DSS — Deuteron Spin Structure

LNS
Light Nuclei Structure

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STUDY OF DP-ELASTIC SCATTERING WITH INTERNAL AND EXTRACTED NUCLOTRON BEAMS

Brief introduction:

- The selection of _____ of 1.6 and 2.0 GeV o_____ he Internal Target has _____

- The proced_____

- This metho_____ y extracted and internal deuteron beam polarimetry.

The main aim of these investigations is to study the short range nucleon correlations.

Also this reaction is a powerful tool to provide efficient deuteron beam polarimetry at intermediate and high energies.

Deuteron polarimetry

The investigations with the use of high energy polarized deuteron beams proposed at different facilities require the efficient polarimetry at these energies to deduce values of polarization observables reliably. The polarimetry should have a capability to determine both components of polarization simultaneously.

There were some deuteron polarimeters using the same principles (ALPHA (JINR), polarimeter in RIKEN).

The dp-elastic scattering reaction has several advantages as a beam-line polarimetry over the others:
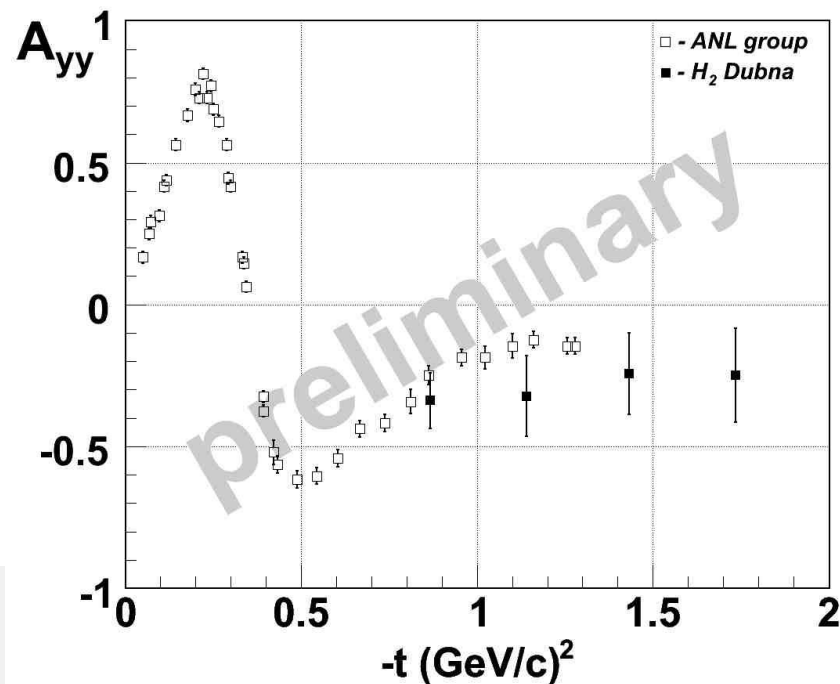
- large values of <u>vector</u> and <u>tensor</u> analyzing powers;

- a kinematical coincidence measurement of deuteron and proton with simple plastic scintillation counters <u>suffices</u> for event <u>identification</u>.

Analyzing powers A_y, A_{yy} for the *dp*-elastic scattering at 2000 MeV
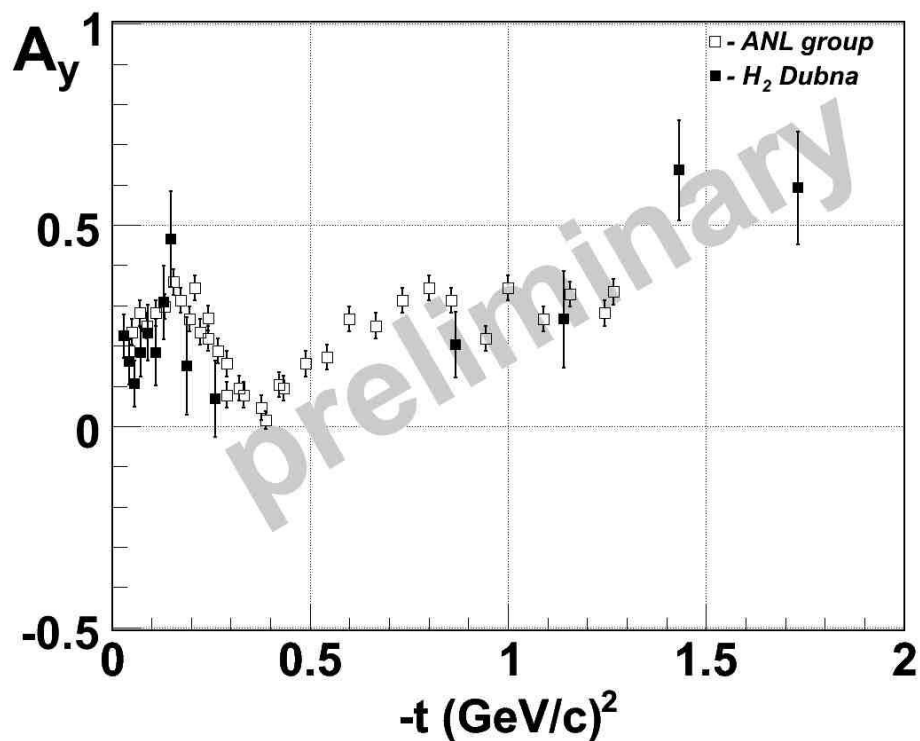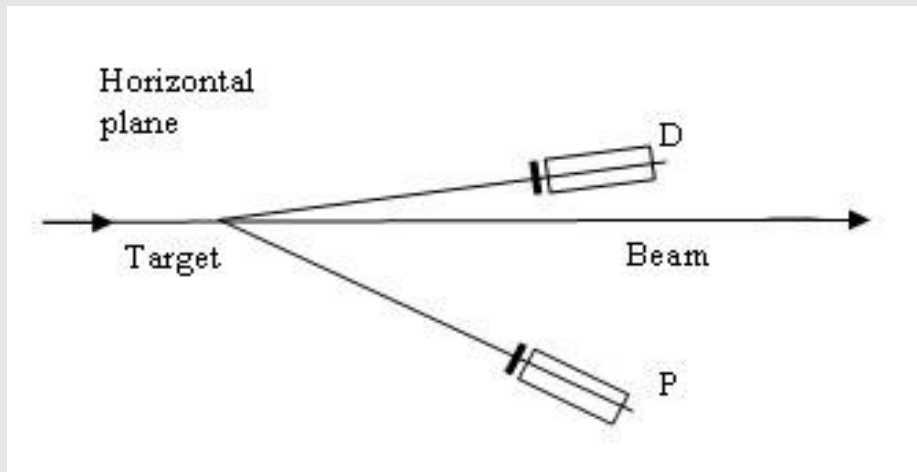

