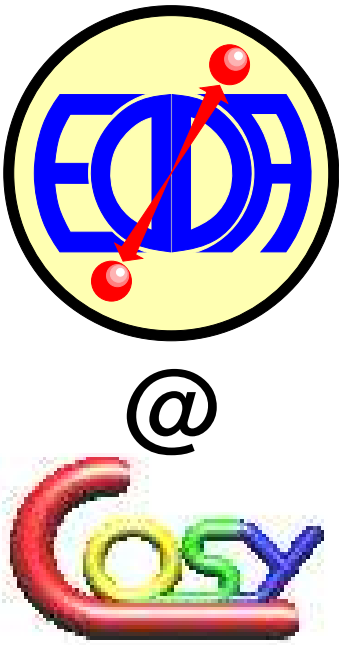


Wirkungsquerschnitte und Spinobservable in der elastischen Proton-Proton Streuung

H. Rohdjeß

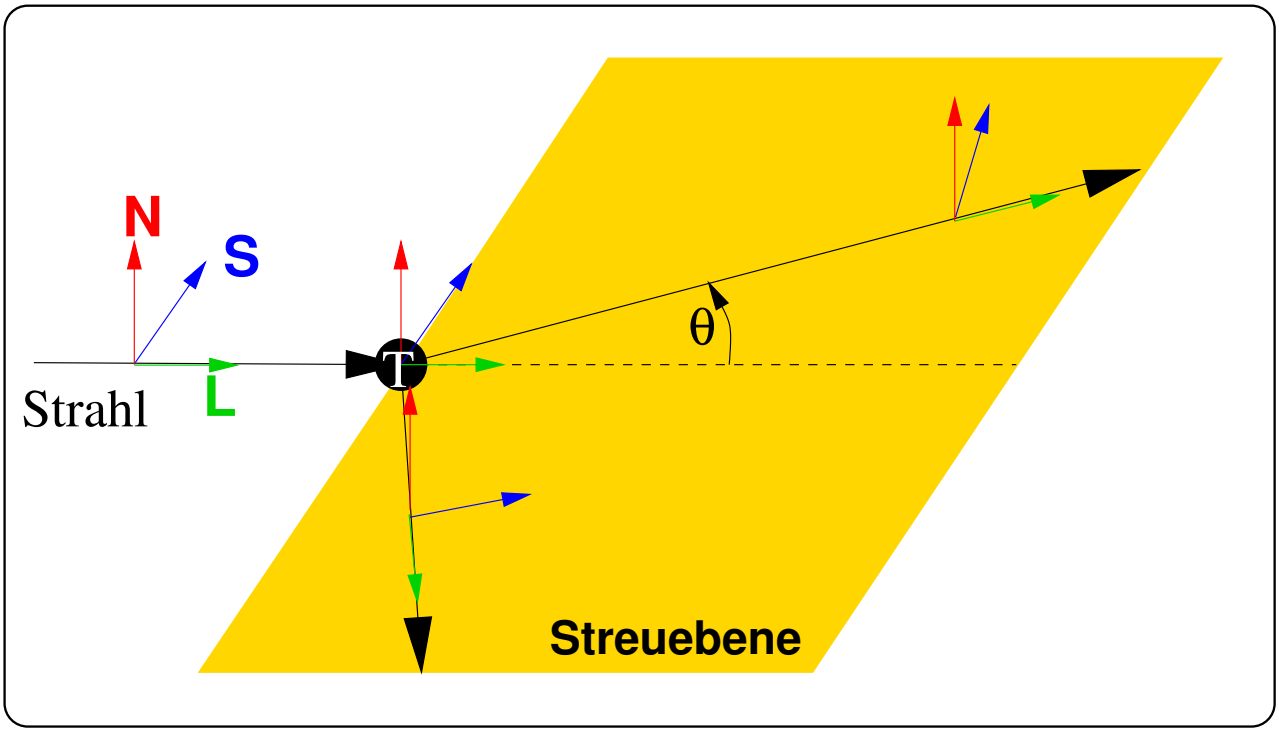
ISKP, Universität Bonn

für die EDDA-Kollaboration

(Bonn, Hamburg, Jülich)

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

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



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

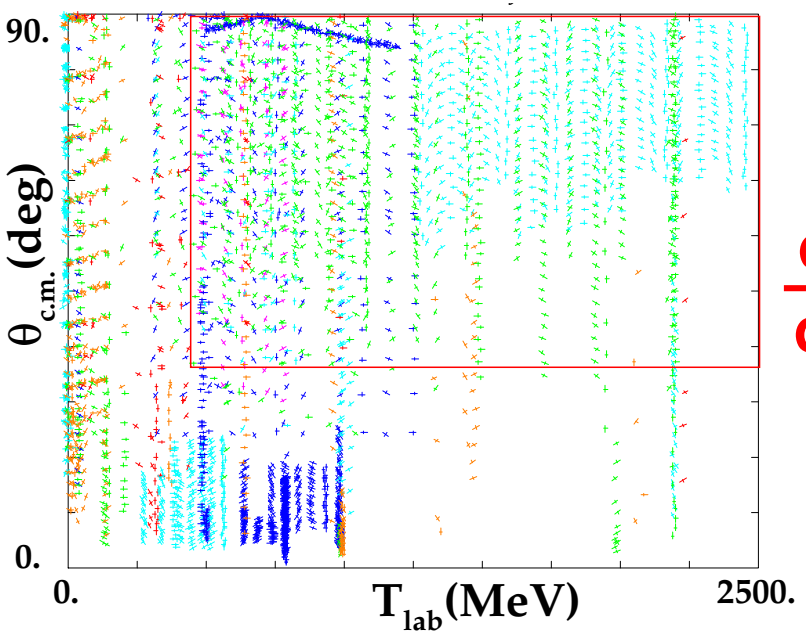
→ Vorhersagekraft !!

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

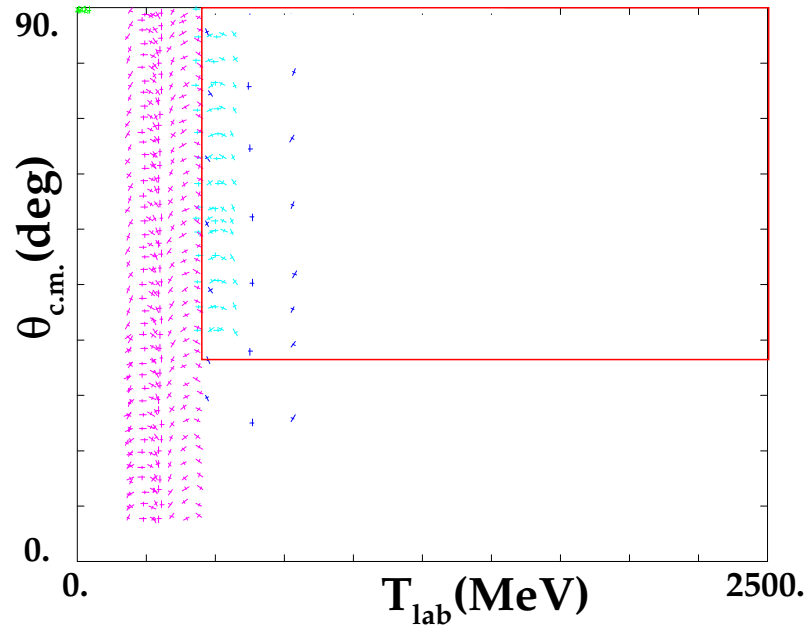
$T_p \in$ 0-3 GeV : 23000 / 12000 pp / np Daten

