Bright star mask for S19A

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Data

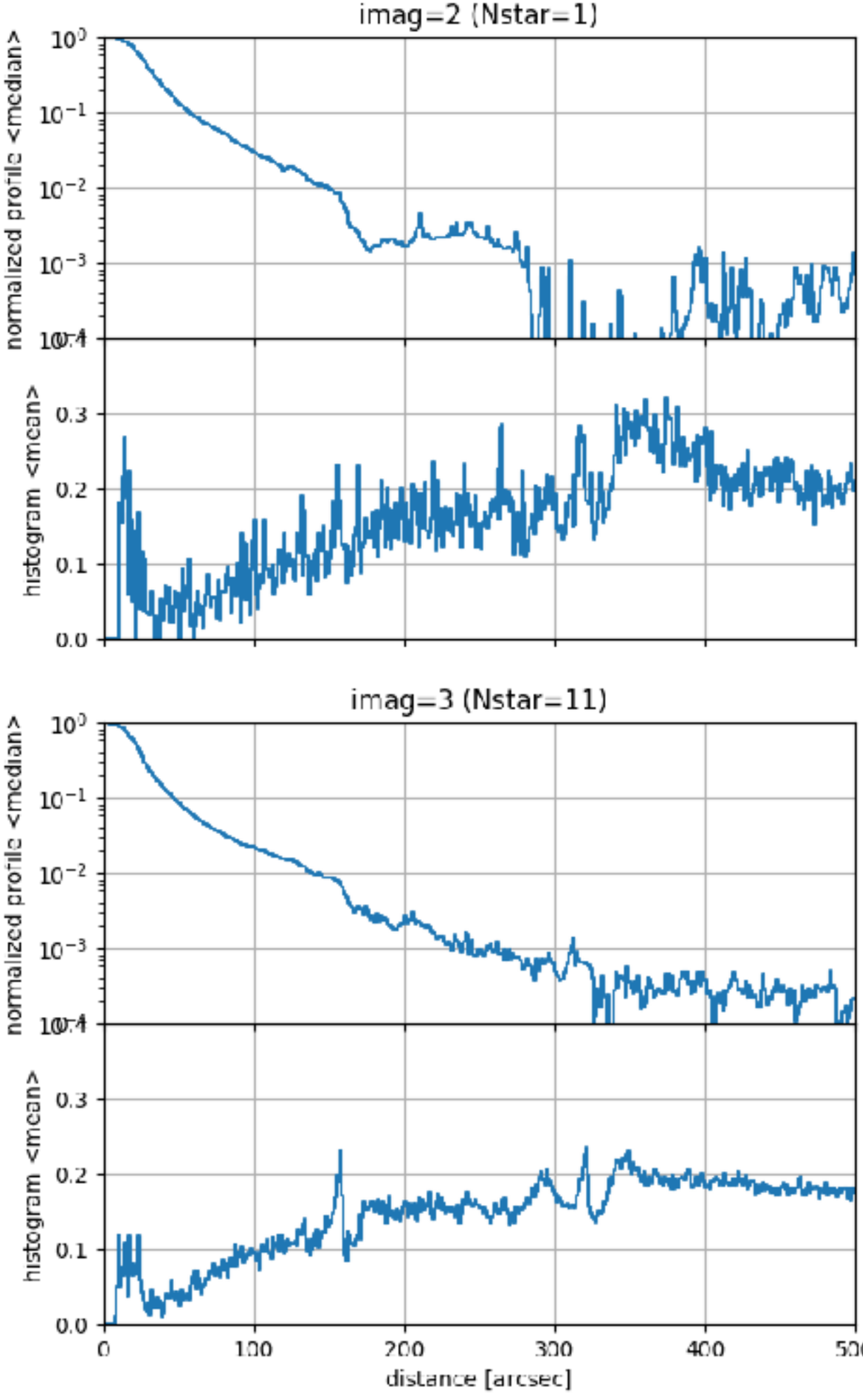
- Input catalog: GAIA DR2 with good photometric data
  - phot_g_mean_flux_over_error > 50 AND phot_bp_mean_flux_over_error > 20 AND phot_rp_mean_flux_over_error > 20 AND phot_bp_rp_excess_factor < 1.3+0.06*power(phot_bp_mean_mag-phot_rp_mean_mag,2) AND phot_bp_rp_excess_factor > 1.0+0.015*power(phot_bp_mean_mag-phot_rp_mean_mag,2)
  - for brighter side (<11 mag): equator regions.
  - for fainter side(>= 11 mag): dud-cosmos, sxds, and deep2 regions.
  - GAIA mags were converted to HSC mags.

