MAST Users Group Meeting

December 15-16, 2016

Hubble Legacy Archive and Hubble Source Catalog

Lee Quick, Brad Whitmore, Rick White

Current Team:

HLA/HSC: Tamás Budavári, Michael Dulude, Anton Koekemoer, Steve Lubow, Brian McLean, Lee Quick, Armin Rest, Rick White, Brad Whitmore, Geoff Wallace, Leonardo Ubeda

MAST Users Group Meeting

December 15-16, 2016

Content

- What is the HLA
- What is the HSC
- Highlights from the past year
- Additions to the system
- How the systems are integrated and growing
- Metrics
- Schedule and future plans

Hubble Legacy Archive goals

1. Process HST data to produce higher-level, science-ready data products: combined images, mosaics, source lists
   - Based on software developed for data analysis (e.g., Astrodrizzle)

2. Develop advanced web interfaces to the archive using next-generation browser technology
   - Portal is replacing the HLA interface (will return to this topic at the end)

HLA hla.stsci.edu

MAST Users Group Meeting

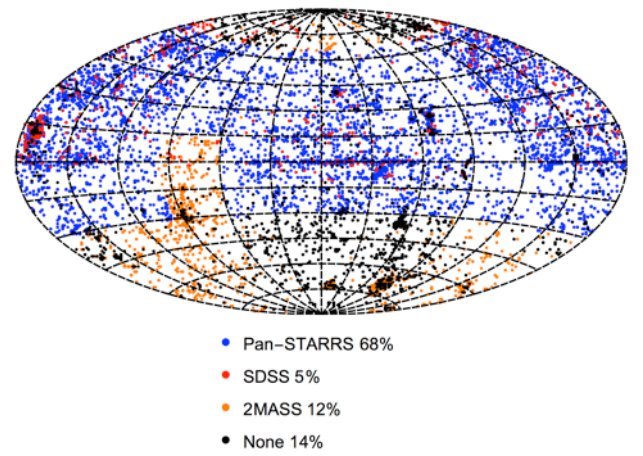
December 15-16, 2016

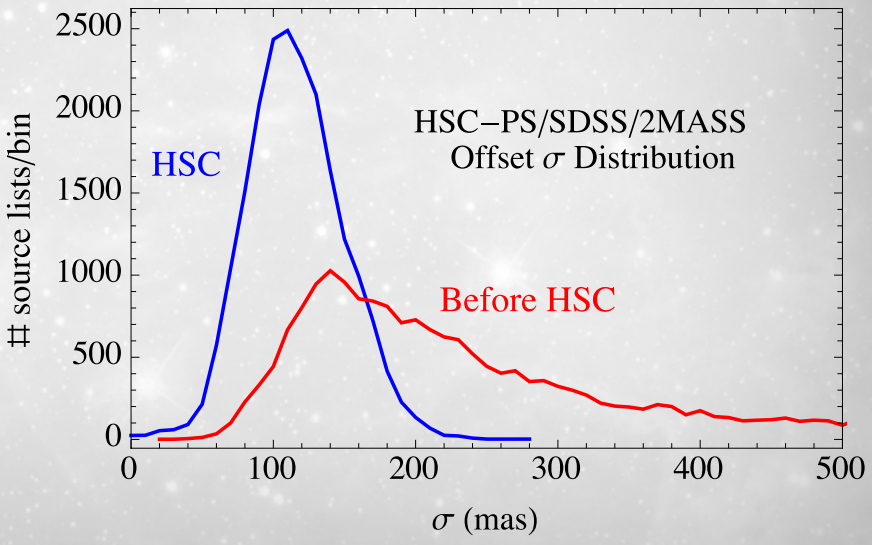
Hubble Source Catalog

1. Combines tens of thousands of SourceExtractor HLA source lists into a single master catalog. Uses matching algorithm from Budavari and Lubow 2012.

2. Includes WFPC2, ACS/WFC, and WFC3.

3. Absolute astrometry is good to ~100 mas (calibrated using PanSTARRS and 2MASS). This can eventually be improved to ~10 mas using Gaia observations).





