

What to expect from DES public
Data?

DECam Community Science
Workshop

Brian Yanny, Fermilab

DES Data Management Project
Scientist

Tucson, AZ March 12, 2015

DES data are released in 4 stages, with different levels of products available at different times.

Product	Release Date	Where
Raw exposures	date_obs+1Yr	(NOAO SA)
Detrended images Single epoch	date_obs+1Yr+N months 0 < N < 12 For Y1: N<=4	(NOAO)
DES DR I: Calibrated coadd images and catalogs	end(Y2)+2Yr (mid 2017) Y1+Y2	(NOAO+NCSA)
DES DR II (final) 45 TB of catalogs	end(Y5)+2yr (mid 2020)	(N&N)

For the hard core DECam enthusiast:

1. Raw exposures:

62 CCD multi-HDU FITS format images,
indexed by exposure number,date-obs,ra,dec,
band,exposure_time,etc.

Calibrations in all filters are also available
(flats, biases) in raw (or in some cases,
detrended format).

Interested users may use their own packages
to process.

You will want to know about various instrumental
signatures present..(see talks of Gary, Frank,Robert)

Raw exposure 392106 from 20141226, i band, 90s (with comet Lovejoy C/2014 Q/2)

The screenshot shows the SAOImage ds9 software interface. The title bar reads "SAOImage ds9". The menu bar includes: File, Edit, View, Frame, Bin, Zoom, Scale, Color, Region, WCS, Analysis, Help.

The metadata panel on the left contains the following information:

File	DECam_00392106.fits.fz[N13]		
Object	DES survey hex 843-268 tiling 3		
Value	<input type="text"/>		
WCS	<input type="text"/>		
Physical	X	<input type="text"/>	Y <input type="text"/>
Image	X	<input type="text"/>	Y <input type="text"/>
Frame 1	x	0.125	0.000 °

The toolbar below the metadata panel includes buttons for: file, edit, view, frame, bin, zoom, scale, color, region, wcs, help, linear, log, power, sqrt, squared, asinh, sinh, histogram, min max, zscale.

The main image display area shows a raw exposure of the comet Lovejoy C/2014 Q/2. The image is a mosaic of several panels. A zoomed-in view of the comet is shown in the top right corner, with a cyan box highlighting a region and yellow arrows indicating the direction of the comet's tail. The main image shows the comet's head and tail against a dark background, with some artifacts visible in the panels.

2. Detrended, astrometrically, photometrically calibrated images:
Have image signature removed in steps applied as described in:

<http://data.darkenergysurvey.org/aux/releasenotes/DESDMrelease.html>

Header keyword update (latest SATURATION, GAIN, READNOISE)

Crosstalk applied between amps of same chip and to nearby chips

Bias subtraction

Linearity correction

Bad-pixel-mask masking

Flat field divide

Pupil scaled and subtracted

Fringe scaled and subtracted (in z,Y filters only)

Starflat response divided, gains normalized

Astrometric calibration determined (position on the sky) to about 200 mas in RA/DEC. Note we use a 3rd order 'TPV' solution in the FITS image headers. (should be able to get < 20 mas relative pos.)

Cosmic ray clean (single epoch), bleed, satellite trails masked.

Photometric calibration determined as zeropoint per image. Usually Good to ~2%, checked via stellar locus colors.

A few pointers for those who are working from the phase 2 (detrended, calibrated) images:

A. If you make coadds (stacks), you should re-register them to improve the relative astrometry from 200--> 20 mas.

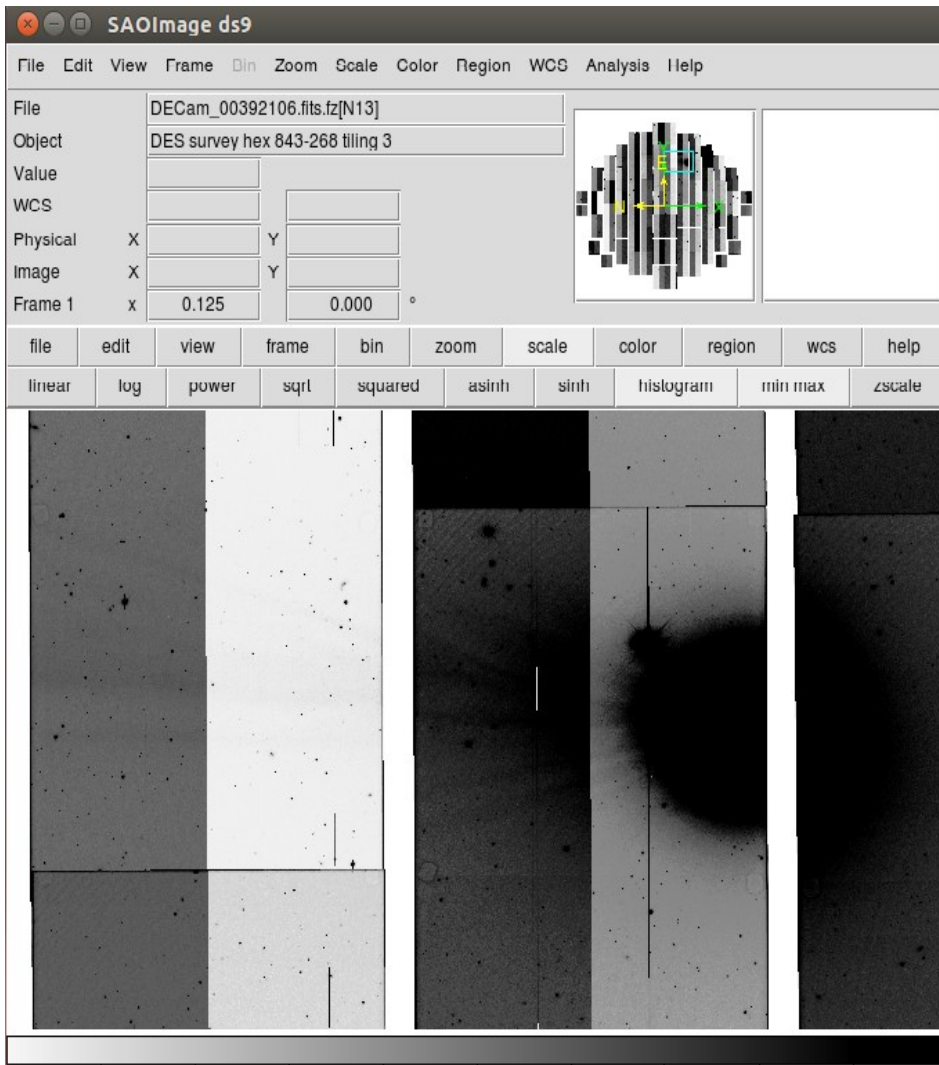
B. Additional improvements in astrometry from 20--> 5 mas require adjustment for the tree ring/coffee stain effect that Gary Bernstein showed.

C. The photometry is pretty good $\sim 2\%$, but there are outlying regions off by 5% in g in Y1A1 western edge, take a look at the SLR map.

