Analyzing power in quasi-elastic proton-proton scattering at 500 and 650 MeV/nucleon
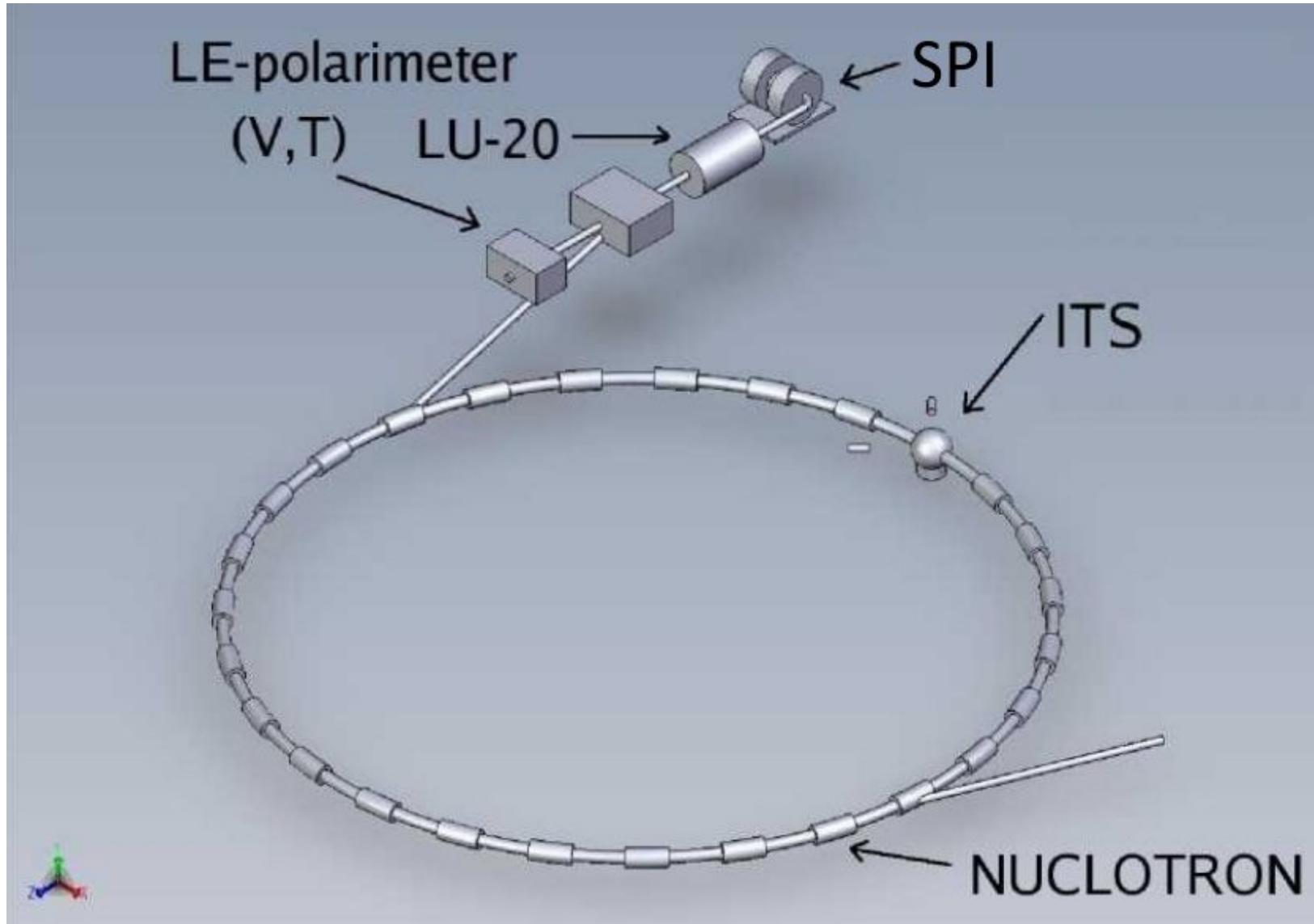
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DSS Collaboration, LHEP JINR

