

Observation Strategy and On-orbit Status of MIRIS

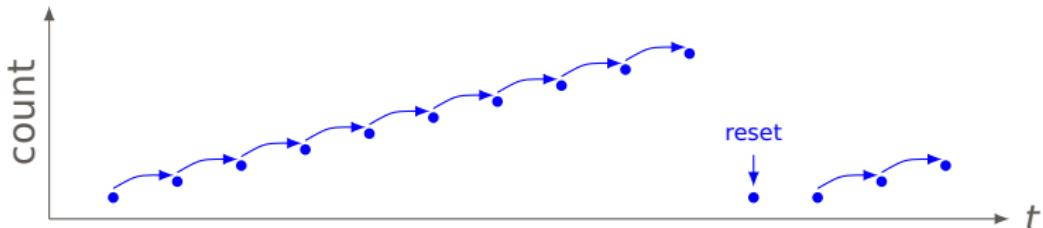
Jeonghyun Pyo & MIRIS Team



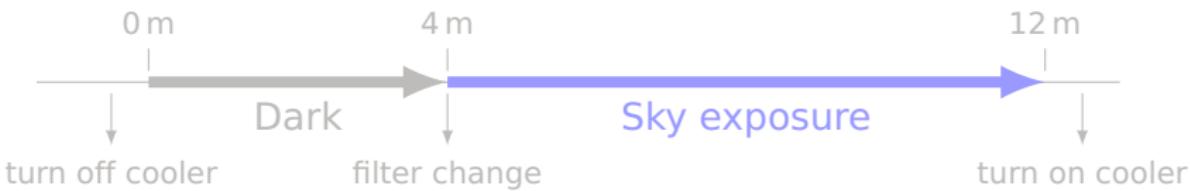
MIRIS Workshop
2015 January 28

Observation Strategy

- Integration per frame: 2 seconds
- Integration for 10 frames, then reset the detector



- Dark current exposures for 4 minutes, followed by sky exposures for 8 minutes

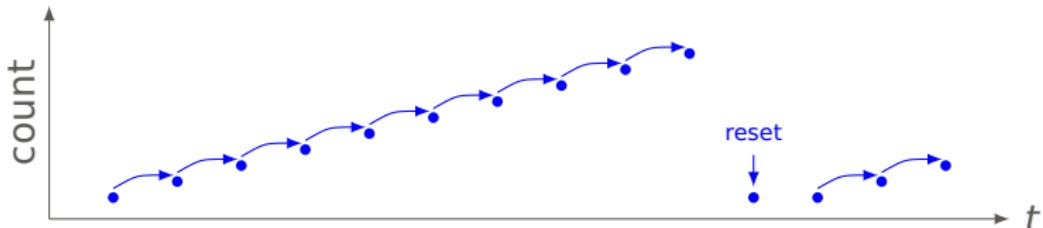


- Effective sky exposure time per observation:

$$8 \text{ min.} \times \frac{9}{11} = 6.5 \text{ min.}$$

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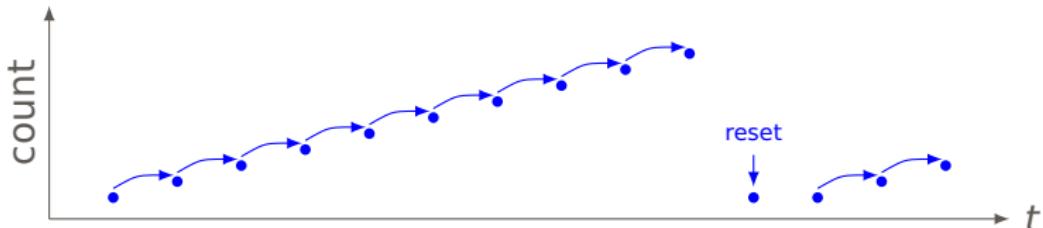


