In Memoriam Bernd Krusche

27.2.1956 - 1.6.2022

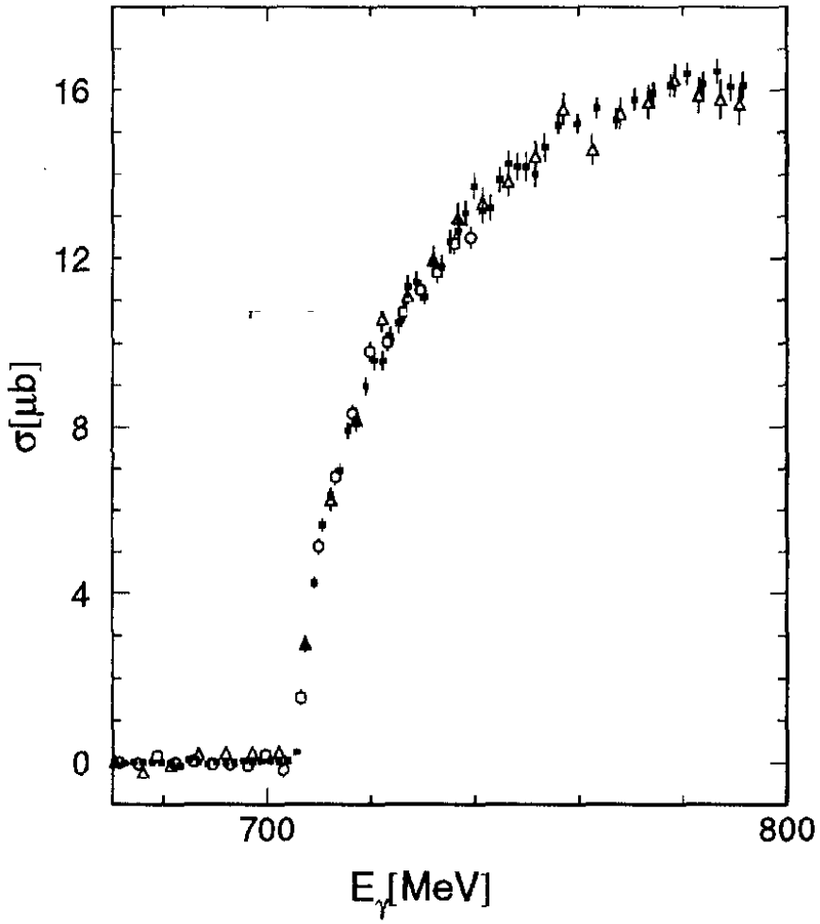
Volker Metag
II. Physikalisches Institut
JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

Bernd Krusche: Curiculum Vitae

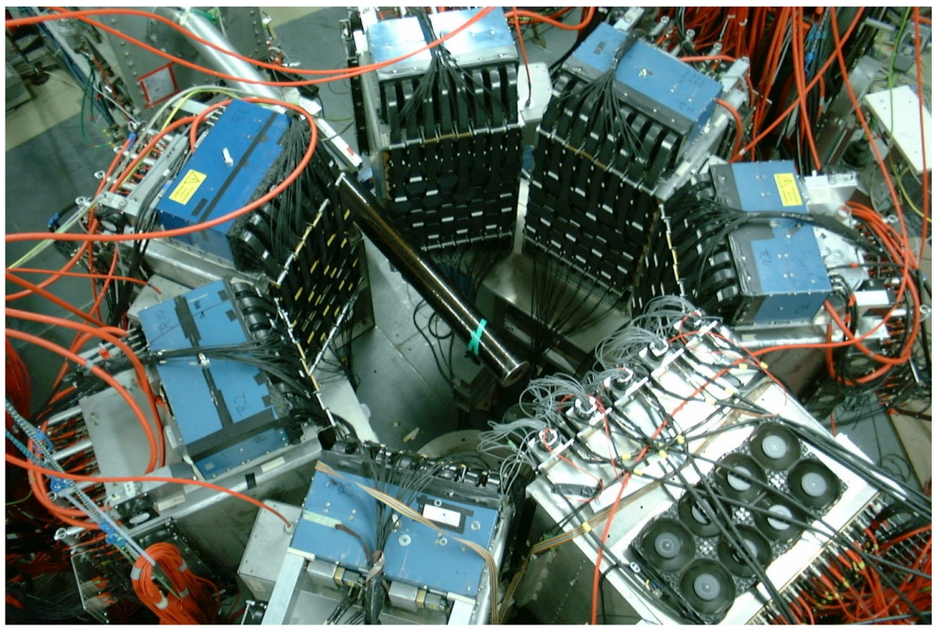
27.2.1956	borne in Salzhemmendorf (Lower Saxony; Germany)
1963 - 1975	schools in Salzhemmendorf and Hameln
1975	Abitur
1975 - 1981	study of physics, mathematics and pedagogy at Univ. of Göttingen
1981	final examination as mathematics and physics teacher at a gymnasium
1982 -1985	PhD student at Univ. of Göttingen; advisor Prof. Peter Lieb
1985	PhD on neutron capture γ-ray spectroscopy (exp. at ILL Grenoble)
1986 - 1990	Staff Scientist at ILL Grenoble
1990 - 1999	Scientific Assistent at II. Physikalisches Institut, Univ. of Giessen
1996	Habilitation: photoproduction of π^0 and η mesons off nucleons and nuclei
1999 - 2022	Professor of Nuclear and Particle Physics, University of Basel
collaborations:	TAPS, CBELSA/TAPS, Crystal Ball, PANDA
service to community	Particle Data Group, NuPECC, referee for PRL, PLB, EPJA
publications:	≈ 300 in refereed journals (thereof ≈70 in PRL/PLB); 2 reviews in PPNP

