Experimental Investigation of Lifted Spray Flame with Preheated Co-flow Condition

Student Name: Kapil S. Sawankar **Guide Name: Prof. Umesh G. Potdar**

The combustion of liquid fuels currently provides the energy used by a variety of power systems such as industrial furnaces, boilers as well as automotive and aerospace engines. The performance of a given spray combustion system depends not only on the fuel droplet size distribution but on the spray spatial distribution and the interaction of the droplets with the gas turbulence that involves a physical mechanism that it is not well understood. Understanding the physical phenomena that control spray combustion processes is desirable, as most practical combustion devices initially introduce the fuel as a two-phase flow. Applications such as residential heating, land and air-based transportation or propulsion, and power generation all utilize liquid fuels. This broad range of application necessitates a fundamental understanding of the mechanisms that control spray flame behavior. Issues such as flame structure, stabilization, and extinction are important aspects of spray combustion that are still not well understood for the wide variety of combustors that exist. In the present study, experimental work is carried out for three different cases i.e. no co-flow condition, normal co-flow condition and preheated co-flow condition. It is observed that the flame lift-off height is directly proportional to injection pressure, and co-flow velocity but inversely proportional to co-flow temperature. Spray injectors are used to inject the fuel with mass flow rate varies from 1.8 Kg/hr to 7.4 Kg/hr. PIV analysis is carried out to study the effect of velocity distribution and vorticity distribution in non-reacting kerosene spray on the stability of spray flame.

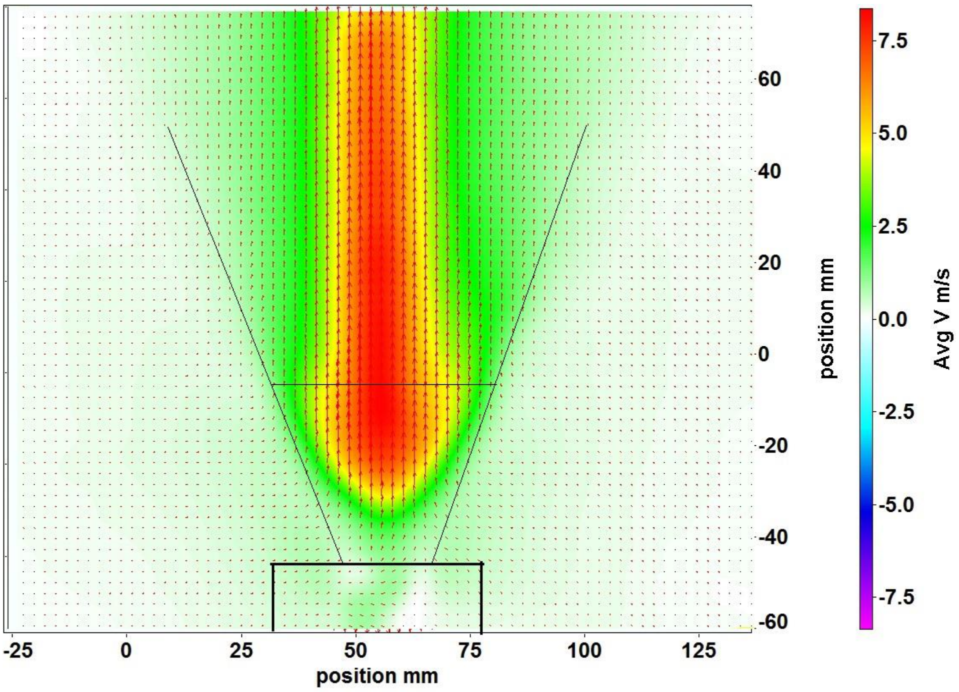

Fig: Average Velocity Distribution of Kerosene Spray at 6 bar Injection Pressure for