Investigation of the Charge Symmetry conserving reaction $dd \to {}^3\mathrm{He}n\pi^0$ with WASA-at-COSY.

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Investigations of charge symmetry breaking in dd collisions is one of the important topics of the physics programme for the WASA-at-COSY. One of the planned studies focuses on the charge symmetry forbidden reaction $dd \to {}^4He\pi^0$.

The calculations [1,2] within the framework of Chiral Perturbation Theory (χPT) based on existing data still lack precise information for determining all needed parameters. Theoretically the most uncertain part of the calculation is the initial state interaction, although significant progress was achieved in recent years [3]. To provide further constraints for calculations new observables are needed. They can be extracted from the data set which would comprise the measurement of p-wave pion production in the $dd \to {}^4He\pi^0$ and of the charge symmetry conserving $dd \to {}^3Hen\pi^0$ reaction.

The data on $dd \to AN\pi$, where A is either ${}^3He$ or tritium will provide important ingredients to control the deuteron-deuteron initial state interaction in $dd \to {}^4He\pi^0$ for both p- and s- wave pion production. For $dd \to AN\pi$ the transition operators can be calculated within χPT with known amplitudes. Moreover, in the corner of the Dalitz plot, where the pion has large energies, the four nucleon final state is at low energies and is, therefore, theoretically fully under control.

The reaction $dd \to {}^3Hen\pi^0$ has been measured at a beam momentum of $p_d = 1.2$ GeV/c, using the WASA-at-COSY facility. For the first time data on the total cross section as well as differential distributions were obtained. The data are described with a phenomenological approach based on the combination of a quasi-free model and partial wave expansion model for the three-body reaction. Data analysis and results will be discussed.

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[1] A. Gårdestig et al. Phys. Rev. C 69, 044606 (2004)

[2] A. C. Fonseca, R. Machleidt and G. A. Miller, Phys. Rev. C 80, 027001 (2009)

[3] A. Nogga et al., Phys. Lett. B. 639, 465 (2006)

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