Motivation

1. Obtaining new data for proton-proton elastic scattering to improve phase shift analysis;
2. Using quasi-elastic proton-proton scattering to obtain the polarization values of polarized deuteron and proton beams at energies up to 1 GeV/n;
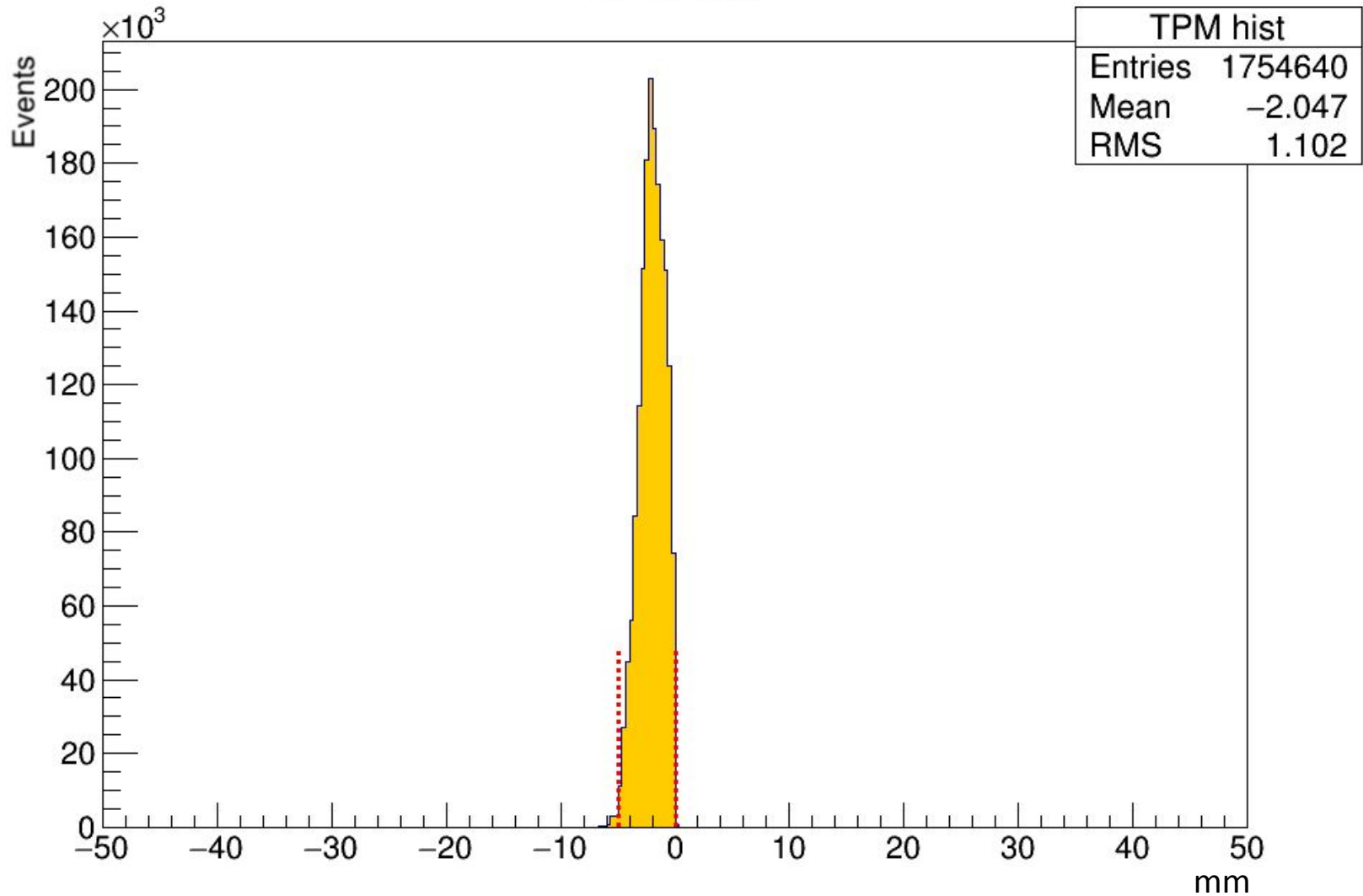
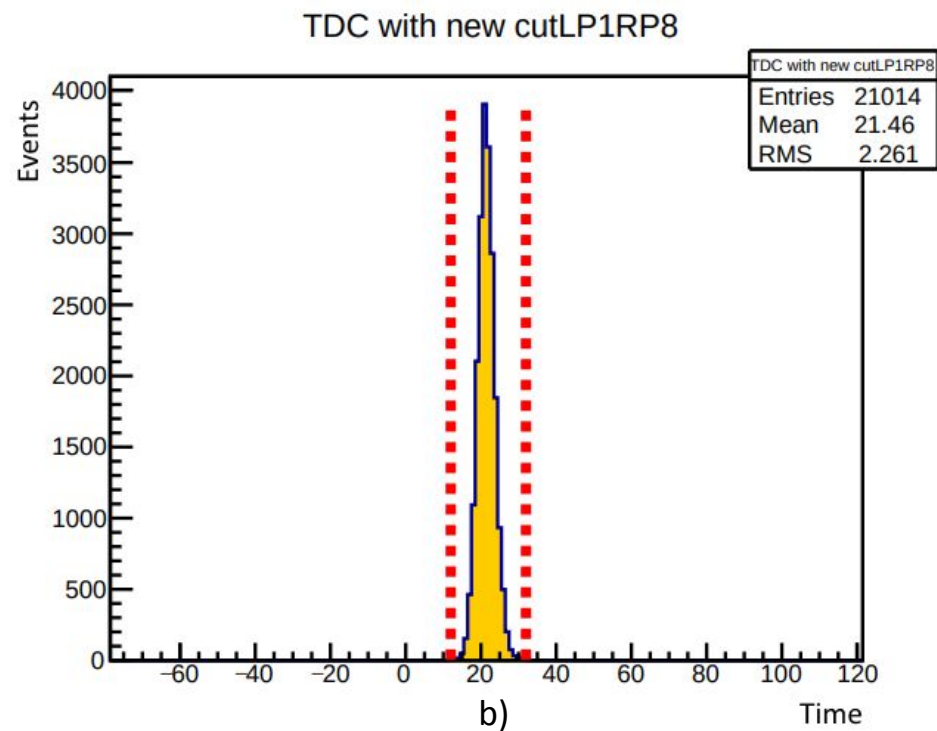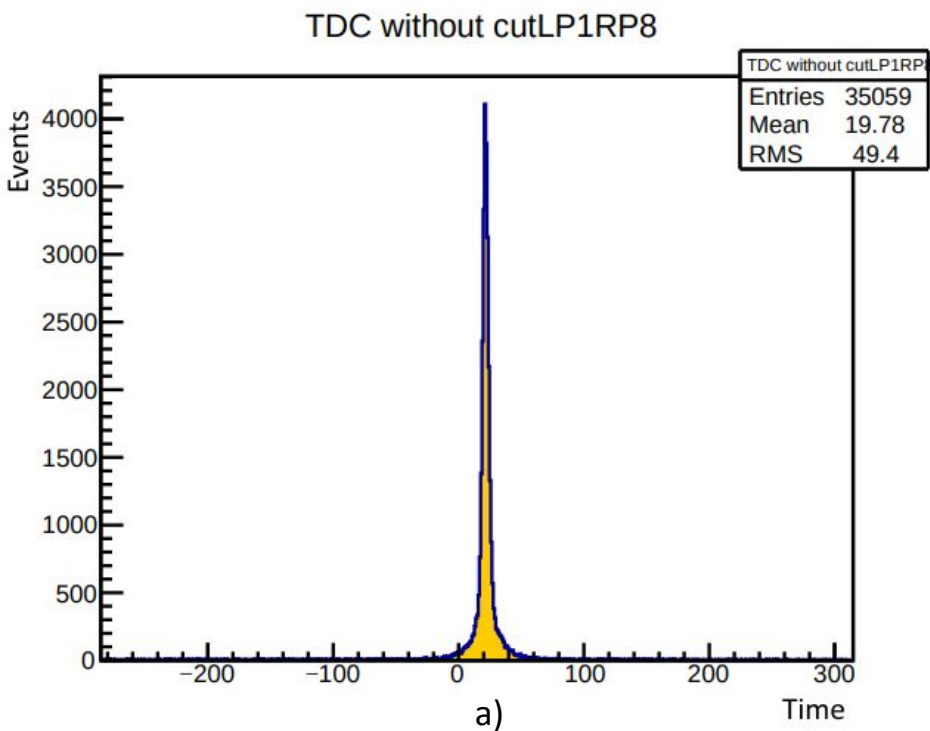# Scheme of the experiment at NUCLOTRON