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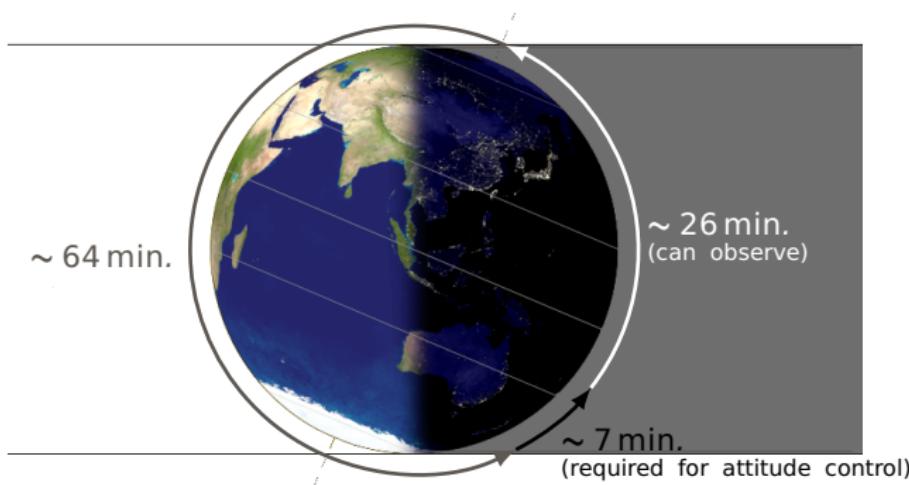


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Observation Strategy

- Observation only during eclipse, avoiding SAA



■ Avoidances

- Sun avoidance: 90° (except during GS contact)
- Moon avoidance: 35° (PAAL & PAAC) or 80° (I & H)
- Earth limb avoidance: 35°

Observation Strategy

- Number of observations per day (2014 Dec.-)
 - 2 orbits every two days for NEP Monitoring
 - 9 orbits per day from Tue. to Thu. for MIPAPS
 - 7 orbits per day from Fri. to Mon. for MIPAPS
- Data size per observation
 - Raw, binary data: 48 MB
 - After FITS conversion: 90 MB

Observation Strategy

Operation Phases

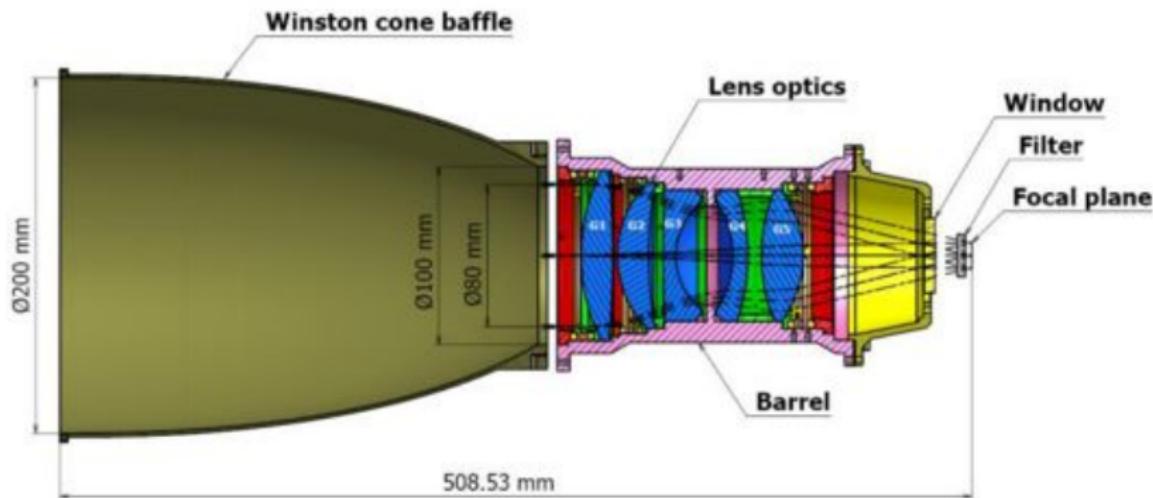
Orbits / day

| Mission | 1 st Phase (1 mo) 2014 Mar. | 2 nd Phase (5 mo) Apr.~Aug. | 3 rd Phase (2 mo) Sep.~Dec. | 4 th Phase (5 mo) Nov.~'15 Mar. | 5 th Phase (> 8 mo) '15 Apr.~ |
|---------|--|--|--|--|--|
| CIB | 8 | | 7 | | |
| MIPAPS | | 7 | | 7 or 9 | Open Time |
| NEPMON | 2 | 1 | 1 | 1 | |

