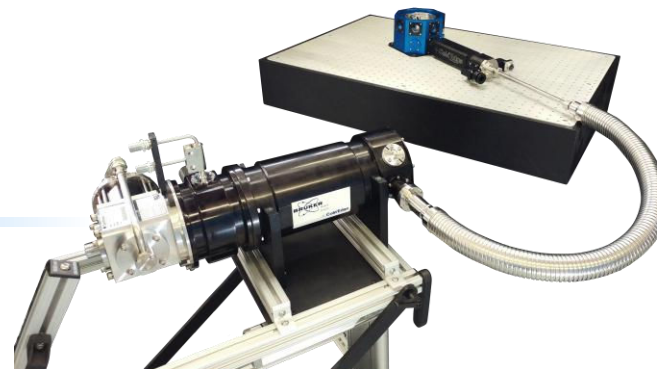




Closed Cycle Gas Flow
Cryogenic Cooling System

Key Stinger Benefits



- **Wide Temperature Range**
 - 3.8 to 800K temperatures directly at the sample point
- **Long Flexible Line**
 - 1.8m (6 ft) or 3m (10 ft) lengths
 - Reduce vibration interference to <10 nanometers at sample
 - Freedom of Cryostat movement XYZ and rotation
- **Completely Closed Cycle**
 - Run system 24/7, all year long
 - No more liquid helium top-offs
- **Multiple Applications**
 - Plugs into a wide variety of experimental cryostats
 - Run multiple experiments off just one cooling system
 - Increase lab productivity with more samples tested per day
- **Adaptable Lab Placement**
 - Works in any orientation
 - Moves cryocooler off-table
 - Small Foot print – no Dewar
 - Automatic operation possible

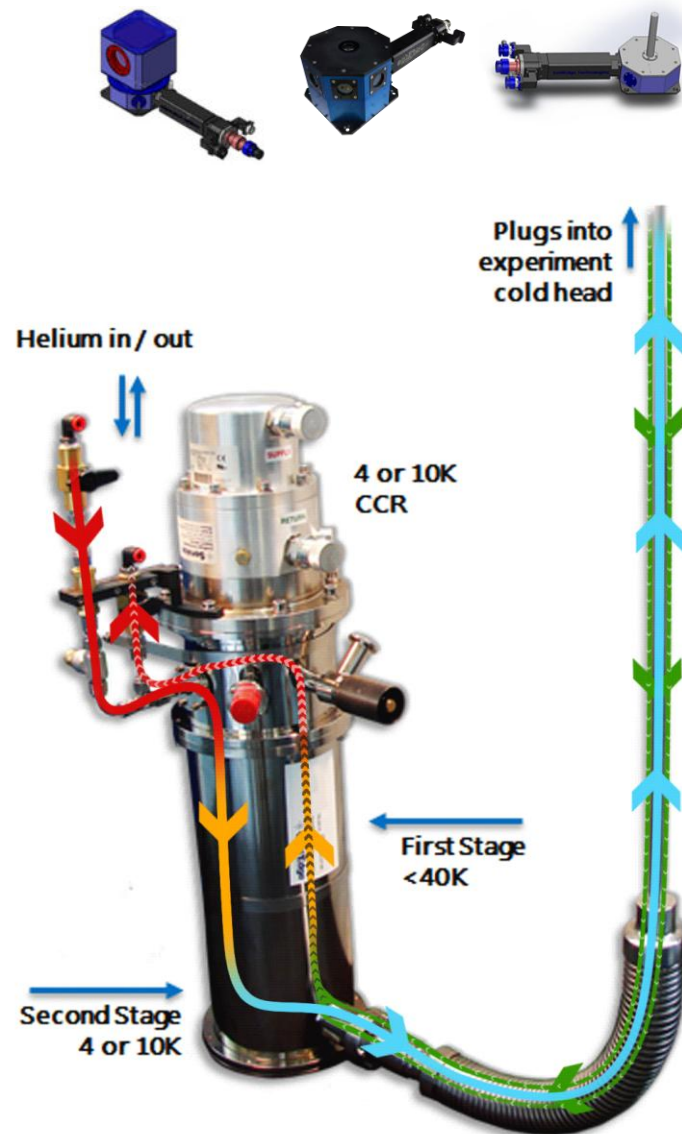
How It Works:

The Stinger uses a **4K or 10K closed cycle refrigerator** as its base cooling system (GM or Pulse Tube cycle).

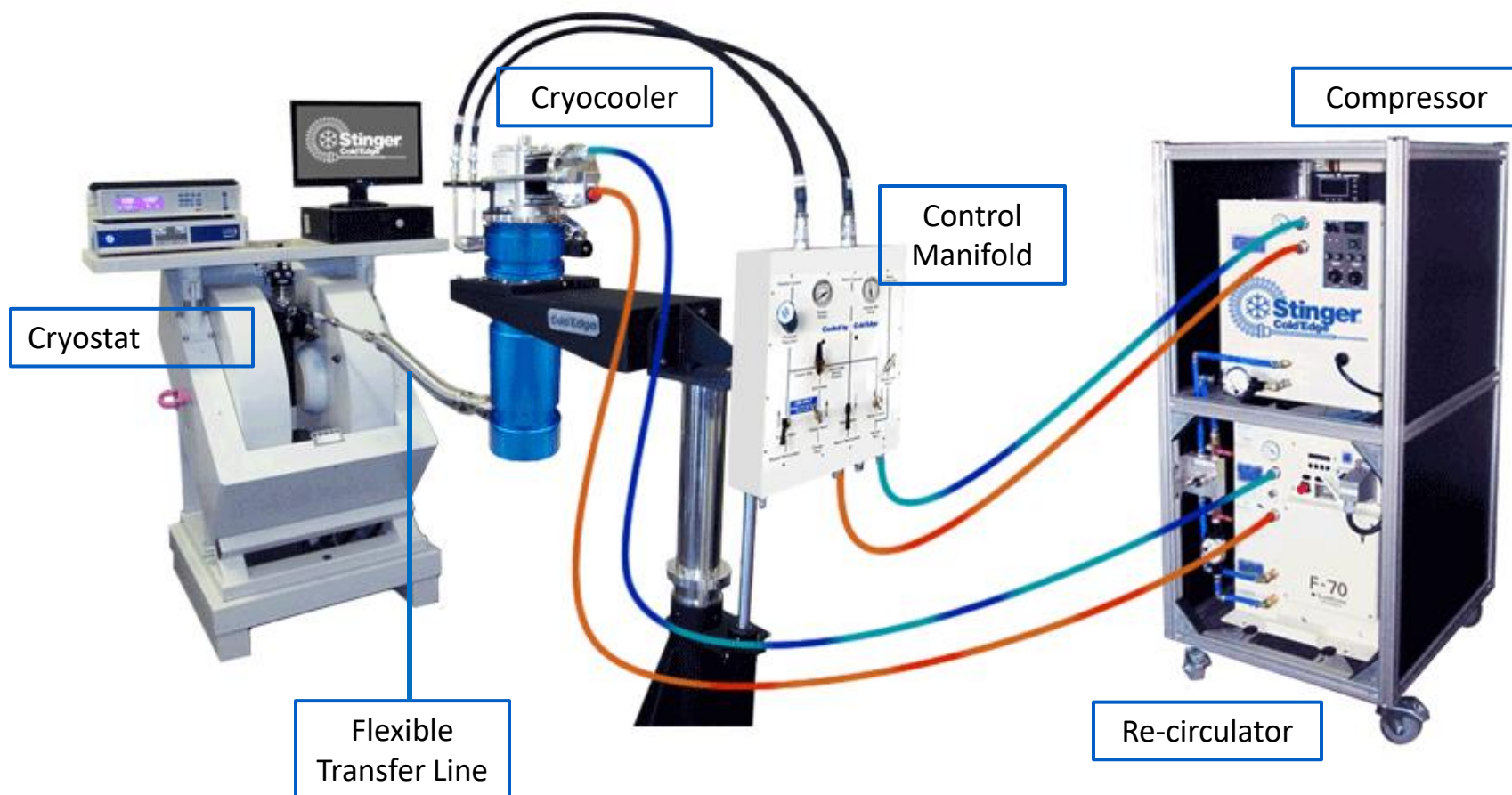
First Stage:	<40K
Second Stage:	4K or 10K
Third Stage:	4K directly at sample

