



## MAJIS IR Filter Update

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On behalf of the IAS engineering team

### Status update:

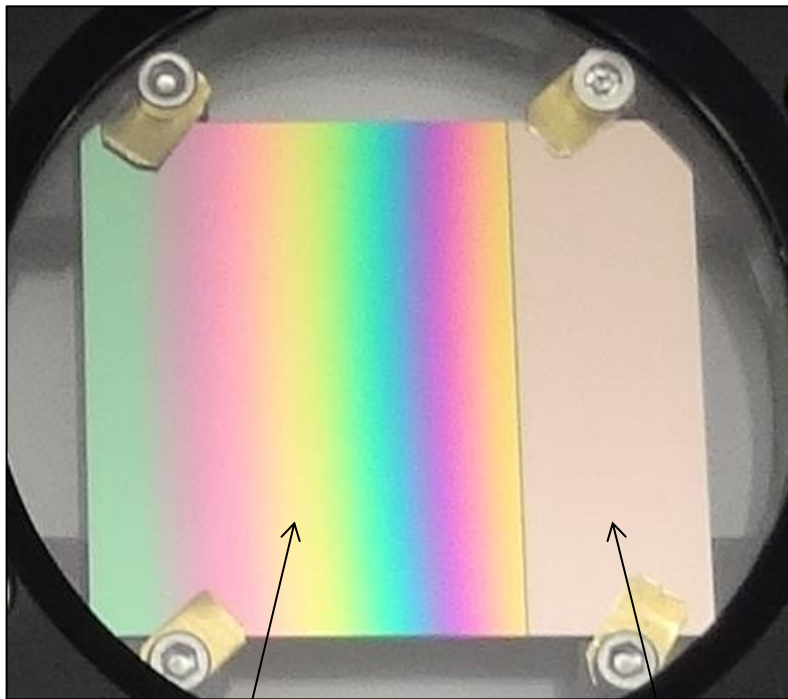
Down-selection of 4 FMFS based on optical measurements by Viavi, visual inspection of surface quality, mechanical compliancy

### Ancillary measurement strategy at IAS:

$\mu$ -FTIR set up in transmission : pixel scale  $\sim$  MAJIS pixel

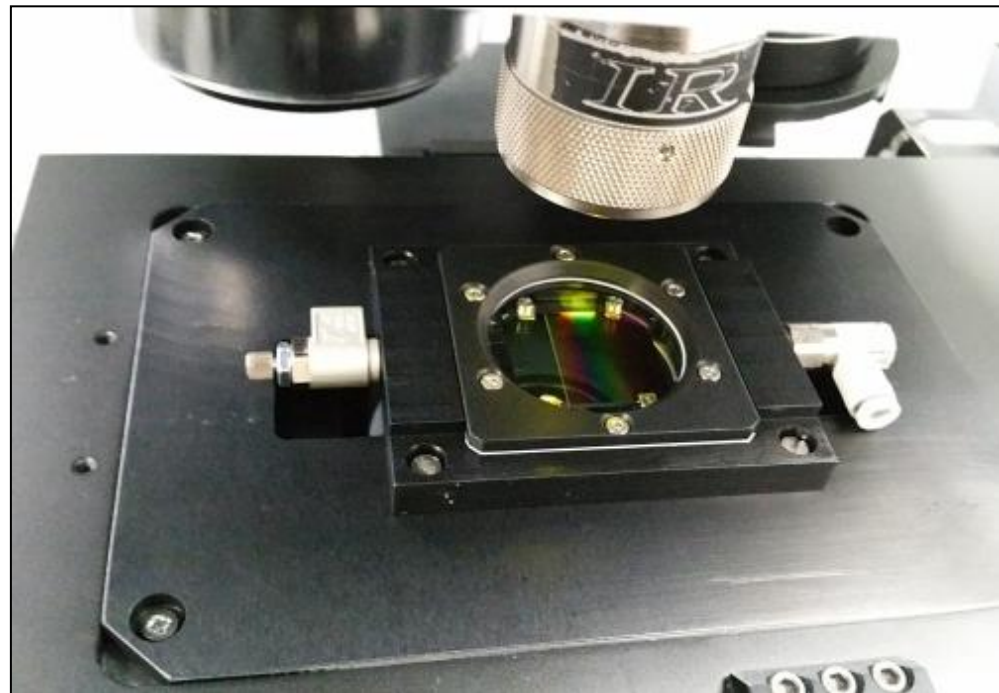
Collaboration with SOLEIL Synchrotron facility & astrochemistry team at IAS

