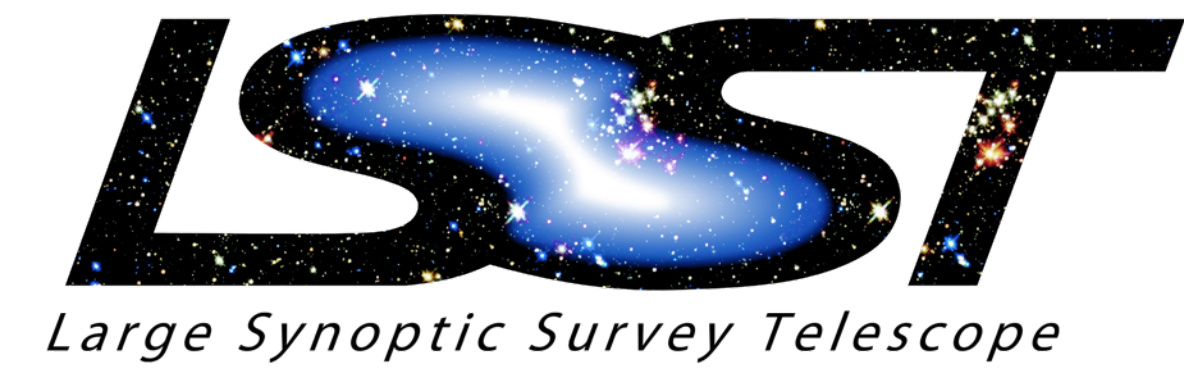


Current status of UK transient work for LSST

Ken W. Smith



Overview

- Sign up to the LSST:UK Transients & Variable Stars Wiki
- March Kick-off meeting with Edinburgh
- Pan-STARRS and ATLAS transient data streams
- What next?

Our UK Wiki: <https://lsst-uk.atlassian.net/>

lsst-uk.atlassian.net/wiki#all-updates

Confluence Spaces

DISCOVER

- All updates
- Popular

SPACES

- Home

All updates

George Beckett [Administrator]

- Mailing Lists**
Updated Jun 03, 2016 (view change)
- Welcome to the LSST:UK Wiki**
Updated May 30, 2016 (view change)
- Mailing-lists, setup and management**
Updated May 30, 2016 (view change)

Bob Mann

- LSST:UK Affiliate PIs and Junior Associates**
Updated May 24, 2016 (view change)

George Beckett [Administrator]

- New-user Introduction**
Updated May 16, 2016 (view change)
- Logos and Generic Publicity Material**
Updated May 16, 2016 (view change)
- LSST UK Science Centre colour flag.ai**
Attached May 16, 2016
- LSST UK Science Centre BW with colour flag.ai**
Attached May 16, 2016
- LSST UK Science Centre BW with colour flag FINAL.pdf**
Attached May 16, 2016
- LSST UK Consortium COLOUR with colour flag FINAL.pdf**
Attached May 16, 2016
- LSST UK Consortium colour flag.ai**
Attached May 16, 2016
- LSST UK Consortium BW with colour flag.ai**
Attached May 16, 2016
- LSST UK Consortium BW with colour flag FINAL.pdf**
Attached May 16, 2016

Welcome to Confluence

Confluence is where your team collaborates and shares knowledge — create, share and discuss your files, ideas, minutes, specs, mockups, diagrams, and projects.

Contact your local Principal Investigator for an account

Log in

lsst-uk.atlassian.net

Use your **Atlassian Cloud** account

Email address / Username

Password

Log in

Keep me logged in

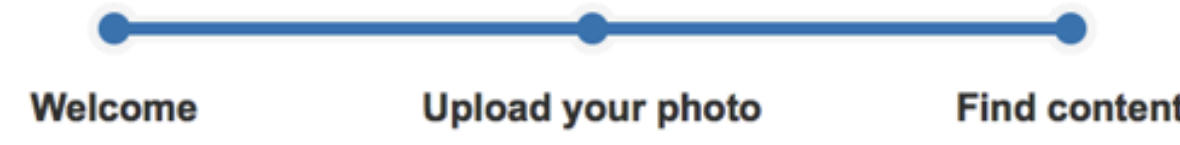
[Unable to access your account?](#)

To request an account, please contact your site administrators.

[Deutsch](#) · [English](#) · [Español](#) · [Français](#) · [日本語](#)

[Terms of Use](#) · [What's New](#) · [Atlassian Cloud Status](#)





Watch a few spaces

When you watch spaces, we let you know when changes are made in them.

- LSST:UK Science Working Group
- LSST:UK Science Centre
- Home
- Demonstration Space

Finish

DISCOVER

- All updates
- Popular

MY WORK

- Recently worked on
- Recently visited
- Saved for later

MY SPACES

- All
- LSST:UK Science Working Gro...
- LSST:UK Science Centre

All updates

Create Space

George Beckett [Administrator]
 20160613_dac_monthly_meeting.txt
 Attached yesterday at 4:52 PM

Aprajita Verma
 Strong Lensing Working/Analysis Group of the DESC & the Strong Lensing Scienc...
 Updated Jun 16, 2016 (view change)

Graham P. Smith

- LSST:UK Clusters White Paper 2016
Updated Jun 16, 2016 (view change)
- Galaxy Clusters (LSST:UK Clusters)
Updated Jun 16, 2016 (view change)
- Birmingham, June 7, 2016
Updated Jun 16, 2016 (view change)

George Beckett [Administrator]
 20160527_dac_monthly_meeting.txt
 Attached Jun 12, 2016

Anonymous

- Lay out your page (step 6 of 9)
Created Jun 09, 2016
- Get serious with a table (step 5 of 9)
Created Jun 09, 2016
- Tell people what you think in a comment (step 8 of 9)
Created Jun 09, 2016
- What is Confluence? (step 1 of 9)
Created Jun 09, 2016
- Welcome to Confluence
Created Jun 09, 2016

Welcome to Confluence



Confluence is where your team collaborates and shares knowledge — create, share and discuss your files, ideas, minutes, specs, mockups, diagrams, and projects.

The screenshot shows a Confluence page for the LSST:UK Science Working Group. The page is titled 'LSST:UK Science Working Group Home' and was created by George Beckett. It features two main columns of content: 'Science Collaborations' and 'Liaison activities with other projects and domains'. The 'Science Collaborations' list includes 'Dark Energy Science Collaboration', 'Transients and variable stars' (circled in red), 'Galaxies', 'Informatics & Statistics', 'Solar System', 'Stars, Milky Way, and Local Volume', and 'Active Galactic Nuclei'. The 'Liaison activities' list includes 'Particle Physics', 'Infra-red', 'Spectroscopy', 'SKA', 'GAIA', 'E-ELT', 'Euclid', 'WFIRST', and 'Athena'. Below these lists, there are sections for 'Other useful links', 'Relevant documents', 'Recent space activity', and 'Space contributors'. The 'Recent space activity' section shows a post by Aprajita Verma about the Strong Lensing Working/Analysis Group. The 'Space contributors' section lists Aprajita Verma, Graham P. Smith, and Jon Loveday.

LSST:UK Science Working Group

Pages
Blog

- PAGE TREE
- Active Galactic Nuclei
 - Athena
 - Cosmological Simulations Working G
 - Cross area activities
 - Dark Energy Science Collaboration
 - E-ELT
 - Euclid
 - GAIA
 - Galaxies Science Collaboration
 - Galaxy Clusters (LSST:UK Clusters)
 - Informatics & Statistics
 - Infra-red
 - Large Scale Structure Working Group
 - Particle Physics
 - Photoz Working Group of the DESC
 - SKA
 - Solar System
 - Spectroscopy

LSST:UK Science Working Group Home

Created by George Beckett [Administrator], last modified by Sarah Bridle on May 27, 2016

Science Collaborations

- Dark Energy Science Collaboration
- Transients and variable stars
- Galaxies
- Informatics & Statistics
- Solar System
- Stars, Milky Way, and Local Volume
- Active Galactic Nuclei

Further information on the structure of the LSST Science Collaborations is available on the [LSST Science Collaborations website](#).

Other useful links:

[Cross area activities](#)

Relevant documents:

- [LSST:UK Science Requirements document](#)
- [Compilation of reports from Liaisons and Points of Contact as input to the May 2016 Oxford LSST:UK Board Meeting](#)
- [LSST:UK Project Scientist report for the May 2016 Oxford LSST:UK Board Meeting](#)

Liaison activities with other projects and domains

- Particle Physics
- Infra-red
- Spectroscopy
- SKA
- GAIA
- E-ELT
- Euclid
- WFIRST
- Athena

Recent space activity

Aprajita Verma
 [Strong Lensing Working/Analysis Group of the DESC & the Strong Lensing Science Collaboration updated Jun 16, 2016 - view change](#)

Space contributors

- [Aprajita Verma \(4 days ago\)](#)
- [Graham P. Smith \(4 days ago\)](#)
- [Jon Loveday \(19 days ago\)](#)

- E-ELT
- Euclid
- GAIA
- Galaxies Science Collaboration
- › Galaxy Clusters (LSST:UK Clusters)
- Informatics & Statistics
- Infra-red
- Large Scale Structure Working Group
- Particle Physics
- Photoz Working Group of the DESC
- SKA
- Solar System
- Spectroscopy
- › Stars, Milky Way, and Local Volume
- Strong Lensing Working/Analysis Group
- Supernova Working Group of the DES
- Theory and Joint Probes Working Group
- Time-domain Follow-up
- **Transients and variable stars**
- Variable Stars Working Group of the LSST
- › Weak Lensing Working Group of the LSST
- WFIRST

Transients and variable stars

Created by George Beckett [Administrator], last modified by Stephen Smartt on May 12, 2016

Consortium Information	
UK Point of Contact	@Stephen Smartt (primary PoC for Science Collaboration, specialising in Transients), Aleks Scholz (Variable stars)
UK Mailing-list address	lusc-var@jiscmail.ac.uk
LSST Project Site	https://tvs.science.lsst.org/

Joining the LSST Science Collaboration

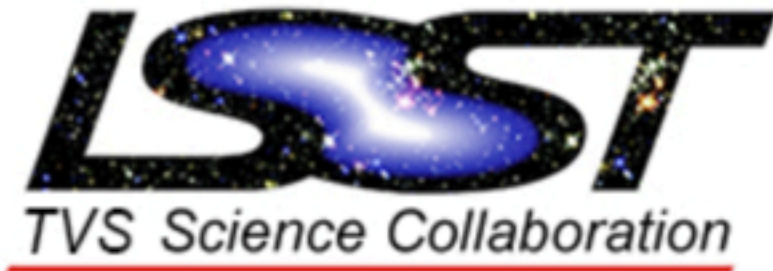
The US LSST project description of this Science Collaboration is as follows : "The LSST Transients and Variable Stars collaboration focuses on the transient sky, including a large and diverse range of phenomena: variable events, periodic or not, explosive and eruptive transients, and geometric transients (e.g. eclipsing binaries and planets). Variability is a tell tale of the nature of the object observed, but it also enables galactic studies (the mapping of the galactic structure), extragalactic studies (the characterization of the intracluster medium), and cosmological studies. Because of their physical and phenomenological diversity, the objects we study span a wide range of timescales, and present themselves in a range of brightnesses, and colors. LSST also holds great potential for discovery of new transient phenomena, especially at the very short and very long time scales."

In the UK we view the nature of the science requirements and exploitation for "Transients" and "Variable stars" to be different, with some overlap areas. Therefore we have two points of contact for this Science Collaboration (S. Smartt and A. Scholz, with contact details above).

