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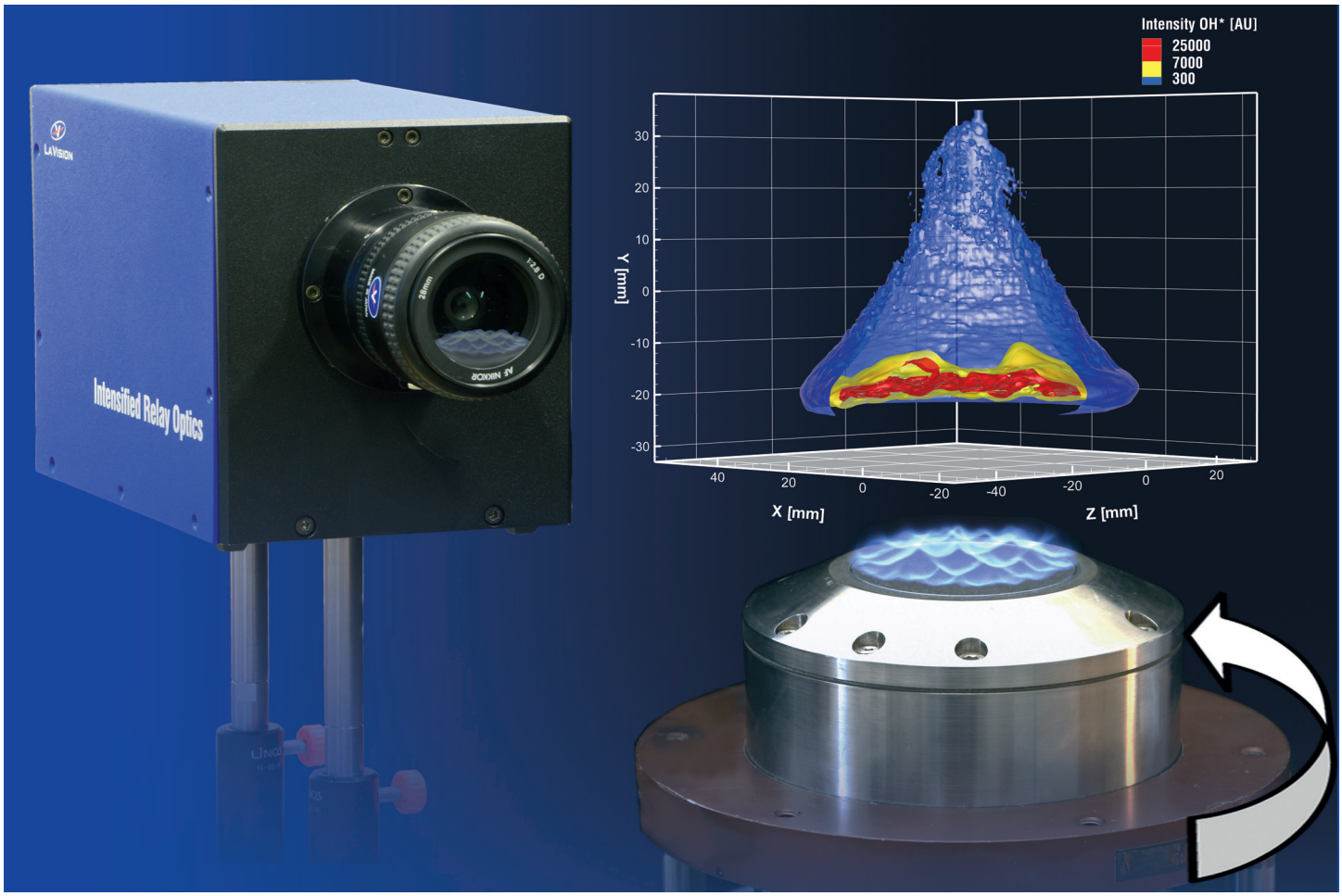
In Application

3D Flame Imaging based on Tomographic Reconstruction



Reconstructed time-averaged 3D OH distribution in a premixed CH_4 - air flame*

Introduction

Volumetric flame imaging based on tomographic reconstruction gives insights into the complex 3D-distribution of flame species. The chemiluminescence of the flame radical OH* visualizes the flame front and is related to the heat release rate, which determines the stability of the combustion process. 2D-camera images of the OH* emission from a number of viewing angles are used to reconstruct the time-averaged mean volumetric OH* distribution of the flame.

