CFHT's User Meeting - Marseille May 9th 2007

WIRCam's preprocessing pipeline

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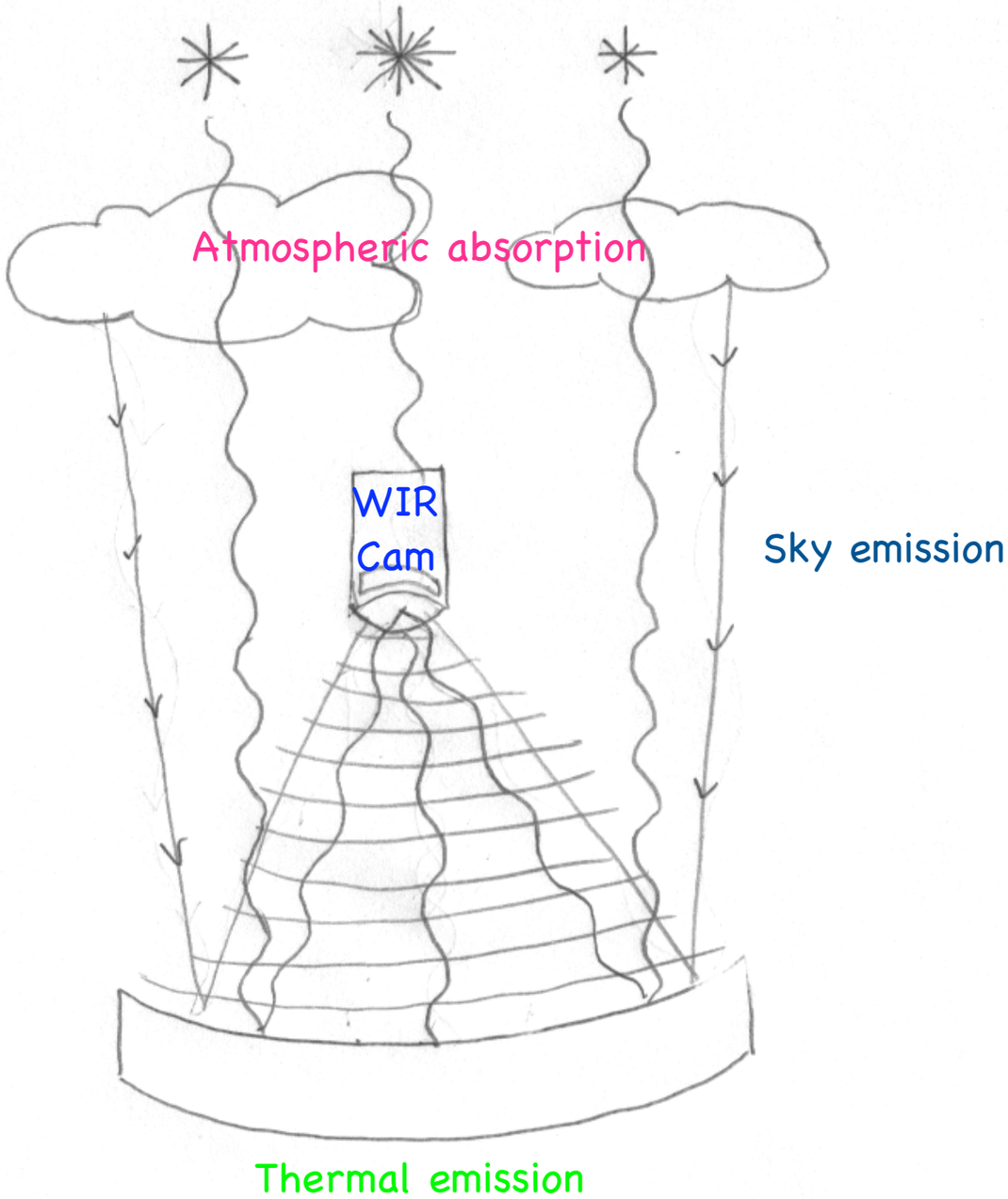
with help from:
Stéphane Arnouts (CFHT)
Chi-Hung Yan (ASIAA)
Peter Forshay (CFHT)

`I`iwi

the `I`iwi Interpretor of the Wircam Images


Atmospheric absorption
WIR
Cam
Sky emission
Thermal emission

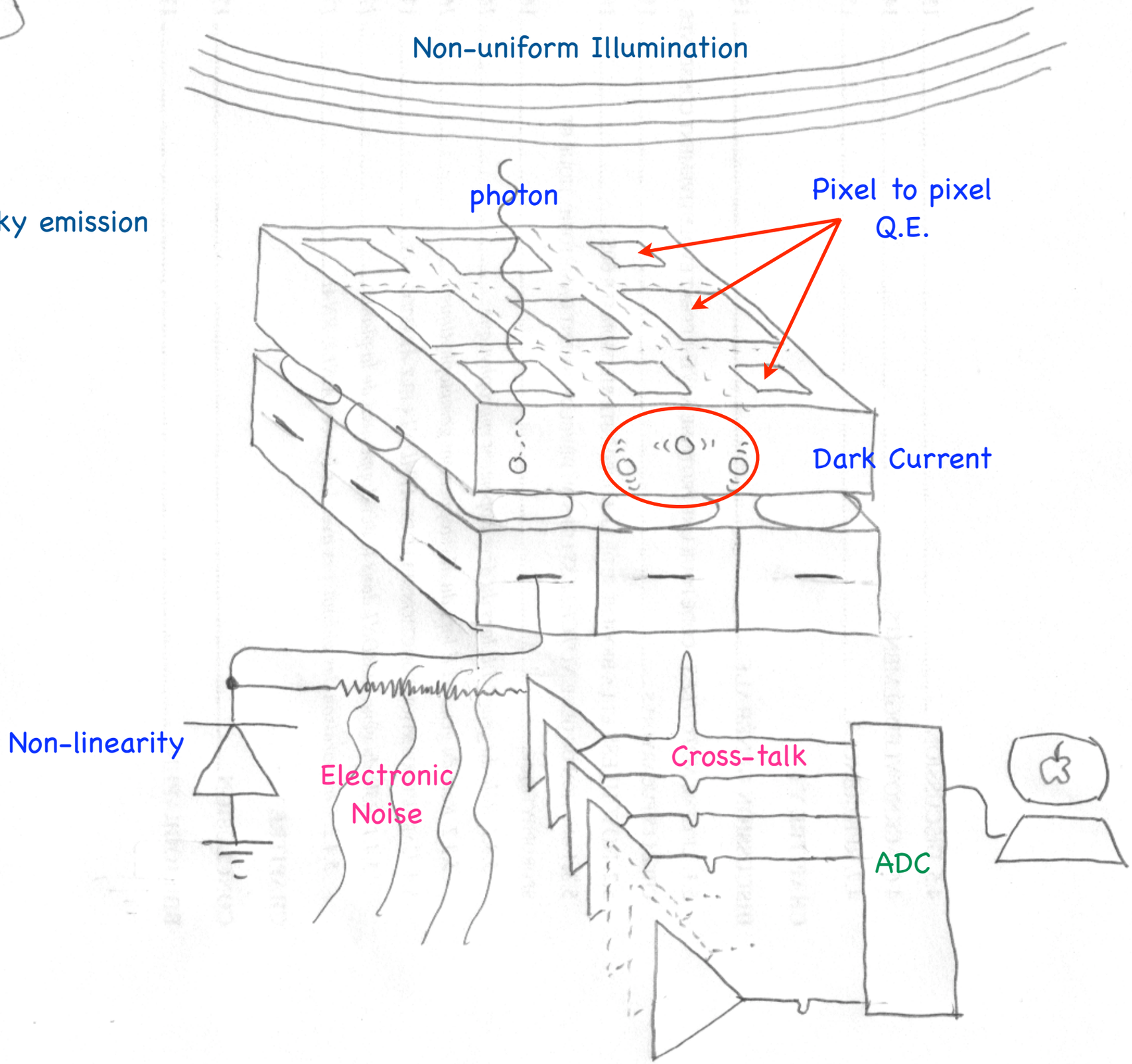
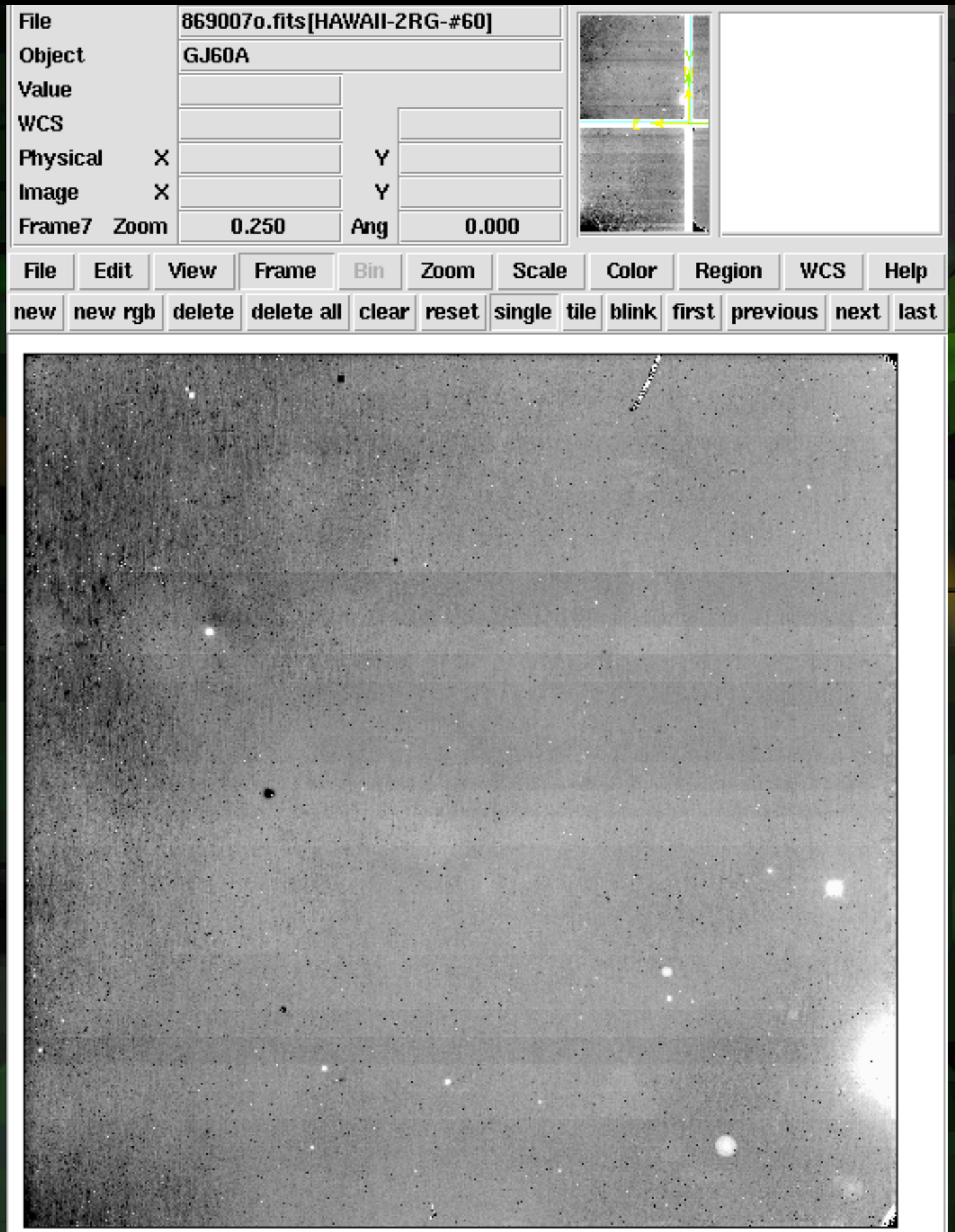

