GEODETIC MEASUREMENTS FOR 6 M MAGNETIC SPARK SPECTROMETER ITEP

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Experimental functioning of the 6m spark spectrometer (MIS) of ITEP demands periodical high precision geodetic measurements.

The task is to determine 3-dimensional Cartesian coordinates of fiducial marks in the working volume of the track detector installed in the strong magnetic field.

A microlateration network in the form of a geodetic quadrangle is developed on the magnet's lower pole surface, it serves as a reference for 3-D coordinates determinations.

The vertexes of the quadrangle are fixed by precision cylindrical holes 11mm in diameter and 35mm deep; the distances between centres were measured by invar tapes, the scales being read by means of microscopes. Mean square errors of these measurements $\mu_s = \pm .03$mm. The vertical coordinates were determined by geometrical levelling using Koni-007 automatic levels. Mean square error of a relative height measurement on a station is $m_h = \pm .04$mm.

The geodetic measurements were carried on by two stages:

1. While dealing with spark chambers (1) situated in the magnet's aperture (Fig.1) the coordinates of fiducial marks were measured by intersection method the horizontal and vertical angles being measured by a Theo-010 theodolite (Fig.2).

A geometrical construction called "Hansen's double task" together with angle intersection method was investigated (Fig.3). The accuracy of coordinates in our conditions turned to be ± .1mm.

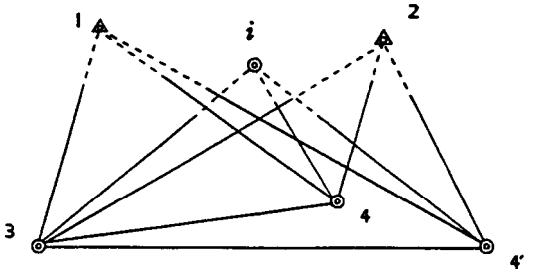

Fig. 3

The reference points A1 and A2 are situated on the magnet's pole, the points 3 and 4 are fixed on portable tripods, *i* - a fiducial mark to be located.

2. The coordinates of the electrodynamic chambers fiducials were derived from offset measurements by Taylor-Hobson microtelescope.

In the spectrometer magnet aperture there are 64 spark chambers, each of them, has 2 fiducial marks and 4 reference strings.

Current measurements of chambers is carried on on a special stand (Fig.4) which consist of a pattern-frame 1 on which a chamber 2 and microtelescope frame are fixed.

The reference marks of the pattern-frame were measured by means of a precise ruler and checked on coordinate-chiselling machine with precision not worse than .03mm.

Using these measurements the coordinates of reference strings with soundconductors axes intersection points and reference strings inclinations are calculated. Then the coordinates are transformed into the spectrometer coordinate system.

The origin of the spectrometer coordinate system is located in the centre of the upstream end of the magnet aperture, the X axis is directed along the beamline, the Z axis is directed upwards. The system is right-handed (Fig.5). On this figure positioning of chambers in magnet aperture is shown (look from above).

In the working position inside of the magnet the coordinates of the right and left fiducials of each chamber are measured. These measurements are carried on before and after every run of the experiment.

Position of chambers along X axis are measured by a precision tape the whole chamber structure on the supporting frame being extracted out of the magnet.

The results of geodetical measurements by means of special program are being transformed into a form needed for track parameters calculating.

Geodetical measurements described make possible to reconstruct tracks space coordinates with accuracies .3mm for Y and 1.6mm for Z.

The error for Y includes multiple dispersion and error for Z is determined by the angle of inclined strings of chamber relative to plumbline.

The accuracy of geodetical measurements themselves and corrections needed for calculations are ± .1 mm for Y and ± .2mm for Z.

The author expresses his gratitude to the whole team of the spectrometer for their help in measurements and result treatment.

