INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION

PR NO. 1000049023 **RFx No. 6100002310**

Technical specifications for High-Capacity 3D X-ray Microscope (1 Unit)

Sr. No.	Description	Value / Range	Technical Compliance (YES / NO)	Additional Information (if any)
1.	**Key Generic Requirements:**			
1.a.	The tenderer must provide an installation scheme showing the physical space (footprint) of the machine(s) as well as space re- quired for routine access and all installations including the MFCs (Mass flow controller), and other related accessories.			
1.b.	The vendor should have installed similar types of systems in centrally funded technical institutes or government research labs. Purchase order (PO) and user list should be provided as supporting evidence.			
1.c.	The compliance sheet should be provided by the vendor. Failure to submit the compliance sheet may result in the rejection of the bid.			
1.d.	For each compliance, supporting evidence such as manuals and other necessary and supporting documents needs to be provided.			
1.e.	The vendor should have an Indian representative who can take care of the urgent troubleshooting or any process-related queries on an urgent basis.			
1.f.	Radiation Safety features like interlocks to prevent errors in operation, emergency shut-down options, and necessary protocols should be separately mentioned.			
2.	**Technical Specifications (Generic):**			
2.a.	The system must be cleanroom compatible.			
2.b.	The machine must be software-controlled with appropriate software and hardware interlocks to protect the machine from any possible operational or non-operational failure, thereby ensuring the safety of the operator and the machine.			
2.c.	The system must contain all the necessary sensors and controls to aid in safety monitoring, performance monitoring, automatic operation, and diagnostics. A complete set of system operation and maintenance manuals must be provided.			
2.d.	A library for materials that can be processed by the machine and well-documented by the company must also be included.			
2.e.	The control computer system/PLC should be state-of-the-art with a pre-loaded operating system and the software required to run the machine. The control panel must contain all the buttons needed to operate the machine.			

2.f.	The software must allow for configurable user groups with different access privileges. Three different modes: operator, engineer, and admin should be provided for easy and safe tool handling.			
2.g.	The software must provide complete system monitoring and recording of full system states in log files.			
2.h.	The system must provide access to sample process history and security protocols.			
2.i.	The system must provide system fault detection and diagnosis.			
2.j.	Automatic and manual control modes should be available in the software. The system should provide programmable control over all the X-ray imaging parameters.			
3.	**Technical Specifications (Specific):**			
	Component Name:	**Specifications:**		
3.a	**X-Ray Source**	170 kV, 20W power or higher with detailed detectability up to 200 nanometers or better Open Type (Filament replaceable)		
3.b	**Detector**	*High contrast detector with below specifications:* • Pixel size: 140 µm or better • Sensitive surface: approximately 200 X 200 mm² (8" X 8") or higher • Greyscale resolution: 14 bits or higher		
3.c	**Sample Manipulator**	*5 Axis Sample Manipulator with below specifications:* • Traverse path (X-Y): for sample movement • Z axis for Geometric magnification: up to 1800-fold or more for 2D inspection • For 3D - Geom. magnification: 90X or higher • Max. voxel resolution: down to 2 µm, resolution depending on the sample size. • Oblique angle (detector tilt) 0°-60° or higher • R-axis: Rotation (turntable) n X 360° • For 3D CT FoV should be Ø 60 mm x 60 mm or larger for a maximum sample size of Ø 250 mm x 180 mm • Sample size for 2D should be 450 mm x 350 mm or higher • Sample weight carrying capacity: 2 kg or higher for 3D and 9 kg or higher for 2D • Laser based Positioning assistance		

3.d	**Software**	• Software should be comprehensive control software package for tomography applications. The software should control all components of the CT system (such as the tube, detector, manipulation) and should permit the control of all relevant steps during CT measurement, such as the creation of projection data sets, reconstruction of volumes, visualization of volumes and projections. **Main required features:** • Recording of projections, single view, quad view, zooming, interpolation, etc. • Automatic detector correction (offset, gain, and defective pixels) • Image processing tools and projection filtering • X-ray tube control and monitoring • Complete control and monitoring of manipulation • Automatic optimization of high-resolution CT scans • Completely automated acquisition and reconstruction of multi- scans, • Automated piecewise reconstruction of large volumes • "Regions of interest" with samples for which full 360° rotation is not possible can be viewed • Quick CT recordings without the sample being stopped • Module for automated analysis of BGA solder joints • Module for automated inspection of IC die attach • Module for automated voiding analysis of C4 bumps • Semi-automated inspection of IC multi-layer PCBs • Report generation into PDF directly • Inspection for Quad Flat Pack-age, Quad Flat No-Lead, Plated Through Hole • VG Software basic for 3D visualization, even of very large CT data sets – with almost no limit on data quantity • Real-time ray tracing for a photo-realistic look • Combined visualization of voxel and polygon data • Arbitrary orientation of 2D slices • 2D slice rotation view around a customizable axis • Gray value classification of data set		

