The WIYN One Degree Imager: Updates and recent progress

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02/18/2013 @ UW Madison

Content

- What is pODI
- User interfaces
- Image products
- What works and what doesn't
- Pipeline, Portal & archive
- Quicklook pipeline

What is pODI

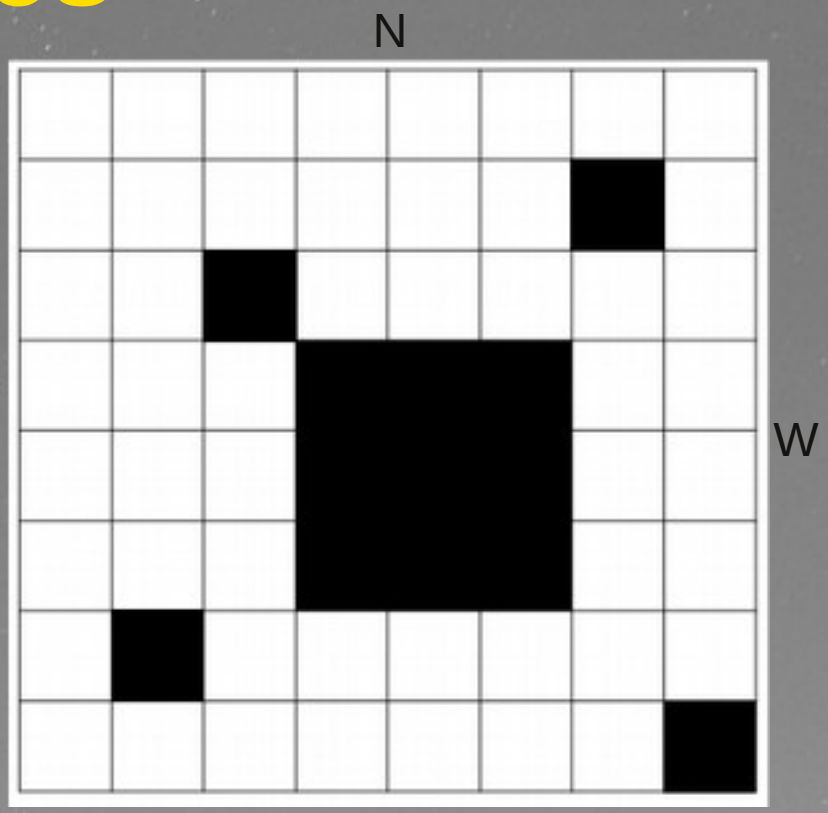
- Original plan (~2002-05):
- 1 square degree
- 64 OTAs with 4Kx4K → ~ 1 GPixel
- OT shifting as ~semi-adaptive optics to improve seeing
- Focus sensors to maintain perfect focus

ODI: Specs

Field of view:
~25x25 arcmin in center
+ 4x 8x8 “guide fields”

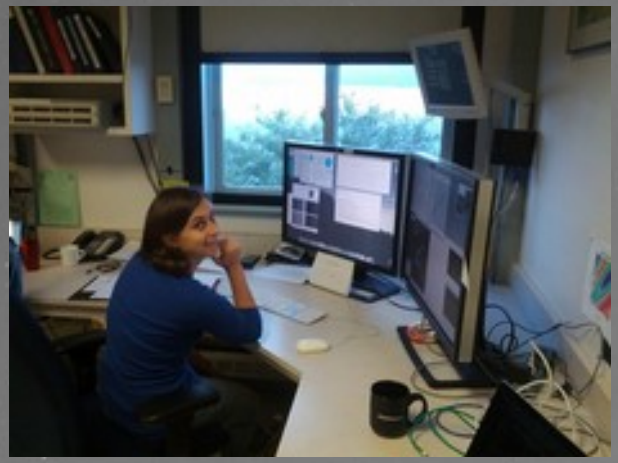
Pixelscale: 0.11"

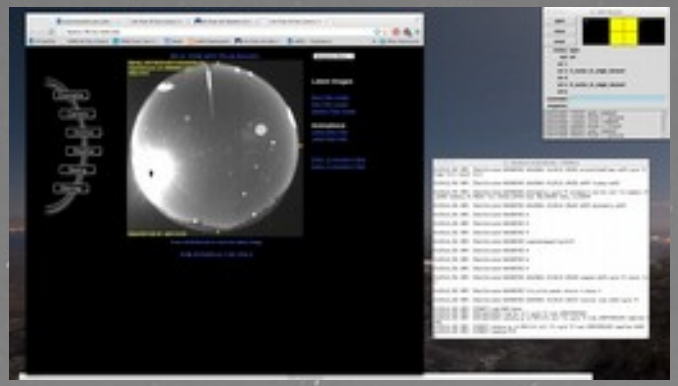
Readout-time: 7s

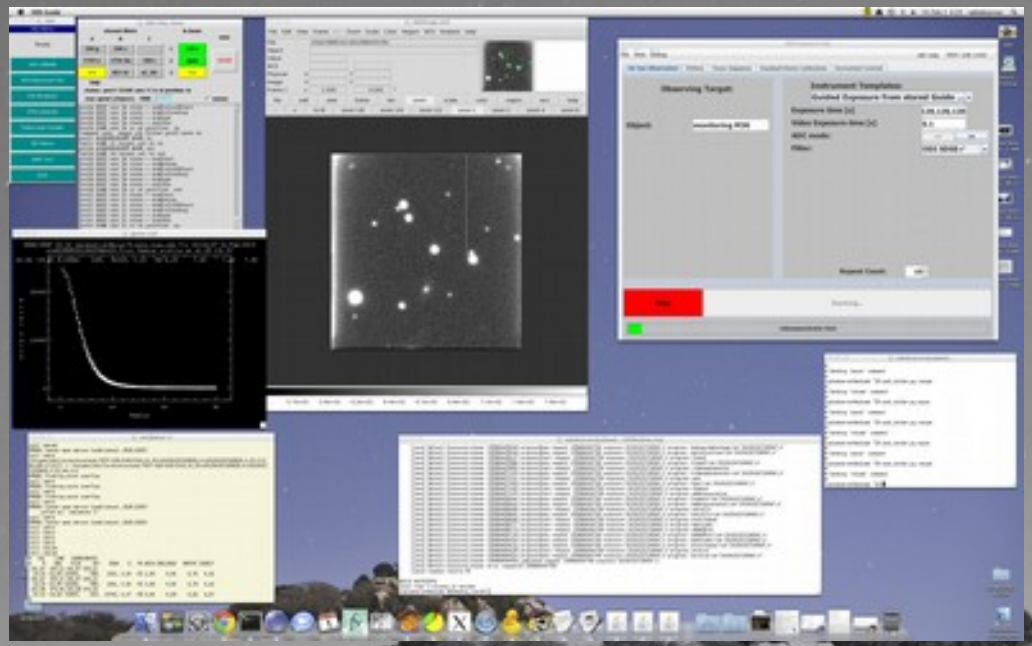


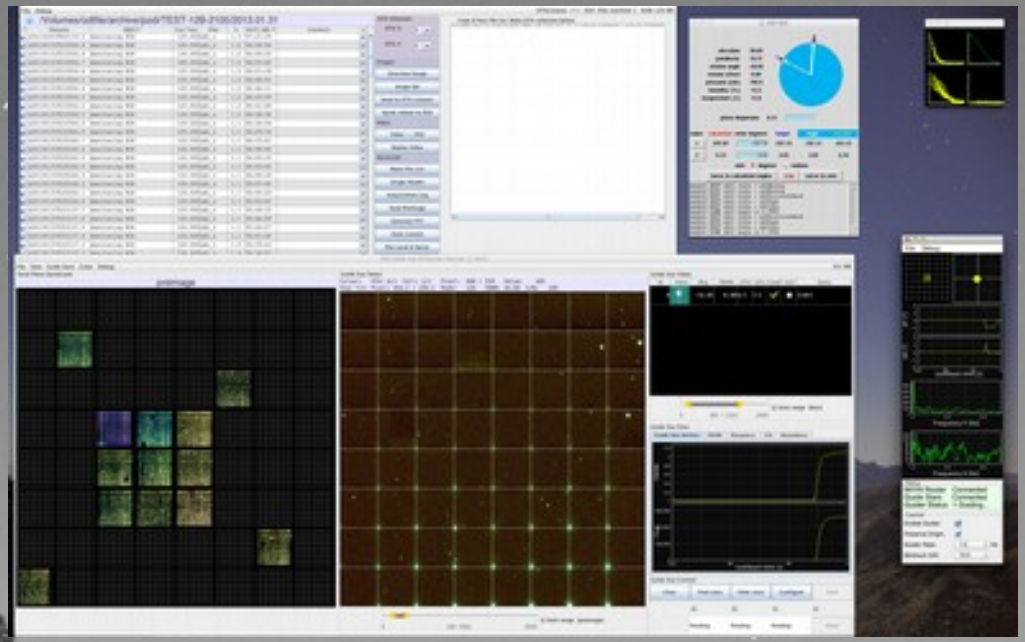
Filters: SDSS griz + SDSS u, Hα, OIII
+ all Mosaic filters on request

