Phase A Weak Lensing: LSST-Euclid Synergy

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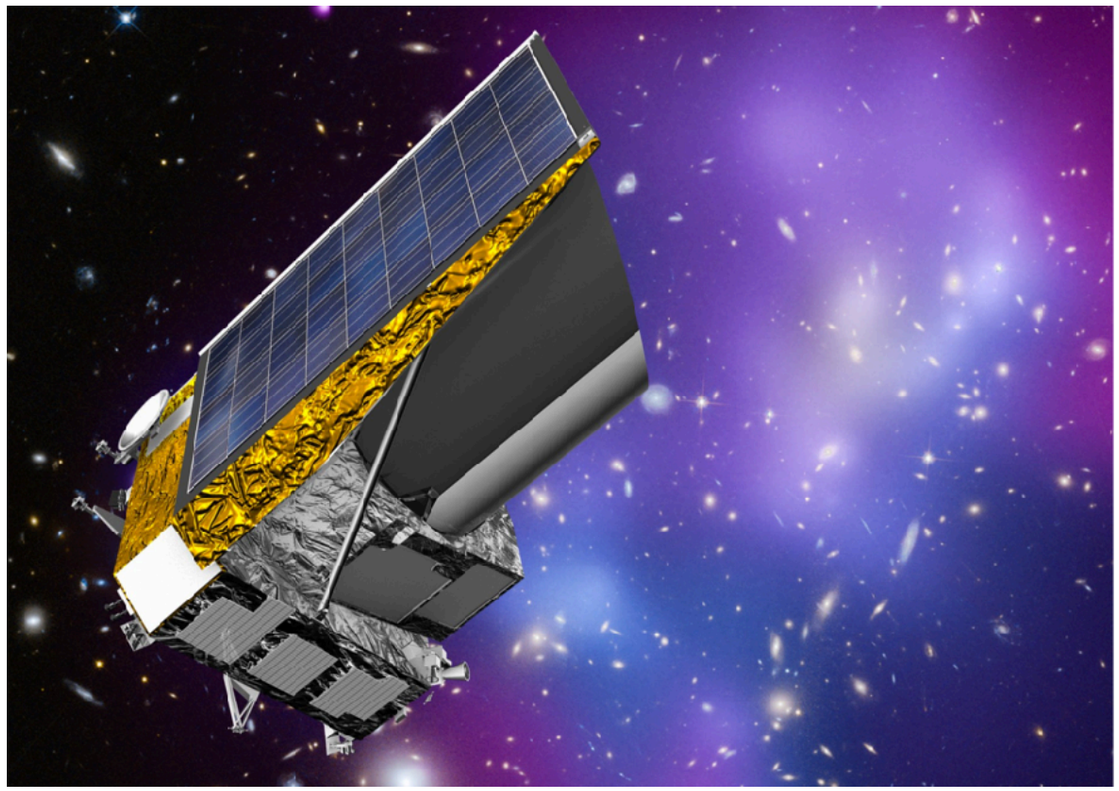
for Robert Schuhmann and Catherine Heymans

