

Simulation piezogesteuerter Dieselinjektoren mit flexibler Einspritzverlaufsformung

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FEV Motorentechnik GmbH

FLUIDON Konferenz 2011, Aachen

26.05.2011

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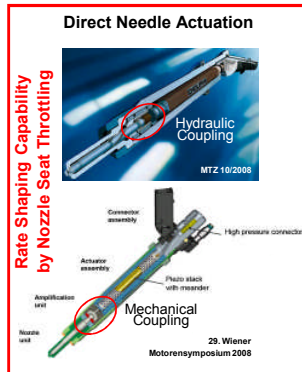


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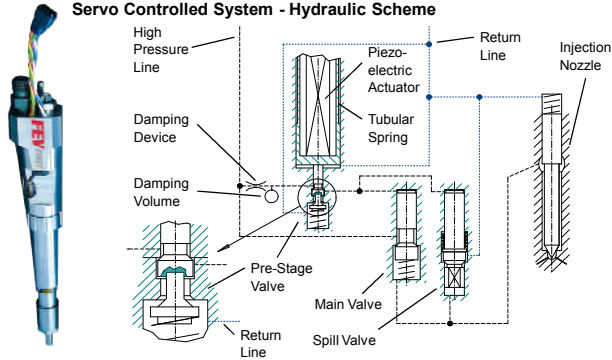
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FIRST Common Rail Injection System Hydraulic Setup

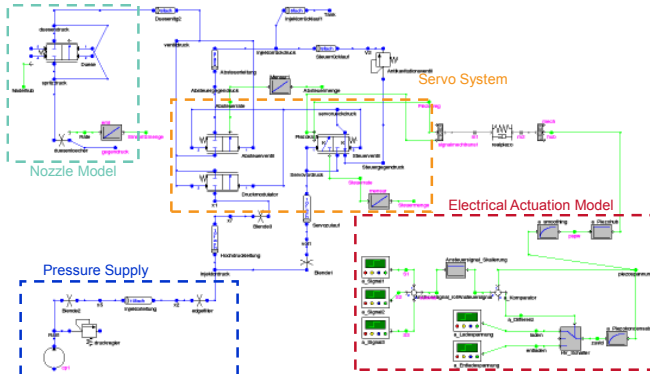


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FIRST Common Rail Injection System DSHplus Model

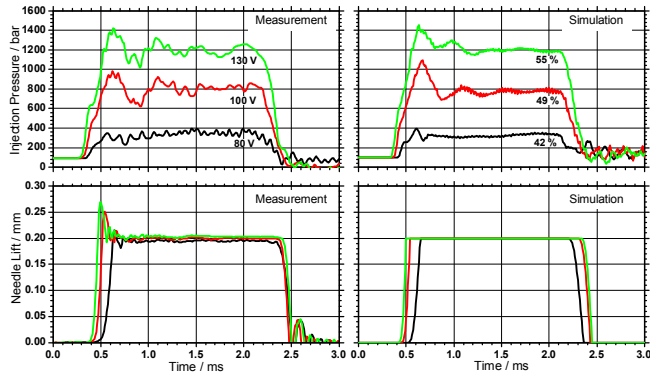


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FIRST Common Rail Injection System Square Injection – 1400 bar

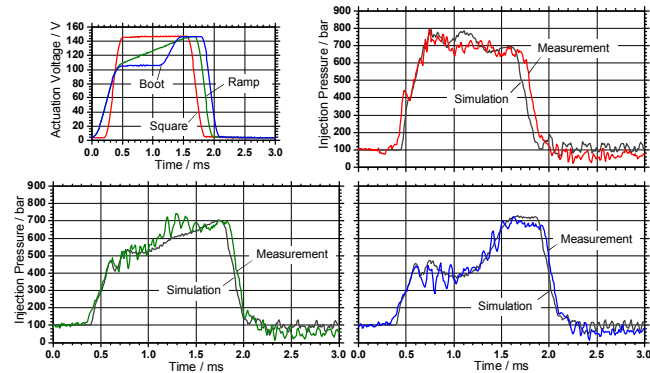


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FIRST Common Rail Injection System Rate Shaping – 800 bar



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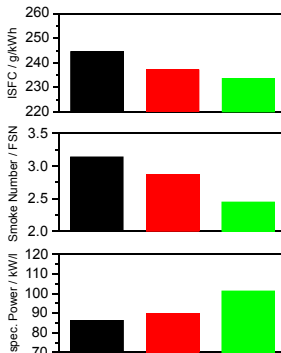


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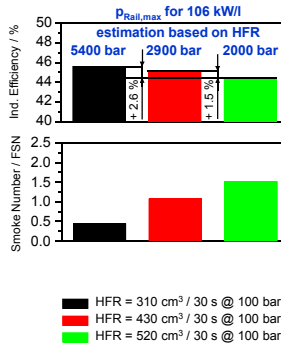
High Pressure Injection Nozzle Flow Variation



