INFUSE 2020b Award Notification

Company: Commonwealth Fusion Systems, DUNS: 117005109

Title: Time-Dependent Boundary Modeling to Inform Design of SPARC Diagnostic and Actuators

Abstract:

In order to inform near-term design and enable future advanced control, CFS is looking to obtain modeling of the time-dependent boundary plasma behavior it can expect in SPARC. This will be used to test plasma response to various actuator designs provided by CFS and as inputs to synthetic diagnostic modeling to inform design decisions. This activity requires laboratory assistance because of the complexity of performing boundary plasma simulation that can accurately capture plasma, neutrals and their dynamic, self-consistent behavior. This is not a present capability of CFS or a capability that is commercially available, but is one that DOE maintains and improves as part of its Fusion Energy Sciences mission.

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Laboratory: ORNL

Lab PI: Dr. Jeremy Lore, lorejd@ornl.gov

INFUSE 2020b Award Notification

Company: General Fusion Corp., DUNS: 117111477

Title: Ion Temperature Diagnostic Improvement

Abstract:

This project is to improve General Fusion's ion temperature diagnostic for fusion plasmas. An accurate, time- and spatially-resolved measurement of ion temperature will enable experimental confirmation of fusion reaction rates.

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INFUSE Innovation Network for Fusion Energy

November 25, 2020

INFUSE 2020b Award Notification

Company: Princeton Fusion Systems, LLC, DUNS: 0020074970

Title: Magnetic Field Vector Measurements Using Doppler-Free Saturation Spectroscopy

Abstract:

A non-perturbative diagnostic will be deployed to measure the topology of the equilibrium magnetic field in the PFRC-2 device at PPPL. The diagnostic implements Doppler-free saturation spectroscopy to obtain a 2D high-resolution, spatially resolved, measurement of the H_α spectral line profile.

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Laboratory: PPPL

Lab PI: Dr. Samuel Cohen, scohen@pppl.gov

INFUSE 2020b Award Notification

Company: Magneto Inertial Fusion Technologies, Inc, DUNS: 065262557

Title: Staged Z-pinch modeling with HYDRA and CHICAGO codes

Abstract:

The Staged Z-pinch (SZP) fusion concept is a magneto-inertial compression scheme where small amounts of fusion fuel (pure deuterium gas, or a mixture of deuterium and tritium gas) are brought to fusion relevant conditions by passing multi-million amperes strong current through a cylindrical shell of high atomic number material. Modeling with the MACH2 code suggests that net fusion energy gain can be achieved when currents in the 10 million amperes range compress a 50%-50% mixture of deuterium and tritium gas. In this project various SZP configurations will be explored with the HYDRA and CHICAGO codes through collaboration with the Lawrence Livermore National Laboratory. HYDRA is a radiation-magnetohydrodynamic code, similar to MACH2, while CHICAGO is a particle-in-cell code which is suitable for a more realistic treatment of the alpha particle heating. Of particular interest are models for high current machines. The ultimate project goal is to provide independent confirmation of net fusion energy gain from the Staged Z-pinch.

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Laboratory: LLNL

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INFUSE 2020b Award Notification

Company: Renaissance Americas, Inc, DUNS: 065262557

Title: Innovative Joints for High-Temperature Superconducting Tapes

Abstract:

The ability to segment HTS coils for tokamaks and stellarators is very attractive but requires joints of ultra-low resistance, well below 1 nOhm. These could be enabled by ultra-thin In-Ag solder (at BNL) between ad-hoc HTS splices (from U. Houston).

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Laboratory: BNL

Lab PI: Dr. Bill Sampson, wsampson@bnl.gov

INFUSE 2020b Award Notification

Company: TAE Technologies, DUNS: 065262557

Title: Measurement of Magnetic Field using Doppler-Free Saturation Spectroscopy (DFSS) in C-2W FRC plasma

Abstract:

In TAE Technologies' fusion approach, which requires high population of confined fast ions, Field Reversed Configuration (FRC) plasma provides an advantage due its unique magnetic field profile. In the experiment, measurement of internal magnetic field profile is important to verify the presence of the FRC and to estimate/simulate the orbit of confined fast ions. Doppler-Free Saturation Spectroscopy (DFSS) is capable of measuring Zeeman and Stark splitting with a resolution nearly three orders of magnitude when compared to conventional OES capabilities, and hence serve as excellent non-perturbative diagnostic to measure a low magnetic field.

A feasibility study conducted by ORNL in collaboration with TAE Technologies has shown that measurements of magnetic fields with an error of ± 5 Gauss may be possible to obtain in C-2W FRC plasma. In this proposal, ORNL will temporarily deploy their mobile Doppler Free Saturation Spectroscopy (DFSS) diagnostic system on TAE's C-2W FRC plasma device. ORNL will also help with the operation and data analysis of DFSS system on C-2W. The main goals of this collaboration are:

1) Validate that adequate signal-to-noise ratio (SNR) as well as temporal and spatial resolution can be achieved with DFSS in C-2W plasma.
2) Demonstrate the capability of DFSS to non-intrusively measure low magnetic fields and its direction in the core of the FRC plasma.
3) Experimentally assess the presence of a reversed magnetic field configuration inside the C-2W plasma.

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Laboratory: ORNL

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INFUSE 2020b Award Notification

Company: TAE Technologies, DUNS: 065262557

Title: Feasibility Study of High-Flux FRC Formation via Spheromak Merging for C-2W Experiments

Abstract:

This project on MRX at PPPL will allow us to assess the feasibility of new spheromak-merging high magnetic-flux FRC formation technique for C-2W NBI experiment at TAE that could further advance C-2W performance to achieve higher energy density regime.

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Laboratory: PPPL

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INFUSE 2020b Award Notification

Company: Tokamak Energy, Inc., DUNS: 117135313

Title: XGC1 predictions of Scrape of Layer width in present and future high field spherical tokamaks

Abstract:

This project aims to calculate the Scrape-Off-Layer width and the heat power deposition of present and future high field spherical tokamak reactors using the global gyrokinetic code XGC1 developed at PPPL.

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Lab PI: Dr. Choonseok Chang, cschang@pppl.gov

INFUSE 2020b Award Notification

Company: Tokamak Energy, Inc., DUNS: 117135313

Title: Fabrication and characterization of transition metal hydrides for radiation shielding in tokamak devices

Abstract:

Metal hydrides are identified as key radiation shielding materials to protect components in tokamak reactors. This project will investigate the fabrication and characterization of metal hydrides manufactured by the powder metallurgy process.

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Laboratory: LANL

Lab PI: Dr. Caitlin Taylor, caitlin@lanl.gov

INFUSE Innovation Network for Fusion Energy

November 25, 2020

INFUSE 2020b Award Notification

Company: Type One Energy Group, Inc., DUNS: 117135313

Title: Characterization and Qualification of JK2LB Alloy for Additive Manufacturing of Fusion Components

Abstract:

JK2LB is a nuclear alloy providing fast clearance for fusion components. The project provides initial characterization & qualification of JK2LB for additive manufacturing (AM). The ORNL High Flux Isotope Reactor will irradiate AM-JK2LB specimens followed by tensile & microstructural analysis.

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INFUSE Innovation Network for Fusion Energy

November 25, 2020