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**Velocity measurements in the wake of laboratory-scale vertical axis turbines and rotating circular cylinders** DANIEL ARAYA, JOHN DABIRI, California Institute of Technology — We present experimental data to compare the wake characteristics of a laboratory-scale vertical-axis turbine with that of a rotating circular cylinder. The cylinder is constructed to have the same diameter and height as the turbine in order to provide a comparison that is independent of the tunnel boundary conditions. Both the turbine and cylinder are motor-driven to tip-speed ratios based on previous experiments. An analysis of the effect of the motor-driven flow is also presented. These measurements are relevant for exploring the complex structure of the vertical axis turbine wake relative to the canonical wake of a circular cylinder. 2D particle image velocimetry is used to measure the velocity field in a two-dimensional plane normal to the axis of rotation. This velocity field is then used to compare time-averaged streamwise velocity, phase-averaged vorticity, and the velocity power spectrum in the wake of the two configurations. The results give insight into the extent to which solid cylinders could be used as a simplified model of the flow around vertical axis turbines in computational simulations, especially for turbine array optimization.

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