DARK ENERGY SURVEY

Agenda

- DES Project Overview - Liz Buckley-Geer
- DESDM Refactoring work – Mike Wang
- DES and OSG/FermiGrid – Marko Slyz
- DES Analysis Framework – Jim Kowalkowski

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DES Project Overview

- Introduction
- Topics I will cover
  - Online Database and web tools
  - OBSTAC
  - Nightsum
  - DES Data management
  - Image cut-out service

Installation of the cage on the telescope June 2012

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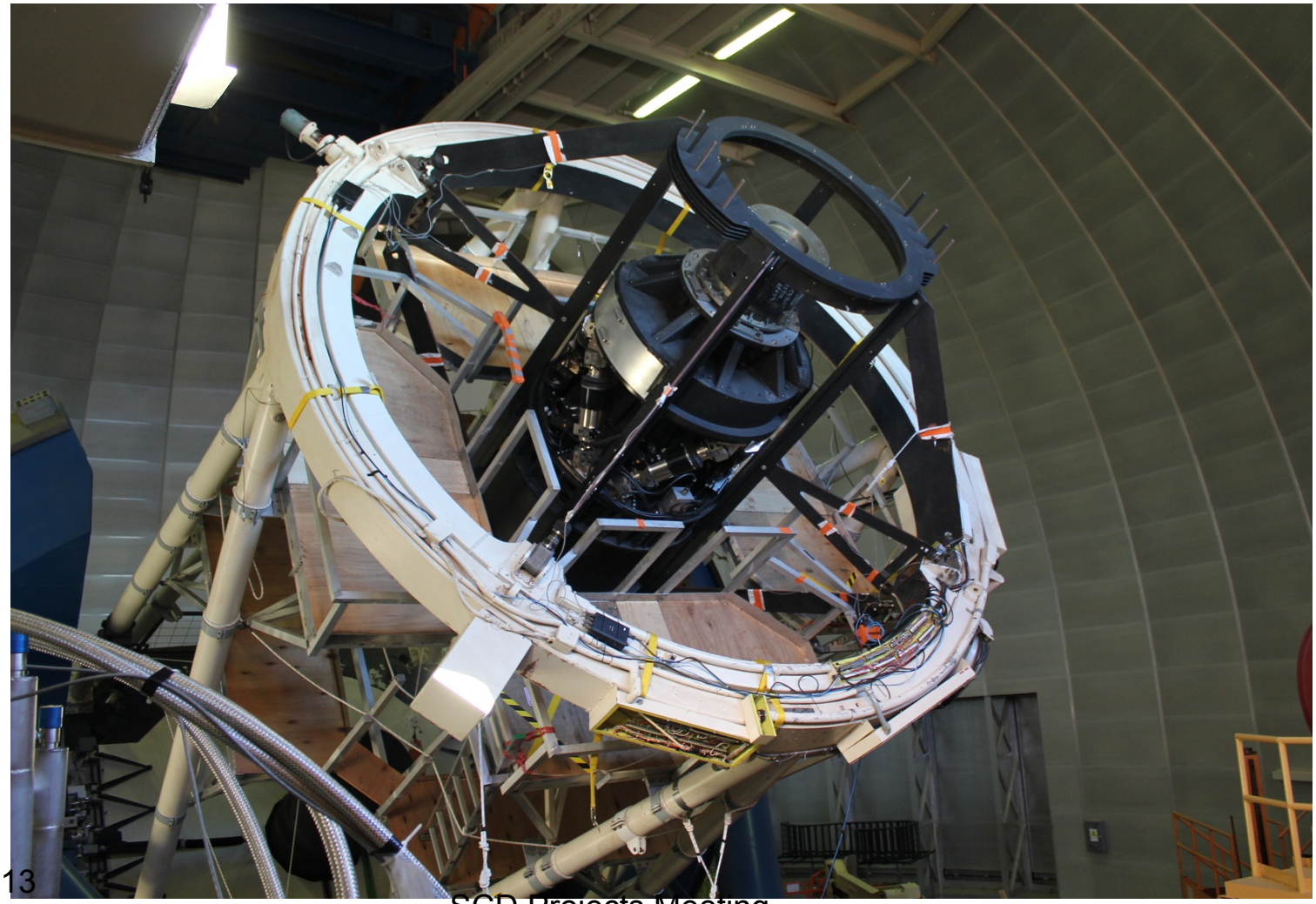

