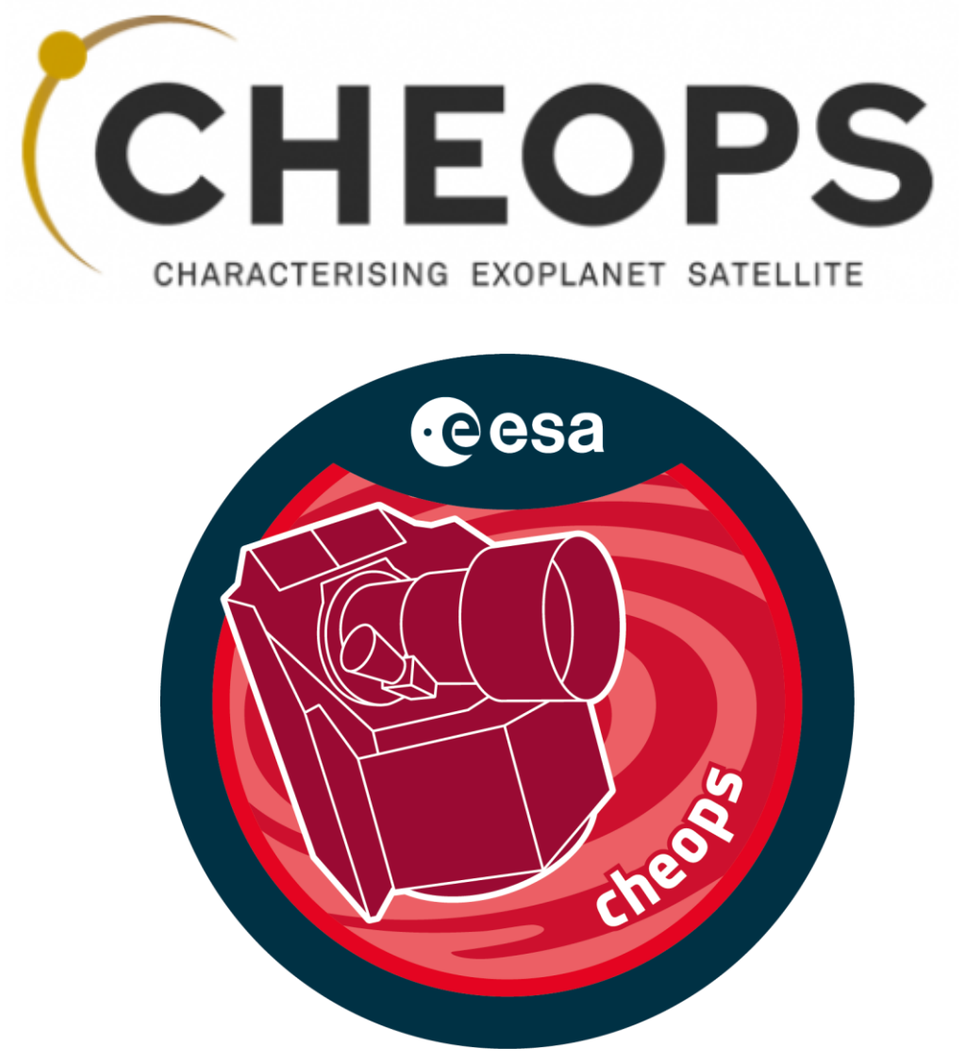


CHEOPS Feasibility Checker Guidelines

(v_3.0, March 2025)

(SFC 11.16.0)

*Prepared by Nicolas BILLOT, Anja BEKKELIEN, Alexis HEITZMANN and Adrien DELINE on behalf of the CHEOPS **S**cience **O**perations **C**enter*

Feasibility Checker Guidelines

The CHEOPS Scheduling Feasibility Checker (SFC) is a tool that simulates your observations and provides an overview of the expected schedulable opportunities of a given observation request with CHEOPS, considering all the constraints related to CHEOPS' orbit.
Note that the SFC is not updated with CHEOPS' latest orbital data. The SFC results are therefore to be taken with a grain of salt, especially when it comes to the timing of the Earth constraints.

This guide explains how to use the SFC.

PRELUDE

Using the SFC is the most advanced way of knowing when and how a target is schedulable with CHEOPS. While we emphasize that most of the time, it is **crucial** to make use of the SFC to maximize the chances of an observation request being scheduled, there are simpler ways to estimate, at first order, whether any given target is observable:

- Sky visibility maps
- CHEOPS Visibility Tool

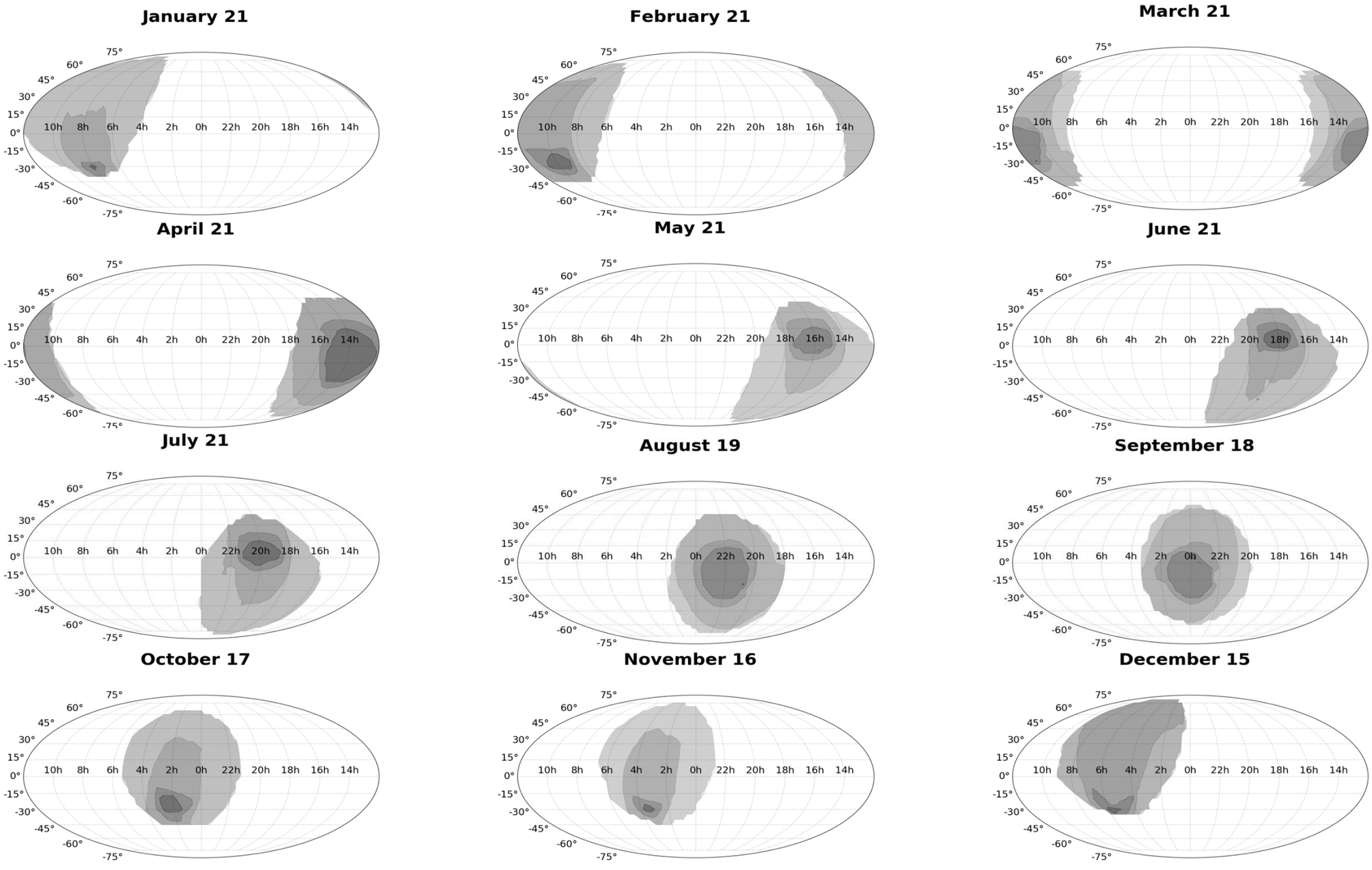
Both are presented in the following slides, before moving on to the actual SFC guidelines.

Starting from the AO-6 call, the SFC and the Visibility Tool are available on **ESA's Datalabs platform**, which makes it possible to run the tools in a web browser without any prior software installation. Please follow the instructions on https://www.cosmos.esa.int/web/datalabs/self-registration to get access to Datalabs. Request your account two working days prior to its expected usage.

Feasibility Checker Guidelines

PRELUDE 1 – Sky visibility maps

If your target is in the grey zone, then it is observable at that time. Lighter shades of grey indicate longer interruptions, down to 50% efficiency (i.e., 50% of the visit will contain data)



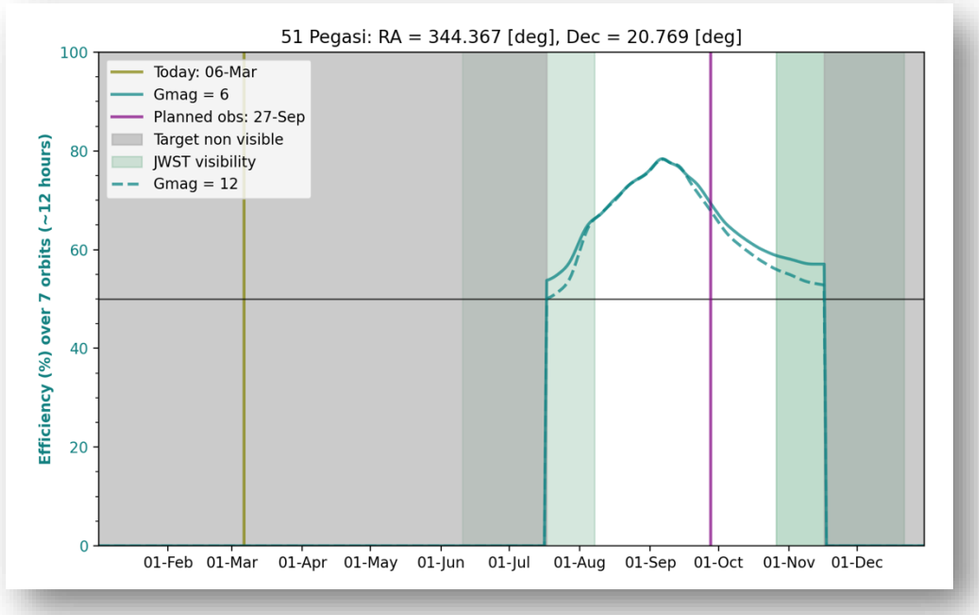
Feasibility Checker Guidelines

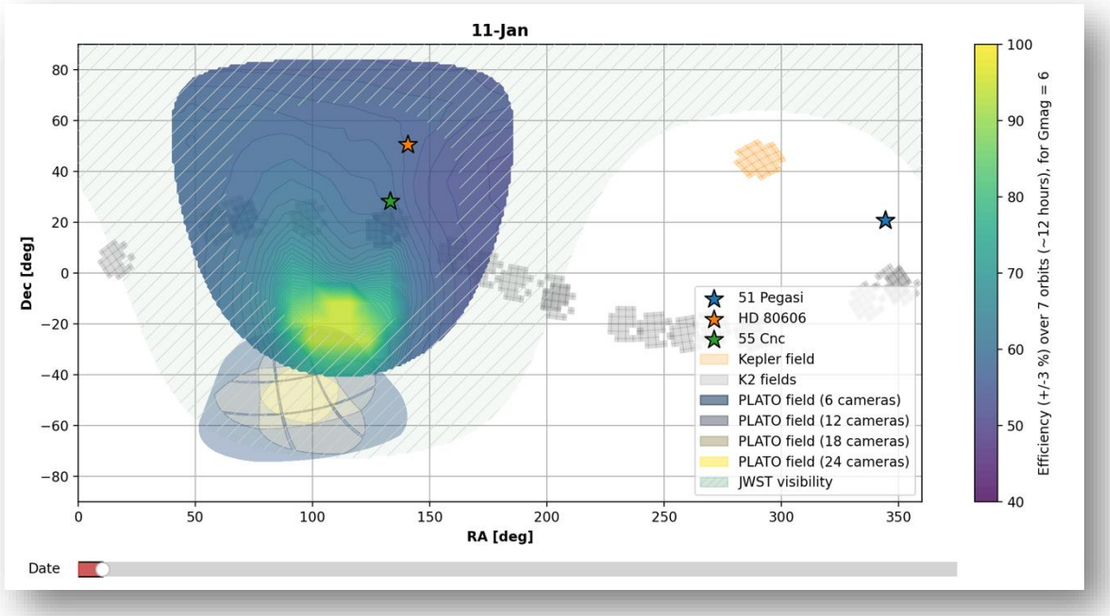
PRELUDE 2 – CHEOPS visibility tool

The CHEOPS Visibility Tool is a simple tool that will allow you to know when your target(s) is(are) visible and with what efficiency. Efficiencies (fraction of visit containing data) are estimated at a given RA/Dec for a 'standard' visit designed to average out all interruptions (Earth occultations, Earth straylight and South Atlantic Anomaly crossings).

This tool is made to:

- Easily and quickly check observability
- Assess if the efficiency is sufficient for the required science case
- Obtain the efficiency profile over the visibility window for the bright and faint case
- See if your target is the FOV of Kepler/K2, JWST and PLATO.





Since the CHEOPS AO-6 call, the CHEOPS Visibility Tool is on the **ESA's Datalabs platform**. On the next slide we explain how to access and use the tool.

! The Visibility tool should not replace the use of the SFC to submit a CHEOPS proposal !

