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a faster way to fusion

Strategies and Expectations for the 2020s

Jonathan Carling

CEO

Tokamak

My fusion pedigree

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Our strategy

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Add two key technologies

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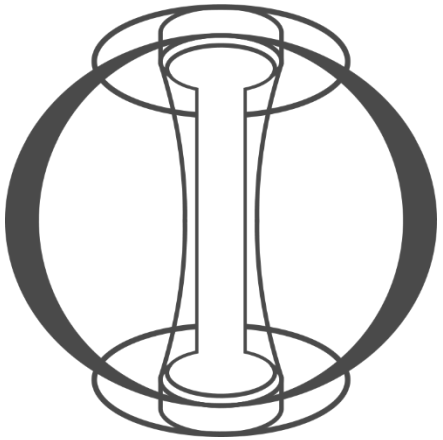
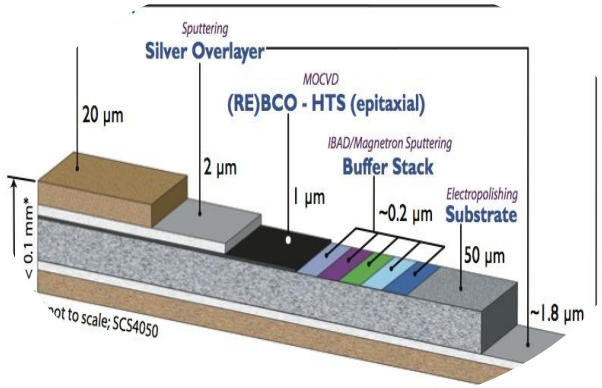
Spherical Tokamak
Squashed shape
Highly efficient

High Temperature Superconductors
High current at high field





Fusion Power

Smaller, Cheaper, Faster...

