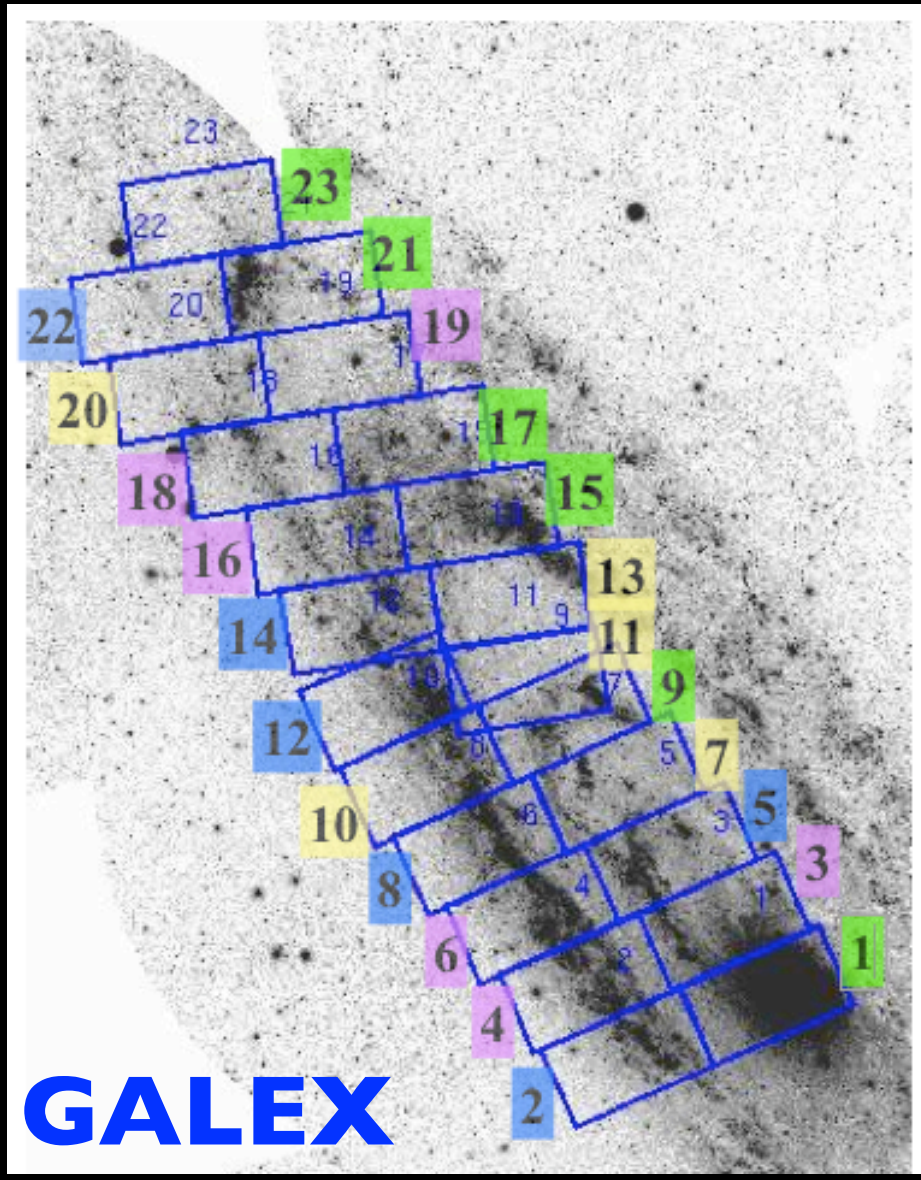
The Panchromatic Hubble Andromeda Treasury

