

Pan-STARRS1: Completeness Masks for Clustering

Daniel Farrow

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Outline

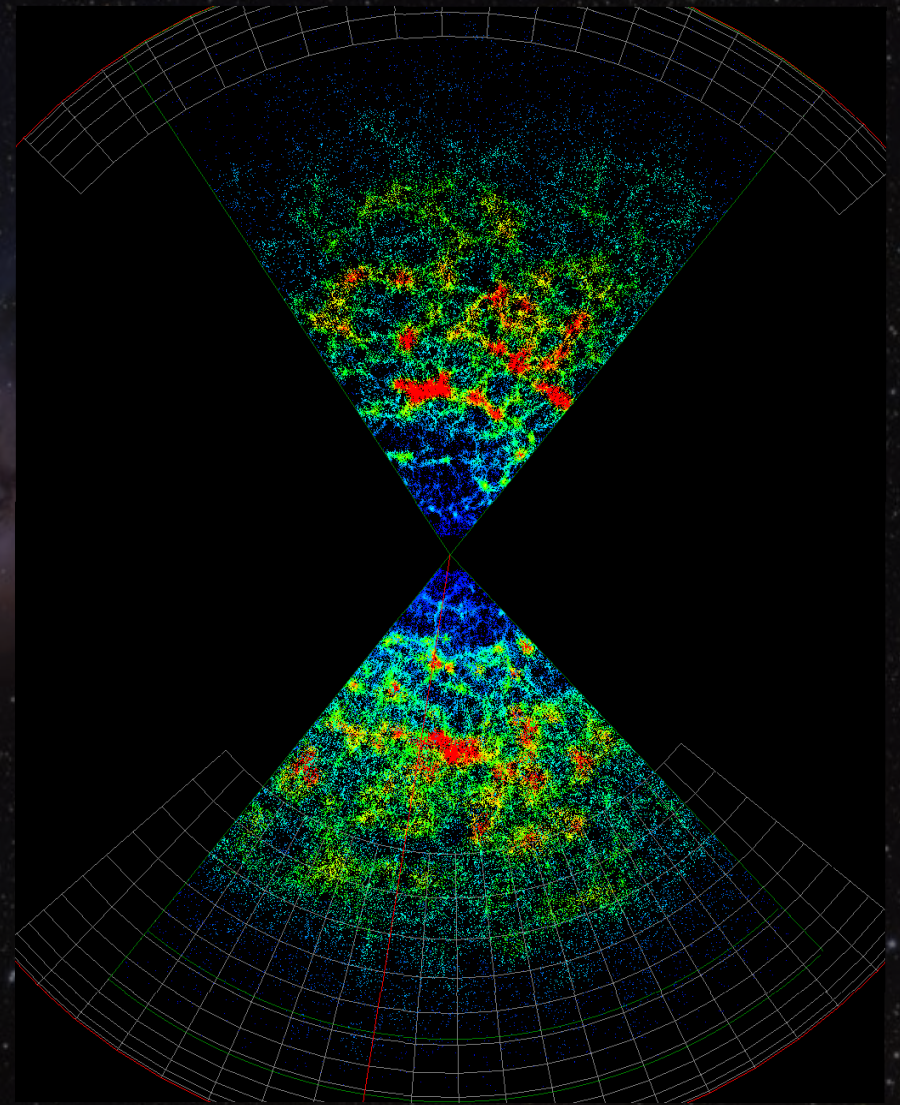
- Brief revision of galaxy clustering
- Selecting galaxies in Pan-STARRS
 - First clustering measurement
- The need for completeness masks
- Generating completeness masks

Galaxy Clustering

- Galaxies aren't uniformly distributed in space
- Simplest measure:

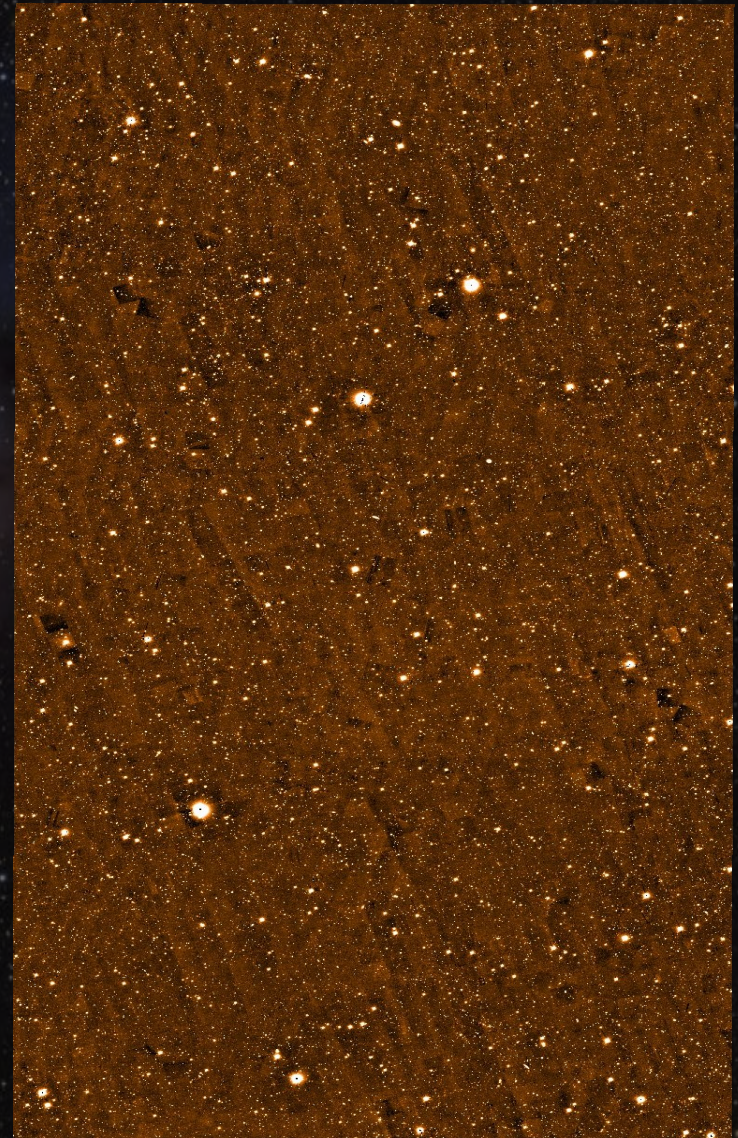
$$w(\theta) + 1 = N_{DD}(\theta) / N_{RR}(\theta)$$

- Measures density variations
- Roughly fit with a power law of slope ~ -0.8



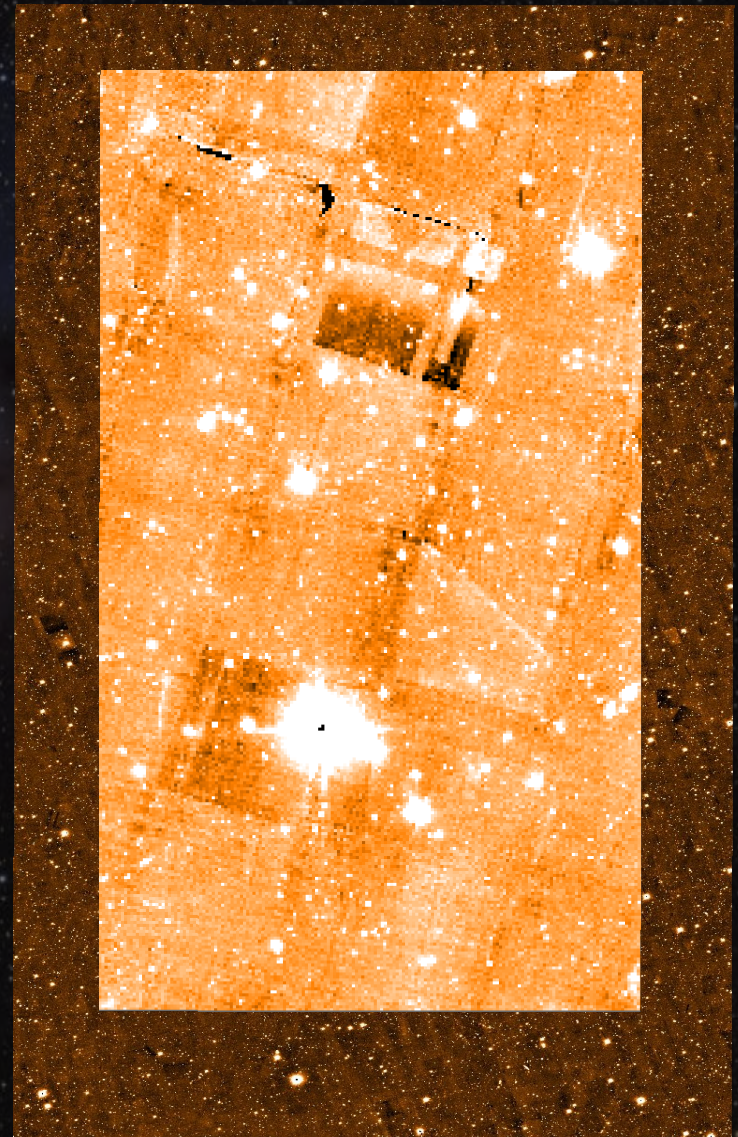
Small Area Survey 2

- We work with stacks
- SAS2: ~ 64 sq deg
demo of 3π
- We bin variance maps
& images into $3''$ pixels
to be a manageable
size
- Wave like pattern in
SAS2

