

# Flow map visualization across tissue engineered heart valve prostheses

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**Background:** The purpose of this study was to evaluate for the first time the feasibility of using laser technique to examine the hemodynamic performance of a new polyurethane scaffold for aortic valve tissue engineering. **Material and methods:** A new experiment set-up was developed to simulate blood flow in the aortic position and to visualize the flow field along valve scaffolds. This set-up includes a perfusion system, silicon models, a blood-like solution, an aortic compliance simulator, a ventricle assist device (MEDOS Medizintechnik AG, Stolberg, Germany), a laser optical measurement system PIV (ILA GmbH, Juelich, Germany), a high speed CCD Camera (PCO AG, Kelheim, Germany), pressure sensors (Hottinger Baldwin Messtechnik, Darmstadt, Germany), a flow meter (Transonic Systems Inc., Stuttgart, Germany) and many monitoring systems. Blood-like (glycerine water) solution and silicon tube models were prepared with the same refraction index  $n= 1.41$  to avoid deflection of the laser light. Polyurethane aortic valve scaffolds ( $n= 6$ ) were sprayed at the Institute of Textile Technology and process engineering (Denkendorf, Germany) with similar dimensions as nature aortic valves and evaluated by means of time resolved 2D particle image velocimetry (PIV). **Results:** The results showed the possibility to apply conventional evaluation methods for the flow analysis of tissue engineered heart valves. **Conclusion:** PIV can be successfully applied to visualize hemodynamic performance and back jet flow of polyurethane scaffolds for heart valve tissue engineering. New developed aortic valve scaffolds seem to function properly under physiological conditions and may offer a new option for aortic valve therapy.

