

Hunting for the $1 < z < 2$ LBG: I. How to build the catalog

Cheng Cheng (程诚)

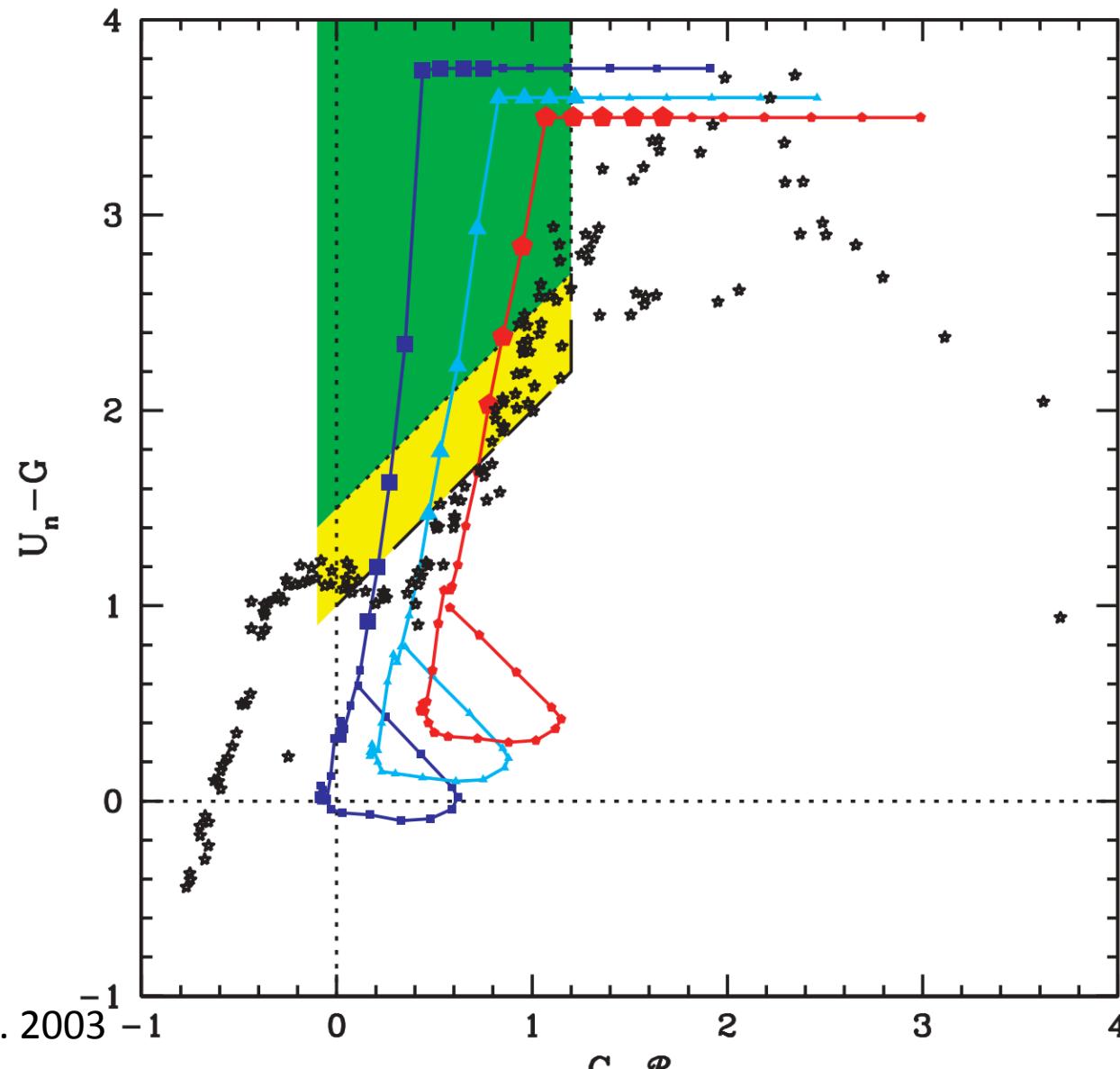
Supervisor: Jiasheng Huang

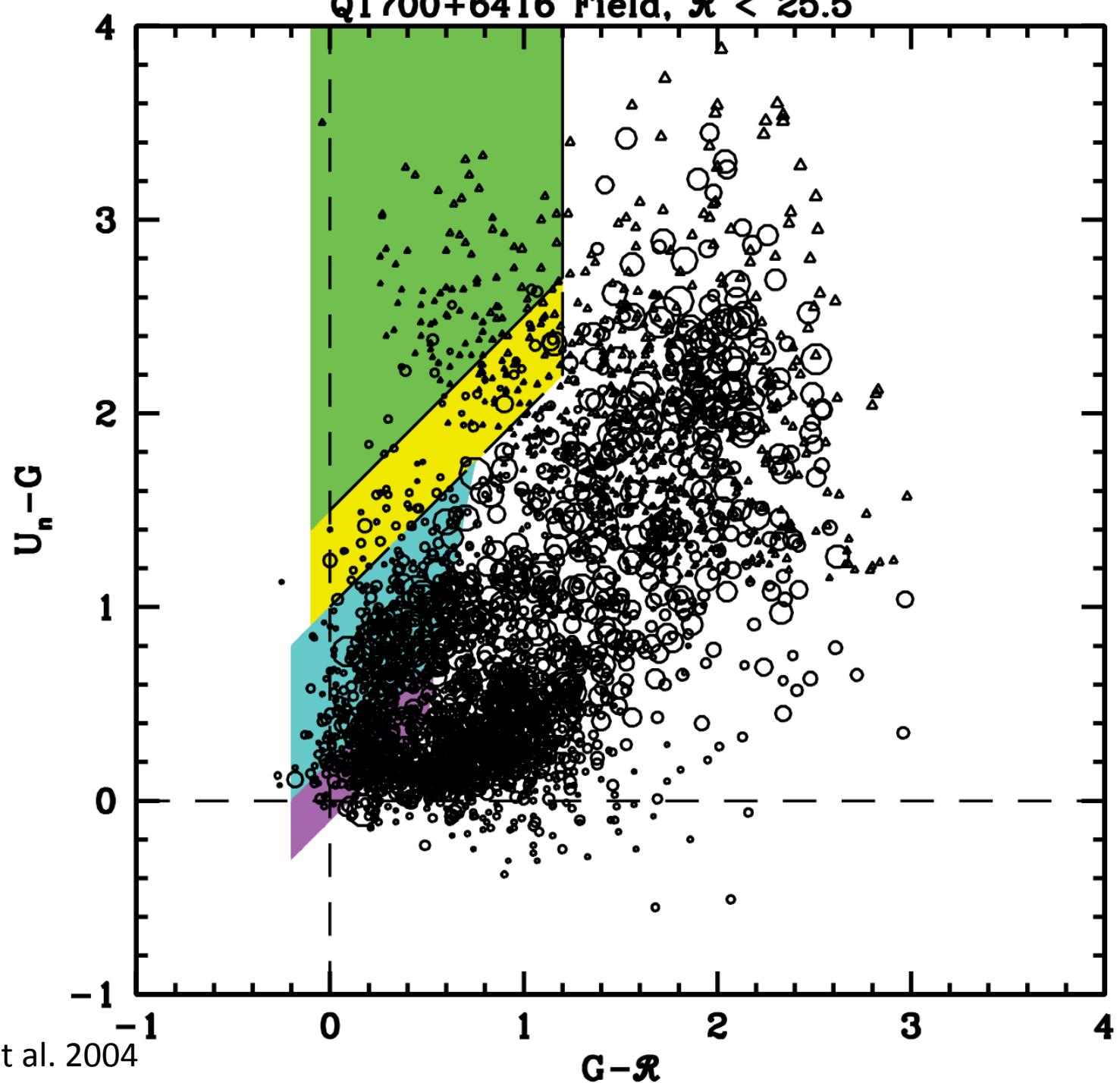
NAOC

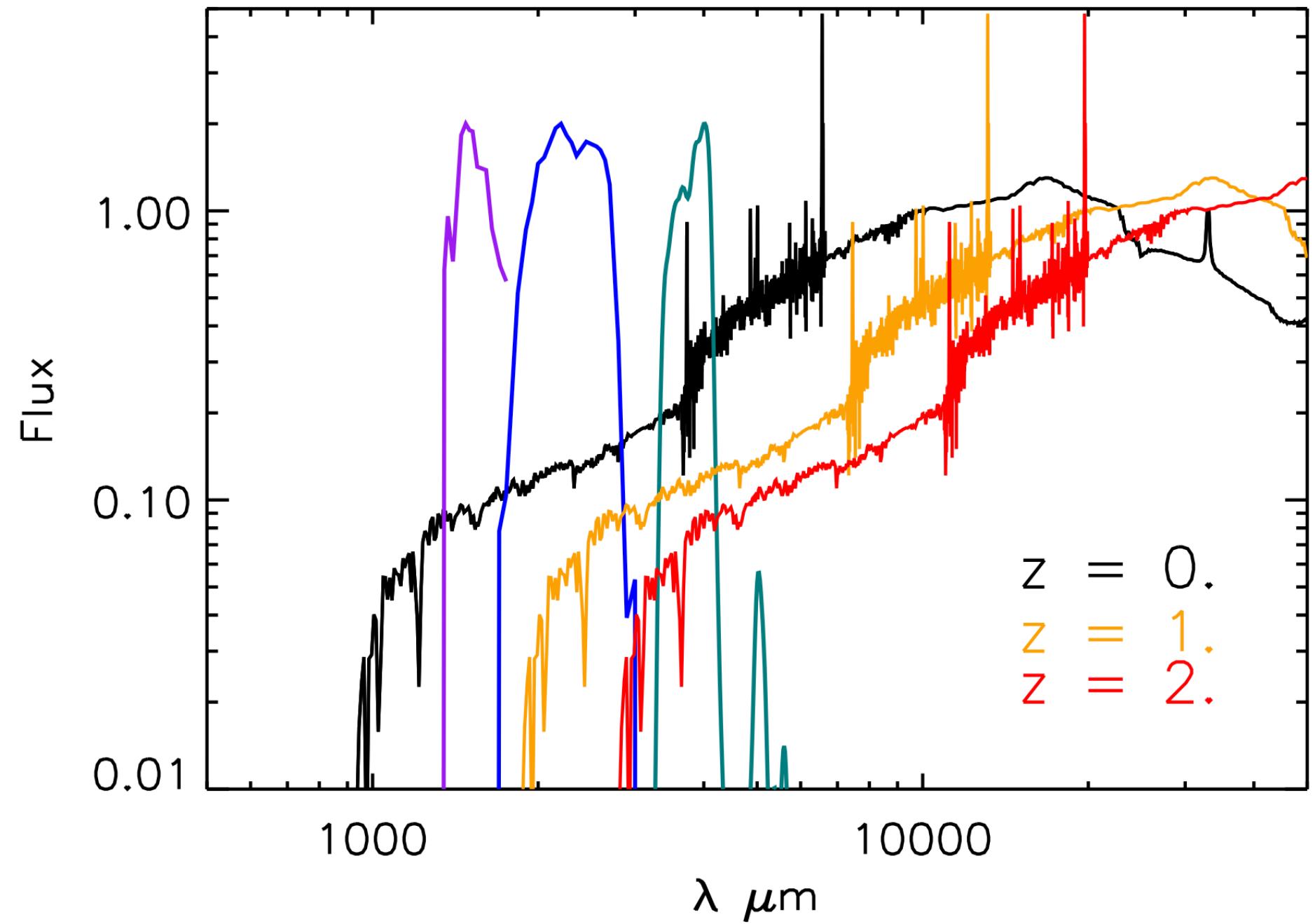
About the speaker Cheng Cheng

- USTC: physics
- IHEP: Active galactic nuclei
- NAOC: galaxy
- Observation: Lijiang 2.4m 110 half nights
- Research: 3.6um selected galaxy population

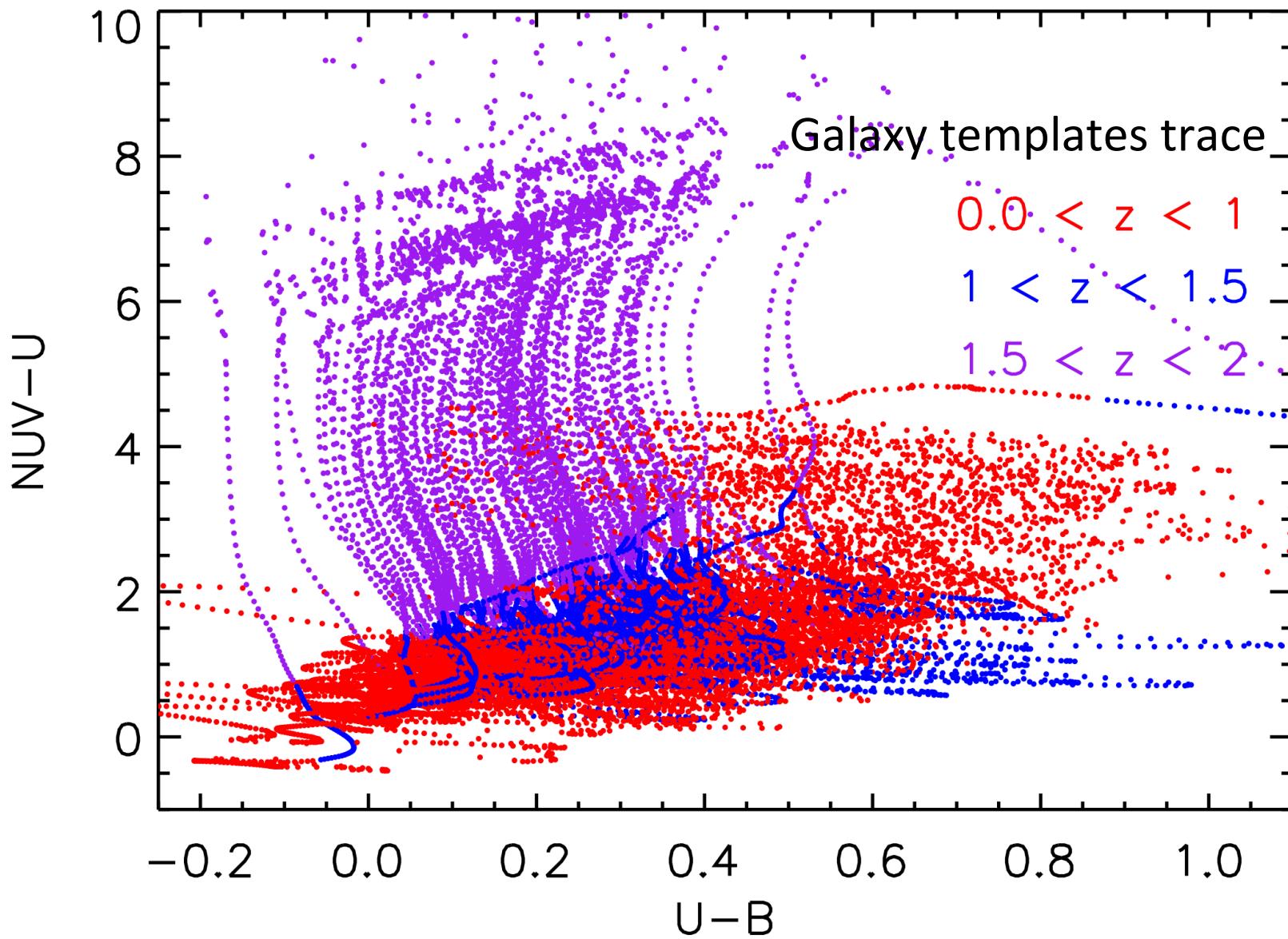
Lyman break galaxy







UV drop galaxy



Build a UV drop galaxy catalog: Motivation

- To sample the SF galaxy from the redshift 1 to 2:
Evolution, morphology, etc.

Build a UV drop galaxy catalog: Motivation

- To sample the SF galaxy from the redshift 1 to 2: Evolution, morphology, etc.
- To understand the meaning of low resolution image completeness

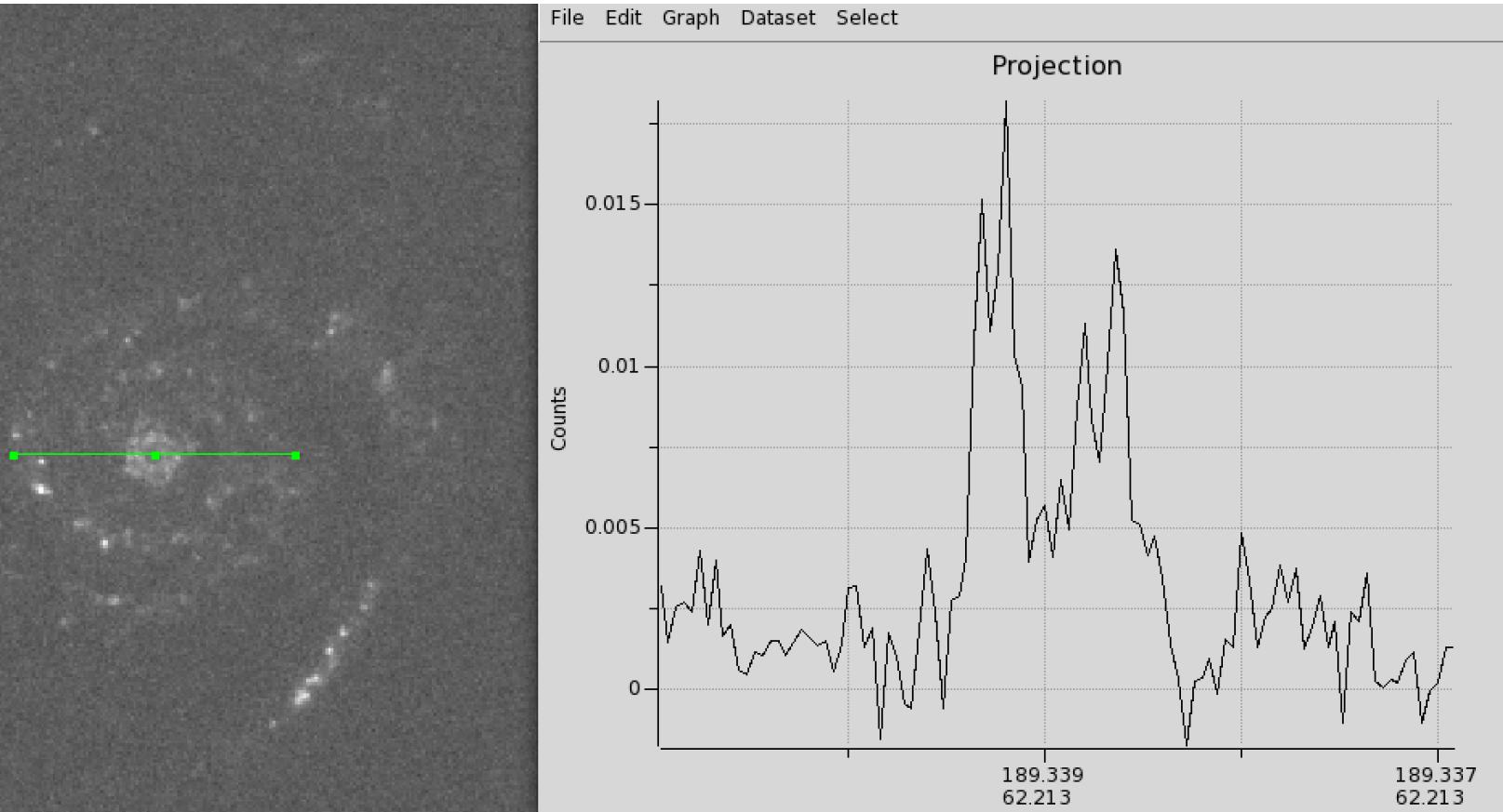
Build a UV drop galaxy catalog: Motivation

- To sample the SF galaxy from the redshift 1 to 2: Evolution, morphology, etc.
- To understand the meaning of low resolution image completeness
-

Build a UV drop galaxy catalog: Motivation

- To sample the SF galaxy from the redshift 1 to 2: Evolution, morphology, etc.
- To understand the meaning of low resolution image completeness
-
- To have fun

HST UV image



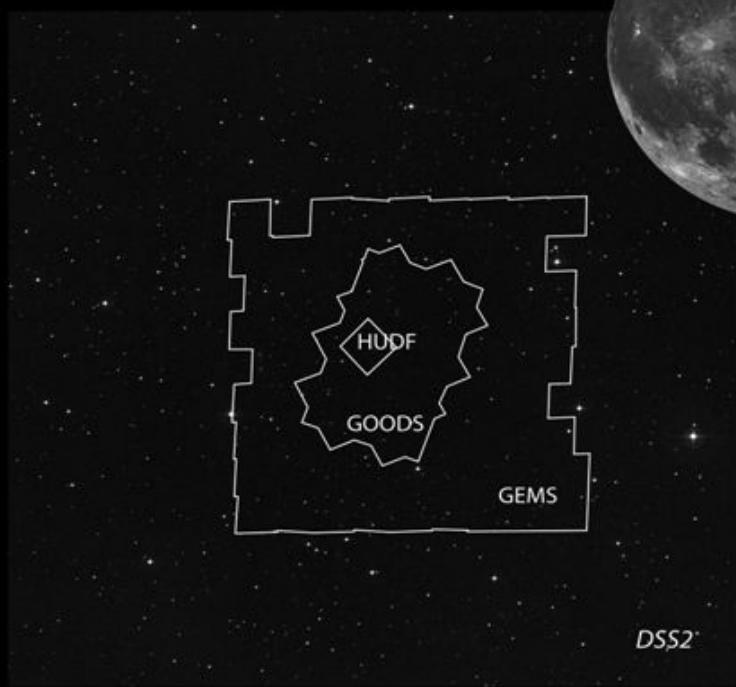
Build a UV drop galaxy catalog

- What do we need?
 - Deep u band image

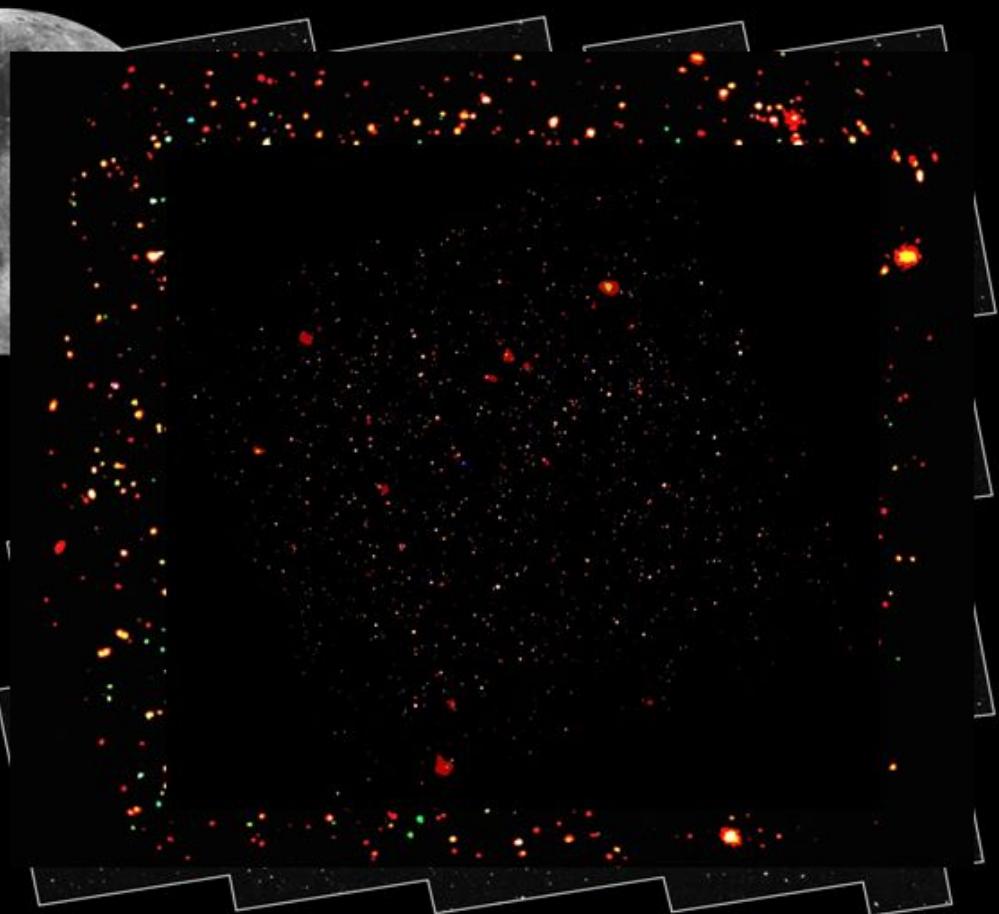
COSMOS survey



Relative Sizes of *HST* ACS Surveys



2 deg² equatorial
HST treasury project
Deep: ACS $i_{AB} < 27$
Similar volume as SDSS, but fainter and higher z



