

Introduction of Sumitomo Heavy Industries, Ltd. and Cryogenics Business

Sumitomo Heavy Industries, Ltd. (<http://www.shi.co.jp>)

Founded: November 20, 1888
Incorporated: November 1, 1934
Business: Manufacturing of industrial machinery
Capital : 30,871.65 million Yen (as of March 31, 2011)
Employees: 17,025 (consolidated) (as of March 31, 2011)
Net Sales: 548,015 million Yen (FY2010 ending March 2011)
Head Office: Tokyo, Japan
President: Yoshinobu Nakamura



Head Office (Osaki, Tokyo)

[About Sumitomo]

Sumitomo's businesses originated from the [Besshi copper mine](#). Other than SHI, the companies are spread over a diverse range of business categories. The "Sumitomo's Business Philosophy" that has been inherited from the historical Sumitomo Family, is adhered to by these companies to this day.

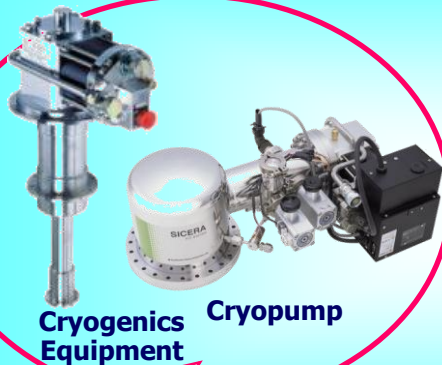
1. Sumitomo shall achieve strength and prosperity by placing prime importance on [integrity and sound management](#) in the conduct of its business.
2. Sumitomo shall manage its activities with foresight and flexibility in order to cope effectively with the changing times. [Under no circumstances, however, shall it pursue easy gains or act imprudently.](#)



Besshi Copper Mine

Product Introduction <By segment>

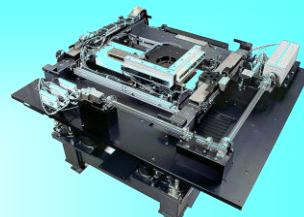
Precision Machinery



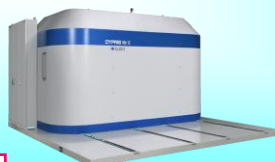
Cryocoolers for Superconductivity (MRI, R&D), Vacuum application as incorporated into Cryopumps (Semiconductor)



