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.

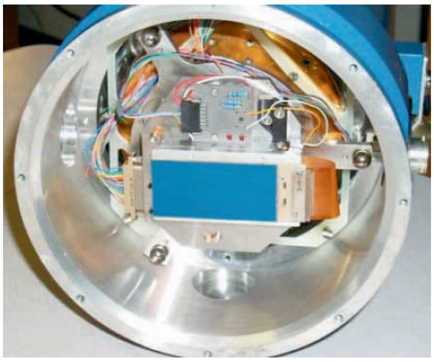

Figure 2. A photo of one of the ING cameras (with a test chip mounted) complete and awaiting the delivery of the first red CCD.

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` ¤

Simon Tulloch (smt@ing.iac.es)

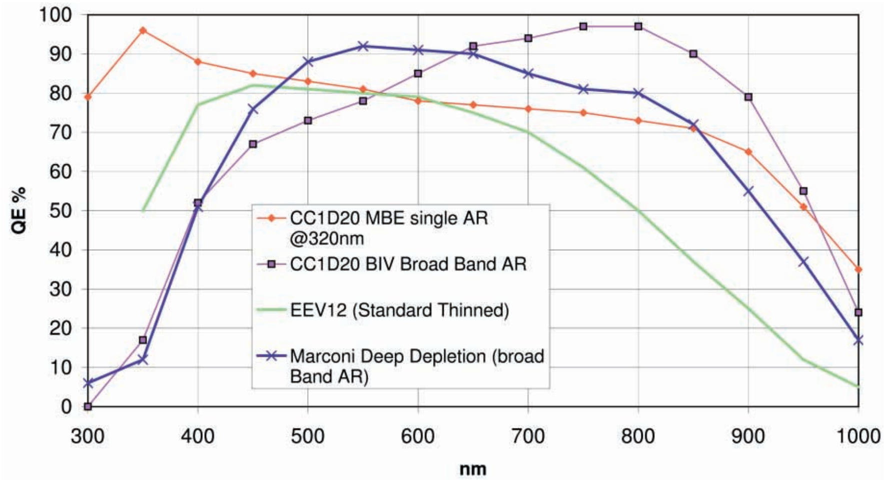

Figure 3. Quantum Efficiency comparison between current and new red CCDs.

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.

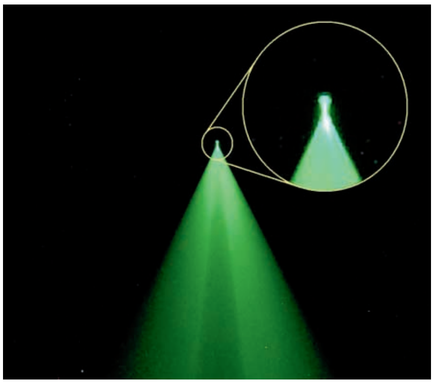

Figure 1. High power laser launch through the 30-cm f/6 launch system.

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.

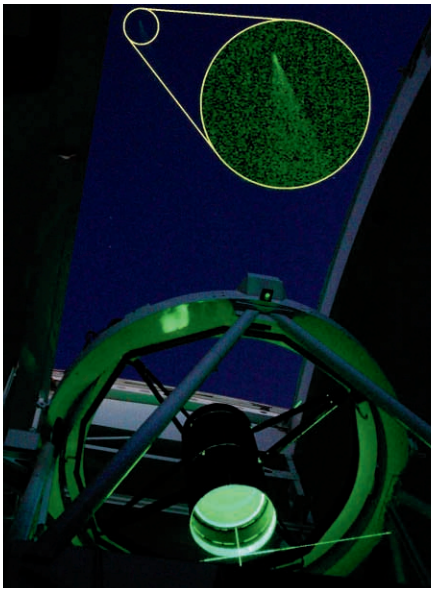

Figure 2. The laser launch through the WHT.

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 fly through the laser beam (the mountain top itself is actually a 'no fly' zone).

The 'bow tie' structure seen in Figure 1 is a result of focussing the laser at a particular altitude. The laser is actually pulsed (although the beam appears continuous to the human eye) and a high speed pockels cell shutter is used to range-gate the return pulse at the focal height. The focal spot then appears as a low altitude star which can be used to correct atmospheric turbulence with an Adaptive Optics system. The novel optical configuration used during the Phase A run is shown in Figure 3.

