

Status of the experiment to study reaction dp breakup.



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The purpose of this experimental program is to obtain the information about spin – dependent part of the $3NF$ from two processes:

1. dp-elastic scattering;
2. dp-breakup with registration of two protons at energy $300 - 500 \text{ MeV}$.

dp breakup reaction

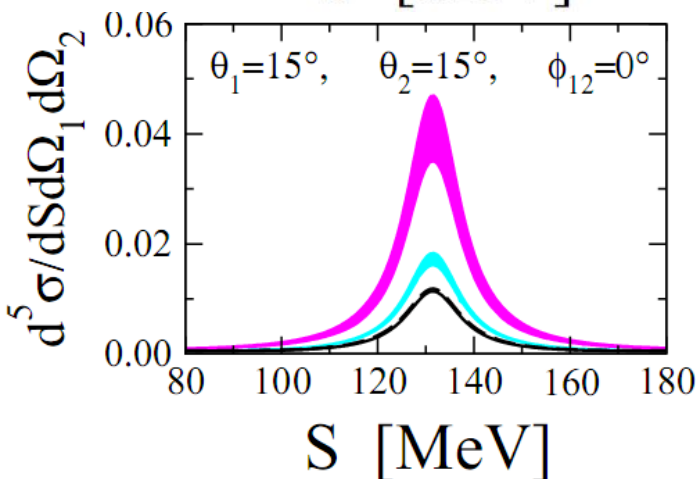
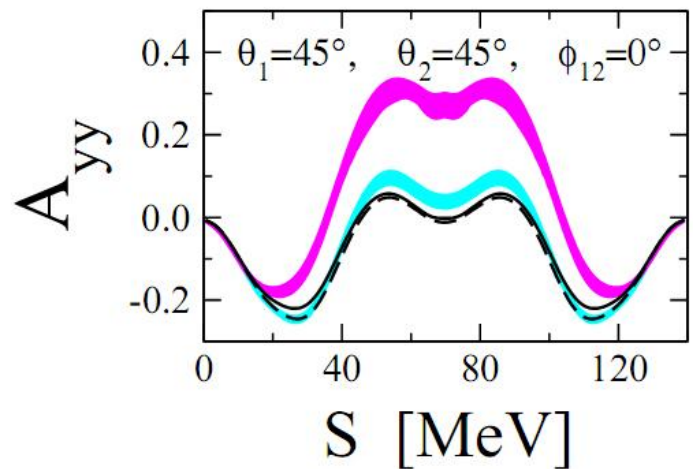


- The light shaded band (blue) contains the theoretical predictions based on CD-Bonn, AV18, Nijm I, II and Nijm 93.

- The darker band (magenta) represents predictions when these NN forces are combined with the TM 3NF.

- The solid line is for AV18+Urbana IX and the dashed line for CD Bonn+TM

One can see that the inclusion of 3NF have great impact on the values of analyzing power and cross section.



Θ_1 – polar angle of the 1-st proton.

Θ_2 – polar angle of the 2-nd proton.

S – arc length along the kinematical curve.

Φ_{12} – azimuth angle with respect to the horizontal plane.

Status of experiment

($\Delta E - E$ detector).