Vector Ay analyzing power

Tensor A_{yy} analyzing power

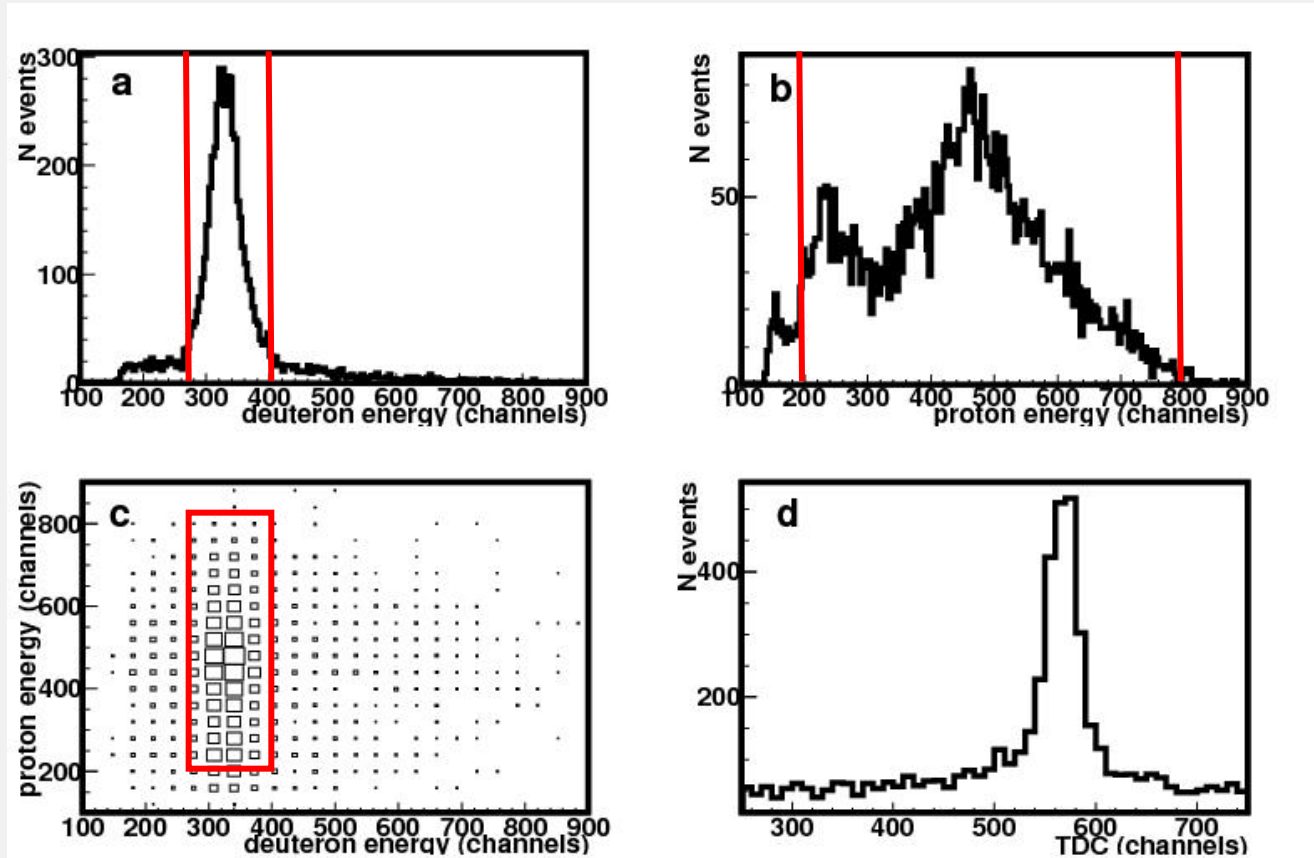# Experiment at the extracted beam of Nuclotron

P-proton detector, **D**-deuteron detector

- 1.6 and 2.0 GeV deuteron beam energy

- CH_2 and C targets

- D-detector - at 8° in lab

- The P-detector - in the kinematical coincidence.

Data handling

CH$_2$

DATA

The results obtained at **2.0 GeV** deuteron beam on **polyethylene** target: a) deuteron energy losses, b) proton energy losses, c) correlation of proton and deuteron energy losses, d) time difference between the signals for deuteron and proton detectors.
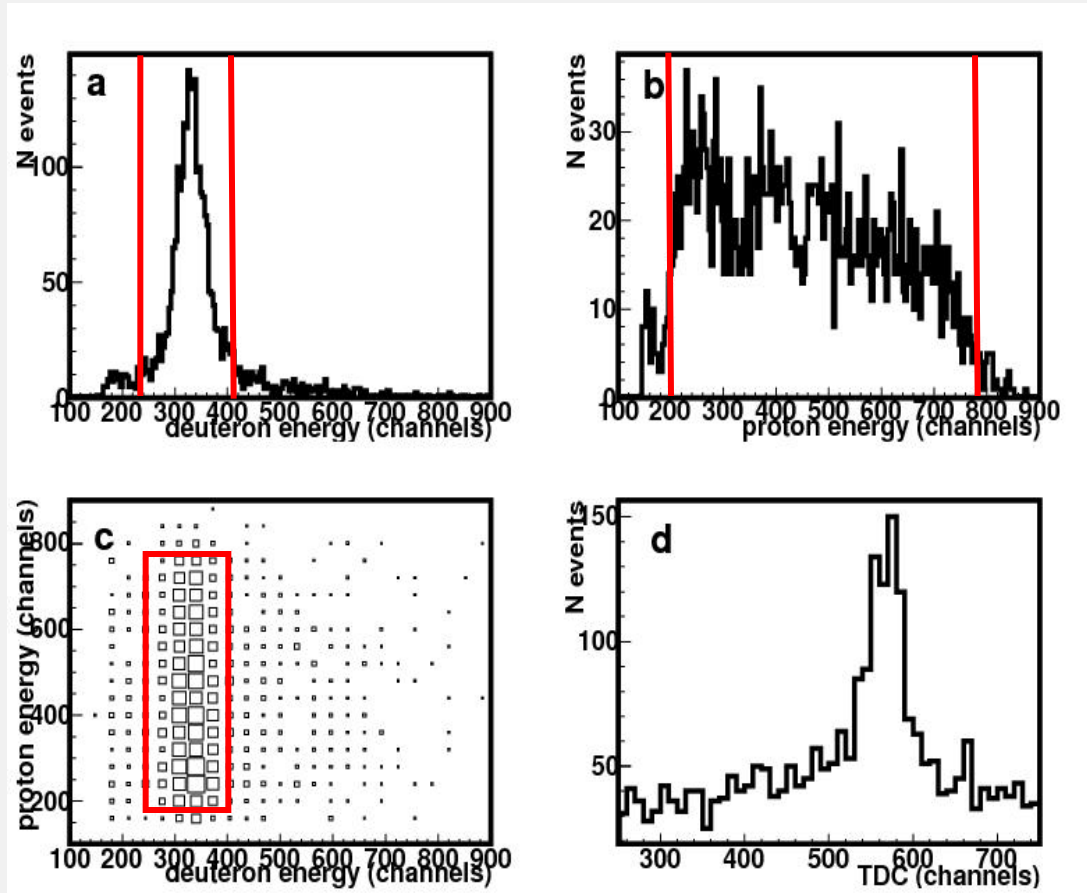
The selection of the *dp*-elastic scattering events by the energy losses correlation
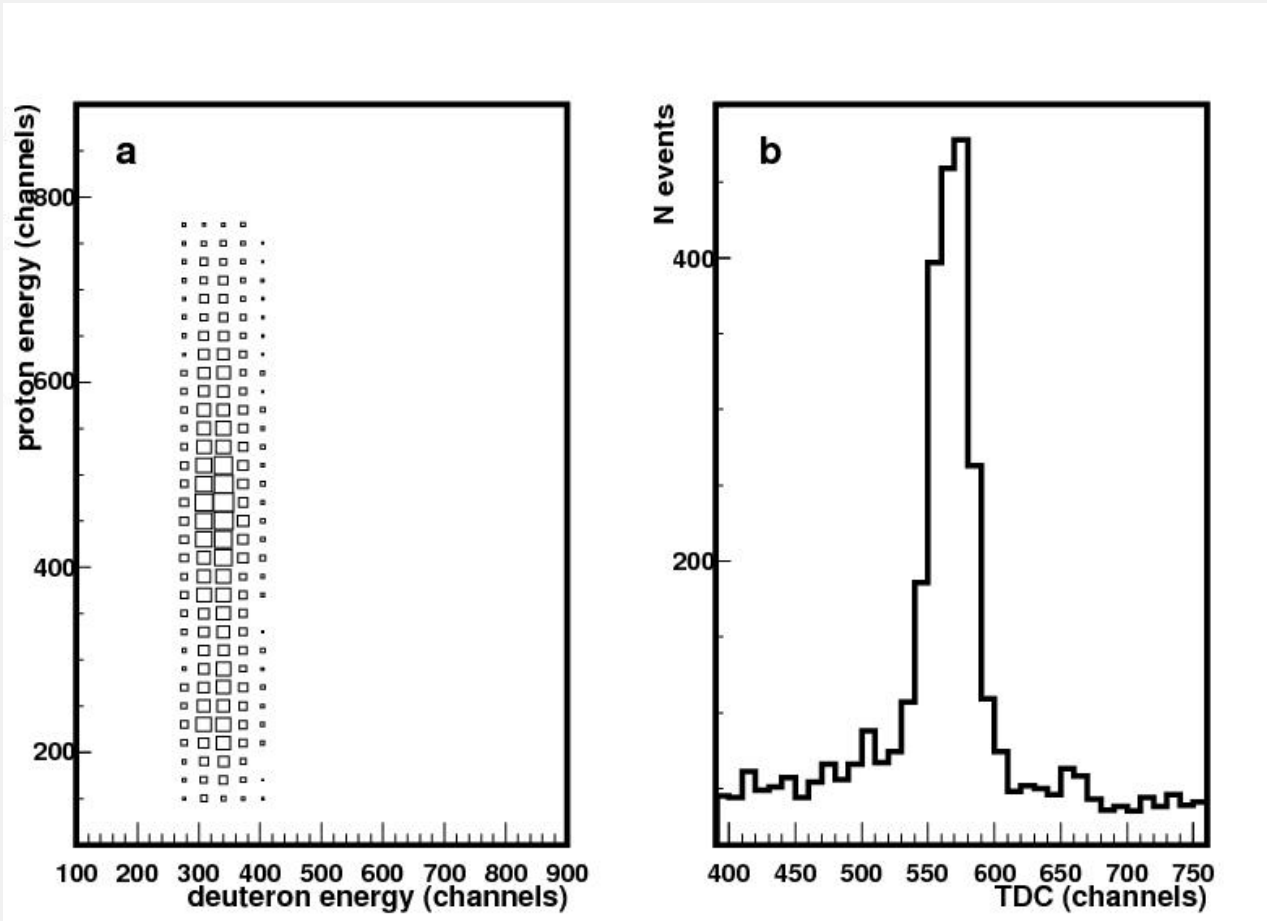
a) Gates on energy losses correlation

