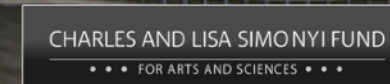
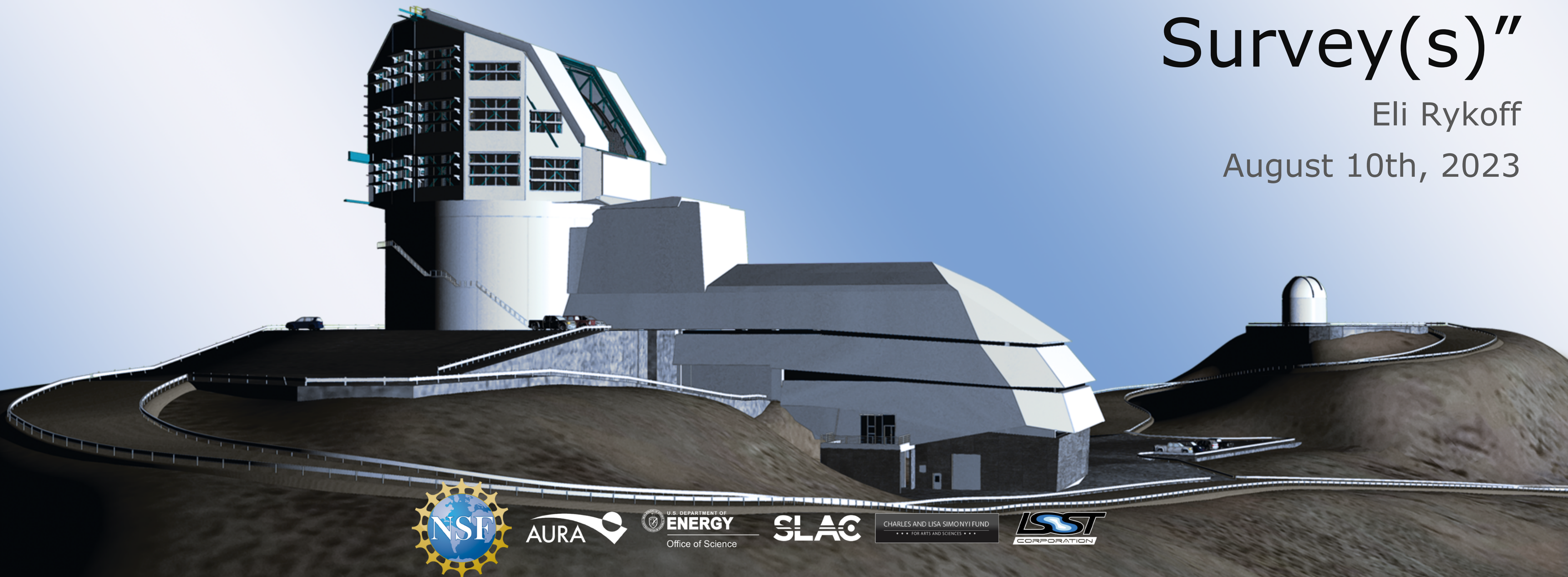


