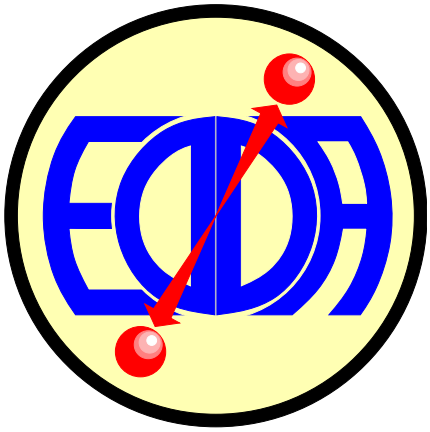
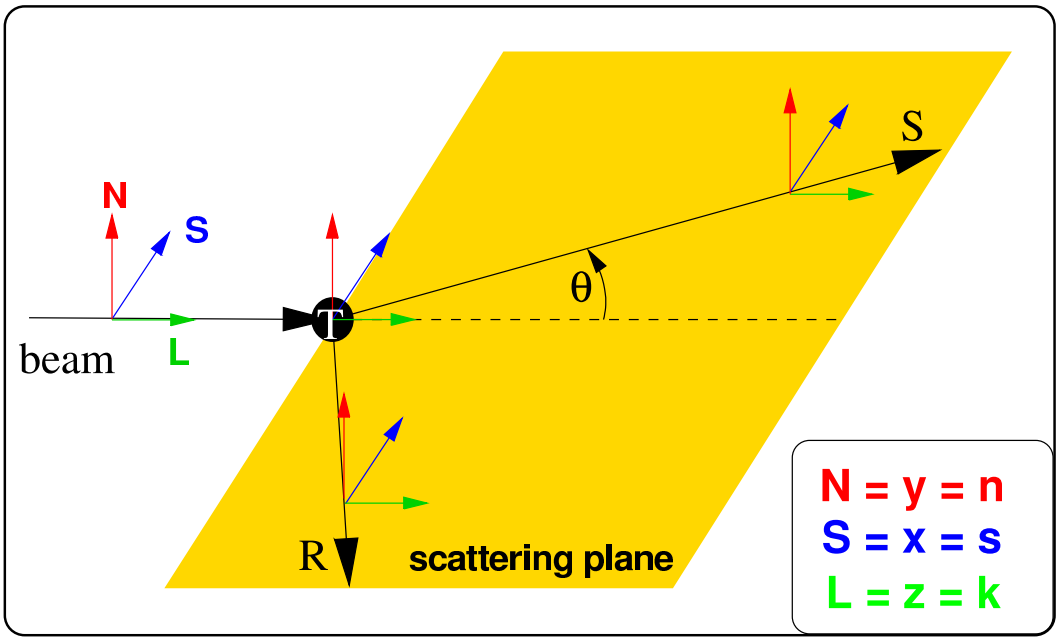
SPIN 2003–Conference, Dubna, Russia

# EDDA at COSY: Spin–Correlation Coefficients of Elastic Proton–Proton Scattering in the 0.8 – 2.5 GeV Range

K. Ulbrich
HISKP, Universität Bonn
for the EDDA Collaboration
Universität Bonn, Universität Hamburg, Forschungszentrum Jülich