b) Time difference spectra after applying of the gates on energy losses correlation.

The results obtained at 2.0 GeV deuteron beam on carbon target

CARBON

**DATA**

TO SUBTRUCT BACKGROUND

a) deuteron energy losses, b) proton energy losses, c) correlation of proton and deuteron energy losses, d) time difference between the signals for deuteron and proton detectors

Getting normalization coefficient fitting the time difference spectra

a CH2 DATA

b CARBON DATA

Gauss+const fit

$$K = const_{CH2}/const_C$$
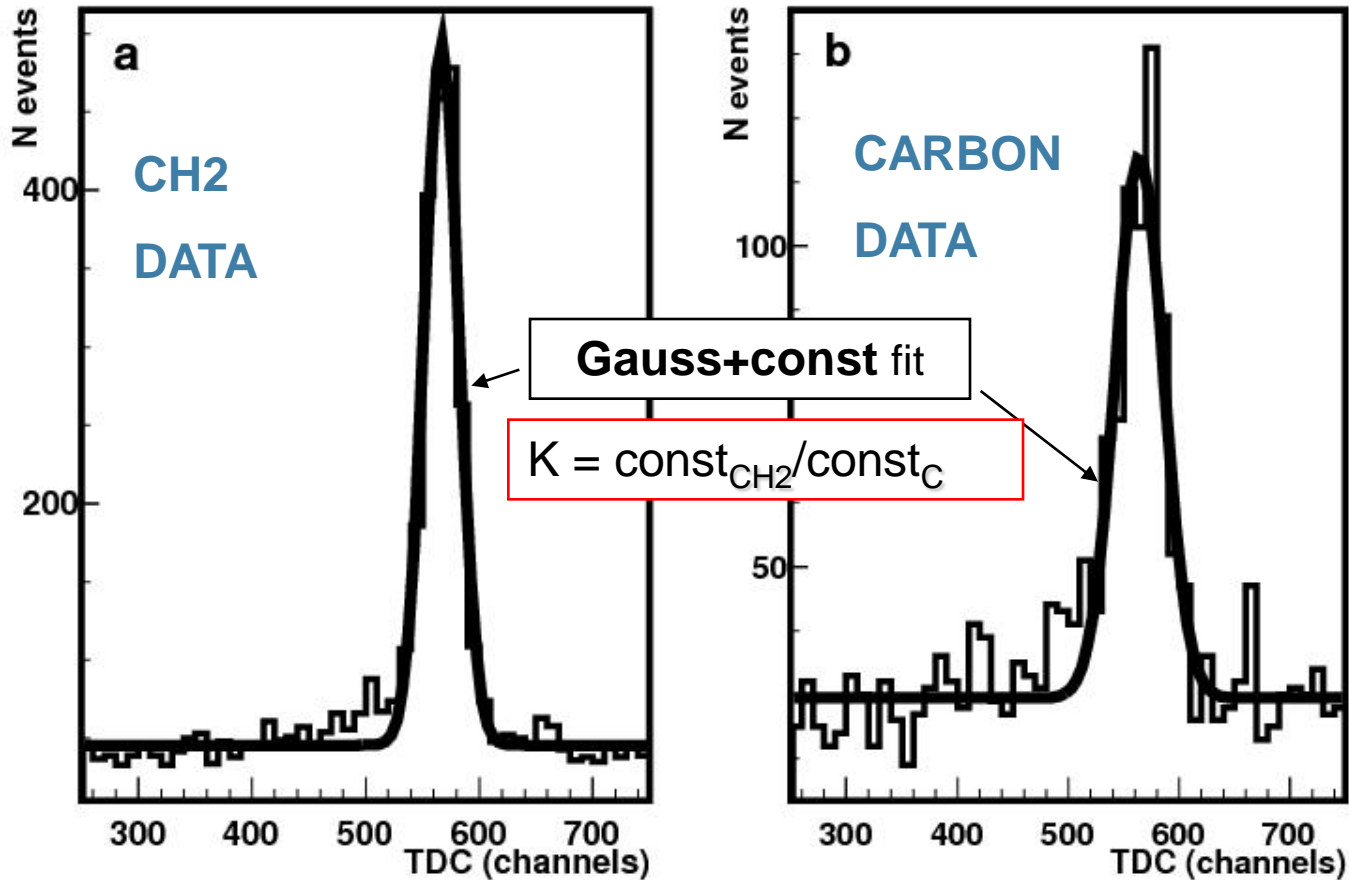
Time difference spectra obtained on polyethylene (a) and carbon (b) targets.

