TRGB Distance to Galaxy NGC 4639

Dr. Adam Batten

Postdoctoral Researcher is Space Situational Awareness and Extragalactic Astrophysics

With Jeremy Mould and Mitchell Dixon

Swinburne University of Technology

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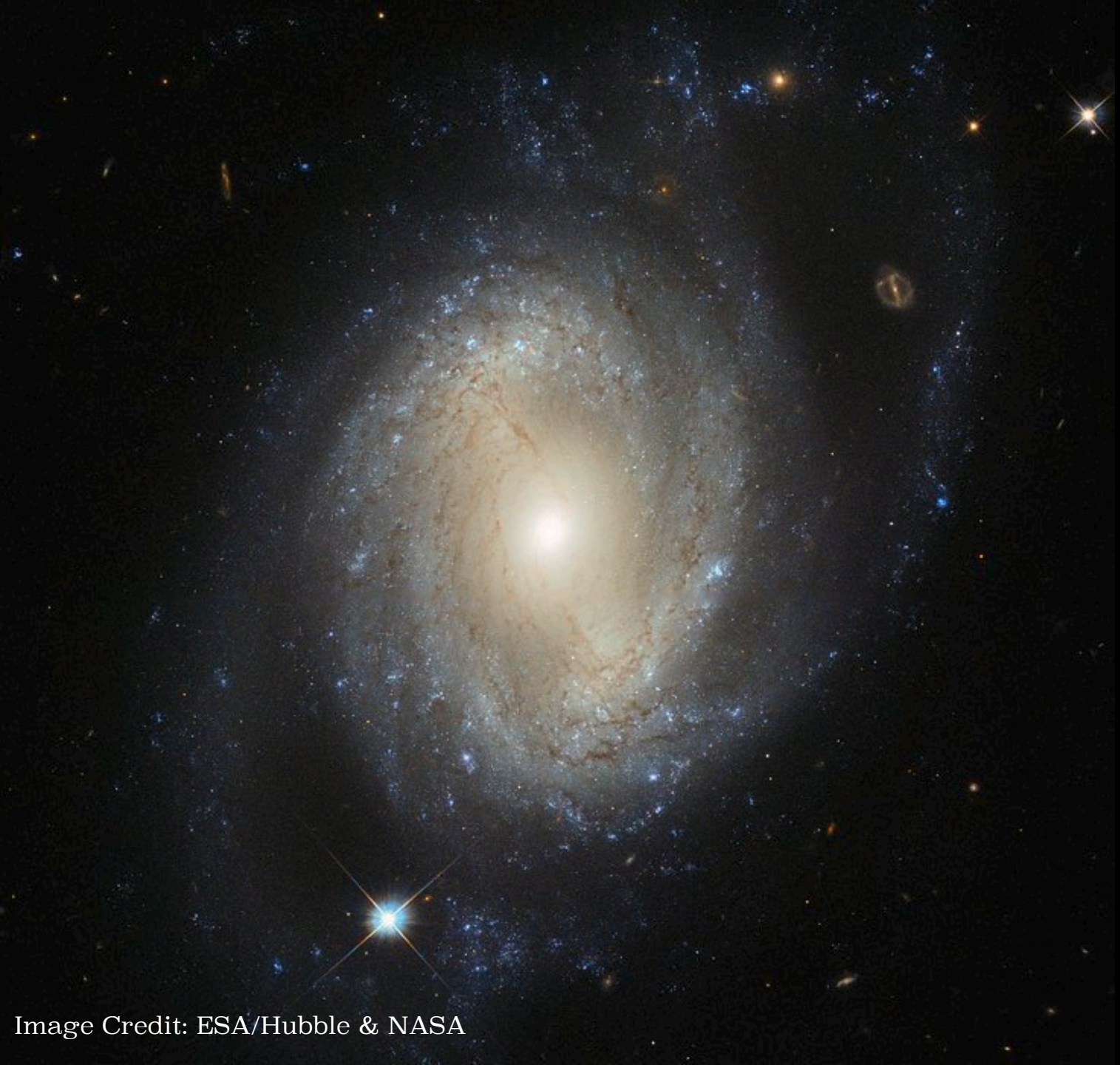

NGC4639

$\mu_{\mathrm{Ceph}} = 31.53$ [(Riess et al. (2016)]

