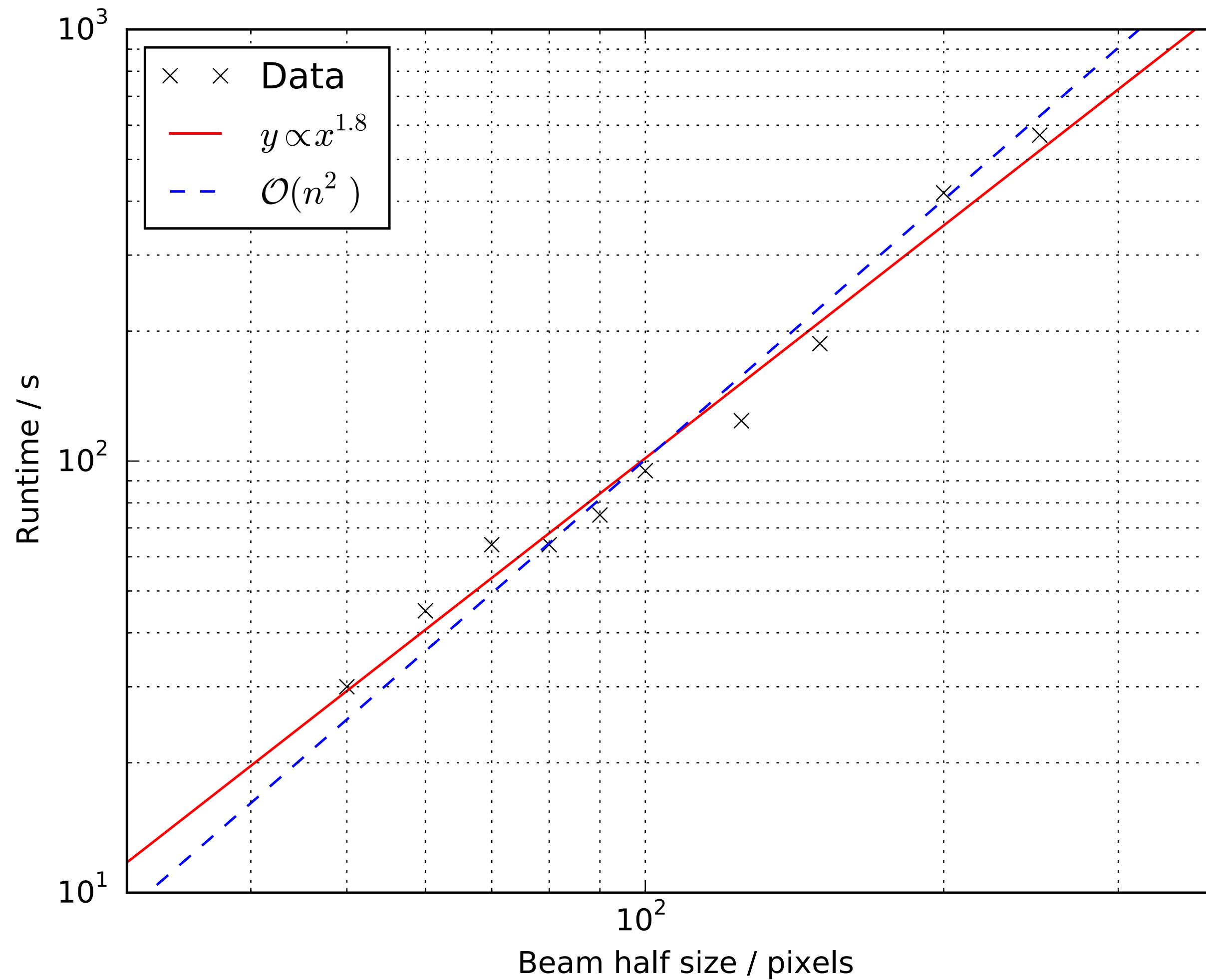


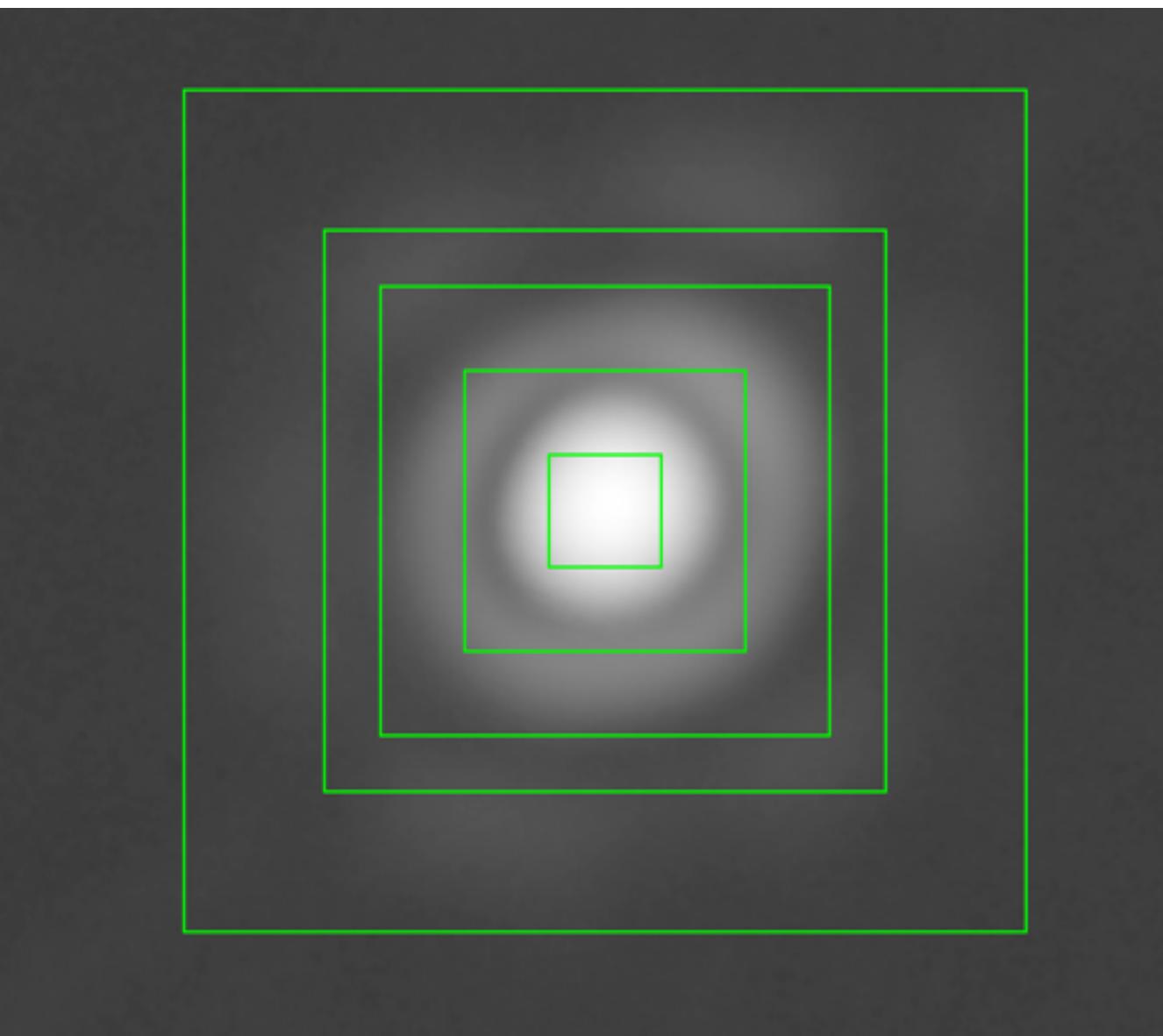
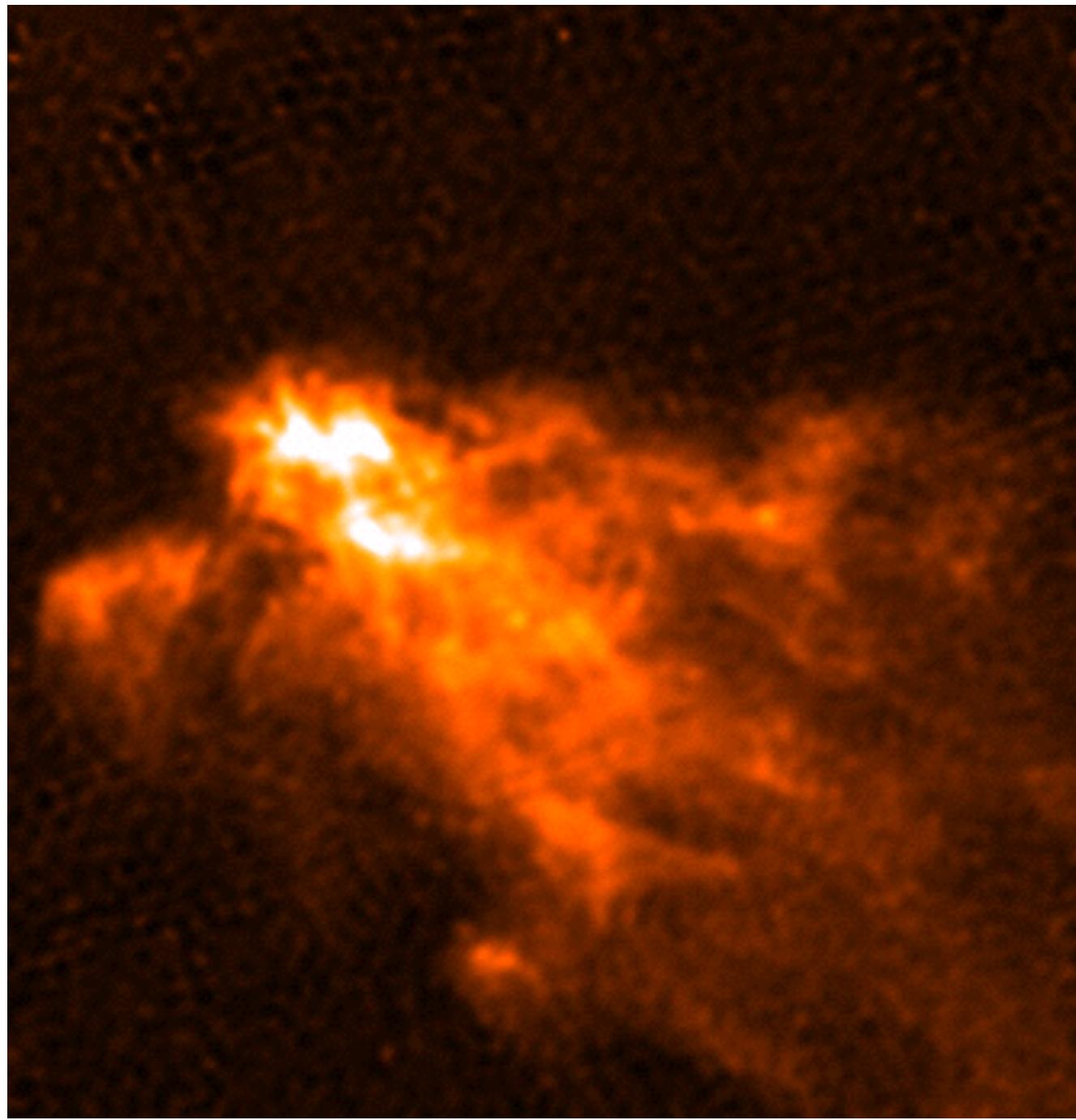
# Code