Internal Target Station Setup

RP8

RPP

LP1

LP8

Internal
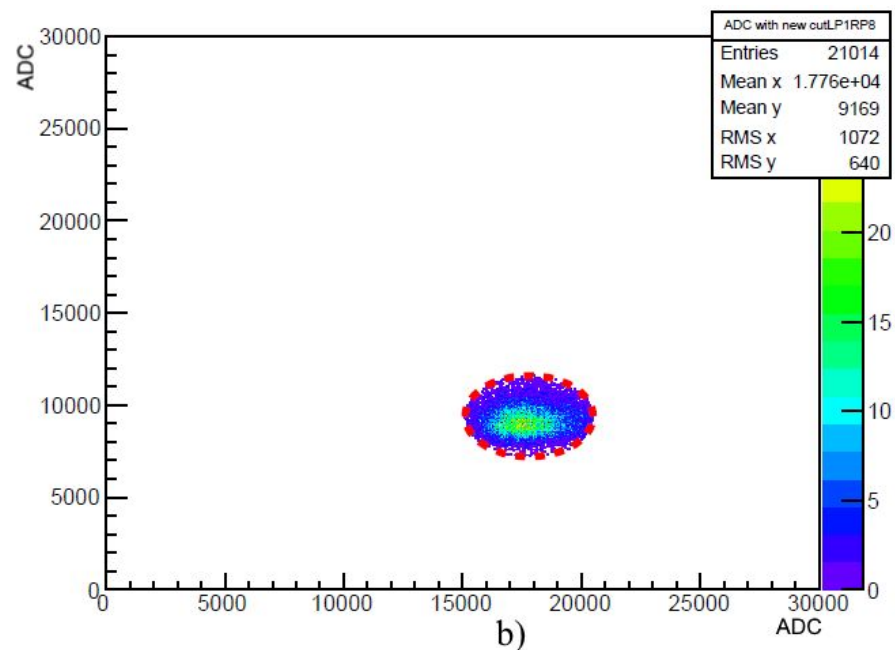target

LPP
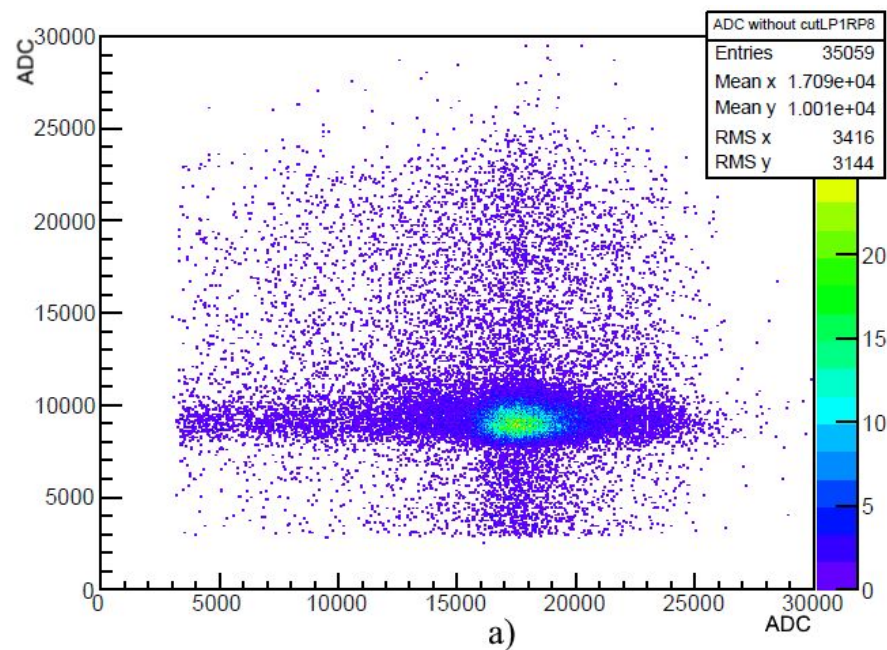
Polarized
deuteron beam
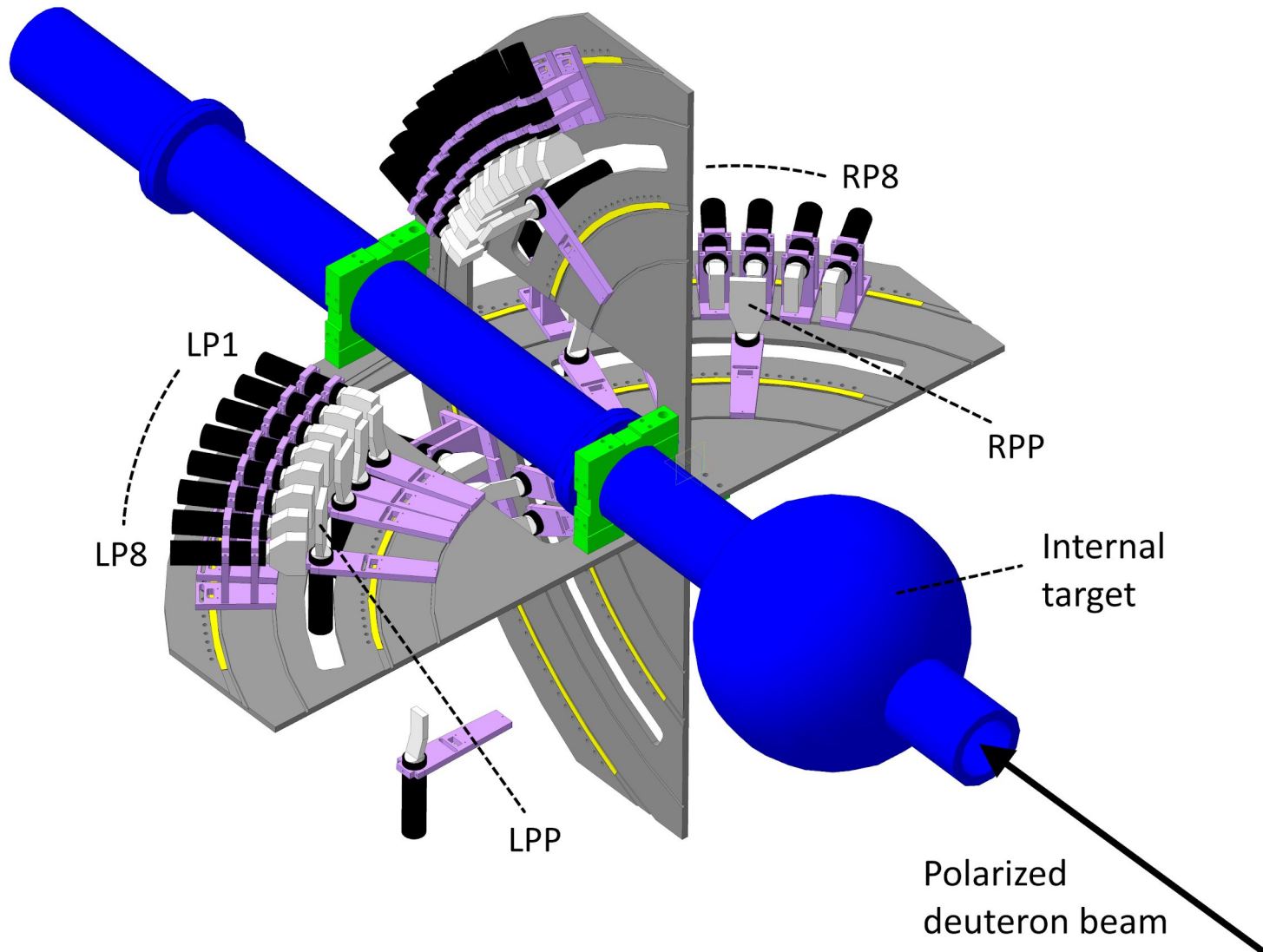
