



DEPARTMENT OF MECHANICAL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY KANPUR

KANPUR, UTTAR PRADESH, INDIA, PIN – 208016

(An Institute of National Importance under Ministry of H.R.D., Govt. of India)

Tender Inquiry

<u>Subject:</u>	High speed dye laser with suitable dyes for time resolved planar laser induced fluorescence (PLIF) system operating with 1 -20 kHz pump laser
<u>Tender Reference No:</u>	IITK/ME/SDE/2018/PLIF/DYELASER/3
<u>Tender Type:</u>	Open (two-bid)
<u>Date of Opening:</u>	May 30, 2018
<u>Date of Closing:</u>	June 22, 2018
<u>Pre-bid meeting:</u>	on or before Jun 6, 2018
<u>Address for communication:</u>	DR. SANTANU DE Assistant Professor, Department of Mechanical Engineering Indian Institute of Technology Kanpur Pin – 208016, U.P., India Office: NL 302 (Northern Laboratory), IITK Telephone No. 0512-259-6478 (O) 0512-259-8709 (R) Fax No. +91-512-259-7408 E-mail: sde@iitk.ac.in
<u>Technical Contact Person</u>	MR. SAIKAT SARMA Office: NL 302, Department of Mechanical Engineering Ph. No. +91-8853144159 E-mail: sarmasaikat@gmail.com sarmasai@iitk.ac.in

We intend to purchase a **high speed dye laser (up to 20 kHz) with suitable dyes** for it for our Time resolved PLIF facility (high speed). You are requested to send sealed quotations along with compliance report, for the below listed products (**dye lasers along with specified Dyes** for the Time resolved PLIF system), as per given specifications. Your quotation should be containing two parts in sealed envelopes clearly marked Technical Bid & Financial Bid. The envelope must be inscribed with "[Quotations for High-Speed Dye Lasers with Dyes](#)". Last date to submit your bids is June 11, 2018.

Scope of Work:

- 1) This high speed dye laser will be used for time resolved PLIF facility only. A high speed pump laser with 532 nm and 355 nm output will be provided to the vendor and the vendor has to integrate the dye laser with the pump laser by providing supporting optics.
- 2) The dye laser should be capable of generating 210 to 900 nm output (tuning range) approximately by using different dyes with 532 nm and 355 nm pump output.
- 3) During PLIF experiment following species will be observed: OH (283 nm), CH (387 nm, 314 nm, 431 nm), HCHO (355 nm), HCO (259 nm), acetone as a tracer (peak between 270 nm to 280 nm) and toluene as a tracer (266 nm), and some other combustion species and radicals (210 – 900 nm).



Technical Specifications of the high speed dye laser and dyes:

The desirable hardware and software capabilities and specifications are given below:

A. Tunable Dye Laser:

The vendor should provide a tunable dye laser with high repetition rate (up to 20 kHz or better) having integrated frequency doubling unit (FCU), oscillator and resonator in *separate dye cells*. The FCU must be easily removable *and the dye laser can be used with or without FCU as per the experimental requirement*. Integration of the dye laser with the existing pump laser (EdgeWave IS200) must be done *mandatorily* by the OEM. Please see the details of the pump laser from the following websites:

<http://www.edge-wave.de/web/en/produkte/short-pulse-systeme/is-serie/>

<http://www.edge-wave.de/web/wp-content/uploads/2018/03/ISweb2018.pdf>

The dye laser should satisfy the following specifications:

- 1) **Repetition Rate:** up to 20 KHz or better (0.1 – 20 kHz) and capable of working with very high repetition rate.
- 2) **Primary Grating:** 2400 l/mm primary *long* (90 mm) grating.
- 3) **Grating Lift/Dual Grating/Secondary Grating:** long grating lift/dual grating with 1800 l/mm long secondary grating. Please mention the mechanism for grating change (*motorized sliding and automatic calibration will be given preference*). The vendor has to ensure proper training for grating change and ensure no misalignment of the total system during the grating change
- 4) **Pump Wavelength:** different wavelength *pumping option* (532 nm, 355 nm) and should be flexible in using with any of the mentioned wavelength according to experimental requirement.
- 5) **Linewidth:** $\leq 0.05 \text{ cm}^{-1}$ @ 625 nm or better (very narrow line width is required).
- 6) **Tuning range:** gap free tuning of 380 (or lower) – 900 nm or better without frequency doubling and 210 – 450 nm or better with frequency doubling. Please include suitable *BBO crystals* with model name and type.
- 7) **Beam profile:** The dye laser should provide very precise Gaussian/tophat beam profile for enhanced energy intensity. The dye laser must have polarization of $\geq 98\%$. All characteristics of the output beam should be submitted along with the technical bid.
The software provided with the dye laser should be capable of providing all information of beam characteristics.
- 8) **Output Energy:** The dye laser should be optimized in such a way so that the output energy efficiency from the dye laser should be as much as possible. The dye laser should give –
 - $\geq 0.4 \text{ mJ}$ @ 283 nm, 10 KHz (*after FCU*) with an input pump laser energy of 9 mJ @ 532 nm, 10 kHz using Rhodamine
 - $> 0.6 \text{ mJ}$ @ 431 nm, 10 KHz (*without FCU*) with an input pump laser energy of 4 mJ @ 355 nm, 10 kHz using Exalite 428



