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Performance and Improvement of the Karlsruhe Polarized Target Facility KRYPTA

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In the KRYPTA¹) facility polarized targets are produced by the brute-force method. The cryostat contains a 9 T magnet and a ${}^{3}\text{He} - {}^{4}\text{He}$ dilution refrigerator with a base temperature of 5 mK. The magnet is of the split-pair type with a gap of 26 mm to allow for neutron scattering experiments. Some angular regions are blocked by spacers in the gap, but by a small rotation of the magnet all angles can be reached. The magnet has a bore of 75 mm allowing for targets with a thickness up to 50 mm. The polarization facility is presently installed at the polarized neutron facility POLKA²) at the Karlsruhe cyclotron to measure the spin correlation parameter A_{yy} for \vec{n} - \vec{p} scattering between 16 and 50 MeV.

The target consists of a pressed sample of TiH₂ powder (35 mm length, 25 mm diameter). Without neutron beam a temperature below 11 mK can be attained. In the neutron beam (intensity > 10^6 neutrons/s between 16 and 50 MeV) the temperature remains around 12 mK, corresponding to a proton polarization of about 65%.

In order to be able to correct for the neutron scattering by the Ti nuclei in the TiH₂ sample, the scattering from a pure Ti sample also has to be measured. In our cryostat both targets have been mounted at a distance of 38 mm above each other, see Fig.1. A provision on top of the cryostat enables to move the cryostat insert vertically relative to the cryostat dewar and the magnet. In this way a target change can



Fig. 1. Position of the TiH₂ and Ti samples in the cryostat.

be carried out without opening the cryostat. The calculated eddy current heating, due to the movement of the samples in the magnetic field, should be below the detectable level when the target change is carried out in about 1 h. This has been confirmed experimentally. The typical polarization time for the TiH₂ sample is 3.5 days due to the large energy content of the proton spins. The cooldown time of the Ti sample alone has been measured to be 0.5 days.

After finishing the A_{yy} experiment on protons, it is planned to begin with a series of spin-spin cross section measurements on various nuclei, starting probably with ⁹Be and ²⁷Al. From our experience with the polarized proton target we expect polarizations for these nuclei of 20% and 45%, respectively, during the experiment.

References

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