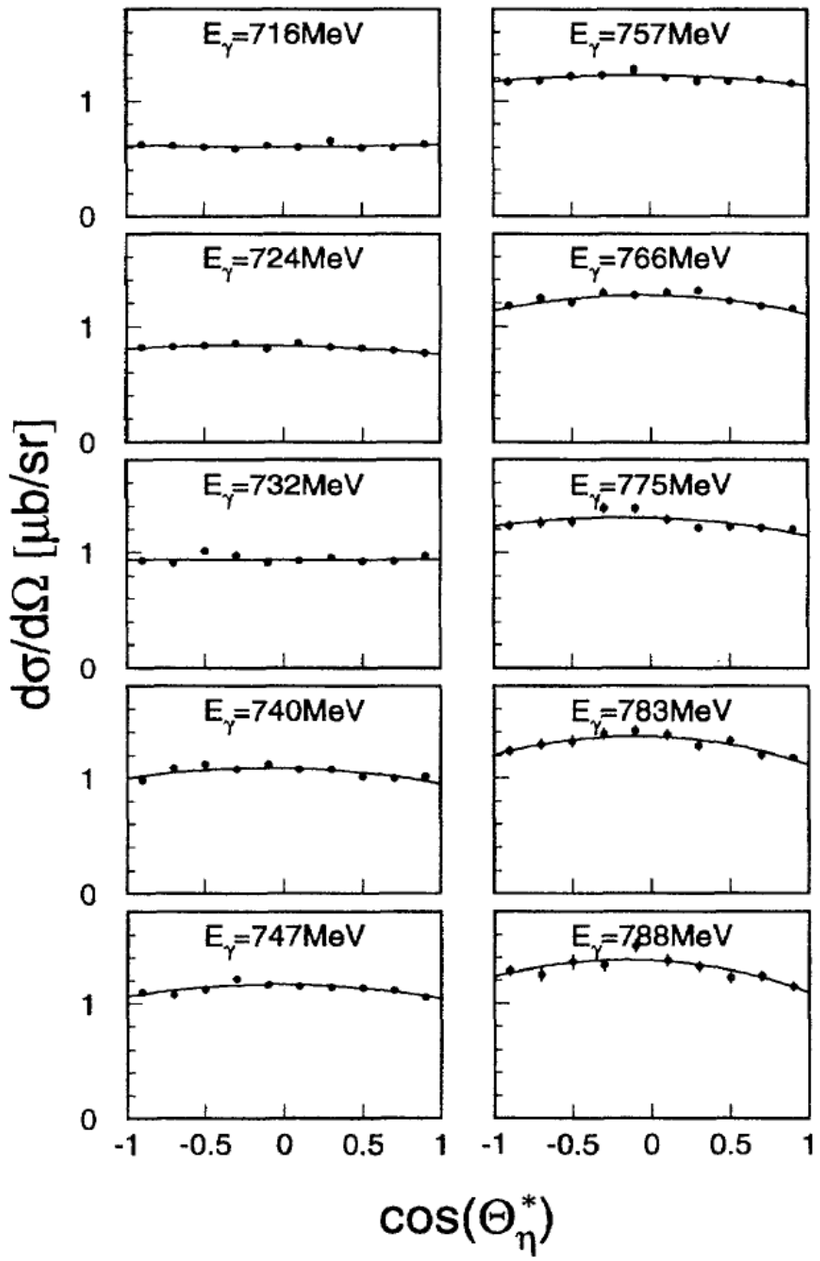
Photoproduction of η mesons off the proton

B. Kusche et al., PRL 74 (1995) 3736; cited 344 times
B.Krusche et al., Z. Phys. A 351 (1995) 237



TAPS: 6 block array with 512 BaF2 detectors





η - production dominated by $S_{11}(1535)$ excitation

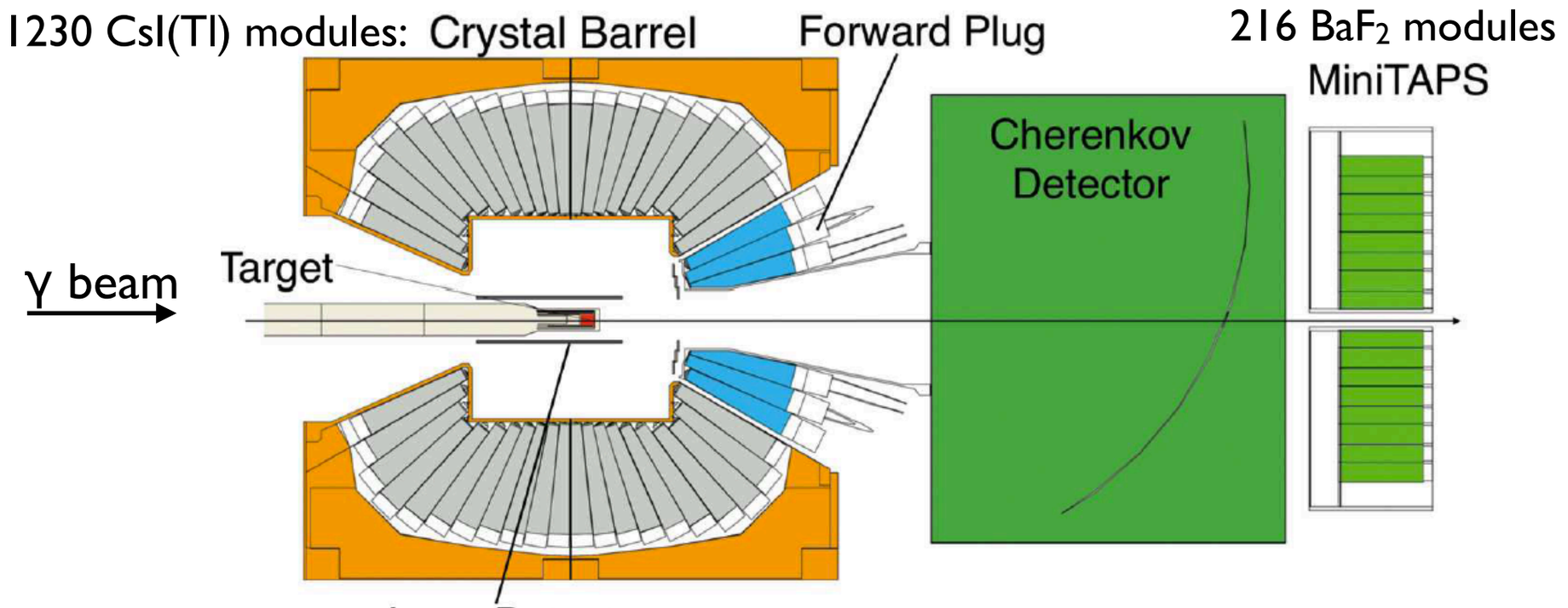
$\gamma p \rightarrow S_{11}(1535) \rightarrow p\,\eta$