Rubin Observatory

# “AuxTel Photometric Survey(s)”

Eli Rykoff

August 10th, 2023

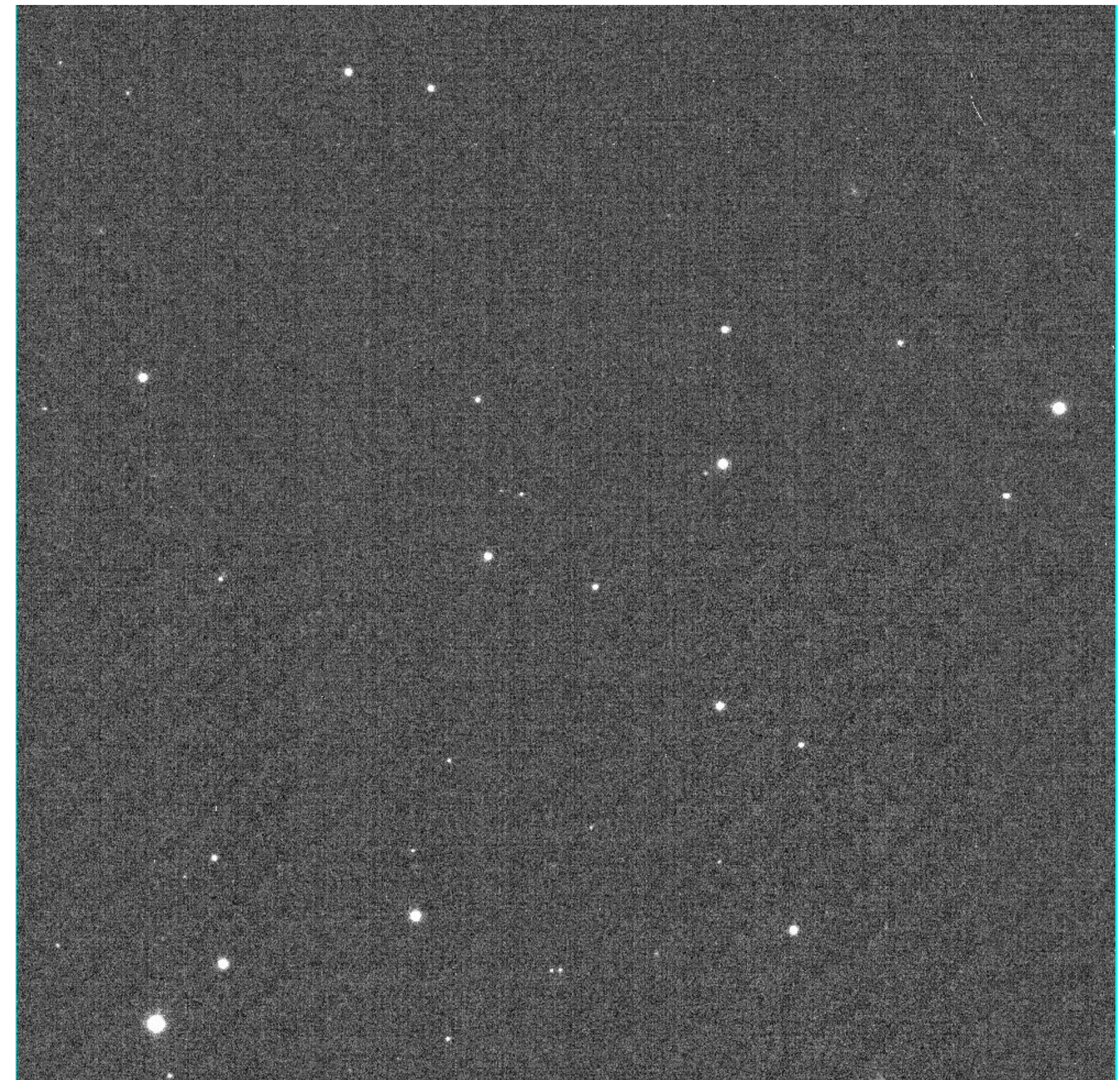
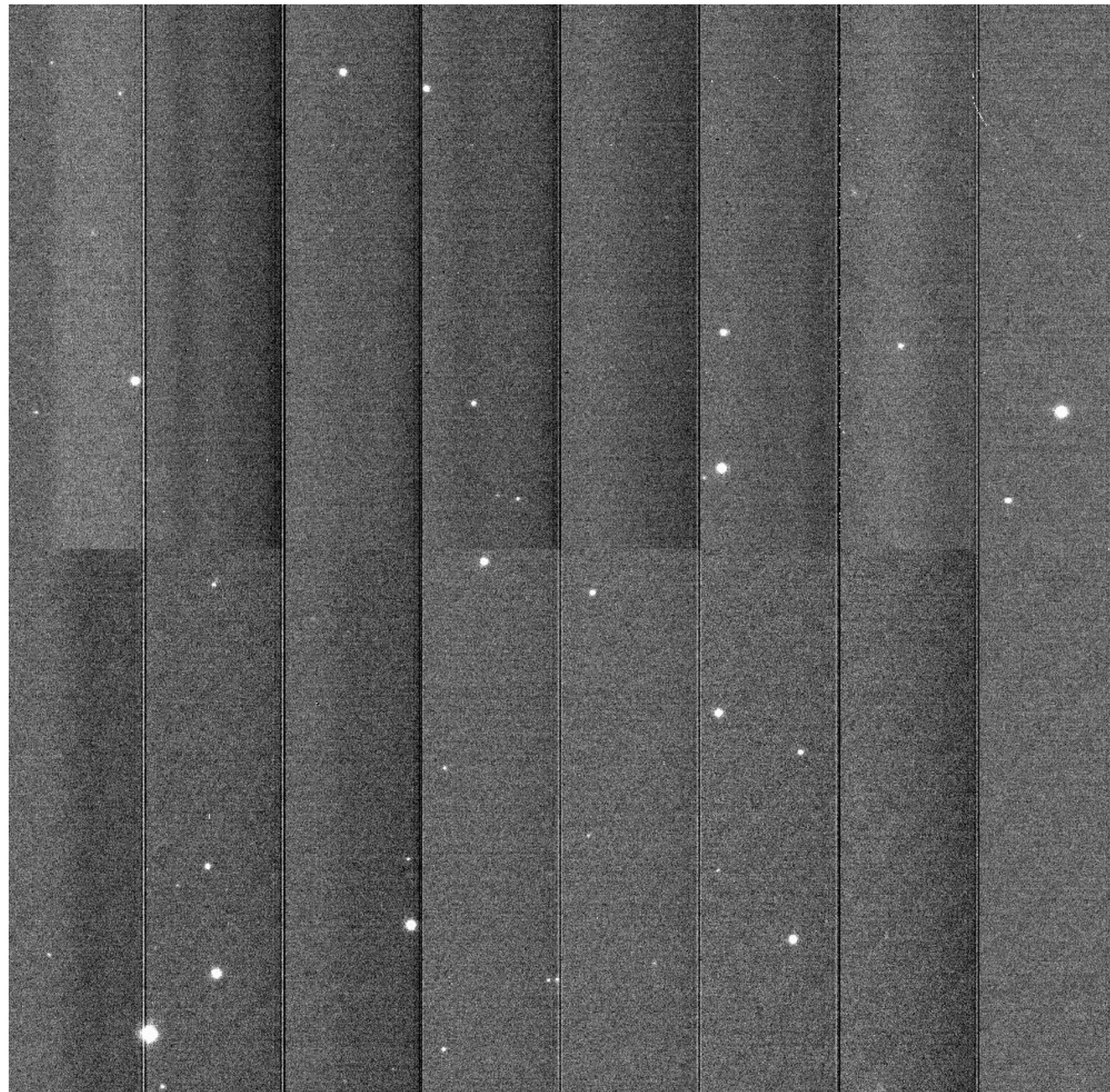




