We thank the reviewers #1 and #2 for their substantial comments. We believe their effort helped improving the manuscript a lot. We tried to follow the suggestions of the reviewers as good as possible. Our response to the comments are highlighted in green.

Anonymous Referee #2

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General Comments: This is a paper that presents the operating principle along with the technical details, of an instrument (SÆMS) continuously measuring the spectral extinction coefficient of atmospheric aerosol particles. A case study is also analyzed, and for the reliability of the atmospheric products provided by SÆMS a comparison with other instruments (lidar, sun photometer, in situ sensors) is reported. The study reported here is, in reviewer's opinion, worth of being published in Atmospheric and Measurement Techniques scientific journal.

I would suggest to the authors, especially to the abstract and conclusion section, to highlight more the rationale behind this development. The message from this paper should be more clearly stated.

We have added some quantitative results from our work.

To the reviewer's knowledge, SÆMS is the first instrument capable of reproducing ambient aerosol optical properties at near ground level, and this is the major advantage of SÆMS, compared to other commercial instruments. The paper is well written, very innovative and in order to be improved I would suggest to the authors to take into consideration the following comments.

Minor Comments:

1. Page 8652, line 18 [Equation 5]: The sign of minus is missing from the right side of the Ångström exponent equation.

We apologize for this mistake. We have corrected the equation.

2. Page 8670: The caption of Figure 5 is really very explanatory, but it is recommended also a legend on the plots [especially for the bottom plot of Fig.5], for better and easier understanding of the case.

Thank you for your comment. We have inserted a legend.

3. Page 8659 line 10: Please add to the reference, the “Ansmann, 2006”, you are mentioning in this line.

We have added the missing reference.

Major Comments: 4. Page 8658, line 1: “The slight AOT decrease with time may be partly related to a decrease in relative humidity in the PBL from the morning to the noon hours”. Is this correct? From AERONET time series for the case study shown, during early morning hours from [05:00-10:00 UTC] AOT values are quite stable at 0.5 [at 500nm], with varying total columnar water vapor values [from 1.38 to 1.51 cm]. In addition from 09:00 to 11:00 UTC there is a sharp increase in the PBL top height, staying stable later on. The same behavior [with the same rate actually] can be observed for values of AOT at 500nm. As the PBL top height increase, is easier for the aerosol entrapped below this height limit, to be diffused in larger areas, leading to slightly smaller AOT values. Why not the AOT variation is not linked with the PBL top height instead of the RH values measured in ground level?

You are perfectly right with your comment. The decreasing in AOD may partly result from transport processes of aerosol to the top of the boundary layer where the aerosol can be better distributed away from local sources within the city of Leipzig. We have added the following to our discussion of this case. “**During the growth of the PBL by convection also locally produced aerosol is lifted to higher altitudes where it may be distributed over larger areas further away from the local sources. By this effect a decrease of the overall AOD could be expected.”** With the AOD-values and the PBL height we have calculated extinction coefficients. (bottom graph of Fig. 5, filled triangle). We mentioned that for this particular case higher aerosol layers affect the result. For this reason, the calculation was also performed with a constant aerosol layer height of 3 km. Generally (in other cases), the PBL is taken as a basis for the calculation.

5. Before 09:00UTC lidar measurements do not exist? If so, from where information of the PBL top height was taken for the production/calculation of dark blue triangles used at the last plot of Figure 5? For those calculations, is the first lidar observational value of the PBL at 09:00UTC [800m] used, supposing stable PBL

height until 09:00 UTC? In any case this is something that should be mentioned in the paper.

Before 09:00 we have used GDAS data instead of lidar measurements for the calculation. Now, this detail is mentioned. As we stated before, we used the aerosol layer height for further calculations.

6. Figure 7: In the same way that the aerosol extinction coefficient retrieved by SÆMS at 550nm [circle filled with green color], would be also great to be demonstrated for the other also near lidar wavelengths [355 and 1064nm].

We added our results (SÆMS) for 390 nm and 880 nm. The resolution of the spectrometer (10 nm) has limited the wavelengths und the UV and the NIR range because of the absorption trace gas absorption (convolution with the apparatus function). So the wavelengths are not quite the same. In the NIR range we have implemented a new high resolution channel to solve the problem in the future.

7. In Figure 9 the authors are demonstrating the spectral particle extinction coefficient measured with SÆMS, in-situ measuring dry aerosol particles and AERONET. It is clearly explained why a spectral slope of 33% difference is observed between AERONET and SÆMS. What is not sufficiently explained is why in all wavelengths the extinction vertical mean values up to 3km, derived from AERONET is always lower than the ones measured by SÆMS, at ground level. A discussion on this was made by the authors in page 8658 lines 13-16 [Because relative. . .SÆMS values], is this really the case? SÆMS measure the extinction coefficient for an optical path [3 km] in ground, while AERONET in the atmospheric column, with a lot of assumptions.

This is true to our opinion, because of our assumption of a 3 km thick aerosol layer. This layer is assumed to be homogeneous, which is not perfectly right as one can see in the lidar plot. We think that at 08:00, the situation is nearly the same. The AERONET-based data for 08:00 UTC are lower than the data from our ground level measurements.

8. Please provide some references in the text, for the aerosol optical properties and inverted products, retrieved by AERONET sun-sky radiometer. It would be very interesting if the authors could provide a more quantitative error indication on the volume size distribution calculations by the three instruments, demonstrated in

Figure 10. This could give an idea of how such a comparison would be in case of coarse particle domination from ground up to the top of PBL height, in case that this is not examined so far.

We agree that the information would improve the quality of this Figure. We have added the uncertainties in Figure 10 for the maxima of the size distribution. From the AERONET products the accuracy is given e.g.:

http://aeronet.gsfc.nasa.gov/new_web/Documents/inversions.pdf

The inversion of the SÆMS data provides the mean of the possible solutions and the range (now marked).

Besides, in the future we have to analyze more cases to get more accurate comparisons.

9. The authors estimated that the temporal changes to the derived particle extinction coefficient could lead up to 5% uncertainty. This is due to the 30 min of measurement cycle because of the usage of one mirror [element 6 from Figure 1] for reference and measurement tower procedure. The usage of an extra mirror splitting the initial light source to the corresponding towers would significantly decrease the measuring cycle to 15 min, since the procedure will be done in parallel for both towers. How possible is the approach to use the same optomechanichal detection module but different mirrors for sending the light to the retroreflectors?

This is a very interesting idea. However, with the current setup it is not possible to install a second mirror in the dome. The outgoing ring-like beam has a diameter of 40 cm. There is no space … We think about reconstructing the whole system and, of course, your suggestion might be a possibility to reduce the time of a measurement cycle.