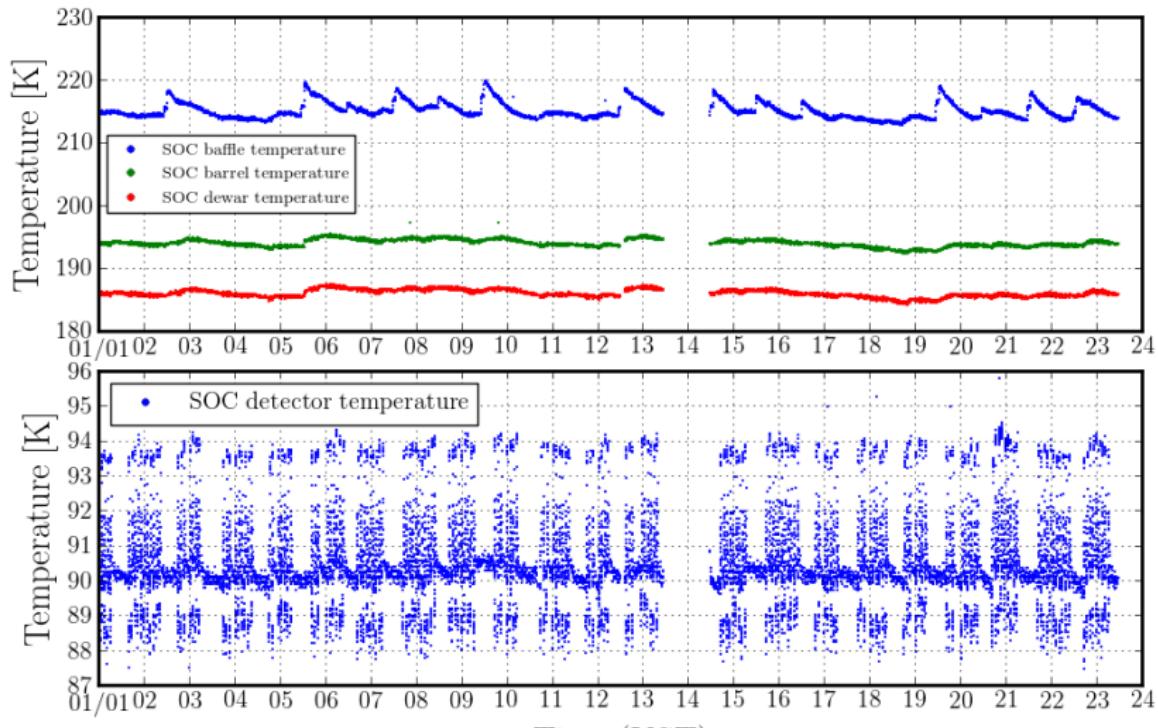
Temperature Control

Requirements

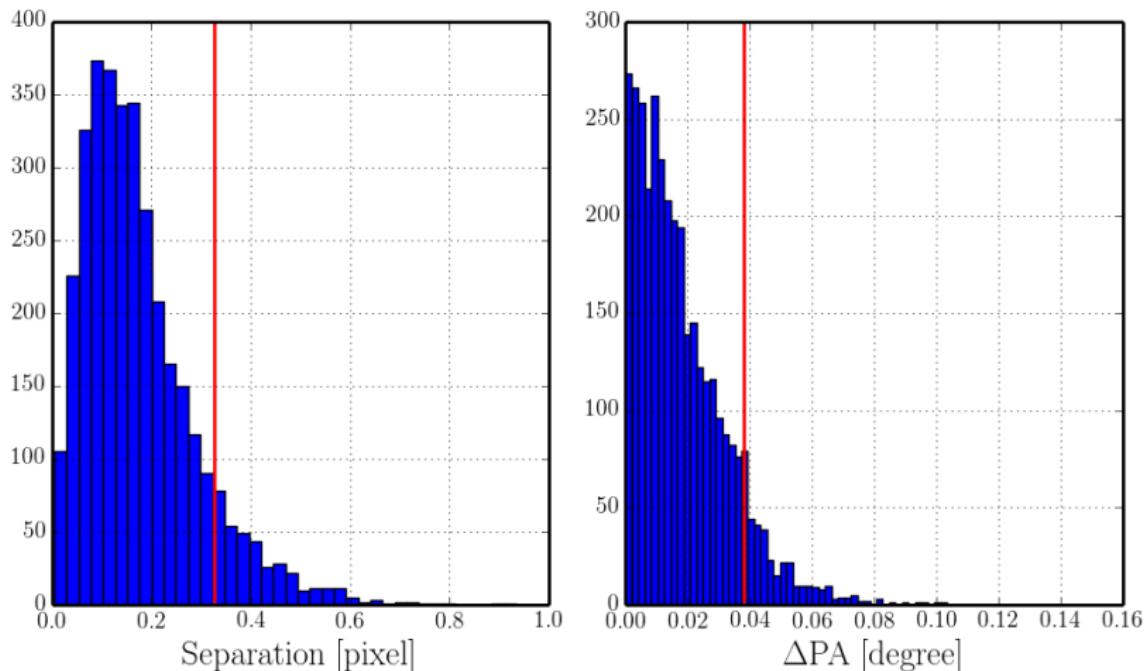
- Baffle: < 230 K through passive cooling
- Telescope: < 200 K through passive cooling
- Detector: ~ 90 K through active cooling