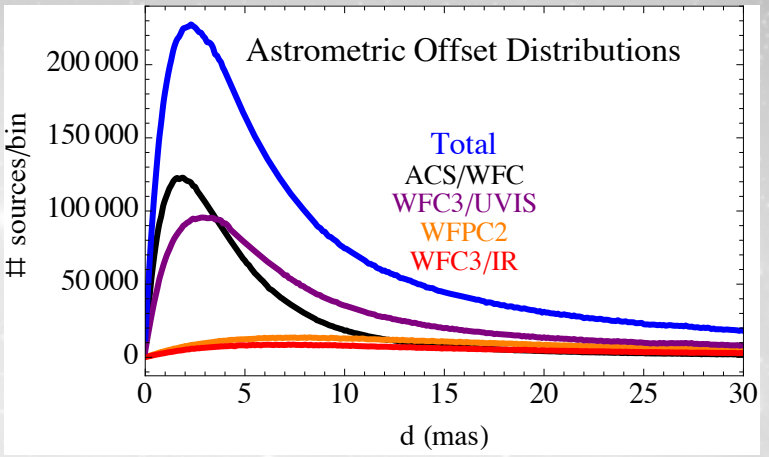
HSC archive.stsci.edu/hst/hsc

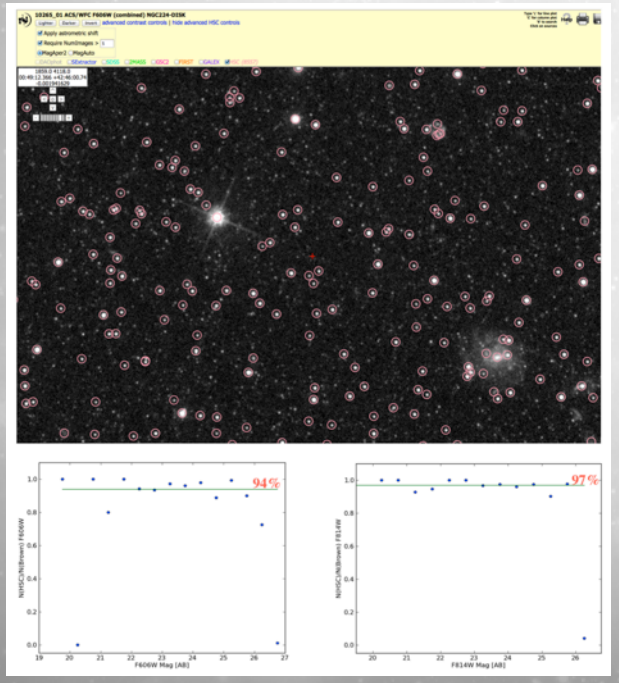
MAST Users Group Meeting

December 15-16, 2016

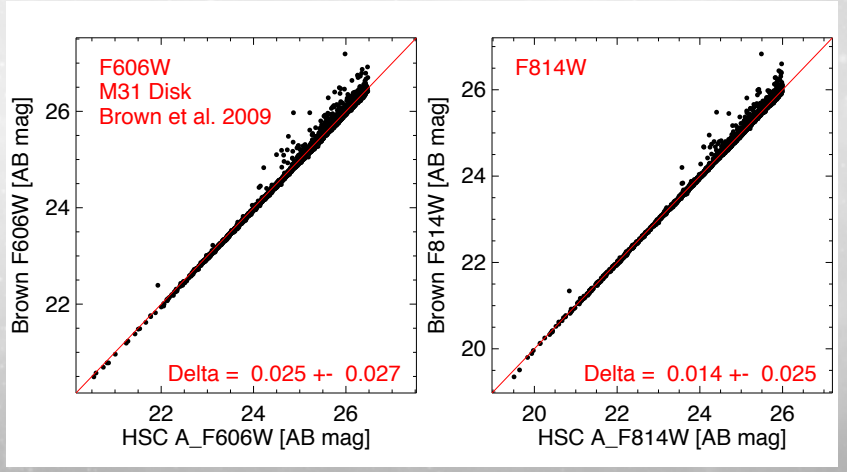
Hubble Source Catalog

4.Relative astrometry good to better than ~10 mas; ~2 mas is the peak of the distribution.





5. Photometry (aperture) typically good to 0.10 mag and 0.02 mag when S/N is sufficient.



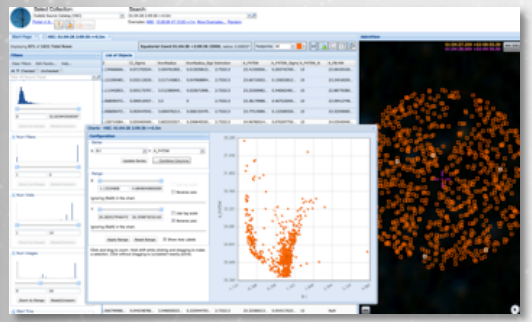
HSC archive.stsci.edu/hst/hsc

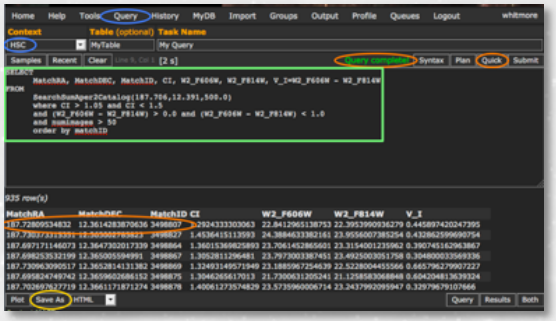
MAST Users Group Meeting

December 15-16, 2016

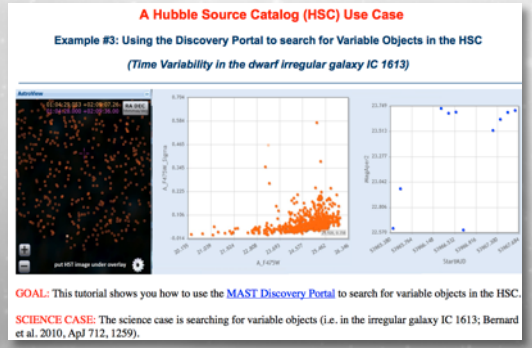
Hubble Source Catalog

6. The MAST Portal is our primary interface, but we also have a CasJobs interface (similar to SDSS) for larger and more complex queries, and a simple HSC search form for special cases and scripted queries.





7. A range of "documents" and learning aids are available (e.g., FAQ, use cases, videos, journal article - Whitmore et al. (2016) - "Version 1 of the HSC.



HSC archive.stsci.edu/hst/hsc

MAST Users Group Meeting

December 15-16, 2016

HLA/HSC Highlights for 2016

September 2016

HSC 2.0

- Four additional years of ACS source lists. All ACS source lists go deeper than version 1
- One additional year of WFC3 source lists
- Cross-matching between HSC sources and spectroscopic COS, FOS, GHRS and ACS grism observations

HLA 9.1

- All new ACS and WFC3 source lists (for data public on June 2015)
- Much faster overlays (e.g., “visible area” only option)
- Gaia overlays

MAST Portal 2.7

- New Advanced Search interface
- HSC spectral results page and crossmatching available
- Number of sources displayed has increased from 10K to 50K

HSC CasJobs 2

- Include both HSC versions 1 and 2 (and supporting tables)

Future HLA/HSC additions: Photometry on Demand (POD)

- Photometry on Demand is an HSC-related tool designed to provide an easy and flexible way for users to obtained "fine-tuned" photometry for the specific datasets, and science needs, they are interested in.
  - In development now (Armin Rest)

- Potential HSC users may not be able to use the "general usage" source lists employed by the HLA.