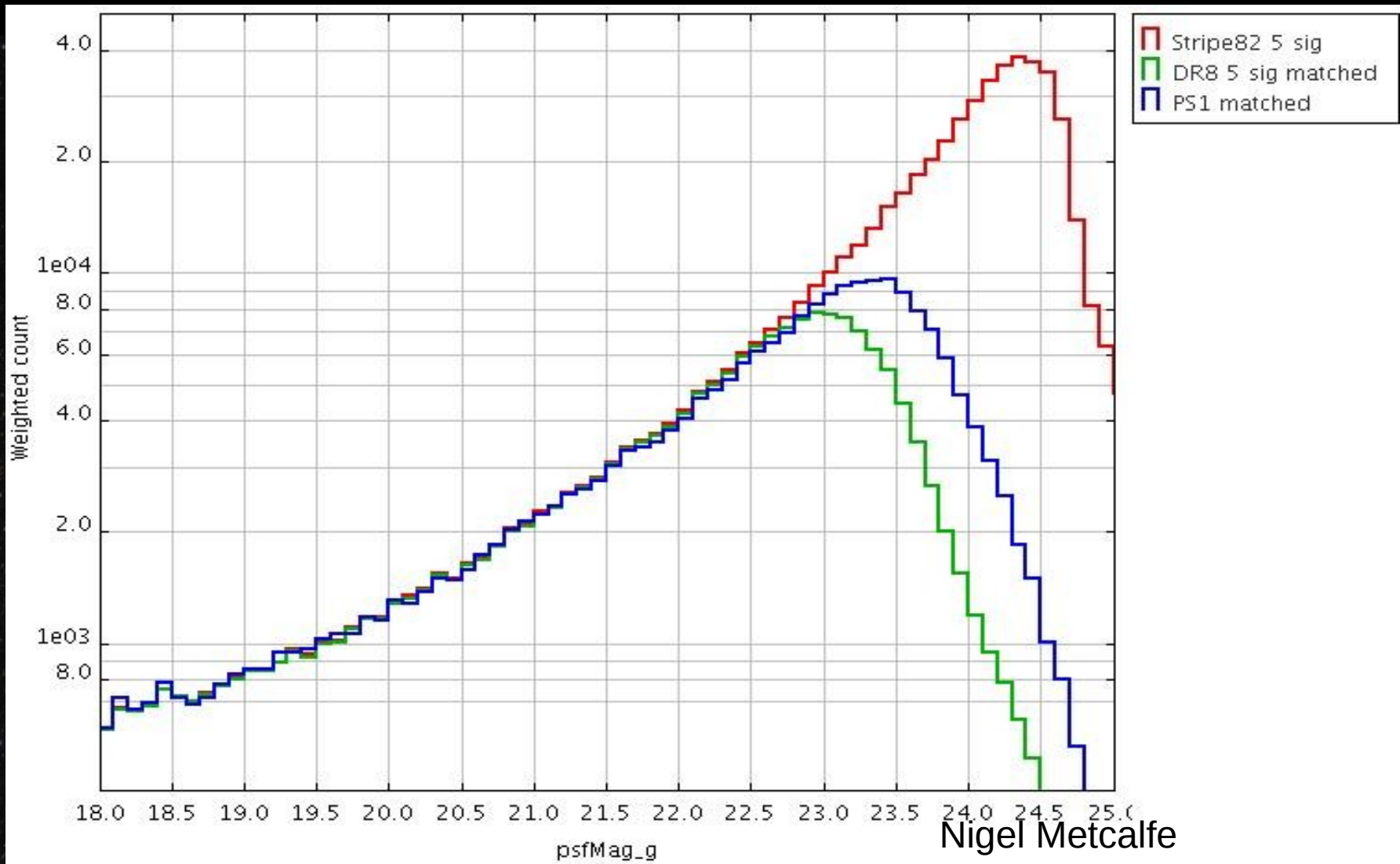


Small Area Survey 2

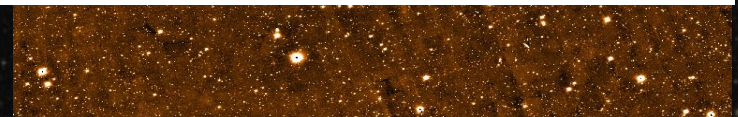
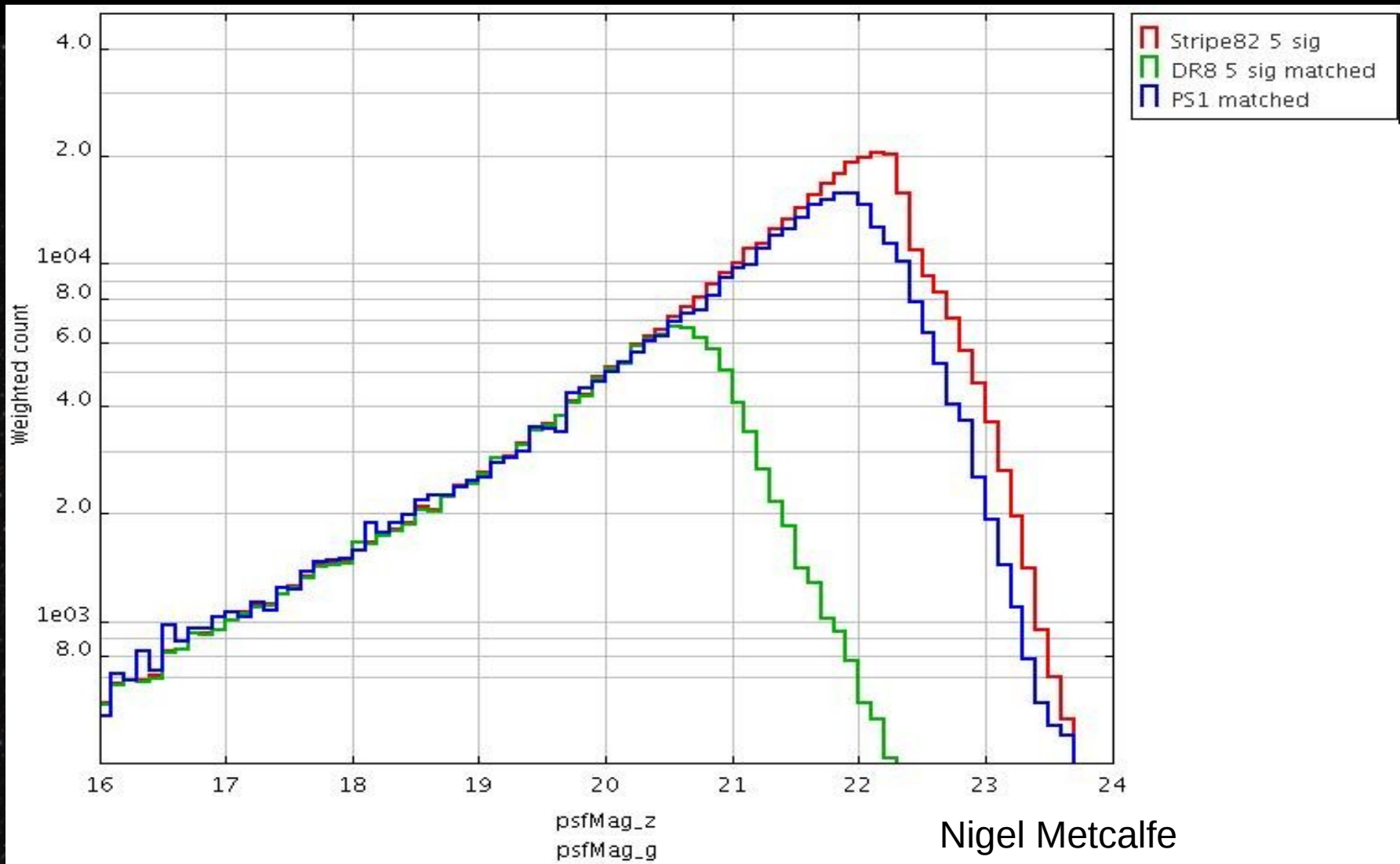
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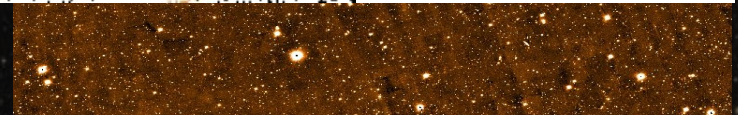
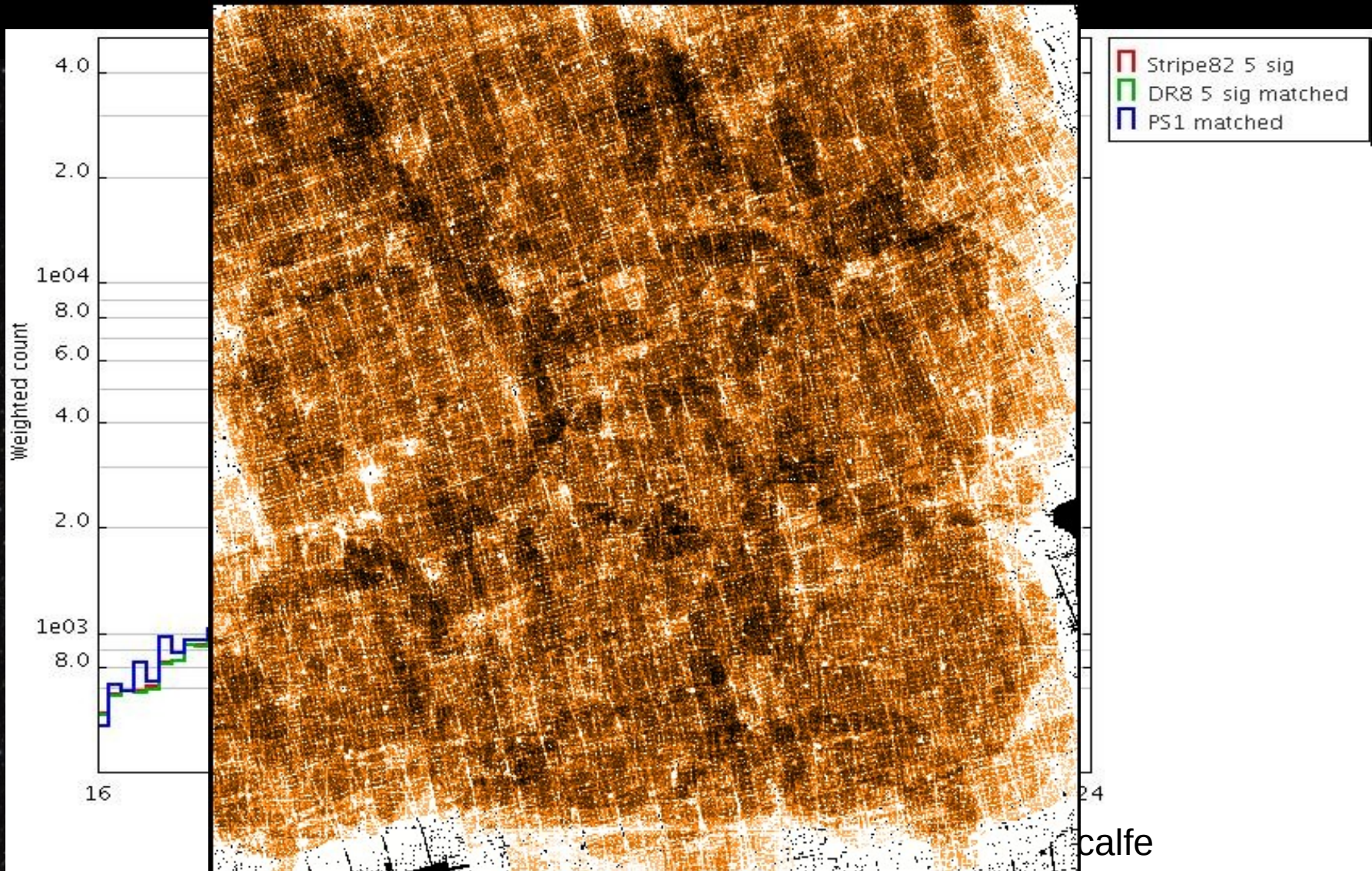
Small Area Survey 2



