

Upgrade of PRC Spray Facility for Evaluation of Liquid Injector Technology

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Overview

The PRC Spray Facility deals with the study of liquid propellant injection. Also, it can be used to study fuel injection using various styles of full-scale rocket engine injectors.

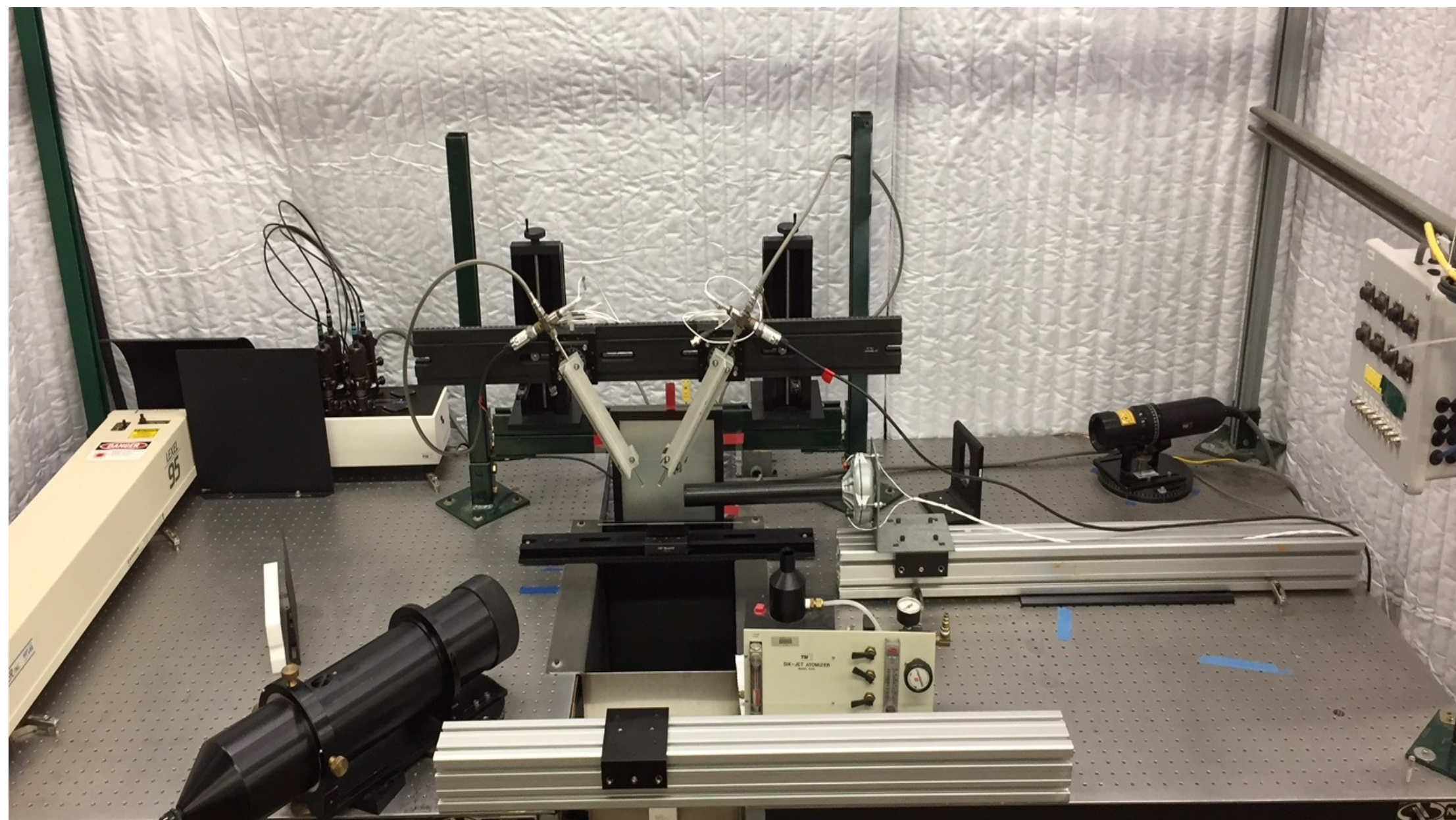


Figure 1: Impingement injector test stand

The objective is to enhance capabilities of the facility, and conduct a series of check-out and cold flow tests after facility upgrades like:

- New data acquisition system installation
- Control circuit modification
- PDPA setup and calibration
- High pressure system reconfiguration
- Experimental tests (Impingement and Spray)

Through the upgrade, the quality of the gathered data is improved. Besides the safety at the test stand has increased due to removal of tripping hazards.