HST/XMM/Chandra COSMOS
[Scoville, Hasinger, Elvis]

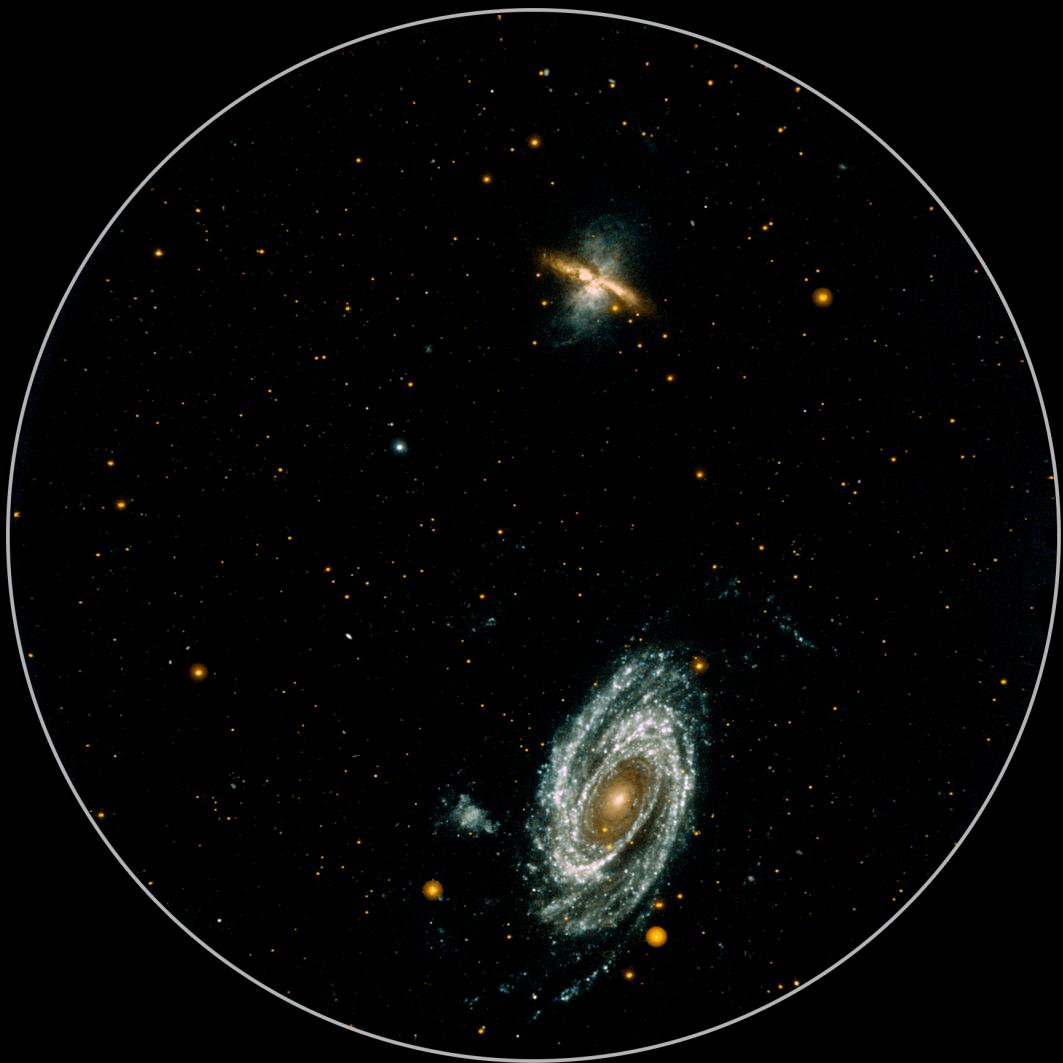
Build a UV drop galaxy catalog

- What do we need?
 - Deep u band image **COSMOS**
 - Deep FUV, NUV image

GALEX Field of View



**Full Moon
(relative area)**



← 1.2 Degrees →

Build a UV drop galaxy catalog

- What do we need?
 - Deep u band image **COSMOS**
 - Deep FUV, NUV image **GALEX**
 - Photometry

Build a UV drop galaxy catalog

- What do we need?
 - Deep u band image **COSMOS**
 - Deep FUV, NUV image **GALEX**
 - Photometry **Just code it**

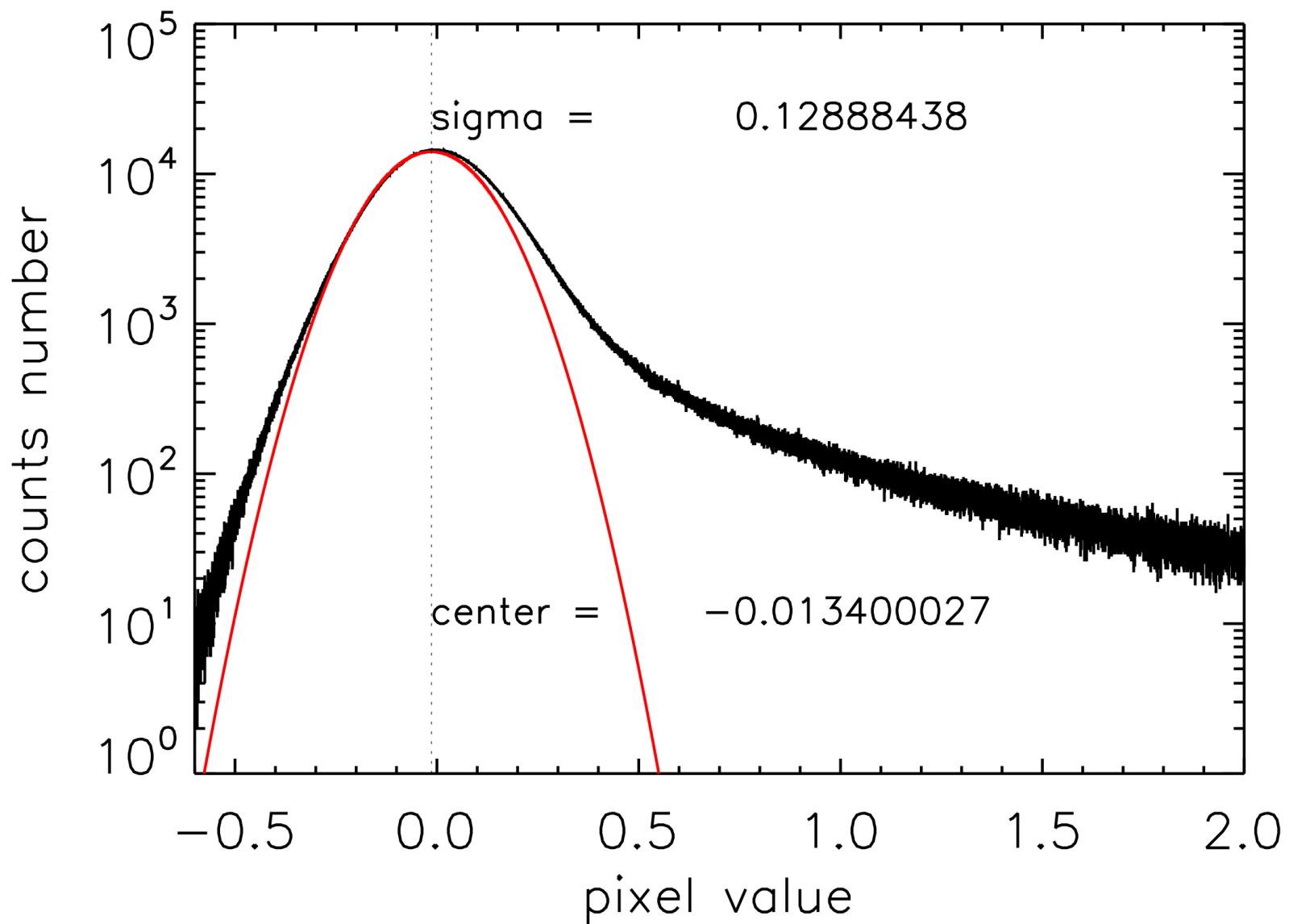
How to build the catalog

- Preparation
- U band source detection
- Completeness
- Photometry and uncertainty
- Galaxy number density
- Astrometry (Option)
- Photometry on the UV band image
- Photometry on the other band image

Preparation

- Noise analysis
- GALEX mosaic
- PSF construction

CFHT u band noise

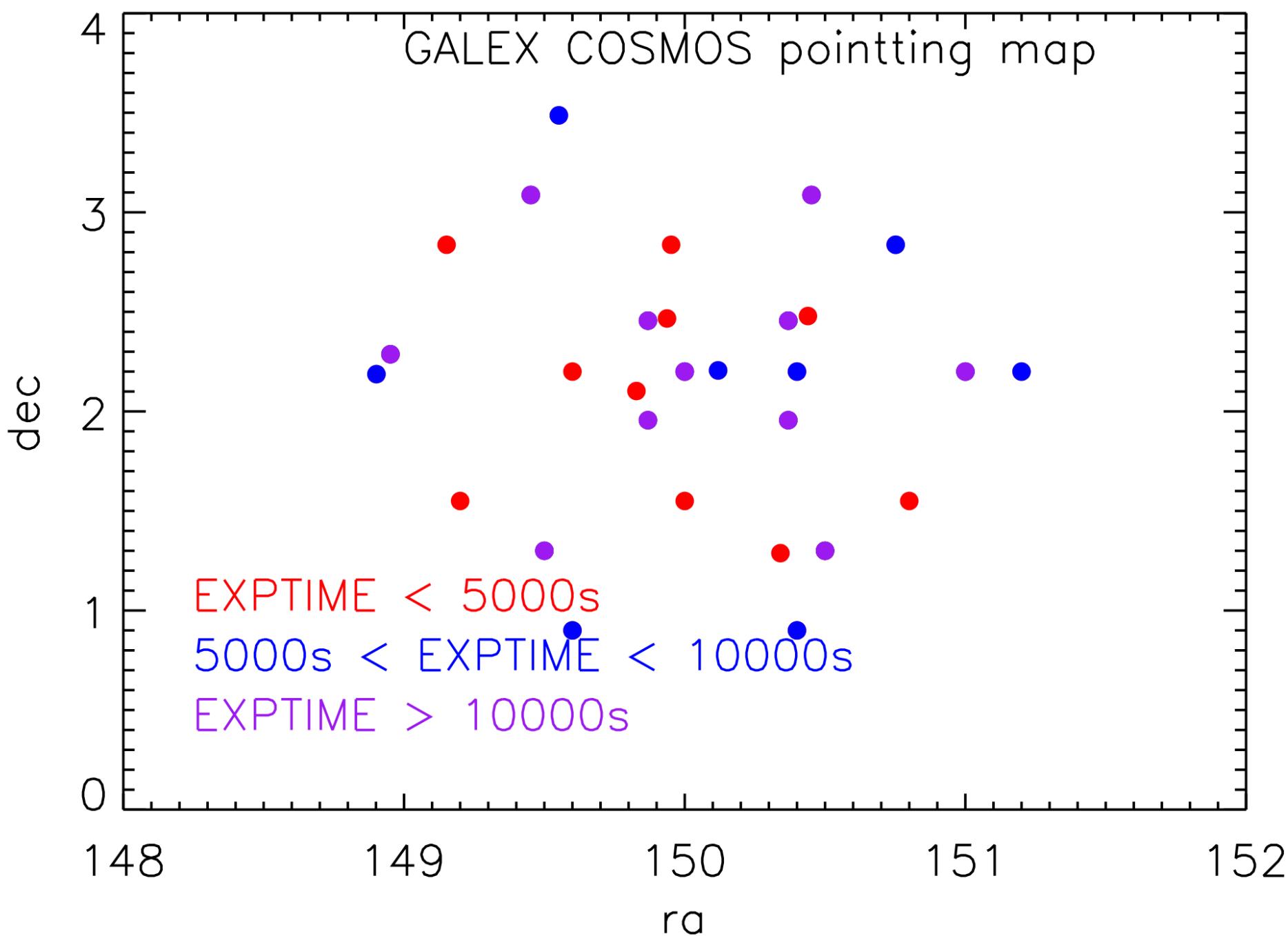


CFHT u band noise

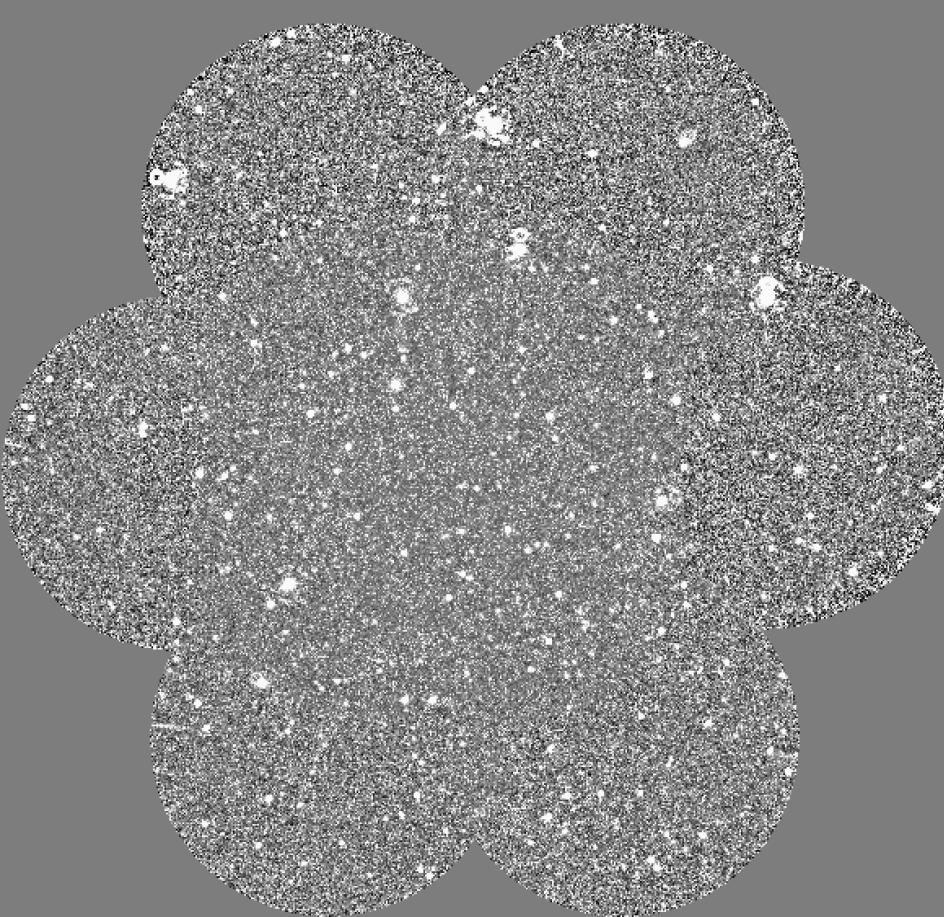
Table 1. COSMOS CFHT u band image limit AB mag

aper size	1σ mag	3σ mag	5σ mag
1"	28.28	27.08	26.53
2"	26.77	25.58	25.02
3"	25.89	24.70	24.14

