The Wide Field Camera and Infrastructure

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This paper gives a brief overview of the development of the Wide Field Camera and its associated data acquisition system.

1 The Wide Field Survey Infrastructure

1.1 The Wide Field Camera

The Wide Field Camera (WFC) was originally envisaged as a system containing four 2k×2k Loral devices (Ives et al., 1996) and was commissioned in this format during May 1997. Unfortunately the Loral devices never functioned to specification, thus in 1997, it was decided to retrofit the camera with 4k×2k EEV42 devices. The large format of these involved a redesign of the mounting system within the WFC, and enabled effectively the entire field of view provided at the prime focus of the INT to be imaged. The 'new' WFC was commissioned at the INT in April 1998. Figure 1 shows the WFC.

1.2 The WFC Auto-guider

The WFC's auto-guider system, employing a Loral 2k×2k CCD operating in frame transfer mode, is mounted on the same baseplate as the science CCDs. It views the edge of the WFC field through the same filter as being employed for the observations. This has the disadvantage that guide stars may sometimes not be available in the U band. However, it does mean that the geometry of the guider with respect to the science CCDs is extremely stable, thus aiding (re) acquisition and guiding.

2 The UltraDAS

The advent of large detector arrays was a main driver towards the implementation of a more sophisticated data acquisition system (UltraDAS) to replace the legacy DAS system. This included the introduction of an interim data acquisition system that was a pre-cursor to UltraDAS (Walton et al., 1998). The UltraDAS was designed with the intention to support all ING optical and infra-red detectors, and to enable specialist modes such as high-speed photometry (Rixon et al., 2000) and was implemented at the WFC in September 1999. The UltraDAS produces FITS format files using the Multi-Extension FITS (MEF) format. This is further discussed by Walton and Rixon (2000).

2.1 UltraDAS Design

The primary concern with UltraDAS was that it enables silicon limited readout speeds. The 4×2k detectors in use at the ING are designed with maximum readout speeds of a few microsecs/pix, implying a readout time of some 30 sec for the full CCD. The HgCdTe array employed in INGRID can have frame rates of a Hz. UltraDAS delivers these readout speeds.

The UltraDAS client-server architecture (see Figure 2) was designed such as to be common for all ING detectors. However, the system is structured so as to be adaptable to meet current and possible future detector requirements. The UltraDAS commands can be called from shell scripts, as can the telescope, auto-guider and instrument commands. This facilitates semi-automated observing.

2.2 The SDSU Controllers

The detector control electronics forms the heart of the DAS. UltraDAS employs the Generation-2 detector controller from the CCD laboratory at San Diego State University (SDSU-2

Figure 1. This image shows the four EEV science CCDs in the open dewar. The square CCD to the right is the Loral CCD used for auto-guiding. Each EEV is approximately 28 mm×56 mm in size.

3 The Observing Control System

To support the implementation of the new UltraDAS and the WFC, the observing control system was updated (Walton et al., 1998). This involved modernisation of the Telescope Control System (TCS). The Instrument Control System (ICS) for the WFC includes integrated ICS and DAS functionality. All control sub-systems (e.g. the DAS, TCS, ICS for the WFC, auto-guider control, etc.) have been integrated into a unified system. The implementation allows for automated control of the WFC with the INT.

The WFC was the first instrument at the ING where the servers controlling the telescope, auto-guider, instrument and detectors all have common interfaces and can be controlled in parallel from one client-programme. This has enabled a number of observing tools to be implemented. The `SMARTFLAT` utility uses the INT's prime-focus auto-guider as an exposure meter for taking flat-field observations in twilight, whilst the `FOCUSRUN` utility is employed to determine the best telescope-focus.

4 Integration with the ING Data Management System

A key design consideration in the design of the UltraDAS was that it should be compatible with the ING's Data Management System (DMS) (Lewis & Walton, 1998). The UltraDAS is thus architecturally integrated with the DMS, ensuring that the WFC data generated is available to be pipeline processed and archived in both the ING's science (`http://archive.ast.cam.ac.uk/ingarch`) and engineering archive systems (`http://orion.roque.ing.iac.es/ing_eng`).

The processing flow of WFC data is described more fully by Greimel et al. (this issue). Their article covers the pipeline processing system developed for WFC imaging data, the 'Gigawulf' processing unit implemented to power the pipeline and the data's integration into the archiving system.

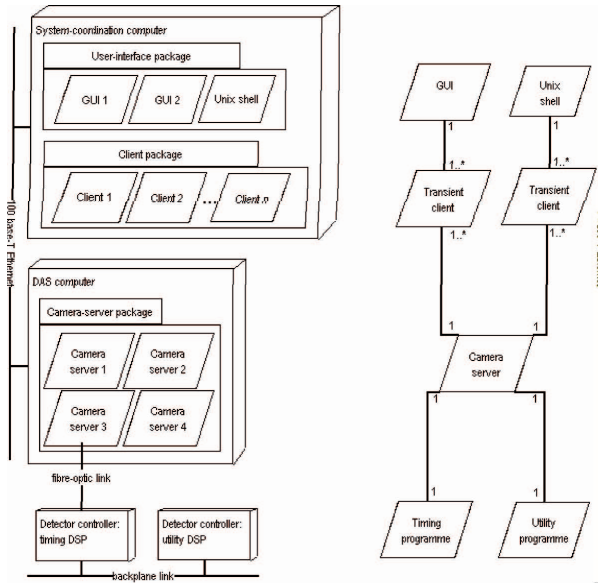

Figure 2. The left hand chart shows the WFC hardware network, whilst the right hand chart represents the UltraDAS client layering.

4.1 Quality Control

The reduced data products from the WFC have an operational benefit in addition to their scientific worth. A number of key quality control performance measures are extracted on a nightly basis from the generated object catalogues. These indicators include instrumental information such as sky brightness levels, image quality (ellipticity, FWHM of images), and throughputs from extraction of standard star fluxes and comparisons with known zero point data. An example of can be seen Wide Field Survey Release 0.1 at `http://www.ast.cam.ac.uk/~wfcsur/release.summary`. The quality indicators enable early feedback as the functional performance of the WFC.

5 Closing Remarks

The WFC is now fully operational in a stable state at the INT. Later in 2001 UltraDAS will be upgraded to run with the PCI interface cards (as opposed to the SBUS cards currently used), resulting in somewhat reduced readout overheads (the readout time will remain as now, but associated readout processing overheads will fall dramatically).

For the future, the observing scripts will be standardised, with calibration scripts, for example, offered to observers. With the move to more survey style observing, it is envisaged that routine calibration sequences will be carried out via these scripts.

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