

Hubble Legacy Archive and Hubble Source Catalog

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Current teams: +

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Hubble Legacy Archive (HLA)

<http://hla.stsci.edu>

- Goals:
 - Process HST data to produce higher-level, science-ready data products: combined images, mosaics, source catalogs
 - Based on software developed for data analysis (e.g., Multidrizzle) and research projects (e.g., Anton's pipelines for GOODS, COSMOS, etc.)
 - Develop advanced web interfaces to the archive using next-generation browser technology
- Primary future focus is on data product generation as MAST portal becomes the user interface
 - HLA user interface concepts (and some technology) adopted by portal and used for many other MAST services already
- History: DR1 (2008 Feb 08) through DR8 (2014 Dec)





Hubble Source Catalog (HSC)

<http://archive.stsci.edu/hst/hsc>

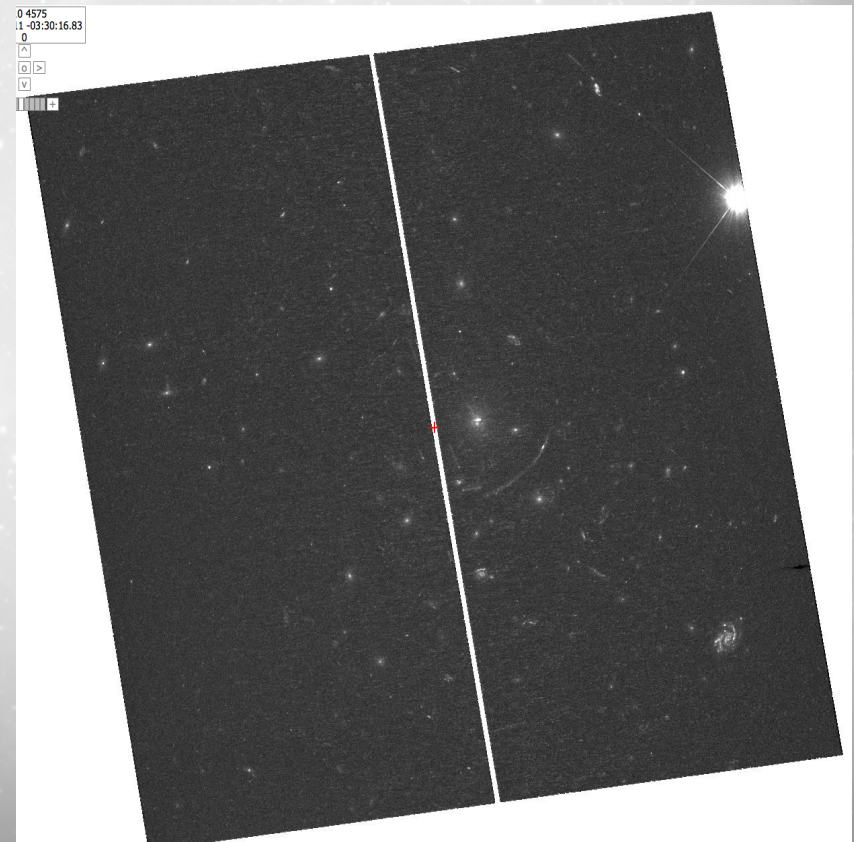
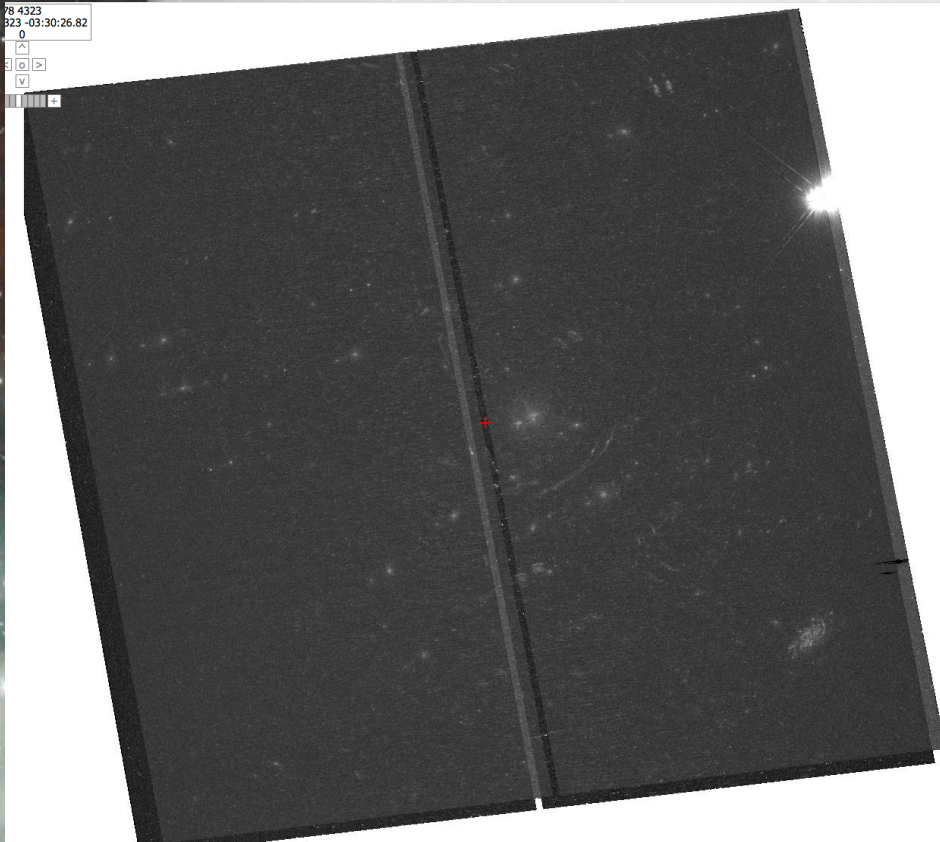
- Goal: Create master catalog of objects from HST images to enable database-driven research
- Challenges:
 - Highly inhomogeneous sky coverage, hundreds of filters
 - Unreliable astrometry makes cross-matching hard
- History:
 - **Beta 0.1 (2012 June)**: ACS/WFPC2 HLA SExtractor source lists (Budavári & Lubow 2012 paper)
 - **Beta 0.2 (2013 May)**: Improved source matching (using automated pre-offsets from 2MASS), improved tools (HLA source overlays, summary form, ...)
 - **Beta 0.3 (2014 March)**: Includes WFC3/UVIS and WFC3/IR HLA source lists, better source matching (fewer spurious sources)