Distance ~ 20.2 Mpc

Image Credit: ESA/Hubble & NASA

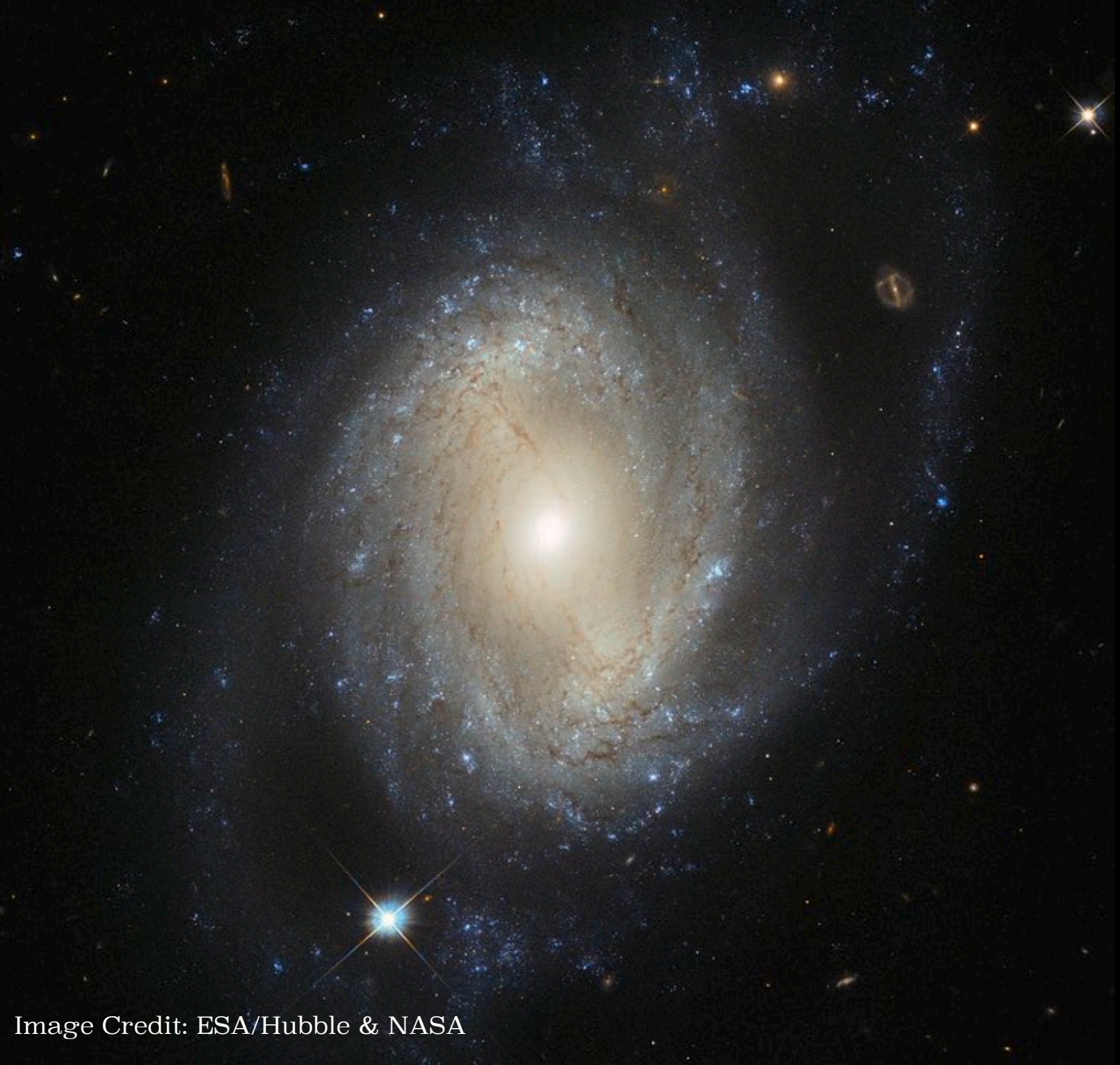

Image Credit: ESA/Hubble & NASA

NGC4639

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Archival HST Data

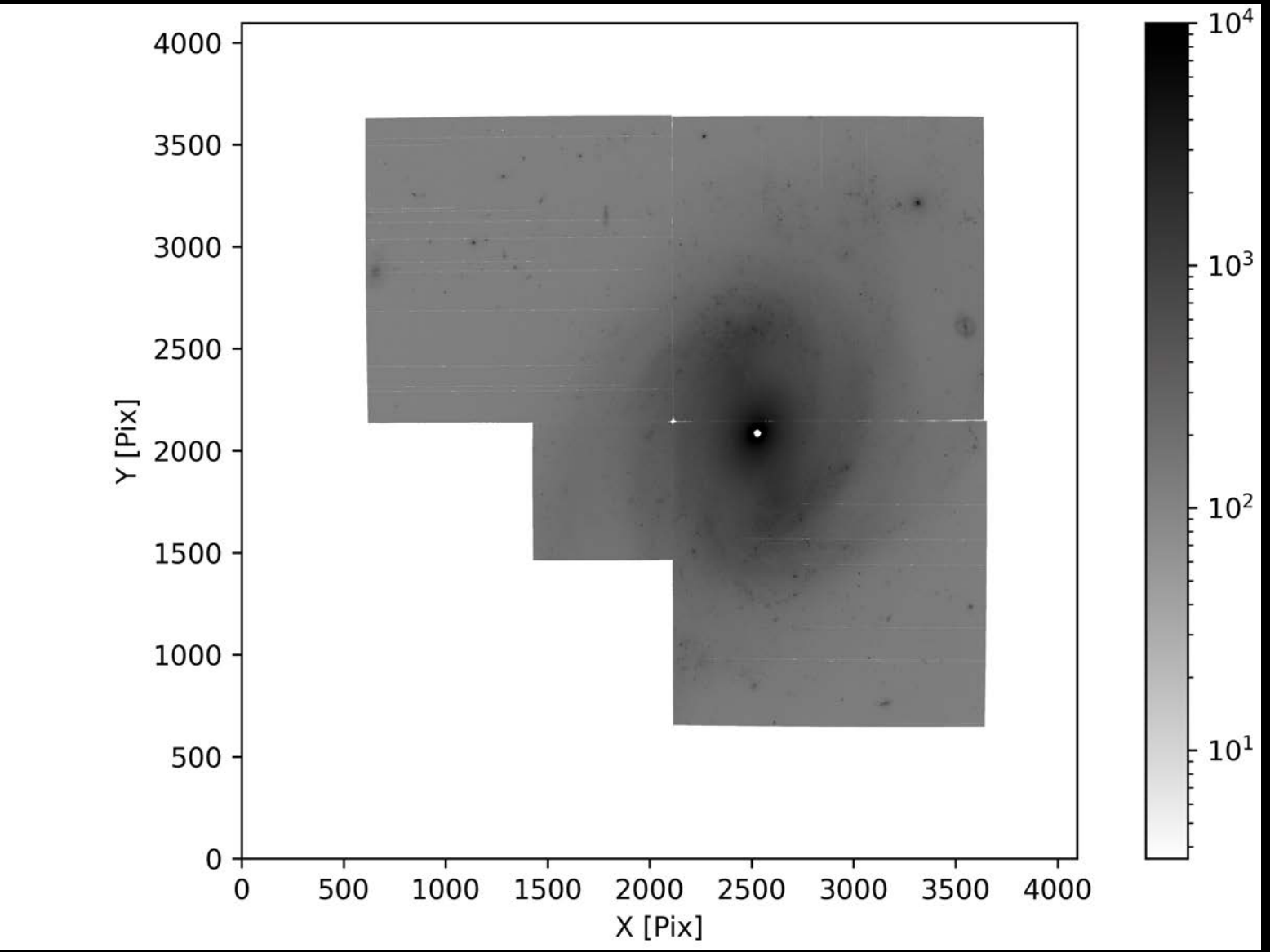
- F555W (V Band)
  - WFPC2
  - Exposures: 96
  - Exp Time: 235200 s

