



# photutils

An `Astropy` Package for Photometry



**Photutils** is an Astropy coordinated package for source detection and photometry (and related tools).

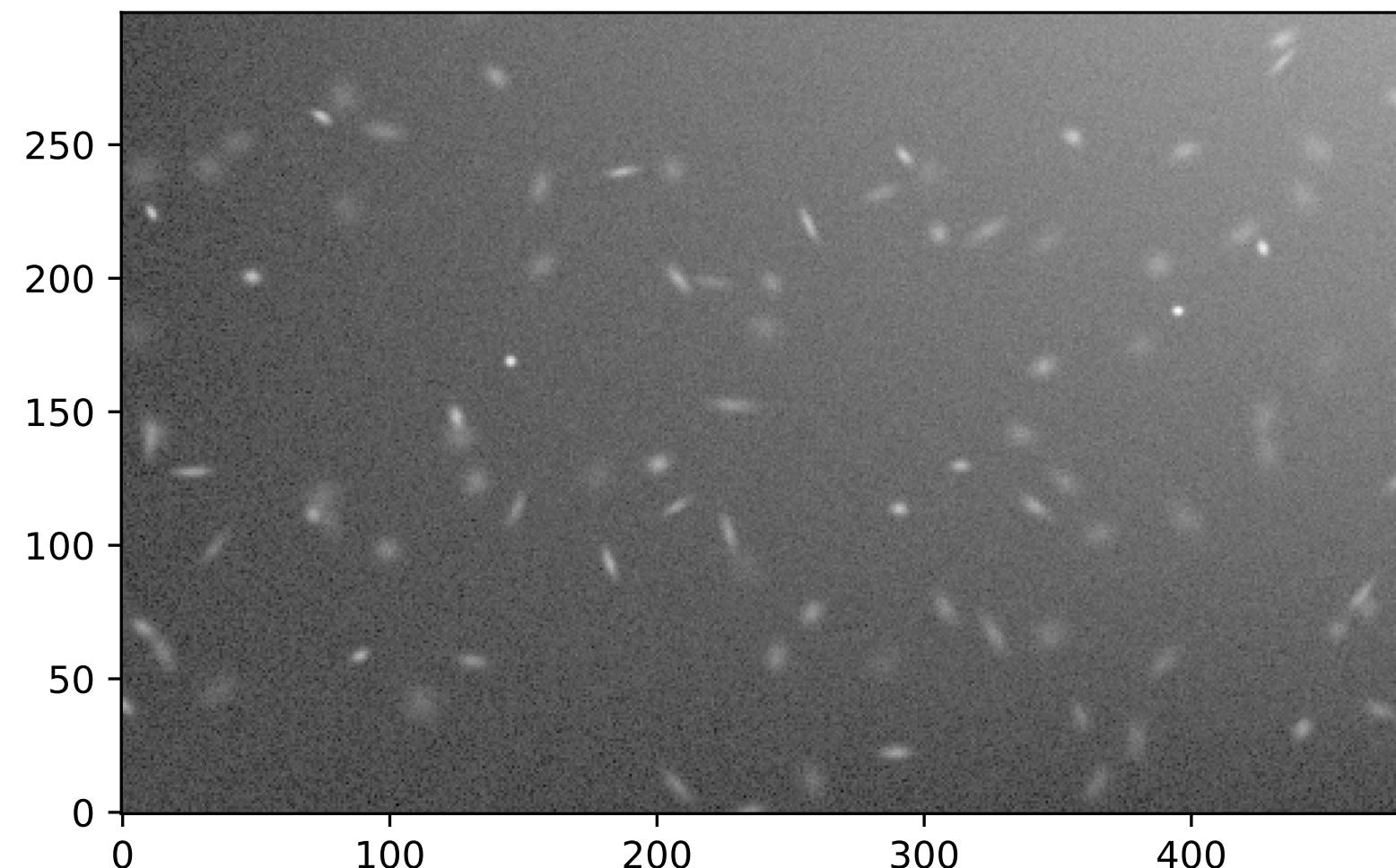
**It provides flexible/modular tools for:**

- 2D Background (and RMS) Estimation
- Source Detection/Extraction
- Aperture Photometry
- Image Segmentation (incl. Isophotal and Kron photometry)
- PSF Photometry
- Building an effective PSF (ePSF)
- PSF Matching
- Radial Profiles
- Elliptical Isophotal Fitting and Analysis
- Centroids

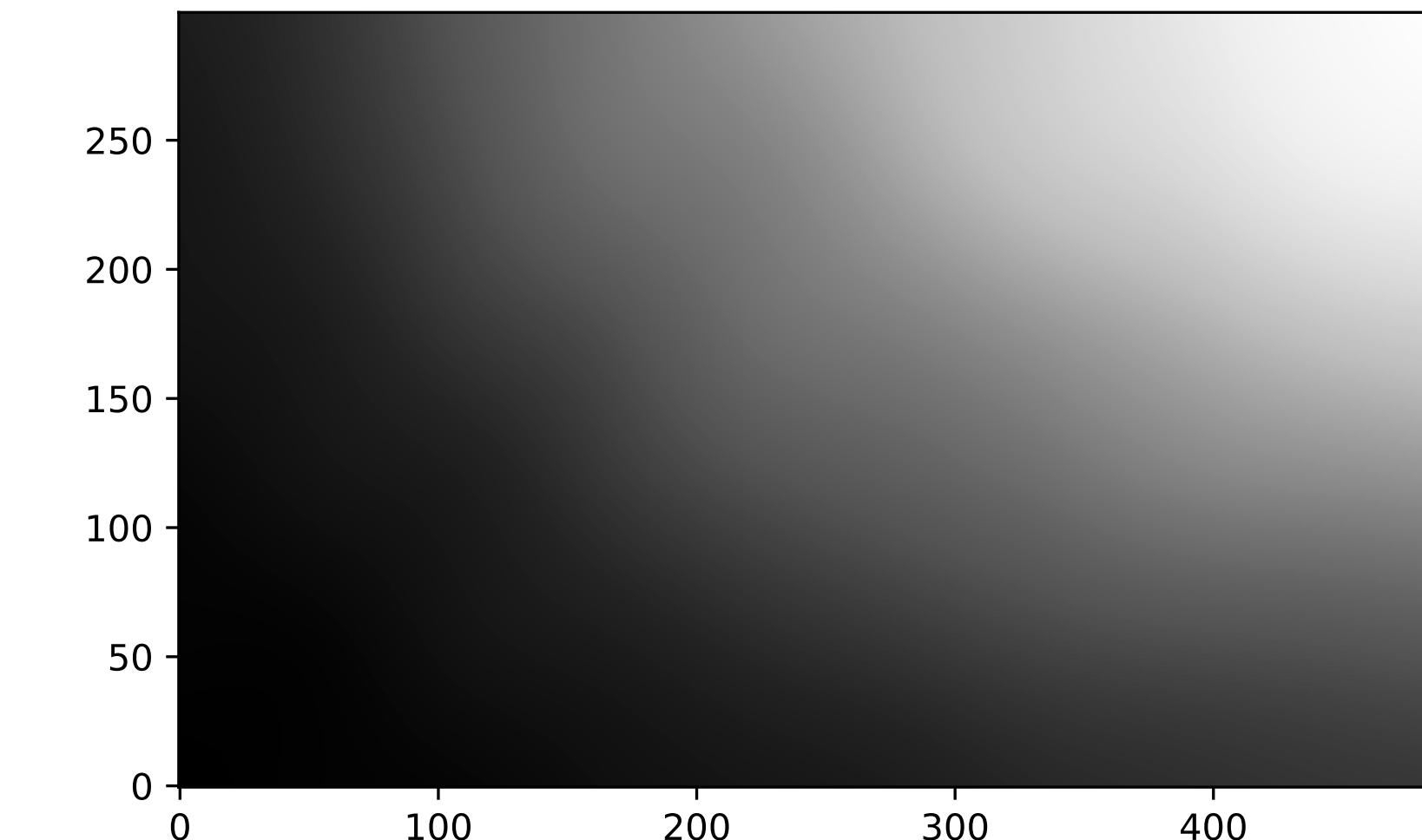
# 2D Background Estimation

photutils.background

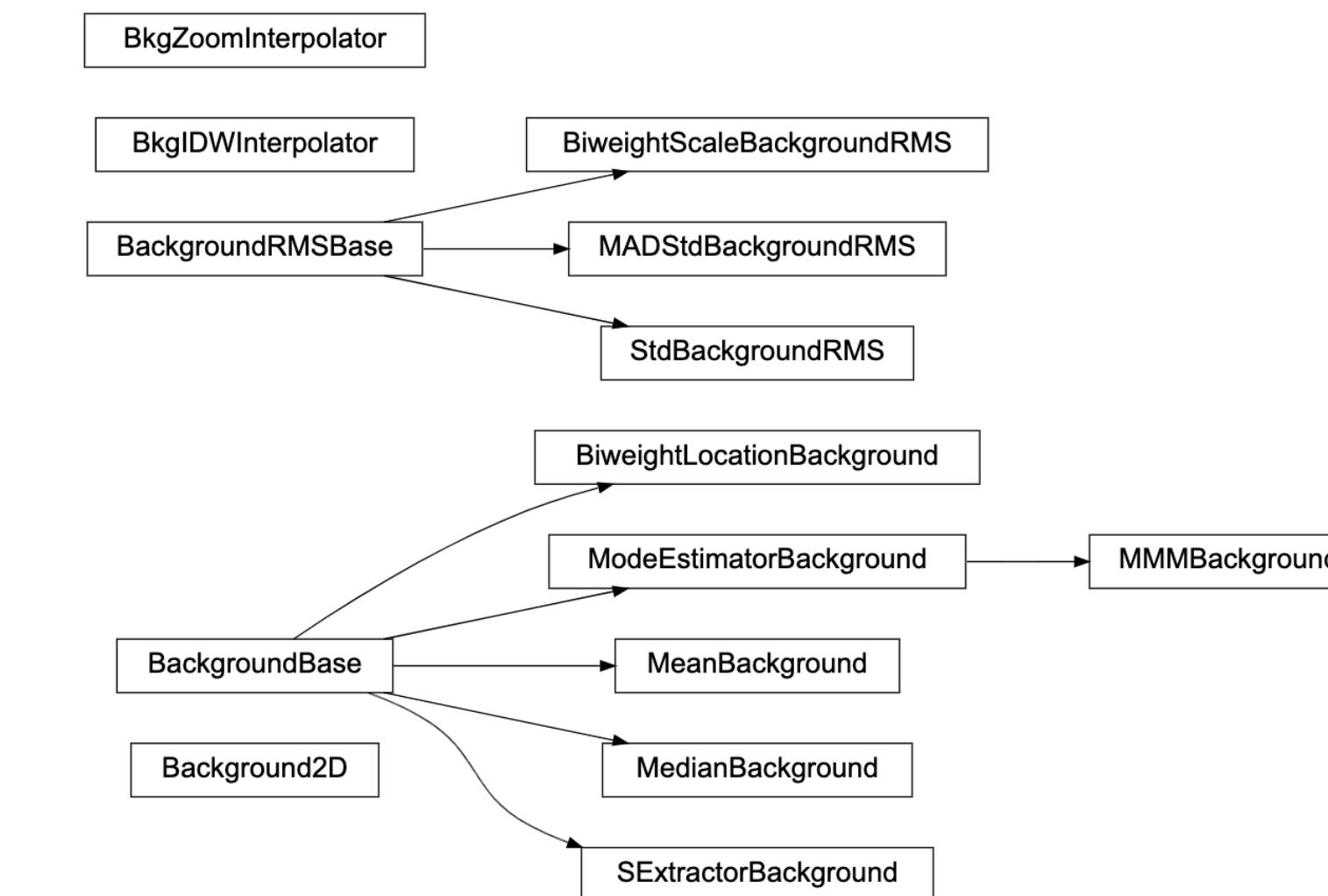
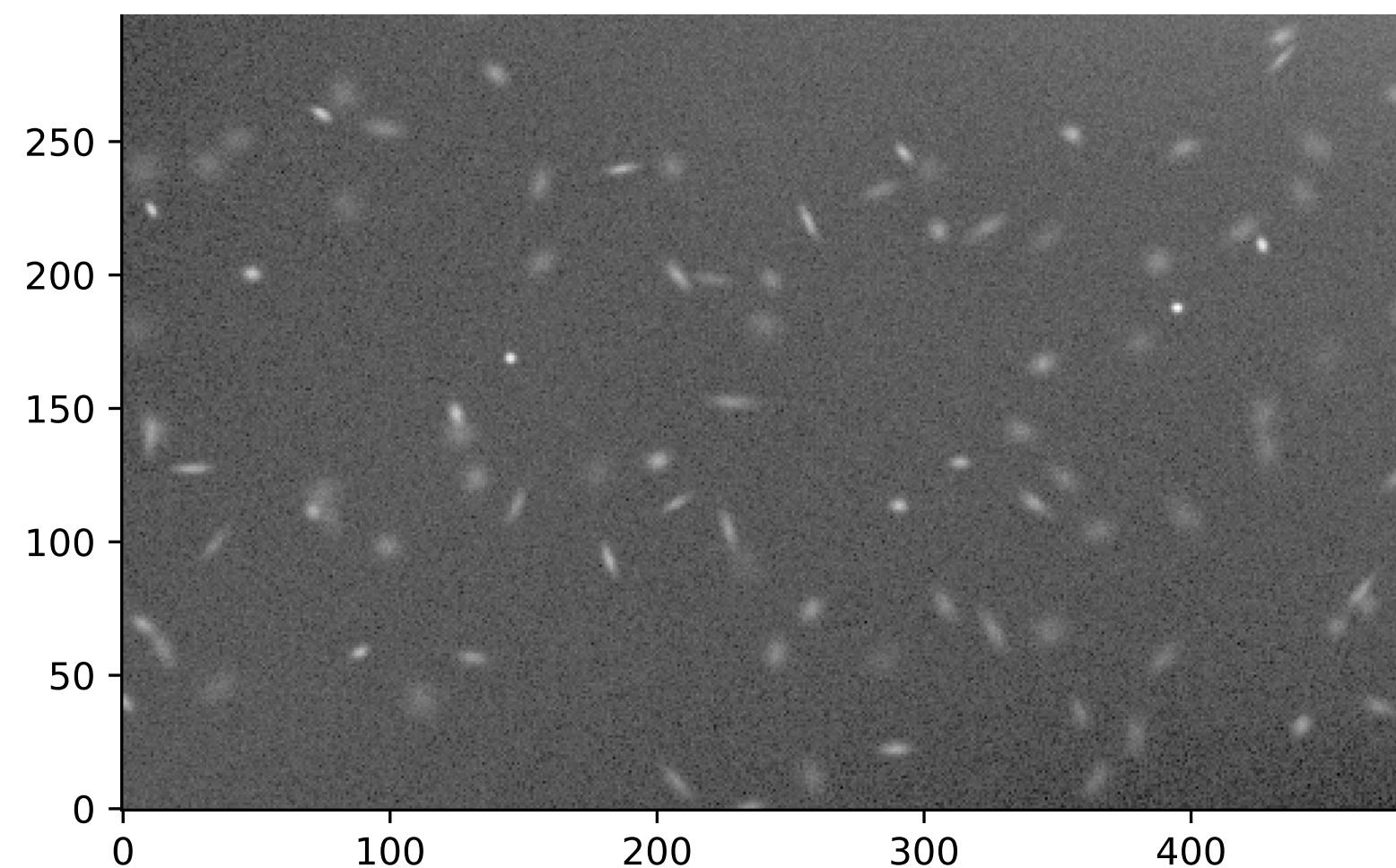
Data + Background



