



TH  
LISBON  
2018  
INTERNATIONAL SYMPOSIUM  
ON APPLICATIONS OF LASER AND IMAGING TECHNIQUES TO FLUID MECHANICS  
FROM 16 TO 19 JULY

The logo for the TH LISBON 2018 International Symposium is located in the upper right quadrant. It features a stylized '19' where the '1' is composed of overlapping green and yellow triangles and the '9' is a grey circle with a white center. To the right of the '19' is the text 'TH LISBON 2018' in a sans-serif font, with 'TH' in grey, 'LISBON' in teal, and '2018' in yellow. Below this, the words 'INTERNATIONAL SYMPOSIUM' and 'ON APPLICATIONS OF LASER AND IMAGING TECHNIQUES TO FLUID MECHANICS' are written in teal, and 'FROM 16 TO 19 JULY' is written in yellow.

# FINAL PROGRAM



19th International Symposium on Application of Laser Techniques to Fluid Mechanics

**JULY 16**

**Welcome Remarks**

9 - 9:10

**KEYNOTE LECTURE**

9:10 - 10

**Numerical and Experimental Studies on Blood Flow from Macro to Micro Scale**  
Marie Oshima

**PIV & LIF I**

*Auditorium 2*

Fabrice Lemoine, José Nogueira

**BACKGROUND ORIENTED  
SCHLIEREN I**

*Auditorium 3*

Edouard Berrocal, Christoph Brücker

**MICRO-SCALE PIV AND  
MICROFLUIDICS I**

*Room 1*

Rui Lima, Yoshiyuki Tagawa

**ENGINES I**

*Room 4*

Yuji Ikeda, Nobuyuki Kawahara

Temporally Resolved PLIF Measurements of the Temperature Inside Droplets Impinging on a Hot Solid Surface  
*W. Chaze, R. Collignon, O. Caballina, G. Castanet, F. Lemoine*

Smartphone Background-Oriented Schlieren for Locating Gas-Leak Source in Emergencies  
*K. Hayasaka, S. Kawamoto, M. Kameda, Y. Tagawa*

Ψ-PIV: a Novel Framework to Study Unsteady Microfluidic Flows  
*A. Kislaya, A. Deka, D.S.W. Tam, J. Westerweel*

High-Speed Tomographic PIV in an IC Engine  
*M. Braun, W. Schröder, M. Klaas*

10:05 - 11

Heat Release Rate Imaging During Side-Wall Flame Quenching using Laser-Induced Fluorescence of Formaldehyde and Hydroxyl Radicals  
*H. Kosaka, F. Zentgraf, B. Böhm, A. Dreizler*

Simultaneous Conventional and Plenoptic Background Oriented Schlieren Imaging  
*J.N. Klemkowsky, C.J. Clifford, B.S. Thuroow, B.F. Bathel*

Three-Dimensional Measurements in Microfluidic Flows with Adaptive Optical Image Correction  
*L. Büttner, M. Teich, N. Koukourakis, H. Radner, J. Czarske*

OH PLIF Investigation on Flame Development in Gasoline Engine Under Strong Tumble Flow  
*S. Kumar, T. Moronuki, M. Shimura, Y. Minamoto, T. Yokomori, M. Tanahashi*

Two Color LIF Techniques Applied on a Two Jets Mixing Flow: Challenges and Experimental Program on a Complex Mock Up  
*M. Chitt, B. Cariteau, D. Guenadou, G. Ricciardi, L. Rossi*

Shock Wave Boundary Layer Interactions at Compression Ramps Examined by Converged Statistical Schlieren  
*Z. Sun, T. Gan, Y. Wu*

Confocal Microscopy as a Means to Investigate the EHD-Driven Deformation of Liquid-Vapor Interfaces Along an Array of Microgrooves  
*N. Cardin, L. Davoust, S. Lips, S. Siedel, J. Bonjour*

Soot Formation in GDI Engines  
*G. Marseglia, C.M. Medaglia*

COFFEE 11

BREAK 11:30

Lisbon, Portugal, 2018

19th International Symposium on Application of Laser Techniques to Fluid Mechanics

JULY 16

**PIV & LIF II**

*Auditorium 2*

Fabrice Lemoine, José Nogueira

**BACKGROUND ORIENTED SCHLIEREN II**

*Auditorium 3*

Edouard Berrocal, Christoph Brücker

**MICRO-SCALE PIV AND MICROFLUIDICS II**

*Room 1*

Rui Lima, Yoshiyuki Tagawa

**ENGINES II**

*Room 4*

Yuji Ikeda, Nobuyuki Kawahara

11:30 - 13

Influence of Boundary Layer Deformations on Mass Transfer and Chemical Reactions  
*S. Kastens, J. Timmermann, M. Hoffmann, M. Schlueter*

A Comparison of Calibrated and Rainbow Schlieren in Axisymmetric Supersonic Jets  
*R. Mariani, D. Lim, B. Zang, U.S. Vevek, D.T.H. New, Y.D. Cui*

Visualization of the Effect of Temperature on the Velocity of an Evaporating Droplet using Micro-PIV  
*R. Boubaker, S. Ouenzerfi, A. Koched, S. Harmand*

Spark-Induced Breakdown Spectroscopy (SIBS) in a Hydrogen Spark-Ignition Engine  
*N. Kawahara, H. Tani, E. Tomita, Y. Takagi, Y. Mihara*

Application of Stereoscopic PIV and Acetone PLIF to Study Mixing in the Near Field of Turbulent Swirling Jets  
*A. Lobasov, Z. Kravtsov, D. Sharaborin, D. Markovich, V. Dulin*

Decorrelation Effects in Speckle BOS Measurements Close to Walls  
*P. Bühlmann, T. Roesgen*

Determining the Energy Budget of Cavitation-Induced Pressure Waves by Means of Differential Interferometry  
*S. Kordel, J. Hussong*

Influence of Injection Timing on Large-Scale In-Cylinder Flow in a Spark-Ignition Direct-Injection (SIDI) Engine  
*L.G. Clark, S. Kook*

Methodology and Comparison of Quantitative NO-LIF Imaging in a Bunsen Burner With Numerical Simulation Results  
*S. Mashruk, R. Marsh, J. Runyon, S. Morris, P. Bowen*

Non-Contact Pressure Measurement of Underwater Shock Wave in a Microtube Using Background-Oriented Schlieren Technique  
*S. Yamamoto, Y. Tagawa, M. Kameda*

