# Dual radiance standards can minimise calibration uncertainty in the SWIR region

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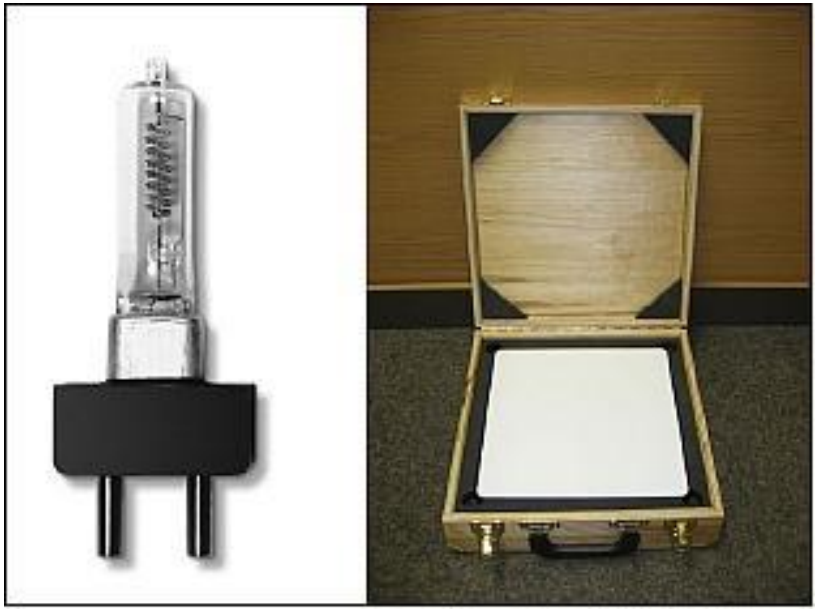
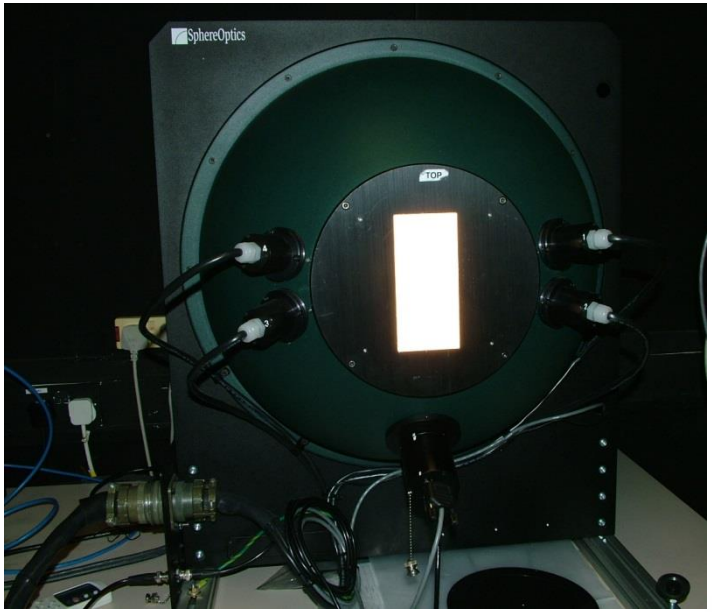
# Radiance Calibration Sources



FEL Irradiance Lamp & Reflectance Panel – credit DLR




Integrating Sphere Radiance Source – credit NERC

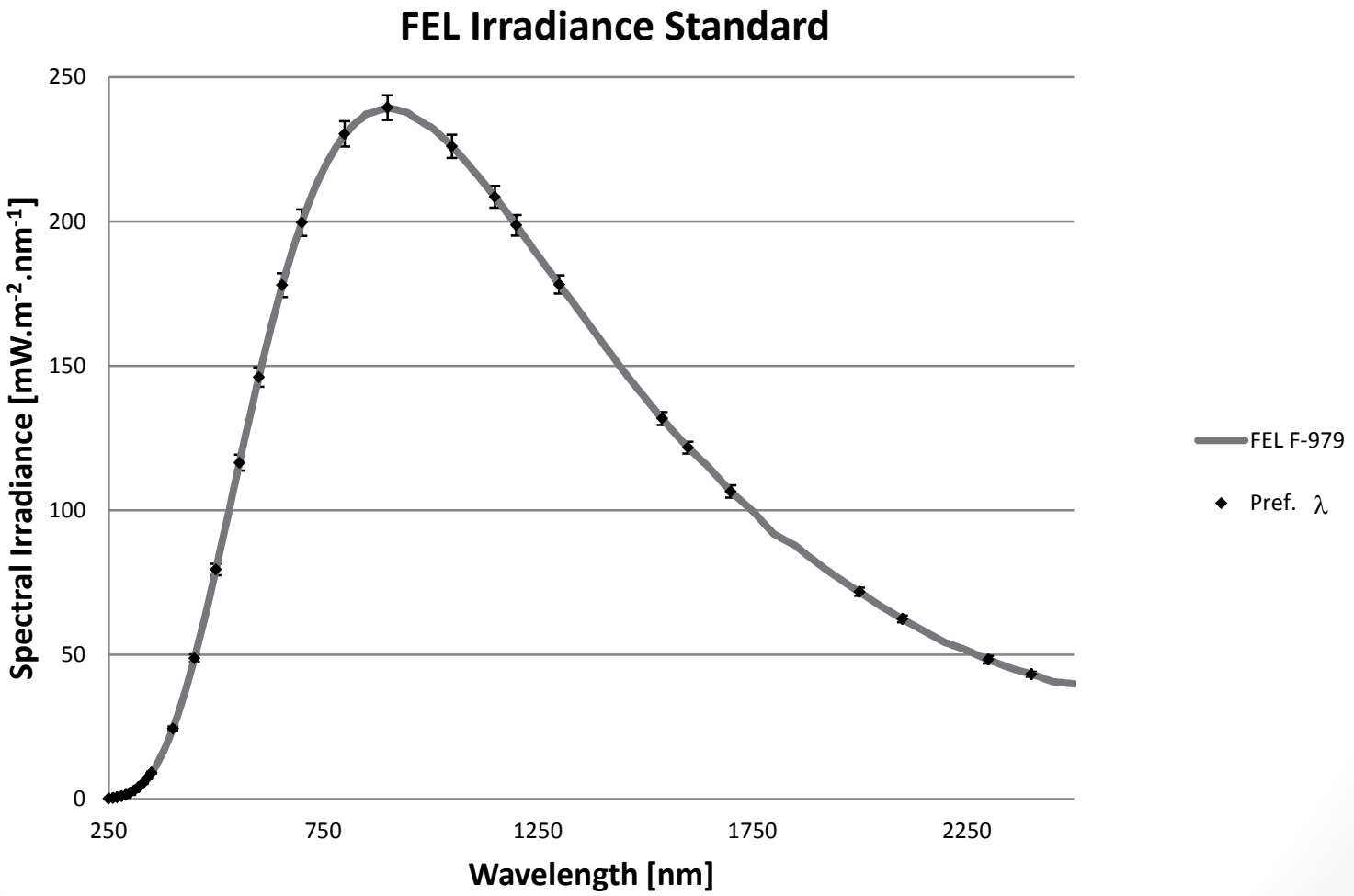
# FEL Irradiance ⇒ Radiance

- FEL Lamp with stabilised current source, calibrated for spectral irradiance, *E*
- Diffuse reflectance panel or tile, calibrated spectral radiance factors, $\beta$ for a specific viewing geometry, 0°:45°

