bulk gfa_reduce NERSC processing on 11/19/2019

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Input raw file list

- All gfa*.fits.fz exposures with flavor=science from 20191015 through 20191117
- Includes both “spectro/data” and “spectro/staging/lost+found” areas at NERSC
- Total of 3,670 GFA exposures selected
- Simple flavor=science criterion includes things like dome screen data (no attempted cuts on PROGRAM)

Outputs

- Calling this version “v0001”, likely to go through a number of further v000? iterations in the near future
- /project/projectdirs/desi/users/ameisner/GFA/reduced/v0001

successes/failures

- “success” = running to completion
- 3,655 exposures successful of 3,670 exposures total
- 15 failures

Notes on failures

- data/20191107/00025397/gfa-00025397.fits.fz
- GUIDE3 image is 2248 x 62 pixels

Notes on failures

- lost+found/20191016/00000011/gfa-00000011.fits.fz
- Seems like a test exposure with very low EXPID, probably in lost+found because it was really never intended to be useful for downstream analysis

Notes on failures

- 7 exposures that may be simulated data:
  - Image dimensions 2248 x 1024 instead of 2248 x 1032
    - gfa-00028144.fits.fz, gfa-00028147.fits.fz, gfa-00029282.fits.fz, gfa-00029283.fits.fz, gfa-00029284.fits.fz, gfa-00029285.fits.fz, gfa-00029286.fits.fz
- 7 cases where SKYRA, SKYDEC are missing
  - This currently crashes my pipeline; I will implement a workaround
  - Includes previously mentioned case gfa-00000011.fits.fz

Timing

- Each exposure always run as a one-CPU Python process (no parallelization across cameras)

- ~75-80 seconds is typical per-exposure processing time end-to-end

- The above timings include all I/O; would be faster if writing of reduced image outputs were skipped

- Appears to run ~1.35-1.6 times faster on mountain computers like desi-1 than at NERSC

- Still lots of room for straightforward speed-ups

Astrometry

- Currently using my own astrometry solver that recalibrates each GFA image independently using Gaia DR2; (SKYRA, SKYDEC) seed initial WCS guess

