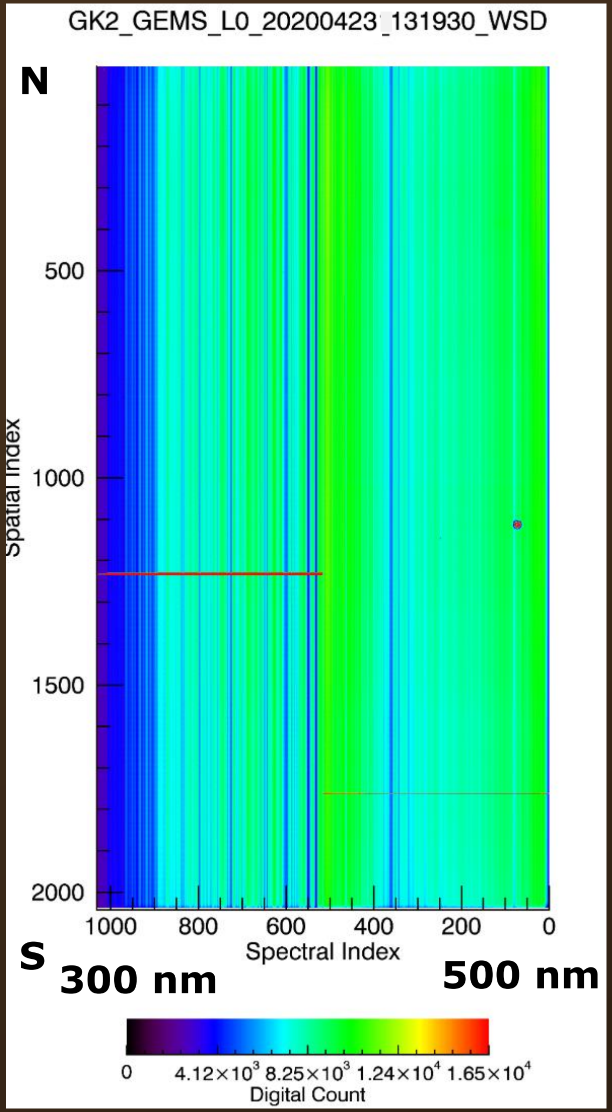
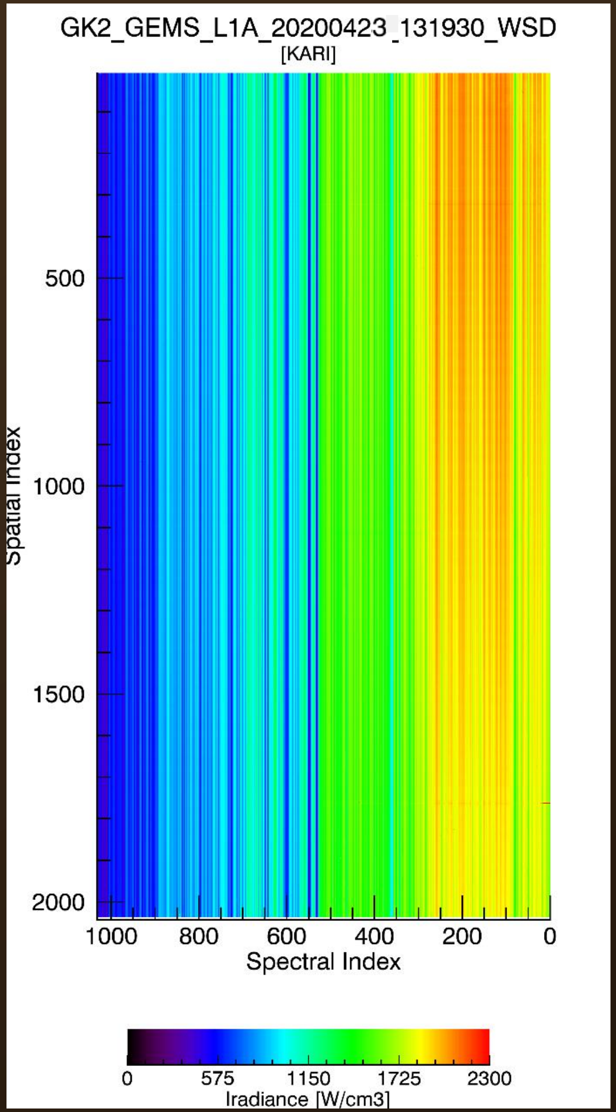
The first irradiance



Calibration

- ✓ Bad pixel
- ✓ Linearity
- ✓ Smear
- ✓ Gain
- ✓ PRNU
- ✓ DC
- ✓ Stray light
- ✓ Spectral
- ✓ ….



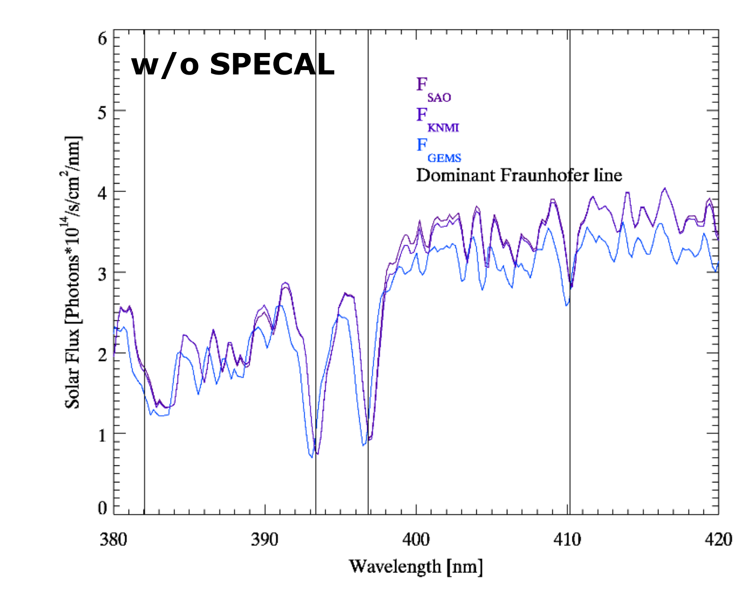
- Spectral calibration
- Absolute radiometric calibration
- Spatial pattern
- Stray light
- …..and others

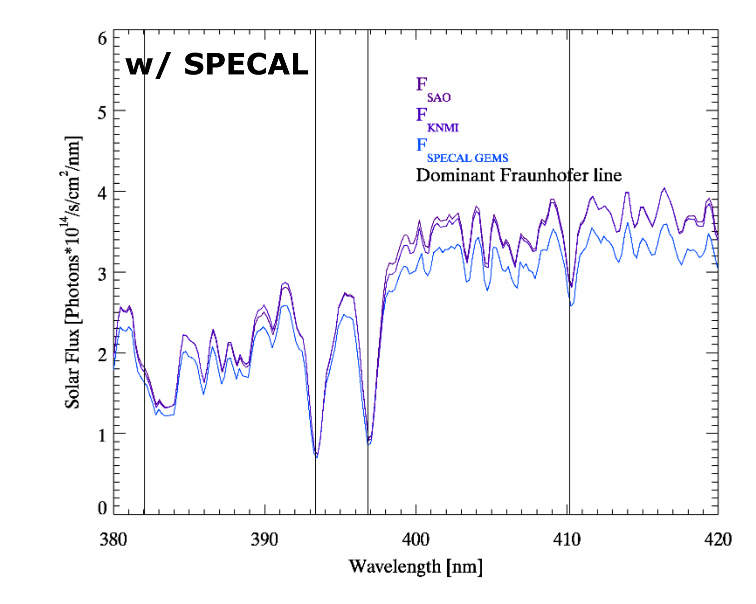
Spectral calibration

Spectral calibration

- Clear indication of spectral mismatch between measured and reference, asking for an update of spectral calibration

