ASW2DF Source extraction results

1. RMS/Noise maps construction

1.1 Introduction

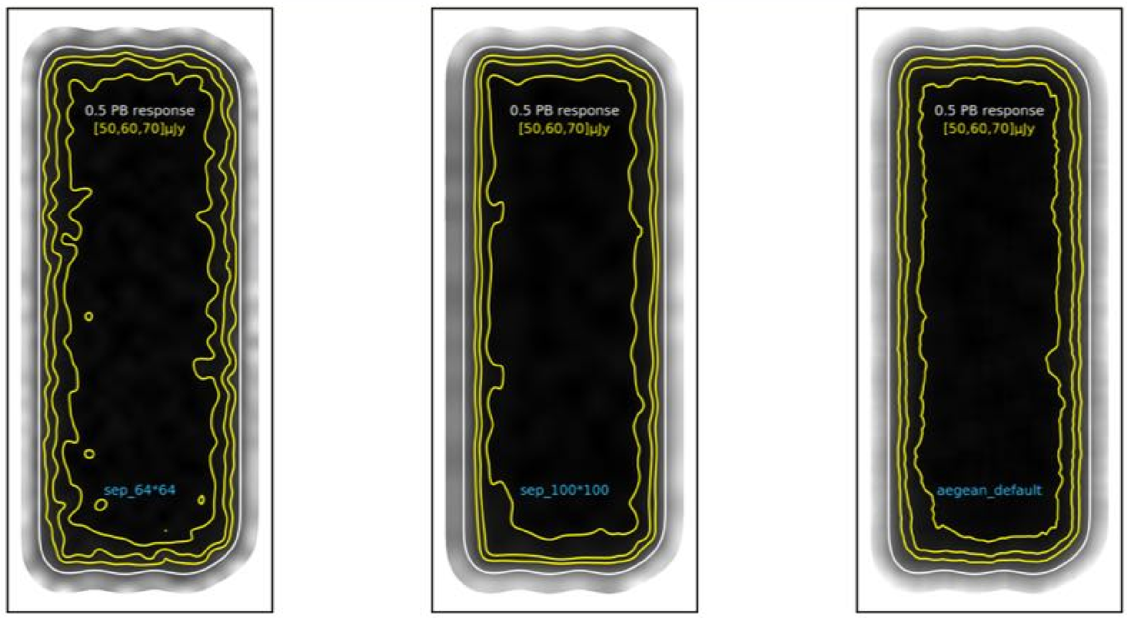
Both the tools of SEP (Sextractor) and AEGEAN can construct the rms/noise maps from the flux maps (uncor/cor). The tools use the popular way to calculate the standard deviation of a box (with box size*box size) as the rms noise of the centered pixel/grid (with grid size*grid size).

PyBDSF also can produce the same thing but for now I didn’t try it yet, cause it is impossible to install this software in Mac OS X system.

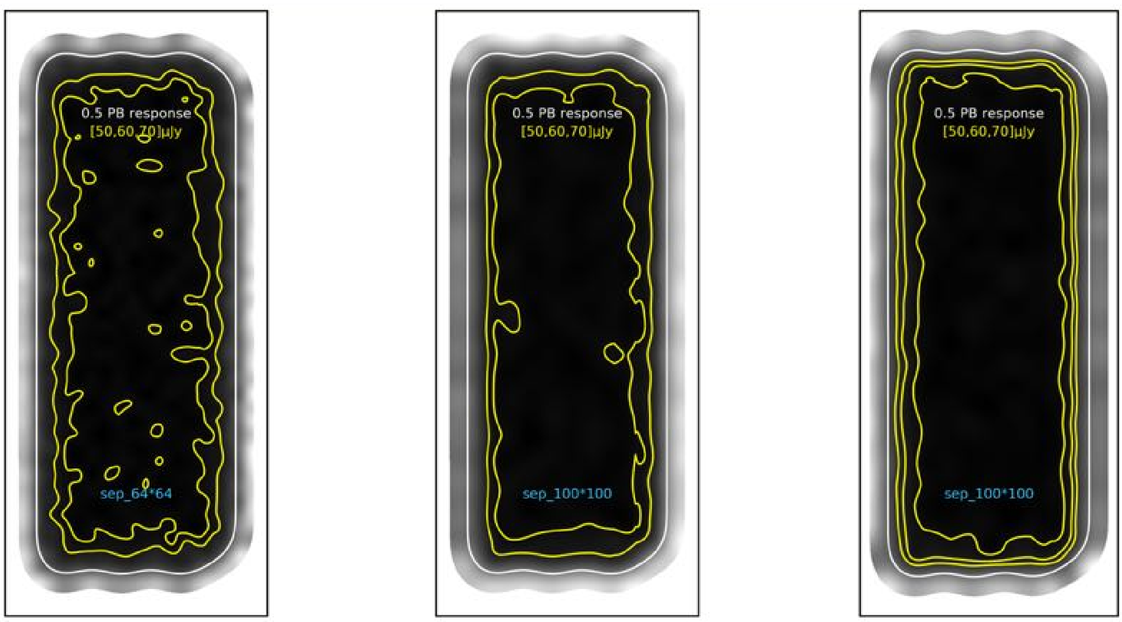
Refer to the PyBDSF docs:
In general, it is best to choose a box size that corresponds to the typical scale of artifacts in the image, such as those that are common around bright sources. Too small of a box size will effectively raise the local rms near a source so much that a source may not be fit at all; too large a box size can result in underestimates of the rms due to oversmoothing.
A step (grid) size of 1/3 to 1/4 of the box size usually works well.

