

# LLNL Progress towards Ignition & Weapons Physics Experiments on NIF



**Presentation to: SEAB**

**October 12, 2011**

**Ed Moses  
Director, NIF and Photon Science**



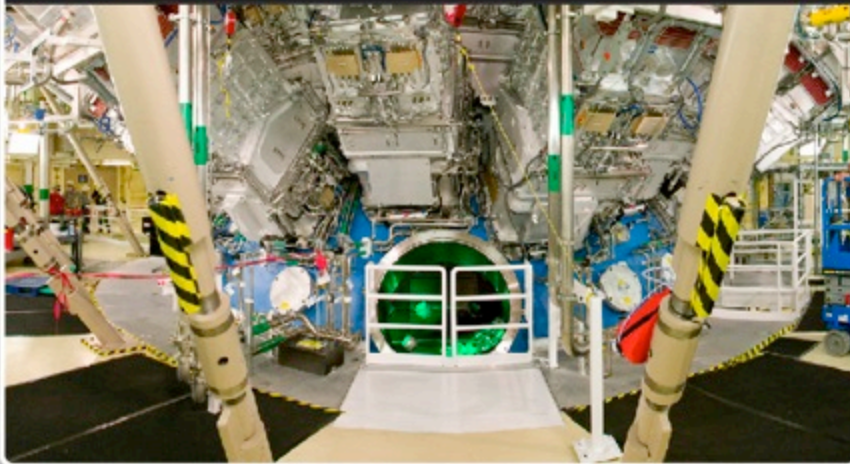
**May 30, 2011: Second anniversary of operation—  
NIF is becoming everything that we thought**





