PACE-OCI pre-launch crosstalk characterization

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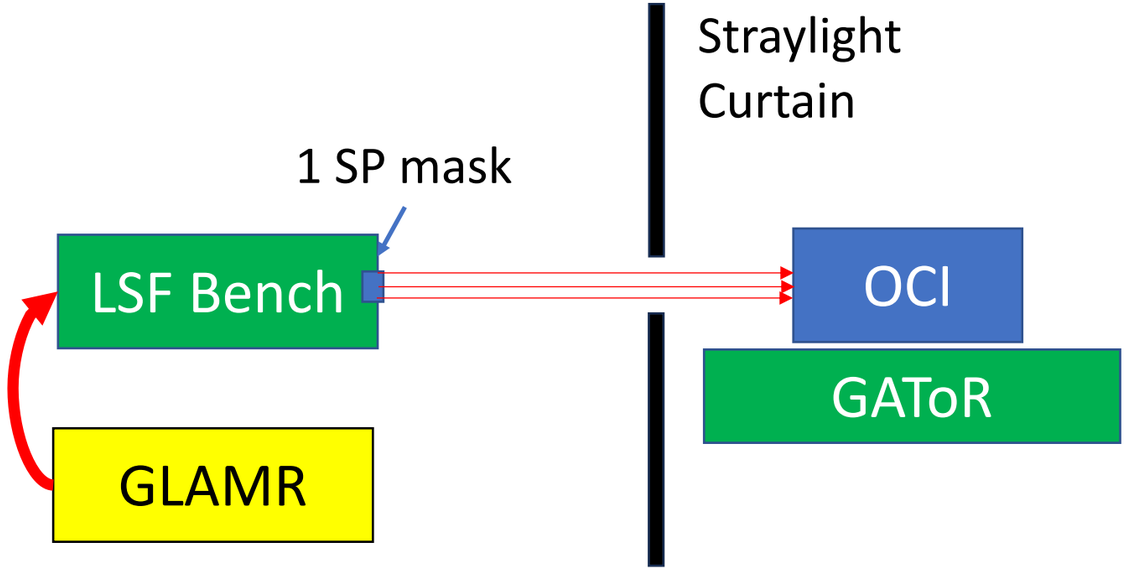
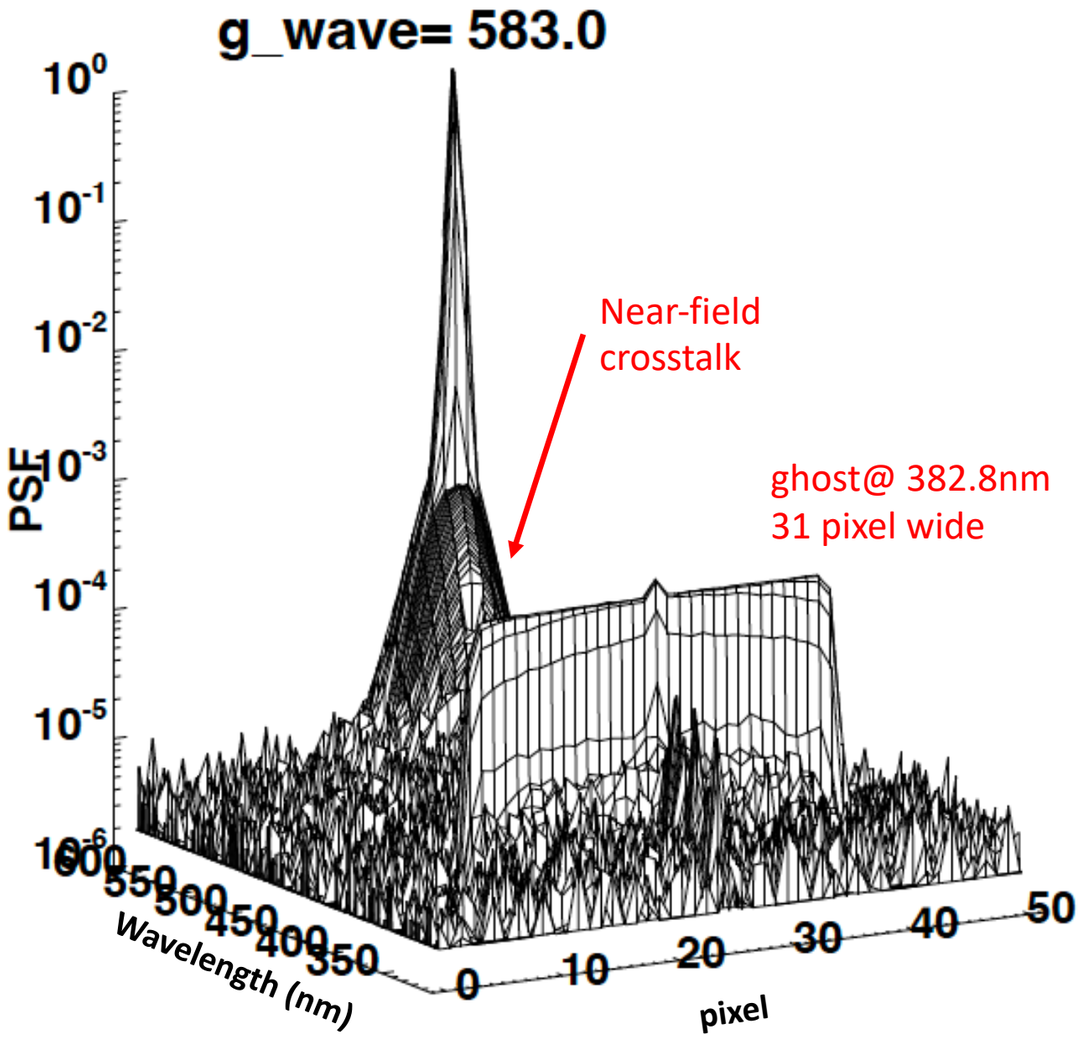
High Contrast Scene Measurements

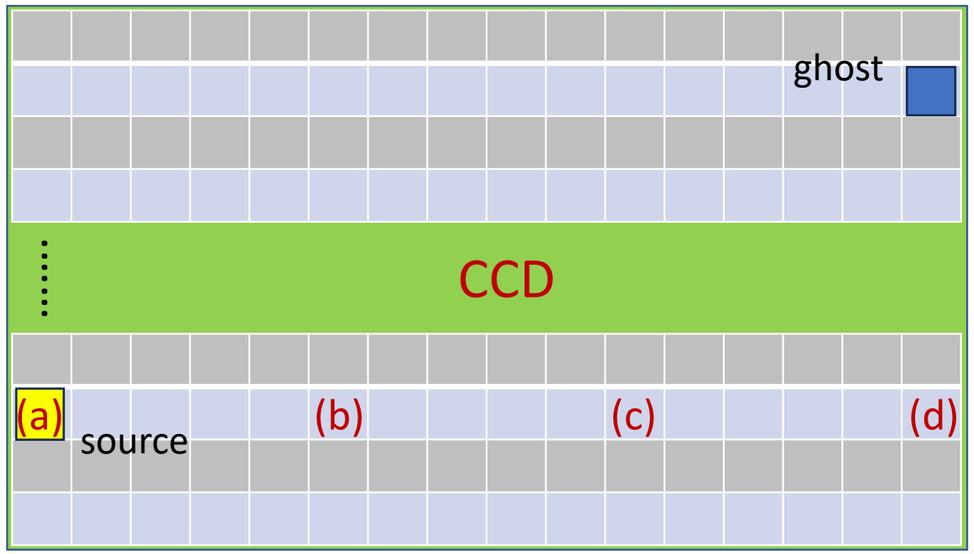




- Source: collimated, mono-chromatic light (GLAMR) @ 583 nm.
- Near-field crosstalk into adjacent pixels and wavelengths (bands); exponential decay
- Ghost at specific wavelengths and pixels; constant

