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First results from the iSpin Performance Transparency Project (PTP)

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Summary

The measurement phase of the iSpin Performance Transparency Project (PTP) [2] - one of the largest and most systematic demonstration projects for a wind measurement system - has successfully started. 59 of in total planned 90 iSpin systems have been installed, covering two different turbine types - each of them located in three wind farms of different terrain complexity. The first findings for one year of iSpin data along with site specific reference system data (met mast or nacelle LiDAR) and the comparison with conventional nacelle anemometer data are presented.

Motivation

The main motivation behind PTP is to demonstrate the capability of spinner anemometers for performance monitoring of wind turbines irrespective of terrain complexities.

The PTP aims to show that the iSpin Spinner Transfer Function (STF), once being obtained for a turbine in one terrain, can be transferred to other wind turbines as long as these turbines are of the same type and running with the same general settings.

Fig. 1: iSpin Spinner Anemometer

Furthermore the robustness of the iSpin measurement under consideration of 360° inflow conditions - and not only for free inflow sectors - will be evaluated.

Method

For each of the PTP wind farms the STF is generated for a reference turbine using a met mast or a nacelle lidar system. In order to evaluate the STF stability over time, at least 12 months of combined met mast/nacelle lidar and iSpin data are evaluated.

iSpin based power curves (PCs), using site specific and turbine specific STFs, are compared with met mast based PCs according to IEC 61400-12-2 [1] for the reference turbine and for all PTP turbines per site. Furthermore 360° PCs and derived Annual Energy Production (AEP) values are compared to free inflow PCs and their resulting AEPs.

First results and findings

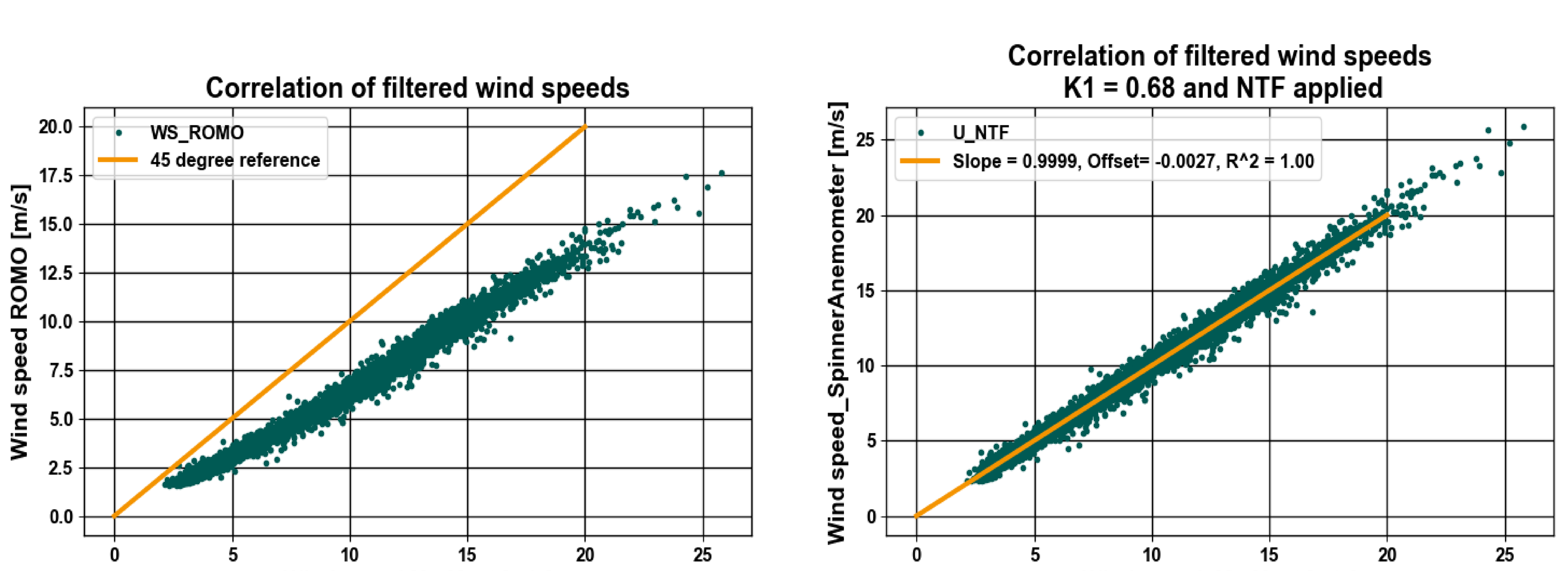

Fig. 2: iSpin K1 and STF generation for complex site PTP turbine (site calibration applied): On the left, iSpin wind speeds corrected with calibration factor K1 & Kalpha have been plotted against the metmast wind speeds. This correlation is used to generated the STF (or NTF), which has been plotted on the right.

