NY interactions studied in FSI

Hartmut Machner, FZ Jülich and Univ. Duisburg-Essen

Frank Hinterberger, Univ. Bonn

Regina Siudak, PAN Krakow

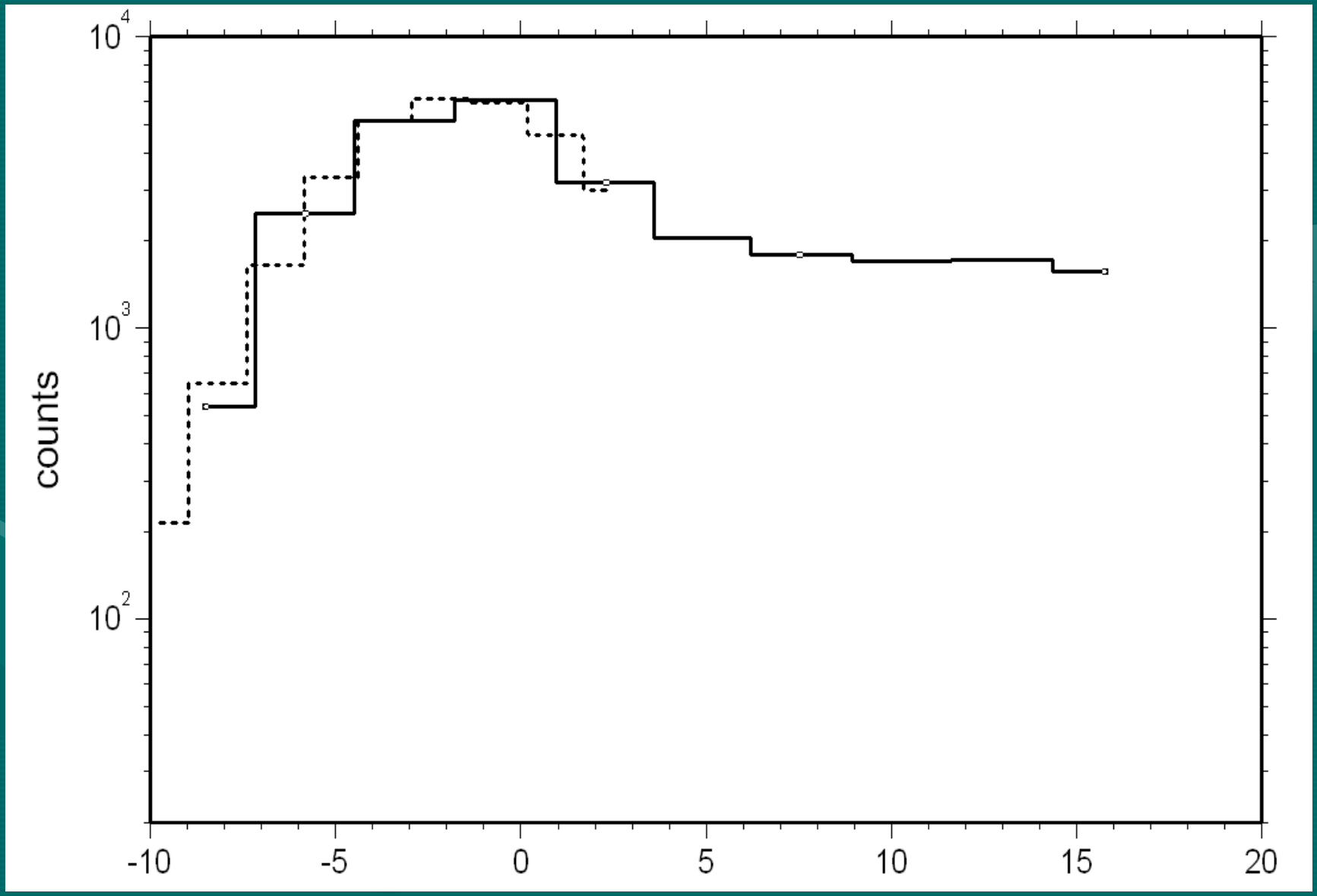
for the HIRES@COSY collaboration

Why is this important?

- NN interactions ←→ Nuclear potential, nuclear structure
- NY interactions ←→ Hypernuclear potential, hypernuclear structure

What can be expected from high resolution?

Saclay $pp \rightarrow \pi^+(pn)$ 1000 MeV



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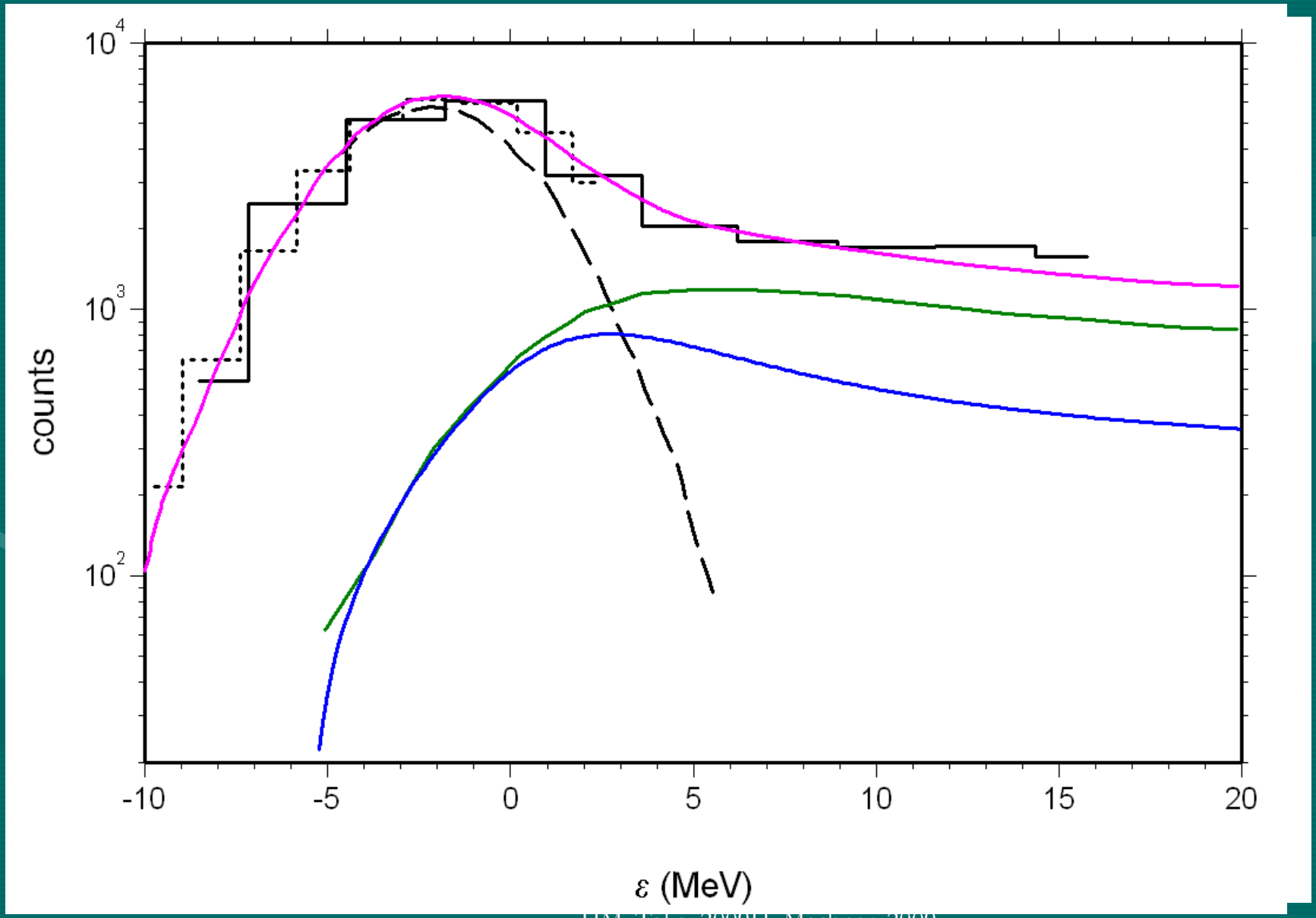