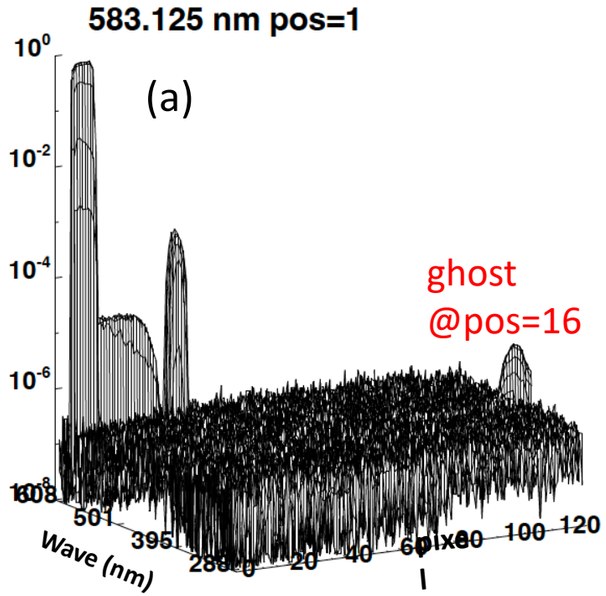
LSF = Line spread function

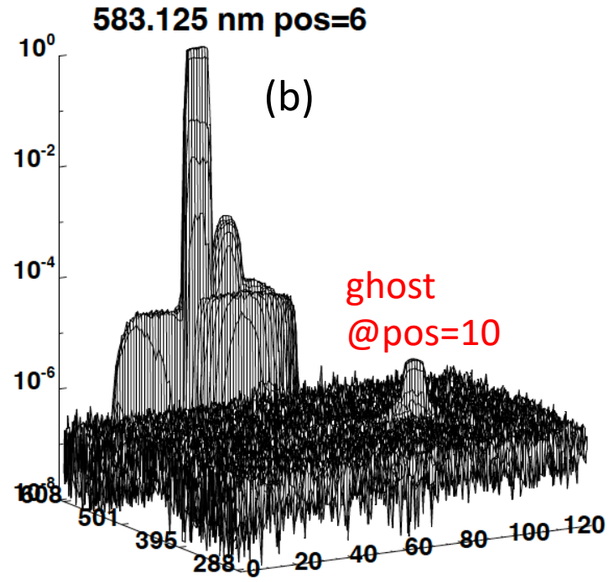
Ghost vs. TDI

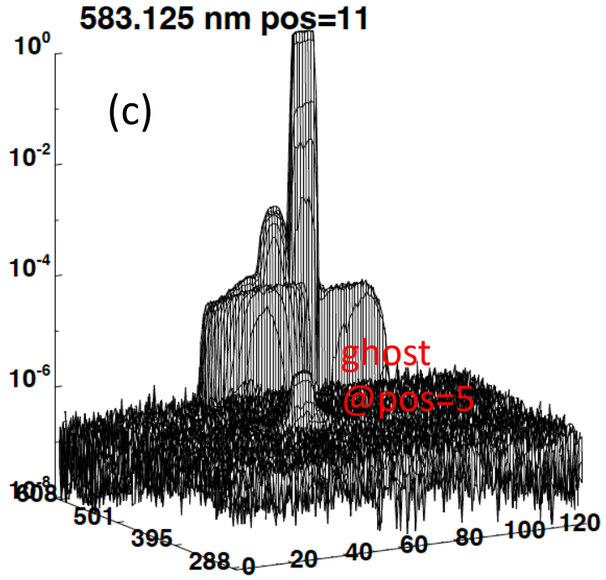


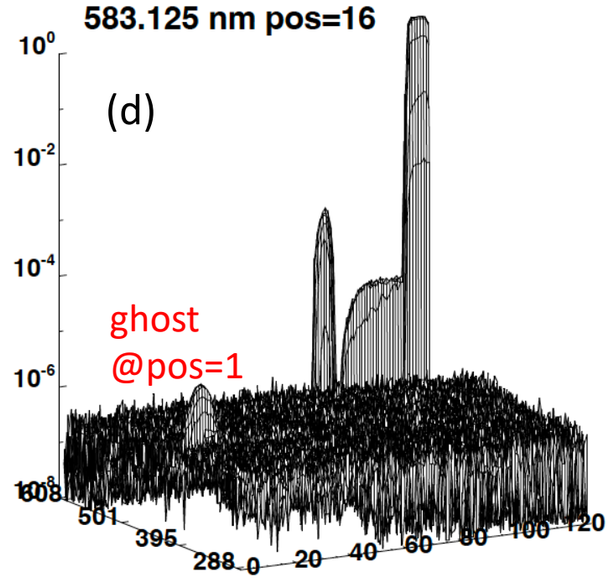
Spatial: 128 CCD detectors (16 science pixel) for TDI

- Ghost and TDI are spatially asynchronous. Source and corresponding ghost pixels are at mirrored positions.
- Effects illustrated by OCI optical model
- Quantified using test data

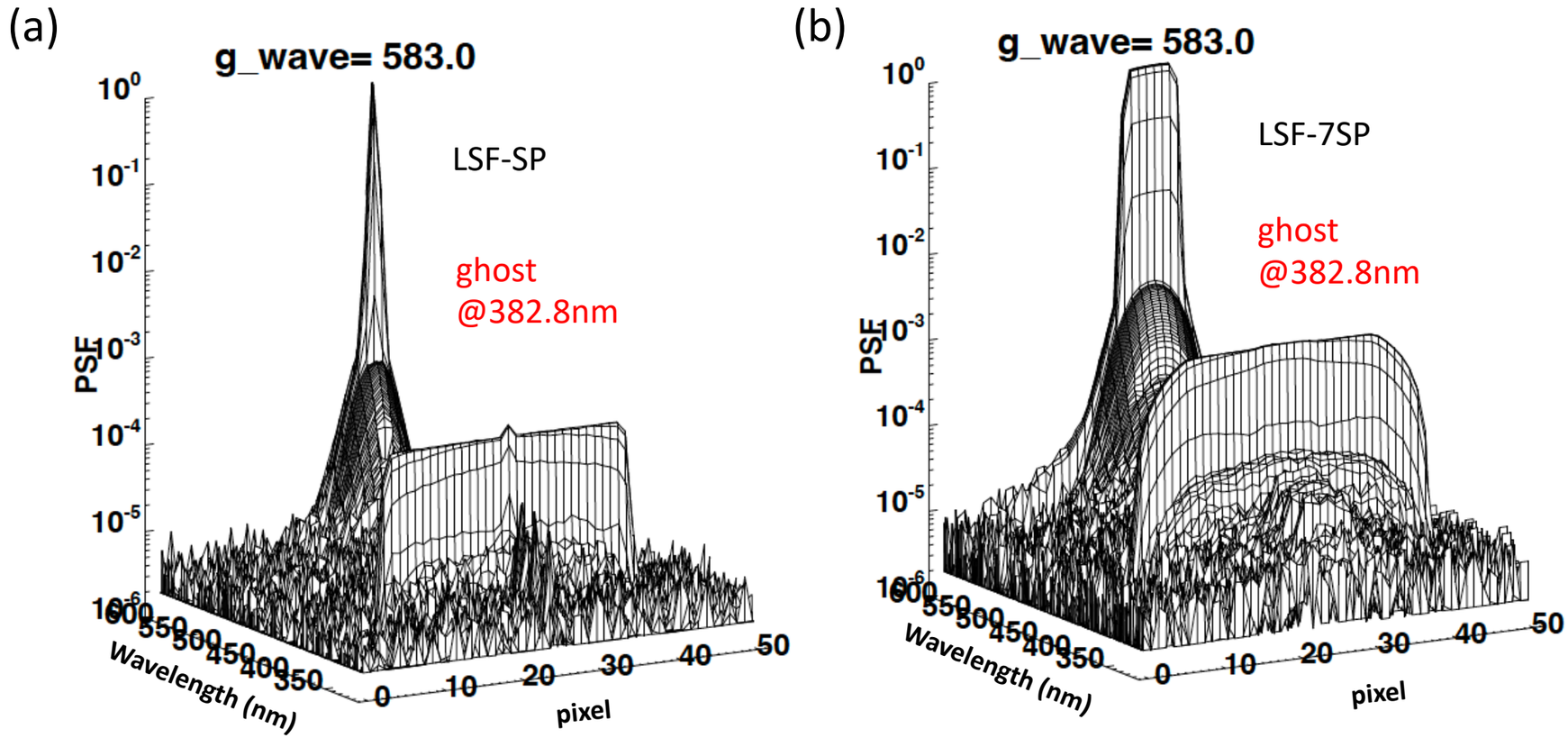








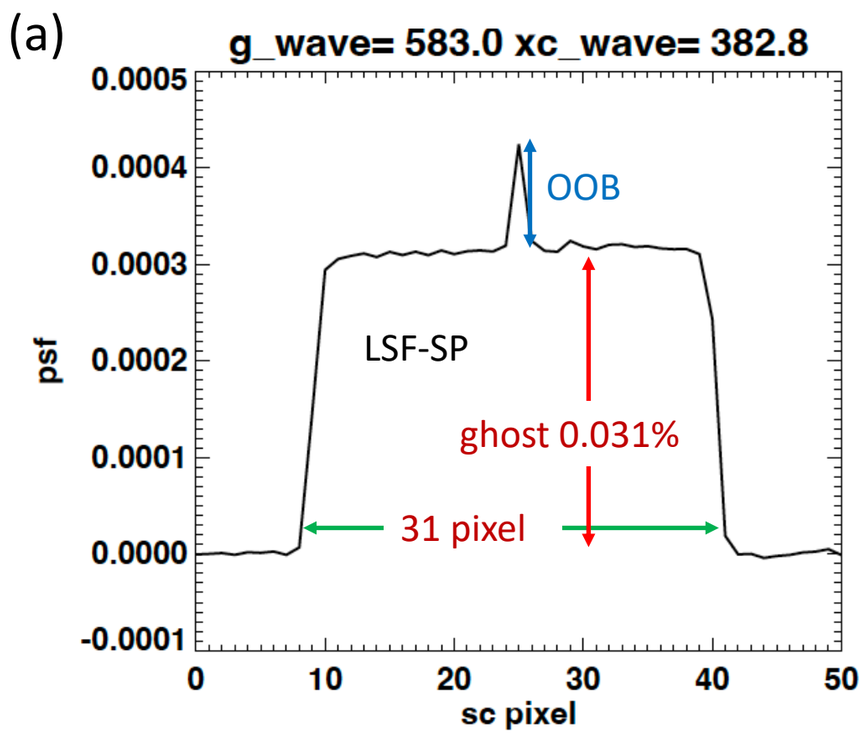
High Contrast Scene Measurements

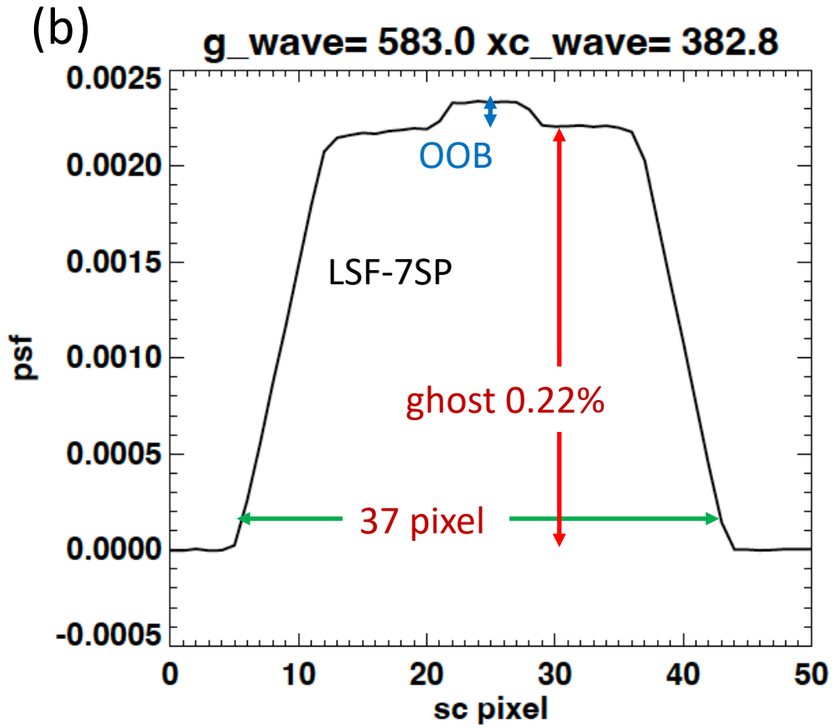


- LSF 1 science pixel mask (LSF-SP) vs. 7 science pixel mask (LSF-7SP)
- Stronger and wider ghost in LSF-7SP data than LSF-SP data