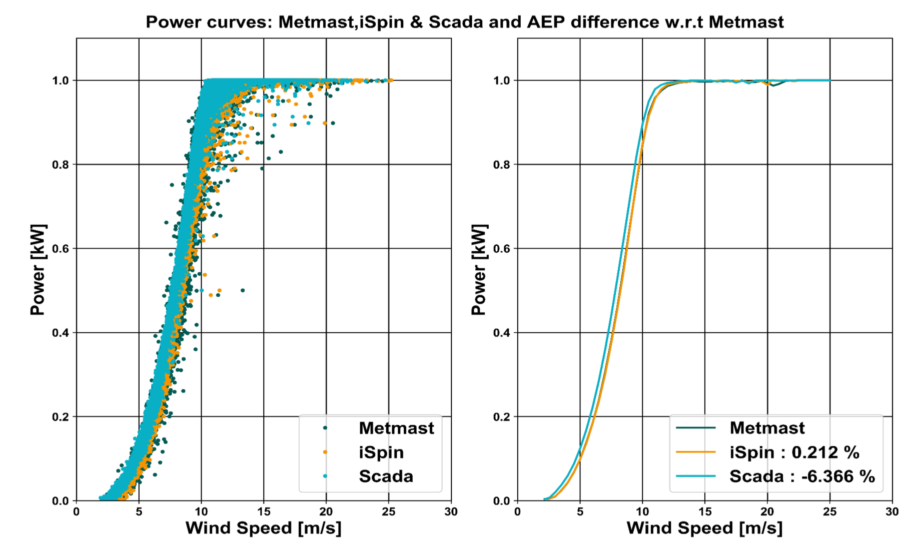

Fig. 3: iSpin, Scada & Met mast based PCS

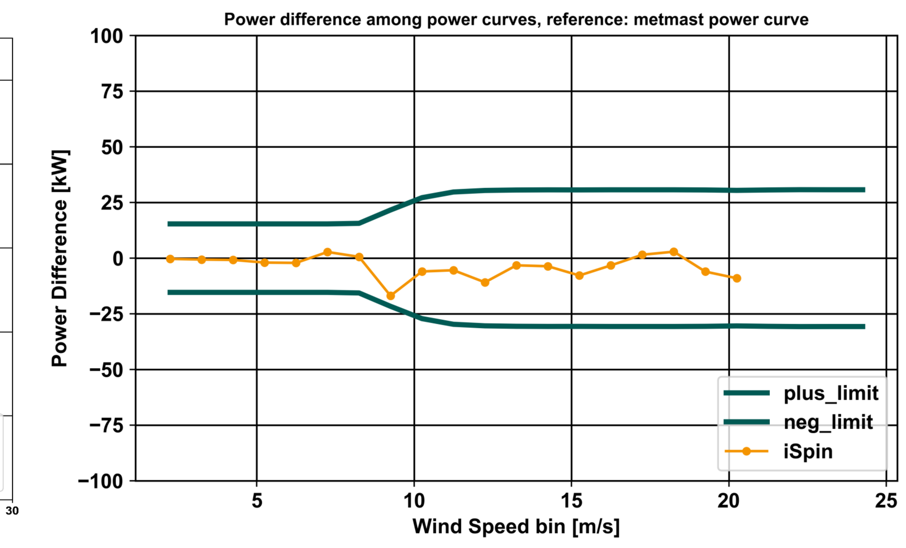

Fig. 4: Succesful STF consistency check

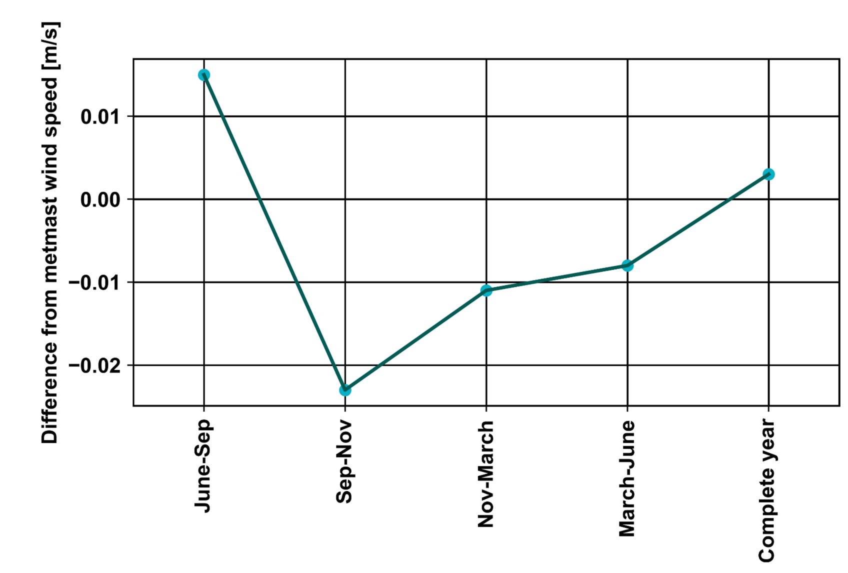

Fig. 5: High seasonal STF robustness

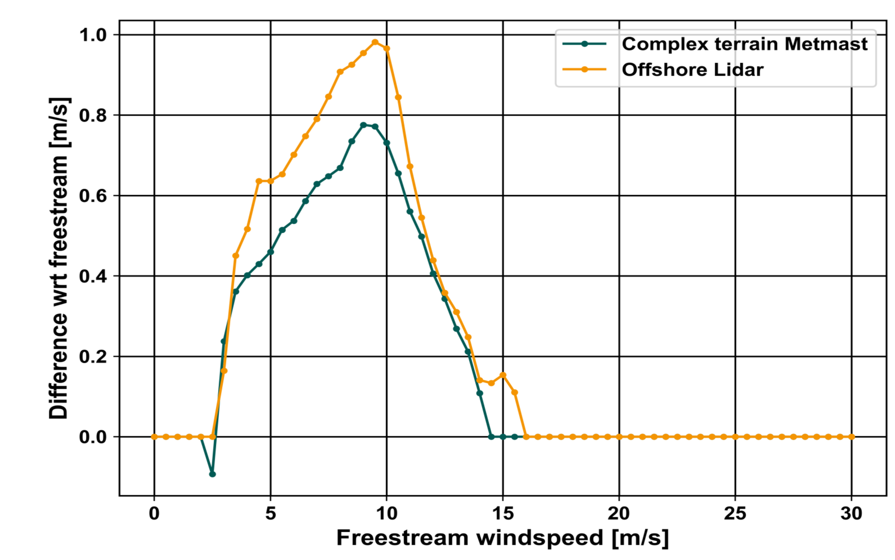

Fig. 6: Good inter wind farm transferability

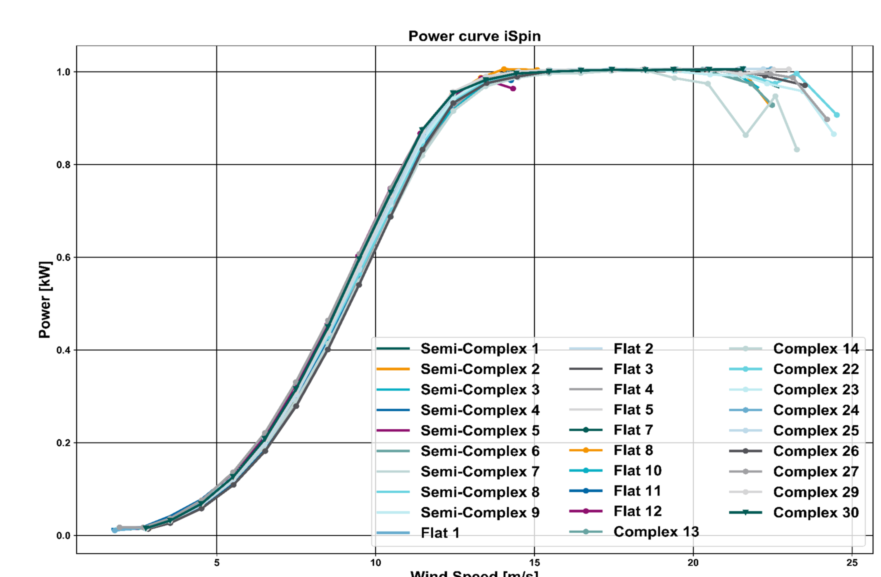

Fig. 7: iSpin based PCs at all 3 PTP sites

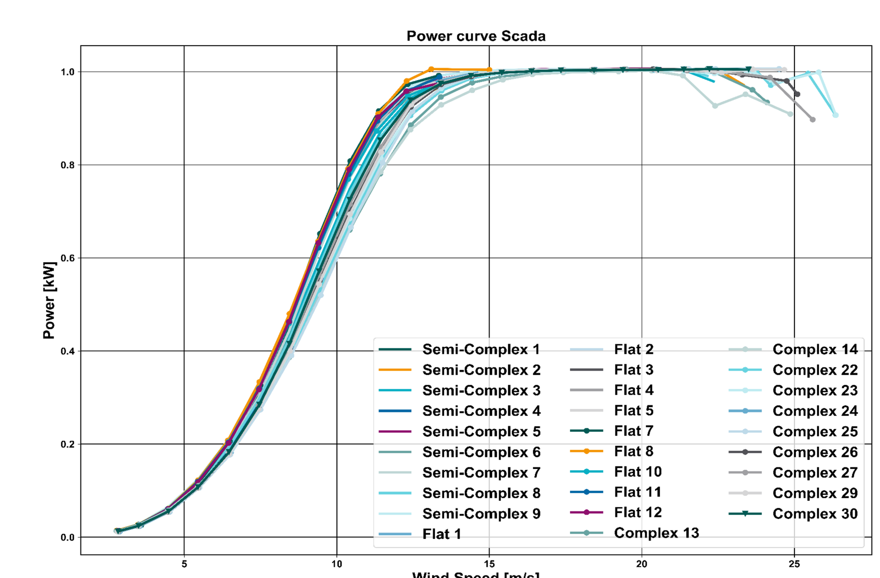

Fig. 8: SCADA PCs for 3 PTP sites

