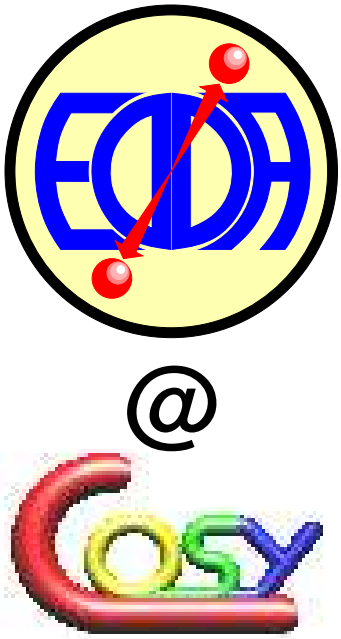


Proton-Proton Streuung: Ergebnisse des EDDA Experiments an COSY

H. Rohdjeß

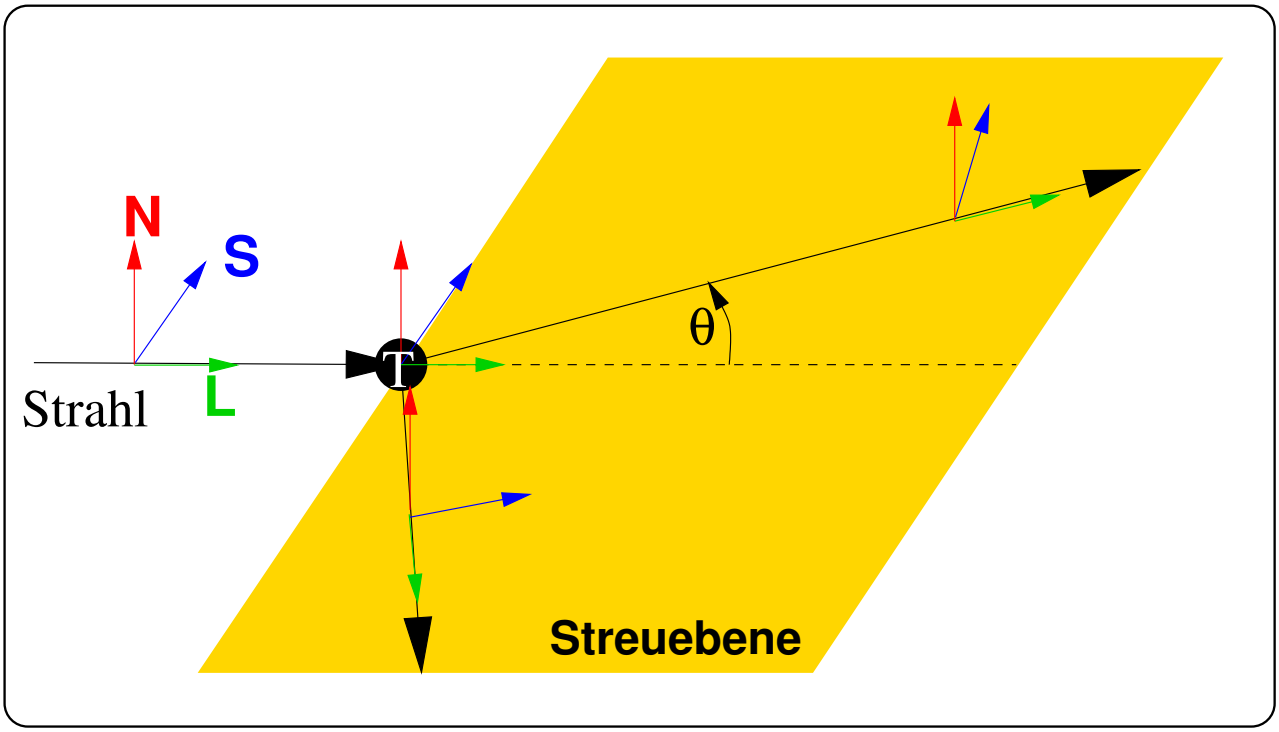
ISKP, Universität Bonn

für die EDDA-Kollaboration

(Bonn, Hamburg, Jülich)

$\vec{p}\,\vec{p} \rightarrow p\,p$ $\quad T_p = 0.5 \ldots 2.5$ GeV

$\frac{d\sigma}{d\Omega}$ A_N $\quad A_{NN}$ A_{SS} A_{SL}



Phasenanalyse (PSA)

- **Partialwellenzerlegung**

$$S_J = e^{2i\delta_J} \quad ; \quad \vec{J} = \vec{L} + \vec{S}$$

- **Physikalische Randbedingungen**

z.B.: $L > L_{max}$: OPE

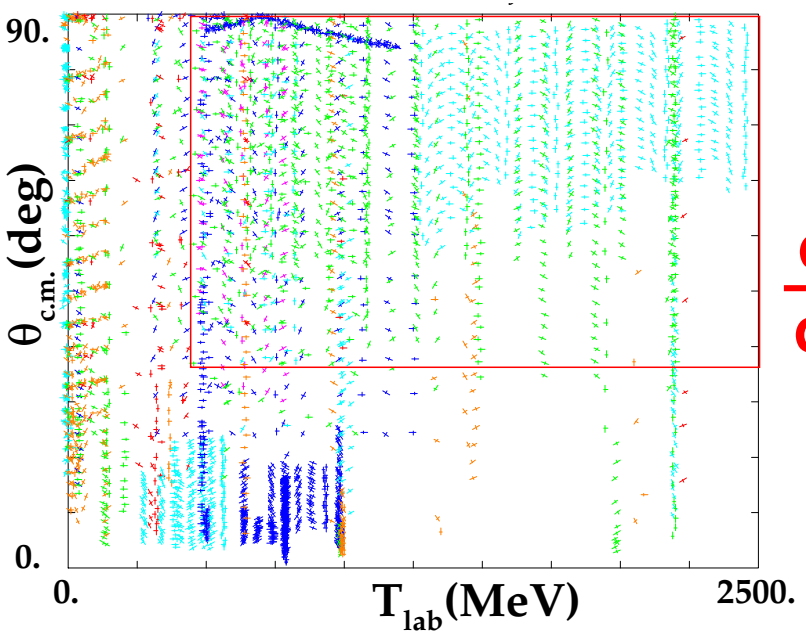
→ Vorhersagekraft !!

z.B. VPI (SAID) R. Arndt et al.

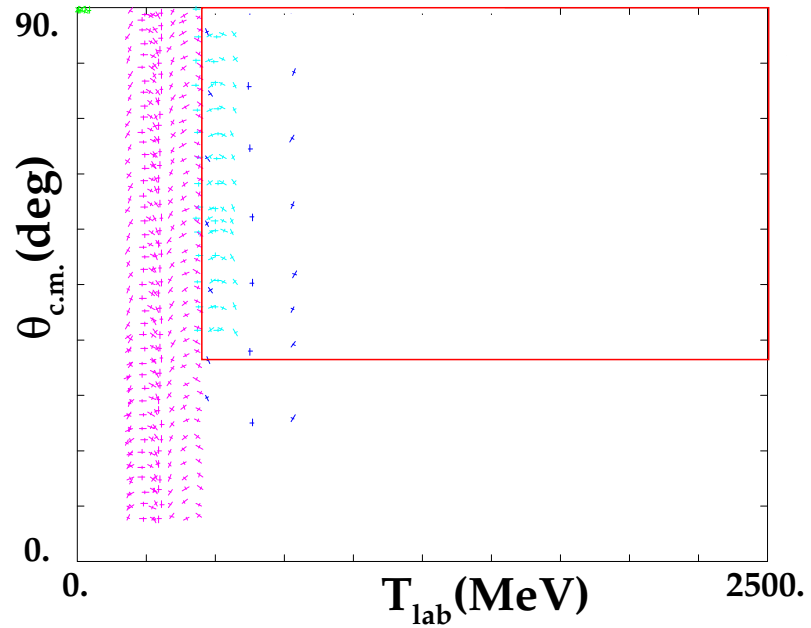
$T_p \in$ 0-3 GeV : 23000 / 12000 pp / np Daten

