Author’s response to the anonymous reviewer#2

The manuscript presents a function control for SMPS measurements of ambient aerosol. While the basic concept (SMPS vs stand-alone CPC) is certainly not new, the implementation seems simple enough for routine applications within larger networks. However, the article seems terribly short and leaves some significant questions unanswered.

The authors thank the anonymous reviewer for his useful comments.

1. The 20nm cut-off is a problem, as referee #1 pointed out already. However, I do understand that it is not feasible to include sub-20nm in the quality control. But you do lose a lot of information. And the quality control will necessarily miss the onset of problems in the SMPS setup which are likely to occur first in the smaller sizes. To mitigate these issues to a degree, I wonder if it would be possible to extend the setup in such a way that the transfer CPC and the SMPS-CPC both measure total aerosol for a while during each control cycle. That would at least ensure CPC operation and increase confidence in sub-20nm SMPS data. It would also be possible to measure total aerosol during each SMPS cycle (with the SMPS CPC) and thus have a continuous indicator of operational quality. During nighttime, there is typically little activity in the small size ranges, and one would essentially expect similar values for SUM(SMPS) and CPC_total. All without diffusion screens. Of course it would also be possible to let the system run with screens for an hour each night. Only the CPC calibration would need to be checked every now and then, and no transfer CPC would be needed. In short, what I’d like to see is some discussion as to why the presented setup is indeed the best option we have. What are the downsides of possible alternatives? It’s a rather short manuscript, so I think it should at least cover all bases.

Answer: The scope of this paper is to present a method to check long-term stability of mobility particle size spectrometers, leaving the sub-20nm particles unattended. To clarify, why the cut-off at 20 nm was chosen, we will add the following paragraph in the revised manuscript:
“…Thus, to ensure comparability between total PNCs derived from mobility particle size spectrometers and CPCs, the automated function control should be equipped with diffusion screens with a 50% cut-off diameter around 20 nm. The purpose of the diffusion screens is, thereby, the removal of the high fluctuating sub-20 nm particles and the reduction of the total particle number concentration below 1×10^{4} cm^{-3} in order to comply the particle concentration range for this CPC type….”
The certified transfer CPC is used as a calibration standard for the particle number concentration and circulates between the three measurements sites for fine and ultrafine particles in the Saxon air quality monitoring network. The certified transfer CPC checks the performance of the mobility particle size spectrometer inclusive the SMPS-CPC. For this reason, the second CPC, called transfer CPC, is needed and from our point of view it’s a very valuable solution.
Your comment to extend the setup in such a way that the transfer CPC and the SMPS-CPC both measure total aerosol for a while during each control cycle is quite useful to ensure SMPS-CPC operation. Instead, we checked the SMPS-CPC regularly (twice a year) against the reference aerosol

electrometer in the calibration facility and do some maintenance work including the cleaning of the focusing inner nozzle.
We will clarify this in the revised manuscript as follows: "…the transfer CPC and the CPCs from the mobility particle size spectrometers are calibrated against the reference aerosol electrometer twice a year. Our experiences showed that it is recommended to clean the focusing inner nozzle of the CPCs on a regularly basis.…"

Regarding your other remark concerning the similarity for SUM(SMPS) and CPC_total during nighttime, we refer to the lower graph of Figure 4 and will add a comment in the revised manuscript "…During daytime the underestimation is highest (cf. lower graph in Fig. 4) when nucleation mode particles are present originating mainly from traffic and photochemical processes. By contrast, the ratio is about 0.9 and the variability is lower during the night.…"

Additionally, a new Figure (Figure 6 in the revised manuscript) will be added to the manuscript showing the diurnal variability WITH diffusion screens and gives an impression how results changing when comparing with Fig.4. Please see also our answer to remark no. 6.

2. Table 1 - what exactly is the point?

Answer: Not sure what the referee exactly means! We show that the zero air measurements are always successful.

3. Fig. 3 seems rather useless. What is the information it is supposed to provide?

Answer: Here, we come up to a wish from a former reviewer (AMTD discussion forum) to allow the reader or reviewer to evaluate the design of the diffusion screen, or to reproduce the experiments.

4. Fig. 4: Wouldn't it be nice to see the same thing WITH diffusion screens? The screens play kind of a central role, and they should be characterized properly from different angles.

Answer: The temporal evolution of the ratio $PNC_{mob.}$ to PNC_{tCPC} is already shown, but in fact, a correlation plot and second plot that illustrates the diurnal variation will help to compare results WITH and WITHOUT diffusion screens. Please also scroll down to our answer to remark no. 6.

