

# Planck-HFI unit conversion and color correction routines: tutorial

Sergi R. Hildebrandt, Juan Macías-Pérez  
*LPSC, Grenoble, France*  
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## I. NECESSARY BANDPASS INFORMATION

The necessary information are the measurements of the bandpasses. These values are recovered either from the RIMO (fits file) or from the IMO (HFI Core Team access).

There are two versions considered: v1.01 and v2.01. The first one corresponds to the bandpass measurements used in the DX4 exchange. The second ones were obtained in the summer of 2010, with a special attention to the transmission values at the CO emission lines.

The routine is: `hfi_read_bandpass`.

The output is a structure with the complete name of the detector, the frequencies at which the bandpass have been measured and the corresponding values of the spectral transmissions.

Examples are:

- `bp = hfi_read_bandpass('v201', /rimo )`
- `bp = hfi_read_bandpass('v101', /imo )`

**NOTE for CVS:** If a CVS repertory is to be used, the RIMO FITS file can be called with the use of the Keyword “IN\_PATH”.

## II. UNIT CONVERSION

In order to obtain the unit conversion from  $K_{\text{CMB}}$  to  $K_{\text{RJ}}$ , or to MJy/sr in the  $\nu I_\nu = \text{cnt.}$  convention, the routine to be used is: `hfi_unit_conversion`.

An example is (notice first the bandpass information has to be read with the routine above)

- `uc = hfi_unit_conversion(bp, '353', bolo_uc )`

“UC” refers to the unit conversion of the channel. It corresponds to a direct average of the detectors of that channel, without considering RTS detectors (70.143.8, 55.545.3 and 74.857.4). The reference frequencies for the flux unit conversion are the *nominal* values in consistency with DX4 exchange. “BOLO\_UC” contains the values for each of the detectors in that channel. RTS detectors are flagged.

More examples are to be found in the header of the script.

## III. COLOR CORRECTIONS

In order to obtain the color correction from a given flux prediction to the units of the  $\nu I_\nu = \text{cnt.}$  convention, the routine to be used is: `hfi_color_correction`.

There are three options for the SED (Spectral Energy Distribution) so far: power-law, a modified Planck law to account for the dust and also a vector containing the values of intensities and its corresponding associated frequencies.

Examples of applications are (see the code for more. Notice first the bandpass information has to be read)

- `cc = hfi_color_correction(bp, '353', bolo_cc, /powerlaw, alpha = 4.)`
- `cc = hfi_color_correction(bp, '353', bolo_cc, /modblackbody, betabd = 2., tbd = 17.)`

“CC” is the color correction associated with a channel, again computed as a direct average of the detectors of that band, omitting RTS detectors.

**NOTE OF USE:** The color correction per detector has to be used in the following way. Let us assume that a particular SED of a source predicts  $S_{\text{MODEL}}$  MJy/sr. Then  $S_{\nu I_\nu = \text{cnt}} = S_{\text{model}} \times \text{CC}$ .

In this way, flux units for the maps are given in a **unique convention**, whereas each model is (color) corrected to be expressed in the same units as the maps.

More examples are to be found in the header of the script.