# NIF has broad array of technical and operational capabilities

**1.6 MJ laser**



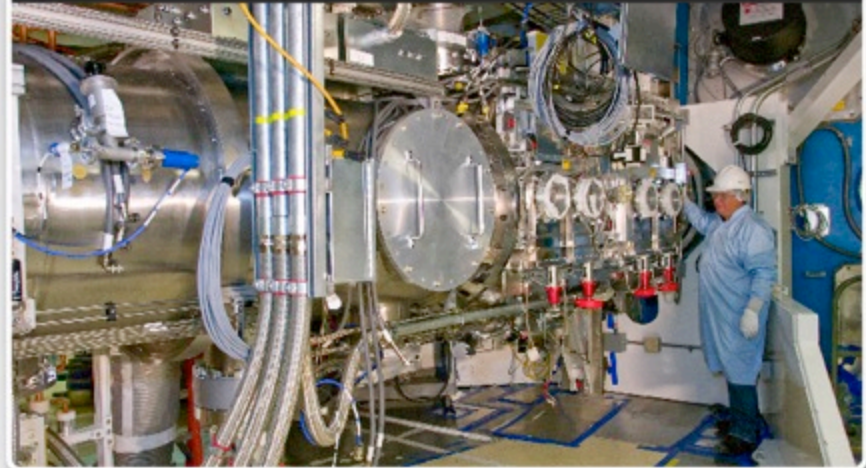
**Diagnostic platforms**



**Target Fabrication Lab**



**Cryogenic targets**





# NIF is now capable of its long-term goals

## High yield operations



