STABILITY WITH RESPECT TO PARTICLE SIZE AND CONCENTRATION OF *CAST*

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INTRODUCTION

The Combustion Aerosol Standard (CAST) generates submicron soot particle with adjustable particle size and concentration. It is a calibration instrument and an useful tool for the aerosol research. The stability and the reproducibility respectively of the particle characteristics play an important role for its applications. The stability of the CAST depends on the quality of the mass flow controller, the gas and air quality, the ambient air condition, and the quality of the particle dilution. The stability of the CAST is a consequence of the stability of all these influence factors. As the CAST is a new instrument, there is not much information about its long-term stability. The study of long-term stability of CAST has been performed at Swiss Federal Office of Metrology and Accreditation (METAS) that has been using the CAST for the calibration of particle measuring instruments.

MEASUREMENTS

The CAST has been installed in an air conditioned Lab where the ambient air temperature has been set to 21 ± 1 °C. The quality of the gases and of the air was as follows: pure propane (> 99.95%), pure Nitrogen (> 99.999%), dry and particle free compressed air with a dew point below 4 °C and stable oxygen content ±0.1 cL/L (%).

The CAST was warmed up for 30 min after it was switched on. The particle sample inlet and the rotating particle dilutor were cleaned of the soot. The measurement program began with the operation point for particle size (mode) of 200 nm, went on with the next smaller particle size and ended with the operation point for particle size of 30 nm. The CAST was stabilized for each operation point during 20 min. To characterize the soot particle, number particle size distribution was determined by the same SMPS (DMA and CPC). The dilution of soot particles was performed with a constant dilution factor that keeps the CPC in count mode (below 10^4 particle/cm^3).

CONCLUSIONS

The results of the long-term study of CAST shows that the particle size was in generally stable over months. Stronger variation shows the operation point for 190 nm. The standard deviation of this operation point amounts to 6 nm while 2-3 nm were found for the other operation points. The particle concentration shows stronger variation in comparison to particle size during the study. However, as shown at operation points for 190 nm, 106 nm and 30 nm, there was no constant direction of the variation. Lower relative standard deviation (RSD < 5.4%) was found for 190 nm, 106 nm, 89 nm and 40 nm. The operation points for 143 nm, 128 nm and 30 nm show higher RSD (6% ~ 7%).

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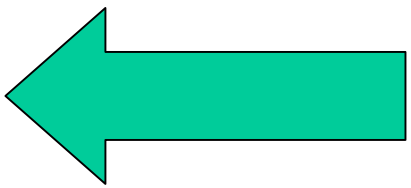
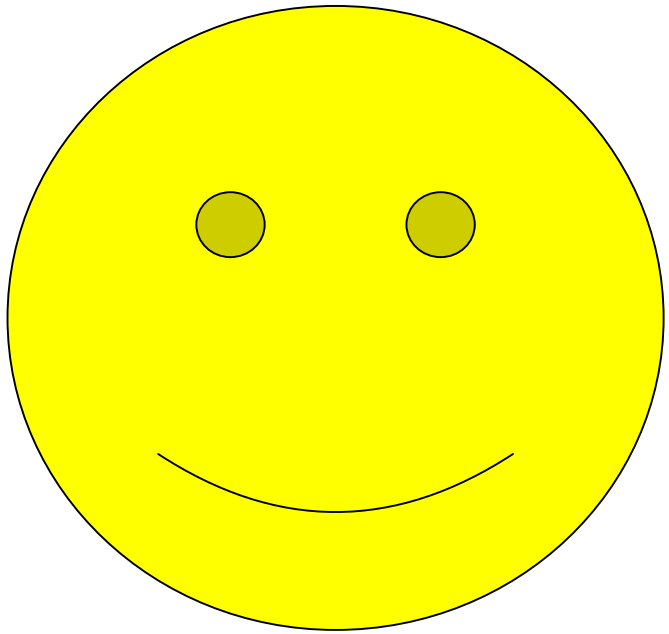




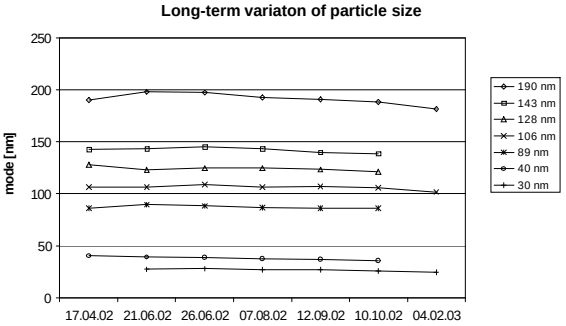
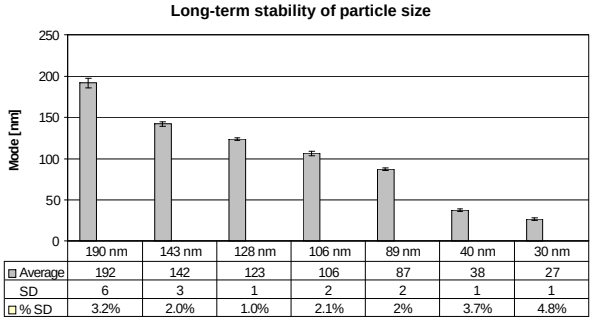


Figure 1 Particle size of seven operation points and its changes.



	190 nm	143 nm	128 nm	106 nm	89 nm	40 nm	30 nm
Average	192	142	123	106	87	38	27
SD	6	3	1	2	2	1	1
% SD	3.2%	2.0%	1.0%	2.1%	2%	3.7%	4.8%

Figure 2 long-term standard deviation of particle size of seven operation points.

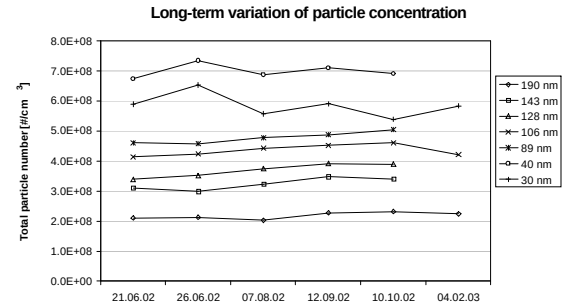
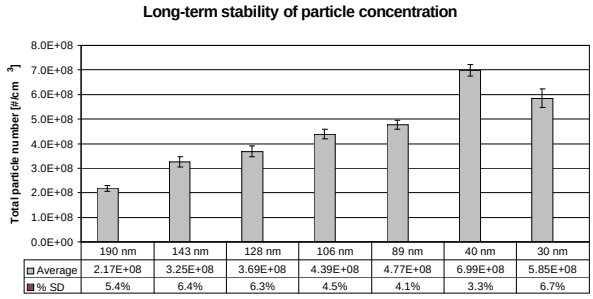


Figure 3 Particle concentration of seven operation points and changes.



	190 nm	143 nm	128 nm	106 nm	89 nm	40 nm	30 nm
Average	2.17E+08	3.25E+08	3.69E+08	4.39E+08	4.77E+08	6.99E+08	5.85E+08
% SD	5.4%	6.4%	6.3%	4.5%	4.1%	3.3%	6.7%

Figure 4 Long-term standard deviation of particle concentration of seven operation points.