

APPENDIX

Here are some supplementary notes:

- Fig. S1. The slightly tilted trends in the DeepDrill panels may be due to calibration differences for extended sources and also exist in other work (e.g., Nyland et al. 2017). The small “antenna-shaped” structures in the VIDEO panels, where the original magnitudes are higher than *The Tractor* magnitudes for some faint sources, are mainly composed of sources around bright stars, and we attribute much of these source fluxes to the backgrounds contributed by the adjacent stars. The degree to which the plots appear to “funnel” out in the faint regime depends on the detection significance thresholds of the original catalogs as well as the total number of plotted sources (or the plotting settings). For example, the original ESIS catalog has a relatively higher threshold and fewer sources, and thus the noise of the ESIS panels is less.
- DES DR2 outliers. DES outliers are selected by comparing VIDEO ZY and DES zy magnitudes (see Footnote 7). Fig. S1 further shows that *The Tractor* magnitudes of these outliers also deviate from the corresponding DES magnitudes in all the DES bands, and thus we suggest applying the DES outlier flags to all the DES bands. Although many of these outliers present clearly saturated images (i.e., with trapezoidal brightness profiles), the others do not show abnormal images. The actual causes for these outliers, however, are still unclear.

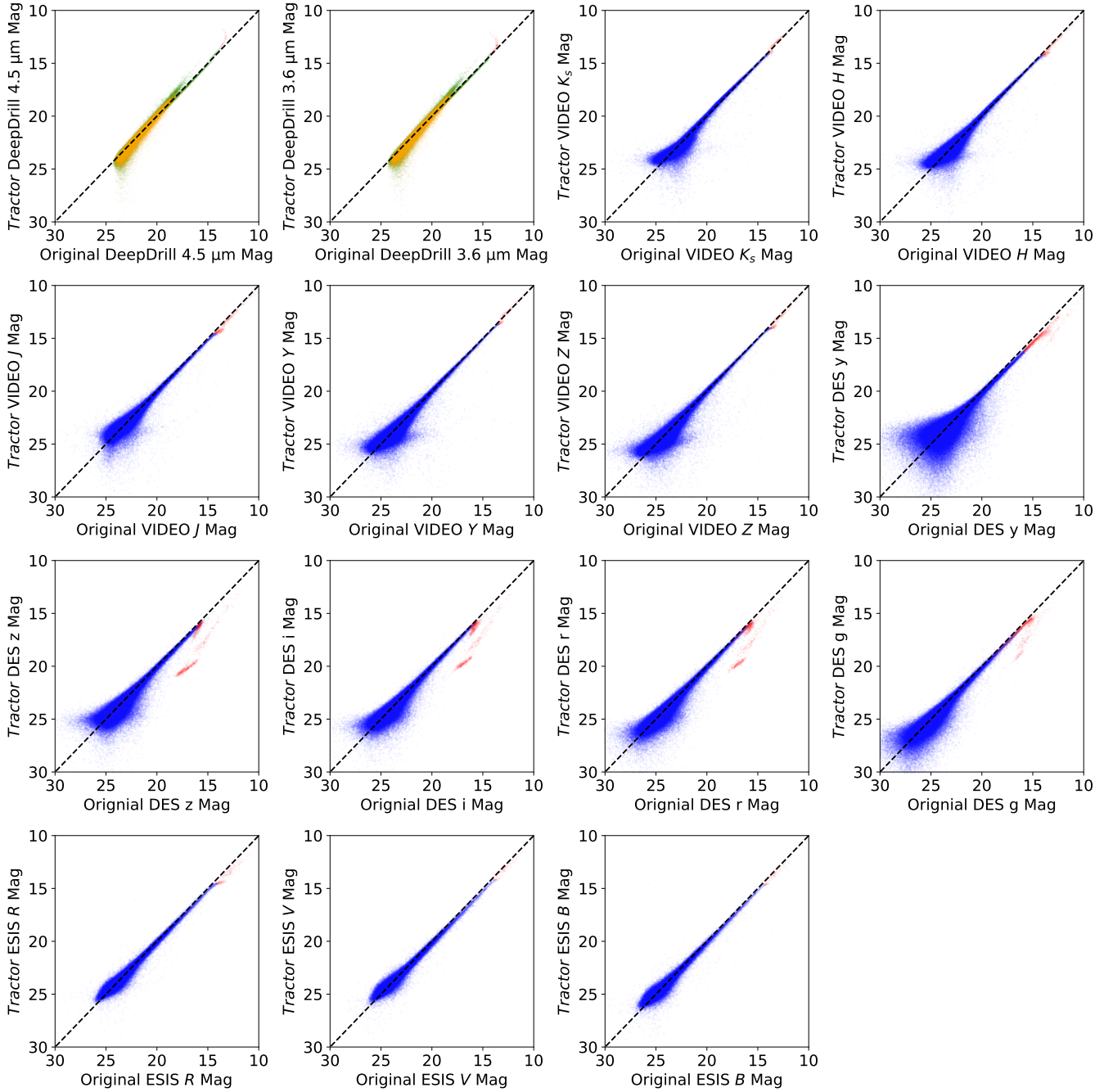


Figure S1. Comparison between *The Tractor* photometry and original AB photometry for all the bands except *u* band, which only has available images but does not have an original catalog. The black dashed lines mark one-to-one relations. The red points are flagged sources. For DeepDrill, the orange points are possibly blended sources (i.e., nearest-neighbor separations $< 3.8''$), and the green points are other sources, which are less likely to suffer from blending issues. The original magnitudes used for comparisons here are aperture-corrected magnitudes within an aperture of radius = $1.9''$ for DeepDrill, Petrosian magnitudes for VIDEO, and MAG_AUTO magnitudes for DES and ESIS.

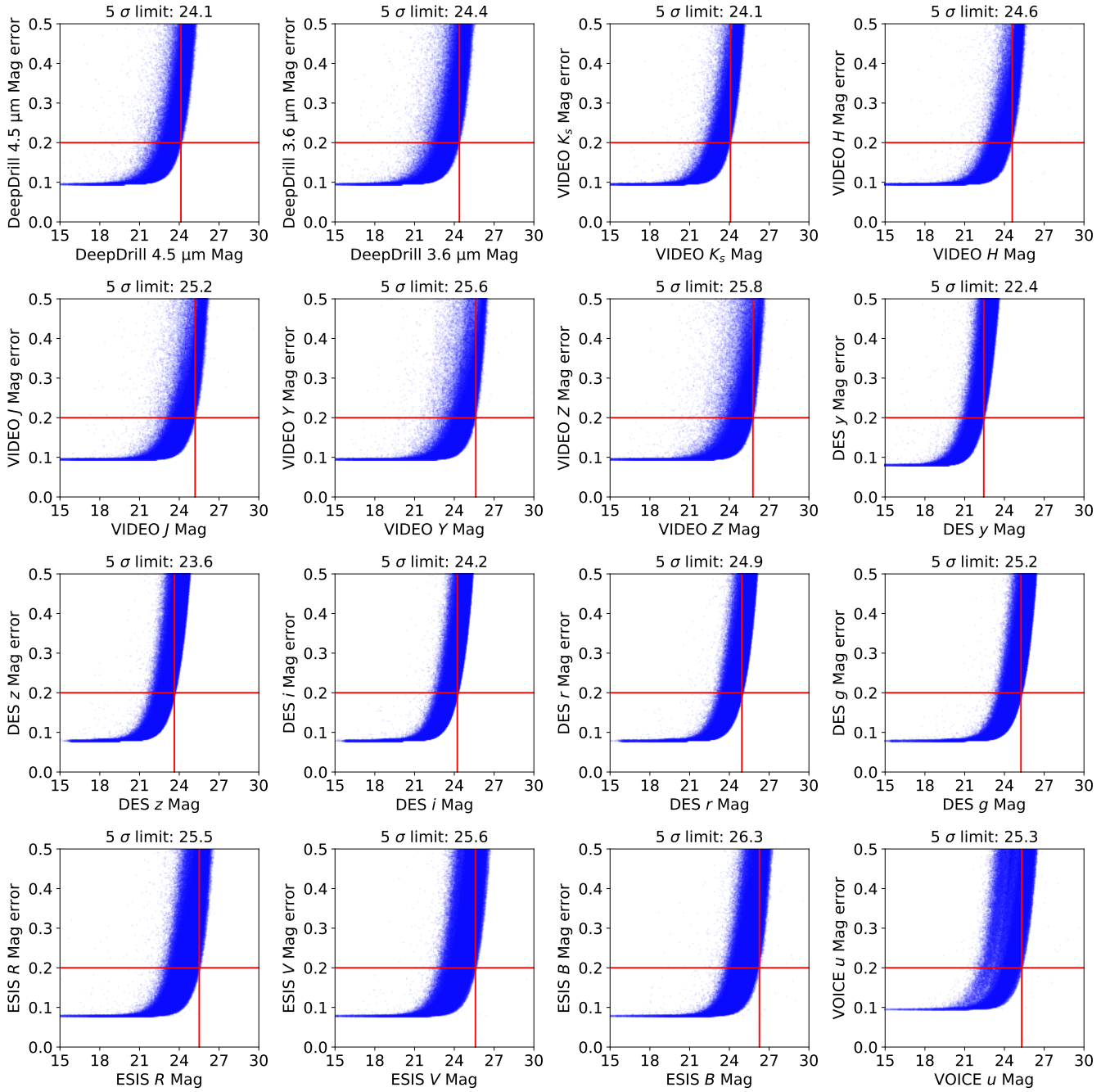


Figure S2. *The Tractor* magnitude errors versus AB magnitudes. The red lines mark the 5σ limits, where the errors are 0.2, and the limits are displayed as the titles. Note that the actual limits vary among different regions in the field for non-uniform surveys (e.g., the u band of the VOICE survey, whose exposure time varies across the whole field), and the limits quoted here only refer to the deepest regions.