Attaching the Imager to the cage
August 30 2012

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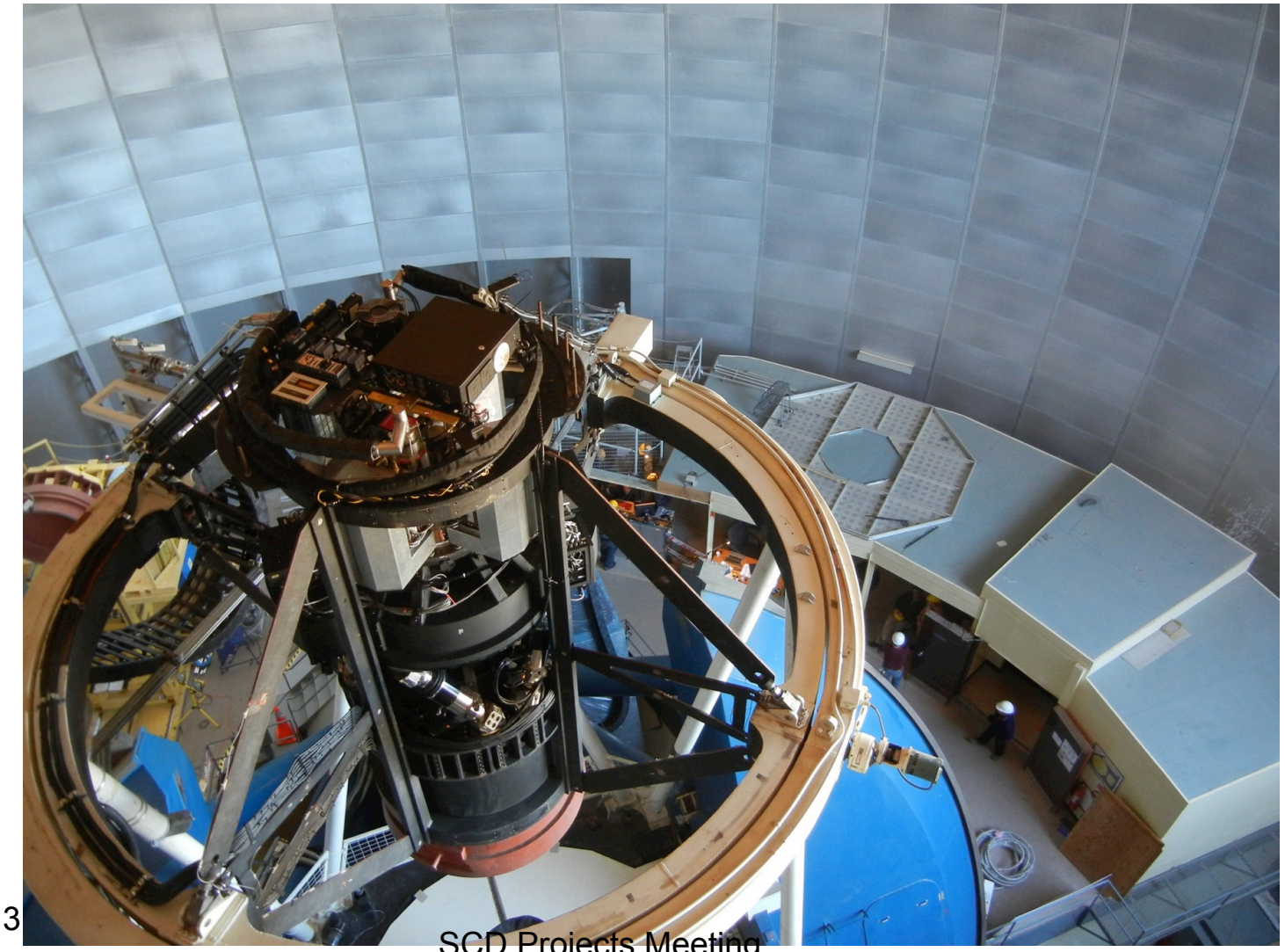
Everything installed September 2012



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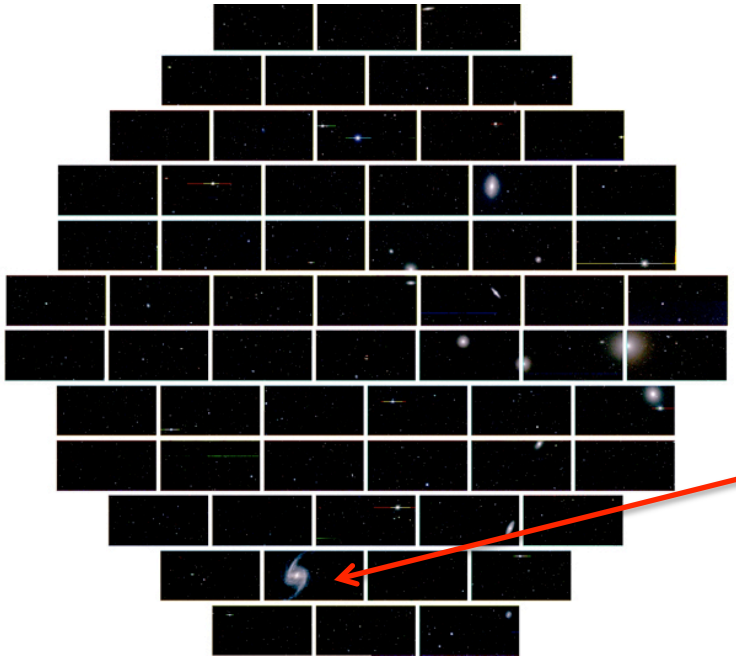
First Light
September 12 2012