Proton therapy system



Precision positioning Equipment



Cyclotron PET



Plastics Injection Molding Machinery

Machinery Equipment



Power transmission equipment

Construction Machinery



Hydraulic excavators

Ships



Ships

Industrial Machinery



Logistics & handling system



Material handling system



Automated parking system



Turbines & pumps



Forging press

Environmental Facilities & Plants



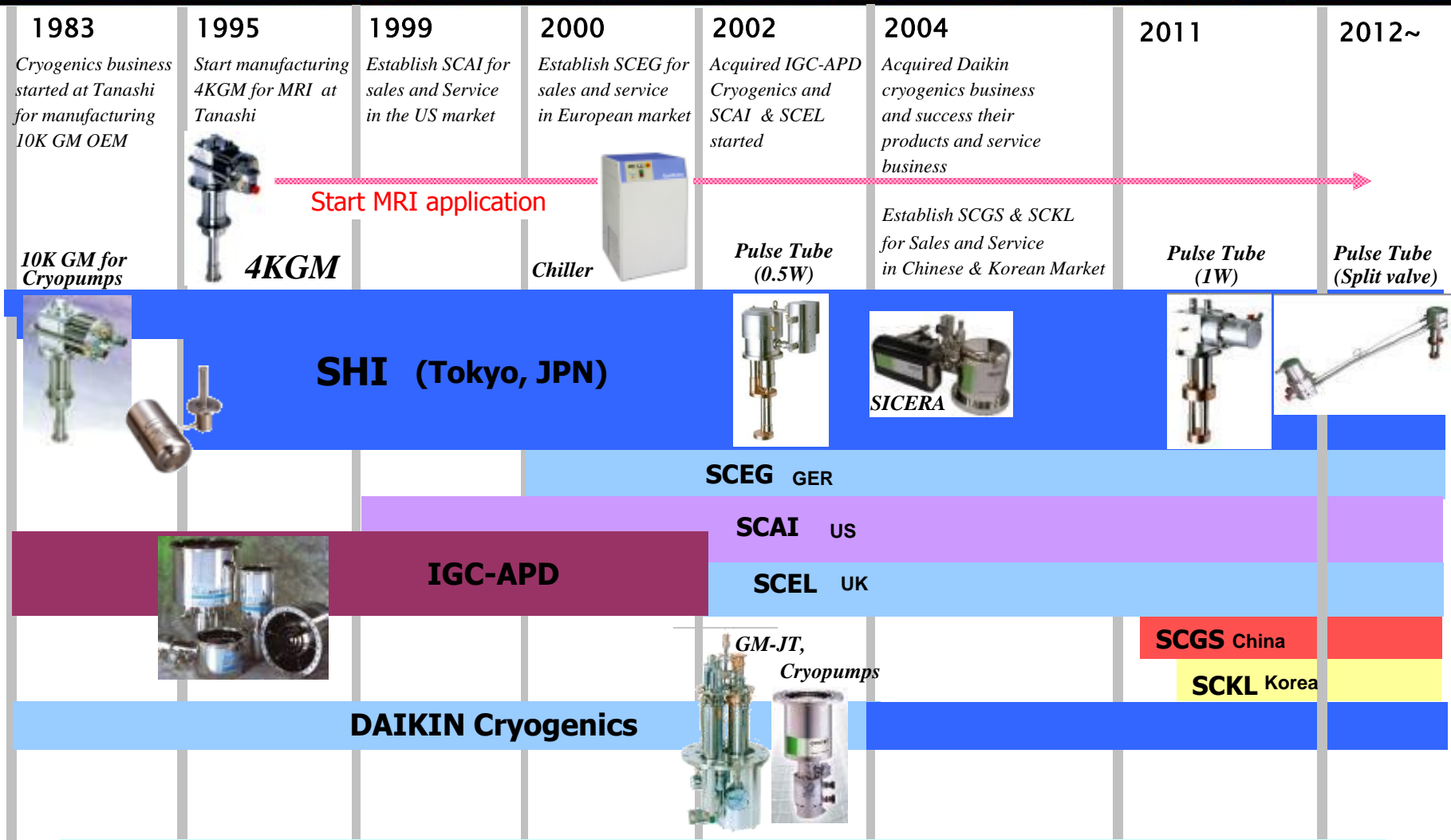
Water treatment system



Energy-related system

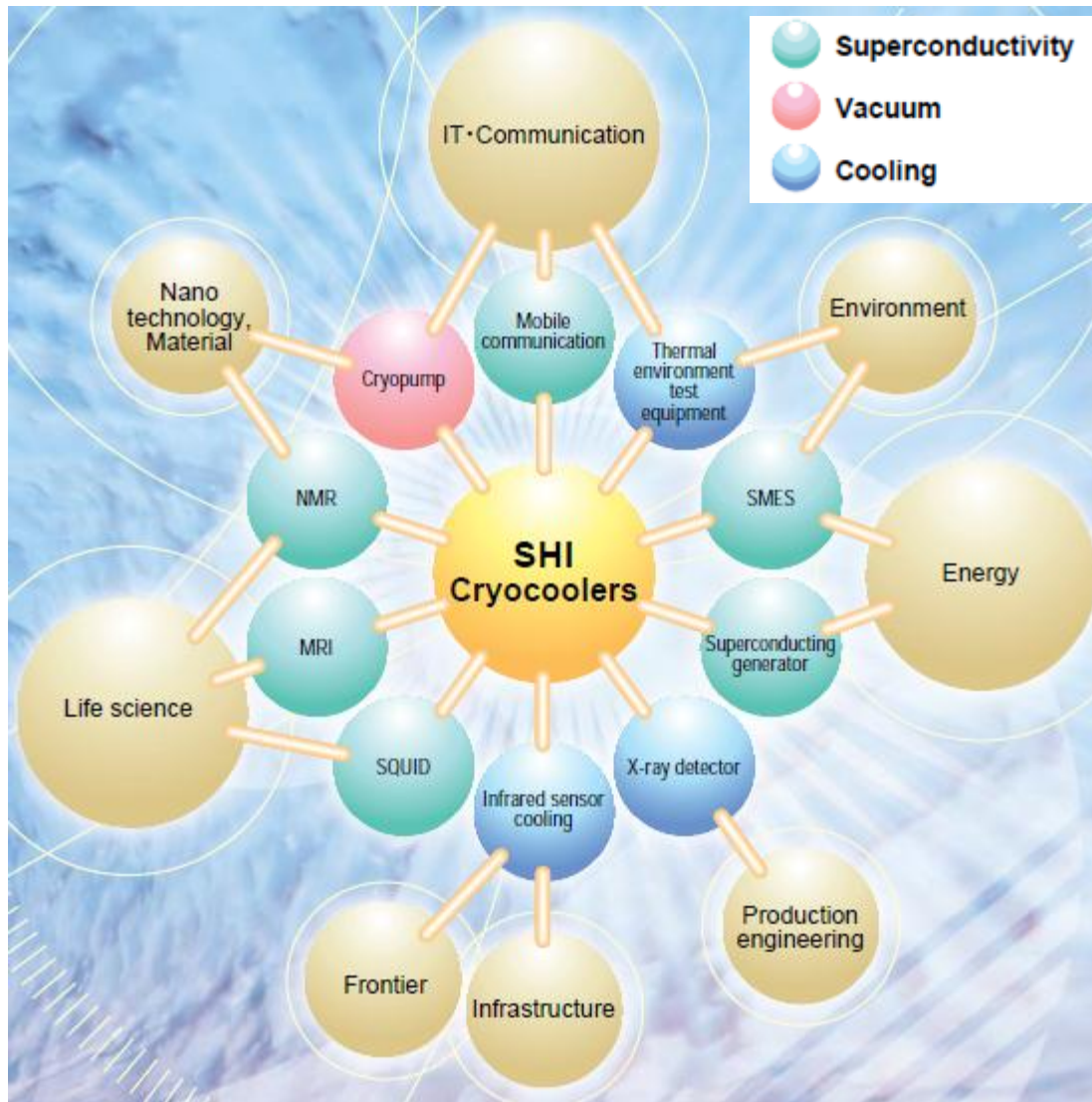
Introduction of Sumitomo Cryogenics

Sumitomo Cryogenics History



SHI Cryogenics group offers a wide range of Cryocooler and Cryopump products. As No.1 Cryocooler manufacturer, our mission is to provide "Quality Product" with our customers to make them satisfied and successful in their own business.

Cryogenics Application: Superconductivity, Vacuum, Cooling



【Superconductivity】

Creating Superconductivity

- Low temp.: 4K※~20K ※Kelvin
(-269°C ~ -253°C)
- High temp.: 40K~80K
(-233°C ~ -193°C)

【Vacuum】

- Ultra-High Vacuum Pump by cooling a panel inside a chamber (around at -260°C), where most of the atmospheric gases solidified