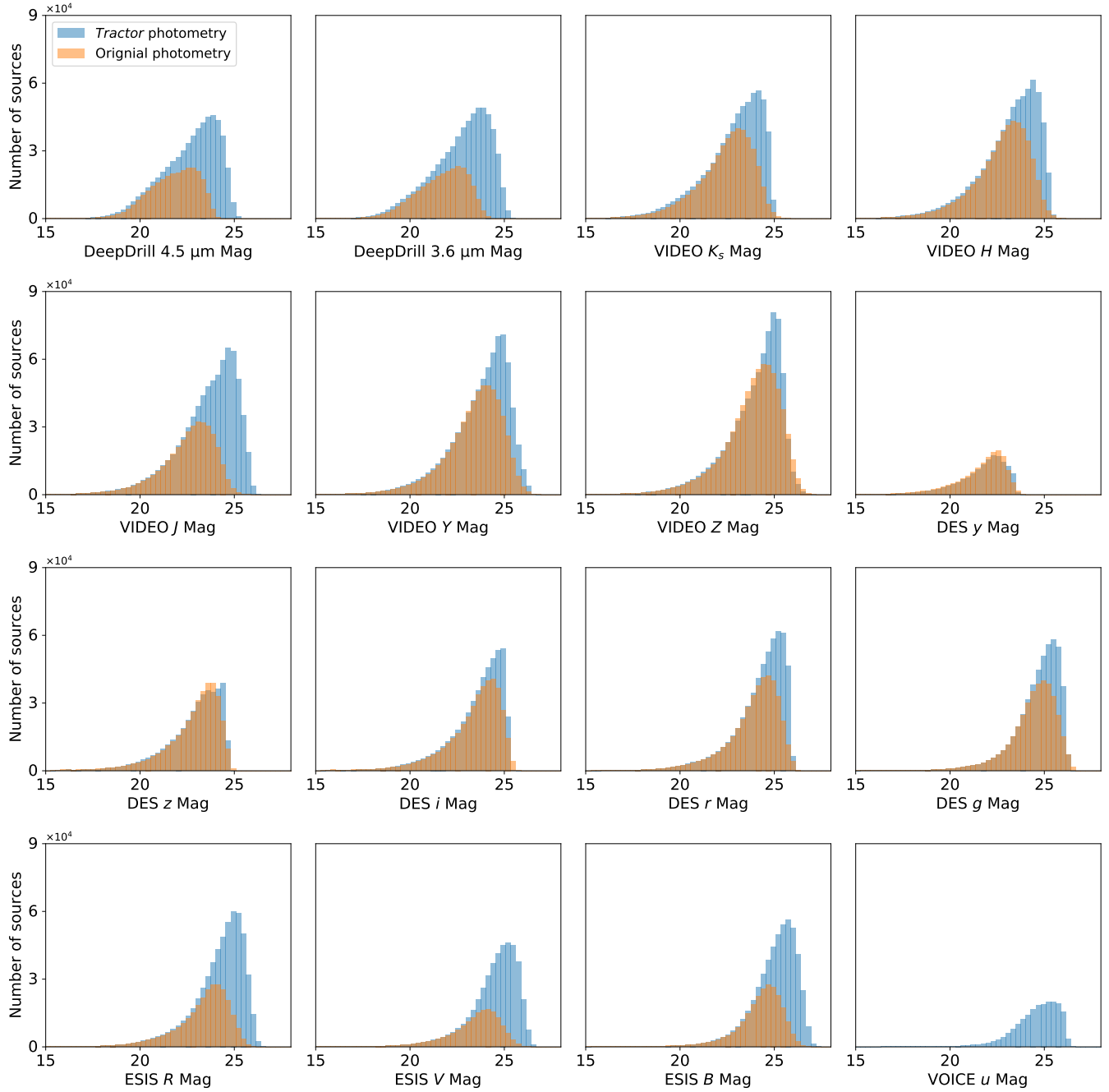


Figure S3. Magnitude distributions for our catalog from *The Tractor* and original catalogs in each band. Only sources with magnitude errors smaller than 0.54 are shown, where the threshold roughly corresponds to signal-to-noise ratios = 2 (e.g., see Eq. 4 in Abbott et al. 2021). No original catalog is available for the VOICE u band.