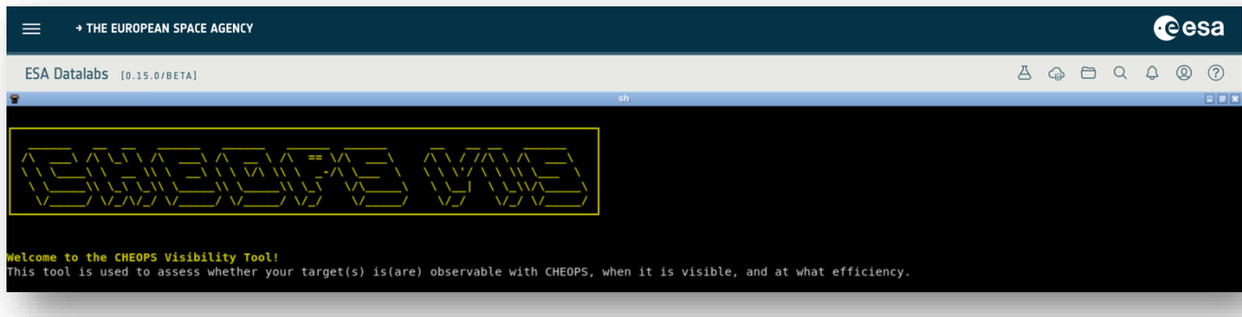
Feasibility Checker Guidelines

PRELUDE 2 – CHEOPS visibility tool

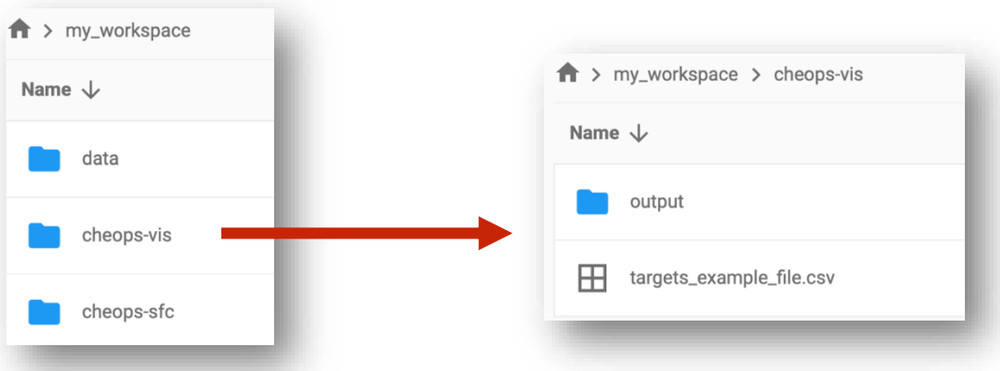
Accessing and starting the Visibility tool, i.e, the **cheops-vis** datalabs on the **ESA's Datalabs platform**, is done very similarly to the SFC as described later in the document:

1. Follow the procedure described on *slide 7* , replacing **cheops-sfc** with **cheops-vis**

2. Wait for the datalab to start. Once ready, a terminal with all the instructions on how to use the tool will appear.



3. To access the folder associated with the visibility tool, follow the procedure described on *slide 9*. In */my_workspace/cheop-vis/, you will find:*
- The output folder, containing one efficiency plot and one summary .csv file for each target requested.
- An example 'targets_example_file.csv' file for the Multi-target mode of the tool. Note: You can copy this file as described on *slide 10* to have your own custom file. The file **needs** to be in this folder to be used with the '-- target_file' argument (see instructions in the datalabs).

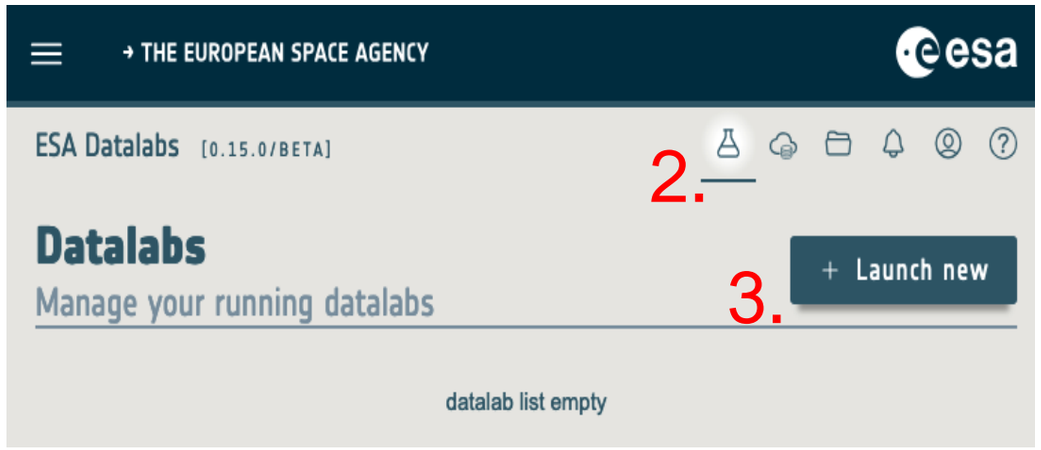


Once you have found when and how well is your target visible with CHEOPS, move on to the following pages to use the SFC, which will tell you when each opportunity of your observation requests occurs.

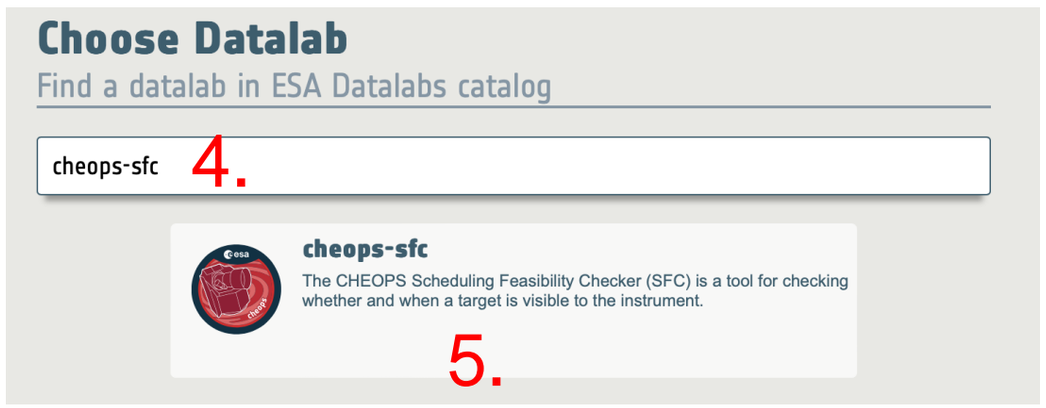
Feasibility Checker Guidelines

Launch the CHEOPS-SFC datalab

1. Open https://datalabs.esa.int in a web browser and log in using your ESA Cosmos credentials.
2. Click on the flask icon in the top right menu.
3. Click the “Launch new” button.



4. Search for the name of the datalab
5. Then select the datalab by clicking on it in the results below.

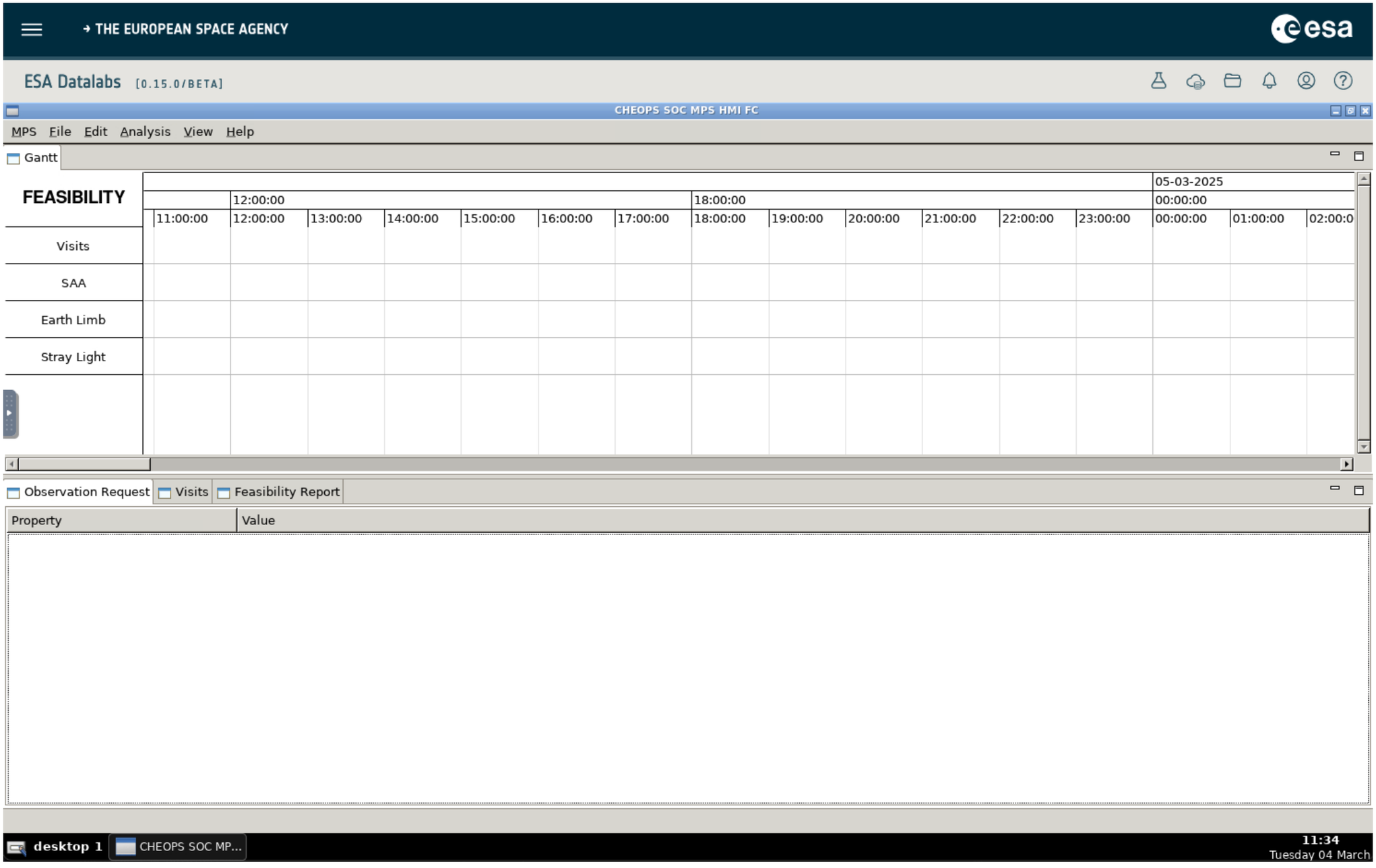


6. Optionally, give the datalab a name of your choice.
7. Press “Launch it!”.

Feasibility Checker Guidelines

Launch the CHEOPS-SFC datalab

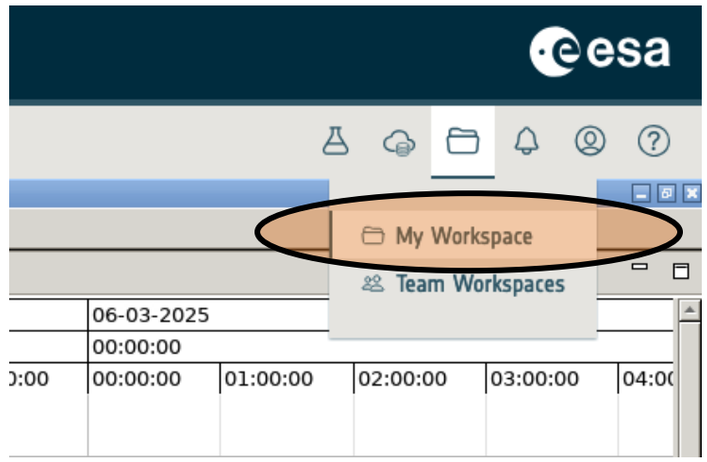
Wait for the datalab to start, which can take up to 20 seconds. Once ready, the SFC GUI will pop up.

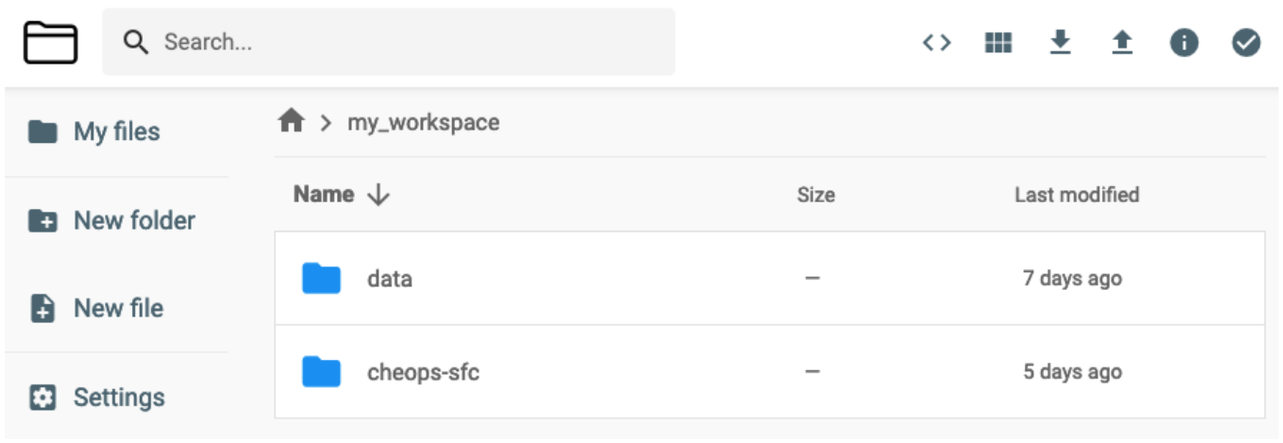


Feasibility Checker Guidelines

Datalabs Workspace

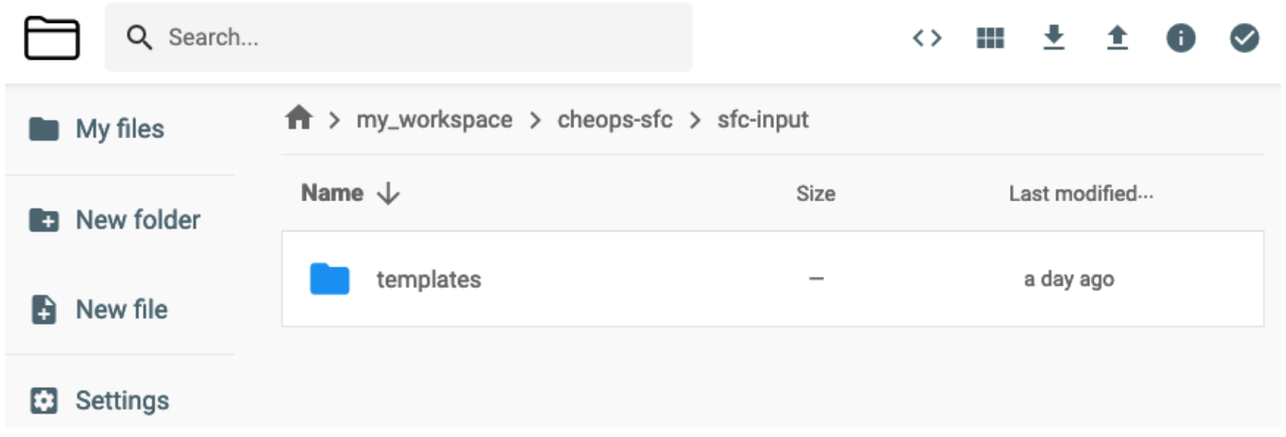
Go to your Datalabs Workspace by hovering the mouse pointer over the “Folder” icon in the top menu, then click on “My Workspace”.





