## APPLICATION OF A NOVEL OPTICAL IMAGE CAPTURING TECHNIQUE

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Within the framework of the present project two new measurement techniques have been developed and applied on real flow in a wind tunnel. Both of them are used for Particle Image Velocimetry (PIV).

One of them uses a Panoramic Annular Lens (PAL), by which measurements could be performed in regions, where the optical access with conventional optics is difficult or not possible. On *figure 1* the cross-section of the PAL optics can be seen.

Several tests are presented, which have been performed to characterize the PAL-optics and its behaviour during PIV-application: its spatial resolution has been determined that resulted about  $0.4 \sim 0.5^{\circ}$ ; the viewing angles have been measured ( $\alpha$ =39.0° and  $\beta$ =106.4°); PIV-related tests have been performed (displacement and particle imaging).

Measurements were made in the free stream flow of the wind tunnel. The images have been re-transformed by a B-spline function to eliminate the distortion that the PAL-optics introduces. The image pairs then have been analysed by *widim* to compute the velocity fields. The mean result on the free stream flow can be seen on *figure* 2, which is promising concerning the PIV application of the optics.

The other technique is the Stereoscopic PIV. This has already been developed, but the angular method has not been used at the VKI yet. Measurements have been performed on the backward facing step and statistical quantities (mean, RMS) have been obtained from 672 sets of images. The *mapping* technique has been used for the data processing; the images have been first re-transformed using a third order polynomial connecting function to compensate the distortion due to the perspective view; then the image pairs were processed by *widim*; from the corresponding vector fields the third components of the velocity vectors have been determined.



Figure 1: Cross-section of the PAL-optics



Figure 2: Mean PIV result on free stream flow with the PAL-optics (based on 200 image pairs)



with stereoscopic PIV