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# An update on the UK fusion programme

Ian Chapman

# Government is backing fusion development

“The UK Government’s strategy to move from a fusion science superpower to a fusion industry superpower..

Overarching goals of the fusion strategy:

1. For the UK to demonstrate the commercial viability of fusion by **building a prototype fusion power plant in the UK**

2. For the UK **to build a world-leading fusion industry which can export fusion technology** around the world in subsequent decades”

Department for Business, Energy & Industrial Strategy

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Towards Fusion Energy

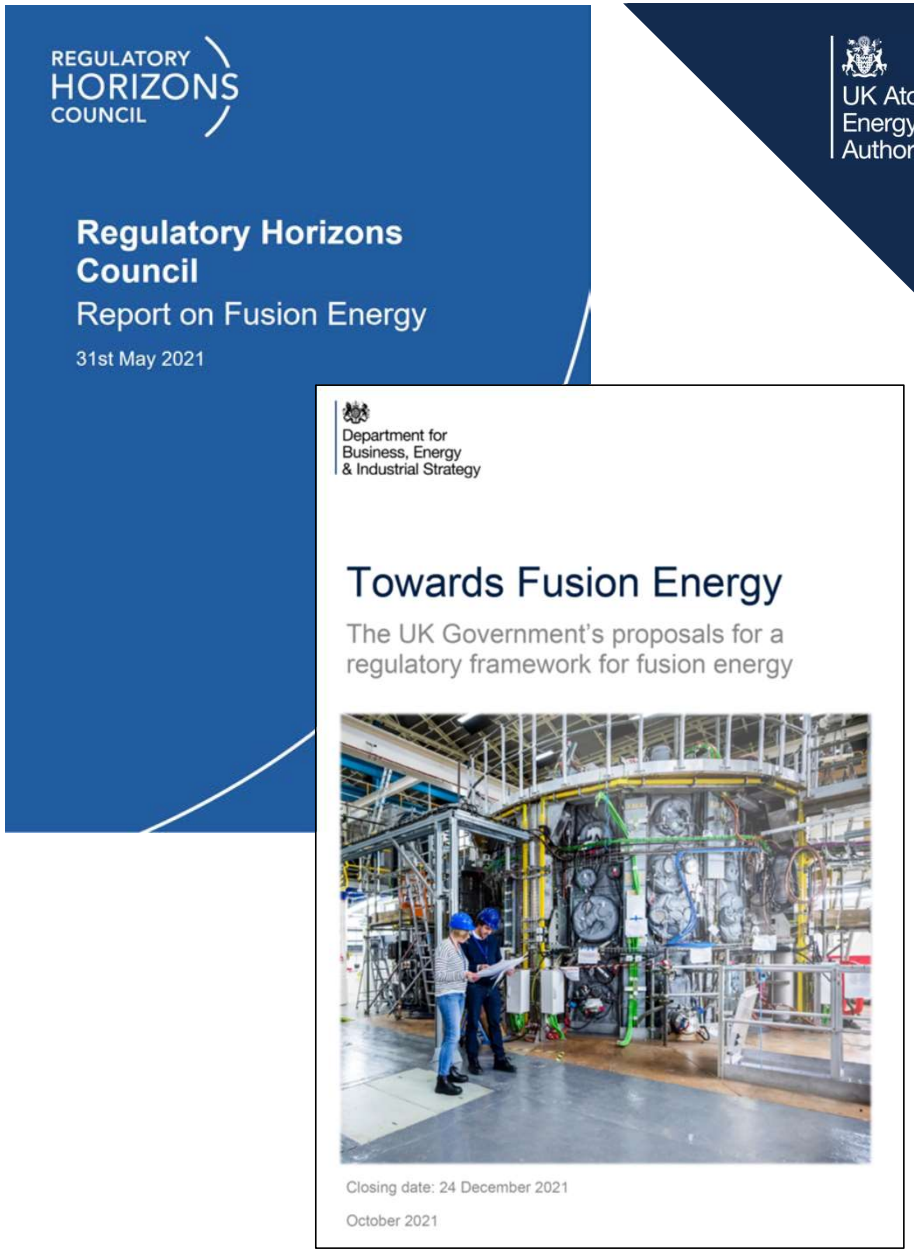
The UK Government’s Fusion Strategy


October 2021

# Fusion regulation

"The RHC recommends that the **UK champions the way for a non-fission approach**, by setting out and consulting on a bold, forward-looking vision of how HSE and EA could lead and evolve the regulatory approach for STEP"

