

Program Plan for Fusion Energy Sciences: Roadmap of Objectives and Performance Targets

2006

2008

2010

2012

2014

2016

Burning Plasma

● The Department's role in the ITER is established (2005) **INTL**

○ Demonstrate progress in developing a predictive capability for key aspects of burning plasmas using advances in theory and simulation benchmarked against a comprehensive experimental database of stability, transport, wave-particle interaction, and edge effects. (2015)

Initiate experiments on the National Ignition Facility (NIF) to study ignition and burn propagation in IFE relevant fuel pellets (2012) **NNSA**

Fundamental Understanding

Achieve a fundamental understanding of tokamak transport and stability in pre- ITER plasma experiments (2009)

Evaluate the process affecting the transport of petawatt laser energy in dense plasmas (2009) **NNSA**

Create and measure properties of high energy density plasmas using intense ion beams, dense plasma beams and lasers (2012)

Major aspects relevant to burning plasma behavior observed in experiments prior to full operation of ITER are predicted with high accuracy and are understood (2015)

○ Demonstrate progress in developing the fundamental understanding and predictability of high energy density plasma physics, including potential energy producing applications. (2015) **NNSA**

Configuration Optimization

Achieve long-duration, high-pressure, well-confined plasmas in a spherical torus sufficient to design and build fusion power-producing Next-Step Spherical Torus (2008)

Demonstrate use of active plasma controls and self-generated plasma current to achieve high-pressure/well-confined steady-state operation for ITER (2008)

Evaluate the ability of the compact stellarator configuration to confine a high temperature plasma (2012)

○ Demonstrate enhanced fundamental understanding of magnetic confinement and in improving the basis for future burning plasma experiments through research on magnetic confinement configuration optimization. (2015)

● Advance plasma science and computer modeling to obtain a comprehensive, and fully validated, plasma configuration simulation capability. (2020)

Materials, Components, & Technologies

Start production of superconducting wire needed for ITER magnets (2006)

Deliver to ITER for testing the blanket test modules needed to demonstrate the feasibility of extracting high temperature heat from burning plasmas and for a self-sufficient fuel cycle (2013) **BES**

Future Facilities (Cross cut and support multiple objectives and targets):

ITER: construction begins for this international collaboration to build the first fusion burning plasma experiment capable of a self-sustaining fusion reaction. (2006) **INTL**

Next-Step Spherical Torus (NSST) Experiment: construction begins to test the spherical torus, an innovative concept for magnetically confining a fusion reaction. (2010)

ITER: operation begins. (2014) **INTL**

NSST: operation begins (2016)

Integrated Beam Experiment (IBX): Begin construction of an intermediate-scale experiment to understand how to generate and transmit the focused, high energy ion beam needed to power an IFE reaction (2013)

Interdependencies: (Descriptions)

Broadly with **ASCR** on computational developments, both hardware and software, affecting all facets of basic research and advanced instrumentation.

BES =with **BES** on nano-designed materials

NNSA =with **NNSA**

INTL =with international community on ITER

● =Key Intermediate Objective from DOE Strategic Plan
○ =Long Term Success Measure from PART

This timeline is for planning purposes only and does not constitute financial or contractual commitments by the Federal Government.

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