... With Distinct Competitive Advantage

Push the pace

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Private funds

Compact devices

Start-up culture

Grown-up capability

Magnets and Plasma in //

Diverse talent

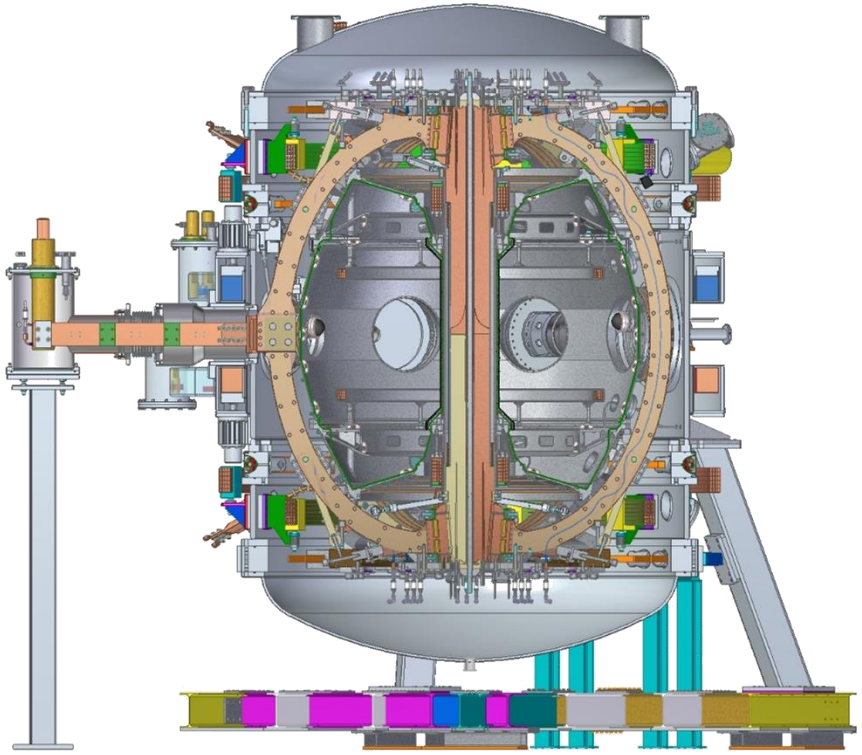
Learn from others

Collaborate

Innovate & Industrialise in //

2013

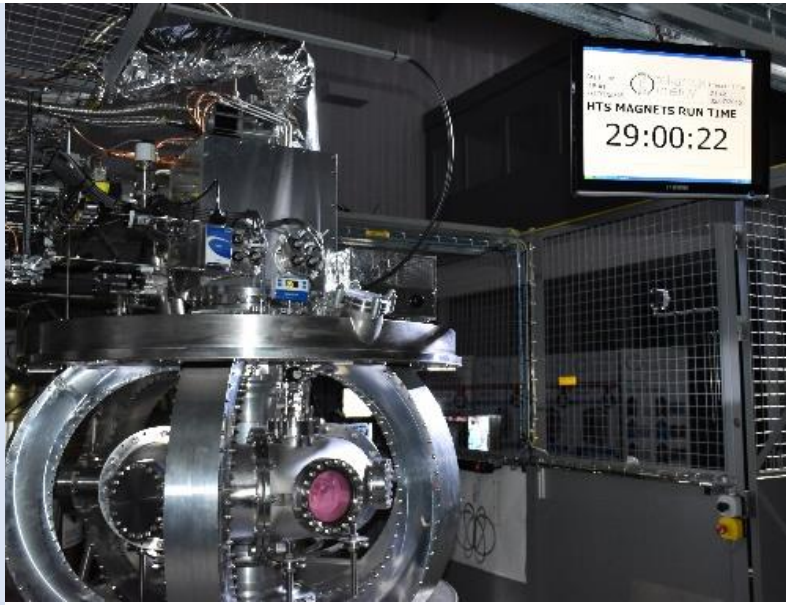
ST25: Working prototype with copper magnets



2015

ST25 (HTS):
First HTS tokamak - all high temperature superconducting magnets

Continuous plasma for 29 hours



2017

ST40: First high field spherical tokamak (3T+)