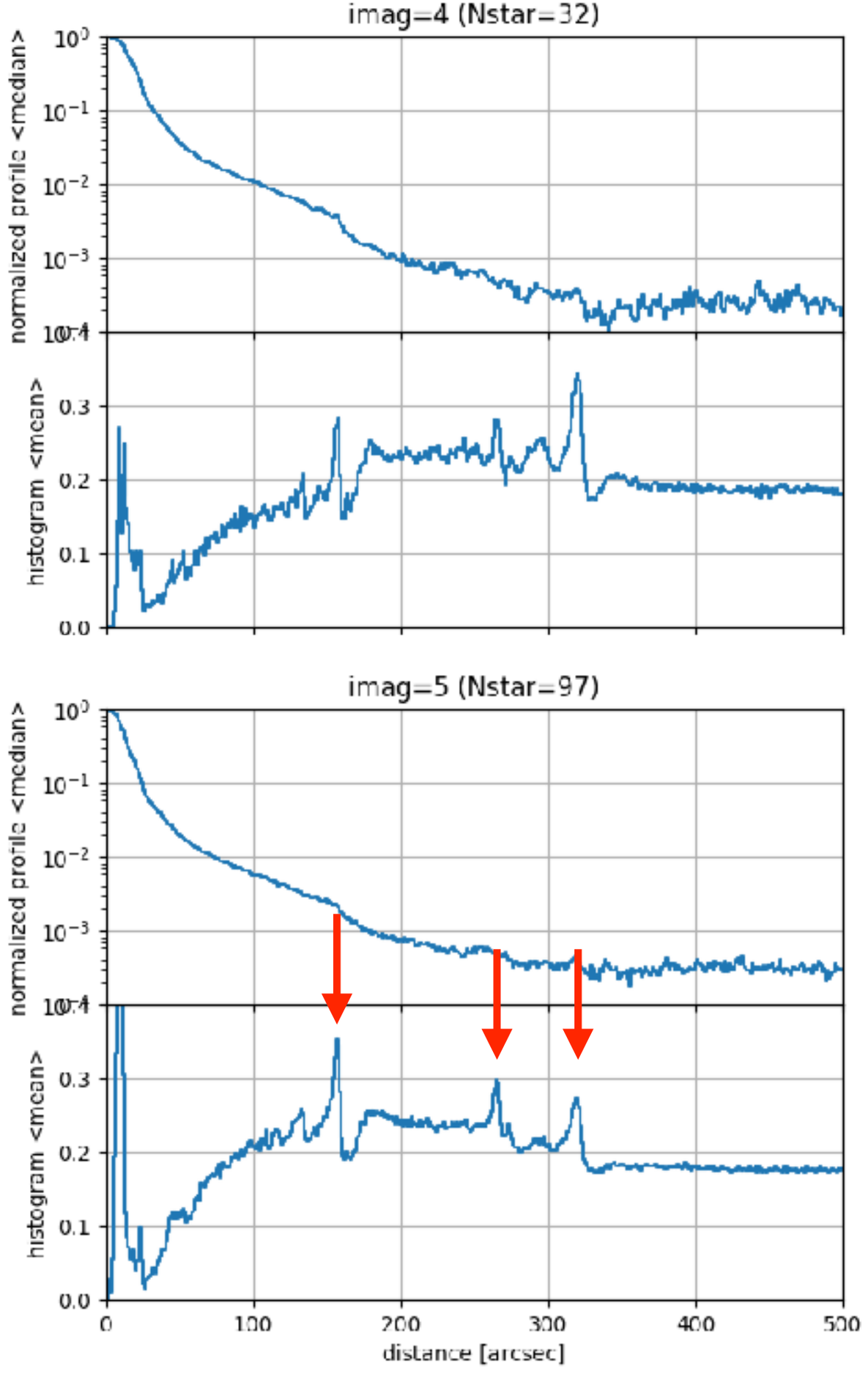
- HSC data
  - **Catalog-based**: to check the distance where false detections arise.
    - Create histograms (dN/dr vs r) of the number of detected sources around the GAIA star.
    - Take mean values for magnitudes between x and x+1.
  - **Image-based**: to check the "halo" size.
    - Make radial profile (normalized at central value).
    - Take median values for magnitudes between x and x+1.
  - Saturation trail and(or?) muxbleed are not yet considered.

Results

- The histograms settle to ~0.2 at large distance.
  - The settle distance is closer with fainter sources.
  - This distance will be the mask size.

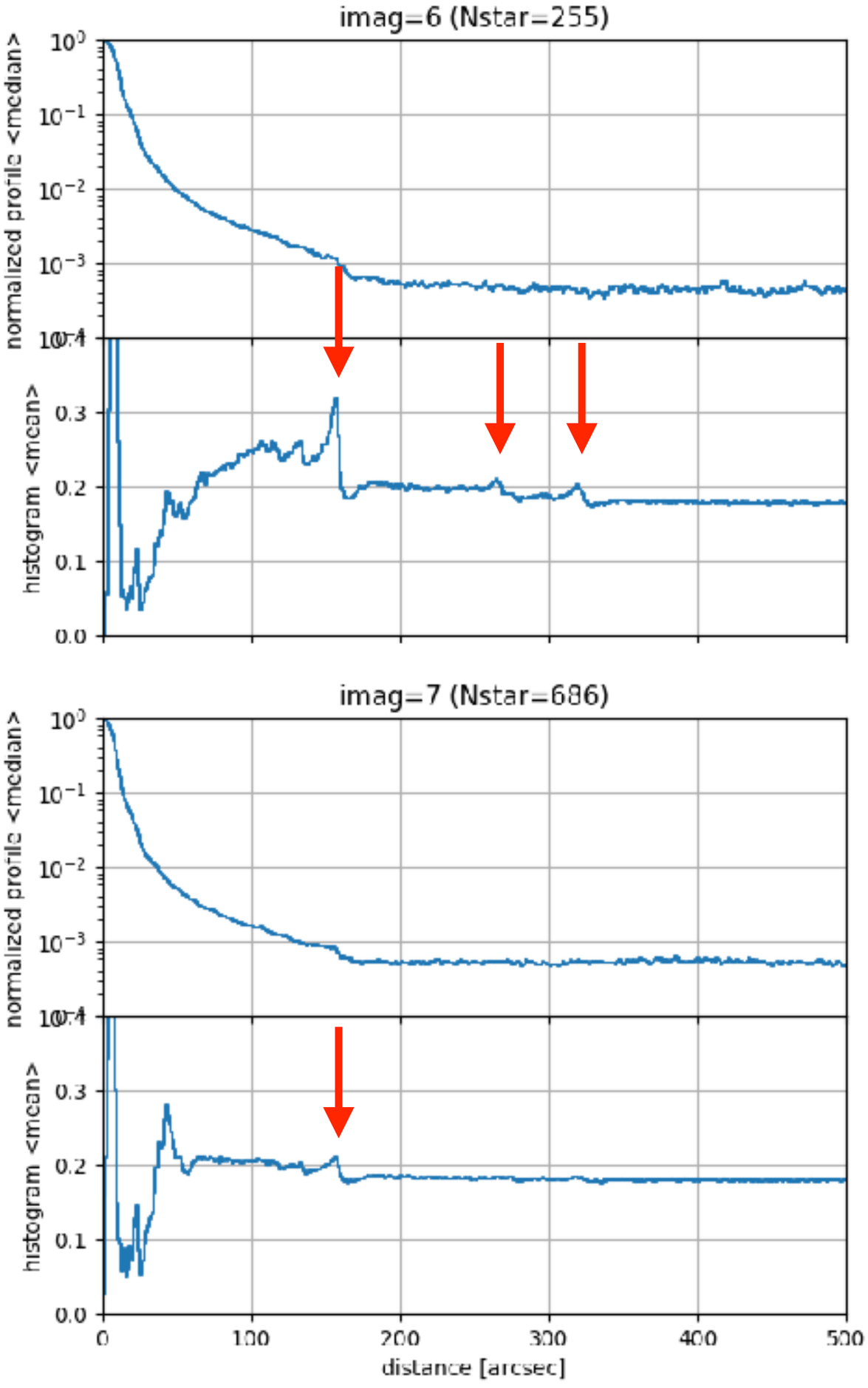
- Bright (<= 7 mag) sources have a feature at 160 arcsec, for both the histogram and radial profile. This distance does not depend on magnitudes; it is thought to be caused by optics.
- Much brighter (<= 6 mag) sources have additional features at 260 and 320 arcsec. They may be the same cause.
  - For bright sources, we should make additional "halo" mask with 350 arcsec radius at maximum.

