长三角先进材料研究院
Advanced Materials Research Institute, Yangtze Delta

Csi-Lab

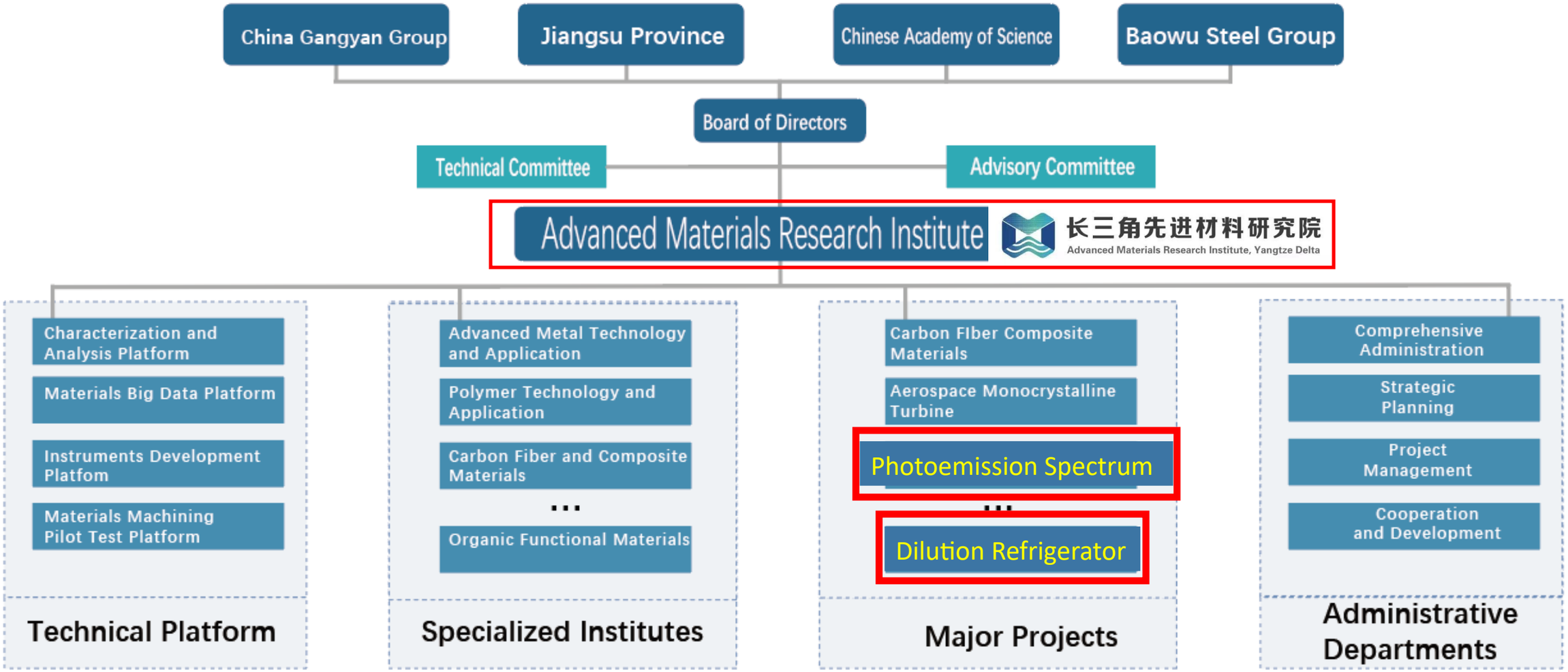
Dilution Refrigerator and Photoemission Spectroscope---

high quality instruments from China

2023.9

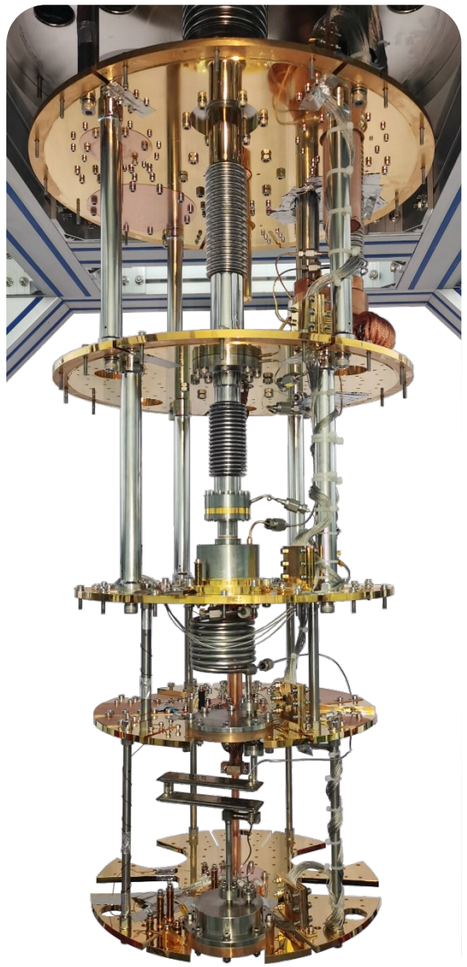
Brief Introduction of AMRI-JITRI

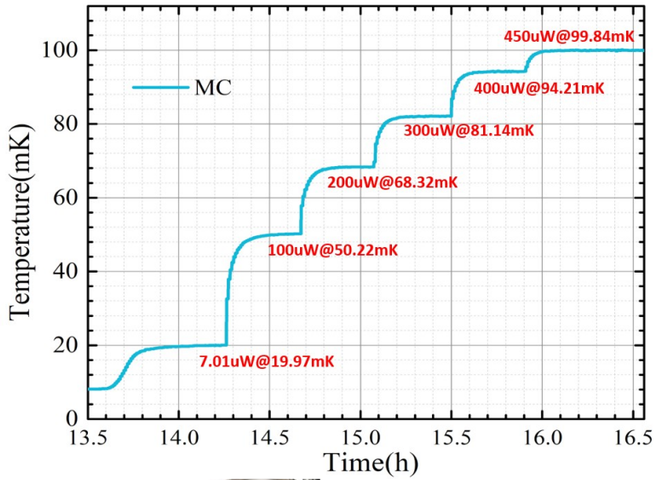
Organization



Dilution refrigerator

Dry Dilution Refrigerator





Technical Data	Specifications
Base Temperature	≤10mK
Base Temperature Stability	±0.2mK
Cooling Power	≥450 μW@100 mK
Precooling time	~30h to 10K, ~40h to 4K
Operation Mode	Continuous
Sample plate size	ϕ300mm
Sample Environment	Sample in Vacuum

