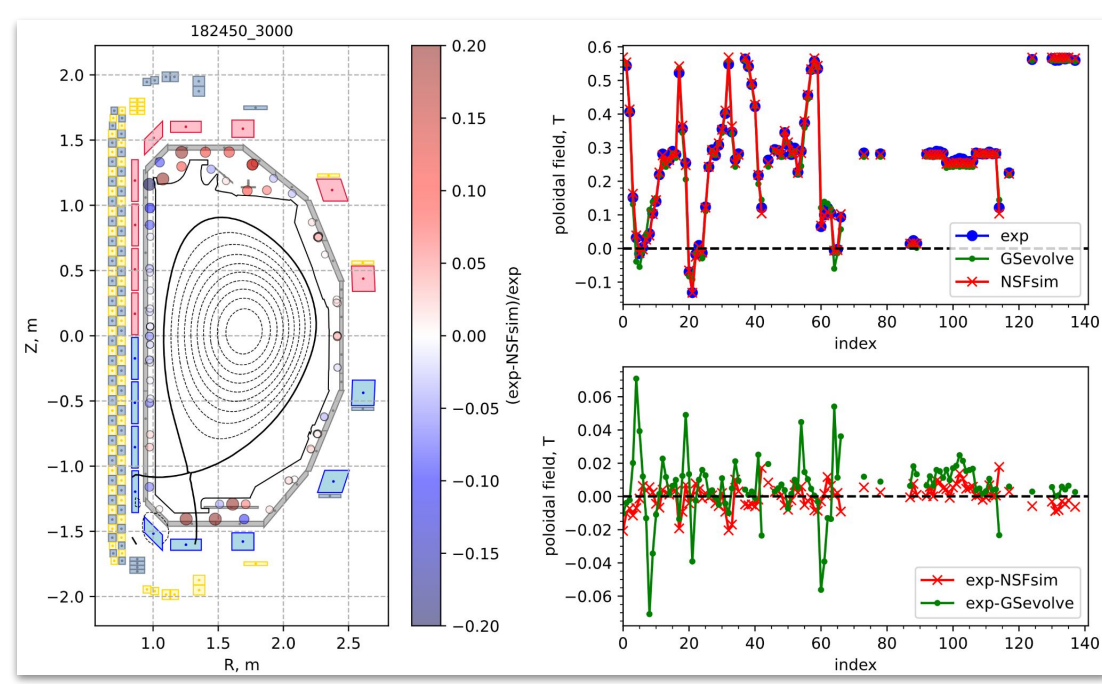




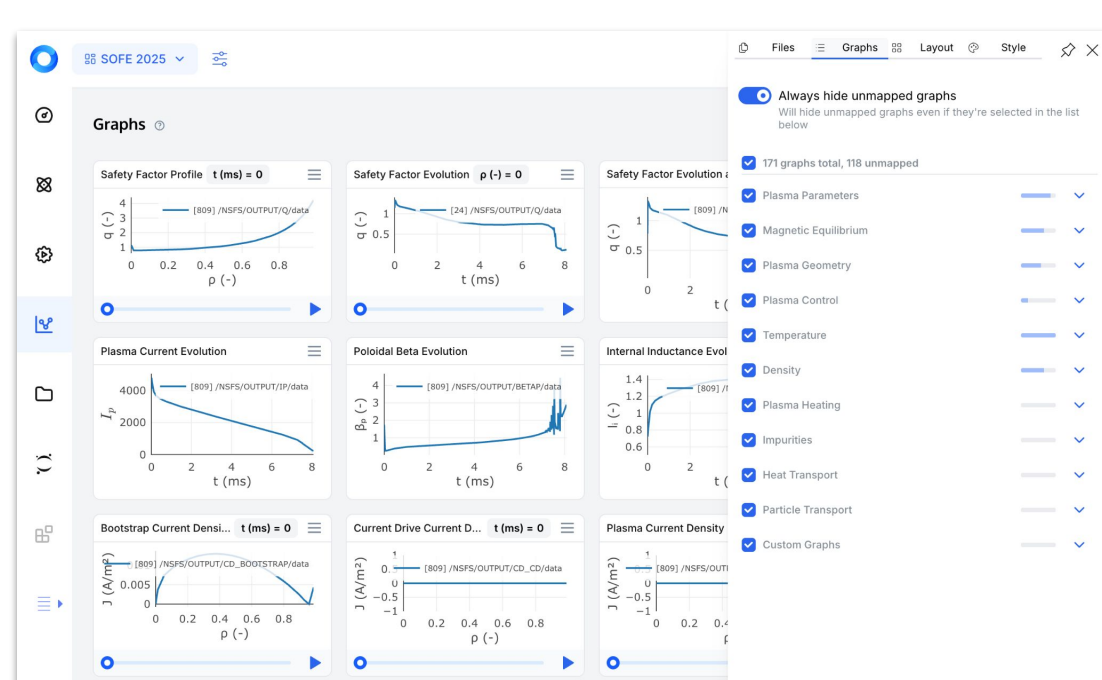
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Available for free on **fusiontwin.io**