# Scattering of Polarised Protons




**5 complex amplitudes → 9 observables**

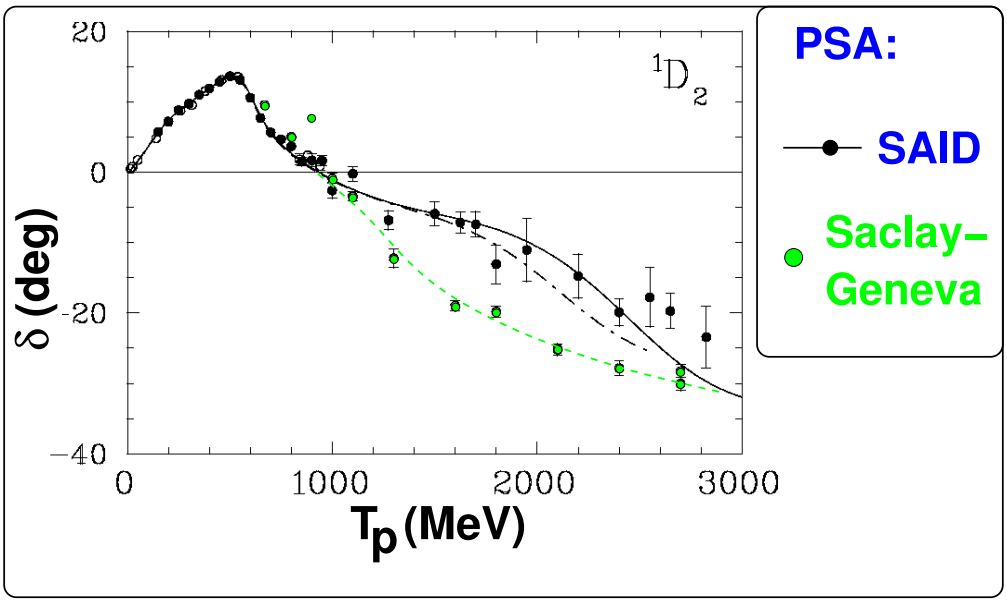
## Measured Polarisation Observables

$A_N$ : **polarised target, unpolarised beam**

$A_{NN}, A_{SS}, A_{SL}$ : **polarised target, polarised beam**

# Why pp Elastic Scattering?

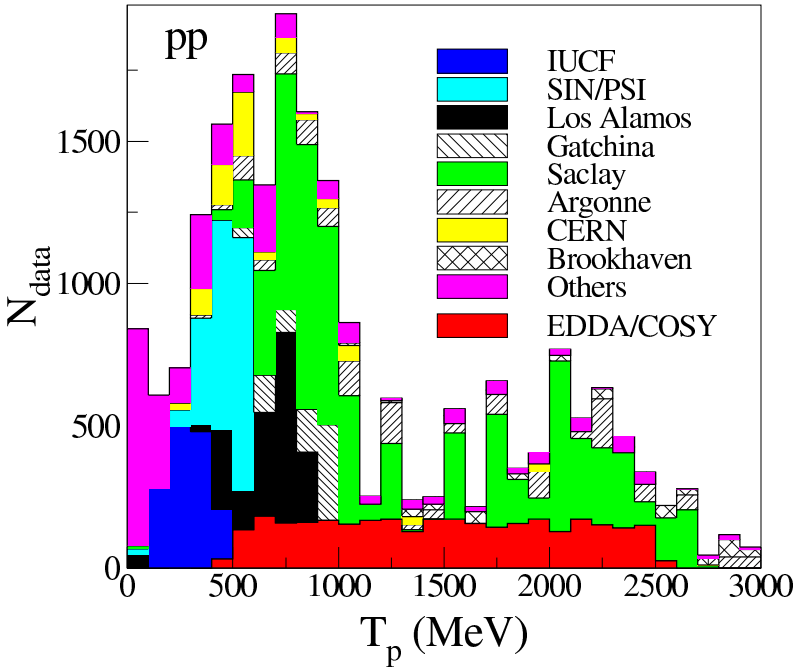
## Discrepancies in Phase Shifts



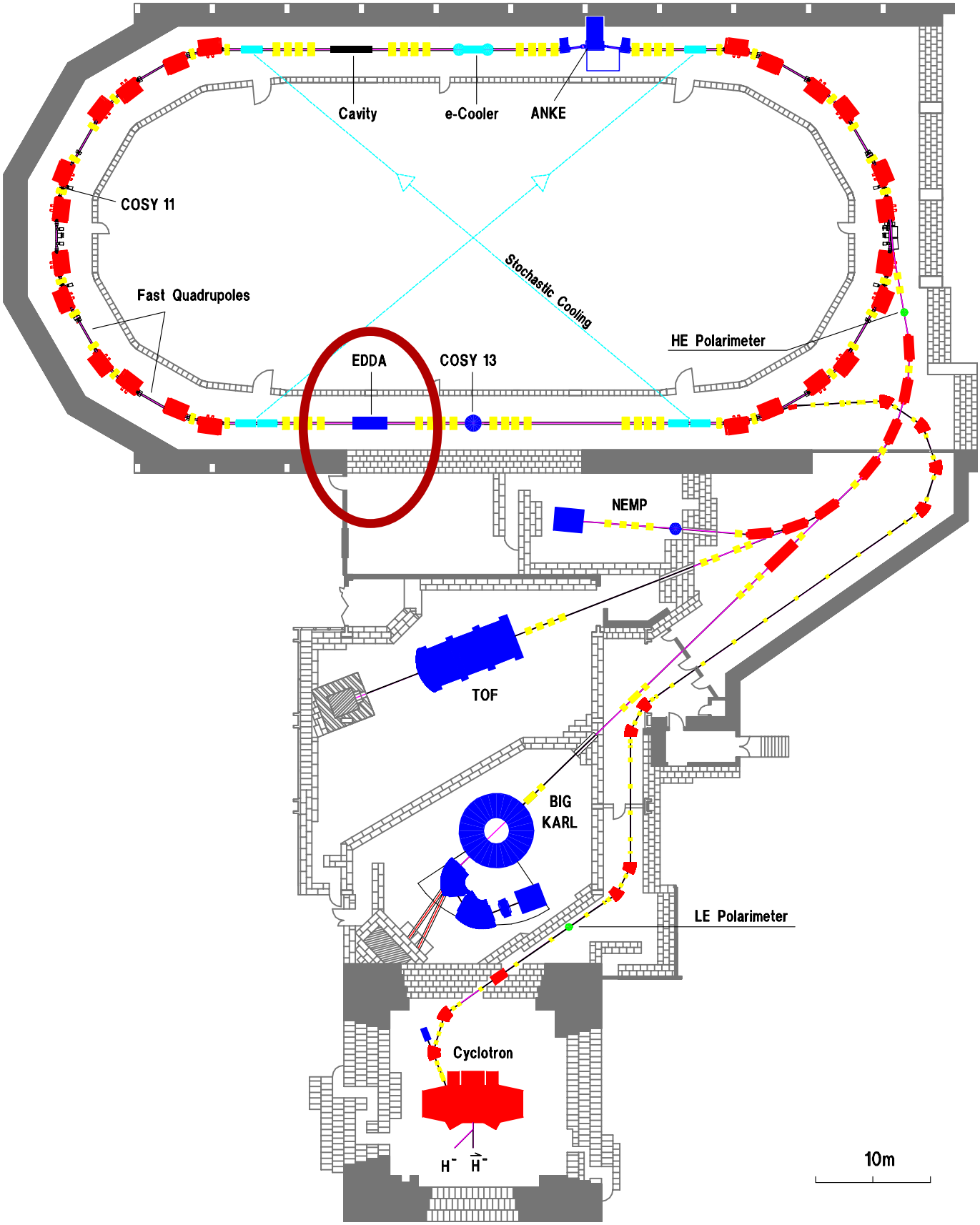

Bystricky, Lechanoine–Leluc, Lehar Eur. Phys. J. C4, 607 (1998)

Arndt, Strakovsky, Workman, Phys. Rev. C62, 034005 (2000)