Temperature Control

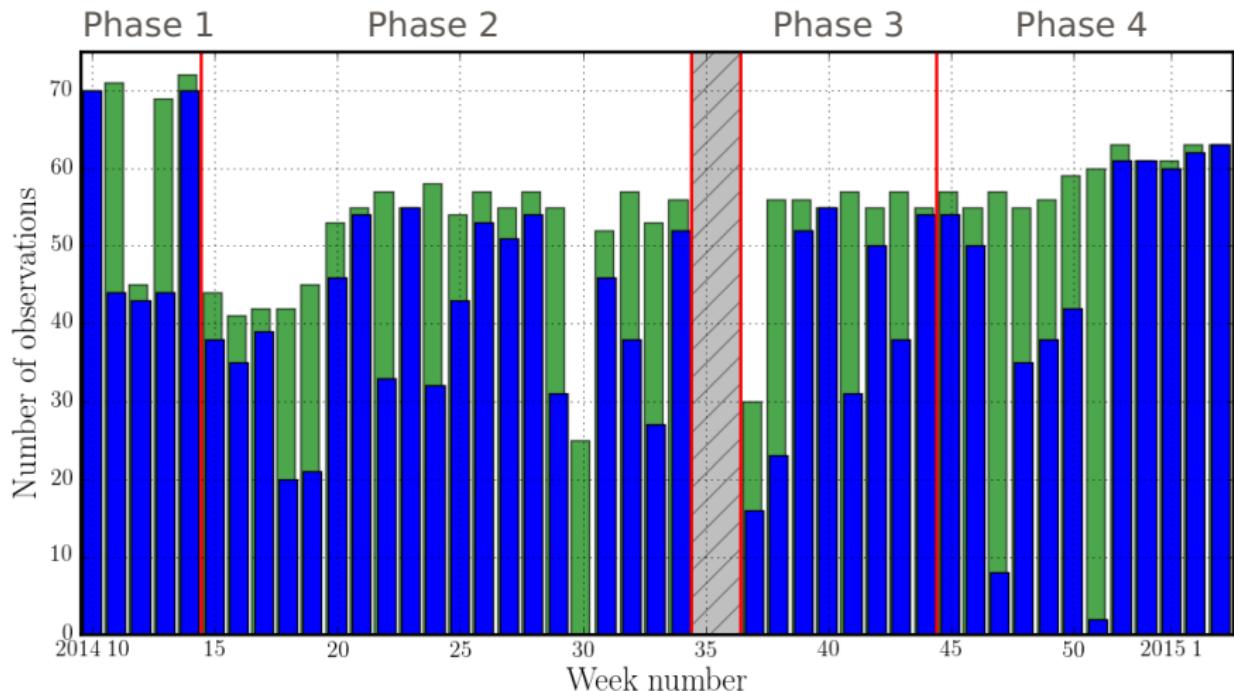


Attitude Control



For the case of NEP Monitoring observations during 2015 Jan.

Observation Statistics



Observation Statistics

| Proposal | Observations | Percentage |
|----------|--------------|------------|
| MIPAPS | 1125 | 58.8% |
| NEPMON | 261 | 13.7% |
| NEPCIB | 197 | 10.3% |
| SGPCIB | 100 | 5.2% |
| NGPCIB | 83 | 4.3% |
| PAAPOB | 80 | 4.2% |
| PAFLAT | 31 | 1.6% |
| Others | 35 | 1.8% |
| Total | 1912 | 100.0% |

(by 2015 Jan. 28)

- **SOCdr**: Data reduction pipeline for SOC images
- **Python**-based, **Astropy**-powered
- Use external programs, *Astrometry.net*, *SExtractor* and *Montage*, for post-processing
- Components of SOCdr
 - **getfits()**: Wraps functions to query database and to convert raw data to FITS format
 - **MainProcessing**: Class wrapping main processing components
 - **PostProcessing**: Class wrapping post-processing components

SOCdr » Pre-processing (preproc)

MIRIS.dat(, ancil.)