Dry Dilution Refrigerator- control unit

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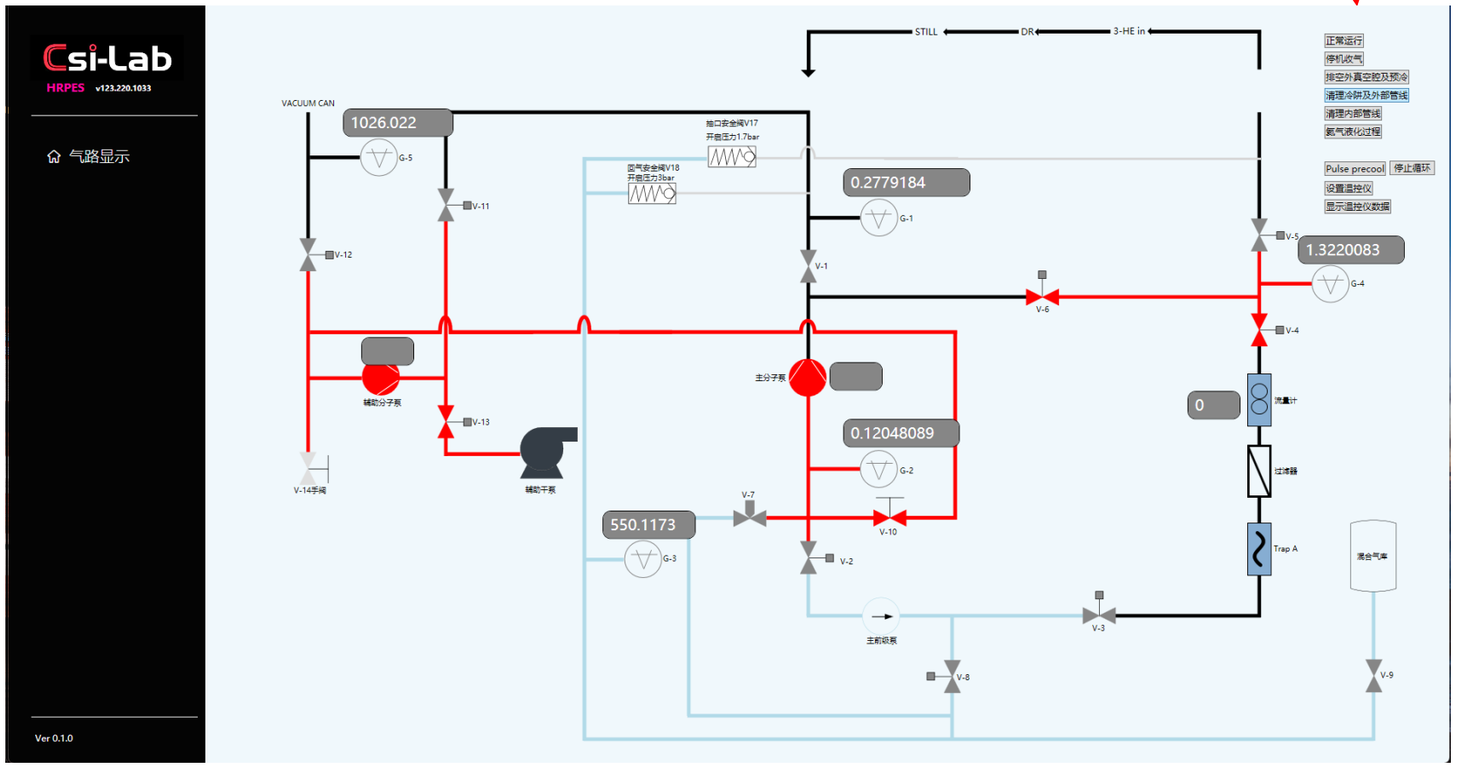
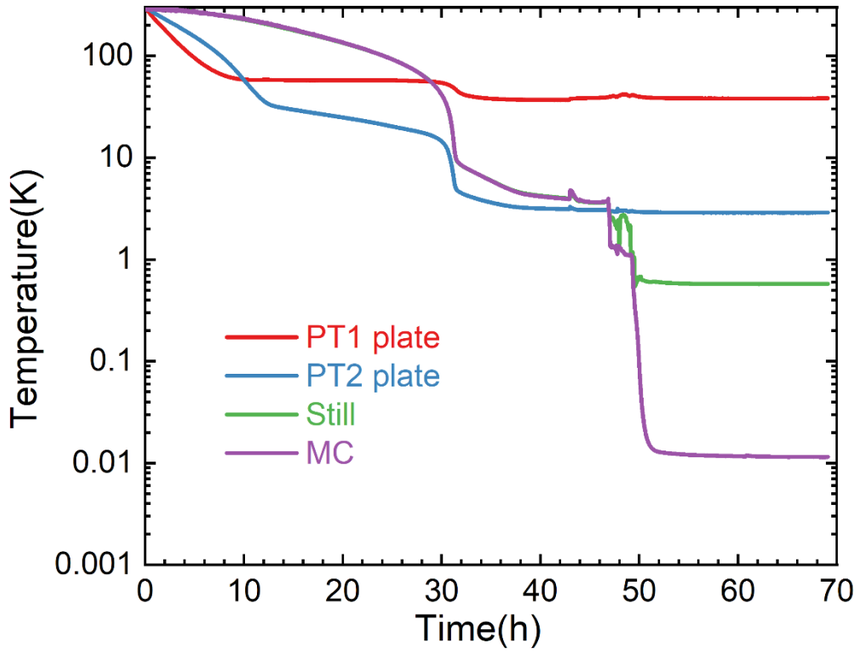
Buttons here



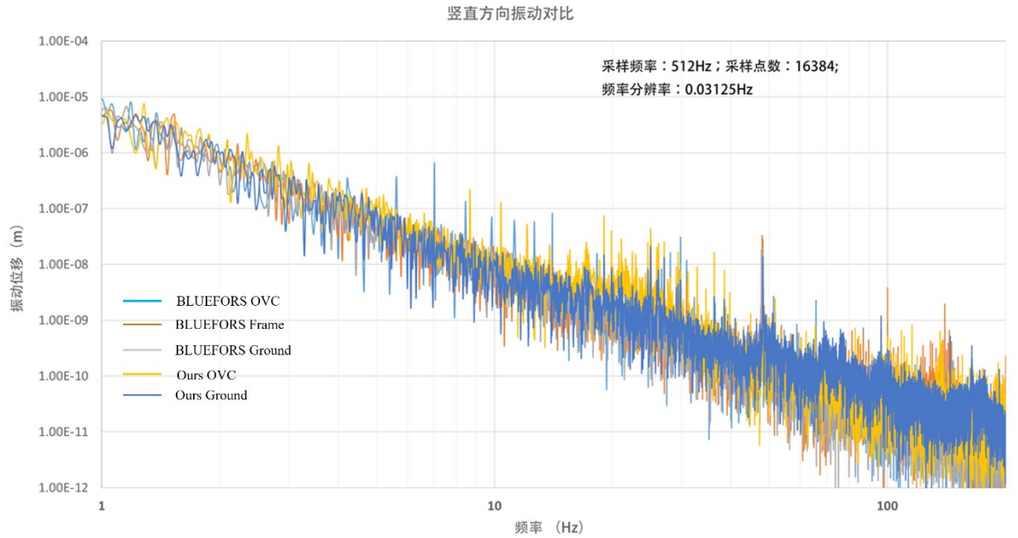
Dry Dilution Refrigerator- precool time

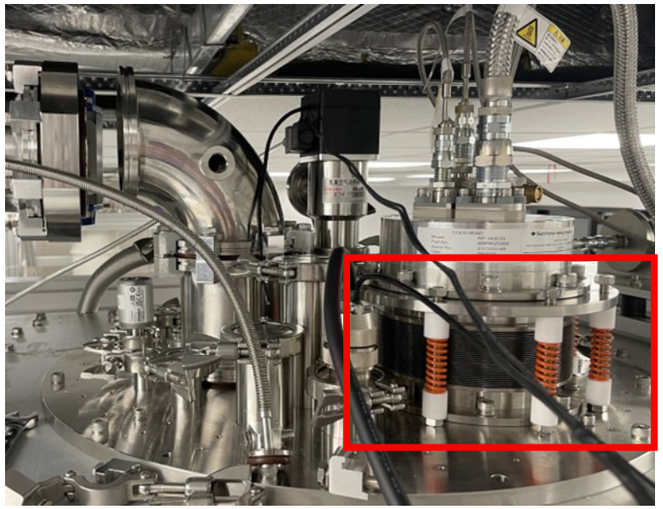
- Mechanical heat switch
- LN2 precooling line under development, should be tested this month
- Pulse-cooling way is developing in software, should be tested this month
- Gas gap heat switch is under development

