

IMPLEMENTATION OF A CONTROLLER FOR THE COLLECTION OF DIGITAL IMAGES CAPTURED BY EMCCD SENSORS

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Overview

The BTFI (Brazilian Tunable Filter Imager) is a new interferometric optical imager under development by a partnership of national (Brazilian) and international institutions that will be mounted on the SOAR telescope in Chile. The BTFI is being developed for faint source observations, and to achieve this, its detector has to work in a "rapid scanning" mode where the selected wavelength is continuously scanned.

Technique

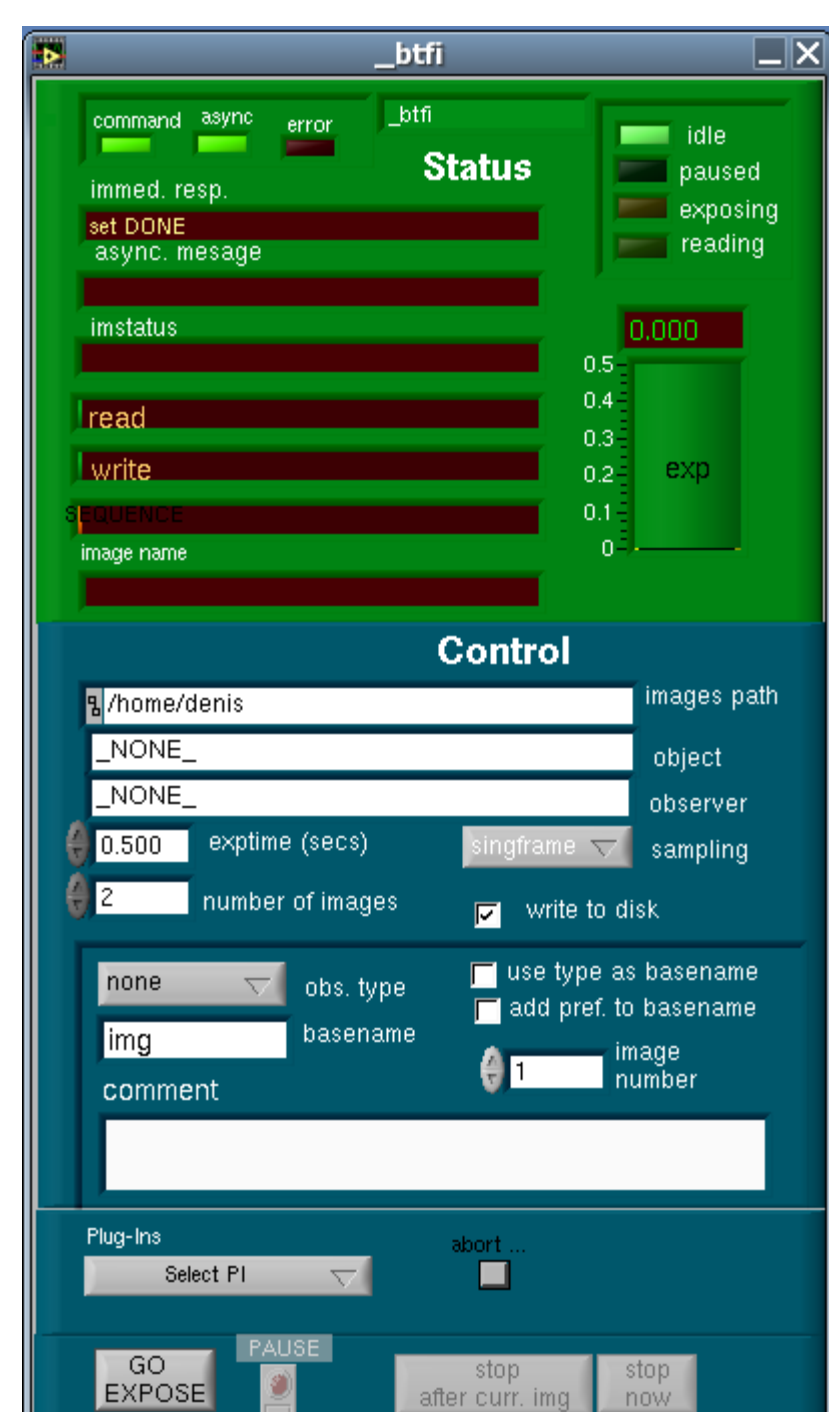
A massive 3-dimensional data-cube will be acquired and integrated into to achieve the required signal-to-noise. By using a "rapid scanning" technique, problems from atmospheric turbulence and variable extinction over long exposures will be eliminated by taking the average of all accumulated frames in the data-cube. Normal CCDs are non-optimal under these circumstances as the readout noise will dominate the noise from the target's signal. To avoid this problem, we will use a relatively new CCD technology developed and made available over the last half a decade: the EMCCD (Electron Multiplication Charged Couple Device). The main advantage of the EMCCD is that its readout noise is in effect zero in the "photo counting" mode (or PMC).