The dependence of the events yield on the position of the target inside the ion tube
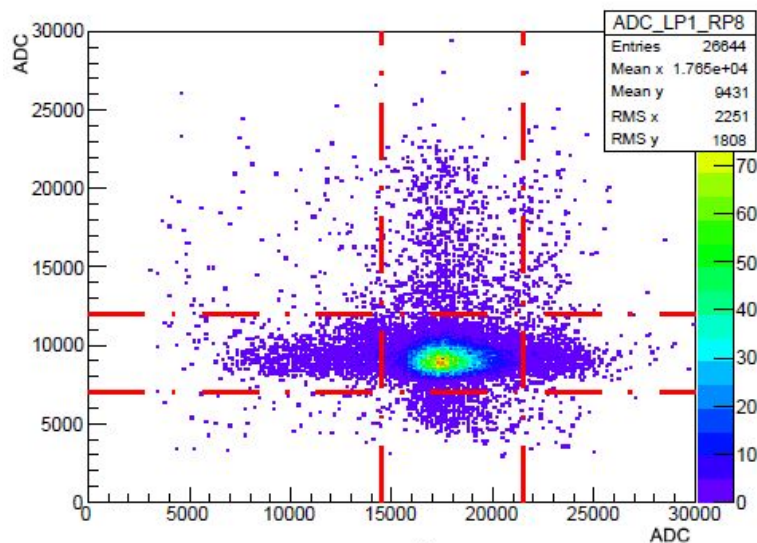
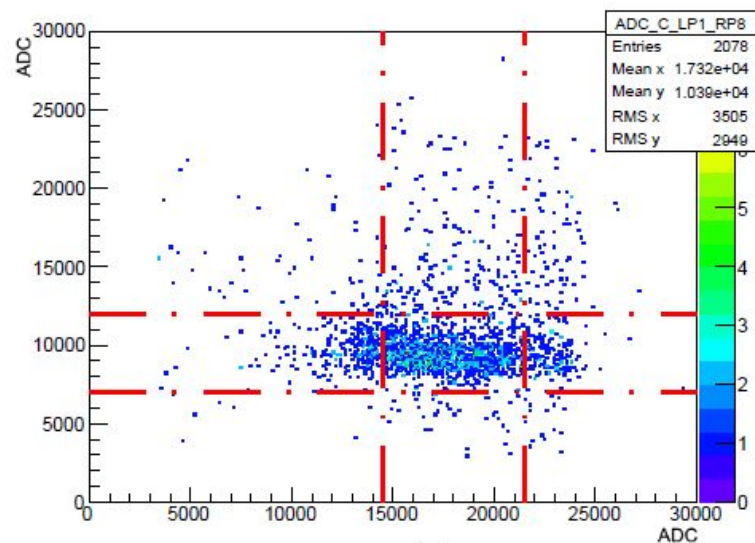# The time of flight difference