↔ Theorie

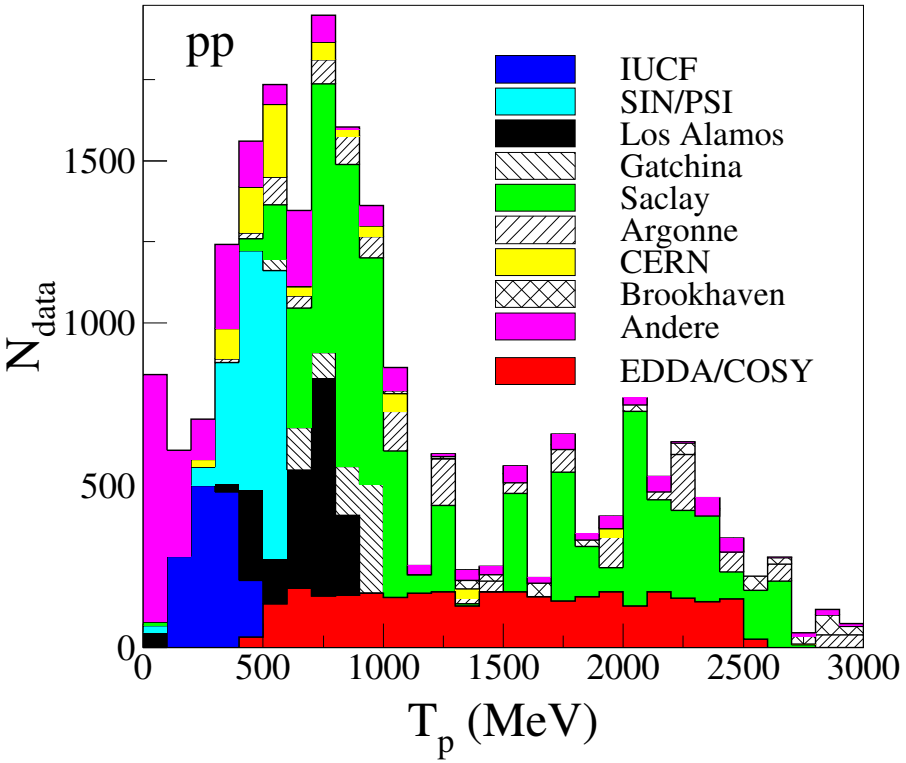
NN Datenbasis



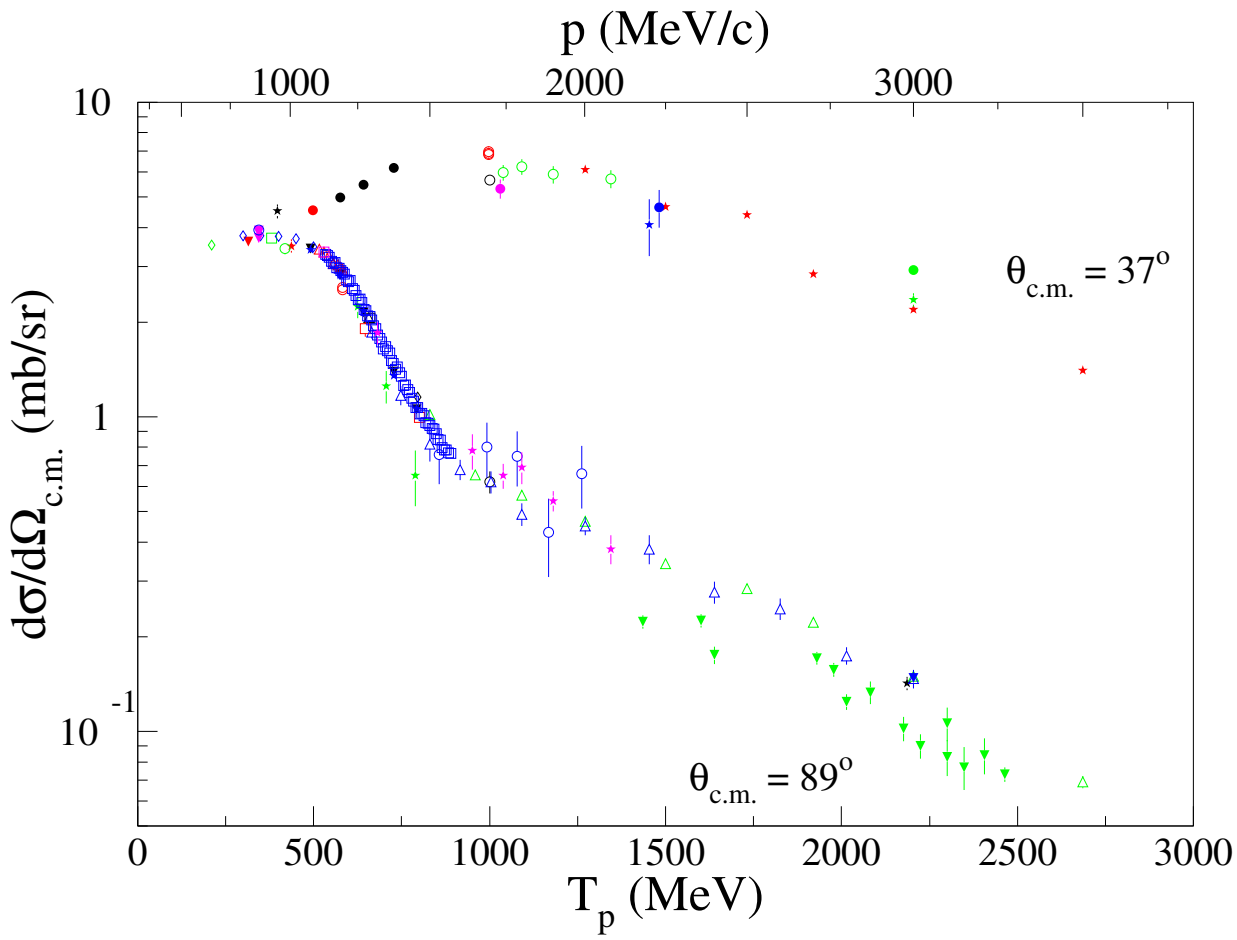
$\frac{d\sigma}{d\Omega}$



A_{ss}

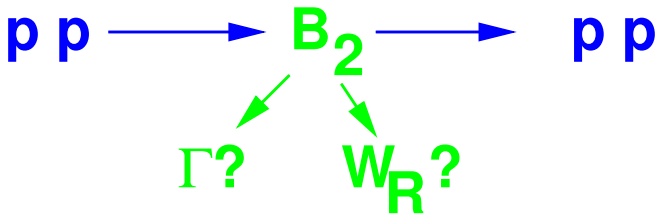


Motivation



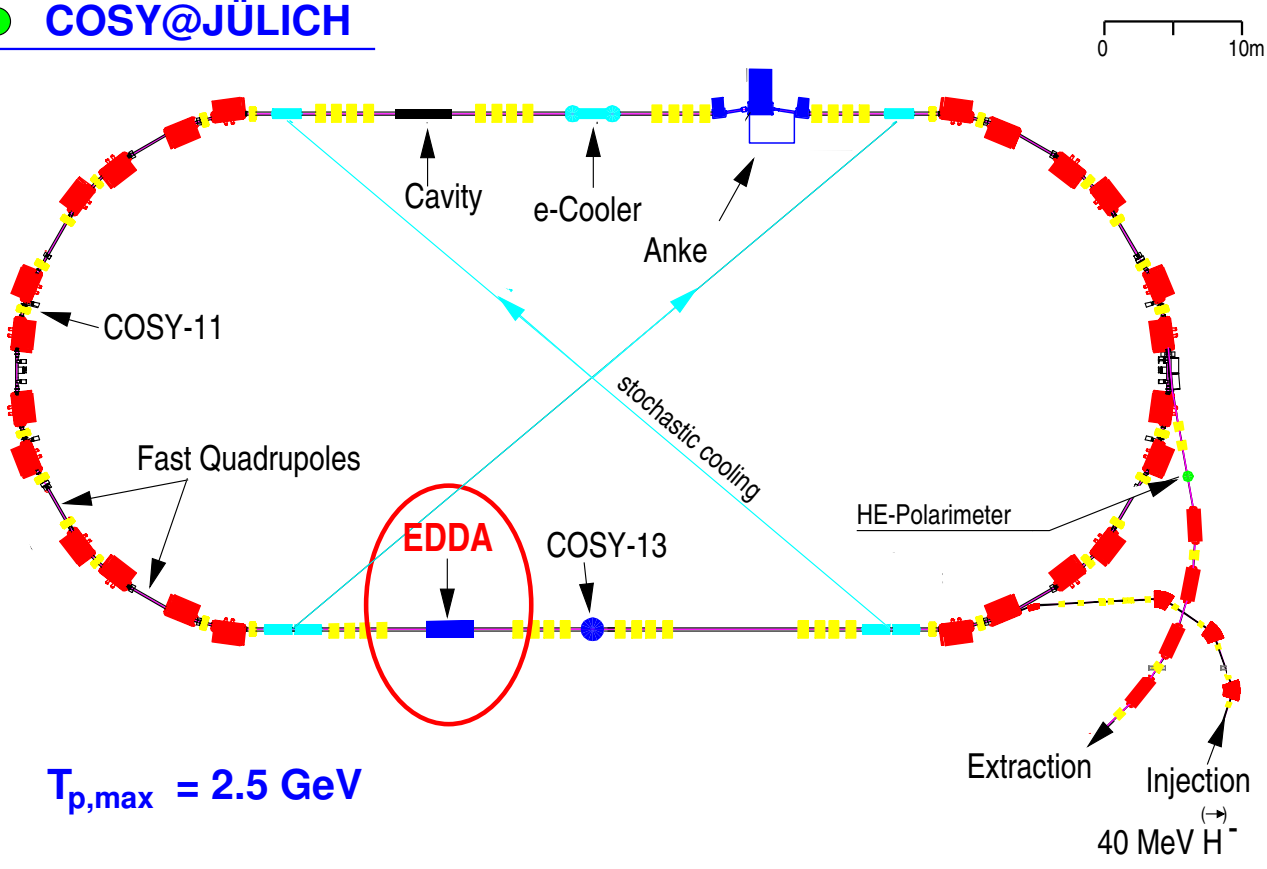
Anforderungen:

- **Statistik**
- **Konsistenz**
- **Spin Observablen**
- **Kleine Energieschritte**



Experimentelle Technik

COSY@JÜLICH



Internes Experiment

$p + CH_2$ Fädchen	→	$\frac{d\sigma}{d\Omega}$	√
$p + \vec{p}$ Atomstrahl	→	A_N	√
$\vec{p} + \vec{p}$ Atomstrahl	→	A_{NN} A_{SS} A_{SL}	(√)

Anregungsfunktionen

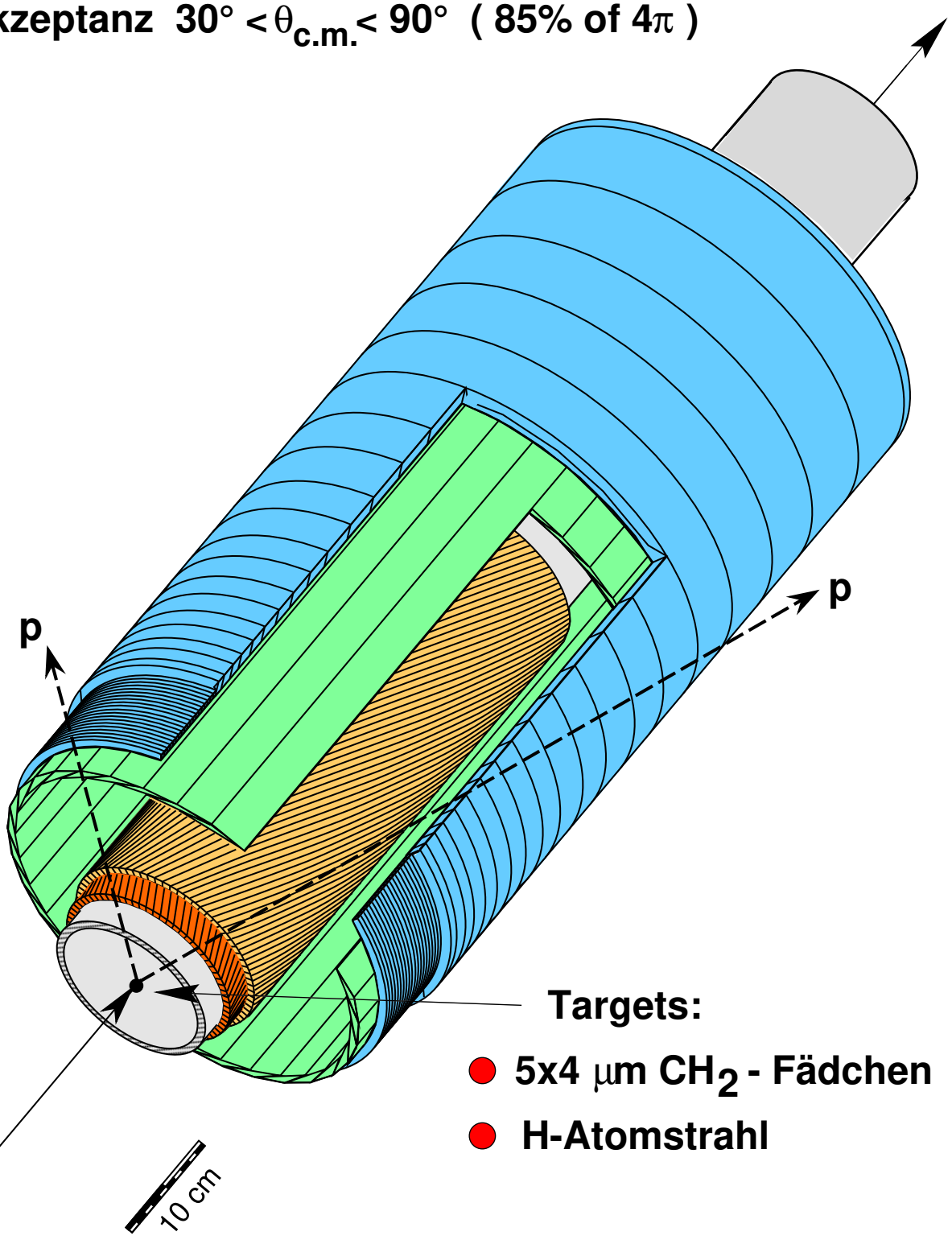
DAQ während Beschleunigung / (Abbremsen)

T_p = 300 .... 2500 MeV in 2 s

EDDA@COSY: Detector

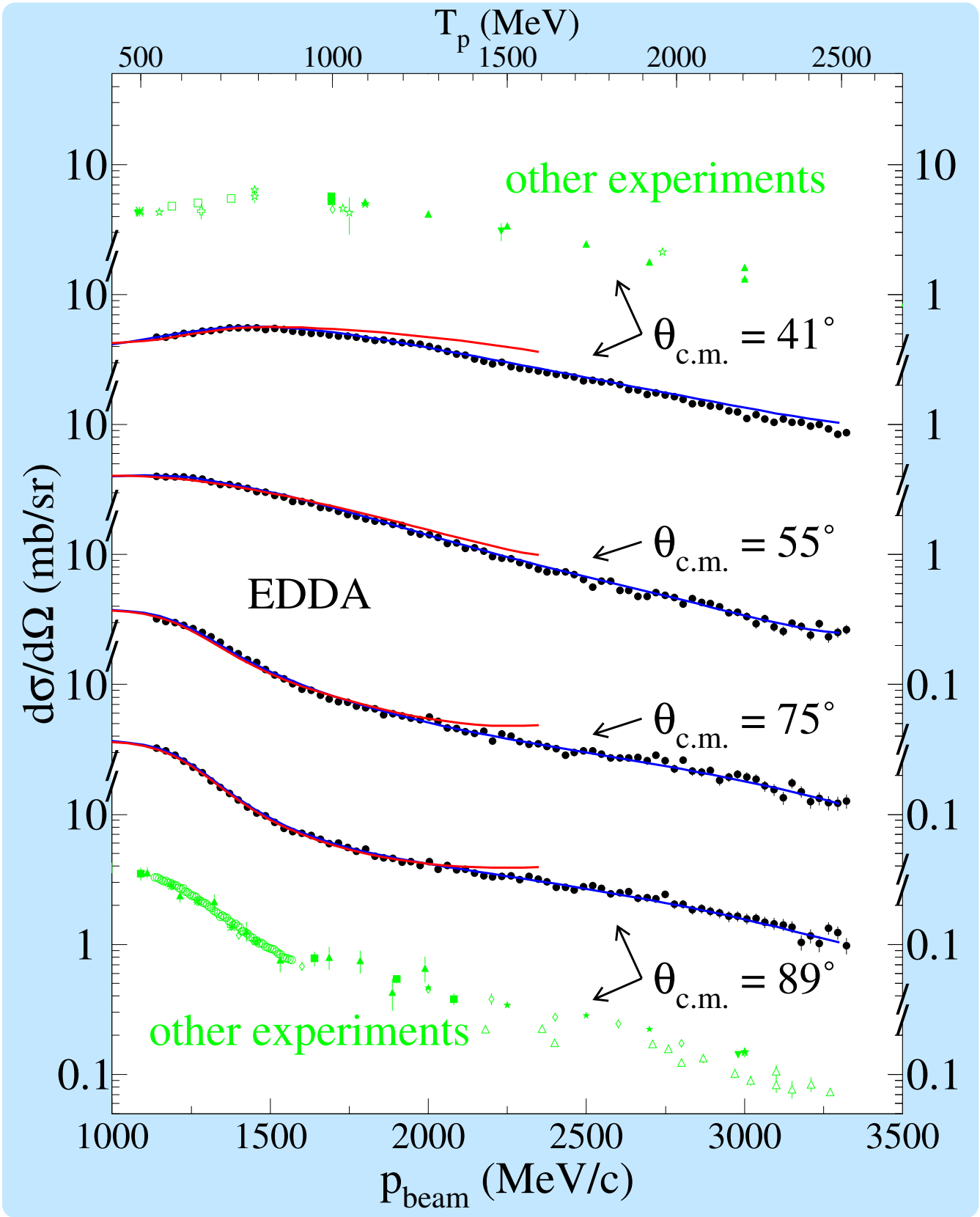
Bonn,Hamburg,Jülich

- Akzeptanz $30° < \theta_{c.m.} < 90°$ (85% of 4π)