- The algorithm based on the non-linear least square fitting (Kang et al., 2020) is applied to full spectrum for each spatial index using a reference solar spectrum
  - ✓ It also derives parameters of analytical spectral response function (SRF) for GEMS



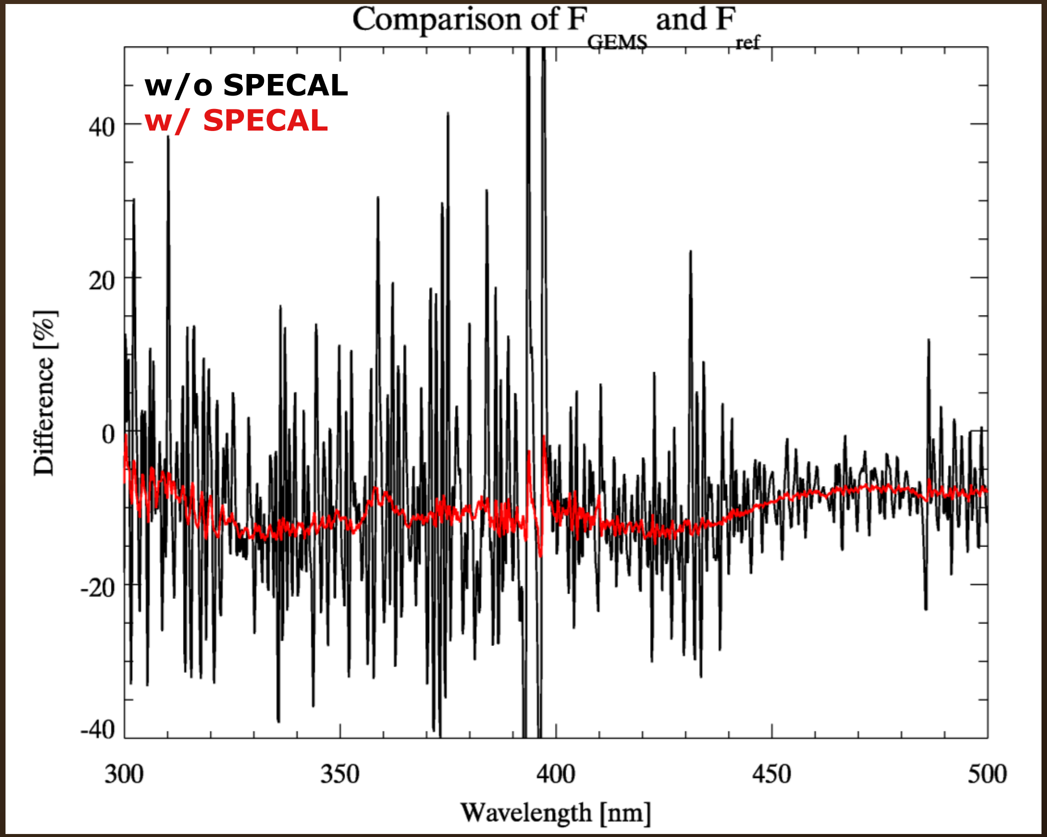


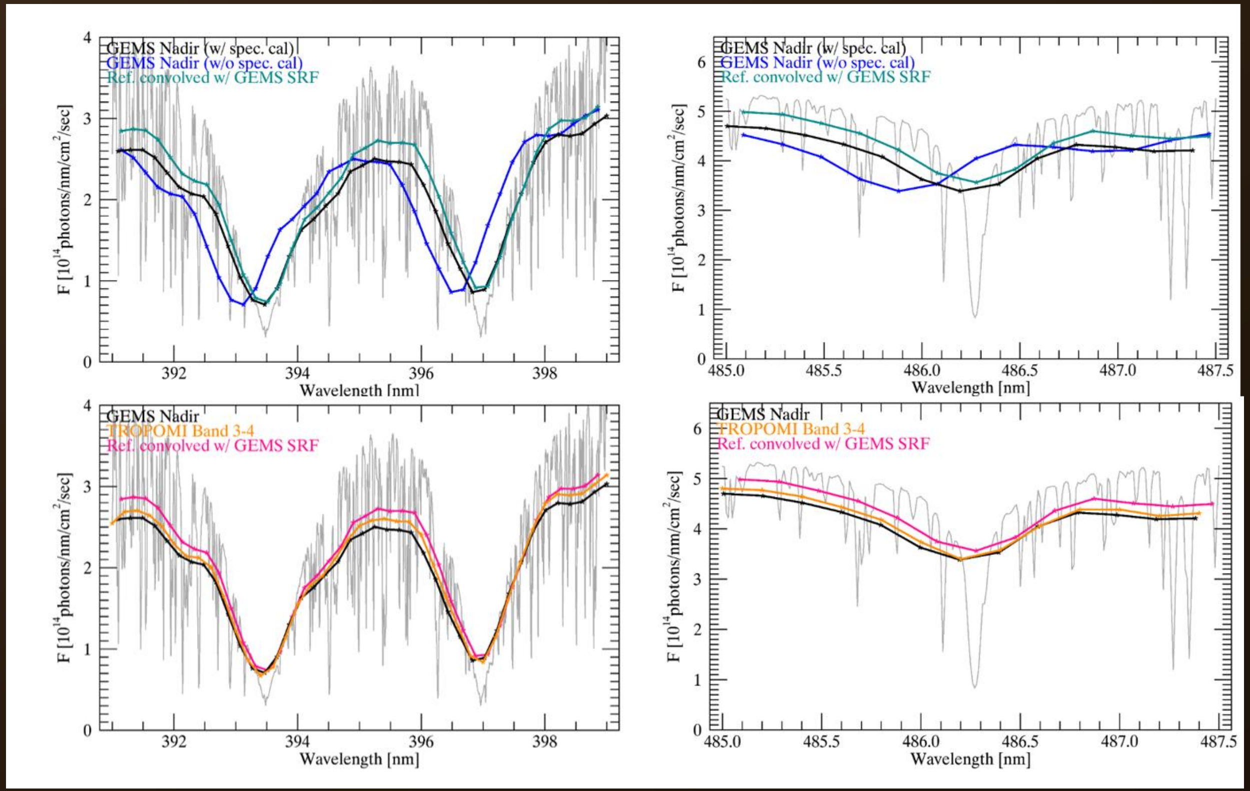
F_{GEMS} is nadir measurement (spatial index is 1024)

Spectral calibration

Updated results

- Update of spectral calibration reduces the high frequency variation significantly at all spatial positions
- However, there are systematic differences of irradiance as much as about 10%