- All code for tests/analysis is at:
- <https://github.com/badders/spire-hires-testing>
- CSV files containing filtered observation lists inside **obs-lists** subdirectory
- Statistics on full archive in **stats** subdirectory

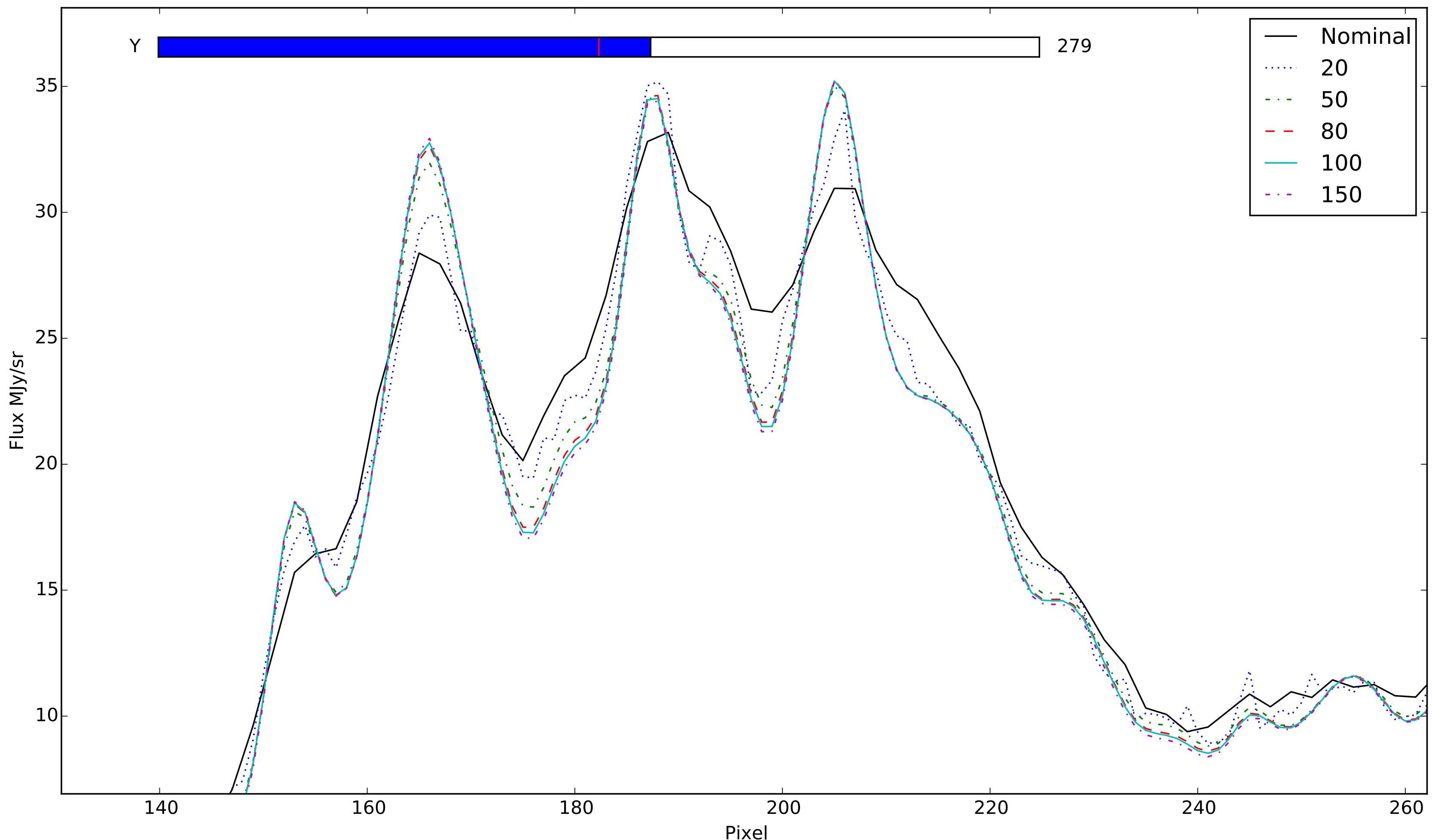
# HiRes Time Complexity - Beam Size



- Approximately quadratic time in terms of beam width
- Approximately linear in terms of beam area