EDDA Results: $\frac{d\sigma}{d\Omega}$

D.Albers et al.*Phys. Rev. Lett.* **78**, 1652 (1997)



SAID PSA: SM94, SM97

Results: Analyzing Power

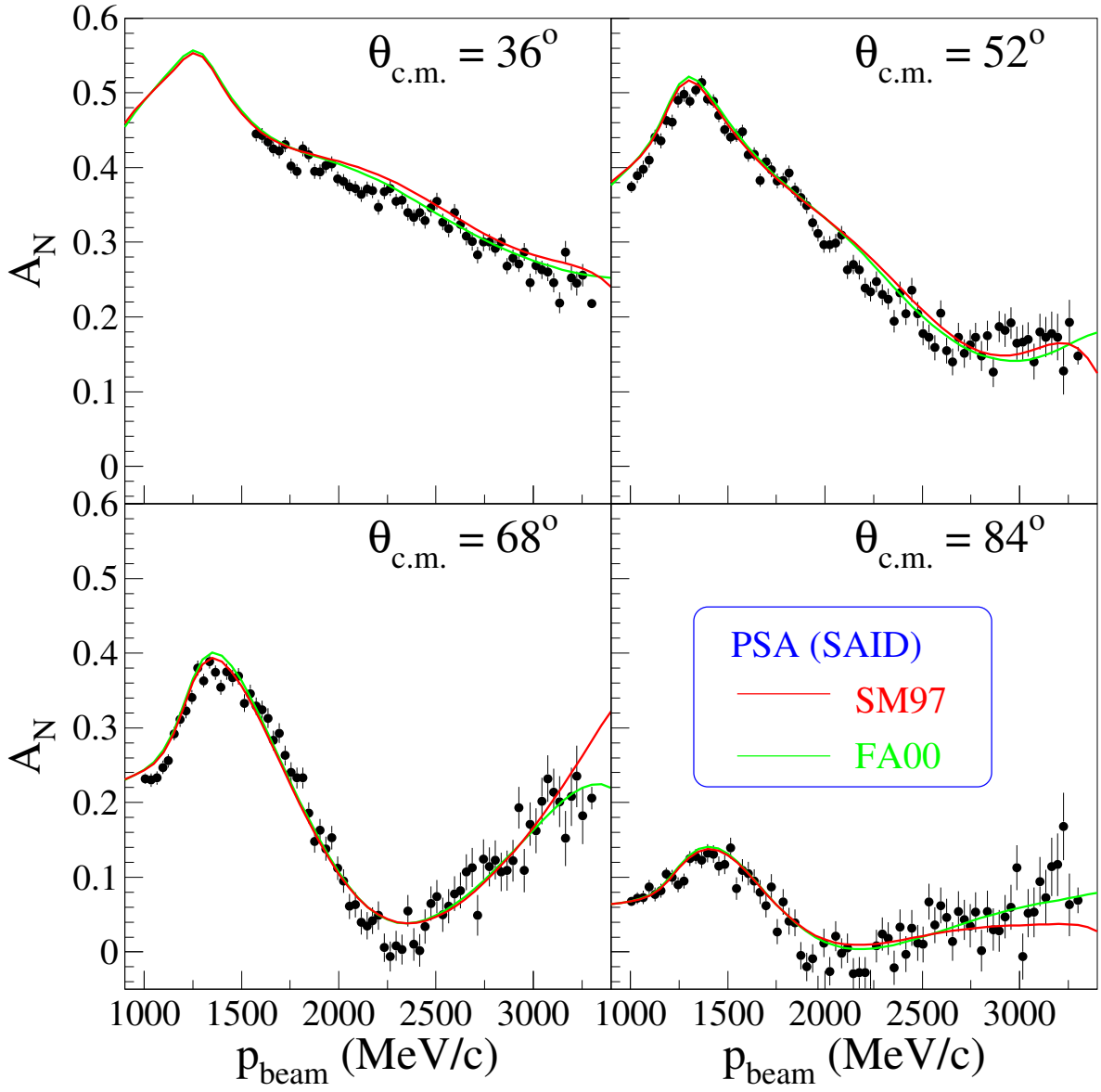
M.Altmeier et al. *Phys. Rev. Lett.* **85** ,1819 (2000)

$p \vec{p}$

25×10^6 Events

$\Delta\theta = 4°$

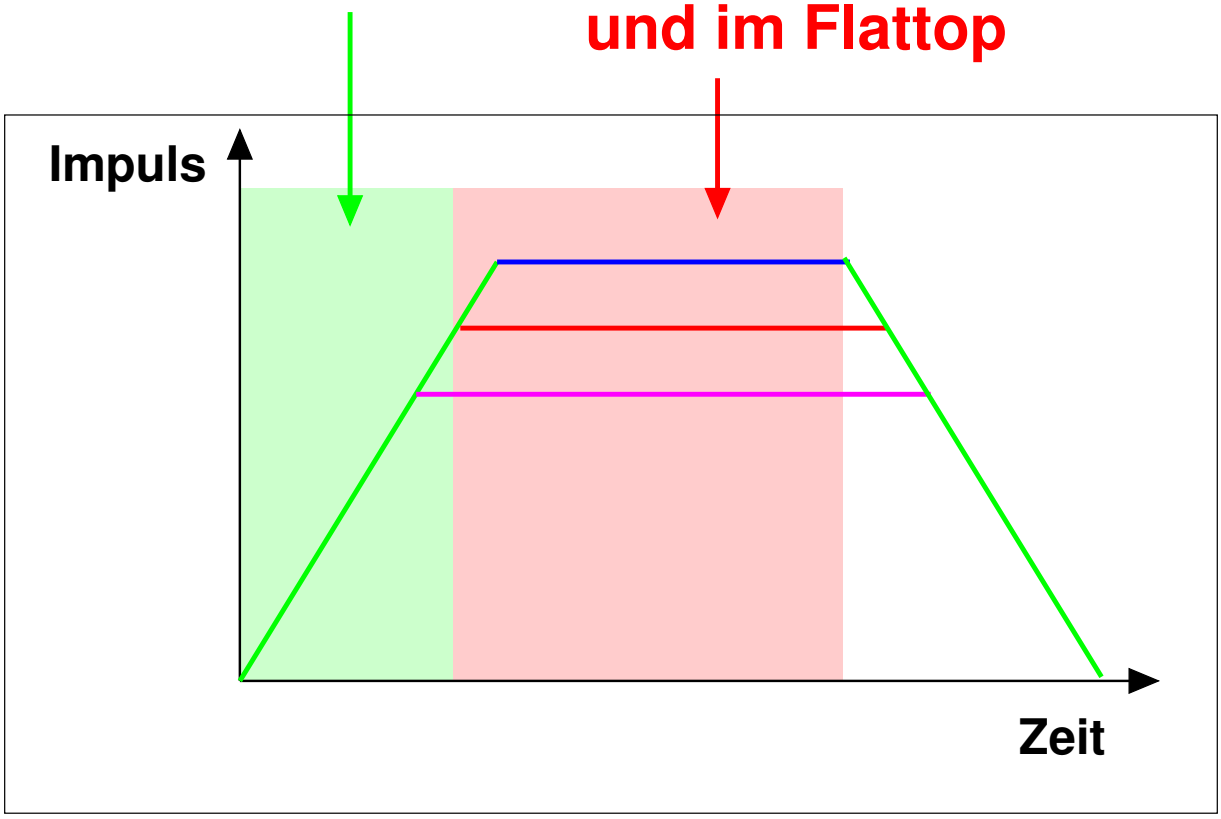
$\Delta p = 30$ MeV/c



Messungen mit $\vec{p}\,\vec{p}$

während der Beschleunigung

und im Flattop



Spineinstellungen: Strahl (p) + Target(q)

