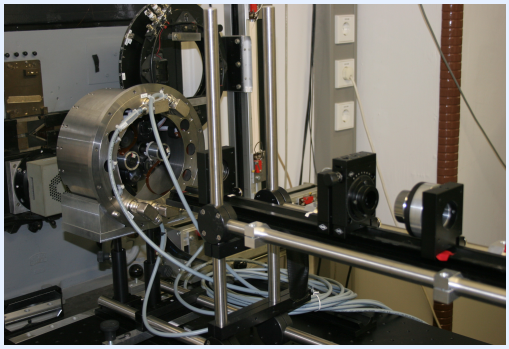
Physics of the Sun

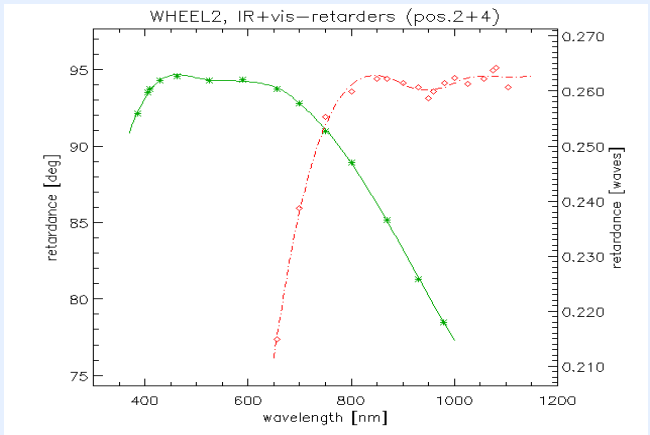
GREGOR – the calibration unit

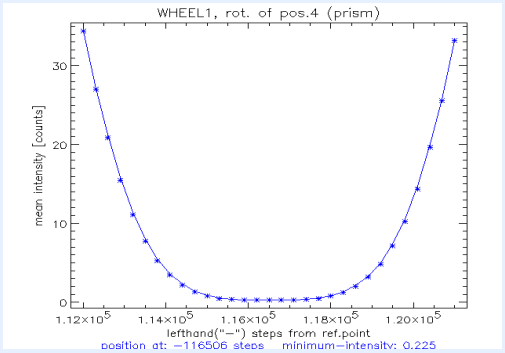
A. Hofmann, J. Rendtel, and K. Arlt

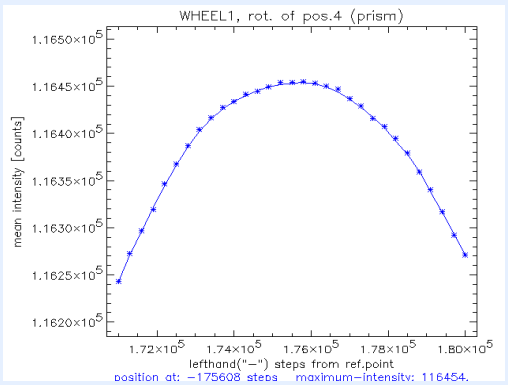
AIP



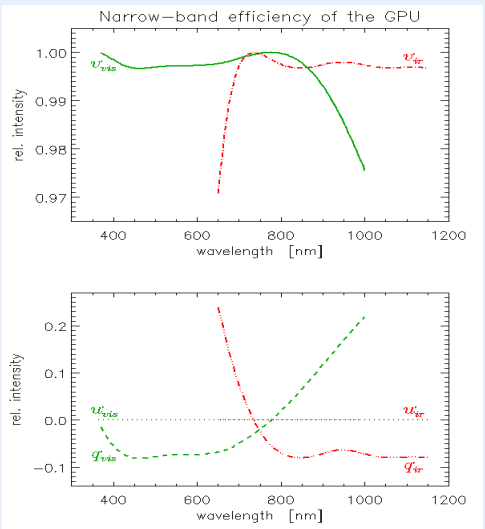
GREGOR is designed to observe small-scale dynamic magnetic structures below a size of 70 km on the Sun. with high spectral resolution and high polarimetric accuracy. For this purpose the polarimetric concept of GREGOR is based on a combination of post-focus polarimeters with a pre-focus unit for high-precision calibration. The GREGOR calibration unit was designed and built at AIP. The development of control software and an extensive program of test measurements have been performed in the Solar Observatory EinsteinTower.







The parameters of the polarimetric components were measured in numerous test series. The dispersion of the retardances of the two calibration waveplates is shown above.
From the measurement of the transmission parameters (right) of the polarizing prism we obtain an extinction ratio of ER = 1.938 ×10^{-6}.



The polarimetric throughput of the unit depends on the parameters of the individual components and is described by:

$$\text{Input} : \vec{S} = (I, Q, U, V)$$
$$\text{Output}: \vec{S}' = (I', Q', U', V') = \vec{S}'(\varphi_1, k_1, k_2, \varphi_2, \delta)$$
$$= \mathbf{G}(\varphi_2, \delta)\ \mathbf{P}(\varphi_1, k_1, k_2) \cdot \vec{S}$$

This can be used to calculate the polarimetric efficiency of the unit, which is shown for generating circular polarized light (left). The alternative use of two wave-plates ensures that it is higher than 99.7% over whole wavelength range from the visible to the infrared. Thus the calibration unit will become an essential component for high resolution spectro-polarimetry with GREGOR.