⟷ Theorie

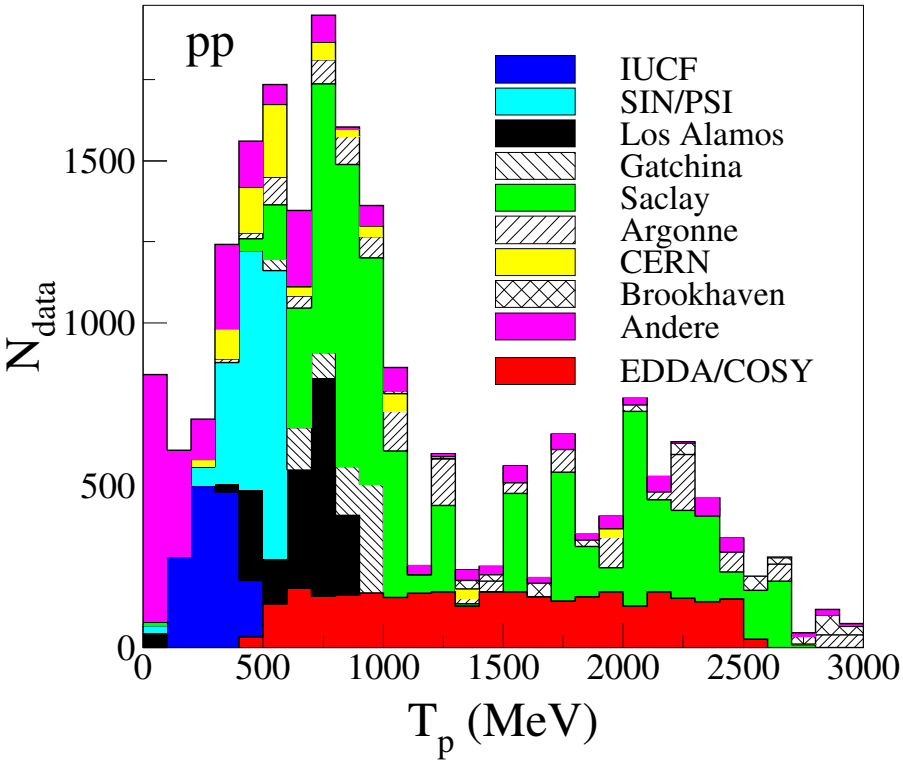
NN Datenbasis



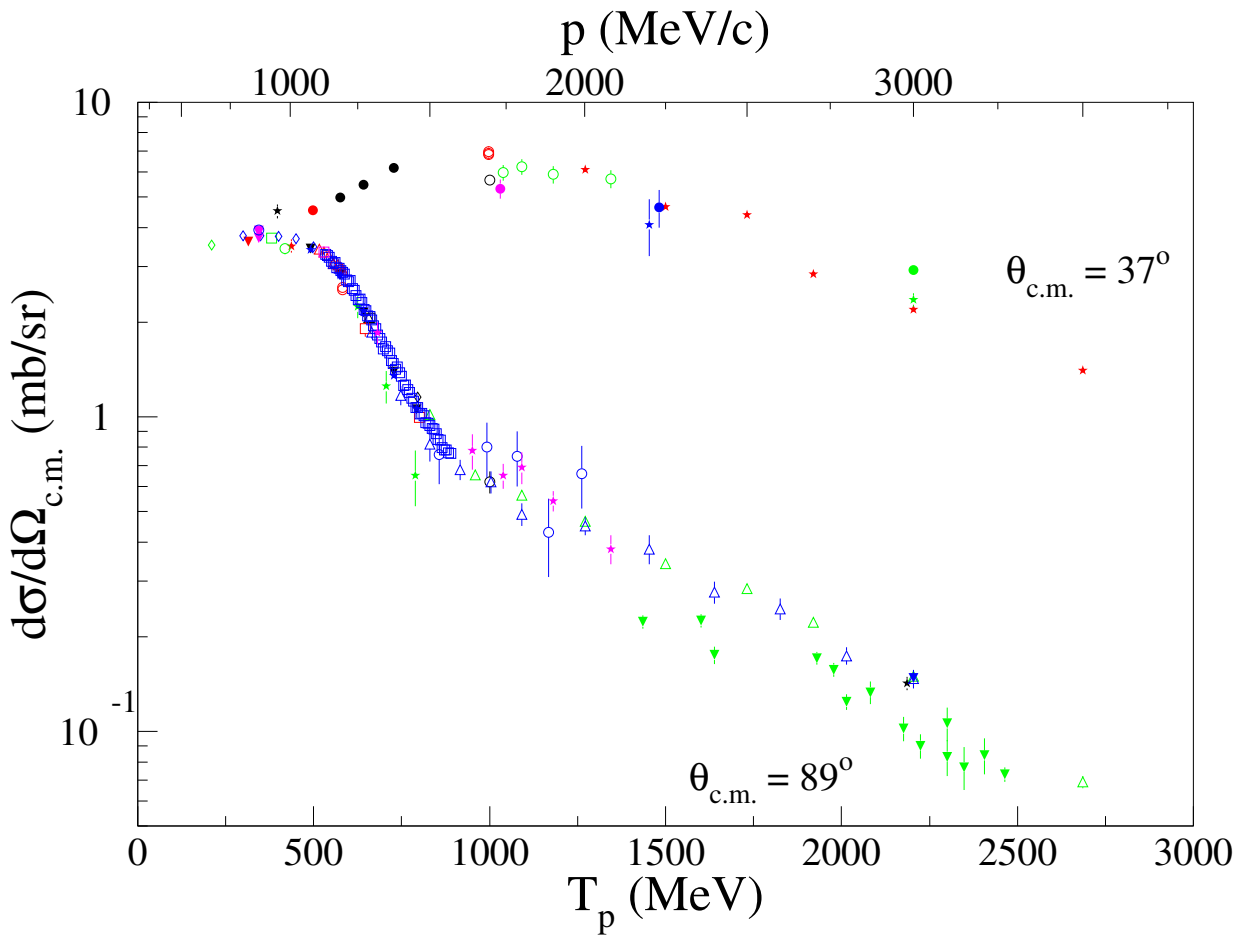
$\frac{d\sigma}{d\Omega}$



A_{ss}

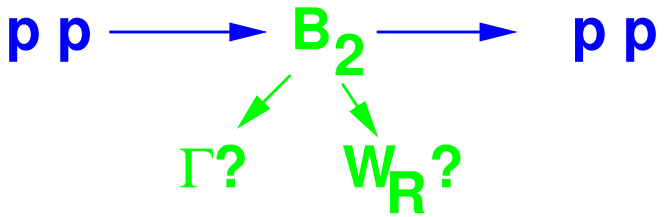


Motivation



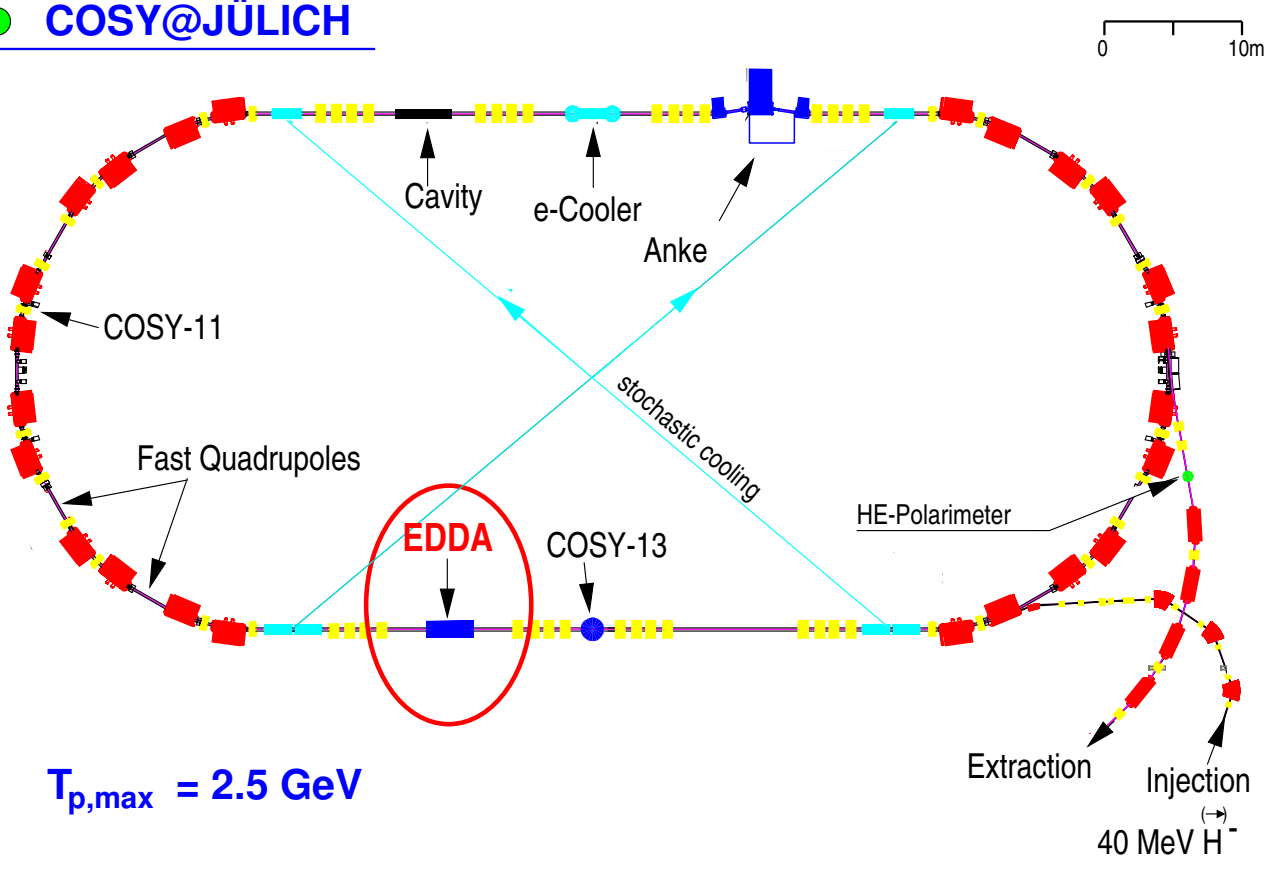
Anforderungen:

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



Experimentelle Technik

COSY@JÜLICH



$T_{p,max}$ = 2.5 GeV

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

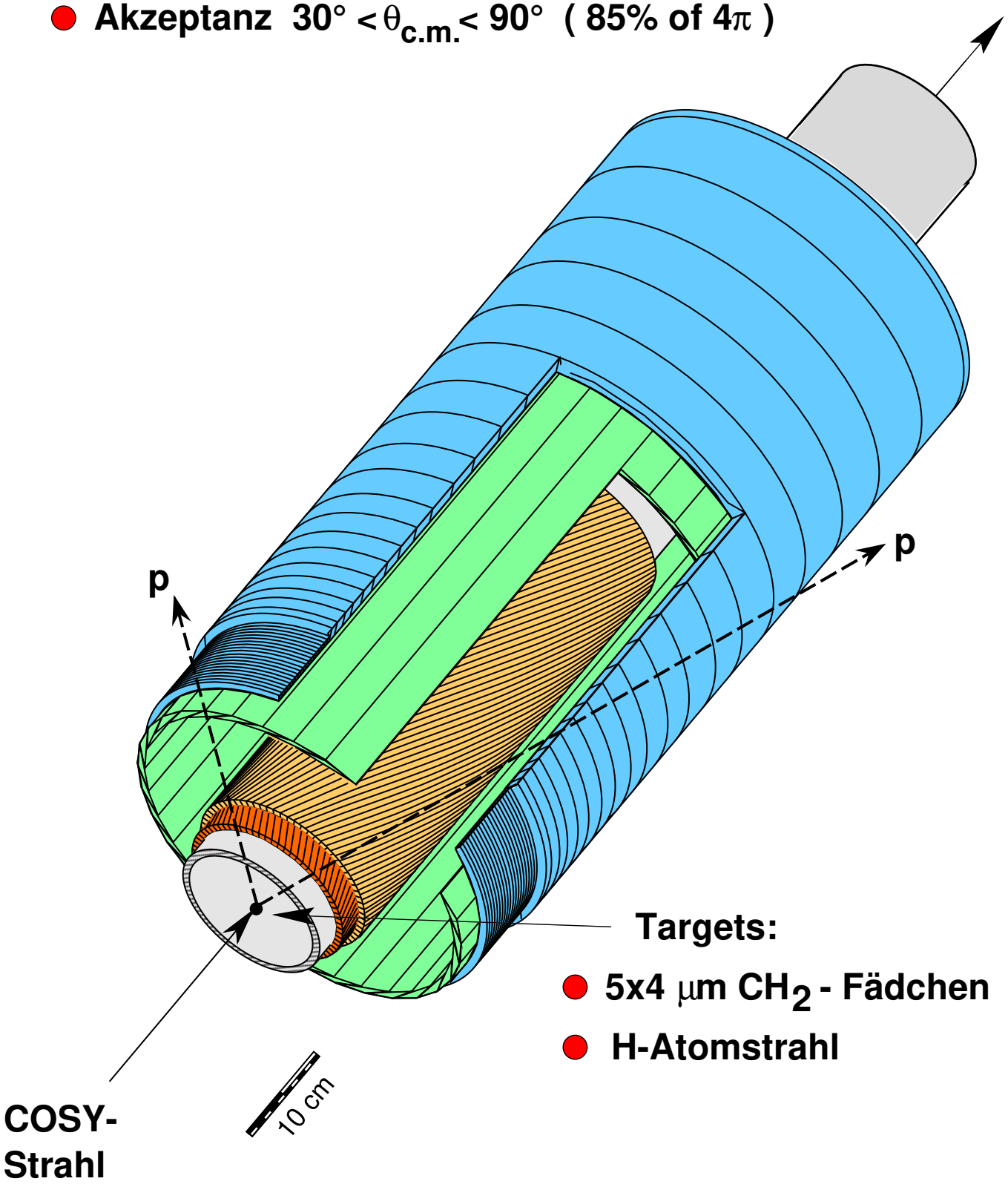
DAQ während Beschleunigung / (Abbremsen)

