

Inter University Accelerator Centre (IUAC)
Aruna Asaf Ali Marg
POST BOX NO: 10502
New Delhi 110067

Notice Inviting Tender No. IUAC/NIT/ 09 /BK/2018-19

Name of the Work : **Purchase, Installation and Testing of a Compact High Power Nd-YAG laser along with proper beam Delivery To photo cathode and beam scanning system for Cleaning of Copper Photocathode for Delhi Light Source**

No. of Pieces : **One Nd-YAG Laser system along with optical table, beam Scanning and beam delivery system to photocathode.**

Estimated Value : **70,000 USD (~ 50 Lakhs INR)**

Earnest Money Deposit (EMD)* : **1400 USD (~1,00,000 INR)**

***Bidders registered with NSIC and Foreign Bidders quoting directly are exempted from paying EMD.**

Last Date and Time of Submission of Tender : **24/08/2018----- at 3.00 p.m.**

Date & Time for opening of Tender (Technical bid part-A) : **24/08/2018----- at 3.30 p.m.**

Date & Time for opening of price bid (Part-B) : **Will be intimated later on to technically qualified bidders**

Address for submission of tender : **Administrative Officer(S&P),
Inter-University Accelerator Centre
Aruna Asaf Ali Marg
Post Box: 10 502
New Delhi - 110067**

Place of Opening of the Tender : **Inter-University Accelerator Centre**

GENERAL CONDITIONS OF TENDER:

1. Submission of Tender: Tenders should be submitted in a sealed envelope in two Parts separately, i.e. "Technical bid" (Part-A) and "Price bid" (Part-B). Both the parts should be further sealed in an envelope super-scribing NIT No & name of work, due date for opening, bidders name & address. The tender duly filled in may be sent to above mentioned address either by post or hand delivered in the **tender box kept in the area near west side entrance, after ensuring that due entries are made in the register kept at the counter.** It should not be handed over to any employee of the Centre. **No tender shall be accepted later than the time schedule specified above. Any clarification/amendments/corrigenda etc. to NIT will only be available on website: www.iuac.res.in**

2. Technical Bid (Part-A) : In this, the bidder should submit his company profile, organizational setup, credentials, and copies of successfully executed work orders for reputed laboratories during the last five years. No deviations in respect of NIT conditions are acceptable. **The bidders are required to attach entire NIT (except for the price bid part) duly signed & stamped as a token of acceptance to the NIT conditions with this bid. The following specific conditions are essential for pre-qualification:-**

Entire NIT (except Price bid) duly signed & stamped by the bidder.

The bidder must be an internationally reputed firm/company/manufacturer or their representative of Nd-YAG Laser system, who has supplied similar type Laser system to the internationally reputed laboratories worldwide and in India and carried out similar work in the laboratories worldwide.

The company should supply the complete Nd-YAG Laser system along with the optical table, beam delivery and beam scanning system on the photocathode as listed in the scope of work. Partial quotation for the individual subsystems will not be accepted. The company should attach a brief justification note to ascertain their capability criteria to undertake the order.

The list of users who have used similar item and model/make along with their name, E-mail address, Institute address & contact numbers should be submitted with the

quotation. If the identical or similar equipment have been supplied to other Laboratory/Institute in India/Abroad, the details of such supplies for the preceding five years must be given together with the prices eventually or finally paid. Copies of work orders during the last five years should be included. No deviations from the technical specifications listed in the annexure A will ordinarily be permitted. However, the Centre reserves the right of final decision regarding acceptable technical specifications.