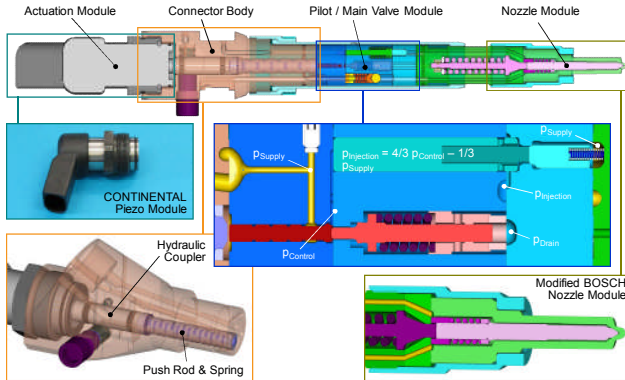
Full Load – $n = 4800 \text{ min}^{-1}$



Part Load – $n = 2280 \text{ min}^{-1}$



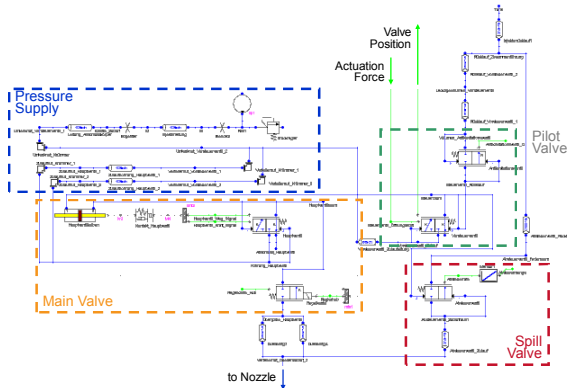
HiFORS Injector Design Characteristics



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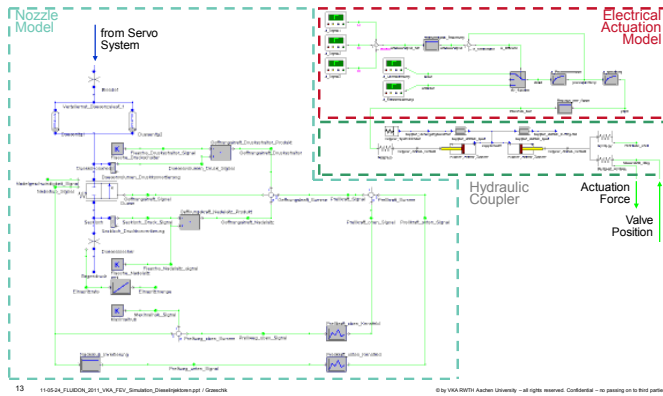
HiFORS Injector DSHplus Model – Servo System



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HIFORS Injector DSHplus Model – Actuation / Nozzle

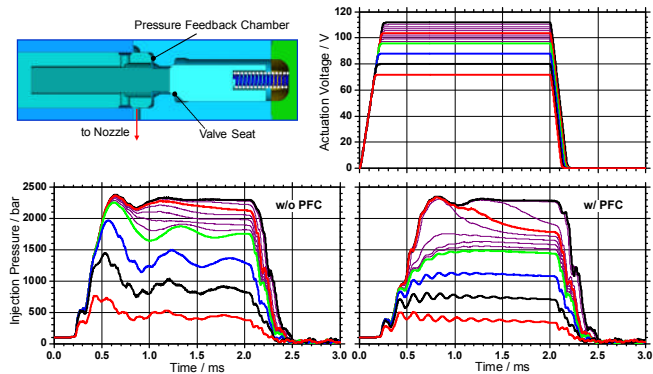


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HIFORS Injector Simulation Results – Square Injection

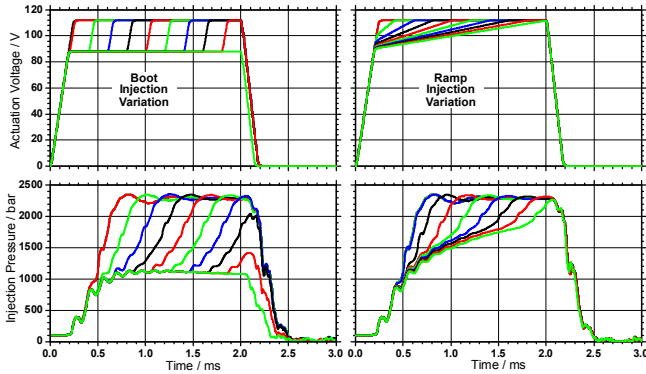


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HiFORS Injector Simulation Results – Boot and Ramp Injection