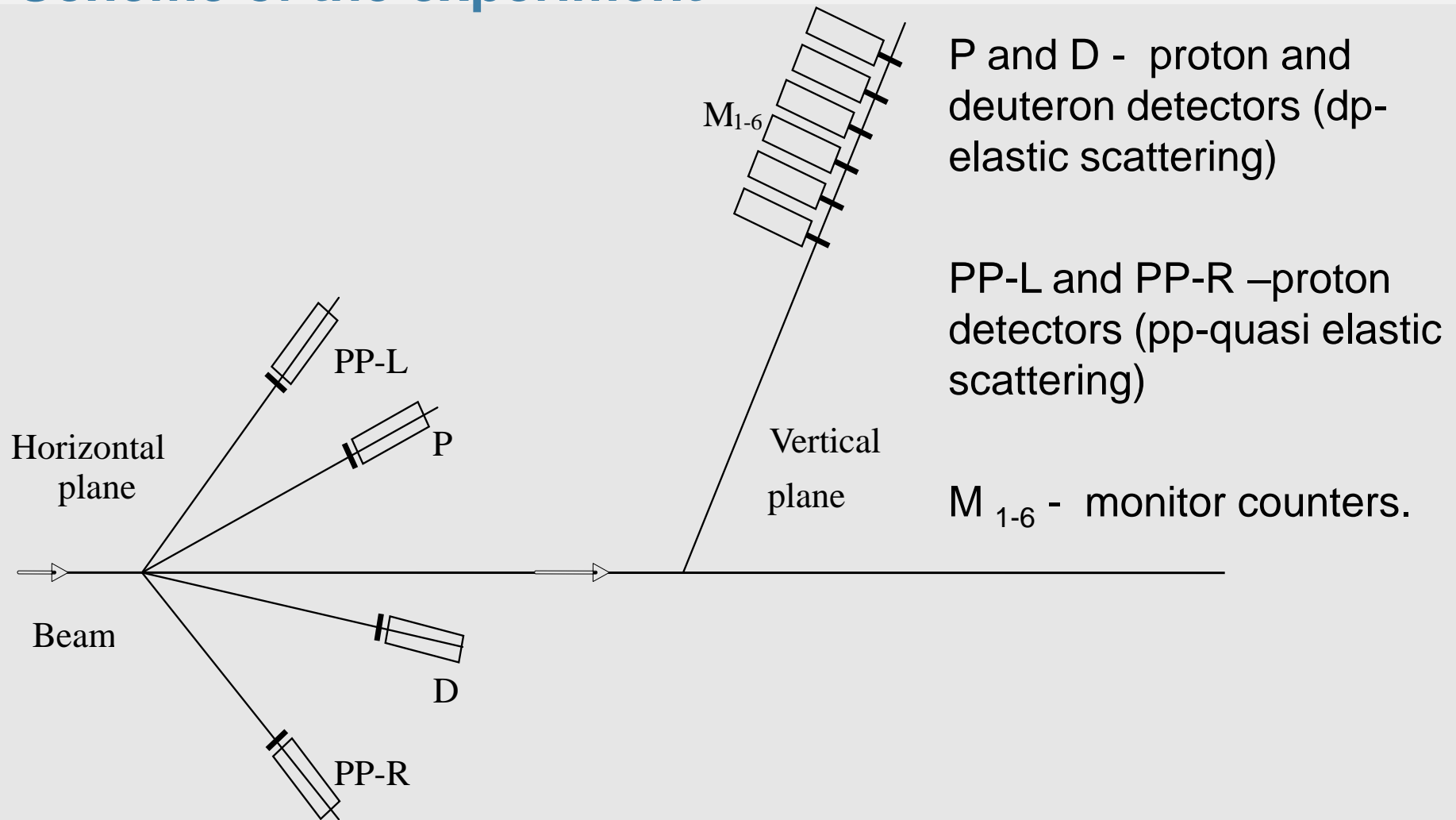# Time difference spectra CH$_2$-C subtraction (internal beam)
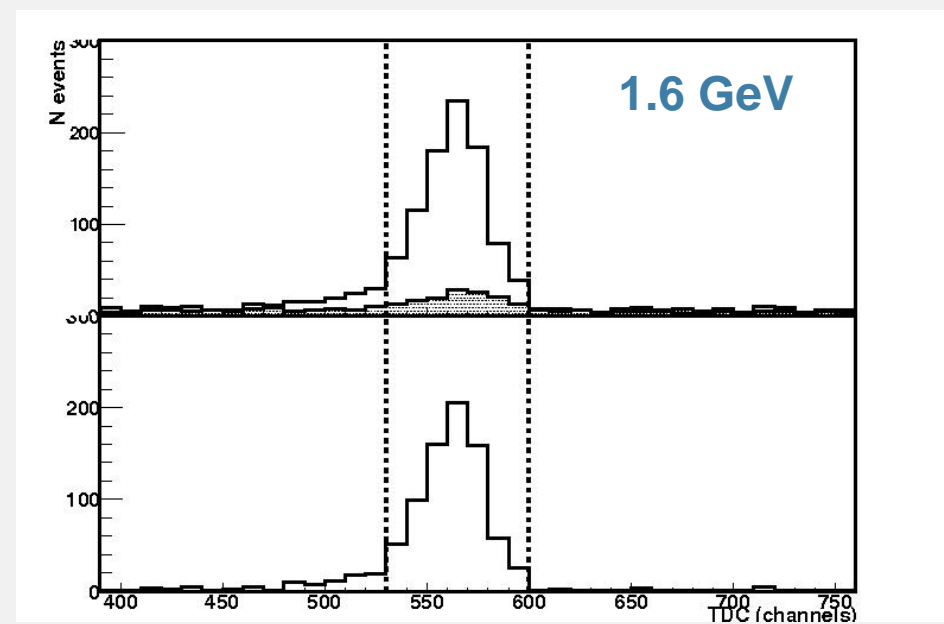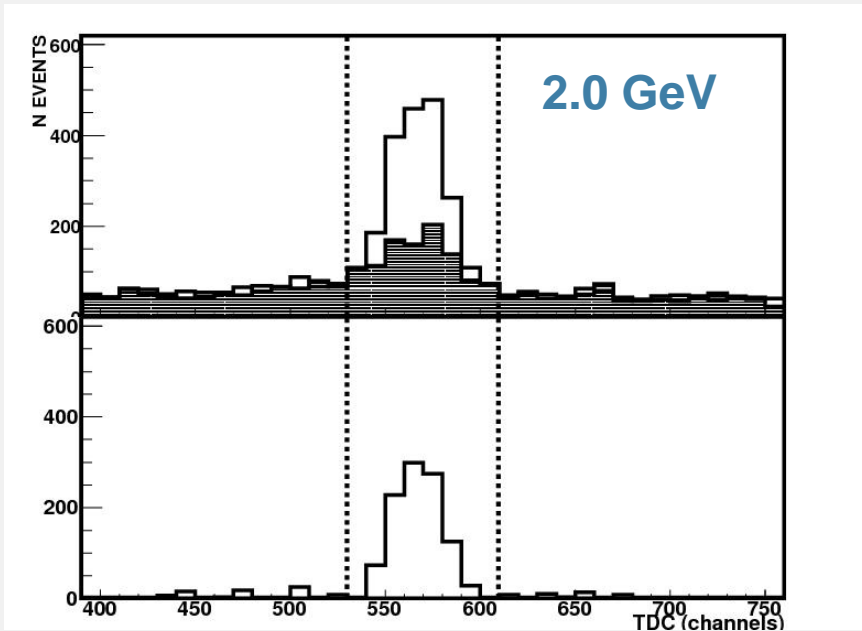
Time difference distribution for *dp*-elastic events obtained from CH$_2$-C subtraction at the deuteron energy of 2.0 and 1.6 GeV.

Internal Target Station

M_{1-6}

P and D - proton and deuteron detectors (dp-elastic scattering)

PP-L and PP-R –proton detectors (pp-quasi elastic scattering)

PP-L

P

Horizontal plane

Vertical plane

M_{1-6} - monitor counters.