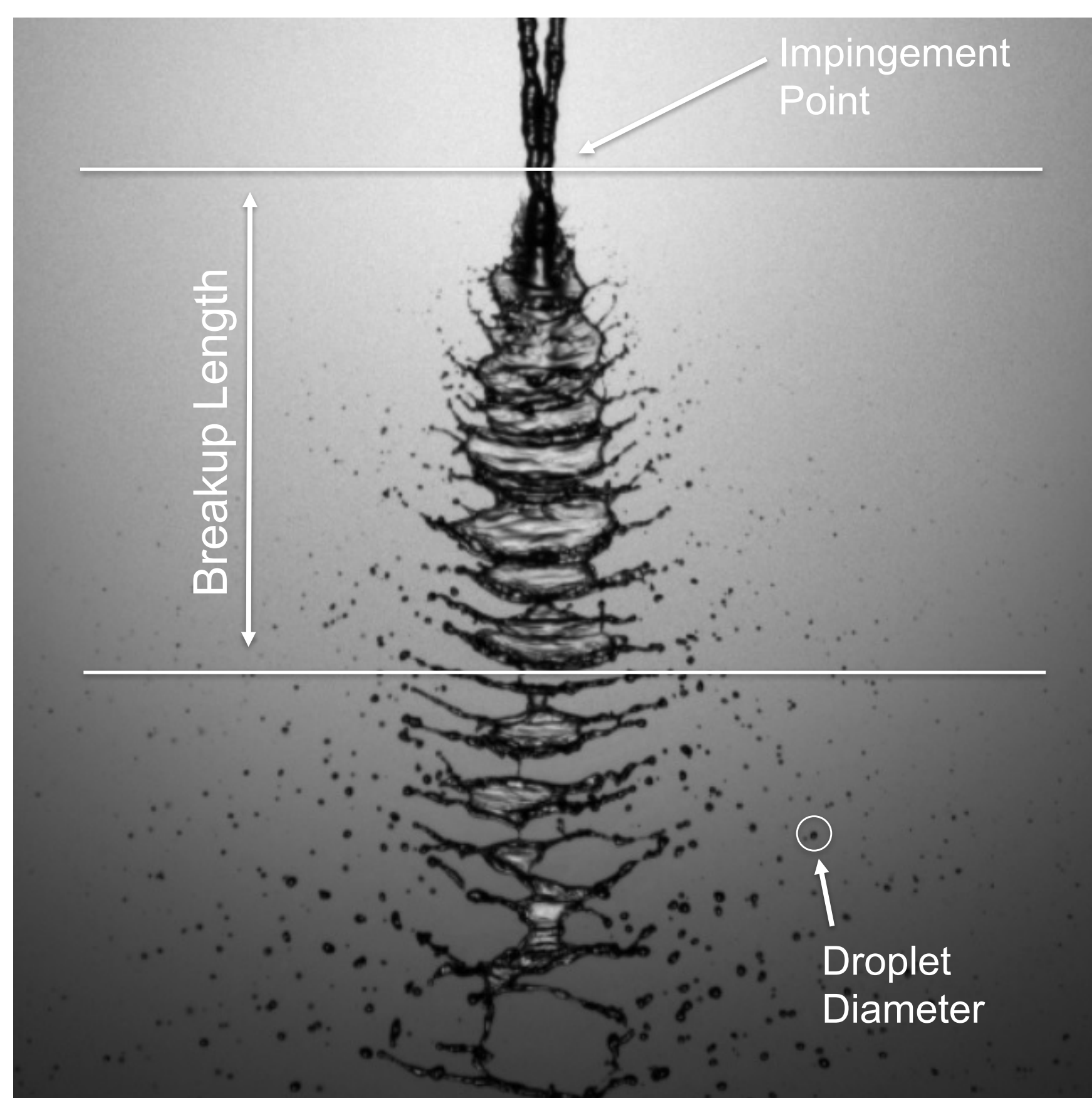


Figure 2: Details of a Flat sheet using a like-doublet injector

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Key Findings

Check-out tests are used to better understand the phenomenon of impingement injection and atomization. To receive accurate data, a high-speed camera and the Phase Doppler Particle Analyzer (PDPA) are used. From the tests, fluid instability is studied.