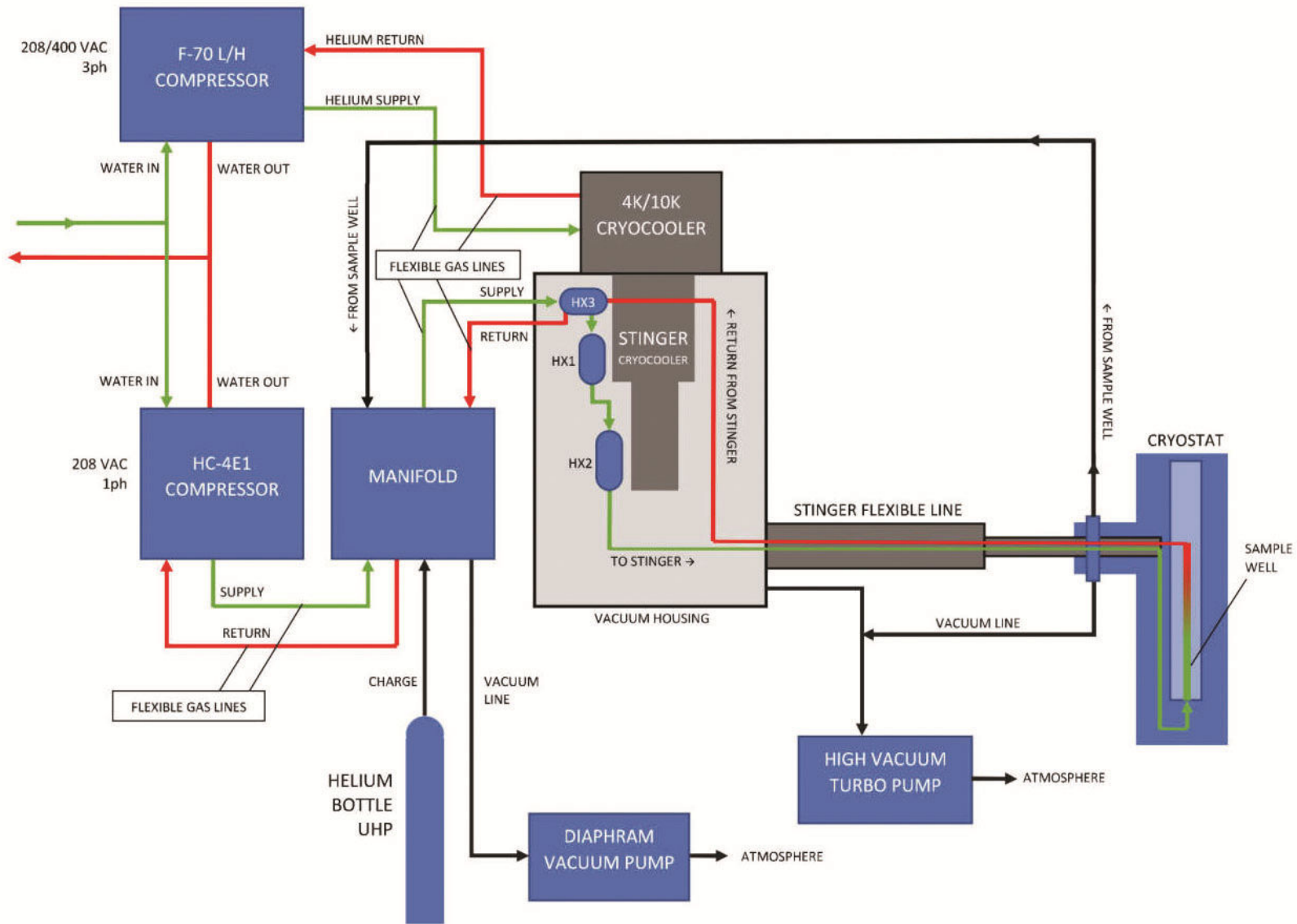
A **closed loop re-circulator** moves helium gas to cool the sample space (separate from the cryocooler circuit).

- Gas flows through Stinger transfer line to cool experimental cold head
- Used gas returns to cooler via transfer line
- Cooled gas exits to be re-circulated by pump



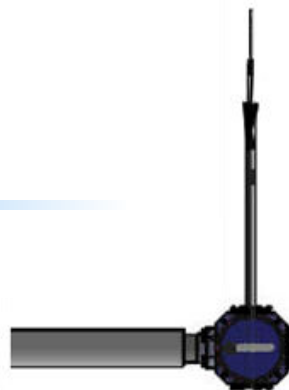
Stinger Cooling System Components





Stinger Line Configurations

90-degree cryostat insert



Straight cryostat insert



500 Gauss limit point is at cooler, meters away from the magnet field

Flexible line is available in 1.8m (6 ft) or 3m (10 ft) lengths.