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

EDDA@COSY: Detector

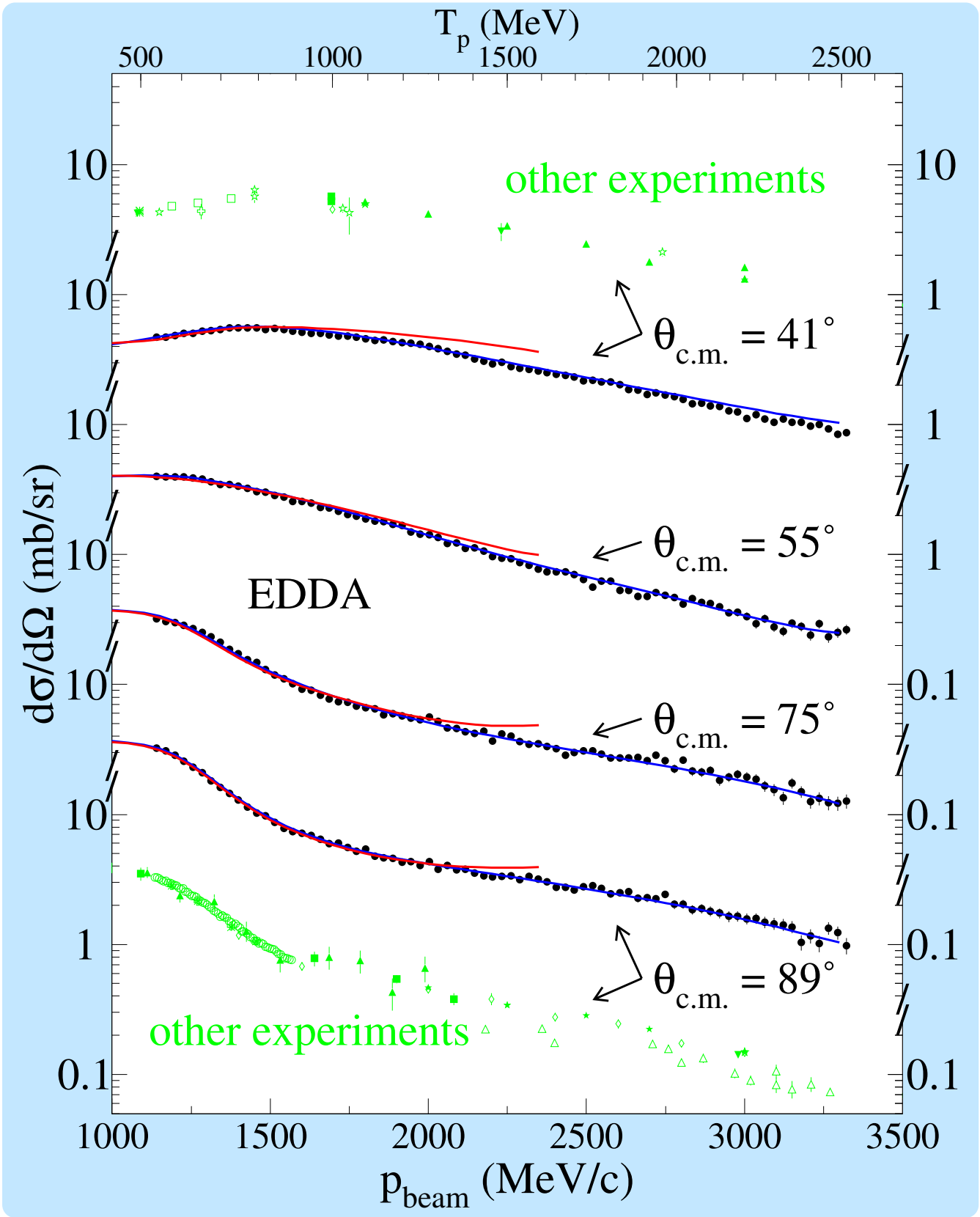
Bonn,Hamburg,Jülich

- 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

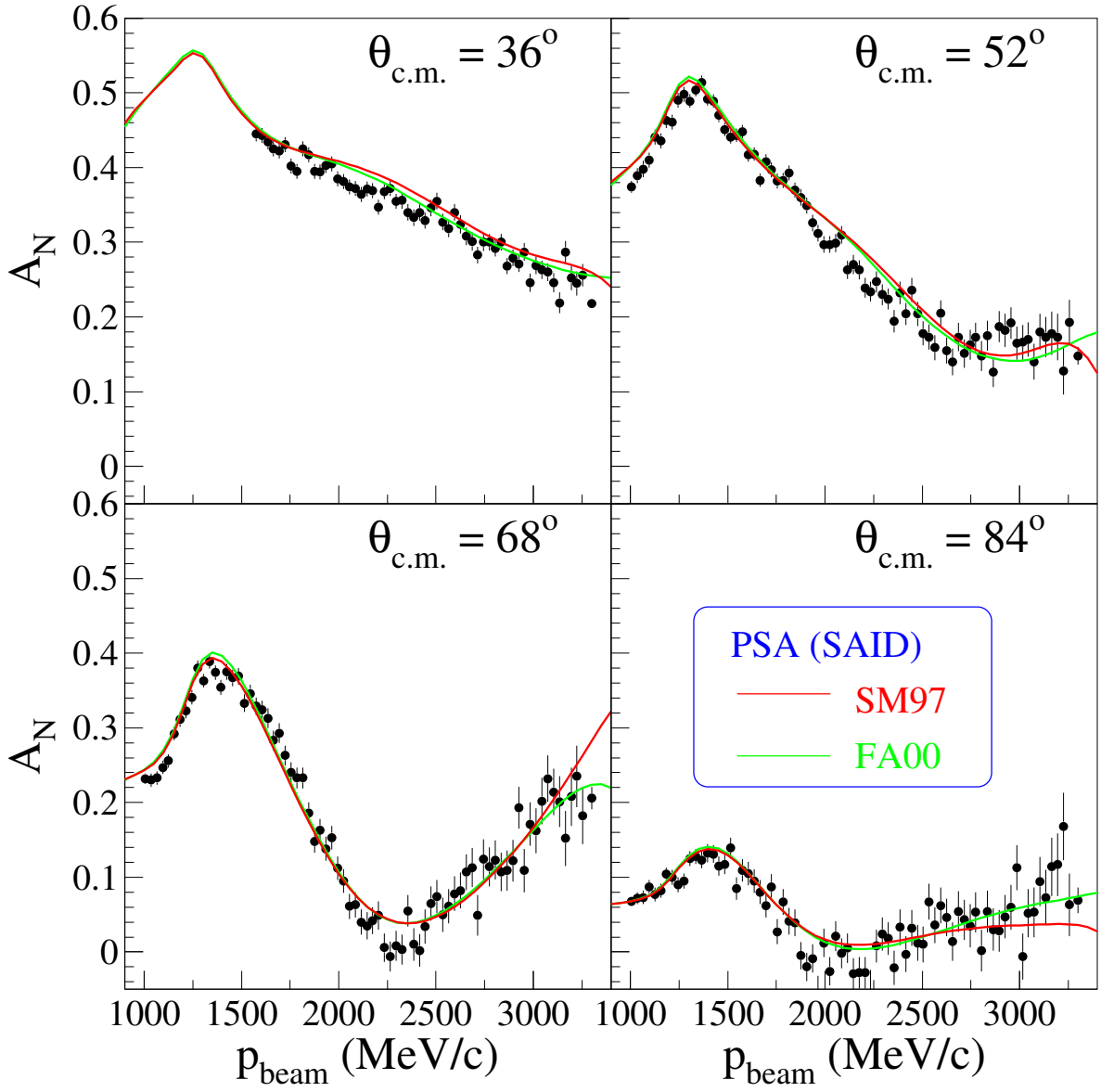
M.Altmeier et al. *Phys. Rev. Lett.* **85** ,1819 (2000)