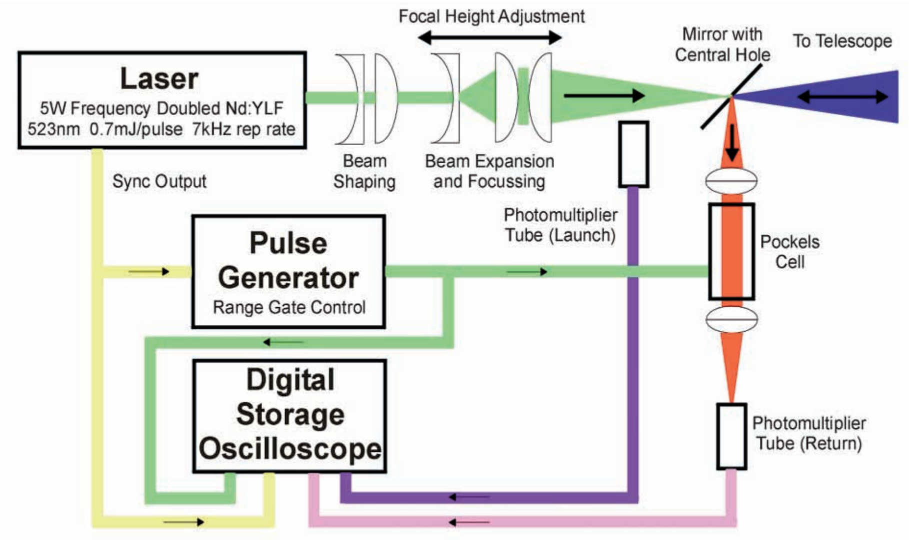

Figure 3. Optical configuration used during the Phase A run.

Fluorescence Measurement

One of the main objectives of the WHT run was to establish if fluorescence from the telescope optics would prevent return measurements during the next phase of the project. The trace in Figure 4, taken just before sunrise on May 13th using a photomultiplier tube, shows return scatter and fluorescence from the telescope optics decaying within 2.5 µs, establishing that return above 400 m should be observable without difficulty.

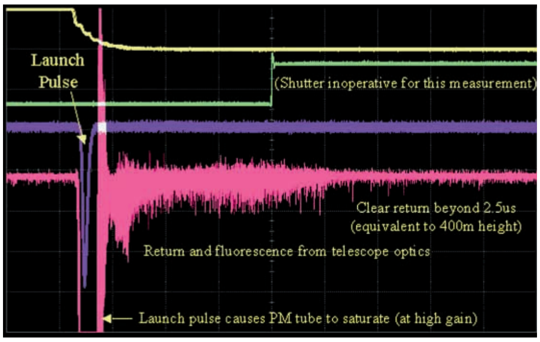

Figure 4. Fluorescence measurement.

Range-Gated Return

The range-gate pockels cell shutter was tested during the May 13th slot on the WHT. The return from differing altitudes was observed using a photomultiplier tube looking at the telescope via a 'mirror with a hole' (to separate launch and return beams — see Figure 3). The 'bow tie' structure is formed as the return passes through focus where most of the light is lost through the hole (see Figure 5). The bow tie was seen to change position as expected as the focal height was altered.

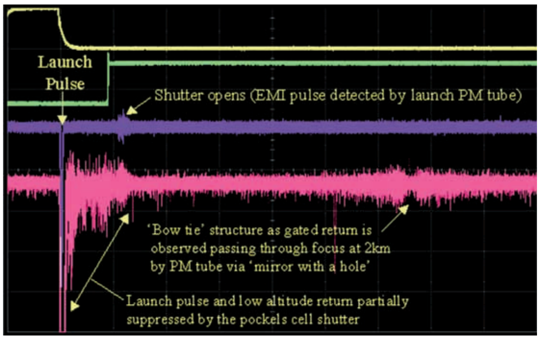

Figure 5. Range-gated return.

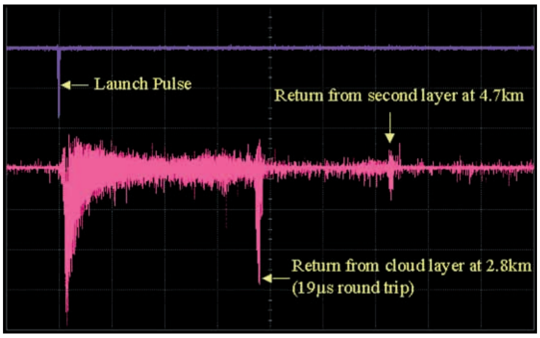

Figure 6. Cloud ceiling detection.

Cloud Ceiling Detection

An interesting by-product of the Rayleigh laser system, when used with photomultiplier return detection, is the ability to accurately resolve cloud layers above the telescope. The trace in Figure 6 was taken on May 15th using the 30-cm f/6 launch system from the LN_2 building. Two thin cloud layers at 2.8 km and 4.7 km are clearly visible. ¤

Paul Clark (paul.clark@durham.ac.uk)