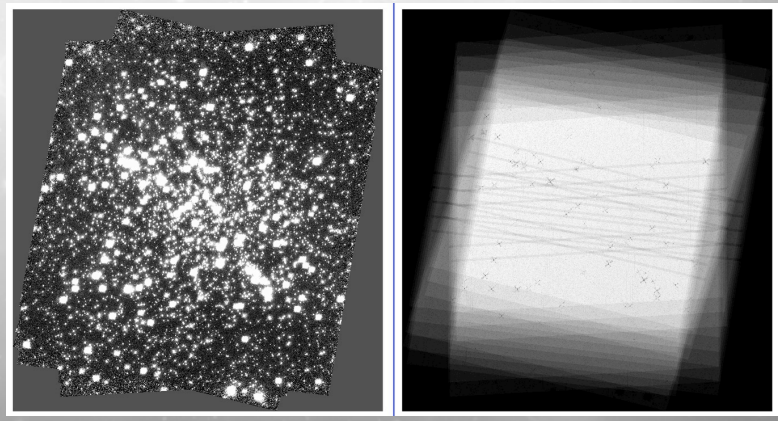
- Examples are that they might want/need:
  - PSF-fitting photometry for crowded regions,
  - deeper limiting magnitudes,
  - better time resolution

MAST Users Group Meeting

December 15-16, 2016

Future HLA/HSC additions: Super Mosaics

- A project to make "super mosaics" using HLA data has begun, under the leadership of Anton Koekemoer
- A test mosaic in the globular cluster M4 developed using the offsets between the images as determined by the HSC.
- Quality is good - HSC offsets will be sufficient for making mosaics



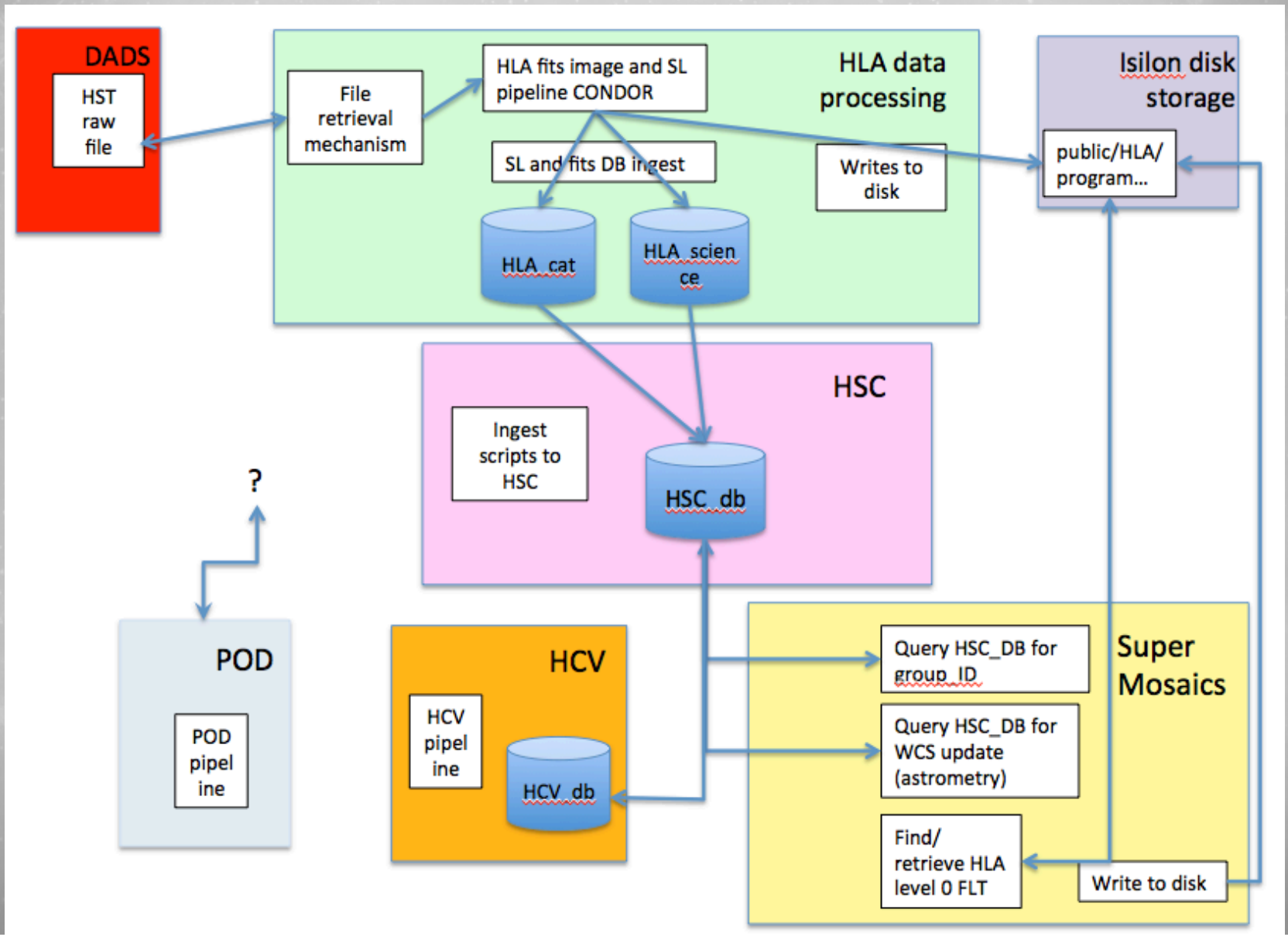
Future HLA/HSC additions: Hubble Catalog of Variables (HCV)

