# Longwave (LW) Spectral Response Characterization

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# Total Channel Spectral Response

- Total Channel (0.3-200um) is a broadband measurement channel. Calibration lamps are used for SW and FTS is used for the LW.

- Ground Calibrations for LW used NFBB measurements at various temperatures-205K-312K.

- FM1 is considered in this analysis.

# Filtered Radiance

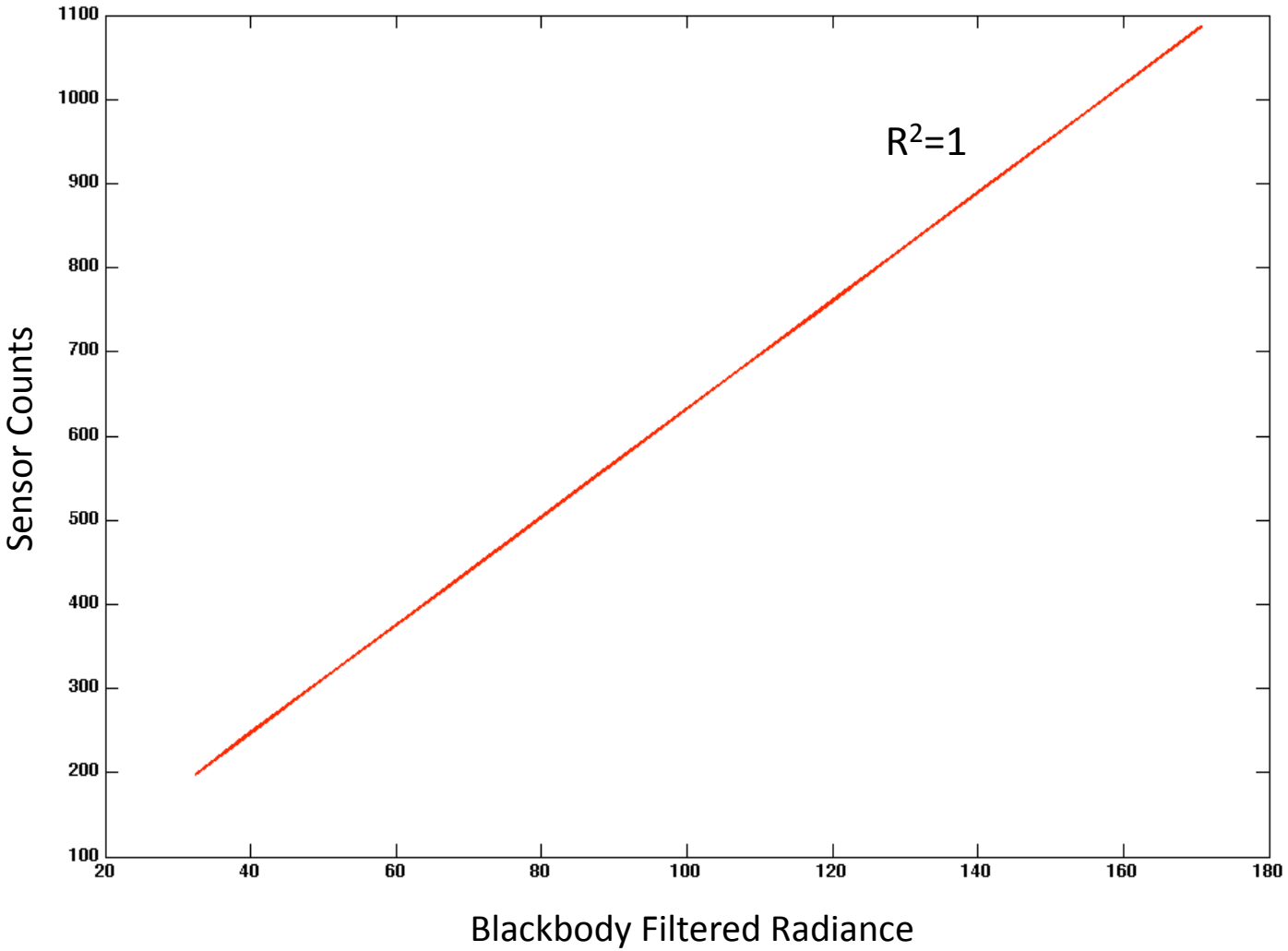
Filtered Radiance $$I_T^f = \int_{\lambda=0}^{\infty} S_\lambda I_{\lambda,T_{NFBB}} d\lambda$$

