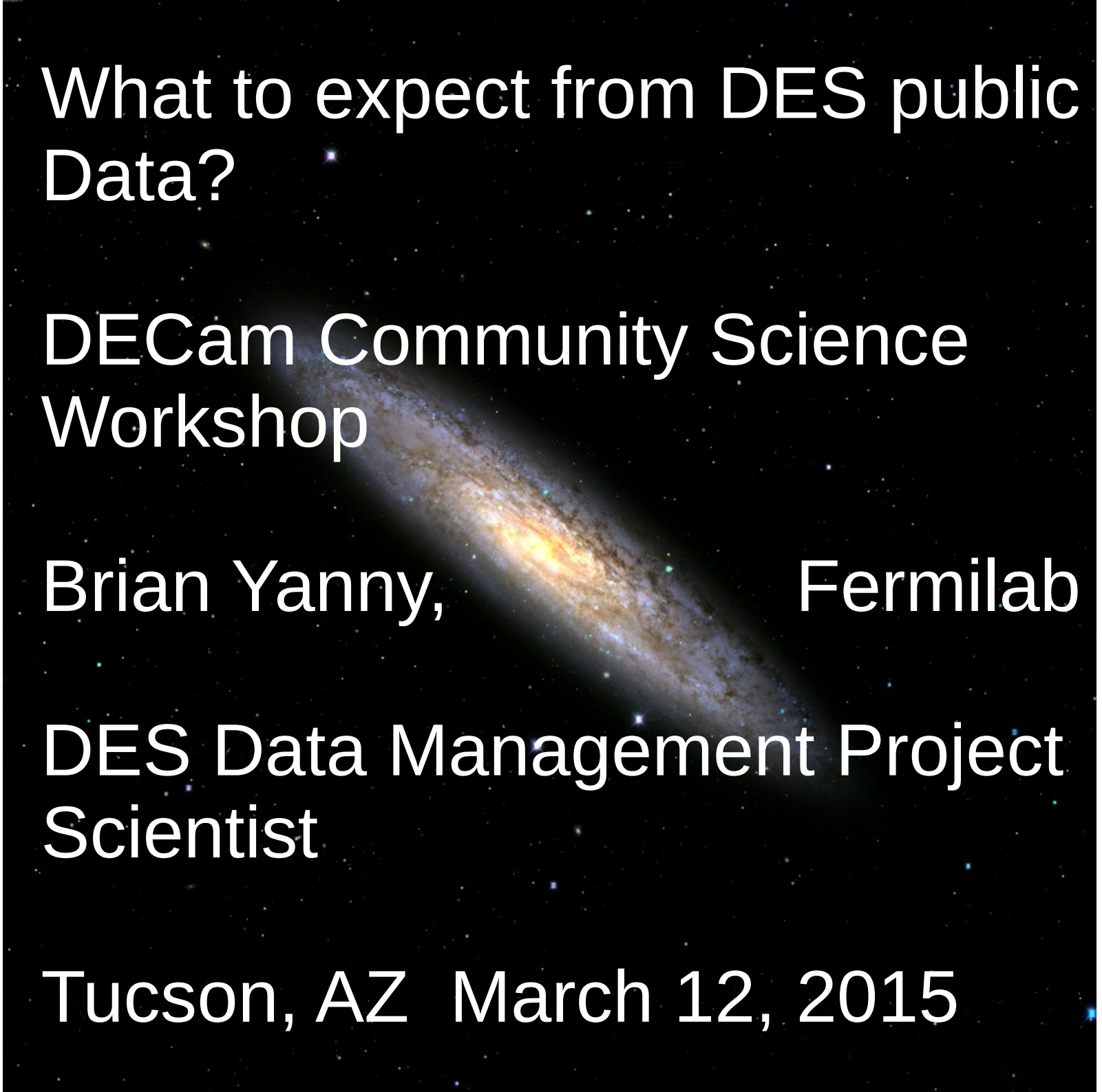


What to expect from DES public Data?