This will open your private file storage area. The sub-folder cheops-sfc was created automatically when you launched the CHEOPS-SFC datalab.

Double click on the cheops-sfc folder to enter inside it, then double click on the folder named sfc-input. This is the folder where you will store your observation request files.



Feasibility Checker Guidelines

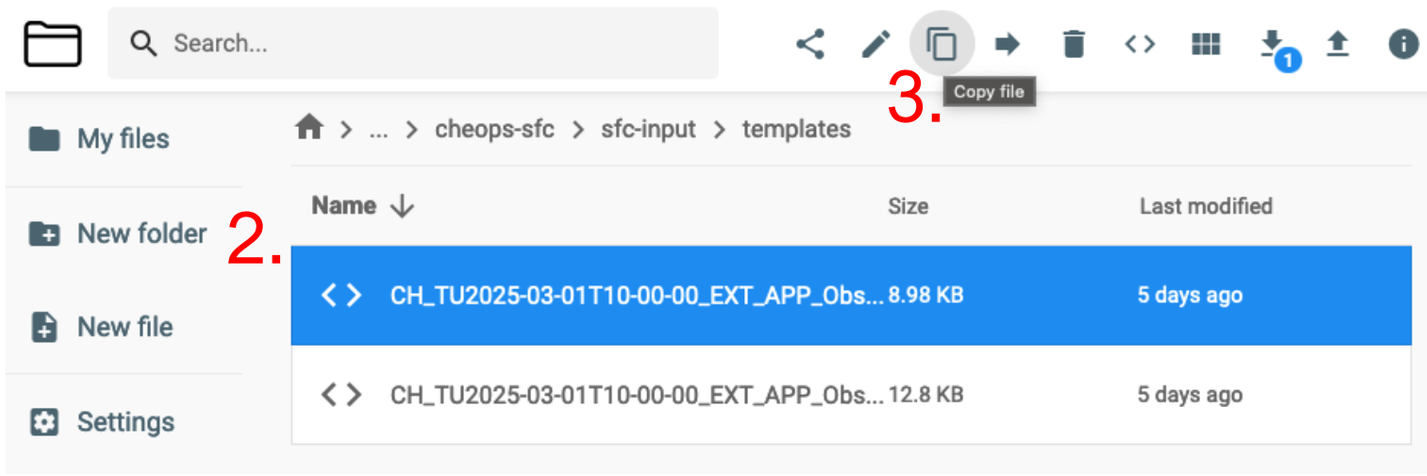
Copy observation request template file

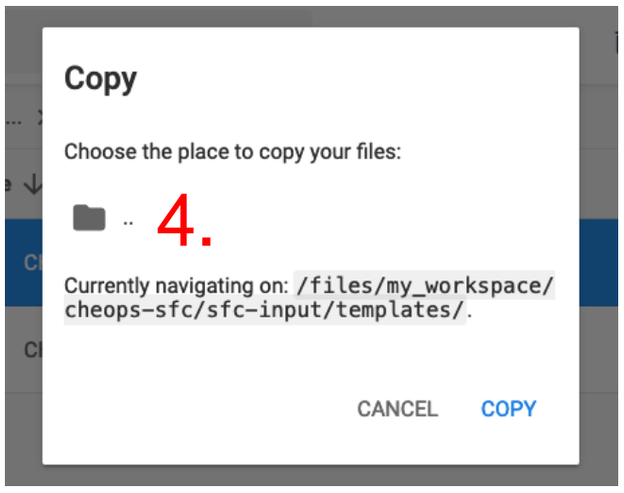
The templates folder contains two observation request templates that you can use as a starting point:

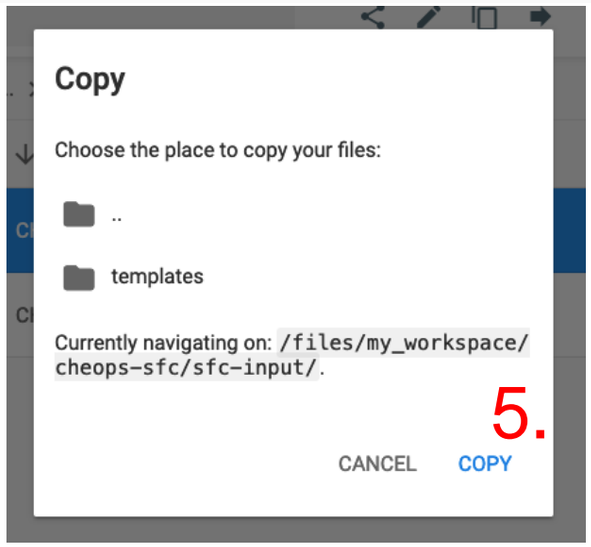
CH_TU2025-03-01T10-00-00_EXT_APP_ObservationRequests_V0003.xml (time critical observations)
CH_TU2025-03-01T10-00-00_EXT_APP_ObservationRequests_V0004.xml (non-time critical observations)

Copy the file you wish to use into the sfc-input folder following the steps below. *Do not modify the templates themselves!*

1. Double click on the templates folder to go inside it.
2. Mark the template file you wish to copy by clicking on it.
3. Click on the “copy” icon in the menu.
4. In the popup window, double-click on the “folder” icon to select the parent folder.
5. Click “Copy”.
6. You will be taken back up to the sfc-input folder which will now contain the copied file.







TIPS:
It is also possible to drag-and-drop files from your computer into the sfc-input folder.

Feasibility Checker Guidelines

Edit the observation request file to define technical details of your desired observation

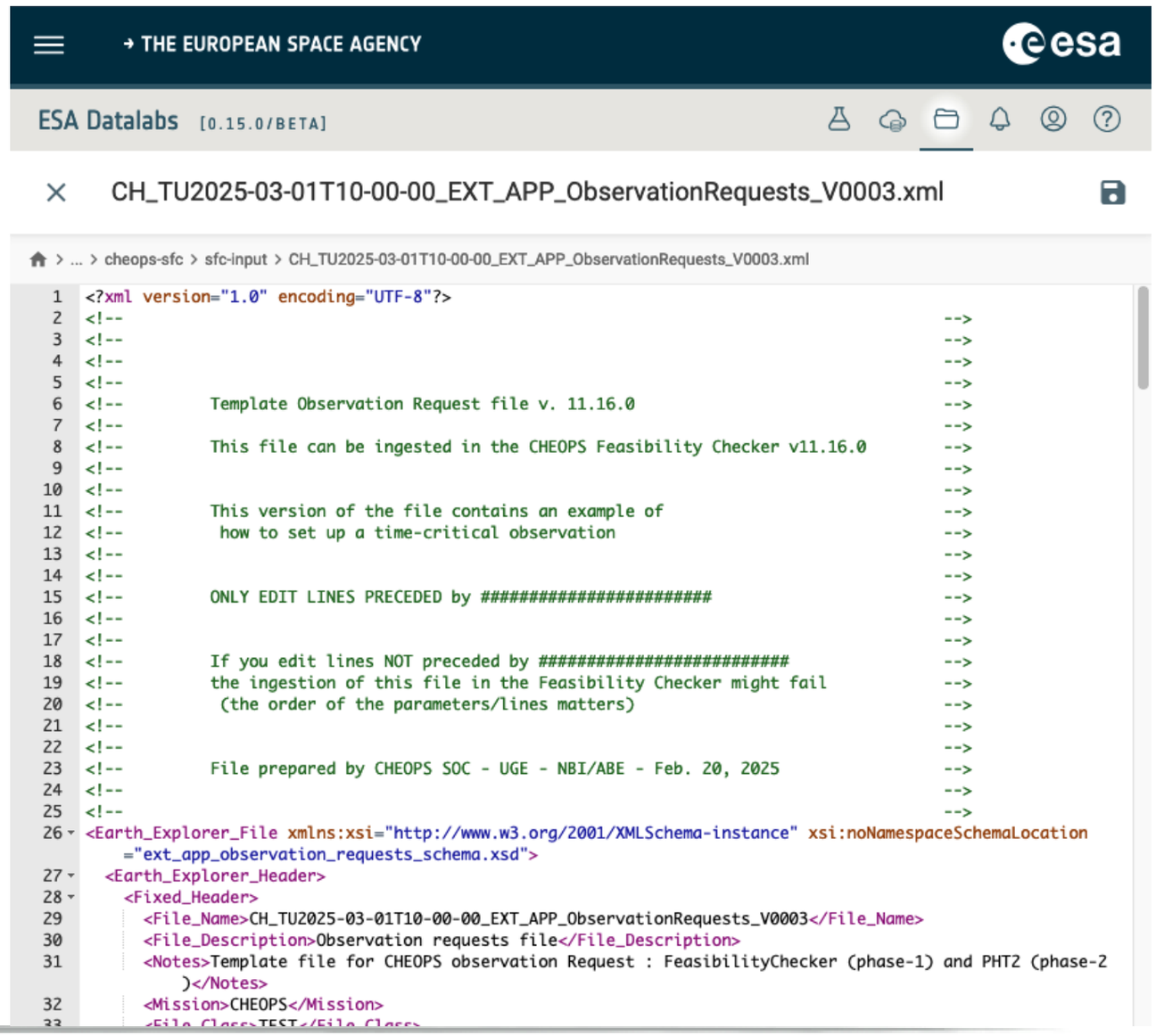
You can edit your file directly in the Datalabs Workspace by double-clicking on it. This example shows the copy of the template file CH_TU2025-03-01T10-00-00_EXT_APP_ObservationRequests_V0003.xml.

Follow instructions from file header, only edit relevant parameters:

Target_Name
Target_Magnitude
R.A. — Dec
Earliest_Start / Latest_End (***optional***)
Transit_Time
Transit_Period
Visit_Duration
Minimum_Effective_Duration
Earliest/Latest_Observation_Start
Critical phase ranges (***optional***)

Save the file after editing

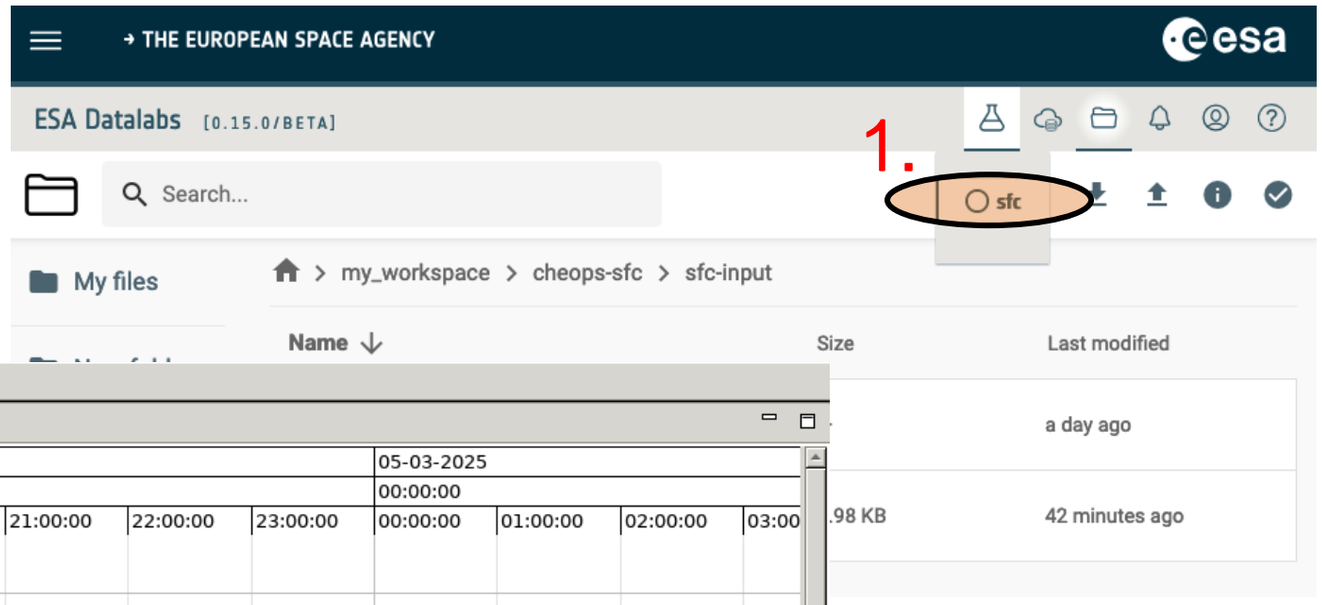
WARNING:
This file must contain only one request (it will fail otherwise), and only the above parameters should be modified. They are identified as such in the file (see header). Re-organizing the file structure or changing not-recommended parameters will likely make the file ingestion fail!