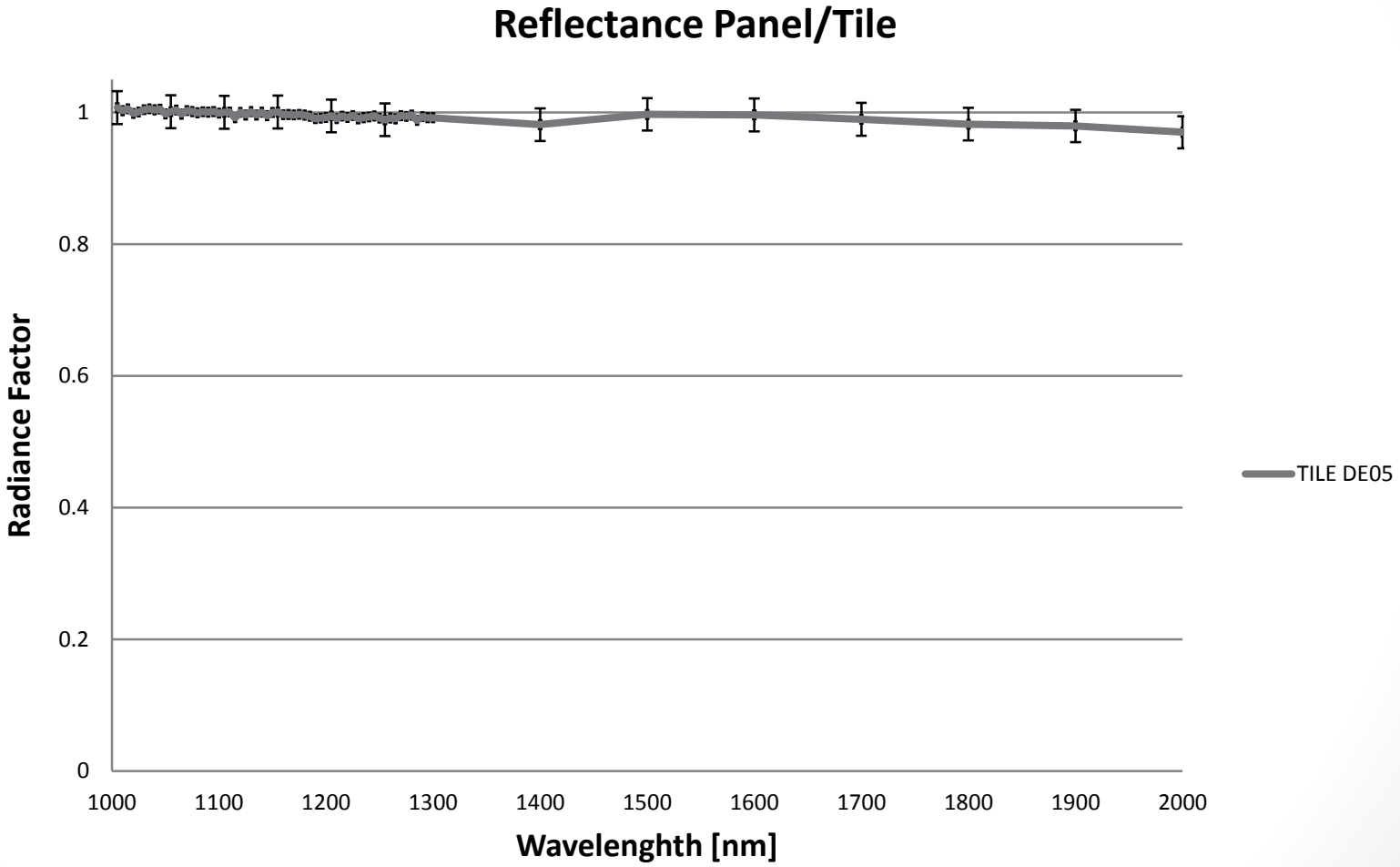
- Radiance of panel, $L = E * \beta / \pi$

- Sources of uncertainties
  - Non uniformity of panel illumination -> radiance across FOV
  - Radiance factors
  - Stray light
  - Measurement distances

