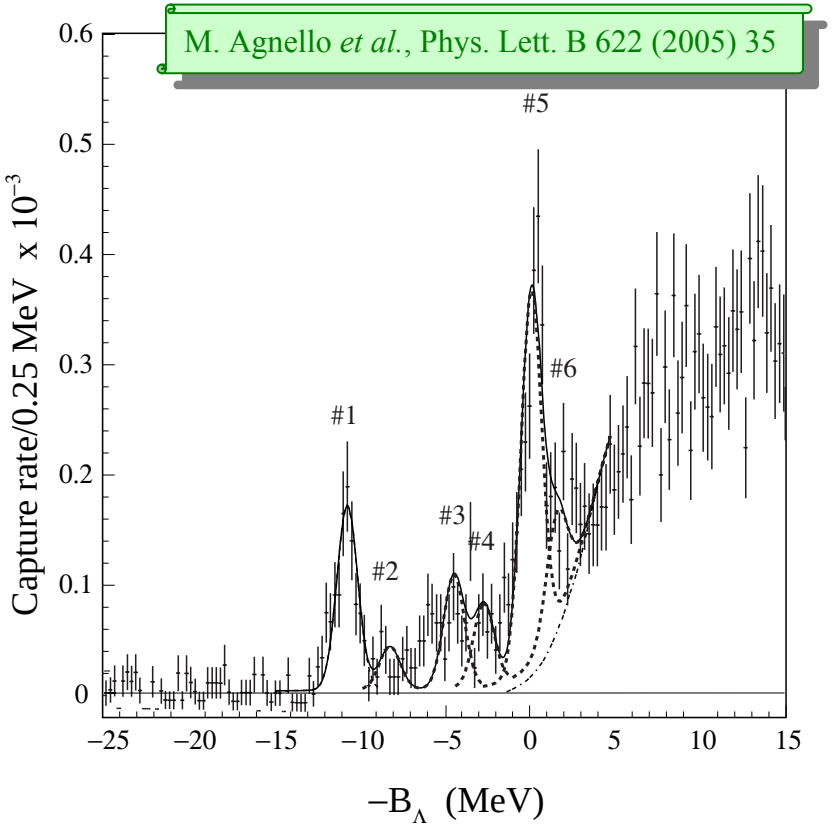
background process giving π⁻ following K^- absorption on ^{12}C

FINUDA vs. KEK-E369

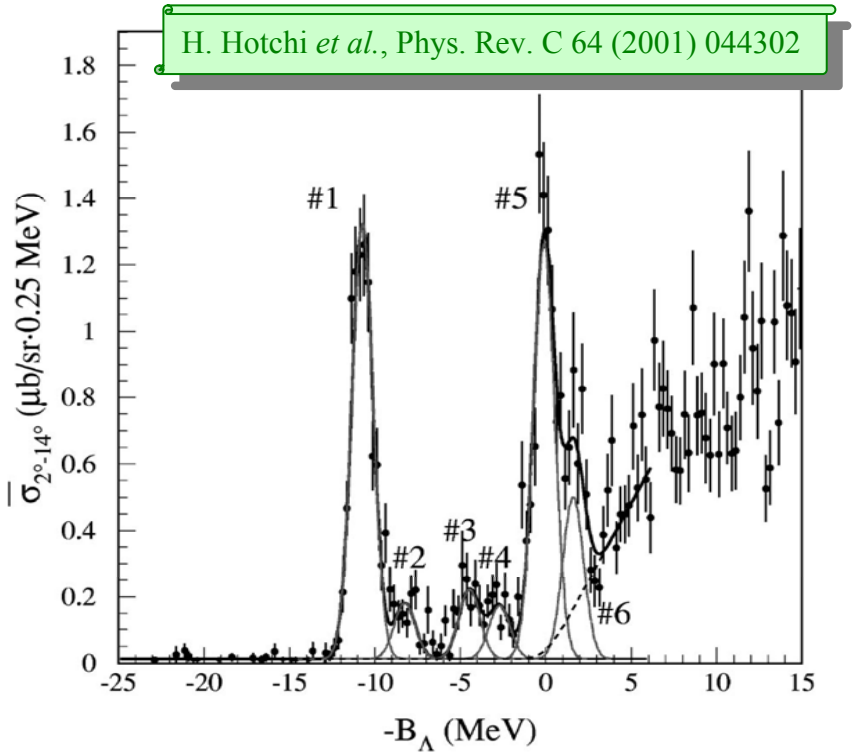
$^{12}C(K^-_{stop},\pi^-)^{12}_{\Lambda}C$

ΔE ~ 1.3 MeV FWHM

M. Agnello *et al.*, Phys. Lett. B 622 (2005) 35



H. Hotchi *et al.*, Phys. Rev. C 64 (2001) 044302



$^{12}C(\pi^+,K^+)^{12}_{\Lambda}C$

ΔE ~ 1.5 MeV FWHM

FINUDA results on ^{12}C

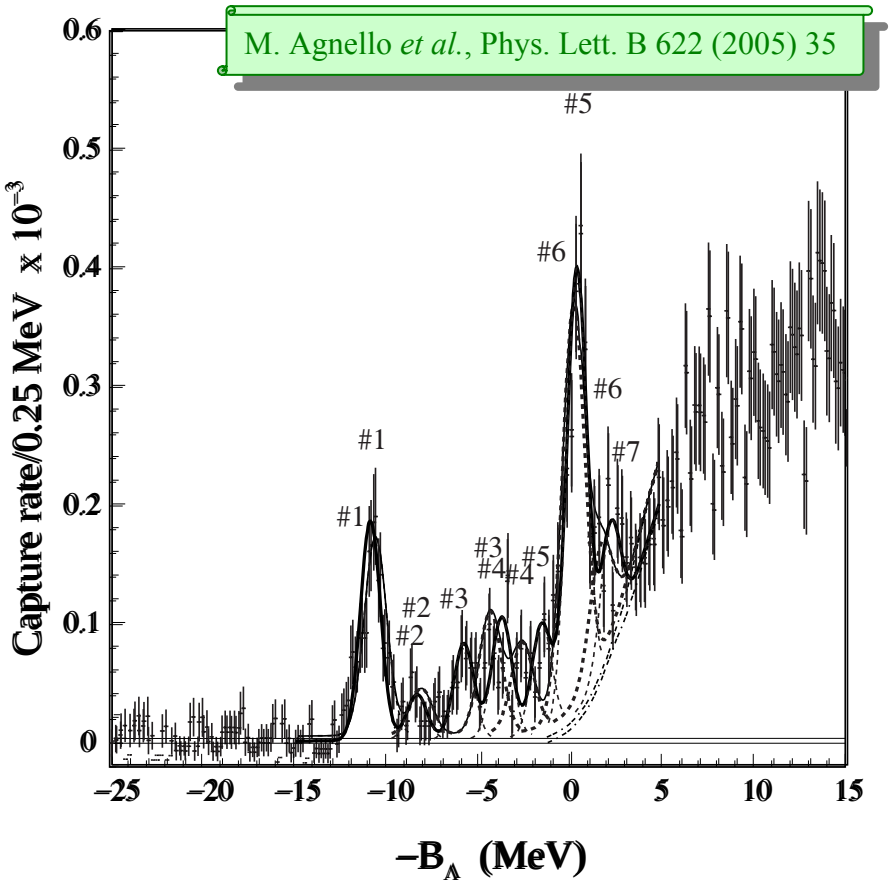
Peak number	$-B_\Lambda$ (MeV) (Fixed at E369 values)	Capture rate/(stopped K^-)$[\times 10^{-3}]$
1	−10.76	$1.01 \pm 0.11_{stat} \pm 0.10_{syst}$
2	−8.25	0.23 ± 0.05
3	−4.46	0.62 ± 0.08
4	−2.76	0.45 ± 0.07
5	0.10	2.01 ± 0.14
6	1.61	0.5 ± 0.11

Peak number	$-B_\Lambda$ (MeV)	Capture rate/(stopped K^-)$[\times 10^{-3}]$
1	-10.94 ± 0.06	$1.01 \pm 0.11_{stat} \pm 0.10_{syst}$
2	-8.4 ± 0.2	0.21 ± 0.05
3	-5.9 ± 0.1	0.44 ± 0.07
4	-3.8 ± 0.1	0.56 ± 0.08
5	-1.6 ± 0.2	0.50 ± 0.08
6	0.27 ± 0.06	2.01 ± 0.17
7	2.1 ± 0.2	0.58 ± 0.18

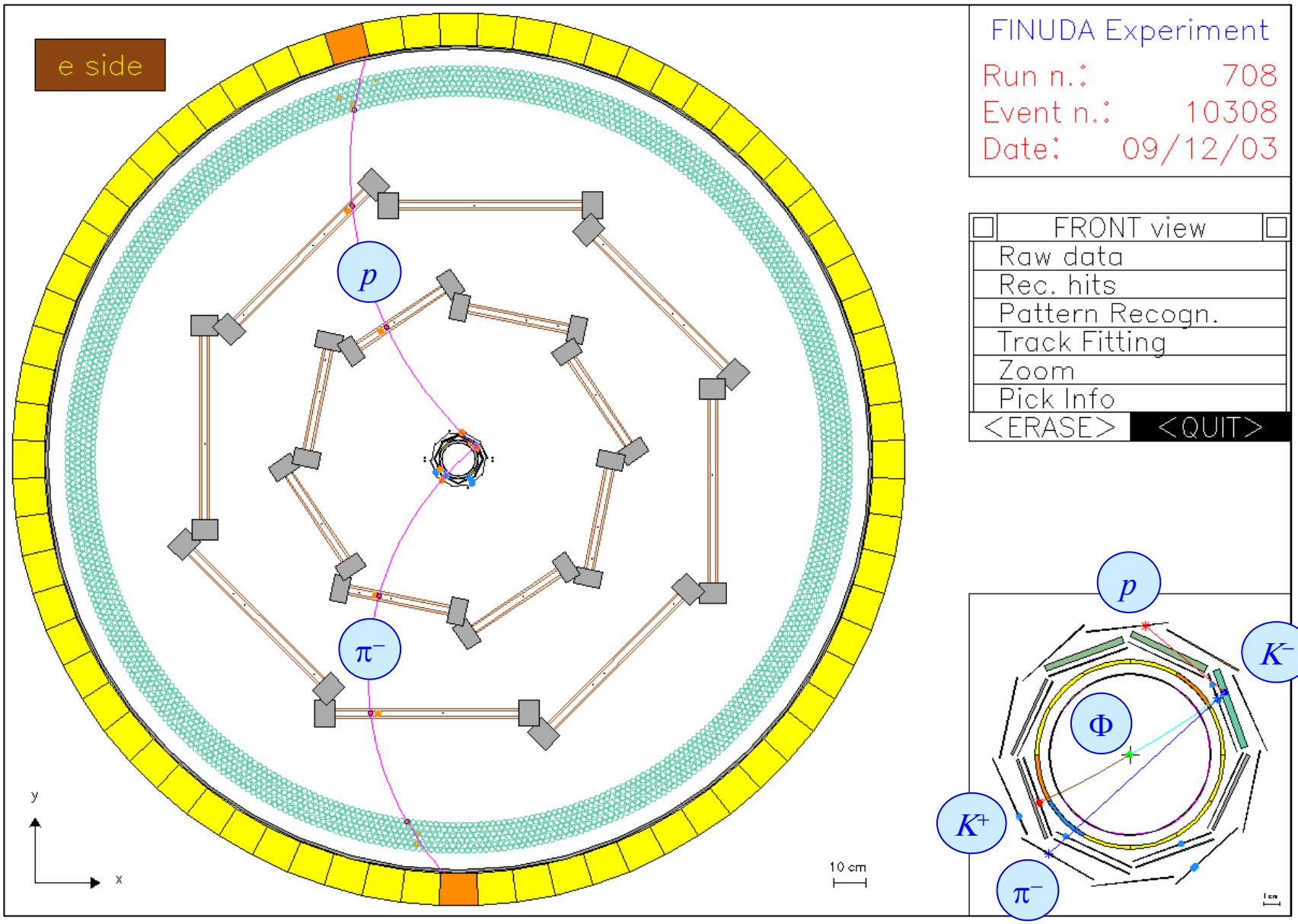
$^{12}C(K^-_{stop},\pi^-)^{12}_{\Lambda}C$

ΔE ~ 1.3 MeV FWHM

M. Agnello *et al.*, Phys. Lett. B 622 (2005) 35



$^{7}Li_{\Lambda}$ candidate event

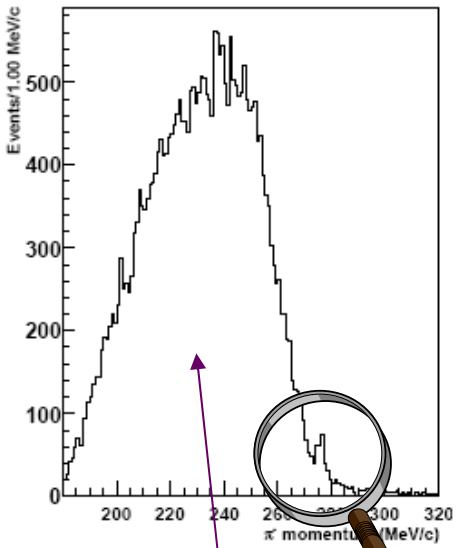


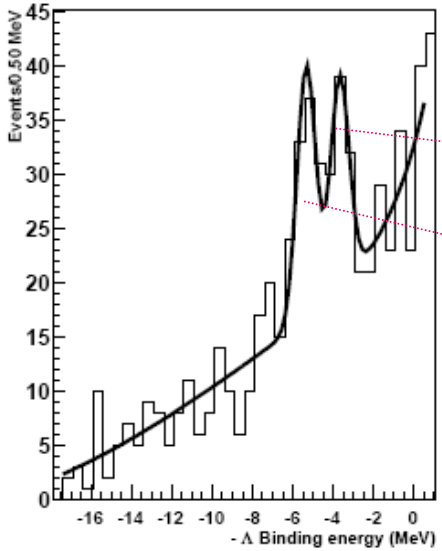
FINUDA results on ^{7}Li

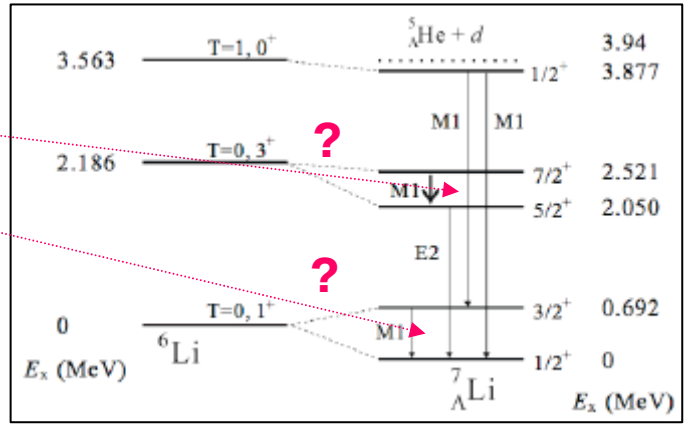
$^7Li(K^-_{stop},\pi^-)^7_\Lambda Li$

ΔE ~ 1.1 MeV FWHM

M. Ukai *et al.*, Phys. Rev. C 73 (2006) 012501







$B^{g.s.}_\Lambda = 5.58 \pm 0.03$ MeV

M. Jurić *et al.*, Nucl. Phys. Rev. B 52 (1973) 1

background process giving π^- following K^- absorption on ^{7}Li

$K^- (\mathscr{N}\mathscr{N}) \rightarrow \Sigma^- \mathscr{N}$

$\Sigma^- \rightarrow n\pi^-$

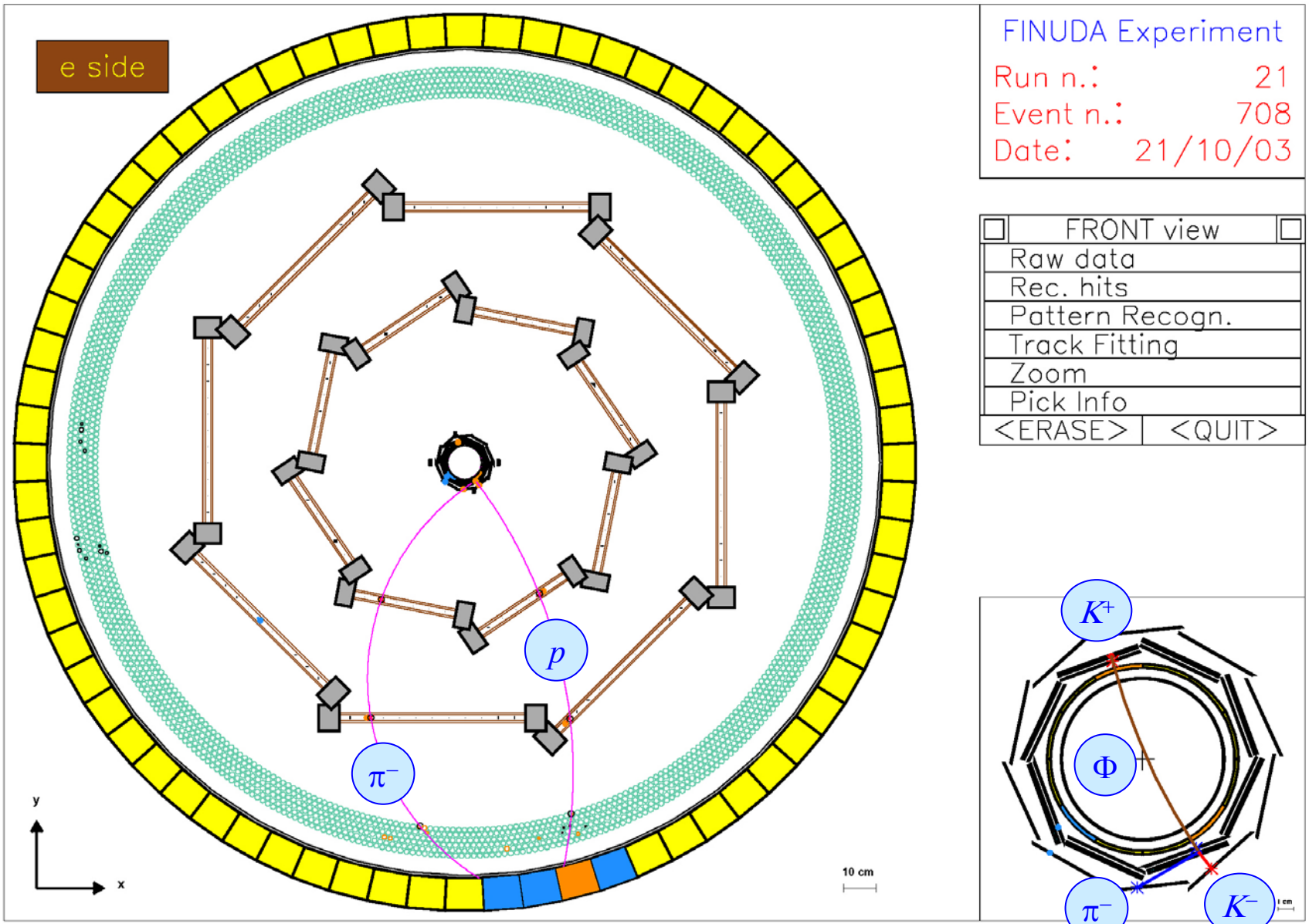
$K^- n \rightarrow \Lambda\pi^-$

$K^- \rightarrow \mu^-\nu_\mu$ in flight

	$-B_\Lambda \pm stat. \pm syst.$ (MeV)	Yield (events)	Production rate (per K^- stop)
1	$-5.33 \pm 0.13 \pm 0.18$	52 ± 11	$0.47 \pm 0.12 \pm 0.11$‰
2	$-3.68 \pm 0.15 \pm 0.18$	44 ± 10	$0.39 \pm 0.11 \pm 0.11$‰

