

JPCam Observing Planner (JOP) Documentation

Due to the specific spatial distribution of CCDs and filters in JPCam, an observational strategy needs to be designed to accommodate its peculiarities.

Broadband Strategy (Exact Copies of Filters, T5, T6, T7 - gri Bands)

One scenario occurs when copies of the same filters are distributed across the 14 CCDs. This is the case for the gri-band filters, where we employ 14 copies of the filters and observe a set of pointings to maximize area coverage and fill gaps between CCDs. We identify the trays with 14 copies of the same gri-band filters as Tray 5, 6 and 7 (T5, T6 and T7). Selection of these trays in the JOP results in what we call the *Broadband Strategy*.

The default (and recommended) strategy to observe a specific contiguous area is to observe a set of 4 pointings to fill the gaps between CCDs and then shift in RA and Dec (if needed) by the size of JPCam. The area coverage in this recommended default mode is shown in Fig. 1.

The area for 1 pointing of JPCam, which internally contains 4 pointings to fill CCD gaps, at Dec = 0 deg, is 6.3 deg² (using the default supported dithering pattern). This value gives an idea of how many pointings are required for a project, depending on the desired area.

In order to obtain the pointings covering a specific area centered on the coordinates of your interest, use the JOP tool available at <https://www.cefca.es/jop/plan/> to generate the pointings and the effective field of view. The *Broadband Strategy* is used when the “T5 T6 T7” trays are selected. The parameters defining a scientific project are as follows:

- **Field Prefix:** A name of your choice to label the project’s pointings.
- **RA:** Right Ascension of the center of the pointing (in degrees).
- **Dec:** Declination of the center of the pointing (in degrees).
- **No cover gaps (T567):** Select this option if you do not want to cover gaps between the CCDs internally (only available for broad-band strategy).
- **NPx:** Number of pointings of the grid in RA to increase the area (not to cover CCD gaps which is managed internally).
- **NPy:** Number of pointings of the grid in Dec to increase the area (not to cover CCD gaps which is managed internally).
- **Dither:** Use of dither (True/False). Use of dithering is highly recommended as it is the supported option by the OAJ to ensure optimal reduced data.
- **Dither Shift:** The dither shift (in degrees). A shift of 0.236 degrees is highly recommended as it is the supported option by the OAJ to ensure optimal reduced data.

The dither pattern is highly recommended, as it is the mode supported for data reduction by the OAJ. This dither pattern of 0.236 degrees is optimized to achieve precise absolute flux calibration and optimal sky background subtraction. The 4 exposures dithered pattern is shown in Fig. 2.

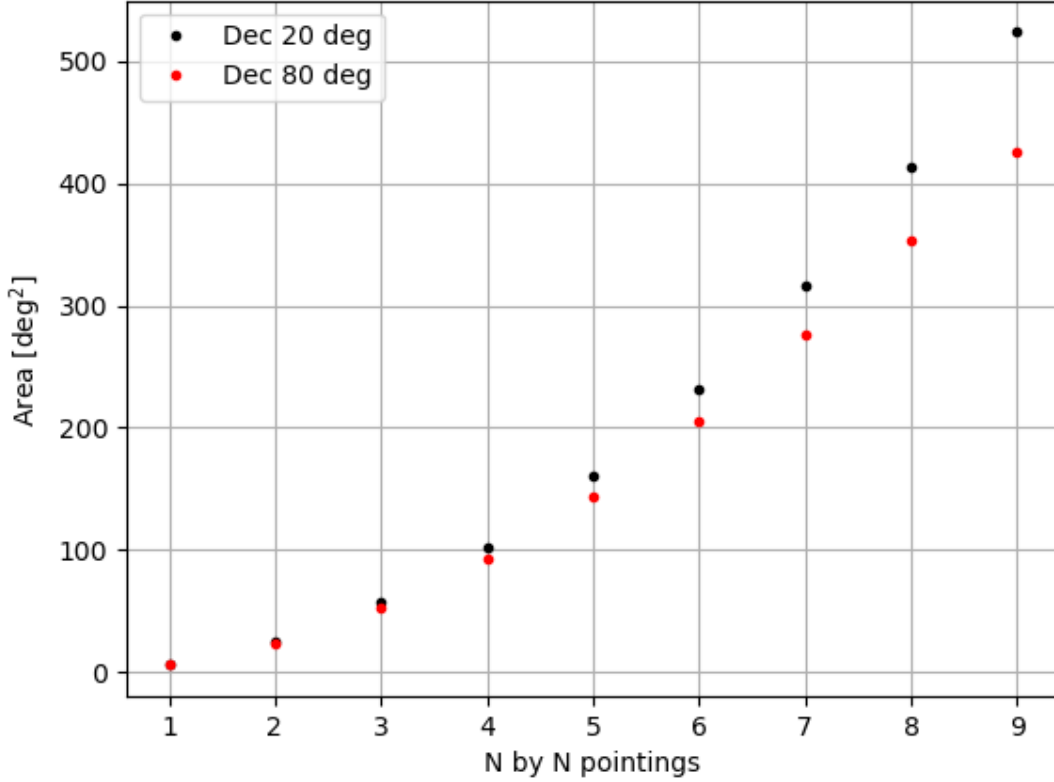


Figure 1: Area covered by the selected filter in the *Broadband strategy* versus the number of pointings per dimension, N , in a squared mosaic.

