STATEMENT OF WORK/REQUIREMENTS DOCUMENT
Title: Procurement of Advanced Photodetector System
Requesting Lab: PML / 681

I. BACKGROUND INFORMATION

The National Institute of Standards and Technology (NIST), Biophysical and Biomedical Measurement Group (BBMG) within the Microsystems and Nanotechnology Division of the Physical Measurement Laboratory (PML) requires an advanced spectral photodetection system for incorporation into NIST's unique and world-class Serial Flow Cytometer for high temporal and spectral resolution optical measurements of biological micro and nanoparticles. This will enable accomplishment of our mission of developing microscale measurement science and technology applied to characterization of biological systems.

Flow cytometry is a technology that rapidly analyzes properties of thousands of single cells or particles per second as they flow in a fluid stream. A laser incident on the fluid stream interrogates the cells, which can be labeled with fluorescent markers to enable the quantification of specific cell markers and classification of different cell types within populations. NIST develops a Serial Flow Cytometer (SFC) that uses multiple light sources to repeat optical measurements of single cells to provide uncertainty quantification (UQ). UQ is a valuable outcome that enables optimization of flow cytometers and modeling to improve confidence in flow cytometry measurements and instrument comparability.

Purpose/Objective: NIST requires a complete, multichannel and multispectral photodetector system as listed below in the Scope and specified below in Minimum Requirements. The system will integrate directly into NIST's Serial Flow Cytometer to perform sensitive, dynamic, and hyperspectral fluorescence measurements of rapidly flowing micro and nanoparticles including cells, gene therapy nanoparticles, and fluorescence calibration particles. Incorporation of the system within NIST instruments requires compatible connections to optical lines and routing of voltage signals to NIST recording devices.

The advanced photodetector system is critical to achieve NIST project missions as it will enable the R&D team to build generalizable, multimodal cytometric tools with world-class deep spectral probing to advance Critical and Emerging Technologies (CETs) in Biotechnology. Since the advanced photodetector system is needed to conduct preliminary experiments to guide microdevice development, it must be awarded in FY26.

II. SCOPE

The Contractor shall deliver an advanced multichannel multispectral photodetection system that meets the specifications described within this document, including warrantied hardware. The contractor is also responsible for providing installation instructions and facilitating initial training and troubleshooting of the system either in-person or remotely.

III. MINIMUM REQUIREMENTS

The Contractor shall provide a system that meets all technical specifications identified below. All items must be new. Used or remanufactured equipment will not be considered for award. Experimental, prototype, or custom items will not be considered. The use of "gray market" components are not authorized for sale in the U.S. by the Contractor is not acceptable. All line items shall be shipped in the original manufacturer's packaging and include all original documentation and software, when applicable.

Line Item 0001:
Description: Advanced Spectral Photodetector System
Quantity: 1

A. Technical Specifications

a. Performs multispectral light detection with ≥ 16 spectral channels, each detecting a non-overlapping wavelength bin of bin width ≤ 20 nm, distributed over a spectral sensitivity range including ≤ 450 nm to ≥ 750 nm.
b. Detects light from ≥ 4 light sources, either through multiplexed detection to one system unit or through separated detection to multiple detector modules
c. Accepts one fiber optic input per light source (SMA905 connector, fiber NA ≥ 0.1 and core diameter ≥ 105 µm)
d. Internal detector format: photomultiplier tube, avalanche photodiode, silicon photomultiplier, or hybrid
e. Typical peak photon detection efficiency ≥ 10 %, net bandwidth ≥ 500 kHz, Readout noise ≤ 10 mV p-p, and Dynamic range ≥ 10,000
f. Max voltage output with 500 mV ≤ max output ≤ 10 V and per-channel standard connector (i.e., SMA or BNC) to differential digitizers
g. Includes power supply and tunable amplification gain via provided hardware or (if needed) via computer control
h. Gain range for resolving fluorescence intensities between ≤ 10^2 MESF and ≥ 10^5 MESF

Line Item 0002:
Description: Installation/training
Quantity: 1

A. Technical Specifications

a. Instructions for installation, validation, and training must be provided.
b. Remote or in-person meeting(s) will meet this requirement.

Line Item 0003:
Description: Shipping / Receiving
Quantity: 1

A. Technical Specifications

a. The cost for shipping and receiving to NIST Gaithersburg, MD, must be provided.

IV. DELIVERABLES

Description	*Quantity or Format*	*Due Date*
Spectral photodetector system meeting the specification described above	Physical instrument consisting of one or more photodetector modules.	12 weeks after award
Operations and maintenance manual for the system covering proper operation, routine maintenance, and troubleshooting for the instrument	Electronic (.pdf) or paper copies	At the same time as delivery

Standards of Acceptance: The NIST TPOC or COR shall review that the unit is functioning to specifications as outlined in Section III and respond with an acceptance or request for revision email to the Contractor Point of Contact (POC) within 2 months of receipt of deliverable. This

section applies to deliverables which must be reviewed and approved for acceptances (draft plans, drawings, etc.)

V. PLACE OF PERFORMANCE

a) Construction and fabrication of the equipment shall be completed at the contractor's facility.
b) If necessary (i.e., if remote installation cannot be achieved), installation and training will be performed at 100 Bureau Dr., Building 225, Gaithersburg, MD 20899.
   i) The government will provide access to Building 225 to the contractor for the entire period of performance of this contract.

VI. PERIOD OF PERFORMANCE/LEAD TIME

See "IV. Deliverables" above

VII. DELIVERY TERMS

Delivery shall be F.O.B Destination and shall occur in accordance with the delivery due dates provided in the above table.