$p \vec{p}$

25×10^6 Events

$\Delta\theta = 4°$

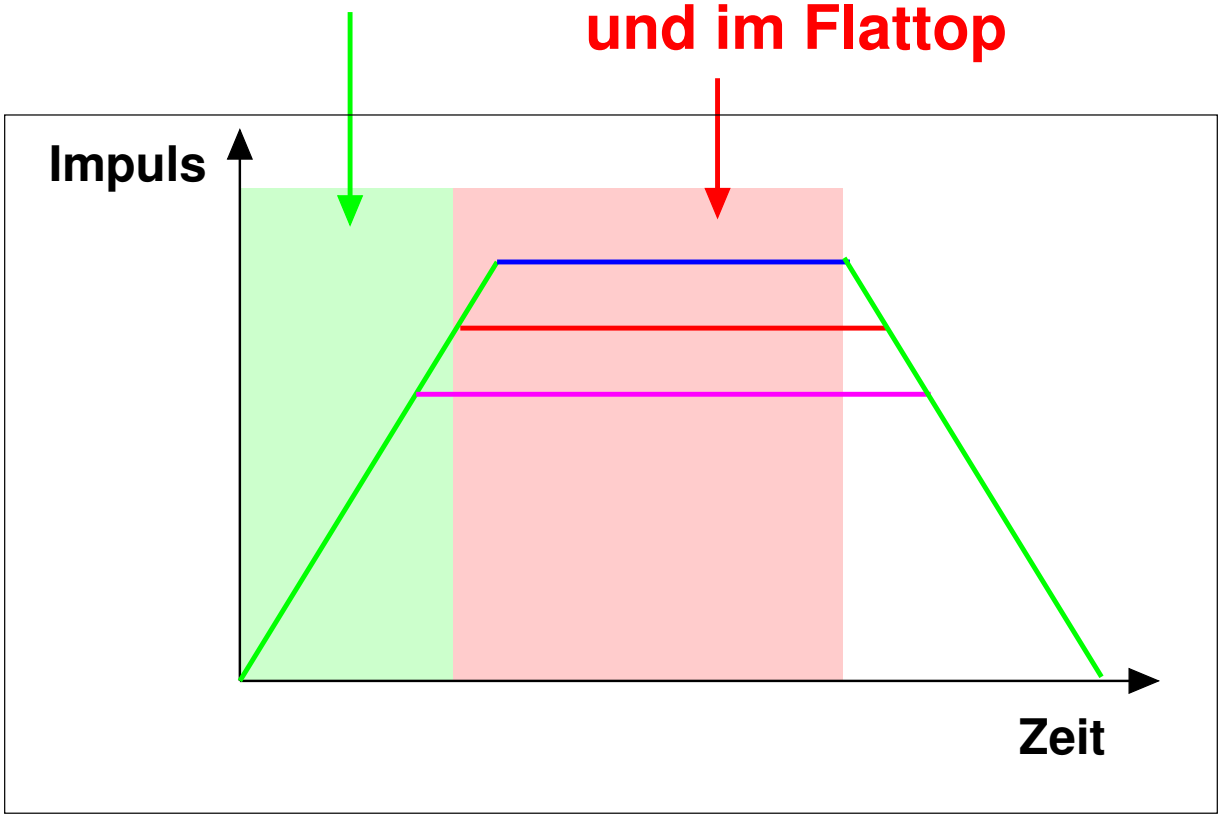
$\Delta p = 30$ MeV/c



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

während der Beschleunigung

und im Flattop



Spineinstellungen: Strahl (p) + Target(q)

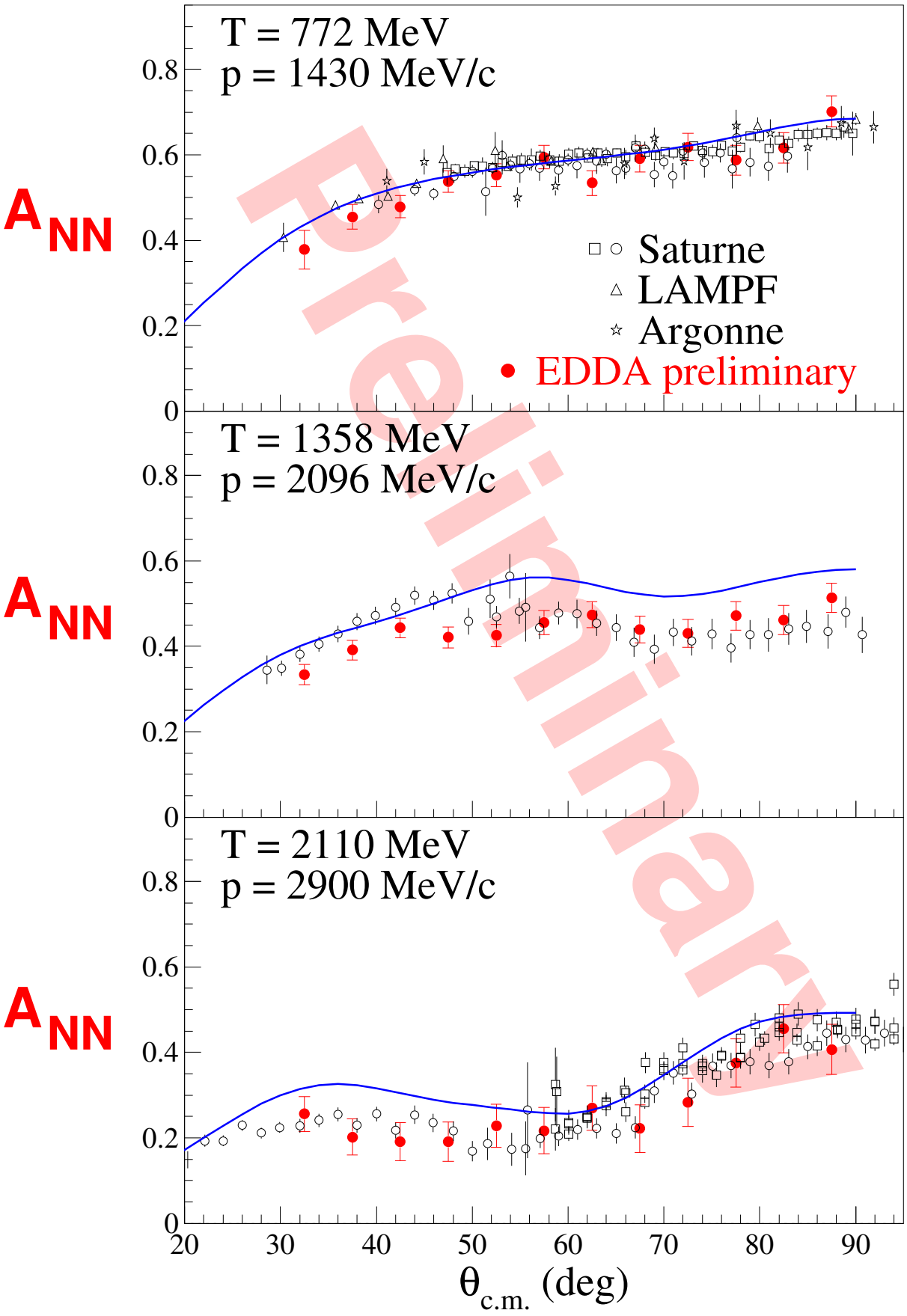
$$\frac{\sigma}{\sigma_0}(\phi) = 1 + A_N\{(p_y + q_y)\cos\phi + q_x \sin\phi\}$$

