P I S Z K E S T E T O   M O U N T A I N   S T A T I O N

U S E R S' G U I D E T O T H E 1M RCC T E L E S C O P E & I T S I N S T R U M E N T S

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WARNING: THIS MANUAL IS NO WAY A SUBSTITUTE FOR AN INTRODUCTION TO THE TELESCOPE AND CAMERA BY A STAFF ASTRONOMER!
YOU ARE ASKED TO CONSULT ONE BEFORE STARTING YOUR OBSERVATIONS!

OBSERVATORY DATA

Location: Piszkesteto, Matra Mountains, Hungary

Latitude: +47deg 55.1

Longitude: +19deg 53.7

Height above the sea level: 958m

Time zone: MET

TELESCOPE DATA

Diameter: 1.01 meter

Focal length: 13 500 mm

Optical design: Ritchey-Chretien-Coude

Field of view: 45'

Year of installation: 1974

First light: 1975

Instrumentation: (Wright Instruments EEV CCD05-20 CCD-camera),
Photometrics CCD-camera with UBV(RI)c filters,
UBV(RI)c cooled photometer.

TELESCOPE OPERATION

*********** at the dome ***********

- disconnect the fire alarm cable

- switch on the main power switches
(behind the console in the switchboard)

- switch on the telescope-control on the console
(yellow button next to the red one)

- open the dome

- open the tube covers

- open the mirror covers

- open finder and guiding telescope covers

...

- close finder and guiding telescope covers

- close the mirror covers

- close the tube covers

- move the telescope to vertical position
  (tau=0h0m, delta= 47deg 55m)

- close the dome, and rotate it to the initial position

- switch off the telescope-control

- switch off the main power

- connect the fire alarm cable

remark: the red buttons in several places in the dome are
        the main (emergency) power-off switches

1. Positioning:

Decl.: two-level (one fine motion)
R.A.: three-level (two fine motions)

These features can be used only if the sideral-clock motor is working! (orange button on the smaller pillar)

There are built-in stops for avoiding any crash with the pillar, or to move the telescope any forbidden position (negative altitude e.g.) Anyway, be careful! With the raw motion stop well before the required position! Don't move the telescope suddenly to the opposite direction! For smaller corrections in position (less than 5 degrees) use only the fine motions!

2. Sideral time:
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can be seen on the console
set with the help of the key on the console
(check it every night before observing!!!)

3. DCF-time:
----

is available through the dome-computer (in a heated box)

4. Dome-rotating:
----

from the console (Left & Right buttons), as no automatic dome-rotating is installed, don't forget to rotate it occasionally during observing. Dome-rotating is also available through one of the control panels.

5. Flat-fielding:

For observing with the CCD-camera, one could also want to take dome-flats. There are two different lamps for that purpose:

- 100 W lamp for (B),V,I,R flats
- 1500 W lamp for U,B,(V) flats

Also a white sheet is fixed inside the dome for homogenous illumination. If you rotate the dome to the position indicated by a small green plaster tape (the fixed and the moving one should coincide with each other) then the following position is desirable for the telescope :

tau = 0h 41m 41s
delta = -5 deg 27'

* * *

The following options are also available through two tasters mounted on the telescope: 1., 4.

You are asked to write the basic parameters (time, weather, condition of the instruments) of your observing session into the telescope and CCD log-book.

*********** at the observing room ***********

At the observing room one can check the instantaneous position of the telescope on the console.

7. Focusing:

can be made on the same console, and also from the telescope, one can alter function of one of the tasters between dome-rotating/focusing, with a switch 3 different velocities of adjusting

8. Fine guiding:

If between exposures the object had been moved on the screen, you can correct the position of the telescope using the four fine-guiding buttons It works the same way in the dome from the taster. The layout of the tasters is the following:

```
------------------------------
|                            |_____________________
|  ()     ()     ()     ()   |---------------------  --->
|                            |             to the telescope
------------------------------
   |      ^     <--     -->
   |      |
   v      |
    Decl.          R. A.
```

WRIGHT INSTR. CCD-CAMERA & AT1 SOFTWARE OPERATION
(presently unmounted)

-Switch on the camera and the cooling system, and check that the filters are chosen correctly.

