

SPECIFICATIONS
for
Three-dimensional High Speed Optical Tracking System

1.0 General Description and Requirements:

The tomographic Particle Image Velocimetry (PIV) system must be capable of resolving the three-dimensional, three-component (up to 1 million independent vectors) of velocity in a volume (order 10 cm x 10 cm x 10 cm) per individual measurement at temporal resolutions up to 100 independent velocity measurements per second (200 image captures per second). The time displacement between adjacent image pairs needs to be on the order of 2 microseconds with velocities up to 2 meters per second in the measurement volume. The system shall perform digital volumetric reconstruction of the tracer particles in the measurement volume using a three-dimensional cross-correlation or some alternative technique suitable for determining accurate three-dimensional velocities.

2.0 System Requirements

2.1 Four-Camera System Requirements:

2.1.1. 4 ea CMOS cameras with a minimum capabilities: 1 mega-pixel resolution sensor, 1000 frames/second at full resolution, 12-bits digital output, 8 GB on-board memory, GigE interface, minimum 5-meter camera cables.

2.1.2. 4 ea Sensor Tilt Lens Adapters for optimization of depth of focus.

2.1.3. 4 ea f 1.4, 50mm focal length lenses.

2.1.4. Preferred camera mounting system based on optical rails with sliders, clamps and 3-axis gear heads for rigid mounting of 4 cameras simultaneously but with continuous adjustment of camera positions and viewing directions; or other mounting system that allows for mounting and adjustment of camera position and viewing angles for 4 cameras simultaneously.

2.1.5. Volume calibration target.

2.1.6. External USB interfaced Synchronization Electronics with at least 16 output channels, at least 3 input channels and at least 10 ns time resolution. Provide additional on-board programmable input/output with 16 programmable output channels and 4 programmable input channels.

2.2 Pulsed Illumination System

2.2.1. High rep rate dual cavity laser system with minimum 50mJ per pulse @ 100 Hz (200 laser pulses per second) and 50ns pulse duration with integrated cooling system and power supply.

2.2.2. Adjustable collimated volume illumination optics that converts the laser beam to volume illumination.

2.3 Computer Hardware and Software

2.3.1. 2 ea System Computers including 2 x quad-core processors, minimum 4 GB RAM, 1 x 250 GB main hard disk, 4 x 500 GB internal RAID (minimum required).

2.3.2. System control must be integrated into system software.

2.3.3. System software needs to include all of the following capabilities: (a) integrated hardware control for configuring and controlling cameras and laser, (b) capturing images as multi frame images, (c) hierarchical data storage and management system, (d) online image preview, (e) automated volume calibration, (f) volumetric self calibration, (g) tomographic reconstruction of fluid volume, (h) 3D cross correlation based volumetric grid interrogation and volumetric velocity display or alternative method for obtaining accurate three-dimensional velocities, (i) 3D Particle Tracking Velocimetry (PTV), (j) all necessary software licenses including free software updates for the life of the system, electronic format manuals and free telephone support.

3.0 Installation and Delivery

Contractor shall be responsible for installation and testing of the system at the Naval Research Laboratory, Stennis Space Center, MS. Delivery and installation date no later than 30 September 2009.

4.0. Test Plan

Offerors shall provide an acceptance test plan with their proposal which demonstrates how the system will meet the Governments requirements. Acceptance test plan must include acquisition of images of two-phase flow in a 25 cm square channel (sealed conduit) that is optically clear, but containing flowing water and mobile glass beads (in addition to flow seeding material that are at least an order of magnitude larger than flow seeding material). The system software must then process a single set of images to provide both accurate PIV measurements of the three-dimensional water velocity, and accurate PTV for the three-dimensional Lagrangian velocities of the glass beads embedded in the flow.

5.0 Warranty

Offeror shall provide a standard commercial warranty.