PDG: M = 1530 MeV; Γ = 150 MeV

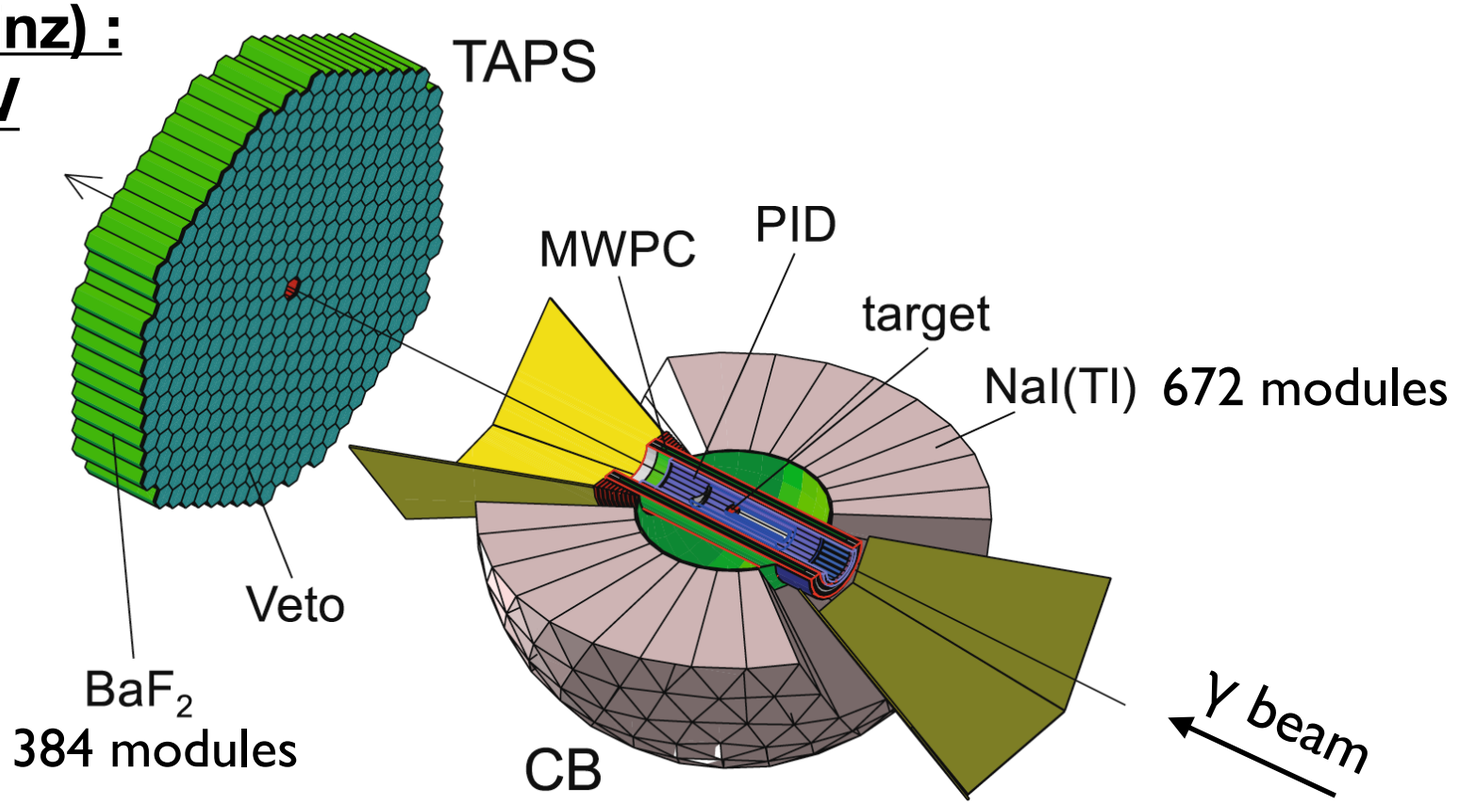
TAPS workshop 2003 at Rauischholzhausen

4π modular photon detector systems

CBELSA/TAPS (Bonn) : $E_\gamma \leq 3.2$ GeV



Crystal Ball (Mainz) : $E_\gamma \leq 1.55$ GeV



Photoproduction of η mesons off the neutron (proton)

B. Krusche et al., PLB 376 (1996) 331 (TAPS)

I. Jaegle et al., PRL 100 (2008) 252002 (CBELSA/TAPS)

D. Werthmüller et al., PRL 111 (2013) 232001 (Crystal Ball)

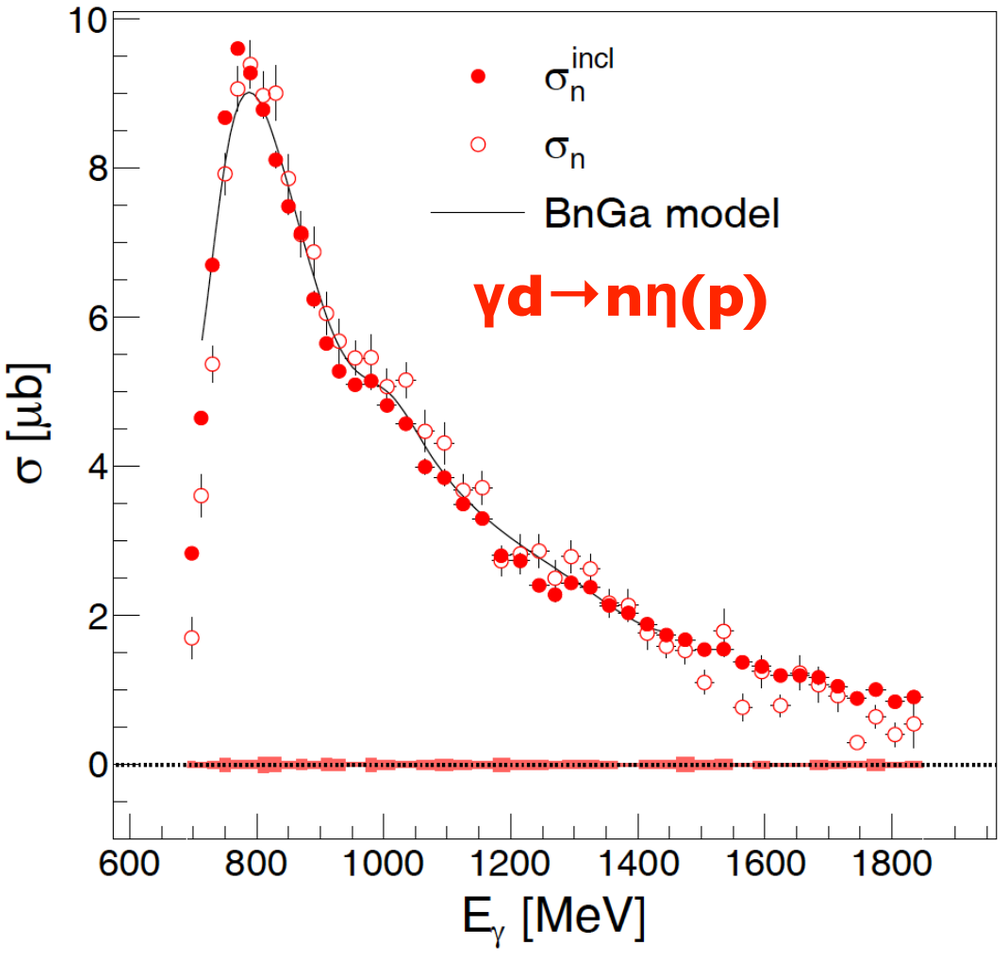
L. Witthauer et al et al., PRL EPJA 53 (2017) 58 (CBELSA/TAPS)

