Velocity measurements of Sprays

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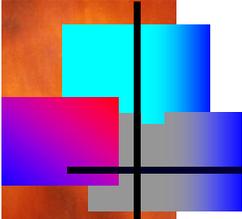
Background

➢ **Several instruments available on the market**

➢ **Single point measurements obtained using LDV, PDA, hot wire anemometry**

➢ **For planar velocities, PIV is the most commonly used instrument (requires capture of images of individual particles)**

➢ **Image correlation velocimetry does not require resolution of individual particles, but requires distinct patterns**

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Basic Arrangement

High speed camera

Spray

Uniform background light
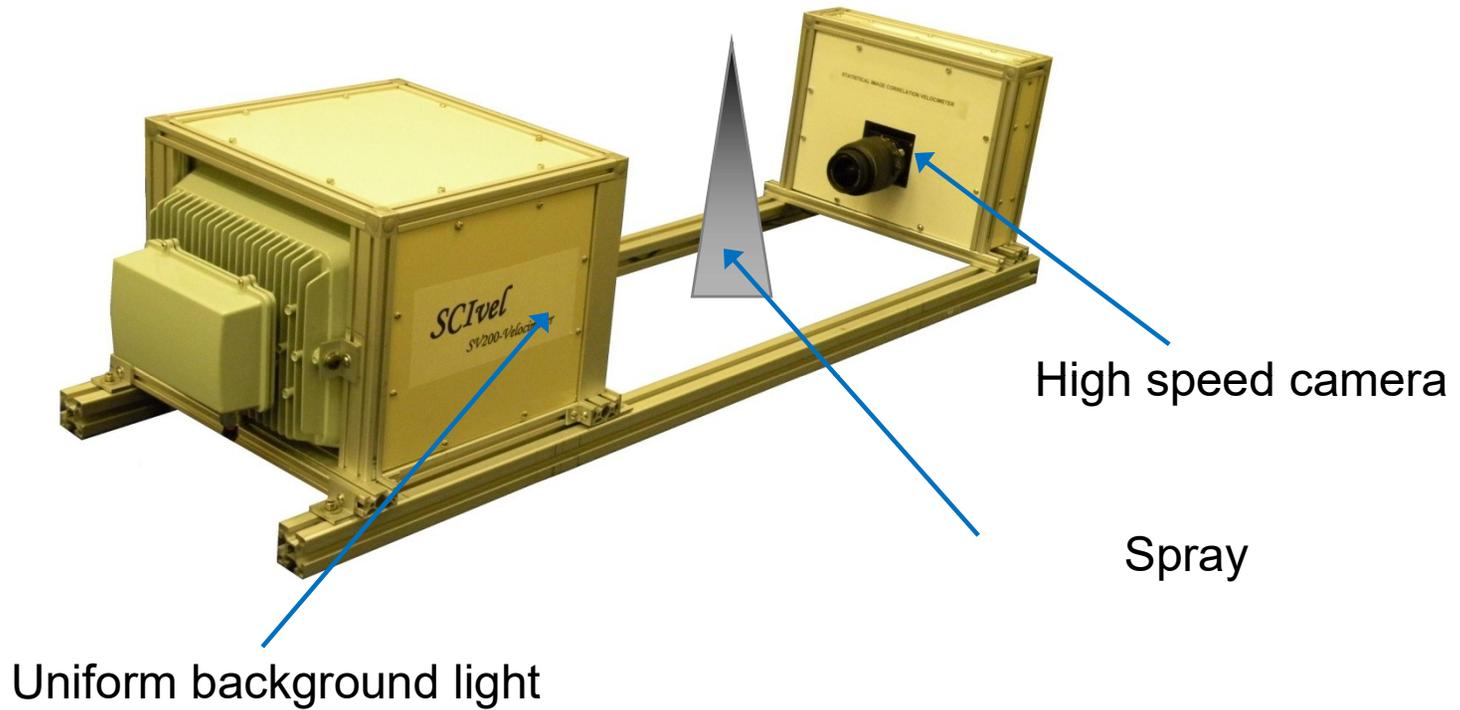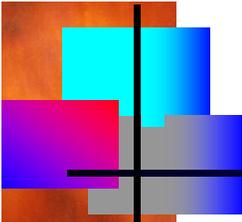
An Overview of Process Flow