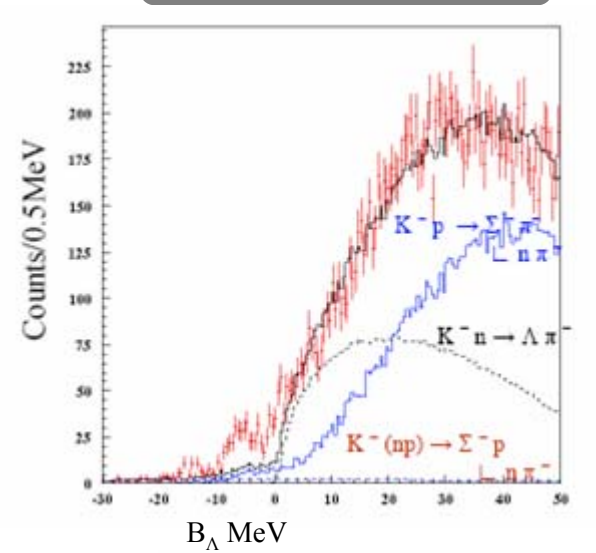
spin-flip amplitude ≈ 0 ⇒ ❶ ≡ 1/2⁺, ❷ ≡ 5/2⁺

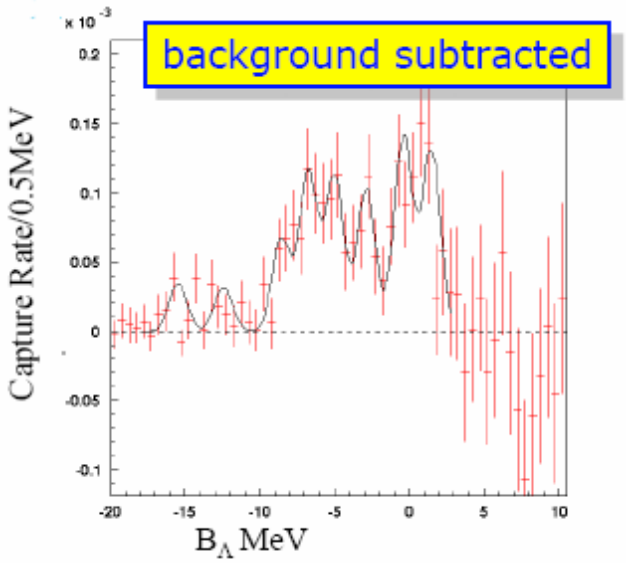
$^{27}Al_{\Lambda}$ candidate event



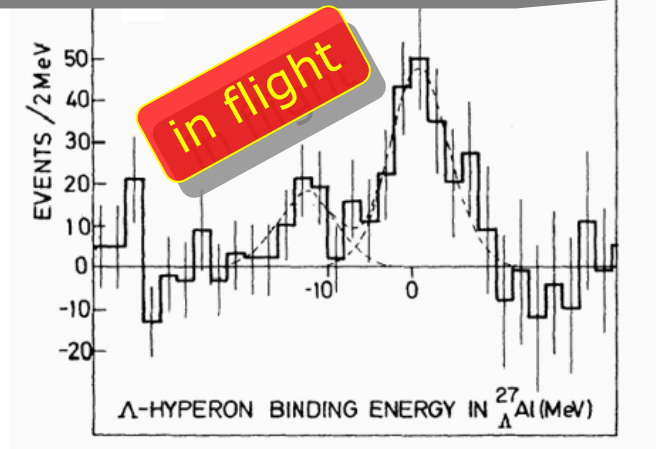
FINUDA results on ^{27}Al

$^{27}Al\ (K^-_{stop},\pi^-)^{27}_{\Lambda}Al$





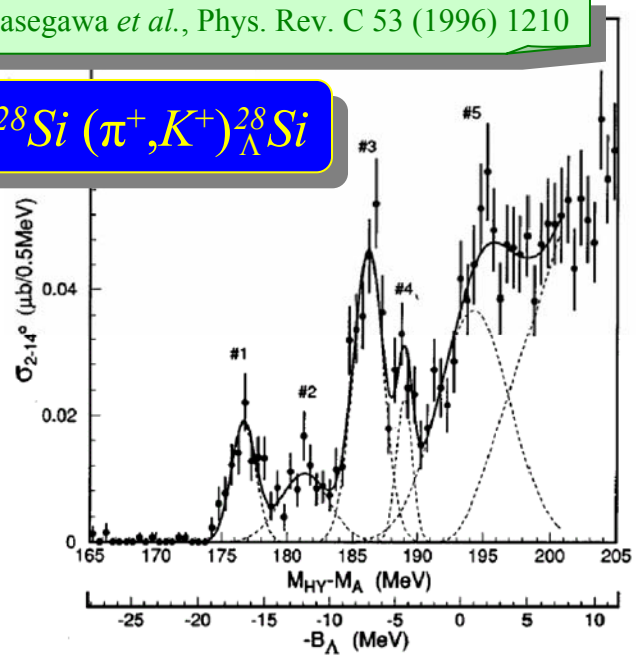
G.C. Bonazzola *et al.*, Phys. Rev. Lett. 34 (1975) 683



ΔE ~ 6.0 MeV FWHM

T. Hasegawa *et al.*, Phys. Rev. C 53 (1996) 1210

$^{28}Si\ (\pi^+,K^+)^{28}_{\Lambda}Si$



ΔE ~ 2.0 MeV FWHM

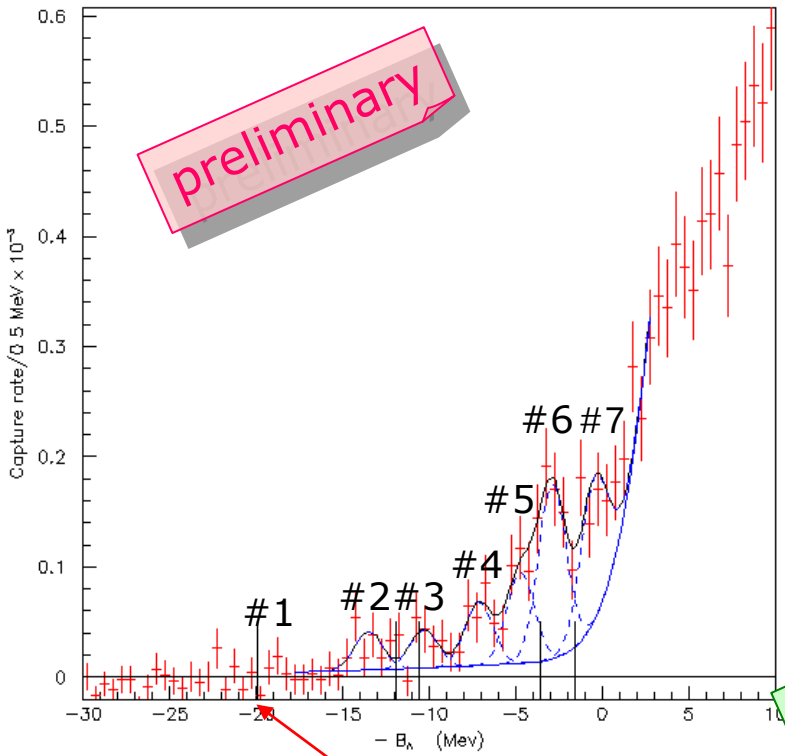
FINUDA results on ^{51}V

$^{51}V(K^-_{stop},\pi^-)^{51}_{\Lambda}V$

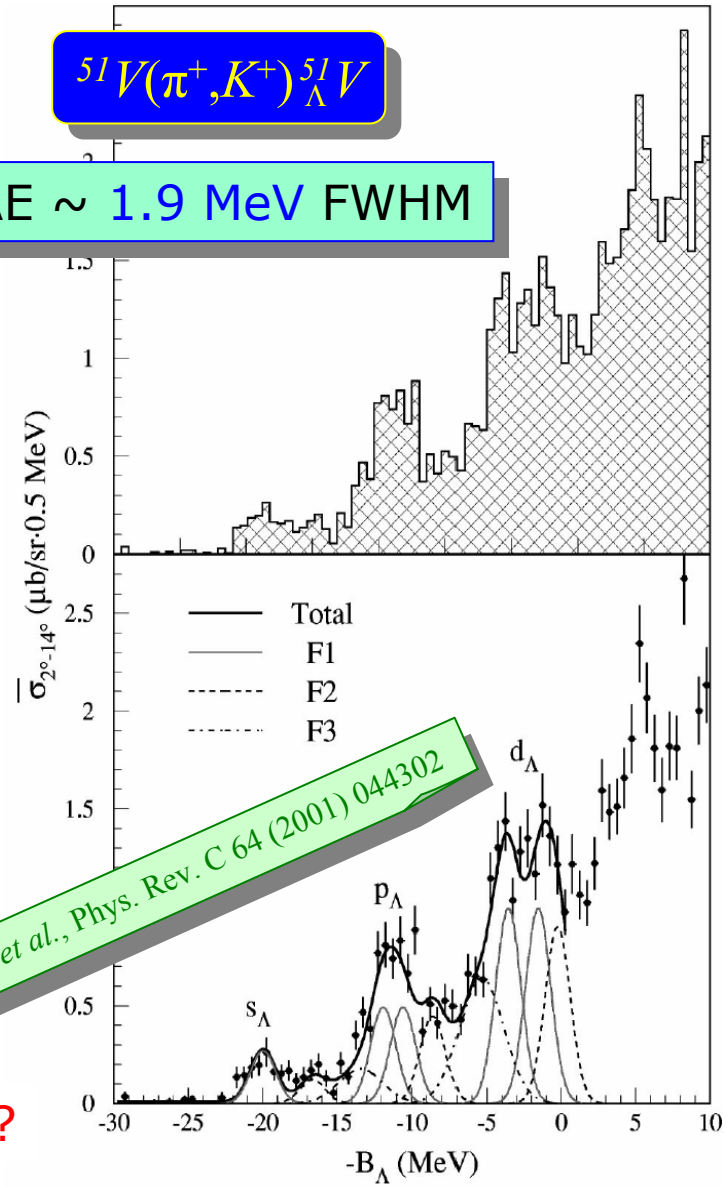
ΔE ~ 1.1 MeV FWHM

$^{51}V(\pi^+,K^+)^{51}_{\Lambda}V$

ΔE ~ 1.9 MeV FWHM



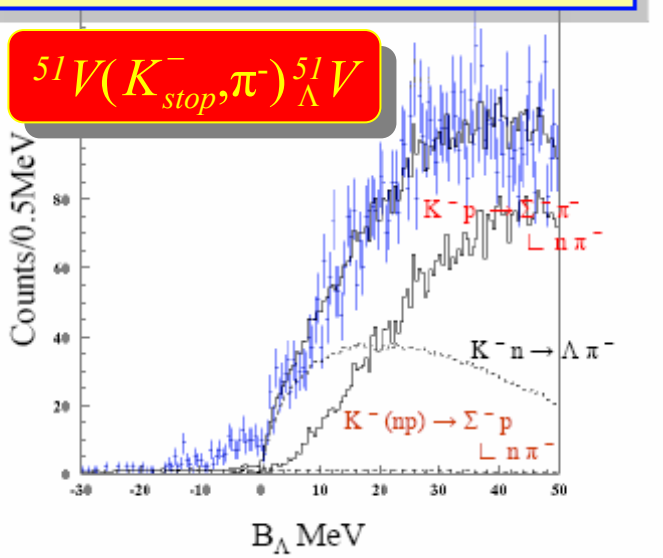
ground state missing?