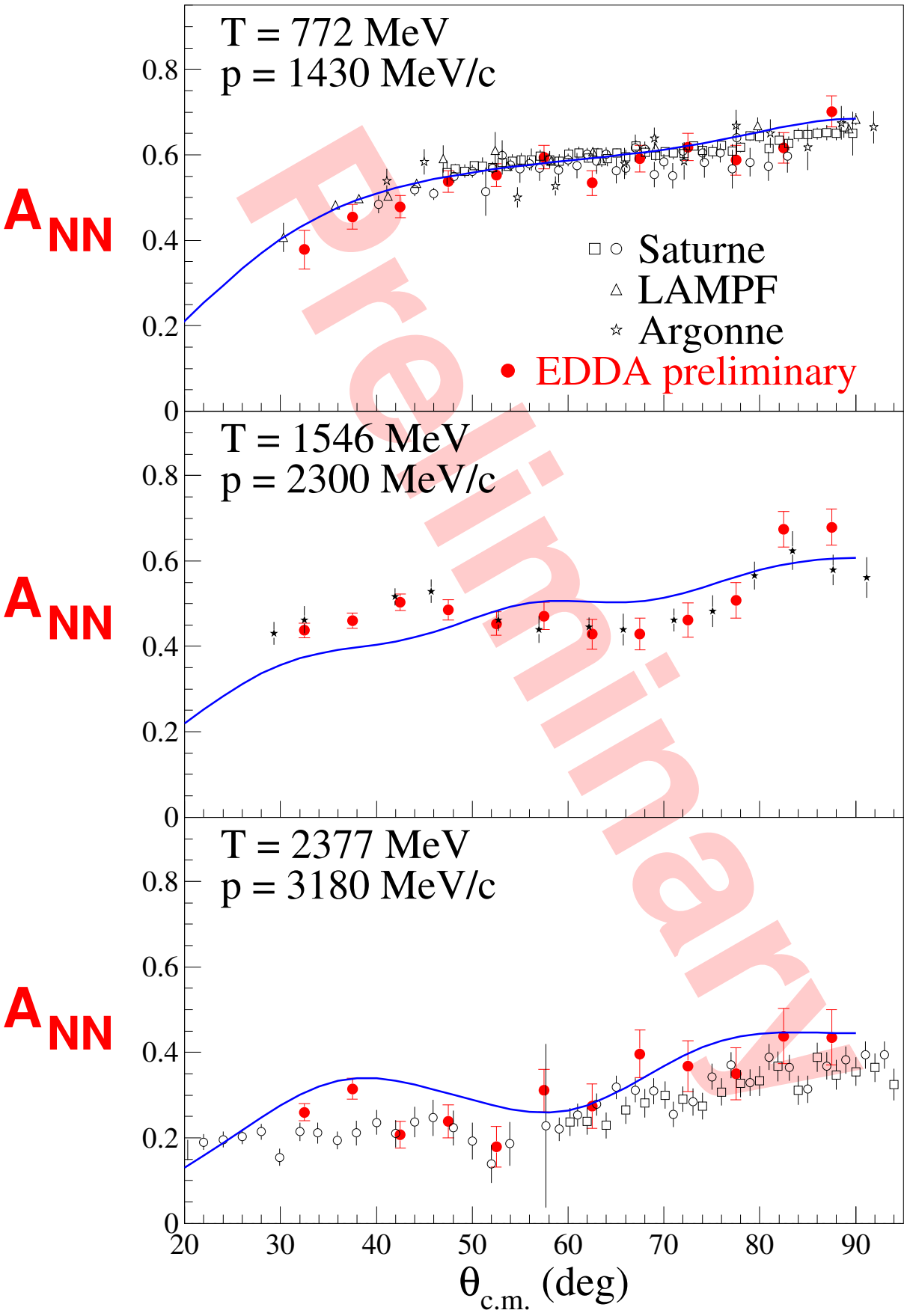
$$\frac{\sigma}{\sigma_0}(\phi) = 1 + A_N\{(p_y + q_y)\cos\phi + q_x \sin\phi\}$$

$$+ A_{NN}\{p_y q_y \cos^2\phi - q_x p_y \sin\phi\cos\phi\}$$

$$+ A_{SS}\{p_y q_y \sin^2\phi + q_x p_y \sin\phi\cos\phi\}$$

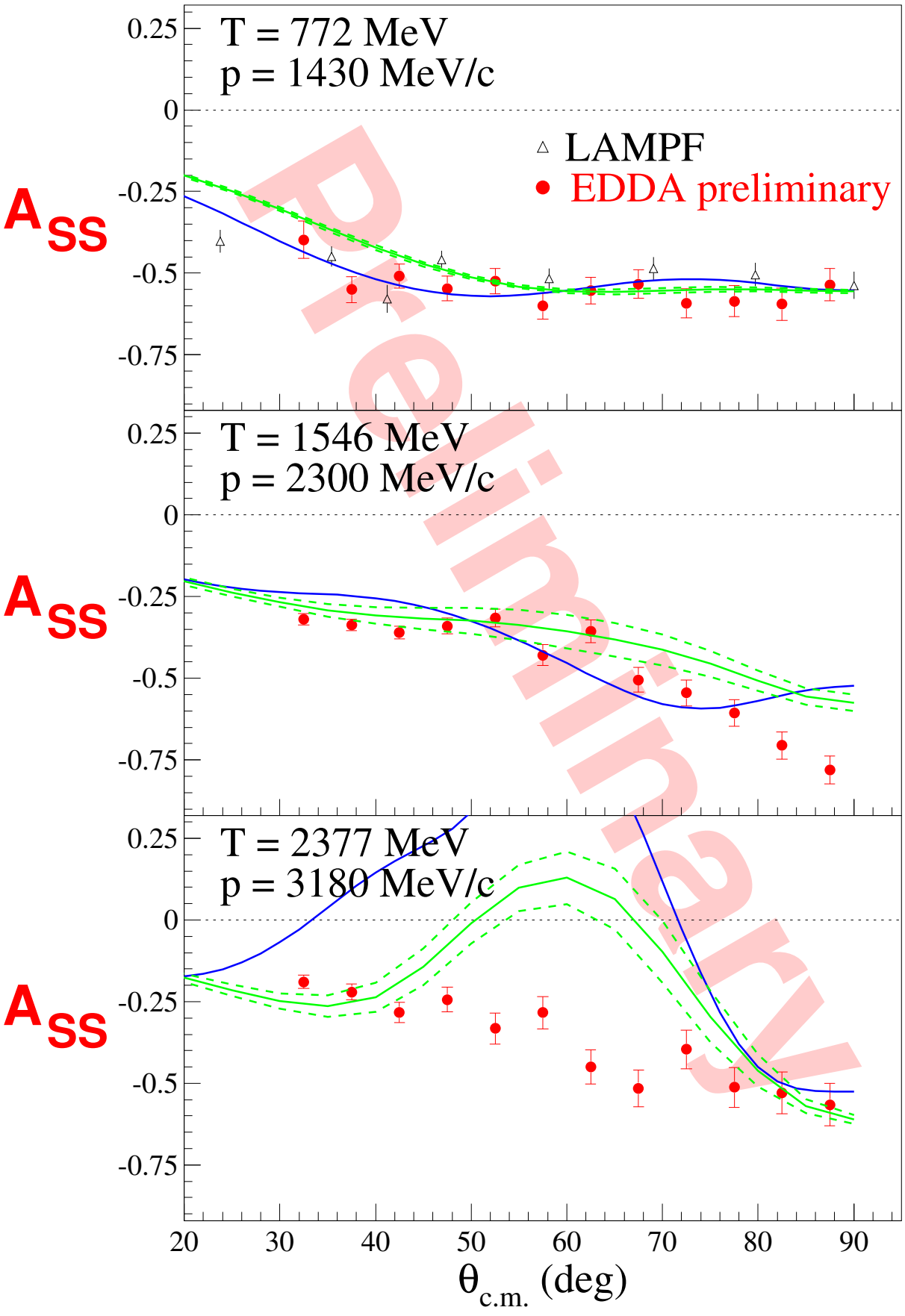
$$+ A_{SL}\; p_y q_z \cos\phi$$

Spinkorrelationsparameter



PSA: SAID(SM00)