User interface

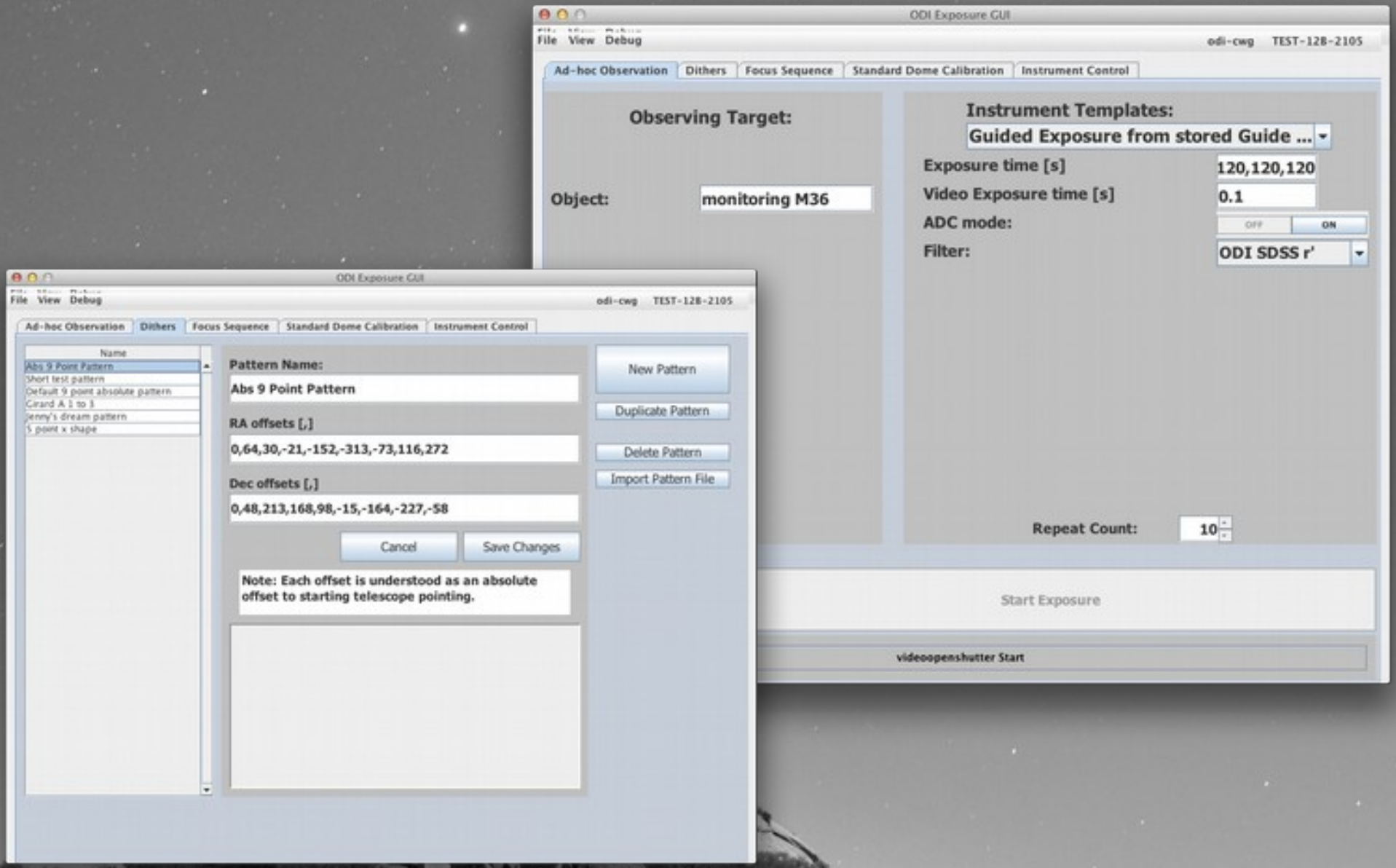




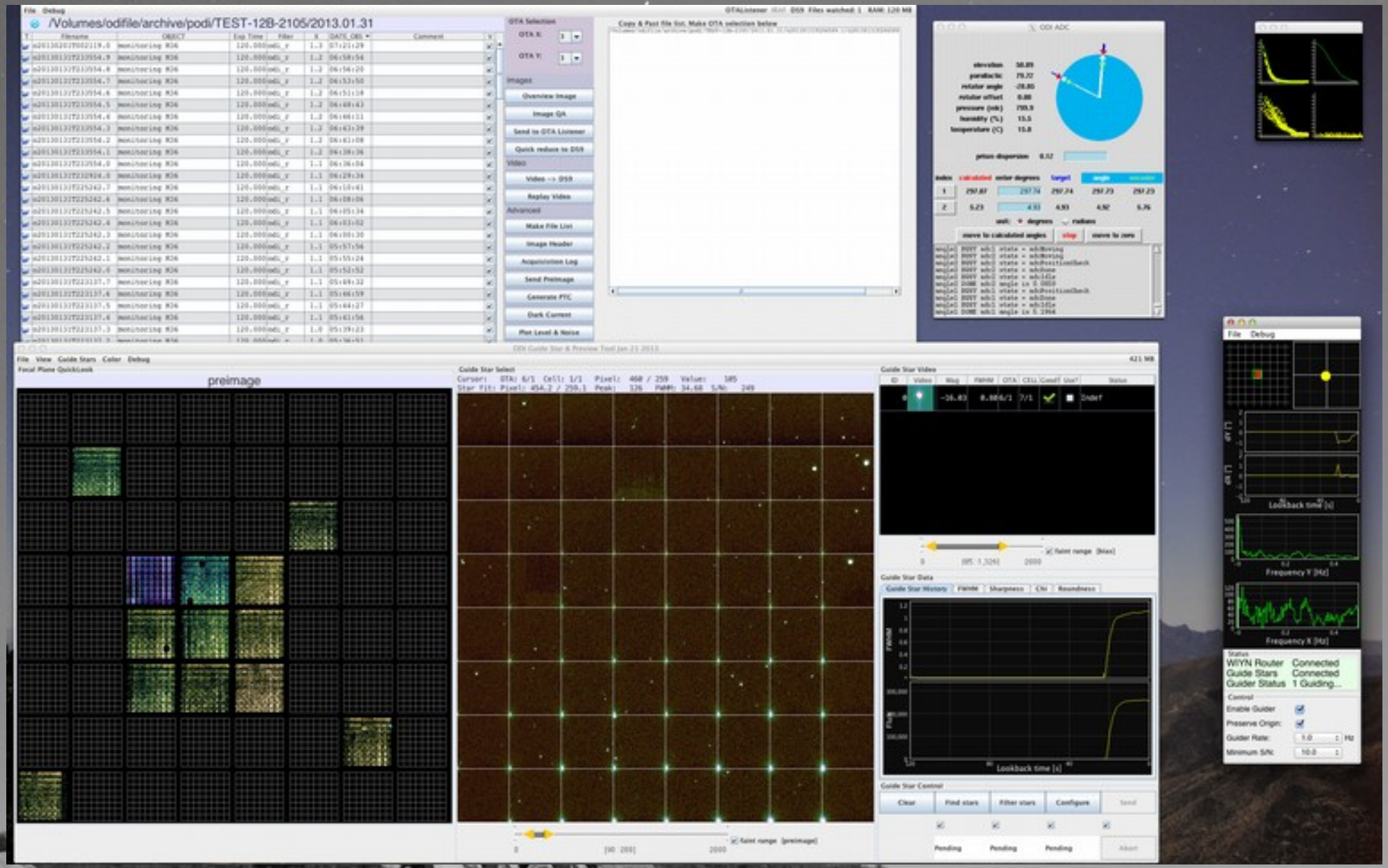




ODI exposure GUI



OTA Listener and Guide star tool



What does data look like?

rkotulla on galev: /backup2/podi_raw

```
(galev) /backup2/podi_raw > ls o20121220T044346.0
exposure.log                    o20121220T044346.0.24.bin8.jpeg   o20121220T044346.0.43.bin64.jpeg
metainf.xml                     o20121220T044346.0.24.fits        o20121220T044346.0.43.bin8.jpeg
o20121220T044346.0.00.bin64.jpeg o20121220T044346.0.24.txt        o20121220T044346.0.43.fits
o20121220T044346.0.00.bin8.jpeg  o20121220T044346.0.32.bin64.jpeg o20121220T044346.0.43.txt
o20121220T044346.0.00.fits       o20121220T044346.0.32.bin8.jpeg  o20121220T044346.0.44.bin64.jpeg
o20121220T044346.0.00.txt        o20121220T044346.0.32.fits       o20121220T044346.0.44.bin8.jpeg
o20121220T044346.0.16.bin64.jpeg o20121220T044346.0.32.txt        o20121220T044346.0.44.fits
o20121220T044346.0.16.bin8.jpeg  o20121220T044346.0.33.bin64.jpeg o20121220T044346.0.44.txt
o20121220T044346.0.16.fits       o20121220T044346.0.33.bin8.jpeg  o20121220T044346.0.55.bin64.jpeg
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o20121220T044346.0.22.bin64.jpeg o20121220T044346.0.33.txt        o20121220T044346.0.55.fits
o20121220T044346.0.22.bin8.jpeg  o20121220T044346.0.34.bin64.jpeg o20121220T044346.0.55.txt
o20121220T044346.0.22.fits       o20121220T044346.0.34.bin8.jpeg  o20121220T044346.0.61.bin64.jpeg
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o20121220T044346.0.23.fits       o20121220T044346.0.42.bin8.jpeg  o20121220T044346.0.jpeg
o20121220T044346.0.23.txt        o20121220T044346.0.42.fits       temp
o20121220T044346.0.24.bin64.jpeg o20121220T044346.0.42.txt
(galev) /backup2/podi_raw >
```
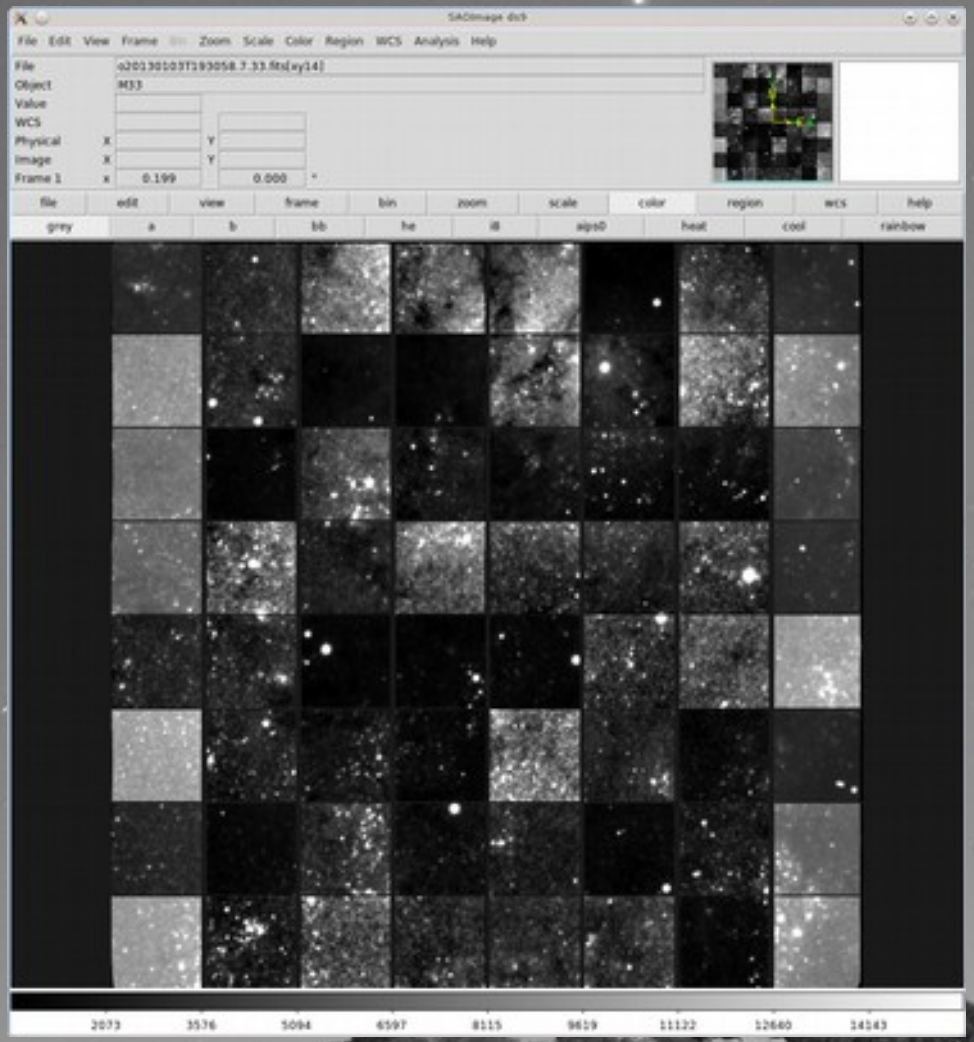
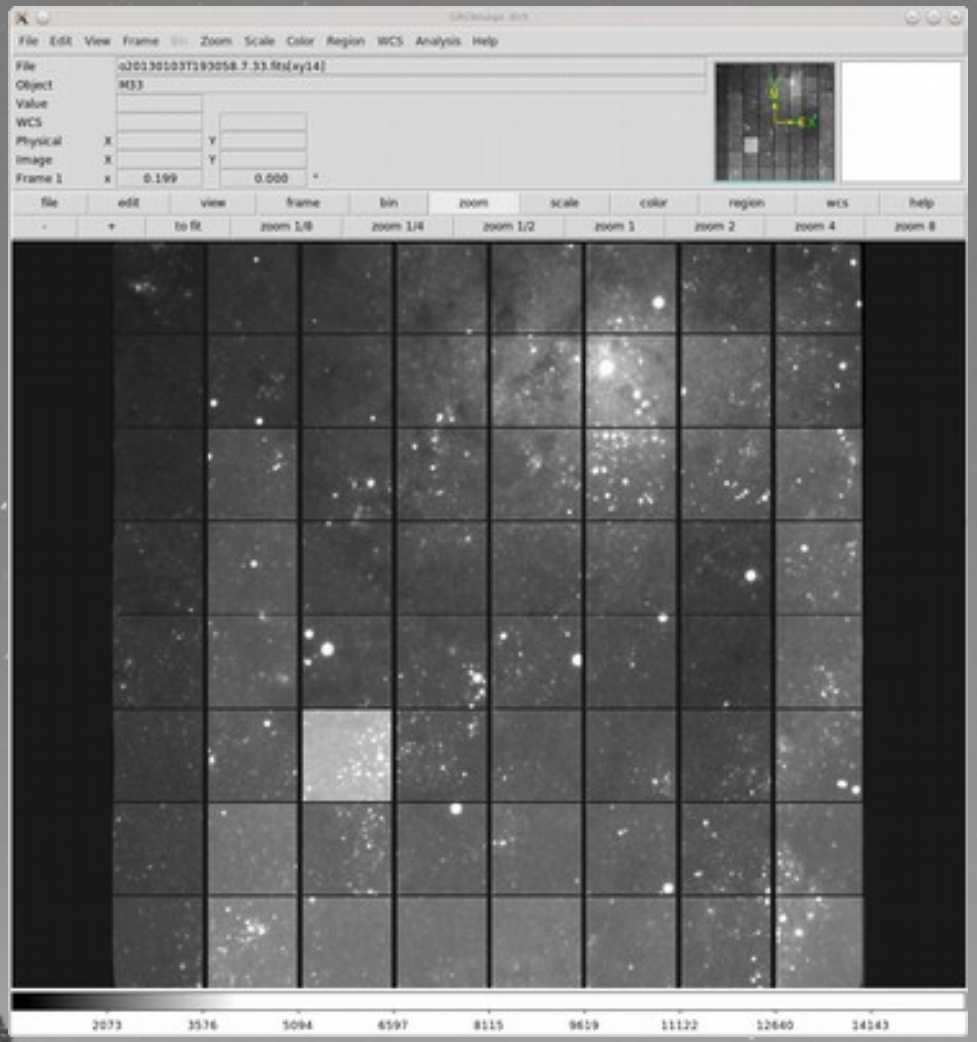