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

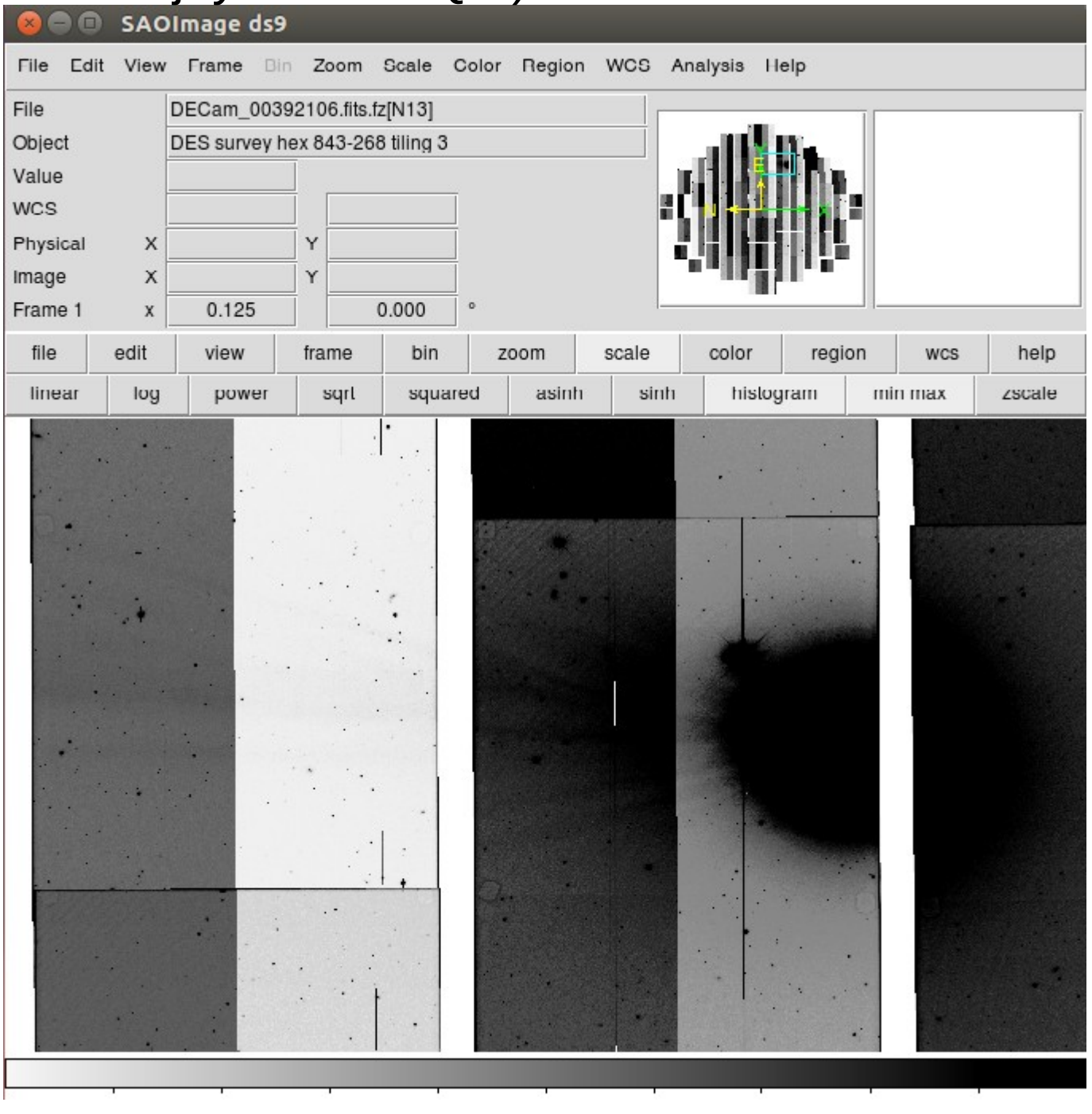
For the hard core DECam enthusiast:

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)



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.

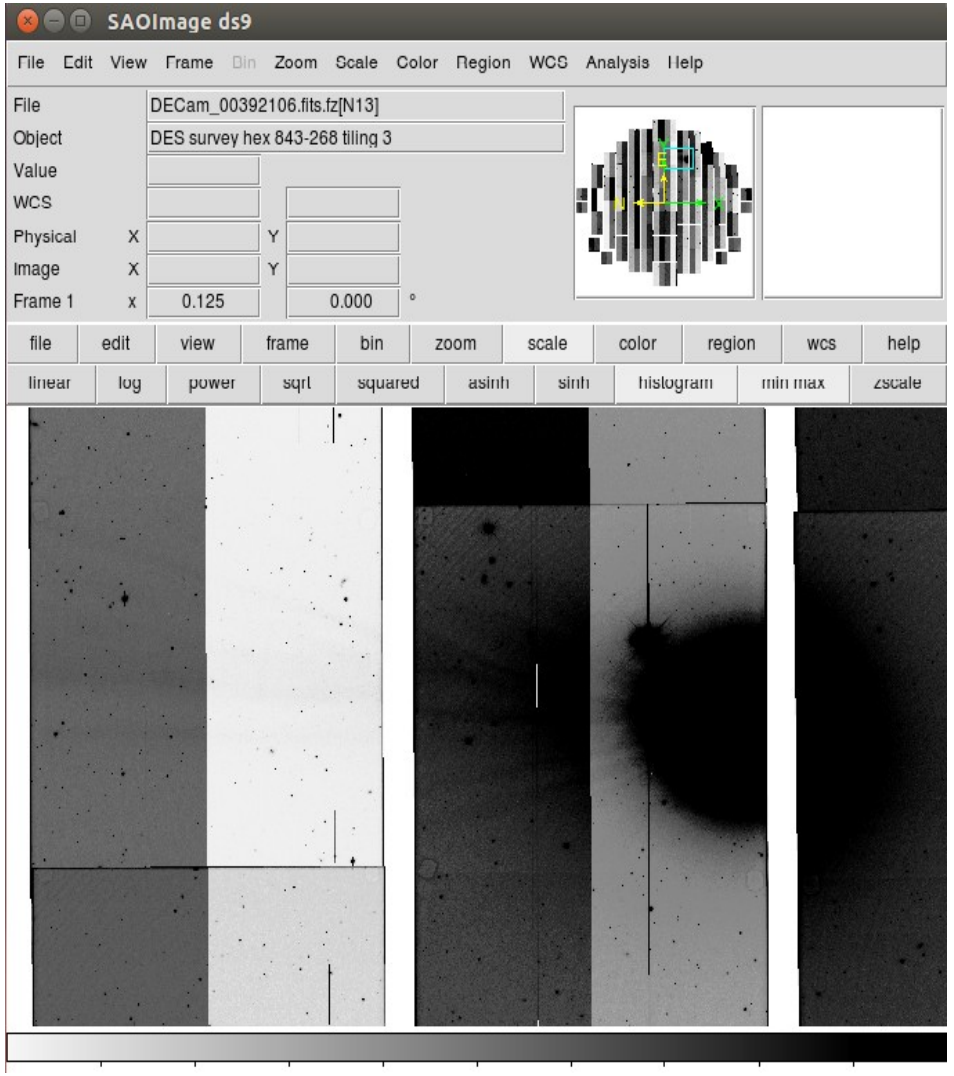
B. Additional improvements in astrometry from 20--> 5 mas require adjustment for the tree ring/coffee stain effect that Gary Bernstein showed.