Register to DB



obsid, observer, proposal,

MySQL Database

Obtain data from DB



SOC0123456789.dat

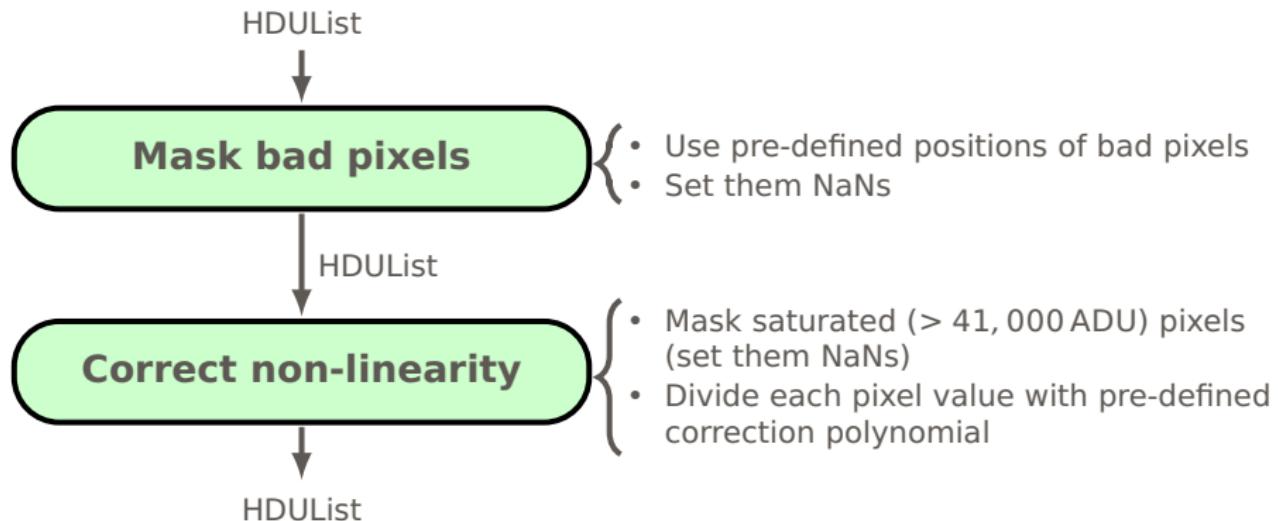


Convert to FITS



HDUList

- Remove or fix bad frames
- Remove data from reset frames
- Convert raw header info. to meaningful values (time, filter, coordinates, etc.)
- Make multi-HDU FITS file



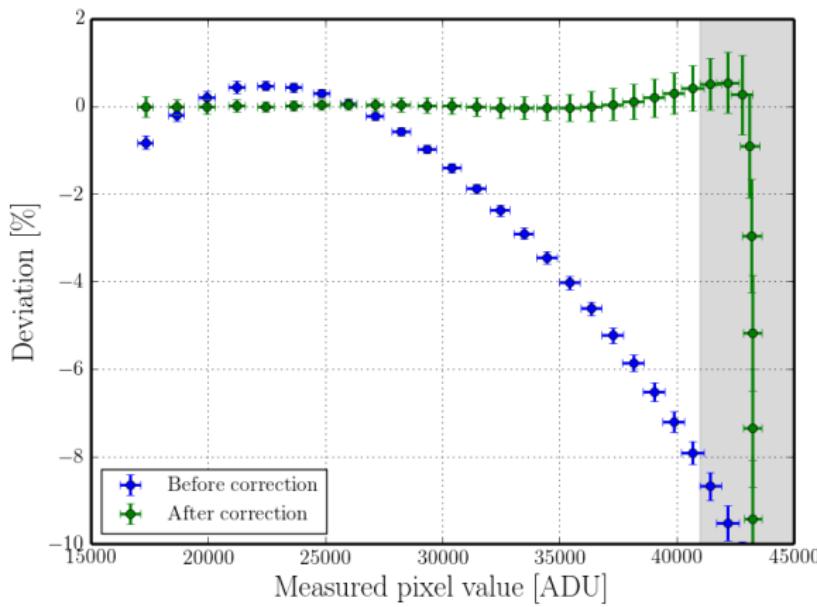
Mask bad pixels

- Found during checking the linearity of each pixel
- In total, 17 bad pixels were found.