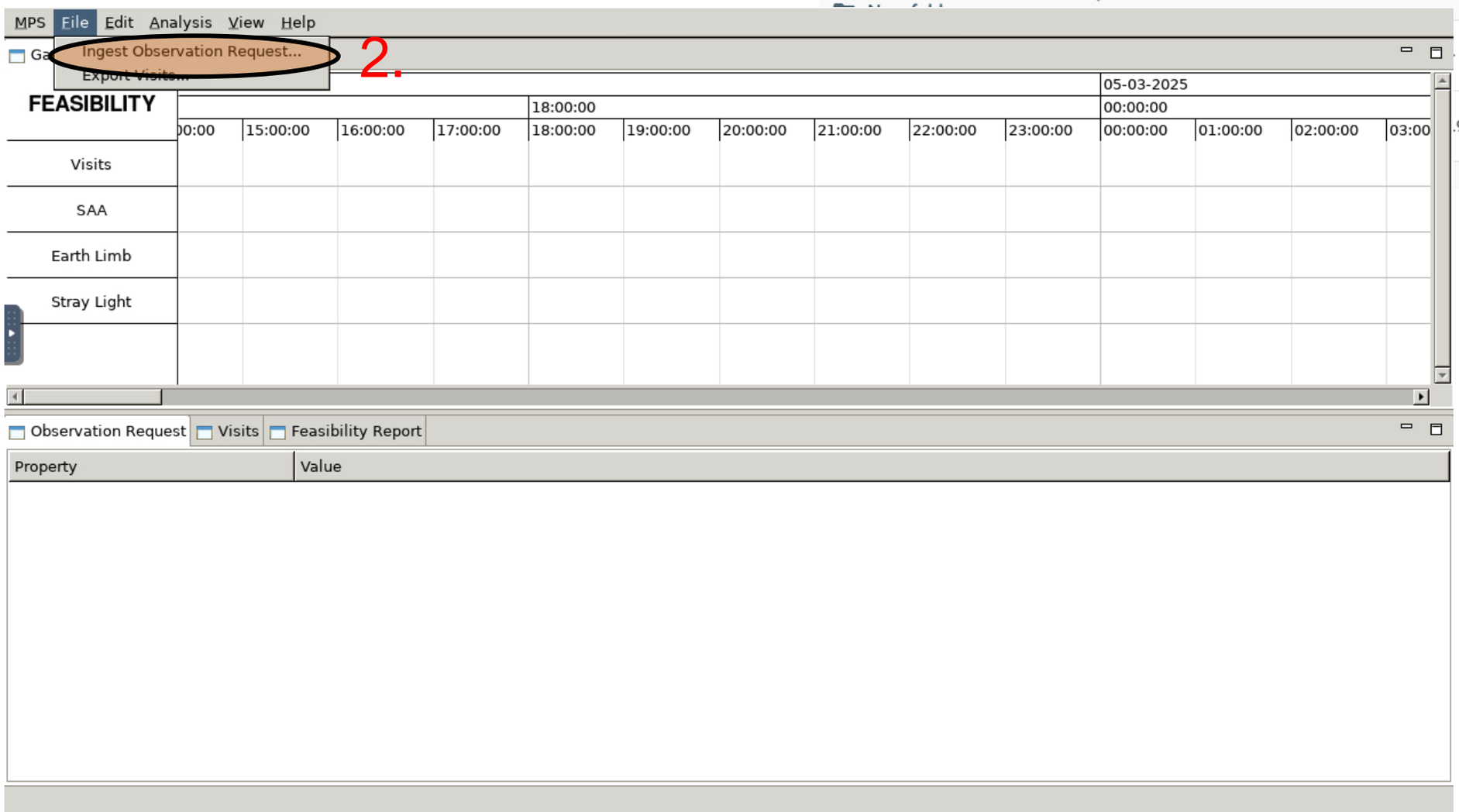


Feasibility Checker Guidelines

Read in the observation request file in the Feasibility Checker

1. Go back to the CHEOPS-SFC datalab by hovering the mouse pointer over the flask icon in the Datalab menu and select your datalab.



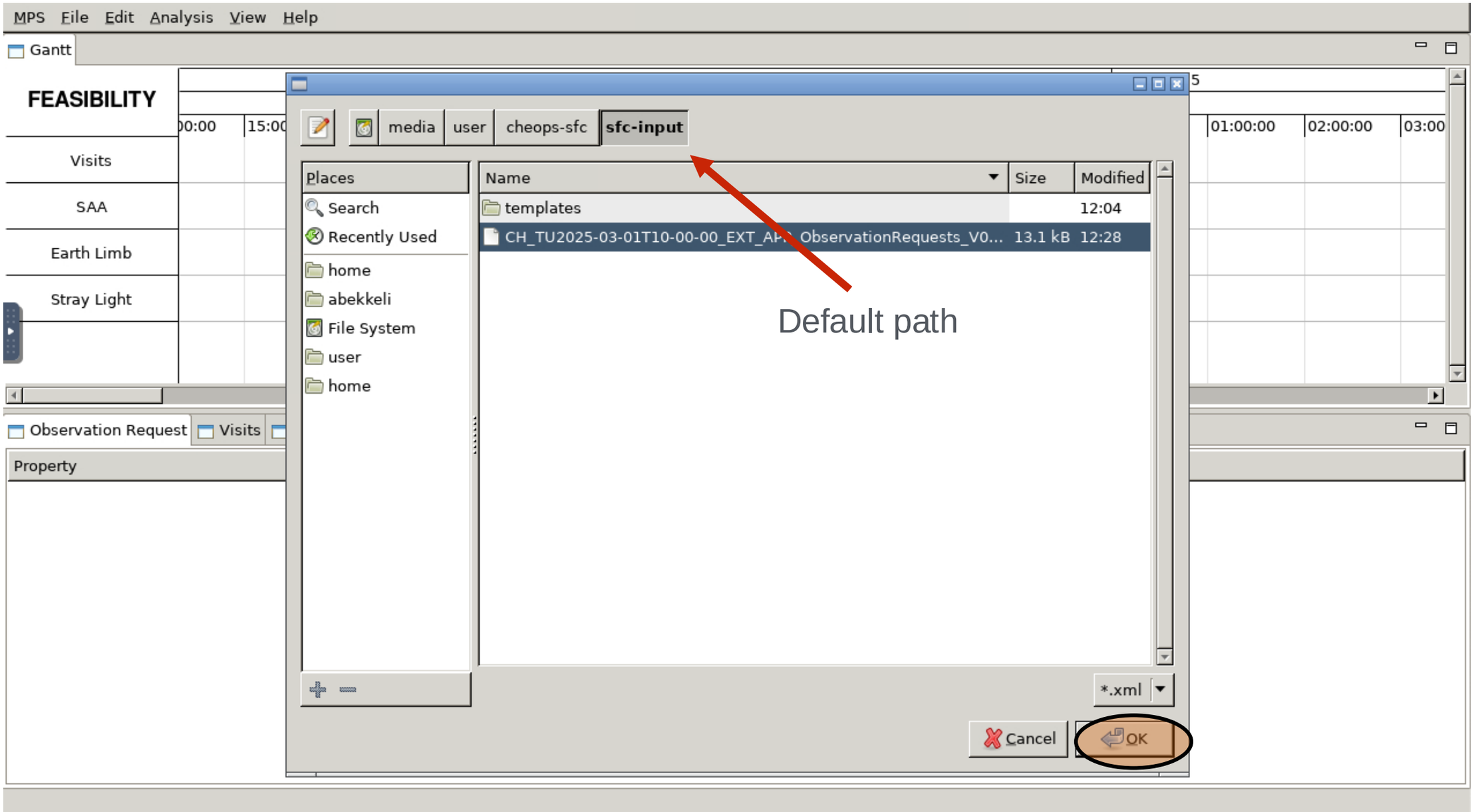


2. Then, inside the datalab, select “File”, then “Ingest Observation Request…” from the SFC’s menu.

Feasibility Checker Guidelines

Read in the observation request file in the Feasibility Checker

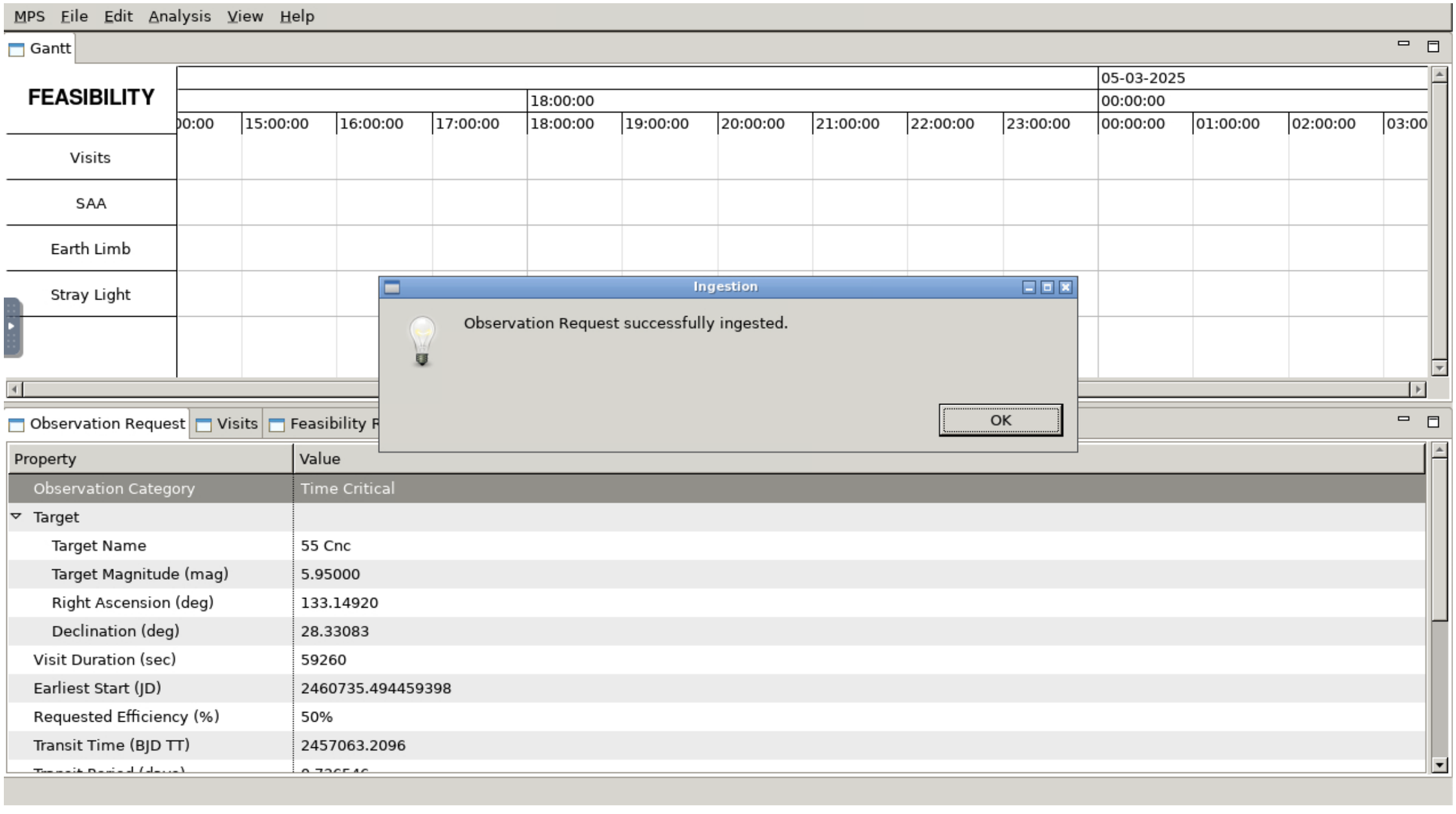
Select you observation request file and press OK.



Feasibility Checker Guidelines

Read in the observation request file in the Feasibility Checker

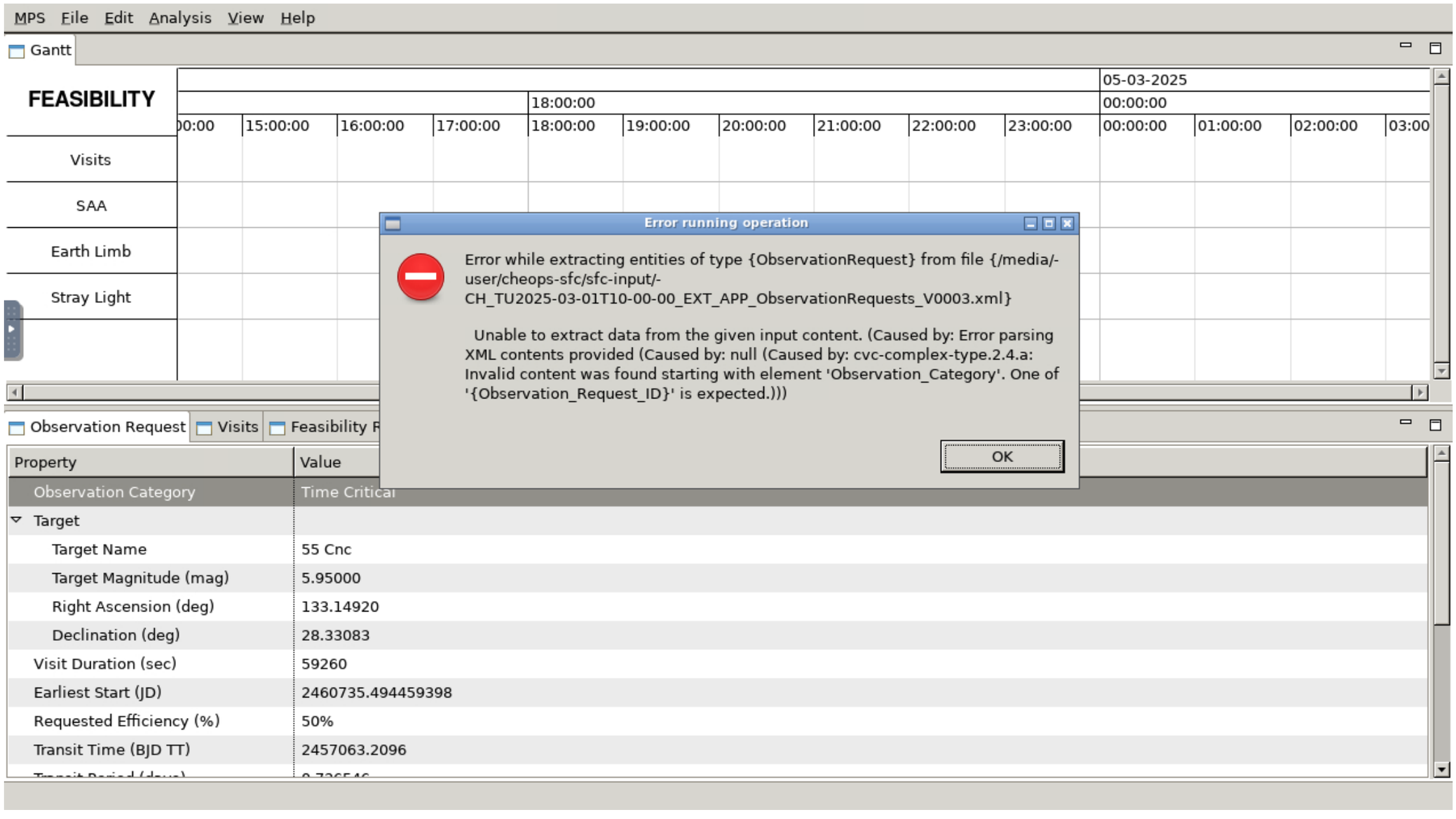
Successful ingestion of the observation request file.



