MEGARA Fiber Bundles

Multi Espectrógrafo en GTC de Alta Resolución para Astronomía

Pérez-Calpena, A.[1], Sánchez-Blanco. E.[1], García-Vargas, M.L.[1], Gil de Paz, A.[2], Arrillaga X.[3], Aube, H.[4], Martínez-Delgado, I.[1], Gallego, J.[2], Carrasco E.[5], Sánchez, F.M.[6], Vílchez, J.M.[7], Iglesias, J.[7] & MEGARA Team

[1]FRACTAL SLNE (Madrid, Spain), [2]UCM (Madrid, Spain) , [3]AVS (Guipuzkoa, Spain), [4]SEDI (Paris, France), [5]INAOE (Puebla, México), [6]UPM (Madrid, Spain), [7]IAA (Granada, Spain)

Abstract

MEGARA is the future optical Integral Field Unit (IFU) and Multi-Object Spectrograph (MOS) for the 10.4-m Gran Telescopio CANARIAS (GTC). This poster summarizes the design of the MEGARA Fiber Bundles, from the GTC focal plane, to the entrance at the spectrograph pseudo-slits. MEGARA passed the Optics Detailed Design Review in May 2013 organized by GRANTECAN. The poster summarizes also the prototypes that are being tested at laboratory and the strategy of the installation at the GTC.

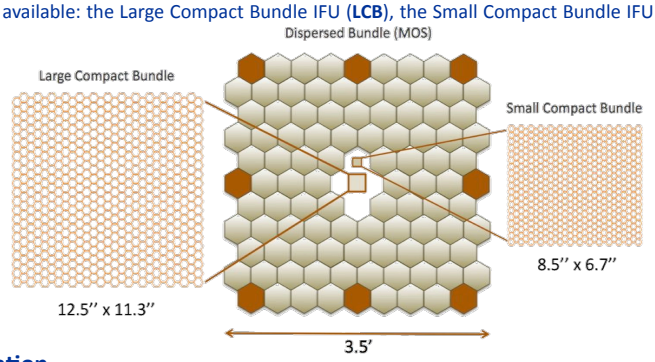
MEGARA modes: Fibers arrangement at the Folded Cassegrain Focal Station

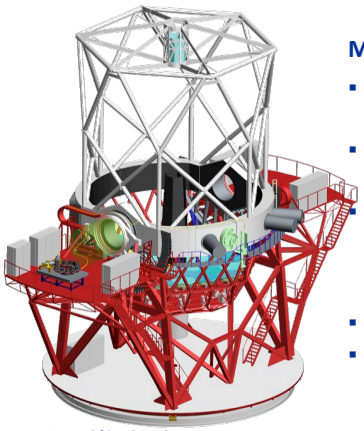
MEGARA shall provide three different modes, which corresponds with the three fiber bundles available: the Large Compact Bundle IFU (**LCB**), the Small Compact Bundle IFU (**SCB**) and the Multi-Object Spectrograph (**MOS**) mode (also called the Dispersed mode).

The **LCB** is composed by **567 fibers of 100 µm** core displayed on a square area of about **12.5'' x 11.3''** near the optical axis of the instrument **plus 8 positioner robots** (orange hexagons in the figure) located in the outer edge of the instrument FOV used for measuring the sky background simultaneously with the observations with the LCB.

The **SCB** is composed by **500 fibers of 70 µm** core distributed in a square image area of **8.5'' x 6.7''**, whose center is offset approximately 19' from the center of the LCB.

The fibers belonging to **MOS** mode are in total **644 fibers of 100 µm** core and can be positioned anywhere in the central **3.5' x 3.5'** around the two IFU bundles thanks to the positioner robots, which support a **minibundle of 7 fibers each (1.6''** in diameter**)**.