Spectral Response Function

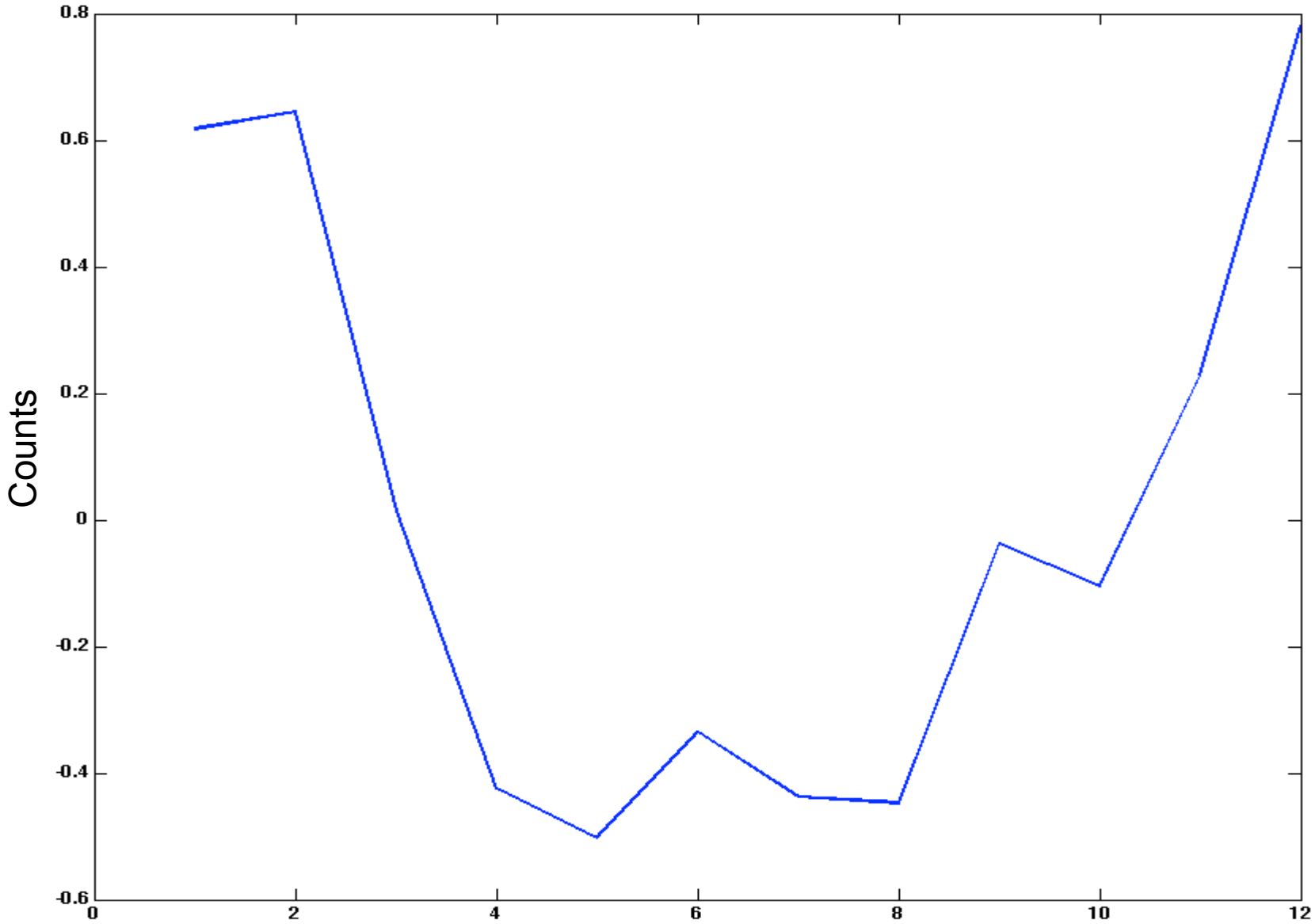
Radiance of Source

# Ground Cal- Radiance vs. Counts

Assume flat spectral response

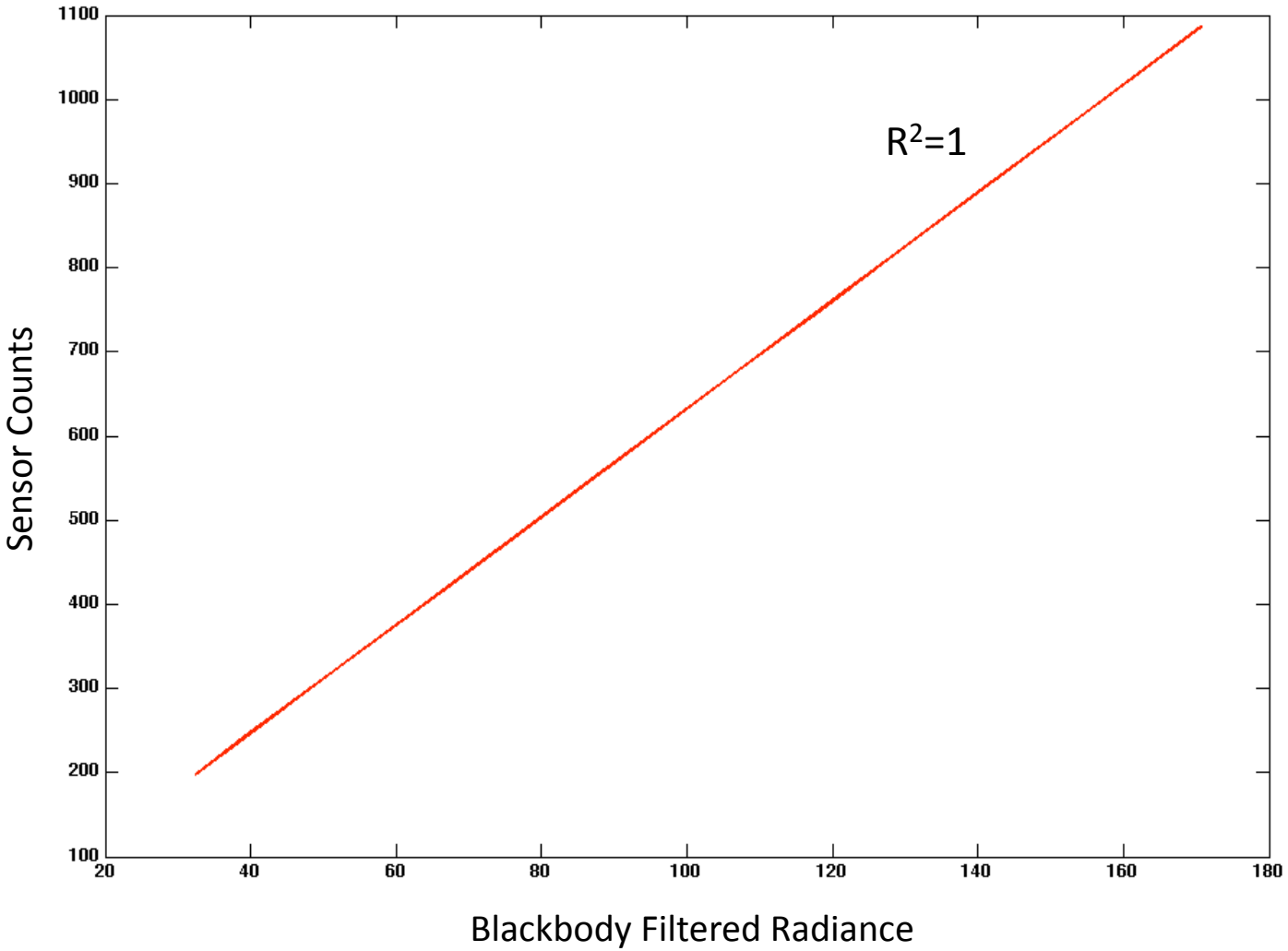


# Residual



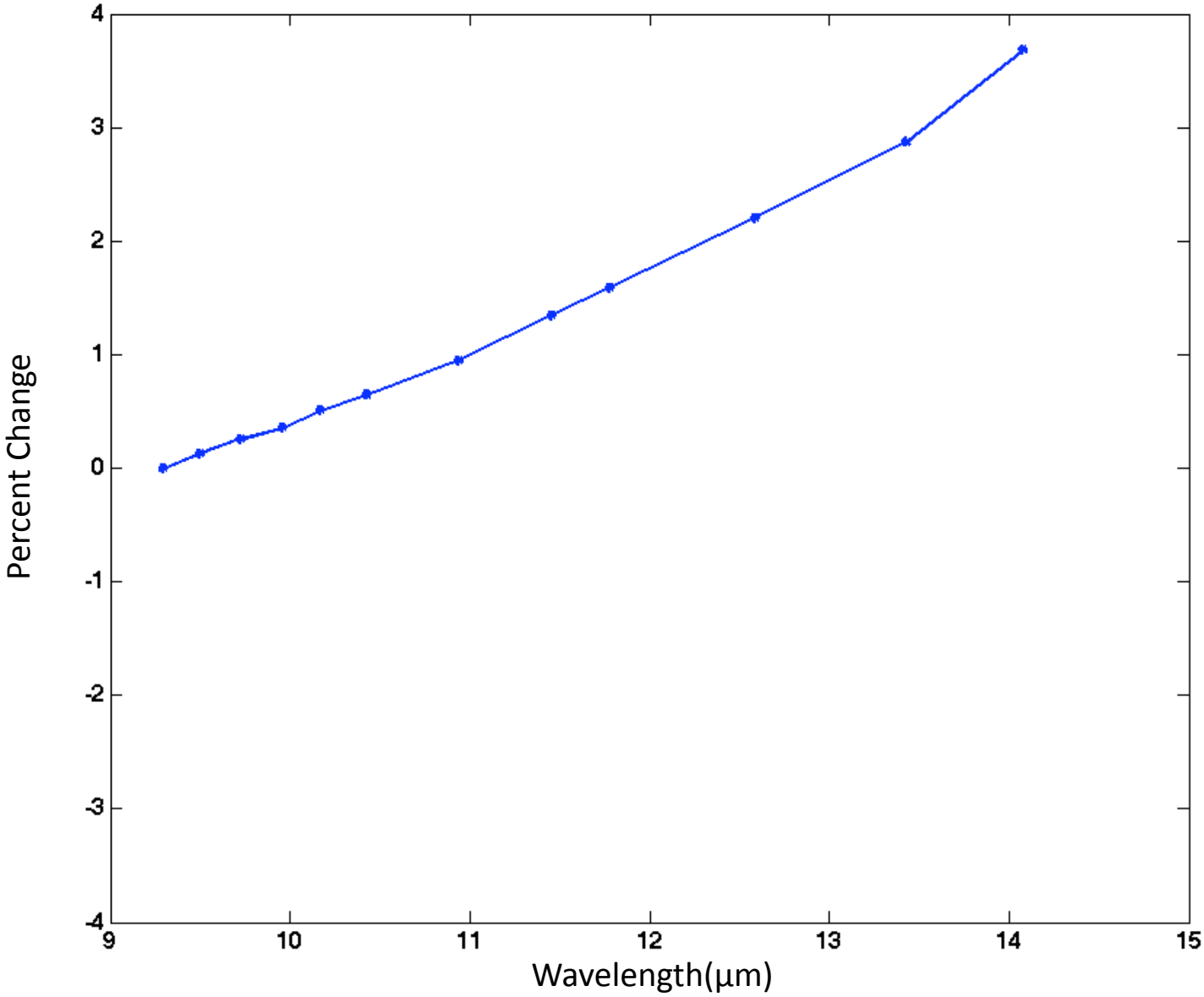