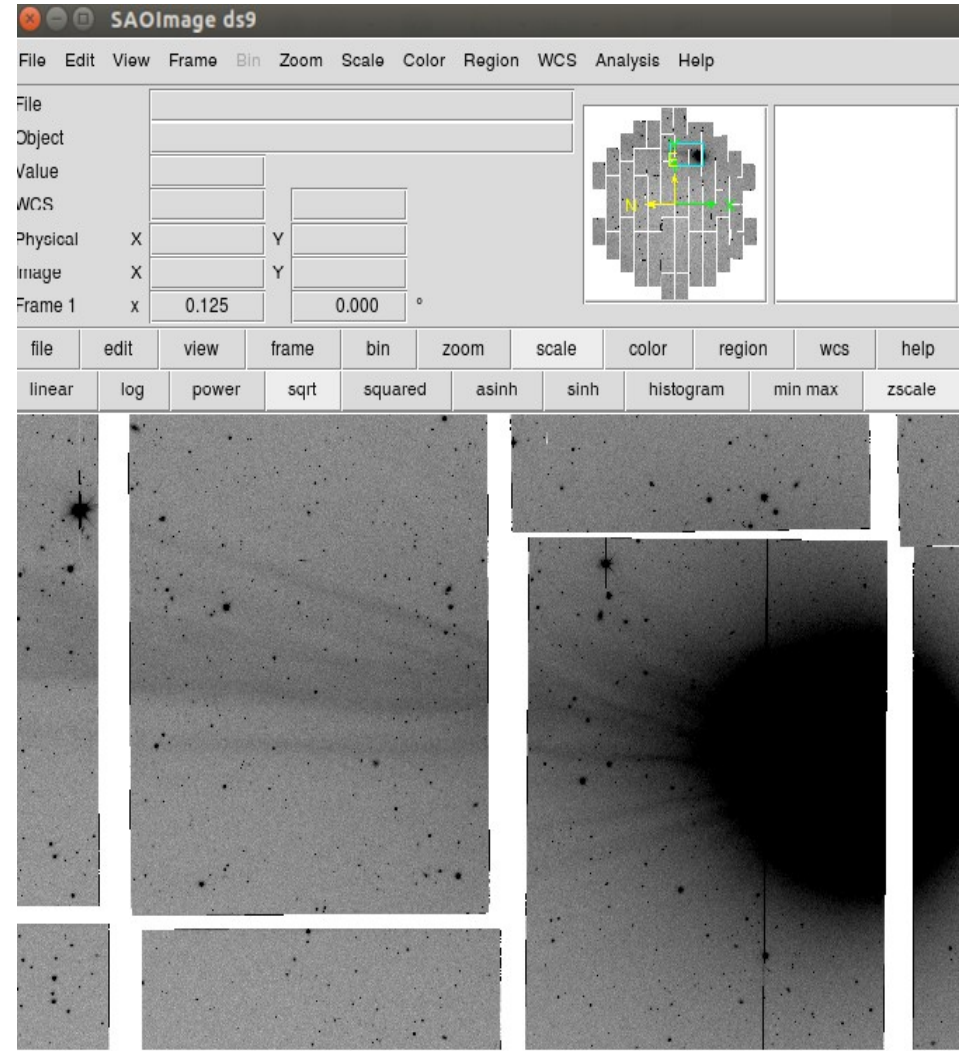
D. There are some artifacts, masked bright stars and bleed trails. Mask/weight planes are available, but take some getting used to. Will improve in future years.

DESDM processing goes from raw DECam exposures to detrended, calibrated image 392106, i band 90s..

Raw



Reduced



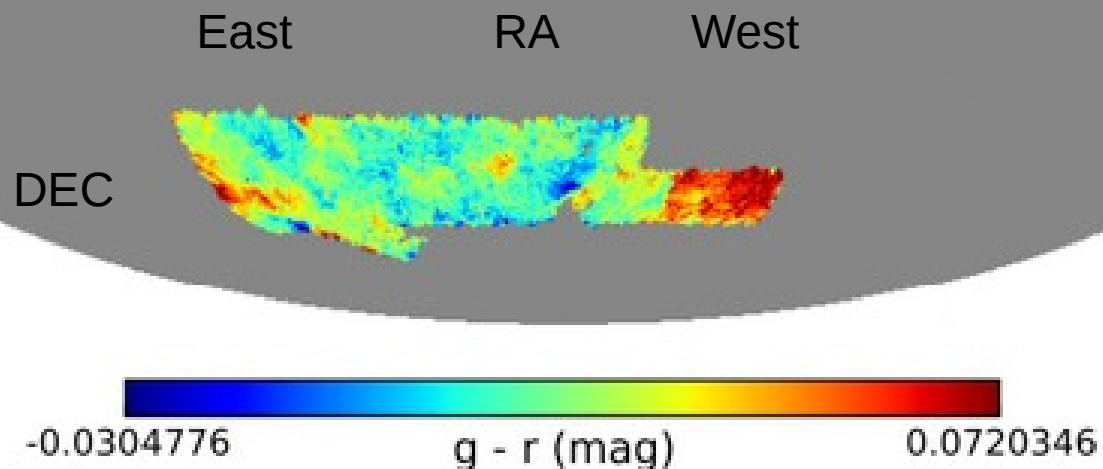
Photometric calibration is separate step (Douglas Tucker et al in prep) which leads to a zeropoint per image to go from counts to magnitudes

Note on photometric calibration of Year 1 images in NOAO SA:
Calibration is generally good to 2% rms in g,r,i,z however
There is an excursion in g band in the far west of the
Survey (RA < 330) where g-band is off by 5%. (See link on prev. page)

SPT: With Extinction Correction

DES Year 1 SPT (south polar telescope
Overlap region) footprint (Equatorial)

