# TROPOMI on Sentinel-5 Precursor: Re-processing of entire mission

- Started public release of reprocessed products of the entire mission (May 2018-July 2022) on https://s5phub.copernicus.eu/dhus/#/home
- Planned to publish all S5P reprocessed datasets (inc. Level 1B) during the first quarter of 2023
- Re-processing version is same as active in forward stream since 20 July 2022
- Productname example:
  S5P_**RPRO**_L2__CO____20180430T001950_20180430T020120_02818_**03**_020400_20220901T170054.nc
- Product read-me files, ATBDs, ...: https://sentinel.esa.int/web/sentinel/technical-guides/sentinel-5p/products-algorithms
- For those with accounts on the expert-hub: already more data available there (for example ¾ of the L1 data)

For latest availability see:

https://sentinel.esa.int/web/sentinel/-/copernicus-sentinel-5-precursor-full-mission-reprocessed-datasets-forthcoming-availability/1.4

# Changes in observed straylight in TROPOMI

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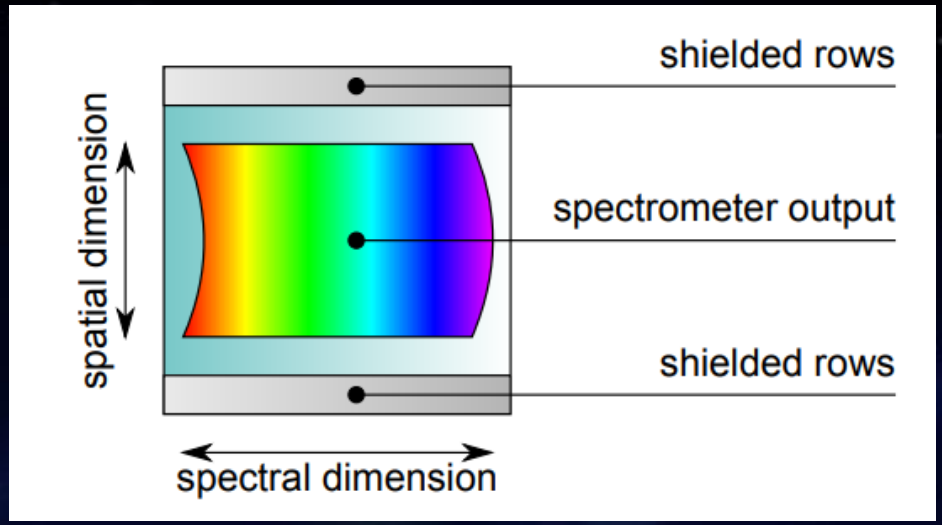
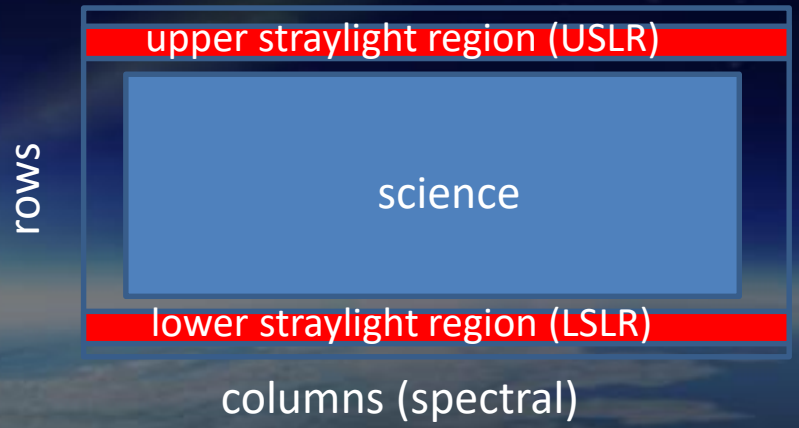
# TROPOMI in-flight straylight monitoring