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

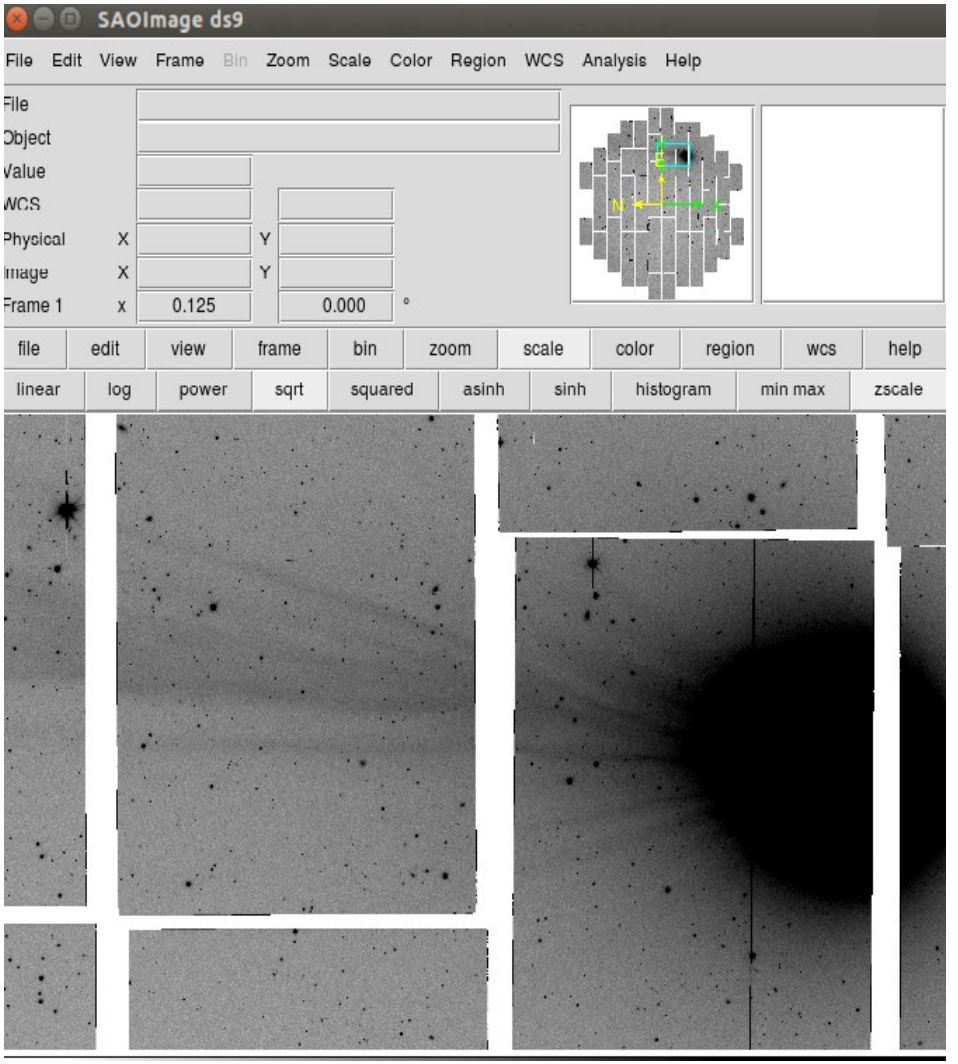
D. There are some artifacts, masked bright stars and bleed trails. Mask/weight planes are available,
but take some getting used to. Will improve in future years.