$\sim$ 10 full days of measurements on FMFS, not accounting tests and measurements on QMs



*LVF segment*

*BPF segment*

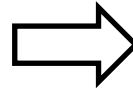


*Ambient measurements, then corrected for temperature (@90K)*

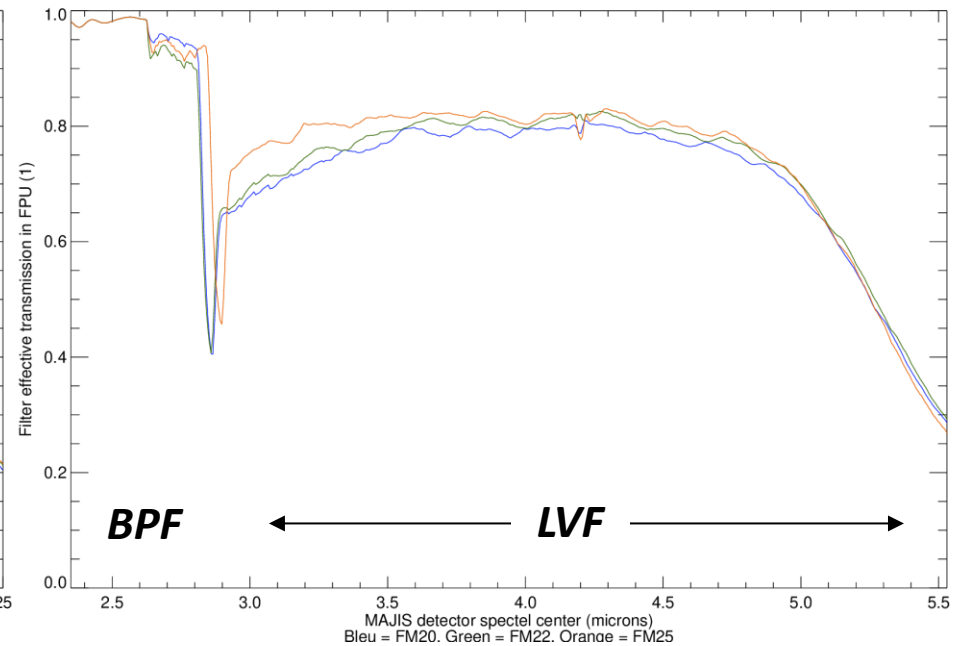
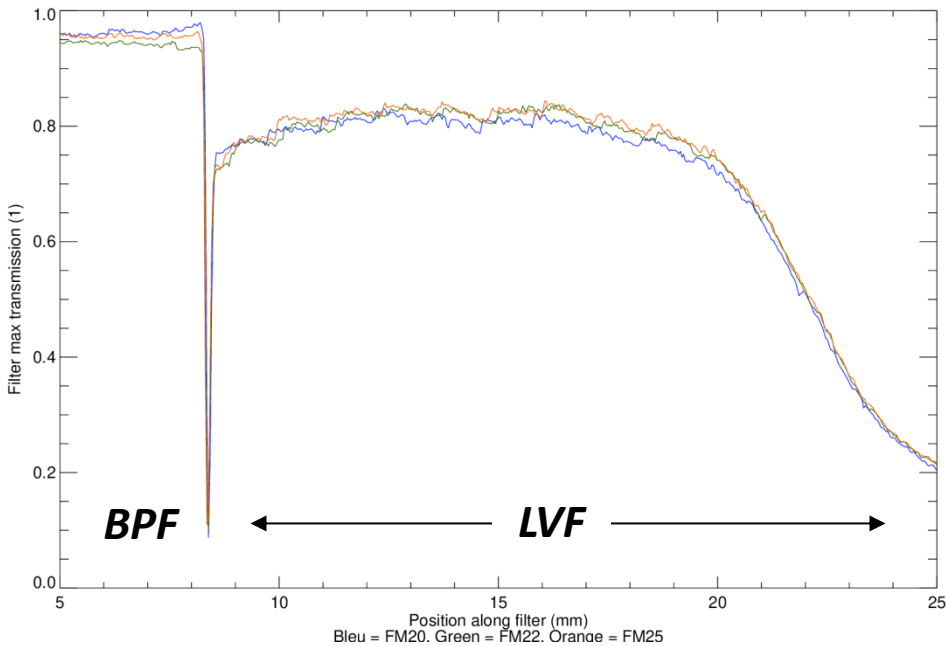
# Filter transmission

