



# Indian Institute of Science Bangalore

Prof. Mayank Shrivastava  
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## Global Tender Notification for the procurement of Millikelvin dilution refrigerator setup

GTE Approval Number: IISc-GTE-2022-211

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**Request for Quote from Global Original Equipment Manufacturer (OEM) or their authorized distributor for Millikelvin dilution refrigerator setup**

**Indian Institute of Science, Bangalore  
(Last Date: 25<sup>th</sup> September 2023)**

Dear Sir/Madam,

Kindly send your best price quotation for the following item with various accessories on CIP, Bangalore basis to the undersigned. Your quotation should clearly indicate the terms of delivery, delivery schedule, payment terms, etc.

Your quote should also include mode of payment and should reach the undersigned, duly signed on or before 10.00 hours (IST) on 25<sup>th</sup> Sep. 2023.

The quote must include all details of technical specifications of the equipment along with the commercial terms and conditions, the bill of materials, printed technical brochure and any other supporting document. Vendors will be required to submit a technical proposal and a commercial proposal in two separate sealed envelopes. Please enclose a compliance certificate, printed on your letter head, along with the quote. The commercial bid must be in CIP Bangalore and the quotation should address to:

The Chairman,  
Department of Electronic Systems Engineering  
Indian Institute of Science, Bangalore – 560 012

### I. Technical Specifications of Different Parts of Millikelvin dilution refrigerator setup

The general specification of the dilution refrigerator system that can be integrated with quantum measurement and control setup is as below:

#### Main System Specifications:

Base Temperature	10 mK
Cooling power at 20 mK	12 $\mu$ W
Cooling power at 100 mK	450 $\mu$ W

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Cool down time	< 25 hrs
$^3\text{He}/^4\text{He}$ requirement	Upto 18 litres
Pulse Tube refrigerator (High voltage)	1.5 W

- This base temperature should be achieved with factory-installed wiring and RF cabling
- Gas and instrumentation control racks should also be included
- Closed cycle operating system is needed.
- Compressor and Dewar need to be included in the main system
- The system should include the secondary insert so that we can customize the number of DC and RF lines later.
- Outer cans, frame and outer vacuum chamber should provide the shielding of external magnetic field.
- Layout should be customizable.
- Please provide the plots of measurements of the system performance (such as cool-down vs time) clearly specifying the conditions under which the measurement was conducted.
- The system should have an appropriate amount of  $^3\text{He}/^4\text{He}$  mixture to achieve the above-mentioned parameters. Please specify the amount of  $^3\text{He}/^4\text{He}$  gases.
- There should be at least 240 mm of vertical space beneath the mixing chamber plate and the cold plate at the mixing chamber must be at least 290 mm in diameter (till the inner most radiation shield).
- Temperature Controller: Fully automated temperature control with appropriate temperature sensors, heaters and heat-switches.
- Appropriate cold traps are required to run the refrigerator for extended periods of time (more than six months) without circulation loop blockages.
- Very less mechanical vibration in both horizontal and vertical directions at the mixing chamber plate while the fridge is in operation.
- Pulse tube should have mechanical vibration isolation from the rest of the cryostat. Pulse tube and compressor should be electrically isolated from the cryostat.
- Automatic cool down to base temperature. Safety interlocks allowing unattended operation; remote control operation; continuous monitoring and logging of the system parameters.
- Control software should be based on Windows 7 or higher version operating system architecture. Free upgrades of software.

## Magnetic System

Type	Superconducting solenoid
Strength	12 T
Bore size	70-80 mm

- Power supply of magnet should be also included
- Magnet should be added such that we should be able to detach the magnet and do measurements without



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any magnetic field

- System must be setup such that a magnetic can be attached later or customized later.

## RF Lines:

- The system should include 10 RF lines
- RF lines should be semi rigid with operating frequency in GHz range(18GHz and 40GHz).
- 10 CuNi-CuNi from RT to 4K
- 10 NbTi-NbTi from 4K to 10mK (mixing chamber)

## DC Lines:

- Number of DC lines required=24
- DC lines should be semi rigid
- 24Cu from RT to 4K
- 24 NbTi from 4K to 10mK (mixing chamber)

All wires should be terminated with suitable connectors at room temperature, 4 K plate, and at mixing chamber plate. All wires should have proper thermal anchoring at each temperature stage.