- We encourage the development of value-added products such as "The Hubble Catalog of Variables", a 3-year ESA program to use the HSC to find variable stars. http://archive.stsci.edu/archive_news/2016/07-Jul/index.html#article4
- PI = Alceste Bonanos – based at the University of Athens
- The group will validate the candidates using a wide variety of different algorithms (Sokolovsky et al. 2016).
- The HCV will be ingested into the MAST archives in the spring of 2018

MAST Users Group Meeting

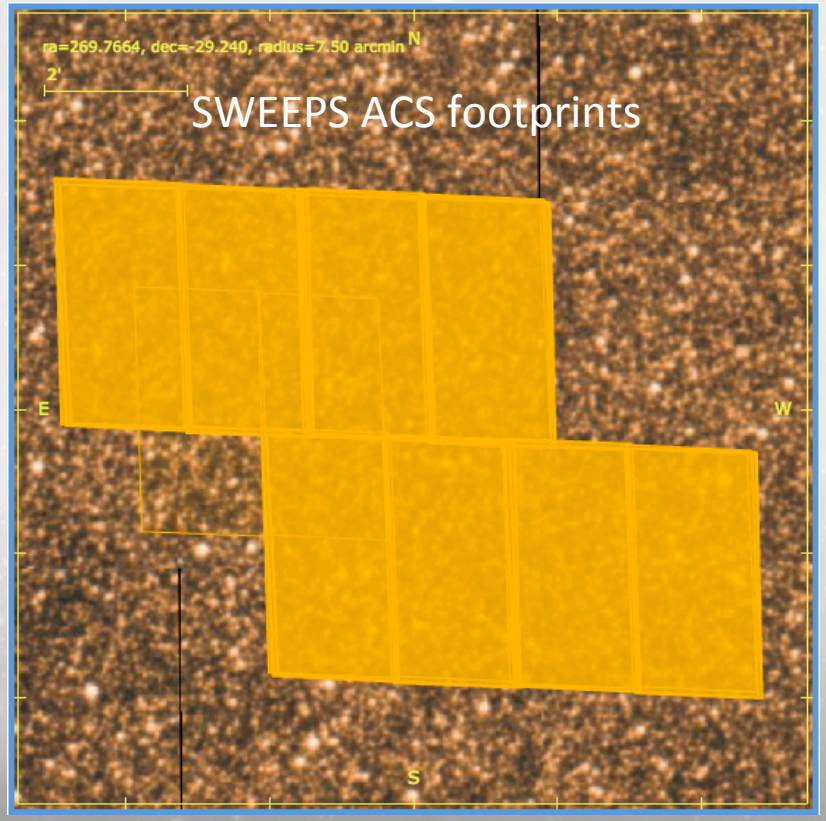
December 15-16, 2016

HLA/HSC system design



Future HLA/HSC additions: Astrometry

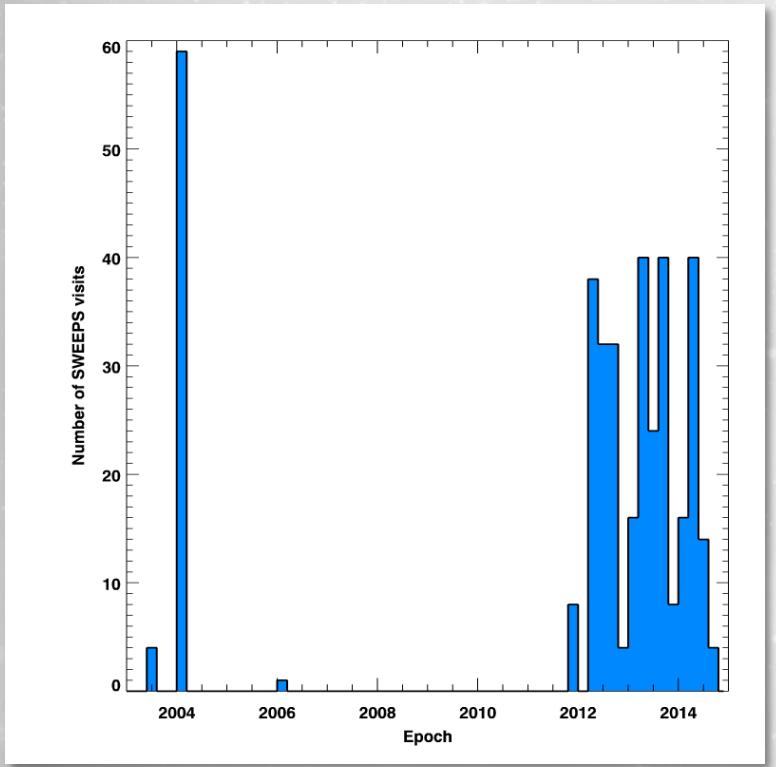
- HSC absolute astrometry will be inserted into the headers of HLA images (Spring 2017)
- Relative astrometry is excellent in SWEEPS field