# Ground Cal- Radiance vs. Counts

Assume flat spectral response



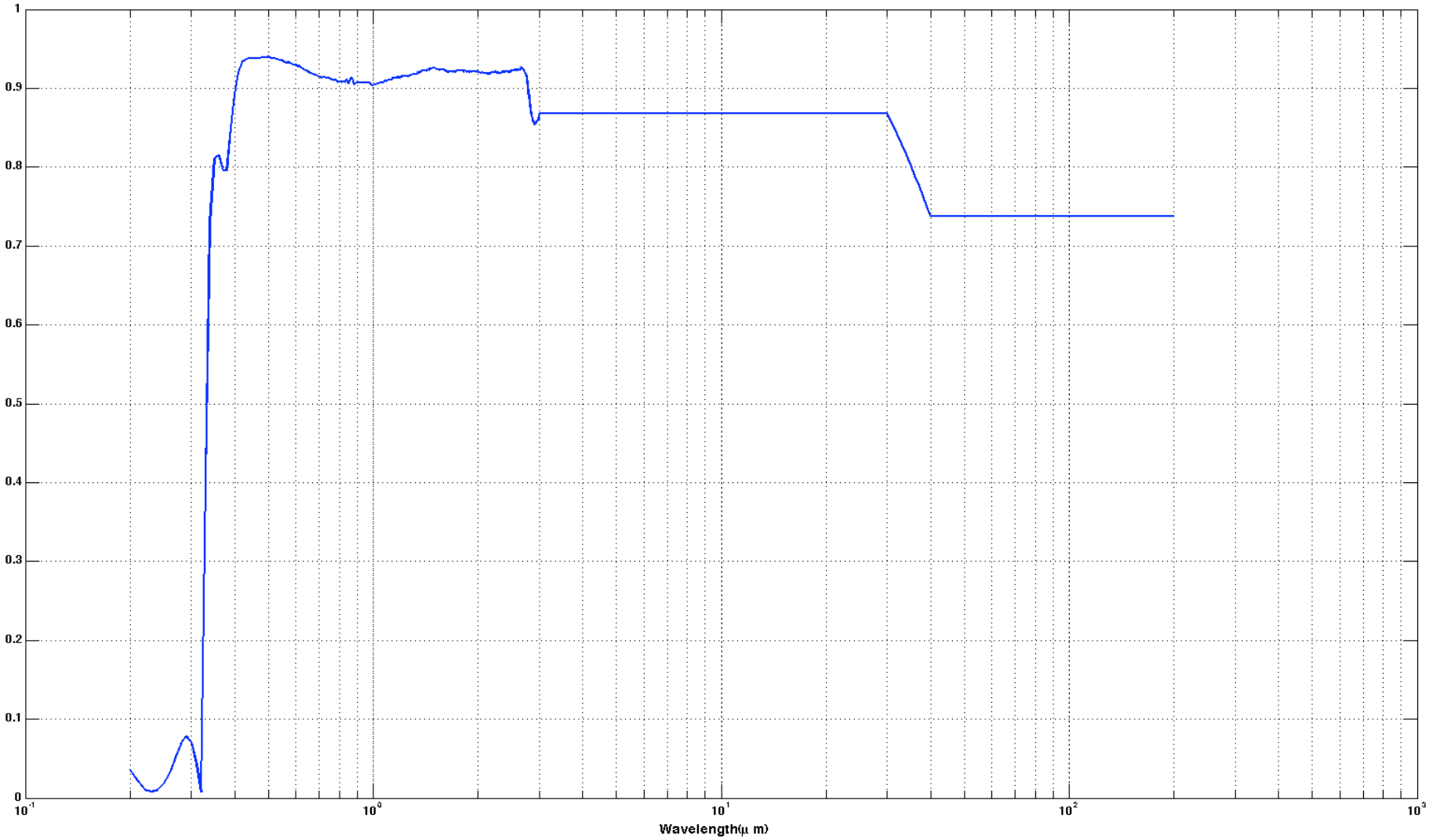

Provides Gain-
No Spectral
Information

# Ground Cal: Radiance-Counts Ratio

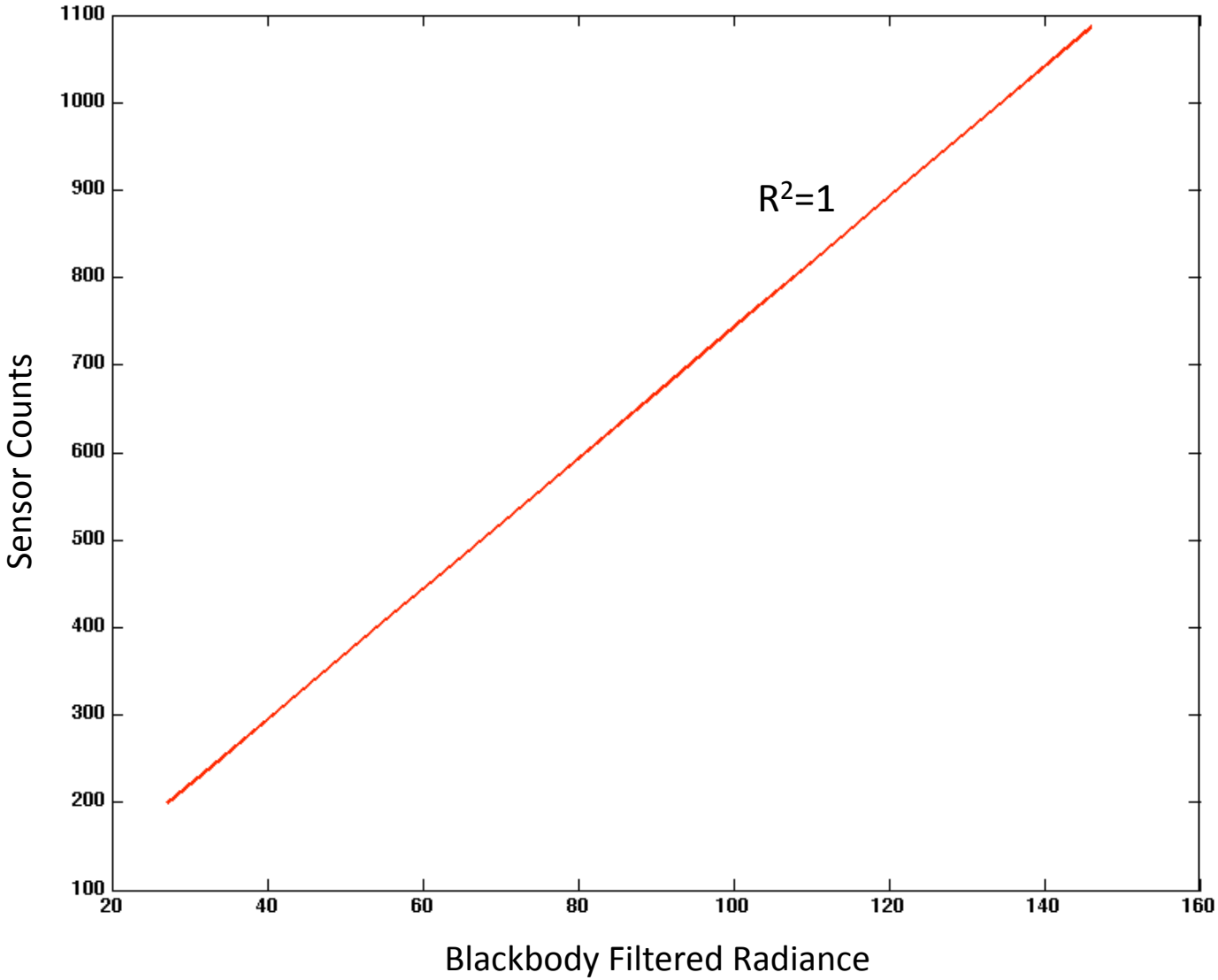



$\lambda = 2898/T$

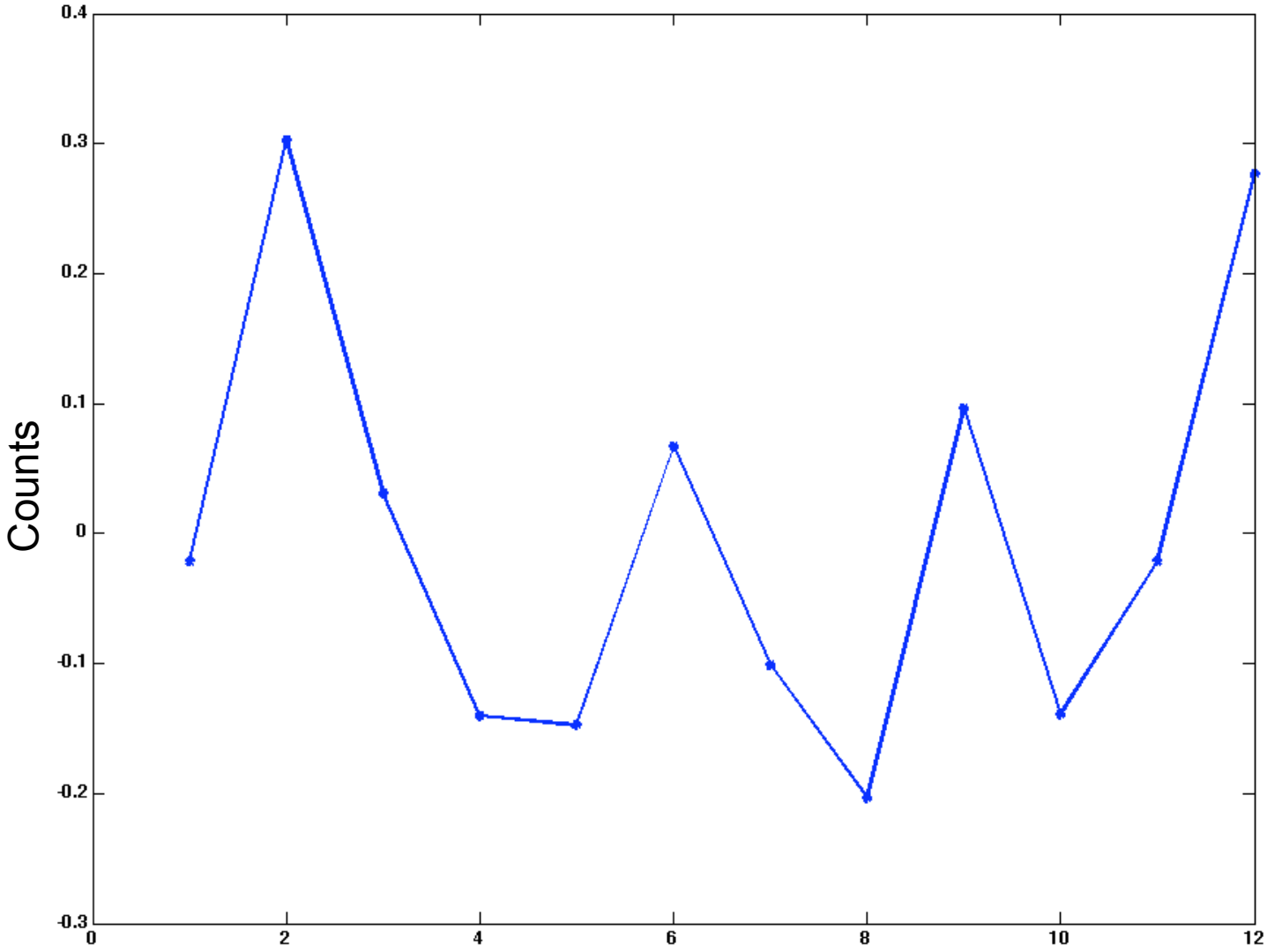