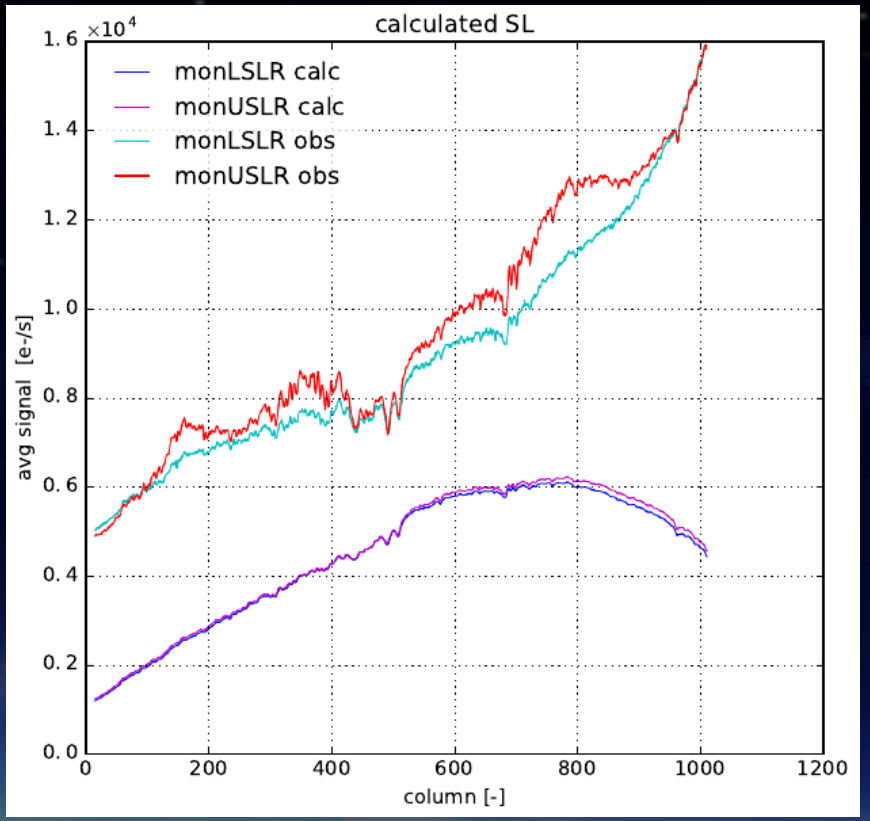
- On each detector there are shielded rows (“upper and lower straylight regions”)
- These regions are binned (factor 37) to one row each, for all (ir)radiance measurements
- Signals in these regions are monitored per scanline
- Monitor_straylight_calculated: the straylight signal(in the straylight regions) calculated from (on-ground) calibration keydata
- Monitor_straylight_observed: the in-flight straylight observed in the straylight regions
- After straylight correction, the signal in the regions should be zero: *observed - calculated =0*



# Straylight in irradiance measurement

- Example: signal in the straylight regions for an irradiance measurement
- The calculated straylight *in the straylight regions* is ca 50% lower than the observed signal in the straylight regions.
- The largest discrepancy is near extreme columns (wavelengths)

