1. INTRODUCTION:
In Ophthalmology and Visual Science laser scanning devices are used for a variety of tasks including refractive surgery, corneal microscopy, photo coagulation, photo dynamic therapy, stimulation, and retinal imaging. In some of these applications the laser scanning systems have complemented or replaced traditional analogue techniques, such as CRT monitors for stimulation or film based fundus cameras for retinal imaging. On the other hand, recent technologies for instance video projectors or digital still cameras also allow for the digitization of ophthalmic equipment. In this paper a custom made, multi-purpose scanning laser ophthalmoscope (SLO) will be described and its advantageous properties compared to digital wide field systems will be highlighted.

2. INSTRUMENTATION
To reduce the risk of motion artifacts inherent to ophthalmoscopy a high frame rate of an SLO is of great importance. A pair of resonant scanners that oscillate in anti-phase to double the deflection angle makes a line scan rate of around 16 kHz possible. Typically, we use 512 lines per image which results in a frame rate of 30 Hz. Three solid state and diode lasers (532, 635, 785 nm, each of which can be modulated) for illumination and two detectors (APD, PMT) for dual-wavelength recordings are fitted into a compact set-up [1]. The maximum field of view is 20° x 20°, the focussing range – by means of a trombone - is between +15 and -15 dioptres. For the future it is envisaged to incorporate an active adaptive optics module to increase the lateral resolution from currently 6 µm to resolve single receptors (2µm) [2].

3. EXPERIMENTS
The system can run in two modes of operation. (1) In the “imager mode” of operation the laser illumination is continuous; the reflected or fluorescent light is detected, and (false) colour images are displayed. Changes in reflectivity at different wavelengths can be analysed, to extract photopigment densities (retinal densitometer). For us of particular interest are measurements of the kinetics of photopigment regeneration after intense bleaching exposures. (2) In the “stimulator mode” of operation, visible laser light is presented to the retina as a spatio-temporal pattern, by modulation of the lasers via a graphics card. The electro-retinogram (ERG) can then be recorded for stimuli of high extinction ratios and intensities.

4. CONCLUSIONS
Despite the availability of digital cameras and LCD projectors a multi-wavelength SLO remains a versatile and promising research tool in ophthalmology and visual science. In particular, the combination of the optical sectioning capability – resulting from confocal detection conditions – and the increase in resolution to cellular level – resulting from the action of an active adaptive optics sub-system – offers novel experimental possibilities unmatched by non-scanning systems.