



DECam Community Pipeline (CP)

Francisco Valdes (NOAO)

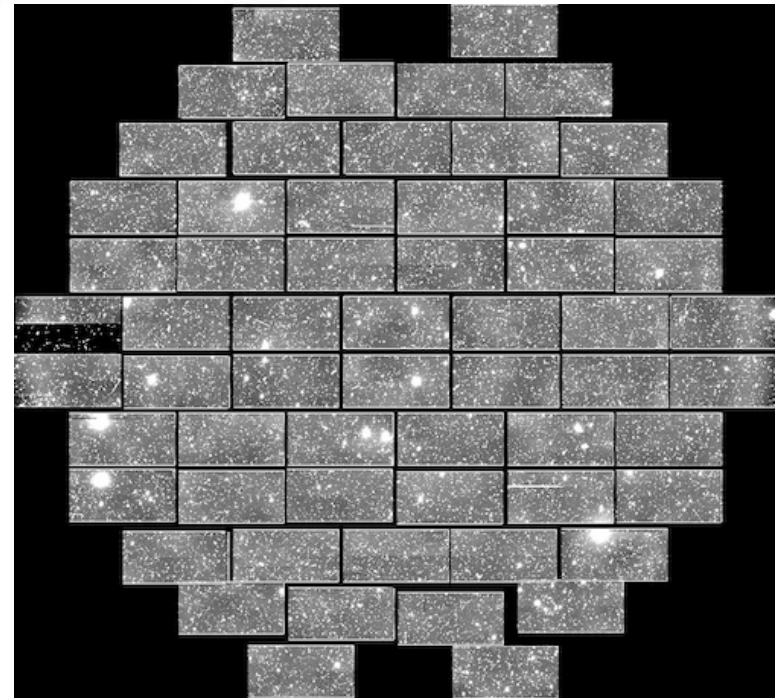
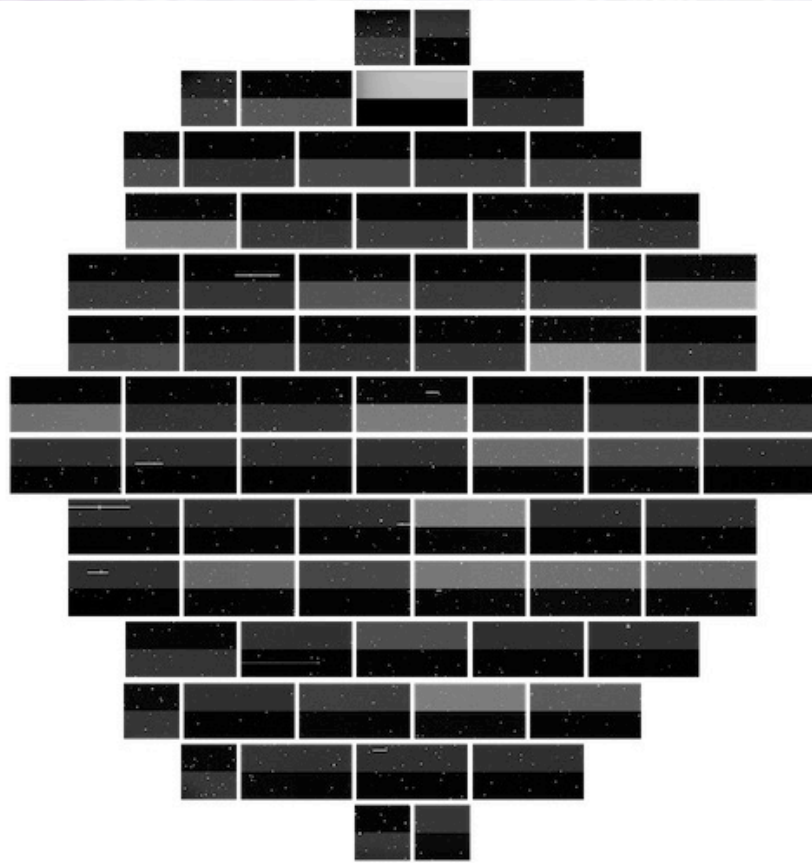


Credits

- Dark Energy Survey & NOAO MOU
 - Peoples, Frieman, Silva, Smith, ...
- DESDM: Yanny, ...
 - FermiLab
- DESDM-CP: Gruendl, Mohr, Petravick, ...
 - NCSA / Univ. Illinois
- NOAO: Valdes



CP Instrumental Calibration





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March 11-13, 2015

DECam Community Science Workshop



CP Operations: New Runs

- Raw data flows to NSA during the night using DTS and is available almost immediately.
- CP processing begins after the end of run (except by prior arrangement) with a goal of finishing within a week. New runs have priority over reprocessing.
- CP data products are stored in the NOAO Science Archive (NSA) and accessed through the NOAO Portal.
- An email notification is sent to the PI.



