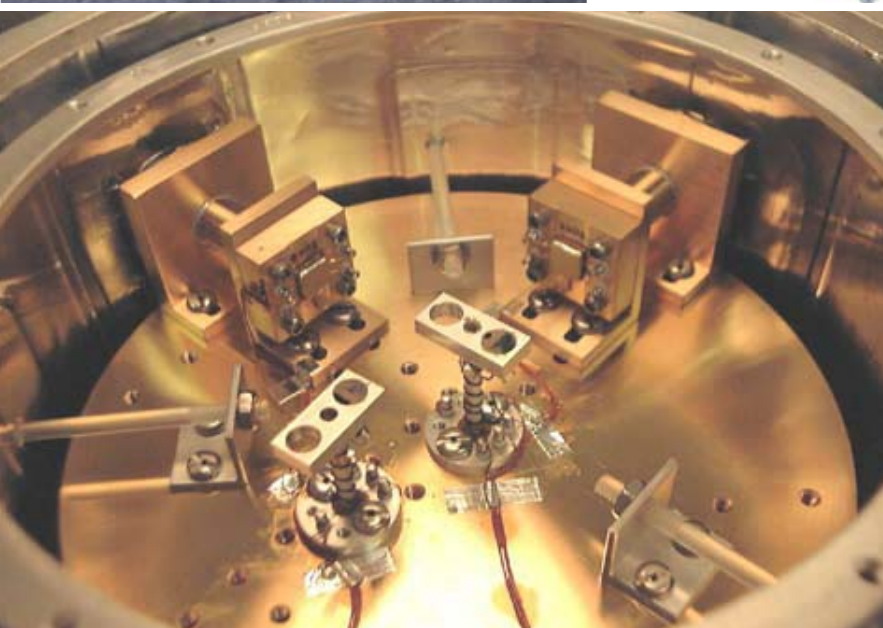
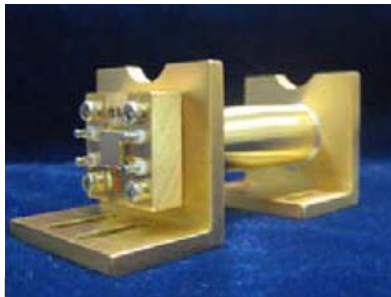


# Bolometer SYSTEMS



Fourier Transform IR Spectroscopy

Molecular Beam Spectroscopy

High Magnetic Field Research

Terahertz Research

**IRLabs**  
Infrared Laboratories

## What is a Bolometer?

Bolometers are detectors used to measure incident Infrared radiation. They are very sensitive to thermal radiation and are predominantly used in the Infrared

spectrum between 10 to 5000 $\mu$ m (30THz to 60GHz).

The detector element is an extremely sensitive thermistor that is cooled to LHe temperatures in order to decrease the thermal background. Any thermal radiation that impinges upon the detector will cause a temperature change. This will cause a change in resistance which is amplified and measured as a voltage difference.

Because bolometers measure a change in temperature, the incident radiation must be modulated. This allows the bolometer to excite and relax, thus a measurement of the change in resistance is made that corresponds to the energy of the incident radiation. The speed at which the bolometer reacts to this temperature change is dependent upon several factors that can be altered, if desired, at the time the system is ordered.

## The Basic System

All composite silicon bolometer systems are housed in an IRLabs, HDL-5 model, liquid helium dewar with a liquid nitrogen cooled radiation shield. Standard hold

times are greater than 20 hours between fills for 4.2K systems and 10 hours for our 1.6K models.

The detector comes with an IR light collecting cone assembly, vacuum-sealed wedged window, field of view baffling, and low noise electronics. The bolometer system is then outfitted with a single cut-on IR filter or a cold, manually operated, 2 or 3 position filter wheel.

Infrared Laboratories offers a selection of far IR cut-on long pass filters that range from 10 to 285 $\mu$ m.

If your application requires longer hold times, increased work height, dual detectors, or more filter positions are required, please let us

know. We are committed to building a custom designed system to meet your individual needs. Special requests for custom designs are always welcome.

