HIGH ENTHALPY FLOW DIAGNOSTICS

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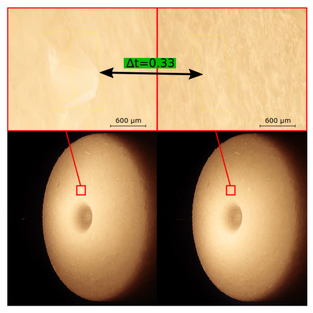
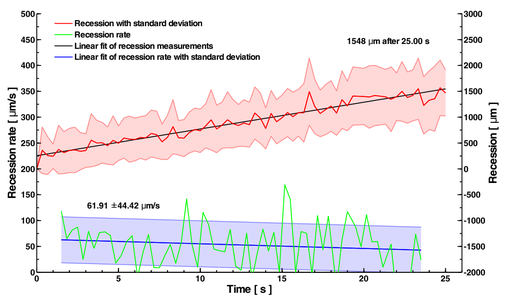
The High Enthalpy Flow Diagnostics Group at the Institute of Space Systems of the University of Stuttgart focuses on development and application of diagnostic methods to characterise high-enthalpy flows as occuring during re-entry, supersonic combustion, and rocket flights. The measured data improves the understanding of fluid-structure interaction and the application in real flight provides validation of the testing.

PHOTOGRAMMETRY

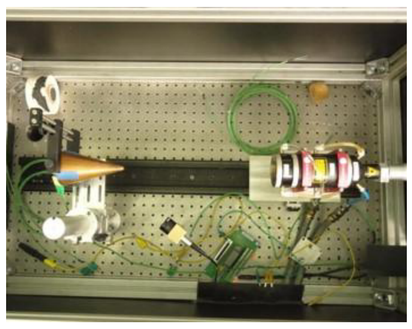
Time resolved measurement of the 3D surface of samples during test using DSLR cameras [1].

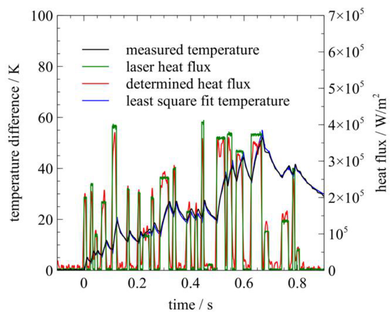




INVERSE METHODS

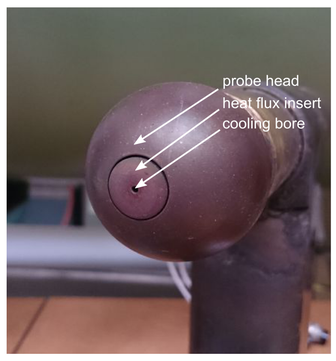
Transient heat flux measurements using laser calibration for system identification [2].

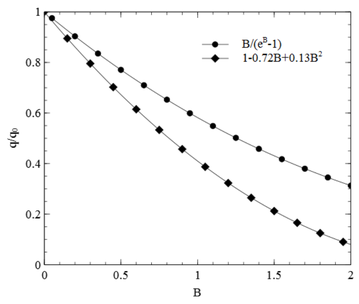




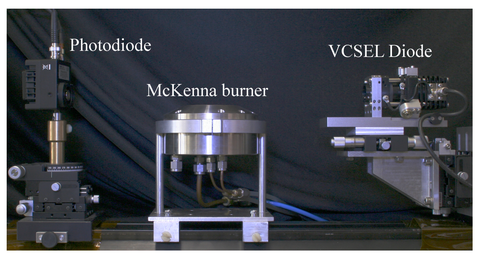
ENTHALPY PROBE

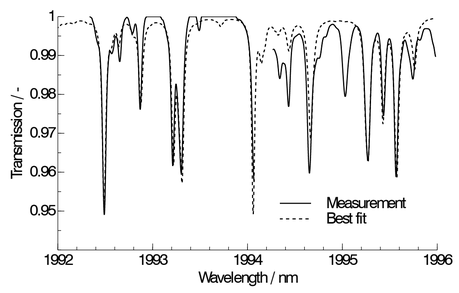
Measurement of the local mass-specific enthalpy using mass injection [3].