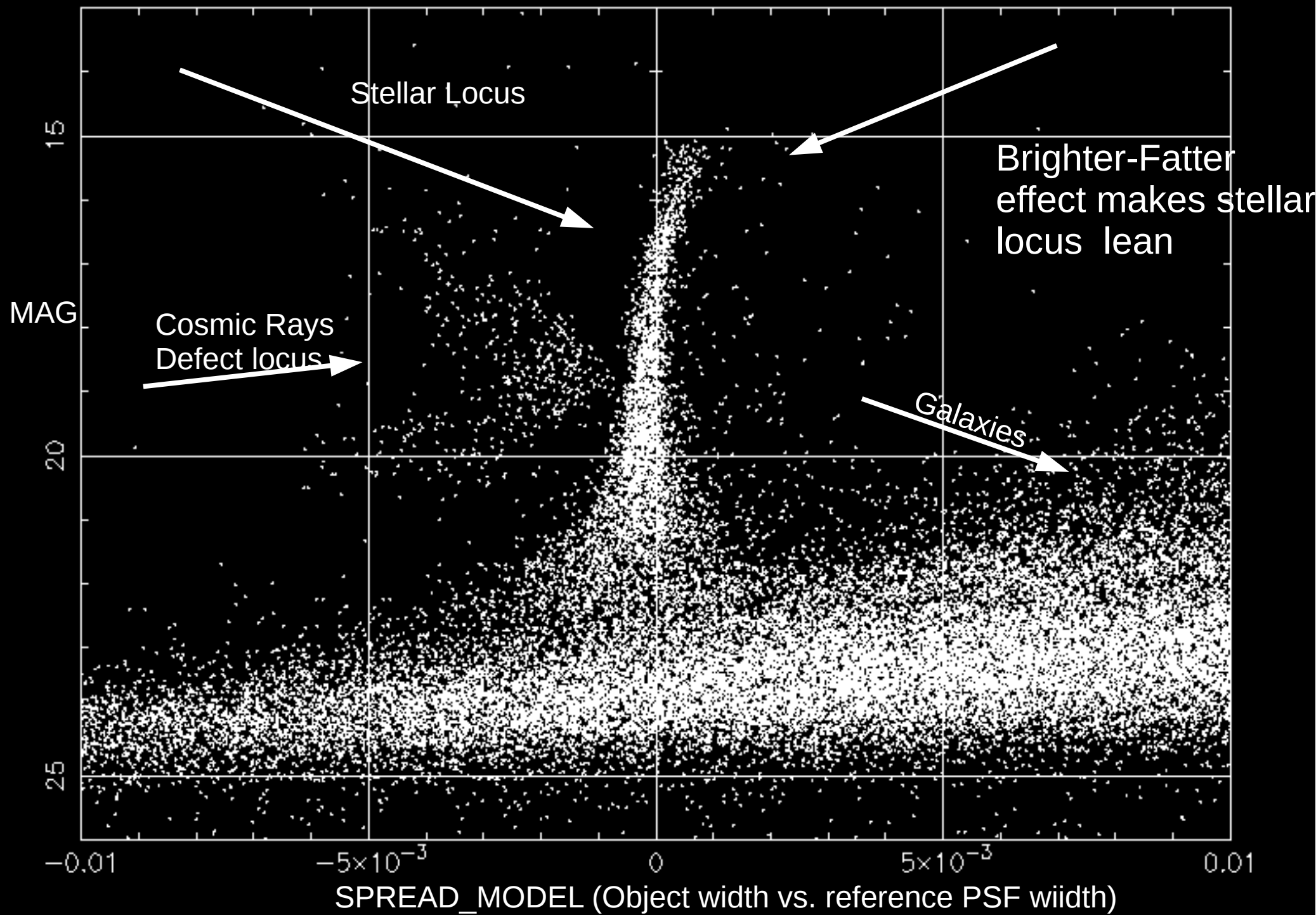
Color gives stellar locus regression test
Offset, an indication of the accuracy of the
Photometric calibration.