- F814W (I band)
  - WFPC2
  - Exposures: 20
  - Exp Time: 52000 s

- We use DAOPHOT to obtain instrumental magnitudes.

- Convert to Cousins V & I (Hill+1998)

Sample Selection



Instrumental Magnitude Errors:

- F814W Error < 9.000
- F555W Error < 9.000

"Edges Mask"

- Select stars near the edge of the frame in the halo of the galaxy to avoid the crowded stars of the galaxy and AGB stars.

V-I Colour

- -2 < V– I < 4 [Mags]

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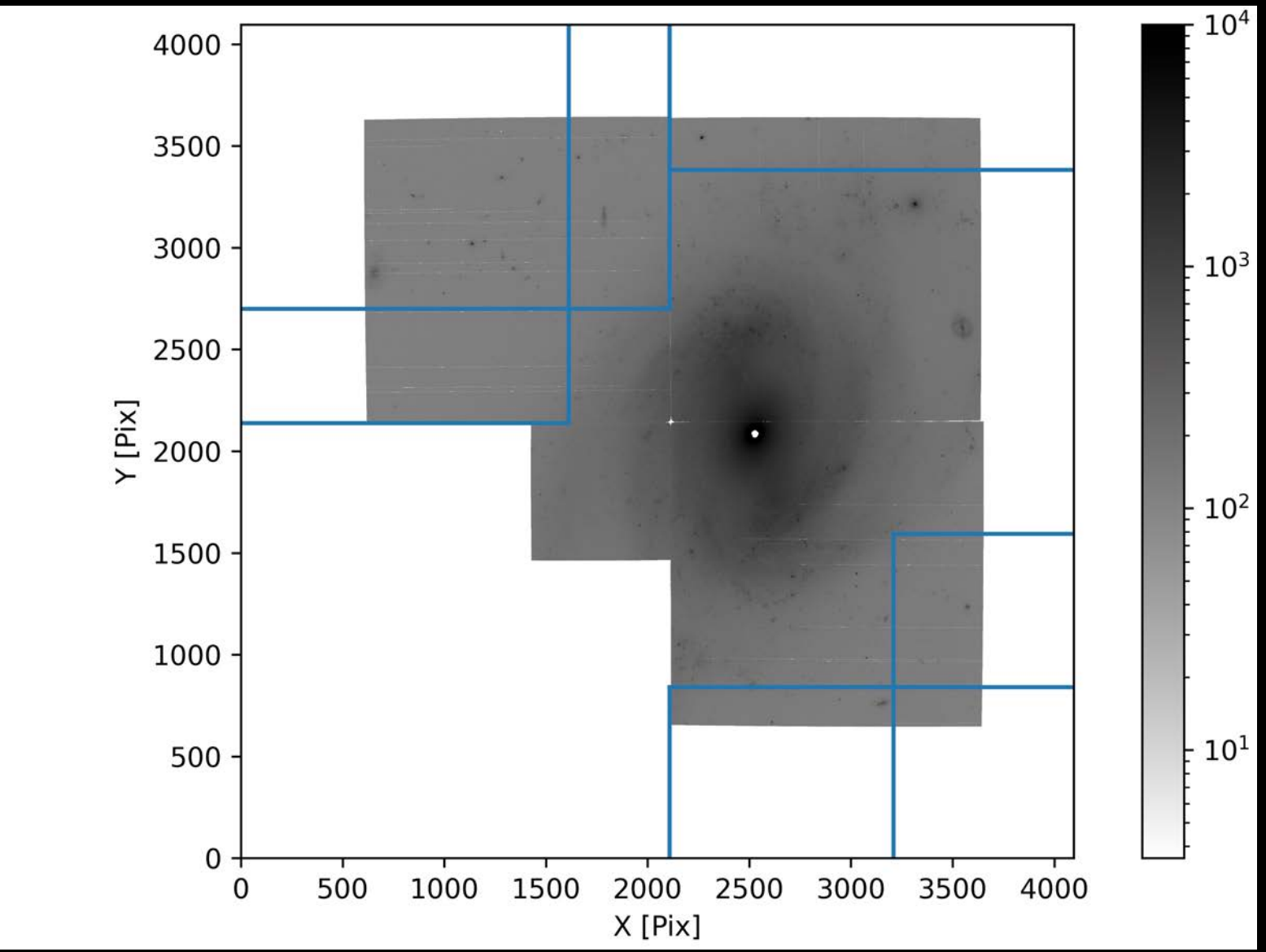