Feasibility Checker Guidelines

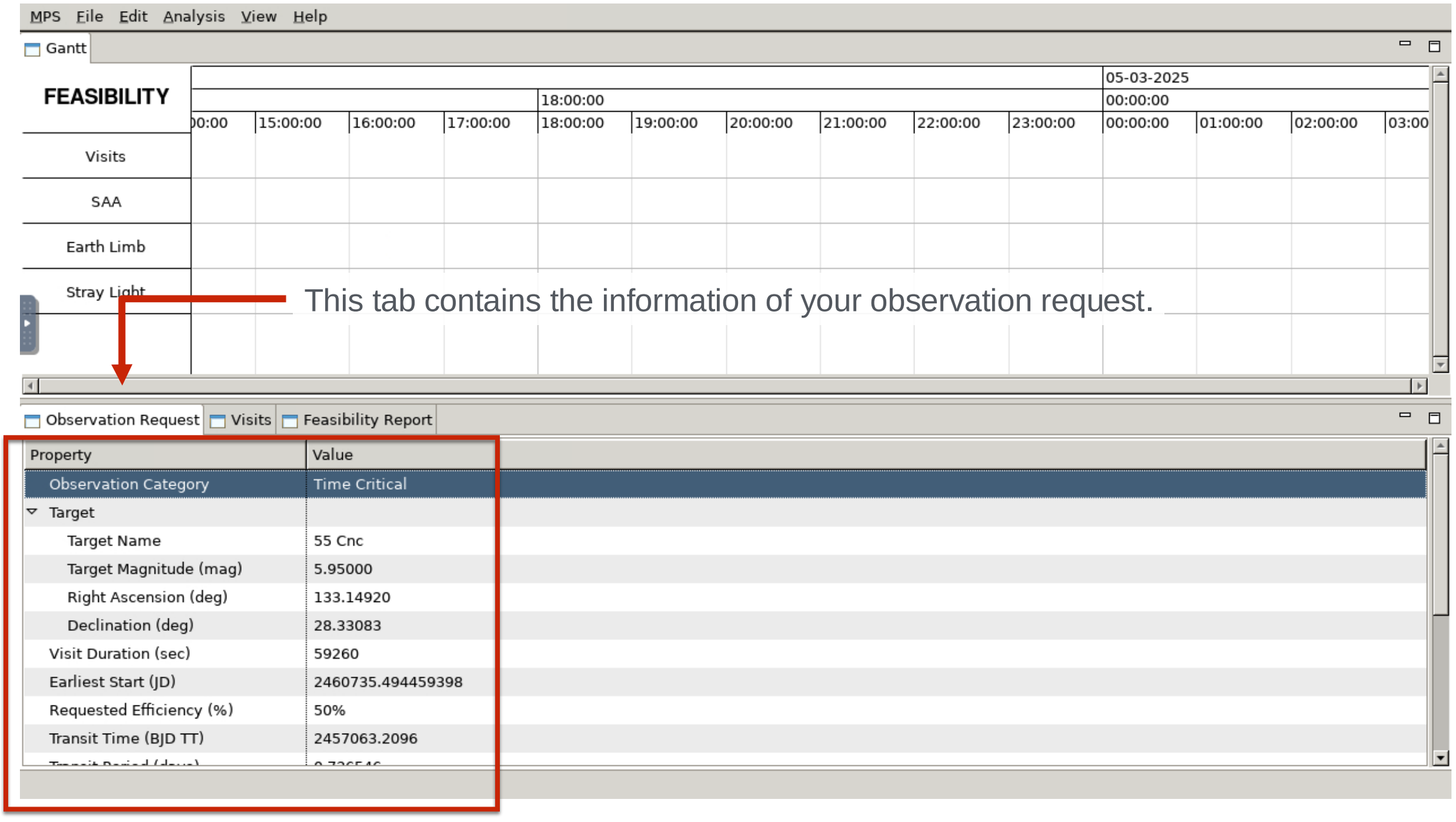
Read in the observation request file in the Feasibility Checker

If you obtain a similar error message, it means that you have made an error when modifying the observation request file. Restart from the original observation request file following instructions found in the file to solve this issue.



Feasibility Checker Guidelines

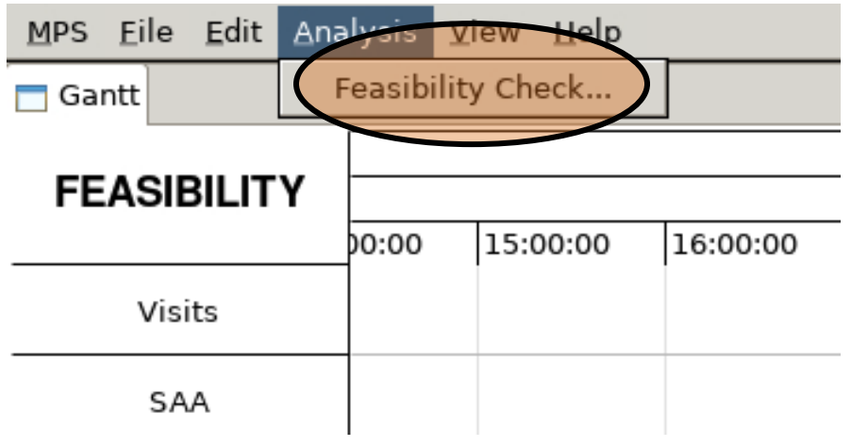
Read in the observation request file in the Feasibility Checker



Feasibility Checker Guidelines

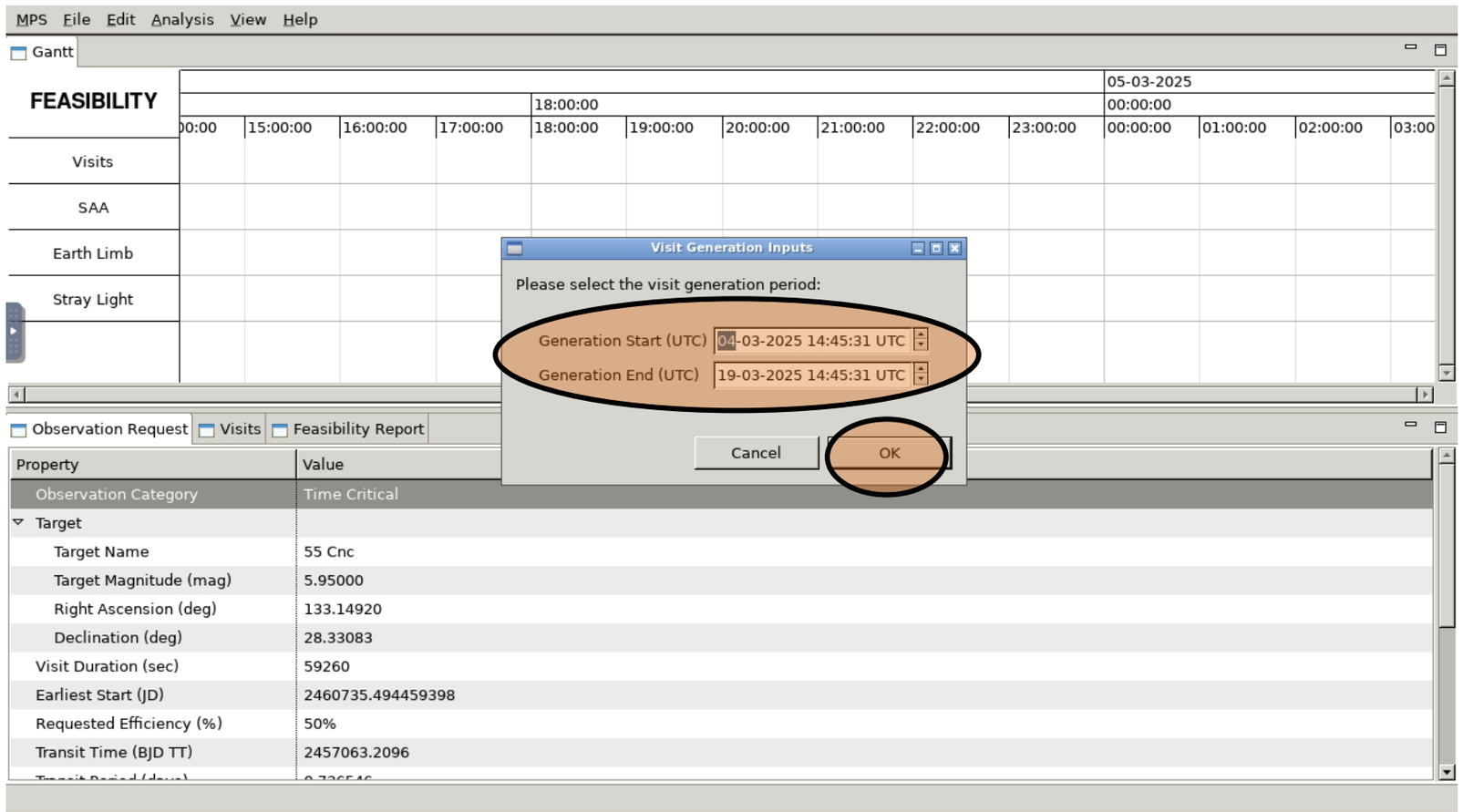
Run the Feasibility Checker

1. Go to "*Analysis*", and "*Feasibility Check*…"



2. Set the time interval to be explored for generating the possible visits (valid until 31 Dec 2028).

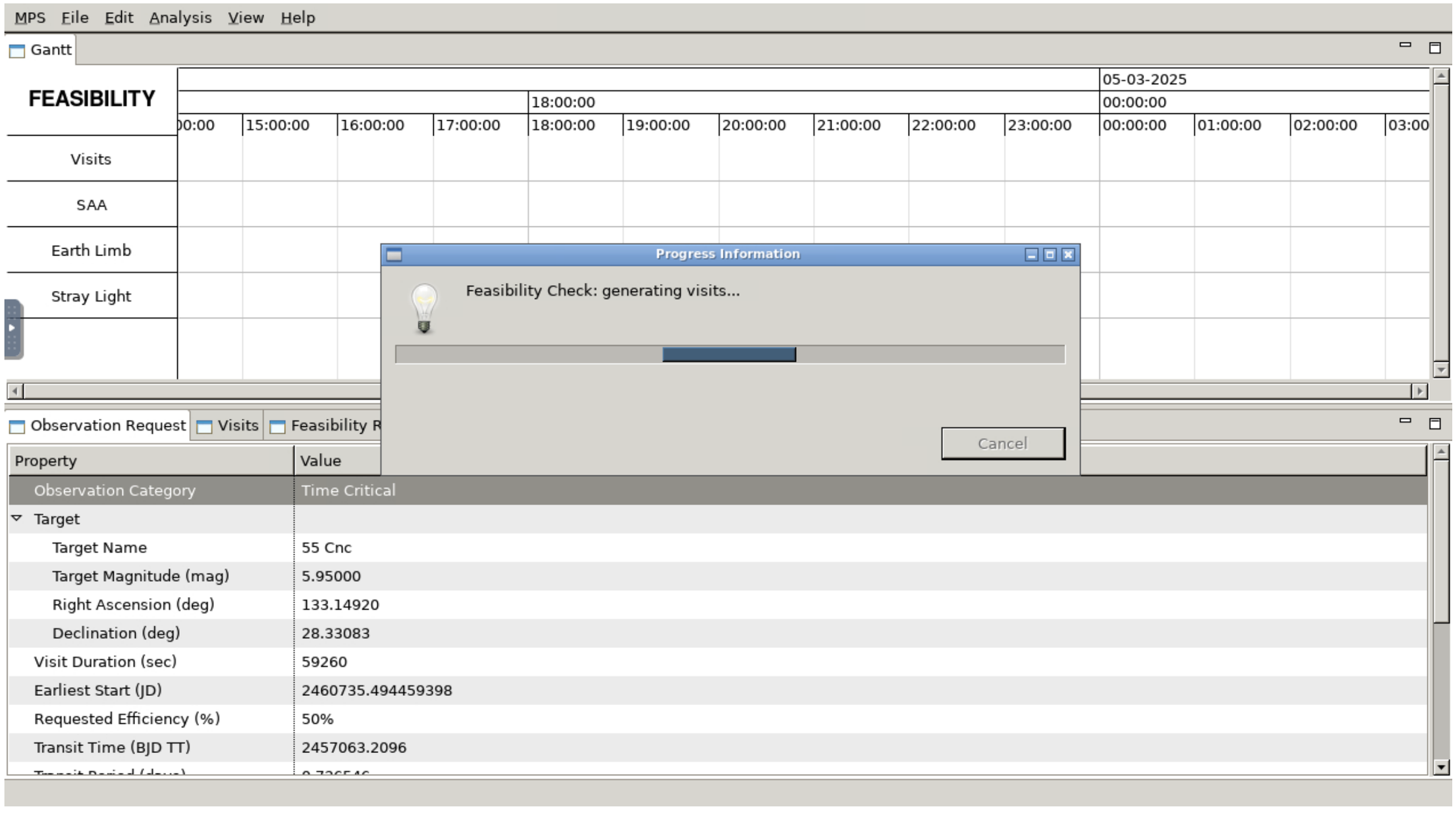
3. Hit "*OK*".



Feasibility Checker Guidelines

Run the Feasibility Checker

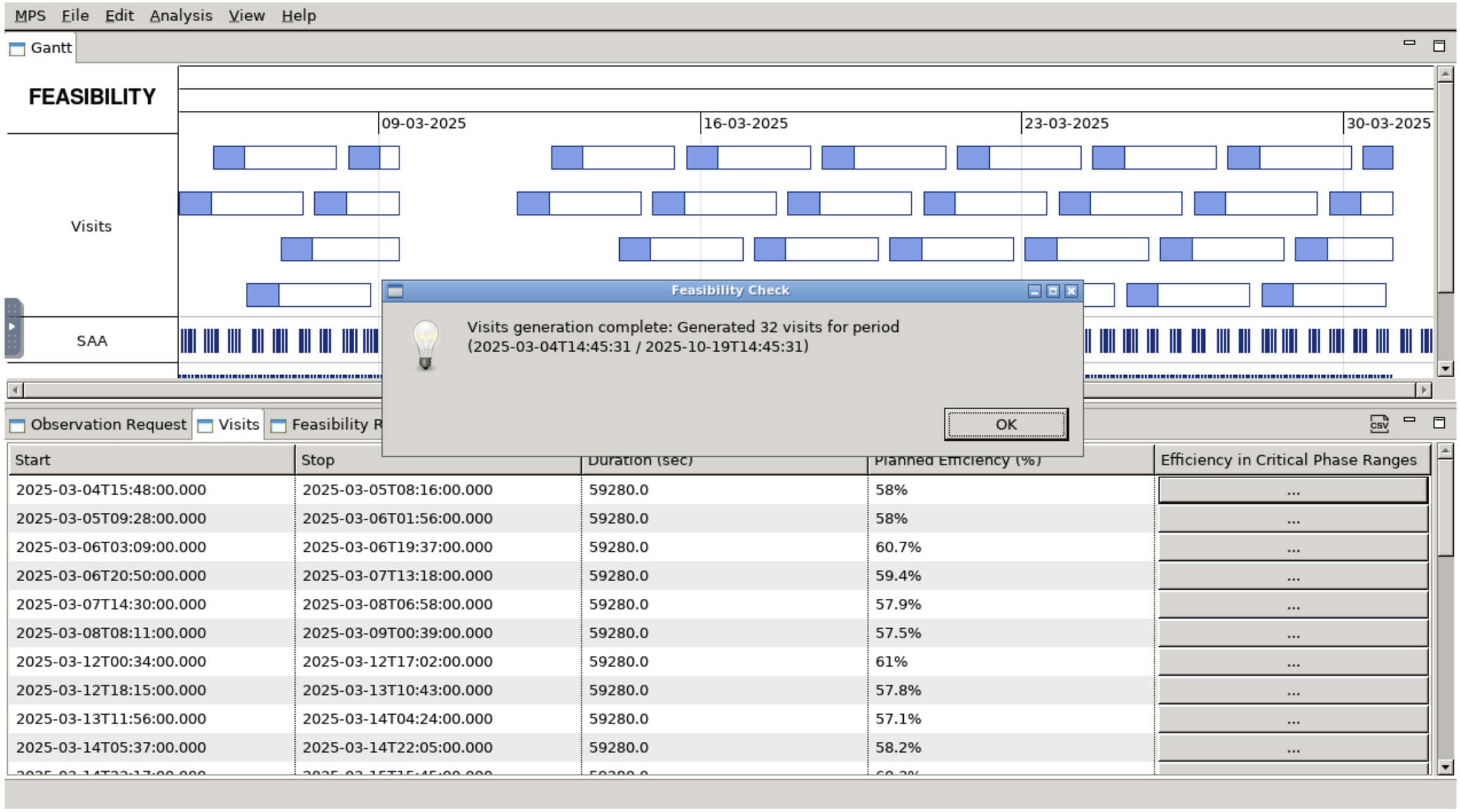
Depending on the requested period, the computation may take a few minutes.