Small Area Survey 2

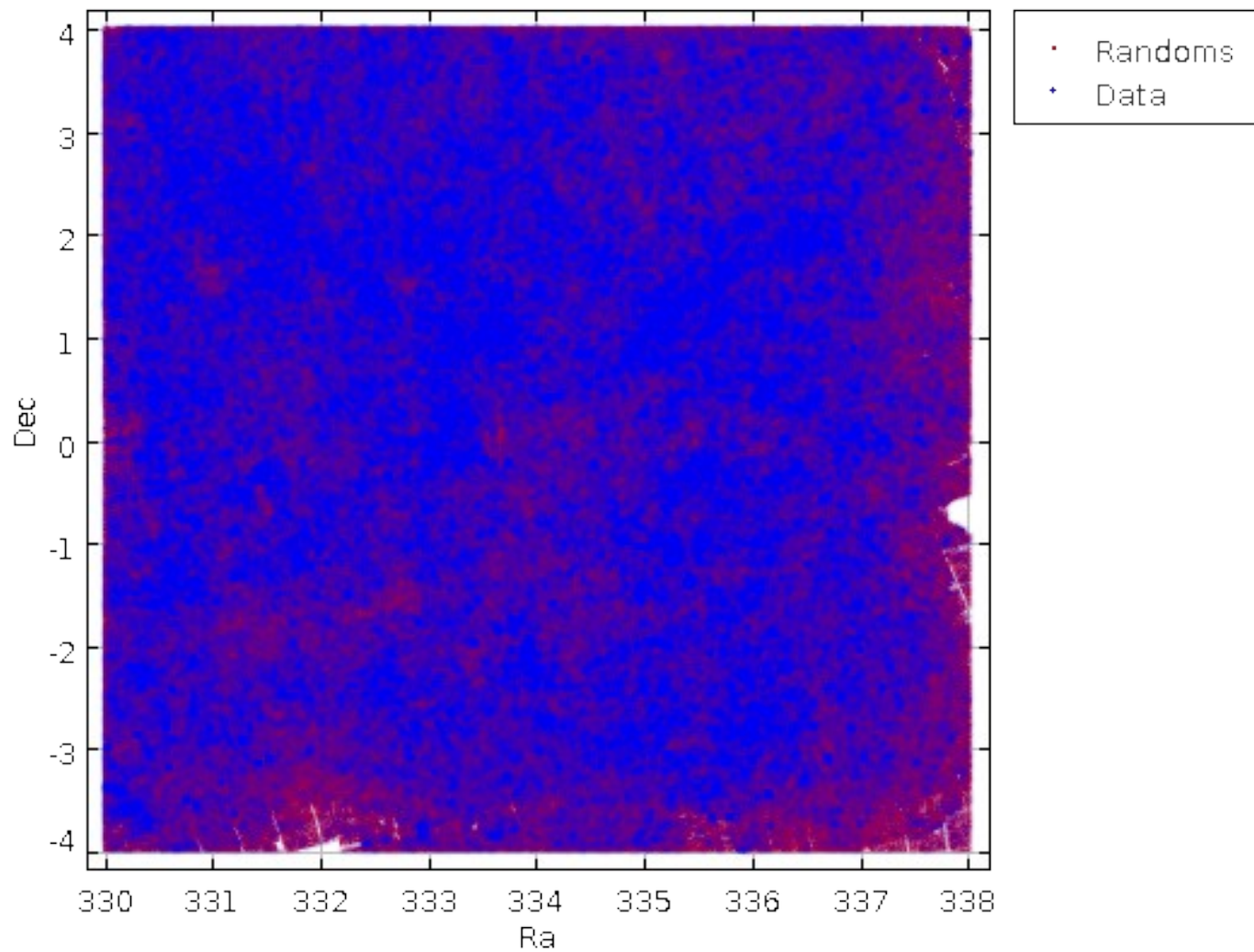


Small Area Survey 2



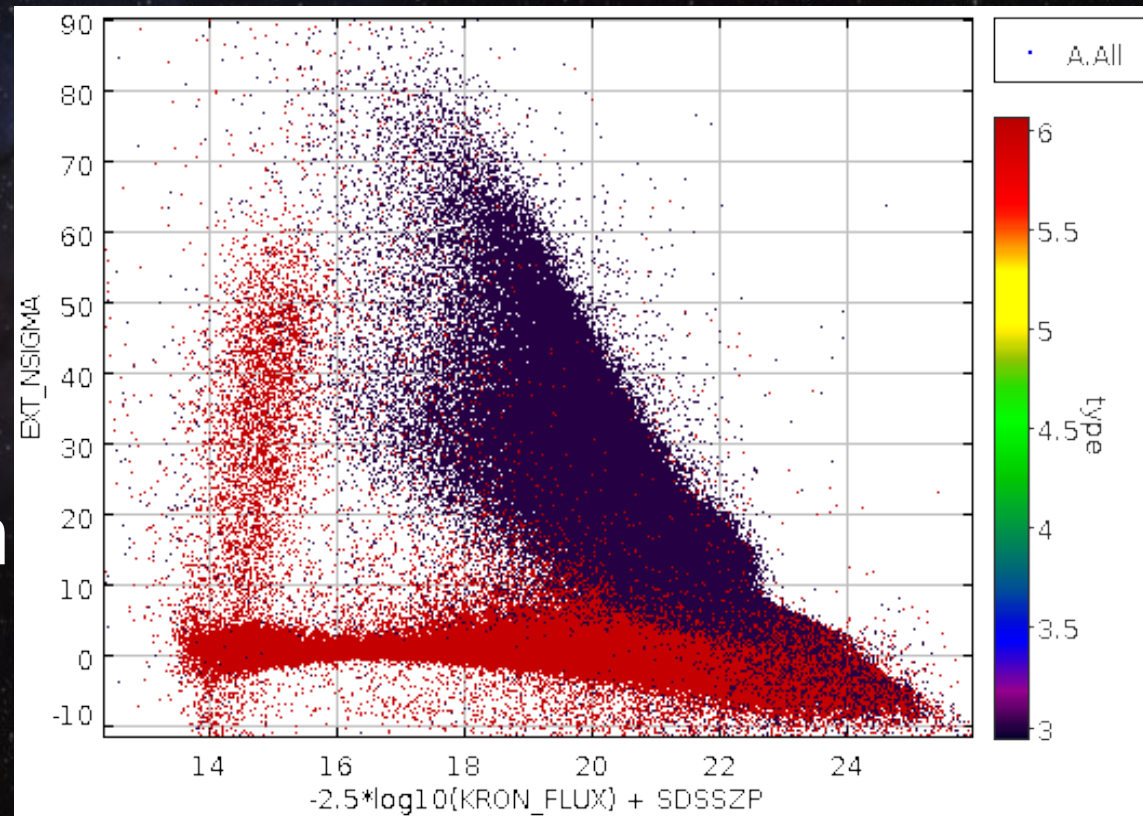


The Randoms

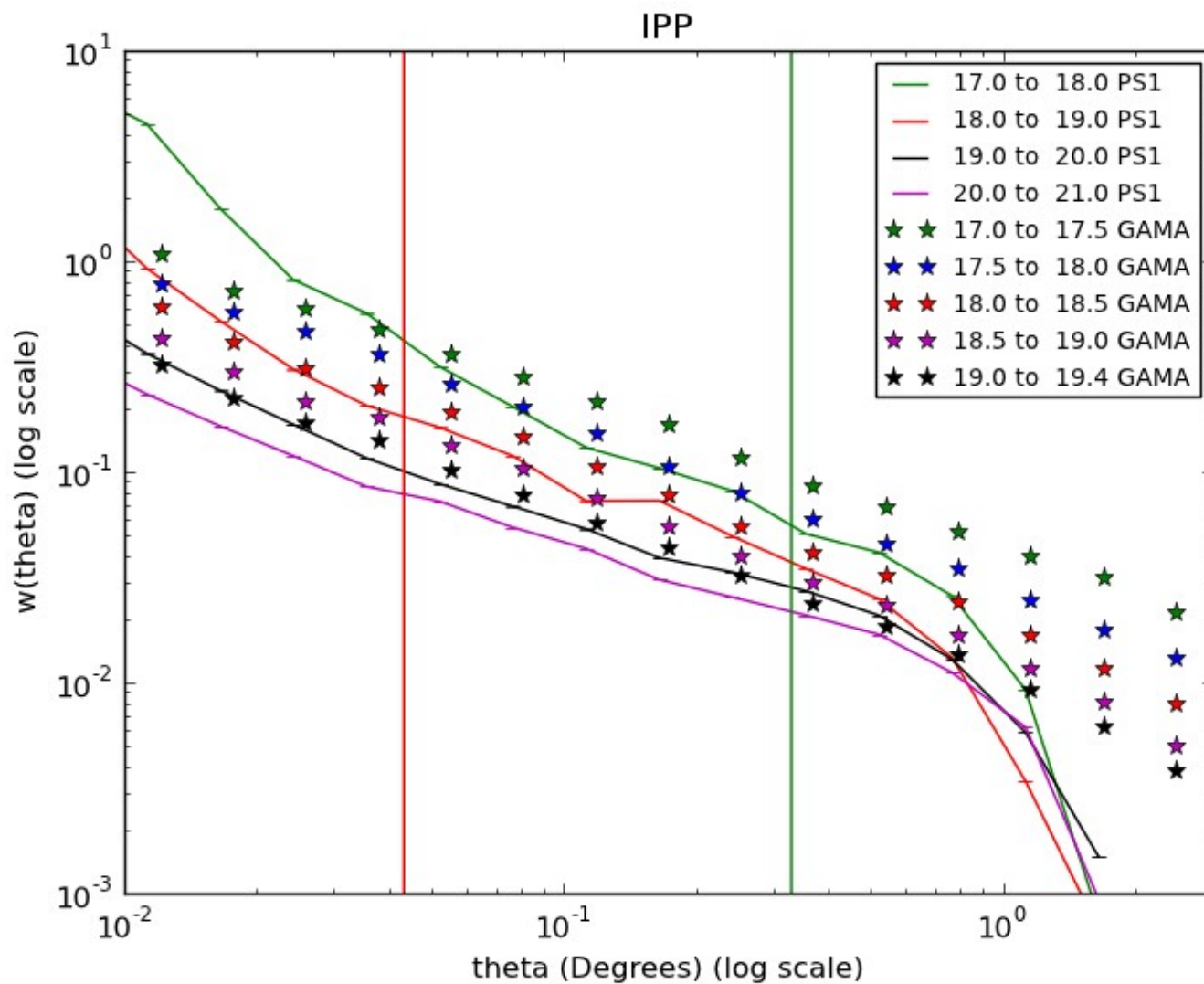


Sample Selection

- Selection in apparent magnitude based on psphot (11/2011) Kron Magnitudes