NGC 1365

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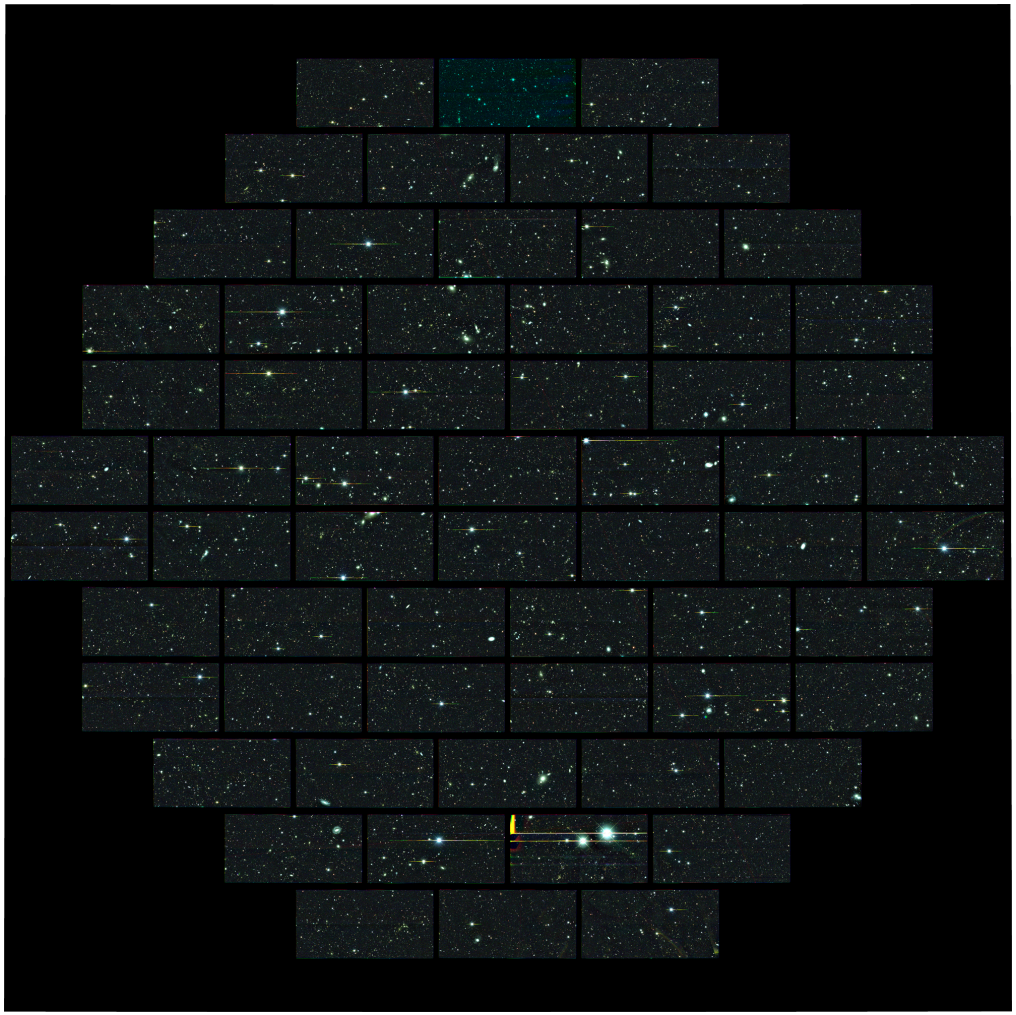
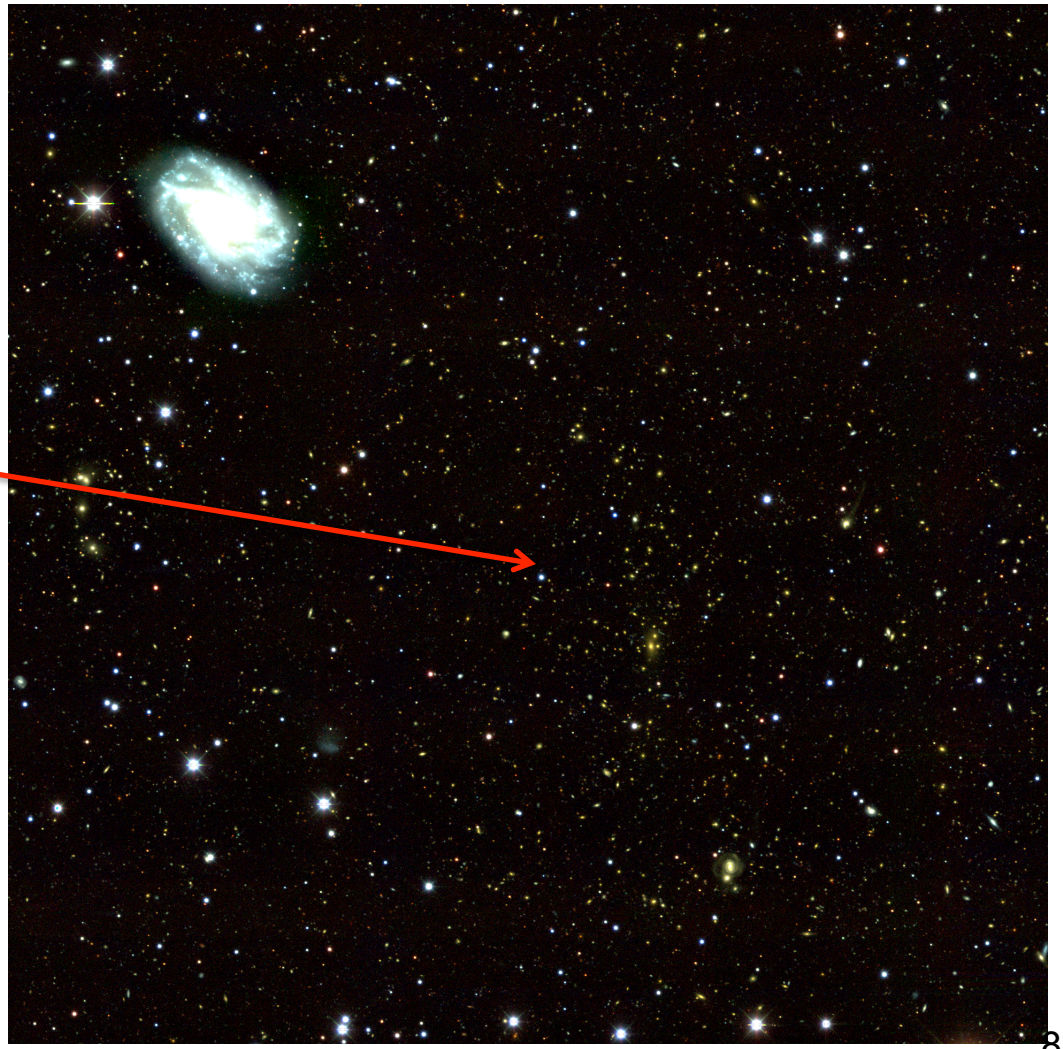
Image of a deep Supernova Field



Galaxy Cluster

DECam 1x1deg grizY co-added image of a galaxy cluster at red shift z=0.32



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Online Database and Web Tools

- The online system for DECam is called SISPI (Survey Image System Process Integration)
- A PostgreSQL database is used to track the status of the system and to store the state of the various components
- The SCD/SP/REX/Database Application group (Igor Mandrichenko, Margherita Vittone, Vladimir Podstakov) developed a number of web based tools for us that allow us to access data in different parts of the database
  - Telemetry Viewer, ConstantsDB, Exposure browser, Alarms browser
- They are written in Python and use wsgi to talk to the Apache server

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Telemetry Viewer

- The data that we record about the status of the camera is referred to as 'Telemetry'
- The Telemetry Viewer is a tool that allows the user to make time history plots and correlation plots of quantities in the Telemetry tables in the database. They can also make arbitrary SQL queries and either see the results on the screen or save them to a CSV file.
- Uses ChartDirector to visualize the data (http://www.advsofteng.com/)
- The query string that is used to create the plot can be saved and used on a web page to automatically create the plot. We use this feature to display plots in the SISPI GUI that automatically update

http://system1.ctio.noao.edu:8080/TV/app/T/time_plot3?sis_instance=&table=environmental_data&tcolumn=time_recorded&from_t=&to_t=&last_number=2&last_unit=minutes&column%3Apmw_temp=on