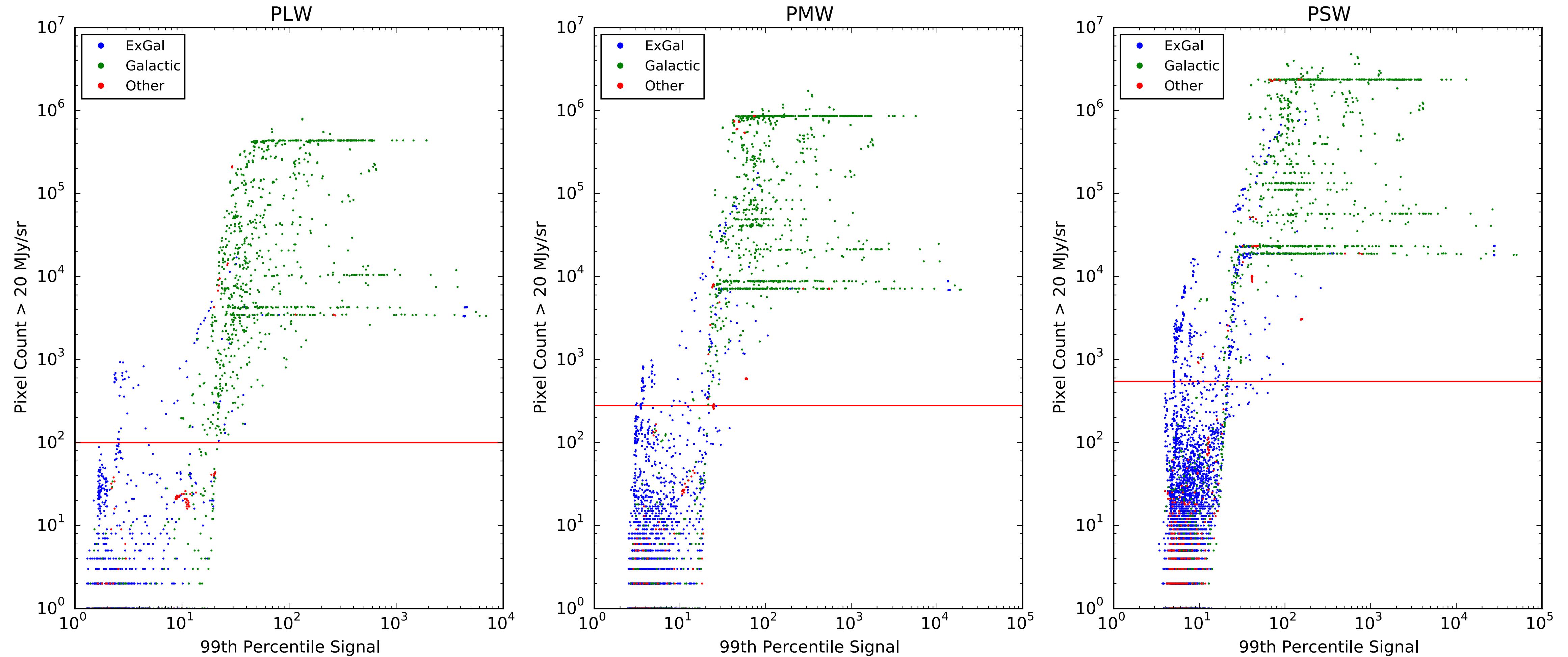
# Varying HiRes input beam size



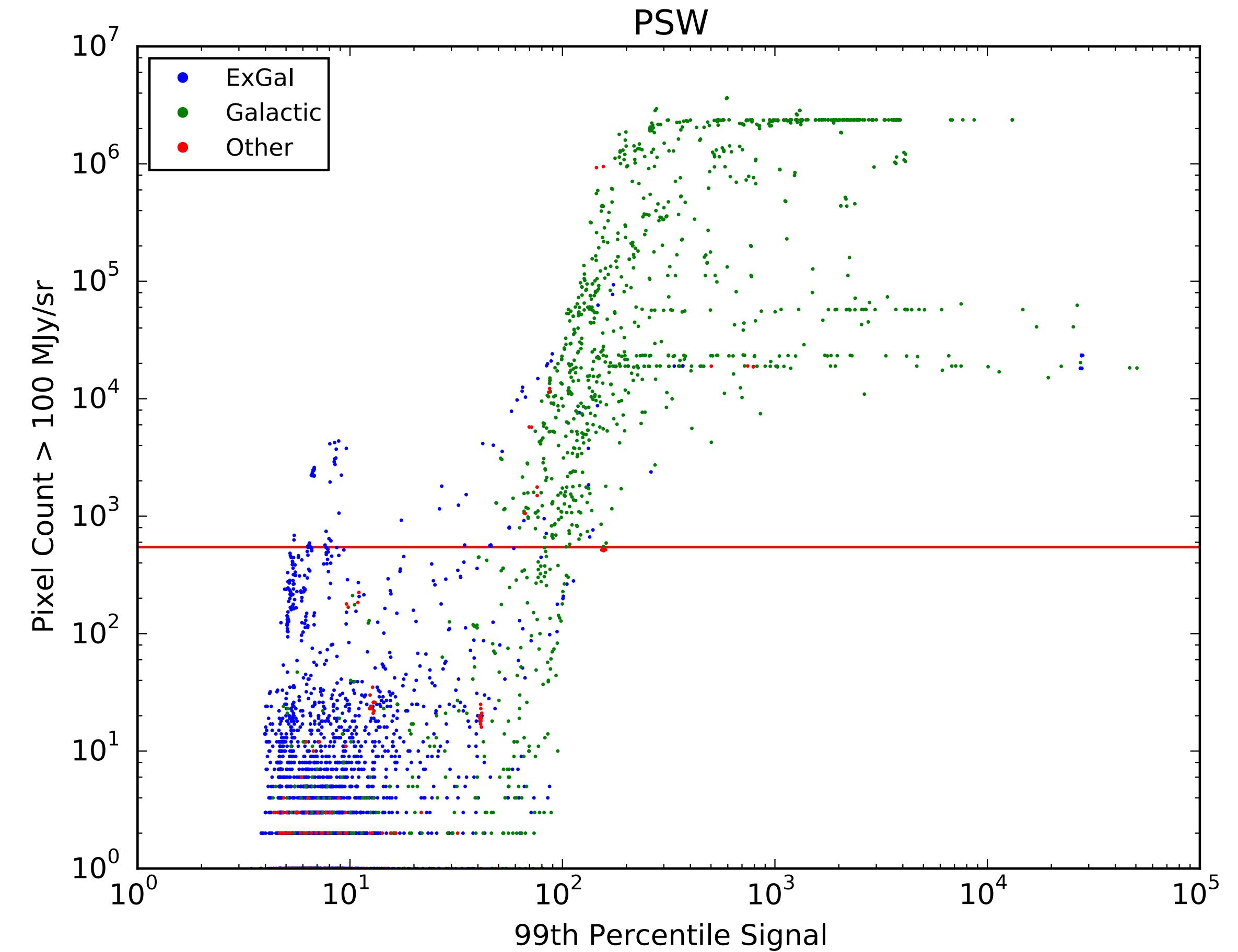
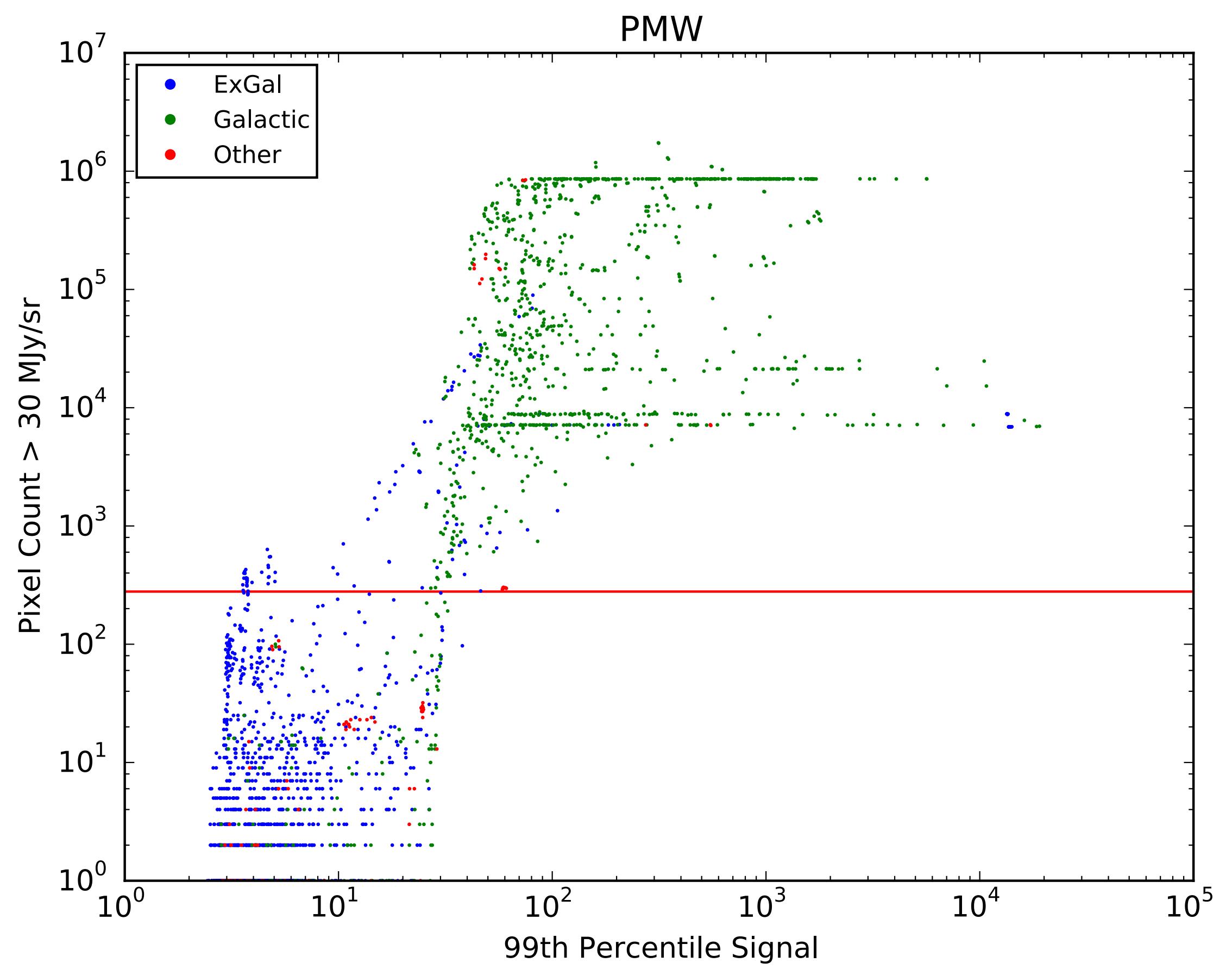
# Beam Size affect on Quality

- < 1st minima introduces artefacts (unsurprisingly)
- 2nd Minima seems noticeably better then using 1st minima in ROI, marginally better than 2nd maxima, but very little
- Current beam sizes are 80, 60, 40 for PLW, PMW, PSW respectively
- Going to 2nd minima would increase processing time by about half, so need to decide if the quality improvement is worth it - probably not, so enclosing first two maxima should be enough