System Features

- 3D-flame structure in all details
- volumetric distribution of the flame radicals OH*, CH*, …
- software controlled multi angular scanning with automatic 3D camera calibration
- highly accurate tomographic reconstruction algorithm
- link to Tecplot™ for 3D visualization
- instantaneous and time-resolved 3D flame images with multi-channel detectors

LaVisionUK Ltd
2 Minton Place / Victoria Road
Bicester, Oxon / OX26 6QB / United Kingdom
E-Mail: sales@lavision.com / www.lavisionuk.com
Phone: +44-(0)-870-997-6532 / Fax: +44-(0)-870-762-6252

LaVision GmbH
Anna-Vandenhoeck-Ring 19
D-37081 Göttingen / Germany
E-Mail: info@lavision.com / www.lavision.com
Tel. +49-(0)551-9004-0 / Fax +49-(0)551-9004-100

LaVision Inc.
211 W. Michigan Ave. / Suite 100
Ypsilanti, MI 48197 / USA
E-mail: sales@lavisioninc.com / www.lavisioninc.com
Phone: (734) 485 - 0913 / Fax: (240) 465 - 4306

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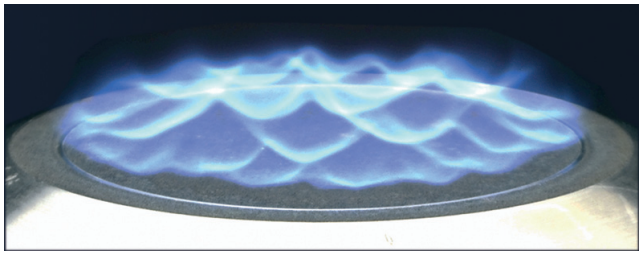
3D Flame Imaging
based on Tomographic Reconstruction

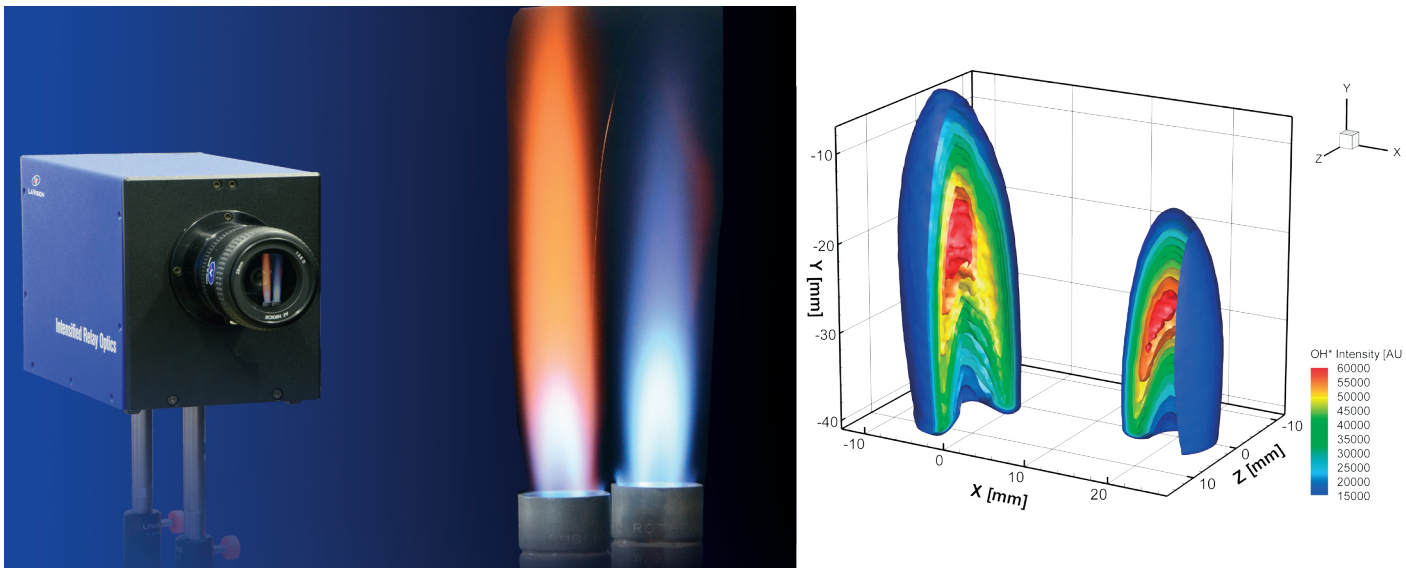
Principle of tomographic flame imaging using a single camera
An intensified CCD camera records first a calibration target and then the line-integrated projections of the OH* emission from 15 viewing angles of a premixed CH_4-air flame featuring a strongly corrugated and slightly flickering 3D-flame front.
Due to this instability time averaged imaging is applied to get stable OH* images for each viewing angle. The tomographic reconstruction software module in **DaVis** generates from these 15 2D-images the mean volumetric OH* distribution of the flame.



Snapshot of the corrugated flame front of the premixed CH_4- air flame

Instantaneous 3D-flame imaging
A minimum of 8 projections are already sufficient to resolve the main features of this nearly stable but complex flame structure. An imaging system supporting simultaneously 8 views with short exposure times will therefore capture the instantaneous 3D-structure of most turbulent flames.

Applications
- 3D flame structure
- model validation
- burner instabilities
- thermoacoustics / burner vibrations



3D-view of the time averaged OH distribution of two side-by-side turbulent propane-air burners*

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LaVision GmbH
Anna-Vandenhoeck-Ring 19
D-37081 Göttingen / Germany
E-Mail: info@lavision.com / www.lavision.com
Tel. +49-(0)551-9004-0 / Fax +49-(0)551-9004-100

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211 W. Michigan Ave. / Suite 100
Ypsilanti, MI 48197 / USA
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Phone: (734) 485 - 0913 / Fax: (240) 465 - 4306