- Star/Galaxy separation based on conservative cut of $EXT_NSIGMA > 10.0$

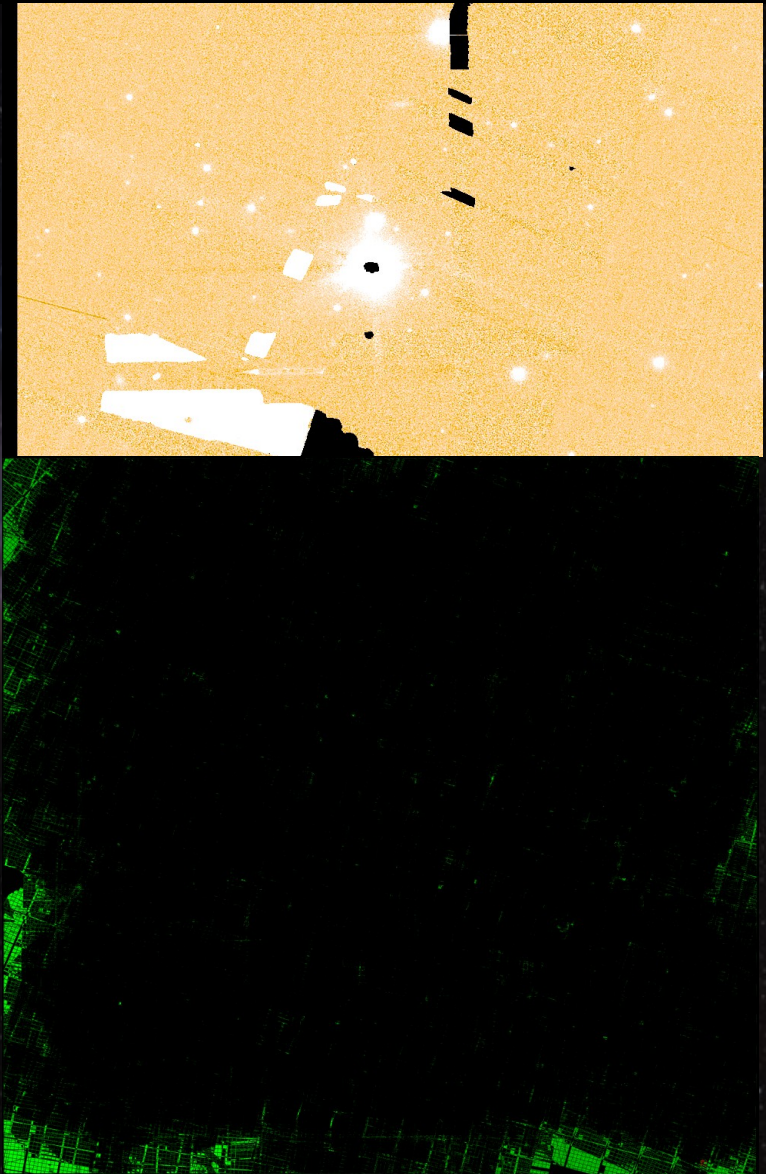


Early Results



Sample Selection – Mark 2

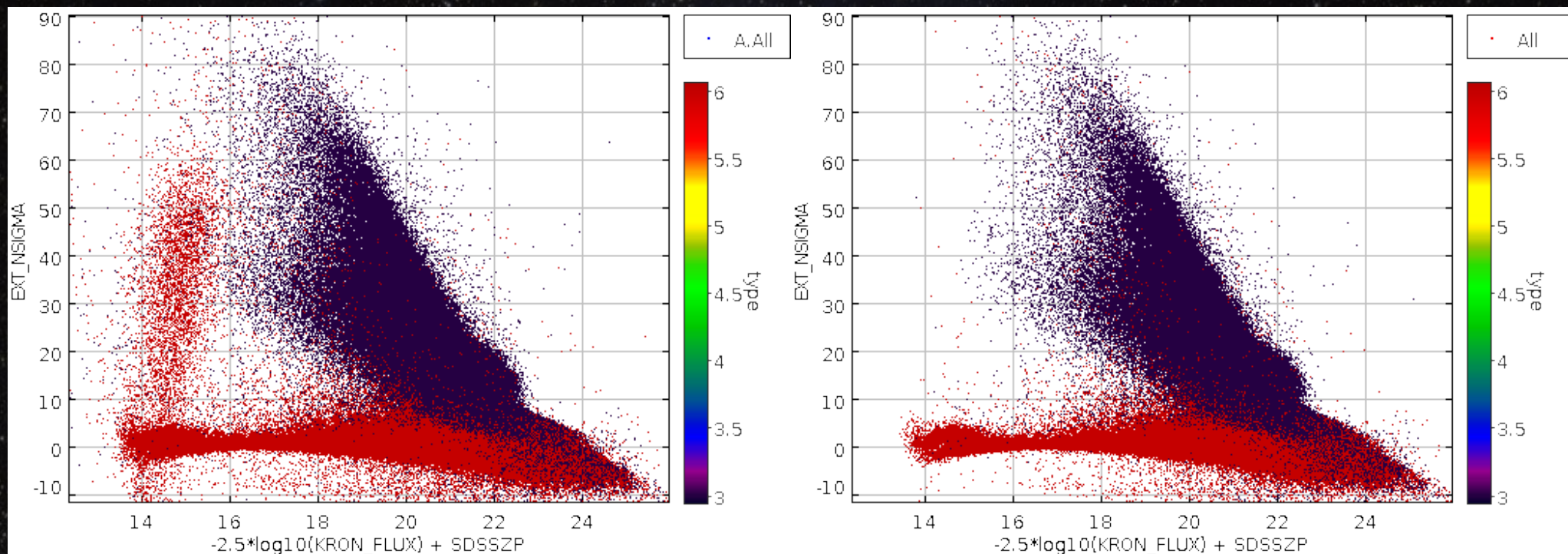
- Found clustered false detections when compared to DR8
- Mask out low coverage regions & mask area around bright stars



