Experimental Studies of Gas Motion Subjected to Compression

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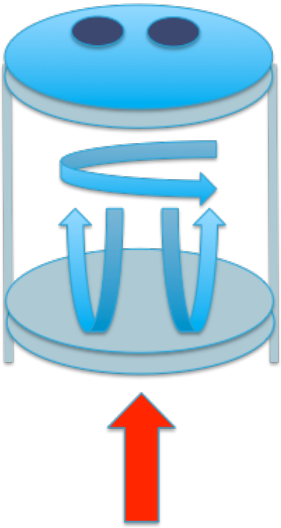

The combustion in an internal combustion engine is very complex with complicated interactions between the fuel spray, the gas flow and the combustion itself. There are many parameters that can be adjusted in order to control the flow motion and the most efficient way to explore these possibilities are through simulations. The missing piece to be able to simulate the entire process of a four-stroke diesel engine is the compression stroke. Currently there are no reliable data for the charge gas motion during the compression stroke, data that are needed to validate simulations.

The flow field is usually characterized by its swirl and tumble components. Earlier studies have shown a strong link between engine performance and the cylinder flow field. The main finding is that increased tumble improves the engine's performance, that is, it lowers the fuel consumption and hydrocarbon emissions and increases power and torque output. However also the swirl seems to have strong influence on the combustion.

The focus of this study is to investigate how the swirl and tumble motions are affected by the compression by the piston. A generic compression cylinder apparatus is being developed where the piston motion can be controlled and an initial flow field set up inside the cylinder before the compression starts. In this way the tumble and swirl can be studied separately or in combination. The apparatus will give optical access to the inside of the cylinder thereby making measurements with stereo three-component Particle Image Velocimetry (PIV) possible.

The results of this project will help in creating a more efficient combustion process and also increase the knowledge of turbulent gas motion during compression.