## Classified experiments



## 24/7 operations



## Outfitted Operational Support Facility

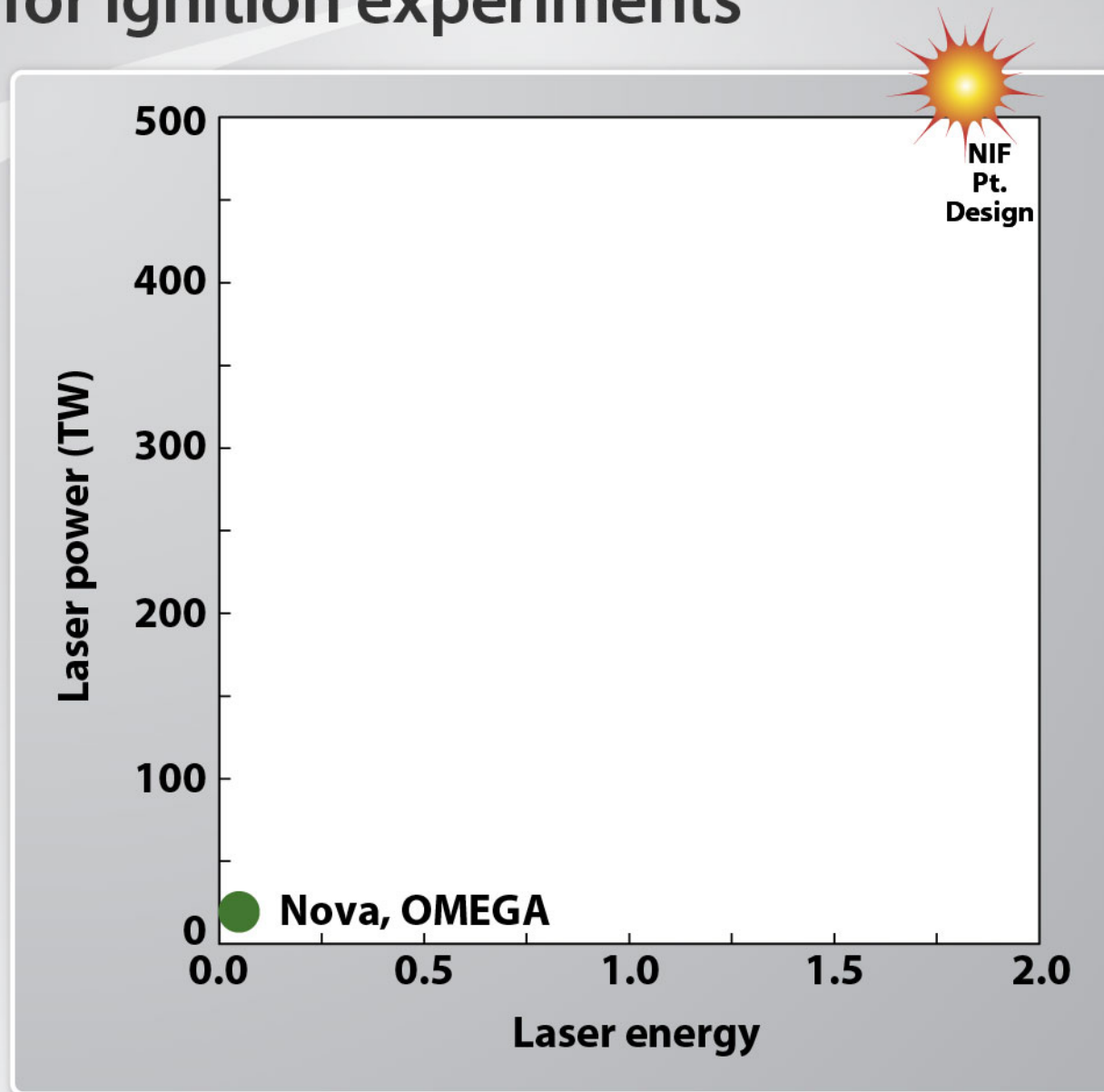






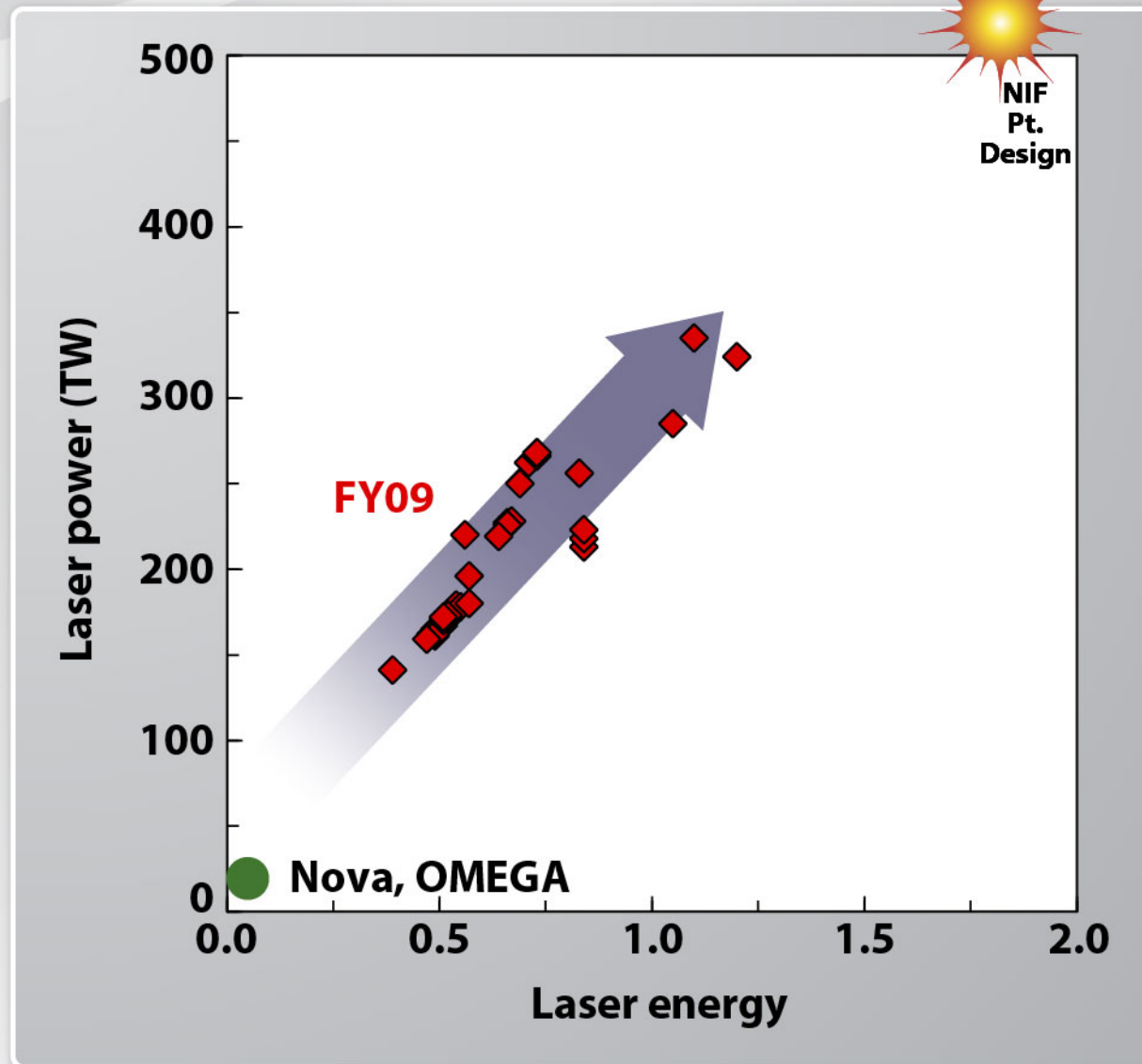


We are steadily increasing the laser energy and power available for ignition experiments