- We have had many photometry campaigns on AuxTel LATISS.
  - Observations in dense and non-dense fields; range of airmass; etc.
  - Early observations were done with original filter set that were degrading rapidly from the outside in (don't epoxy your filters!)
  - Many sequencer updates, testing of ISR configs, etc.
  - Earlier programs did not do any dithering (just tiling)
- I am not talking about the past, I am focused on the present and the future



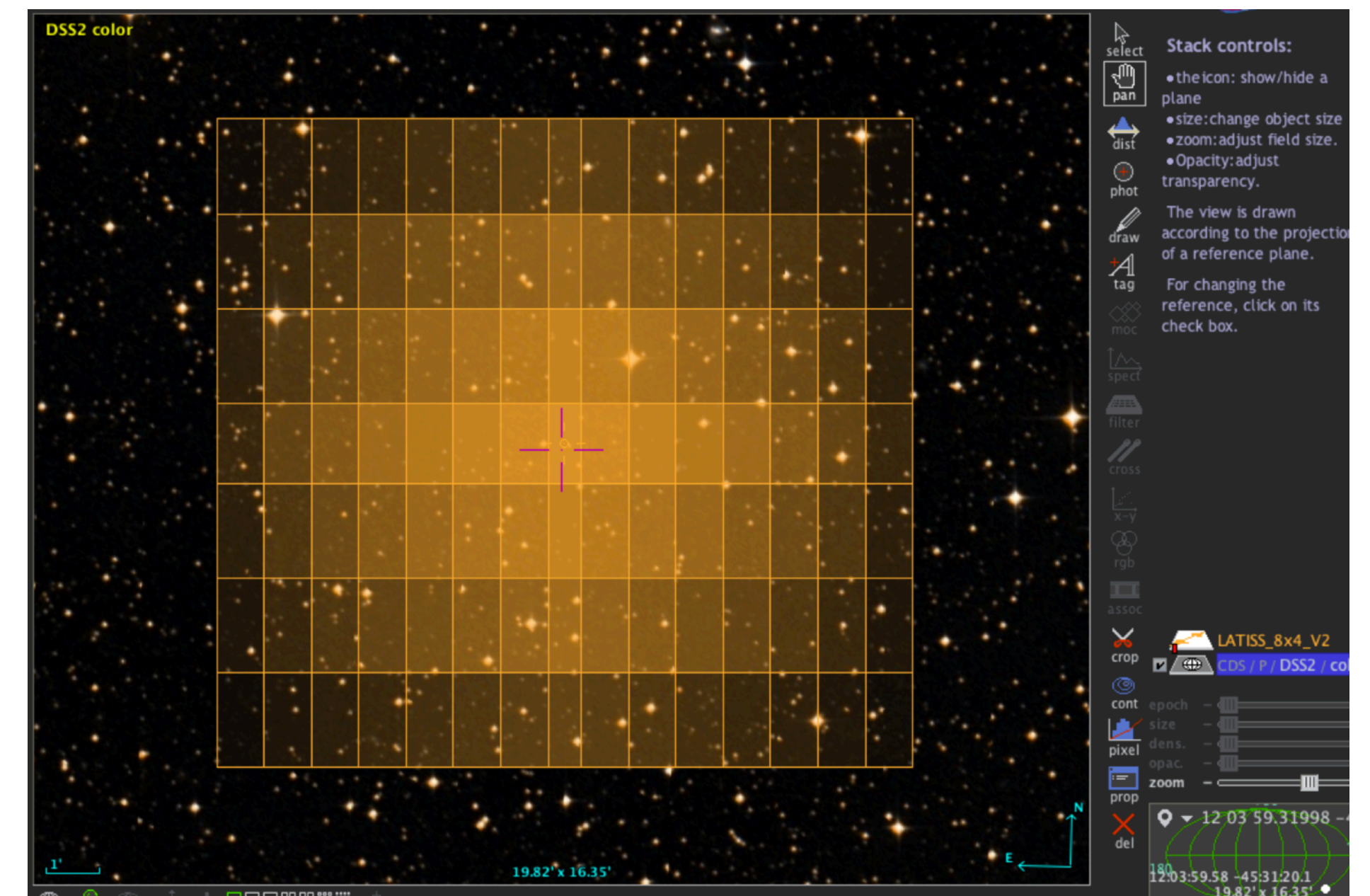
# Improvements in ISR





# The Present Survey Strategy

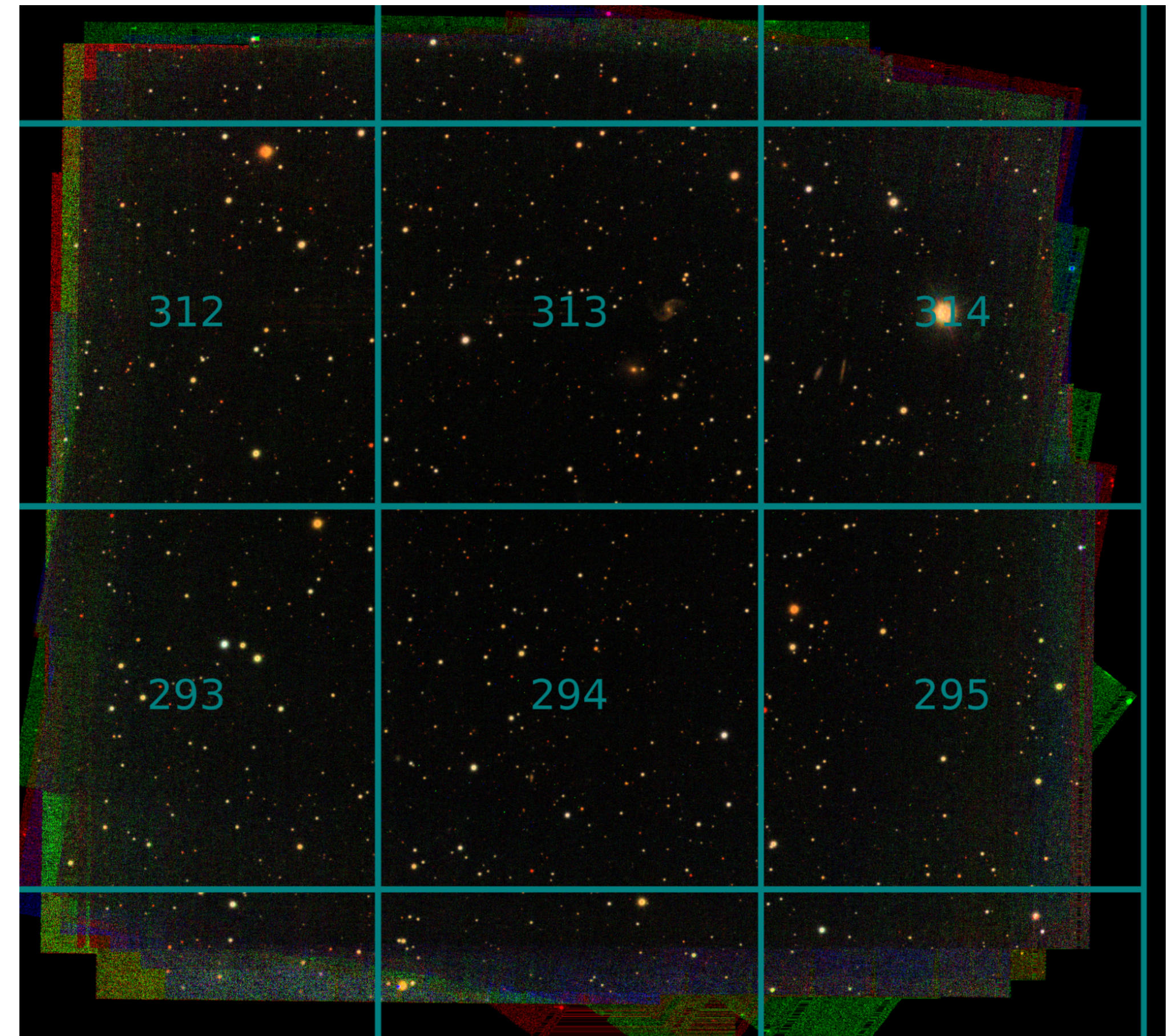
- New SDSS filters installed in October 2022
- New dithered observing strategy from Spring 2023 (thanks, Erik Dennihy!)
- New sequencer version and calibrations (Yousuke Utsumi and Chris Waters)
- Using parallel overscan correction, crosstalk corrections, etc.
- We have 381 dithered observations in g, r, i taken over several nights.





# The Deep Coadd

- Processing led by Huan Lin, visualization and q/a from Lauren MacArthur
- We have things going through to coaddition.
- But the metrics for photometric repeatability have ... not been satisfactory.





