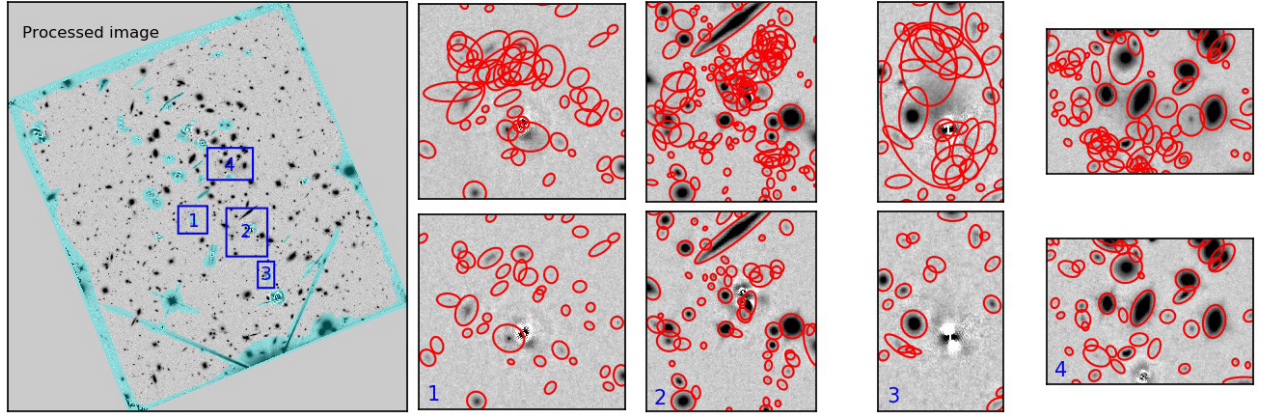


# Local background correction

Nonetheless, we found that there are four local regions where the Kron ellipses of detected sources are significantly overestimated and appear to be very crowded on the image by visual inspection. These special regions are marked with blue boxes, along with their id numbers in the left panel of Figure 1, while in its immediate right-hand side panels of the four columns show the respective zoom-in regions with Kron ellipses and id numbers labelled. Through tests, we find that it is impossible to find suitable setup parameters to accurately measure these sources properties (i.e., the reasonable ellipse sizes for targets), especially for faint sources (see the panels). The reason for this is that the faint diffuse light within these regions hinders the faint source measurement. We notice that these are the remnant residuals from our subtraction procedure, where region1, 2 and 3 are due to bCG residuals, and region 4 shows ICL residual. In order to deal with this particular issue, we further subtract those extra diffuse residual light for each region, using a median filtering procedure similar to that used in removing extended envelopes of ebCGs. We judge the residual quality by examining the local background pixel histogram (after conservatively masking the real objects). The resulting pixel histograms for our cleaned regions are centered at zero values, but they skew towards positive values before being cleaned. After local background corrections, this refined processed image is used as the detection image for a robust and homogenous source measurement.

Next, we rerun SExtractor cold+hot mode on detection image with identical parameter settings as previously obtained. This time we have obtained best overall detected sample, resulting in reliable Kron ellipses, i.e, with proper sizes enclosing the sources. The bottom row of zoom-in panels in Figure 1 shows the cleaned special regions with reasonable source Kron ellipses overplotted. Therefore, this demonstrates that our method could dramatically improve the measuring accuracy for faint sources (in comparison with upper zoom-in panels).

To require a better catalog completeness, we therefore use more extreme/aggressive set of parameters for hot mode to maximize the number of faint sources close to the detection limit, which are crucial for a variety of scientific goals. However, on the other hand this strategy would inevitably plague the resulting catalog by introducing false detections such as noise peaks and small-scale fluctuations that should be removed. To increase catalog purity, we visually check each detected object in the catalog with Kron ellipse labelled against detection image to eliminate those apparent contaminants. This step ensures that the inaccuracies in source identification and photometry will not be reflected into the subsequent galaxy profile fitting procedure, which contributes to the high rate of successful fits.



**Figure 1:** The left panel shows the processed image. Overlaid in translucent cyan color indicate masked regions. Note that such plot is only for visualization purposes, because the mask image is directly applied to modify the corresponding weight image, not the processed image, during the source extraction process. The blue boxes labelled with id numbers mark four special regions, where source measurements are impaired by the contamination from remnant diffuse residuals from our previous subtraction procedure. The four columns in the right-hand side of processed image displays the corresponding zoom-in equivalents, while the bottom row indicates the cleaned counterparts after median filtering subtraction. Column 1, 2, and 3 (as labelled in bottom left corners) are associated with bCG residuals, and column 4 corresponds to ICL residual. The red Kron ellipses overplotted in the upper and bottom rows of panels are calculated from two separate SExtractor runs using the same configuration parameters, on the processed images before and after local background correction, respectively. By visually comparing the Kron ellipses between the two rows of panels, one can clearly see that the accuracy of source measurement has been effectively improved after removing extra diffuse residuals, especially for faint sources.