ENERGY

# Modelling type B effects in the 4$^{th}$ Quadrant using BLADED

## PCWG mtg 9, OREC, Glasgow

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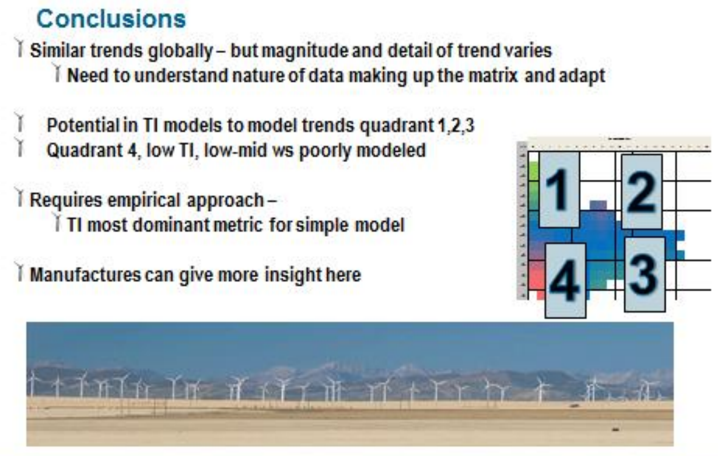
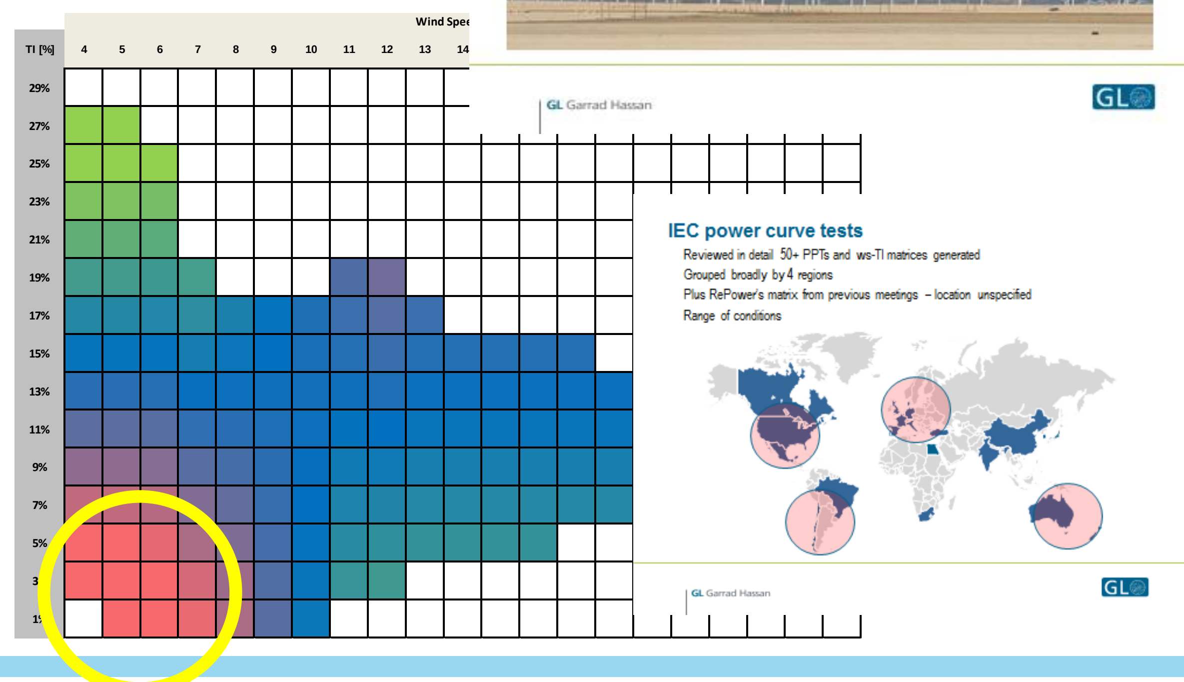
16 December 2014