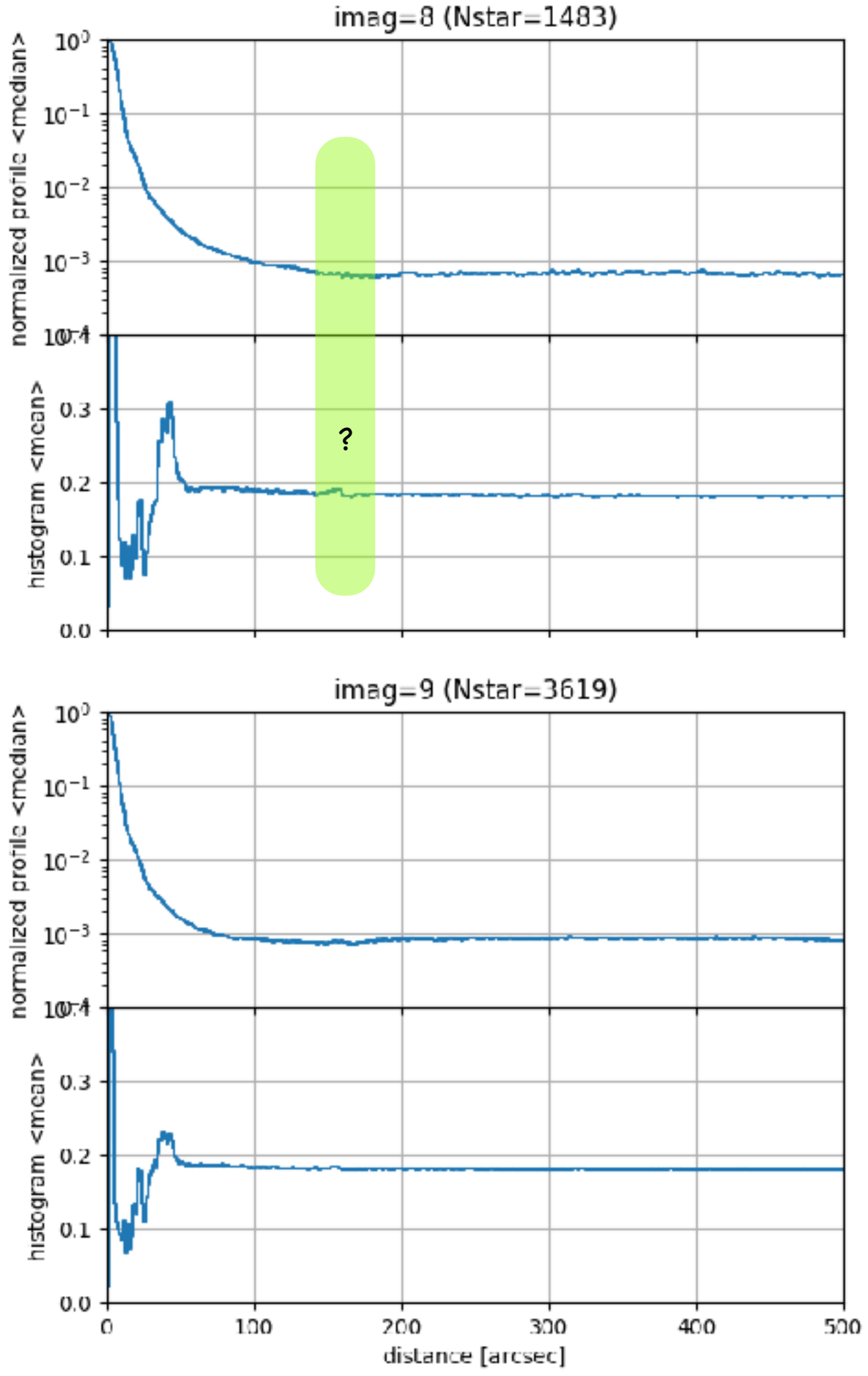

imag=2 (Nstar=1)
normalized profile <median>
histogram <mean>


imag=4 (Nstar=32)
normalized profile <median>
histogram <mean>

imag=3 (Nstar=11)
normalized profile <median>
histogram <mean>
distance [arcsec]

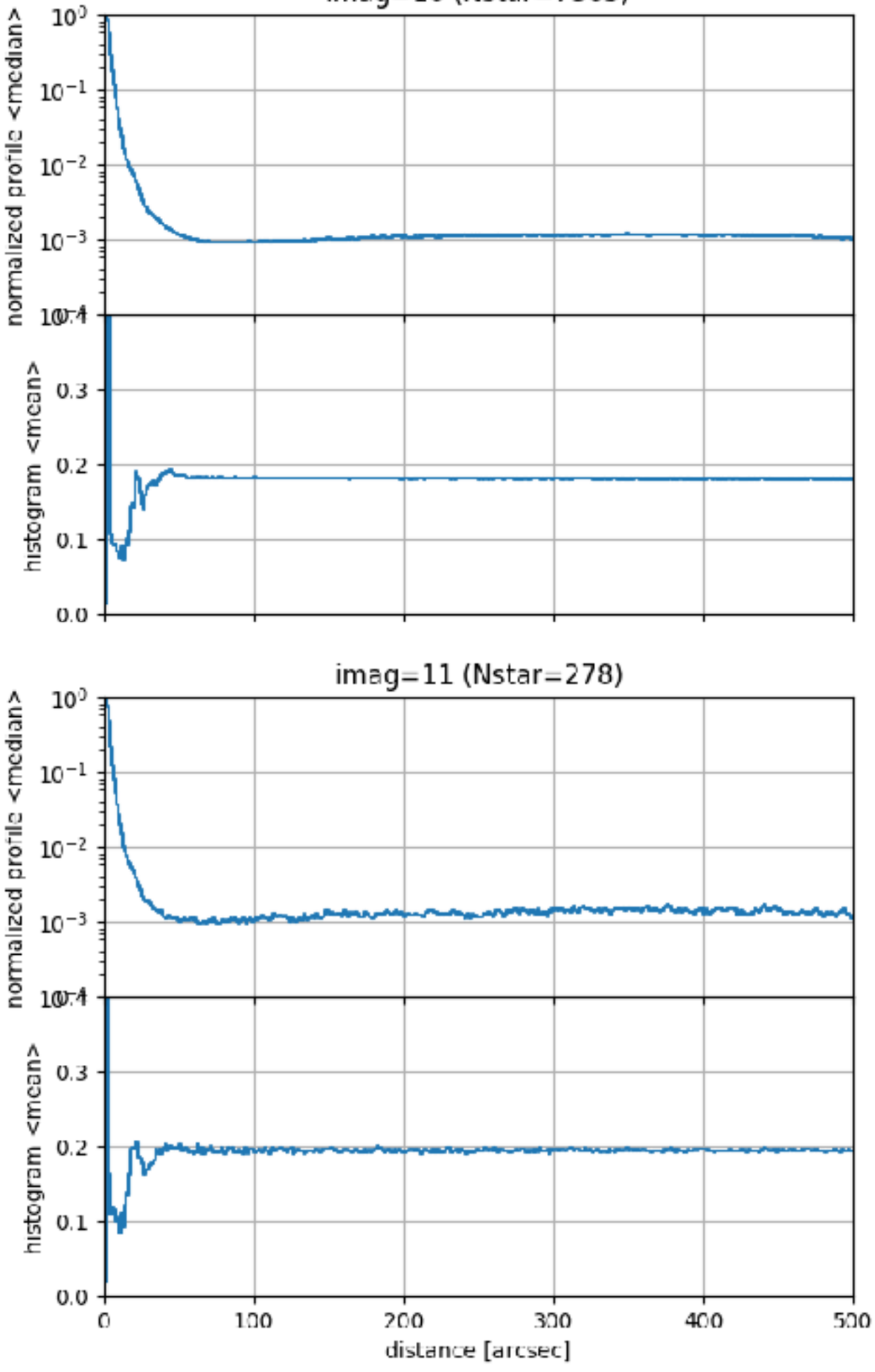
imag=5 (Nstar=97)
normalized profile <median>
histogram <mean>
distance [arcsec]

