Annexure A

Technical specifications for the Protein Crystallography system

Specifications	Compliance/Remarks/Deviations if any
X-ray generator: Rotating anode **Source:** Cu **Power**: 2.5 kW or higher **Microfocus:** 70 µm focal spot size at the anode or lower **Beam diameter:** Focal spot (smallest beam size) at sample position should be 100 µm or lower. **Mean Flux Density:** $1x10^{12}$ photons/sec/mm^2 or better at 50 µm pinhole diameter (sample size). A minimum flux of $2.5x10^{11}$ photons/sec/mm^2 or better at 100 µm pinhole diameter (sample size) should be demonstrated during the installation with a special detector and a 100 µm pinhole. The pinhole and the detector should be supplied along with the equipment. A factory certified flux of $1x10^{12}$ photons/sec/mm^2 is mandatory. **Ports:** Dual port. Equal intensity/flux on both sides. Should be upgradable with second detector later. **Beam divergence:** Should be ≤10 mrad, suitable for macromolecular crystals with large cell parameters. **Resolution:** Highest resolution achievable for a typical macromolecular crystal should be mentioned in the technical quote and demonstrated at the time of installation using a test crystal. **Stability**: Stability of X-ray source and the beam over different time periods of continuous usage should be mentioned.	
Chiller: Low maintenance chiller and other necessary accessories to be included.	
X-ray optics: The optics should ensure high spectral purity (>98% for Cu Kα). Capable of automatic beam intensity and beam divergence angle optimization with software control for crystal diffraction screening. Beam alignment kit, including a PIN diode should be provided. Beam divergence angle should be adjustable automatically with software (between 10 to 1 mrad). Should be operating under vacuum to prevent radiation damage of the mirrors.	
Goniometer: Highly accurate and fast four-circle kappa goniometer for higher resolution data collection in a shorter time. **Speed:** Details should be mentioned in the quote. **Sphere of confusion**: < 10 µm **Beam stop:** Manual or motorized. **Collimator:** Multiple ones to be provided as per the system requirement.	

Goniometer head: Manual with magnetic base. Should be upgradable with automated head for crystal centering and multiple sample screening with robotic sample changer. **Note:** Must ensure easy mounting of previously cryopreserved crystal and recovery without having to remove any parts.	
Detector: Flat or curved. Capable of higher frame and count-rate performance, wide dynamic range, and high signal/noise ratio. High quantum efficiency. Type: Direct photon counting HPC/HPAD detector for shutterless and faster data collection. Active area (W x H): 77 x 79 mm or higher. Pixel size: 100 µm or less. Speed: The detector should be able to collect data quickly. Read-out time of < 1 µsec. Humidity: Should be operable at a larger range of humidity, at room temperature, that may vary from season to season.	
Crystal viewing/centering: Color video microscope with display screen for crystal viewing/centering with cross-hair to be provided with optimum cold light source and to be housed within the safety enclosure.	
Software: User friendly software suite for data collection, automated data collection strategy, data indexing, integration, scaling & reduction. Software should control all components which are X-ray generator, goniometer, detector and accessories such as cryo-device. Software should be upgraded without additional charges up to equipment lifetime. Images should be exportable and readable by third party software such as HKL2000/3000, autoPROC, iMOSFLM, DIALS and XDS. This capability is to be demonstrated at the time of installation and training. The data collection software should be capable of automatic data collection strategy using the parameters obtained from the screening experiment, with optimized crystal to detector distance, exposure time and goniometer management within a shorter time. The software should come with site license that enables installation on any number of computers at ICGEB. The cost for upgrade of existing license for HKL3000 (licensed to ICGEB) or purchase of new license (for 5 years) in the name of ICGEB to be borne by the vendor.	
Polarizing stereo zoom microscope: with 10 x eye pieces, objectives (1x and 2x) for mounting crystals (> 5 µm size) form 96-well and manual crystallization plates and should come with a color camera (5 megapixel resolution or better). To be housed inside the enclosure.	

Cryocooling system: Latest system with necessary accessories such as autorefillable LN_2 tank (60 L, 1 quantity) with LN_2 storage tank (150-160 L, 1 quantity) for refill with pressure regulator, transfer line and necessary accessories. Should have software controlled and programable remote annealing capability without physical manipulation. Capable of auto optimization of shield gas flow rates and auto diagnostics and eco mode. Temperature range 80-400K. System should be capable of running at 100 ± 0.1 K without ice formation on the sample and the pin.	
Mandatory accessories: 1) Additional collimators (one quantity each), if manual, beam stop (1 quantity), goniometer heads (if manual, 2 quantity) with magnetic bases. 2) Anode -1 quantity. 3) One additional cryo-cooling system accessories/spares as back up for seamless operation of the X-ray data collection with less than 3 days of down time.	
Enclosure: Should have fail-safe system (interlock switches) to ensure safety. X-ray leakage should be less than 1.0 µSv/h at 10 cm distance or lesser distance. Should be transparent and spacious enough to accommodate a microscope for crystal mounting from the table.	
Remote access for diagnosis and maintenance: The system should have capabilities for remote access by the manufacturer or authorized vendor to diagnose and troubleshoot problems from remote.	
UPS: Brand new online continuous "double-conversion" operation UPS that will meet the need of the system with minimum 60 minutes of backup power. Should come with built-in isolation transformer and event logging capability. Must be from branded manufacturer such as Eaton/Vertiv. Should have EMI/RFI filtering. Batteries should be provided along with the UPS.	
Computer and monitors: (2 quantities each of below configuration) CPU: Intel Core i9-132900K (or a CPU with higher number of cores for data collection and faster data processing) with built-in graphics. Storage: 1 TB PCIe Gen 4 NVMe M2 SSD and 4 x 10 TB (72000 rpm Enterprise edition) HDD GPU slot: PCIe NVMe slot for full size GPU RAM: 32 GB DDR5 (in a single or two DIMM architecture) OS: Compatible with data collection and processing software. Monitors: 27”or higher curved LED monitors (2 quantities, Full HD) Keyboard and optical mouse.	

