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Hydrodynamic effects induced by nanosecond sparks in ambient air.[1] SERGEY STEPANYAN, NICOLAS MINESI, GABI-DANIEL STANCU, CHRISTOPHE LAUX, EM2C Laboratory, CNRS UPR288, CentraleSuplec — This work presents the results on hydrodynamic effects induced by nanosecond repetitive sparks in ambient air. In order to monitor the hydrodynamic effects, four optical diagnostics were combined: emission spectroscopy, Planar Laser Induced Fluorescence, Schlieren and fast imaging. The mentioned diagnostics were synchronized with electrical energy measurements to (i) observe the spatial distribution of gas temperature and active species produced in the discharge afterglow, (ii) investigate hydrodynamic coupling between the discharges at high frequencies of applied pulses. One of the major experimental findings was the synergy between the discharges at higher frequencies (>1 kHz). The volume occupied by hot gas and active species after a burst of N sparks is larger than N times the volume occupied after a single discharge. It has been demonstrated that the energy density in the case of high-frequency discharge redistributes spatially during a period shorter than the typical ignition delay time. It has also been shown that the value of the energy density is sufficient for ignition of lean mixtures. Therefore we believe that this effect can be used as an efficient tool for volumetric ignition that can improve the combustion of lean mixtures. .

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Nicolas Minesi
EM2C Laboratory, CNRS UPR288, CentraleSuplec

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