

Written by: Greg Snyder; gsnyder@stsci.edu . April 2014.
Data as produced by Chris Moody before Fall 2013.

Key Data Sets

1. **Mock images, in 5 HST filters, consisting of:**

- a. noiseless high-resolution simulated images (calculated using Sunrise with dust attenuation).
- b. images convolved with appropriate PSFs and re-binned to 0.06 arcsec/pixel.
- c. the results from the previous step, with CANDELS-wide-like noise

2. **Post-processed catalogs, combined by Chris Moody.**

A lot of work has been done post-processing these data. Many of these quantities were compiled by Chris Moody in Fall 2013, and are now posted at:

<https://bitbucket.org/juxtaposicion/catalog> (Please let Greg or Joel know if that link ever stops working, we can re-host these data.)

You can download all of the catalogs from a small link on the right. There are a few different lists in here, including simulation quantities such as stellar mass and halo mass (among many others; "sim"), magnitudes ("restframe" and "redshifted"), plus Mark's visual classification catalogs and Priya's GalFit measurements for a subset.

There is limited documentation for these. Greg has been using these in conjunction with the images, so please let him know if he can help parse them or match them to the images in helpful ways.

Disclaimer: Of course, the simulations and analyses are ongoing, so this document merely reflects the snapshot of data and knowledge as of April 2014, as viewed by Greg. In particular, many more mock image Filters and settings could be made available with some effort (some are currently stored as raw output on supercomputer platforms), and Sunrise may have been run on more simulations. For updates, contact Greg, Joel, or Miguel Rocha (UCSC).

Structure of Image Data

The basic unit is a “timestep” identified by the simulation **Name** and **Expansion Factor**; e.g., “MW1_a0.410_...” where Name=MW1 and expansion factor a=0.410. Note: some folders omit the “a” preceding the expansion factor. Each folder with data (some may be empty) should contain a tar.gz file that expands in to an “images” folder containing the mock images as individual FITS files. These mock images contain **very useful headers** and so if you don’t want to use the filenames to track simulation names or redshift, etc, much of these data are stored in the FITS headers.

For each such unit, there are usually as many as 30 sets of 3 mock images (for a total of 90). The 3 types are described above and again below. The 30 sets are for 6 viewing directions and 5 filters (F606W, F775W, F850LP, F125W, F160W). The viewing directions are defined such that “CAMERA0” is face-on, “CAMERA1” is edge-on; and the rest should be considered randomly oriented. Sometimes images are missing owing to corrupted data and there are fewer than 30 in a folder.

The 3 basic units for each camera and filter are identified by the file suffix:

1. Noiseless high resolution image directly from Sunrise: “*_simulation.fits” (**note units not specified in header: $W/m/m^2/Sr$** ; this can also be worked out from the header information in the subsequent CANDELized images, but this might save time.)
2. Convolved with PSF, re-binned, in HST image units (AB zeropoints located in FITS file headers): “*_candelized_noise.fits”. These are simple, assuming single exposures.
3. The previous, with CANDELS noise added (appropriate for CANDELS-wide, I believe): “*_candelized_noise.fits” (I believe it might be the same background cutout for all simulated images). It is easy to adjust the noise assumption by adding a newly chosen background to the previous noiseless image.

In addition to the headers, the **Viewing Angle** and **Filter** are identified in the FITS filenames, something like:

“Name_ExpFactor_HaloID_**CAMERA_FILTER**_candelized_noise.fits”. “HaloID”, also present in the parent folder name for each timestep, can be used to robustly cross match the image to the post-processed catalogs above (and eventually to the non-parametric catalogs), in addition to the Name and Expansion Factor.

Verifications and Other Data

GS spent some time in Fall 2013 verifying the header information and FITS file contents --- especially those related to units, noise, pixel scales, etc, should be considered trustworthy (kudos to the builders!). GS also has a lot of experience manipulating these data, and probably has some Python code snippets for doing basic manipulations of these images if you are interested in examples.

Specific other CANDELized images: A subset without dust attenuation, compiled by Greg in December 2013, available upon request. Also PSF-matched versions of everything if those might be useful.

Simulation Sets (as of April 2014 with CANDELized images)

For more info: Joel Primack, Daniel Ceverino, Chris Moody

1. Generation 1 -- old version of feedback models. wide range of masses, approx 30 simulations. do not match Mstar-Mhalo relation. (Ceverino & Klypin 2009)
2. Generation 2 -- approx 22 simulations CANDELized, feedback with strong supernova feedback. Better match to Mstar-Mhalo relation. ("VELANN_**")
3. Generation 3 -- approx 10 simulations CANDELized, limited range of masses (log Mstar/Msun from 9.3 to 10.5), but **same halos as Gen 2**, Better still match to Mstar-Mhalo, especially at low masses. "Radiation Pressure" feedback from Ceverino+ 2013/2014. **Much higher time resolution than previous runs.** ("VELAMRP_**")

Credits and Current Projects with Mock Images:

Simulations: Joel Primack, Daniel Ceverino, Avishai Dekel, Anatoly Klypin

Sunrise Mock Images: Christopher Moody (UCSC PhD 2013) --- (Sunrise code credit Patrik Jonsson 2006)

Mock image "CANDELization": Mark Mozena (UCSC PhD student), Chris Moody

Advanced "CANDELization": Anton Koekemoer (STScI)

Clumpy Galaxy Analyses: Yicheng Guo (UCSC), Chris Moody

Non-parametric Morphologies & Mergers: Greg Snyder and Jen Lotz (STScI), Peter Freeman (CMU)

GalFit catalogs from subset of CANDELized images (as of April 2014): Priya Kollipara (UCSC PhD student) , Some values included in Moody's catalogs

GalFit comparison between CANDELized and "Ideal" images: Elizabeth McGrath (Colby) & students

Galaxy Zoo preparation: Jeyhan Kartaltepe

Current Data Contacts, i.e., people using or with access to these data in April 2014 who might be able to answer questions (or at least refer to the right person):

Joel Primack, Greg Snyder, Yicheng Guo, Jeyhan Kartaltepe, Anton Koekemoer, Liz McGrath, Chris Moody