Data storage and Management: A NAS storage device (disk station with memory and storage populated) with the following specifications: CPU Capacity: Quad-core > 2.0 GHz RAM: 32 GB (Single or dual DIMM) Cache acceleration: Dual PCIe NVME M2 slots (SSDs optional) Ports: USB 3.2, 1/10 GB Ethernet ports. Storage Capacity: up to 96 to 100 TB, populated with enterprise edition 3.5" HDDs 7200 rpm, hot swappable and RAID10 capable. Drive bay: Minimum 8 with expansion capability. Software: User friendly and automated backup utility mandatory. File system support: EXT4	
Site modification: Appropriate site modification, including air-conditioning, humidity control, to house the entire X-ray data collection system along with UPS, should be given along with the technical bid. **Please do site visit before submitting the quote.**	
Warranty: 5 years (including consumables, parts, and labor). Warranty will start from the date of handing over the fully functional unit to the ICGEB, against manufacturing defects of material and workmanship. **Note**: Downtime due to natural calamities and unforeseen pandemic outbreak such as COVID-19 will have to be adjusted to make warranty to 5-year period. ICGEB will not be responsible for longer delays if parts must be sent back to the manufacturer for any repair abroad. **Post-warranty CMC and AMC**: For additional 5 years (6th-10th year) should be quoted as optional.	
Response time: Complaints should be attended within 24-48 hrs, and through 24/7 online support.	
Manpower: A full-time company (OEM) onsite trained technician should be provided by the vendor for the smooth operation of the entire X-ray data collection facility for 5 years. Salary to be borne by the vendor.	
Future upgrades: System should be capable of upgradation such as automatic sample mounting and crystal screening from plates.	
Gas cylinders: Helium or other gas cylinders (2 numbers) to be provided, if required to run the system, along with regulators. All gas cylinders to be housed outside the building.	
Certificate for spare availability up to 10 years for the quoted model to be provided along with technical bid.	
Authorization certificate from the OEM must be included in the technical bid.	
Unpacking and shifting of the instrument, including manpower during installation must be in the vendor scope.	

Site inspection certificate to be enclosed in the technical bid duly signed and stamped by the supplier.	
Company must provide a compliance statement supported by technical literature and website.	

Addition instructions/specifications:

1) **Vendors can quote multiple configurations with different technologies for all components.** The cost of each component should be provided clearly in the price bid, giving a complete break-up. The vendor will take responsibility for the integration of different components of the system and complete responsibility for the functioning of the entire system. All the components of the facility should be installed by factory-trained engineers and run seamlessly to provide optimal data from test crystals. In-depth on-site training for a minimum of 5 days should be provided to personnel managing the facility, and to the users to render them capable of operation and routine maintenance of all components. The Director, ICGEB New Delhi, reserves the right to award the tender in full or in parts. Failure to comply with this condition will entail rejection of their bid.

2) Postwarranty comprehensive maintenance contract (CMC): The postwarranty (after 5 years) CMC should be quoted for spares and labor for the complete system, which includes all the accessories supplied, such as UPS, etc. Spare parts: Separate price list of all spares and accessories and consumables, if any (including minor), required for maintenance and repairs in the future after the guarantee/warrantee period must be attached/enclosed along with the sealed quotation (financial bid) failing which quotation will not be considered. If any spares and accessories other than the ones mentioned in the price list attached/enclosed by the firm are required for future repair, it will be borne by the firm only.

3) Spare and service certificate from OEM: A certificate must be provided from OEM for the availability of spares for the quoted model for at least 10 years.

4) All locally sourced items should be quoted in Indian rupees. Other items should be quoted in respective foreign currencies. The technical and financial bids should be separately sealed in distinct envelopes and clearly marked. NOTE: Failure to comply with this condition will entail the rejection of the bids. The price comparison shall be made considering the basic price and post warranty CMC.

5) The quoted equipment should be of international standards, and examples of successful installations in India and elsewhere for each of the components: generator, detector, and cryocooling systems should be provided. Attachment of feedback from the Indian/foreign users of the quoted equipment (in parts or full) would be appreciated.

6) The vendors are required to quote the mode of shipment by Air/Sea. Should give separate breakages of freight and insurance charges.

7) The supply of equipment implies supply, installation and commissioning at the site. No separate charges will be paid.

8) Uptime guarantee: The supplier should provide an uptime guarantee of 95% during the warranty period of 5 years.

9) Downtime penalty clause: During the guarantee/warranty period, a desired uptime of 95% of 365 days is needed. If the downtime is more than 5%, the institute shall be entitled to impose a penalty in the form of an extended warranty period equal to twice the downtime period. The vendor must undertake to supply all spares for optimal upkeep of the equipment for at least TEN YEARS after handing over the unit to ICGEB. If accessories/other attachments of the system are procured from the third party, then the vendor must produce the cost of accessory/other attachment and the CMC from the third party separately along with the main offer, and the third party will have to sign the CMC with the ICGEB if needed.

10) The original equipment manufacturer (OEM) shall guarantee to ICGEB in the form of a certificate that their Indian branch or International/Indian distributor will supply and maintain the equipment for a minimum of 10 years from the date of installation. If a dealer ceases to exist within this period, the OEM shall be responsible for appointing a new distributor (or) provide Warranty/CMC/AMC/maintenance services directly in accordance with the original purchase agreement. A certificate should be provided by the OEM.

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