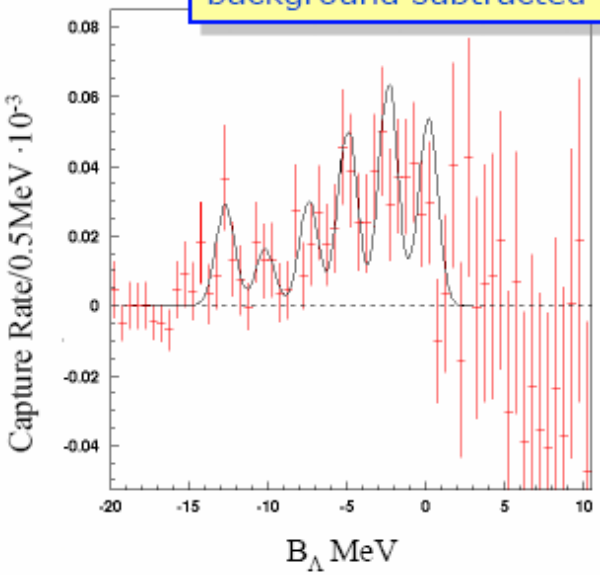
FINUDA results on ^{51}V

background reactions superimposed

$^{51}V(K^-_{stop},\pi^-)^{51}_{\Lambda}V$

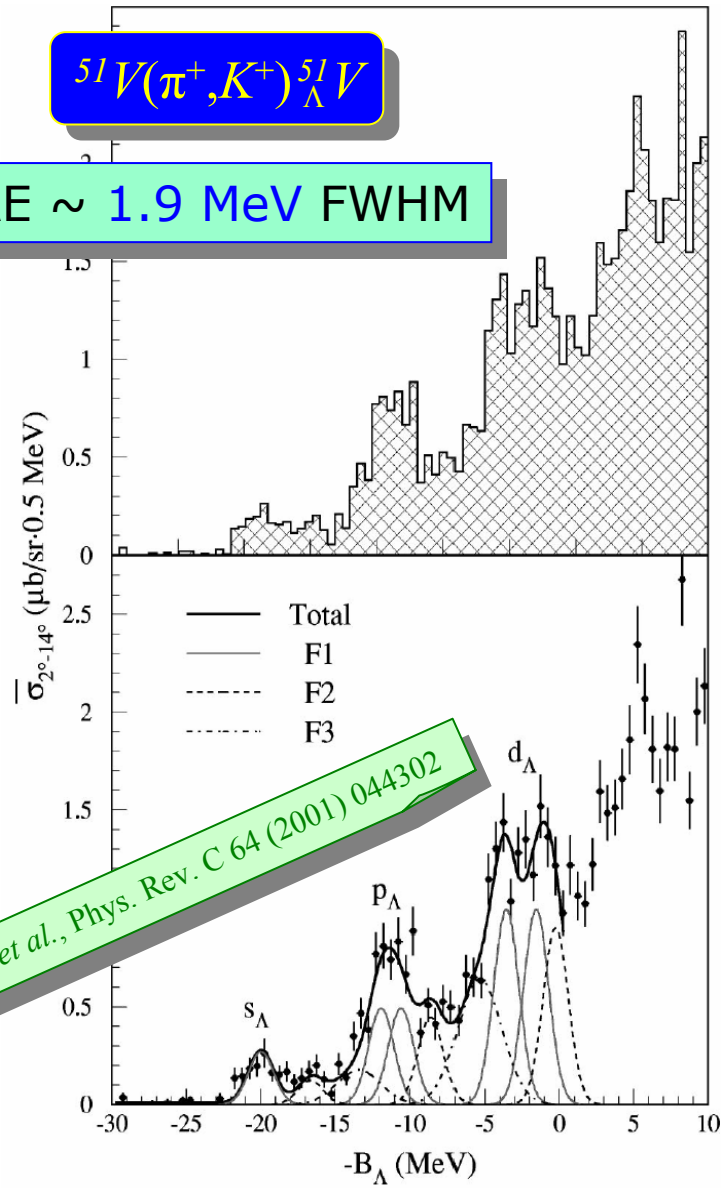


background subtracted



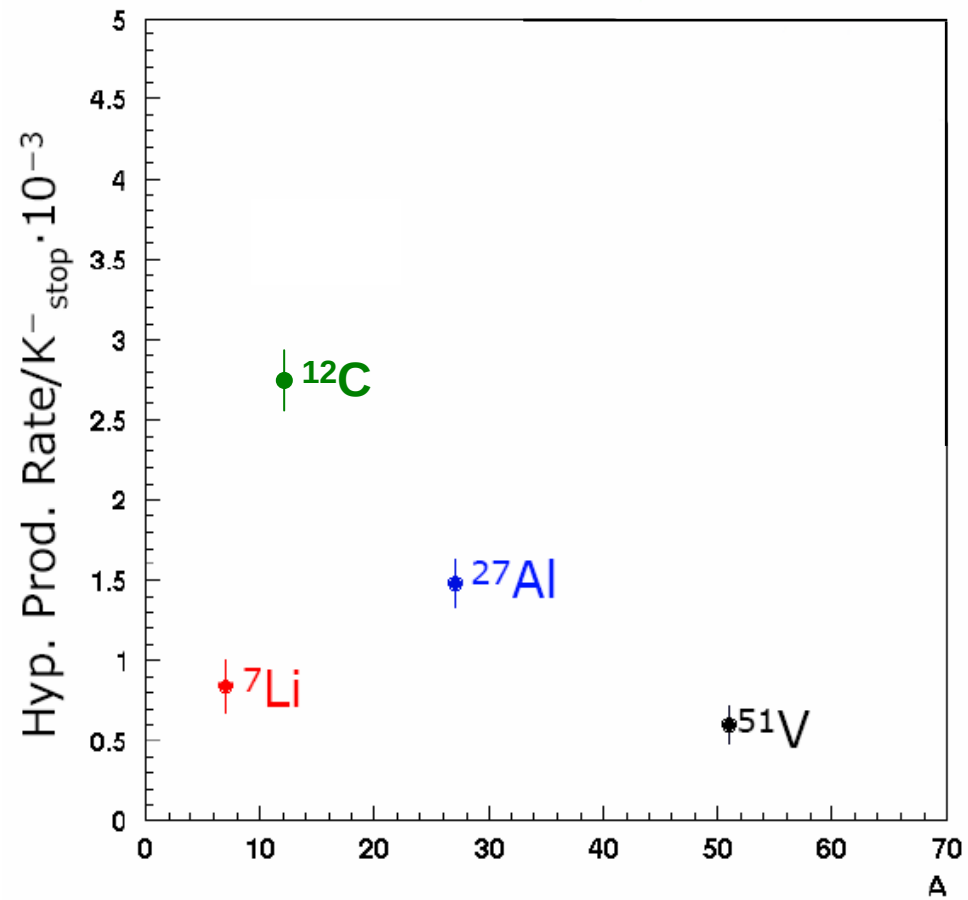
$^{51}V(\pi^+,K^+)^{51}_{\Lambda}V$

ΔE ~ 1.9 MeV FWHM

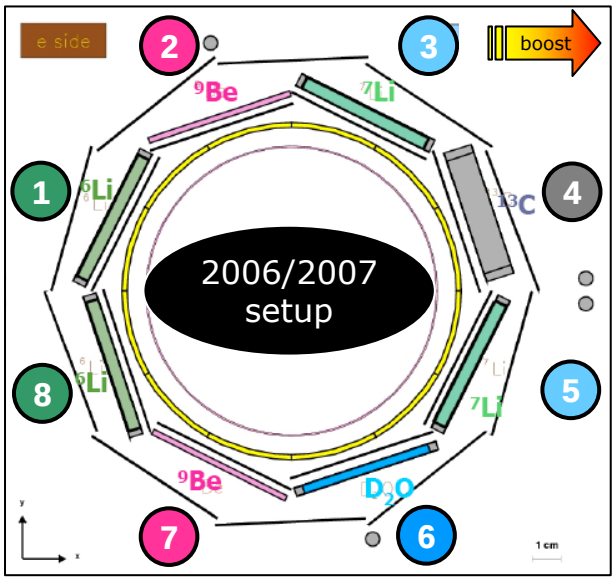


H. Hotchi *et al.*, Phys. Rev. C 64 (2001) 044302

Hypernuclear capture rates

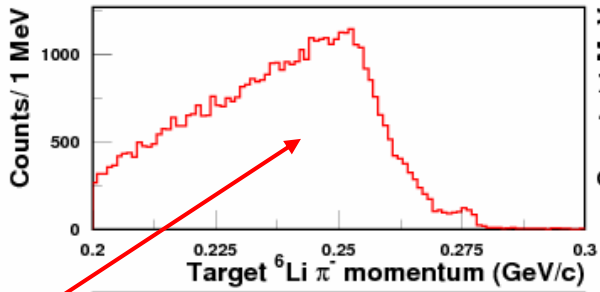


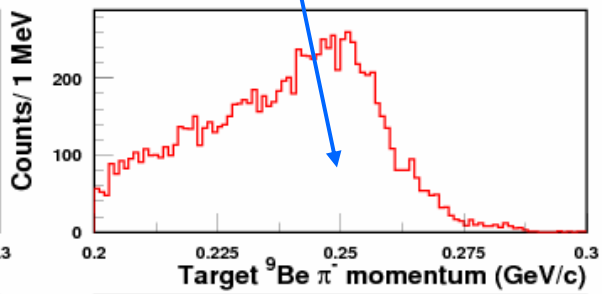
FINUDA 2nd round



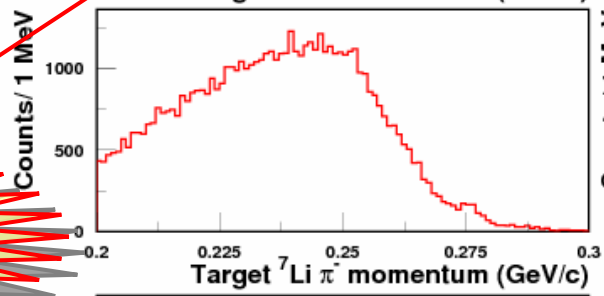
very preliminary

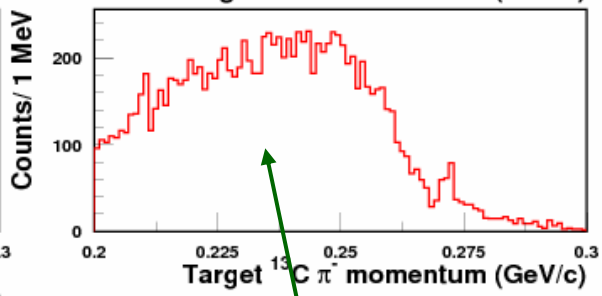
spectroscopy



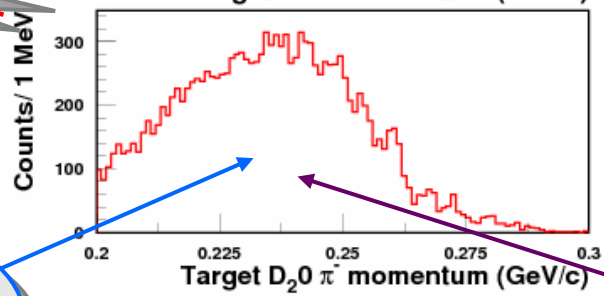


best suited for
$\bar{K}$ nuclear states





spectroscopy

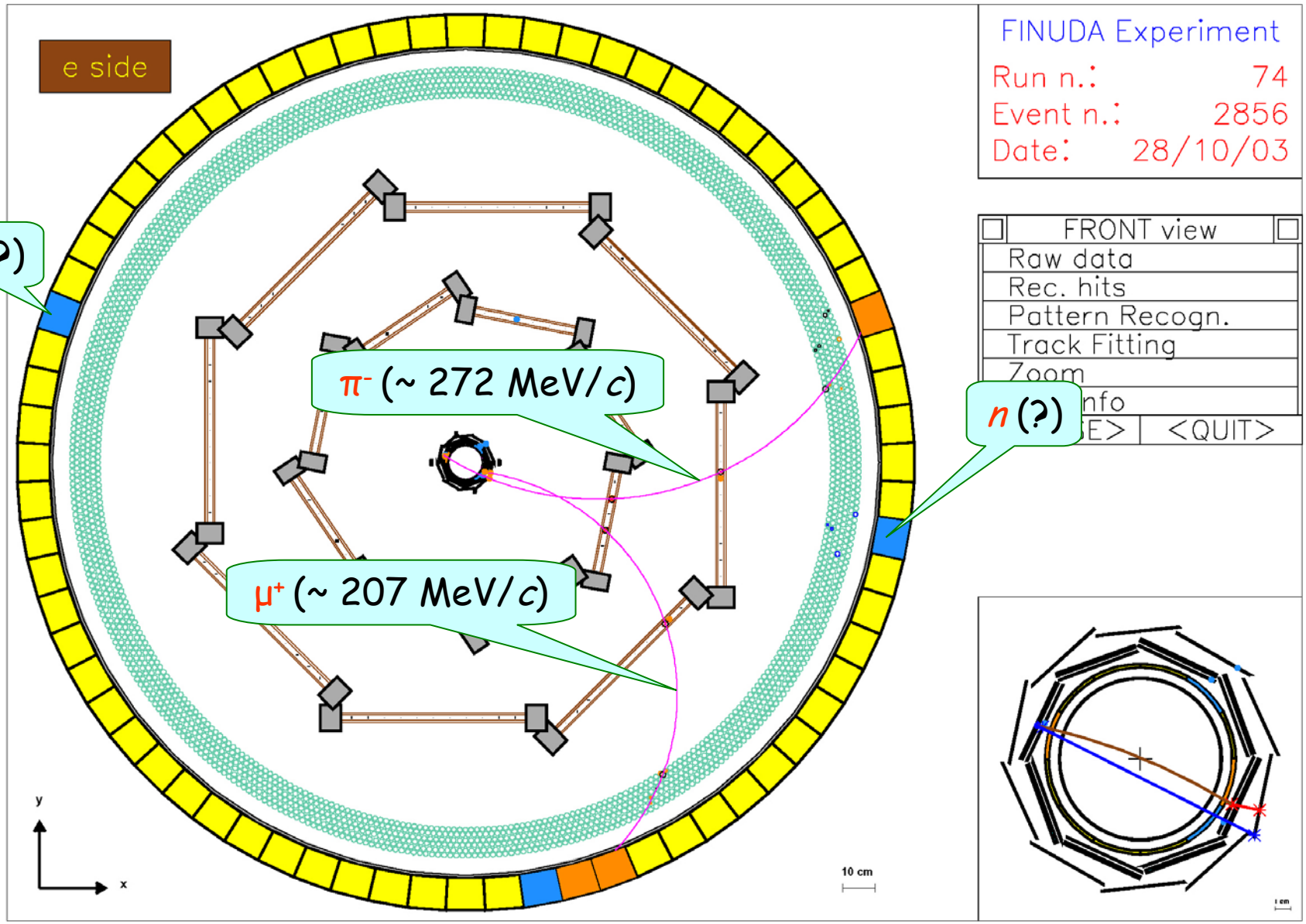


O_2 target

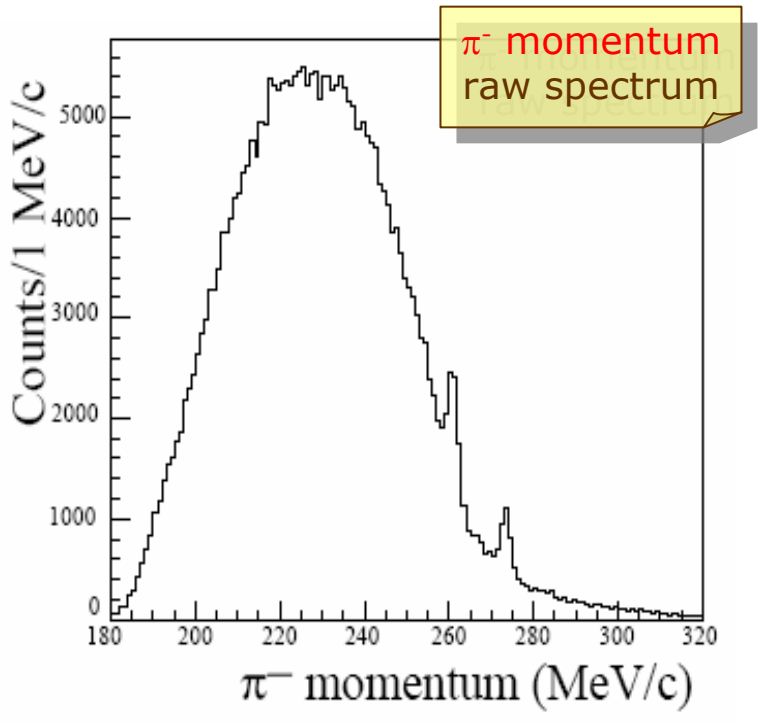
K^+ charge exchange reaction on D_2

non-mesonic weak decay

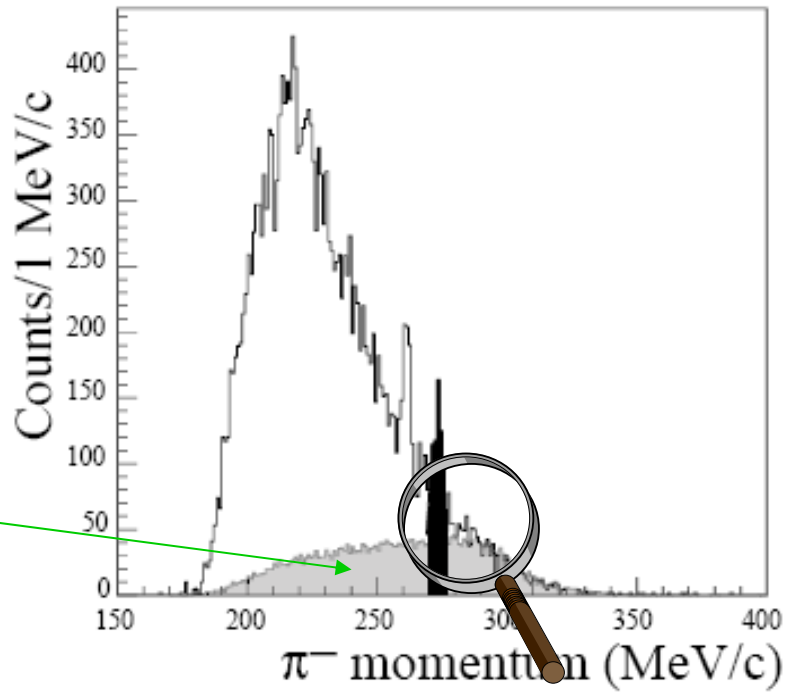
A n-induced non mesonic weak decay



$^{12}C_{\Lambda}$ non-mesonic decay



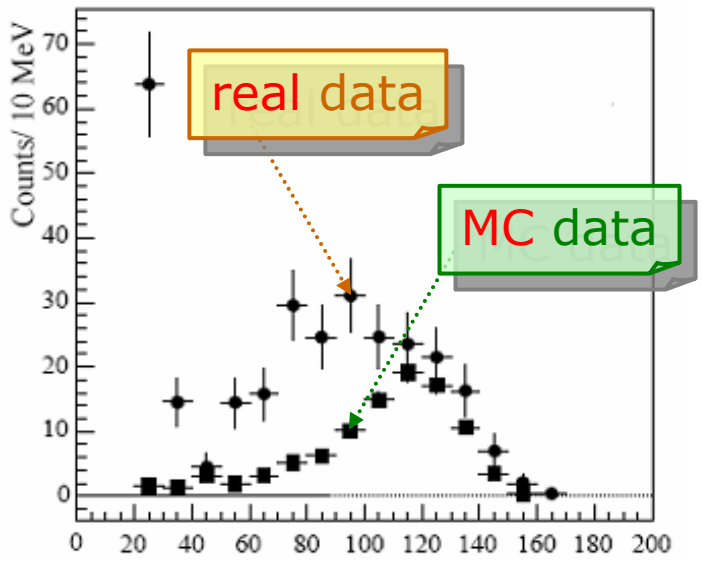
p detected
in coincidence

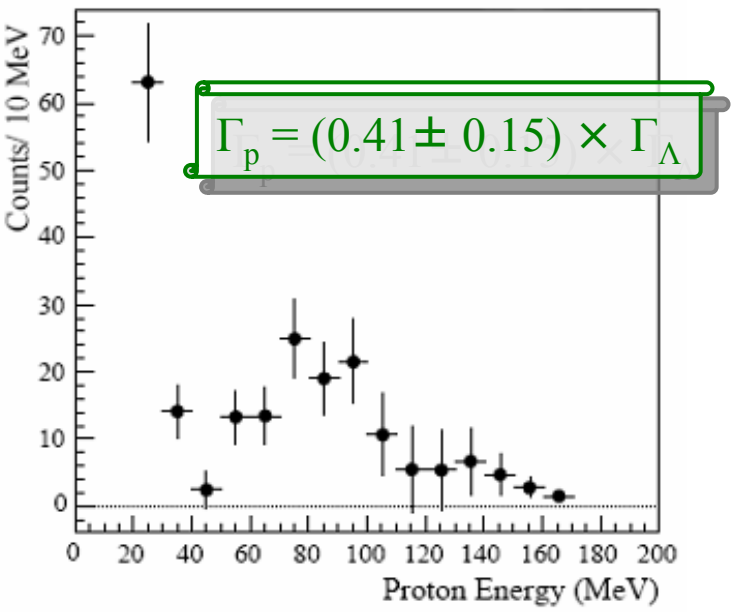


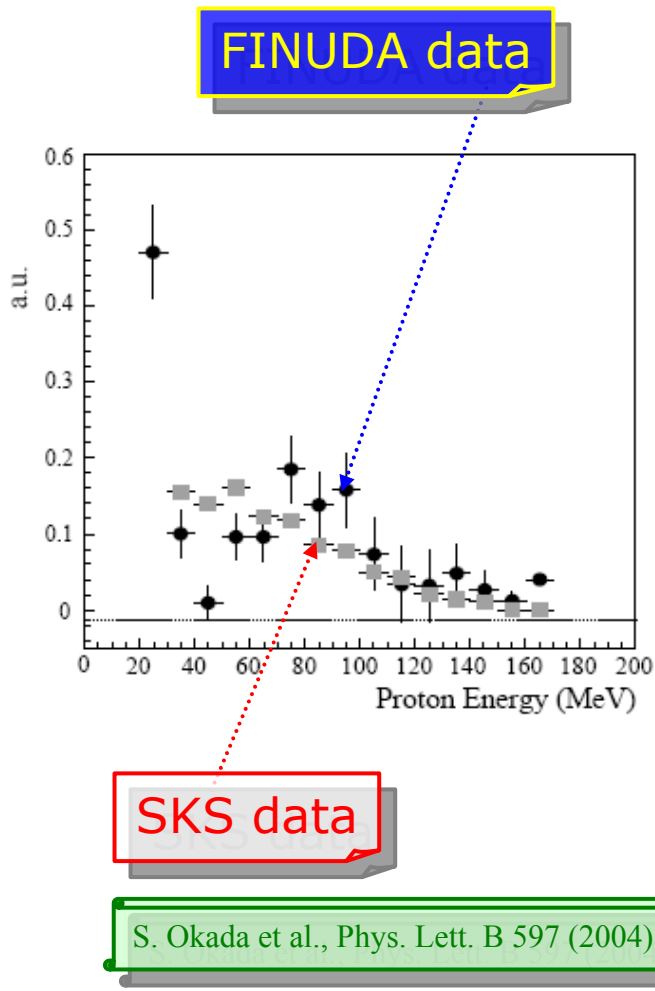
main background:

$K^- (np) \rightarrow \Sigma^- p$
$\Sigma^- \rightarrow n\pi^-$

$^{12}C_{\Lambda}$ non-mesonic decay

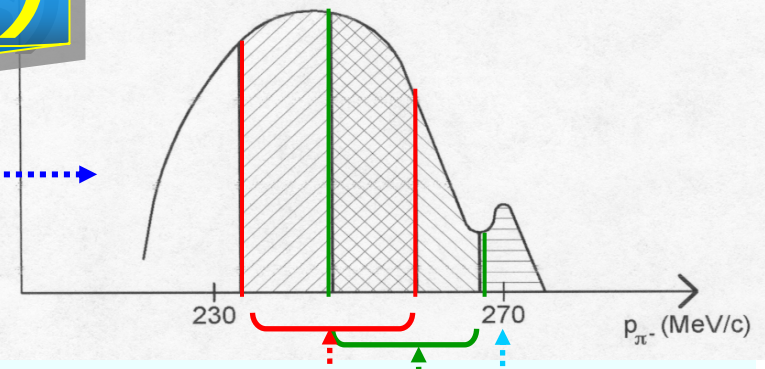






S. Okada et al., Phys. Lett. B 597 (2004) 249

$^4He_\Lambda$ (rare) decay(s)



