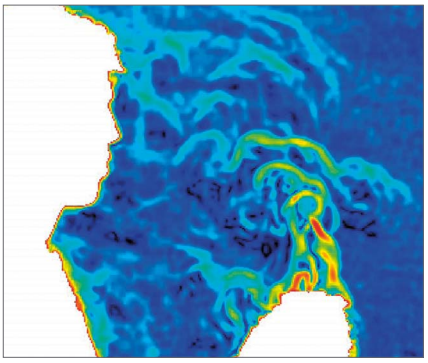
LAVISION

FOCUS ON IMAGING

Digital Schlieren Imaging for Flow Visualization

BOS imaging system based on digital image correlation



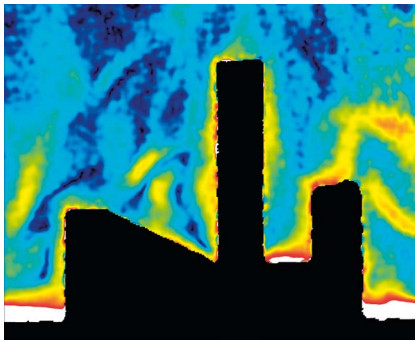
BOS imaging of a thermal flow

movie and more

Background **O**riented **S**chlieren (**BOS**, also known as Synthetic Schlieren) is a simple and cost-effective imaging method for the visualization of gas motion, mixing and thermal flows all based on local refractive index variations. Compared to the conventional knife-edge Schlieren method, **BOS** can visualize large scale flow phenomena and measures the optical flow distortion (density gradient field) in form of a digital vector map. For 2-dimensional or axisymmetric flows, **BOS** provides the potential to measure absolute 3D density and temperature fields.

BOS is a line-of-sight imaging technique and measures locally the density gradient as an integrated value over the line of sight. In practice, only a random dot pattern in the background of the flow is imaged with a high resolution camera before and during the test. By comparing - or more precisely by digitally correlating - the two pictures, the local displacement of the background pattern is used to provide lateral information on path-integrated refractive index variations measured as a gradient vector field. In case of 2-dimensional or axisymmetric flows absolute 3-dimensional gas density and temperature fields are reconstructed from this vector field applying a numerical discretization method.

BOS imaging setup



Conventional knife-edge Schlieren system

Thermal flow visualization (Schlieren image) around a heated building model

BOS imaging system features

- simple flow visualization technique on large scales without flow seeding
- advanced image correlation technique applied on background targets
- time-resolved Schlieren imaging using high-speed cameras
- **BOS** software module in **DaVis** for quantitative density (temperature) imaging in 2D and axisymmetric flows

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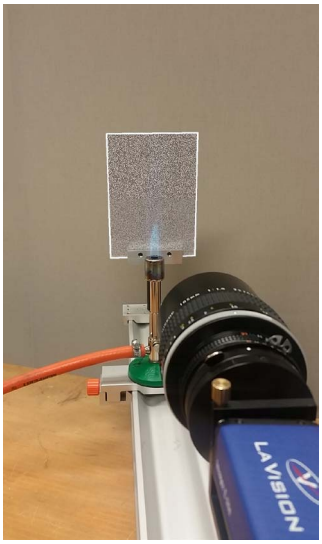
Applications

- localization of eddies, vortices and Schlieren
- mixing of gases and liquids
- thermal flows and flame temperature
- sound and shock waves
- gas leakage detection

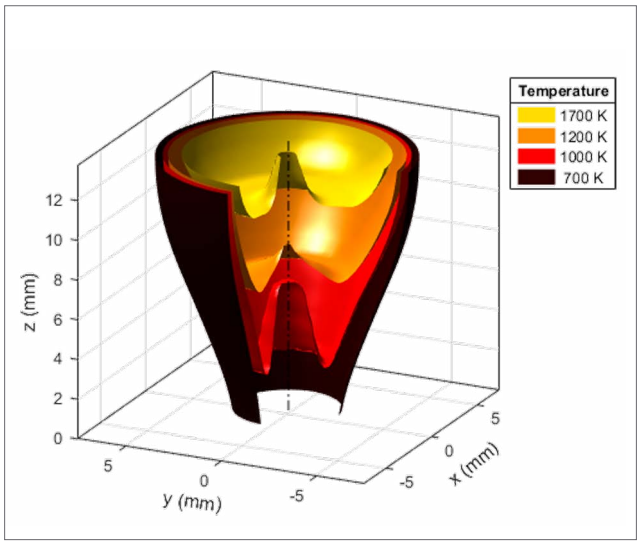
BOS imaging of an axisymmetric Bunsen flame

For flame temperature measurements using **B**ackground **O**riented **S**chlieren imaging (**BOS**), a background pattern is placed behind the flame and recorded with and without the flame. The optical distortion of the pattern caused by the hot flame gases is recorded with a high resolution camera. The symmetry of this conical flame allows the numerical reconstruction of the absolute 3D temperature field of this Bunsen flame. This 3D-reconstruction module together with the DIC image processing engine is provided in our **BOS** software package.
LaVision's **FlowMaster** PIV systems can be easily upgraded for **BOS** imaging adding the **BOS** software package.



BOS imaging setup

Conical Bunsen flame



3D temperature field of the Bunsen flame

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