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

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

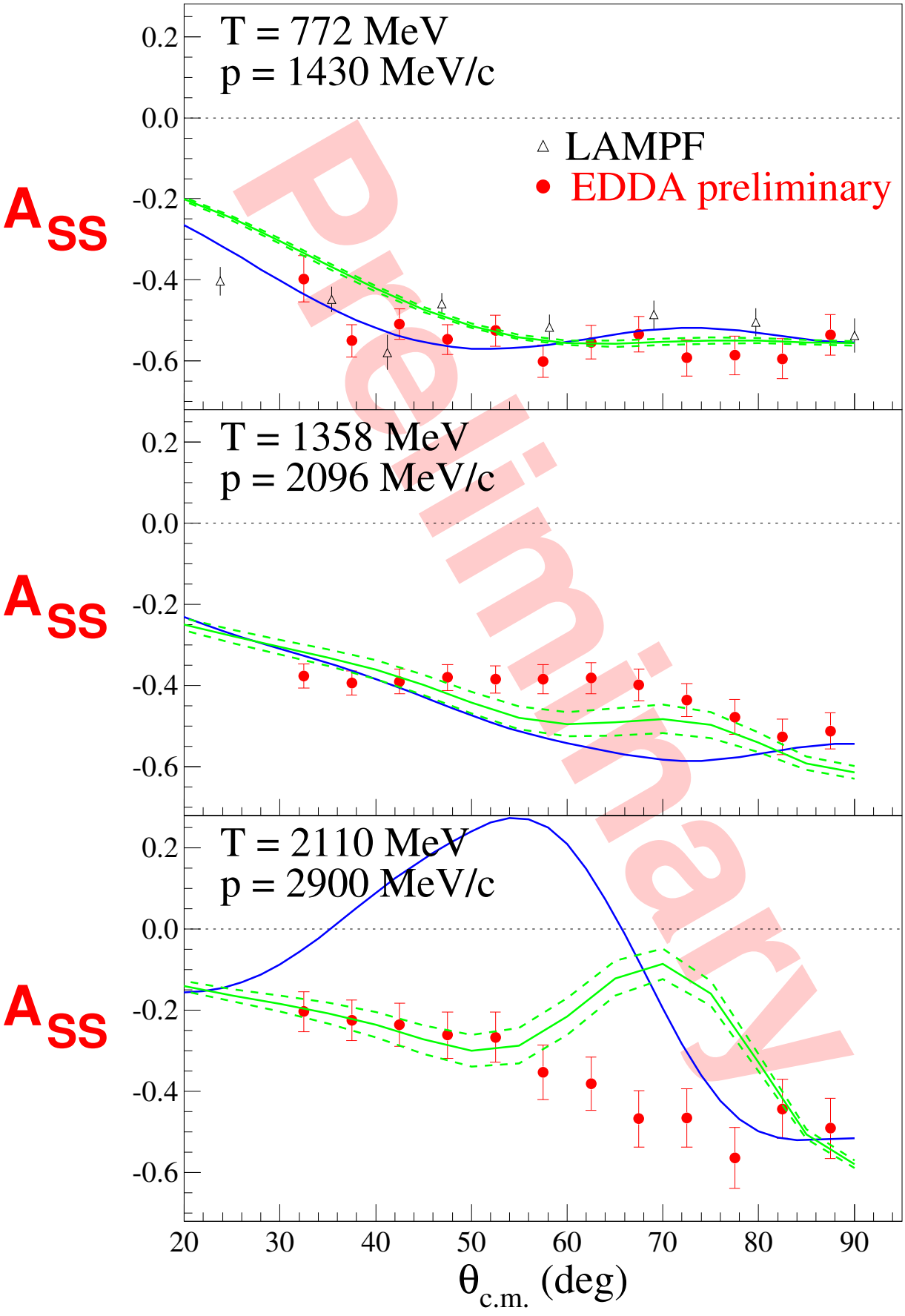
$$+ A_{SL}\; p_y q_z \cos\phi$$

Spinkorrelationsparameter



PSA: SAID(SM00)