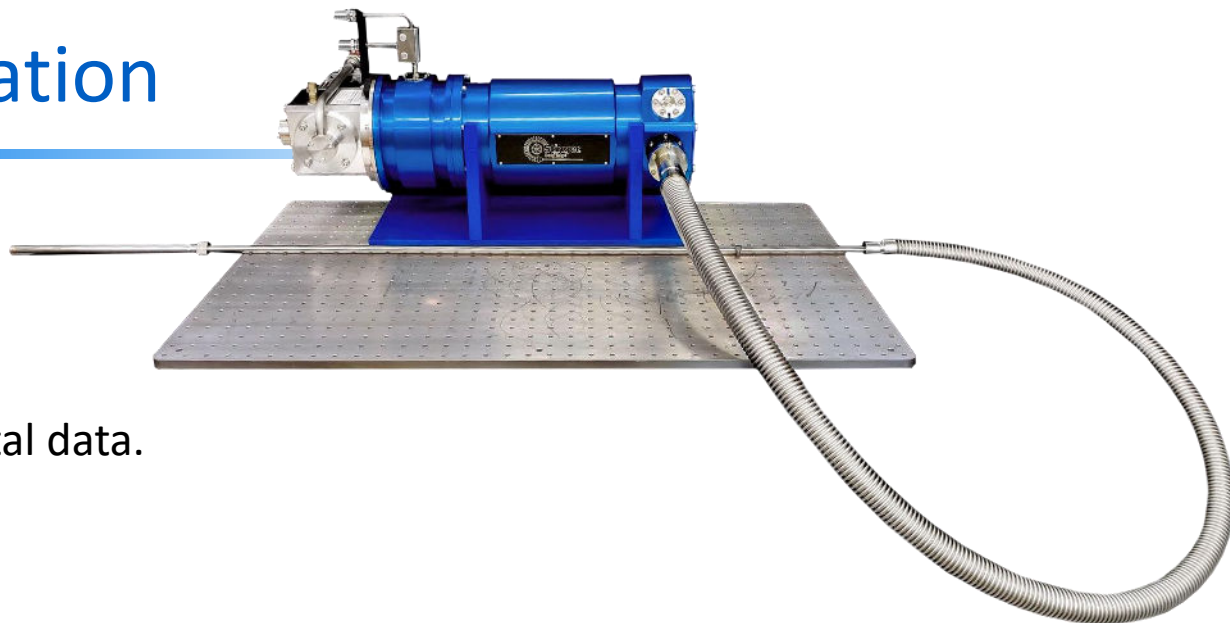
Electrically-isolated transfer line detaches here, field-swappable to allow multiple configurations.

Ultra low vibration transfer line adapter bellows kit

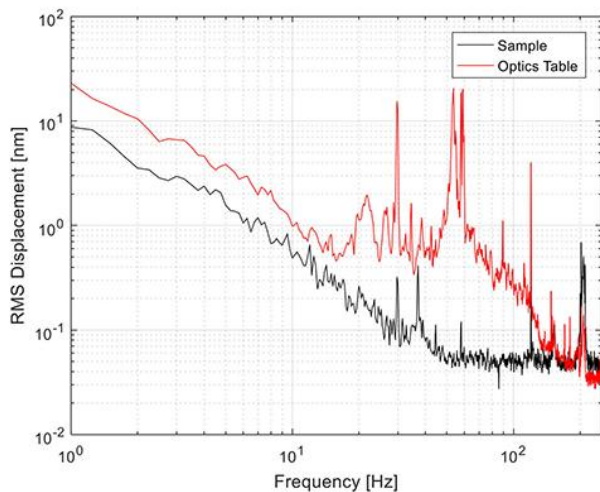
Vibration with will be < 5 nanometer of displacement (properly mounted and isolated from CCR)

Ultra Low Vibration

Flexible line bleeds off vibration energy without compromising experimental data.



Spectral Data



Standard Stinger:

<10 nm displacement at cryostat cold plate
(when cryostat has also been designed for low vibration)

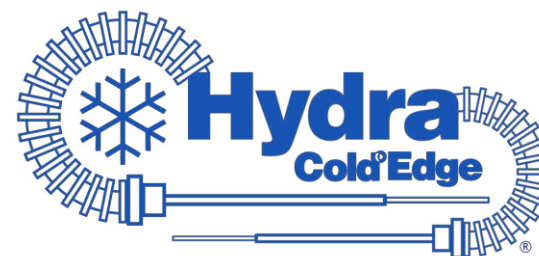
ULV “Gas Gap” Option:

<3 nm displacement at cryostat cold plate
(cooler is physically isolated from system via gas gap)

The Hydra - Dual Flexible Lines

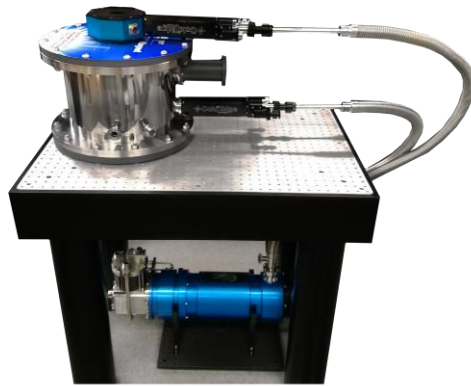
Operate two cryostat heads at the same time.

- Two flexible 1.8m (6 ft) transfer lines
- Operate one or both lines simultaneously, fully independent of each other
- Detector stays cold while sample cycles
- Greatly increases lab productivity (run up to 4 samples per day)



