

Ganymede Wavelength Calibration

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Procedure

1. Obtain Ganymede apodization without any filter (figure 1). Make sure lens is far from any nearby surface (no light is collected from the sample arm).
2. Obtain two additional apodizations (figure 2):
 - With Thorlabs FTLH850 long pass filter in the reference arm path
 - With Thorlabs FTLH950 long pass filter in the reference arm path
3. Derive Transmission factor (T) of the long pass filter (850 & 950) by using (figure 2):
$$T = \sqrt{\frac{I_f}{I_i}}$$

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$I_f = \text{Apodization with filter}$
 $I_i = \text{Apodization without filter}$

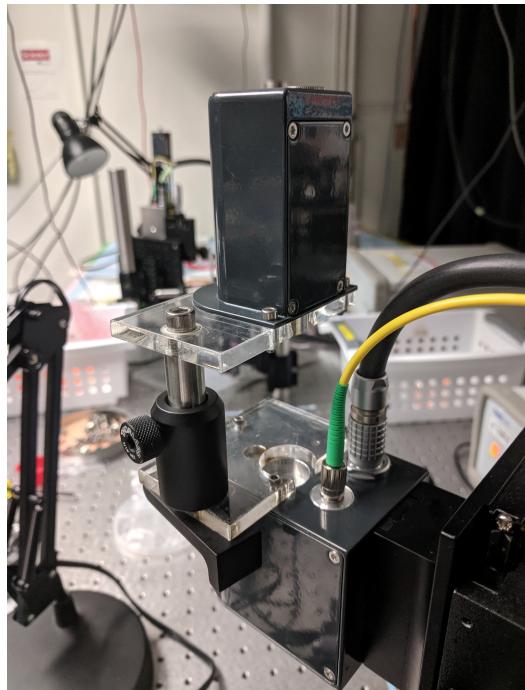


Figure 1

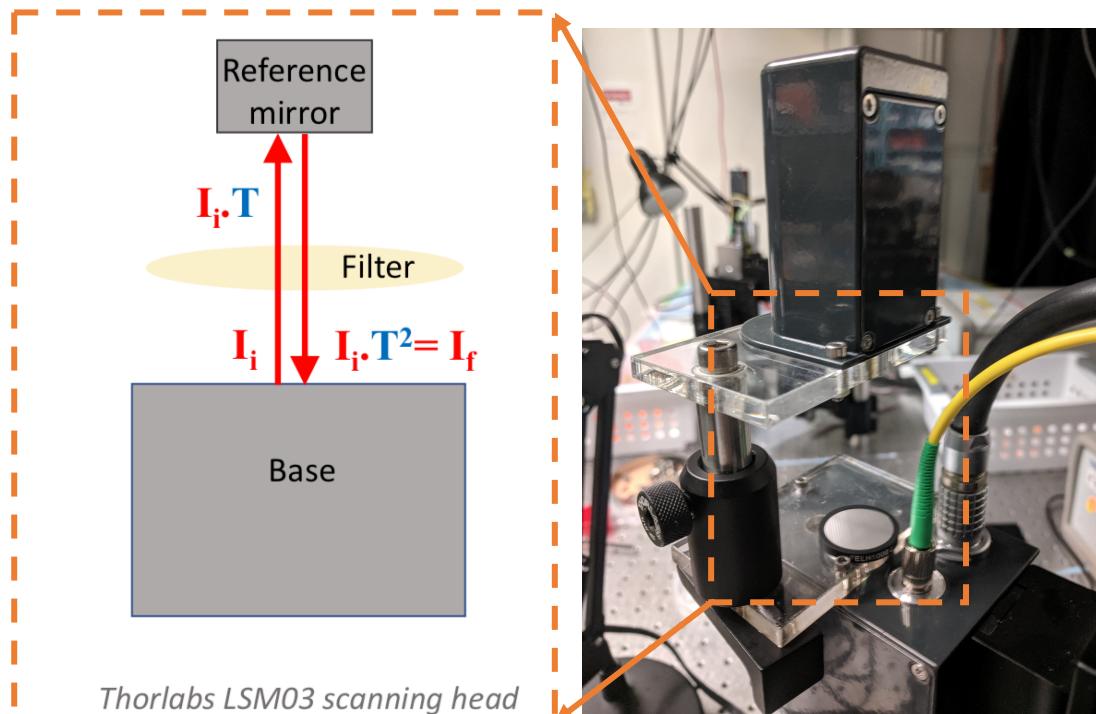


Figure 2

Procedure

4. Compare the two Transmission factors (T) to the transmission data of each long-pass filter provided by Thorlabs.
5. Using optimization*, fit the transmission factor (T) of each long-pass filter to Thorlabs data assuming linear translation in the form of:

$$T_{Thor} = a * T_{\text{Thor}}(c * (\lambda - b))$$

T_{Thor} = transmission data of each long – pass filter provided by Thorlabs

a = scaling factor

b = translation factor of lambda values

C = translation scaling of lambda values

Results

1. Ganymede Apodization: without filter, with 850nm filter, and with 950nm filter (figure 3)

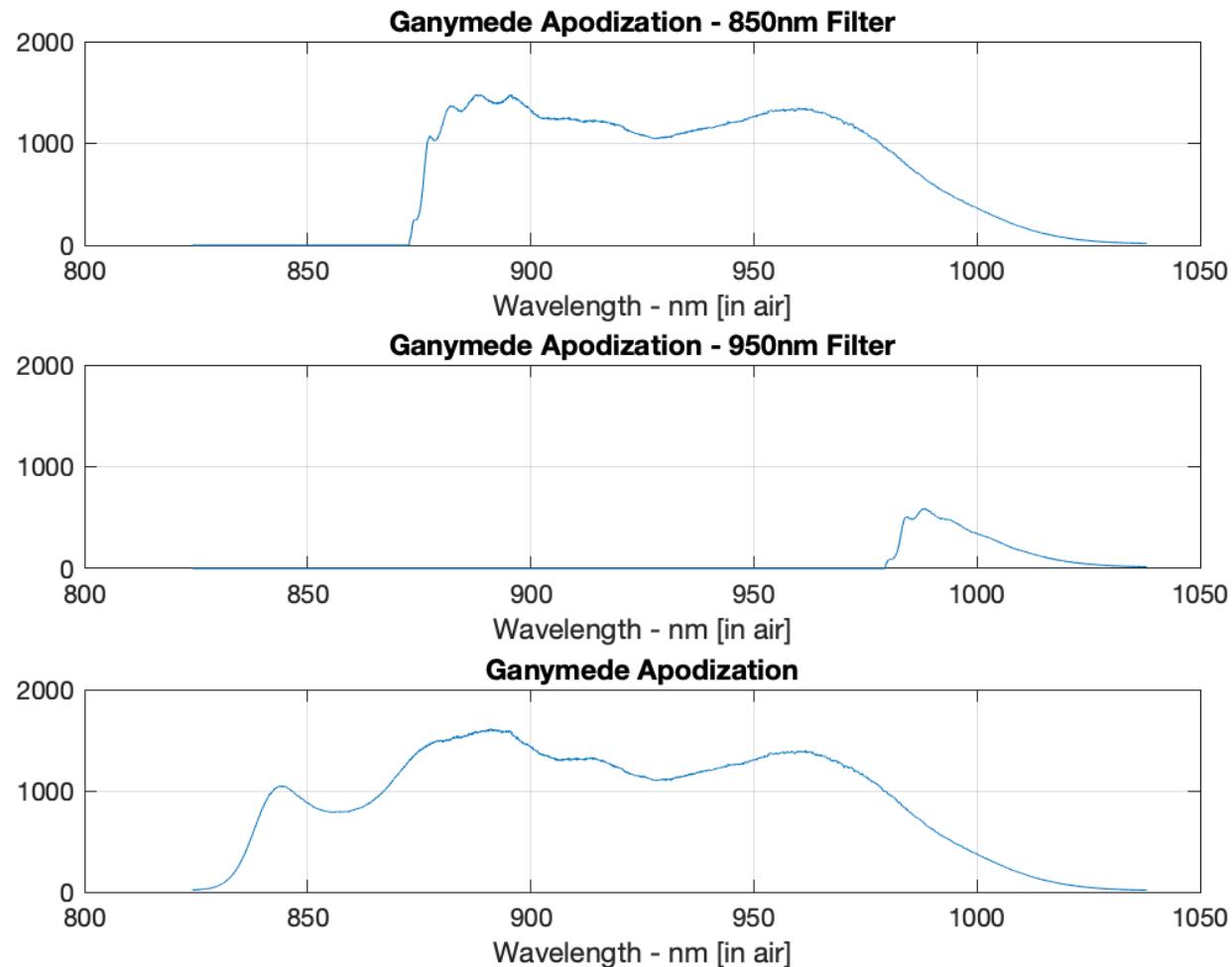