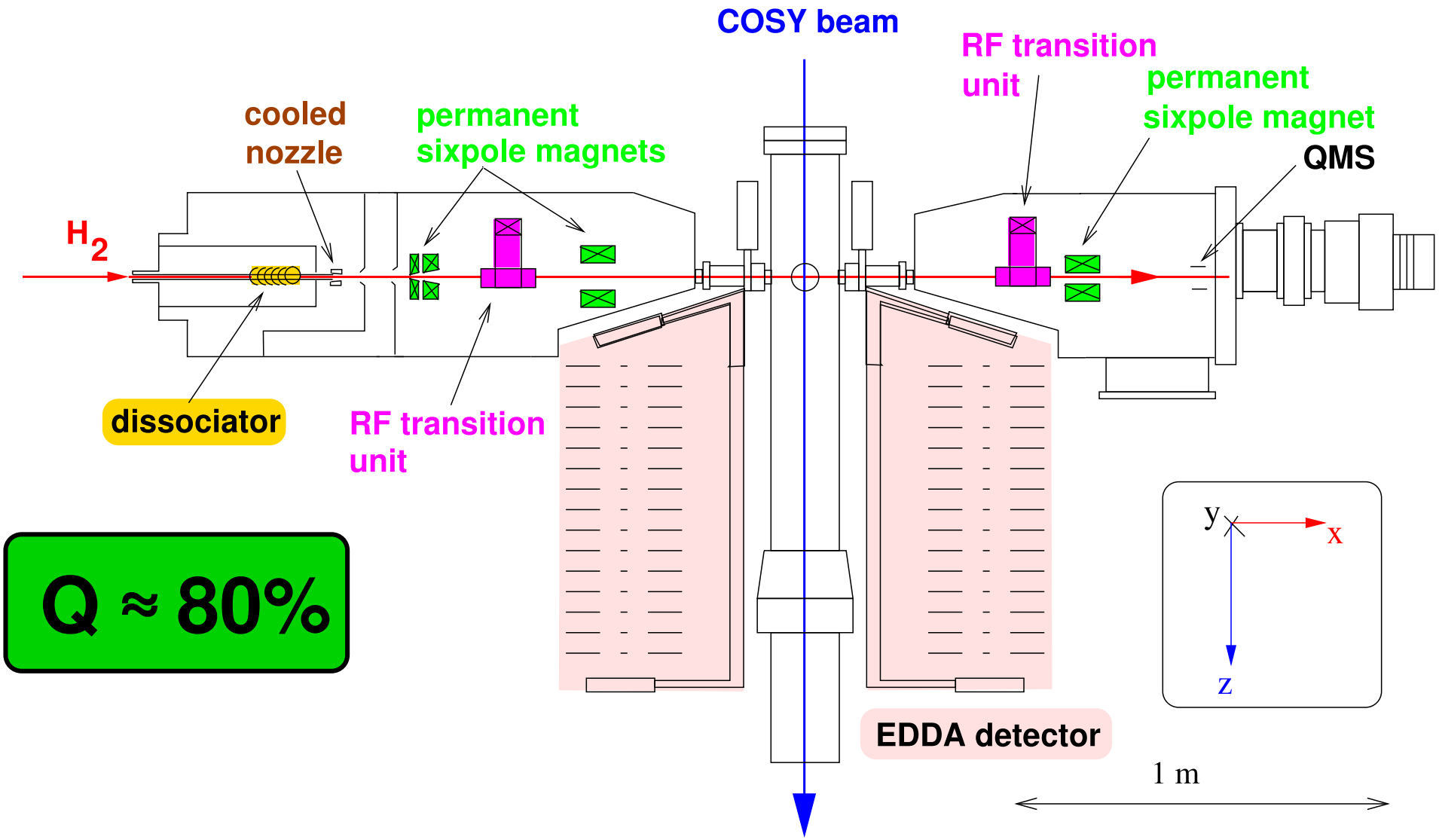
## pp World Database



# COSY Accelerator Facility

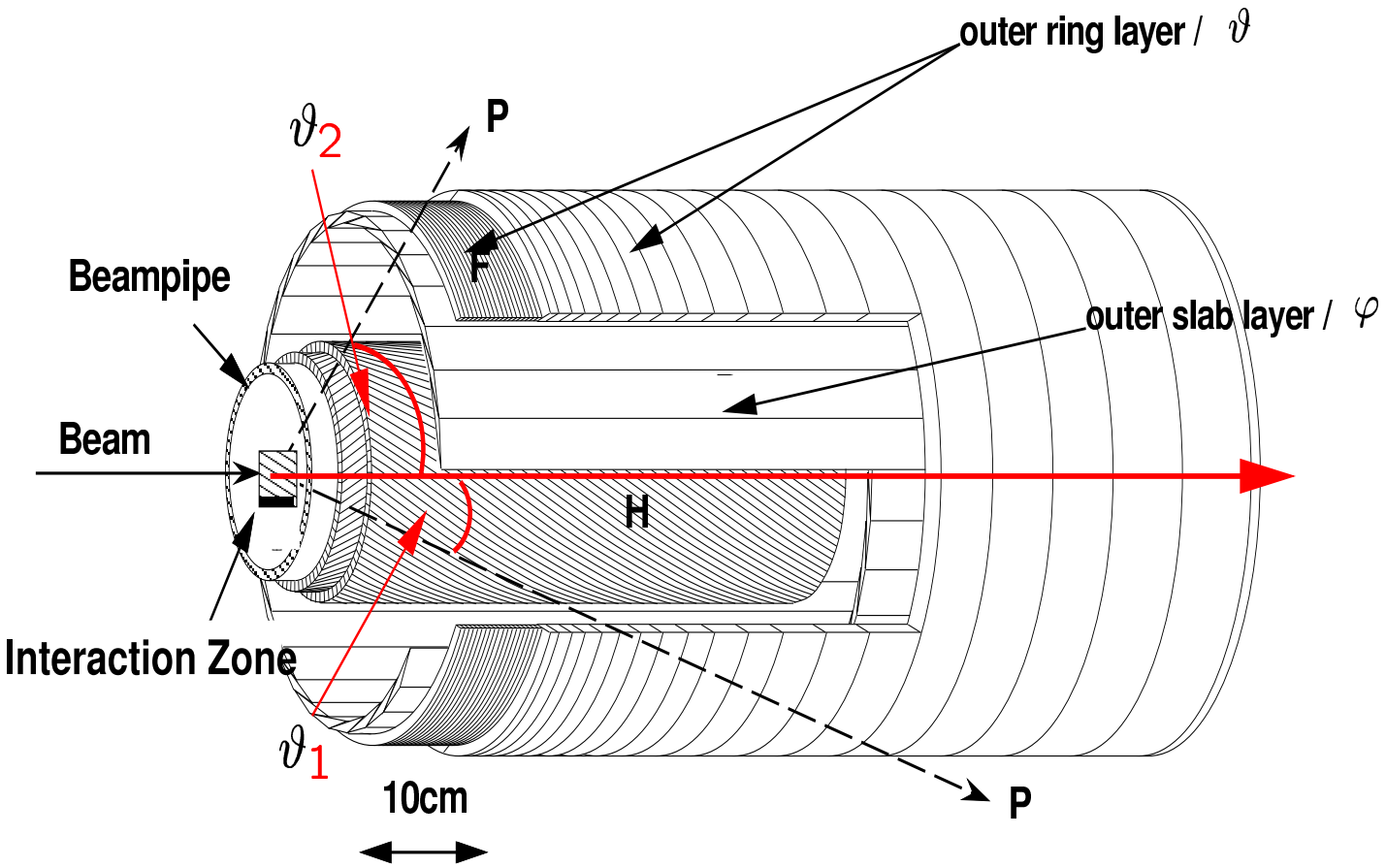


# Atomic Beam Target




**Q ≈ 80%**

# EDDA–Detector




$$\Delta\varphi \approx 1.8^\circ, \Delta\vartheta_{cm} \approx 1.5^\circ$$

**Differential cross section, laboratory coordinates, beam polarisation along y–axis:**

$$\begin{aligned}\frac{\sigma}{\sigma_0} = 1 \;&+\; A_N(\vartheta)[(P_y + Q_y)\cos\varphi + Q_x \sin\varphi] \\ &+\; A_{SS}(\vartheta)[P_y Q_y \sin^2\varphi + P_y Q_x \cos\varphi \sin\varphi] \\ &+\; A_{NN}(\vartheta)[P_y Q_y \cos^2\varphi - P_y Q_x \cos\varphi \sin\varphi] \\ &+\; A_{SL}(\vartheta)[P_y Q_z \sin\varphi]\end{aligned}$$