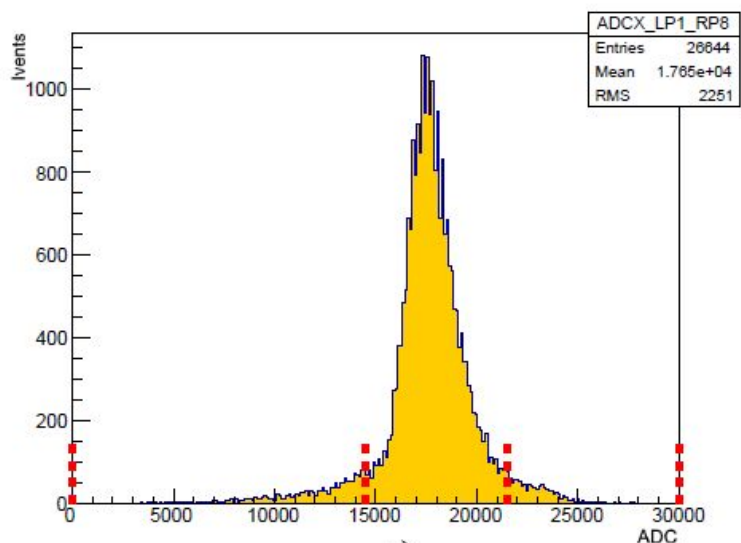# ADC correlation of the counters pair

The process of setting up cuts
for the CH2-C subtraction procedure

a)

b)