CP Operations: Reprocessing

- If problems are discovered with the processing or more recent pipeline version enhances the science.
- Upon request at NOAO's discretion after discussion.
 - custom stacking is generally not grounds for reprocessing
- Datasets from older pipeline versions are reprocessed as compute time is available (check **PLVER** keyword).
- Note that reprocessing will result in multiple versions in the archive. Older versions will be deleted at some point.



CP Data Products

Raw Bias	zero	zri					MEF CCD
Raw Dome Flat	dome flat	fri					MEF CCD
Raw Object	object	ori					MEF CCD
MasterCal Bias	zero	zci		zcw			MEF CCD
MasterCal Dome Flat	dome flat	fci		fcw			MEF CCD
MasterCal Illumination	illumcor	ici					MEF CCD
InstCal	object	ooi		oow	ood		MEF CCD
Resampled	object	opi		opw	opd		MEF CCD
Stacked	object	osi	osj	osw	osd	ose	MEF Tile

Organized by OBSTYPE, PROCTYPE, PRODTYPE. Naming convention:
http://ast.noao.edu/sites/default/files/File_Naming_Conventions_v12.pdf



CP Documentation and Help

- <http://ast.noao.edu/data/docs> - Data Handbook
 - See poster by Richard Shaw
- <http://www.noao.edu/noao/staff/fvaldes/CPDocPrelim/>
- sdmhelp@noao.edu



CP Instrumental Calibration: Steps

- Electronic Bias Calibration
- Crosstalk Correction
- Saturation Masking
- Bad Pixel Masking and Interp.
- Bias Calibration
- Linearity Correction
- Flat Field Gain Calibration:
Dome Flat and Star Flat
- Fringe Pattern Subtraction (zY)
- Bleed Trail/Edge Masking & Interp.
- Astrometric Calibration (2MASS)
<http://fits.gsfc.nasa.gov/registry/tpvwcs/tpv.html>
- Single Exp. Cosmic Ray Masking
- Photometric Characterization
(USNO-B1/PS1)
- Sky Pattern Removal w/ Pupil Ghost
- Preliminary streak masking
- Illumination Correction
- Remapping
- Multi-Exposure Transient Masking
- Moving Object Detection System
(only select programs)
- Coadding/Stacking (2 versions)



CP Instrumental Calibration: Missing Steps

- Exposure optimized fringe subtraction
- Improved streak masking
- Brighter/fatter calibration
- “Tree-ring” astrometric calibration / WCS
- Pixel area correction in InstCal products
- Possible calibration of CCD 31 (science quality unknown)



CP Instrumental Calibration: Files

- Crosstalk Coefficient File¹
- Saturation Level File¹
- Linearity File¹
- WCS Coefficients File¹
- Bad Pixel Map¹
- Bias/Zero Calibrations²
- Dome Flat Calibrations²
- Star Flat Calibrations¹
- Fringe Templates¹
- Illumination Calibrations²

