

# Modeling the point-spread function for DES Year 6

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Stanford/SLAC

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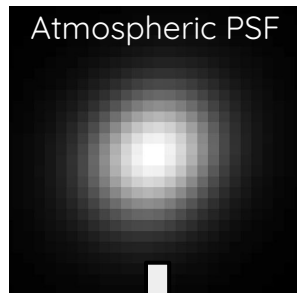
# The role of the PSF

PSF = point-spread function

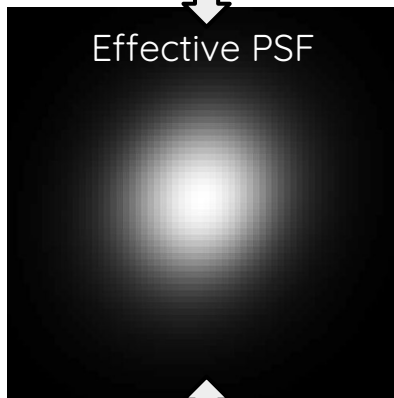


Galaxy with shear

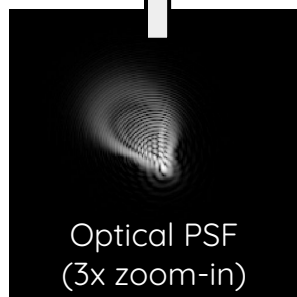
\*



Atmospheric PSF



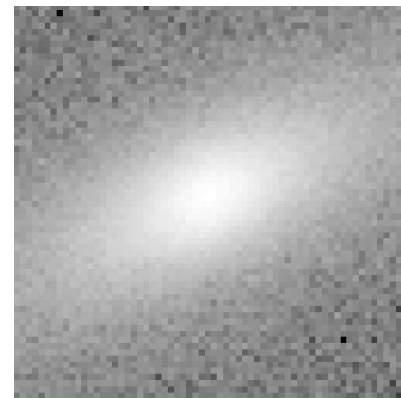
Effective PSF



Optical PSF  
(3x zoom-in)

+ noise

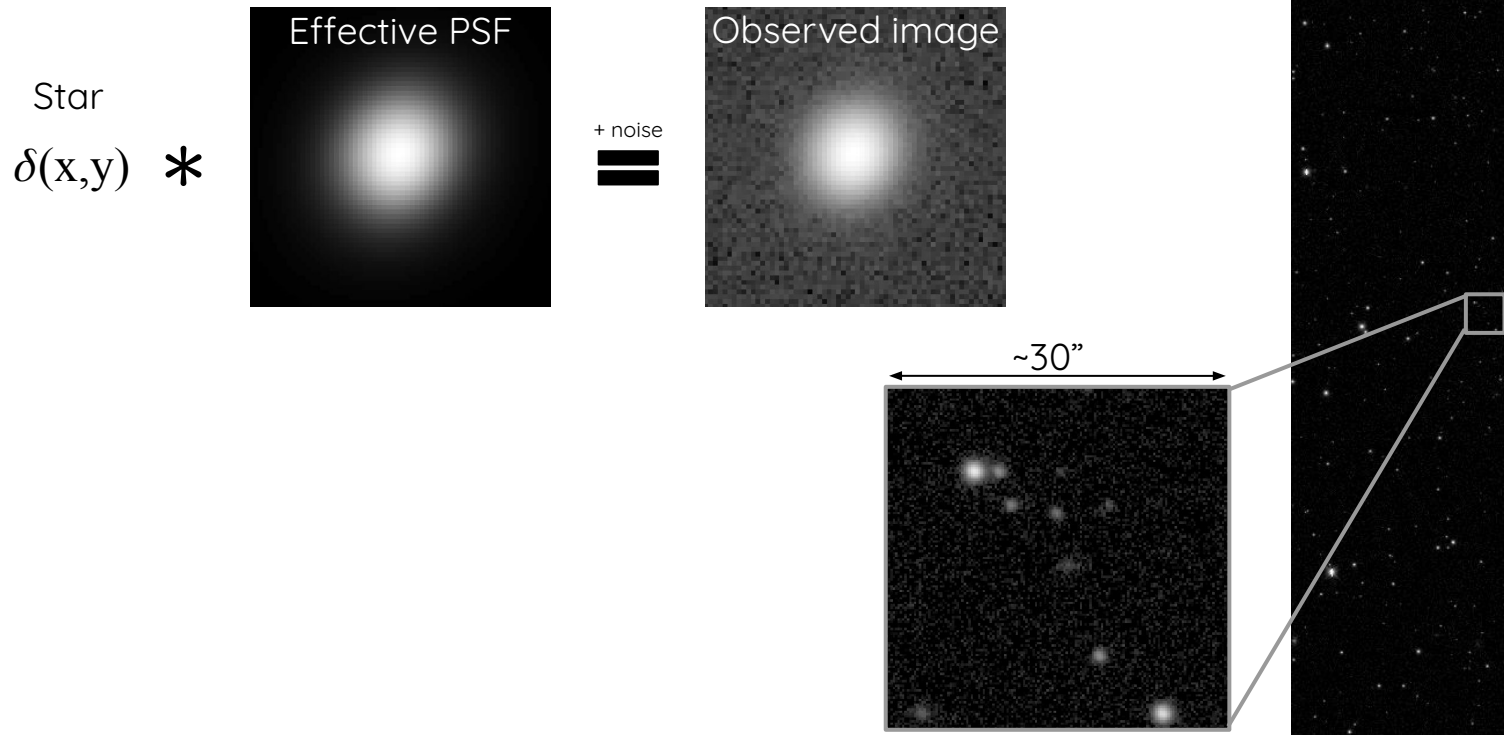
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Observed image