Background



Background-subtracted Data



# Source Detection/Extraction

## Star Finders (photutils.detection)

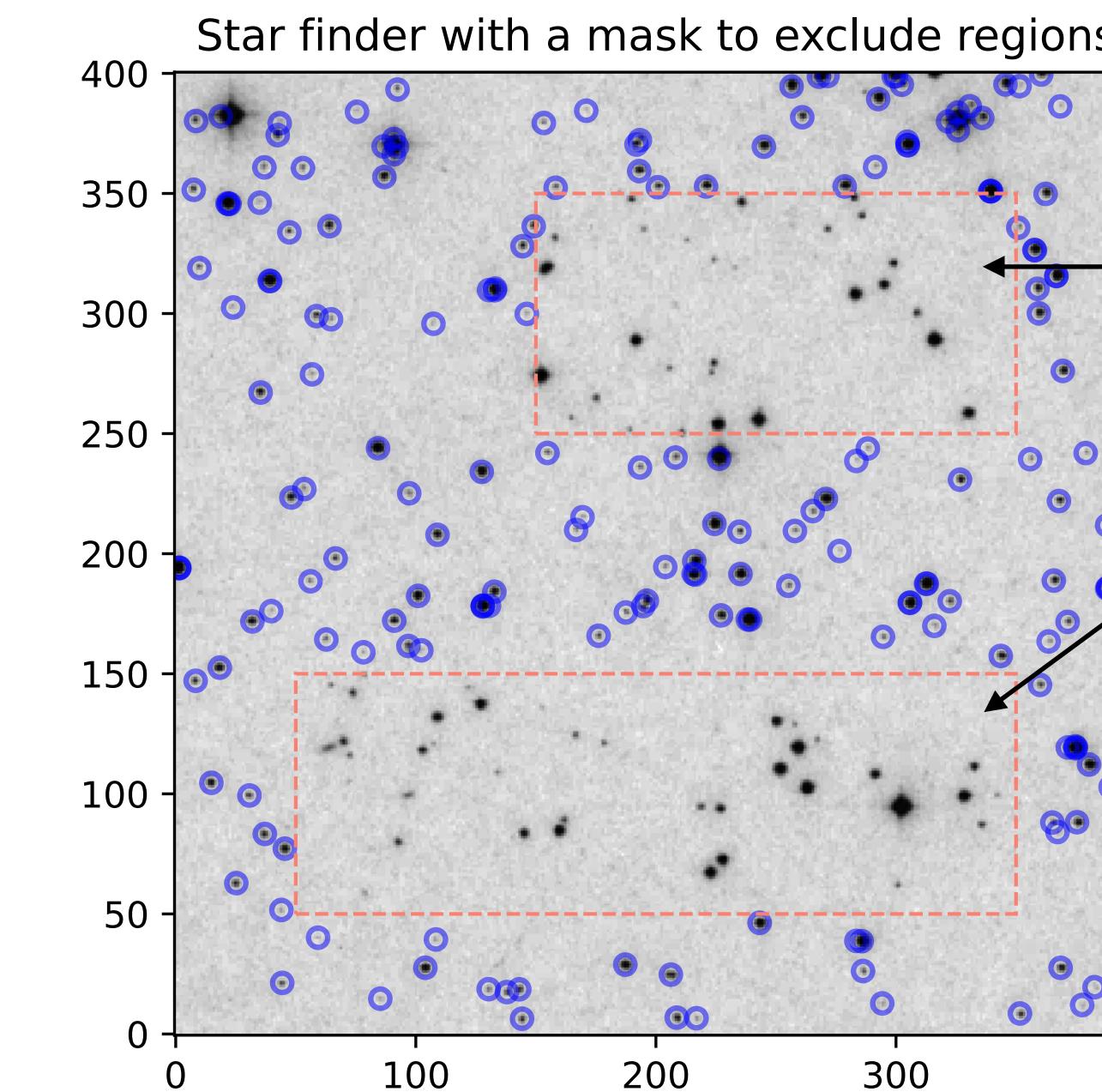
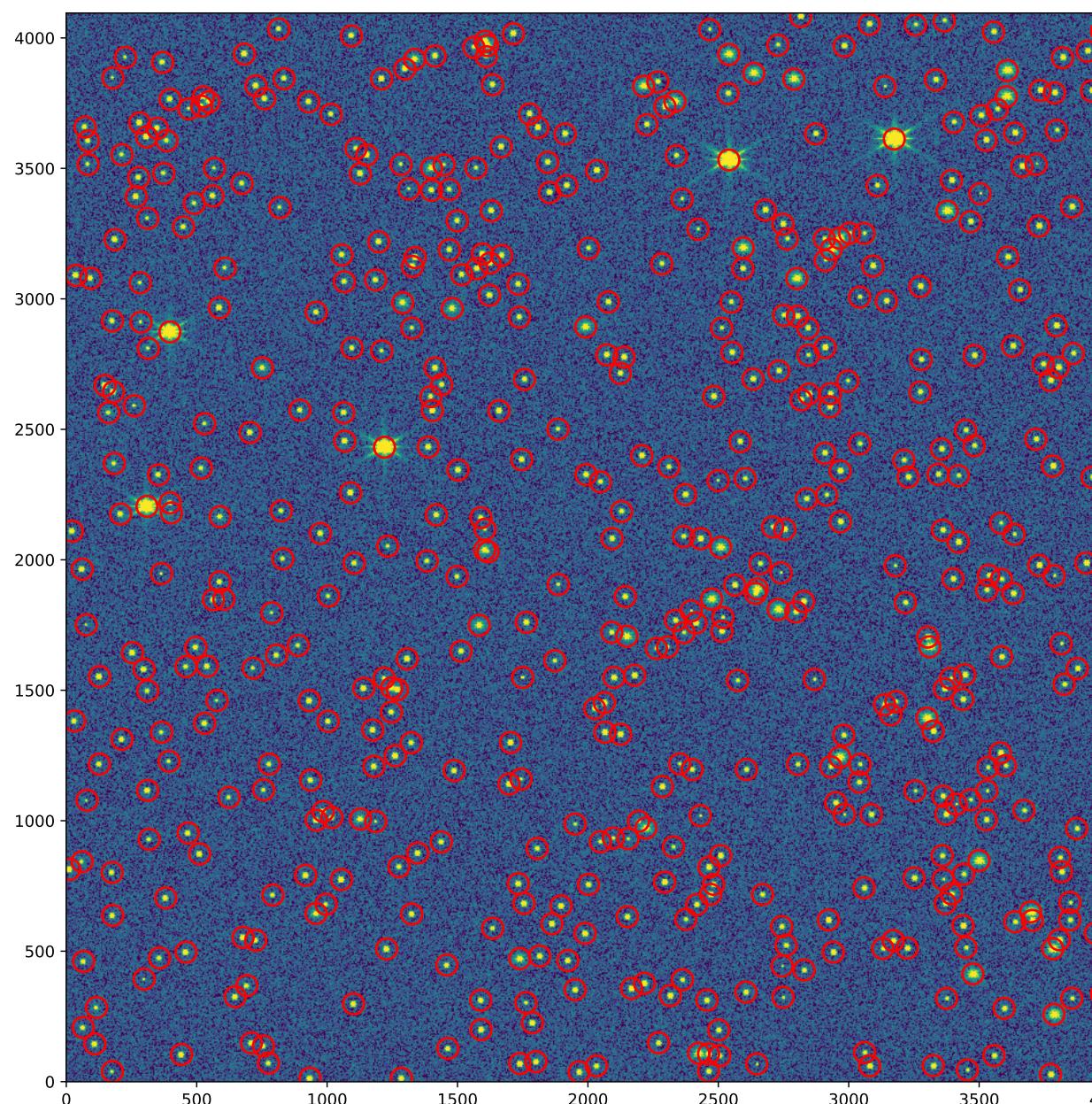


