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In Situ Particle Tracking around kW Sized Wind Turbines IAN BROWNSTEIN, JOHN DABIRI, Stanford — Laboratory studies of model wind turbines are typically unable to match both the Reynolds number (Re) and tip speed ratio (TSR) of full-scale wind turbines. In order to match both relevant parameters, a quantitative flow visualization method was developed to take in situ measurements of the flow around full-scale wind turbines. The apparatus constructed was able to seed an approximately 9mx9mx5m volume in the wake of the turbine using artificial snow. Quantitative results were obtained by tracking the evolution of the snow using particle tracking algorithms. As a step toward full 3D-PTV measurements, results will be presented in which a 2D measurement is taken with a single camera positioned at the base of the turbine looking upward. The resulting tracking is therefore integrated in the span-wise direction. This method is demonstrated through a comparative study of a five-bladed VAWT producing power in different wind conditions at the Field Laboratory for Optimized Wind Energy (FLOWE) in Lancaster, CA. Future work to expand this method to 3D-PTV is also discussed.

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