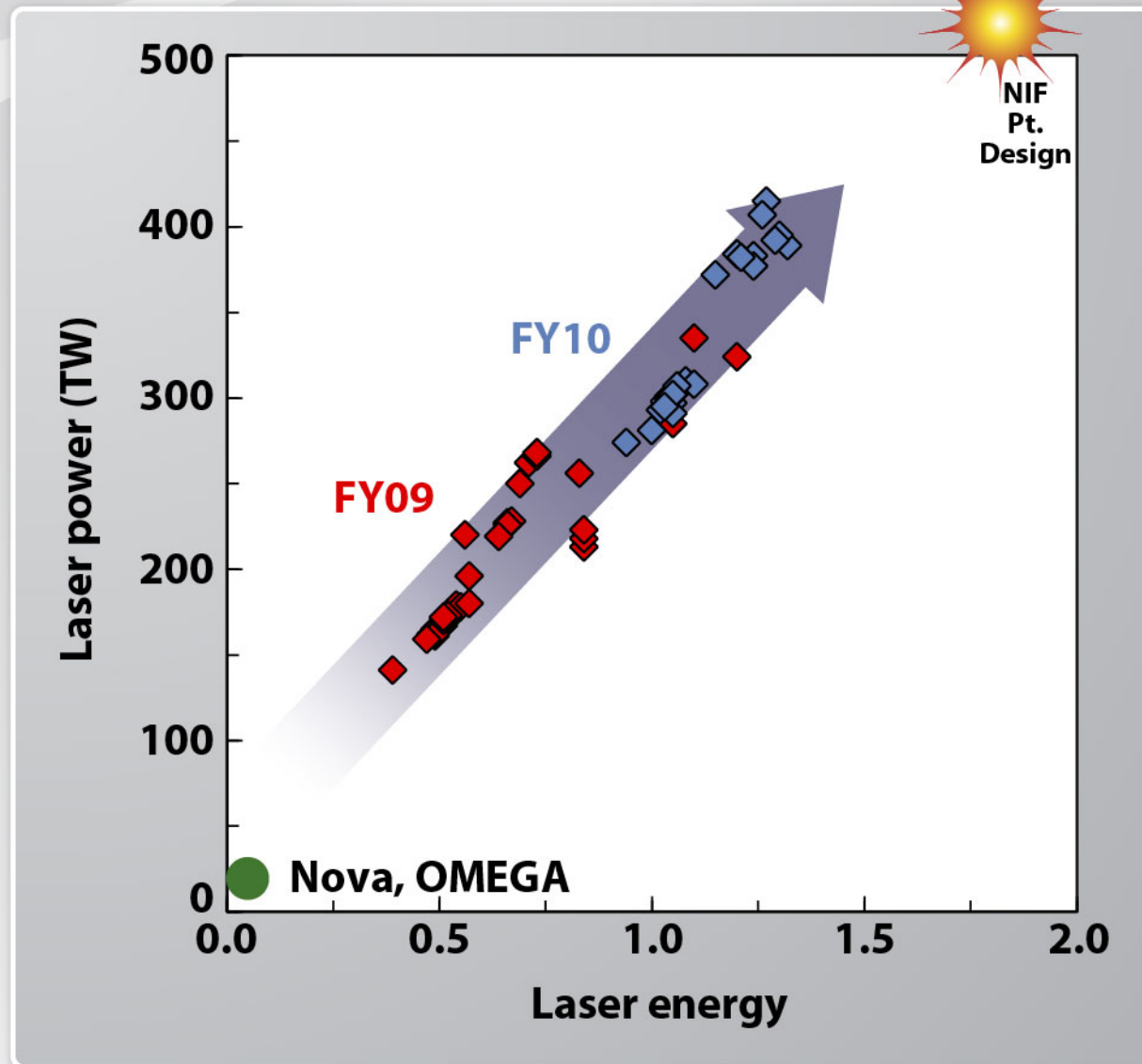


We are steadily increasing the laser energy and power available for ignition experiments **FY09**