- Making a clean UHV atmosphere

【Cooling】

- Improving the sensitivity and/or resolution of measurement by cooling a sensor
- Creating a cold atmosphere for semiconductor wafer inspection

Applications of Cryocoolers

[Vacuum]

No.1 in Energy Saving

Vapor Deposition

Ion Implanter (SEN)

Sputtering (for semiconductor)

PET Cyclotron (Quantum Div.)

Creating 'clean' ultra-high vacuum environment

Cryopump (UHV pump incorporating Cryocooler)

Cryocooler No.1! [Superconductivity]

MRI

MCZ magnet (for silicon wafer)

Magnet for accelerator (SPRING-8)

Magnetic Separation

Creating Superconducting environment (*-269°C)

SMES (Supercon. Magnet energy storage)

[Cooling]

Astronomy (ALMA in Chile)

NMR (Nuclear Magnetic Resonance)

•Improve sensitivity

•Environmental test

Sumitomo Cryogenics Global Network



**R&D, Applications, Mfg,
Service and Sales**



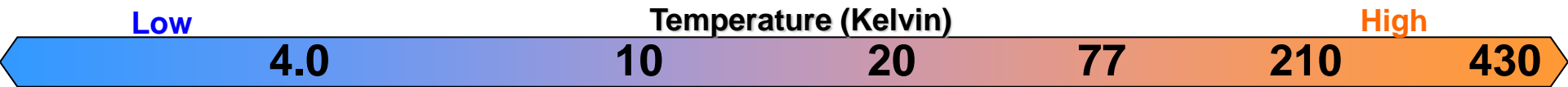
**Applications,
Service and Sales**



**Service
And Sales**



Mfg



**GM+JT
Cryocooler**



- Largest cooling capacity at 4K (only one manufacturer)
- Low vibration
- Low power consumption



