In the framework of a general program for studying πN interaction, a new series of experiments on measuring the differential cross sections of $\pi^- p$ charge exchange scattering $\pi^- p \to \pi^0 n$ started in 90s at the pion channel of the PNPI synchrocyclotron. The experiments covered the same energy range (from 300 to 600 MeV) as the previous series of the $\pi^+ p$ elastic scattering investigations. Existing experimental data on differential cross sections of $\pi^- p$ charge exchange scattering were very scarce and contradictory, and new precision 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 the 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.

As the next step, the differential cross sections of the reaction $\pi^- p \to \pi^0 n$ at small angles were measured in the energy range from 300 to 600 MeV. A novel device – the neutral meson spectrometer – was designed and created at the Meson Physics Laboratory for this experiment. This 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. Using the neutral meson spectrometer the cross sections at angles close to 0° (*i.e.* for forward scattering) were obtained with a high precision at ten values of the incident pions energies in the above mentioned range.