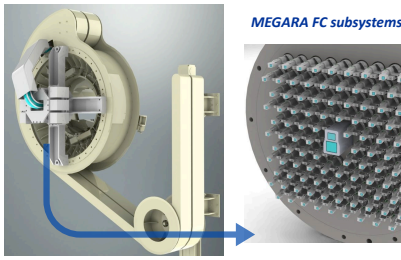




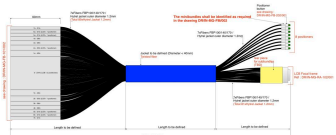
Estimated fiber length is 32 m

MEGARA at the Folded Cassegrain Focal Station

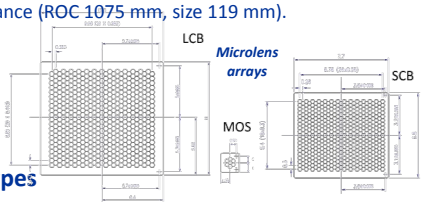
- The **field lens** shall correct the lack of telecentricity of the GTC focal station providing a field curvature below 0.1'' in the whole FOV.
- The **focal plane cover** shall allow to occult part of the fibers (LCB and MOS) for performing null-cross-talk observations.
- The 2D refractive **microlens arrays** shall couple the science light at the telescope focal plane into the fibers, defining the FOV and adapting F# from f/17 to f/3 to minimize FRD. The spaxel size shall be fixed to 0.62'' for LCB and MOS and 0.42'' for SCB.
- **Fibers cables** are FBP 100/140/170 and FBP 70/140/170 from Polymicro.
- The **Fiber MOS** shall consist of 100 robotic positioners (8 of them for LCB sky subtraction). Each fiber minibundle patrols a circular area of diameter Ø23.21 mm thanks to the two rotations provided by the positioner robot.
- Finally, the fibers of each bundle shall be arranged in a row at the **pseudo-slit**, which shall be divided in boxes to simulate the focal plane curvature at the spectrograph entrance (ROC 1075 mm, size 119 mm).

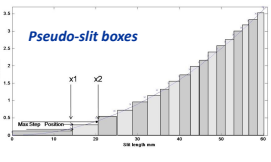


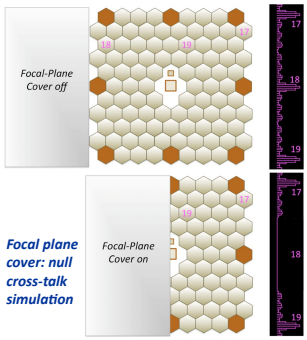
MEGARA FC subsystems



LCB fiber bundle schematic from the focal plane to the pseudo-slit





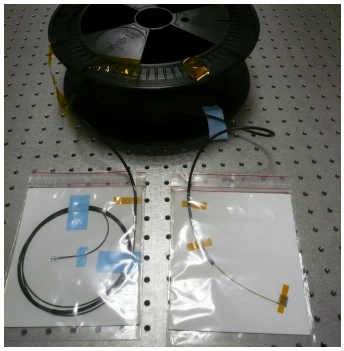


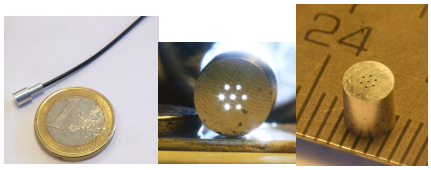
Focal plane cover: null cross-talk simulation

Fiber MOS and Fiber bundles prototypes

Two prototypes have been manufactured during the preliminary design: the Fiber bundle prototype and the Fiber MOS positioner prototype. In both prototypes the fiber link is 40 m to simulate the most pessimistic estimated length (at PDR) at GTC (between Folded Cassegrain focus and the Spectrograph location).

The Fiber Bundle prototype includes a minibundle of 7 fibers. This prototype ends on one side (the Folded Cassegrain Focal Station end) by a standalone positioner button (without the positioner) over which the microlens array shall be mounted and, on the other side (the spectrograph position), by a replica of a pseudo slit box.

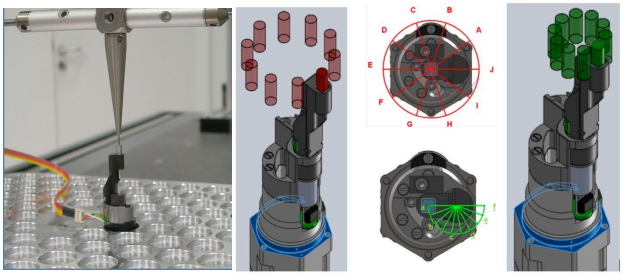




This prototype will be used to carry out several optical tests, as FDR measurements, in order to check the real optical behaviour of the entier fiber system (fibers and microlenses). These tests will be performed at LICA laboratory at the Complutense University (LICA-UCM). We have also proposed to integrate this prototype at GTC in order to repeat these measurements on the GTC when F/C rotator will be installed.

The Fiber MOS positioner prototype includes a complete Fiber MOS positioner and the 7-fiber minibundle attached to the positioner.. The positioner was designed and manufactured at AVS and then was sent to SEDI, where the fiber minibundle was integrated.

Geometrical tests have been carried out to determine the behavior of both rotations (R1 and R2) concluding that the positioner prototype achieves the requirements and provides high repeatability and high positioning accuracy.



Follow us at:
http://guaix.fis.ucm.es/megara
megara_project

CONSORTIUM

Participating companies