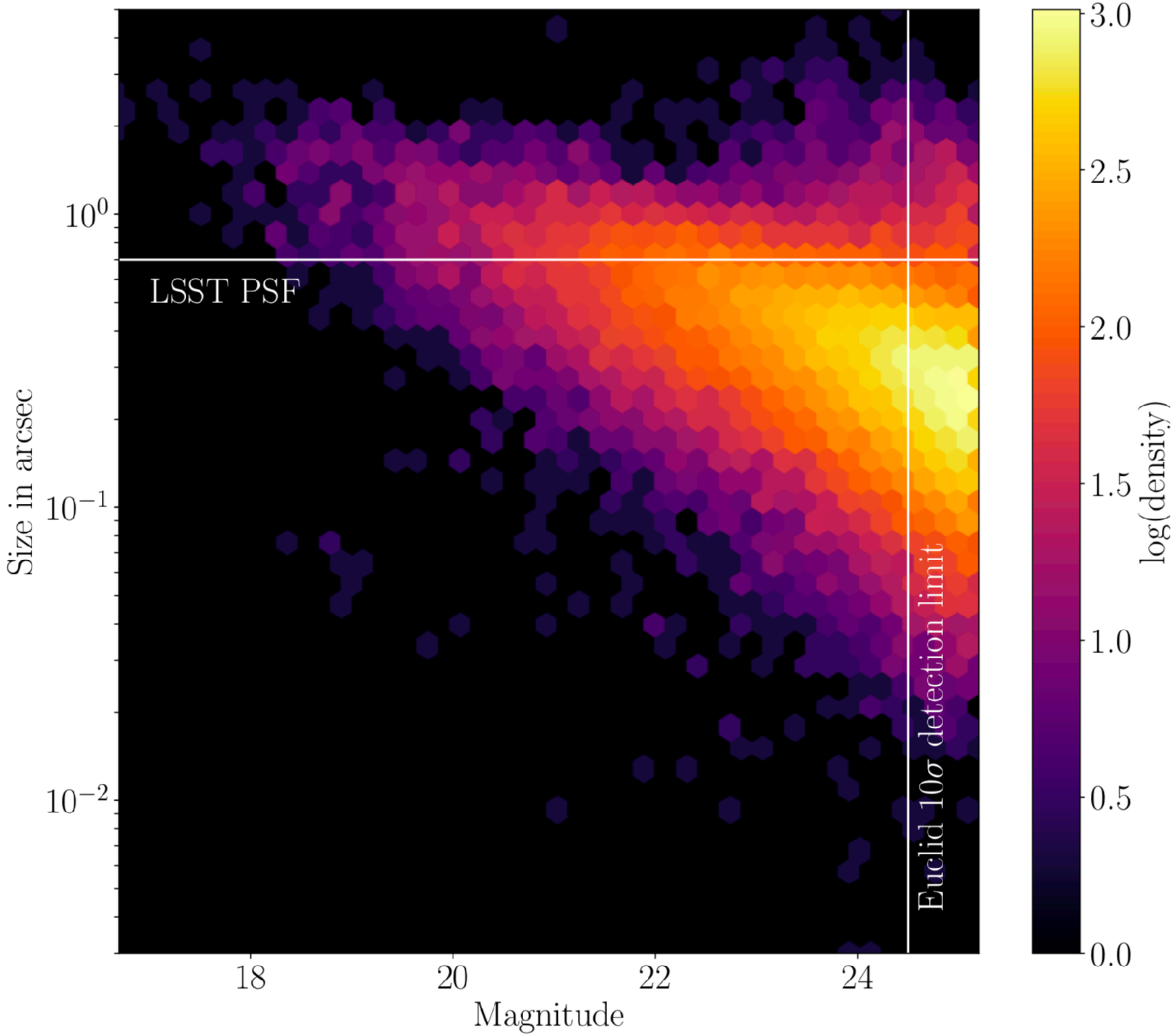
LSST & Euclid



- PSF 0.7 arcsec
- Mag. lim. 5σ r ~ 27.5
- Six filters

- PSF 0.06 arcsec
- Mag. lim. 10σ ~ 24.5
- Single broad filter

- e.g. Rhodes et al (2015), Jain et al (2017)


LSST PSF
Euclid 10σ detection limit
Size in arcsec
10^0
10^{-1}
10^{-2}
18
20
22
24
Magnitude
3.0
2.5
2.0
1.5
1.0
0.5
0.0
log(density)

