

## COMPUTER MODELS FOR SKY IMAGE ANALYSIS OF THE INASAN ZVENIGOROD OBSERVATORY

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**Abstract.** The information systems including archives of digital copies of the Astrograph plate collection obtained in the Zvenigorod Observatory of the Institute of Astronomy, RAS, and means for access to those copies are developed. There are possibilities to have a look at preview photos in JPG, to view any part of the image from the primary file in FITS format with the ability to save and print the fragment. A remote access system is implemented on cross-platform SQL Server FireBird v.2.1.

### 1. INTRODUCTION

The Zvenigorod Astrograph plate collection includes more than 4.5 thousand plates. At the present time digitized plate records in FITS file format by mean of EPSON 1640 XL scanner are produced (for more information see in Chupina and Vereshchagin; Tsvetkov, 2005).

The need for automated processing of plates, digitized in FITS format and the necessary plate information is long overdue.

In this report we present the preliminary results from the attempt to transfer FITS format into the database and create software to obtain the necessary information from the database. This software should work both for the user located on the territory of the observatory (LAN), as well as outside the territory (WEB).

### 2. THE TASK OF CONSTRUCTING MODELS

The task of constructing models is to create a user-friendly software interface for viewing, copying and analyzing archival photographs of the sky. The main properties software interface includes:

1. Viewing files of low resolution scans in JPG format with the provision of information about the time of the observations, the coordinates of the center of the plate, etc.

2. Saving an external file and printing information.

3. Viewing any part of the scan with high resolution in BMP format providing information on the time of observations coordinates of the center of the plate, and information about the objects file (list of stars with known parameters, including name of stars and other important parameters). The query to the database can be used for variety of user's tasks: for example, to select plates for a certain star, to show the image of this star with the ability to print and copy it, and so on.

This problem is actually not trivial and requires a systematic approach. For example: as the program shell is created, then it should be provided to convert FITS format to BMP format – as the average size of the FITS file is 700 MB. Because of the need to obtain various information, this information should be stored in a database. It is necessary to select the appropriate database server, and, therefore, have the necessary means to access the server. Below is a list sequence of items that should have been resolved.

## **2.1. Development of a database**

FireBird v.2.1. was chosen for the database SQL-server. It has the following advantages:

Cross-platform;

It consumes very little system resources;

SQL dialect is strongly developed;

There are powerful tools for administration and development;

Free.

## **2.2. Choice of software**

A high-level language DELPHI was chosen to develop software shell. The main advantages are: fast speed of development, large selection of visual components for both the choice of the user interface and access to SQL server, object-oriented programming.

## **2.3. Development of control programs**

This is the main and most time-consuming process of constructing the model. This item includes both the development of test programs and program development for the end user. To work with the files was necessary to develop several testing programs for the following tasks:

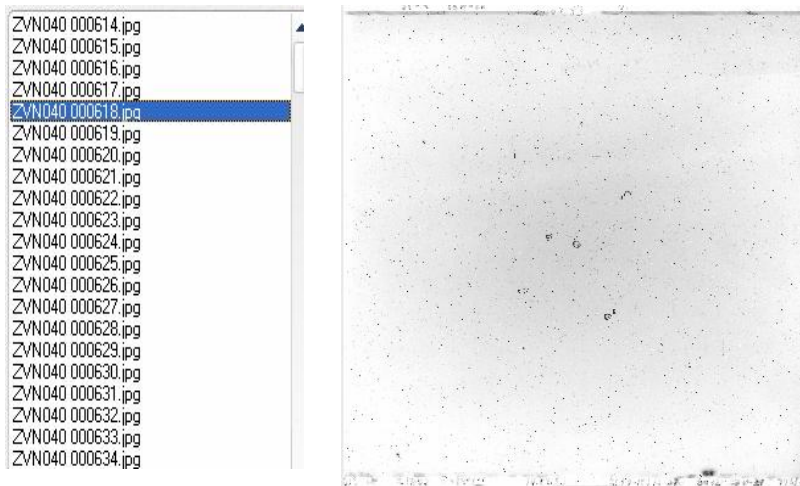
- Choice of coordinates of the center of the star and the image area:

1. Working with the file: Image of the file, copying and saving.

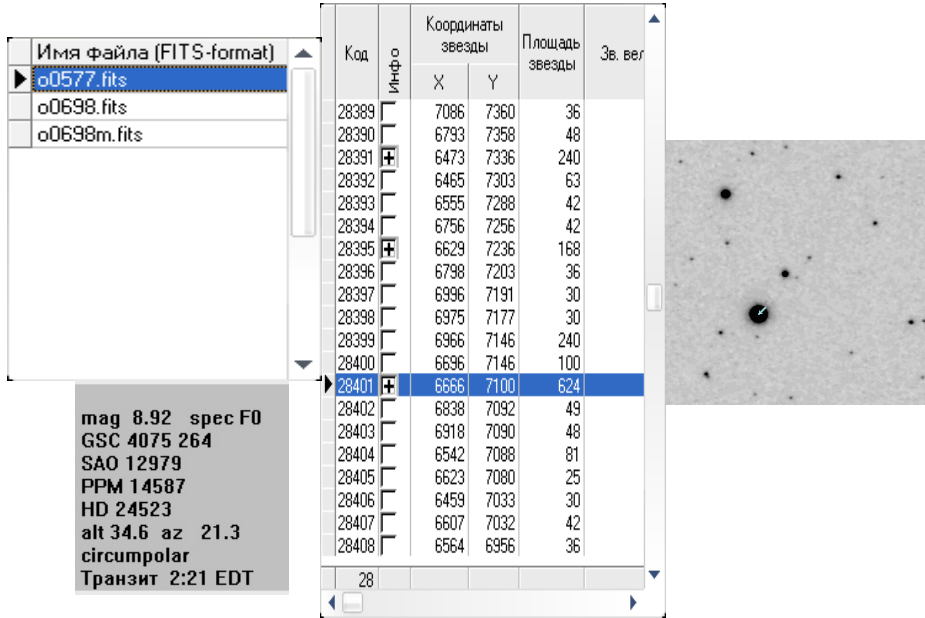
2. Analysis of error coordinates transformation of the plate in the stellar coordinates.

3. Analysis of errors converting the image area in magnitudes.
  4. Automatic data processing and recording the basic parameters of the file in the database.
- User program:
1. To develop a program to view the database (local version) - available only to users connected to the LAN.
  2. To develop a program to convert FITS in JPEG, including sample information from FITS, in view of transfer to a remote server.
  3. Development of a selection of FITS without loss of resolution.
  4. Development of queries in a database for retrieval of information, taking into accounts the transfer to a remote server.

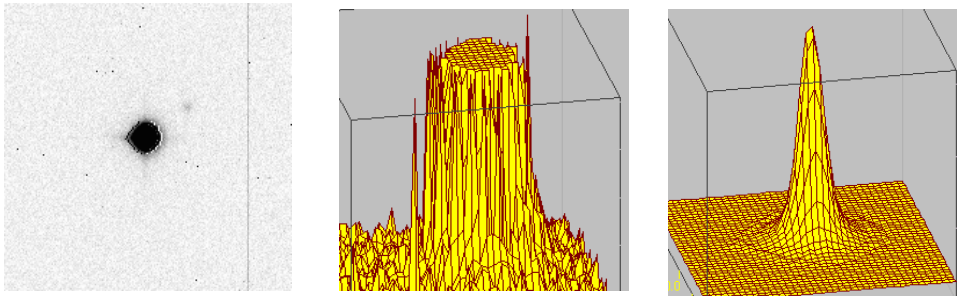
### 3. THE MAIN RESULTS OBTAINED



**Figure 1.** View of the list of files with low resolution.



**Figure 2.** Selected FITS file and received information from the database.



**Figure 3.** Distortion is the true spatial distribution of brightness caused by the nonlinearity of the transformation of FITS to BMP.

In Fig. 1 a list of plates that were converted to low-resolution preview files is shown. Information about files can be found in the database, as well as in (Tsvetkov, 2005).

Fig. 2 shows the process of selecting the necessary information on file 00577 (plate ZVN040 00,577). For this plate in the database there is a list of objects (stars, etc.) and information on each object. For example, an object with a unique code in the database 28401 is marked with a cross. This means that it is identified from the listed catalogs. This object is shown with arrow in Fig. 2 (bmp-format 700x700 pixel).

#### 4. CONCLUSIONS

The work on this project continues today. Several problems have to be solved, namely:

- Getting the distribution volume of the brightness of the objects;
- Connection of the objects in the database with the catalogs of stars (Name of star, and so on).

After solving these problems the solution given in the paragraph 1 «The task of constructing models» seems a trivial task.

The author would be pleased to accept criticisms and suggestions for the development of this project.

It should be noted that the algorithms to automate the processing of plates of the Zvenigorod observatory are also applicable to other plates transferred to FITS-format.

#### Acknowledgements

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#### References

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