→ Each exposure is a directory full of files

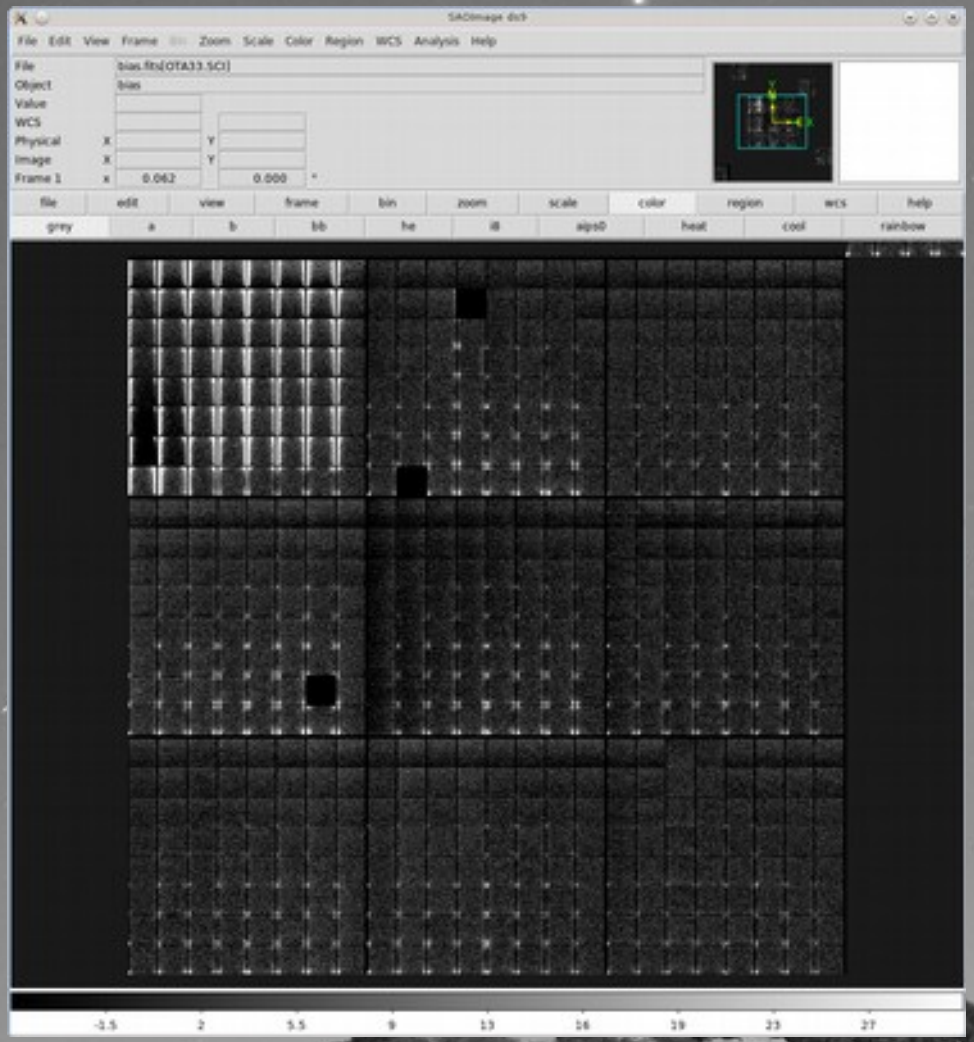
A closer look at OTA 3,3

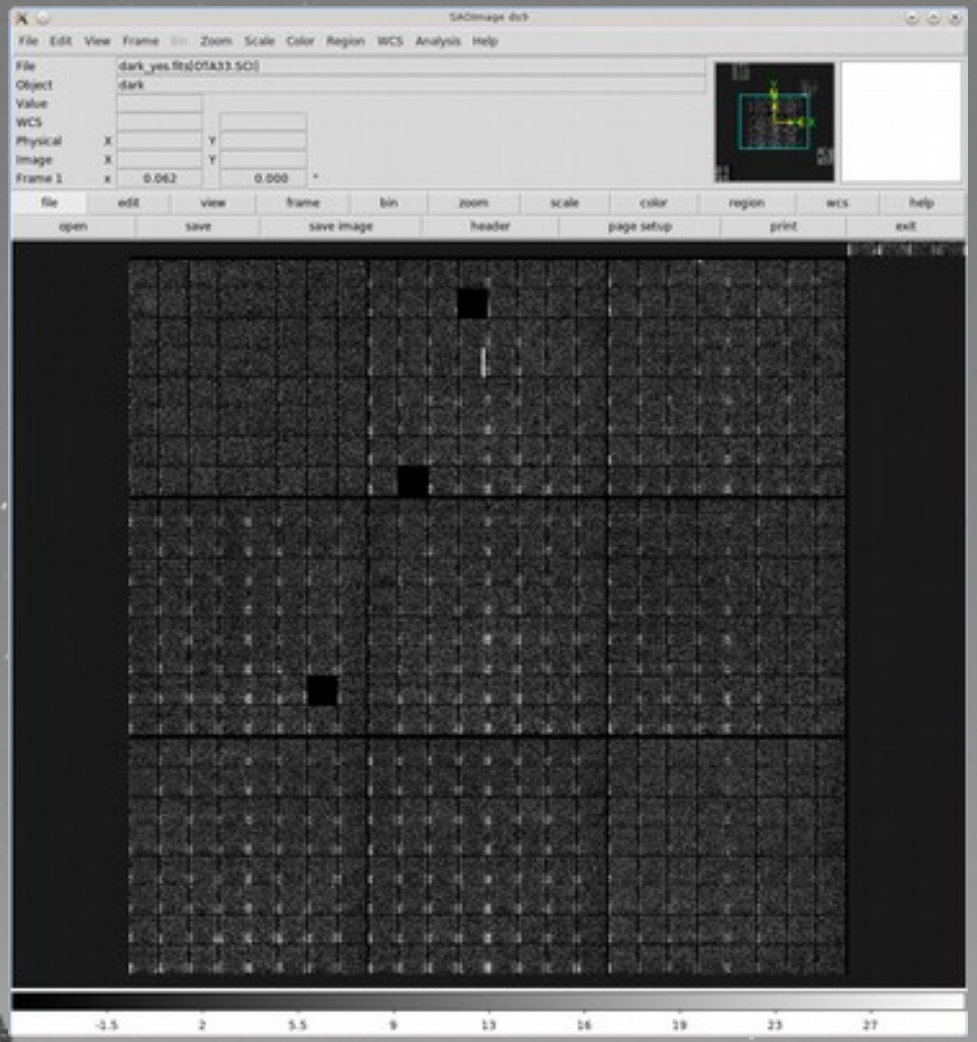
1 OTA = 64 cells (w/ 64 overscan regions/gains/etc) = 1 fits w/ 65 extensions



