TEMPERATURE MEASUREMENTS INSIDE A THIN FLUID LAYER WITH BACKGROUND ORIENTED SCHLIEREN METHOD

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ABSTRACT: Background oriented schlieren (BOS) is a quantitative measurement method based on refractive index change of the fluid in question [1,2]. The change of the refractive index is related with density, temperature and concentration gradients [1,3]. So far, the technique has been used in various flow types [1-4]. Since the measurement includes acquisition of an image of a background target, all previous applications were on test sections where both sides are optically accessible. In this study, we aim to extend the application to cases where the optical access to the test section is limited to only one direction. The experimental setup is given in Figure 1. We performed measurements in a thin fluid layer (3 mm thick) bounded by a glass plate on top and highly reflective surface below. Flow was provided by two parallel jets. Using the reflected image of background target, it became possible to measure 2D temperature gradients with a good precision. The temperature gradients are integrated to compute the temperature distribution inside the fluid layer. Independent temperature measurements were done with thermistors and used as boundary condition for the integration and comparison of the results. Temperatures can be estimated with an accuracy at the order of 10 mK.

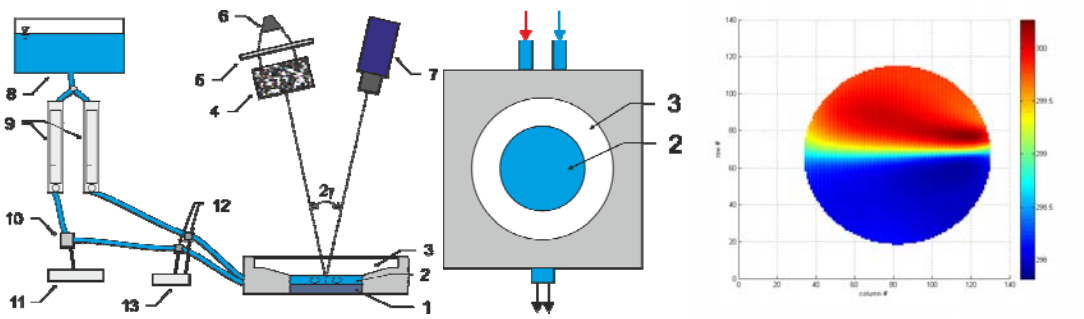

Fig. 1 Sketch of the experimental setup (left), top view of the test section (middle), absolute temperatures computed with integration (right). Components are; 1: reflective surface, 2: fluid layer, 3: glass cover, 4: background target, 5: Fresnel lens, 6: metal halide lamp, 7: BOS camera, 8: reservoir, 9: flow meters, 10: heater, 11: heater controller, 12: thermistors, 13: temperature acquisition.

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