STUC Update April 2011

6-Filter HST Tiling of M31



Year 1
- 21
- 15
- 9
- 1
- 17
- 23

Year 2
- 12
- 14
- 2
- 5
- 8
- 22

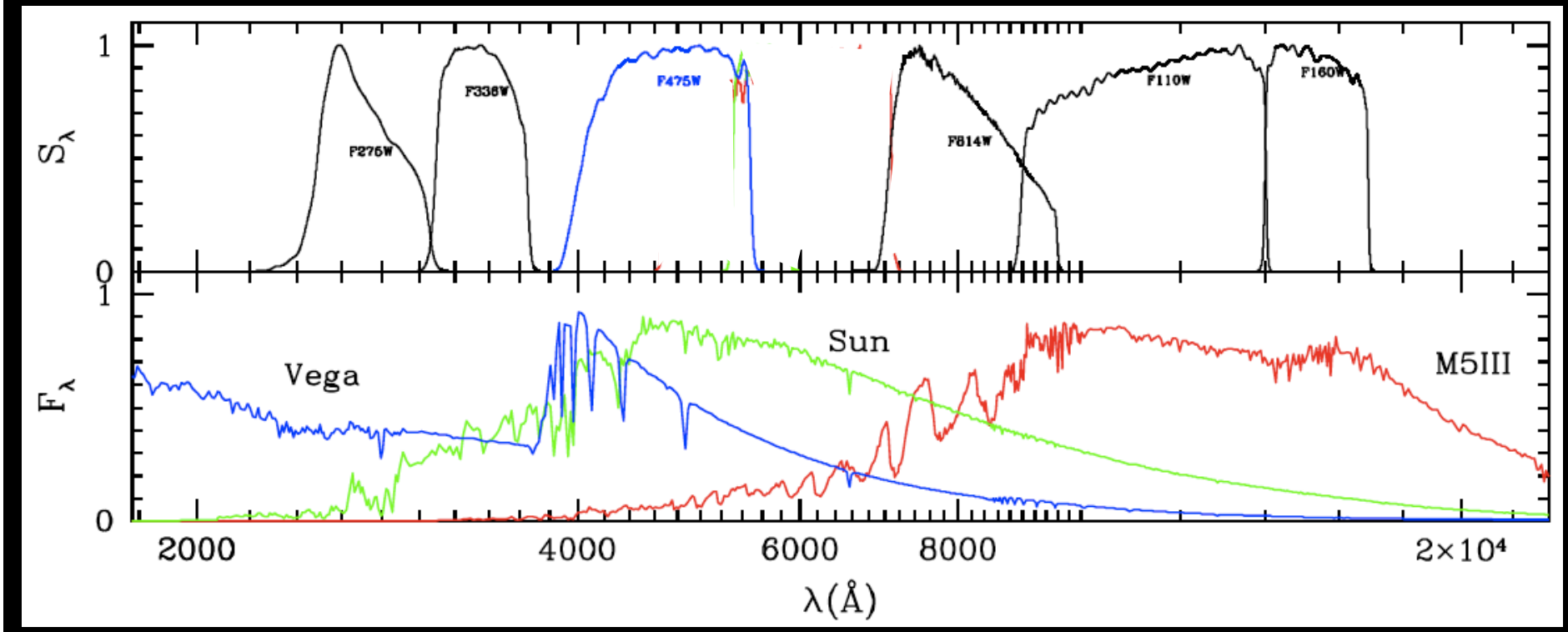
Year 3
- 6
- 16
- 4
- 18
- 3
- 19

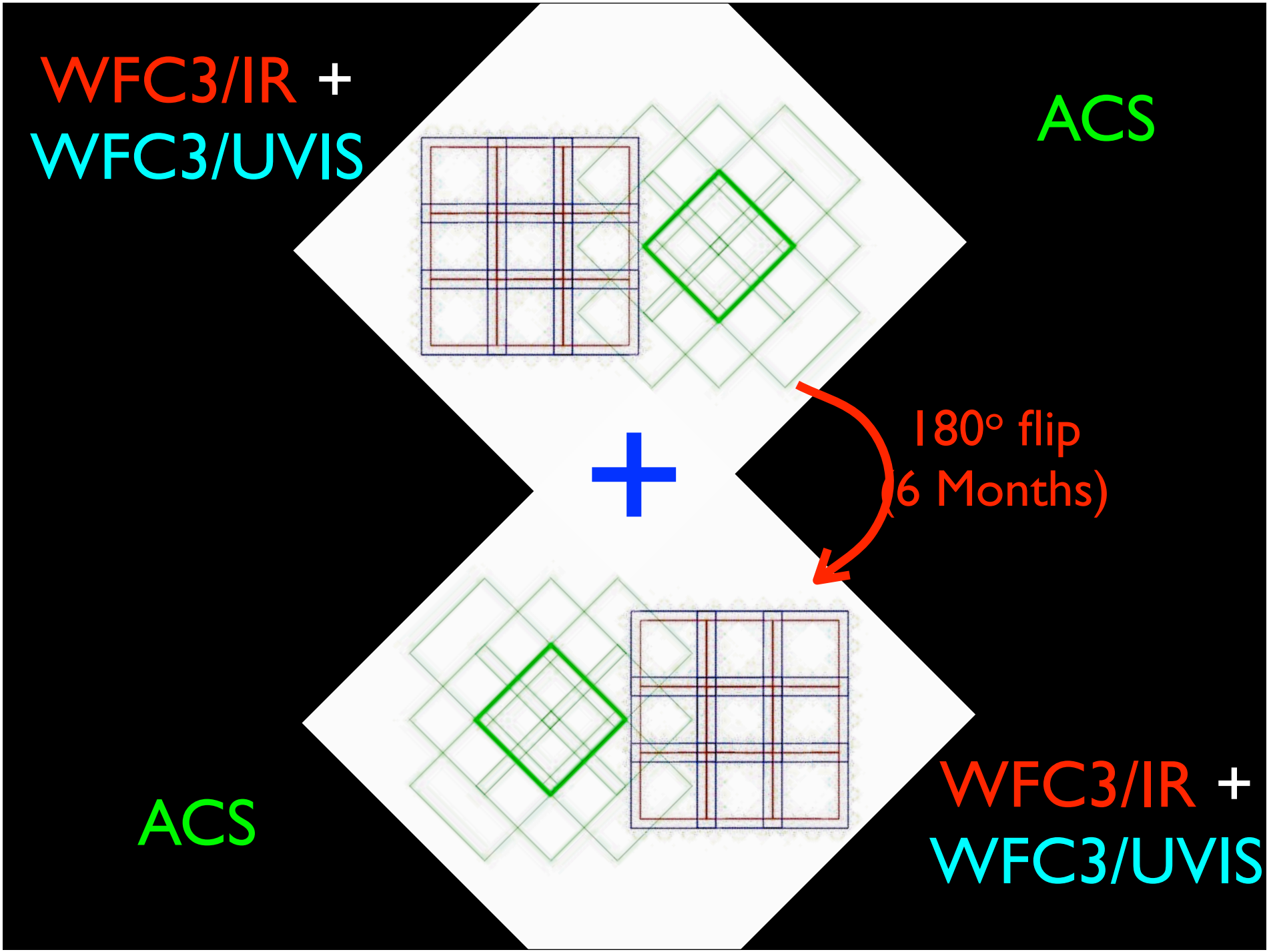
Year 4
- 10
- 20
- 7
- 13
- 11

828 Orbits

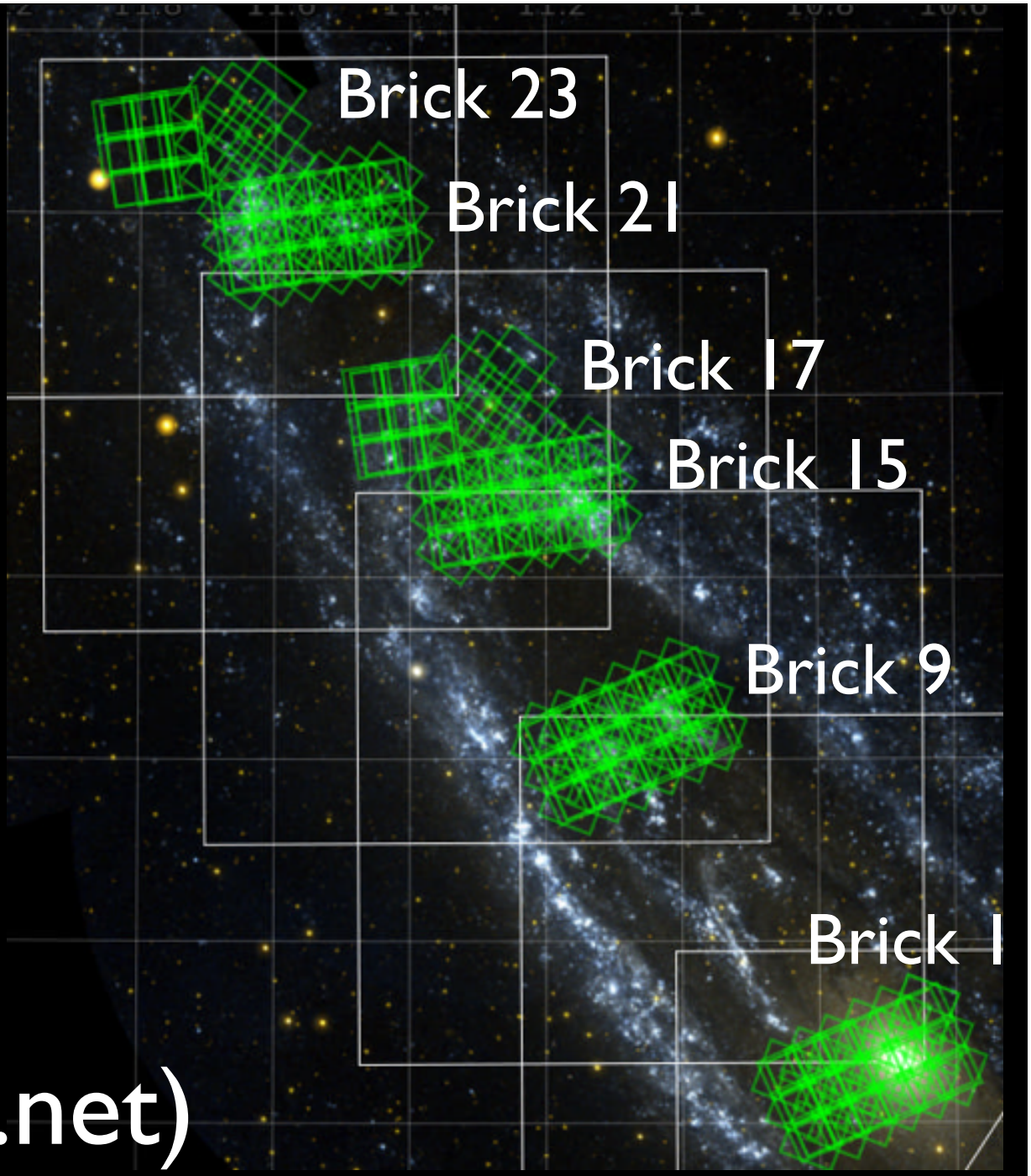
Filters

F275W F336W F475W F814W F110W F160W



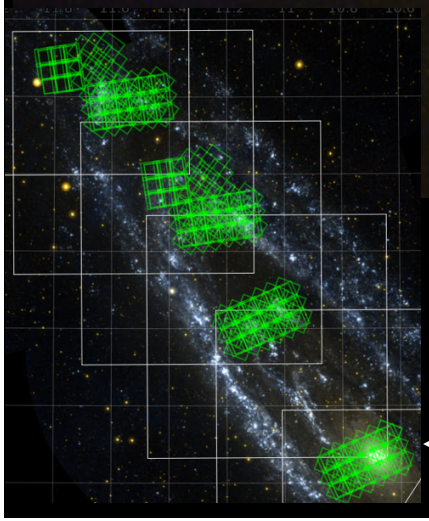

WFC3/IR +
WFC3/UVIS
ACS
180° flip
(6 Months)
ACS
WFC3/IR +
WFC3/UVIS

Status

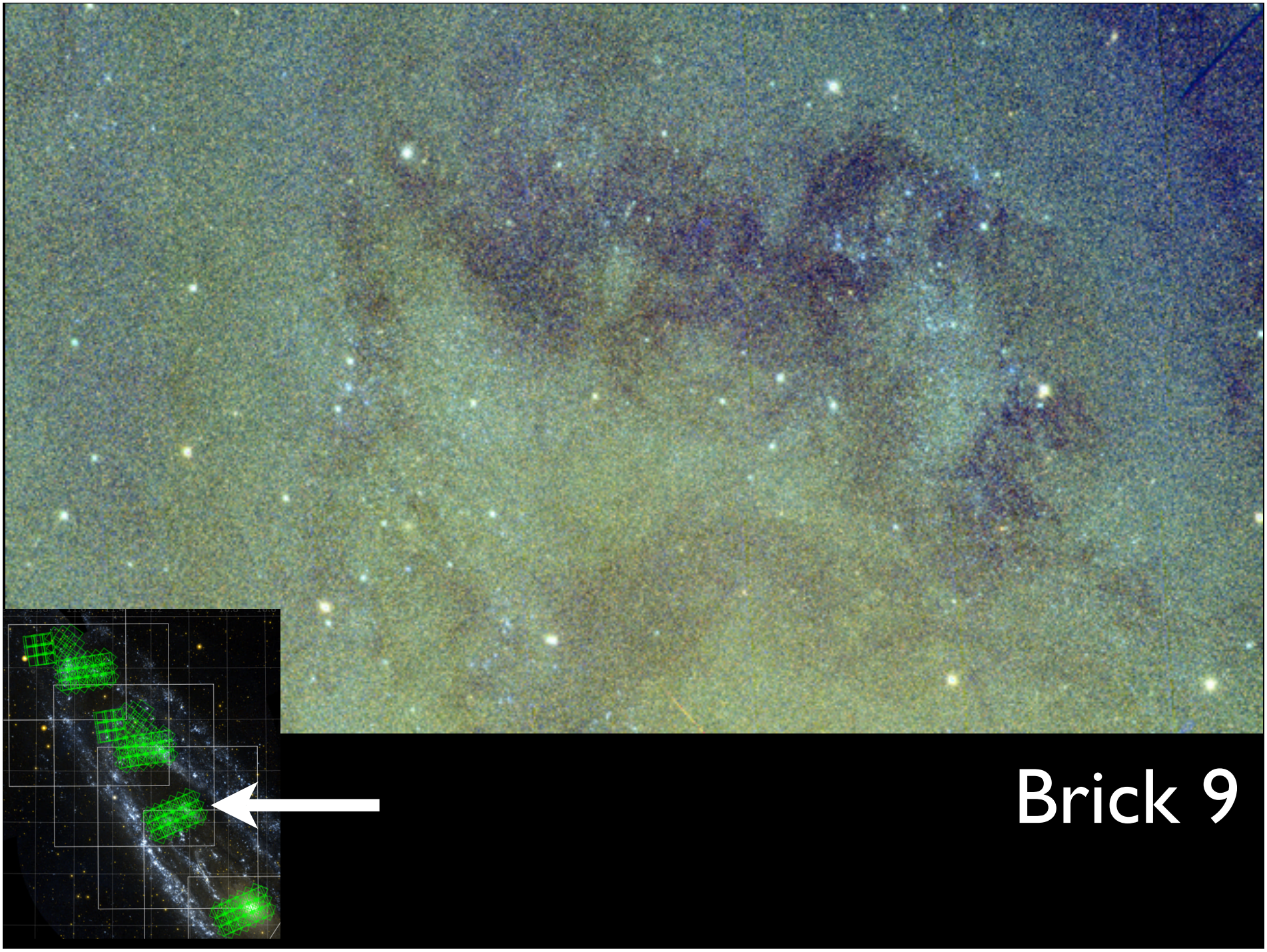


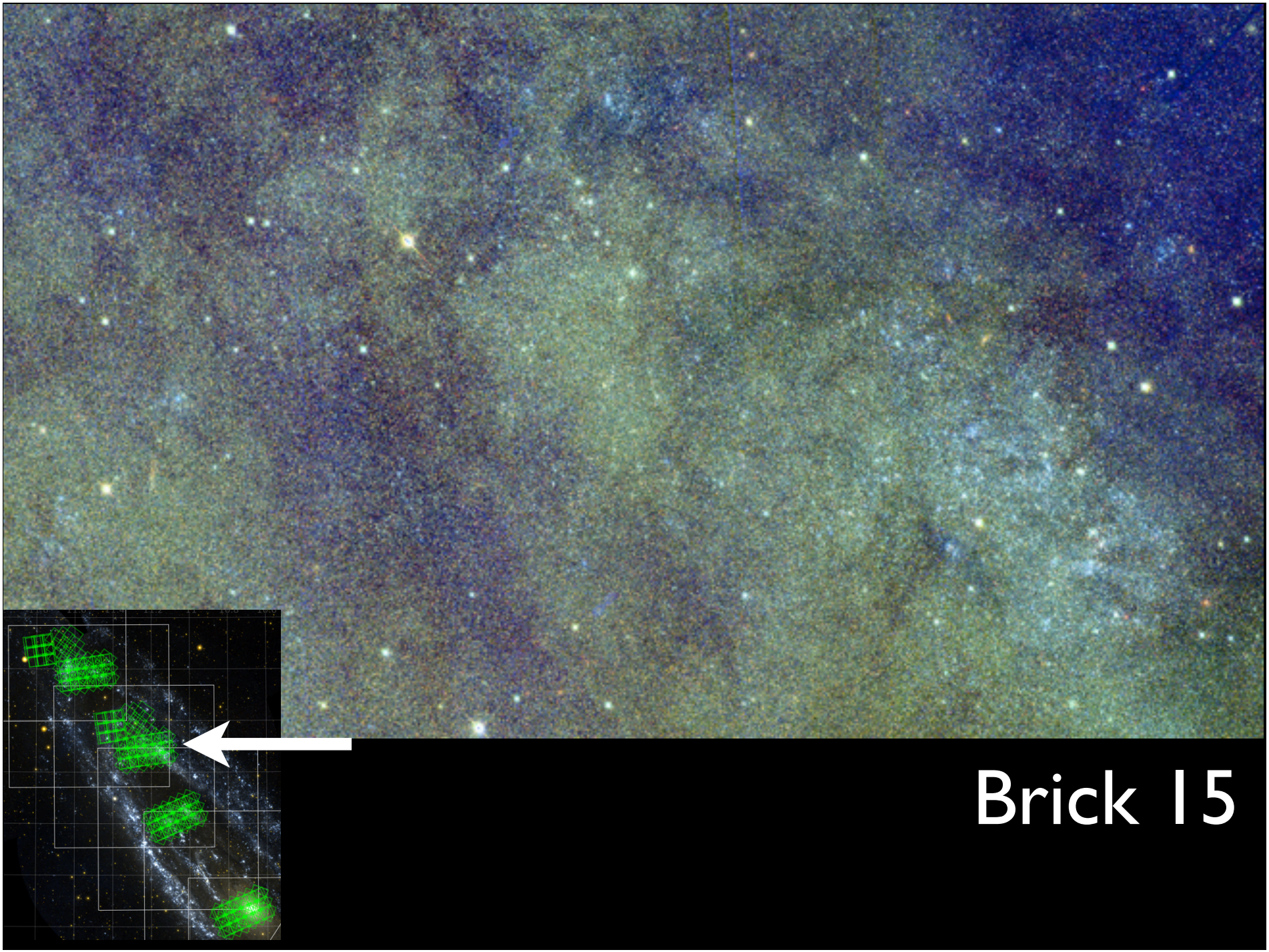
Dustin Lang
(astrometry.net)