*Infrared Laboratories, Inc. has been the world leader in supplying cooled Infrared bolometers since 1967. Our highly sensitive and cost effective Composite Silicon Bolometer Systems are designed for a wide range of applications from Infrared Astronomy, Fourier Transform IR Spectroscopy, High Magnetic Field Research, Terahertz Research to Molecular Beam Physics.*



## IRLabs Silicon Bolometers are Available in 4 Standard Detector Classifications

### General Purpose 4.2K Bolometer System

Our most popular and versatile bolometer system covers a wide range of applications. It consists of a 4.2K bolometer detector element bonded to a 2.5mm diamond absorber. It operates best in the range of 15 to 2000µm (20THz to 150GHz) with modulation frequencies in the 200 to 400Hz range.

### Hi-Res 4.2K Bolometer System

This system provides a lower thermal conductivity detector and increased spectral resolution. The configuration offers a slower responding system with modulation frequencies best kept below 200Hz. This system is more sensitive and the NEP values are an order of magnitude lower than the general purpose 4.2K system.

### Standard 1.6K Bolometer System

Similar to our general purpose 4.2K system in spectral response (15 to 2000µm) with the added benefits provided by lowering the temperature of the detector. These benefits include a lower NEP, higher sensitivity, and the advantage of a quick response time. This system can work at modulation frequencies greater than 1 KHz.

### Far-IR 1.6K Bolometer System

Specifically configured to detect the lower energy signals present in the longer wavelengths of the IR spectrum and will perform well from 300µm to 5mm. It has a very low thermal conductivity compared to our other bolometer systems. This aids in providing longer integration times to capture the low signal strengths and is best operated at modulation frequency less than 300Hz.

	Thermal Conductance	Bolometer Resistance	Electrical Sensitivity	Noise Equivalent Power (NEP)	Noise
<b>General Purpose 4.2K Bolometer System</b>	G[µW/K]: ~ 16	Ro[MΩ]: ~ 10 to 20	S[V/W]: ~ 2.4 X 10 <sup>5</sup>	NEP[W/Hz <sup>1/2</sup> ]: ~ 1.2 X 10 <sup>-13</sup>	Vn[nV/Hz <sup>1/2</sup> ] at 80 Hz ≤80
<b>Hi Res 4.2K Bolometer System</b>	G[µW/K]: ~ 4	Ro[MΩ]: ~ 14	S[V/W]: ~ 6.1 X 10 <sup>5</sup>	NEP[W/Hz <sup>1/2</sup> ]: ~ 4.3 X 10 <sup>-14</sup>	Vn[nV/Hz <sup>1/2</sup> ] at 80 Hz ≤40
<b>Standard 1.6K Bolometer System</b>	G[µW/K]: ~ 12	Ro[MΩ]: ~ 77	S[V/W]: ~ 7.5 X 10 <sup>5</sup>	NEP[W/Hz <sup>1/2</sup> ]: ~ 4.6 X 10 <sup>-14</sup>	Vn[nV/Hz <sup>1/2</sup> ] at 80 Hz ≤40
<b>Far-IR 1.6K Bolometer System</b>	G[µW/K]: ~ .3	Ro[MΩ]: < 1000	S[V/W]: ~ 1.0 X 10 <sup>7</sup>	NEP[W/Hz <sup>1/2</sup> ]: ~ 3.6 X 10 <sup>-15</sup>	Vn[nV/Hz <sup>1/2</sup> ] at 80 Hz ≤50

### General Purpose 4.2K Bolometer System Configuration

IR Labs model HDL-5 Dewar:

- LN2 Consumption = 0.045 liters/hour
- LHe Consumption = 0.065 liters/hour
- Hold time: > 20 hours

High Density White Polyethylene window  
 Low noise preamplifier IR Labs model LN-6C  
 with cold first stage

*\* The items in red on the diagram below are items that can be changed/upgraded.*

General Purpose 4.2K Composite Bolometer  
 Cone F# 3.8

Two Position manually operated filter wheel

- IR Long pass filter with 13 micron cut-on
- IR long pass filter with 100 micron cut-on