HLA Progress: Conversion to AstroDrizzle Pipeline

- Better registration between images (e.g., correction of guide-star errors between orbits)
- Improved geometric distortion corrections
- Correction of Multidrizzle software bugs
- New compute servers allow processing all WFC3 data in ~1 week

Before

After





MAST
Users
Group
Meeting

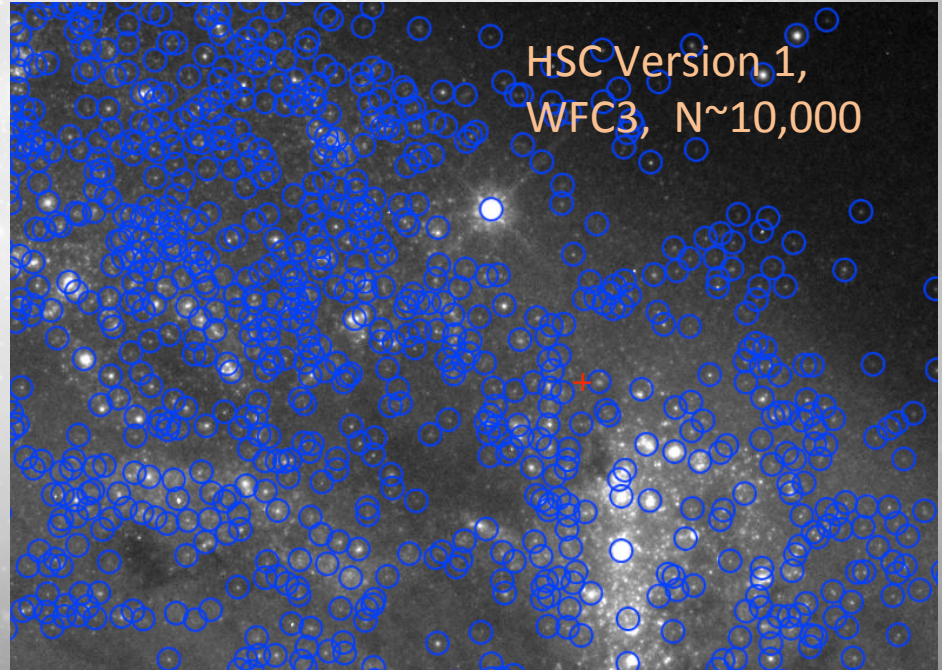
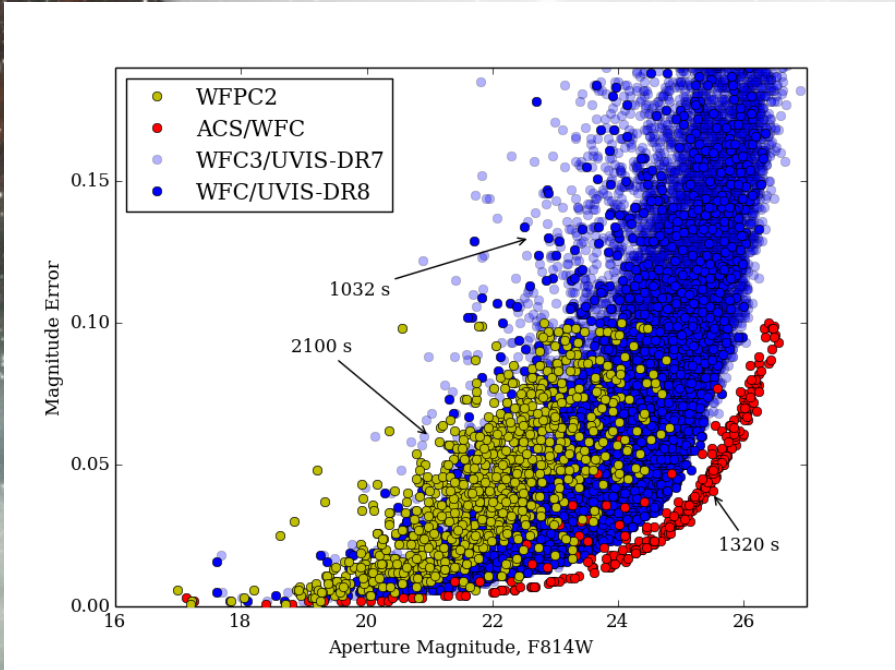
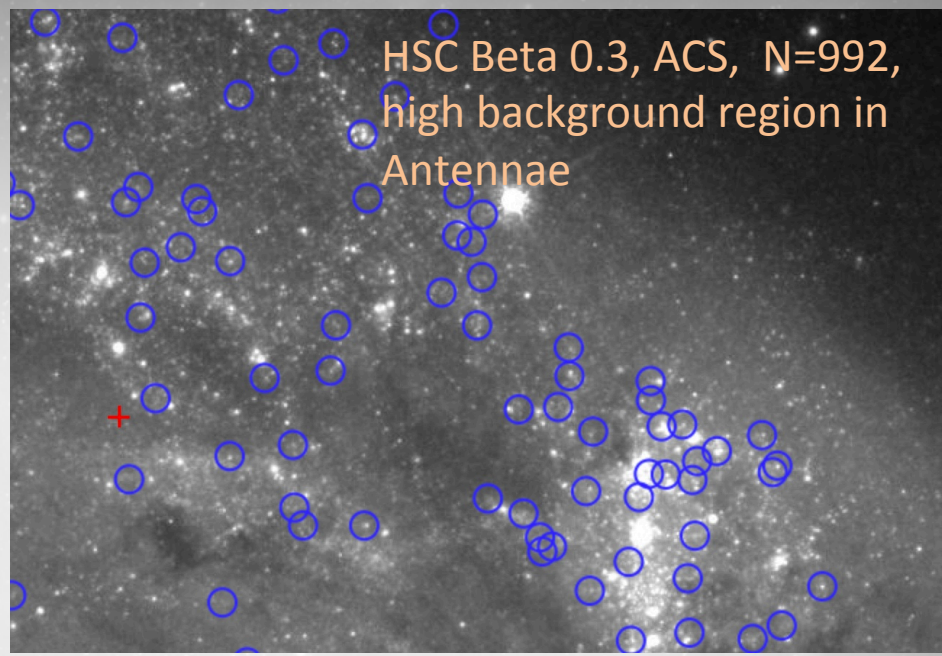
Dec 2,
2014

HLA Progress: Source Lists

The quality of WFC3 source lists represents a dramatic improvement in **uniformity** and **depth** compared to existing ACS and WFPC2 source lists.

