HOLICAM – A NEW DEVICE FOR ASTROMETRY

JÖRG SANNER, ANDREA DIEBALL, JÜRGEN SCHMOLL, KLAUS REIF AND MICHAEL GEFFERT
Sternwarte der Universität Bonn
Auf dem Hügel 71, D-53121 Bonn, Germany

1. Introduction

HoLiCam is the new wide field CCD camera operating at the 1m Cassegrain telescope at Hoher List Observatory of Bonn University near Schalkenmehren, Germany. HoLiCam was constructed for direct imaging, for example for photometry of globular and open clusters [Geffert *et al.* , 1995], monitoring of gravitational lenses [Sinachopoulos *et al.*, 1996] and solar system objects. Here, we present first *astrometric* applications of the camera:

The distortion has been tested by comparing observations of the open cluster NGC 2158 with the positions given in the GSC 1.2.

The use of HoLiCam for astrometry of solar system objects was tested with several observations of the comets C/1996 B1 (Szczepanski) and 29P (Schwassmann-Wachmann 1). We present results on the internal accuracy of these observations.

2. Main Technical Characteristics

HoLiCam is the successor of the WWFPP camera which has been used at Hoher List as well as at other observatories before [Reif *et al.*, 1993]. It was constructed in order to have such a type of camera permanently available at Hoher List observatory.

With a size of approx. 3 cm $\times$ 3 cm, the chip of HoLiCam contains 2048 $\times$ 2048 pixels with a pixel size of 15 μm. The focal reducing system of the telescope provides a field of $28'$ in diameter for the CCD which leads to a resolution of $0.8''$ per pixel. The effective focal length is 2.50 m. Exposures can be taken with Johnson B, V, R, I, and Hα filters.

A schematic view of HoLiCam and the focal reducer attached to the telescope is shown in fig. 1.

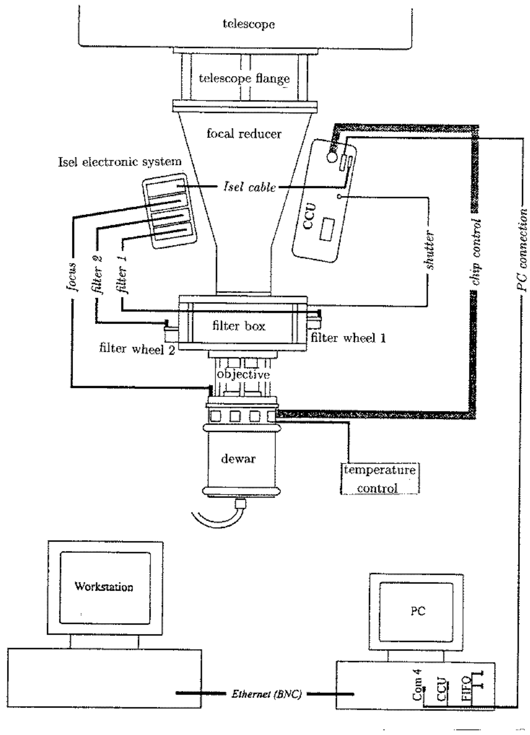

Figure 1. HoLiCam – Schematic view

3. Why Astrometry With HoLiCam?

There are important advantages for the use of a camera like HoLiCam for astrometric measurements.

The field of 28′ obtained with the use of focal reducing techniques is sufficiently large to cover enough reference stars for a proper astrometric reduction. In the examples shown below, there are at least 30 GSC stars in each frame.

Due to the high sensitivity of CCD detectors we need much shorter exposure times to reach the same limiting magnitude as with photographic plates. Faint solar system bodies then show much smaller elongation effects than in photographic data because of the minor motion of the object relative to the background stars. This may lead to a much higher accuracy in astrometric measurements.

Another advantage of CCD astrometry is the much higher dynamic range: The center of extended objects can be much better determined on an intensity-linear CCD image than on a "uniformly black" stellar image on a photographic plate.