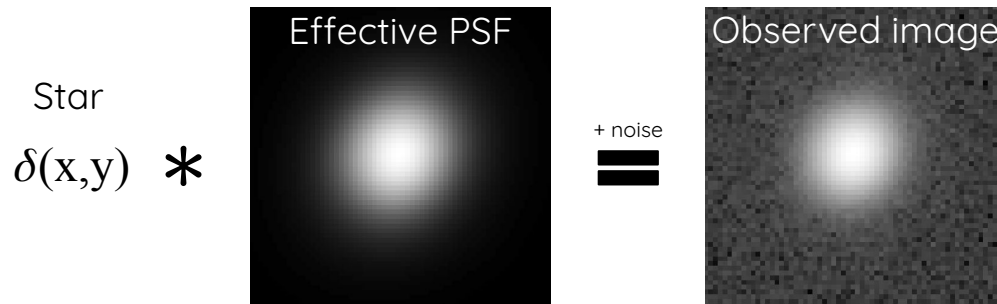
# Solving for the PSF with PIFF (PSFs in the Full FOV, Jarvis+ 2021)

1. Estimate PSF at star locations



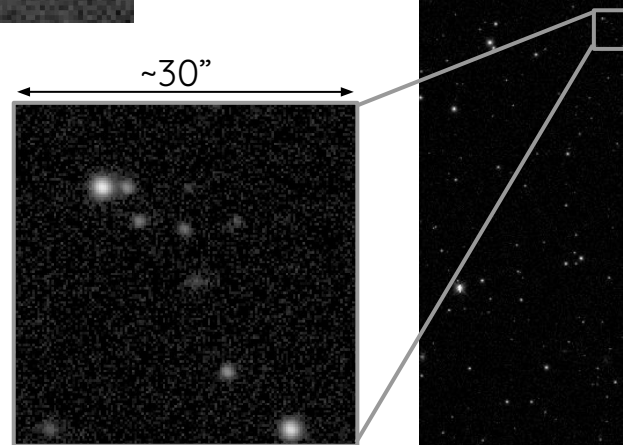
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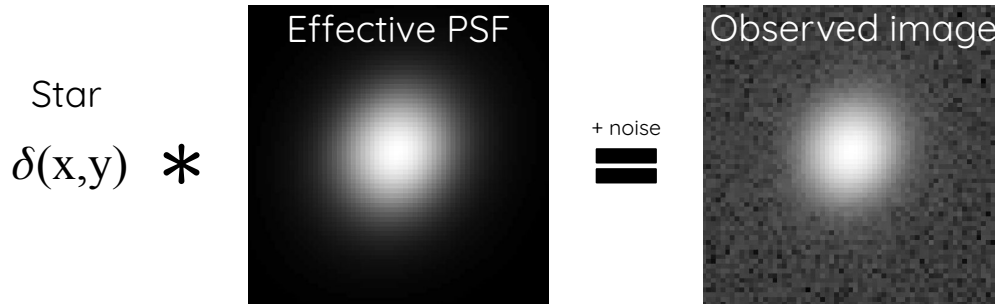
## 2. Interpolate across CCD

