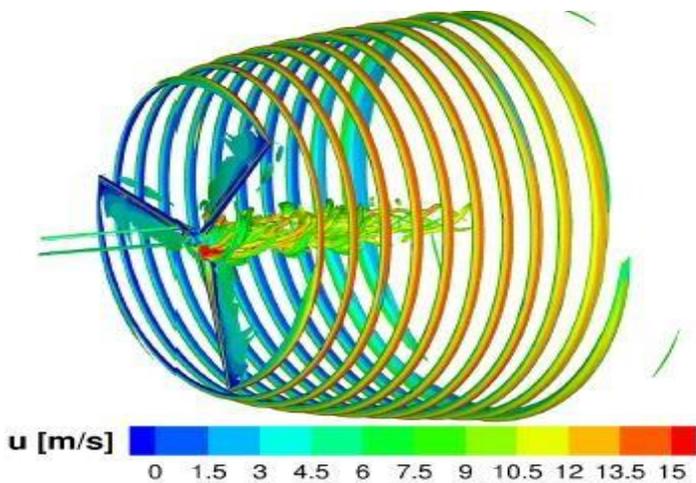


# Case Study: N8 HPC and the University of Liverpool

## Air Flows Around Wind Turbines



### Project

Polaris, the N8 High Performance Computer was used by the University of Liverpool to test and develop the understanding of air flows around wind turbines. Researchers at the University of Liverpool have already developed the Helicopter Multi-Block a model for analysing air flows and aerodynamics in a variety of high speed settings. However, wind turbines operate at very low speeds (low Mach) in comparison with a jet engine, helicopter rotor or similar and the methods used for the analysis of these types of high speed air flows must be altered to allow good predictions of the dynamics of low Mach airflows. As wind turbines increase in size, new tools are needed to allow accurate modelling of the aerodynamic forces on the blades as they rotate. The project aimed to validate the model developed by the team at Liverpool for use with wind turbines. The codes were run using the Helicopter Multi-Block solver (HMB).

### Partners

**Professor George Barakos** – Department of Engineering, University of Liverpool

**CENER** – National Renewable Energy Centre of Spain



### Testimonial

“The use of the N8 HPC allowed the validation of our CFD code to be conducted in a short time and using computer power that wasn't available to us through our existing system. This highlighted some improvements to our algorithm and has given us confidence in our code for use at low speeds. The physics of low speed wakes have been resolved to a great detail, and this has enabled us to start a new activity to translate the results into simple engineering models that can be used by researchers and wind turbine manufacturers for real-time simulations. The results of this project are also to be exploited for the F7 EU project AVATAR.”

- Professor George Barakos, University of Liverpool.

### Impact

The research carried out by Professor Barakos and his team (Marina Carrion, Rene Steijl and Mark Woodgate) paves the way for more accurate simulations that could be used by researchers and manufacturers to improve the design of wind turbines and increase their efficiency and operating performance.

### Success

The Helicopter Multi-Block Computational Fluids Dynamics (CDF) Code developed by the project team has been successfully validated for flows around wind turbines and its parallel efficiency enhanced. The updated code with its low Mach option can now be used for the analysis of any wind turbine.