- 3. Price Bid (Part-B) :** In this bid, the bidder is required to quote the FOB price of item along with the break up as provided in Annexure C (Part I) for the works mentioned in the scope of work & technical specifications. The bidders should quote unconditional rates, neatly written without any overwriting and duly signed & stamped on all pages. The bidder may have to provide a certificate with the price bid mentioning that the price quoted by them is not higher than that the price quoted by them to other laboratories/institutes for similar product during last year.
- 4. Scope Of work/supply:** Purchase, Installation and testing of a compact high power Nd-YAG Laser along with suitable optical table, beam scanning and beam delivery system to photocathode for the cleaning of Copper Photocathode for Delhi Light Source as per detailed technical specification and guidelines mentioned in NIT as **Annexure A**.
- 5. Validity of Tender:** The prices must be valid for a period of **six months** from the date of opening of the quotation. No escalation of cost will be acceptable in any condition after opening of tender.
- 6. Escalation:** No escalation over and above items rates quoted by the bidder shall be paid during the execution of contract.
- 7. Pre installation requirements:** – Pre installation requirements like Space, Power Supply, Water Line, temperature or humidity control or any other essential requirements which are to be kept ready/completed by IUAC before supply of equipment, must be informed by the bidder clearly in their quotation to avoid any delay in Installation & Commissioning of equipment. Operating conditions and environment should clearly be mentioned.
- 8. Inspection :-** The consignment shall be opened in presence of company's representative and inspection of the system will be done by IUAC technical

experts/scientists. In case company's representative is not available, the inspection will be done by IUAC team and discrepancy will be intimated to the supplier accordingly. All short supplies will be arranged by the supplier itself. In case of receipt material in damaged or defective condition, the supplier will have to arrange the replacement of goods free of cost.

- 9. Installation/commissioning:** - The whole system must be installed/ commissioned and demonstrated by the supplier at IUAC within a suitable time period on a mutually agreed basis after delivery of goods at IUAC and the same will be put under operation to the satisfaction of the team of experts constituted by IUAC who will test the performance of the equipment. The system will be accepted after the No separate charges for installation etc. will be paid to the party beyond the quoted prices. Detailed specifications are enclosed with this NIT as Annexure A.
- 10. Correspondence:** All the correspondence in respect of tender/contractual obligation shall be made to the Admin. Officer (S&P), Inter-University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067 E-mail: joseph@iuac.res.in, Ph. +91-11-26892603,26892601
- 11. Terms of Payment :** L/C will be opened for 100 % of FOB value after receipt of acceptance of order from successful bidder. 70% of payment will be released against presentation of complete shipping documents. Balance 20% of order value shall be released after satisfactory installation, commissioning and testing of the equipment. Remaining 10% will be released after the warranty period OR against a Performance Bank Guarantee equivalent to 10% value and valid for the warranty period plus two months.
- 12. Earnest Money:** EMD of ₹ 100000/- has to be enclosed along with the Technical bid (Part-I). The EMD shall be only in the form of Bank Draft in the name of "Inter-University Accelerator Centre", payable at "New Delhi". No cheque / cash shall be accepted as EMD. EMD of technically disqualified bidders will be returned within 30 days from the date of evaluation of the technical bids. EMD of successful bidder will be released on successfully delivery of the laser system at IUAC, Delhi. Tender received without earnest money from the bidder other than NSIC/SME and foreign bidders will be rejected.

- 13. Post Warranty Period: Annual Maintenance Contract (AMC)** for a period of five years of post-warranty with required spares should be offered. During AMC the spares will be kept at IUAC except some major components. During the period of AMC, it should be specified that who will be the authorized personnel for servicing/maintenance etc. The response time for attending a fault should be within 3 days in case of Indian agent and 2 weeks in case of foreign workers. In such cases the supplier will pay the travel, lodging, etc. charges.
- 14. Manpower Training:** IUAC Scientist/Engineers will be trained by supplier at IUAC. The personnel will witness and participate in the complete process of assembly, system integration and testing of various sub system up to the final acceptance test as listed in Annexure A. The detailed schedule time schedule needs to be conveyed by the supplier well in advance.
- 15. Spares:** Supplier should quote separately as option for spares required for trouble free operation of the Laser system round the clock for 5 years. Some of the major spares are listed in Annexure C (Part –II) for the supplier to quote. All the additional spare items should be included by supplier.
- 16. Vendor Data sheet:** The vendor should submit the vendor data sheet along with all the information as mentioned in Annexure B (Part I).
- 17. Documents and Manual:**

 - i. Upon delivery of the complete system to IUAC, two sets of as built, signed, final prints of mechanical, optical and electrical systems shall be supplied by the vendor. These prints shall be made to the highest professional standards. All drawings shall also be delivered on CD/pen drive.
 - ii. Upon delivery of the laser system to IUAC, two copies of the final parts list shall be supplied by the vendor. It shall also include a recommended critical spare parts list and test routine/schedule for such spares if they are to be stored. The data shall include current unit price and supplier of all component parts. All parts lists shall also be delivered on CD in either MS Word or MS Excel format.

