In the framework of a general program for studying πN interaction, a new series of experiments on measuring differential cross sections of $\pi^- p$ charge exchange scattering $\pi^- p \to \pi^0 n$ started in 90s on the pion channel of the PNPI synchrocyclotron. The experiments covers the same energy range (from 300 to 600 MeV) as the previous series of the $\pi^\pm p$ elastic scattering investigations. At present, experimental data on differential cross sections of $\pi^- p$ charge exchange scattering are very scarce and contradictory and new precise results, being used in performing a new phase shift analysis, will lead to a further essential improvement of our knowledge of the πp scattering amplitude. In particular, the charge splitting effect in P_{33} phase shifts will be defined with higher accuracy.

In the first experiment, the differential cross sections of $\pi^- p$ charge exchange scattering to the backward hemisphere were measured by detecting the recoil neutron in coincidence with one gamma from the decay $\pi^0 \to 2\gamma$, the neutron energy being determined by means of the time-of-flight technique. Obtained results exceed by an accuracy all experiments which were made earlier in another scientific centres; moreover, they cast some doubts on the majority of previous results, which were used as a basis on the phase shift analyses of pion-proton scattering. scattering amplitude at 560 MeV.

As the next step, we started to measure the forward-angle differential cross sections of the reaction $\pi^- p \to \pi^0 n$ at the energy range from 300 to 600 MeV. A novel device – π^0 spectrometer – was designed and created at the Meson Physics Laboratory for this experiment. The π^0 spectrometer consists of two total absorption electromagnetic calorimeters each made of 24 CsI(Na) crystals. Owing to a good energy and spatial resolutions of calorimeters, the energies of both photons from the decay $\pi^0 \to 2\gamma$ and the emission angles of these photons can be measured with a good accuracy. On the base of these measurements, one can reconstruct the energy of π^0 meson produced in the reaction $\pi^- p \to \pi^0 n$ and the angle at which this meson was produced. The experiment is underway now at the PNPI pion channel.