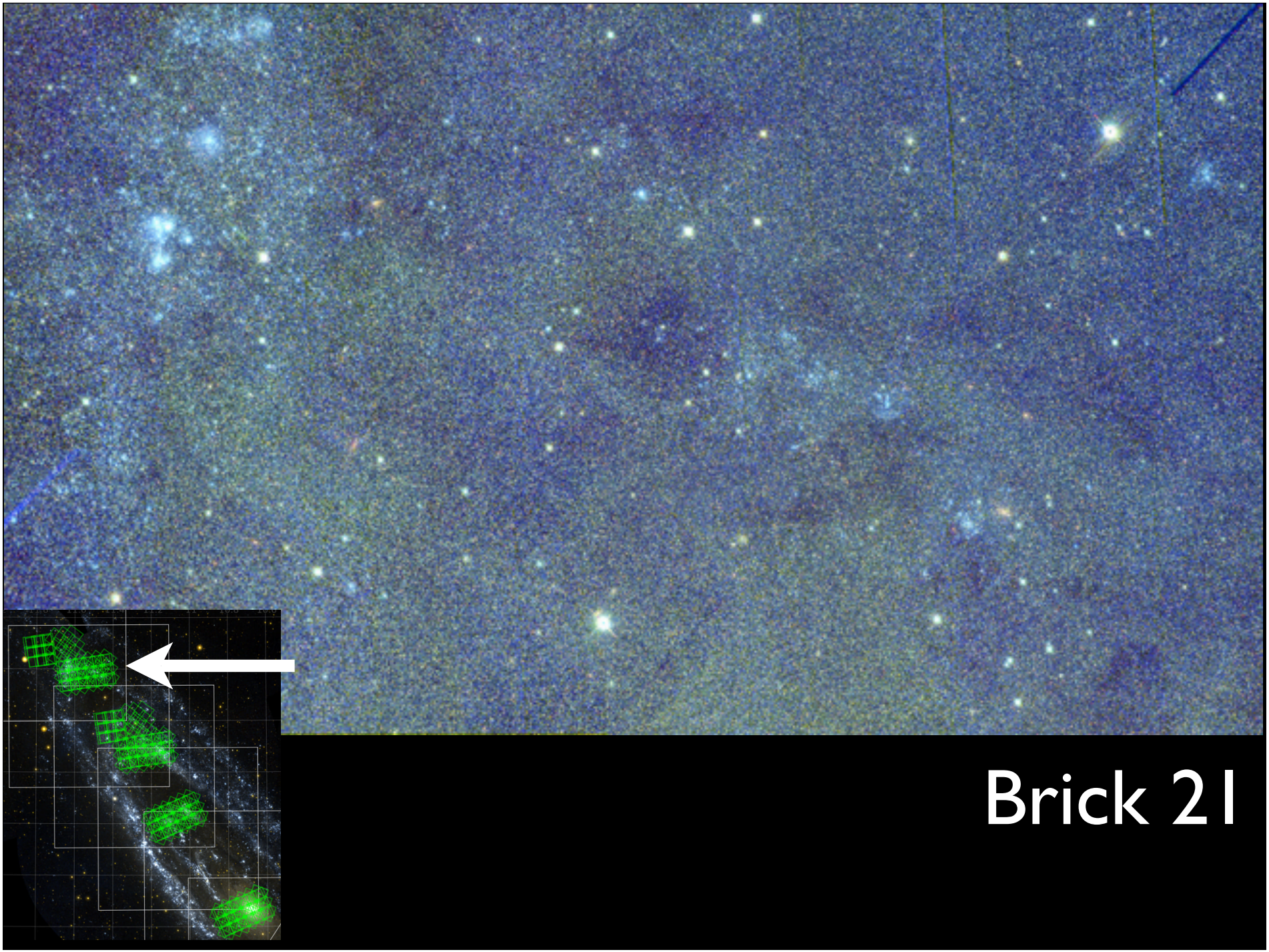
18 pointings
12'x6.5' (2.7x1.5kpc)
F336W+F475W+F814W



Brick 1


Brick 9

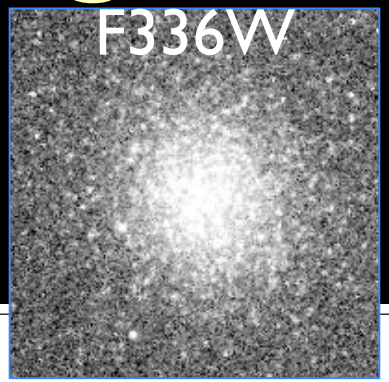

Brick 15

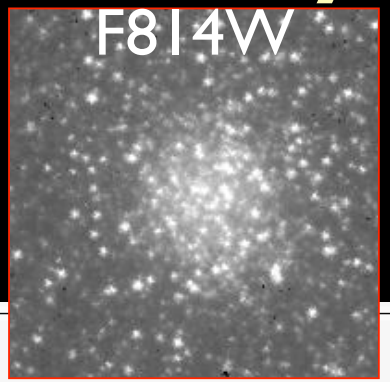

Brick 21

Technical Progress

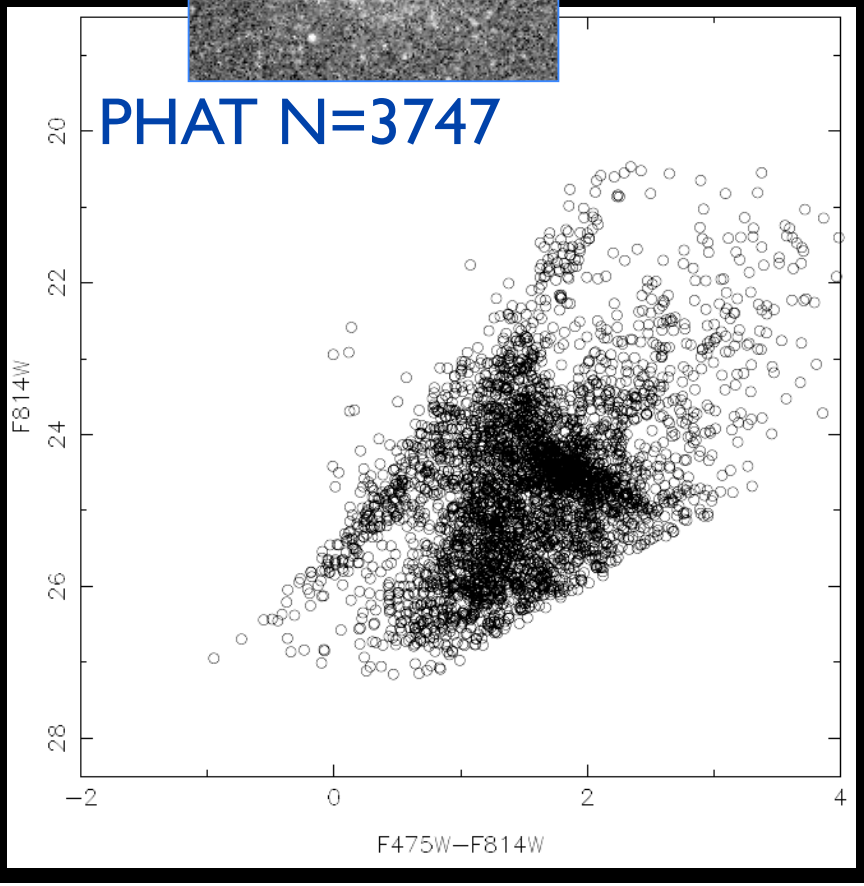
- Data reduction complete (or at least, it was until a major UW disk crash...)
- Astrometry in good shape. Currently limited by accuracy of distortion corrections.
- Very very very close to moving processing to the cloud.
- Coordinating w/ STScI for first data release