Build & test fast

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KeV plasma 16 weeks later

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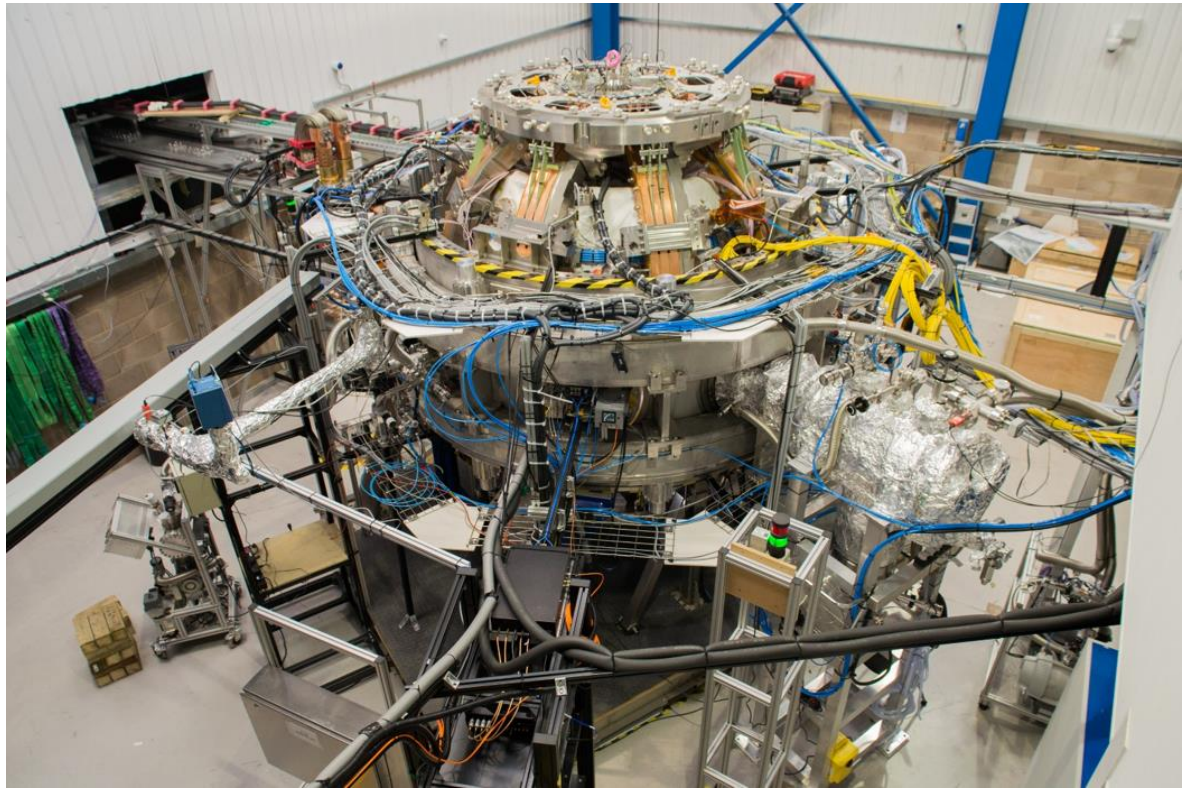
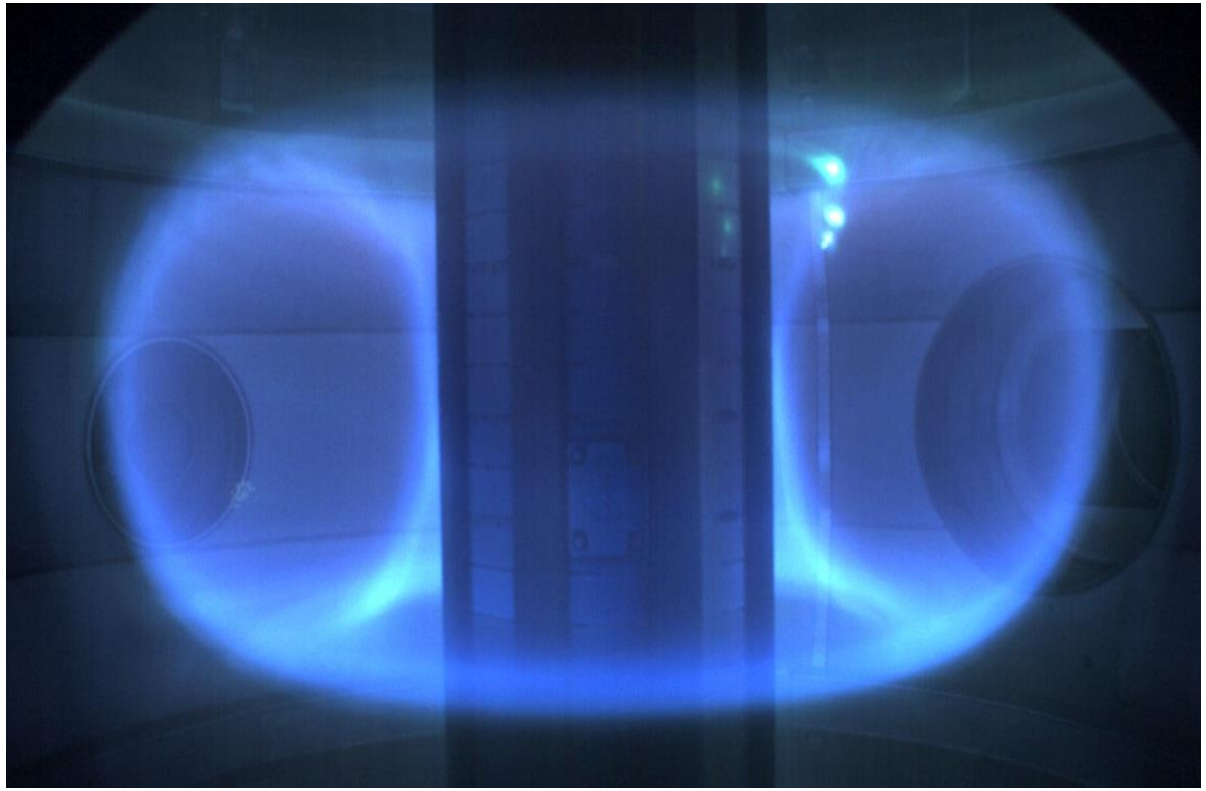