Those of you who are LSST:UK PIs (as joint affiliates) or Junior Associates, can apply to join the US collaboration. Apply here : <https://tvs.science.lsst.org/apply>

S. Smartt has applied, and was approved, although the process took a long time and formal notification was not obvious. We would encourage all approved LSST:UK scientists to go through this procedure. If and when you do, please add your name to the list at the bottom of this page. Note that the following is an incomplete, example list of people in the UK who expressed interest in this area. This list is illustrative and is not used as a project definition list, or email list, or anything else like that. So don't panic if you are not on it. Add your name, and apply on the above US based project site.

LSST:UK focused work



Home » LSST Transients and Variable Stars Membership Application

LSST Transients and Variable Stars Membership Application

Name *

Email *

Affiliation *

Current interests (Full sentences; 50-500 words) *

Please include a description of your current scientific interests and of your area of expertise, and their relevance to the LSST survey and its preparation (500 words maximum)

Proposed Contribution over the next two years *

The image shows a screenshot of a Confluence wiki page. The browser's address bar at the top displays the URL: https://lsst-uk.atlassian.net/wiki/display/LUSCSWG/LSST%3AUK+Science+Working+Group+Home. The Confluence header includes the logo, navigation links for Spaces, People, and Create, and a search bar. On the left sidebar, the page is identified as 'LSST:UK Science Working Group' with a star icon. Below this, there are sections for 'Pages', 'Blog', and a 'PAGE TREE' listing various sub-pages such as 'Active Galactic Nuclei', 'Athena', 'Cosmological Simulations Working G', 'Cross area activities', 'Dark Energy Science Collaboration', 'E-ELT', 'Euclid', 'GAIA', 'Galaxies Science Collaboration', 'Galaxy Clusters (LSST:UK Clusters)', 'Informatics & Statistics', 'Infra-red', 'Large Scale Structure Working Group', 'Particle Physics', 'Photoz Working Group of the DESC', 'SKA', and 'Solar System'. The main content area features the title 'LSST:UK Science Working Group Home' and a sub-header 'Science Collaborations'. A list of collaborations includes 'Dark Energy Science Collaboration', 'Transients and variable stars', 'Galaxies', 'Informatics & Statistics', 'Solar System', 'Stars, Milky Way, and Local Volume', and 'Active Galactic Nuclei'. A paragraph of text states: 'Further information on the structure of the LSST Science Collaborations is available on the LSST Science Collaborations website.' The phrase 'the LSST Science Collaborations website' is circled in red. To the right, under the heading 'Liaison activities with other projects and domains', a list includes 'Particle Physics', 'Infra-red', 'Spectroscopy', 'SKA', 'GAIA', 'E-ELT', 'Euclid', 'WFIRST', and 'Athena'. Below the main text, there are sections for 'Other useful links' (with a link to 'Cross area activities'), 'Relevant documents' (with links to 'LSST:UK Science Requirements document', 'Compilation of reports from Liaisons and Points of Contact as input to the May 2016 Oxford LSST:UK Board Meeting', and 'LSST:UK Project Scientist report for the May 2016 Oxford LSST:UK Board Meeting'), 'Recent space activity' (showing a post by 'Aprajita Verma' about the 'Strong Lensing Working/Analysis Group of the DESC & the Strong Lensing Science Collaboration' updated on Jun 16, 2016), and 'Space contributors' (listing 'Aprajita Verma (4 days ago)', 'Graham P. Smith (4 days ago)', and 'Jon Loveday (19 days ago)'). The bottom of the page shows 'Space tools' and a double arrow icon.

Through a generous matching grant from Charles Simonyi and Bill Gates, the LSSTC is able to invest in a new science research initiative called **Enabling Science**. The initiative will help advance the science of cosmology, astronomy, and physics in support of the LSST project and its accompanying big data.

As a recipient of an LSSTC grant in 2015, CIERA/Northwestern's **LSSTC Data Science Fellowship Program** (DSFP) will enhance a traditional astrophysics curriculum--extending a strong physics education to one that encompasses computational techniques, programming skills, data management, statistics, and data analysis.

LSST Science Collaborations

There are currently ten LSST Science Collaborations. Additional information about their work and membership can be found at the links below or by contacting the individual chairs, or the [LSSTC Science Collaborations Coordinator \(LSSTCSCC\)](#), Lucianne Walkowicz.

Galaxies

[Michael Cooper](#) (UC Irvine); [Brant Robertson](#) (University of California, Santa Cruz);

Stars, Milky Way, and Local Volume

[John Bochanski](#) (Rider University); [John Gizis](#) (University of Delaware); [Nitya Jacob Kallivayalil](#) (University of Virginia);

Solar System

[Lynne Jones](#) (University of Washington); [David Trilling](#) (Northern Arizona University);

Dark Energy

[Rachel Bean](#) (Cornell University); [Jeffrey Newman](#) (University of Pittsburgh);

Active Galactic Nuclei

[Niel Brandt](#) (Pennsylvania State University);

Transients/variable stars

[Federica Bianco](#) (New York University); [Ashish Mahabal](#) (Caltech);

Large-scale structure/baryon oscillations

[Eric Gawiser](#) (Rutgers The State University of New Jersey); [Shirley Ho](#) (Carnegie Mellon University);

Strong Lensing

[Phil Marshall](#) (KIPAC);

Informatics and Statistics

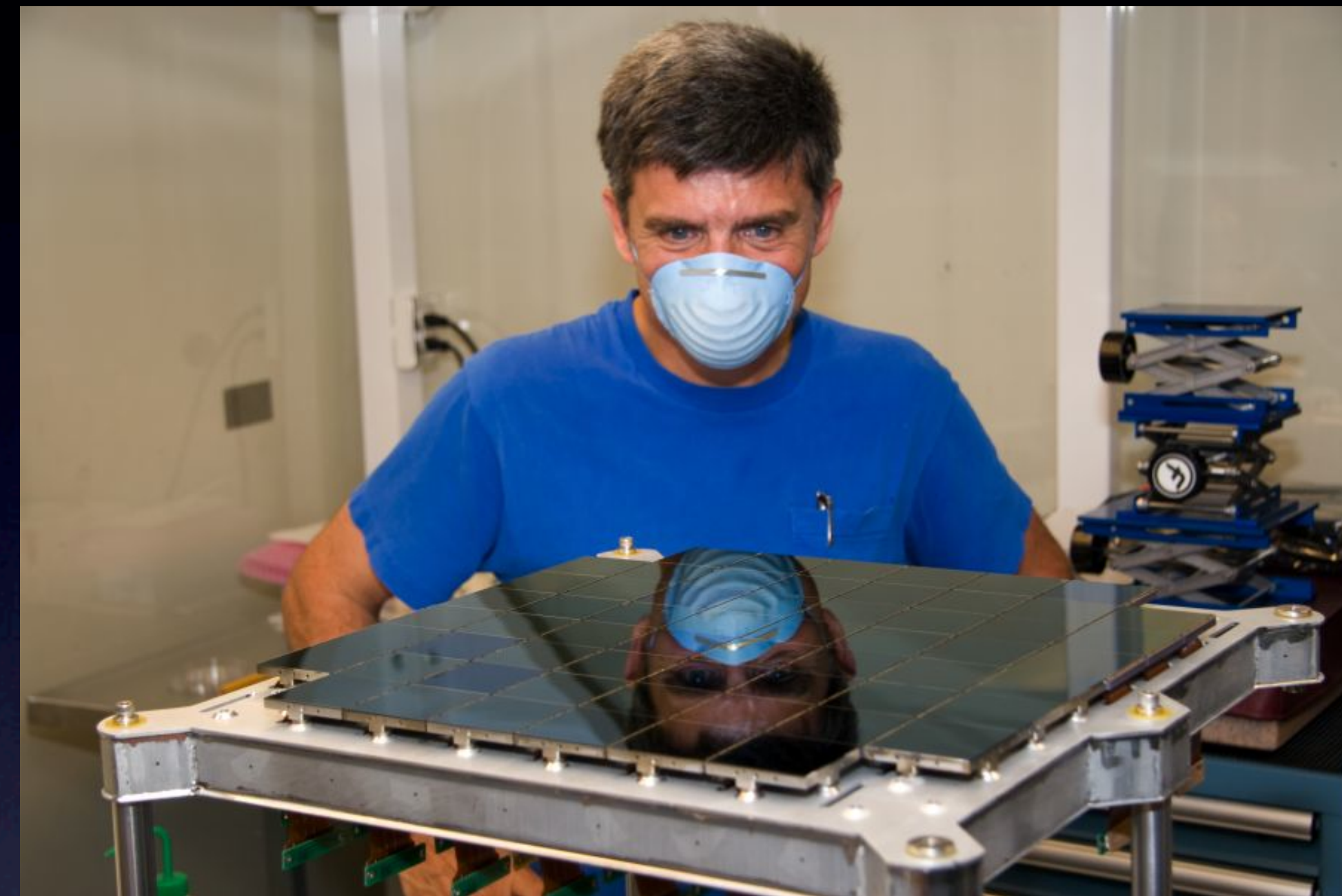
[Tom Lored](#) (Cornell University); [Chad Schafer](#) (Carnegie Mellon University);

Back to Top

LSST QUB March Meeting

- Overview of Data Access Centre
- Overview of science objectives / applications for LSST
- Pan-STARRS (& ATLAS) applications developed and running at QUB
- Object context classification
- Machine learning applied to massive data sets
- PESSTO marshal software (prioritisation of spectroscopic followup)
- 'qServ' evaluation (LSST database)
- LoDEn / CoDEn development platform + feedback from QUB
- LUSC collaborative tools