# Production SRF



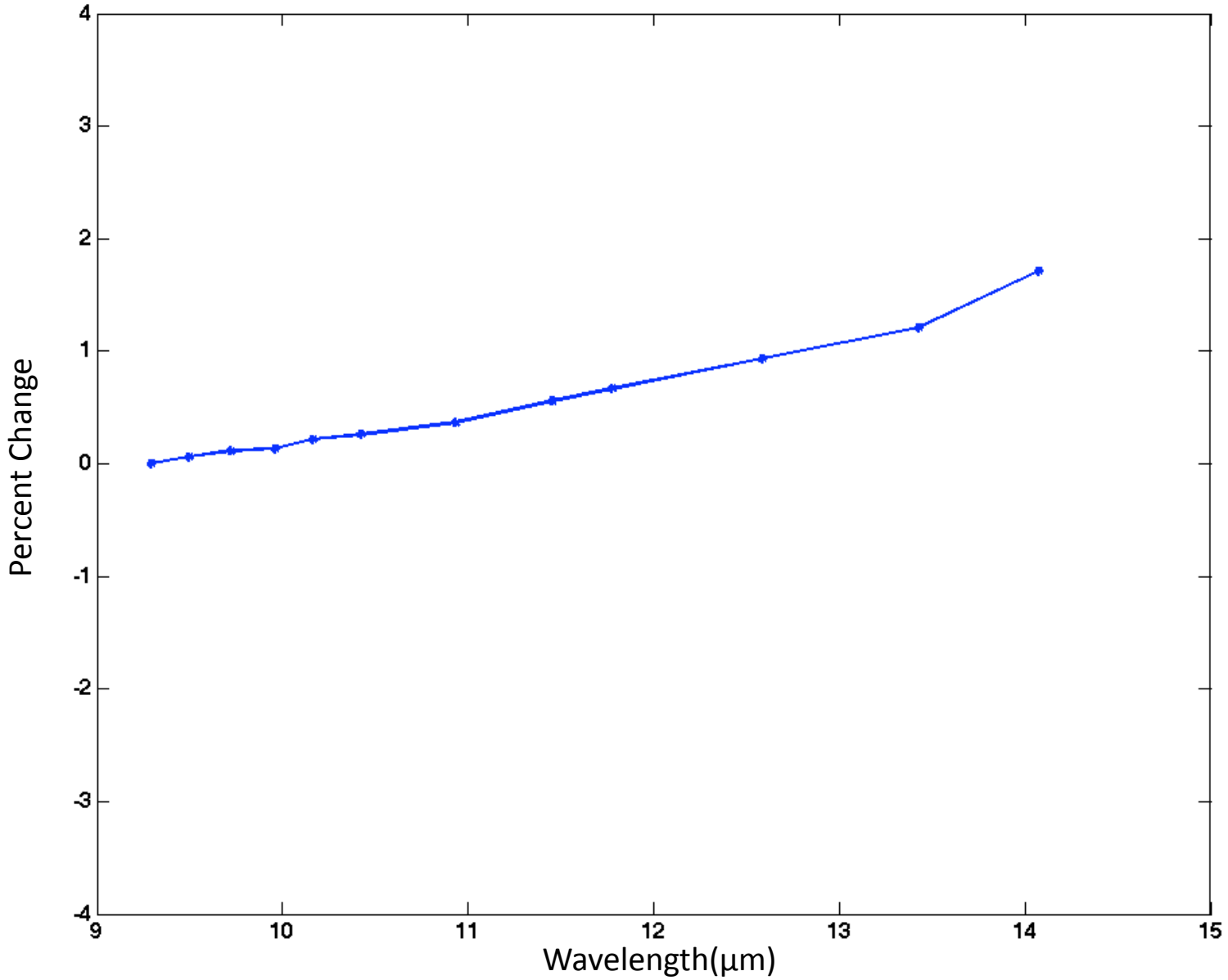
# Radiance vs. Counts- Production SRF



# Residual



# Radiance-Counts Ratio- Production SRF



# FTS Spectral Characterization

- BIORAD-60A Spectrometer is used as a broadband spectral source.
- Measurements taken by CERES instrument as well as a reference detector.
- Spectrally flat Lithium Tantalate Pyroelectric Reference Detector (PRD) is used as a reference.
- Spectral estimate is obtained by taking ratio of CERES sensor measurement with PRD measurement.

