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ELMER IMAGING: CHARACTERIZATION AND PERFOMANCE RESULTS FROM THE PRE-SHIPPING ACCEPTANCE TESTS

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Elmer is a multi-purpose instrument for the GTC designed for both Imaging and Spectroscopy in the visible range (365-1000 nm). Imaging will be done in a 4.2' circular Field of View (FOV), through standard SDSS broad band filters (g', r', I', and z') as well as narrow band filters (Hα broad, Hα narrow, Hβ, [OI], [OII], [OIII], [SII] broad, and [SII] narrow).

Since March 2004 to date, an exhaustive set of tests have been performed with Elmer at the Instituto the Astrofísica de Canarias. The Imaging mode is now fully characterized. Image quality has been measured in the best focus position. The EER80 values (radius of the spot that includes the 80% of the energy) are smaller than 1 pixel (15 μm) for the broad band filters and most of the narrow band filters. The distortion is less than 0.4% over the whole FOV. The plate scale is $0.194'' \pm 0.001''$ per pixel, being uniform over the whole FOV and temperature-independent. The flexure is less than 1.3 pix over 180° rotation around the optical axis in both spatial directions and in any gravity vector orientation. For each filter we have determined the fiducial positions (the center of the FOV measured in each particular filter, relative to the pointing origin of the acquisition system). The ghosts due to the filter manufacturing defects have been determined in geometry, position and relative intensity with respect to the source. The values resulting from all these tests are within the specifications and the design requirements have been successfully fulfilled.

A very comprehensive characterization of the narrow band set of Elmer filters have been also carried out to evaluate the central wavelength displacement with the incidence beam angle (that changes with the source position within the FOV). This displacement has been calibrated with real data at laboratory, obtaining maximum displacements from extreme positions in the FOV of the order of 12–15Å respect to the central wavelength of the filter. This effect will be more restrictive for the narrowest filters (those with $\Delta\lambda$=17Å). This is not the only effect to take into account, as the filter transmission is also affected by the different incidence angles. The final flux calibration shall be done during the commissioning at the telescope, by observing a bright planetary nebula with known and flux calibrated emission lines in different positions within the FOV. This will allow us to obtain a calibration map as a function of the FOV position associated to each narrow band filter.

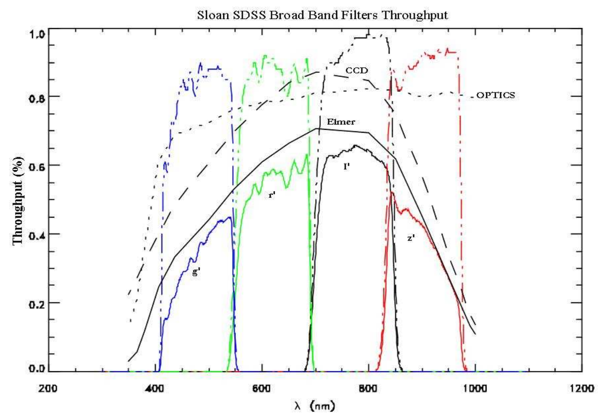

Fig. 1. Measured troughput of Elmer, taking into account the contribution of the optics, CCD and filters.

Elmer CCD is a EE2V CCD44-82 detector (2k × 4k, 15 μm/pixel). This detector has a larger surface than the one required for imaging the FOV (approximately 2k × 1k pixels in Spectroscopy and 1k × 1k in Imaging). This allows the use of some observing modes like charge shuffling and fast photometry, which use the remaining area as charge store. Having placed Elmer's FOV in the upper half of detector and using the frame-transfer capability very high duty cycles can be achieved. Furthermore, the frame-transfer capability shall be used as the standard read-out mode both in imaging and long slit spectroscopy. These fast modes open a wide range of scientific possibilities for time-resolving spectrophotometry.

More details about Elmer's characterization and performance can be seen in García-Vargas et al. (2006, Proc. SPIE, 6269, 19), and Cabrera-Lavers et al. (2007, this volume).

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