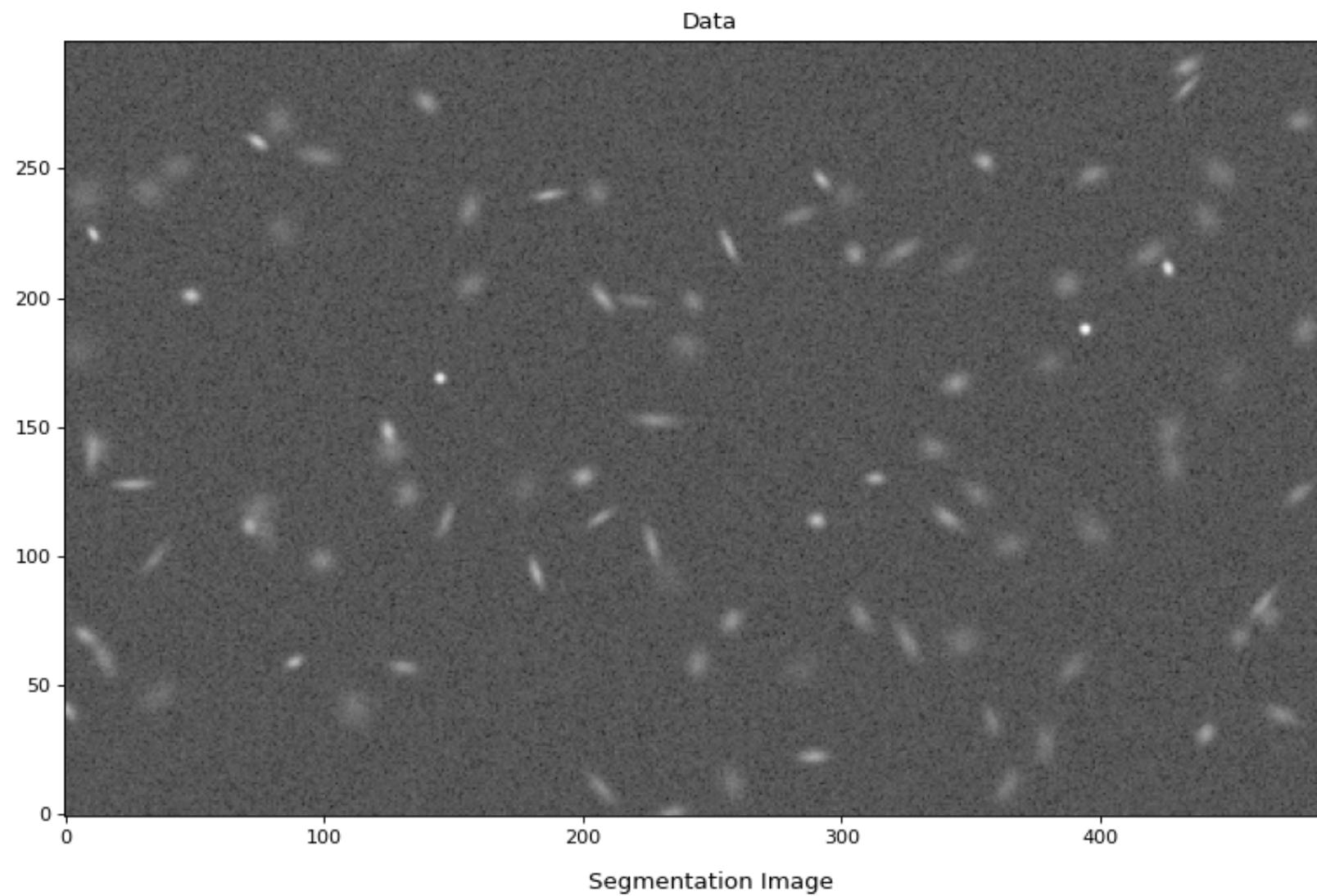
Table length=286

<b>id</b>	<b>xcentroid</b>	<b>ycentroid</b>	<b>sharpness</b>	<b>roundness1</b>	<b>roundness2</b>	<b>npix</b>	<b>sky</b>	<b>peak</b>	<b>flux</b>	<b>mag</b>
<b>int64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>	<b>int64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>
1	144.24757	6.3797904	0.58156257	0.20351244	-0.0082188029	25	0	6903	5.6976747	-1.8892441
2	208.66907	6.8205805	0.48348966	-0.12585138	-0.030811133	25	0	7896	6.7186388	-2.0682032
3	216.92614	6.5775933	0.69359525	-0.70664632	-0.096088688	25	0	2195	1.6662764	-0.55436758
4	351.62519	8.5459013	0.48577834	-0.3415136	0.015124942	25	0	6977	5.8970385	-1.9265849
5	377.51991	12.065501	0.52038488	0.36971562	-0.06508248	25	0	1260	1.1178252	-0.12093477
6	294.27284	12.737191	0.68021892	0.10631228	-0.3445009	25	0	2059	1.4809613	-0.42635928