Data Stream #1: Panoramic Survey Telescope and Rapid Response System



PS1 & PS2 80 x 4800 x 4800 pixel chips (0.259"/pixel)
= 1.4 gigapixels

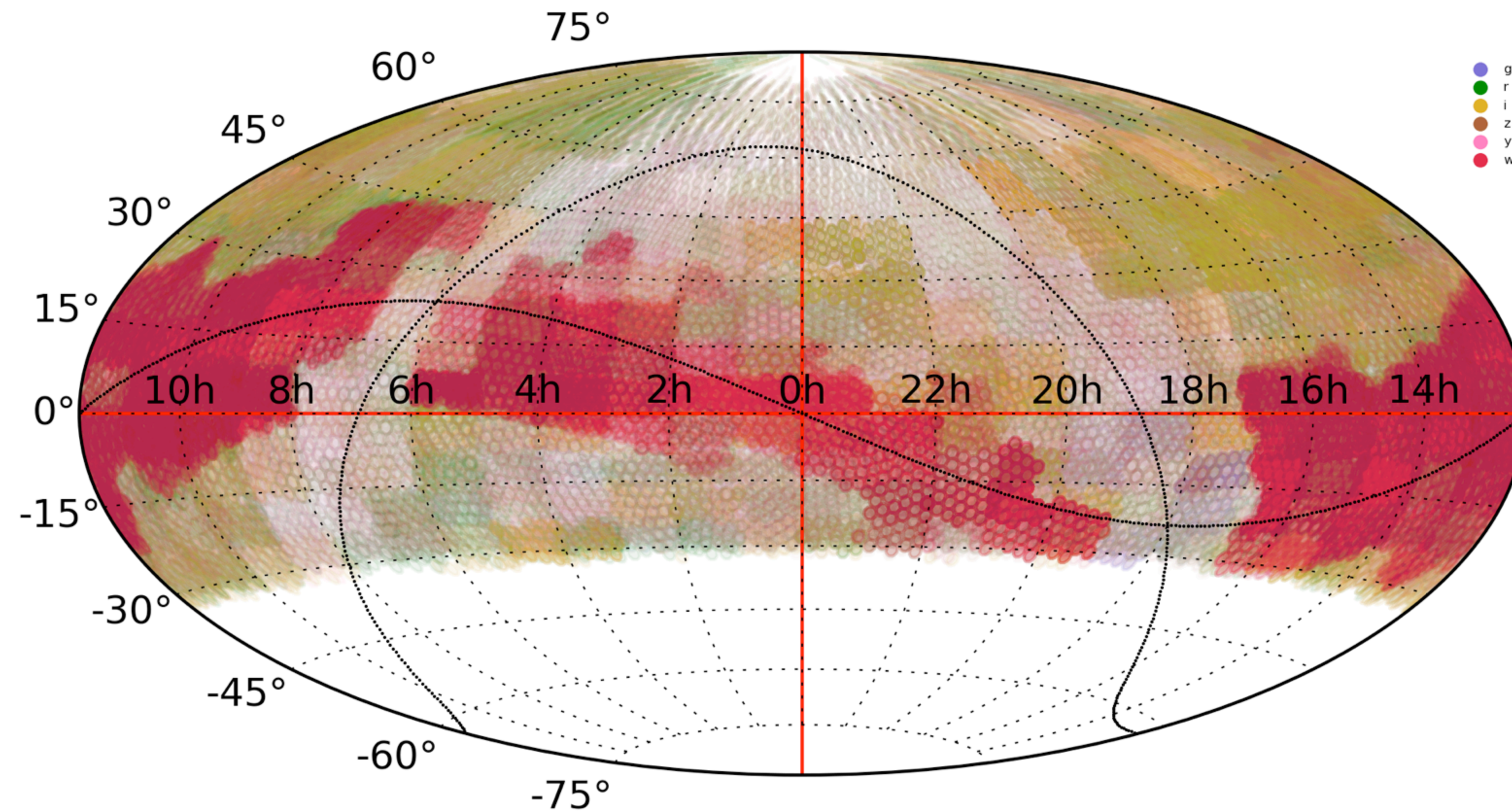
7 square degrees field of view

2 Telescopes located together on Haleakala
PS2 is undergoing commissioning

Difference Detections ingested since June 1st 2013 (with
some operational gaps)

PSST Exposures Processed (DB = 1.2 TB, stamps = 2.5TB)

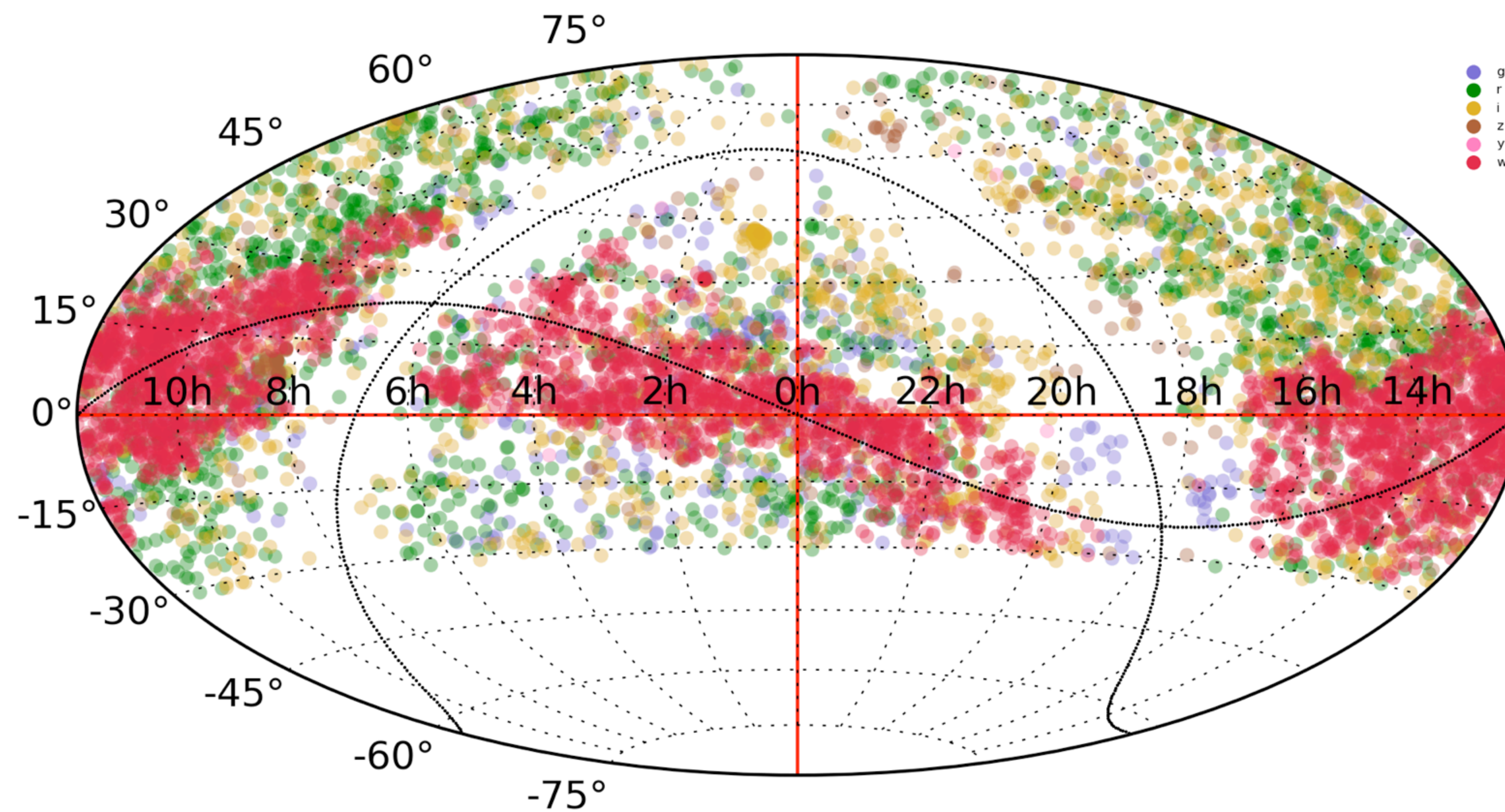
1 billion objects, 2.2 billion detections



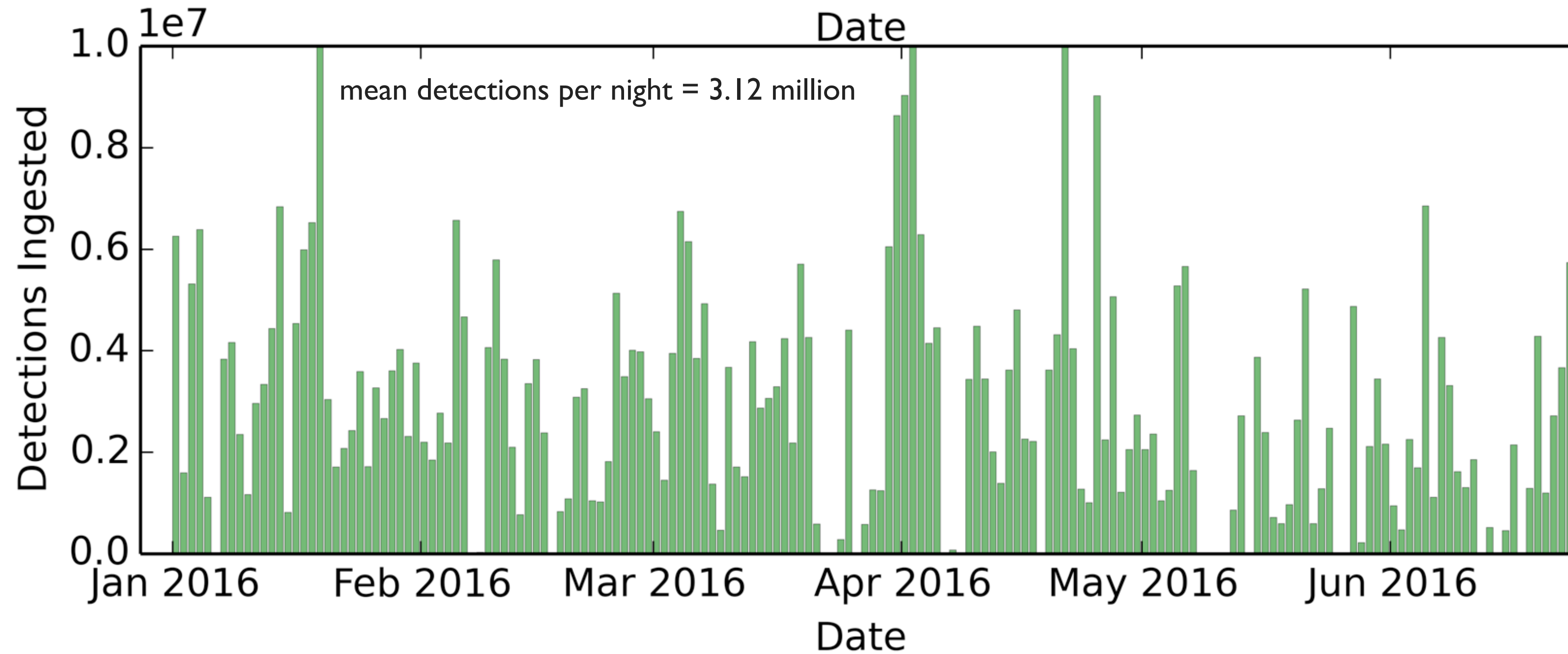
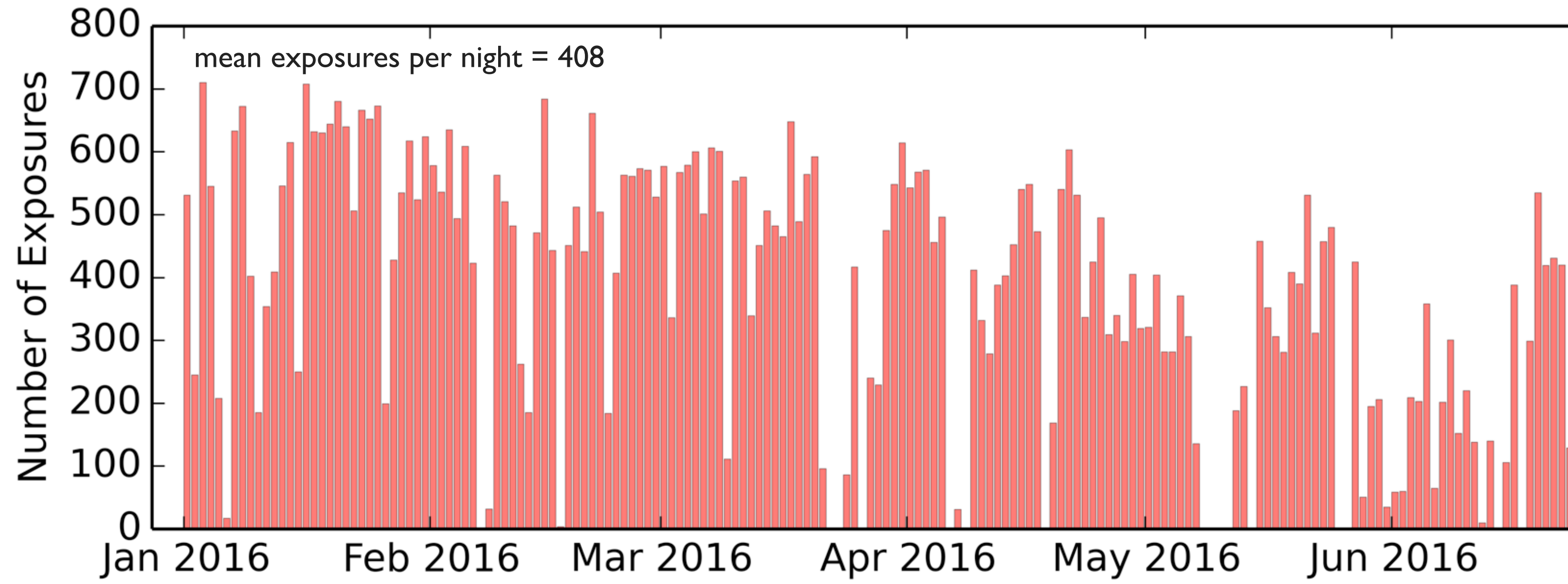
The Pan-STARRS Survey for Transients (PSST) - first announcement and public release, M. Huber et. al., ATel #7153