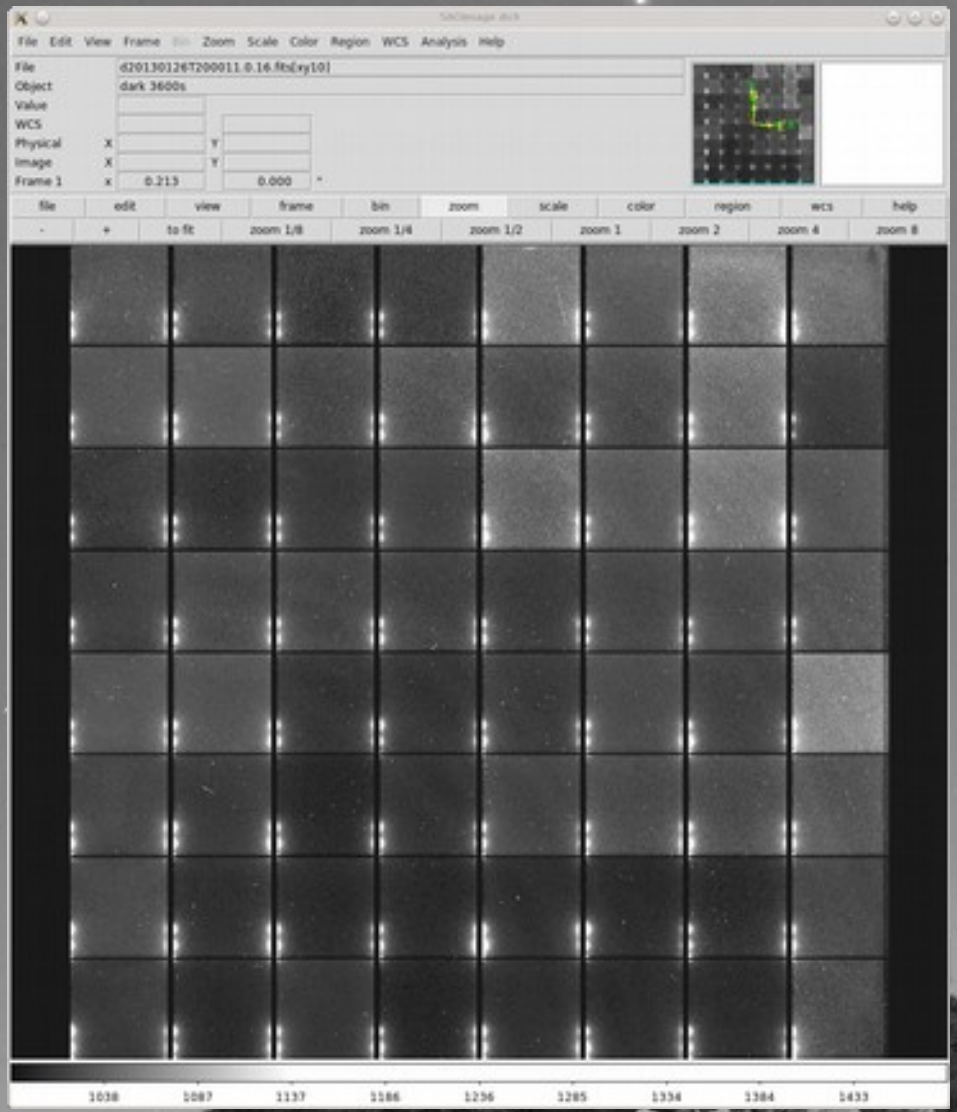


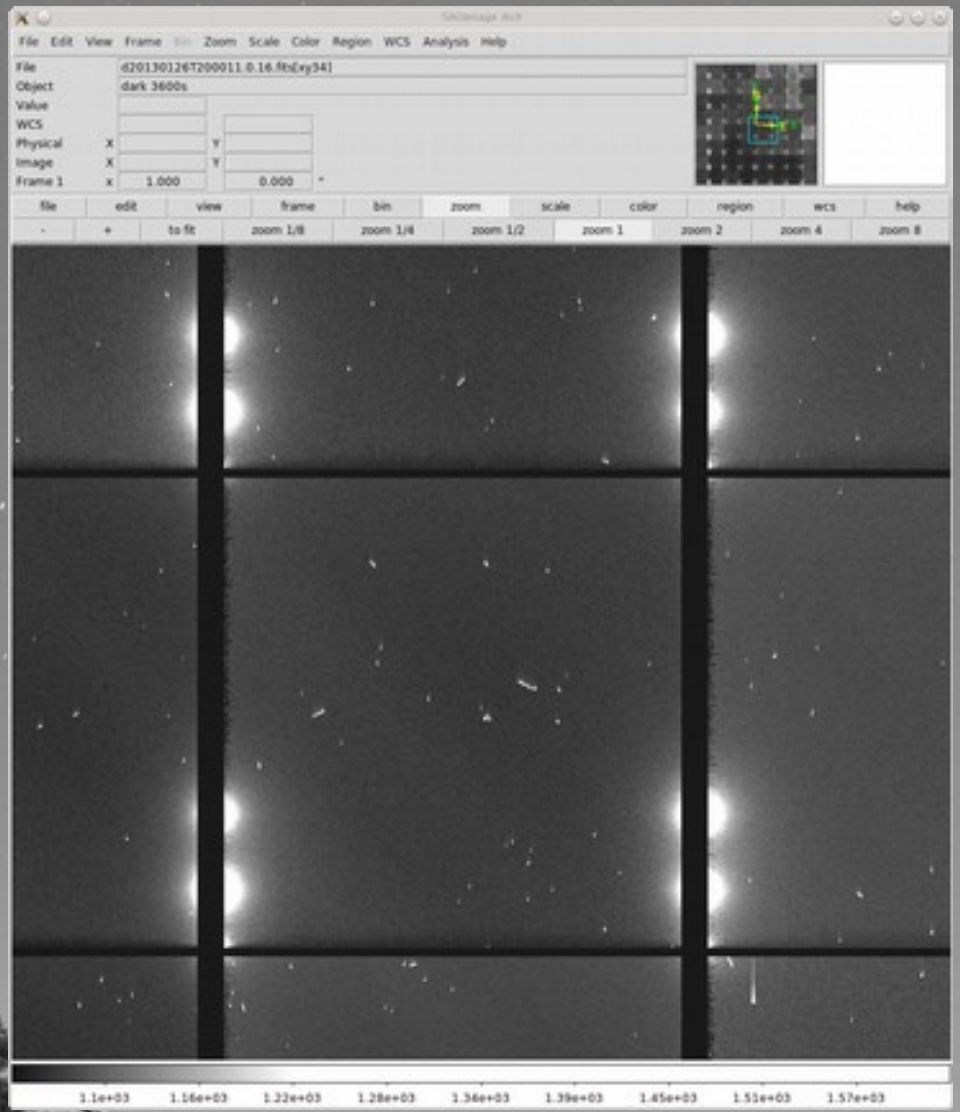
Calibrations: Bias and dark





readout glow and detector glow

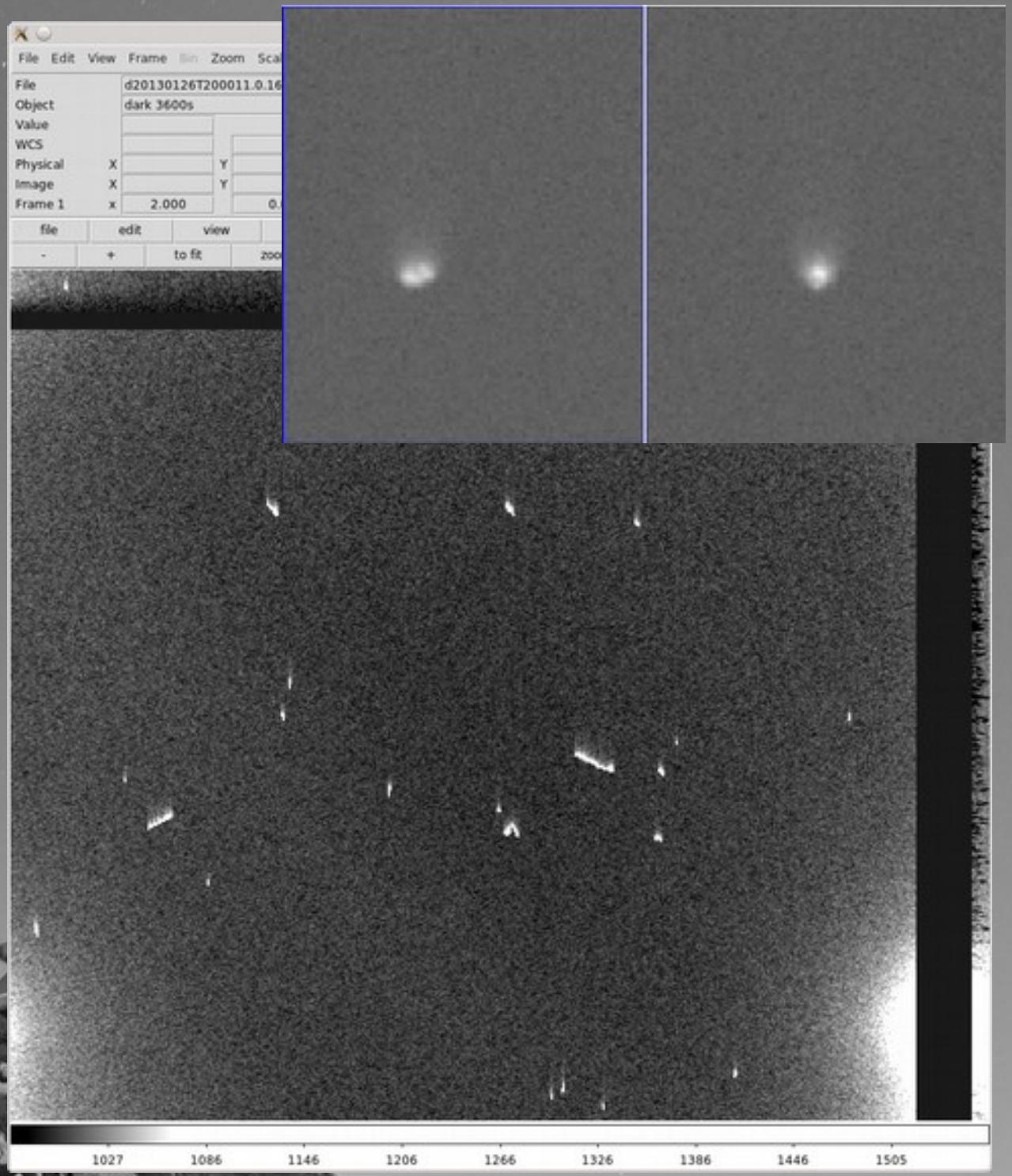




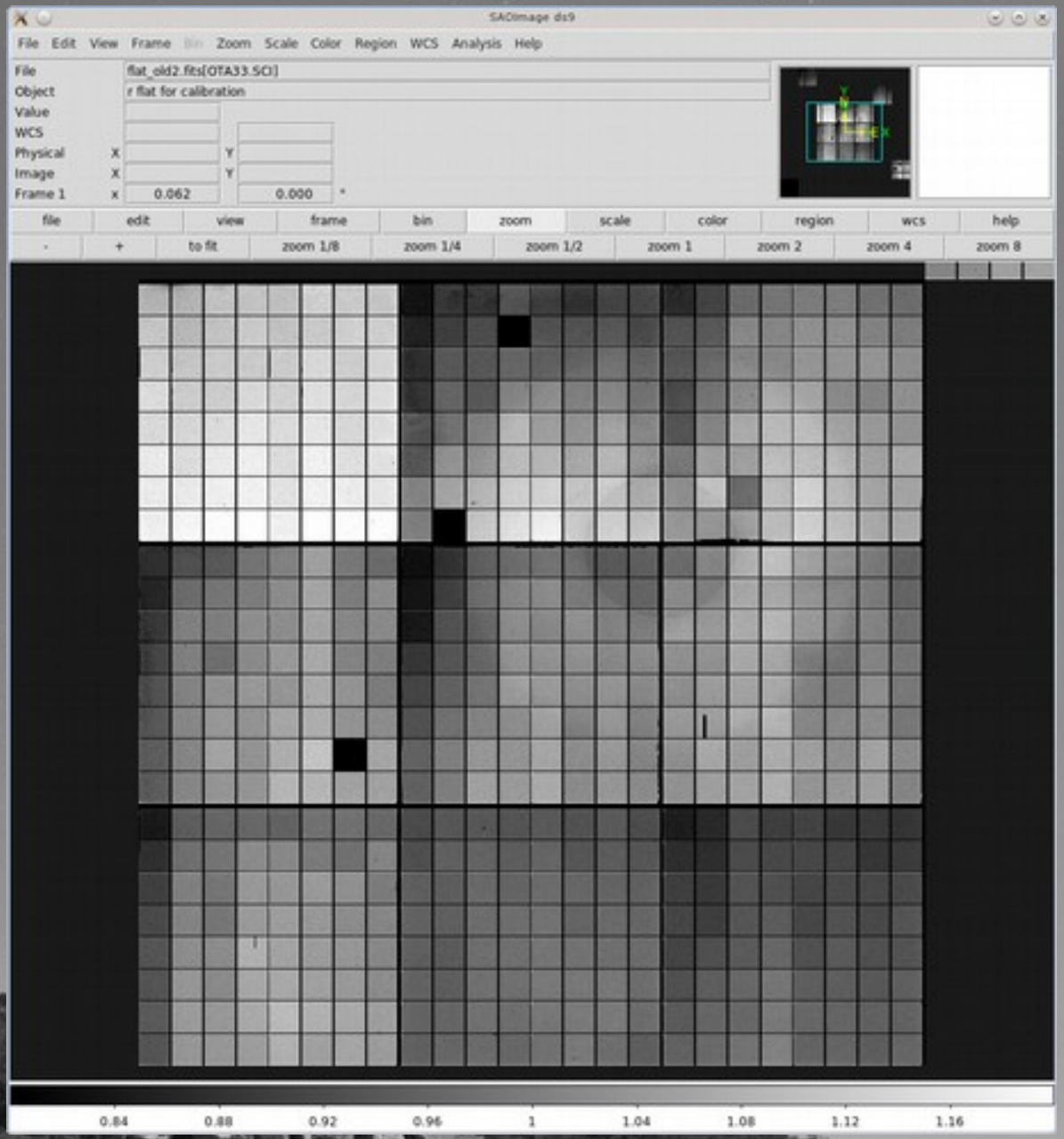
Trailing at low background levels

Potential problem for frames with background levels < 50-70 counts:

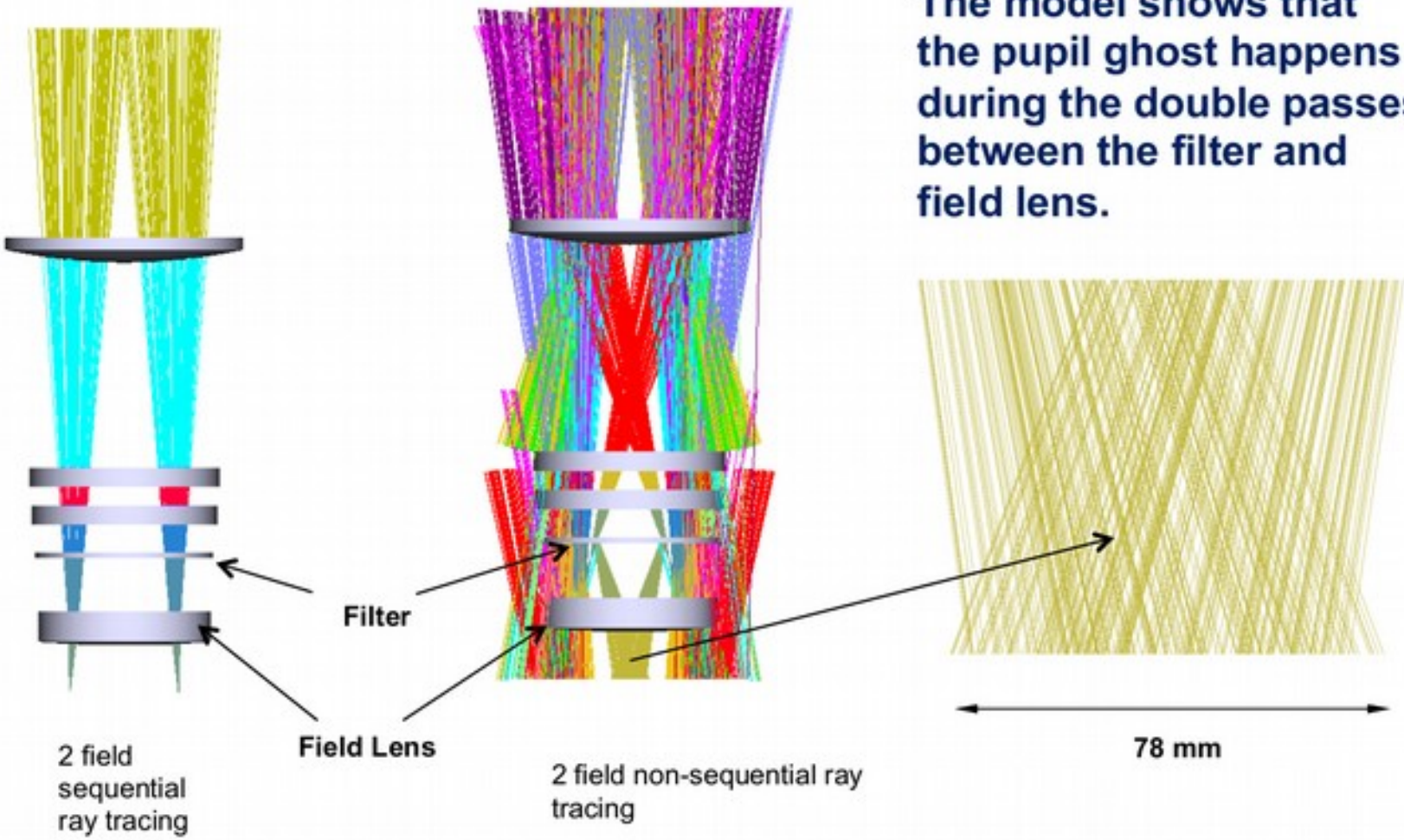
- short exposures:
  guiding,
  U-band during dark time
- narrow-band data



Flat-fields: pupil ghost

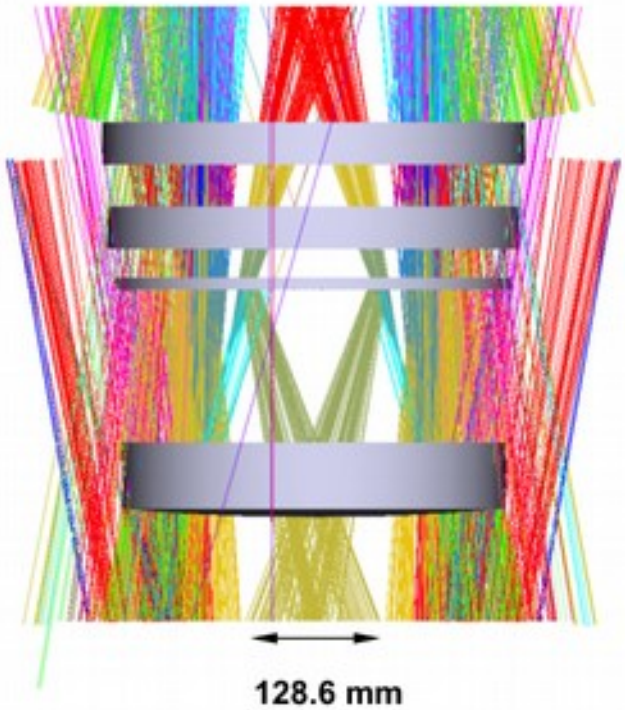


ODI Pupil Ghost Images: Non-sequential Results

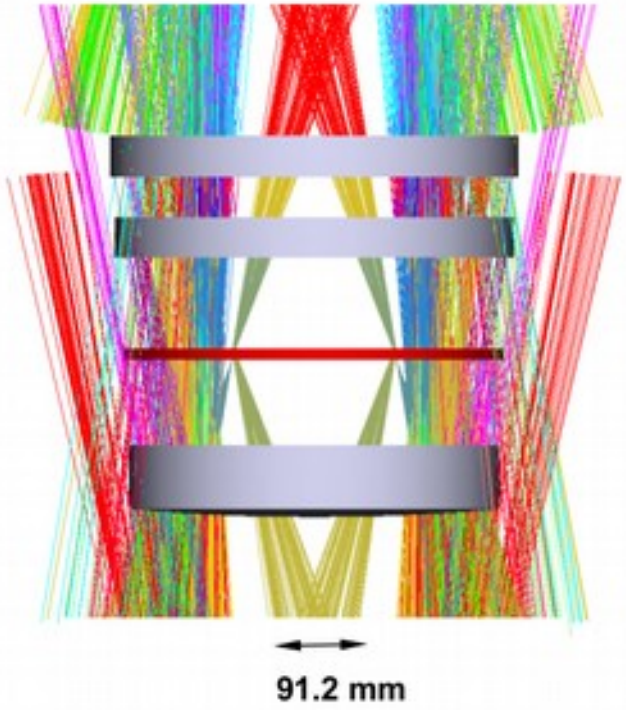


The model shows that the pupil ghost happens during the double passes between the filter and field lens.

ODI Pupil Ghost Images: Change Filter Position Can Reduce The Intensity of The Pupil Ghost Image.