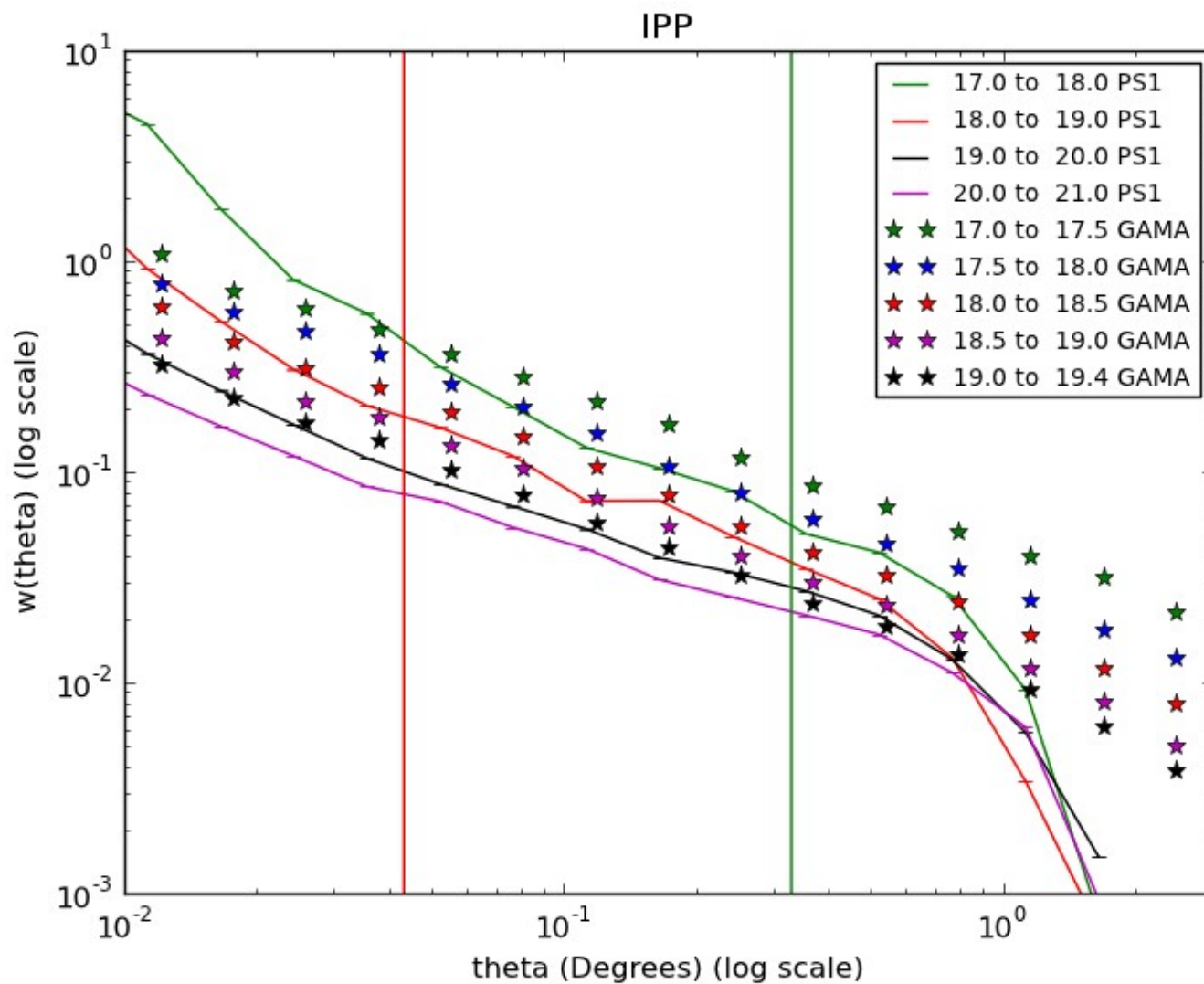
Sample Selection – Mark 2

Before

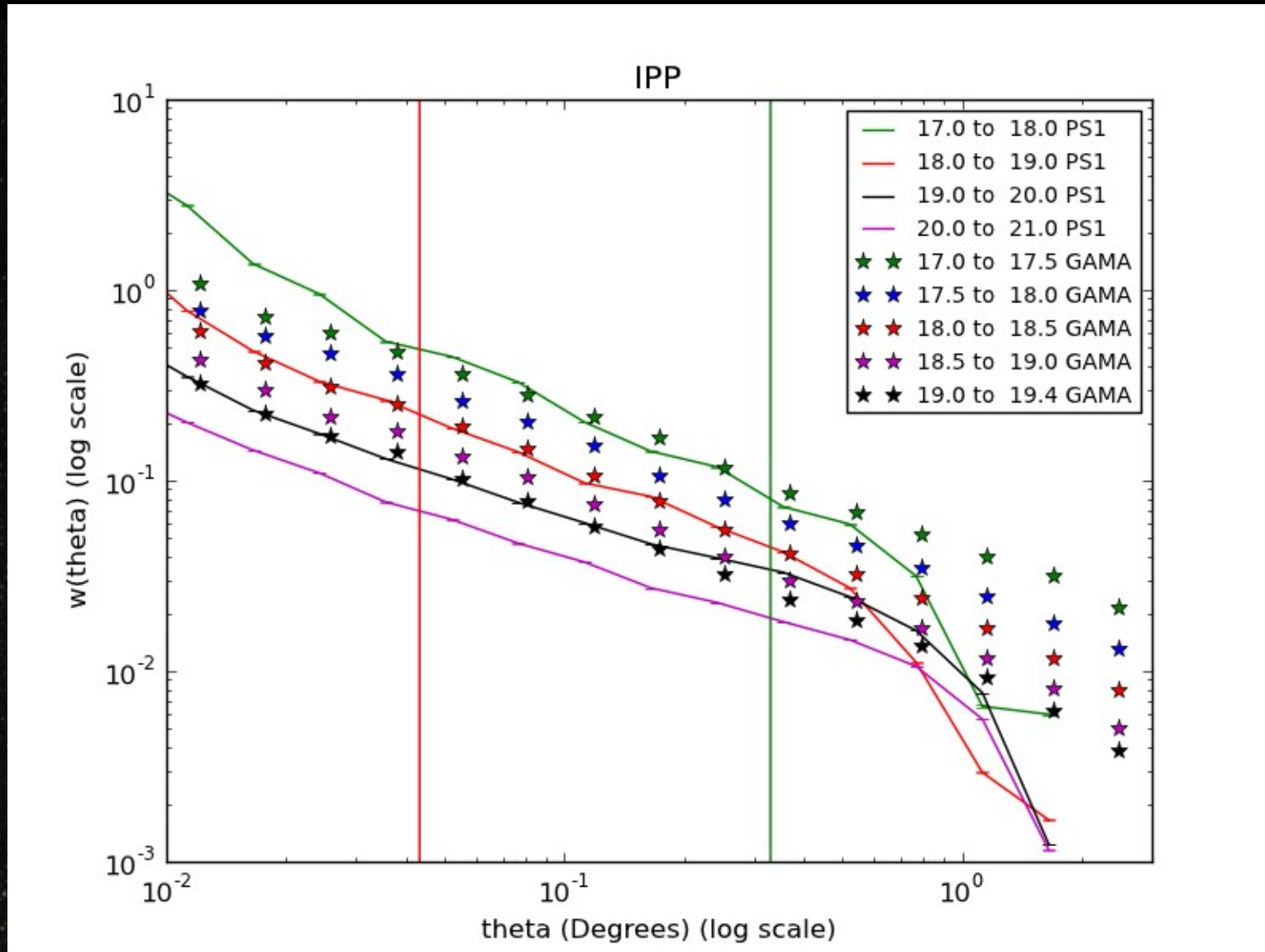
After



Early Results

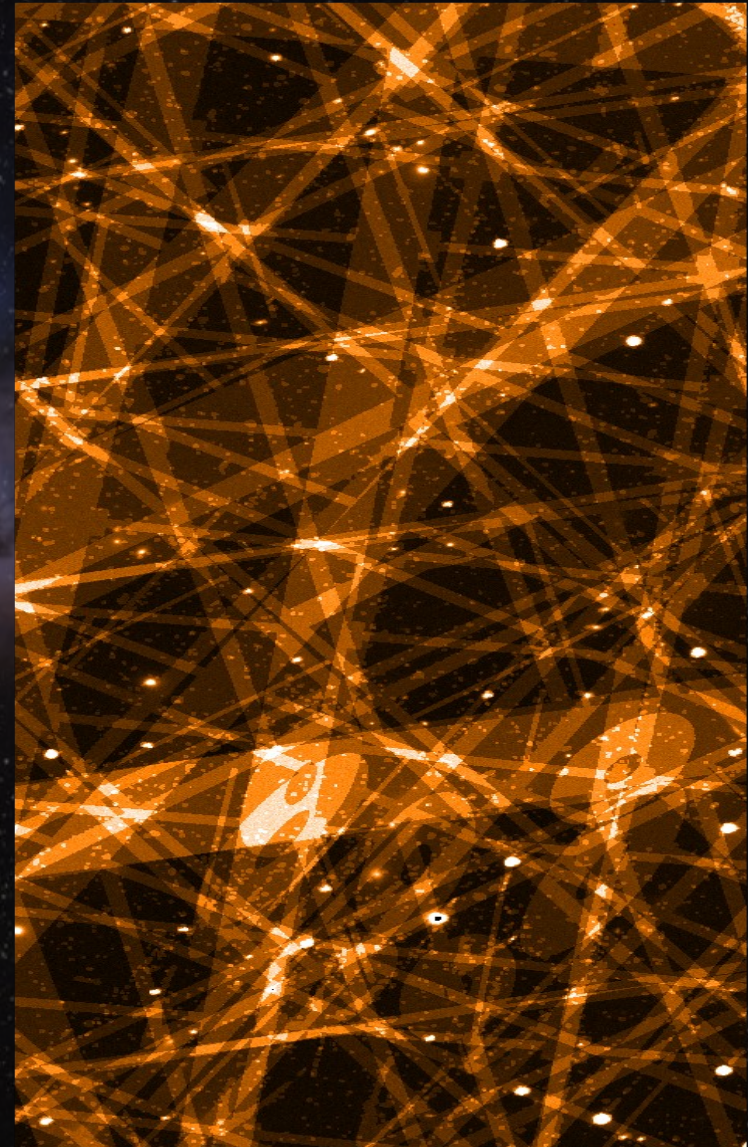


Updated Clustering



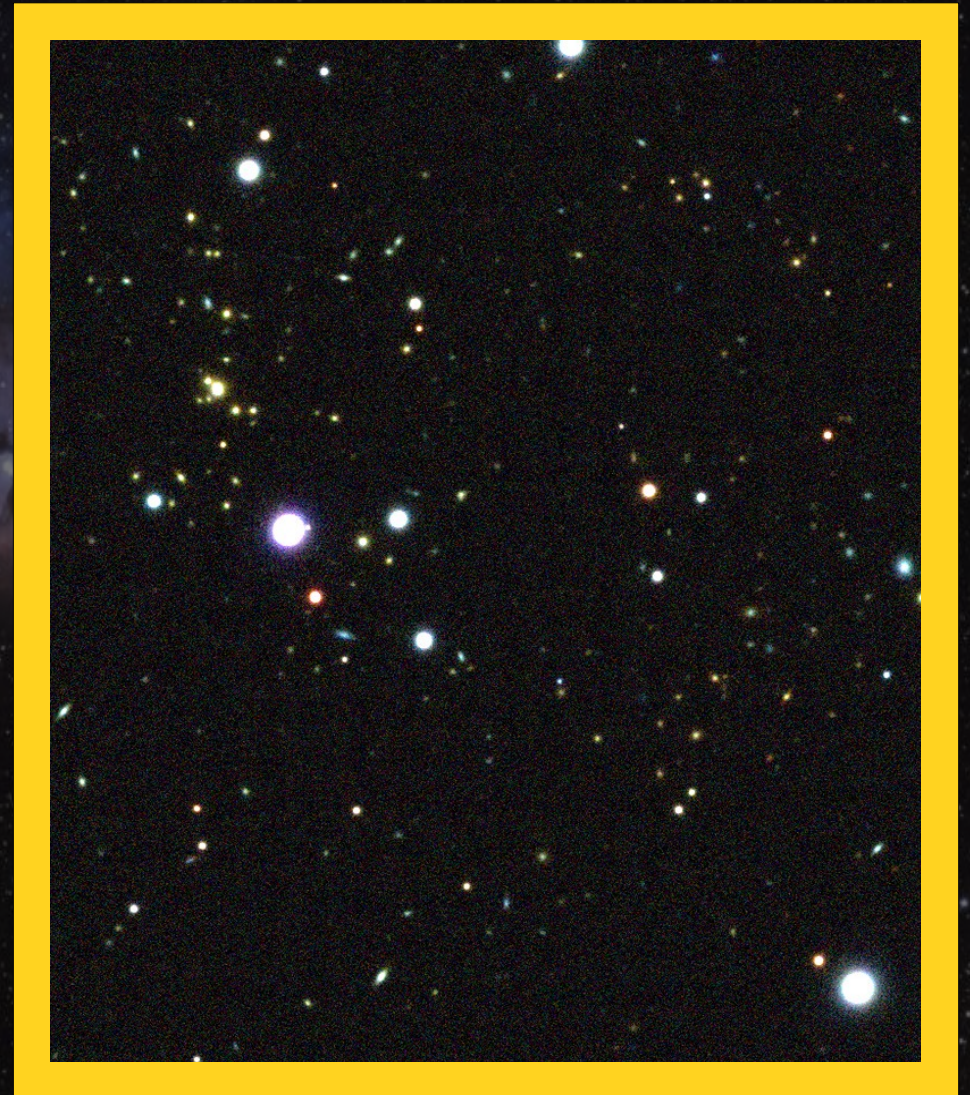
Detection Efficiency

- Depth varies across the image
- Adds extra terms to the correlation function
- Need to remove this