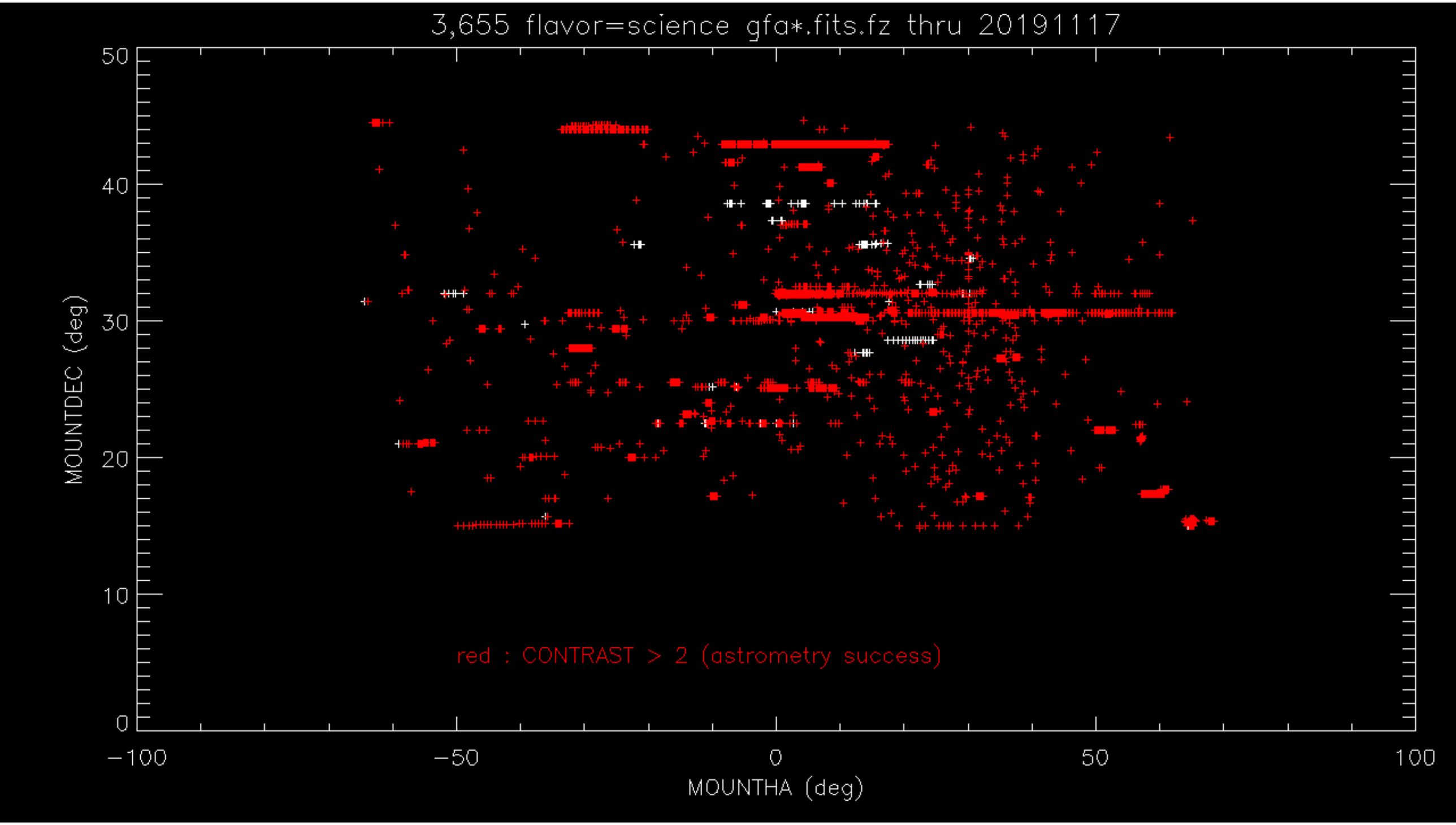
- Worth comparing against Dustin's astrometry.net approach in terms of run time, resource usage, performance for very sparse/shallow fields — could eventually switch to simply calling Dustin's code from gfa_reduce

- Recalibrated astrometry is put into reduced image output headers, regardless of whether the recalibration was of high quality

    - CONTRAST keyword also added to indicate WCS solution quality; (CONTRAST > 2) appears to be reasonable definition of success; perhaps could push somewhat lower in terms of CONTRAST

- 83% astrometric recalibration success rate (including dome screen data, out of focus data, very short exposures, "noisy" images with readout problems…)

(HA, Dec) distribution of successful astrometric recalibrations



Gaia DR2 matches

- Gaia matching is now plugged into the main pipeline, so Gaia cross-matches based on recalibrated astrometry are in the “_catalog.fits” GFA source catalog table for each exposure, row-matched with GFA detections
    - This is in contrast to the CI Gaia matches, which were provided via their own separate file
- Gaia matches are included to large separation, so one should require small ANG_SEP_DEG catalog column value to restrict to true Gaia counterparts