## Other Necessities

- Heat sinks for both DC and RF lines
- Vibration at sample, Cooling time with and without magnetic system must be mentioned
- Should include a written guide (tutorial) as well as a demonstration of how to integrate numerous components of the Dilution refrigerator.
- The setup should include all the hardware and software modules that are necessary for the system setup.
- Please provide the details about the required equipments that need to be purchased separately (if any).
- Packing freight and Installation cost should be included.

## II. Optional Items

- Other magnetic system configurations up to 14 T. Please mention cost difference for all such magnetic system configurations. Please also provide the expected cool down time for all such magnetic system configurations.
- Mention the cost reduction if 8T and 5T magnet is selected instead of 12T.
- Warm up heaters to reduce the warm up time from base temperature to room temperature.
- Fast sample exchange (Bottom loading option) addition to the dilution refrigerator, which can allow us to keep the system at 4K and load the sample from the bottom.
- 0dB,10dB and 20dB attenuators should also be provided with the system. More importantly these attenuators must be detachable.
- All other connectors, wirings, isolators and directional couplers must be included.
- Please provide a separate letter indicating annual maintenance charges (AMC) post warrantee / guarantee period.

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### III. Additional Items (Must be added to compliance certificate as well):

1. Support: Please provide details of support provided within the warranty period
2. Shipping: The quote must be in CIP, Bangalore.
3. Installation: Please list a set of acceptance tests for on-site (vendor) inspection and after installation at IISc Bangalore.
4. Other Options: Necessary spare parts should be quoted as an option.
5. Please include any other options currently available that can be added on in the future.
6. Training: Please state if training is required to operate this instrument, and if yes, please highlight the extent of training provided as part of this purchase and for how many days.

**All of the above-mentioned technical specifications are highly desired. However, lower technical specifications may be considered if the above-mentioned specifications are found to be unsuitable in financial terms. The Institute reserves the right to go for lower specifications taking into consideration its technical preferences and financial constraints. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.**

### PI Terms and conditions (should be included in compliance certificate):

1. Necessary training to operate the procured setup and required literature support should be provided without additional cost.
2. In principle onsite installation should be free of cost. The amount of time / day committed by the engineer during installation must be clearly stated.
3. Software upgrade, if any, must be free of cost for next 5 years.
4. The vendor must assure that there are no bugs and glitches with the integration. In case of glitches or bugs at the time of installation, vendor must fix the issues in less than three days from the start date.
5. In case of hardware/software issues or support, vendor should be able to provide required solution within three days.
6. All equipment must be well calibrated before and after installation.
7. Additional quote for an annual maintenance contract should be included for the next 5 years.
8. The vendor should have a good track record of delivering such equipment at universities/research institutions (please furnish the details).
9. Please provide list of customers who have procured your equipment in last 5 years.
10. The vendor should be able to repair and maintain the equipment, once it is installed in India. No travel claims must be made by vendor for servicing during the warranty/guarantee period.
11. The lead time for the delivery of the equipment should not be more than 2 months from the date of receipt of our letter of intent. The smallest lead time will be appreciated. Our expectation is shipment immediately after PO and full or part payment post installation.
12. On all systems the payment terms will be specified in the commercial proposal and is subject to negotiation.
13. The validity period of the quotation should be 90 days at least.



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14. Please provide details of the number of trained personnel in India, who can service the machine.
15. Highlight the system/computer requirement to integrate the setup, if any other than specified in the specifications above.
16. See other Terms & Conditions in enclosed document in the next pages.

Sincerely,

Prof. Mayank Shrivastava  
Associate Professor  
Department of Electronic Systems Engineering,  
Indian Institute of Science,  
Bangalore, Karnataka 560012, India  
Secretary (Ms. Rekha's) Contact: 9972525771  
(On Behalf of Purchase Committee)  
Email: [msdlab.es@iisc.ac.in](mailto:msdlab.es@iisc.ac.in) (for tender related queries)