

Interactive comment on “A novel rocket borne ion mass spectrometer with large mass range: instrument description and first flight results” by Joan Stude et al.

Joan Stude et al.

joan.stude@dlr.de

Received and published: 15 October 2020

Dear Referee #2 Thank you very much for your helpful review. Actions and answers to your comments are provided below.

"My only substantive question is around charge balance. The positive ion spectrum at 69 km in Figure 6 shows a much lower integrated countrate than the negative ion spectrum at 70 km in Figure 7. Do these counts needs to be scaled in some way to compare them directly?"

ADDED: additional section 3.5 Charge balance at 70 km altitude

C1

In principle these count rates can be converted to ion densities ($N=c/(A v)$). c as counts, A as intake area, v rocket speed. For 69/70 km: Quasineutrality requires: $N_+ = N_- + N_e$. Measured electron densities: SAURA: $\sim 500 \text{ e/cm}^3$ (Latteck 2019). With: $c_+ \sim 26 \text{ kHz}$ and $c_- \sim 300 \text{ kHz}$ (200 kHz light ions + 100 kHz heavy ions): $N_+ = 32 \text{ cm}^{-3}$ and $N_- = 379 \text{ cm}^{-3}$ (see chapter 3.5 for more details). Payload charging to positive values in the sunlight could explain this discrepancy, as the positively charged rocket would attract negatively charged particles and repel positivly charged.

"One final point: the data availability needs to be specified – location and electronic address."

CHANGED: The data will be made available through HALO database: <https://halo-db.pa.op.dlr.de>

Minor points:

"line 5: major"

CORRECTED

"line 20: there are some more recent references (from the Leeds group) which might be appropriate here: Frankland, V. L.; James, A. D.; Feng, W.; Plane, J. M. C. (2015): The uptake of HNO_3 on meteoric smoke analogues, *Journal of Atmospheric and Solar-Terrestrial Physics*, 127, 150-160, 127, 150-160. James A. D., J. S. A. Brooke, T. P. Mangan, T. F. Whale, J. M. C. Plane, and B. J. Murray (2018), Nucleation of nitric acid hydrates in polar stratospheric clouds by meteoric material, *Atmospheric Chemistry and Physics*, 18, 4519-4531."

ADDED: references

"line 59: presumably the payload detaches from the rocket motor at some point before measurements commence? This should be made clear here, since it sounds as though the motor is attached throughout flight."

C2

CHANGED: ...supersonic speed of the payload...

"line 59 and elsewhere: supersonic is usually written as a single word"

CORRECTED

"line 65: the end of this sentence reads a little strangely. Perhaps rewrite to something like “: : cryopump also provides structural support.””

CHANGED: ... which serves also as structural support...

"line 67: on the ground"

CORRECTED

"line 68: ... transmission, independent bias potentials can be applied to the intake cone, lens and quadrupole ...

CORRECTED

"Figure 2 caption: what is “Bat.” – presumably battery, but this should be spelled out."

CHANGED

line 111: “..). For the inline: : :”

CHANGED: For the line mode...

line 118: “: : the ram direction”

CORRECTED

line 120: “: : of a standard : : :”

CORRECTED

line 121: “: : atmosphere with a composition: : :”

CORRECTED

C3

line 170: “: : operate up to 49”

CORRECTED

line 172: “Thus ions enter the instrument”

CORRECTED

line 173: “In contrast to 70 km,”

CORRECTED

line 182: “In contrast to the calibration”

CORRECTED

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-203, 2020.

C4