➢ **Install camera with diffuse light source**

➢ **Configure camera f-stop and focus**

➢ **Calibrate millimeters to pixels conversion**

➢ **Record reference frames with no spray**

➢ **Configure settings in SPIV**

➢ **Processing and post-processing**
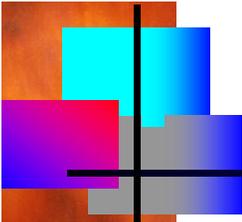
Statistical Pattern Imaging Velocimetry

➢ **Does not rely on capturing individual particles or distinct patterns**

➢ **Requires large ensemble of images**

➢ **Computes statistical correlation between patterns over the entire pixel range**

➢ **Image correlation velocimetry does not require resolution of individual particles**

Sample Results (GDI Injector)
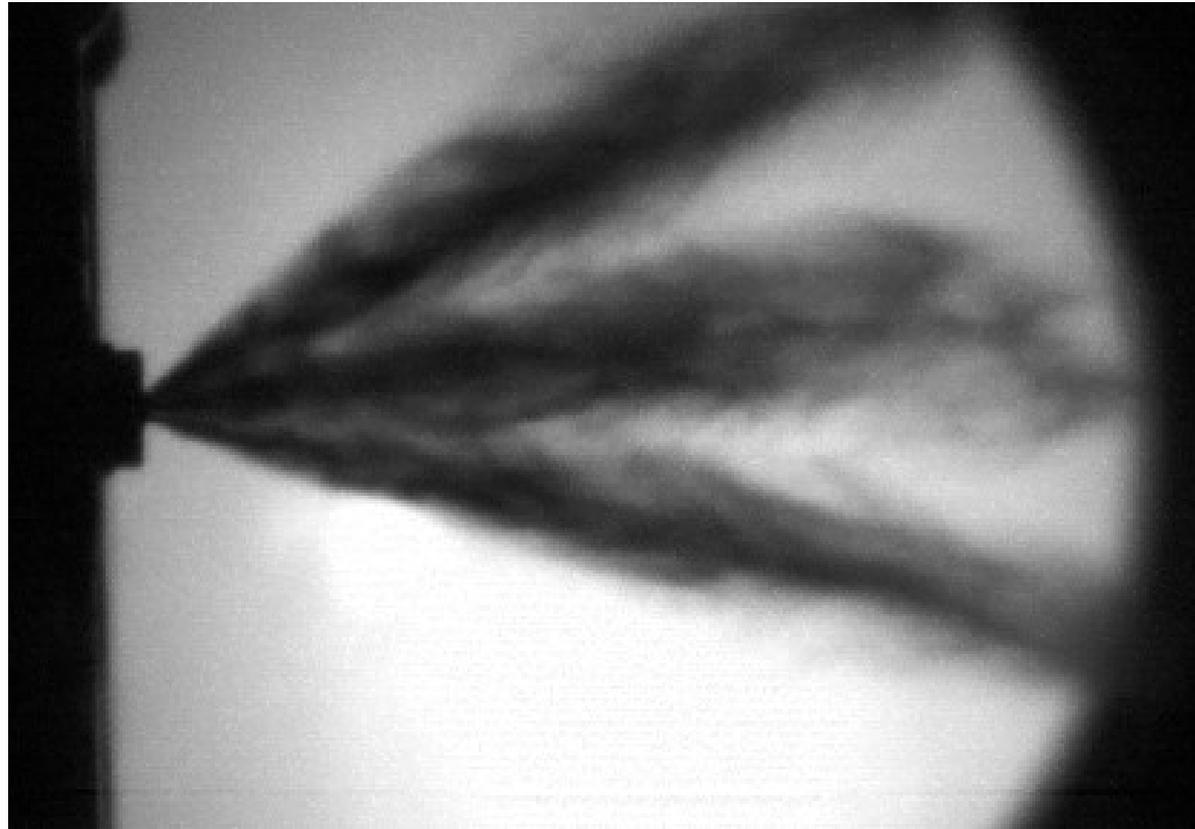
Full Flow Field Mean Axial Velocity of GDI Injector