PSF = point spread function, g_wave = GLAMR wavelength

Ghost: LSF-SP vs LSF-7SP

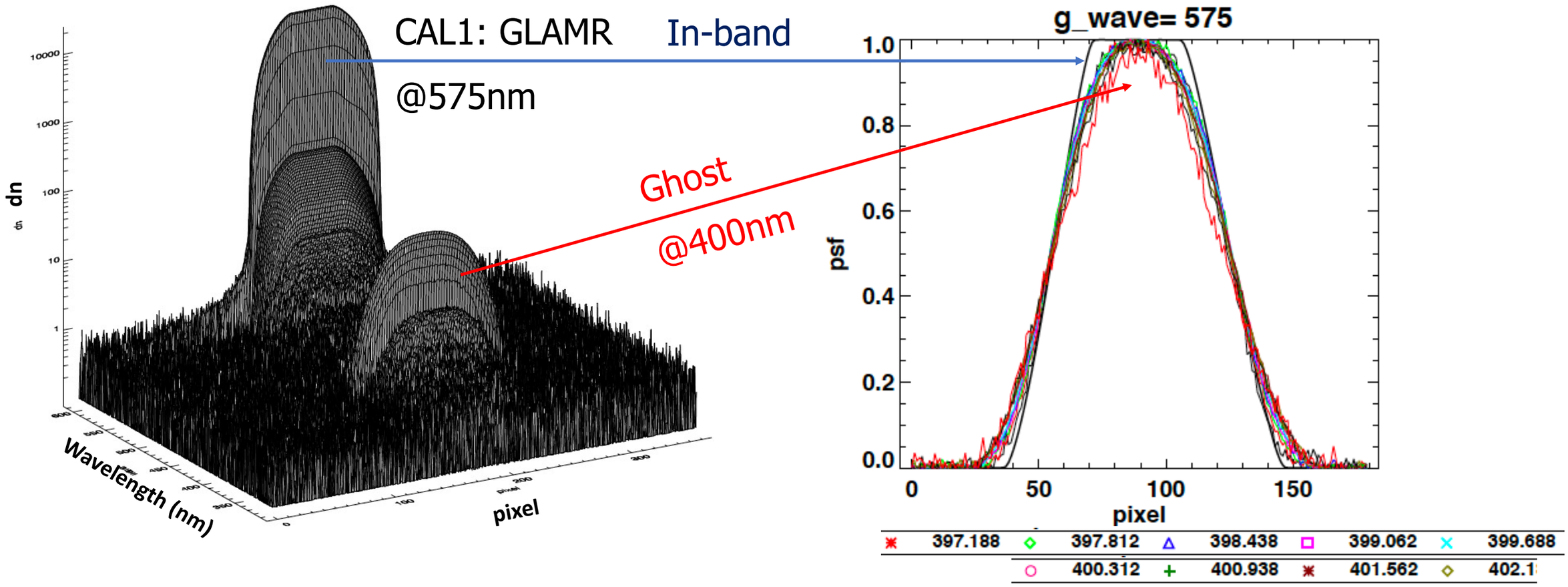




- Ghost Magnitude: LSF-7SP ~ 7x LSF-SP
- Ghost Spatial extent: LSF-7SP ~ LSF-SP + 6 pixels
- Ghost = convolution of (source and ghost feature; squared waves)
- OOB response (RSR): LSF-7SP ~ LSF-SP

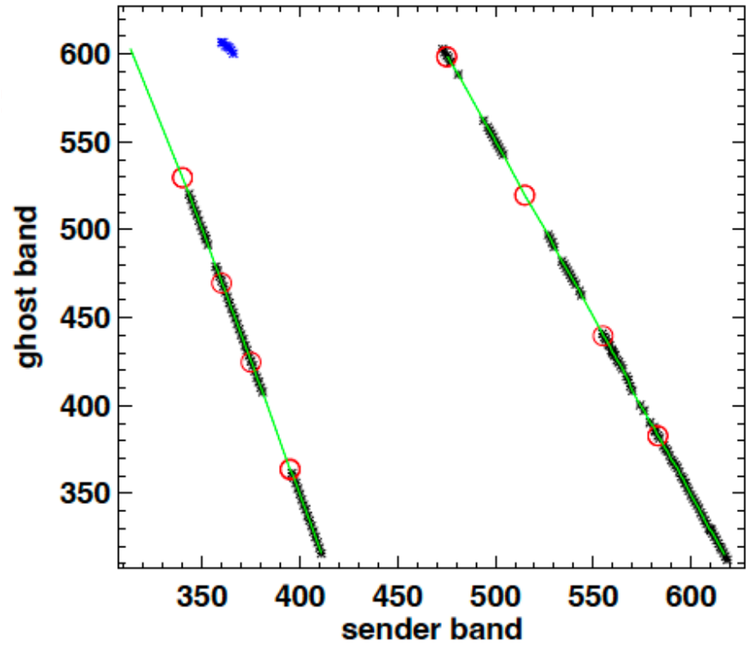
OOB = out-of-band

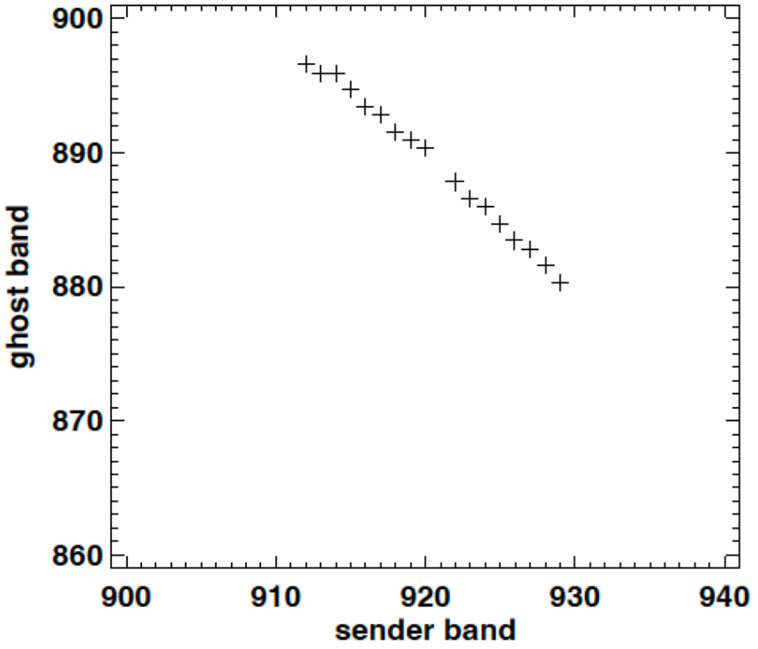
Ghost: monochromatic broad source

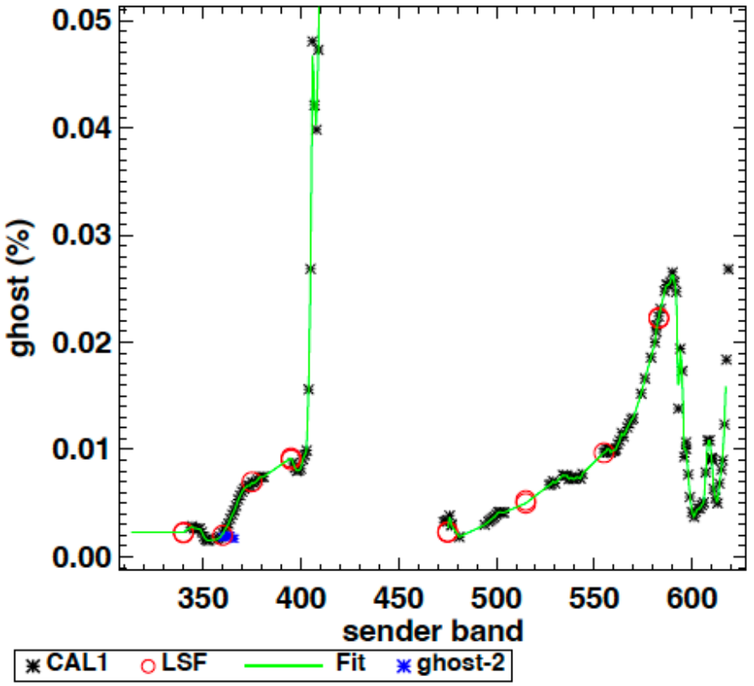


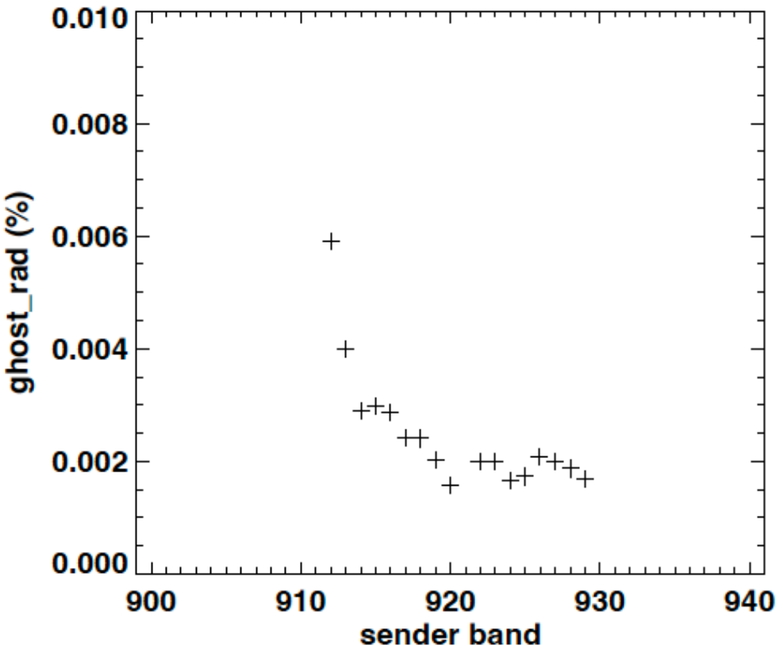
- ***From LSF-SP: Ghost = convolution of (source and LSF-SP ghost feature)***
- In-band response: source profile
- Ghost response: gaussian like shape
- OOB (not shown) response = in-band response