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Consider the pulse width of the pump laser is ≤ 10 ns

For 532 nm pumping with Pumping Energy of 9 mJ			
Dye	Required Wavelength	Output Energy with FCU (mJ)	Output Energy without FCU (mJ)
Rhodamine 6G (in Ethanol)	283 nm		
Pyromethene 580	283 nm		
Rhodamine B (in Ethanol)	308 nm		
Rodamine 101 (in Ethanol)	310 nm		
DCM (in Ethanol)	314 nm		
Styryl 8 (in DMSO)	387 nm		
Styryl 9 (in DMSO)	431 nm		
LDS 867 (in Ethanol)	431 nm		
Pyridin 2	355 nm		
Pyridin 1	355 nm		

Please submit the complete set of these dye tuning curves for 532 nm pumping

For 355 nm pumping with Pumping Energy of 4 mJ			
Dye	Required Wavelength	Output Energy with FCU (mJ)	Output Energy without FCU (mJ)
Coumarin 120 (in Ethanol)	431 nm	N/A	
Stilbene 3 (in Ethanol + H ₂ O)	431 nm	N/A	
Exalite 389 (in p-Dioxane)	387 nm	N/A	
Exalite 428 (in p-Dioxane)	431 nm	N/A	
Mix. Exalite 389/398 (in p-Dioxane)	387 nm	N/A	
Coumarin 153 (in Ethanol)	270 nm		

Please submit the complete set of these dye tuning curves for 355 nm pumping

Please make a chart of **available energy** from the following dyes (with and without FCU) **with individual and comparative tuning curve:**

9) **Frequency Doubling Unit (External/internal):**

- **Multi crystal Frequency conversion unit** (for enhanced energy output) must be **flexibly** operated **according to experimental requirements** (some experiments may or may not need frequency doubling unit)
- Please **mention the name and type of FCU crystals** (temperature stabilized BBO crystals) with **model numbers and their specific wavelength range**
- The FCU must be **controllable** and **flexible** (can be used whenever it is needed to double the frequency). The vendor should provide proper training so that the **FCU can be placed/removed** according to experimental requirement. Also, training should be provided to **change different nonlinear crystals according to their range**
- Please mention the average efficiency range of the frequency doubling unit
- The FCU should be controlled and operated from both hardware and software
- The FCU should be equipped with **stepper motor drive and driver**
- The FCU must come with standalone **auto-tracking facility** with necessary software
- All necessary parts/measures should be there to have most efficient FCU. The FCU should be optimized in such a way so that **maximum energy output** can be obtained



