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Radiative shocks: an opportunity to study Laboratory Astrophysics.

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A shock becomes radiative when it produces a significant upstream ionizing photons. This phenomenon occurs for shock velocities exceeding a given threshold which depend strongly on the medium. These velocities are typically or the order of 100 km/s and more, common value in astrophysics. Here we shall present a serie of experiments performed at LULI laboratory using the old 6 beams and the new LULI2000 facility. Scaling laws and hydrodynamic simulations allowed to design the target characteristics according to the available laser energy. A strong shock was driven in a layered solid target (CH-Ti-CH) which then accelerates into a gas cell (≈60km/s) filled with Xenon at low pressure (0.1-0.3bar) producing a radiative supercritical shock. A laser beam (8ns-532nm) probes the Xenon gas in the transverse direction and was injected into either a Mach-Zenhder or a VISAR interferometer. In this last case two additional optical framing cameras was used. On the rear side, self-emission and VISAR diagnostics were utilized. All these diagnostics allow to determine many relevant parameters linked to the shock or the radiative precursor. Indeed we shall present experimental data for the shock temperature and velocities, the precursor 2D time evolution, its electron density, density gradient and temperature. Data were obtained for different laser intensities and gas pressures. Comparisons with 1D (MULTI) and 2D (DUED) radiative hydrodynamic codes will be presented for all measured parameters (shock velocity, shape, radial expansion, and temperature as well as precursor velocity and precursor electron density).