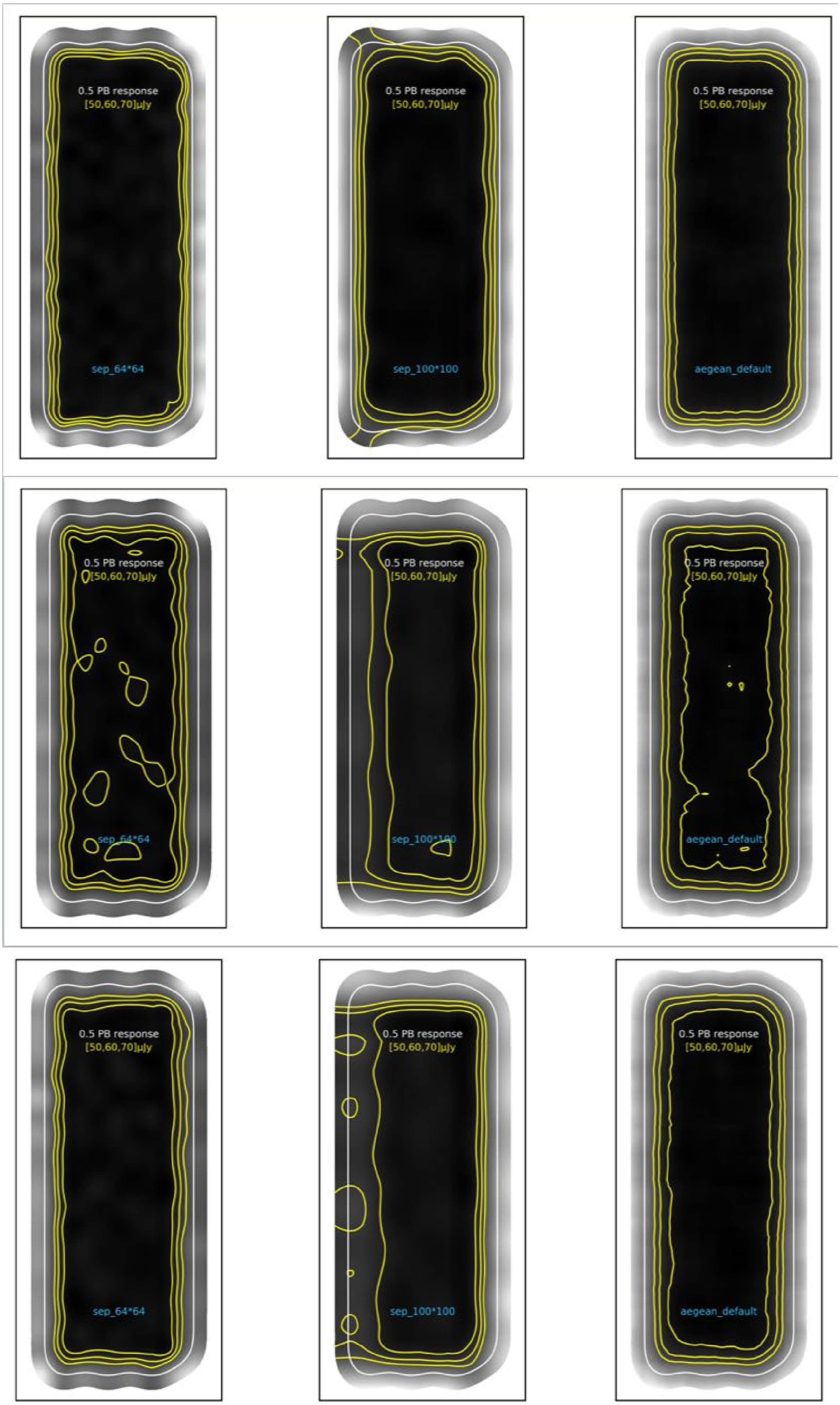
1.2 Comparison of noise maps from different tools

Left: SEP with default settings (box size=64, grid size=3)
Mid: SEP with modified settings (box size=100, grid size=1)
Right: AEGEAN with default settings (box size~120, grid size~20)
Contours: 50,60,70 μJy for yellow and 0.5 PB response for white
Results: The middle panels are worst in the margin regions, and the left ones will affect by the strong sources sometimes. SEP will also calculate the ‘nan’ value regions and I can not fix it by now. The right panels works better overall, without big problems.
Nots: These maps are calculate from the PB corrected images.