- For DES Y6, we use a 2D polynomial in  $(u,v)$  and 1D in color

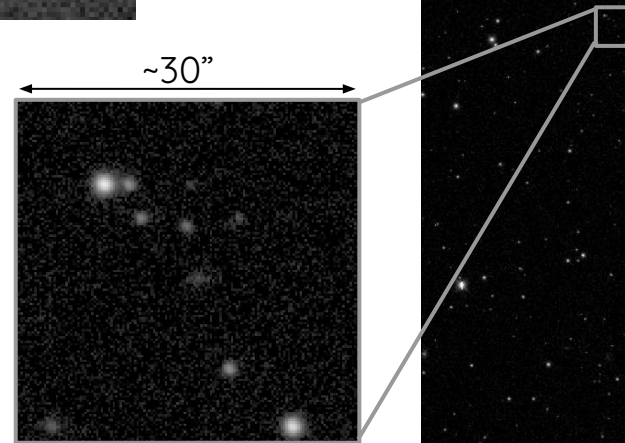


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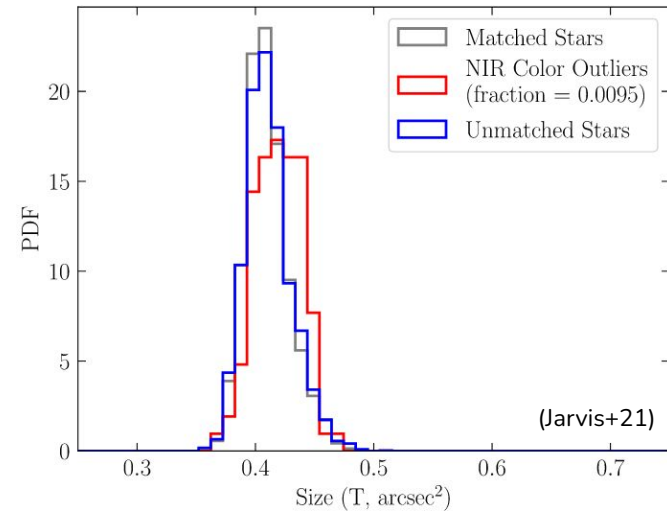


2. Interpolate across CCD
  - o For DES Y6, we use a 2D polynomial in  $(u,v)$  and 1D in color
3. Compare interpolated model PSF to real stars reserved for testing



# Open problems from Y3

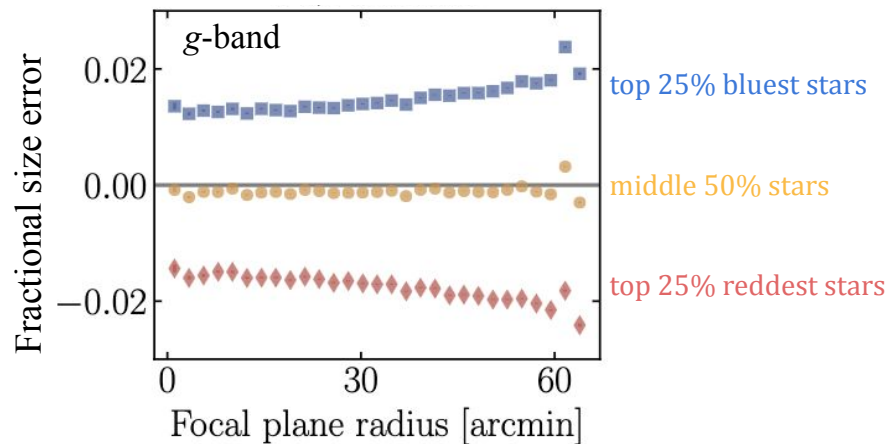
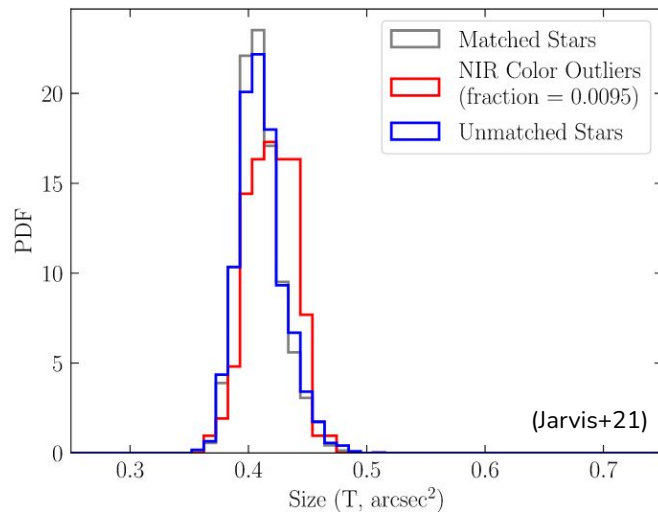
Possible **galaxy  
contamination** of input  
stars