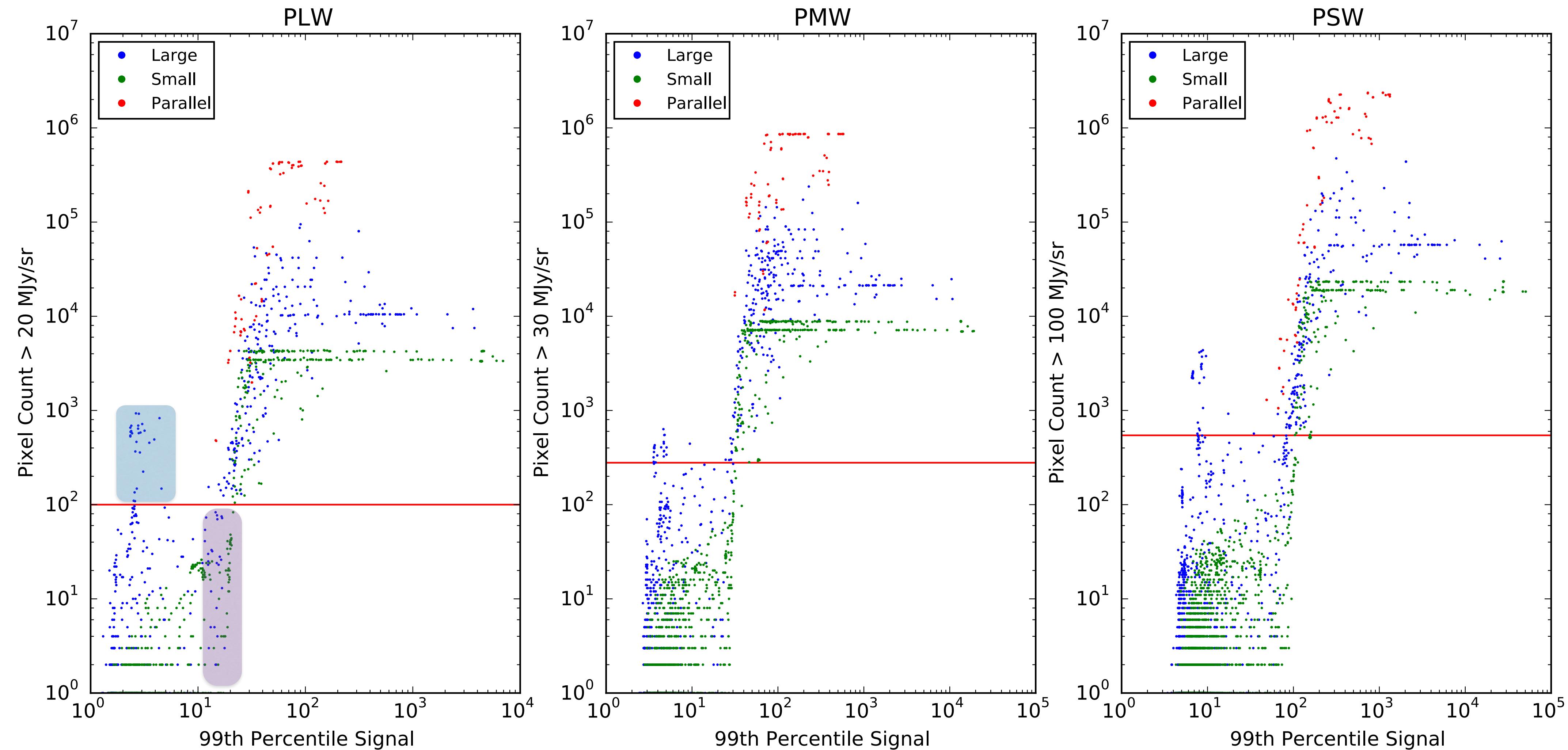
# Thresholds for HiRes



# Updated Brightness thresholds for PMW/PSW



# Thresholds for HiRes



- From previous work by Chris and my own undergraduate project work suggests that HiRes starts to make sense around a 99th percentile SNR of 20-30
- Statistics on entire archive suggest this correlates roughly with around 100 pixels (PLW) being greater than 20 MJy/sr
- Area scaled for PMW/PSW but also need a different threshold

# Below threshold but high SNR ( $\text{pix\_gr\_20} < 100$ and $\text{SNR} > 17$ )

Obs Ids (Right then down)

1342268378

1342255087

1342254493

1342266693

1342237513

1342224023

1342210935

1342240284

1342224973

1342239913

1342210542

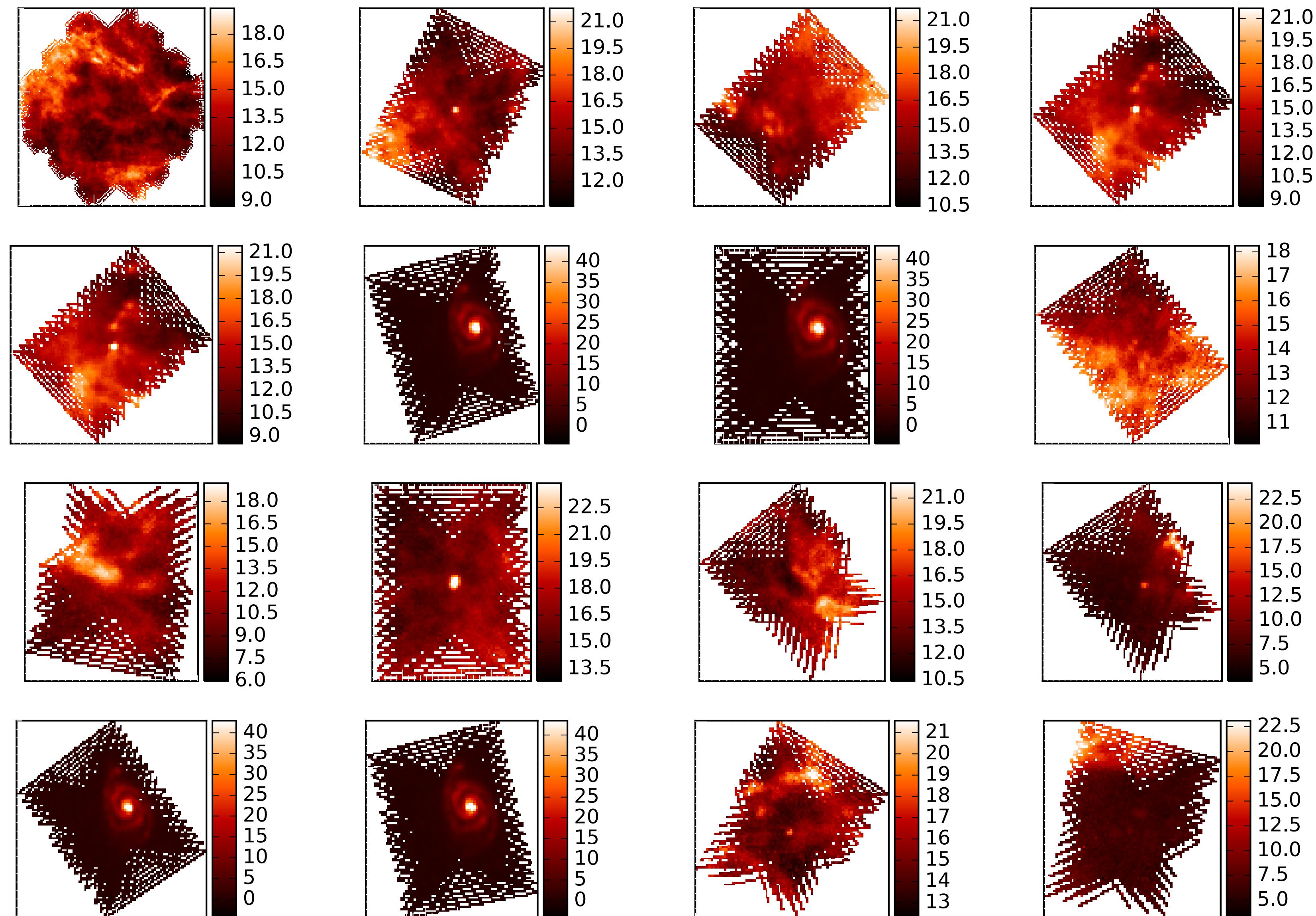
1342247978

1342265305

1342229204

1342268390

1342239795



- Observations are very low brightness and/or very small FOV
- Kepler SN observation is large, but very dim
- M51 observations are short exposure and small FOV, very dim apart from galactic center
- Visual inspections suggests only on areas with per pixel brightness of around 20 MJy/sr benefit from HiRes
- OK to ignore, HiRes can still always be applied by the user

# Above threshold but Low SNR ( $\text{pix\_gr\_20} > 100$ and $\text{SNR} < 5$ )

Obs Ids (Right then down)

