# NIRISS Pupil

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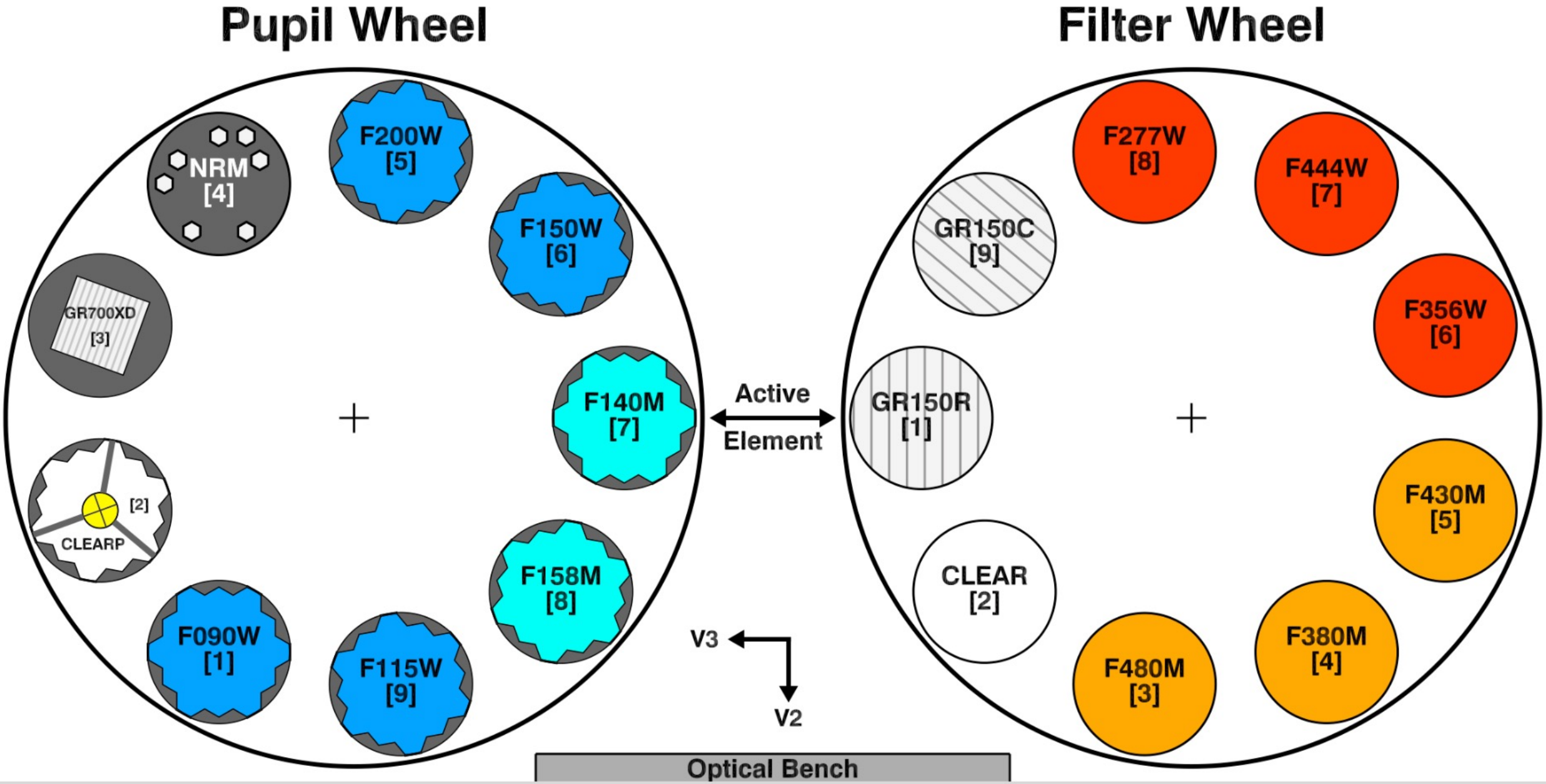