c)
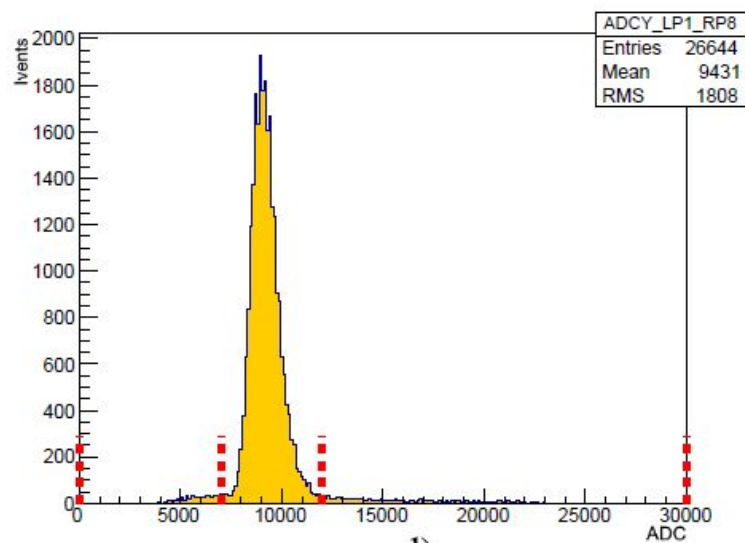
d)