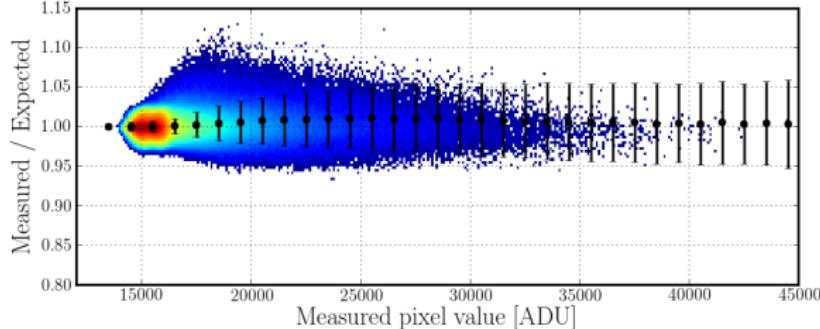
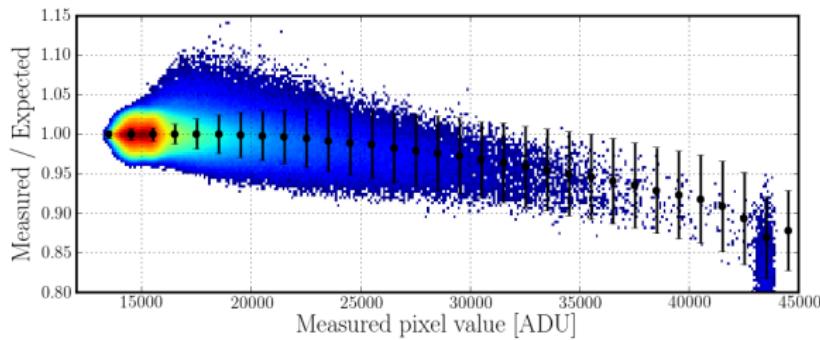
Correct non-linearity

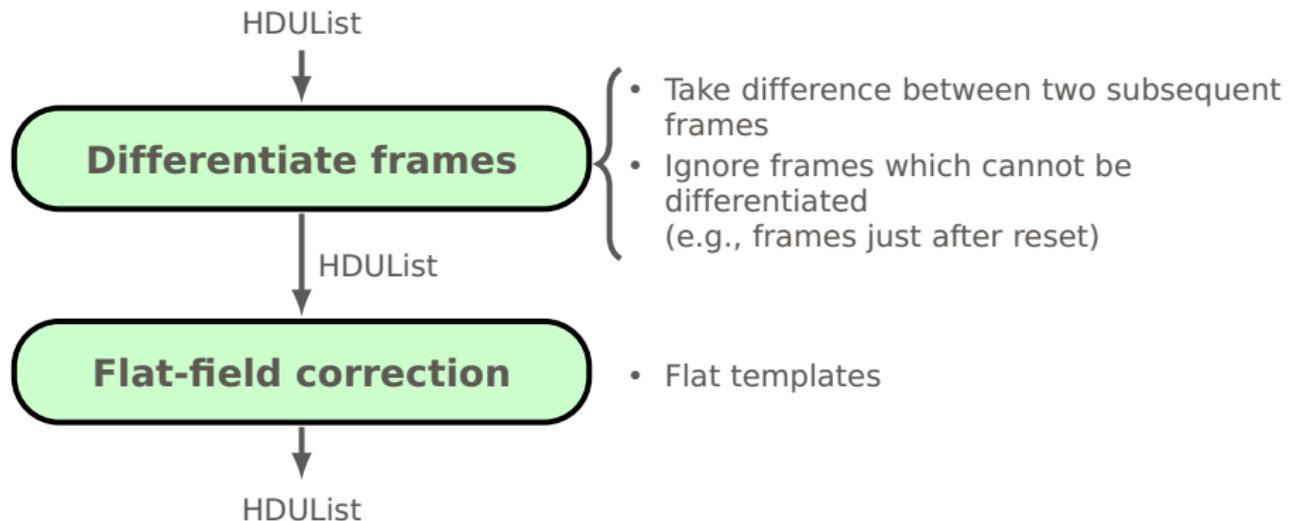
- Correction by dividing measured pixel values with 4th order polynomial based on the lab experiment