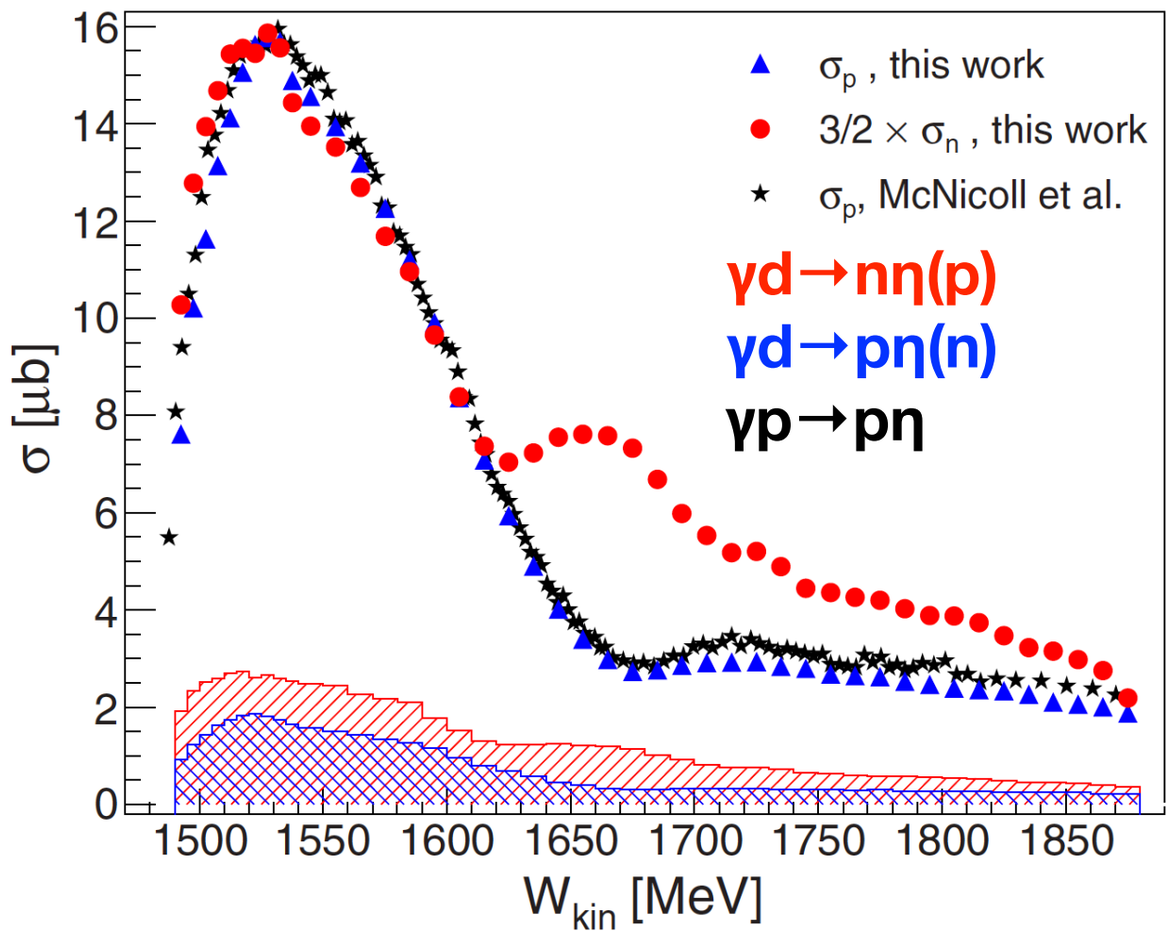
<u>two problems:</u>

1.) $\varepsilon_n \approx 30\%$, $\varepsilon_p \approx 95\%$,

2.) Fermi motion

exclusive measurement with complete reconstruction of the final state kinematics to remove Fermi motion effects in d, ^{3}He





γ n → n η: narrow structure at W = (1670±5) MeV; Γ = (30±15) MeV

γ p → p η: dip at W≈1670 MeV, associated with opening of pω and KΣ channels ?

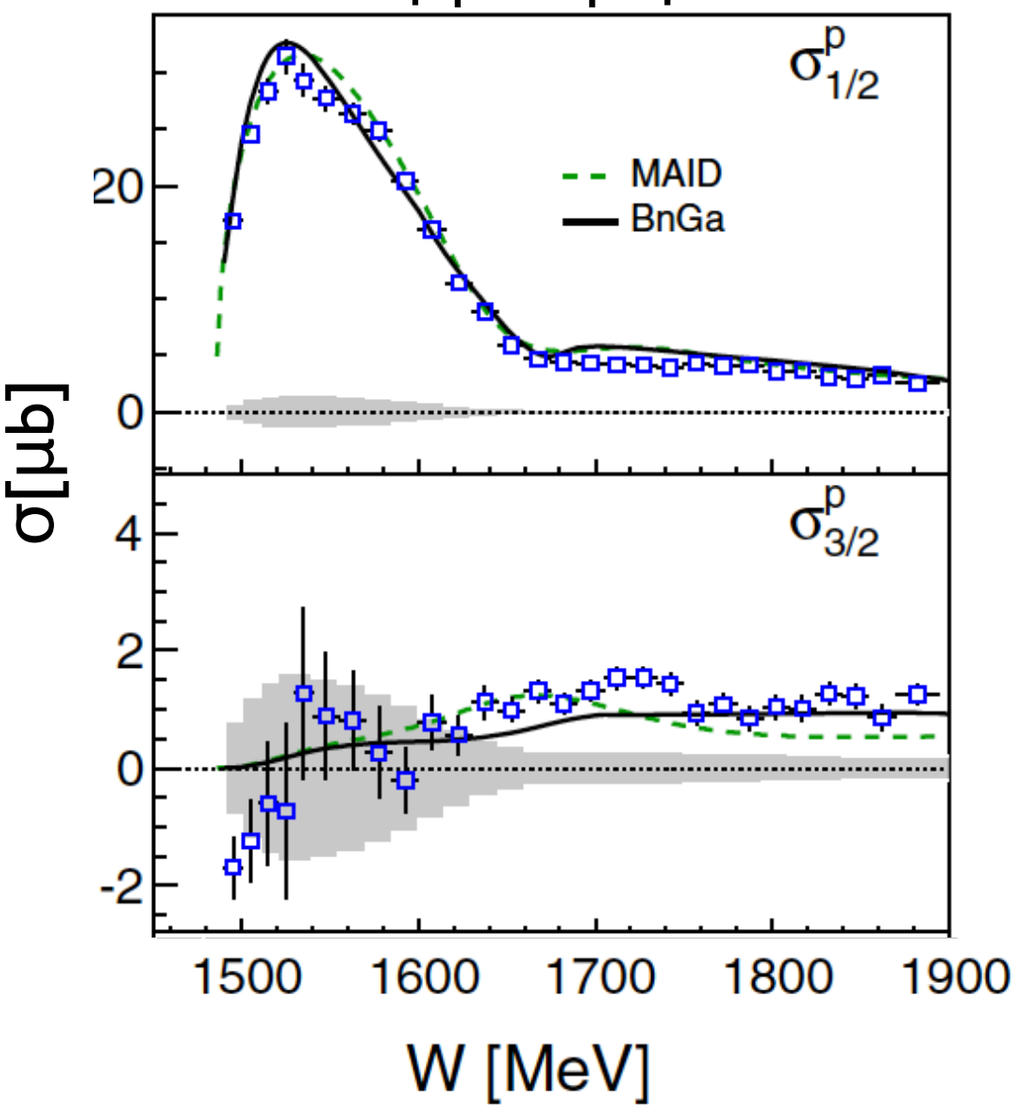
A.V. Anisovich et al., EPJA 51(2015)72: interference of $S_{11}(1535)1/2^-$ and $S_{11}(1650)\ 1/2^-$??