Guide CCD centers compilation

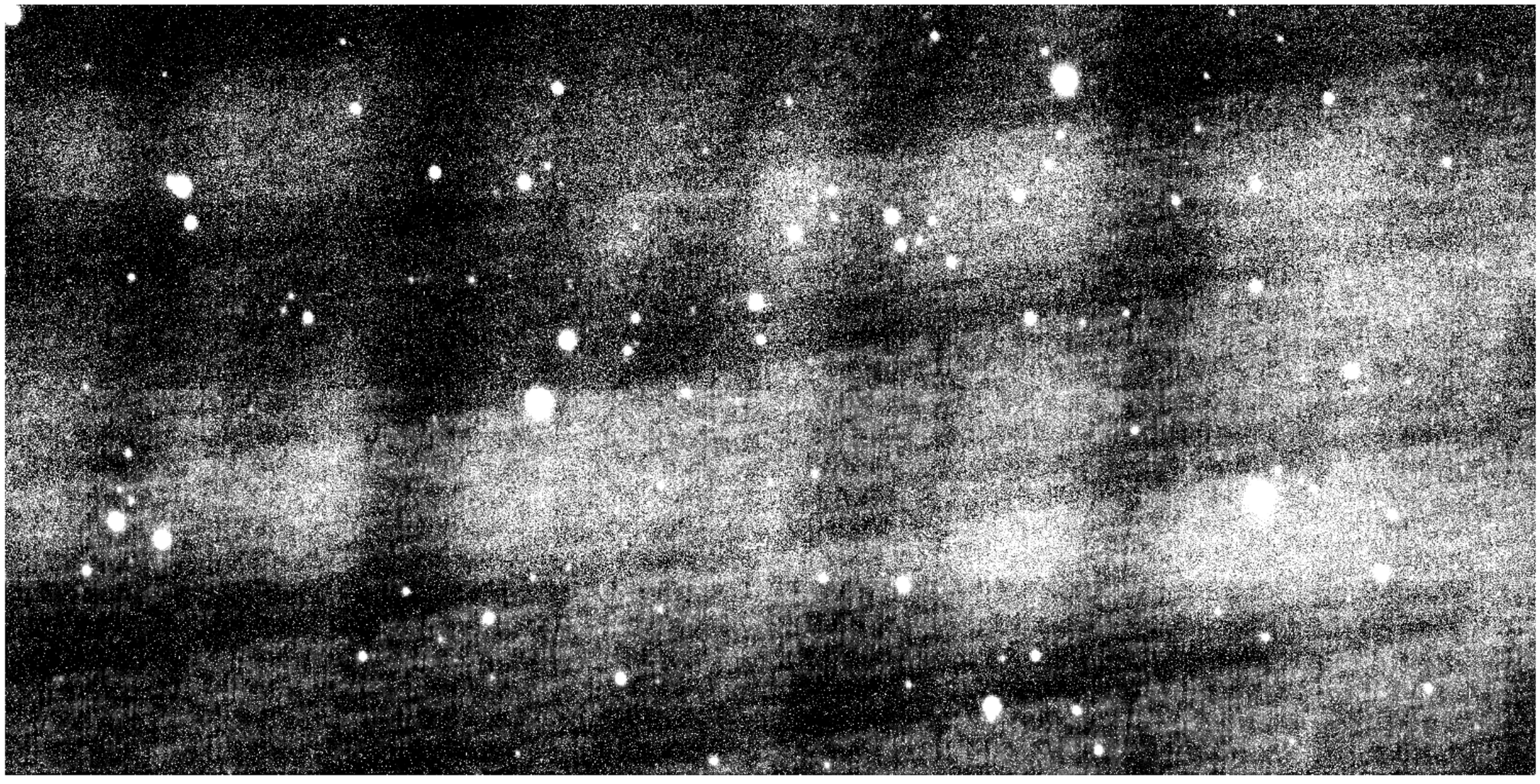
- /project/projectdirs/desi/users/ameisner/GFA/etc/radec_ccd_centers-v0001.fits

- Currently run as an afterburner; will make this part of the main pipeline by adding CCD centers to “_ccds” output table

- Could be useful for studies of field rotation etc.