Superconducting

- Single crystal silicon grower for wafer production
- SMES

**GM / Pulse Tube
Cryocooler**



- Compact 4K Cryocooler)
- Stable performance
- Orientation-free
- High quality, reliability
- Selection of 4K lineup



Superconducting

- **MRI application** (share >95%)
- Other **superconducting application** (industrial & research)

Cryopump



- Energy saving (multiple operation)
- Stable performance
- Shorten down time (large pumping capacity)



Vacuum

- Sputtering Equipment
- Ion Implanting Equipment (for semiconductor production)

**Stirling
Cryocooler**



- Small, compact (integrated)
- Low power consumption



Cooling

- Dew point meter
- Infrared Camera

Chiller unit



- Large capacity, wide temperature range (improving throughput)
- Energy saving
- Small footprint



Cooling

- Wafer Inspection Machine (Prober)

MRI (Magnetic Resonance Imaging)

- Recondensing liquid helium which cools superconducting magnet coils.
- 4K Cryocooler makes 'zero boil-off' possible which saves running cost of MRI



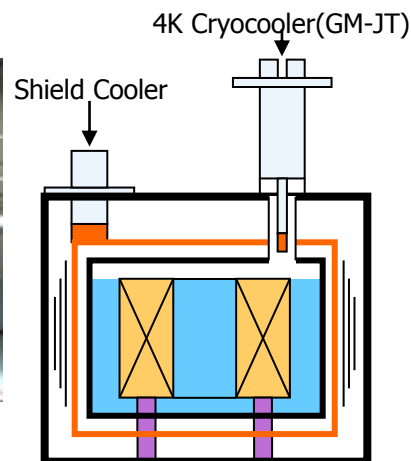
NMR (Nuclear Magnetic Resonance)

- 10K Cryocooler cools superconducting magnet of the probe head to improve resolution and measurement time



SMES (Superconducting Magnet Energy Storage)

- Recondensing liquid helium which cools superconducting magnet coils.
- 4K Cryocooler makes 'zero boil-off' possible which saves running cost of MRI



MCZ (Magnetic field applied CZ)

- 4K Cryocooler directly cools superconducting magnet coils
- No liquid helium required making operation and maintenance easier



Magnetic Separation

- High magnetic field used to remove weakly magnetic contaminants from mineral slurries
- 4K Cryocooler directly cools superconducting magnet coils



4KGM – Generation 3



- **Quality:** Improve from Gen.2 based on our enormous field experience and analysis
- **Cost:** Pursue lower cost
- **RoHs Compliance:** 1st 4KGM without lead regenerator material
- **Launch:** Targeted from Q4/2012

4K Pulse Tube Family

0.5W type 1.0W type 1.5W type	<p>Integrated type</p> <p>1st : 30W @65K 2nd : 0.5W @4.2K</p>	<p>Remote valve type</p> <p>1st : 20W @65K 2nd : 0.4W @4.2K</p>
	<p>1st : 40W @45K 2nd : 1.0W @4.2K</p>	<p>1st : 35W @45K 2nd : 0.9W @4.2K</p>
	<p>Under Development Under Development</p>	

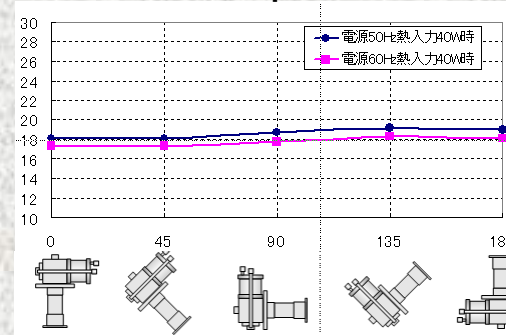
High Power 20K Single Stage



Engineering Model

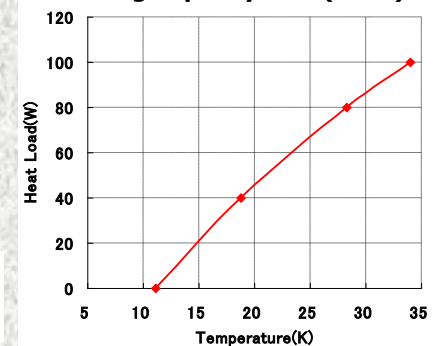
- Large cooling capacity at 20K (Target: 40W/50W at 50/60Hz)
- Orientation-Free
- Quieter
- Quality and reliability proven by Sumitomo GM technology
- Global network for customer support
- **Launch:** Targeted from Sep. 2012

