

TIME-DOMAIN ICE GIANT SCIENCE WITH 14 YEARS OF WFPC2 IMAGING DATA.

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Introduction: The Hubble archive is populated with over 14 years of WFPC2* images of the ice giants Uranus and Neptune. We review research enabled by this resource and demonstrate the Planet Pipeline: a search tool, ephemeris database, and repository for calibrated solar system data.

Planet Pipeline: The Planet Pipeline is a high level science product that enables users to search the entire body of WFPC2 solar system observations (Figure 1). The observations are properly indexed, such that the user does not need to know the target name used by the observers, which is often different from the name of the object itself. The immediate output of the search is a table of observations, similar to a general HST archive query result. However, customizable information specific to planetary observations can be shown, derived from the JPL Horizons† database. See Mutchler et al. (2013) for a full list of included ephemeris parameters.

Figure 1: Planet Pipeline search page. “Neptune” is offered as an autocomplete option while the user types in the target field. Output columns in the search result include many common ephemeris parameters. Default output is an HTML (internet browser) table, but many other machine-readable options are also available. See <http://archive.stsci.edu/prepds/planetpipeline>.

In the near future, specially processed data will also be accessible through this interface. Users will be able to download image data where cosmic rays have been removed using Laplacian edge detection, geometric

distortion has been corrected, the target has been rotated so that planetary north is up in the image, and a calibration factor is supplied to convert the data into I/F reflectivity units.

Ice giants in the Hubble archive: A search using the Planet Pipeline tool yielded over 1500 frames of Uranus and Neptune data. Overall program and publication data are given in Table 1.

Table 1: HST/WFPC2 Neptune and Uranus observing program data. Publication count includes only papers listed in the HST archive for each program

Date range	1994-06-27 to 2008-09-10
Num. images	1516
Num. programs	25
Num. papers	34
Avg. papers/program	3.6
Avg. programs/paper	2.5
Max programs/paper	13

The high value of these archival data for investigation of time variable phenomena is quantitatively demonstrated by the ever-increasing number of publications. By the end of 2008, only 2.2 papers per program had been published. Although no new data entered the archive between then and now, that number has risen to 3.6 papers per program. Through 2004, the average publication cited 2 WFPC2 programs. In 2005 and later, the average paper used data from 4 programs. The title of Karkoschka (2011) says it all: “Neptune’s cloud and haze variations 1994–2008 from 500 HST-WFPC2 images.”

As our solar system’s ice giants crawl along their distant orbits, the HST archive will continue to provide a reference for seasonal changes, cloud activity, atmospheric circulation, ring and satellite dynamics, and satellite variability. At the workshop, we will review some of the findings in these areas that are uniquely enabled by the long baseline of Uranus and Neptune data in the WFPC2 archive.

References

- McMaster, M. and Biretta, J., 2008. *WFPC2 Instrument Handbook, Version 10.0* (Baltimore: STScI).
 Mutchler, M. et al., 2013. *LPSC Abstracts*, #2633.
 Karkoschka, E., 2011. *Icarus* 215, 759–773.

* WFPC2 = Wide Field and Planetary Camera 2 (McMaster and Biretta 2008).

† Available at <http://ssd.jpl.nasa.gov/?horizons>