PSST Exposures Processed (DB = 1.2 TB, images = 2.5TB)

7,136 Objects Promoted



Diff Detections ingested from PSI



PS16ha

12:44:32.86 -05:12:28.3

See also: [MLS151217-124433-051228](#)

Local Name: 6A3Phaa

Flag Date: Jan. 9, 2016

Survey: RING

Processing Flags: targetfinders reffinders stamps
locationmap eph ghost brightstar

PS1 Name: PS16ha

Number of Detections: 76

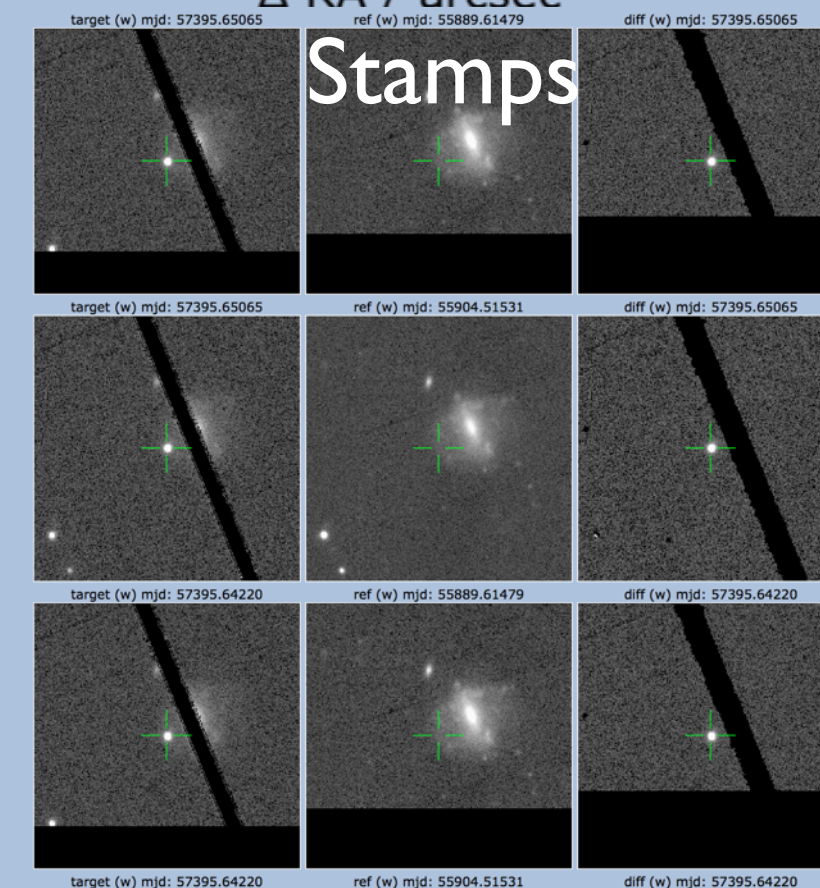
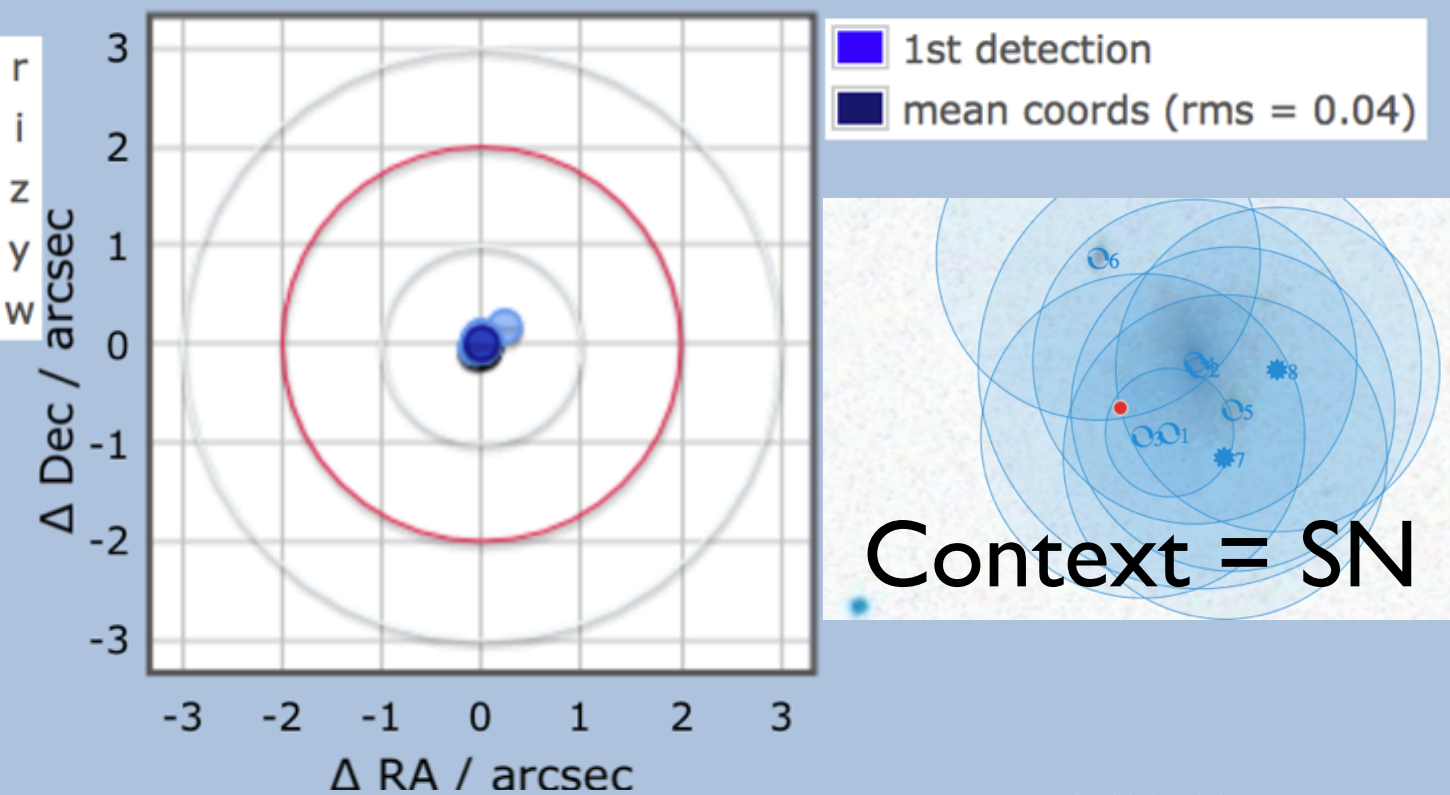
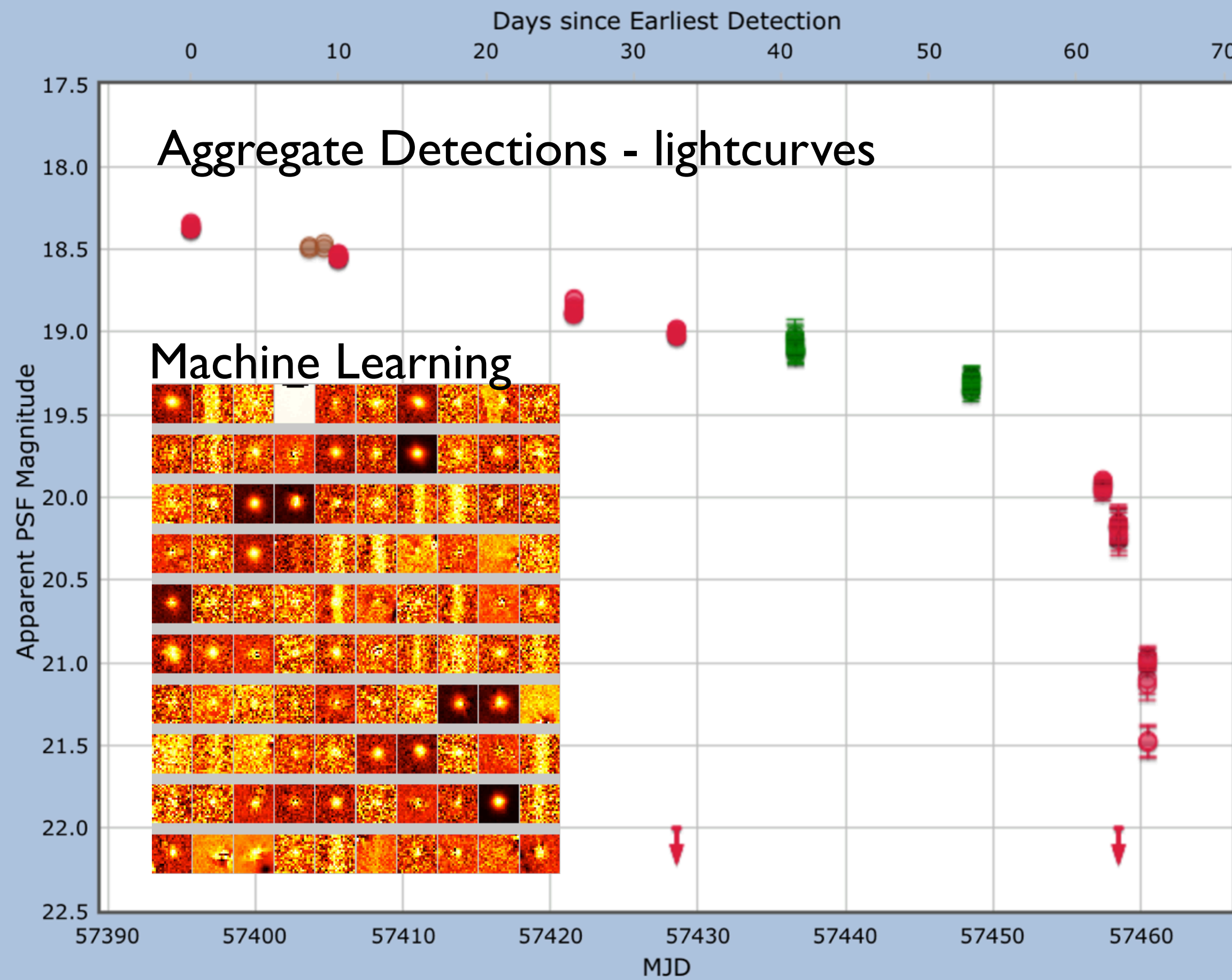
Object List: good

Spectral Type:

Internal Followup ID: 4883013

Internal ID: 1124432860051228300

Contextual Classification: sn



Possible Associations

Catalogue	ID	Separation
NASA Extragalactic Database	APMUKS(RJ) B124157.59-045505.9	6.66"
NASA Extragalactic Database	APMUKS(RJ) B124157.34-045555.8	10.89"