FOB Destination means: The contractor shall pack and mark the shipment in conformance with carrier requirements, deliver the shipment in good order and condition to the point of delivery specified in the purchase order, be responsible for any loss of and/or damage to the goods occurring before receipt and acceptance of the shipment by the consignee at the delivery point specified in the purchase order; and pay all charges to the specified point of delivery. The contractor shall deliver all Line Items to:

National Institute of Standards and Technology
Shipping and Receiving
100 Bureau Drive, Building 301
Gaithersburg, MD 20899
Attn: Matthew DiSalvo, Building 225

*****Due to ongoing limited site access of the NIST facilities, the Awardee SHALL confirm with the Designated Government Official and the Contracting Officer prior to ANY shipment to NIST*****

VIII. INSTALLATION

The system shall be installed by NIST staff with the option for Supplier to be present. This activity must lead to meeting contract specifications no later than 1 month after delivery. Installation, at a minimum, shall include uncrating/unpackaging of all equipment, rigging, set-up and hook-up of the system, demonstration of all specifications, and removal of trash. Onsite installation shall be done at NIST, (Gaithersburg, MD- Building 225).

IX. TRAINING

The contractor shall conduct training session(s) for up to 2 users at NIST. The training shall provide a demonstration of all system/solution functions, maintenance, data administration, and basic troubleshooting. The training may be completed either on-site at the NIST Gaithersburg campus or remotely, Monday – Friday during the operating hours of 8:00 am - 5:00 pm (eastern time), within 10 business days after installation.

1. After the system passes the site acceptance test, the contractor shall train users on the operation and maintenance of the system.

The contractor shall supply the initial installation manual, utility requirements, and full system design schematics for the system at the time of award.

X. INSPECTION & ACCEPTANCE

In addition to the inspection and acceptance terms articulated in 52.212-4, the Government reserves the right to perform such performance tests and evaluations as defined below to verify specified system performance. Such tests and evaluations, if performed, shall be conducted within the environment that the system is to be operated. The Contractor has the right to be present during the tests and evaluations, if performed, at the Contractor's expense.

Performance Tests:

1. Basic functions will be tested including:
    a. Connecting the instrumentation optical fibers and signal digitizers.
    b. Ensuring the instrument powers on.
    c. Ensuring that communication is established to control the instrument and any accessory interfaces.
    d. Ensuring that the instrument performs spectral measurements via flow cytometry of single-stained calibration particles.
    e. Validation of the noise, sensitivity, resolution, and dynamic range Specification of Line Item 0001 via flow cytometry of an intensity calibration ladder.

NIST may choose at its discretion to forego this part of acceptance testing.

A visual inspection of the equipment will be performed by the NIST TPOC to identify surface defects or any form of indication that any equipment was damaged during transport to NIST. The Government shall have sole discretion to require repair or replacement of damaged and/or nonconforming supplies at no cost to the Government. The Government at any time prior to acceptance shall reject the equipment due to defects and/or nonconformance. The vendor is responsible for latent defects discovered any time after final inspection. However, the extent of its liability shall be prorated over the useful life of the equipment.

Ownership of the equipment shall transfer to NIST upon acceptance by the Government.

The Government will test, inspect, and accept or reject the equipment within (insert working days it will take to inspect, accept or reject) of the receipt of the equipment unless otherwise indicated above. The Government reserves the right to conduct quality assurance testing to confirm that a given instrument(s) meets the manufacturer's and/or the Government's performance specifications. It is anticipated that the equipment will meet all manufacturer's specifications and/or the Government's performance specifications identified in the most recent operations and maintenance manual for each piece of equipment and/or in this document.

XI. WARRANTY

At a minimum, the Contractor shall provide a 12-month limited warranty, starting upon acceptance, to cover defects in materials and workmanship of the photodetectors.

XII. PAYMENT SCHEDULE

Advance payment is not authorized. The Contractor must invoice in arrears according to the payment schedule. The Contractor shall be paid, in accordance with Net 30-day payment terms, upon receipt and acceptance of a proper invoice:

NOTE: Partial shipments and partial invoices will not be accepted, unless otherwise requested and accepted by the Contracting Officer prior to award offer. Proposed payment schedules shall be submitted with vendor's response to the RFQ for consideration.

XIII. CONTRACTOR SUPPLIED MATERIALS

The contractor shall supply all parts, hardware, equipment, and labor required to perform the tasks listed, unless specifically noted above.

XIV. MISCELLANEOUS INFORMATION

Safety: The Contractor employee must be responsible for knowing and complying with all installation safety prevention regulations. Such regulations include, but are not limited to, general safety, fire prevention, and waste disposal.

Security: NIST is a restricted campus. An identification badge is required for access for entry into buildings and is shown to the armed Security Police when entering the campus.

Regular Business Hours. Regular business hours are Monday through Friday, 8:00 am to 5:00 pm Eastern Time, excluding Federal holidays and NIST closures.

Identification Badges: Contractor employees must comply with NIST identification and access requirements. Each Contractor employee must wear a visible identification badge provided by the NIST Security Office.

Vehicle Registration: All Contractor employees must register their vehicles with the NIST Security Office to gain access to the campus. A valid driver's license, Government-furnished civilian ID, proof of insurance and current registration must be presented to the NIST Security Office, at which time a NIST vehicle pass will be issued. The pass must be displayed on the vehicle in accordance with NIST Security Office instructions.