

HLIS



roman-hlis-cosmology.caltech.edu



github.com/Roman-HLIS-Cosmology-PIT



Early Career Scientist Talk: Stage IV Observation, Stage IV Computation

Presenter: Kaili Cao (The Ohio State University)

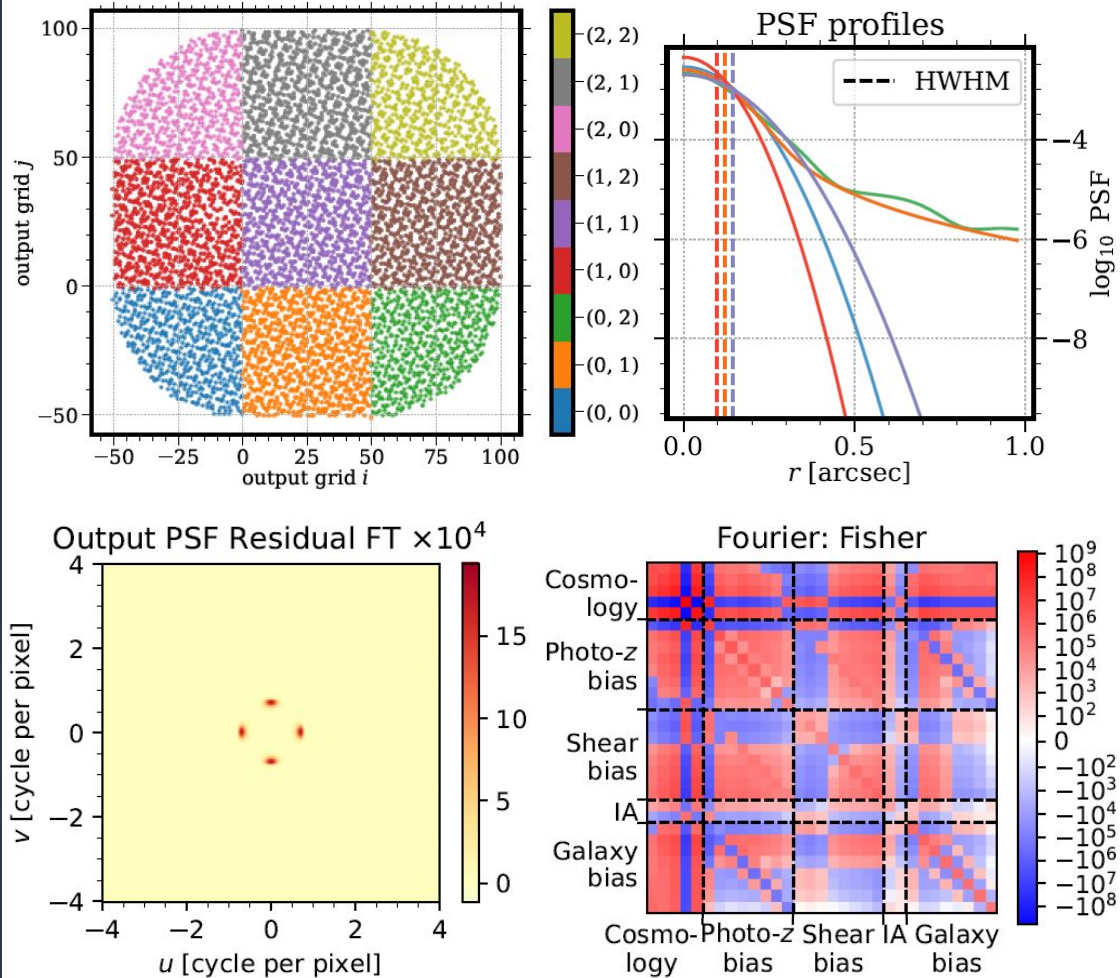
Roman HLIS Cosmology PIT Face-to-Face Meeting 2025, November 19, 2025

↖: PyIMCOM
Instrument (P3)
KC, CH++ 2025a (Fig. 1)

