



Optical Cryostat - Microscopy

The **DE204*F-DMX-20-OM** is our Ultra Low Vibration Closed Cycle Cryostat for Optical Microscopy applications such as MicroRaman and Micro Photoluminescence. The DE204*F-DMX-20-OM uses a Helium Exchange Gas to decouple the sample from the cold tip of the DE204 Cryocooler. This prevents almost all vibration from being transmitted to the sample. Sample vibrations of 3-5 nm have been demonstrated by users. Due to the exchange gas being less conductive, the base temperature will increase by 4-5K and the cooling capacity is roughly cut in half at varying temperatures.

Applications

- Micro Raman
- Micro Photoluminescence (Micro-PL)
- Micro Spectroscopy
- Micro FTIR
- Low Vibration Optical Experiments
- Magneto-Optical Kerr Effect (MOKE)

Features

- **Ultra Low Vibrations (3-5 nm)**
- Supports working distances as small as 1.5mm
- Continuously Adjustable Sample Holder (1.5-7 mm)
- Low Profile Windows
- Cold Tip Down Orientation
- Fully customizable

Typical Configuration

- Cold head (DE-204AF)
- Compressor (ARS-4HW)
- 2 Helium Hoses
- DMX-20-OM Ultra Low Vibration Interface
- Aluminum vacuum shroud with 1 window port for optical microscopy and electrical experiments.
- Nickel Plated OFHC copper radiation shield
- 1 High purity quartz window
- Instrumentation for temperature measurement and control:
 - 10 pin hermetic feed through
 - 50 ohm thermofoil heater
 - Silicon diode sensor curve matched to ($\pm 0.5K$) for control
 - Calibrated silicon diode sensor (± 12 mk) with 4 in. free length for accurate sample measurement.
- Wiring for electrical experiments:
 - 10 pin hermetic feed through
 - 4 copper wires
- Sample holder for optical and electrical experiments
- Temperature Controller

Options and Upgrades

- Transmission experiment upgrade
- Rotatable sample platter upgrade
- Magnet Post upgrade
- 4K Coldhead (0.2W @ 4.2K)
- 5.5K Coldhead (3W @ 10K)
- 450K High Temperature Interface
- 800K High Temperature Interface
- Turbo upgrade for faster cooldown times
- Custom temperature sensor configuration (please contact our sales staff)
- Custom wiring configurations (please contact our sales staff)
- Window material upgrades (custom materials available)
- Sample holder upgrades (custom sample holders available)



The above picture shows a 4K DE204 Cryocooler installed on a DMX-20-OM interface.



The above picture shows the compressor for the system. What is not shown is a required vacuum pump, Helium Hoses (included with system), temperature controller and Helium Gas bottle with regulator for the exchange gas.



Optical Cryostat - Microscopy

Cooling Technology-

DE-204	Closed Cycle Cryocooler
Refrigeration Type	Pneumatically Driven GM Cycle
Liquid Cryogen Usage	None, Cryogen Free

Sample Vibrations-

Independent Mounting	3 - 5 nm
Direct Soft Mount	< 140 nm

Temperature*- DMX-20-OM adds 4-5K to base temperature

DE-204AF	< 10K - 350K
DE-204PF	< 5.5K - 350K
DE-202SF	< 4.2K - 350K
With 800K Interface	(Base Temp + 2K) - 800K
With 450K Interface	(Base Temp + 2K) - 450K
Stability	0.1K
*Based on bare cold head with a closed radiation shield, and no additional sources of experimental or parasitic heat load	

Sample Space -

Diameter	19 mm (0.75 in.)
Height	1.5-7mm (Continuously Adjustable)
Sample Holder Attachment	1/4 - 28 screw
Sample Holder	www.arscryo.com/Products/SampleHolders.html

Optical Access-

Window Ports	1 (2 with transmission option)
Diameter	25.4 mm (1 in)
Clear View	23 mm (0.9 in)
#/F	Variable
Window Material	www.arscryo.com/Products/WindowMaterials.html

