

## **X-Ray Measurements of Mass Distributions in the Near-Nozzle Region of Sprays from Standard Multi-Hole Common-Rail Diesel Injection Systems**

P. Leick<sup>1\*</sup>, A.L. Kastengren<sup>2a</sup>, Z. Liu<sup>2b</sup>, J. Wang<sup>2b</sup> and C.F. Powell<sup>2a</sup>

<sup>1</sup> Robert Bosch GmbH, Corporate Research, Gerlingen, Germany

<sup>2a</sup> Center for Transportation Research, Argonne National Laboratory, Argonne, USA

<sup>2b</sup> Advanced Photon Source, Argonne National Laboratory, Argonne, USA

### **Abstract**

Unlike most quantitative optical measurement techniques, x-ray-radiography is not restricted by multiple scattering effects, and it has been demonstrated in recent years that the mass distribution in a Diesel spray can be deduced from the measured extinction of a monochromatic x-ray beam, even in the dense near-nozzle region. In prior applications of the technique, single- or three-hole research nozzles were generally used, and data evaluation was almost exclusively based on radiography measurements. In this paper, the first application involving standard, 5-hole production-type passenger car nozzles is reported, and the radiography results are complemented by a comprehensive set of high-quality optical spray images. The combination of the two techniques leads to a very thorough description of the sprays and is used to investigate the influence of gas density on the spray properties.

Key words: Diesel sprays, x-ray radiography, primary break-up, mass distribution, spray imaging

---

\*Corresponding author, philippe.leick@de.bosch.com