1342247216

1342236240

1342245412

1342245510

1342246580

1342238251

1342236234

1342237553

1342237550

1342234749

1342246632

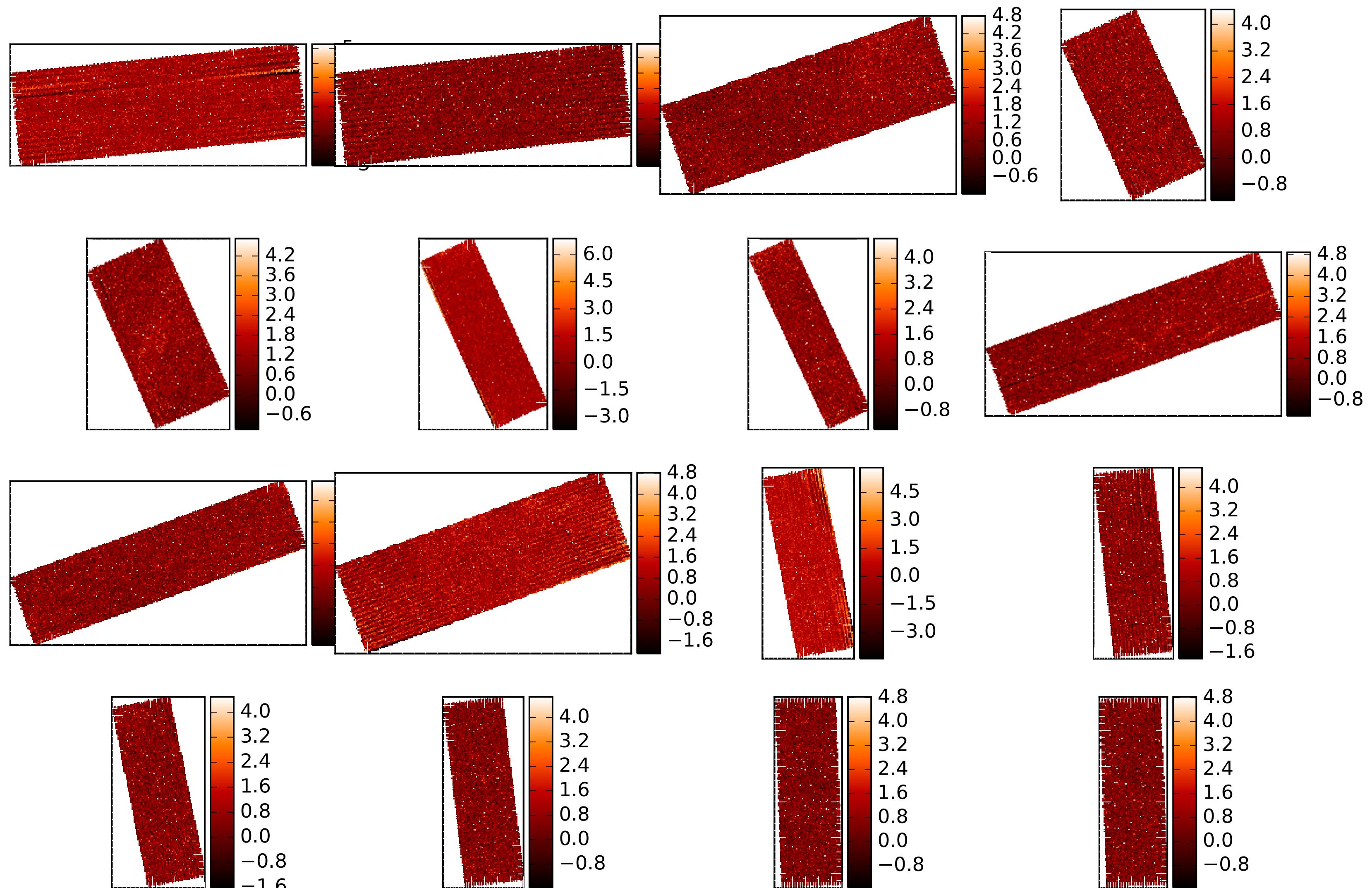
1342237563

1342236232

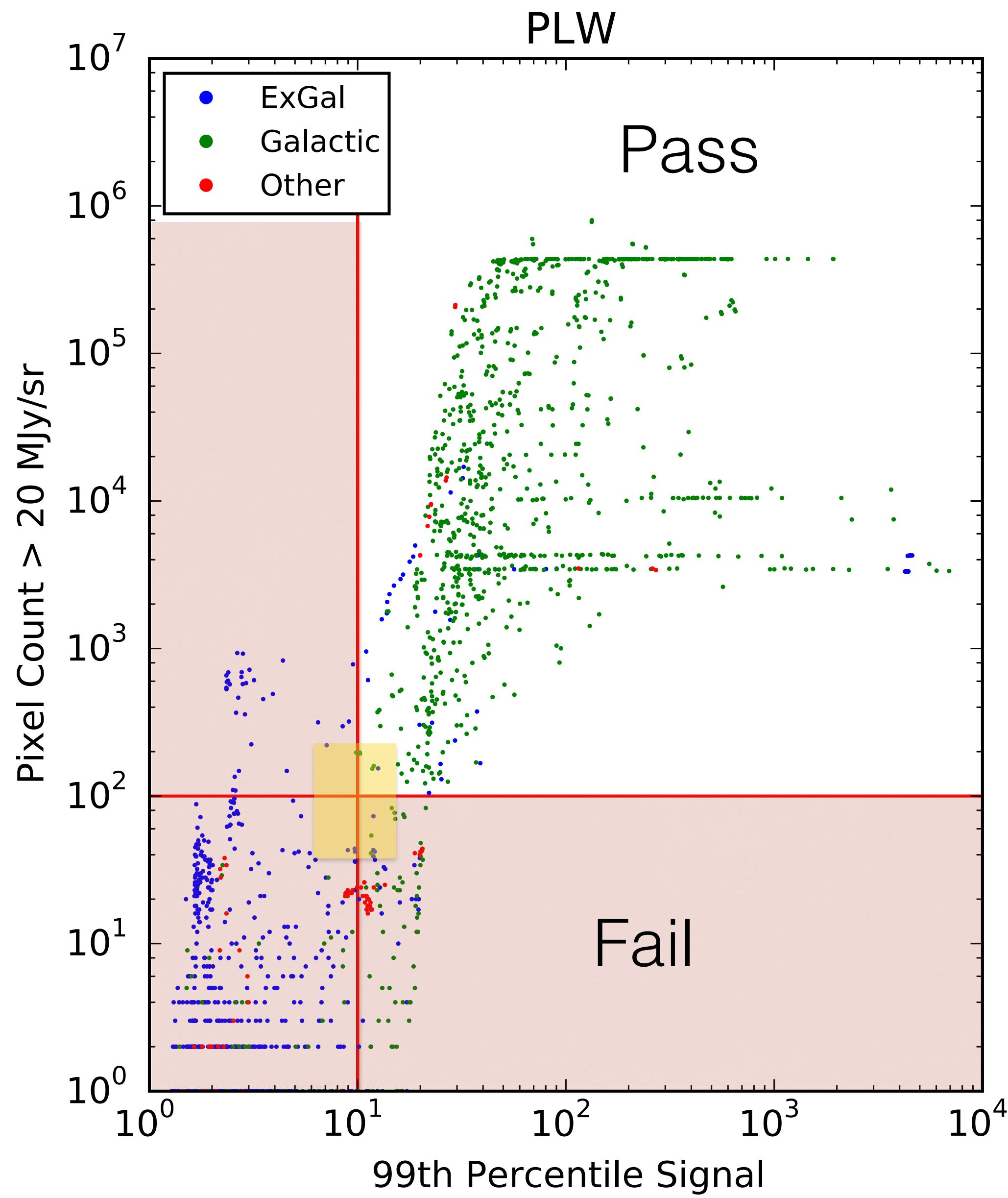
1342245413

1342232365

1342245512



- Observations are very large FOV but dim, but as we are counting the pixels they just rise above our threshold test
- Don't want more complicated testing such as bright pixel proximity etc, suggest adding a second threshold of 99th percentile SNR as both this and the pixel count tests are both computationally very quick. Suggest 99th percentile signal of 10, 15, and 30 for PLW, PMW, PSW