***Narrowband Strategy* (Different Filters on Each CCD, T1, T2, T3, T4)**

The distribution of filters across JPCam in trays 1 to 4 (T1 to T4) is illustrated in Fig. 3.

54 narrow and 2 mid-band filters are distributed across trays T1 to T4. Selection of one of these trays in the JOP results in what we call the *Narrowband Strategy*.

In this strategy, spatial coverage is achieved by observing contiguous pointings, shifting each pointing by the effective (unvignetted) size of the CCD in both RA and Dec. Consequently, different CCDs exhibit varying spatial coverage, although there is a common central area that expands as more pointings are added. Initially, the area coverage increases with the number of observed pointings, and can be further extended by adding more contiguous pointings. Area coverage depends on declination. We show the covered area for different $N \cdot N$ squared grid pointings in Fig. 4.

In order to obtain the pointings covering a specific area centered on the coordinates of your interest, use the JOP tool available at <https://www.cefca.es/jop/plan/> to generate the pointings and the effective field of view. The *Narrowband Strategy* is used when the T1, T2, T3, or T4 Trays are selected.

The parameters defining a scientific project for the *Narrowband Strategy* are:

- **RA:** Right Ascension of the center of the pointing (in degrees).
- **Dec:** Declination of the center of the pointing (in degrees).
- **NPx:** Number of pointings of the grid in RA to grow the area.
- **NPy:** Number of pointings of the grid in Dec to grow the area.

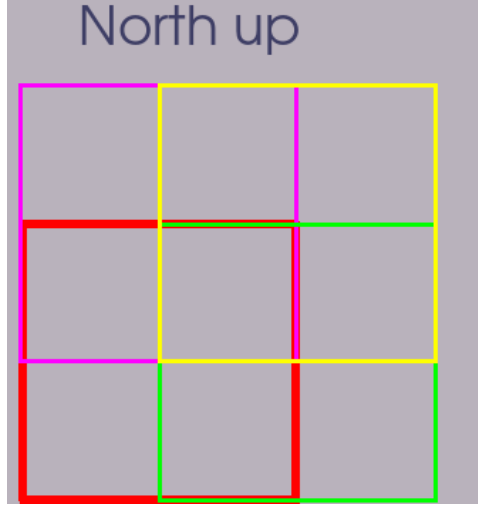


Figure 2: A very basic sketch illustrating the dithering pattern applied (the useful area of a single CCD is shown). Each color represents the FoV of the CCD on the sky for each of the 4 exposures.

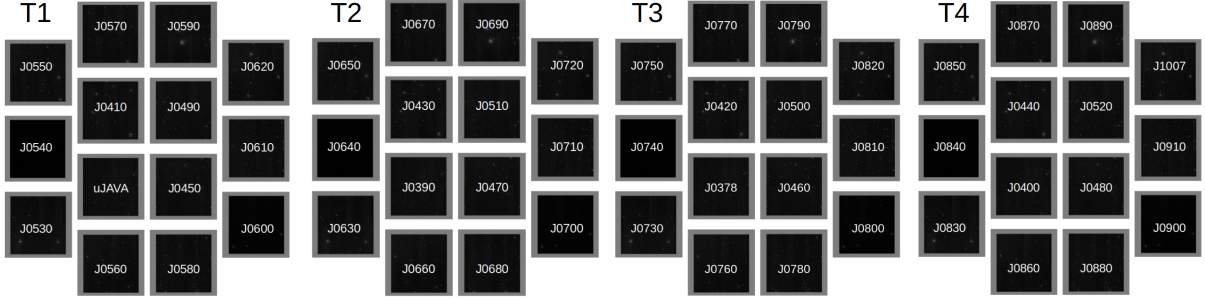


Figure 3: Filter distribution per Tray.

- **Tray:** Values: 'T1', 'T2', 'T3', or 'T4'. This is required to display and choose filters for calculating the common area. All filters are selected by default. Specific filters can be selected or deselected as desired. The use of official filter colors is optional; better color contrast can be obtained with non-official colors.
- **Dither:** Use of dither (True/False). Dithering is highly recommended and supported by the OAJ for optimal data reduction.
- **Dither Shift:** The dither shift (in degrees). A shift of 0.236 degrees is highly recommended for optimal data reduction by the OAJ.