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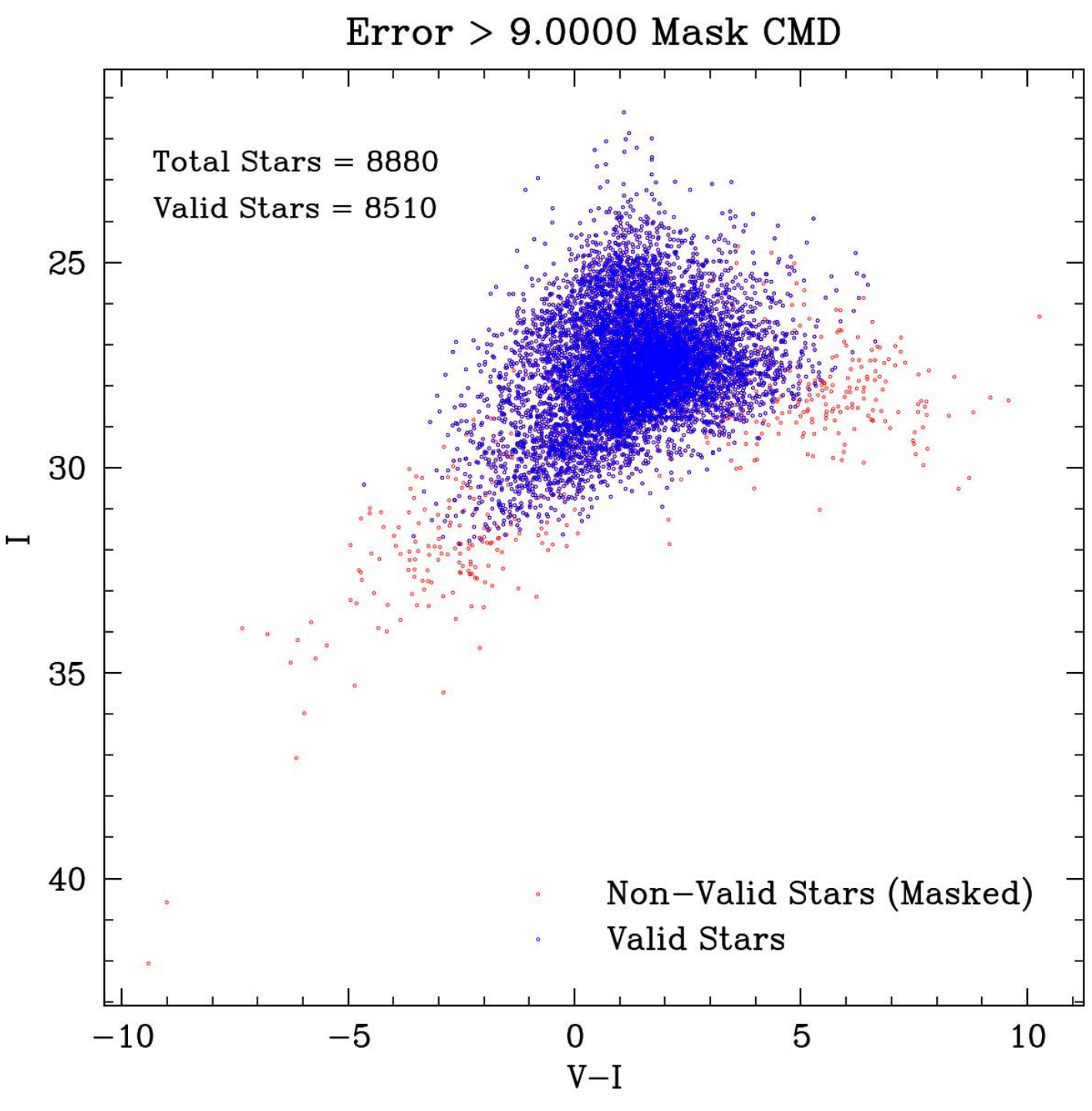

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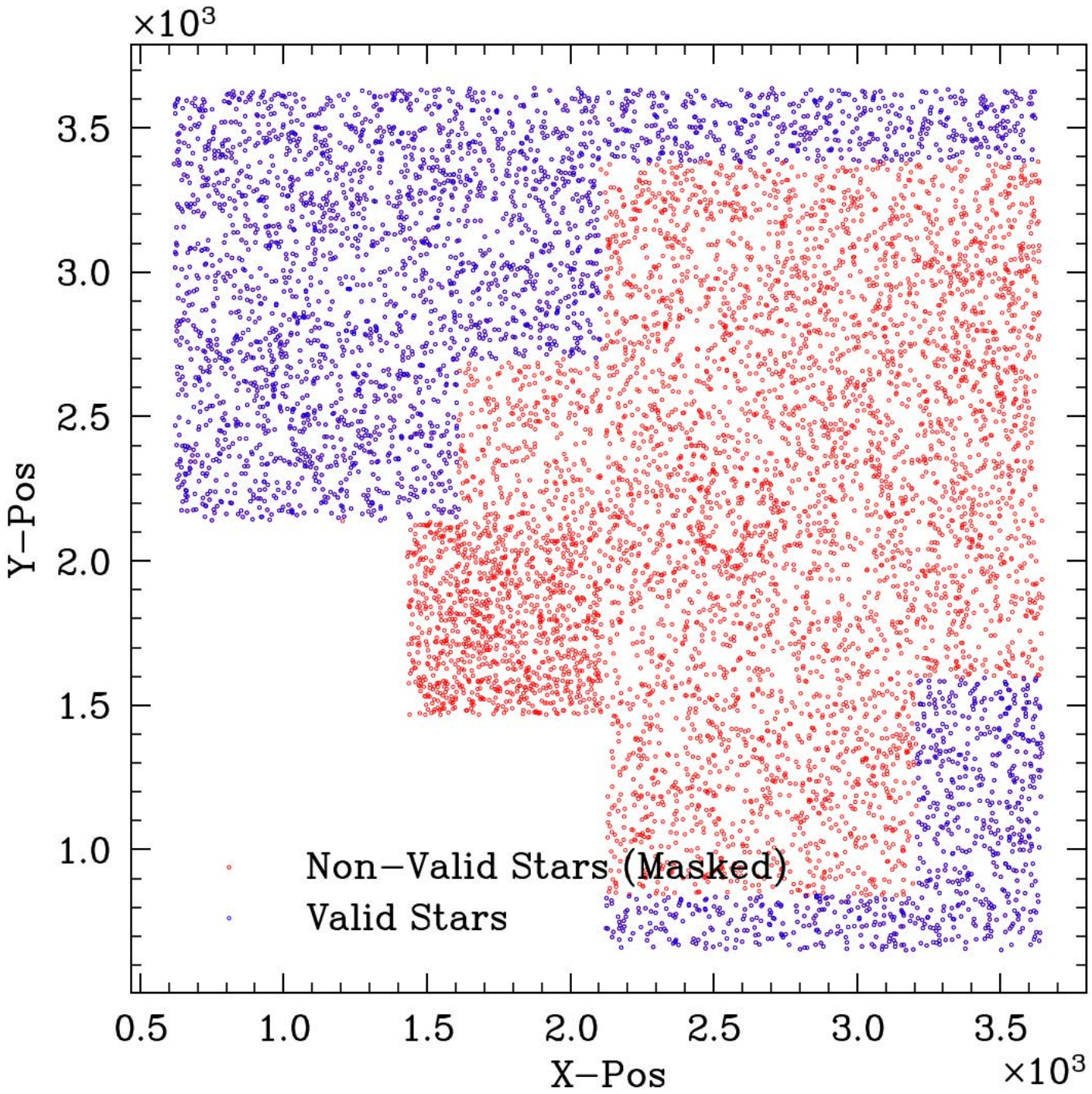