Non-uniform Illumination
photon
Pixel to pixel
Q.E.
Dark Current
Non-linearity
Electronic
Noise
Cross-talk
ADC

Image Processing Recipe

1. Non-linearity correction **(to implement)**
2. Reference pixels correction
3. Dark subtraction
4. Bad pixel masking
5. Flat fielding
6. Guide window crosstalk masking
7. Sky construction/subtraction **(improvement ongoing)**
8. Common to 32 amplifiers crosstalk removal **(improvement ongoing)**
9. Positive crosstalk removal **(to do)**
10. Source extraction, IQ evaluation
11. Astrometry to 1” precision (linear solution per chip)
12. Absorption measurement based on the 2MASS catalogue

Raw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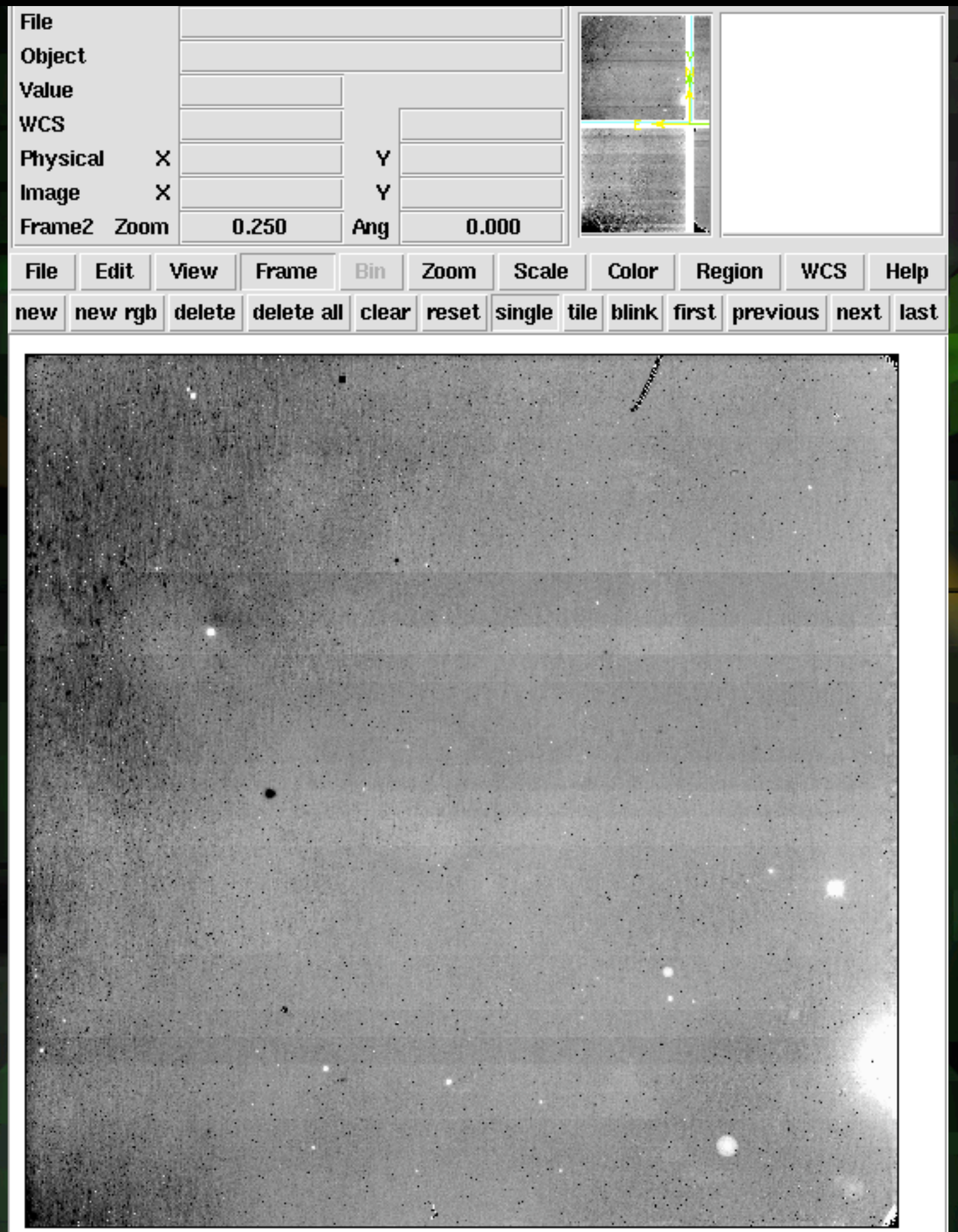
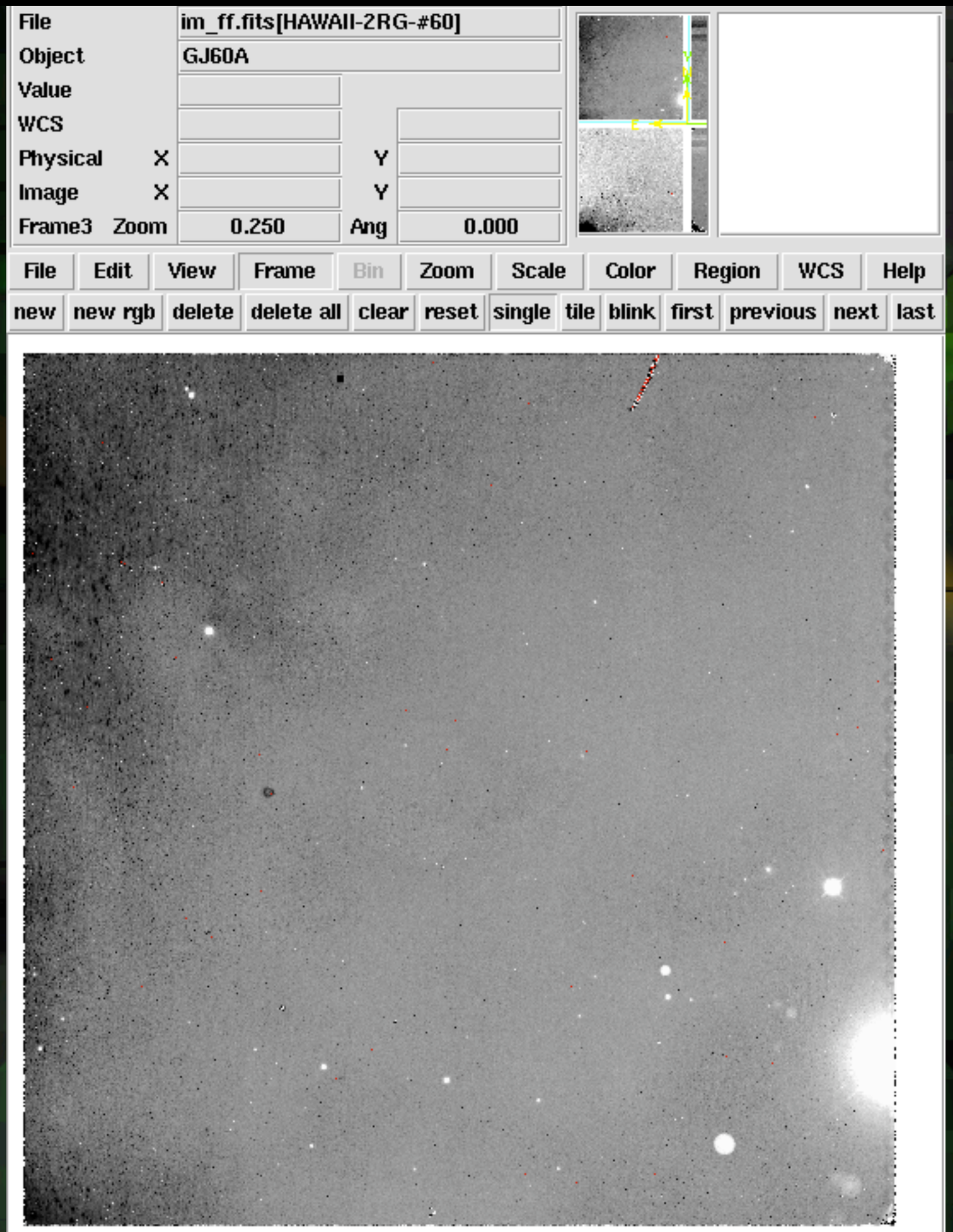
869007o.fits[HAWAII-2RG-#60]
Object
GJ60A
Value
WCS
Physical X Y
Image X Y
Frame7 Zoom 0.250 Ang 0.000
File Edit View Frame Bin Zoom Scale Color Region WCS Help
new new rgb delete delete all clear reset single tile blink first previous next last