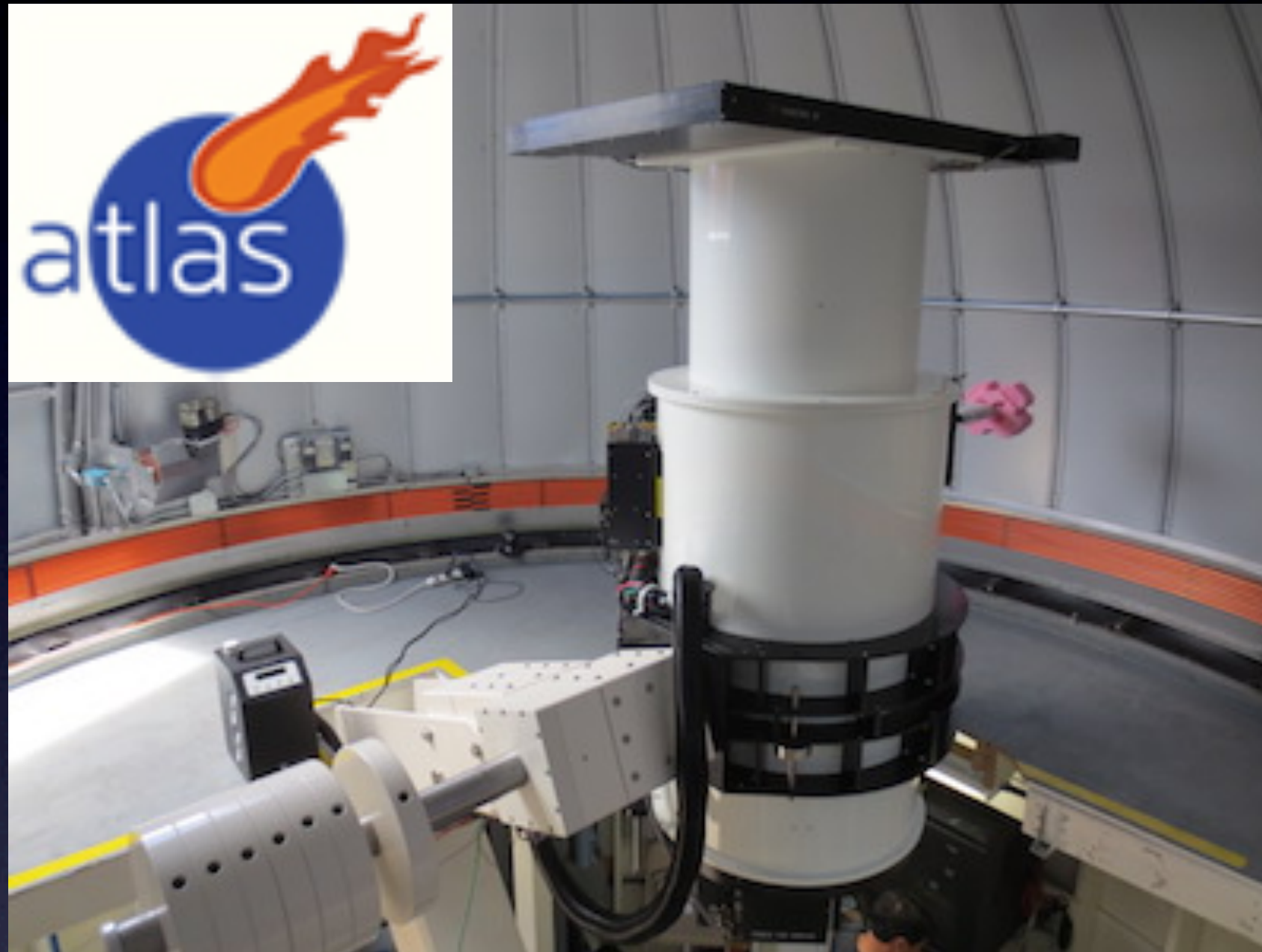
External Information

(12^h44^m43.08^s -05^h12^m59.1^s)

SDSS DR12

WIKISKY
SDSS DR12 Navigate
NED: 10 arcsec radius

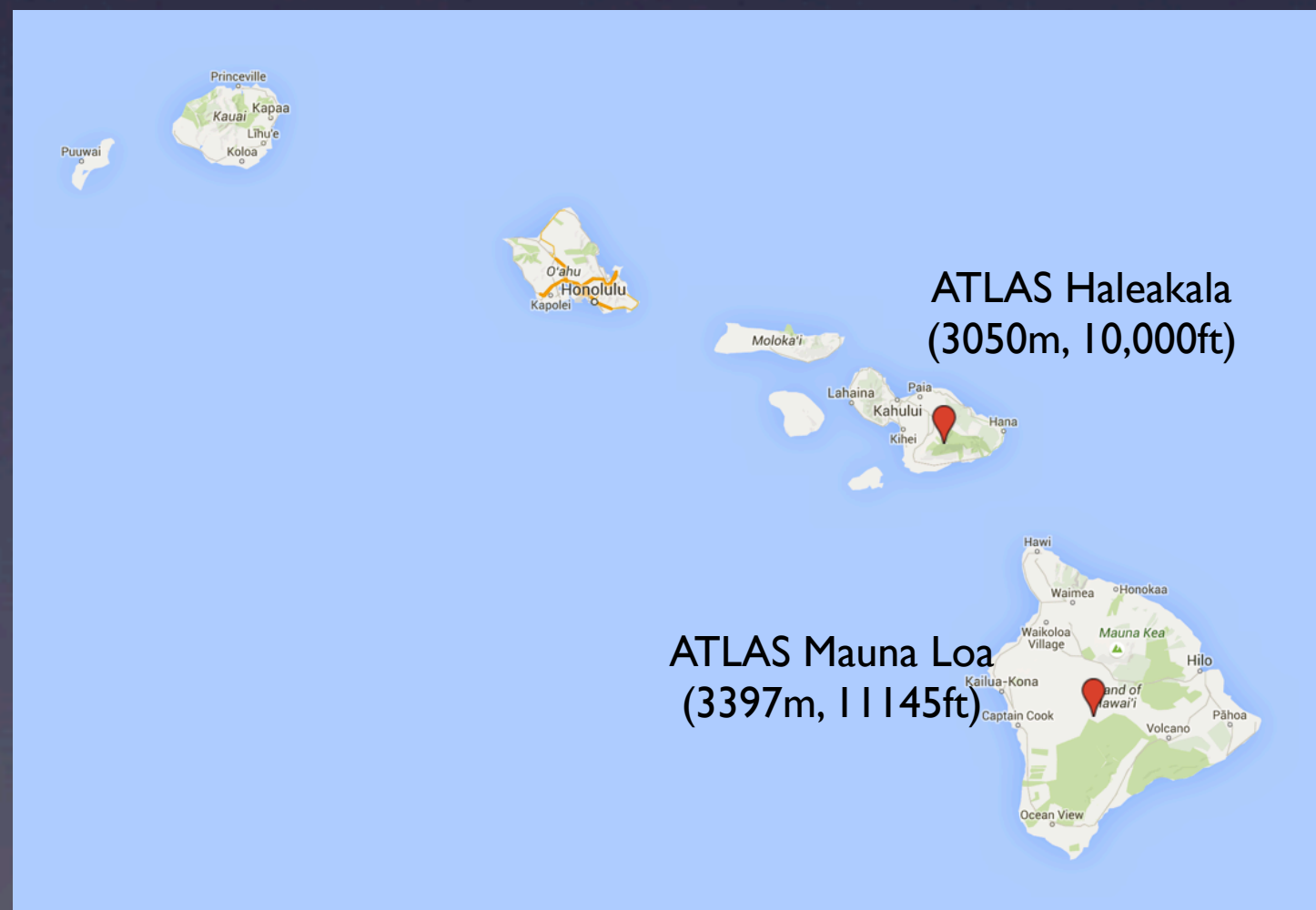
Data Stream #2: Asteroid Terrestrial impact Last-Alert System



John Tonry / Larry Denneau



Larry Denneau



ATLAS STA 10500 x 10500 pixel single chip (1.86"/pixel)
= 110 megapixels

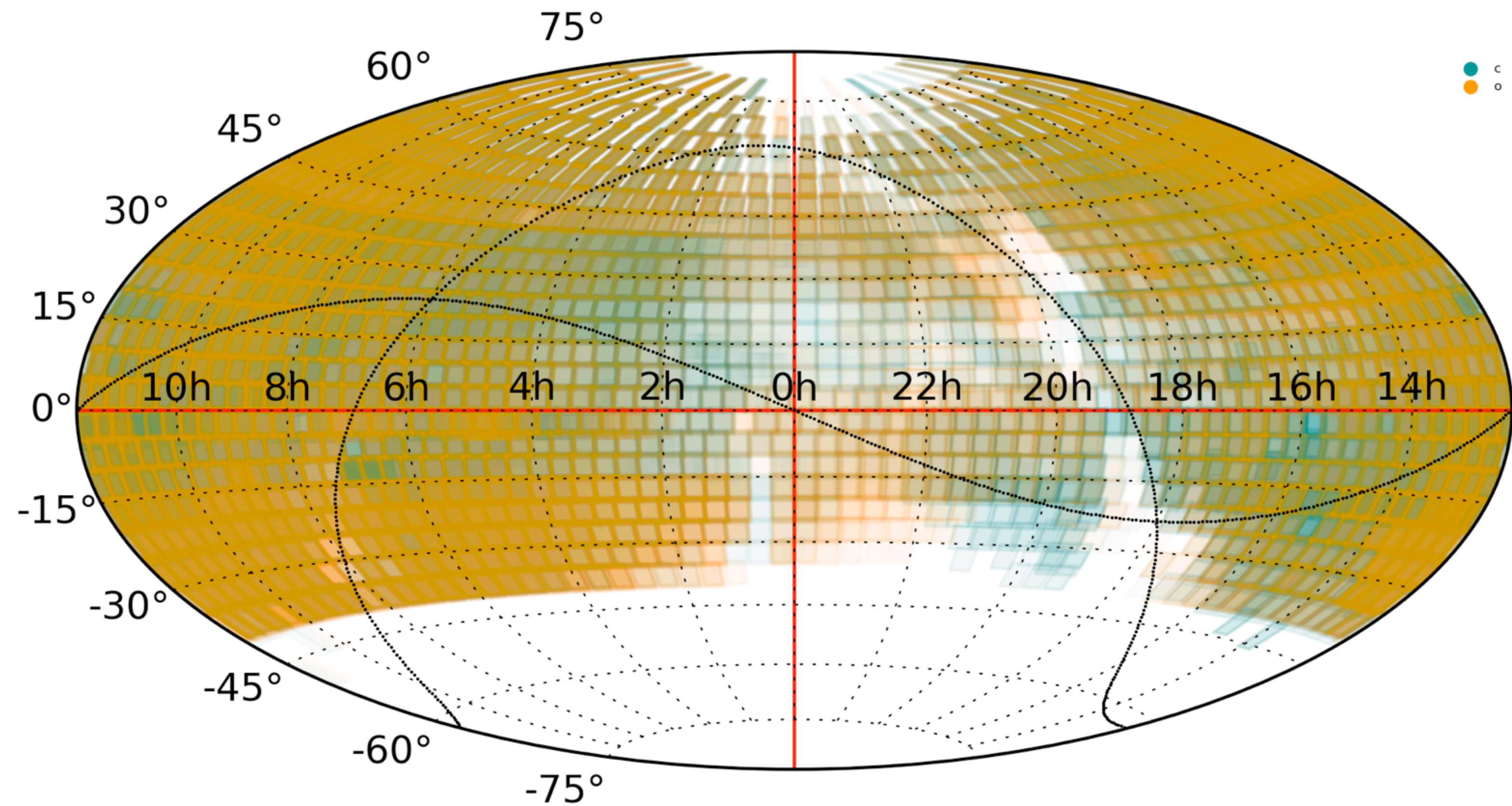
29.4 square degrees field of view

2 Telescopes on Haleakala and Mauna Loa
(MLO not yet fully operational)

Difference Detections ingested since December 21st 2015

ATLAS (Haleakala) Exposures Processed (DB = 245GB, stamps = 500GB)