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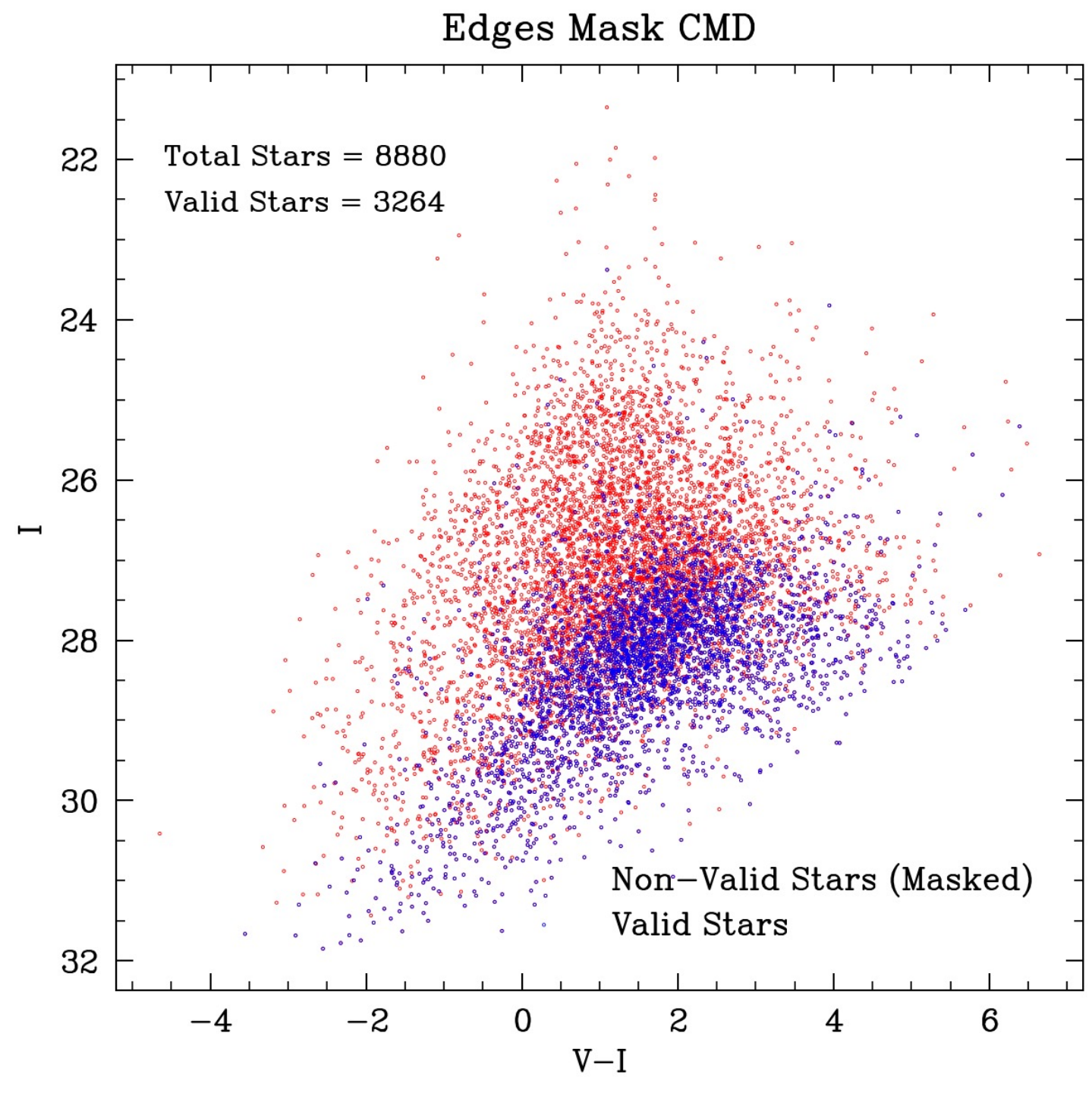