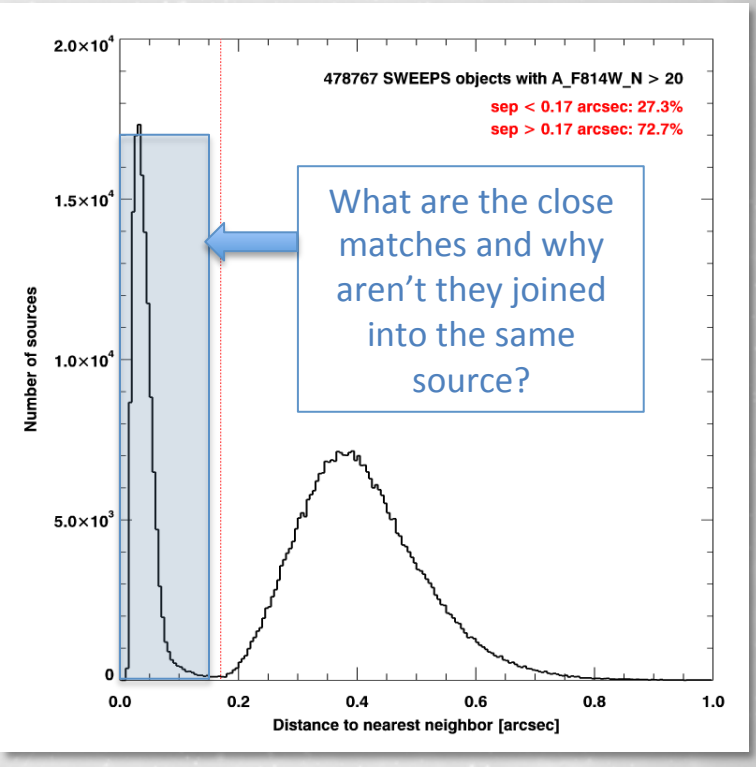
MAST Users Group Meeting

December 15-16, 2016

HLA/HSC additions –Astrometry



SWEEPS field: a decade of observations



Distance to nearest neighbor in the HSC

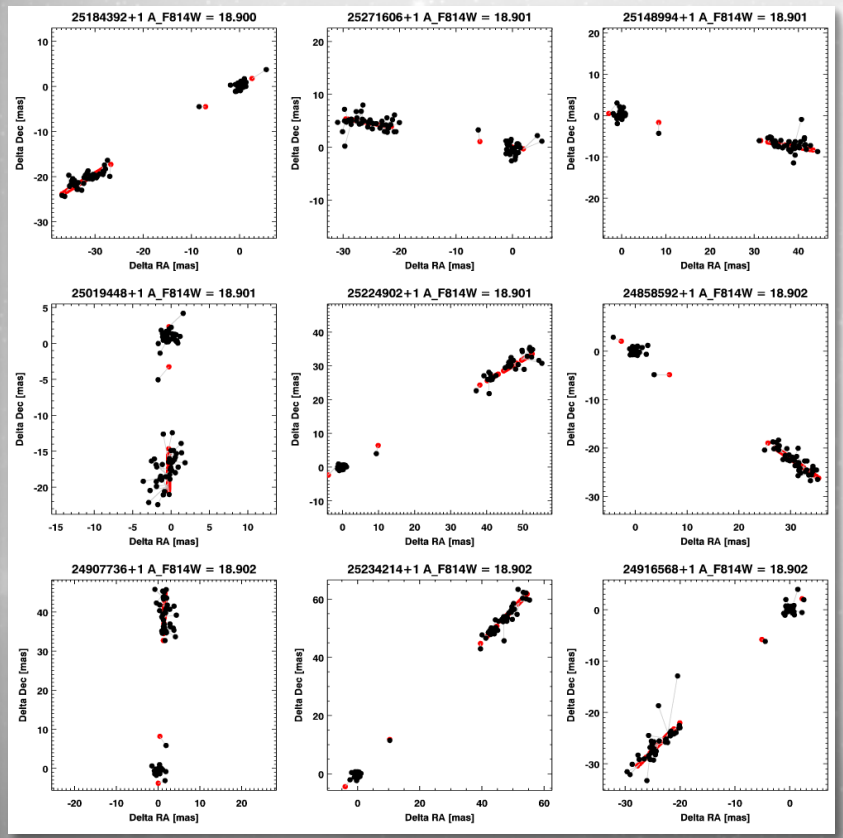
MAST Users Group Meeting

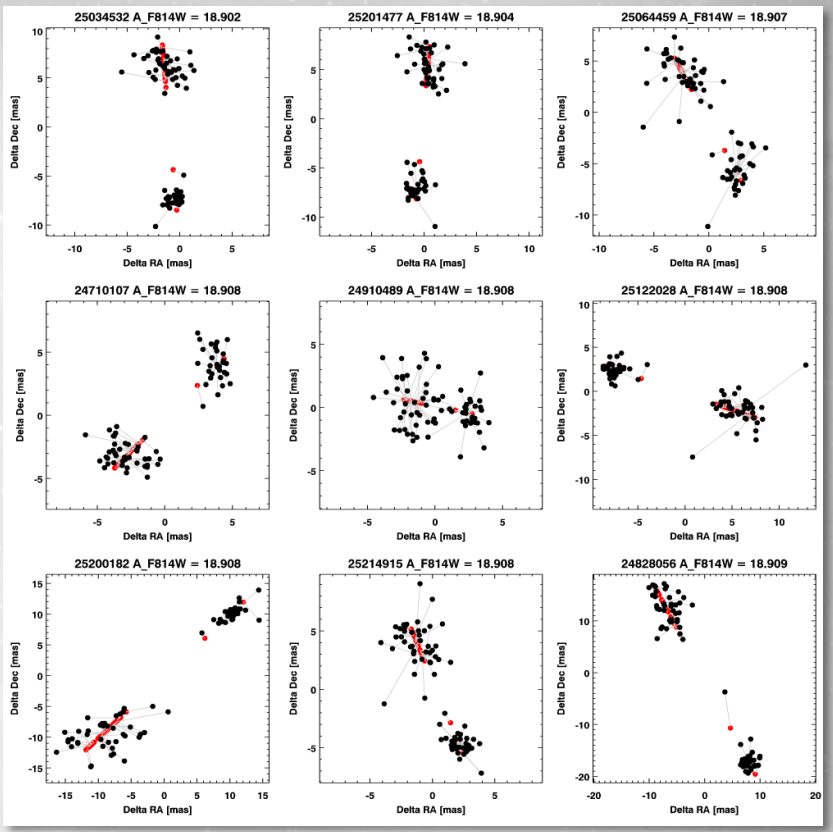
December 15-16, 2016

HLA/HSC additions –Astrometry

Answer: Proper motion!