fig A

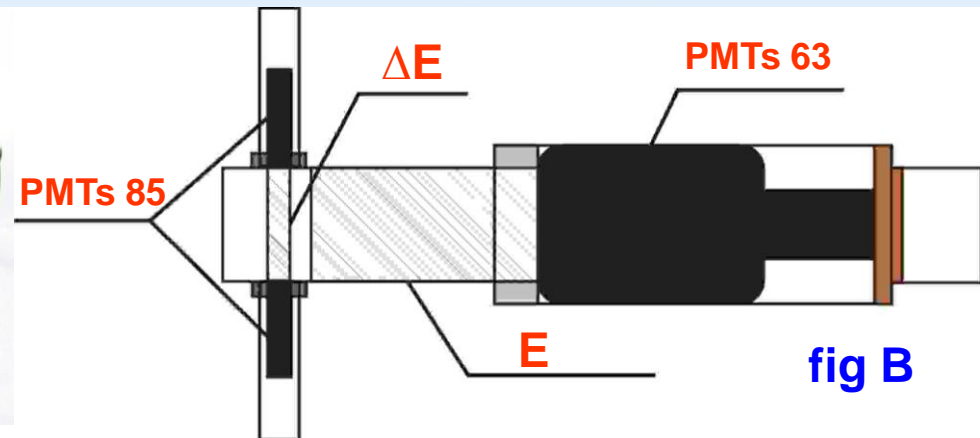


fig B

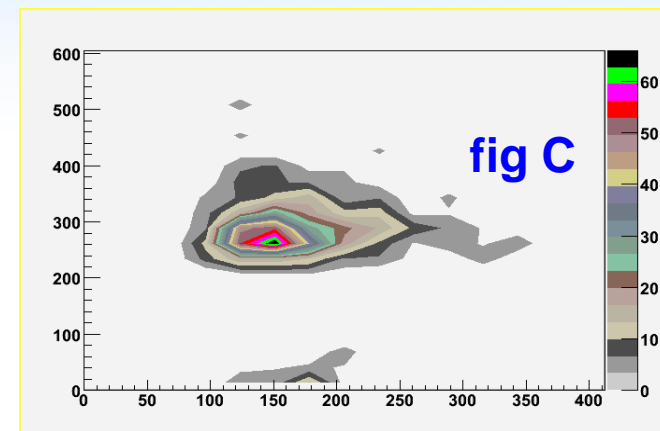
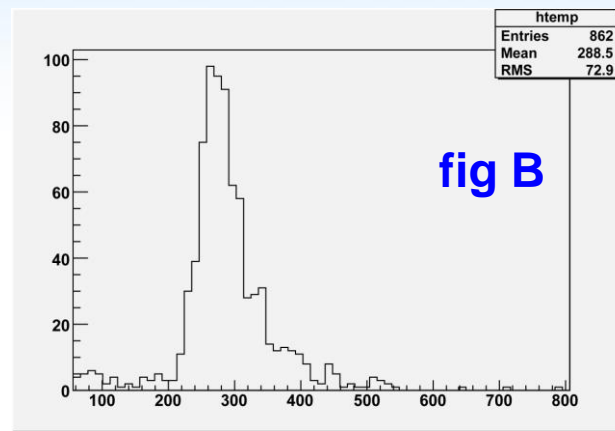
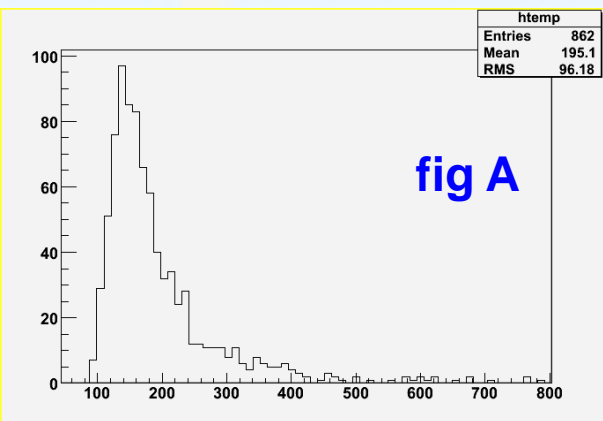
Photography (fig A) and a schematic view (fig B) of the detection system.

The dp breakup reaction will be investigated in another experiment using $\Delta E - E$ technique for the detection of protons.

Each detector consists of 2 scintillation counters: the first one with a thin scintillator (1 cm) and the second with 20 cm in length. The diameter of the E-counter scintillator is 10 cm. Useful events will be selected by the time of flight difference and $\Delta E - E$ information for the detected particles.

Status of experiment

(cosmic rays test for ΔE - E detectors).