Controller

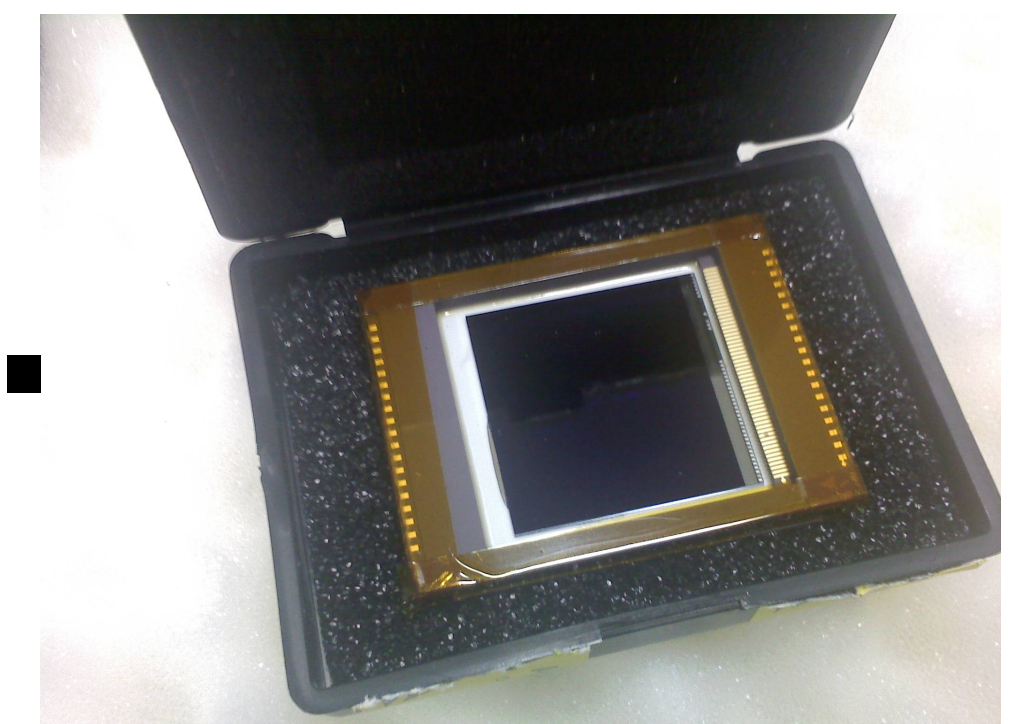
We will use a controller named the **CCCP** (CCD Controller for Counting Photons) to readout the detectors. This controller uses a new clocking architecture optimized for driving the EMCCDs at up to a 20MHz pixel rate and a fast vertical transfer. With this controller the CIC (Clock Induced Charges) noise, which is often the dominant source of noise at low flux levels and high frame rates becomes very low (0.001 - 0.0018 electron/pixel/frame), over the range of the EM gain employed. These low noise levels make the EMCCD behaves as a near-perfect photon-counting device down to very low fluxes.