9 objects fainter than 18.9 that have close neighbors





Objects that are not split also have proper motions

Next version of the HSC will include proper motion measurements.

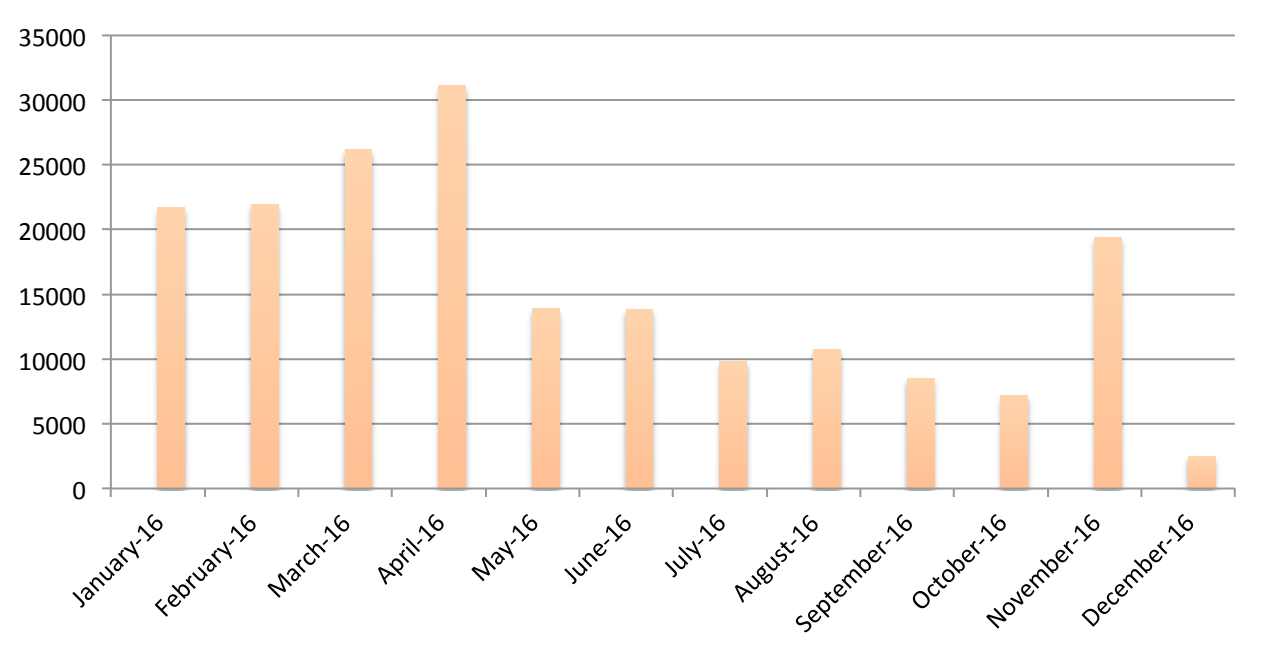
MAST Users Group Meeting

December 15-16, 2016

HLA/HSC metrics

- HLA only
- hla.stsci.edu

Number of searches per month

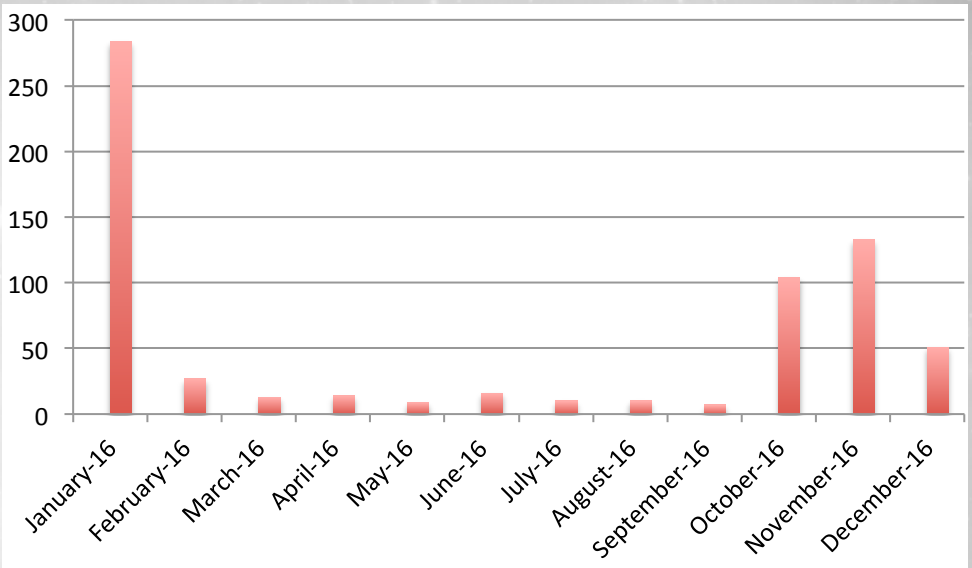


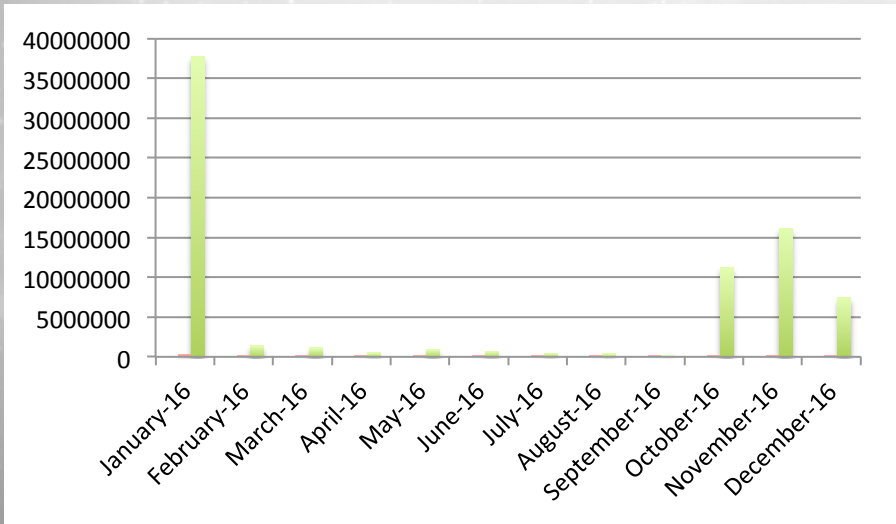
MAST Users Group Meeting

December 15-16, 2016

HLA metrics

Total downloads file size GB





Total number of files downloaded

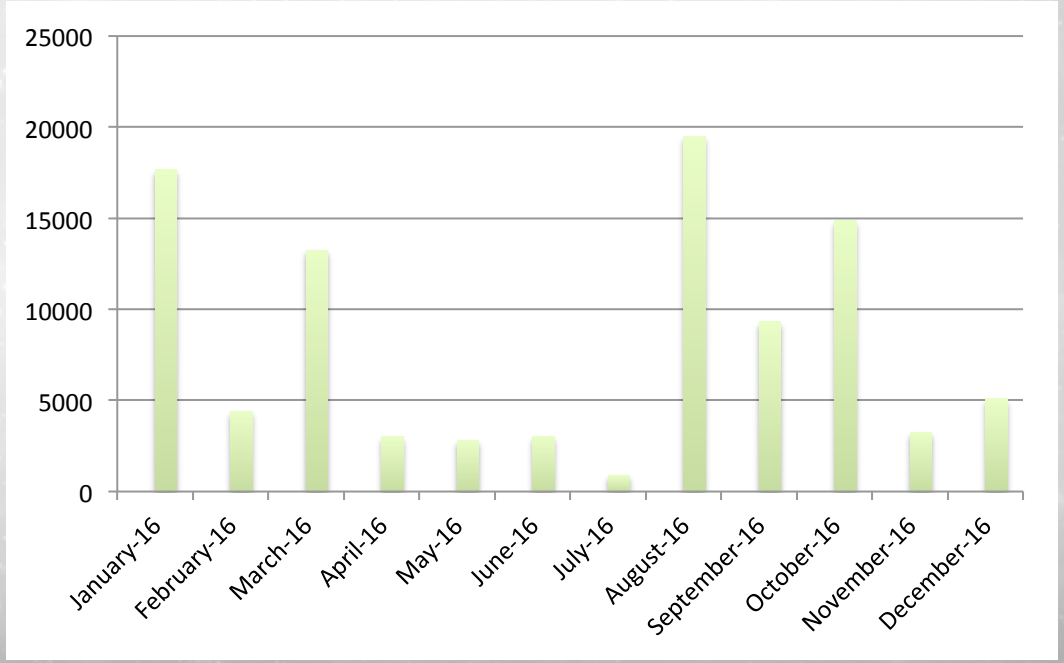
MAST Users Group Meeting

December 15-16, 2016

HSC metrics

- Forms view
- archive.stsci.edu/hst/hsc

Number of queries using MAST forms

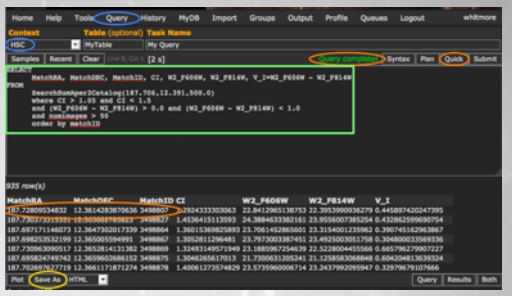


MAST Users Group Meeting

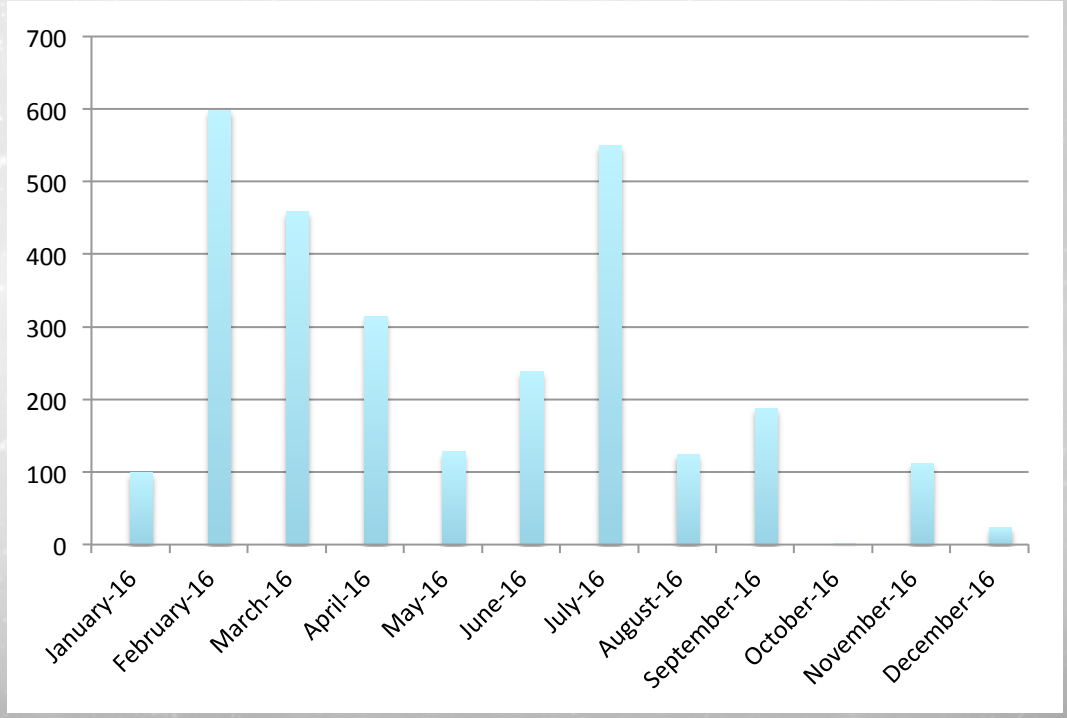
December 15-16, 2016

HSC metrics

- Casjobs
- mastweb.stsci.edu/hcasjobs/



