

# **SPECTRAL RESPONSE SETUP**

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## SYSTEM OPERATING PROCEDURE

### General Preparation

- To Load Device
  - a. Put on gloves
  - b. Open the cryostat after venting
  - c. Unload previous sample
  - d. Mount device with correct orientation as per wirebonding and wiring scheme of the cryostat
  - e. Close cryostat
  - f. Attach cryostat to the vacuum pump. Vacuum pump the cryostat to at least  $1e^{-3}$  mbar
  - g. Turn on blackbody source to a specific temperature 30 minutes before.

### **Filling LN2:**

1. Place funnel in opening of cryostat
2. Pour liquid nitrogen in cryostat slowly
3. Place funnel in opening of calibration device
4. Pour liquid nitrogen in calibration device



5. Wait until boil off stabilizes
6. Pour in liquid nitrogen for both cryostat and calibration device a second time
7. Wait at least 30 minutes for detector to cool

- **Check Resistance of Device**

1. Once cooled, check thermal resistance of dewar (multimeter should read between 1.1-1.2 Mohms). Also, make sure the bottom-bottom contacts do not show high resistance (should be between 20-30 ohms).

## Measurement

### **Responsivity**

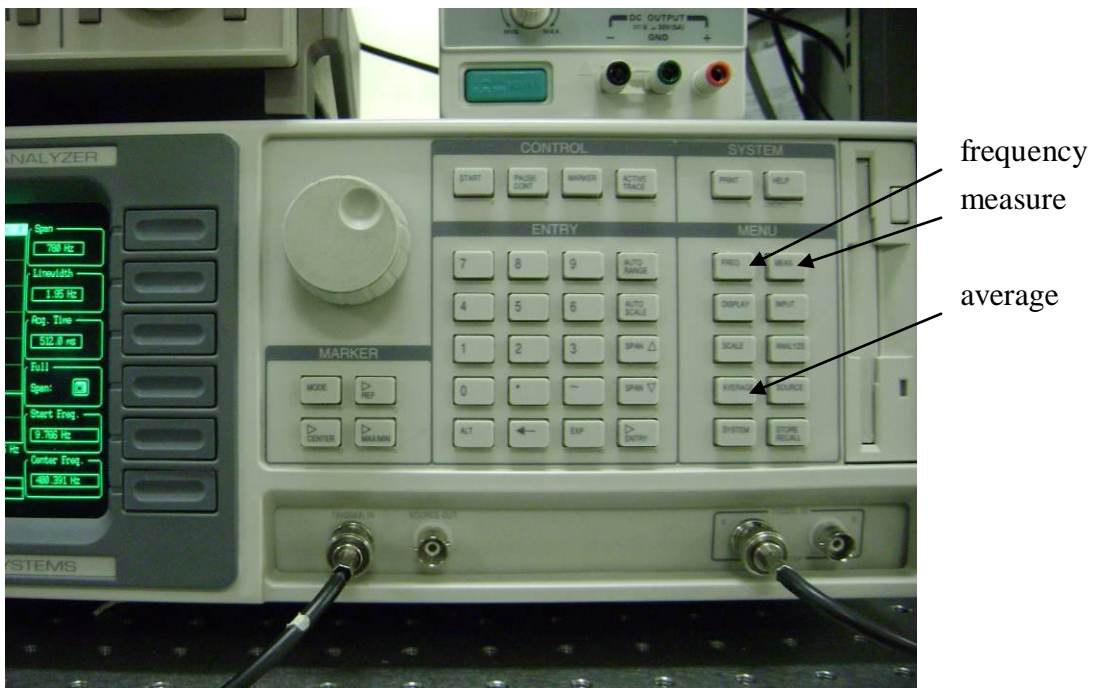
#### ➤ **Signal measurement:**

1. Make sure blackbody is set to specific temperature
2. Turn on Spectrum Analyzer
3. Turn on Current Amplifier
  - a. Turn off zero check
  - b. Set the gain to  $1e3$
  - c. Set voltage bias to zero, enable voltage bias
4. Place calibration device on platform 11 cm away from opening of blackbody box
5. Connect cable of calibration device to the input of the current amplifier
6. Turn on the Chopper and set to specific frequency, typically 400 or 800 Hz
7. Adjust height of the platform and align the position and orientation of the calibration device to obtain maximum response
8. Set centre freq 400 Hz, Span 195 Hz and Acquisition time (typically 2-3 sec, 2.048sec)
9. Remove connection of calibration device
10. Connect cryostat to current amplifier
11. Place cryostat on platform 11 cm (9.5+1.5 cm) away from opening of blackbody box
12. Ensure marker is at the chopper frequency
13. Adjust height of the platform and align the position and orientation of the dewar to obtain maximum response
14. For Spectrum Analyzer
  - a. Make sure average is off
  - b. Press Autorange twice (see appendix)
    - i. First will turn off autorange
    - ii. Second will enable autorange

