Publications of the Department of Astronomy — Beograd, № 6, 1976.

THE VACUUM MERIDIAN MARKS OF BELGRADE OBSERVATORY

by

Lj. Mitić and *I. Pakvor*

Summary: The examinations of the system of the Large Transit Instrument — vacuum meridian marks of Belgrade Observatory are being continued. The examinations of the motion of vacuum tube end according to temperature variation are carried out. Obtained values show clear dependence on the temperature variations, however, they are within tolerable limits.

Rezime: Nastavljena su ispitivanja sistema Veliki pasažni instrument — vakuumske mire Astronomske opservatorije u Beogradu. Vršena su ispitivanja pomeranja kraja vakuumske cevi u zavisnosti od temperature. Dobijene vrednosti pokazuju jasnu zavisnost od temperature, međutim, po veličini padaju u dozvoljene granice.

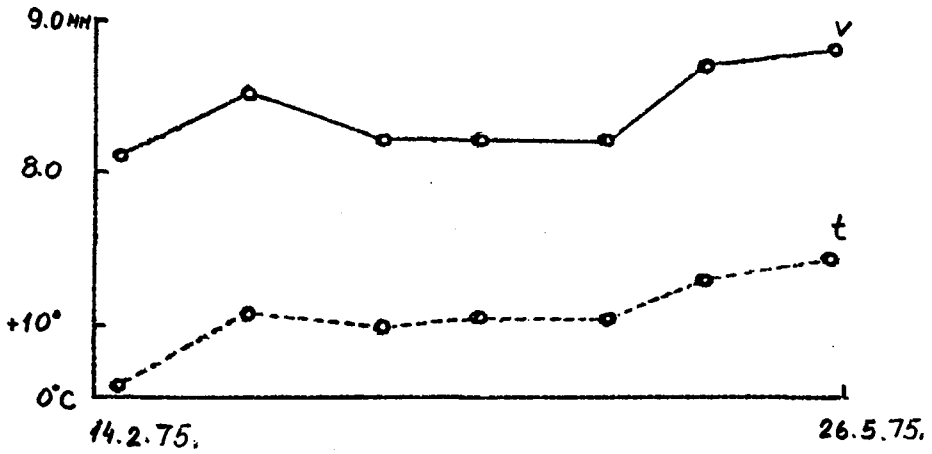
Former examinations of the vacuum meridian marks of Belgrade Observatory (Pakvor 1972/73, 1975 and Mitić, Pakvor 1975) were directed in two basic trends. First, it was necessary to determine to which degree succeeded the elimination of the refraction disturbance as the main cause of random and systematic errors of mark readings and second, to find out which systematic errors develop by inserting such a foreign body as the vacuum tubes are. As is published in the mentioned references, the elimination of refraction disturbance completely succeeded, which undoubtfully proves the mean square error of the individual mires reading of $\pm$ 0^s.004. This is, after all, an extreme limit of reading accuracy with such an instrument (Large Transit Instrument).

With such satisfactory results from the first stage of the research, examinations were continued to investigate the possible influence of the variation of the angle between two planparallel glasses on both ends of each tube. It was shown theoreticaly (Nemiro 1972) that in case of our meridian marks system, variations which are under 2 arc seconds can be neglected.

For the purpose of these examinations, special equipment was applied, which enabled the following of motion of the vacuum tube end, with reference to the collimator pillar, the latter constituting an enterity with the main pillar of the instrument. The equipment consists of a plumb line with a needle, which accurately transmits the motion of the tube end, a milimeter scale, which is firmly

fixed to the collimator pillar and a telescope, which enables clear reading to tenth part of a milimeter without the influence of the parallax or the observer. This was attained by putting the telescope on the other collimator pillar, at the distance of about 5 m.

In the graph below, the first preliminary results are shown. The mean half--monthly values of plumb line readings (V) and external temperature (t) are given. A clear corresponding between two curves is easily noticeable which permits us to claim that the temperature variation is the main cause of the tube motion. It



can be also seen that the size of the motion is very small and totally neglectable. The mean value of 0.05 mm per 1°C, in view of the fact that temperature variations during observations are relatively small, completely lies within tolerable limits of 2′ minutes of arc.

As it was mentioned above, the milimeter scale, on which the readings are related, lies on the collimator pillar, which on the other hand means that all measurements are related to the pillar. The pillar can, however, for such examinations be considered immobile, because it was previously found that the seasonal variations of the pillar inclination are in the limits of $\pm$ 3″, which results in our case to $\pm$ 0.1 mm. A torsion of the pillar is also neglectable.

How can such stability of the vacuum tubes system be explained? We believe that the answer must lie in the steel structure of the tubes, where the temperature equalization is quickly reached, and also in relatively high rigidity and weight of the system (approx. 4 tons).

To obtain a complete and true picture of the motions at both tube ends, it is necessary to carry out more complex examinations, comparing readings from the different angles and from both ends. It is the authors intentions to realize that in the approaching period.

If the results after such complete examinations are in given limits, we will be able to claim that the second fundamental problem of vacuum tubes is solved — the sufficent stability of the vacuum tubes —, and that, on the other hand, means the solution of the vacuum mires problem in general. The main cause of the inaccuracy in the right ascensions will disappear.

REFERENCES

Mitić, Lj., Pakvor, I. 1975, Trudy 20. astr. konf. SSSR, Leningrad.

Nemiro, A. A., 1972, Priv. Commun.

Pakvor, I., 1972/73, Bull. Obs. astr. Beograd, *125*, 1.

Pakvor, I., 1975, Publ. Obs. astr. Beograd, *20*, 205.

Van Herk, G., De Munk, J. C., 1954, Observations of mires without refraction disturbances, Publ. Netherlands Geodetic Commission.