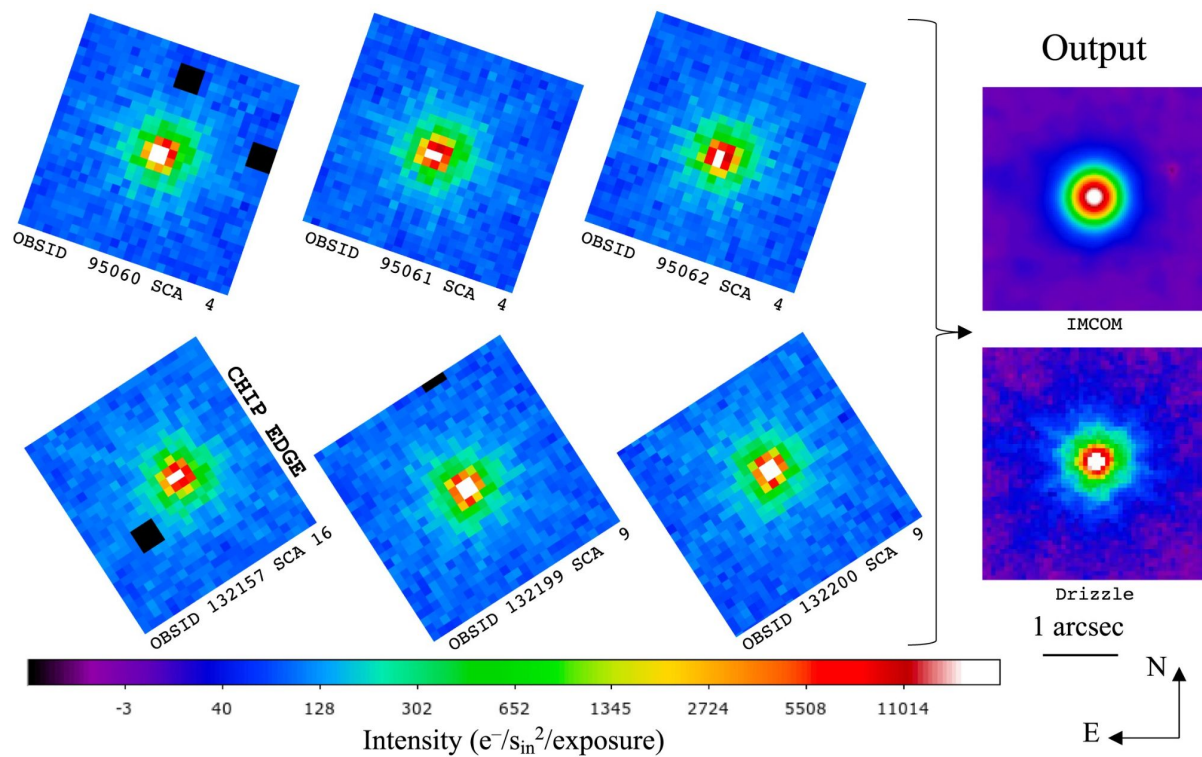
↗: PyIMCOM
Optimization (P4)
KC, CH++ 2025b (Fig. 2)

↙: Fast IMCOM
Demonstration
KC 2025 (Fig. 5)

↘: Fisher Forecasts
KC, DW++ 2025c (Fig. 4)



SCM M2a. Image Coaddition (with IMCOM)