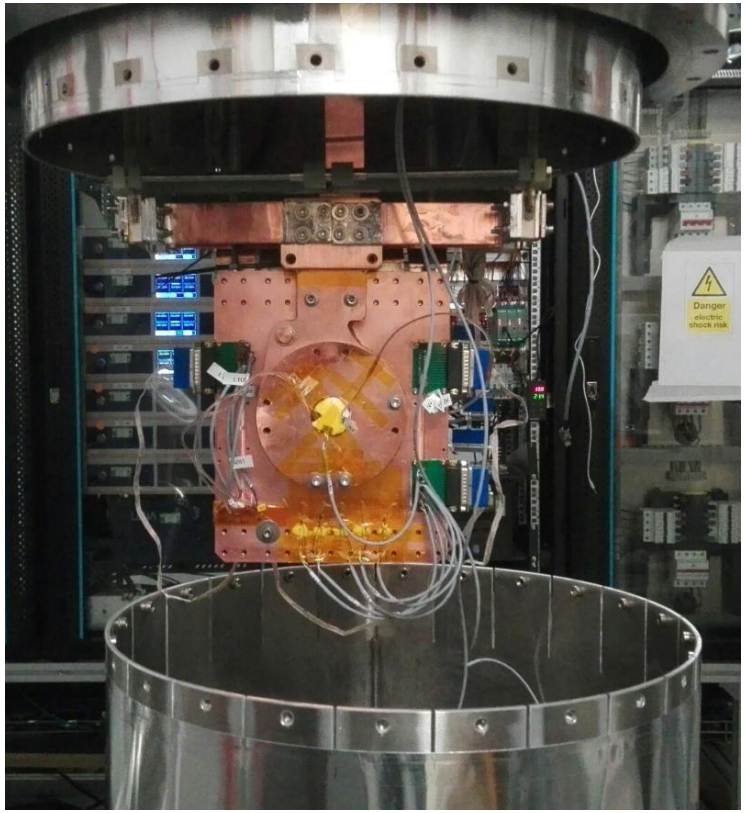


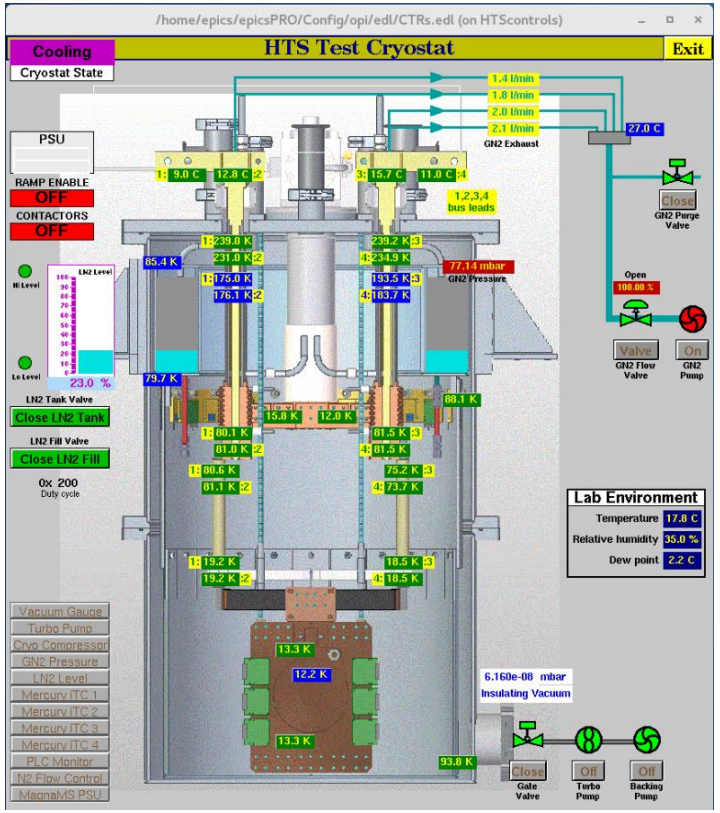
2019 ST40

New central column - solenoid
NBI heating (First 1 MW delivered)
Enhanced diagnostics
New and upgraded power supplies
Activate magnet cryogenic cooling