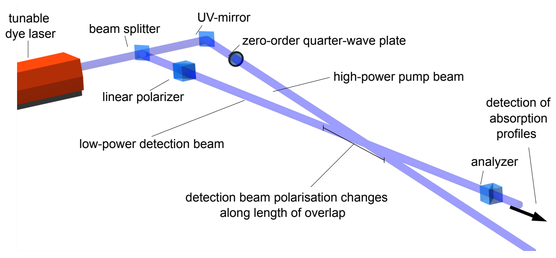


Diode Laser Absorption (DLAS) [4]

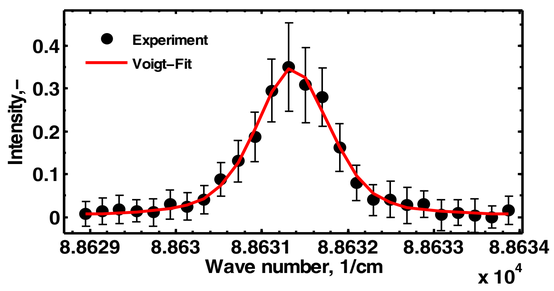




Two-Photon Polarisation Spectroscopy (TIPS)

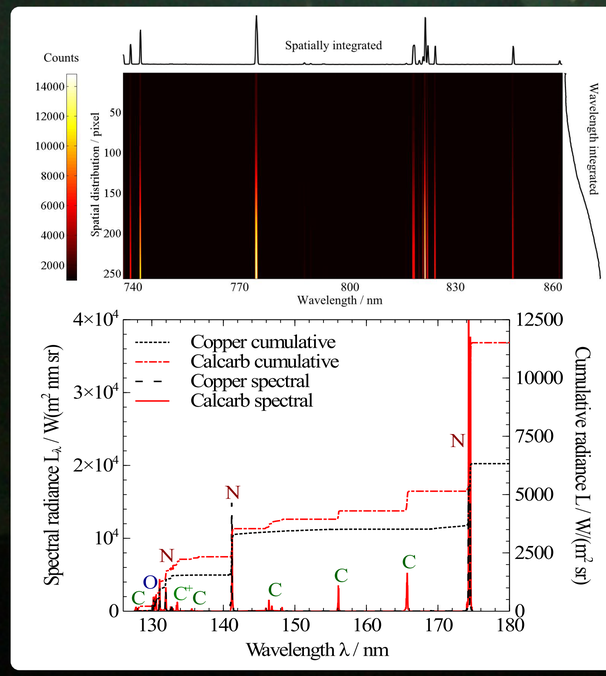


Laser-induced Fluorescence (LIF) [5]