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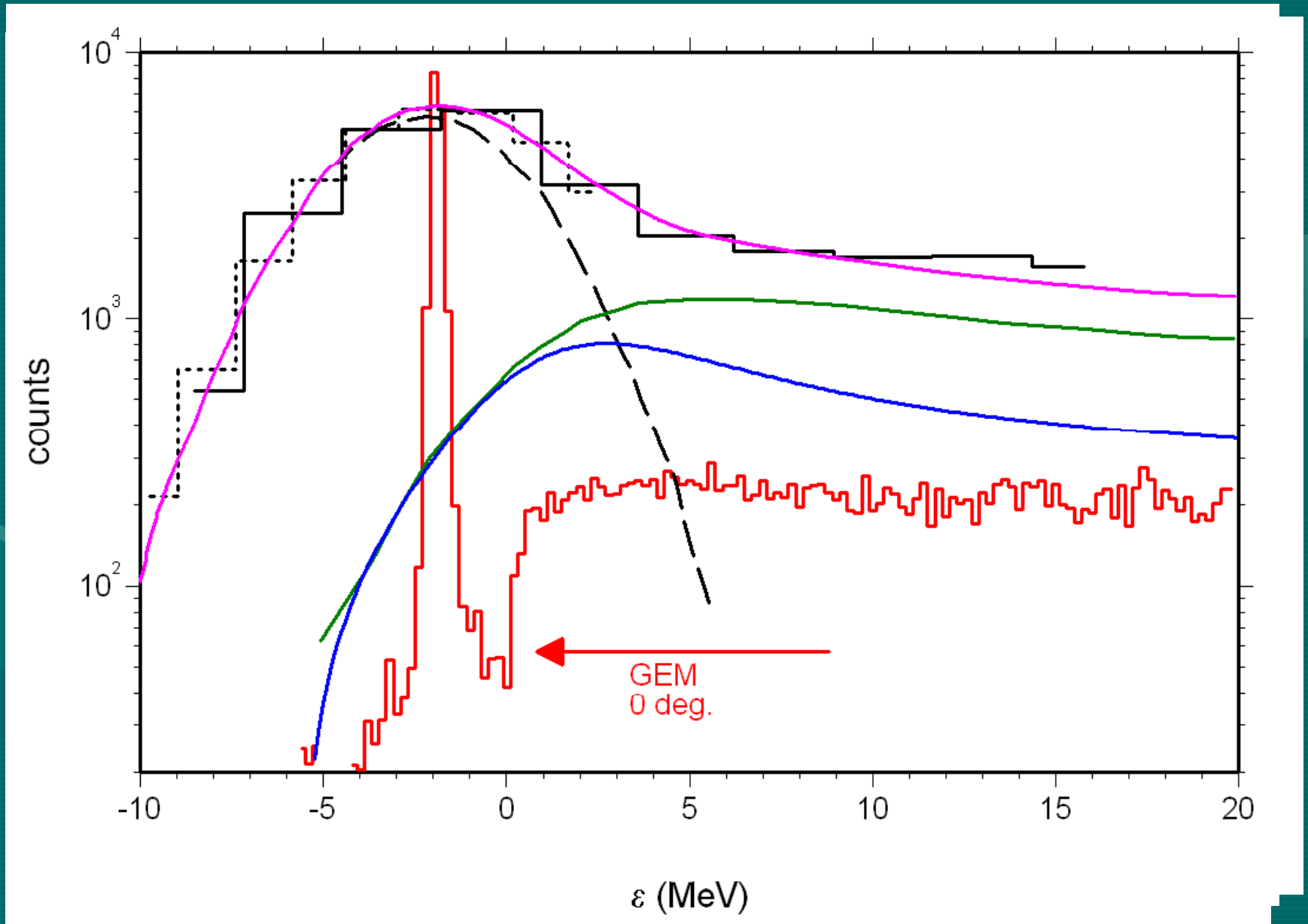
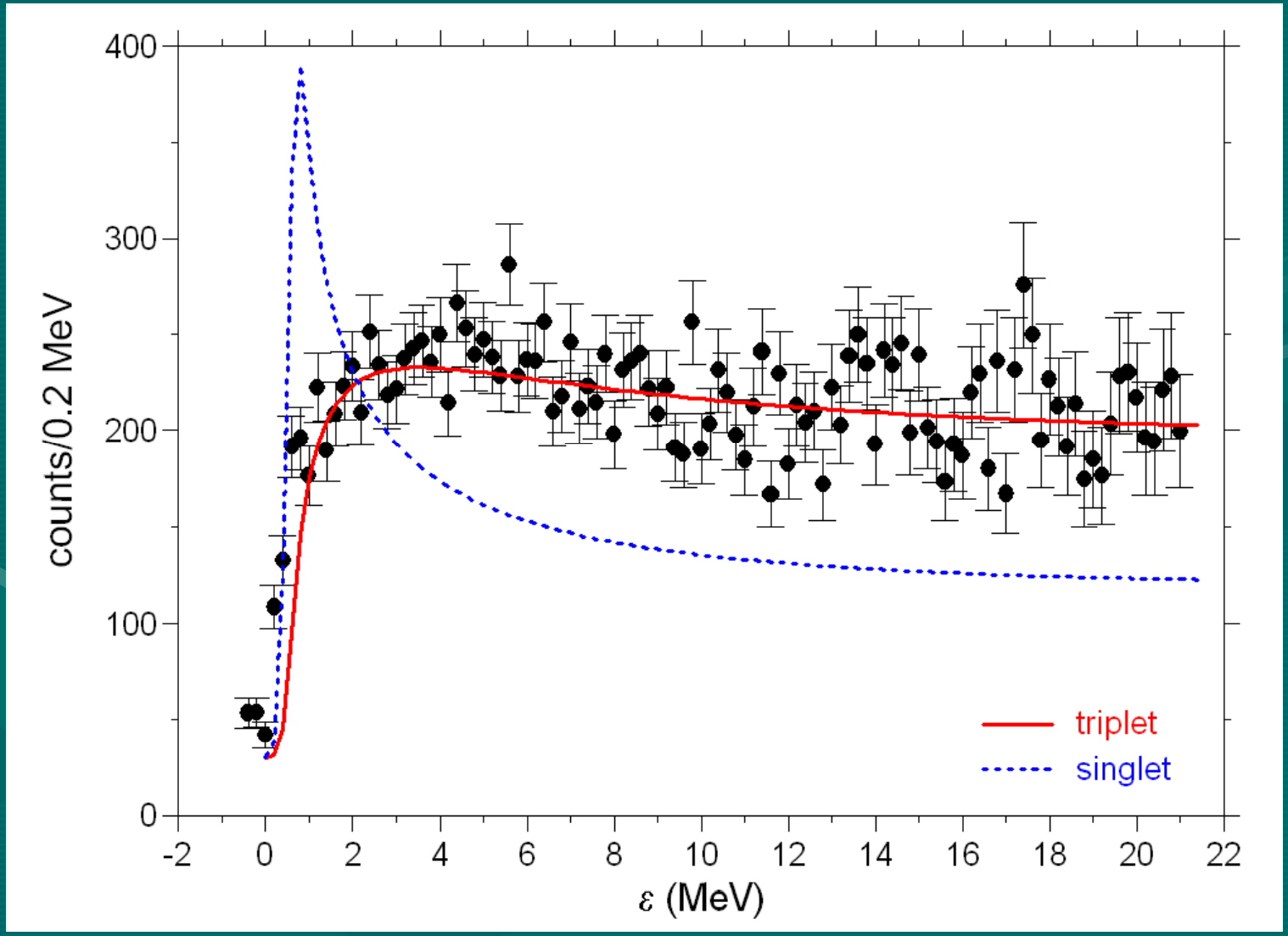


singlet
triplet

GEM: singlet and triplet?