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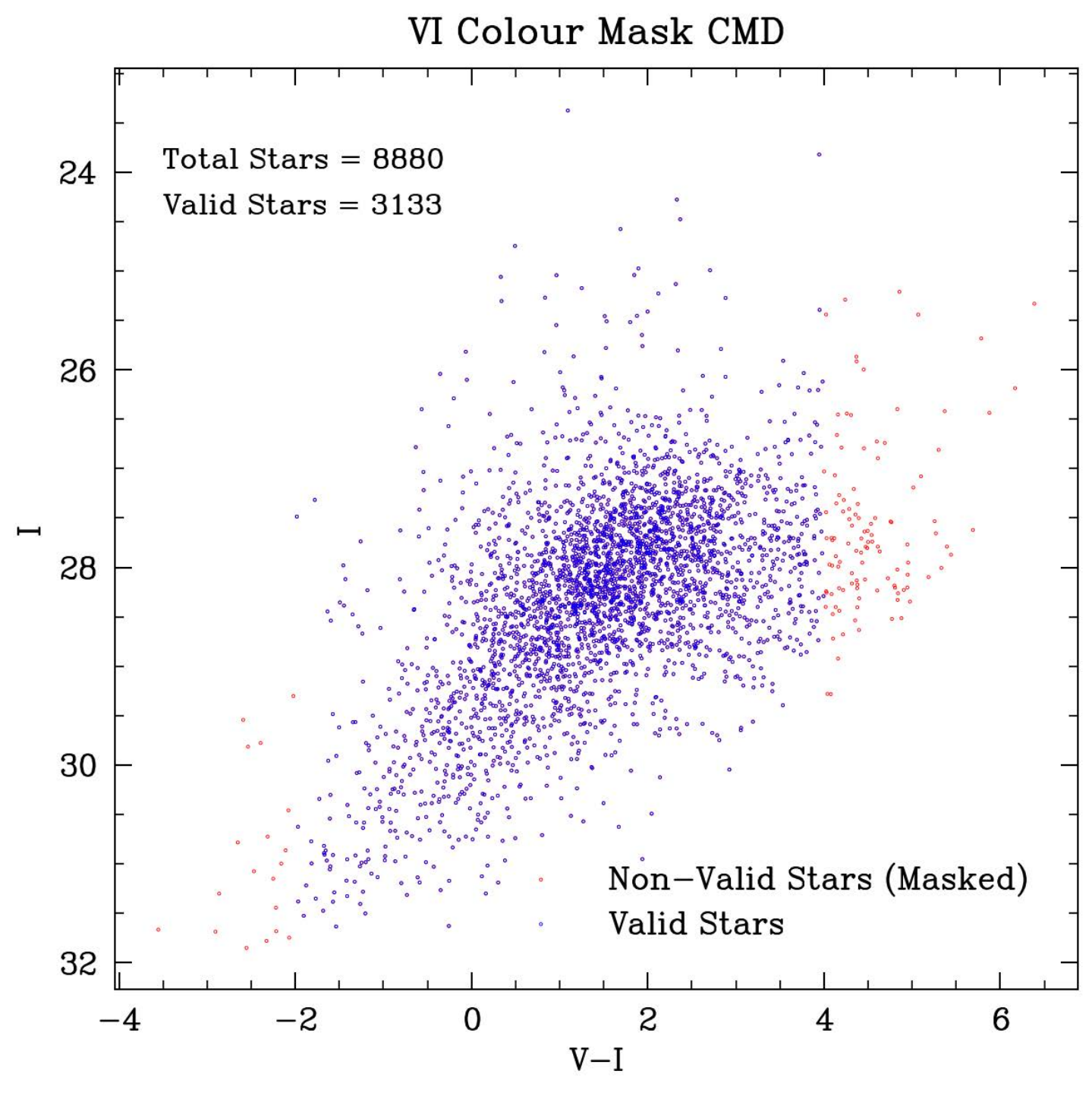

