Authors' response to reviewer 2 comments on manuscript titled "Fast time response measurements of particle size distributions in the 3-60nm size range with the Nucleation Mode Aerosols Size Spectrometer", submitted to AMT 24th January 2018

The authors would like to thank the reviewer for their considered and positive evaluations of the manuscript. Our responses are detailed below, with the reviewer comments in normal text and our response in italics.

1. P4 l3-13, an SMPS has been shown to work quite well down to 3 s scan time (Trostl et al. 2015).

   A good point, this has now been discussed p4 lines 15-18. New text reads,
   "It has been shown that an SMPS performs well with scan times as low as 3s (Trostl et al., 2015), however, operation with these fast scans is challenging and uncommon, and the low charging efficiencies for nucleation and Aitken mode particles limits the sensitivity. Further, at reduced pressure, the sizing range of an SMPS may be limited because particles have higher electrical mobility at a given voltage setting."

2. P13 lines 15-19, how is the theoretical Kelvin diameter estimated for Fig3? Does it take into account the flow velocity and supersaturation profiles inside the condenser? Check for example Giechaskiel et al. (2011). This should be discussed a little bit more in the main text, since the disagreement in fig3 is quite large.

   The theoretical Kelvin diameter is estimated following the method in Baron and Willeke (2001) without taking into account flow velocity and supersaturation profiles. We have now included this information in the main text (p14 lines 5-11) and discussed the implications there. New text reads,
   "For a given temperature difference between saturator and condenser, the measured d_{50} in Fig.3 is larger than the theoretical Kelvin diameter (Baron and Willeke, 2001). The Kelvin diameter is the minimum diameter at which it is possible for particles to nucleate, while d_{50} is the diameter at which 50% of particles are actually detected in the instrument. The discrepancy between the theoretical Kelvin diameter and d_{50} in Fig.3 is likely because the NMASS saturator does not reach the maximum theoretical supersaturation. Because we lack information on the mass and thermal diffusivities of FC-43, we cannot simulate the coupled heat and mass transfer within the condenser to explore this difference. However, as long as the degree of saturation is constant (which it is expected to be since pressure, flow and temperature are constant), the d_{50} of each NMASS channel should also be constant."

   References:

   Baron, P. A., and Willeke, K.: Aerosol measurement : principles, techniques, and applications, 2nd ed., Wiley, New York, xxiii, 1131 p. pp., 2001.

   Trostl, J., Tritscher, T., Bischof, O. F., Horn, H. G., Krinke, T., Baltensperger, U., and Gysel, M.: Fast and precise measurement in the sub-20 nm size range using a Scanning Mobility Particle Sizer, J. Aerosol Sci, 87, 75-87, 10.1016/j.jaerosci.2015.04.001, 2015.