*Example for 3 FMFS*

FMFS intrinsic transmission

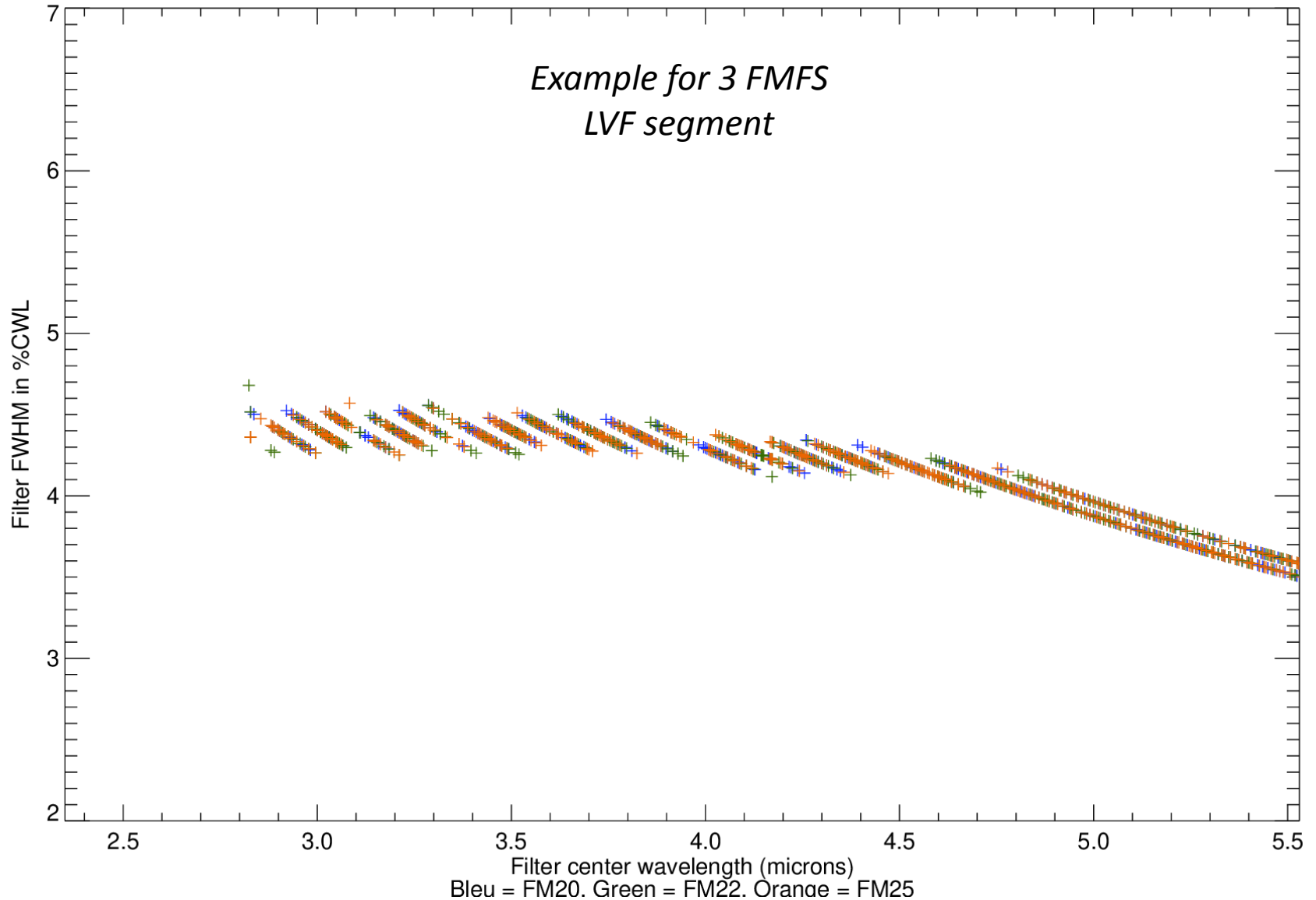


FMFS effective transmission  
(model)



