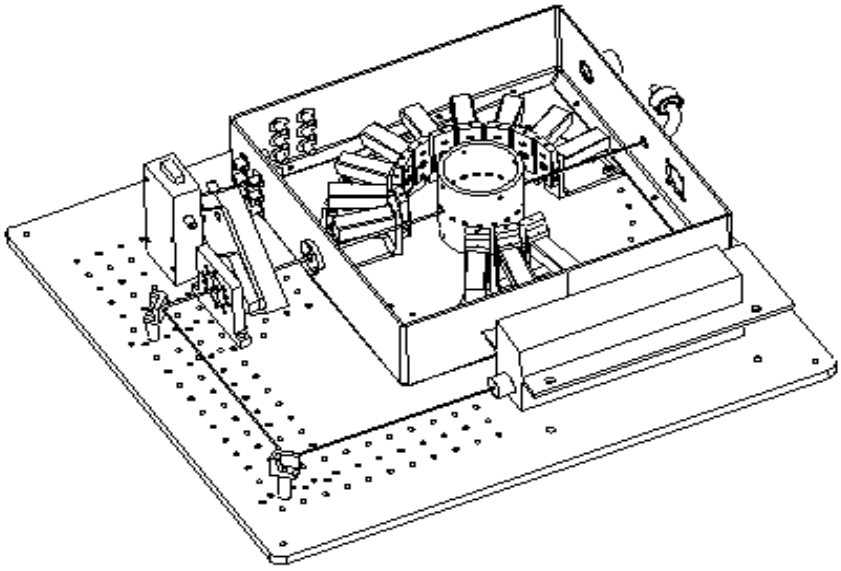
Diesel Particle Scatterometer

New Berkeley Lab instrument measures diesel exhaust particle sizes in real time



There is a growing body of evidence for the deleterious health effects of diesel exhaust emissions. Airborne particulates are known to constitute a major human health risk. Recent epidemiological studies report that particles with diameters of less than 2.5 μm are most dangerous — a fact of particular relevance to diesel emissions that are principally in this range. Further, these particles are known to have a profound effect on visibility, and constitute a major source of carbonaceous particulates in populated areas.

Arlon Hunt of Berkeley Lab has developed a dedicated instrument for real-time sizing of diesel exhaust particles to study particle characteristics as a function of engine type, load, RPM, fuel composition, and post-combustion processes (aftertreatment, dilution, etc.)

Berkeley Lab's new approach to particle characterization, the Diesel Particle Scatterometer (DPS), is based on simultaneous fitting of three angle-dependent Mueller matrix elements for polarized light scattering. The DPS performs rapid, *in situ* measurements of the size distribution and optical properties of exhaust from both new, cleaner and older diesel engines. The new instrument shows good sensitivity and discrimination of the diesel exhaust for various running conditions and using different dilution ratios.

An important advantage of the instrument is the rapid response time; it has been tested at greater than 1 Hz data acquisition rate. This rapid response allows for the measurement of particle characteristics during changing loads and provides data on real-time particle loading during individual firing events.

The detector output is digitized and analyzed by the software developed for the instrument. The three angle-dependent matrix elements are plotted on the computer monitor and are fit by modeled calculations using a Levenburg-Marquardt optimization program. The result is plotted as a size distribution and the refractive and absorptive optical properties of the particles. The absorptive component of the index of refraction gives a measure of the graphitic carbon content of the exhaust particles.

Berkeley Lab seeks partners to further develop and commercialize the new DPS to provide the means for particle characterization for engine manufacturers, service facilities, and possibly for state and federal emissions compliance.

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Berkeley Lab seeks partners for licensing and/or collaborative development and commercialization of this new technology

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