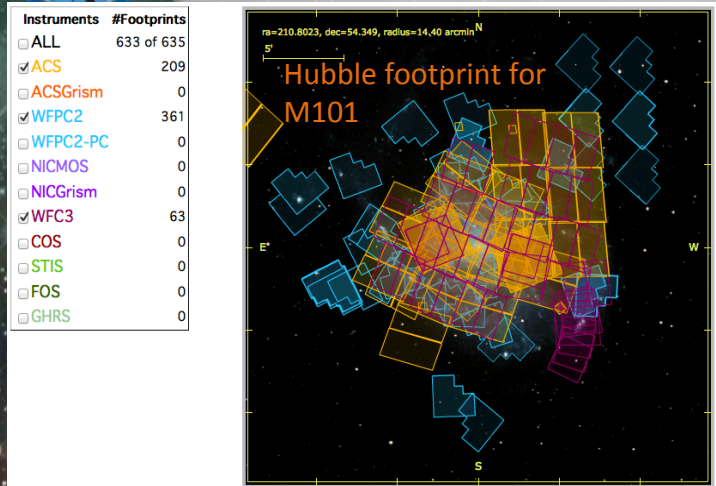
The new (HLA DR8) WFC3 source lists are similar in quality to DR7, but **reject more spurious sources**

More than **2.5 times as many source lists** with addition of new data

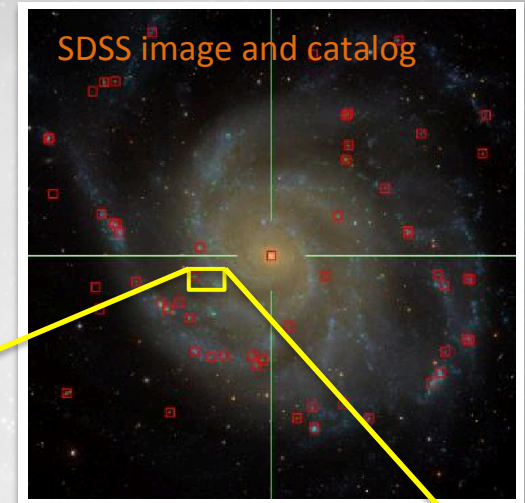




HSC Motivation: The Big Picture

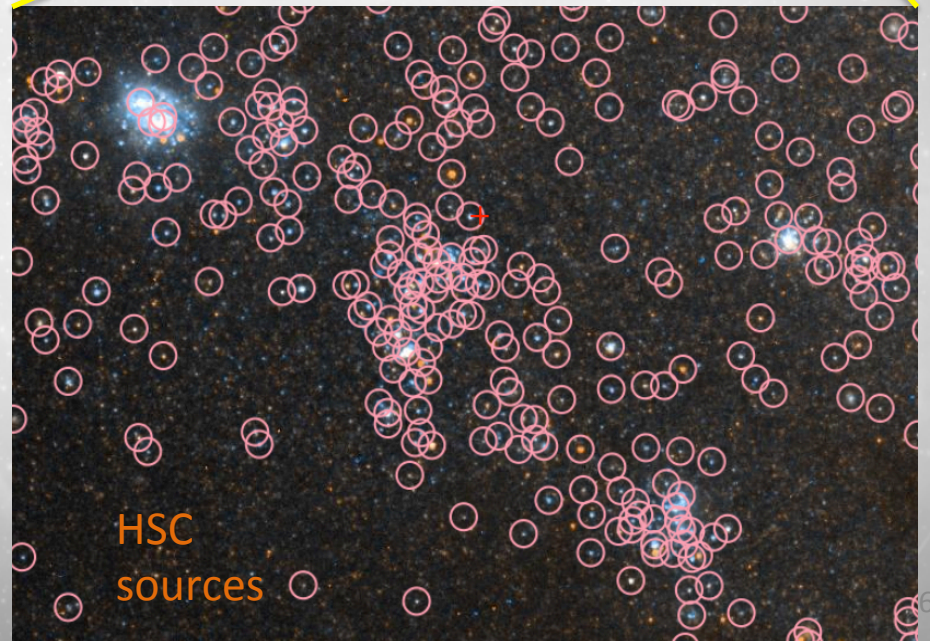


Example of potential for supporting Database Astronomy:



The Hubble Source Catalog:

- Combines tens of thousands of HLA visit-based source lists into a **master catalog**.
- Provides entry into the rapidly growing field of **Database Astronomy**.
- Will be a fundamental reference for **JWST** users, and upcoming **surveys** (e.g., PanSTARRS, LSST).