Spectroscopized

$K^- + {}^6Li \rightarrow \pi^- + \ldots$

$^5_\Lambda He + p$

- τ
- Γ_p **(in coinc.) about 10/pb^{-1}**
- Γ_n **(in coinc.) a few/pb^{-1}**
- $\Gamma_{\pi-}$ **about 10^2/pb^{-1}**

$^4_\Lambda He + p + n$

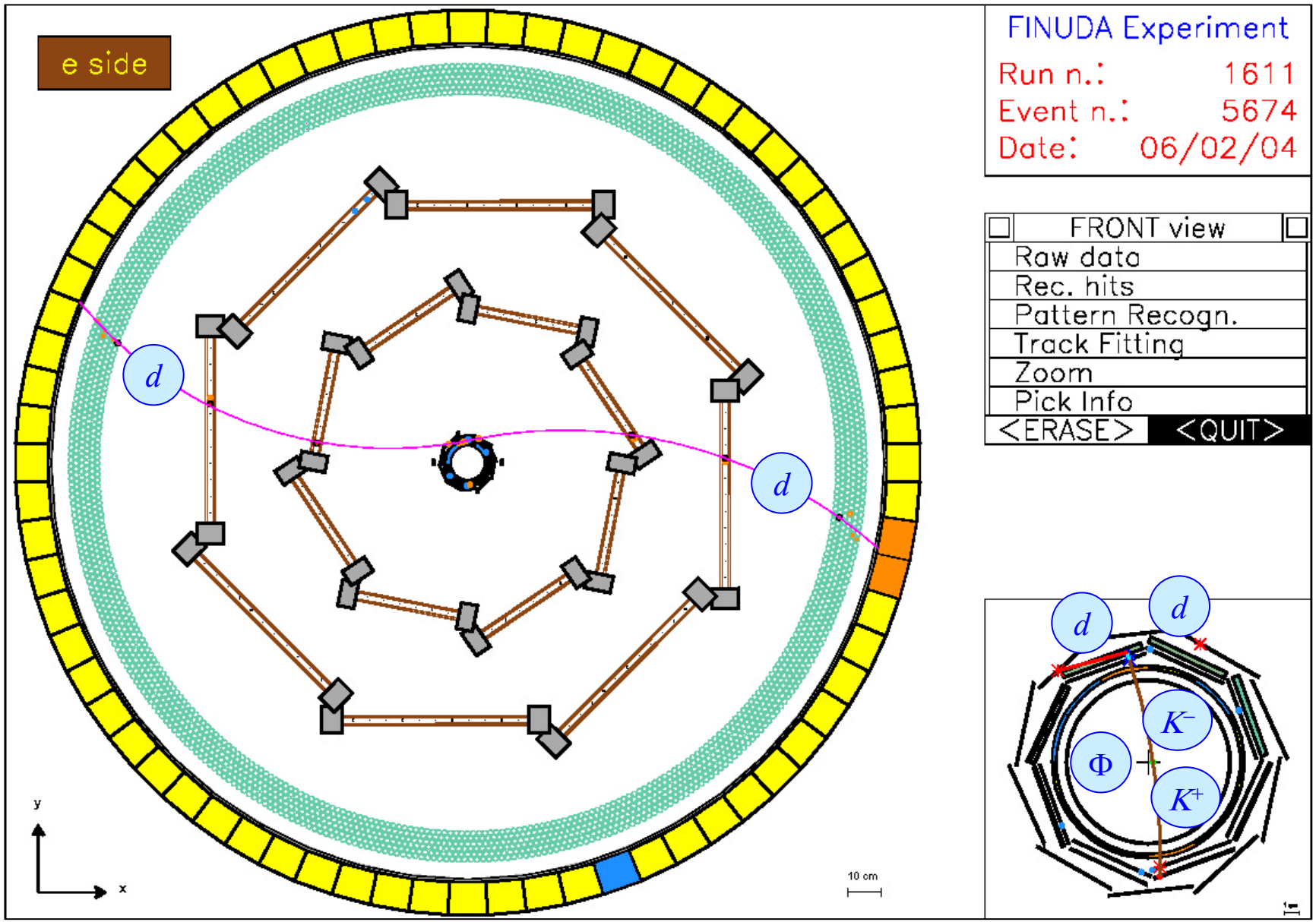
- $d + d$ **spectr.** (~0.3/pb^{-1} if B.R. ~10^{-3})
- $p + {}^3H$ **spectr.** (0.2/ pb^{-1} if B.R. ~10^{-3})
- $\pi^+ + n + {}^3H$ **many events** (~ 10^2/**pb^{-1}**)

how distinguishable?

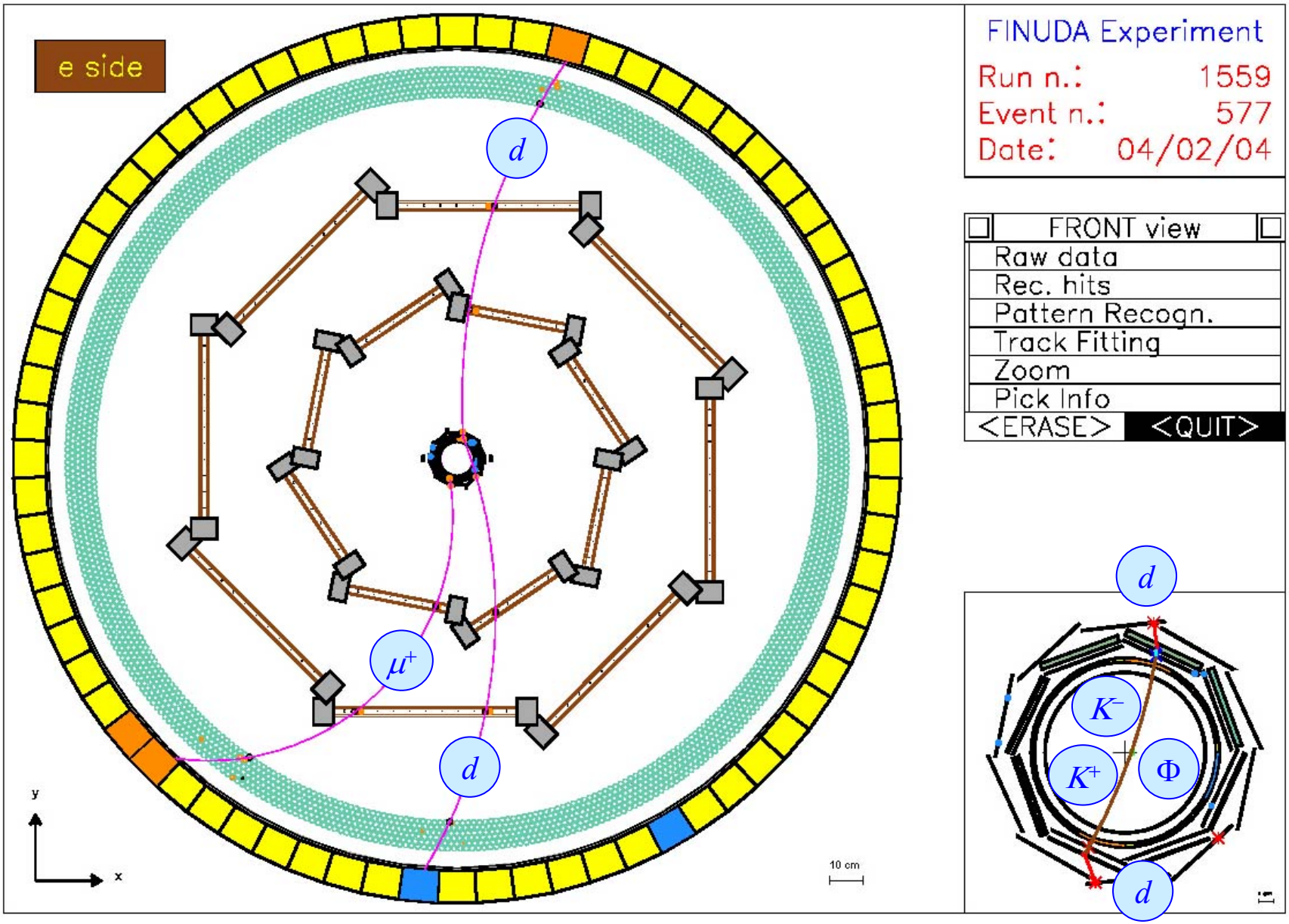
$^4_\Lambda H + p + p$

- $^4He + \pi^-$ spectr. (10^2/pb^{-1}) calibration

$^4He_\Lambda \rightarrow d + d$ (rare) decay



$^4He_\Lambda \rightarrow d + d$ (rare) decay



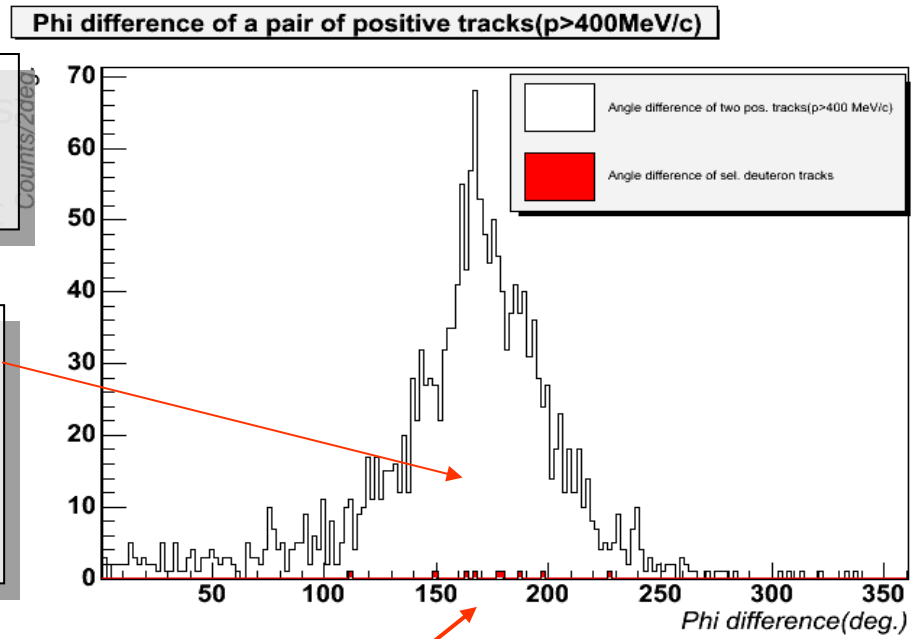
$^4He_\Lambda \rightarrow d + d$ (rare) decay

events with two positive tracks
from ^{6}Li targets
with momentum > 400 MeV/c

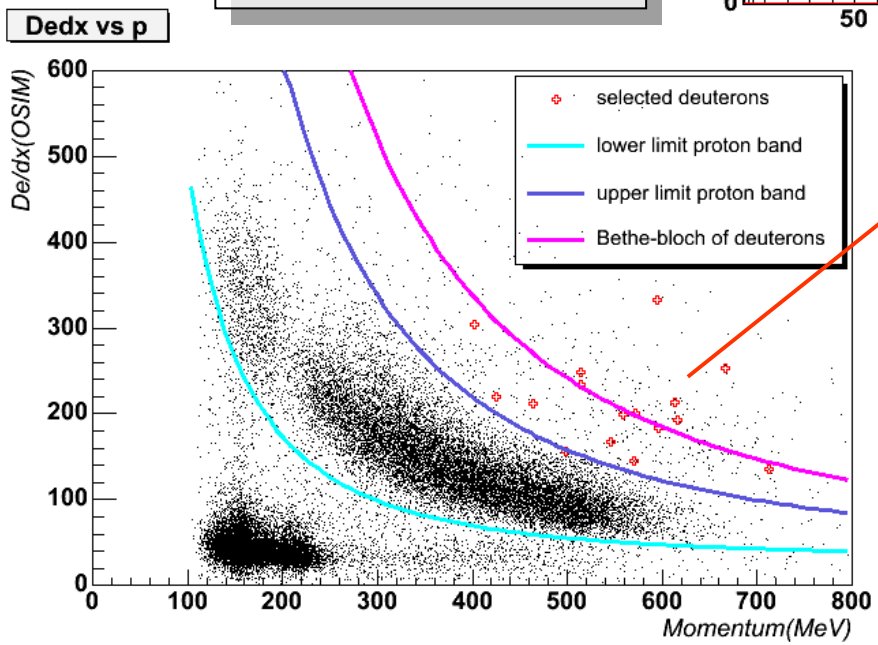
interesting events
to be recognized

$$^4_\Lambda He \rightarrow d + d$$

$$^4_\Lambda He \rightarrow d + p + n$$



azimuthal angle difference



candidates $^4_\Lambda He \rightarrow d + d$

accurate backtracking and
kinematic analysis needed

neutron-rich hypernuclei

neutron-rich hypernuclei

2 production mechanisms:

1) strangeness + double charge exchange

$$K^- + p \rightarrow \Lambda + \pi^0$$
$$\hookrightarrow \pi^0 + p \rightarrow n + \pi^+$$

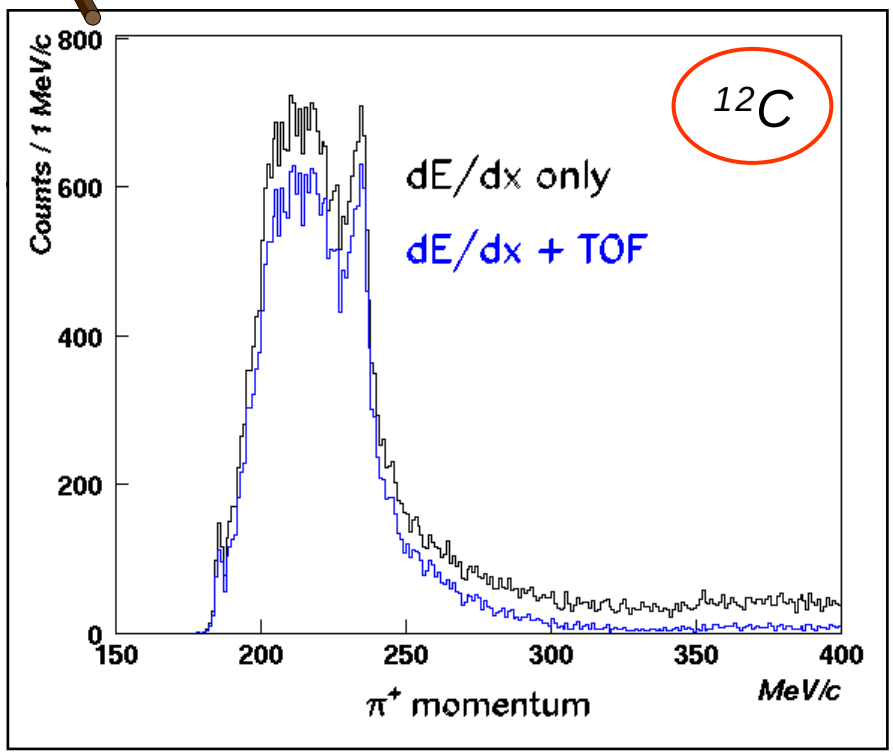
$$\pi^- + p \rightarrow \pi^0 + n$$
$$\hookrightarrow \pi^0 + p \rightarrow K^+ + \Lambda$$

two step processes!

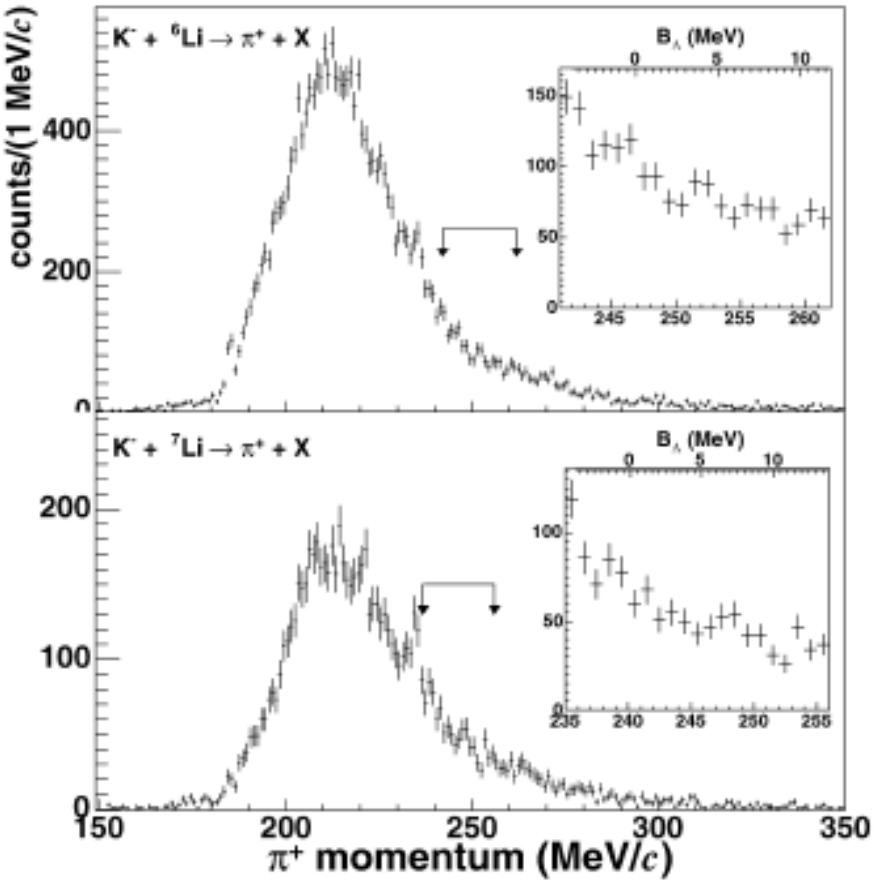
2) strangeness exchange wi coupling

$$K^- + p \rightarrow \Sigma^- + \pi^+$$
$$\hookrightarrow \Sigma^- + p \rightarrow \Lambda + n$$

$$\pi^- + p \rightarrow \Sigma^- + K^+$$
$$\hookrightarrow \Sigma^- + p \rightarrow \Lambda + n$$