Temperature Instrumentation and Control - (Standard) -

Heater	50 ohm Thermofoil Heater anchored to the coldtip
Control Sensor	Curve Matched Silicon Diode installed on the coldtip
Sample Sensor	Calibrated Silicon Diode with free length wires
Contact ARS for other options	

Instrumentation Access-

Instrumentation Skirt	Bolt-On, Stainless Steel
Pump out Port	1 - NW 25
Instrumentation Ports	2
Instrumentation Wiring	Contact sales staff for options

Vacuum Shroud -

Material	Aluminum
Length	39 mm (1.52 in) Sample Platter thickness
Diameter	127mm (5 in) at the sample space
Width	127 mm (5 in) at the sample space

Radiation Shield -

Material	Nickel Plated OFHC Copper
Attachment	Bolt On
Optical Access	1 (2 with transmission option)

Cryostat Footprint -

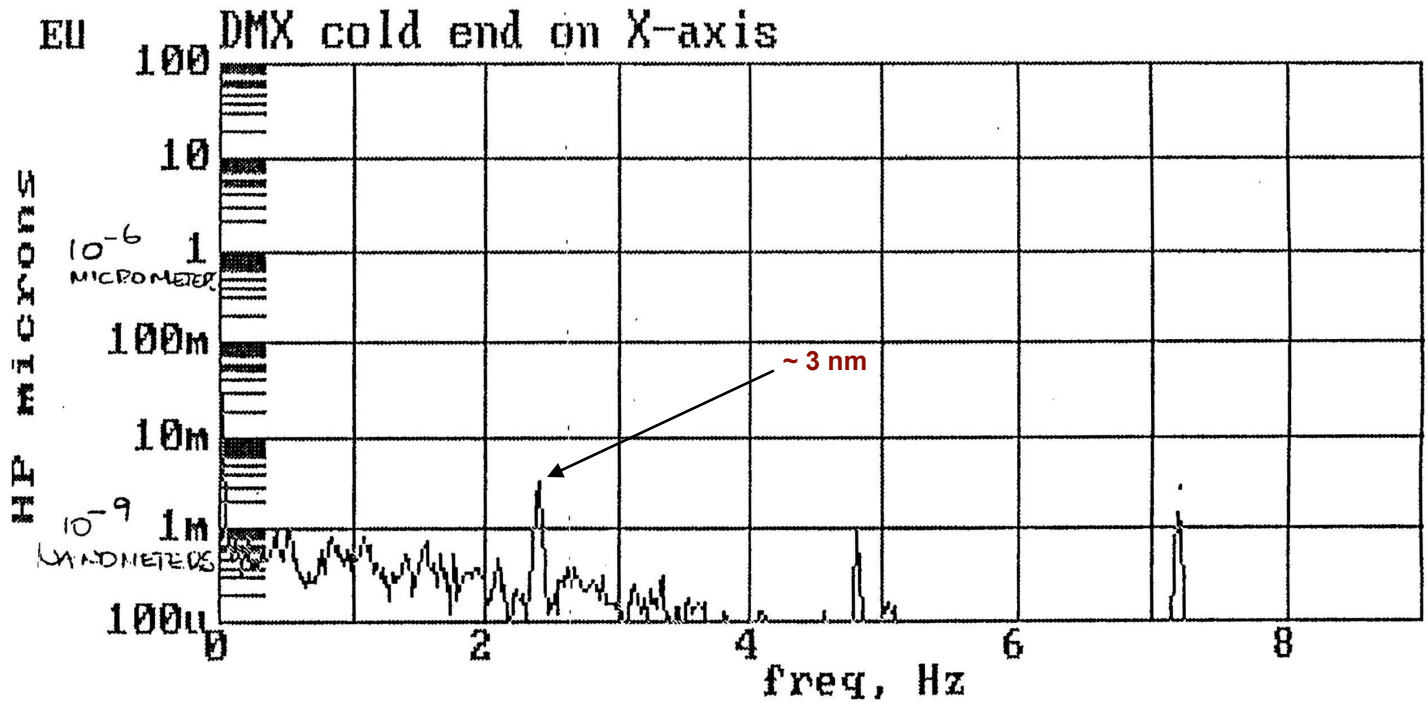
Overall Length	645mm (25.4 in)
Motor Housing Diameter	114 mm (4.5 in)
Rotational Clearance	200 mm (8 in) with "G" Configuration