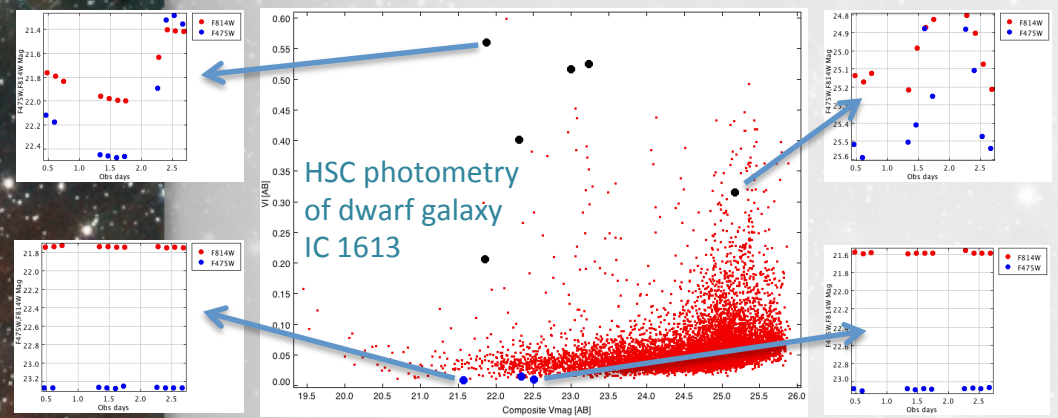




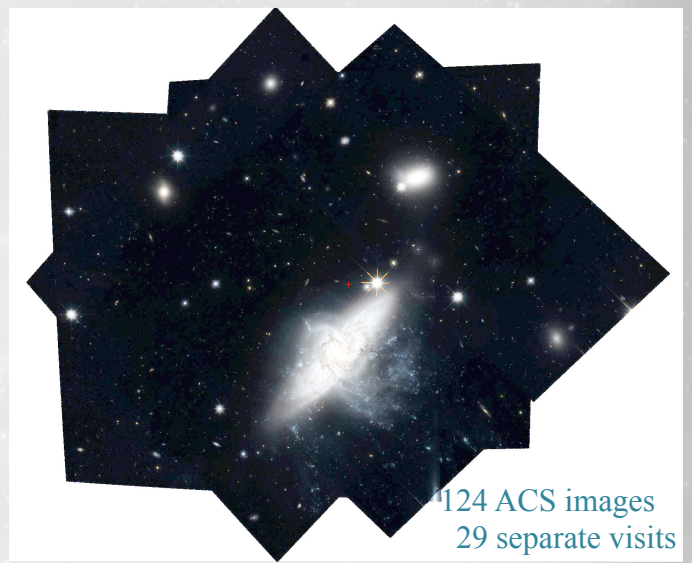
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Three more reasons to build the HSC

1. **Time-variable phenomena** – The HSC supports time-variable studies over **>20 year baseline**.

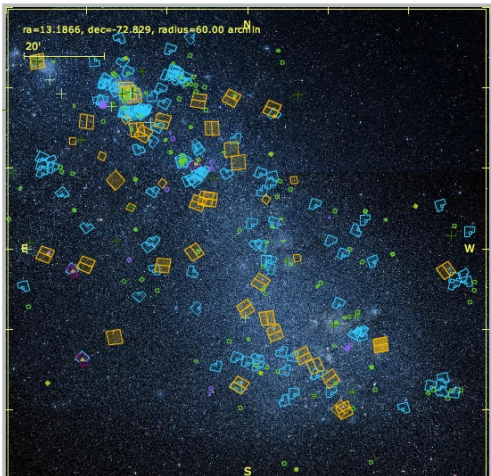


2. **Mosaics** – Accurate spatial offsets between observations are needed to build the HSC. These can then be used to make **mosaics**.



Instruments	#Footprints
<input checked="" type="checkbox"/> ALL	3720
<input checked="" type="checkbox"/> ACS	376
<input checked="" type="checkbox"/> ACSGrism	0
<input checked="" type="checkbox"/> WFPC2	916
<input checked="" type="checkbox"/> WFPC2-PC	813
<input checked="" type="checkbox"/> NICMOS	126
<input checked="" type="checkbox"/> NICGrism	0
<input checked="" type="checkbox"/> WFC3	6
<input checked="" type="checkbox"/> COS	452
<input checked="" type="checkbox"/> STIS	844
<input checked="" type="checkbox"/> FOS	143
<input checked="" type="checkbox"/> GHRS	44