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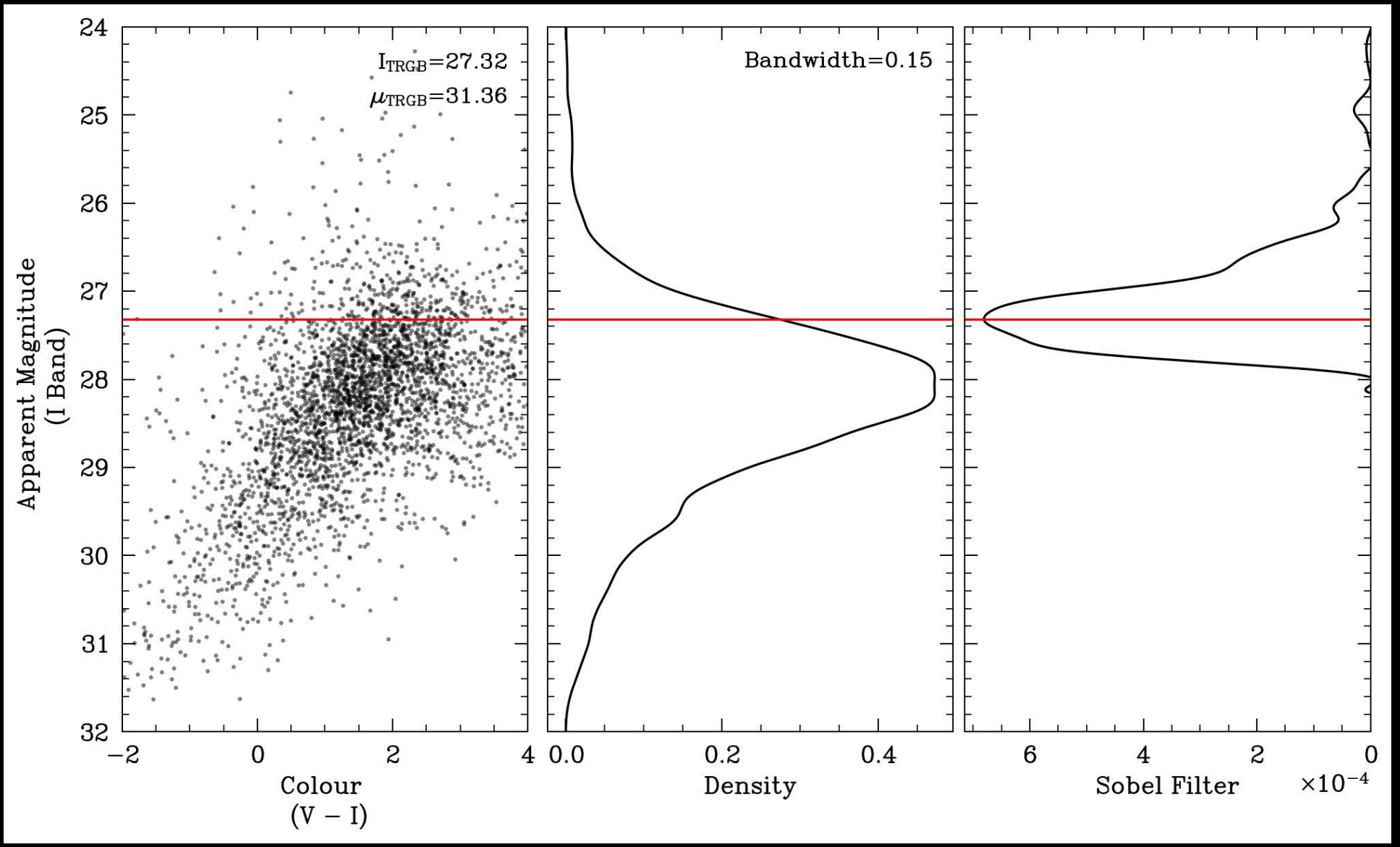
Measured Tip of the Red Giant Branch I_{TRGB}



Measured

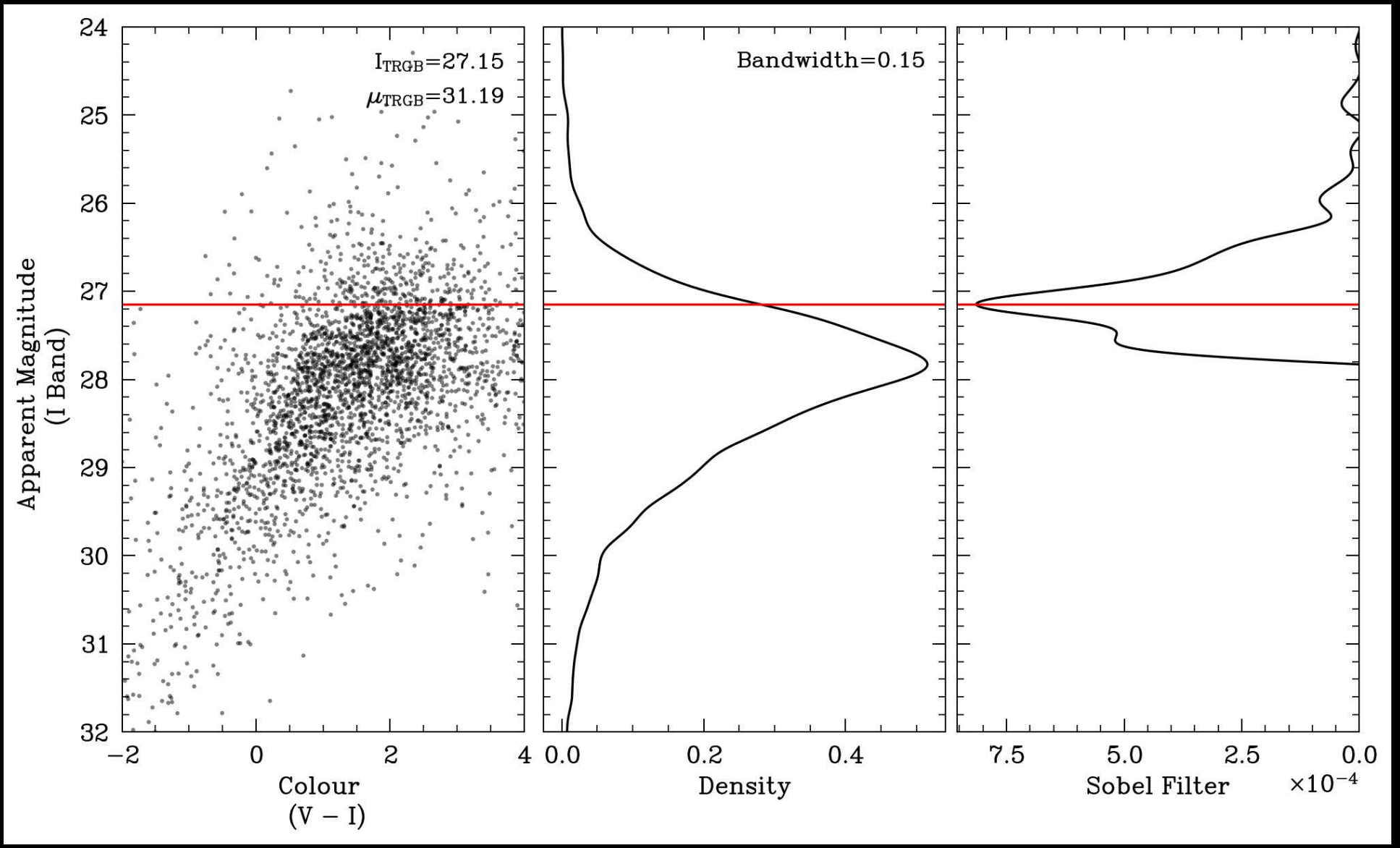
$I_{TRGB} = 27.32$

$\mu_{TRGB} = 31.36$

(Assuming $M_I^{TRGB} = -4.042$)