Beam

D

PP-R

Experimental setup at the Internal Target Station

P and D detector

Counter # 2 for P и D detectors
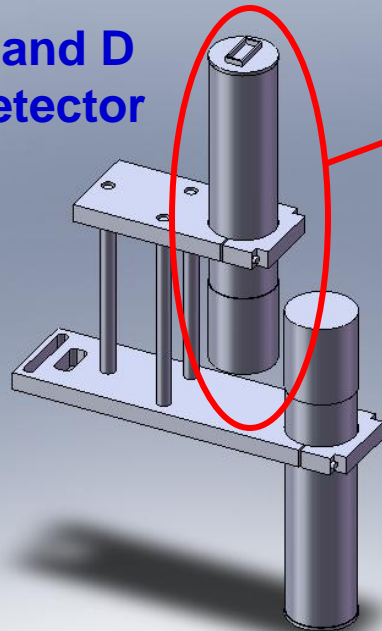
Detect

Photomultiplier FEU-85

Scintilator's cover

Hull

Scintillator

PMT base
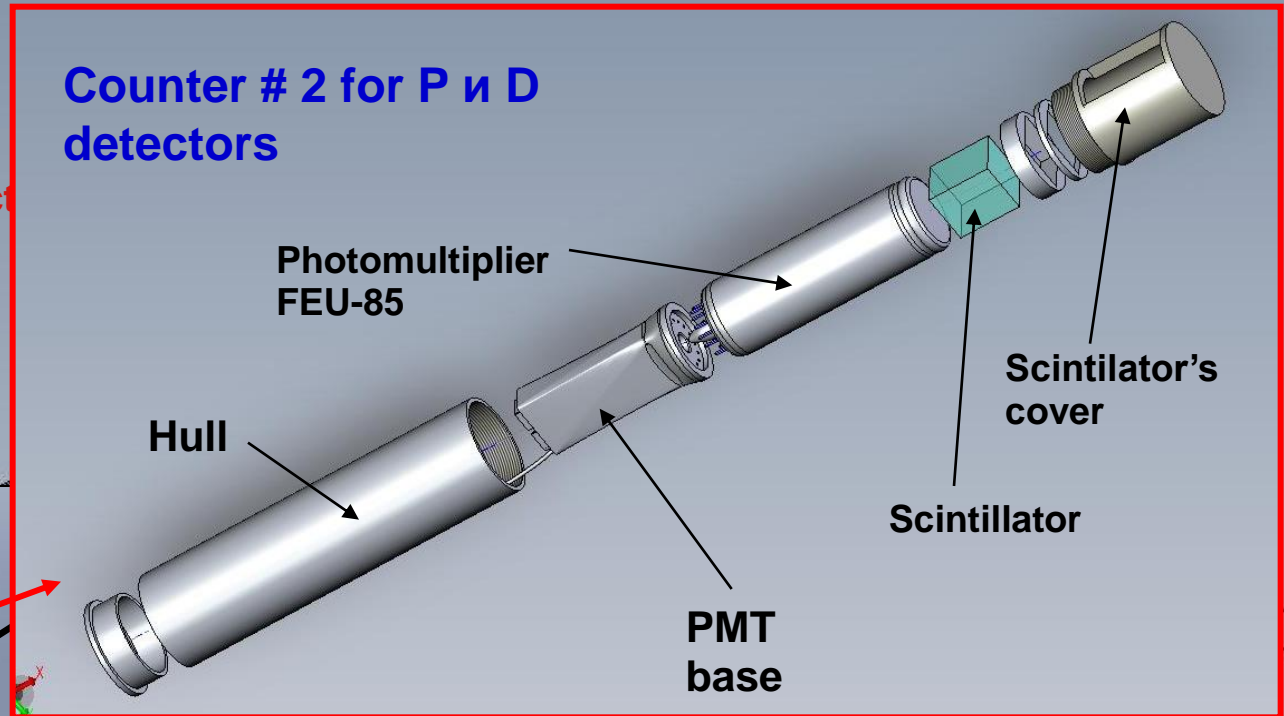
-Scintillators:
  1) 5*20*25mm (counter #1)
  2) 20*20*25mm (counter #2)
Photomultipliers FEU-85
-Digital PMT bases

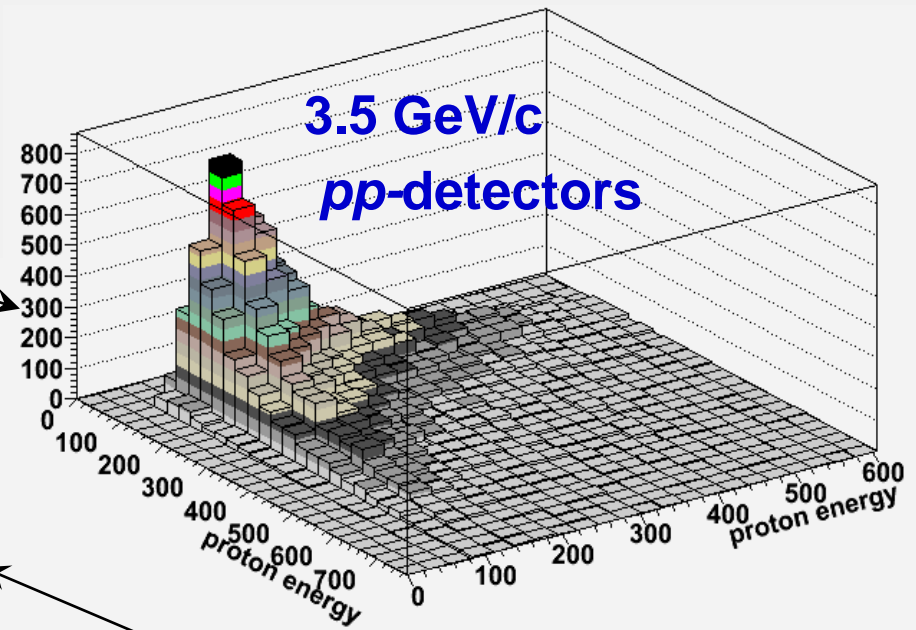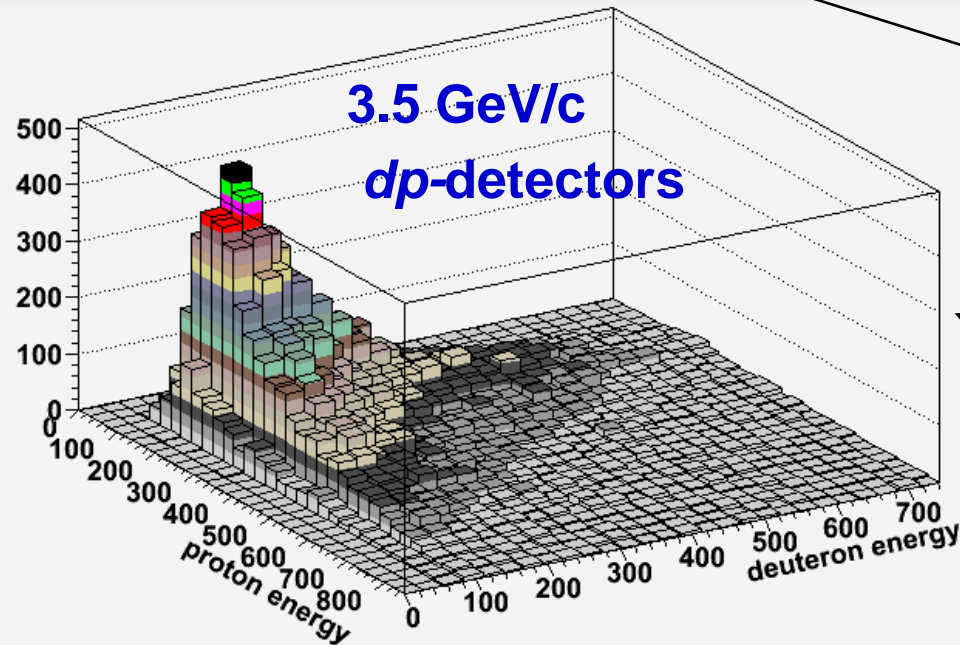# Results obtained using 3.5 GeV/c deuteron beam