- Empirically infer the effect from data
- Or model detectability



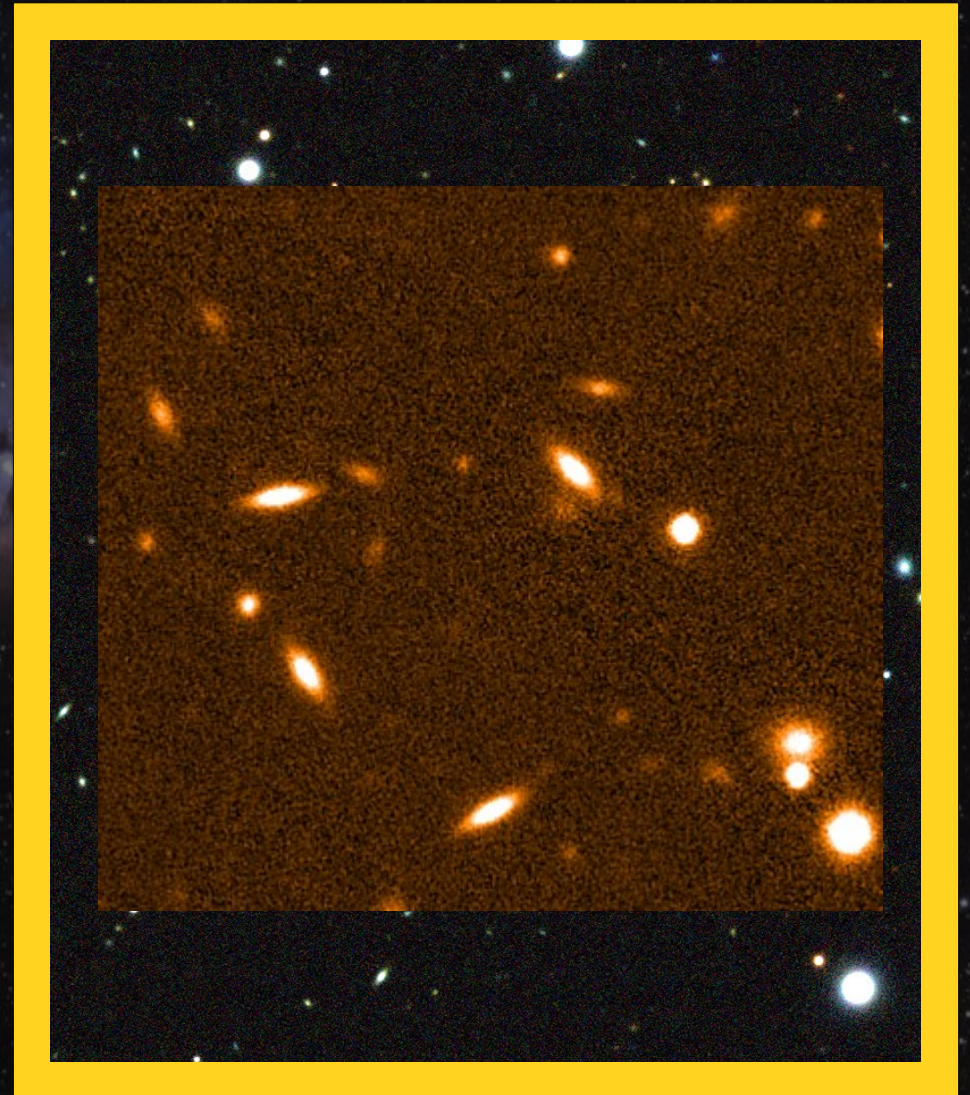
Modeling Detection Efficiency

- Use overlapping region to empirically relate an SNR like measurement to depth, apply to whole field
- Generate realistic fake images



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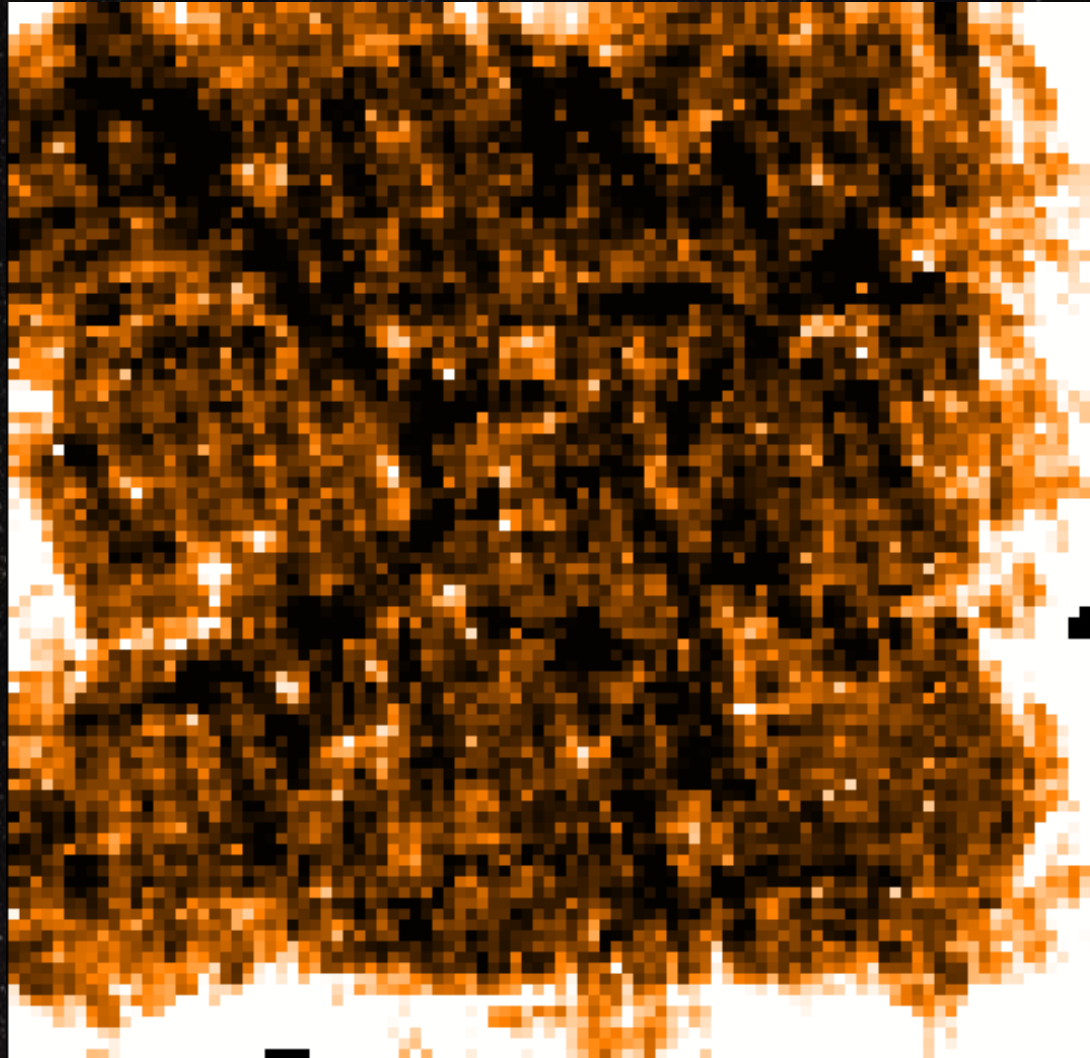
Aside: Fake Image Server