Move filter 31 mm forward, the diameter of the pupil ghost increase to 128.6 mm(the first filter position)



Move filter 31 mm backward , the diameter of the ghost pupil increase to 91.2 mm (the third filter position)

Comparing L2 and L1 flats

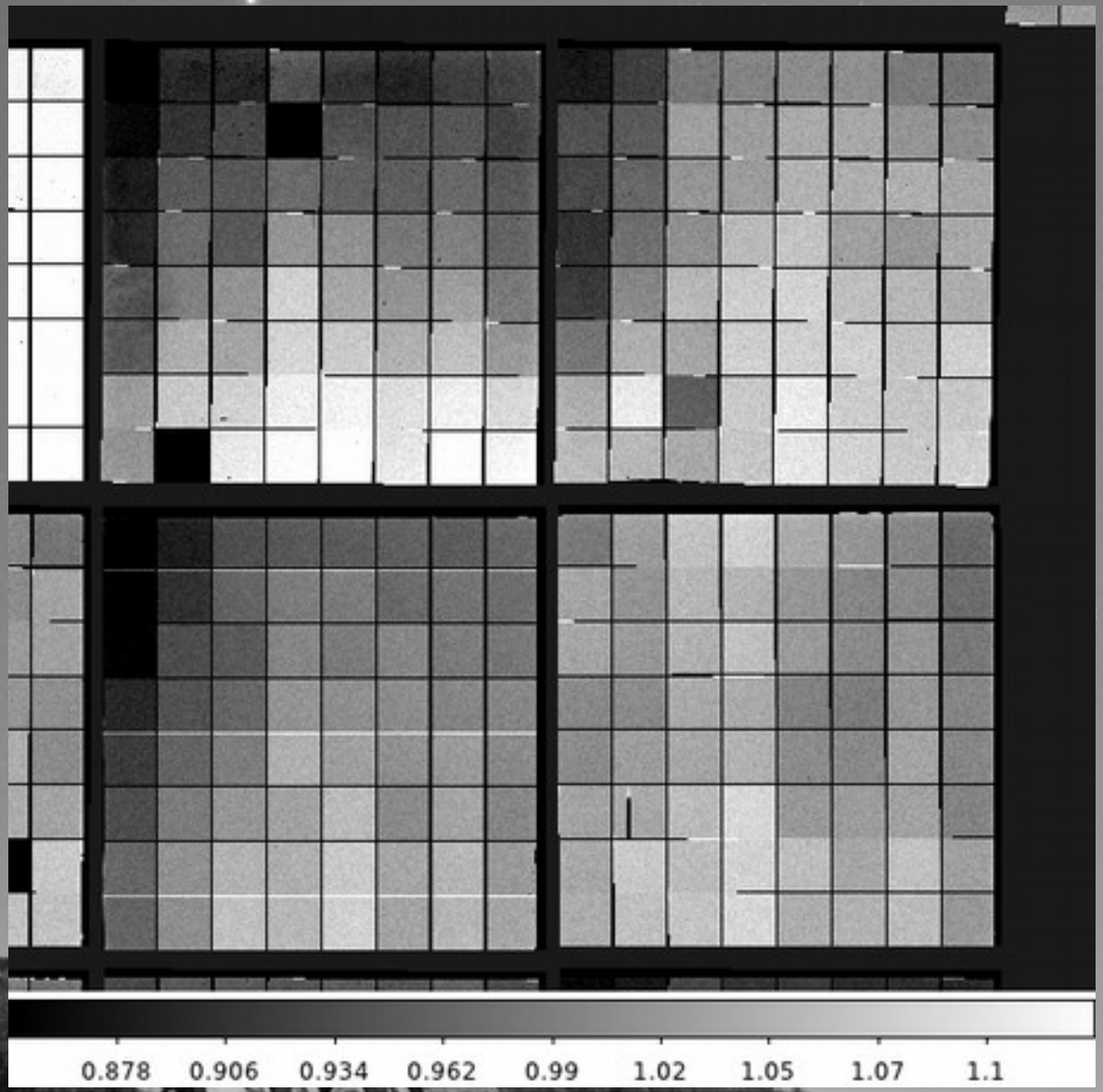
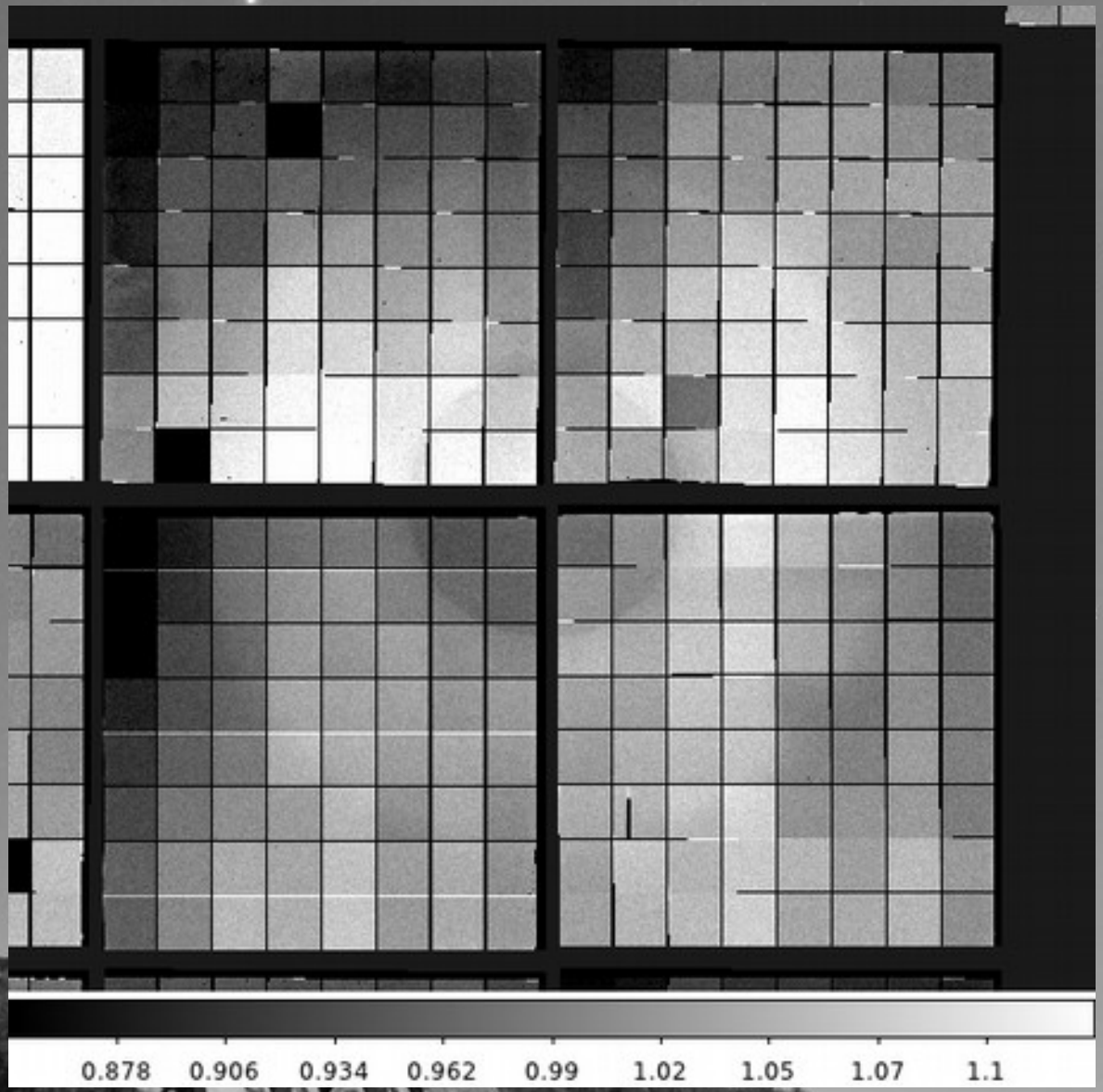
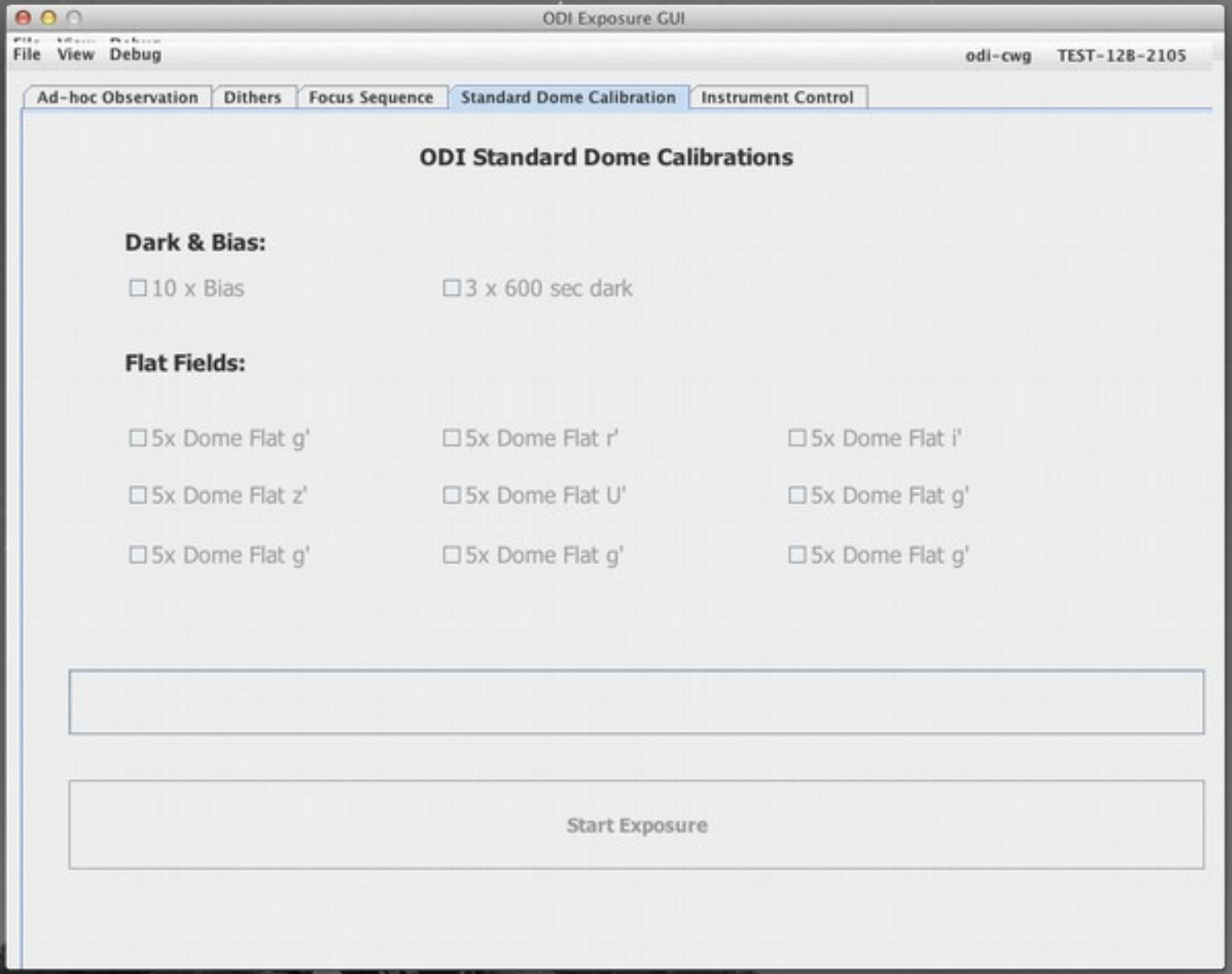


Image of pupil ghost template and before and after



Standard Calibration Plan



OT shifting

Principle:
(charge in) pixels follows image motion

Modes:

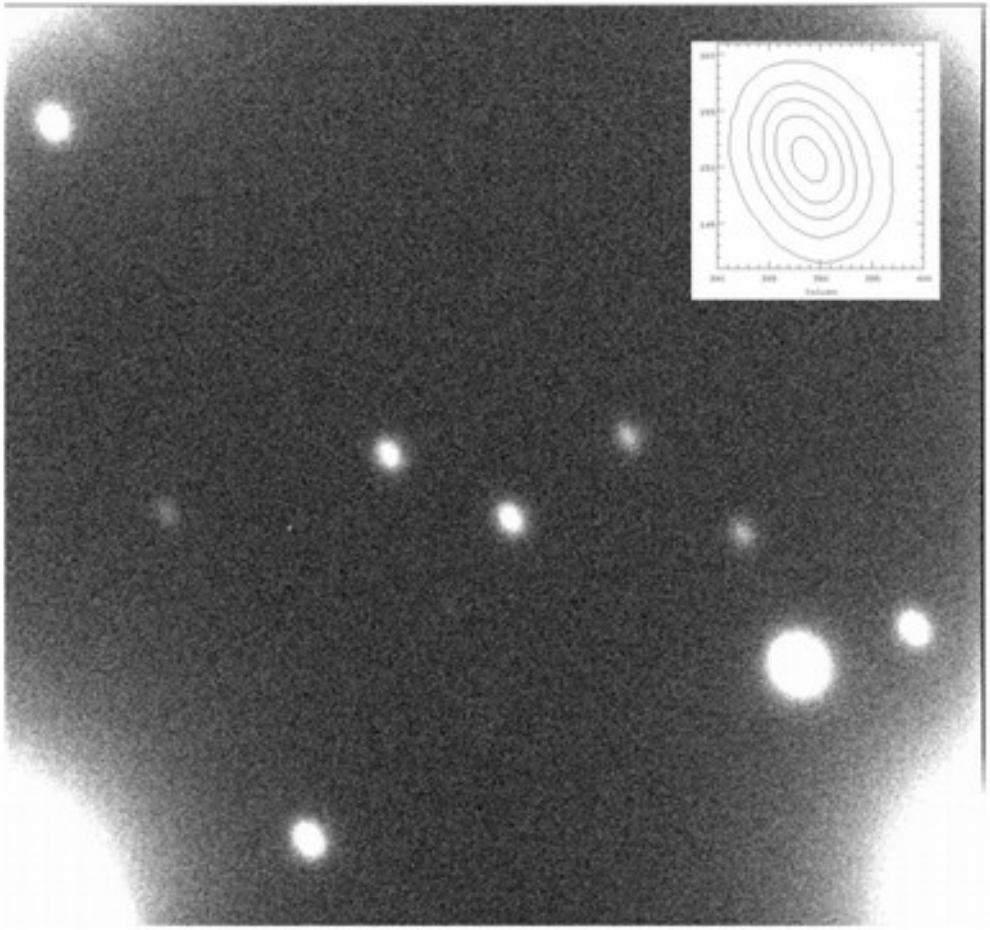
- Fast guiding (>= 1 guide star)
- Coherent guiding (>= 3 guide stars)
- Local guiding (>1 guide star per OTA)

