2° Forum della Ricerca Sperimentale e Tecnologica

FERRET:

Focal planE laboratory for tElescope opTics

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INTRODUCTION

The FERRET Team activity consists on the design, development, testing and validation of opto-mechanical, opto-electronic systems and the control and analysis software for ground-based and space instruments in the spectral band from 300 to 2500 nm.

THE MAIN RESEARCH PROJECTS of the recent years:

GIANO

Design, development, commissioning (AIV/AIT) of the high spectral resolution 900-2400 nm infrared spectrograph GIANO (R=55000), currently in use at the Galileo National Telescope

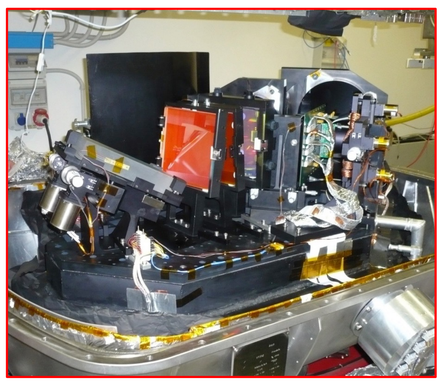
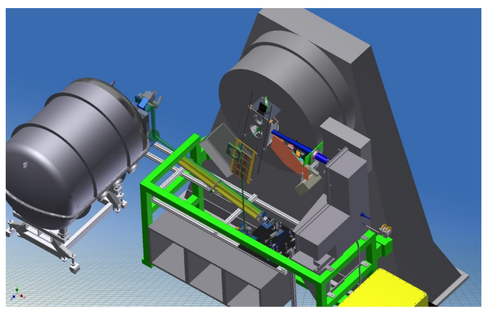


Fig.1: Lateral View of GIANO spectrograph

GIARPS@TNG:

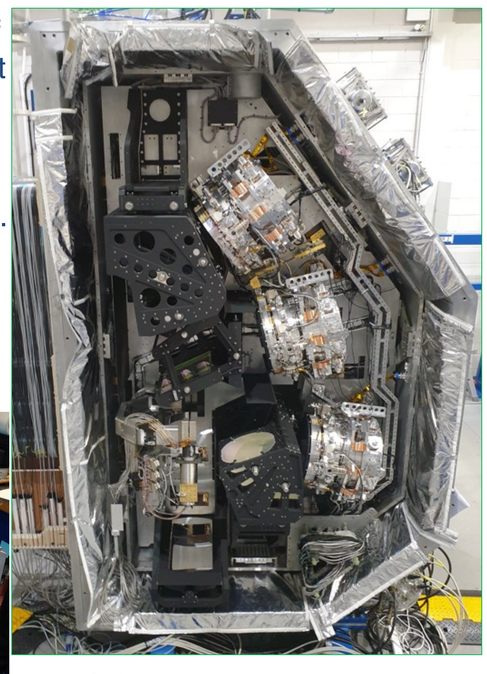
Fig.2: Mechanical solution for the housing of GIANO (left side) in Nasmyth B working in parallel with HARPS-N



MOONS

Design construction and commissioning (AIV/AIT) of some components of MOONS, the Multi-object optical and near-IR spectrograph for ESO-VLT: in particular, the collimator, the dichroic group and the two movement and alignment systems of the RI and H dispersers, 400 kg of opto-mechanics able to operate at 90K [4].

Fig.3: Internal View of MOONS. The cryostat houses the 3 arms spectrographs.
It weights 7 tons and is cooled at 130K.



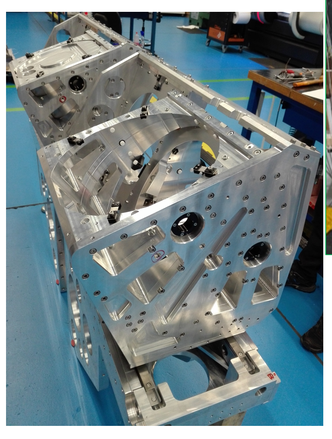


Fig.4: Interchange mechanism for the High and Low resolution gratings during manufacturing phase at ADS International.