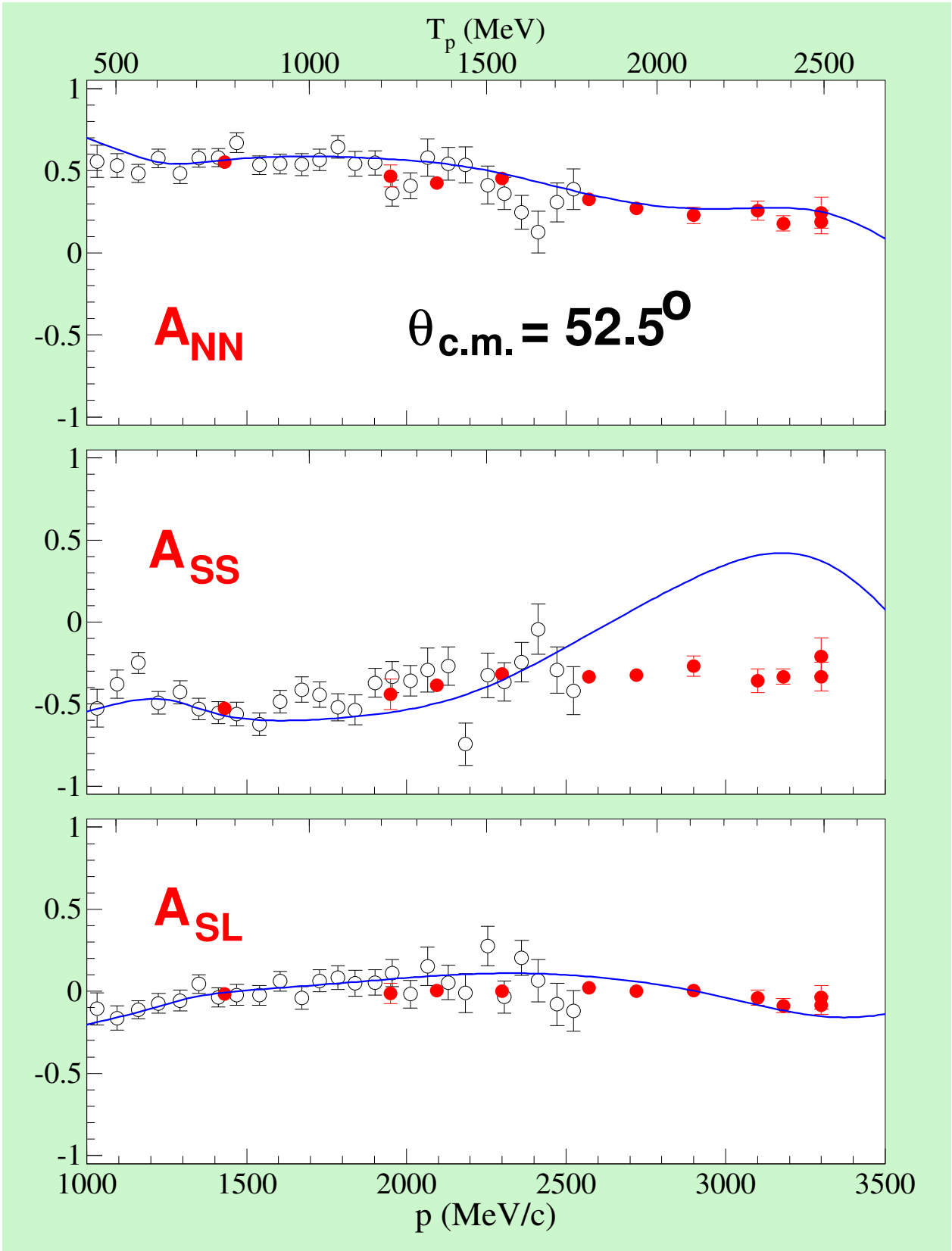
Spinkorrelationsparameter



PSA: SAID(SM00) Saclay-Genf

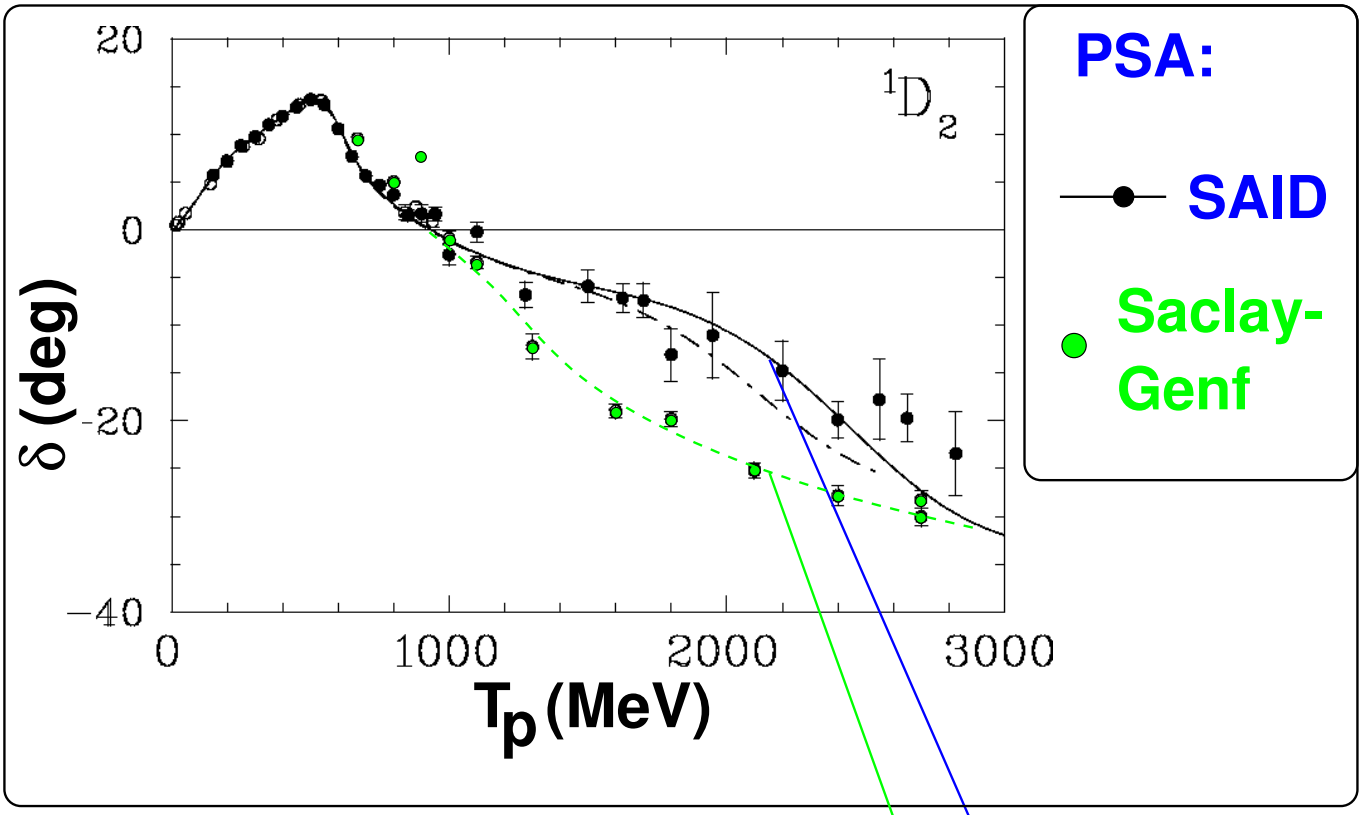
Anregungsfunktionen

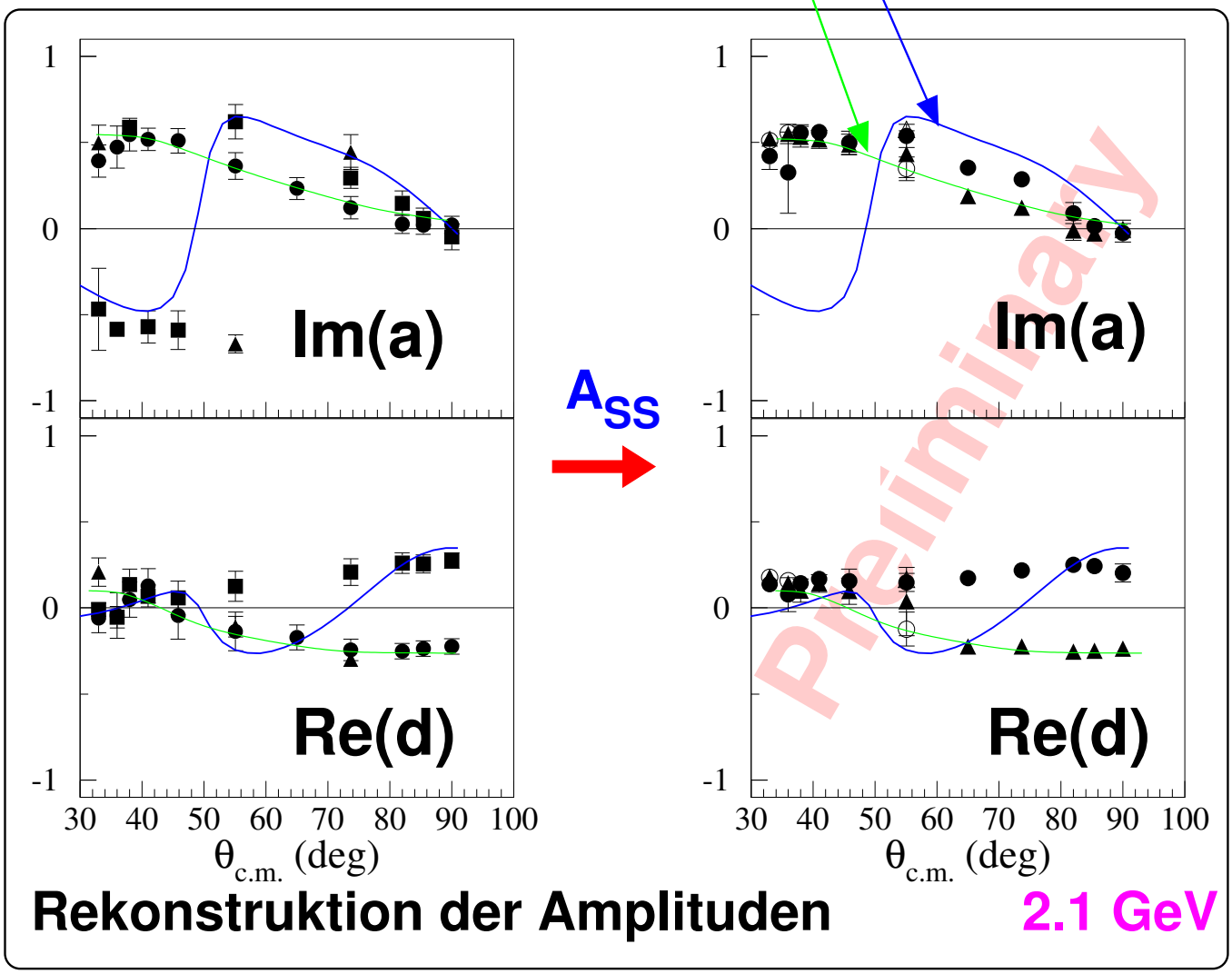
EDDA preliminary



PSA (SAID SM00)

Ambiguitäten in Streuphasen





Dibaryonen

- **farbneutrale Zustände:**

	Baryonen	Mesonen	
Warum nur	qqq	$q\bar{q}$	beobachtet
und nicht	$qqqq\bar{q}$	$qq\bar{q}\bar{q}$	??
	$qqqqqq$		

- **Viele theoretische Vorhersagen !**
  für I=1 ,S=0 : $W_R \approx$ **2.1 ... 2.7 GeV**

  $\Gamma =$ **10...150 MeV**