Data shown were collected on cosmic muons in May 2008.

fig A is the amplitude from one PMTs 85.

fig B is the amplitude from PMTs 63.

fig C is the correlation of these amplitudes.

Status of experiment (*hardware bay*).



Hardware bay consists of 4 vertical steel arc (two with each sides of ion guide at **Nuclotron**). Each arc can moves in the horizontal plane. On the arc take up position two carriages for installing $\Delta E - E$ counters. Counters move relatively arc in the vertical plane.



Status of experiment

(system of high voltage).



Photomultiplier tube (PMT 85) is controlled by module connected with computer through the bus [RS232](#). The module was designed at LHEP JINR.

The high voltage system for Photomultiplier tube (PMT 63) is based on “[Wenzel Elektronik](#)”, whose voltage is adjusted and checked online through [DAC](#) and [ADC](#) modules [CAMAC](#).

Photography of voltage system based on module “[Wenzel Elektronik N-1130](#)”

Status of experiment

(high voltage control system).

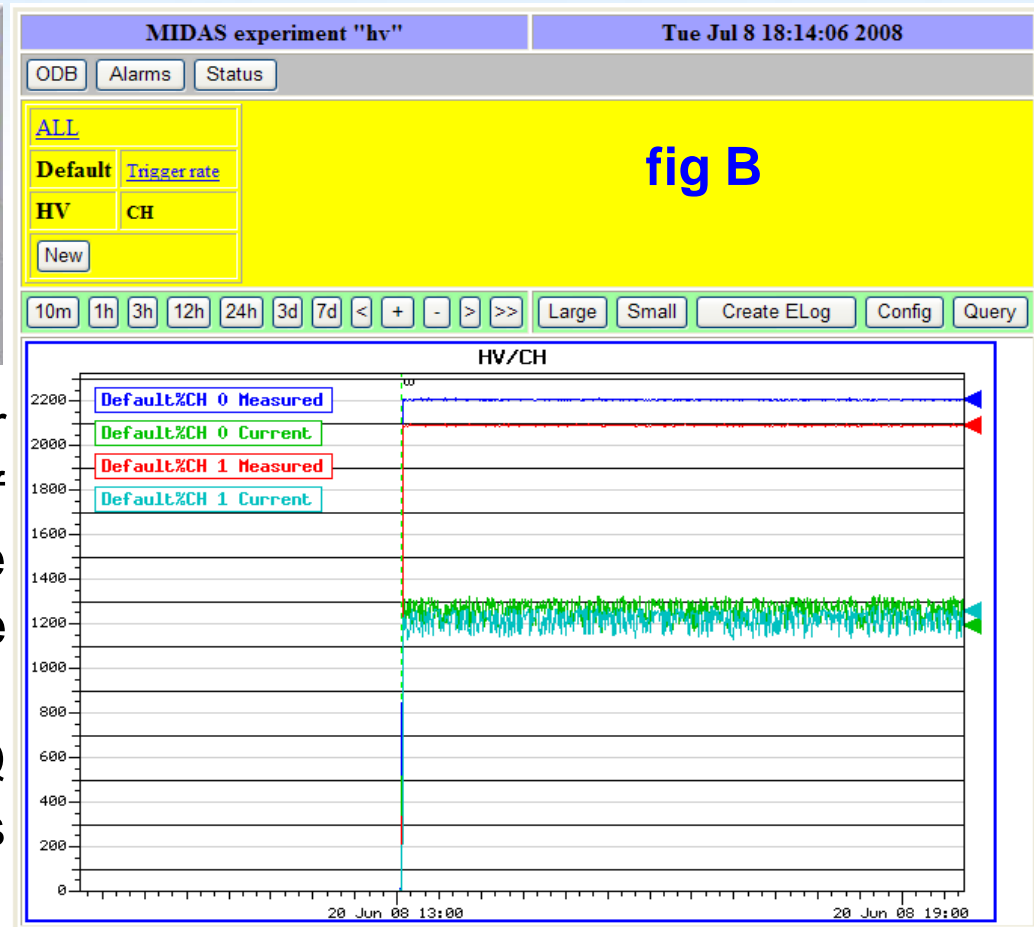
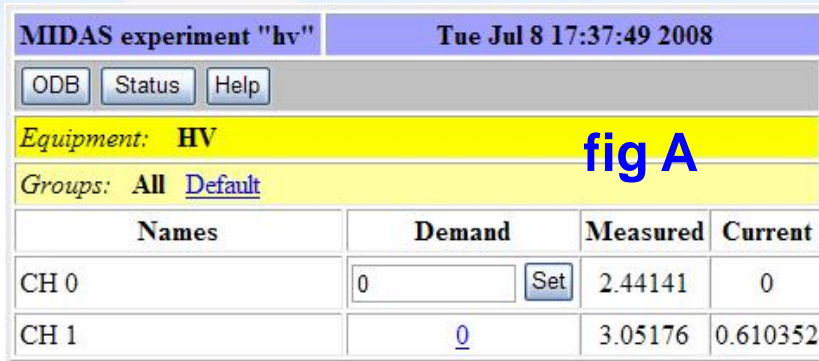
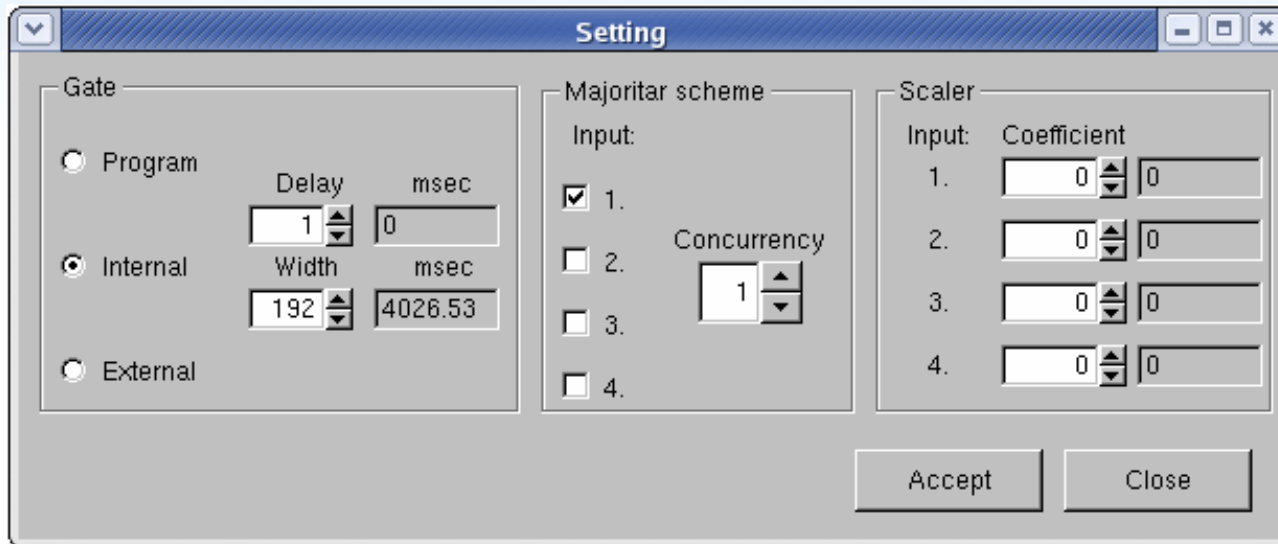


fig A is MIDAS window for online control and checking of high voltage module. fig B is the "history" window of package MIDAS.

MIDAS is a versatile DAQ system for middle range physics experiments.

Status of experiment

(trigger module LT320D).



Screenshot of **LT320D** trigger module control program.

One of the important advantages of this module is the possibility to control online the status of majority coincidence circuit.



Status of experiment

(beam test for dp breakup reaction).