HiFORS Injector Detailed FE Analyses / Pilot Valve Body

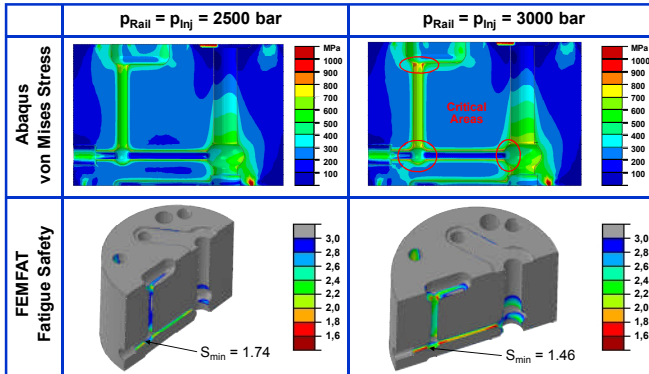


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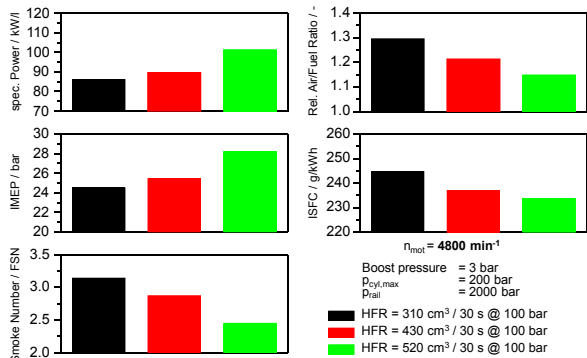
Summary



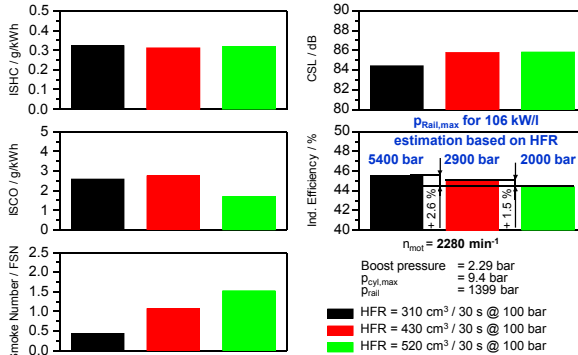
- Using 1D hydraulic simulation, VKA and FEV have developed the FIRST injector, a passenger car common rail injection system with high needle opening and closing velocities and flexible rate shaping capability.
- Needle lift and injection pressure measurements on the injector show a good correlation between model-predicted and real-world behavior.
- Based on the experience gained in this project, VKA and FEV are currently developing the high pressure HiFORS injector for supply pressures of 2500 bar.
- Despite of design restraints due to high pressure capability, the refined 1D model of the new injector shows satisfactory hydraulic properties.
- FE calculations carried out in Abaqus and FEMFAT confirm the high pressure durability of the new injector.

Thank you for your attention!

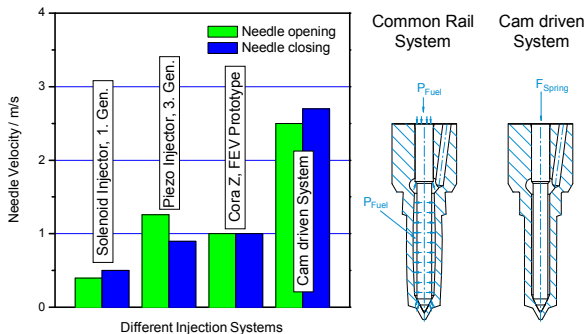
High Pressure Injection
Nozzle Flow Variation



High Pressure Injection Nozzle Flow Variation – Part Load Results



State-of-The-Art Injection Systems Nozzle Needle Opening and Closing Velocities

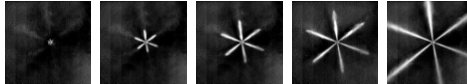


FIRST Common Rail Injection System Spray Pattern under Ambient Conditions

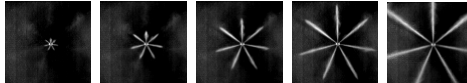


Rail pressure: 1150 bar, comparable single hole flow rate

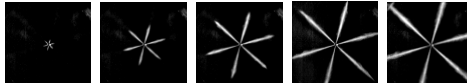
Serial
Production
Solenoid
Injector



Serial
Production
Piezo
Injector



FEV
Prototype
Injector
FIRST



BOI 100 µs a. BOI 200 µs a. BOI 300 µs a. BOI 800 µs a. BOI

Injection into atmospheric conditions!

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HiFORS Injector Piezo Actuation Module Measurements

