INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

MATERIALS MANAGEMENT DIVISION

PR NO. 1000051456 **RFX No. 6100002604**

Technical specifications for Laser with Photon Counter Module System for Single Photon Detection (1 Unit)

Sr. No.	Description	Value / Range	Technical Compliance (YES / NO)	Additional Information (if any)
1.	**Laser with Photon Counter Module System tool for Single Photon Detection in Single Photon Avalanche Photodetectors (SPADs): (Itemized pricing of each component should be provided)**			
1.1	**Laser Picosecond**	• Available wavelengths: 635nm • Spectral width ± 10nm • Pulse duration down to 50ps (FWHM) • From 1KHz up to 80MHz repetition rate • Up to 150mW pulse peak power • Average CW power at 80MHz > 1mW • Single-mode fiber coupled module (FC/PC type) • External and internal digital sync trigger available (LVTTL 2.5V @ 50Ohm and LVDS interface) • Desktop-size-compact (135×110×50 mm) Light weight (510g		
1.2	**Fiber Based Delivery System**	• Attenuation range 0-100 db, optical path to tune down power to mW level- • 90:10 fiber splitter for 635nm ps laser source • Power attenuator • 50 : 50 fiber splitter for 635nm ps laser source		

1.3	**Reference Photon Counting Device**	Wavelength: 200-1060nm • Dead time: 50ns • After pulse:3-8% • Dead time step: QE@700nm ~ 65%, • Dark count 200-500 cps		
1.4	**TCPSC - Pulse generation unit**	• 4 pulse outputs • 8 delay outputs (opt.) • Resolution 5ps • Output jittering < 25 ps rms • Trigger rates to 10 MHz • Transition time <2ns • Output level: 5.0 V		
1.5	**Photon counting receiving**	• 5 input channels • Time jitter <4ps • Max DNL (rms) <0.2ps • Minimum time bin width :1ps • Maximum count rate 300Mhz • Input voltage range -2V to 2 V • 4 Output Channel • Min. output pulse width: 6 ns (TTL), 1 ns (NIM) • Max. rate per output channel 250mhz		
1.6	**Voltage to current conversation unit**	• Custom PCB to convert SPAD current into voltage • 1 gate input (SMA) • 1 bias voltage input (SMA/screw terminal) • 1 photon voltage out (SMA) • 2 I/O to cryostat for interfacing with SPAD (SMA)		
1.7	**Fiber Reference power meter**	•Wavelength range 350-1100nm •Power range 100pW to 5mW		
1.8	**Reference Sample**	A reference sample to test the system configuration along with the mentioned specifications should be provided.		
1.9	**Software integration**	Computer control of TCSPC, bias voltage, picosecond laser. Suitable computer system should be provided.		

1.10	**Customized Temperature Chamber**	• Cooling method: LN2 • Electronic signal level: pA level • Temperature range: -190℃ to room temperature • Temperature accuracy: ±0.5℃, resolution 0.1℃ • Control speed, 0~10℃/min • Control method: PID ; sensor PT100 • Working distance between chamber stage to window <25mm • Optical widow size 1-1.5inch • Size window for optical alignment will be provided • 45-degree reflective mirror holder beside chamber stage • Vacuum chamber <5pa (with Vacuum Pump) • Customized sample stage 25*25mm; • chamber size >130*388mm • 4 adjustable probe pins: adjustment range ±6mm , resolution 3 um • 1 customized probe pin for fiber alignment at ~85 degrees. Adjustment range ±6mm, resolution 3 um; • Specially design on vacuum sealing for fiber alignment arm • Temperature Chamber weight < 5KG • Roughing Vacuum pump provided, pressure <5Pa • LN2 Tank provided 2L • Temperature Controller provided • Chamber system weight <8KG • Sample stage: conducting and to be connected to via a triax cable to apply bias to the devices from the back side.		

1.11	**Fiber alignment vision system**	• Top view camera with full HD monitor display • FOV: 1 mm to 4 mm • Magnification (50X) • FOV ： 0.36mm @ 50X • Magnification 5X 20X normal objective lens for easy allocation of the sample • Objective turret • Travel: 100 mm Z, 20 mm X, 20mm Y • Side view camera with full HD monitor display • FOV: 4 mm to 8 mm • Magnification (1 – 10x) • Travel: 20 mm XYZ • Mechanical system for both cameras included.		
1.12	System operation and maintenance manuals (paper, file and softcopy)			
	Substrates to be used include:			
1.13	**Si, Si/SiO_2, Sapphire and quartz.**			
1.14	**Sample Size:**	**25 mm X 25 mm**		
	Programmable/Controllable features:			
1.15	The system must offer fully programmable of TCSPC, bias voltage, picosecond laser. Suitable computer system with latest windows operating system (version 10 or higher) should be provided.			
1.16	**Dimensions: To fit within standard laboratory spaces.**	Compact dimensions preferred, specify exact dimensions in the quote. Material: Stainless Steel with Cleanroom Compatible painting		
1.17	**Demonstration of the tool's capability:**			
a.	The system should be able to detect single photons with minimal error.			