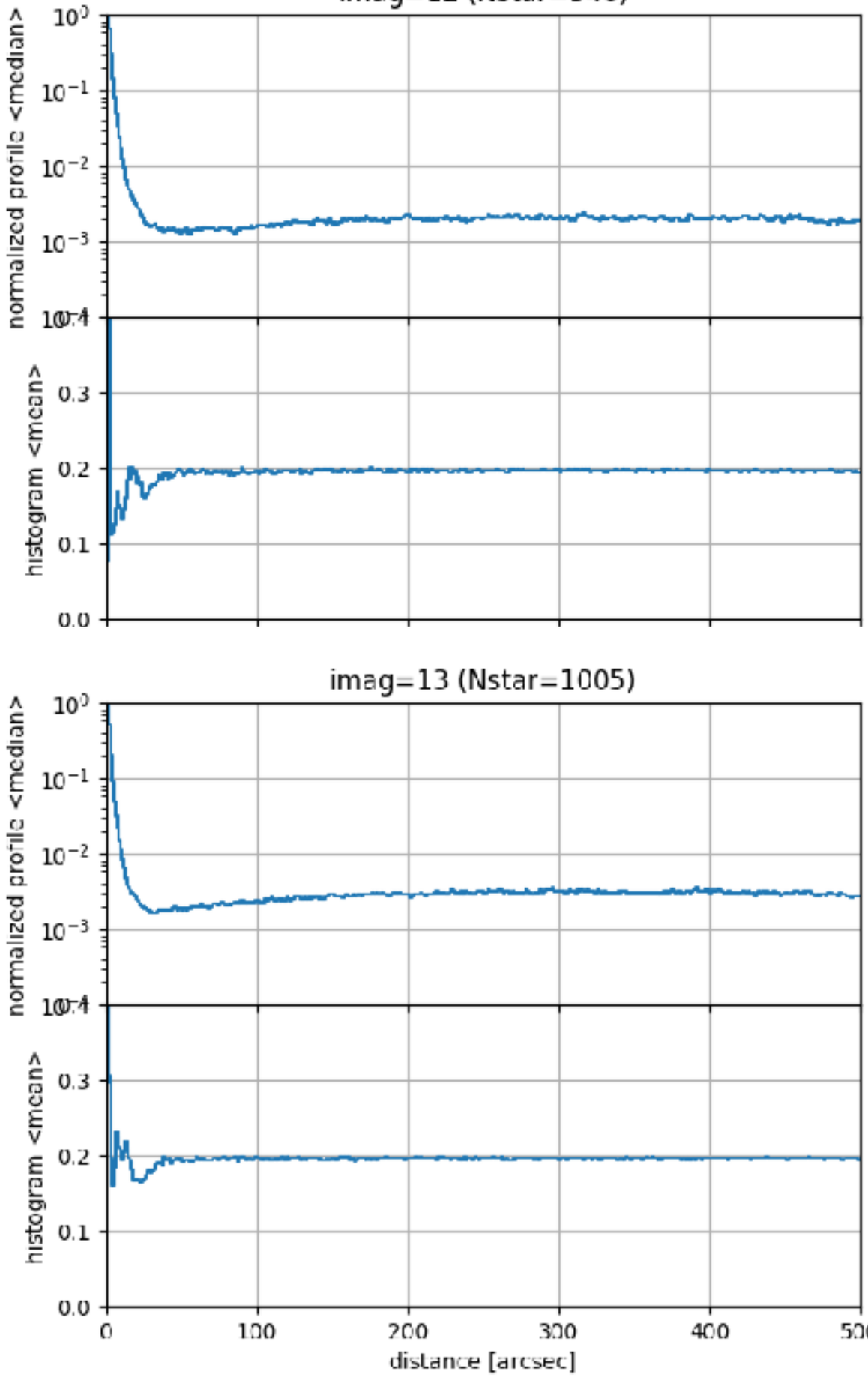

imag=6 (Nstar=255)
normalized profile <median>
histogram <mean>
distance [arcsec]


imag=8 (Nstar=1483)
?
normalized profile <median>
histogram <mean>
distance [arcsec]

imag=7 (Nstar=686)
normalized profile <median>
histogram <mean>
distance [arcsec]