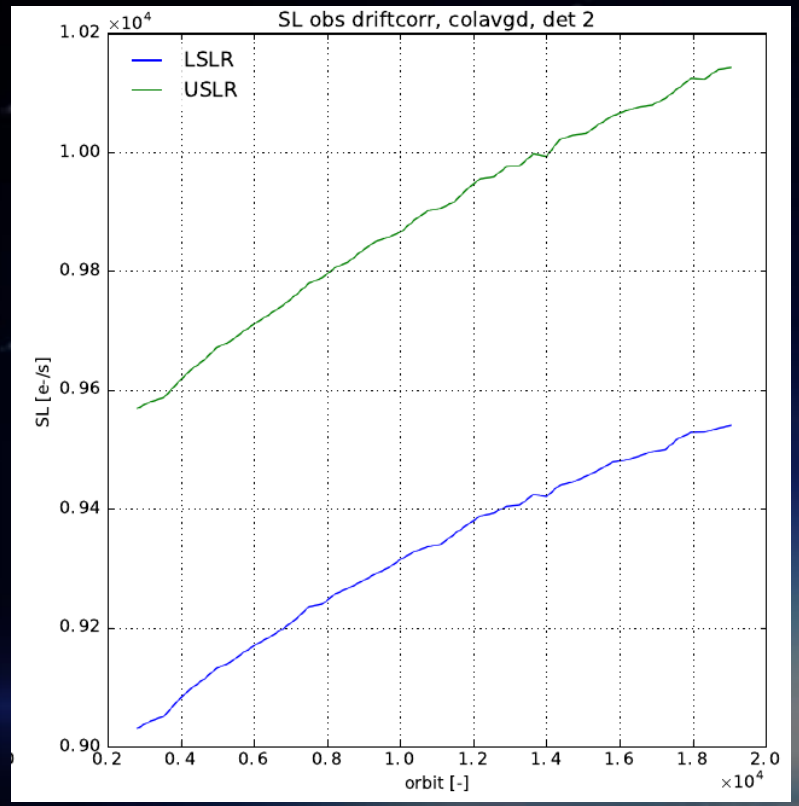



300nm 500nm

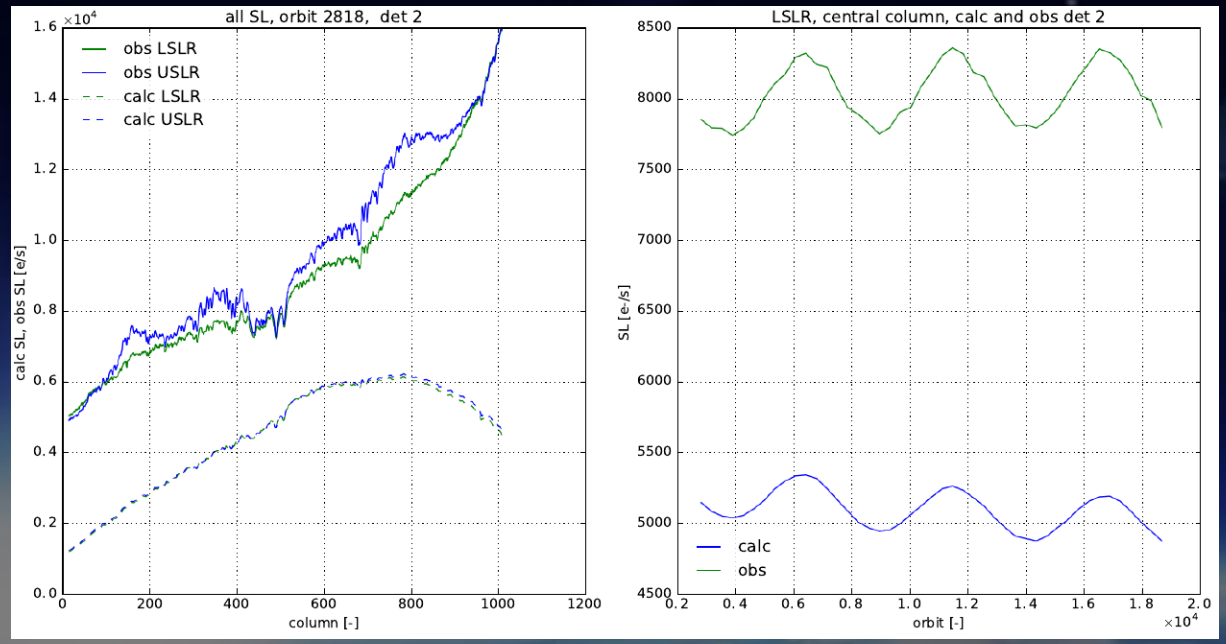
UVIS detector, orbit 2818 in April 2018

# Increase in observed straylight

- Between orbits 2818 and 19018, the observed straylight in the straylight regions increases relatively
- Effect is especially severe in UV (30%), less for UVIS (6%) and NIR (3%)