Example of poor detrending

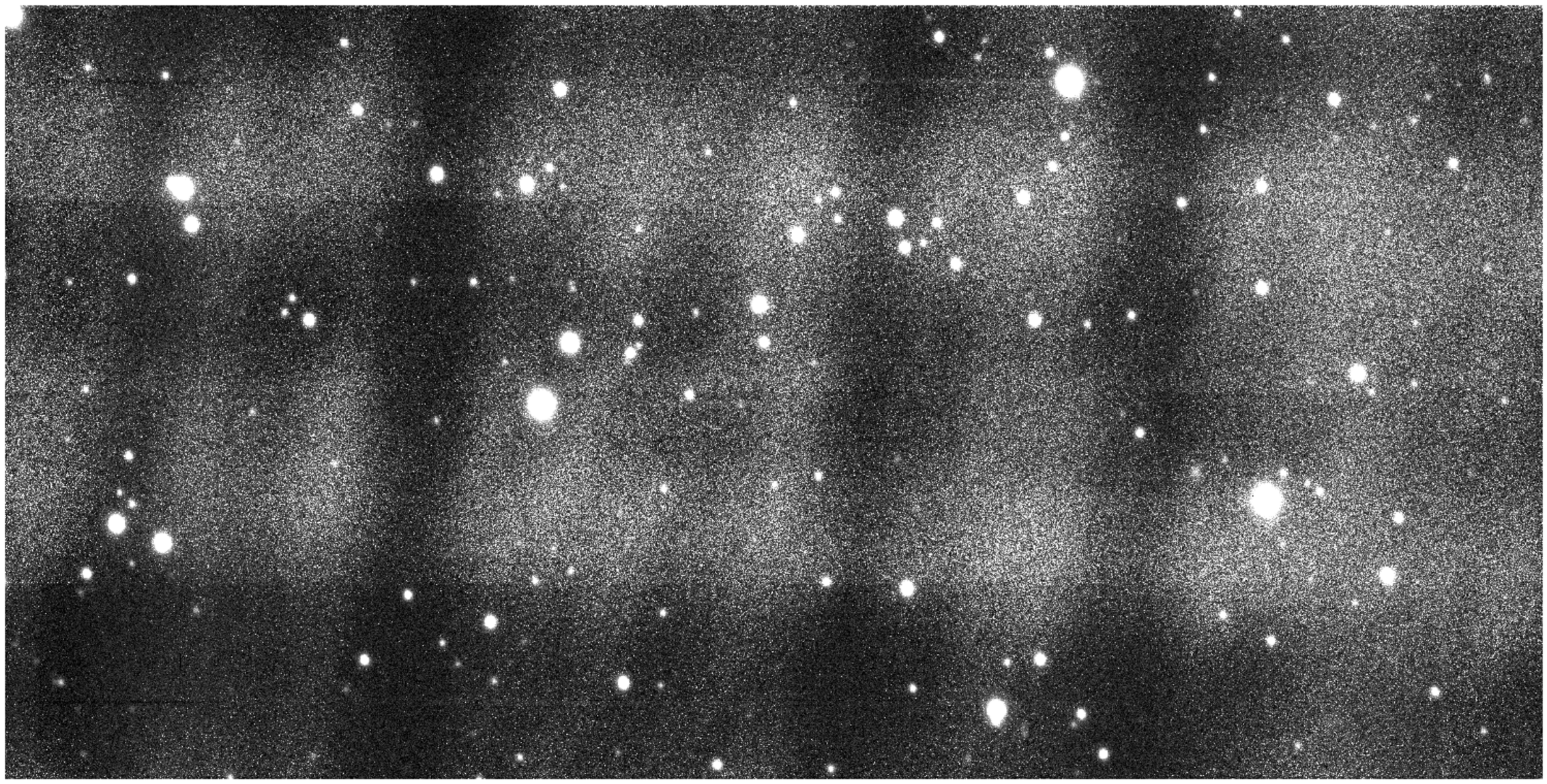
raw ; expid = 21338 ; extname = GUIDE0 ; black = med - 50 ADU ; white = med + 150 ADU



https://portal.nersc.gov/project/cosmo/temp/ameisner/GUIDE0_21338_poor_detrending.gif

Example of poor detrending

detrended ; expid = 21338 ; extname = GUIDE0 ; black = med - 50 ADU ; white = med + 150 ADU



https://portal.nersc.gov/project/cosmo/temp/ameisner/GUIDE0_21338_poor_detrending.gif

Lots of ‘speckle’ noise remaining after detrending

- Book-keeping error on my part?