Figure 3

Results

2. Experimentally derived two Transmission factors (**T**) compared to **Thorlabs data*** (figure 4)

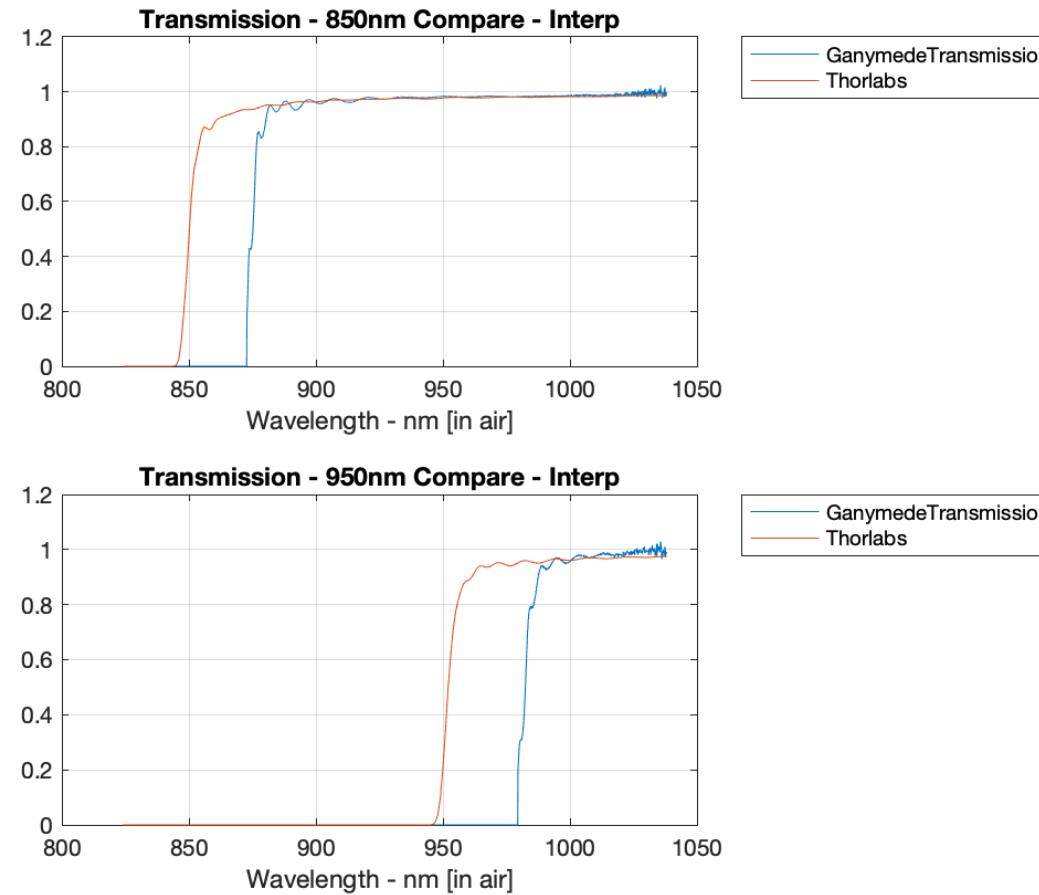


Figure 4

* Thorlabs data was interpolated to the lambda values of Ganymede

Results

3. Using optimization to fit the two transmission data sets to Thorlabs data (figure 5)

- a) fminsearch function

For 850nm transmission:

$$a = 0.9912$$

$$b = 28.3345$$

$$c = 0.9958$$

For 950nm transmission:

$$a = 0.9832$$

$$b = 26.9525$$

$$c = 1.0035$$

Averaging:

$$a_{\text{avg}} = 0.9814$$

$$b_{\text{avg}} = 27.6435$$

$$C_{\text{avg}} = 0.9996$$

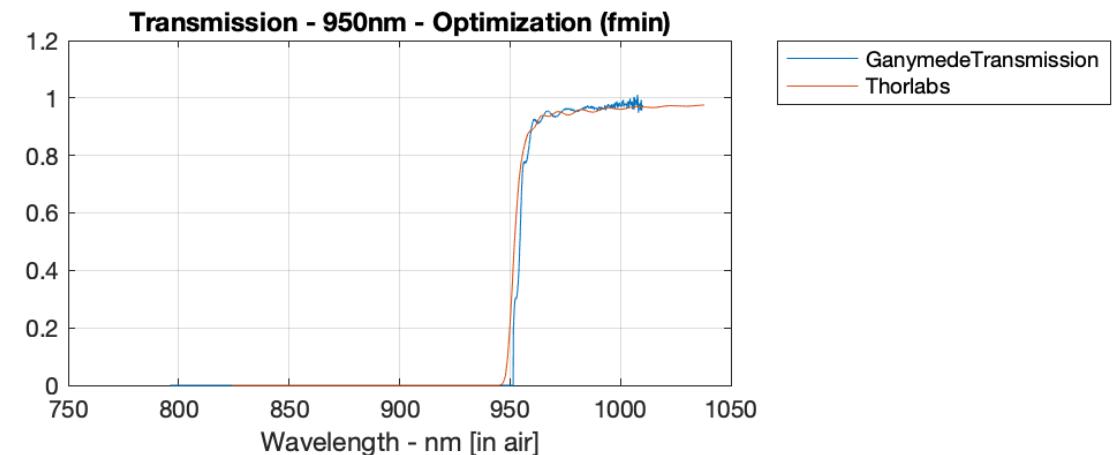
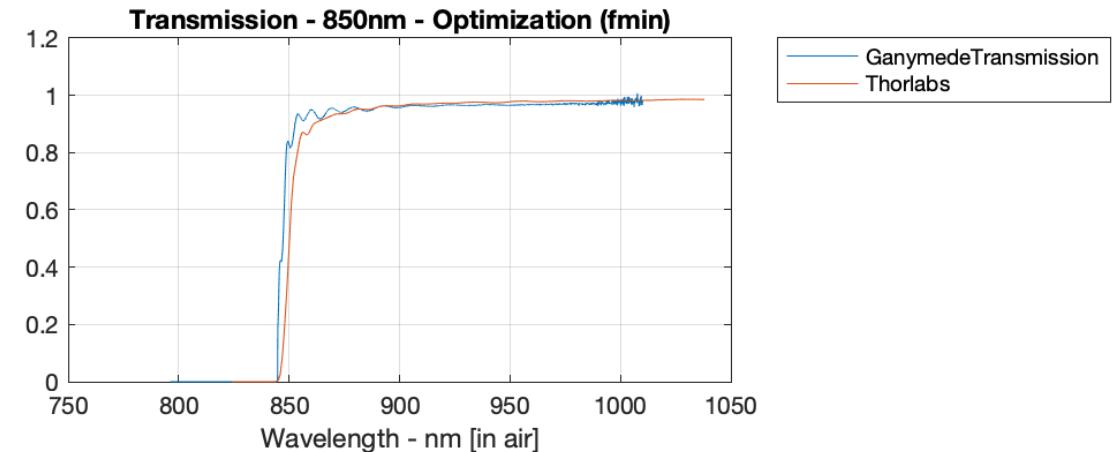