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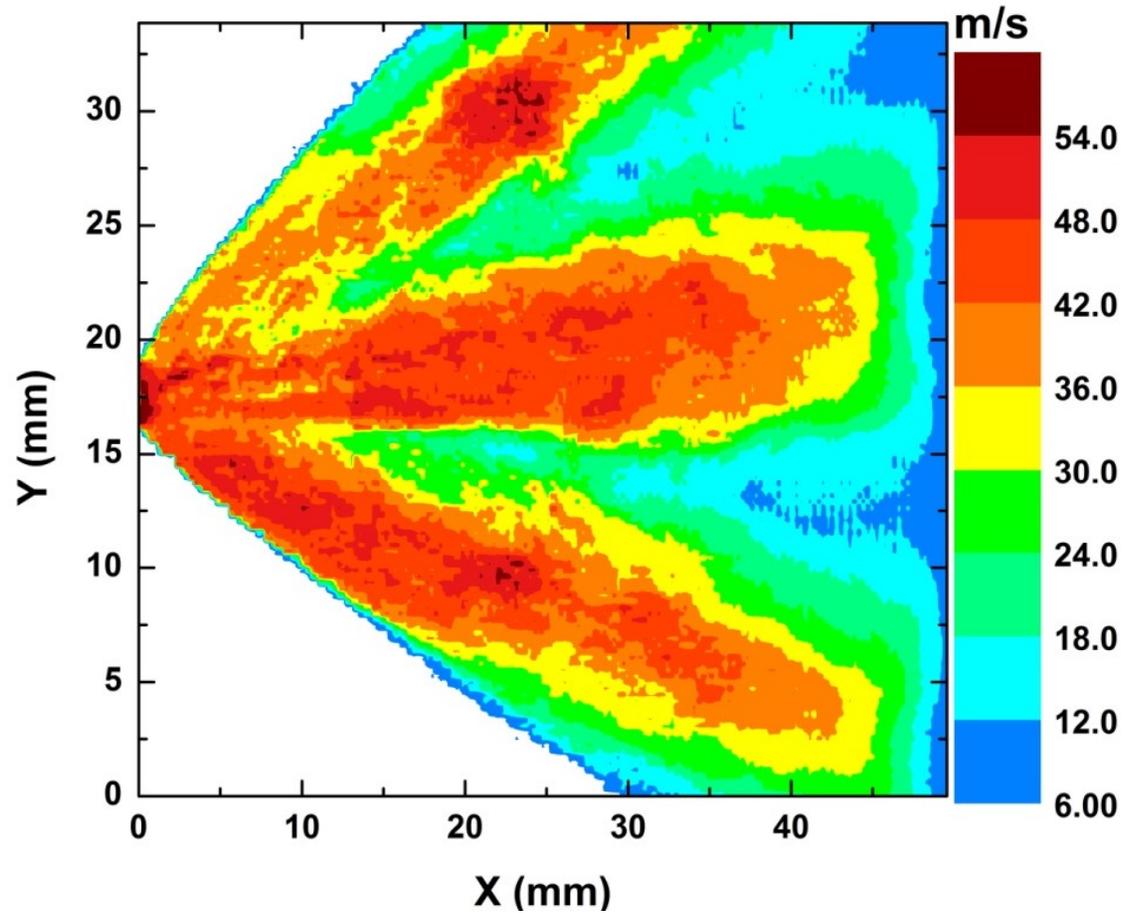
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Comparison of our SPIV with PDA
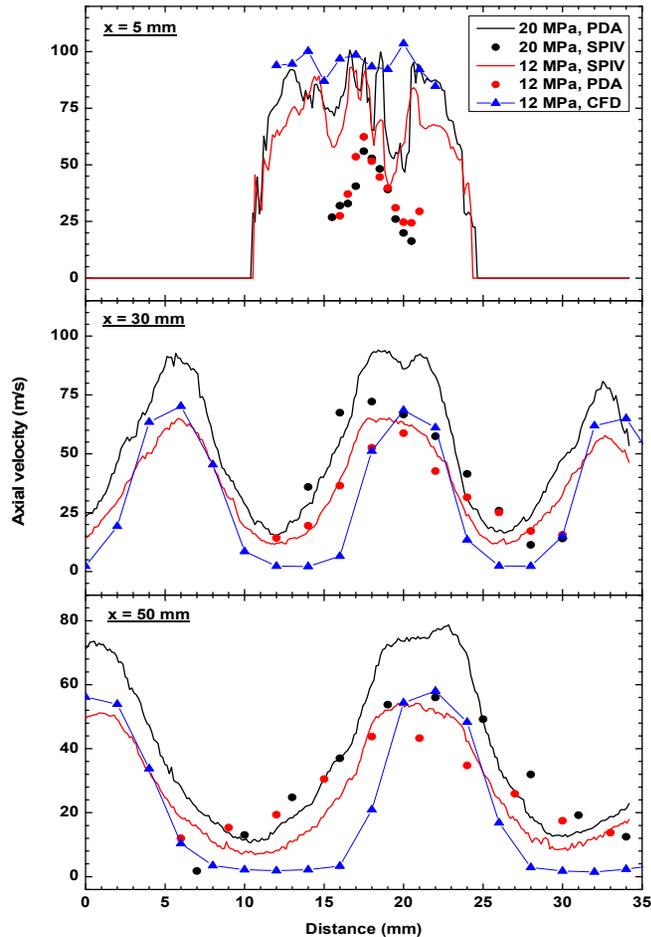
- ➢ **GDI injector**