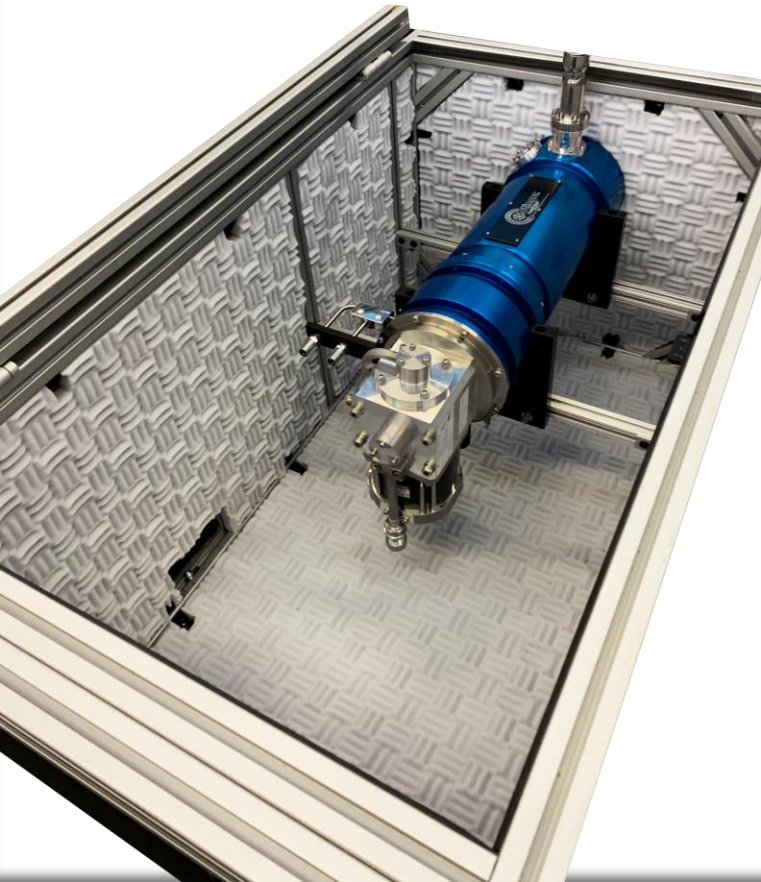
Stinger Logistical Advantages

Reclaim Laboratory Space



- Position Stinger under/over the experiment, instead of on table
- Mount system in any orientation
- Stop moving and resupplying Dewar LHe tanks
- Place compressors up to 20m (65ft) away, out of the lab
- Flexible line allows cryostat XYZ and rotation on transfer line

Stinger Logistical Advantages



Eliminate Noise Sources

- Electrical
 - Transfer line is electrically isolated (Optional)
- Vibrational
 - Flexible line combined with ULV gas gap design provides the lowest vibrational system commercially available today
- Audible
 - Enclose Stinger cryocooler in an acoustic box
 - Place compressors 20m away from experiment

Key Specifications

Standard Stinger

- Compressor water cooled, 200 or 380/400/480V 3 phase, 50/60Hz
- 6, 10 or 20m gas line set & CCR head power cable
- Re-circulation compressor, 220/230V 50/60Hz 1 phase
- 1.8 meter transfer line flexible section (3m optional)
- 10nm vibration levels (with properly configured Cryostat)
- Stinger assemble can operate in any orientation

Capacity on Cryostat cold plate

SRDK-305 <u>4K Cryocooler</u> system. Cooling capacity* 0.4 W @ 4.2K <ul style="list-style-type: none">• 10m gas line set	0.2 watts@4.2K
SRDK-408 <u>4K Cryocooler</u> system. Cooling capacity* 1 W @ 4.2K <ul style="list-style-type: none">• 6m gas line set & head power cable for CCR	0.5 watts@4.2K
SRDK-412 <u>4K Cryocooler</u> system. Cooling capacity* 1.2 W @ 4.2K <ul style="list-style-type: none">• 10m gas line set & head power cable for CCR	0.6 watts@4.2K
SRDE-415 <u>4K Cryocooler</u> system. Cooling capacity* 1.5 W @ 4.2K <ul style="list-style-type: none">• 20m gas line set & head power cable for CCR	0.7 watts@4.2K
10K Stinger[®] CH-210N 6.5K, 4 W @ 10K <ul style="list-style-type: none">• 6m gas line set & head power cable for CCR	0.25 watts@10K

Key Specifications

HYDRA Stinger with two transfer lines

Capacity on Cryostat cold plate

<p>Hydra SRDK-415 4K Cryocooler system. Cooling capacity* 1.5 W @ 4.2K</p> <ul style="list-style-type: none"> • 20m gas line set & head power cable for CCR 	<p>0.7 watts total @ 4.2K</p> <p>0.35 watts @4.2K Per line</p>
<p>Hydra SRDE-418 4K Cryocooler system. Cooling capacity* 2 W @ 4.2K</p> <ul style="list-style-type: none"> • 20m gas line set & head power cable for CCR 	<p>0.8 watts total @ 4.2K</p> <p>0.4 watts @ 4.2K Per line</p>

ULTRA LOW VIBRATION Stinger – CCR tip down operation

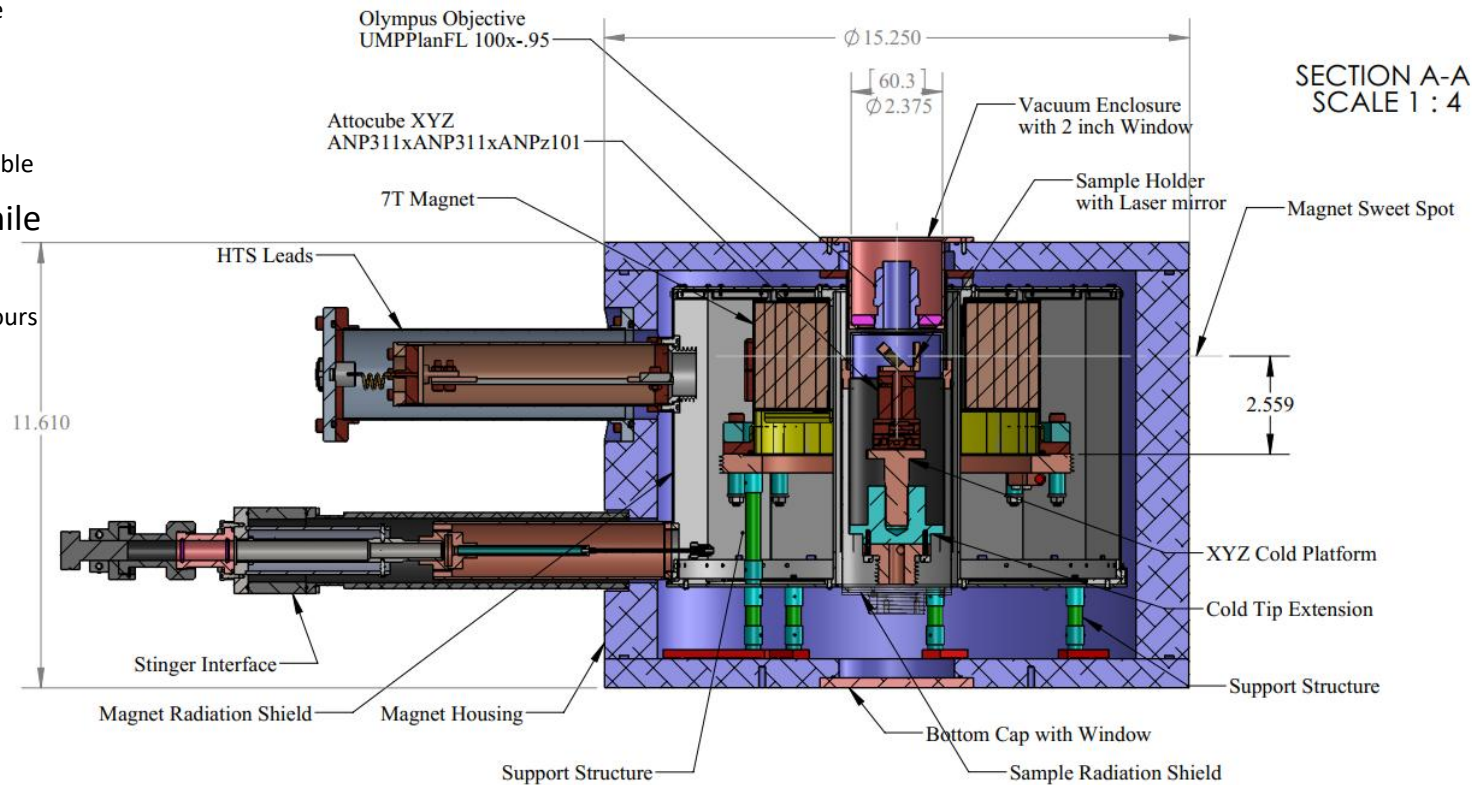
<p>ULV Stinger SRDK-415 4K Cryocooler system. Cooling capacity 1.5 W@4.2K</p> <ul style="list-style-type: none"> • 20m gas line set & head power cable for CCR • Vibration with will be < 3 to 5 nanometer of displacement (properly mounted and isolated from CCR) 	<p>0.2 watts@4.2K</p>
<p>ULV Stinger SRDE-418 4K Cryocooler system. Cooling capacity 2W@4.2K</p> <ul style="list-style-type: none"> • 20m gas line set & head power cable for CCR • Vibration with will be < 3 to 5 nanometer of displacement (properly mounted and isolated from CCR) 	<p>0.3 watts@4.2K</p>

