

Image slicer for 2D spectroscopy

Objective

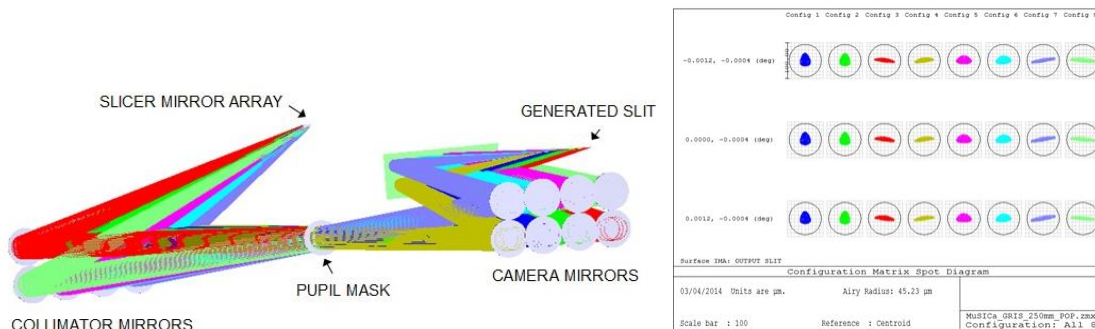
The objective is to develop a prototype of an Integral Field Unit (IFU) based on an image slicer optimized for GRIS, the infrared spectrograph of GREGOR telescope, to make solar observations and validate the concept for the EST instrumentation. The image slicer reorganizes a 2-D field of view of 24.5 arcsec² into a slit of 66.8 arcsec by 0.37 arcsec. IAC and Winlight Optics work together to define the best optical and mechanical design to produce narrow slices (of ~100 μm) and small collimator and camera mirrors (with a diameter of a few mm). The alignment of all these elements is crucial to produce a straight output long slit without aberrations.

Analysis performed

The main specifications of the IFU prototype which will be coupled to GRIS, are summarized in the following table.

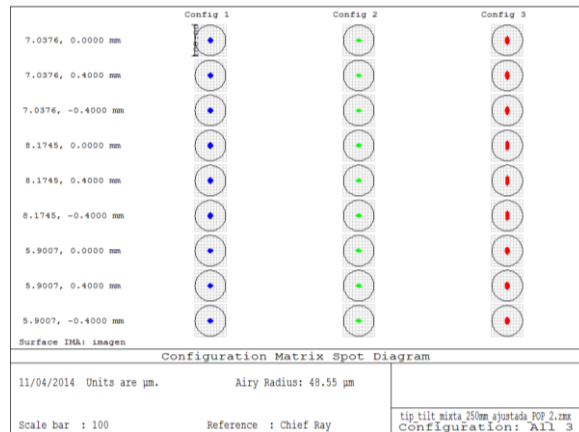
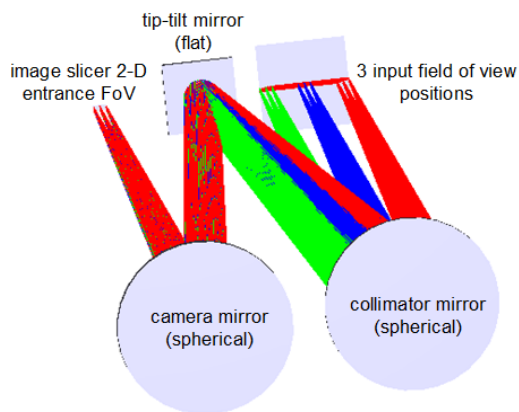
Input focal-ratio	F/39.79	Slices width	100 μm
Output focal-ratio	F/39.79	Number of output slits	1
FoV	24.5 arcsec ²	Generated slit field of view	66.8 x 0.37 arcsec ²
Number of slices	8	Optimum illumination	telecentric

The optical design is a 1:1 telecentric optical system with a focal length of 250 mm and an optical quality at diffraction limit.



Left: Zemax optical layout of the IFU. Right: Spot diagram at diffraction limit of the IFU, Each column represents a piece of the output slit.

The IFU permits to make simultaneous spectral observations in a Field of View (FoV) of 24.5 arcsec². An adequate scanning system will be provided to increase the observed area in sequential measurements. As GREGOR is already equipped of a vertical FoV scanning system centring the entrance FoV in the optical axis, a possibility under study includes an additional system for horizontal scanning with a 1:1 tip-tilt FoV scanning system.



The ZEMAX optical layout of the tip-tilt FoV scanning system presents an optical quality limited by diffraction. This FoV scanning system and the image slicer will be coupled and different geometrical distributions are being considered to fix the systems to the available space at GREGOR. Commercial elements are being considered for the tip-tilt scanning system.

Next steps

Tolerances study, straylight analysis, Physical Optics Propagation analysis (POP) and thermal analysis of the IFU are under study in contact with Winlight Optics.

Another alternative for the horizontal FoV Scanning system based on 1 folder mirror & one pair of scanning mirrors is in progress.