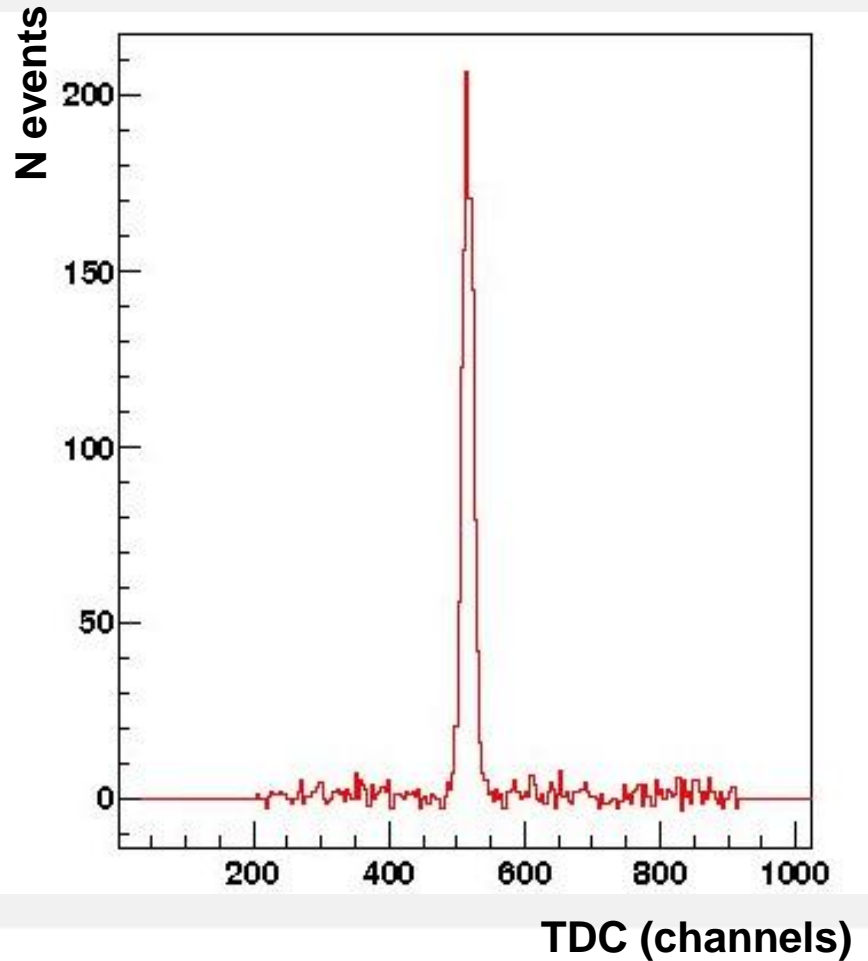**Conditions:**
^{12}C target
D scat.angle=70° c.m.s
P angle= 90° c.m.s

