

Portfolio Paper

Visualizing Mass Transport by Particle Advection in an In-Vitro Model of the Human Lung

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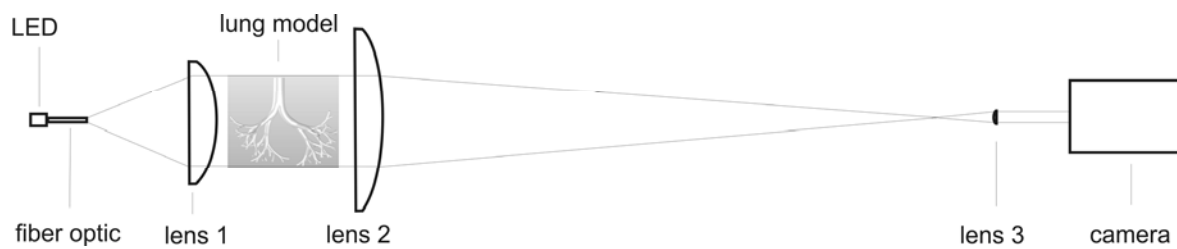


Fig. 1 Schematical set-up for image acquisition

The method of backlight illumination (Fig. 1) is used to visualize the motion of particles within an in-vitro model of the human lung (Fig. 2). For this purpose small, neutrally buoyant particles are injected to the flow in the form of a bolus at the top end of the model trachea. Subsequently, an oscillating motion with amplitude below the dead space of the model is applied to the fluid in the branches. Nevertheless, particles pass the complete model and leave it through the open, lower (distal) ends of the bifurcations. The set-up in figure 1 shows the illumination technique of the particles by an LED whose light pulse of just $1\mu\text{s}$ duration is captured by a High – Speed camera (Photron APX RS) through a telecentric lens set-up. With an image resolution of 512×512 pixels of the camera a total number of 8190 images during 63 oscillating periods equivalent to 130 images per period are captured during each measurement. The single images are superposed for one measurement resulting in the probability distribution of particle positions as shown color coded in Fig. 3, red corresponds to high, blue to low particle probability.



Fig. 2 Positive model of the human bronchial tree (top), silicone model with hollow branches used for measurements (bottom)

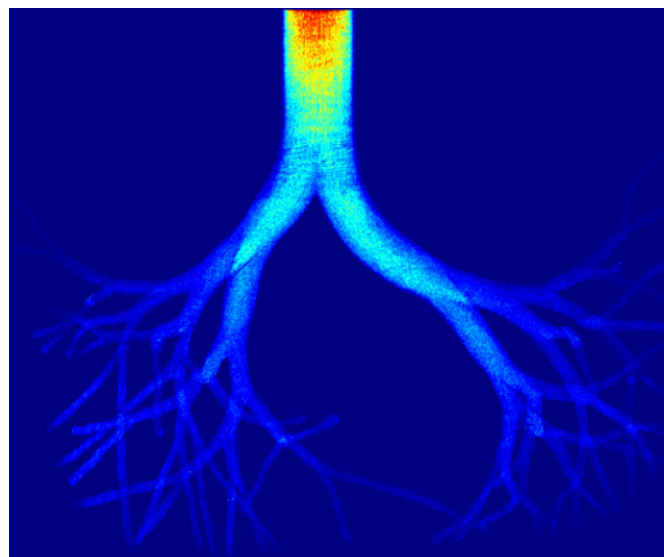


Fig. 3 Particle position probability distribution, red color indicates high particle probability, blue low probability