

# An optimised scheduler for Radial Velocity measurements at Telescopio Nazionale Galileo

Project duration: 2 years

Allocated Budget: 20000 Euro

People: Lorenzo Cabona, Laura Asquini, Monica Rainer, and Davide Ricci

## Proposal Goals:

As stated in the grant application:

*“The scheduling software which We will develop, will be able to:*

- provide a night-by-night dynamical schedule.*
- preparing “on-the-fly” a backup schedule for the night allowing the user to face rapid changes during the operations that might come from varying weather conditions, technical losses or target of opportunity (ToO) observations that require a rapid response.*
- define an observative schedule that complies with the observation time allocated to the different proposals or groups that use the facility.”*

To these initially proposed goals for our software scheduler, other needs and constraints emerged during the work of WP1 (for more information see the following slide). This heavily modified the mathematic approach that was decided to follow for the development of the scheduler and thus the work to be done in WP2.

## Work Packages:

WP1: Study the GAPS2 and other “traditional” RV scientific cases (1 quarter ). **Done.**

WP2: Optimization of the scheduling algorithms and parallel computing (2-5 quarter) **In progress.**

First results: the mathematical approach with respect to what was proposed has changed radically considering what was obtained from WP1.

WP3: Develop of the scheduling software for GAPS2 follow-up observations (4-6 quarter ). **In progress, early stage.**

WP4: Development of the scheduling software for TNG (6-8 quarter). **In progress, early stage.**

From what emerged in WP1, the scheduler must be fully compatible with all RV observer schedules made at TNG from the beginning.

WP3 and WP4 are carried out completely in parallel.

## WP1

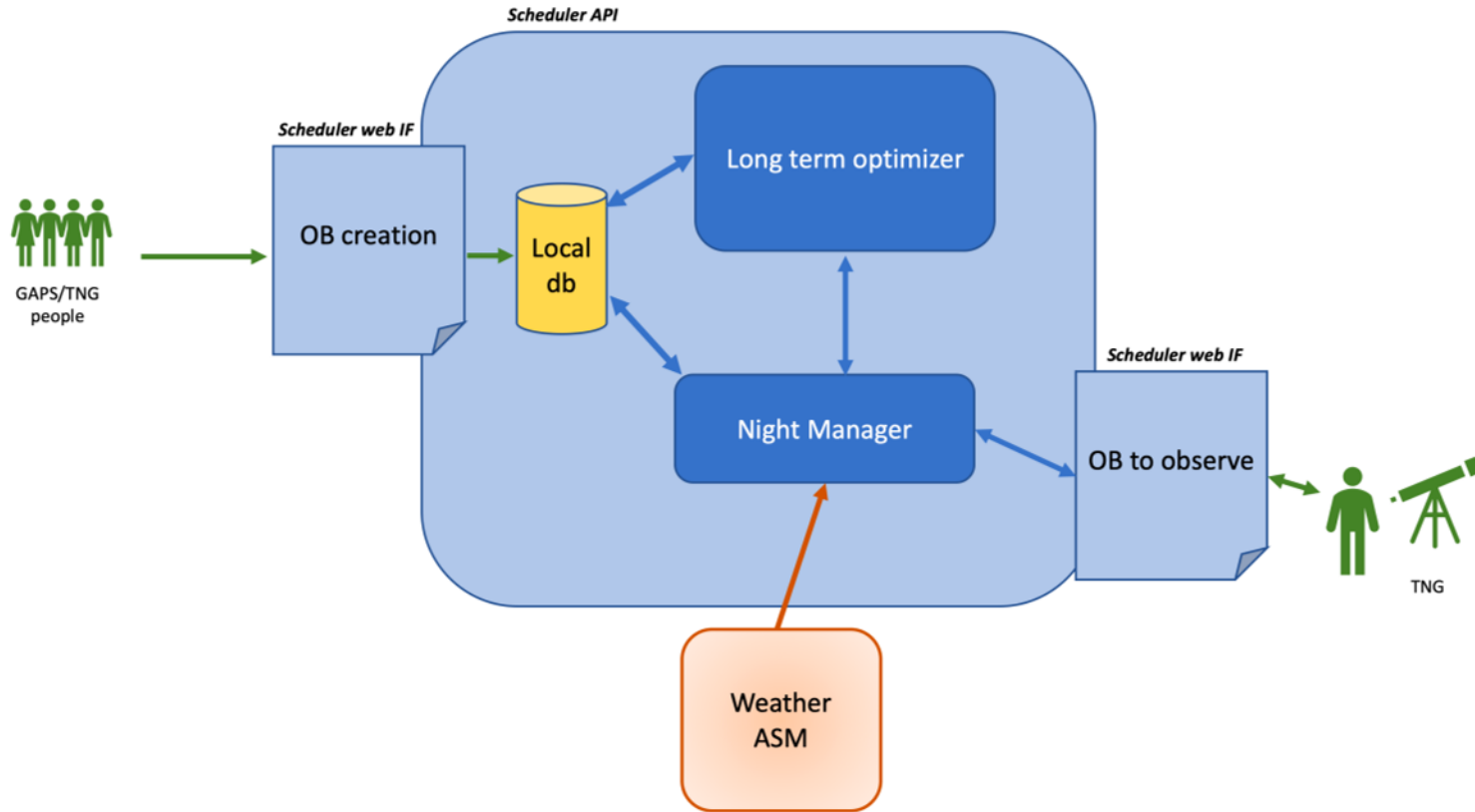
Additional requests regarding the scheduling SW:

- The nights that the scheduler will have to manage (for the different RV programs) are about 90 per semester.
- The proposed schedule for each individual night must respect the percentages allocated to the different programs.
- The time allocated to GAPS must take into account the different GAPS sub-programs (respect the time percentages).
- Each target has a fixed, predefined observation time, and observational constraints (max. airmass, max seeing, ...)
- The optimization of the schedule is focuses on the airmass but keeping the overhead (TNG pointing time) as low as possible.
- The scheduler must produce a file containing the Observing blocks (OB) that can be directly imported into the HARPS-N (NSTS) and GIANO-B management sw. However, it is important to note that the creation of the observation schedule file to be imported into NSTS must also contain the OBs for the acquisition spectra during the exoplanetary transits (these observations are time-critical and cannot be changed by the scheduler).
- In the event of an inability or interruption of a transit observation (which normally occupies many continuous hours of observation), the scheduler with its 'on fly mode' must schedule RV observations to fill the unexploited observation time.
- The scheduling SW developed in Python 3 must be managed through a web-based User Interface.
- The scheduler must take into account the data from the weather station and the DIMM (which measures seeing) at the TNG

## WP2

Some of the above-mentioned objectives will be achieved by exploiting functions that was already developed by Laura Asquini for the scheduler of the SOXS spectrograph.

## Overall workflow of the RV scheduler



### WP 3-4

The testing phase of the developing scheduling algorithm has begun, and preliminary results will soon be available.

Will be proposed a talk/poster at the conference: **Observatory Operations: Strategies, Processes, and Systems X**; SPIE Yokohama, Japan, June 2024.

### Miscellaneous:

- It is not clear the date by which the project must be finished, and funds expire. We consider the project started on 2023 January 17, when we received the funds. Please provide information on this point.