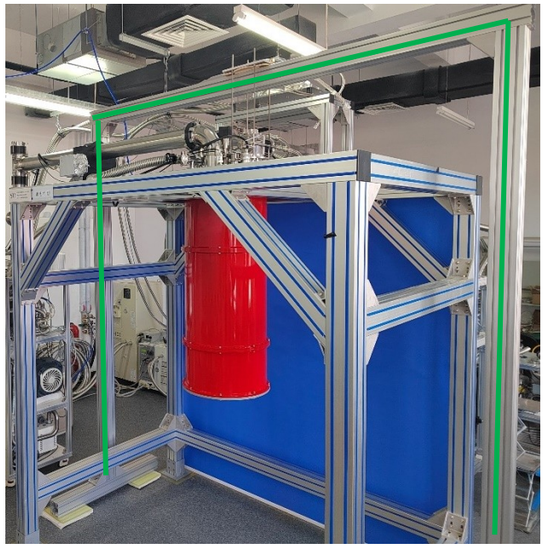


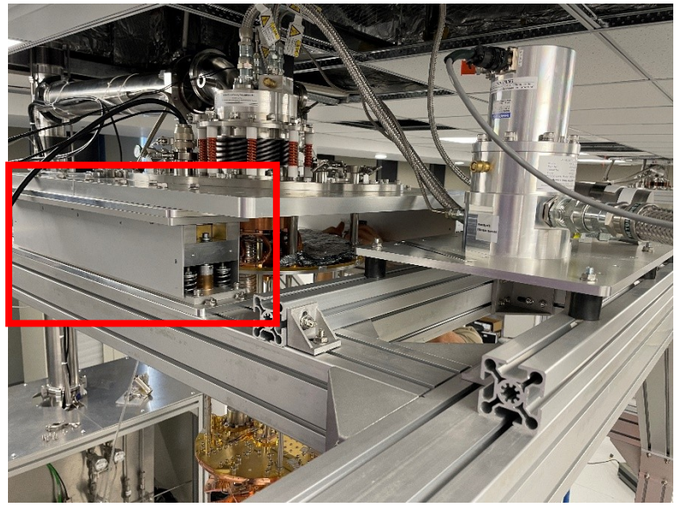
Dry Dilution Refrigerator- vibration

- Normal spring loaded dampers
- Double frame design
- Herz passive dampers
- Herz passive dampers + double frame + sand bags

