

HDice, Highly Polarized Low-Background Frozen-Spin HD Target for CLAS at Jefferson Lab

X. Wei^a, C. Bass^a, A. D'Angelo^b, A. Deur^a, G. Devern^a, T. Kageya^a, M. Khandaker^{a, c}, D. Kashy^a, V. Laine^{a, d}, M. Lowry^a, T. O'Connell^e, A.M. Sandorfi^a, R.W. Teachey^a, and M. Zarecky^a

^aJefferson Lab, 12000 Jefferson Ave., Newport News, VA 23606, USA

^bUniversità di Roma "Tor Vergata" and INFN-Sezione di Roma2, Rome, Italy

^cNorfolk State University, 700 Park Ave., Norfolk, VA 23504, USA

^dBlaise Pascal University, 34 Avenue Carnot, 63000 Clermont-Ferrand, France

^eUniversity of Connecticut, 2152 Hillside Road, Storrs, CT 06269, USA

Large, portable frozen-spin HD (Deuterium-Hydride) targets have been developed for studying nucleon spin properties with low backgrounds. Protons and Deuterons in HD are polarized at low temperatures ($\simeq 10mK$) inside a vertical dilution refrigerator (Oxford Kelvinox-1000) containing a high magnet field (up to 17T). The targets reach a frozen-spin state within a few months, after which they can be cold transferred to an In-Beam Cryostat(IBC). The IBC is a thin-walled horizontal dilution refrigerator for use with quasi- 4π detector system in an open geometry with minimal energy loss for exiting reaction products in nucleon structure experiments. The first application of this advanced target system has been used for Spin Sum Rule experiments at the LEGS facility in Brookhaven National Laboratory. An improved target production and handling system has been developed at Jefferson Lab for experiments with the CEBAF Large Acceptance Spectrometer, CLAS.