<http://data.darkenergysurvey.org/aux/releasenotes/DESDMrelease.html#ExposureTable>

Table of 10884 Y1A1 SPT Exposures

NITE	EXPNUM	F	ETIME	RA	DEC	FWHM	ELLIP	teff	xsig	ysig	xoff	yoff
20130815	226650	z	90.0	306.180070	-50.938140	0.95	0.096	1.1140	0.159	0.149	-0.021	0.036
20130815	226650	z	90.0	306.180070	-50.938140	0.95	0.096	1.1140	0.159	0.149	-0.021	0.036
20130815	226650	z	90.0	306.180070	-50.938140	0.95	0.096	1.1140	0.159	0.149	-0.021	0.036
20130815	226651	z	90.0	308.664730	-51.952500	1.06	0.062	0.9160	0.148	0.153	0.003	0.038
20130815	226651	z	90.0	308.664730	-51.952500	1.06	0.062	0.9160	0.148	0.153	0.003	0.038
20130815	226651	z	90.0	308.664730	-51.952500	1.06	0.062	0.9160	0.148	0.153	0.003	0.038
20130815	226652	z	90.0	311.261120	-52.967610	1.00	0.074	1.0490	0.149	0.155	-0.006	0.047
20130815	226652	z	90.0	311.261120	-52.967610	1.00	0.074	1.0490	0.149	0.155	-0.006	0.047
20130815	226652	z	90.0	311.261120	-52.967610	1.00	0.074	1.0490	0.149	0.155	-0.006	0.047



What's available right now (March 2015)?

Raw images from DES SV period (Sep 2012-Feb 2013)
20,000+ exposures, including flats/biases

Raw images from DES Y1 (Aug 2013-Feb 2014).
20,000+ exposures

Reduced images from DES Y1A1 (single epoch).
12,000+ science exposures.

The DES data are available from the NOAO Science Archive:

NOAO Science Archive: Search NOAO data - Mozilla Firefox

NOAO Science Archi... x

www.portal-nvo.noao.edu/adql/query

Search

Enter parameter constraints in the Query Form, then click "Search". To find data from your own NOAO programs, choose "Search My Data" under Search Type. Data from the Results may be staged and retrieved from the Staging Area.

Reset Search Type: Search All Data Search

Target

Object name

Resolve

Coordinates

RA:

Dec:

Search box size (arcmin)

Observation

Program number

Principal Investigator

Observing calendar date

=

Original Filename

Archive Filename

Telescope & Instrument

Telescope & Instrument

- KPNO 4m + Mosaic Imager
- KPNO 4m + NEWFIRM IR Imager
- KPNO 4m + FLAMINGOS IR Imager/S
- KPNO 4m + COSMOS
- KPNO 4m + Miscellaneous instrumen
- WIYN 3.5m + Mini-Mosaic Imager
- WIYN 3.5m + WHIRC IR Imager
- WIYN 3.5m + Bench Spectrograph
- KPNO 2.1m + CCD Imager
- KPNO 2.1m + GoldCam Spectrograph
- KPNO 2.1m + FLAMINGOS IR Imager
- KPNO 2.1m + SQUID IR Imager
- KPNO Coude Feed Spectrograph
- WIYN 0.9m + Mosaic Imager
- WIYN 0.9m + S2KB Imager
- CTIO 4m + Mosaic-2 Imager
- CTIO 4m + NEWFIRM IR Imager
- CTIO 4m + ISPI IR Imager
- CTIO 4m + CCD Spectrograph
- CTIO 4m + DECam
- SOAR 4m + Goodman Spectrograph
- SOAR 4m + OSIRIS IR Imager/Spectro
- SOAR 4m + SOAR Optical Imager
- SOAR 4m + Spartan IR Imager
- CTIO 1.5m + Cassegrain Spectrograph
- CTIO 1.5m + Fiber Echelle Spectrogra
- CTIO 1.3m + ANDICAM Imager
- CTIO 1m + Y4KCam Imager
- CTIO 0.9m + Cassegrain Imager

Data products

Public release date

=

All Instruments

Raw

Mosaic, NEWFIRM and DECam

Calibrated images

Reprojected Images

Stacked images

Master calibration files

NEWFIRM only

Sky subtracted images

Dark Energy Survey (DES) public data

Raw data Reduced data

Exposure time (seconds)

DECam
SV (public)
RAW Images of
Omega Cen

3-s in g,r,i

Detrended
(no cr clean)
mosaic
of exposures
from 20130221

Expnums:
180799-802 g
180807-810 r
180815-818 i
(DECam
exposure
numbering)

Available
From NOAO SA.
Search for 3s
Raws from
20130221



Fig 1. from Plazas, Bernstein and Sheldon PASP 2014 126,942

Limits astrometric precision to ~ 20 mas. DES hopes to Remove in Y3 and beyond, allowing < 5 mas rel. positions.

