LASER DOPPLER MEASUREMENT SYSTEM (LDMS) LAD-056 
FOR 3D DIAGNOSTICS OF MULTIPHASE GAS-LIQUID FLOWS

Description
A semi-conducting laser 3D measurement system LAD-056 is developed on the basis of new anamorphic
optic schemes and modern powerful semi-conducting lasers with a low degree of spatial and time coherence
for metrological support of fundamental research of the multiphase flows under the mode of reverse light
scattering; the important physical results are obtained.

Technical specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of measured velocities, components X, Y</td>
<td>$5 \times 10^{-5} \ldots 30$ m/s</td>
</tr>
<tr>
<td>Range of measured velocities, component Z</td>
<td>0.02…100 m/s</td>
</tr>
<tr>
<td>Static error of the traced spectral peak of Doppler signal, not worse than</td>
<td>0.1 %</td>
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<tr>
<td>Measurement error of the average velocity: components X, Y</td>
<td>0.5 %</td>
</tr>
<tr>
<td>component Z</td>
<td>1.5 %</td>
</tr>
<tr>
<td>Focal distance of outlet objectives, (F)</td>
<td>0.25…1.0 m</td>
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<tr>
<td>Size of the probe optic field, not higher than</td>
<td>$\varnothing 0.05 \times 1$ mm (F=0.5)</td>
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<tr>
<td>Service life, up to</td>
<td>40 000 h</td>
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</tbody>
</table>

Fig. 1. Laser Doppler 3D measurement system (LDMS) LAD-056 for diagnostics of gas-liquid flows.

Technical appraisal and economic benefits
The main parameters of this system correspond to the best world analogues (developed by DANTEC and TSI companies) at significantly smaller sizes and lower cost. This product has forestalled the best foreign development on semi-conducting lasers (DANTEC) by three years.
The level of implemented R&D solutions meets the modern demands and is in line with the predicted development of fundamental and applied science in foreseeable future.

This device is considerably cheaper than the closest foreign analogue DANTEC (its minimal cost in 2006 in Russia was more than 300—600 thousand euros).

The important advantage of this system for the consumer is its possible application both for 3D measurements and as two full-function 2D semi-conducting laser Doppler anemometers.

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**Application areas**

Precision optic measurements of the multiphase flows in physics, chemistry, biology, medicine, ecology and engineering in the mode of reverse light scattering. Experimental hydro-, gas-, and plasmodynamics of the multiphase systems, safety, resources and ecology in power engineering, aviation, rocket and atomic engineering, shipbuilding, land transport, machine-tool and instrument making. The distant experiments were implemented. Because of the simple application and relative safety, the device can be used for educational purposes.

**Development stage**

A full cycle of R&D works was carried out (2003—2006), design documentation is available, pilot samples were constructed, and small-scale production is possible. This system is used at the largest enterprise of Russian turbine construction: the Open Joint-Stock Company “Power Machines” (St. Petersburg) for bench tests, hydroturbine optimization and improvement of safety at the objects of Russian hydropower engineering (2004—2006). Besides, the measurement sets are used at the Institute of Hydrodynamics SB RAS, Institute of Thermophysics SB RAS, and Perm State University.

**Patent situation**

Patents of the Russian Federation are obtained; additional patenting is in progress.
Commercial offers
Supply of the measurement system and technical support.
Fast modification according specific consumer requirements is possible.

Estimated cost
Contract cost is approximately 220 000—290 000 USD (depending on conditions and delivery set; it is twice as low as the cost of a foreign analogue).

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