5. Fig. 5: Are there any alternatives to cut the smallest particles away? Why are diffusion screens the best option? One seems to lose rather a lot of bigger particles, too.

Answer: Currently, no alternatives to cut the smallest particles from the size distribution are known. Commercial provider, e.g. TSI's Particle Size Selector 376060 (http://www.tsi.com/productView.aspx?id=22614&LangType=1033) based on the same principle of diffusion screens.

6. Fig. 6: It doesn't show "a full year", does it?

Answer: Will be corrected to "…a one year period…"

The text states that "variability can be seen from cycle to cycle, which cannot be fully explained at present". I'd really like to see a hypothesis or two discussed. Has the shape of the PNSD any influence? Meteorological conditions? The periods in November and March show a very clear and opposite drift. What's up with that? You state that the function control doesn't work for fast changes in PNSD. How does this figure look like when you take only situations into account when the PNSD doesn't change too quickly (nighttime, no wind)? Summary: You must have lotsa data, but you show precious little of it. Some more discussion of the choices you made and of the results you gained.

Answer: Thank you for this important advice. In the revised manuscript we will discuss some options for the cycle to cycle variability (e.g. faster variation of the shape of the PNSD caused by the traffic near the site). Concerning any other influence we will add the following paragraph in the revised manuscript:
"Figure 6 illustrates the same as Fig. 4 but with diffusion screens. In contrast to Fig. 4, the 1:1 line goes through the scatter plot and the ratio is about unity and doesn't show any diurnal variation. In turn, parameters with a distinct diurnal curve, i.e. temperature, relative humidity, and global radiation (induce new particle formation) do not have an influence on the results."
The reason for the drift during March 2013 is already written in the manuscript (line 25ff on page 10558). After re-examination we found the same reason for the drift in November 2012 as for March 2013. Therefore, we decided to add a recommendation for a regular cleaning of the focusing inner nozzle for this CPC type.

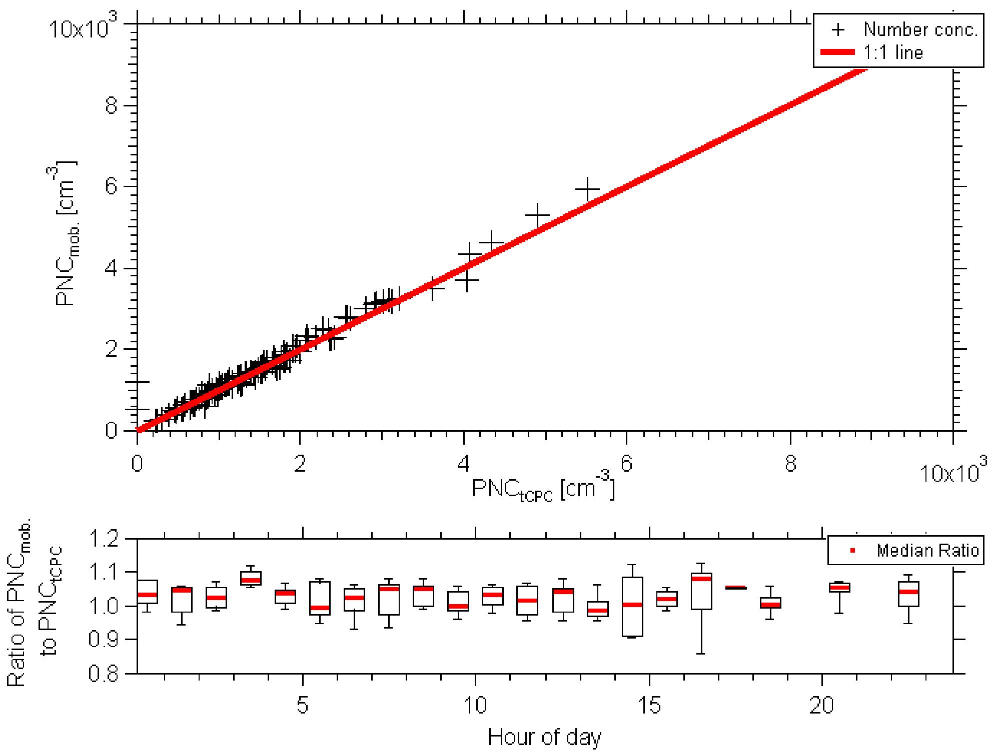

Fig. 6: Same as Fig. 4 but with diffusion screens.