Cryocooler Model		DE-204AF		DE-204A(T)F		DE-204PF		DE-204SF	
		60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz
Frequency		60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz
Base Temperature		<9K	<9K	<9K	<9K	<5.5K	<5.5K	<4.2K	<4.2K
Cooling Capacity*	4.2K	-	-	-	-	-	-	0.2W	0.16W
	10K	2W	1.6W	2.7W	2.2W	3.5W	2.8W	4W	3.2W
	20K	9W	7.2W	12W	9.6W	8W	6.4W	8W	6.4W
	77K	17W	14W	23W	18.4W	14W	11W	14W	11W
Radiation Shield Cooling Capacity		18W	14W	24W	19W	18W	14W	18W	14W
Cooldown Time*	20K	30 min	36 min	25 min	30 min	40 min	48 min	40 min	48 min
	Base Temperature	60 min	72 min	50 min	60 min	80 min	102 min	90 min	108 min
Compressor Model		ARS-4HW		ARS-4HW		ARS-4HW		ARS-4HW	
Typical Maintenance Cycle		12,000 hours		8,000 hours		12,000 hours		12,000 hours	



Optical Cryostat - Microscopy

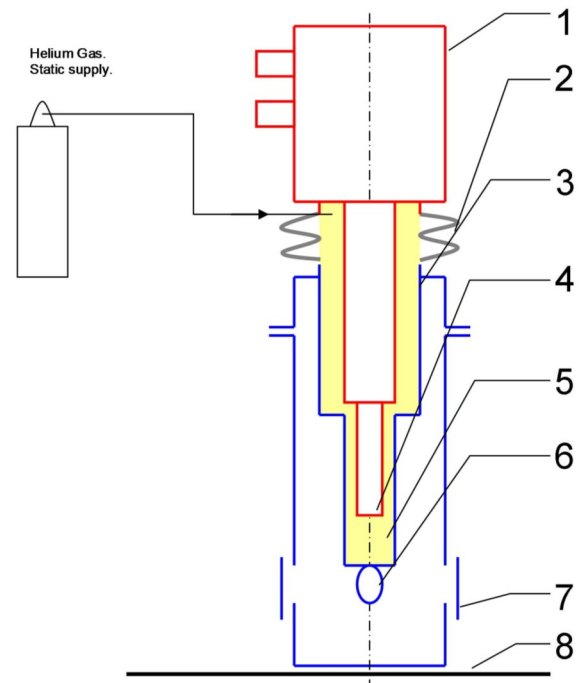
DE202*F-DMX-20 Vibration Spectra



Understanding the DMX-20 Interface

The X-20 Interface uses a Helium Exchange Gas to decouple the sample space from the cold tip of the cryocooler. This prevents almost all vibration from being transferred to the sample space. Scientists have demonstrated vibration levels as low as 3-5 nm with the DE202*F-DMX-20 (as shown above)