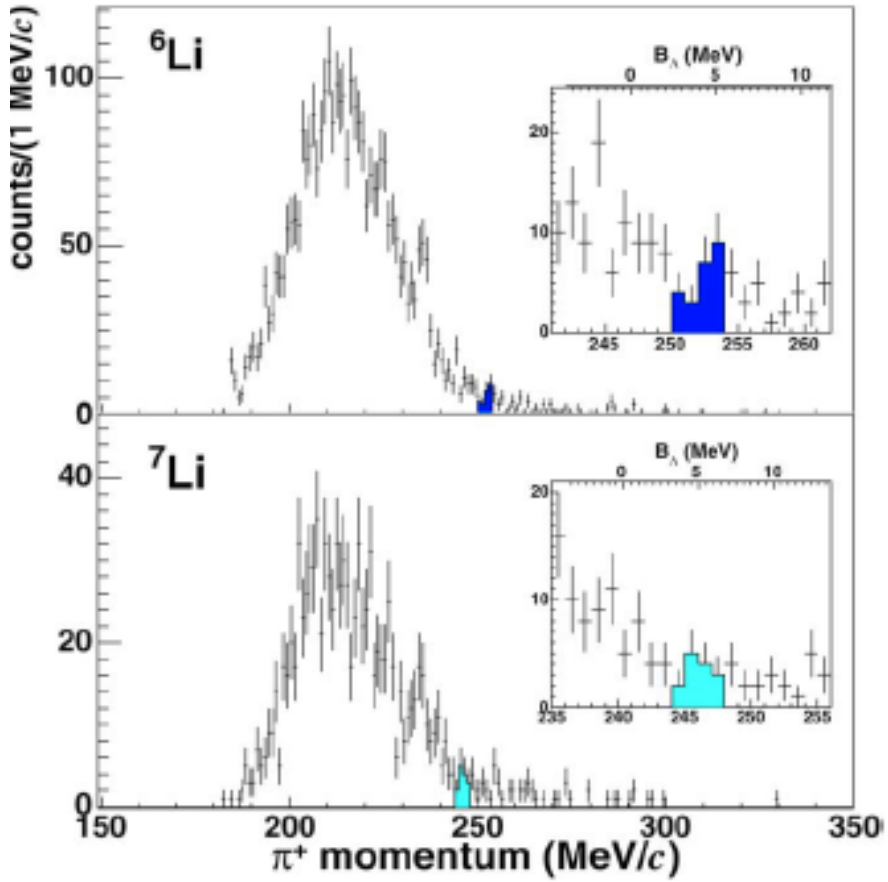


Search for NRH



main background:

$$K^- + p \rightarrow \Sigma^+ + \pi^-$$
$$\hookrightarrow n + \pi^+ \quad (\sim 130 < p_{\pi^+} < \sim 250\ \mathrm{MeV}/c)$$
$$K^- + pp \rightarrow \Sigma^+ + n$$
$$\hookrightarrow n + \pi^+ \quad (\sim 100 < p_{\pi^+} < \sim 320\ \mathrm{MeV}/c)$$



✓ background reduction

FINUDA results on NRH

$K^-_{stop} + {}^{12}C \rightarrow {}^{12}_{\Lambda}Be + \pi^+$

$p_{\pi^+} = 262.9 \text{ MeV}/c \pm 2\sigma_{p_{\pi^+}}$

$< (2.0 \pm 0.4_{stat}\, ^{+0.3}_{-0.1}\, _{syst}) \times 10^{-5}$

$< 6.1 \times 10^{-5}$

M. Kubota *et al.*, Nucl. Phys. A 602 (1996) 327

$K^-_{stop} + {}^{6}Li \rightarrow {}^{6}_{\Lambda}H + \pi^+$

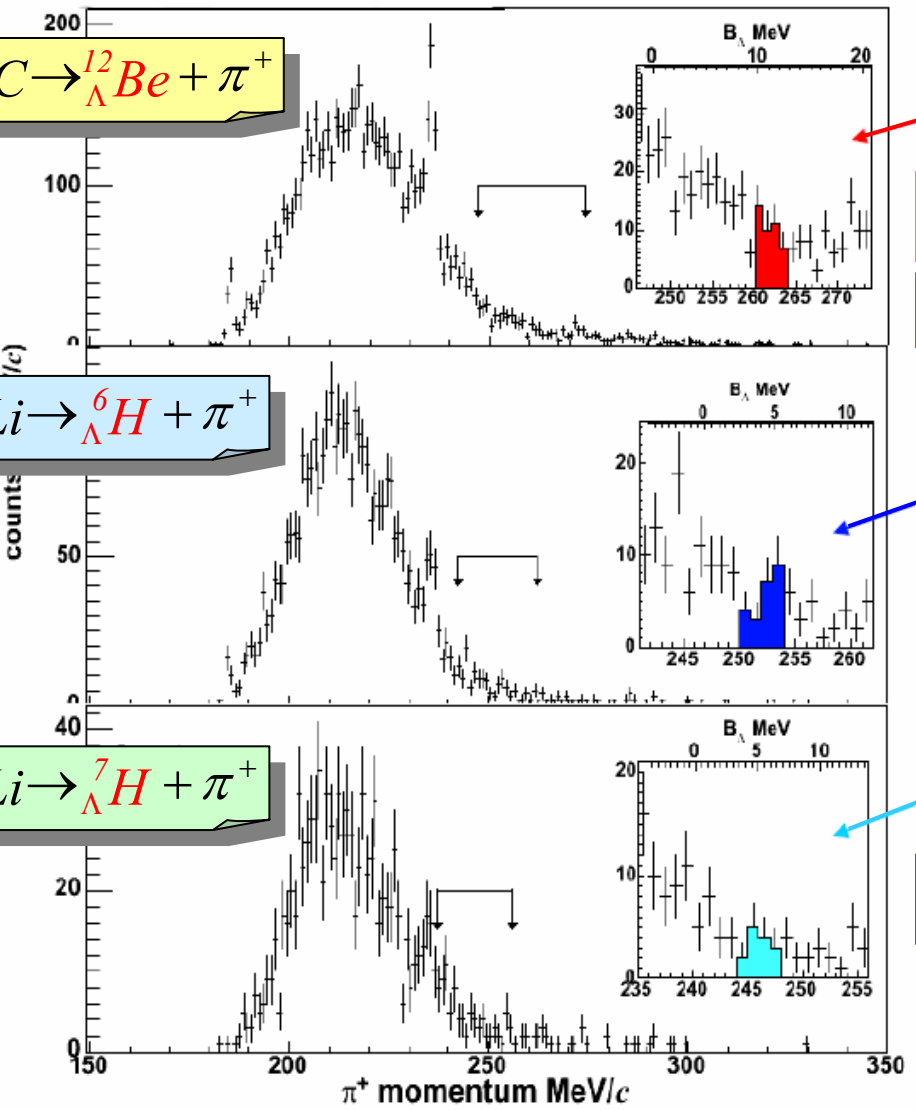
$p_{\pi^+} = 249.1 \text{ MeV}/c \pm 2\sigma_{p_{\pi^+}}$

$< (2.5 \pm 0.4_{stat}\, ^{+0.4}_{-0.1}\, _{syst}) \times 10^{-5}$

$K^-_{stop} + {}^{7}Li \rightarrow {}^{7}_{\Lambda}H + \pi^+$

$p_{\pi^+} = 246.4 \text{ MeV}/c \pm 2\sigma_{p_{\pi^+}}$

$< (4.5 \pm 0.9_{stat}\, ^{+0.4}_{-0.1}\, _{syst}) \times 10^{-5}$

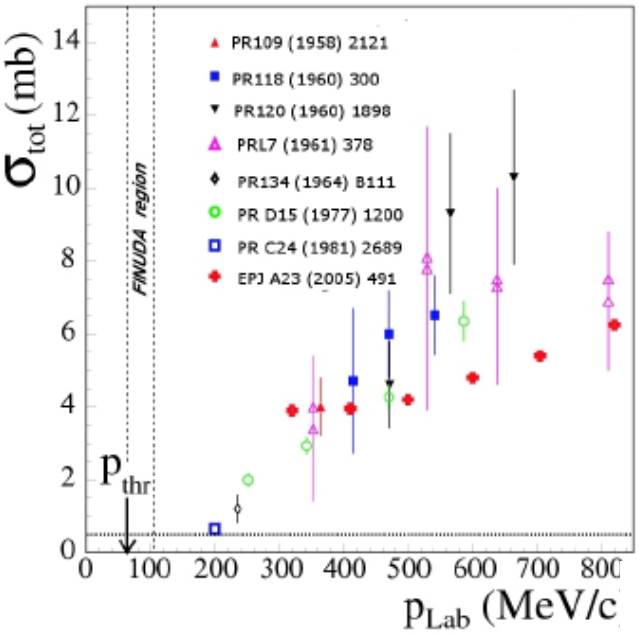


M. Agnello *et al.*, Phys. Lett. B 640 (2006) 145

low-energy K^+ interactions

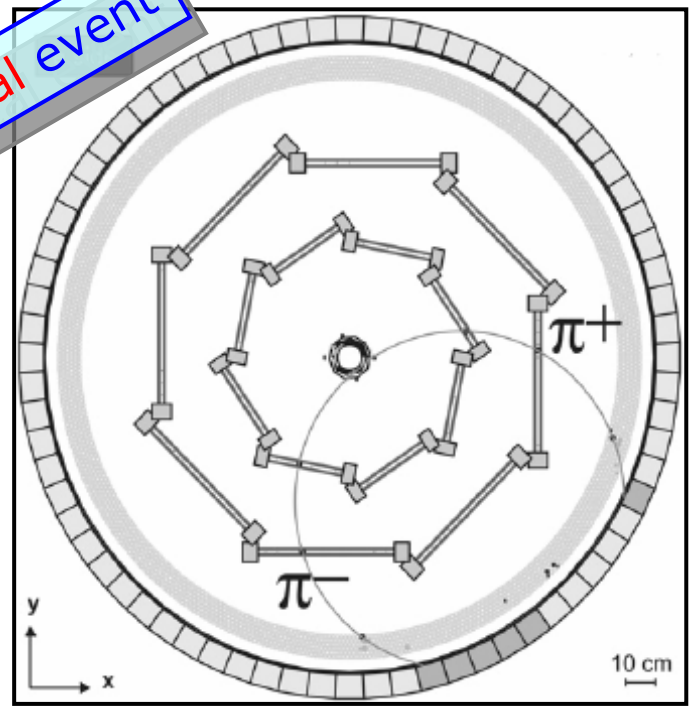
(K^+,K^0) charge exchange reaction

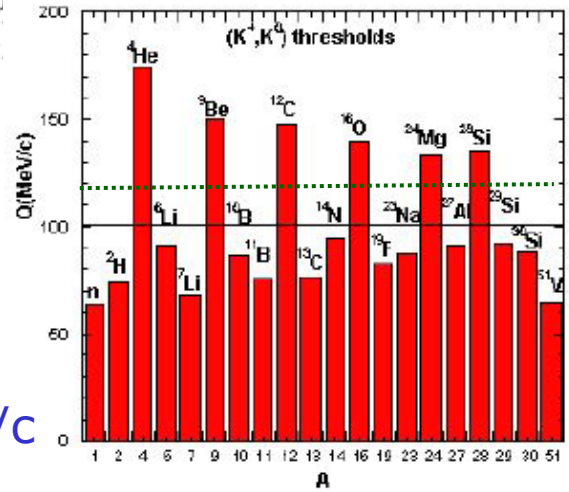
$$K^+ + n \rightarrow K^0_S + p$$

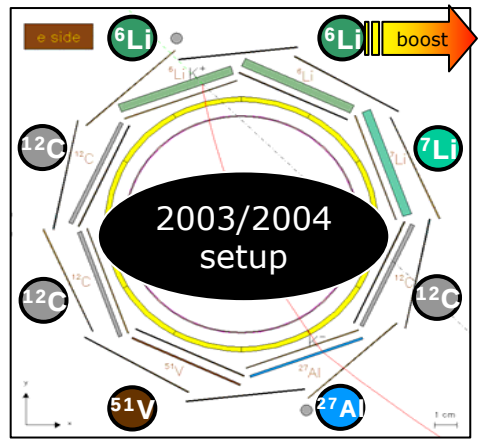


$$\pi^+ + \pi^-$$

real event







th_{cex} = 63.8 MeV/c

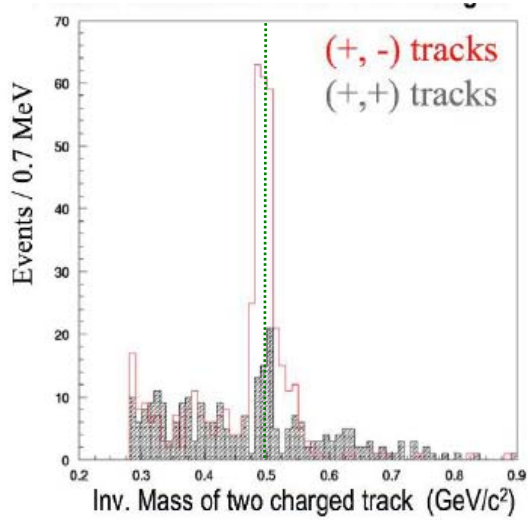
(K^+, K^0) charge exchange reaction

main background:

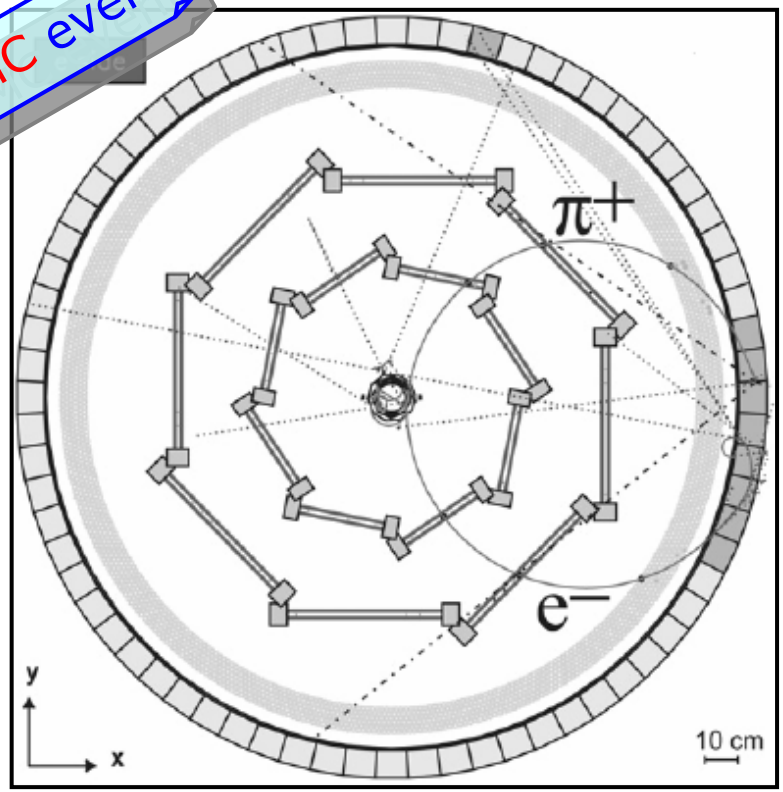
$$K^+ \rightarrow \pi^+ + \pi^0$$

$$\gamma + \gamma$$

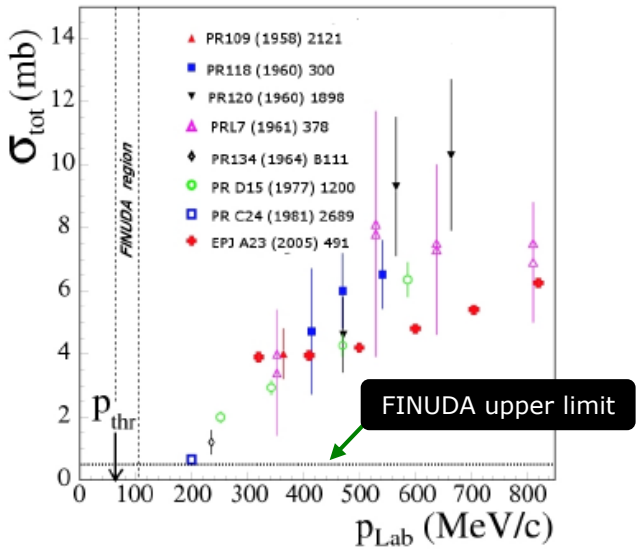
$$\gamma \rightarrow e^+ + e^-$$



MC event



$$\sigma[^7Li(K^+, K^0)^7Be] \leq 2\ mb$$

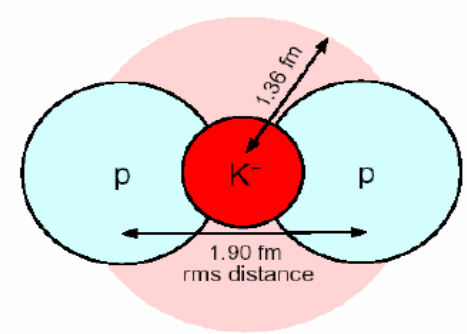


Search for $\bar{K}$ nuclear bound states

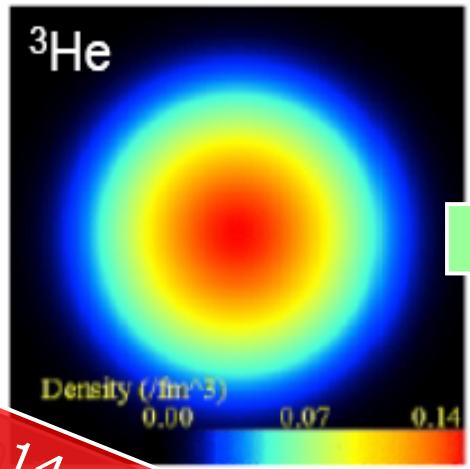
$\bar{K}$ nuclear bound states

few nucleon clusters gathered together by a $\bar{K}$

☛ deeply bound?



nuclear density



+ $\bar{K}$

0.14 / fm³

medium effect

- hadron's mass and properties change
- (partial) chiral symmetry restoration

astrophysical interest

- condensed strange nuclear matter
- constituent of neutron star cores

A.Doté *et al.*, Phys. Rev. C 70 (2004) 044313

$\bar{K}$ nuclear bound states: theoretical debate

deep or shallow $\bar{K}$-nucleus potential?

