Contribution ID: **21** Type: **Oral**

Overcoming Barriers to Computing Access to Undertaking Nuclear Safety: A journey into advancing Structural Integrity Through High-Performance Computing.

As the UK advances toward a nuclear renaissance to meet clean energy goals, ensuring the structural integrity of reactor components, particularly in fusion energy, has become increasingly critical. Fusion materials must endure extreme environments, making those developed through fission research inadequate. Moreover, existing regulatory and compliance frameworks, largely based on fission standards can impose overly conservative constraints, potentially hindering innovation in next-generation fusion technologies.
My research addresses this gap by developing high-fidelity finite element models that link microscale material behavior to component-scale performance, helping to reduce overconservatism in current nuclear design codes. By leveraging the Isambard 3 supercomputing facility with HPC system of over 55,000 CPU cores and GPU acceleration, these simulations model can efficiently process large-scale data and complex deformation mechanisms, enabling faster and more detailed insights into material behavior under extreme fusion-relevant conditions.

The technical journey of my PhD began with limited knowledge of supercomputing. Coming from a background where computing was neither emphasised in school nor easily accessible with experimentalist background unfamiliar with the potential of high-performance computing, I started my research with minimal exposure to the digital tools that now underpin my work. Navigating a male-dominated field like structural integrity added another layer of challenge. My path reflects not only a steep personal learning curve, but also a broader issue: the unequal access to computing opportunities.

This poster shares both the technical insights and personal journey behind HPC-enabled nuclear safety research, highlighting how inclusive access to computing can diversify the voices shaping our energy future.

Confirm eligibility

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Session Classification: Afternoon Session

Track Classification: Poster