

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Wind Turbine Experiments at Full Dynamic Similarity¹ MARK MILLER, Princeton University, JANIK KIEFER, Technische Universitt Mnchen, CARSTEN WESTERGAARD, Texas Tech University, MARCUS HULTMARK, Princeton University — Performing experiments with scaled-down wind turbines has traditionally been difficult due to the matching requirements of the two driving non-dimensional parameters, the Tip Speed Ratio (TSR) and the Reynolds number. Typically, full-size turbines must be used to provide the baseline cases for engineering models and computer simulations where flow similarity is required. We present a new approach to investigating wind turbine aerodynamics at full dynamic similarity by employing a high-pressure wind tunnel at Princeton University known as the High Reynolds number Test Facility (or HRTF). This facility allows for Reynolds numbers of up to 3 million (based on chord and velocity at the tip) while still matching the TSR, on a geometrically similar, small-scale model. The background development of this project is briefly presented including the design and manufacture of a model turbine. Following this the power, thrust and wake data are discussed, in particular the scaling dependence on the Reynolds number.

¹Supported under NSF grant CBET-1435254 (program manager Gregory Rorrer)

Mark Miller
Princeton University

Date submitted: 31 Jul 2015

Electronic form version 1.4