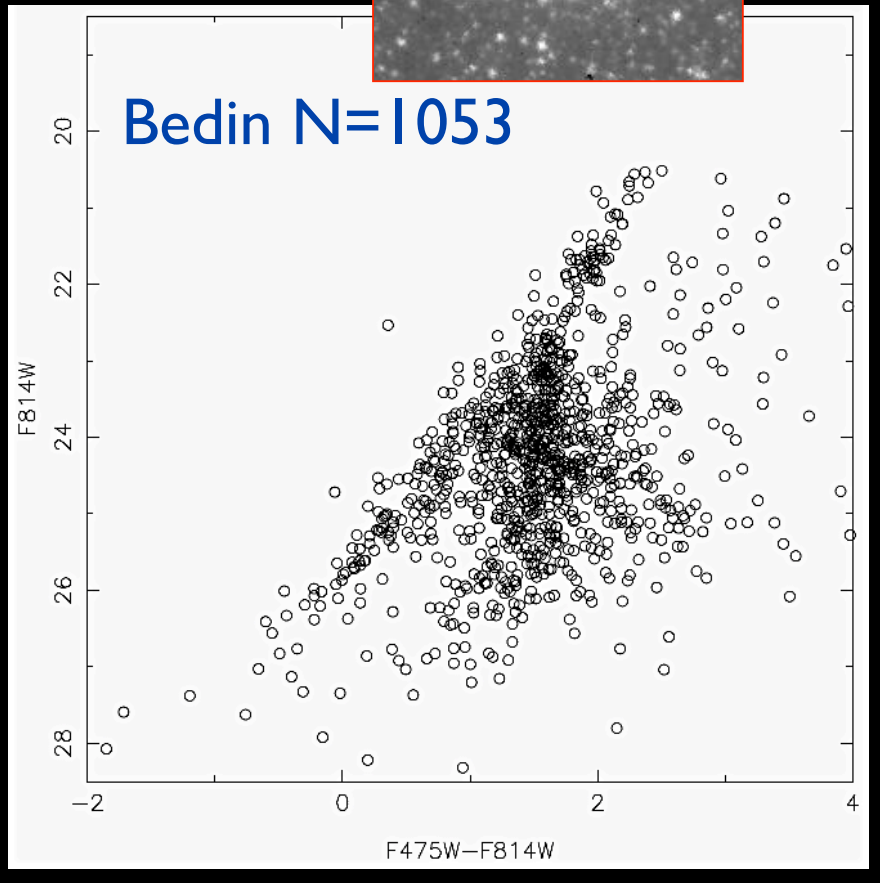
High Photometric Quality



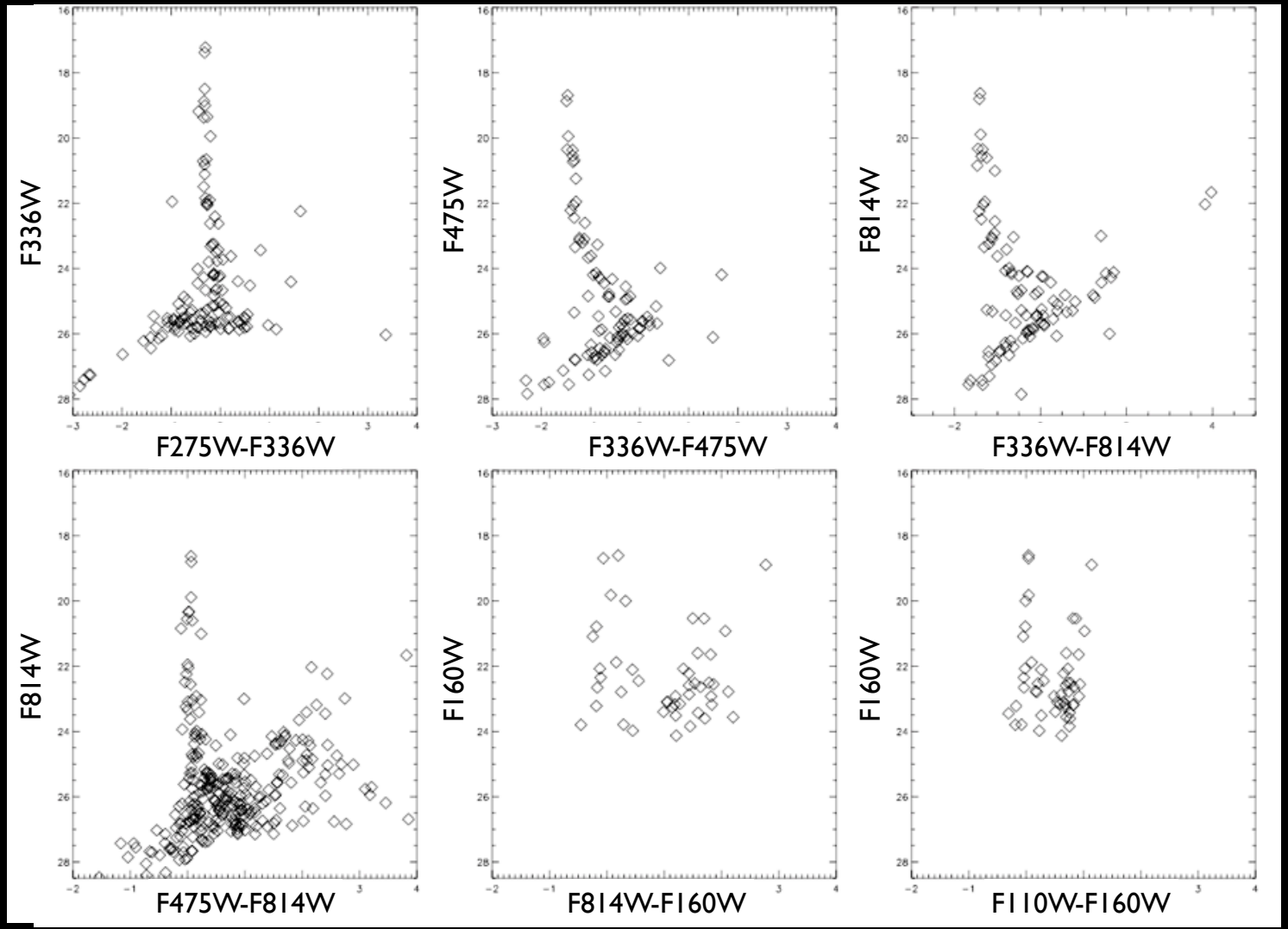


Cluster B229-G282





High Photometric Quality



A young cluster in Brick 21

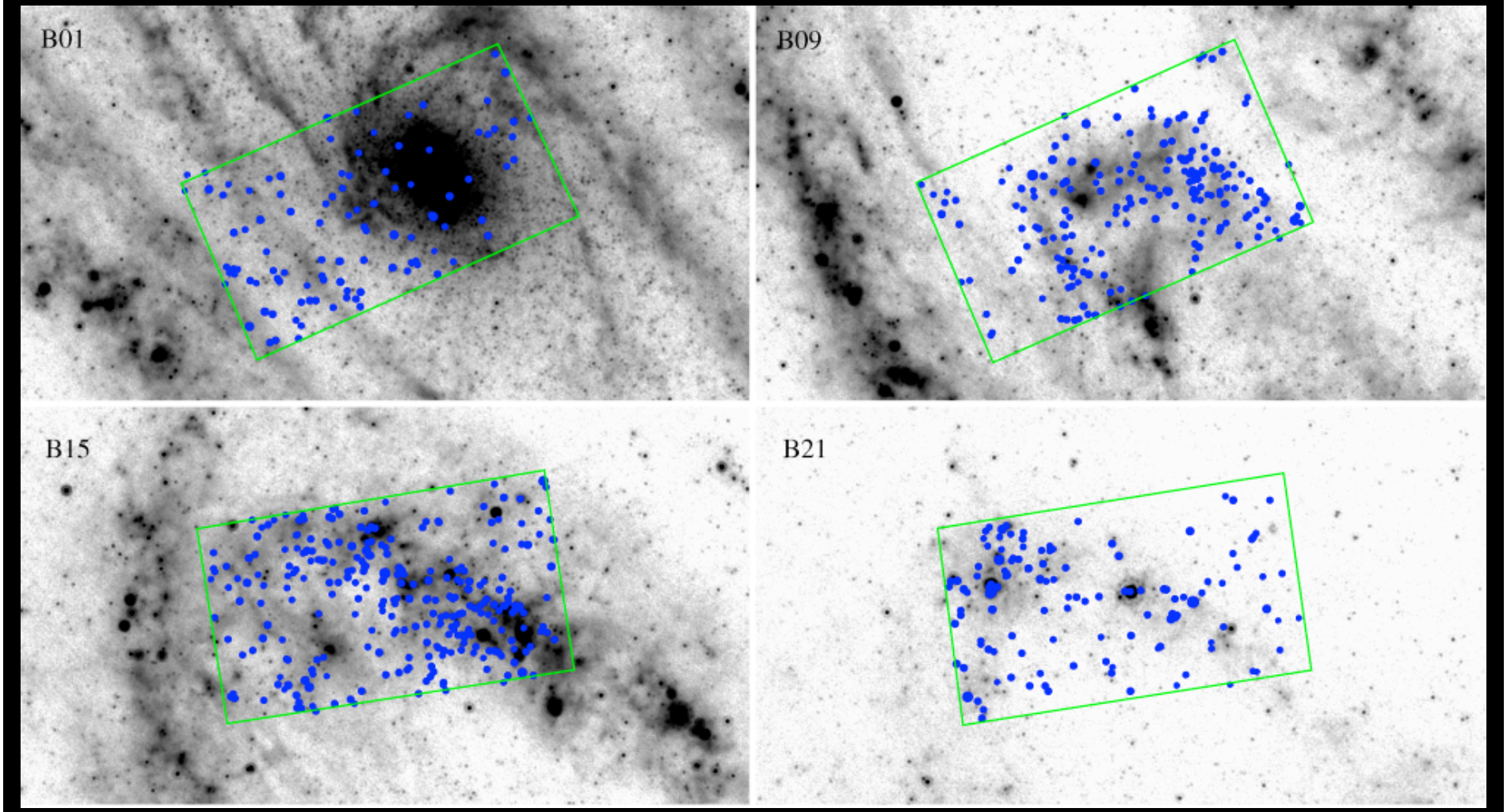
On-going Technical Progress

- Suite of photometry tests to further optimize parameters for field and clusters
- CR rejection in UVIS w/ 2 exposures/pointing
- Simultaneous photometry across overlapping cameras
- Improving distortion corrections
- Generalizing artificial star test results
- Optimizing SED fitting of stellar templates

Scientific Highlights

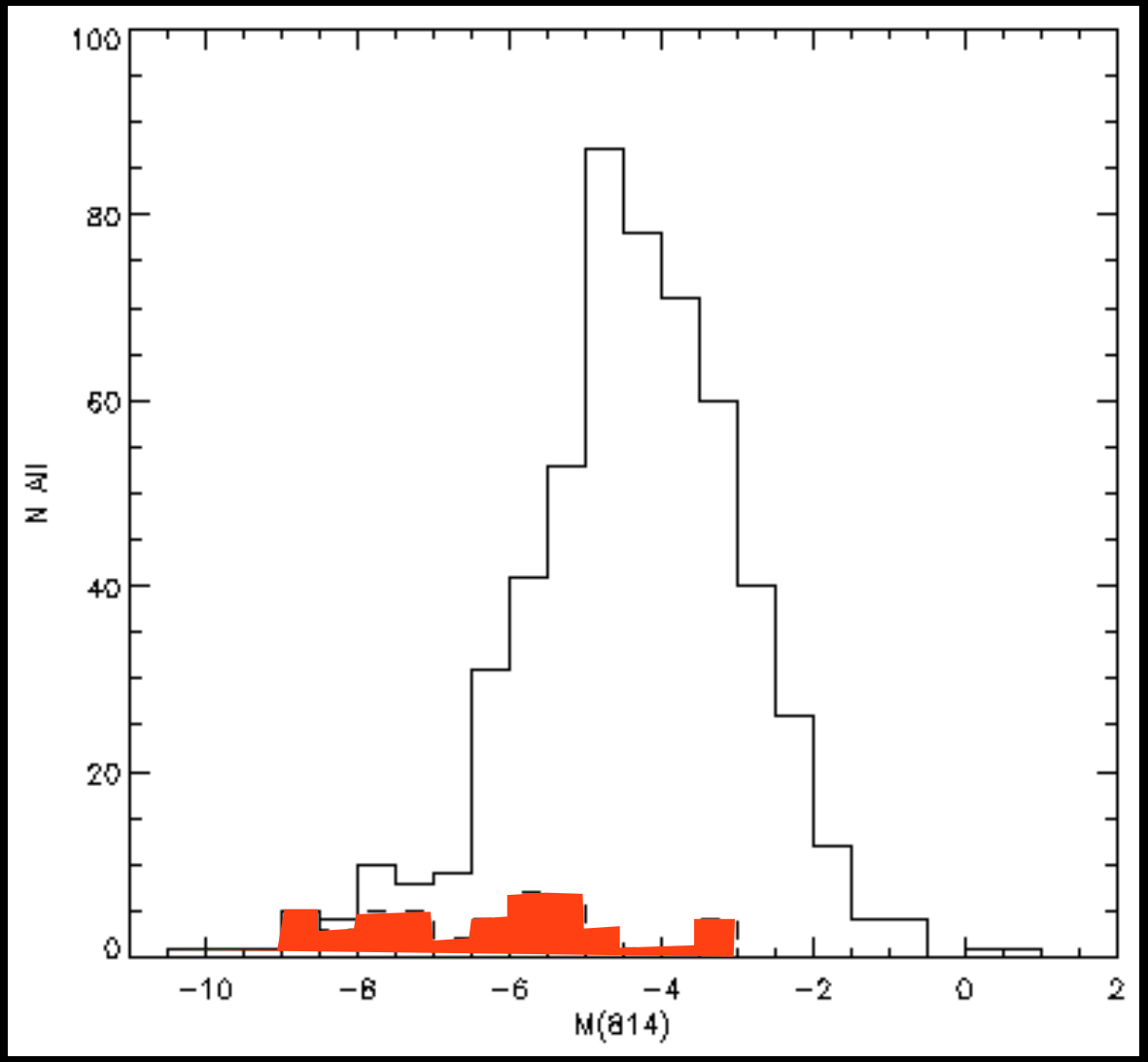
- By-eye cluster identification complete in first 4 bricks
- UV stellar populations in bulge
- Dust mapping
- SED fitting of stars

Stellar Clusters



24 micron

Stellar Clusters

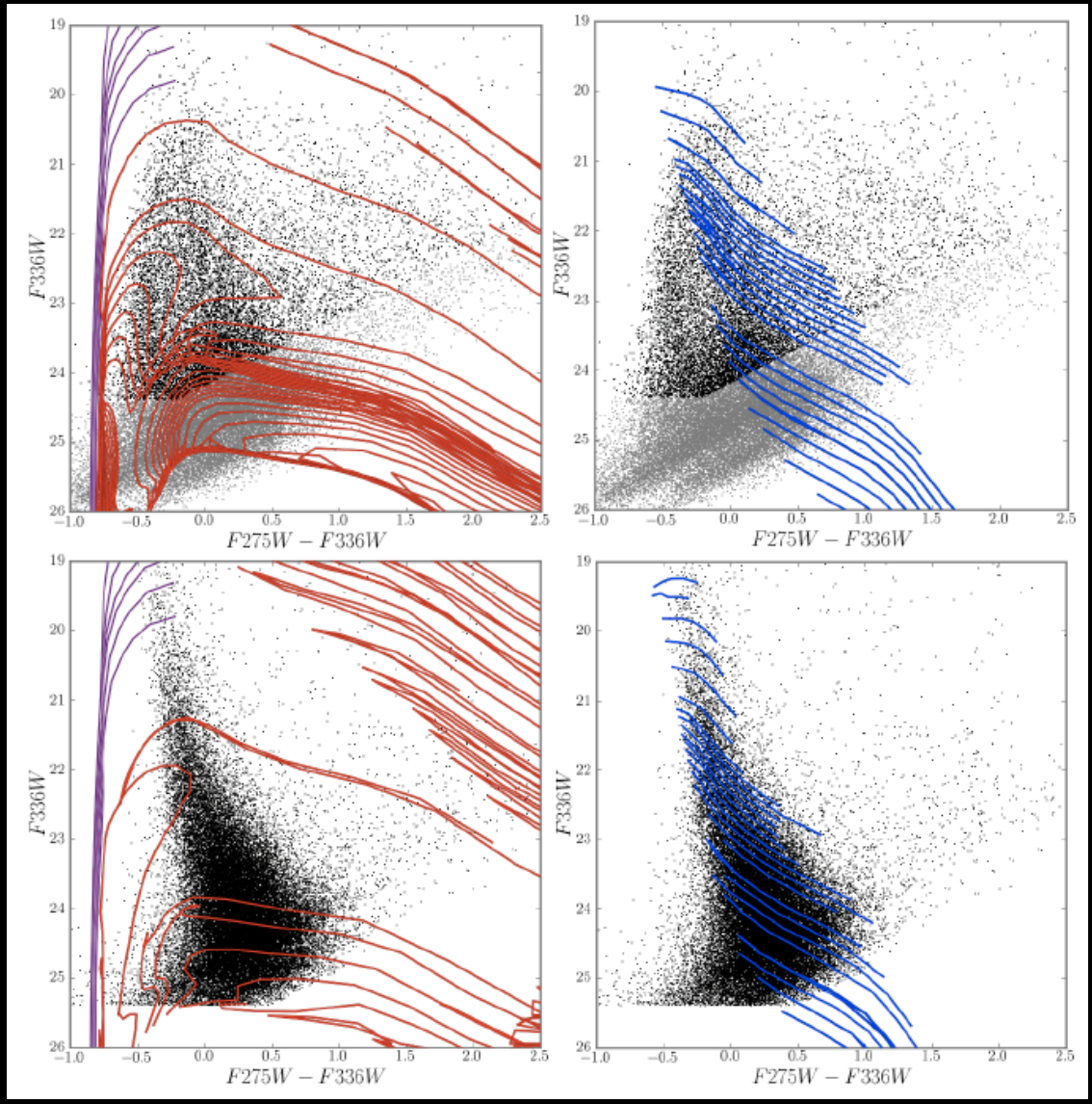


Hundreds of clusters, >80% new

Bulge UV Stellar Populations

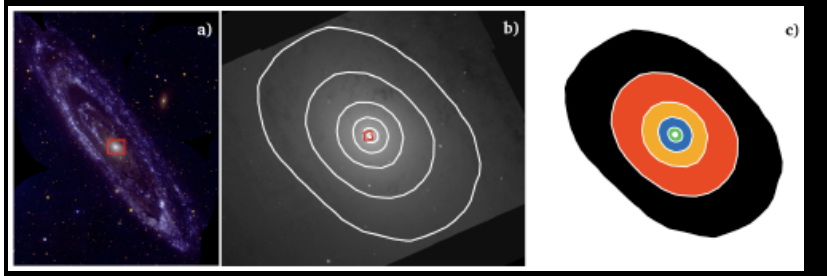
Bulge:
bright post-AGB +
faint AGB-manque