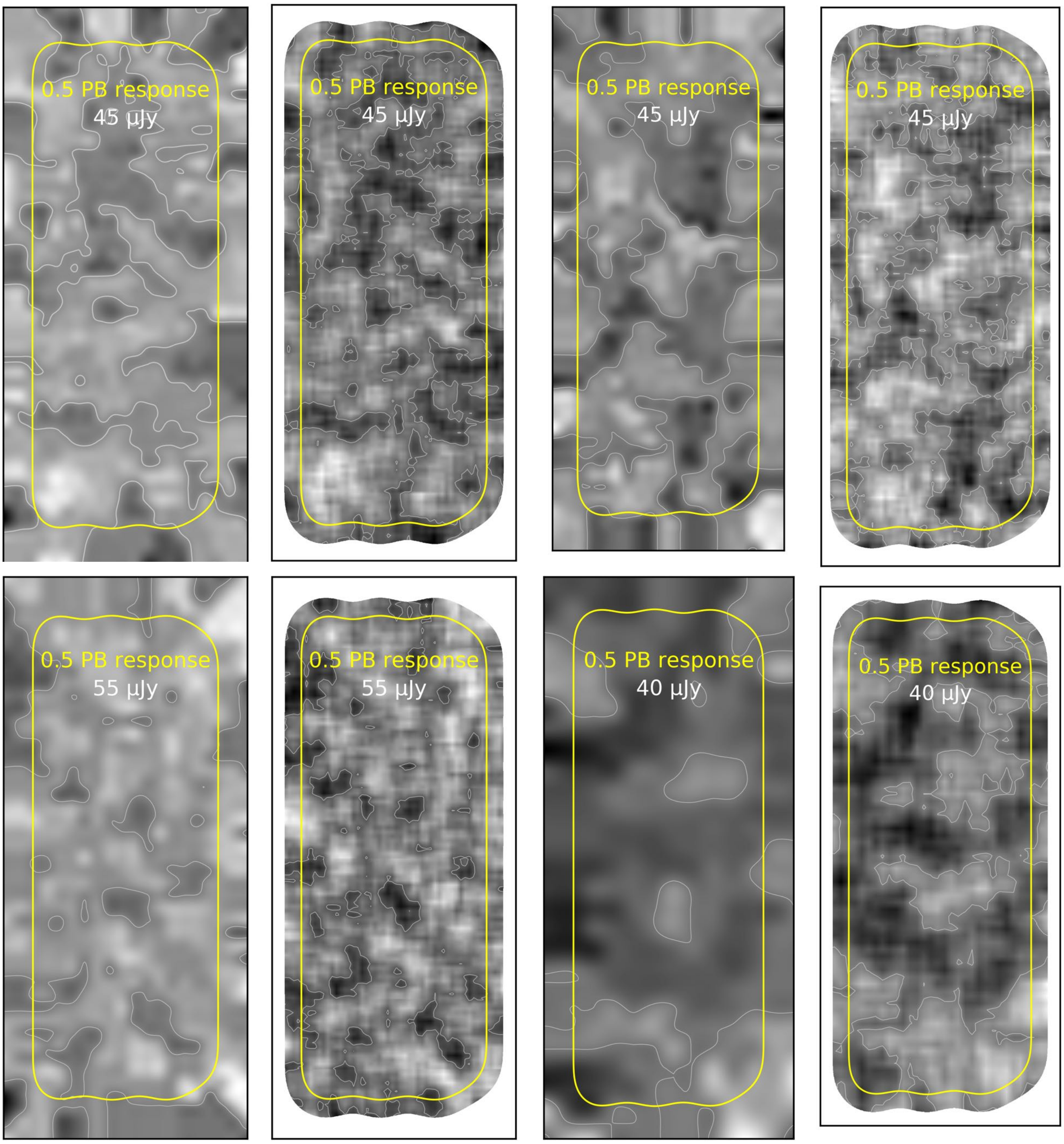

0.5 PB response
[50,60,70]μJy
sep_64*64
0.5 PB response
[50,60,70]μJy
sep_100*100
0.5 PB response
[50,60,70]μJy
aegean_default

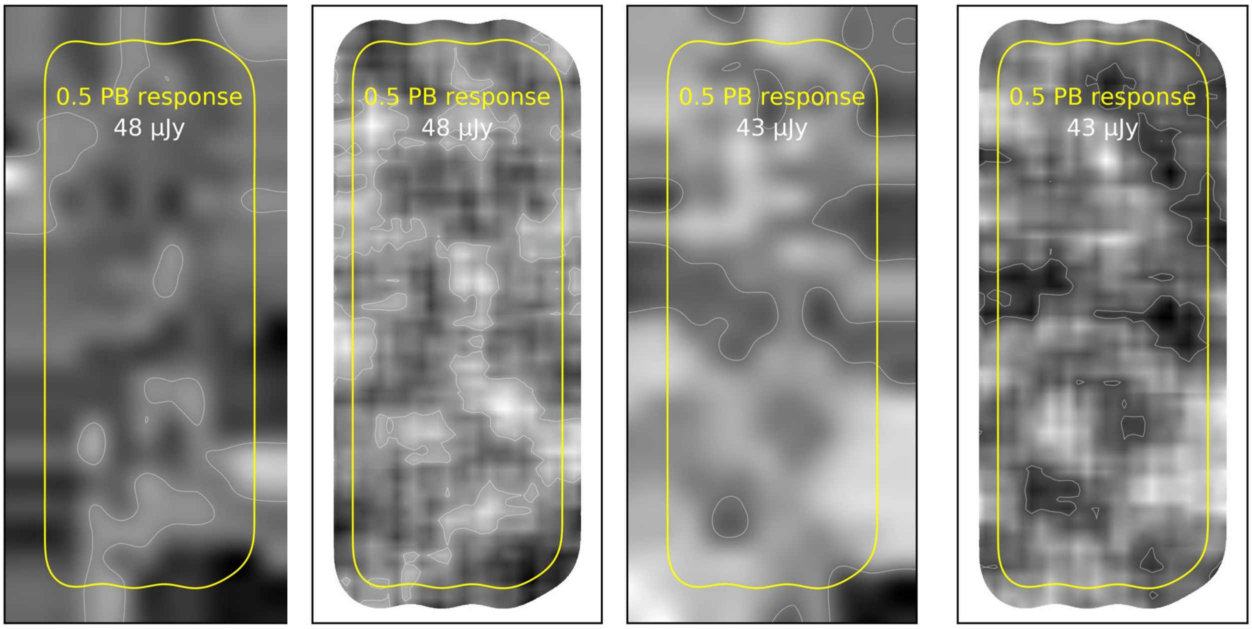

0.5 PB response
[50,60,70]μJy
sep_64*64
0.5 PB response
[50,60,70]μJy
sep_100*100
0.5 PB response
[50,60,70]μJy
aegean_default


0.5 PB response
[50,60,70]μJy
sep_64*64
0.5 PB response
[50,60,70]μJy
sep_100*100
0.5 PB response
[50,60,70]μJy
sep_100*100


0.5 PB response
[50,60,70]μJy
sep_64*64
0.5 PB response
[50,60,70]μJy
sep_100*100
0.5 PB response
[50,60,70]μJy
aegean_default
0.5 PB response
[50,60,70]μJy
sep_64*64
0.5 PB response
[50,60,70]μJy
sep_100*100
0.5 PB response
[50,60,70]μJy
aegean_default
0.5 PB response
[50,60,70]μJy
sep_64*64
0.5 PB response
[50,60,70]μJy
sep_100*100
0.5 PB response
[50,60,70]μJy
aegean_default

Left of each Field (Two Panels): SEP with default settings
Right of each Field (Two Panels): AEGEAN with default settings
Contours: [45, 45, 55, 40, 48, 43] µJy for each field
Results: The PB uncorrected images are very uniform, so the produced noise maps do not have the increasing trend toward outside. And the contours and color scale only present the tiny noise fluctuation in the filed. Same with PB corrected, SEP can not separate the 'nan' value regions, and smooth a lot in the whole image.