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

Raw

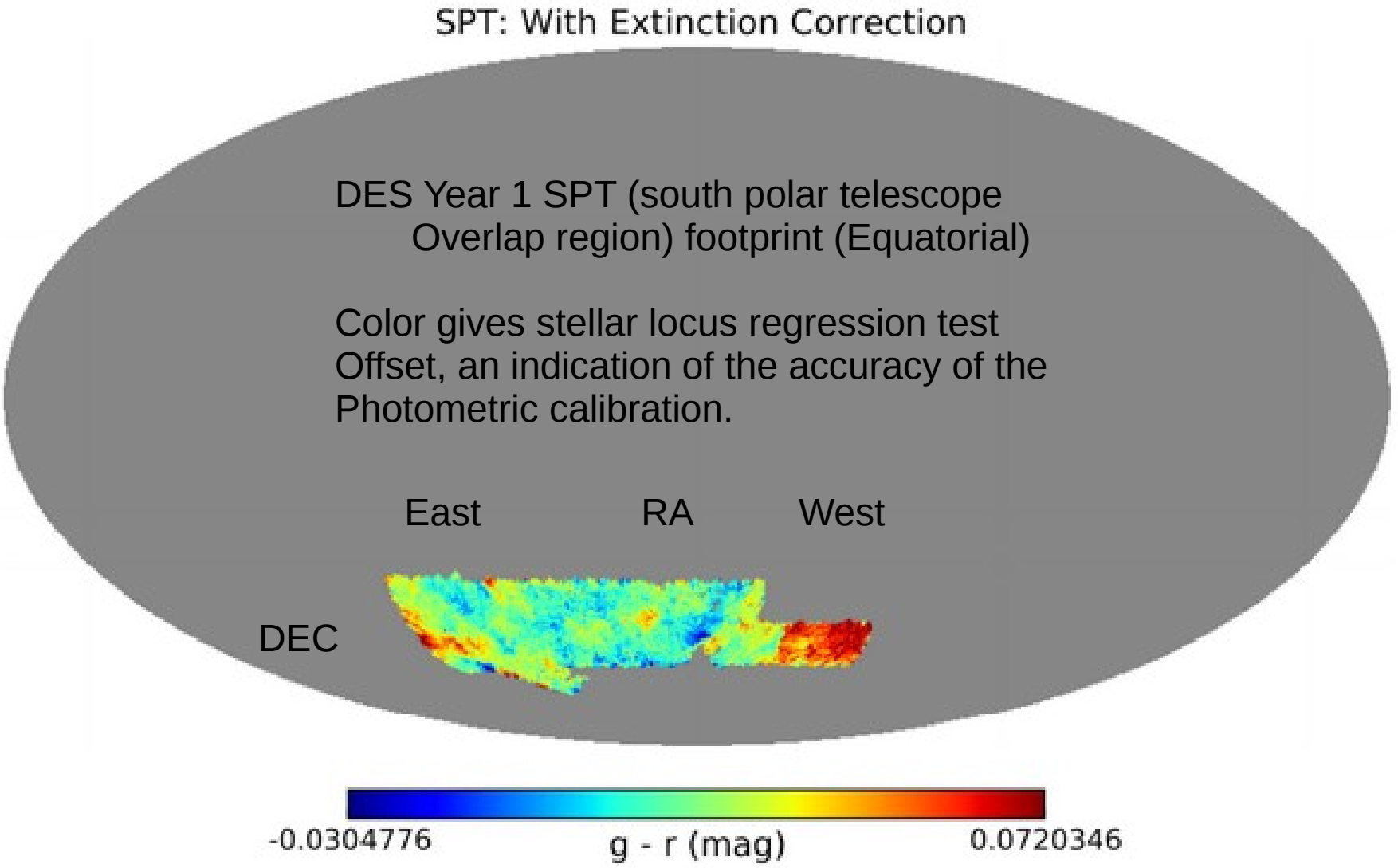


Reduced



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

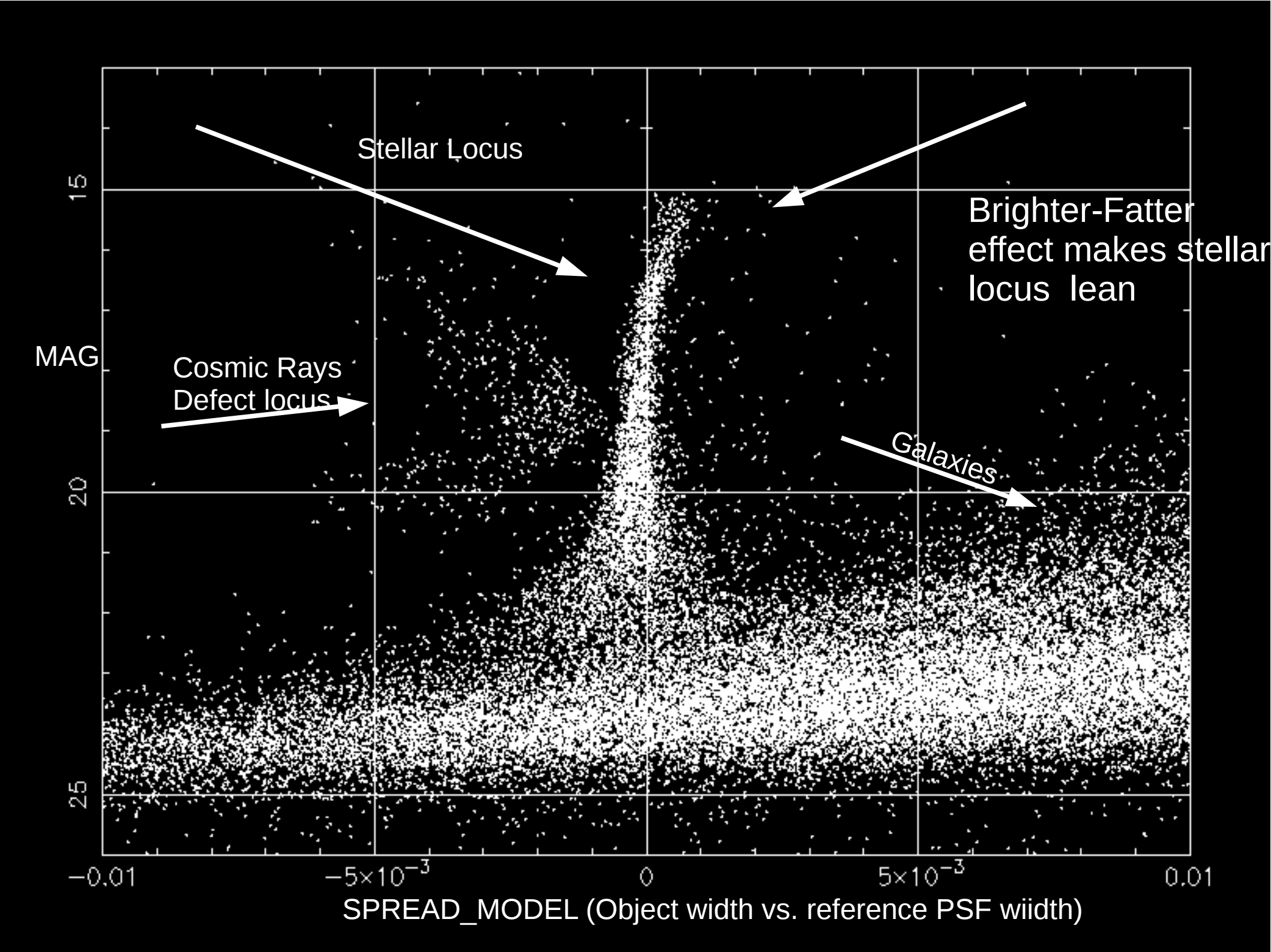
Note on photometric calibration of Year 1 images in NOAO SA:
Calibration is generally good to 2% rms in g,r,i,z however
There is an excursion in g band in the far west of the
Survey (RA < 330) where g-band is off by 5%. (See link on prev. page)



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


Stellar Locus
Brighter-Fatter
effect makes stellar
locus lean
Cosmic Rays
Defect locus
Galaxies
MAG
15
20
25
−0.01
−5×10−3
0
5×10−3
0.01
SPREAD_MODEL (Object width vs. reference PSF wiidth)