Joint Analysis Approaches

1. Combined final lensing catalogs

2. Euclid catalog used as prior for LSST deblending, LSST catalog used for Euclid photo-z

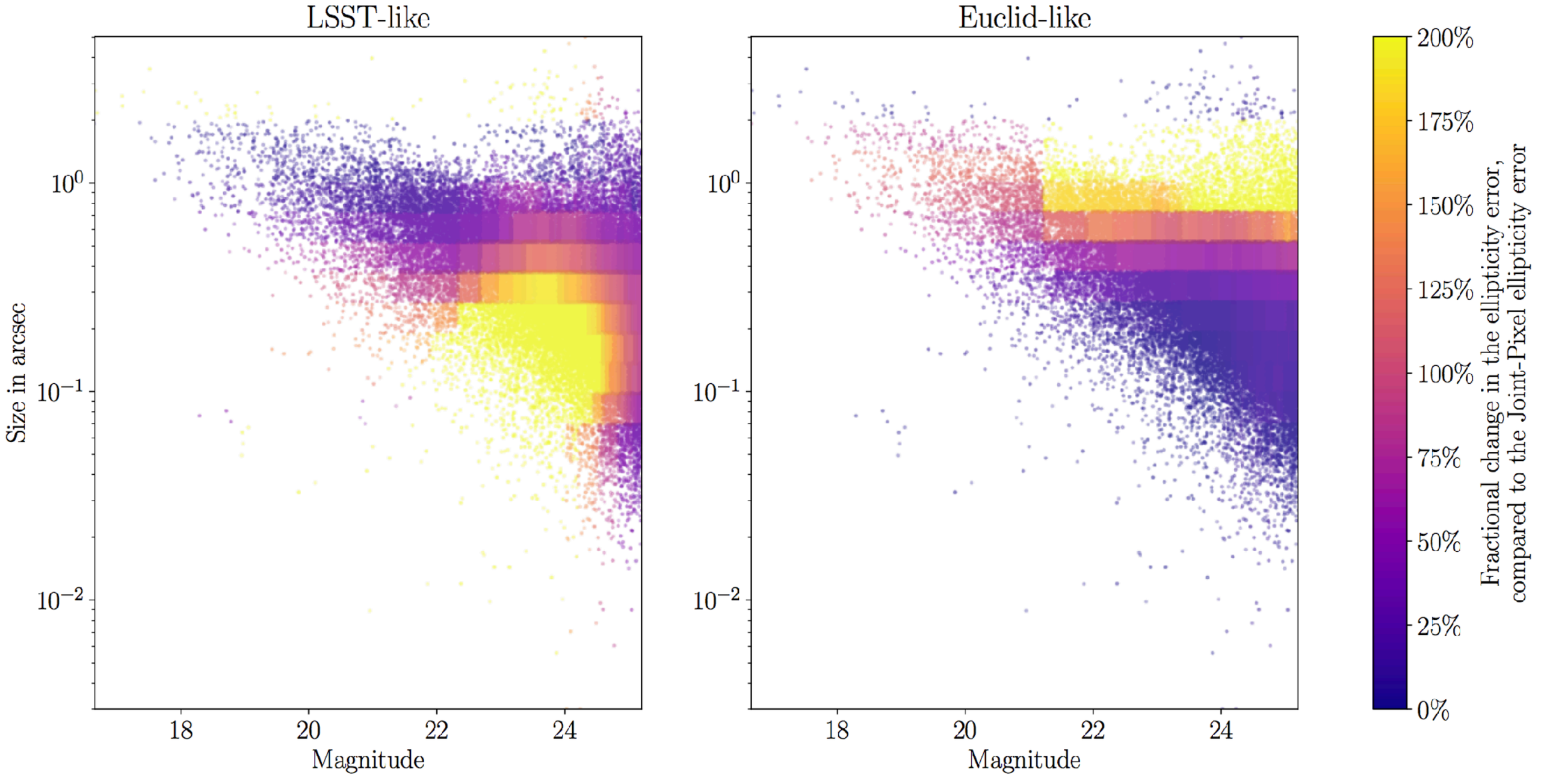
3. Joint pixel analysis, particularly for lensing analyses

