The Hubble Space Telescope Wide Field Camera 3 Quicklook Project

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Abstract

The Hubble Space Telescope's Wide Field Camera 3 (WFC3) instrument has been acquiring ~50-100 images daily since its installation in 2009. The WFC3 Quicklook project provides a means for WFC3 instrument analysts to store, calibrate, monitor, and interact with these data through the various Quicklook systems: (1) a ~175 TB filesystem, which stores the entire WFC3 archive on disk, (2) a MySQL database, which stores image header data, (3) a Python-based automation platform, which currently executes 22 unique calibration and monitoring scripts, (4) a Python-based code library, which provides system functionality such as logging, downloading tools, database connection objects, and filesystem management, and (5) a Python/Flask-based web interface to the Quicklook system. The Quicklook project has enabled large-scale WFC3 analyses and calibrations, such as the monitoring of the health and stability of the WFC3 instrument, the measurement of ~20 million WFC3/UVIS PSFs, the creation of WFC3/IR persistence calibration products, and many others. The Quicklook system may be extended to support the forthcoming James Webb Space Telescope mission.

Filesystem

- ✓ Stores entire WFC3 archive on disk
- ✓ Storage available for WFC3 related projects
- ✓ 172 TB (24 TB calibration, 32 TB science, 116 TB general use)
- ✓ Stores calibrated, uncalibrated, and engineering files
- ✓ Iterate over datasets quickly and easily

```
Quicklook/14452/Visit01/1id3l01cij_jif.fits
Quicklook/14452/Visit01/id3l01cij_jit.fits
Quicklook/14452/Visit01/id3l01ciq_drz.fits
Quicklook/14452/Visit01/id3l01ciq_flt.fits
Quicklook/14452/Visit01/id3l01ciq_flt_hlet.fits
Quicklook/14452/Visit01/id3l01ciq_ima.fits
Quicklook/14452/Visit01/id3l01ciq_raw.fits
Quicklook/14452/Visit01/id3l01ciq_spt.fits
Quicklook/14452/Visit01/id3l01ciq_trl.fits
```
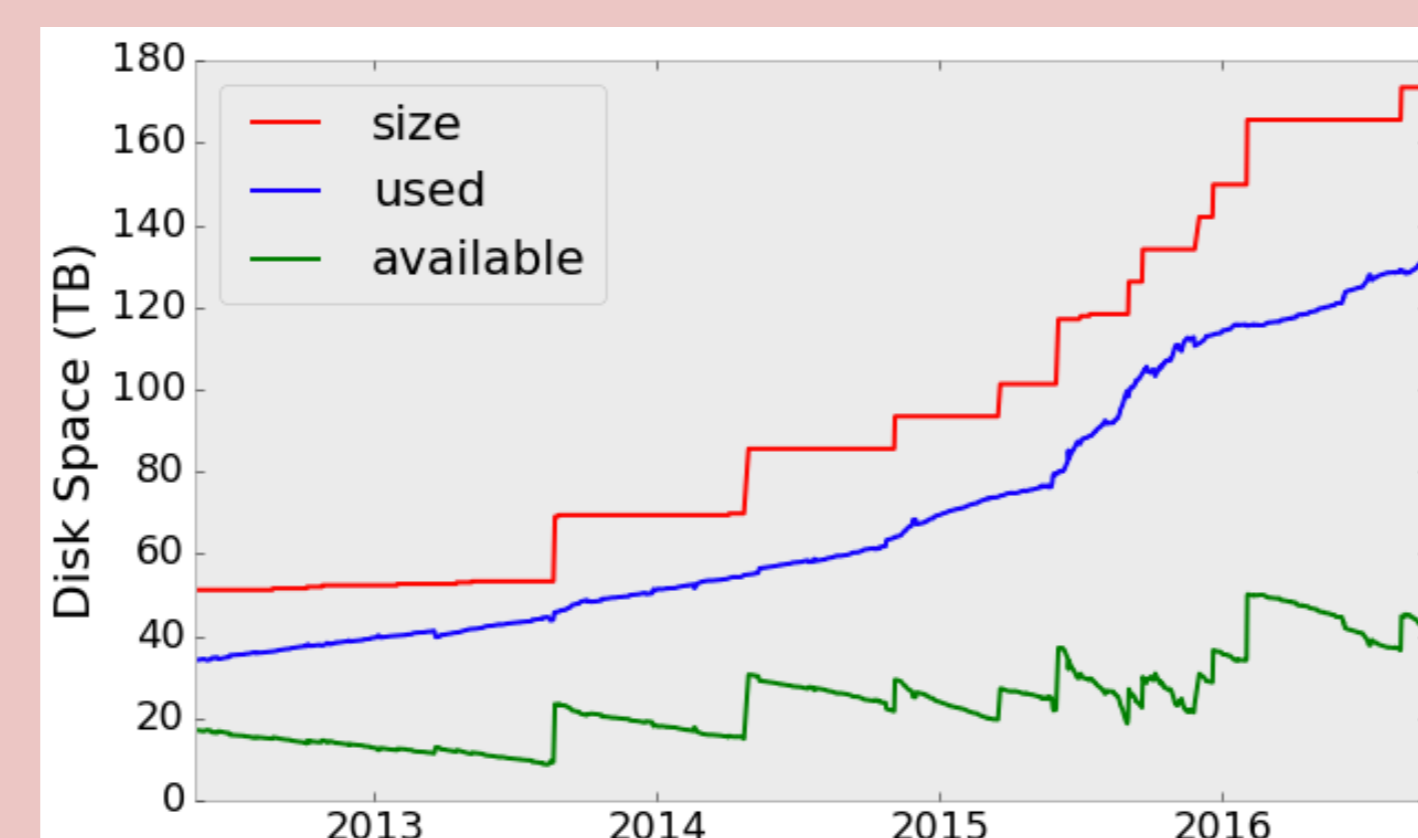