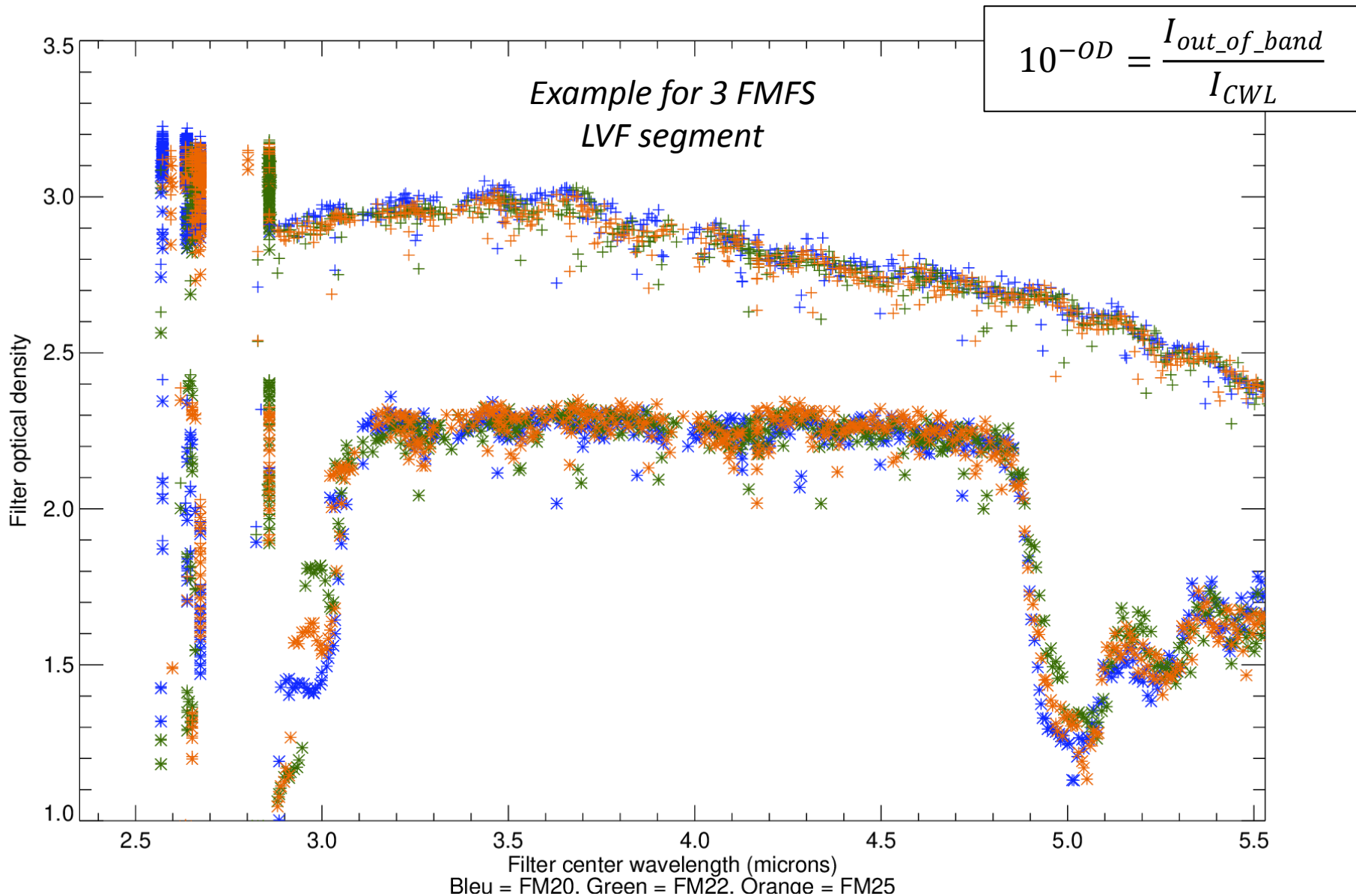
FMFS *effective* transmission assumes near perfect alignment of the filter with respect to the grating dispersion