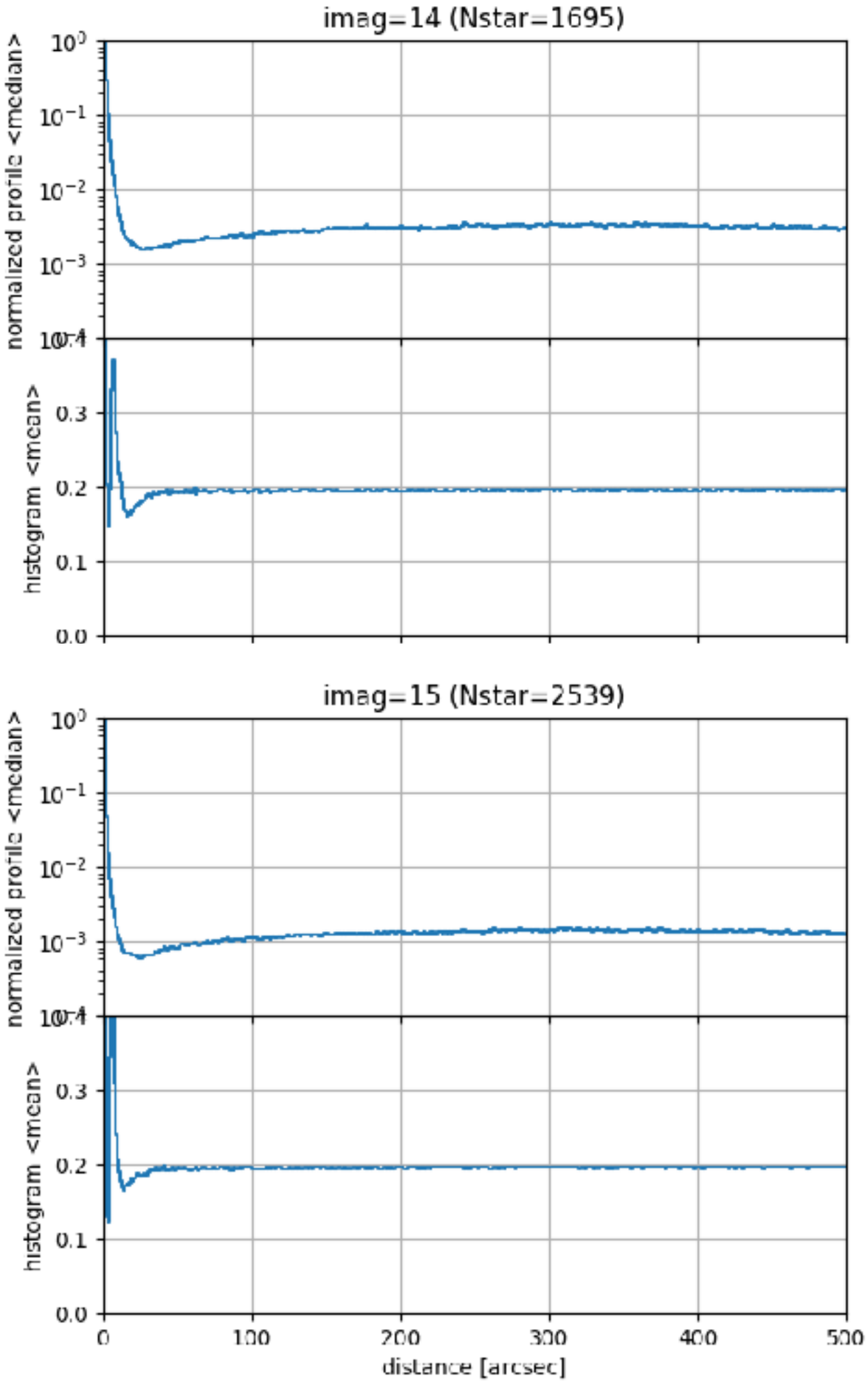
imag=9 (Nstar=3619)
normalized profile <median>
histogram <mean>
distance [arcsec]

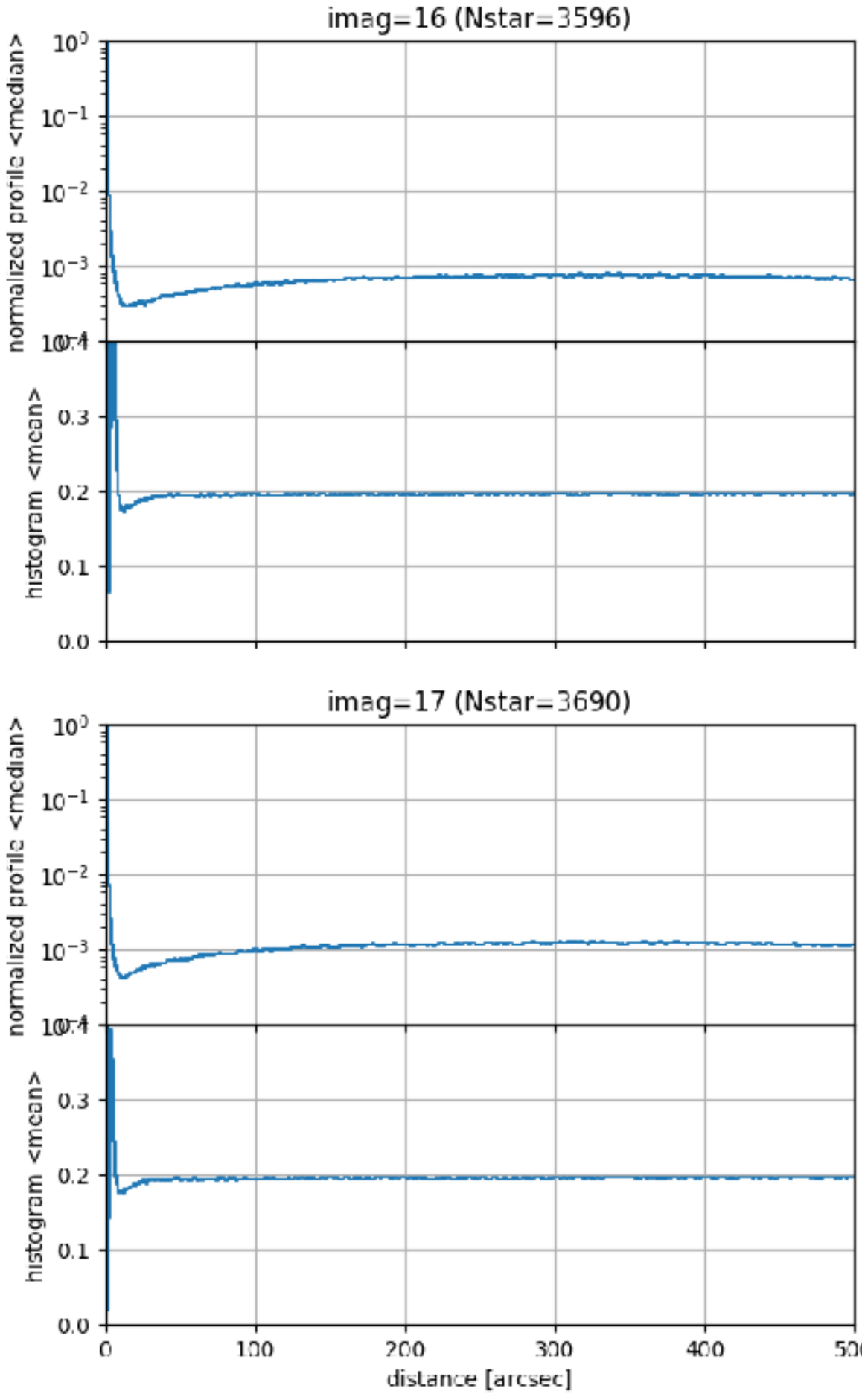

imag=10 (Nstar=7363)
normalized profile <median>
histogram <mean>


imag=12 (Nstar=546)
normalized profile <median>
histogram <mean>

imag=11 (Nstar=278)
normalized profile <median>
histogram <mean>
distance [arcsec]