# Open problems from Y3

Possible **galaxy contamination** of input stars

Y3 PSF models did not include **color dependence**

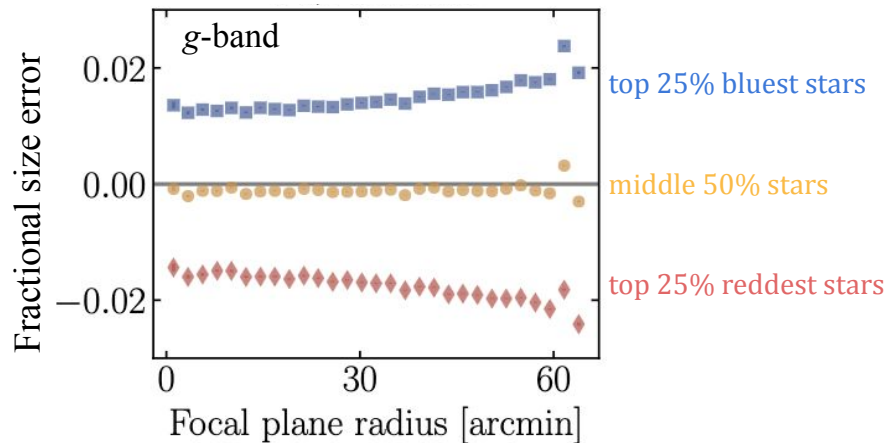
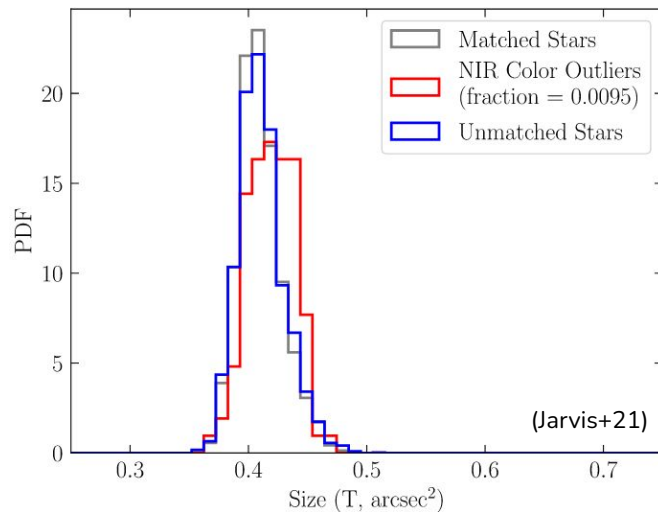