# Filter FWHM



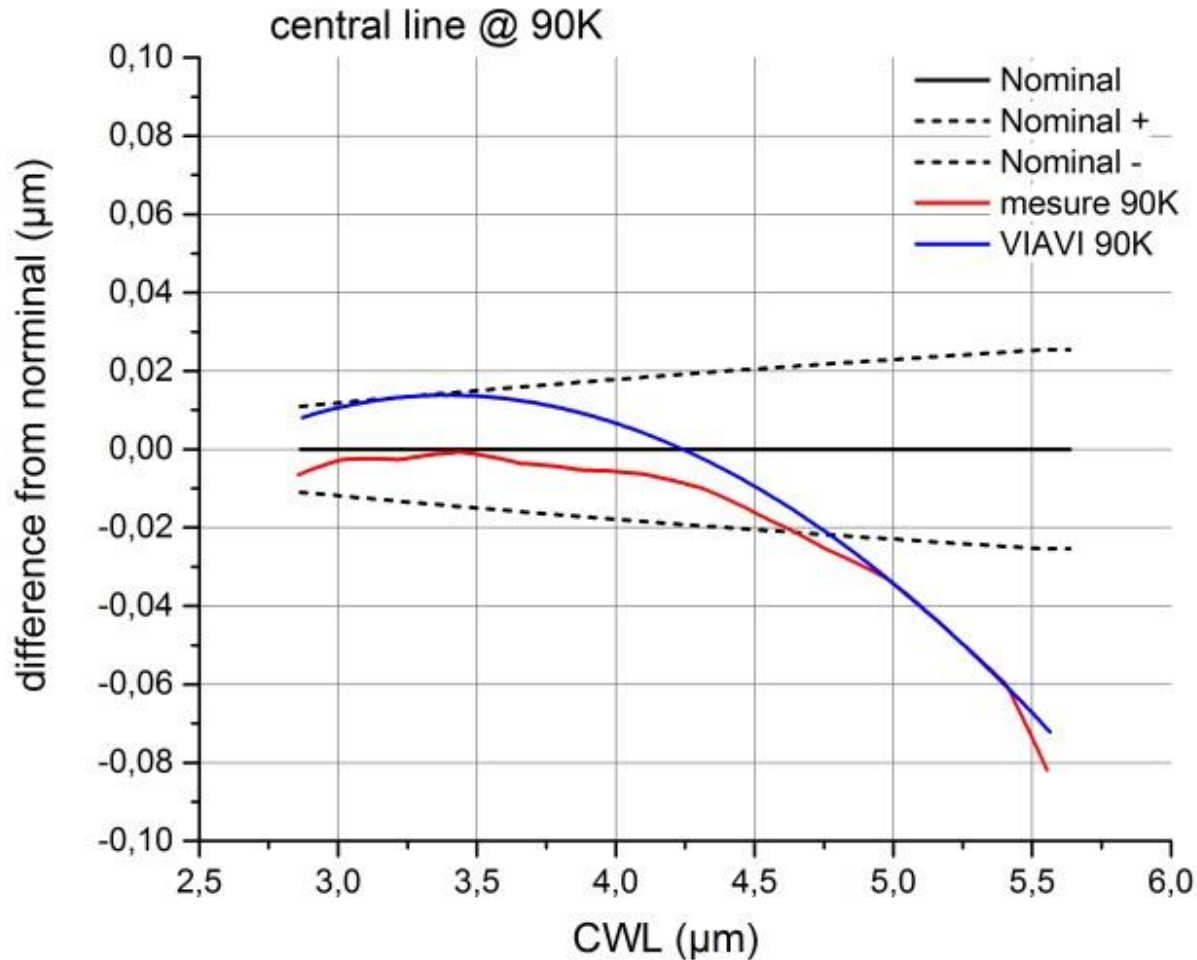
**A decreasing FWHM in %CWL towards 5  $\mu$ m was not foreseen, it is a good thing!**

