Technical specifications for ‘High-speed Particle Image Velocimetry’

system HIGH SPEED PIV (2D-2C):

I. High Speed Laser:

The vendor should provide Dual Head (DH) Nd: YLF laser that combines the output from two identical lasers. The laser should satisfy the following specifications.

1. Laser type: Monolithic cavity Nd:YLF
2. Wavelength (nm): 527
3. Pulse Energy from single cavity (mJ) @ 1kHz: ≥ 30
4. Pulse Width (ns) @ 1kHz: ≤ 150
5. Repetition Rate: Single shot to 10 kHz
6. Beam diameter, at exit: < 10mm
7. Beam Divergence: <10 mrad
8. BeamCircularity: >85%
9. Long Term Stability: <0.5% rms
10. Operating condition: Should operate even at 80% relative humidity.
11. Interface: RS 232, External TTL Triggering, GUI software included
12. Operating Voltage: 100 - 240 V
13. Input power Line Frequency: 50 Hz
14. Cooling: Water
15. Chiller with water as a cooling medium for adequate cooling of the laser, which works up to an ambient air and water temperature of 40°C should be provided.
16. Internal and external trigger options
17. Flexibility in time delay between pulse pairs
18. Training on the operation of the system should be provided.

I. Single compact light sheet optics unit

1. Should generate divergent light sheets.
2. Suitable for high-speed PIV measurement with coatings.
3. Wavelength (nm): 220 – 800
4. Adjustable focus (m): minimum 0.35 to 2.
5. Adjustable light sheet thickness
6. Optical transmission: >95%
7. 360 degrees adjustable light sheet orientation
8. Mountable on articulated mirror arm or can be used as a separate unit
9. Should not be affected by laser polarization
10. Diameter: 40-60 mm (Usually it is 25 mm - 50 mm).
11. Cylindrical Lenses: -15 mm and -25 mm (25 and 14 degree divergence respectively).

1. High speed camera

1. Minimum Resolution of 1 MP
2. Sensor Type: CMOS
3. Frame speed ≥6000 fps at the above prescribed resolution
4. Sensor 12-bit CMOS with a monochrome sensor with size between 10 μm to 20 μm.
5. Minimum onboard memory 32 GB
6. Global electronic shutter ≤2 μs independent of frame rate
7. Capable of working in low light conditions with ISO of ≥6400 (daylight)
8. Phase locking option to synchronize camera with an external source
9. Standard image formats: JPEG, AVI, TIFF, BMP, RAW (compressed or uncompressed), PNG etc.
10. Active cooling unit to cool the camera
11. Operating Temperature 20 to 40 °C
12. Power requirements 100 V - 240 V AC ~ 1.5 A, 50 Hz
13. Triggering Option: BNC-Trigger, Software trigger
14. All necessary cables should be provided including BNC cable for triggering purposes
15. Rugged camera case
16. Adapter (F, C, EOS and EF) to mount the appropriate lens
17. Control Software: A PC-based software program that should interface with ethernet communication. The graphical user interface (GUI) should provide automatic configuration of the camera, session saving for easy configuration and experiment setup reloads. The software should be able to control the camera, image capturing, image processing and should also allow playback of the recorded videos. Further, the software should support multiple devices.

2. Camera Lens

- Lens for Camera with minimum 50 mm focal length
- Aperture f/1.8
3. **Band pass filter**

- Wavelength 527±nm
- FWHM±10 nm
- Transmissivity>80% @ 527 nm

4. **Power meter to measure laser power** (1 qty)

5. **Synchronizer**

Control and synchronization of all integrated hardware devices by one software platform supporting the embedded synchronization unit

1. Should be able to work in high-speed mode
2. Minimum of 24 outputs and 4 input channels for triggering
3. Ethernet (TCP/IP) control with the suitable software
4. Time resolution maximum of 1 ns
5. Jitter ≤±0.2 ns
6. 5ns rise time, TTL compatible pulse
7. Repetition rates from 0.1 Hz up to 10 MHz
8. Delay between external triggers (minimum 30 MHz)
9. 100 Mb ethernet connection for communication with PC
10. Laser control by Q Switch or gate or frequency.
11. Positive or inverted TTL signal for all outputs configurable
12. Software for standard and high speed PIV timing
13. The same synchronizer should be usable for future simultaneous stereo PIV, Tomo PIV and PLIF measurements

6. **PIV Software for 2D PIV**

1. For 2D2C PIV processing
2. User license allowing usage of the user interface
3. Image pre-processing and post processing features
4. Cross correlation, autocorrelation and speckle shift analysis modes
5. Supports TIFF, BMP, JPEG, PNG, and other image formats
6. Image batch processing
7. Vorticity, velocity calculation for each image frame
8. PIV uncertainty quantification for both single vector and derived quantities to verify quality of PIV data
9. Should be capable of controlling all hardware items related to the PIV system
10. Output data should be compatible with the plotter like Matlab, Tecplot
ADDITIONAL TERMS AND CONDITIONS:

1. Mandatory supporting documents such as brochure and literature for the complete technical specification is requested.

2. The bidder/OEM must provide the complete software manuals (as pdf files) with text description, tables, work flow charts etc. to prove the reliability and document the content of the corresponding software/packages as offered.

3. All components items should cover for a warranty of 1 year.

4. The bidder/OEM should provide continuous technical support and maintenance of the work done. The bidder/OEM should have trained service engineers in India capable of servicing high speed Nd-YLF laser. The company should provide the name of the engineer & customer references in this regard.

5. Details of the subcomponents should be provided as per the above list specifying the makes.

6. Installation and Commissioning by the bidder/OEM is mandatory. The bidder/OEM should demonstrate the laser performance as per the specifications listed.

7. Onsite training should be provided for the whole system post-installation.

8. The bidder/OEM should have supplied at least 3 similar items to IITs, NITs, IISERs, CSIR Labs or other Govt. R&D organizations in the last 10 years, PO copies or installation certificates along with contact details of end user need to be submitted as the proof of supply. IIT Bombay reserves its right to verify the claims submitted by the bidder and the feedback from the previous customers will be part of technical evaluation.

9. Tender Specific Manufacturer Authorization Form from OEM Required.

10. The Institute reserves the right of accepting or rejecting any quotations without assigning any reason thereof.

11. The bidder/OEM should deliver all the items within 120 days from the date of release of PO.