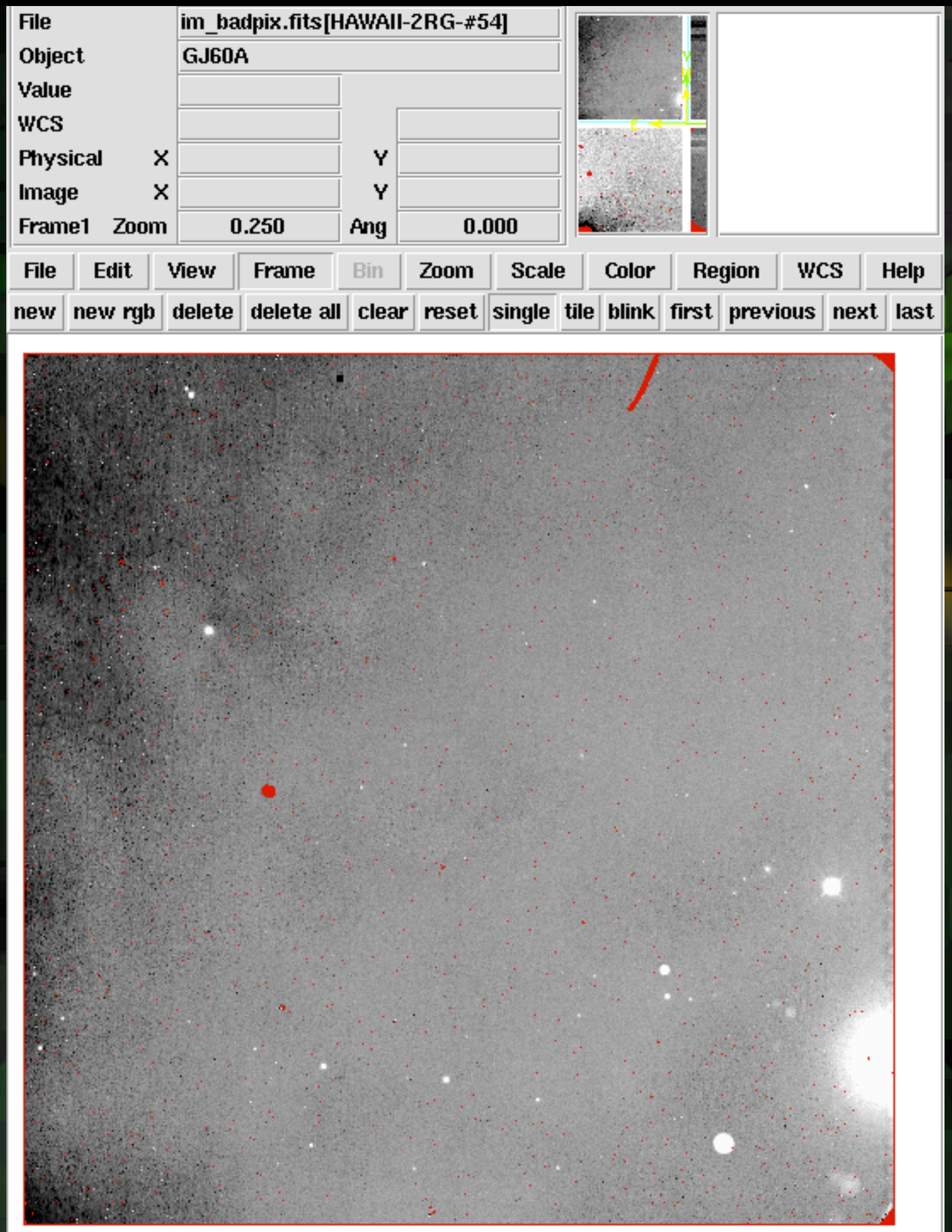
dark subtracted



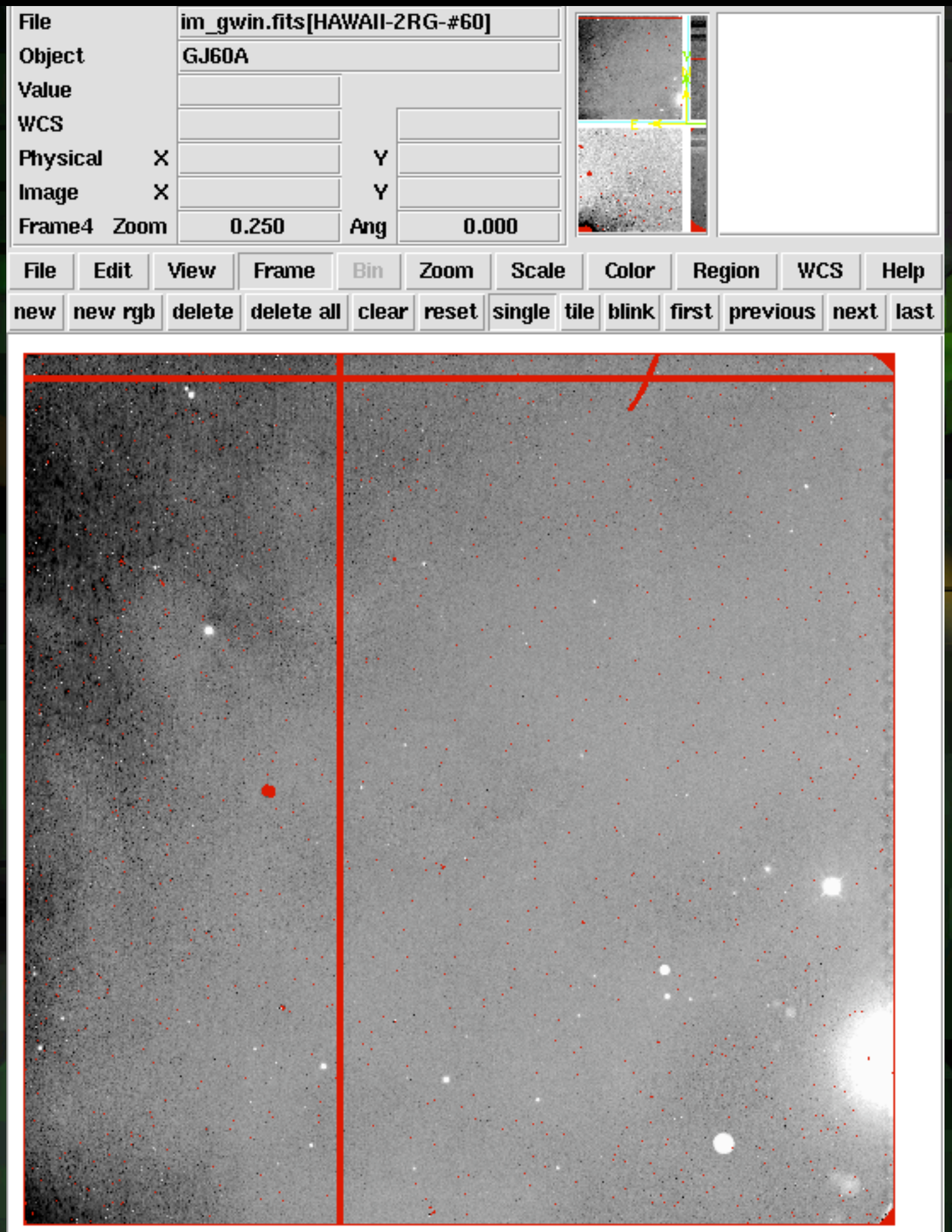
flat fielded



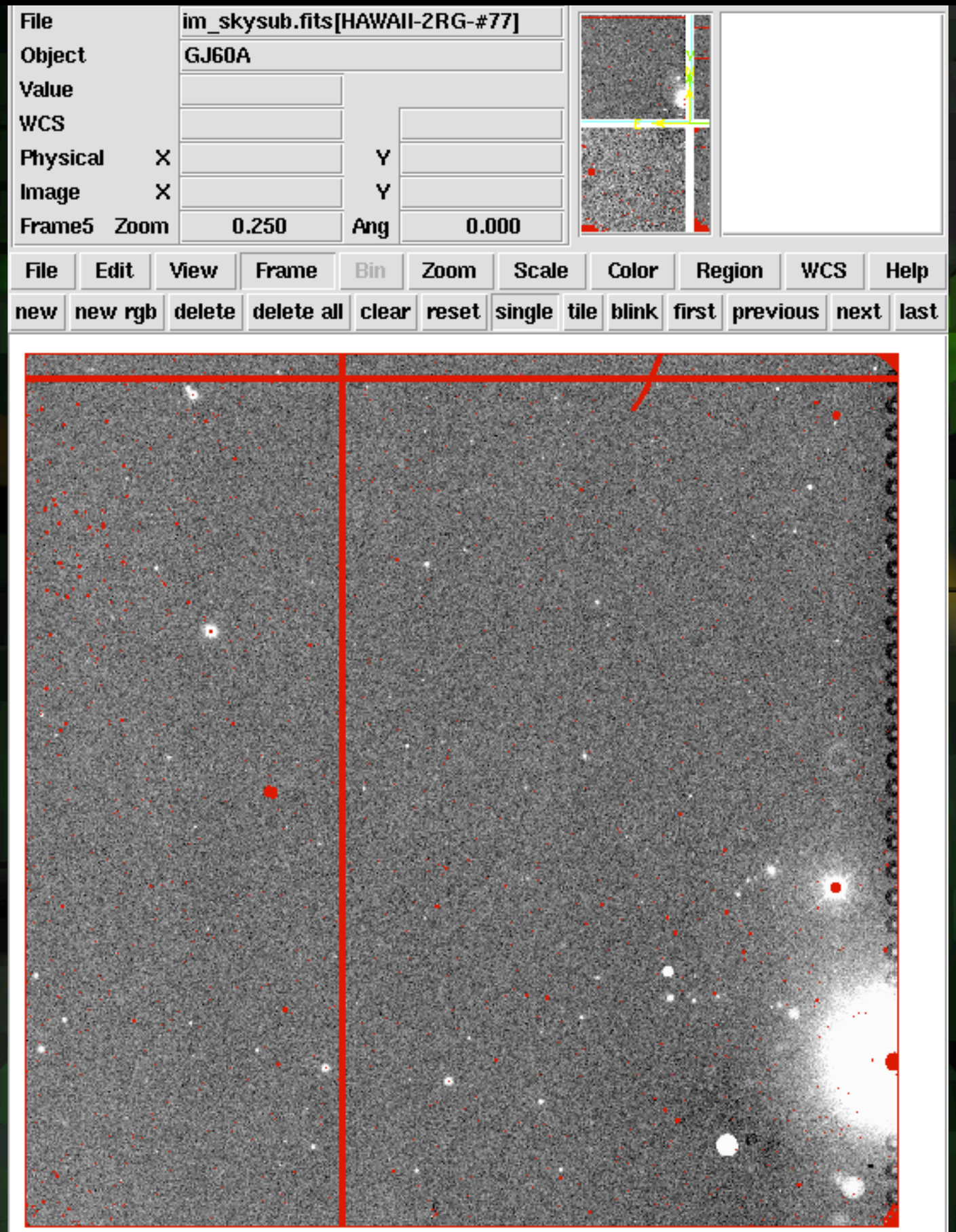
bad pixels masked



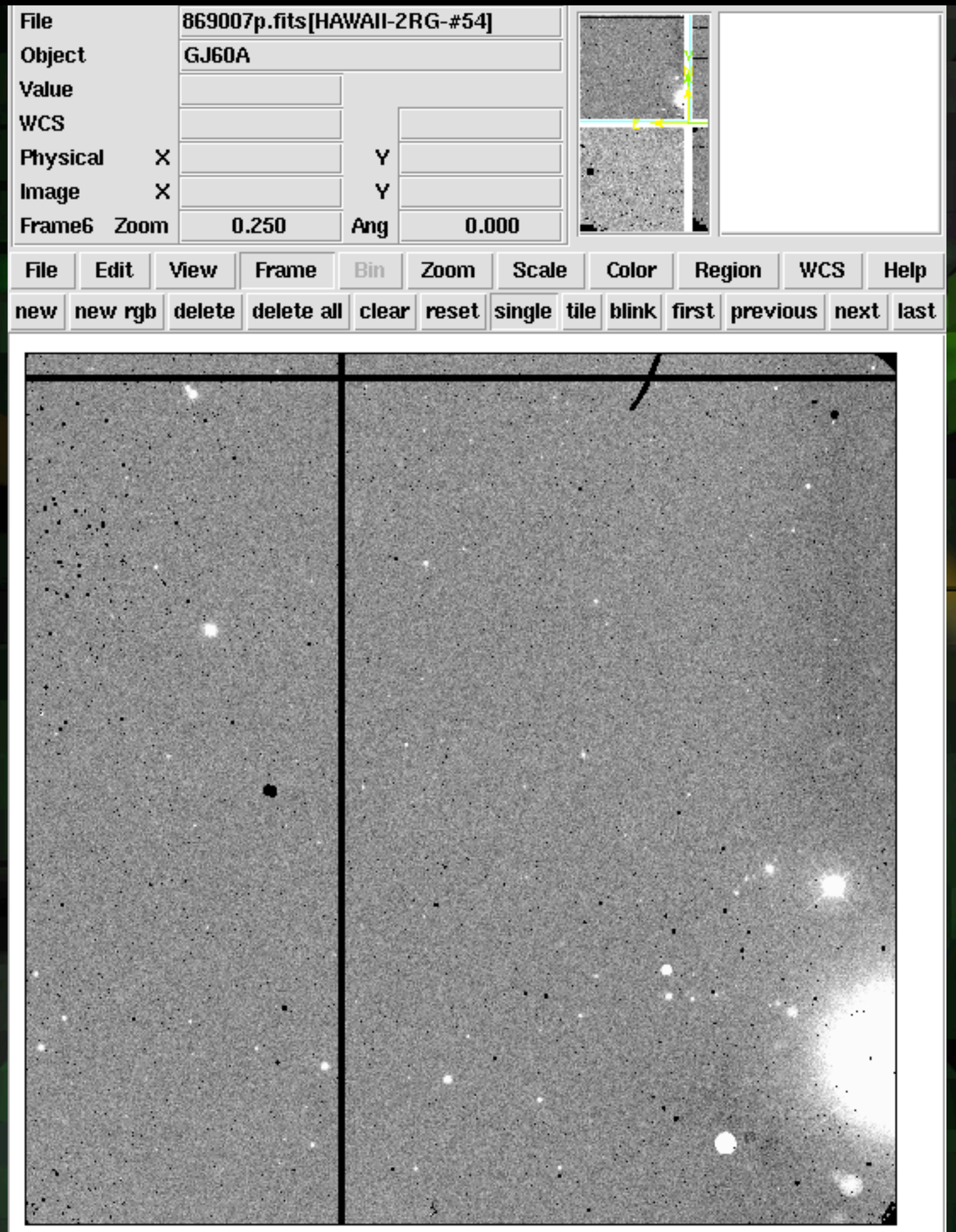
guide window masked



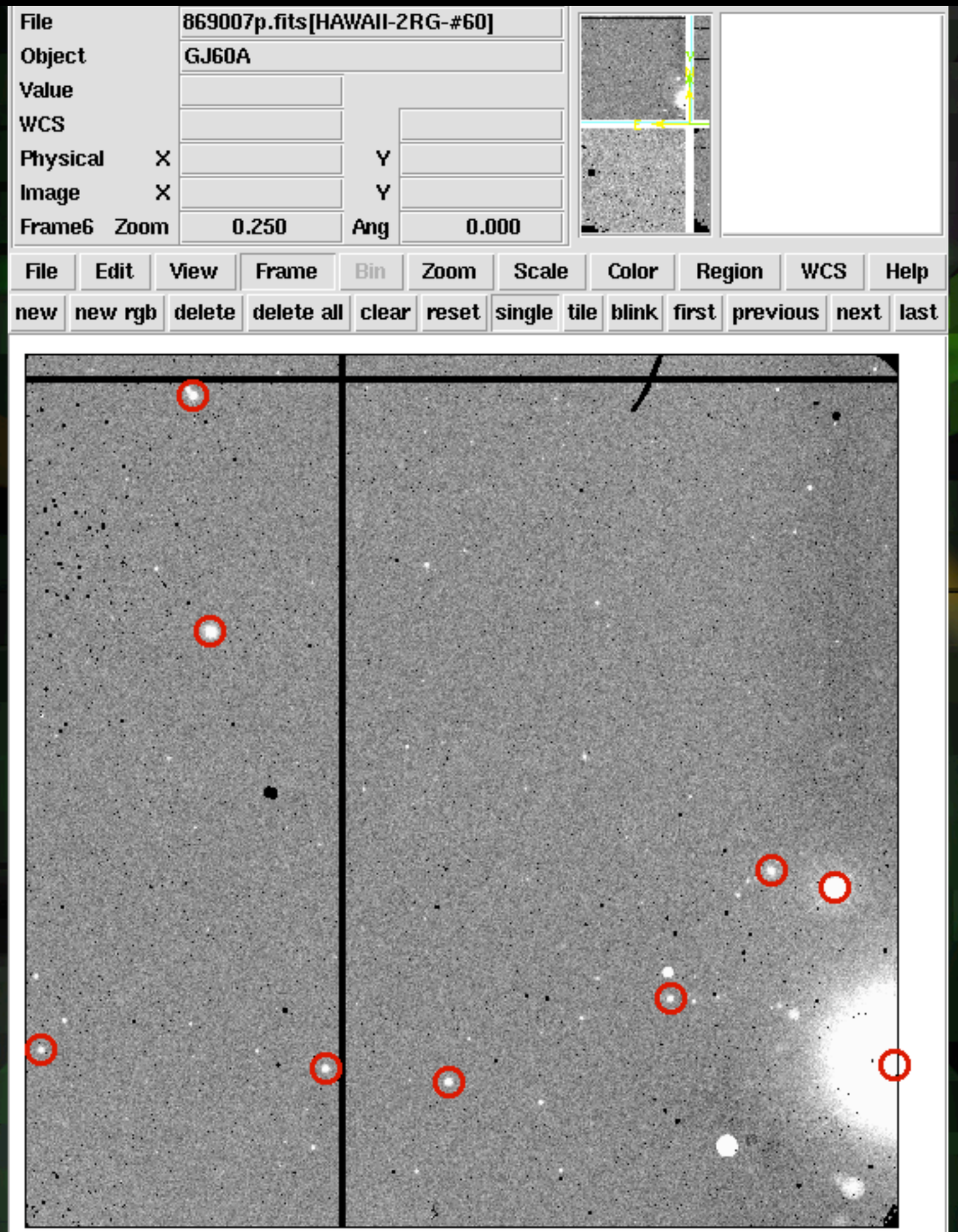
sky subtracted



crosstalk corrected



astrometry & photometry



Current Work

- Data Flow & Sky Construction
- Non-Linearity
- Crosstalk
- Photometric Calibration

"Sky intensity varies by 10% in 10 minutes..."

-canonical rule

Sky Construction - sliding median with source masking

Adjustable constraints in time and number of DPs:

example: use images taken no more than 15 minutes away and with sky positions different by at least 15"

Pipeline philosophy: Subdivide processing of images in natural groups of runid / night / target / filter

Runid	Target	Filter	Night	IDL Script
06BH49	A370	LowOH1	20060904	wcreduc_06bh49_a370_lowoh1_20060904.pro
		LowOH1	20061003	wcreduc_06bh49_a370_lowoh1_20061003.pro
		Y	20060909	wcreduc_06bh49_a370_y_20060909.pro
06BC24	D3	J	20070126	wcreduc_06bc24_d3_j_20070126.pro
		Ks	20070128	wcreduc_06bc24_d3_ks_20070128.pro
etc...				

`I`iwi runs IDL scripts in parallel on 2+ different computers

WIRCam Processing Queue for albert

File Edit View Help

Semester: 06B | Log | Remove | Kill | Hold | Enqueue | Script... | wcreduc_06bh49_a370_y_20 | Value: 06BH49 | Start Queue 06B

	Script_Name	Object	Runid	Crunid	Filter	Night	Priority	Status	Date_Queued	Date_Started	Date_Completed/Updated	Du
1	wcreduc_06bh49_a370_lowoh1_20060904	A370	06BH49	06Bw01	LowOH1	20060904	5	COMPLETED	2007-04-25HST19	2007-04-25HST19	2007-04-25HST20:29:48	0::
2	wcreduc_06bh49_a370_lowoh1_20061106	A370	06BH49	06Bw03	LowOH1	20061106	5	COMPLETED	2007-04-25HST20	2007-04-25HST20	2007-04-25HST20:35:38	0::
