A new method for Stereo-PIV cameras calibration in Scheimpflug condition

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An easy technique to achieve higher depth of field in a Stereo-PIV camera configuration is to tilt the image sensor respect to the lens plane, under Scheimpflug condition, such that the image plane, laser plane and the lens plane intersect in a unique line. The calibration of a Scheimpflug SPIV device is actually achieve in two steps **[**Fournel et al.2004] **[**Louhichi et al. 2007] from a bundle adjustment technique [Lavest et al. 1998]. The SPIV recording system is first calibrated by imaging the planar target at different location and then the laser plane equation is obtained from a geometrical optimization. Such an approach can present two practical advantages. Firstly it does not require metrological calibration targets so that calibration targets can be home-made and easily adjusted to be studied field of view. Secondly it relaxes the constraint of an accurate positioning of the calibration plate by a controlled translation stage device.
Despite these advantages, the misalignment between the laser sheet plane and the calibration plane always remains significant [Coudert and al 2001].
Thus, a new camera model and its respective calibration must be firstly developed, which includes the Scheimplug angle in the intrinsic camera parameters. Then this two mentioned steps must be combine in one level. It consists of making the calibration directly into the laser sheet. This new approach is based on the use of a target formed by spherical *macro-particle* of diameter close to the thickness of the laser sheet. First, the new camera model and its respective calibration are defined. Then, the principle of this approach is presented in order to understand how the parameters of the cameras and the parameters of the laser plane can be obtained simultaneously. Finaly, this new method is studied by simulation data. Experimental results on real data show the relevance of the proposed method.

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