Tabletop Stinger Superconducting Magnet System



Example
Cryostat

- 6T with 69mm warm bore or
- 3T with 115mm warm bore
- 3.8 to 500K temperatures at sample point with Stinger cooling magnet and integrated sample holder simultaneously
- Ultra low vibration
 - 10nm or less at sample
- Compact table top design
 - Cryocooler is off the table
- Sample is changed while magnet stays Cold
 - Run 3 samples in 10 hours



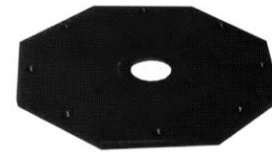
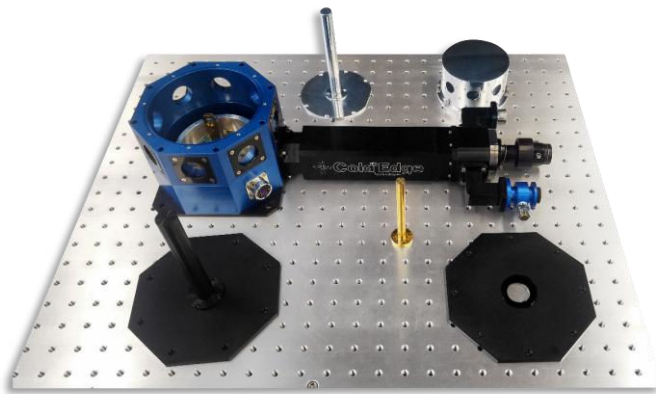
Tabletop Superconducting Magnet Systems

6T Magnet	
Field Range	0 – 6 Tesla
Room Temp Bore	69mm
Current	0 – 16 Amperes
Homogeneity	<1% over 10mm DSV
Ramp Rate	0 – 7 T in 50 min.
Stray Field	<5G at ~1.9m from center at 7T
Orientation	Vertical or Horizontal
Operation Temp	4.5K
Cooldown time	RT to 4.5K in <12 hours
3T Magnet	
Field Range	0 – 3 Tesla
Room Temp Bore	115mm
Current	0 – 16 Amperes
Homogeneity	<1% over 10mm DSV
Ramp Rate	0 – 3 T in 50 min.
Stray Field	<5G at ~1.6m from center at 3T
Orientation	Vertical or Horizontal
Operation Temp	4.5K
Cooldown time	RT to 4.5K in <12 hours

<4K to 800K Closed Cycle CryoPlatform

Interchangeable components allow researchers to transition between multiple interfaces.