3	wcreduc_06bh49_a370_lowoh1_20061108	A370	06BH49	06Bw03	LowOH1	20061108	5	COMPLETED	2007-04-25HST19	2007-04-25HST19	2007-04-25HST19:41:06	0:!
4	wcreduc_06bh49_a370_y_20060901	A370	06BH49	06Bw01	Y	20060901	5	COMPLETED	2007-04-24HST21	2007-04-24HST22	2007-04-25HST00:30:46	2::
5	wcreduc_06bh49_a370_y_20060902	A370	06BH49	06Bw01	Y	20060902	5	COMPLETED	2007-04-24HST21	2007-04-24HST22	2007-04-25HST00:29:46	2::
6	wcreduc_06bh49_a370_y_20060903	A370	06BH49	06Bw01	Y	20060903	5	COMPLETED	2007-04-24HST21	2007-04-24HST22	2007-04-25HST00:10:27	1:!
7	wcreduc_06bh49_a370_y_20060905	A370	06BH49	06Bw01	Y	20060905	5	COMPLETED	2007-04-24HST21	2007-04-24HST22	2007-04-24HST23:27:26	1:!
8	wcreduc_06bh49_a370_y_20060908	A370	06BH49	06Bw01	Y	20060908	5	COMPLETED	2007-04-24HST21	2007-04-24HST22	2007-04-25HST00:04:50	1::
9	wcreduc_06bh49_a370_y_20060909	A370	06BH49	06Bw01	Y	20060909	5	COMPLETED	2007-04-24HST21	2007-04-24HST22	2007-04-24HST23:36:15	0:!
10	wcreduc_06bh49_a370_y_20060910	A370	06BH49	06Bw01	Y	20060910	5	COMPLETED	2007-04-24HST21	2007-04-24HST22	2007-04-24HST23:03:36	0::
11	wcreduc_06bh49_rsync_to1disk	ALL	06BH49	ALL	ALL	ALL	101	COMPLETED	2007-04-25HST20	2007-04-25HST20	2007-04-25HST20:54:15	0::
12	wcreduc_06bt09_ic348_ch4on_20070101	IC348	06BT09	06Bw04	CH4On	20070101	5	COMPLETED	2007-04-11HST16	2007-04-11HST16	2007-04-11HST18:29:51	2::
13	wcreduc_06bt09_ic348_h_20060907	IC348	06BT09	06Bw01	H	20060907	5	COMPLETED	2007-04-11HST16	2007-04-11HST16	2007-04-11HST17:33:06	1::
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15	wcreduc_06bt09_ic348_ks_20060907	IC348	06BT09	06Bw01	Ks	20060907	5	COMPLETED	2007-04-11HST16	2007-04-11HST16	2007-04-11HST17:23:15	1:!
16	wcreduc_06bt09_ic348_y_20060907	IC348	06BT09	06Bw01	Y	20060907	5	COMPLETED	2007-04-11HST16	2007-04-11HST16	2007-04-11HST16:47:30	0::
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halea: load 0.0 0 scripts disk 61% ula: load 0.1 0 scripts disk 93%

