USER'S GUIDE
(CIS_v1.0 - October 2013)

1.- The simulator starts with empty frames of 512 × 512 (or 256 × 256) pixels covering 18.4″ × 18.4″ (or 9.2″ × 9.2″) on the sky. In this version, the initial frame dimensions depend on the size of your screen, and the pixel scale is 0.036″. Later you can reduce the field of view and go into detail by using the zoom button. For a given frame (source model or final image), there are two light blue panels attached to it. These bottom horizontal and right vertical panels trace fluxes along the row and column for the position of the pointer, respectively. You can also see the pointer position in the bottom right, light blue square. In the final image, this square also reports the instrumental flux (counts/pixel) for the pointer position. Log and square-root scales can be also used.

2.- The first step is to select a channel (FUV or NUV). Do not forget the peak throughputs (1400 Å and 2500 Å for the FUV and NUV channels) when entering fluxes of sources (*see item 3*). You should also set the filter wheel configuration (open = no filter, NF1 = neutral filter with a constant transmittance of about 0.1, NF2 = neutral filter with a constant transmittance of about 0.01) and the exposure time.

3.- Go to the source parameters (below the left-hand frame), and then choose the type of source. Point-like sources are displayed as red stars, while uniform, Gaussian, exponential and de Vaucouleurs (extended) sources are shown as light blue, green, yellow and orange ellipses, respectively. There are two different ways to add sources in the left-hand frame: **specific object** and **random distribution**. After selecting one option, you must set several additional parameters.

a) **Specific object**

You can add one source, indicating its position (x, y; both in pixels), flux (in erg cm^{-2} s^{-1} $Å^{-1}$) and structure parameters. For a point-like object, you can type/paste any value of these last parameters, since they are ignored by the simulator. However, an extended source with elliptical isophotes is characterised by the major radius of the ellipse enclosing 50% of the total light ($R_{1/2}$ in pixels), as well as its ellipticity ($\varepsilon = 1 - b/a$, where a and b are the semi-major and semi-minor axes) and orientation (PA in degrees) of isophotes.

b) **Random distribution**

Enter the **number of sources**. In a second step, enter the lower and upper limits of fluxes (in erg cm^{-2} s^{-1} $Å^{-1}$) for point-like objects. For extended objects, you also need to assign the ranges to their structure parameters $R_{1/2}$, ε and PA (see here above).

Once you enter all data for a **specific object** or a **random distribution**, click on the add source(s) button. You can put the pointer on any point-like or extended source to see its parameters: *x y flux* (point-like) or *x y flux* $R_{1/2}$ ε *PA* (extended). You can add as many sources as necessary, change the position of any object (click on it, drag and drop) and remove it (double click). The simulator provides a list of sources, using a row for each object and a column for each parameter.

4.- The source model leads to a final image in the right-hand frame. First, physical fluxes (in erg cm^{-2} s^{-1} $Å^{-1}$) are converted to cps using a realistic cps-to-flux ratio for the corresponding channel, i.e., 3.36×10^{15} (FUV) or 1.14×10^{17} (NUV). These ratios are properly reduced when using a neutral filter (*see item 2* for transmittance factors). Second, the source model is convolved with the expected central PSF for the FUV/NUV channel. Third, a sky background is added to the image. This is due to the Earthsine (ES), the Zodiacal light (ZL) and the Geocoronal emission (GC), taking as a reference ES, ZL and GC average fluxes in the Hubble Space Telescope (HST). The ES for the WSO-UV telescope should have smaller values than those for the HST, because the higher Earth orbit of the WSO-UV (less affected by the reflected sunlight). However, although the ES background is overestimated, the total background signal is dominated by the GC (ES < ZL < GC). This sky background also depends on the selected channel and filters, and its open-open values are $\beta = 4.9 \times 10^{-3}$ cps/pix (ES + ZL = 7.2×10^{-12} cps/pix) in the FUV and $\beta = 3.5 \times 10^{-4}$ cps/pix (ES + ZL = 2.1×10^{-5} cps/pix) in the NUV. The current version of the simulator does not account for any instrumental background (e.g., dark current).

5.- In a final step, the simulator takes into account the exposure time (T in sec) to produce a number of counts in each pixel, and then generate Poisson fluctuations. The final image initially displays counts in pixels, but the user is allowed to modify the brightness scale, i.e., log (C) or sqrt (C) instead of C counts (*see item 1* for zooming). In general, the signal-to-noise ratio (per pixel) is given by SNR = $(C - B)/C^{1/2}$, where $B = \beta \times T$. Hence, the square-root scale is useful to quantify the SNR across the field of view when C >> B.

Two remarks:

6.- Once you are working on a given source model and the corresponding final image, besides adding, moving and/or removing sources, and using the zoom and/or brightness scale selector, you are allowed to modify the initial parameters (channel, filters and/or exposure time; *see item 2*). These changes in the initial instrumental configuration produce new final images for your source model, so you do not need to define the model again.

7.- You can get a PNG file for each frame (click on the PNG option). Regarding the final image, it is also possible to display on your screen and save (download) a RGBA data file. This red-green-blue-alpha file can be converted into a FITS file for subsequent analysis. While there are some tools to convert from RGBA to FITS (e.g., http://fits.gsfc.nasa.gov/fits_viewer.html), in the STDOUT document you can find a simple way to make a FITS file. Probably the recipe in STDOUT.PDF is not the shortest or simplest way to generate a standard (FITS) output, but it has a main advantage: only commonly-used astronomical software (DS9 and IRAF) is required.

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Your comments and suggestions
will help us to improve this software!

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