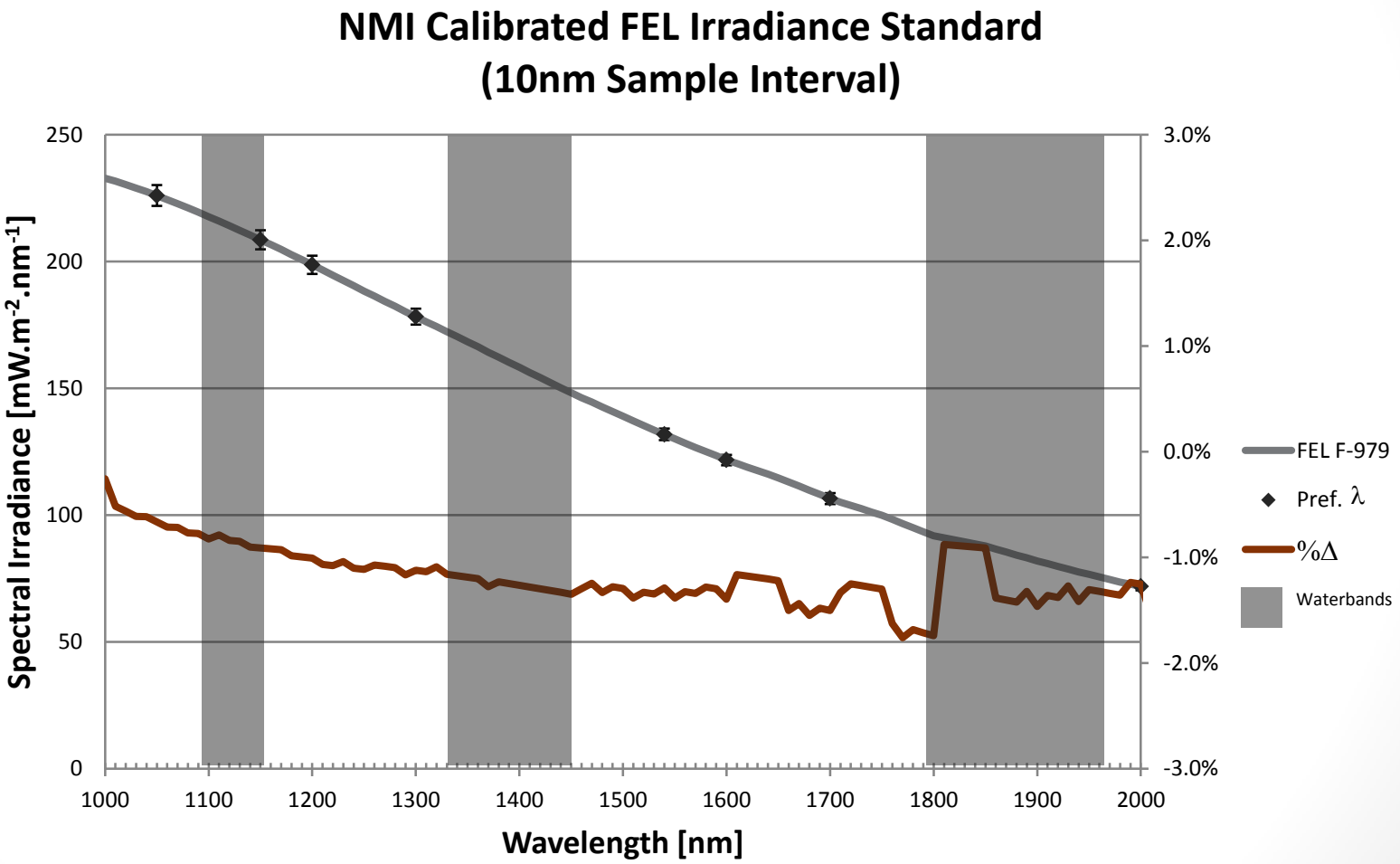
# Irradiance Standard



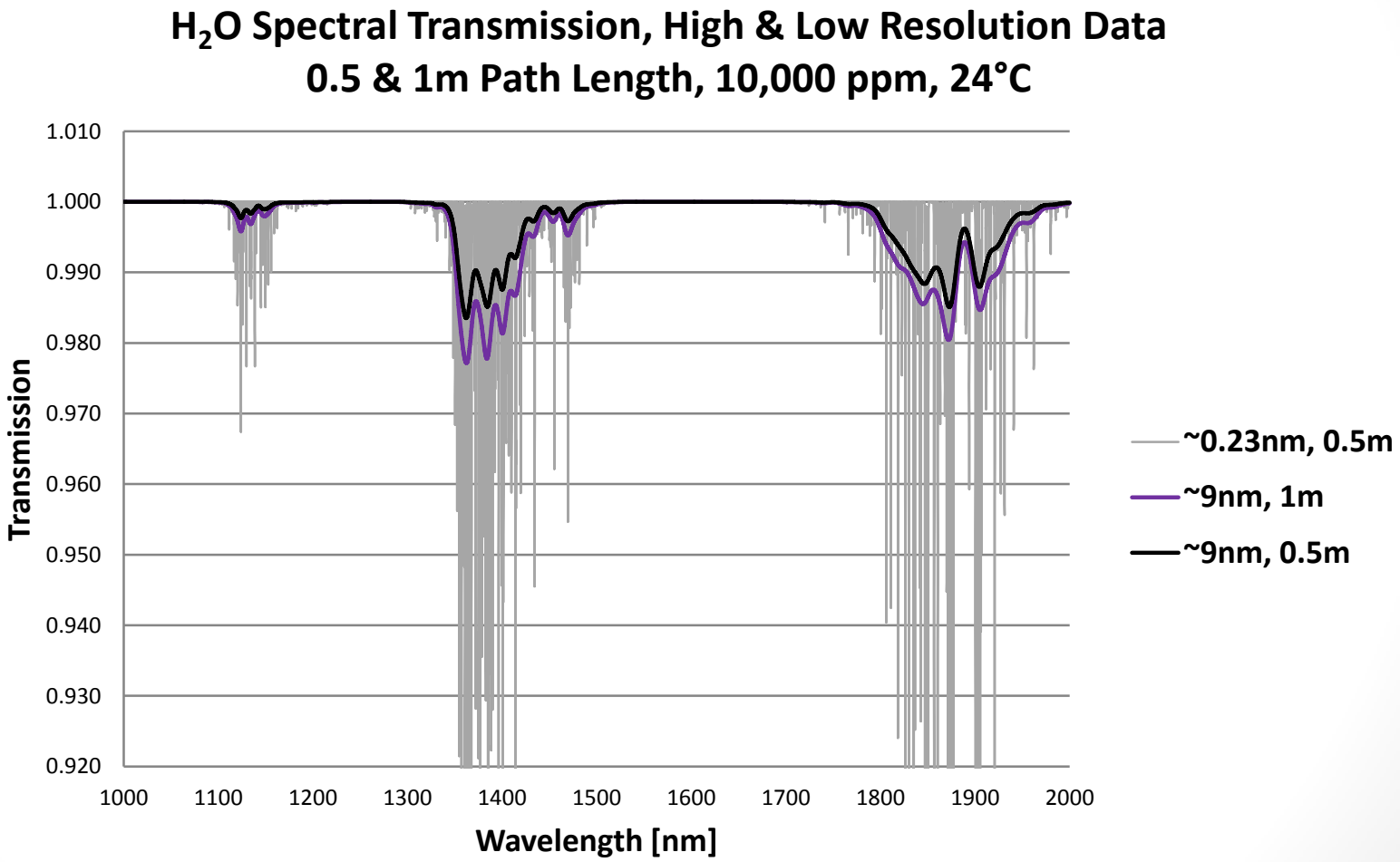
# Panel Radiance Factors, β0:45°