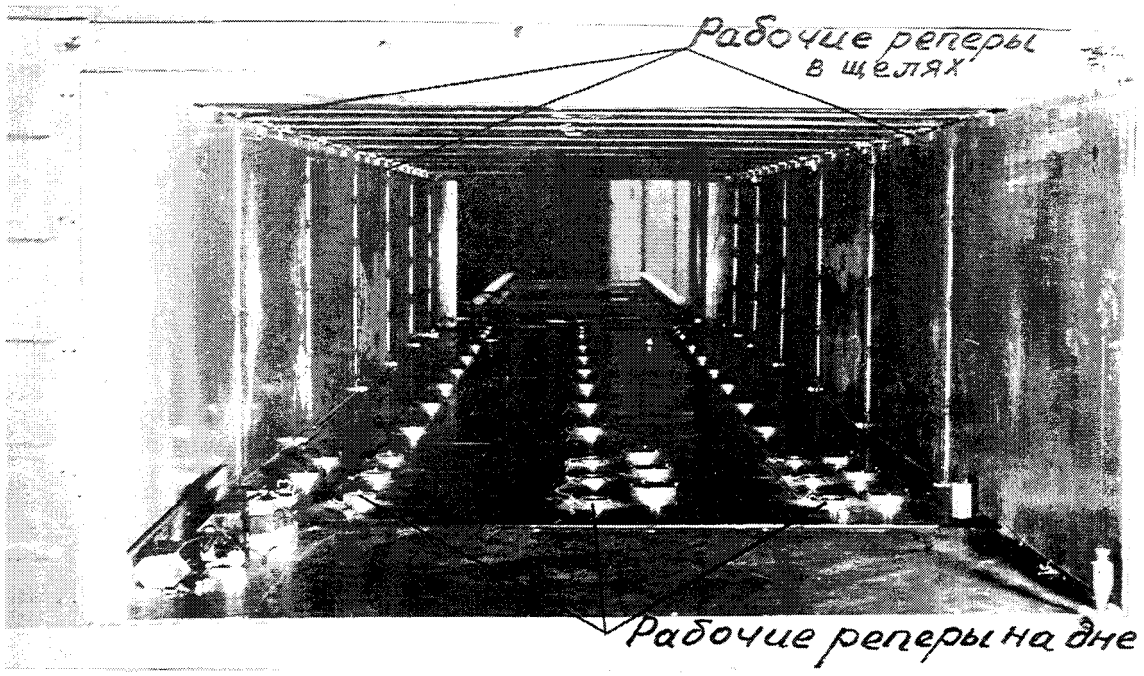

Рис. 1. Вид на зазор магнита 6-метрового спектрометра по направлению пучка.

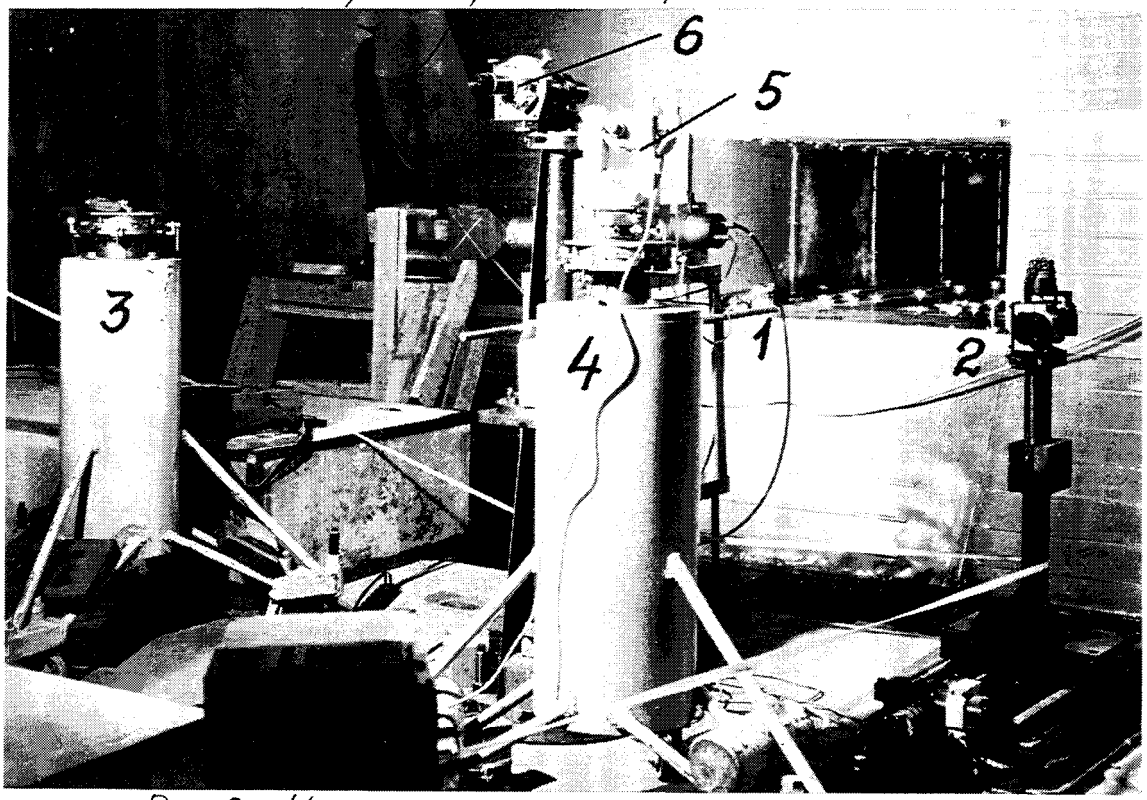

Рис. 2. Измерение положения рабочих реперов с переносных знаков. 1 и 2-опорные знаки, 3 и 4-переносные знаки, 5-теодолит Theo-010, 6-микротелескоп „Тейлор-Гобсон".