- iii. Upon delivery the vendor should provide the guarantee documents mentioning all the terms and conditions in details.
- iv. All the information along with all test results, technical descriptions, data sheets shall be supplied in a bound design and operations manual.
- v. Set of documents must include operating manuals, safety manuals, periodic maintenance, troubleshooting manuals and maintenance procedure.
- vi. Any other documentation necessary for safe and reliable operation of the equipment should also be supplied. Two sets of the manual should be provided without additional cost.

18. Software and application

All the software installations required for operation of the Nd-YAG Laser system will be done at IUAC. All the application and development software including OS, drivers etc with required license with installable media (if applicable) should be supplied.

- 19. Final Acceptance:** The final acceptance of the system is defined as successful completion of shipment, installation and acceptance tests at IUAC to substantiate compliance with the specification mentioned in annexure A. The system will only be accepted after the completion of the acceptance test mentioned in Annexure B (Part II). Complete system with all the accessories and spare parts should reach to IUAC safely with all the mentioned warranty intact.

20. Guarantee/ Quality Assurance

1. The Vendor shall furnish a manufacturing plan and acceptance test procedures to be approved by IUAC. Approval by IUAC shall not release the Vendor from his responsibility for conceptual design, manufacturing, or any other mistakes committed in the fabrication of the laser system.
2. All purchased articles from subcontractors or manufacturers released for inclusion in this laser system shall be clearly identified to indicate conformance to Vendor's receiving inspection.

3. The bidder should guarantee for the works/items executed/supplied by him from the manufacturing/engineering defect and bad material/workmanship for a period of at least one year and preferably two years from the date of successful installation at the IUAC. During this period if any replacement of items and/or repairs/rectification is needed, he shall make the same free of cost.
4. Only calibrated test equipment shall be used. Copies of the test data sheets shall include lists of the instruments used to perform the tests and the calibration due date of each instrument.
5. The Vendor shall establish those controls and processes necessary to ensure uniformity of all deliverable articles. All controls, inspections, tests and quality provisions established during development and pre-production tests shall be indicated on the applicable drawing and shall be performed on each deliverable article.
6. All units and parts of the equipment shall be properly packaged and delivered in an undamaged condition to IUAC.

21. Force Majeure: IUAC may grant an extension of time limit set for the completion of the work in case timely completion of the work is delayed by force majeure beyond the supplier's control. Force majeure is defined an event of effect that cannot reasonably be anticipated such as acts of God (like earthquakes, floods, tsunami etc.), the direct and indirect consequences of wars (declared or undeclared), national emergencies, civil commotions and strikes (only those which exceeds a duration of ten continuous days) at successful Tenderer's factory. Apart from the extension of the time limit, force majeure does not entitle the successful Tenderer to any relaxation or to any compensation of damage or loss suffered.

22. Liquidated damages: In case the delivery of the listed items is delayed beyond the specified delivery period for reasons attributable to the supplier, deductions on account of liquidated damages @ **0.5 %** per week of the total order value will be deducted subject to maximum 5% of the total order.

23. IUAC reserves the right to reject any or all the tenders in full or in part without assigning any reasons whatsoever, and the decision of the Centre in this regard will be binding on all the bidders. Tenders not complying with any of the provisions stated in this tender document are liable to be rejected.

Director, IUAC reserves the right to accept or reject any tender without assigning any reason and does not bind himself to accept the lowest tender.