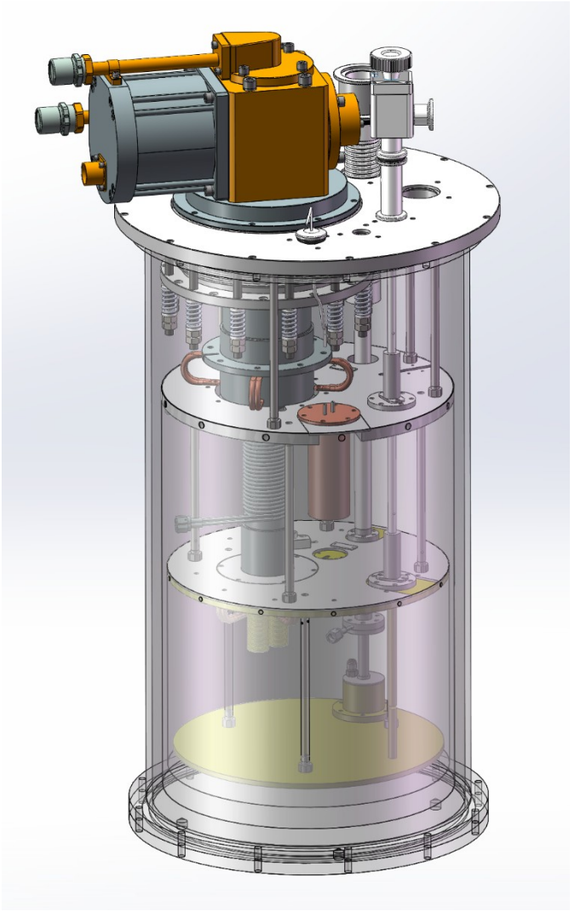




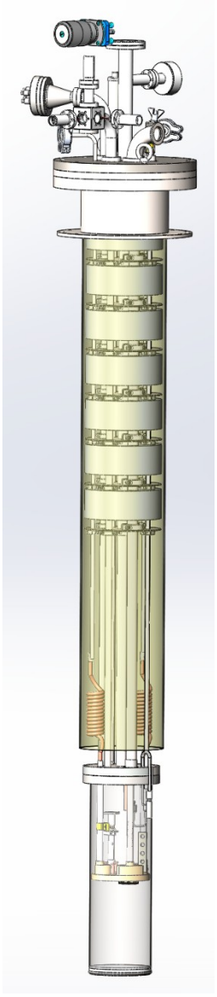




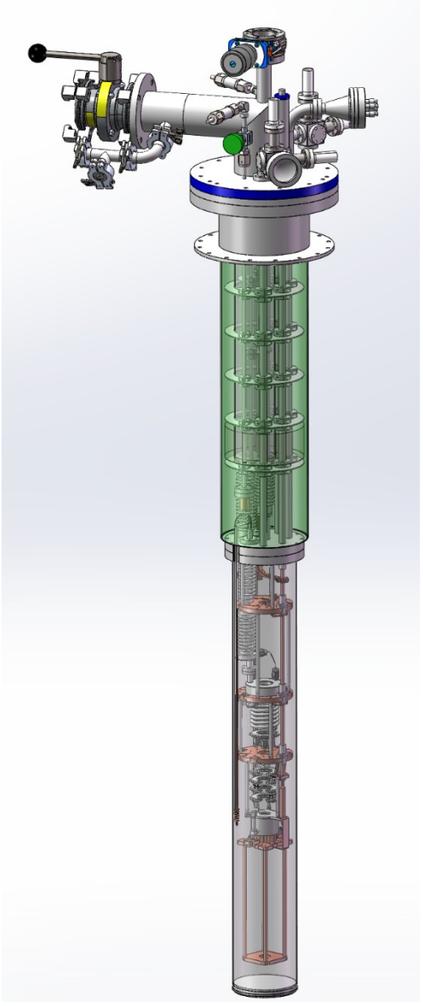
More cryostats



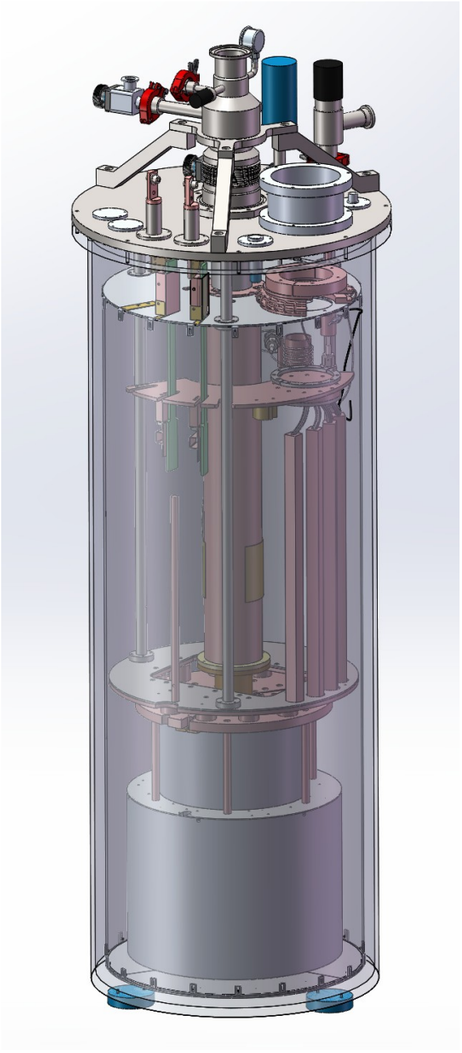
Dry 1K/ 3He system



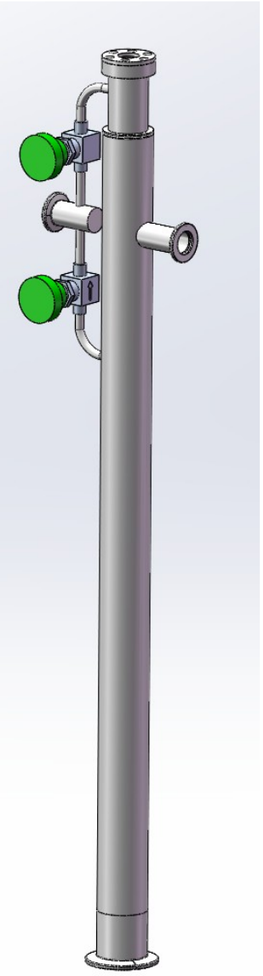
Wet 1K system



Wet DR system



Dry 1.5K-300K VTI system



Fast loading

Photoemission Spectroscope

Photoemission Spectroscope

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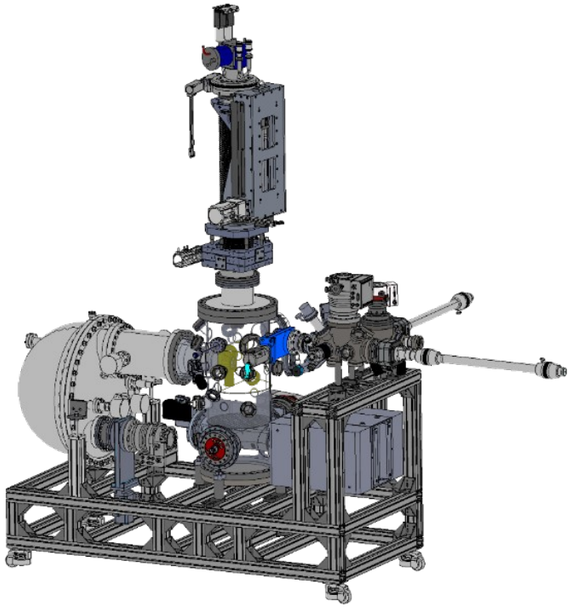
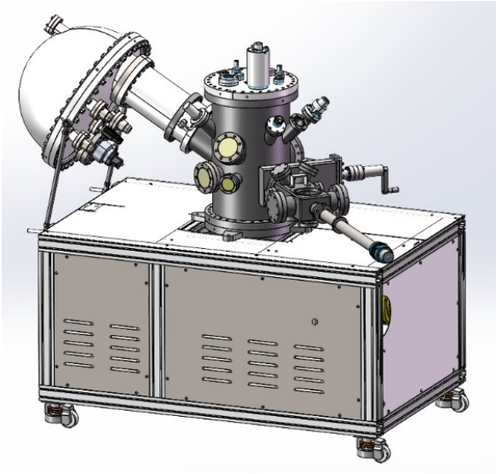
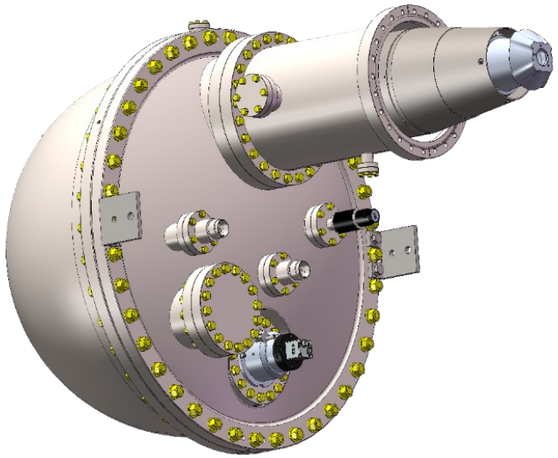


