



Mid-infrared ELT Imager & Spectrograph



METIS Overview

METIS (Mid-infrared ELT Imager & Spectrograph) is one of the first-generation ELT instruments. The instrument consists of a high contrast imager and a spectrograph. It is fully encased in a cryogenic environment to achieve good performances at mid-IR wavelengths (3 - 13 μ m regime). METIS is also capable of conducting low to high resolution spectroscopic (R ~ a few hundred to 100,000) observations. Furthermore, METIS focuses on the adaptive optics capability to deliver high contrast imaging which is critical for the exoplanet studies.

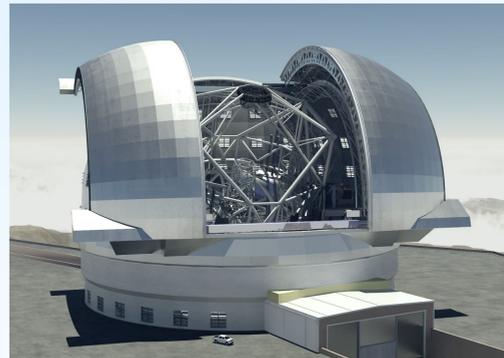
Contribution from ASIAA

ASIAA is a member of METIS consortium and mainly contribute in four areas:

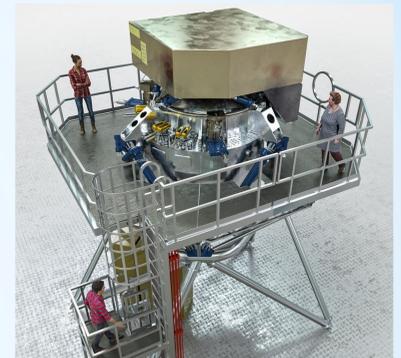
1. Development of chopper control system.
2. Development of optics wheels.
3. Develop the supporting equipment for the METIS system assembling, integration, and verification supporting equipment.
4. Development of data processing pipeline and simulation software with the Austria team.

The collaboration

The investment in METIS of ASIAA include the hardware and manpower. The contribution is around 7.5%. In return, ASIAA scientists can join the METIS science team which will generate the plan for the METIS GTO time (in total 68 nights). This will allow ASIAA members to use the ELT for the studies of star formation, planetary disk and planet formation, galactic center physics, AGNs and extragalactic science.



The ELT model, the height of telescope enclosure is ~74m, diameter on the ground is ~86m.



The METIS model: the instrument is ~4m high, the service platform is also ~4m high above the ground.

METIS Consortium

The METIS consortium is mainly composed of 10 European institutes. In addition, University of Michigan and ASIAA are partners outside of Europe.



Status of the technical development

Chopper Development

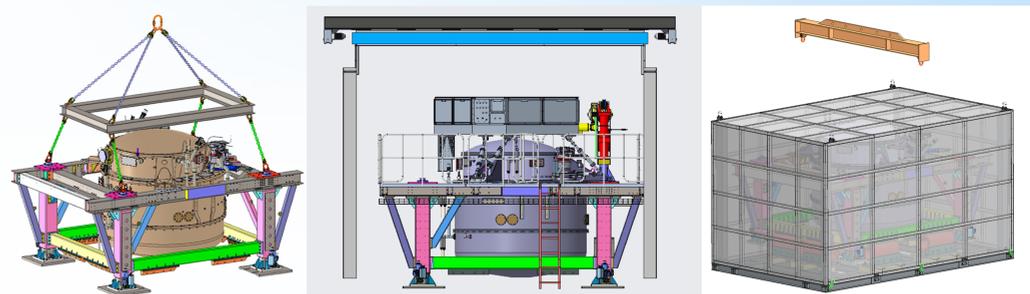
ASIAA is in charge of the development of the chopper control algorithm. In METIS the chopper shall provide stable chopping movement to have good background subtraction. The chopper movement is required be stable after 8ms with an accuracy of 6.5 arcsec and a chopping frequency of 0.1 - 2 Hz. The chopping algorithm has been developed under simulation platform. We are trying to implement the algorithm to the actual chopper and eventually do the verification inside a cryogenic chamber.



Prototype of the chopper. The mirror inside the red circle can do piston move or tilt to chop among fields

Supporting Equipment for AIV

ASIAA is in charge of the design, integration and fabrication of METIS AIV supporting equipment such as the Assembly Supporting Frame, the clean tent, the assembly lifting platform and the transportation box. Currently the clean tent is under fabrication and will be delivered to ETH in Jan. 2024. The ASF has passed the manufacturing review and will be fabricated soon.

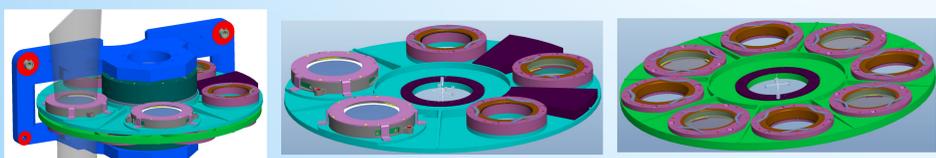


Left panel shows the ASF overview; the middle panel shows the clean tent covering the ASF. The right panel shows the design of the transportation box.

METIS Optics Wheels

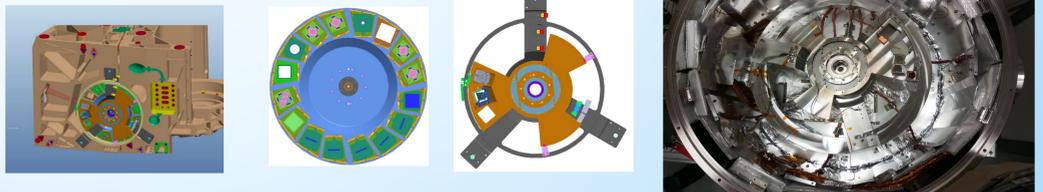
ASIAA is in charge of the design, integration and verification of two wheel systems in METIS. One is the pupil plane 1 (PP1) wheel and the other one is the focal plane 2 (FP2) wheel. PP1 wheel has two layers, one layer carries varies of masks and the other one mainly carries the ADCs; FP2 wheel also contains two layers. One layer carries slits with different widths and masks with different shapes/functionalities (such as vortex phase masks and Lyot stop masks). The other layer mainly carries the pick-off mirror/beam splitter to the spectrograph. The challenges come from the tight repeatability and alignment accuracy at 60K. Currently we have completed the design of both wheels and are undergoing the manufacturing review for FP2 wheel.

PP1 Wheel



Left: PP1 wheel overview. Middle: the upper wheel which contains ADCs and two other masks. Dark purple blocks are counter weights for balancing. Right: the lower wheel which mainly carries different sizes and shapes of masks.

FP2 Wheel



Left: FP2 wheel installed on main cold structure; Middle: two panel shows the FP2 wheel and LMS pick-off wheel, respectively. Right: prototype of LMS pick-off wheel. It has been verified to satisfy the system requirement of lateral shift < +/- 10 μ m and tilt < +/- 10 arcsec.