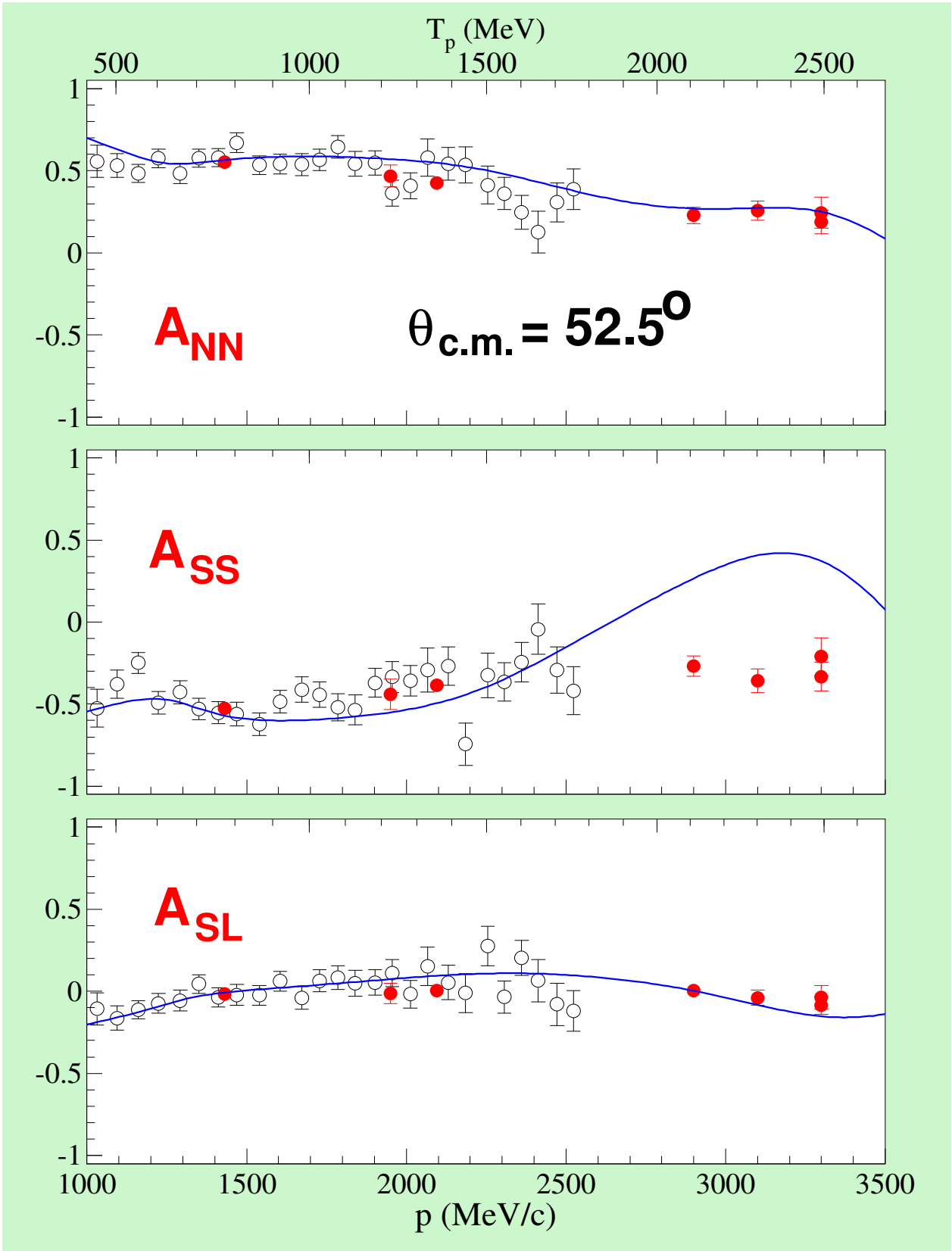
Spinkorrelationsparameter



PSA: SAID(SM00) Saclay-Genf

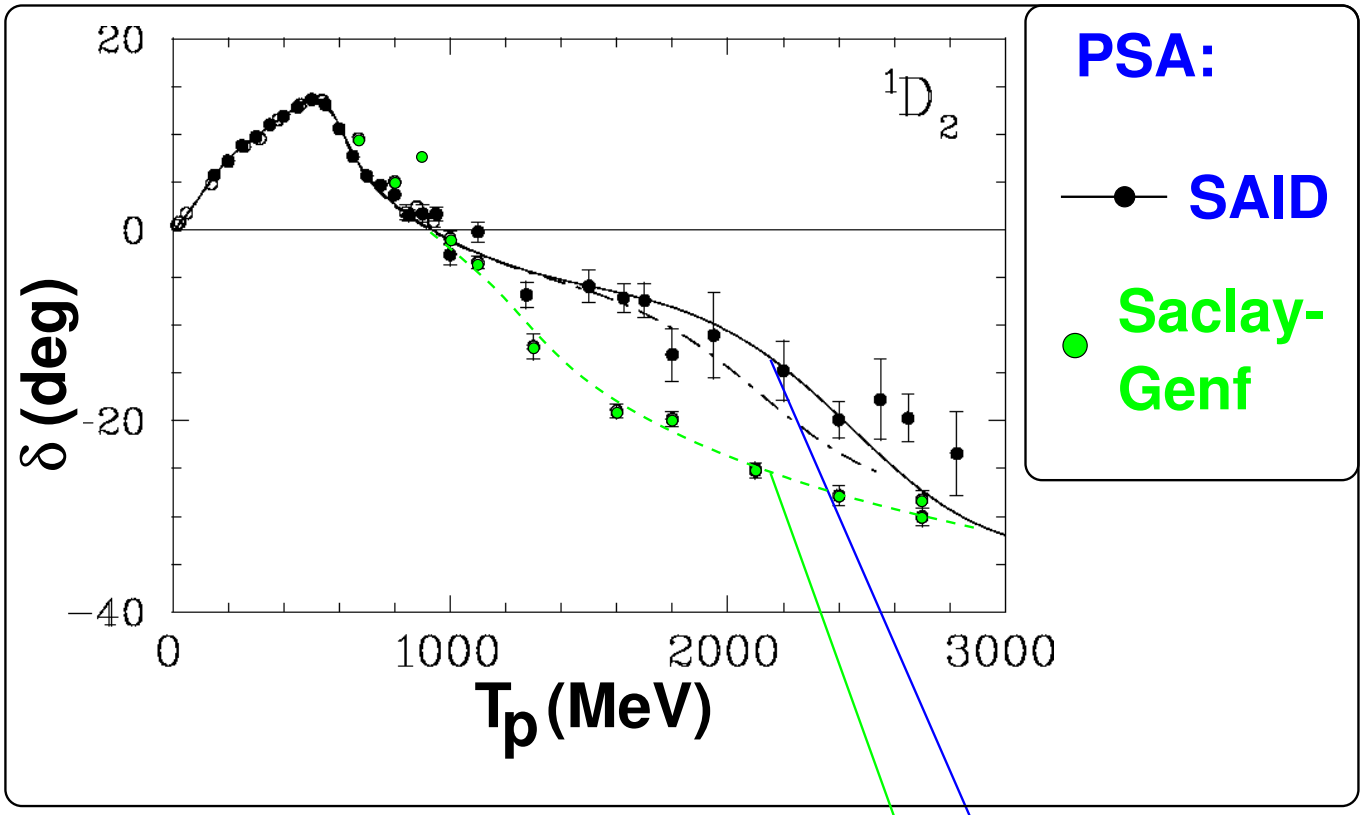
Anregungsfunktionen

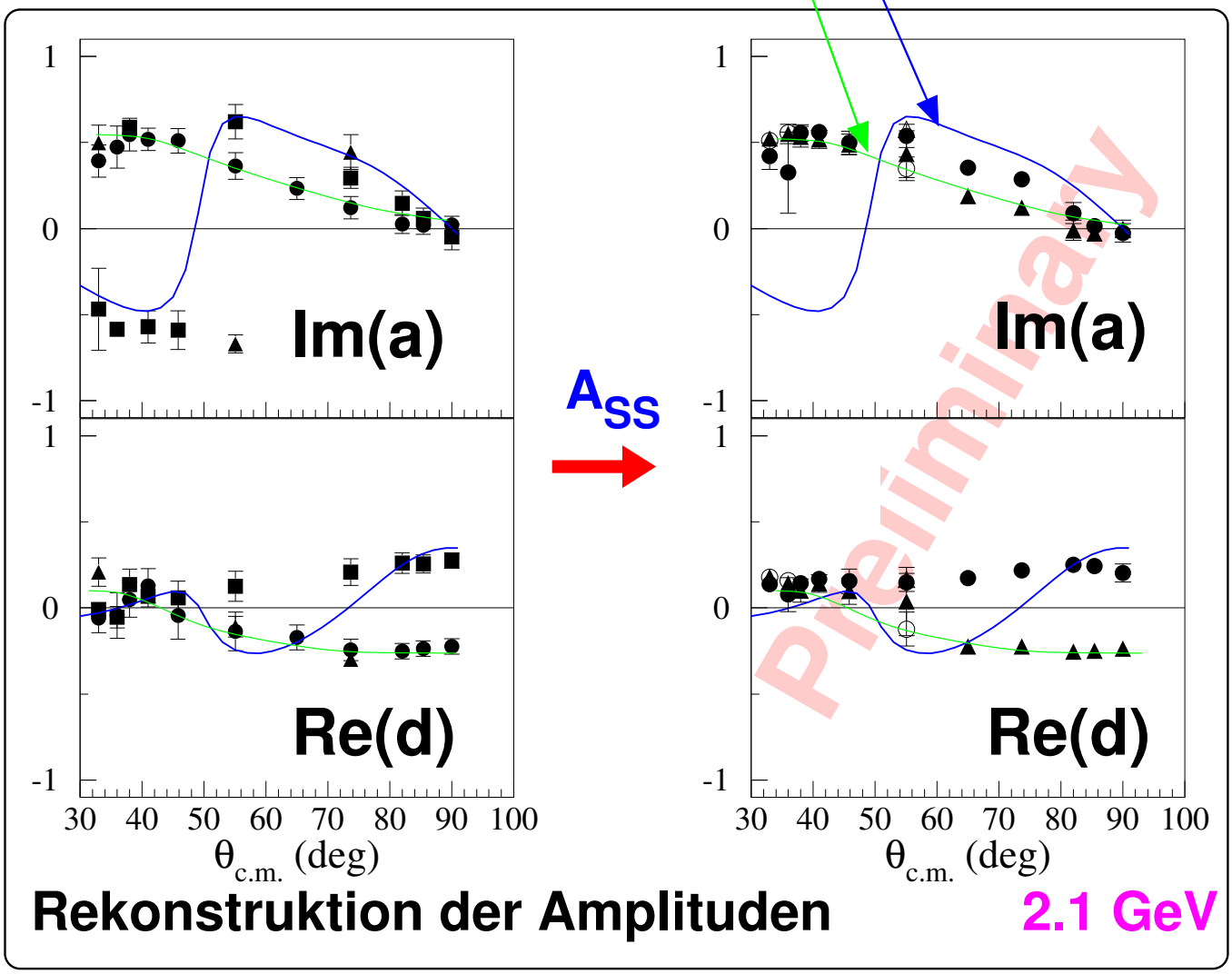
EDDA preliminary



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**

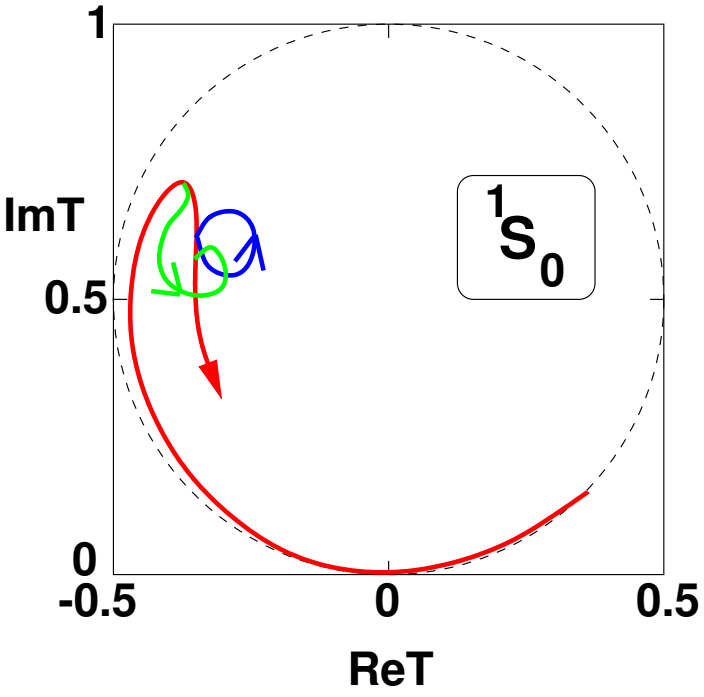
  } **NΔ Schwelle/Resonanz** $^5S_2$, $^5P_3$

Dibaryonen?

- **KEINE EVIDENZ** !!