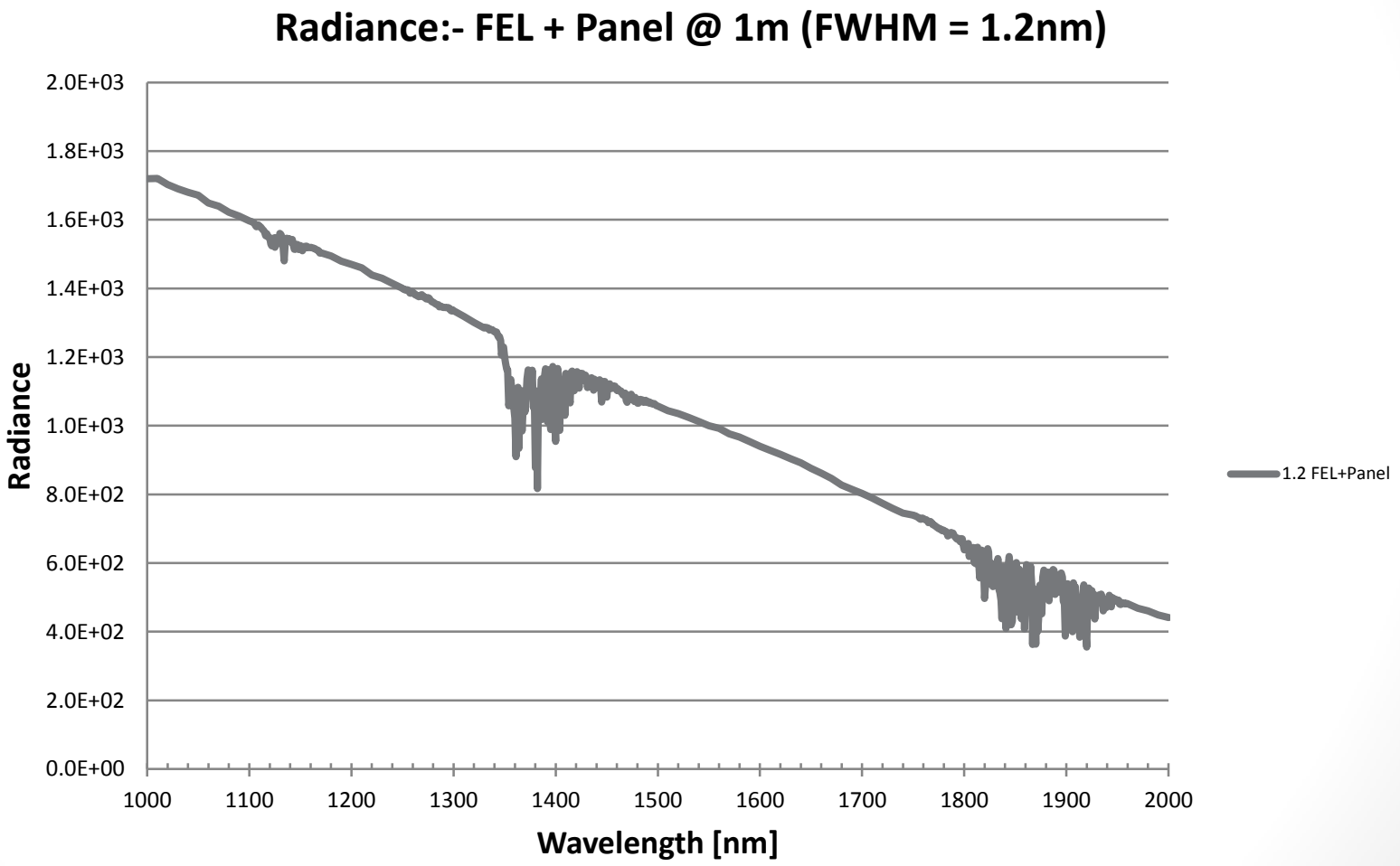
# SWIR Region 1000 – 2000nm



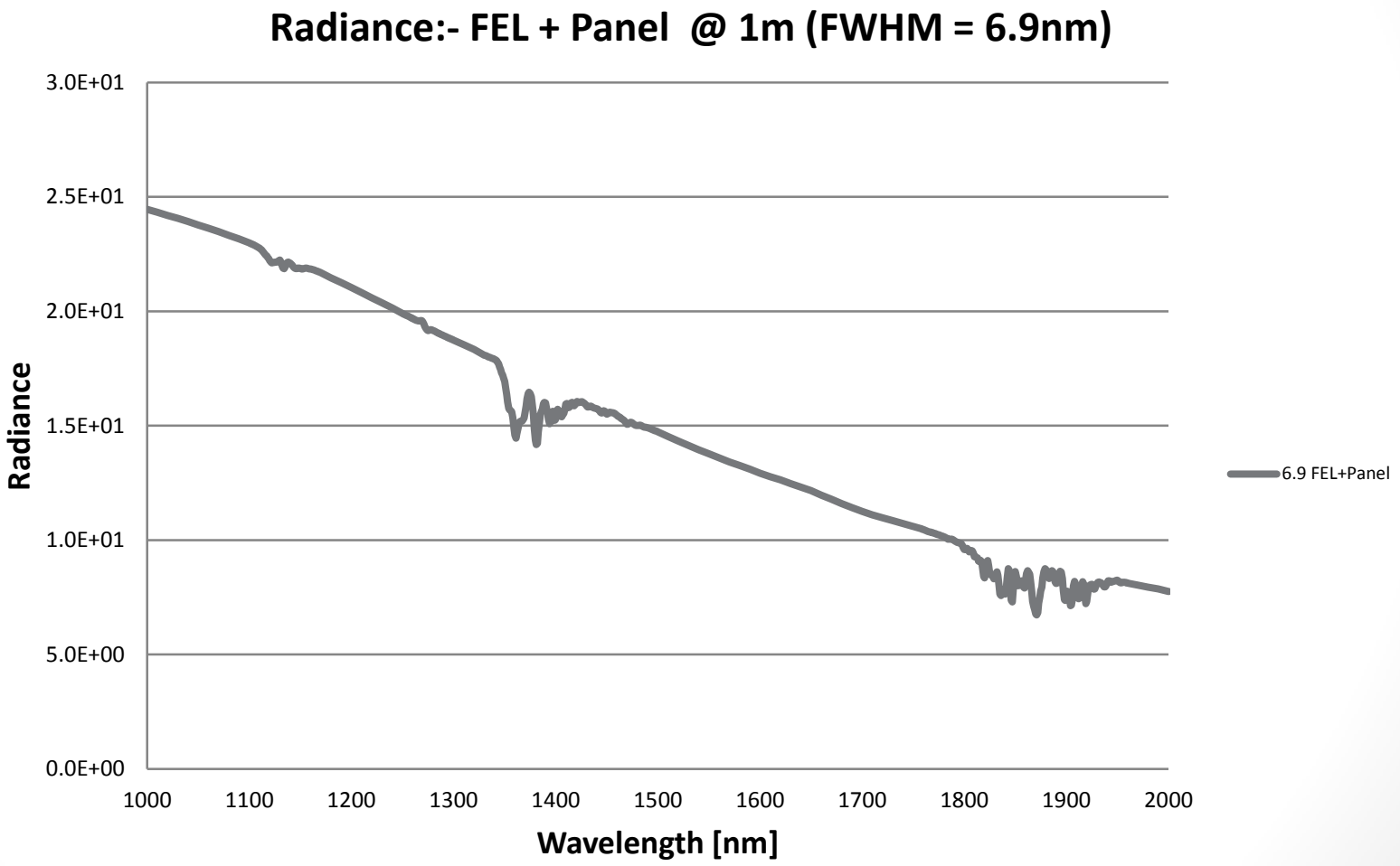
# HITRAN $H_2O$ Data