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- It should be equipped with electronic integration unit, diverse optical components (please mention which optics will be provided) with all necessary mounts and housings
- 10) **Precise Wavelength Control:** The dye laser should be optimized in such a way so that fully automated wavelength calibration and control can be achieved to have very precise control of wavelength during experiment. This should include active temperature control, online energy control and stabilization as well as online bandwidth control.
- 11) **Oscillator/Resonator** (ensure minimum loss) and **amplifier** unit with **separate dye cells** (suitable for high repetition rate and best available dye cells). Please indicate the dye cell model name and type. Also provide the data sheet for these dye cells.
- 12) **Basic Dye circulators:** **Minimum Two** high repetition rate (best suitable and available) and high flow rate **dye Circulator** for oscillator/resonator and amplifier respectively. Each dye circulator (temperature stabilized) should consists of reservoir (4 liter minimum or better), suitable pump and **filter cartridges must be provided. Please mention the flow rate of the dye circulator clearly.** Provide the model number and datasheet for the dye circulators
- 13) **Additional Dye circulators:** As we are going to use different dyes **at least two additional dye circulator** (one for amplifier and one for resonator) are required. Therefore, **additional dye circulators must be quoted separately.** Each additional dye circulator (temperature stabilized) should consists of reservoir (4 liter minimum or better), suitable pump and **filter cartridges must be provided. Please mention the flow rate of the dye circulator clearly.** Provide the model number and datasheet for the dye circulators
- 14) **Additional large reservoir (≥ 8 liter volume)** for short lifting dyes. Please mention the size of that additional reservoir.
- 15) Set of **Pellin-Broca** prism for **wavelength separation**
- 16) **Compensator** for temperature stabilized BBO crystals
- 17) **Pump beam alignment** (including mounts pedestals and optics)
- 18) Include all necessary **software and CD from OEM**
- 19) Include all necessary and suitable cables, mounts, optics for total system integration. Onsite installation by qualified engineer
- 20) **Integration with pump laser:** **The integration and alignment** of the dye laser with the pump laser of specified energy (provided by the institute) **is an important criterion.** We are buying the dye laser for our specific pump laser application as mentioned above. After delivering the dye laser, the vendor has to provide **OEM's Engineer only** to align the pump dye laser with the pump laser and to help us in setting up the total facility. One can **check the model number and the characteristics of the pump laser** from the link given above. Institute will provide the relevant output beam from the pump laser and an optical table. Please provide the **schematic of the integrated and aligned set up** along with the technical specification and also **mention the optics, mounts** (type, model etc.) which will be provided by the vendor for integration.
- 21) At least 10 days onsite training (**out of which 3 days at least by the OEM's Engineer**) should be provided for installation, operating and maintenance



B. Dyes:

The vendor should supply the following dyes mentioned below. Please note that, on the quotation mention the unit price of each dyes.

For 532 nm pumping:

- *Rhodamine B (in Ethanol): 1 g*
- *Rhodamine 6G (in Ethanol): 1 g*
- *Rodamine 101 (in Ethanol): 1 g*
- *Pyromethene 580: 1 g*
- *DCM (in Ethanol): 1 g*
- *Styryl 8 (in DMSO): 1 g*
- *Styryl 9 (in DMSO): 1 g*
- *LDS 867 (in Ethanol): 1 g*
- *Pyridin 2: 1 g*
- *Pyridin 1: 1 g*

For 355 nm pumping

- *Coumarin 120 (in Ethanol): 1 g*
- *Stilbene 3 (in Ethanol + H₂O): 1 g*
- *Exalite 389 (in p-Dioxane): 1 g*
- *Exalite 428 (in p-Dioxane): 1 g*
- *Mix. Exalite 389/398 (in p-Dioxane): 1 g*
- *Coumarin 153(in Ethanol): 1 g*
- *Flouxscein (in ME basic): 1 g*

The vendor should also suggest some suitable Dyes which would fulfill our requirement (for 532 and 355 nm pumping) with necessary energy figure and tuning curve.



Terms and Conditions:

1. Preparation of bids:

- Please submit your quote in *two parts*, i.e. **Technical Bid** and **Financial Bid**.
- The technical bid should *consist of all technical details* along with commercial terms and conditions
- Please indicate *item-wise price* in the Financial Bid for each and every component. The *unit prices* of each component and/or item should be mentioned.
- The vendor is also requested to *split the prices of each component of the dye laser* (as much as possible).
- If the vendor wants to offer some extra feature as optional then please indicate the price of those optional items separately
- Please indicate *cost per unit for each system component* (i.e. for each part of the dye laser as per specifications) in the financial bid
- The prices (in quotation) should be in **Indian currency**. For currencies other than Indian currency, please obtain a prior permission from the Institute.
- In case any of the items listed above require **Export License Compliance/End user certificate**, please *mention* in detail on the quote and also mention the necessary time for obtaining the export clearance.
- Bidder should organize the quotation in such a way that it should match the original technical specification mentioned above (*i.e., please indicate each component/feature mentioned above as it has been organized in the above chart*). If there is *any extra feature/technical component specific to the vendor please list/mention* that also on the technical bid. Higher/better feature will be welcomed.
- Bidders should *provide contact details (including contact no.) of technical service person/s* with the quotation document for communication during the tender process and in future to discuss technical and financial issues