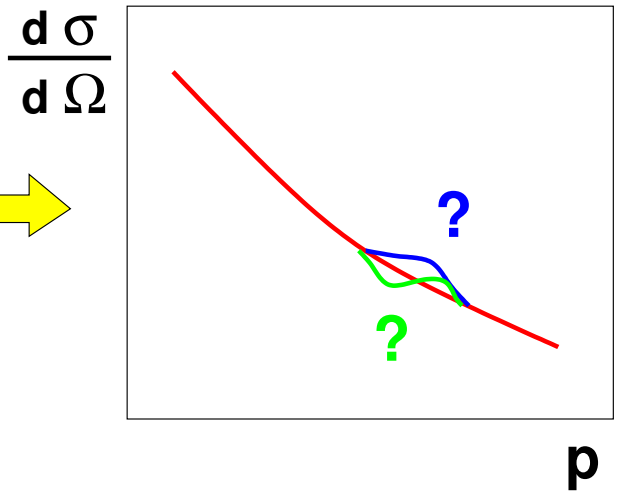
- **OBERE GRENZEN ?**

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

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

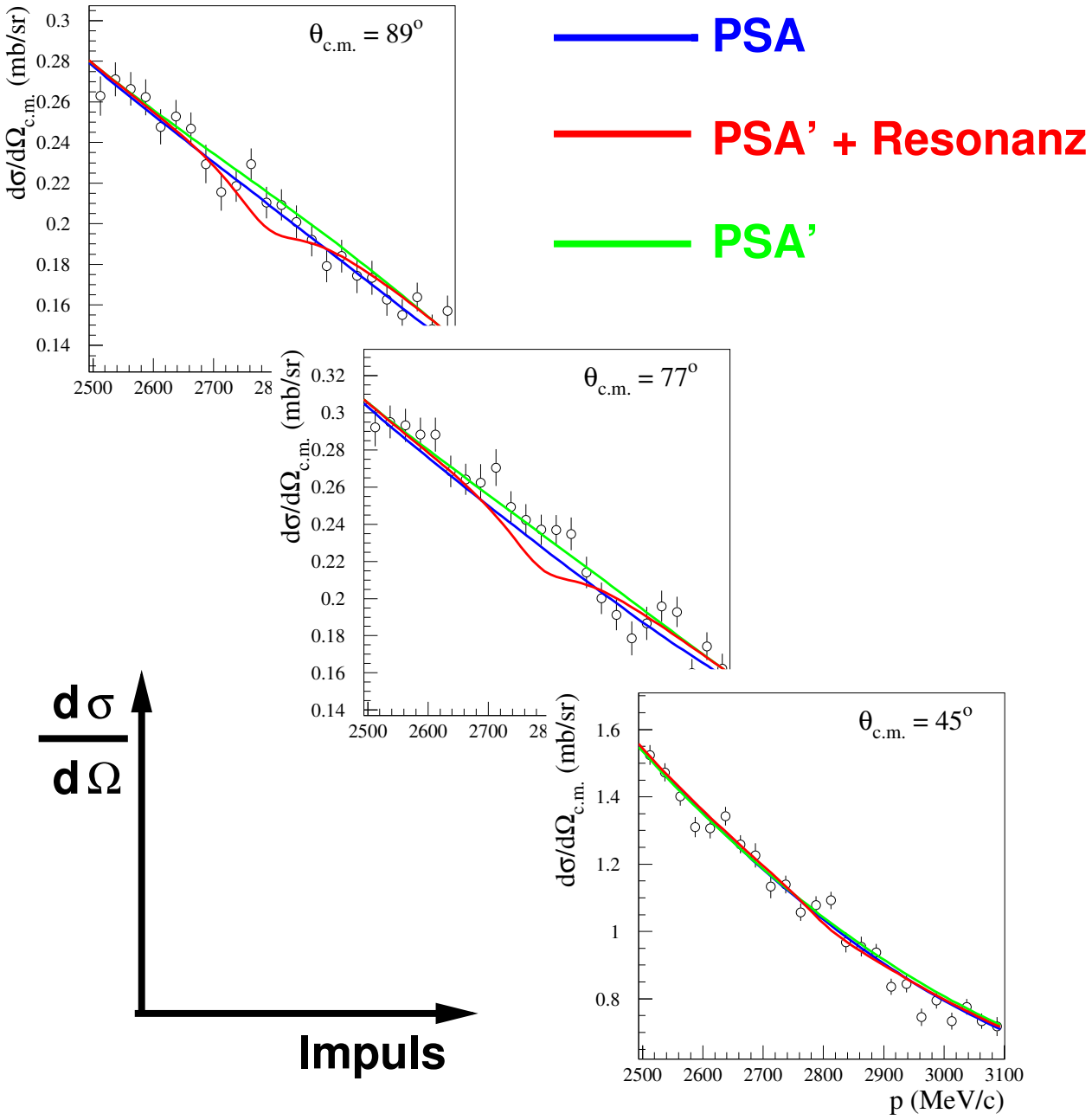
Obere Grenzen für Γ_{el}/Γ_{tot}

Beispiel: $^1S_0$

$W_R = 2700$ MeV

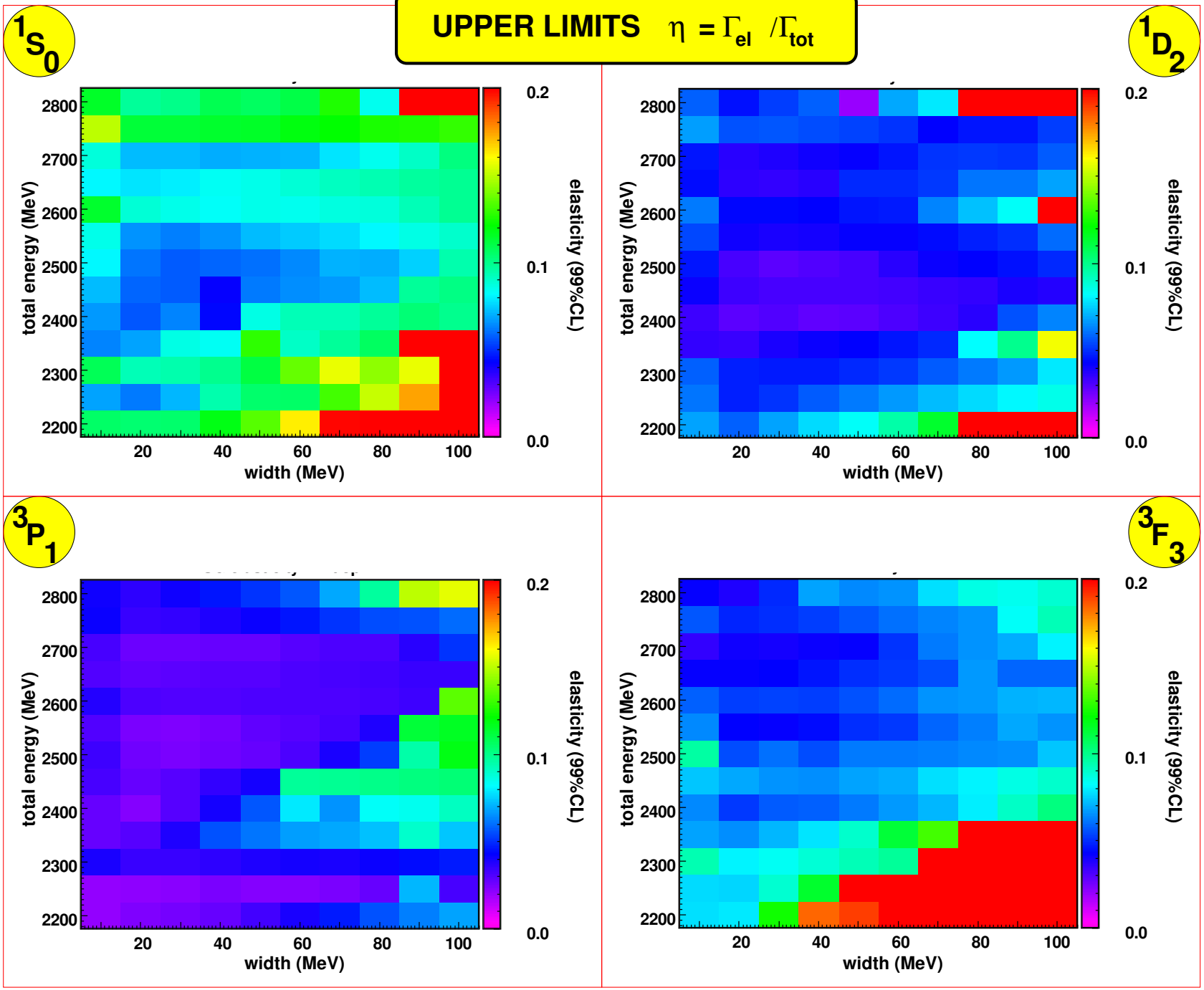
$\Gamma_{tot} = 50$ MeV

$\phi = -60^o$



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

UPPER LIMITS $\eta = \Gamma_{el} / \Gamma_{tot}$



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

W_R = 2.2 ... 2.8 GeV

Γ = 10 ... 100 MeV

η_{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

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