24. This contract shall be governed by the Indian laws. Any dispute arising out of this contract will be subjected to jurisdiction of New Delhi/Delhi.

Accepted

(Signature of bidder)

Annexure A

I. General Overview

1. This specification sheet is for the order and procurement of the Nd-YAG laser system required for photocathode cleaning for the Delhi Light Source (DLS) project at Inter University Accelerator Center (IUAC), New Delhi.
2. The DLS facility of IUAC is expected to be the unique Free Electron Laser user facility of India for producing THz. In the first phase of this project it has been decided that Cu photocathode will be illuminated with an appropriate laser system to produce quality electron beam. To improve the quantum efficiency of the photocathode it is required to clean the photocathode surface by ablation process.
3. It is decided that an appropriate high energetic Nd-YAG laser will be used for the cleaning of the photocathode surface. The laser system will be kept close to the Insertion chamber where the photocathode will be inserted. The laser beam should be delivered and scanned over the photocathode for cleaning the oxide layer to have better quantum efficiency. The detailed lay out is explained in part III.
4. Procured Nd-YAG laser system should meet the requirement as mentioned in the specification data sheet. The detailed architecture of the laser system will be designed and manufactured by the vendor and any advanced standardized technical approach should meet the specification.
5. The laser system shall be manufactured in accordance with the best of existing techniques and recognized good engineering practices.
6. Materials used in the manufacture of the Nd-YAG laser system for DLS project shall be of the kind, composition, and physical properties best adapted to their various purposes in accordance with good engineering practice. Tolerances, fits and techniques used in the manufacturing of finished products shall conform to the best modern shop practices. All like parts shall be interchangeable between units wherever possible.

II. Required Specifications of the Nd-YAG Laser system

The required specification of the Nd-YAG laser system for the cleaning of photocathode is listed in the following table. The laser system should be compact, easy for handling and operation.

Optical Specification	
Central Wavelength (nm)	1064nm
Pulse Width	8-10 ns
Pulse Energy @ 1064 nm	90mJ - 100 mJ
Repetition rate	100Hz /200 Hz
Required repetition rate flexibility	From single shot to the highest repetition rate
Second harmonic wavelength	532 nm
Pulse energy @ 532 nm	50 mJ - 60mJ
Fourth harmonic wavelength	266 nm
Pulse energy @ 266 nm	8mJ - 10 mJ
Beam diameter at waist ($1/e^2$ level, mm)	~ 2-5 mm
Beam Quality	TEM ₀₀ ; $M^2 \leq 1.7$
Beam Divergence (Full angle, mrad)	< 1 mrad
Beam Roundness	> 90%
Polarization ratio	1000:1
Pulse energy stability @ 1064 nm	< 1% rms
Pulse energy stability @ 532 nm	< 2% rms
Pulse energy stability @ 266 nm	< 4% rms
Signal to noise ratio for energy	10 ⁵ :1
Pointing Stability (fraction of laser beam)	< 2% of the beam diameter ($1/e^2$ width)
Termination	Free space collimated beam

Time jitter (RMS)	± 1 ns
System Specification	
Separate optical outlet for 1064nm and 266nm	Unused 1064nm and 532 nm after second and fourth harmonic generation should be available from the separate outlet than 266nm outlet.
Simultaneous availability of all wavelengths	The unused 1064nm and 532 nm should be available with 266 nm simultaneously without removing harmonic modules
Pumping mechanism	diode pump
Lifetime	Should be more than 1 billion shots
Interchangeable Harmonic modules	Second and fourth harmonic modules should be easily mountable and detachable mechanically.
Tuning of harmonics	Remote controlled auto tuning mechanism for harmonics generation
Electrical Specification	
Supply Voltage	230V +/- 10V for single phase
Voltage stabilizer	Voltage stabilizer should be incorporated to eliminate the effect of voltage fluctuation on laser pulse energy.
Supply Frequency	50Hz +/- 2Hz
Environmental Specification	
Chiller	Air cooled or water cooled*
(*If water cooled then it should be loop water connection)	
Operating Temperature	20 ⁰ -30 ⁰ C (Tolerance should be specified by the company. Should not be less than +/- 2 ⁰)
Humidity	~50% - 70%