    - Simultaneous modelling of the two data sets

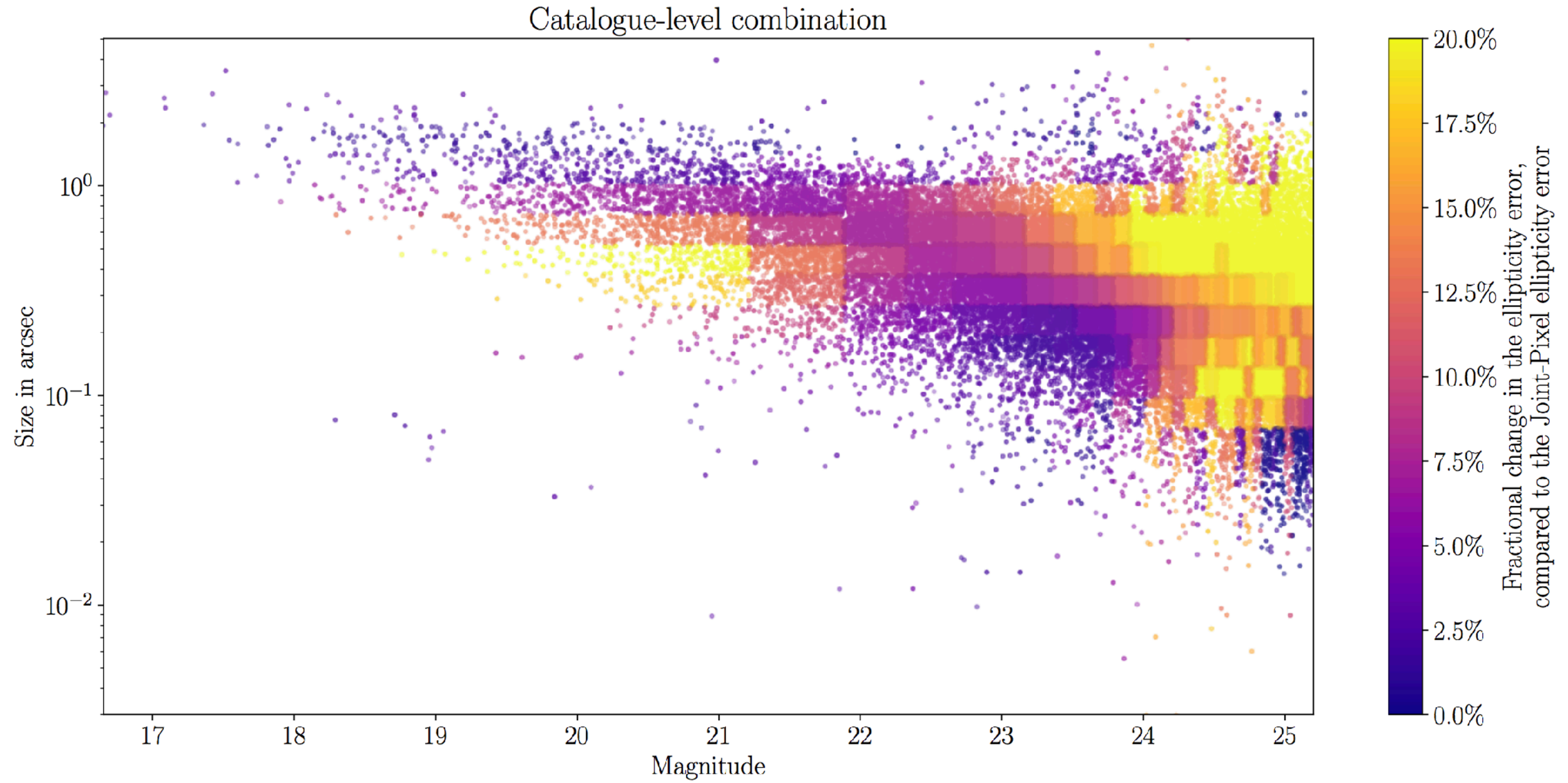
Phase A Paper

- What is the purely statistical gain from a joint-pixel analysis
    - Neglect deblending!
- Since blending will dominate, this sets **minimum improvement** from combining data sets
- Schuhmann, Heymans, & Zuntz arXiv 1901.08586