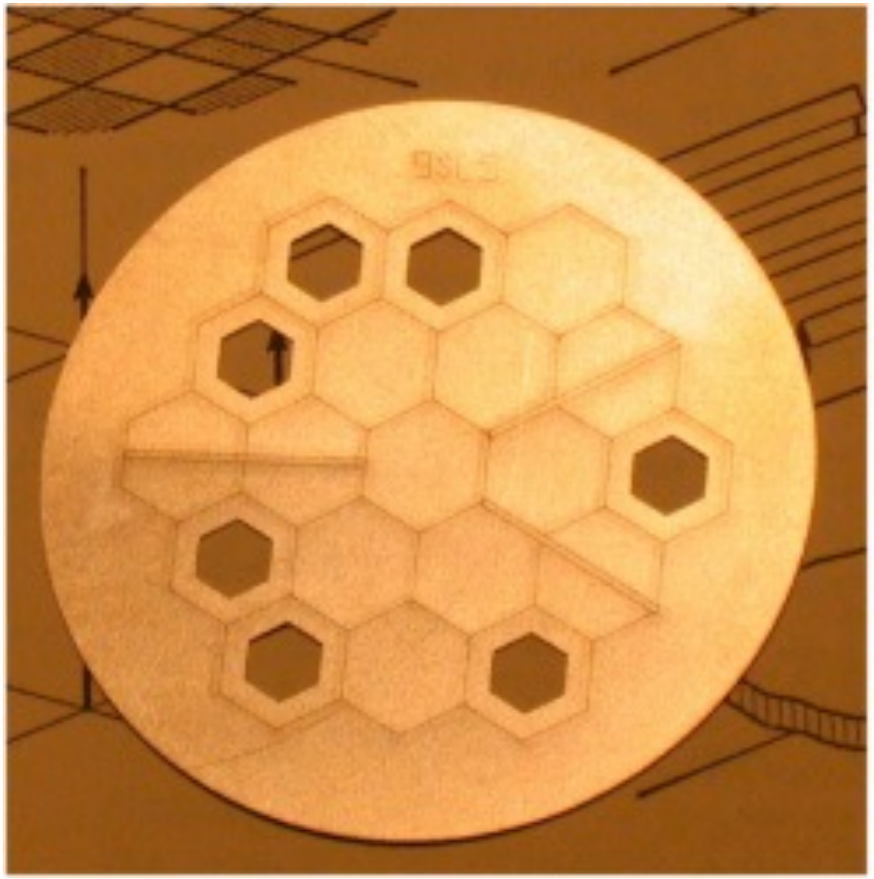
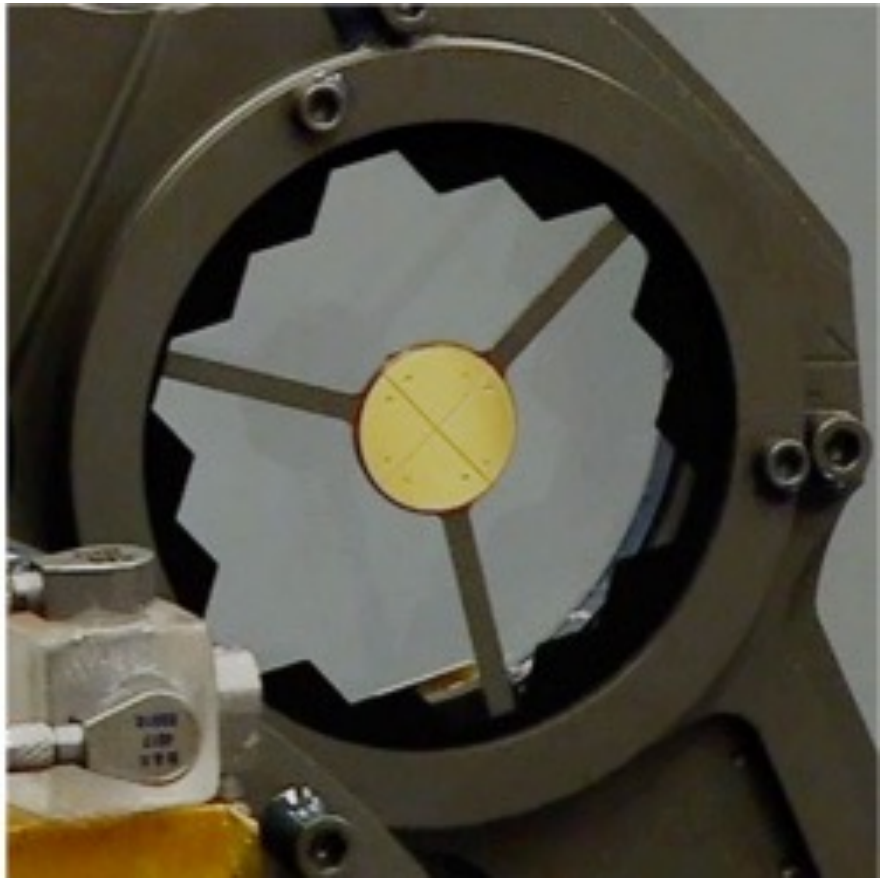