OT shifting: Pros

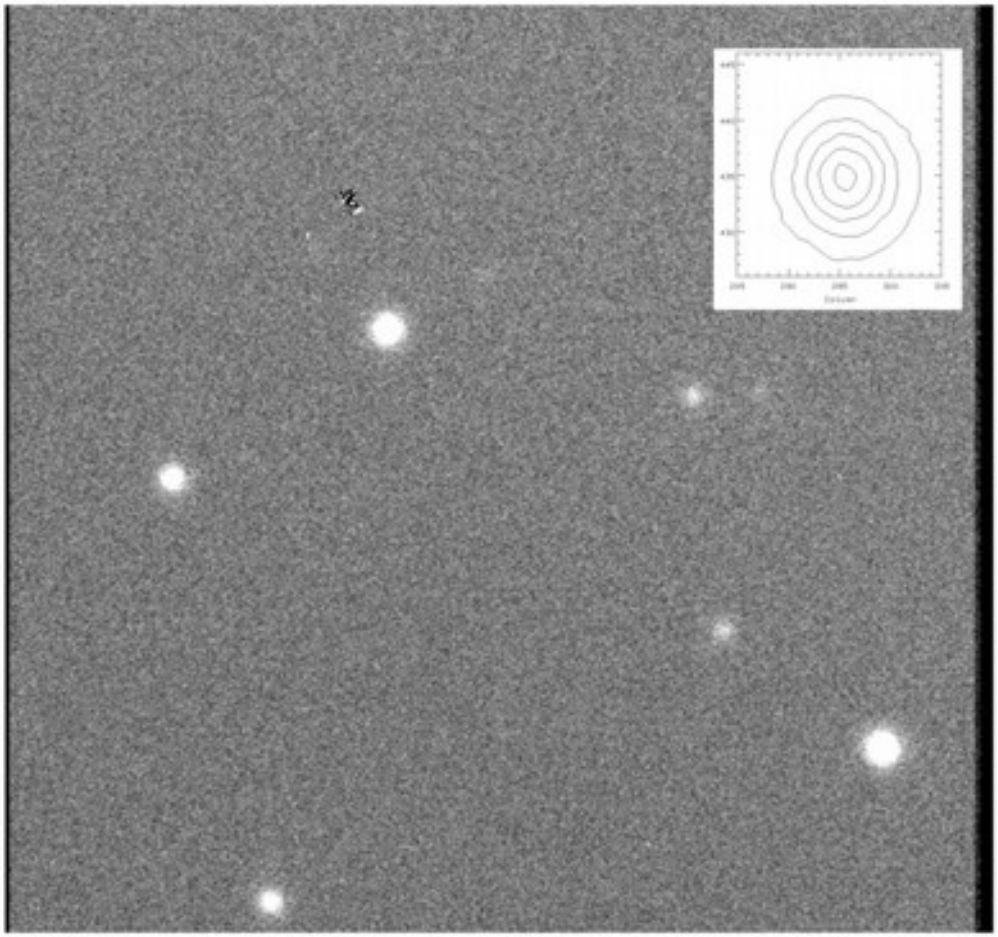
- Better seeing or at least rounder stars
- Reduced windshake in windy conditions

pODI Coherent Correction Mode

First Light Jan 23 2013



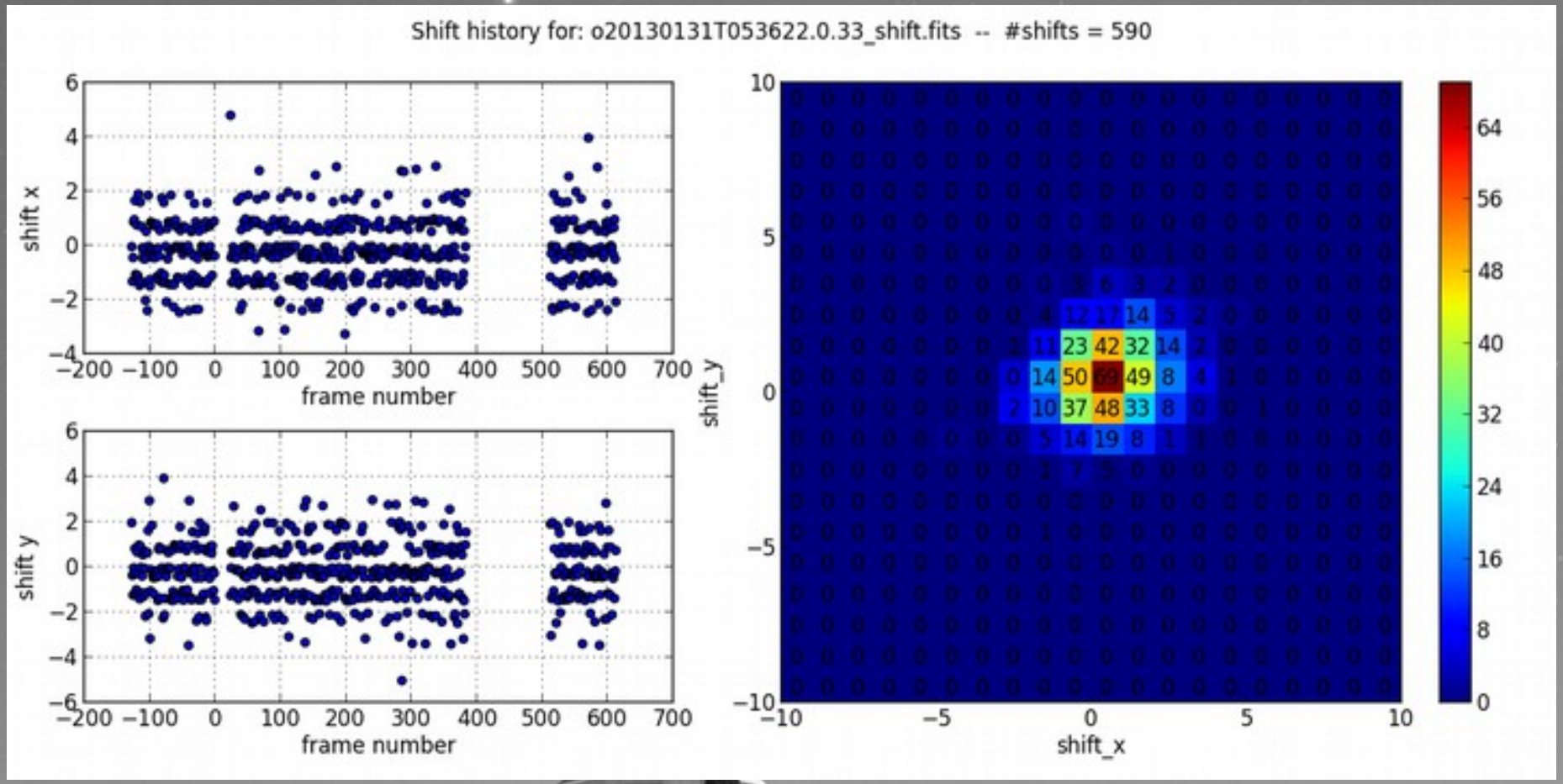
No OT-correction: Elongated stars due to telescope drift.



OT-correction applied: Round stars, telescope drift is compensated.

pODI Image o20130123T224451.0

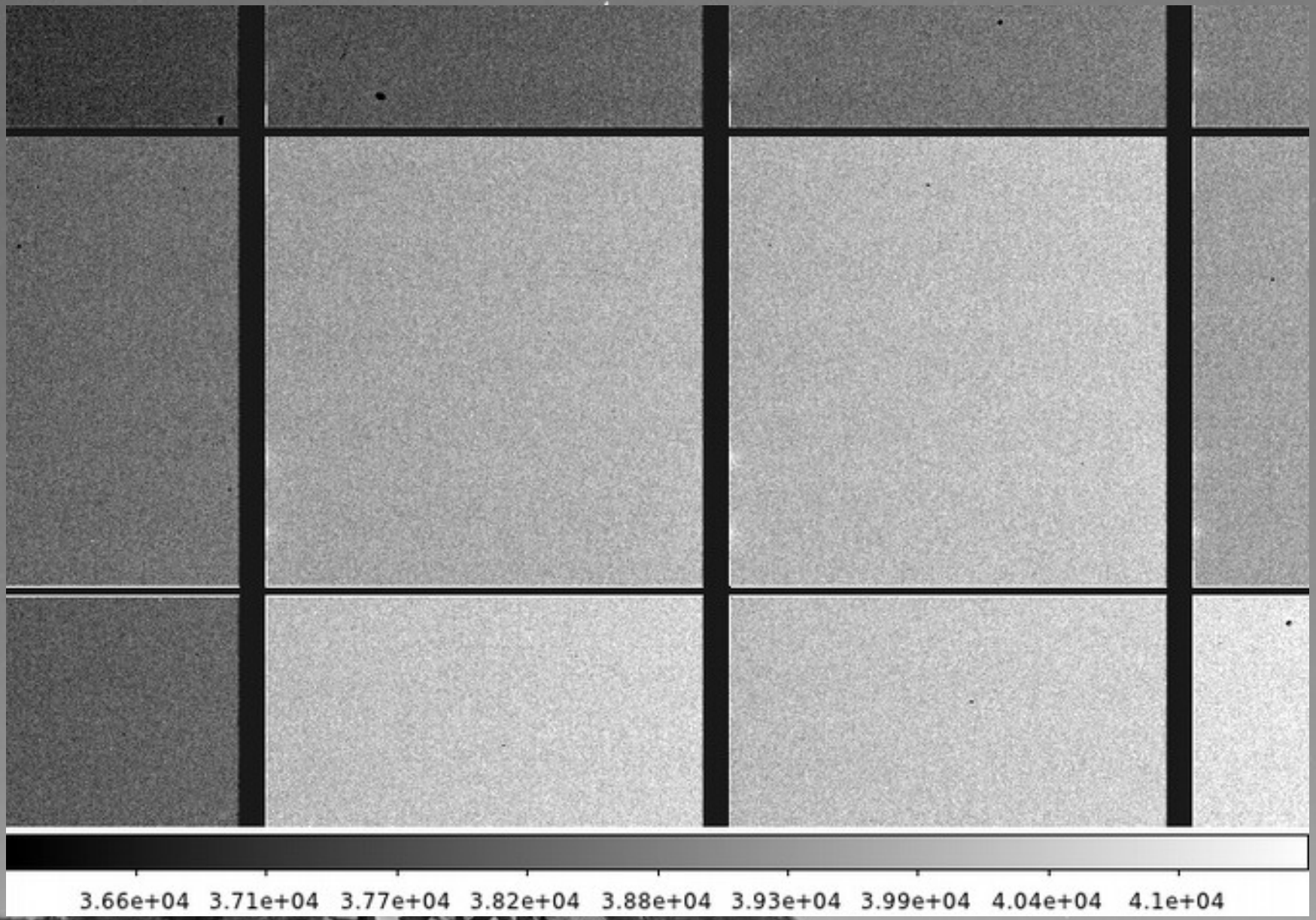
OT shift history



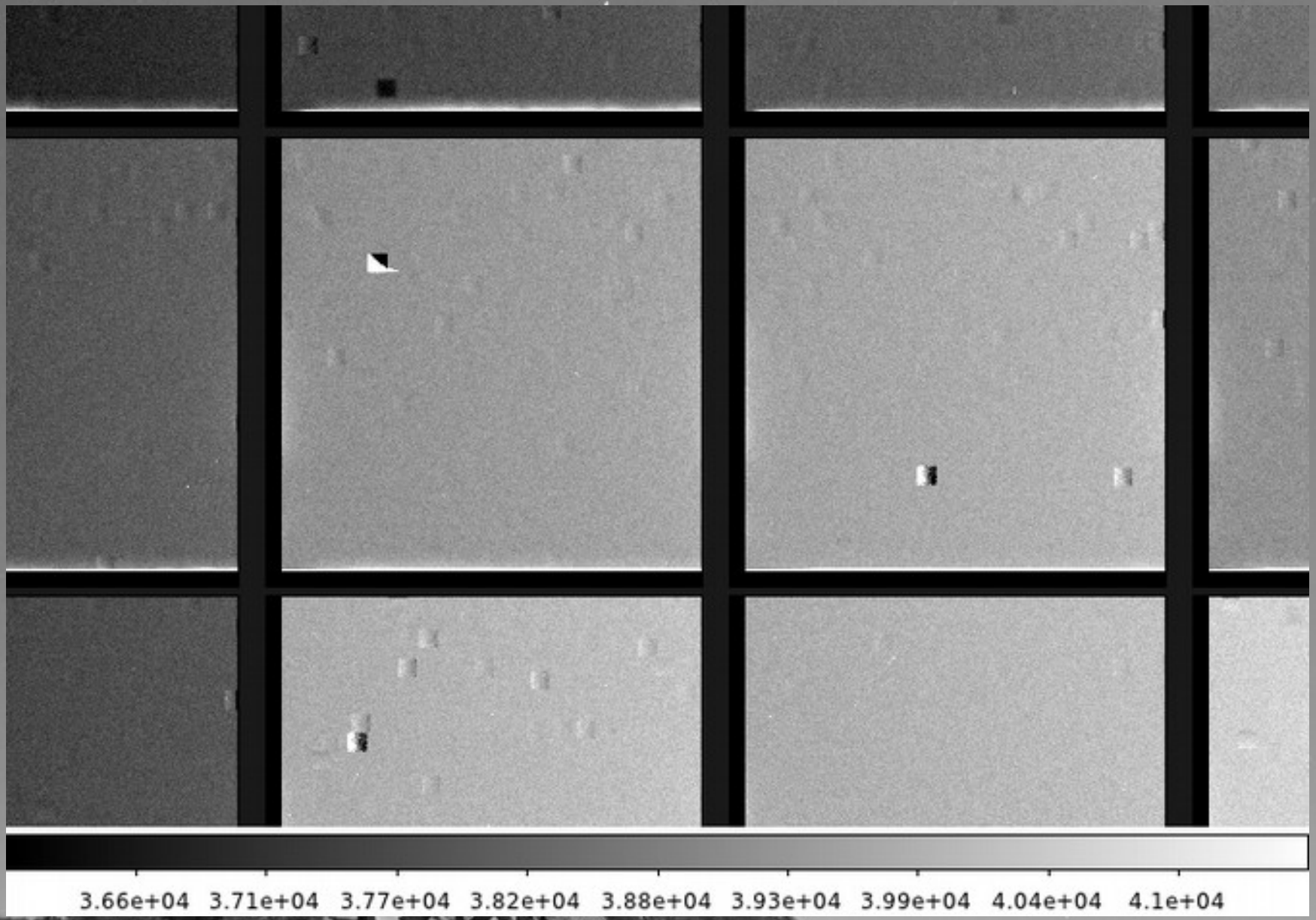
OT shifting: cons

- Traps cause image artefacts
- slighly smaller detector area (shift pixels off chip)
- Needs (many) bright guide stars
- For now: Guide readout to slow to make OT shifting effective (work in progress)
- Data reduction trickier: Need to convolve calibration files with shift history

