Jet formation in a shock tube

Ivo R. Peters, Alexander Klein, Gerben J. Morsink, Chao Sun, Devaraj van der Meer and Detlef Lohse

We create a pressure shock with amplitudes up to 70 bars at the bottom of a water-filled steel tube with a length of 100 cm, using an eddy-current actuator. The steel tube of diameter 25 mm is smoothly connected to a glass tube with diameter 8 mm. The shock wave travels through the steel tube into the glass tube, where it reflects on the free surface, setting the liquid in motion. The meniscus of the free surface in the glass tube focuses the moving liquid into a thin jet, which can reach speeds up to 50 m/s. We numerically investigate the formation of the jet by applying the pressure profile as it is measured in the experiments using PVDF sensors, to the free surface in a boundary-integral simulation. We find excellent agreement between experiments and the numerical simulations of the jets.