From rgmr@ing.iac.esWed Feb 12 16:46:25 1997
Date: Wed, 12 Feb 1997 16:11:24 +0000 (GMT)
From: Rene Rutten <rgmr@ing.iac.es>
To: Peter Moore <pcm@ing.iac.es>
Subject: CCD TV system

Hi Peter,
here's draft version of specs I started to draw up for TV CCD sy stems.
It never got much further than that. I've also been discussion these
issues a bit with people at RGO, where they are looking into a similar
developement for Gemini. We may want to piggy-back on that.
R.

Dear all,

Stuart and I have looked at the specifications for CCD-based
TV systems which will replace the TV systems that are currently
in use at the ING. In order to write these requirements we
first assessed the performance of our current system, taking
the WHT ISIS slit-view TV as a working base line.
The new CCD TV system as described below will have a much
broader functionality than 'just' viewing the sky; the
additional possibilities will be of great benefit to observers
and allow persuing scientific objectives in their own right, or
supplement data taken with the main instruments.

This is only a first draft; comments are appreciated !

Stuart and Rene'

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Specifications for future CCD-based TV systems
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area of application of the TV systems

The future CCD-TV systems will be designed to replace the
current integrating tube TV systems. The TV syst ems are in
use at the WHT Cassegrain focus for ISIS slit viewing and
direct sky viewing, in the Nasmyth foci for UES slit viewing
and at GHRIL for sky viewing and autoguiding. At the INT TVs
are used for IDS slit viewing and in the guider telescope.
At the JKT TVs are used for sky viewing with CCD imaging, and
for slit and direct sky viewing with RBS.
Apart from the their main functionality, the TV systems are
also used for seeing measurements, collecting engineering
data, and occasionally for autoguidi ng,
This functionality, and more, has to be incorporated into the
new CCD-based TV systems.

Performance of the current TV systems

The optical quality of the existing TV systems is rather
poor. The tubes suffer from s evere distortions which renders
the images unsuitable for accurate measurement of spatial
distances for scientific and engineering purposes. The cosmetic
quality of the image is also poor due to periodic striping,
electronic interference and a non-uniform background. The TV
systems also suffer from a poor dynamic range of only 6 bits,

as measured on actual digitised images, their quantum efficiency is poor compared to CCD systems, and there is the constant risk of damage due to excessive light levels.

Apart from these fundamental problems, our systems suffer from limited functionality due to the design of their control system which renders them extremely inflexibility (e.g. try to grab, store and transfer a digitized image !). ING supports different systems on the three telescopes, which adds to the support overhead.

In spite of all these negative points, the existing TV systems do provide a working system which is fairly robust, pleasant and easy to work with, at least for the standard applications.

Performance requirements for the CCD-TV systems

sky-projected pixel size	- better than 0.2 arcsec/pixel
field-of-view	- depending on focal station
chip size	- minimum 500 x 500
dynamic range	- 10 bits, minimum of 8 bits
read noise	- better than 10 electrons
response time	- variable at least from 0.2 to 100 seconds
gain	- variable from 1 to some large number to allow use of full well capacity with dynamic range

additional requirements are:

1. real-time display of images
2. photometry on at least three user-defined sub-windows
3. automatic flat fielding (optional)
4. storage as FITS files (optional)
5. good blue response (optional)
6. on-line bias subtraction, flat fielding and masking of cosmetic defects (optional)
7. readout of any sub-window
8. on-chip binning (optionally)
9. built-in centroiding on point source
10. autoguiding on point source (integration with TCS)
11. logging of centroiding errors for engineering purposes
12. automatic positioning of an object on pre-defined CCD pixel by offsetting the telescope (integration with TCS)
13. color and range of ND filters to allow bright stars
14. safe to high light levels

Comparison of the current performance of the TV systems against CCD images taken under identical sky conditions show that a CCD-TV system should double or even tripple the S/N of stellar images. Limiting magnitudes should improve substantially (by at least one, possibly two magnitudes, depending on sky brightness). Images from a CCD-TV system will become an important tool in their own right, particularly if they can be pre-processed and archived. For instance, photometry will allow continuous measurement of important parameters such as seeing, sky transparency, and slit losses. In particular the latter will be of great benefit to all spectrophotometric work.

Hardware environment

Software environment

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