- Extended sources
- Fake warped backgrounds
- PS1 psf

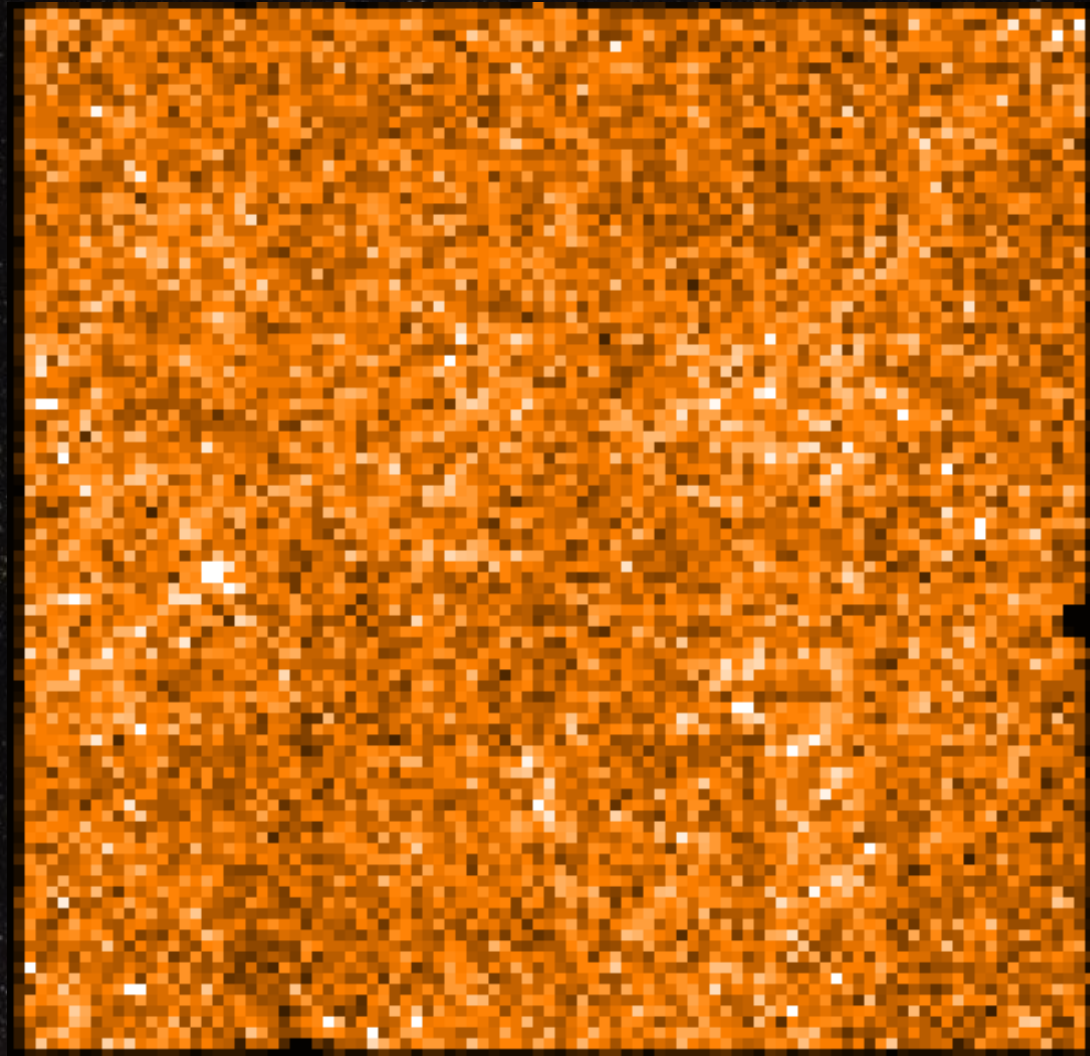


The screenshot shows the PSFAKE website interface. At the top left, the text "PSFAKE" is displayed in large white letters, with the tagline "The PS1 fake image server" below it. To the right is the Pan-STARRS PS1 Science Consortium logo. A navigation bar contains links: | Home | Add Fakes to Real PS1 Images | New Fake Image | Job Queue | Logout |. Below this is a "Welcome" section with a teal heading and a paragraph: "This tool adds fake sources to PS1 stacks. An example source file is available here". The main section is titled "Add Fake Sources to a PS1 Stack" in teal. It contains a form with the following fields: "Stack ID:" with a white input box; "Zeropoint:" with a white input box; "Source File:" with a white input box and a "Browse..." button; and "Your Email:" with a white input box. A "Submit" button is located below the email field. At the bottom of the page, there is a footer with the text "Daniel Farrow, Durham University 2011" and "Contact d.j.farrow@durham.ac.uk". A white box at the bottom of the screenshot contains the email address "d.j.farrow@durham.ac.uk".