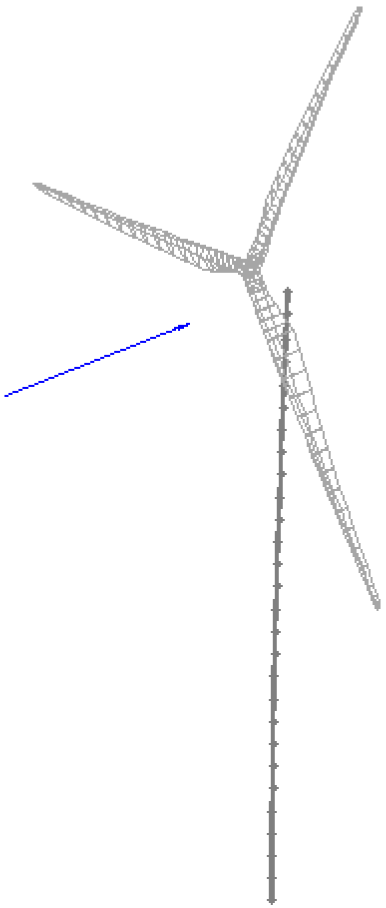
# Where to start with type B?

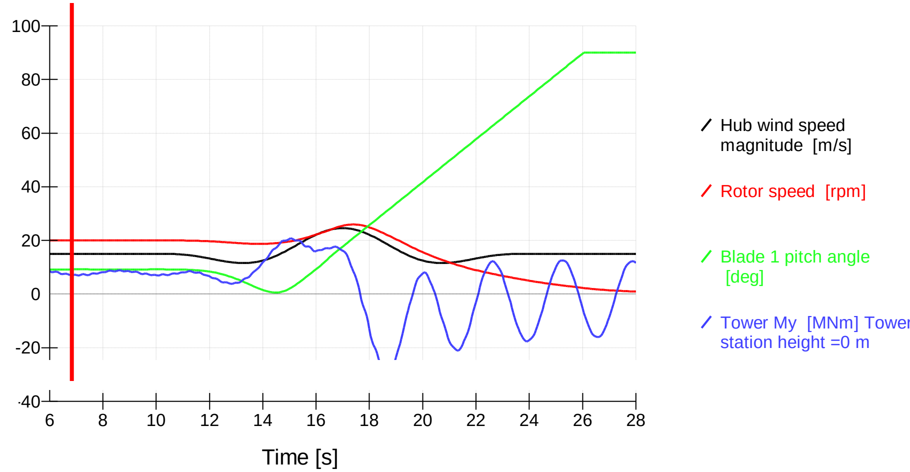
- Can we start to model losses beyond those implied by TI & REWS analytical models?
- First set of BLADED simulations targeted at 4th Quardrant
- Initial results look interesting