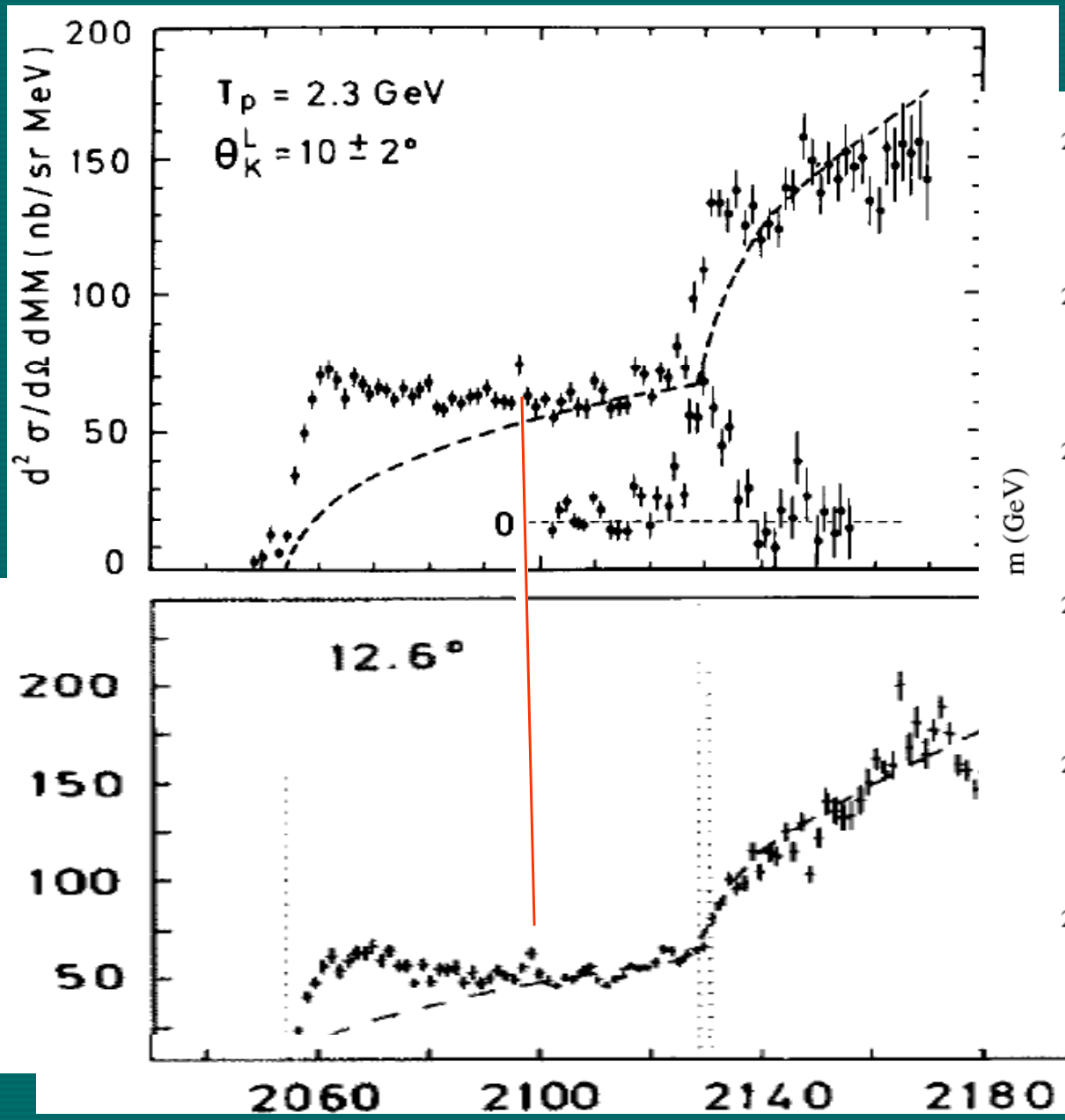
p=1642.5 MeV/c

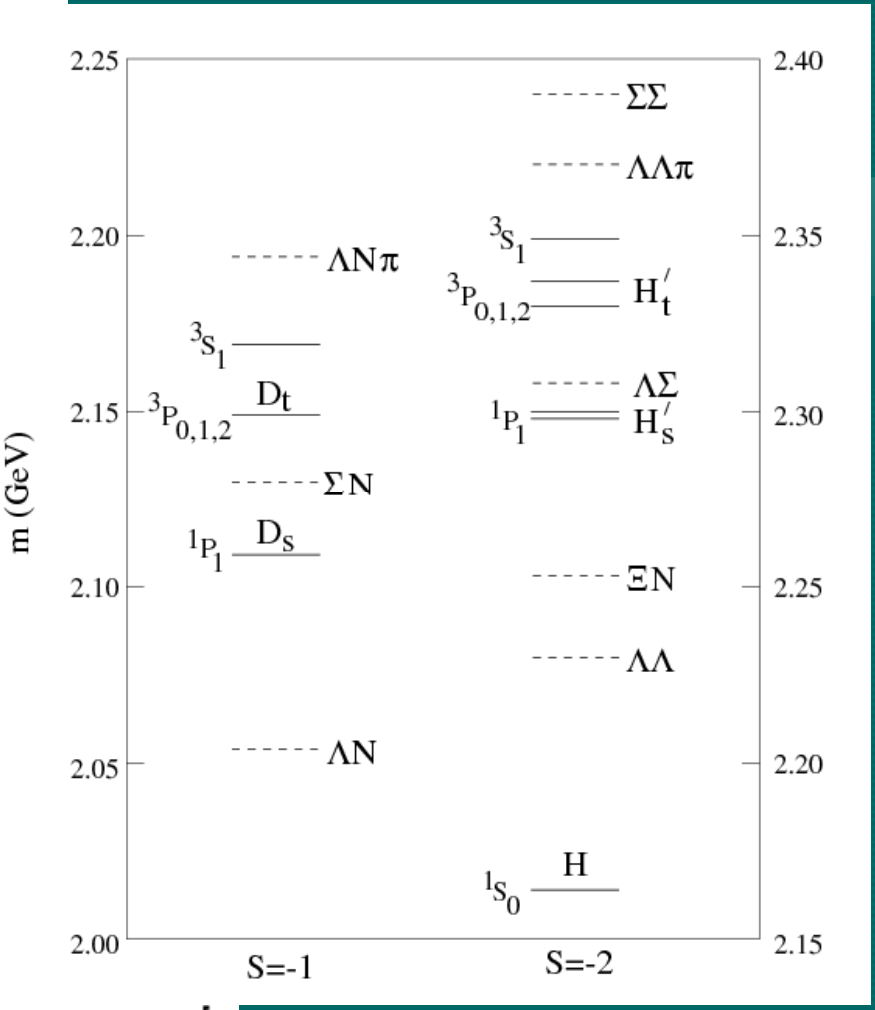
PLB 610 (2005) 31

PRC 79 (2009) 061001(R)

YN FSI and YN Dibaryon?