Correlation of the protons energy loses from PP detectors

3.5 GeV/c
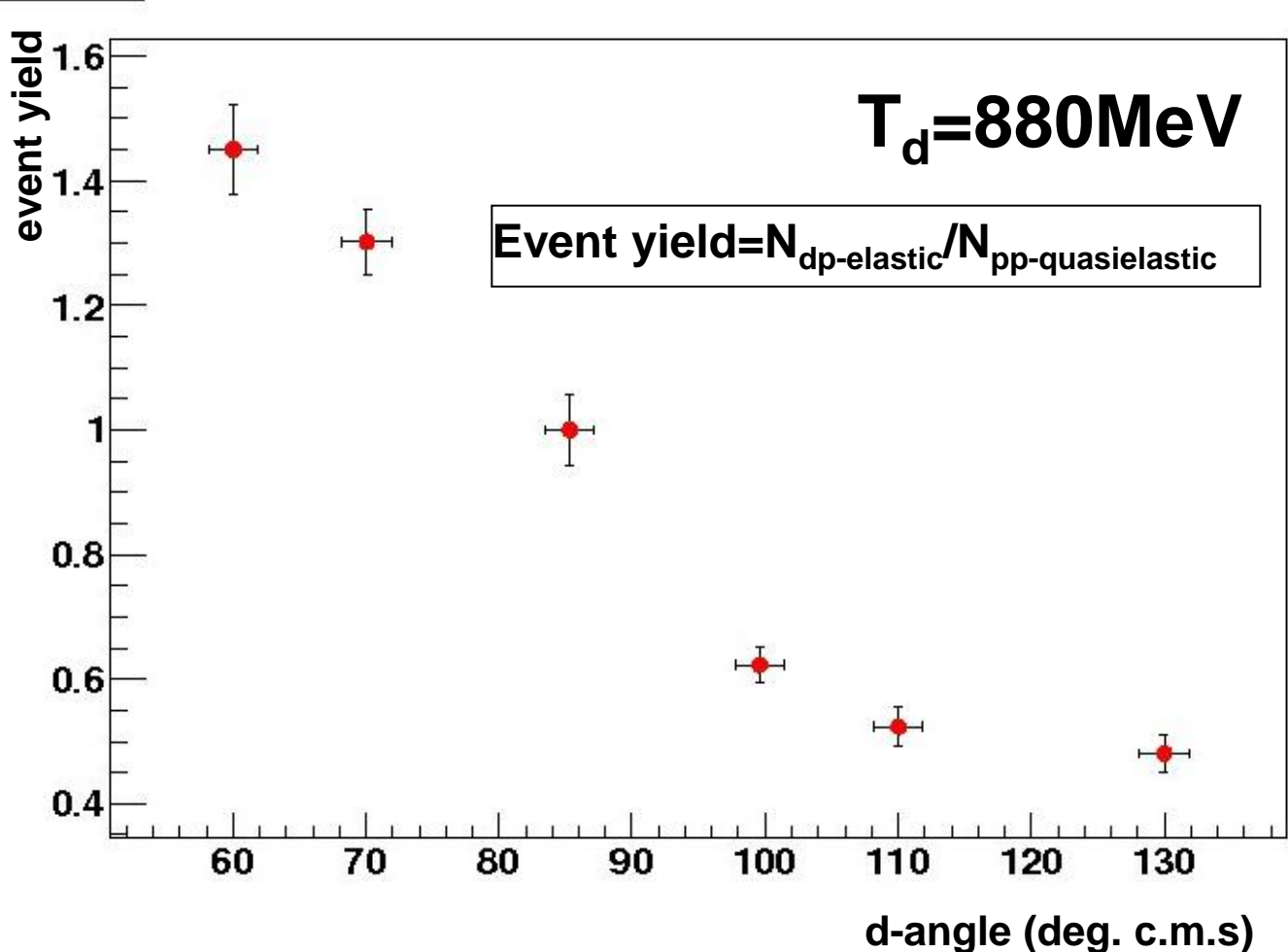*pp*-detectors

3.5 GeV/c
dp-detectors

Correlation of the proton and deuteron energy loses from P and D detectors

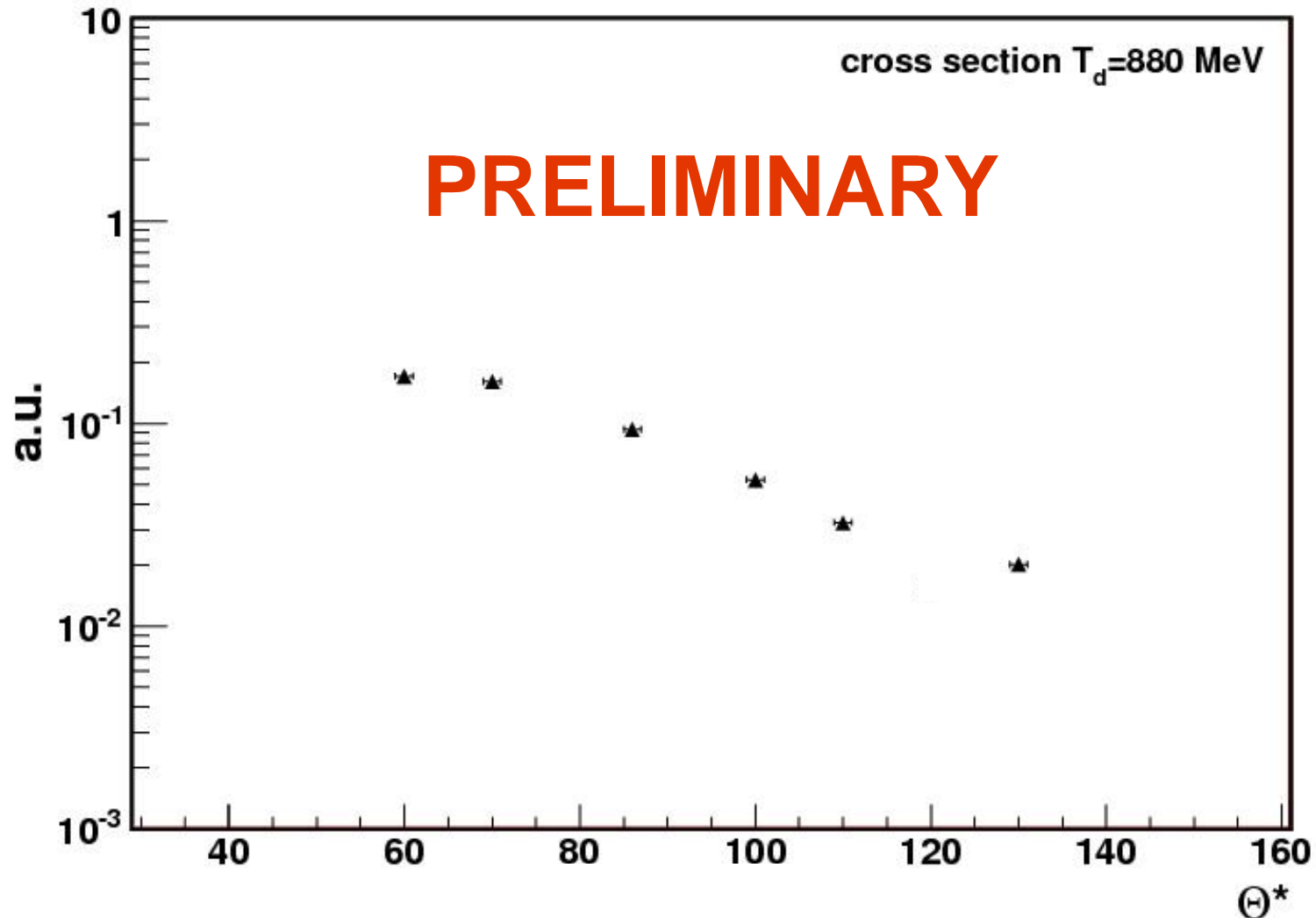# Procedure of the CH$_2$-C subtraction at the energy 880MeV
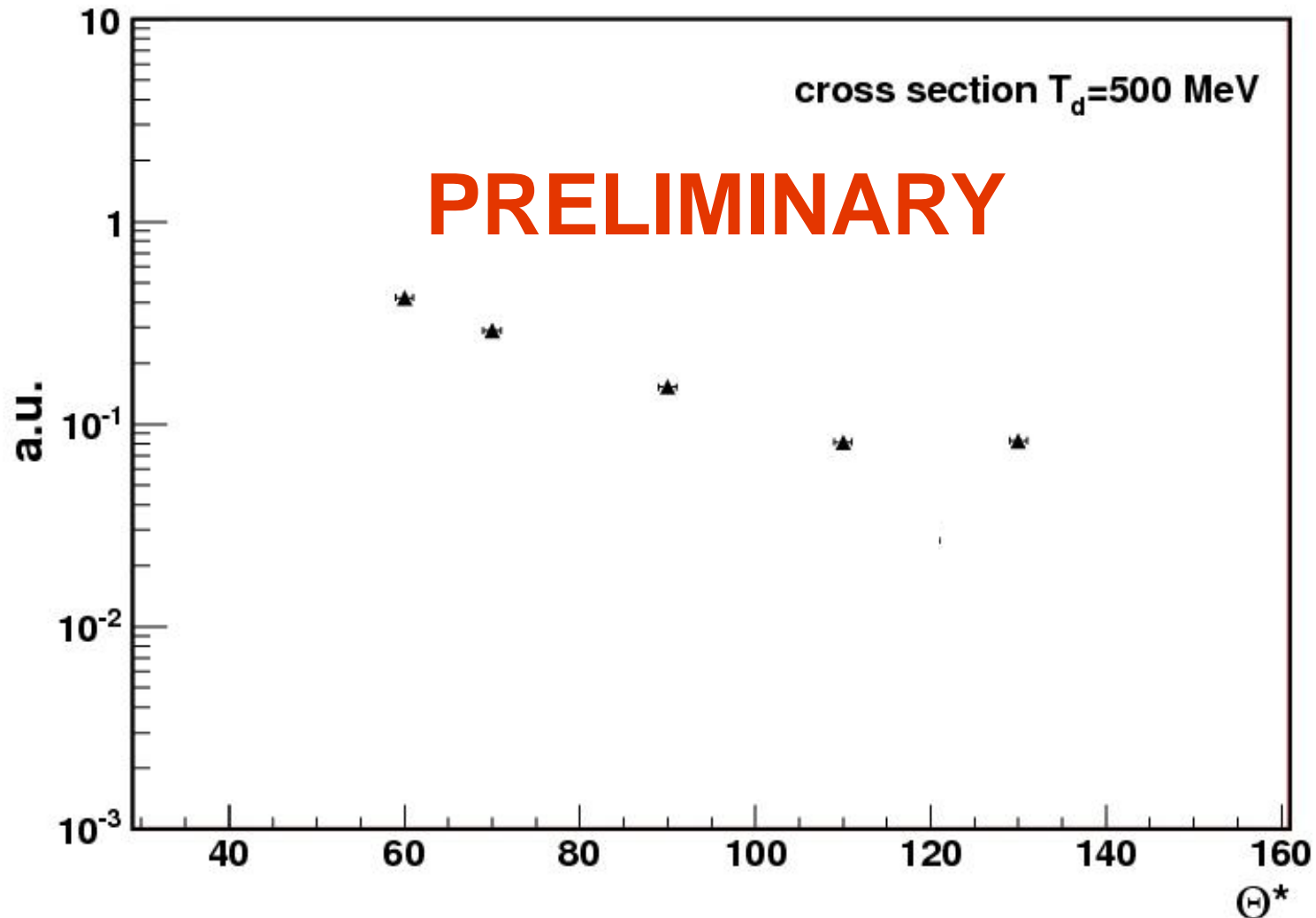
D angle = 70° c.m.s
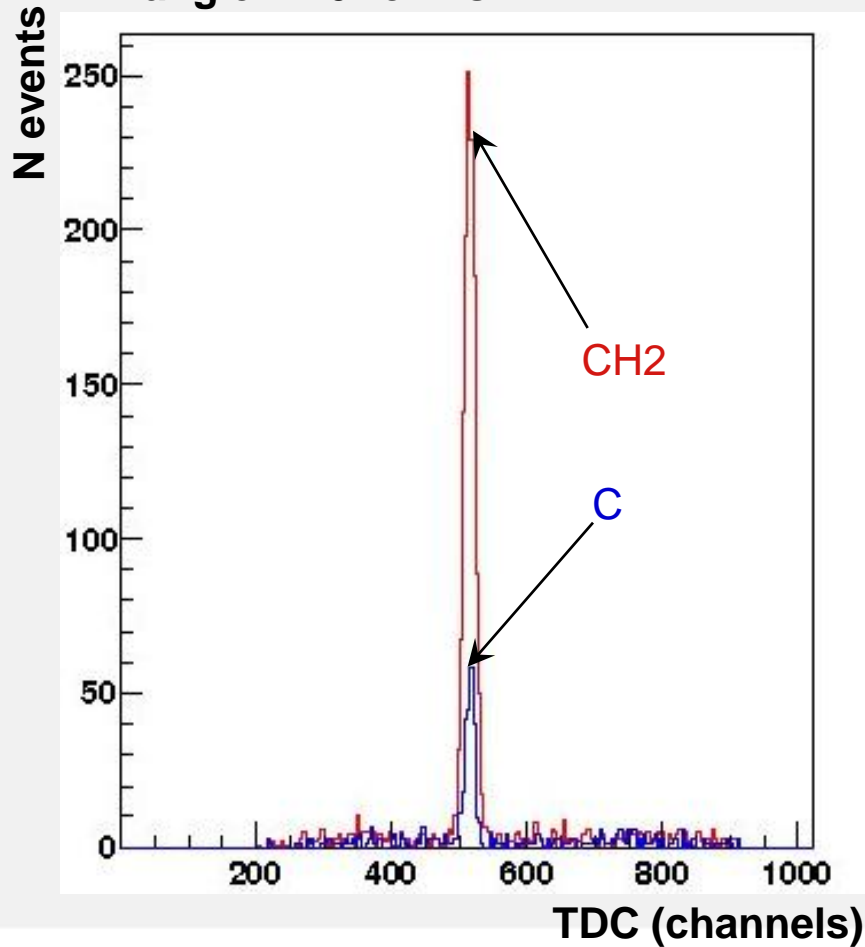
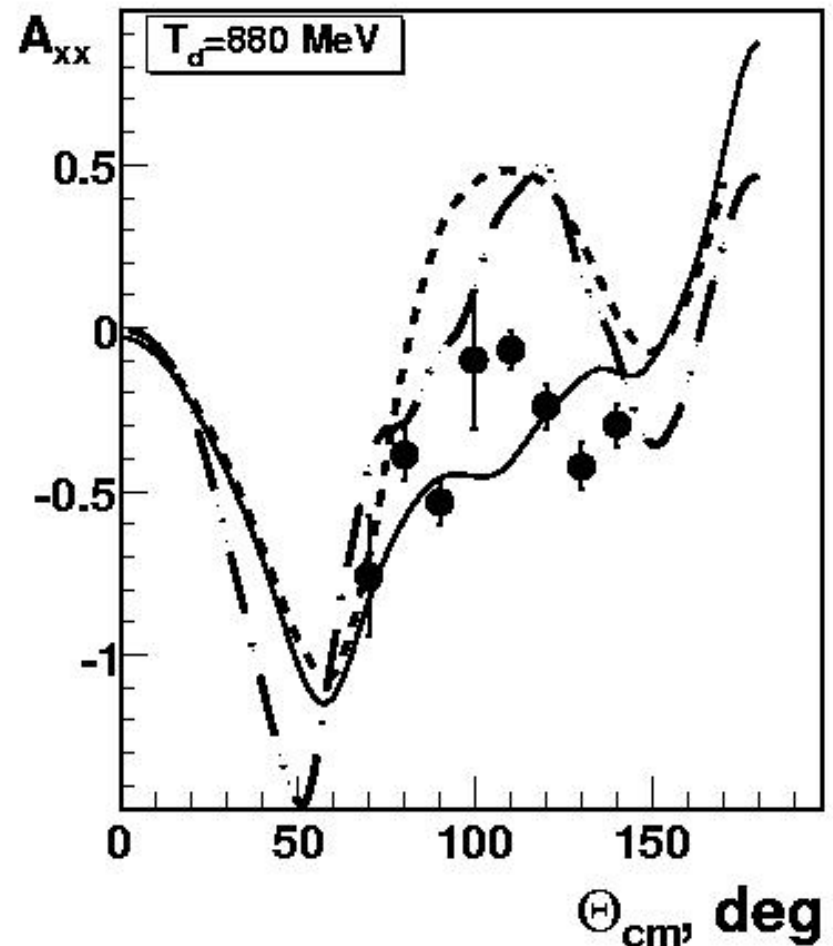# Results, obtained from March 2010 Nuclotron run