$P_i$ : **beam polarisation**

$Q_i$ : **target polarisation**

# EDDA Results: Analyzing Power

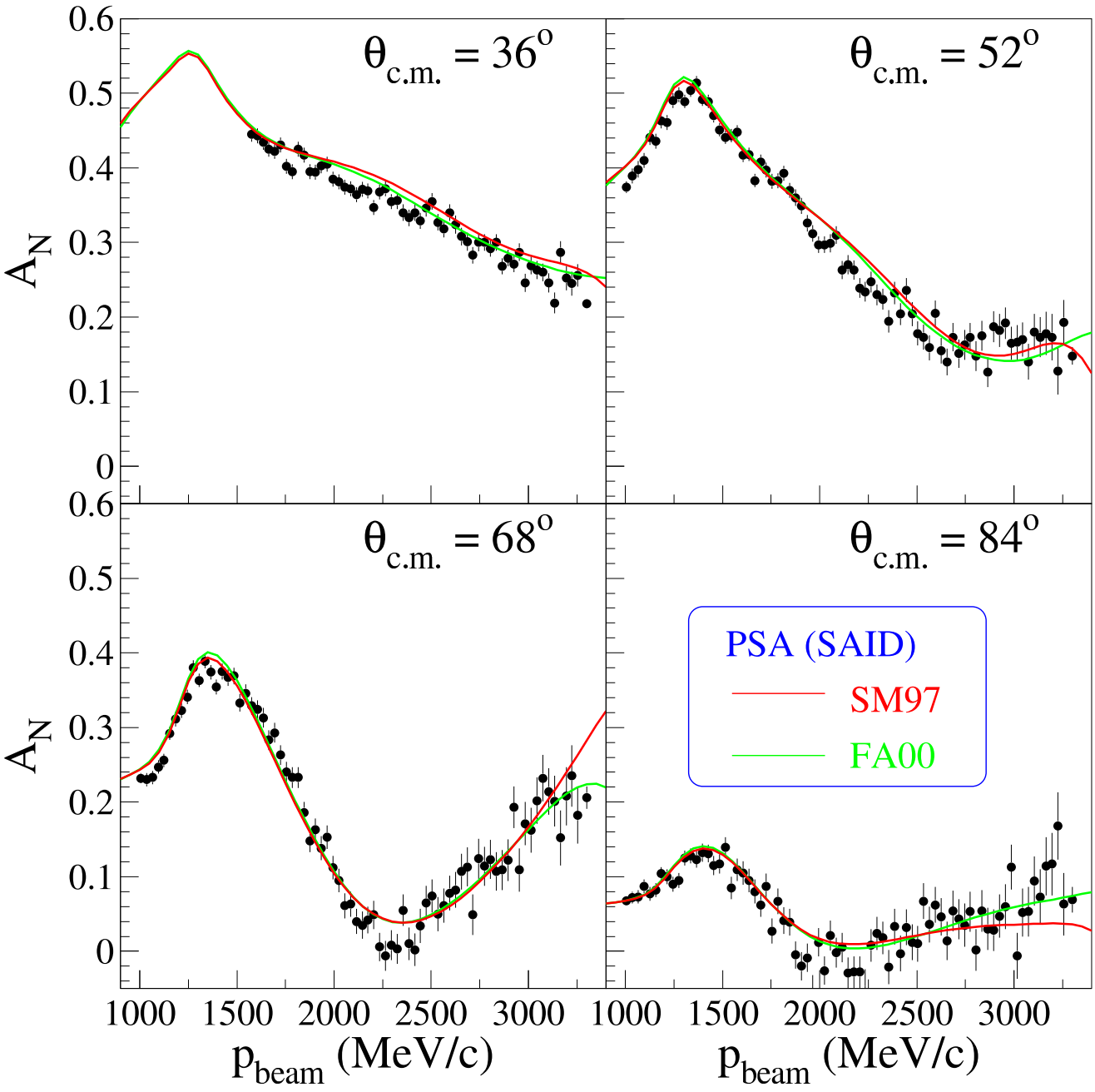
M.Altmeier et al. *Phys. Rev. Lett.* **85** ,1819 (2000)