Image acquisition

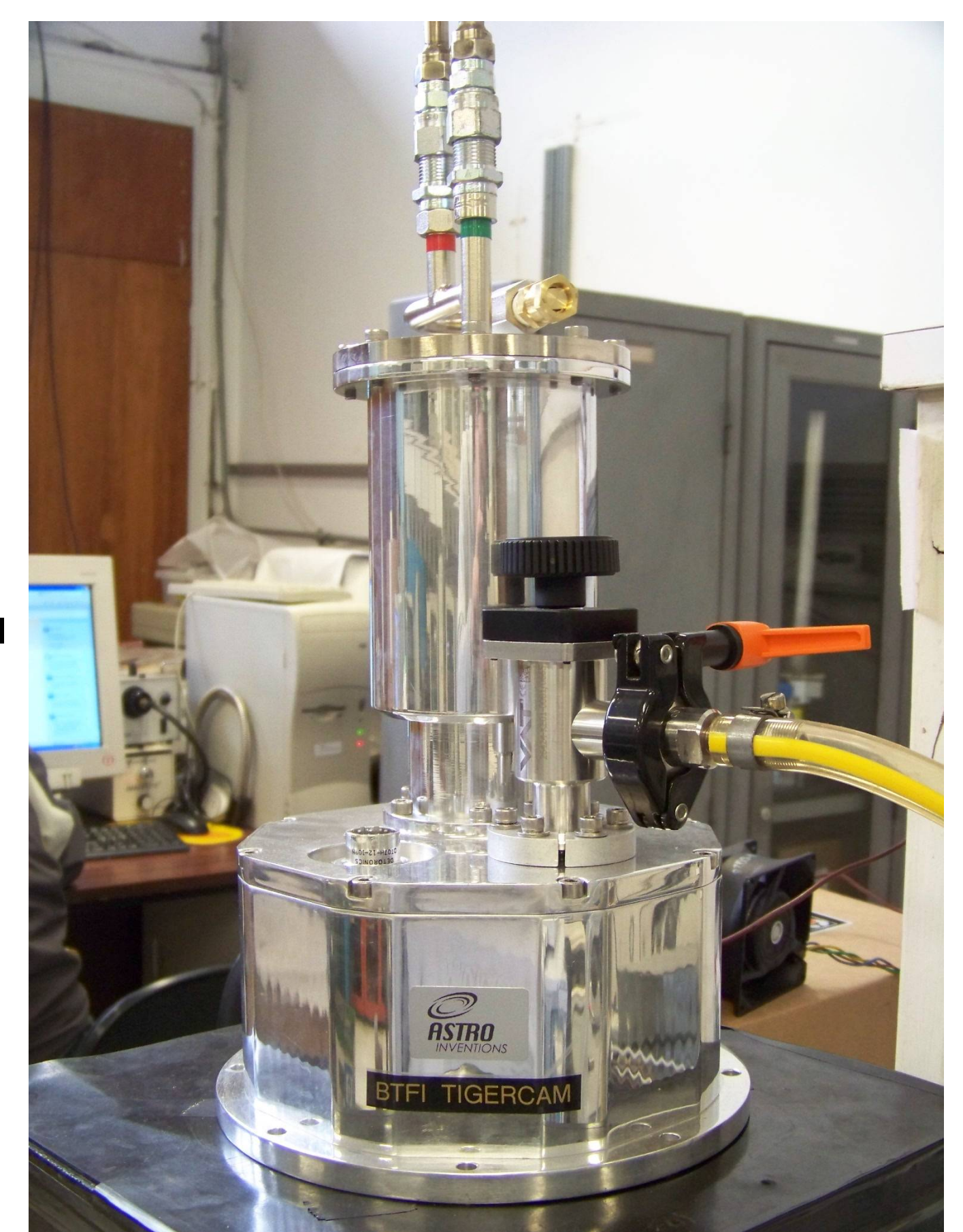
The image-taking process will be automated using a program in LabView. This program is known as PanView and was developed especially for CCD data acquisition at the SOAR observatory where BTFI is to be deployed. Panview is composed of various modules that are responsible for all steps required for acquiring images, such as communication with the controller, acquisition control, FITS file creation, image storage and communication with other instrument modules.