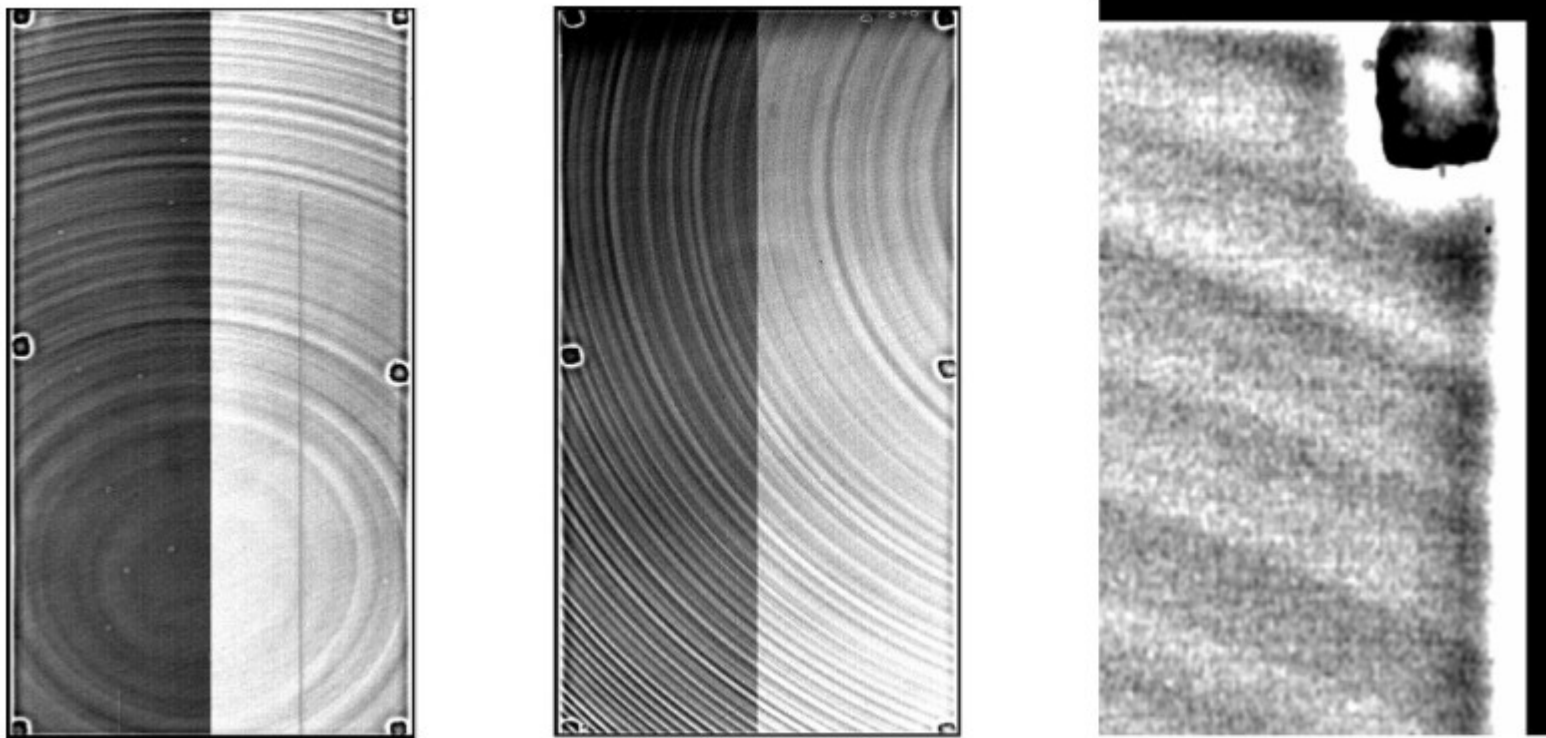


Fig. 1.— Master dome flat images from two of the DECAM CCDs in the q band. Each image is

3. DES DR I: expected mid-2017 for Year 1 and Year 2 of DES data.

Products: single epoch calibrated images as before, plus coadd (multi-epoch) images and Calibrated coadd catalogs.

Available from NOAO SA and NCSA.
*Some sort of SQL database access (like SDSS-CAS) for catalogs.