Current Work

- Data Flow & Sky Construction
- Non-Linearity
- Crosstalk
- Photometric Calibration

Array Response Linearity

Flux (ADU)

5×10^4
4×10^4
3×10^4
2×10^4
1×10^4
0

0
20
40
60
80

Deviation of Response from Linear Fit

Deviation (%)

2
0
−2
−4
−6
−8
−10

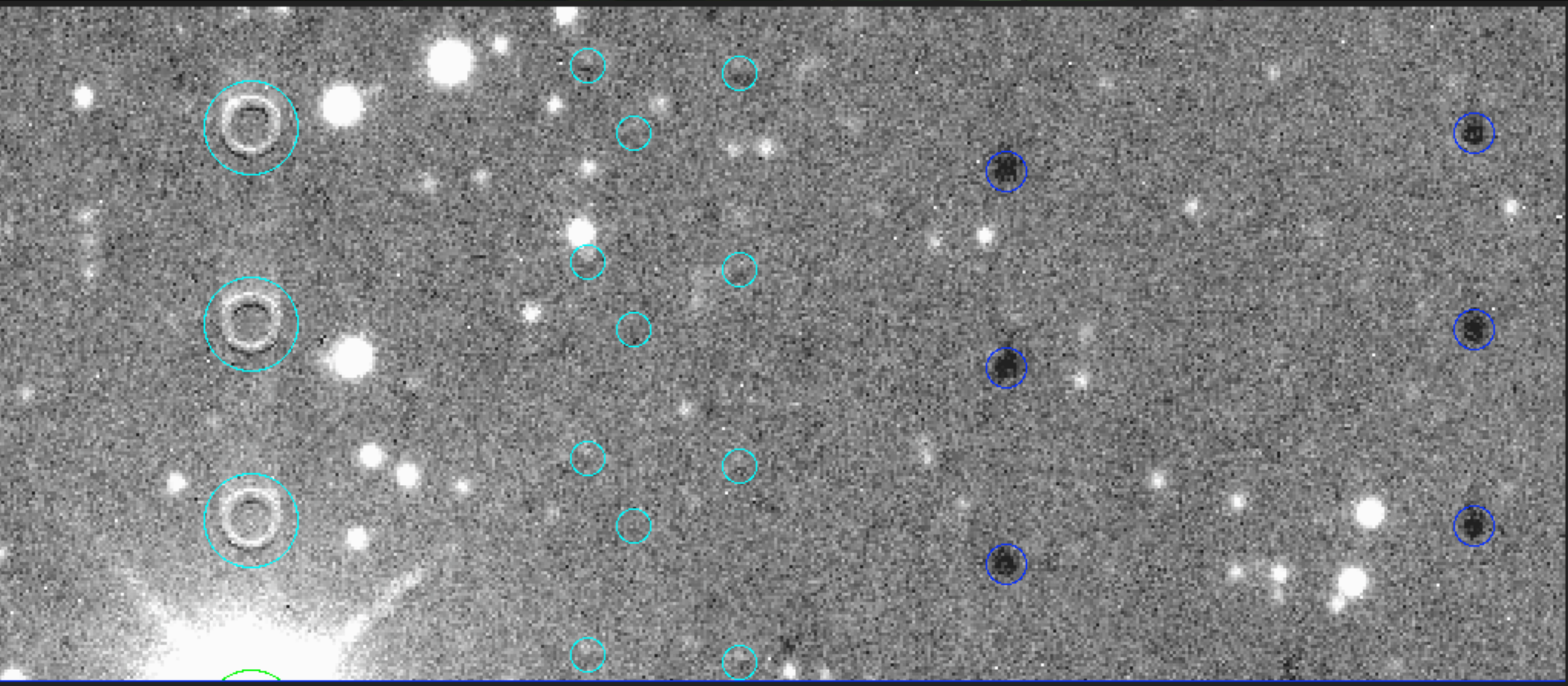
0
20
40
60
80

Effective Exposure Time (s)

Current Work

- Data Flow & Sky Construction
- Non-Linearity
- Crosstalk
- Photometric Calibration