Paired OCT Sensing-Light-Sheets for Microfluidic PTV  
*J.M. Hallam, E. Rigas, H.D. Ford, T. Charrett, R.P. Tatam*

Investigation of Transient Ignition Characteristics in a Model Scramjet Combustor using Spark Plug Sensor during Acceleration Experiments  
*H. Lian, H. Gu, L. Yue, X. Chang*

Dot Tracking and Cramer-Rao Lower Bound for Background Oriented Schlieren (BOS) measurements  
*L.K. Rajendran, S.P.M. Bane, P.P. Vlachos*

Micro PIV to Observe Three Dimensional Flow in an Evaporating Water Droplet  
*E. Ramos*

The Interaction Between In-Cylinder Flow and Flame Propagation in An Optical SI Engine Measured By High-Speed PIV  
*Y. Ikeda, A. Nishiyama*

Study of the Transport of Magnetic Particles in a Capillary Model by Digital Holography  
*M. Gómez, J. Lobera, P. Arroyo, N. Andrés, J. Pallarés, V. Palero*

LUNCH  
BREAK

13:00  
14:30

Lisbon, Portugal, 2018

19th International Symposium on Application of Laser Techniques to Fluid Mechanics

JULY 16

**PIV UNCERTAINTY  
QUANTIFICATION PERFORMANCE I**  
*Auditorium 2*  
James Dawson, Brian D. Piorek

**VELOCITY/TEMPERATURE  
MEASUREMENTS**  
*Auditorium 3*  
Kenneth Kiger, Zhengzhong Sun

**BIOMEDICAL FLOWS I**  
*Room 1*  
Mark Jermy, Thomas Rösgen

**COMBUSTION I**  
*Room 4*  
Mário Costa, Mamoru Tanahashi

Denoising 400-KHz "Postage-Stamp PIV" using Uncertainty Quantification  
*S.J. Beresh*

Combination of Robust Point Measurement Techniques on the Vortex Tube: FRS, DGV and L2F Deliver Thermodynamic and Flow Properties  
*E.J. Burow, M. Beversdorff, G. Stockhausen, M. Schroll, C. Willert*

Magnetic Resonance Velocimetry of Inspiratory and Expiratory Flow in the Human Lungs  
*S. Jalal, T. Van De Moortele, O. Amili, F. Coletti*

Camera Based Full-Field Laser Interferometric Vibrometry for Combustion Diagnostics  
*F. Greiffenhagen, J. Woisetschläger, J. Gürtler, R. Kuschmierz, J. Czärske*

Advanced Metric For Particle Image Velocimetry Accuracy Estimation  
*J. Novotny, L. Novakova, I. Machovska*

Laser-Optical Characterization of the Flow Field Behind the NGV Cascade of a Three-Sector Combustor Simulator using Filtered Rayleigh Scattering  
*M. Dues, U. Doll, T. Bacci, A. Picchi, G. Stockhausen, C. Willert*

Ground-Truth Experiments for Measuring Wall Shear Stress with Magnetic Resonance Velocimetry  
*A. Bauer, S. Wegt, C. Tropea, A. Krafft, N. Shokina, J. Hennig, G. Teschner, H. Egger*

CO<sub>2</sub> Spontaneous Raman Scattering: An Alternative Thermometry for Turbulent Reactive Flows  
*F. Guichard, P. Boubert, D. Honoré, A. Cessou*

14:30  
-16

Finding the Uncertainty of the Mean for Correlated Data from PIV  
*G. Richards, B.L. Smith, D.R. Neal*

Recent Progress in Filtered Rayleigh Scattering: Towards the Simultaneous Acquisition of Pressure, Temperature and Three-Component Velocity Fields  
*U. Doll, E.J. Burow, G. Stockhausen, C. Willert*

MRI Flow Lab: a Dedicated Magnetic Resonance Laboratory for Quantitative Flow Measurements and Method Development  
*M. Bruszewski, K. John, S. Grundmann*

Filtered Rayleigh Scattering Measurements of Mixture Fraction in an Optically Accessible Conical Quarl Burner  
*Y. Krishna, Y. Yue, A.M. Elbaz, G. Magnotti*

A new look on the "Valid Detection Probability" of PIV Vectors  
*S. Scharnowski, A. Sciacchitano, C.J. Kähler*

Simultaneous Measurements of Velocity and Temperature Fields in Rayleigh-Bénard Convection using Thermochromic Liquid Crystals  
*S. Moller*

A Hybrid Acoustic PIV Approach to Characterize Sound Generation in a Human Larynx Model  
*A. Lodermeier, S. Becker, E. Bagheri, M. Tautz, M. Döllinger, S. Kniesburges*

Investigation of Coherent Structures in a Turbulent Premixed High-Swirl Jet-Flame by PIV/OH PLIF/HCHO PLIF  
*A. Lobasov, L. Chikishev, D. Markovich, V. Dulin*

Full Characterization of the Peak-Locking Error by Means of Orthogonal Functions and Application to the Flow around a Helicopter Fuselage Mode  
*M. Legrand, J. Nogueira, R. Jiménez, A. Lecuona, F. De Gregorio*

Cross-Correlation Filtered Rayleigh Scattering (CCFRS)  
*M. Boyda, G. Byun, T. Lowe*

Transport and Dispersion of Particle-Laden Streaks in a Standardized Human Nasal Geometry  
*D.D. Borup, L.E. Engel, C.J. Elkins, J.K. Eaton*

Two-Photon CO Laser-Induced Fluorescence and Chemiluminescence Measurements in Counterflow Premixed Methane-Air Flames  
*Y. Liu, Y. Hardalupas, A.M.K.P Taylor*



19th International Symposium on Application of Laser Techniques to Fluid Mechanics

JULY 16

PIV UNCERTAINTY  
QUANTIFICATION PERFORMANCE II

Auditorium 2

Daniel Troolin, Raf Theunissen

THERMOMETRY

Auditorium 3

David Rival, Cecil Hess

BIOMEDICAL FLOWS II

Room 1

Pavlos Vlachos, Tommaso Astarita

COMBUSTION II

Room 4

Pedro Coelho, Gaby Ciccarelli

Experimental Investigation of Solid Tracer Particle Response Across a Mach Disk by PIV and Schlieren  
*M.R. Haghdoost, J. Förster, D. Edgington-Mitchell, K. Oberleithner*

Thermal Imaging of Rapidly Evaporating Saltwater Drops  
*S. Valley, C.J. Brownell*