double polarization observable: E

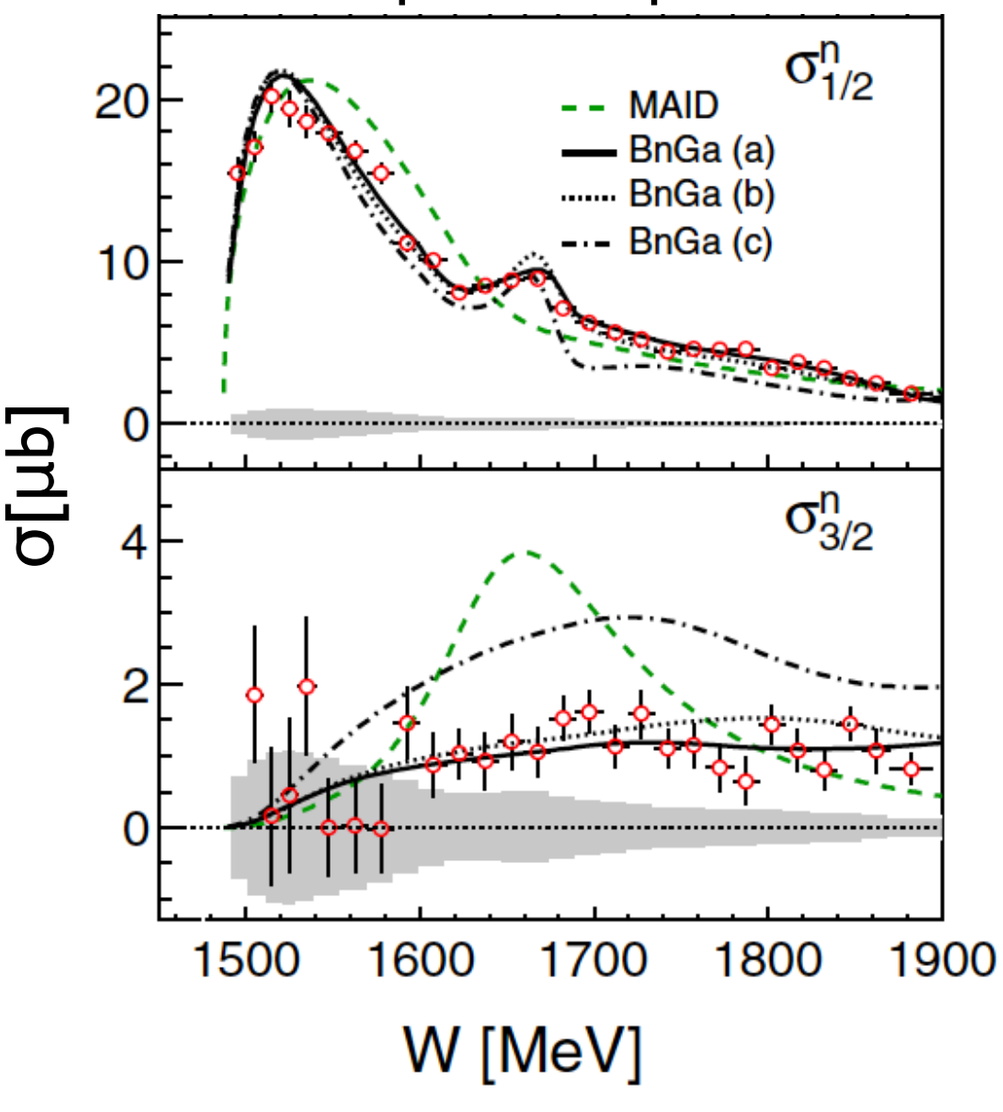
circularly polarised γ beam and longitudinally polarized target:
decomposition of cross section into helicity-1/2 and helicity-3/2 contributions

L. Witthauer et al et al., PRL 117 (2016) 132502 (Crystal Ball)

$\gamma p \rightarrow p \eta$



$\gamma n \rightarrow n \eta$



structure only seen in helicity-1/2 channel → only S_{11} and P_{11} resonances involved

best fit with S_{11} wave + narrow P_{11} resonance at W=1670 MeV; but not listed in PDG

The Basel team

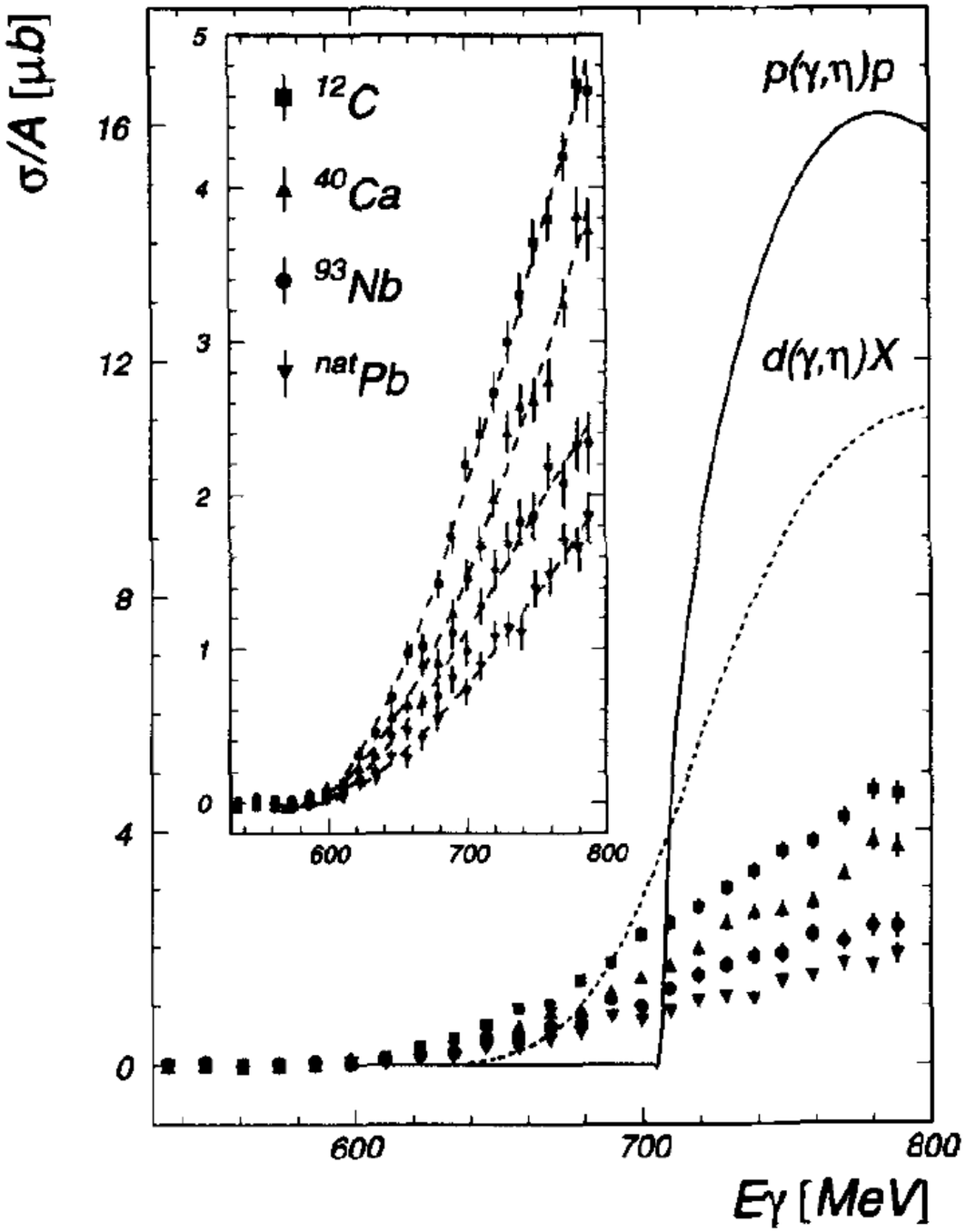
PhD celebration Dominik Werthmüller (3.4.2013)