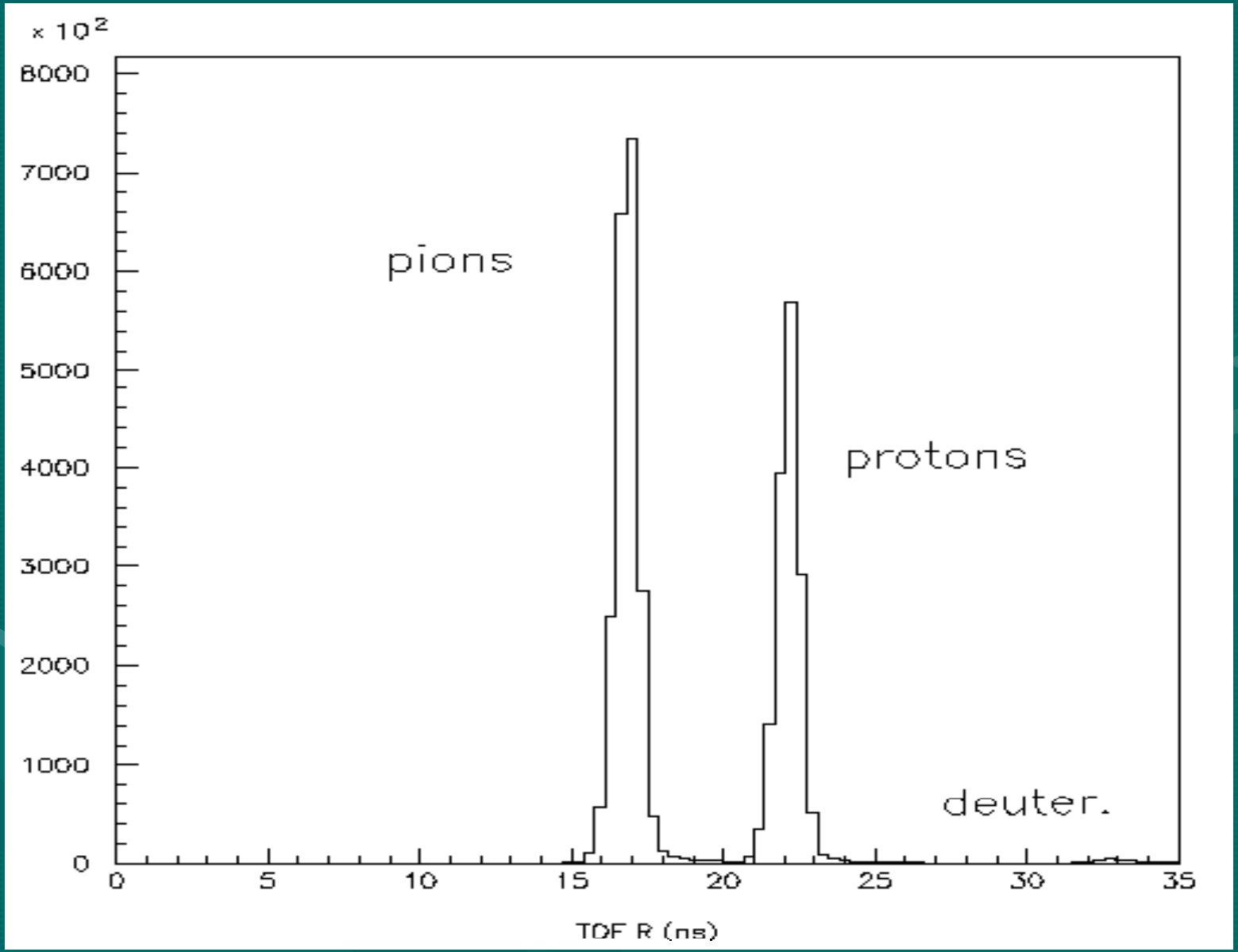
Saclay, NP A 567 (1995) 819





Nijmwegen group

p+p → X

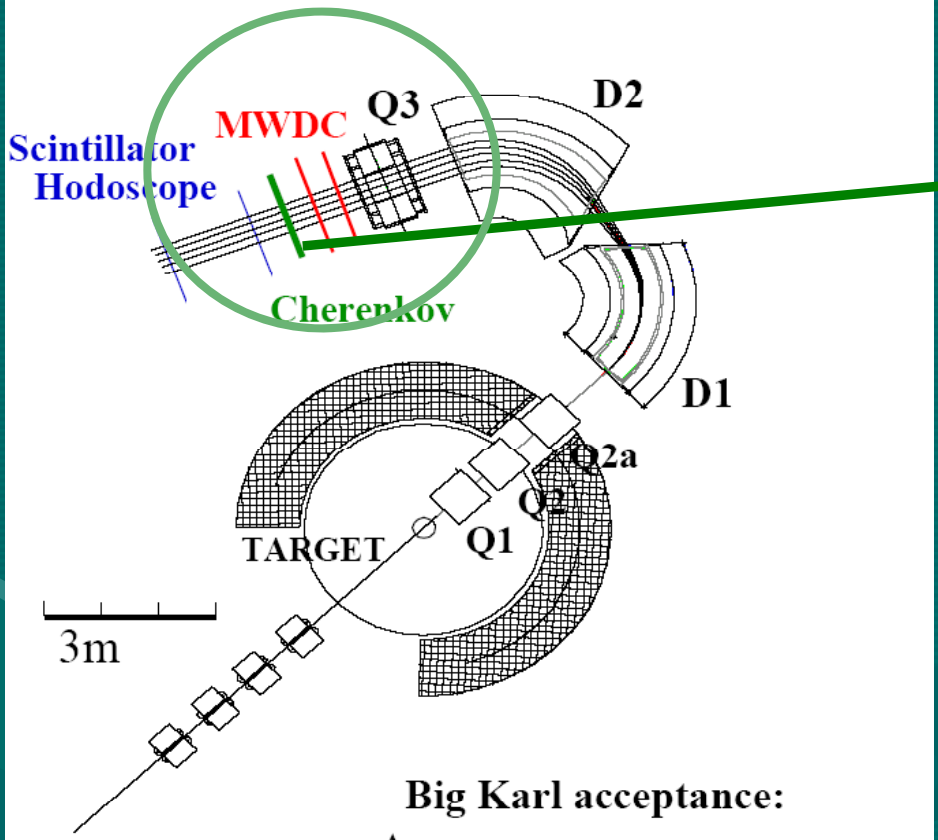


P_{beam} =2735 MeV/c
p_{BK} = 1070 MeV/c

Particle identification

BIG KARL – Magnetic Spectrometer

resolution $\frac{\Delta p}{p} \sim 10^{-4}$



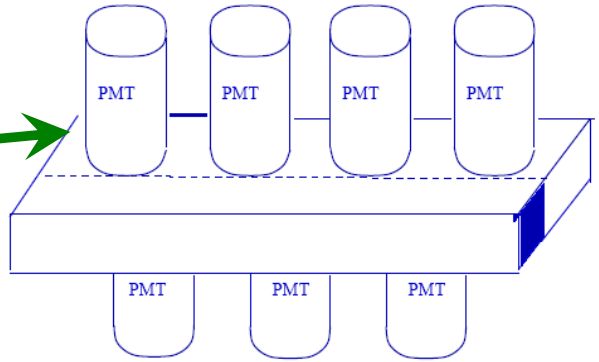
Big Karl acceptance:

$\frac{\Delta p}{p} = \pm$ 4.5 %

$\Delta X = \pm$ 28 mrad

$\Delta Y = \pm$ 100 mrad

Silica aerogel threshold Čerenkov detector



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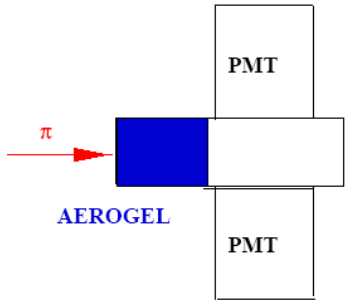
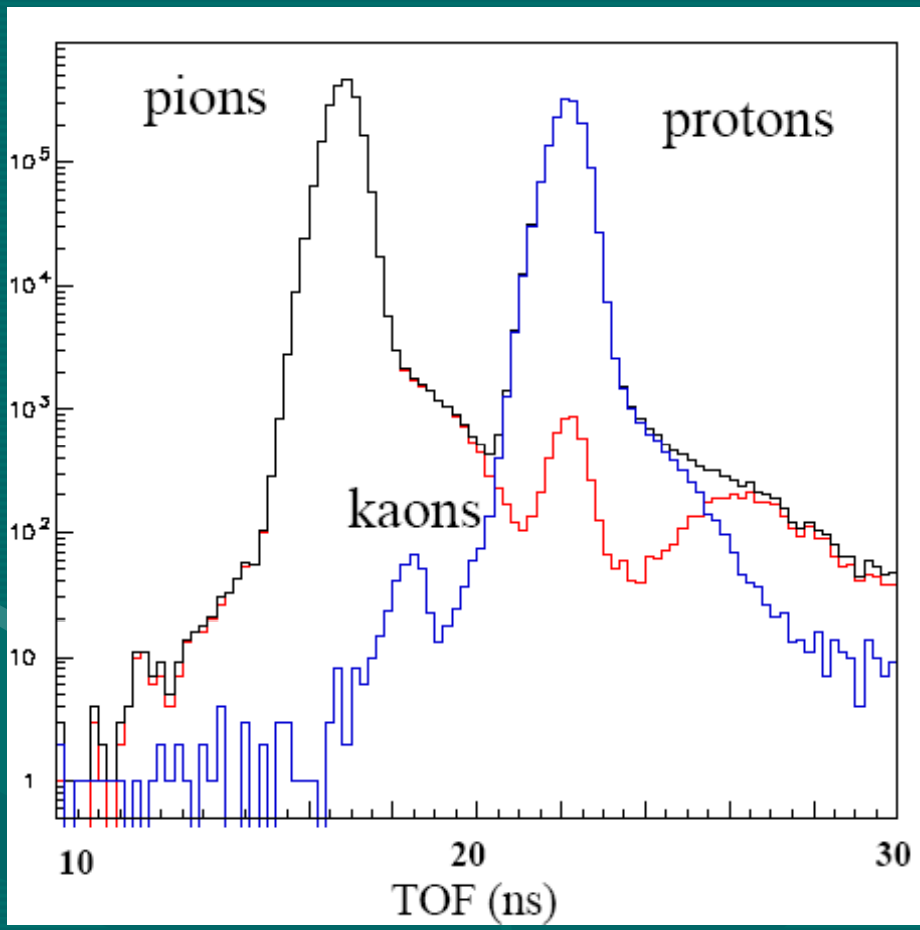
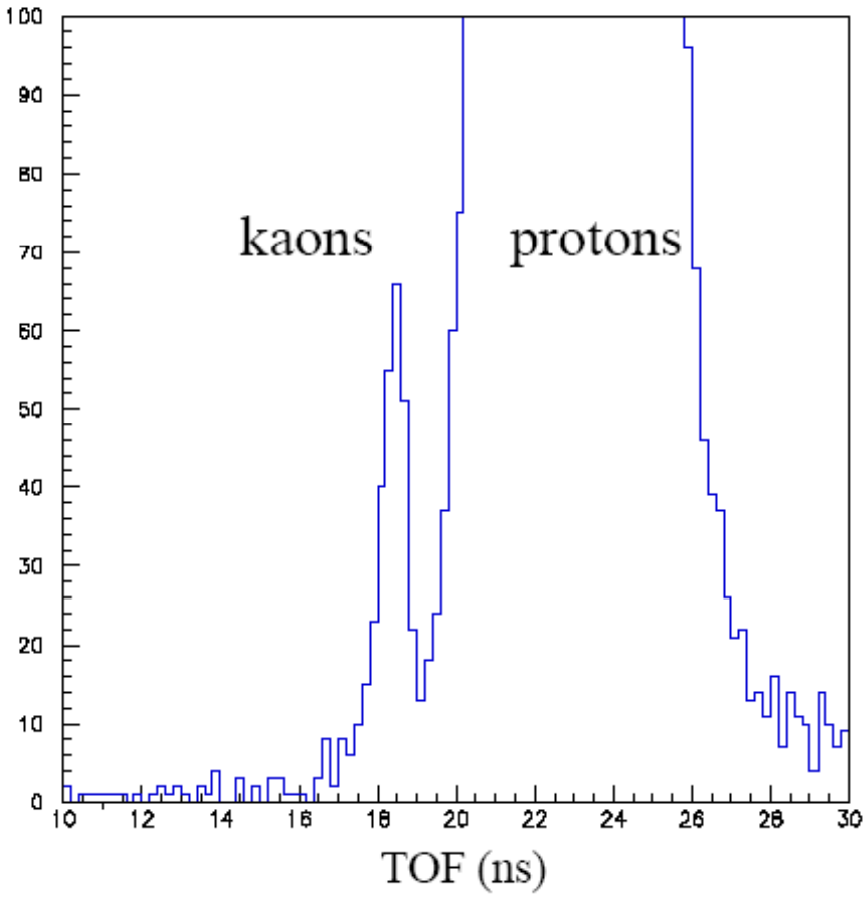


- aerogel of n=1.05 from Matsushita Electric Work, Japan
- Goretex reflector
- Burle 8854 photomultiplier

p(p,X)

