Review of the AMT manuscript amtd-8-8483-2015
"Operation of the Airmodus A11 nano Condensation Nucleus Counter at various inlet pressures, various operation temperatures and design of a new inlet system"
by J. Kangasluoma et al., 2015

The above manuscript deals with the characterization of a particle counter capable to measure aerosol particles in the sub-3-nm size regime. As this is highly relevant for the investigation of new particle formation events, such a paper is valuable for the scientific community and well suited to be published in AMT.
However …
The manuscript is NOT well written. I have the feeling that I read a draft, not the final manuscript, and I cannot imagine the well-known co-authors read the manuscript. The English is partly not good, the style is partly bad, the use of parameters and units is frequently wrong, partly wrong terminology…
The manuscript might be worth being published, but only after major revision.
And, to be honest, next time I would likely reject such a manuscript, not because of its content, but because of the bad presentation of the results.

General remarks:
Besides the criticism already made above, one major criticism is that almost only literature from the own (Helsinki) group was cited. When reading the paper, one gets the feeling that the principle instrument idea was developed there and is brand new (page 8484, lines 19&20). But that´s not true. The PSM goes back to Okuyama et al., AS&T, 1984, there are other important papers on this device, like for instance Kim et al., AS&T, 2003 or Gamero-Castaño and Fernández de la Mora, JAS, 2000, please provide more references to the underlying work principle.

Specific remarks:
- p. 8484, l.7: There are four sentences in a row which start with "We …"
The abstract is not bullet point list, please change.

- p. 8484, l.9: please insert "lower" previous to "cut-off" to be more precise

- p. 8484, l.12: which "background"? atmospheric background aerosol? electronic noise?

- p. 8485, l. 5: "It is crucial …" for what?

- p. 8485, l. 8-11: The "Kangasluoma 2013/12014" references for the given statement. This is again an example of the selective citation of the authors. Jiang et al., AS&T, 2011 have shown the same, but two years earlier, so why do you not cite this literature source?

- p. 8485, l. 26: the "heat conditioned inlet", what does this imply? When you heat or cool the sampled aerosol particle material might evaporate or condense thus changing the original particle size. How large is this effect?

- p. 8485, l. 28: 90 nm particles can be optically detected, see the UHSAS, hence the given statement is not true. But it is hard to detect them and needs some effort.

- p. 8486, l. 1: what is a “size distribution of 1-2 nm” particles? Do you mean a scan over nominal about 1 nm diameter particles?

- p. 8486, l. 3: “whereas” is wrong, the second part of the sentence is no contradiction to the first part

- p. 8487, l. 5: Why do you use the word “PSM” for the combination of your PSM plus CPC? You already have an acronym for this combination “A11”, so please use this one and PSM only if PSM is really meant.

- p. 8487, l. 7: “under pressure” is misleading, please use “low-pressure” throughout the manuscript

- p. 8487, l. 10: I do not know on which planet the author lives, but on Earth 50 kPa corresponds to about 5600 m altitude (US standard atmosphere) not 4000 m.

- p. 8487, l. 15: “mass flows were calculated by Q/p” a volume flow (rate) divided by a pressure does not give a mass flow (rate). This is given when multiplying a volume flow rate with the density. Wrong units!

- p. 8487, l. 22, Eq. 3: The units on the right side of the equation are not the same (Q = Q/p ?)!

- Fig 2: What is a “Herrmann DMA”? What instrument is the circle with the “x” inside? The pressure sensor, does it measure a pressure difference (as suggested by two lines)?

- p. 8488, l. 2, the fill bottle was connected to the inlet line to equilibrate the different pressures (right), but in the next sentence (l. 3) you write that the fill bottle was not used. So what, if you did not use it, why do you describe the fill bottle connection?

- p. 8489, l. 4: please explain “THABr” when you use it for the first time

- p. 8489, l. 9: “maximum detectable size range” sounds for me that you checked the upper detection threshold, you probably mean the “lower detection threshold”

- Fig. 3: “a” and “b” missing, the electric filter cannot be understood, just by looking at the figure

- p. 8489, l. 25: which concentrations were used to calibrate the inlet line? As you use two electrometers the concentrations should have been several thousand particles per cubic centimeter.

- Fig. 4: This figure can only be understood if the reader knows how the flow of the four inlets and outlets of the PSM in Fig. 1 is controlled. But this is not described in the text. It is only stated the sample volume flow rate is constant because of the critical orifice in the CPC (right for the pressure range you investigated, at lower pressures also a critical orifice does not guarantee a constant volume flow rate anymore), but how is the flow controlled for the other two inlets and one outlet? Please describe and please do not refer to another paper, the reader should understand this just be reading this manuscript.

- Fig. 4: on the y-axis a volume flow rate is displayed but in the figure caption you speak of mass flow rates, again do not mix this and be correct concerning the units

- p. 8490, l. 8: is it really the counting efficiency? In the literature, there are several examples which show that the detection efficiency of a CPC changes at low-pressure. This can also be caused by changes in the supersaturation profile, which is not related to the counting efficiency (as you use it). Same for Fig. 5 caption.

- Fig. 6: the slope of the detection efficiency curve at 3 nm is not zero; the curve is still going up, although the detection efficiency is already 100%. Please explain this behavior.

- Fig. 6: please provide uncertainty bars to the measurement points

- p. 8491, l. 16: "for reasons we cannot yet explain."
What does literature say to this shift, e.g. Ito et al., JAS, 2011?

- p. 8491, l. 20: I miss the discussion on Fig. 8

- Fi.9: I do not understand the difference between the two curves of the same color. This is not related to the figure, which is clear, but rather to the description what was measured.

- p. 8492, Sect. 3.3: the first part of this section is text book knowledge and has been applied to many field inlet systems before. Moreover, it is unlikely that other users will use exactly the same inlet set-up, hence they would have to do their own calibration measurements (anyway recommended). So the first part is of little new information and could be deleted or shortened. Same for the Conclusions. More interesting is the second part about the electrical filter, which should be described more in detail.

- p. 8492, l. 11: should be "smaller" instead of "larger"

Technical corrections:

Please …

- p. 8484, l. 3: should be "subject" not "subjected"

- p. 8484, l. 25: replace "are representative of" with "are still valid in"

- p. 8484, l. 26: replace "Subsequently" with "Thereby"

- p. 8485, l. 1: rephrase the first sentence

- p. 8485, l. 2: delete "of"

- p. 8485, l. 16: replace "big" with "large"

- p. 8485, l. 19-22: articles ("a" and "the") are missing

- p. 8486, l. 8: "supersaturation fields" should probably read as "supersaturation regions"

- p. 8486, l. 12: delete "and understand"

- p. 8487, l. 9: "strangling" sounds for me to be the wrong word, please replace

- p. 8487, l. 17: replace "is." with "occurs."

- p. 8490, l. 11: replace "Figure" with "figure"

- Fig. 5: legend outside the graph, caption replace “lowering” with “lower”, insert “lower” previous to “pressure”, the green point at 55 kPa can only be reached if you used the fit curves of the CPC detection efficiency and for the dilution, but not the measurement points, please state this either in the legend or in the figure caption.

- p. 8490, l. 25: replace “cut-offs” with “lower threshold diameters”, also on the figure caption

- p. 8491, l. 8: replace “to onset supersaturation” with “to the onset”

- p. 8491, l. 14: insert “of” after “flows”

- p. 8491, l. 14: replace the “>” signs in the text with text

- Fig. 11: delete the second sentence of the figure caption; figure interpretation should be done in the text not in the caption