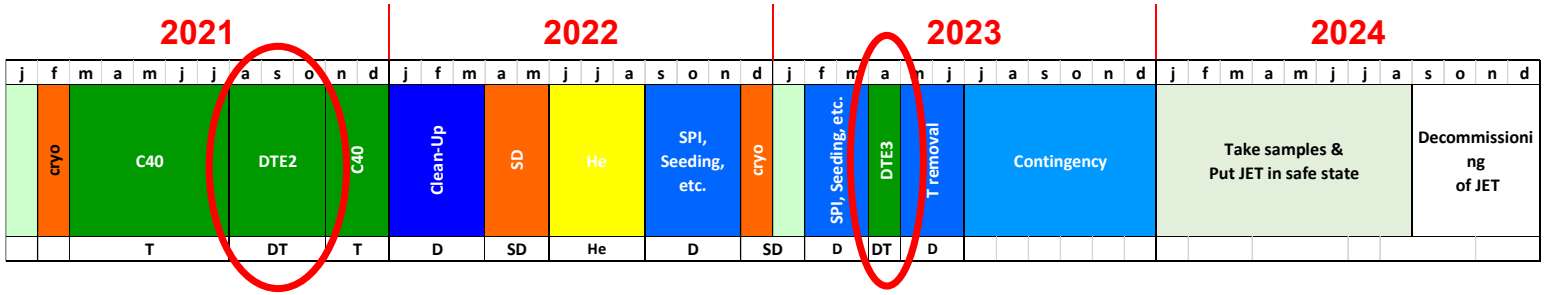
George Freeman (Minister for Science) – "We want to **trailblaze a proportionate and pro-innovation approach** and collaborate internationally to maximise fusion's long-term global potential. With this plan, the UK hopes to lead the world on fusion regulation and enable the safe and rapid development of [fusion]"

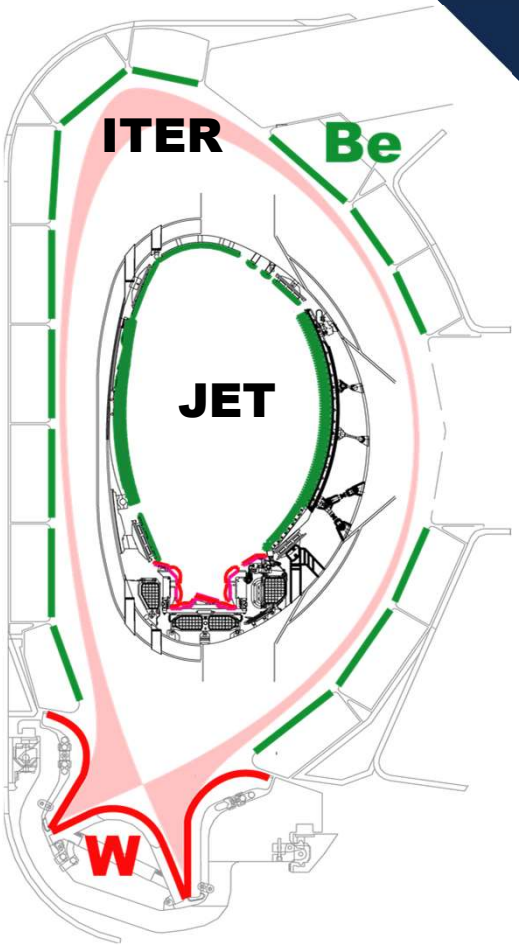


# Exciting time at JET

- Last year JET set a new world record for fusion neutrons produced in deuterium only
- We are nearing completion of D-T operation for the first time since 1997 in preparation for ITER

- Operation until 2023, then begin a high-innovation decommissioning programme over next ten years



# JET Update

- **15th PINI successfully exchanged** and final cycle of DT campaign now underway where we are pushing for max performance
- EUROfusion and European Commission have **congratulated the whole team on the provisional DT results so far**.
- Release of results to the public **currently embargoed** but a number of **press events planned for early 2022**