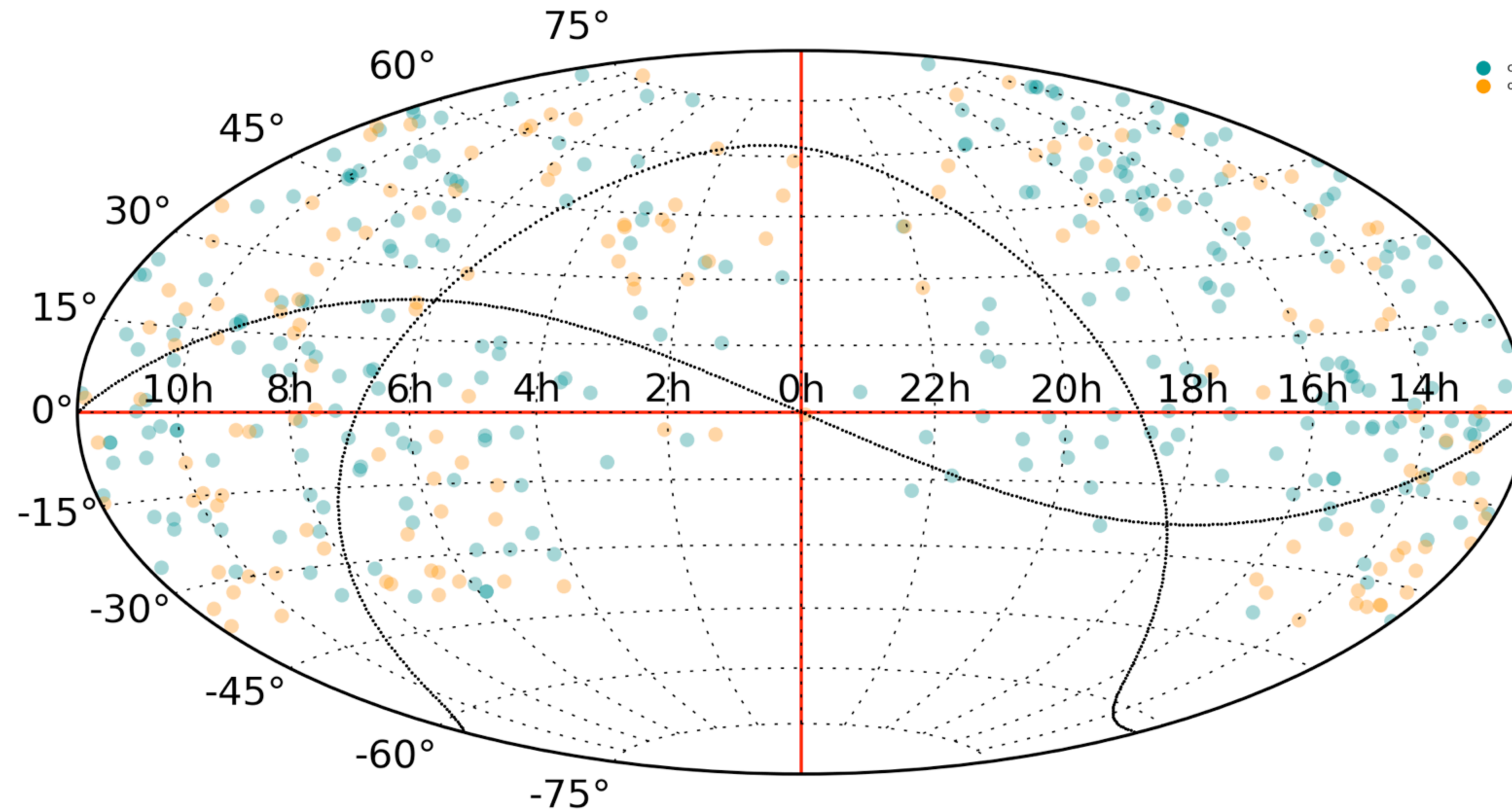
300 million objects, 500 million detections



Discovery and Classification of 3 Type Supernovae by ATLAS, J. Tonry et. al., ATel #8680

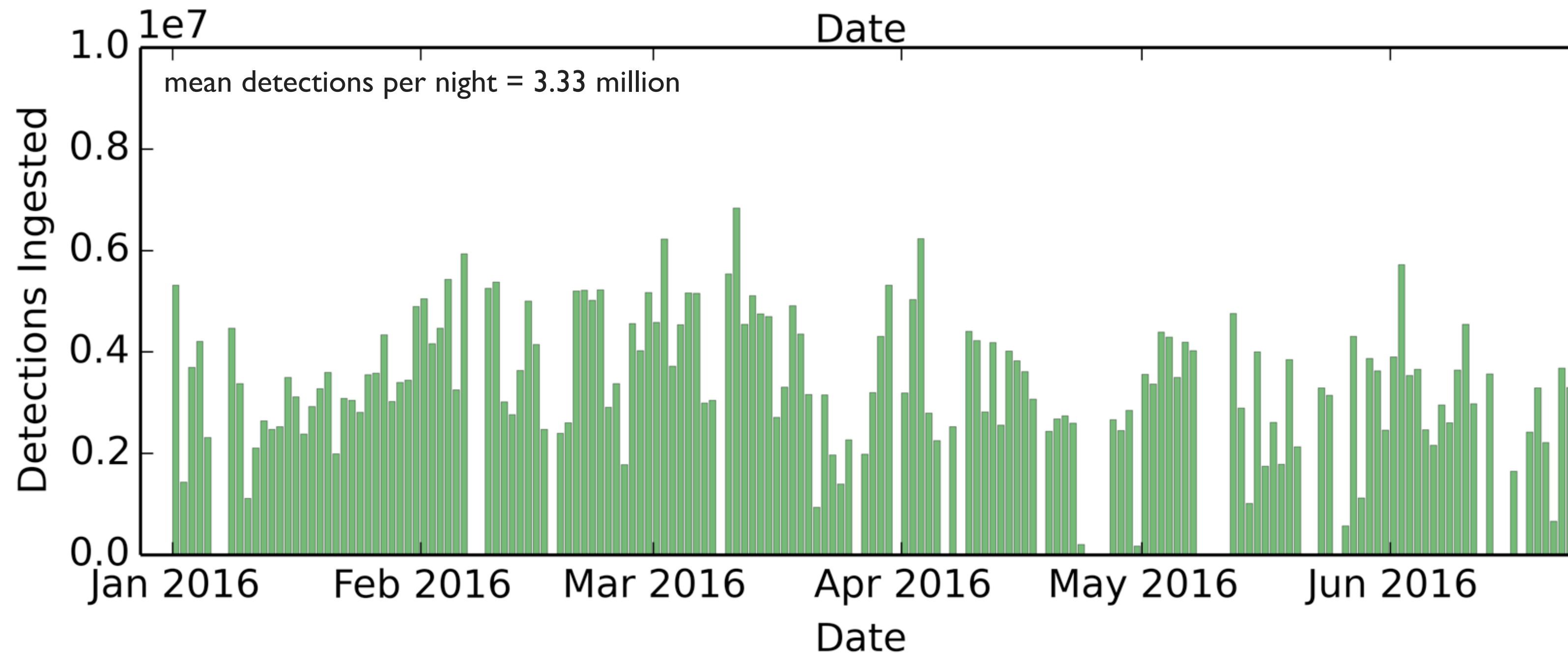
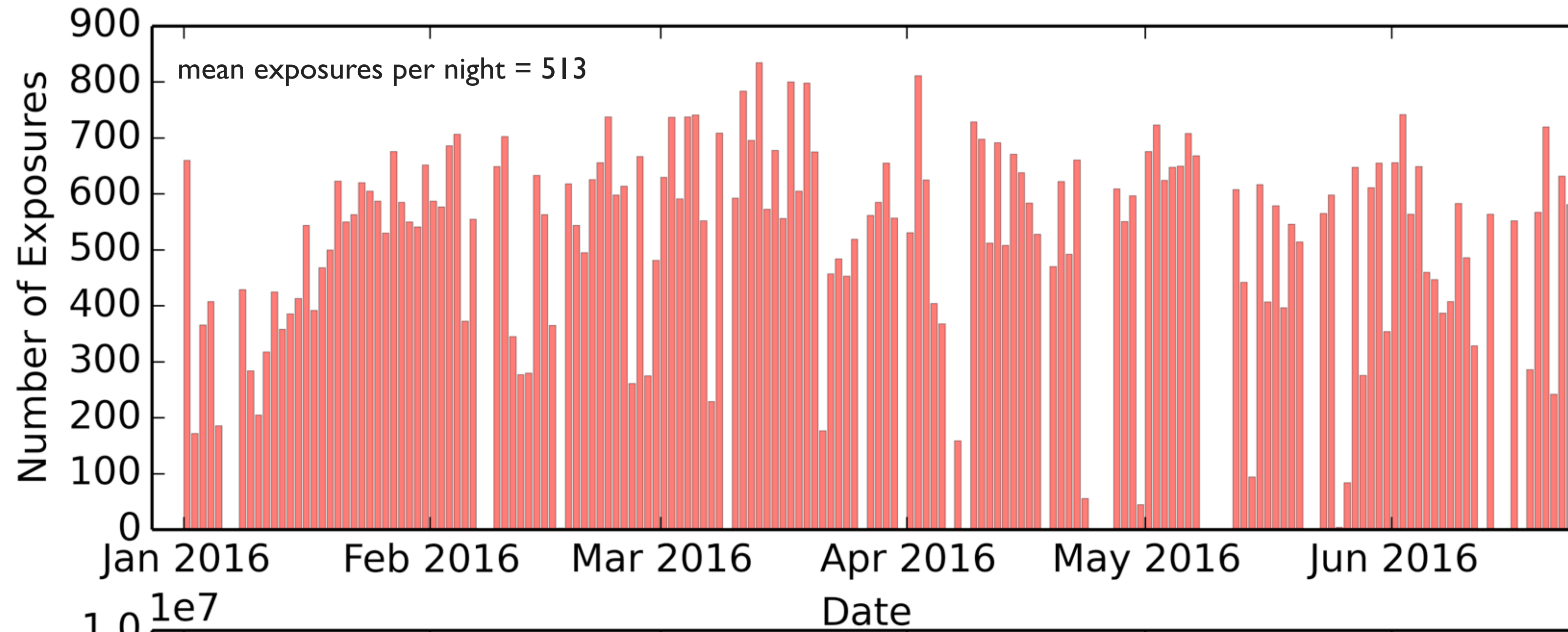
ATLAS Exposures Processed (DB = 245GB, images = 500GB)

429 Objects Promoted
(Still tuning the filtering algorithms + Machine Learning)



Discovery and Classification of 3 Type Supernovae by ATLAS, J. Tonry et. al., ATel #8680

Diff Detections ingested from ATLAS



ATLAS16avw

12:02:51.71 +44:15:27.7
(180.71548 +44.25770)