CCD Ghosts









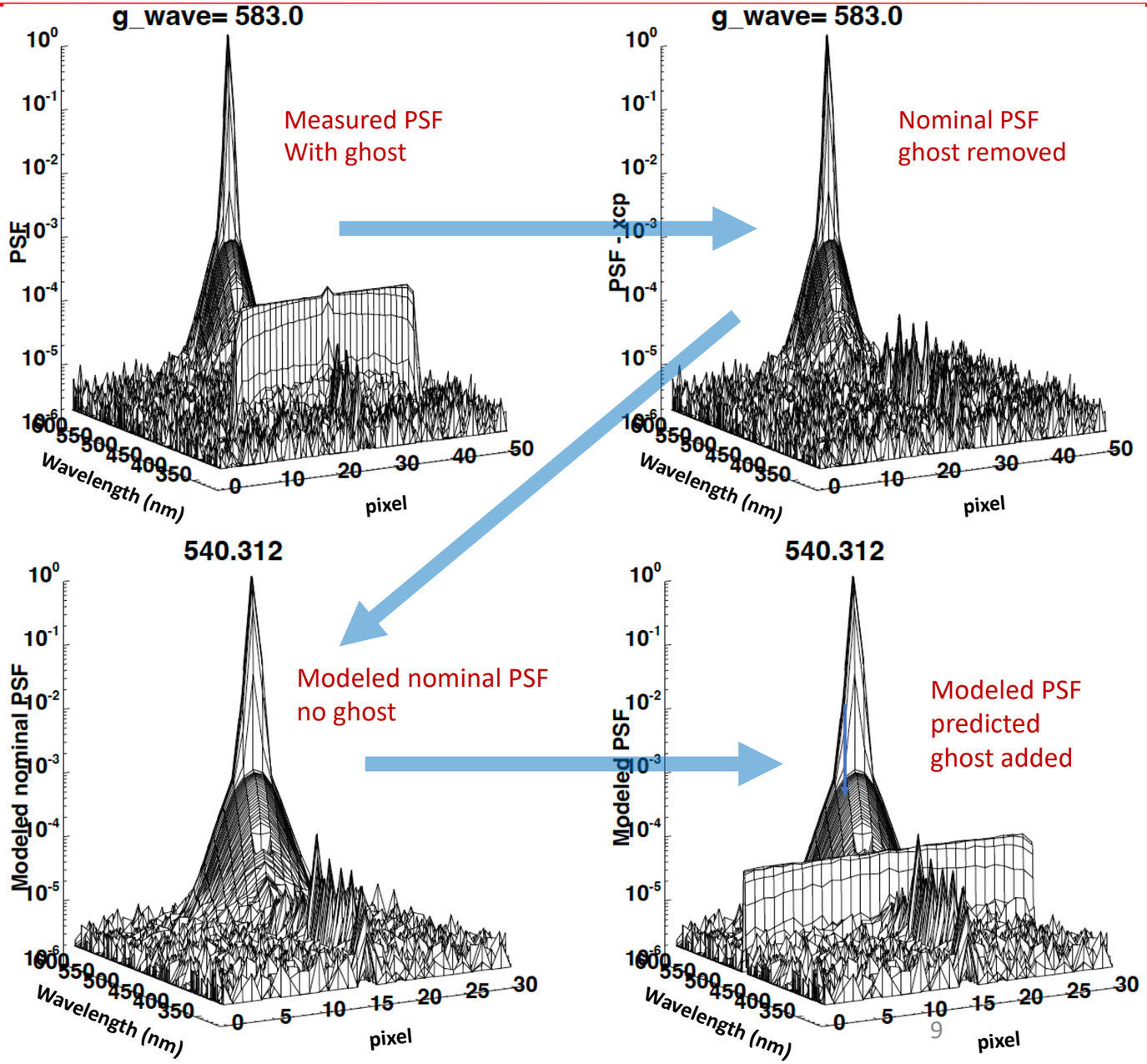
- LSF: collimated source @ selected wavelengths; Most accurate in ghost characterization
- Cal1: GLAMR broad source data@1-nm step
- Fit: interpolate LSF & Cal1 data

- Blue CCD has more and stronger ghosts than red CCD
- Red CCD ghosts originated from SWIR wavelengths
- Global science impact analysis show the red CCD ghost impact is under 0.01%. Ignore this in correct to simplified L1b processing.

Crosstalk Map Method

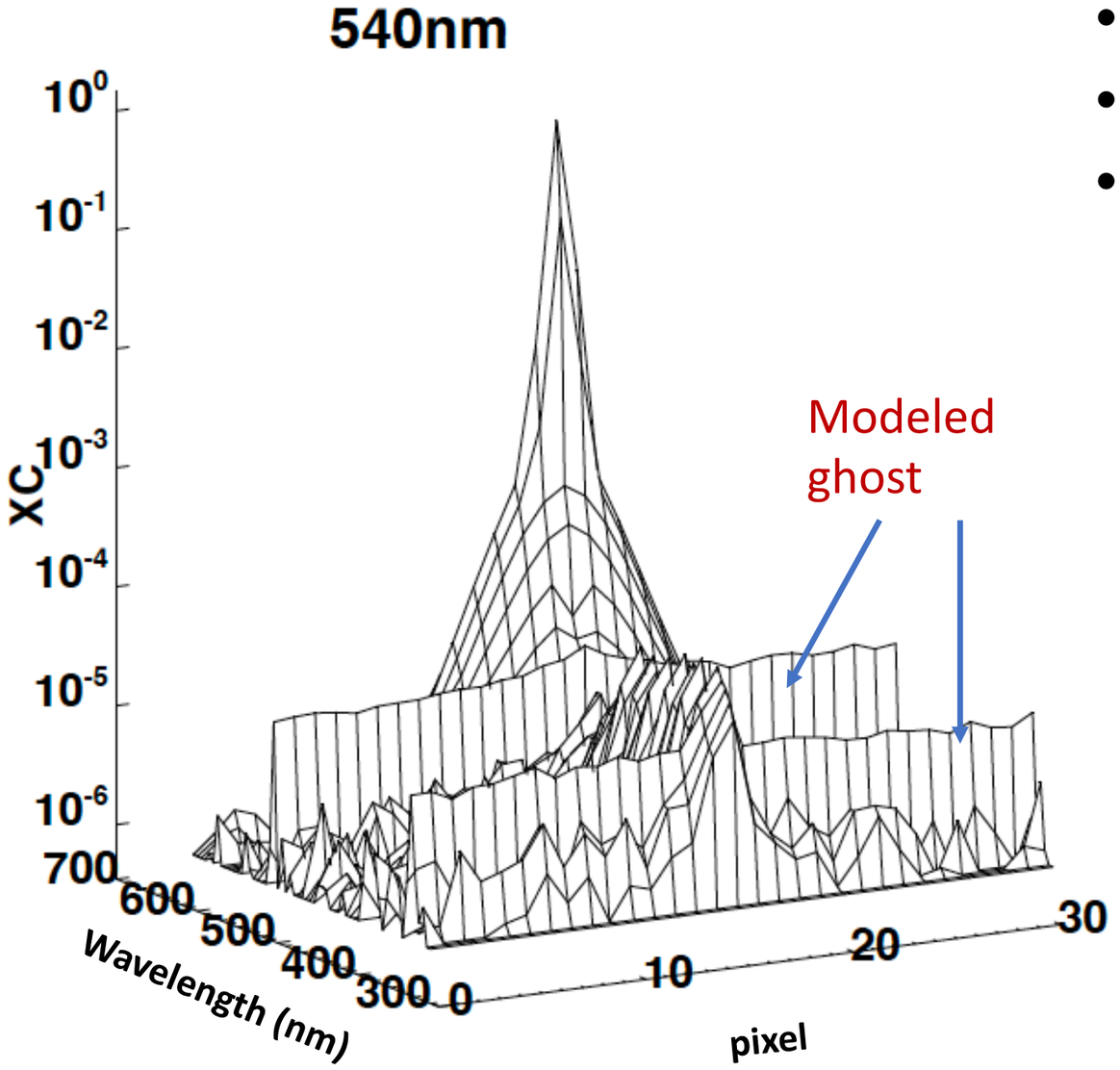
- **PSF**
  - Determine ghost wavelength and magnitude in LSF and CAL data
  - Interpolate from measured wavelength to all CCD bands
  - In LSF-SP data, remove ghost in PSF to create nominal PSF.
  - For each band, compute modeled nominal PSF by interpolating 2 adjacent nominal PSFs.
  - Add ghost based on the predicted wavelength and magnitude.
- **PSF to crosstalk**
  - For each band, compute crosstalk map with sender bands from the same CCD using the modeled PSFs.
  - Crosstalk map is computed in 0.625nm resolution from 325nm to 890 nm; Can be aggregated to 5nm bands for science data analysis

