Proxima Fusion

QI-HTS stellarator reactors

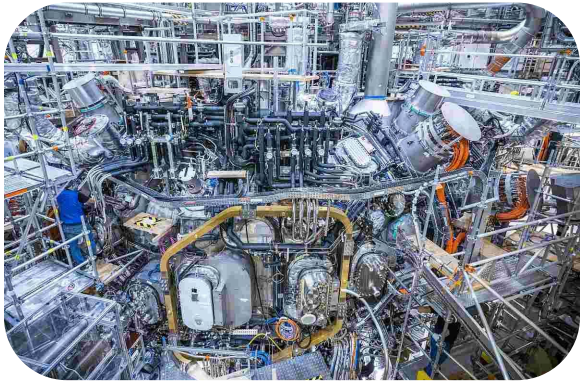
Steady-state, intrinsically stable fusion power

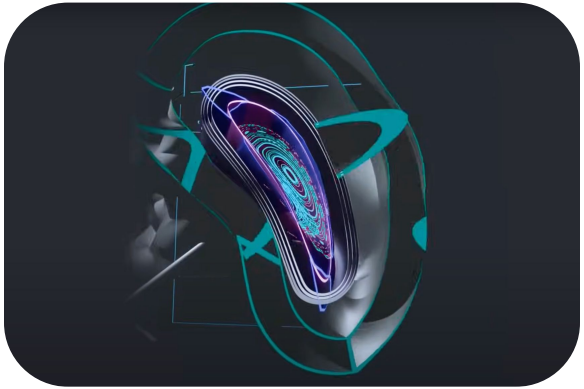
F. Sciortino

Co-Founder & CEO

ARPA-E Meeting, July 9, 2025

Who are we?





Origins

Proxima was founded in 2023 as the first spin-out of the **Max Planck Institute for Plasma Physics**, home of Wendelstein 7-X (W7-X), the world's most advanced stellarator.

Growth + Funding

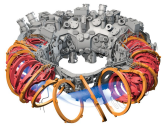
Proxima's fast-growing team of **90+** physicists, engineers, and operators has raised approx **$200M+** in private + public funding.

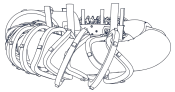
Areas of Focus

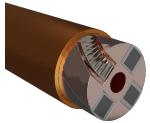
- → Integrated stellarator **design**
- → **Magnet design**, **simulation** and **manufacturing**
- → System integration and **assembly**

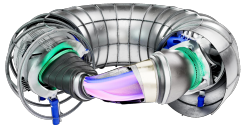
Proxima Fusion

Proxima's path to a fusion power plant









	2023	Q2 2024	Q1 2025	2027	2031	2030s
VC Funds	$8M	$21M	$150M			
Public Funds	$10M	$25M				
Funding Stage	Pre-Seed	Seed	Series A			
	W7-X in full operation Spin-out from Max Planck	Team growth; reactor design	Stellaris + Magnet design + hardware prototypes	Demo magnet + Alpha design	Alpha – *Net energy in steady state* for the first time	Stellaris – FOAK fusion power plant

Our connections to the USA

Inspired by MIT/CFS work on HTS magnets

A team of Europeans and Americans who lived, studied, worked in the USA

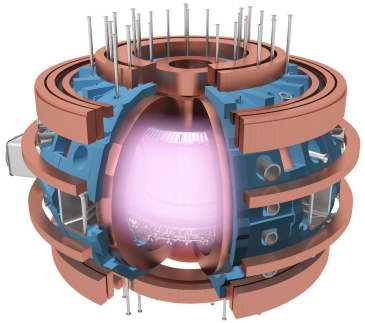
Partnering with the US venture capital community

Collaborating with scientists and engineers at MIT, Columbia, Wisconsin, PPPL ...

arpa·e
Advanced Research Projects Agency • ENERGY

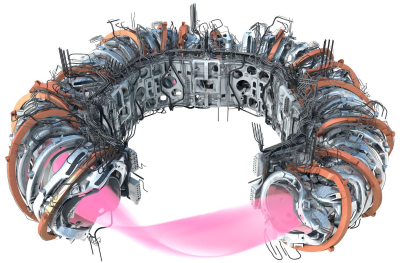
Design, not *control*, holds the key to fusion

Tokamaks



Simple to design, but **hard** to operate.

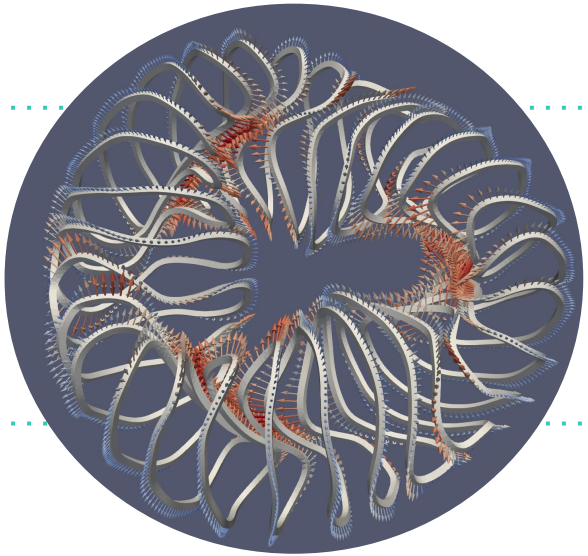
Stellarators



Harder to design, but **simple** to operate.