deep:
- strong B ≈ 150–200 MeV
- small Γ ≈ 10–20 MeV

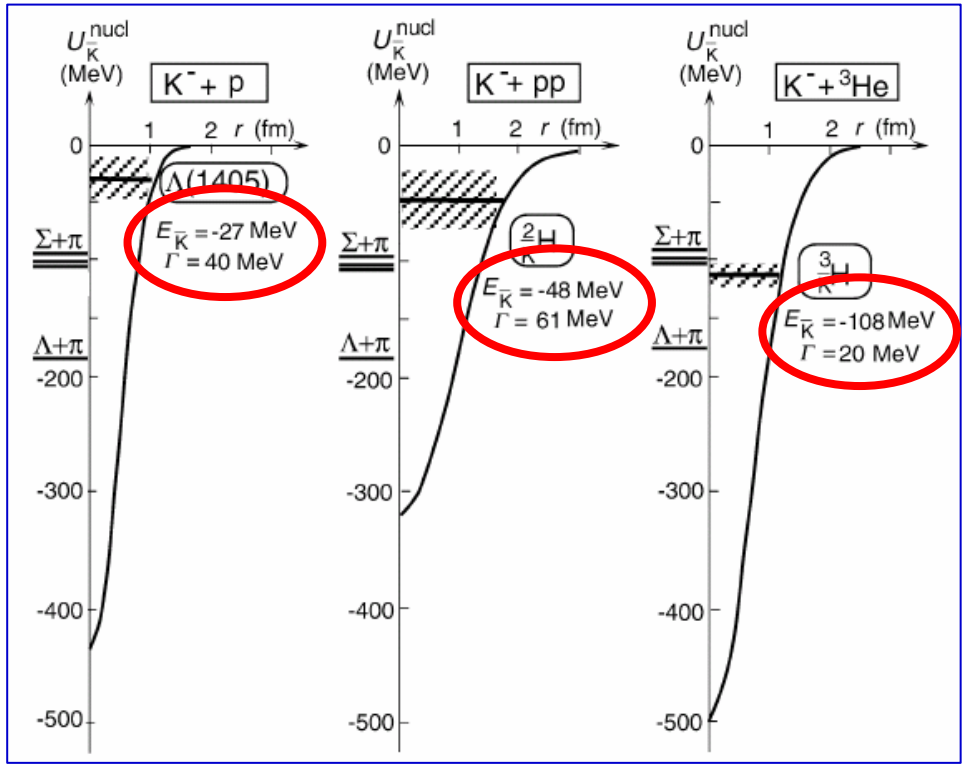
shallow:
- weak B ≈ 50–75 MeV
- large Γ ≈ 80–100 MeV

density dependent:
- strong B ≈ 100-200 MeV
- small Γ ≥ 50 MeV

The Akaishi-Yamazaki approach

- $\bar{K}\mathcal{N}$ scattering lengths
- energy level shift and width of kaonic hydrogen
- Λ(1405) binding energy and width

I = 0 $\bar{K}\mathcal{N}$ interaction very attractive

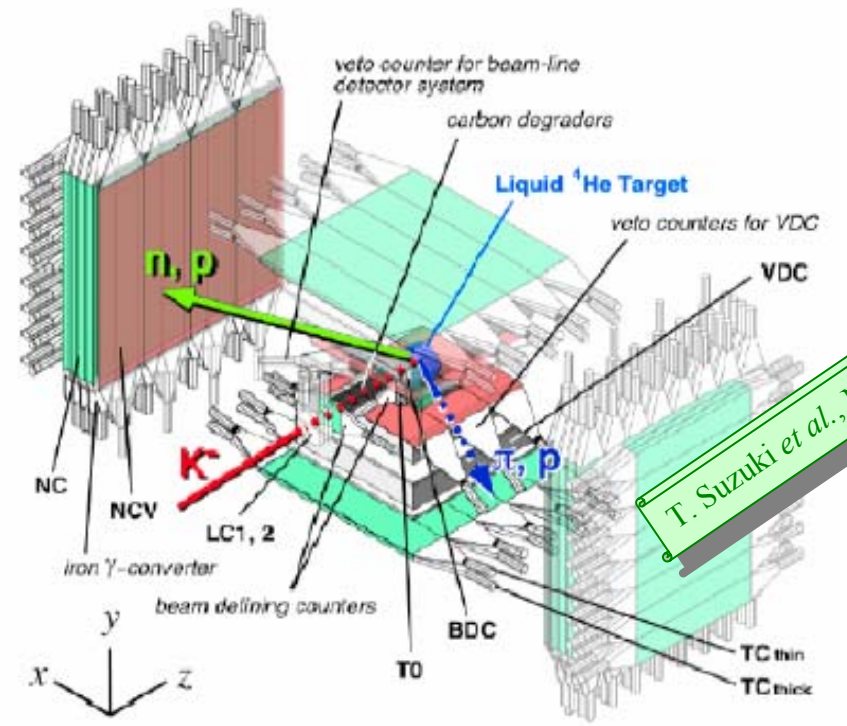


KEK-PS-E471 evidence for strange tribaryons

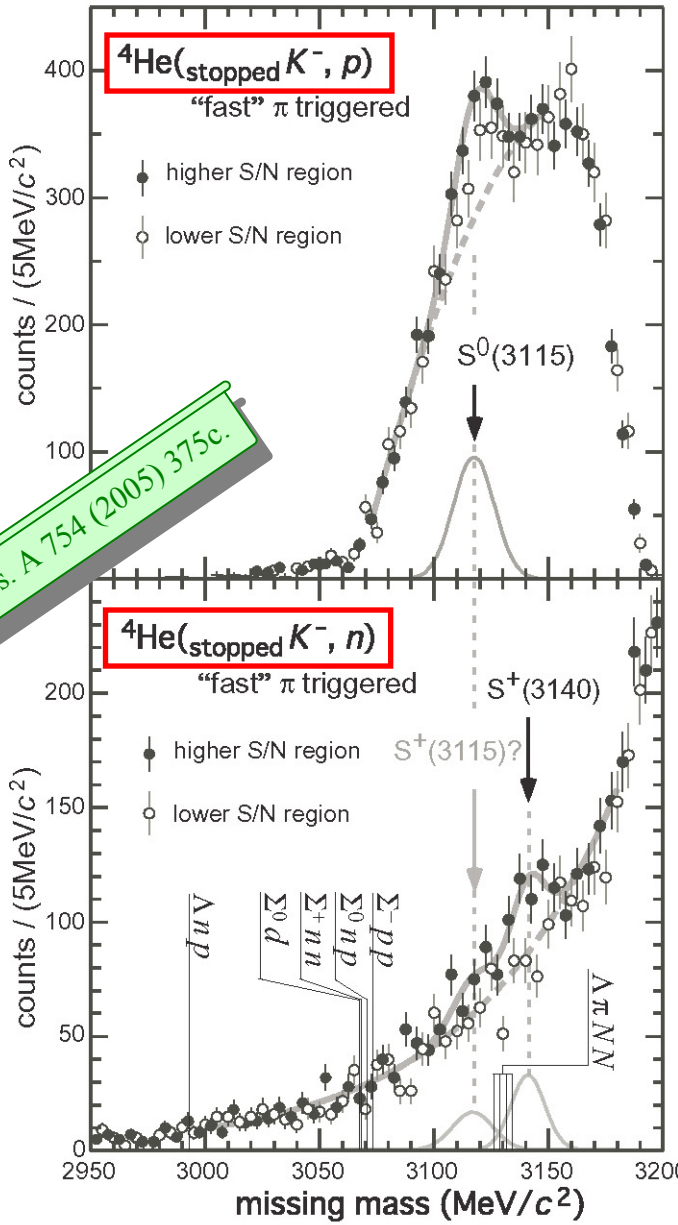
$$^4He(K^-_{stop}, p)S^0(3115) \equiv K^- pnn$$

I = 1

B = 193 MeV
Γ ≤ 21 MeV



T. Suzuki *et al.*, Nucl. Phys. A 754 (2005) 375c.

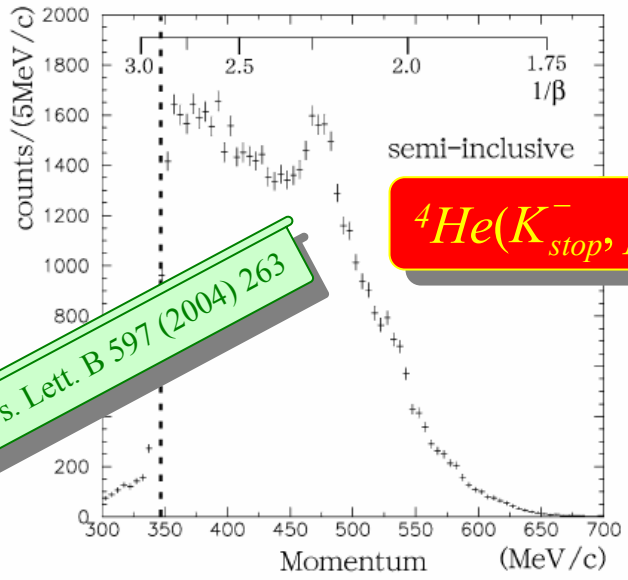


$$^4He(K^-_{stop}, n)S^+(3140) \equiv K^- ppn$$

I = 1

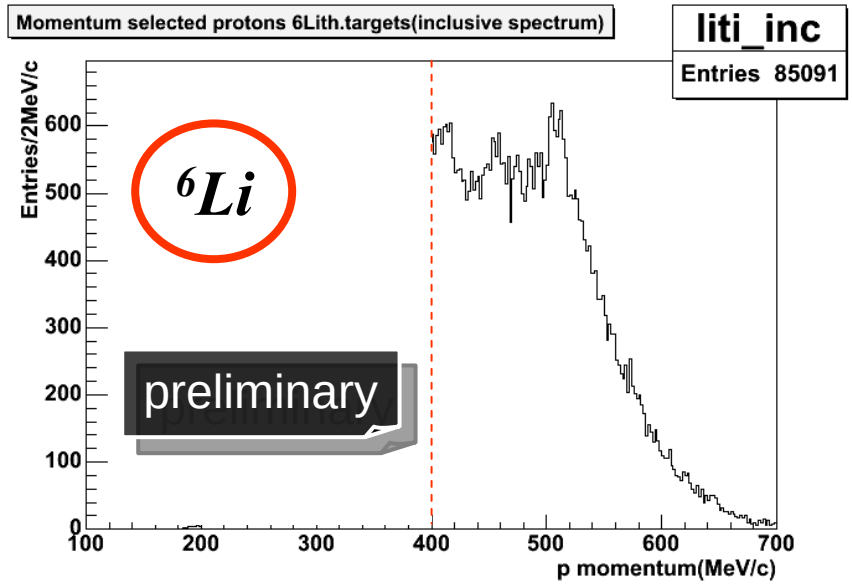
B = 169 MeV
Γ ≤ 21 MeV

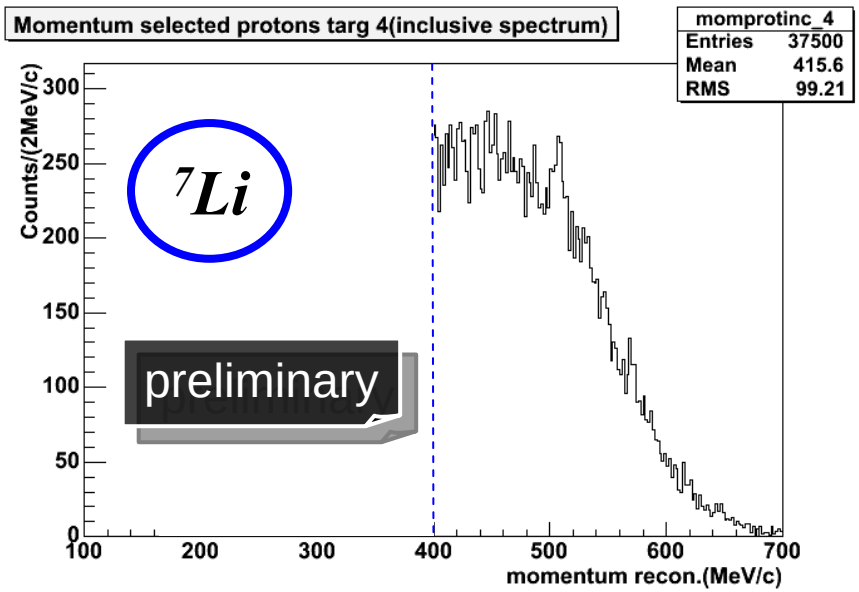
FINUDA vs. KEK-E471

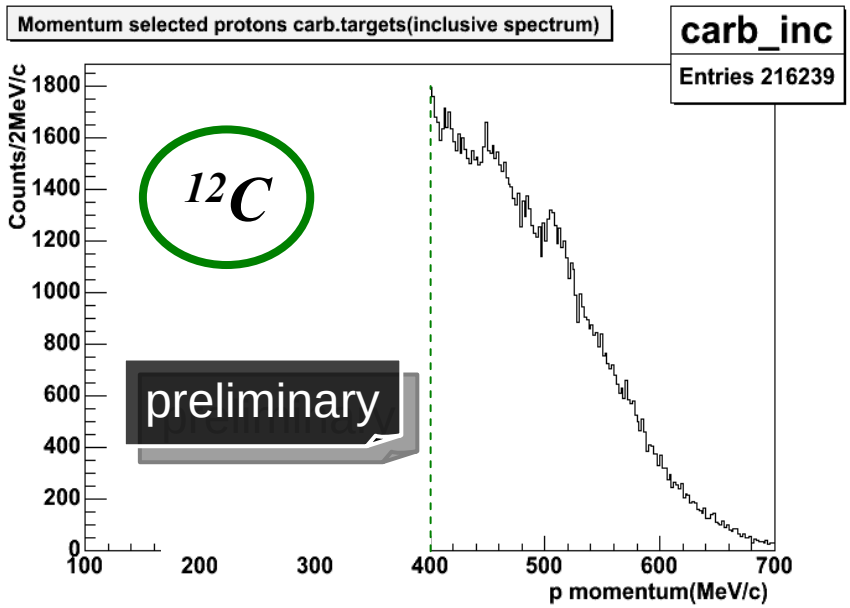


$^4He(K^-_{stop}, p)$

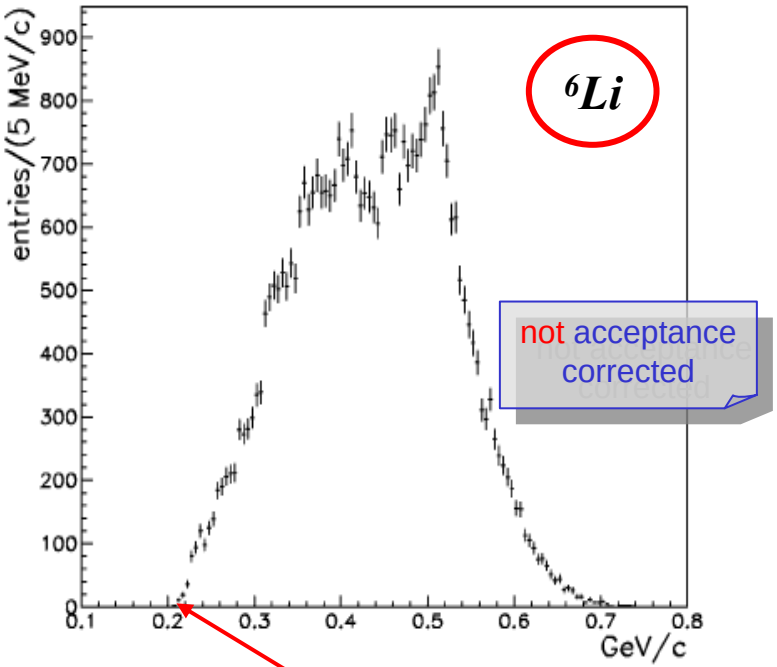
T. Suzuki *et al.*, Phys. Lett. B 597 (2004) 263