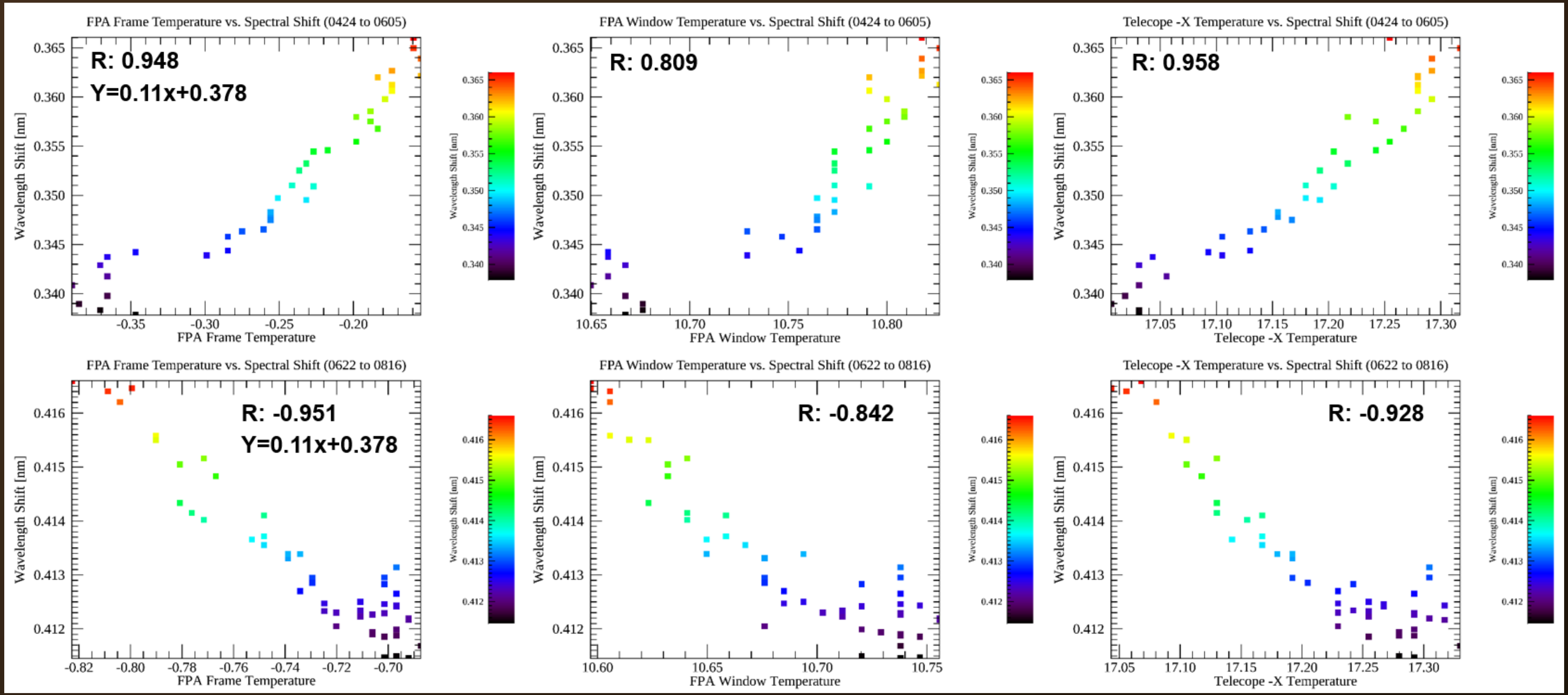




Spectral calibration

Thermistor dataset vs. spectral shift

- Spectral shifts are closely related with several GEMS thermistors
  - ✓ FPA temperature, and telescope temperature

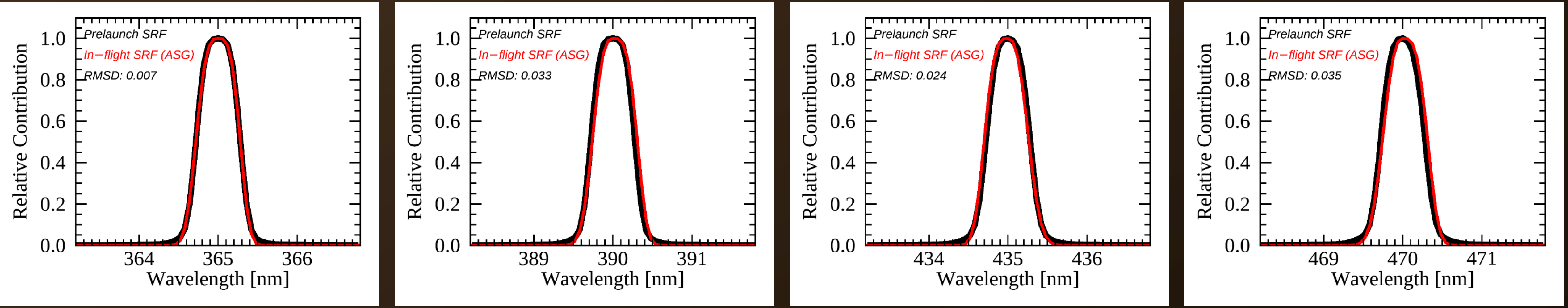


Spectral calibration

Spectral response function

- SRF of GEMS is also characterized using the SRF parameters of a best-matched analytical function (Asymmetric Super Gaussian function) derived during the spectral calibration process

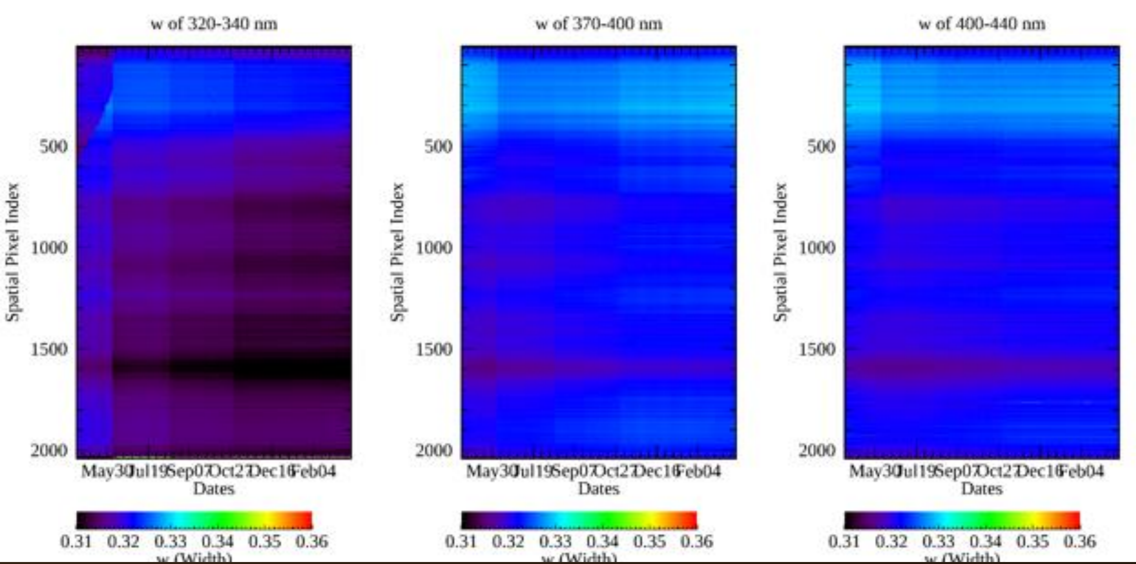
- In-flight SRFs retrieved from the first GEMS irradiance are similar to prelaunch ones
  - ✓ No significant change occur during the harsh launch process

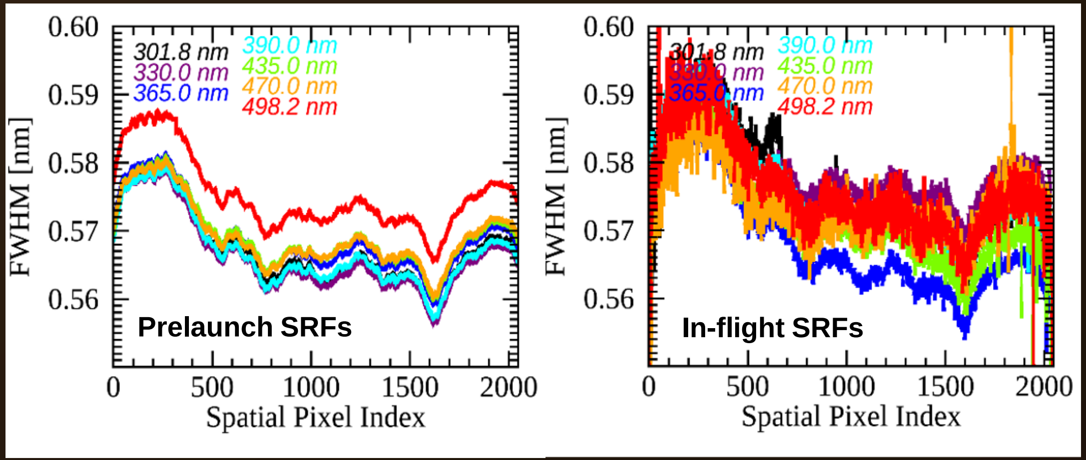


Spectral calibration

Monitoring of in-flight SRF

- Continuous monitoring of the GEMS SRF for the whole mission lifetime is necessary
- The temporal variations of width over from April 23, 2020 to March 21, 2021 indicate quite a stable variation given the preliminary nature of the daily GEMS irradiance
  - ✓ Variations of w (half width at 1/e intensity) are smaller than 0.006 nm and 0.004 nm for 330.0 nm and 390.0 nm, respectively ,
  - ✓ In-flight spectral performance and characteristics of GEMS are similar to those investigated from prelaunch