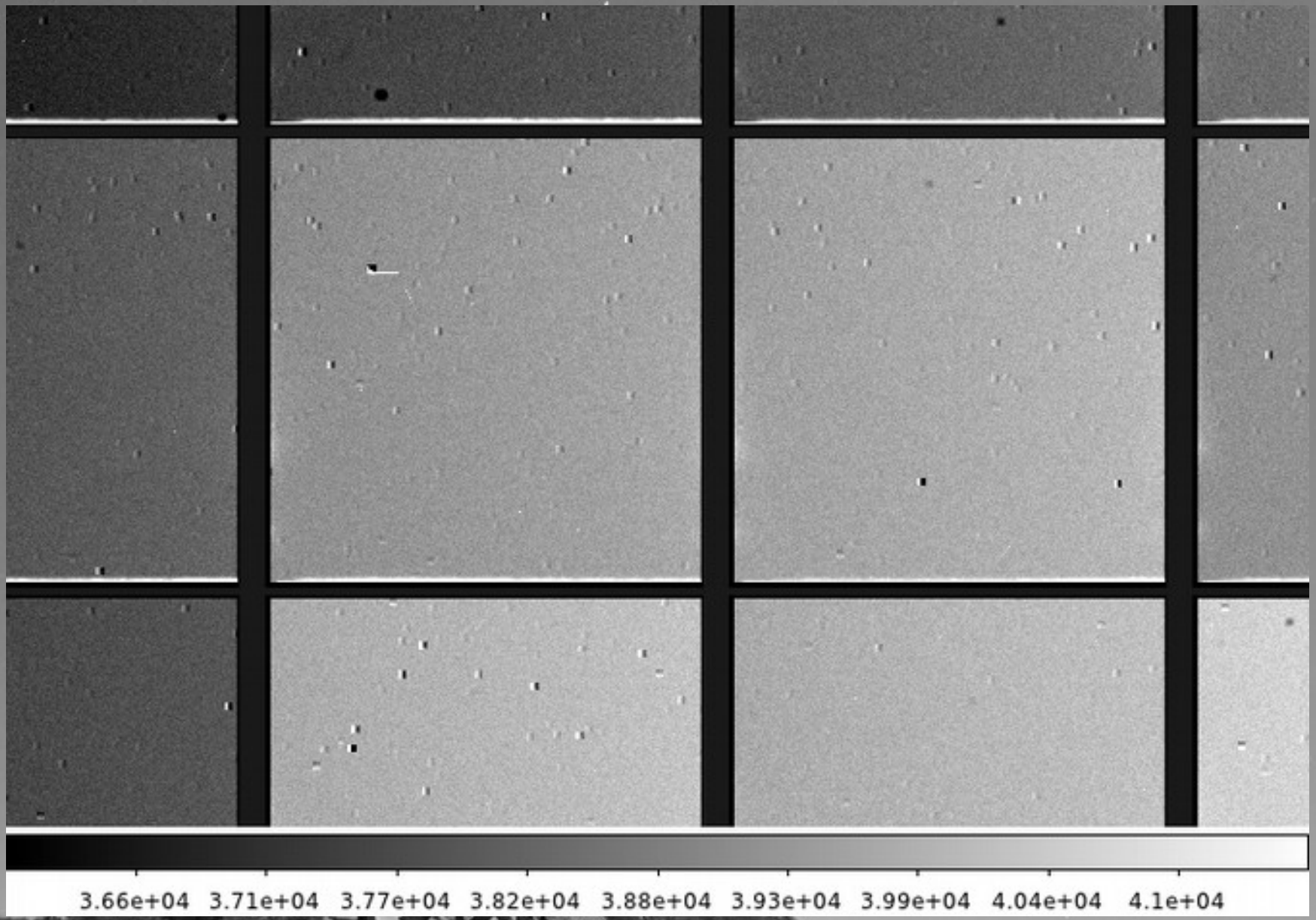
OT shifting artefacts



OT shifting artefacts

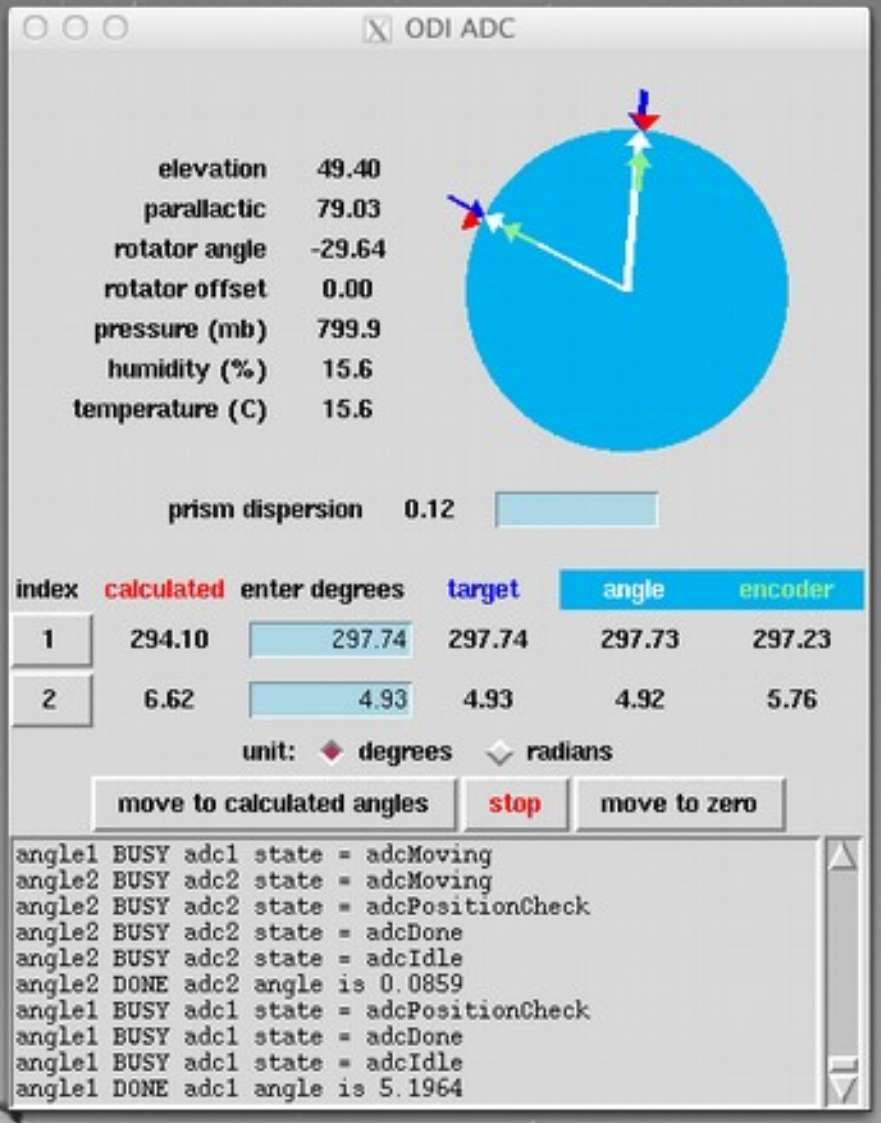


OT shifting artefacts

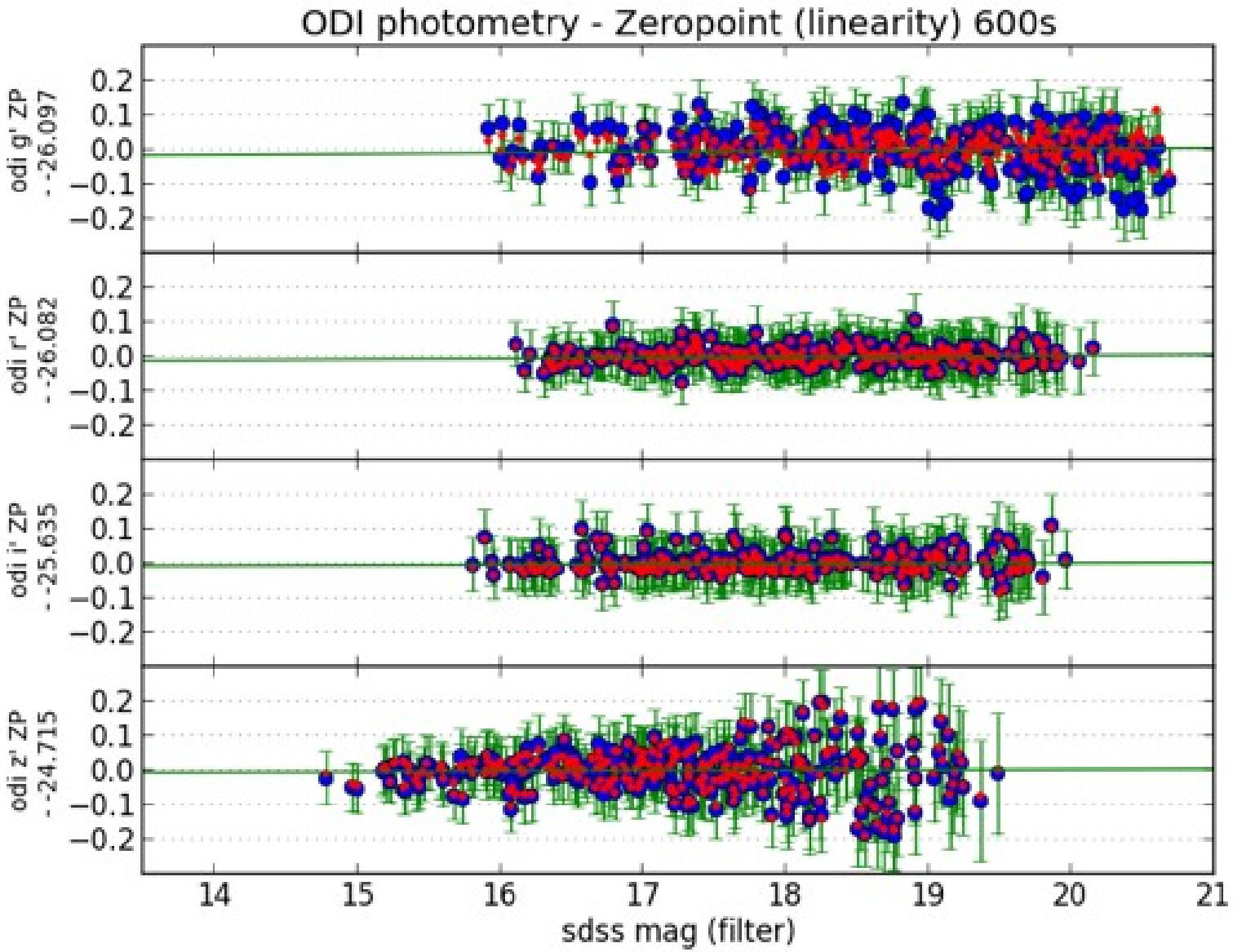


Atmospheric dispersion corrector

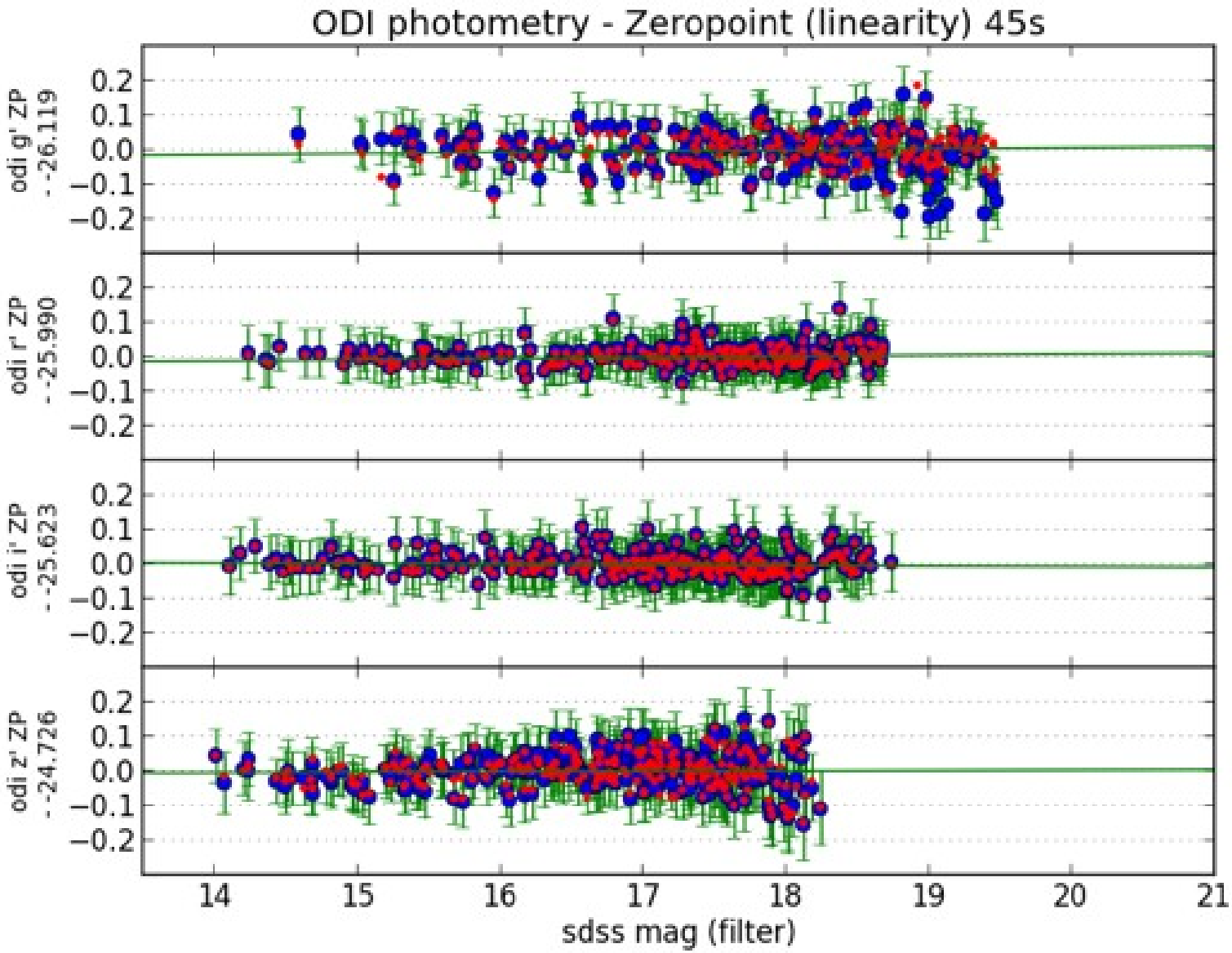
- Two rotating prisms



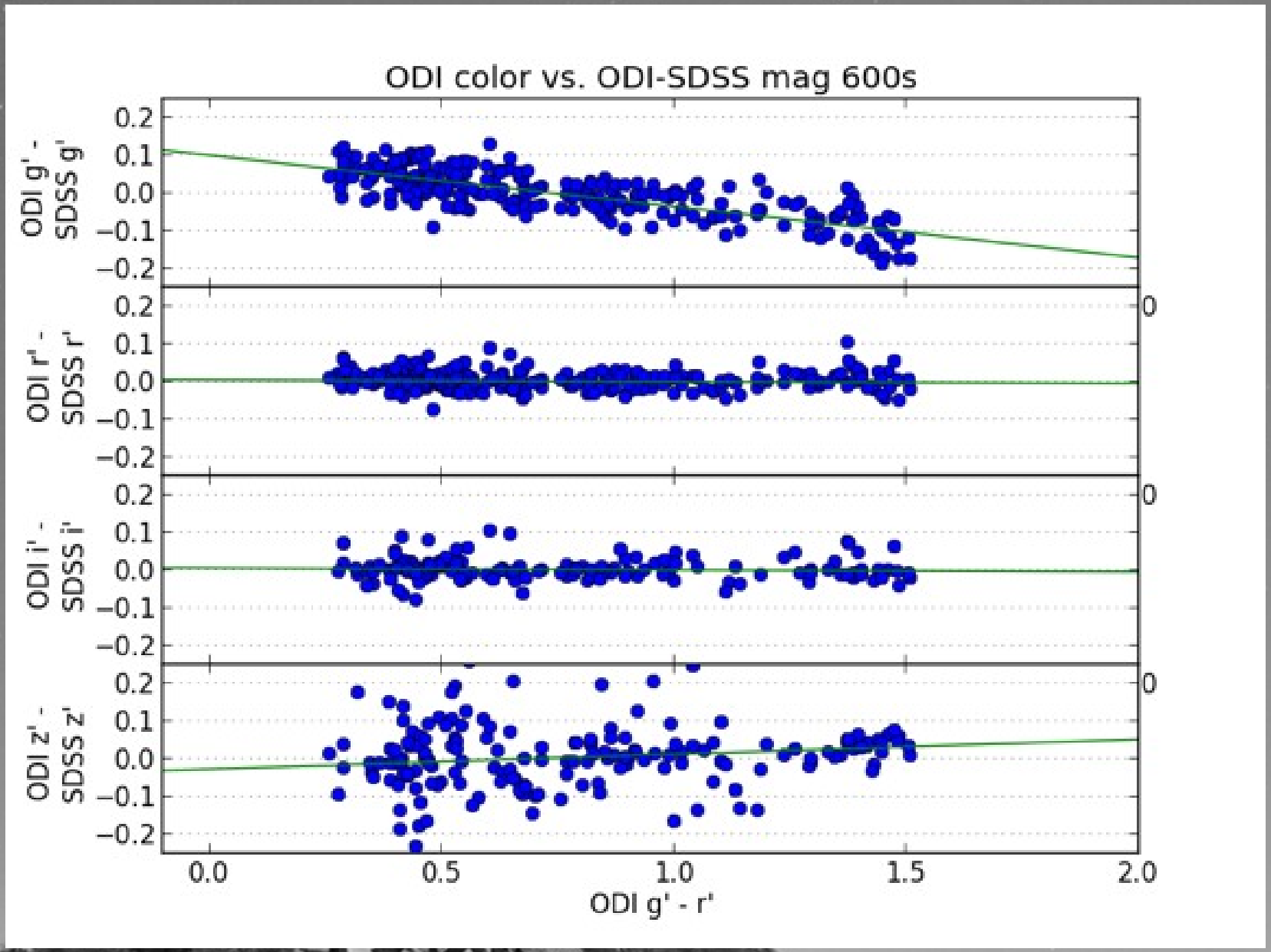
Photometric calibration



Photometric calibration



Color terms ODI vs SDSS



Portal, Pipeline & Archive (PPA)

- portal.odi.iu.edu
- Run by Indiana U.
- Frontend to access/download/manipulate data
  → demo
- Official pipeline still under construction
  Rumours: Release at end of month

pODI Quickreduce pipeline

- Basic reduction directly at telescope (overhead, bias, dark, flat, [WCS], [[photometry]])