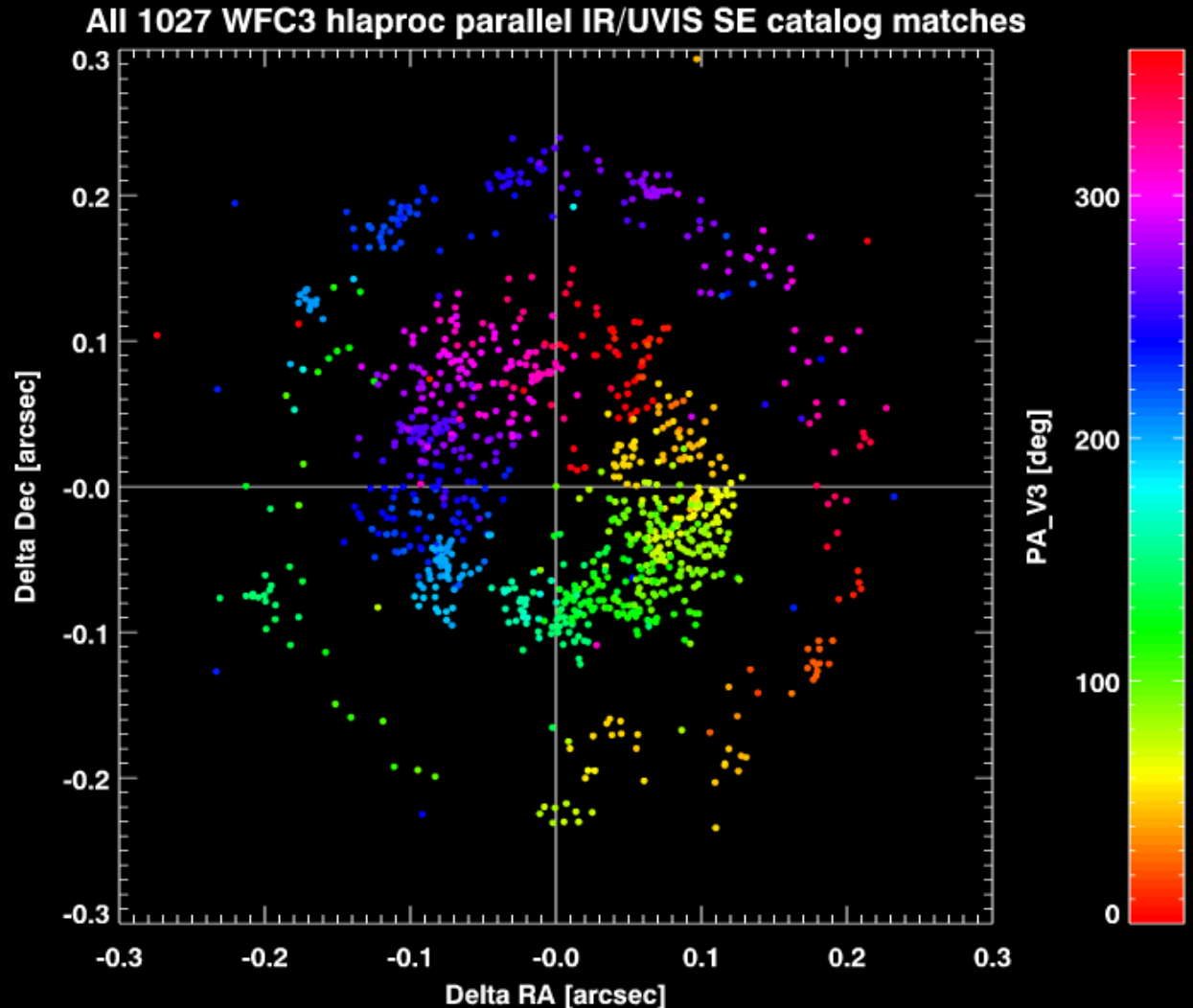
Hubble images of the SMC



3. **Very large datasets** – Replicating what is available in the HSC in seconds would take most researchers **weeks, months, or years** to produce.