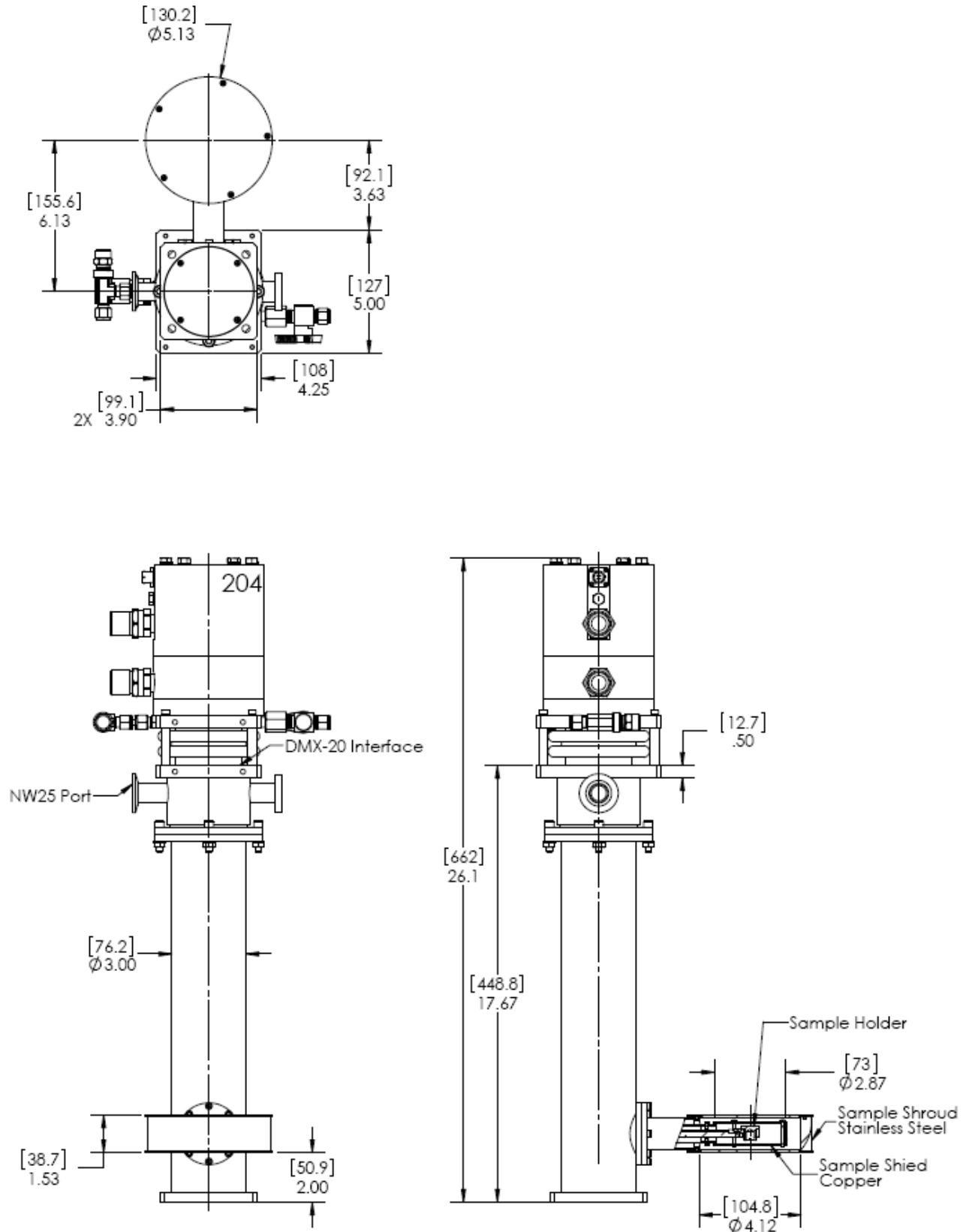
1. The Cryocooler is supported from a Floor Stand
2. The soft rubber bellows minimize vibrations transmitted to the sample while keeping in the Helium Exchange Gas
3. The X-20 interface has no contact with the cryocooler except through the rubber bellows.
4. The cold tip has 10-30 micron vibrations (depending on CCR model) but no direct contact with the sample space.
5. Convective pockets of Helium Exchange Gas cools the sample space.
6. The sample is only in contact with the X-20 Interface
7. Windows for Optical Experiments
8. The X-20 Interface is mounted directly on a (user provided) Vibration Isolation Table.