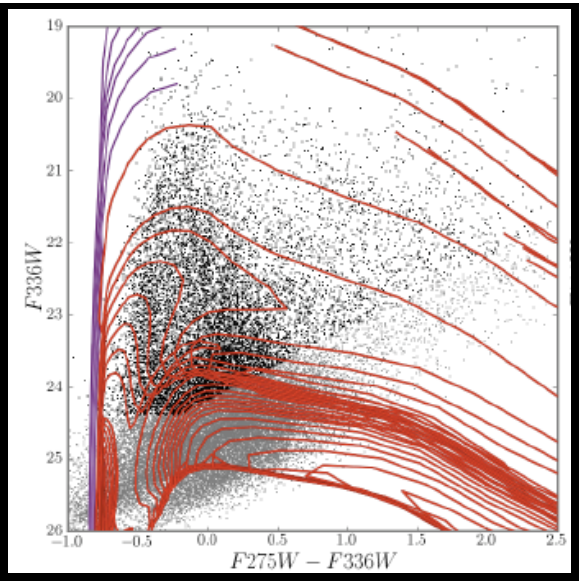
Disk:
main sequence

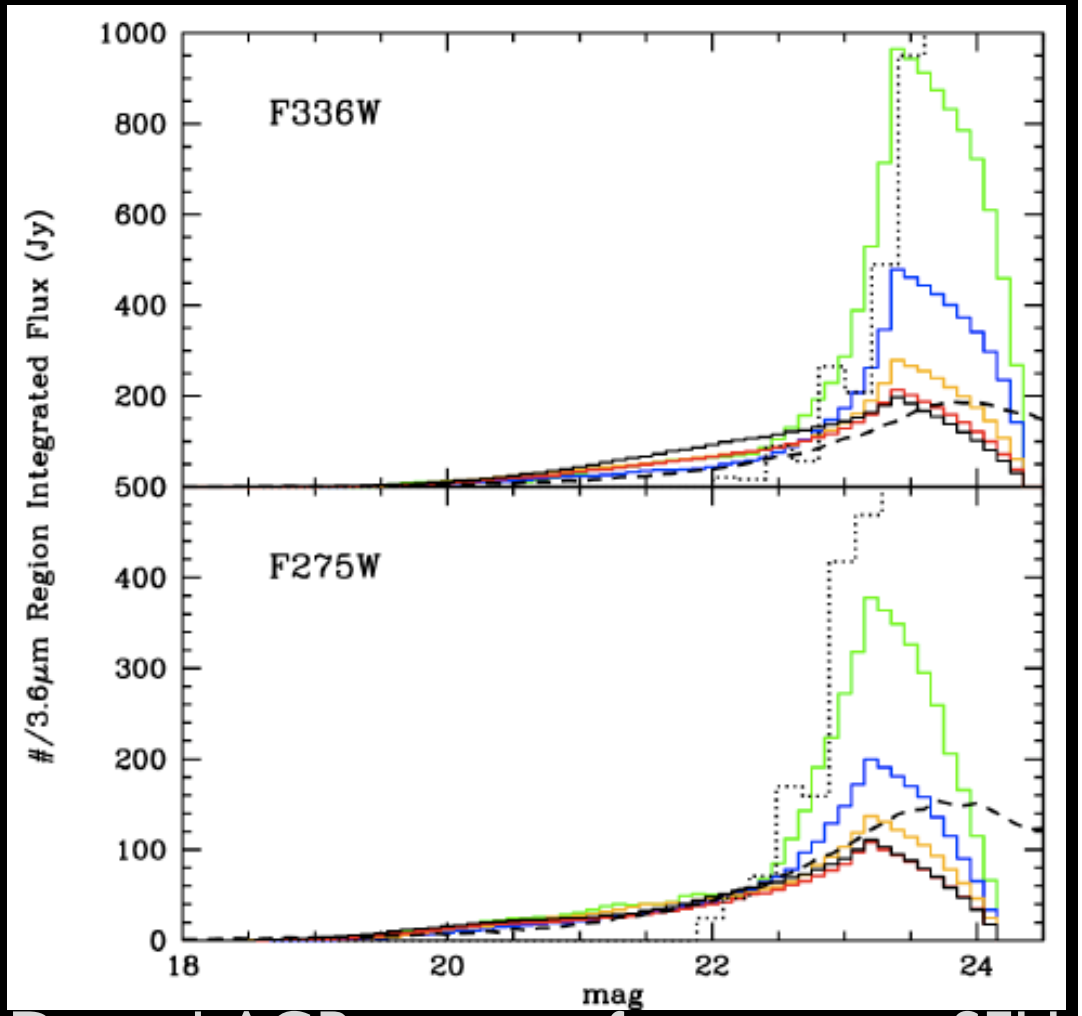


Bulge UV Stellar Populations

Strong radial gradient in AGB-manque population



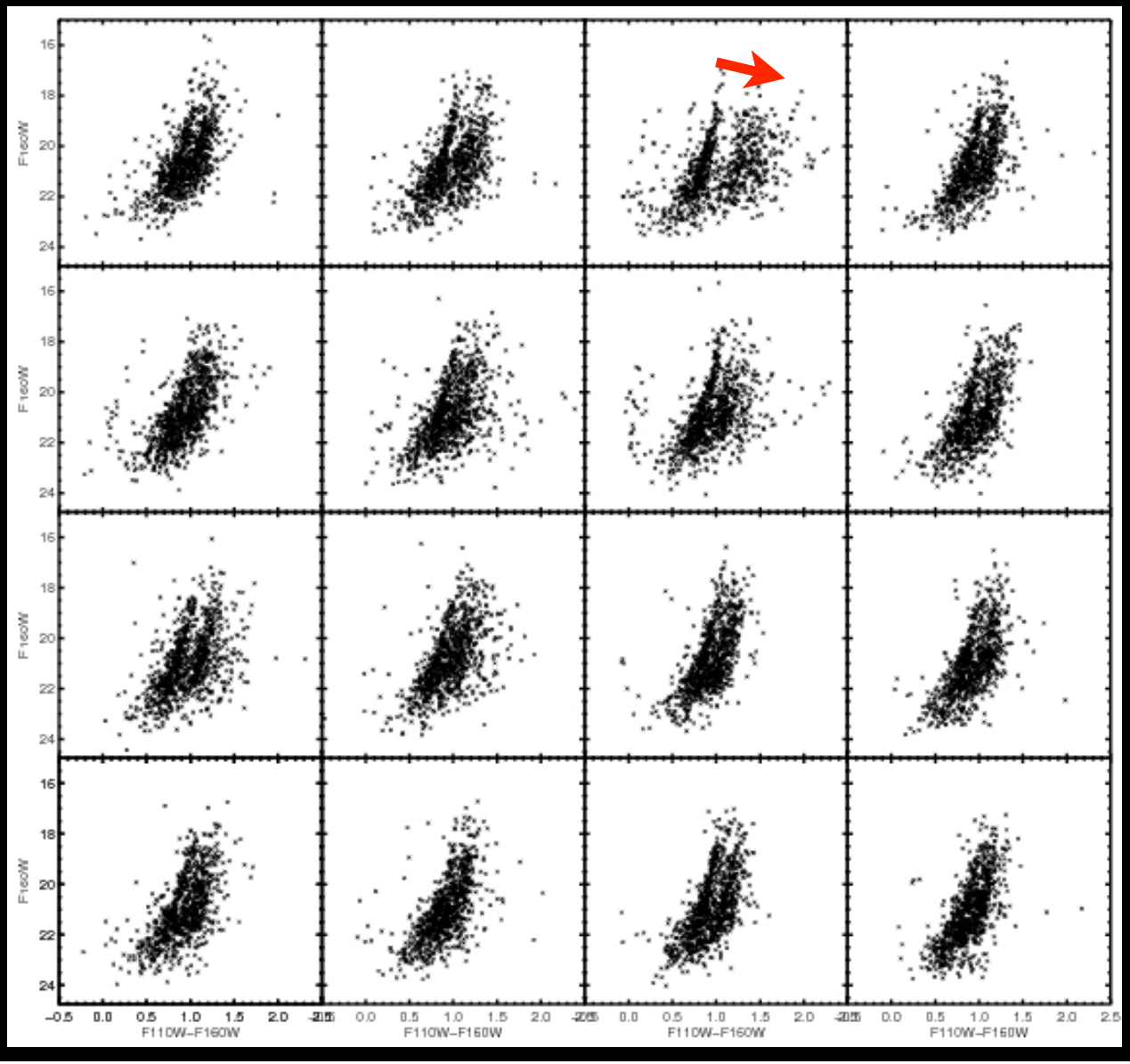


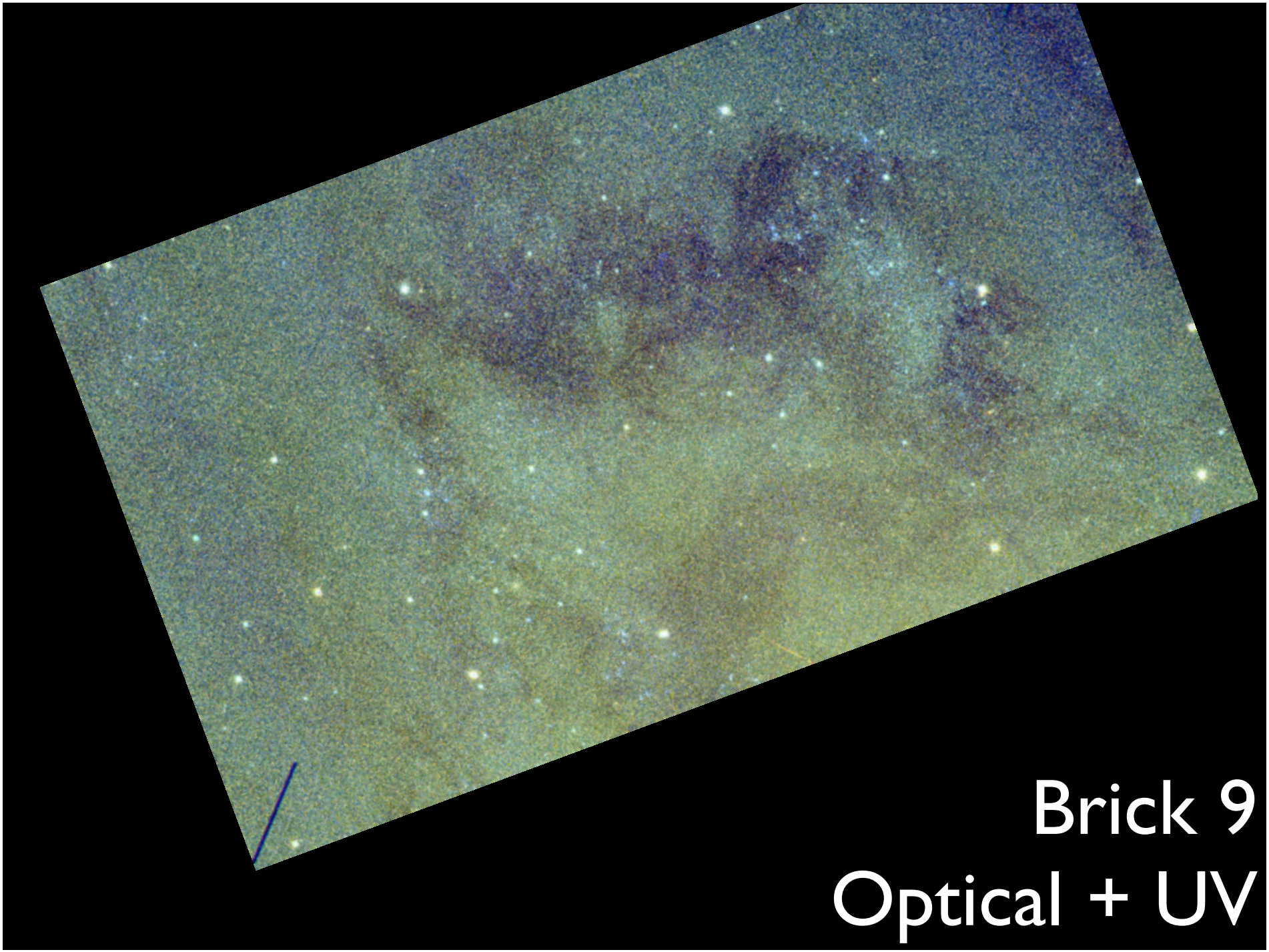


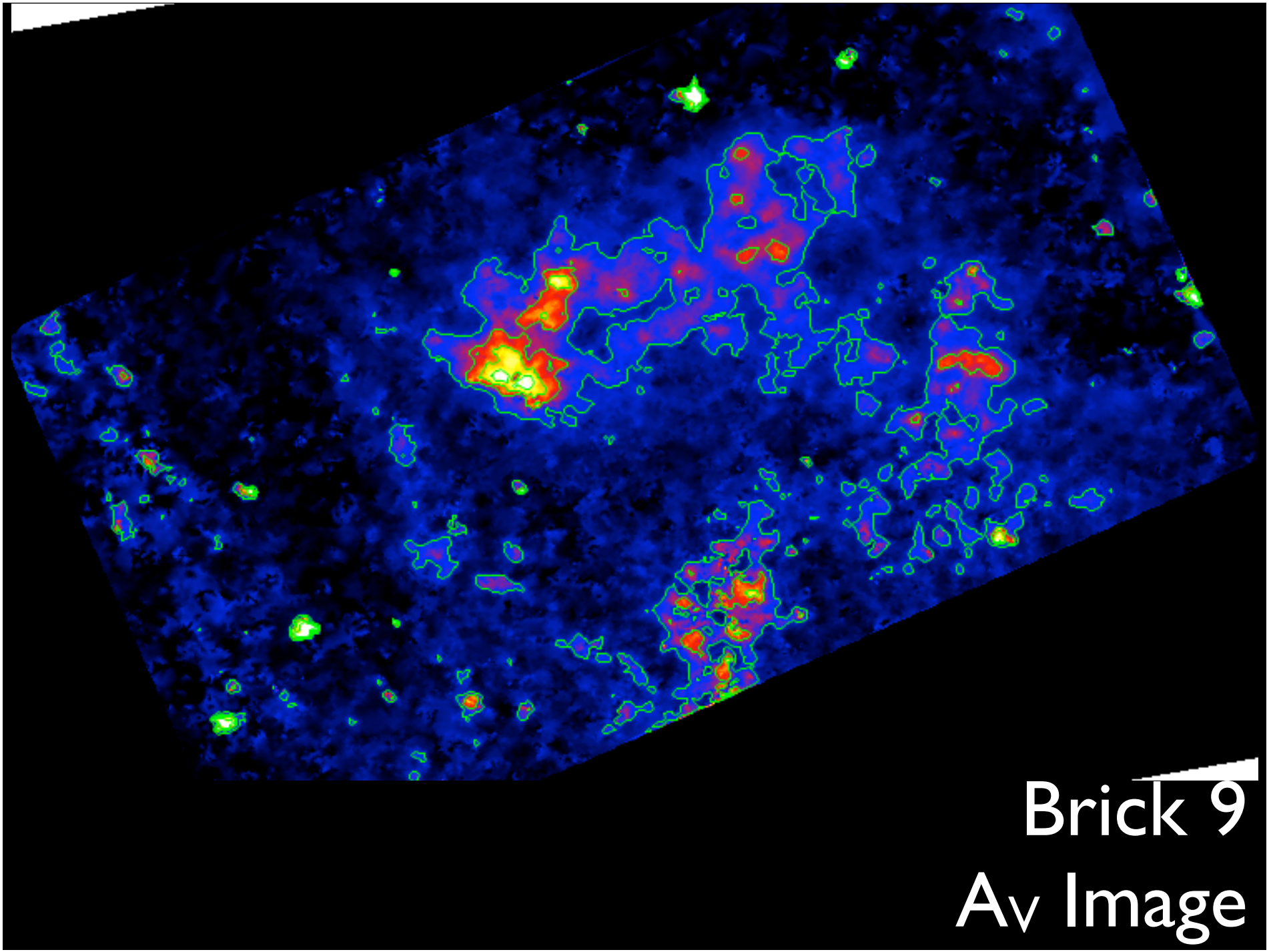
Dotted: AGB-manque for constant SFH

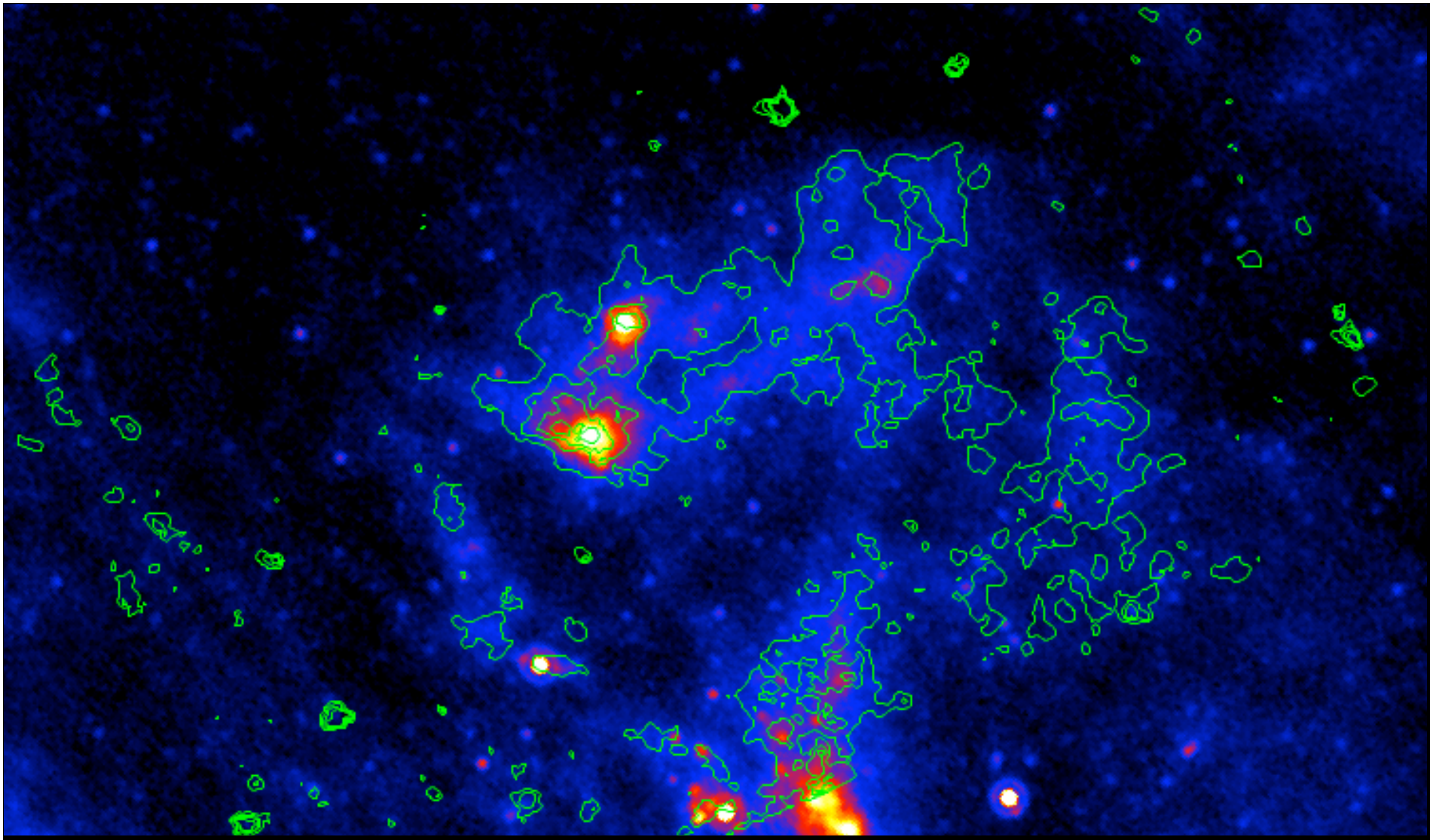
Dashed: MS for constant SFH

Dust Mapping w/ NIR RGB



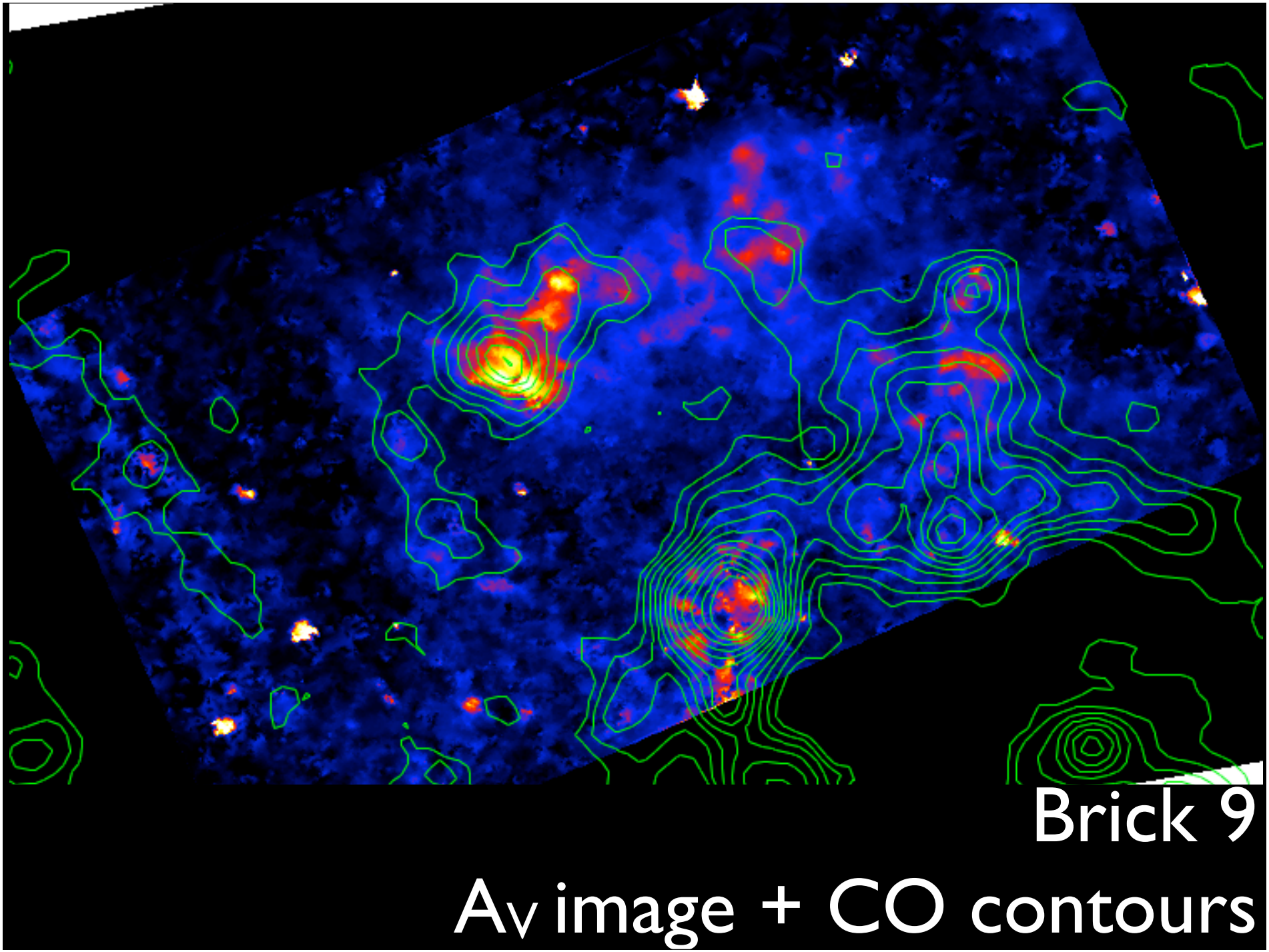

Brick 9
Optical + UV


Brick 9
A_V Image

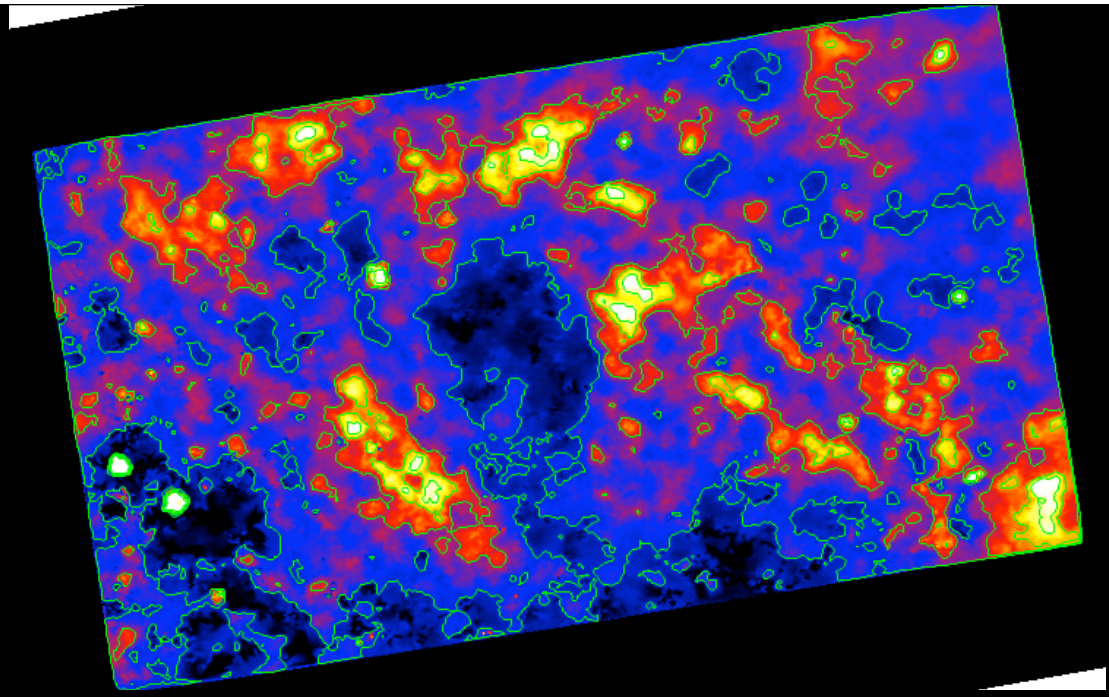


Brick 9

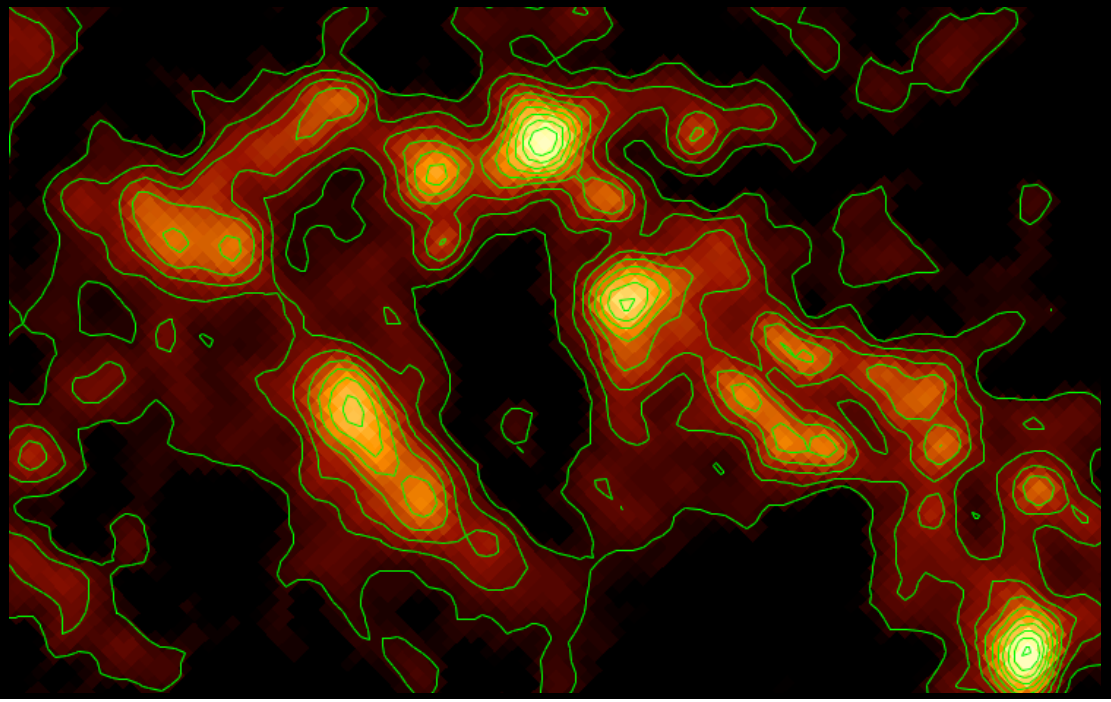
24 micron image + A_V contours


Brick 9
A_V image + CO contours

Brick 15



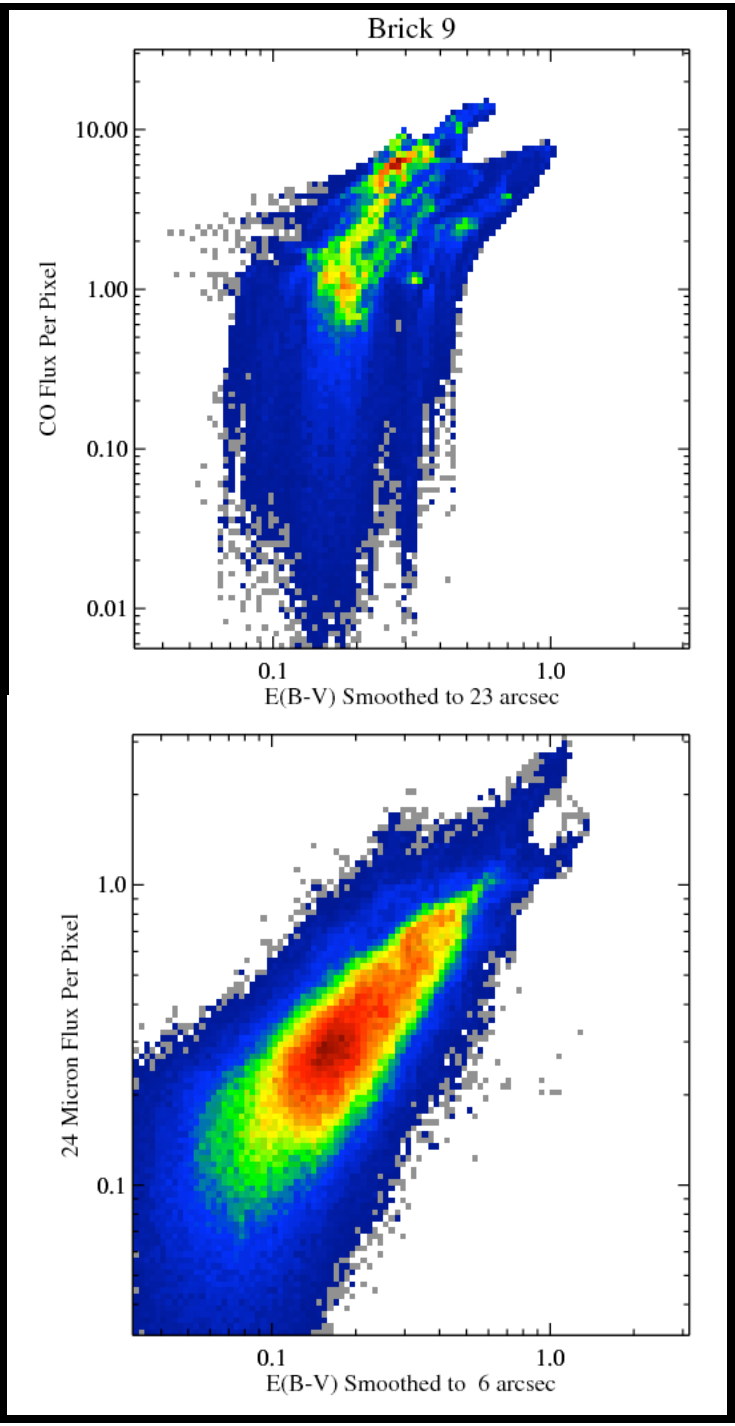
Av

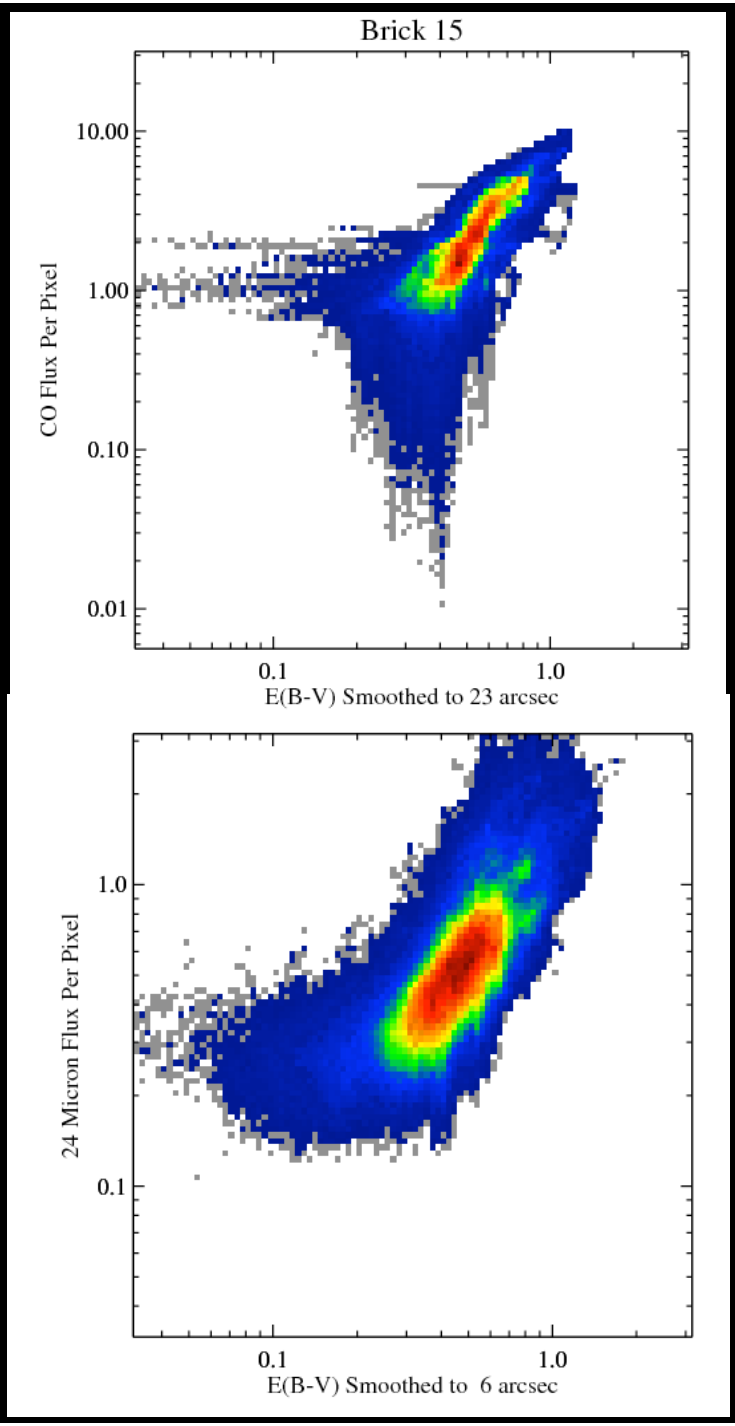


CO

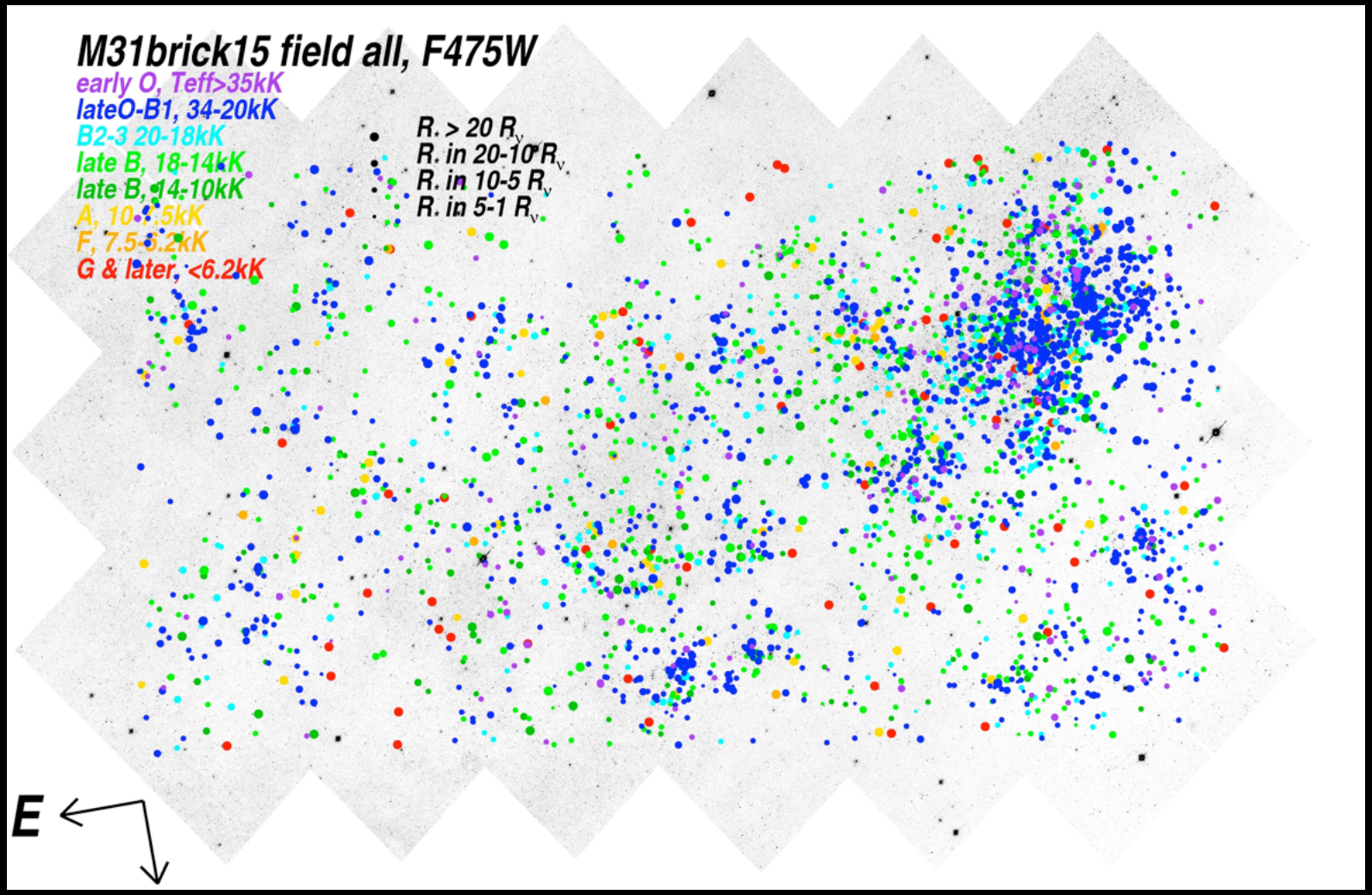
CO

24 micron


Brick 9
CO Flux Per Pixel
10.00
1.00
0.10
0.01
0.1
1.0
E(B-V) Smoothed to 23 arcsec
24 Micron Flux Per Pixel
1.0
0.1
0.1
1.0
E(B-V) Smoothed to 6 arcsec


Brick 15
CO Flux Per Pixel
10.00
1.00
0.10
0.01
0.1
1.0
E(B-V) Smoothed to 23 arcsec
24 Micron Flux Per Pixel
1.0
0.1
0.1
1.0