imag=13 (Nstar=1005)
normalized profile <median>
histogram <mean>
distance [arcsec]


imag=14 (Nstar=1695)
normalized profile <median>
histogram <mean>

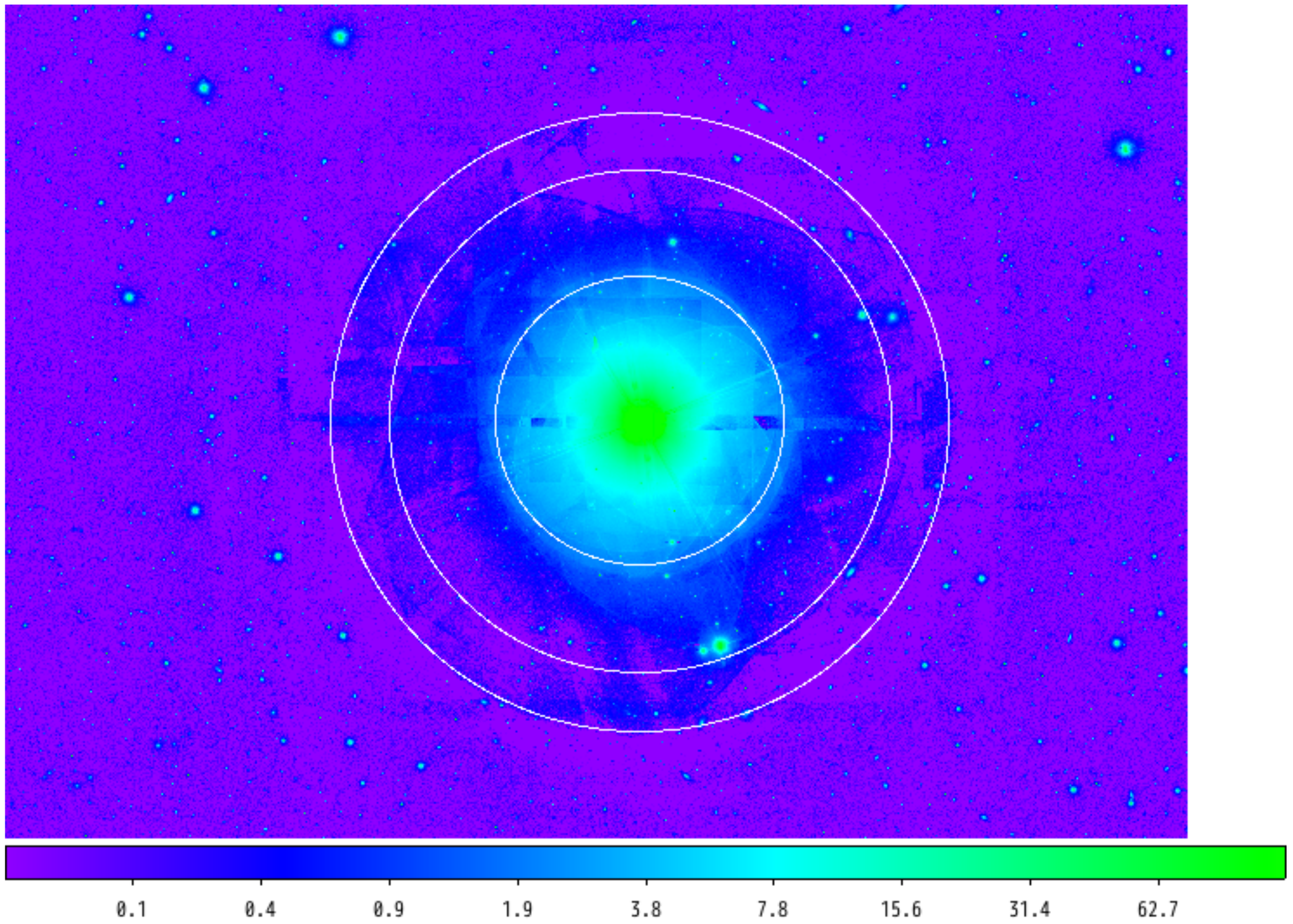

imag=16 (Nstar=3596)
normalized profile <median>
histogram <mean>

imag=15 (Nstar=2539)
normalized profile <median>
histogram <mean>
distance [arcsec]

imag=17 (Nstar=3690)
normalized profile <median>
histogram <mean>
distance [arcsec]