P_{beam} =2735 MeV/c p_{BK} = 1070 MeV/c

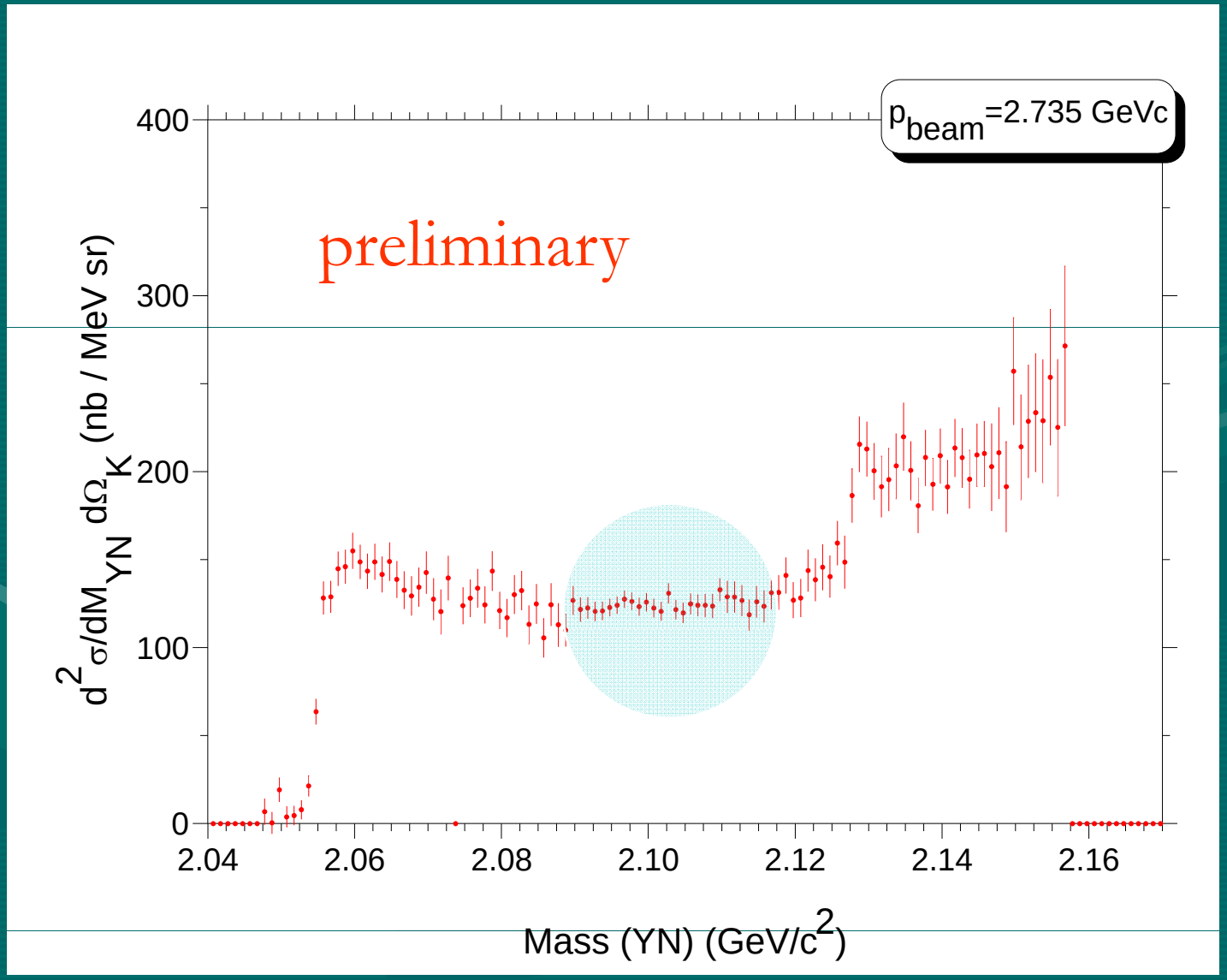




cherenkov signal

vetoed with cherenkov signal

Experimental Result



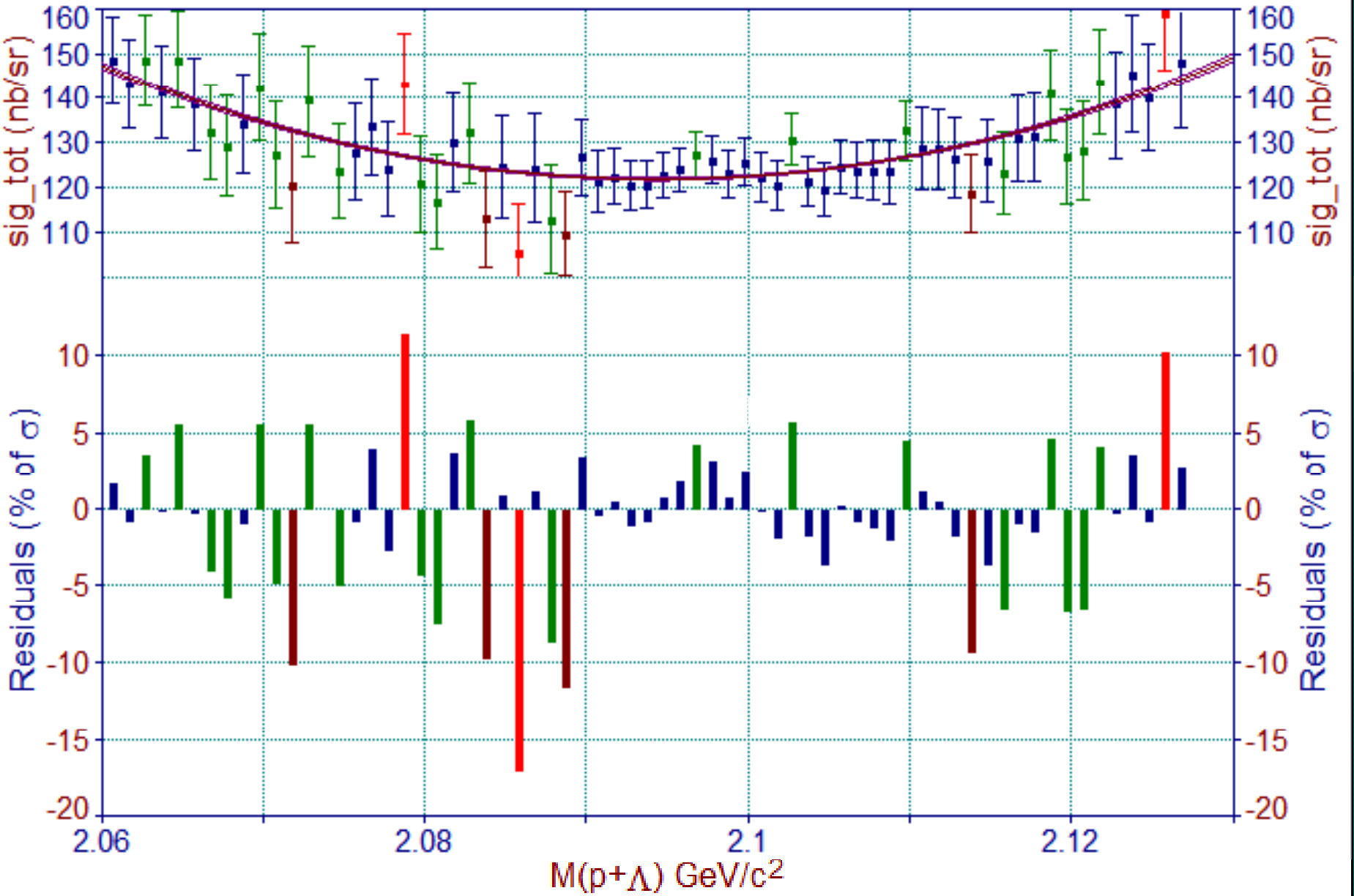
No strange di-baryon!

Does the Saclay peak exist?

