

Beam request for COSY experiment #146.1
”Commissioning and Initial Research with PIT at ANKE”

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1 Status of the PIT Installation

During the shutdown in summer 2005, the Polarized Internal Target (PIT) consisting of Atomic Beam Source (ABS) and Lamb-shift Polarimeter (LSP) has been installed at the ANKE target chamber. The PIT is described in Sec. 3.4.1 of the Proposal on “Spin Physics from COSY to FAIR” [1] and more details will be given during the oral presentation at the PAC meeting. The successful implementation of all components of the PIT at ANKE puts us in the position to now request the beam time coordinator to schedule the **two weeks** of beam time that have been granted to the present proposal in calendar weeks #41 and #47.

2 Plan for the Beam Time

During week #41/2005 we would like to commission the target by measuring the nuclear polarization of the atomic jet for hydrogen and deuterium, i.e. without a storage cell, in the presence of the D2 fringe field of the ANKE spectrometer magnet. We believe that this offers a convenient way to verify that the ABS is performing as expected, i.e. that the atomic beam from the ABS does not encounter zero-field crossings in the D2 fringe field or the like. The polarization and the target density of the jet will be measured through $pp\vec{p}$ and $p\vec{d}$ scattering. The elastically scattered protons or deuterons are registered in the ANKE forward detector system. The atomic jet provides a point-like vertex with a lateral extension of about 9 mm, quite similar to the properties of the cluster jet. Once this measurement is successfully accomplished, the PIT commissioning can proceed mainly through beam optimization studies using the storage cell, fed by unpolarized gas, i.e. without the ABS.

During week #47/2005 we will proceed with the machine tuning for the storage cell of the PIT at ANKE. For this purpose the cell support frame needs to be reinstalled. The storage cell setup to be used in this experiment is shown in Fig. 1. The cell walls will be

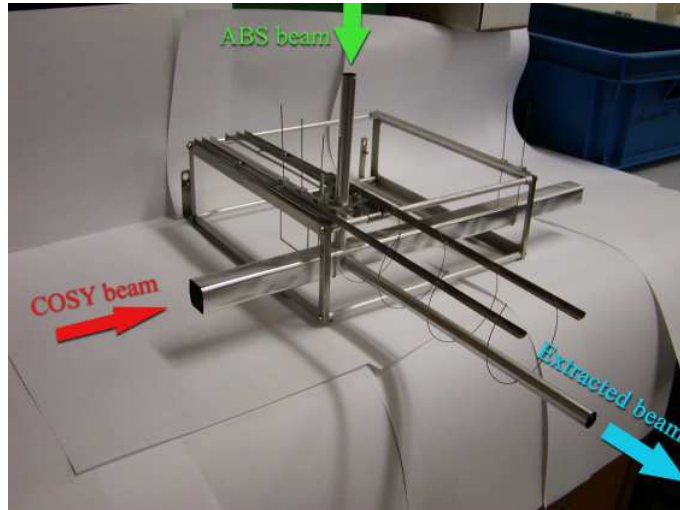


Figure 1: Storage cell for the ANKE PIT. The cell has a transverse cross section of $20 \times 20 \text{ mm}^2$ and a length of 400 mm. The cell walls are made from $25 \mu\text{m}$ Al foil, coated with Teflon.

coated with Teflon to prevent depolarization of the atoms. The week shall also be used to optimize the LSP and to try to use it to determine the polarization of the target gas in

the cell. We believe that electron cooling may substantially reduce the background from the interaction of beam particles with the cell wall, because it leads to a smaller beam size at injection energy. During the machine development week #45, the electron cooler should be set up. Because the D2 magnet can be kept at 0° , it will be possible to detect neutral H^0 atoms and to optimize the overlap of electron and proton beam. During both machine development weeks preceding our runs (#39 and #45), we need one night to set up the ABS. During the winter shutdown 2005/2006 the PIT will be deinstalled because the cluster target at ANKE is needed for other experiments (#125, #140, etc.) in the first half of 2006.

3 Conditional Beam Time Request

At present there exist no plans to hold a PAC meeting in the spring of 2006. For the commissioning of the PIT this circumstance is quite unfortunate, because in all likelihood the two weeks in 2005 (#41 and #47) will not suffice to provide us with the required quality of the COSY beam for regular data taking in the framework of the upcoming spin physics experiments. We believe that **two additional weeks** for beam optimization studies with the storage cell are required to ensure progress. One week should be scheduled before the summer shutdown 2006. During this shutdown we will reinstall the PIT again and the second week should therefore be scheduled after the summer shutdown in 2006. The conditional approval of these additional two weeks should be based on the results obtained during the runs in the fall of 2005. Otherwise, the commissioning work for the PIT would be delayed by almost a year, until the fall of 2006. It should be noted in this context that commissioning and initial research with the PIT provides the basis for the PhD thesis of Kirill Grigoriev. We will keep the PAC members informed about our progress in a written intermediate report which will be available by the end of this year.

References

- [1] A. Kacharava, F. Rathmann, and C. Wilkin for the ANKE Collaboration, *Spin Physics from COSY to FAIR*; available from <http://www.fz-juelich.de/ikp/anke>.