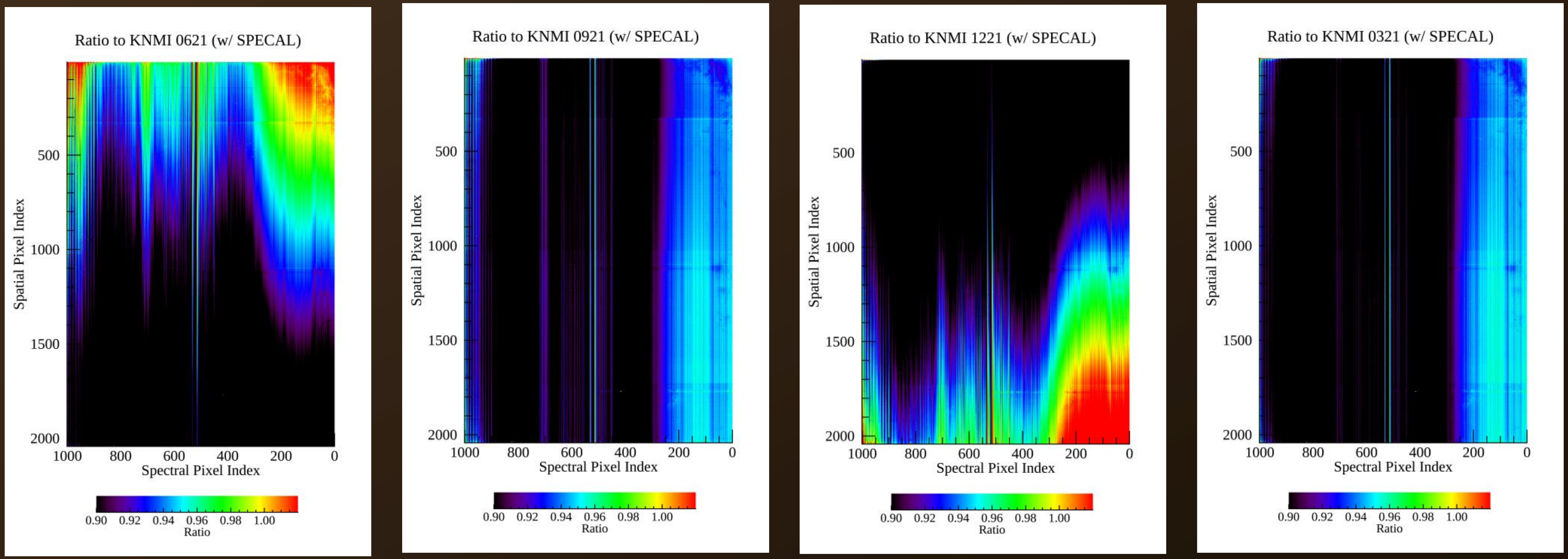




Relative irradiance

Variation of relative irradiance

- During the year, irradiance data show a large variation along both spatial and spectral direction
  - ✓ The variation pattern differs for different wavelength and locations
  - ✓ Such a spatial variation is not clear in the radiance data, which is one of reason the angular effect of BTDF variation with the incident sun geometry



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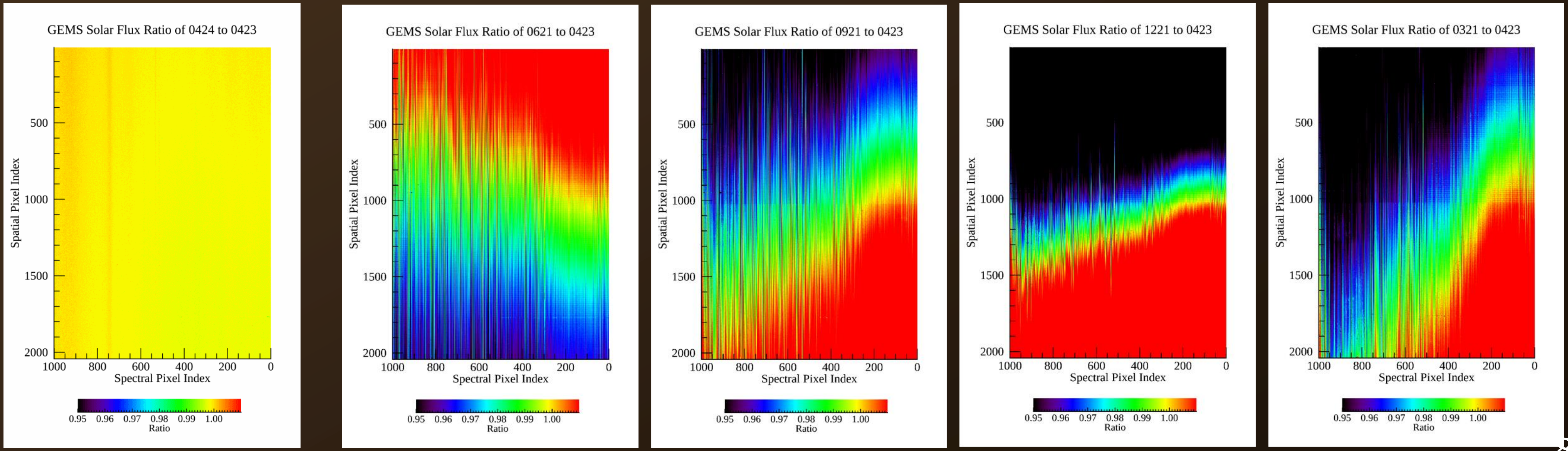
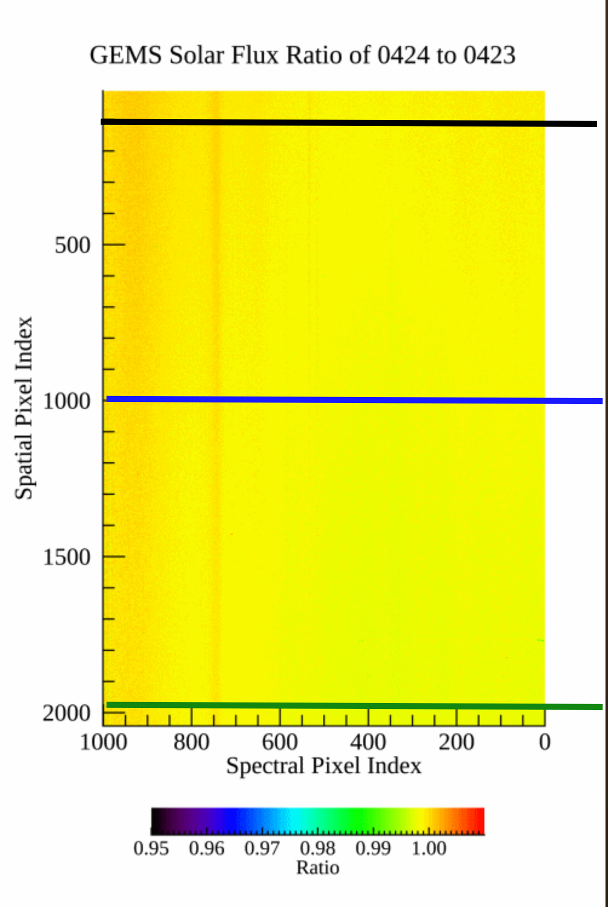
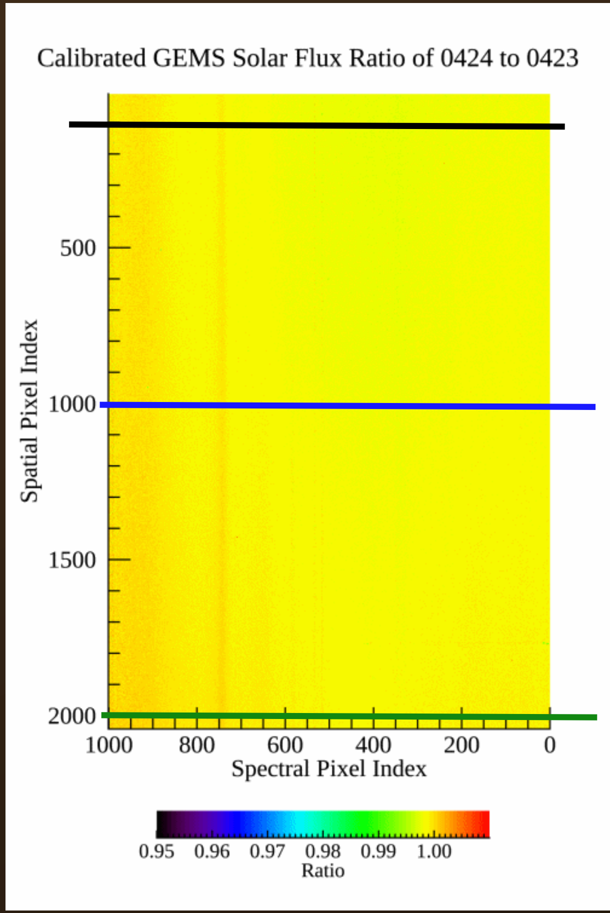