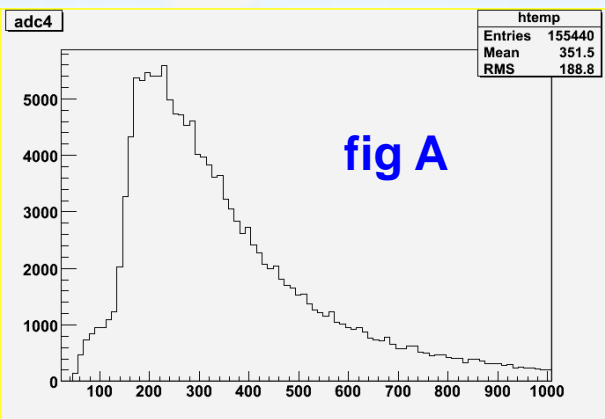


fig A

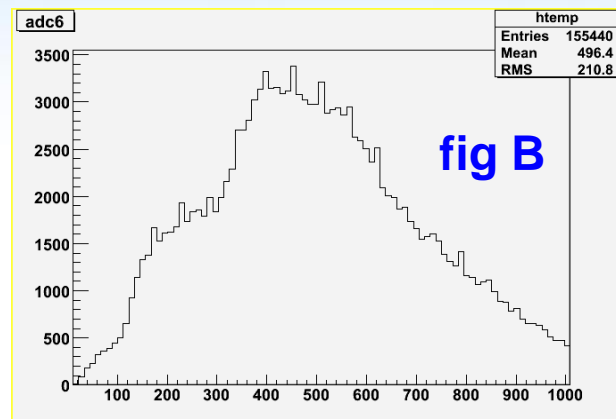


fig B

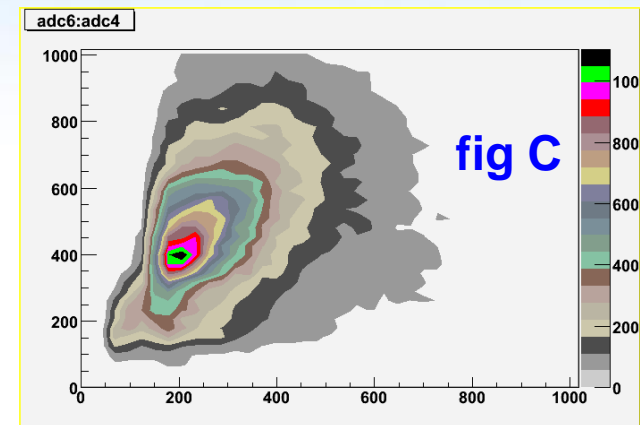


fig C

Data shown were acquired with deuteron energy **2.3 GeV** on ^{12}C target in June 2008 using module **LT320D**. The trigger based on coincidence from two detectors located in the horizontal plane on the left and right from the beam.

fig A is the amplitude from one of the PMTs 85.

fig B is the amplitude from PMTs 63 of the same detector.

fig C is the correlation of these amplitudes.



Status of experiment

(beam test for dp breakup reaction).