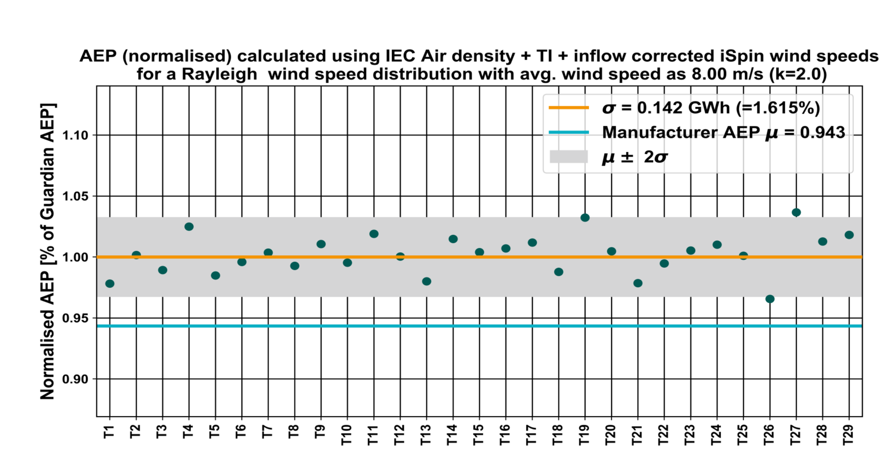

Fig. 9: iSpin based AEPs with narrow confidence band for all 3 PTP sites

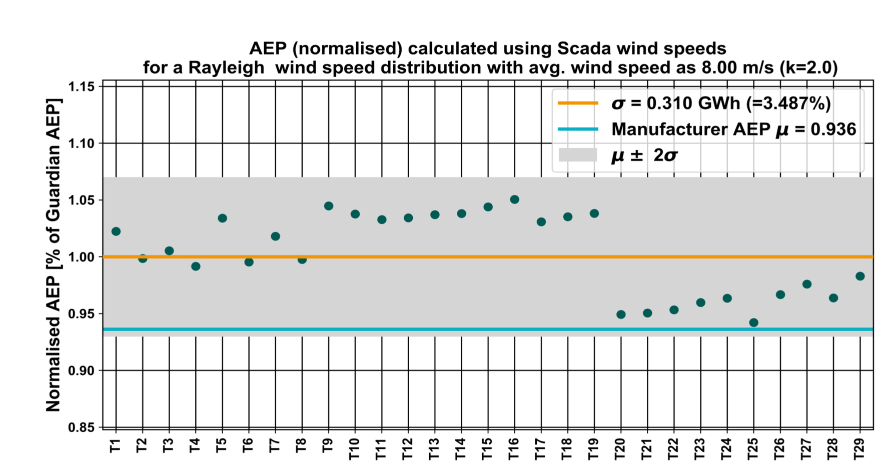

Fig. 10: SCADA based AEPs with wide confidence band for all 3 PTP sites; clustering visible

Conclusion and Future work

- STF stability achieved with minimal seasonal variations (see Fig. 5)
- High STF robustness, proving intra wind farm STF transferability (see Fig. 3 and 4)
- Initial STF comparisons for 2 different terrains show good results; see Fig. 6
- Excellent inter wind farm transferability, across different terrains (see Fig. 7 and 9)
- The PTP methodologies and data under evaluation by acknowledged 3rd party consultants and project partner DTU Wind Energy
- Installation for third turbine type sites in planning and preparation.

References

1. IEC 61400-12-2:2013; Power performance of electricity producing wind turbines based on nacelle anemometry
2. http://www.ispin-ptp.com; official PTP web site; May 2018

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