- ➢ **PDA fails near injector due to high obscuration**

- ➢ **10000 Hz camera**

- ➢ **Good agreement at lower positions**

- ➢ **Full planar axial velocity available**

Example results with low spray opacity

Raw Data
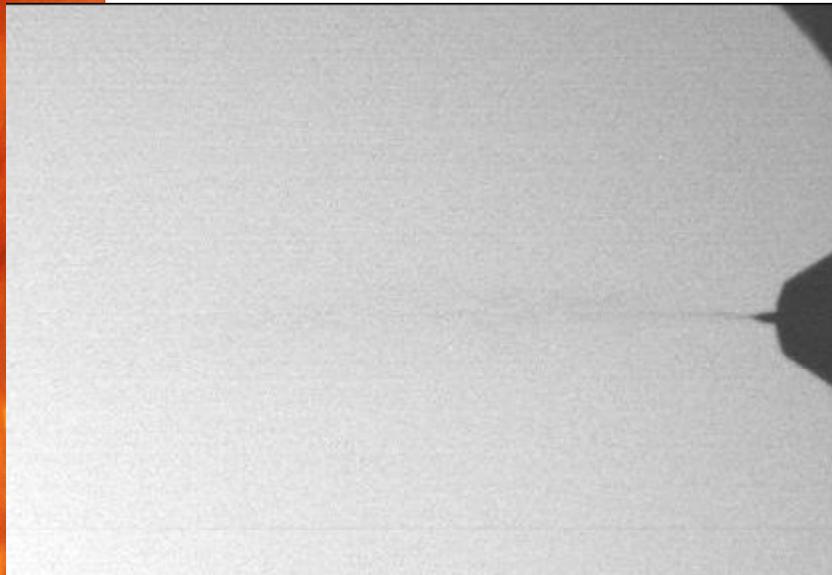
Processed Velocimetry Results
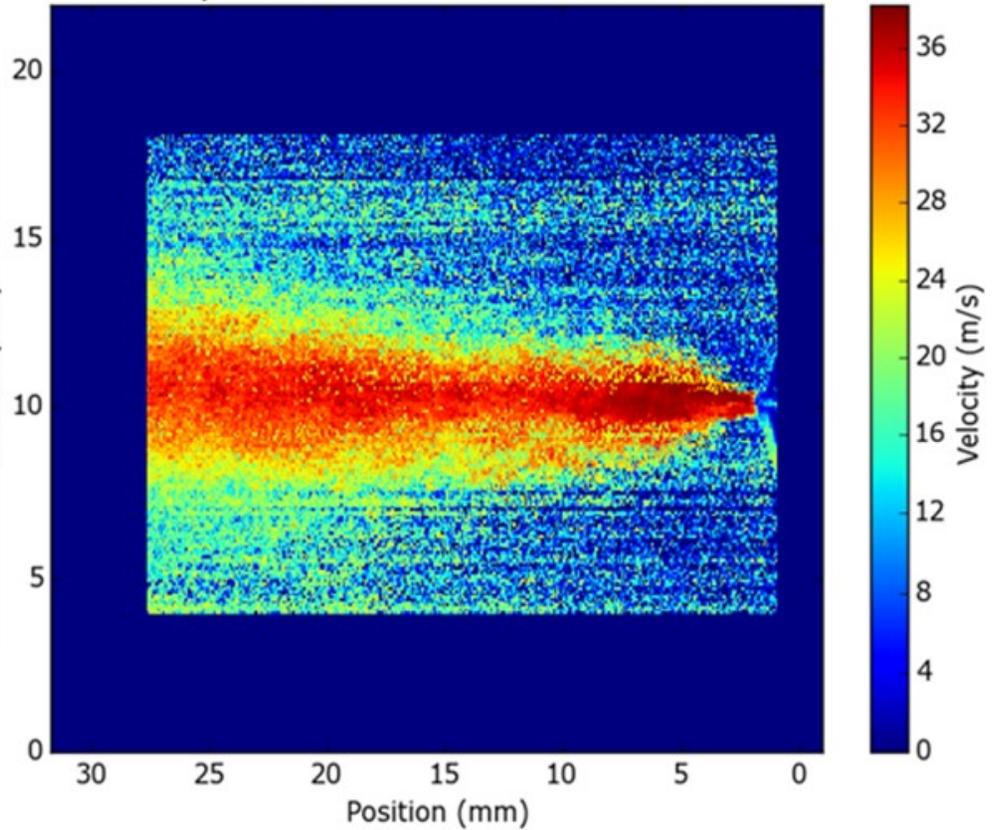
Signal to noise of 1.1