ARPES

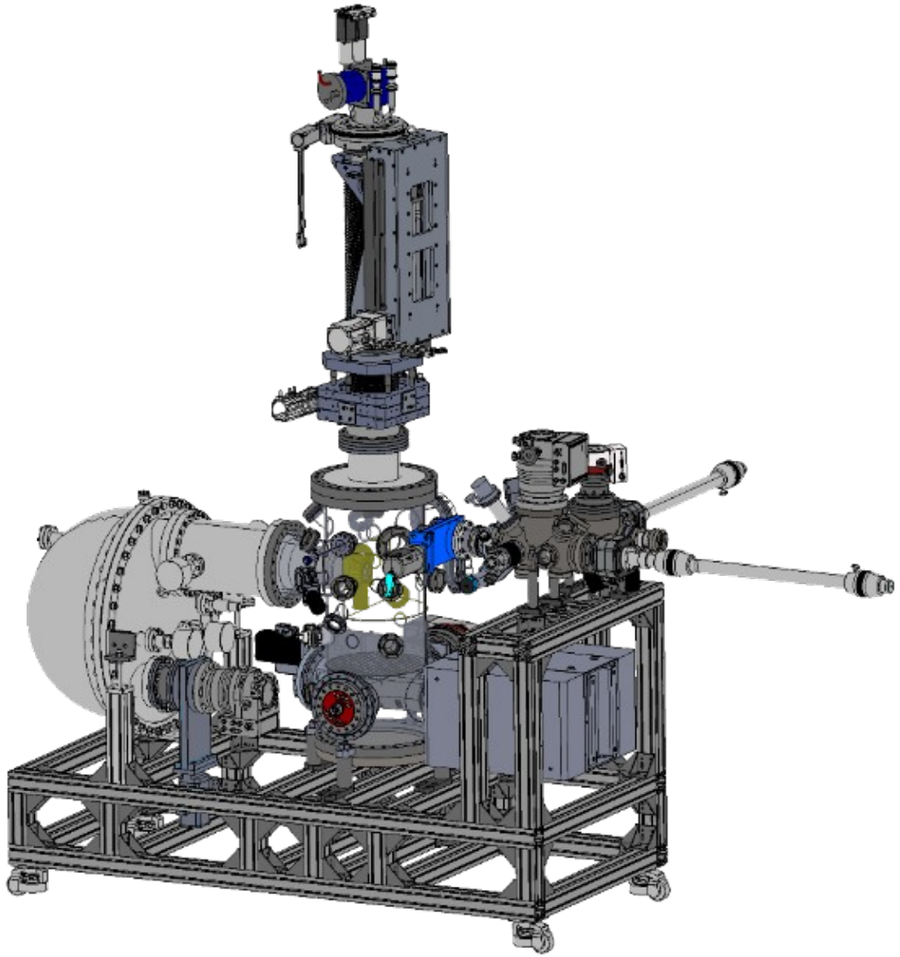


XPS



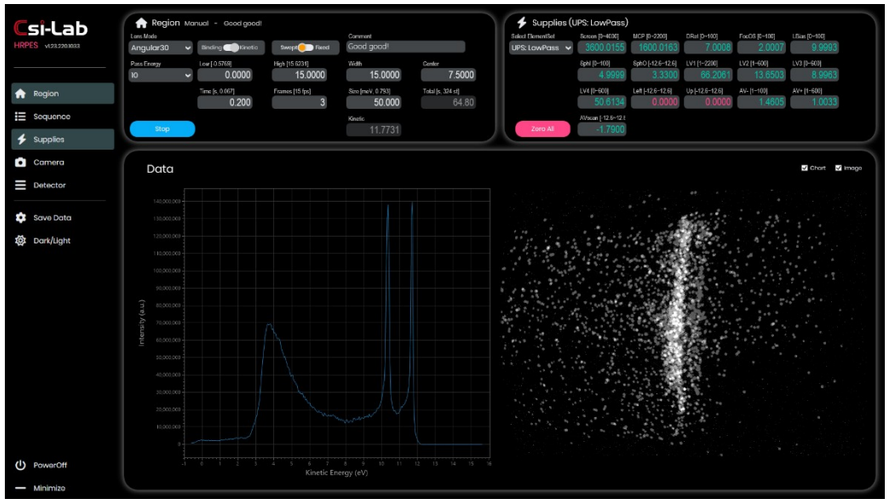
Components and parts

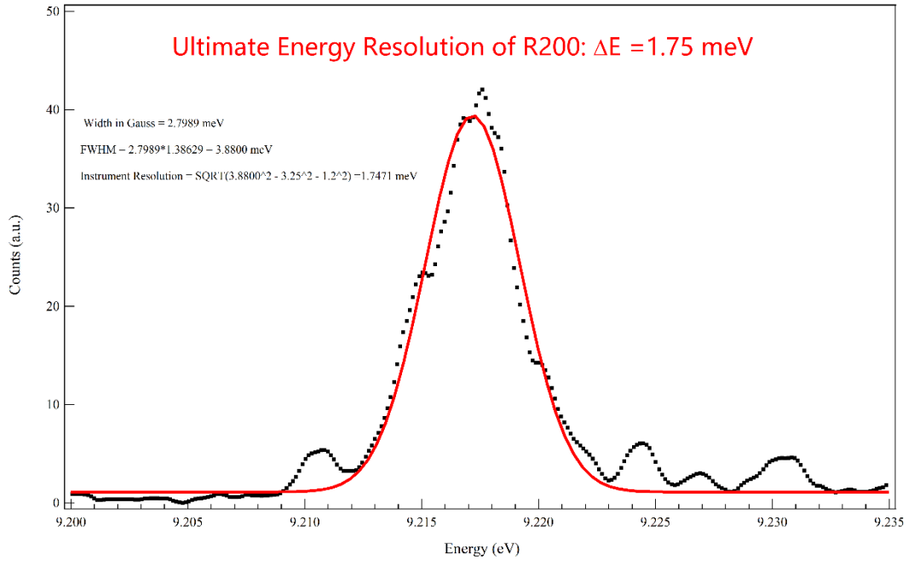
Photoemission Spectroscope- ARPES

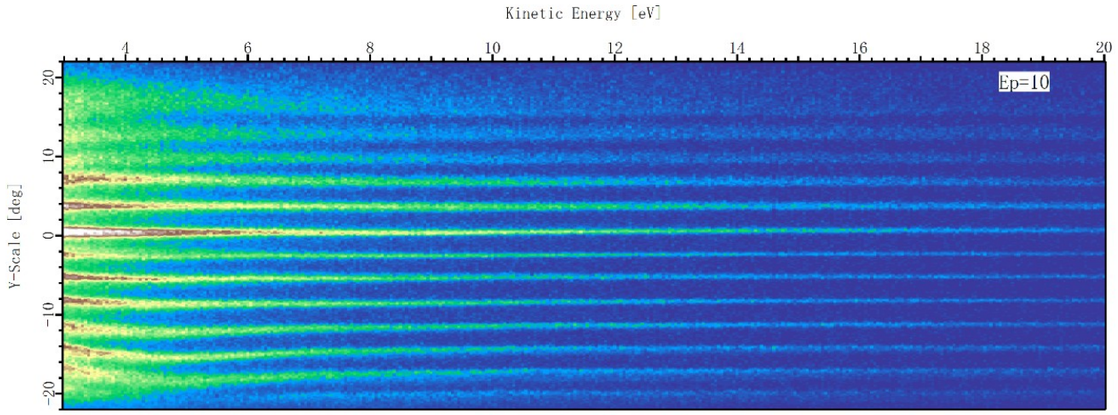


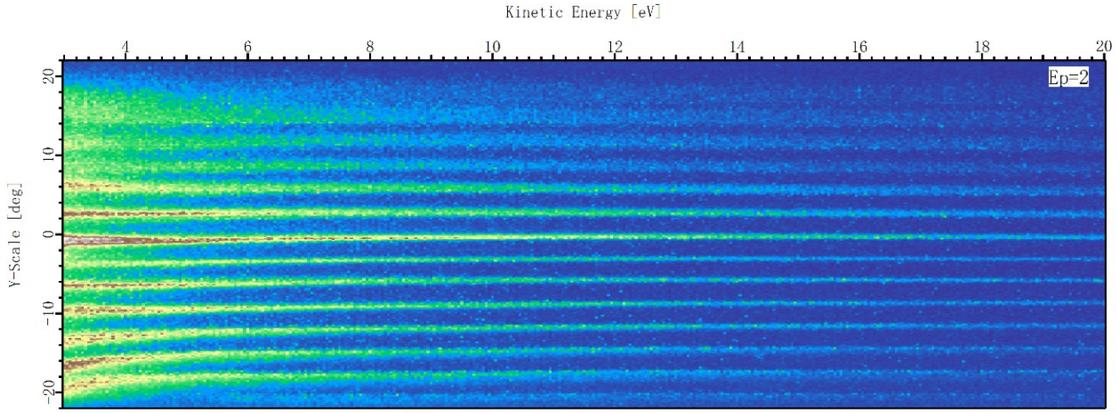
Technical Data	Specifications
Energy Resolution	≤1.8 meV FWHM @ Ep = 2 eV ， Ek = 9.1 eV
Angular Resolution	≤ 0.1°@ 0.1 mm Spot size
Angular Mode	±15° ， ±7° ， ±3.5°
Sample Manipulator	Open (Closed) cycle 6-axes cryogenic manipulator
Lowest Temperature	Typical value 6K; Optimal value 4K
UV Source	VUV430-AF-MONO Type
Applicable Gases	He ， Ne ， Ar ， Kr ， Xe etc.
Ultimate Vacuum	≤5E^{-11} mbar （ with sufficient pumps and long baking ）