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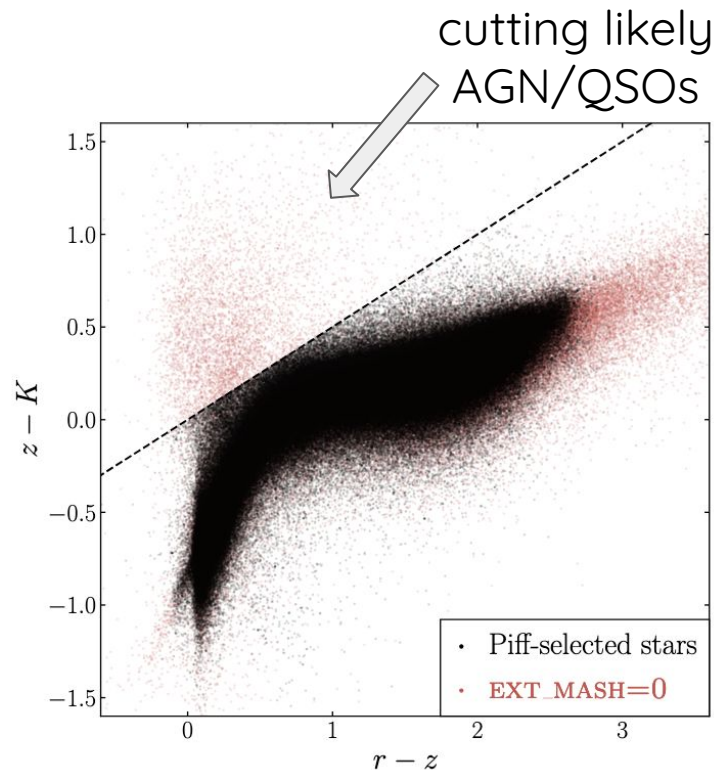
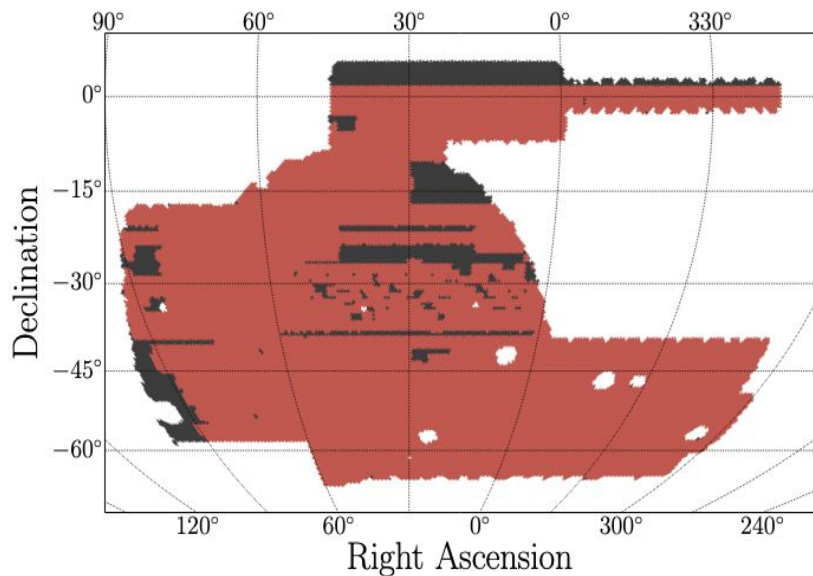
⇒ ***g-band data was not used in Y3 weak lensing analysis!***





