

Polarized Internal Gas Target of ANKE at COSY : hardware upgrade status

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Since 2005 the ANKE experiment at COSY/Jülich is equipped with a Polarized Internal gas Target (PIT) [1], which consists of an Atomic Beam Source (ABS) [2] feeding a storage cell (SC) and a Lamb-shift polarimeter (LSP) [3]. After several beamtimes were completed successfully we decided to upgrade the hardware of the ABS due to the following reasons:

- the ANKE facility requires a luminosity upgrade;
- the ANKE ABS should have a higher duty time.

The first problem can be partly solved without big investment into the COSY machine by use of a storage cell with smaller cross section. But future experiments will require an openable storage cell. Moving the storage cell parts out of the beam during single or stacking injection and acceleration procedures will have the following advantages:

- no losses on the cell walls during injection;
- no need to use long stacking injection;
- increasing of the target density by minimizing the cross section of the storage cell beam tube.

All possible configurations of the ABS feeding and the beam tubes of the storage cell were simulated. Based on these results, the best dimensions were found. The openable storage cell should have a 11 mm round feeding tube with length of 140 mm and rectangular shape beam tube of 11 x 11 mm² with round corners. Bending radius of them should be about 2 mm. Compared to the fixed storage cell a factor 3 in the density of the polarized hydrogen gas target can easily be achieved. The mechanism to open and close the storage cell (see Fig. 1) was designed to allow the installation together with 4 silicon tracking telescopes (STT) [4] around the cell. The space limitation leaves almost no freedom for the construction.

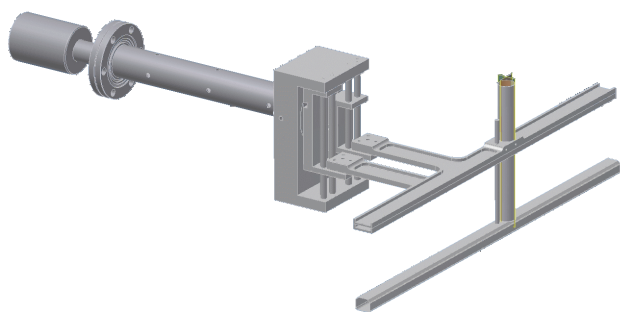


Fig. 1: The mechanism to open and close the storage cell.

Together with all improvements (shorter dead time during the cycles, increased luminosity and background-free data) a new openable storage cell will allow coming experiments at ANKE to be completed in a shorter time. A first prototype of the openable storage cell was installed at ANKE in spring 2011. Unfortunately, after several operating cycles it stopped to close tightly because the mechanism was damaged during installation.

One possibility to increase the duty time of the ABS during experiments at ANKE is the exchange of existing

cryopumps by turbopumps. The current pumping system of the ABS consists of 3 cryopumps and 7 turbopumps. Due to space limitations, no gate valves were foreseen to be installed on the ABS to separate the cryopumps from the ABS chambers during regeneration. This leads to appreciable pressure bumps by the evaporating gas from the cryopumps during the regeneration procedure, which takes about 5 hours every week. Due to the fact that a number of turbopumps were available from earlier experiments we start to prepare the replacement of the currently used cryopumps.

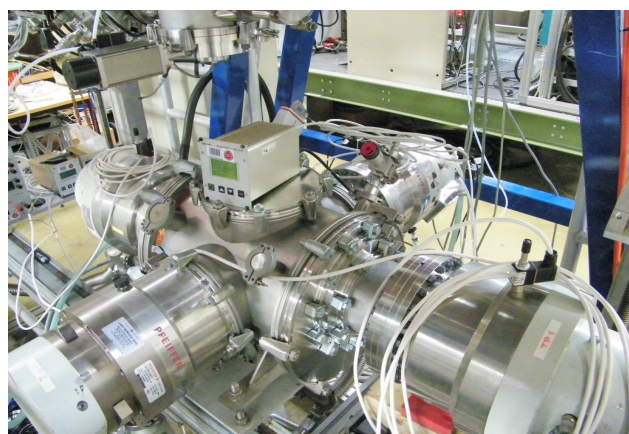


Fig. 2: Installation of the pumps at the test chamber.

An additional argument to exchange the pumps was found in the expenses for the necessary periodic maintenance of the pumps. The costs for replacement of the displacers in the cooling units of the cryopumps and the oil adsorbers in the compressors are substantially higher than those to exchange the oil in the turbopumps. In addition, the power and cooling water consumption by the turbopumps is much less than that of the cryopumps.

Prior to the exchange, the turbopumps were attached to a test chamber (see Fig. 2). The dedicated WinCC program code was written to stand different extreme regimes of work (accidental stop of one of the pumps, emergency shutdown) and normal operating modes (pumping, venting, etc). In the beginning of 2012 these turbopumps will exchange the cryopumps of the ANKE ABS.

References:

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