

PPPL capabilities available to support the U.S. fusion industry

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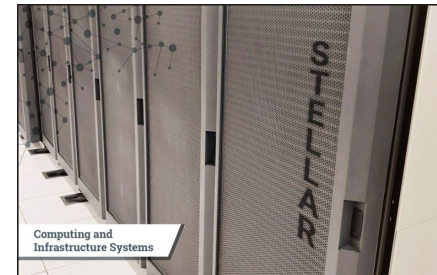
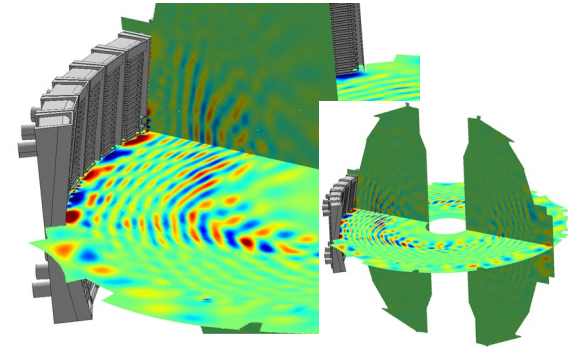
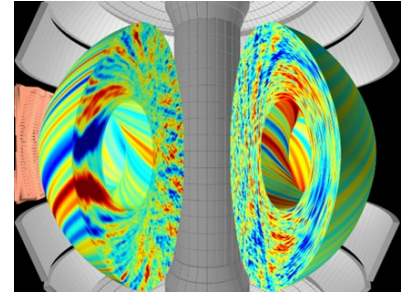


4th INFUSE Workshop
Spokane, WA
Oct. 19, 2022

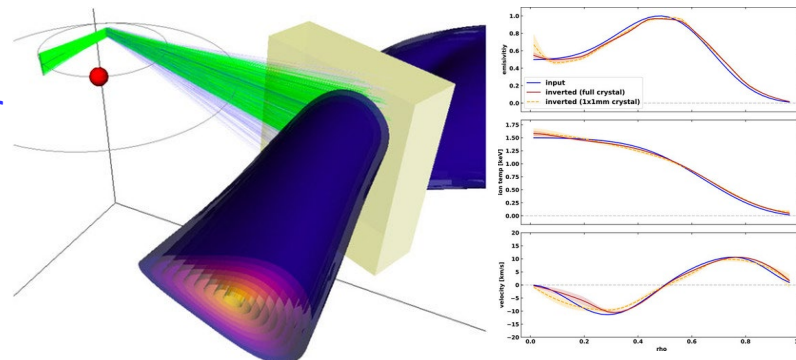
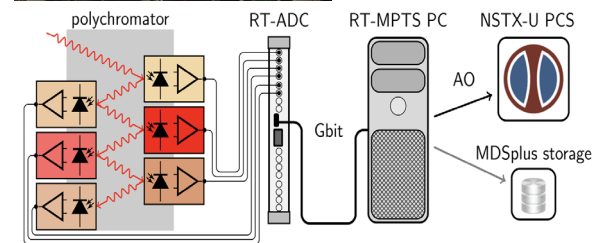


**PPPL is excited by, and committed to,
supporting private fusion companies
that will deliver commercial fusion energy**

- Comprehensive, high fidelity plasma simulation
 - MHD equilibrium & stability
 - Transport and turbulence
 - Energetic particle/alpha instabilities and transport
 - Heating & current drive
 - Boundary modeling (kinetic, fluid; atomic physics)
 - Beam, beam/plasma simulation and modeling
- Integrated plasma modeling and analysis
- Tokamak control / real-time algorithms
- Stellarator design and optimization
- Computational sciences
 - Stellar cluster and Traverse GPU cluster, with many code executables available
 - Artificial Intelligence / Machine Learning
 - Algorithm development
 - Whole device modelling and design capabilities



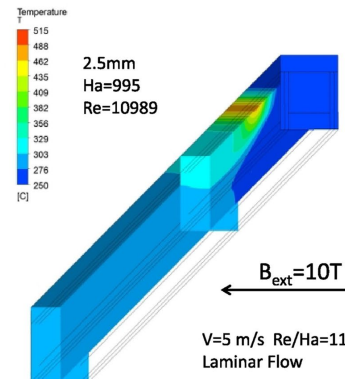
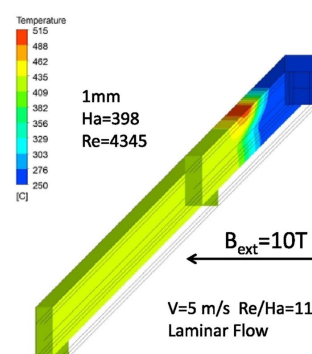
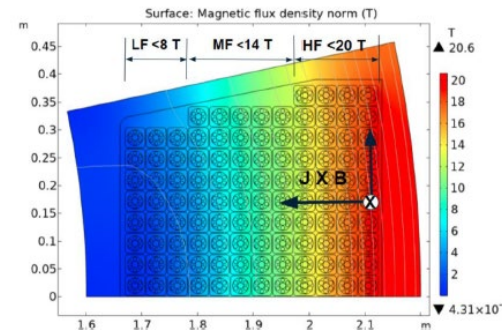
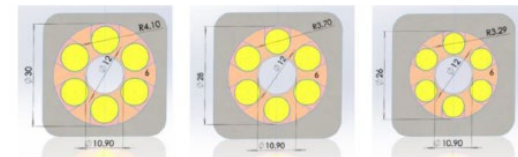
- Active spectroscopy (CHERS, ...)
- Thomson scattering
- X-ray spectroscopy
- Laser-induced fluorescence
- Reflectometry
- Magnetically-insulated probe designs for divertors and limiters
- Magnetic probe design
- Mass injection (powder, granules)
 - High-velocity electromagnetic particle injector
- ICRF antenna design and fabrication
- Neutral Beam Injection systems