Example results ensemble averaging 4ms spray bursts

E = 1 events
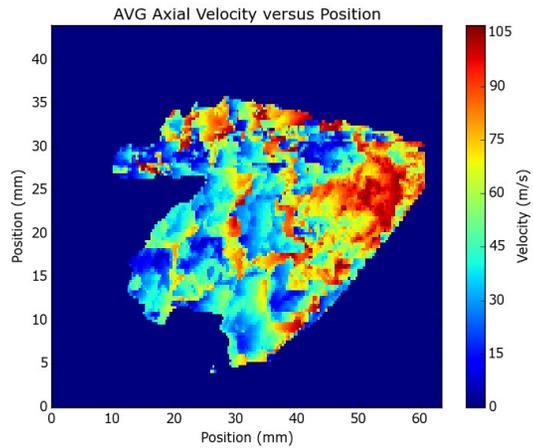
E = 5 events
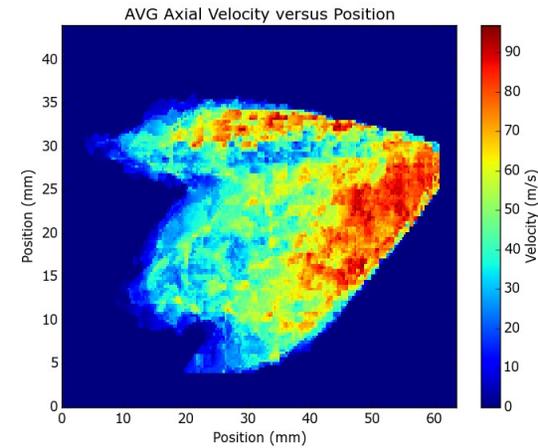
E = 10 events
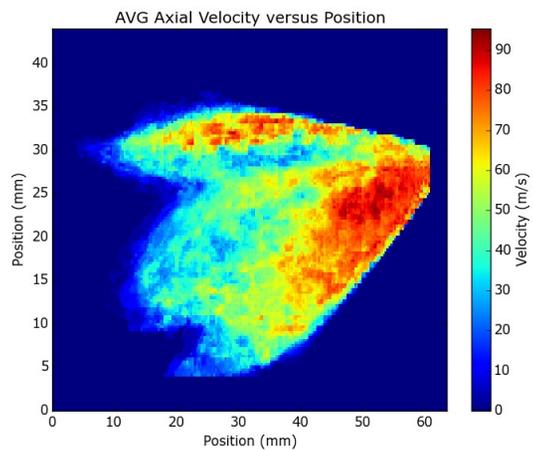
E = 30 events

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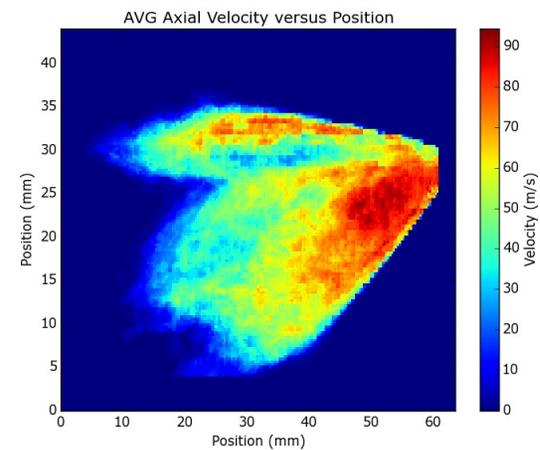
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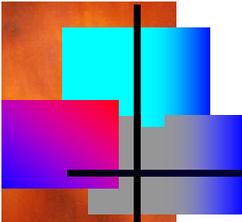
Questions?

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