- Optical
- Non-optical
- Narrow Gap
- Integrated Microscope Objectives



VACUUM COVER WITH WINDOW



OPTICAL VACUUM ADAPTER



OPTICAL RADIATION SHIELD



OPTICAL SAMPLE HOLDER

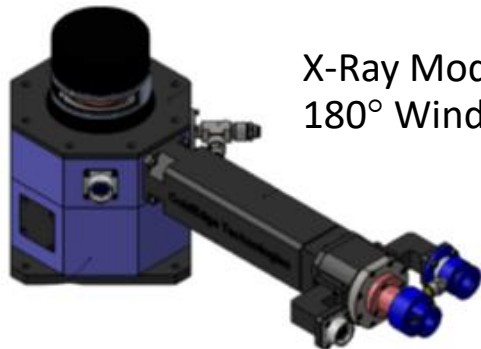


CryoPlatform Configurations



Modular Optical
Microscope Platform

Narrow Magnet Gap

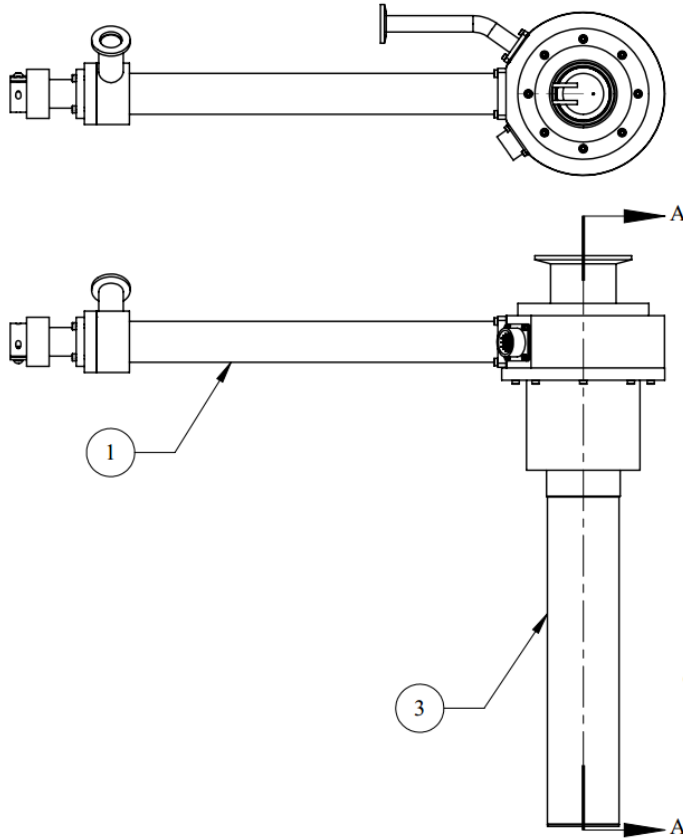


X-Ray Module with
180° Window

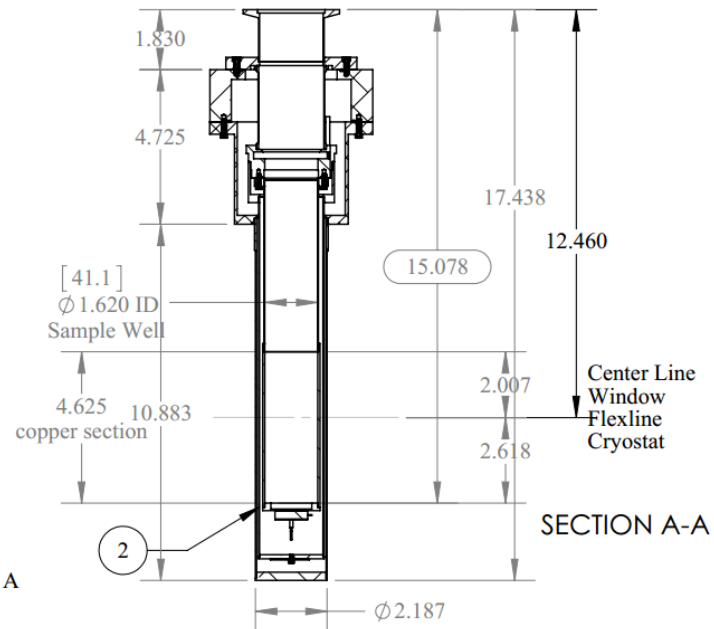


Diamond Anvil Cell, Flat
Window Access

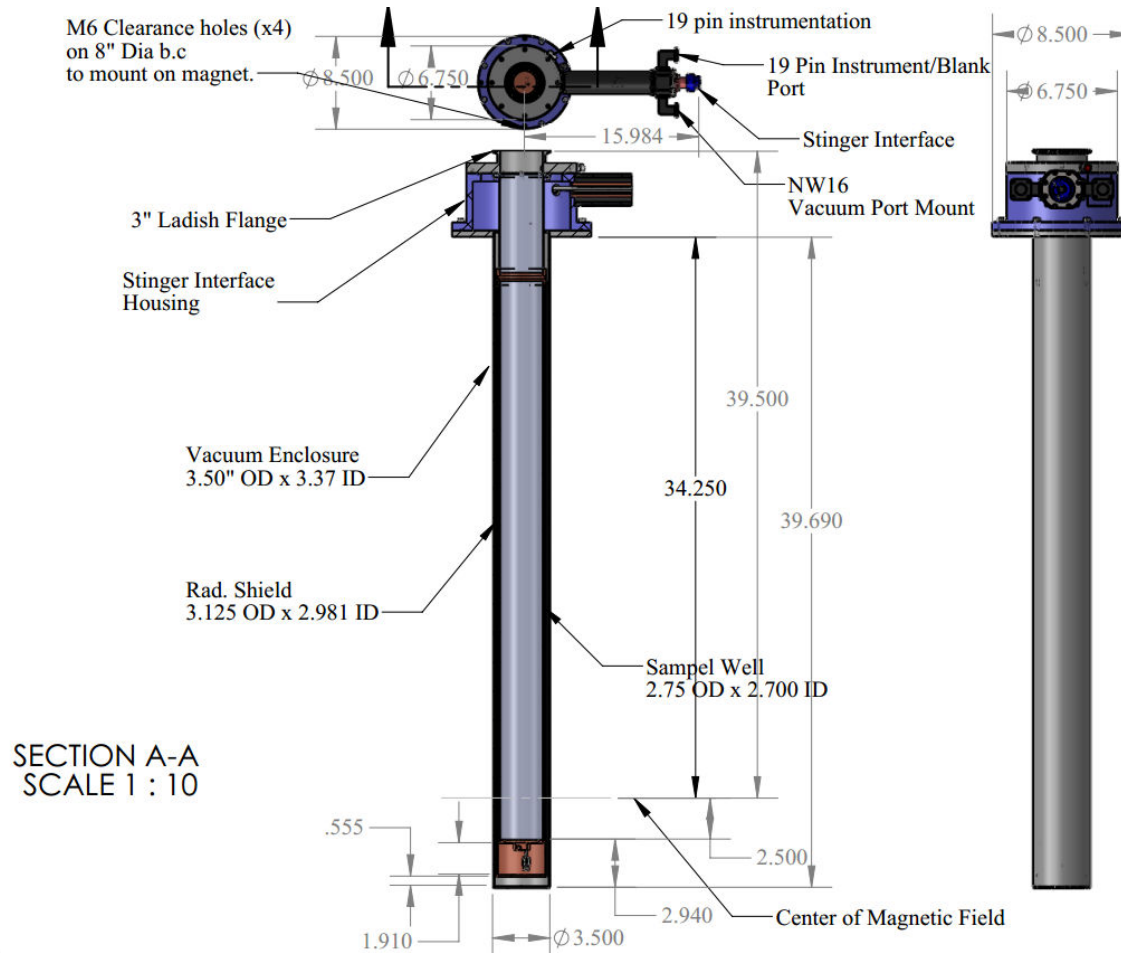
Top Loading Sample in Vapor



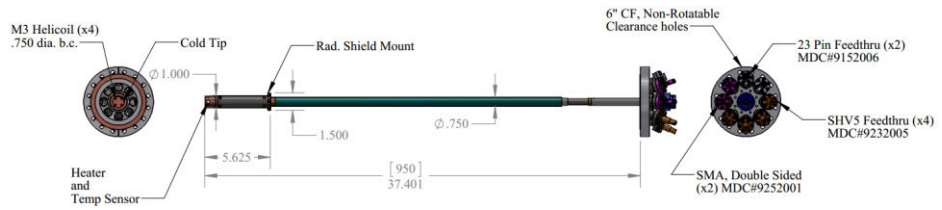
**LANL Top Loading
Sample in Vapor
4.2 to 800K**