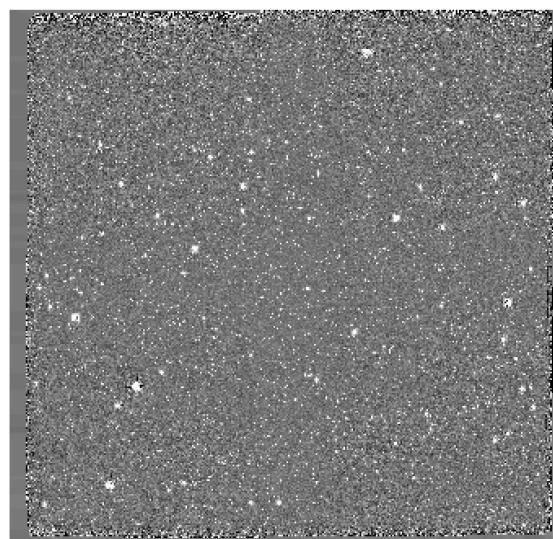
GALEX COSMOS pointting map



GALEX NUV

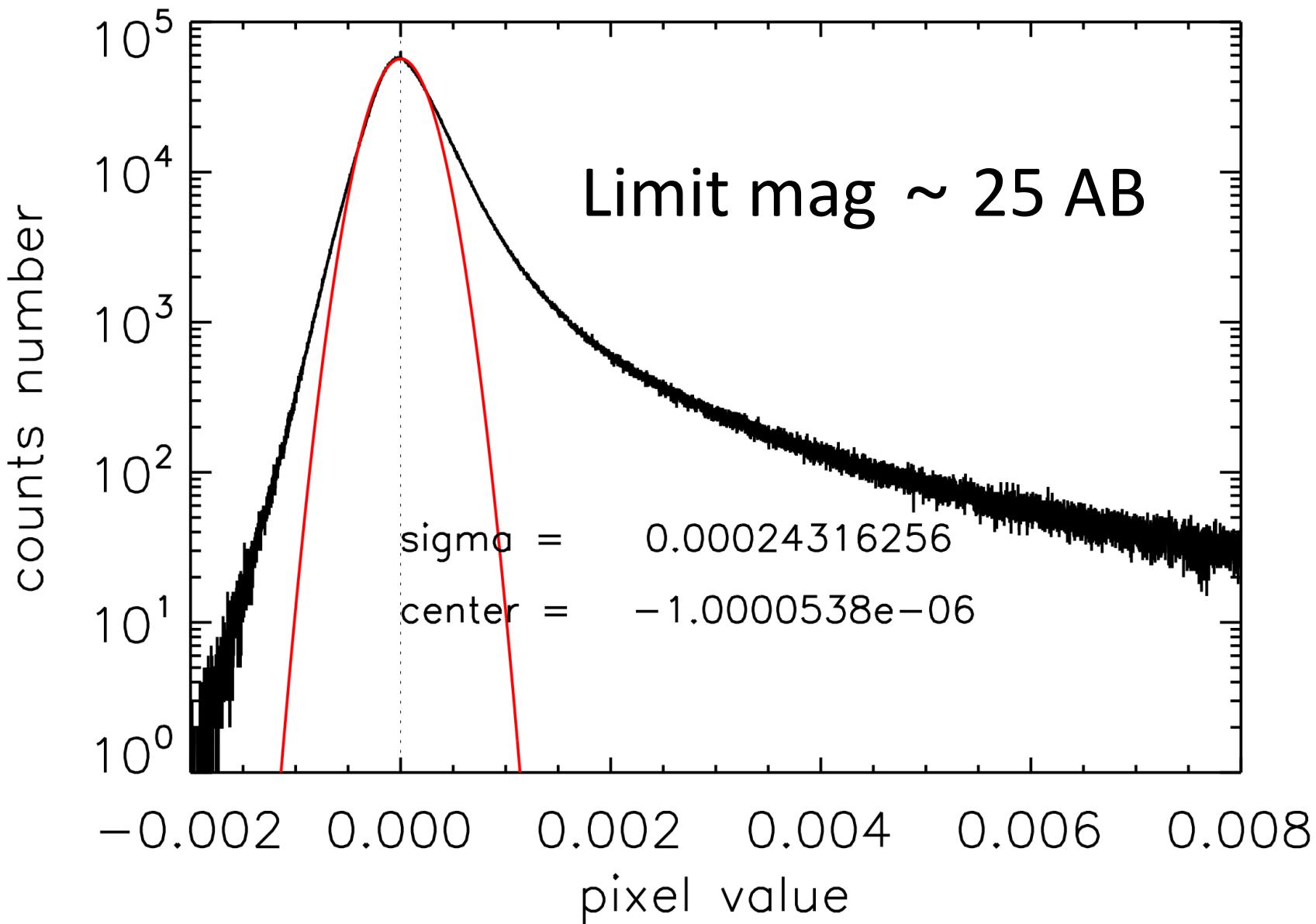


CFHT u

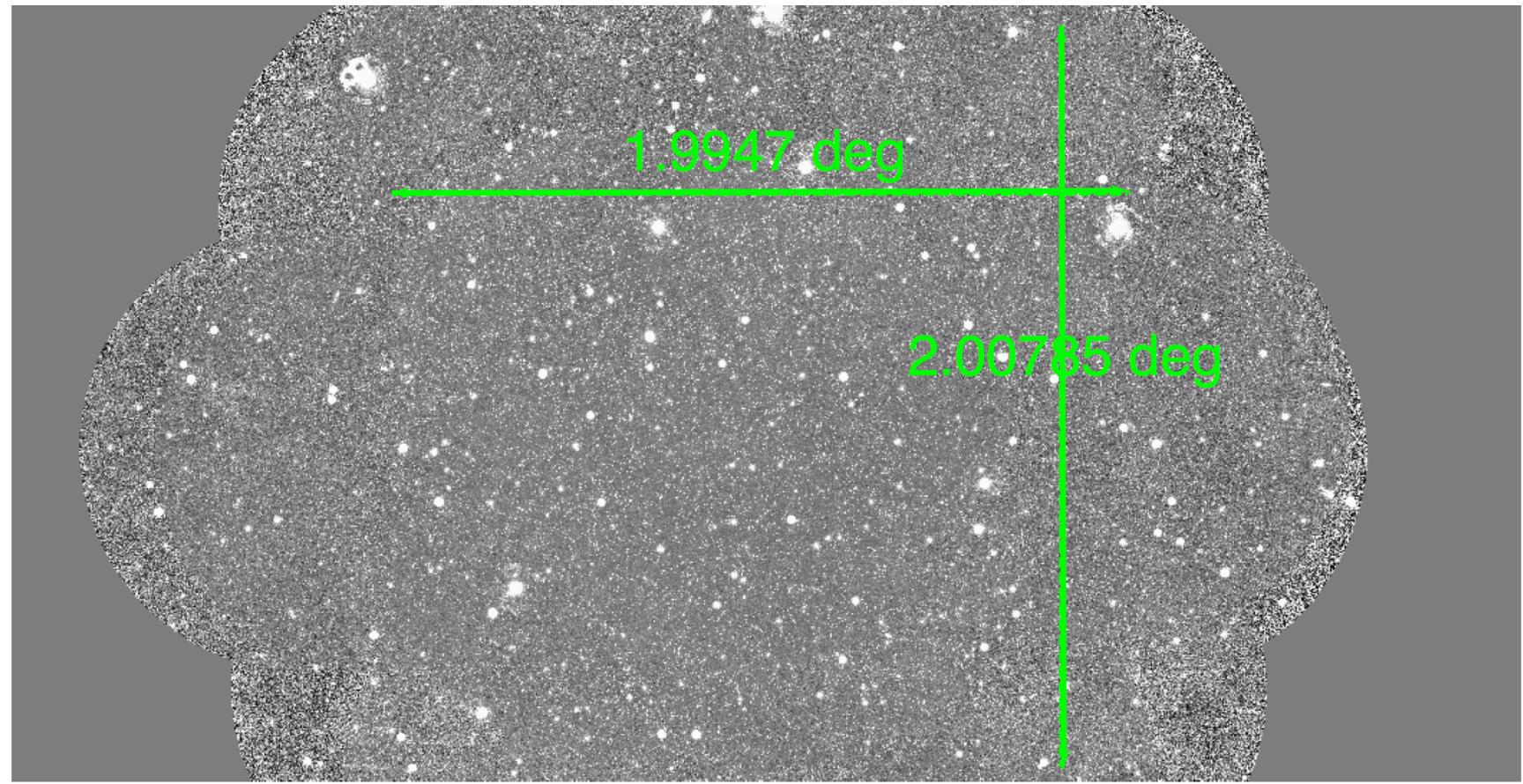


2.00495 deg

GALEX NUV band noise

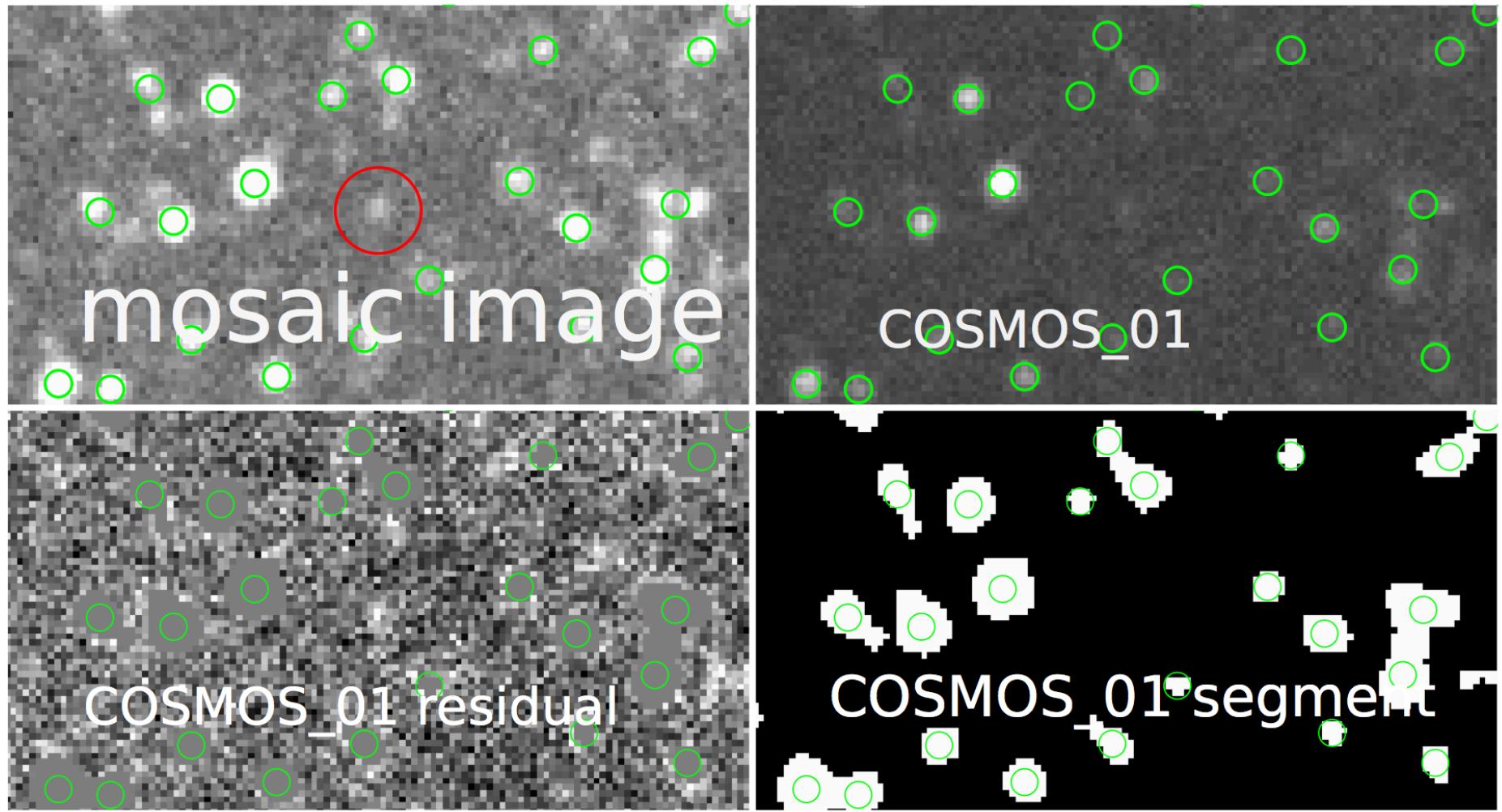


GALEX-COSMOS mosaic



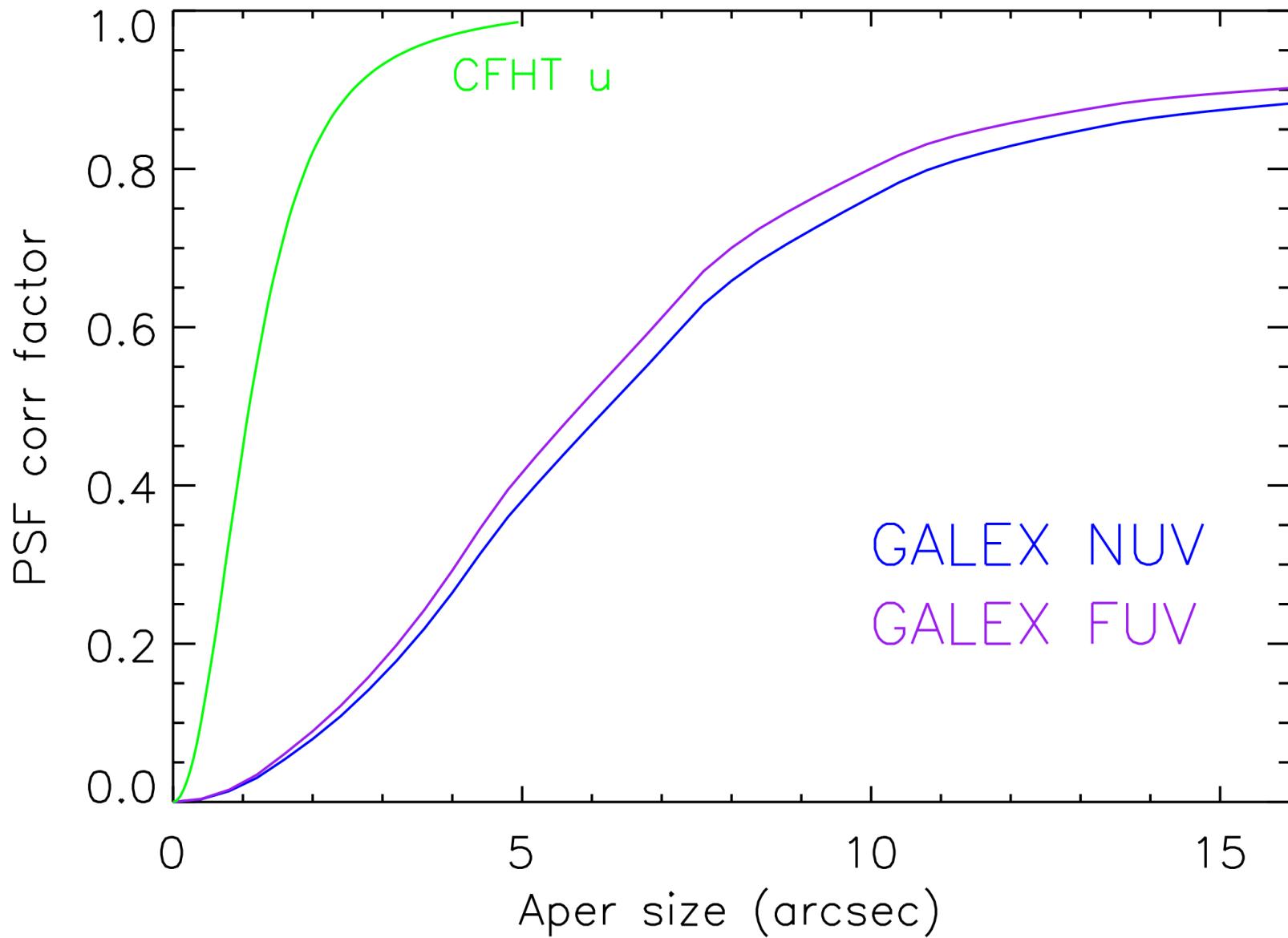
-0.0017 -0.0013 -0.001 -0.00066 -0.00033 4.4e-06 0.00034 0.00067 0.001 0.0013 0.0017

Mosaic



-0.0012 -0.00094 -0.00071 -0.00047 -0.00023 3.1e-06 0.00024 0.00047 0.00071 0.00095 0.0012

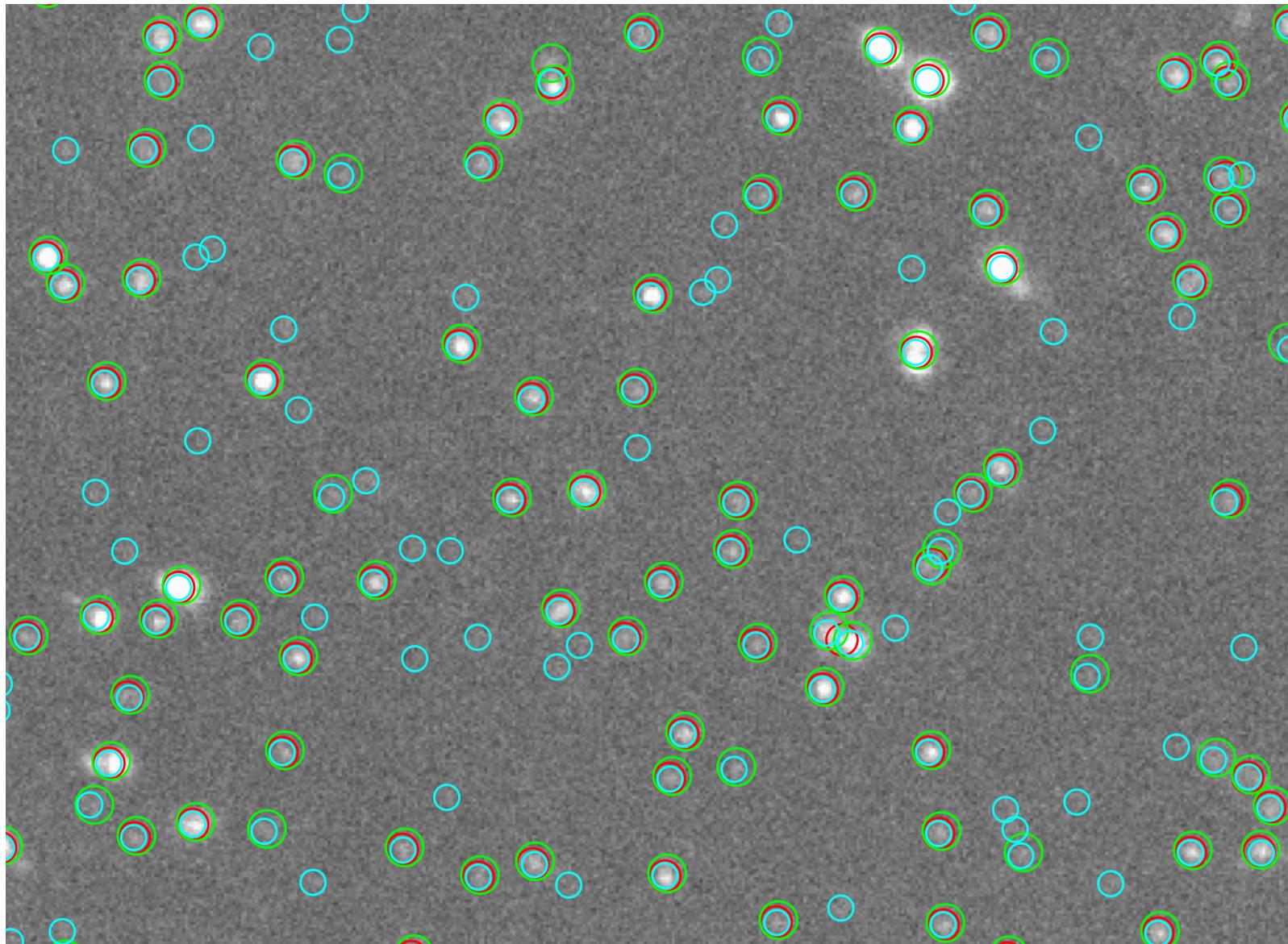
PSF stacking

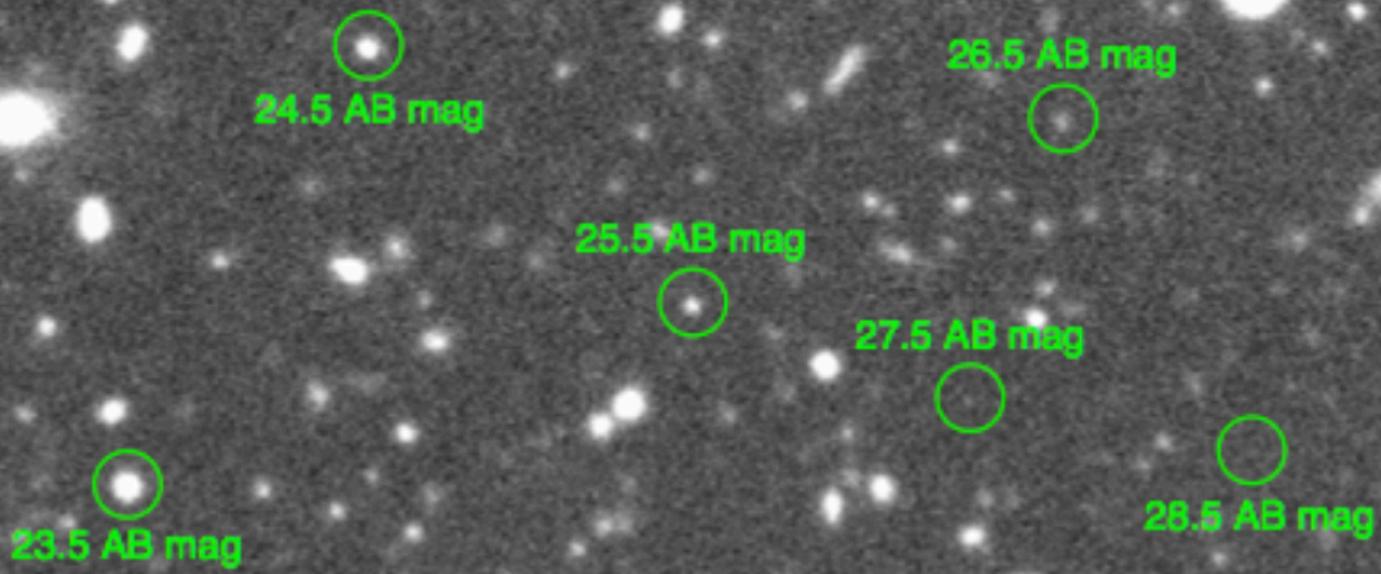


How to build the catalog

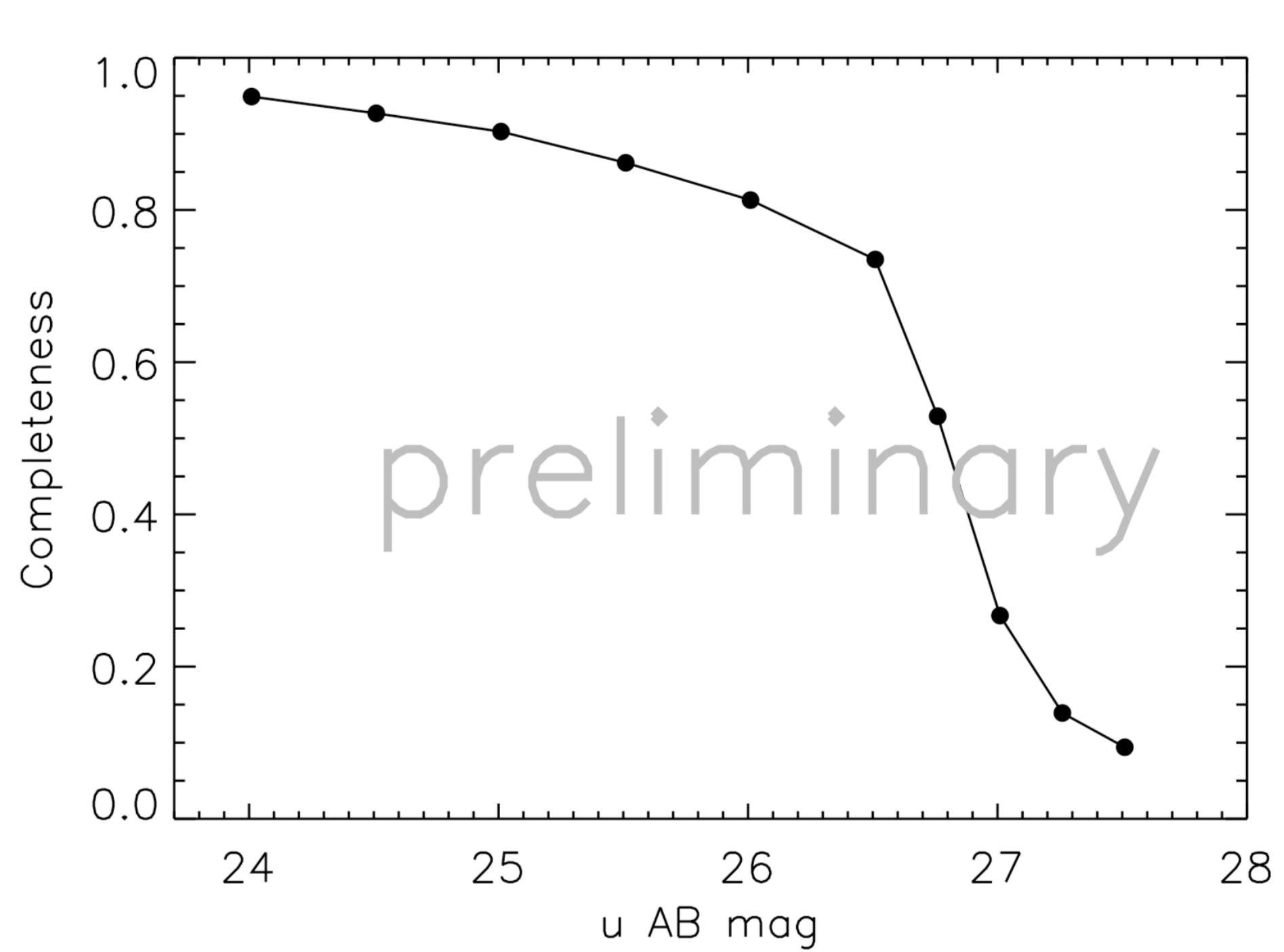
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Source detection

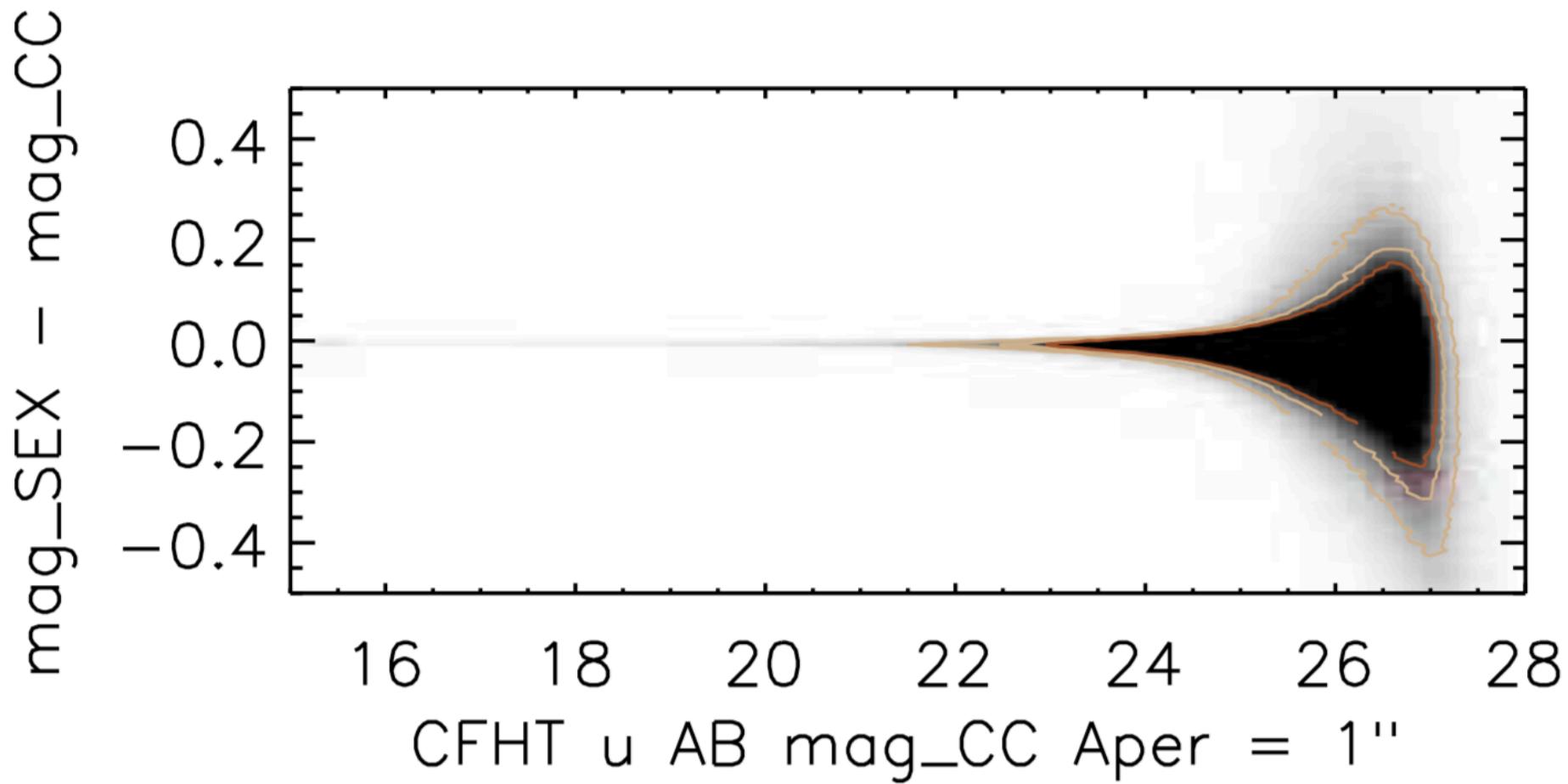




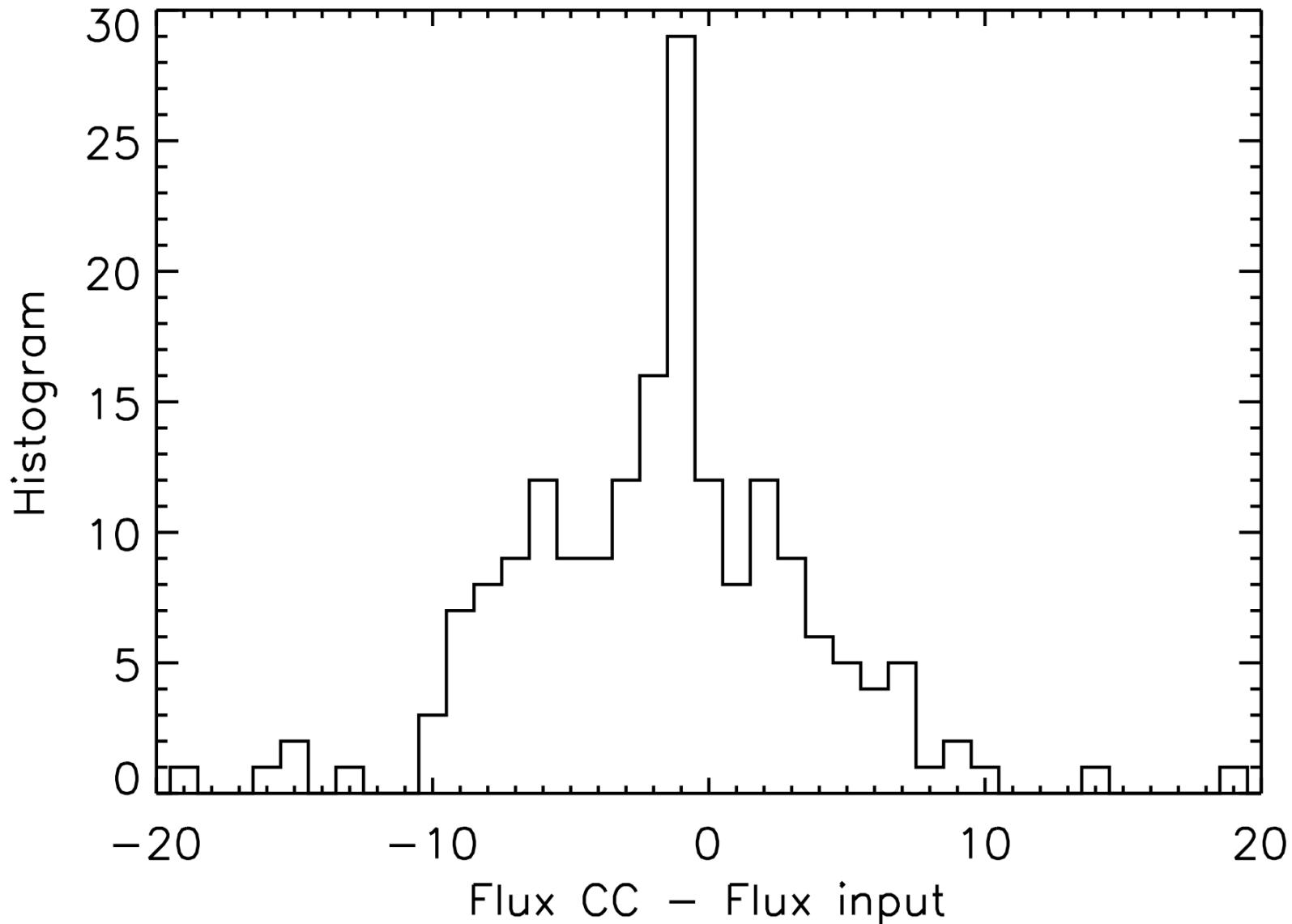
-0.47 -0.34 -0.2 -0.057 0.081 0.22 0.36 0.5 0.64 0.77 0.91