¹ <http://www.ctio.noao.edu/noao/content/DECam-Calibration-Files>

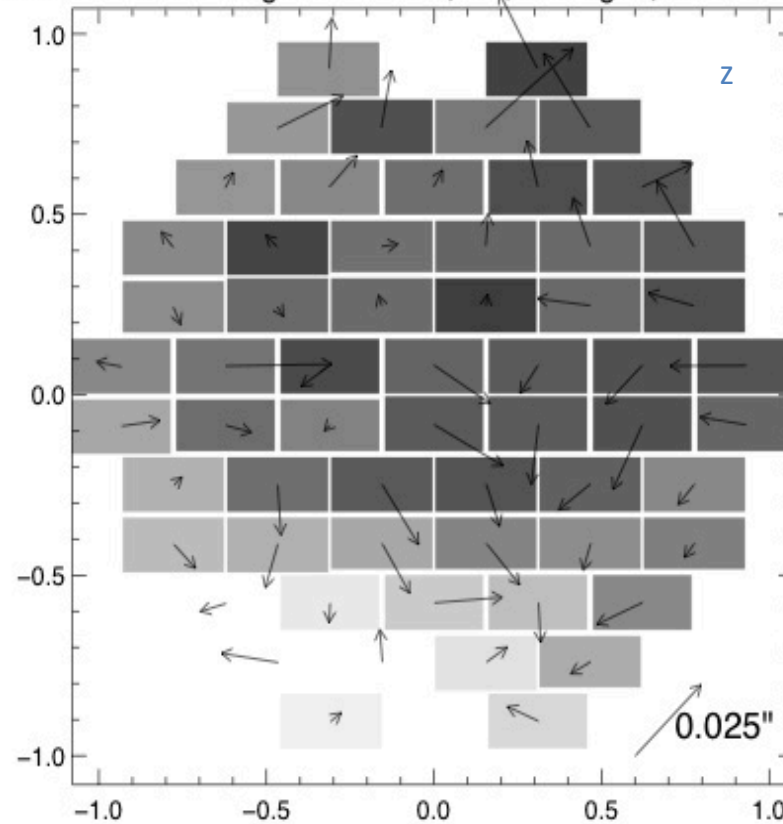
² <http://portal-nvo.noao.edu> (NSA/Portal)



Science Verification

Comparison to PS1 per CCD
Courtesy of DECaLS (Dey, see
talk on Thursday)

Relative Offsets: Average of all data ; 1440 images; $-0.005 < \Delta m_0 < 0.012$