Key advantages of QI stellarators with modular coils

No I_p-driven disruptions



No I_p-driven limits

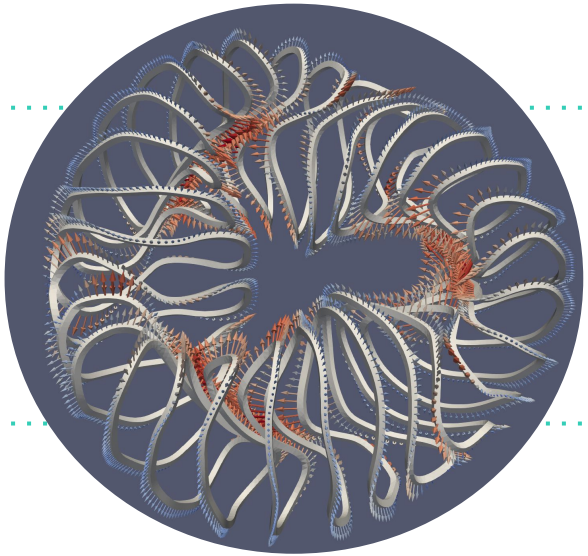
Continuous operation

Lower recirculating power

Key advantages of QI stellarators with modular coils

No I_p-driven disruptions

No I_p-driven limits

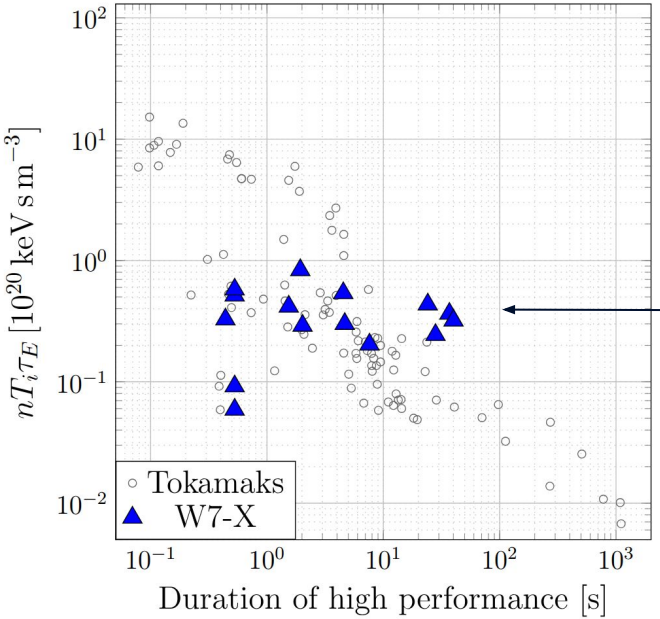


Continuous operation

Lower recirculating power

*Stellarators look hard, but once you dig in… they are **simpler** than tokamaks overall.*

W7-X shows the way



W7-X is limited in performance by its (LTS) magnet technology, but already displays **steady-state** and **intrinsically stable** operation

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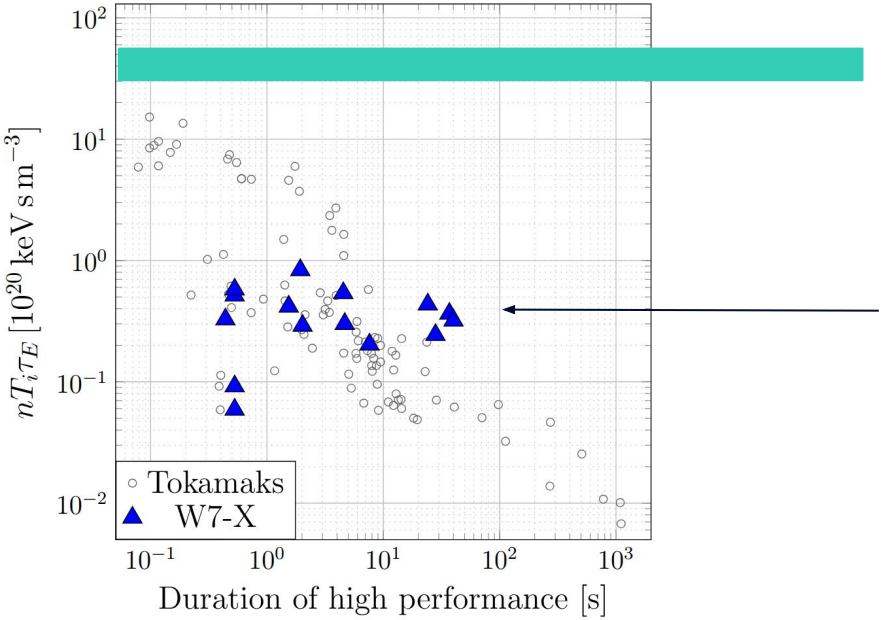
W7-X shows the way



Alpha stellarator target (HTS magnets)

W7-X is limited in performance by its (LTS) magnet technology, but already displays **steady-state** and **intrinsically stable** operation