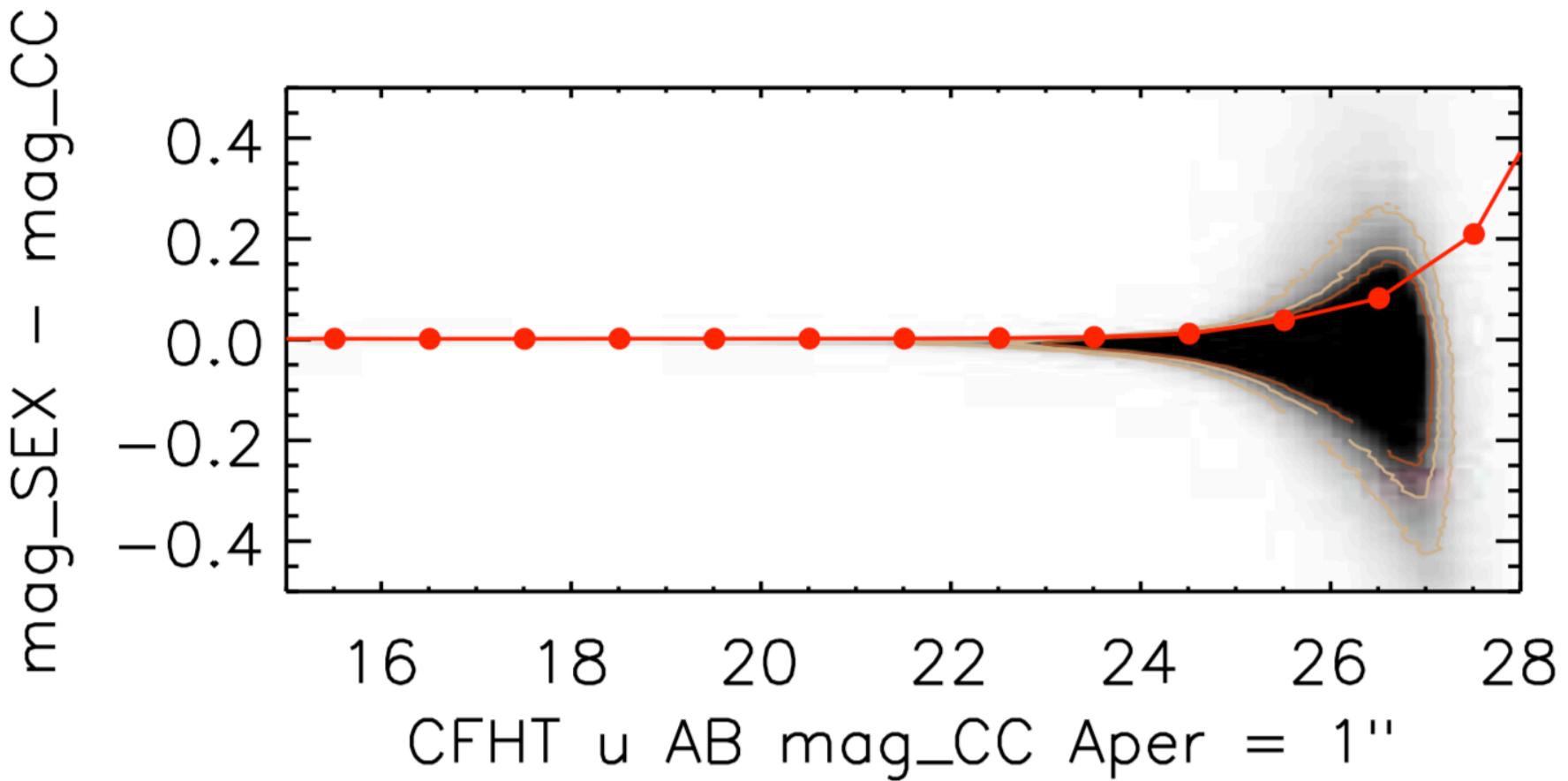
Aperture photometry



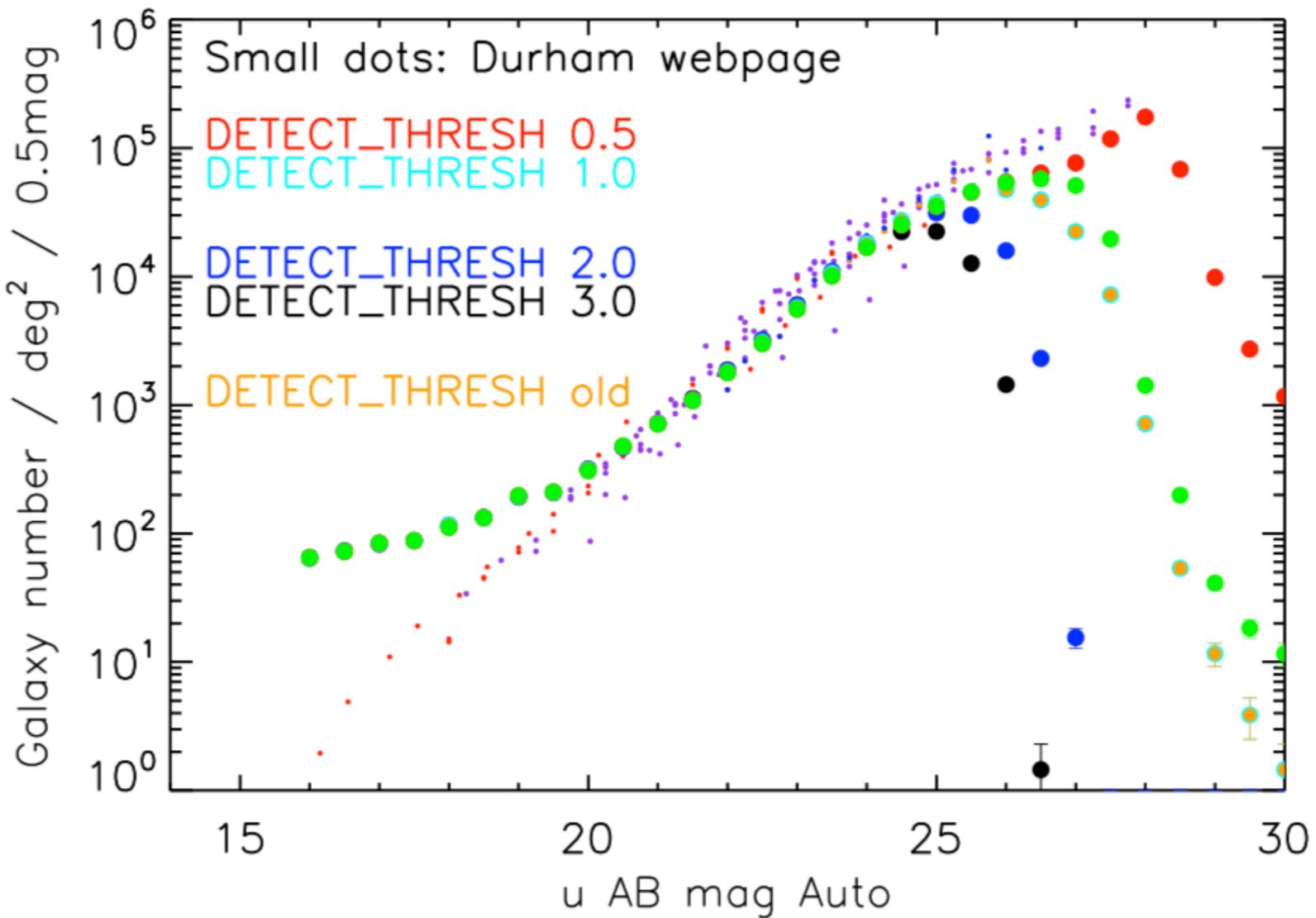
Aperture photometry: uncertainty



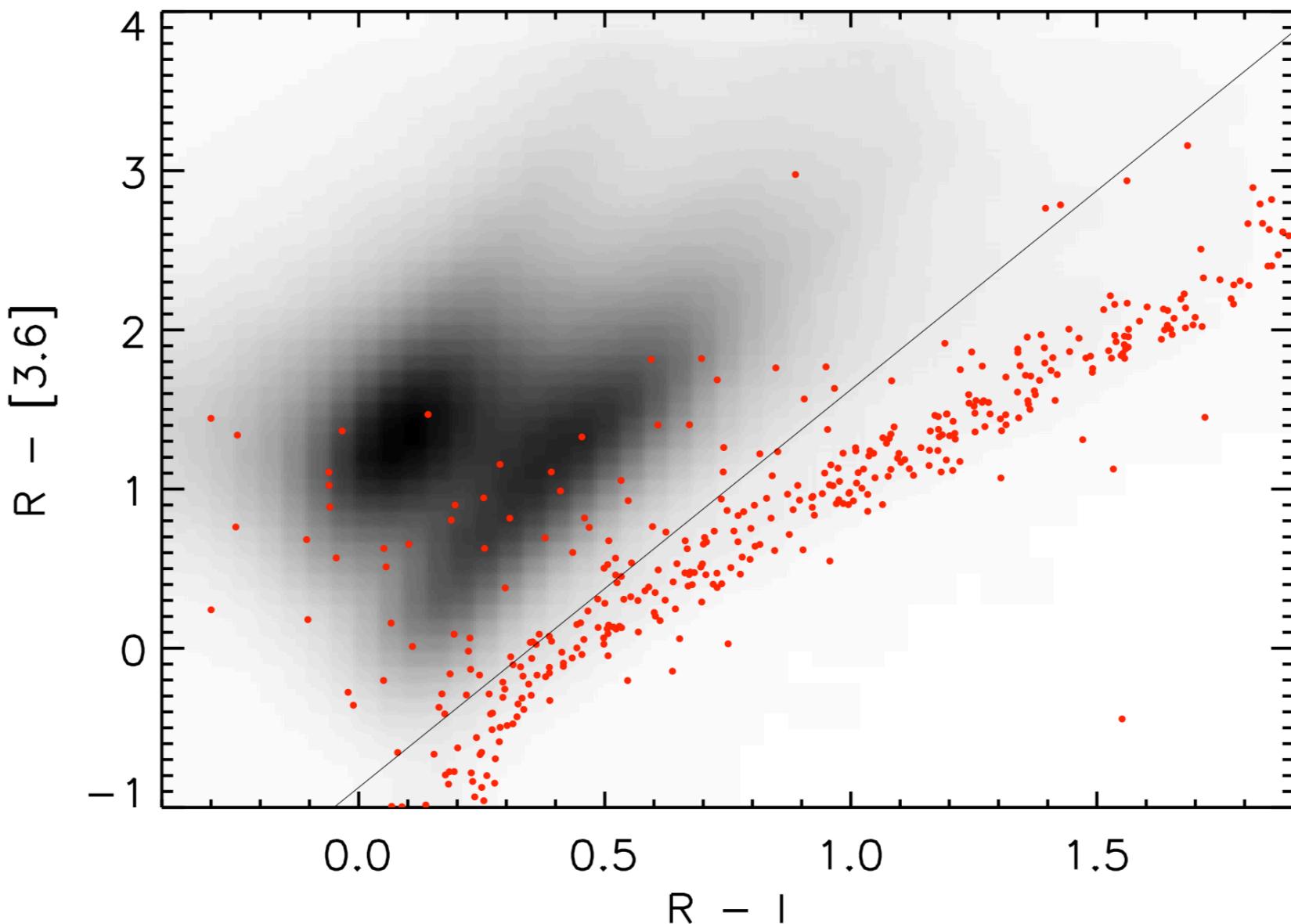
Aperture photometry: uncertainty



Source number density

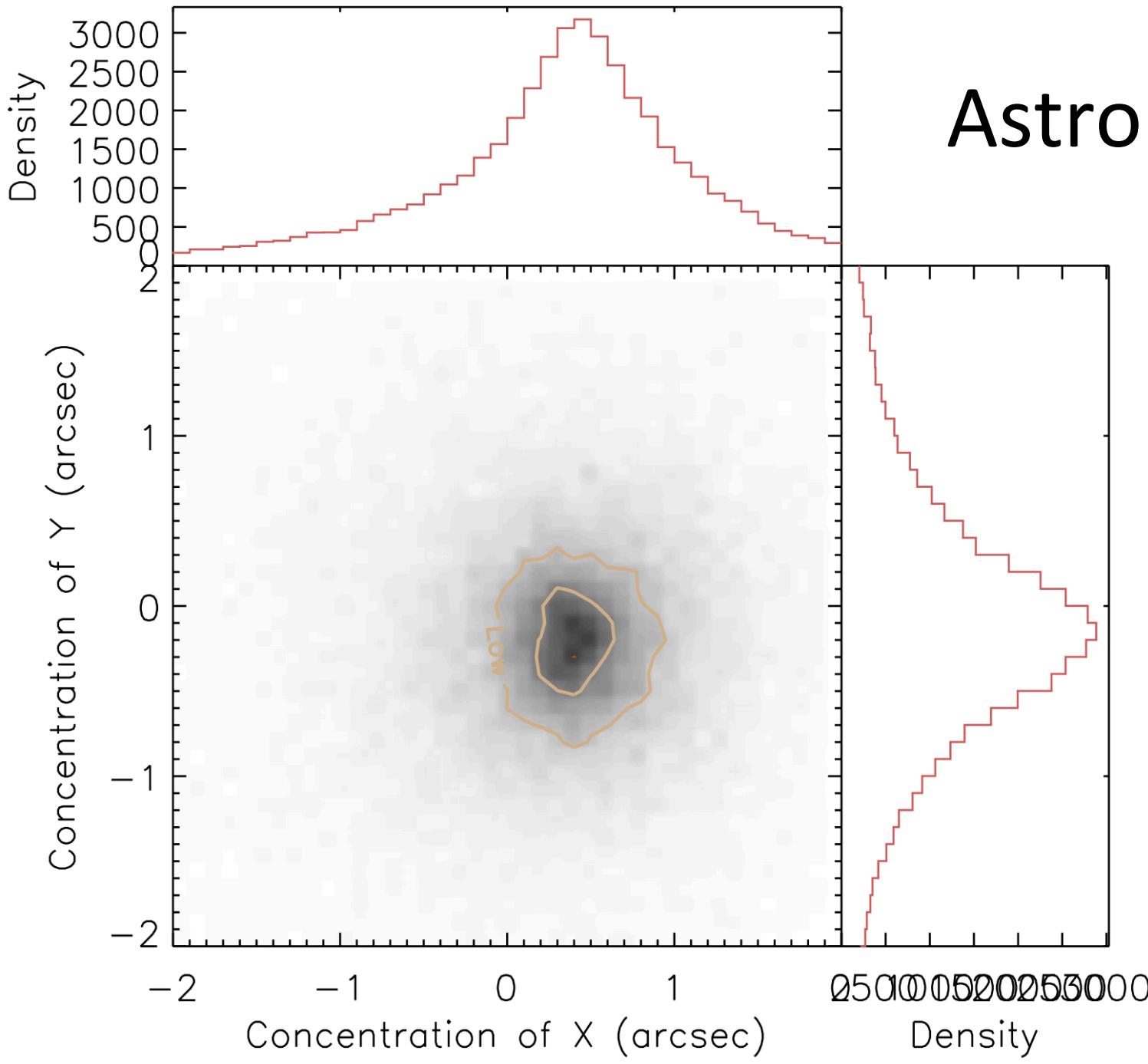


Star/galaxy separation



The CFHT u band selected catalog

- $\sim 4 \text{ deg}^2$
- 80% completeness: 26.1 AB mag
- ~ 400000 galaxies (80% complete)