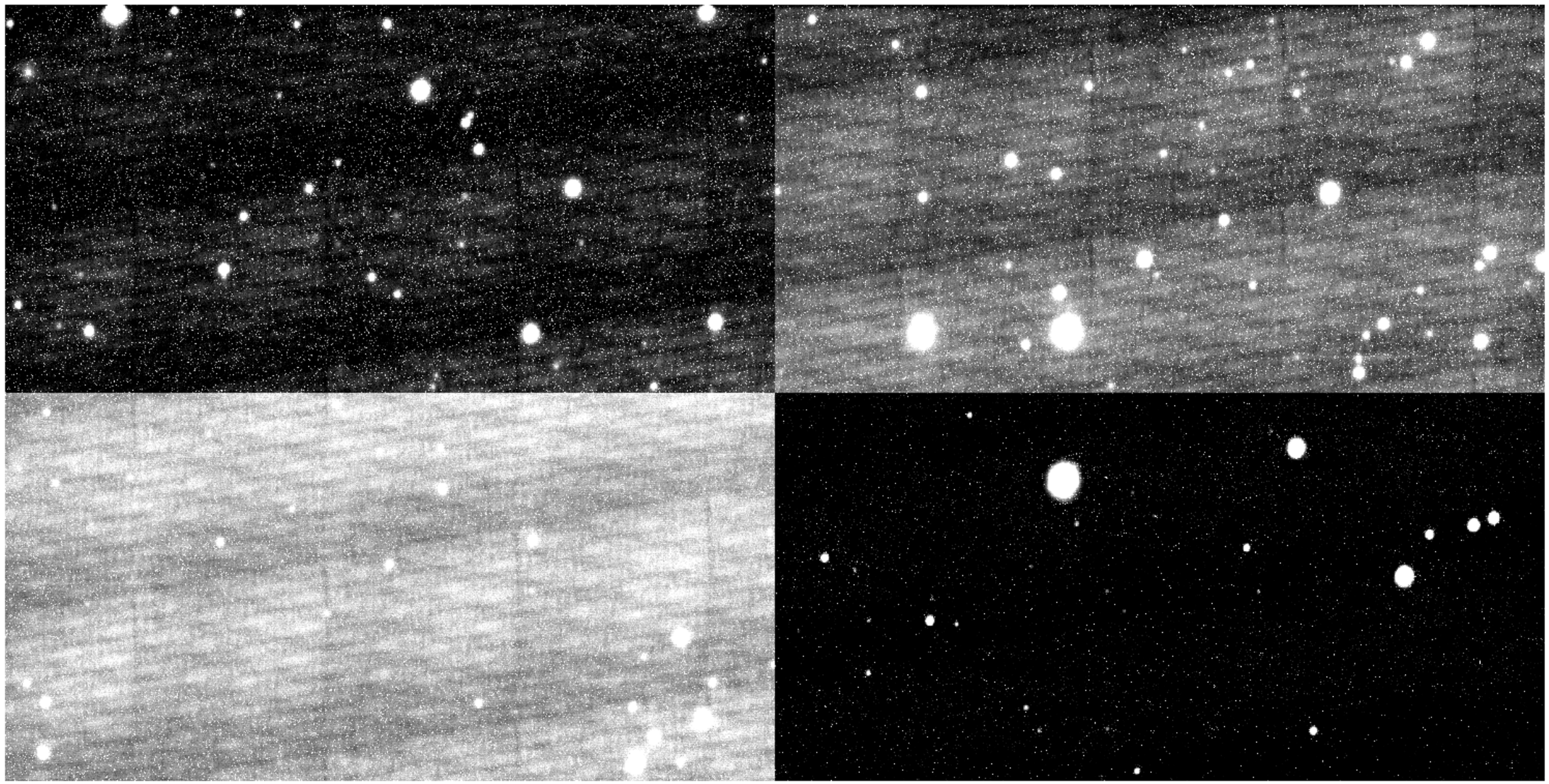
- Very different temperature scaling for different pixels within the same camera?

- Low-order dark current structure seems well-removed, but lots of moderately hot pixels are very poorly corrected

- In general, GUIDE0, GUIDE3, GUIDE7, GUIDE8 seem affected, whereas GUIDE2 and GUIDE5 look much more well-behaved