Photoemission Spectroscope- Software



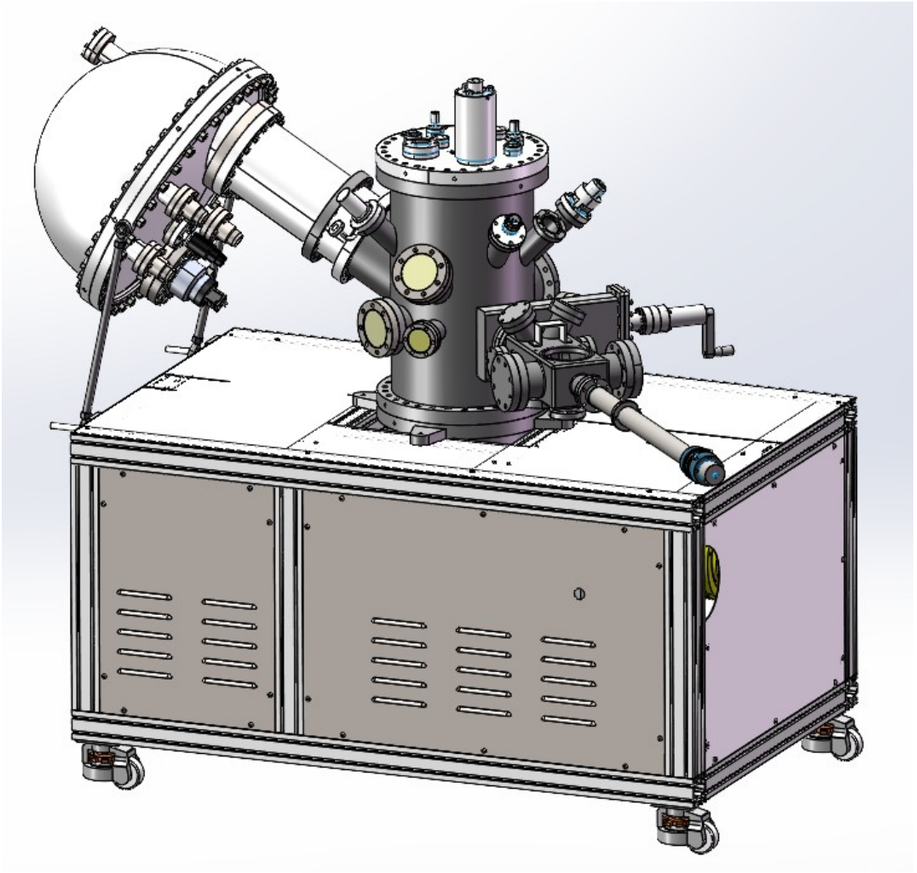






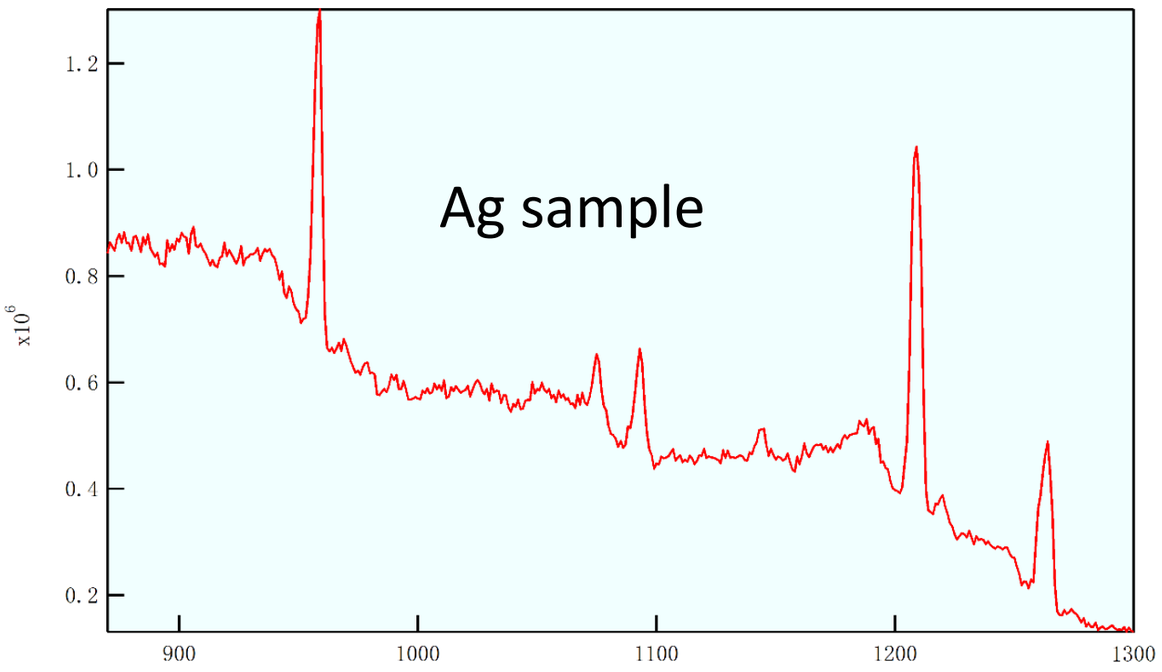
Angular30, Ek=3 to 20eV, Ep = 2 to 10eV

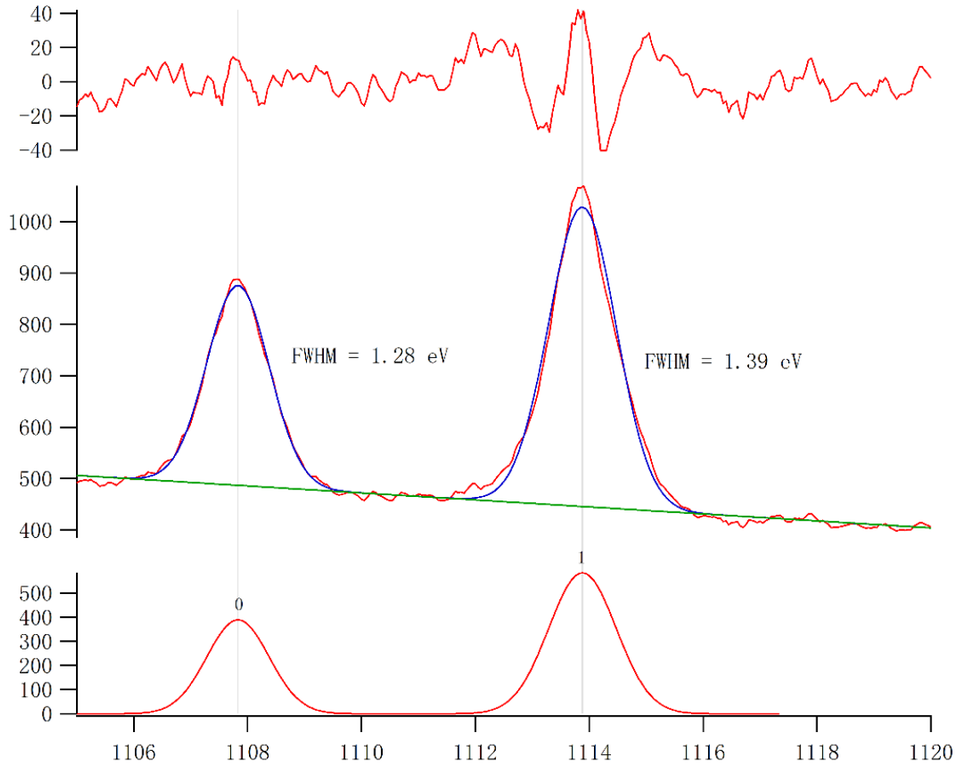
Photoemission Spectroscope- Software



Technical Data	Specifications
Energy Resolution	≤10 meV FWHM @ Ep = 2 eV ， Ek = 9.1 eV
Sample Stage	Automatic 5-axes sample stage
Energy	Al Target @ HV = up to 15KV
Pass Energy Ep	1 ~ 500 eV ， Multiple options
X-ray Source	μXR275 Type
UV Source	VUV430-AF-MONO Type
Applicable Gases	He ， Ne ， Ar ， Kr ， Xe etc.
Ultimate Vacuum	≤5E^{-9} mbar （ with sufficient pumps and long baking ）