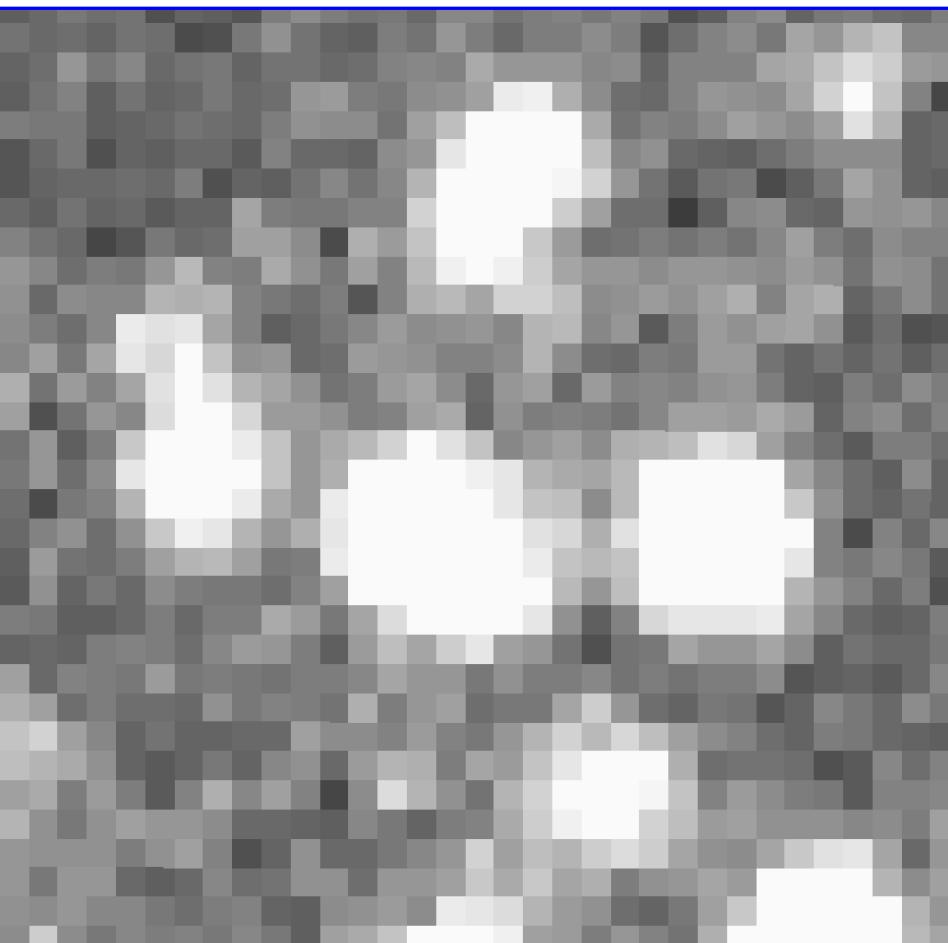
Astrometry

GALEX
CFHT

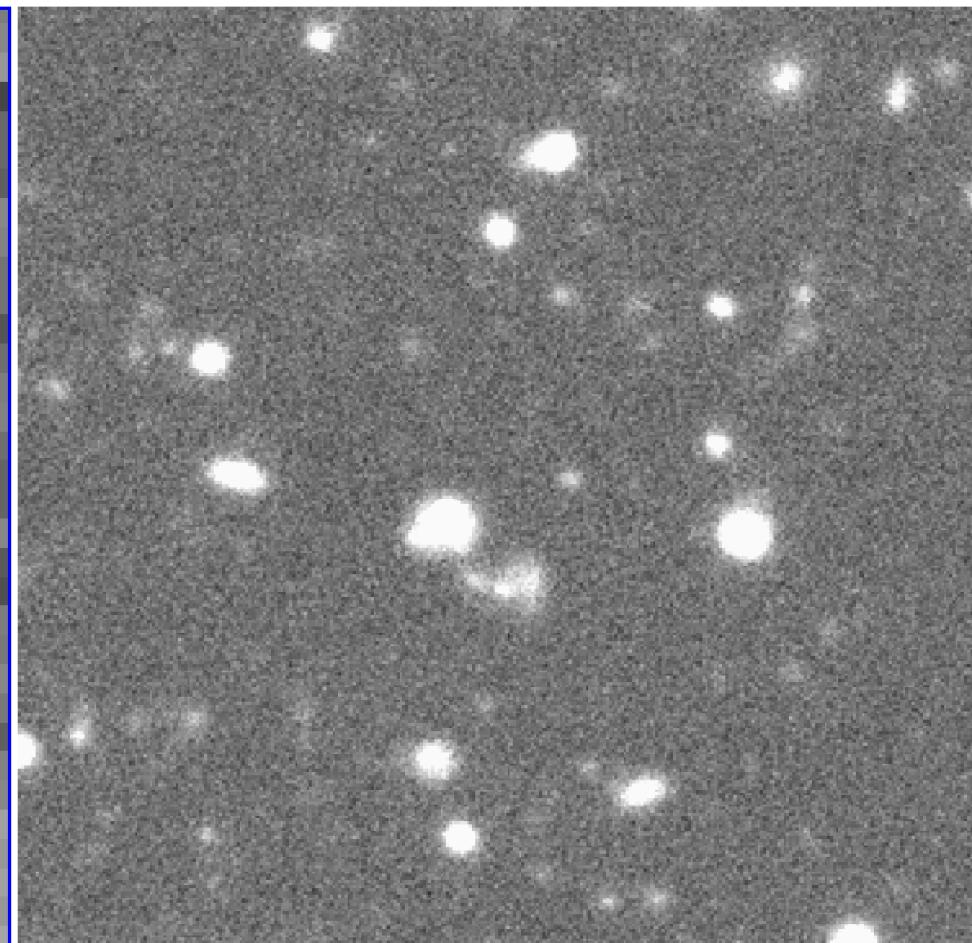
How to build the catalog

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GALEX photometry

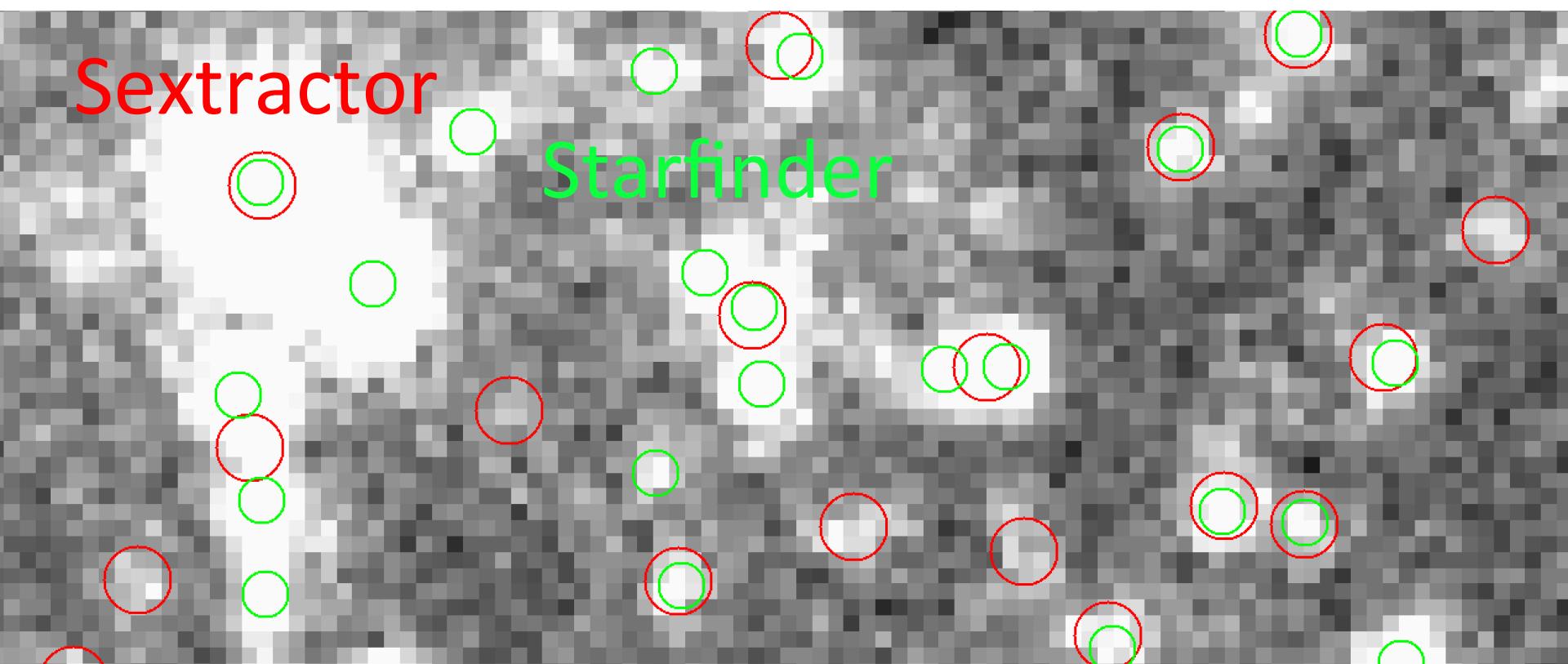


NUV

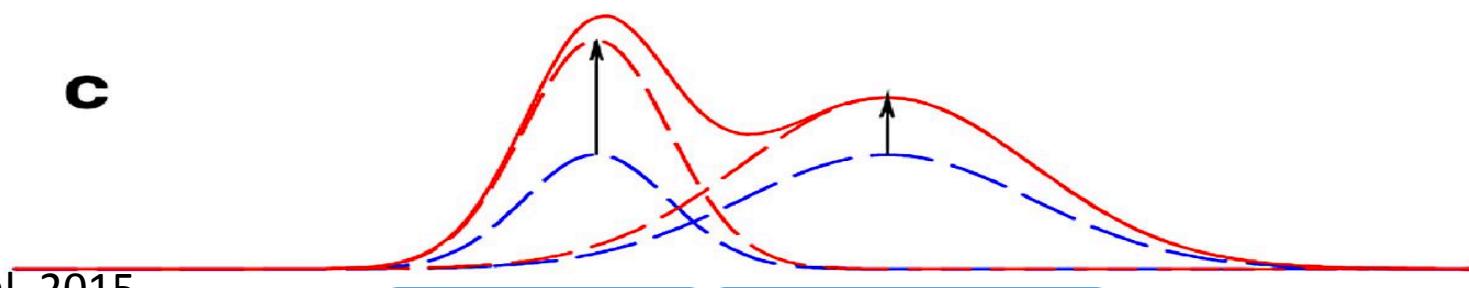
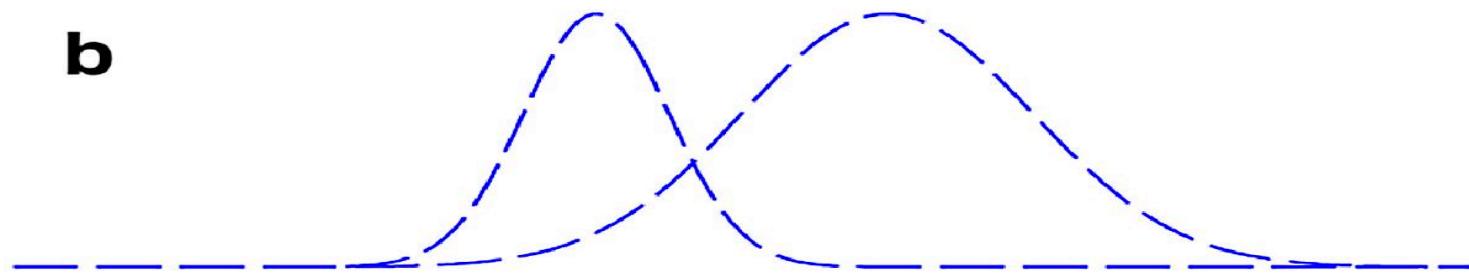
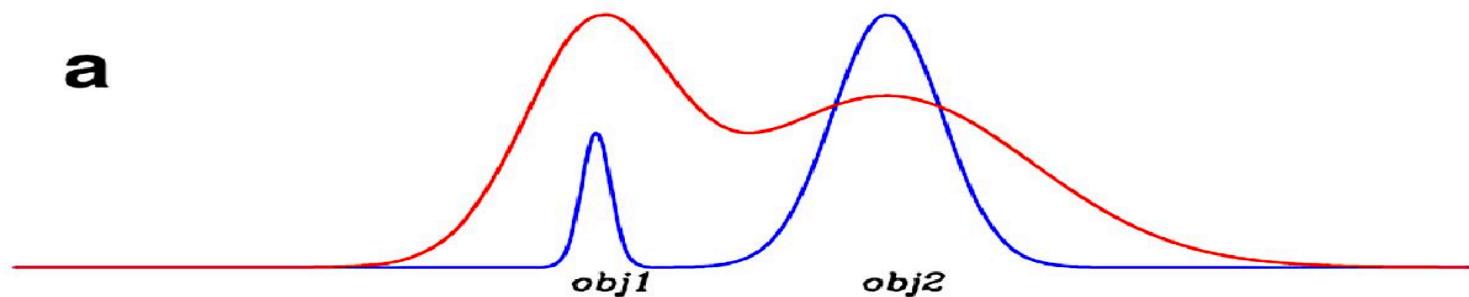


U

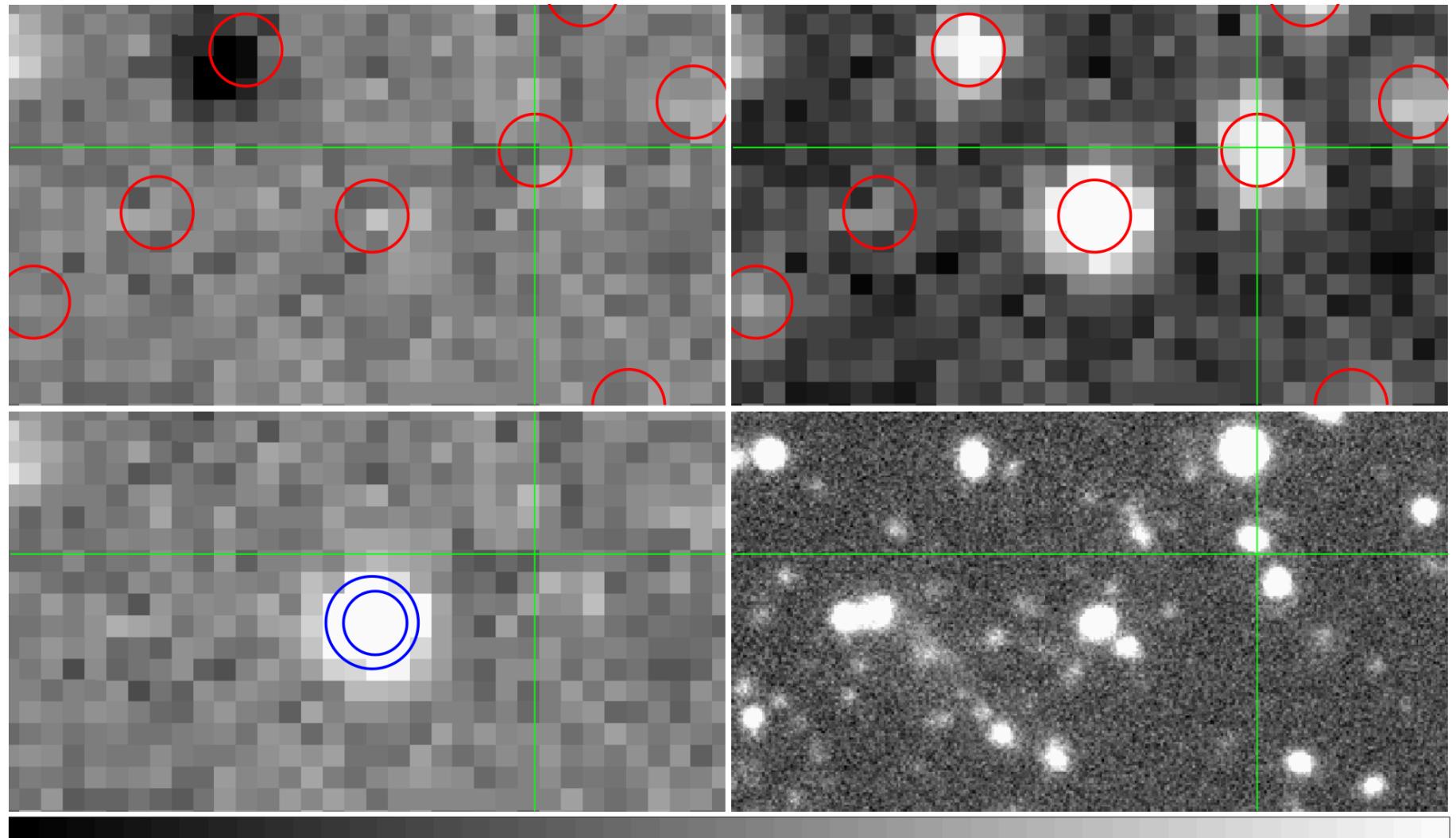
GALEX source detection



GALEX photometry method: TFIT



GALEX photometry method: TFIT

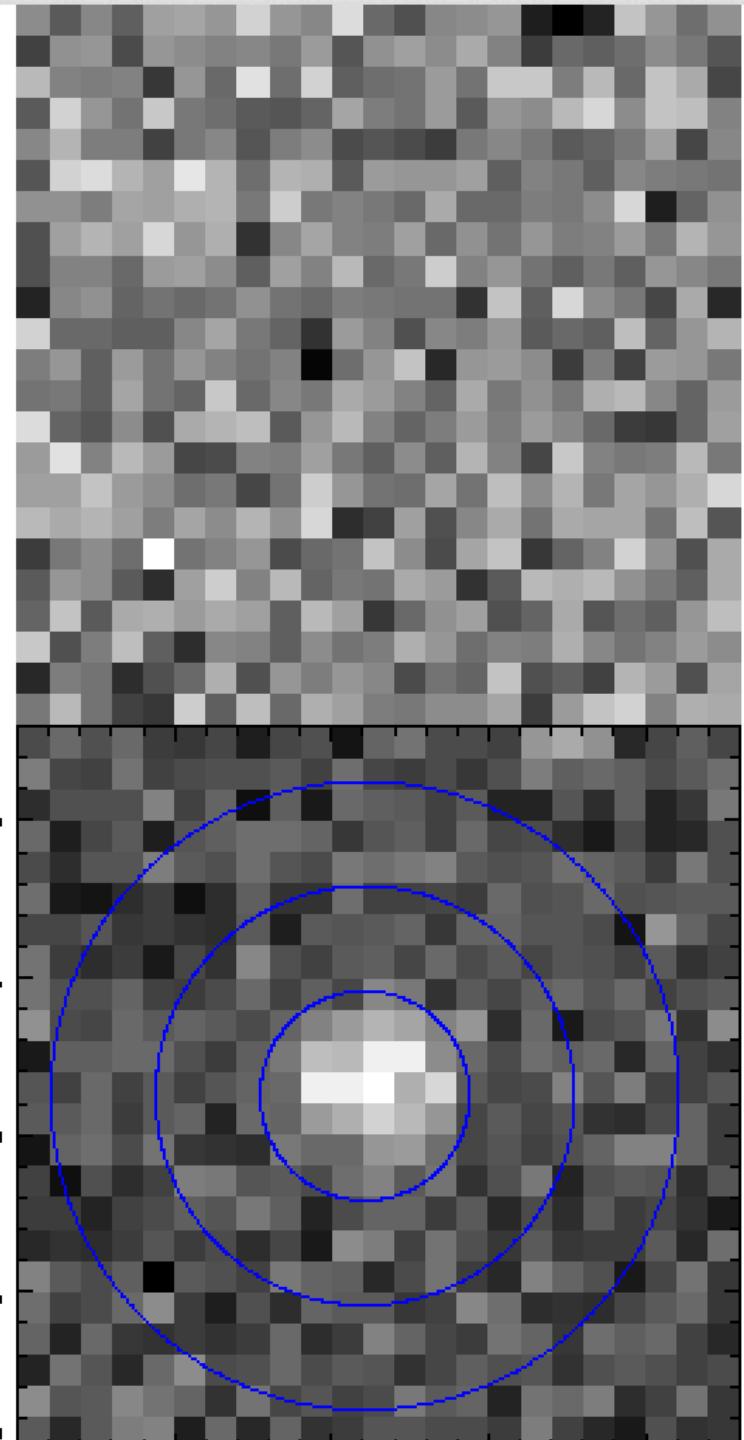
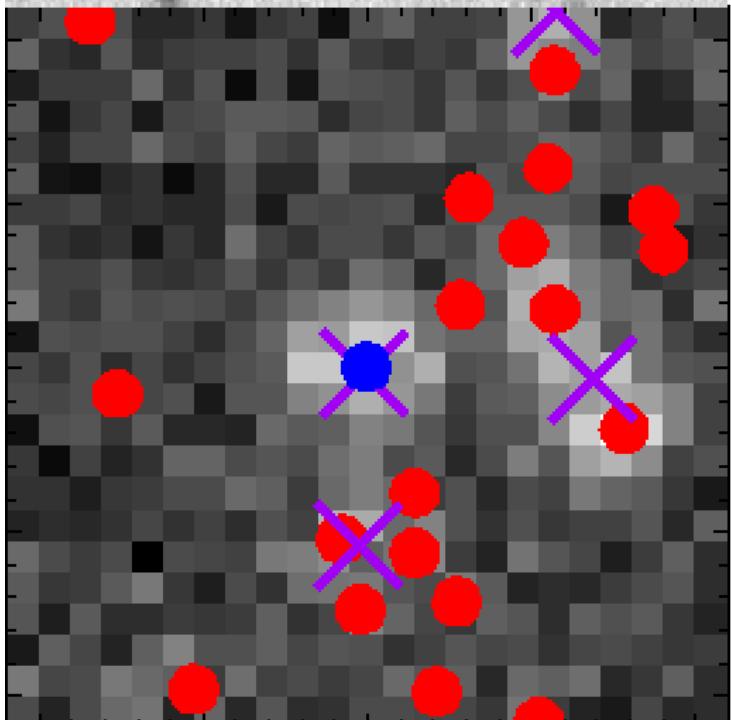


-0.0018 -0.0014 -0.0011 -0.00073 -0.00038 -2.6e-05 0.00033 0.00068 0.001 0.0014 0.0017

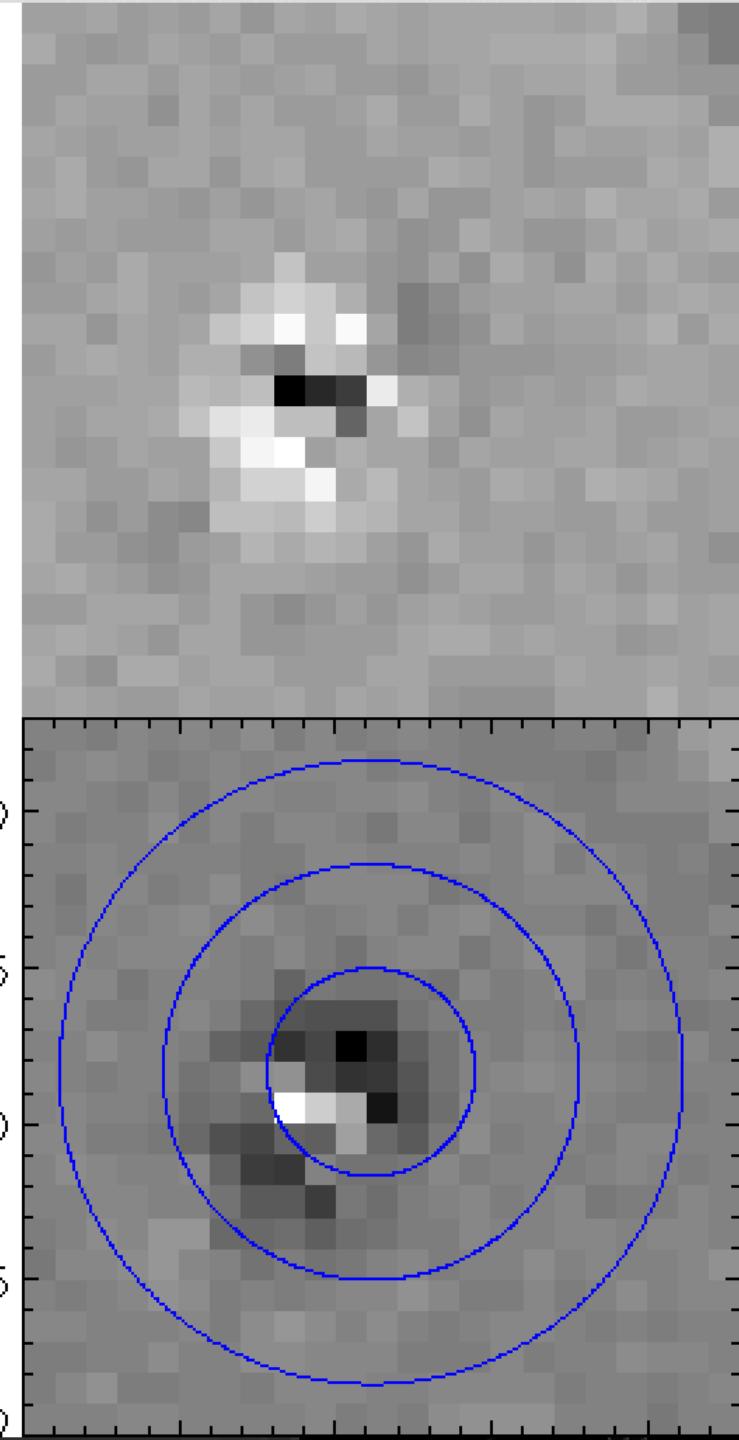
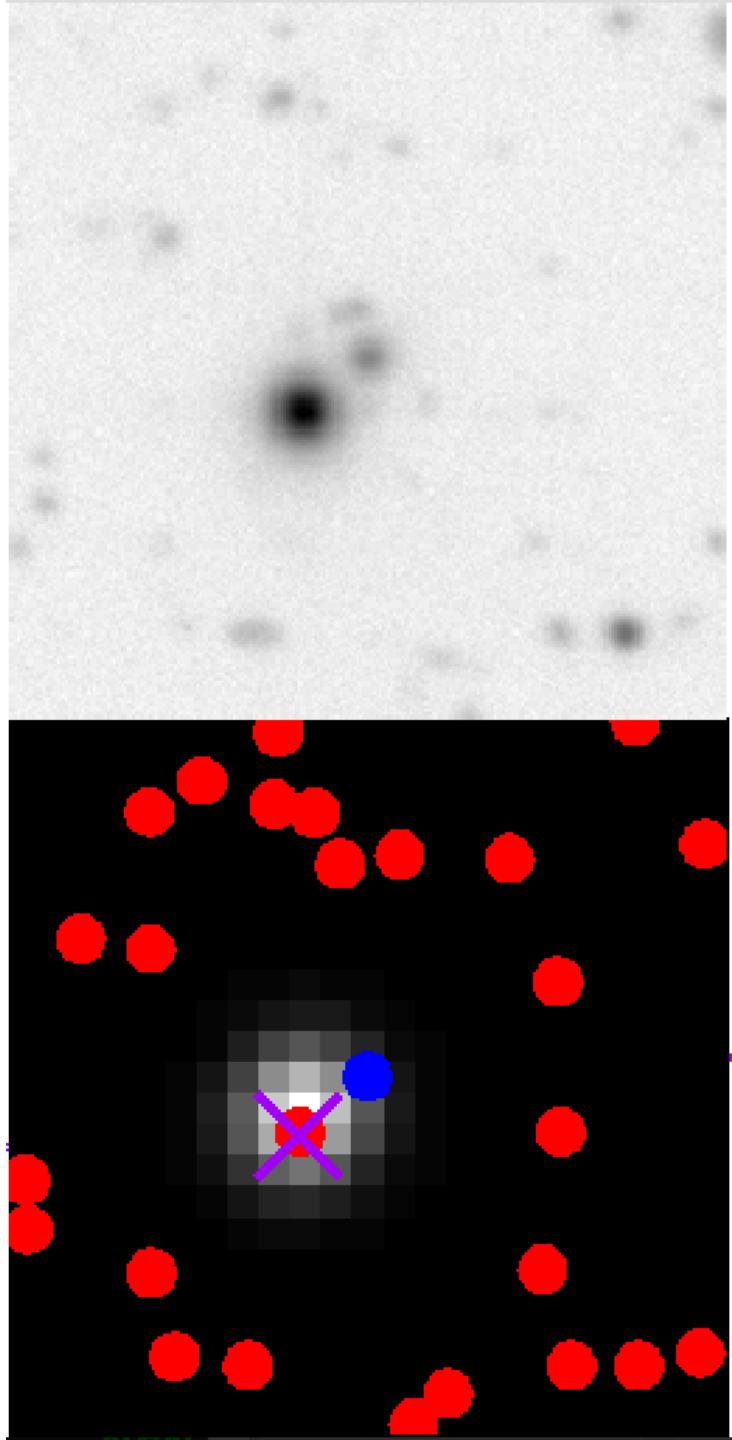
GALEX photometry method: PSF-FIT

- PSF fitting the GALEX image with u band catalog position fixed
- Subtract the nearby PSF fitting flux
- Aperture photometry
- Aperture correction