# Filter OD



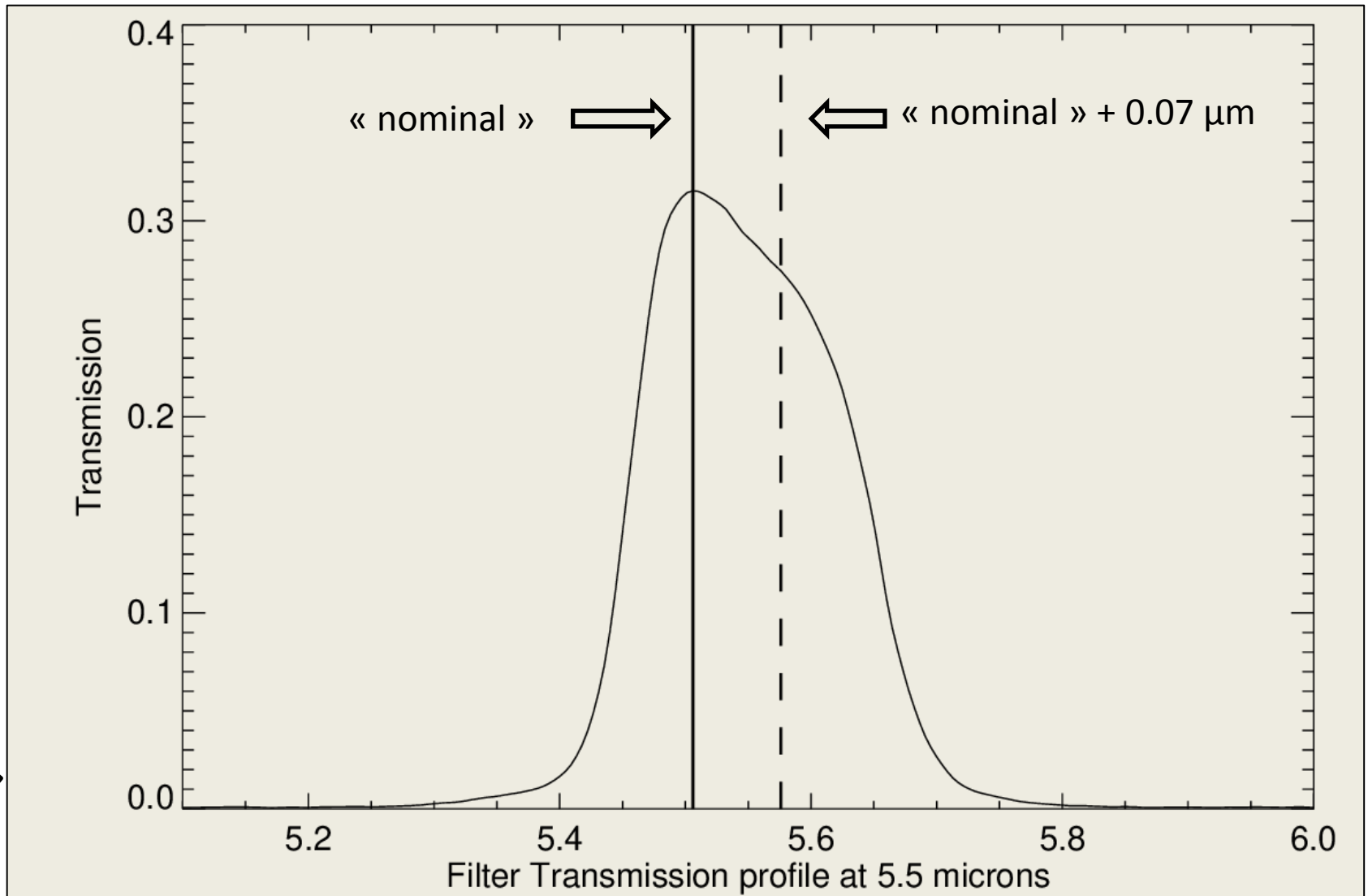
**We injected the actual out-of-band transmission into the radiometric performance model to verify that the thermal background is not a performance limiter**

# Filter CWL gradient



**Gradient in the > 5 µm region may not seem fully compliant with spec, but the FWHM width and passband profile allows for more tolerance on the CWL position**

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# Optical performance: results

*Verification using the SOLEIL/IAS bench:*

Filter intrinsic performance parameters	Compliance
<b>Spectral gradient of Central Wavelength of the LVF</b> Based on LDO-provided grating dispersion at filter plane in 2018 MAJIS IR Filter dispersion shall be 0.180 $\mu\text{m}/\text{mm}$ +/- 1%	OK
<b>Transmission of the LVF + BPF</b> * $\lambda < 3.5 \mu\text{m}$ $T \geq 50\%$ (goal $T \geq 70\%$ ) * $\lambda > 3.5 \mu\text{m}$ , $T \geq 30\%$ (goal is $T \geq 50\%$ )	OK
<b>Spectral smile of the LVF</b> Goal: $\leq 0.030 \mu\text{m}$ at any position of the active surface	OK
<b>FWHM of the LVF</b> Target value of 4,5% $\pm 10\%$ of the CWL	OK
<b>Out-of-band rejection</b> OD2 (goal OD3) on average outside in-band transmission	OK

Spectral mapping done at SOLEIL was also injected into the MAJIS radiometric performance model to consolidate impact of filter performance