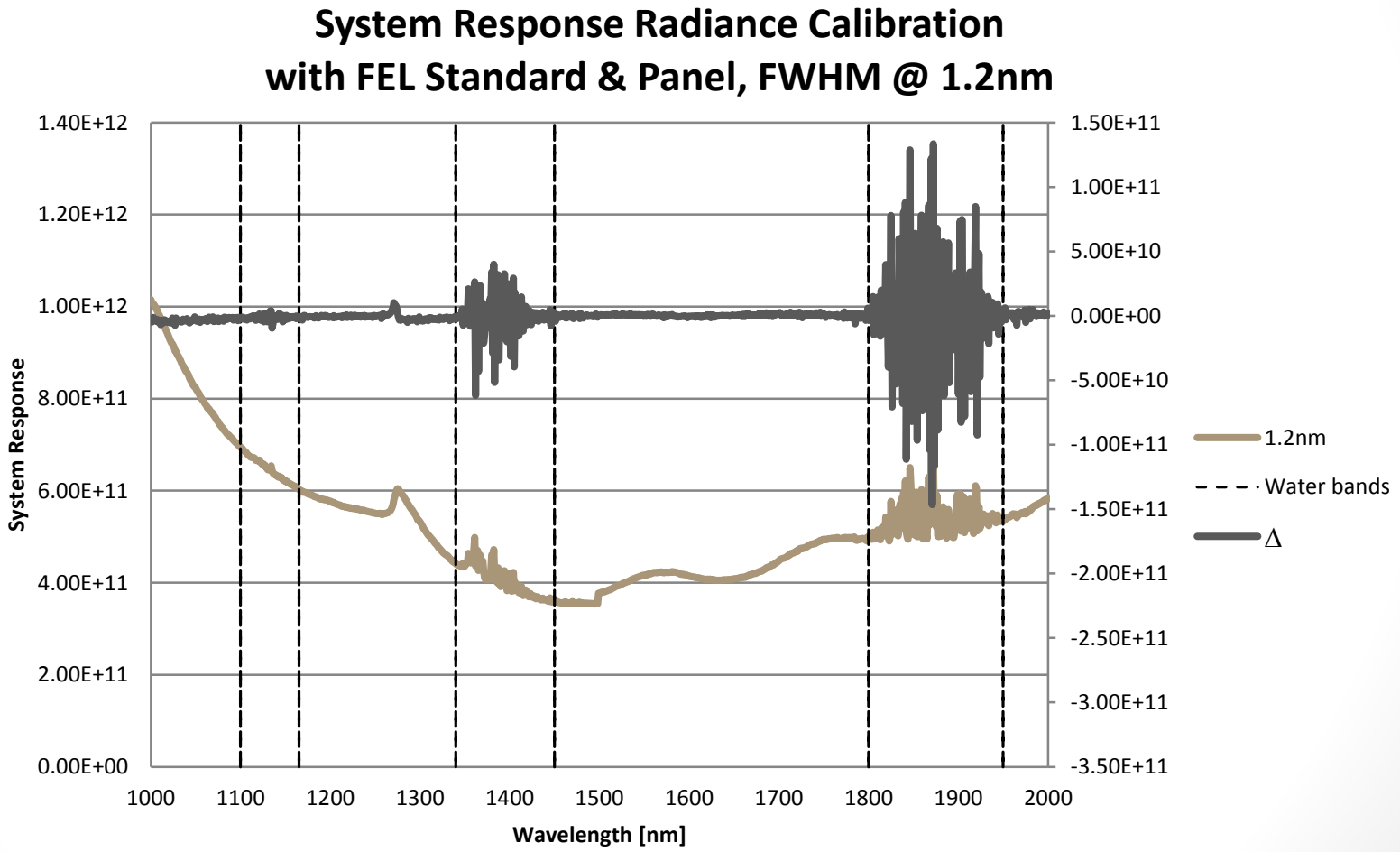
# Radiance (with Absorption)



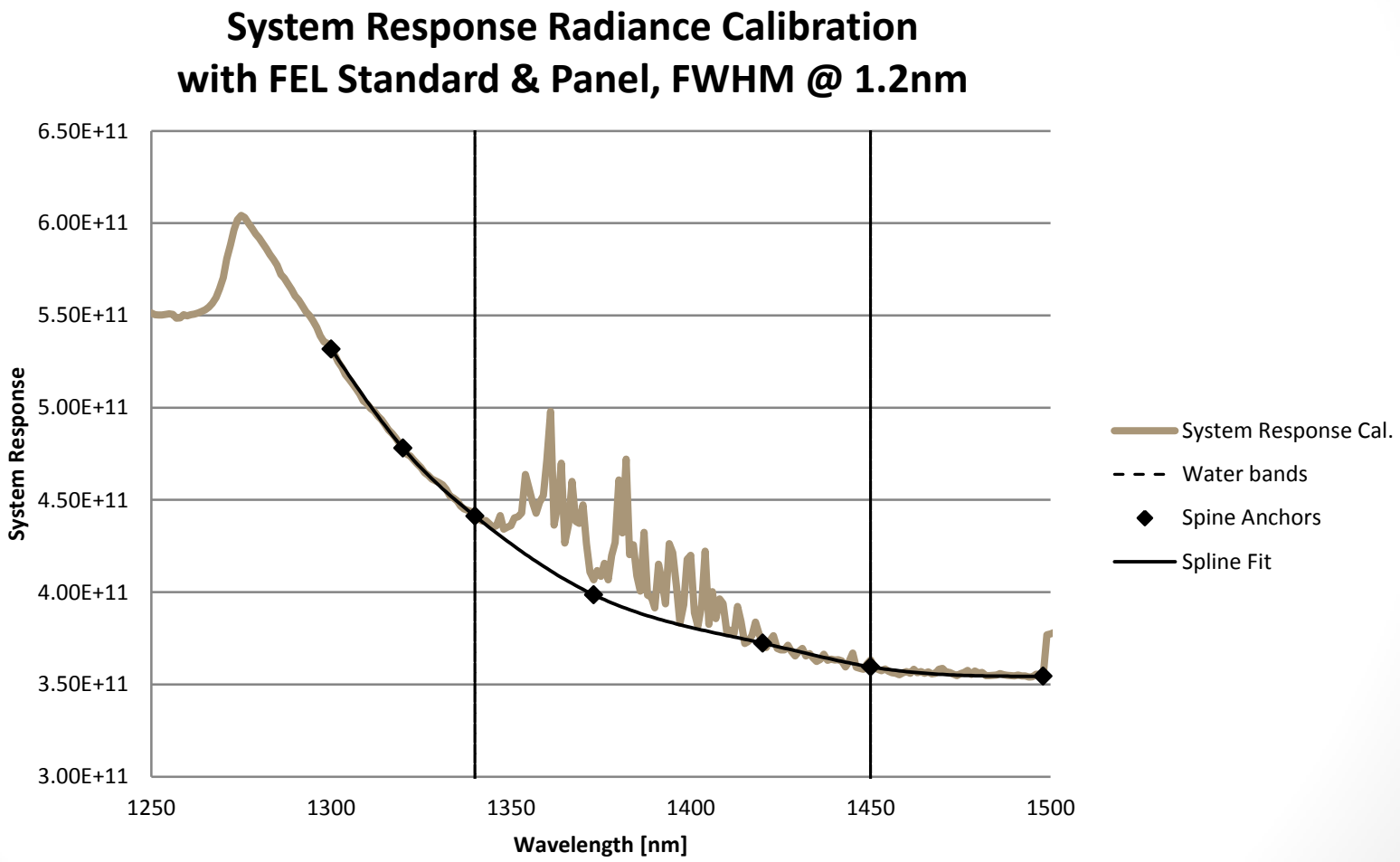
# Radiance (with Absorption)