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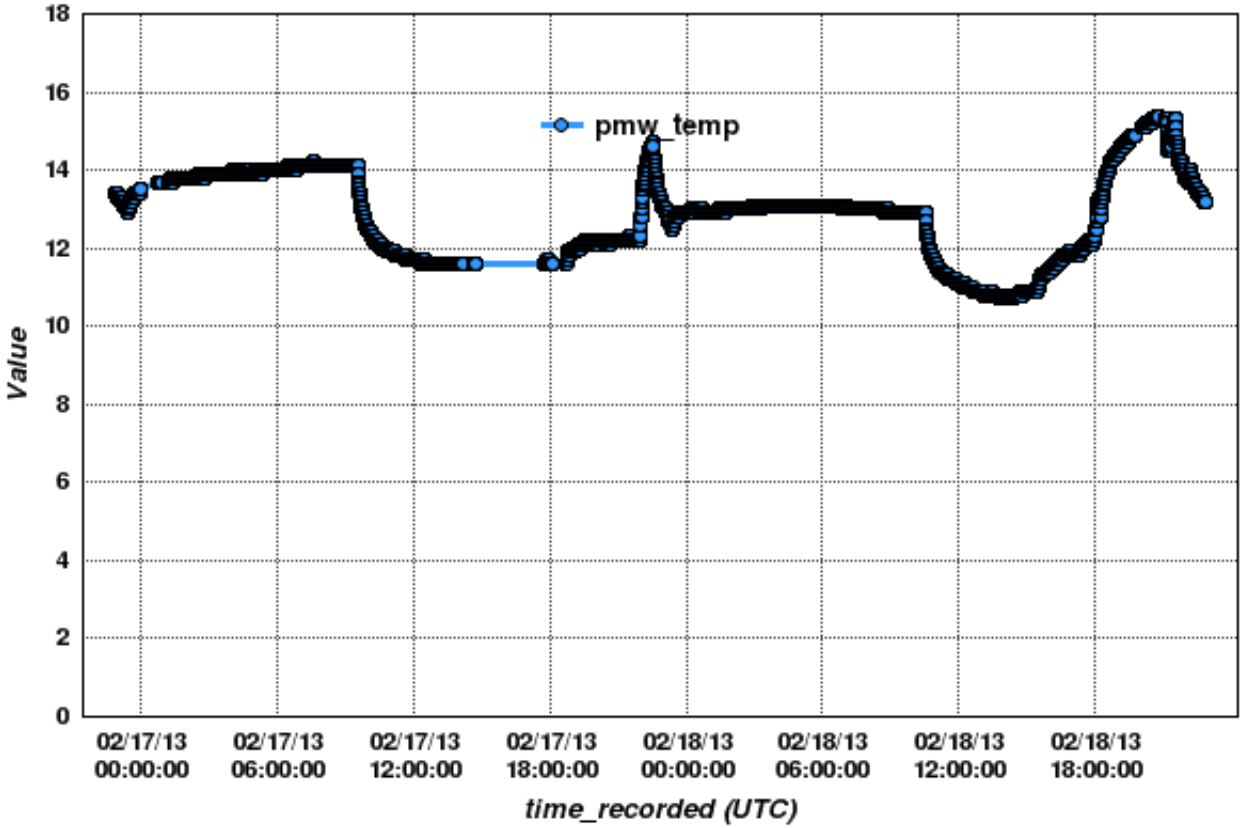
Example time history plot



Example of a correlation plot

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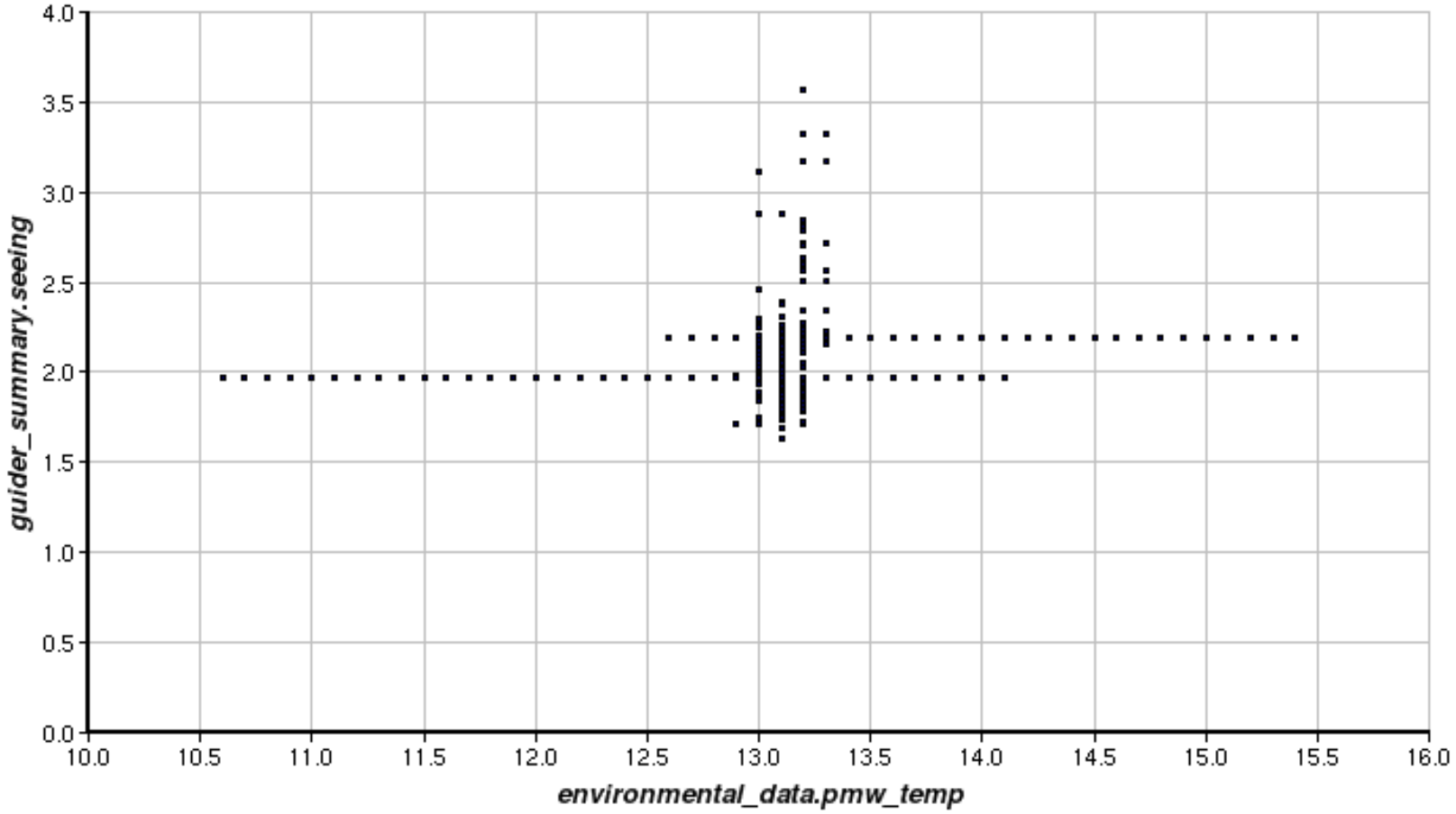