# A Note About The Processing Pipelines

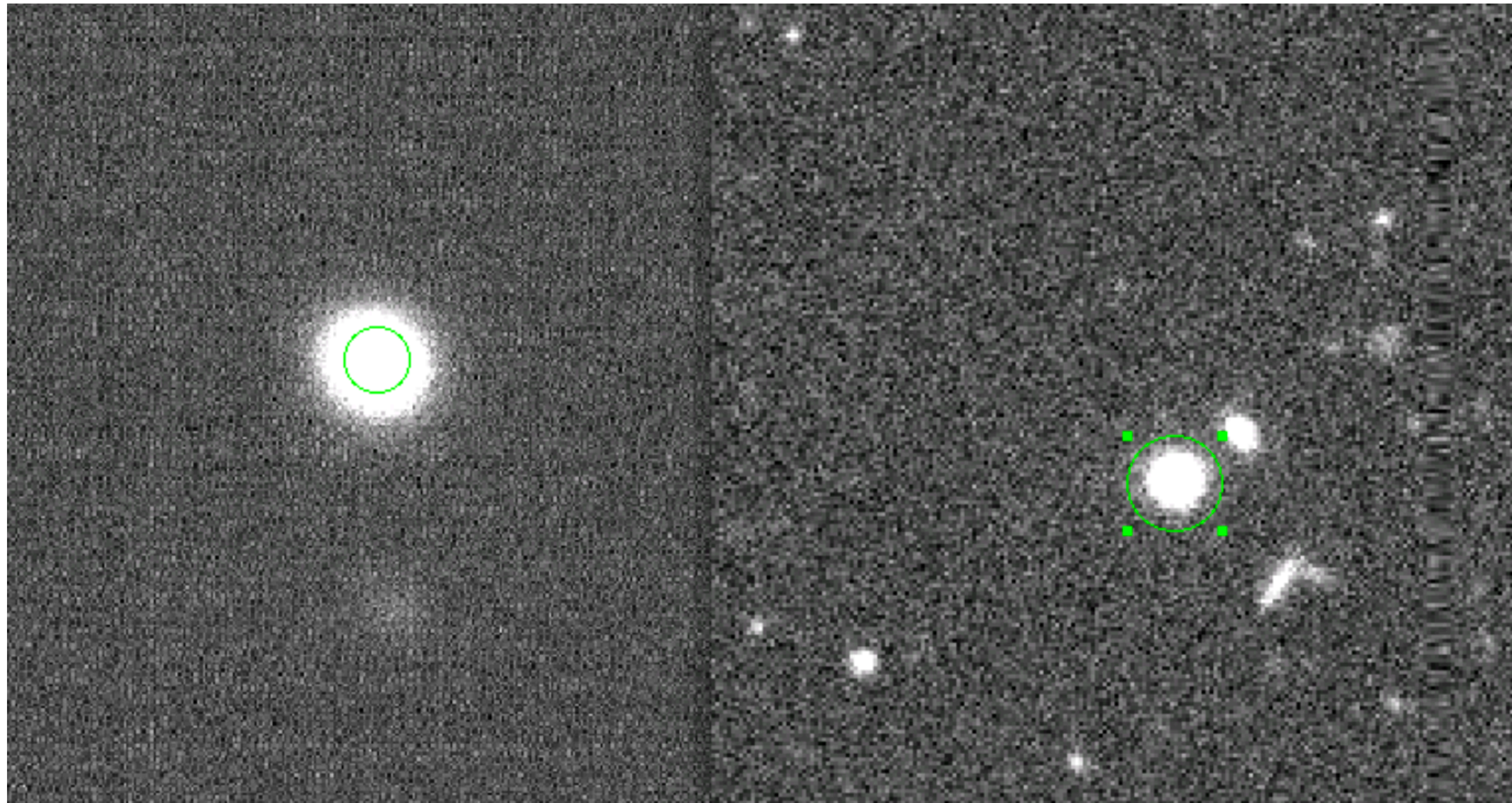
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- NB: We have not yet implemented the plans from CalibPalooza, which makes this better.
- Single frame processing runs ISR and measures a “large aperture” flux for all the stars used for calibration.
- There is a simple astrometric and photometric calibration performed.
  - This photometric calibration is one zero-point per detector based on refcat matching
- The global calibration step (FGCM) is used to solve for the illumination correction (variation of throughput for focused light, which will be significantly different than that of the flat fields)
  - We have not been doing this step until now.
- Warping and coaddition uses the spatially variable photometric calibrations.



# Oops, that wasn't very large after all...

- But a funny thing happened along the way... the pixel scale of LATISS is much different than that of HSC or the main telescope.
- We failed to override the default "large aperture" size (in pixels).