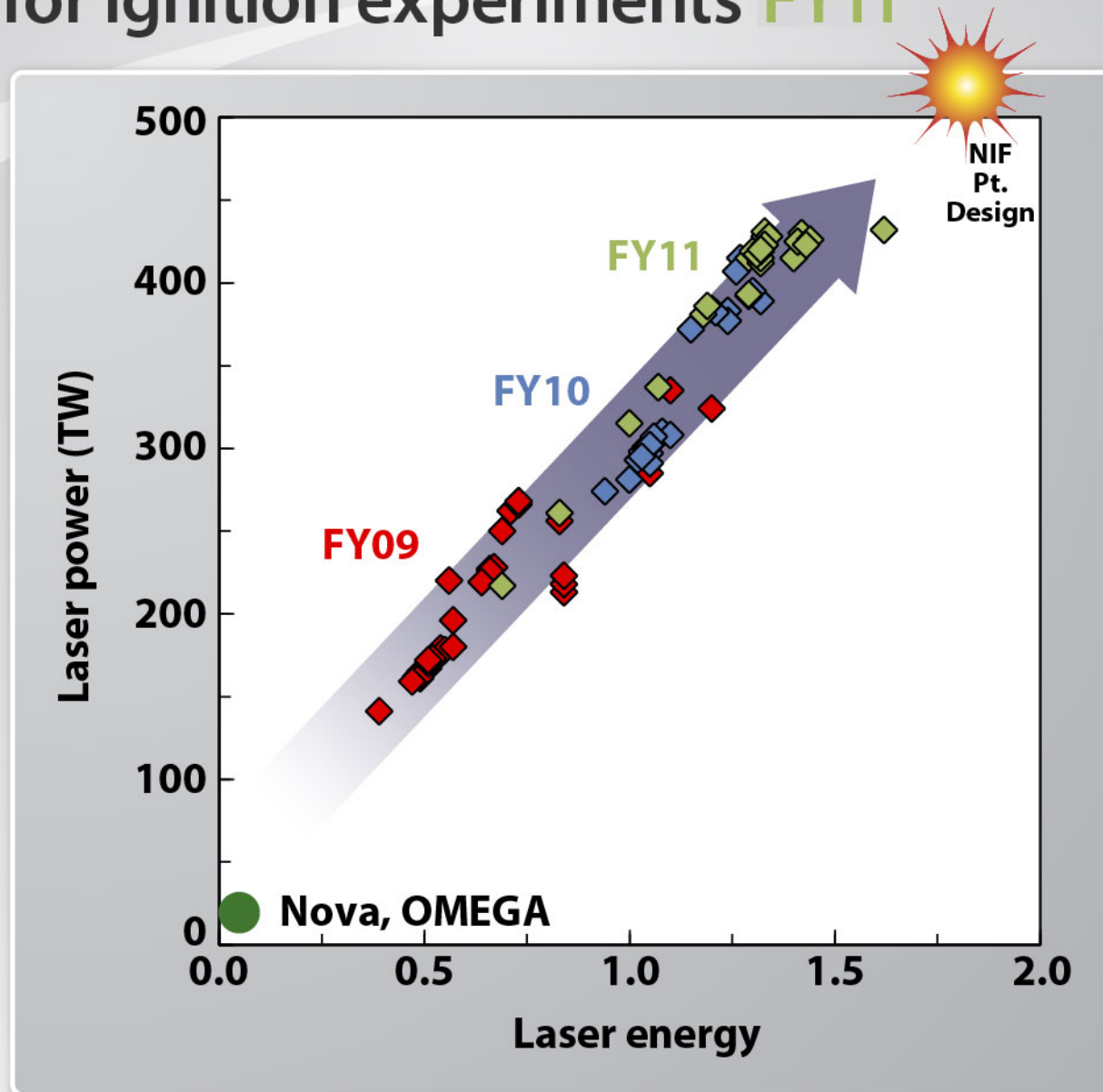


We are steadily increasing the laser energy and power available for ignition experiments **FY10**