Pupil Wheel
Filter Wheel
NRM
[4]
F200W
[5]
F150W
[6]
GR700XD
[3]
F140M
[7]
[2]
CLEARP
F158M
[8]
F090W
[1]
F115W
[9]
Active
Element
F277W
[8]
F444W
[7]
GR150C
[9]
F356W
[6]
GR150R
[1]
F430M
[5]
CLEAR
[2]
F380M
[4]
F480M
[3]
V3
V2
Optical Bench



NRM



CLEARP

Includes the permanently mounted pupil alignment reference (PAR), which was used for optical alignment during assembly and ground-based testing. It reduces transmission through the slot by ~16%.

# CLEARP model

Properties:

- 39 mm outer diam, corresponds to the circumscribing pupil of JWST
- 2.0 mm vane width
- 6.0 mm radius for central obstruction

Additional offset of secondary w.r.t. entrance pupil from ground testing, in fraction of PM:

- pupil_shift_x = 0.0243  # CV3 on-orbit estimate + OTIS delta from predicted
- pupil_shift_y = 0.0141

Pupil magnification:

6.603464/39.0 =  0.1693 meters (JWST primary) per mm (NIRISS internal pupil)

# CLEARP model: WebbPSF & Poppy

- WebbPSF optical elements:
  - primary = webbpsf.optics.WebbPrimaryAperture()
  - secondary = poppy.AsymmetricSecondaryObscuration(secondary_radius=6.0 * pupil_mag,