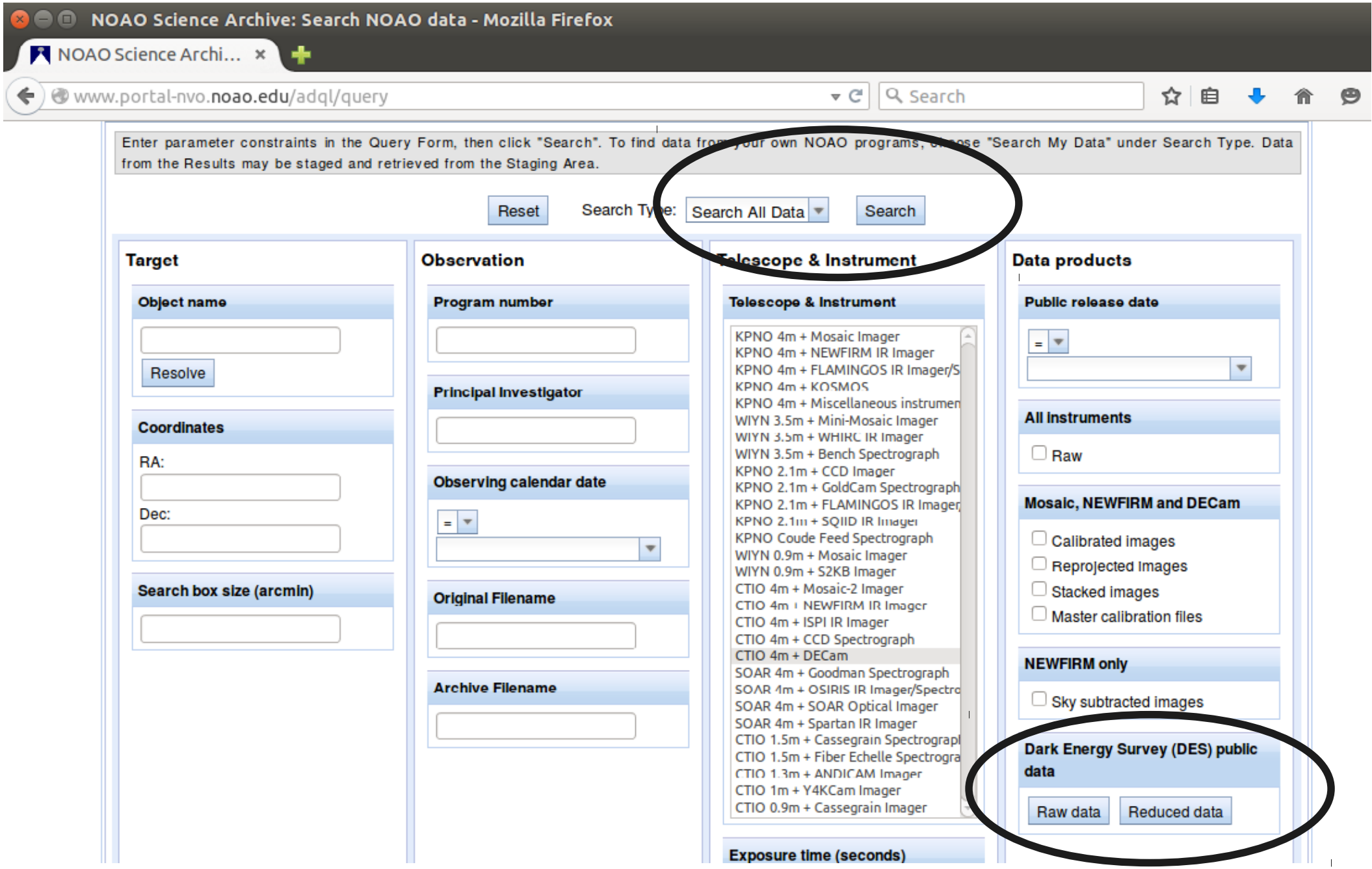
What's available right now (March 2015)?

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:



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.