Optical Cryostat - Microscopy

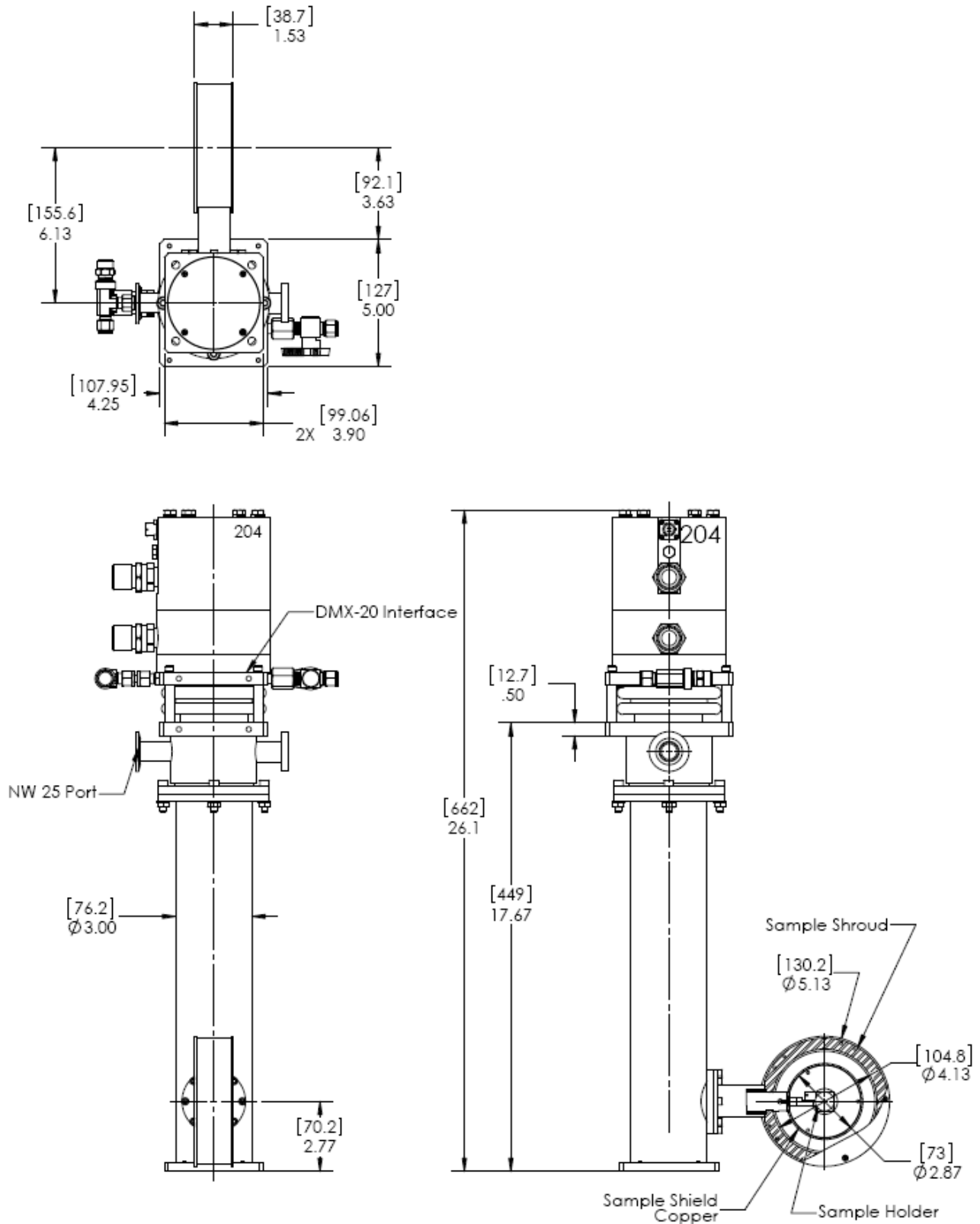
DE204*F-DMX-20-OM- Outline Drawing





Optical Cryostat - Microscopy

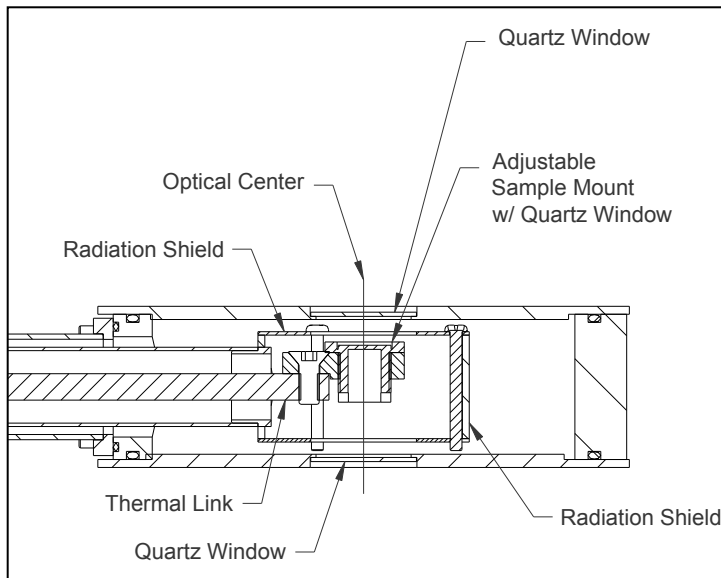
DE204*F-DMX-20-OM- Rotated Outline Drawing