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# Winner of the RAEng Major Project Award for 2021


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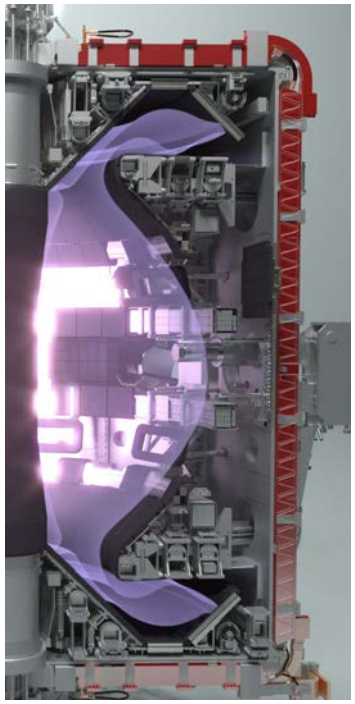
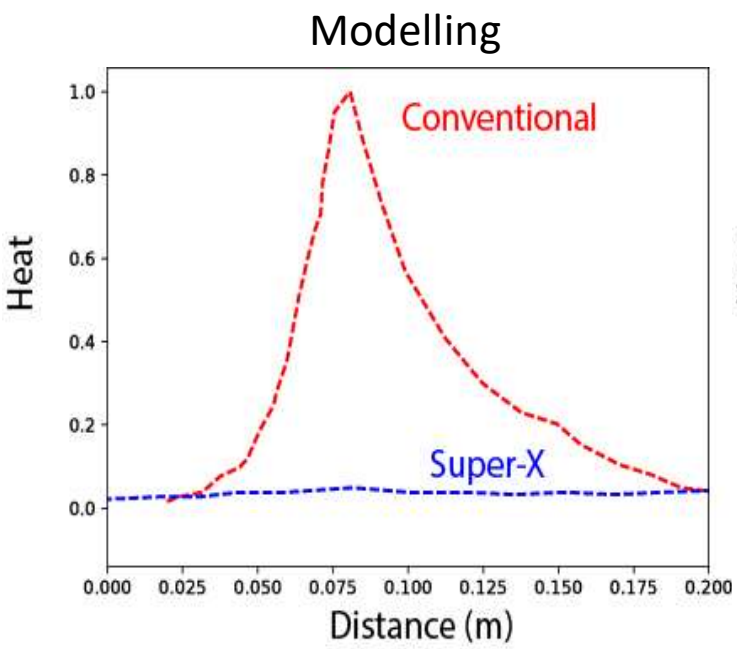
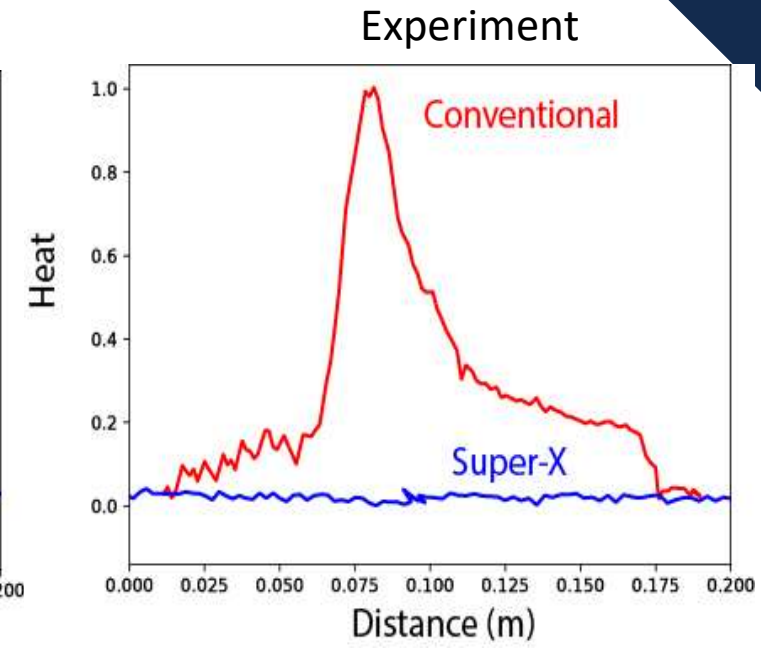
# Reduced heat by more than 10 times



