A two-phase PIV-system was developed to evaluate instantaneous flow fields of both rising bubbles and the continuous phase (Fig. 1). The measurement of the liquid velocities in the bubble swarm was done by adding fluorescing seed particles. Images of bubbles and fluorescing tracer particles were acquired by two CCD cameras. The signals from tracers and bubbles were separated by optical interference filters with a band width corresponding to the emitting wavelength of the fluorescing tracer particles and the wavelengths of the applied Nd-YAG pulsed laser. To improve the phase separation of the system the CCD cameras were placed in a non-perpendicular arrangement with respect to the light sheet.

The acquired images were evaluated with a cross-correlation algorithm developed by Gui et al. (1997). In order to obtain information about bubble motion and the local velocity of the fluid 500 to 1000 image pairs were recorded and evaluated. By averaging the instantaneous velocities of bubbles and fluid, mean velocities and fluctuating components could be obtained. In addition turbulence intensities were deduced from the measurements. The turbulence properties were used to characterise bubble-induced turbulence for various bubble mean diameters and gas hold-ups. Moreover, the determination of the average bubble slip velocity within the bubble swarm was possible.