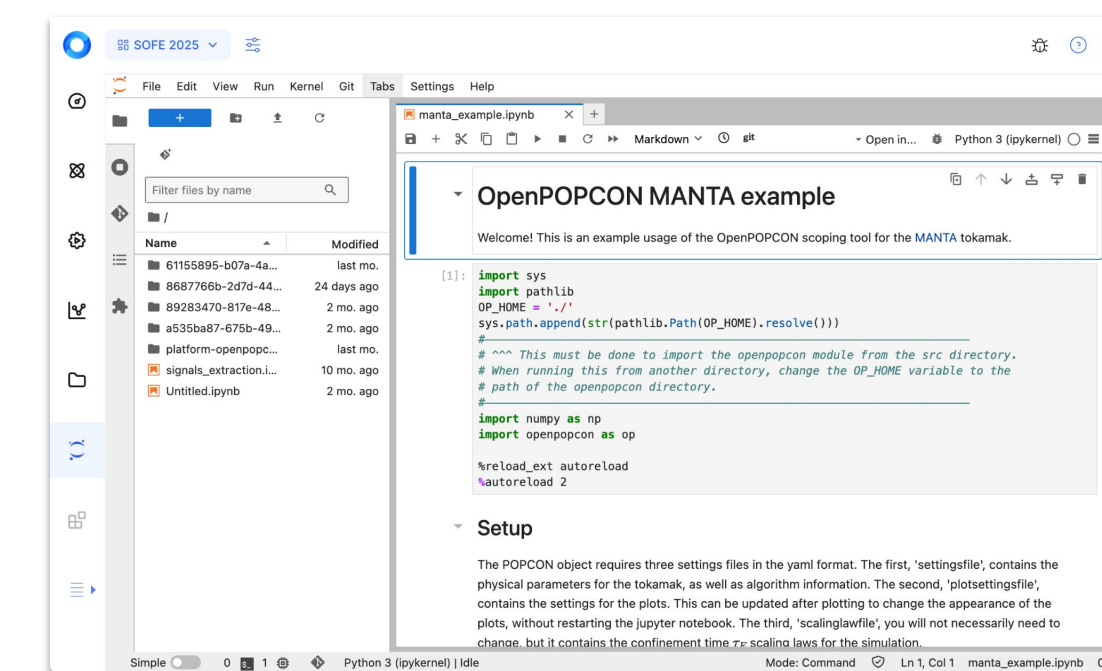
Advanced tokamak simulations using NSFsim

- NSFsim is a free-boundary Grad-Shafranov and 1D transport solver for advanced tokamak simulations, plasma scenario development, device design¹ and optimization, and ML applications².
- It simulates plasma evolution coupled with coil currents, induced currents in passive structures, and synthetic signals from magnetic diagnostics.
- NSFsim enables full scenario development, predicting plasma parameter evolution, magnetic control requirements, and stability margins.
- Each simulation relies on a *digital replica*³ built from the magnetic system's geometry and electrical properties, including poloidal coils, vacuum vessel, and limiter, all represented on customizable meshes.
- No extra software or hardware is needed to run NSFsim simulations of the DIII-D⁴, ISTTOK, SMART, HBT-EP, and a few other tokamaks.



