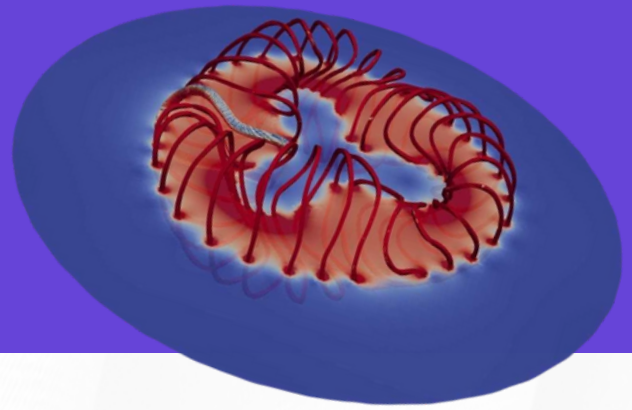


Superconductor simulations in the cloud

See what's possible in complex HTS simulations when RAM isn't a bottleneck



Overview

This webinar provided an in-depth look into solving HTS simulations with Quanscient Allsolve, a cloud-based multiphysics simulation software. The key demonstration was a 3D nuclear stellarator simulation with 300M+ DoF solved live in less than 9 minutes using 500 cores. The webinar highlighted Quanscient Allsolve's significance in superconductor simulations, presenting cloud computing and the Domain Decomposition Method (DDM) as transformative solutions in HTS simulations.

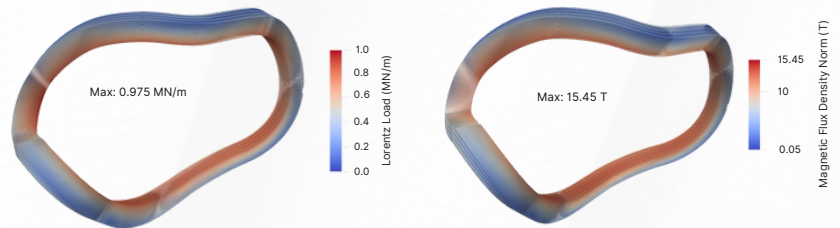
Key demonstrations and results

3D Nuclear Fusion Stellarator with 317M+ DoF

Objective: Showcase Quanscient Allsolve's capabilities in handling complex 3D HTS simulations with a third of a billion unknowns efficiently, leveraging DDM and cloud scalability to eliminate RAM limitations and enable fully parallel computation.

Process in the GUI:

- Initiation of parallel simulations
- Configuration of simulation parameters, including node count and size
- Execution of simulations



Results: Full-sized stellarator magnetostatics simulation achieved in:

- **504 seconds** (8.4 min) with **317M unknowns** using **500 x 32 GB nodes**
- **780 seconds** (13 min) with **317M unknowns** using 200 x 32 GB nodes
- **73 seconds** (~1.2 min) for **4.8M unknowns** using **15 x 16 GB nodes** (coarser mesh for visualization)

Cumulatively RAM utilized: **22.64 TB**

About the speakers

Dr. Lyly and Ruuskanen are both Senior Solutions Specialists from our Application Engineering team with extensive backgrounds of more than a decade in applied superconductivity.



In collaboration with:



Dr. Mika Lyly
Senior Solutions Specialist

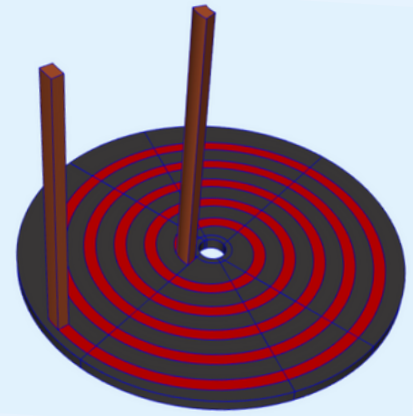
Dr. Janne Ruuskanen
Senior Solutions Specialist

Magnetoquasistatic H-phi Formulation coupled with Thermodynamics

Objective: Showcase the capability to set up and execute a magnetoquasistatic H-phi formulation coupled with thermodynamics, emphasizing the software's intuitive GUI.

Process

- 1. Geometry and Mesh Creation:** Importing geometry, creating additional geometric objects, applying diverse meshing parameters
- 2. Shared Expression Functions:** Creating functions for use as material properties.
- 3. Material Application:** Assigning properties to various domains.
- 4. Physics Setup:** Implementing H-phi magnetoquasistatic formulation, current source with automated cuts for unconstrained coils, circuit coupling, and heat transfer formulation including Joule heating



5. Simulation Configuration: Transient analysis setup with the implicit Euler method: defining the time-stepping parameters and specifying the number of CPUs for the computation

Results: The post-processing phase showcased AC losses calculation and the ability to select and plot output fields, demonstrating Quanscient Allsolve's post-processing capabilities for detailed analysis and visualization of magnetoquasistatic and thermal interactions.

Additional benefits discussed

1

Collaboration possibilities

Quanscient Allsolve allows unlimited user access within an organization, facilitating easy project sharing while always ensuring version compatibility. Fully in the browser, lightweight GUI, and intuitive interface enable easy expansion within an organization.

3

Hardware and maintenance cost reduction

The cloud-based nature of Allsolve eliminates the need for heavy hardware investments, with the assurance of always running the latest software versions on advanced hardware.

2

Flexible pricing model

Usage-based pricing offers cost-effective scalability – from startups to large enterprises, ensuring optimal resource utilization and financial efficiency.

4

Robust data security

Leveraging cloud providers' extensive security measures, Allsolve ensures high-level data protection, benefiting from AWS's significant investments in cloud security.

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- Instant access from your browser with no downloads involved
STEP file of the AC loss of twisted filaments wire featured in the webinar

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