REAL World Advanced Technologies foR Diesel Engines

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Project partners:

1 - AVL - AVL List GmbH - AT
2 - REN - Renault SAS - FR
3 - VCC - Volvo Car Corporation - SE
4 - CRF - CRF SCpA - IT
5 - CNRIM - Instituto Motori – Consiglio Nazionale delle Ricerche (CNR) - IT
6 - JM - Johnson Matthey Plc - UK
7 - RIC - Ricardo Plc - UK
8 - SCF - Schaeffler Technologies AG & Co. KG - DE
9 - LMM - Le Moteur Moderne - FR
10 - DELPHI - Delphi Automotive Systems Luxembourg S.A. - LU
11 - UNR - Uniresearch BV - NL
12 - IFPEN - IFP Energies Nouvelles - FR
13 - VIF - Virtual Vehicle Research Center - AT
14 - CTH - Chalmers Tekniska Högskola - SE
15 - CTU - Czech Technical University - CZ
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Publishable Executive summary

Diesel engine efficiency may be still improved levering on the combustion parameters; for that reason, IFPEN focused its activity within WP3 on the development of a new combustion system adapted to the FIAT Engine 1.6L, allowing at the same time a reduction of both emissions and fuel consumption.
First, a 3D CFD combustion simulation campaign was performed, in order to evaluate the impact of an innovative fuel injection system, eventually combined with an adapted in-cylinder swirl and bowl profile. The simulation results suggested generally a reduction of the injector flow rate and the enlargement of the bowl, allowing a better air-fuel mixture preparation, at both full load and partial load conditions.

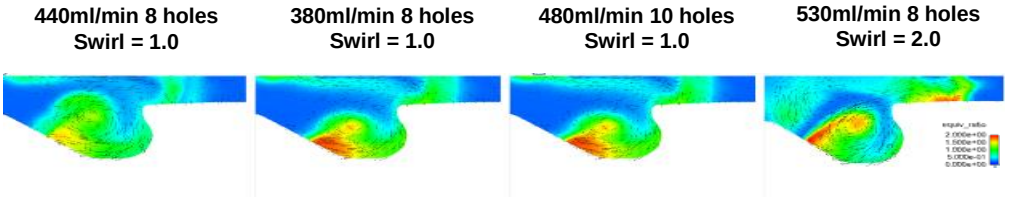

Figure 1: Local equivalence ratio for 4 levels of injection flow rates and hole numbers

Following this orientation, the proposed combustion system was tested on a single cylinder engine.
Test bed results confirmed the prediction of the 3D CFD simulation results: IFPEN combustion system solution presents the advantage of higher full load power (+10%), and improved fuel consumption (-3%) and smoke emissions (down to 0.1 FSN) at low and medium loads, at constant NOx emissions.

As a final point, 3D simulation results have been confirmed by experimental tests: the overall outcome confirms interest in supporting combustion chamber design on 3D simulation analysis, and the good test-to-simulation synergy that can be obtained.