Figure 5

Results

3. Using optimization to fit the two transmission data sets to Thorlabs data (figure 6)

b) Globalminsearch function

For 850nm transmission:

$$a = 0.9906$$

$$b = 1.3289$$

$$c = 1.0275$$

For 950nm transmission:

$$a = 0.9749$$

$$b = 31.4902$$

$$c = 0.9991$$

Averaging the two:

$$a_{\text{avg}} = 0.9828$$

$$b_{\text{avg}} = 16.4096$$

$$C_{\text{avg}} = 1.0133$$

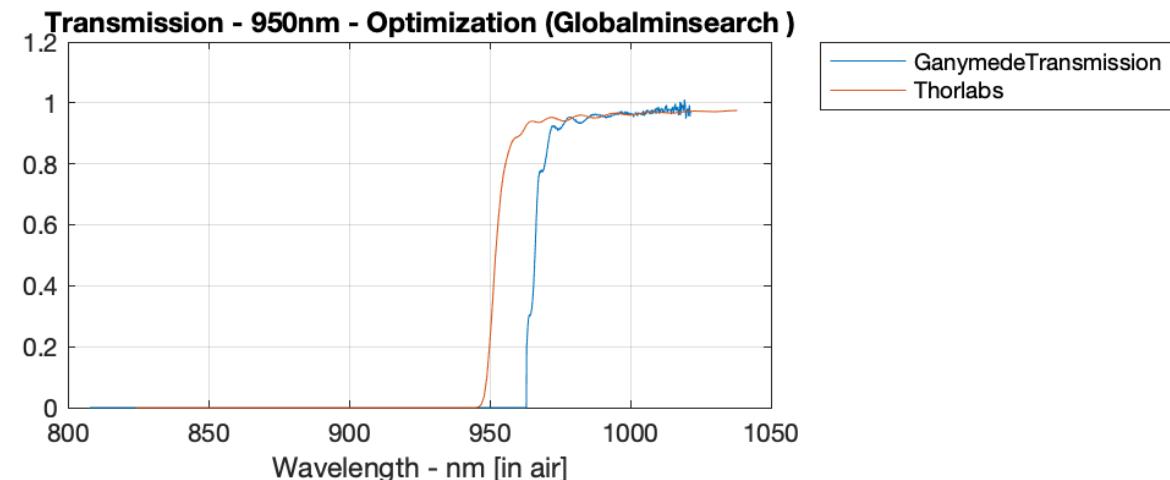
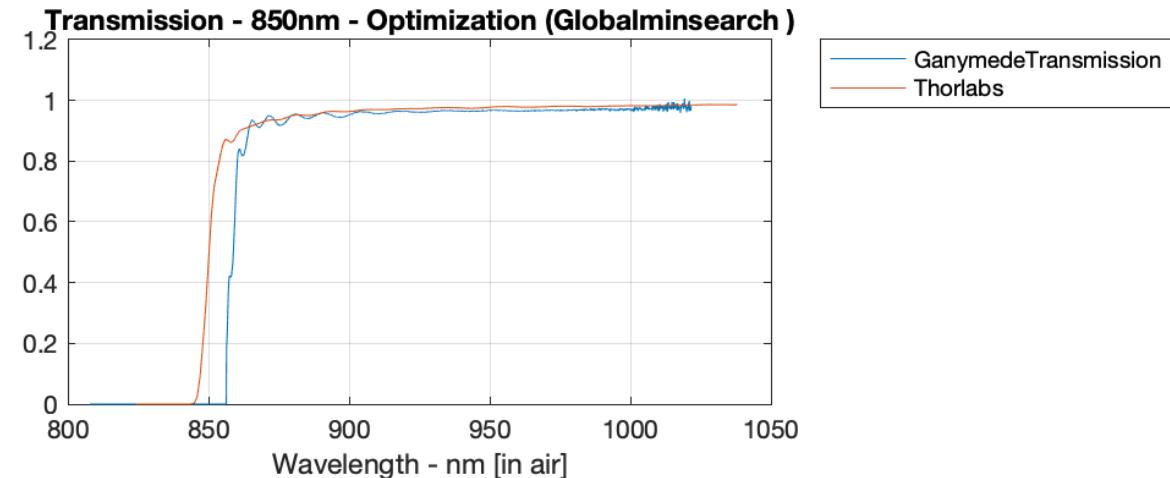


