VIRTUAL ENGINEERING CENTRE



Dr Konstantin Vikhorev – Simulation Team Leader Digital Reactor Design Programme



Virtual Engineering Centre - Background:

- A leading UK centre, established in 2010 to provide the latest research and development in advanced modelling, simulation and immersive visualisation
- A School of Engineering, University of Liverpool and aerospace sector initiative
- Collaborate across University disciplines bringing academic research and applying to industry challenges
- Aim is to support organisations digital adoption strategies
- Establishing partners:













Virtual Engineering Centre - Focus:

- Bridge the 'innovation gap' both SME & large organisations
- Test and demonstrate "the art of the possible" in a safe and realistic environment
- Fostering collaboration across sectors shared learning and best practice
- Provide digital architectures (frameworks) to support digital twinning from component, sub systems, system to full eco system





Cross sectoral experience:



Collaborative Working Platforms

Experiential Simulation

Common Infrastructure and Toolkits

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Integrated Nuclear Development Environment:



 To develop a digital integrated framework to support future nuclear reactor build – design through to decommissioning

Aims:

- Providing a safe environment for scenario planning
- Provide a way of working that encourages a new way of working between the supply chain
- Enables easier access for non nuclear community stakeholders and new supply chain
- Provide UK nuclear sector with a competitive advantage over global competitors

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Pa	artners		INTEGRATED DIGITAL NUCLEAR DESIGN PROGRAMME
	wood.	VIRTUAL ENGINEERING CENTRE	NATIONAL NUCLEAR LABORATORY
			Hartree Centre Science & Technology Facilities Council
	UNIVERSITY OF LIVERPOOL	Imperial College London	UNIVERSITY OF CAMBRIDGE

- Engagement with broader nuclear sector and stakeholders is critical and key to understand requirements for future framework
- www.digitalnucleardesign.com





Partners

University of Liverpool:

- Professor Eann Patterson Academic lead and expertise in INDE concept
- Professor Bruno Merk Computational modelling for Nuclear Engineering •
- Dr Edoardo Patelli Expertise in uncertainty quantification to support safety • assurance roadmap
- Virtual Engineering Centre Digital Architecture Development & Integration
- Institute for Risk & Uncertainty- Methodologies •

NNL – Strategic vision, advisory capacity, safety assurance and security roadmap, access to key software and development of international links/use of HPC in sector

Wood Group – Project management, expertise in new build and radiation transport codes

Hartree Centre, Science and Technology Facilities Council – High **Performance Computing facilities and expertise**

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GRAMME



Partners(2):

Rolls Royce – UK reactor designer expertise and key player in UK nuclear landscape

EDF Energy – Expertise as UK reactor operator across all stages of nuclear life cycle

University of Cambridge – Advisory role through the Engineering Design Centre

Imperial College – Expertise in reactor physics methods development

Discussions with US Department of Energy - VERA





PWR Use Case

- Test cases being defined in more detail and covering:
 - PWR rod ejection (Lead RR)
 - Multiple drivers for application:
 - UK has operating PWR Sizewell B
 - Multiple plans for LWR in future
 - Prospects for SMR design





Illustration of a space time dependent power distribution during a control rod ejection accident

Codes – WIMS, PANTHER, ENIGMA





AGR Use Case

- Test cases being defined in more detail and covering:
 - AGR probabilistic brick cracking, multi-physics challenge(lead Wood)

 Codes – WIMS, PANTHER, MCBEND, FEAT(G), Code ASTER





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Advantages



DIGITAL NUCLEAR DESIGN PROGRAMME

- Shortened development times
 - More reliable prediction of development times, allowing better synchronisation
 - Reduced risk and perception of risk
- Increased credibility, operability, reliability & safety
 - Directly & through enhanced training & skills development
 - Reduced risk and perception of risk
- Reduced costs
 - Shorter timescales for preliminary tests, development & licensing
 - Increased return on investment through efficient operation & maintenance
 - Limiting decommissioning costs to budget
 - Lower risk leading to reduction in financing costs
 - Improved public perception leading to more friendly operating conditions

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Status



- INTEGRATED DIGITAL NUCLEAR DESIGN PROGRAMME
- Demonstration of integration of diverse codes and data transfer between modules
- On-going development on the framework to implement requirements
- PWR and AGR use case integrated and close to completion
- Demonstration of distributed framework
- Demonstration of current visualisation capabilities
- Next event on September 27th, 2018







Thank you www.digitalnucleardesign.com