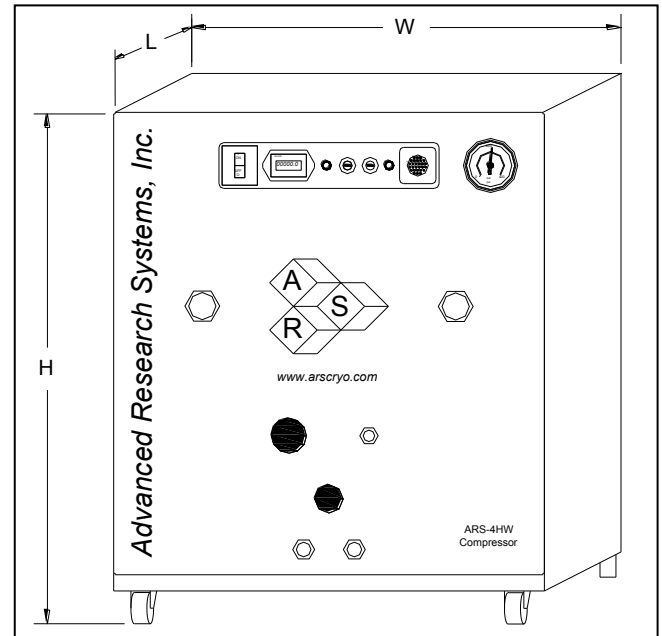


Optical Cryostat - Microscopy

Sample Space

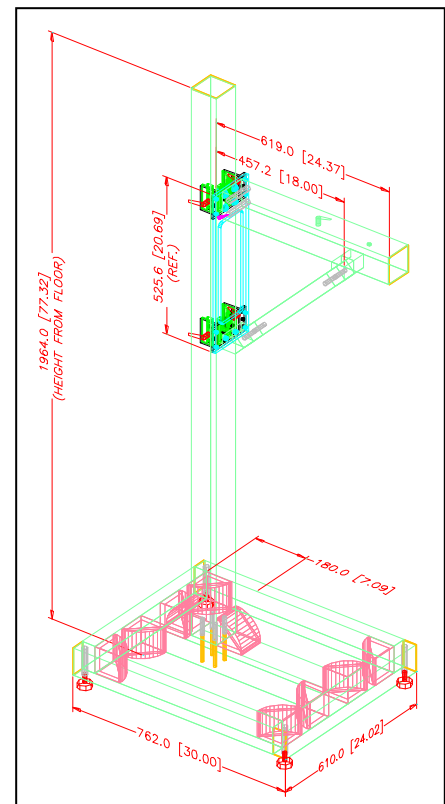


ARS-4HW Compressor



Compressor Model		ARS-4HW	
	Frequency	60 Hz	50 Hz
Standard Voltage	Min	208 V	190 V
	Max	230 V	210 V
Transformer Options	10%		220 V, 230 V
	15%		240 V
Power Usage	Single Phase	3.6 kW	3.0 kW
Refrigerant Gas		99.999% Helium Gas, Pre-Charged	
Noise Level		60 dBA	
Ambient Temperature			
Cooling Water	Consumption	2.3 L / min (0.6 Gal. / min)	
	Temperature	10 - 35 C (50—95 F)	
	Connection	3/8 in. Swagelok Fitting	
Dimensions:	L	483 mm (19 in)	
	W	434 mm (17.1 in)	
	H	516 mm (20.3 in)	
Weight		72 kg (160 lbs)	
Typical Maintenance Cycle		12,000 hours	
Water Recirculation Option		CoolPac Compatible	