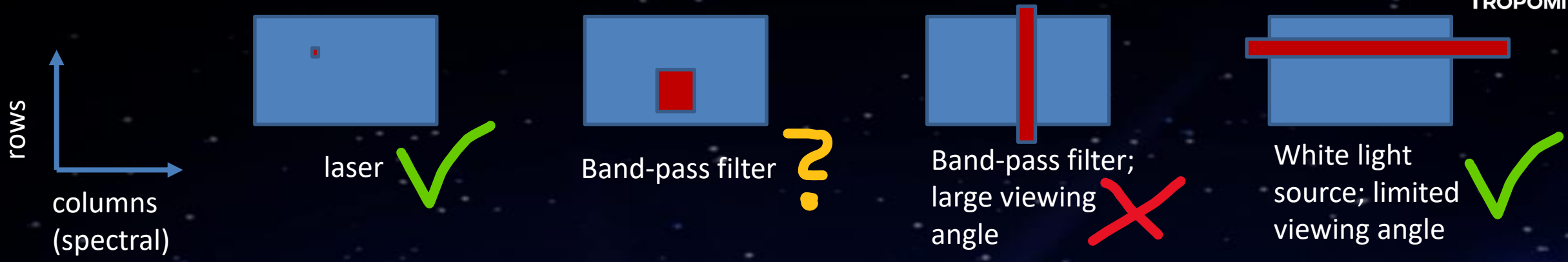

2018 UVIS detector, avg 2021




2018 2021

UVIS detector, center column

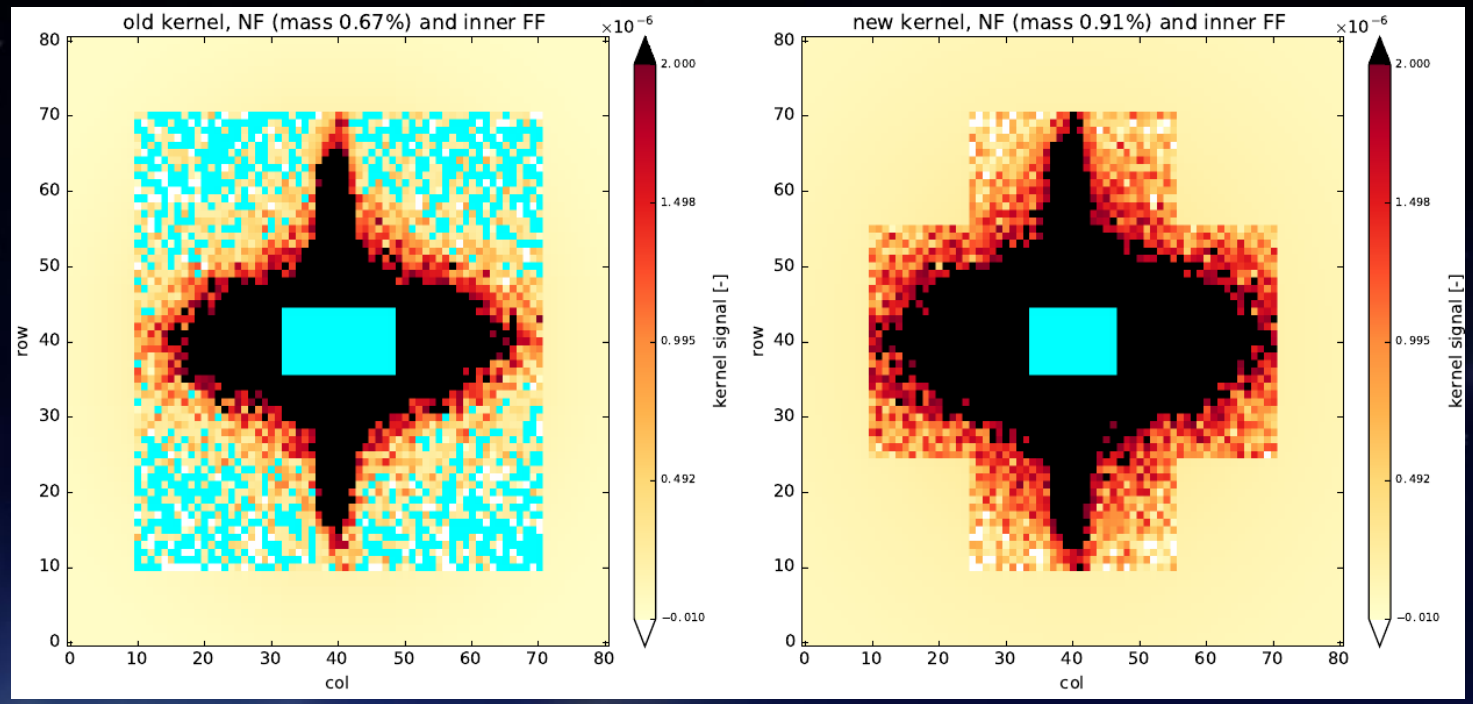
# Straylight calibration key data




- Calibration of straylight experimentally constrained
- The straylight calibration key data is a convolution kernel, constructed by combining a near-field and a far-field part
- Near-field part: calibrated using laser measurements (simply averaging 18 processed images)
- Far-field part: calibrated using external white light source measurements and *modeled* using a 1D decay parametrization, and *assuming* axisymmetrial scattering

# Re-analysis of on-ground data (near & far field)

- Repaired clipping of low values (leads to a bias)
- Decreased size of direct region (DR) (rectangle) , consistent with actual ISRF
- Ensured consistency with far field straylight