Feasibility Checker Guidelines

Run the Feasibility Checker

Successful generation of the possible visits.

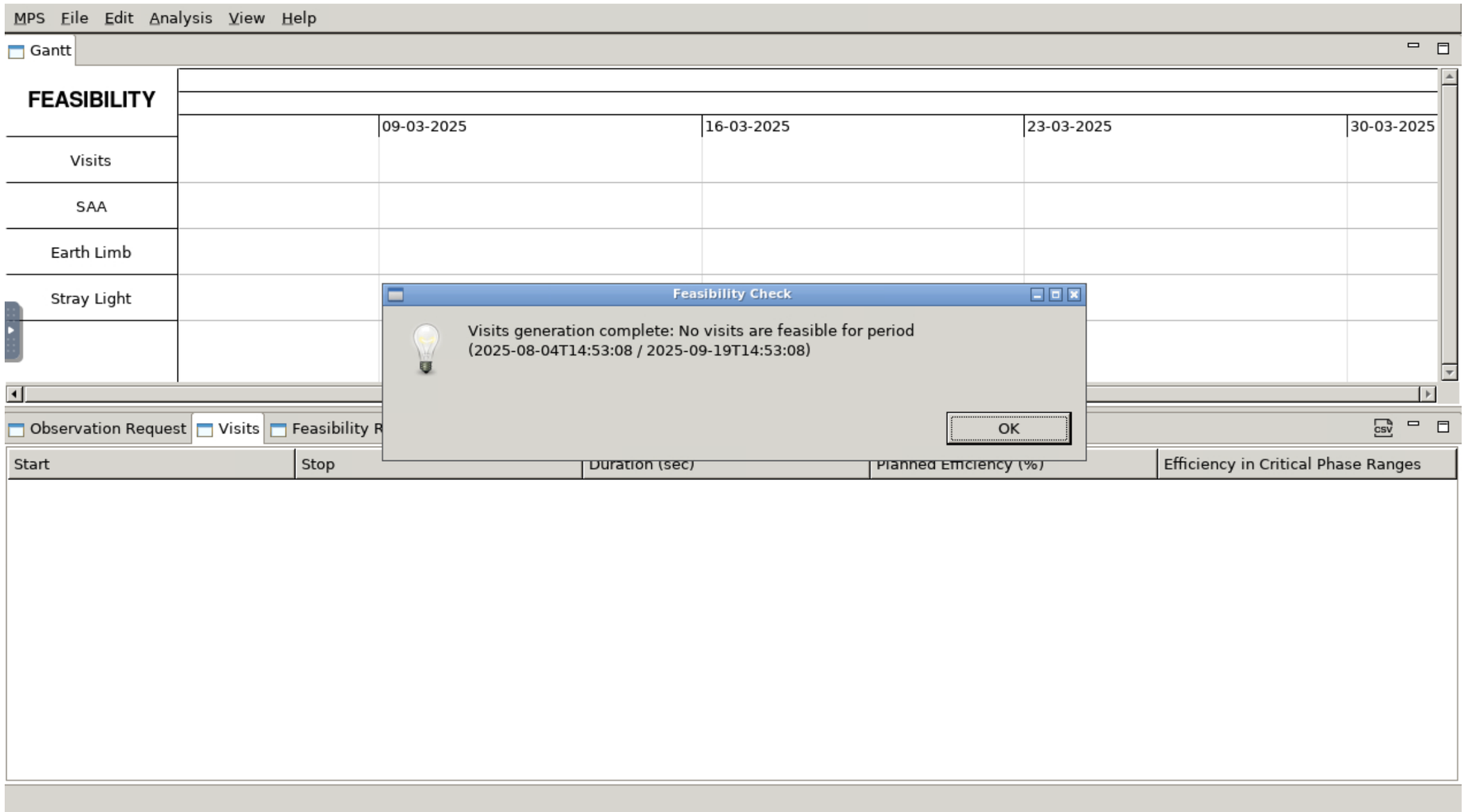


Feasibility Checker Guidelines

Run the Feasibility Checker

Sometimes, no possible visits are found in the requested period. You will then see this error message.

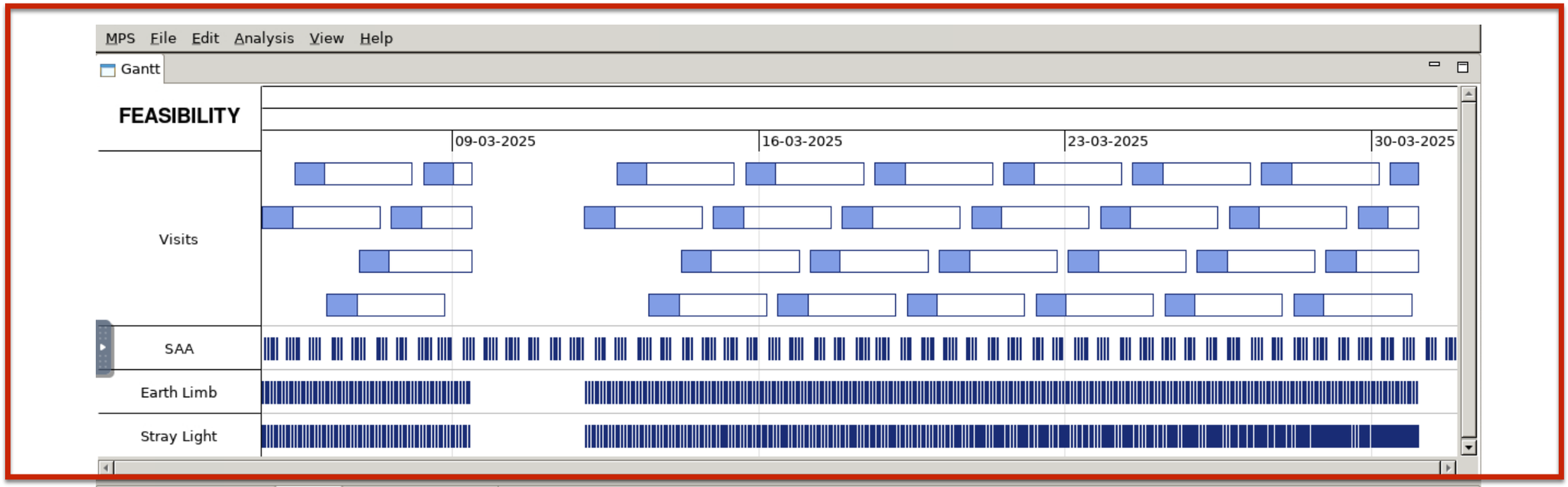
- **Your target might not be visible (you can use CHEOPS visibility tool to check, see first slide), or**
- **You may want to relax the "*Earliest Start*" / "*Latest End*" parameters in the observation request file.**



Feasibility Checker Guidelines

Explore the result

The Gantt chart shows the possible visits over the requested period, along with associated interruptions due to Earth occultations (Earth Limb in HMI), South Atlantic Anomaly crossings, and unacceptable levels of stray light. *The timing of interruptions is not accurate but only indicative!*



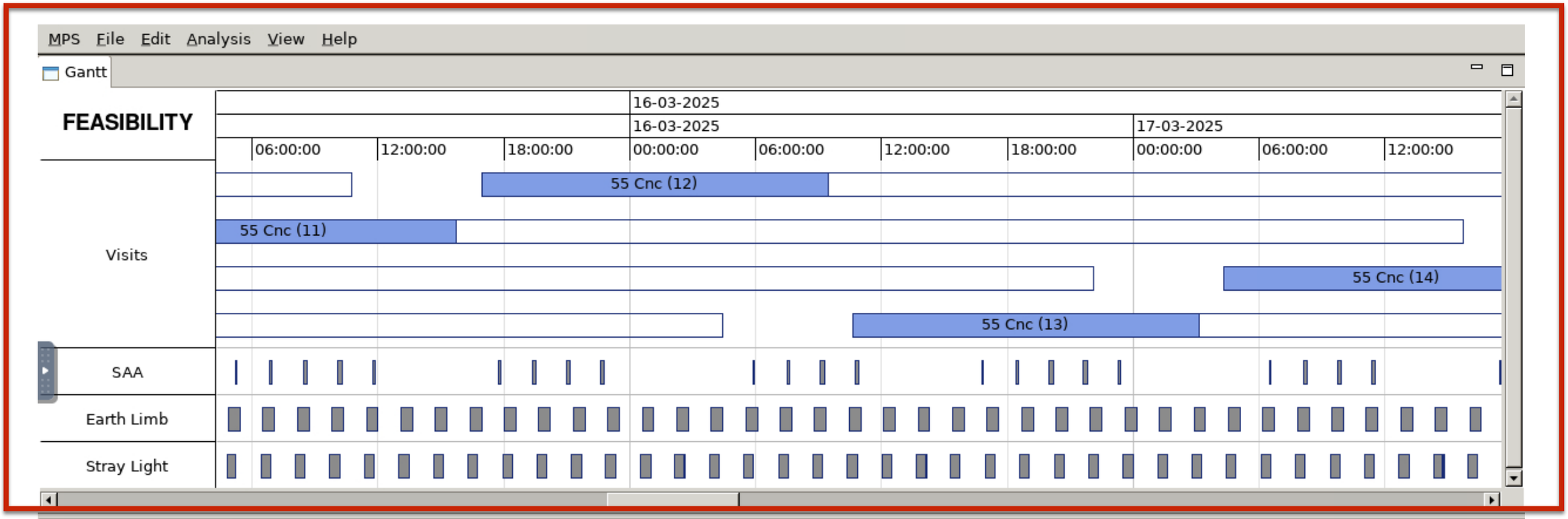
Observation Request | Visits | Feasibility Report

Start	Stop	Duration (sec)	Planned Efficiency (%)	Efficiency in Critical Phase Ranges
2025-03-04T15:48:00.000	2025-03-05T08:16:00.000	59280.0	58%	...
2025-03-05T09:28:00.000	2025-03-06T01:56:00.000	59280.0	58%	...
2025-03-06T03:09:00.000	2025-03-06T19:37:00.000	59280.0	60.7%	...
2025-03-06T20:50:00.000	2025-03-07T13:18:00.000	59280.0	59.4%	...
2025-03-07T14:30:00.000	2025-03-08T06:58:00.000	59280.0	57.9%	...
2025-03-08T08:11:00.000	2025-03-09T00:39:00.000	59280.0	57.5%	...
2025-03-12T00:34:00.000	2025-03-12T17:02:00.000	59280.0	61%	...
2025-03-12T18:15:00.000	2025-03-13T10:43:00.000	59280.0	57.8%	...
2025-03-13T11:56:00.000	2025-03-14T04:24:00.000	59280.0	57.1%	...

Feasibility Checker Guidelines

Explore the result

You can zoom in/out using “*Control*” + “*Mouse wheel*” (two-finger scroll on touchpads).



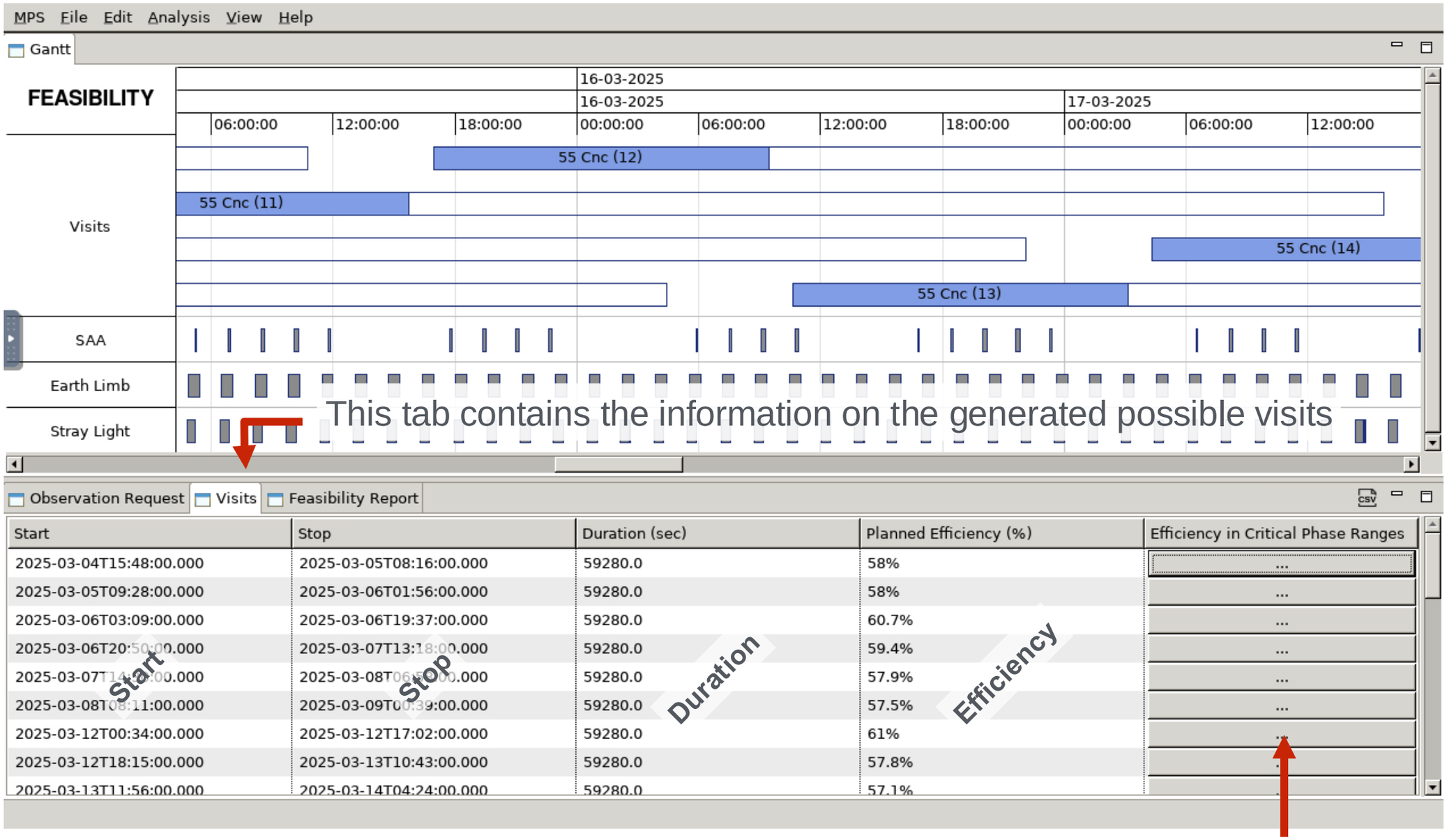
Observation Request | Visits | Feasibility Report