E(B-V) Smoothed to 6 arcsec

SED Fitting of Stars



Error cuts in 6 filters to favor hot well-measured stars

Dot size proportional to stellar radius

Scientific Goals

1. Initial Mass Function & Variations
2. Star Formation History
3. Formation & Evolution of Stellar Clusters
4. Calibration of Stellar Models
5. Counterparts of Multi-Wavelength & Transient Sources
6. Constraining Interaction Between Star Formaiton and ISM

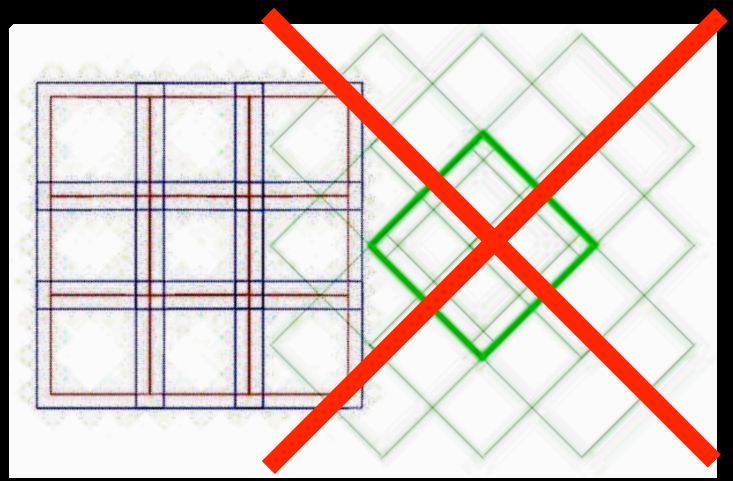
Scientific Progress

- Good.
- Harder problems have longer time-scales (i.e., lots of pieces that have to be extensively tested and verified)
- Risk of drowning in data, but hopefully better when we finish the transition to the cloud

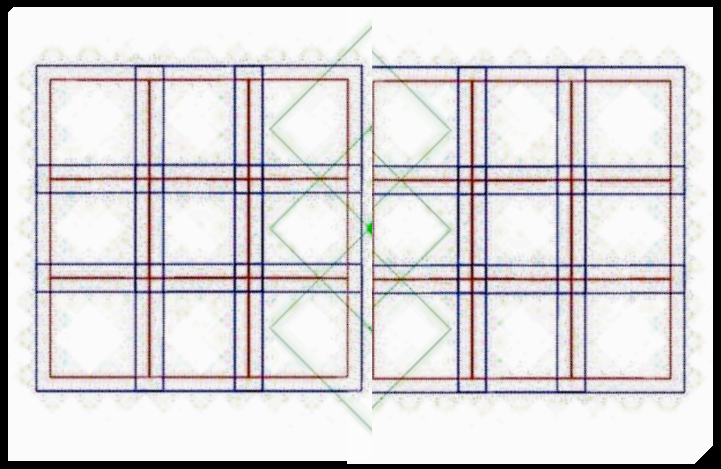
Science Team

- Two recent hires coming on-line
  - Morgan Fouescue -- stellar clusters
  - Hui Dong -- super-high resolution bulge analysis & Nyquist imaging
- Collaborations developing
  - Evan Kirby -- blue spectroscopy
  - David Hogg -- Bayesian tools for IMF
  - Martha Boyer -- High mass loss AGB
  - Herschel large project (MPIA)
  - VLA and CARMA large proposals (A. Leroy)