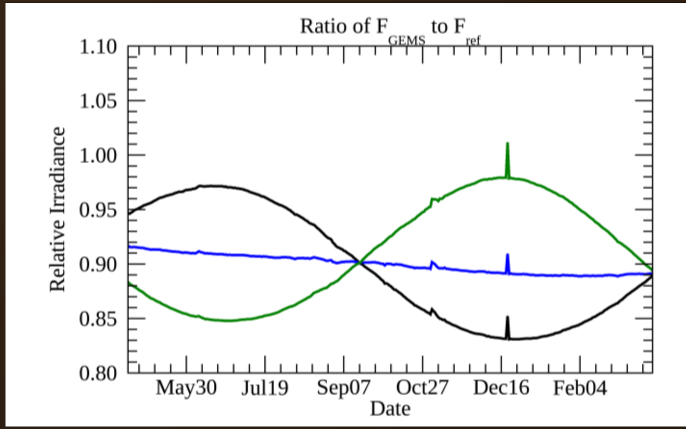
BTDF update (preliminary result)

In-flight calibration of BTDF

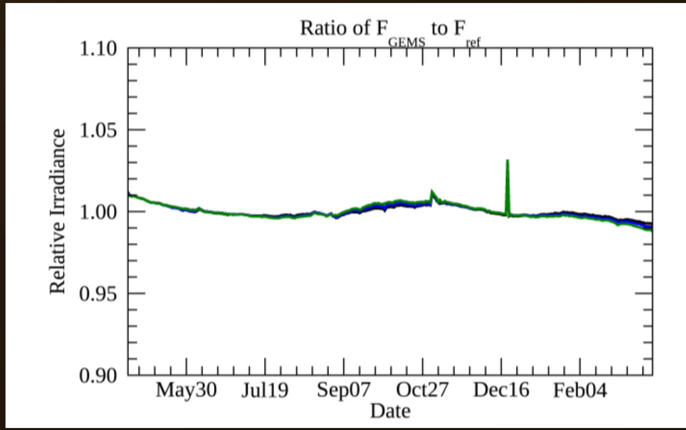
- Update the ground BTDF map using solar reference spectrum and calibrate using azimuth and relative irradiance (goniometric correction) (Dobber et al., 2004; Kleipool et al., 2020)







Spatial index 100, 1000, 2000

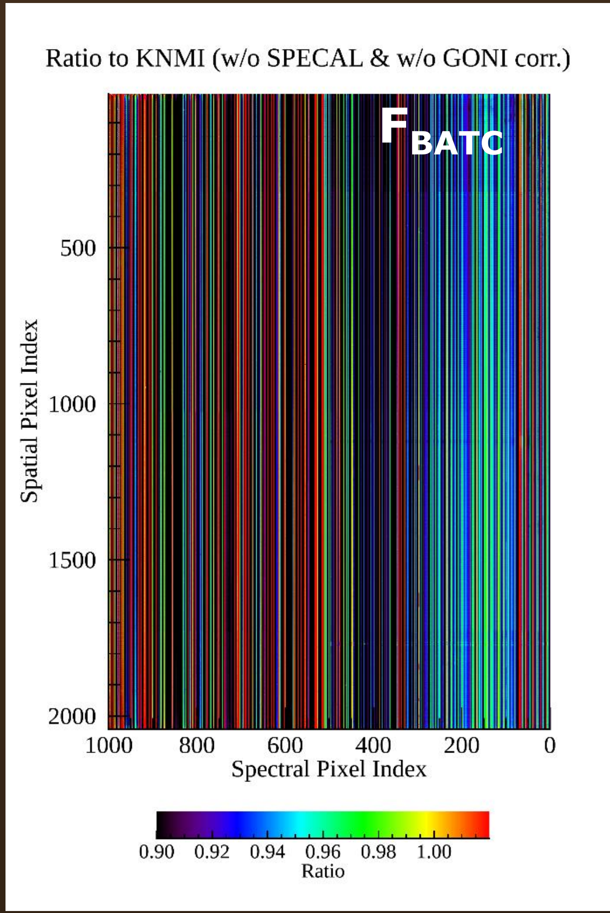


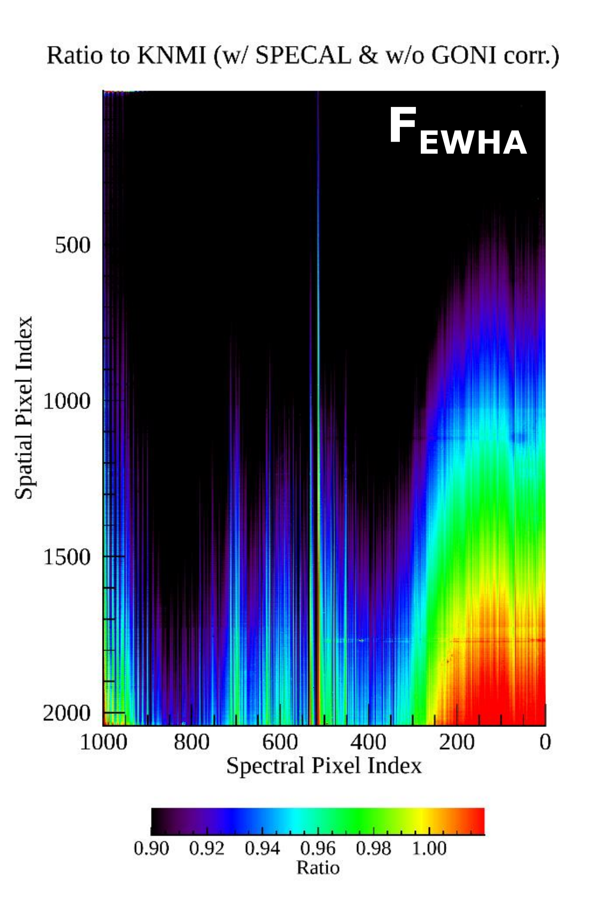
BTDF update (preliminary result)