	(Tolerance should be specified by the company. Should not be less than +/-5%)
I/O control Specification	
Output shutter for 266 nm	Switch and remote control open/close shutter
Output shutter at 532 nm	Switch control open/close shutter
Output shutter at 1064 nm	Switch control open/close shutter
Output shutter for the diagnostic outlet	Switch control open/close shutter
Rep rate control	Option to change the repetition rate from 1 Hz to 100 Hz.
Emergency stop	Option for Stopping the laser in emergency
Interlock	Interlock termination feature (Emergency Shutter is preferable)

Important Notes

1. The system should be dimension wise compact, light and easy to be handled. Smaller footprint is preferable.
2. The system should have pre mounted optics for easy cleaning and exchange.
3. IUAC laser person or its representative is preferred to be acquainted with the system during testing and installation (Site Acceptance Test). IUAC laser person should have the flexibility to troubleshoot the problems during operation if required following the suggestions from the supplier.
4. Mention Signal to Noise ratio for energy in the data sheet.
5. Our main intention is to drive the laser system in a stable way for cleaning of the photocathode material. Therefore special care should be taken while designing to obtain longer lifetime with more than 5000 hours average time between failures.
6. Machine protection should be incorporated in the design. The system should have good interlock features and laser system must turn off the beam within few msec after a

problem appears. Uninterruptible power supplies (UPS), which protects the laser system components from damage in case of the power failure, should be part of the system

7. Pulse energy and pulse width should not fluctuate with time. If the pulse energy and pulse width deteriorate from their mentioned value vendor has to take the responsibility to fix it.

III. The complete set up for photocathode cleaning

Along with the ND YAG laser system the vendor should deliver the optical table, required optical elements and beam scanning system to be used for photocathode cleaning. The laser system should be kept as close as possible to the insertion chamber where the photocathode plug will be inserted. The insertion chamber will be installed in the main beam line as shown in the figure 1. The laser beam (266nm) will be delivered to the insertion chamber through the laser insertion port on to the photocathode. The laser beam should be scanned over the photocathode horizontally and vertically. The schematic lay out is shown in the figure 1 and in figure 2.

1. The laser system should be placed over a proper optical table close the insertion chamber. The table top should not be more than 900mm X 600mm. The tabletop should have honeycomb structure with broadband damping. The legs should be rigid.
2. Height of the laser cleaning port is 1100 mm from ground. Periscope Height should be adjusted according to that. If the optical table height can deliver the laser beam up to 1100 mm height then periscope can be avoided.
3. The optical table can be placed minimum of 50 mm away from the main beam line stand. Therefor the Distance from the photocathode to the laser outlet port can be maximum of ~475 mm.
4. The fourth harmonic (266 nm) laser beam should be focused to 1mm spot size on the photocathode.
5. The laser beam will go through the Sapphire window of the laser cleaning port of the insertion chamber. The damage threshold of the window will be $\sim 20\text{mJ}/\text{mm}^2$.
6. The window will be DN63 standard
7. The effective scanning area on the photocathode will be 10mm X10mm

8. The lay out on the breadboard can be modified by the supplier according to the optics and components requirement. The main goal is to deliver the laser beam to the photocathode inside insertion chamber with proper beam scanning system.