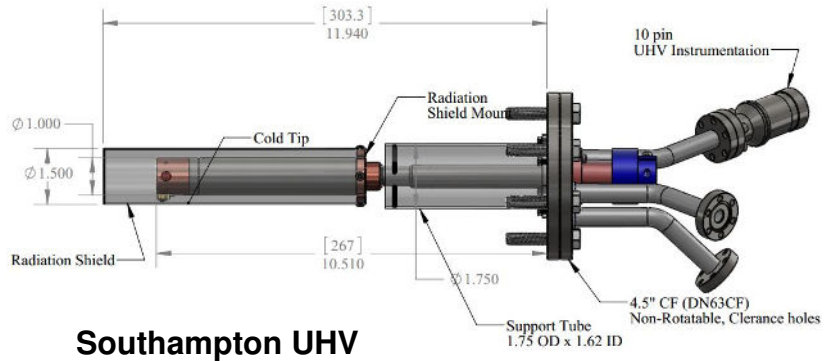
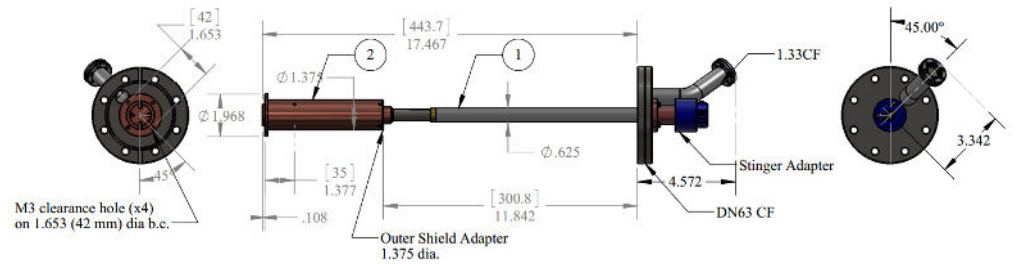
NMR Top Loading Sample in Vapor



BNL UHV

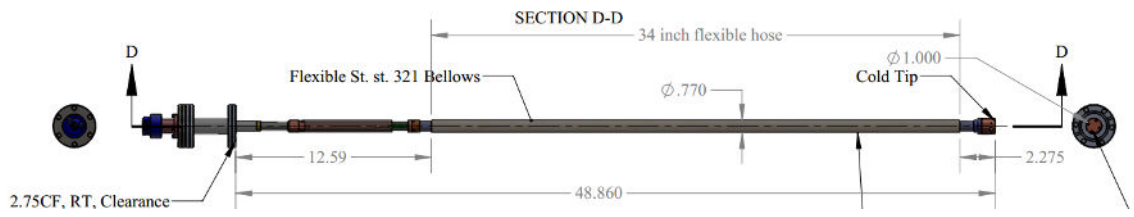


Diamond UHV ARPES



Southampton UHV

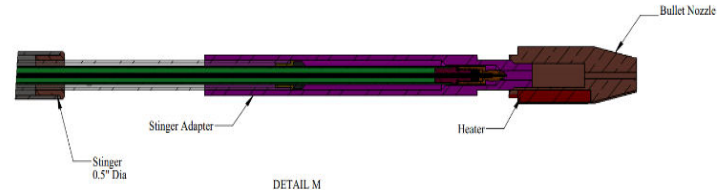
UHV In Chamber Flex



ST-400 Compatible

A) ST-400 adapter kit

- Screw on Bullet tip
- Sensor, heater and instrumentation connector

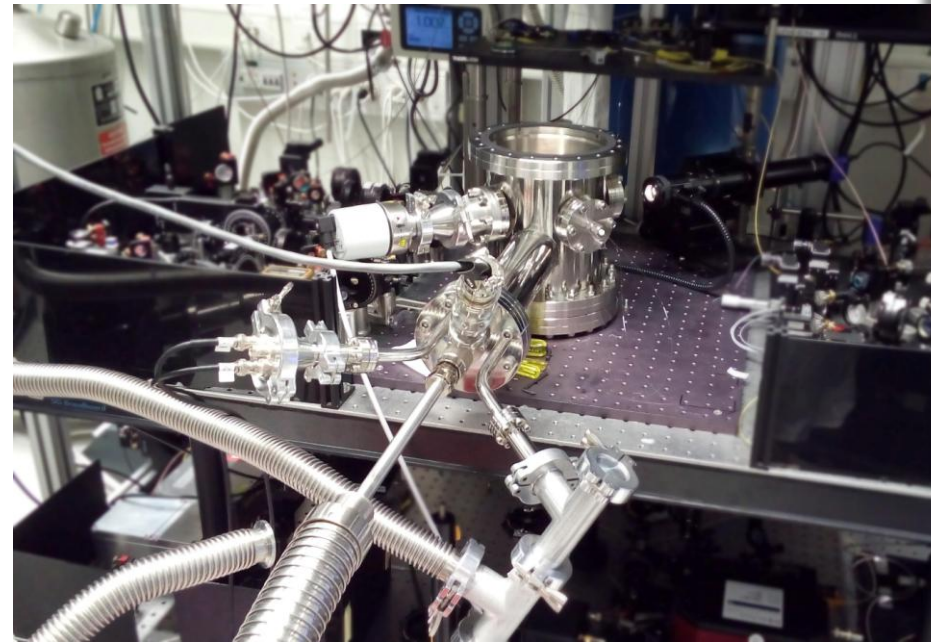
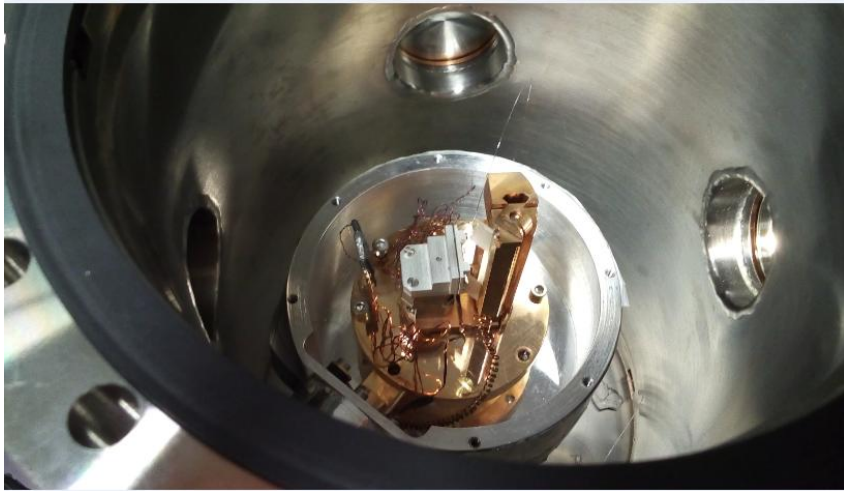
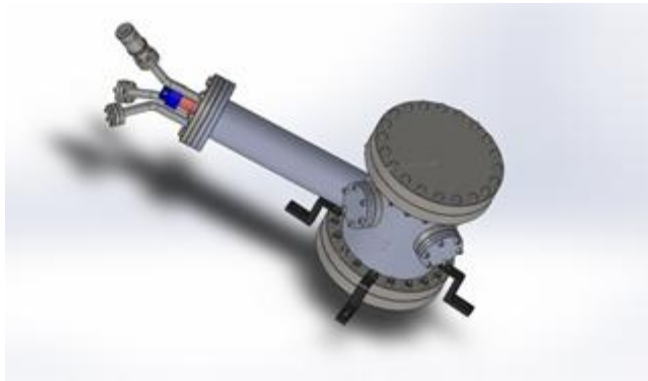