A Passive Microfluidic Device For Cell Sorting and Deformability Measurements  
*V. Faustino, D. Pinho, S. Catarino, J. Miranda, G. Minas, R. Lima*

Simultaneous High-Speed OH-PLIF and PIV of a Turbulent Swirl Flame Experiencing Thermoacoustic Bi-Stability  
*D. Ebi, U. Doll, R. Bombach, N. Noiray*

High-Speed Particle Image Velocimetry for Efficient Turbulent Kinetic Energy Dissipation Rate Estimation  
*D. Zaripov, R. Li*

Investigation of Joule-Thomson Cooling in Choked Flows using Thermographic Particle Image Velocimetry  
*B. Fond, C.-N. Xiao, C. Abram, C. T'Joen, B. Van Wachem, F. Beyrau*

Lagrangian Reconstructions of Post-Stenotic Flows using Two-Dimensional Particle Tracking Velocimetry  
*M.D. Jeronimo, K. Zhang, D.E Rival*

Laser-Induced Spark Ignition of Pulsed Methane Jets in Homogeneous and Isotropic Turbulence Without Mean Flow  
*C. Chen, G. Charalampous, Z. Shi, Y. Hardalupas*

16:30 -18

Error Field Correction for Material Acceleration Calculation using Lagrangian Pseudo-Tracking  
*J. Mcclure, S. Yarusevych*

Trade off Between Thermalisation and Spatial Resolution for LITGS Measurements at 355 Nm using Biacetyl as an Absorber  
*F. De Domenico, L. Fan, S. Lowe, L. Weller, S. Hochgreb*

The Flow Field in Compliant and Rigid Models of the Human Aortic Arch  
*S.G. Yazdi, P. Docherty, A. Khanafer, M. Jermy, P. Geoghegan, N. Kabaliuk, P.N. Williamson*

The Investigation of Detonation Phenomenon using Simultaneous Schlieren Photography and Soot Foil  
*G. Ciccarelli, M. Kellenberger*

Effect of Peak-Locking on Stereoscopic PIV  
*G.K. Jankee, M. Ferreira, B. Ganapathisubramani*

Gas Thermometry using Four Different Optical Methods  
*F. Fuest, M. Schütte, S. Seefeldt, M. Psotta*

Comparative PIV Analysis of Oscillatory Flow in Flexible Straight Vessels using Newtonian and Blood Analog Fluids  
*P. Dörner, W. Schröder, M. Klaas*

Modified Boltzmann Plot for Thermometry Employing Blended Spectra  
*J. France, M. Gamba*

SPIV Analysis of Airflow in the Neonatal Upper Airway During Maximal Effort Breathing  
*M. Jermy, P. Geoghegan, M. Buchajczyk, C. Spence, J. Aplin*

WELCOME DINNER

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PÁTEO DA GALÉ

JULY 17

KEYNOTE LECTURE				
9:10 - 10	<p><b>The dynamics of bat flight and structured vortex wakes</b> Kenny Breuer</p>			
	<p><b>PTV TECHNIQUES I</b> <i>Auditorium 2</i> Andreas Schröder, Steven Beresh</p>	<p><b>TURBULENT BOUNDARY LAYERS I</b> <i>Auditorium 3</i> Julio Soria, Bharathram Ganapathisubramani</p>	<p><b>TWO-PHASE FLOWS: DROPLET/PARTICLE I</b> <i>Room 1</i> Shigeo Hosokawa, Christian Poelma</p>	<p><b>IMAGING I</b> <i>Room 4</i> David Nobes, Michael Klaas</p>
	<p>Introduction and Testing of a Novel Scanning Particle Tracking Velocimetry Technique <i>V. Koothur, M. Kosul, N. Worth, J. Dawson</i></p>	<p>Characterizing Turbulent Structures in the Atmospheric Boundary Layer with Super-Large-Scale Particle Image Velocimetry <i>M. Heisel, T. Dasari, A. Petersen, Y. Liu, J. Hong, F. Coletti, M. Guala</i></p>	<p>Translation and Rotation of a Spherical Particle in a Turbulent Boundary Layer <i>Y.H. Tee, D. Barros, E.K. Longmire</i></p>	<p>Non-Intrusive Measurement of Complex Free Surfaces using Laser Induced Fluorescence and Stereo Imaging <i>M.V. Meerkerk, C. Poelma, J. Westerweel</i></p>
10:05 - 11	<p>Parallax corrected PTV for Precise Near Wall Boundary Layer Measurements <i>T. Fuchs, M. Bross, S. Scharnowski, C. J. Kähler</i></p>	<p>Investigation of a High Reynolds Number Turbulent Boundary Layer Flow With Adverse Pressure Gradients Using PIV and 2D- and 3D- Shake-The-Box <i>A. Schröder, D.Schanz, M.Novara, F. Philipp, R. Geisler, J. Agocs, T. Knopp, M. Schroll, C. E. Willert</i></p>	<p>Experimental Study of Transition to Turbulence in Particulate Pipe Flow <i>S. Singh, A. Potherat, C.C.T. Pringle, I. Bates</i></p>	<p>3D Particle Location From Perspective-Shifted Plenoptic Images <i>E.M. Hall, D.R. Guildenbecher, B.S. Thurow</i></p>
	<p>Multi-Exposed recordings for 3D Lagrangian Particle Tracking in Turbulent Boundary Layer Flows by Means of Multi-Pulse Shake-The-Box <i>M. Novara, D. Schanz, R. Geisler, C. Voss, A. Schröder</i></p>	<p>Uniform Momentum Zones in a Turbulent Boundary Layer with Spanwise Traveling Surface Waves <i>W. Li, V. Paakkari, D. Roggenkamp, M. Klaas, J. Soria, W. Schröder</i></p>	<p>Investigation of Dense Particle Plumes in Quiescent and Turbulent Environments <i>A. Petersen, F. Coletti</i></p>	<p>A Semi-Synthetic Camera Calibration Method for 3D Reconstruction of Shocks in Supersonic Jets <i>H.D. Lim, D.T.H. New, Y.D. Cui</i></p>



COFFEE 11  
BREAK 11:30

19th International Symposium on Application of Laser Techniques to Fluid Mechanics