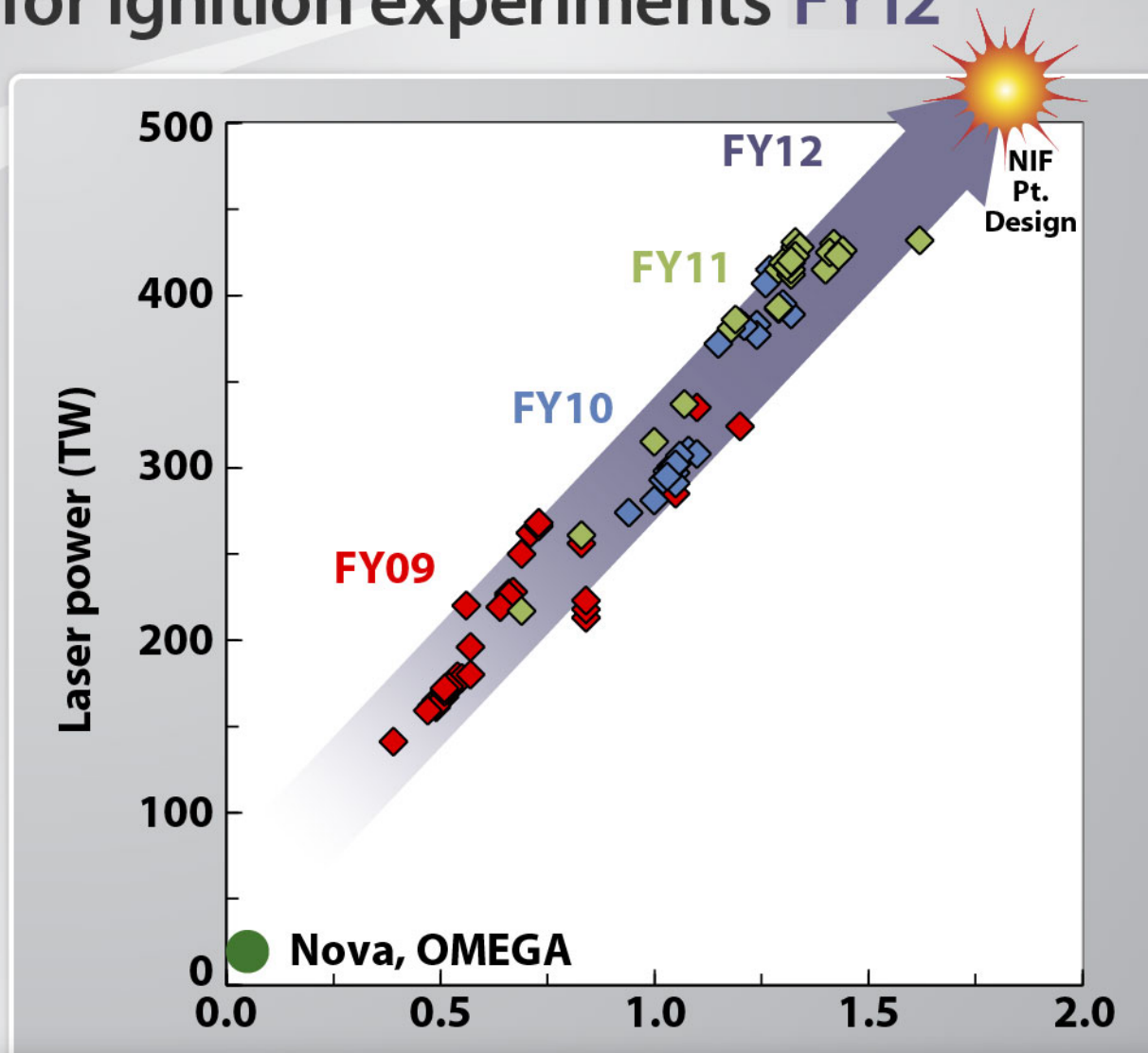




We are steadily increasing the laser energy and power available for ignition experiments **FY11**



We are steadily increasing the laser energy and power available for ignition experiments **FY12**