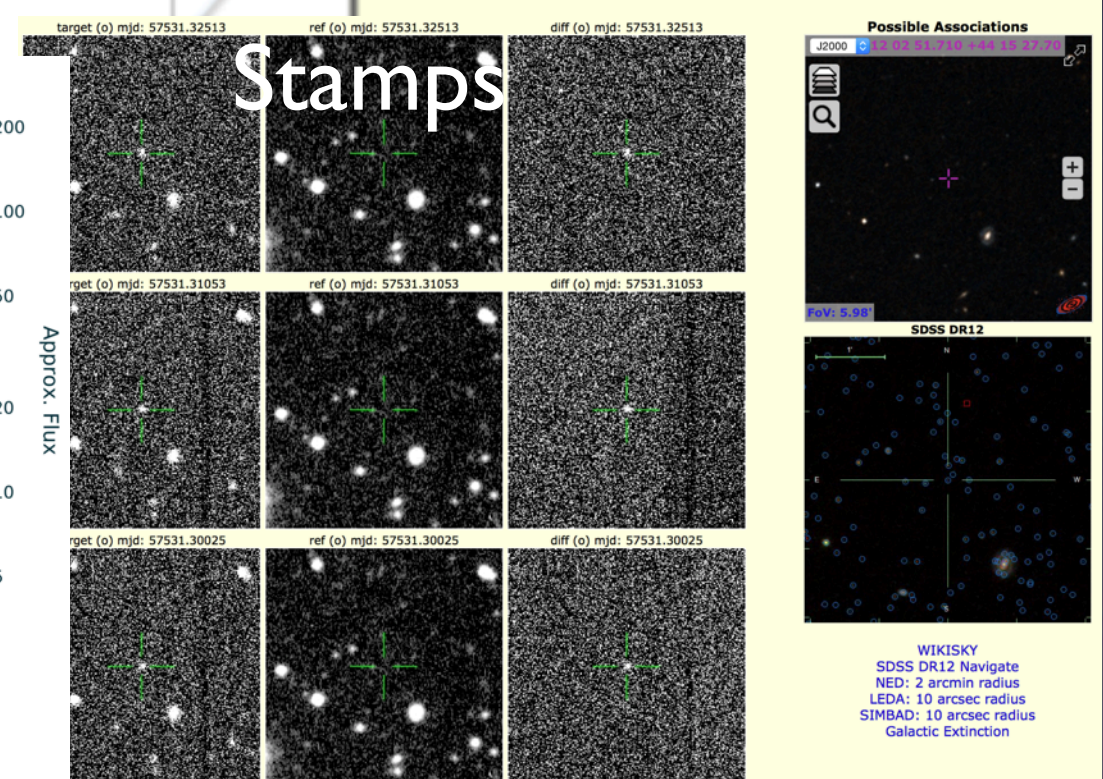
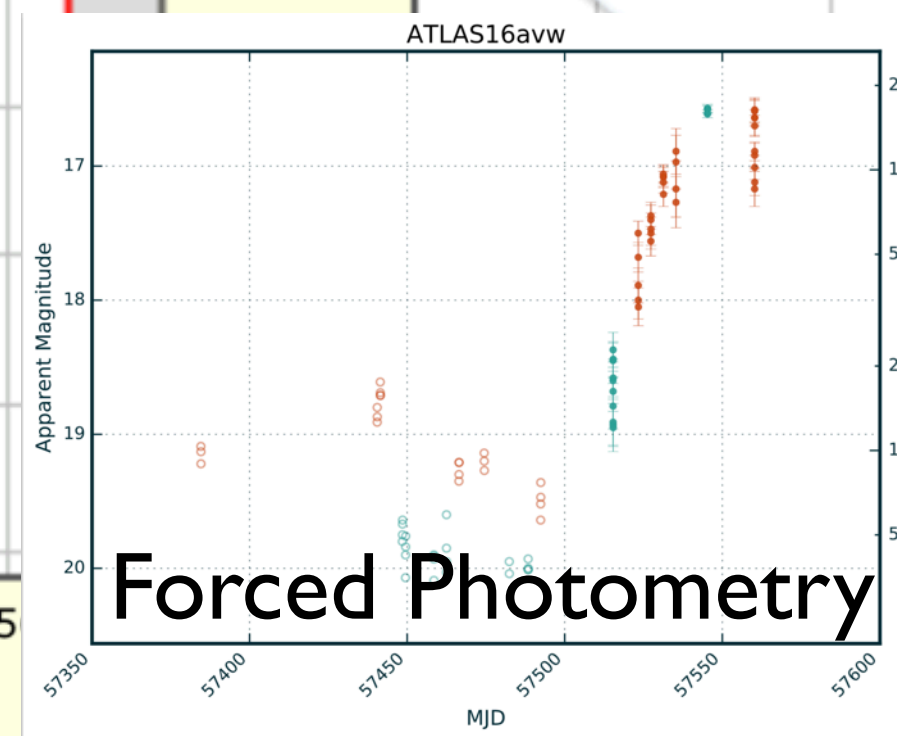
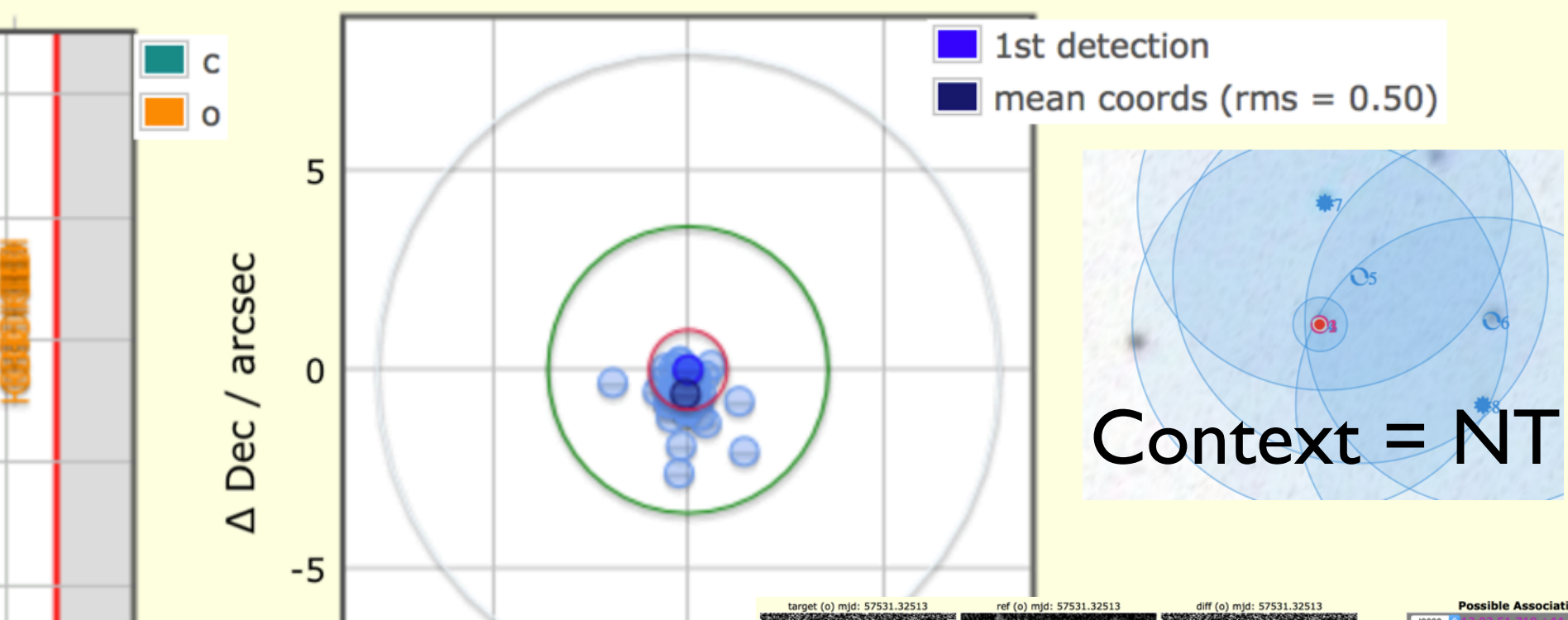
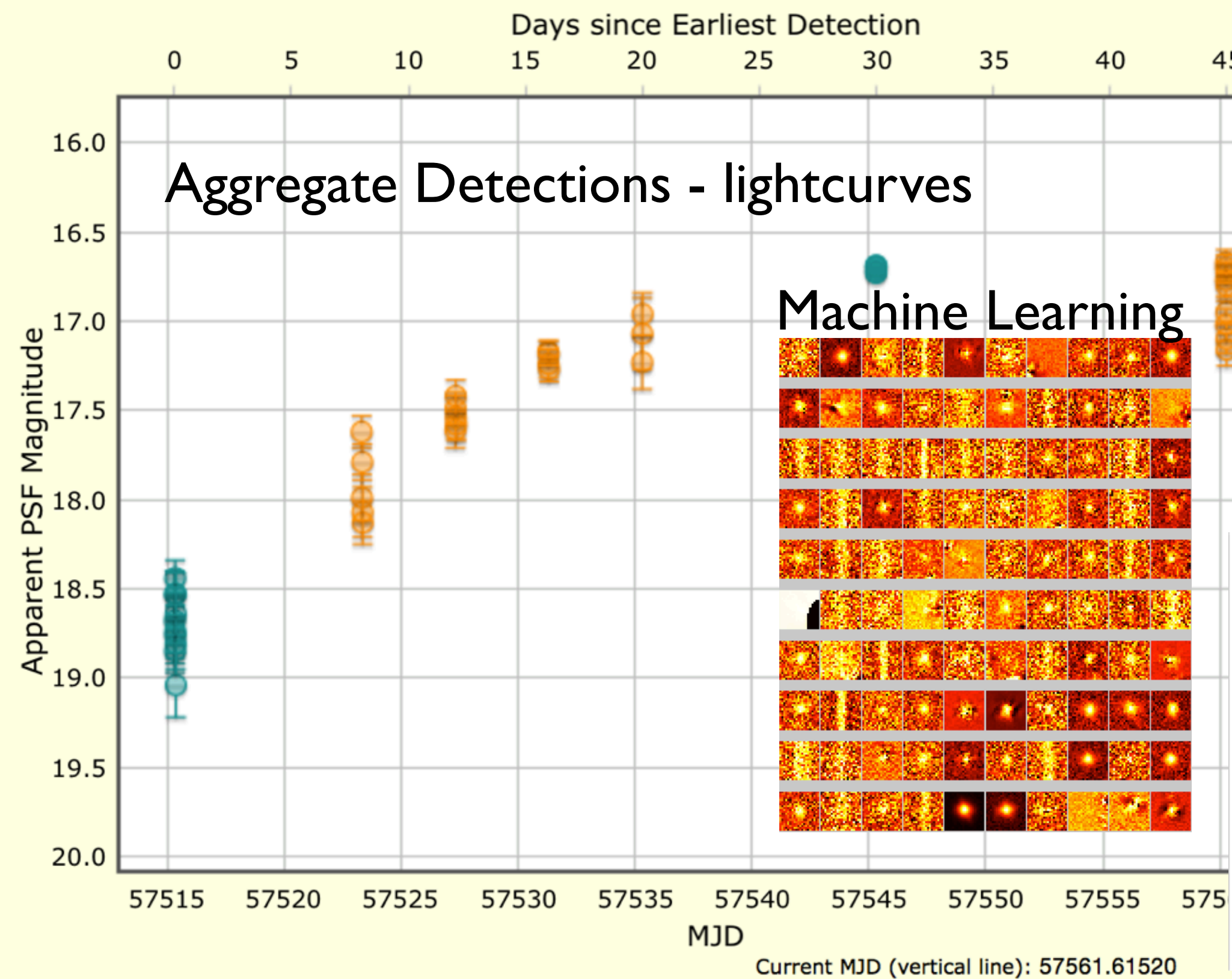
See also: [Gaia16apd](#)

Local Name:
Flag Date: May 19, 2016
Survey:
Processing Flags:

Internal Name: ATLAS16avw
Number of Detections: 41
Object List: good
Spectral Type: SLSN-I

