Steve Magee, Neil O'Mahoney, Roberto Martínez, John Telting, Bart Van Venroy and Sue Worswick. ¤

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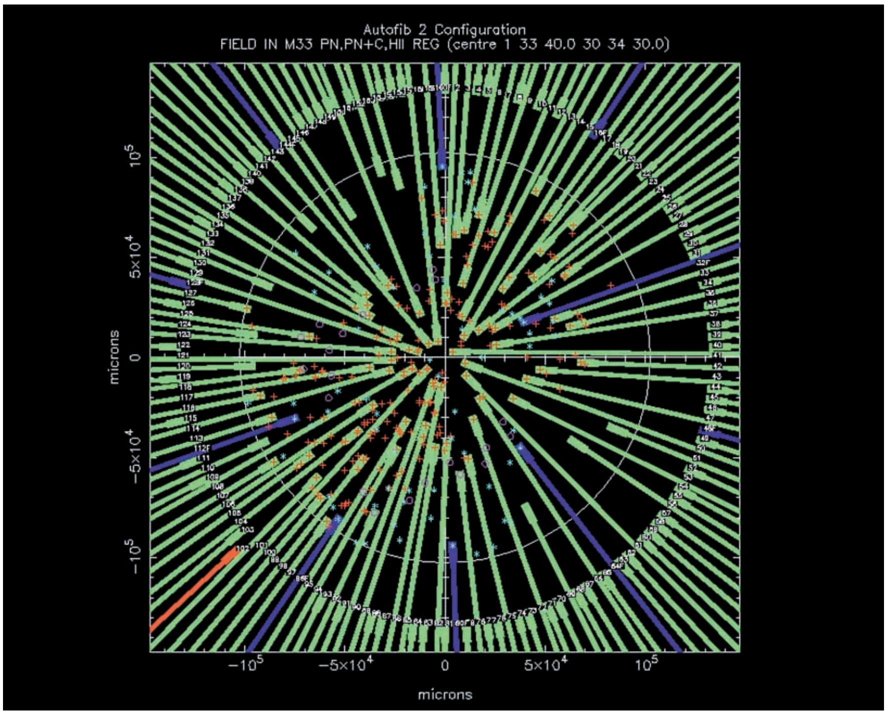

Figure 6. Example of a science fibre configuration on the nearby galaxy M33. The science fibres are shown in green (in red a fibre that was temporarily disabled), and the fiducial bundles in blue. Targets are the red crosses, while light-blue stars are fiducial stars for acquisition and guiding. The white circle shows the usable field of view (1 degree diameter).

The ING Red Sensitive CCD Project

Simon Tulloch (ING)

This project aims to improve the red sensitivity of our instruments through the use of low-fringing high-Quantum Efficiency (QE) CCDs. These are being produced by MIT Lincoln Labs for a consortium of observatories. Gerry Luppino manages the consortium at the University of Hawaii. His Company, GL Scientific, is providing CCD packages and cables. The ING commitment to the consortium is $141,000. This will give us at least three science grade devices.

The wafers will be divided and put through two different processes. The first process, called BIV, will give excellent red response but very poor blue performance. The second process, called UV or MBE, will improve the blue response whilst leaving the red response intact. The MBE process is still being developed (as of spring 2001). We have requested that our first chip be from the BIV process. This chip will be used at ISIS RED as its blue response is not important. Our subsequent chips will hopefully come from the MBE process, depending on its success. Two of these devices will be incorporated into a mosaic camera for use with WYFFOS long, UES and possibly for prime focus imaging on the WHT. If the wafer run has good yields we can expect a fourth device for use with OASIS. Additional sources are being investigated for a fourth chip should the yields from this contract be lower than expected.

CCD Characteristics

Size: 2048 × 4096 pixels
Type: CC1D20
Pixel size: 15 × 15 microns

Two outputs with a high sensitivity of 15 μV/e⁻

Fringing at 1000 nm ≤ 10%

Manufactured from 40-micron thick high-resistivity silicon

The Physics of Deep Depletion CCDs

Standard thinned CCDs are typically 15 microns thick. As the wavelength approaches 1 micron, the absorption depth of silicon increases rapidly and the CCD becomes transparent. The red sensitivity suffers accordingly. There is an additional problem, called 'fringing' which in some applications is an even more serious drawback than poor QE. As the transparency of the chip increases at longer wavelengths the CCD acts as a Fabry-Perot cavity with light reflecting back and forward between the front and rear surfaces. Interference is produced that heavily modulates the spatial uniformity and reduces the SNR of the observations. The solution is to make the CCDs thicker than the absorption depth of the silicon, incident photons will then be absorbed on their

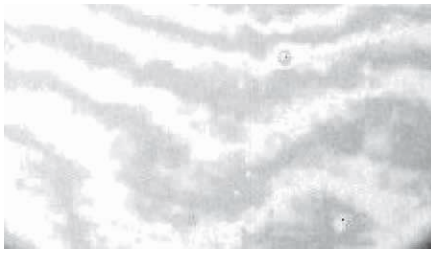

Figure 1. Image showing the effects of fringing in a thinned astronomical CCD.

first pass and reflection from the rear surface will be greatly reduced. Our CCDs will be 40 microns thick. Standard silicon cannot be used for this process since it cannot sustain the high electric field throughout the full depth of the device that is so important for good QE. Instead a special grade of high-purity high-resistivity silicon must be used.

