Wind Energ. Sci. Discuss., referee comment RC1
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Comment on wes-2021-65

Anonymous Referee #1

Referee comment on "Development of a curled wake of a yawed wind turbine under turbulent and sheared inflow" by Paul Hulsman et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-65-RC1, 2021

General comments

In this research article a comprehensive measurement campaign of the wake behind a yawed wind turbine under different turbulent and sheared inflow conditions is presented. A short-range scanning Lidar system is used to map the wake flow at number of downstream locations, results showing good agreement with reference hot-wire measurements on the same setup. The high quality of Lidar measurements on these small scales is impressive to see, while pre-programmed scanning patterns show great future potential for acquiring full-field wake scans in a wind tunnel in a relative short time.

The paper is well-organized and has a very high quality of language and presentation of data. The results of the time-averaged wake flow for three inflow conditions and yaw angles are supplemented by an analysis of the dissipation rate, which is considered valuable for comparison with previous hot-wire measurements and future CFD simulations of the setup. The main findings on the inflow's influence on wake of yawed turbine confirm findings from previous experiments and simulations, which are cited at the right locations. Given the large amount of research on yawed turbine wakes during the last years, the main findings in this article are not completely novel. The very detailed analysis, well-organized presentation and good discussion of the results contribute to the high quality of this research.

Regarding the content of the article, I only have very few minor comments and technical corrections, which are listed below. Overall, this is an impressive piece of experimental research, and I am looking forward to seeing more following.

Specific comments:

P3.L25. Please provide more information on the operational point(s) of the model turbine for the different yaw angles, i.e., thrust and power, if possible. So far, the only info given here is the tip speed ration of 5.7. These would be valuable data for potential CFD simulations or repetitions of the setup.

P10.L21. lateral displacement of the tower wake in yawed conditions. "This is a result of conservation of mass…". How much is the streamwise distance of from the rotor center to the tower center? Could this contribute to a lateral displacement of the tower wake when the turbine is yawed?

P14.L13. "The high dissipation rate at the wake centre can be related to the root vortices within the near wake." I do not really see any significant signature of root vortices in the plots describing the near wake at 2D. There seems to be one "yellow dot" in the central wake in Fig.7(e), but is this really a root vortex signature? Why isn't it visible in Fig. 7(b)?

P28.L1. "An online database is currently being prepared." That is a very good idea to make this extensive dataset available for validation purposes. I hope the authors can provide a link to the dataset in the final version of this paper.

Technical corrections:

P4.L8. "Equations 2 approximates…" -> Equation

P9.L11. "… the turbulence is higher initially and the rapidly decays moving downstream …" -> it

P20.L17. "… which can casue spatial averaging …" -> cause

P21.L4. "At 1D in Figure 12…" -> Figure 13?