Conventional Super-X




Predicted more than 10 times reduction now shown in experiments

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# Thermal Hydraulics Testing

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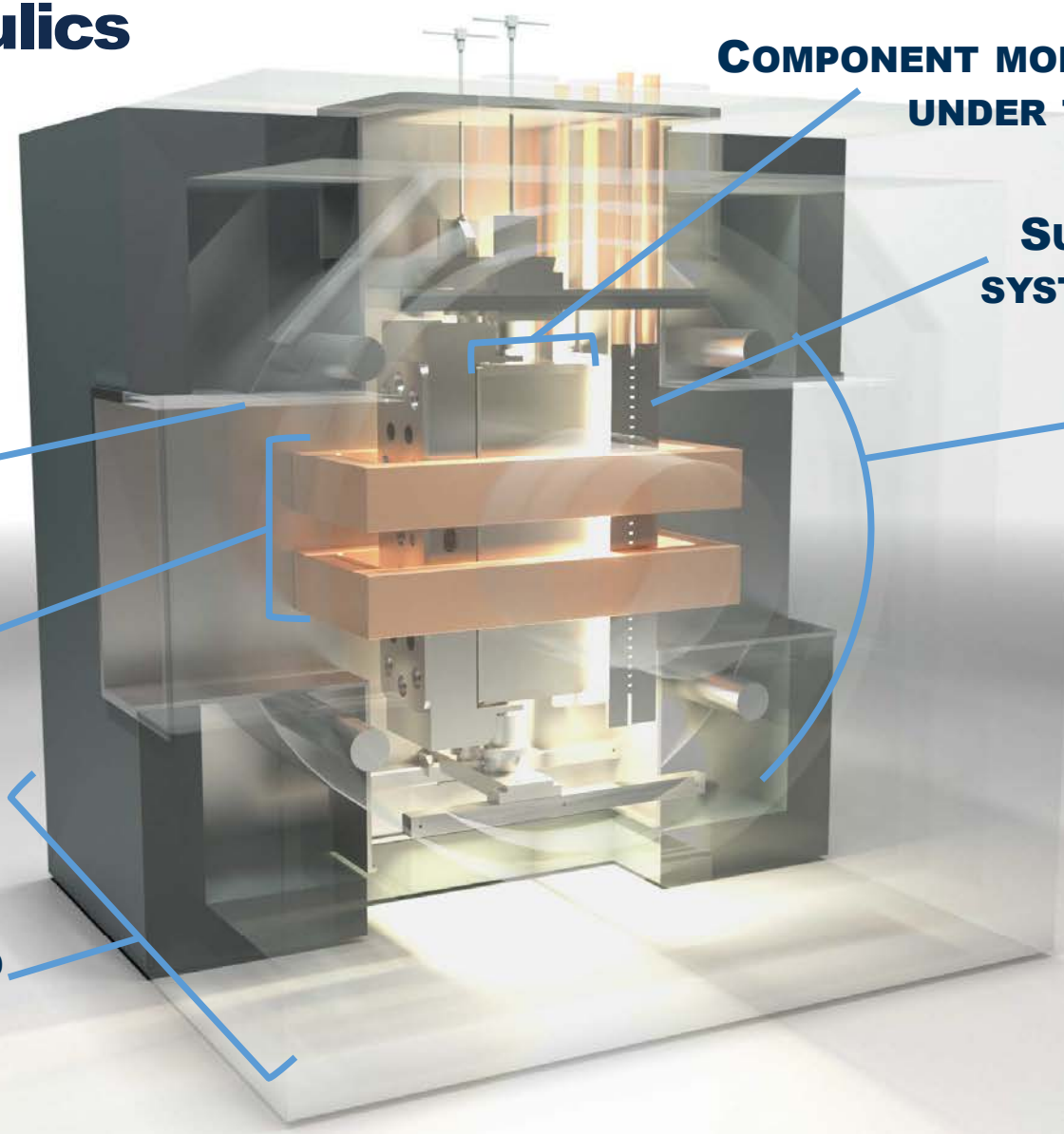