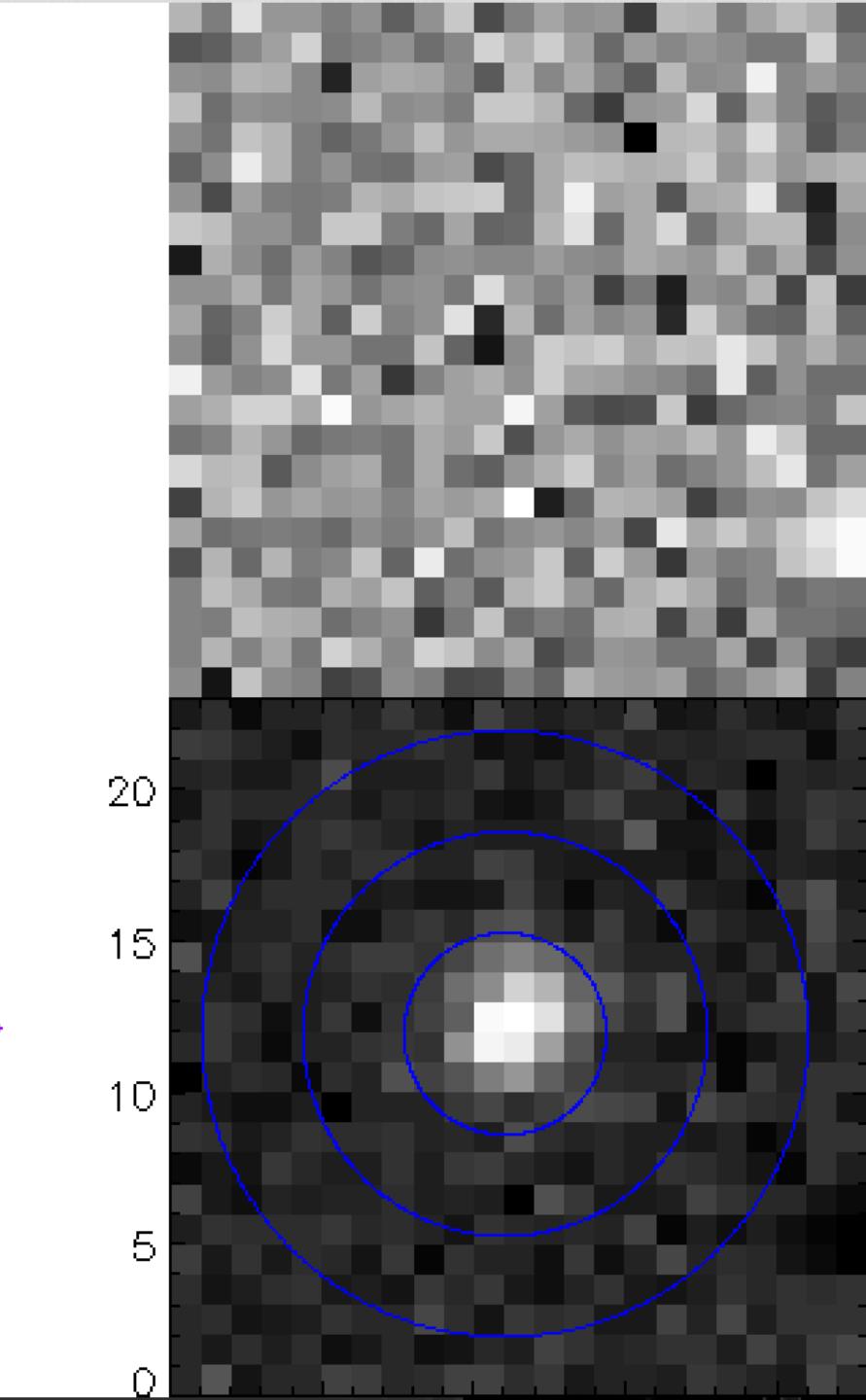
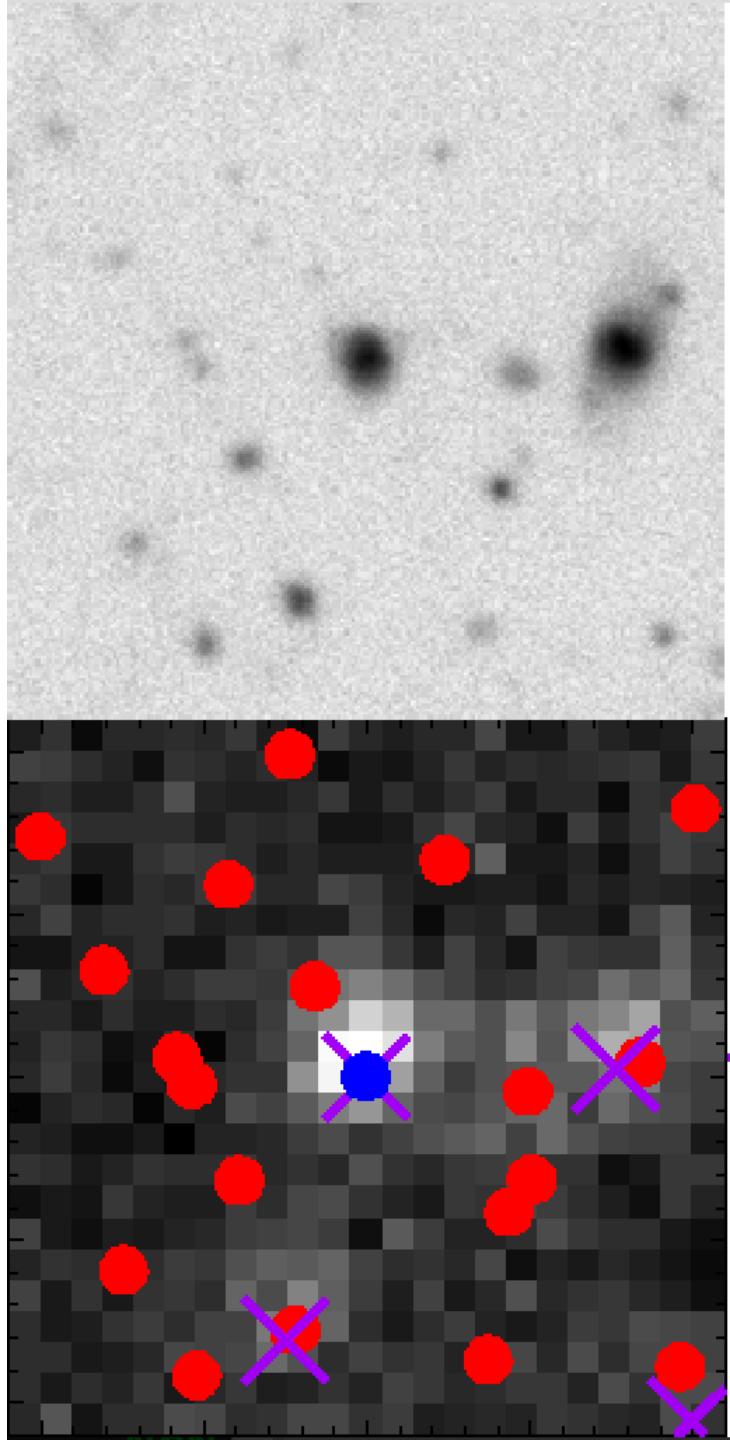
Photometry Atlas



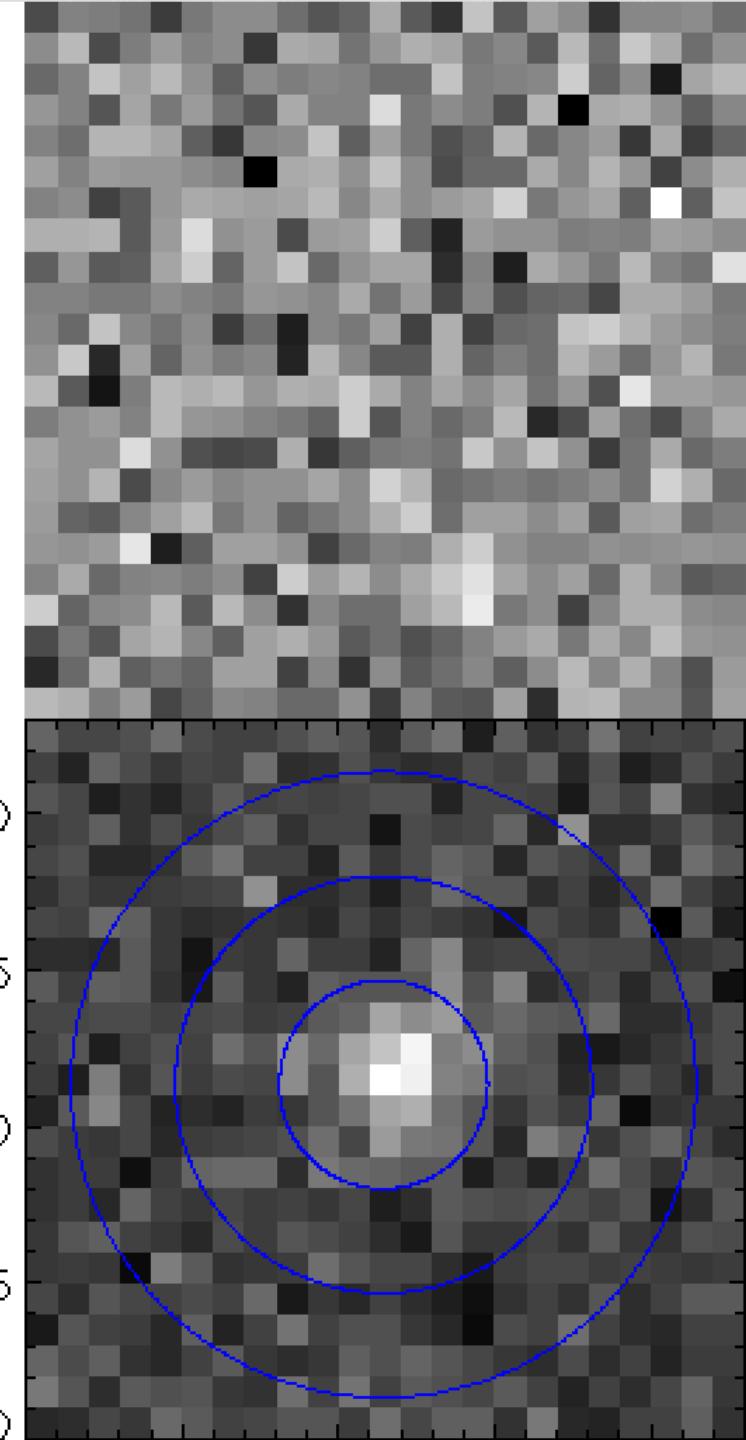
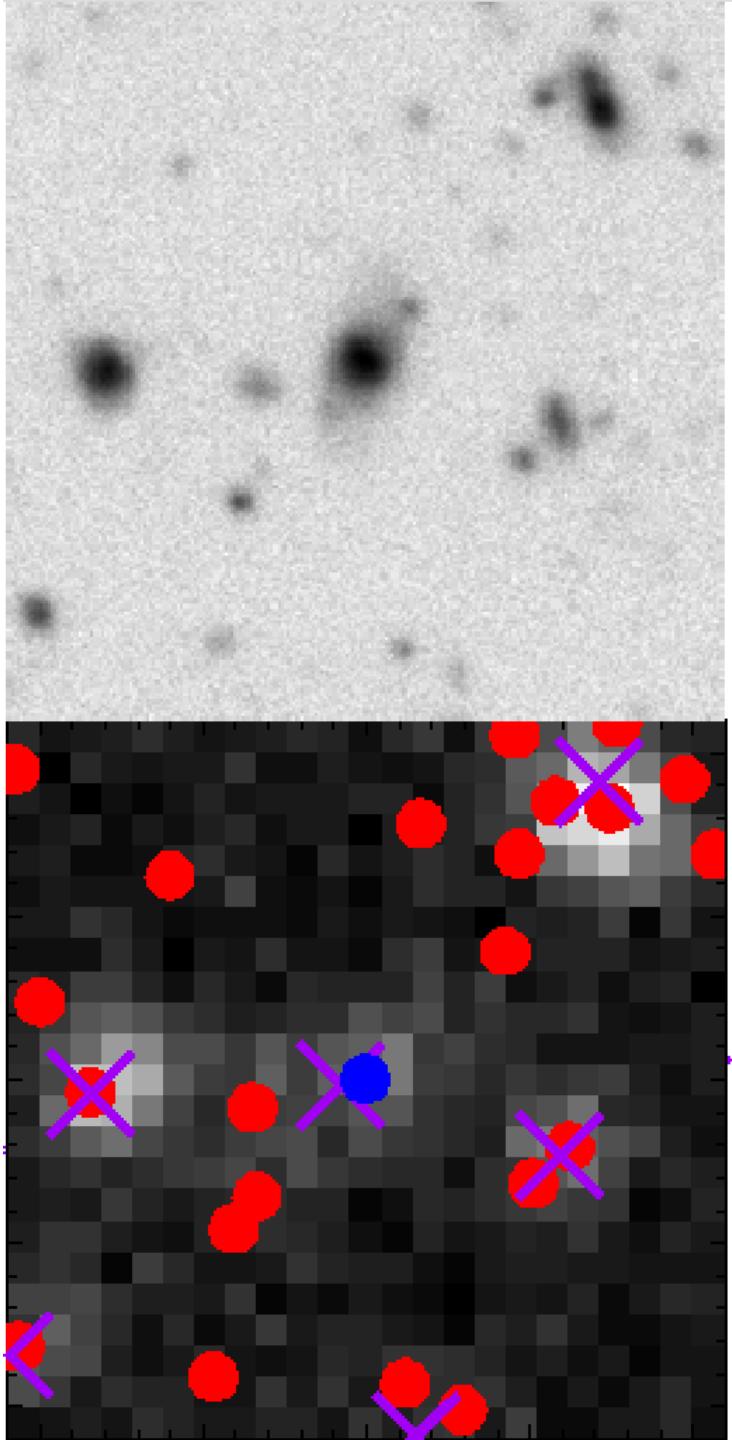
Photometry Atlas



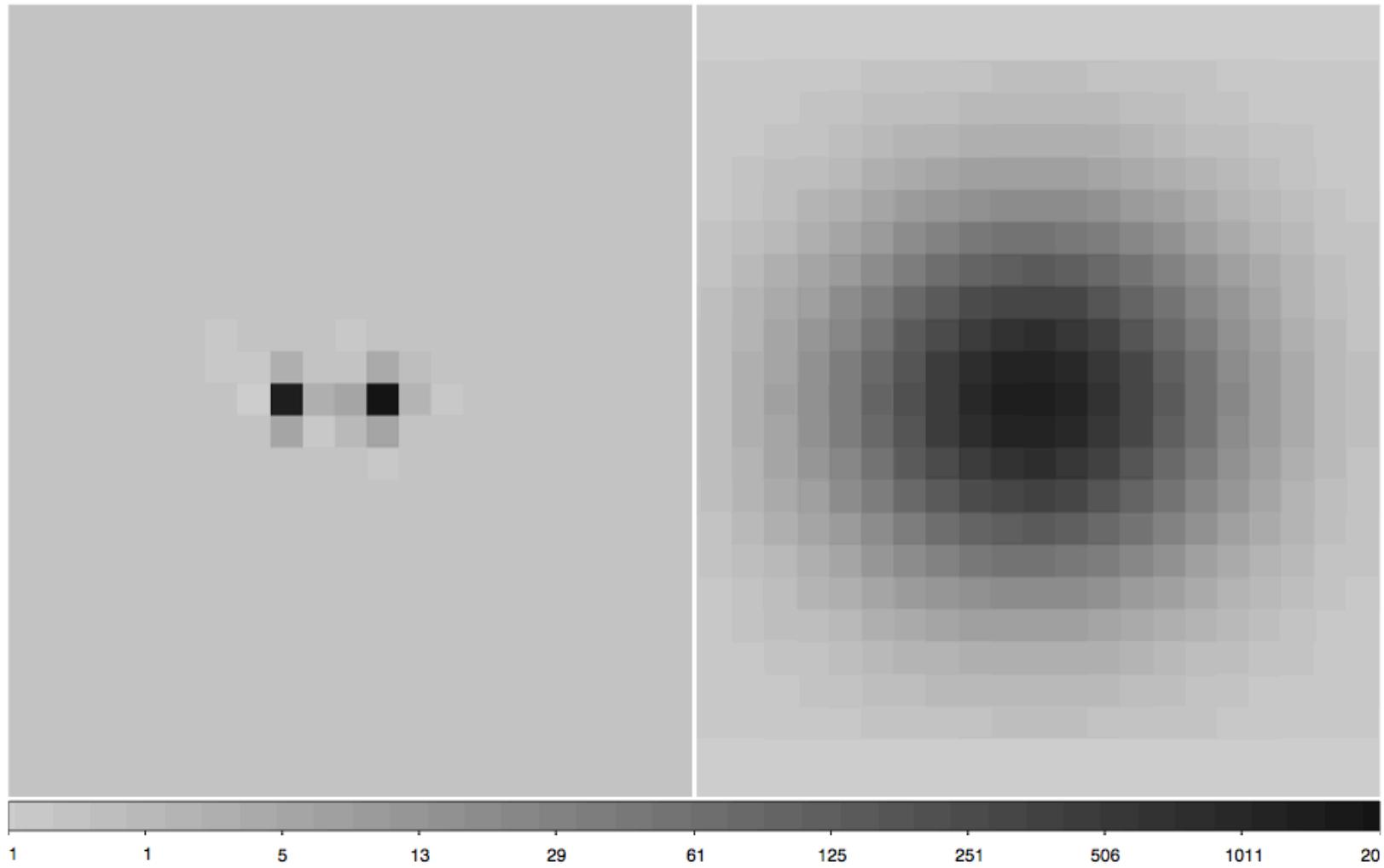
Photometry Atlas



Photometry Atlas



GALEX PSF-FIT photometry uncertainty



GALEX PSF-FIT photometry uncertainty

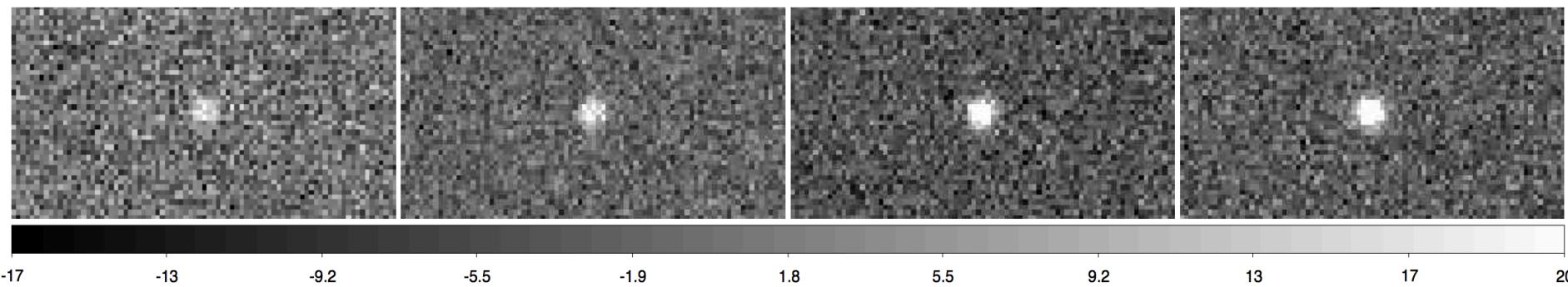


Fig. 1.— Different signal noise ratio.