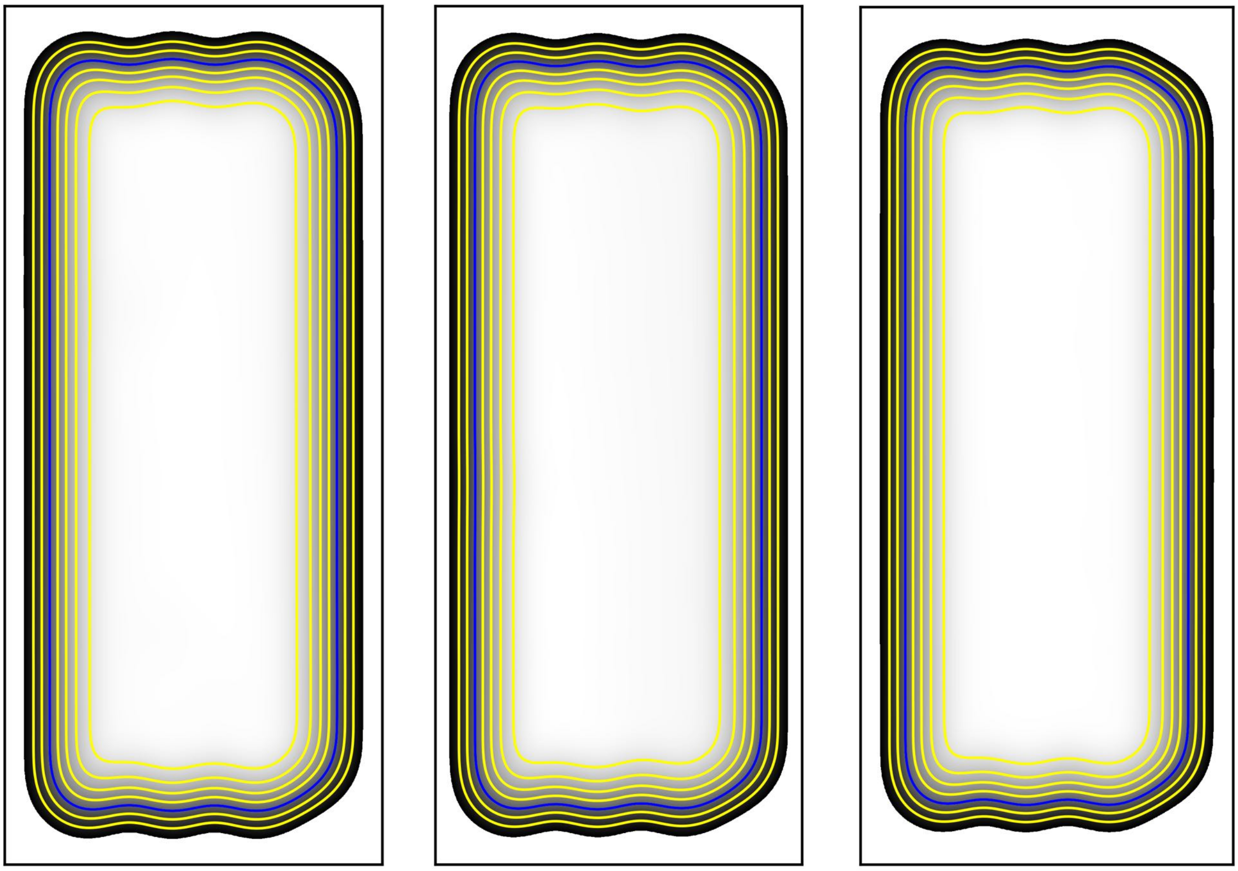


1.3 Primary beam response

Primary beam (PB) images of Field 1-3 are shown here, cause all are very similar

Contours: primary beam response=[0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9]

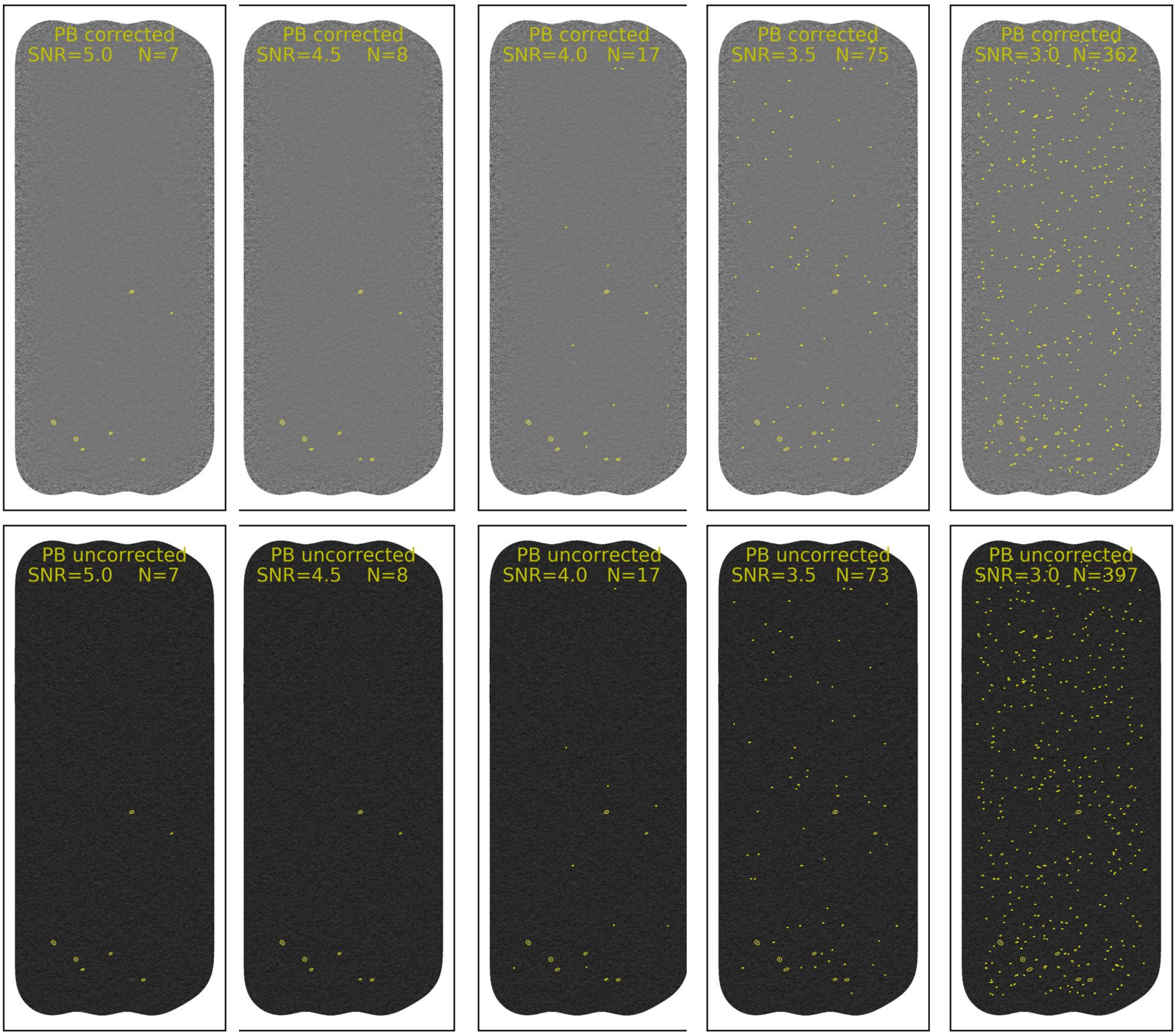
Notes: People usually detect sub-mm sources in the regions where PB>0.5 or PB>0.3.