Orientation Dependence Test



*Sample N = 1

Cooling Capacity Test (50Hz)

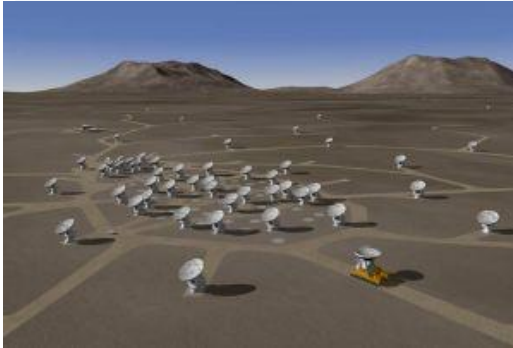


*Sample N = 6

Note: Target may change without notice.

ALMA

(Atacama Large Millimeter/submillimeter Array)



in Chile

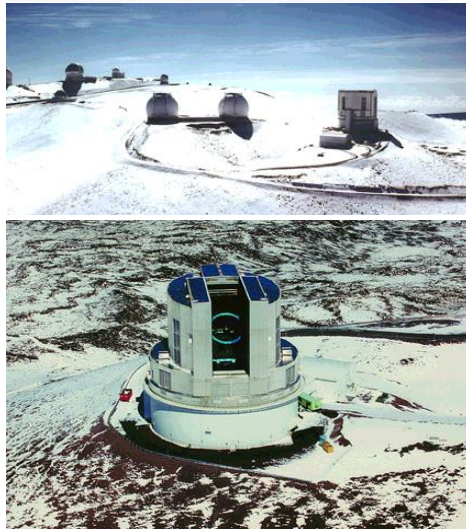
Mobile Anisotropy Telescope



in San Pedro

Subaru Telescope

in Hawaii



Cooling mid. infrared Camera and spectrometer

Nobeyama Radio Observatory

in Japan

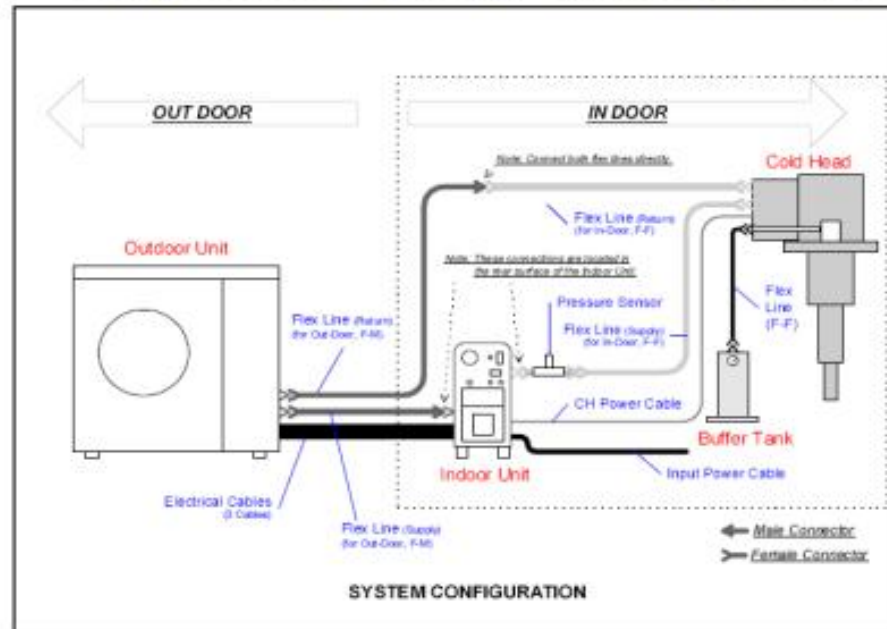


High Altitude Qualification Tests of the Cryogenic-System for ALMA

*Cryogenic- Laboratory at 5000m
above sea level on the
Chajnantor Plateau*



- 3-Stage Cold Head + He-pot on the 4K stage
- Air Cooled He-Compressors (Indoor/Outdoor)
- Low noise receiver are cooled to less than 4K
- Temperature Stability shall be better than $\pm 5\text{mK}$