$\mu_{\mathrm{Ceph}} = 31.53$

Random Gaussian Shift in Instrumental Magnitudes



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$\mu_{TRGB} = 31.36$

(Assuming $M_I^{TRGB} = -4.042$)

$\mu_{\mathrm{Ceph}} = 31.53$

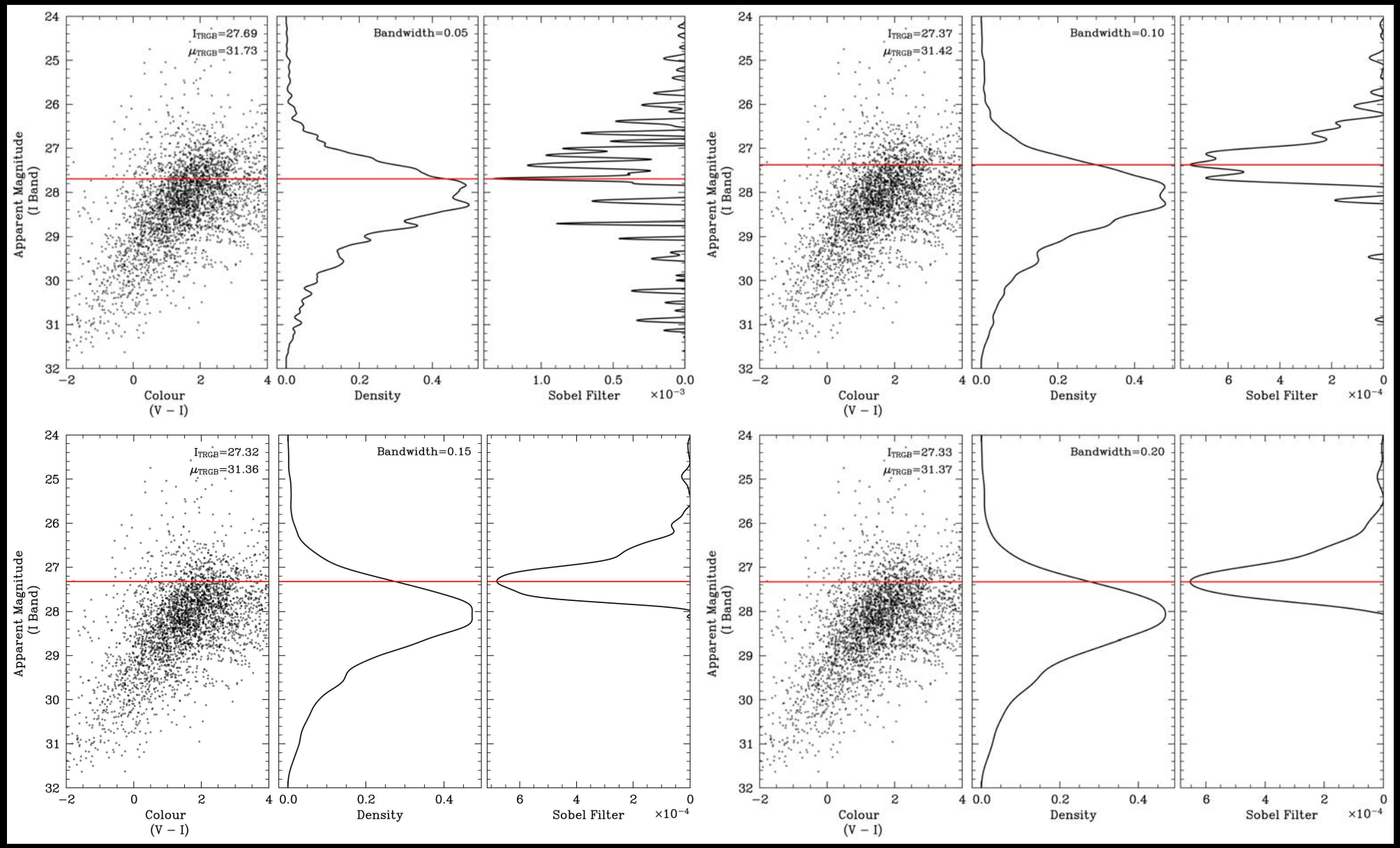
After Gaussian Shift

$I_{TRGB} = 27.15$

$\mu_{TRGB} = 31.19$

$\Delta_{TRGB} = -0.17$

Increasing KDE Bandwidth decreases I_{TRGB} ~ 0.05 mags



Summary

- We measure the TRGB in I band for NGC4639 to be: I_{TRGB} = 27.32
  - Assuming Dixon et al. 2023 we find μ_{TRGB}= 31.36 (~18.71 Mpc)
  - Compared to μ_{Ceph}= 31.53 (~20.23 Mpc)

- Random resampling of the instrumental magnitudes decreases I_{TRGB} ~ 0.17 mags.
- Increasing KDE Bandwidth decreases I_{TRGB} ~ 0.05 mags

Some Things Still To Do

- Check that we obtain the same magnitudes from individual frames.
  - We are using the stacked framed, just a sanity check the calibration is correct.
- Account for different gain ratios across the detector.
- Obtain a full picture of the systematic and statistical uncertainties.