Example of good detrending

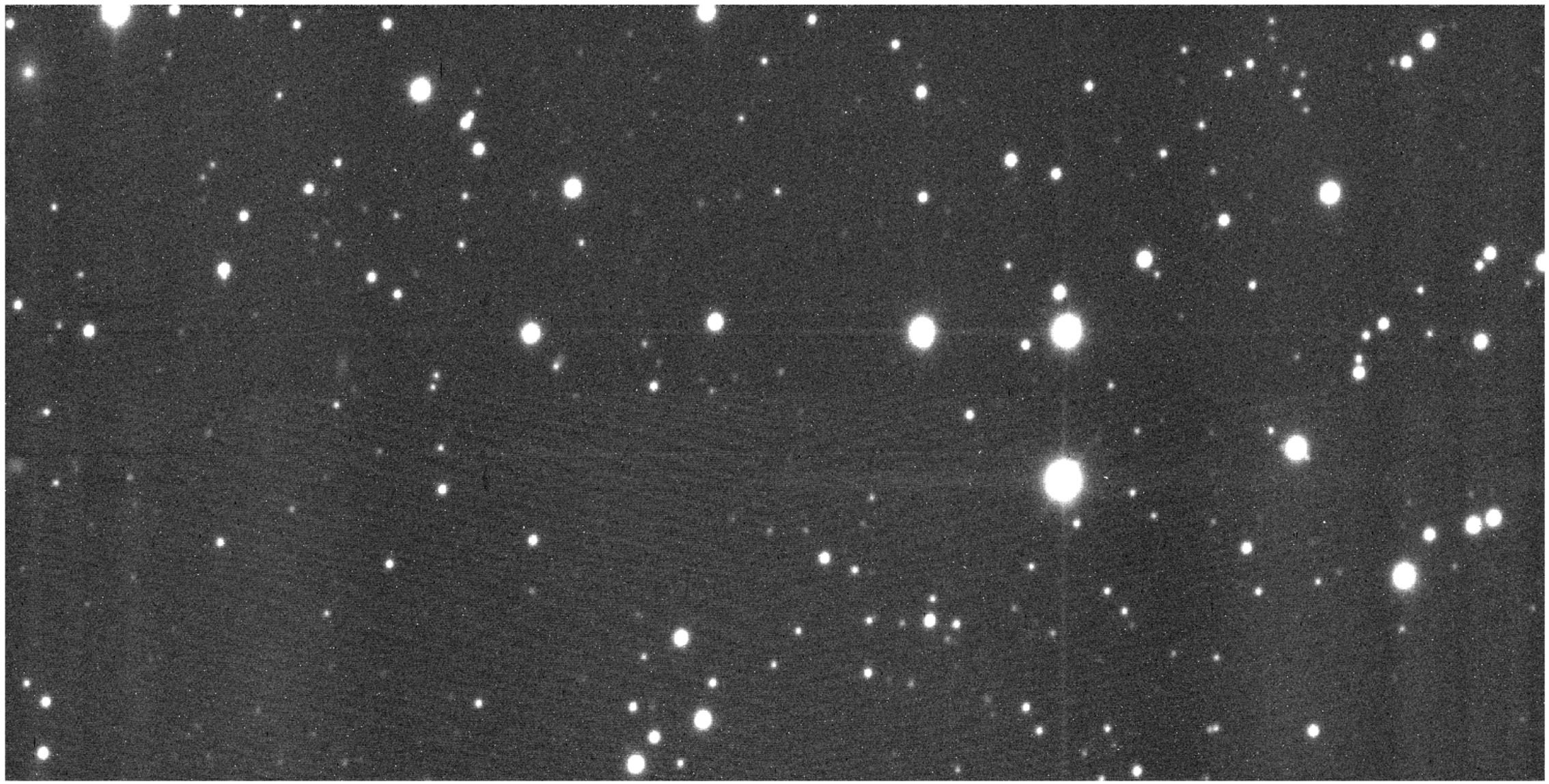
raw ; expid = 21338 ; extname = GUIDE2 ; black = med - 50 ADU ; white = med + 150 ADU



https://portal.nersc.gov/project/cosmo/temp/ameisner/GUIDE2_21338_good_detrending.gif

Example of good detrending

detrended ; expid = 21338 ; extname = GUIDE2 ; black = med - 50 ADU ; white = med + 150 ADU



https://portal.nersc.gov/project/cosmo/temp/ameisner/GUIDE2_21338_good_detrending.gif