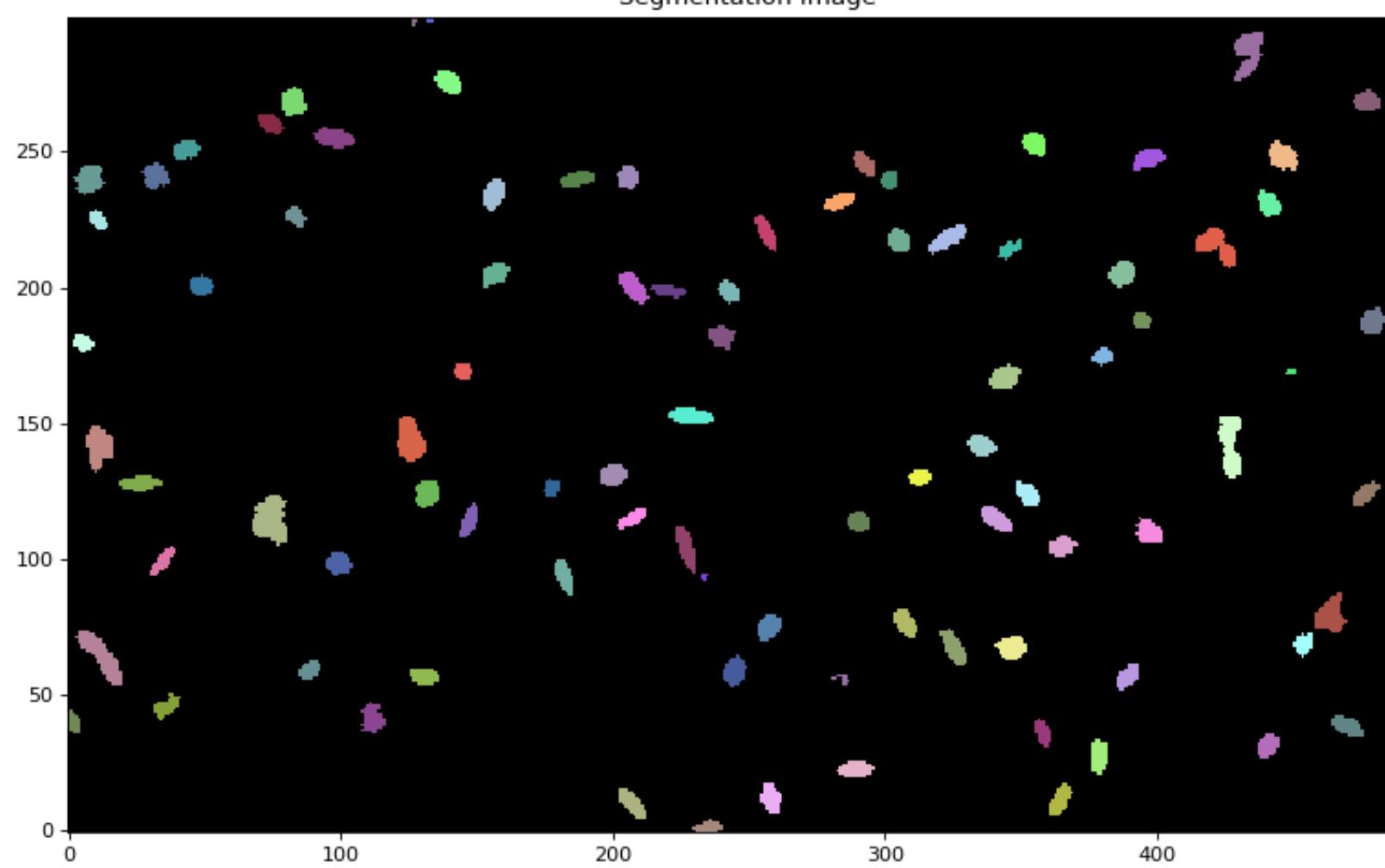
# Source Detection/Extraction

photutils.segmentation

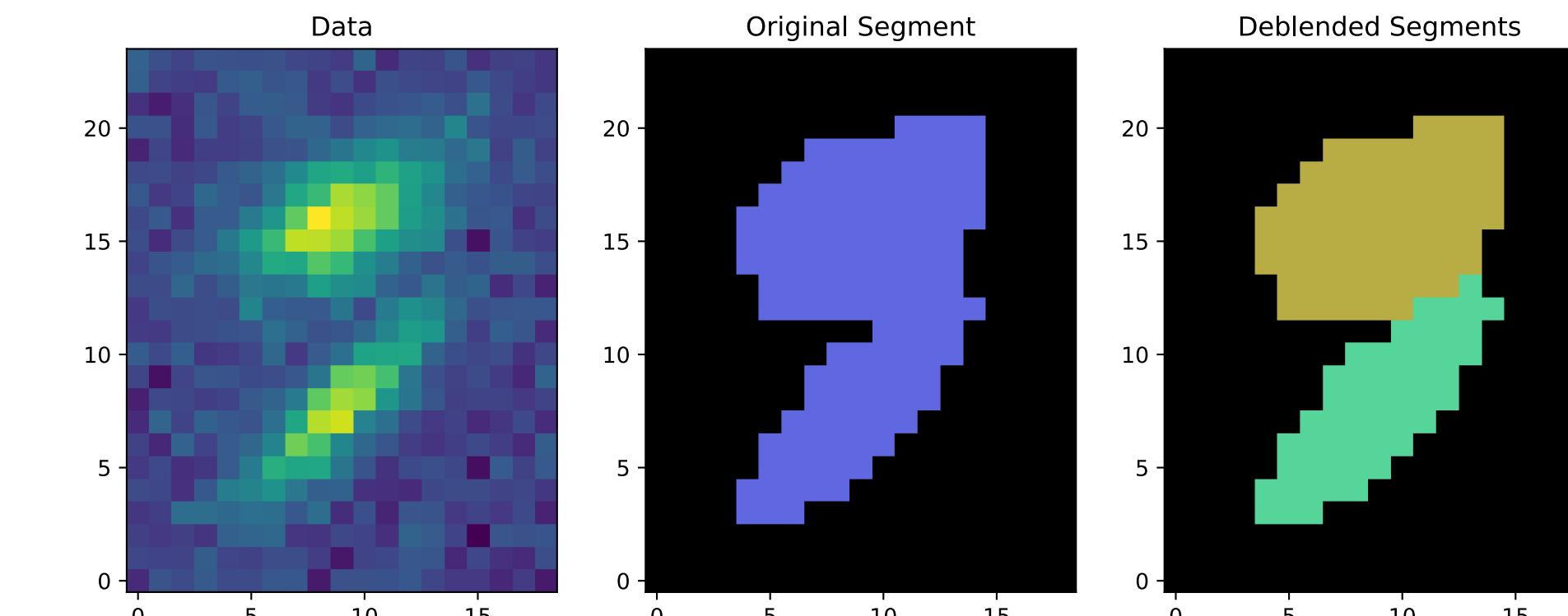
## Image Segmentation



Isophotal  
footprints



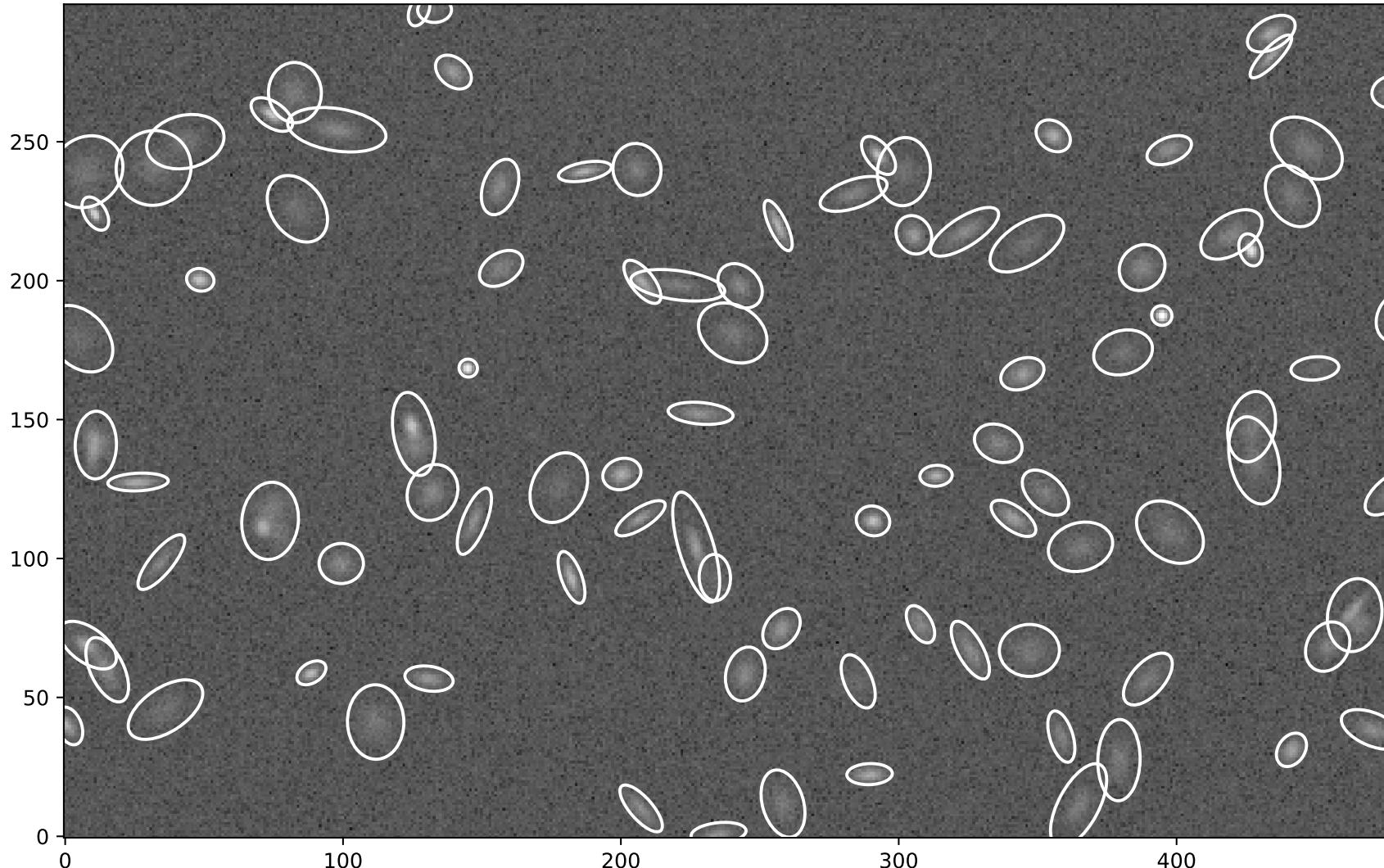
## Source Deblending



# Segmentation Source Properties

## photutils.segmentation

Data with Kron apertures

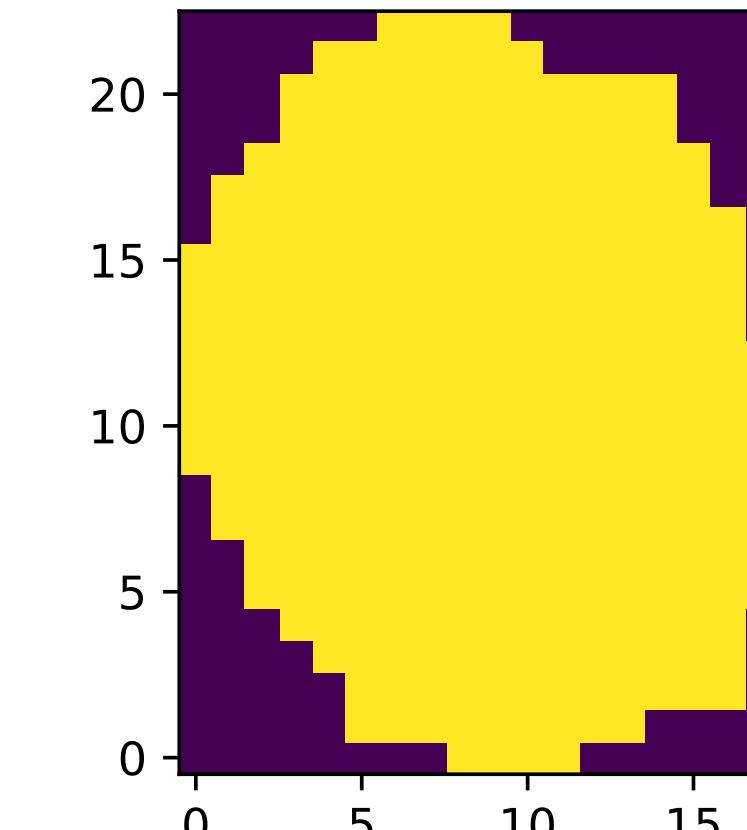


QTable length=96									
label	xcentroid	ycentroid	sky_centroid	bbox_xmin	bbox_xmax	bbox_ymin	bbox_ymax	area	pix2
int64	float64	float64	deg,deg	pix	pix	deg	deg	pix2	
1	235.15994548598488	1.1019363515760263	197.8891333890605						
2	494.1648399473006	5.815935953898595	197.8856485248648						
3	207.290303145485	10.043557337021124	197.8897357404737						
4	364.73470373040815	11.120059964585835	197.8875743005350						
5	258.35830595777417	11.794386115254312	197.8890683924085						
6	289.50776917508296	22.38789345042522	197.888805159201						
7	379.26466328650133	27.43041730313587	197.8877649170074						
8	441.35047241552144	31.13414794240034	197.886991496371						
9	358.5244001571732	35.89964374499677	197.888256852880						
...	...	...	...						
87	127.36799389690849	297.227058646046	197.897756617036						
88	132.94675194989202	297.4816793083705	197.897885238913						
89	15.125460682071289	59.96340390837348	197.8936066873385						
90	8.128010606993607	68.81666446868586	197.8939169395143						
91	427.9702251835680680	135.32252435935993	197.8896844787063						
92	427.00840180006264	147.4561897963997	197.88998898143344						
93	426.62968590768867	211.09852364716932	197.891526054939						
94	419.738453481306	216.63609521504304	197.891755494259						
95	433.9475733797084	280.7111800761216	197.8930999310714						
96	434.0856635403912	288.9265048214162	197.8932956891991						