4.DES DR II: expected mid-2020 for Year 1 through Year 5 DES data.

Products: single epoch calibrated images as before, plus coadd (multi-epoch) images and calibrated coadd catalogs.

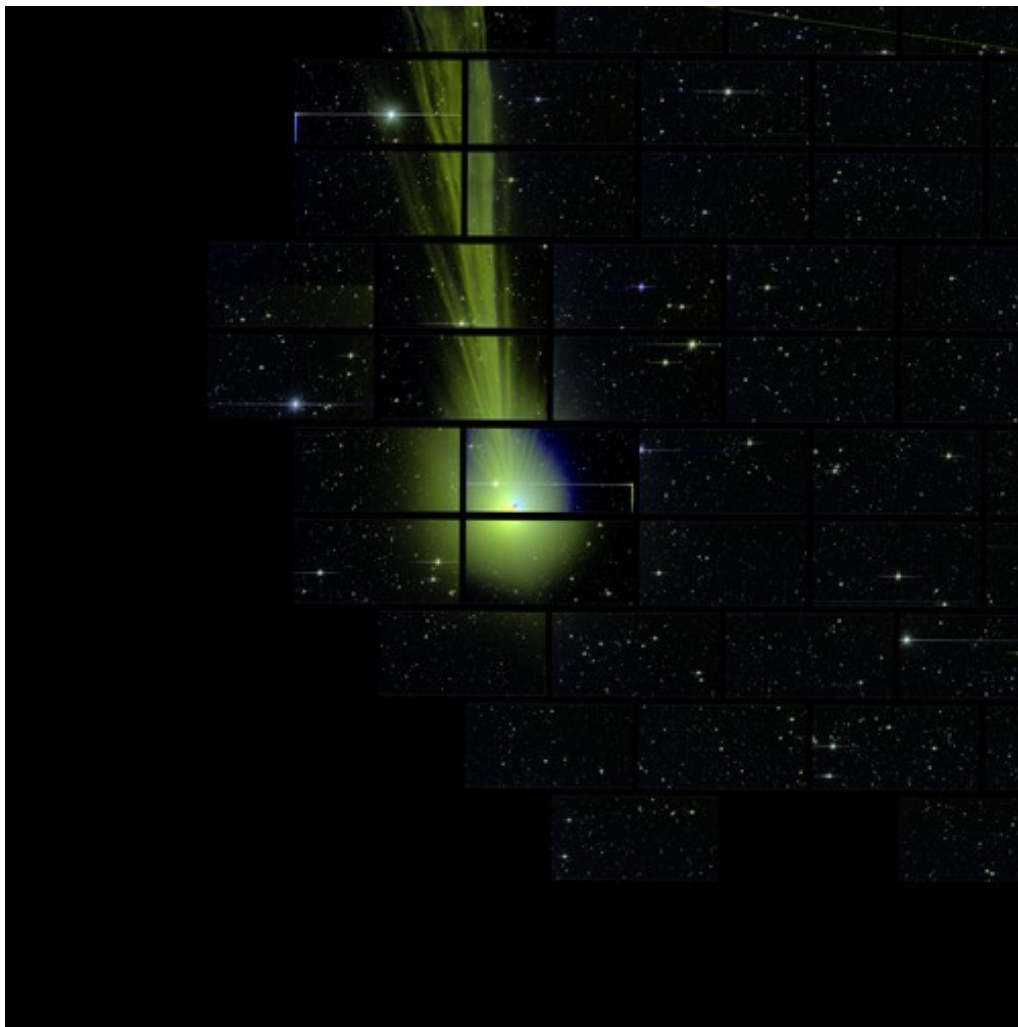
Available from NOAO SA and NCSA.

Some SQL 'SDSS CAS' database access portal will be available.

DES Data to NOAO Science Archive release timeline:

SV Raw	Sep 13 – Feb 14	(Complete)
Y1 Raw	Sep 14 -- Feb 15	(Complete)
Y1 Red	Dec 14 – Feb 15	(Complete)
Y2 Raw	Sep 15 – Feb 16	
Y2 Red	Feb 16	
Y3 Raw	Sep 16 - Feb 17	
Y3 Red	Feb 17	
Y1+Y2 stacks/cats	Aug 17	(DES DR I)
Y4 Raw	Sep 17-- Feb 18	
Y4 Red	Feb 18	
Y5 Raw	Sep 18 – Feb 19	
Y5 Red	Feb 19	
Y1+Y2+Y3+Y4+Y5 Stacks and Catalogs	(DES DR II)	Aug 2020

Not mentioned: SV Reduced, re-reductions with improvements of earlier years in later years (implicit in DR I,II, but also could be made available.)