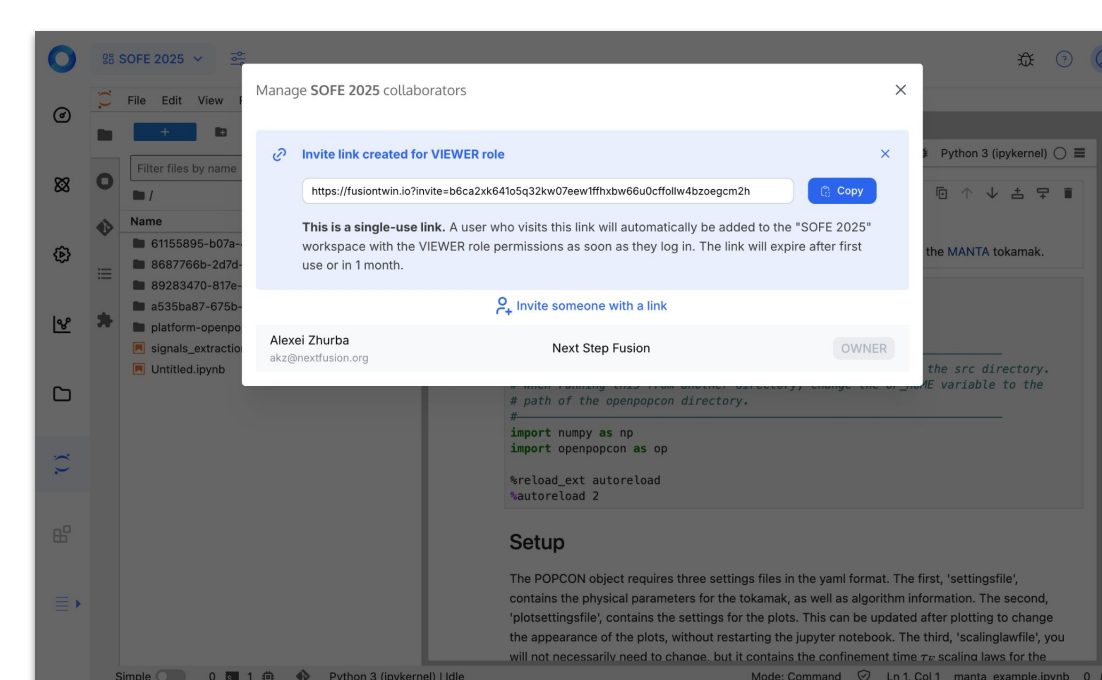
Visualization and customization flexibility (HDF5)

- Flexible and fast visualization tools for uploaded experimental data and simulation results enable quick analysis and comparison.
- Uploaded experimental data in the HDF5 format can be mapped to the platform's internal representation to automatically create hundreds of predefined or custom graphs.
- The results of any tokamak simulation on the platform are automatically mapped and visualized as over 150 graphs of the most important plasma and tokamak parameters.
- To enable quick data analysis, results from multiple simulations can be plotted on the same canvas for comparison.
- A custom saving tool allows for the customization of pictures and saving them as PNG, JPEG, WebP, or SVG, enhancing reports and publications.



Public web API and Python notebooks (JupyterHub)

- Integrated JupyterHub offers Python notebooks for advanced users and developers to launch OpenPOPCON and other codes, process data, and build custom tools.
- Uploaded and simulated data is seamlessly integrated into JupyterHub, allowing direct access from notebooks or download without requiring additional data transfers.
- A public web API provides programmatic access to simulations, allowing for running magnetic equilibrium simulations step by step, developing and testing controllers, performing parameter scans, or generating datasets.
- github.com/Next-Step-Fusion/platform-api-examples is the repository with examples for utilizing the public web API from both Python and MATLAB/Simulink.



Collaboration, sharing, and data management

- All uploaded and simulated data is seamlessly integrated and fully available for downloading without limitations, ensuring complete data ownership and flexibility.
- Collaborate effortlessly by sharing your workspace with team members, assigning viewer or editor roles to control access and facilitate cooperative research and development.
- Share your work publicly and effortlessly by generating a direct link to your workspace, making it simple to present results or provide access to a broader audience.
- For private users, dedicated features enable the use of their tokamak replicas in an exclusive private mode, ensuring the confidentiality and security of proprietary research.

[1] S. Guizzo et al., "Electromagnetic System Conceptual Design for a Negative Triangularity Tokamak," arXiv:2501.14682, 2025.
[2] G. F. Subbotin et al., "Reconstruction-free magnetic control of DIII-D plasma with deep reinforcement learning," arXiv:2506.13267, 2025.
[3] D. P. Schissel et al., "Summary report from the mini-conference on Digital Twins for Fusion Research," Phys. Plasmas 32, 050601, 2025.
[4] R. Clark et al., "Validation of NSFsim as a Grad-Shafranov Equilibrium Solver at DIII-D," Fusion Eng. Des. 211, 114765 (2025).
[5] M. S. Stokolesov et al., "Reconstructing the Plasma Boundary with a Reduced Set of Diagnostics," arXiv:2505.10709, 2025.

Next Step Fusion is

- Luxembourg-based fusion supply chain company
- Supporting tokamak developers in the design, simulation, optimization, control, and operation
- Developing NSFsim, PCS, and ML-based solutions

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