Model PSF

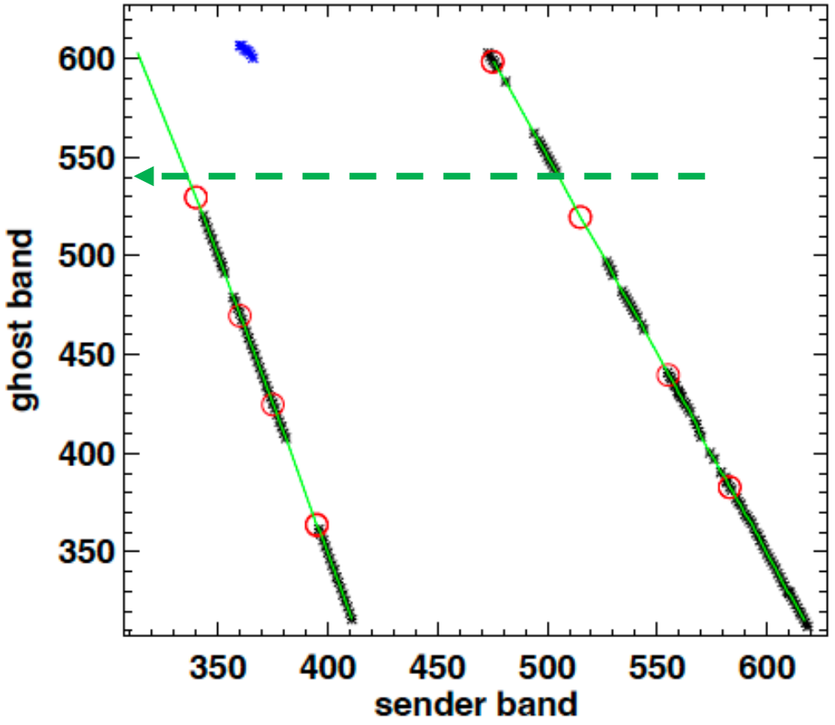


- Nominal PSF (Top R): ghost feature removed from measured data.
- Modeled nominal PSF (Bot L): interpolated from 535 and 555 nm nominal PSF.
- Modeled PSF (Bot R): Add ghost feature in modeled nominal PSF.

Crosstalk

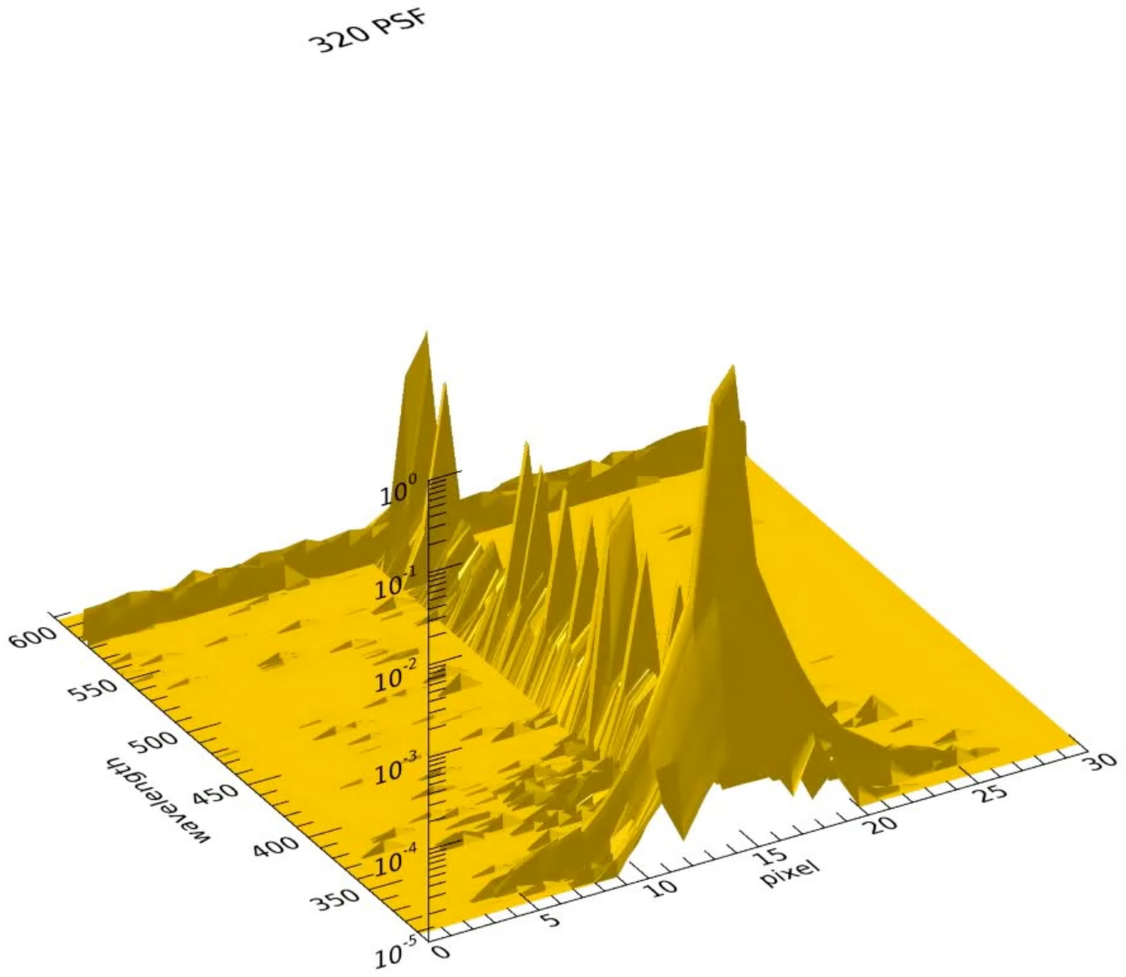


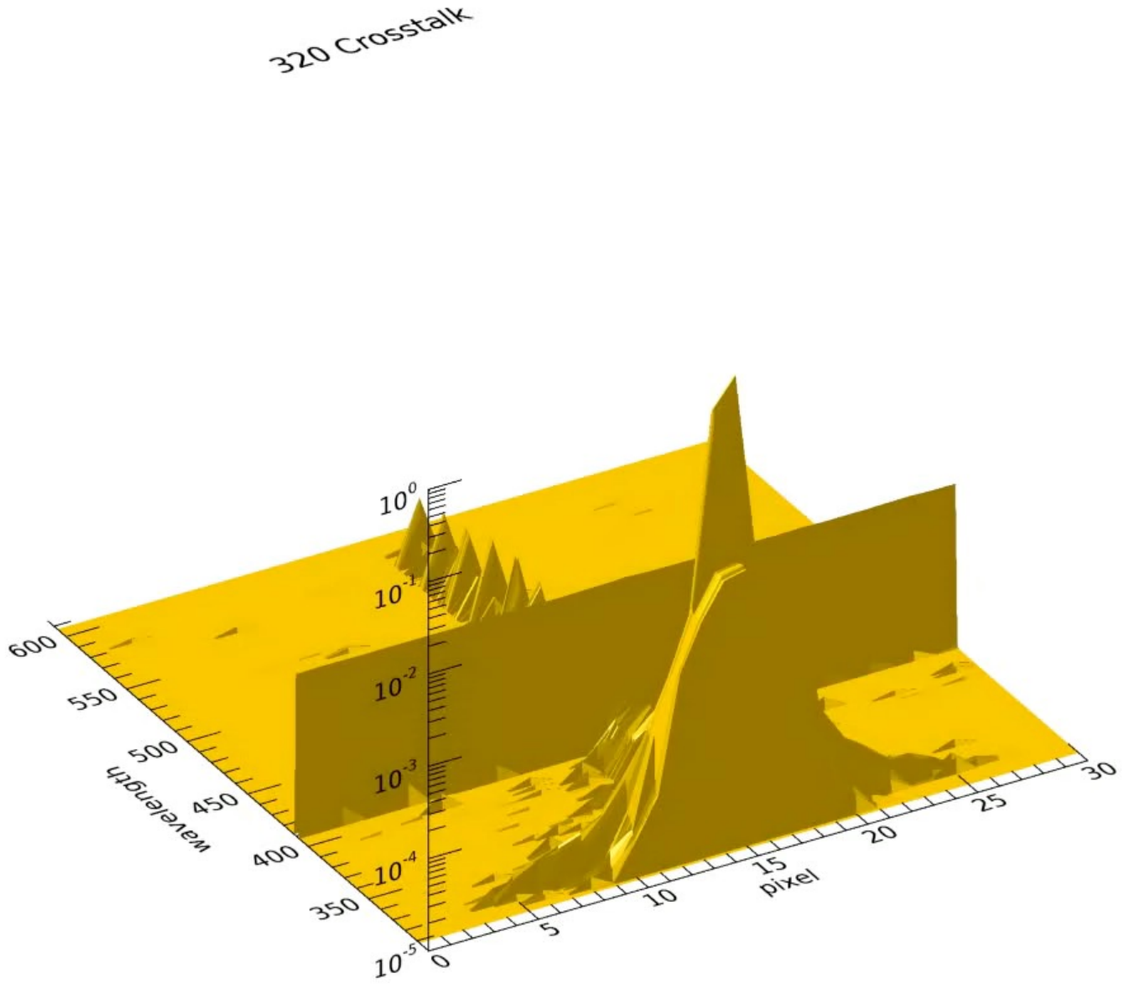
- Compute crosstalk from modeled PSF
- 2 ghosts in crosstalk vs. 1 ghost in PSF.
- 2 bands send ghosts into the same wavelength