# Progress with FGCM

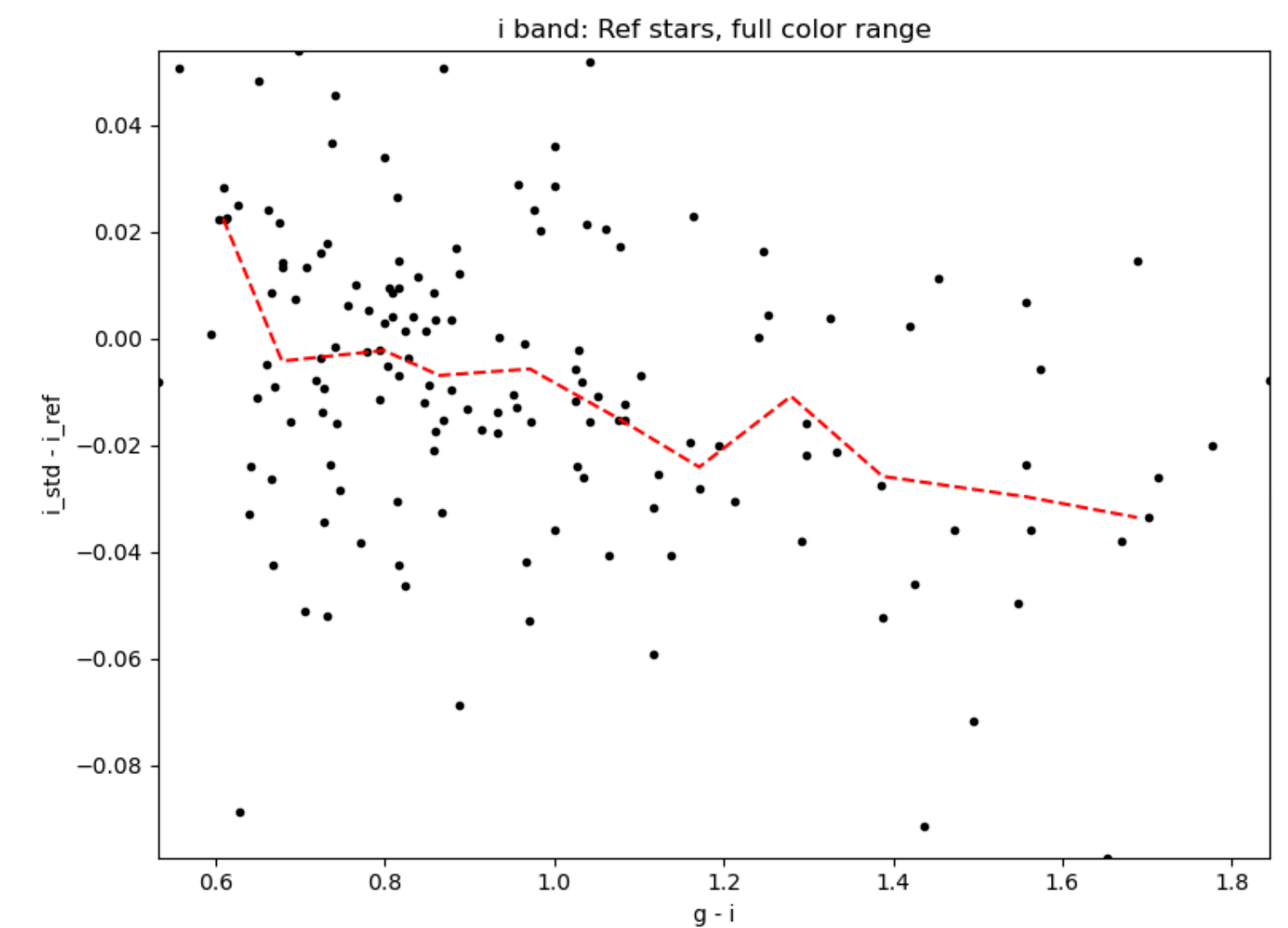
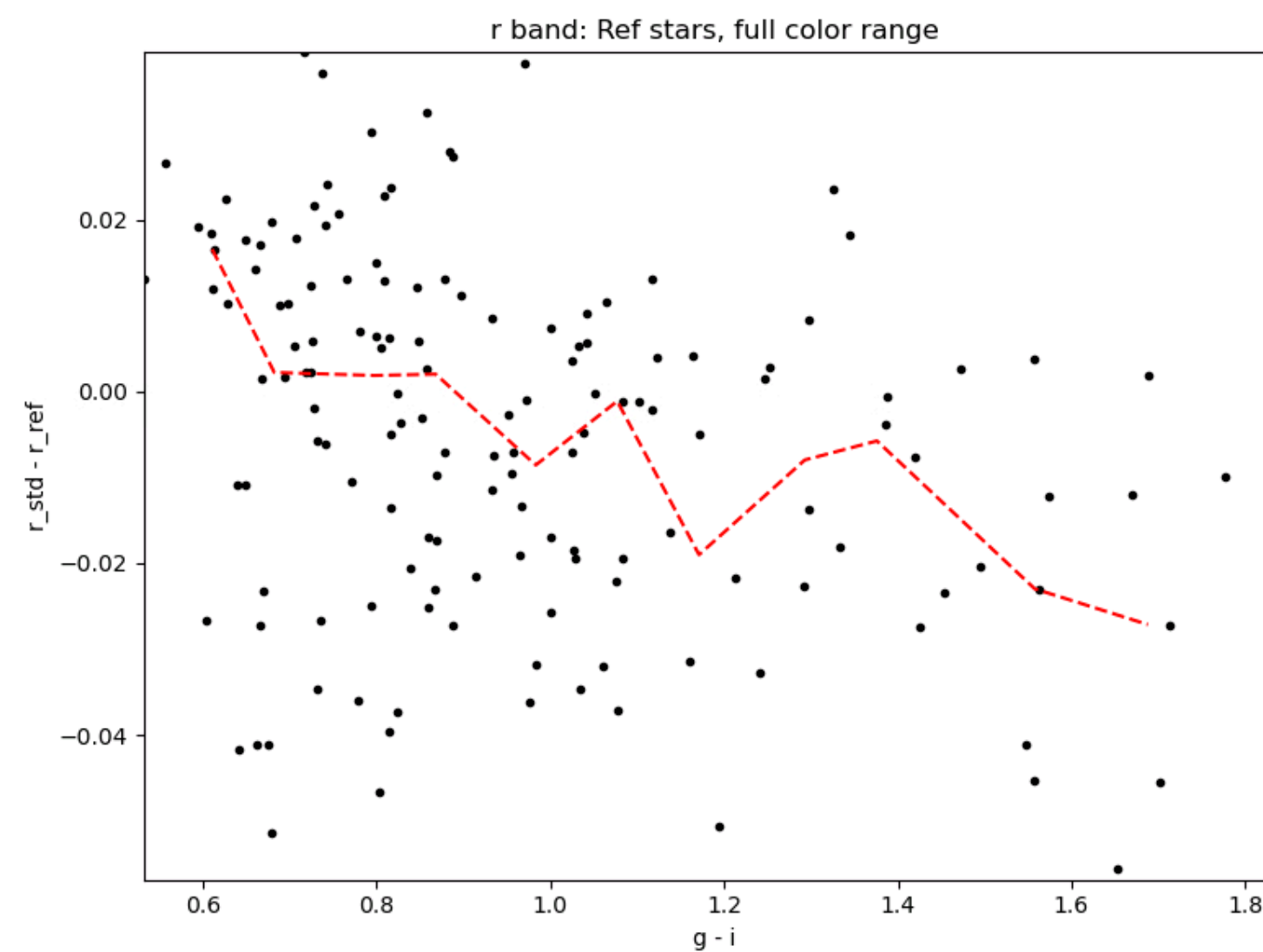
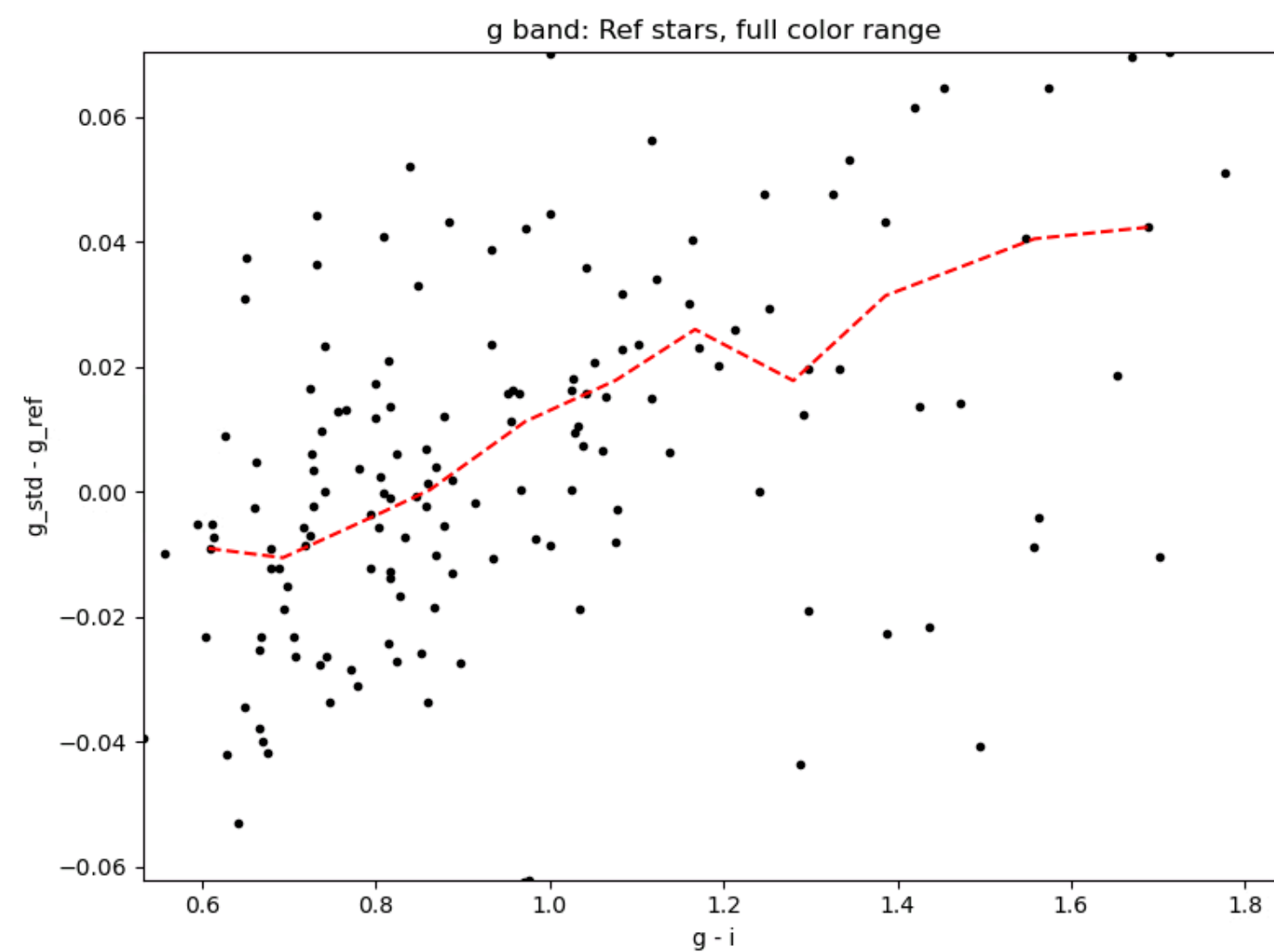
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- Fixed this aperture and reprocessed.
- Ran through to the Forward Global Calibration Model (FGCM) step.
- Got things working well enough before /repo/embargo on USDF fell down.