Photoproduction of η mesons off nuclei

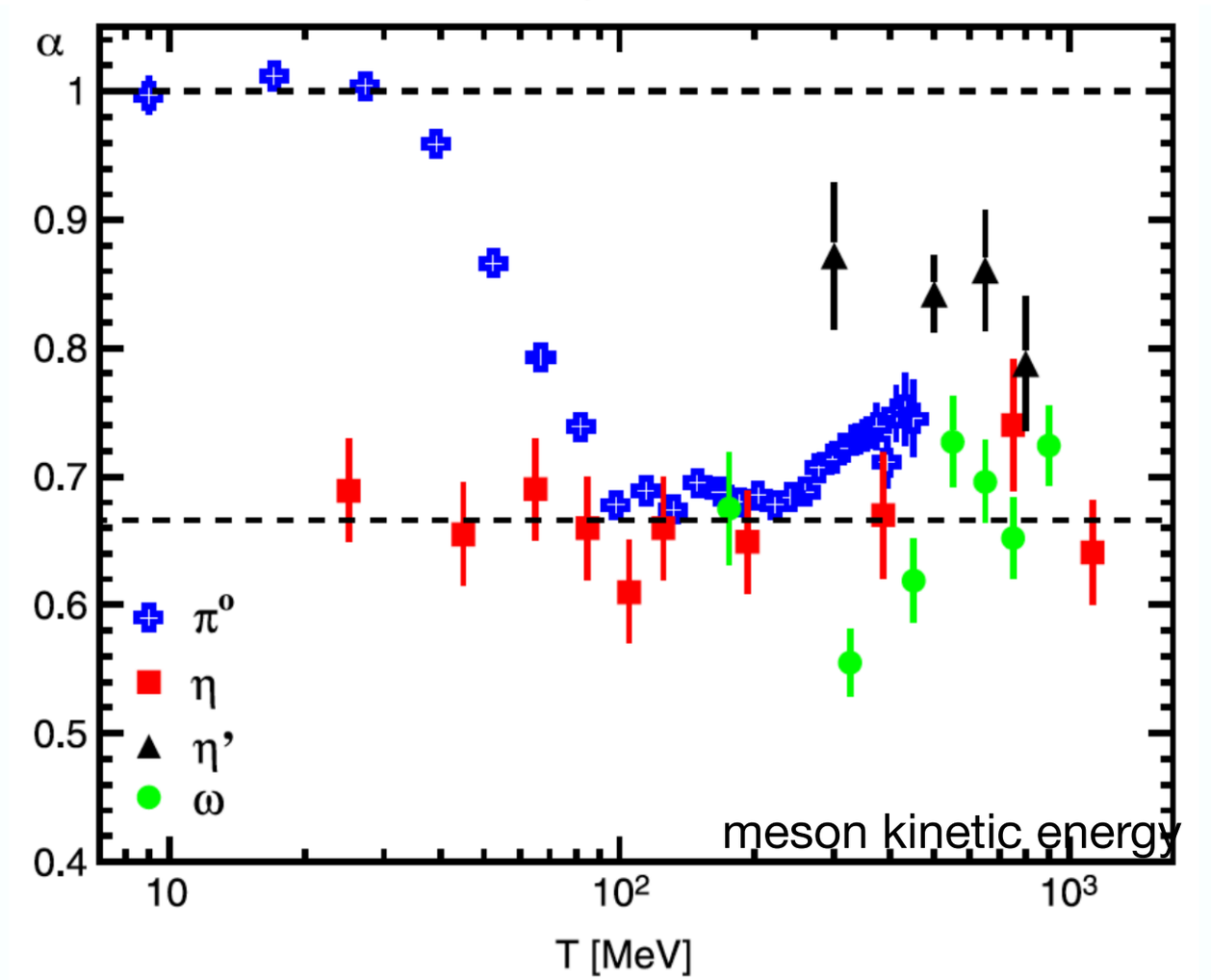
M. Roebig-Landau et al. PLB 373 (1996) 45 (TAPS)

T. Mertens et al., EPJA 38 (2008) 195 (CBELSA/TAPS)

information on meson absorption in nuclei



$\sigma = \sigma_0 \cdot A^{\alpha(T)}$



$\sigma_{abs}^{\eta N} = (30 \pm 6)$ mb

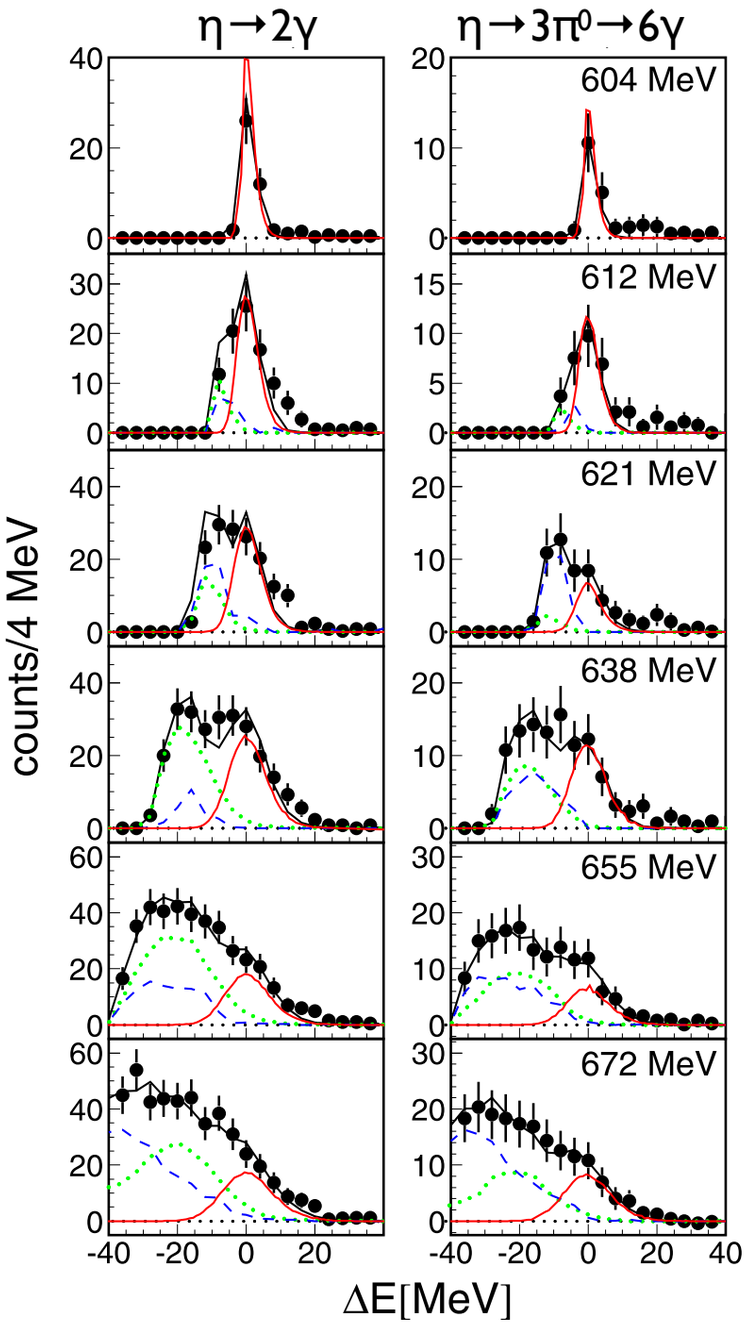
$\lambda = 2.0$ fm $< R_{nuclei}$; $\alpha \approx 2/3$

