

Development of polarized Hydrogen-Deuteride (HD) target for future LEPS experiment at SPring-8

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Polarized HD target project [1] started in April 2005. The first purpose of the project is to investigate the $s\bar{s}$ -quark content of proton and neutron by measuring double polarization asymmetries for the ϕ meson photoproduction [2]. In addition, the measurement of the double polarization asymmetries provides a good opportunity to present important information to determine the spin-parity of the Θ^+ particle. We are developing the polarized HD target for future LEPS experiment at SPring-8 [3].

We performed a cooling test of a ^3He - ^4He dilution refrigerator (DR) and the temperature of the DR mixing chamber reached 6 mK. We installed a superconducting magnet for the DR. We performed a test to excite the superconducting magnet. The maximum field of 17 Tesla was achieved at the current of 272 A in two hours and the magnet was operated with the persistent mode for 20 hours. Magnetic field data measured are compared with the simulation results shown in Fig. 1. Since no large difference from the simulation results is found in the data, the HD target can be transported without losing its polarization.

In this fiscal year, we have obtained four refrigerators needed in the polarized HD target project. One is In Beam Cryostat (IBC) shown in Fig. 2. The IBC is a ^3He - ^4He dilution refrigerator with magnetic field. The IBC will be used during the experiment at SPring-8. The lowest temperature of the IBC mixing chamber is 250 mK and the magnetic field to hold the polarization of the HD target is 1 Tesla. Under this condition, the relaxation time of about 30 days is possible for the HD polarization. The polarization direction can be rotated by using two magnets. The homogeneity of the longitudinal magnetic field is 7×10^{-4} in the HD target region. The polarization of the HD target can be observed during the experiment by using NMR system. The other three cryostats are ^4He cryostats used during the transportation of the HD target. Thanks to good collaboration with France ORSAY group, the cryostats were provided to us after the end of their project. We will purify the HD gas by using the gas distillation system [4] and try to polarize the HD in 2007.

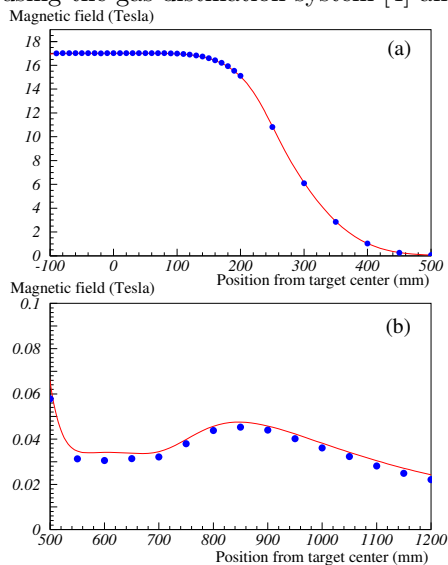


Figure 1: Field distribution of the DR 17 T superconducting magnet (a) around the target (-25~25 mm) and (b) around the mixing chamber (550~620 mm). Circles are the measured data and the curves are the results of the simulation calculation.

References

- [1] M. Fujiwara *et al.*, Photoproduction Experiment with Polarized HD Target at SPring-8, LEPS/RCNP proposal (2003).
- [2] A.I. Titov, Y. Oh, and S.N. Yang, Phys. Rev. Lett. 79, 1634 (1997).
- [3] H. Kohri *et al.*, Annual Report of RCNP, 16 (2005).
- [4] T. Ohta *et al.*, Annual Report of RCNP, (2006).

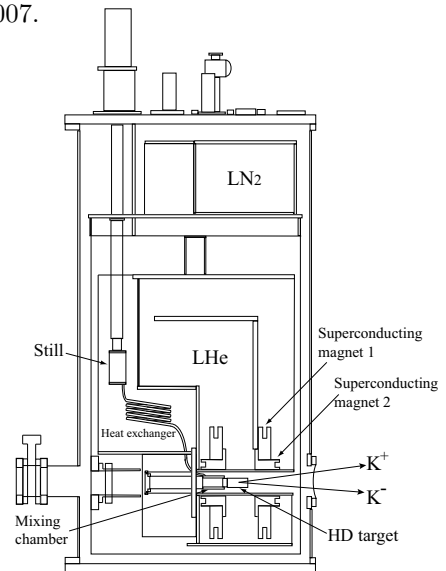


Figure 2: Schematic drawing of the In Beam Cryostat (IBC) used during the experiment.