ARIEL

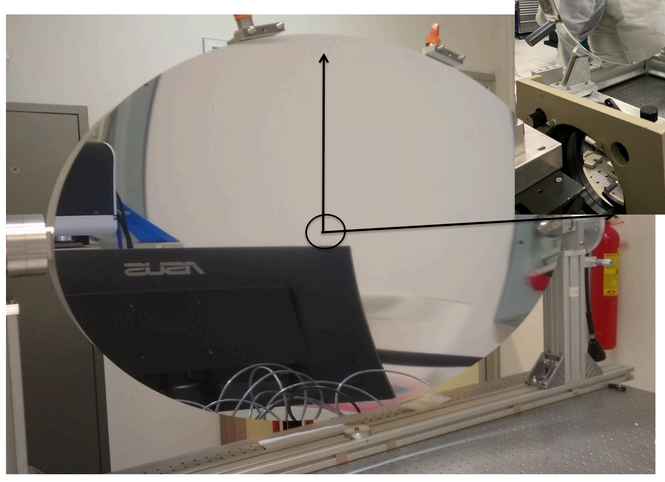
ARIEL is an ESA Medium Size mission devoted to the study of exoplanets atmospheres. Its key technological aspect is the fact that all the telescope mirrors are entirely made of aluminum at a working temperature of 50 K.

Due to the high degree of innovation and risk of the implementation (see [1] and [2]), the Design Authority remained with the team headed by INAF, which continues the Research & Development activity on some critical parts of the telescope, mainly the Primary Mirror M1 with its mechanical support, and the M2-M4 mirrors.

Given the expertise present in FERRET in building infrared and cryogenics instruments, Arcetri plays a pivotal role for the success of the mission. Important activities:

- **Thermal and Interferometric Tests on M1 SM model:**

Fig.5: M1 SM model and BB mirrors under test in the FERRET laboratory at Arcetri.



Thermal tests on the first BB mirrors and, currently, interferometric tests on the M1 SM model to experimentally measure the gravity deformation on M1 (see Fig. and Picchi P. poster on this topic).

- **Modelling the thermal contact between M1 and Flexure Hinges,** the mechanical support that let sustain M1 on the optical bench.
- **Test campaign on samples in vacuum** to update the models and strongly reduce the preloads. This activity will be entirely done at the cryogenic lab in Arcetri.
- **ARIEL STOP analysis** is carried out by the FERRET team, crucial to model and evaluate the telescope performances in all the relevant scenarios [5].

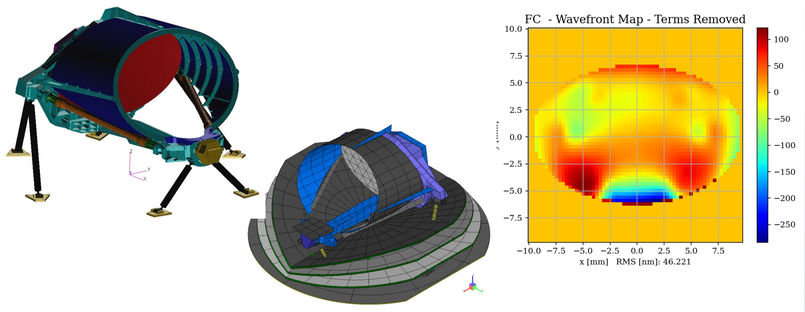


Fig.6: Different steps of the STOP Analysis: FeM model (Left), Thermal Model (center), Full compensated WFS maps (Right).

ANDES

The optical-infrared High Resolution Spectrograph **ANDES** (ArmazoNes high Dispersion Echelle Spectrograph) is included in the first generation of the ESO-ELT instruments. The FERRET Team is responsible of [3,6]:

- **THE FIBER-LINK (FL) SUBSYSTEM:**

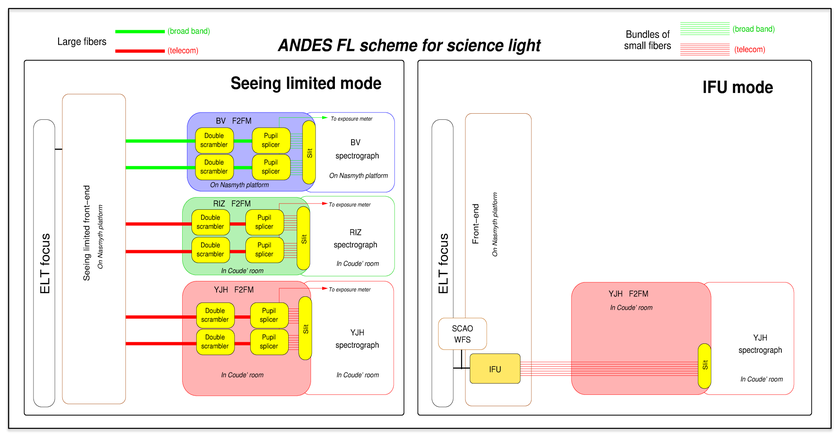


Fig.7: Block scheme with the optical FL modules for the baseline observing modes.