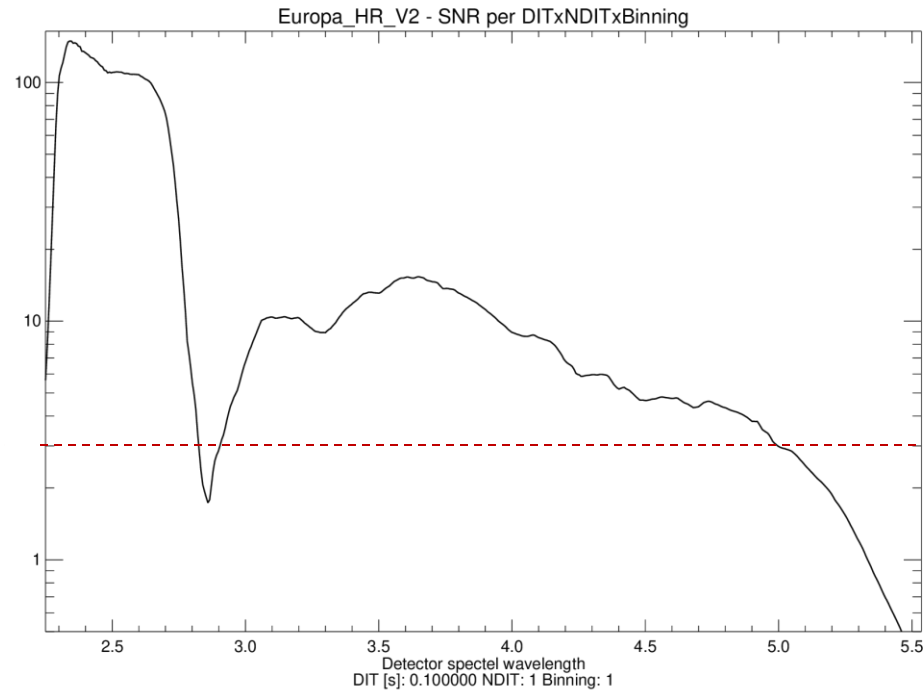
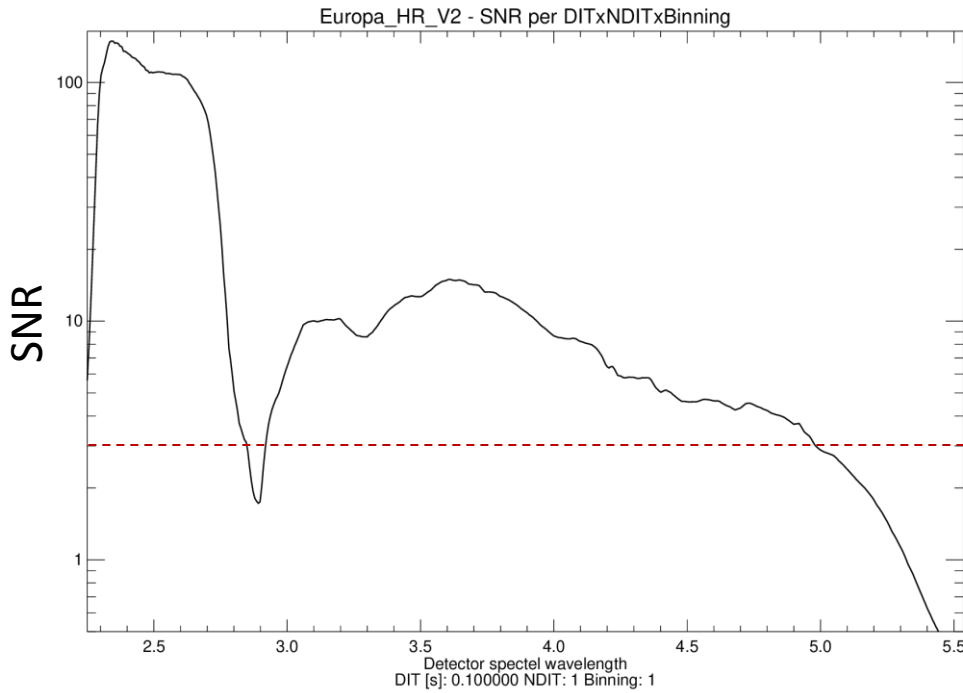