2. Dates and time period:

- The date of opening the tender is **30th May, 2018**
- The last date for sending the quotation in *sealed envelope* is **22nd June, 2018**
- The validity of quotation should be *at least 120 days*
- Delivery period should not be more than **16 weeks** from the date of purchase order and letter of credit (LC) and delivery should be at the Institute. The installation should be done *within 21 days after delivery*

3. Meetings and Presentation:

- The vendor **must** have to come to the institute for a **pre-bid meeting** session and according to purchase committee's decision this meeting has to be done *after floating the tender but before the bid is submitted by the vendor*. The date and time will be decided according to convenience. But, ideally the meeting should be within 7 days after floating the tender and based on the discussion the vendor should quote accordingly
- The institute purchase committee may ask the vendor for a **technical presentation before financial bid**



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4. **Warranty:**

- The vendor should provide a minimum **three years standard warranty** for the total dye laser system **from the date of installation** of the system. The warranty should include each and every components of the dye laser. The warranty includes replacements of the damaged parts and onsite visiting charge, service charge, etc.
- The vendor should **quote additional two years** (after first 3 years) **warranty separately (as an option)** for the dye laser. The institute may/may not **purchase** the extended warranty depending on available budget. This extended warranty also includes damaged parts replacements, visiting and service charge.
- The warranty should include onsite **visit and service** by the technical service team of the vendor for **at least thrice a year within the warranty period**.
- The purchaser shall promptly notify the supplier/vendor if any problem arises in any of the dye laser and the supplier has to **reply and send their technical support team promptly and fix the problem/repair the item within 7 days or replace the faulty item/component within 30 days**.
- The vendor has to ensure **satisfactory after sales support and supply of spare parts for the system**
- Defective part in equipment, if found before installation and/or during warranty period, shall be replaced within 30 days (from reporting date by the institute). Early delivery will be preferred.

5. **Supplier's Capability:**

- Availability of after sales service and support in India. Supplier should **compulsorily** indicate details of facilities / expertise/ qualification of support staff in India. Factory trained engineer/s should be available in India for complete product support.
- The firm should supply authorization certificate by the original equipment manufacturer, for dealership/distributorship along with the quotation, if applicable. Parent company should be an established and reputed company with good number of installations
- The firm should give a declaration that they have not been blacklisted/debarred for dealing by Government of India in the past.
- The vendor should present should ensure that the **installation and training** should be provided by the **OEM's engineering team only**

6. **Technical Details:**

- The vendor **must fulfill** the above mentioned specification in the **technical specifications section**. These specifications are minimum criteria for participating in the tender process.
- The vendor should **mention all the technical specifications of each system component of the dye laser in detail** (like model no. and flow rate of dye cell, circulator, no. of prisms, alignment optics etc.) and that should **at least match the above mentioned technical specifications**.
- The firm should submit and **enclose complete technical brochure/catalogue** with all technical details
- Please note that the technical **specifications of the above mentioned system components** are only **indicative and minimum requirement**. If there are **specific system components (related to particular vendor)** required for total system



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integration and successful performance of the facility, then those *should be mentioned and provided. It is the responsibility of the bidder to include all the required accessories and components* for successful integration and operation of the facility.

- *Special features specific to any particular* vendor will be welcomed if they indicate that clearly on the quote
- Please *clearly mention* (in the quotation) *the OEM's name and model number* for each system component of the total facility. This is a **mandatory criteria**.
- The vendor should also supply all necessary *operation and maintenance manuals (written in English), drawings, driver CD/Software support CD (supplied by the OEM)* of each system component.
- Non-compliance of tender terms, lack of clarity of all specifications, non-submission of required document or any contradiction may lead to rejection of the bid.
- Inspection and *end test* prior to shipment of each and every items are *desirable* for the verification of the system performance. End test certificate provided by the OEM should be submitted to the institute at the time of delivery
- A very important criteria is to *integrate* the dye laser with pump laser provided by the institute. For integration *all the mirrors and other optics, mounts, pedestals and all necessary alignment optics and accessories should be provided by the vendor*. The vendor should also mention clearly all these components they are providing with the dye laser in detail for integration and also should send a *schematic of the integrated system* (pump laser and dye laser)
- Under special condition and circumstances, the Institute can give *relaxation to any of the technical specifications* of the dye laser. Final marks will be given according to the final configuration selected

