

## Comment on amt-2021-357

Anonymous Referee #1

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Referee comment on "Spectral performance analysis of the Aeolus Fabry–Pérot and Fizeau interferometers during the first years of operation" by Benjamin Witschas et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-357-RC1>, 2021

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As noted in lines 250-255, this is a complex system where the behavior of one interferometer impacts the downstream performance of the others. As such, this detailed description is helpful and insightful (and necessary). In fact, I would argue this is an important piece of work to have documented for posterity, particularly the mathematical descriptions of the specific Aeolus interferometer implementation and the detailed on-orbit operational performance. The mathematical approach appears correct and robust.

Doppler lidar is challenging because so many effects can appear as Doppler shifts. Changes in laser frequency, thermal shifts, plate spacing – all can appear as Doppler shifts and have to be separated from the actual atmosphere-induced Doppler shift. There is a comment early in the manuscript about thermal impacts on the telescope. Are there any thermal impacts being noted on the interferometers?

In discussing the results shown in Figure 4 (e.g., manuscript lines 351-364), it would be helpful to know, from forward modeling, how good the fit has to be to maintain bias at  $<1$  m/s,  $<5$  m/s,  $<10$  m/s, etc. In my experience, the absolute wind determination is highly sensitive to the FPI fit. Thus, even the small amount of variability as shown in Figure 5, for example, can have large impact on the wind retrieval. This manuscript does a good job of explaining and quantifying the measured instrument response. What is not answered is the question, "Is this good enough?" In other words, perhaps add a succinct description of how well the errors have to be minimized to have less than X m/s impact on the final product. This would help the reader understand how close the team is to best possible performance, or if this is best possible and is at the limit of noise. There must have been an initial expectation of controlling instrument parameters to some limits, to maintain wind error less than some specified amount. How well did the initial expectation or modeling match the measured results?

Minor point: Figure 4 is referenced in line 183, well before it appears in the document and before Figure 3. Best practice is to have the figures in the order they are referenced.

Grammatical issue: The authors use the phrase "in order to" nearly 40 times in this manuscript. Use of "in order to" is poor grammar. It's one of the few useful things I retain from grammar school, but "in order to" should never be used. Instead, just "to." For example, "In order to provide valuable input data..." is more appropriately simply "To provide valuable input data..."