- The Sumitomo Units together with Special designed components forming the Cryogenic System of ALMA

High flex He-Special He-Lines suitable operation in the elevation wrap (270.000 bending cycles / $r < 300\text{mm}$)



Protective enclosures for the He-Compressor Units

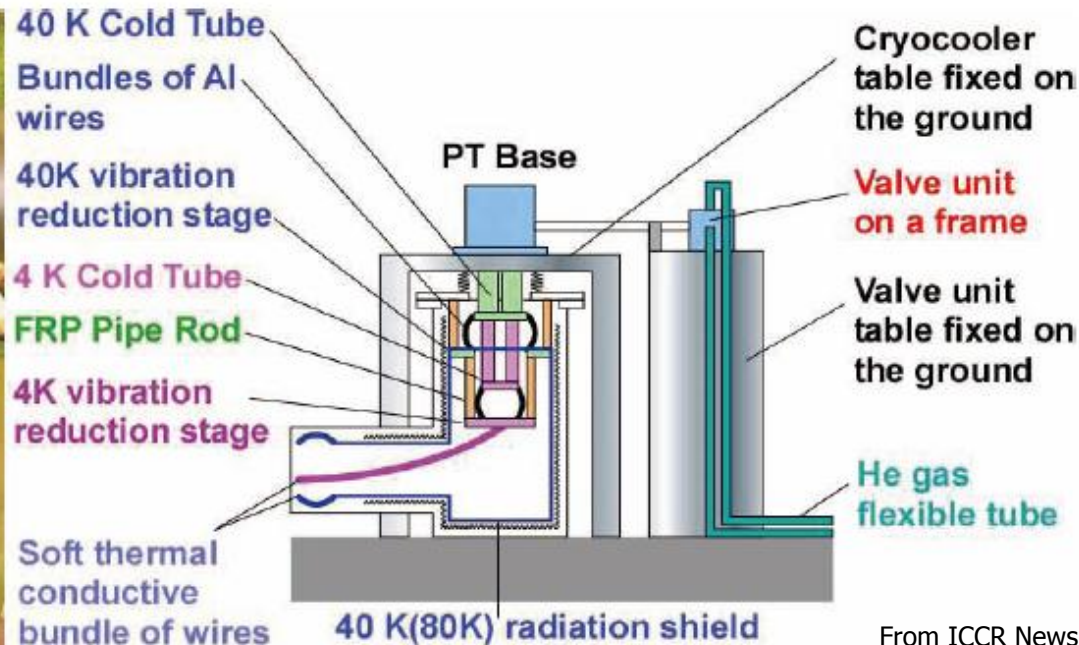
Cooling Low Temperature Mirror

Kamiokande Observatory



Courtesy of
Kamioka Observatory,
ICRR (Institute for Cosmic
Ray Research), Univ. of
Tokyo

Cryostat for Low Temperature Mirror



From ICCR News No.70 (Nov.1, 2009)

MARATHON[®] CP Series Cryopumps



CP-8LP



CP-250LP



CP-8



CP-12



CP-16



CP-20

Performance Specifications

	CP-8	CP-8LP	CP-250LP	CP-12	CP-16	CP-20
Air (liters/second)	1,500	1,800	3,000	3,600	4,800	9,700
Water (liters/second)	4,200	4,200	6,300	9,560	17,300	29,100
Argon (liters/second)	1,250	1,500	2,500	3,100	4,100	8,300
Hydrogen (liters/second)	2,300	3,000	5,000	7,300	12,000	14,000
Argon Throughput (torr liters/second)	11.0	11.0	11.0	12.6	11.4	11.3
Argon Capacity (standard liters)	1,200	1,600	1,600	2,000	5,500	6,000
Hydrogen Capacity (standard liters)	25	23	30	50	50	33
Crossover Rating (torr-liters)	220	220	300	650	500	400

Thank you



**Committed to providing the best in
Cryogenic Products and Services The
World`s Leading Supplier of Cryogenic
Cooling and Cryogenically Cooled Solutions**