The filters available for each tray are:

- **T1:** 'J0620', 'J0610', 'J0600', 'J0590', 'J0490', 'J0450', 'J0580', 'J0570', 'J0410', 'uJAVA', 'J0560', 'J0550', 'J0540', 'J0530'.
- **T2:** 'J0720', 'J0710', 'J0700', 'J0690', 'J0510', 'J0470', 'J0680', 'J0670', 'J0430', 'J0390', 'J0660', 'J0650', 'J0640', 'J0630'.
- **T3:** 'J0820', 'J0810', 'J0800', 'J0790', 'J0500', 'J0460', 'J0780', 'J0770', 'J0420', 'J0378', 'J0760', 'J0750', 'J0740', 'J0730'.
- **T4:** 'J1007', 'J0910', 'J0900', 'J0890', 'J0520', 'J0480', 'J0880', 'J0870', 'J0440', 'J0400', 'J0860', 'J0850', 'J0840', 'J0830'.

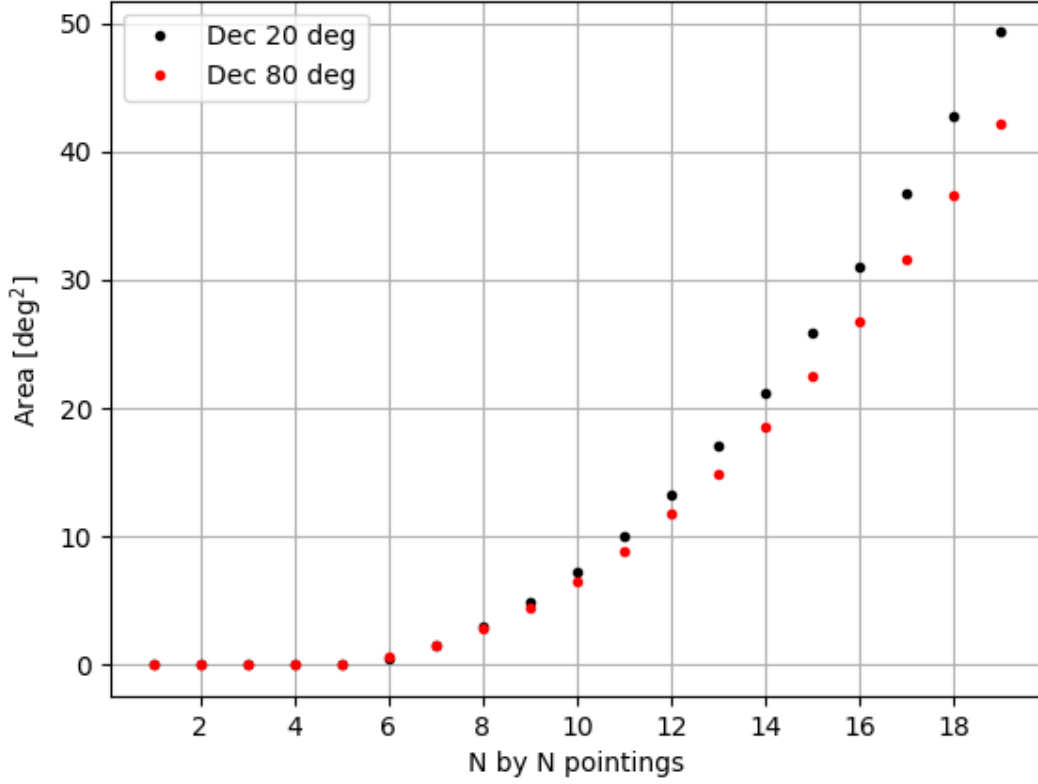


Figure 4: Area in common covered by all filters in the *Narrowband strategy* versus the number of pointings per dimension, N , in a squared mosaic.

Outputs

The JOP tool displays two images: one showing the pointings (on the left) and another showing the area for each filter and the common area for all selected filters (on the right). In addition, the number of pointings to be used in the Observing Time Application Platform appears in red. This number will be used to estimate the total time of the project.

The user can download a CSV file containing the list of pointings for the observational project (dithering information is not included in this list). Additionally, a DS9 region file (.reg) with the common area for the selected filters can be downloaded, as well as a set of DS9 region files with the individual coverage area for each selected filter (in narrowband strategy). These region files allow the user to compare the observational region with the desired astronomical field.

Advanced: self-defined pointings

There is the option to upload self-defined pointings in a csv format. This option can be opened clicking on the upload icon appearing to the left of the Help icon. The format to be uploaded is the same as the one created with this tool. Upload your pointings and compute the area of your desired Tray and set of filters. OAJ can not assure the quality of the reduced data when using self-defined pointings and inquiries should be sent to cefca@cefca.es if you plan to ask for different modes from those described in the documentaion and the CfP.