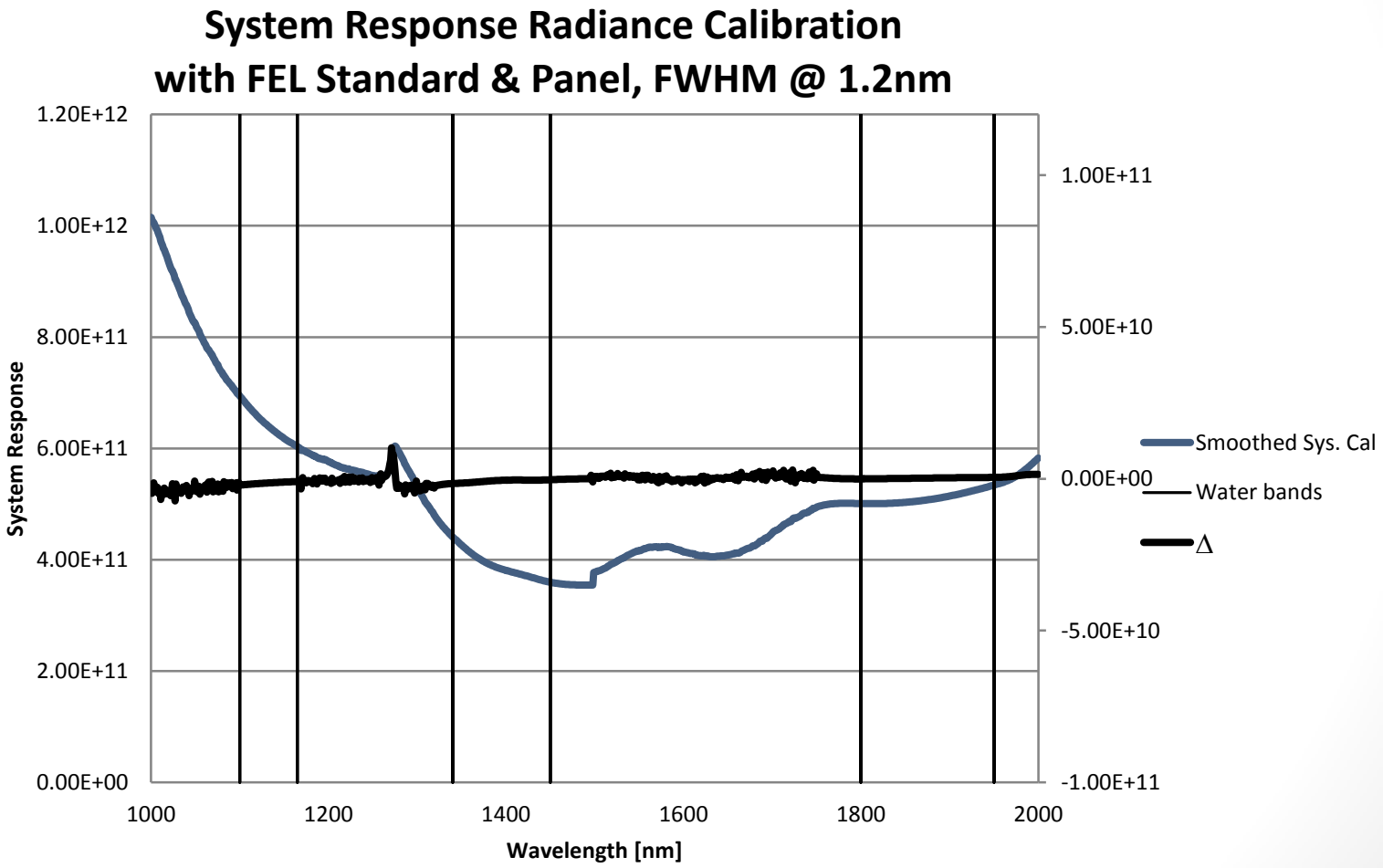


# Radiance Calibration (SWIR)



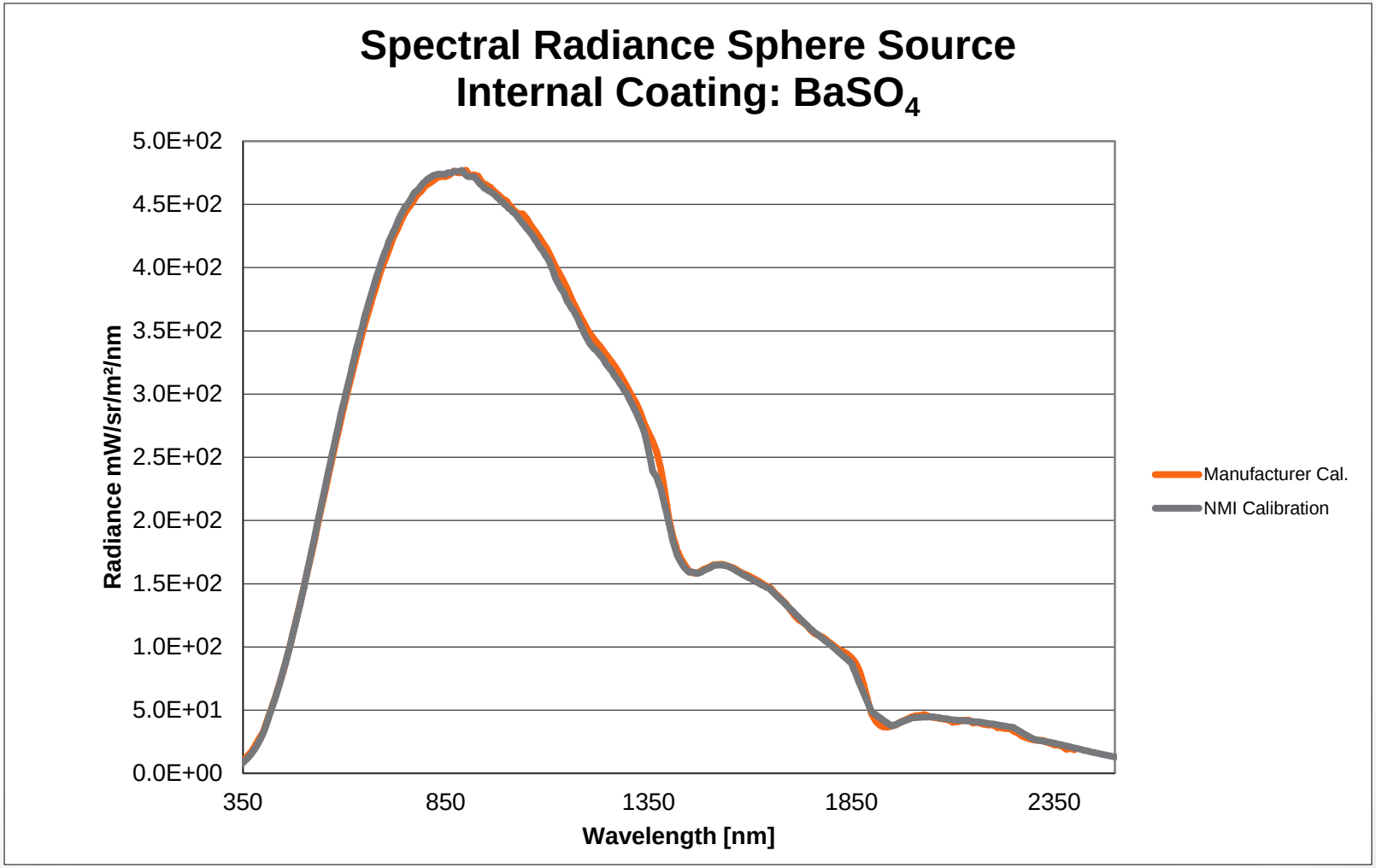
# Spline Fit Across Water Bands



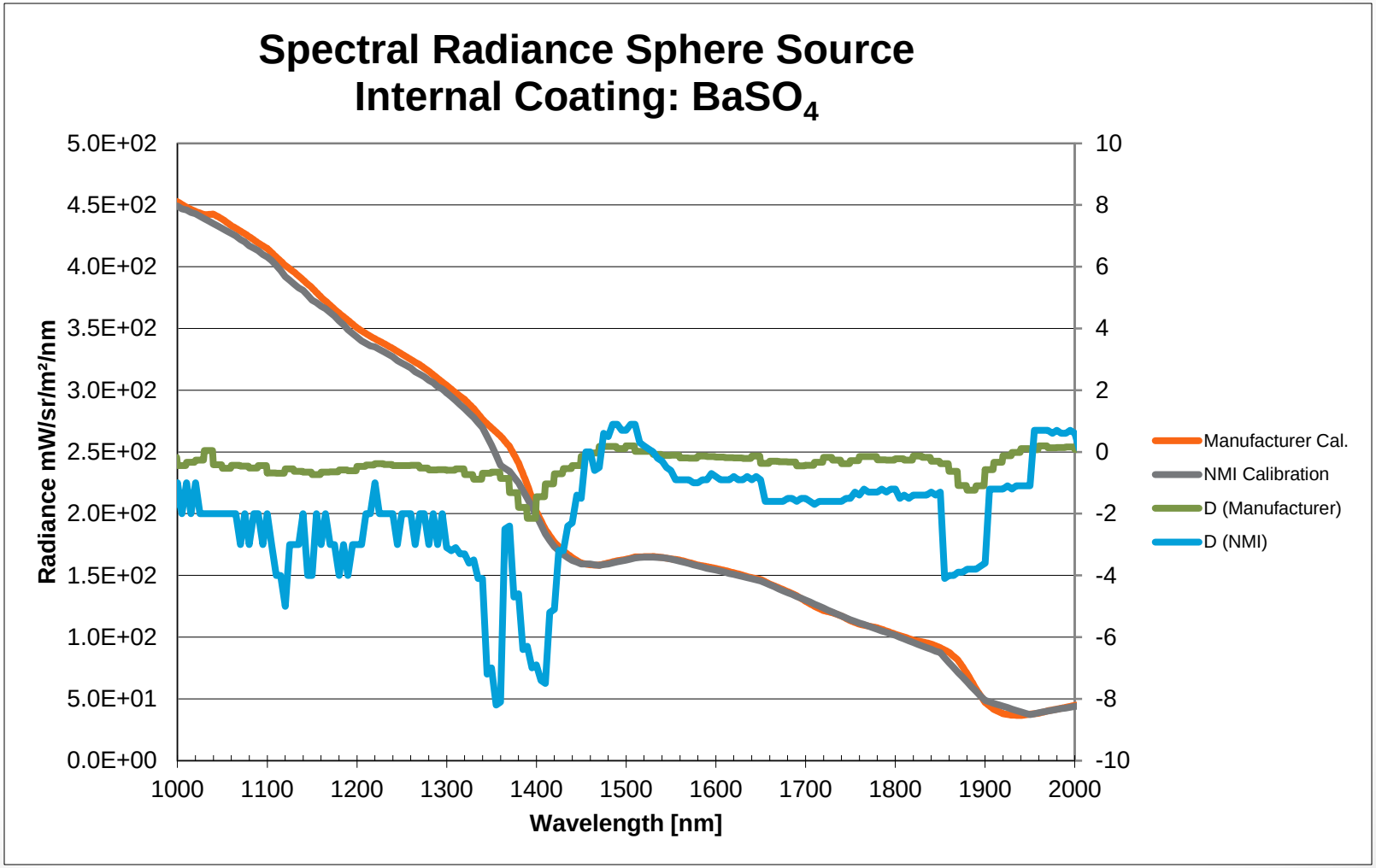

System Response Radiance Calibration
with FEL Standard & Panel, FWHM @ 1.2nm
System Response
1.20E+12
1.00E+12
8.00E+11
6.00E+11
4.00E+11
2.00E+11
0.00E+00
1.00E+11
5.00E+10
0.00E+00
-5.00E+10
-1.00E+11
1000
1200
1400
1600
1800
2000
Wavelength [nm]
Smoothed Sys. Cal
Water bands
Δ