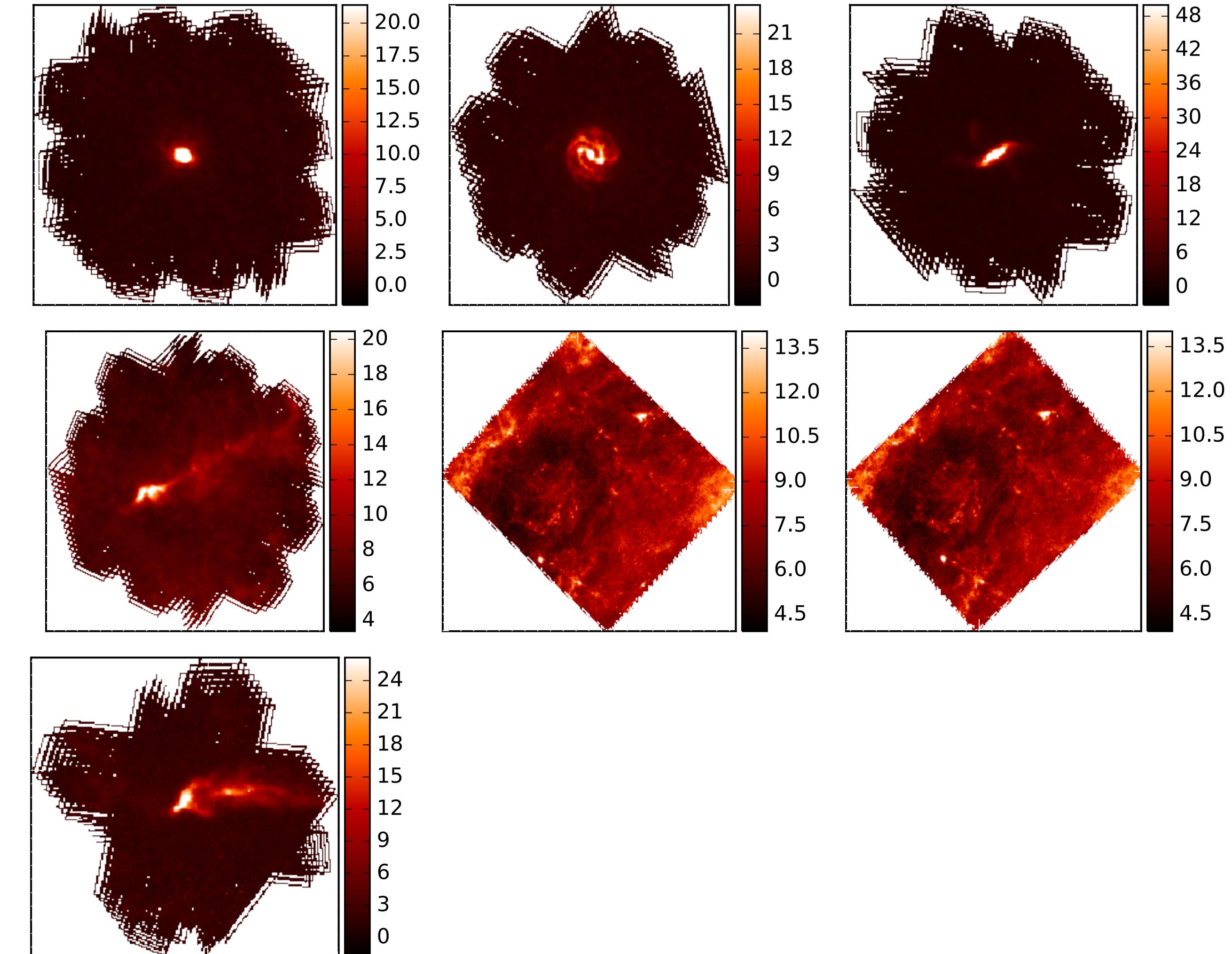
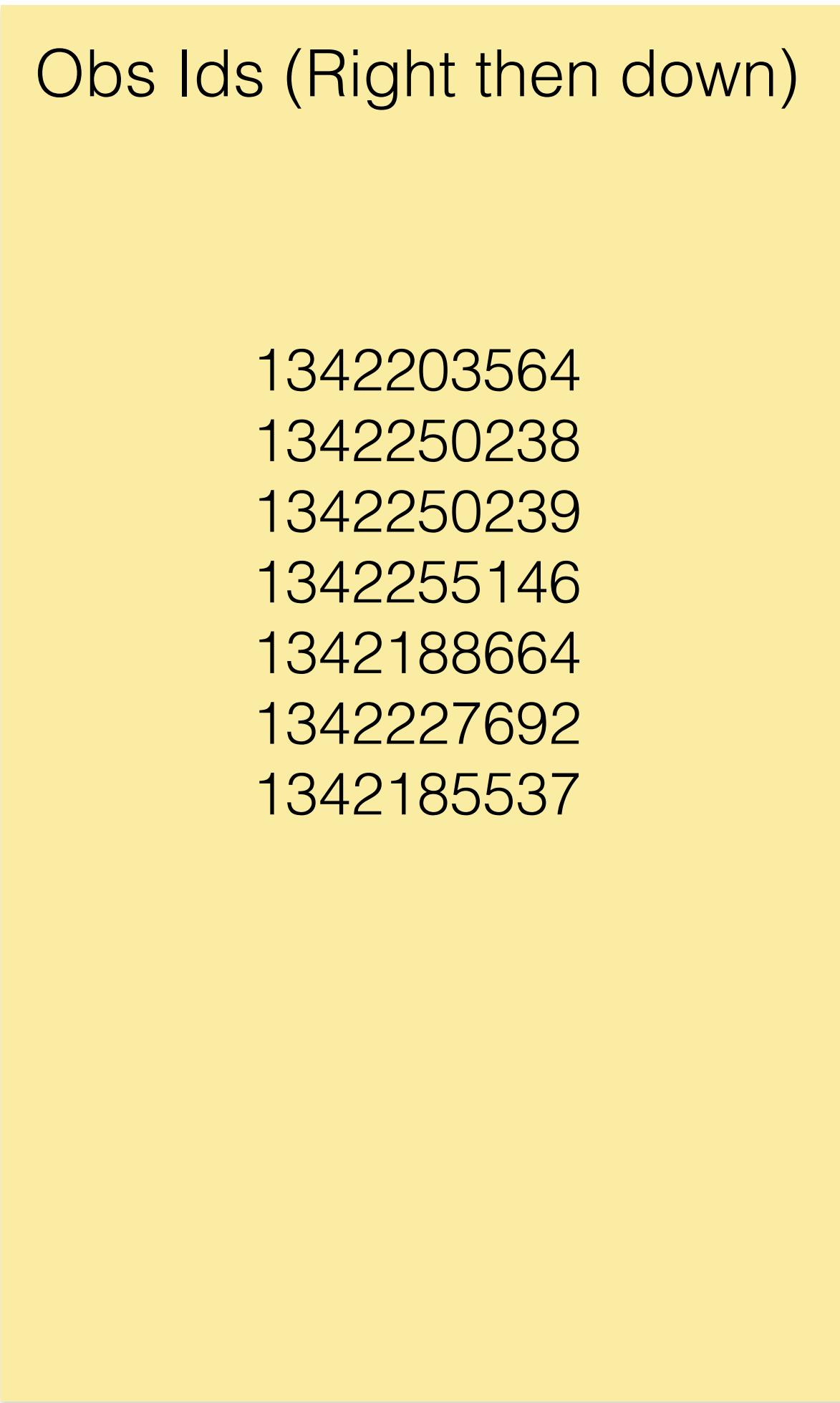


With suggested thresholds:

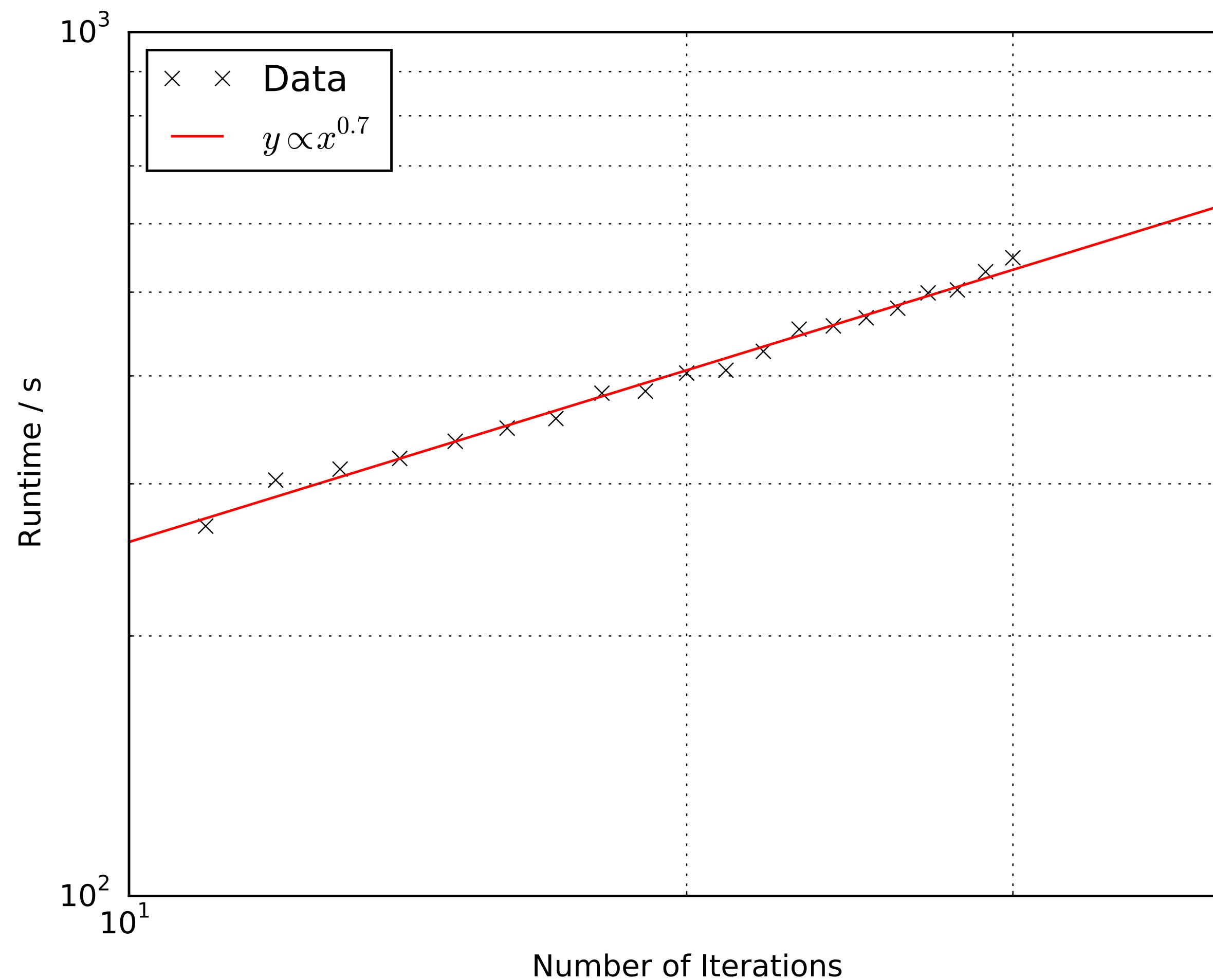
Band	Pass	Fail
PLW	1012	4873
PMW	1132	4753
PSW	972	4913