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ConstantsDB

- The ConstantsDB is intended for data that is required to initialize applications or other static data such as FITS header keywords that change infrequently but needs to be version controlled.
- The schema were designed with considerable input from Igor
  - **constants** This is an individual constant. It consists of a name, value and version. It also has an associated description and type. Currently type can be INTEGER, DOUBLE PRECISION or TEXT. A constant must be unique within an element - the primary key for the constants table is (version, name, element_name). All constants are stored in a single table.
  - **elements**
    An element is a collection of related constants. An element consists of a name and version. An example of an element might be all the FITS header parameters for the telescope.
  - **groups**
    A group is a collection of elements. For example a group would be all the FITS header elements. It is characterized by a name and a version.
  - **snapshots**
    A snapshot is a collection of specific versions of groups. For example GROUP1 version 3, GROUP2 version 5 etc. It is characterized by a version and a name.
  - **snapshot_tags**
    A snapshot tag is a tag that can be assigned to a different snapshot at different times. For example we want to define the tag **CURRENT** and associate different versions of the snapshot **SISPI** to it over the course of time. A snapshot_tag has a primary key that consists of the tag name and the snapshot name that should be associated with it. It also includes the snapshot version.

ConstantsDB

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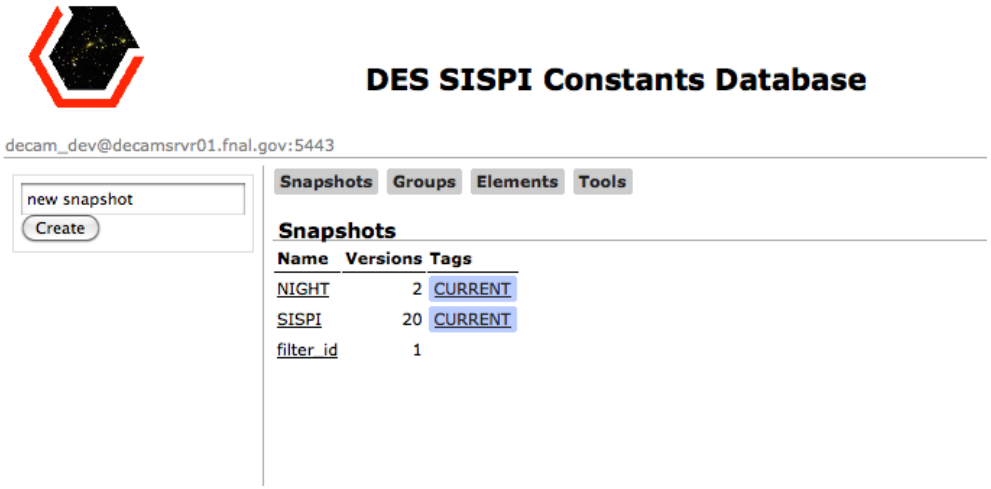
- We use a web front end to manipulate the database and keep everything consistent



- New constants can be created directly in the web tool or bulk uploaded as XML files.

Alarms Browser

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DES Alarms Browser

Select level: All

Component: Device: Time (GMT) interval: from to (yyyy-mm-dd[hh:mm:ss]

ID: SISPI Instance: Within last hours

Go

More Info

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AlarmID	Level	Component	Device	Message	Instance	Time
2405	EVENT	OCS	OCS	OCS configuring (Constants: DECAM:CURRENT)	DECam_20130219	02/19/2013 19:17:41
	WARNING	OCS	OCS	Invalid prop Id: . You will not be able to configure SISPI unless this is changed.	DECam_20130219	02/19/2013 19:06:04
2701	WARNING	DHS	DHSC	Transfer thread exiting	DECam_20130218	02/19/2013 18:59:37
2701	WARNING	DHS	DHSC	Display thread exiting	DECam_20130218	02/19/2013 18:59:37
2701	WARNING	DHS	DHSB	Display thread exiting	DECam_20130218	02/19/2013 18:59:36
2701	WARNING	DHS	DHSC	Scan thread exiting	DECam_20130218	02/19/2013 18:59:36
2801	WARNING	IB	IB5	Image builder thread exiting	DECam_20130218	02/19/2013 18:59:36
2701	WARNING	DHS	DHSB	Transfer thread exiting	DECam_20130218	02/19/2013 18:59:35
2801	WARNING	IB	IB5	Check for completion thread exiting	DECam_20130218	02/19/2013 18:59:35
2701	WARNING	DHS	DHSA	Transfer thread exiting	DECam_20130218	02/19/2013 18:59:35

Exposure Browser

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- This uses the Query Engine

