2° Forum della Ricerca Sperimentale e Tecnologica

MICADO PSF-R: an insight on the telemetry data volume

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GOAL:

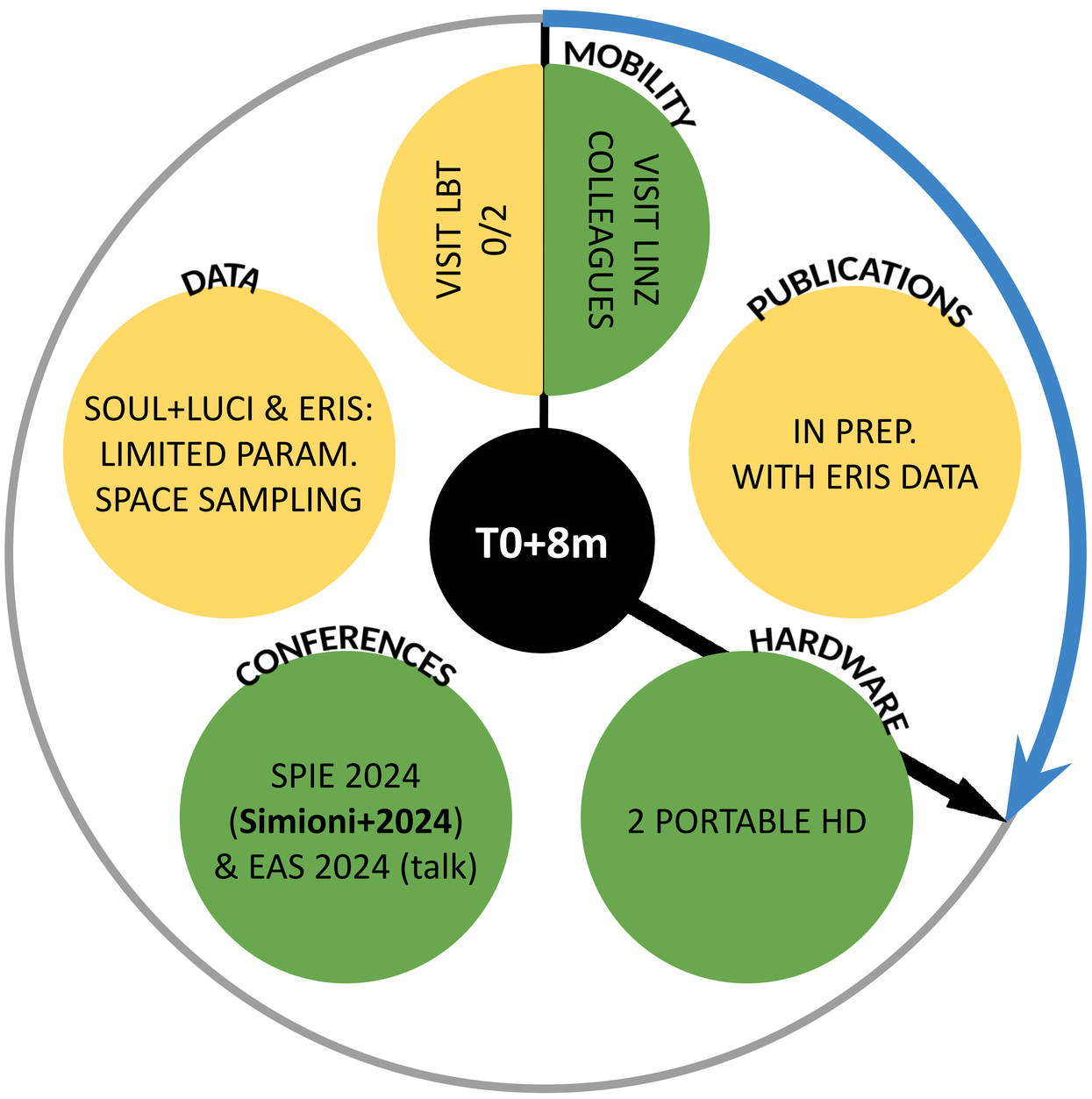
To **promote professional growth and gain specific AO expertise**.
The proposed research will focus on the **characterization of the AO telemetry data volume** needed for the **MICADO PSF reconstruction** (PSF-R) method (Wagner+2018; Simioni+2022; Wagner+2023).
Two aspects will be critical in achieving the proposed goals:

1. **hands-on experience** with current AO facilities; that will provide experience in calibrating instrument response and real data to work with.
2. **direct interaction** with the colleagues that are implementing the PSF-R software; this will ensure an insight into the PSF-R tools

KEY ACTIVITIES:

- refinement of a suitable strategy for data acquisition;
- hands-on experience in the use of SCAO instruments;
- **collection suitable set of observations**, correlated by synchronous AO telemetry;
- direct interaction with the colleagues in Linz that are currently working on the development of PSF-R algorithm for AO instrument.