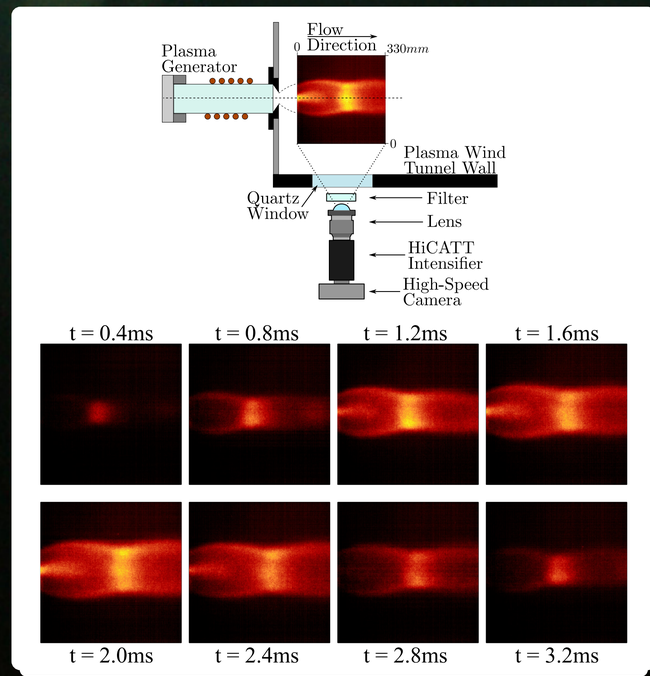
LASER DIAGNOSTICS

Number density, temperature, and velocity measurements through diode laser absorption, polarisation and laser-induced fluorescence spectroscopy [4,5].



EMISSION SPECTROSCOPY

Analysis of aerothermodynamics and chemistry through measurements of VUV to NIR spectra [6].

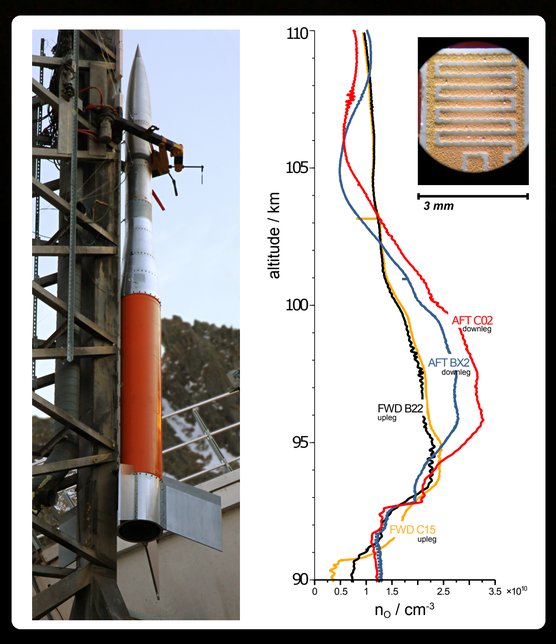


HIGH SPEED IMAGING

Analysis of temporal variations in the steady state flows from high speed imaging data [7].

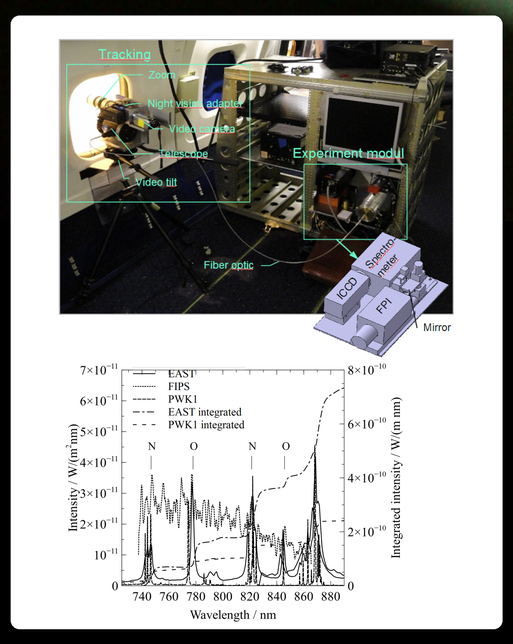
WADIS

Sounding rocket experiment to measure atomic oxygen using solid electrolyte sensors [8].