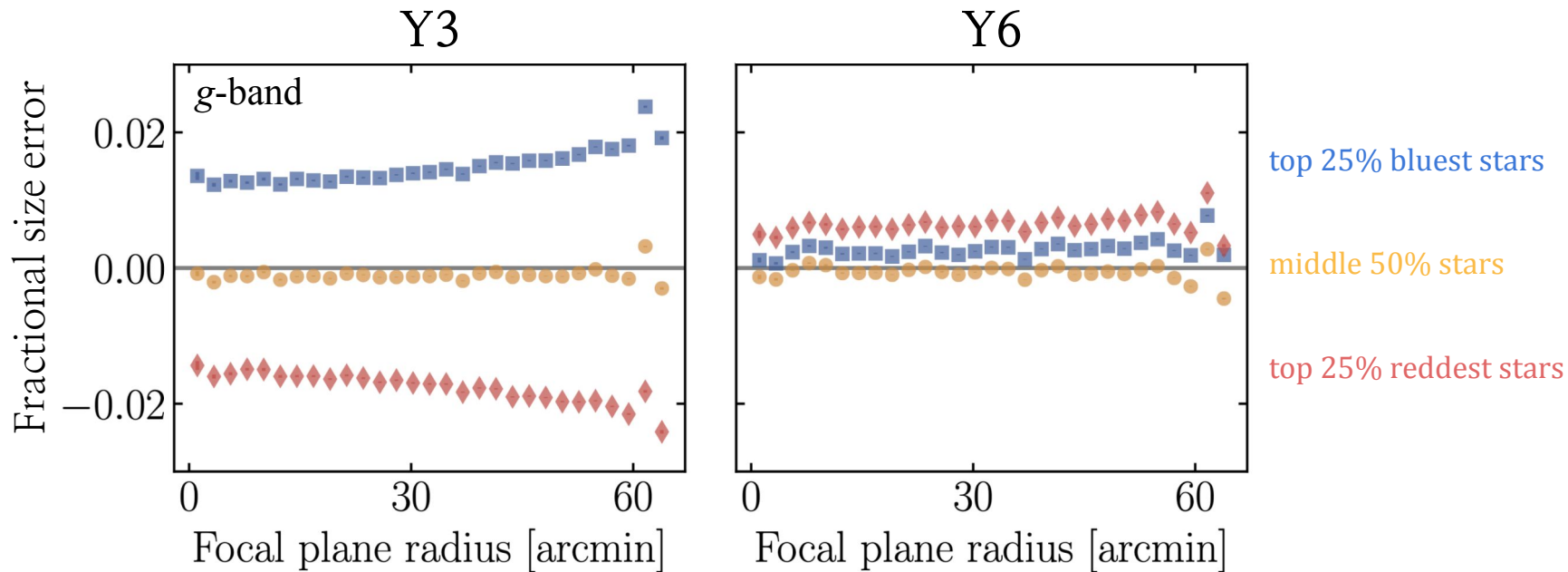
# Y6: Refines star/galaxy separation with IR photometry

87% overlap w/ IR surveys



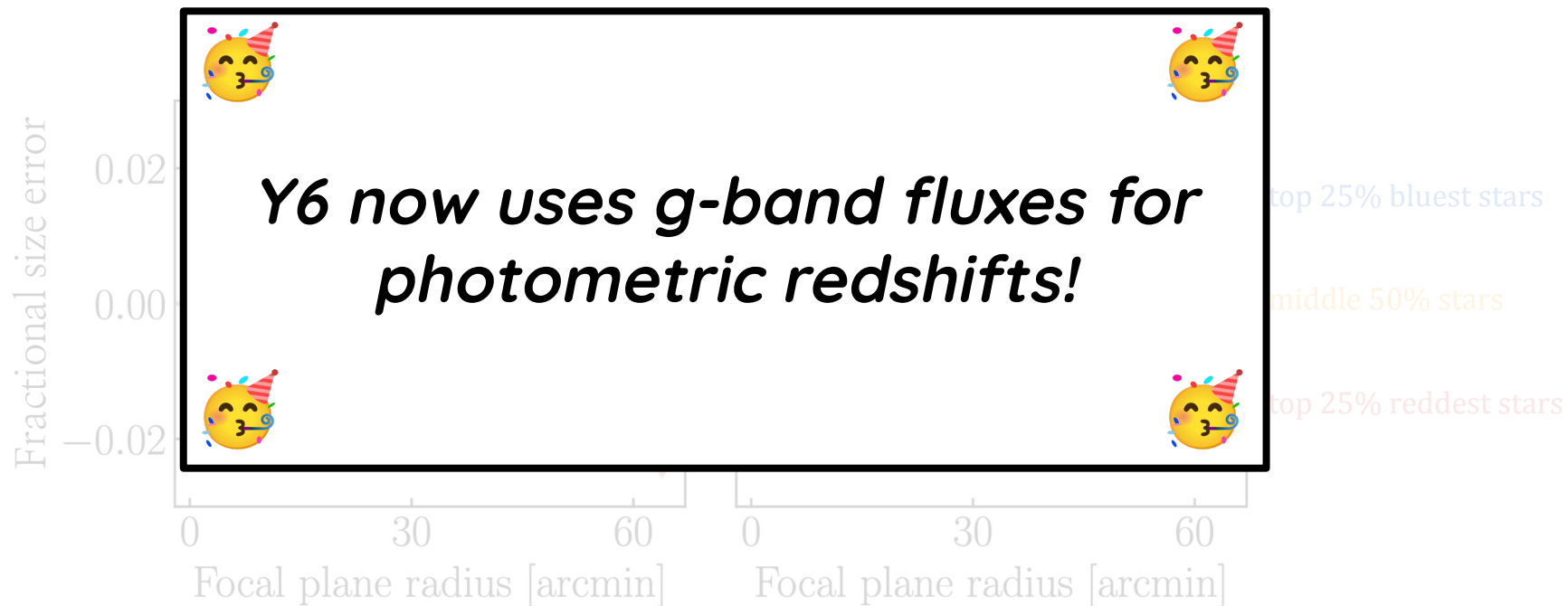
# Y6: Introduces color-dependent modeling