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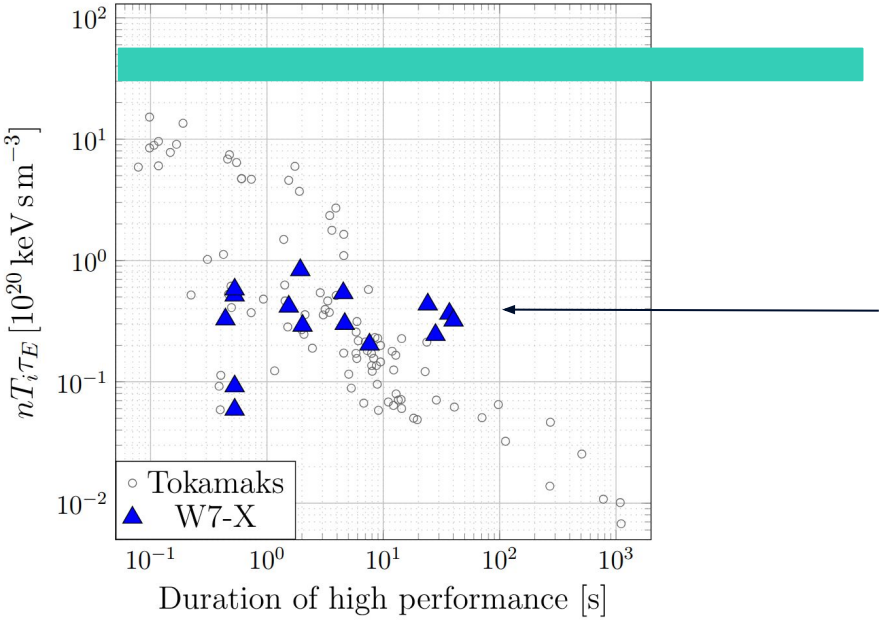
W7-X shows the way



Alpha stellarator target (HTS magnets)

W7-X is limited in performance by its (LTS) magnet technology, but already displays **steady-state** and **intrinsically stable operation**

No physics blockers since 2022

→ Landreman & Paul, PRL, 2022
→ Goodman et al., JPP 2023
→ **Lion et al., FED 2025**

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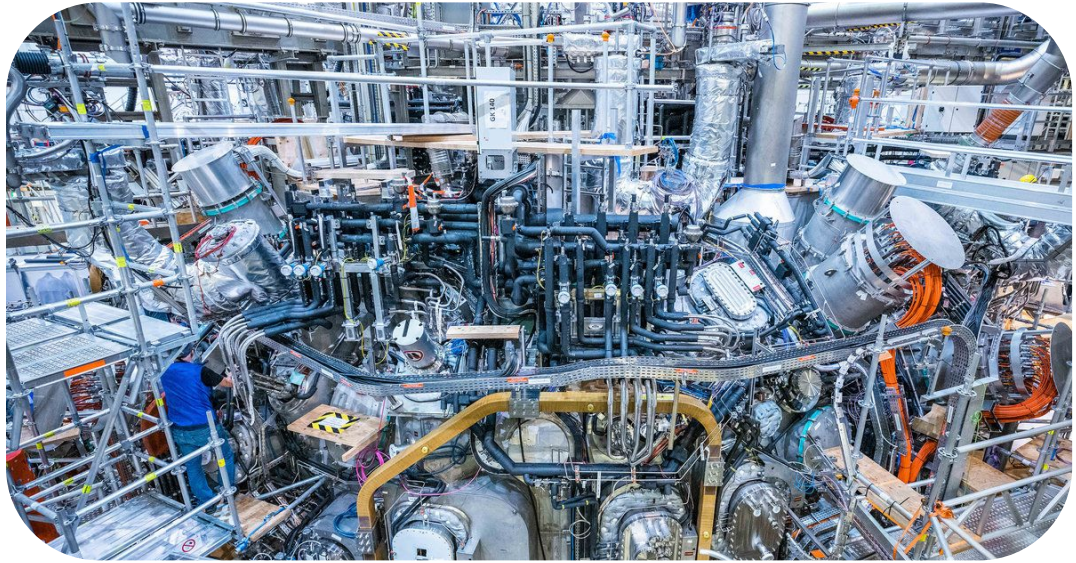
Proxima Fusion

From experiments to reactors



The path forward:

- Simulation-driven engineering
- High-field magnets

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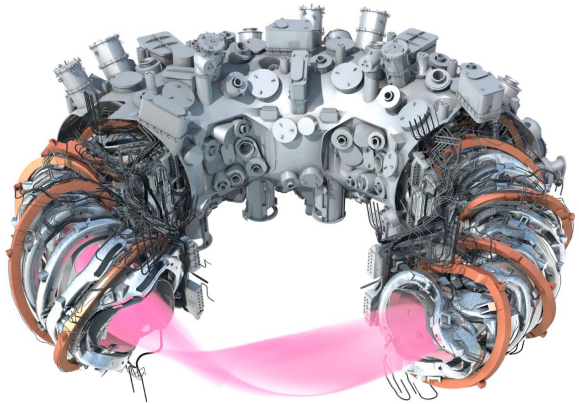
KIT Karlsruher Institut für Technologie