Figure 6

Results

4. Fminsearch results provide a better fit, therefore, the new λ_{\min} & λ_{\max} will be derived as follow:

$$\lambda_{\min} = C * (\lambda_{(\text{Manufacturer number})} - b) = 0.9996 * (824.1600 - 27.6435) = 796.23$$

$$\rightarrow \Delta \lambda_{\min} = 824.1600 - 796.23 = 27.93$$

$$\lambda_{\max} = C * (\lambda_{(\text{Manufacturer number})} - b) = 0.9996 * (1038.03 - 27.6435) = 1010.03$$

$$\rightarrow \Delta \lambda_{\max} = 1038.03 - 1010.03 = 28$$

5. Figure 7 present the apodization corrected to the new lambda min and max values, compared to original and to Thorlabs data

6. Correct λ_{\min} & λ_{\max} values can be found at the matlab script:
`yOCTLoadInterfFromFile_ThorlabsHeaderLambda.m`

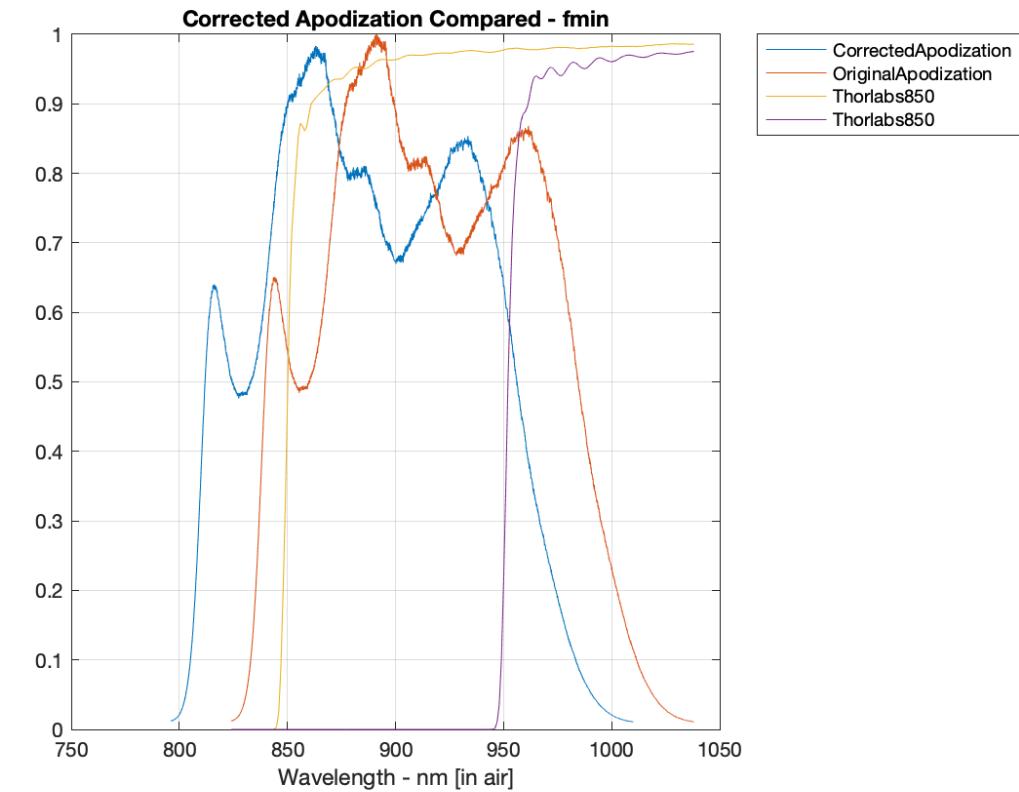


Figure 7