2. Source detections

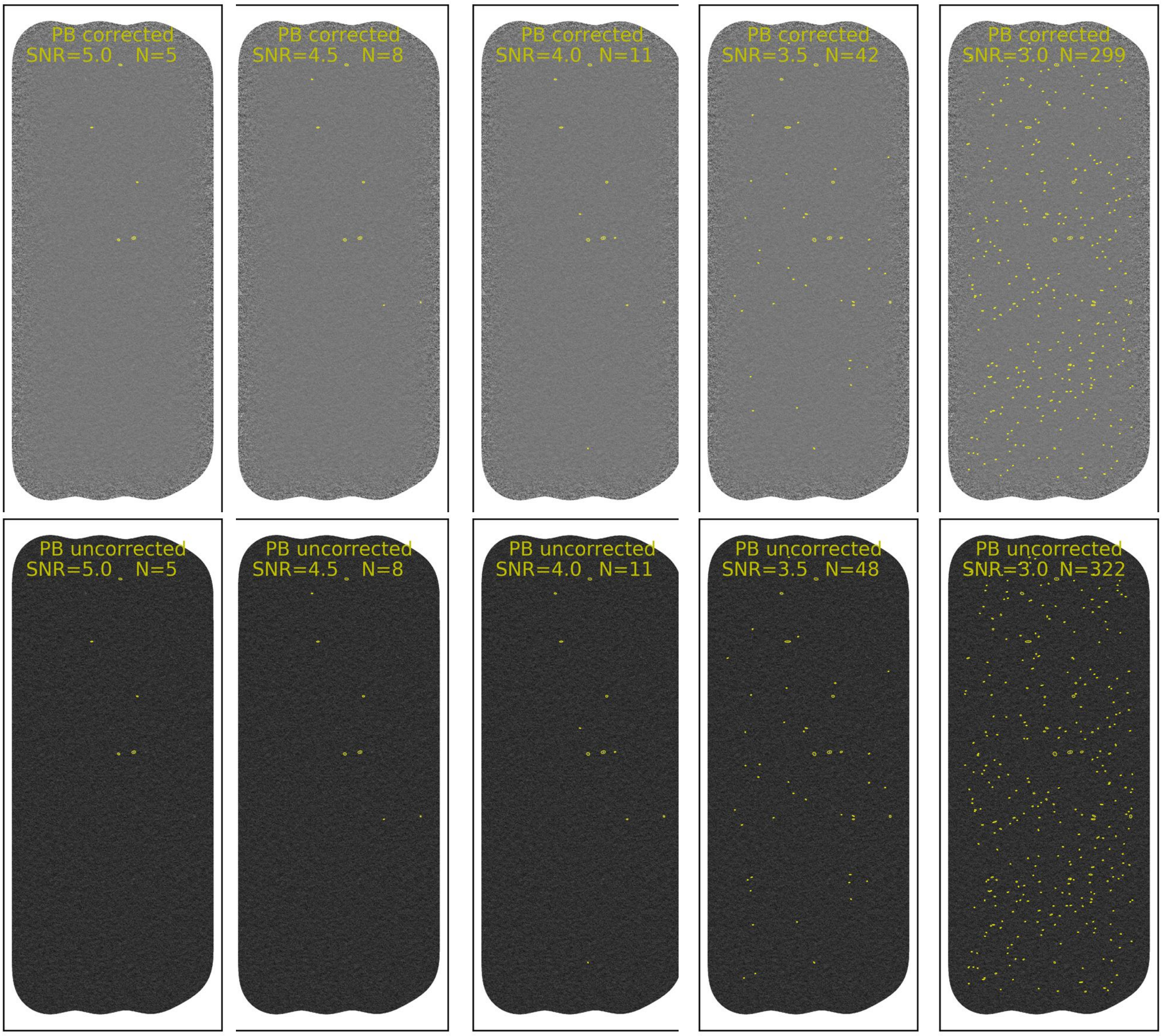
2.1 Detections in PB (un)corrected images

For all the fields, the number of the sources detected in the PB uncorrected images is almost alway larger than the PB corrected images.
Except the sources detected in Field 1 at SNR=3.5, the corrected detections is slightly higher than that in uncorrected image (75-73=2).
For Field 1, at SNR=4, there is one source detected in the uncorrected image but not detected in the corrected one. Inversely, there is also one detected in the corrected image but not shown in the uncorrected one.

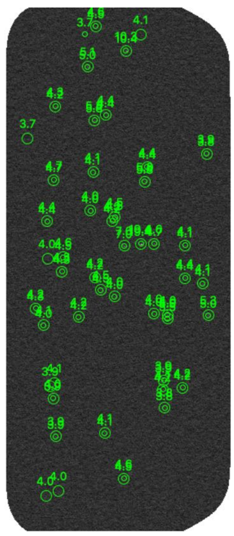


For Field 2, the number of sources detected at SNR=4/4.5/5 in the two images are same. At SNR=3.5, the uncorrected detections are more than the corrected ones (48-42=6), mostly at the edge.

Field 2:



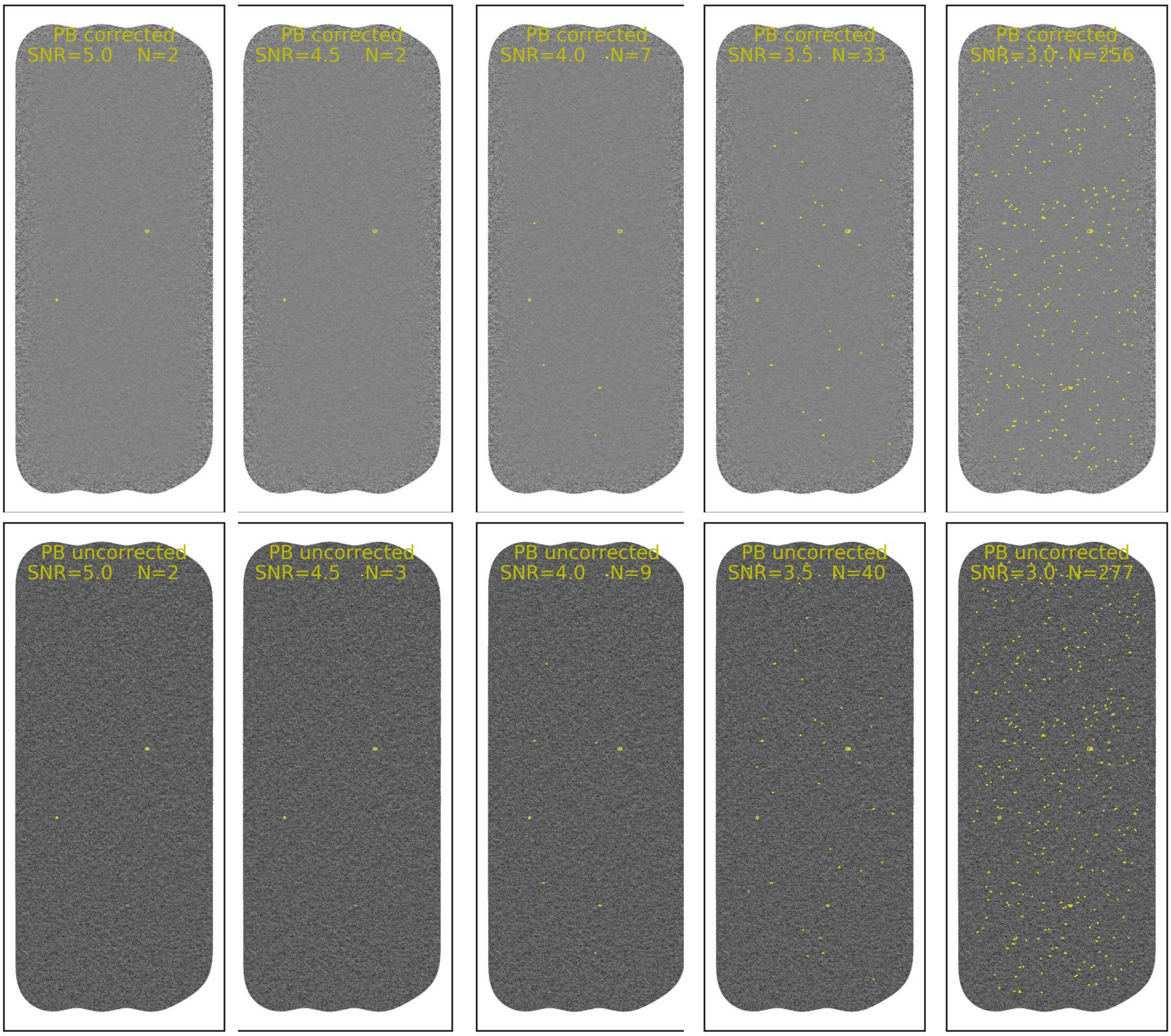
But sorry, it it difficult to show the outlier with different colors cause the picture are plotted by python, one can easily check them in ds9 with reg files.



For Field 3, it is interesting to see even at 4.5 sigma the uncorrected detections is more than the corrected ones (3-2=1), as well the 4.0 sigma (9-7=2).

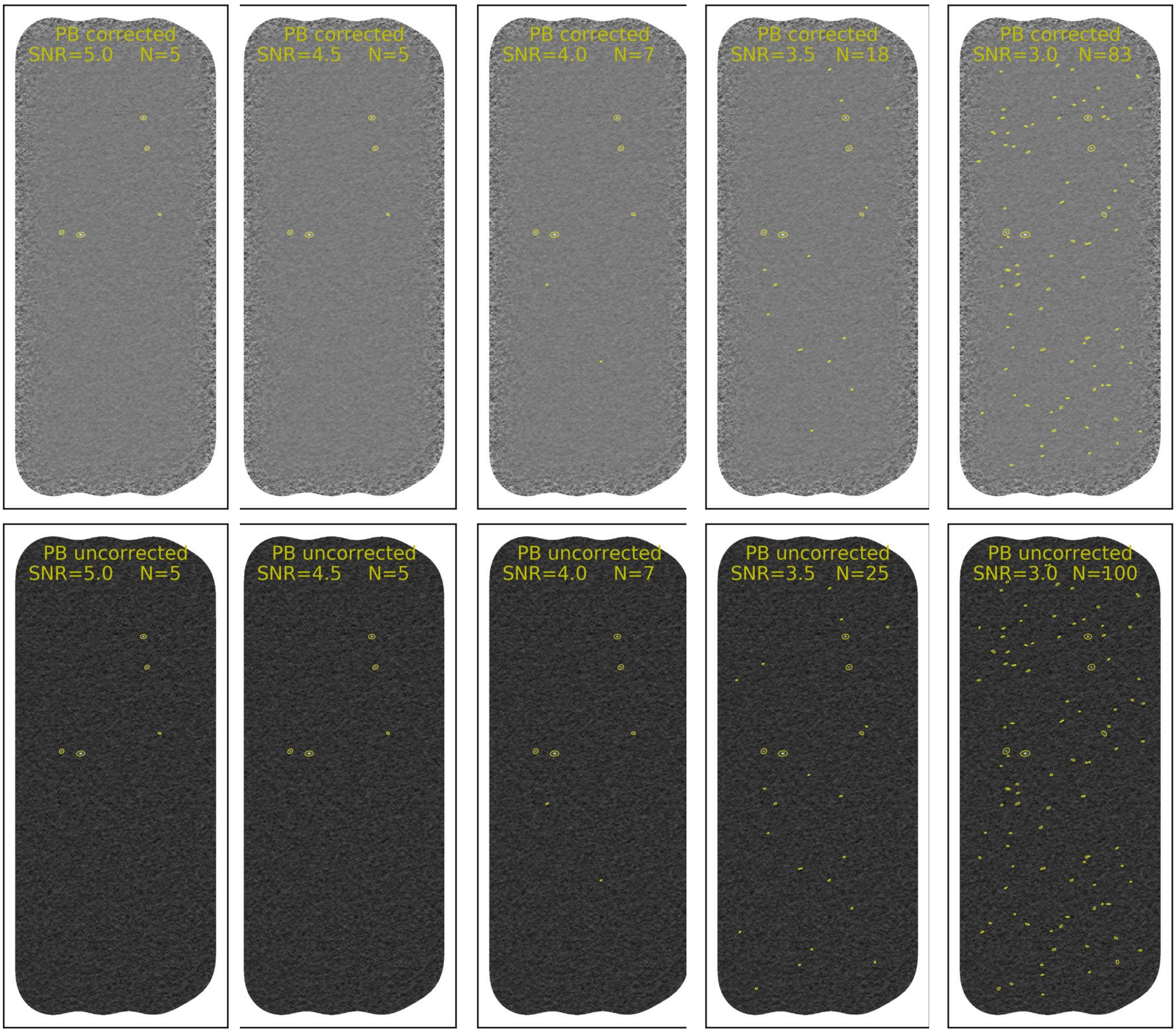
Since sep detect them as a detection with at least 5 continues pixels, I d rather to believe these are real. We need further check on this.