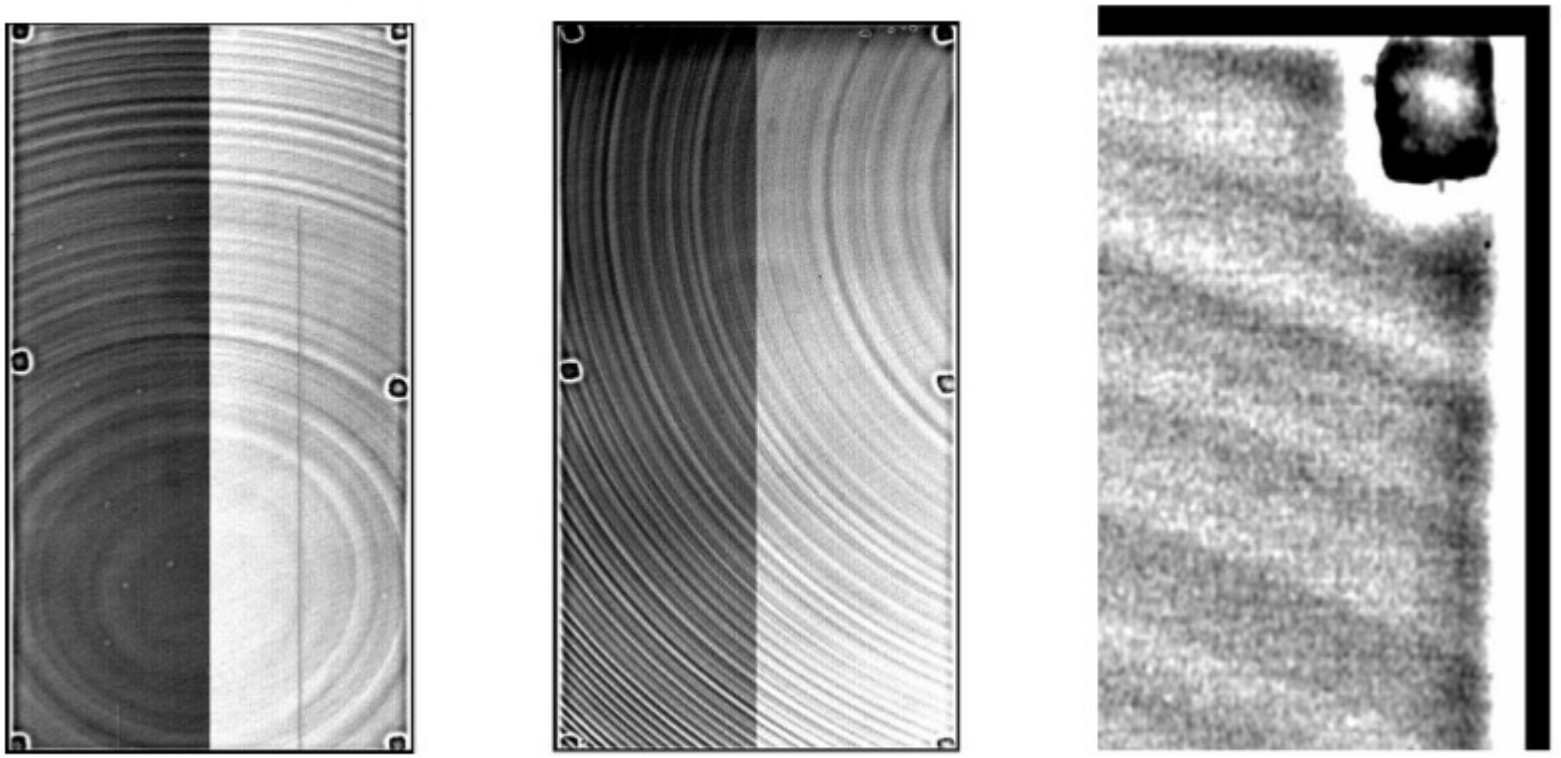


Fig. 1.— Master dome flat images from two of the DECam CCDs in the g band. Each image is

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.

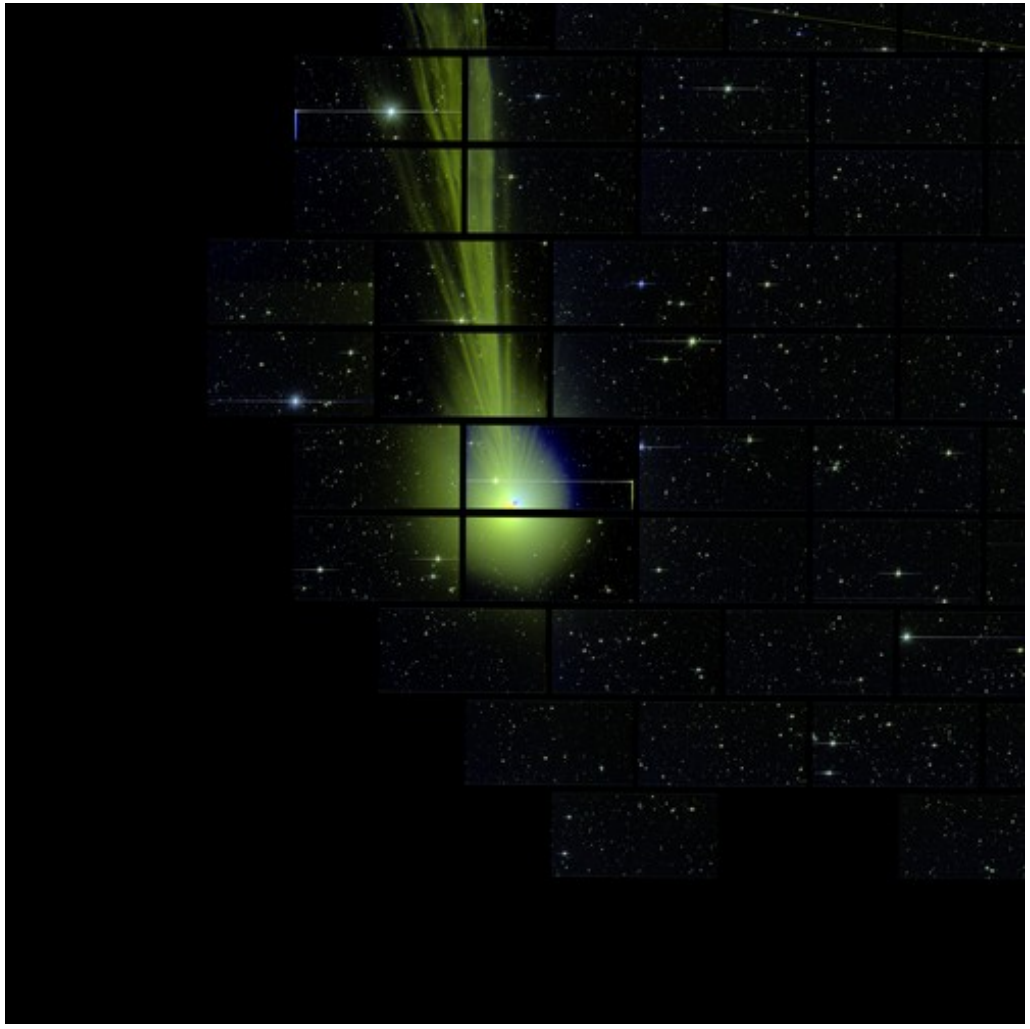
Products: single epoch calibrated images as before, plus coadd (multi-epoch) images and calibrated coadd catalogs. Available from NOAO SA and NCSA.

