First results from the CELSIUS/WASA facility

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Meson production in proton-hydrogen collisions has been studied during the 1990s using a detector setup with a limited solid angle, the PROMICE/WASA setup. Since PANIC99, a 4π detector, the Wide Angle Shower Apparatus, WASA, has been commissioned and is now used for studies of decays and production of light mesons. Regular data taking started in the autumn of 2001.

CELSIUS provides an internal beam of protons with a maximum energy of 1360 MeV. Small frozen hydrogen spheres (pellets) pass through the internal beam with high velocity and are targets for the circulating protons. The pellets have a diameter of about 40 μm, a speed of 60 m/s and occur with a frequency of 8 kHz [1].

The CELSIUS/WASA facility consists of the central WASA detector and the forward detector used in previous experiments. The forward detector covers scattering angles from 3 to 18 degrees and its main purpose is to measure charged target recoil particles and scattered projectiles. It [2] consists of several planes of plastic scintillators and of proportional counter drift tubes for determination of the tracks after charged particles. Four layers, each having 24 sector-shaped 11 cm thick plastic scintillators are used to determine the energy of charged particles from their energy losses.

The centralWASA detector is optimized for measurement of electrons, photons and charged pions. It consists of a cylindrical drift chamber, placed inside of a superconducting solenoid and of an electromagnetic calorimeter of CsI crystals. It measures the decay particles from the produced mesons, primarily electrons and photons but also charged pions and muons. The photons and also penetrating charged particles are measured in the 16 radiation lengths thick, electromagnetic calorimeter consisting of 1012 sodium-doped CsI scintillating crystals. The momentum of the charged particles are determined from the track curvature in the axial magnetic field of up to 1 tesla. The tracks are obtained from the 17 layers of thin drift tubes, 1738 in total.

The production of ηs and pions in pp collisions is being studied. Two pions cannot come from an η decay since it is forbidden by CP invariance, so they are directly produced in the pp interaction. Results will be presented on meson production as well as of decays of ηs into three-pion states.

Pionic decay modes of the η are important not only for refining the ChPT, but they are also sensitive to C-violation through their decay distributions. The decays $\eta \rightarrow \pi^0\pi^0\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ violate isospin and provide information on the mass difference between the light quarks (m_d - m_u).

1. C. Ekstrom et al., Nucl. Instr. and Meth. **A371**, 572 (1996).
2. Calen, H. *et al.*, Nucl. Instr.And Meth. A**379**, 57 (1996).

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