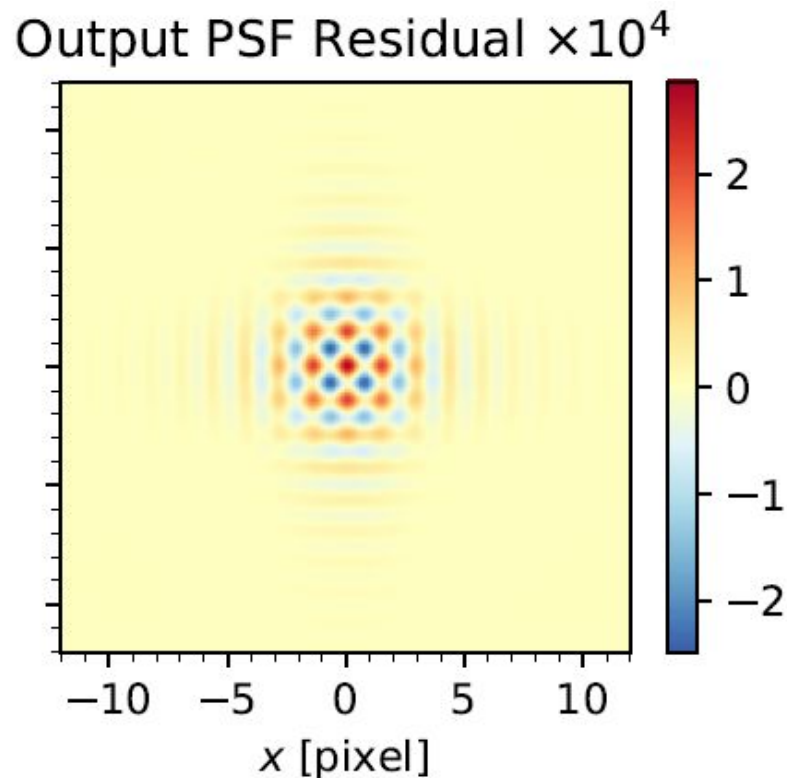
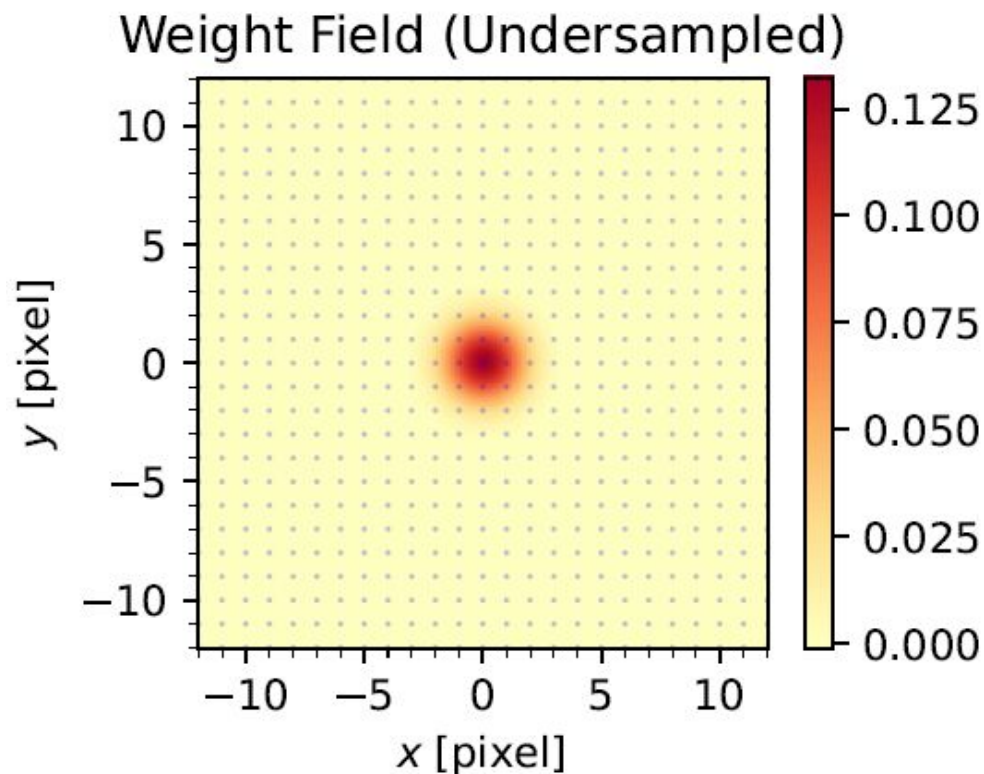
←: 3 dithers × 2 passes
(typical for Medium and
Wide Tiers of HLWAS)

↗: IMCOM (IMage
COMbination) – optimal
image coaddition

↘: Drizzle – efficient
image coaddition

*Credit: Figure 9 from
CH++ (incl. KC) 2024*

Fast IMCOM – Efficient Optimal Coaddition



Fast IMCOM – Efficient Optimal Coaddition

Algorithm	Traditional IMCOM	Fast IMCOM
Strategy	Single-step matrix inversion	Two-step: regrid then coadd
Est. Compute Cost	~100M core-hours	< 10M core-hours
Est. Storage	~1.5 PB	~0.2 PB
Noise Properties	Random realizations	Semi-analytic model
Survey Optimization	Full simulations	Simple calculations

New possibility: A feedback loop for improving astrometry, calibration, PSF modeling.