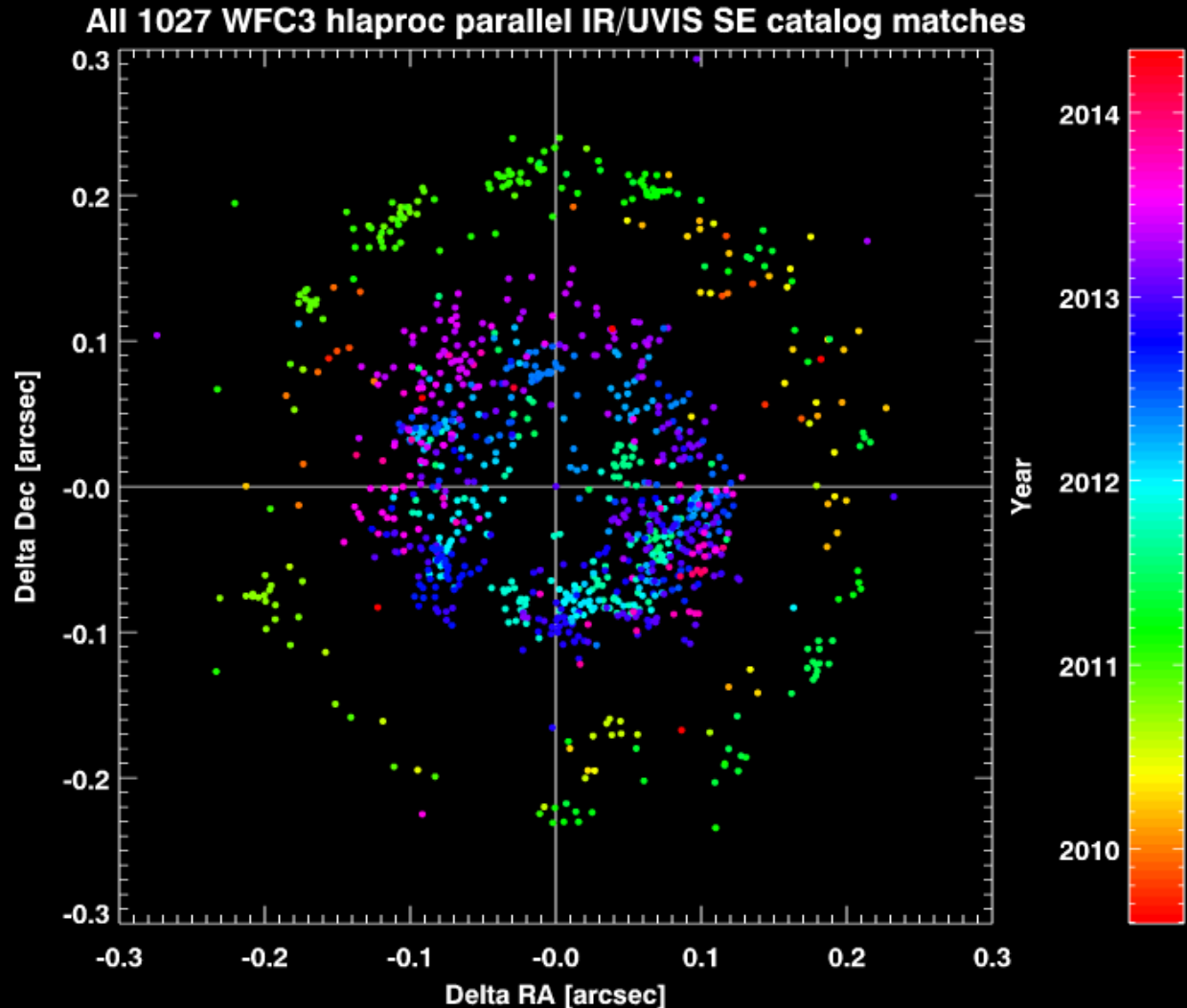
Aside: Comparison of WFC3/IR & WFC3/UVIS astrometry (within same visit, using same guide stars)

The circle centered on zero, with the PA_V3 correlation, indicates a shift between the IR and UVIS apertures



Aside: Comparison of WFC3/IR & WFC3/UVIS astrometry (within same visit, using same guide stars)