Database

- ✓ MySQL database, built and maintained with SQLAlchemy
- ✓ Stores file metadata and image headers
- ✓ Create customized datasets


```sql
SELECT master.rootname,
       uvis_flt_0.targname,
       uvis_flt_0.exptime,
       uvis_flt_0.ra_targ,
       uvis_flt_0.dec_targ,
       uvis_flt_0.filter
FROM master
JOIN uvis_flt_0
WHERE uvis_flt_0.targname LIKE 'NGC%'
AND uvis_flt_0.date_obs > '2015-01-01'
AND uvis_flt_0.date_obs < '2015-01-30';
```

Automation

- ✓ 85 modules across 22 scripts (25k+ lines of code)
- ✓ Performs instrument calibration and monitoring
- ✓ Performs Quicklook system maintenance

```
cal_ir_make_bad_actor.py           ql_wfc3_check_duplicate_proposal_folders.py
cal_ir_make_bias_plots.py          ql_wfc3_check_filesystem.py
cal_ir_make_blob_plots.py          ql_wfc3_check_fsys2qldb.py
cal_ir_make_persistence.py         ql_wfc3_check_mast2qldb.py
cal_ir_make_snowballs.py           ql_wfc3_check_qldb2fsys.py
                                   ql_wfc3_get_missing_files.py
cal_uvis_make_bowtie.py            ql_wfc3_get_new_datasets.py
cal_uvis_make_ctecorr_darks.py     ql_wfc3_get_proposal_status.py
cal_uvis_make_darks.py             ql_wfc3_make_cron_summary.py
cal_uvis_make_eper_cte.py          ql_wfc3_make_log_plots.py