$p\vec{p} \rightarrow pp$

$25 \times 10^6$ Events

$\Delta\theta = 4°$

$\Delta p = 30$ MeV/c



**Coplanarity:**

$$|\varphi_1 - \varphi_2| = \pi$$

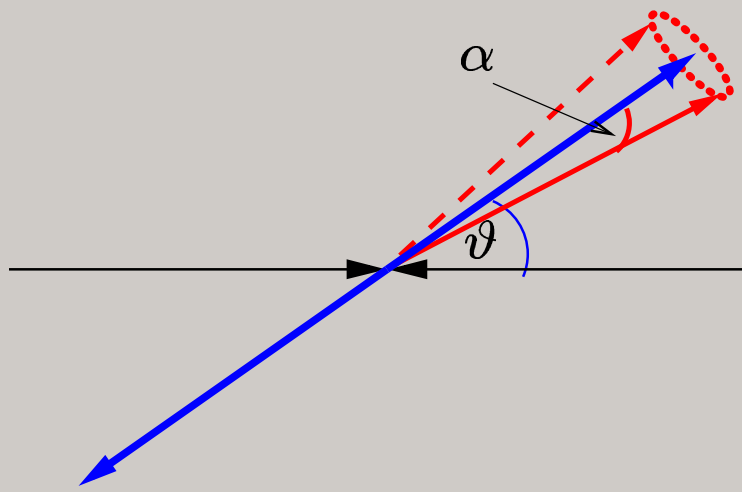
**Coplanar Trigger**

**Kinematical Relation:**

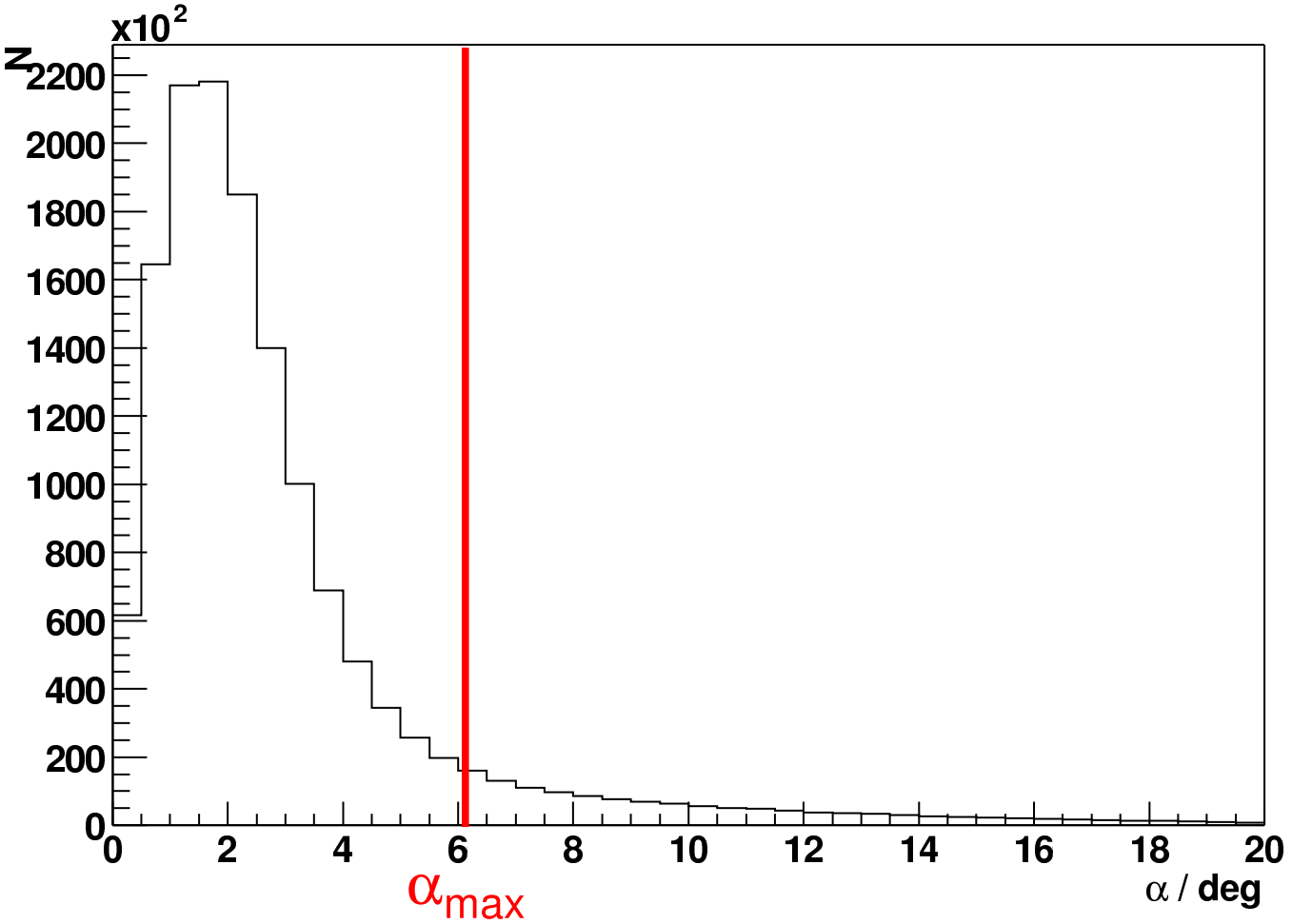
$$\vartheta_{1,cm} + \vartheta_{2,cm} = \pi$$