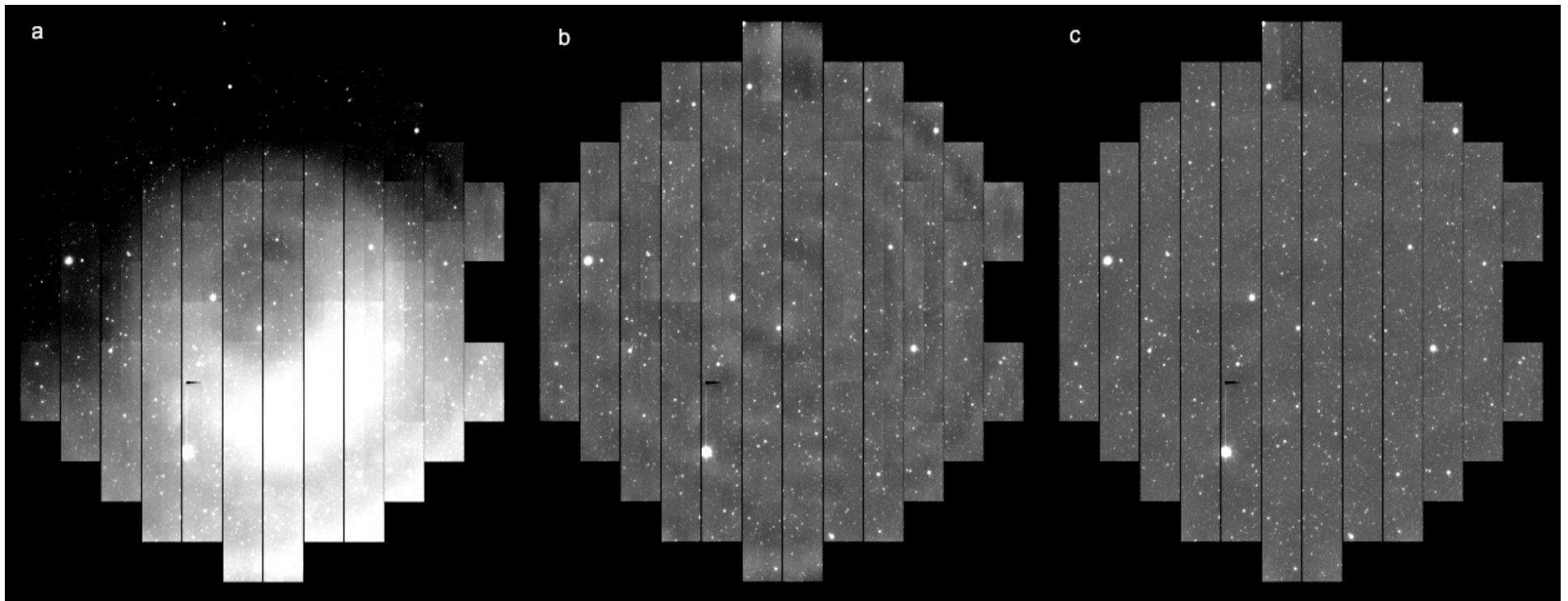




Pupil, Sky, Illumination

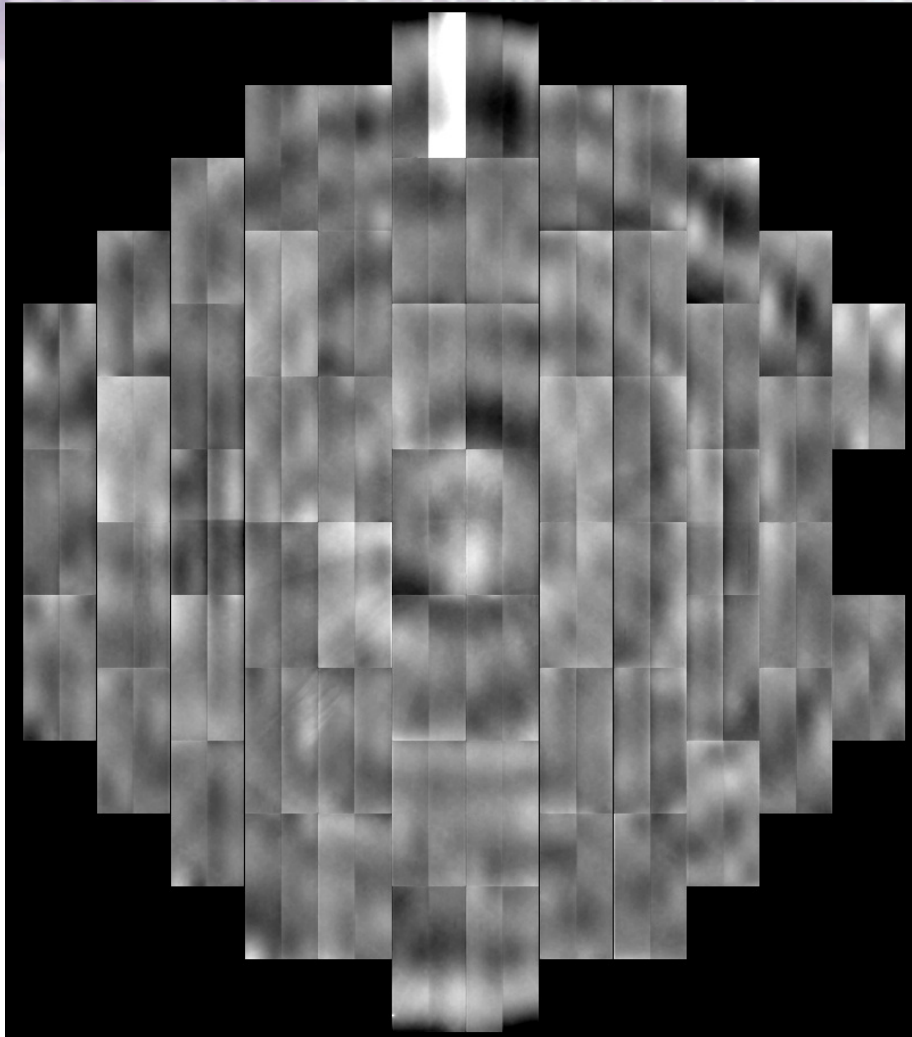
The figure below illustrates the post-star flat calibration steps following a single 60s z-band exposure. All images are shown with the same display stretch. Pupil amplitude is about 3% of sky.