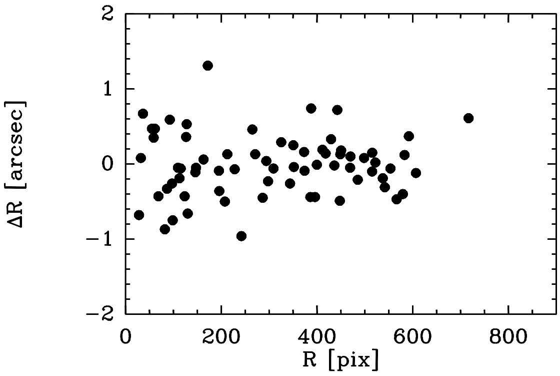

Figure 2. Distortion of HoLiCam: Positional residuals for stars in the open cluster NGC 2158 are shown as a function of the distance of the star to the center of the image. The data refer to a 60s Johnson R exposure.

4. Distortion of HoLiCam

Using exposures of the open star cluster NGC 2158, we compared the positions of about 70 stars with their positions given in the Guide Star Catalog 1.2. As an example, fig. 2 shows post fit residuals of position as a function of the radial distance of the star from the center of the frame for a 60s R exposure.

We find a mean deviation of well below $1''$, which seems to reflect the uncertainties of the GSC. There is no distortion up to a distance of about 700 Pixels (9 arcmin) from the center.

The measurement of the distortion will be improved in the future using more accurate reference catalogues.

5. Accuracy of Comet Observations

During four nights in March, 1996, we observed the comets C/1996 B1 (Szczepanski) and 29P (Schwassmann-Wachmann 1). We determined the positions of both objects [Sanner *et al.*, 1996a and 1996b] by reducing the observations to the Guide Star Catalog 1.1.

A fit of a third order polynomial of time to the coordinates of our observations leads to mean deviations of $0.3''$ which may be taken as an estimate of the internal accuracy of our observations. The deviations in α and δ are plotted in fig. 3.

According to B. Marsden (private communication) our positions deviate by less than $1''$ from the mean orbit determined from all observations of the comets. So, we may state that also the external accuracy of our measurements are very satisfactory.

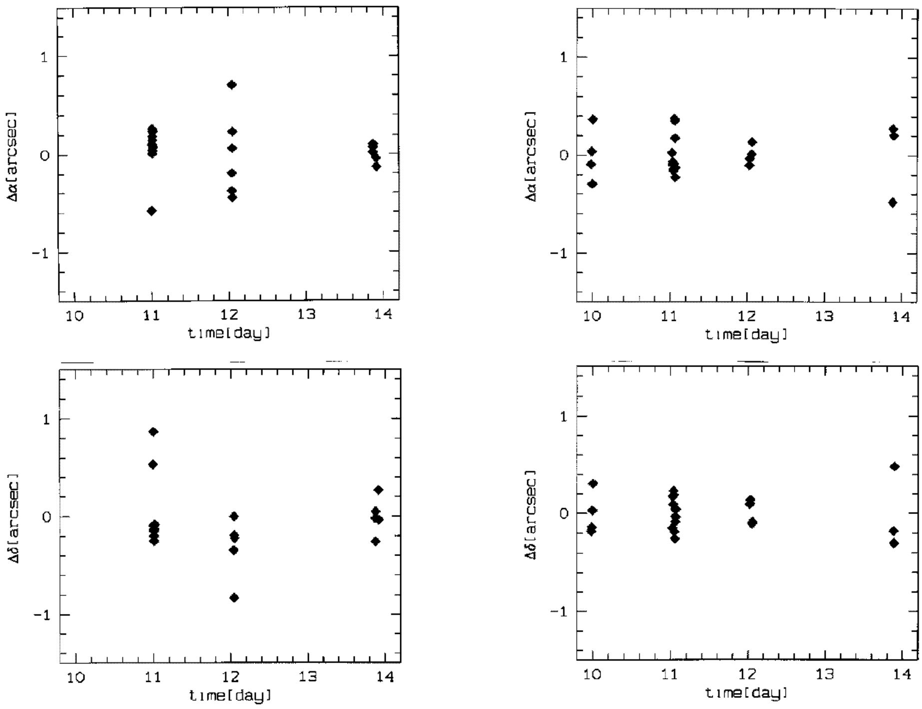

Figure 3. Accuracy of comet observations: The plots show the internal deviations of our measurements of C/1996 B1 (Szczepanski) (left) and 29P (Schwassmann-Wachmann 1) (right) in α and δ. Time is given in days from March 1, 1996.

6. Summary

HoLiCam proves to be a useful tool for the determination of positions of comets and other solar system bodies.

After more accurate tests of the distortion we plan to include HoLiCam observations also for determination of proper motions of open and globular star clusters.

References

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