Exposure Browser search

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DES Exposure Browser

Link to this data
CSV: commas tabs

Edit SQL query that produced this page

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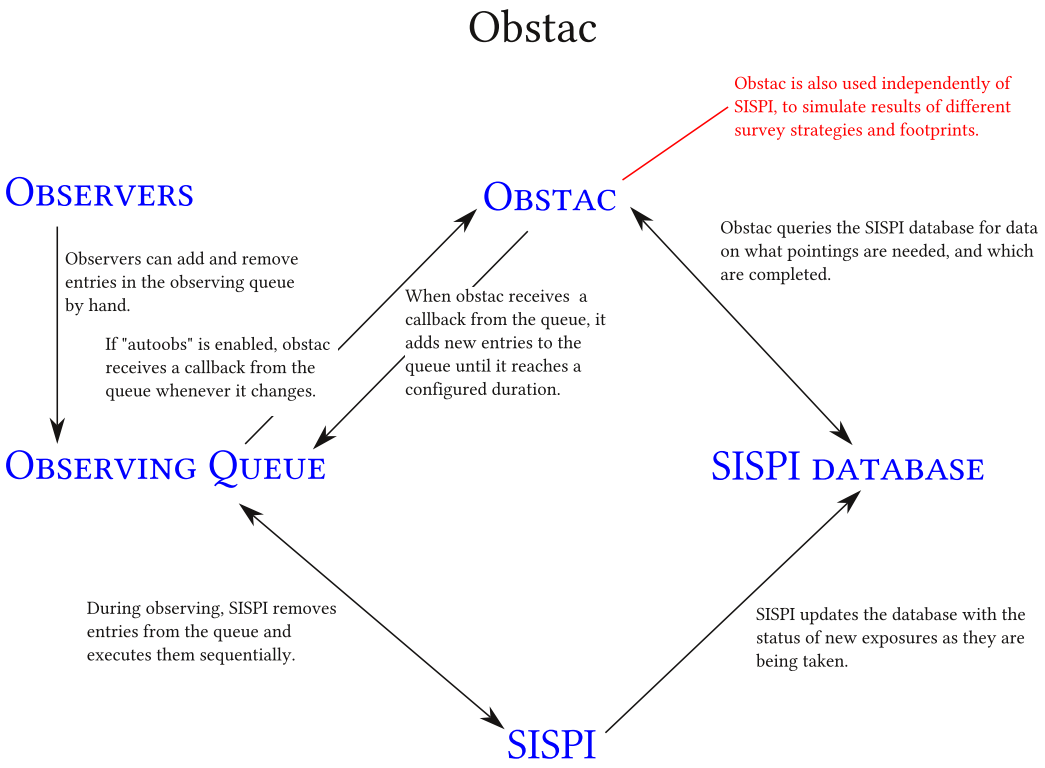
expnum	instance	date	obstype	ra	declination	exptime	filter	file_uri	image
179299	DECam_20130219	2013-02-19 20:40:44.228577+00:00	dome flat	201.348333	-43.05	10.0	r	(null)	(null)
179298	DECam_20130219	2013-02-19 20:40:07.656303+00:00	dome flat	201.348333	-43.05	10.0	r	pipeline1.ctio.noao.edu:/data_local/images/DTS/2012B-0003/DECam_00179298.fits.fz	images/png/DECam_00179298.png
179297	DECam_20130219	2013-02-19 20:39:31.198388+00:00	dome flat	201.348333	-43.05	10.0	r	pipeline5.ctio.noao.edu:/data_local/images/DTS/2012B-0003/DECam_00179297.fits.fz	images/png/DECam_00179297.png
179296	DECam_20130219	2013-02-19 20:38:54.775252+00:00	dome flat	201.348333	-43.05	10.0	r	pipeline4.ctio.noao.edu:/data_local/images/DTS/2012B-0003/DECam_00179296.fits.fz	images/png/DECam_00179296.png
179295	DECam_20130219	2013-02-19 20:38:18.321947+00:00	dome flat	201.348333	-43.05	10.0	r	pipeline3.ctio.noao.edu:/data_local/images/DTS/2012B-0003/DECam_00179295.fits.fz	images/png/DECam_00179295.png
179294	DECam_20130219	2013-02-19 20:37:41.762625+00:00	dome flat	201.348333	-43.05	10.0	r	pipeline1.ctio.noao.edu:/data_local/images/DTS/2012B-0003/DECam_00179294.fits.fz	images/png/DECam_00179294.png
179293	DECam_20130219	2013-02-19 20:37:05.378043+00:00	dome flat	201.348333	-43.05	10.0	r	pipeline5.ctio.noao.edu:/data_local/images/DTS/2012B-0003/DECam_00179293.fits.fz	images/png/DECam_00179293.png