JÜLICH Forschungszentrum

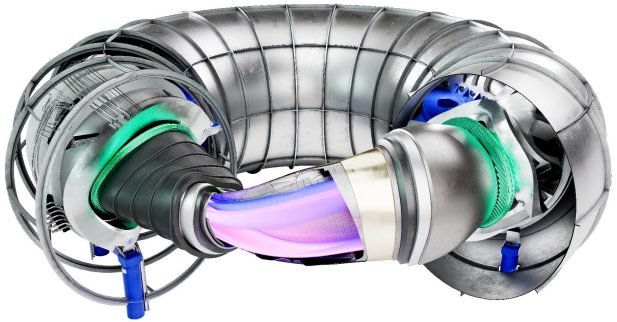
U.S. DEPARTMENT of ENERGY

Stellaris: A new class of QI-HTS stellarators born from W7-X

W7-X



Stellaris



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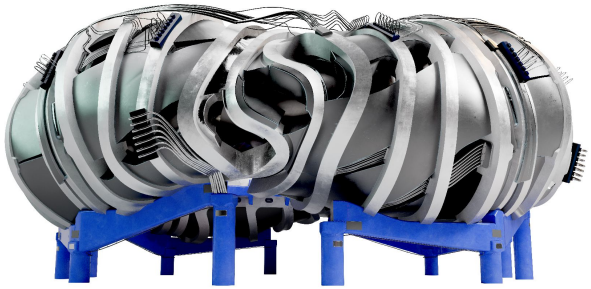
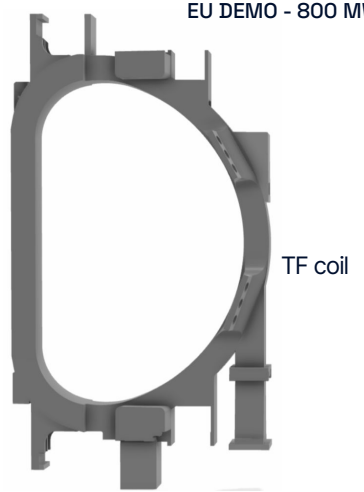
Stellaris: the world's first QI-HTS reactor conceptual design

Peer-reviewed paper:
QI configuration, HTS magnets at >20T, physics & engineering analysis covering all critical domains, 3 GWth

