Determination of the ANKE detector coordinates

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Knowledge about detector position is very important for the data analysis. Tracking detectors are suited to provide information about track with precision better than 1 mm, thus determine momentum resolution. Therefore, it is very important to know chamber positions to a good accuracy.
In August 2007 a precision measurements of ANKE detector positions has been done for several settings of the D2 spectrometric magnet. In these measurements coordinates of the 10 points on the ANKE detectors have been determined in arbitrary coordinate system. Each set of measurements contains information about coordinates of the rod installed at the top of the D2 magnet. Position of the rod with respect to the center of the ANKE coordinate system, which coincides with the center of the D2 chamber, is precisely known. Thus, coordinates of the rod are used for recalculation of the measured detector coordinates to the ANKE coordinate system.
In August 2007 new positive stop side chamber (SdMWPC2) support system has been implemented. From this time ANKE stop chamber is rotating around the axis which is fixed with respect to the D2 magnet at the low momentum side. The high momentum side of the chamber support is fixed on the Fd platform such that it keeps constant distance between FdMWPC2 (second forward multi-wire proportional chamber) and SdMWPC2. New forward detector (Fd) support system is designed such that all the Fd detector rotating around one point, and parameters of this rotation are determined by the position of the D2 magnet, which is set by the linear drive (LA1). The linear drive shift determines distance between COSY beam axis and the center of ANKE D2 magnet in X direction. Thus, new ANKE detectors support system makes detector coordinates predictable on the basis of information provided by COSY (See Fig. 1).

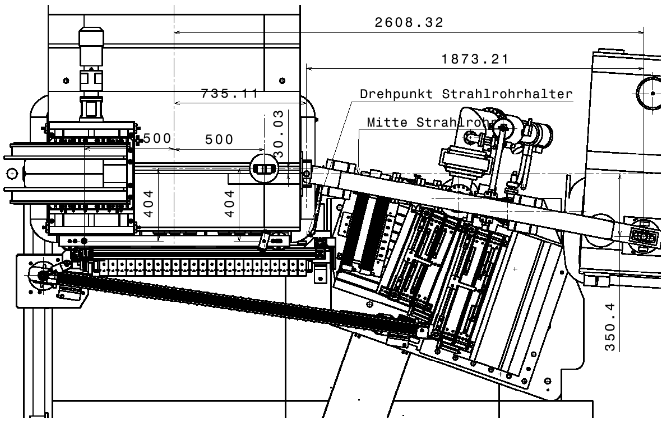

Fig. 1: Sketch of the ANKE detector system.

A simple C++ code has been developed to determine detector coordinates for any linear-drive position [1]. This program use user selected set of the measured points to produce output detector coordinates for any linear drive position. Output contains detector coordinates in form used in both old and new ANKE analysis codes.
The analysis of the all data shows internal consistency of the measurements at different positions of linear drive. Sizes of the detectors as well as distances between them remain constant within a precision of roughly 0.1 mm (see Table 1). However, geometrical sizes of chambers extracted from all the measurements differ from ones extracted from the drawings. This leads to the systematic shift of the detector positions, which has been determined using calibration reactions.

Detector	S_{meas}	σ_{meas}	S_{known}
Rod	1000.14	0.0866	1000
SdMWPC2	2126.67	0.101	2125
FdMWDC1	361.123	0.058	360
FdMWPC2	472.531	0.038	472
FdMWPC3	594.035	0.073	592

Table 1: Comparison between measured and known sizes of the detectors. All dimensions are in millimeters.

LA1	Δ_{dc1}	Δ_{pc2}	Δ_{pc3}
278.9	0.75	1.37	0
274.2	0.94	1.47	0
266.1	0.59	1.27	0
263.1	0.59	1.27	0
258.2	0.75	1.47	0

Table 2: Systematic shift of the chamber positions determined from the experimental data as a function of the linear drive position. All dimensions are in millimeters.

The results of the Fd detector position calibration using pp elastic scattering for different LA1 is presented in Table 2. Systematic shift in the X coordinate for the first and second chambers has been implemented on the basis of the information about reconstructed track. Difference between values of shifts for different energies is of the oder of the measurement uncertainty.
Analysis of the precision measurements of the ANKE detector positions has been done. It is shown that the measurements are internally consistent. On the basis of this measurements a program has been developed which allows to determine the detector positions for any settings of spectrometric magnet.

References:

[1] http://ankecvs.ikp.kfa-juelich.de/forum/viewtopic.php?t=107

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