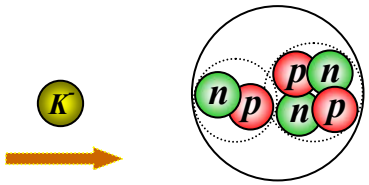




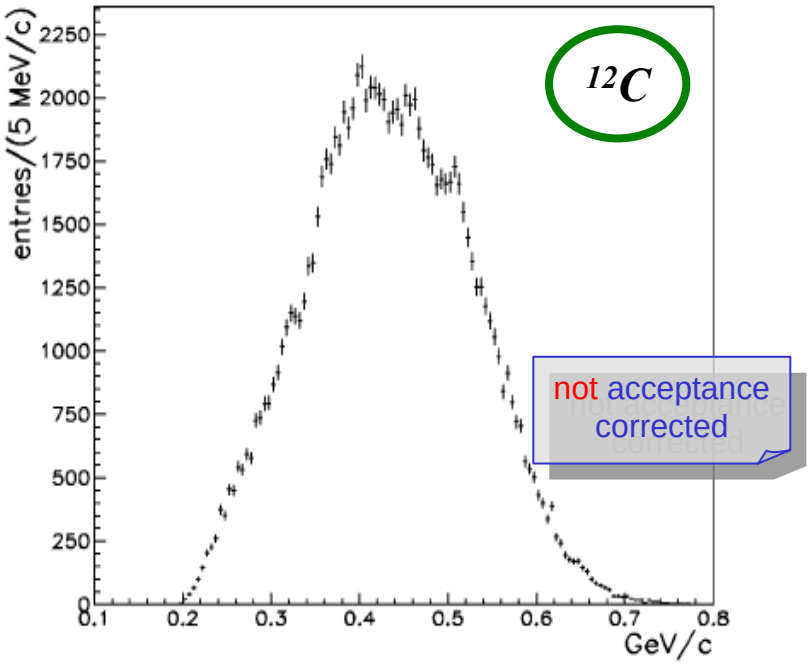


FINUDA vs. KEK-E471



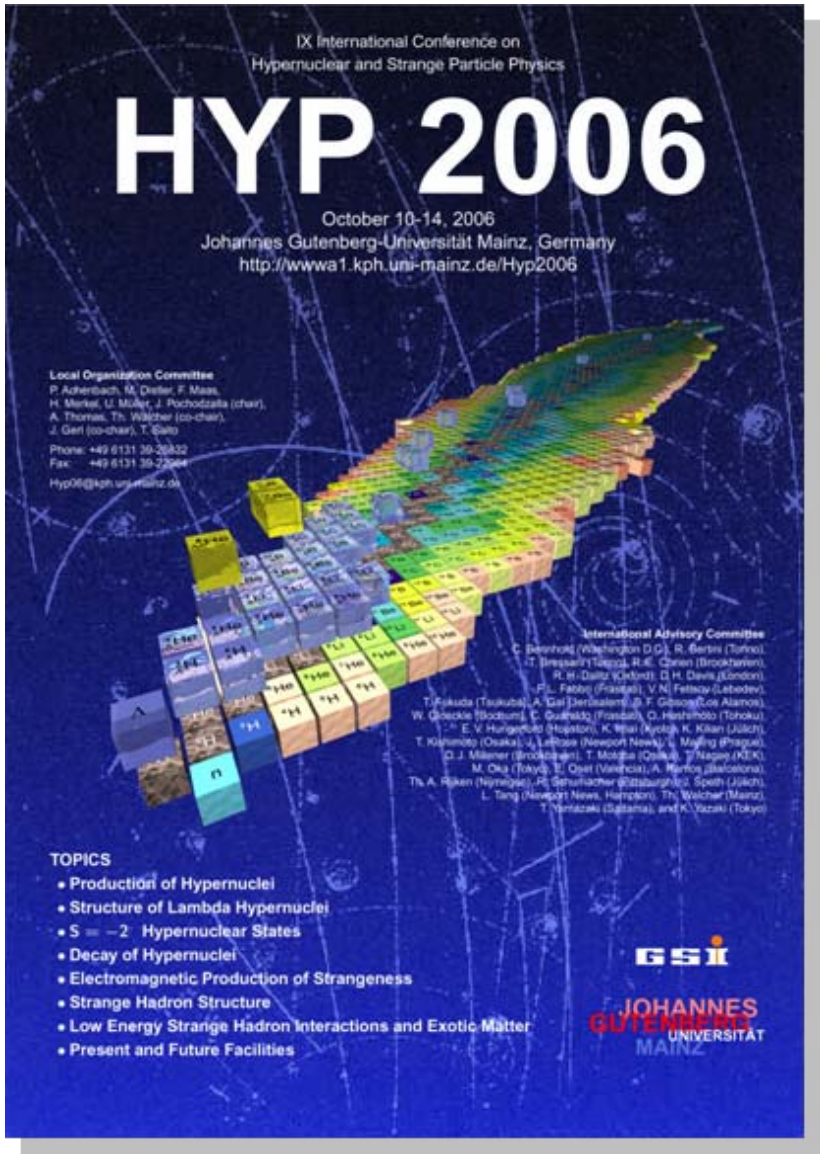


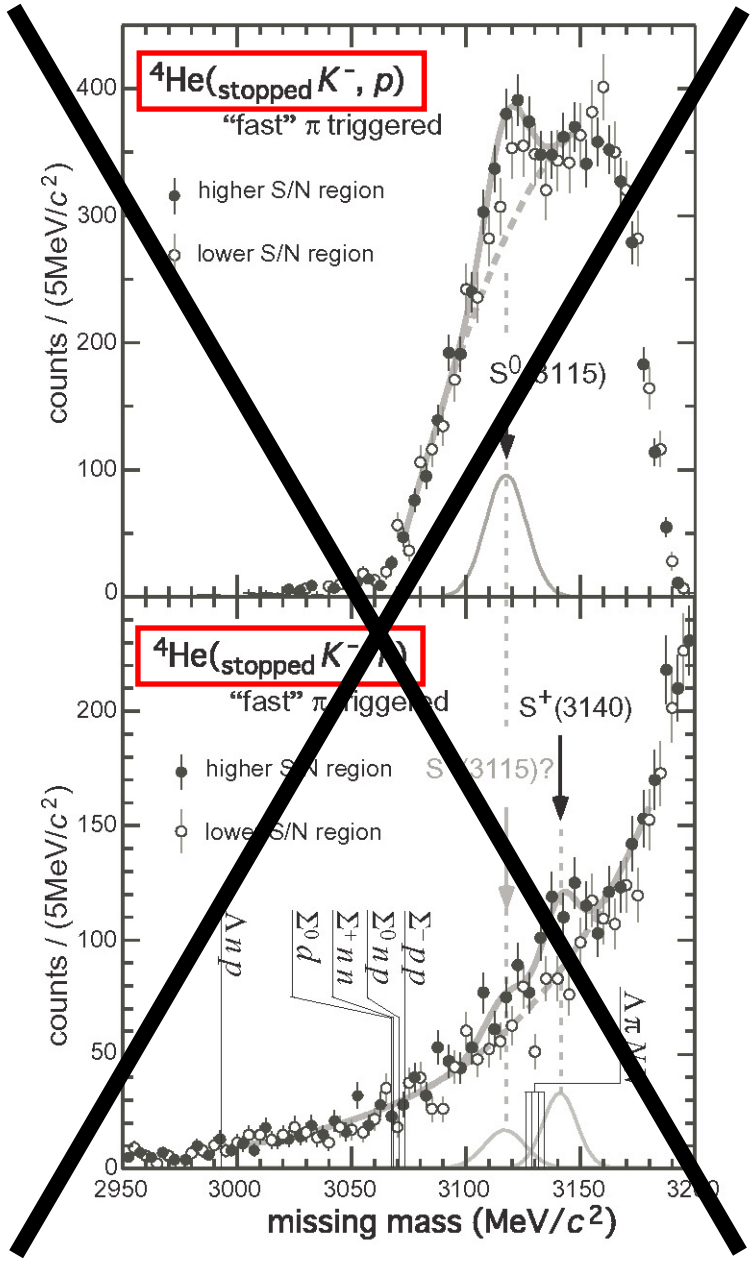
$$K^- \text{“}d\text{”} \rightarrow \Sigma^- p$$



M. Agnello *et al.*, Nucl. Phys. A 775 (2006) 35

KEK-PS-E471 evidence for strange tribaryons





kaon-nuclear states search with Λ tagging

- missing-mass spectroscopy:

$$K^-_{stop} + {}^4He \rightarrow \begin{cases} K^- ppn + n \\ K^- pnn + p \end{cases}$$

☛ a kaonic nucleus emits a **hyperon** in its decay

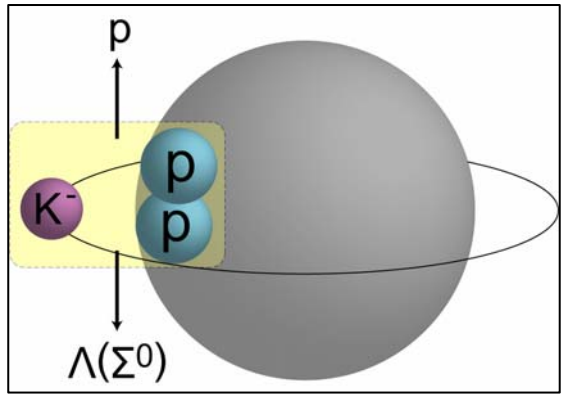
- invariant-mass spectroscopy:

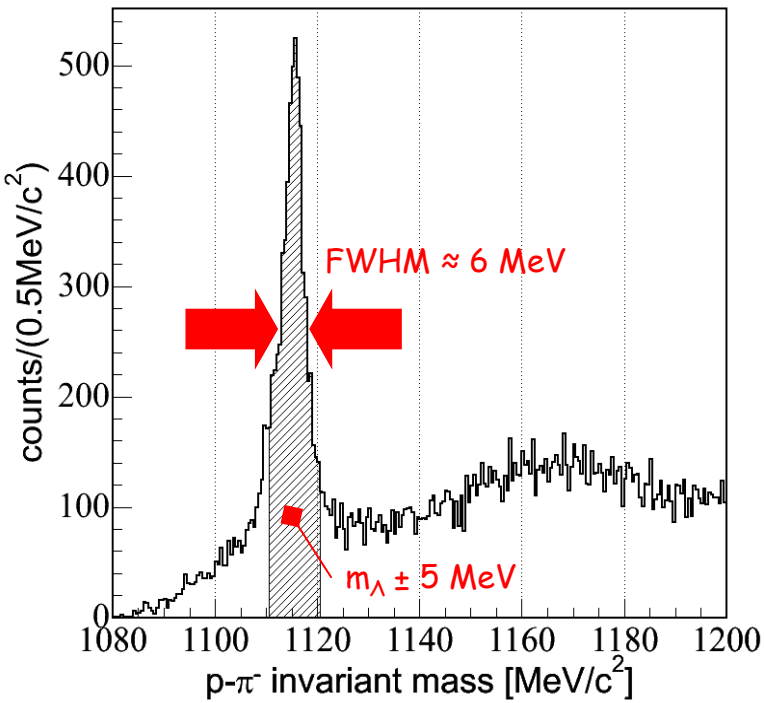
$$K^- pp \rightarrow \Lambda + p, \quad K^- ppn \rightarrow \Lambda + d\ (p+n)$$

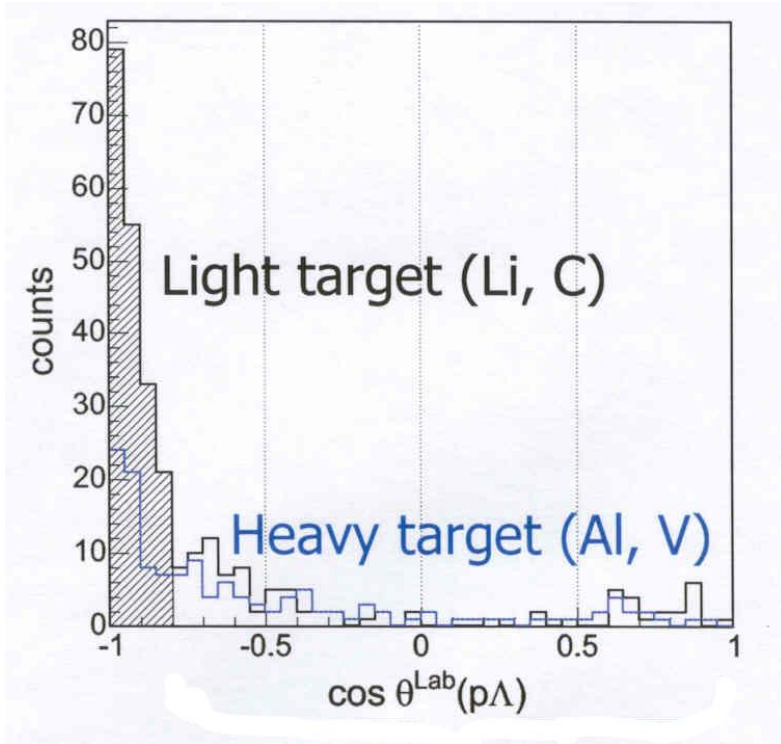
FINUDA search for B=2 kaon-nuclear states

$$A(K^-_{stop}, \Lambda p)A'$$

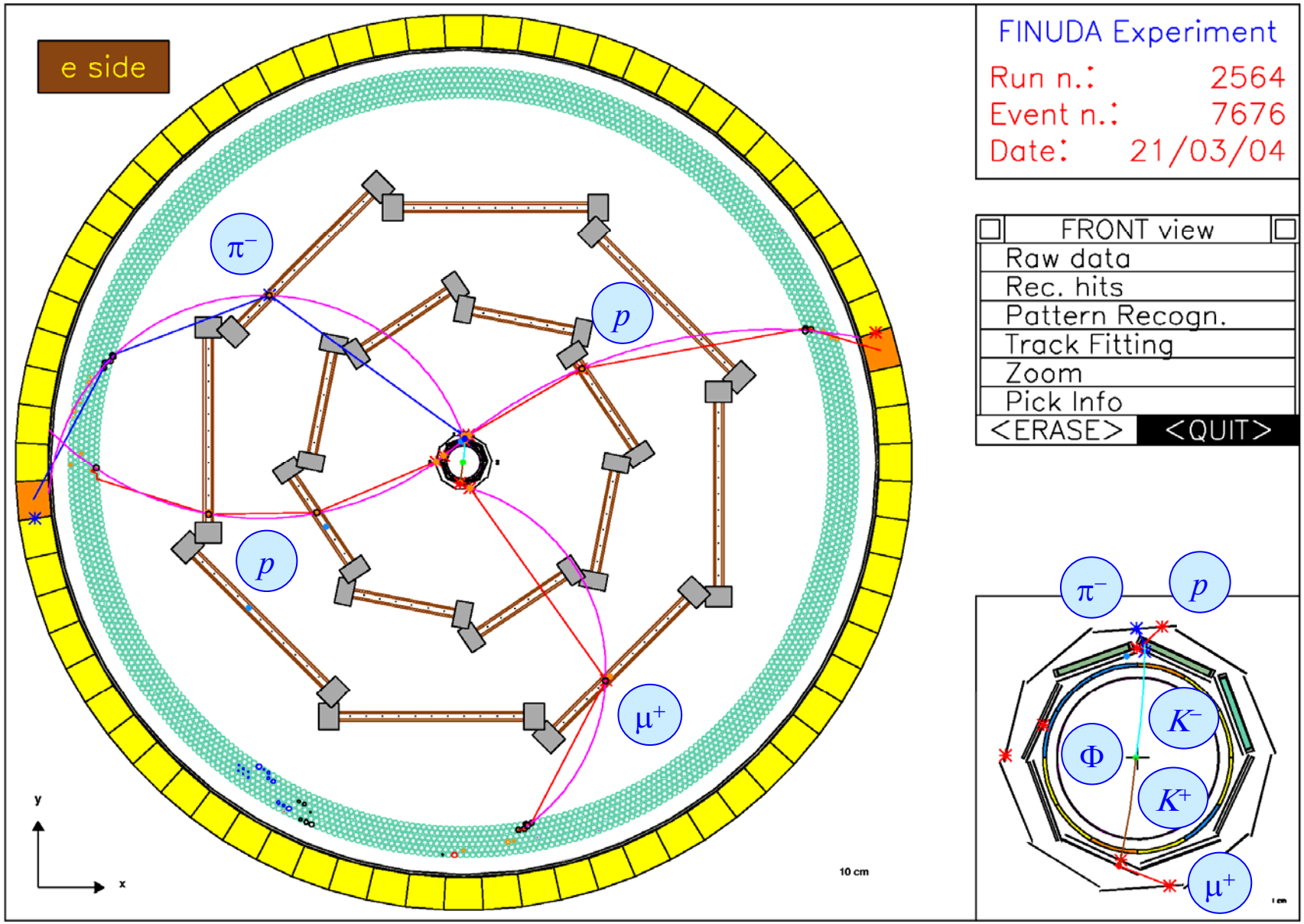
$$K^- pp \rightarrow [K^- pp] \rightarrow \Lambda p$$





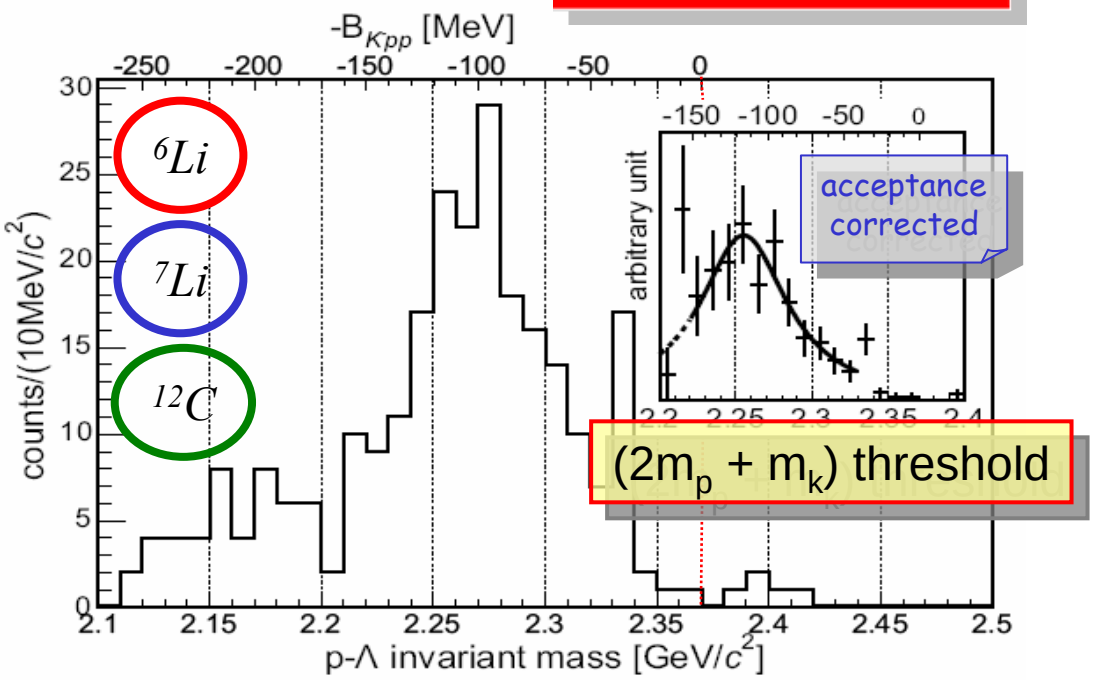


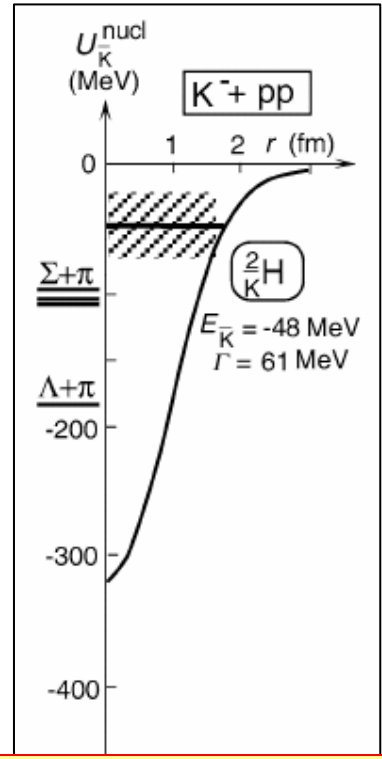
"K⁻pp" → Λp → ppπ⁻ candidate event



FINUDA search for B=2 kaon-nuclear states

$A(K^-_{stop}, \Lambda p)A'$





$$B = 115\,^{+6}_{-5}\,^{+3}_{-4}\ \mathrm{MeV}$$

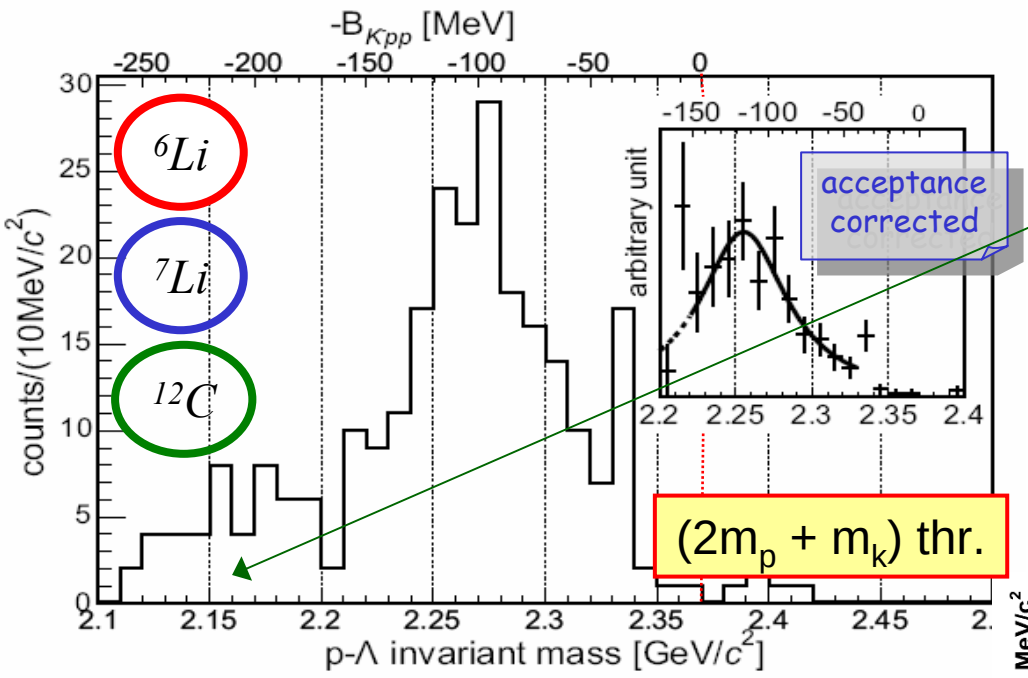
$$\Gamma = 67\,^{+14}_{-11}\,^{+2}_{-3}\ \mathrm{MeV}$$