EMCCD
CCD207-40

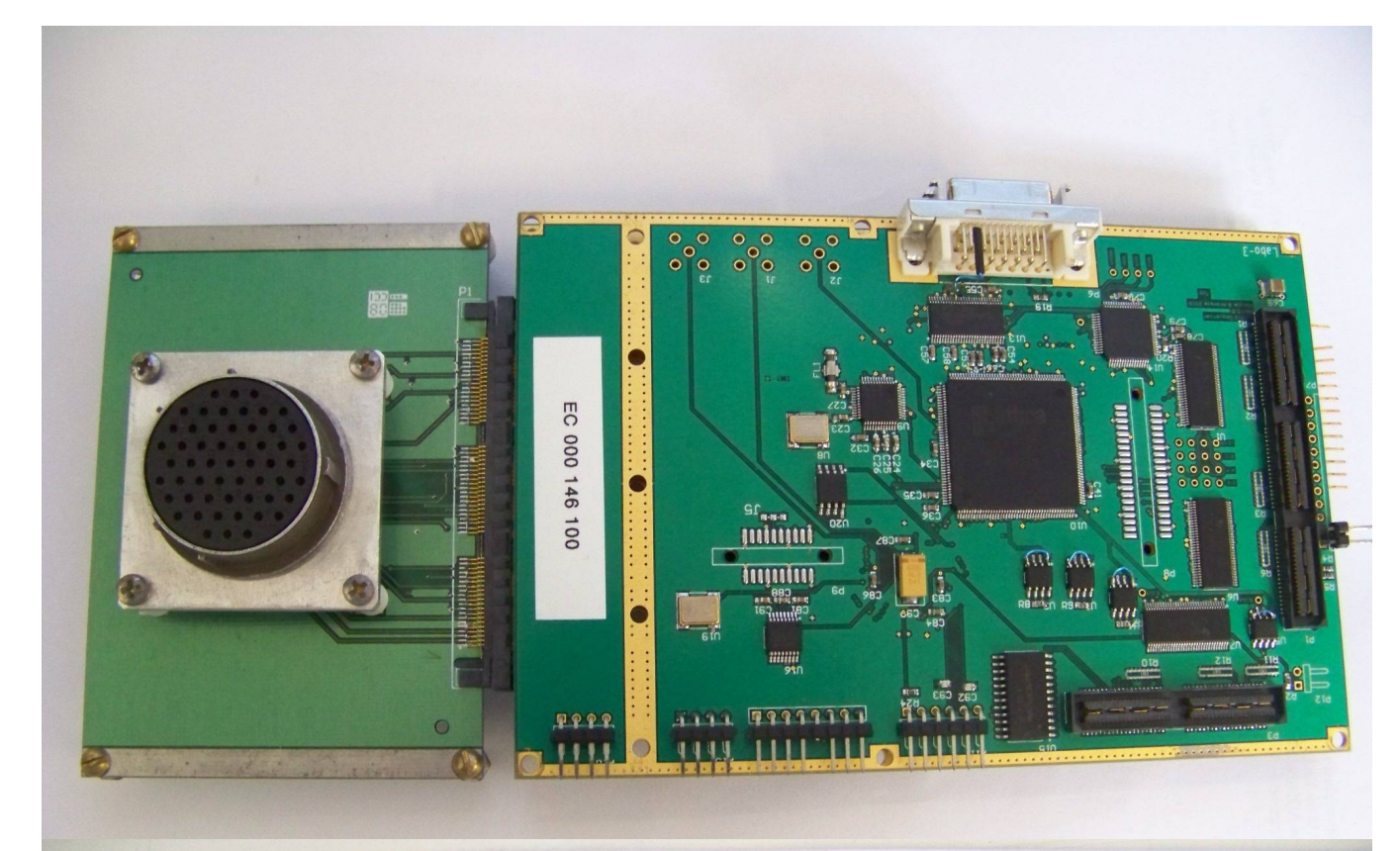


CRYOTIGER
CAMERA



CCCP
CONTROLLER

FRAME
GRABBER



PANVIEW