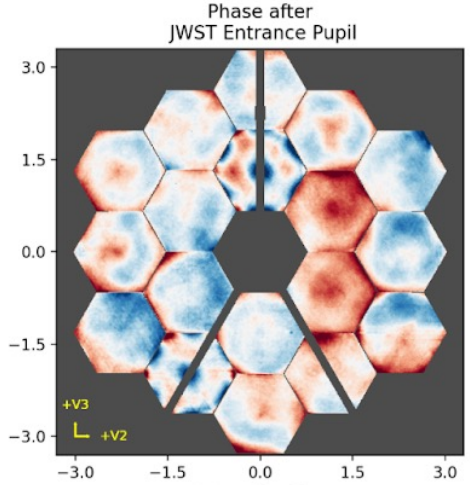
  support_width=2.0 * pupil_mag,

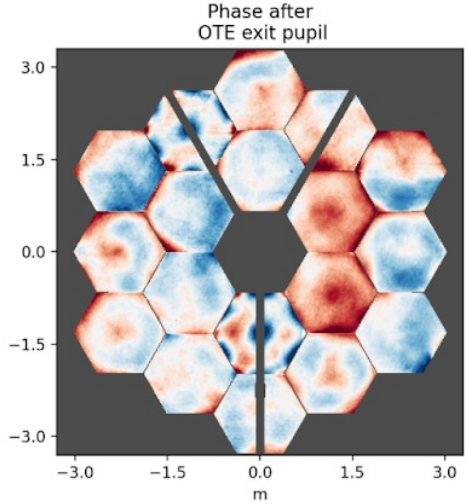
  support_angle=support_ang_rot,

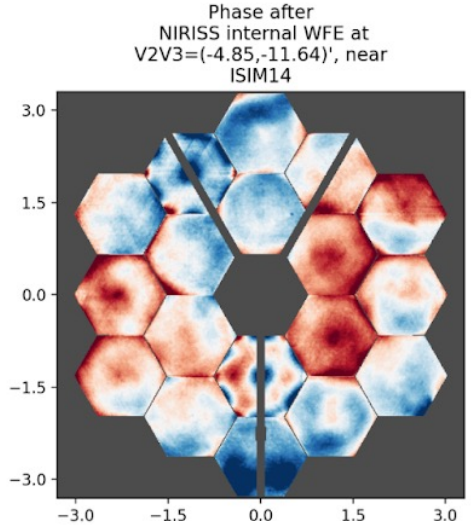
  shift_x=xoff,

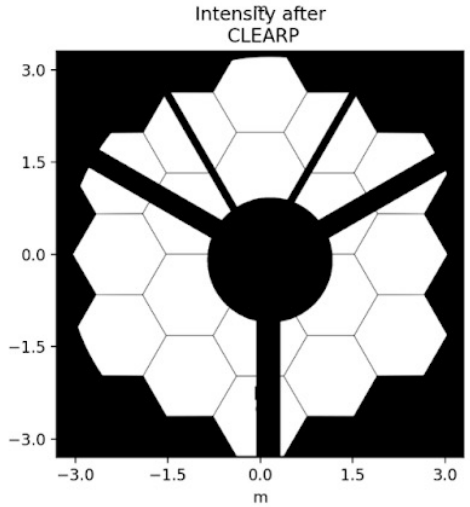
  shift_y=yoff)
- Rotation + translation from pupil wheel offset