$$M = 2255 \pm 9\ \mathrm{MeV/c^2}$$

$$Y \approx 0.1\%/K^-_{stop}$$

M. Agnello *et al.*, Phys. Rev. Lett. 94 (2005) 212303

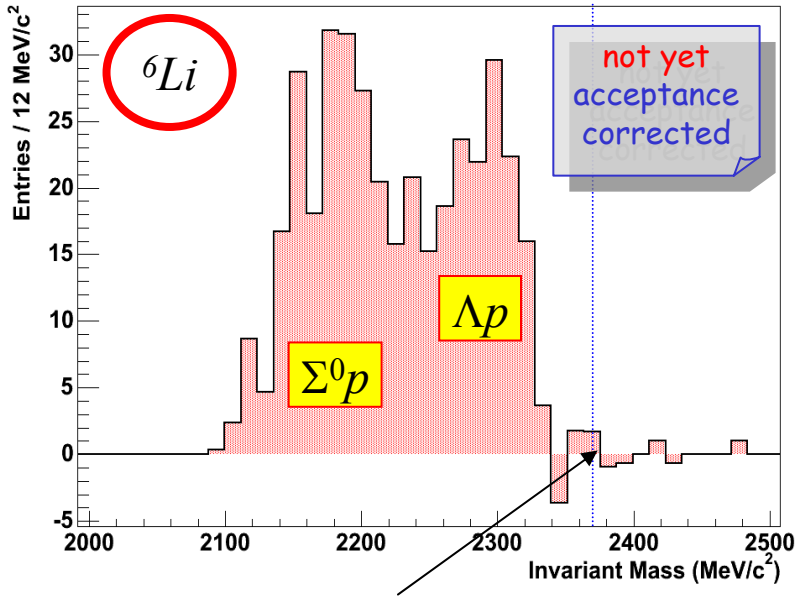
FINUDA search for B=2 kaon-nuclear states



contribution from Σ^0+p decay are seen in low mass region

modified P.R.

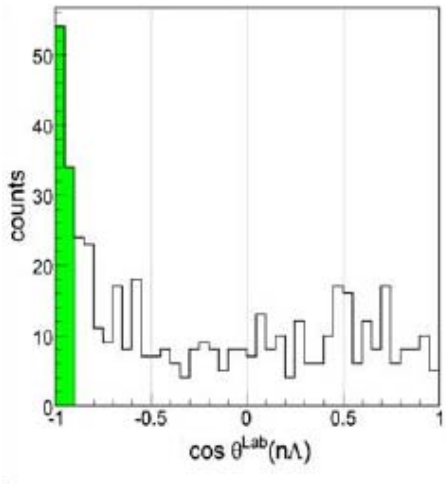
$$A(K^-_{stop}, \Lambda p)A'$$

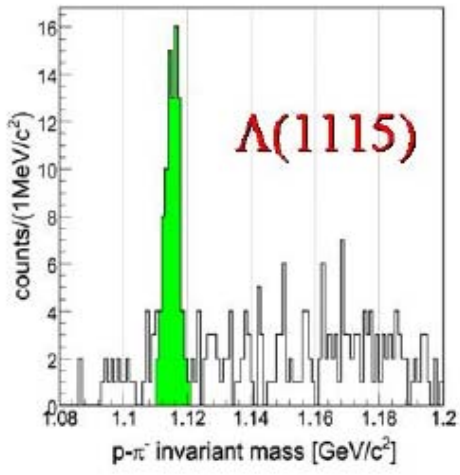


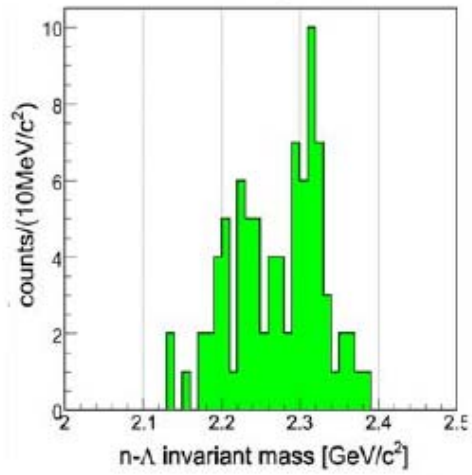
m$_p$+ m$_p$+ m$_K$-

FINUDA search for B=2 kaon-nuclear states

$$K^- pn \rightarrow [K^- pn] \rightarrow \Lambda n$$

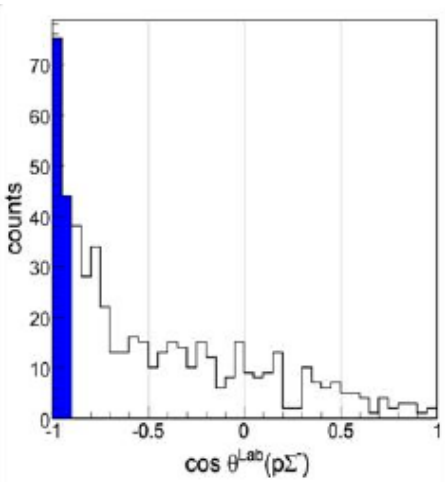


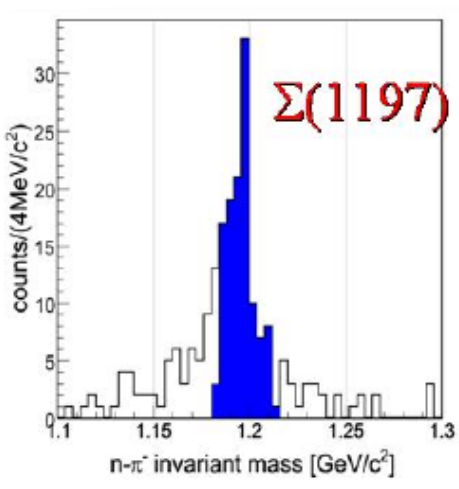


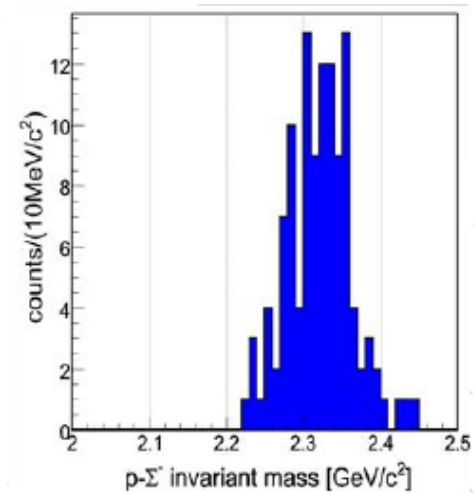


$$K^- pn \rightarrow [K^- pn] \rightarrow \Sigma^- p$$

$$\Sigma^- \rightarrow \pi^- n$$







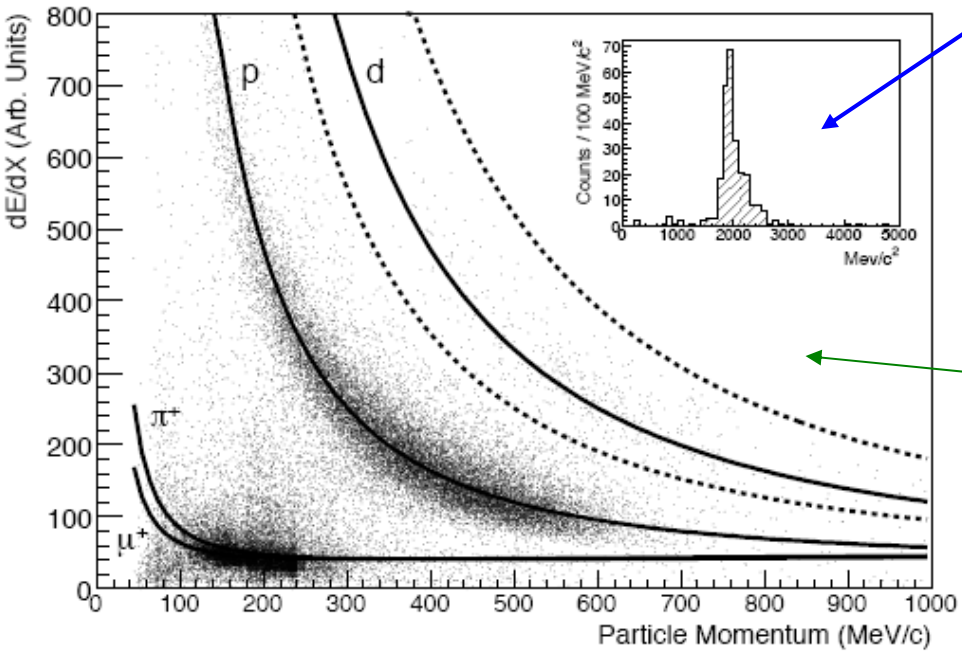
FINUDA search for B=3 kaon-nuclear states

$$A(K^-_{stop}, \Lambda d)A'$$

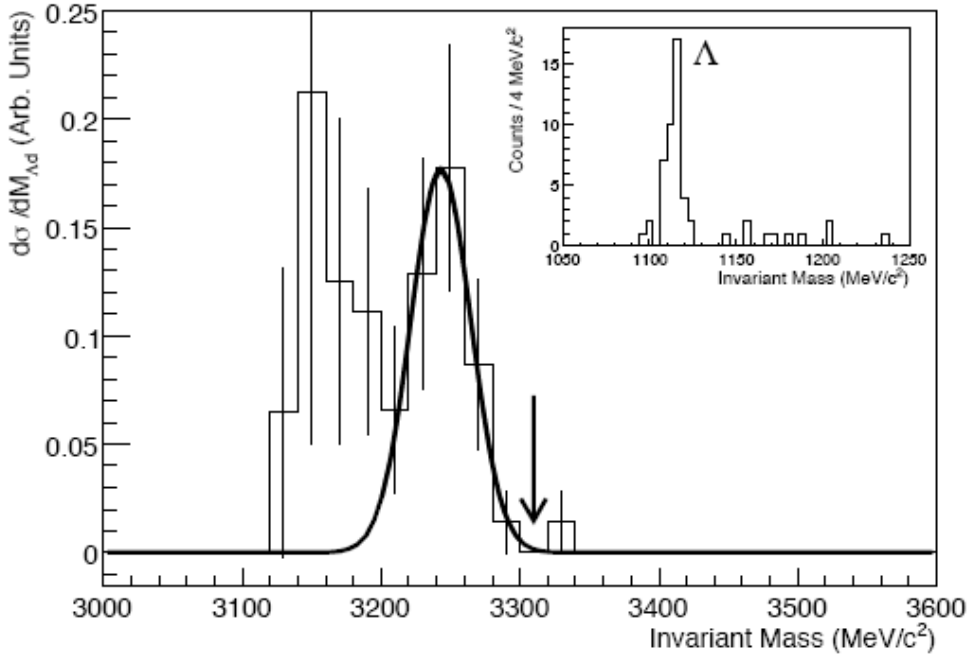
$$A \equiv {}^{6}Li,\ {}^{12}C$$
$$A' \equiv A - 3$$

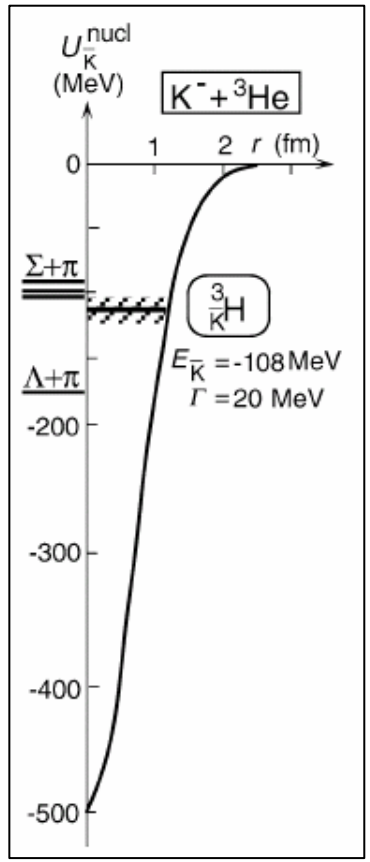
reconstructed by T.O.F.

PID by OSIM



FINUDA search for B=3 kaon-nuclear states





$$B = 64.6 \pm 5.3\,\mathrm{MeV}$$

$$\Gamma = 36.8 \pm 9.7\,\mathrm{MeV/c^2}$$

$$M = 3243 \pm 5\,\mathrm{MeV/c^2}$$

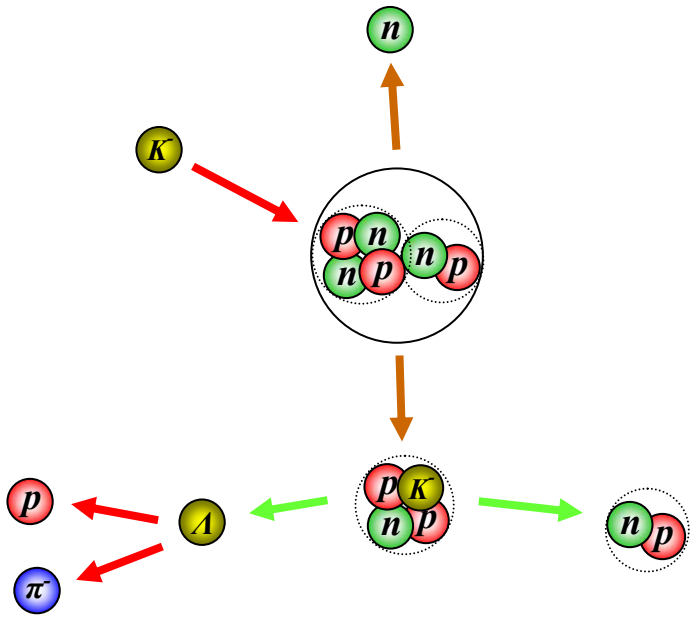
$$Y = (5.4 \pm 1.4) \times 10^{-3}/K^-_{stop}$$

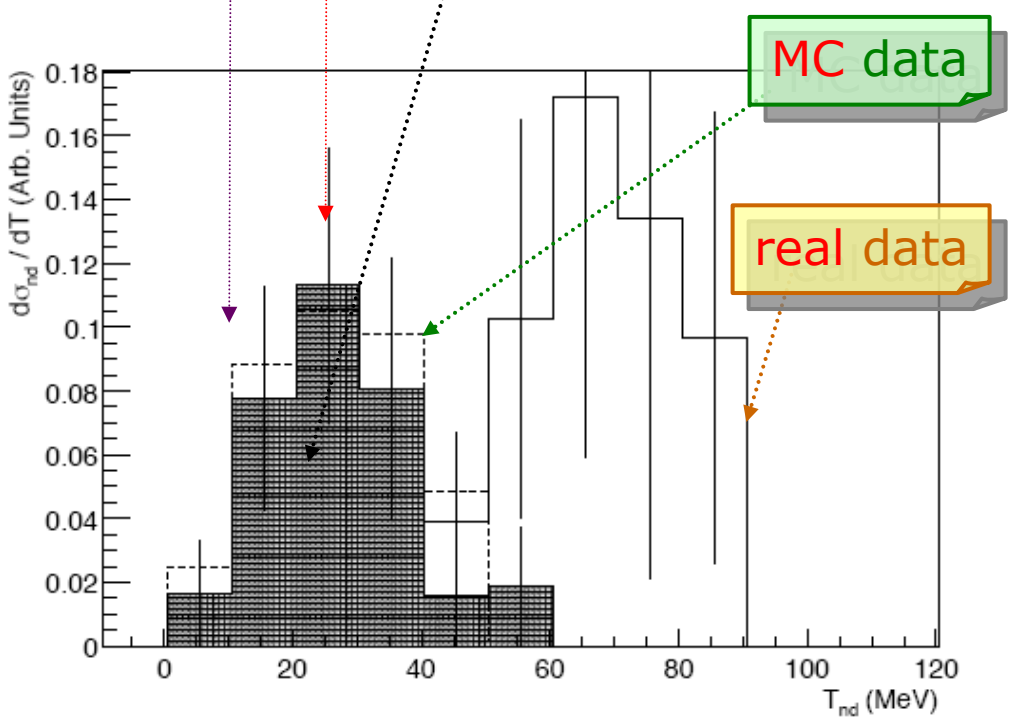
FINUDA search for B=3 kaon-nuclear states

$$\begin{cases} {}^{6}Li(K^-_{stop},\ \Lambda d)pnn \\ {}^{6}Li(K^-_{stop},\ \Lambda d)dn \\ {}^{6}Li(K^-_{stop},\ \Lambda d)t \end{cases}$$

$m_{\Lambda d} \leq 3220$ MeV/c^2

$3220 \leq m_{\Lambda d} \leq 3280$ MeV/c^2





The FINUDA potentialities

	today	yesterday
data-taking	2006-2007	2003-2004
period	01.11.06 - 03.06.07	01.12.03 - 25.03.04
$\int \mathscr{L}$	958 pb^{-1}	220 pb^{-1}
total collected events in collision $x\ 10^6$	242.8	37.2
total events $x\ 10^6$ / $\int \mathscr{L}$	0.26 / pb^{-1}	0.17 / pb^{-1}
HYP $x\ 10^6$	210.0	29.7
BHABHA $x\ 10^6$	32.8	7.5
COSMICS B=0 T $x\ 10^6$	8.8	5.5
COSMICS B=1 T $x\ 10^6$	3.7	1.8