OBSTAC – Eric Neilsen



Simulation Results

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Simulated 5 year survey

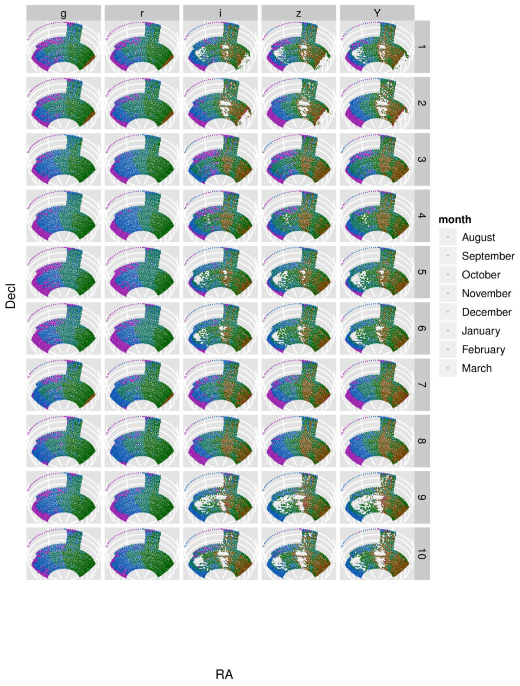
Year 1

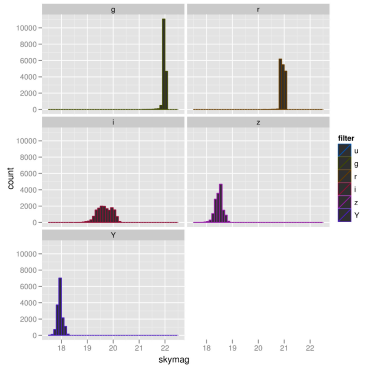
Year 2

Year 3

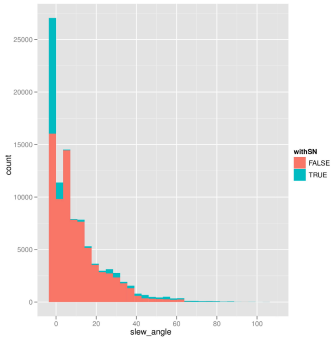
Year 4

Year 5





Sky Brightness



Size of slews between fields

Night Summary – Eric Neilsen

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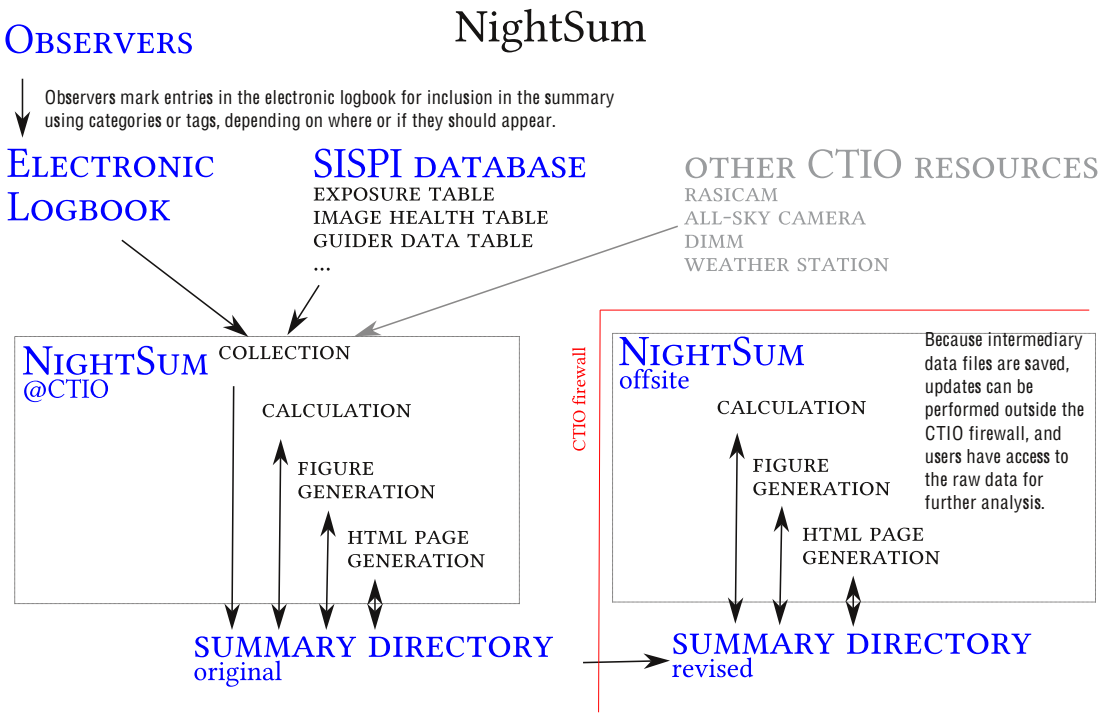
ECL - instance is Installed at CTIO



We have begun extending the nightsum framework to generate quality assessment and survey progress pages for data processing.

Example of a night summary

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Synopsis

bnord (02/08/2013 01:55:32)

Observing Team

Observers: Brian Nord (RM), Marisa March (obs1), Ricard Casas (obs2), Philip Rooney (RM Trainee)
Telops: Claudio Aguilera
Also present: Anja von der Linden, Douglas Applegate (AM community observers)

Observing Plan (despite clouds; can see a handful of stars)

- Normal plan
  1. Dome flat sequence: (grizY)
  2. Standards in grizY (3 fields early in the night; 1 before handover)
  3. SN observations:
     - X2 griz (deadman);
     - S1 griz; (short and good for cloud tests
     - C3 z ((probably too long); spt-e instead
     - C1,C2,S1,S2 griz
  4. SPT-E via obstac if seeing < 1.3
  5. Get photos of Clouds for rasicam
- Bad Weather Contingency
  1. DECal via David James
  2. Push SN obs during clouds to the edge

Accomplishments

Much clearer than expected; a lot of cirrus, but only lower clouds intermittently. about 4 exposures with sub-arcsecond seeing.

- Normal plan
  1. Dome flat sequence: (grizY)
  2. Standards in grizY (3 fields early in the night; 1 before handover)
  3. SN observations:
     - X2 griz (deadman);
     - C1 griz; (tried to do S1, but temporary 4map sensor loss prevented obtaining before it set)
  4. SPT-E via obstac
  5. photos of clouds for comparison with RASICAM output
- no really bad weather

Problems

bnord (02/08/2013 01:56:33)

- 4map sensor lost contact with subsystem; telescope to zenith; 4map restarted; recovery (.25hr loss)
- Guider plots GUI was frozen; Herman restarted.
- a lot of cloud movement, causing extinction, but the seeing was good, so we stayed on SPT-E

Conditions and Statistics

Sun

	Civil (6°)	Nautical (12°)	Astronomical (18°)
Evening	2013-02-08 00:03:24Z	2013-02-08 00:32:53Z	2013-02-08 01:04:15Z
Midpoint	2013-02-08 04:57:36Z	2013-02-08 04:57:35Z	2013-02-08 04:57:35Z
Morning	2013-02-08 09:51:47Z	2013-02-08 09:22:18Z	2013-02-08 08:50:56Z

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Conditions and Statistics

Sun

	Civil (6°)	Nautical (12°)	Astronomical (18°)
Evening	2013-02-08 00:03:24Z	2013-02-08 00:32:53Z	2013-02-08 01:04:15Z
Midpoint	2013-02-08 04:57:36Z	2013-02-08 04:57:35Z	2013-02-08 04:57:35Z
Morning	2013-02-08 09:51:47Z	2013-02-08 09:22:18Z	2013-02-08 08:50:56Z

Moon

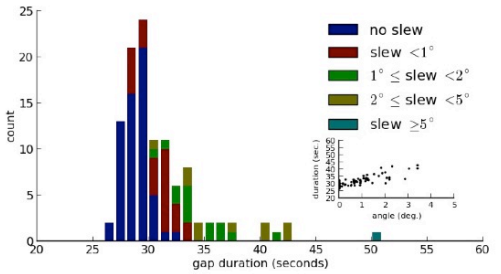
Phase: 6.1%
Moonset: 2013-02-07 22:58:55Z
Moonrise: 2013-02-08 06:52:03Z

Numbers of exposures, and gaps between

Open shutter of first exposure: 12 minutes before nautical twilight
Close shutter of final exposure: 1 minutes before midpoint
Total wall clock time: 275 minutes
Number of exposures: 127
Total open-shutter time: 164 minutes (59.52 %)
Mean gap time (close to open shutter): 53.2 seconds (sd. dev. = 82.4 seconds)
Median gap time: 30.2 seconds (MAD = 1.9 seconds)

Distribution of normal gaps

The following plot only includes gaps of less than one minute. Gaps are the time between the closing of the shutter in one exposure and the opening of the shutter in the next.