COMPONENT MODULE UNDER TEST

SURFACE HEATING SYSTEM (0.5 MW/m²)

4 TESLA NbTi SUPERCONDUCTING MAGNET + IRON CORE

VACUUM TEST CHAMBER

PULSED MAGNET COILS
0.5 Tesla in 40 ms

MAGNETIC YOKE AND SHIELD

# CHIMERA – Due for completion in 2022

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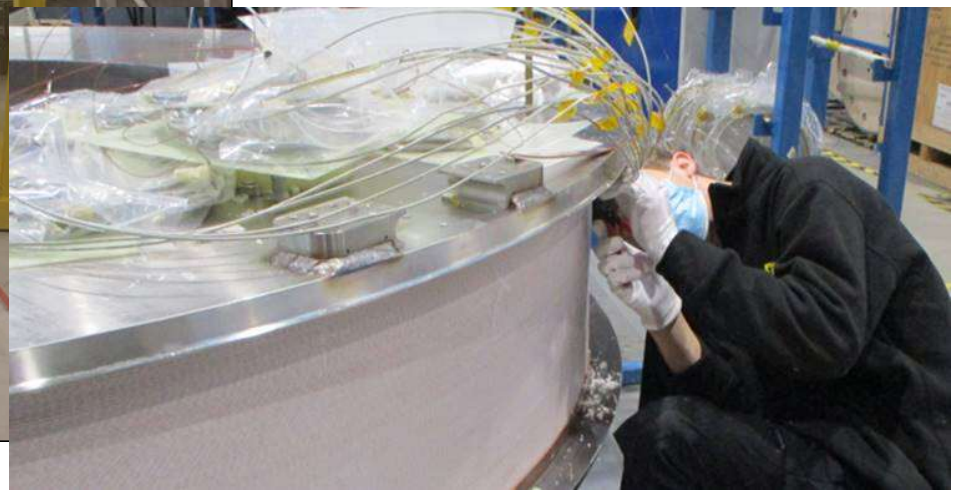

# The largest tritium research facility in the world

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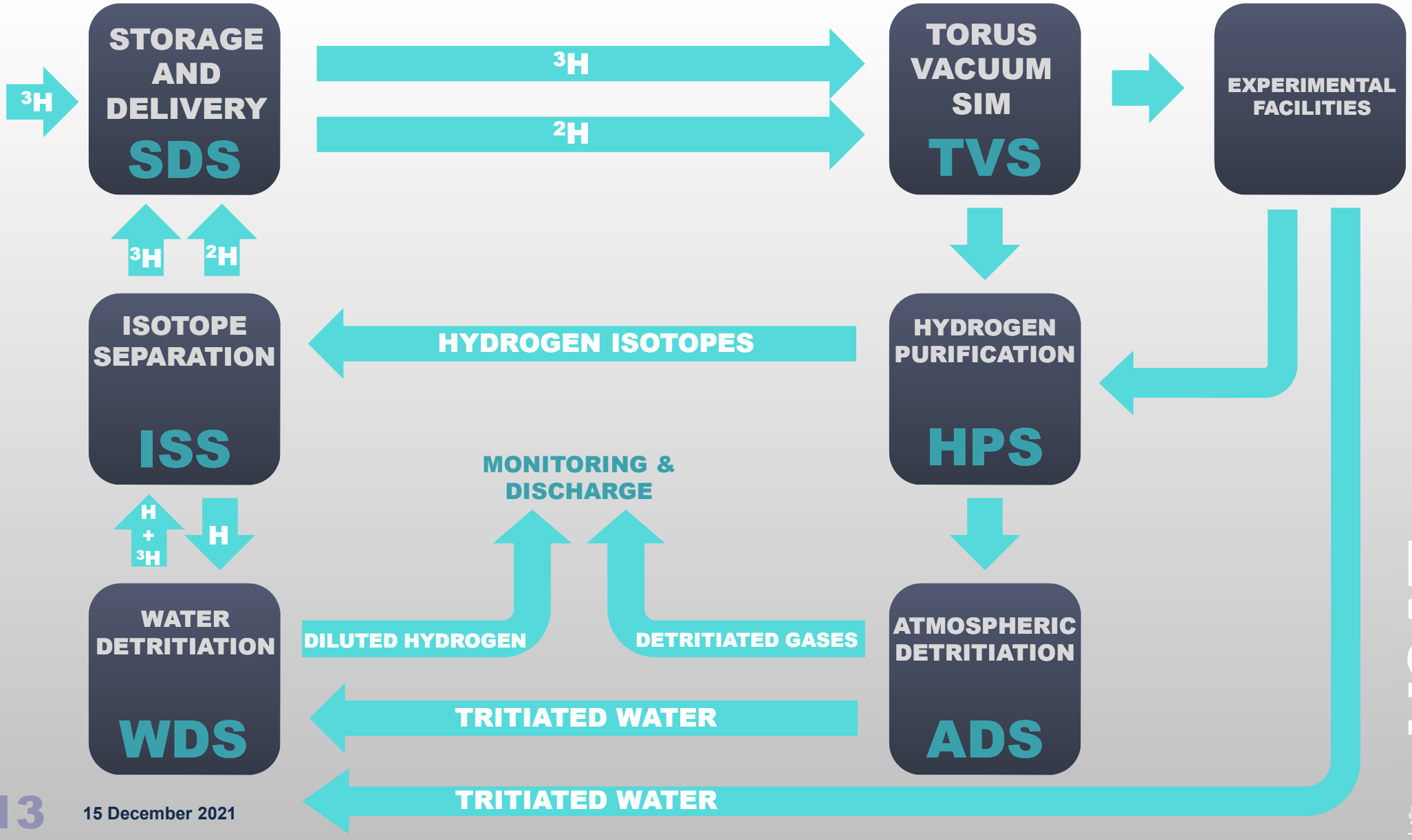