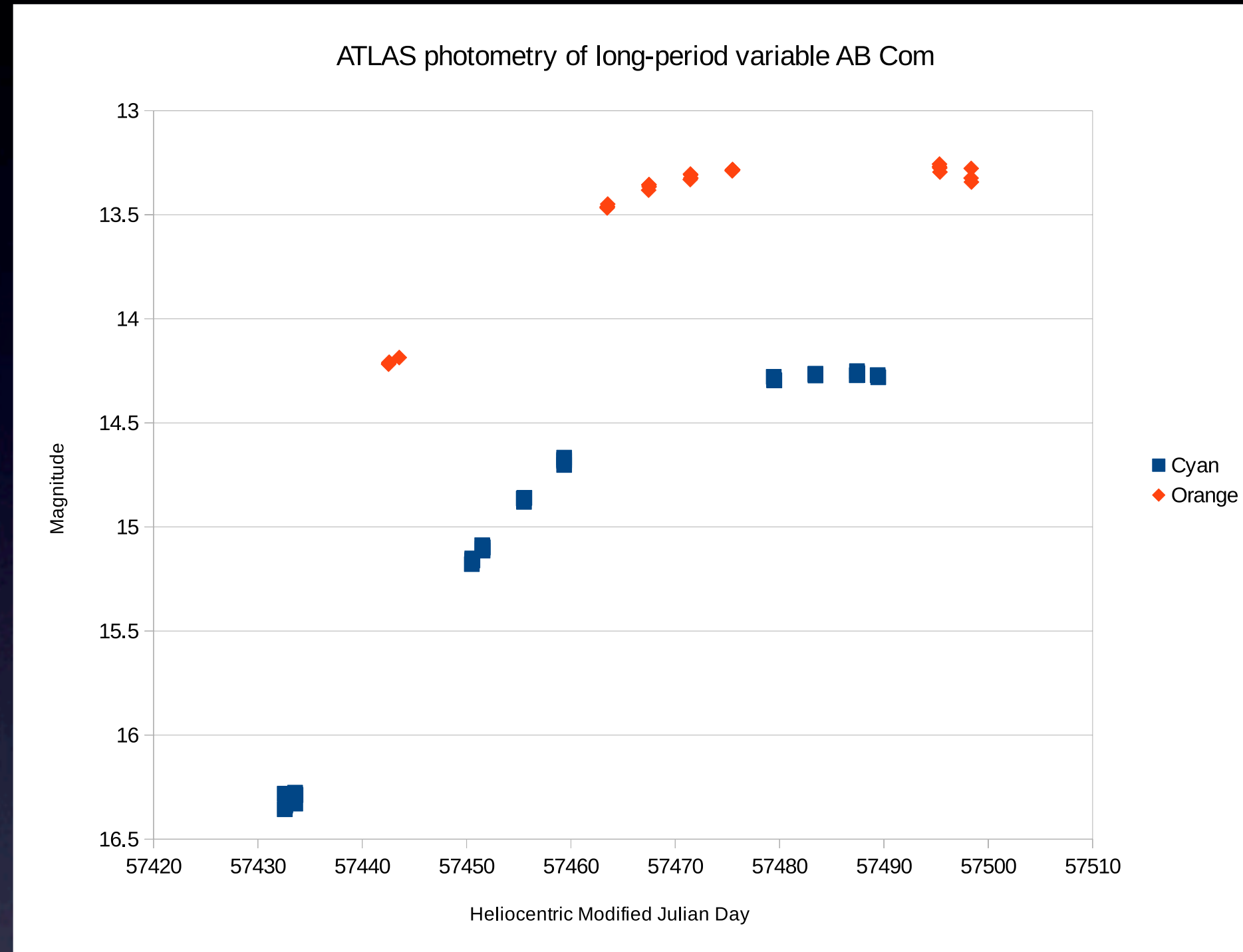
Internal Followup ID: 815370
Internal ID: 1120251721441527100
Contextual Classification: nt
Galactic (l,b): (149.45875,70.28422)

Comments: Good, but known Gaia object: SLSN type I, z=0.1



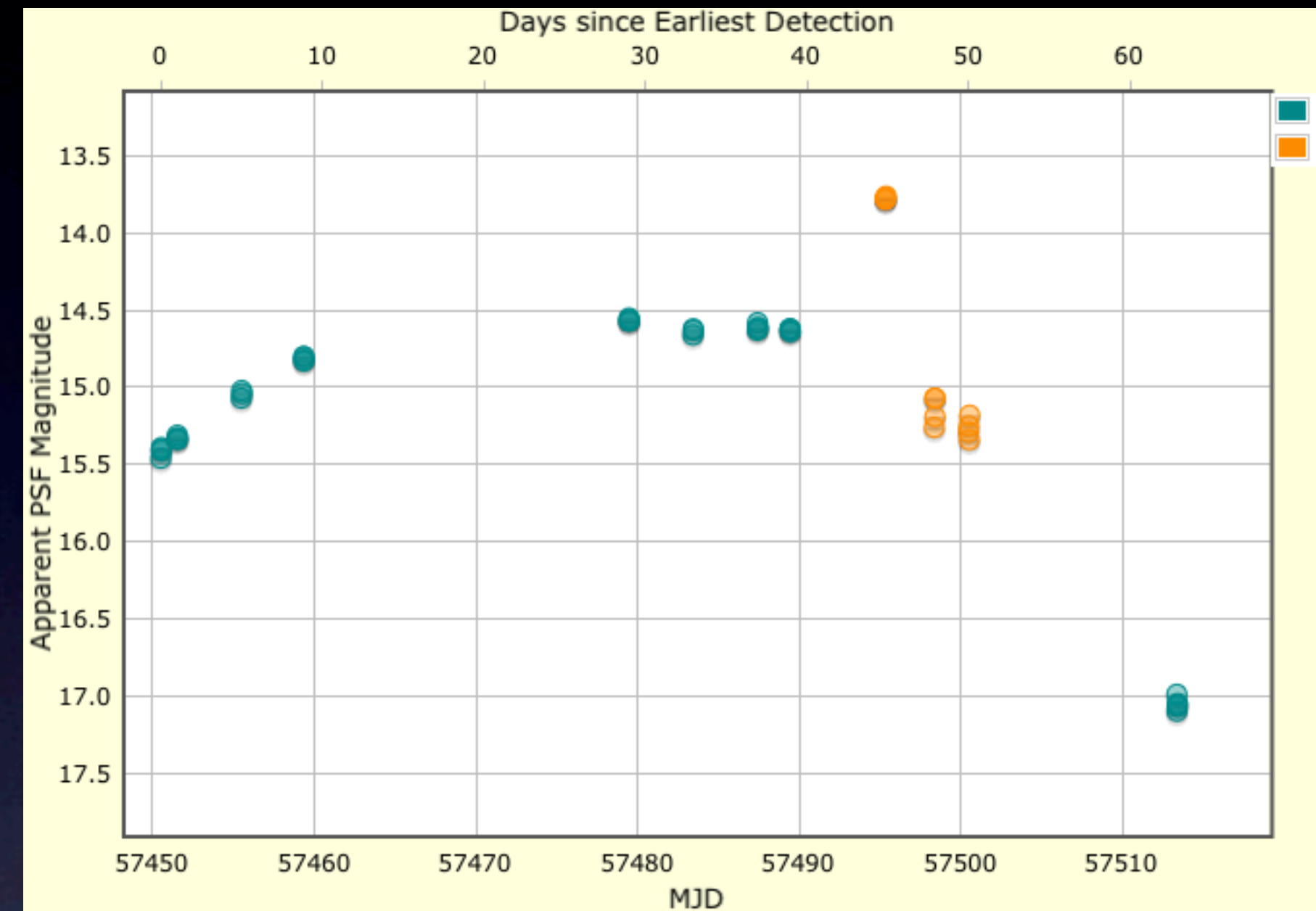
Datastream #2a: ATLAS Billion Stars

Non-diffed data variable star



Ari Heinze, University of Hawaii

Same star in diff data

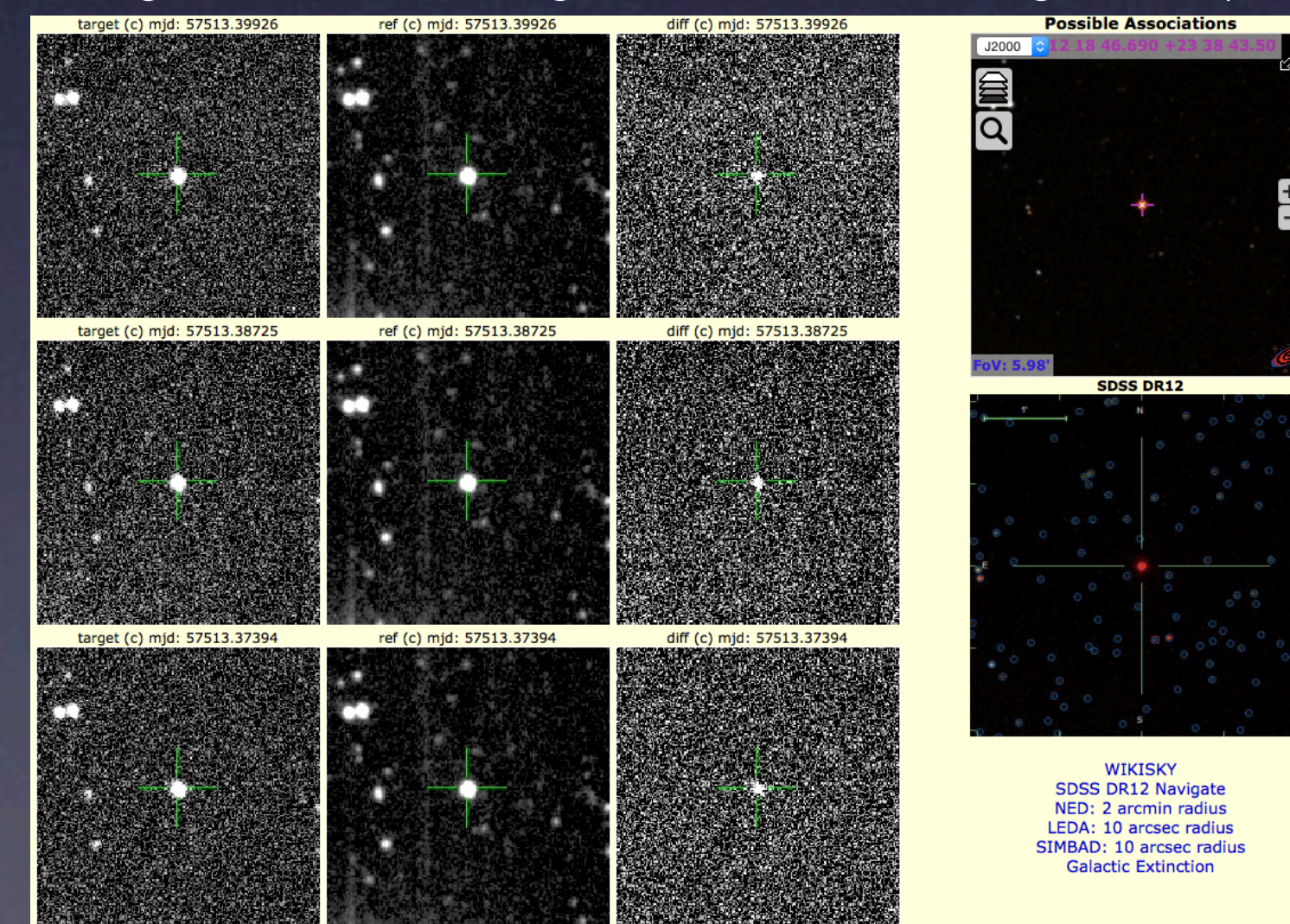


(orange data missing because star was brighter when reference image created)

ATLAS will produce 1 Billion Star + 1000 point lightcurve data based on non-diff data required.

Conservative estimate of database size = at least 100TB per year database, assuming 100 bytes per detection, plus insertion rate of 64K detections / sec.

Good test data for LSST qServ?



What Next?

- Understand how to subscribe to LSST Transients
 - Find out how to get stamps around transients
 - Apply filters + machine learning to catalogues and stamps
 - Apply context classification
 - Disseminate the transients data to the community
-
- Complete/Tune ATLAS diff detection pipeline - including context classification
 - Train the machine learning classifiers (both catalogue and pixel)
 - Add Mauna Loa telescope data stream
-
- Test Ingest of ATLAS Difference Detections into qServ
 - Test Ingest Variable Star Detections into qServ
 - Start using collaborative tools & development environment in anger