JULY 17

**PTV TECHNIQUES II**

*Auditorium 2*

Andreas Schröder, Steven Beresh

**TURBULENT BOUNDARY LAYERS II**

*Auditorium 3*

Julio Soria, Bharathram Ganapathisubramani

**TWO-PHASE FLOWS: DROPLET/PARTICLE II**

*Room 1*

Shigeo Hosokawa, Christian Poelma

**IMAGING II**

*Room 4*

David Nobes, Michael Klaas

11:30 - 13	Particle Separation in Narrow-Gap Taylor-Couette Flows Investigated by an Adapted Astigmatism PTV-Procedure <i>P. Brockmann, H.T. Kazerooni, L. Brandt, J. Hussong</i>	Scalar Mixing in a Turbulent Boundary Layer <i>J. Eisma, D. Tam, J. Westerweel, W. van de Water</i>	Inner Flow Structure of an Adhering Oscillating Droplet in Shear Flow <i>S. Burgmann, B. Barwari, U. Janoske</i>	Quantitative Optical Measurement of Contact Lines on Milliscale Metal Structures Dipped into a Liquid Pool <i>F. Gerlach, S. Garoff, C. Tropea</i>
	On the Use of Full Particle Trajectories and Vorticity Transport for Dense Velocity Field Reconstruction <i>J.F.G. Schneiders, F. Scarano</i>	Investigation of Shock-Induced Flow Separation over a Transonic Compressor Blade by Conditionally Averaged PIV and High Speed Shadowgraphs <i>J. Klinner, A. Hergt, S. Grund, C. Willert</i>	Vortex Ring Formation in Dense Suspensions using Index-Matched Hydrogel Particles <i>K. Zhang, D.E. Rival</i>	Ray-Tracing Based Image Correction of Optical Distortions Caused by Transparent Spheres for Application in PIV <i>F.J.W.A. Martins, C. C. Silva, C. Lessig, K. Zähringer</i>
	An Evaluation of Particle Tracking Algorithm Applied in Temperature Measurement by Brownian Motion of Gold Nanoparticles <i>J.-Y. Lee, C.-L. Sun</i>	Characterization of Directional Slip Over a Superhydrophobic Surface using 3D Lagrangian Particle Tracking <i>W.A. Rowin, S. Ghaemi</i>	A Feasibility Study for Mapping the Movement of Raising Fibers in DC and AC Electric Field <i>D. Jasikova, M. Kotek, T. Kalous, J. Valtera, V. Kopecky</i>	Laser Schlieren Cinematography of Ultrafast Plasma Jets <i>K.T.K. Loebner, V.A. Miller, M.A. Cappelli</i>
	Time-Resolved Particle identification and reconstruction for Volumetric 4D-PTV <i>A. Boomsma, D. Troolin</i>	Cross-Plane Stereo-PIV Measurements in a Refractive Index Matched Flume of the Turbulent Flow Structure around Interacting Barchan Dunes <i>N. Bristow, G. Blois, J. Best, K. Christensen</i>	Particle Classification for Interferometric Particle Imaging by Convolutional Neuronal Networks <i>E. Ebert, N. Damaschke</i>	Behavior of a Single Bubble and its Wake in Swarm-like Background Turbulence <i>K. Haase, C. Kähler</i>
			Diagnostics of Flow about a Contaminated Single Drop using Spatiotemporal Filter Velocimetry <i>S. Hosokawa, G. Shigekane, K. Hayashi, A. Tomiyama</i>	Experimental Investigation of Dam-Break using Low Cost Laser Sources and Image Processing Techniques <i>S. Cordero, G.O.D. Fasanella, D. Poggi</i>





JULY 17

PLENARY SESSION

14:30 - 16

MANUFACTURERS

Auditorium 2

OxxiUS



UNDERSTANDING,  
ACCELERATED



Artium



LAVISION

FOCUS ON IMAGING



LUMIBIRD  
MORE THAN LASERS

19th International Symposium on Application of Laser Techniques to Fluid Mechanics

JULY 17

**PIV SYSTEM  
DEVELOPMENT**

*Auditorium 2*

Bernhard Wieneke

**TURBULENT  
BOUNDARY LAYERS III**

*Auditorium 3*

Dmitriy Markovich, Fábio Martins

**TWO-PHASE FLOWS:  
INTERFACIAL**

*Room 1*

Filippo Coletti, Ana Moita

**ROTATING AND  
VORTICAL FLOWS**

*Room 4*

Edgar Fernandes, Maarten Vanierschot

80-Eyes PIV using Mirror Array  
*J. Sakakibara, A. Maekawa*

Estimating the Wall-Shear Stress after a Rough-to-Smooth Step-Change in Turbulent Boundary Layers using Near-Wall PIV/PTV Experiments  
*C.M. De Silva, M.L. Mogeng, R. Baidya, A. Rouhi, D. Chung, I. Marusic, N. Hutchins*

Experimental Study of Primary Instability of Thick Liquid Films under Strong Gas Shear using Laser-Induced Fluorescence and Shadow Techniques  
*A.V. Cherdantsev, S.V. Isaenkov, M.V. Cherdantsev, D.M. Markovich*

Particle Image Velocimetry for Distorted Turbofan Engine Inlet Applications  
*T. Guimarães, K.T. Lowe, W.F. O'Brien*

The Effect of Microlens Size on the Performance of Single-Camera Plenoptic PIV  
*T.W. Fahringer, B. Thurow*

Extended-POD-Based Dynamic Estimation of Very Large Scale Motions in High-Reynolds-Number Pipe Flow  
*S. Discetti, G. Bellani, R. Örlü, J. Serpieri, C. Sanmiguel Vila, M. Raiola, X. Zheng, L. Mascotelli, A. Talamelli, A. Ianiro*

Measurement of Liquid Film Thickness using Laser Illuminated High-Speed Imaging  
*J. Feldmann, C. Tropea, I.V. Roisman*

Impact of Vortex-Rings Upon V-Shaped Walls  
*D.T.H. New, B. Zang, S. Shi, J. Long*

Multiple-View Camera Calibration for Large Scenes with Limited Spatial Access at the Rotterdam Zoo  
*K. Muller, D.S.W. Tam, J. Westerweel*

Flow Reversal in Turbulent Boundary Layers with Varying Pressure Gradients  
*C. Willert, J. Soria, C. Cuvier, J.M. Foucaut, J.P. Laval*

High-Resolution Planar Two-Component PTV Measurements in a Breaking Wave  
*M. Vested, F.G. Ergin, S. Carstensen, E.D. Christensen*

The Short-Wavelength Instability in the Impinging Vortex Ring Measured by Scanning-PIV  
*Z. Sun, Q. Li, C. Breucker*