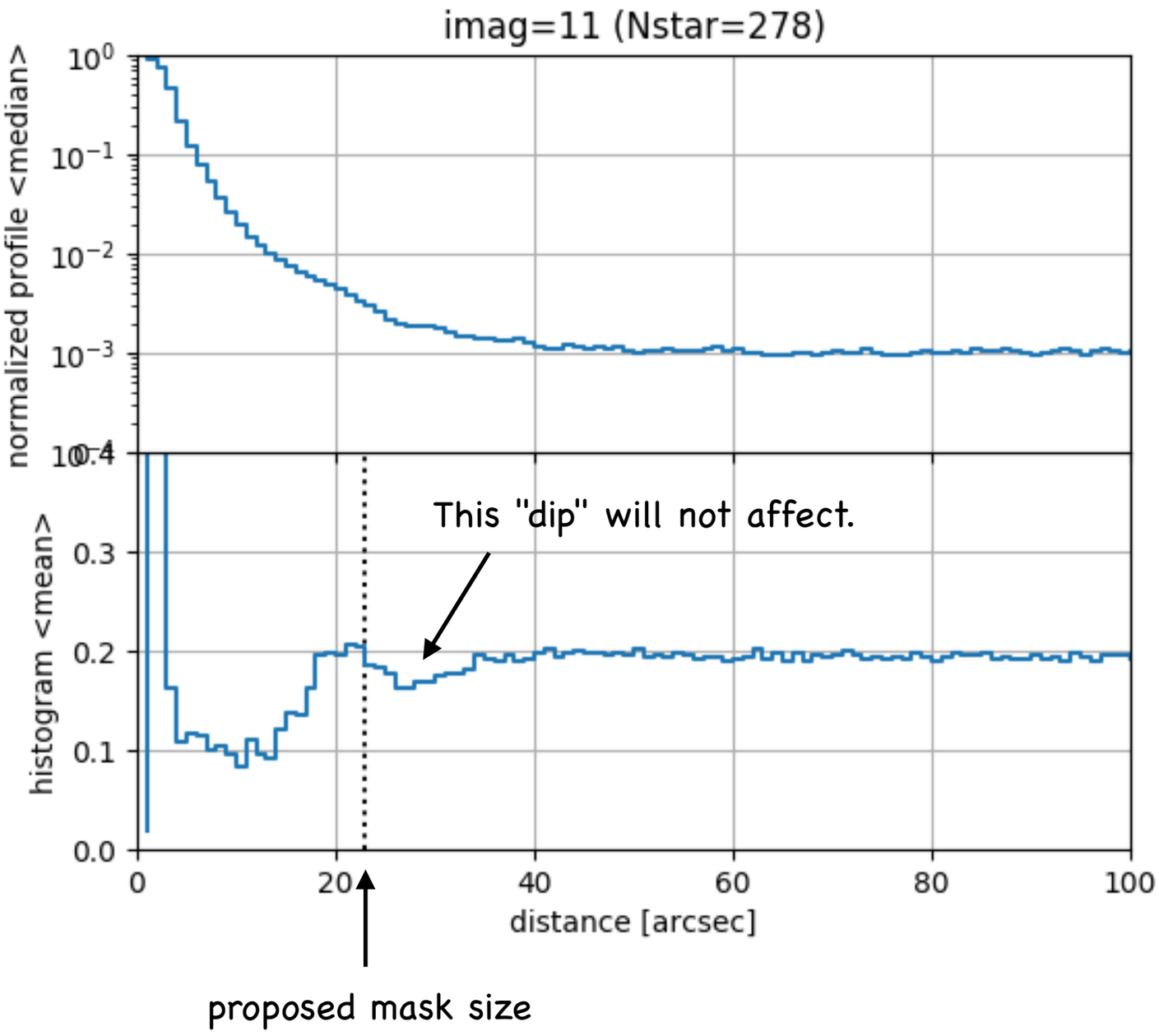
imag = 3 source

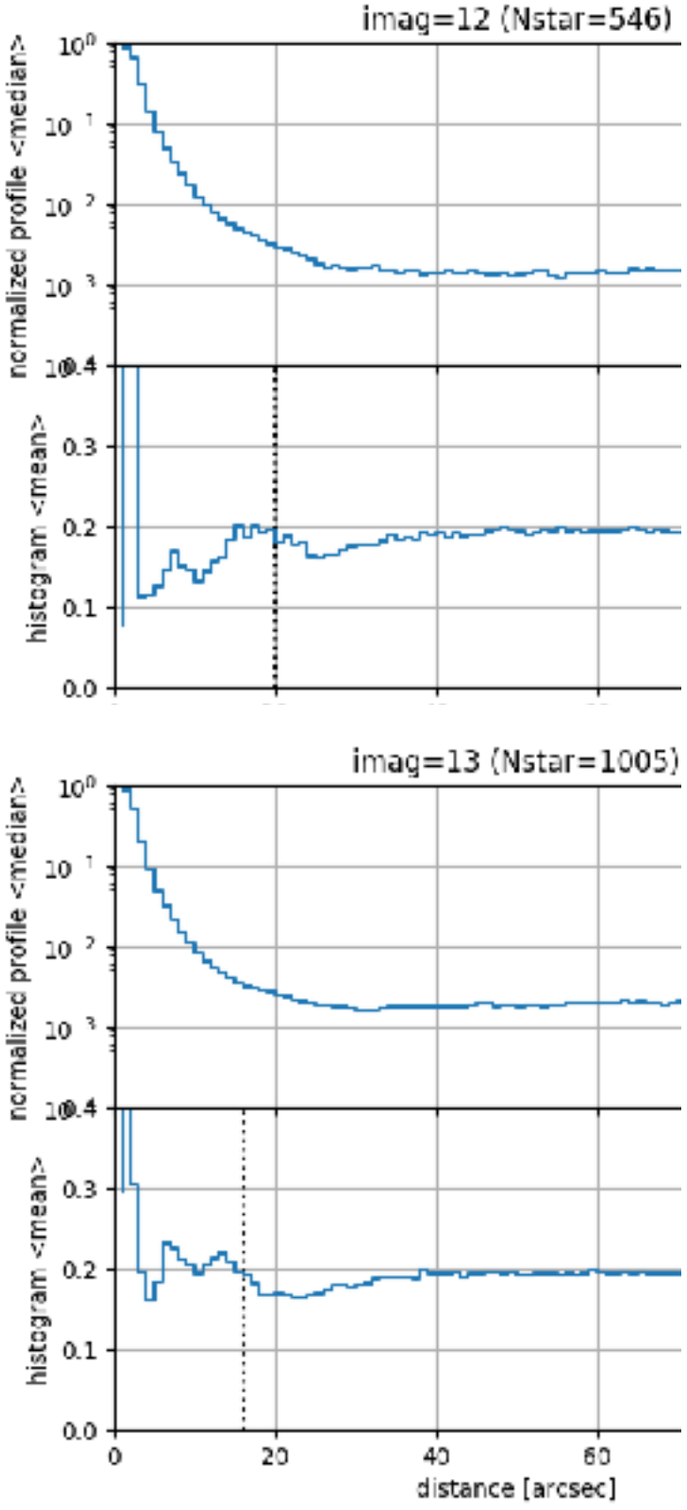
circle radii are 150, 260, and 320 arcsecs.

