COMBUSTION DIAGNOSTICS
Advanced Optical Measurement Solutions
Velocity characterisation of a spray combustion facility using Stereoscopic PIV, National Institute of Standards and Technology, Gaithersburg, US.
Combustion processes are used in many modern technologies such as electrical power production, heating, and automotive and aircraft/space-shuttle propulsion. Laser diagnostic techniques can help improve our understanding of combustion processes and thus contribute to reducing the carbon footprint of mankind.

Combustion Diagnostic Systems

Dantec Dynamics offers a full range of combustion diagnostics measurement solutions that integrate advanced timing devices, state-of-the-art lasers, the latest camera and image intensifier technology with image acquisition and data analysis software. This makes the systems powerful yet easy to use, so that you can concentrate on the measurements.

The DynamicStudio software platform includes all the features - from instrument calibration routines and acquisition management to data analysis and presentation - to make your measurements successful. It combines a flexible database structure designed to handle vast amounts of data with a wide range of analysis modules, and it can be adapted to the numerous and different measurement situations that your laboratory might encounter, now and in the future.

All this is combined into complete systems that provide:

- Non-intrusive measurements
- High spatial and temporal resolution
- Modular systems allowing for easy upgrading to extend the system capabilities even further
- Data calibration
- Background subtraction and on-line monitoring and correction of laser pulse energy fluctuations
- Statistical analysis of data
- Visualisation of data and results
Combustion Radicals and Products Measurements by LIF

Laser-Induced Fluorescence (LIF) is the most powerful technique available today for experimental diagnostics of combustion processes. Based on the physics of interaction between light and individual molecules, the technique allows for species-selective measurements with high sensitivity.

Dantec Dynamics' highly advanced and flexible system for combustion LIF is capable of measuring a wide range of combustion radicals and products. It facilitates:

- Imaging of several combustion radicals
- Whole-field flame front visualisation by LIF of OH or CH
- Imaging of pollutant species such as NO and CO

In addition, high-speed OH LIF makes it possible to study temporal evolution of combustion processes.

OH LIF showing the area of the flame front and post-flame gases in a flame from a Bunsen burner (left) and the corresponding image after post-processing showing the location of the main flame front by means of gradient detection (right).
Fuel Visualisation by Tracer-LIF
By adding a fluorescent tracer species (e.g. acetone) to a non-fluorescent fuel, you can carry out diagnostics studies of the combustion as well as pre-combustion process. Dantec Dynamics’ powerful yet easy-to-use tracer-LIF dedicated system enables you to study a wide range of applications, from open flames to internal combustion engines, for properties such as:
- Fuel distribution
- Ignition phenomena
- Fuel injection behaviour

Fluid Dynamics and Flame Structures by Simultaneous LIF/PIV
The modular structure of Dantec Dynamics’ systems allows you to control several different measurement systems from the same master PC. In this way, the processes under investigation can be studied in more detail by combining, for example, fuel visualisation with flame front tracking.

Naturally, velocity information from PIV equipment can be integrated for further advanced analyses combining combustion chemistry and fluid mechanics.

Simultaneous flow field, fuel mauve and OH green visualisation in a turbulent atmospheric flame. Courtesy of R. Collin and P. Petersson, Division of Combustion Physics, Lund University, Sweden.
Soot Diagnostics by LII
Dantec Dynamics’ system for Laser-Induced Incandescence (LII) is a solution for quantitative determination of soot volume fraction. The LII software provides access to advanced image calibration and analysis methods, as well as non-linear signal compensation algorithms for greater accuracy when working with sooty processes.

The system includes features such as:
- Numerical methods for calibrating line-of-sight, LII decay time and gas composition dependence of the LII signals
- User-friendly image processing interface with scientific accuracy to gain direct information on soot volume fraction (in ppm) and carbon concentration equivalent (in mg/cm³)
- Methods for statistical analysis of LII results

The view through the optical piston from below (a) and from the side (b), together with single-shot soot-volume-fraction images. Courtesy of H. Bladh et al, Lund University.
Temperature Mapping by Rayleigh Scattering

Light that is elastically scattered by molecules, Rayleigh scattering, is directly related to the density of the molecules. This can in turn be converted to temperature, making Rayleigh scattering a suitable tool for 2D thermometry in combustion research.

Chemiluminescence Imaging

Chemiluminescence imaging can be a valuable diagnostics tool for combustion processes. The technique relies on detection of the naturally emitted light from chemically excited species in the flame and does not require a laser source. This makes the technique cost-efficient as well as straightforward to use. With Dantec Dynamics’ system, the technique can even be extended to time-resolved investigations using a high-speed camera and image intensifier, facilitating studies of the temporal evolution of many different combustion processes.

Your Partner for Progress

By partnering with Dantec Dynamics you will benefit from:
- The most diverse range of products and techniques to match your measurement requirements
- Access to the knowledge of our highly trained and competent staff with strong academic backgrounds
- The world leader with several thousand measurement systems in operation around the world at leading universities and companies
- Local support from our five subsidiary companies and a strong network of distributors
About Dantec Dynamics

Dantec Dynamics is the leading provider of laser optical measurement systems and sensors. Since 1947 we have provided solutions for customers to optimize their component testing and products. Our large number of customers benefit from our quality solutions within:

- Fluid Mechanics
- Thermal Comfort
- Strain, Stress & Vibration

- Particle Characterization
- Microfluidics
- Non-destructive Testing

- Combustion Diagnostics
- Paper Process Optimization
- Disatac Tachometers

Worldwide representation

From our six offices and more than 30 representatives worldwide we approach our customers individually. We examine the specific needs and find the best solution for you. For us you are a long-term partner in improving efficiency, safety and quality of life. A list of representatives is available at our website.

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