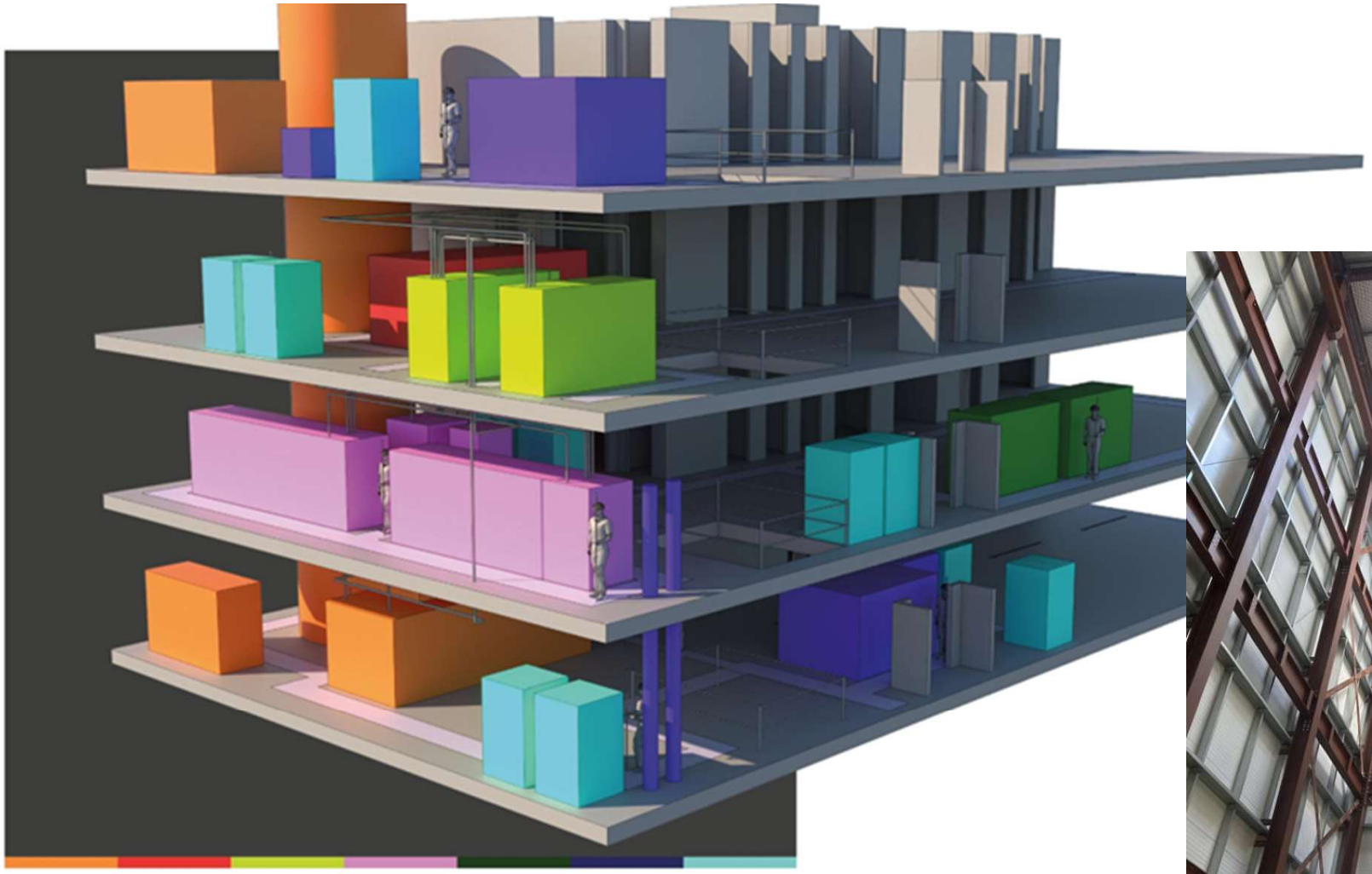

Isotope Separation System (ISS)
Storage and Distribution (SDS)
Torus Vacuum Simulation (TVS)
Hydrogen Purification System (HPS)
Analytical System (ANS)
Water Detritiation System (WDS)
Electrical and Control Panels (ECP)

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RACE