Fig. 1 View into the 6-m magnet spectrometer

Fig. 2 Measurements of the bench-marks position

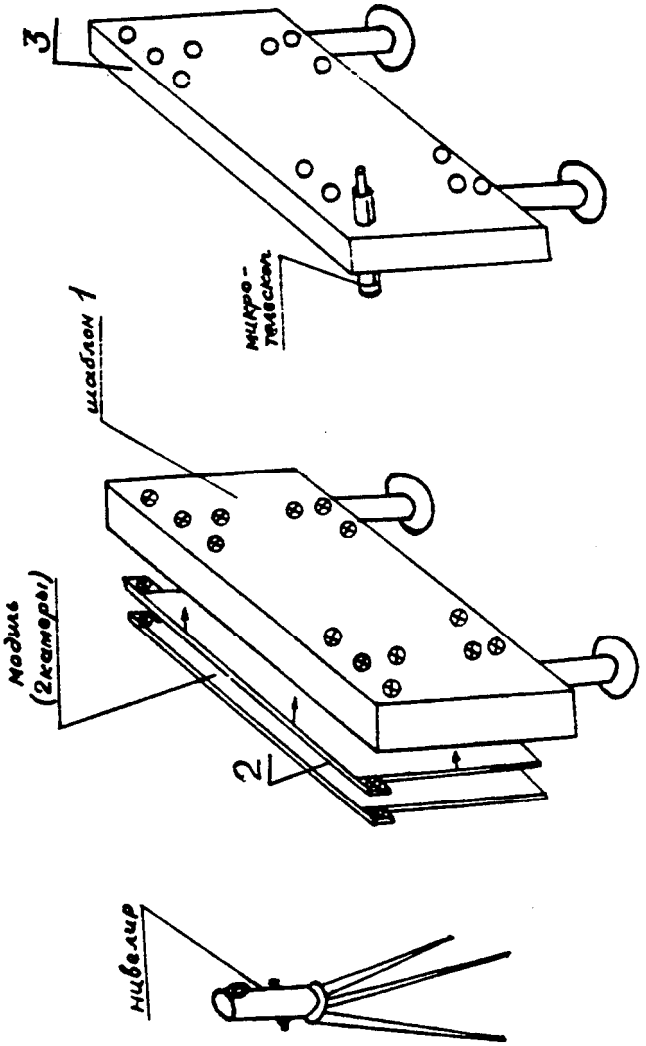

Рис.4. Стенд для аттестации камер:
1-рама-шаблон, 2-камера, 3-рама для микротелескопа.

Fig. 4 Stand for camera's tests

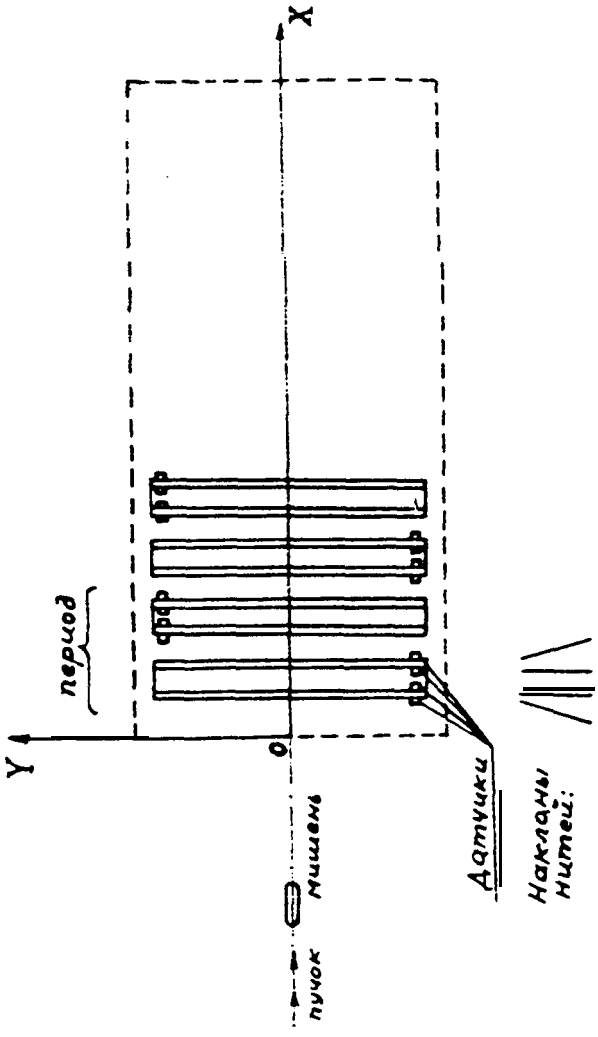

Рис.5. Расстановка камер в магните спектрометра (вид сверху)

Fig. 5 Distribution of the cameras in the magnet of spectrometer (view from top)