At the observing room there is a computer and an additional display monitor. The AT1 software package designed to control the Wright Instruments camera is installed on this computer. This software is developed for taking exposures, reading out of the camera and storing data in standard form. A brief introduction and the description of the most commonly used features of the software are presented here:

Getting started

First of all copy the following files into your directory on C:\ drive:

```
at1.bat
at1.sav
exp.sav
```

Then start the program by typing at1.
The program consists of a large number of "screen"s. First you meet the 00 introduction screen. You can move between screens by pressing F9 followed by the 2 digit number appearing in the top right hand corner of the required screen. Here are some of the most important screens:

screen number	name of screen
13	display setup
20	camera
21	expose
26	format
33	edit

One can get on-line help by pressing F10.

It's important to know before starting observation, if the CCD has reached it's nominal temperature. Do that by examining the camera screen (No. 20), and checking the right values:

```
    camera number must be   0
    Mark                    2
    Chip temp.            LOW
    CCD power              OK
```

Now we are ready to start setting the characteristics of our exposure formats.

Exposure Formats

On screen No. 26 you can find the CCD readout Format set-up. The options altered here are stored in exp.sav file. An observer usually uses several formats corresponding to different readout area, gain, filter, binning factor and offset value. Pressing F3 makes the specified format to be saved.

Taking Exposures

Moving to screen No. 21 you can access the CCD camera exposure control.

- Exposure time can be set to the accuracy of 1 second
- Set the format number
- Display as image? Y

...

- Store data on disk? Y (very important!)

...

- repeat count (for multiple exposures with the same format)

You can alter between rows with (Shift) Tab.

F3 for single exposure
F1 for repeated readout by format
F4 to increase filename before exposure (it's very comfortable)
F5 to cancel current exposure

Exposures longer than 30 seconds are possible only for F3 and F4.

After starting an exposure the camera readout starts, and after a few seconds the image appears on the display monitor.

```
Examine data file
-----------------
Screen No. 33 shows the pixel values in ADUs, and helps you
to obtain the right exposure times, avoid saturated objects
etc. Maximum values allowed are (without binning)
 9 000 ADU - Gain 1
32 767 ADU - Gain 4

LUT
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In image display mode

CTRL-END           Reduces the image data value giving black
output
CTRL-PGDN          Increases the image data value giving black
output
CTRL-LEFT ARROW    Decreases the image data value giving white
output
CTRL-RIGHT ARROW   Increases the image data value giving white
output

Data storage & transportation facilities
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Frames are stored in standard FITS format, having standard
header keywords, such as

NAXIS      Number of data axis
TIME-BEG   Exposure start time
TIME-END   Exposure end time
CAMGAIN    Camera gain setting
DATE-OBS   Date of data acquisition
etc.

Images taken by the camera can be stored on DAT-cartridges
(separate DAT-drive), or on removable hard-disk drive for
Konkoly Observatory staff.

Leave AT1 by pressing F8 twice.

If you are interested in more information, please consult
the AT1 Quick Reference Guide or CCD Camera Manual, or the
"Preliminary and temporary  'guide' for executing the
simplest CCD-observing jobs with AT1 software" (in Hungarian)
at the observing room.
```

WRIGHT INSTR. CCD-CAMERA FACT SHEET

Camera: Wright Instruments

Chip: EEV CCD05-20, phosphor coated

Size: 800 (hor.) x 1200 (vert.)

Effective size: 770 x 1152 because of overscan area

Pixel area: 22.5 micron^2

Cooling system: 4-level Peltier

Working temperature: 200K

Dark current: <0.1 e-/pix/sec

Charge transfer efficiency: 10^-5 /transfer

Readout noise: gaussian, mean: 0, r.m.s.: 10 e-

Full well capacity: 10^5 e-

Gain: 1x, 4x

1 pixel equals to ~0.35" on the sky

Camera field of view: 4'x 6'

For more details consult CCD Camera Manual at the observing room, or in the library.

PHOTOMETRICS CCD CAMERA

THE PMIS SOFTWARE & PHOTOMETRICS CAMERA OPERATION

First switch on the cooling system and the camera head control unit after switching on the power of the console. Wait some minutes until the detector reaches its working temperature (ca. -40 deg Celsius). The number of the filter presently in the optical path can be seen on the display of the filter-wheel.

The PMIS Image Processing Software program is a Microsoft Windows compatible software product designed to completely control the Photometrics Camera. Here we summerize the essential and often used Menu items and macros.