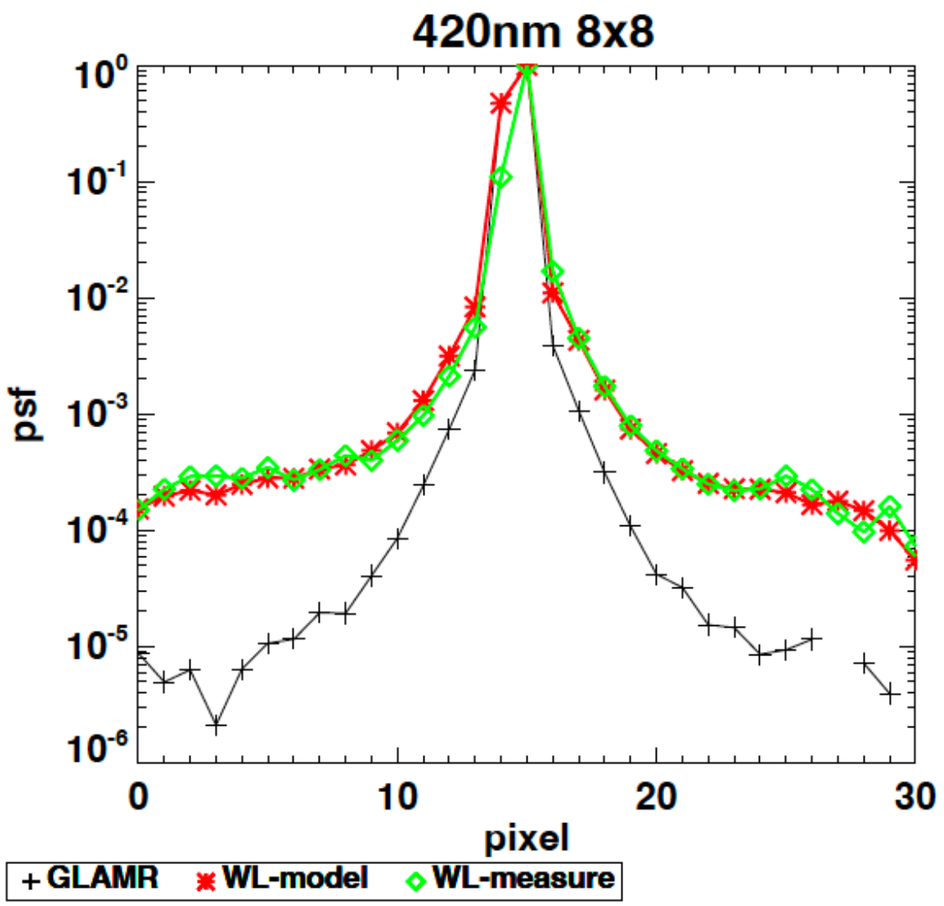
Nominal PSF

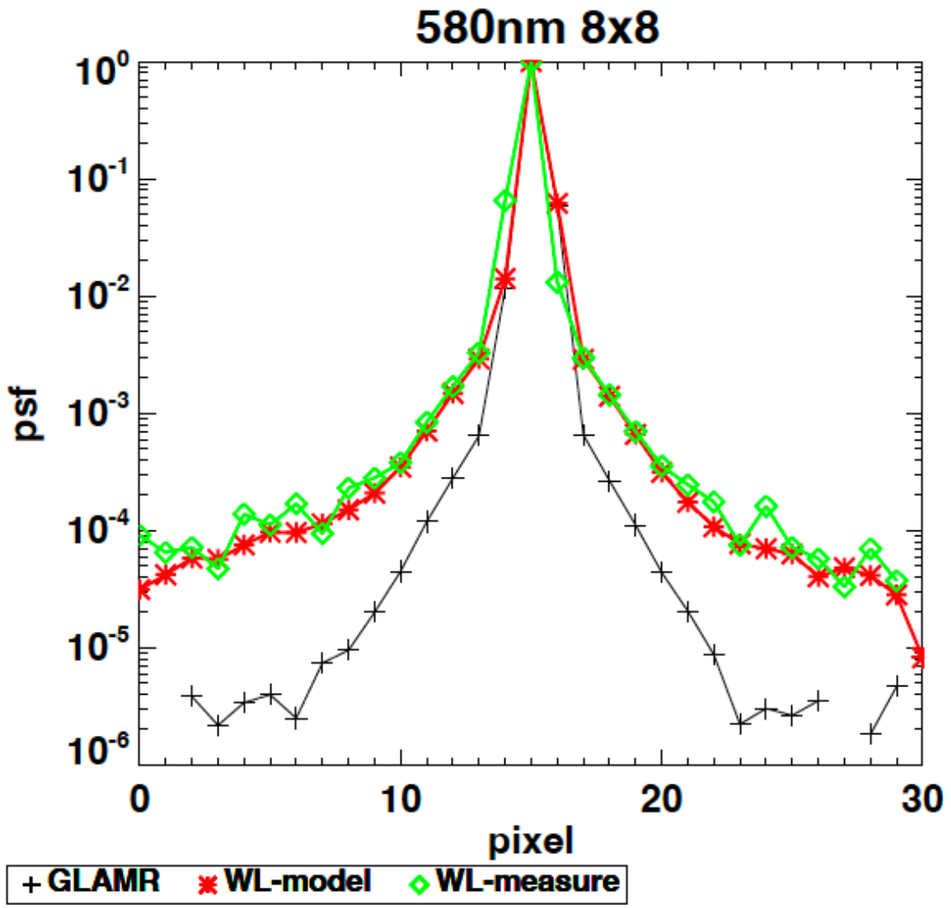
PSF vs. crosstalk map





Crosstalk map evaluation





Estimate white light response from modeled PSFs.

WL-model = modeled white light PSF

WL-measure = measured white light PSF

GLAMR = monochromatic light PSF.

Summary

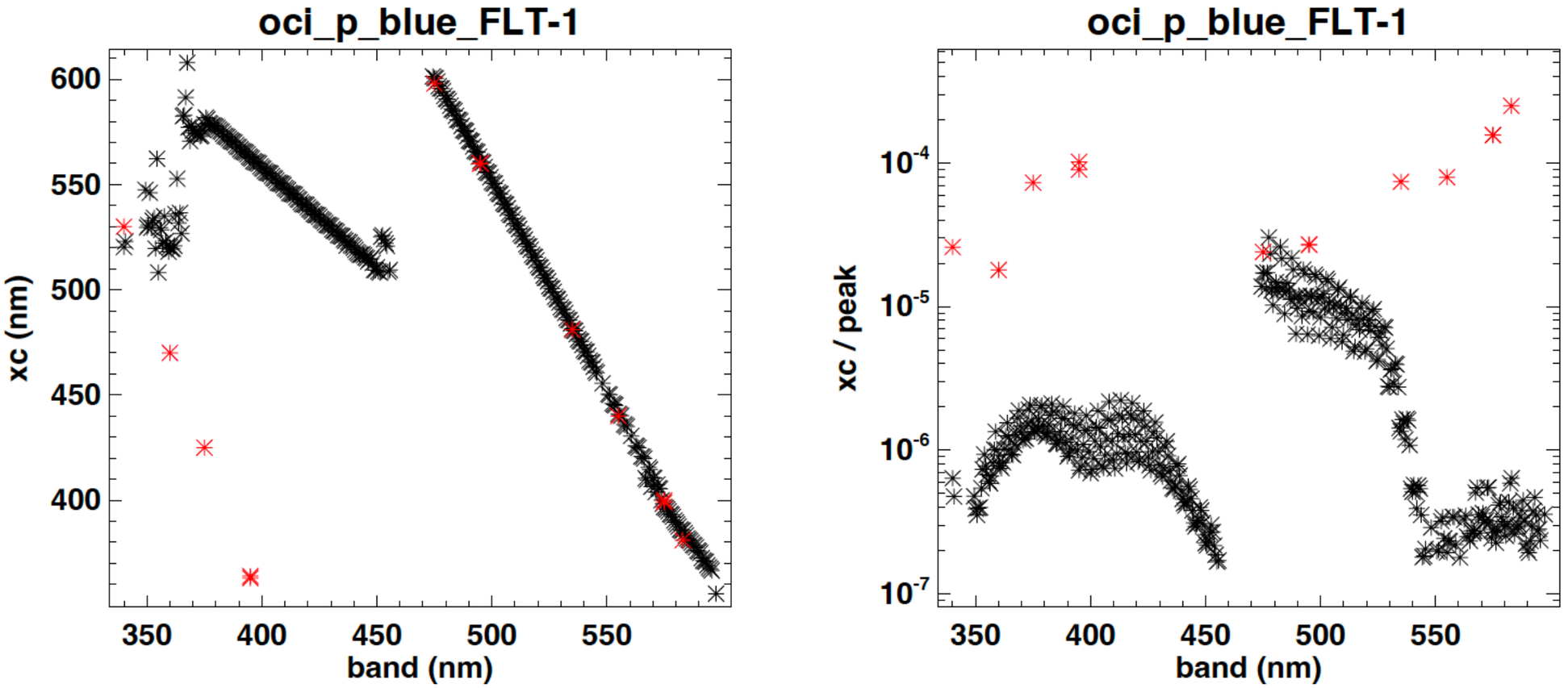
- The crosstalk including ghost feature were characterized using high-contrast scene (LSF), and broad source calibration (CAL-GLAMR) data.
- The OCI CCD bands crosstalk have a spatially continuous ghost feature that has a constant impact up to 15 pixels away.
- The ghost impact can not be mitigated by typical cloud mask (1-2 pixels buffer)

On-going:

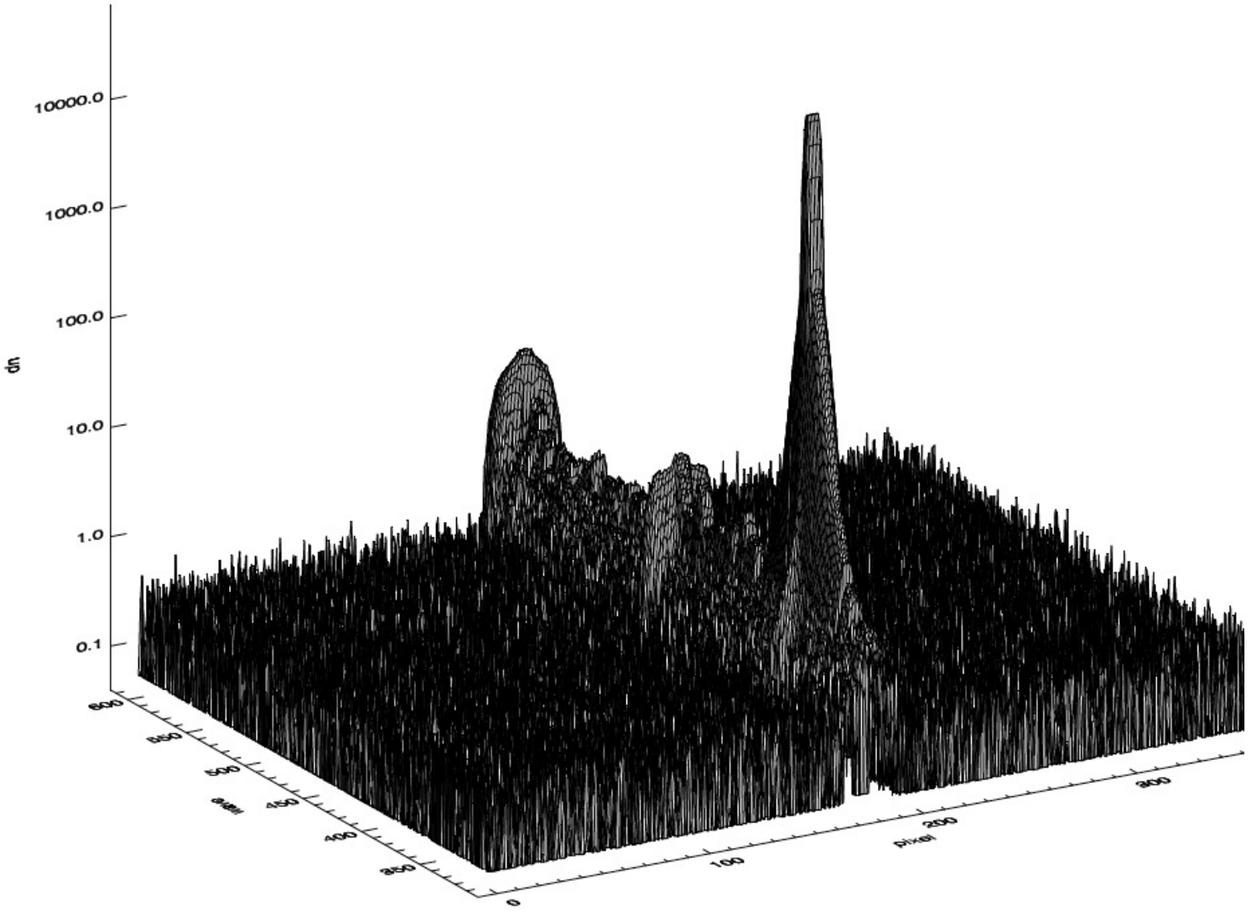
- *implement crosstalk correction in L1B processing*

backup

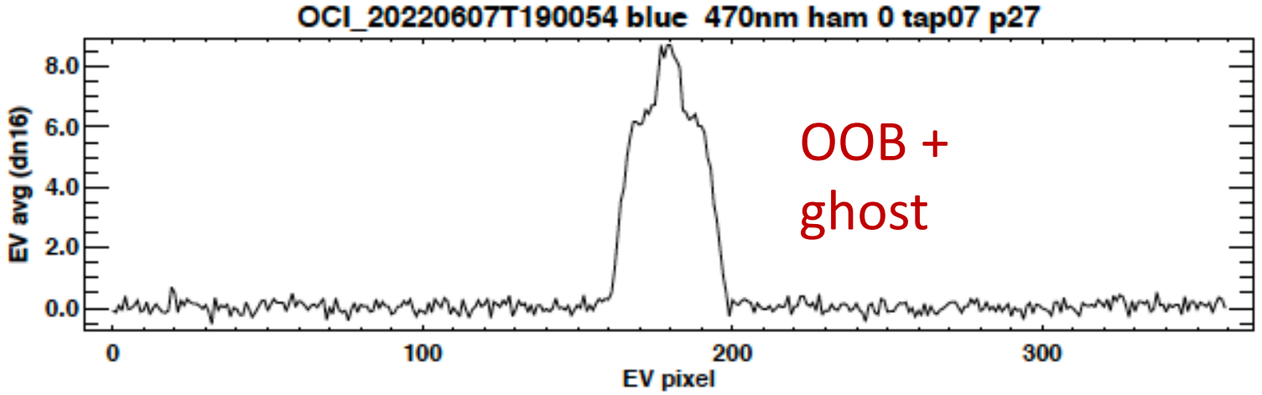
FU1 measured vs. model

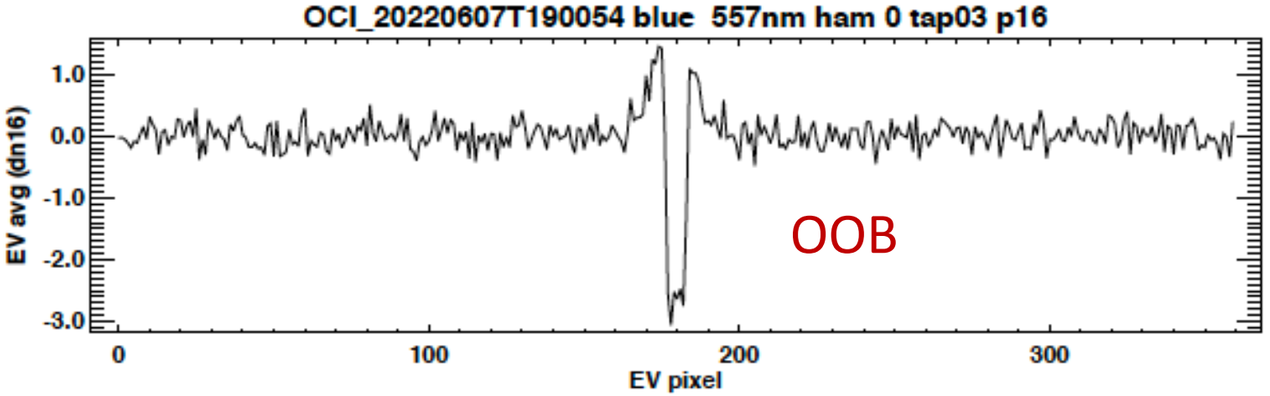


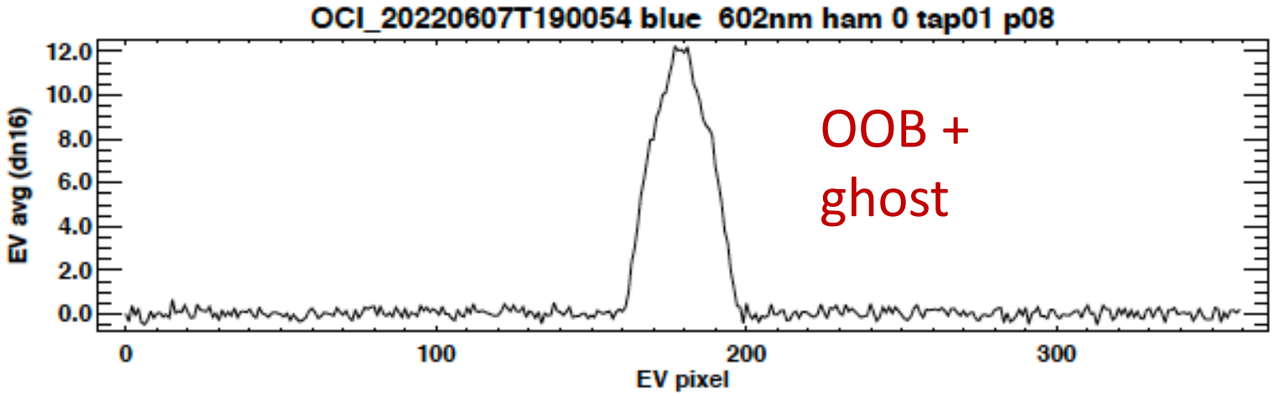
- ghost wavelength (Left) and magnitude (Right)
- Black: model, red: FU1 data



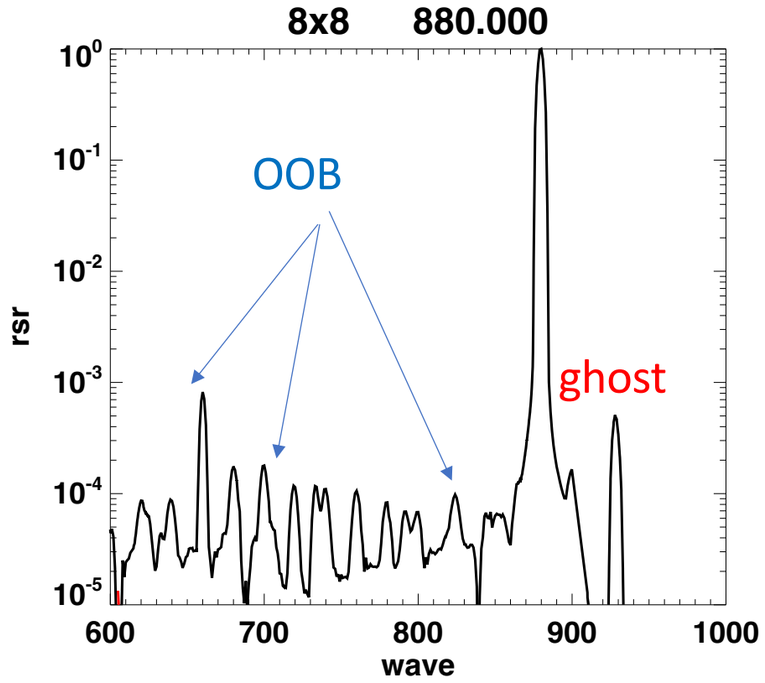
LSF-7SP @ 360nm (cds8x1)