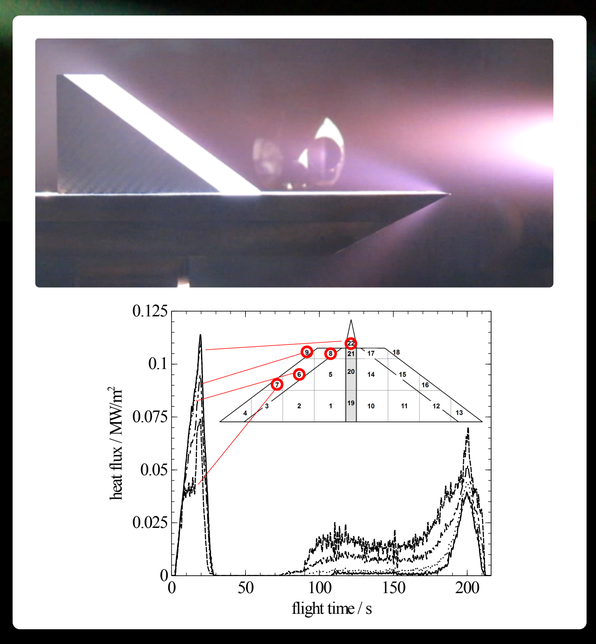
HAYABUSA

Fabry-Perot interferometric measurement of kinetic temperature during re-entry [9].



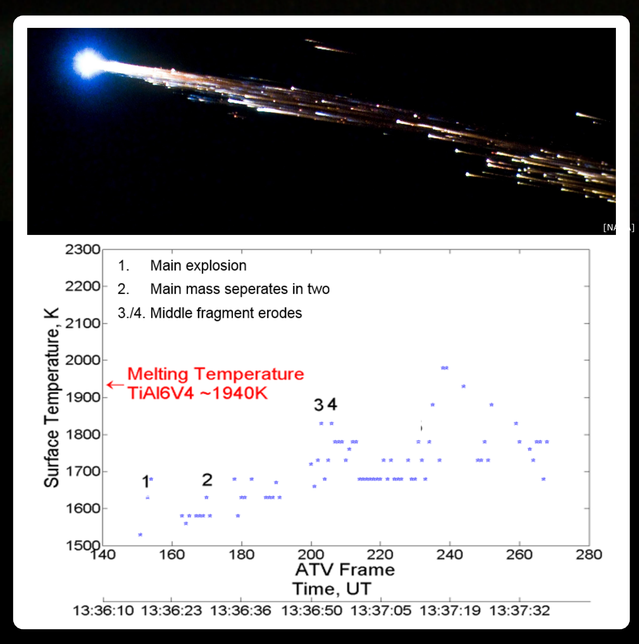
HIFiRE V

Heat flux distribution measurement on a ceramic fin during flight [10].



ATV-1

Emission spectroscopy in the UV during airborne observation of the destructive re-entry of ATV-1 [11].



References:

[1] Loehle, S., Staebler, T. Reimer, T., "Photogrammetric Surface Analysis of Ablation Processes in High Enthalpy Air Plasma Flow", AIAA Journal, accepted for publication, 2015
[2] Loehle, S., Fuchs, U., Digel, P., Hermann, T., Battaglia, J.-L., "Analysing Inverse Heat Conduction Problems by the Analysis of the System Impulse Response", Inverse Problems in Science and Engineering, 2014
[3] Loehle, S., Steinbeck, A., Fasoulas, S., "Local Mass-Specific Enthalpy Measurements with a new Mass Injection Probe", AIAA JTHT, in press 2015
[4] Fulge, H., Loehle, S., Fasoulas, S., "Analysis of Wavelength Modulation Spectroscopy for Water Vapour Measurements in Supersonic Combustion", 11th AIAA Thermophysics Conference, Atlanta, 2014.
[5] Marynowski, T., Loehle, S., Fasoulas, S., "Two-Photon Absorption Laser-Induced Fluorescence Investigation of CO_2 Plasmas for Mars Entry", AIAA JTHT, Vol. 28, No. 3, 2014.
[6] Hermann, T., Loehle, S., Zander, F., Fulge, H., and Fasoulas, S., "Characterization of a Re-entry Plasma Wind Tunnel Flow with Vacuum Ultraviolet to Near Infrared Spectroscopy", AIAA JTHT, 2015, submitted.
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