# NOMAD Obs Planning Instructions

## Requirements:

* SpiceyPy
* Python 3.6
* Various standard packages (numpy, os, sys, datetime, matplotlib)
* Xlsxwriter and xlrd

## Introduction:

There are four scripts:

|  |  |
| --- | --- |
| Name | Description |
| obs\_config.py | Contains hardcoded paths to main directories to find e.g. cop tables, spice kernels, etc.  Modify before running program (if required) |
| obs\_functions.py | Contains the functions and calculations that do the obs planning.  In general, do not modify. |
| obs\_inputs.py | Contains the information for all previous mtps and is where new information is to be added by the user for the upcoming mtps. E.g. observation types, mtp start/end times, regions of interest, lists of observation types to be added.  Information must be added here before the script is run for a new mtp. |
| run\_planning.py | This is the script to be run.  In general, do not modify, except the mtp number |

## Instructions for setting up:

Modify obs\_config.py as required. There are five paths to be specified:

|  |  |
| --- | --- |
| BASE\_DIRECTORY | This is the directory containing the 4 scripts, and is where new orbit plans will be placed. |
| OBS\_DIRECTORY | This is the base directory for the master version of the website. All input files must be placed here, and all output files, webpages and images will be generated here. |
| DEV\_DIRECTORY | This is the base directory for the website, to be placed on the web dev server. A copy of all images and files will be made here. |
| COP\_TABLE\_DIRECTORY | This is the directory containing the cop table directories. Can be temporarily modified to a local folder for testing new cop table patches in the system. |
| KERNEL\_DIRECTORY | This is the base directory containing up to date spice kernels. The subdirectories contain each type of kernel e.g. mk, ck, ik, etc. inside this directory. |

Plus the metakernel name METAKERNEL\_NAME. This should always be em16\_plan.tm for planning purposes. On windows, the path to the kernel directory will need to be given inside the file i.e.

PATH\_VALUES = ( ‘<path>\kernels' )

## Instructions for running:

Add required information to obs\_inputs for the mtp to be planned. Minimum required:

|  |  |
| --- | --- |
| mtpStart | This is the EXMGEO\_TD2N start time as specified by Bojan or Claudio |
| mtpEnd | This is the EXMGEO\_TD2N end time as specified by Bojan or Claudio |
| copVersion | This is the cop table folder for this MTP. Remember that after each patch is executed onboard, this must be updated to reflect the new COP rows. |

Optional additions:

|  |  |
| --- | --- |
| occultationObservationDict  nadirObservationDict | These are the dictionaries of all known observation types, of the form:  #name:[[list of diffraction orders], integration time, rhythm, number of detector lines, channel]  Where integration time is in milliseconds, rhythm is in seconds (usually 1 for occultation, 15 for nadir); the number of detector lines is usually 16 for occultation and 144 for nadir; and channel=0 for SO and 1 for LNO.  These names are used in the final orbit plan. |
| occultationRegionsOfInterest  nadirRegionsOfInterest |  |
| occultationRegionsObservations  nadirRegionsObservations |  |
| USE\_TWO\_SCIENCES |  |
| OCCULTATION\_KEYS  OCCULTATION\_MERGED\_KEYS  OCCULTATION\_GRAZING\_KEYS  NADIR\_KEYS  NADIR\_LIMB\_KEYS  NADIR\_NIGHTSIDE\_KEYS |  |

In run\_planning.py, change mtpNumber to the desired value.

Run the script. Step 1 will be initiated, and the orbitList list will be populated with all the geometric data for the MTP

The generic orbit plan *nomad\_mtp015\_plan\_generic.xlsx* will be placed in base directory. The generic script generally includes too many LNO dayside nadirs. Remove some by deleting some of the entries in the LNO dayside column (a blank entry means no observation will be run). Note that:

* If the observation corresponds to a region of interest, this will be indicated in the last column – it is better to keep these observations and remove others before/after to keep to the LNO 50% duty cycle.
* Do not delete limbs.
* If a row has no SO or LNO observations, the orbit type in the 1st column must be changed to type 14.

See previous MTPs for examples. Send *nomad\_mtp015\_plan\_generic.xlsx* to nomad.iops@aeronomie.be

When the modified version is received from the OU, check for errors - e.g. remove observations that are not allowed, for example UVIS observations scheduled during OCMs. There are two types of UVIS nightsides, which will be highlighted in blue or yellow:

* Those in yellow are calibration measurements. If desired, LNO can run nightside measurements in these slots (add blue are

Place this file in the orbit\_plans/mtpxxx folder and run entire script again.

The following files will be generated in the base directory:

* lno-uvis joint observation file will be created in base directory.
* Send this and the generic orbit plan to nomad.iops

#if all is ok then place it in the orbit\_plans/mtpxxx folder and run entire script again

#final orbit plan will be placed in base directory. Check for issues

#if all ok then place it in the orbit\_plans/mtpxxx folder and run entire script again

#the following files will be generated in cop\_rows/mtpxxx folder:

#calibration file must be filled in manually. Use values from solar\_calibrations.xlsx file for miniscans/fullscans. See previous mtps for examples.

#this and the other ir cop rows should be checked (compare to summary files from bojan/claudio), particularly timings and number of rows in files

#lno orbit number file, for uvis ops team

#joint occultation file, for acs team. This will be sent by bojan/claudio to the soc.

#send all files in the cop\_row/mtpxxx folder to nomad.iops@aeronomie.be

# Important things to remember:

Add nightside LNOs

Check targeted nadir:

Curiosity (134/136)

Francesca surface hydration sites (191)

Add more CH4 release sites (134/136)

1st observation after OCM slot should always be LNO+UVIS to keep instrument warm

Check starting orbit matches with Bojan/Claudio

Add nightsides and limbs manually to orbit plan

Add/remove observations to keep 50% LNO duty cycle. Half of all rows should be of type 4!

Check number of orbits in file matches with Bojan/Claudio

Add LNO solar occultations manually if desired -> change 0 to 1 in 5th column

Remember to check what calibrations there are, and send calibration COP rows separately!

Add manually to comment section where required:

&PDHUMaintenanceSlot

&NightsideUVIS

Check all orbit type 28 have been added for LNO+UVIS limbs