Start	Stop	Duration (sec)	Planned Efficiency (%)	Efficiency in Critical Phase Ranges
2025-03-04T15:48:00.000	2025-03-05T08:16:00.000	59280.0	58%	...
2025-03-05T09:28:00.000	2025-03-06T01:56:00.000	59280.0	58%	...
2025-03-06T03:09:00.000	2025-03-06T19:37:00.000	59280.0	60.7%	...
2025-03-06T20:50:00.000	2025-03-07T13:18:00.000	59280.0	59.4%	...
2025-03-07T14:30:00.000	2025-03-08T06:58:00.000	59280.0	57.9%	...
2025-03-08T08:11:00.000	2025-03-09T00:39:00.000	59280.0	57.5%	...
2025-03-12T00:34:00.000	2025-03-12T17:02:00.000	59280.0	61%	...
2025-03-12T18:15:00.000	2025-03-13T10:43:00.000	59280.0	57.8%	...
2025-03-13T11:56:00.000	2025-03-14T04:24:00.000	59280.0	57.1%	...

Feasibility Checker Guidelines

Explore the result

You can consult the details of generated visits: Start / Stop time and (effective) duration.



Visits details

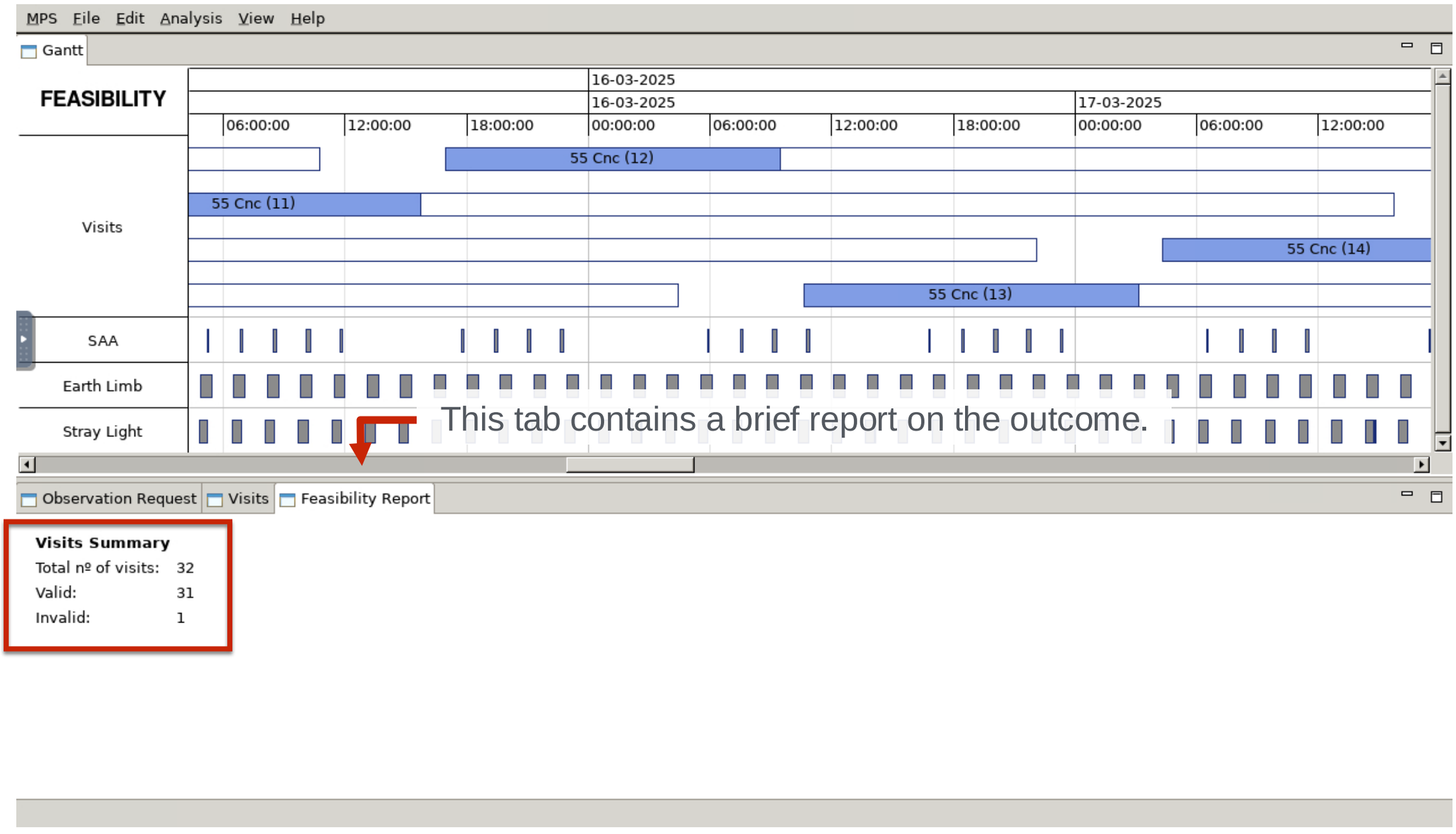
Invalid visits are marked in red with an [X]

Only relevant if you have provided phase ranges

Feasibility Checker Guidelines

Explore the result

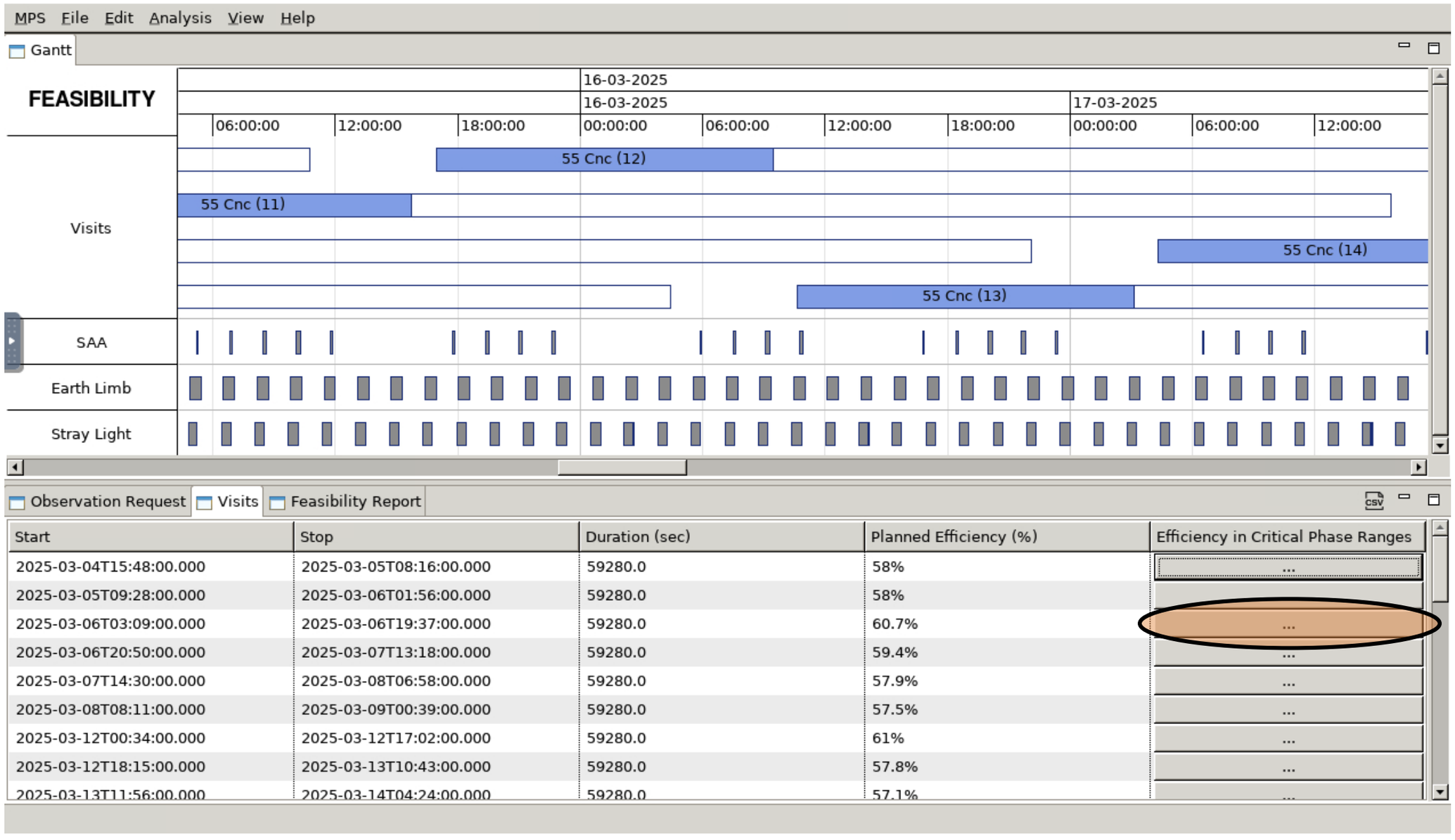
In this case, out of the 32 possible visits, 31 are declared valid as they have observing efficiencies higher than requested.



Feasibility Checker Guidelines

Explore the result (critical Phase Ranges)

If you have ingested an observation request with critical phase ranges you can explore the observing efficiencies within the pre-defined phase ranges.



Start	Stop	Duration (sec)	Planned Efficiency (%)	Efficiency in Critical Phase Ranges
2025-03-04T15:48:00.000	2025-03-05T08:16:00.000	59280.0	58%	...
2025-03-05T09:28:00.000	2025-03-06T01:56:00.000	59280.0	58%	
2025-03-06T03:09:00.000	2025-03-06T19:37:00.000	59280.0	60.7%	...
2025-03-06T20:50:00.000	2025-03-07T13:18:00.000	59280.0	59.4%	...
2025-03-07T14:30:00.000	2025-03-08T06:58:00.000	59280.0	57.9%	...
2025-03-08T08:11:00.000	2025-03-09T00:39:00.000	59280.0	57.5%	...
2025-03-12T00:34:00.000	2025-03-12T17:02:00.000	59280.0	61%	...
2025-03-12T18:15:00.000	2025-03-13T10:43:00.000	59280.0	57.8%	...
2025-03-13T11:56:00.000	2025-03-14T04:24:00.000	59280.0	57.1%	...

Feasibility Checker Guidelines

Explore the result (critical Phase Ranges)

In this particular case, the requested efficiency in both phases is 50%. The observed efficiency in the first phase is only 28.4% but since <*Fulfil_all_Phase_Ranges*> = *FALSE* in the input file, the visit is still valid.

The efficiency in the critical phase ranges is not accurate but only indicative!

Phase Ranges Efficiency

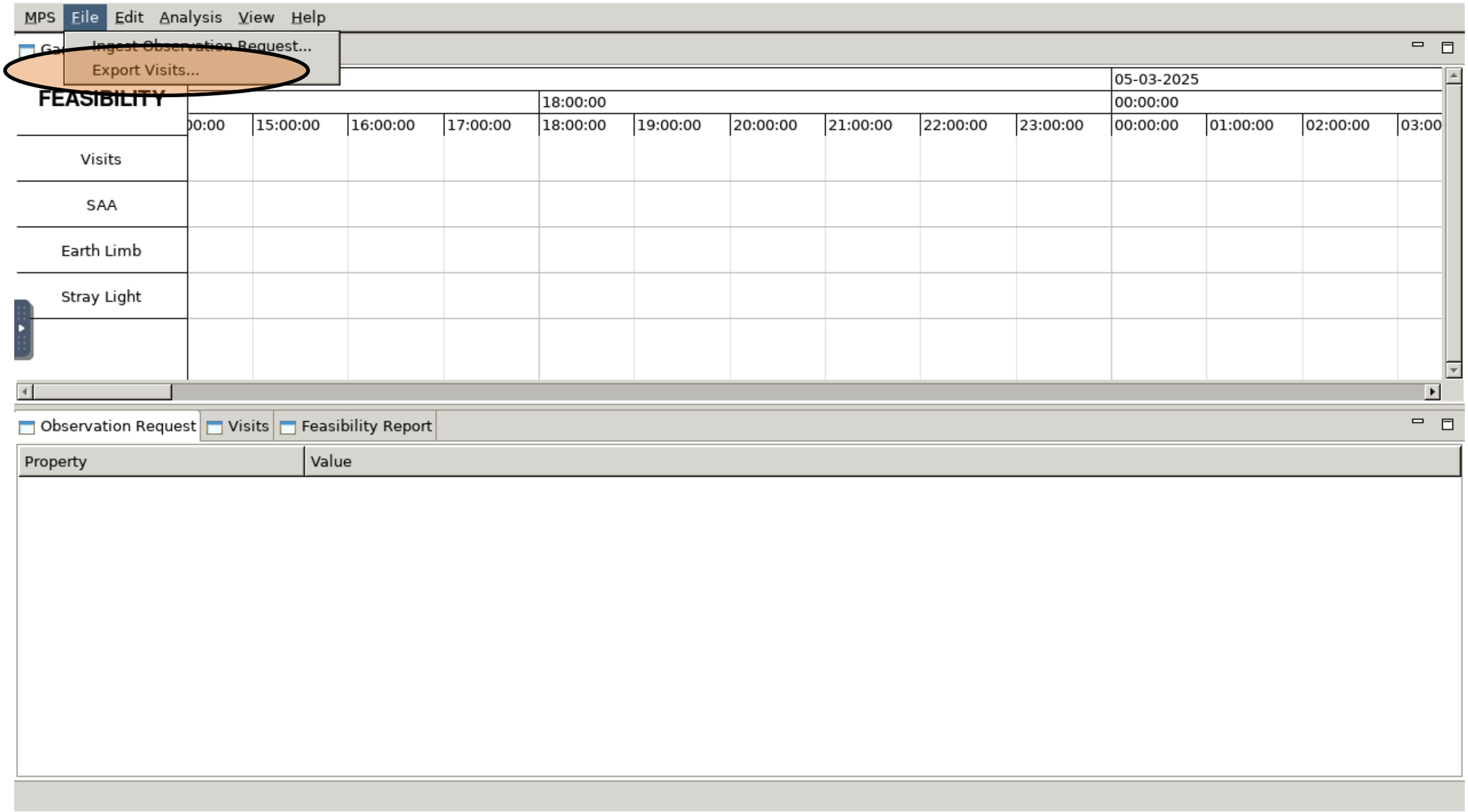
Start	Stop	Phase Start	Phase Stop	Requested Efficiency (%)	Planned Efficiency (%)
06-03-2025 23:22:00	07-03-2025 00:20:00	0.94300	0.99900	50%	28.4%
07-03-2025 00:23:00	07-03-2025 01:22:00	0.00100	0.05700	50%	78%