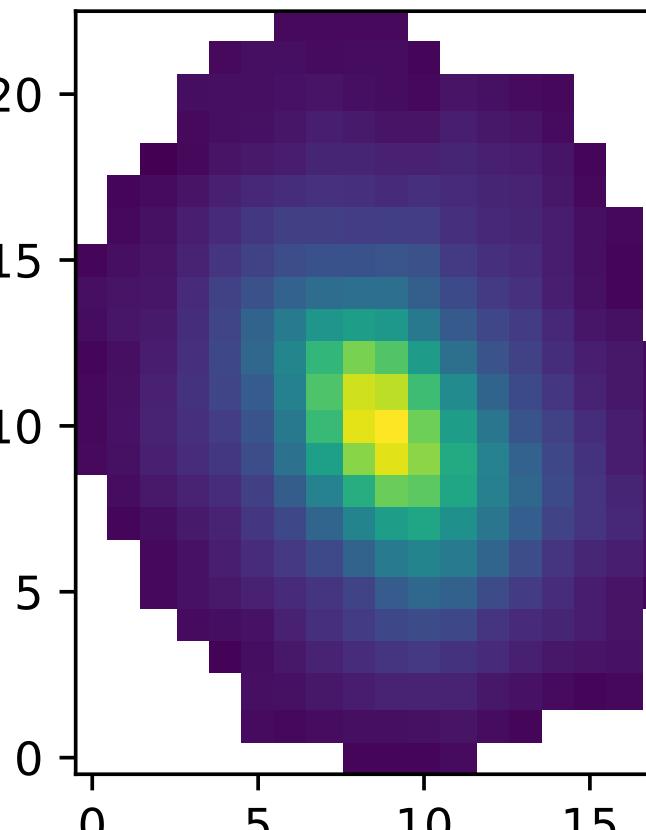
Segmentation Image with Kron apertures



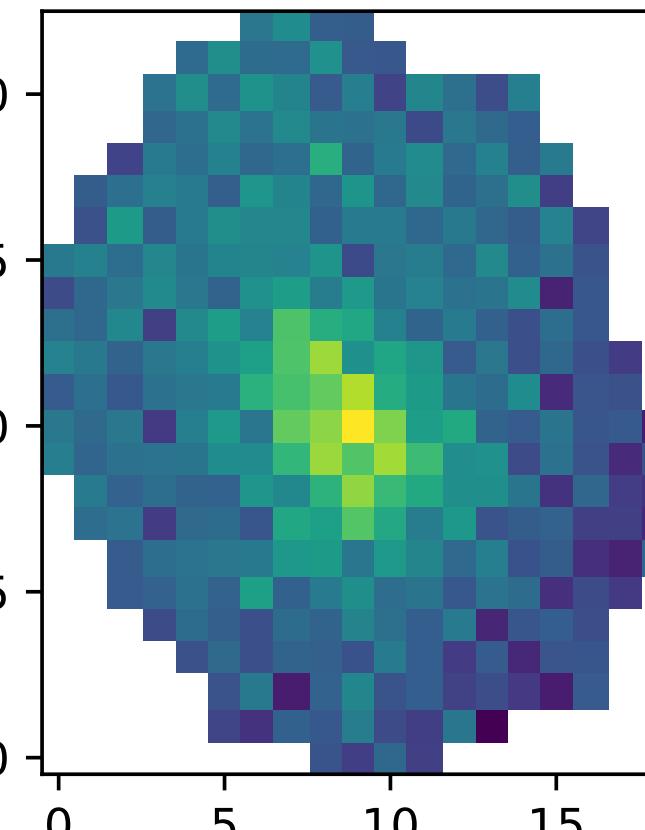
Source label=12 Segment



Source label=12 Data

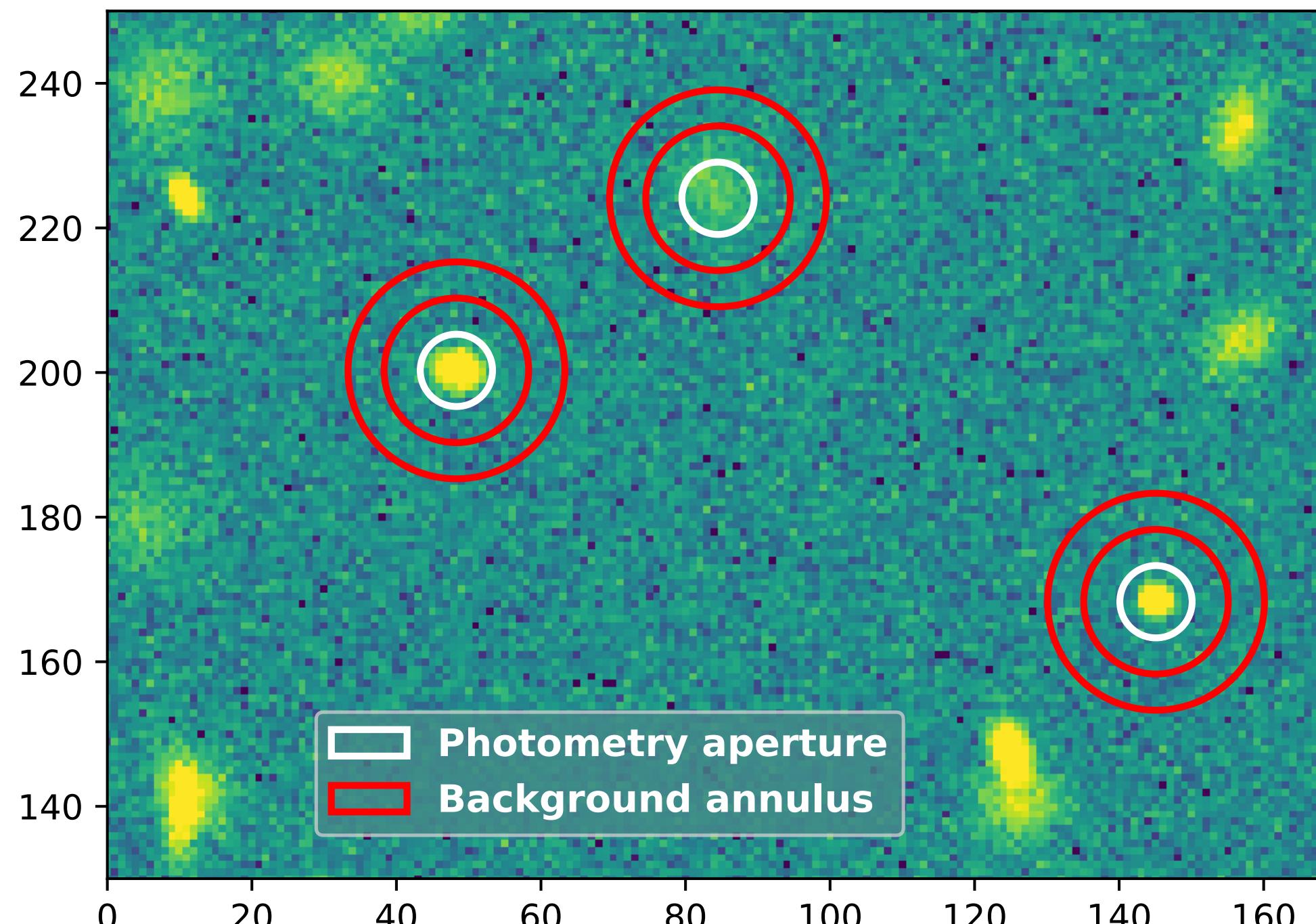


Source label=12 Error



# Aperture Photometry

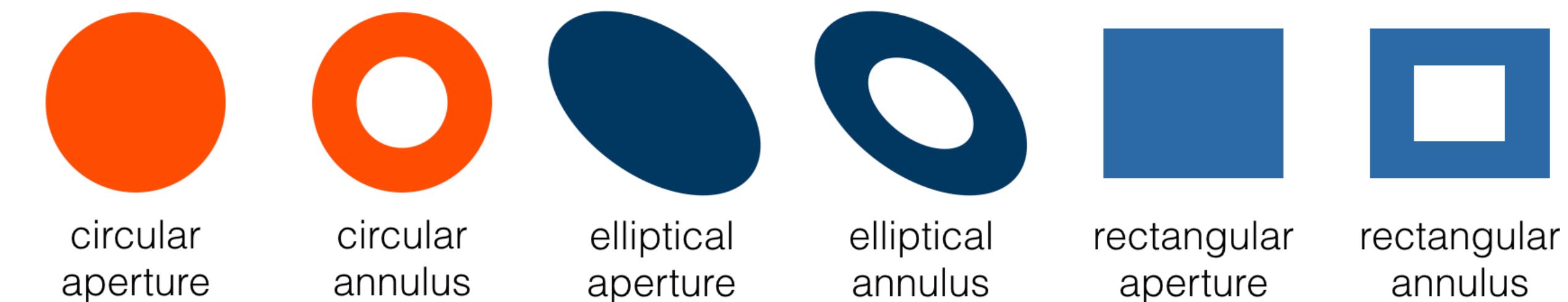
photutils.aperture



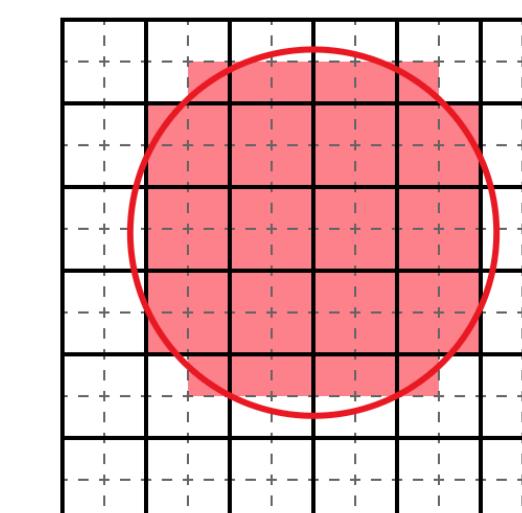
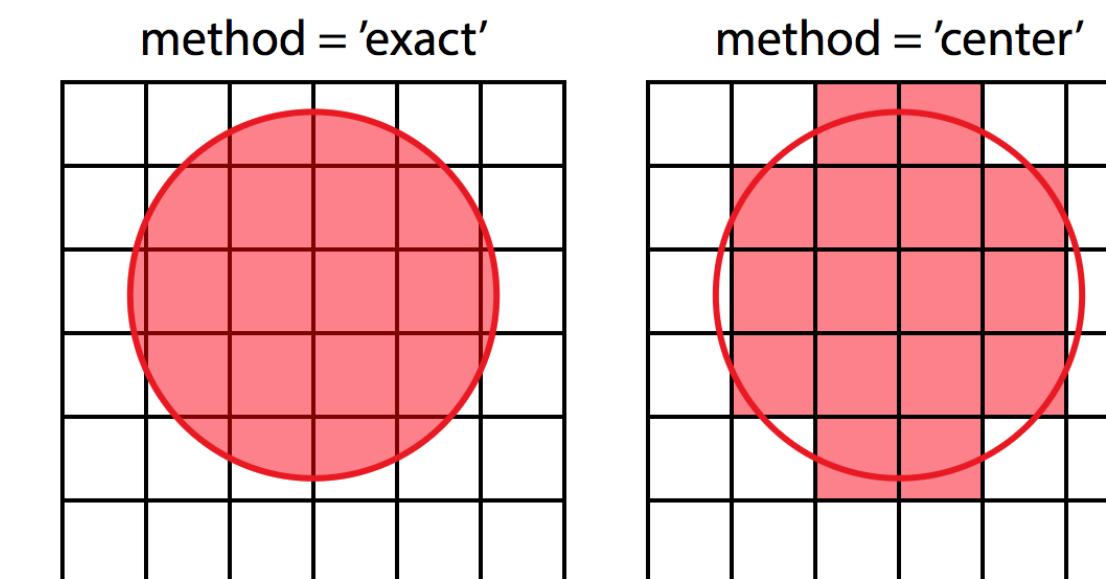
QTable length=3

	<b>id</b>	<b>xcenter</b>	<b>ycenter</b>	<b>aperture_sum_0</b>	<b>aperture_sum_err_0</b>	<b>aperture_sum_1</b>	<b>aperture_sum_err_1</b>
		<b>pix</b>	<b>pix</b>				
	<b>int64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>	<b>float64</b>
1	1	145.1	168.3	1131.5794219396346	23.35849263294723	1950.1741825747145	47.225615152137244
2	2	84.5	224.1	746.160643858321	20.999164191036634	2004.473120746215	51.63625874462207
3	3	48.3	200.3	1250.2185660077996	22.122686708826034	1947.6843963275142	50.422058132736446