**NIF continues to evolve as a target shooter!**

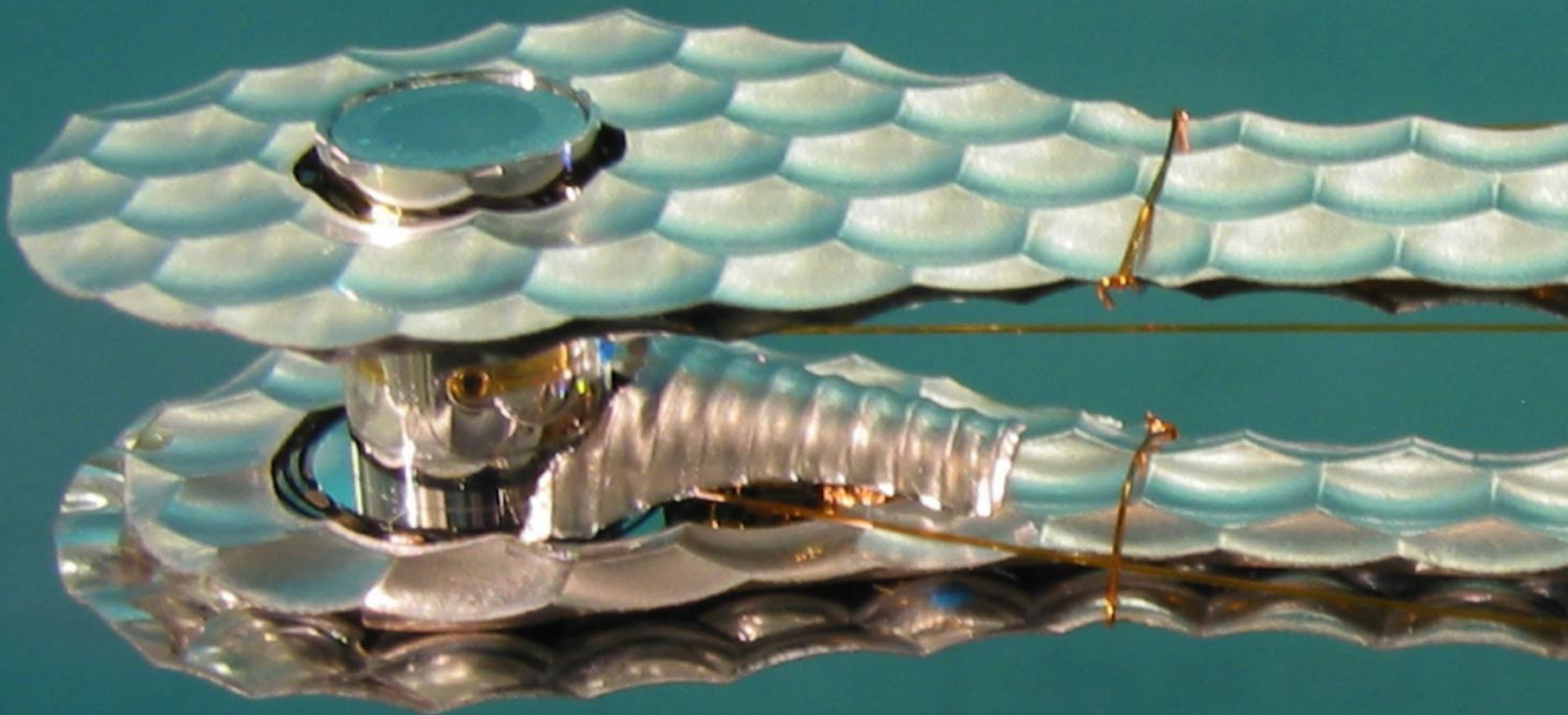


# Target Fabrication Lab

Precision manufacturing and assembly processes are required to meet target requirement