$$S_\lambda = \frac{m^f_{\lambda,CERES}}{m^f_{\lambda,PRD}}$$

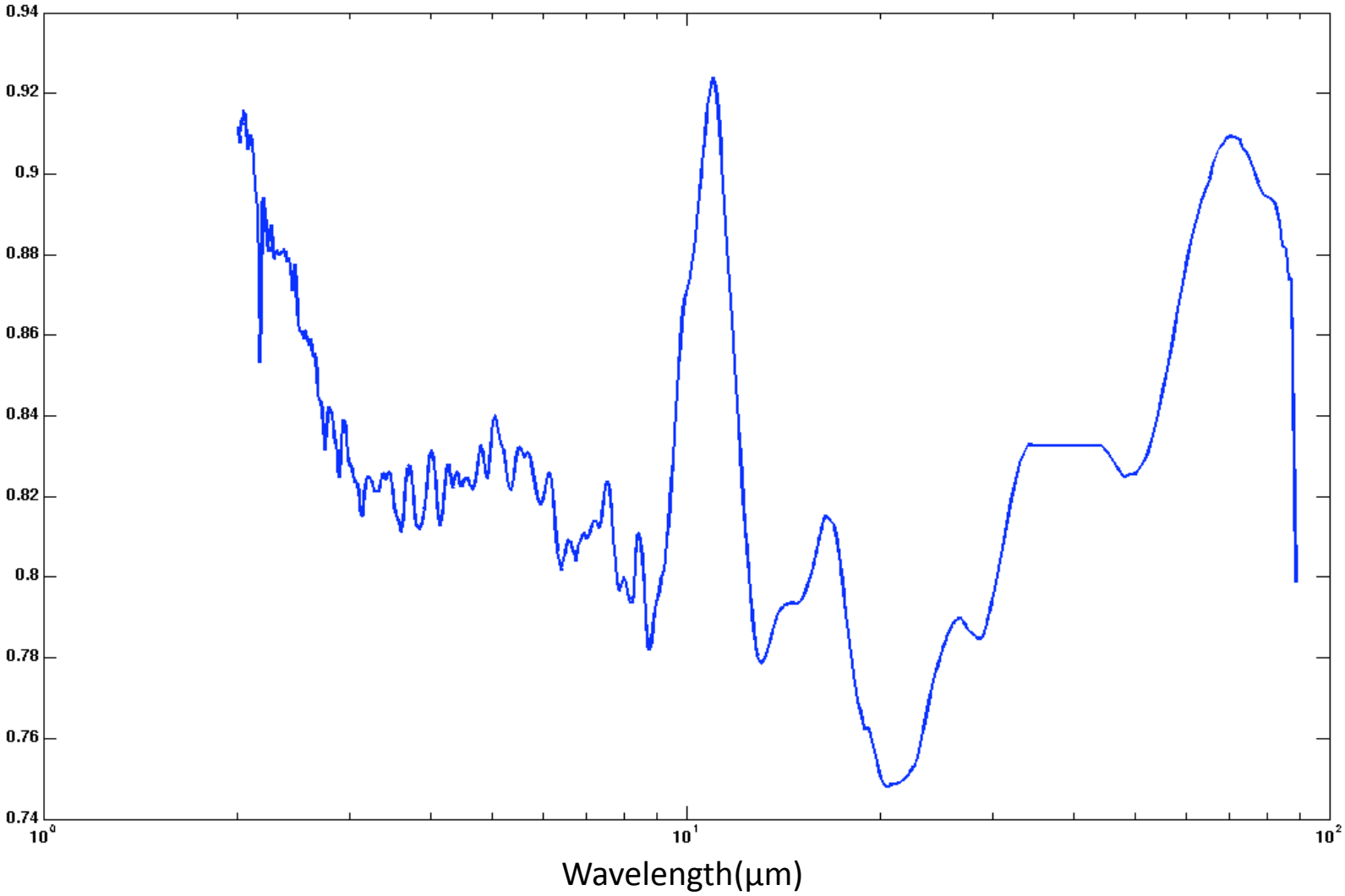
# FTS Wavelength Bands and Sources Used

- **NIR**
  - 2-4um
  - Source: Quartz Tungsten Halogen lamp
  - Beamsplitter: Quartz
- **MIR**
  - 2-20um
  - Source: Ceramic Glow bar
  - Beamsplitter: KBr
- **FIR**
  - 10-50um
  - Source: Ceramic Glow bar
  - Beamsplitter: Mylar
- **VFIR**
  - 20-100um
  - Source: Ceramic Glow bar
  - Beamsplitter: Mylar
- **XFIR**
  - 40-100um
  - Source: Ceramic Glow bar
  - Beamsplitter: Mylar