Negative and Edge Crosstalks

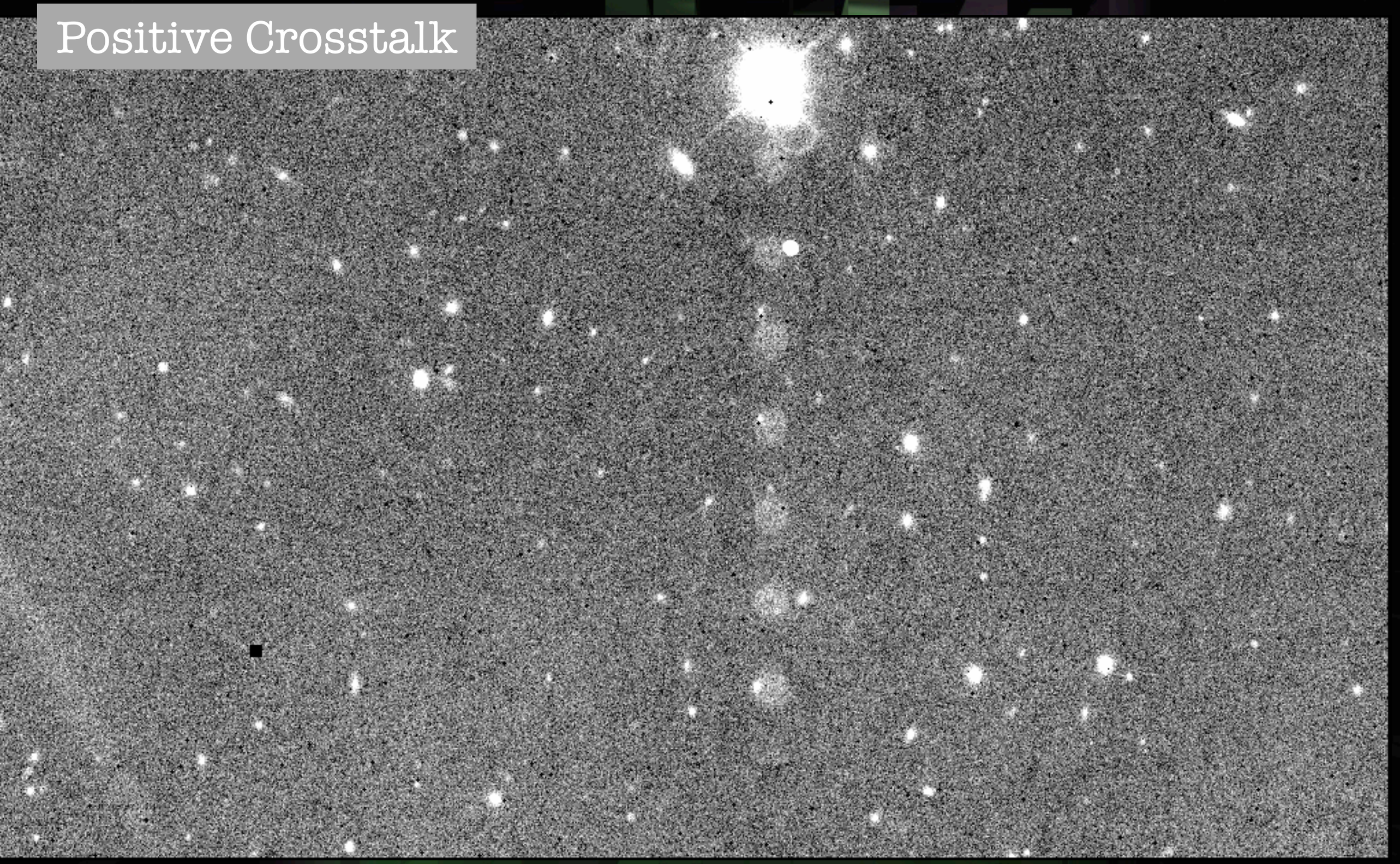


Median of the 32 amplifiers isolates commonalities

Edge Crosstalk

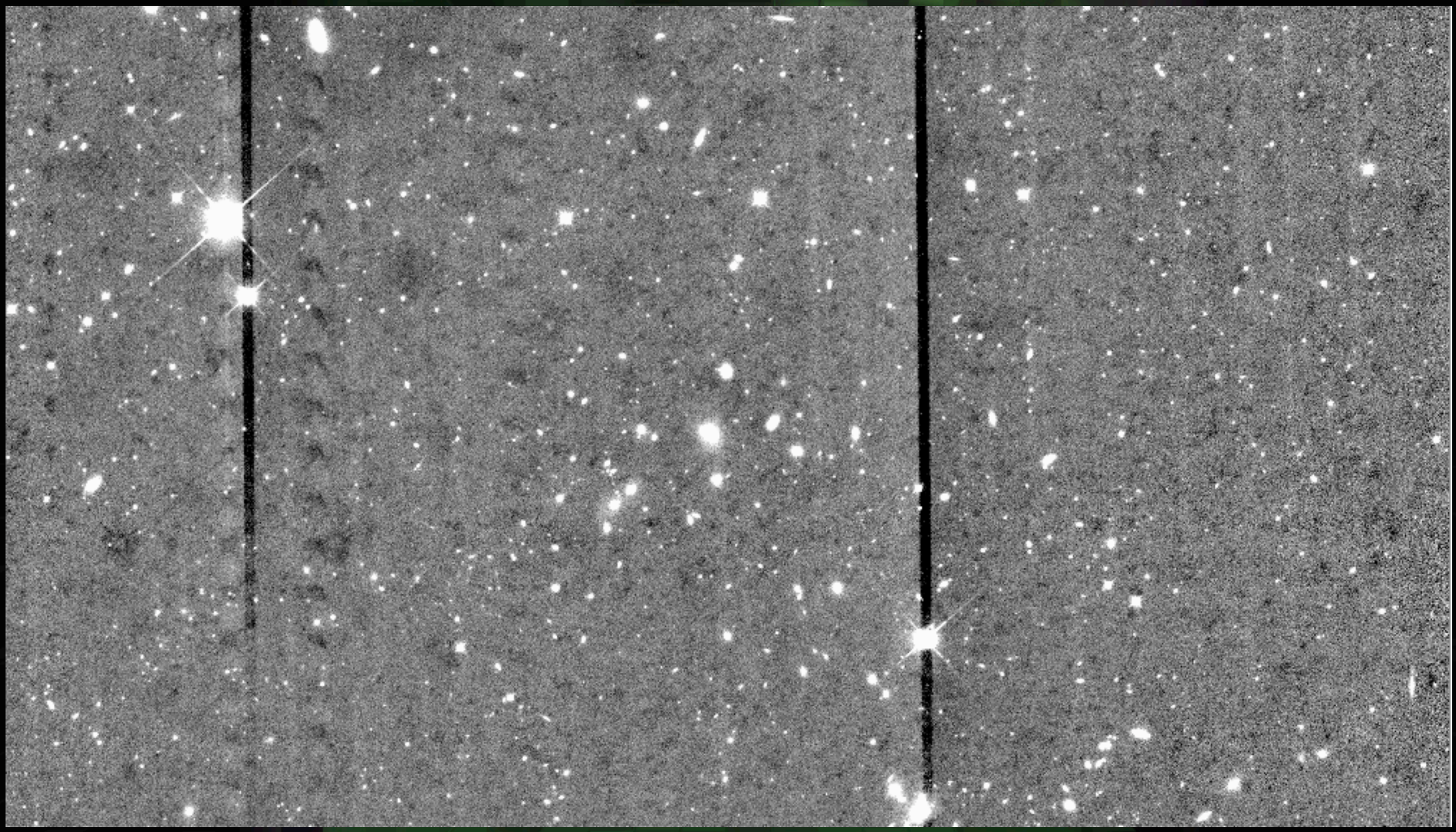
Negative Crosstalk

Positive Crosstalk

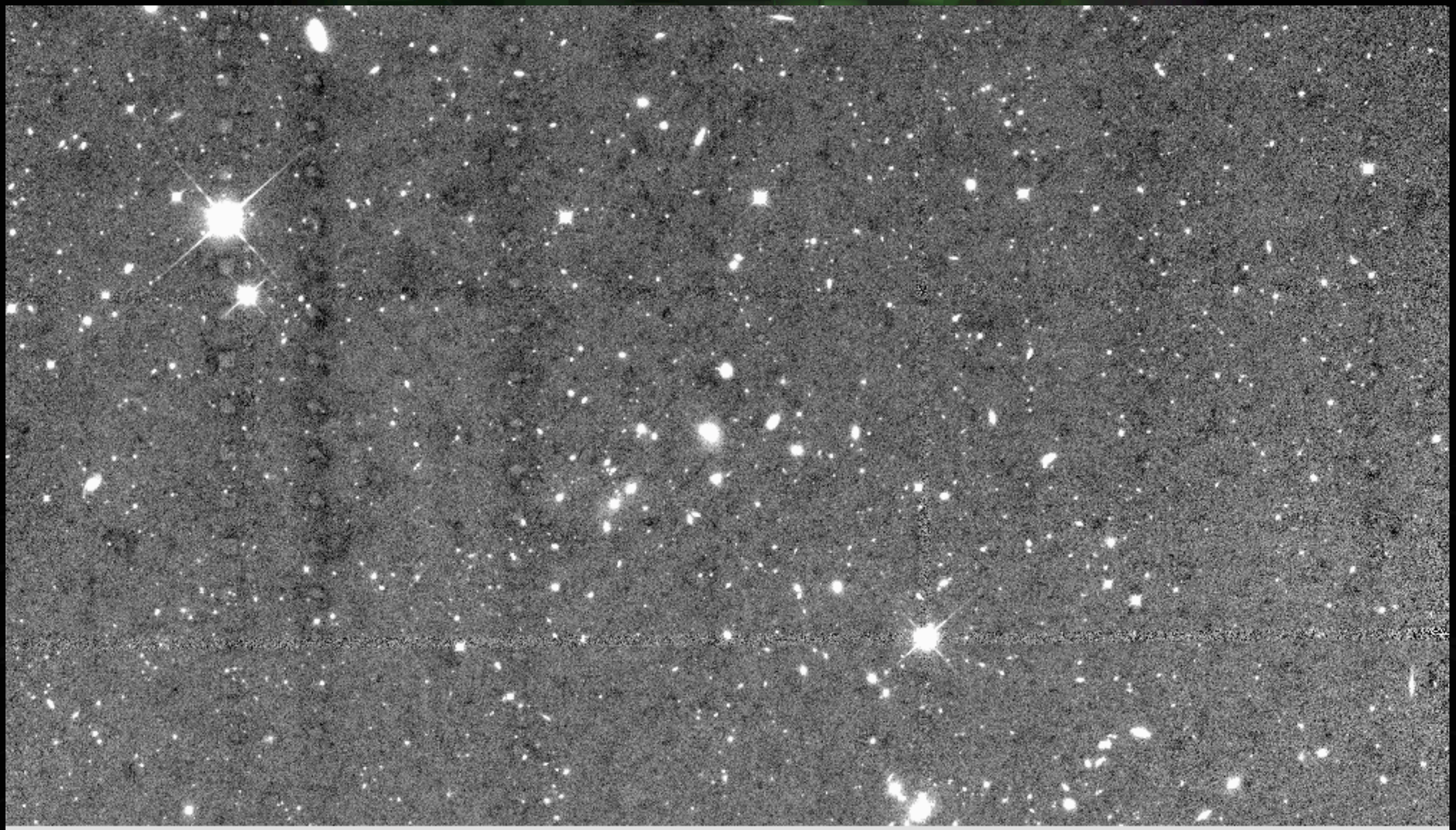


Median of the 8 amplifiers (1 video board)