Start	Stop	Duration (sec)	Planned Efficiency (%)	Efficiency in Critical Phase Ranges
2025-03-04T15:48:00.000	2025-03-05T08:16:00.000	59280.0	58%	...
2025-03-05T09:28:00.000	2025-03-06T01:56:00.000	59280.0	58%	...
2025-03-06T03:09:00.000	2025-03-06T19:37:00.000	59280.0	60.7%	...
2025-03-06T20:50:00.000	2025-03-07T13:18:00.000	59280.0	59.4%	...
2025-03-07T14:30:00.000	2025-03-08T06:58:00.000	59280.0	57.9%	...
2025-03-08T08:11:00.000	2025-03-09T00:39:00.000	59280.0	57.5%	...
2025-03-12T00:34:00.000	2025-03-12T17:02:00.000	59280.0	61%	...
2025-03-12T18:15:00.000	2025-03-13T10:43:00.000	59280.0	57.8%	...
2025-03-13T11:56:00.000	2025-03-14T04:24:00.000	59280.0	57.1%	...

Feasibility Checker Guidelines

Explore the result

Detailed list of visit can be exported to an ascii file for further analysis. Go to “File”, then “Export Visits…”.

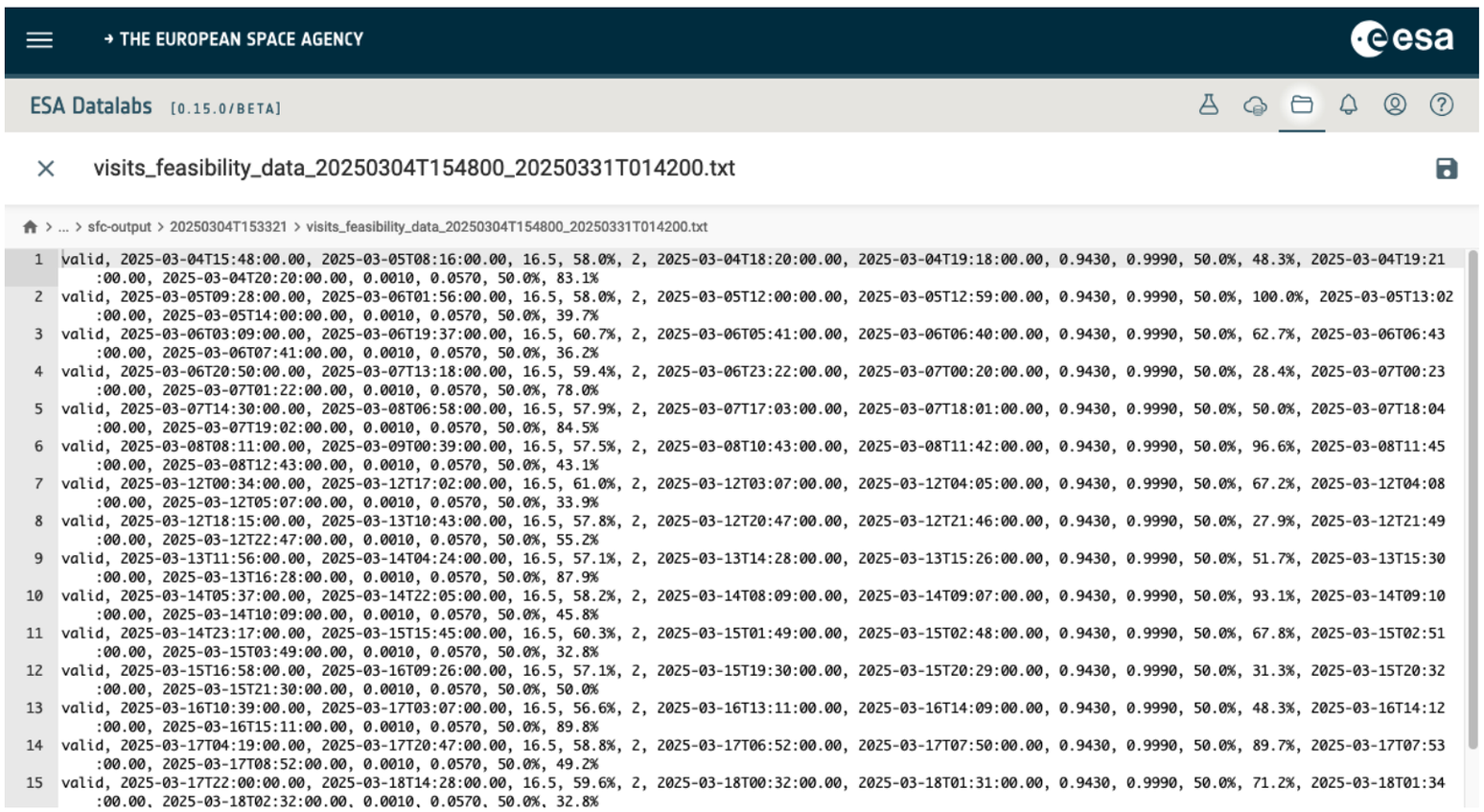


Feasibility Checker Guidelines

Explore the result

The output file is saved to my_workspace/cheops-sfc/sfc-output/ inside your Datalabs Workspace.

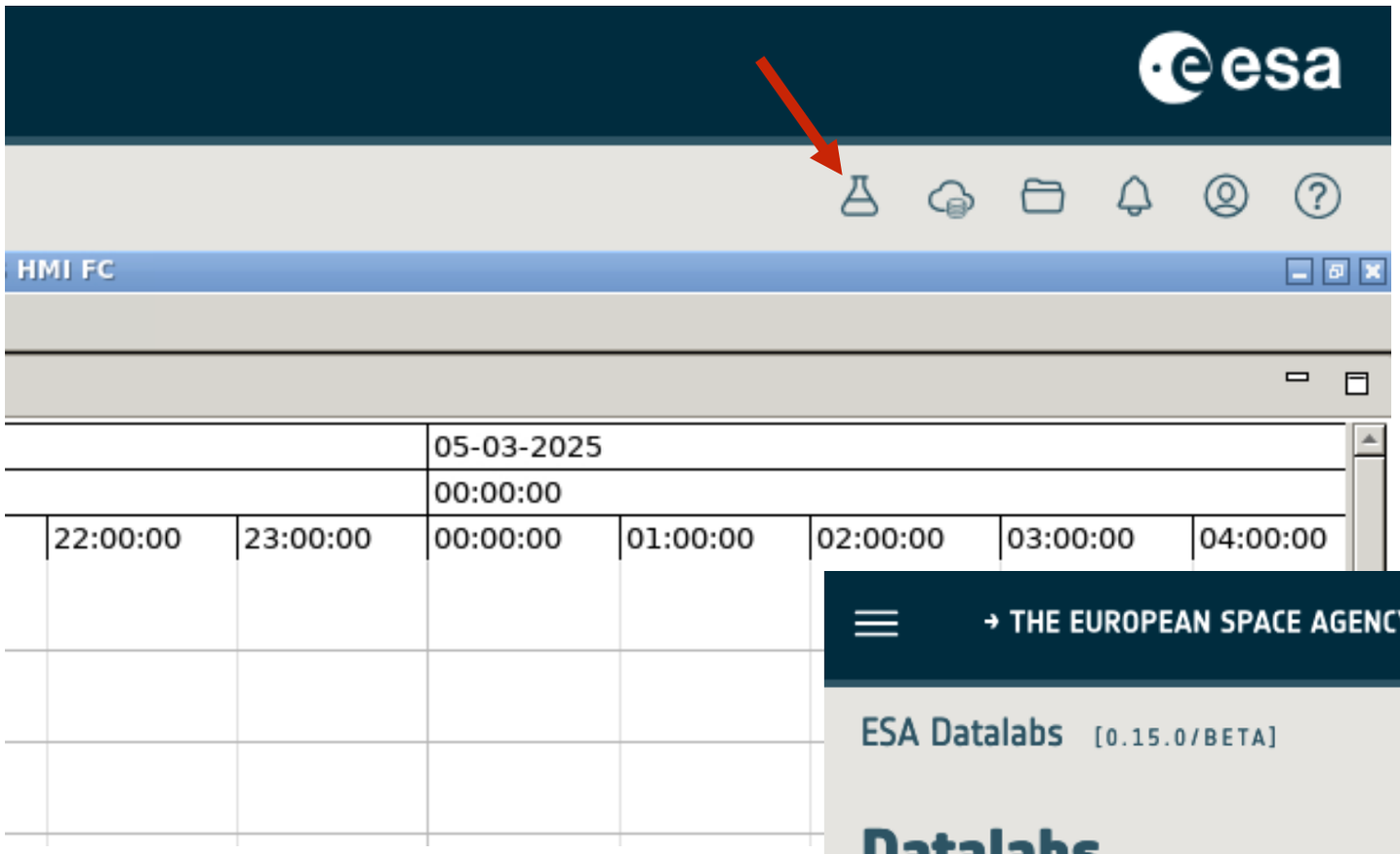
Double click on the file to open it.

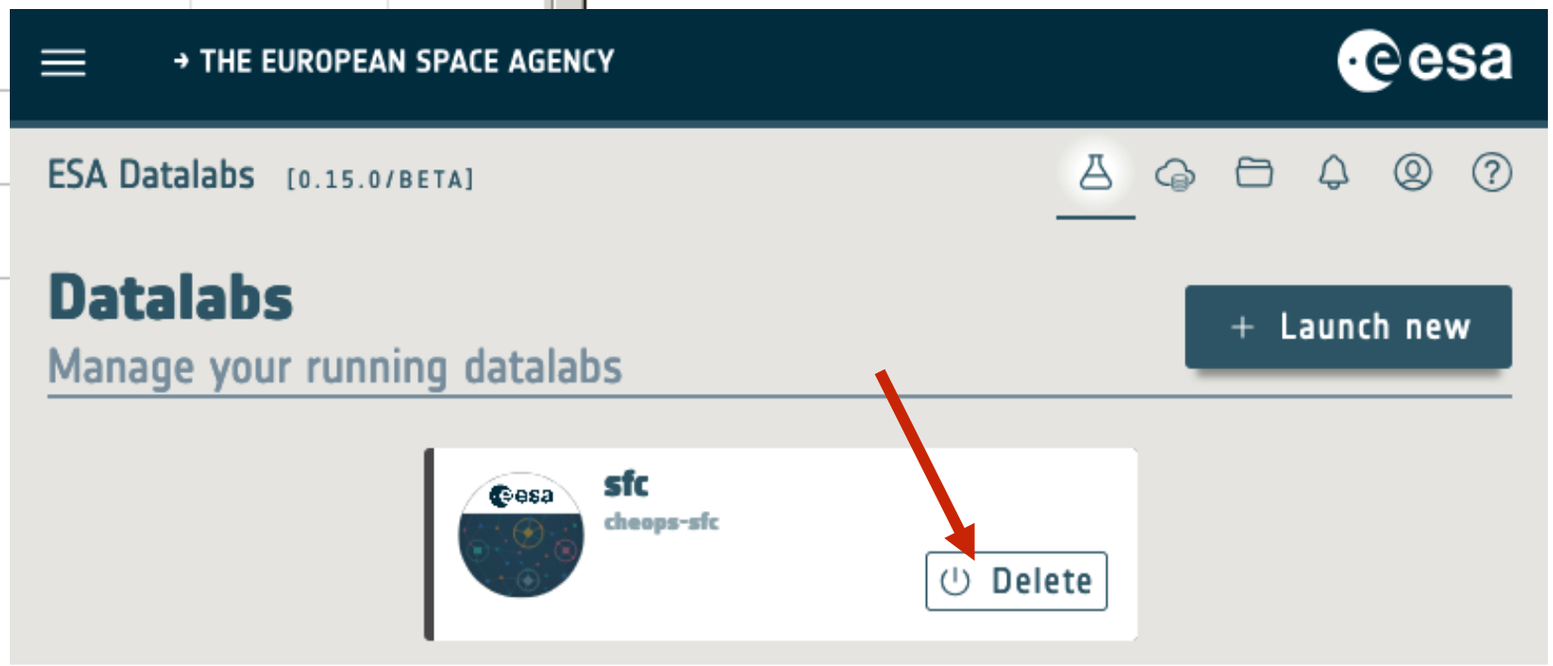


Feasibility Checker Guidelines

Delete datalab

Delete the datalab by clicking on the ‘flask’ icon in the Datalabs menu, then press the ‘Delete’ button on the CHEOPS-SFC datalab. Deleting the datalab **will not affect** the files in your Datalabs Workspace.





Feasibility Checker Guidelines

Known bugs

- Attempting to minimize the SFC window in the **cheops-sfc** datalab yield a 1x1 pixel window that is unrecoverable. If this happens, restart the datalab.

- The slider plot in the **cheops-vis** datalab can freeze occasionally. Exit the plot and relaunch the command.

Additional tips

- The PYCHEOPS software (made for CHEOPS light curve analysis) has a function called 'make_xml_files'. This is a community-developed tool to generate XML files for input to the SFC, based on a data table for multiple observing requests provided by the user.

- The CHEOPS Visibility tool can also be accessed in our gitlab for users that wish to have it on their local work station: https://gitlab.unige.ch/cheops/CHEOPS_visibility_tool/-/tree/datalab-1.0.1