$\sigma = a(+bM+cM^2)^2$

a=4093.8292 b=-3898.828

c=930.79077



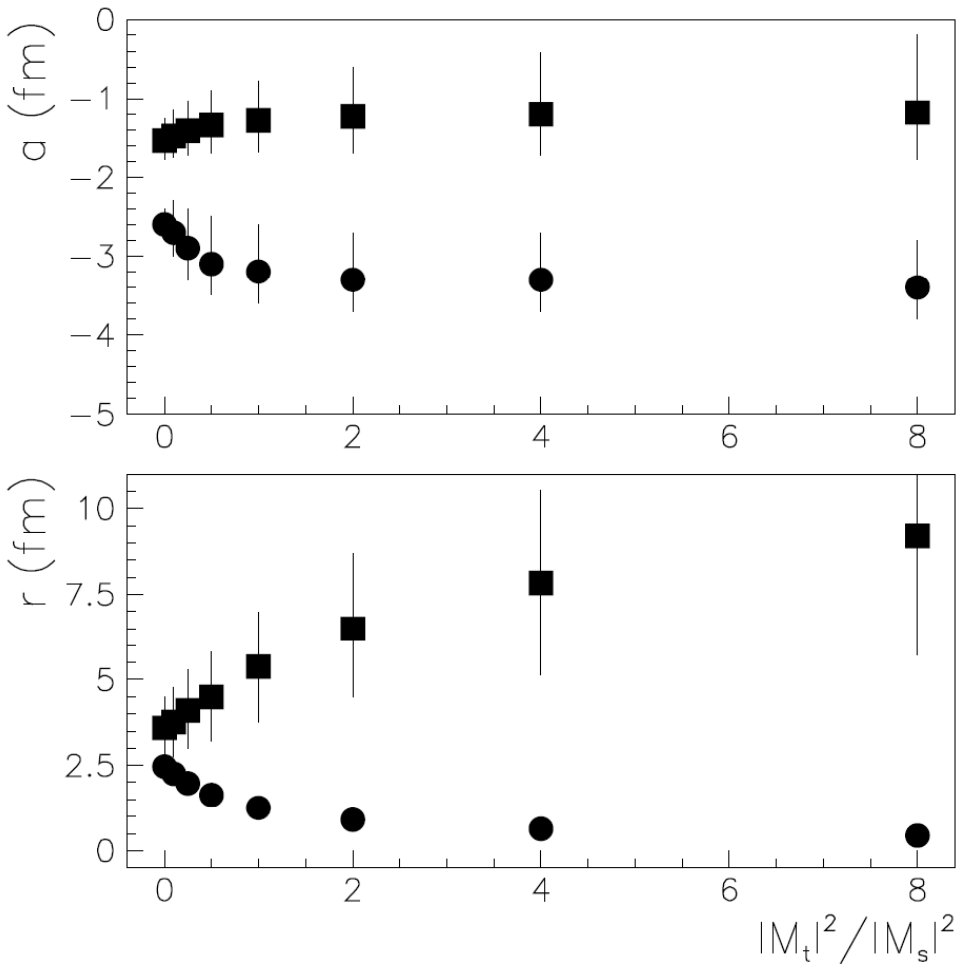
1σ

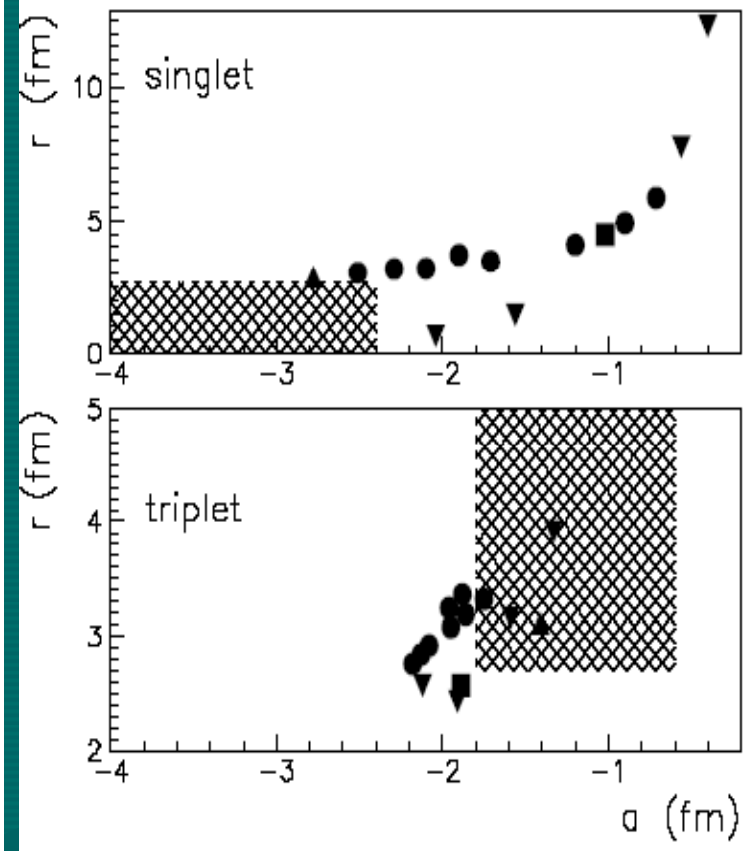
2σ

3σ

>3σ

FSI parameters of the Λp system

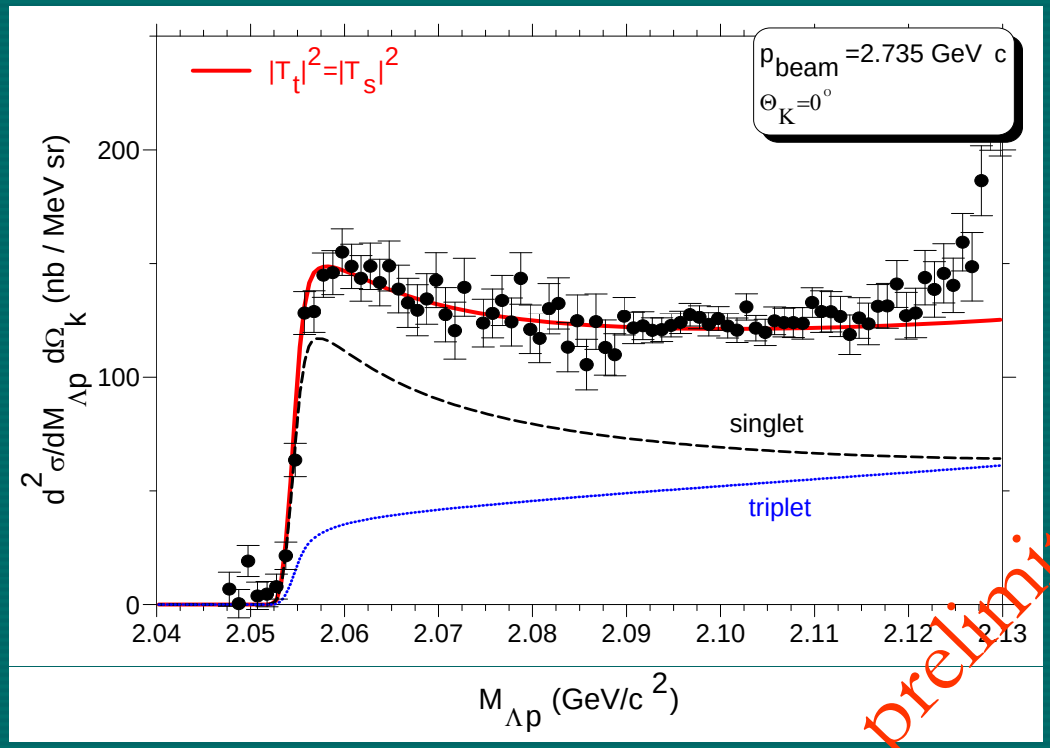


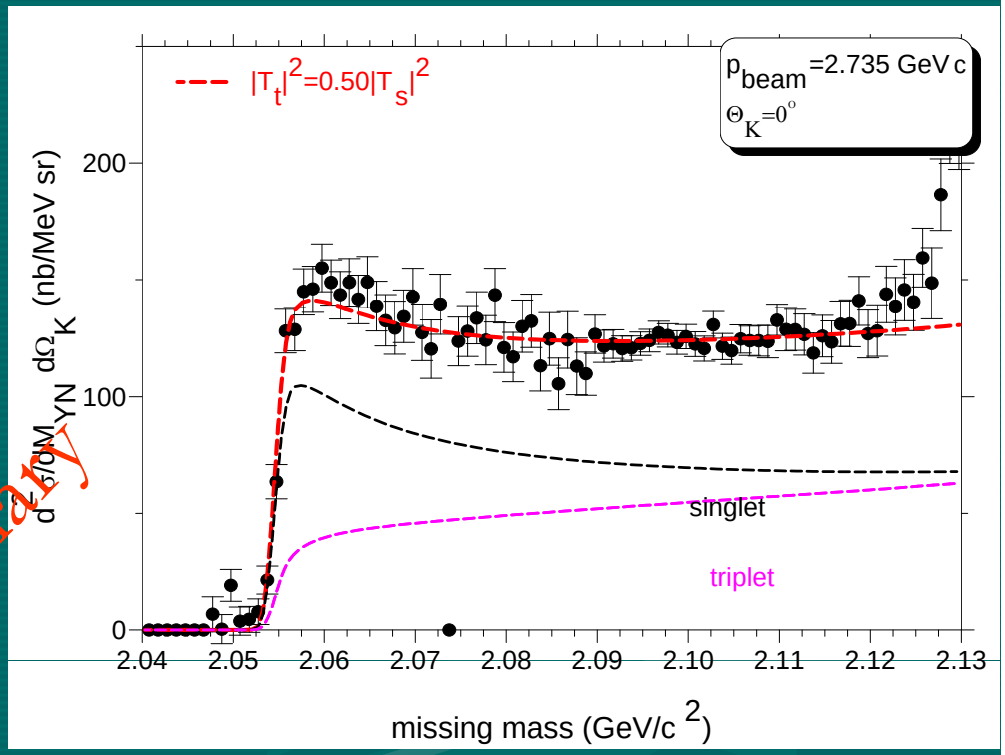


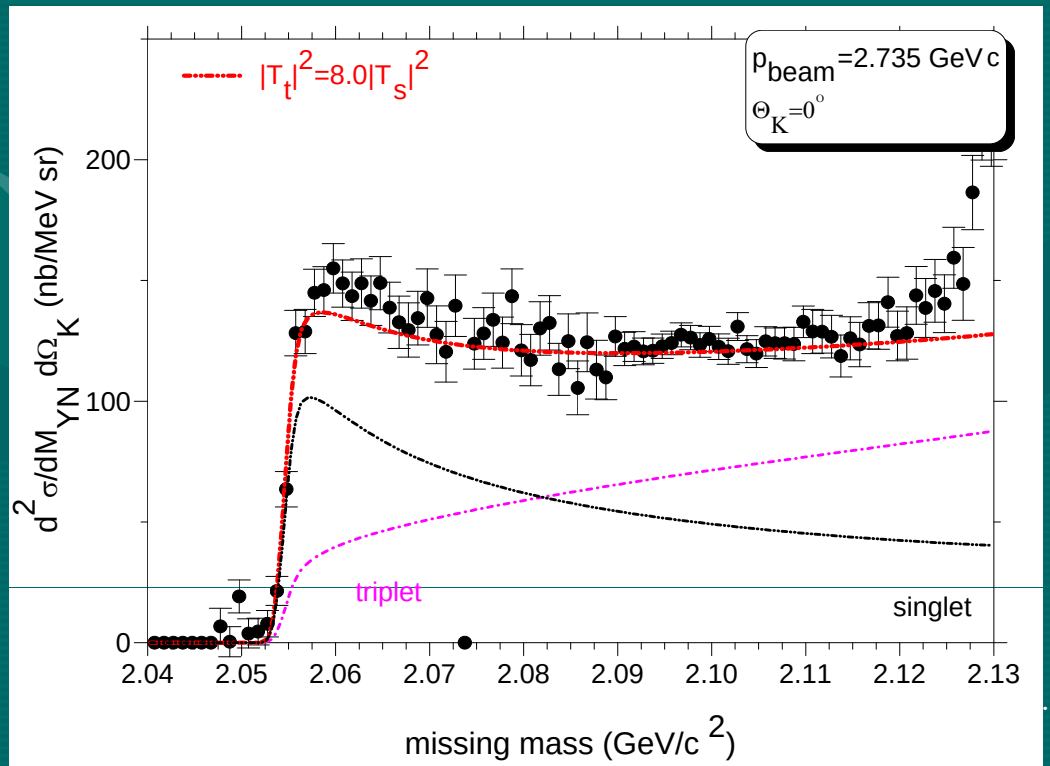