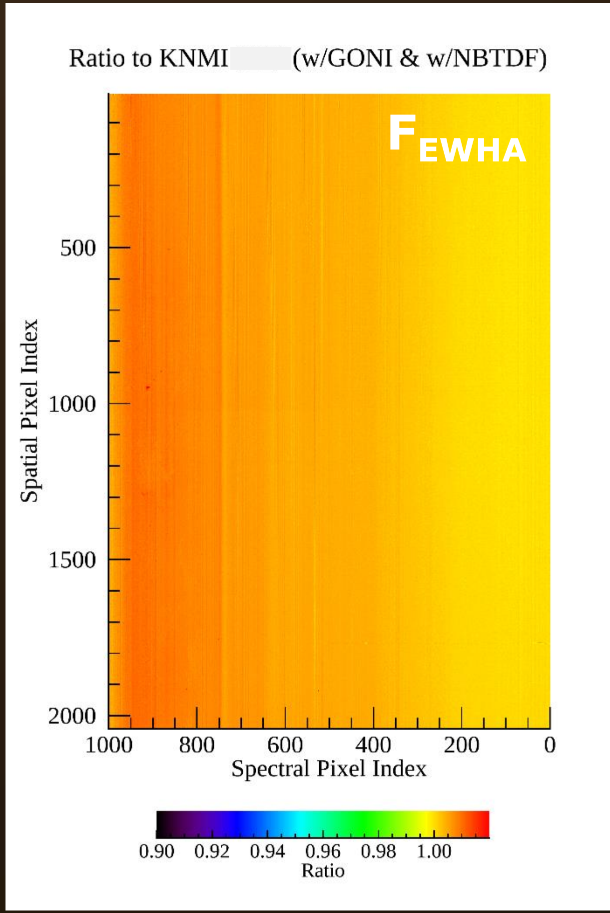
In-flight calibration of BTDF

- Systematic biases and clear spatial inhomogeneity are improved

F_{GEMS} (November 17, 2020)





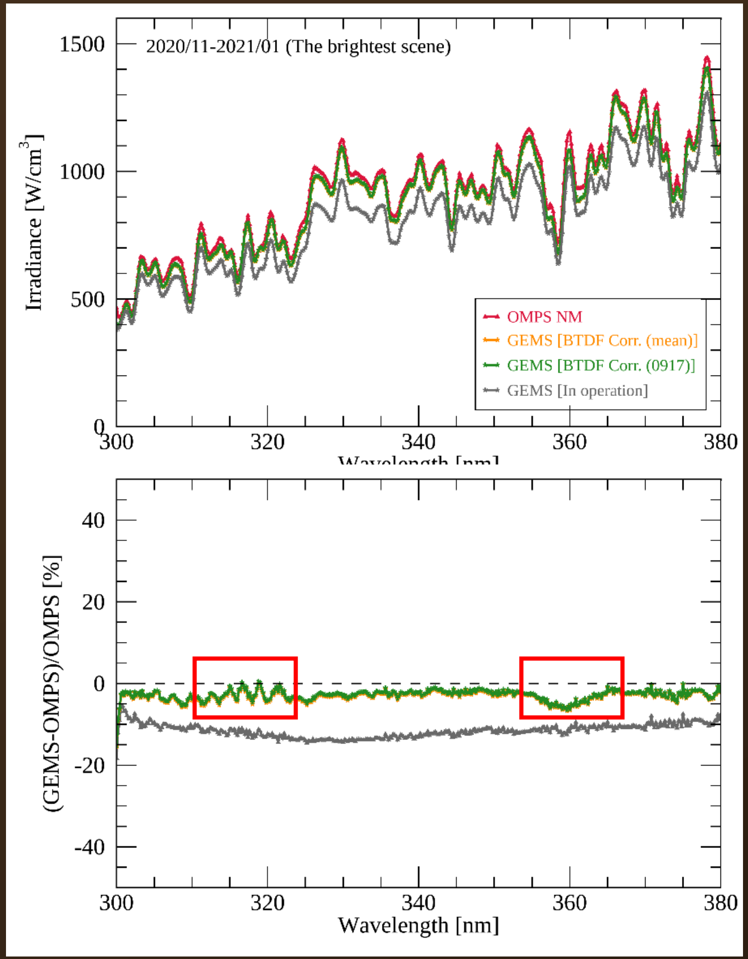


BTDF update (preliminary result)

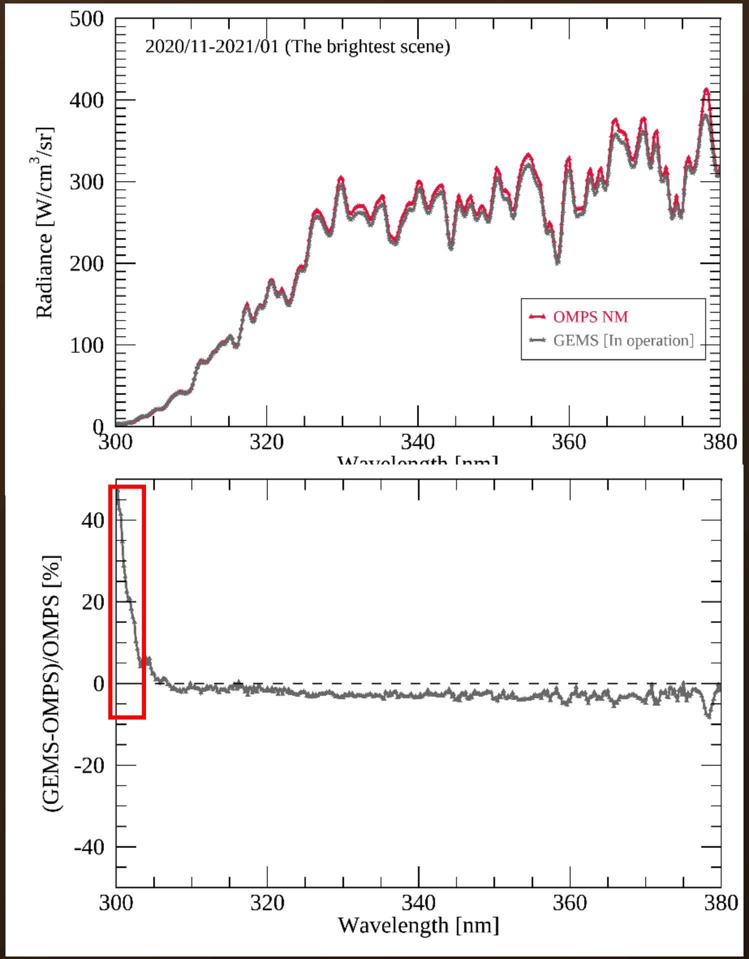
Inter-comparison with OMPS and TROPOMI

- On deep convective cloud (the brightest scene) [every 5 days, November 2020 to January 2021]