Contingency for ACS Failure



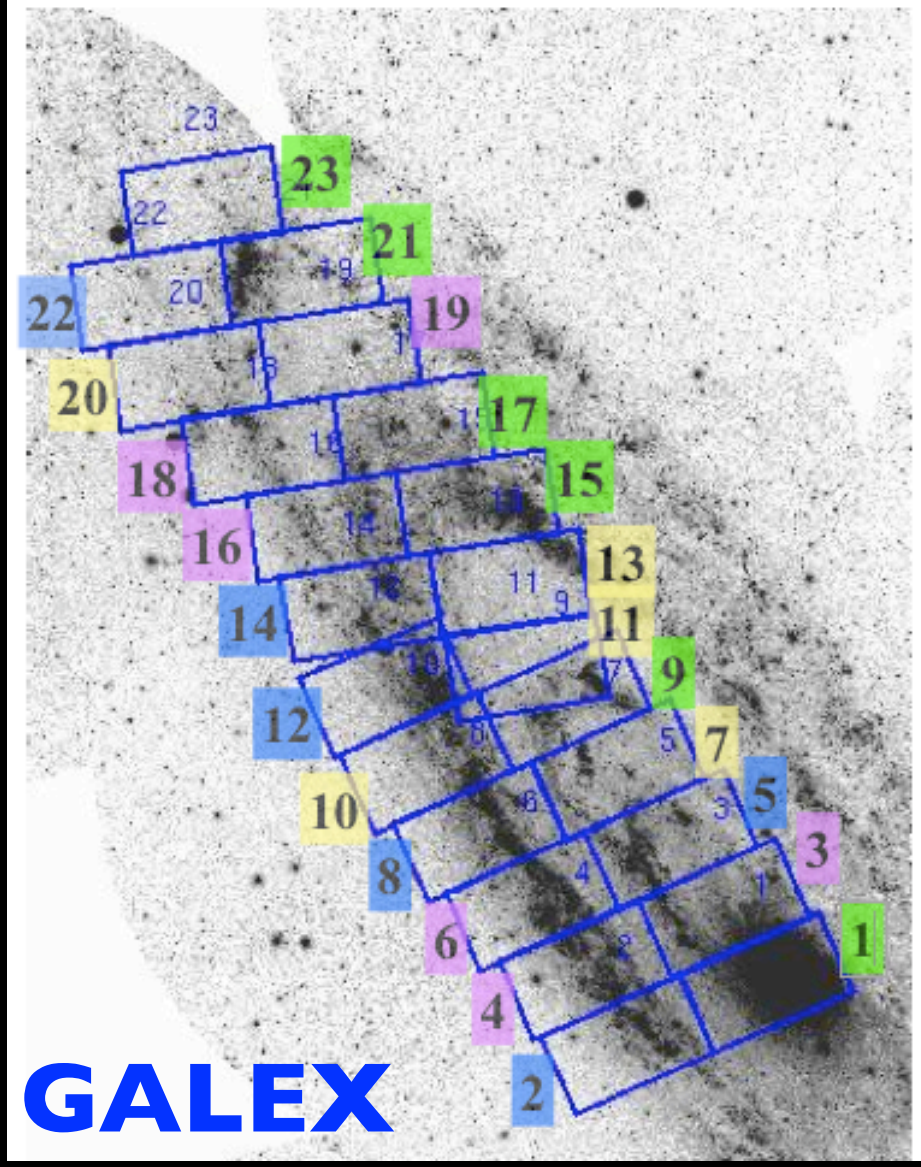
2 orbits per pointing



3-4 orbits per pointing

Same pointings, but additional WFC3/UVIS exposures needed to replace optical parallels

With Same Orbits, Cut # of Bricks



Year 1
- 21
- 15
- 9
- 1
- 17
- 23

Year 2
- 12
- 14
- 2
- 5
- 8
- 22

Year 3
- 6
- 16
- 4
- 18
- 3
- 19

Year 4
- 10
- 20
- 7
- 13
- 11

828 Orbits

High Level Science Products

Approximately Six Months After Completion of a Brick (First Release expected Late Summer 2011)

- Astrometrically aligned photometric parameters, merged into brick-wide 6-filter catalogs. These will be initially released as binary FITS tables, but will eventually be released as an SQL database with region-selection functionality.
- Reduced images for each field.
- Reduced, merged images for each brick.

On track for this summer

High Level Science Products

Approximately One Year After Completion of a Brick (First Release expected by Spring 2012)

- Stellar parameters from SED fitting (L_{bol}, T_{eff}, A_V)
- Catalogs of stellar clusters.
- Rectified 2D spectra, extracted 1-d spectra, along with radial velocities and spectral types derived from the spectra.
- Nyquist-sampled images for each brick, and accompanying deconvolved photometry. (Note that this data product requires a large amount of software development, and the initial release may not make the Spring 2012 deadline, although all subsequent releases would be expected on an accelerated schedule).

High Level Science Products

On-going Releases (accompanying scientific papers describing updates)

- Updated functionality in DOLPHOT
- Revised Padova isochrones
- Catalogs of variable stars, selected off of overlapping images
- Catalogs of QSO's
- Catalogs of PNe

STScI Support?

- Heads up on issues that instrument teams are investigating. We can help!
- New TinyTim PSF models
- IDCTAB implementation of Bellini et al distortion corrections for WFC3

Lessons Learned

- Communication is good!
- If you get the right people (talented + low conflict), everything is way easier than it should be.

Unexpected Problems

- Not much -- team is pretty experienced.
- Getting repeat observations scheduled fast enough, to avoid 1 year delays for brick completion.

Thanks!