Simulation of Star configurations in BINA detector

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Star Anomaly is one of the most intriguing and still unsolved problems in the domain of few-nucleon systems. Significant discrepancies between theoretical predictions and the available experimental data are observed for Space Star configurations [1,2]. In proton-deuteron breakup reactions the Star condition is defined as a configuration in center of mass system, where the momentum of the three outgoing particles has the same magnitude and plane containing these particles can be inclined by α from the beam direction. Depending on this angle we can distinguish coplanar Star (α=0° or α=180°), Space Star (α=90°) and intermediate Star (angle between those two extremes) configurations. Unfortunately, all recent research has focused on low energies and deuteron-proton breakup.

Upcoming experiment in CCB (Cyclotron Center Bronowice) using BINA (Big Instrument for Nuclear-polarization Analysis) detector will be a great opportunity to provide more data containing Star configurations at intermediate proton beam energies (108 MeV, 135 MeV and 160 MeV) [3]. BINA consists of two detector systems, "Wall" and "Ball", which together cover the angular range 10°-165°. The dedicated simulation was created in order to perform feasibility studies of the detector response with respect to the Star configurations. Since "Wall" is characterized with higher angular resolution than "Ball", the acceptance for Star configurations registered as coincidences of two protons in "Wall" or with one proton registered in "Wall" and one proton in "Ball" should be studied separately. One interesting parameter studied in simulation is the acceptance for proton-proton coincidences for numerous Star configurations with regard to the rotation by β about an axis perpendicular to the decay plane. Analysis of the configurations rotated by β is a new approach in the studies of the Star Anomaly.

[1] J. Strate *et al.*, Nucl. Phys. A **501** (1989) 51
[2] K. Ohnaka *et al.*, Few-Body Syst. **55** (2014) 725
[3] A. Łobejko *et al.*, Acta Phys. Polon. B **50** (2019) 361