T_d=880MeV

Event yield=$N_{dp\text{-}elastic}$/$N_{pp\text{-}quasielastic}$

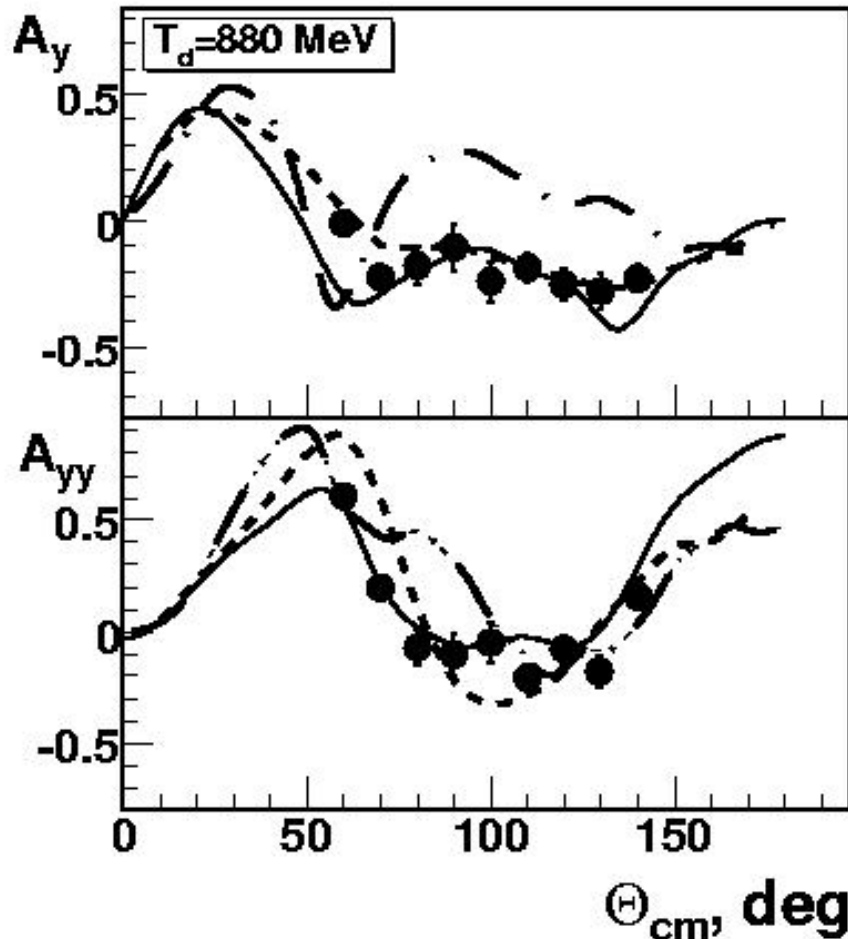# Cross section of *dp*-elastic scattering reaction T_d=880MeV

Cross section of *dp*-elastic scattering reaction T_d=500MeV

Analyzing powers A_y, A_{yy}, A_{xx} for the *dp*-elastic scattering at 880 MeV

Conclusions

The following results has been obtained:

- The possibility of the *dp*-elastic scattering events selection at high energies and small scattering angles using extracted beam of Nuclotron has been demonstrated.

- The possibility of the internal deuteron beam polarimetry has been shown. This method uses *dp*-elastic scattering at high energies and large angles in c.m.s.

Collaboration

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TO BE CONTINUED

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