- Start the program by clicking on PMIS icon under Windows

Camera Window

It's useful first to have a look at the camera window. Camera menu provides access to the camera initialization dialog as well as camera control functions. Click on Camera/Initialize, and you will find Camera type, Camera (readout) speed (40 kHz), Columns(1024) Rows(1024) etc. These values define the physical size and valid acquisition region of the imaging surface and are usually fixed. The Acquisition Parameters dialog box allows you to change the area to be used for subsequent image acquisition. For example, to access the whole physical surface of the camera set Serial/Parallel Subarray Origin to 0, and Ser./Par. Subarray Size to 1536/1024. The binning factors, and camera gain also can be modified in this dialog box.

The Main Window
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Image submenu

The Image/New Image menu item creates a new image data

area and an associated display window to be used by
subsequent image acquisition and display.

Macros submenu

The most efficient and the simplest way to take exposures, execute observing blocks and store data in standard format is running macros. The Macros submenu offers you to creat a new, edit and run an existing macro. These macros are written in CLI form which is the command line interpreter of PMIS. Single CLI commands can be executed from the Main Menu window, too. By running expf.cmd macro you can take exposures with the same exposition time and filter.
The tserfits.cmd was written to get exposures with three different filters and exposure times. Also these macros control data storage in fits format, and can repeat an observing sequences several times creating incrementing file names. Of course every existing macro can be modified; in the header of the files one can find descriptive lines helping to understand the function of the macro. It's convenience to develop new macros for every specific observing runs.

Options submenu
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offers choice between monochrome and pseudo-color image-display. Another important perspective is modify LUT (look up table), where low intensity and low contrast parts of the image can be made visible.

Help submenu
----
provides on-line information about using PMIS.

The Image Window
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also contains submenus, such as File, Acquire, Process, Dispay, ROI, Plot, Options and User.

First one is to save, import and print images unless they are saved by above mentioned macros. From File submenu it's only possible to save PMI format or fits format images without header. Therefore strongly recommended to use the easy-to-handle macros for that purpose. On the other hand import and display fits files is also not supported by the program ...

The Acquire submenu allows the user to change the position and the size of image areas acquired from the camera, and the binning factors. Acquires/Focus performs continuous exposures on a rectangular area of the camera surface until the user press <Esc> key. It's a useful tool to focus the telescope.

Process performs image processing and mathematical operations using one or more image operands. We mention here only one feature: data scaling. Most astronomical frames can be best fitted to human eye using Optimal non-linear method. Try it.

Display menu items can be used for zoom or squeeze images. One frame can fill the whole monitor window. Also a sequence of images can be shown as a movie.

ROI is an option that supports creating subregions of images defined by a rectangular or polygonal boundary, called "Region Of Interest". Though the whole image is read out, certain manipulation can be restricted to the subregion of interest.

Plot menu provides access to graphical representations of image pixel data or image pixel statistics. Intensities along a straight line can be plotted; histogram displays the pixel intensity distribution in the image, or active ROI. 3D view shows intensity in the form of a simulated 3D surface.

Please read PMIS User's Manual for more details in the Observatory's library.

PHOTOMETRICS CCD CAMERA FACT SHEET

Camera: Photometrics

Chip: TH7896 M, UV-coated

Size: 1024 x 1024 pixels + 18/18 serial pre/postscan pixels
2/2 parallel pre/postscan rows

Pixel size: 19 micron x 19 micron

Imaging area: 19.5 x19.5 mm

Nonlinearity: 0.07%

LINEAR Full Well: 375 000 e-/pixel

Dark Current: 0.4 e-/pix/sec

Temperature: -40 C (Peltier + liquid cooling system)

Readout bits/speed: 16bits/40kHz

Frame readout: ~60 sec

Gain:	Nominal	Measured (e-/ADU)	Noise (e-/rms)
	1x	5.5	5.8
	4x	4.5	1.4

COMPUTERS in the RCC-DOME

There are two PCs in heated boxes in the dome. The less one at the northern pillar can serve as the telescope positioner and DCF-time receiver. The other one is for controlling the camera operations and the filter-wheel. This computer is connected to the local area network (LAN) via Ethernet. Telnet and ftp from the C:\NCSA directory are also available.
There is another Linux-PC (M2) connected to the LAN in the lower observing room.

GENERAL RULES

No instrumentation should be installed or modified without the permission of the technical deputy director.

Publications using observations made at Piszkesteto should contain an acknowledgement, and should appropriately refer to the telescope and detector.

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In case of technical problems with the dome or the telescope contact Miklos Racz (racz@konkoly.hu) .

More information about the local computer system can be found at http://www.konkoly.hu/computers/computers.html in the "Guide to the computer system at the Piszkesteto Mountain Station".