Photoemission Spectroscope- XPS





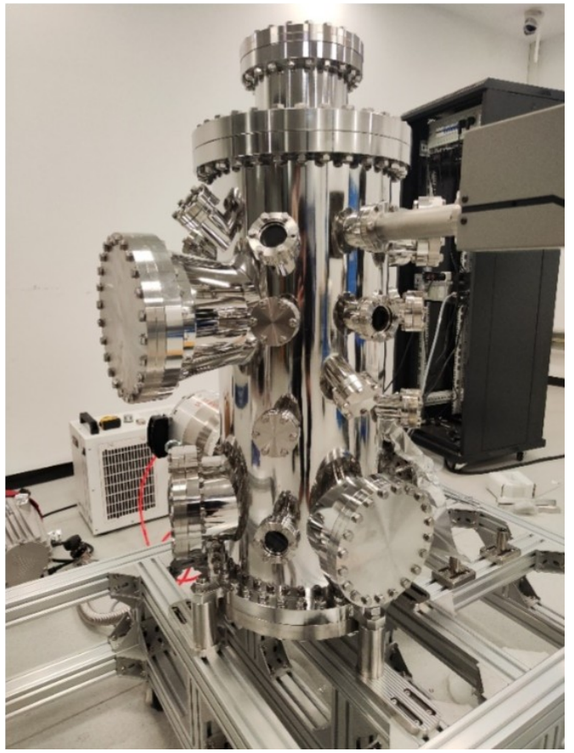
Components

R200 for ARPES

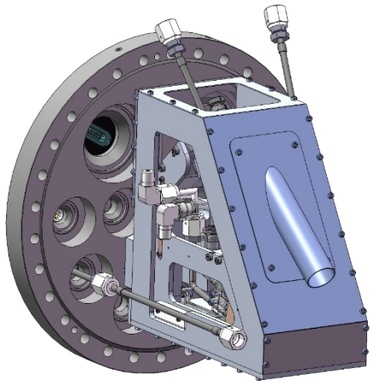
R150 for XPS

Manipulator

μ-metal UHV chamber

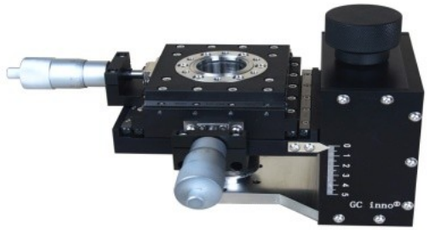


UV source



X-ray source

Components- UHV parts



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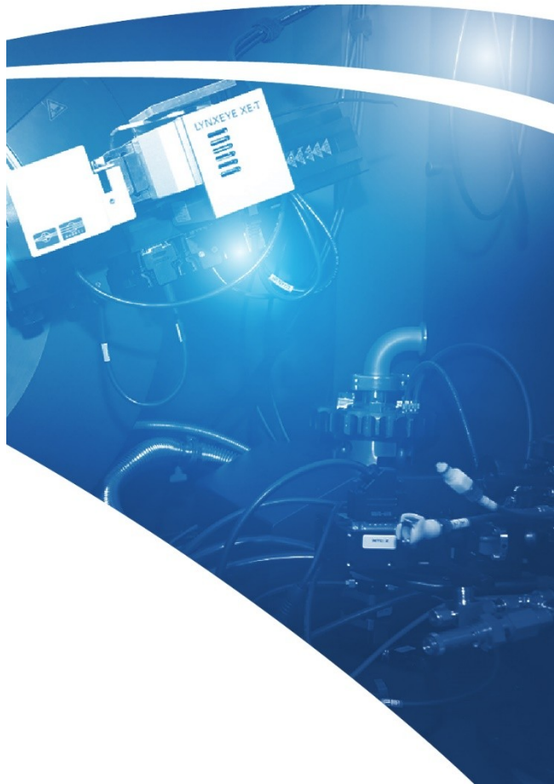

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Dry Dilution Refrigerator

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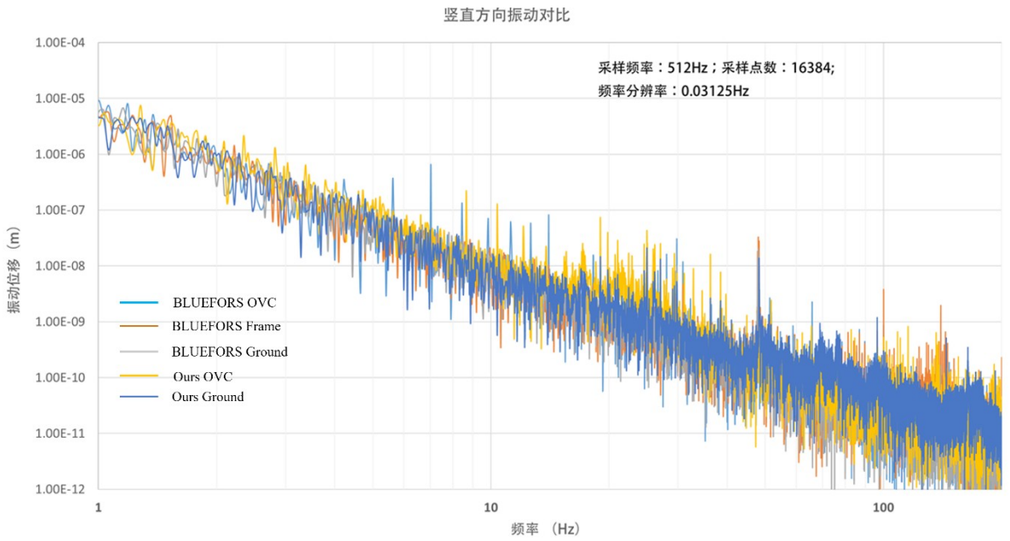
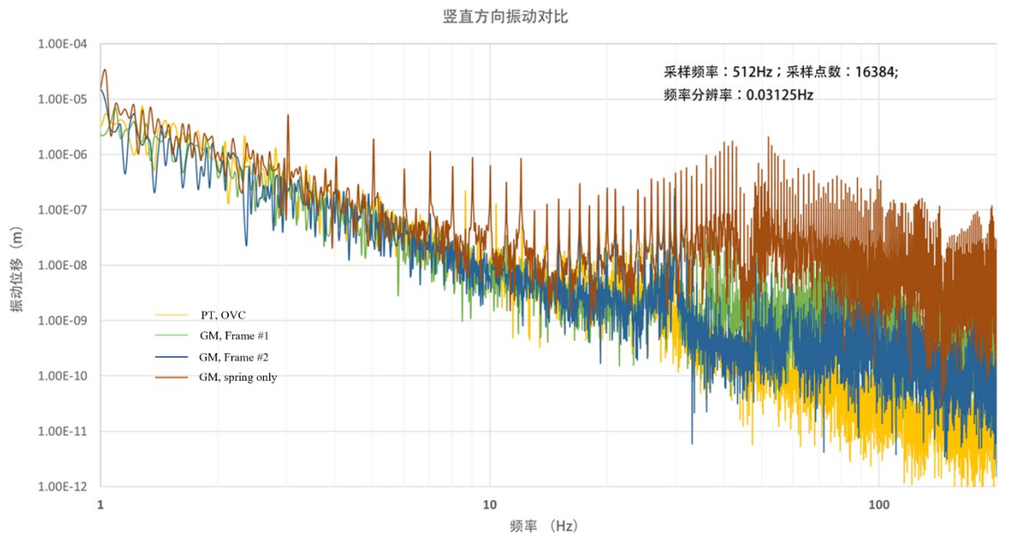
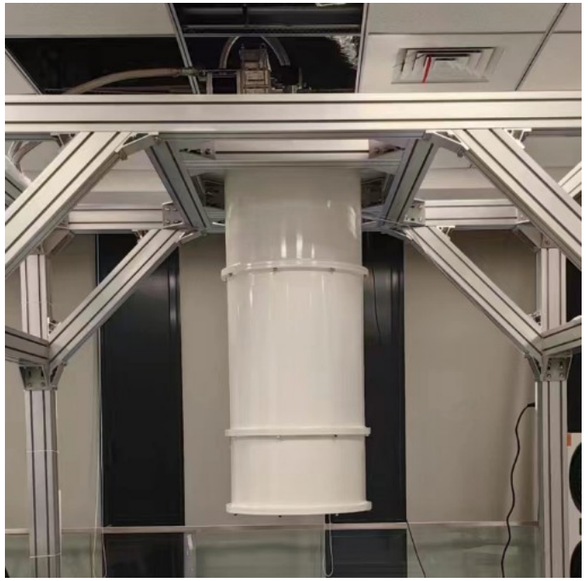
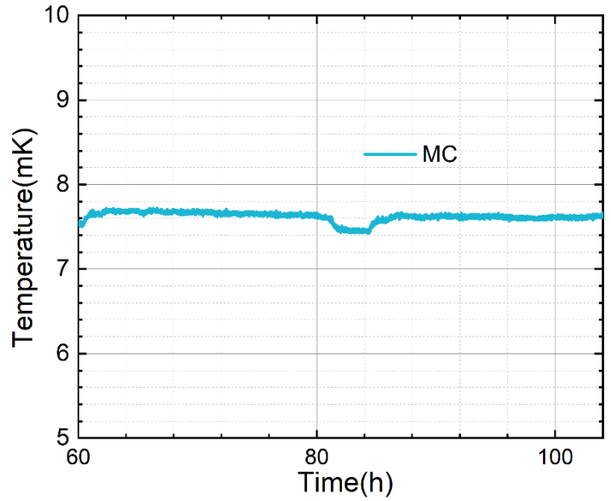
Vibration damping results