Field 3:



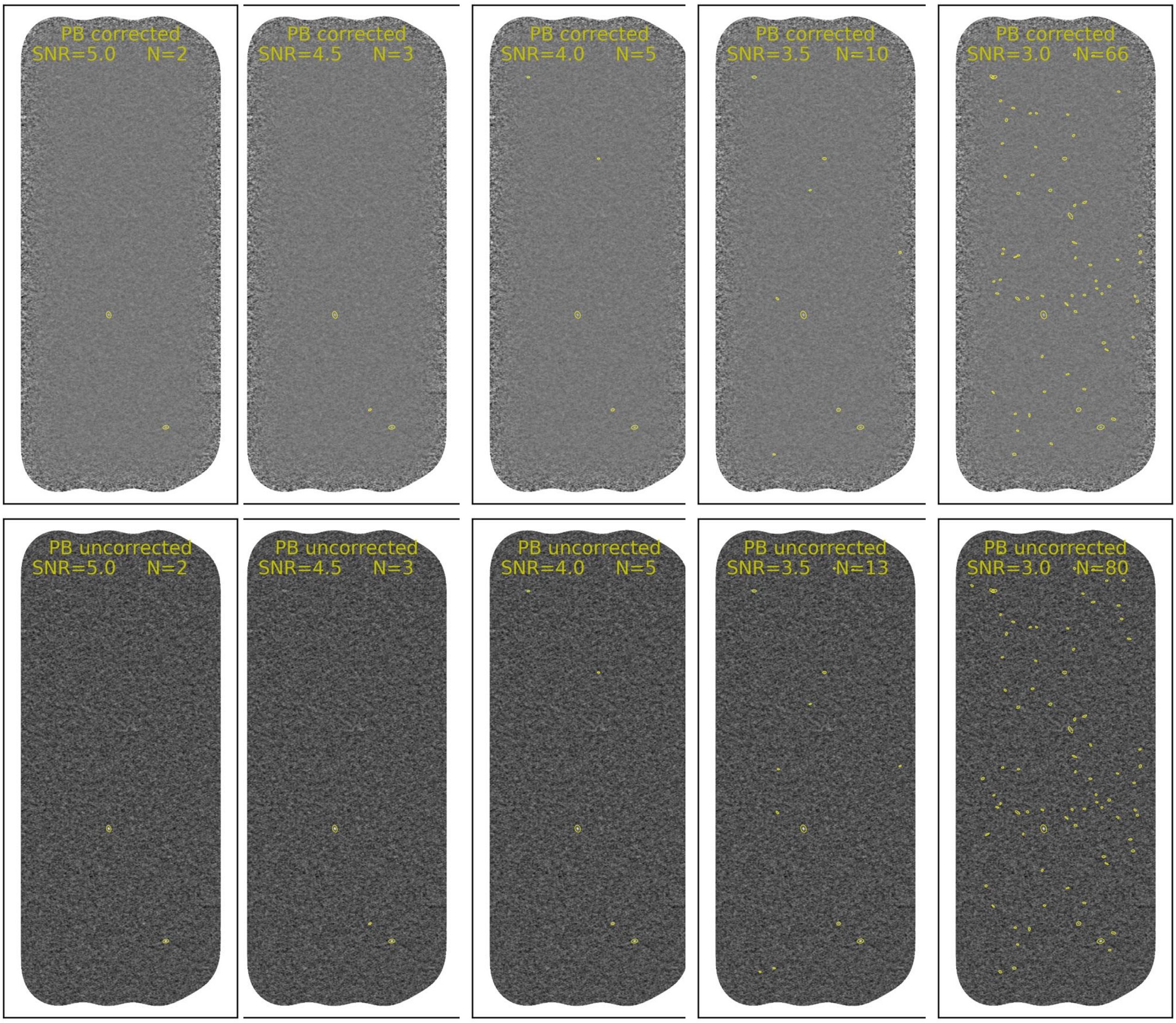
For Field 4-6, I found the source number is largely different with the previous three fields. It could be due to the original resolution as well the sensitivity. The number of sources in Filed 4-6 are less than Field 1-3 at any significance.
For Field 4, only at 3.5/3sigma the sources in uncorrected images are more than that of corrected ones,

Field 4:



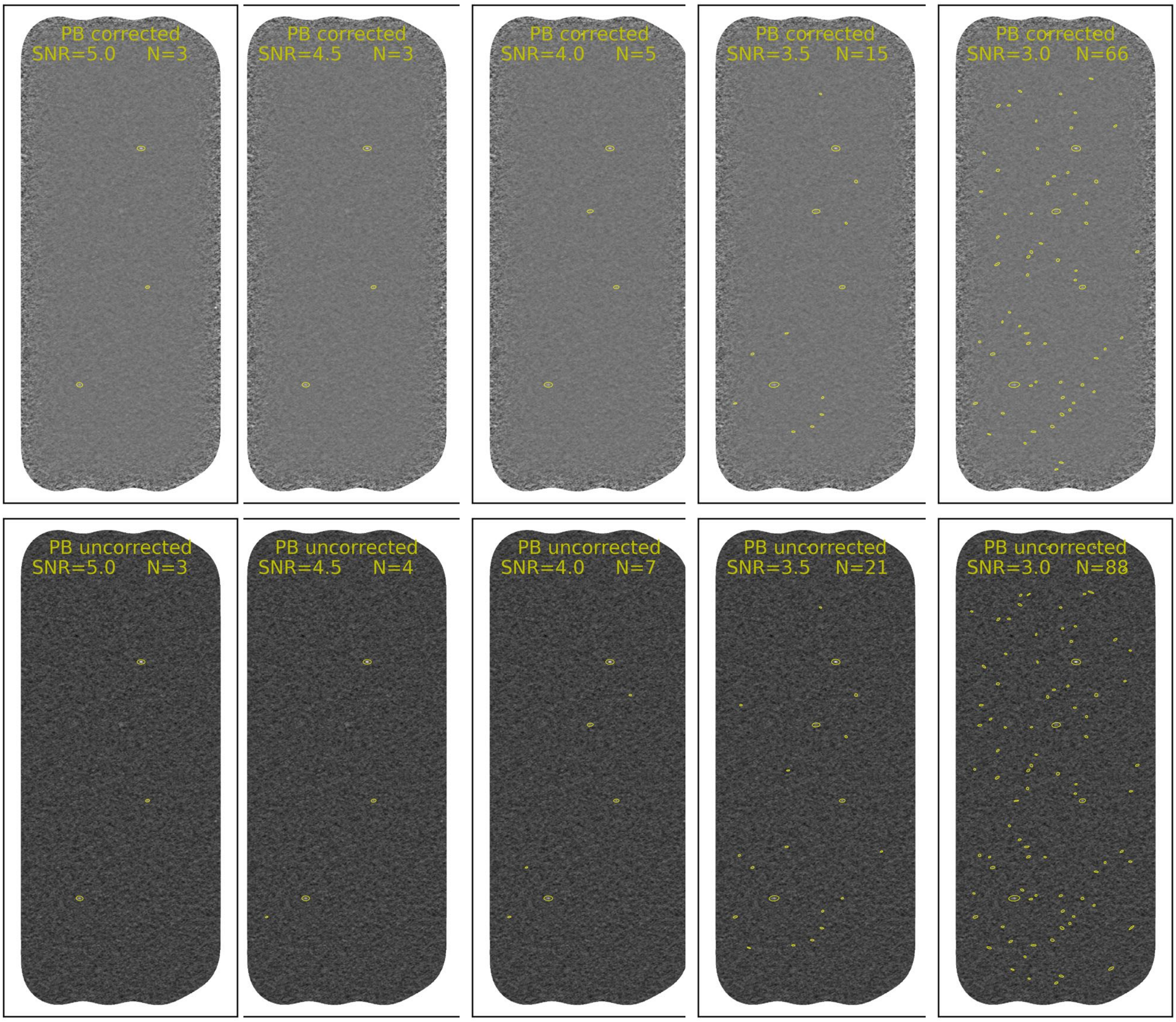
For Field 5, since little sources are detected in this filed, only slightly difference shown on the uncorrected/corrected images at 3.5/3 sigma.