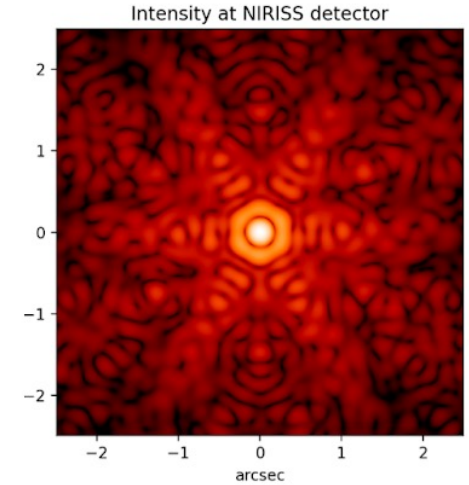
NIRISS, filter= F480M

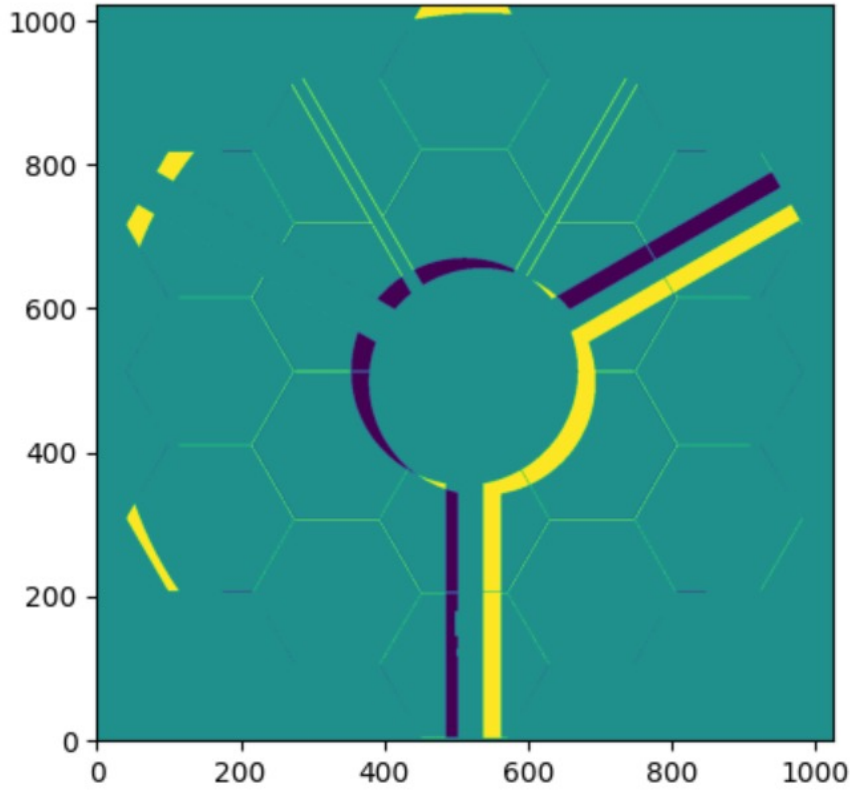


Exit pupil orientation

# Model flexibility

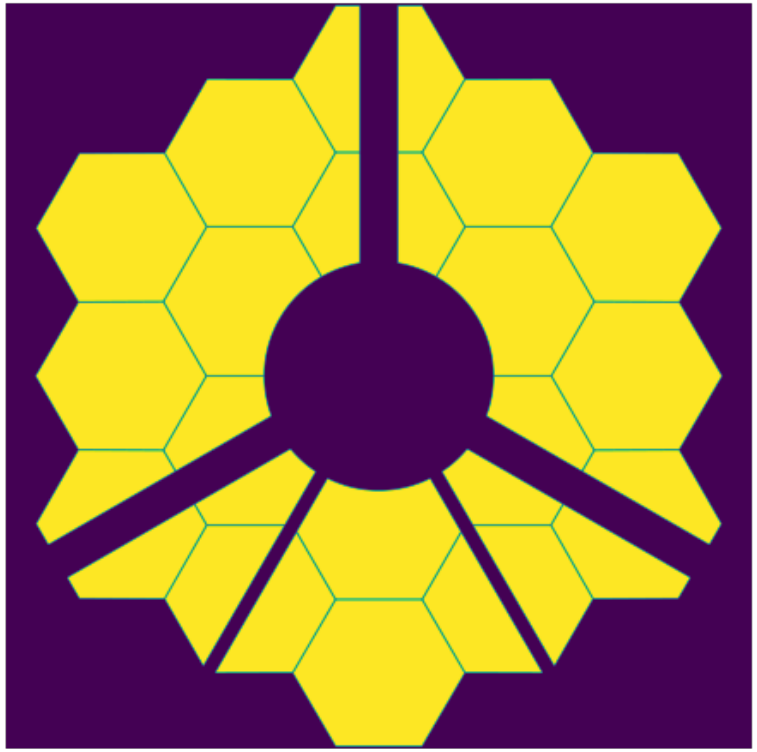
make_clearp(mag=None, wheelrot=None…)

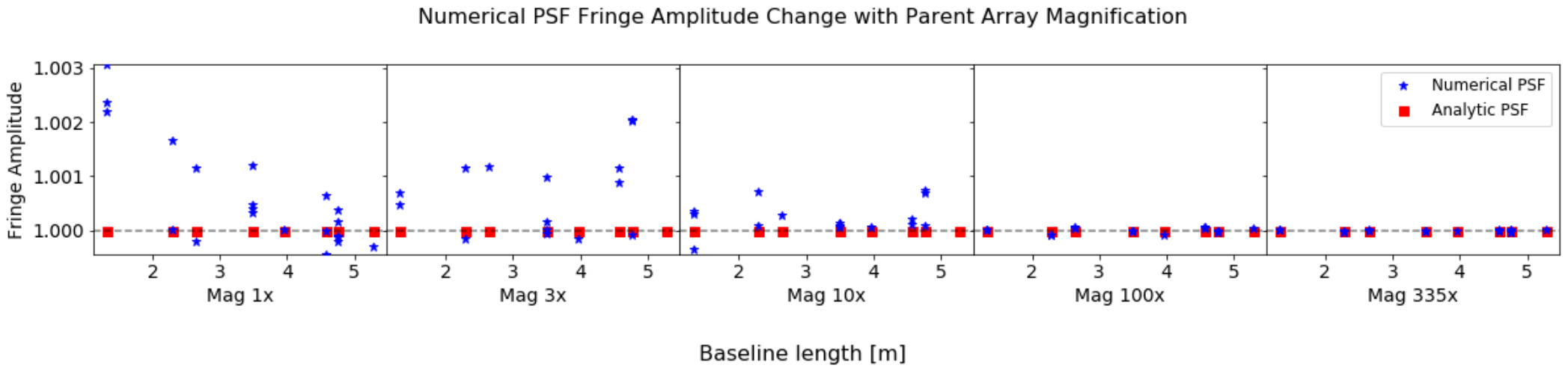
Wheel rotation:

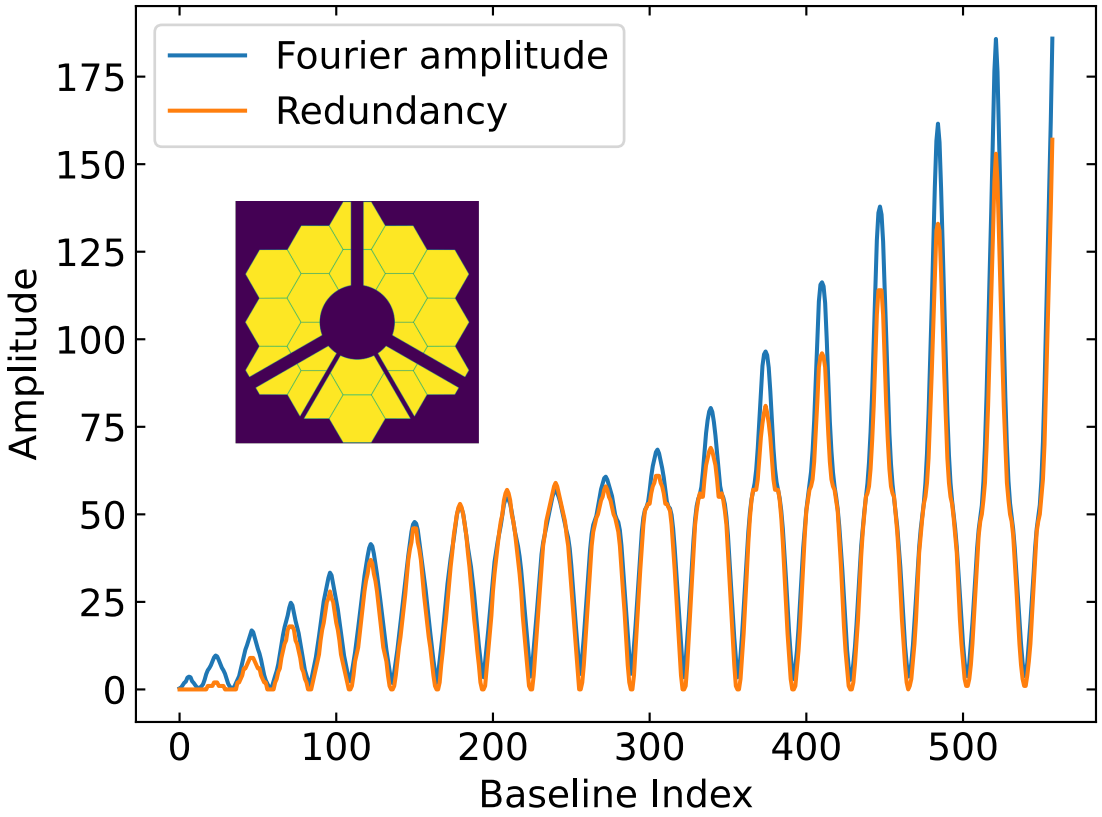
- NIRISS pupil wheel angular repeatability: ±0.1651° (± 0.04°)
- Value recorded in FITS headers

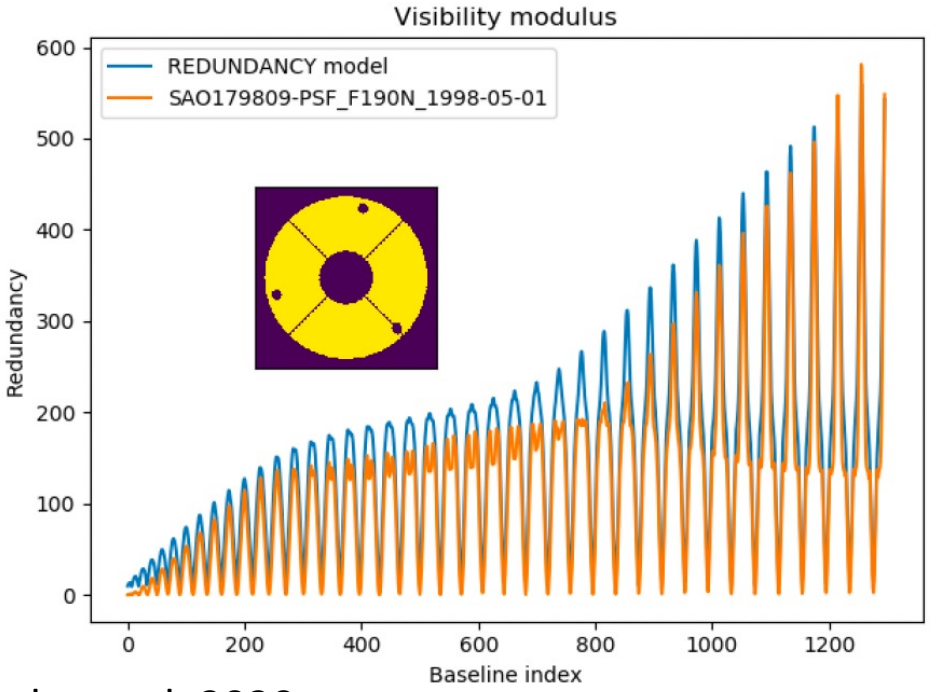
Magnification:

- Model oversampling & rebinning was critical for NRM model accuracy, enabled for CLEARP








Martinache et al. 2020