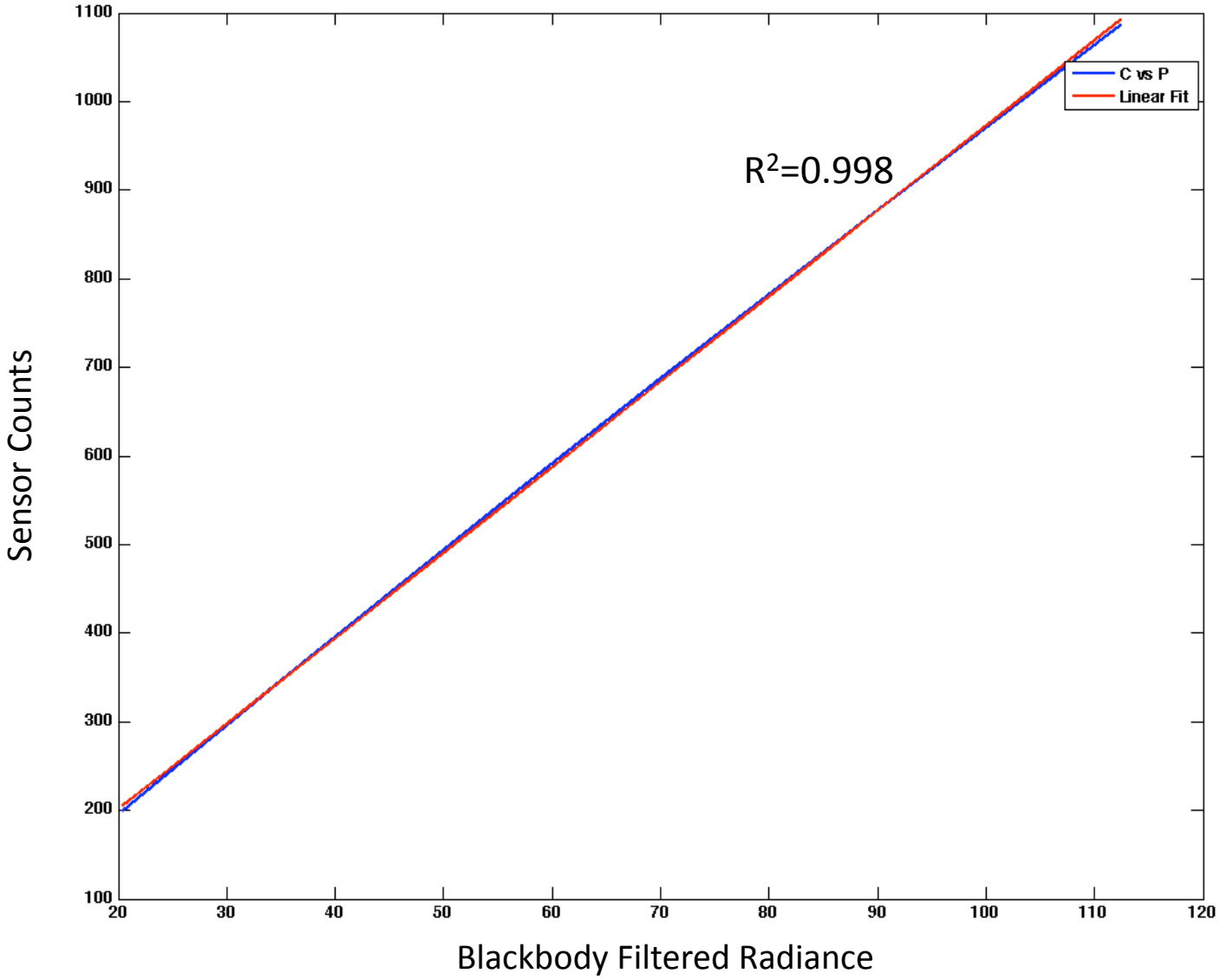
# Tying various spectral bands

- For each spectral band, an estimate of the spectral response function is obtained by taking the ratio of the sensor output to the PRD output.
- The overlap regions are used to tie adjacent spectral regions.
- Since the detector is broadband, the gain is assumed to be constant across all wavelengths.
- Tie the various spectral bands together while retaining the spectral features and keeping the gain constant.