Field 5:



For Field 6, similar to Field 3, the number of sources are different between the uncorrected and corrected images, even at 4.5 (4-3=1) sigma and 4.0 sigma (7-5=2).

Field 6:

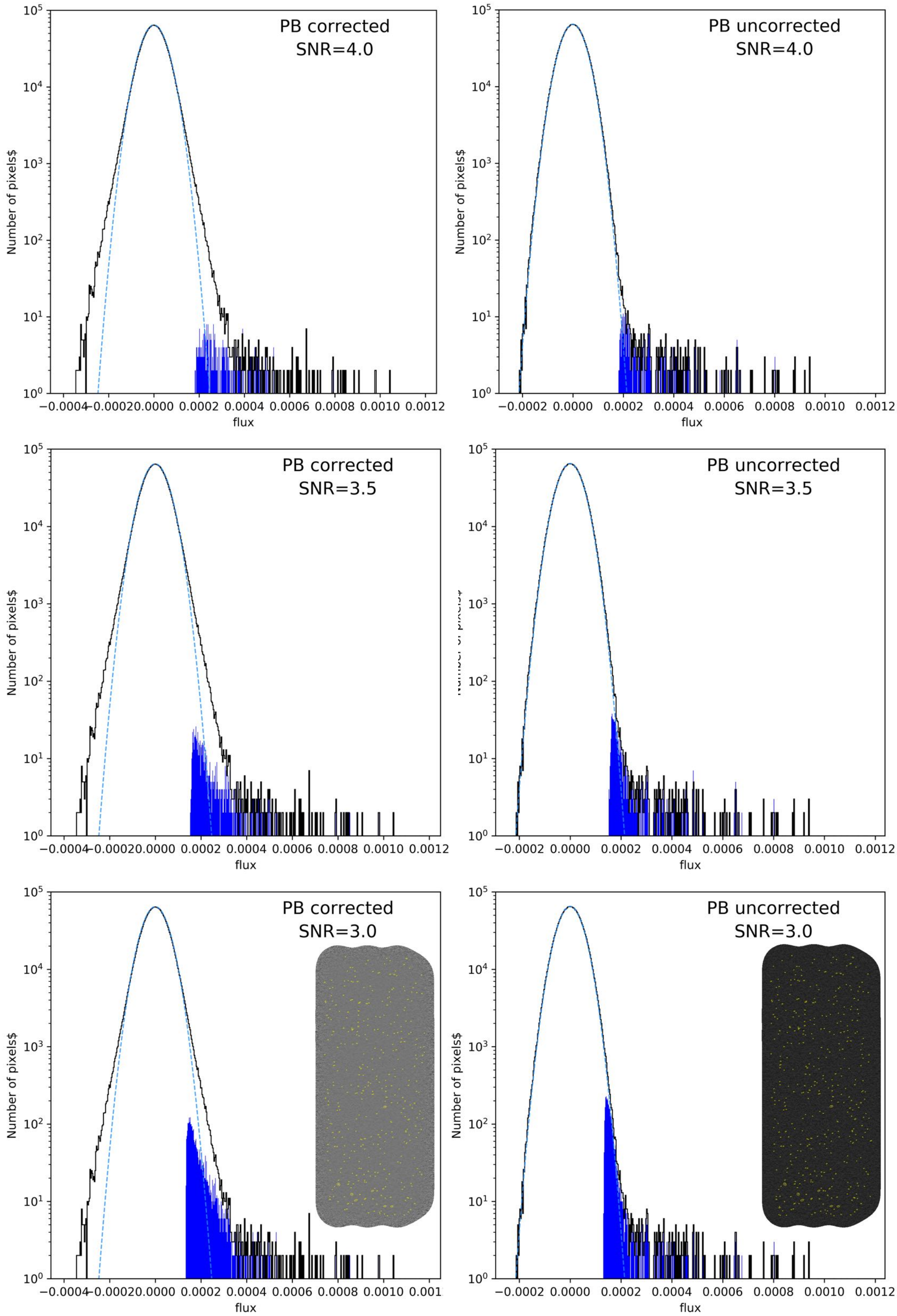


2.2 Pixel distribution of the PB (un)corrected images

Left: flux distribution of PB uncorrected image

Right: flux distribution of PB corrected image

Since the y axis are log scaled, the ‘fat’ tail of the corrected distribution are not come from the detected sources.



2.3 Flux measurement

********* (I expect to make it in several days) ***********

Summary

Now I mostly use the RMS map produced by the bane/sep from the PB uncorrected flux images, and use sep to extract sources with the default parameters.
With further discussion and visual check with other bands images, we could make a better decision on the selection of tools and settings
Next step is to do the flux measurement and size/morphology estimate, then the regular MC simulation on completeness/boosting things.