NEXT STEP FUSION

Fusion Industry Partner

On a mission to support and accelerate fusion companies by bridging world-class science with deployable, industry-ready solutions.

COMPANY OVERVIEW

Next Step Fusion is a specialized fusion company based in Luxembourg, bringing together 20+ plasma physicists, fusion engineers, and machine learning specialists — 100% dedicated to fusion energy.

We provide integrated modeling, plasma diagnostics and control solutions for next-generation MCF devices, combining proven science with novel AI/ML techniques — with results demonstrated on operating fusion devices and 5+ tokamak startups supported across concept, design, and engineering.

Our partners span leading research institutions and private fusion builders — including UC San Diego, Columbia University, and DIII-D National Fusion Facility — making us a trusted supply-chain partner for the commercial fusion sector.

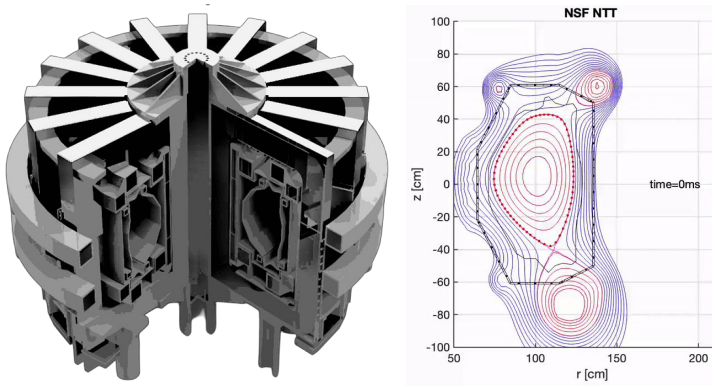

Fig. 1. NSF NTT concept design: 3D model (left) and NSFsim VDE simulation at t ≈ 27 ms for two vacuum vessel cone-shaped design options, showing plasma boundary and flux surfaces (right).

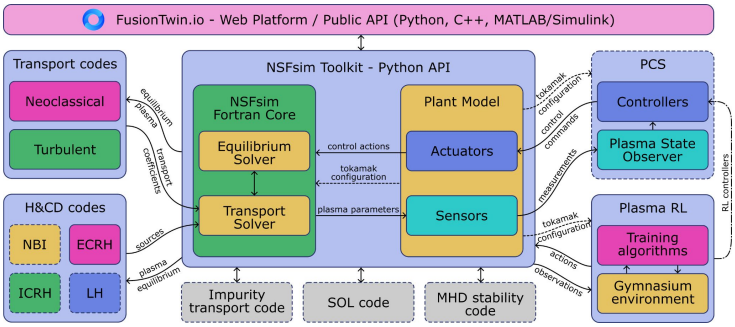

Fig. 2. NSFsim integrated modeling framework architecture: transport and H&CD codes (neoclassical, turbulent, NBI, ECRH, ICRH, LH) coupled with equilibrium and transport solvers, SOL, MHD stability, and impurity transport codes, integrated with a plant model and plasma control system including conventional controllers and reinforcement learning.

INTEGRATED MODELING

Our integrated modeling framework covers end-to-end physics calculations from small university devices to ITER scale. At its core is NSFsim — our simulator that models plasma using a digital device replica, coupling 2D Grad-Shafranov and 1D transport solvers with TRAVIS, ASCOT5, TGLF, and others for multi-physics scenario analysis.

The entire framework has been extensively verified and validated against experimental data. While it is oriented at axisymmetric configurations, much of its capabilities extend to arbitrary MCF devices.

We apply it across the full device lifecycle — covering everything from magnetic system design, plasma scenario development and disruption assessment to outputs feeding mechanical, electrical, structural, and manufacturing teams.

DIAGNOSTICS SOLUTIONS

We offer plasma diagnostics solutions for next-generation MCF devices and future fusion power plants (FPPs) — from standalone diagnostics to our Modular Diagnostics Platform (MDP), a unified, standardized end-to-end I&C solution designed for commercial fusion operation.

MDP is built around microwave diagnostics — ECE, profile reflectometer, and CTS — as the core of a compact industrial diagnostic suite. For magnetic diagnostics, we are developing graphene-based Hall sensors able to withstand the harsh neutron environment of future FPPs.

The platform consolidates measurements into a minimalist, supply-chain-ready architecture with real-time data acquisition and reconstruction of missing plasma parameters — using PINNs and fast solvers to enable reliable plasma control and device safety.

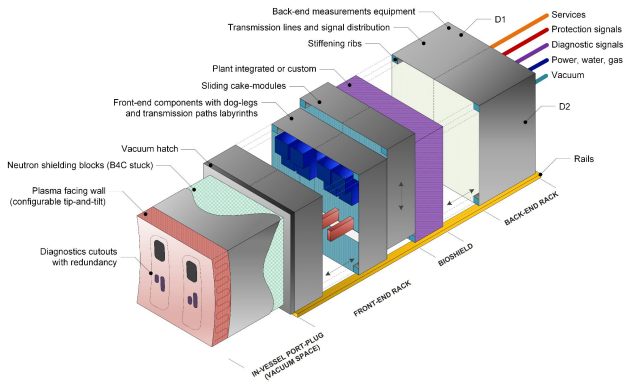

Fig. 3. MDP port-plug and rack assembly: in-vessel port-plug, front-end rack, bioshield, and back-end rack.

WHY NSF & OUR APPROACH

Fully Fusion-Focused
100% of our work is dedicated to fusion energy — rooted in deep plasma physics expertise and active engagement with the fusion community, from leading conferences to the latest industry developments.

Full I&C Stack
Integrated modeling, diagnostics, plasma control, and AI/ML under one roof — covering the full I&C stack. Our control solutions combine physics-based modeling, conventional controllers, reinforcement learning, and more.

Supply-Chain Ready
From tokamak design through full diagnostics development, we actively manage our supplier and partner network — ensuring component quality, repeatability, long-term availability, easy maintenance and support.

Proven Physics Basis
Our physicists bring decades of expertise in plasma modeling and experimental validation. We develop NSFsim, contribute to other codes (e.g. TRAVIS), and know how to solve complex fusion physics problems.

Verified & Validated
We work closely with leading physicists and engineers — including on the customer side — to ensure our models and results are rigorously verified and validated against experimental data from multiple tokamaks.

Early Engagement
The earlier we engage, the better the outcome — from the first tokamak concept, the first hint of a modeling problem, or as soon as major device parameters are taking shape for diagnostics. Don't wait until construction begins.

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Planning a new MCF device or need diagnostics support? Talk to us early.