February 2007



April 2007

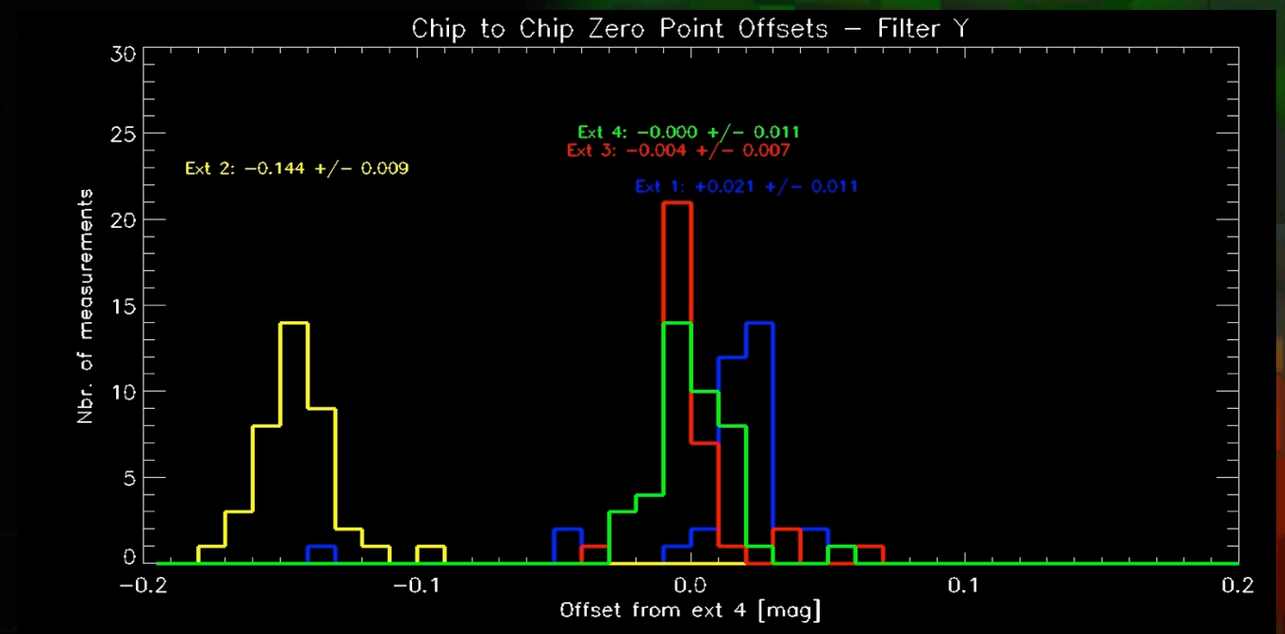


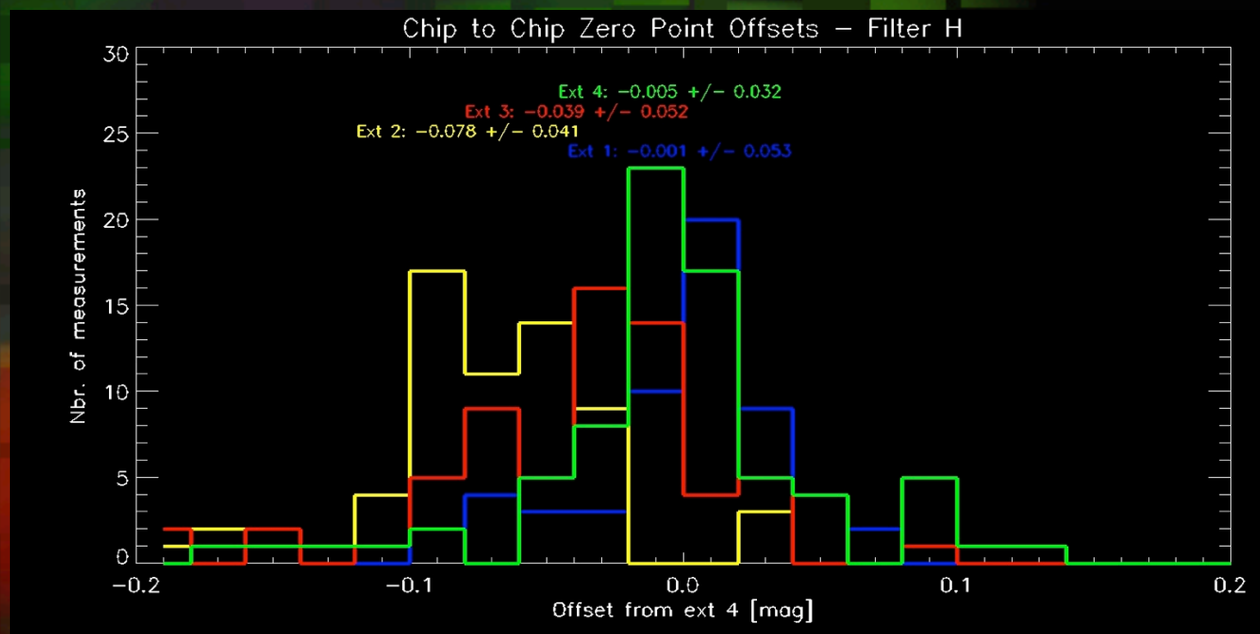
Current Work

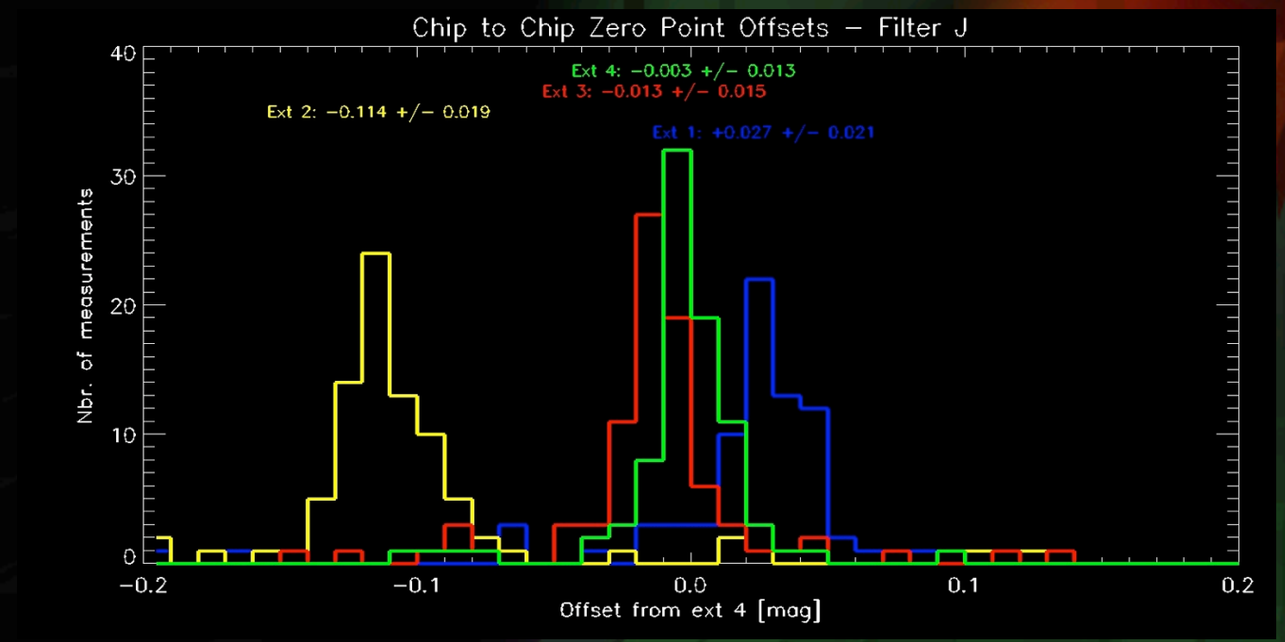
- Data Flow & Sky Construction
- Non-Linearity
- Crosstalk
- Photometric Calibration

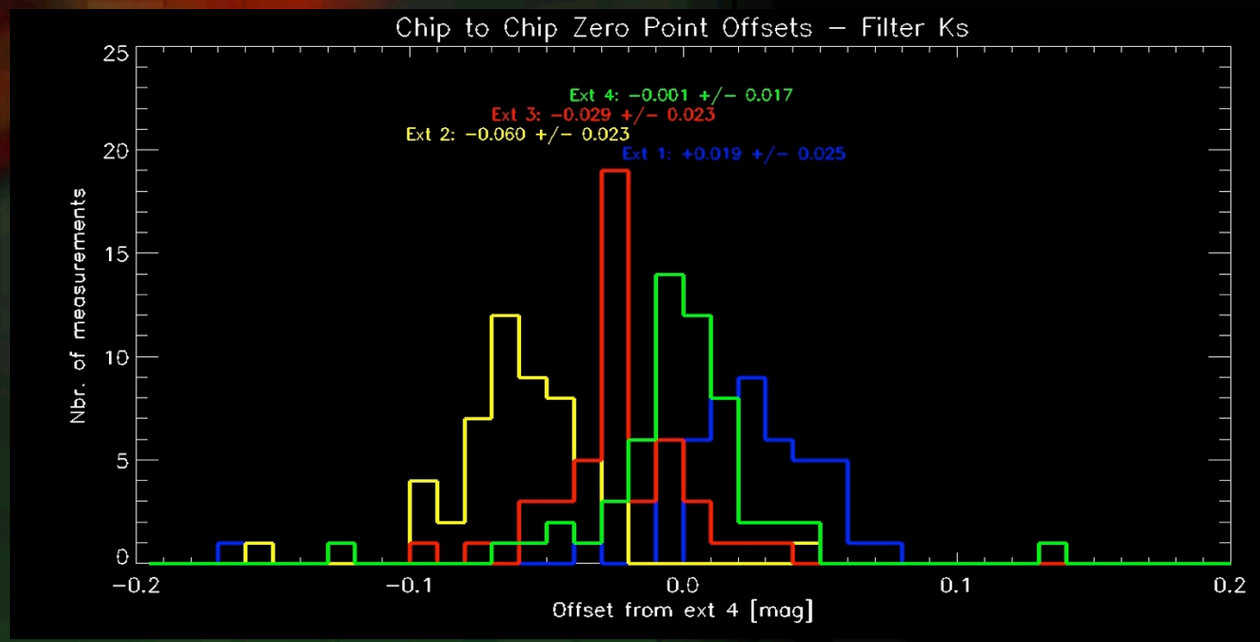
Photometric Calibration on Standard Stars