# Integrating Sphere Sources

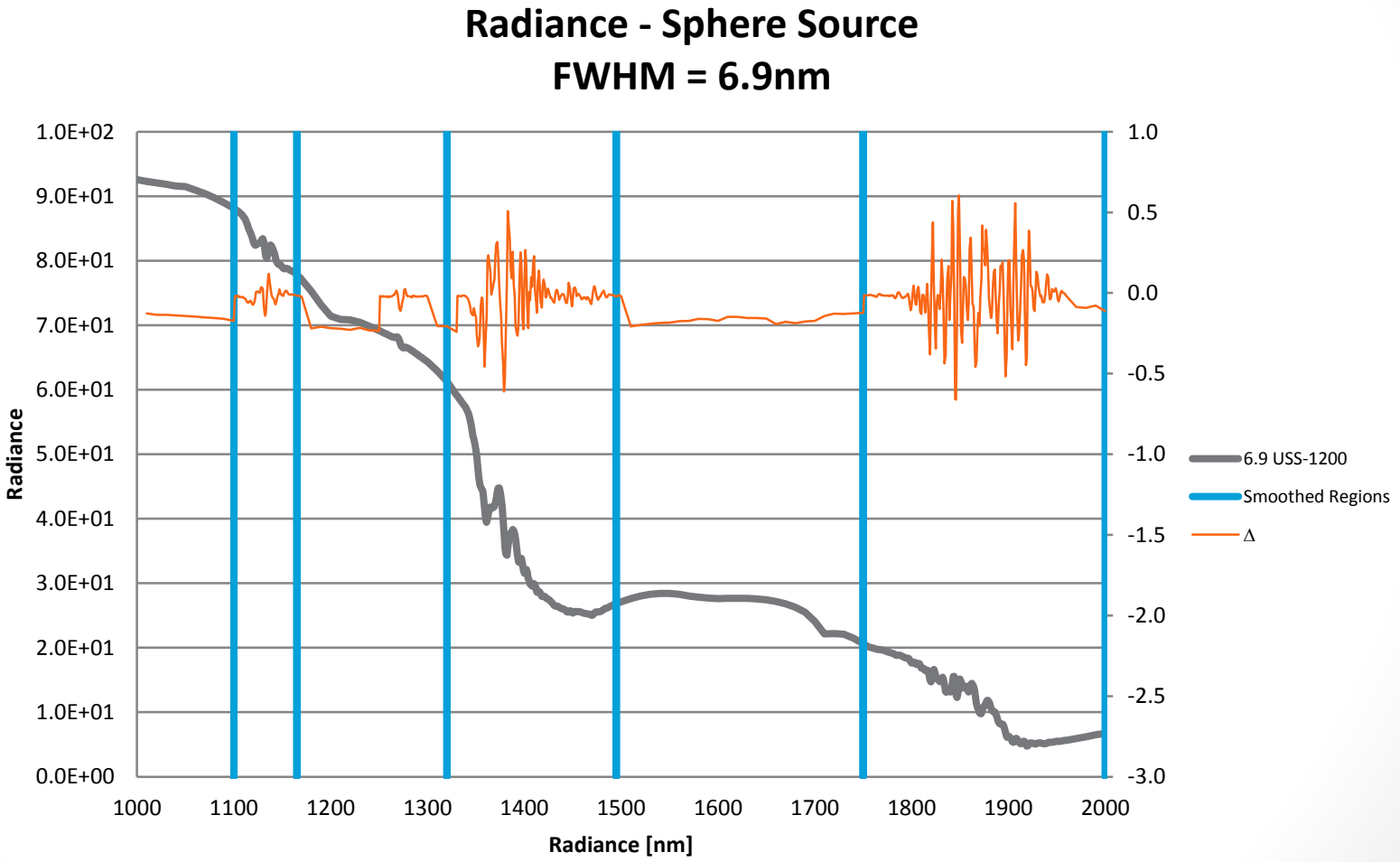
# Interpolation & Sampling Issues



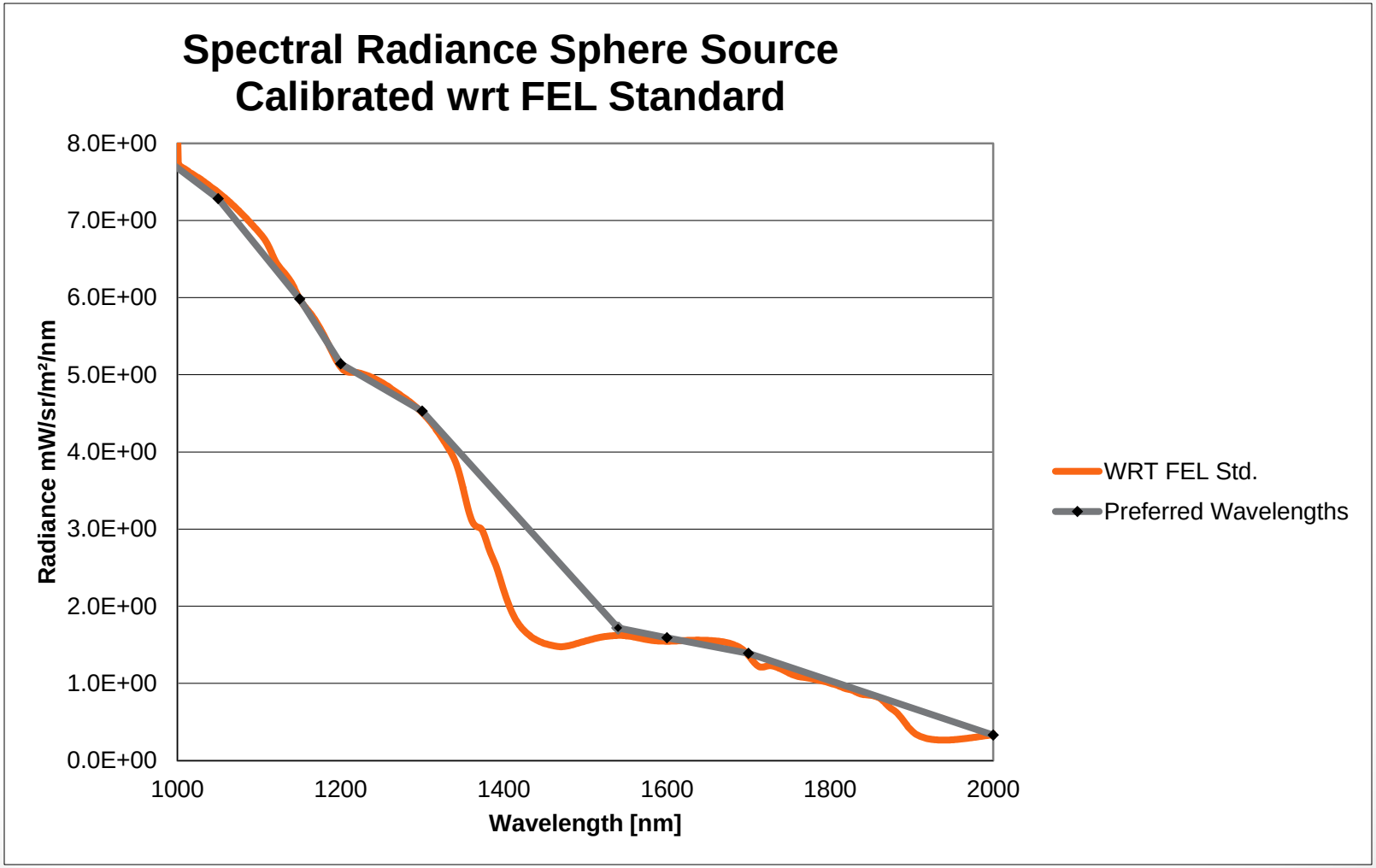
# Δ SWIR Region (Sphere Source)



# Sphere Source Cal. wrt FEL Std



# Filling in the blanks



# Pressed PTFE Sources