Number Bands	Pass
3	956
2	71
1	106

# thumbnails of Observations closest to thresholds (pix\_gr\_20 within 50 to 200 and SNR within 5 to 15)

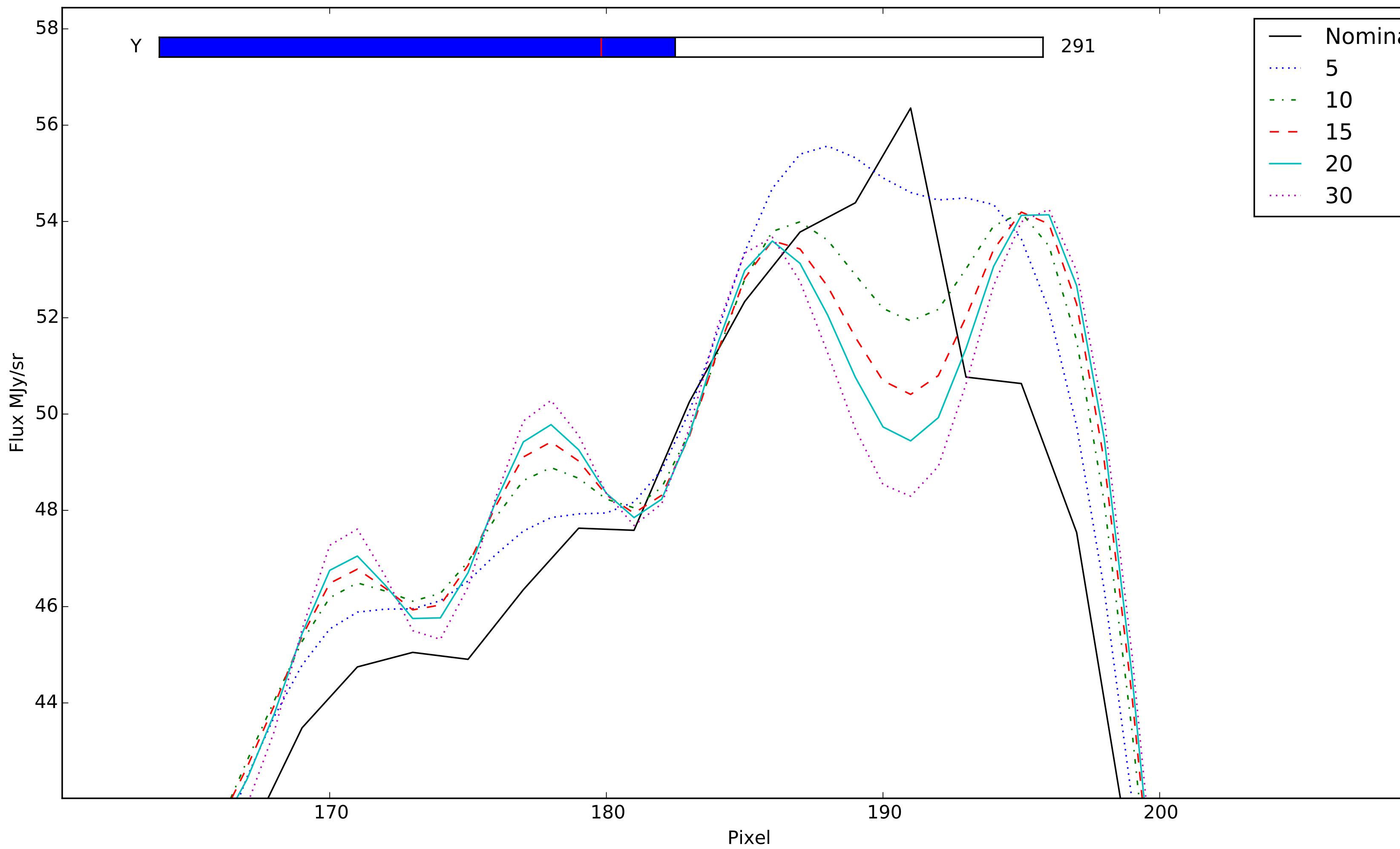


# HiRes Time Complexity - Iterations

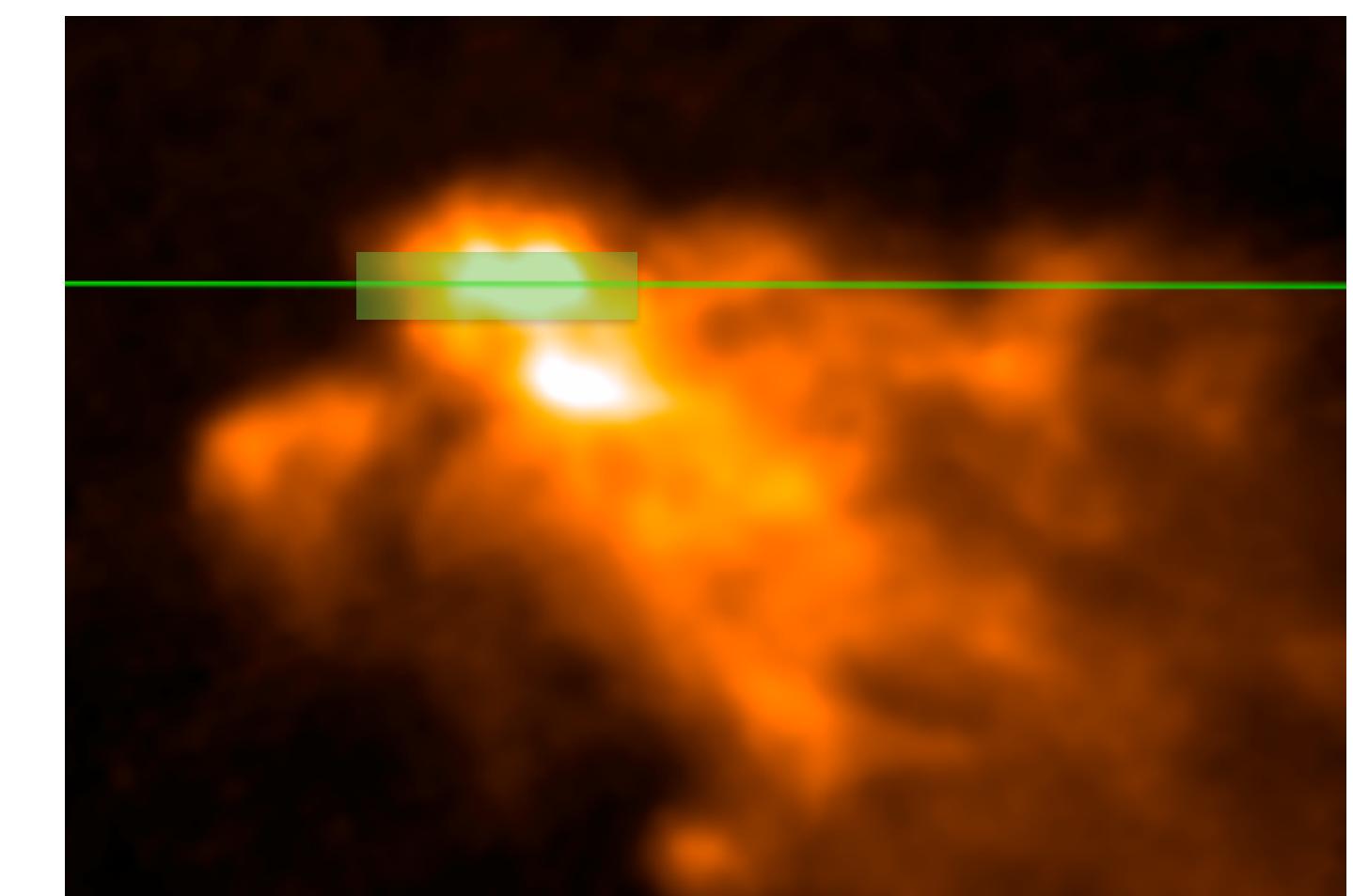


Slightly better  
than linear

# Number of HiRes Iterations



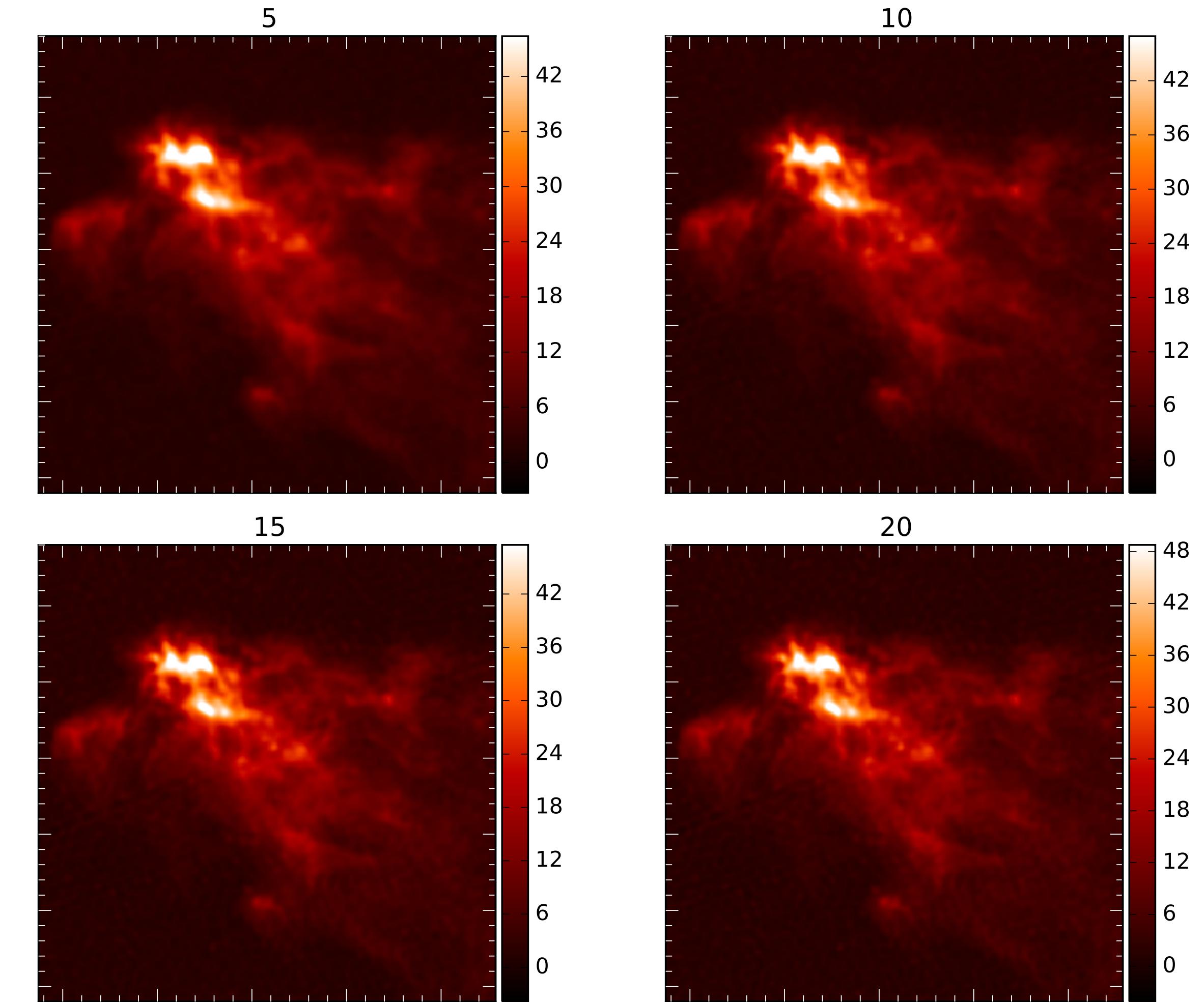
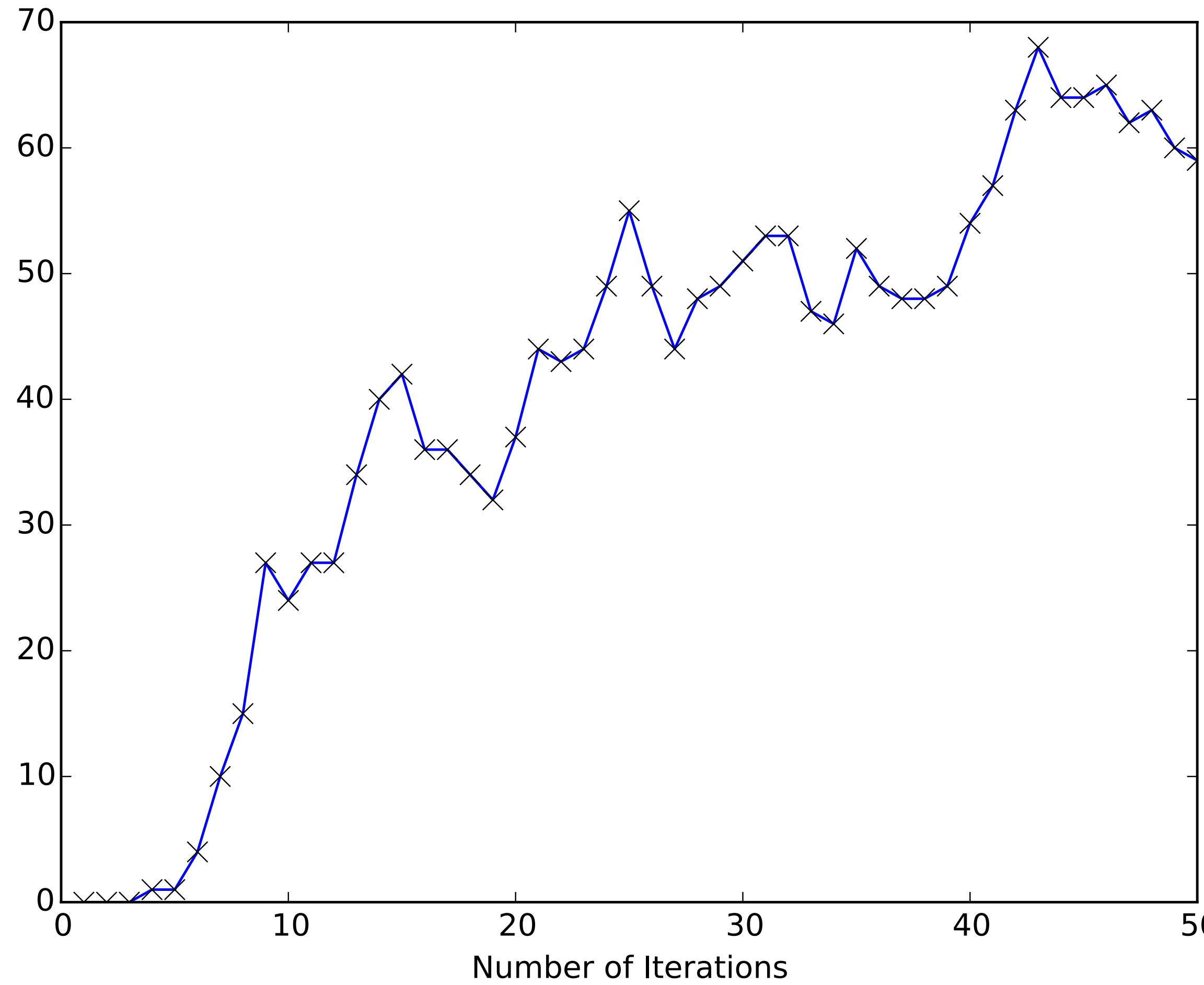
Obsid: 1342249237

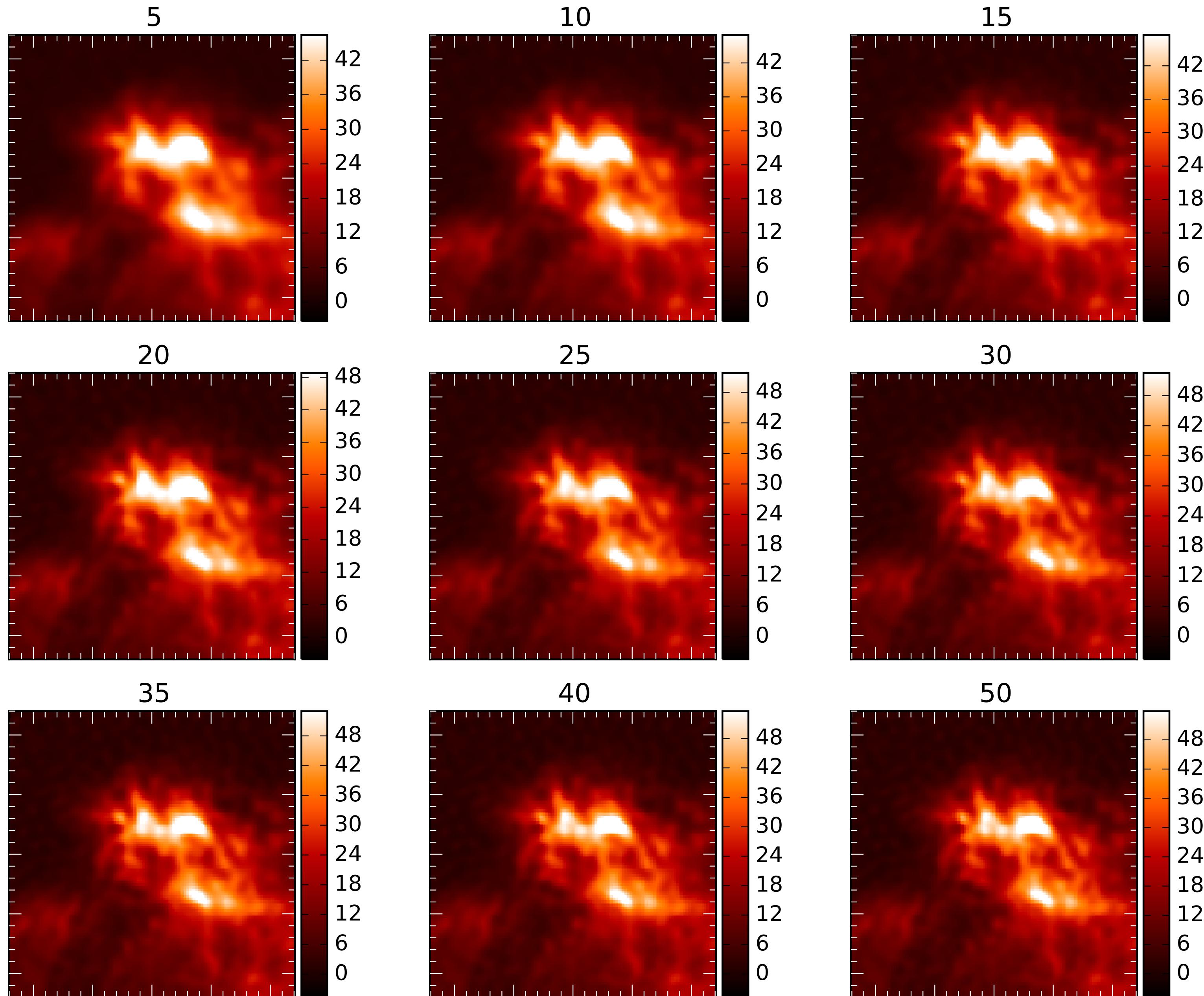


# Number of HiRes Iterations

Obsid: 1342249237

RMS Pixel Difference from nominal





Obsid: 1342249237  
Zoomed to 0.25 degree  
region

At 20 iterations it appears that some detail is introduced that wasn't shown at 15 iterations (although is apparent on the profile), and is further visible at higher iterations.

- Difference rapidly increases from 5-15 iterations, but then rate of change of image differences becomes small
- Small difference from 15-20 iterations (20 current default) but doesn't appear to be adding structure, just enhancing that which is already clear at 15 iterations.
- Time complexity suggests we can save around 1/4 to 1/5th of the processing time by dropping down to 15 iterations