$$\frac{d^2\sigma}{d\Omega_K dM_{\Lambda p}} = \Phi_3\left(\frac{1}{4}|T_s|^2\frac{q^2+\beta_s^2}{q^2+\alpha_s^2}+\frac{3}{4}|T_t|^2\frac{q^2+\beta_t^2}{q^2+\alpha_t^2}\right)$$

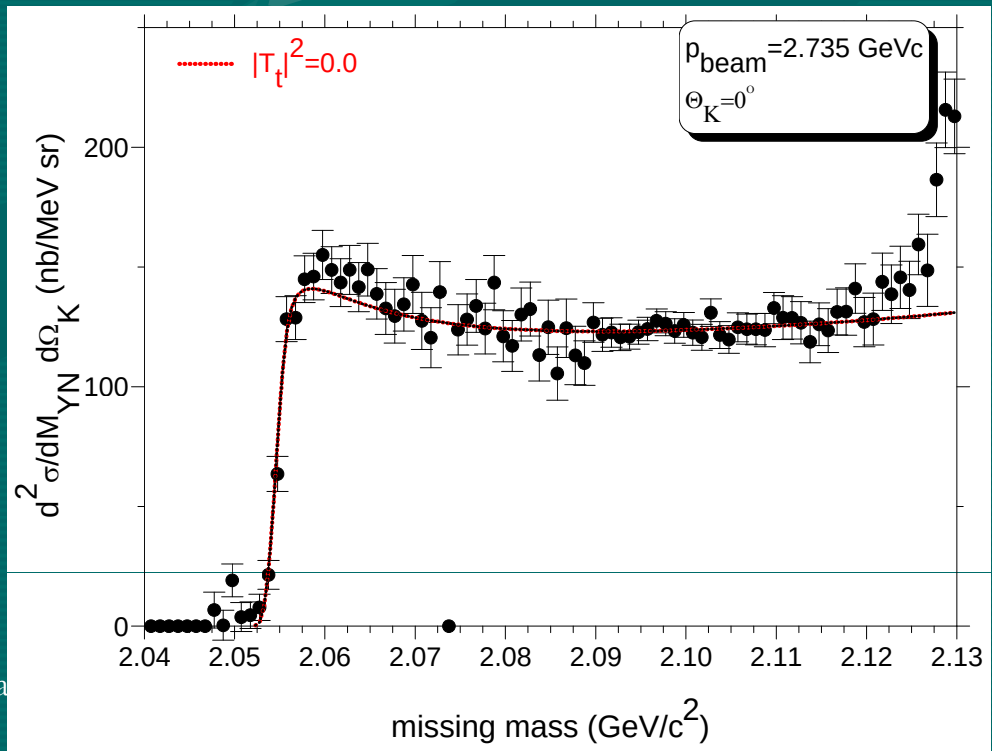
$$\alpha = \frac{1}{r}\left(1-\sqrt{1-2\frac{r}{a}}\right),\ \beta = \frac{1}{r}\left(1+\sqrt{1-2\frac{r}{a}}\right)$$