Floor Stand





Optical Cryostat - Microscopy

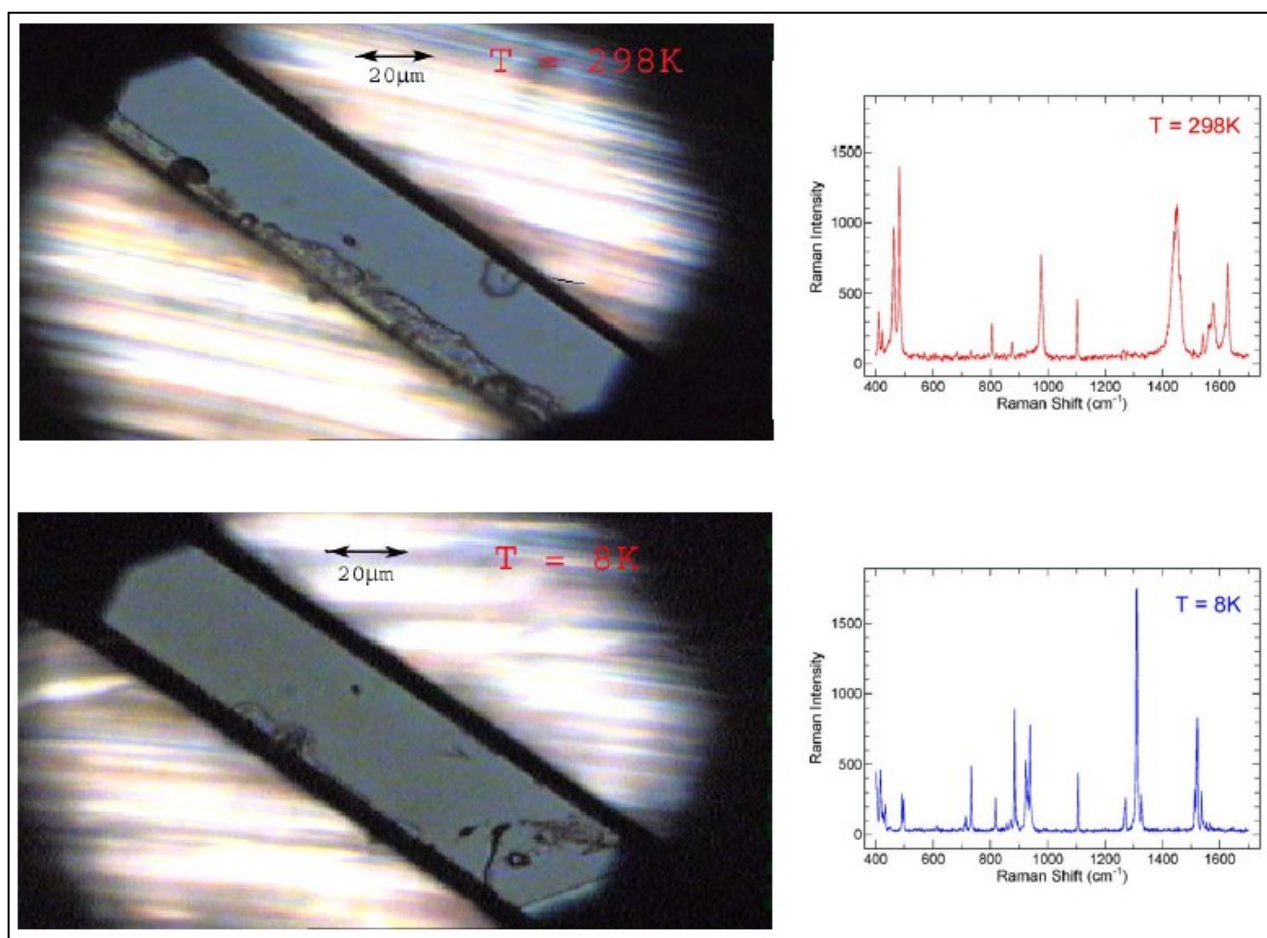
DE204SF-DMX-20-OM

This is to inform you about our recent tests on the closed-cycle cryostat designed for Raman and infrared experiments under the microscope.

Here you can find two photos taken, one at room temperature with the system off, and the second one at 8K and their relative Raman spectra. As you can see from the pictures, no vibration can be detected and the Raman spectra are pretty nice. This sample was also interesting because it displays a phase transition on cooling down: Raman spectra at different temperatures clearly show the onset of this phase transition.

In conclusion we are really satisfied.

Dr Matteo Masino
Dip. Chimica Generale ed Inorganica



Needle crystal is a charge-transfer molecular crystal.

(tetrathiafulvalene-chloranil)



Optical Cryostat - Microscopy

SEM Setup



The picture shows the Displex and its interface. All items showing stainless steel in the photo are modifications to our JSM-5910 SEM. Please also note the published papers on my website, which demonstrate CL results that were acquired with this cooling system.

