THE VERIFICATION OF DATA OF MEASUREMENTS AT THE CREATION OF SKY SURVEY CATALOGUES WITH AUTOMATIC MEASURING MACHINES PARSEC

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ABSTRACT. The system of an automatic control and the data verification in real time at the measurements with the automatic measuring machines PARSEC, had been developed to obtain the best accuracy, reliability and certainty of the results of the measurements and the high productivity in the same time. The principles and methods which had been used as a base of the developed system are presented in this paper.

Key words: Astronomical instruments and techniques - astronomical instruments: measuring machines - Astronomical instruments and techniques - data processing

The problem of the data verification at the measuremens with semi-automated measuring machine such as Ascorecord had being decided by the operator in accodance with his experience directly during the process of measuring. The reliability and certanty of obtained data had been based on operator's level of proficiency. The using of automatic measuring machines PARSEC, which provide at present the rate of coordinate and diameter measurements in real time of 500-800 images per hour, make it impossible for any man to make an estimation ofthe reliability and certanty of output infomation flows. As a matter of fact, the operator of PARSEC is separated from the control of the reliability of obtained data of measurements. Therefore the system of information technology with an automatic control and data verification in real time is urgently need. Such system had been developed and successfully used for the measurements of the sky survey plates with PARSEC in the Main Astronomical Observatory of the Academy of Science of Ukraine (MAO ACU) and the State Astronomical Institute of Shternberg, Moscow. The principles and methods which had been used as a base of the developed information technology are present in this paper.

There are many reasons which could cause the uncertainties, unreliability and mistacency of the measurement's data with an automatic measuring machines PARSEC. In the first place, there are problems associated with the quality of plates (transparency, contrast, blurs, ghosts, background unhomogeneity, wide variety of shapes of images, such as ellipticity, spikes, "tails", and so on, some kinds of defects, such as scratches, dark and light spots, proximity of bright stars images with large halo to the measured images, etc.). Secondly, there are some problems associated with pecularities of the measuring algorithm of PARSEC. They depend in some sort on above-mentioned quality of plates and on the third group of complicative factors associated with human activities: nonoptimal organization of all measuring procedures (from quality and accuracy of the input data to the methods of the control and verification of the output data) and variety of blunders, misses and mistakes of operator. Summarizing, the reasons which could interrupt the measuring process of PARSEC or cause the uncertainties of data (so called "unregular situations") and which have been in need of automatic control may be defined as:

- the mistakes of input data (wrong values of preliminary coodinates);
- the dimensions of the measured image exceeding the permitted extreme ones;
- the considerable gradient of density of the image or large unhomogeneity of near-by background;
- the mergered images;
- the noncircular shape of measured image, especially a high ellipticity;
- nearly all kind of blunders, misses and mistakes of operator;
- any kind of malfunctions, faults or failures of hardware.

In order to obtain the best accuracy, reliability and certanty of data with high productivity in the same time in the measurements of the sky survey plates, the system information technology had been developed on the next principles:

- maximum automatization of all stages of the measuring procedure;
- minimization of human-made operations;

- support of stable and stopless procedure of automated measurements;
- optimal organization of input and output data structure;
- supporting of the effective intraction of measuring and computing systems, the hardware and software;
- using the verification software for the check of data reliability at the each stage of the information technology;
- operative processing and the estimation of the quality of measurements in real time during the measurings;
- using the methods of optimal duplication, parallelizm and surplusity for data protection;
- providing the homogeneity of measurements by means of the metrological assessment of PARSEC.
The realization of that principles allow to avoid some of mentioned unregular situations. Other have been analysed and controled by all stage of information technology.

As a part of developed information technology - unregular situation analysing software (USAS) realises the automatic control of some of above-described unregular situation in real time during measurements and ensure in this way the verification of the measured data. The situations being analysed by it are:
1 - the preliminary coodinates values exceed the permitted extreme ones;
2 - the image in the area of view is absent;
3 - impossibility to estimate the image centre for a certain time;
4 - large unhomogeneity of near-by background;
5 - the dimension of the measured image exceeds the permitted maximum value;
6 - the dimension of the measured image is less then the permitted minimum value;
7 - moving of cariage during the scaning of image;
8 - mulfunctions of scaning hardware;
9 - mulfunction of coordinate reading hardware;
10 - fatal errors.

If for measured image the situations 1 - 6 have happened the USAS stops the measurement of that image, makes the message to operator, puts the corresponding marks to the flag field of that image record in output file, then the measurement of next image have begun. In the case of situations 7 - 9 USAS regists them, makes the message to operator, puts the corresponding marks to the flag field, and the measurement of the same image have repeated. So the appearance of marks of situations 1 - 6 in output file means the uncertainties and unreliability of the data for corresponding image. The mark of situations 10 in output file means full uncorrection of the data.

To control the operation of PARSEC hardware in total and to provide the homogeneity of measurements the metrological assessment have been carried out regularly. In order to control the quality of data of the measured plate and the operation of PARSEC hardware during measurements the statistical assessment of data have been accomplished. It presents the estimation of:
- standard deviation of the every control plate mark in the block of measurements;
- mean standard deviation of the marks in the block of measurements;
- mean standard deviation of the marks in the whole file of measurements;
- evaluation of unhomogeneity of a background density on the plate;
- trend of marks during the time of measuring.
(The programm of the statistical assessment was written in TURBO PASCAL by L.K.Pakulyak.)

As a result of above mentioned attempts to control measuring process we have obtained the software, which optimizes the measuring process perfectly well, verificates the data and reduces a possible operator mistakes.