Current kernel

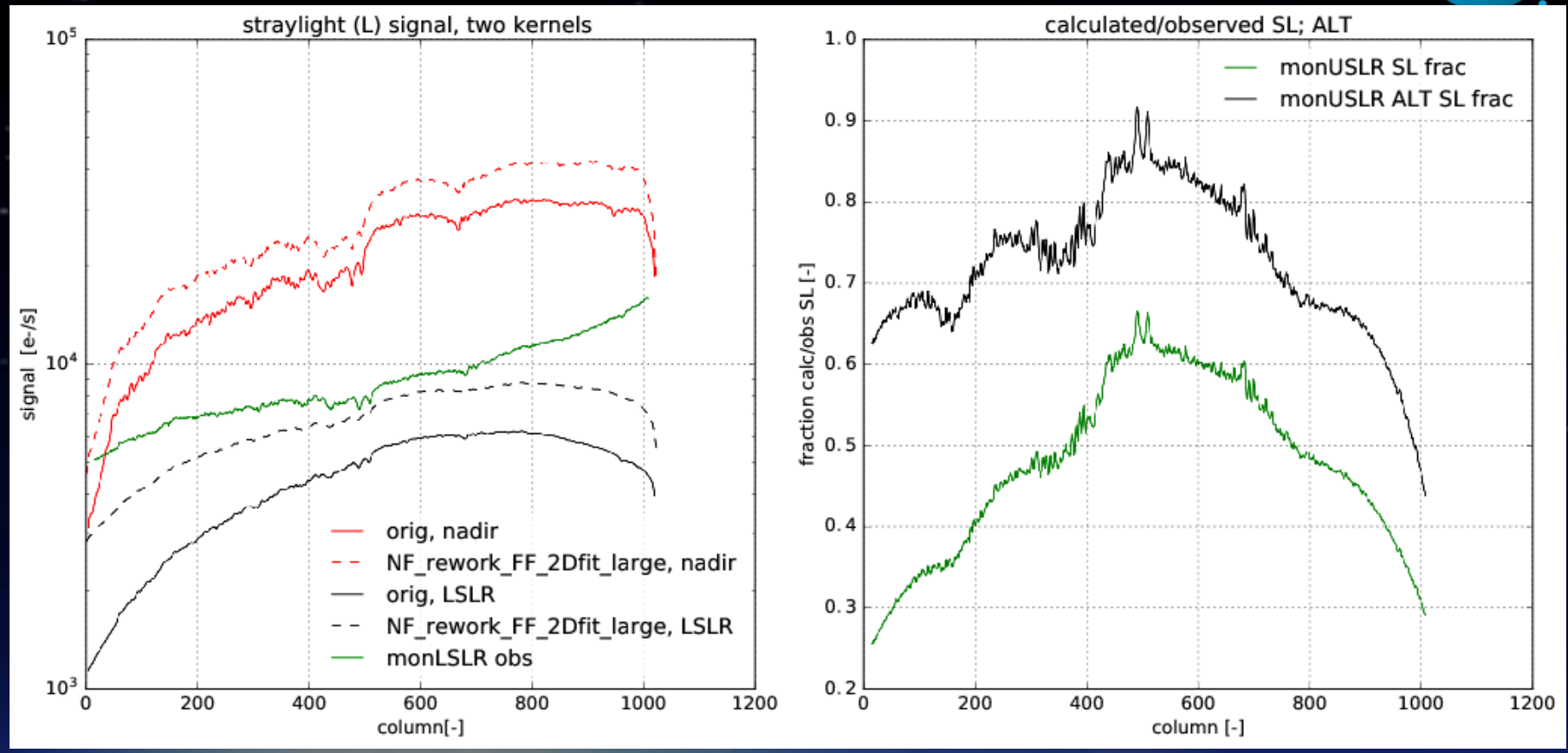
Improved kernel

→Resulting in higher mass for NF-part of kernel

→ Larger straylight correction

# Results for UVIS detector

- Improved kernel results in calculated straylight closer to observation in the straylight row
- The deviations at the detector edges (low and high wavelengths) are still higher




Green: observed straylight signal in the lower straylight region
Black: computed straylight in lower straylight region for the original(_) and improved (...) straylight kernel
Red: straylight signal for irradiance at the center row for the original(_) and improved (...) straylight kernel

Calculated/observed straylight for upper straylight region for orginal kernel(green) and improved kernel (black)

# Conclusion & open questions

- Re-analysis of on-ground straylight measurements resulted in an improved convolution kernel decreasing  the discrepancy with the observation in *the straylight regions*
- Does this also improve the straylight correction for the (ir)radiance data?
- The ratio observed / calculated straylight in the straylight regions increased by 30% (UV), 6% (UVIS) and 3%(NIR) in three years
- Can the observerd change in the straylight regions be used for correction of the (ir)radiance data?