Study of relativistic effects in proton-deuteron breakup reaction*

B. Włoch[1,2], I. Ciepał[2], P. Kulessa[3], A. Kozela[2], J. Łukasik[2], W. Parol[2], P. Pawłowski[2], I. Skwira-Chalot[4], B. Sowicki[2], and M. Zięblinski[2]
[1] *University of Bordeaux, CNRS, LP2I, Gradignan, France*
[2] *Institute of Nuclear Physics Polish Academy of Sciences, Krakow, Poland*
[3] *Forschungszentrum Julich IKP, Julich, Germany and*
[4] *Faculty of Physics University of Warsaw, Warsaw, Poland*

The deuteron breakup reaction is often used as a tool to test theoretical models of the interaction between nucleons at intermediate energies [1]. At higher energies not only the three-nucleon force (3NF) but also the relativistic effects start to play an important role in the three-nucleon system dynamics. The currently developed theoretical models are usually based on a non-relativistic formalism [2,3]. Therefore, to properly describe experimental data measured at higher energies the relativistic treatment of the calculations is crucial. However, the calculations that account for such effects [4] still do not reproduce the data in a proper way [5,6]. This raises the question of whether the relativistic treatment is correct or the 3NF is not yet well understood, or some important ingredients of the system dynamics are still missing.
To test the theoretical predictions [2] a dedicated measurement of the proton-deuteron breakup reaction $p + d \to p + p + n$ at 200 MeV has been performed at the Cyclotron Center Bronowice in Kraków, Poland, with the use of the Kratta detectors [7]. The idea is to measure the proton-proton coincidences for very specific angular configurations at which, according to the calculations, large relativistic effects are expected and in the same time the other dynamical effects (3NF and Coulomb interactions) are negligible.
In this contribution we will present the general overview of the experimental setup and preliminary results of the data analysis. The very first differential cross sections for the deuteron breakup reaction will be compared to the relativistic and non-relativistic theoretical calculations.

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