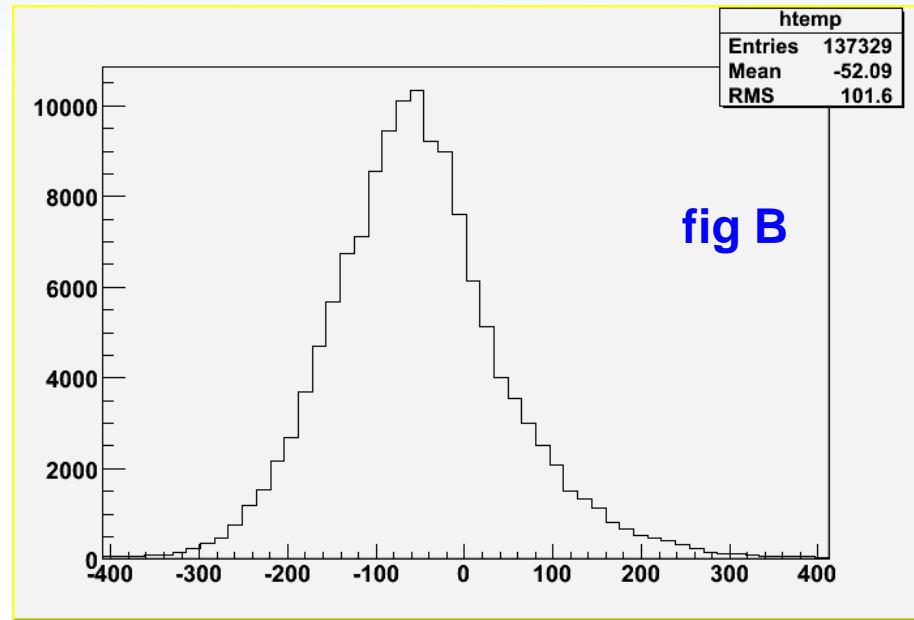
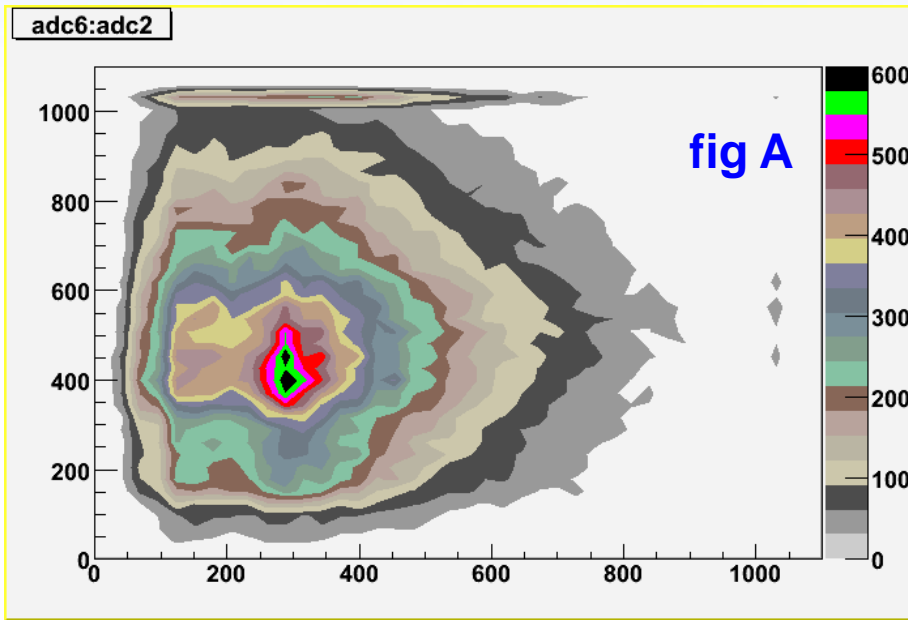


fig A is the correlation of amplitudes from two E-detectors.

fig B is the time-of-flight difference for two E-detectors.

Nearest plans



2008:

- Modification of the DAQ system to VME standard;
- Preparation of the experiment on $dp \rightarrow ppn$ reaction;
- Further data analysis.

2009:

- Cross section measurements for $dp \rightarrow ppn$ with unpolarized beam;
- Measurements of the analyzing powers for $dp \rightarrow ppn$ in **300-500 MeV**;
- Analysis of the obtained data from both experimental and theoretical sides.



Conclusion

- The driver was written and compiled with package **MIDAS** for control high voltage system.
- Included use the trigger module **LT320D** in DAQ system.
- Acquisition and test of $\Delta E - E$ counters, high voltage system and DAQ system at the internal target station at **Nuclotron** were organized.
- We are going to take the data on $dp - \text{breakup}$ using both unpolarized and polarized deuteron beams at **Nuclotron** in 2008-2009.

**THANK YOU FOR THE
ATTENTION!**