almost independent of T

search for η - nucleus bound states

$\gamma\ ^3He \rightarrow \eta\ X$

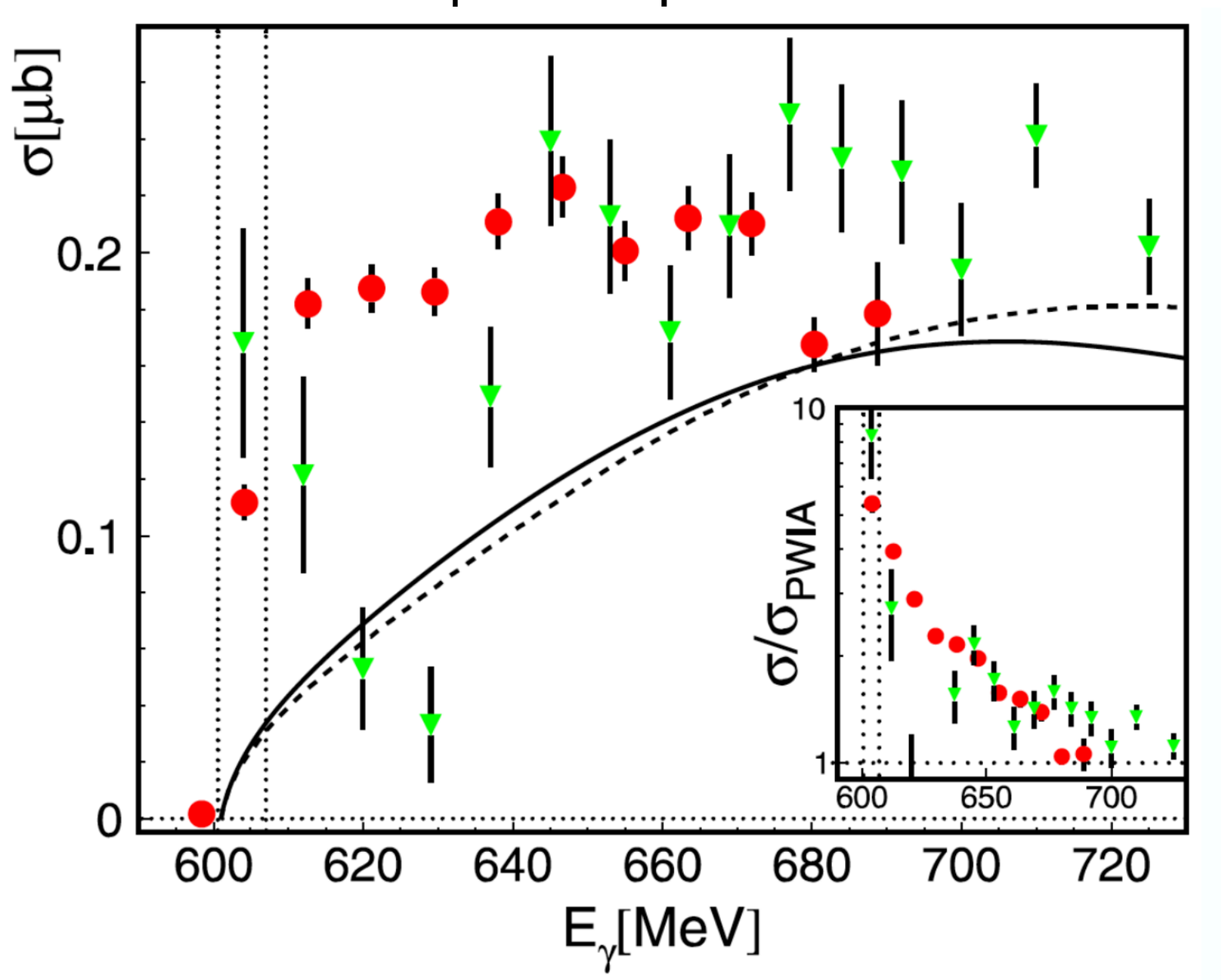
missing energy spectra to select coherent η production



▼ M. Pfeiffer et al. 92 (2004) 252001 (TAPS)

● F. Pheron et al., PLB 709 (2012) 21 (Crystal Ball)