3.e	**Reconstruction / Visualization Workstation**	• High-end workstation based on the latest high-end processor technology (Multicore Design). • 40" Ultra HD Monitor or better • future-oriented 64-bit hard-ware and software technology • CPU (state-of-the-art Multi-core design) • Min 32 GB main memory • High-end graphics processor optimized for using visualization software and accelerated CT reconstruction • Internal data exchanged by Gigabit-LAN • 2 X 2 TB HDD • Keyboard Language should be English		
3.f	**Filament**	Pre-calibrated filaments should be sup-plied along with the system.		
3.g	**Customer Details**	The supplier should submit details of a minimum of 2-3 customer users of a similar type of X-Ray Micro-CT System		
3.h	**Service Support**	The supplier should have proper Ser-vice Support in India, and contact de-tails of the Service Team should be shared.		
4.	**Process Demonstration:** The vendor must demonstrate that high resolution 2D & 3D X-ray Imaging system functionality, performance criteria, and compliance with safety standards. Radiation leakage should be less than 1 micro Sv/hour. The vendor should provide the AERB (Atomic Energy Regulatory Board) NOC or approval for the offered model.			
4.a.	**X-ray Generation and Imaging Tests:** • Perform X-ray beam generation test and confirm stability. • Verify 2D & 3D reconstruction functionality.			
4.b.	**Motion Control and Sample Handling:** • Test the movement and precision of the sample stage. • Check sample loading and unloading			
4.c.	**Radiation Safety Compliance:** • Measure radiation leakage and verify compliance with safety standards. – Demonstrating at the time of installation. • Confirm proper functioning of shielding and interlocks. • Review emergency shutoff and safety protocols.			
5.	**Packaging and Shipment:**			
5.a.	The X-Ray system should be securely packed to prevent damage during transit, with all fragile components properly protected and adequately cushioned.			
5.b.	The packaging should include necessary documentation, installation manuals, and a list of included components.			

6	**Acceptance Criteria:**		
6.a.	**Site Acceptance Test (SAT):** The system must undergo SAT at the IITB site, replicating the fac- tory acceptance test parameters with the following: **Performance Verification:** • Imaging of BGA bumps in flip chip assembled commercial packaged IC on PCB/board (packaged IC about 10-20 mm x 10-20 mm), PCB compatible with maximum sample size in the tool • Imaging of solder bumps in flip chip assembly on substrate. Bump size 100-200 um in diameter. • Void detection resolution down to 300 nm (sample to be brought by the vendor) Samples for BGA and solder bumps will be provided by the customer • Compare obtained results with specifications. • Conduct repeatability and reproducibility tests of one or two samples. • Verify system throughput and acquisition speed. **Radiation Safety Compliance:** • Measure radiation leakage and verify compliance with safety standards. • Confirm proper functioning of shielding and interlocks. • Review emergency shutoff and safety protocols. **Site Acceptance Criteria:** • All components and accessories should be present in good condition. • Software should be functional, and all controls should respond correctly. • X-ray beam should be stable, and imaging quality should meet specified standards. • Motion control and sample handling should be accurate and reliable.		
6.b.	**Installation and Qualification:** Installation and on-site qualification of the system by the OEM.		
6.c.	**Training:** On-site operational training for two engineers, covering system operation, minor troubleshooting, maintenance, and process control.		
6.d.	**Warranty:** One-year standard warranty.		
6.e.	**Application Details:**		
	The application for the system is given below. • Enables non-destructive 2D & 3D imaging of internal structures in metals, ceramics, and composites for failure analysis and quality control. • Examines microstructures of PCBs, microchips, and advanced electronic components to detect defects. • **Assembly & Packaging:** Ensures the integrity and precision of assembled components and sealed packages by detecting voids, misalignments, and structural defects using high-resolution 3D imaging.		