Supporting Information

Comparison of PM emissions from a Commercial Jet Engine burning Conventional, Biomass, and Fischer-Tropsch Fuels

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Line Loss Calibration

Modification of the PM size spectrum due to line loss is an artifact associated with extractive sampling and must be accounted for with calibration experiments. Previous calibration experiments of sampling systems used in gas turbine engine emissions measurements have shown that the penetration of particles through a sampling system is size dependent (*S1-2*). Calibration experiments are designed to yield the penetration characteristics of the sampling system in the form of a size dependent function. When this penetration function is applied to the instrument data the line loss artifacts are removed and the instrument data is rendered as a reasonable estimate of the PM size distributions at the point of entry into the sampling system. Inertial, thermophoretic, and diffusional effects contribute to the loss of particles in the sampling train. While it is harder to experimentally quantify losses due to thermophoretic effects, inertial and diffusional losses can be handled by calibration and accounted for in the data reduction.

The line loss calibration method employed in these studies to characterize the loss of particles in the sampling train is similar to that used in a several previous PM emissions field campaigns (*S1-2*). In these experiments, a poly-dispersed combustion aerosol generated from diesel truck exhaust – a surrogate for a gas turbine engine is used as the calibration source. The size distribution of the poly-dispersed aerosol is measured with the DMS500 at two locations in the sampling train: the probe tip and the end of the sampling train. Identical lines are used to connect the DMS500 to the two ends of the sample train. The ratio of the differential concentration at the end of the sampling train to the concentration at the probe tip provided the penetration factor (Pen) for the selected sizes recorded in the distribution. A function is fitted to the experimentally obtained data and this function is then used to correct all PM data for line loss. Figure S1 is a plot of the penetration data acquired for the sample line used in this study. The associated penetration function fitted to the data is presented in equation:

$$Pen = -0.00665*(Dp)^4+0.13354*(Dp)^3-1.01636*(Dp)^2+3.48256*(Dp)-3.63902$$

where Dp is the particle diameter

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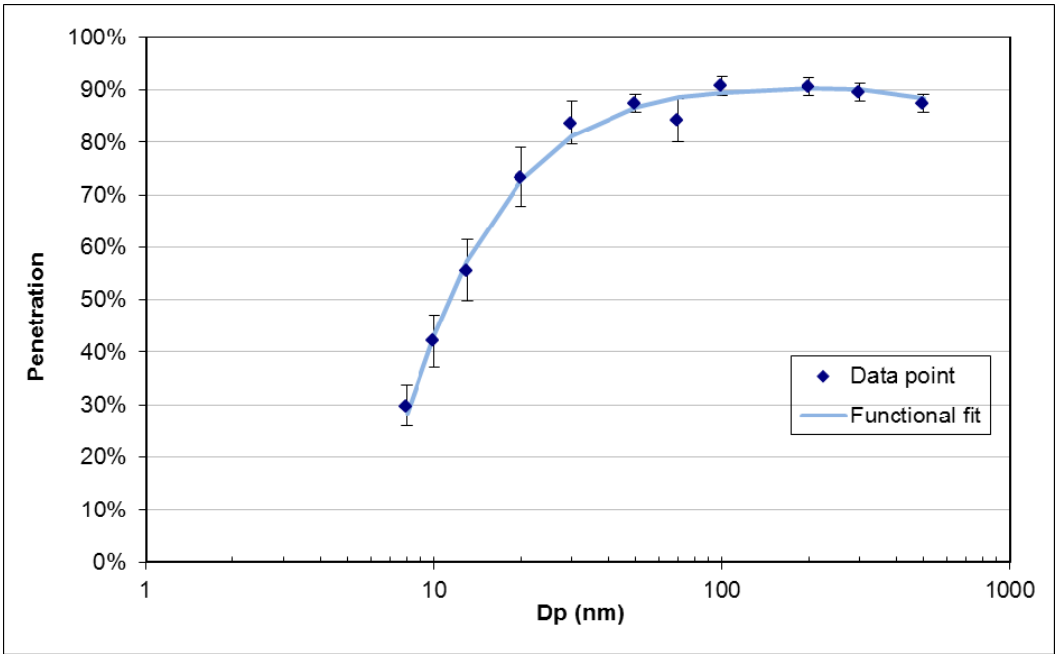

Figure S1: Penetration data and function for the sampling system employed in this study

The line loss calibration experiment was repeated multiple times to obtain mean values of penetration for a given size along with measurement uncertainties, represented by error bars which were calculated using one standard deviation in the averaged data set.

References:

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