  keine experimentelle Evidenz !

- **bekannte Strukturen:**

  $^1D_2(2170)$ $\Gamma \approx$ **80 MeV**

  $^3F_3(2250)$ $\Gamma \approx$ **150 MeV**

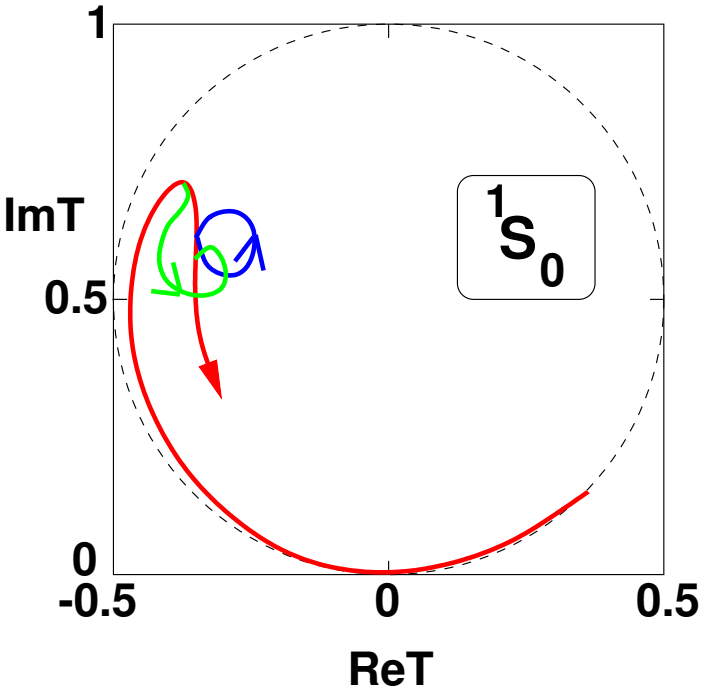
  } **NΔ Schwelle/Resonanz** $^5S_2$, $^5P_3$

Dibaryonen?

- **KEINE EVIDENZ** !!

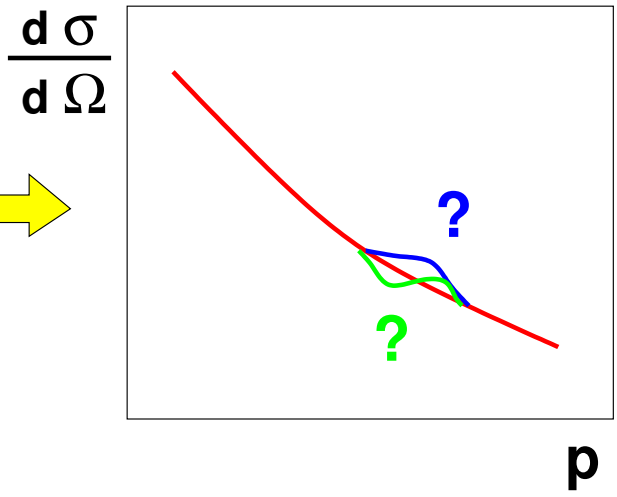
- **OBERE GRENZEN ?**

Argand-Diagramm



T = (S-1)/2i

Observable



$$S_{LJ} = \eta'_{LJ} e^{2i\delta'_{LJ}} = e^{2i\delta_{LJ}} \left(\eta_{LJ} - \frac{i\,\Gamma\,\eta_{el} e^{2i\phi}}{W - W_R + i\,\Gamma/2} \right)$$