15. Wait for the waveform to stabilize
16. Then press Autoscale
17. Press average (on screen)
18. Repeat steps as necessary

### Responsivity Measurement Settings

1. Make sure the display is in spectrum and not in PSD (to access, press measure then menu button)
2. To set frequency, on menu panel press freq. button, then center freq. on display, enter the same frequency as for the chopper



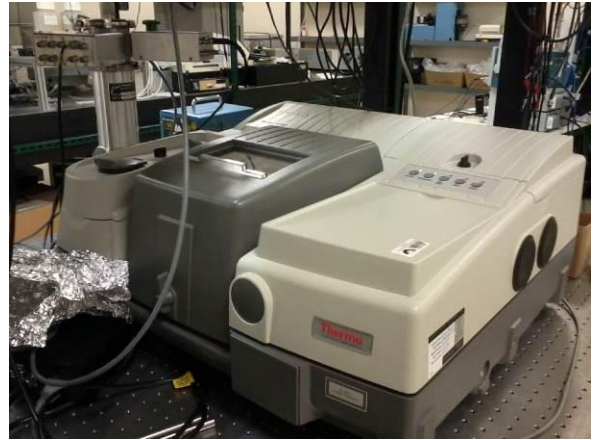
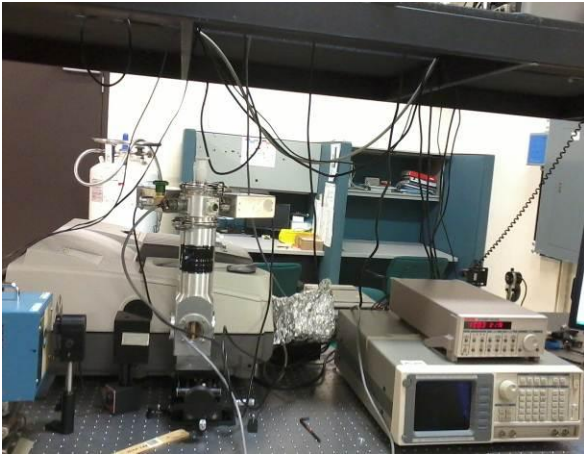
3. Make sure the marker is at the same freq. as the chopper
4. Set the acquisition time
5. To set the average, on menu panel press average button, enter number of averages to be taken, averaging should be linear

➤ **Noise Measurement**

1. Set blackbody temperature to 100 °C and wait for equipment to reach this temperature before turning off
2. Turn off chopper
3. Rotate dewar opening away from blackbody
4. Change Spectrum Analyzer mode to PSD (see appendix).
5. Adjust other parameters as follows using the buttons beside the screen
  - Display – log mag
  - Unit – voltage RMS
  - Freq – centre freq (2000Hz)
  - Span – 97Hz
  - Marker width – wide
  - Marker seek – mean (avg value 800 typically)
6. Change  $t_{acq}$  to 20-100 milliseconds (will allow span to become a few Hertz)
7. Shift marker to a very high frequency (to ensure the noise is white). Also, make sure marker is not within 10 Hz of a noise peak
8. Set to a large number of averages (i.e. between 400-1000 averages)
9. Record  $t_{acq}$  for noise calculations

✚ **Spectral Response measurement:**

1. Place the cryostat on the stage at the focal plane of the convex mirror attached to the FTIR.
2. Check the cryostat temperature. Set the temperature you want to take measurement at.
3. Check that the red laser is falling on the chip inside cryostat properly.
4. Check all connections.
5. Start OMINIC software.
6. Check all the given values.
7. Take a background image and feed the file so that the background will not affect the measurements.
8. Apply a low bias and try to find an interference pattern.
9. Adjust the position of the sample in order to get better signal.
10. Take measurement with different positive and negative bias.



**VIOLATION POLICY:** If user is not following the above mentioned procedure, the authorization/usership shall be dismissed immediately till further consultation with Faculty incharge/Lab Manager.

**TRAINING POLICY:** Due to complexity in the system operating procedure, training is currently not allowed.