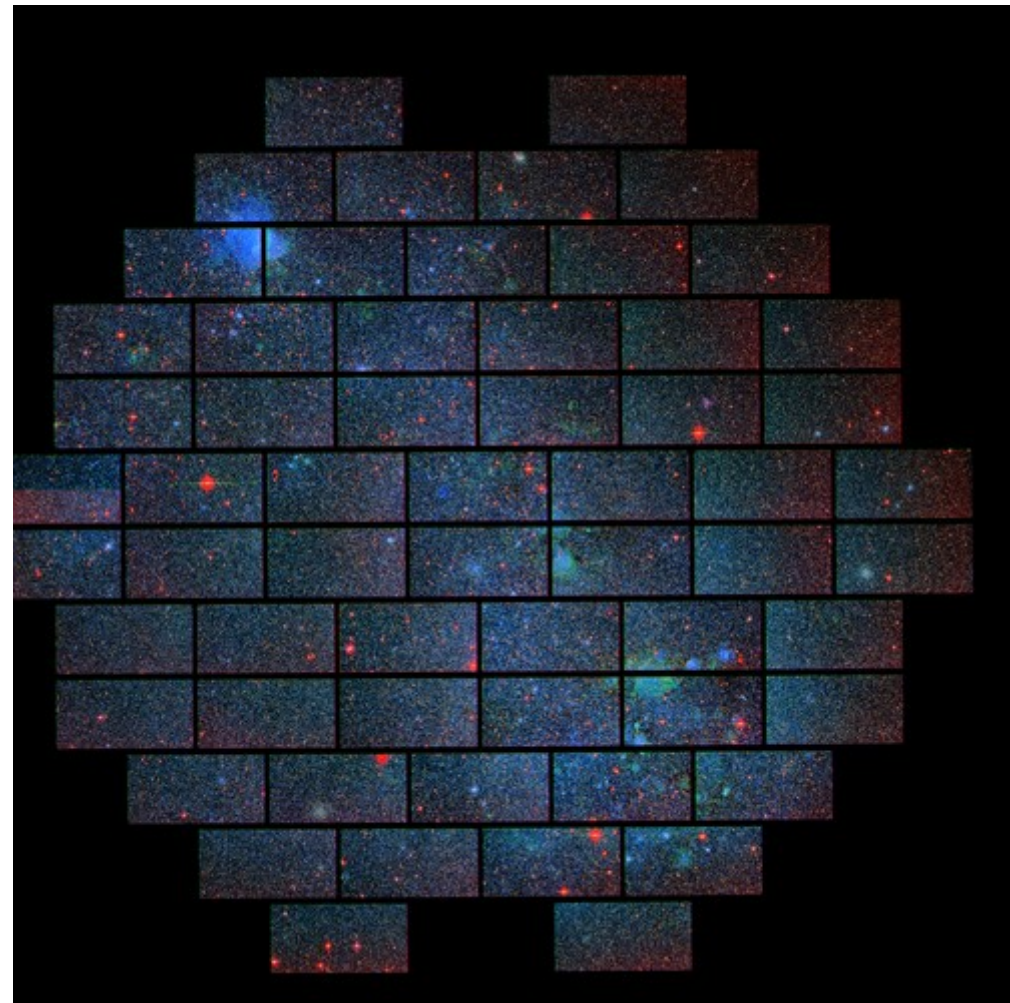


First light (SV) release of SMC:

SMC 20120911 133809,133811,133812
Select 'Raw' 100s 2012-09-11
in the NOAO SA query.

Lovejoy C2014/Q2 20141226
392104, 392106

(Coming in year 2 release)



Summary:

1. Raw data available one year out. Experts welcome.
2. Enormous effort going into understanding, documenting, removing instrumental signatures. Each year brings Improvement in basic astrometry, photometry in detrended, calibrated images. Improvements are passed along promptly as part of releases. Also in touch with CP effort.
3. Catalogs and coadd stacks come with the two data releases.
4. Enjoy!

