A motorized two-arm XY translater system for storage-cell positioning and prototype tests for the polarized internal target of ANKE

J. Sarkadi, R. Engels, K. Grigoriev[a], H. Kleines[b], F. Rathmann, H. Seyfarth, E. Steffens[c], and A. Vassiliev[d]

With the use of diaphragms and prototype tubes, COSY-beam studies have to be performed in order to determine the minimum cross section of the storage-cell tubes for the polarized internal gas target of the spectrometer ANKE. Besides the length of the tube, which is fixed to about 350 mm, its cross section essentially determines the average gas density and thereby the gas-target thickness. Thus, the minimum cross section at a tolerable background, caused by the interaction of the COSY-beam particles and the cell-wall material, has to be found.

To this aim, a light frame of thin stainless steel and aluminium profiles was constructed to carry sets of test diaphragms and/or test tubes. The frame is supported by two thin stainless steel tubes, which are connected to the end flanges of two x-y-z translators[1], mounted at the

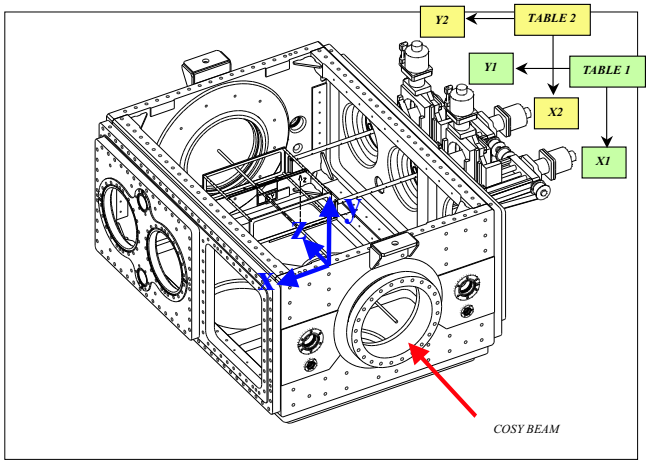

Fig. 1: The support frame, in the figure carrying one diaphragm only, with the two-arm x-y positioning system mounted on the ANKE-target chamber (outer frame dimensions length 390 mm, width 230mm, height 80 mm).

ANKE target chamber as shown in Fig. 1. The x and y movements of both arms (the used coordinate system is found in the figure) are accomplished by four stepper motors, whereas the z movement along the beam direction is not needed.

The configuration of the control system is shown in Figure 2. A S7-300 PLC system[2] controls the movements via S7 stepper motor positioning function modules FM353, while a WinCC PC serves for user interfacing. The modules provide pulse/direction interfaces for the power amplifiers[3] driving the motors. Four free-configurable inputs (reference points, end switches) and four outputs (positions reached) are available to controle the movements.

The user interface, elaborated in WinCC V6.1, is shown in Figure 3. The user can set the wanted positions, then actions are started via pushbuttons (reference point, start/stop, error acknowledge). There are two T flip-flop buttons to select the type of movement (synchroneous x or y movement of both

[1] Vacuum Generators, Hastings, England, Y-Z-Module type MRXXY12 with X slide module type MRXZ1515.

[2] Siemens AG, 52013 Aachen, Germany

[3] Phytron-Elektronik GmbH, 82180 Gröbenzell, Germany

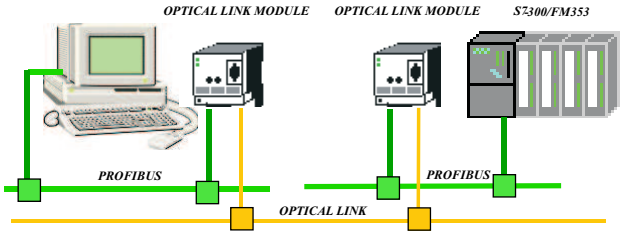

Fig. 2: Configuration of the positioning control system.

arms or of a single one). The latter choice allows to change the horizontal or vertical orientation of the frame, i.e. of the future storage cell to adjust it to the beam direction, if necessary. However, to avoid deforming forces, acting on the frame, the difference in the horizontal (x) or vertical (y) positions of the two arms by the control system is limited to 5 mm.

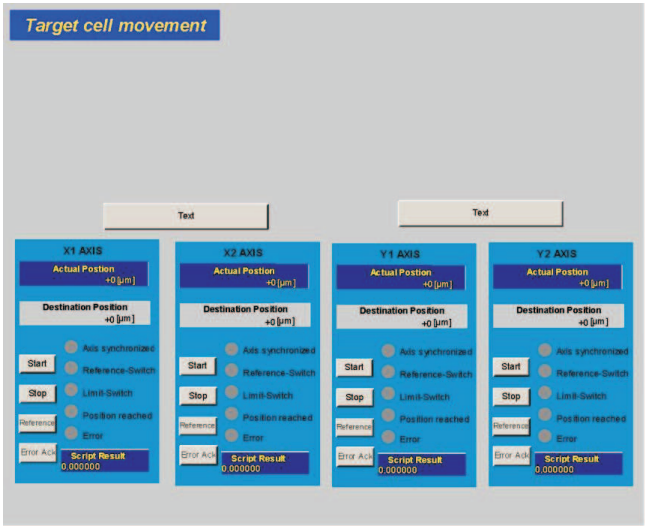

Fig. 3: User interface of the control system, available on two PC, one near the ANKE target position, the other in the ANKE control area.

Three operation modes exist: (1) mode_reference_point, (2) mode_incremental and (3) mode_MDI. The first mode allows to move the arms to reference sensors, which guarantees reproducibility of the positions, e.g. in the case of power cuts. The second mode allows to move the arms by a preselected positive or negative distance from the actual position, whereas mode three allows to move to a preselected position. The position calibration relative to the reference-sensor positions is achieved via cutting a laser beam, well collimated by two 0.2 mm diameter diaphragms on the axis of the chamber, by moving the frame.

[a] PhD student from St. Petersburg Nuclear Physics Institute, Gatchina, Russia.
[b] Zentrallabor für Elektronik, FZ Jülich.
[c] Physikalisches Institut II, Friedrich-Alexander Universität Erlangen.
[d] St. Petersburg Nuclear Physics Institute, Gatchina, Russia.