EGUsphere, referee comment RC2
https://doi.org/10.5194/egusphere-2022-1244-RC2, 2022

Comment on egusphere-2022-1244

Anonymous Referee #2

Referee comment on "Characterisation of a self-sustained, water-based condensation particle counter for aircraft cruising pressure level operation" by Patrick Weber et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-1244-RC2, 2022

Review of “Characterization of a self-sustained, water-based condensation particle counter for aircraft cruising pressure level operation” by Weber et al.

The paper details the performance of a COTS water CPC for use on the IAGOS aircraft. Instrument performance was compared to another butanol-based CPC and an electrometer throughout the pressure range of anticipated flight conditions for two different aerosol species.

The manuscript requires some clarification, added details, corrections, and further editing for grammar and punctuation. However, the discussion is suitable for the publication in AMT.

##

Remarks/Questions

Abstract:
You say "simulated aircraft operational environment", but no temperature characterization across ambient range. Is instrument sensitive to ambient temperature changes affecting sample temperature, and thus, supersaturation and cut size?

Saying "excellent agreement" between the instruments is misleading when you have performance differences in pressure for soot particles.

Figure 1:
Poorly drawn diagram. Uneven spacing, crooked lines, random box sizes, critical orifice gap and protrusion.

Low pressure section incorrectly defined at Flow Control filter. Flow control and "dry side" of the humidity section are redundant.

With 4 flow controllers, do you have any measure of stability of the system? How steady was the sample flow, pressure, and humidity control?

92-95:
Why constant 30 second steps? What were your statistics? Your particle size distribution concentration is varying >3 orders of magnitude across the size range (fig 5), why hold constant DMA steps. Increase time at small sizes to reduce massive error bars in counting statistics.

Why is no data shown above 60 nm if upper limit was 140 nm?

Is 2.5 nm lower limit corrected for diffusion losses changing distribution shape asymmetrically, and shifting peak upwards? Any line loss analysis to approximate what the actual peak was when DMA is set to 2.5 nm?

What is your mixing chamber volume and flowrate to show that 15-seconds between samples is enough flush time? Show flush time is at least 3-5*Tau.

101-125:
Section labeling? Whole section needs to be explained more thoroughly and clearly.

How is ksi determined? Is it calculated, determined experimentally? Where is the equation for it? How can one reproduce your correction method with the information provided here?

Figure 2: What flowrate and offset corrections? Why and how are they performed? You have them listed in Figure 2 but never address. Figure 2 does not add value.

148-163:
CPC operating parameters should be mentioned earlier (first introduction of the instrument).

This is your first use of the term "offset" without defining what it is or how it differentiates from the detector threshold.

You stated only two parameters are adjusted, laser power and detector threshold. Now you're adjusting the offset too?

Move definition of offset at its first usage, and first introduce it when you're defining what parameters you adjust.

Move last sentence (162-163) to where you're talking about threshold set points. You jump from threshold set, to laser power adjust, back to threshold set.

165:
State the aerosol types in the text. Also why you used them as your reference aerosols.

Figure 5 and associated text should be in the Methods section.

Since your data is most significant in the 3-10 nm cut size range, use log y-scale so the concentrations used during the tests are more apparent.

Figure 6: No horizontal error bars accounting for DMA transfer function width. What were your DMA flows? Sizing accuracy analysis?

222-225:
If log-normal fit is inappropriate, don't use a log-normal fit. Use the measured size distribution in your calculations.

Error between log-normal fit and measured size distribution affecting your multiple-charge correction can be calculated. If you're using this as your explanation, prove it.

281-284: This is your first time discussing uncertainty. This should be discussed in detail in the results section, then summarized in conclusions.

##
##############################

Minor remarks/corrections

11: Remove "and more"

26: Punctuation

31-33: nm particles can be detected via charging and electrometer, as you've used. Suggest changing to "... growing them to optically-detectable droplets..."

38: Replace "by" a photodiode with "with" or "using"

51-53: Wordy. "However, butanol's flammability property strongly hinders..." Also, flammability does not hinder the operation, it hinders the desire to operate it.

54-59: Unbalanced parentheses and wordy.

60: define "low-pressure" range. Can it be used in a balloon? High-altitude aircraft?

63-64: Incomplete sentence by itself. No subject.

64-65: define "broad pressure range" and define "aerosol types" and why.

71-73: Avoid using "it". Define. Rework sentence.

77: Why is RH controlled to 30%. Explain significance. State where RH and temperature are measured.

102: Change to "multiply-charged particles". What do you mean by measurement? DMAs do not measure particle size, they size-select based on particle mobility. The issue is using a mobility-based selector as an equivalent to a size-selector.

103: Replace "these" to avoid being ambiguous. Hyphen singly-charged.

104: "this effect" is ambiguous.

105-106: "this artifact" ambiguous. To address multiply-charged particles biasing the concentration discrepancy...

111: Why is Multiple capitalized?

113: Why is Electrometer capitalized?

119-125: Mixture of fonts, inconsistent throughout text. Assume document is printed B&W and can't refer to "red line". Describe what the first order approx. means.

123: efficiency of what?

130-132: Confusing.

132-134: Merge sentences.

134: Compared to what temperature values at normal operation?

144-147: This section should be merged within the paragraph above

149: Remove: initial. Replace "to" with "at".

150: Missing comma, missing "is"

151: insert "and is shown..."

152: efficiently

153: comma after pressure. "as a function"

154: lowered

157-158: merge sentences

158-159: Be specific and mention for the 250 hPa case...

159-160: redundant

174: suggest replacing "concerning" to "with reference to"

175: Comma after 7.

183: Not necessary to have "as illustrated in Figure 7". You've already stated you're referring to Fig 7. Sentences seem redundant with message.

194-195: This sentence seems out of place here... remove?

197: Explain why the second test aerosol case is necessary. What are you exploring with the second choice of aerosol?

214: State this earlier in motivating your methods on why you chose this second case.

215: Source? There are many flights and missions targeting fresh combustion. On commercial flight, you're flying in a corridor route that follows other aircraft.

217: Refer back to Eqn 1 to remind the reader. What is derived vs Exp?

218: As can be seen where?

220-221: Are you saying that your method is incorrect?

222: remove "full-size"

234: reference.

Table 1 & 2: Why is Table 2 Bb when Table 1 is B? Exp. stands for experimental or exponential? Unclear.

243: Refer back to Eqn 1.

249: "agreement... is high". Be quantitative. e.g. "agreement within 10% throughout the range..." "R^2 of ..."

253: Formatting

260: remove comma

261: insert comma after hPa. Change ot "as necessary"

262: "We were able to have a look at 5 units." Relevance?

267: remove "well-engineered". You're not in marketing.

270: change "was" to "were", since you're comparing 2 objects.

272: "Approved" is a strange word choice. Revise?

279: Should "below" be "above"? You didn't test below 200 hPa.