Ziel: für jedes (W_R , Γ), finde obere Grenze für

$$\eta_{el} = \Gamma_{el} / \Gamma$$

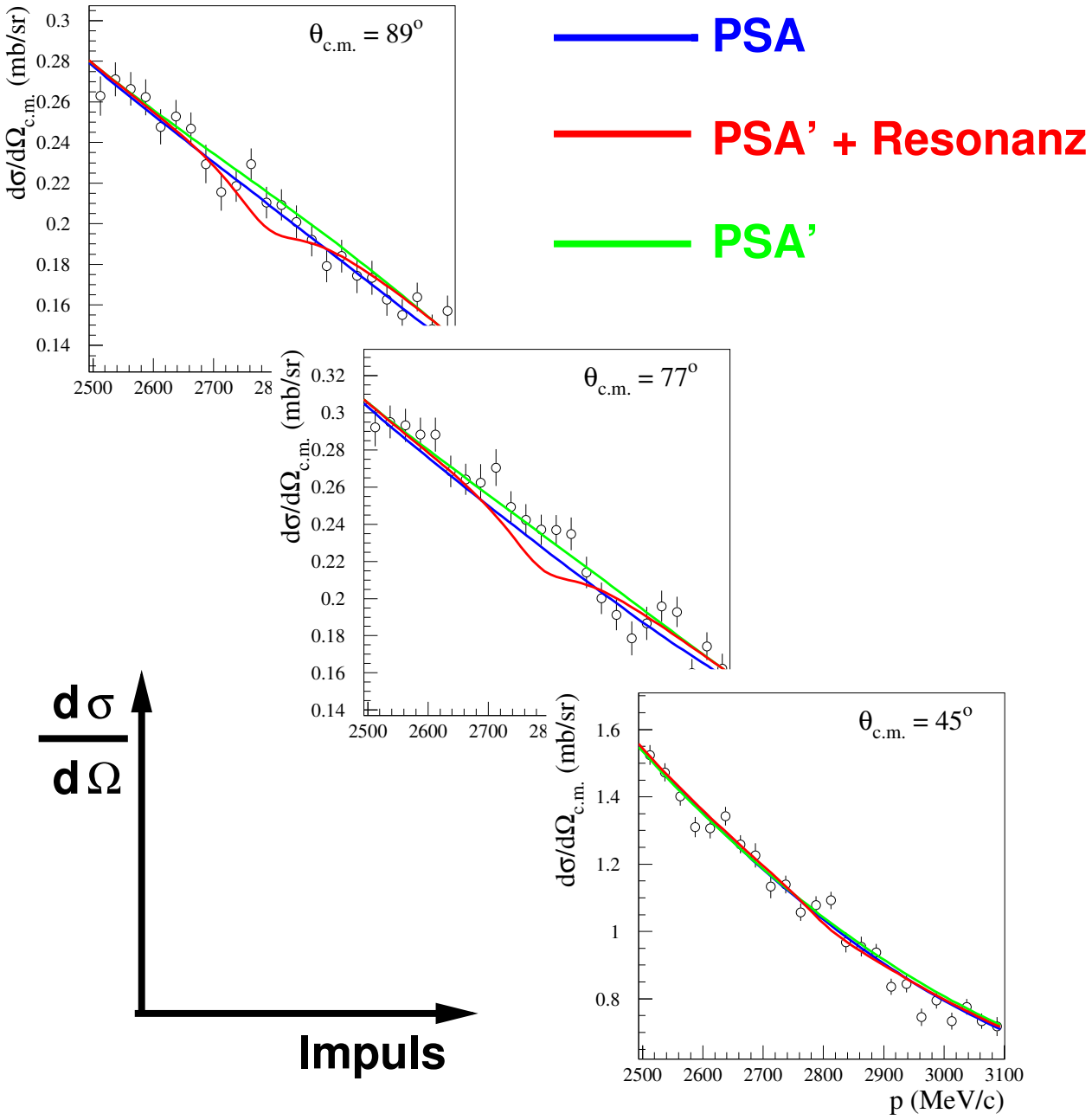
Obere Grenzen für Γ_{el}/Γ_{tot}

Beispiel: $^1S_0$

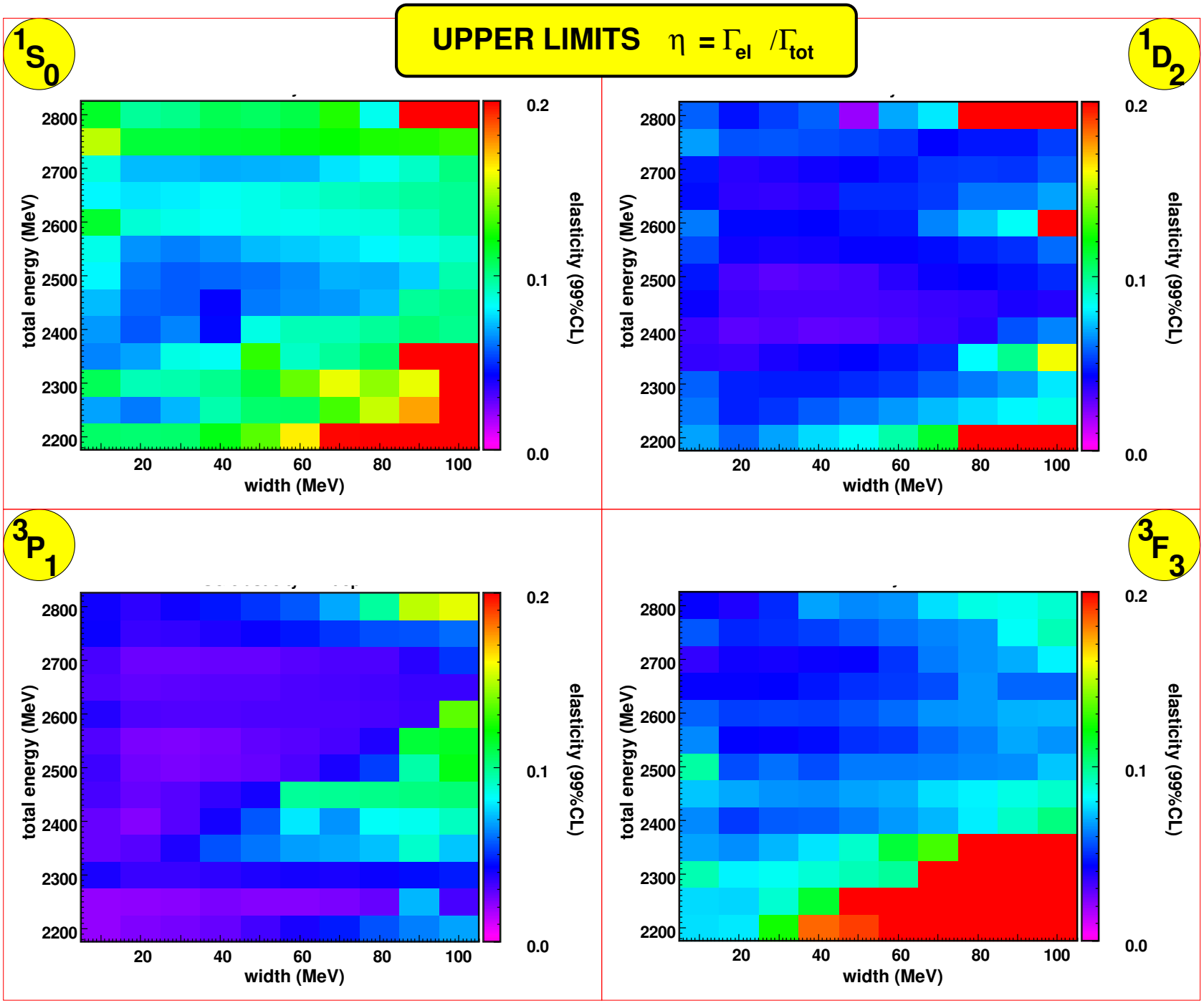
$W_R = 2700$ MeV

$\Gamma_{tot} = 50$ MeV

$\phi = -60^o$



$\Rightarrow \eta_{el} = \Gamma_{el}/\Gamma_{tot} < 0.07$; 99% CL


UPPER LIMITS $\eta = \Gamma_{el} / \Gamma_{tot}$
$^1S_0$
$^1D_2$
$^3P_1$
$^3F_3$
total energy (MeV)
width (MeV)
elasticity (99%CL)
2200
2300
2400
2500
2600
2700
2800
20
40
60
80
100
0.0
0.1
0.2

obere Grenzen für $\eta_{el} = \Gamma_{el} / \Gamma_{tot}$ (99% CL)

W_R = 2.2 ... 2.8 GeV

Γ = 10 ... 100 MeV

$\eta_{el} >$	0.09	$(^1S_0)$
	0.05	$(^1D_2)$
	0.10	$(^3P_0)$
	0.03	$(^3P_1)$
	0.06	$(^3F_3)$

mit 99% Wahrscheinlichkeit ausgeschlossen

Zusammenfassung

- **Anregungsfunktionen** $\frac{d\sigma}{d\Omega}$, A_N

  ⇒ **PSA**

  ⇒ **Test auf resonante Beiträge**

  W_R = 2.2...2.8 GeV , Γ = 10...100 MeV

  η_{el} > 3..10% ausgeschlossen

- **Spinkorrelationsparameter**

  A_{NN} A_{SS} A_{SL}

  ⇒ **Verringerung von Ambiguitäten**

  ⇒ **PSA ?**

The EDDA Collaboration

Spokesmen: J. Bisplinghoff, F. Hinterberger and W. Scobel,

M. Altmeier, F. Bauer, J. Bisplinghoff, K. Büßer, M. Busch,
T. Colberg, L. Demirörs, C. Dahl, F. Dohrmann, P.D. Eversheim,
O. Eyser, O. Felden, R. Gebel, M. Glende, J. Greiff, R. Groß-Hardt,
F. Hinterberger, R. Jahn, E. Jonas, H. Krause, R. Langkau,
C. Lehmann, T. Lindemann, J. Lindlein R. Maier, A. Meinerzhagen,
O. Nähle, C. Pauli, D. Prasuhn, H. Rohdjeß, D. Rosendaal,
P. von Rossen, N. Schirm, W. Scobel, H.J. Trelle, K. Ulbrich, E. Weise,
A. Wellinghausen, T. Wolf, K. Woller, R. Ziegler

Institut für Strahlen- und Kernphysik, Universität Bonn,
I. Institut für Experimentalphysik, Universität Hamburg,
Institut für Kernphysik, Forschungszentrum Jülich.

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