B) Drop-in replacement for ST-400

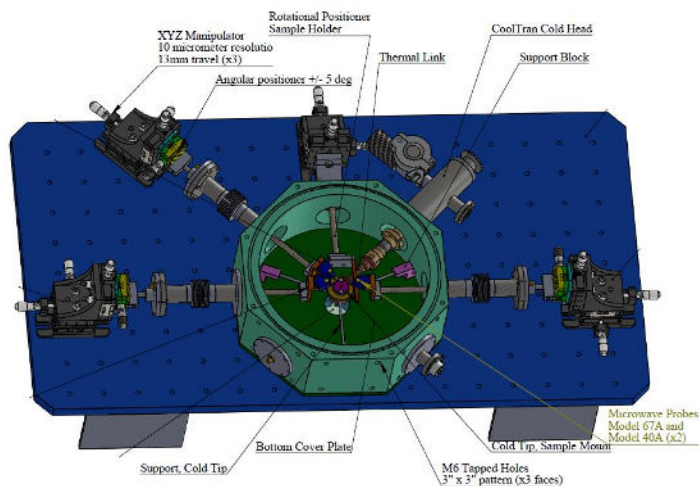
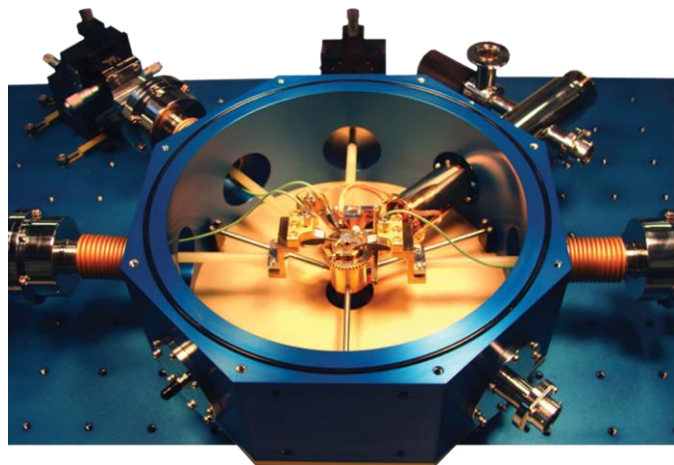
- <4.2K to 500K Temperature Range with Stinger
- DN40CF flange with two DN16CF instrumentation Conflat ports
- External form factor compatible with customer specific ST-400
- Cryostat is bake-able to 200C



Custom Ultra High Vacuum (UHV)



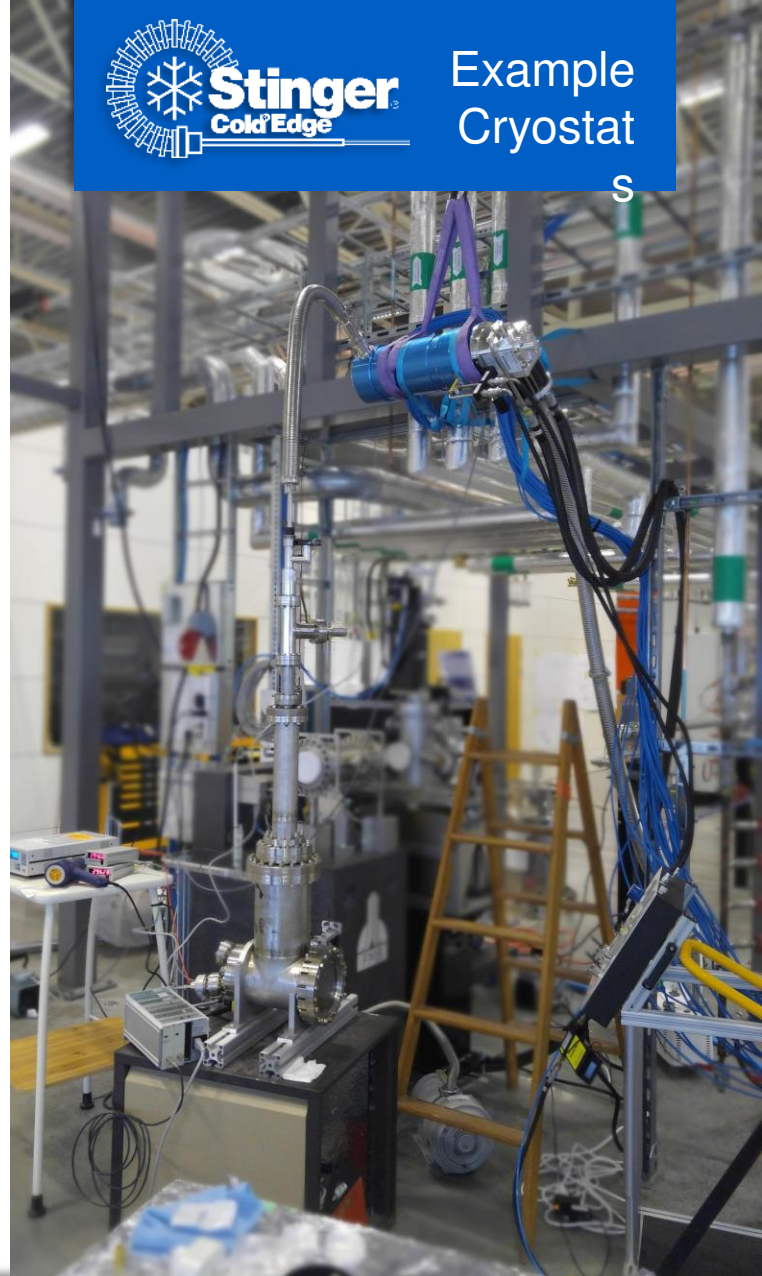
Stinger Probe Station



MaxLabs
ARPES



Example
Cryostat
S



Existing Flow Cryostats

Model	Stinger 4K	Stinger 10K
ESR900	<6K	<14K
CF935	<4.9K	<11K
Optical	3.8K	9K
Microscope	3.8K	9K
NMR	7K	<16K
Oxford Microstat MO 5T Magnet	4.2K	N/A





Key Features

- 3.2 to 800K temperature range
- 6ft / 10ft flexible transfer line
- Completely closed cycle system
- Plugs into multiple cryostat designs
- Double line “Hydra” option now available

Benefits

- <10nm Ultra Low Vibration
- Increased lab productivity (run 4 samples per day)
- Off-table cryocooler can be mounted in any orientation
- Freedom of movement, with XYZ and rotation of sample