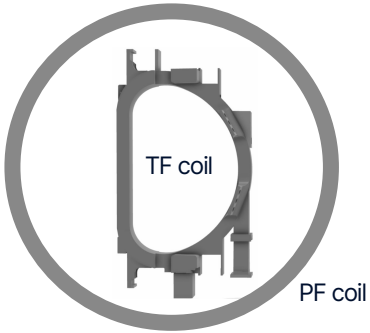


Stellaris: smaller size, modularity & simplicity

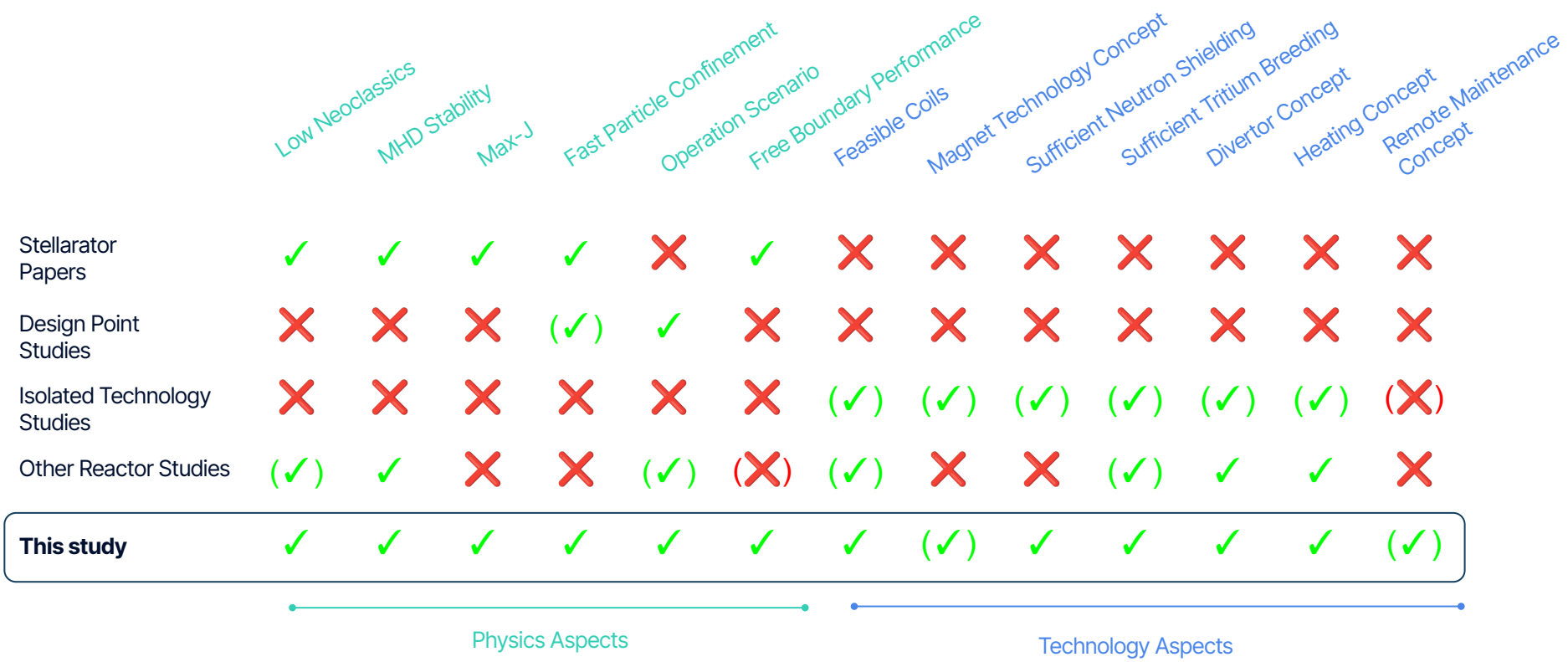
EU DEMO - 800 MWe



ARC - 400 MWe

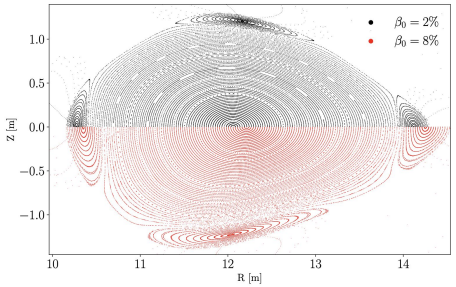


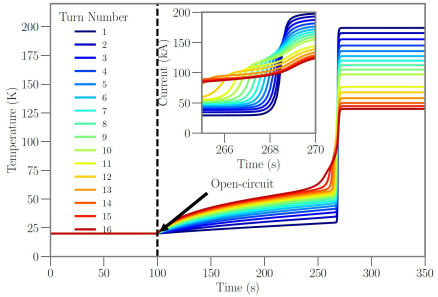
Stellaris - 1000 MWe

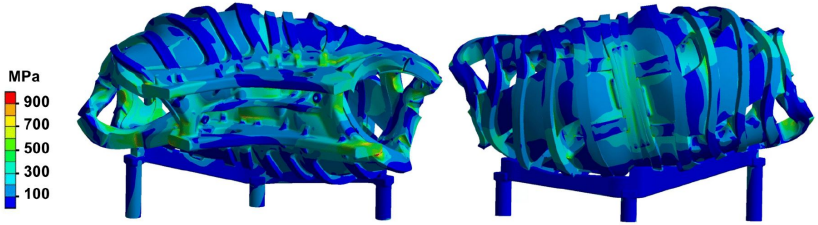

Low Neoclassics
MHD Stability
Max-J
Fast Particle Confinement
Operation Scenario
Free Boundary Performance
Feasible Coils
Magnet Technology Concept
Sufficient Neutron Shielding
Sufficient Tritium Breeding
Divertor Concept
Heating Concept
Remote Maintenance Concept
Stellarator Papers
Design Point Studies
Isolated Technology Studies
Other Reactor Studies
This study
Physics Aspects
Technology Aspects

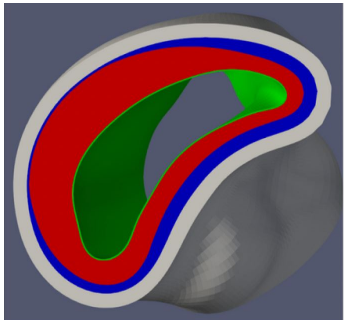
Integrated physics & engineering analysis

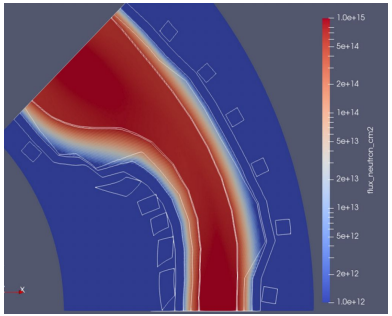
(no cherry-picking of results)

