Experimental Arrangement of the Ion Microscope SNAKE

O. Schmelmer, G. Datzmann, and G. Dollinger

The new ion microscope **SNAKE** (**S**upraleitendes **N**anoskop für **A**ngewandte **K**ernphysikalische **E**xperimente) [1] at the Munich tandem accelerator will be a tool for interdisciplinary research as for solid state physics, geology, biology and medicine. It will deliver a focused ion beam of 100nm (e.g. $100pA$ protons of $20MeV$) for material analysis and modification. Now the experimental setup for the microbeam facility is under construction. Besides a new type of ion source [2] and high precision slits [3] it mainly consists of a target chamber and a helium bath cryostat (Cryovac) containing a superconducting multipole lens. The whole arrangement is situated at the 0° beam line in front of the vertical 90° magnet. A technical drawing of the end station of the setup is shown in fig. 1.

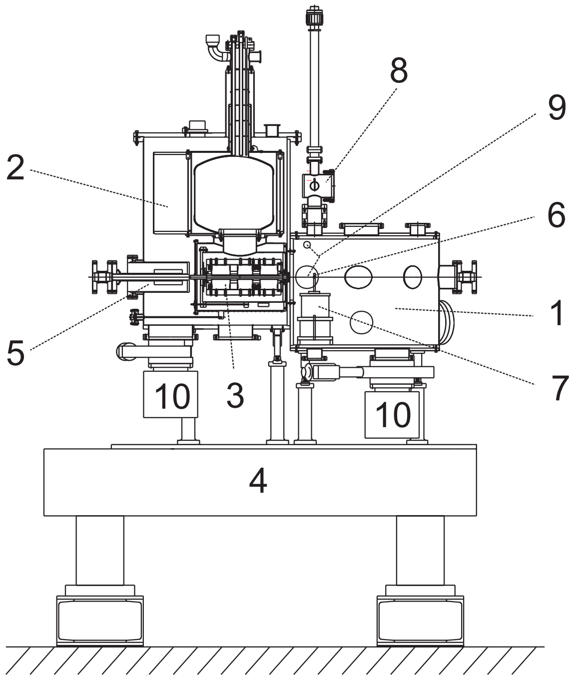

Fig. 1: Technical drawing of the experimental arrangement for SNAKE: 1) target chamber 2) cryostat 3) superconducting multipole lens 4) vibration isolation table 5) magnetic steerer 6) focus 7) in vacuo manipulator 8) load lock 9) port for endoscope and optical microscope 10) pumps.

As any kind of vibrations can destroy the resolution of the facility several efforts must be made to suppress such interferences. In order to get rid of parasitic vibrations originating from the ground of the accelerator building both, cryostat and target chamber are mounted on a passive vibration isolated table (IDE GmbH). To reduce vibrations of beam tube the system is connected to the beam line by flexible couplings.

In front of the cryostat an additional magnetic steerer (S. Fischer) accomplishes a fast scanning mode for MeV protons. The cryostat contains the superconducting multipole lens described in [4] and is pumped by a turbo pump ($390l/s$ N_2). To observe translations of the lens perpendicular to the beam direction resulting from the thermal expansion of the lens mounting it is planned to install a laser interferometer control. So the magnetic steerer can be re-adjusted to compensate these translations.

Right behind the cryostat the target chamber is situated. It is pumped by a turbo pump ($390l/s$ N_2) with magnetic bearings. If vibrations of this pump interfere the measurements the pumping can also be done by a ion getter pump ($110l/s$ N_2). The diameter of the chamber is $690mm$ and offers therefore a large area for different types of detectors in various geometries.

The target sample is mounted on a four axis in vacuo manipulator (AML Ltd.) which is depicted in fig. 2. It enables a sample orientation in micrometer steps in three linear directions and an angular orientation in steps of $2 \cdot 10^{-2} mrad$. For channeling experiments an additional sample holder is planned which enables a rotation around a second axis. A load lock on top of the target chamber accomplishes a quick sample transfer without destroying the vacuum inside the chamber.

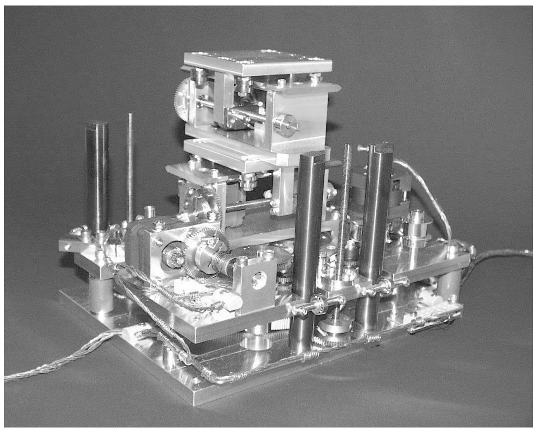

Fig. 2: Four axis in vacuo manipulator (AML Ltd.) for sample orientation.

An optical observation of the actual position of the target sample can be done by an endoscope and a microscope (TSO) being currently under construction. The maximal resolution of the microscope is $2\mu m$ and its maximal object plane is $600\mu m \cdot 600\mu m$. It can be focused and geometrically adjusted by several stepping motors. On both devices video cameras are mounted transmitting the images of the target to a monitor in the control room of the accelerator. Both, the remote control of the sample manipulator and the remote control of the optical microscope shall be integrated in the computer aided control system of the accelerator.

References

[1] G. Datzmann *et al.*, Jahresbericht 1997, p. 106
[2] C. Goeden *et al.*, this report p.99
[3] O. Schmelmer *et al.*, this report p.101
[4] G. Datzmann *et al.*, Jahresbericht 1997, p. 107