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

DES Data to NOAO Science Archive release timeline:

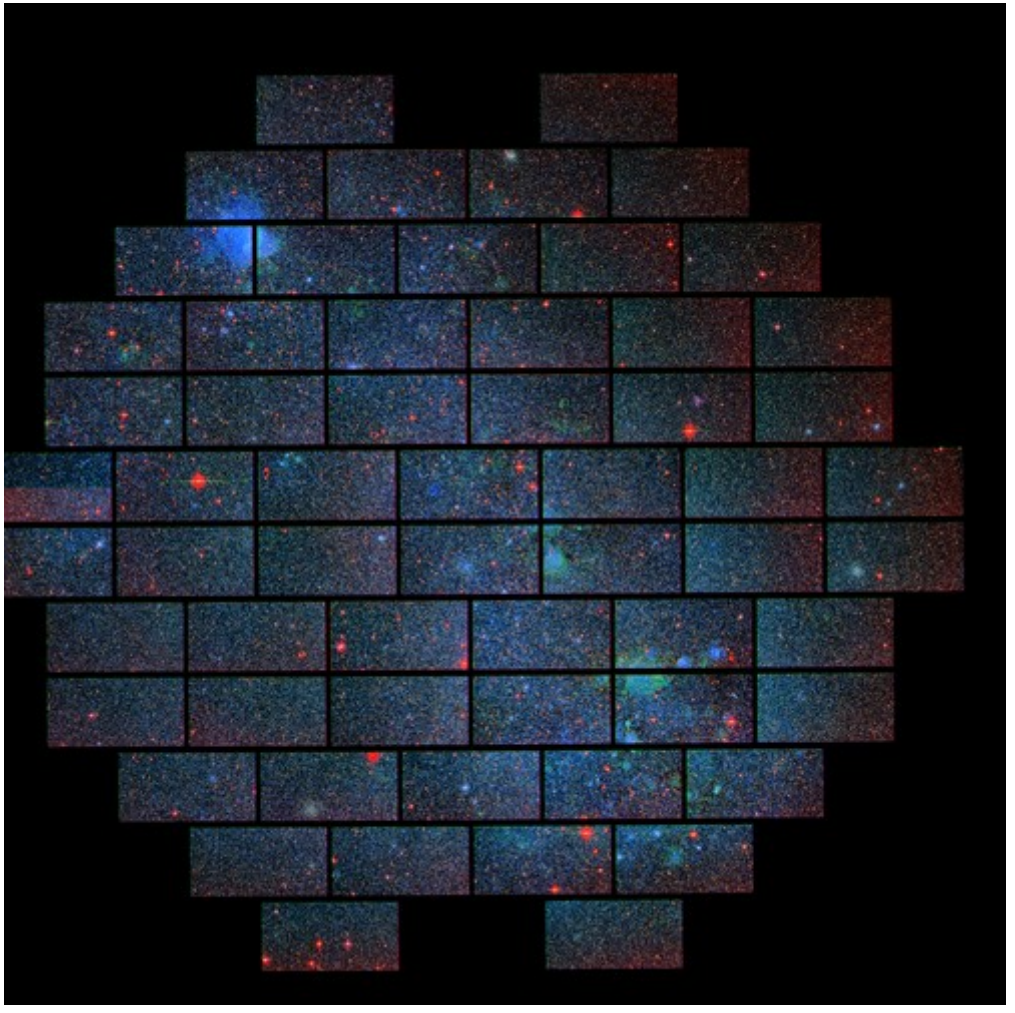
SV Raw Sep 13 – Feb 14 (Complete)
Y1 Raw Sep 14 -- Feb 15 (Complete)
Y1 Red Dec 14 – Feb 15 (Complete)
Y2 Raw Sep 15 – Feb 16
Y2 Red Feb 16
Y3 Raw Sep 16 - Feb 17
Y3 Red Feb 17
Y1+Y2 stacks/cats Aug 17 (DES DR I)
Y4 Raw Sep 17-- Feb 18
Y4 Red Feb 18
Y5 Raw Sep 18 – Feb 19
Y5 Red Feb 19
Y1+Y2+Y3+Y4+Y5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