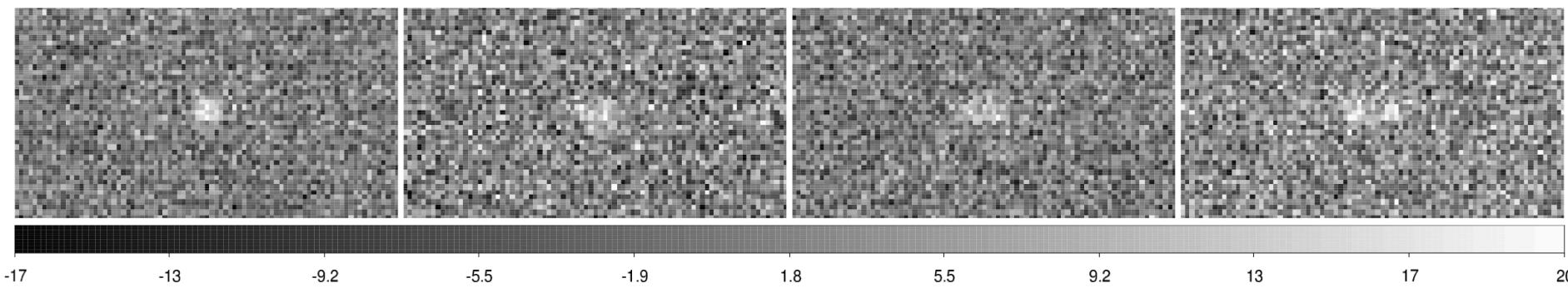
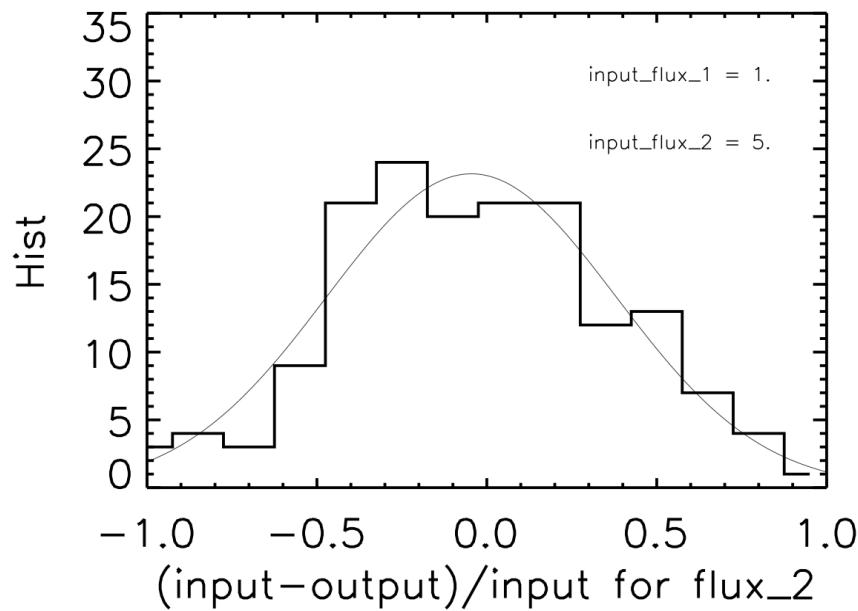
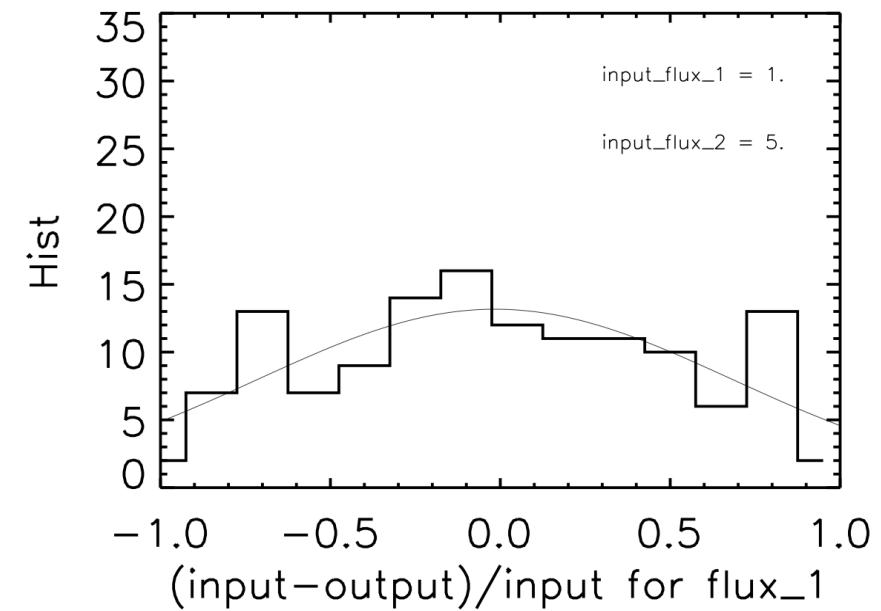
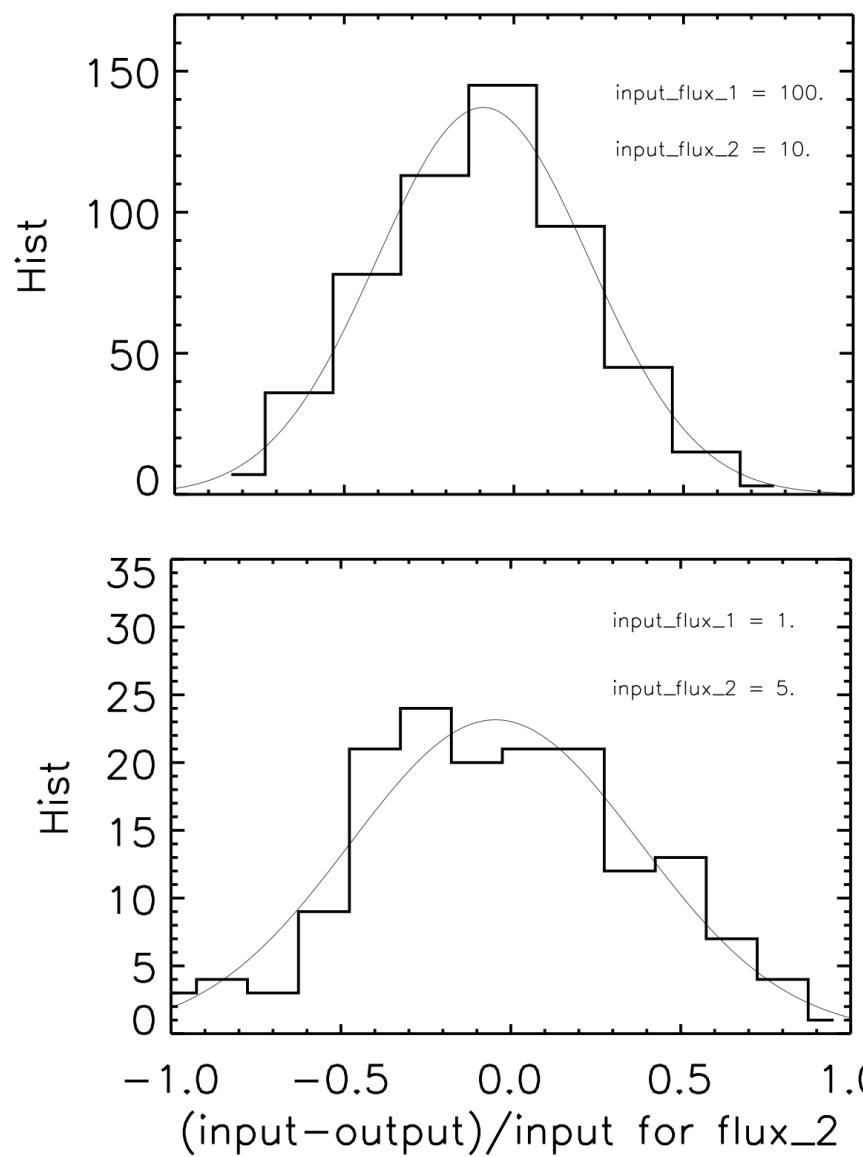
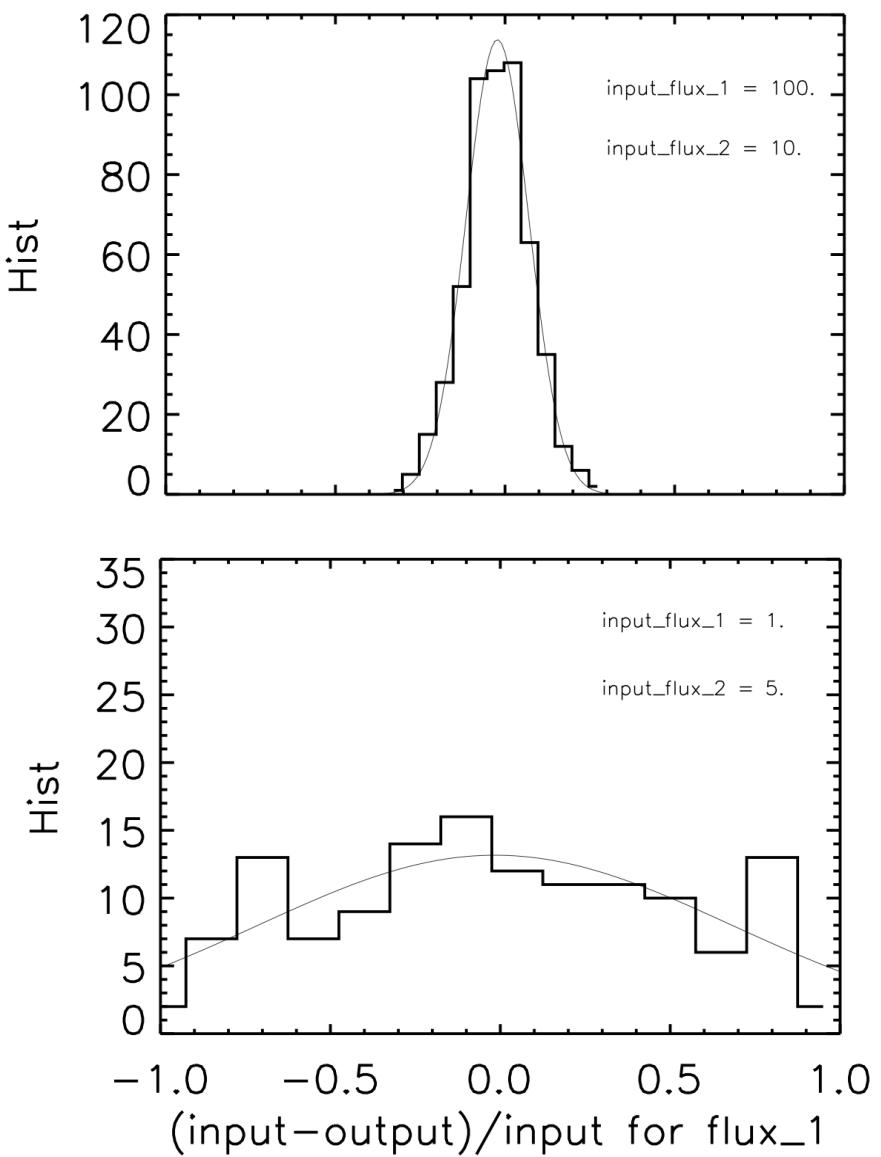
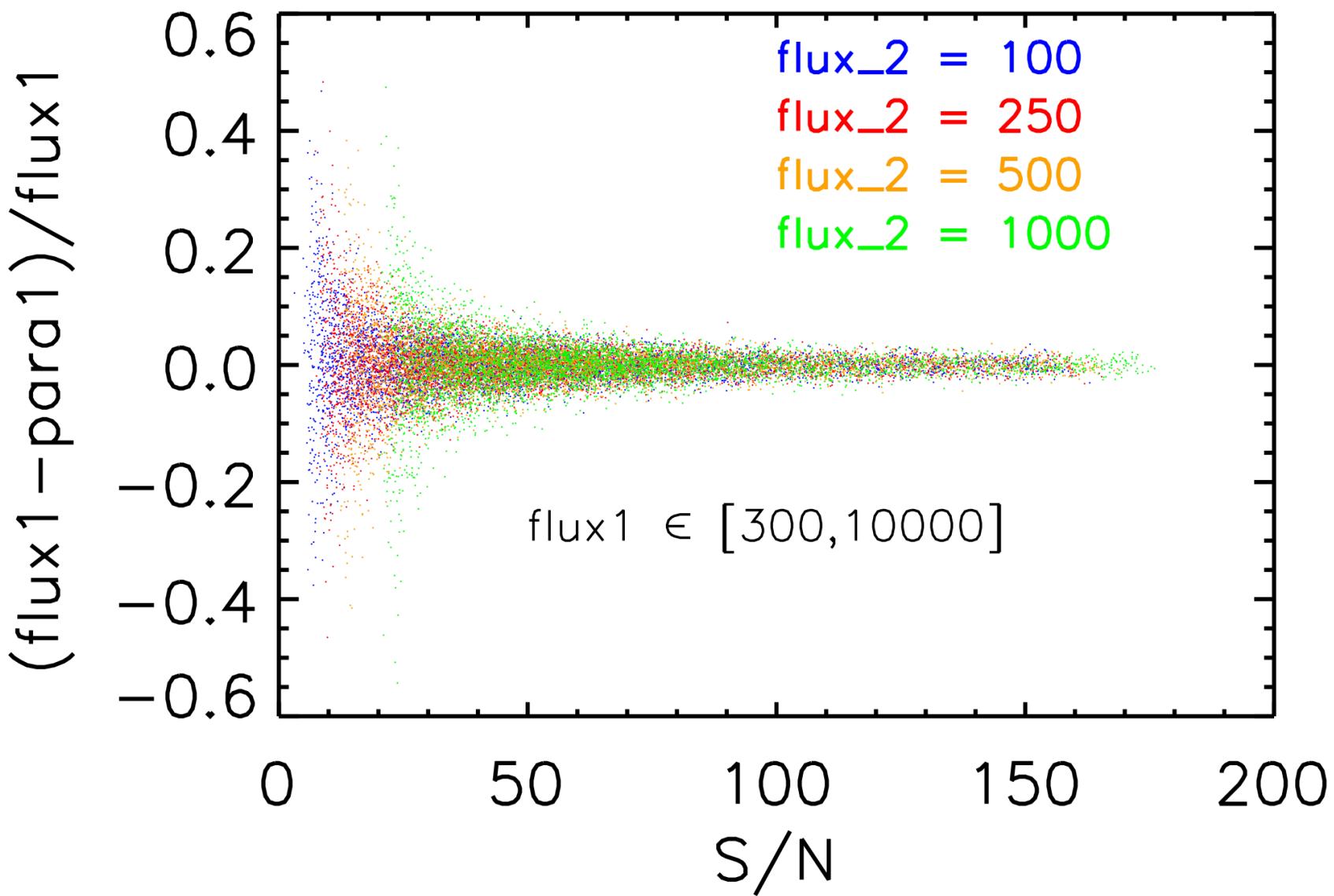


Fig. 2.— Different source distance.

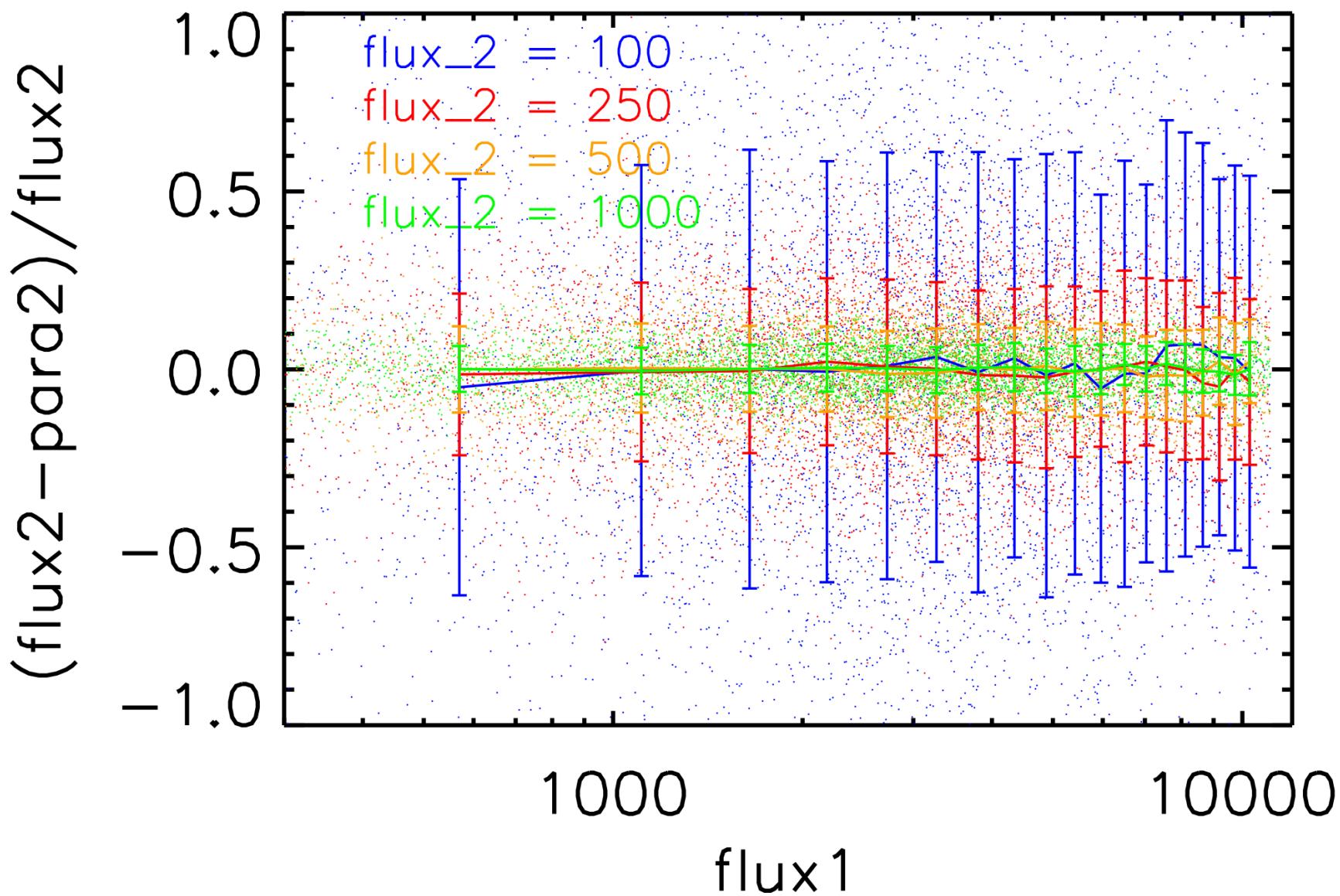
GALEX PSF-FIT photometry uncertainty



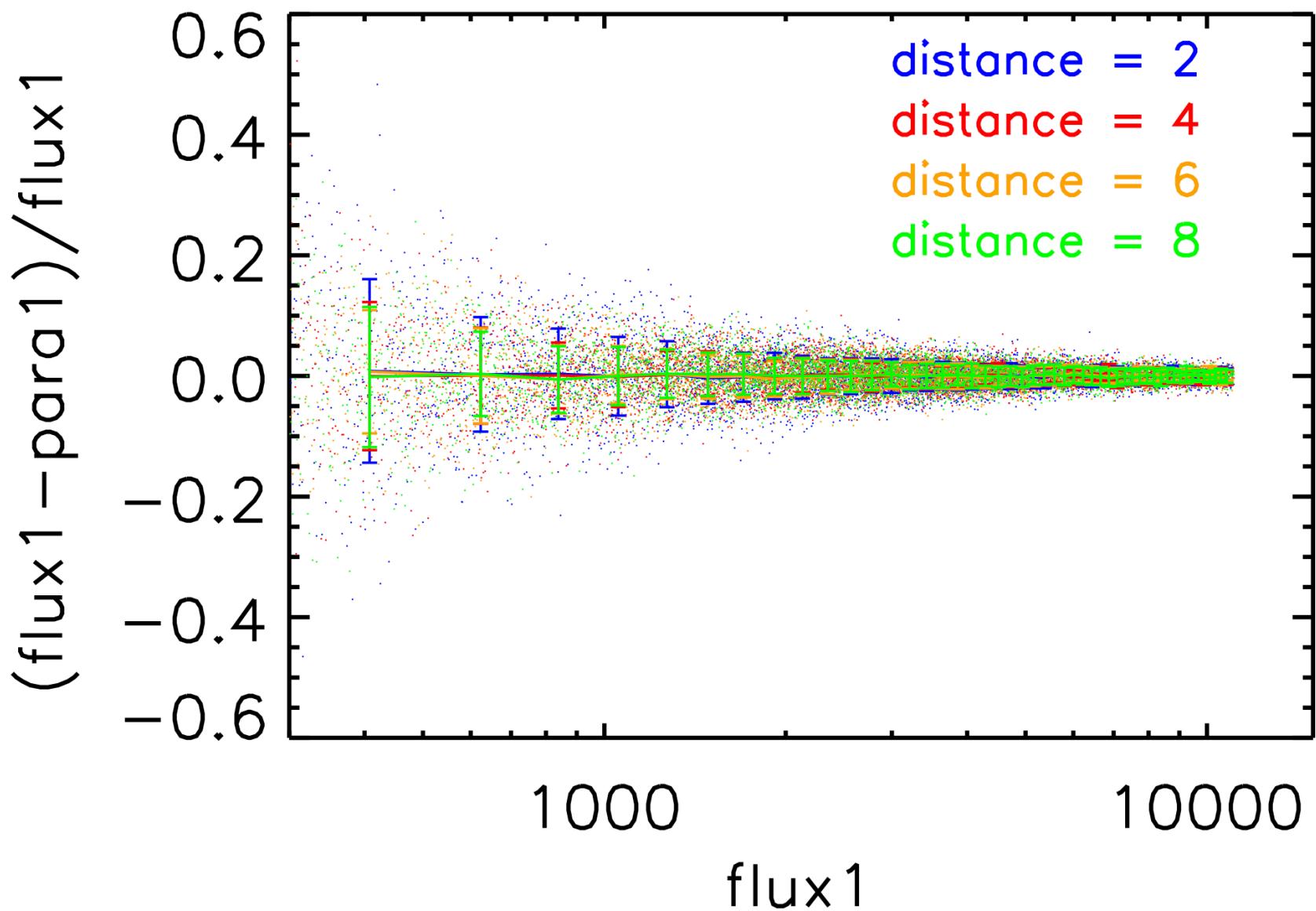
GALEX PSF-FIT photometry uncertainty



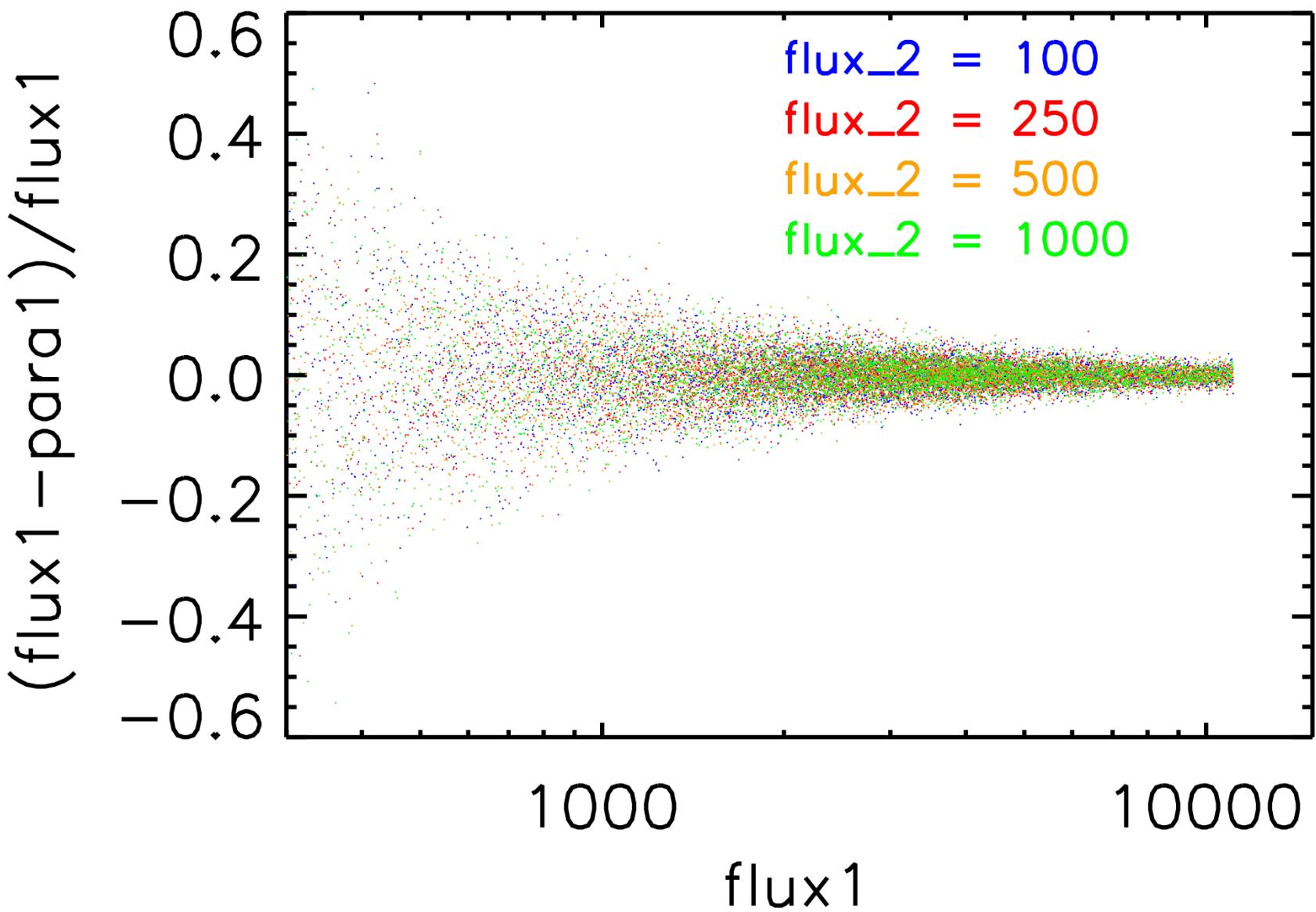
GALEX PSF-FIT photometry uncertainty



GALEX PSF-FIT photometry uncertainty



GALEX PSF-FIT photometry uncertainty



GALEX PSF-FIT photometry uncertainty

- Confusion source S/N
- Nearest distance
- NUV flux

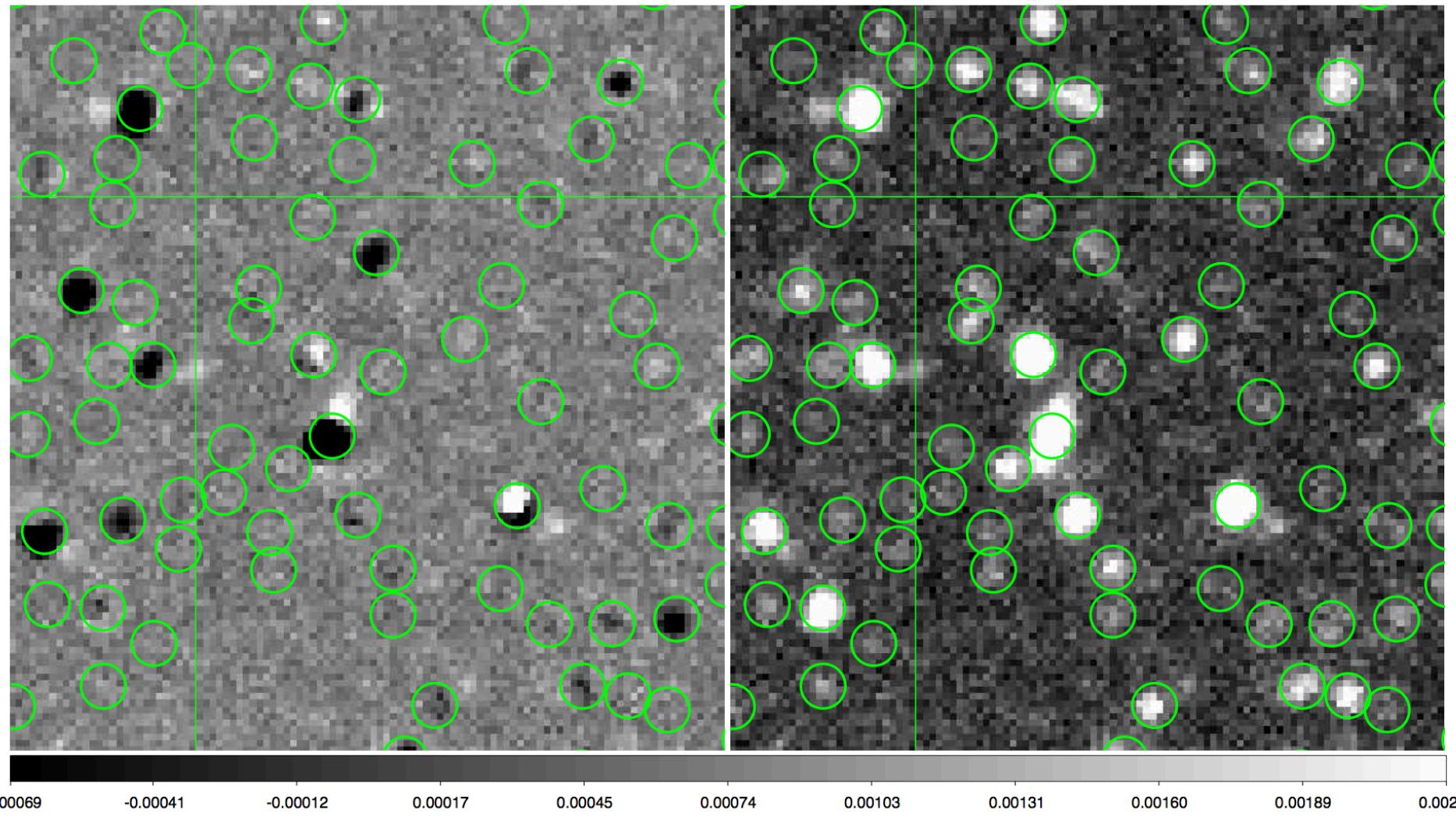
GALEX photometry issue

- Fitting window size
- Aperture size and correction
 - Different aper size for u band and GALEX
 - 5" aperture for u band
- Proper background
 - Local annulus background
 - Uniform background
 - Interpol local background

