Some features of the $pd \to ppn\pi^0$ reaction at 1.037 GeV

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We present here an experimental study of the properties of the neutral pions production from $pd \to (pp)n\pi^0$ reaction. Such charge exchange reaction with large energy and momentum transfer between the deuteron and the low mass two proton system present an interest for understanding the role of heavy meson exchange and/or resonance formation in the intermediate state. The possible intermediate states differ from that in the reactions with the deuteron in the final state.

The experiment was done using PROMICE/WASA set-up at CELSIUS accelerator. Proton beam at the energy 1037 MeV interacted with deuteron cluster jet target. A sample of about 72000 events of $pd \to pp\gamma\gamma + X$ reaction with two identified proton has been selected. The photons were observed in two arrays of CsI(Na) scintillator at angles between 30 and 90 degrees with respect to the beam and the protons energies and angles were reconstructed in the set of drift chambers and the plastic range hodoscope as well as in the CsI arrays proceeded with two layers of plastic DE counters.

The two photon invariant mass distribution reveals clear peak at the pion mass. The bump at the higher invariant masses is mainly due to the events with two neutral pion production when only two photons, out of four, are detected.

A working sample of the reaction $pd \to (pp)\pi^0 n$ have been selected by using the criterion $0.8 < missing\ mass < 1.05$ GeV and by requirement of the photon-photon mass to be consistent with the π^0 mass.

An enhancement is observed in the region of the small invariant mass of the protons with respect to the phase-space Monte Carlo calculation corrected for the detector acceptance. A large portion of events with small invariant mass of the two protons ($M_{pp} < 1.9 GeV$) corresponds to large (greater than 400 MeV) transfer of energy and momentum between the deuteron and the diproton.

The possible mechanisms responsible for the observed reaction properties are discussed.

[1] http://www.tsl.uu.se/wasa