- a) Exposure after dome + star flat calibration
- b) Pupil pattern and global sky subtracted
- c) After illumination correction derived by combining exposures from the science program





Illumination Correction

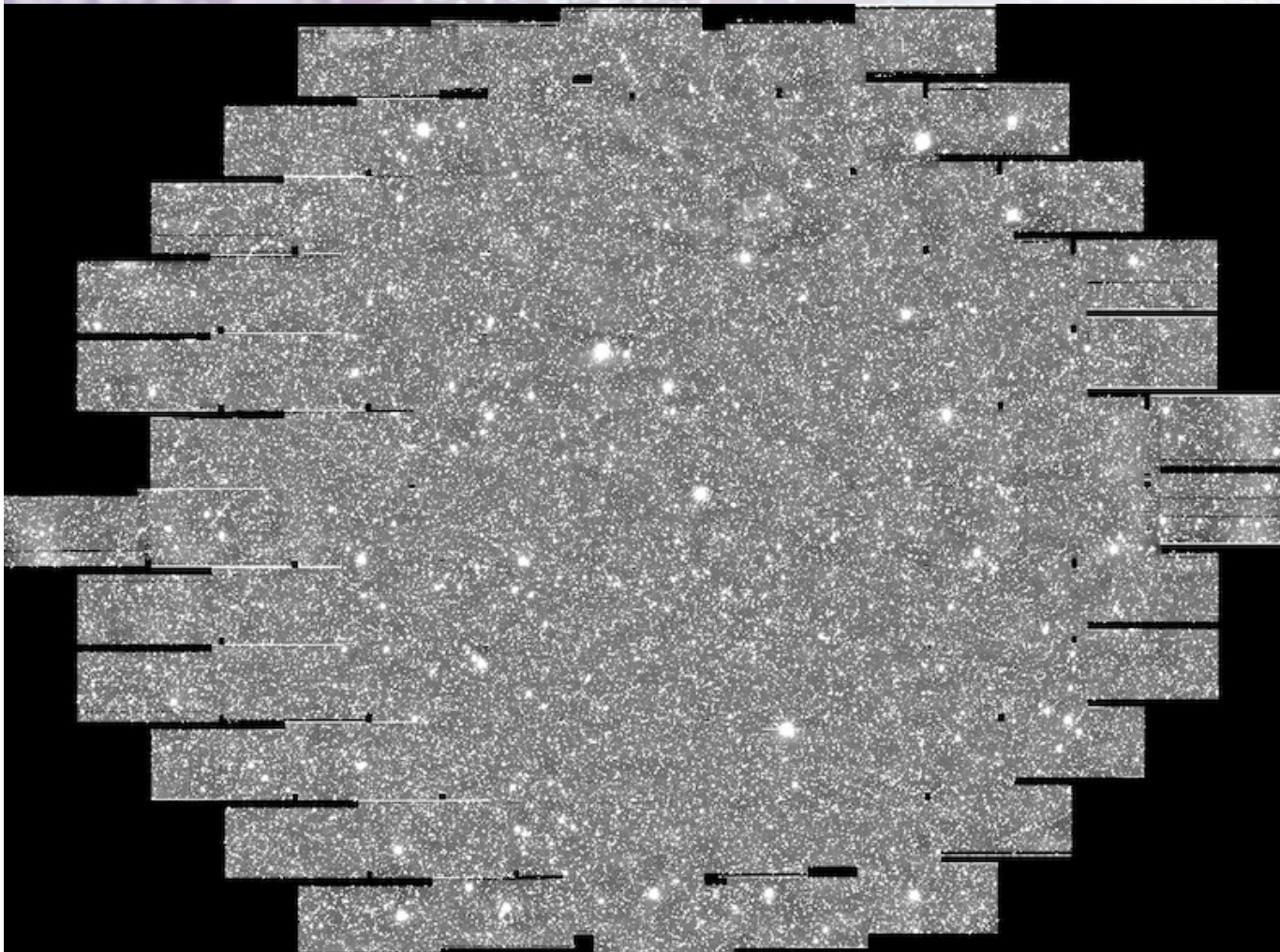


Illumination correction using 386 z-band exposures. Each exposure is scaled by the MEANSKY and stacked. This can be done in parallel by CCD. The stack is smoothed by median filtering over each amplifier (i.e. half CCD image).

This illumination correction is a tertiary gain calibration on top of the dome flat and star flat calibrations.



