

Investigation of the Richtmyer-Meshkov instability: New experiments

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For several decades, we are interested in the understanding and the characterization of flows involving interface instabilities, including the Richtmyer-Meshkov instability (RMI) [1]. These instabilities are studied in shock tubes environment at the interface between two gases. This work is a continuation of those presented in the previous IWPCTM [2], [3] and realised in the context of research on inertial confinement fusion. The experiments take place in the T200 shock tube of the IUSTI laboratory where the instability growth is quantified from acquisition of laser sheet frames. The gas interfaces are initially materialized by nitrocellulosic film separating the gases and a stereolithographed grid gives the desired interfacial shape. A better know-how in the materialization of the initial interface allows to use a wider range of characteristic sizes of the perturbation and so to observe all the stages of growth of the instability developed from 2D or 3D geometries. However, we have already shown that residual pieces of membrane that materializes the initial interface tend to delay the interpenetration and specifically during the initial stages of the interface evolution. So, to reduce these effects in our next experiments, we will increase the intensity of the shock wave ($> \text{Mach } 1.5$). Finally, we are currently extending the experiment chamber from 0.46 m to 1.5 m which should allow the instability to grow farther and thus allow to see the whole non-linear phase until the transition to turbulence.

During the Workshop, we hope to present the results of all these new experiments undertaken for the two gas combinations (positive and negative Atwood numbers).

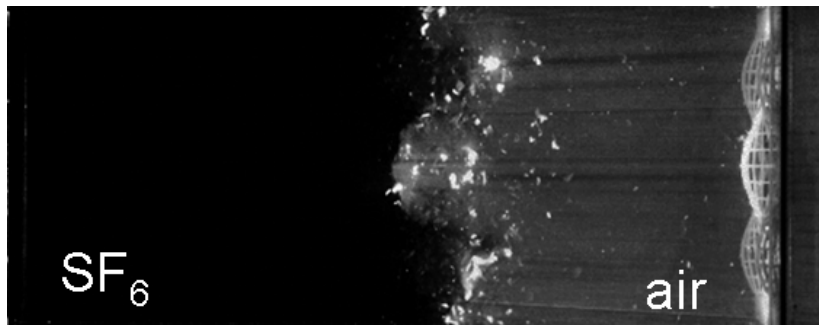


Fig. 1 : Laser sheet frame of a longitudinal section (50 cm \times 20cm) of a 3D light/heavy interface after the impulsive acceleration by a shock wave ($M_{isw}=1.15$)

[1] “Investigation of the Richtmyer-Meshkov instability with stereolithographed interfaces”, C. Mariani, M. Vandenboomgaerde, G. Jourdan, D. Souffland & L. Houas, *Physical Review Letter*, 100, 254503 (2008).

[2] “Experimental investigation of the interaction of spherical and sinusoidal gaseous interfaces”, C. Mariani, G. Layes, G. Jourdan, L. Houas & M. Vandenboomgaerde, in *Proceedings of the 10th IWPCTM, Paris, France* (2006).

[3] “An attempt to reduce the membrane effects in Richtmyer-Meshkov Instability shock tube Investigations”, G. Fontaine, C. Mariani, G. Jourdan, L. Houas & M. Vandenboomgaerde, in *Proceedings of the 11th IWPCTM, Santa Fe, New Mexico, USA* (2008).