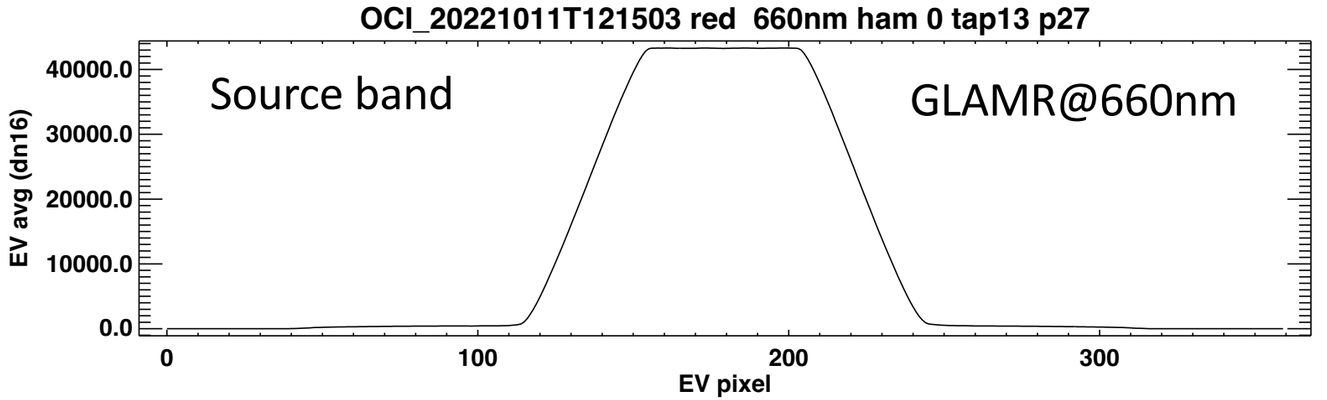


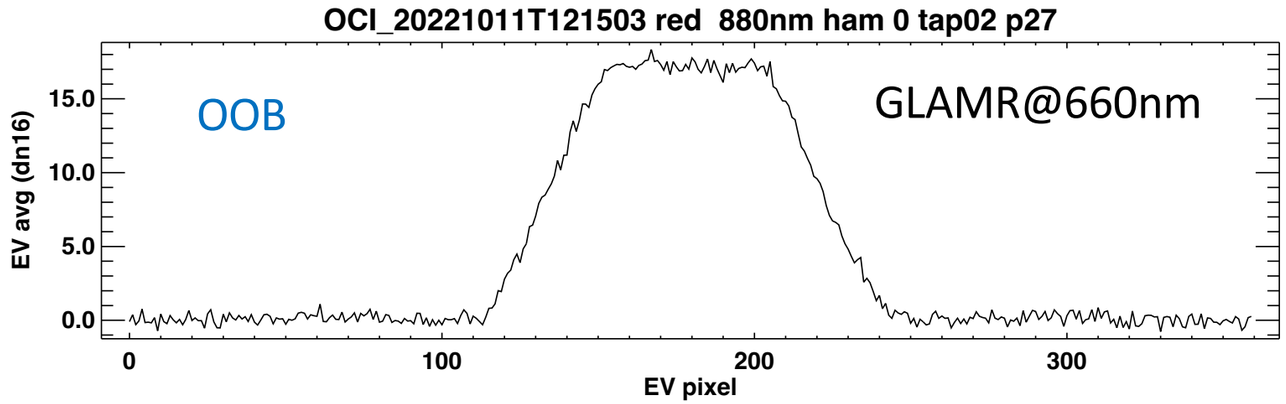
Red CCD Ghosts

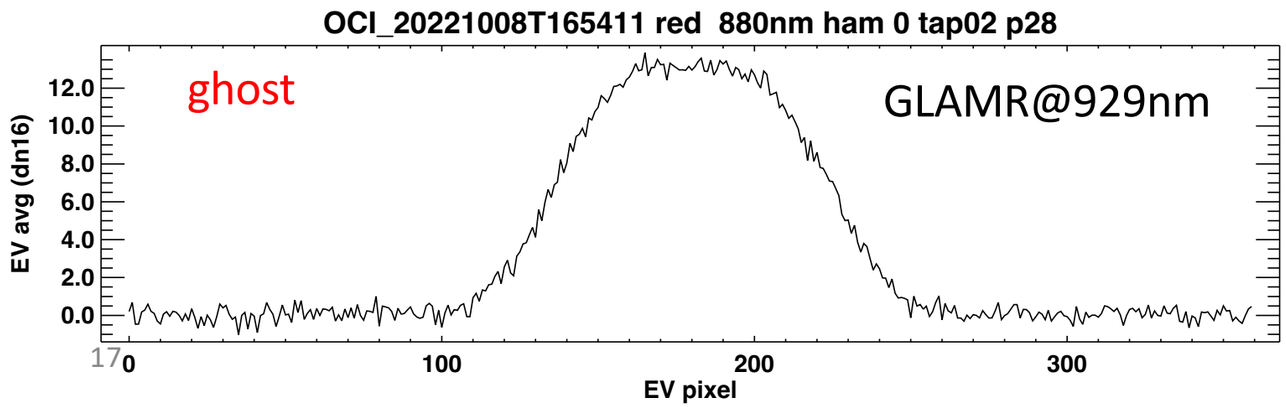


880 nm band RSR

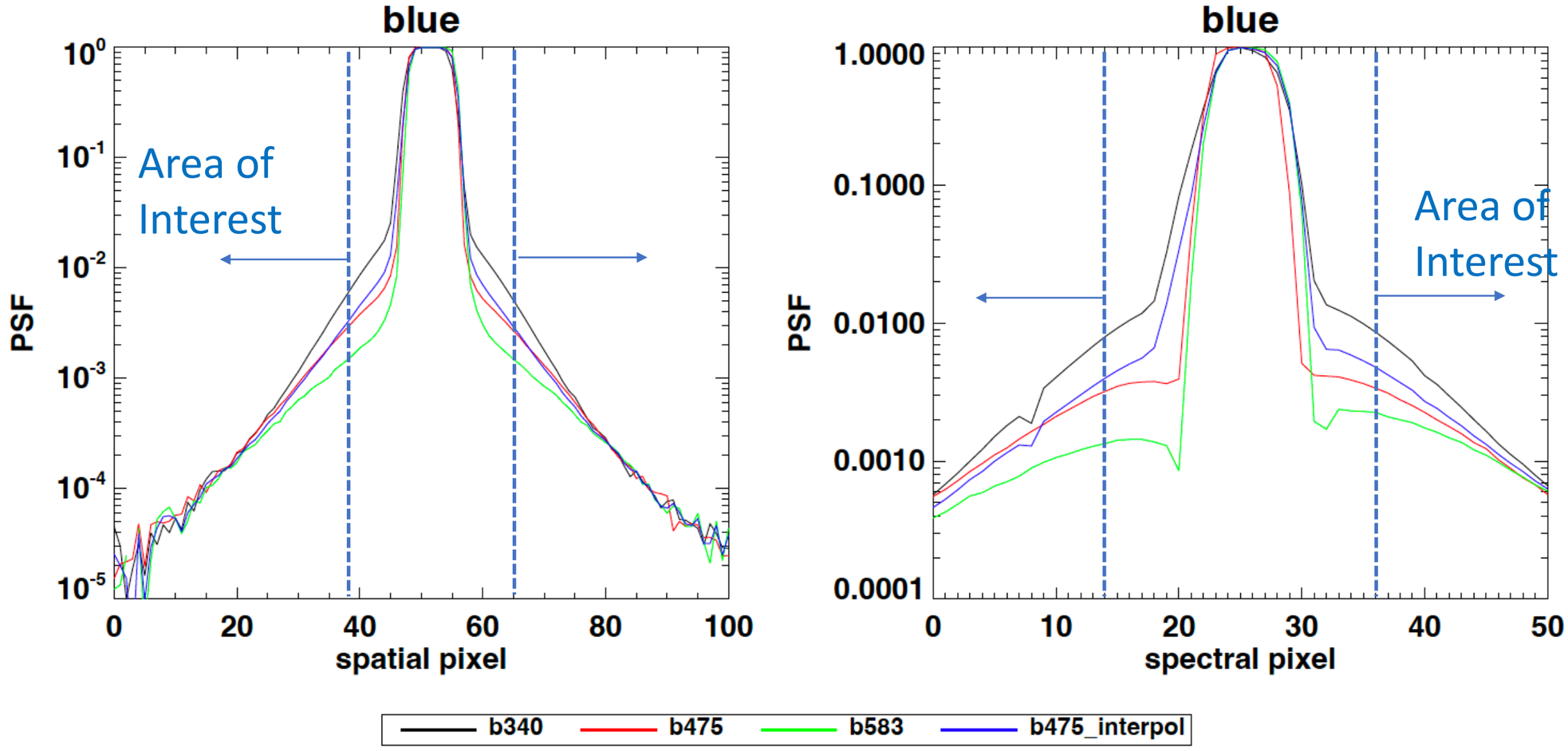
- OOB: same profile as source
- Ghost: wider, rounder profile







LSF-SP GLAMR



- Higher straylight/crosstalk at lower wavelengths
- Interpolate CCD straylight from GLAMR measured wavelengths.
- 475 nm measured vs. interpolated (linear)