Number of successful queries using Casjobs

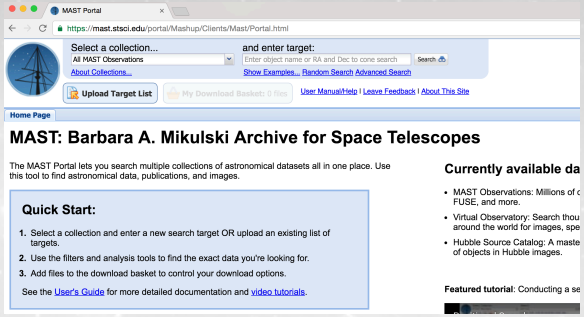


MAST Users Group Meeting

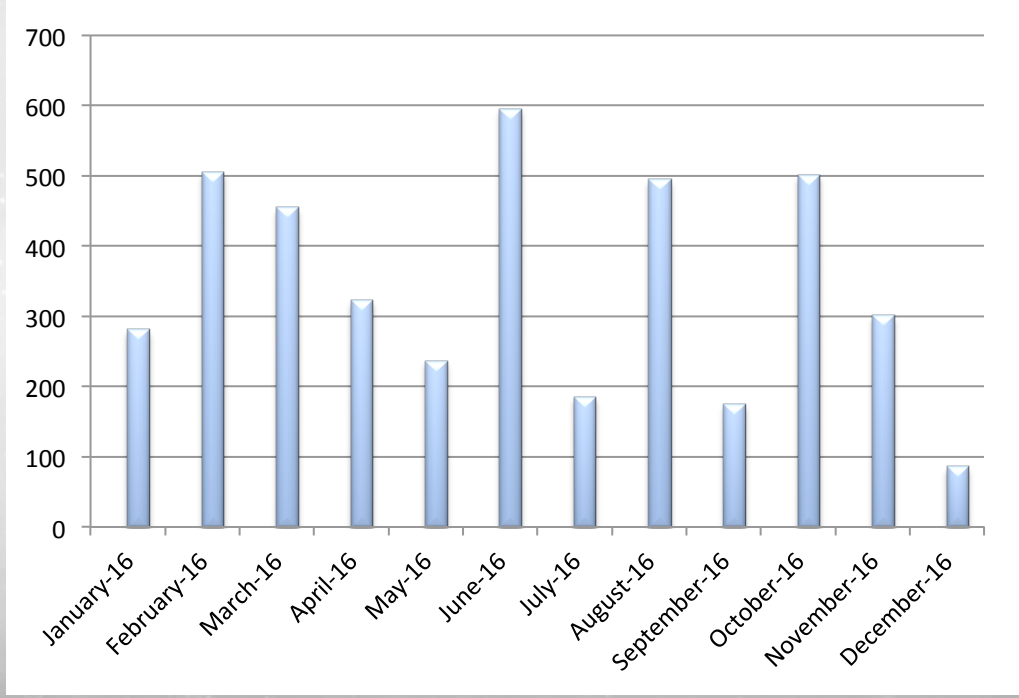
December 15-16, 2016

HSC metrics

- MAST Portal
- mast.stsci.edu



Number of queries to the HSC database via the MAST Portal



HLA/HSC schedule

- HLA WFPC2 study (January 2017)
  - We currently archive CADC-generated products
  - Source lists quality could be improved
- HLA DR 9.3 (March 2017)
  - Corrected WFC3 CTE
- HLA DR 10 (August 2017)
  - Super Mosaics
- HSC v3 (September 2017)
  - Improvements to proper motion, plate scale, edge effects, bright stars
  - WFPC2 (possible)
  - WFC3 CTE
  - Additional spectroscopic cross-matching (STIS,HLSA, …)

HLA/HSC future plans

- NICMOS and STIS astrodrizzled images with source lists
- Incorporate HLA pipeline products into standard HST data processing
- NICMOS and STIS imaging source lists included
- Mosaic image source lists included
- Hubble Catalog of Variables data products and algorithmic improvements (e.g., improved photometry)
- Forced photometry and photometry-on-demand
- Photometric redshifts, SEDs, and other higher-level products

Future of the HLA interface

- HLA user interface concepts (and some technology) have been adopted by portal and used for many other MAST services
- Current plan is to retire the HLA interface in late spring/early summer 2017
  - Aging HLA hardware and software would require additional support to continue operating
  - Transition plan assures that HLA functionality is present in the portal
- Recent MAST survey asked for input on this subject
  - Some users definitely feel strongly about HLA
- We are exploring the option of investing additional effort to make the HLA interface supportable for a longer period and to allow a "softer" transition to the portal for users
  - We ask the MUG for input on this topic