# End-to-end performance

*Example: One 100 ms sub-integration for Europa flyby in HR mode*

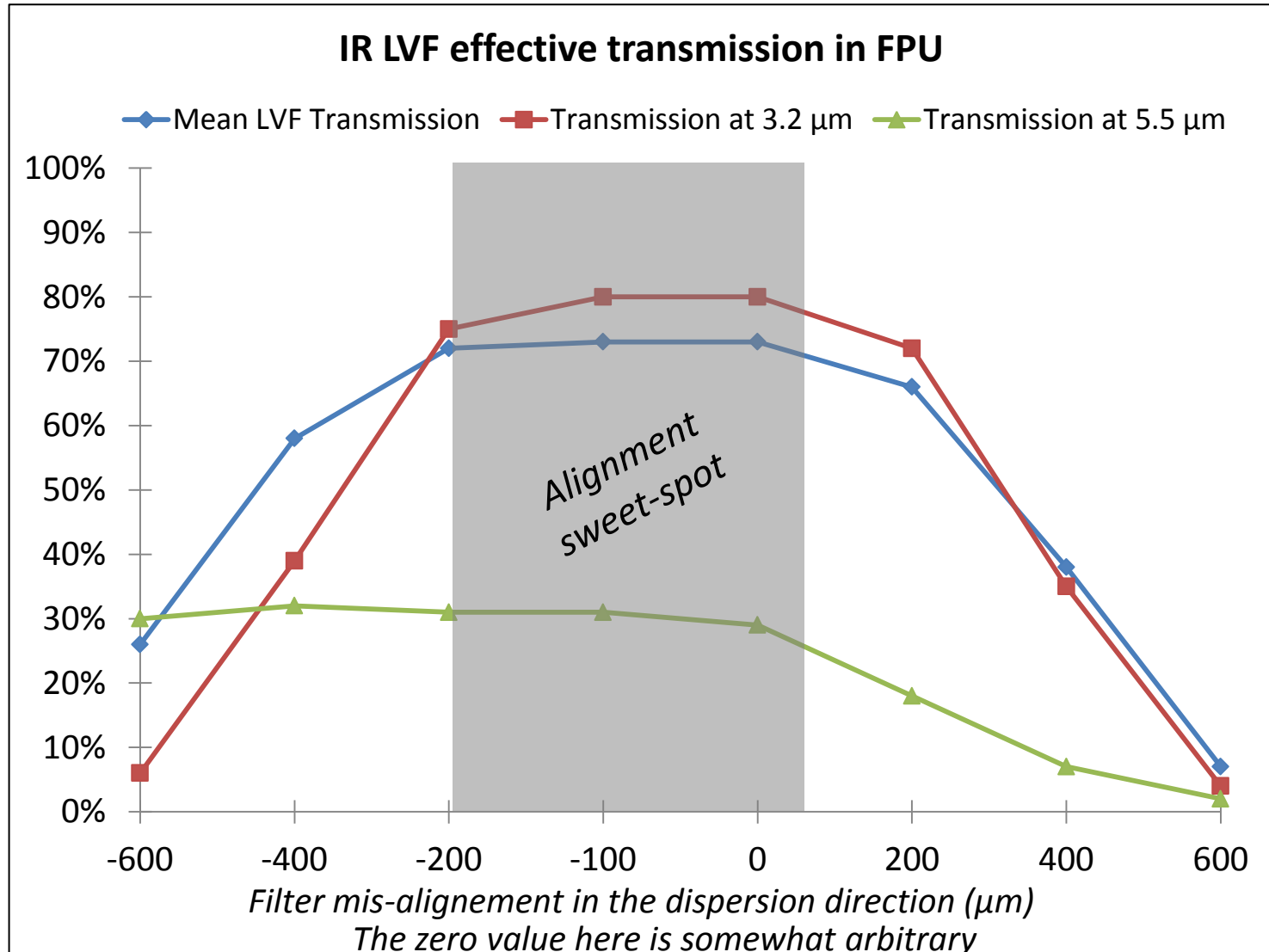
Previous performance  
(based on QM)

Current performance  
(based on FMFS)



→ Negligible impact. Compatible with CDR performance.

# Good filter alignment along the dispersive direction is required to be in tune with the grating dispersion



Knowledge of filter absolute optical position & its error  
both should be to within  $< 200 \mu\text{m}$  &  $< 200 \mu\text{m rms}$



AI: Specific discussion  
with LDO required