The sample temperature, is between 40 K and 50 K.

Courtesy; Prof. Dan Rich, Ben Gurion University, Beer Sheva, Israel.

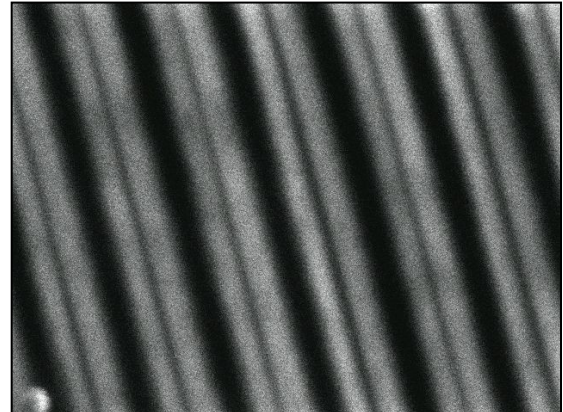


Image of a InGaN/GaN quantum well grown on a patterned GaN substrate. The patterning consists of stripes with a periodicity of 10 microns.

Monochromatic CL image (Mag. 2000) taken with a 390 nm detection wavelength.

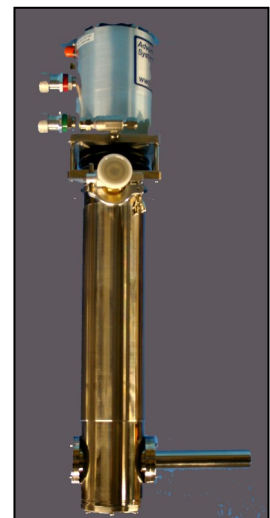
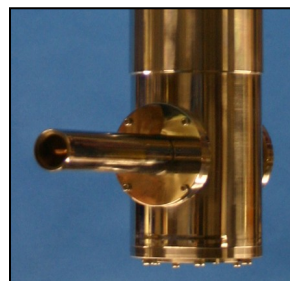
The degradation of image quality from room temperature and 50K suggests that the vibration is less than 10nm.

Courtesy; Prof. Dan Rich, Ben Gurion University, Beer Sheva, Israel.

Magnet Post (MOKE)



DE204SF-DMX-20-OM-MP



Small diameter vacuum housing can be inserted into a narrow gap (high field). The optical window allows collection of light from the sample. The window can be very close to the sample for short focal length objective.