

## **Response to Referee #1:**

*Thank you for your comments and reviewing this manuscript. Please find our responses (bold italics) to each of your comments below.*

"No explanation on the importance of particular construction details is given. Especially, any information on air flow around the instrument and on particle collection effects and their efficiency under atmospheric conditions of intended use is missing."

***Thanks for the comment. We included more explanation on the importance of particular construction details to make the paper more understandable. However, no air flow analysis has been performed. We assumed that the experiment will be able to collect particles based on the fluid flow analysis performed in Hedin et al. (2007a) for rocket-borne particle detection in the mesosphere. The analysis by Hedin et al. (2007) was carried out for detector with a diameter of 80 mm. Our FFU has a diameter of 116 mm. We have included following sentence at page 4 line 22: "Hedin et al. (2007a) investigated the aerodynamics for a rocket-borne particle detector with a diameter of 80 mm. They used a Continuous and Brownian motion model to trace particles in the flow field. According to the finding small smoke particles (<5nm) will follow the gas flow around the FFU. Note that purpose of our experiment is to proof a concept of an in-situ aerosol collection technique in the stratosphere and mesosphere. We do not focus on particle collection of particle with a diameter below 10 nm."***

***As one sample material we used TEM grids to ensure particle collection. TEM grids were previously used in aerosol collection sounding rocket experiments Gumbel et al. (2005) and tested by Reissaus et al. (2006) as mentioned in 8166/18-19. Further, we included different sample material per height bin to test them for atmospheric particle collection under atmospheric conditions. It is hoped that with this demonstration of technology that in the future the instrument can be developed to more efficiently collect particles. We included following sentence on page 8166, line 18: "TEM grids were previously used in aerosol collection experiments on stratospheric balloons (e.g. Bigg et al., Tellus (1970), Testa et al. (1990), and Corte et al. (2012)) and sounding rockets (Gumbel et al. (2005))." And on page 8166, line 26: "In each height bin a TEM grid is exposed to the atmosphere. Further, in every height bin different sample materials are included to test them under atmospheric conditions."***

"A test is performed by exhibiting the sampler earth surface conditions from within a driving car, and particles between 0.25 and 200 m are found. However, from the referenced literature I find that the interest in mesosphere is rather at particle sizes below 30 nm, so the significance of the test remains questionable to me."

***We agree with the reviewer that the conducted test is not significant to test the instrument whether it is possible to sample particles in the mesosphere. The main focus of that test was to test the sealing of the instrument. The significance of this test was that we only found particle on the exposed sample material. The particles we found on the exposed sample were of similar sizes to those we expect to find at lower altitudes. For more clarification we changed the title of the section to: "Contamination Testing."***

"As the goal seems to be finally the chemical / mineralogical analysis of the collected samples, also the construction material of the instrument would be of quite an importance, as the single particle methods are usually sensitive enough to see all the particles abraded from surfaces by mechanical, chemical and temperature stress. I guess the structure is made of aluminium, but whether it was surface-sealed or whether any other potentially contaminants are present doesn't become clear to me."

***Thanks for the comment. We included the following sentence on page 8164, line 24: "The FFU's main structure is made of aluminum with an unsealed surface." Part of the post-flight analysis will include monitoring for any contaminants to the samples from the FFU structure.***

"I would suggest removing the details on the electron microscopy quicklooks, as they do not add significantly to the manuscript."

***We agree with the reviewer and removed the SEM image from the paper.***

"If the manuscript needs to be published quickly, I suggest publishing it as a technical note. Otherwise, first real measurements should be included to prove its usefulness."

***We agree with the reviewer and changed the paper to a technical note.***

#### Remarks/Questions

"8171/6-7: Couldn't there be expected problems in the memory unit due to high energy electromagnetic radiation in mesosphere?"

***The flight memory units have been used in similar sounding rocket missions without any problems.***

"8170/6-11: How can the car test at 25 m/s and (probably) 1000 hPa/270 K in terms of particle collection and sample contamination represent mesospheric conditions of 300-600 m/s (estimate from timing) 0.01-100 hPa, and 210-270 K? Flow regimes (free path/slip/viscosity/compressibility) are quite different. Also temperature stress and chemical stress (e. g., sulfuric acid) is pretty much different."

***We agree with the reviewer. However, the purpose of the car test was not to test collection ability during flight. It was to test that the ACE seal would prevent contamination. The title of section 3.4 "Particle Collection and contamination testing" was misleading and we changed the title to "Contamination testing."***

"At the end I don't see any particular value of the SEM images, as all necessary information is given in text (i. e. no contamination is present for the blind sample, while the others collected some particles)."

***We agree. The SEM images have been removed.***

"8170/16-18: The "road salt" particles, which should be described by spectrum 4 do obviously not contain any Cl, and also no Na is shown; instead we have Si and F here. Either substantial data is missing, or the interpretation is illogic. Fig 9b looks to me rather like a piece of metal abrasion."

**We agree and changed the sentence to: “These particles contained C, O, Si, F, and Ca.”**

“8172, 13: It is rather a summary.”

**8172/13: We have removed the first sentence of the first paragraph to make the conclusion less of a summary. We also removed the last sentence of the last paragraph to remove any misconceptions about the atmospheric test performed. The last sentence of the conclusion has been replaced with “The results of the experiment could be used for future design iterations to collect aerosols in the stratosphere and mesosphere. Furthermore, the collected flight dynamics data could be used for aerodynamics analysis to improve future instruments.”**

Minor Remarks:

“8162/6-9: This creates the impression as if these experiments were already performed and results including the mentions electron microscopy can be found in the paper. As this is not the case, please indicate that it is intended use/a possibility”

**8162/6-9: This has been changed to indicate that it is an intended use. The sentence in question has been changed to “Post-flight electron microscopy will give size-resolved information on particle number, shape and elemental composition.”**

"The figure order 1-3 doesn't fit the order of references in text."

**Thanks for the comment. We corrected the manuscript.**

"8165/15: like already stated in the interactive discussion by others, TEM should also be mentioned as suitable method for smaller particles and for assessing the internal particle structure / crystal structure."

**We agree and included the following sentence on page 8165, line 15: “The returned FFUs will have their aerosol collection samples analysed using scanning electron microscopy (SEM) and transmission electron microscopy (TEM). “ and page 8165, line 21: “For the analysis of smaller particles (<20nm) a TEM with energy-dispersive X-ray spectrometer will be used. The TEM analysis can provide number, size, and shape of the detected particle as well as the elemental composition.”**

"8169/20: Probably a JEOL instrument."

**Thanks for the comment. We corrected that.**

"8170, 1-5: A fiber from a PTFE-coated glass fiber filter should contain fluorine and carbon, and depending on thickness of the coating should also show silicon, so this explanation doesn't fit the spectrum."

***Thanks for the comment. The sentence was misleading. We assume that the fiber originating from the Teflon sealing not from the glass fiber filter. We changed the sentence to: "Analysis of the latter filter revealed that one particle was a 200 µm long fibre most likely originating the teflon sealing between the aerosol collection plate and the baseplate."***

"8171, 3: "Saf" check reference."

***We have changed this.***

"Table 2: Palladium never shows a value, so it can be remove"

***Thanks for the comment. We have deleted the column.***