*Color dependent trends improved by ~order of magnitude!*



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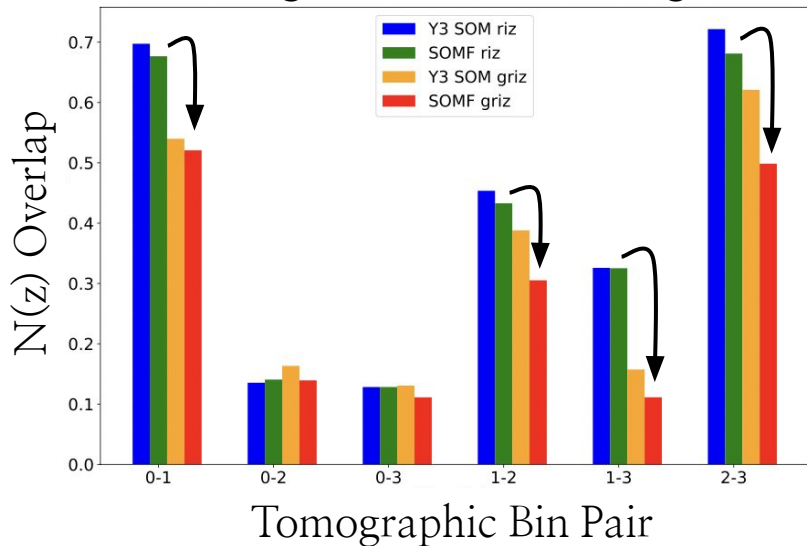
*Color dependent trends improved by ~order of magnitude!*



# $g$ -band photometry helps separate $n(z)$ bins!

See [Campos et al 2024](#) for details.

using Y3 shear catalog



Combined with optimized SOMF method:

~10% improvement on  $S_8$  and  $\Omega_m$  constraints

Improved constraints on IA nuisance params

# Conclusions

Major improvements from Y3 to Y6!

Improved star/galaxy separation

Chromatic PSF modeling

Catalog & datavector tests show PSF errors are negligible 🎉  
(*Yamamoto & Becker+ 2025; DES Y6 1x2pt in prep.*)

Looking forward to Rubin/LSST...

Implementing component-based PSF modeling in PIFF

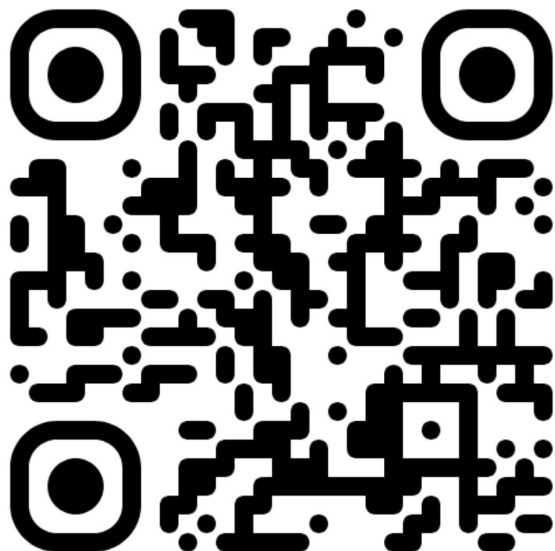
Physical PSFs enable better color dependent modeling

# Check out the DES Y6 PSF work!

PSF modeling

*Schutt et al. 2025*

[arxiv:2501.05781](https://arxiv.org/abs/2501.05781)



Metadetection shape catalog

*Yamamoto & Becker et al. 2025*

[arxiv:2501.05665](https://arxiv.org/abs/2501.05665)