STATUS OF THE PROJECT:



BUDGET:

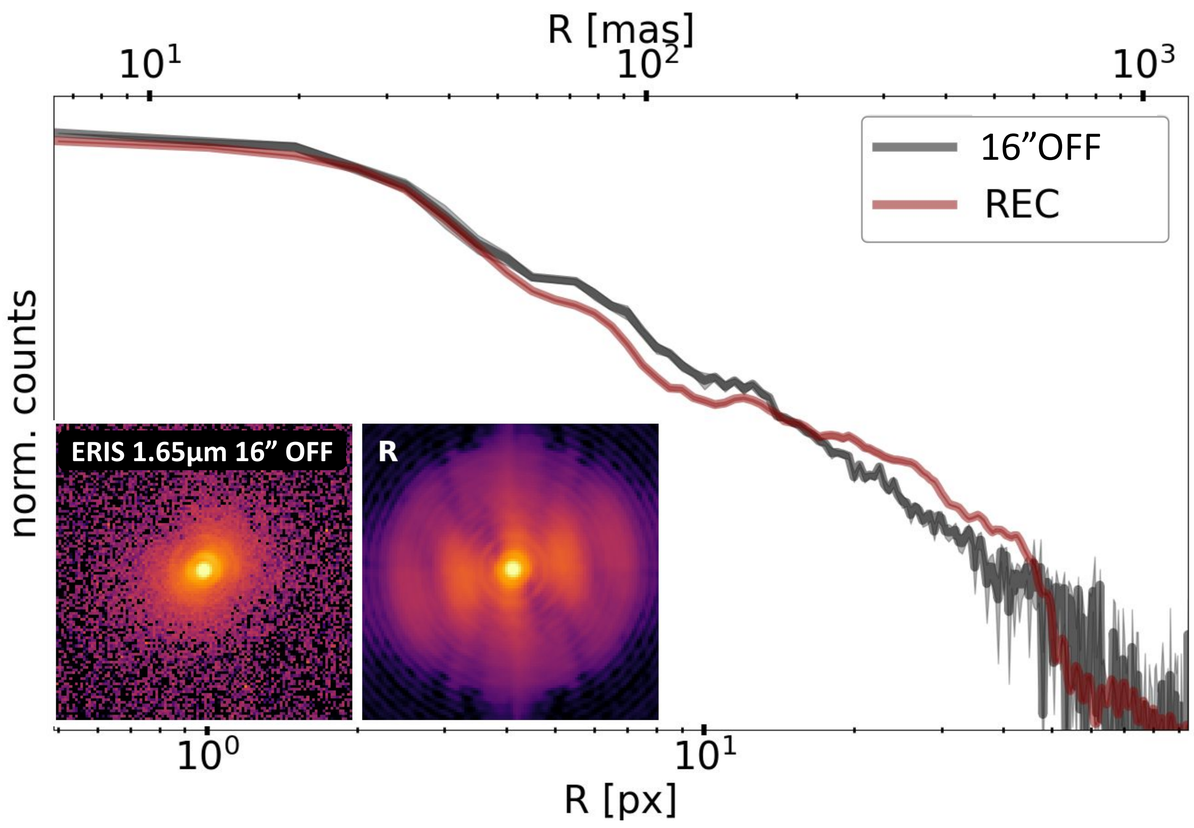
13000€ of which 2000€ spent:

MOBILITY	CONFERENCES	HARDWARE
41%	26%	33%

RATIONALE:

MICADO is the first-light imager and spectrograph of the ELT. Only SCAO observations will be initially possible. MCAO will be possible when when MORFEO will be later integrated.
MICADO will rely on a precise characterization of its PSF to fulfill the planned scientific requirements (Davies+2016; Arcidiacono+2020).
The MICADO consortium has envisioned, as a deliverable of the project, a service to provide observation-specific PSFs to the final user of the instrument (e.g. Simioni+2020; Grazian+2022,2024).

The current **MICADO PSF-R** software allow the determination of observation specific template PSFs without making use of focal plane informations, i.e. **no point source needs to be present in the scientific frames** to obtain reference PSFs (Wagner+2018). Thanks to a temporal tomographic approach, SCAO PSFs in arbitrary off-axis directions can be reconstructed (Wagner+2023).



Precision of the 10% level in SR are usually reached, for off-axis distances of the order of half the isoplanatic angle.
3 main ingredients are required:

1. modelling of the system;
2. knowledge of the AO telemetry;
3. knowledge of the turbulence profile and wind vectors (Masciadri et al.2013);

Concerning 1., valuable experience can be gained focussing on current AO facilities that are similar to what MICADO will be: the preferred one is SOUL+LUCI@LBT; another is ERIS@VLT.

Concerning 2., at least for the initial period of operation, MICADO will save **full** AO telemetry. This is **intensive** in terms of **data storage** and **transmission**: **the reduction of the data volume would lead to better usability and diffusion of the PSF-R tool**.

INSTRUMENT	FULL TELEMETRY VOLUME	
	9hr, 100% open shutter time [TB]	**1min** [GB]
MICADO SCAO	4	7.6
MICADO+MORFEO	8	15.2
SOUL+LUCI	0.4	0.8
ERIS	0.6	1.2

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