Status of the PIT for Spin-Filtering Studies at COSY and AD

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The high physics potential of experiments with stored high-energy polarized antiprotons led to the PAX proposal [1] for the High Energy Storage Ring (HESR) of the FAIR facility (Facility for Antiproton and Ion Research) at GSI (Darmstadt/Germany). It is proposed to polarize a stored antiproton beam by spin filtering with a polarized hydrogen (deuterium) gas target. The feasibility of spin filtering has been demonstrated in the FILTEX experiment [2]. In the current theoretical interpretation [3] only the hadronic interaction is important. In order to test the spin filtering method and find the best operational energy, several experimental studies with protons (at COSY) as well as with antiprotons (at AD/CERN) have to be carried out. These investigations require the set-up of a polarized internal gas target (PIT) with a system of Silicon detectors implemented into a large acceptance section of the storage rings.

The former HERMES polarized atomic beam source (ABS) was set up in Jülich. The vacuum system with the microwave dissociator is operating well and intensities up to $6 \cdot 10^{16}$ atoms/s were reached. A new liquid-cooled microwave dissociator was tested on a test bench (Fig. 1) and will be implemented soon. It is supposed to increase the degree of dissociation at high nozzle throughputs and increase the atomic flow into the sextupole system of the ABS.

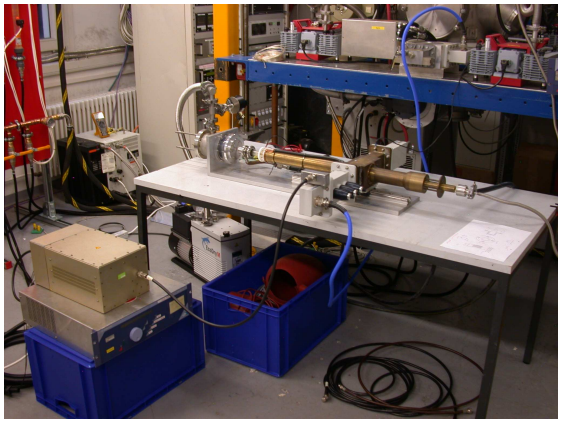

Fig. 1: The liquid-cooled microwave dissociator on the test bench.

The former HERMES Breit-Rabi polarimeter (BRP) [4] was set up in the LKW-Schleuse (Fig. 2). The sextupole magnet configuration was modified and a new strong-field "Dual Cavity" transition was designed and built in order to measure the polarization of hydrogen or deuterium without the usual replacement of the cavity. The cabling of the vacuum part was finished and the slow control system is running. As in the case of the ABS, also the BRP can be controlled and monitored via computer. The two quadrupole mass spectometers were tested and first mass scans were performed.

In order to reach the necessary areal densities for spin filtering, the use of a storage cell is mandatory. The

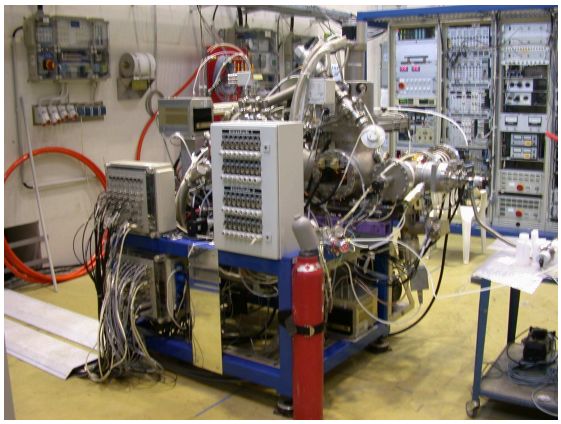

Fig. 2: The Breit-Rabi polarimeter.

present cell design consists of 5 μm Teflon walls supported by an aluminum frame. Teflon suppresses depolarization and recombination of the target gas inside the cell. The first prototype of the target cell has been built at INFN Ferrara. It will be tested with the use of the ABS and the BRP in Jülich in 2009, with an already modified analysis chamber of the ABS. Therefore, the ABS will be installed at the LKW-Schleuse in early 2009.

The vacuum system of the target section comprises two turbo molecular pumps (TMP), backed with smaller TMPs, and a dry forevacuum pump. In addition, a large cryogenic pump will be used at the target chamber. This will ensure that most of the target gas exiting the storage cell is pumped within the target chamber. The adjacent sections will be pumped by a combination of ion getter pumps and TMPs. For the test setup only one TMP will be used.

In order to test the full setup in the LKW-Schleuse, large efforts of various COSY groups were necessary in 2008 to supply the area with water end electricity.

References:

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