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# Remote Applications in Challenging Environments



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# £20M extension to Materials Research Facility

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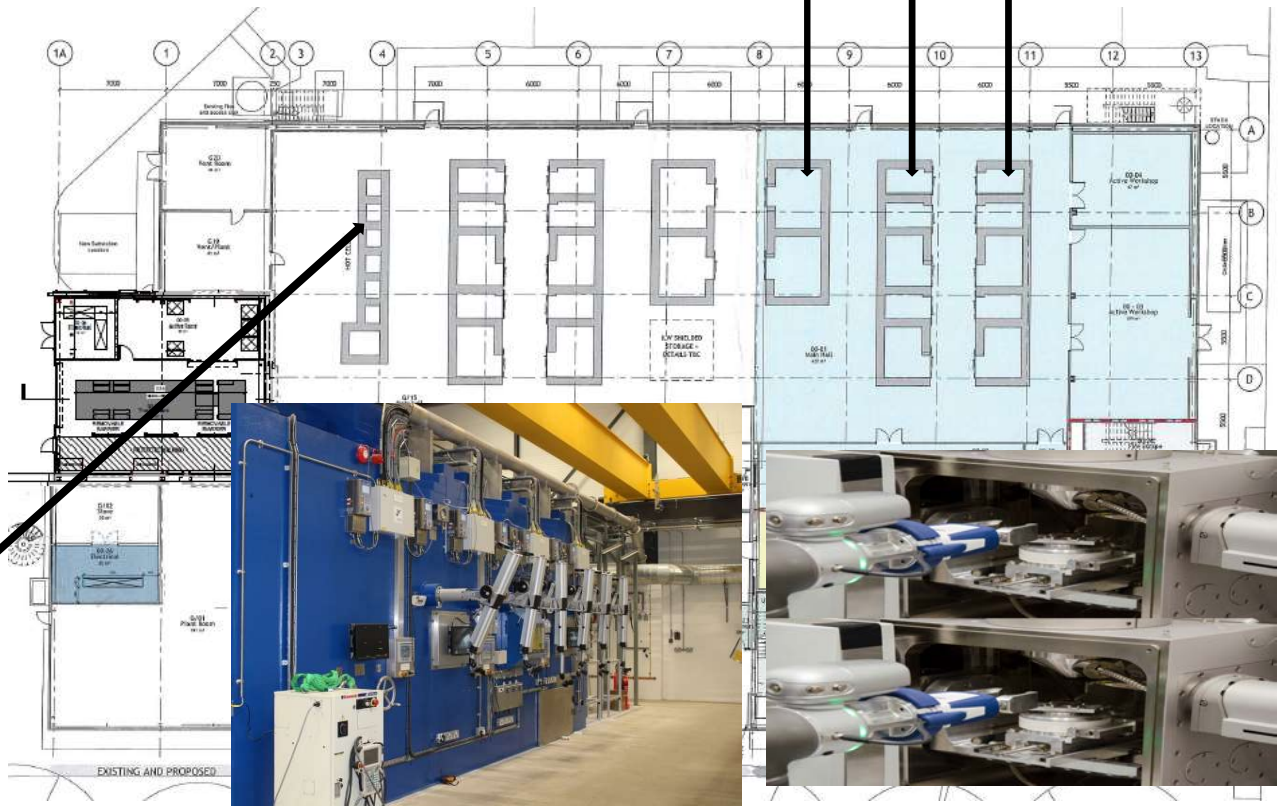
2200m$^2$ doubled to 4400m$^2$ with future proofed power supplies and increased active ventilation capability