cal_uvis_make_gain_plots.py        ql_wfc3_run_ingest.py
cal_uvis_setup_contam.py
```
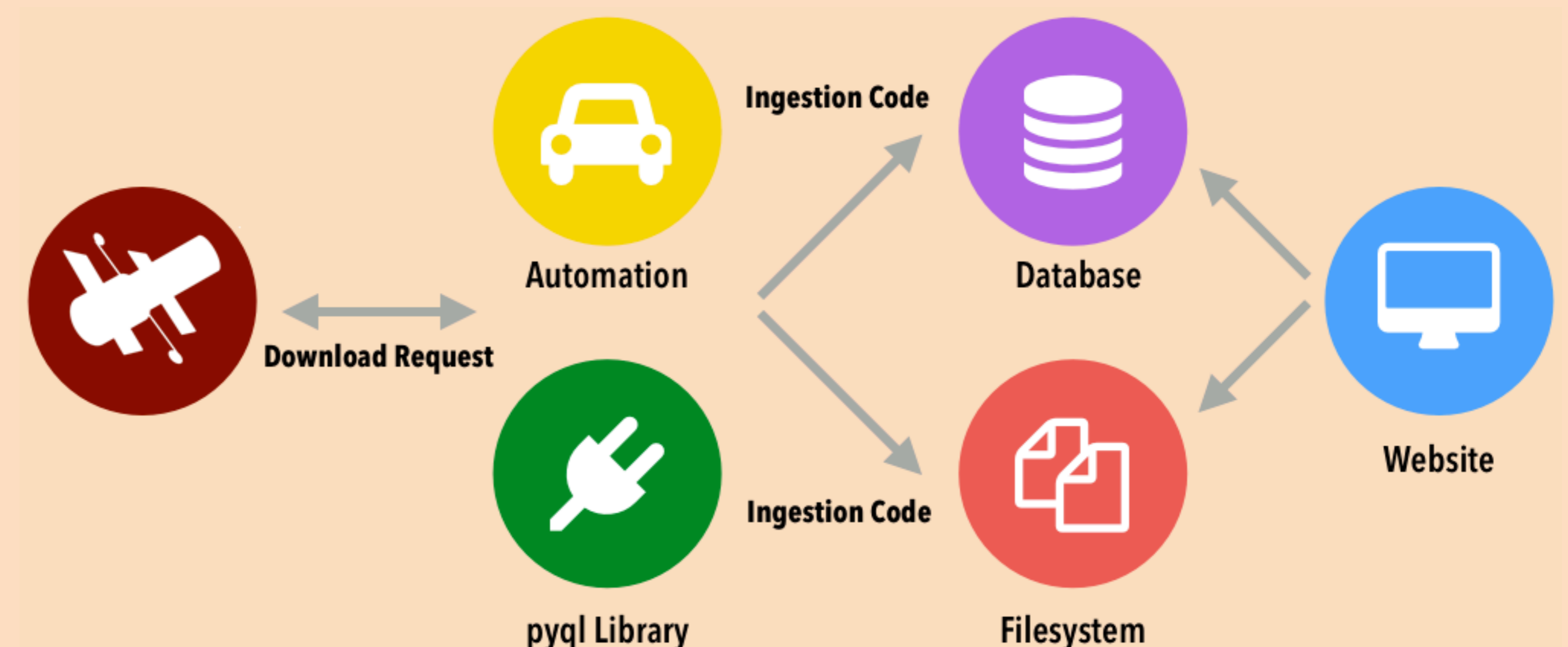
Pyql Library

- ✓ Library code used by automation platform
- ✓ Contains core functionality such as data downloading, logging, filesystem operations, and database ORMs

```python
from pyql.download import download_tools

from pyql.file_system import set_permissions

from pyql.logging.logging_functions import configure_logging
from pyql.logging.logging_functions import log_fail
from pyql.logging.logging_functions import log_info

from pyql.database.ql_database_interface import session
from pyql.database.ql_database_interface import Master
from pyql.database.ql_database_interface import UVIS_flt_0
```

Website

- ✓ User interface to the Quicklook database and filesystem
- ✓ Easily view WFC3 data and header information
- ✓ Flag and track image anomalies
- ✓ View instrument monitoring plots
- ✓ View automated script execution and log files

*Due to the proprietary nature of HST data, the Quicklook website is available to WFC3 team members only.

Workflow

This poster will also presented at the 2016 IAU Symposium 325 on AstroInformatics, October 20-24, 2016 in Sorrento, Italy.

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