$\gamma\ ^3He \rightarrow \eta\ ^3He$



strong rise of cross section at threshold →

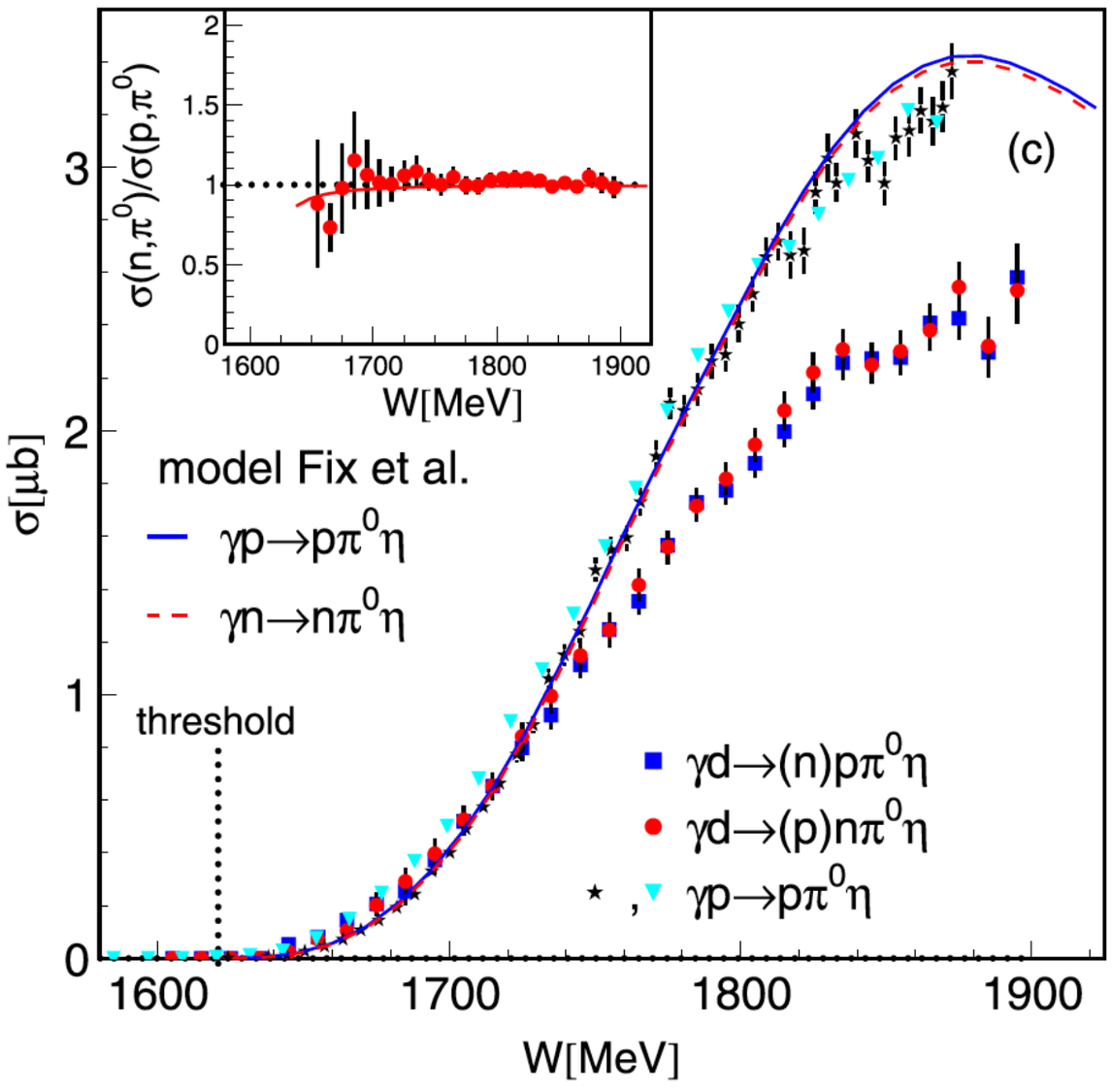
strong η-^{3}He final state interaction, but no convincing evidence for η-^{3}He bound state

photoproduction of meson pairs

A. Käser et al., PLB 748 (2015) 244 (Crystal Ball/TAPS)

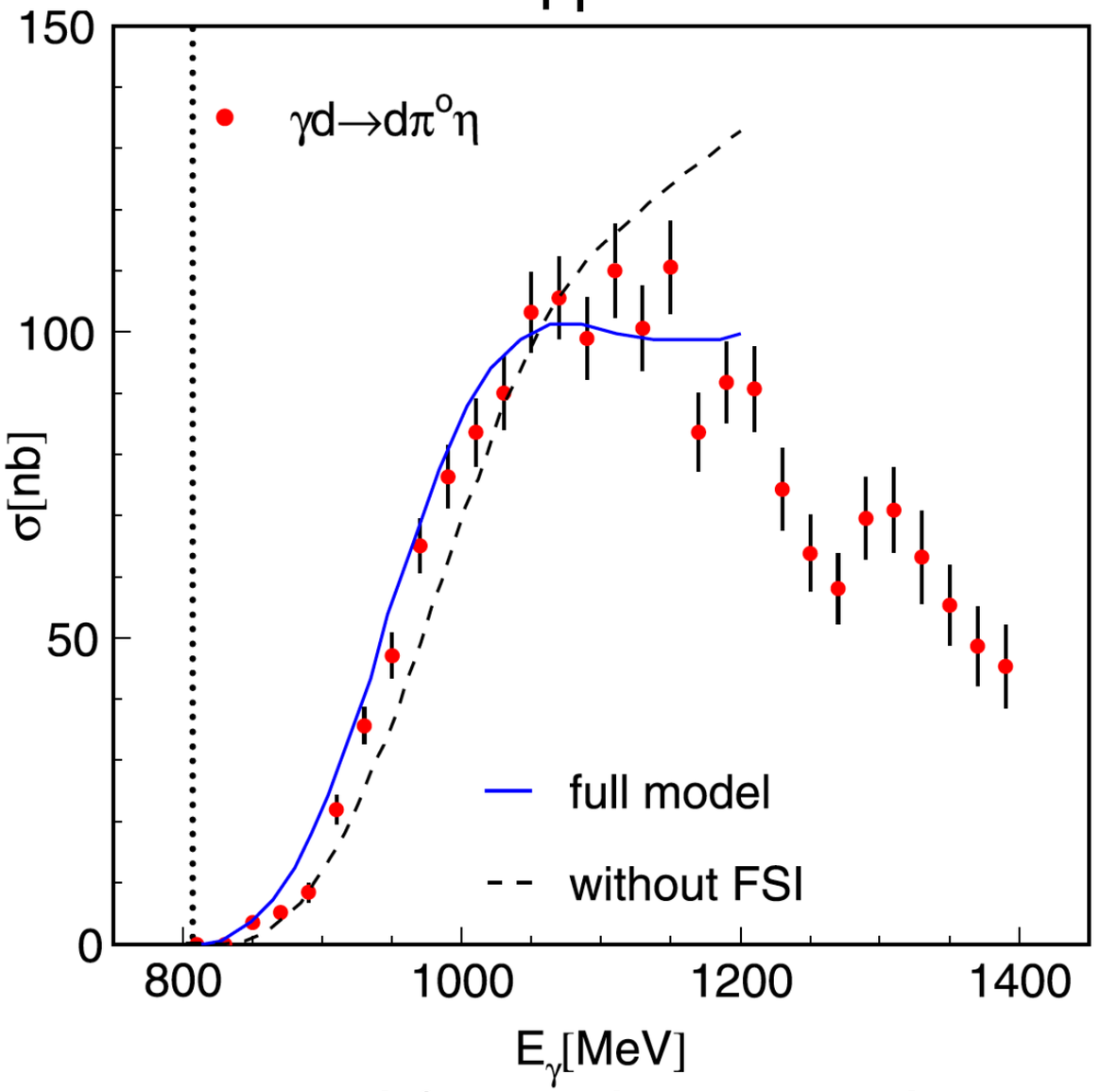
$\gamma\, d \rightarrow \pi^0\, \eta\, (p,n,d)$

$\pi^0\,\eta$ production off the free and bound nucleon



cross section off bound nucleon suppressed by FSI

coherent $\pi^0\,\eta$ production off d



promising tool for studying η-nucleus interaction (search for η-A bound states) by selecting high momentum π^0 and thus low momentum η mesons

Bernd Krusche
27.2.1956 - 1.6.2022

Bernd,
you left us far too early
we miss you

thank you
for all your achievements
and
for your friendship