**Data Reconstruction**

**cm–System: Kinematical Deficite $\alpha$**



# Distribution of Kinematical Deficite / Cut

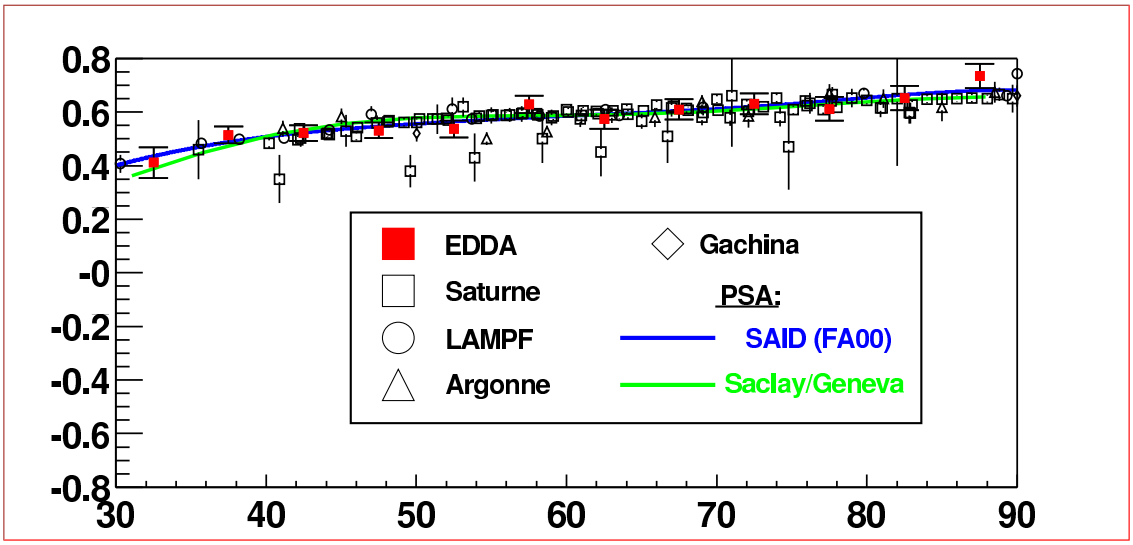


# $A_{NN}$, Angular Distributions

*Preliminary Data*

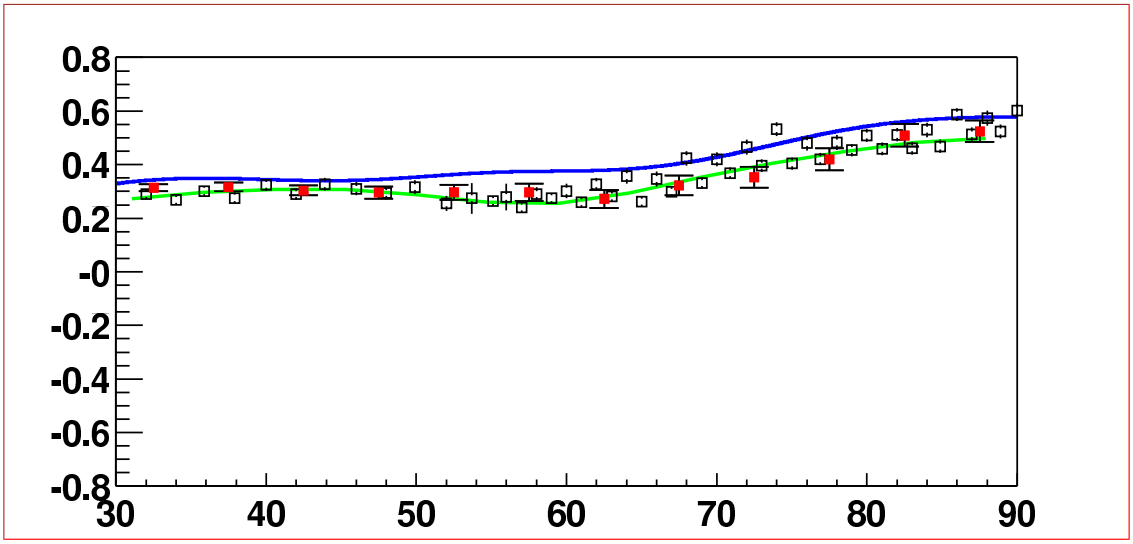
**1430 MeV/c**

**(772 MeV)**



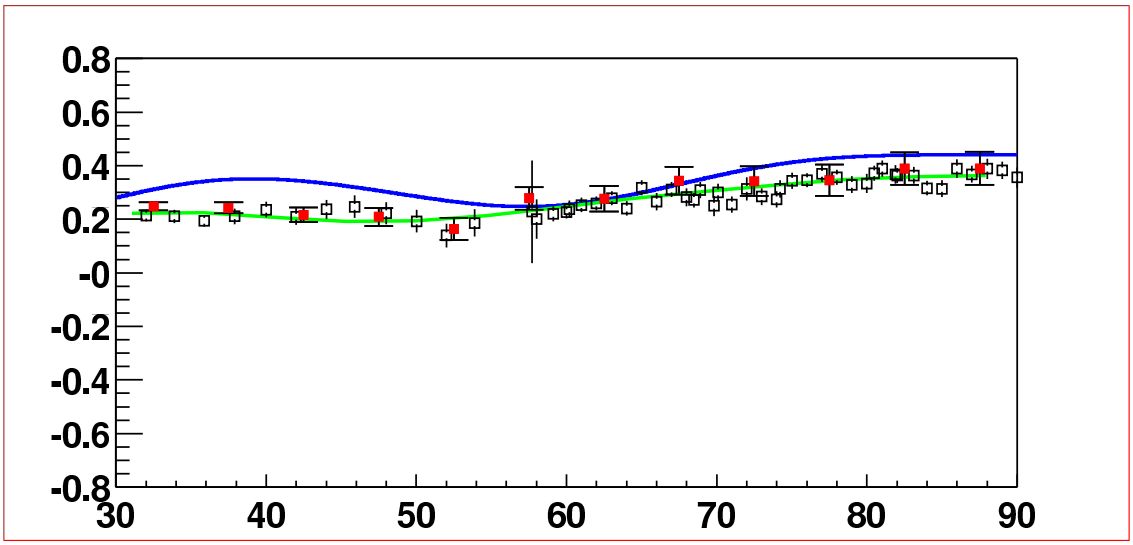

**2572 MeV/c**

**(1800 MeV)**




**3180 MeV/c**

**(2377 MeV)**



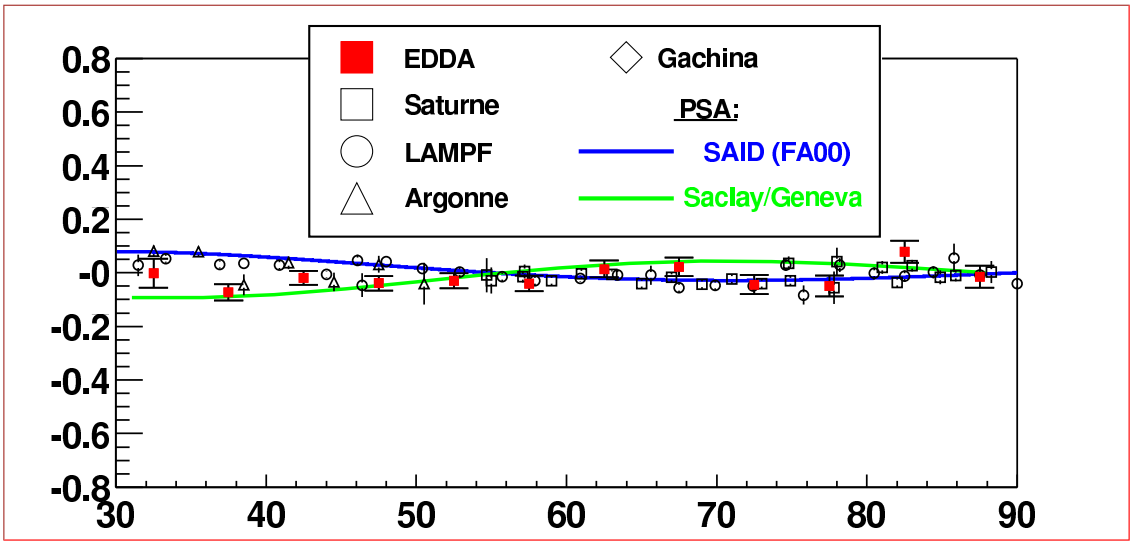

$\vartheta_{cm}$/**deg**

# $A_{SL}$, Angular Distributions

*Preliminary Data*

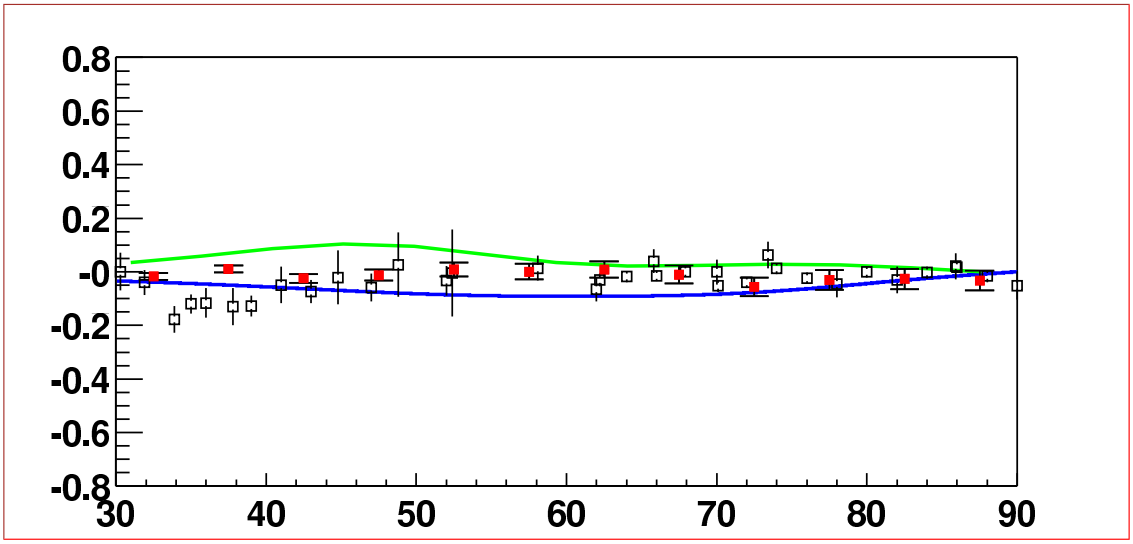
**1430 MeV/c**

**(772 MeV)**



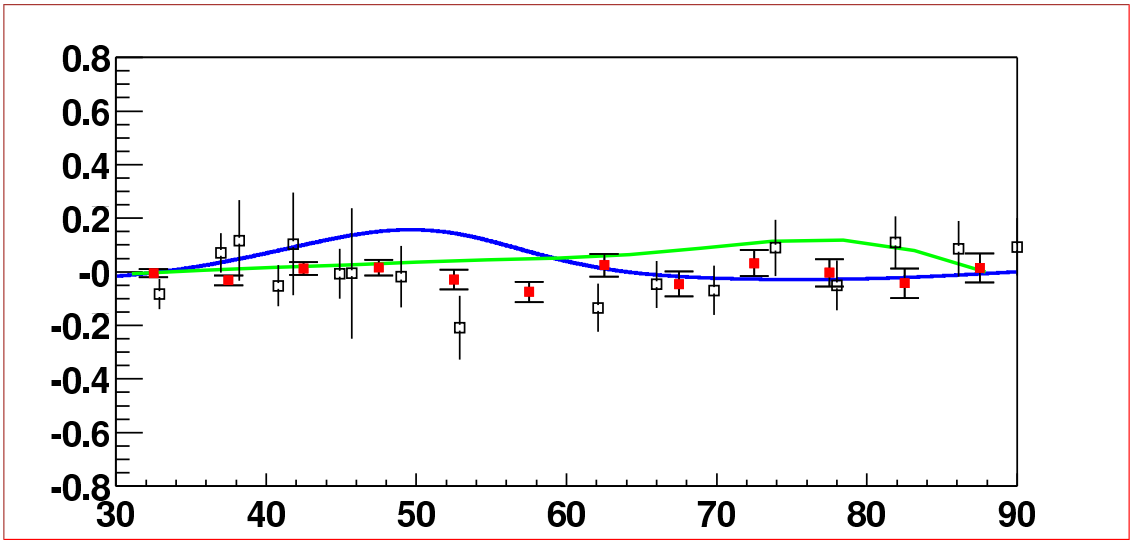