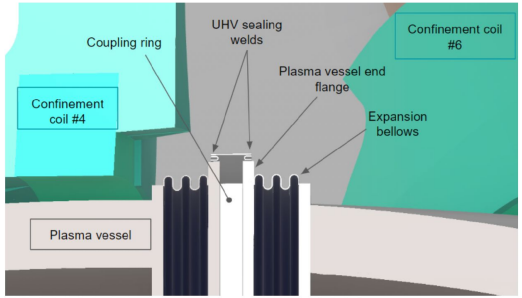


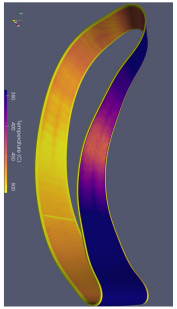




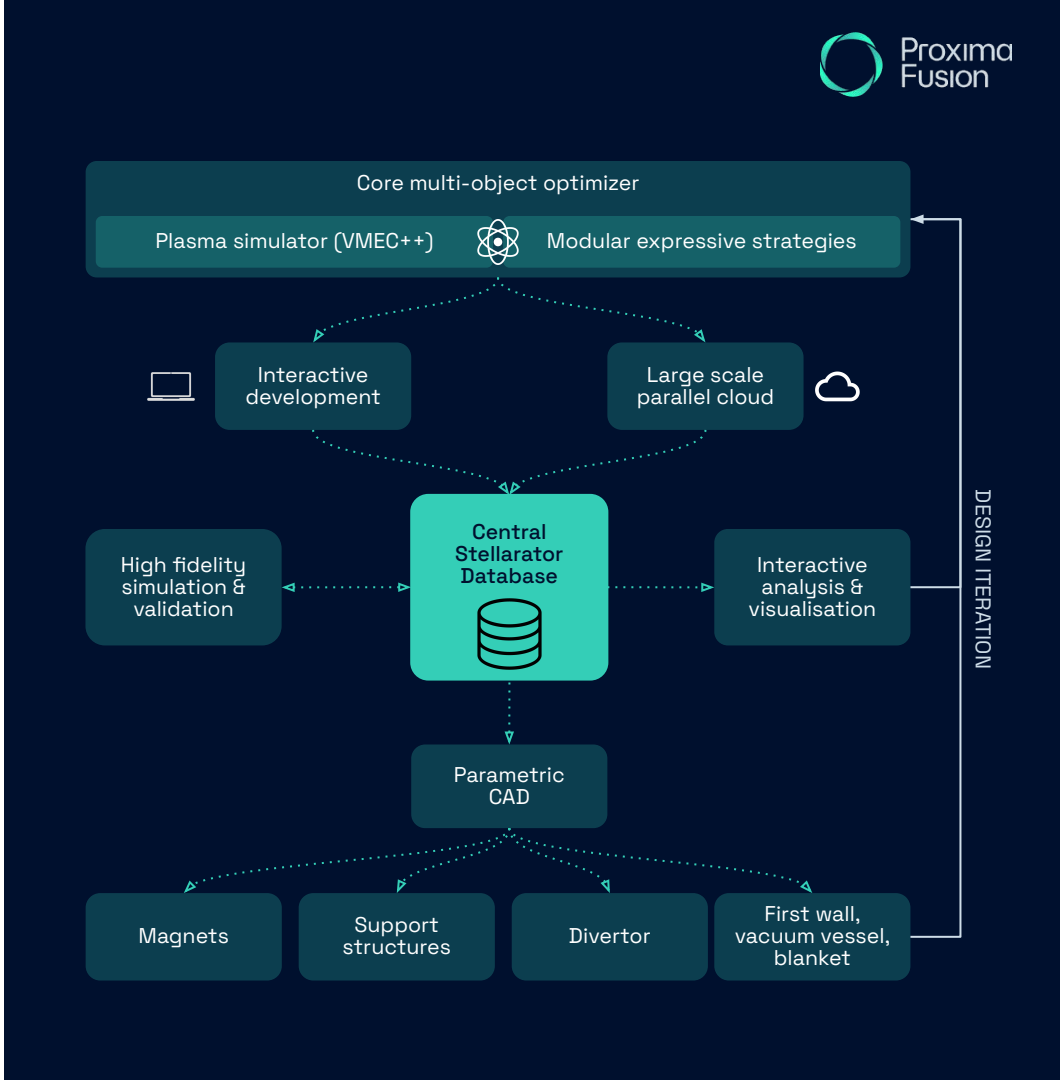




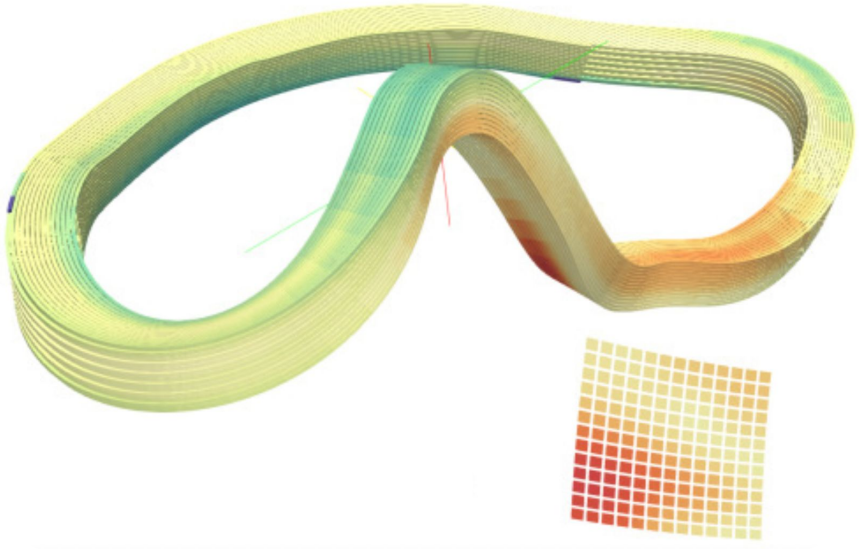




Simulation-driven engineering

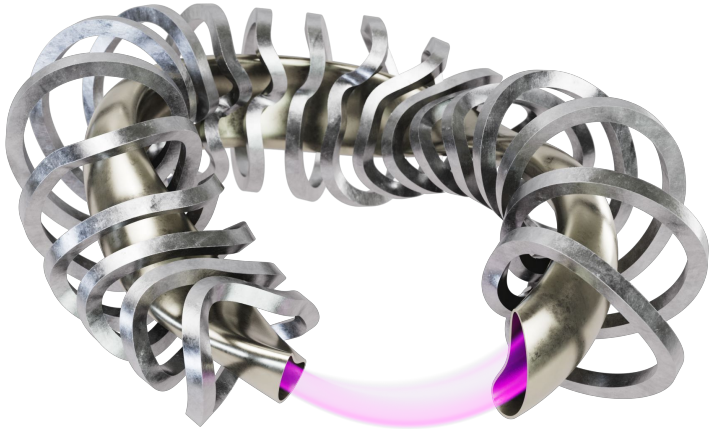


HTS magnets R&D



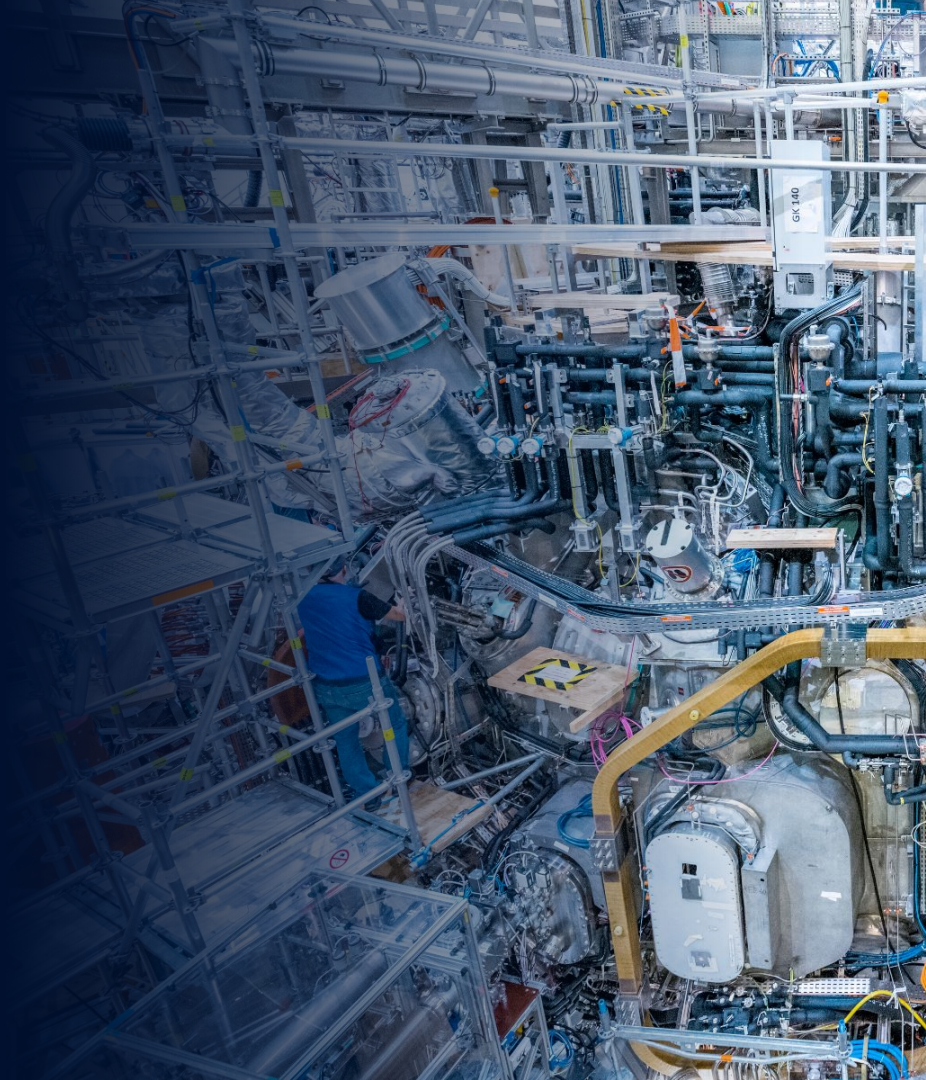
QI Stellarators Forward

- The physics basis of tokamaks and stellarators comes from decades of **international collaboration**
- Proxima intends to maintain an ***open science*** approach and is open to collaboration