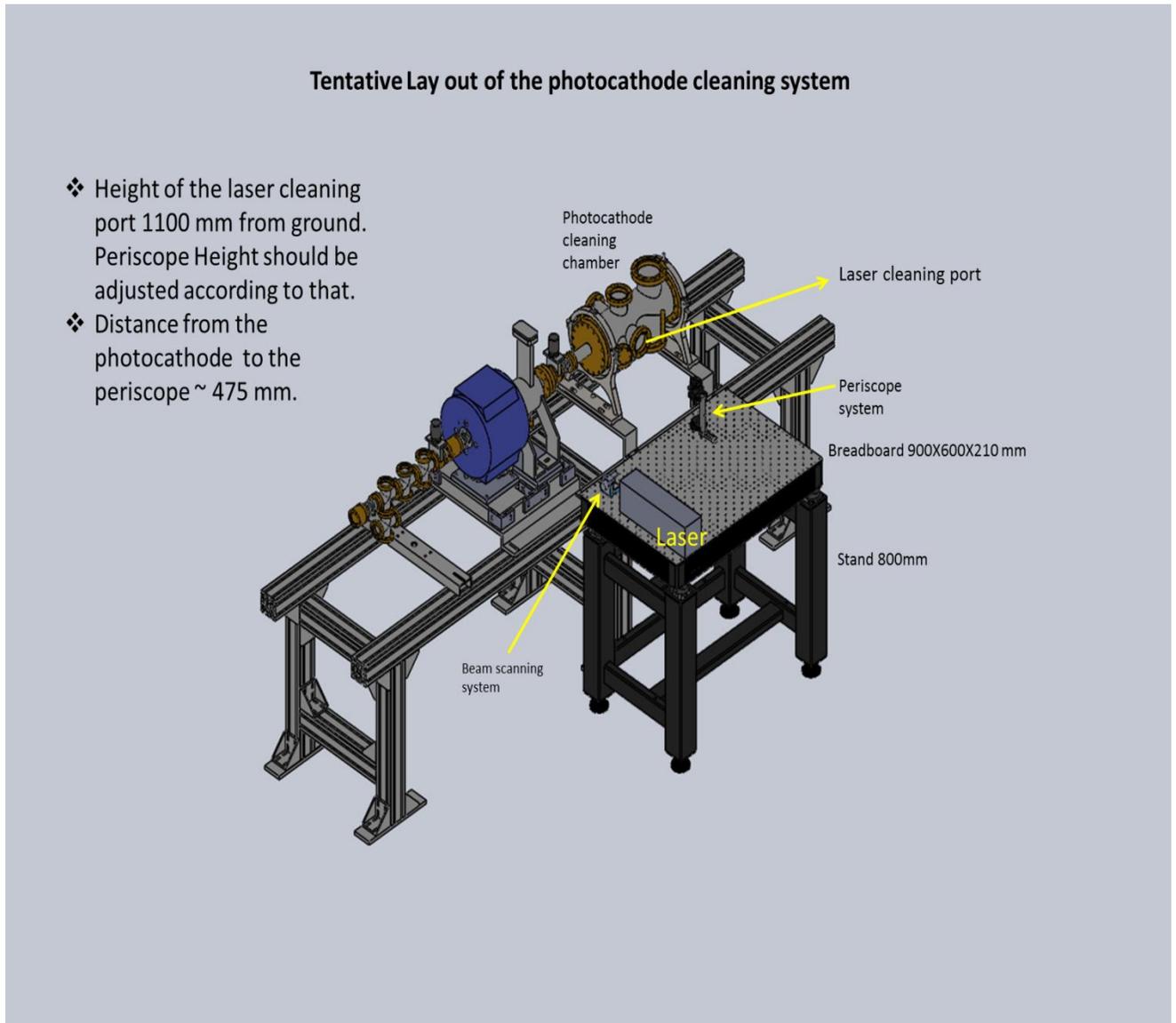


Figure 1: Schematic lay out of photocathode cleaning system

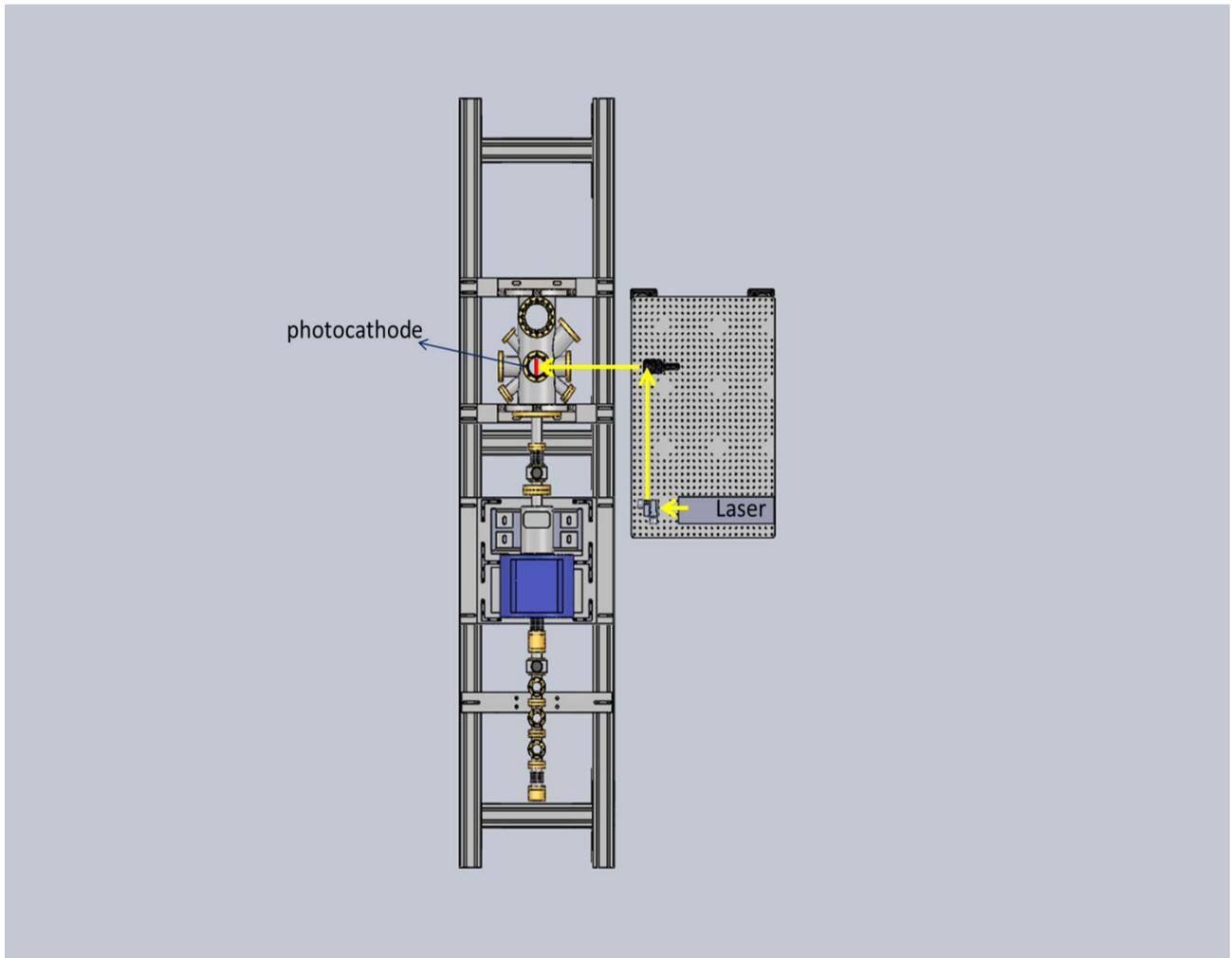


Figure 2: Top view of the lay out of the laser cleaning system

Annexure B

I. Vendor data Sheet

The vendor should submit the following data sheet along with all the important aspect of operation. If any exception from this data sheet is guessed then that also should be mentioned in separate section.

a. Vendor data sheet for the laser system

Optical Specification	
Central Wavelength (nm) and bandwidth	
Measured Pulse Width	
Rep rate	
Pulse energy at Fundamental, 2 nd and 4 th harmonic	
Short term fluctuation in Fundamental, 2 nd and 4 th harmonic pulse energy	
Long term fluctuation in Fundamental, 2 nd and 4 th harmonic pulse energy	
Pulse duration at Fundamental, 2 nd and 4 th harmonic	
Short term fluctuation in Fundamental, 2 nd and 4 th harmonic pulse duration	
Long term fluctuation in Fundamental, 2 nd and 4 th harmonic pulse duration	
Near beam profile for Fundamental, 2 nd and 4 th harmonic	
Far beam profile for Fundamental, 2 nd and 4 th harmonic	
M ² value for Fundamental, 2 nd and 4 th harmonic	
Conversion efficiency of 2 nd and 4 th harmonic generation	
Beam Divergence (Full angle, mrad)	
Measured Beam roundness	
Polarization extinction ratio	
Amplitude noise	

