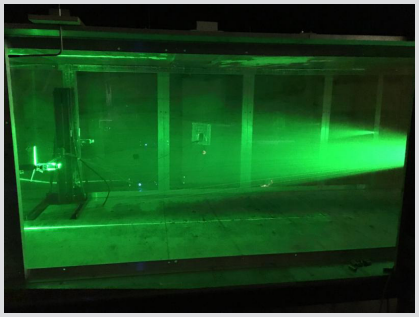
TEXAS TECH UNIVERSITY
National Wind Institute™

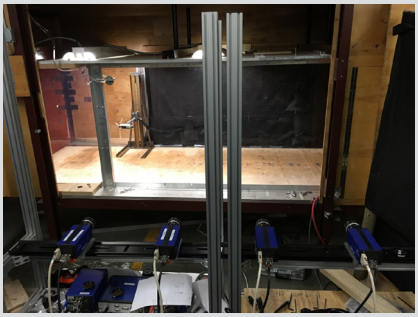
Hyper Accelerated Wind-Farm Kinematic-Control Simulator (HAWKS)

Wind farm output can be significantly improved by implementing wake control strategies steering the wake of each turbine. However, state of the art control development and testing tools are deficient and of limited practical value. Computational Fluid Dynamics based simulations have coarse resolution and are simply not able to resolve the complete flow physics. Also, computer modeling has very long turn around time for just one single point of operation. A NWI research team is currently working on these challenges through an innovative approach which will enable faster than real time wind farm control research, in fact, at least 600 times faster than real time.

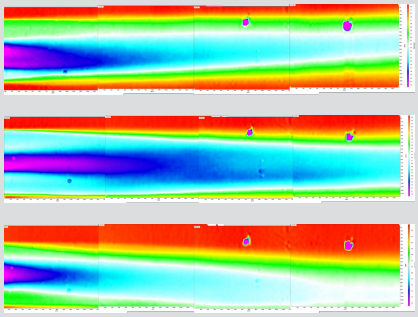
The HAWKS simulator will consist of fully controllable scale wind turbine models to study the dynamics of inter-turbine wake interaction and the effect on the net output power. Individual turbines will have controls that will be operated from a command center similar to a full scale wind farm operation. Wake wind characteristics obtained with a high resolution, laser-based measurement technique called PIV.



The HAWKS turbine in the wind tunnel in NWI facilities at the Reese Technology Center. This test is measuring the laser on the wind turbine wake.



Turbine test setup with four cameras enabling the capability of mapping the entire length of the wake. Turbine is seen to the left and is fully controllable with RPM, blade pitch and yaw system.



Average flow velocity of three different wake configurations emulating wake steering based on turbine yaw for -15, 0 and +15 degree. Each is an average of 300 measurements in time, each containing 20480 measurement points recording in only 30 seconds. That's the power of faster than real time.

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