New research rooms with a significant new suite of instruments (transmission electron microscope, plasma FIB etc) funded via £9m new awards to analyse samples up to 3.75GBq at small scales




Hot cells will be extended to allow meso-scale testing of mechanical properties up to 3.75TBq

# Spherical Tokamak for Energy Production – STEP

- Predictable net electricity production
- Lower capital cost than other fusion power plant designs
- £220M investment for concept design by 2024


# STEP progress

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Design on track. Decided preferred concept

290 industrial partners on the project

Siting process will conclude next year

# Developing a fusion cluster…

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# Fusion Industry Programme

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The challenge scheme winners are:

University of BRISTOL

cage capture

GENCOA

MANCHESTER 1824 The University of Manchester

Full Matrix

assystem

Digital

CAE TECH

is-instruments

Tritium

first light

AQSorption

IDOM

Hybird Ltd

Jacobs

CRA risk analysis

SLINGSHOT SIMULATIONS

# UK fusion is moving at pace

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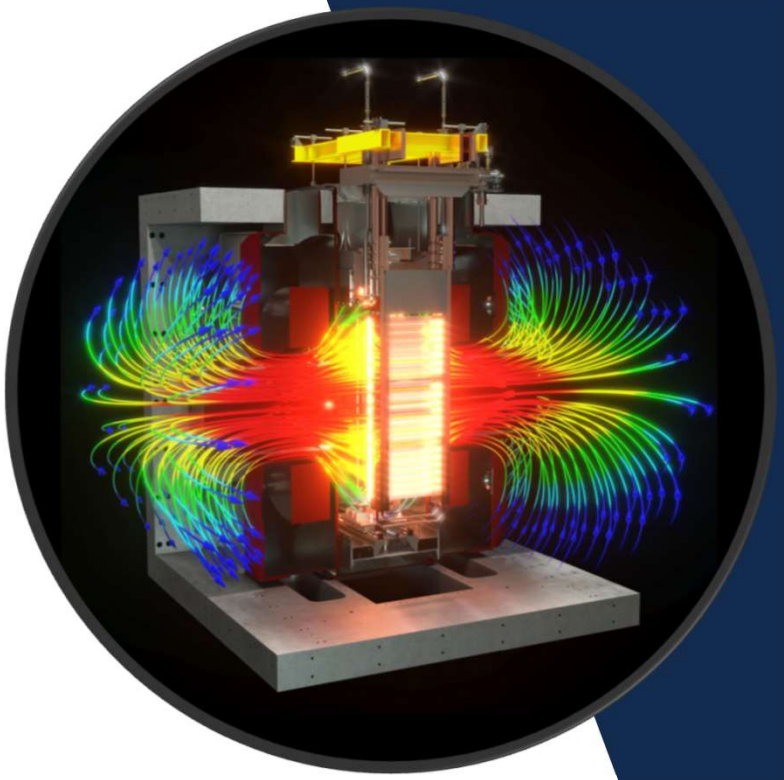

- Government published first ever fusion strategy including regulation consultation
- Major advances this year: JET D-T, MAST-U results; new facilities
- STEP progressing on track. Concept design by 2024
- Growing fast – now ~2500 people
- Major collaboration with industry and likely to see increasing support for this