Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Three-dimensional effects on airfoil measurements at high Reynolds numbers[1] JANIK KIEFER, MARK MILLER, MARCUS HULTMARK, MARTIN HANSEN, Princeton Univ — Blade Element Momentum codes (BEM) are widely used in the wind turbine industry to determine a turbines operational range and its limits. Empirical two-dimensional airfoil data serve as the primary and fundamental input to the BEM code. Consequently, the results of BEM simulations are strongly dependent on the accuracy of these data. In this presentation, an experimental study is described in which airfoils of different aspect ratios were tested at identical Reynolds numbers. A high-pressure wind tunnel facility is used to achieve large Reynolds numbers of $Re_c = 3 \times 10^6$, even with small chord lengths. This methodology enables testing of very high aspect ratio airfoils to characterize 3-D effects on the lift and drag data. The tests were performed over a large range of angles of attack, which is especially important for wind turbines. The effect of varying aspect ratio on the aerodynamic characteristics of the airfoil is discussed with emphasis on the outcome of a BEM simulation.

[1]The project was partially funded by NSF CBET-1435254 (program manager Dr. Gregory Rorrer).

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Date submitted: 30 Jul 2016 Electronic form version 1.4