Long gaps between exposures

The following table lists gaps between exposures longer than one minute. Gaps are the time between the closing of the shutter in one exposure and the opening of the shutter in the next.

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DES Data Management

- Refactored/Standalone/OSG/wrapper system has been essential for:
  - Quick turn-around processing of DESDM commissioning and SV (Science Verification) data.
  - It also allows us to test our calibration suite (flats,biases, bad-pixel-masks, illumination corrections, etc)
  - Testing and finding bugs in the science codes, from the astromatic, sextractor, scamp, psfex codes to the basic image de-trending (imcorrect, crosstalk) codes.
  - It allows processing of 'just one chip within a large 62 chip/1GB exposure' in just a few minutes -- a much more practical turn-around time than the hours to days previously required.
  - The OSG-based standalone model allows distribution of the code to remote sites where astronomers on DES not at FNAL and not at NCSA can try out the code and process data 'independently' without need to attach to a central database or data store. This opens up the number of scientists we can recruit into the development and bug-finding-fixing process.
  - The OSG-based model allows us to take advantage of FermiGRID resources, and devote a 800 core cluster to processing and development -- an effort comparable in size to the NCSA based effort. Both resources (OSG/FermiGRID and NCSA based resources) will be needed as we move into regular daily operations in September 2013.
- Mike Wang and Marko Slyz will give more details

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Image cut-out service (Nikolay Kuropatkin)

- Users want to be able to produce postage stamp images of interesting objects
  - User provides the object WCS coordinates (RA,DEC) and size of the stamp in degrees. User can choose FITS file, gray scale png image or color png image (if 3 filters g,r,i or z are available).
  - The service suppose to work with reduced file, but should be able to work with co-added files too.
- Core software: Don Petravick proposed using the "Montage" package.
  - Two problems with this package as is:

    1. Does not work with the World Coordinate System (WCS) that we use on DES (TPV).
    2. Uses cfitsio for file manipulation and hence does not work with compressed FITS files (.fz format) that we create in DES.
- Solutions:
  - Modify the Montage code to support the TPV system.
  - To process the compressed FITS files we need to unpack them first using funpack. So we used pipe between the funpack and mSubimage programs. The mSubimage program is part of the "Montage" package so we modified the code to allow it to take input from a pipe.
- Imaging programs: We now have two python programs for producing PNG images from FITS files
  - These programs (MakeRGBImage.py and MakeGSImage.py) are highly optimized and are producing reasonable images in subsecond time.

Example of an Image cut-out

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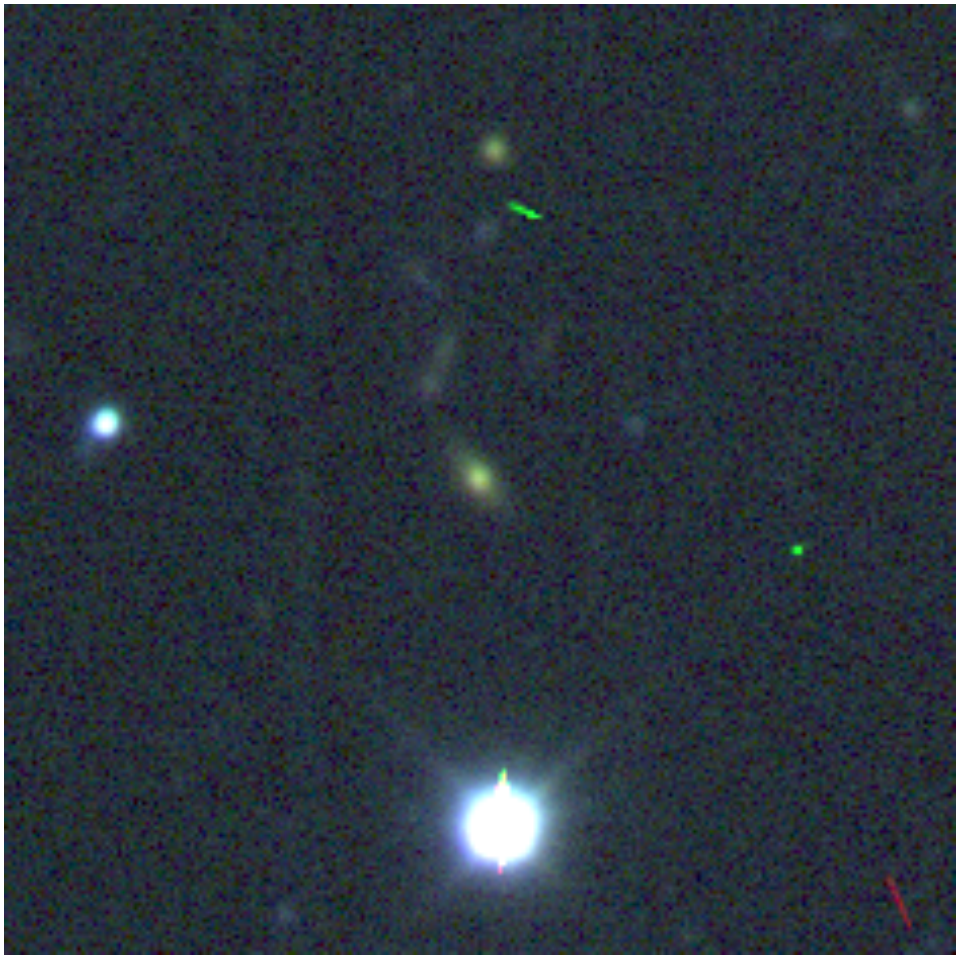
The service will be hosted at NCSA as part of the DES Data Management



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SURVEY

The End