Variance Maps Vs. Detections

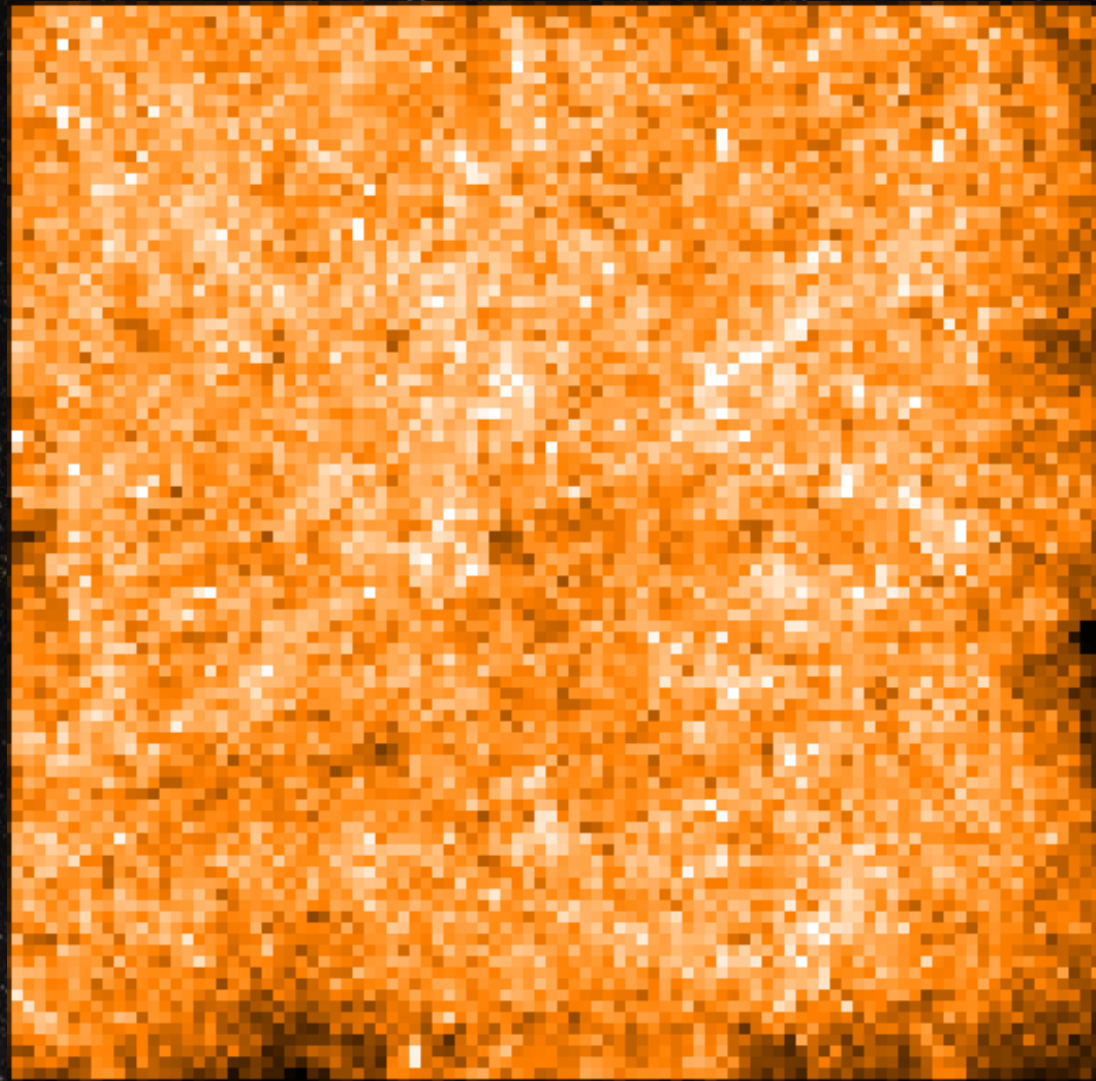


Variance Maps Vs. Detections



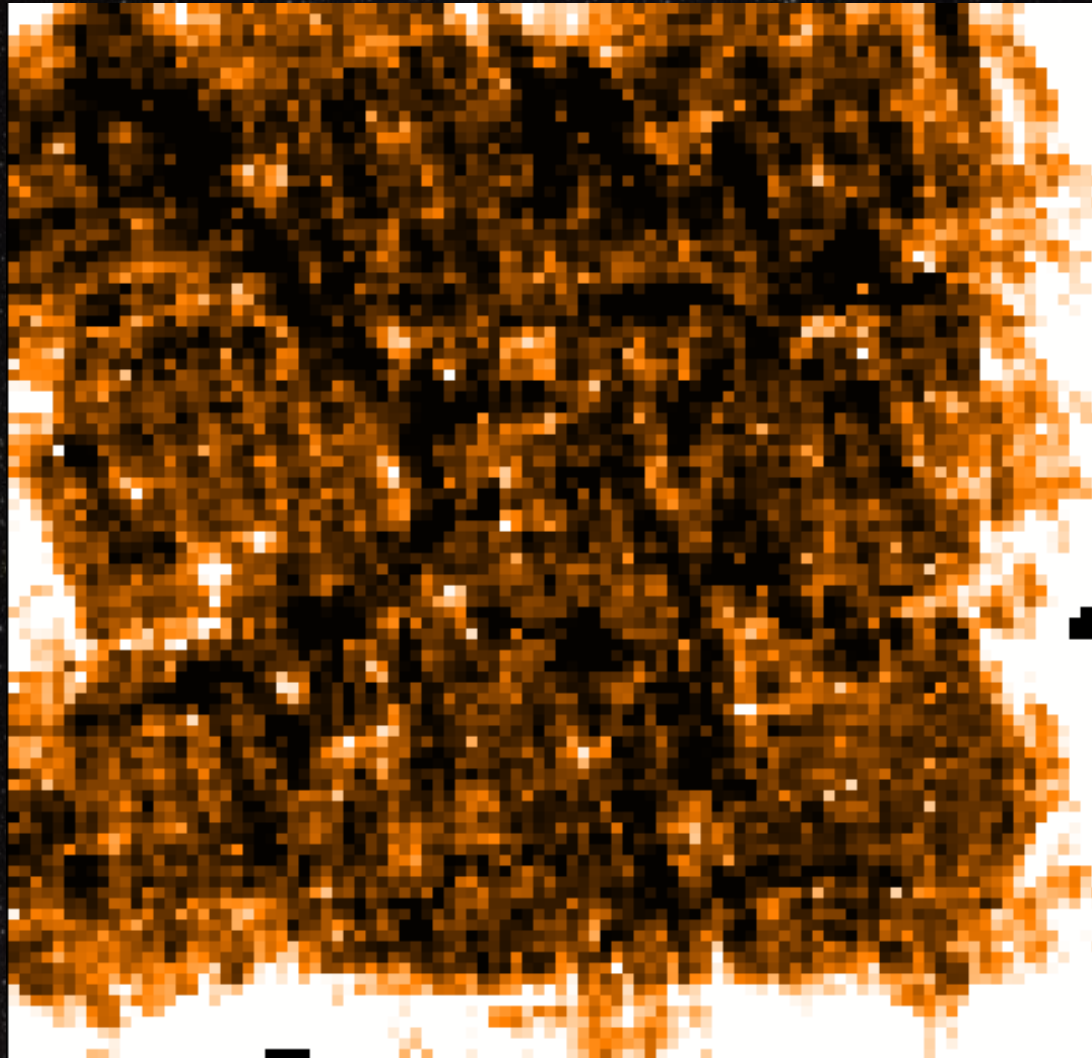
$18 < \text{mag} < 20$

Variance Maps vs. Detections

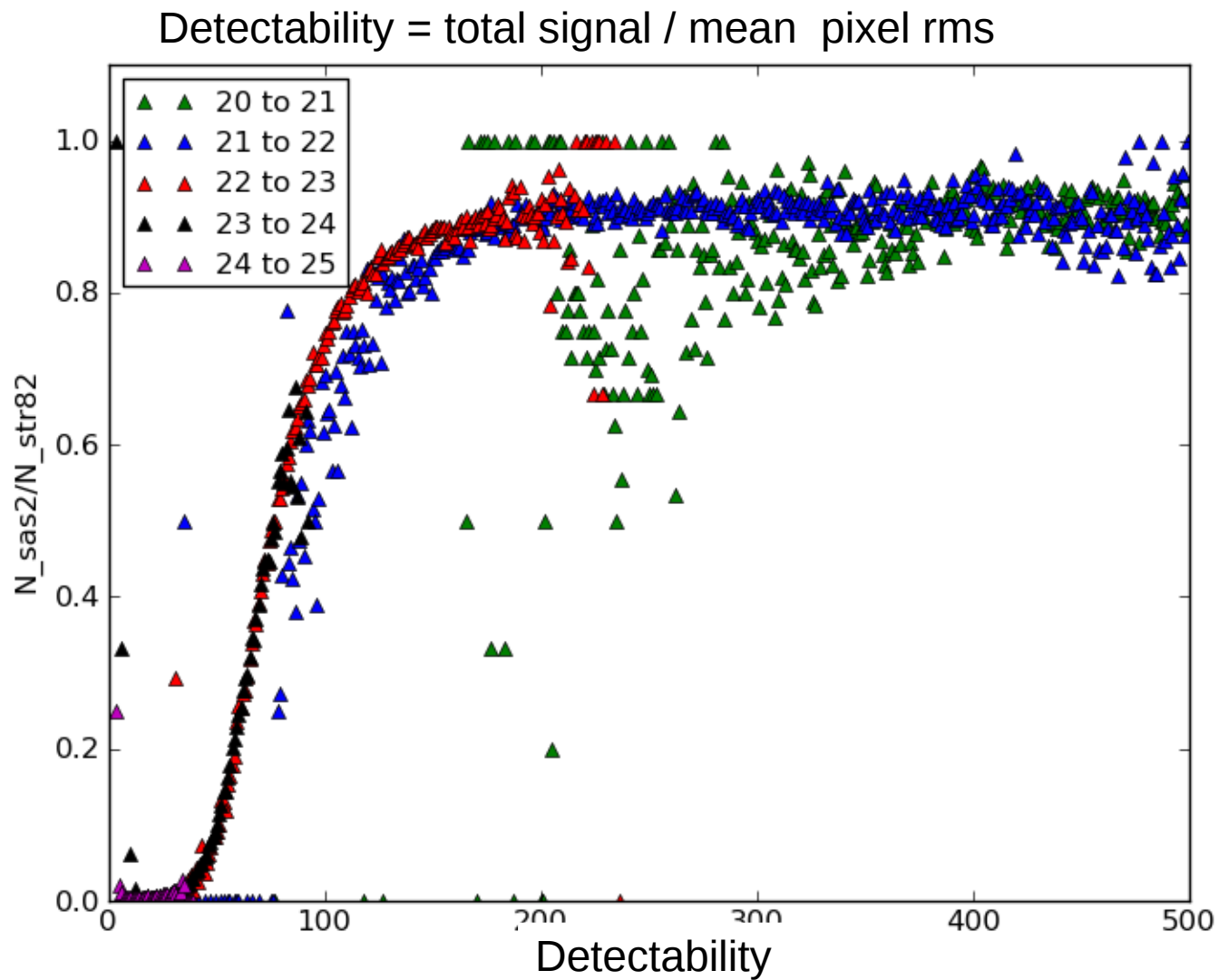


$22 < \text{mag} < 23$

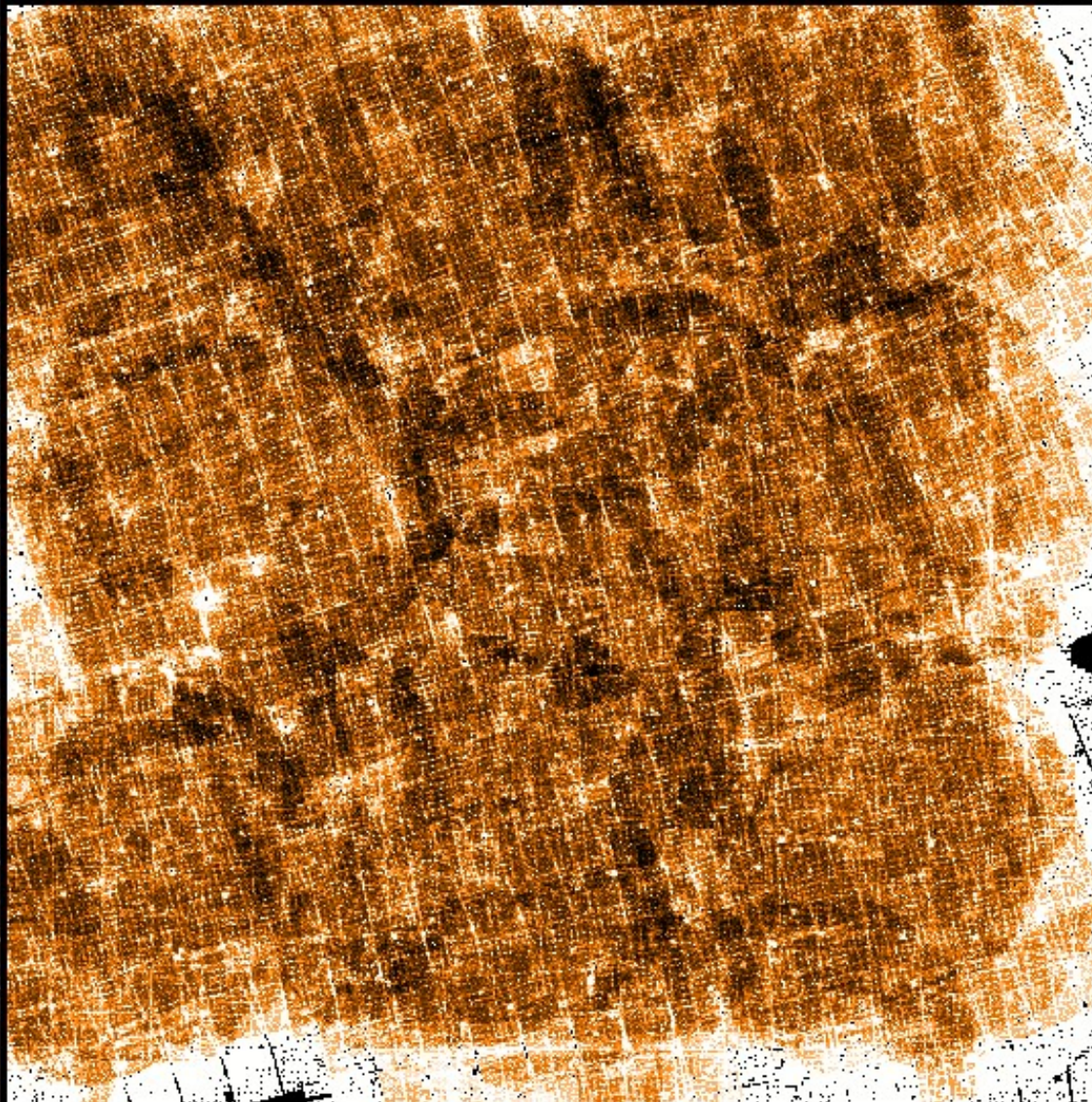
Variance Maps Vs. Detections



Results so Far



Modulate the Randoms



Daniel Farrow

Conclusions & Further Work

- Measured angular clustering in SAS2
- Developed methods to avoid false positives
- Showed detection efficiency strongly depends on the variance
- Need to complete work on detection efficiency & correct randoms
- Need to properly separate between stars/galaxies & junk

Thanks For Listening!

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