  - The ***Alpha*** Q>1 stellarator will be an international research facility, as much as a milestone for commercialization
- **Tailwinds for QI stellarators** are hard to miss: computing, HTS, advanced manufacturing … with physics maturity.
- Greater focus in **public research is needed on low TRLs** – tritium, blankets, materials – to maximize commercial viability

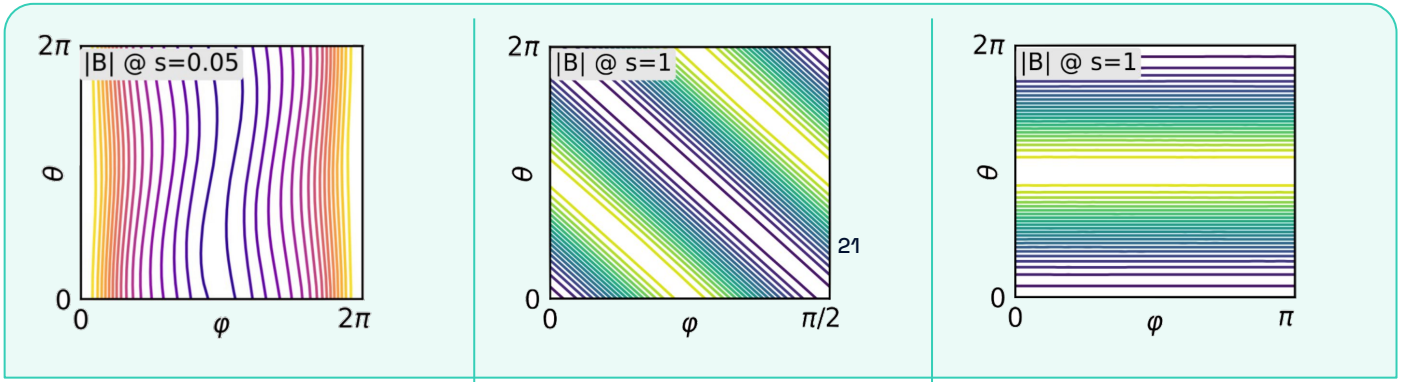


Proxima Fusion

Clean energy, for good



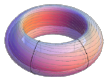
Tokamaks and stellarators: *not so far apart*