Methods of the CH2-C subtraction procedure

The integral method	The spectra fitting method	The least squares method

$$n = \frac{\sum_i N_i^{(CH2)}}{\sum_i N_i^{(C)}}$$

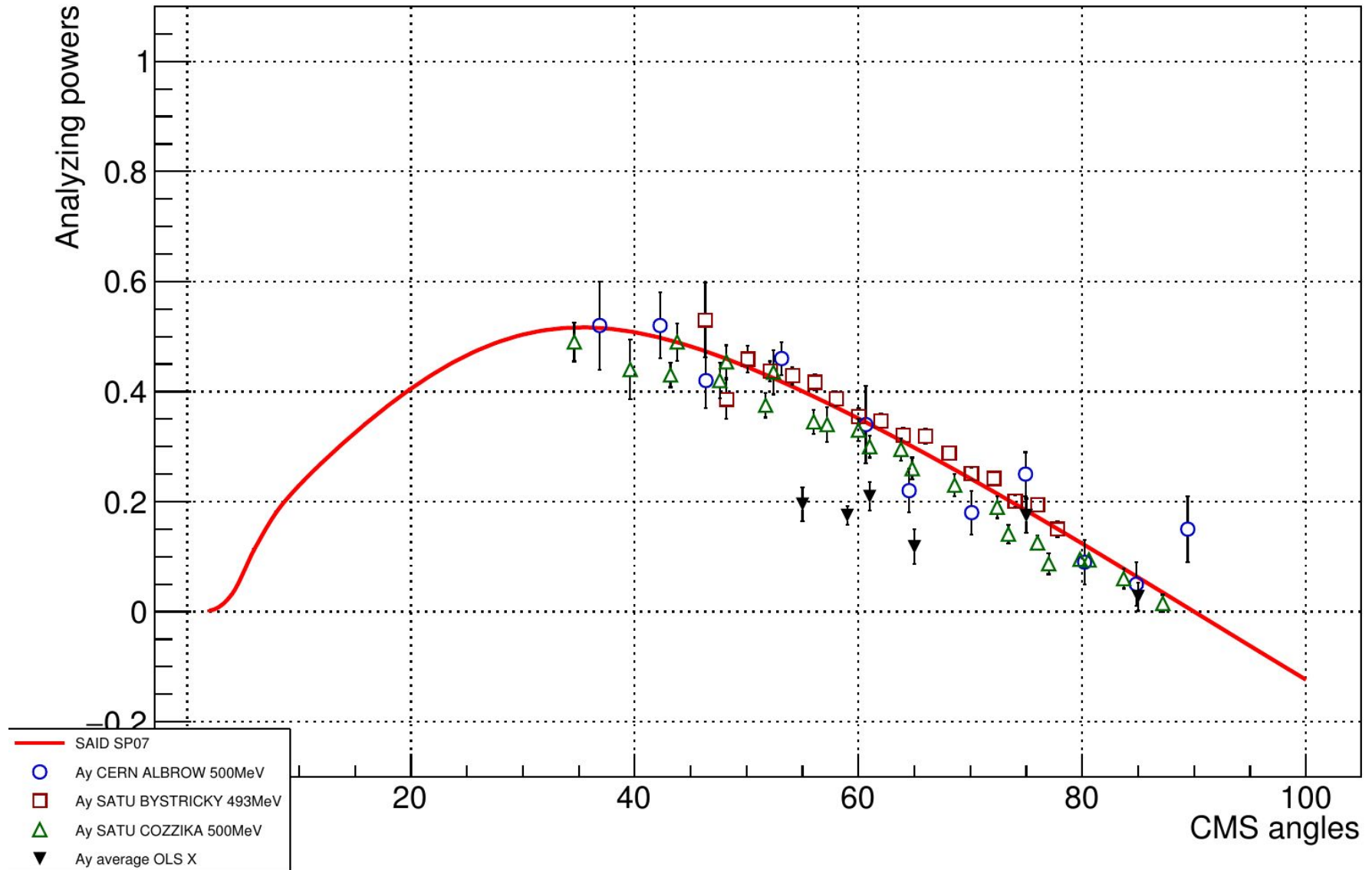$$f(x) = ae^{\frac{(x-b)^2}{2c^2}}$$

$$f(k) = \sum_i (N_{CH2} - kN_C)^2$$
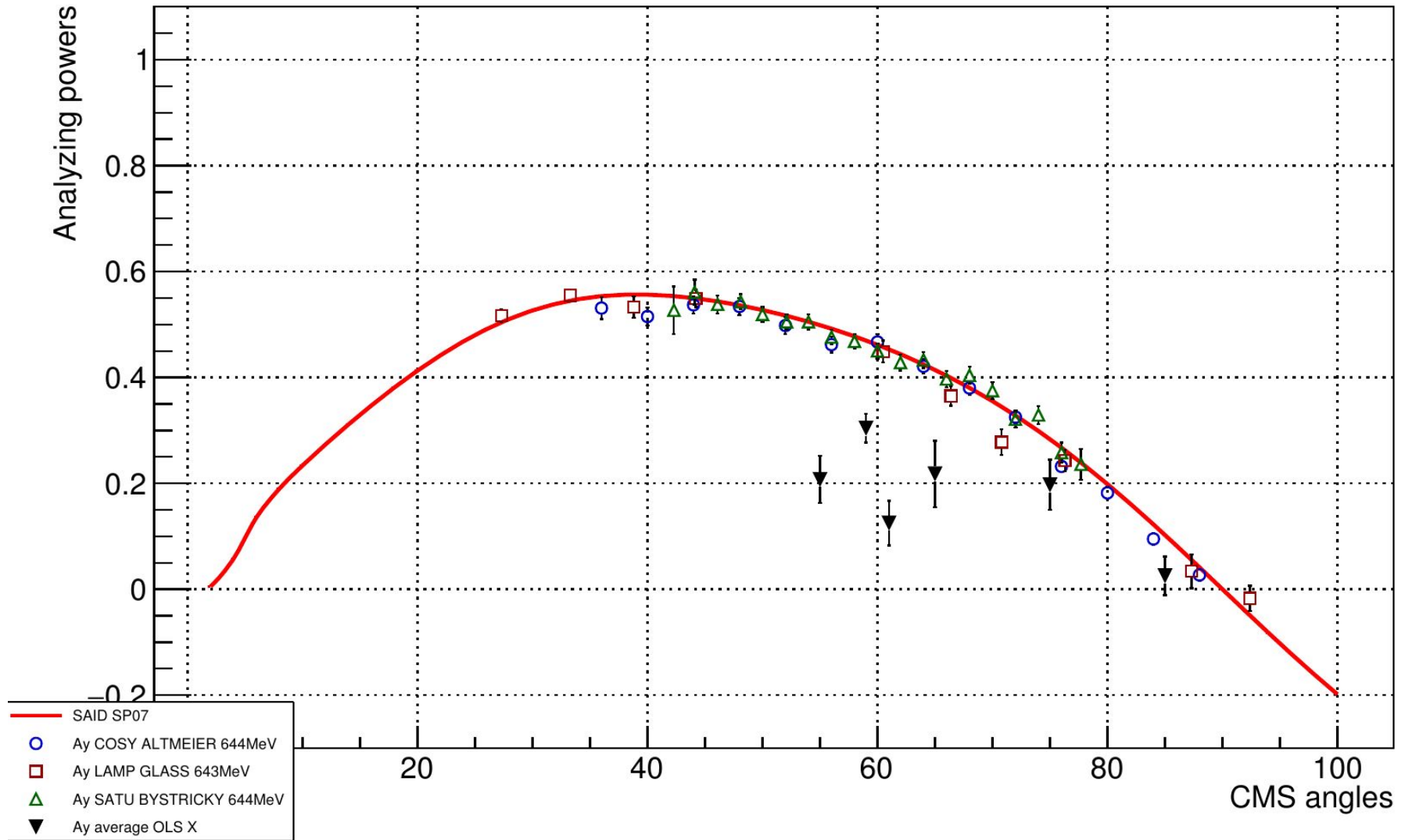
The analyzing powers definition formulas

$$A_{yL} = \frac{\dfrac{N^+ M^0}{N^0 M^+} + \dfrac{N^- M^0}{N^0 M^-} - 2}{2(P_z^+ + P_z^-)}$$

