Comment on **"Optimization of a direct detection UV wind lidar architecture for 3D wind reconstruction at high altitude," by Thibault Boulant, Tomline Michel, and Matthieu Valla**

This manuscript describes an investigation that is relevant to Atmospheric Measurement Techniques in the field of remote sensing technique regarding an airborne UV Doppler Wind Lidar (DWL). The authors describe a study for the architecture of a UV molecular lidar designed to make the lateral and vertical wind measurement in front of an aircraft for Gust Load Alleviation (GLA) applications and optimization of performance on wind measurement. The manuscript is interesting approach to optimize performance on the lateral and vertical wind measurements of the UV airborne DWL. The authors led to the results of both wind measurement errors for the three laser systems and the optimum angle between the direction of laser beam and the airplane axis. I believe that the manuscript will be of interest to the readers of Atmospheric Measurement Techniques. However, regarding the content of the manuscript, there are issues that should be addressed prior to publication:

General comment

The authors assumed to be the measurement time of 0.1 sec, which corresponds to a range resolution of 25m for an aircraft speed of 250 m/sec. The target measurement range is 100 to 150 m. First concerning is the spatiotemporal and accuracy requirements of the wind measurement for the GLA. What is the response speed meeting the requirements? Please add explanation and references for the requirements.

Second concern is the signal to noise ratio (SNR) at the focusing region at the lidar angles θ of 10 and 50 degrees. The backscatter coefficient at an altitude of 10 km is not shown in the manuscript. The size for the laser beam and receiver filed at the focusing plane is not shown. What is the SNR and the detectability required for the GLA?

Regarding to the second concern, third concern is repetitiveness of the wind filed. The θ of 10 and 50 degrees have different volumes. When the laser beam and the receiver filed are focused, the reviewer thinks that the wind filed at the focusing volume will be no longer the repetitiveness around the plane. The refractive turbulence is strong in the UV.

Specific Comments

1. Line 17: Introduction. Please add references regarding to aviation accident and safety.
2. Lines 26-27: "100m- 200m ahead of the aircraft" is the spatial requirement. Please add explanation and reference related to spatial requirement.
3. Lines 31 and 88: "abbreviation for Gust Load Alleviation" is shown again. Please remove "Gust Load Alleviation" if you use the abbreviation GLA.
4. Line 55: QMZ should be "Quadri Mach-Zehnder (QMZ)".
5. Lines 62-63: "a factor √2 increase in statistical error" is not clear. Please add explanation regarding on the factor and the reference.
6. Line 110: How much is the numerical aperture (NA) of multimode fiber assumed in the manuscript?
7. Line 156: What is "moy"?

8. Line 162: “Maximum Likelihood Estimator (MLE)”. Please add reference.
9. Line 165: “Cramer Rao’s lower bound”. Please add reference.
10. Lines 168-169: The laser beam shown in Figure 2(a) should be convergent.
11. Lines 170-171: Please add explanation regarding on relation between F-number and the NA.
12. Line 172: I don’t understand $M^2<8$. Please add explanation regarding on physical meanings of M^2 and $M^2<8$.
13. Line 190: What is “γ(r)2”? Please add explanation. Is “$\gamma(r)^2$” correct?
14. Lines 194, 236, and 240: “0,” should be “0.”.
15. Lines 199-200: The backscatter coefficient at an altitude of 10 km is not shown in the manuscript. Please add the backscatter coefficient.
16. Line 200: “$m^{-1}.sr^{-1}$” should be “/m/sr”.
17. Line 203: Laser has a spectral width of <500 MHz. How long is the pulse width assumed? Is it possible to develop the laser system?
18. Line 204: Please add references regarding the spectral broadening of 3 GHz.
19. Line 207: Figure 3 shows result of the relation between laser average power and pulse repetition frequency (Hz). Do you need to show the results at the laser average power of >10W operating at PRF of < 100 Hz. Is it feasible to develop the laser system in the term of the laser power density and laser-induced optical damage?
20. Line 230: “repetition rate of 400 Hz and delivers 22.5 mJ of energy per pulse”. In Figure 3, Merion C is “9W 40 kHz”. Which is it correct?
21. Lines 225-240: Do three lasers have enough tolerance for the optical damage? Does each laser have enough tolerance for the optical damage?
22. Figure 4: Please embed “high altitude” and “low altitude” int the Figures 4(a) and 4(b), respectively.
23. Line 270: “root mean square error”. “root mean square error (RMS)” should be better.
24. Line 297: “root mean square error” should be removed.
25. Line 325: “Figure 5) displays the results.”. “)” should be deleted. “results”, how did you simulate? It is not clear. Please add explanation. Did you investigate the statistic difference between real wind component and retrieved wind component at two angles of 15 and 50 degree? Please add results and explanation.

Refences

26. Line 445. What is the title? Which journal is the manuscript reviewed?
27. Line 459. 2022 -> 2021.

Miscellaneous

28. The summary of specification parameters used in the simulations will be helpful for the readers. Please add the summary of the specification parameters.