

## Historical overview of main activities

The group was found in 1966, and initially had name “Nucleon-Nucleon Interaction Group”. In 1981 the group was converted into the sector with the same name. From 1986 to 2002 the division had name “Polarization Phenomena Laboratory”. Because the main direction of investigations was changed, in 2003 the laboratory was transformed into the “Nucleon-Nuclei Interactions Group”.

Early on the group experimentally studied the elastic and inelastic processes in nucleon-nucleon interaction. In an experiment “Study of  $\pi^+$  - Meson Production in  $pp \rightarrow \pi^+ pn$  Reaction at 1000 MeV” were measured the momentum spectra of  $\pi^+$  mesons in the wide angular range from  $30.5^\circ$  to  $125^\circ$  c.m. angles. The experimental data were satisfactory fitted to the OPE-model predictions including the Legendre polynomials  $P_2(\cos\theta_0)$  and  $P_4(\cos\theta_0)$ . Within the program of nucleon-nucleon interaction study, the group designed the general-purpose system for creation and transporting the polarized proton beam. Protons were polarized in the scattering of an external beam on a fixed solid-state target. To optimize the experimental condition, there were measured the proton polarization in scattering at nuclei *Be*, *C*, *Al*, and *Pb* in the range  $3^\circ - 12^\circ$  l.s. at 1000 MeV. The system allowed to polarize the beam in horizontal, vertical, and longitudinal directions and inverse the chosen polarization direction. The group designed installation and developed the method of measurement polarization parameters. First in the world was measured the carbon analyzing power  $A_{pC}$  at energies 640 – 1000 MeV. We first have measured triple-scattering polarization parameters  $D_t(D)$ ,  $R_t(R)$ ,  $A_t(A)$  in the range  $30^\circ - 90^\circ$  c.m. at the energy 970 MeV. New measurements were used in the phase-shift analysis of the  $pp$ -scattering.

The usage of the Frozen Spin Polarized Target (FSPT) starts the new phase of investigation the nucleon-nucleon scattering. The FSPT was designed at JINR (Dubna) and had one of the best polarization value and relaxation time in the world. With help of the FSPT were measured:

- Polarization correlation parameter  $C_{nn}(90^\circ)$  at 600 – 950 MeV;
- Energy and angular dependence of the parameter  $A_{nn}(C_{nn})$  in the range 700 – 950 MeV;
- Energy and angular dependence of the parameter  $K_{nn}(D_t)$  at energies 800, 850, 900, 950 MeV;
- Vector polarization in the reaction  $\pi^+ d \rightarrow pp$ ;
- Polarization transfer parameter  $K_{nn}$  at low angles  $9^\circ - 16^\circ$  c.m. ( $22 - 40^\circ$  l.s.).

Since 1998, using newly created proton beam with varying energy from 200 to 1000 MeV, were measured proton induced fission cross-sections at nuclei  $^{209}\text{Bi}$ ,  $^{232}\text{Th}$ ,  $^{233,235,238}\text{U}$ ,  $^{237}\text{Np}$ ,  $^{239}\text{Pu}$ . This work was performed together with the Accelerator team and was sponsored by International Scientific-Technical Center.

Group has performed measurements of the polarization transfer parameter  $K_{nn}$  in the  $pp$ -elastic scattering for incident laboratory energy of 1000 MeV and for small scattering angles  $9^\circ$ ,  $11^\circ$ ,  $13^\circ$ ,  $17^\circ$  l.s. ( $22^\circ$ ,  $27^\circ$ ,  $32^\circ$ ,  $42^\circ$  c.m.). Experiment has been carried out at the PNPI synchrocyclotron.

For more detail review see the article - «**MEASUREMENT OF THE POLARIZATION PARAMETERS IN  $pp$  ELASTIC SCATTERING AT 1 GeV IN THE SMALL ENERGY REGION.**

- V.G.Vovchenko, O.Ya.Fedorov»

- in PNPI report of the High Energy Physics Division "Main Scientific Activities 1997-2001").