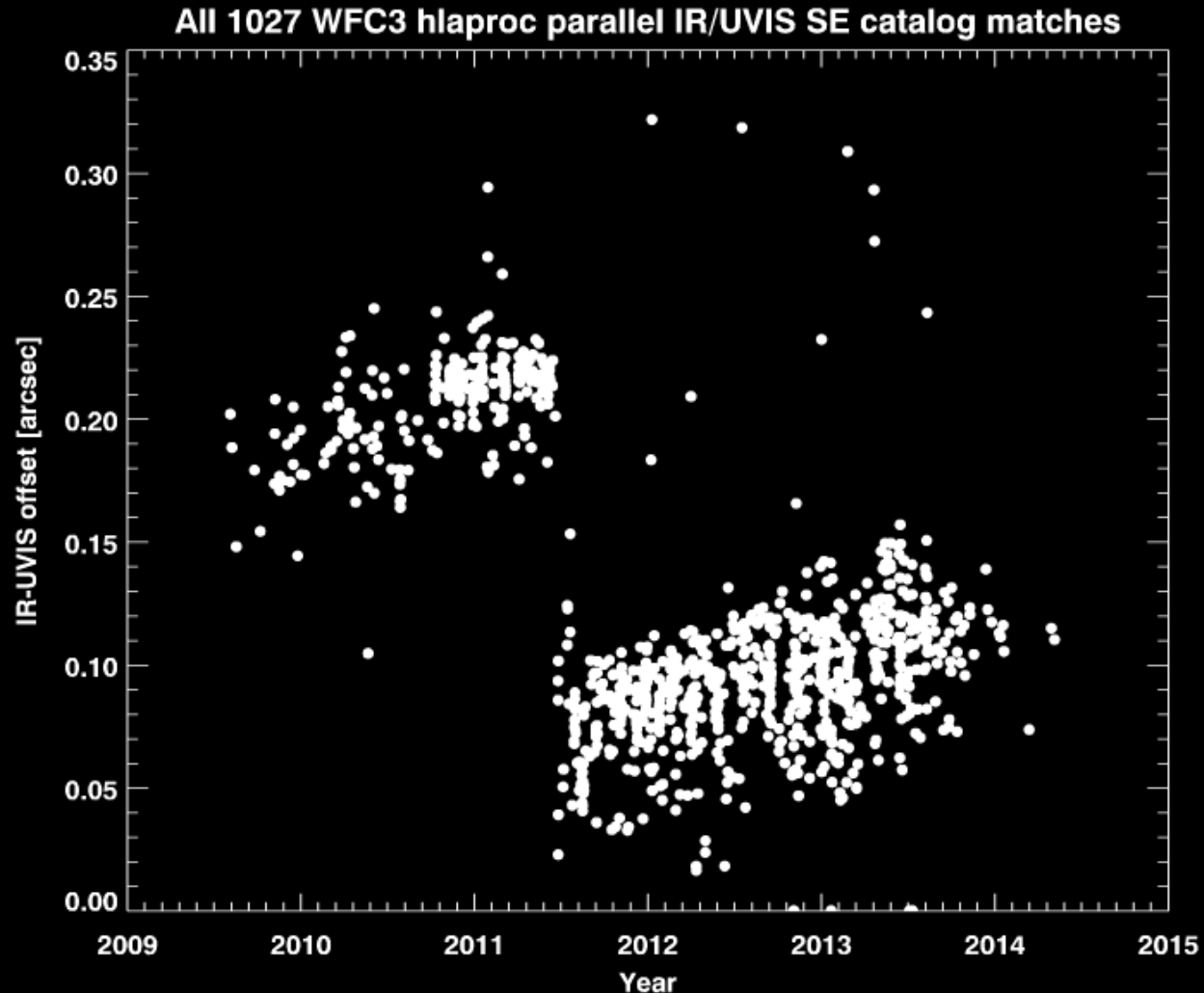
Changing the color coding to observation date shows that the thick radial distribution is a function of date



Aside: Comparison of WFC3/IR & WFC3/UVIS astrometry (within same visit, using same guide stars)

The HSC will be a tremendous source of information on a wide variety of calibration issues (e.g., zeropoint, focus, astrometric stability). Here we show one example: relative positions of science instruments over time.

These aperture offsets will dominate HST astrometry errors once the guide star positions are improved.





HLA & HSC Release Schedule

Dec 2014 – HLA DR8

- New [WFC3](#) images & catalogs processed using [AstroDrizzle](#)
- Two additional years of data ([twice](#) HLA DR7)

Feb 2015 – HSC Version 1

- New [WFC3](#) catalogs from HLA DR8
- [Absolute astrometry](#) from Pan-STARRS, 2MASS, SDSS
- [Discovery Portal Integration](#) Phase 1 (plotting capabilities, new condensed summary form, preview cutouts, arithmetic operations on columns, cross-matching)
- [CasJobs](#) for SQL-based queries

June 2015

- New deeper [ACS](#) and [WFPC2](#) catalogs (based on WFC3-type algorithms)
- Additional astrometric reference catalogs (SkyMapper for south?)
- [PASP paper](#) available

HSC Ready for Science!

- [Catalog](#) and [Portal](#) described further in [Cycle 23 Call for Proposals](#)
- Examples given in [HST Primer](#) and HLA/HSC/MAST sites
- Presentations at AAS