VELOCITY AND DENSITY FIELD MEASUREMENTS OF A MICRO-EXPLOSION

L. VENKATAKRISHNAN[1c], P.SURIYANARAYANAN[1], G. JAGADEESH[2]

[1]Council of Scientific and Industrial Research-National Aerospace Laboratories, Bangalore, 560012, India
[2]Department of Aerospace Engineering, Indian Institute of Science, Bangalore, 560037, India

[c]Corresponding author: Tel.: +918025051566; Fax: +918025051677; Email: venkat@nal.res.in

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ABSTRACT: The physical properties of the blast waves generated from large scale explosions depend on the rate of energy release and the amount of explosives used for detonation. However; determination of shock wave propagation from large scale blasts is cumbersome, expensive, laborious/time-consuming and imposes limitations on applied diagnostics. Small scale explosions or small sized charges offer advantages, as they can be economical, safely used and less time-consuming in the laboratory environment. In this study, the velocity and density field of a spatial-temporally evolving blast wave generated from a micro-explosion of a hand held shock tube[1] is documented using PIV and Background Oriented Schlieren[2] (BOS) respectively. The micro-explosion is generated using a non-electrical (NONEL) tube (M/s Dyno Nobel, Sweden) which consists of a plastic tube coated with thin layer of explosive material (HMX 18mg/m and traces of Aluminum). An electric spark initiates detonation inside the tube and the gases are allowed to escape from the open end of the tube thereby generating a blast wave. The spatial-temporally evolving density field is captured at several instants of time by means of a precise triggering circuit used to control the illumination and imaging. The present experiment requires exceedingly short exposure time due to the transient nature of the flow, hence an Nd:YAG pulsed laser with a pulse width of 10ns is used as the source for both the PIV as well as background illumination for the BOS techniques. Figure 1 shows the experimental setup for the BOS, the density gradient field and the reconstructed density field at 93µs. The data reveal the complex structure of the micro-explosion. The growth of the scaled radius matches point charge explosions. The full paper will also contain the PIV density fields at different time instants.

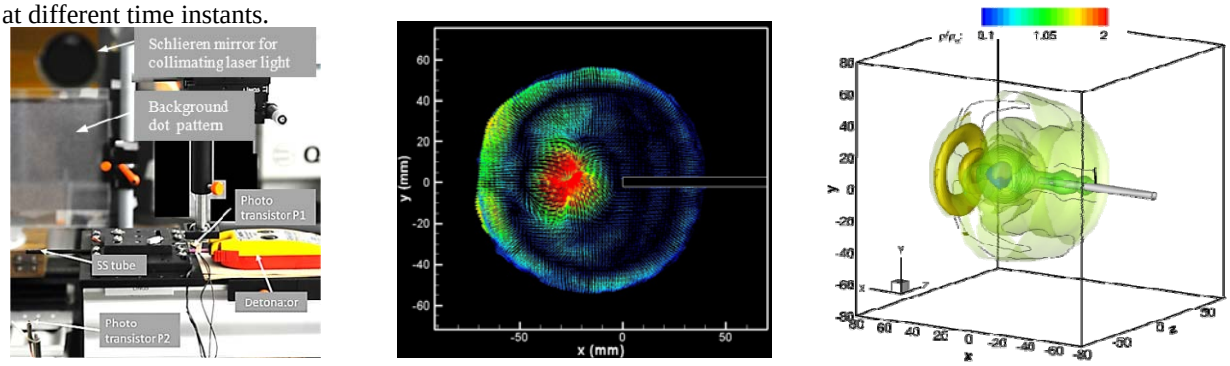

Fig. 1 Experimental setup for BOS (left), density gradient field (center), reconstructed density field at 93µs.

References

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