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ON-BOARD, TIME-RESOLVED DIESEL PARTICULATE MEASUREMENTS BY LASER-INDUCED INCANDESCENCE

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The on-board measurement of time-resolved particulate matter (PM) emissions is a highly desired but elusive capability needed for investigation of real-world emissions. Laser-induced incandescence (LII) offers some unique capabilities compared to conventional techniques in that neither dilution or cooling of the exhaust gas is necessary. The measurements are made instantaneously at data rates up to 20 Hz, providing excellent temporal resolution and sensitivity during vehicle transients. The Artium LII instrument used for this demonstration is capable of unattended operation for periods of months.

For this study, we installed the LII instrument and ancillary equipment in the trunk and fold-down back seat area of a 2002 Volkswagen Jetta with a 1.9 liter TDI diesel engine. The LII instrument and ancillary equipment consisting of a mini-tower PC, flat-screen monitor, laser power supply, ejector pump and compressor to extract exhaust from the tailpipe through a sampling tube clamped to the tailpipe, and an 18 amp gasoline generator fit easily into the Jetta. The exhaust sampling line and the vent lines from the ejector pump and generator were routed through the opening of the ajar trunk lid.

An OBD-II scan tool interface was used to access the vehicle and engine speeds for recording by a dedicated notebook PC as the vehicle was driven around several loop routes in the vicinity of the Sandia National Laboratories California site in the Livermore Valley. These measurements were then time-matched with the LII measurements to obtain a synchronized data set correlating time-resolved PM emissions with vehicle operating conditions that included accelerations from a stop, hill climbing, and freeway driving.