Latest Quantum Efficiency Data

QE data is available for the BIV CCD with a broad band coating. The red response is impressive; up to three times better than a thinned EEV. QE data on the MBE (blue boosted) CCD is only available for a device with an anti-reflection coating optimised for the blue. The red response of this device is not fantastic but should approach that of the BIV, once a broad band coating is applied. Marconi have also started to produce deep depletion CCDs, and the QE of their device is shown in Figure 3.

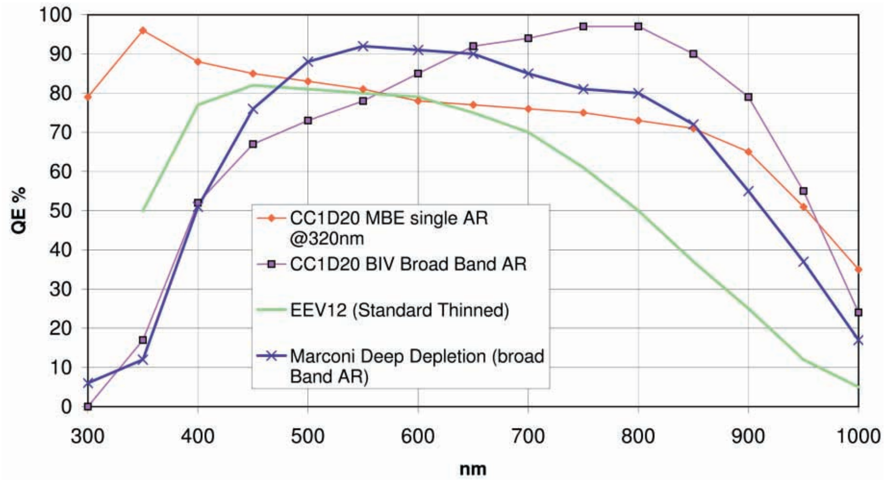

Figure 3. Quantum Efficiency comparison between current and new red CCDs.

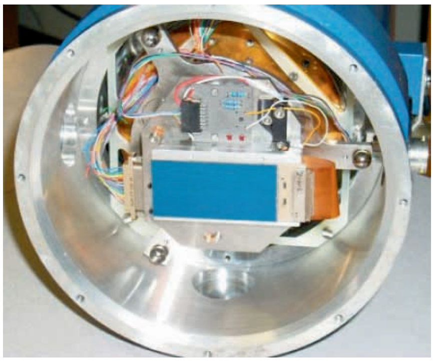

Figure 2. A photo of one of the ING cameras (with a test chip mounted) complete and awaiting the delivery of the first red CCD.

The first of the ING cameras is complete and awaiting the delivery of the first CCD. For additional information, please see the project web site : `http://www.ing.iac.es/~smt/redsense/redsense.htm` ¤

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First Results from the Rayleigh Laser Guide Star Project

Paul Clark (University of Durham)

The Restricted Conjugate Adaptive Optics project is part of the University of Durham Astronomical Instrumentation Group's rolling grant programme, funded by PPARC. The project aims to demonstrate the feasibility of using commercially available laser technology to provide a Rayleigh back-scatter laser guide star system for use with Adaptive Optics. In particular the project investigates low order AO correction over a wide field of view for use with multi-object spectroscopy on the WHT.

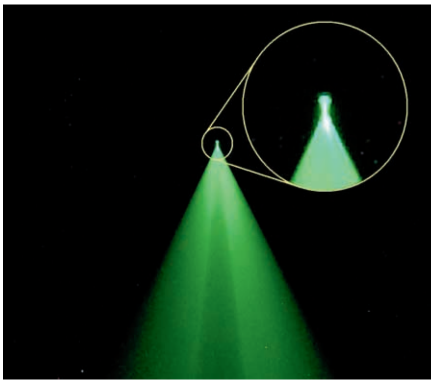

Figure 1. High power laser launch through the 30-cm f/6 launch system.

The project is ongoing with the first (Phase A) run having been completed at the Isaac Newton Group of Telescopes on La Palma during May 2001. Launch tests were conducted using both the 4.2-m William Herschel Telescope and a custom-made 30-cm f/6 launch system housed in an outbuilding adjacent to WHT.

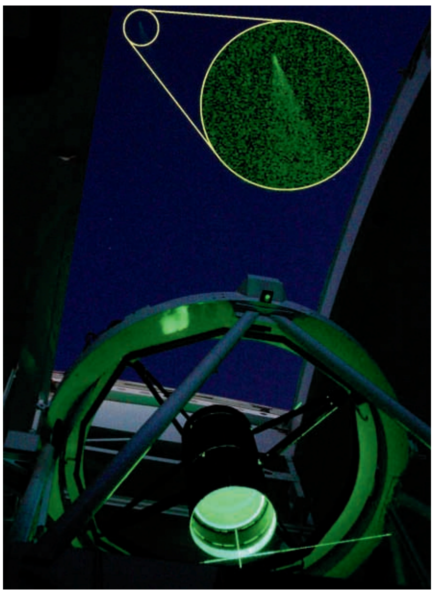

Figure 2. The laser launch through the WHT.

Figures 1 and 2 show the high power laser launch through the 30-cm f/6 launch system and the WHT. Safety considerations form a major part of the project. The laser is only operated by trained staff using protective goggles to prevent eye damage. A plane spotter is used to ensure that no harm comes to aircraft that may