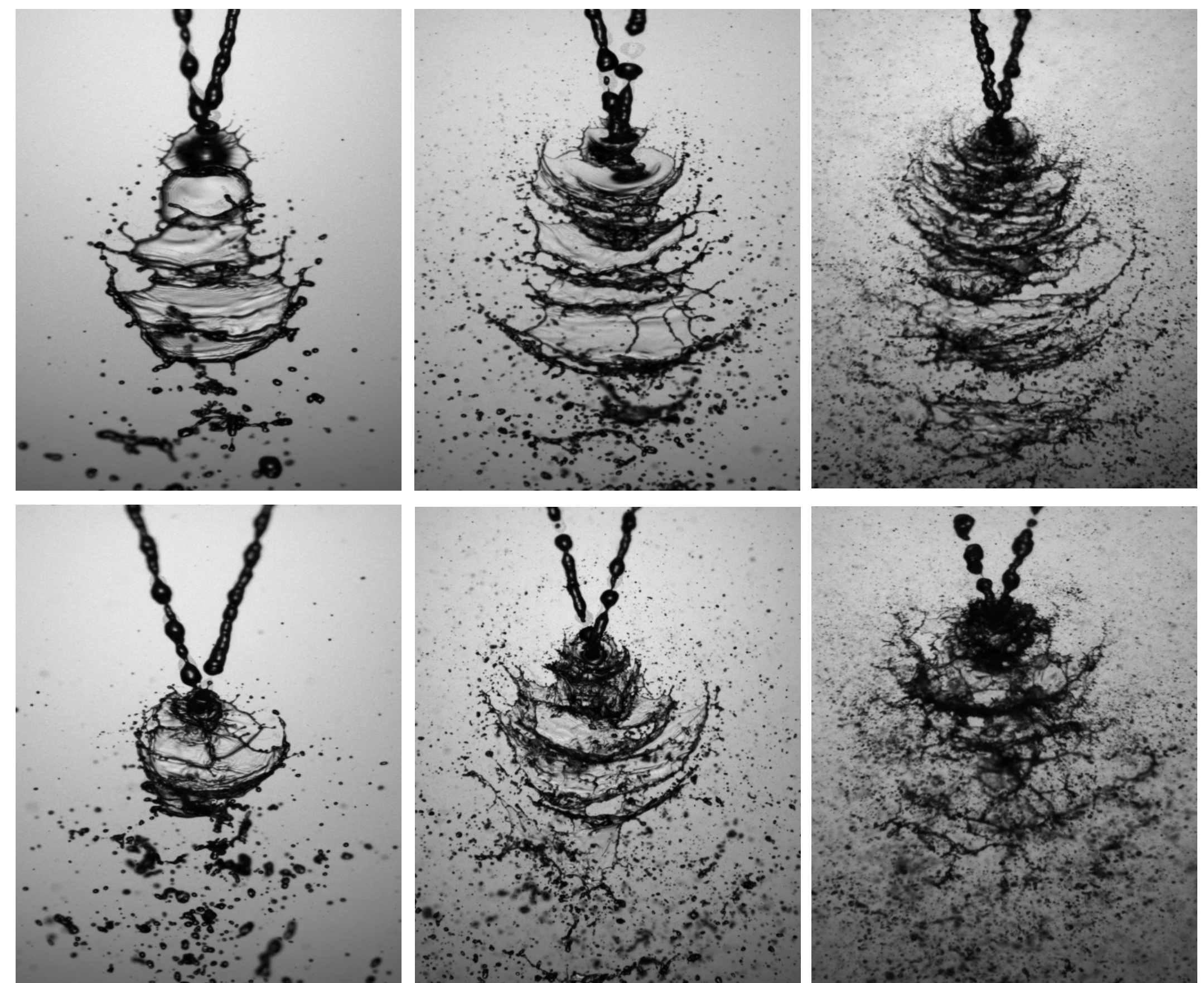


Figure 3: 1st row - snapshots of spray at angles of 60 ° and velocity of 5 m/s, 10 and 20 m/s respectively; 2nd row - snapshots of spray at angles of 90 ° and velocity of 5 m/s, 10 and 20 m/s respectively

Conclusions

Tests conducted using different velocities and impingement angles for different flow regimes through the facility help gather data on the fundamental atomization processes. Better understanding of liquid injectors, droplet sizes and mixing efficiencies help:

- Reduce development costs and time
- Reduce effects of combustion instability
- Improve parameters affecting the performance