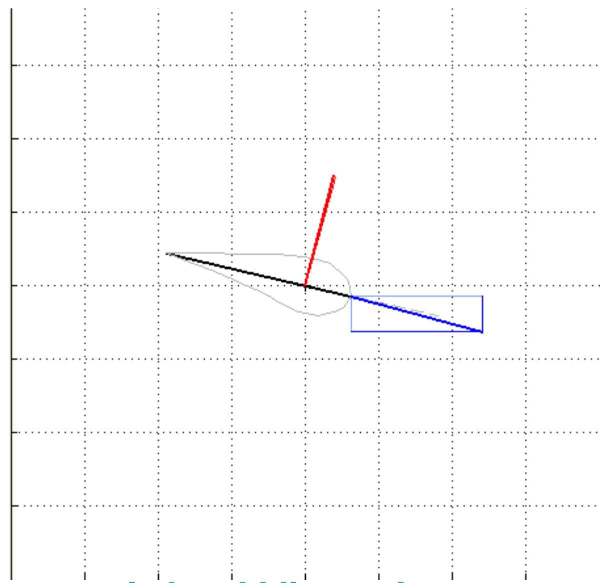


# **Transient loading:** wind gust + turbine shutdown






**Blade middle section**



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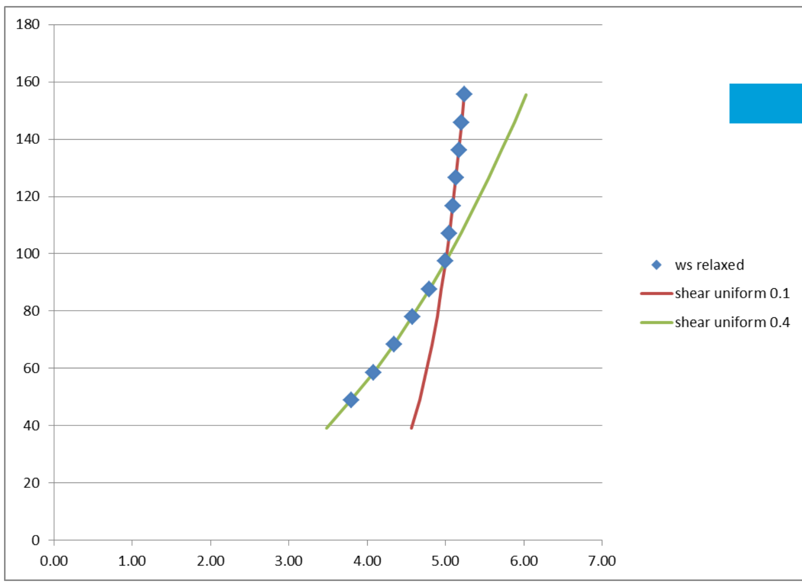
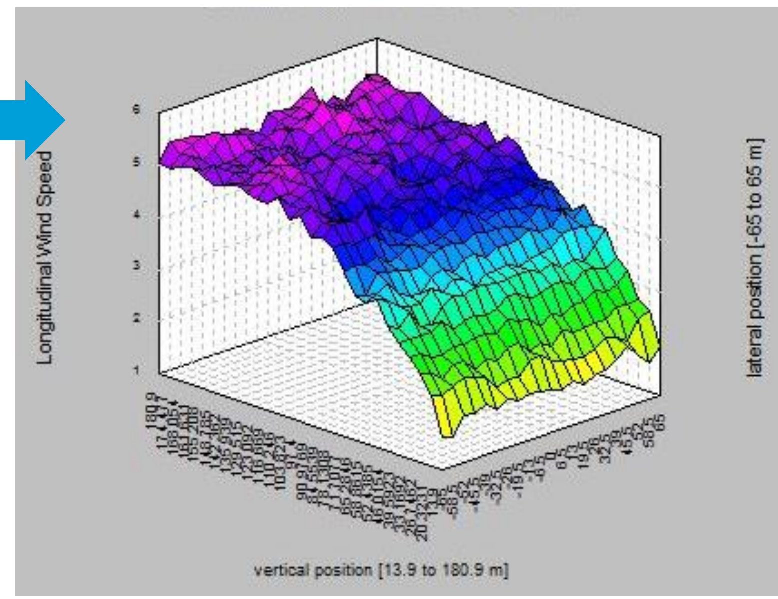
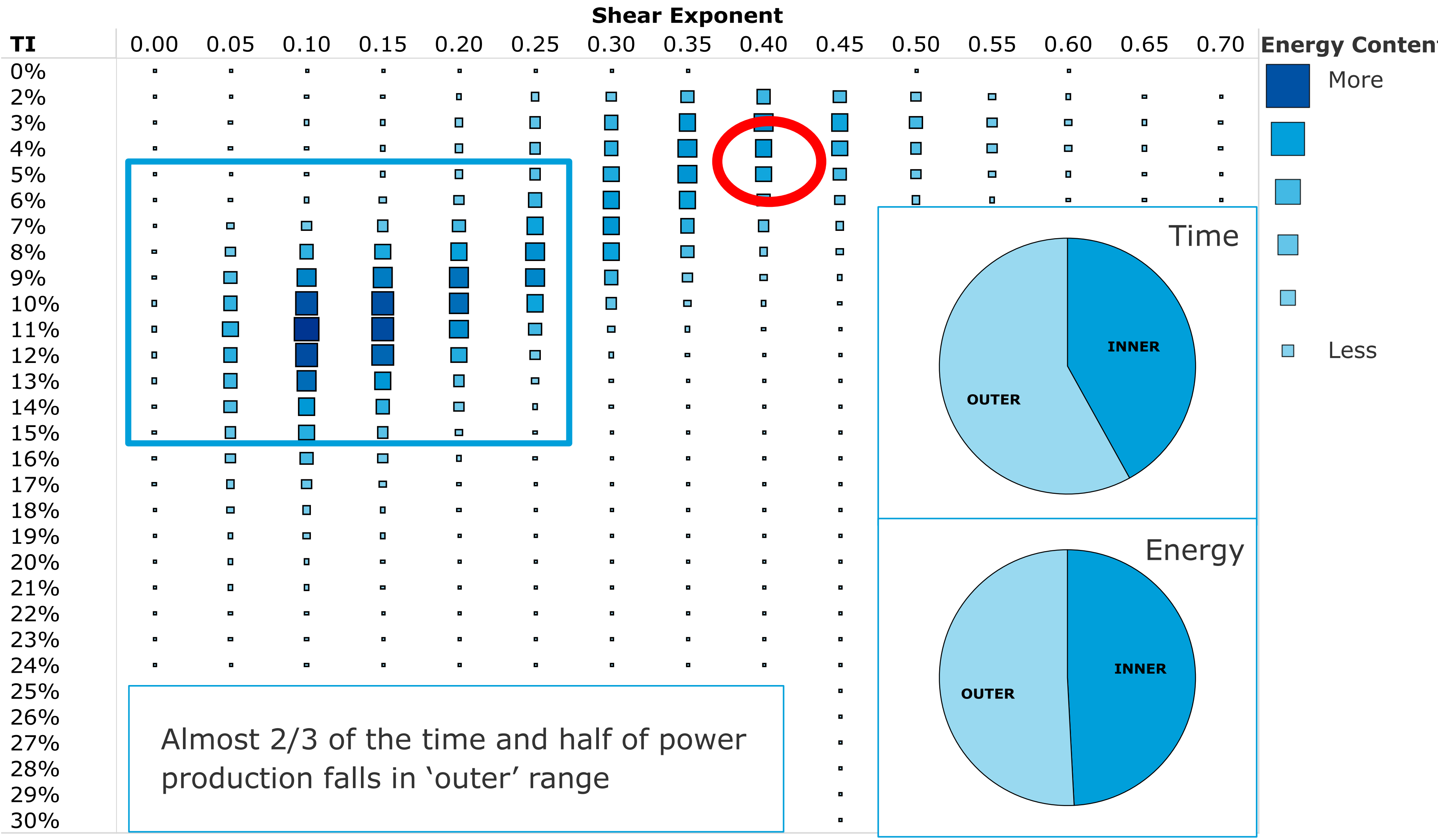
# Initial cases simulated:

- Generic Multi MW turbine
- WS=5 m/s at hub height of 100m
- TI set to 5%
- Uniform shear 0.1
- Uniform shear 0.4
- Relaxed shear  - 0.4 lower rotor, 0.1 above



# More simulations needed!



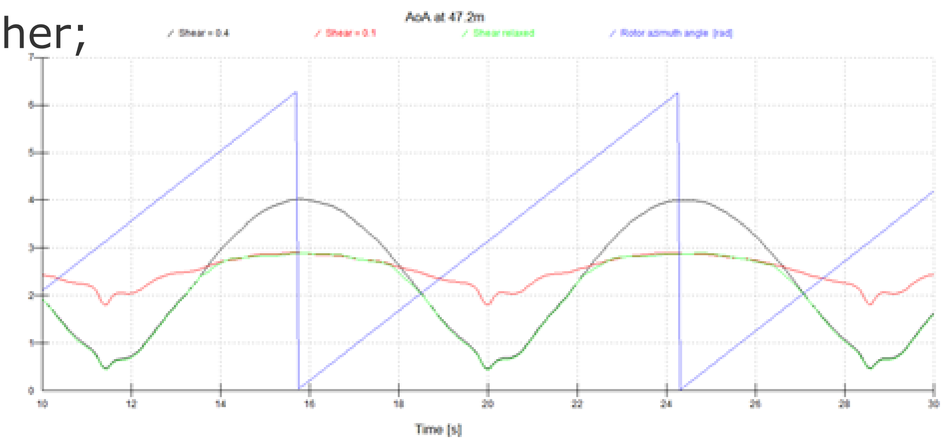

Almost 2/3 of the time and half of power production falls in 'outer' range

# Initial Results and findings

- REWS approach would imply the relaxed shear would reduce power by 11% when c.f uniform shear 0.1 case
- BLADED simulations indicate reduction in power of 15%
- "extra 4%" from "type B?"

- Caveats: limited number of simulations, treatment of TI across rotor, realistic nature of relaxed shear case?

- Parameter sweep with shear/TI/other;
- Inflow
- Use actual measured profiles
- Generic turbine model
- Controller dynamics…..
- Turbulence length scale issues





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# Thanks to Turbine Engineering Support at DNV GL – Graeme McCann and Tao Han

# Discussion

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