b.	Demonstration should include measurement system setup, standard operation and include emergency shutdown and start-up procedures.			
c.	With the test system avalanche voltage value (Va), dark count rate (DCR) or leakage current, single photon detection efficiency (SPDE), after pulse probability (P_a) and the time jitter (TJ) of the supplied reference sample should be measured and the variation in the output values with respect to the change in the input values should be checked.			
1.18	**Packaging and Shipment:**			
a.	The **Laser with Photon Counter Module System** tool should be securely packed to prevent damage during transit, with all fragile components adequately cushioned.			
b.	The packaging should include necessary documentation, installation manuals, and a list of included components.			
1.19	**Acceptance Criteria:**			
a.	**Site Acceptance Test (SAT):** • **The system must undergo SAT at the IITB site, replicating the factory acceptance test parameters with the following:** • **Standard Samples Repeatability:** The vendor must demonstrate that test system is able measure avalanche voltage value (Va), dark count rate (DCR) or leakage current, single photon detection efficiency (SPDE), after pulse probability (P_a) and the time jitter (TJ) of the supplied reference sample and check the variation in the output values with respect to the change in the input value. To verify repeatability, the vendor performs the measurement on the standard samples on-site and shows that the data matches factory data with an error of <5-10%. The vendor should also demonstrate measurement on a user-provided sample on-site within the specs of the tool.			
	Installation and Qualification: Installation and on-site qualification of			

b.	the system by the OEM (Original Equipment Manufacturer).			
c.	**Training:** - On-site operational training for two engineers, covering system operation, maintenance, and basic troubleshooting. - Training shall be provided by the OEM authorized/ certified skilled personnel.			
d.	**Tool Performance Verification**	Data on standard reference factory samples is repeated on-site with a repeatability error of <5-10 % w.r.t factory data. The vendor also demonstrates measurement on a user-provided sample on-site within the specs of the tool. The vendor also demonstrates accurate measurements for various features of the purchased tool (e.g. temperature up to -190 ℃) on-site.		
e.	**Warranty:** One-year standard warranty.			
2.	**Optical Workstation**	• Science desk frame suitable for supporting a 900 mm × 1200 mm optical breadboard, equipped with active vibration isolation system. Approximate working height: 910 mm. • Sealed optical breadboard of size 900 mm × 1200 mm × 60 mm, with M6 threaded mounting hole grid across the surface. • Set of four utility casters compatible with the optical table frame, suitable for safe movement of the table assembly. • Air compressor with 230 VAC power supply, fitted with a		

		European-style plug, suitable for powering active vibration isolation systems. Air filtration and regulation system suitable for conditioning the compressor out		
3.	**Key Generic Requirements:**			
3.1.	The tenderer must provide an installation scheme showing the physical space (footprint) of the machine(s) as well as space required for routine access and all installations including any related accessories.			
3.2.	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.			
3.3	For each compliance, supporting evidence such as manuals and other necessary and supporting documents needs to be provided.			
3.4.	The vendor should have an Indian trained technical representative who can take care of urgent troubleshooting or any measurement-related queries on an urgent basis.			
3.5.	Safety features like interlocks to prevent errors in operation and emergency shut-down options should be available.			
4.	**Technical Specifications (Generic):**			
4.1	The system must be semi-cleanroom compatible with all the necessary support systems, such as vacuum, cooling, power supply systems, computer hardware, and software.			
4.2	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. The system should also incorporate software support to control and monitor thermal properties of materials, guaranteeing ease of use.			
4.3	The tool must contain all the necessary sensors and controls for safety and performance monitoring. A complete set of system operation and maintenance manuals must be provided.			
4.4	A library of material properties for extraction of different parameters processed by the machine, well-documented by the company, must also be included.			
4.5	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.			
4.6	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 handling of the tool.			
4.7	The software must allow the user to write and edit machine recipes.			

4.8	The software must provide full system monitoring and recording of full system states in log files.		
4.9	The system must provide access to sample measurement history and security protocols.		
4.10	The system must provide system fault detection and diagnosis.		
4.11	Automatic and manual control modes should be available in the software. The system should provide programmable control over all optical parameters.		
4.12	The system should be configurable for various environments, including air and inert gases.		