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WSO-UV Field Camera Unit preliminary optical layout

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Abstract. The WSO-UV space observatory, a UV-optimized 1.7 m telescope, will investigate numerous astrophysical phenomena from planetary science to cosmology. The imager instrument on WSO-UV, the Field Camera Unit (FCU), is provided by Italy: It will have three channels that cover a wide spectral range going from 115 nm to 700 nm, with imaging and spectropolarimetric capabilities. This paper describes the preliminary optical design of the 3 channels and the expected optical performances.

1. Introduction

WSO-UV is a Ritchey-Chretien 1.7m, $f/10$ aplanat telescope, with 30′ Field of View, that will fly in the next decade on a circular/geosynchronous orbit with 51.8 deg inclination. More information on the WSO-UV telescope and on its focal plane instruments can be found in Sachkov et al. (2007) and Pagano et al. (2007), respectively. For general information on the WSO-UV imagers see also the paper by Scuderi et al. in this proceeding.

2. Imaging

In the WSO-UV optical bench will be placed the Field Camera Unit, consisting of three channels that will provide imaging and spectropolarimetry capabilities in 115 – 700 nm wavelength range: the Far UV 115 – 190 nm, Near UV 150 – 280 nm, and UV Optical 200 – 700 nm. Main cameras characteristics are given in Table1: Preliminary optical design of FCU cameras has been developed. The central beam is sent to each camera through a pick-up mirror that presently can be a rotating mirror or a three-mirrors pyramid. The first solution is aberration free and allows to use the central FoV and to sequentially observe the same astronomical object with each camera without repointing the telescope. The pyramid solution allows the optimization of each camera by using mirrors with wavelength specialized coating and the parallel observation of three imagers. The three channel designs are driven by the optical requirements, the optical elements efficiency in UV range and optical bench dimensions constrains. Figure 1 shows the pre-

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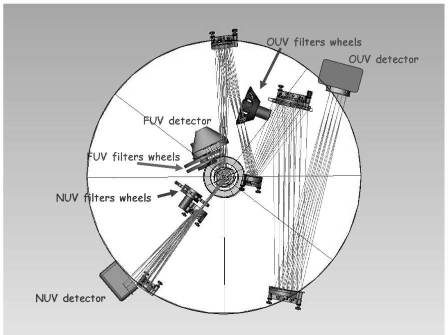

Fig. 1. Three FCU channels with the rotating mirror solution.

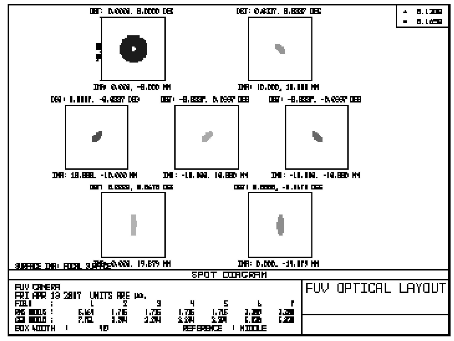

Fig. 2. Polychromatic spot diagram for each field of FUV camera. The Spot Diagram is concentrated in a box of 2x2 pixels for each field, in all FUV Field of View.

liminary optical layout and optical path ray-tracing simulation for each channel. The UVO (200-700 nm) channel preliminary layout will provide a FoV (4.6x 4.6) image on a 15 μm pixel size Charge Coupled Device (CCD) detector, via 4 reflecting mirrors. The NUV (150-280 nm) channel will provide diffraction limited image in a smaller FoV (1.0x1.0) with only two reflecting mirrors image on a 20 μm pixel size Micro Channel Plate (MCP). This channel will have spectropolarimetric capability. The FUV (115-190 nm) channel will have only the reflection from the pick-up mirror, maintaining the WSO telescope scale and providing a FoV of (6.0x 6.0). The FUV and NUV detectors are 20 mm pixel size Micro Channel Plate (MCP). Each FCU channel with ray-tracing technique has been optimized, minimizing reflection number and following the general optical requirements and constrains. The obtained performances are given in Table 1. An example of polychromatic spot diagram obtained for each field of FUV camera in Figure 2 is shown. The Spot Diagram is concentrated in a box of 2x2 pixels for each field and in all FUV Field of View.

Table 1. Main cameras data and polychromatic spot diagram diameter size in microns and energy collected in a box of 2x2 pixel for each camera detector.

CAMERA	*FUV*	NUV	UVO
Range (nm)	115-190	150-280	200-700
Pixel (µm)	20	20	15
N Pixel	2k	2k	4.096k
("/pixel)	0.2	0.03	0.07
("/mm)	12.05	1.5	4.7
F/#	10	81	26
M	1	8.1	2.6
FoV (')	6.6	1	4.6
Spot $\oslash$ (µm)	10.5	33	37
Energy $\oslash$ (%)	100	60	60

3. Conclusions

The WSO-UV project, a 1.7 m UV-optimized telescope, will investigate numerous astrophysical phenomena from planetary science to cosmology. The Field Camera Unit (FCU), is one of the focal plane instruments aboard, with three channels that cover a wide spectral range going from 115 nm to 700 nm. It will have imaging and spectropolarimetric capabilities. Preliminary optical design of the 3 channels and the optical performances in this paper have been summarized.

References

Sachkov et al.(2007), Astrophysics and Space Science Proceedings series, M. Chavez, E. Bertone, D. Rosa-Gonzalez and L. H. Rodriguez-Merino(eds.), Springer, in press

Pagano et al.(2007), Astrophysics and Space Science Proceedings series, M. Chavez, E. Bertone, D. Rosa-Gonzalez and L. H. Rodriguez-Merino(eds.), Springer, in press