Error bar improvement single-surveys → joint-pixel



Error bar improvement catalog-only → joint-pixel



LSST-like

Euclid-like

Bin content/10^5

mean shrinkage: 2.32

mean shrinkage: 1.55

LSST ϵ-error / Joint ϵ-error

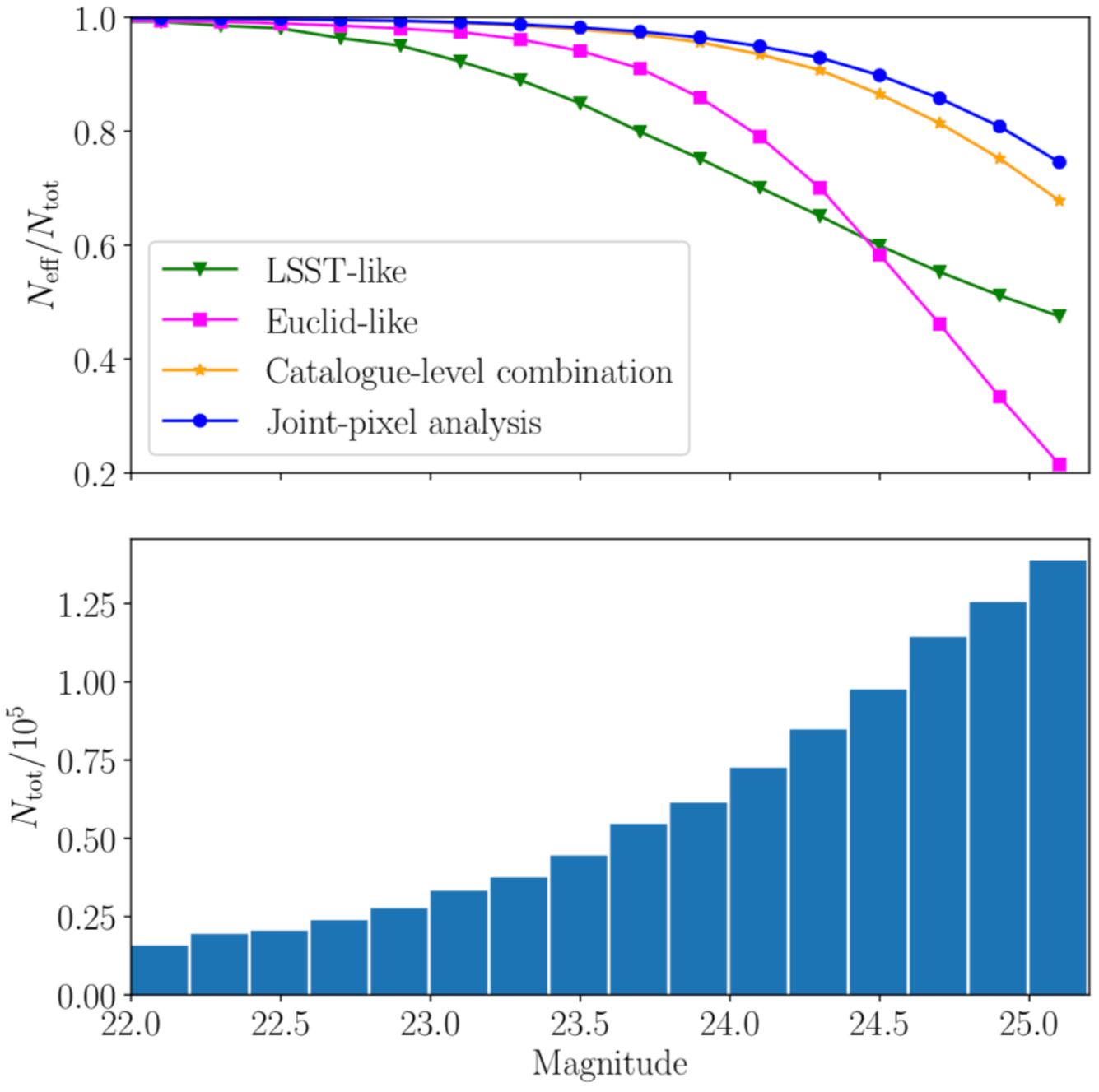
Euclid ϵ-error / Joint ϵ-error

Catalogue combination

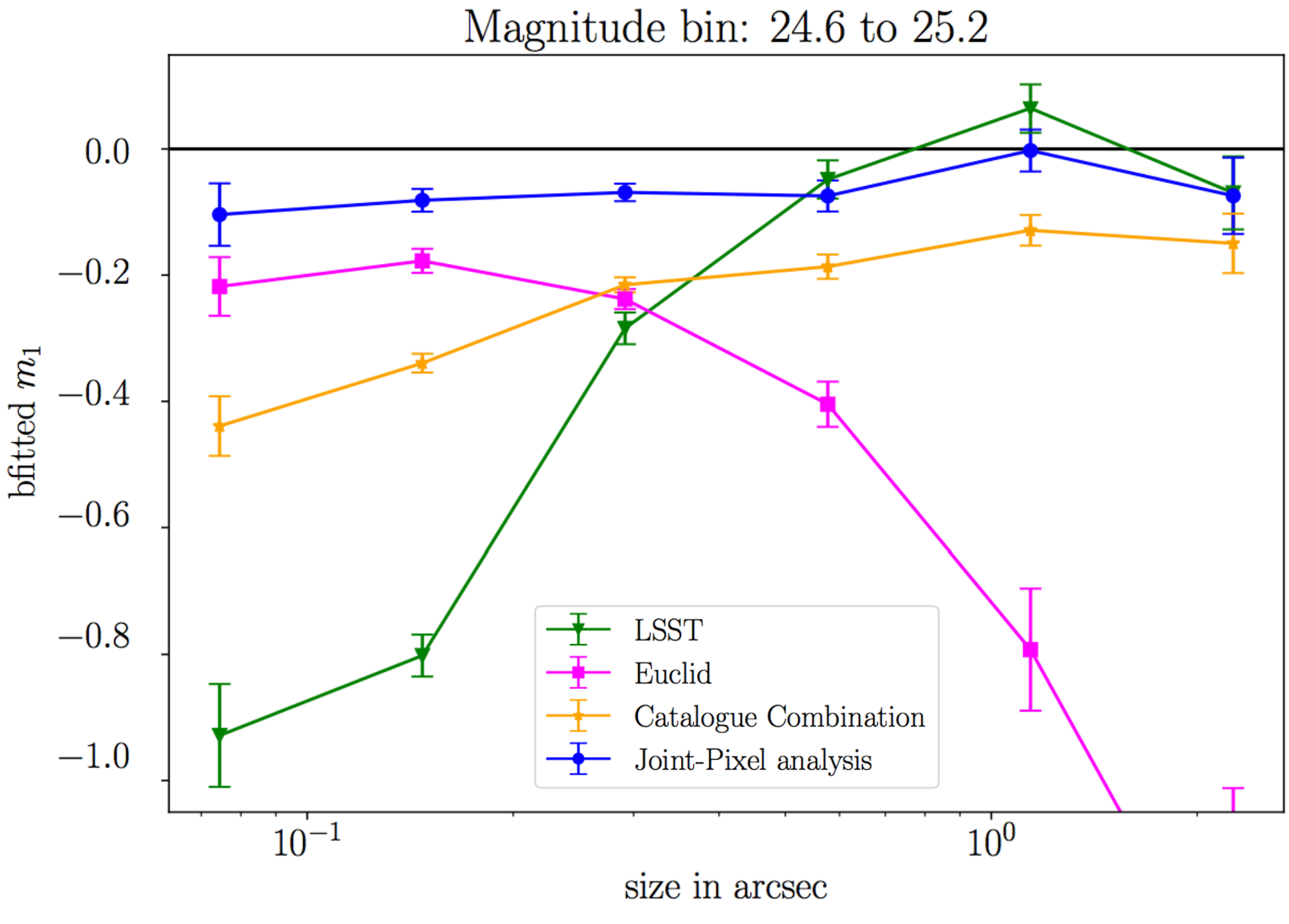
mean shrinkage: 1.14

CatComb ϵ-error / Joint ϵ-error

Number Count Improvement



Multiplicative Error Calibration Needed



UK Potential

- UK membership and expertise in both surveys offers unique chance for joint-pixel work
- Political questions complicated
    - DESC-Euclid MOU attempt on hiatus
    - ODF??

Conclusions

- Joint-pixel analysis is valuable enough *even* if errors were only statistical
    - True gain would be much bigger

- Even this toy analysis was hard!
  Real combination very challenging.

    - If your science would benefit then discuss it now