Installations for the Use of the Polarized Atomic Beam Source at the Internal Storage-Cell Gas Target of ANKE and for Polarized Cell-Gas Studies outside the COSY Ring

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The development of the polarized atomic beam source (ABS) has been brought to an successful end. A beam intensity of 7.8×10^{16} $\vec{\mathrm{H}}$ atoms/s) in two hyperfinestates and polarizations of about +90For deuterium, where somewhat lower prelininary values have been reached until now, final tuning has to be done. The ABS will be utilized to inject the $\vec{\mathrm{H}}$ or $\vec{\mathrm{D}}$ beam into the storage cell of the polarized internal target (PIT) of the ANKE spectrometer.

A Lamb-shift polarimeter (LSP) shall be used to measure

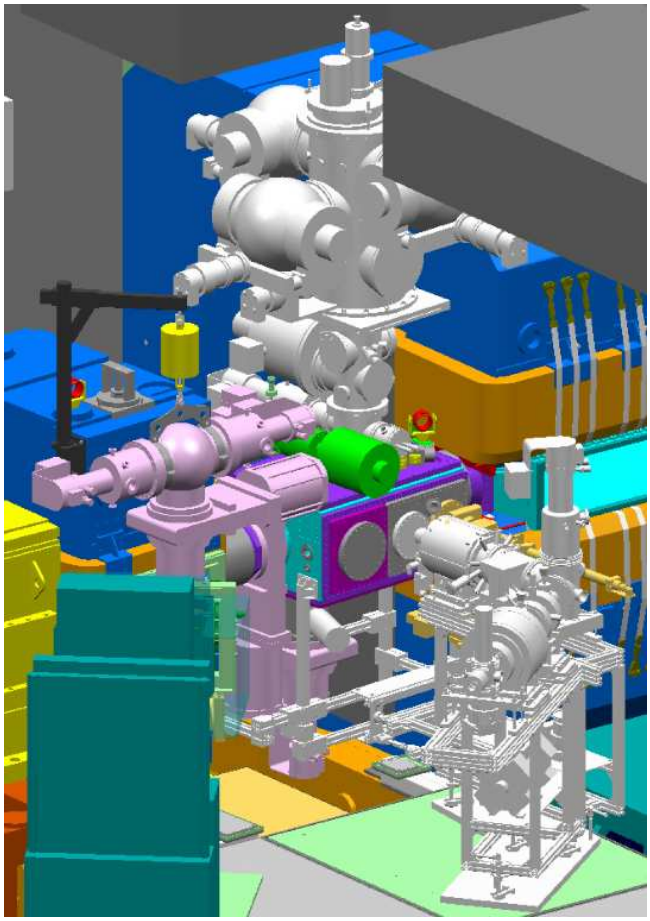

Fig. 1: Future position of the atomic beam source (vertical, grey) and the Lamb-shift polarimeter (horizontal, grey) at the new ANKE-target chamber between the ANKE beam-bending dipole magnet D1 (left-hand side) and the ANKE spectrometer dipole magnet D2 (right-hand side). The COSY beam circulates through the setup from left to right. Not shown is the bridge between D1 and D2, which is being designed and which will carry the source and the vacuum chamber.

and monitor the nuclear polarization of the target gas by deducing a small fraction of the gas by a sample tube. The final development of the LSP itself has been performed with use of the direct ABS beam. The reduction of the incoming intensity by about four orders of magnitude compared to that of the direct ABS beam, puts high requirements to the sensitivity of the polarimeter. At present studies are being performed with the LSP positioned at a test setup of feeding, storage, and sampling tubes made from teflon [1].

The space limitations at ANKE necessitate a 60 $^\circ$ deflection of the LSP ion beam. Such a deflector together with a shorter Wien filter has been designed, built, and tested [2]. Fig. 1 shows the future position of the ABS and the modified LSP at the new ANKE-target chamber. Regarding for the dimensions of the ABS and due to the increased weight, caused by the enlarged target chamber and the ABS, a new bridge between the dipole magnets D1 and D2 is needed. It has to enforce movement of the target chamber and the ABS with the lateral movement of the central spectrometer magnet D2. The bridge is under construction. Furthermore, a stronger linear drive for fine-positioning of the target chamber together with the ABS relative to the D2 magnet will be mounted on topof the D2 yoke. The new construction aims at a target exchange , e.g. replacement of the polarized gas target by the cluster target or vice versa, within one COSY-maintenance week. While the target chamber remains at its position with a special support, the bridge and the ABS are taken off by the crane as a unit.

Both, the ABS and the LSP, will also be utilized in an off-beam experiment. A setup with a superconducting magnet has been developed in the framework of an ISTC project [3] of IKP/FZJülich, IKP/Universität zu Köln, and the Laboratory for Cryogenic Techniques/St. Petersburg Nuclear Physics Institute. It will allow to study the nuclear polarization of the atomic and recombined molecular hydrogen and deuterium gas in storage cells for different cell-surface materials and polarization states as function of parameters like the imposed magnetic field, cell-wall temperature. The cell will be fed by the ABS, the polarization measurements will be performed with the LSP. The combined setup will be installed in the truck sluiceway (LKW-Schleuse) in the COSY hall, but outside the COSY ring. The dual use of ABS and LSP necessitates modular arrangement of the components to facilitate the transfer.

(1) The D1-to-D2 bridge with the ABS and the LSP with its support can each be transferred by one crane run.

(2) All the supply and control units of ABS and LSP are positioned on a transportable platform.

(3) The cooling water is taken from the COSY circuit (DEIONAT, highly demineralized and deionized water) via stainless-steel 60 kW heat exchangers, one installed near the Anke-target position and the other in the truck sluiceway to enable easy connection.

(4) Special support elements in the truck-sluiceway area allow to deposite the bridge, carrying the ABS, above the ISTC chamber.

References:

[1] R. Engels et al., contribution to this report.
[2] T. Ullrich et al., contribution to this report.
[3] **I**nternational **S**cience and **T**echnology **C**enter, project No. 1861 (2001).

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