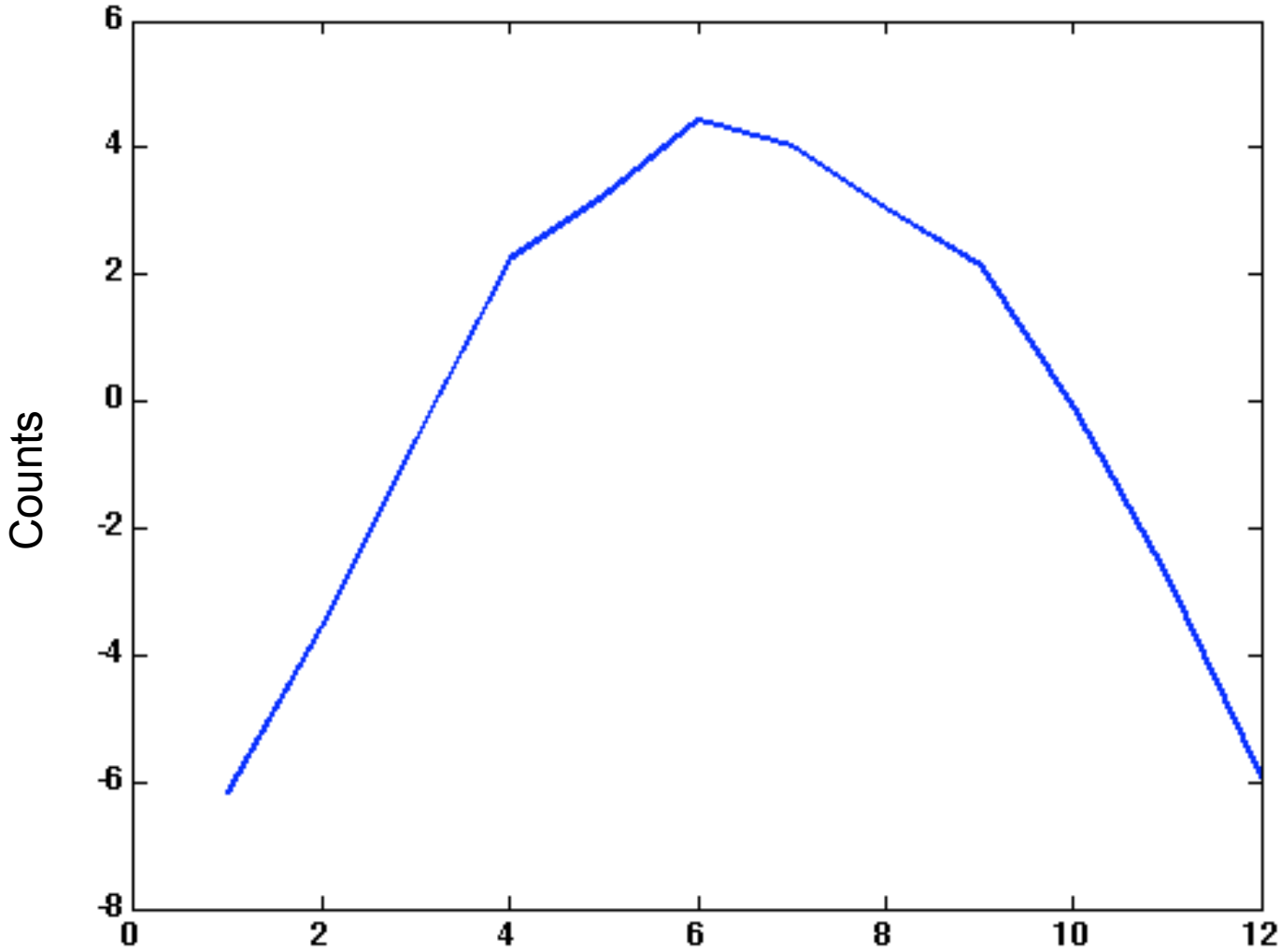
# First-cut Spectral Response



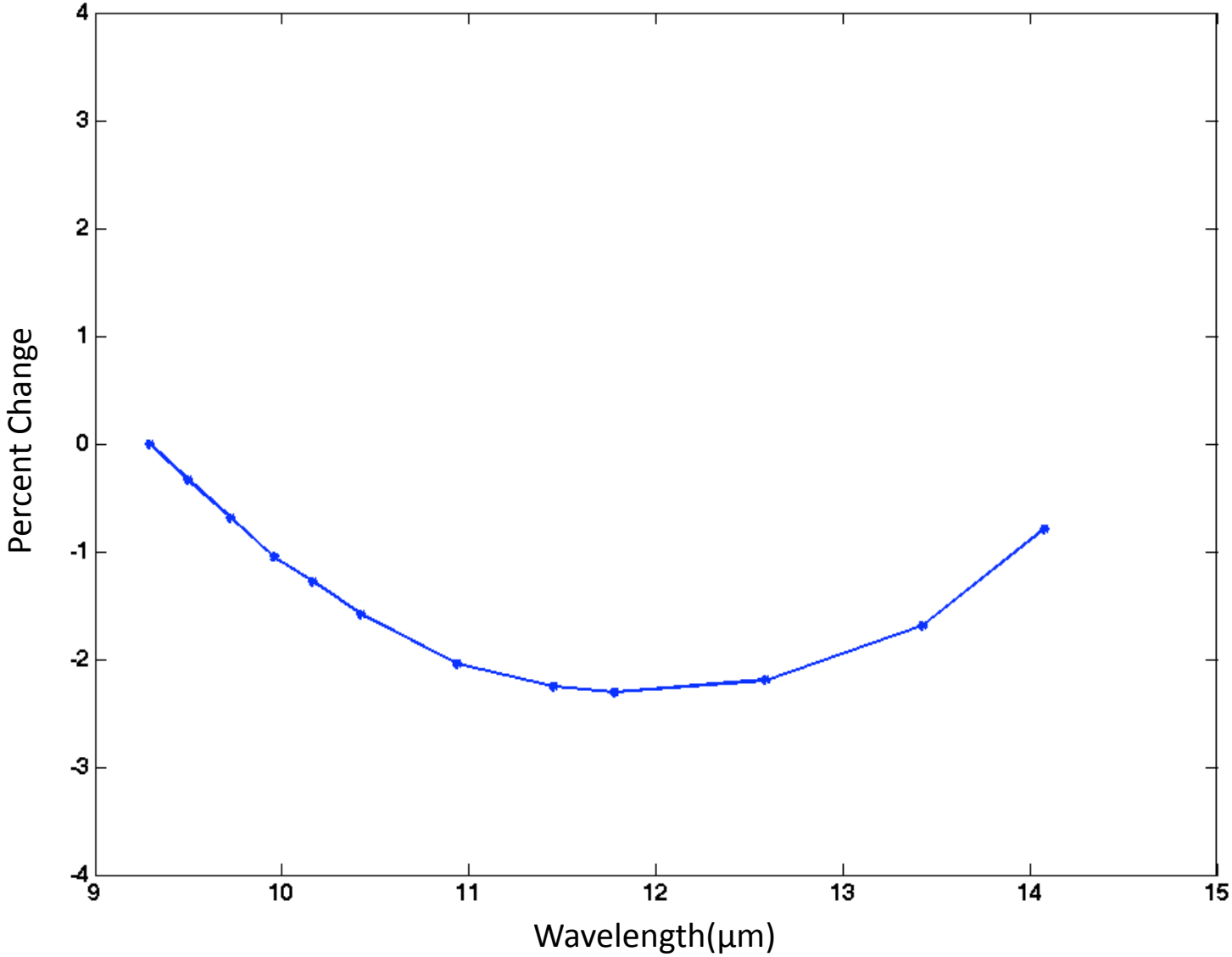
# Radiance vs. Counts



# Residual



# Radiance-Counts Ratio



# FTS System Setup

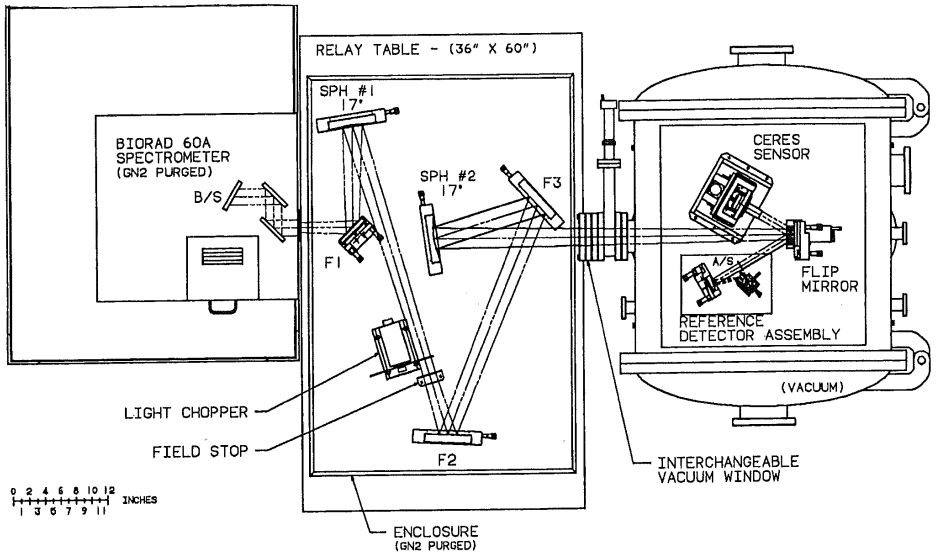



Figure 1. FTS Vacuum Spectral Characterization Facility Layout

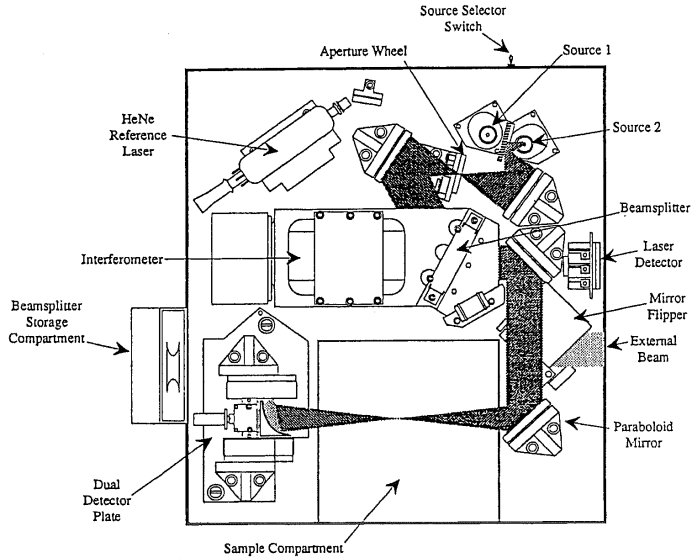



Figure 2. Opto-Mechanical Layout of the BIO-RAD Model 60A Spectrometer