# INSTRUMENT AND METHOD FOR DETERMINATION OF HIGH-PRECISION COORDINATES OF GEOSTATIONARY ARTIFICIAL SATELLITES

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One of the promising ways for improving the precision of the angular coordinates (positions) of geostationary artificial satellites is the application of the long-focus astrograph, equiped with special equipment for tracking the satellites and recording the instants of exposure.

An experiment of determining precise positions of artificial satellites has been carried out at the Main Astronomical Observatory of the Academy of Sciences of the Ukrainian SSR with the help of the Karl-Zeiss double wide-angle astrograph ( 2m focal length, 40 cm objective diameter). The telescope was equiped with a special photo-cassette allowing one to track the satellites at a predetermined orbitrary speed, as well as with an apparatus for recording the instant of observation with a precision of 0.01 sec.

A photographic observation of an artificial satellite, using a photo-cassette is carried out as follows:
Stars are exposured on the plate in the form of dots (with clock mechanism switched on and cassette stopped). The exposes last 10-15 sec. Then, at that very instant, the plate starts following the motion of the satellites. During the exposure (4-5 min) the plate registers the image of the satellite as a dot and those of the bright stars as trails. Two exposures are usually made to facilitate the identification of the satellites. All the instants of starting and stopping of plate's motion are recorded to 0.01 sec.

Figure 1 schematically shows the astroplate with the dotted star images and the geostationary satellite. Some tens of astronegatives with the geostationary satellite images have been obtained at the Main Astronomical Observatory using this method.Measurement and reduction of this



*H. K. Eichhorn and R. J. Leacock (eds.), Astrometric Techniques, 243–245.*

material show the satisfactory quality of obtained satellite and star images. The precision of these measurements with an "Askorecord" is on an average 2–4 $\mu$m.

The estimates of the precision of the satellite position obtained from 9 plates are given in Table 1. Each of the plates images two satellites. The standard errors are in the range 0.48" - 1.67". Those errors exceeding 1" are, mainly, explained by the large systematic and random errors of the SAOC which was used as reference catalogue. Thus, the application of a wide-angle astrograph with a special cassette for observations of geostationary artificial satellites has shown that the precision of determining the coordinates can be substantially improved. A hindrance, however, is a low accuracy of the SAOC. The compilation of a better catalogue will allow one to reach a precision of 0.3" to 0.5".

Table 1.

| N of plate | Date | N of artificial satellite | Quantity of reference stars | $\sigma$ |
|---|---|---|---|---|
| 1 | 4.07.1983 | 1 | 10 | ±1".09 |
| | | 2 | 12 | 0.89 |
| 2 | | 1 | 13 | 1.09 |
| | | 2 | 12 | 0.70 |
| 3 | | 1 | 14 | 0.74 |
| | | 2 | 12 | 0.58 |
| 4 | | 1 | 14 | 1.58 |
| | | 2 | 14 | 0.76 |
| 5 | | 1 | 13 | 1.33 |
| | | 2 | 19 | 1.56 |
| 6 | | 1 | 11 | 1.67 |
| | | 2 | 11 | 1.54 |
| 7 | 5.07.1983 | 1 | 12 | 0.48 |
| | | 2 | 13 | 1.08 |
| 8 | | 1 | 13 | 0.91 |
| | | 2 | 12 | 0.98 |
| 9 | | 1 | 14 | 0.76 |
| | | 2 | 15 | 0.56 |

Reference

1. Duma D.P.,1984, On the increase of angular coordinate determination accuracy of artificial celestial bodies,Nablyudeniya iskusstvennykh sputnikov zemli, Moscow, No 21.

https://doi.org/10.1017/S0074180900076646 Published online by Cambridge University Press

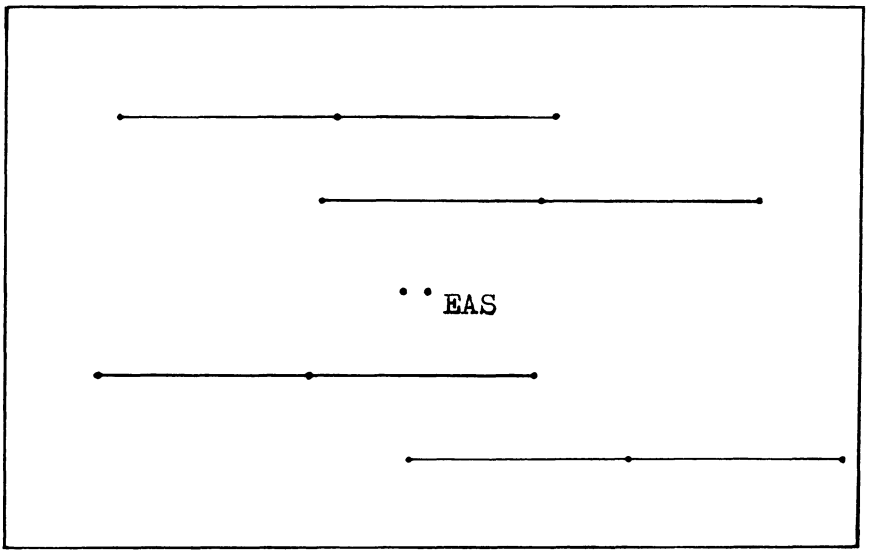


Figure 1. Schematic representation of astronegative.

https://doi.org/10.1017/S0074180900076646 Published online by Cambridge University Press