Particulate emissions from medium scale biomass boiler
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PARTICULATE EMISSIONS FROM A MEDIUM SCALE BIOMASS BOILER:
INFLUENCE OF THE DILUTION SYSTEM WHEN MEASURING WITH ELECTRICAL LOW PRESSURE IMPACTORS (ELPI+)

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PLANT LAYOUT
Measurements were performed at a 4.5 MW wood chip grate boiler providing district heating.

SAMPLING SETUP
One sampling port was used for gas analysis and two sampling ports were used for particulate matter measurements using two Electrical Low Pressure Impactors (ELPI+) each with a different dilution system.

DILUTION SYSTEMS
Porous Tube Diluter + Ejector Diluter (PTD + ED)
PTD: heated dilution stage to lower the vapor pressure and number concentration while preserving the temperature.
ED: cold dilution stage to lower the number concentration and temperature.

Dekati Axial Diluter (DAD 100)
One heated dilution stage to lower the vapor pressure and particle number concentration.

RESULTS
Particulate emissions measured with both dilution systems are presented as particle number size distributions.

CONCLUSION
The particle number size distribution is a relevant quantity to characterize particulate emissions from biomass combustion as aerosol transport and dynamics depend on particle size and particle concentration.
To obtain a representative measurement of the aerosol, the sampling system must be designed to quench all aerosol chemistry and dynamics to prevent modification of the distribution before the aerosol is measured.

When using the sampling system with a two stage dilution system (PTD+ED), in most size fractions, more particles were measured compared to the sampling system with a single stage dilution system (DAD 100).
With the PTD + ED dilution system, a significant positive correlation was observed between the smallest particles and the dilution ratio (DR), suggesting dilution air artifacts increase with increasing dilution.
With the DAD 100 dilution system, a significant positive correlation was observed between the number of particles in stage 5 and DR, suggesting that particle growth by condensation and collision is favored by increasing dilution.