$$A_{yR} = -A_{yL}$$

The vector analyzing power at the beam energy of 500 MeV/nucleon

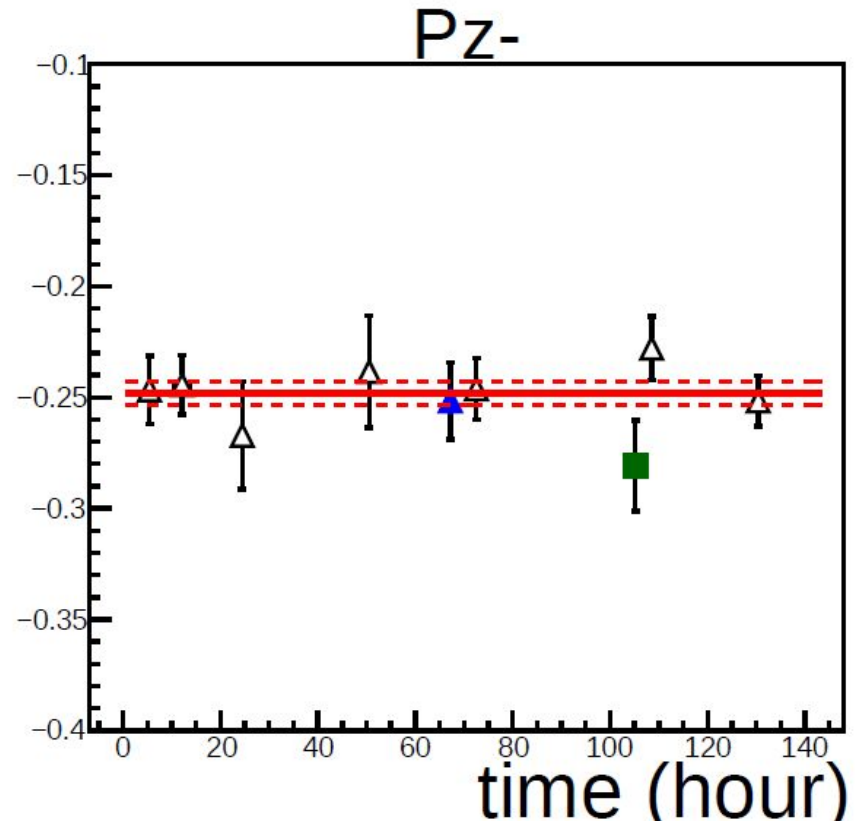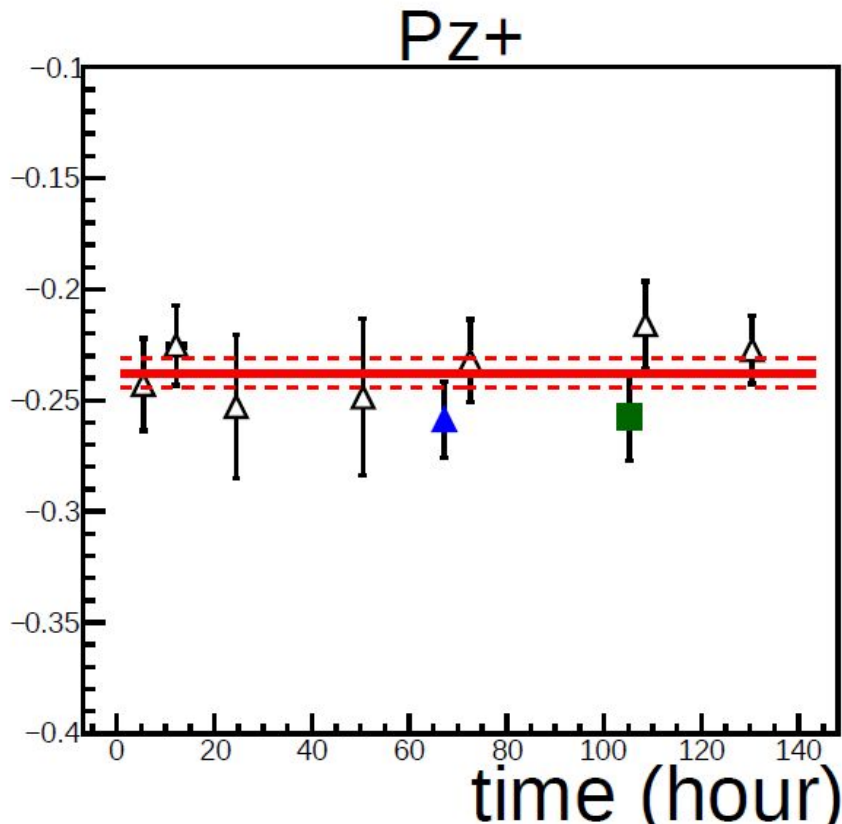# The vector analyzing power at the beam energy of 650 MeV/nucleon

The polarization definition formulas

$$P_z^+ = \frac{\dfrac{N_L^+ M^0}{N_L^0 M^+} - \dfrac{N_R^+ M^0}{N_R^0 M^+}}{2A_y}$$

$$P_z^- = \frac{\dfrac{N_L^- M^0}{N_L^0 M^-} - \dfrac{N_R^- M^0}{N_R^0 M^-}}{2A_y}$$

The beam polarization values at the various energies

△ - polarization values for dp elastic scattering (270 MeV/n)
▲ - polarization values for pp quasi-elastic scattering (500 MeV/n)
■ - polarization values for pp quasi-elastic scattering (650 MeV/n)

14

Conclusion

- The vector analyzing power values of the pp-quasielastic scattering reaction were obtained at the beam energies of 500 and 650 MeV/n;

- The analyzing power values obtained at large cms angles are in good agreement with the results of other researches and also with SAID partial-wave analysis predictions;

- The vector polarization values of the deuteron beam obtained from the asymmetry of quasi-elastic proton-proton scattering are in good agreement with the polarization obtained from the asymmetry of elastic deuteron-proton scattering at the beam energy of 270 MeV/n.

Thank you for your attention!