7. Payment terms and offers:

- Normal payment terms for the institute will be applicable (*90% on delivery of the items and remaining 10% after satisfactory installation/inspection at the institute site*).
- The *total cost* (proposed in financial bid by the vendor) should *include delivery of all components and installation* of the total system along with successful operation of the facility.
- Suppliers shall be *entirely responsible* for *all taxes, duties, license fees, bank charges, packing and forwarding charges*, roads permits, etc., *incurred until delivery of the contracted system components to the institute*.
- For Imports, LC will be opened for 100% FOB/CIF value after final purchase order.
- The vendor should provide maximum educational and other discounts and the price of the items should be quoted after applying all discounts.
- Institute is partially exempted from custom duty

8. Institute's rights:

- The institute reserves the right to *add or delete any item* from the item list. This means that the institute has the *right to choose the final item/component's list* to be purchased during the tendering process.
- The Institute reserves the right to *augment or provide relaxation* to any component/specifications, terms and conditions during the entire tendering process.
- The intender reserves the *right to withhold placement of final order*.
- The *right to reject* all or any of the quotations (at any time of the procurement



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process) and *to split up the requirements* or relax any or all of the above conditions without assigning any reason is reserved.

- The institute reserves the *rights to charge penalty or take any legal action on delayed delivery* of components, supplying *defected/used/refurbished/substandard equipment*.

9. Selection of Bid:

- The final selection will be made based on *weights given to technical merit (including fulfillment of technical specifications, terms and conditions) and pricing as 75% and 25%, respectively*
- Technical merit will be judged according to the fulfillment of the technical specification (which the vendor must clearly mention)
- The pricing merit will be judged based on the best quotation price of the final items to be purchased.
- Please note that the final items/components list will be decided by the institute (as the *institute reserves the right to add or delete any component during the total procurement/tendering process*) and the *pricing merit will be based on this final components' list*.
- According to the final configuration of the dye laser (to be decided by the institute), *LC will be selected*.

10. Packing and delivery:

- All the parts of the dye laser are very delicate. The packaging should be such that *none of the components get damaged* during transit. The supplier has to ensure this and they should take care of all these issues during the shipment process. *Damaged/partly damaged product will not be accepted*.
- *In case of any defect/damage to equipment* during the carriage of supplies from the origin of equipment to the installation site, the supplier has to *replace it with a new one immediately* at his own risk and responsibility. The supplier may deal this with their respective insurance company as per their convenience. *IIT Kanpur will not be liable/responsible to any type of losses in any form*.
- Each Package should be marked (in three sides) with *item nomenclature, OEM and model no., order/contract no., country of origin of goods, supplier's name and address, packing list reference no.* and the marking should be done by *proper paint/ink*.
- Documents to be supplied with delivery are *4 copies of supplier/OEM invoice* showing contract no., item description, quantity, unit price, total amount and *2 copies of the packing list identifying the contents of each packing*.

11. Installation, Commissioning and Training:

- The Institute will only provide the laser beam from the pump laser having specified energy and also provide suitable optical table. The supplier should be able to maneuver the input laser beam to the dye laser using necessary optics/mounts etc. All *integration and demonstration* should be done by the *OEM's Engineer*.
- Installation and commissioning should be done by the vendor within *21 days* from the date of delivery
- Installation, demonstration and training should be done by OEM only. They should assemble the system and make the system operational. The supplier should also be responsible for suitable demonstration and smooth working of the entire system.



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- The supplier should provide the end test certificates from OEM carried out at the factory.
- The vendor should provide 10 days (*out of which at least 3 days by the OEM engineer) towards training for operation, maintenance, and system integration.*
- *Training for each component* of the facility should also be provided by the vendor
- The Institute would try to utilize the facility in conducting multiple experiments and would try different combinations (e.g., generating multiple wavelength from pump and dye laser, using different dyes, changing the camera resolution and fps, controlling the repetition rate of laser, changing tracer for tracer PLIF application and others). *The vendor has to train the purchaser in such a way, so that the purchaser can reintegrate (each and every items), realign, and again fit the system in different position with different experimental setup and perform experiment successfully.*
- If the purchaser face some difficulties in realigning and reintegrating the total system for a specific set of experiment/acquiring result then the vendor must come to the institute promptly (after informing) and should sort out the issue. *Therefore true aftersales support is required.*

In case of any queries, you may please write to sarmasaikat@gmail.com and sarmasai@iitk.ac.in.

Kindly send the quotation in *sealed envelope* latest by **22nd June, 2018** to the following address:

Dr. Santanu De

Assistant professor

NL 302 (Northern Laboratory)

Department of Mechanical Engineering

Indian Institute of Technology Kanpur

Kanpur-208016

Uttar Pradesh, India