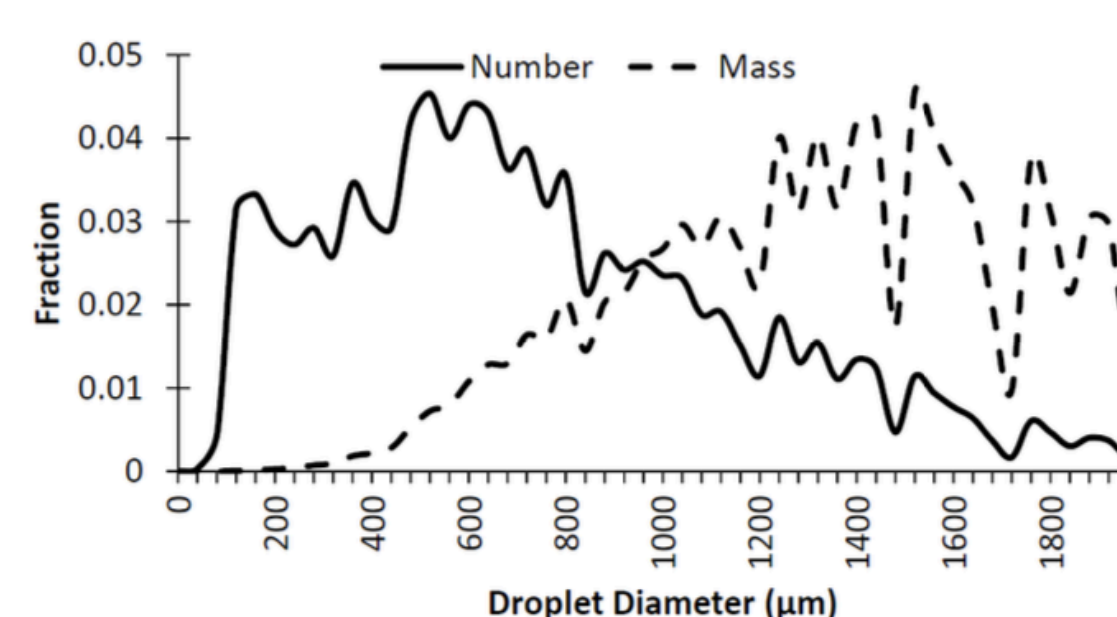


Figure 4: Droplet Diameter at 60 °, 5 m/s and lb/li 1.

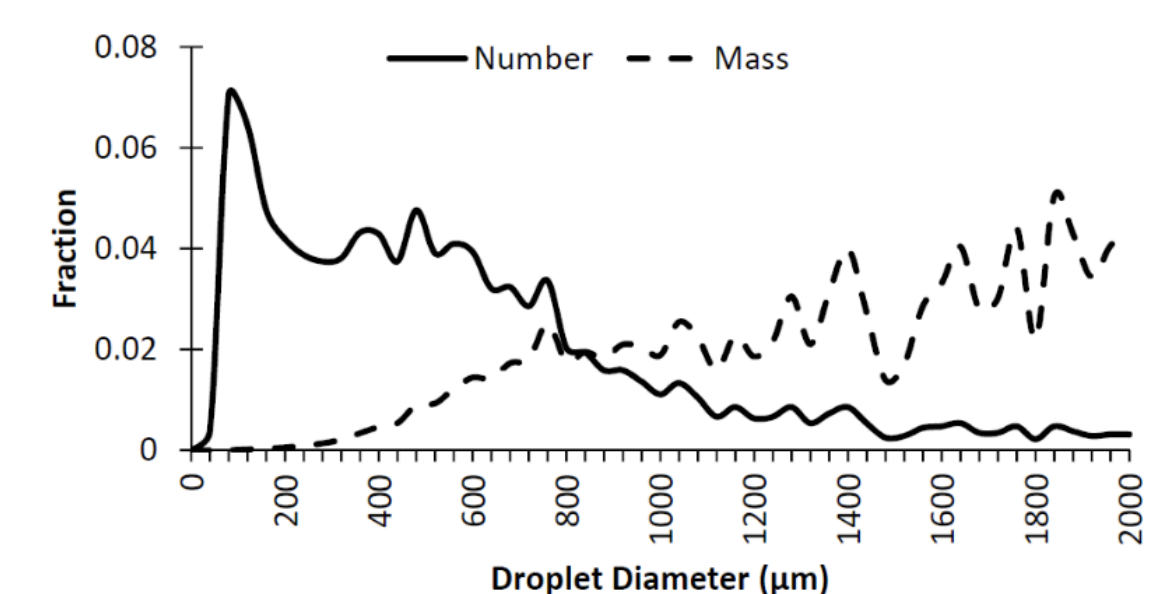


Figure 5: Droplet Diameter at 90 °, 5 m/s and lb/li 1.