Pointing Stacks



- remapped to tangent point grid with equal sized pixels and standard orientation

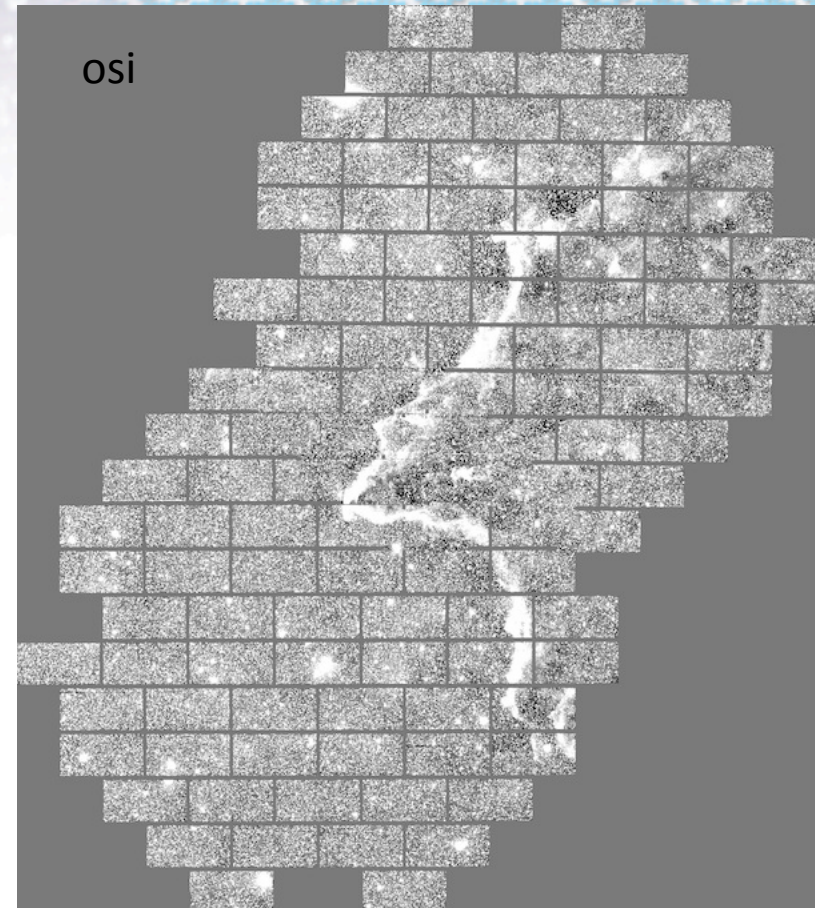
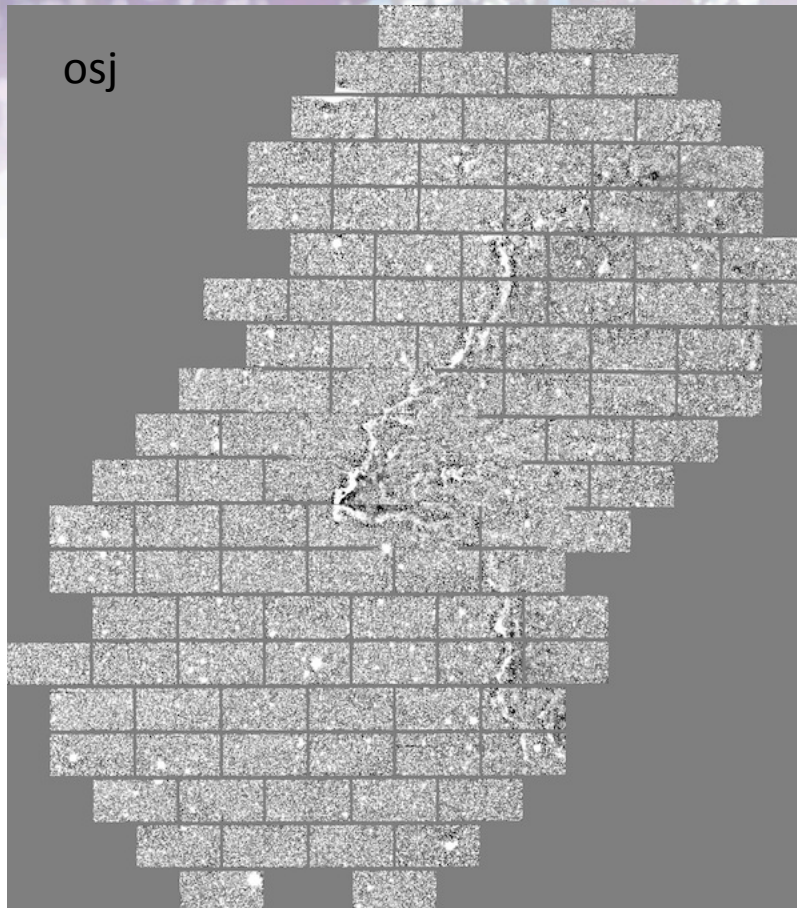