16:10 - 18

FPGA-Accelerated Online Correction of Optical Distortions in PIV Measurements  
*H. Radner, M. Teich, L. Büttner, J. Czarske*

Application of Laser Doppler Anemometry to Estimate Turbulent Power Spectra Inside an Urban Canopy  
*S. Herpin, L. Perret, R. Mathis, C. Tanguy, J.-J. Lasserre*

Exploration of Gas Entrainment from Surface Swirls using the Processing of Flow Visualisation and PIV  
*B. Moudjed, L. Rossi*

Large Scale Flow Instabilities in Sudden Expansion Flows in the Subcritical Swirl Regime  
*M. Vanierschot*

Combining Particle Image Velocimetry (PIV) and Laser Induced Incandescence (LII) to Measure the Velocity Field of Two-Phase Flows  
*L. Fan, D. Mcgrath, C.T. Chong, H. Zhong, S. Hochgreb*

The Use of POD Filtering to Study the Transition from 2D to 3D in Stratified Two-Phase Flow  
*D.B. Hann, K. Loizou, J. Vasques, M.P. Tokarev, A.V. Cherdantsev*

Experimental Investigation of a Tornado-like Vortex using a Particle Image Velocimetry  
*E. Tamura, H. Itoh, H.H. Nigim, H.S. Koyama*

Laser-based Measurements of Stratified Liquid-Liquid Pipe Flows Interacting with Jets in Cross-Flow  
*S.F. Wright, A. Charogiannis, V. Voulgaropoulos, O.K. Matar, C.N. Markides*

LDA Analysis of Swirling Flow in a Hydro Turbine Draft Tube  
*S.I. Shtork, I.V. Litvinov, E.Y. Gorelikov, A.S. Mityakov, K. Hanjalic*

Lisbon, Portugal, 2018

JULY 18

KEYNOTE LECTURE

9:10 - 10

Recent developments on Interferometric out-of-focus imaging of irregular rough particles  
Marc Brunel

**PLIF TECHNIQUE DEVELOPMENT**

*Auditorium 2*

Daniel New, Sven Scharnowski

**PARTICLE/SPRAY MEASUREMENT TECHNIQUES I**

*Auditorium 3*

Christos Markides, Christian Willert

**AERODYNAMICS AND FLOW CONTROL I**

*Room 1*

Brian Thurow, Arne Henning

**AEROACOUSTICS**

*Room 4*

André Silva, Carlos Del Pino

Toluene PLIF in a Smooth Channel  
*G. Gori, S. Nobrega, T. Arts*

Characterization of Supercooled Droplet by Laser-Induced Fluorescence: Temperature and Ice Fraction  
*M. Stiti, A. Labergue, F. Lemoine, D. Stemmellen, S. Leclerc*

Drag Reduction of a Yawed Car Model by Combining Fluidic Flaps and Turbulence Control  
*R. Li, J. Borée, B. Noack, L. Cordier, F. Harambat*

PIV Measurements of Acoustic Streaming in Waveguide Tube  
*K. Kuzuu, H. Yanai, I. Takemura, S. Hasegawa*

10:05 - 11

Quantitative Analysis of Planar Laser-Induced Fluorescence Measurements in a Hypersonic Boundary Layer  
*C. Mcdougall, W.S. Hinman, C. Johansen, B. Bathel, J. Inman, P. Danehy*

Measurement of Spray Trajectories using Phase Retrieval Holography  
*Y. Tanaka, Y. Nakatani, S. Murata*

Flow Control of a Cylinder Wake using Synthetic Jet Technology  
*C.S. Greco, G. Paolillo, T. Astarita, G. Cardone*

Insights Into the Acoustic Near and Far Field Based on Synchronized PIV and Microphone Measurements  
*L. Siegel, A. Henning, K. Ehrenfried, C. Wagner*

Ratiometric-2 Dye-LIF using Non-Toxic Dyes for Temperature Measurements in Large-Scale Water Tunnels  
*J. Shah, J. Allegrini, J. Carmeliet*

Application of Interferometric Particle Imaging to Cavitation Nuclei Measurements in a Ship Model Basin  
*M. Birnolski, M. Van Rijsbergen*

Measurement of Boundary Layer Properties Downstream of a Transition Trip  
*P. Scholz, L. Fohlmeister*



19th International Symposium on Application of Laser Techniques to Fluid Mechanics

JULY 18

**FORCE FROM PIV DATA**

*Auditorium 2*  
Barton Smith, David Johnson

**PARTICLE/SPRAY  
MEASUREMENT TECHNIQUES II**

*Auditorium 3*  
Christos Markides, Christian Willert

**AERODYNAMICS  
AND FLOW CONTROL II**

*Room 1*  
Brian Thurow, Arne Henning

**LASER DOPPLER  
TECHNIQUES**

*Room 4*  
Todd Lowe, Alexandre Labergue

An Assessment of the Ring of Fire Approach for Indoor and Outdoor On-Site Sports Aerodynamic Investigation  
*A. Spoelstra, L.M. Norante, W. Terra, A. Sciacchitano, F. Scarano*

Investigation of Phase Doppler Anemometry Characteristics using a Monte Carlo Simulation  
*J.F. Meyers, G. Wigley*

PIV Measurements of the Effect of Pulsed Blowing Jet on a NACA0012 Wing Model  
*J.H.G. Ortiz, J.A. Cabello, A.G. Gómez, L. Parras, C. del Pino*

Adaptive Sampling in Two Dimensions for Point-Wise Experimental Measurement Techniques  
*R. Theunissen, P. Gjelstrup*

Aerodynamic Drag Determination of a Full-Scale Cyclist Mannequin From Large-Scale PIV Measurements  
*A. Sciacchitano, W. Terra, Y.H. Shah*

Sensitivity of the Time-Shift Technique in Characterising Non-Spherical Drops  
*L. Li, S. Rosenkranz, W. Schäfer, C. Tropea*

POD Analysis of Flow Structures Behind Cylinders with Concave Fillets  
*K.E. Meyer, C. Burlina, C.T. Georgakis*

A Direct Spectral Estimation Method for Laser Doppler Data using Quantization of Arrival Times  
*N. Damaschke, V. Kühn, H. Nobach*

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Thrust and Lift Coefficients of Rigid Flapping Plate Measured in Towing Tank Tests using 2D-PIV  
*J.A. Cabello, A.M. Alcántara, L. Parras, C. del Pino*

