

Mesh and 3D Data Analysis Technology for Digital Twin

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A comprehensive digital twin for fusion energy requires advanced tools for handling complex 3D data. This presentation outlines an integrated technology suite that streamlines the entire simulation workflow, from mesh generation to data analysis. We have developed a robust pipeline that automates the creation of simulation-ready meshes from CAD geometry, significantly accelerating the design-to-analysis cycle for fusion reactors.

Our framework supports the diverse and scalable mesh configurations essential for fusion modeling, including 2D surface meshes of plasma-facing components and 3D partitioned plasma wedges managed by the PUMI infrastructure. Core innovations include a high-performance algorithm for accurately detecting particle-wall collisions and advanced visualization of complex mesh data using Plotly and the Unreal Engine. Ultimately, these technologies are being developed for integration into WILL (Versatile Virtual platform for Integrated fusion simulation and anaLysis), the digital twin platform under development at the Korea Institute of Fusion Energy.

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