- **THE IFU FRONT-END:**

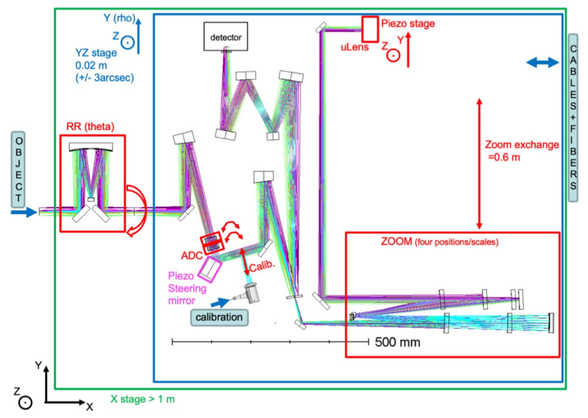


Fig.8: The IFU Front-End module with the axis movements.

Design Activity:

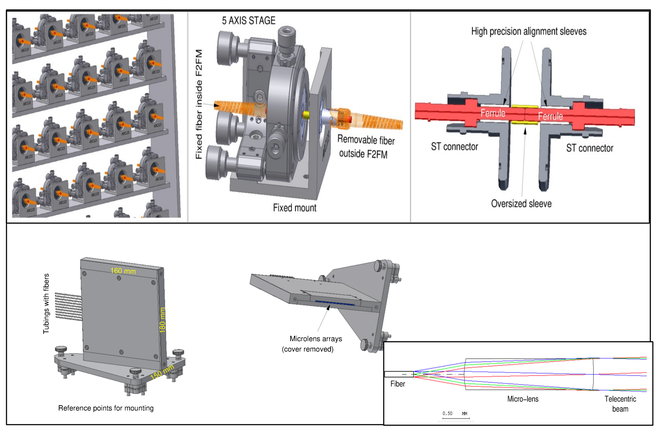


Fig.9: Top: Design of the fiber-mating connectors. Bottom: Fiber views at the input focal plane of each spectrometer. Bottom right: Micro-lenses optical layout.

Laboratory Activity:

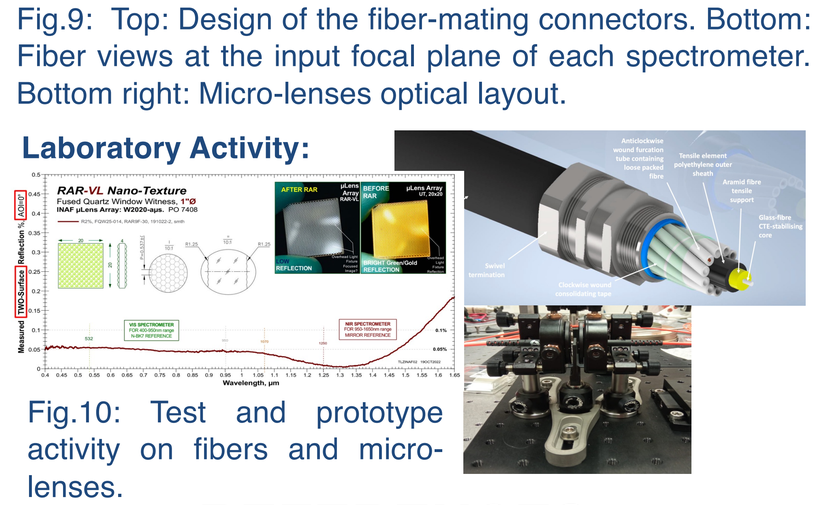


Fig.10: Test and prototype activity on fibers and micro-lenses.

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5. Brucalassi, A. et al., "ARIEL payload STOP analysis: a view on the in-flight operational cases for the telescope assembly", Proc. SPIE 13092; https://doi.org/10.1117/12.3019257.
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