Goal: 8-9 KeV High Field ST plasma

Magnet lab also re-located





25+ global patent families

The way forward

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2018-2021

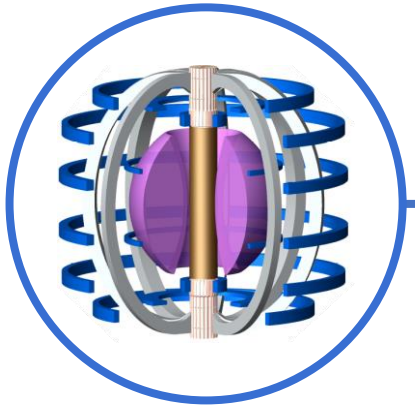
ST40

Copper Magnets

15 M & 100M degrees

Approach energy gain conditions

2021

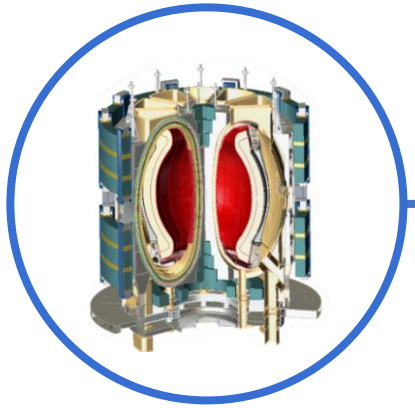


HTS Magnet Demo

Large scale HTS magnet

Validate magnet design and construction

2025



ST-F1

Fusion Power Demonstration

All HTS Magnets

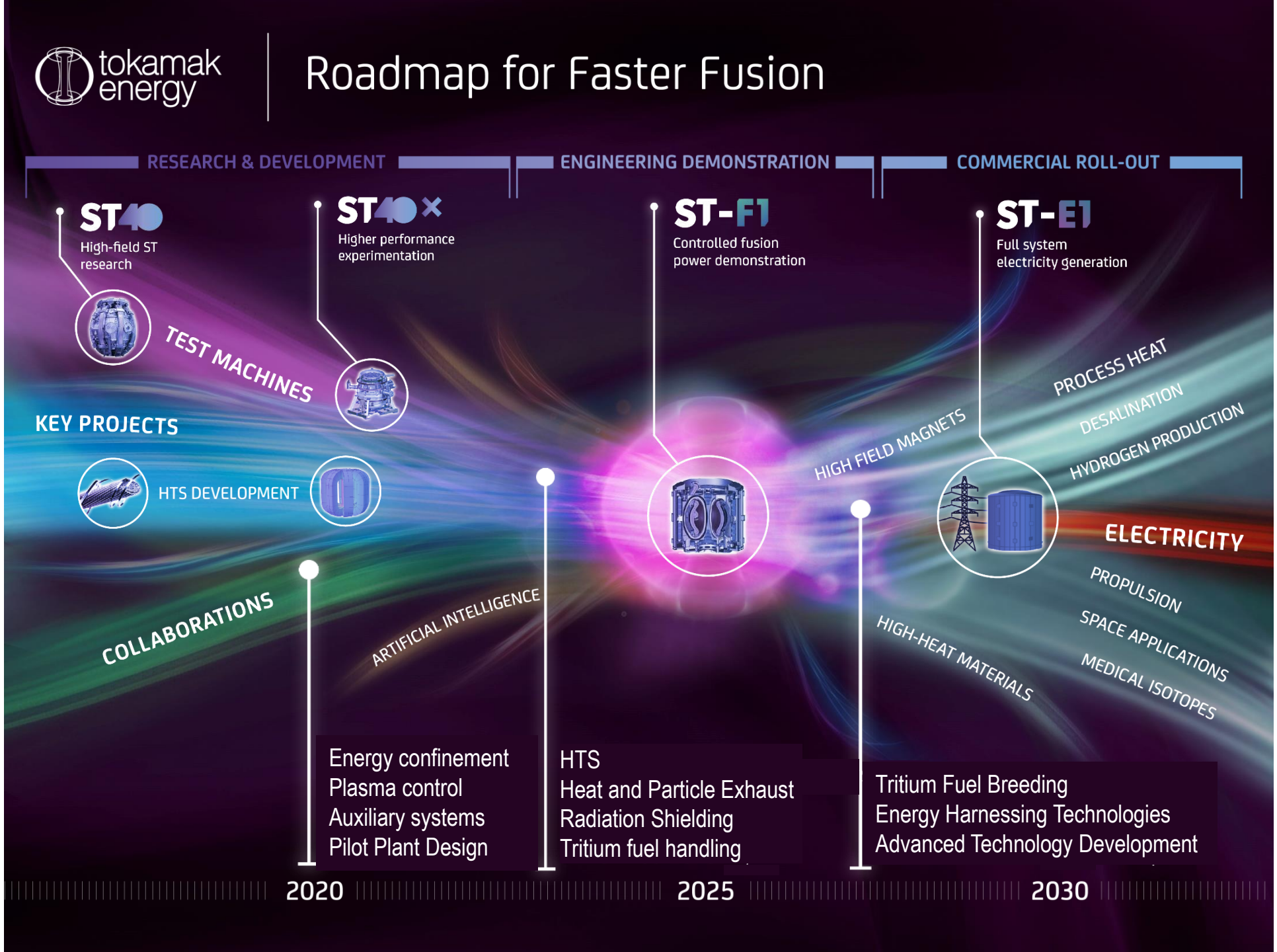
Industrial scale heat production

2030+

ST-E1

Commercial scale module

Electricity production (to the grid)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Roadmap for Faster Fusion
RESEARCH & DEVELOPMENT
ENGINEERING DEMONSTRATION
COMMERCIAL ROLL-OUT
ST40
High-field ST research
ST40×
Higher performance experimentation
ST-F1
Controlled fusion power demonstration
ST-E1
Full system electricity generation
TEST MACHINES
KEY PROJECTS
HTS DEVELOPMENT
COLLABORATIONS
ARTIFICIAL INTELLIGENCE