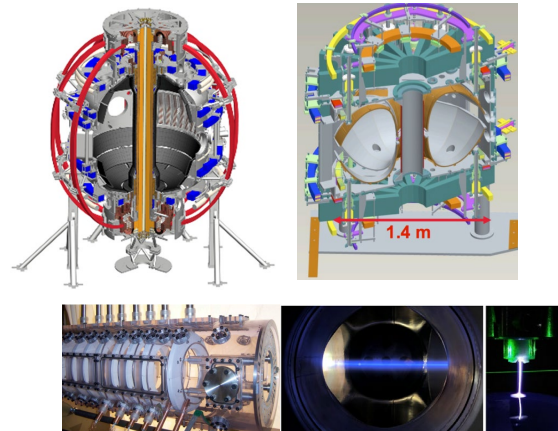
- Mechanical design and analysis
- Magnet design (normal & superconducting)
- Fusion systems engineering
- Fusion device integrated design, layout, maintenance
- ITER diagnostics leadership → diagnostics in fusion / pilot plant environment
- Pulsed power, electrical engineering systems
- Thermal / multi-physics analysis
 - Plasma facing components, liquid metals, ...

Areas of growth

- Expanding virtual engineering
- Multi-fidelity integrated fusion systems analysis



- NSTX-U science, operations, diagnostic expertise
- Lithium Tokamak eXperiment-beta
 - [Associated liquid metals handling / actuators](#)
- Liquid Metal eXperiment (LMX)
- MUSE table-top permanent-magnet stellarator
- Princeton field-reversed configuration (PFRC)-2
- [Plasma Collaborative Research Facility](#) (low temp plasma)



Future

- Princeton Plasma Innovation Center (available 2026/27 - large fusion / X-ray diagnostic development, remote collaboration and visualization center)
- FuRTH (former TFTR) test cell (*next slides*)
 - [Pulsed power, cryogenics, neutron shielding, crane, proximity to scientists/techs](#)

Formerly TFTR test cell - A unique national asset, with premier research space

- 17,000 ft² with 54 ft ceiling height
- 2 hook 110/25-ton crane
- 4 ft thick concrete walls, ceiling
- Ventilated, air conditioned, humidity-controlled
- Negative pressure

Access to:

- MG set peak pulse power 475 MVA, Power converter peak pulse capacity 1,776 MVA
- Steady-state power 30/40/50 MVA 138/13.8 kV
- LN₂: 11,000-gallon dewar
- LHe Refrigerator: 4.5 K, 700 W capable

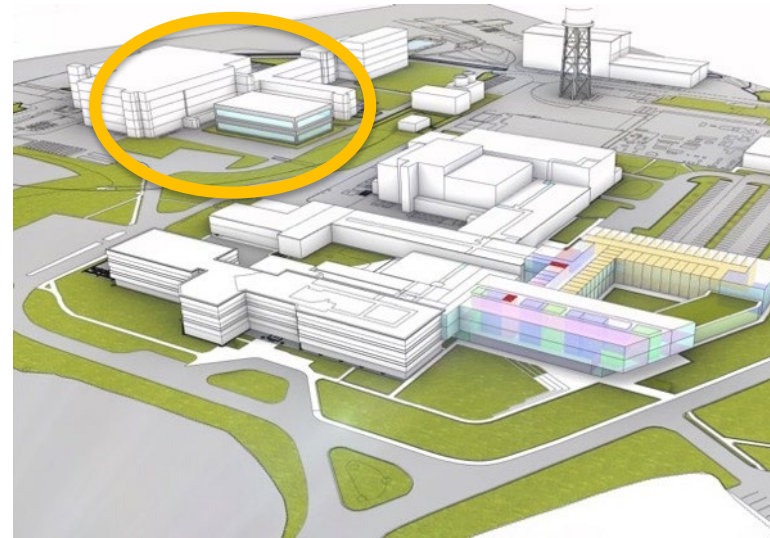


Foster the development of fusion start-up companies and other research initiatives through availability of:

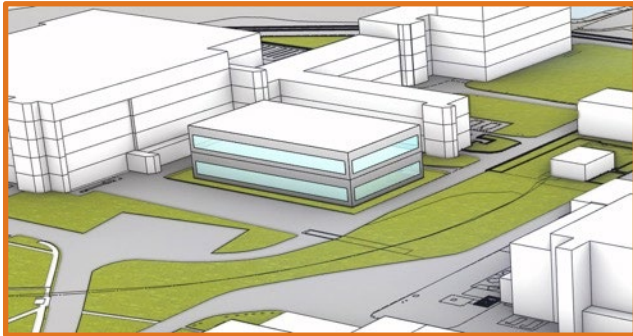
- Large, capable research space; the FuRTH Test Cell
- Unique utilities, nearby staging and technical areas
- Adjacent FuRTH collaboration/office building

Making FuRTH a reality:

- Clear out legacy tritium systems and test cell (2023)
- Build the FuRTH Collaboration building (proposal)
- Prepare test cell for public/private partnership



- Two-story building, 40,000-50,000 GSF
- Collaboration/office space
- ~\$15-19 M
- Build and occupy by FY23
- Similar low-cost construction as those built at other labs
- Swing space for those displaced during PPIC construction



Foster public/private partnerships:

- Researchers and technicians employed by these collaborating companies
- PPPL researchers and operations staff supporting this research; and
- Additional PPPL staff necessary for supporting growth of research programs





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*Feel free to contact me wgutten@pppl.gov (as the PPPL INFUSE
Point of Contact) or any of your PPPL colleagues and friends*