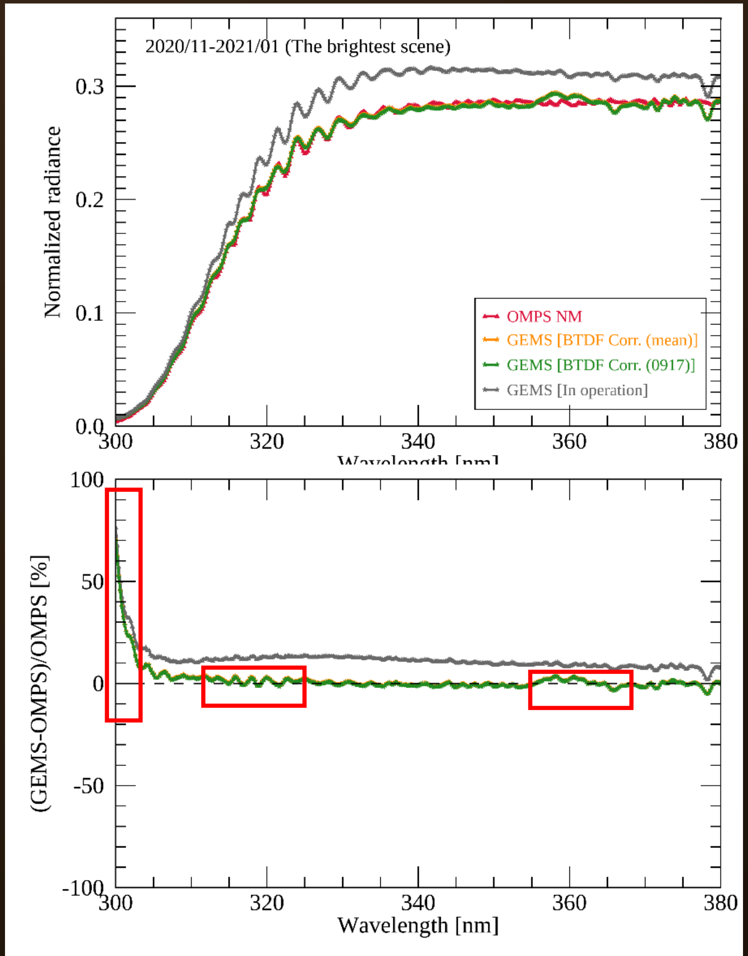
F



I



F/I

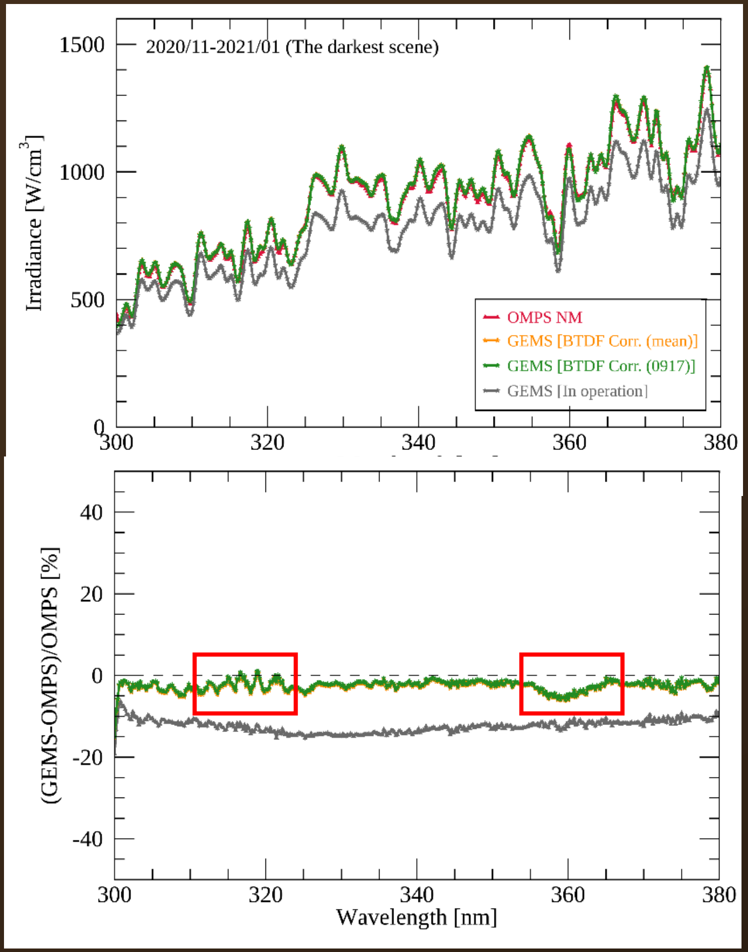


BTDF update (preliminary result)

Inter-comparison with OMPS and TROPOMI

- Clear sky (the darkness scene) [every 5 days, November 2020 to January 2021]

F



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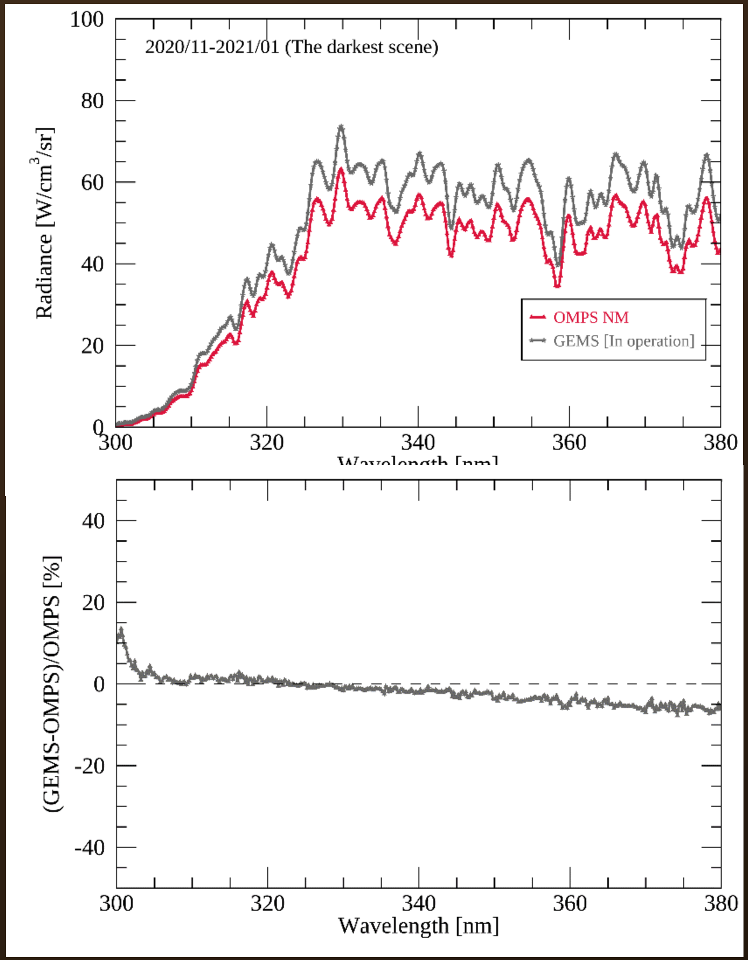
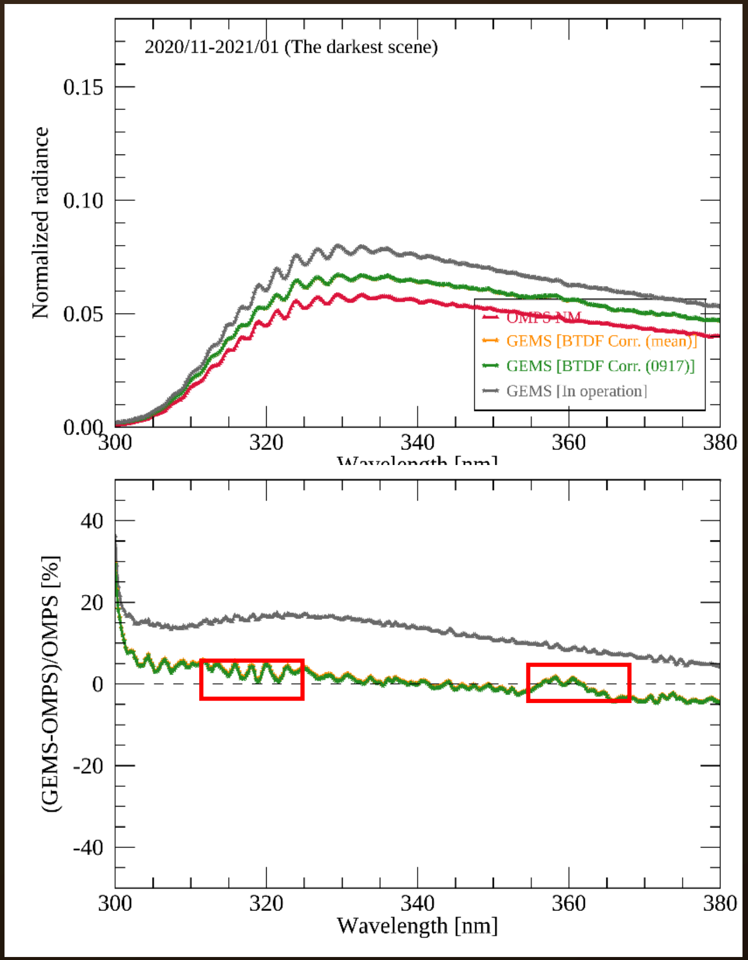