## Aperture Shapes



## Aperture/Pixel Overlap Methods

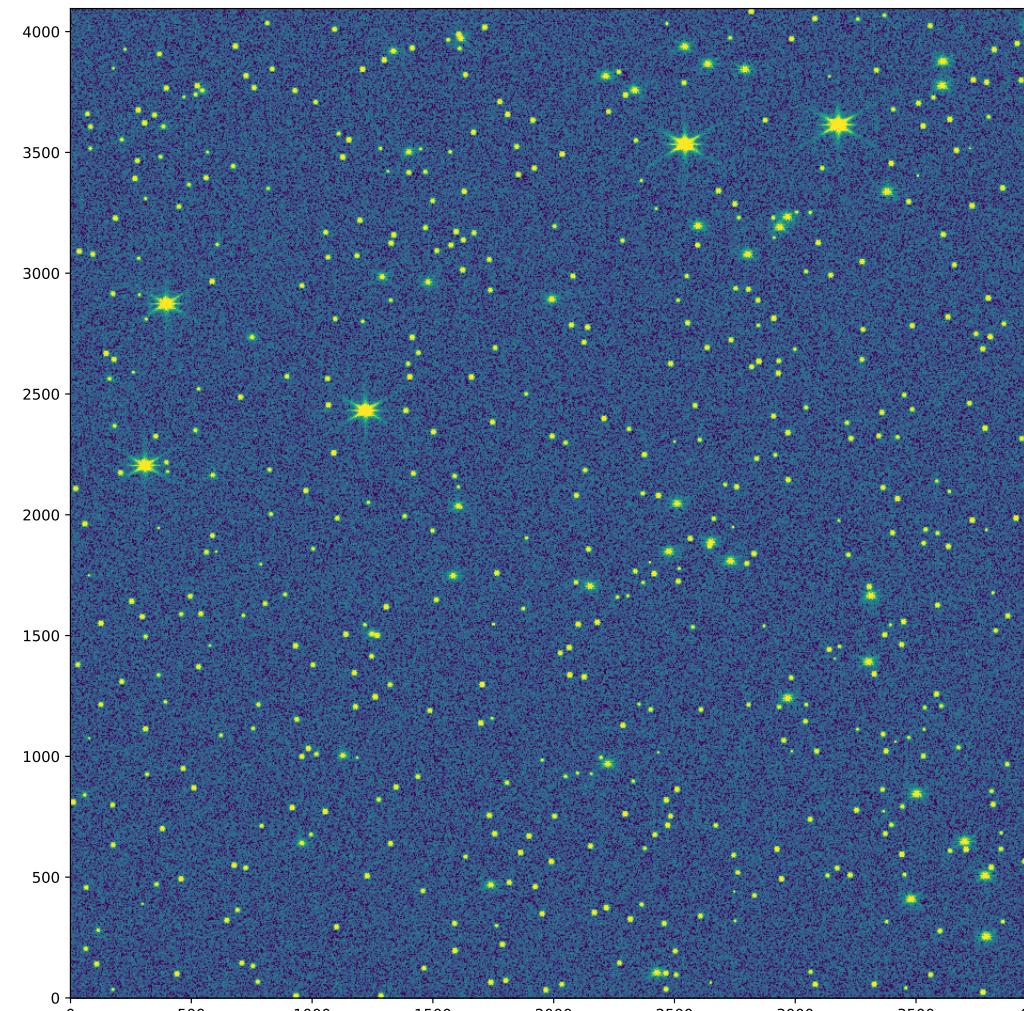


method = 'subpixel'  
subpixels = 2

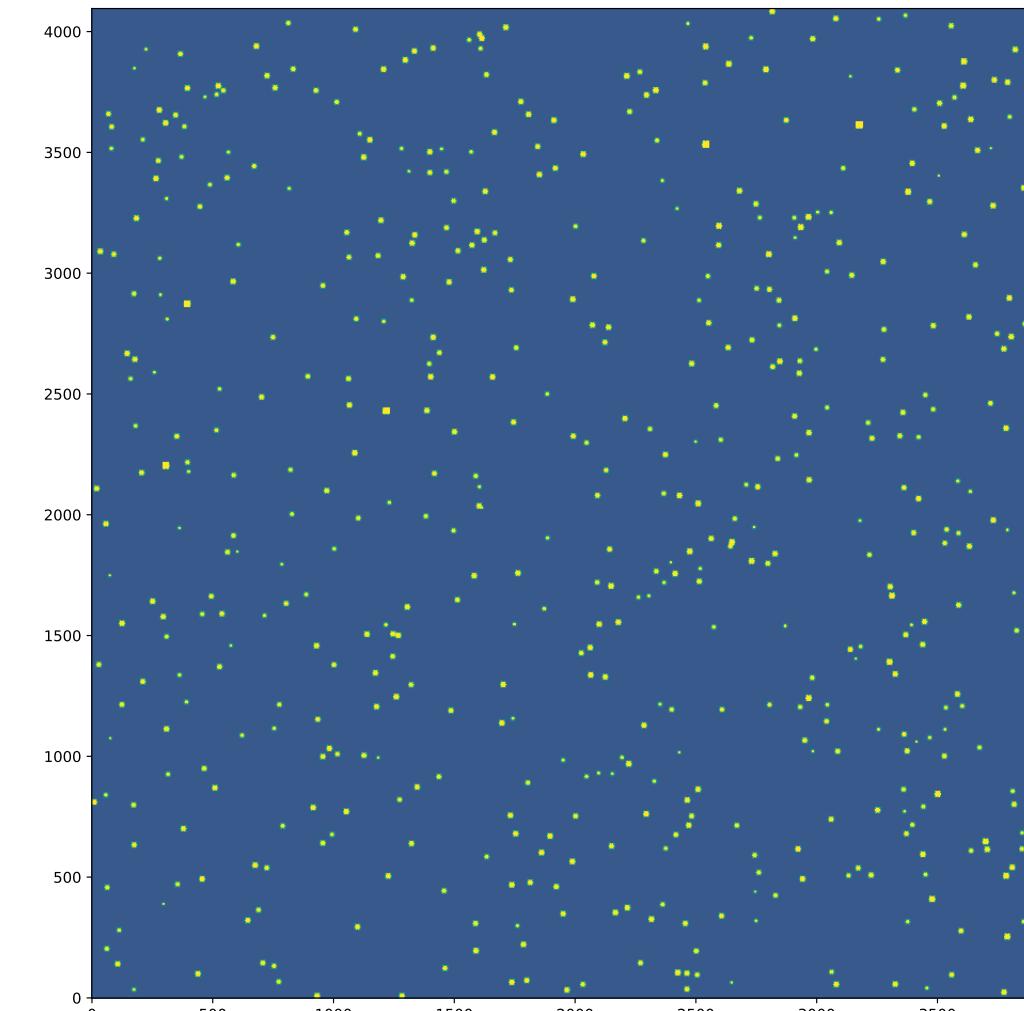
# PSF Photometry

photutils.psf

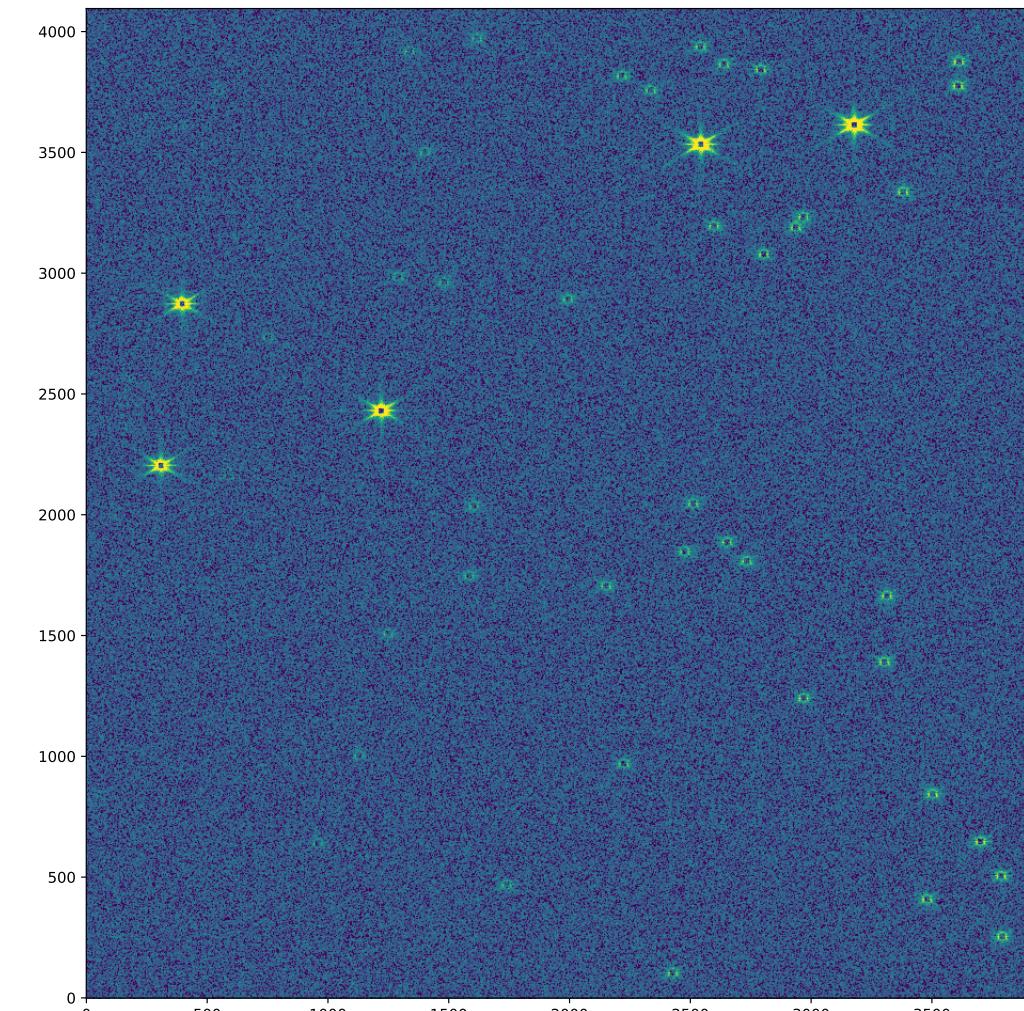
Data



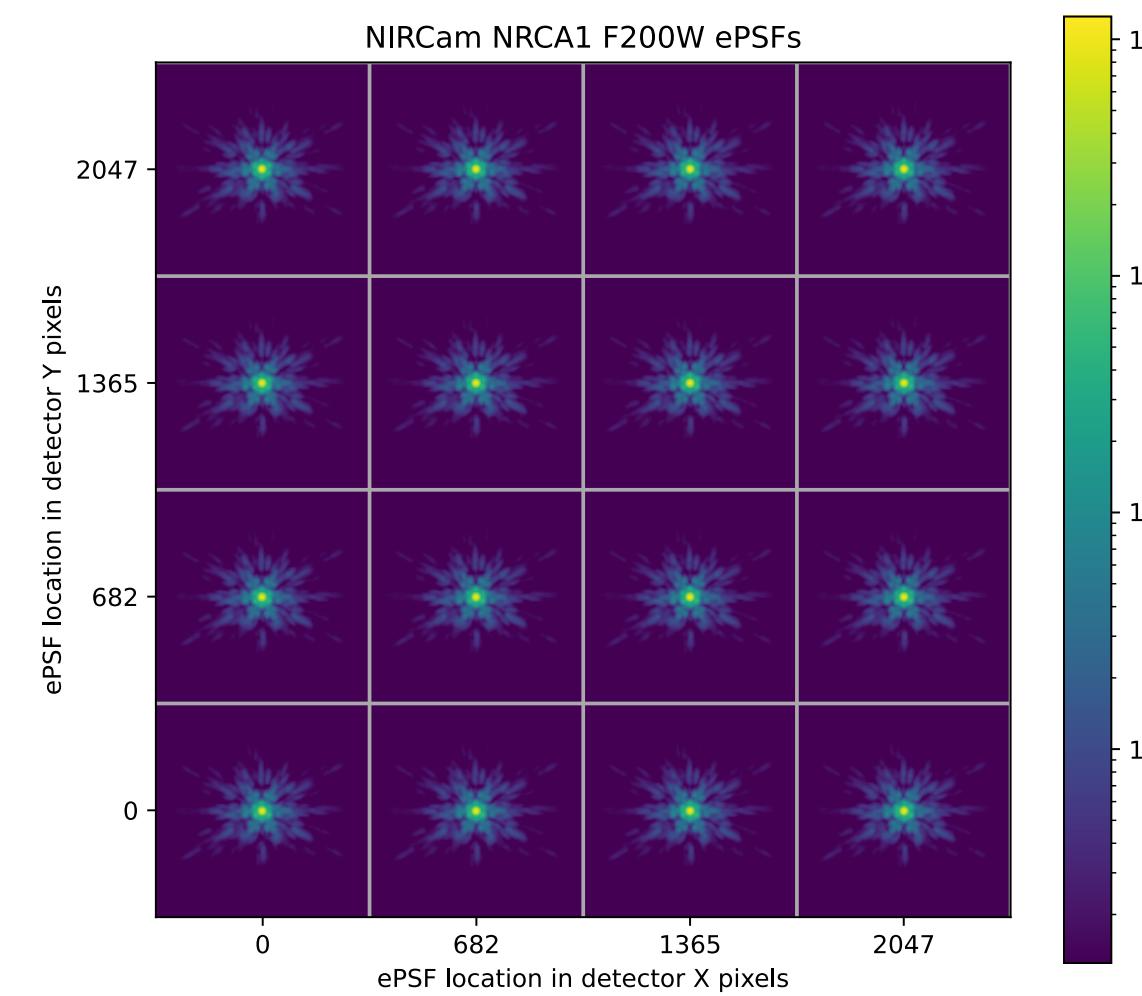
PSF Model



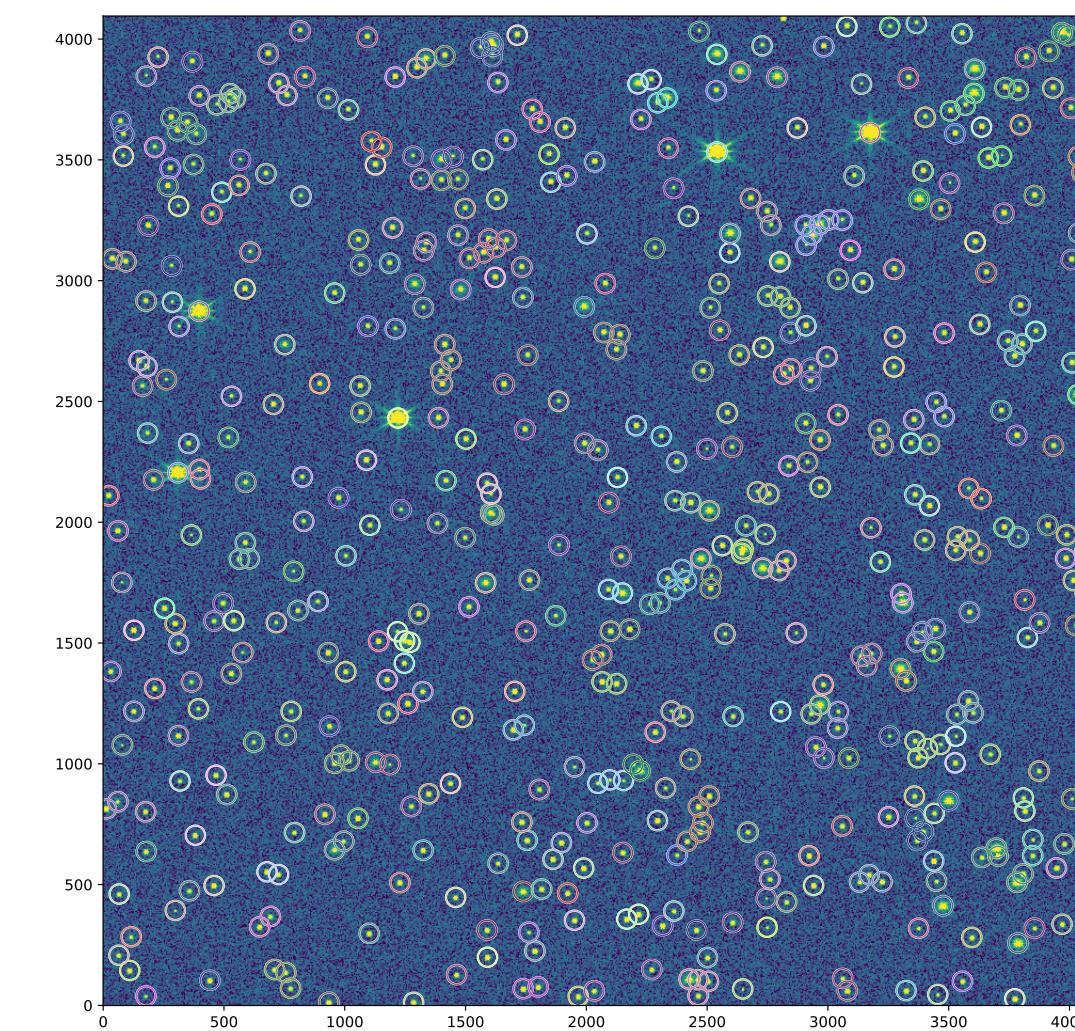