**2572 MeV/c**

**(1800 MeV)**




**3180 MeV/c**

**(2377 MeV)**



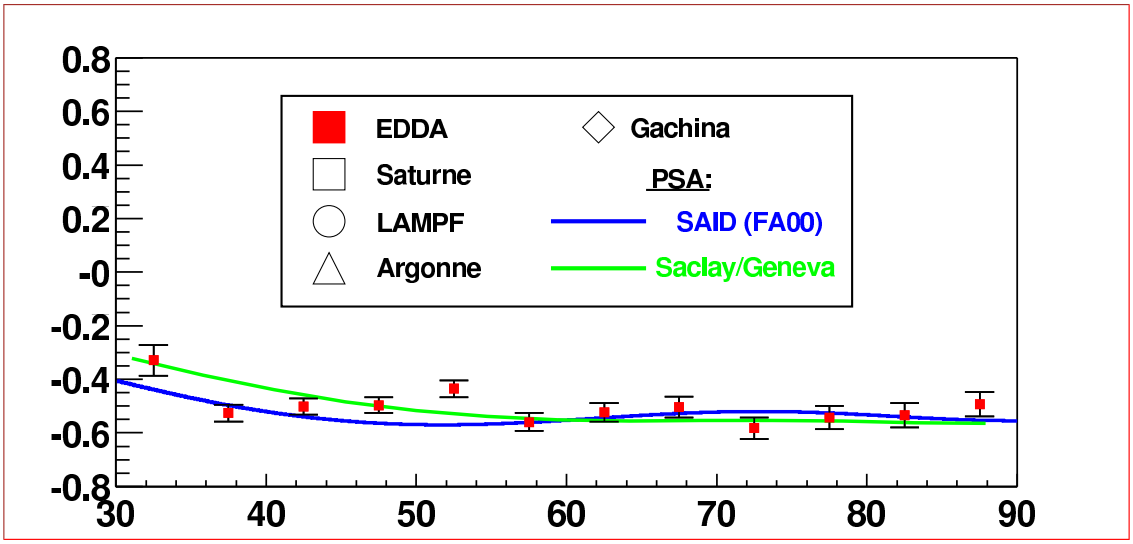

$\vartheta_{cm}$/**deg**

# $A_{SS}$, Angular Distributions

*Preliminary Data*

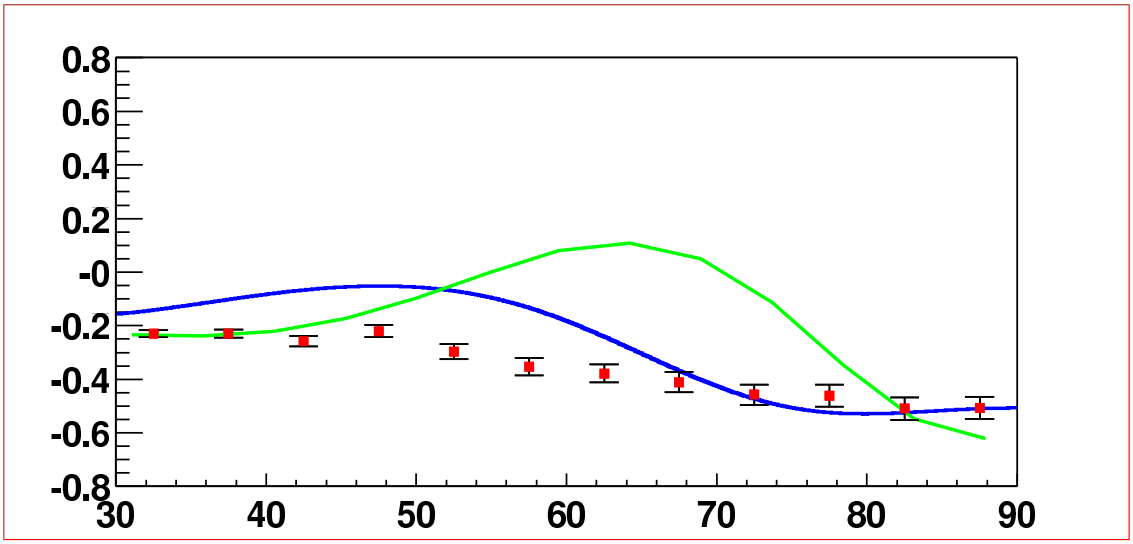
**1430 MeV/c**

**(772 MeV)**



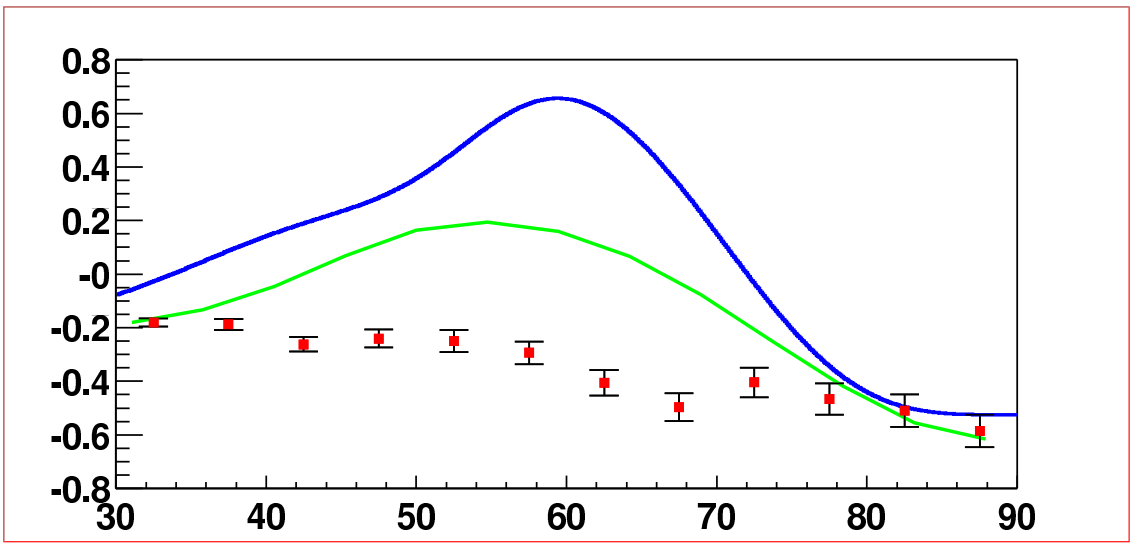

**2572 MeV/c**

**(1800 MeV)**




**3180 MeV/c**

**(2377 MeV)**

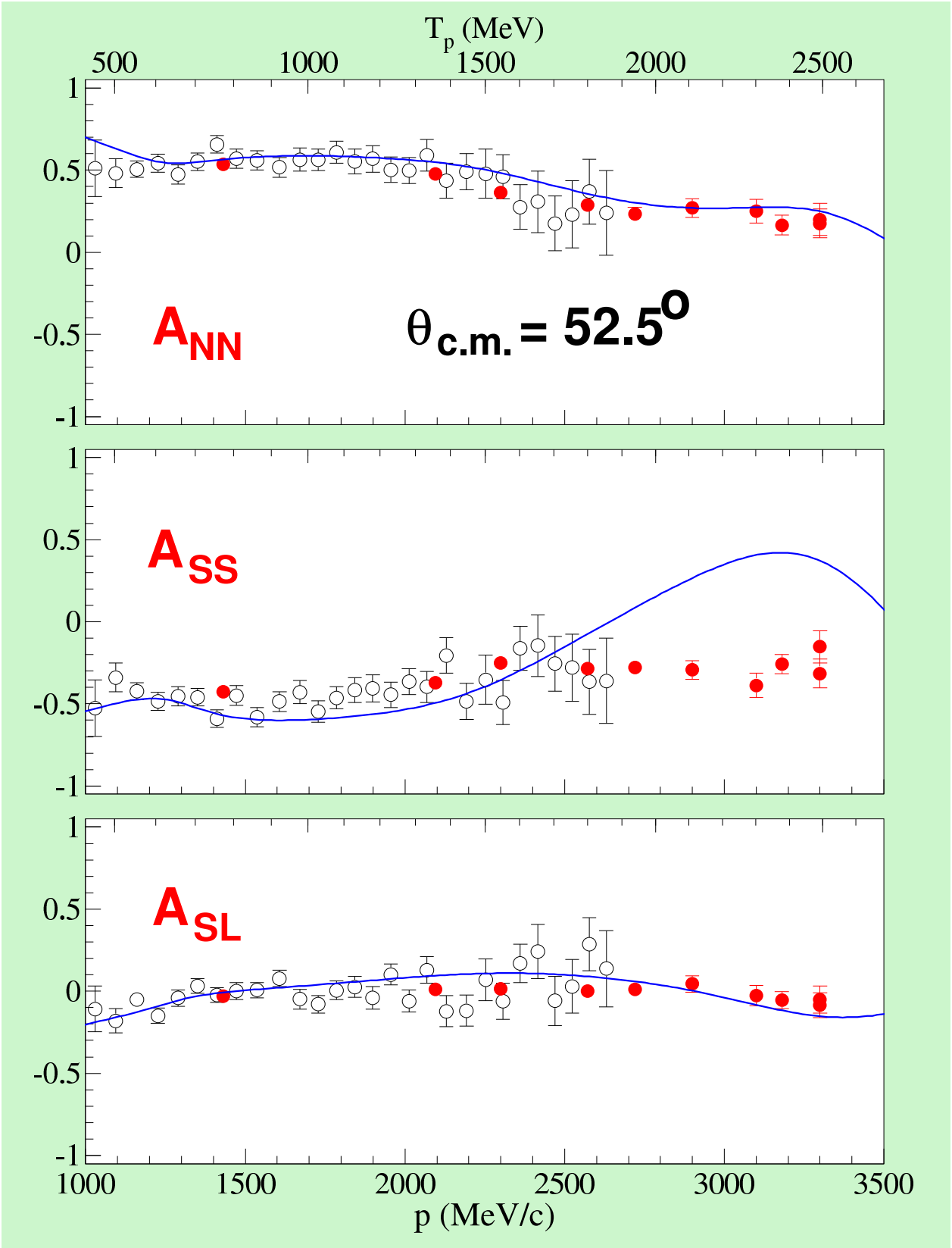



$\vartheta_{cm}$/**deg**

EDDA Collaboration: F.Bauer et al., Phys.Rev.Lett. 90, 142301 (2003)

# Excitation Functions

## EDDA preliminary




PSA (SAID SM00)

# Summary

## $A_N$

- consistent polarisation standard over covered energy range
- impact on PSA

## $A_{NN}$, $A_{SS}$, $A_{SL}$

- $A_{NN}$: good consistency with existing data
- $A_{SS}$: first measurements in EDDA energy range
- important step for improve–ment of PSA

# The EDDA Collaboration


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

F. Bauer, J. Bisplinghoff, K. Büßer, M. Busch,
T. Colberg, L. Demirörs, P.D. Eversheim, O. Eyser,
O. Felden, R. Gebel, F. Hinterberger, H. Krause, J. Lindlein,
R. Maier, A. Meinerzhagen, C. Pauly, D. Prasuhn,
H. Rohdjeß, D. Rosendaal,
P. von Rossen, N. Schirm, W. Scobel, K. Ulbrich, E. Weise,
T. Wolf, R. Ziegler

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



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