1. Chip to Chip Zero Point Offset



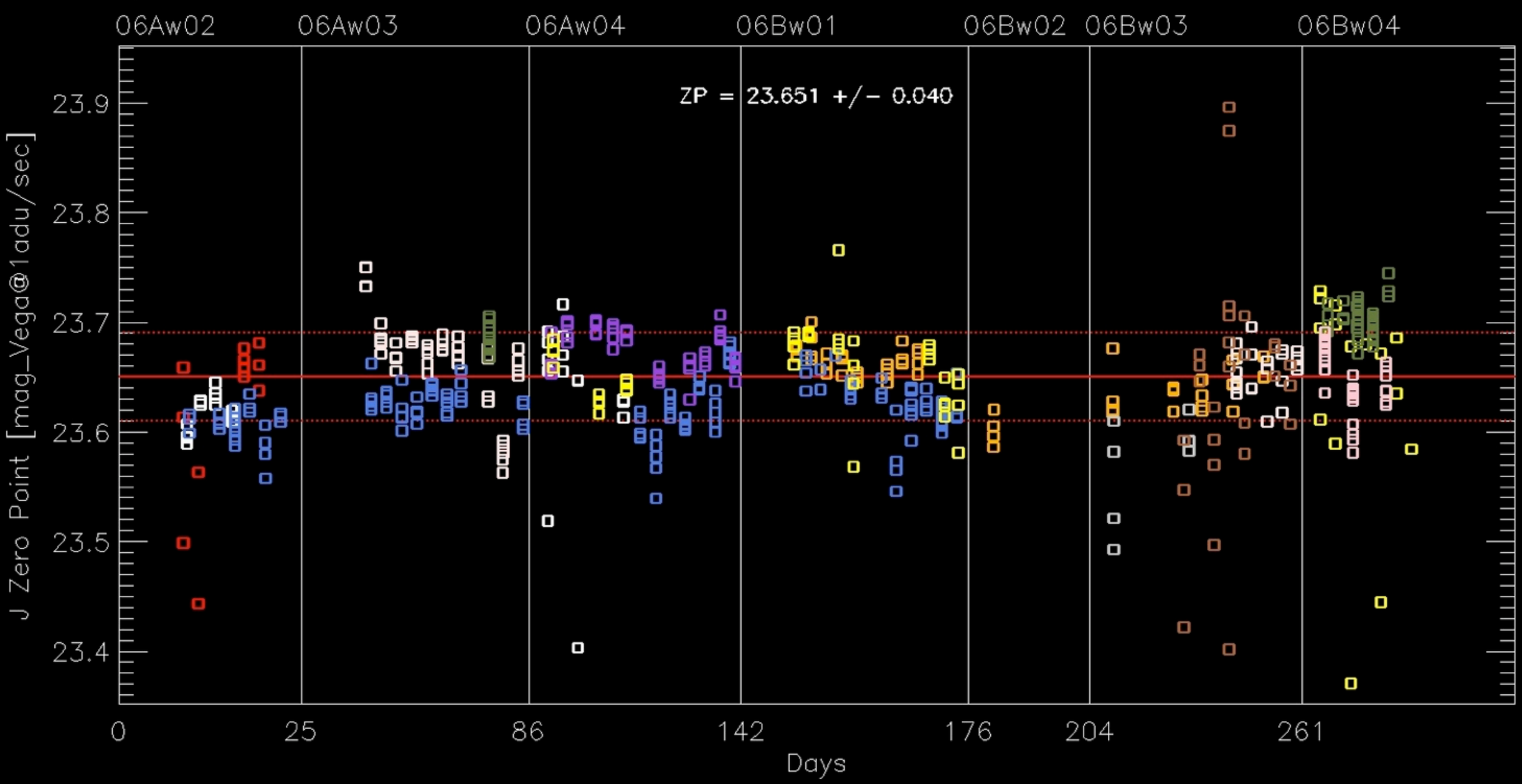






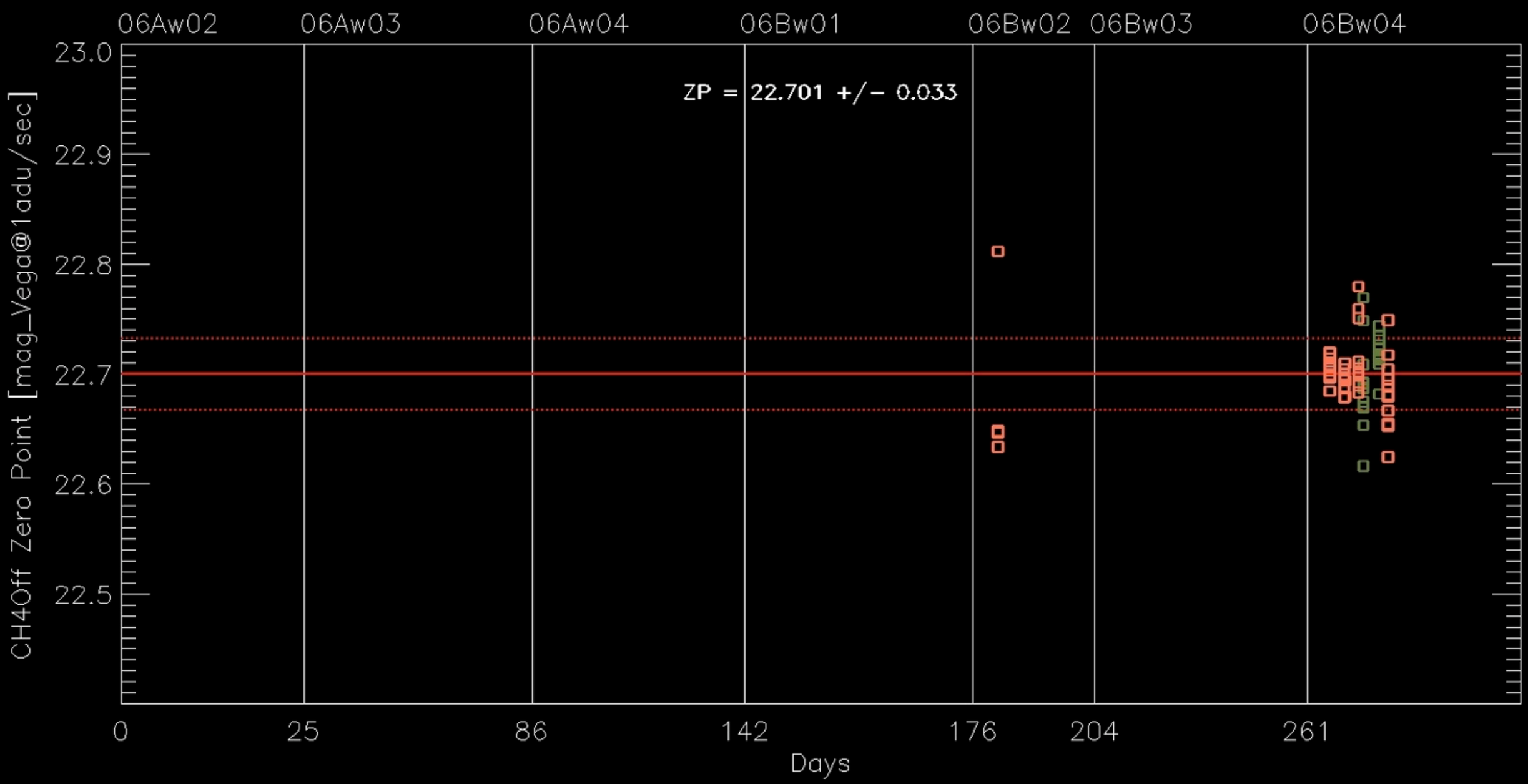
2. Zero Point vs. Time

a) Wide Band filters



2. Zero Point vs. Time

b) Narrow Band filters



- Use 4 CALSPEC spectrophotometric standards with NIR models.

- Compute Absolute ZP using filter curves.

2. Zero Point vs. Time

c) Zero Point Table

Filter	ZP (mag @ 1 adu/sec)	
Y	23.820	0.099
J	23.651	0.040
H	23.811	0.063
KS	23.083	0.049
LOWOH1	21.008	0.072
LOWOH2	25.0	9.999
CH4ON	22.698	0.053
CH4OFF	22.687	0.044
H2	20.530	0.078
KCONT	25.0	9.999
BRG	20.379	0.079

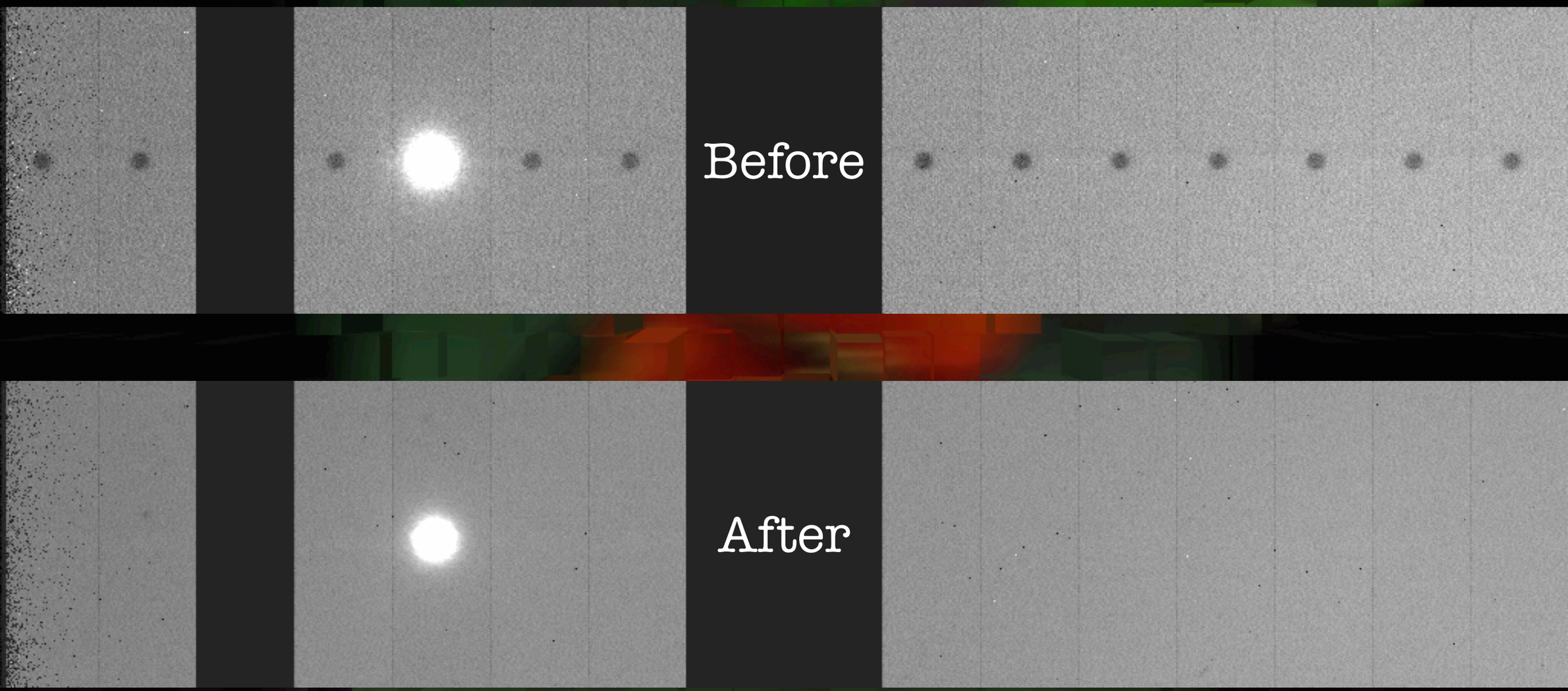
To do: Same analysis with 2MASS field stars from archived data

Latest news! Tests in the lab

=> Engineering detector

=> 32 amps / 4 video board controller - same clocking

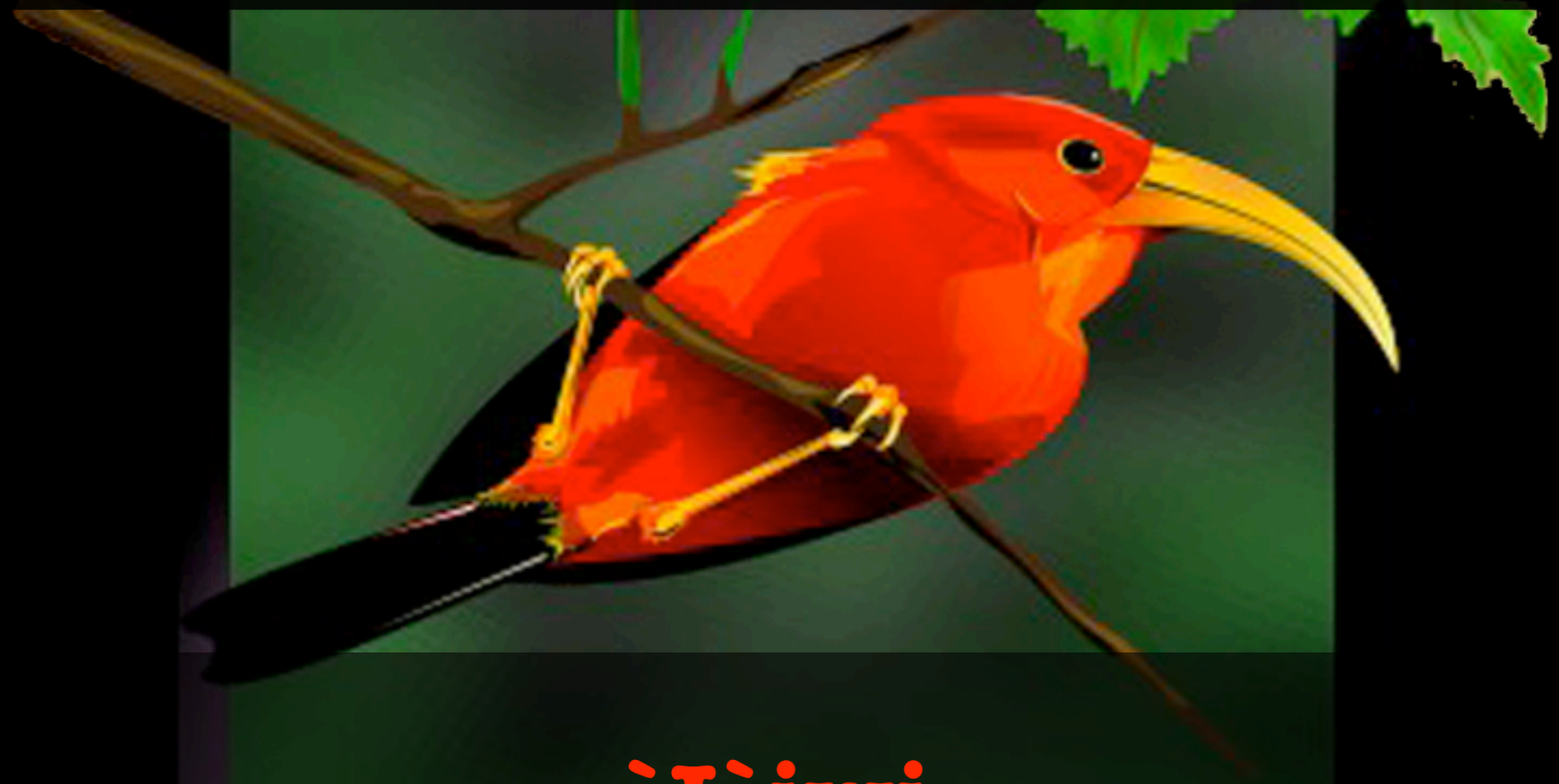
=> Change V_{ref} bias voltage



Questions?

Also see 2 posters on the WIRCam instrument:

1 - The WIRCam On-Chip Guider
2 - WIRCam Design and Performances



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