Development of the Planar Droplet Sizing Technique Applied to a Realistic Kerosene-Fueled Aeronautical Injection System  
*P. Doublet, C. Lempereur, M. Orain, V. Bodoc, P. Gajan*

Time-Resolved PIV of Vortex Shedding Suppression by Piezoelectric Bending Actuators  
*B. Gibeau, C.R. Koch, S. Ghaemi*

Laser-Doppler Velocimeter for Small Sub-Micron-Particles  
*G. Byun, R.L. Simpson*

Determining the Different Contributions to Total Mean Drag From Far-Field Wake PIV Measurements  
*N.T. Baker, D. Bailly, J.-C. Monnier, B. Leclaire, C. Verbeke*

Droplet Sizing with Wavelength Modulated Laser  
*C. Hess*

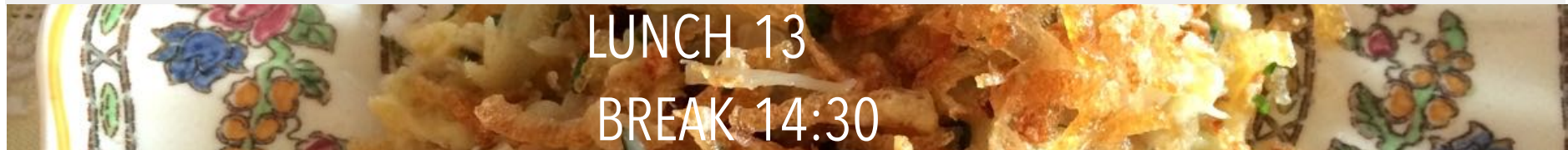
Helicopter Model Rotor Wake Characterization in Presence of Sling Loads  
*R.E. Nargi, F. De Gregorio, R. Camussi, A. Visingardi*

Study of Temperature Budget and Velocity-Temperature Correlations using Dual LDV-Cold-Wire Measurements in a Slightly Heated Turbulent Round Jet  
*J. Lemay, A. Benaïssa, A. Darisse*

Drag Resolution of a PIV Wake Rake for Transiting Models  
*W. Terra, A. Sciacchitano, F. Scarano, B.W. van Oudheusden*

Diagnostics of Spray Characteristics in a Wind Tunnel by a Phase Doppler Anemometer  
*T. Ishima, H. Kawashima, T. Miyaoka, A. Takatsuki, K. Motoi, K. Sugita, S. Umezawa*

Experimental Investigations of a Controlled-Circulation Darrieus Turbine  
*L. Chatellier, J.M.R. Gorle, F. Pons, M. Ba*



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**PIV PROCESSING  
ALGORITHMS I**

*Auditorium 2*

Mathieu Legrand, Holger Nobach

**SPRAYS I**

*Auditorium 3*

Francisco Felis, Sohel Murshed

**AERODYNAMICS  
AND FLOW CONTROL III**

*Room 1*

Charita Silva, William Bachalo

**TWO-PHASE FLOWS:  
BUBBLES I**

*Room 4*

Humberto Chaves, Artem Nikulin

Dynamic Masking Application Examples in Two Phase Flow PIV Measurements  
*F.G. Ergin, J. Olofsson, B. Watz, N.F. Gade-Nielsen*

Effect of Superheated Fuel on Air Entrainment under GDI-Relevant Boundary Conditions Measured with FPIV  
*S. Bornschlegel, R. Welss, A. Durst, C. Conrad, S. Jestrovic, M. Wensing*

Investigations on a SD7003 Airfoil at Disturbed Inflow Conditions  
*R. Hain, S. Herbst, C.J. Kähler*

Colorimetric Study of Oxygen Mass Transfer in a Helically Coiled Pipe  
*P. Kováts, D. Pohl, K. Zähringer*

Volumetric Calibration Refinement using Masked Back Projection and Image Correlation Superposition  
*C. Brückner, D. Hess, B.B. Watz*

Investigating Primary Spray Structures of Diesel Sprays with an Optimized Light Sheet Fluorescence Imaging Approach and X-Ray Phase Contrast Imaging  
*A. Durst, M. Wensing, Jin Wang*

Investigation of Laminar Separation Bubble using PIV and Proper Orthogonal Decomposition (POD)  
*F. Ghorbanishohrat, D.A. Johnson*

Stereo-PIV Liquid Velocity Measurements in the Bubble-Nose Region of Two-Phase Intermittent Flow in a Horizontal Pipe  
*F.J.W.A. Martins, L.S. Fernandes, L.F.A. Azevedo*

Usage of Body-Fitted Windows in PIV Image Processing  
*M. Ward, A. Spencer, M. Passmore*

Ultra-Short Pulsed Off-Axis Digital Holography in the Formation Region of Atomizing Sprays  
*A. Ziaee, M. Minniti, D. Dunn-Rankin*

Shear-Layer Characterization on an Unsteady Airfoil using Time-Resolved PIV with a Plunging Camera  
*J. Kissing, N. Wei, S. Triess, J. Hofmann, C. Tropea*

Spatial Measurement of Swirling Jet of Bubbly Flow by Combined ILIDS and PIV Techniques  
*K. Senoma, Y. Sato, K. Hishida*

Efficient, Robust, Distribution of Correlation Windows for Unstructured Adaptive PIV Sampling – Towards Fully Autonomous Robust PIV Analysis  
*M. Edwards, R. Theunissen*

Laser 2-Focus Velocimeter for Droplet Characterization in Dense Sprays  
*N. Kawaharada, K. Gröger, H. Ueki, F. Dinkelacker*

Lagrangian Analysis of the Formation of a Vortex Pair on a Rotating Flat Plate  
*D. Francescangeli, G. de Guyon, K. Mulleners*

Comparison of Three Different Visualization Techniques for Local Mass Transfer Characterization around Single Bubble Rising in Water  
*F. Xu, N. Dietrich, A. Cockx, C. Le Men, G. Hébrard*

Accuracy of Time-Resolved Velocity Estimation by Adaptive Spatial Filter Velocimetry in Comparison to PIV Cross Correlation  
*T. Steinmetz, M. Schaeper, R. Kostbade, N. Damaschke*

Characterization of Atomization Mechanisms in Air-Assisted Multijet Sprays  
*M.O. Panão, M. Costa, A. Silva*

Stability Analysis of Flow Structures in Hovering Flight using Robotic Experiments and Flow Visualizations  
*A. Marín-Navarro, J.A. Cabello, L. Parras, C. del Pino*