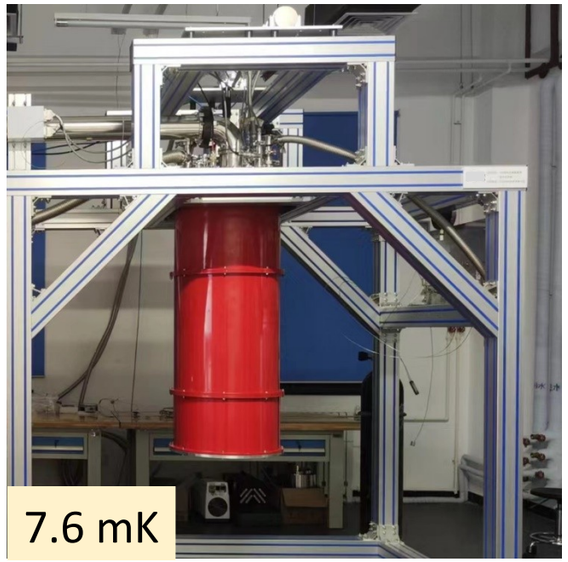


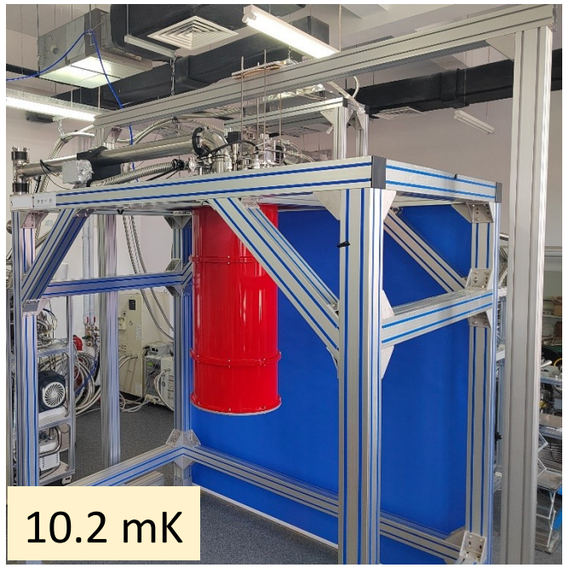


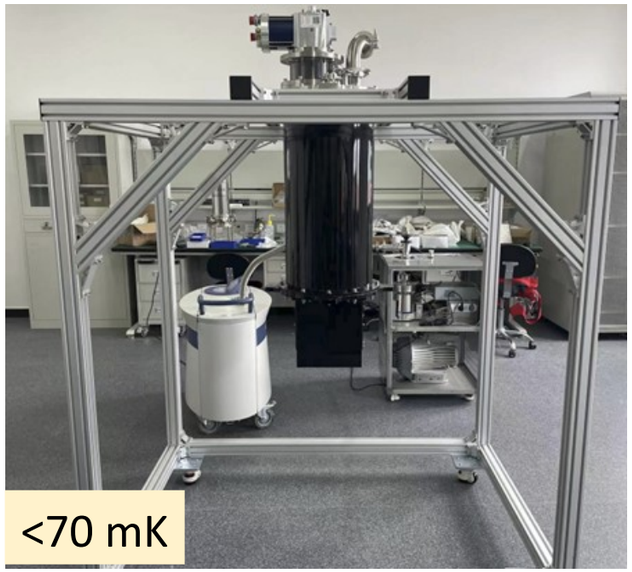
ryostats we manufactured: two by PTs, two by GMs, one with optical window







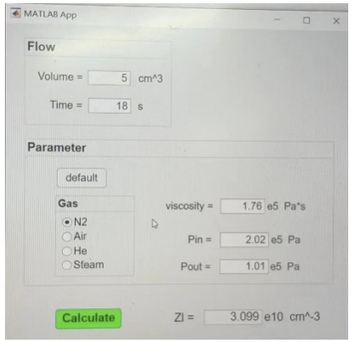




Customers

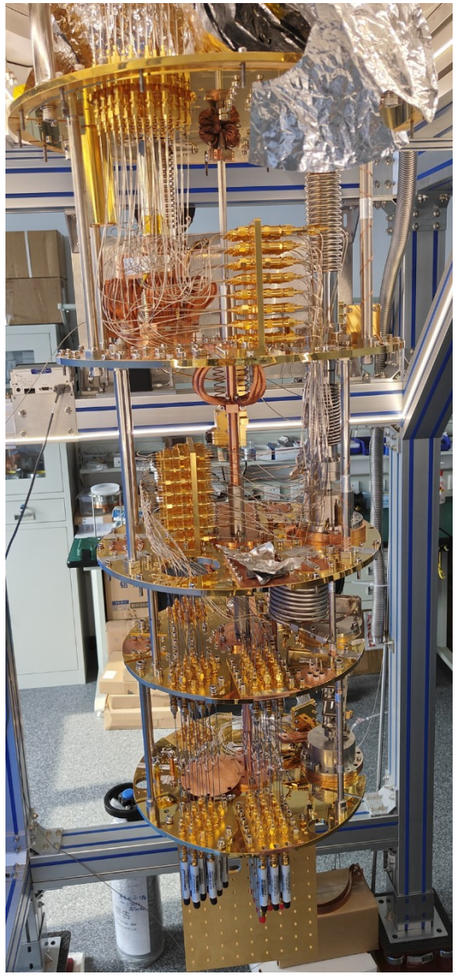
System application on γ-ray detector with SQUID and metallic magnetic calorimeter

Impedance replacement



VTI with optical window repairment

Customers



12mK @ MC bottom with 20 cables installed for superconducting quantum computing

Items	Specifications
Analysis Chamber	SUS316L standard steel with double μ-meatal linear inside
Residual Magnetic Filed	Typical value ≤ 5mGauss; Optimal value ≤ 1mGauss
Ultimate Vacuum	≤5E-11 mbar（ with sufficient pumps and long baking ）
Hemisphere Energy Analyzer	R200 Type
Mean Electron Radius	200 mm
Energy Range	0.5 eV ~ 1500 eV
Pass Energy Ep	1 ~ 200 eV ， Multiple options
Energy Resolution	≤1.8 meV FWHM @ Ep = 2 eV ， Ek = 9.1 eV
Angular Resolution	≤ 0.1°@ 0.1 mm Spot size
Lens Mode	Transmission mode, Angular mode
Angular Mode	±15° ， ±7° ， ±3.5°
Acquisition Mode	Fixed mode, Scanning mode
Sample Manipulator	Open (Closed) cycle 6-axes cryogenic manipulator
Lowest Temperature	Typical value 6K; Optimal value 4K
Cooling Method	Open-cycle or closed-cycle refrigeration
Linear movement	XYZ; Range customized; Best accuracy ≤ 2μm
Rotation	Polar, Azimuth, Tilt three degrees of freedom of rotation; Minimum step 0.001°
Manipulator Control	Fully motor drive; PLC control system; PLC and PC dual control interfaces
UV Source	VUV430-AF-MONO Type
Flux	≥1E14 phs/s
Applicable Gases	He ， Ne ， Ar ， Kr ， Xe etc.
Excitation Sources	Solid microwave source
Monochromator	Toroidal grating or Double crystal monochromator
Transfer Chamber	SUS 316L stainless steel; Customizable
Basic functions of Transfer Chamber	Sample transfer Ar+ gun for sample cleaning Annealing stage for heating treatment
Load Chamber	SUS 316L stainless steel; Customizable
Basic functions of Load Chamber	Fast sample loading Direct connection to glove box or suitcase
Baking System	Hot fan baking; up to 200℃
Control System	Real-time vacuum display, control and system protection