Residual



GriddedPSFModel



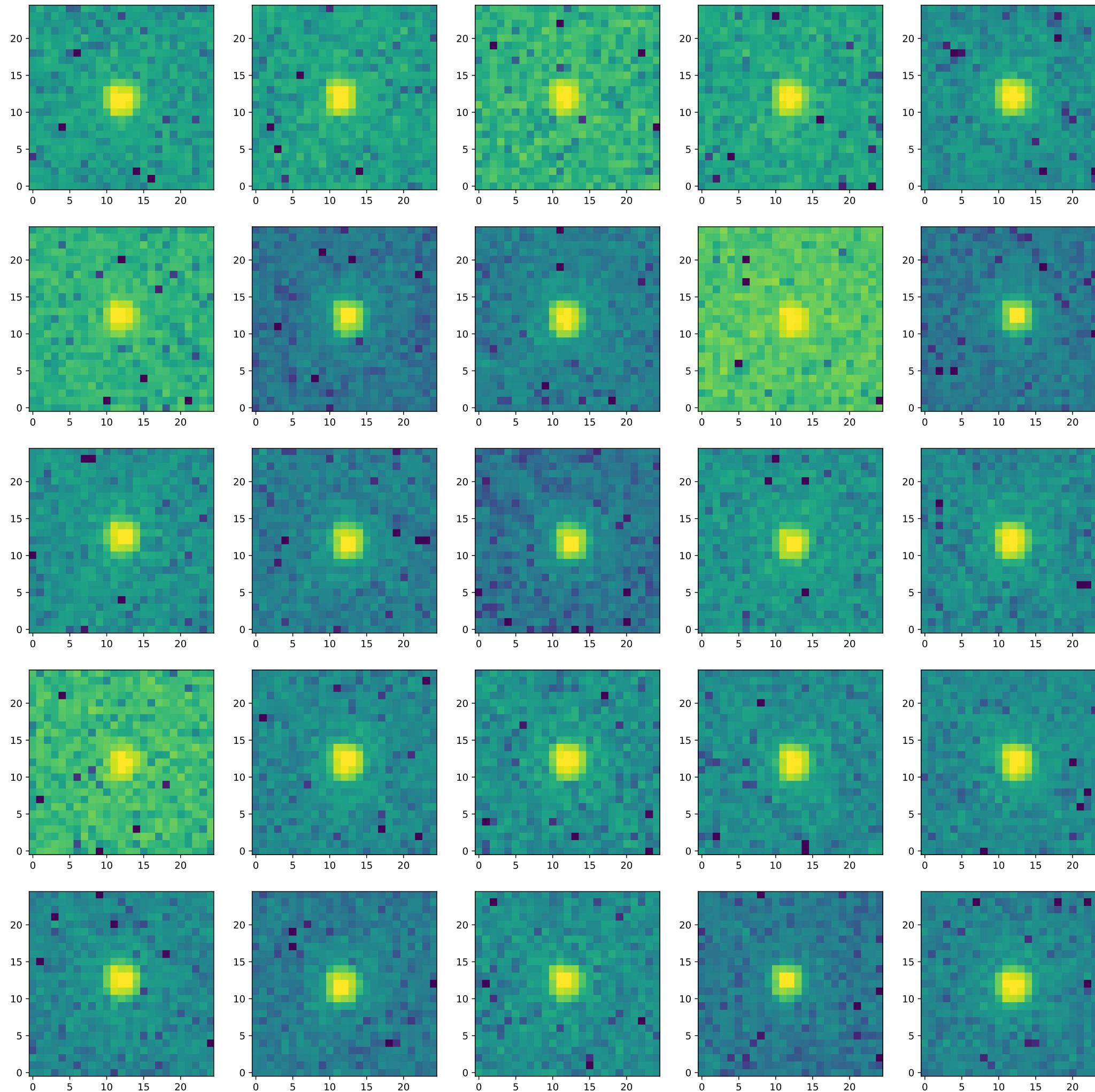
SourceGrouper



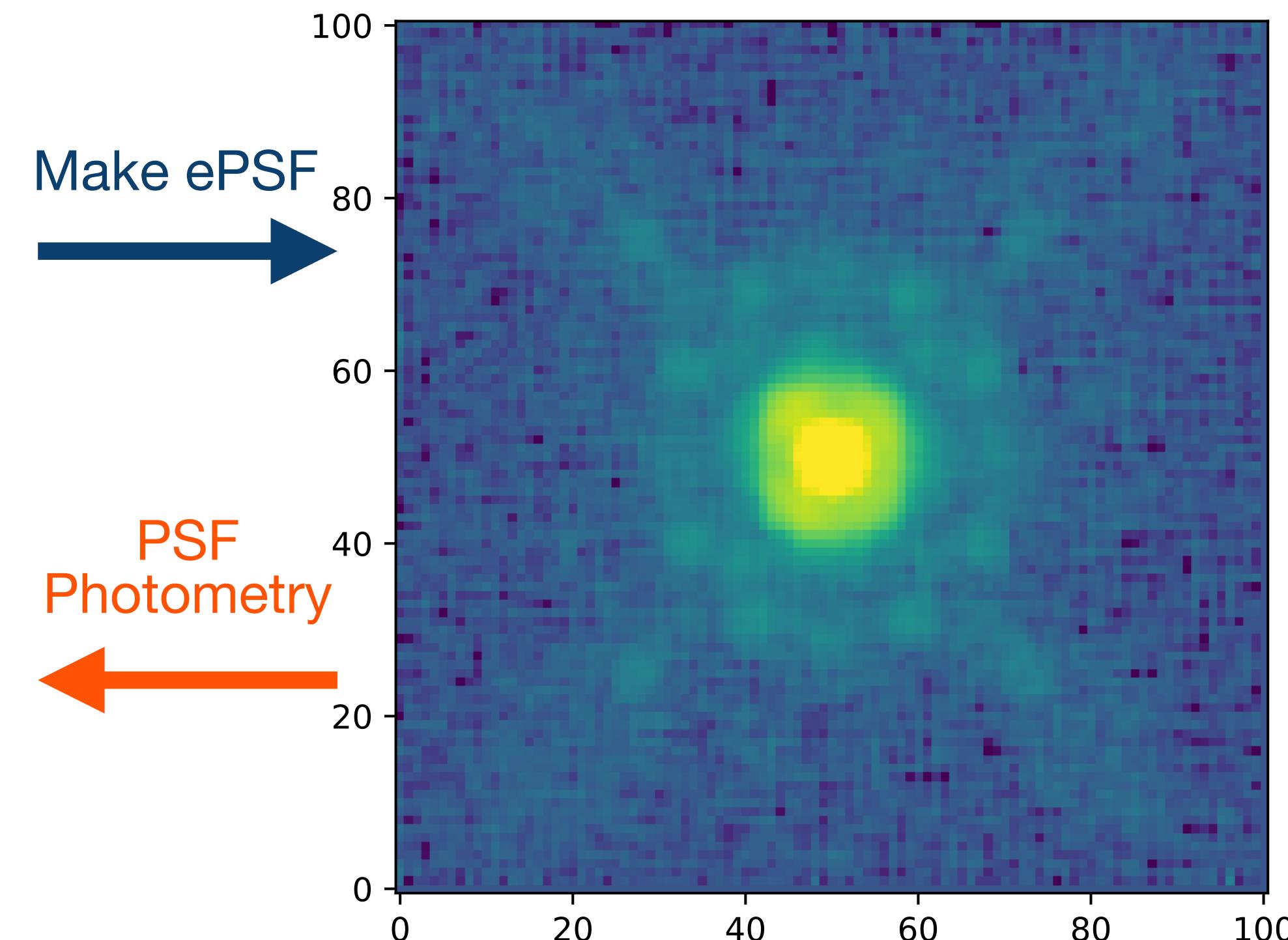
# Effective PSF (ePSF) Building

photutils.psf (EPSFBuilder)

Extracted Stars



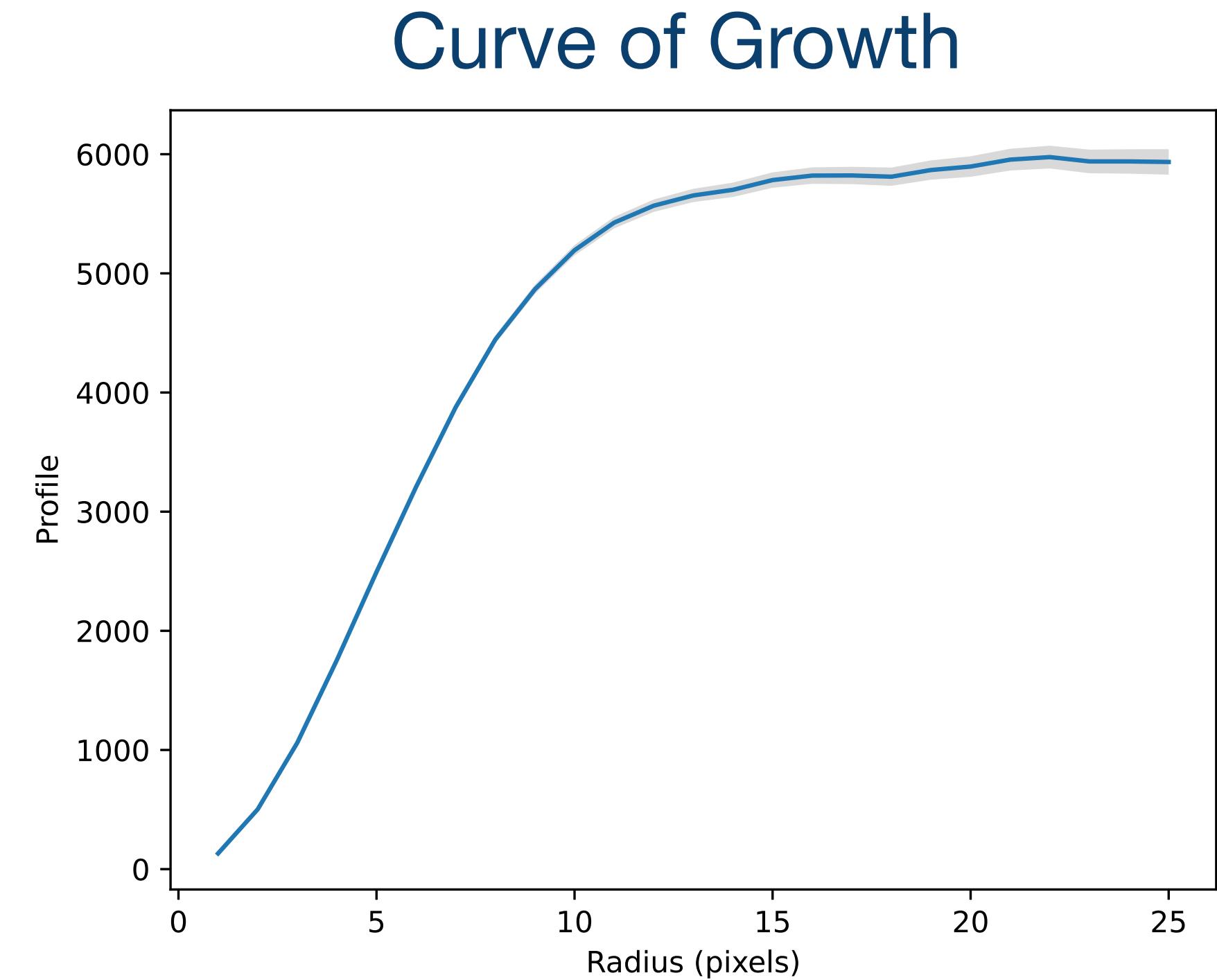
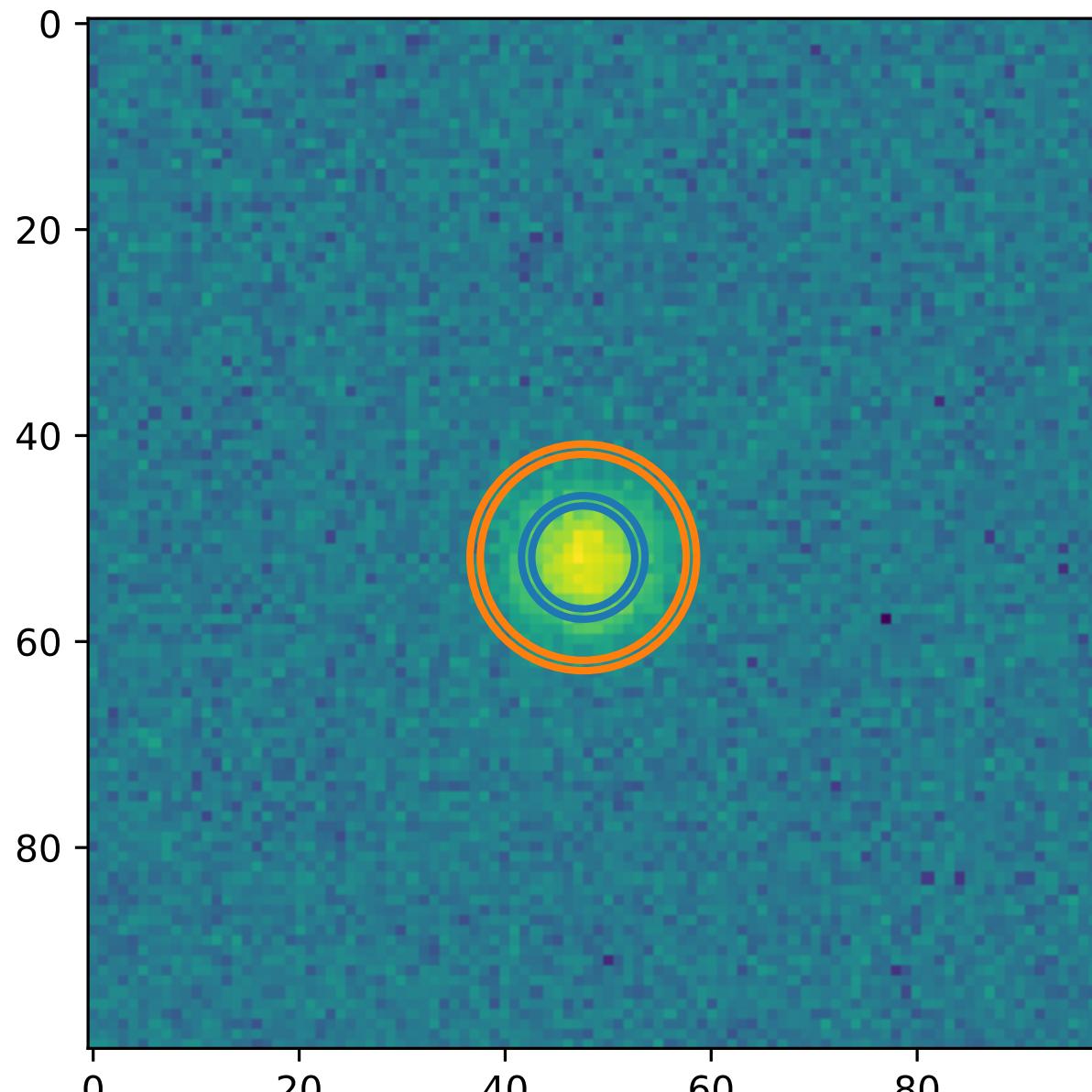
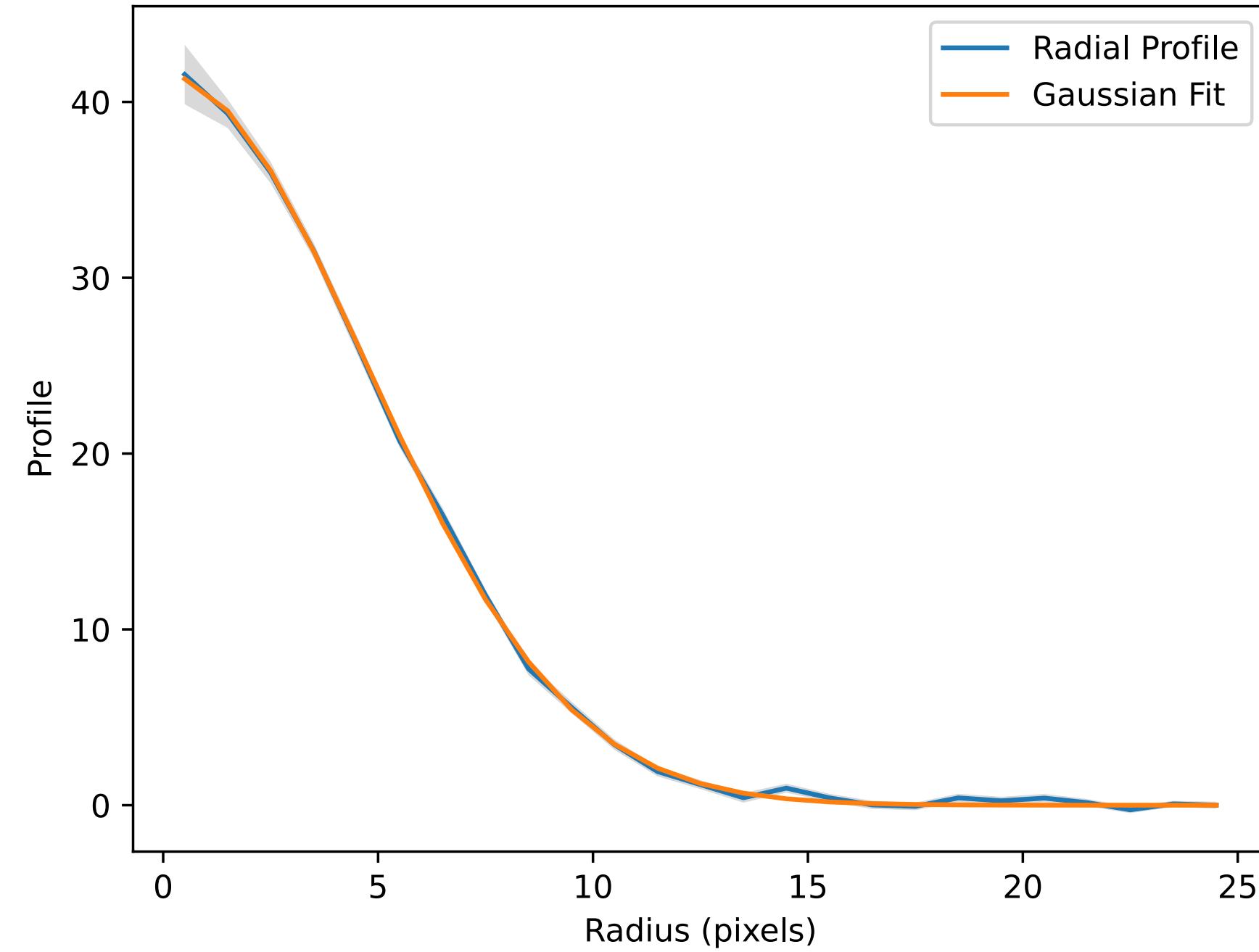
ePSF  
(4x oversampled)