Stacking

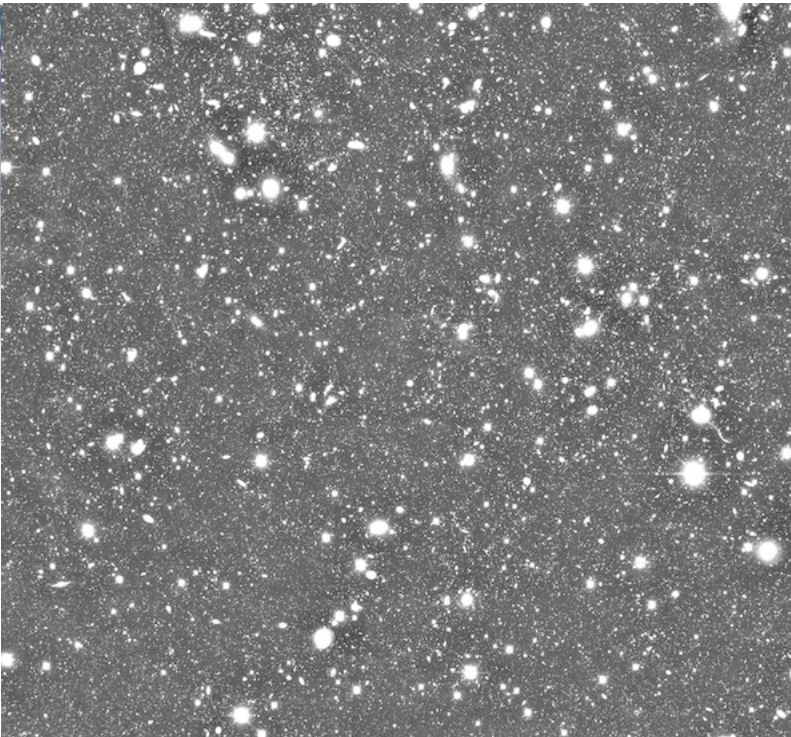
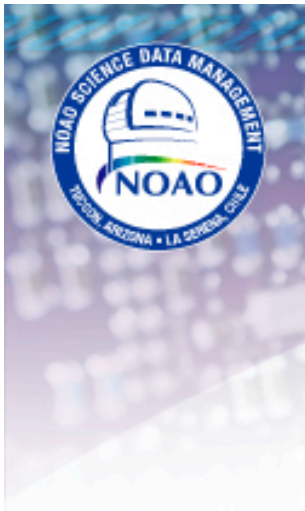
- Pointings are determined algorithmically across all exposures in a block.
- Separated into exposure time bins:
 - $< 1s$, $< 10s$, $< 60s$, $< 300s$, $\geq 300s$
- Limited to 50 exposures per stack.
- Some rejection is done based flux scaling, seeing, and sky brightness outliers.
- Popular for some programs but doing photometry is tricky. Time series programs also produce archival stacks.



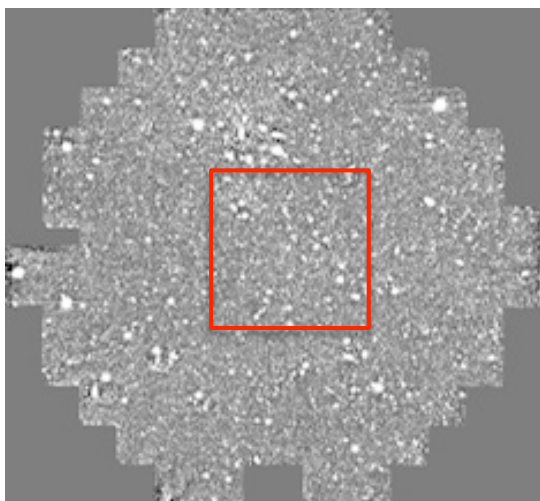
CP Stacks



Note: Two versions, overlap, missing CCD 31.



SV: Dell'Antonio
Abell 3128





DECam and the CP

- Thu. 15:40-16:10: **Round Table Discussion 1**
 - Led by Frank Valdes
 - People are invited to share one slide
 - What is good?
 - What should the CP be doing better?
 - What is the CP not doing at all?
 - Other pipelines beyond CP and DES?
- QUESTIONS?