# Progress with FGCM

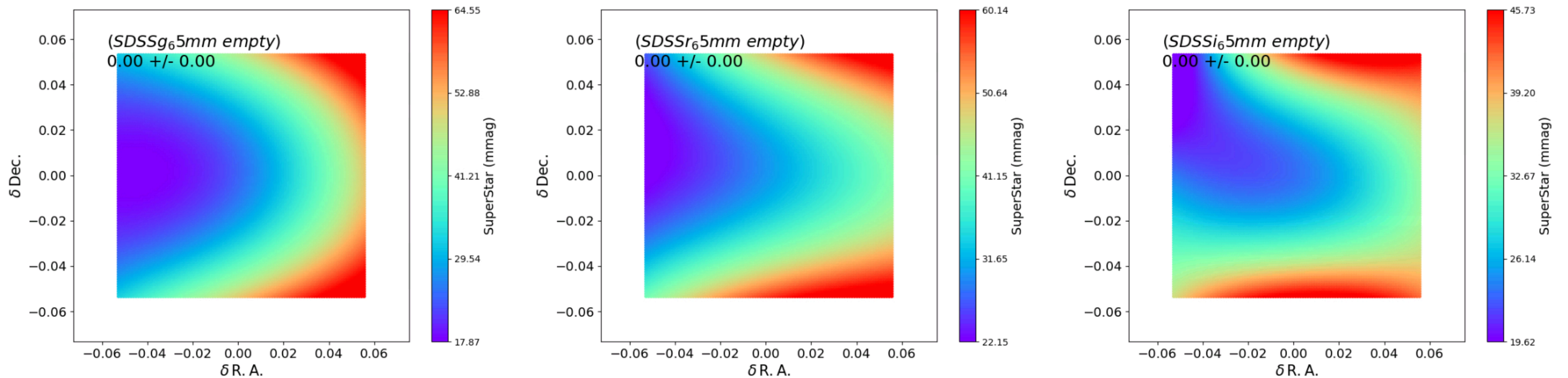
- FGCM looks at color terms between the reference catalog and the AuxTel system.
- Things are still somewhat noisy ... but we can see we need to put in color terms to the default configs.
  - May want a bit more data, but can already do much better than what we have (no color terms at all).





# Progress with FGCM

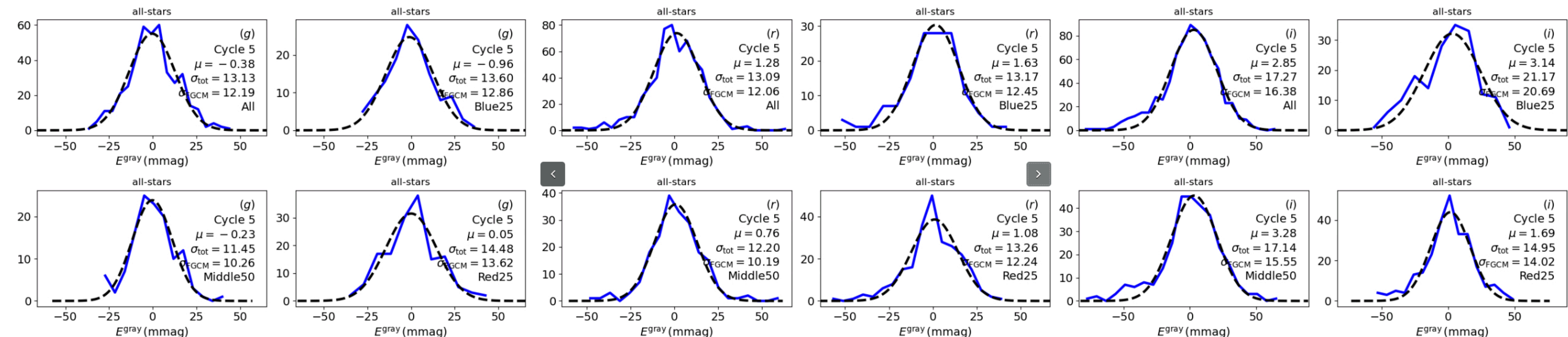
- FGCM generates illumination correction (star flat)
  - This is done as a second degree Chebyshev polynomial (default)
  - 4% (40 mmag) variations across the FOV.
  - This makes a big difference!





# Progress with FGCM

- Repeatability for bright stars as estimated by FGCM is 12 mmag (g/r) to 16 mmag (i).
- This is larger than I would like.
- Have not had a chance to dig in.





- Can we make it to 1% calibrations?
  - Use color terms for refcat -> LATISS.
  - More observations may be necessary.
    - There are just not many star observations per visit.
  - Dithered observations of denser field.
    - Properly factor out illumination correction and get into science pipelines (longer term, but necessary and on the roadmap)
  - Tests as a function of airmass.
    - No obvious residuals in the survey so far, but limited s/n.
  - Additional issues with small-scale flat field variations (dust!)
    - Not enough star observations to really tease this out from the star data