Quasi-Isodynamic (QI) Stellarator

Quasi-Helical (QH) Stellarator

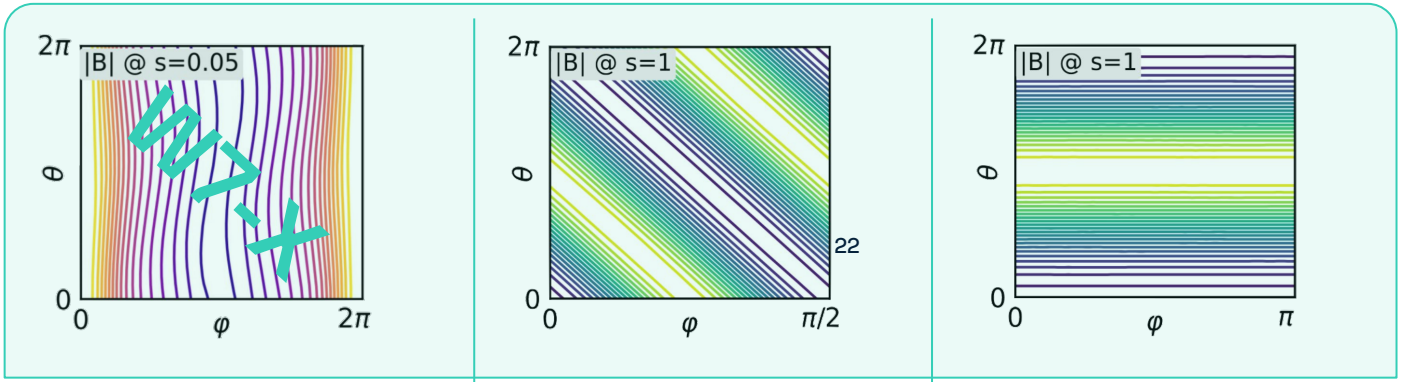
Quasi-Axial (QA) Stellarator



(Axially Symmetric) Tokamak

Boozer Coordinates

Tokamaks and stellarators: *not so far apart*



Quasi-Isodynamic (QI) Stellarator

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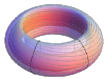
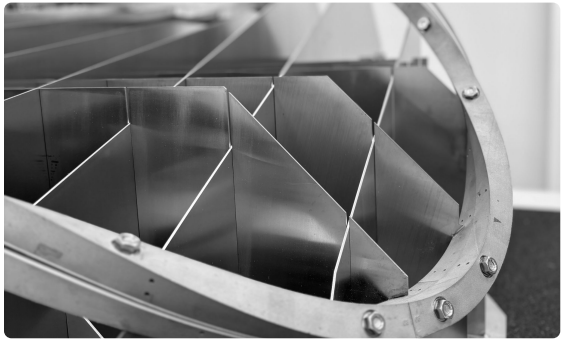


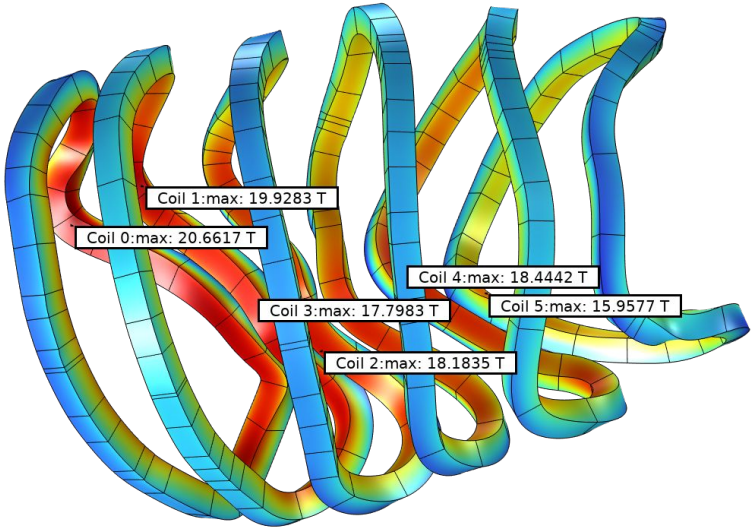
(Axially Symmetric) Tokamak

Boozer Coordinates

Milestone:
The Stellarator Model Coil (SMC)

In 2027, we will complete a stellarator magnet with >100 MJ energy.





Fusion power scales strongly with magnetic field (B):

$$P_{fusion} \sim B^4$$

Increasing B from 2.5T (W7-X) to 9T (Stellaris) gives ~170x power!

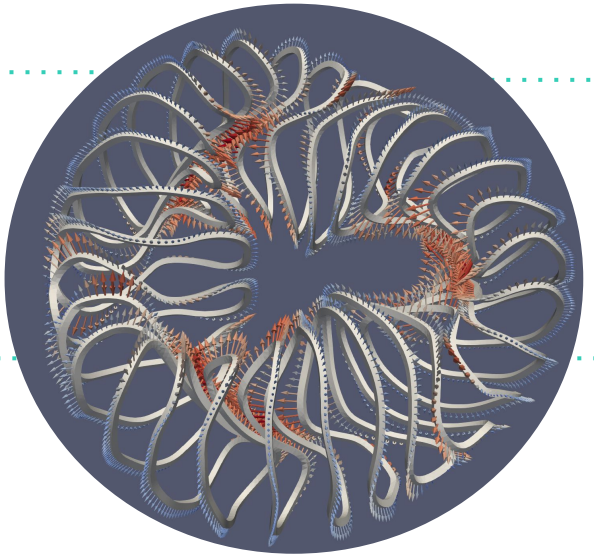
Key advantages of QI stellarators with modular coils

No I_p-driven disruptions

Today, disruptions are “fine”
Tomorrow, intolerable

No I_p-driven limits

Higher density than tokamaks, only power balance constraints



Continuous operation

Lower material fatigue & better energy market fit

Lower recirculating power

No central solenoid, no PF coils, less effort on control

Stellarators look hard, but once you dig in… they are simpler than tokamaks overall.