Studies of η meson decays with WASA detector

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The eta meson with its variety of possible decays is well suited as a low energy Quantum Chromodynamics (QCD) laboratory. There are several predictions for not so rare decays, such as $\eta \to 3\pi$, $\eta \to \pi^+\pi^-\gamma$, $\eta \to \pi^\circ\gamma\gamma$ etc., within Chiral Perturbation Theory (ChPT) [1], which is standard framework for low energy QCD. The decay $\eta \to 3\pi$ is considered as a source of one of the most precise constraint on ratio of light quark masses [2]. Detailed studies of $\eta \to \pi^\circ\gamma\gamma$ decay not only provide window on higher order effects in ChPT but also input for calculations of long range contributions to rare Kaon and eta decays. In very rare eta decays such as $\eta \to e^+e^-$ and $\eta \to \pi^\circ e^+e^-$ fundamental aspects of the Standard Model can be tested. The decays are strongly suppressed and the expected branching ratio is 10^{-8}.

Two methods of eta production for decay studies at ion storage rings such as CELSIUS and COSY will be discussed: reaction $pd \to {}^3\mathrm{He}\eta$ close to threshold and reaction $pp \to pp\eta$ at beam kinetic energy around 1.5 GeV. Initial results from CELSIUS and prospects for COSY will be presented.

[1] *Eta Physics Handbook* Proceedings of the Workshop on Production, Interaction and Decay of the η Meson held at Uppsala, October 25-27, 2001.

[2] H. Leutwyler, Phys. Lett. B 378, 313 (1996).

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