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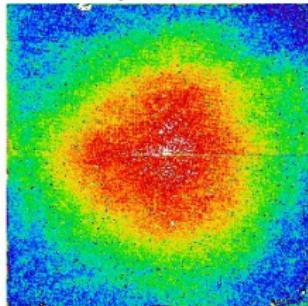




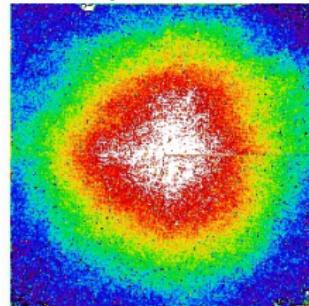
SOCdr » Main Processing (mainproc)

Flat-field correction

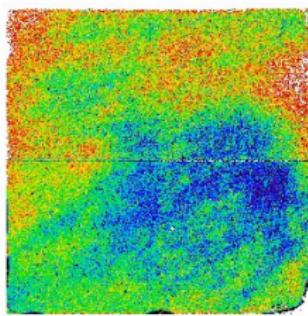
1.1 μm band



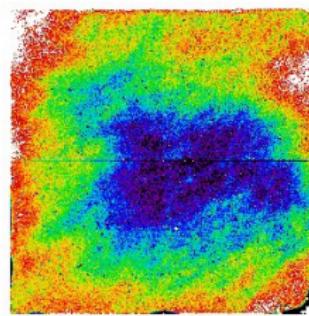
1.6 μm band



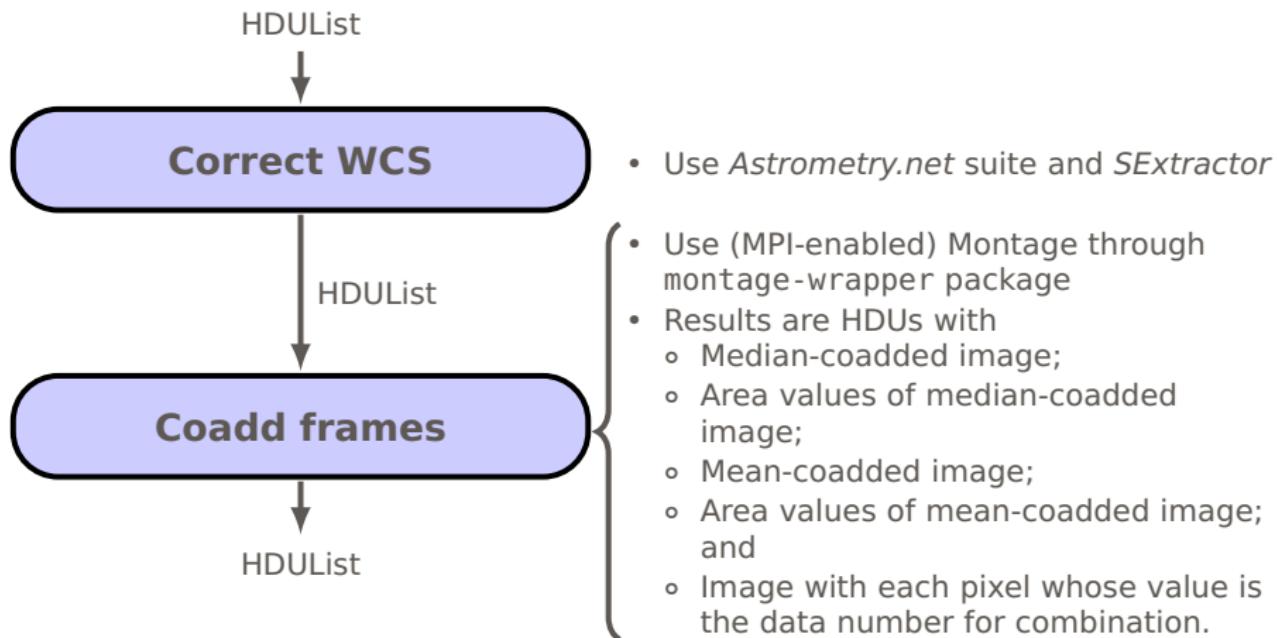
Pa α line filter



Pa α continuum filter

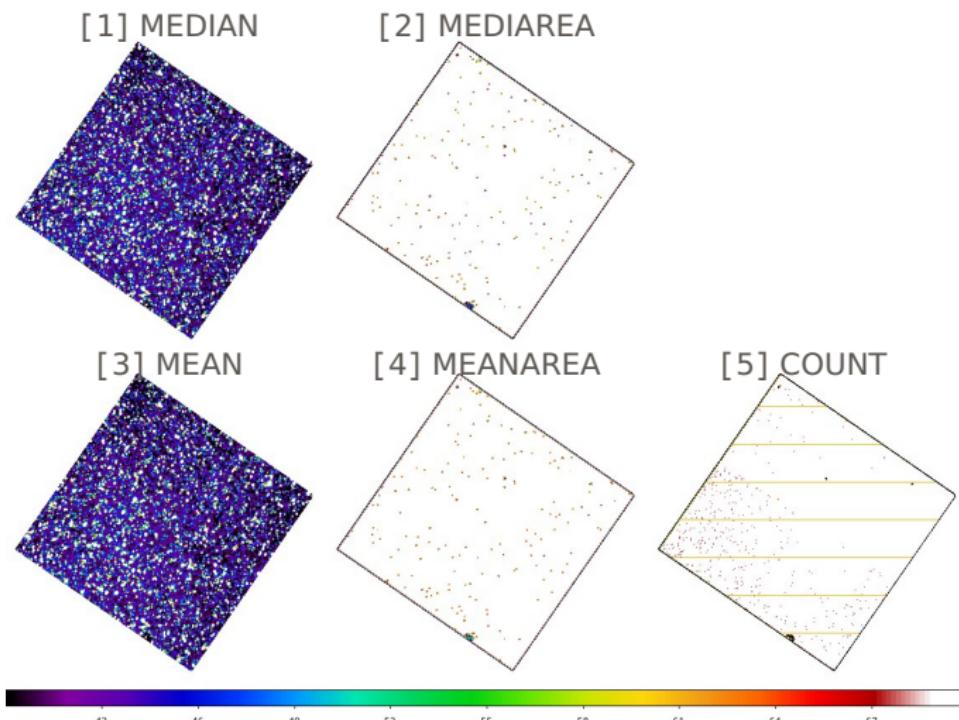


SOCdr » Post-processing (postproc)



SOCdr » Post-processing (postproc)

Coadded data (FITS w/ 5 HDUs)

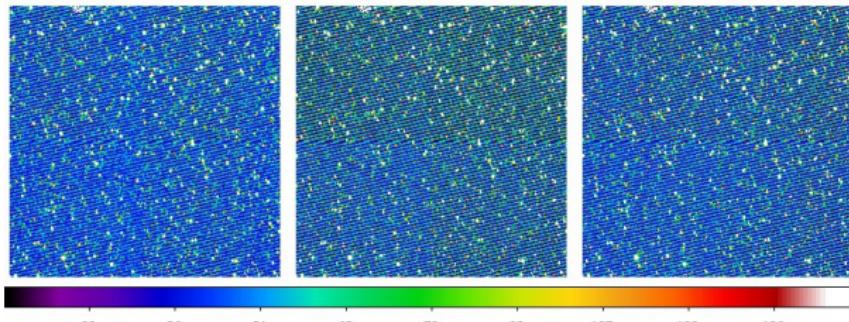


SOCdr » Usage Example

```
>>> import socdr
>>>
>>> mainproc = socdr.MainProcessing(flat=True,
...                                     distcorr=False)
>>> postproc = socdr.PostProcessing(stack=True, mpi=False)
>>>
>>> # if query matches only one pointed observation
>>> socfitsfile = socdr.getfits(your_query)
>>> # got astropy.io.fits.HDUList
>>> socfitsfile1 = mainproc(socfitsfile)
>>> # got processed astropy.io.fits.HDUList
>>> socfitsfile2 = postproc(socfitsfile1)
>>> # got combined astropy.io.fits.HDUList
>>>
>>> # if query matches multiple pointed observations
>>> socfitsfiles = socdr.getfits(your_query)
>>> # get list of astropy.io.fits.HDUList
>>> socfitsfiles1 = [mainproc(x) for x in socfitsfiles]
>>> socfitsfiles2 = [postproc(x) for x in socfitsfiles]
```

Future Plan

- On-orbit calibrations and corrections
 - Flat templates for the Pa α line and continuum filters
 - Absolute brightness calibration for all filters
 - Correction of instrumental noise



- Assessment of the performance and data quality
 - Point spread functions
 - Sensitivity
 - etc.