Signal to noise ratio for energy	
Centroid Position Stability respect to beam spot size	
Pointing Stability	
Time jitter (RMS)	
System Specification	
Pumping source	
Lifetime	
Environmental Specification	
Cooling type	
Operating temperature	
Storage temperature	
Humidity	
Electrical Specification	
Supply Voltage	
Supply Frequency	
Power consumption	
Mechanical Specification	
Laser head Dimension and weight	
Controller Dimension and weight	
Power supply type, dimension and weight	

b. Vendor data sheet for the laser beam scanning set up

Optical table specification	
Dimensions	
weight	

Honeycomb structure (Yes/No)	
Broadband damping (yes/No)	
Table specifications like flatness, dynamic deflection coefficient etc.	
Model and specification of the beam scanning system	
List and specifications of used optical components to deliver 266nm to photocathode.	

Important Notes

1. All anticipated changes in pulse duration, beam profile, timing stability, amplifier stability, and bandwidth as the beam propagates through the system shall be specified.
2. A detailed optical configuration shall be included and all potential damage thresholds caused by either high average or peak powers shall be identified.
3. Any exceptions which the vendor may take to the specification shall be clearly noted in the proposal. The vendor shall state in the proposal that he is in full compliance with all aspects of this specification which are not noted as exceptions.
4. Vendor should also specify how all these data have been tested. All the tests should follow the standard test procedure accepted internationally.
5. Vendor should mention the expected damage probability and chances of deterioration from these mentioned data in future. He should mention the required care and preferred way of operation to reduce the deterioration from the mentioned value.
6. Any major subsystems or components being purchased from outside vendors shall be stated explicitly along with their address, length of time in given business and demonstrated prior success in their given industry
7. Three sets of preliminary outline drawings showing the system overall dimensions, all component placements, preliminary schematics and a preliminary manufacturing schedule shall accompany the proposal.

c. Acceptance Testing

1. Before shifting the system to IUAC the vendor should perform all the measurements and tests as mentioned below:
 - i. Pulse Energy, repetition rate, short term and long term energy stability.
 - ii. Test for measuring pulse duration including all assumptions.
 - iii. Laser beam profile at 1064,532 and 266 nm wavelengths at near and far field.
 - iv. Long term and short term pulse duration stability.
 - v. Noise spectrum and measurement of Signal to Noise ratio for energy
 - vi. Sensitivity and fluctuation in ambient temperature, humidity and vibration.
 - vii. Maximum scanned area by the scanning system.
2. All test data should be recorded, compiled and documented.
3. IUAC scientist/ engineer will see all these test results and may verify all these results by conducting the tests separately at IUAC after the shipment of the system to IUAC.
4. The system will not be accepted in any significant mismatch or failure to fulfil the expected test result.

Annexure C

- I. The price bid format for the Nd-YAG laser based photocathode cleaning system should be like following indicating proper price of the system and its accessories:

Unit	Make	Price
Nd YAG Laser system unit		
Second harmonic unit		
Fourth harmonic unit		
chiller		
Uninterrupted Power supply (UPS)		
Software & control unit		
External Accessories (if Any)		

Optical table		
Laser beam scanning system		
External optical components used to deliver laser beam to insertion chamber		
Installation & warranty		
Annual Maintenance Charge		
Total FOB Cost		

II. The price bid format for the required spare items if any

Unit	Make	Price
Spare pump laser diode		
Power meter for measuring pulse energy		
Spare optical components (if any required)		
Other spares for smooth maintenance (if any)		