HIGH FIELD MAGNETS
HIGH-HEAT MATERIALS
PROCESS HEAT
DESALINATION
HYDROGEN PRODUCTION
ELECTRICITY
PROPULSION
SPACE APPLICATIONS
MEDICAL ISOTOPES
Energy confinement
Plasma control
Auxiliary systems
Pilot Plant Design
HTS
Heat and Particle Exhaust
Radiation Shielding
Tritium fuel handling
Tritium Fuel Breeding
Energy Harnessing Technologies
Advanced Technology Development
2020
2025
2030

Strong themes we expect in 2020s

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‘Pull’ on pace

Private investment

Government labs’ success

Competition

Collaboration

HTS = mainstream

Technology gap closures

B>20T

Regulation

Multiple devices @ Q>>1

Virtual design & sim

Industrialisation

Different supply chain

Lifecycle Cost Engineering

Design for serviceability

PD process

Advanced quality planning

Summary

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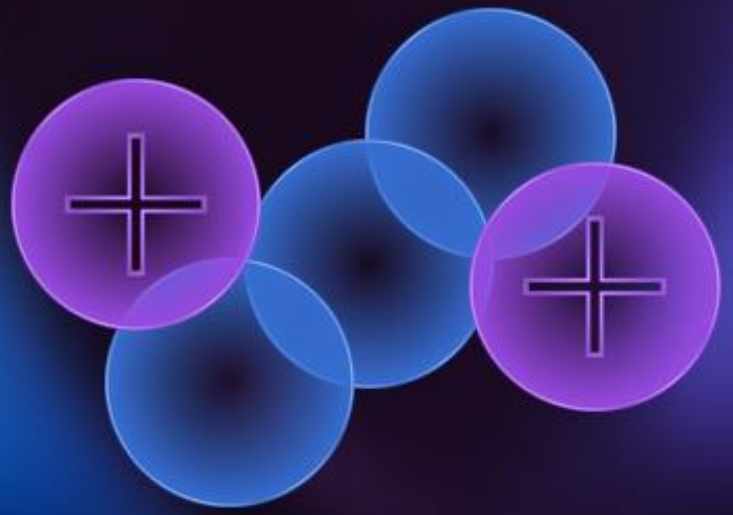
We have many serious challenges in common

Private fusion can bring more than just money to the table



Let's collaborate!