Experiments on Reactive Mass Transfer Around an Oxygen Bubble Rising Freely in a Confined Cell using a Colorimetric Method  
*F. Felis, N. Dietrich, A.-M. Billet, F. Strassl, S. Herres-Pawlis, V. Roig, K. Loubière*

14:30 -16

COFFEE 16  
BREAK 16:30



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**PIV PROCESSING  
ALGORITHMS II**

*Auditorium 2*

F. Gökhan Ergin, Jerry  
Westerweel

**SPRAYS II**

*Auditorium 3*

Yannis Hardalupas, Guillaume  
Castanet

**PRESSURE FROM PIV**

*Room 1*

Fulvio Scarano, Ludovic Chatellier

**TWO-PHASE FLOWS:  
BUBBLES II**

*Room 4*

David Hann, Katharina Zähringer

16:30 -18

A General Approach to  
Evaluate Cross-Correlation  
Response  
*R. Theunissen, M. Edwards*

Two-Photon Fluorescence Laser Sheet Imaging  
for Analyzing Turbid Two-Phase Flows:  
Application to Transient Atomizing Sprays  
*E. Berrocal, M. Miranda, C. Conrad, J. Püls, C.  
Arnold, M. Wensing, M. Linne*

Pressure Evaluation of Spray Induced Flow  
by Means of URANS and Time-Resolved  
Stereo Particle Image Velocimetry  
*N. Kling, L. Opfer, J. Kriegseis, P. Rogler*

Detailed Measurement of Oxygen Mass  
Transfer in a Bubble Column – Application of  
a New Fluorescent Dye  
*P. Kováts, K. Zähringer*

Using Modern Artificial  
Neural Networks for  
Performing End-To-End  
Particle Image Velocimetry  
*J. Rabault, J. Kolaas, A. Jensen*

Effect of Nanoparticles Concentration on  
Nanofluid Sprays for Cooling Applications  
*M. Maly, A.S. Moita, J. Jedelsky, A.P.C. Ribeiro,  
A.L.N. Moreira*

Comparison Between Start-Up and  
Established Flow Conditions in Deformable  
Flapping Wings  
*D. Diaz, T. Jardin, F. Pons, L. David*

Effect of Free Interface on Dynamics of Gas-  
Liquid and Mixing in a Shallow Vessel: PIV  
and LIF Measurements  
*S. Bhujbal, A.H. Thaker, D. Sharma,  
V.V. Buwa*

Motion Estimation Under  
Uncertainty Location,  
Application to Large-Scale  
Characterization of a Mixing  
Layer  
*R. Schuster, D. Heitz, E. Mémín*

Velocity Measurement of Gasoline Spray Near  
a Nozzle Exit by using Ultra-High Speed PIV  
*Y. Zama, S. Sugaya, T. Furuhashi*

An Imaging Derivation of the Pressure  
Field of a Multi-Phase Flow in a Porous  
Media using  $\mu$ -SPIV  
*S. Ansari, Y. Yusuf, R. Sabbagh,  
H. Soltani, L. Kinsale, D.S. Nobes*

Cavitation and Bubble Collapse Produced by  
Fast Liquid Jets  
*H. Chaves*

On the Dynamics of Gas Turbine Fuel Injector  
Flows using Time-Resolved Measurements  
*K. Rajamanickam, A. Potnis, S. Basu*

State Observer-Based Data Assimilation: A  
PID Control-Inspired Observer in the  
Pressure Equation  
*N.J. Neeteson, D.E. Rival*

Comparative Study of Optical Experimental  
Methods for Micro-Bubble Sizing  
*R. Boucheron, V. Aumelas, M. Donnet, D.  
Fréchou, A. Poidatz*

Effect of the Atomizer Geometry on the  
Structure of a Dry-Ice Spray  
*Miguel O. Panão, Mário Barbosa, José J. Costa*

Recognizing Bubble Patterns Using Artificial  
Neural Networks: Application to Analysis of  
PLIF Data on a Two-Phase Bubbly Jet  
*M.P. Tokarev, I.E. Poletaev, K.S. Pervunin, M.V.  
Timoshevsky, M.Y. Nichik, D.M. Markovich*



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JULY 19

**PIV APPLICATIONS I**

*Auditorium 2*

Jun Sakakibara, Rui Ferreira

**NOVEL TECHNIQUES I**

*Auditorium 3*

Nicolas Dietrich, Martin Bruschewski

**JETS AND WAKES**

*Room 1*

Fabrizio de Gregorio, James Meyers

**VOLUMETRIC PIV/PTV I**

*Room 4*

Christian Kähler, Matteo Novara

Fluid-Structure Interaction of a Membranous Hemisphere in Turbulent Flow: PIV Measurements of the Flow and DIC Measurements of the Structure  
*J.N. Wood, M. Breuer*

Flow-Dependent Polarization Anisotropy of Phosphorescent Nanoparticles  
*M.J. Schmidt, T. Roesgen*

Effects of Chevron Exit on Impinging Synthetic Jets  
*C.M. Crispo, C.S. Greco, G. Cardone*

Time-Resolved Volumetric PTV with Multi-Color Layer Illumination  
*H.J. Park, S. Osuka, Y. Tasaka, Y. Murai*

The Effect of Pulsations in Conditions Related to Catalytic Converters  
*E. Gotfredsen, J. D. Kunoy, S. Mayer, C. Poelma, J. Westerweel, K.E. Meyer*

Toward Simultaneous Velocity and Density Measurements using FLEET and Laser Rayleigh Scattering  
*R.A. Burns, P.M. Danehy*

Effect of the Fractal Grid Geometry on the Flow Field of a Turbulent Jet  
*G. Castrillo, G. Cafiero, T. Astarita*

Generation and Control of Helium-Filled Soap Bubbles for Large-Scale PIV  
*D.E. Faleiros, M. Tuinstra, A. Sciacchitano, F. Scarano*

Stereoscopic-PIV Applied to Wall Bounded Swirling Flows in Helically Enhanced Tubes  
*M. Virgilio, I. Mayo, K. M. Van Geem, G. B. Marin, T. Arts*

Laser-Induced Plasma Image Velocimetry  
*Z. Shi, Y. Hardalupas, A.M.K.P. Taylor*

Effect of Surface Roughness on the Characteristic Length Scales in the Wake of a Compressor Blade: a POD Analysis  
*P. Gilge, J.R. Seume, K. Mulleners*