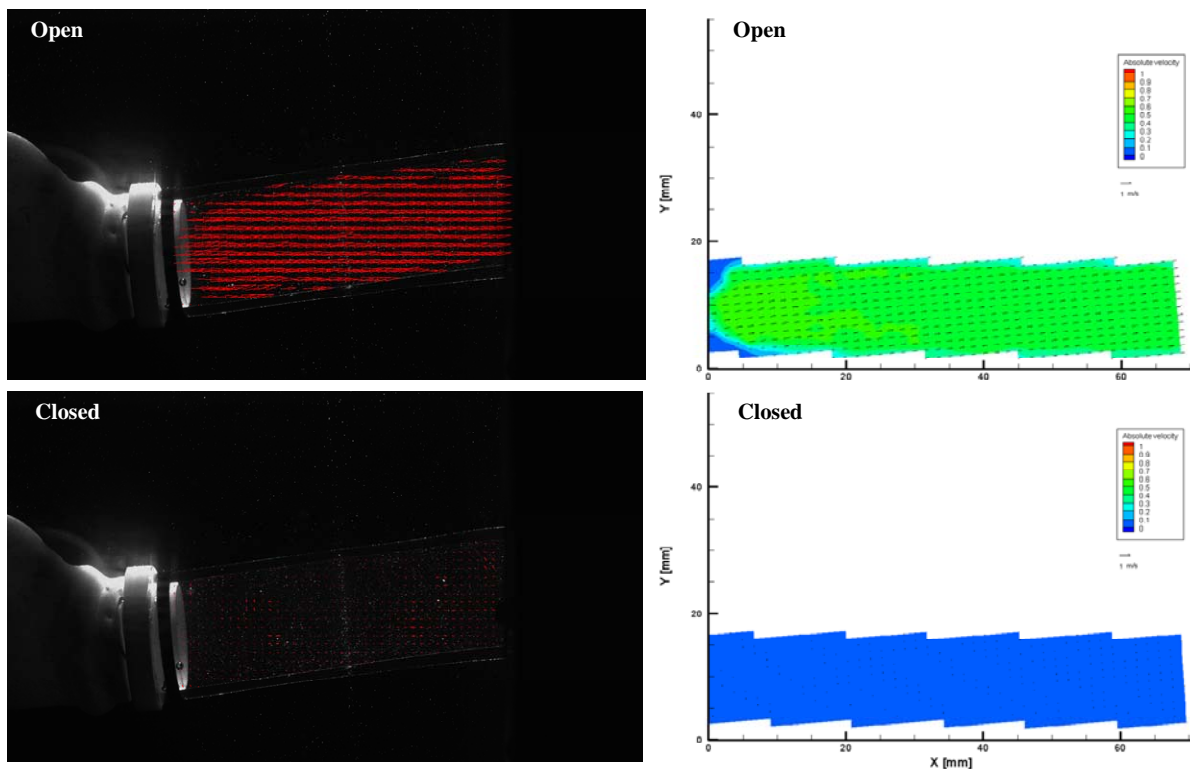


Fig. 1: Flow field analysis of aortic valve scaffolds

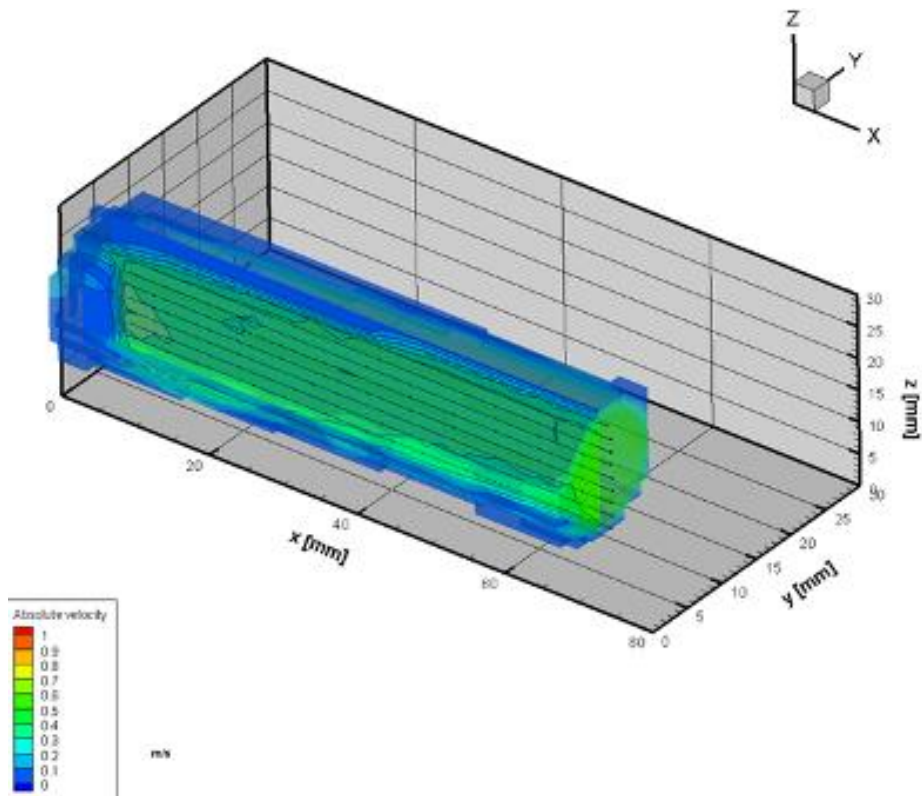


Fig. 2: 3D-Flow visualization

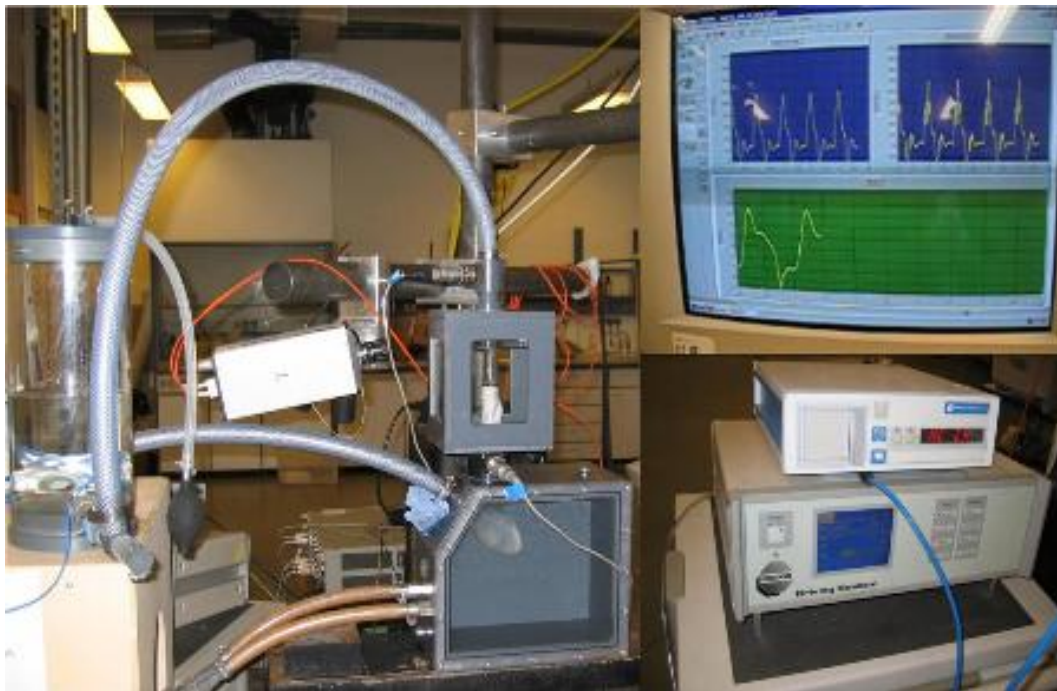


Fig. 3: Experiment set-up

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