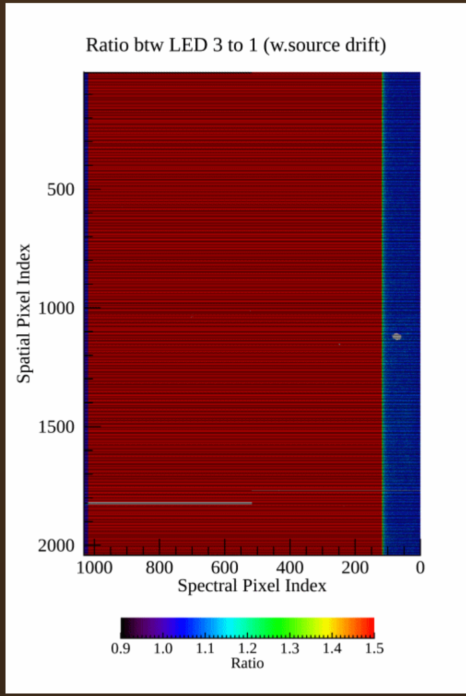
F/I

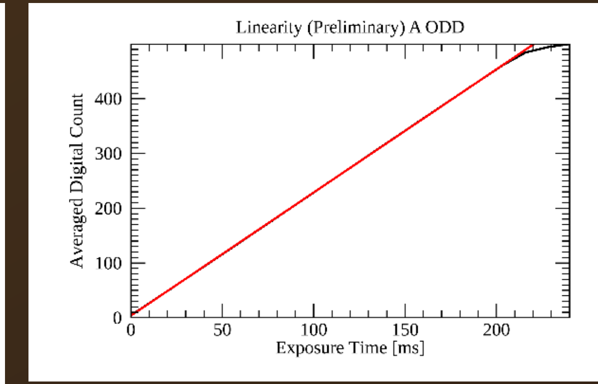


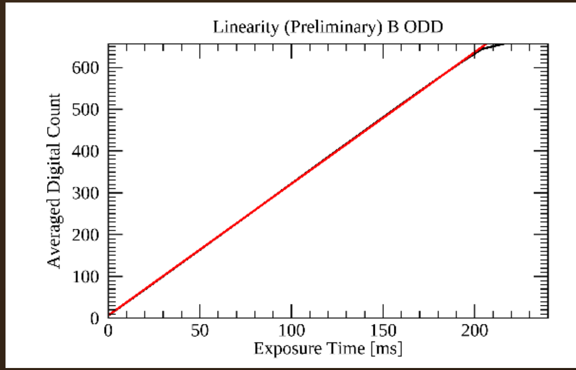
Ongoing works (LED, Dark, RSD, radiance)

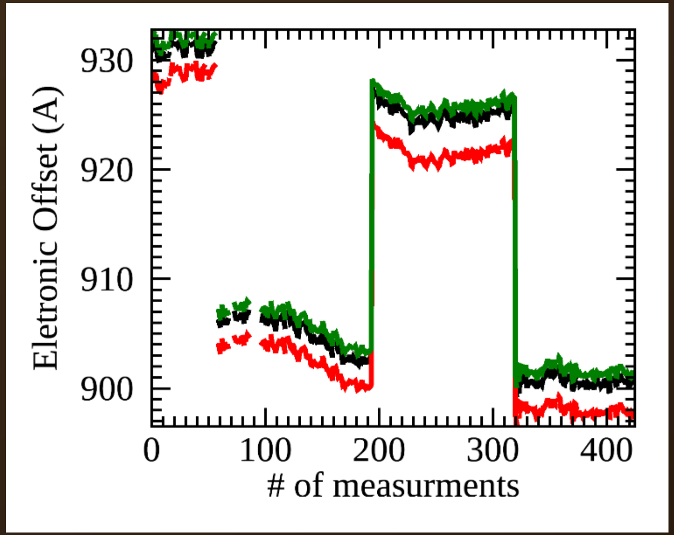
Validate the ground calibration tables & trend monitoring

- Non-linearity, gain, offsets, saturation threshold, bad pixels, etc.

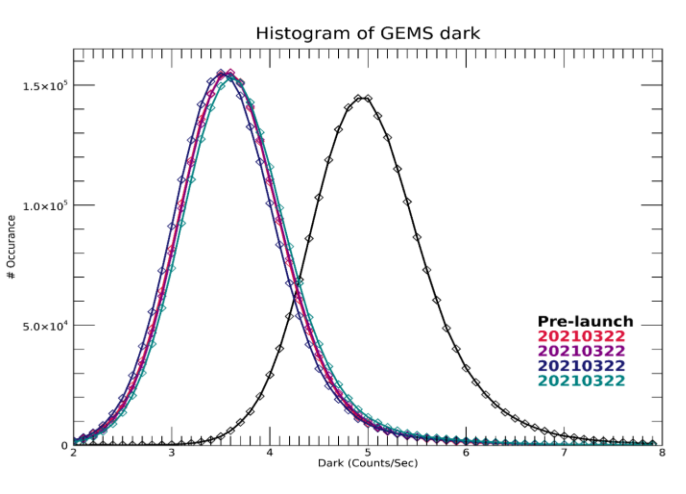


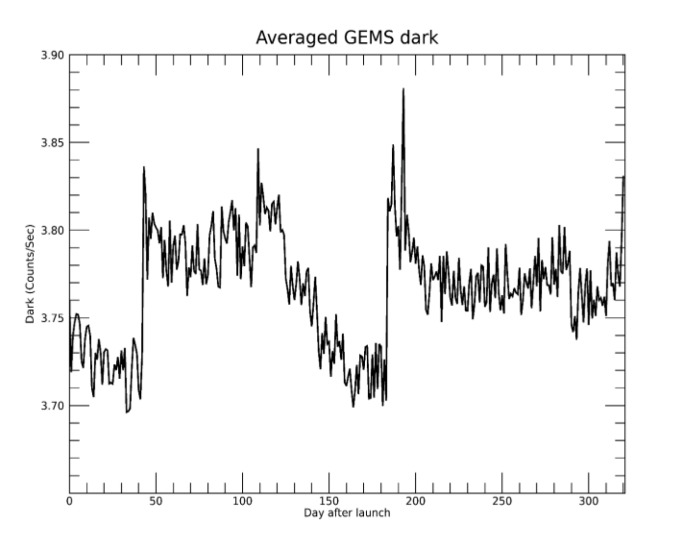






Median Trailing
Mean Leading
Mean Trailing





Summary

- Irradiance show expected characteristics with a few exceptions
  - ✓ There are spatial patterns in both raw digital count and calibrated solar irradiance which also shows a temporal variation
  - ✓ Irradiance values are smaller than OMPS and similar to TROPOMI
- Near future activities
  - ✓ Resolve issues in the diffuser BTDF appeared in updated process
  - ✓ Improve stray light correction, especially at the shorter end of spectrum
  - ✓ Validate the calibration coefficients (linearity, gain...)
  - ✓ Monitor the variation of the in-flight measurements (offsets, dark, LED)

Thank you!