- Help judge data quality
- Written in Python, publicly available
- No IRAF/pyRAF
- Made in Wisconsin :-)

Data reduction facility at UW

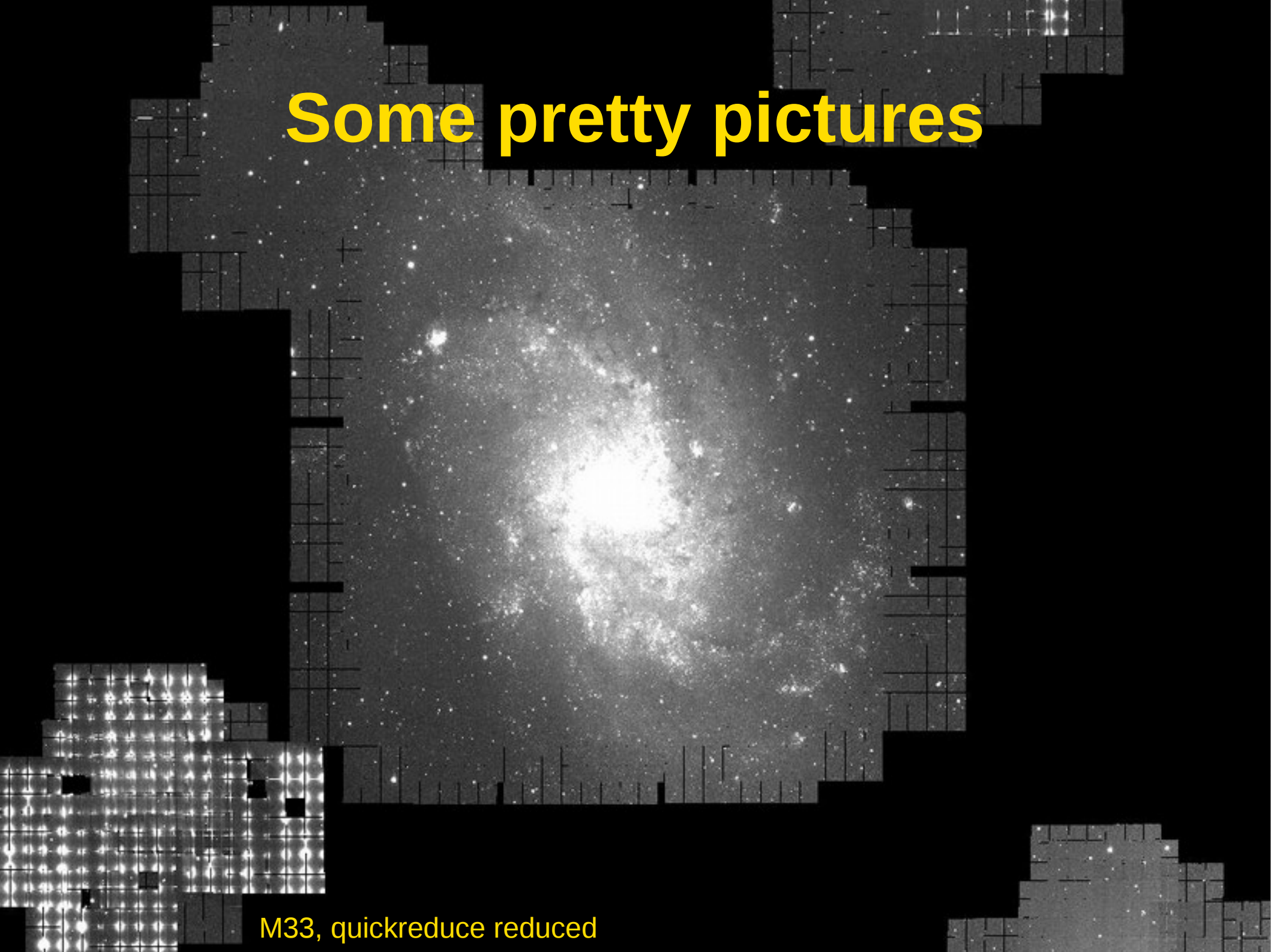
Local pODI reduction:

- 8-core machine
- 54 GB memory
- External Raid disk with ~10 TB capacity
- Raid-0 Solid State Drives with 1 GB/s read/write speed
- Talk to me for account

Things that (don't) work (yet)

- Working:
  Imaging/Dithering, guiding, data reduction, most GUIs, ADC
- Kinda working:
  pipeline, OT shifting
- Not working:
  Focus sensors

Some pretty pictures



M33, quickreduce reduced

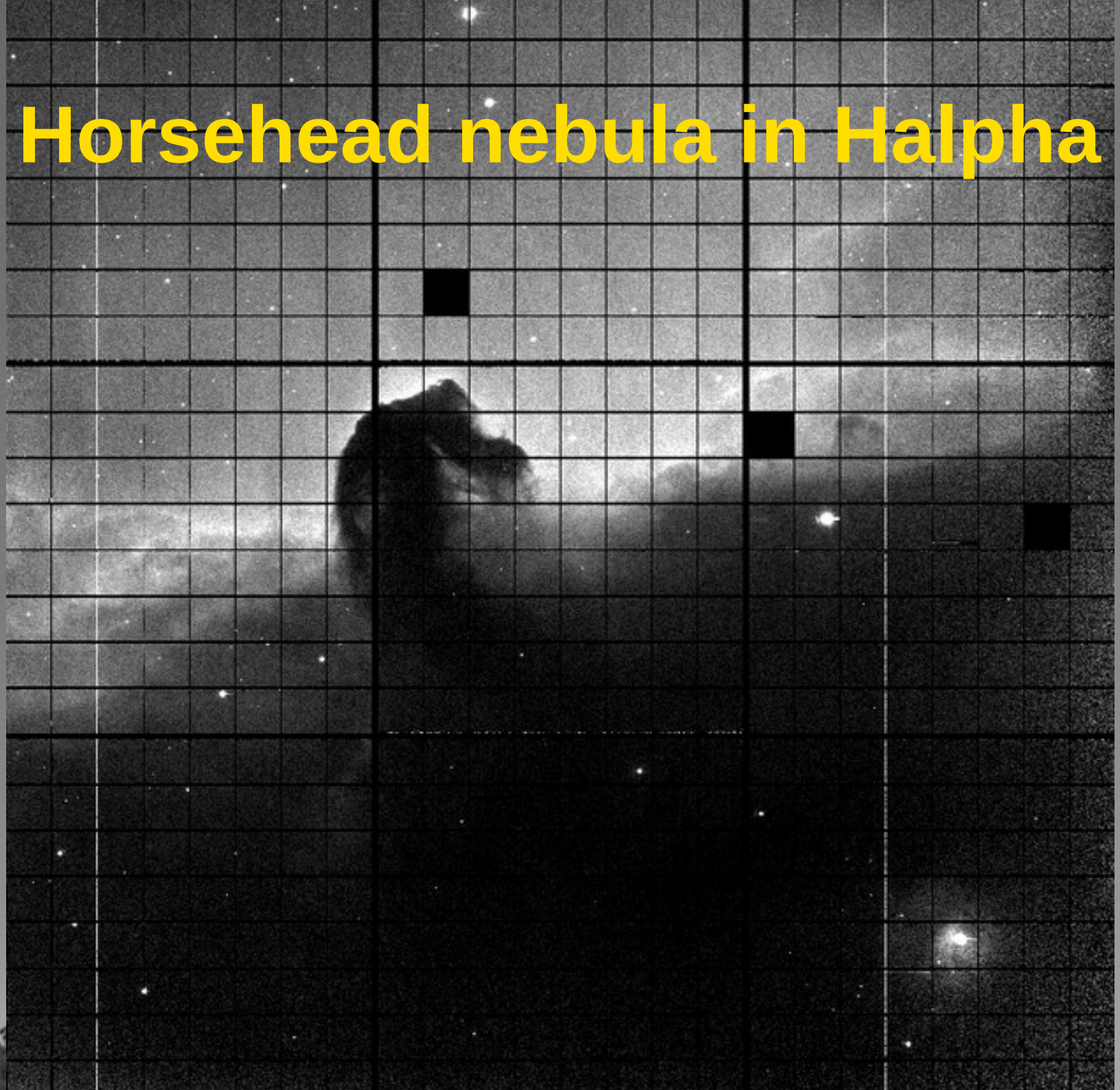
Some pretty pictures

M33, quickreduce reduced

Bubble nebula, pipeline reduced

M15, pipeline reduced

Horsehead nebula in Halpha




Thank you!