Volumetric Measurement of a Supersonic Jet with Single-Camera Light-Field PIV  
*J. Ding, H.D. Lim, S. Sheikh, S. Xu, S. Shi, D.T.H. New*

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-10:50

PIV Measurements of Supersonic Slot-Film Cooling with Shock-Cooling Film Interaction at Cold Injection  
*P. Marquardt, M. Klaas, W. Schröder*

An Epipolar Triangular Connectivity Processing Approach of Multi-Focused Plenoptic Images for Time-Resolved 3D Particle Tracking in Micro-Scale Flows  
*J. Hadfield, D.S. Nobes*

On Mass Entrainment in Variable Thermo-Physical Property Round Jets  
*Y. Brahami, E. Varea, M. Gauding, L. Voivenel, L. Danaïla*

A New Camera Model Combining a Pinhole Model and a Discrete Correction to Overcome Refractive Index Variation Challenges  
*G. Acher, L. Thomas, B. Tremblais, L. David*

PIV Measurements of Horizontal Velocity Fields in Rayleigh-Bénard Cells with Large Aspect Ratio  
*C. Kästner, C. Resagk, C. Cierpka, J. Schumacher*

Cavitation Inception Induced by Interaction Between a Laser-Induced Shock and a Gas Bubble in a Gelatin Gel  
*K. Ando, R. Oguri*

Identification of Coherent Structures in the Far Field of a Turbulent Jet Based on Spectral Proper Orthogonal Decomposition of Time-Resolved PIV Snapshots  
*P. Kuhn, K. Oberleithner, J. Soria*

Tomographic PIV in Compressible Flows, Evaluation of the Effects of Aero-Optical Aberrations in Volume Reconstruction  
*C.L.H. Hernández, P. Cornic, P. Trouvé-Peloux, B. Leclaire, F. Champagnat*

A Novel Boiling Heat Transfer Thermal Efficiency Parameter for Microscale Finned Heat Sinks using Two-Phase Particle Image Velocimetry  
*M. Harrison, A. Moita, J. Gess*

3D Velocity Measurement of Particles Moving with Different Speeds using Doppler Phase-Shifting Holography  
*N. Ninomiya, M. Nishimura, I. Miyauchi, D. Barada*

Experimental Investigation on Flow Visualization inside Subchannels of PWR Rod Bundle  
*S. Kim, H.-S. Choi, B.-G. Jeon, D.-J. Euh, S.-K. Moon*

Volumetric Measurements of a Self-Similar Adverse Pressure Gradient Turbulent Boundary Layer using Single-Camera Light-Field Particle Image Velocimetry  
*Z. Zhao, A.-J. Buchner, J. Ding, S. Shi, C. Atkinson, J. Soria*

COFFEE

BREAK

10:50 ... 11:30

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PIV APPLICATIONS II

NOVEL TECHNIQUES II

AERODYNAMICS  
AND FLOW CONTROL IV

VOLUMETRIC PIV/PTV II

*Auditorium 2*

*Auditorium 3*

*Room 1*

*Room 4*

Ana Ricardo, Christian Resagk

Paul Danehy, Rainer Hain

Sina Ghaemi, Knud Erik Meyer

Virginia Palero, Hyun-Jin Park

PIV Measurements of the Effect of Buoyancy on Urban Flows  
*C. Tsalicoglou, J. Allegrini, J. Carmeliet*

Full-Field Pressure Reconstruction using Deflectometry and the Virtual Fields Method  
*R. Kaufmann, F. Pierron, B. Ganapathisubramani*

Simultaneous Surface Pressure and High-Speed PIV Measurements in Stalled Airfoil  
*T. Berk, G. Lacagnina, P. Chaitanya, P. Joseph, B. Ganapathisubramani*

On the Interaction between Inclined Structures and Flow: Insight from Time-Resolved Volumetric Measurements  
*L.P. Chamorro, Y. Jin, J.-T. Kim, L. Wing, D. Troolin, R. Hortensius*

Measuring the Global Flow Field in Turbulent Rayleigh-Bénard Convection (at High Aspect Ratio)  
*R. Du Puits*

3D Surface Pressure Measurement with Single Light-Field Camera  
*S. Xu, S. Shi, Z. Zhao, M.K. Quinn*

Using High Speed PIV Measurements and POD to Solve the Mystery of Dynamic Stall  
*T.T.B. Wester, S. Bartholomay, D. Traphan, M. Hoelling, J. Peinke, G. Guelker*

Volumetric Reconstruction of Transiting Turbulent Wakes using Stereoscopic PIV  
*C. Bond, N. Neeteson, D.E. Rival*

Development of Hybrid Eco-Ship Design System based on PIV / CFD Integration  
*S. Matsuda, K. Kimura*

High-Speed Measurement of Stress Fields in Soft Material Impacted by Highly-Focused Microjets using Photoelastic Technique  
*Y. Miyazaki, N. Endo, S. Kawamoto, A. Kiyama, Y. Tagawa*

Dynamic Stall Vortex Shedding and Associated Load Fluctuations  
*S. Henne, A. Parikh, J. Deparday, K. Mulleners*

Design and Characterization of a 3D-Printed Helium-Filled Soap Bubble Generator for Large-Scale Volumetric Flow Measurements  
*B. Gibeau, F. McCormick, S. Ghaemi*

Identification of the Complex Nature of Coherent Structures in Open and Coanda Jet Flows Via Time-Resolved 2D3C-PIV  
*V. Castaneda, G. Ogus, A. Valera-Medina, M. Vanierschot*

Characterization of Fine Bubbles for Biocatalytic Processes  
*S. Matthes, S. Kastens, B. Thomas, D. Ohde, P. Bubenheim, A. Liese, S. Tanaka, K. Terasaka, M. Schlüter*

Shear Layer Instability Control Via Trailing Edge Flaplets: Wind Tunnel Study using TR-PIV  
*E. Talboys, C. Bruecker*

Assessing the Mass Flux from a Breached Model Dam with Laser Imaging and Large Scale PIV  
*R.M.L. Ferreira, S. Amaral, A.M. Ricardo, A.M. Bento, T. Viseu*

Cross-Validation of PLIF and BBLIF Towards the Detailed Study of Gas-Sheared Liquid Films in Downward Annular Flows  
*A.V. Cherdantsev, J.S. An, A. Charogiannis, C.N. Markides*

11:30 - 13

**CLOSURE**  
Lisbon, Portugal, 2018