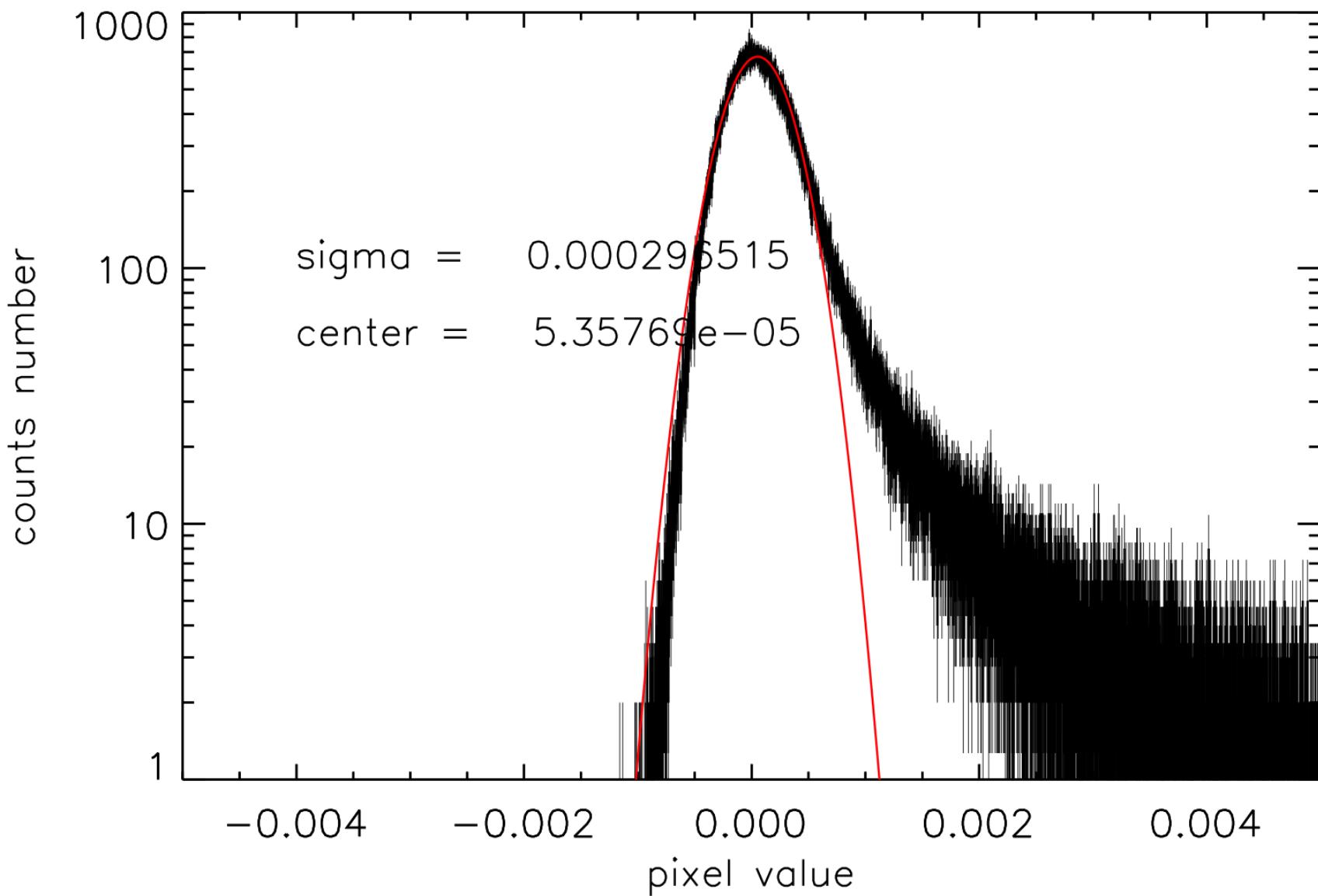
Consistency check: reliable?

- PSF subtraction
- number counts density
- flux scatter

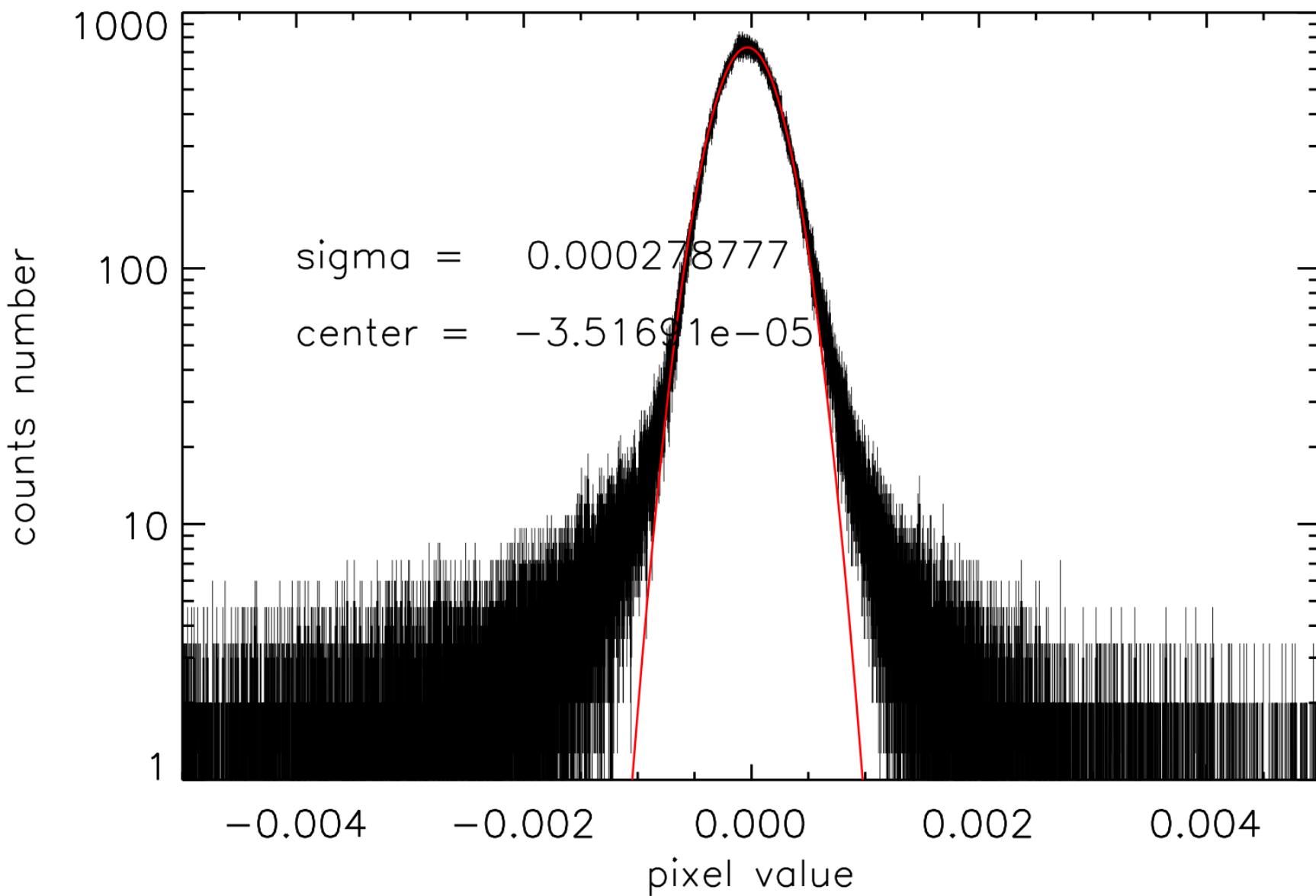
Consistency check: PSF subtraction



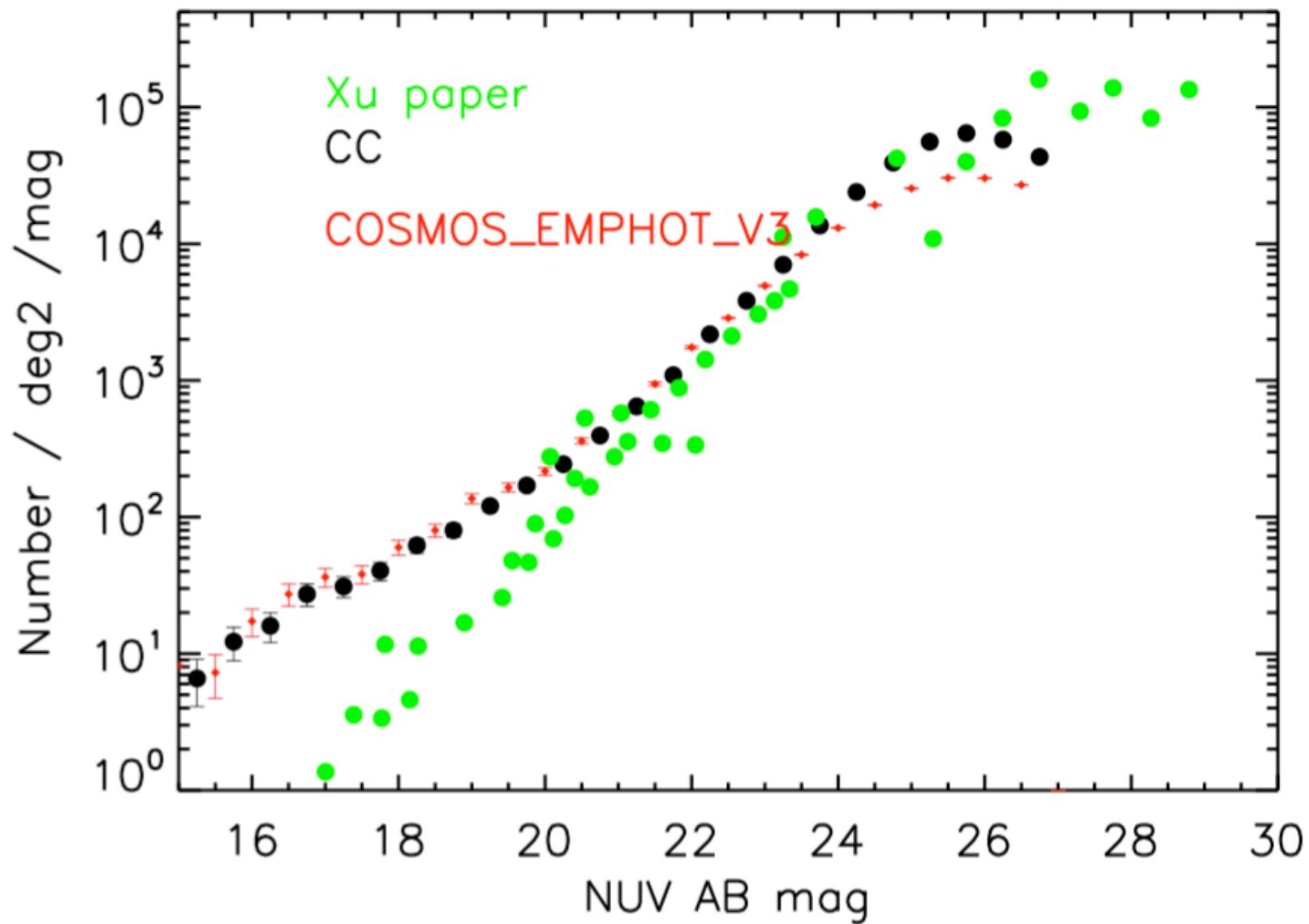
GALEX image pixel value histogram



After PSF subtraction

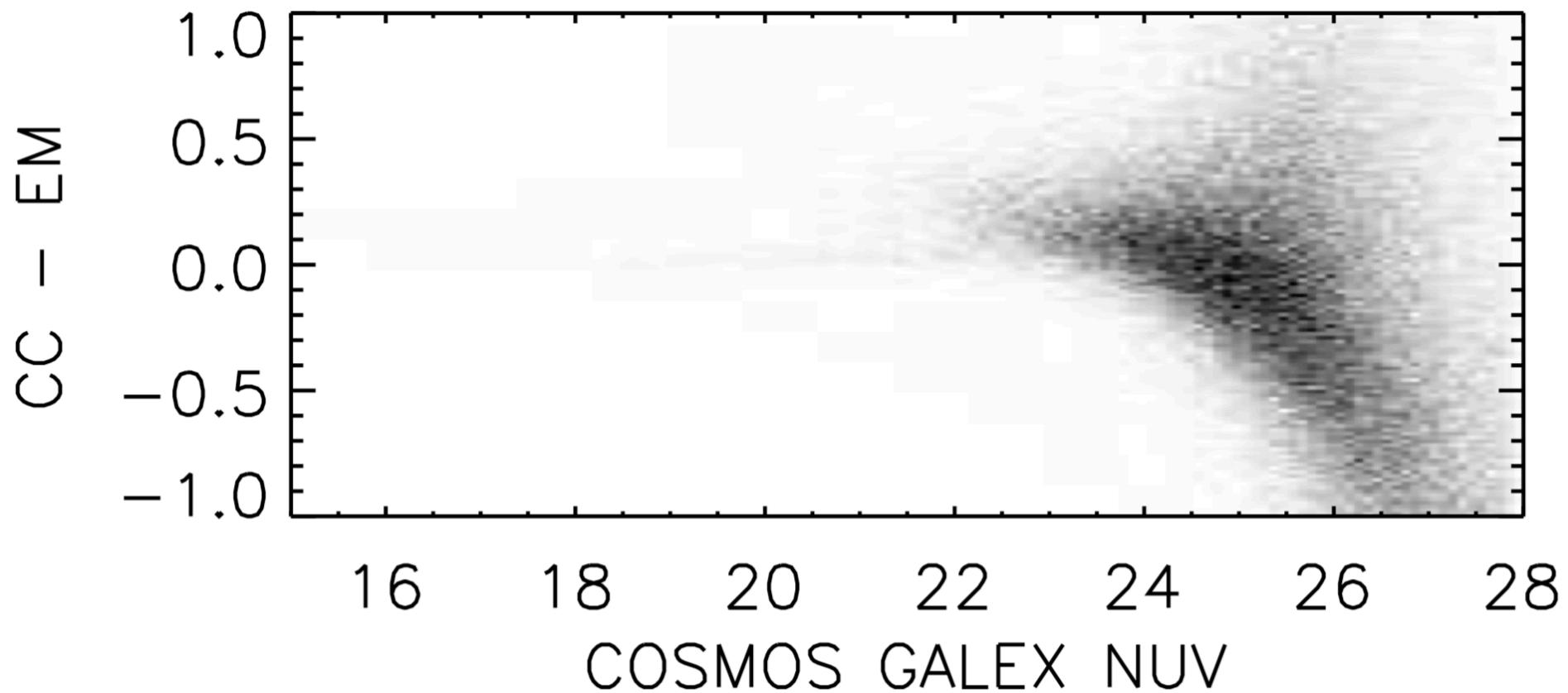


Consistency check

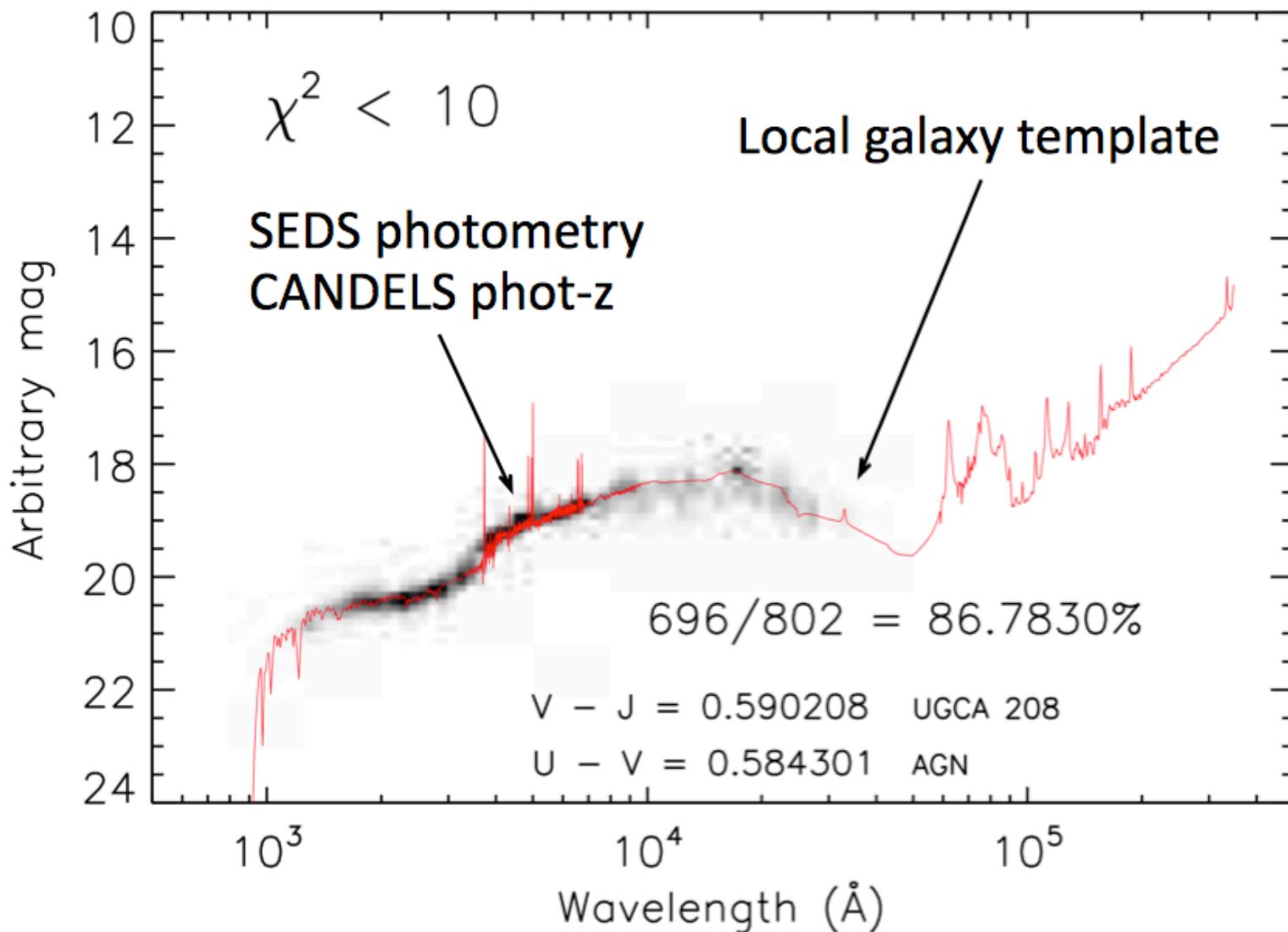


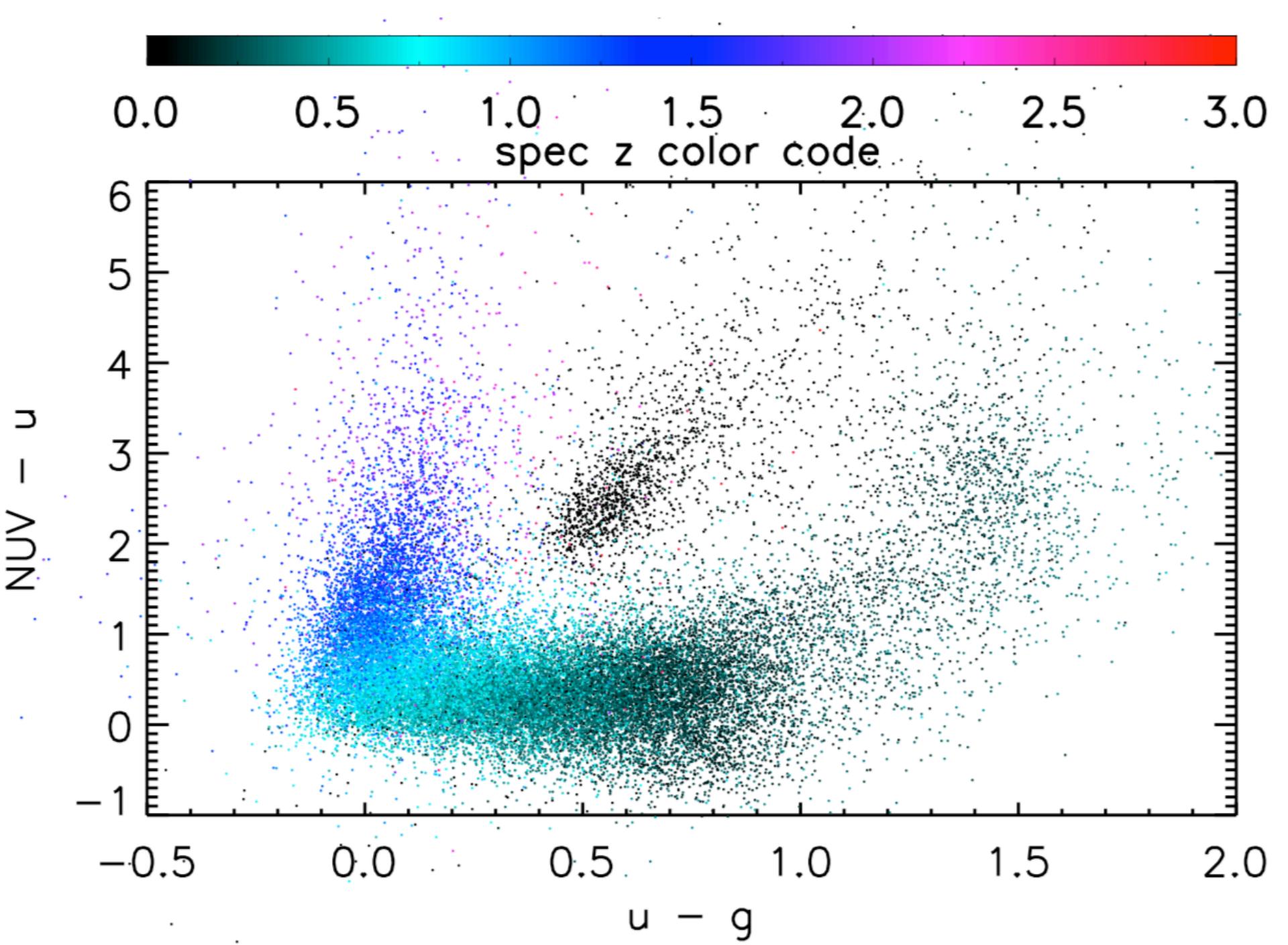
Consistency check: EM results

- My results are not very wrong:



Consistency check: flux scatter





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