F. Hinterberger and A. Sibirtsev, Eur. J. Phys. A 21 (2004) 313
Data from Nucl. Phys. A 567(1994) 819

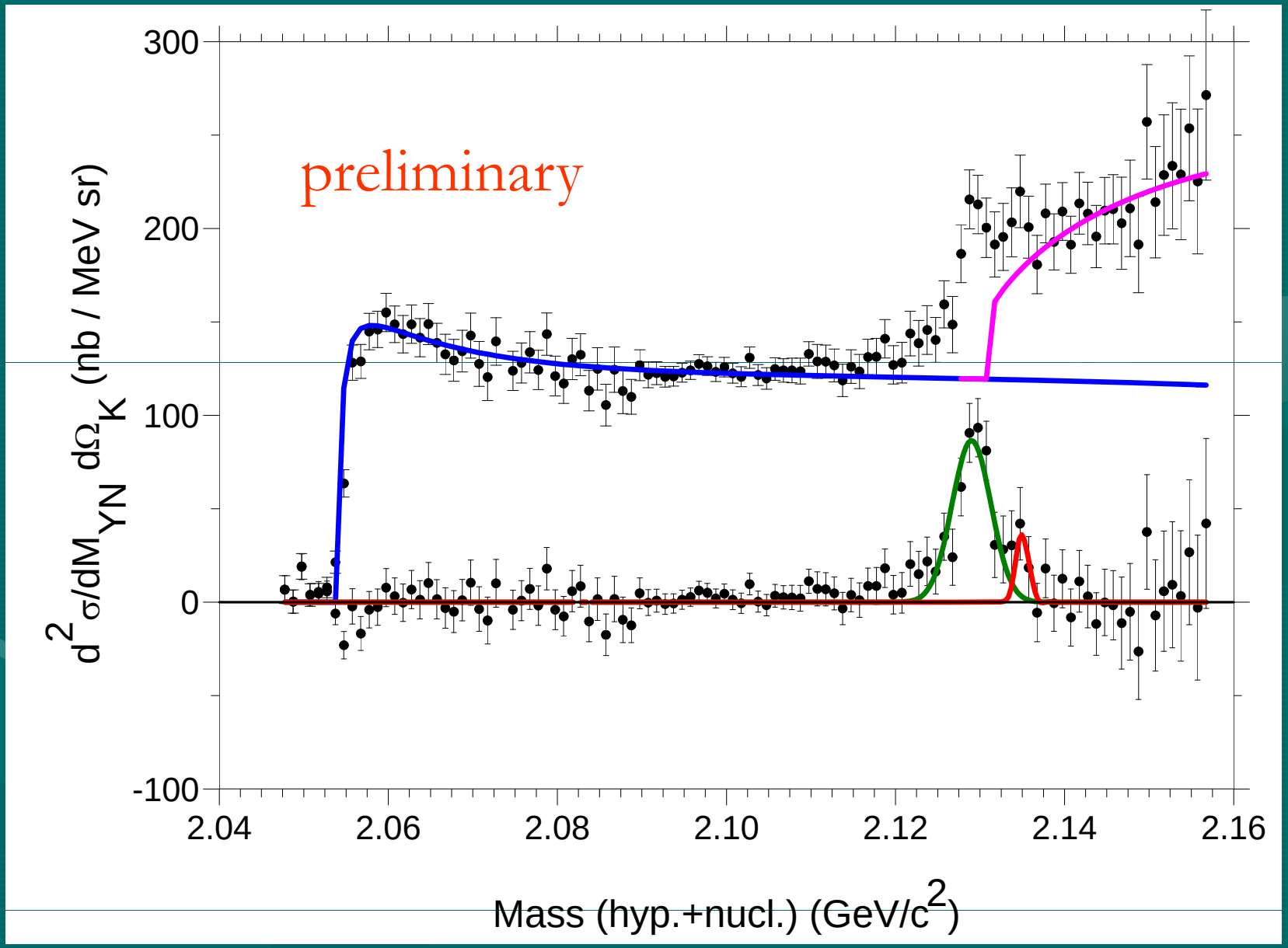




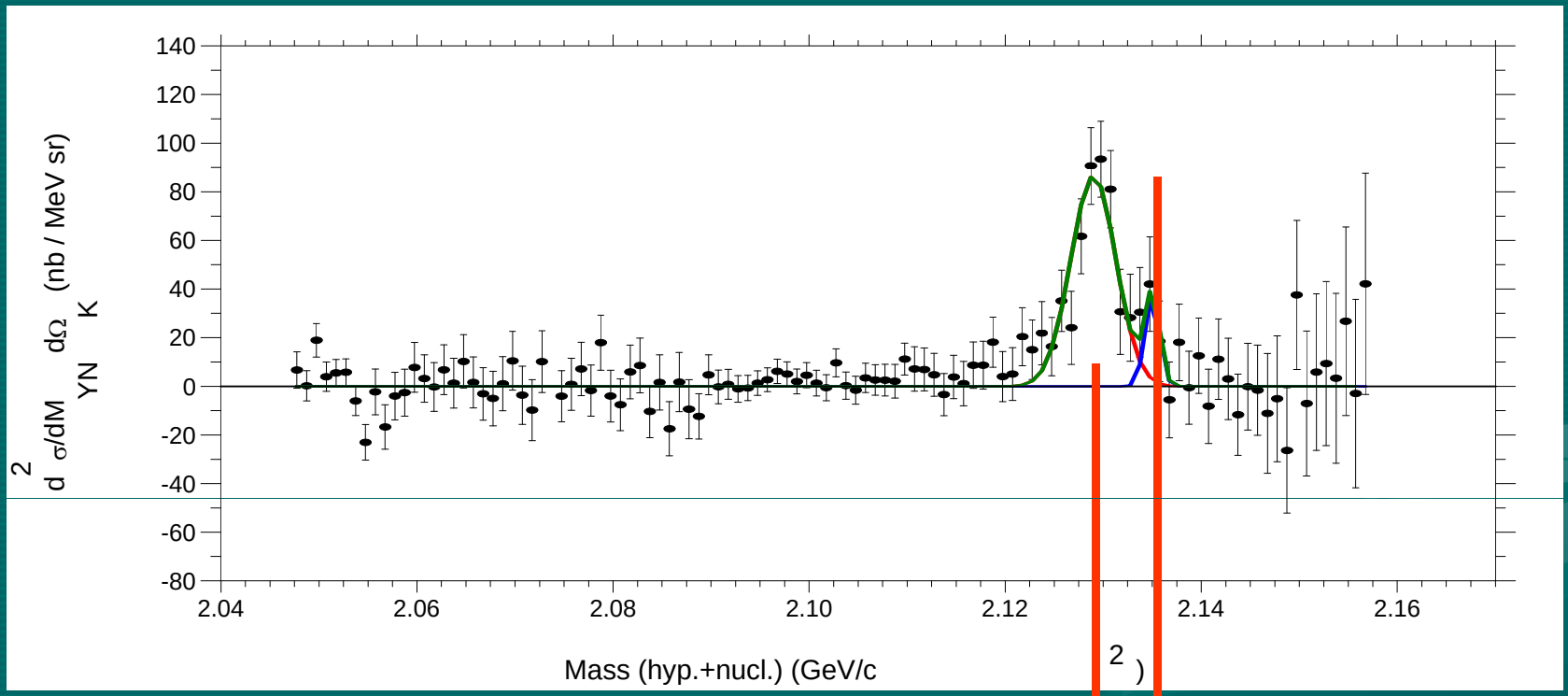


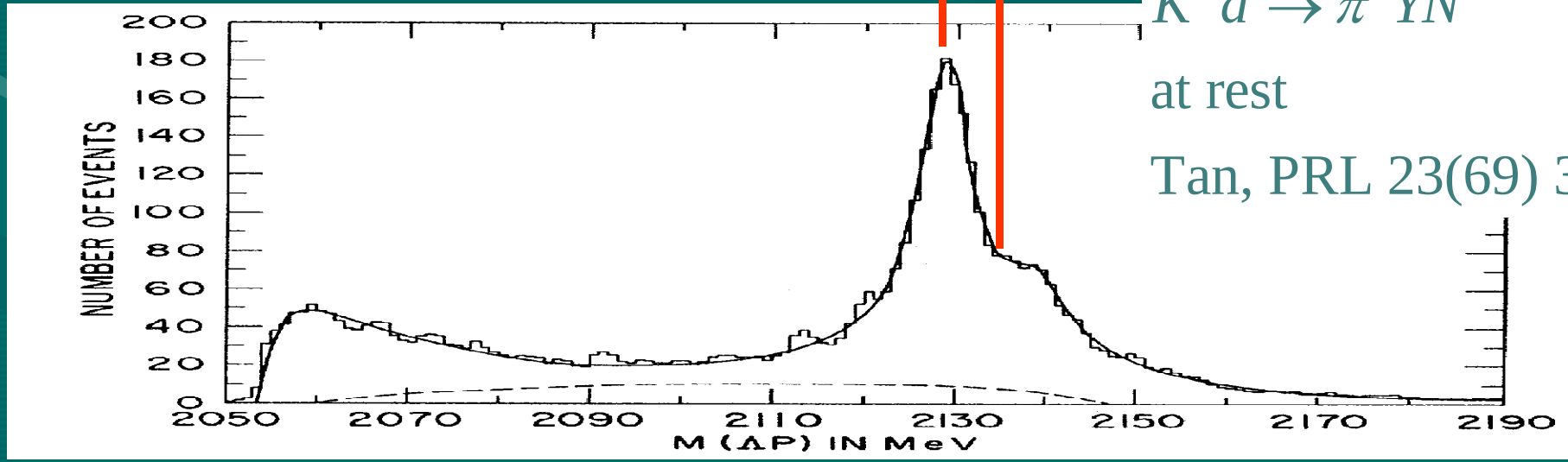


ΣN interaction



ΣN interaction (III)



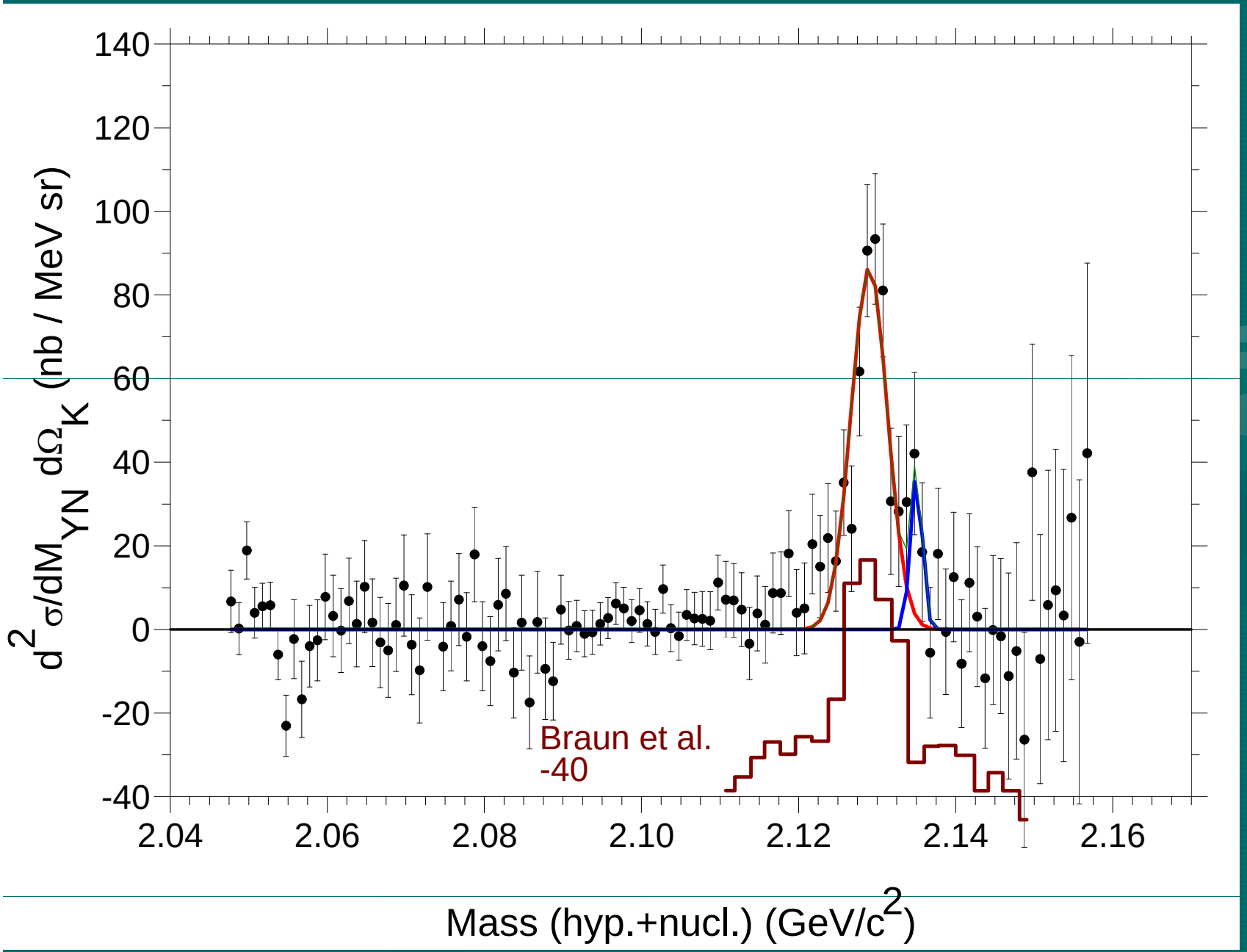


$K^- d \to \pi^- YN$

at rest

Tan, PRL 23(69) 395

ΣN interaction (III)



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Summary

- We have measured the reaction pp->K^+YN with **high** resolution
- The significance of a possible dibaryon around M≈2100 MeV/c is at most 1σ
- We see an enhancement at and below the ΣN thresholds
- What is it?
  - two step process with kinematic matching? No, to large width
  - a cusp? (Nijmegen group: in $^3S_1$ channel)
  - a resonance in Λp→Λp, shoulder from $\Sigma^+n\rightarrow\Lambda\pi$ (Dalitz: fourth sheet pole) ?
  - bound state is excluded (no second sheet pole)