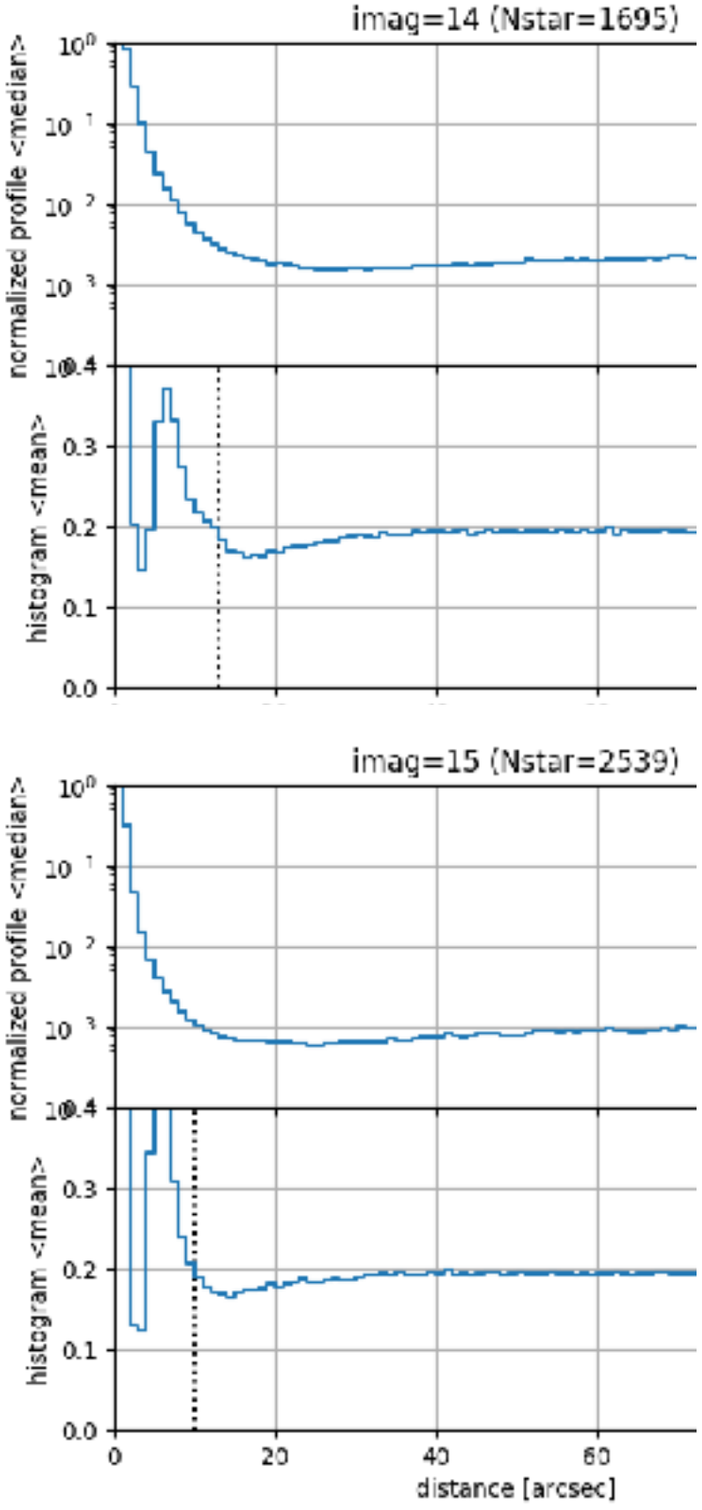


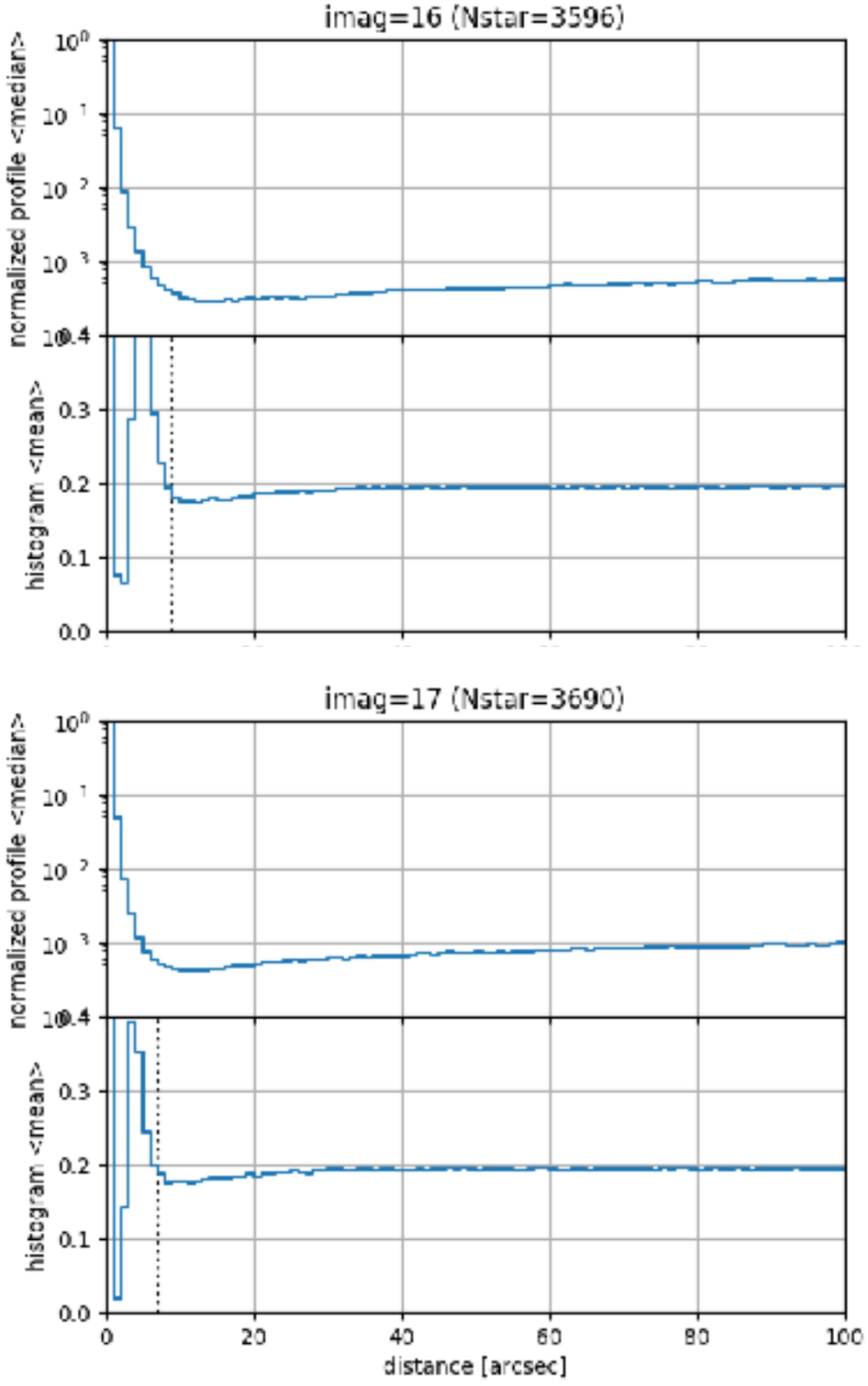
the 320 arcsec radius is a little bit smaller to mask the "halo".

Close-up of the inner region




imag=12 (Nstar=546)
normalized profile <median>
histogram <mean>


imag=14 (Nstar=1695)
normalized profile <median>
histogram <mean>


imag=16 (Nstar=3596)
normalized profile <median>
histogram <mean>

imag=13 (Nstar=1005)
normalized profile <median>
histogram <mean>
distance [arcsec]

imag=15 (Nstar=2539)
normalized profile <median>
histogram <mean>
distance [arcsec]

imag=17 (Nstar=3690)
normalized profile <median>
histogram <mean>
distance [arcsec]

Cosmos region
10055-0,1

red circle: bright star mask
black circle: "halo" mask

<=11 mag sources
need larger mask
or "halo" mask?

-0.044 0.0013 0.093 0.27 0.64 1.4 2.8 5.7 11