# Radial Profiles

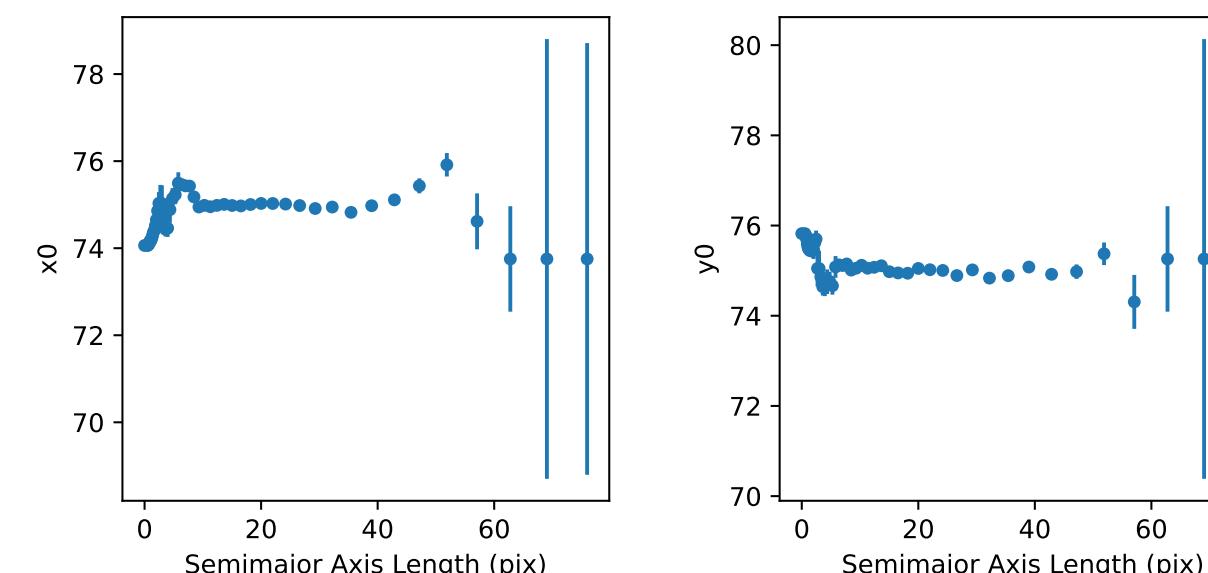
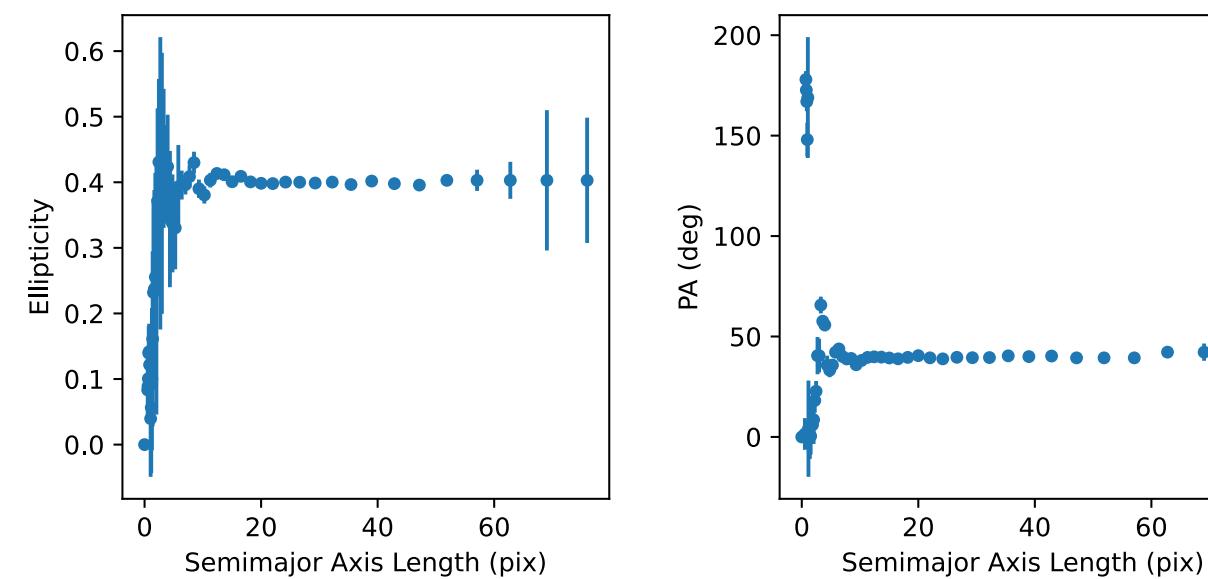
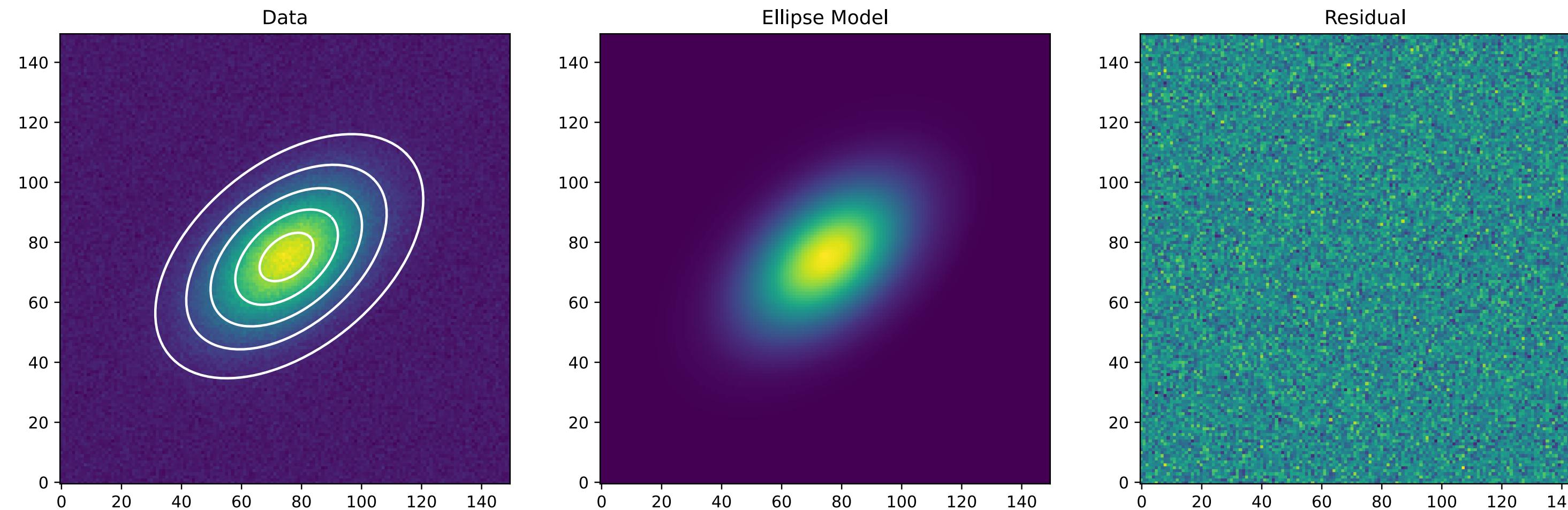
## photutils.profiles

Radial Profile  
(with Gaussian Fit)



# Elliptical Isophote Fitting/Analysis

photutils.isophote





**Code:** <https://github.com/astropy/photutils>



**Read the Docs**

**Docs:** <https://photutils.readthedocs.io>



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# photutils

An [Astropy](#) Package for Photometry

**Photutils** is an [affiliated package](#) of [Astropy](#) that primarily provides tools for detecting and performing photometry of astronomical sources. It is an open source Python package and is licensed under a [3-clause BSD license](#).

## Important

If you use Photutils for a project that leads to a publication, whether directly or as a dependency of another package, please include an [acknowledgment and/or citation](#).

## Getting Started

- [Installation](#)
- [What's New](#)
- [Overview](#)
- [Pixel Coordinate Conventions](#)
- [Getting Started with Photutils](#)
- [Reporting Issues and Contributing](#)
- [Citing Photutils](#)
- [License](#)
- [Changelog](#)

## User Documentation

### Backgrounds

- [Background Estimation \(`photutils.background`\)](#)

### Source Detection

- [Source Detection \(`photutils.detection`\)](#)
- [Image Segmentation \(`photutils.segmentation`\)](#)

### Aperture Photometry

- [Aperture Photometry \(`photutils.aperture`\)](#)

### PSF Photometry and Tools

- [PSF Photometry \(`photutils.psf`\)](#)
- [Building an effective Point Spread Function \(ePSF\)](#)
- [Source Grouping Algorithms](#)
- [PSF Matching \(`photutils.psf.matching`\)](#)

### Source Measurements

- [Image Segmentation \(`photutils.segmentation`\)](#)
- [Centroids \(`photutils.centroids`\)](#)
- [Morphological Properties \(`photutils.morphology`\)](#)

v: stable ▾