What if the **Maker of the Universe** came to tell us the correct cosmological model and parameters?

We would say:

- a) We already know, but thanks!
- b) Thank you for taking our jobs...
- c) That does not sound very likely.
- d) You answer here: ____

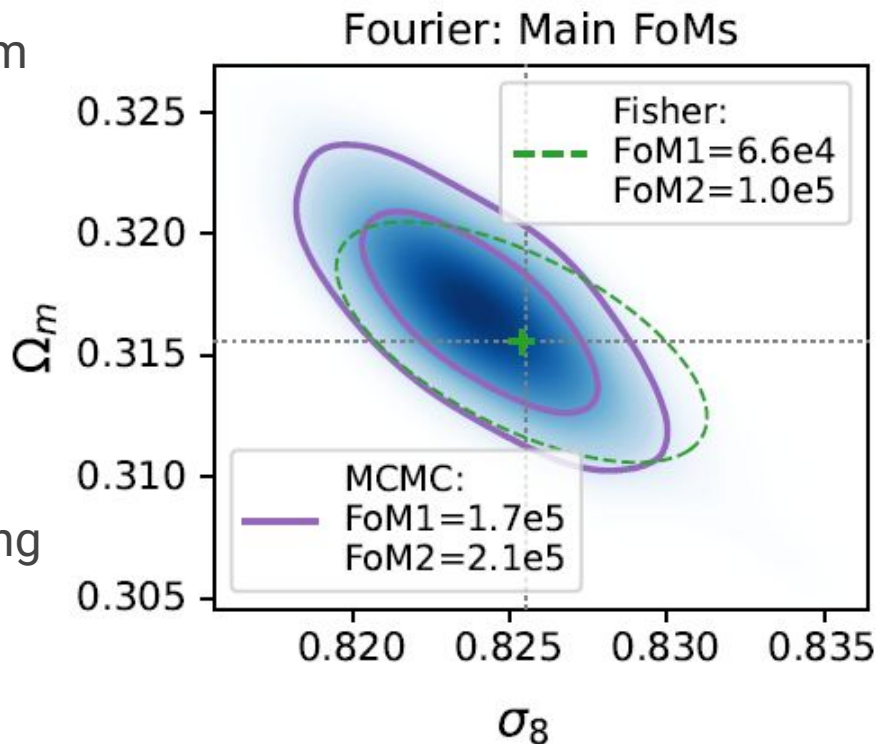
CPIP: Renaissance of Maximization and Fisher

Complementing mainstream
Markov chain Monte Carlo
efforts in the CPIP WG

Using data vectors and
covariance matrices from
Data Challenge 1

Using Cobaya-CosmoLike
Joint Architecture for making
theoretical predictions

Last day of *internal review*!



$$\text{FoM1} = 1/\Delta^2(\sigma_8)$$

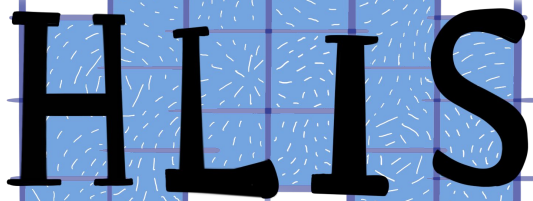
$$\text{FoM2} = \det^{1/2}(\text{Cov}(\sigma_8, \Omega_m))$$

Gray dotted
lines =
Truth
parameter
values



Blurred image: Andy Warhol's Campbell's Soup Cans (1962), a grid of soup-can paintings, with my photo in place of one can.

Credit: Andy Warhol



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