...Up close



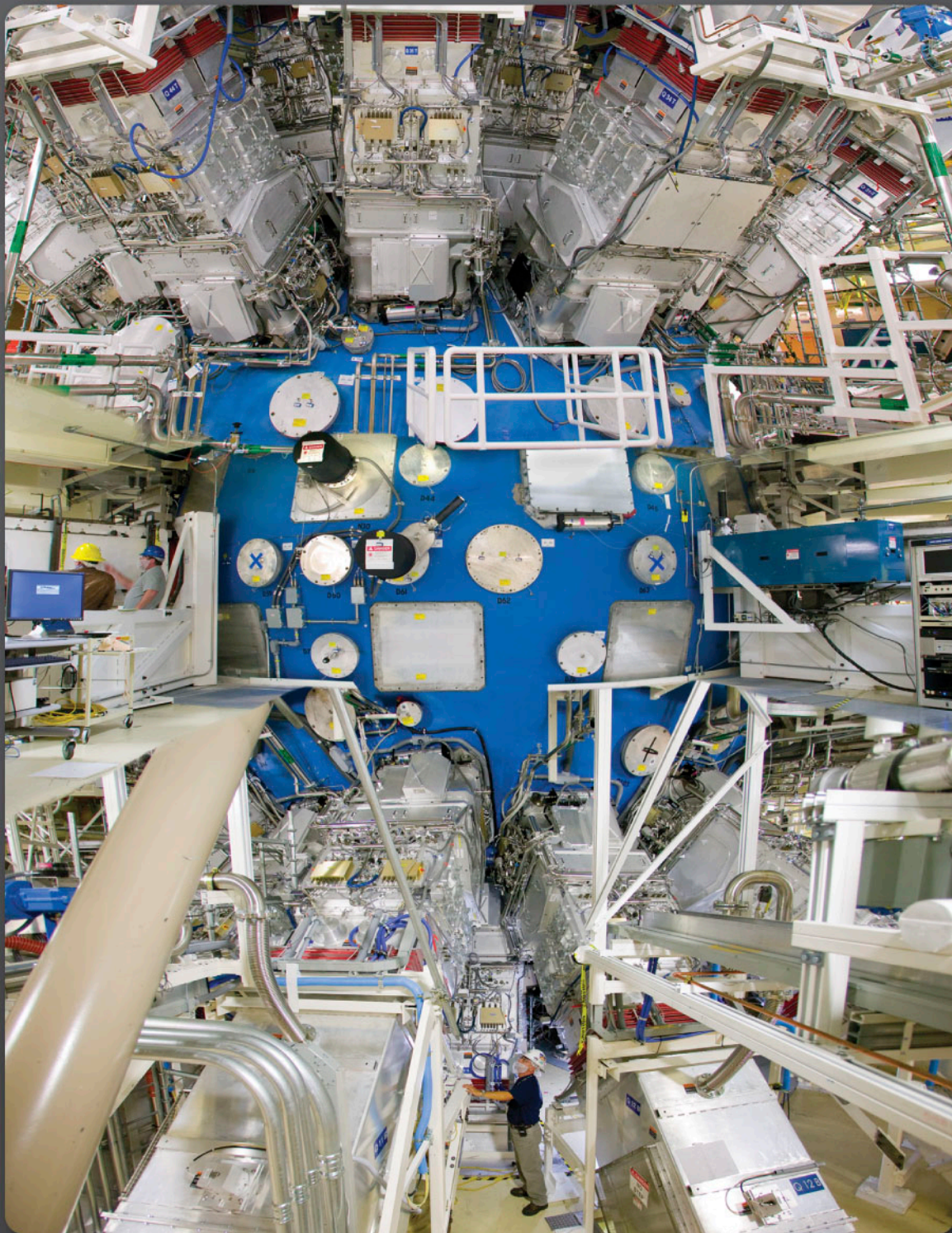
47 cryogenic targets built with 90% yield since July



# NIC Target Assembly

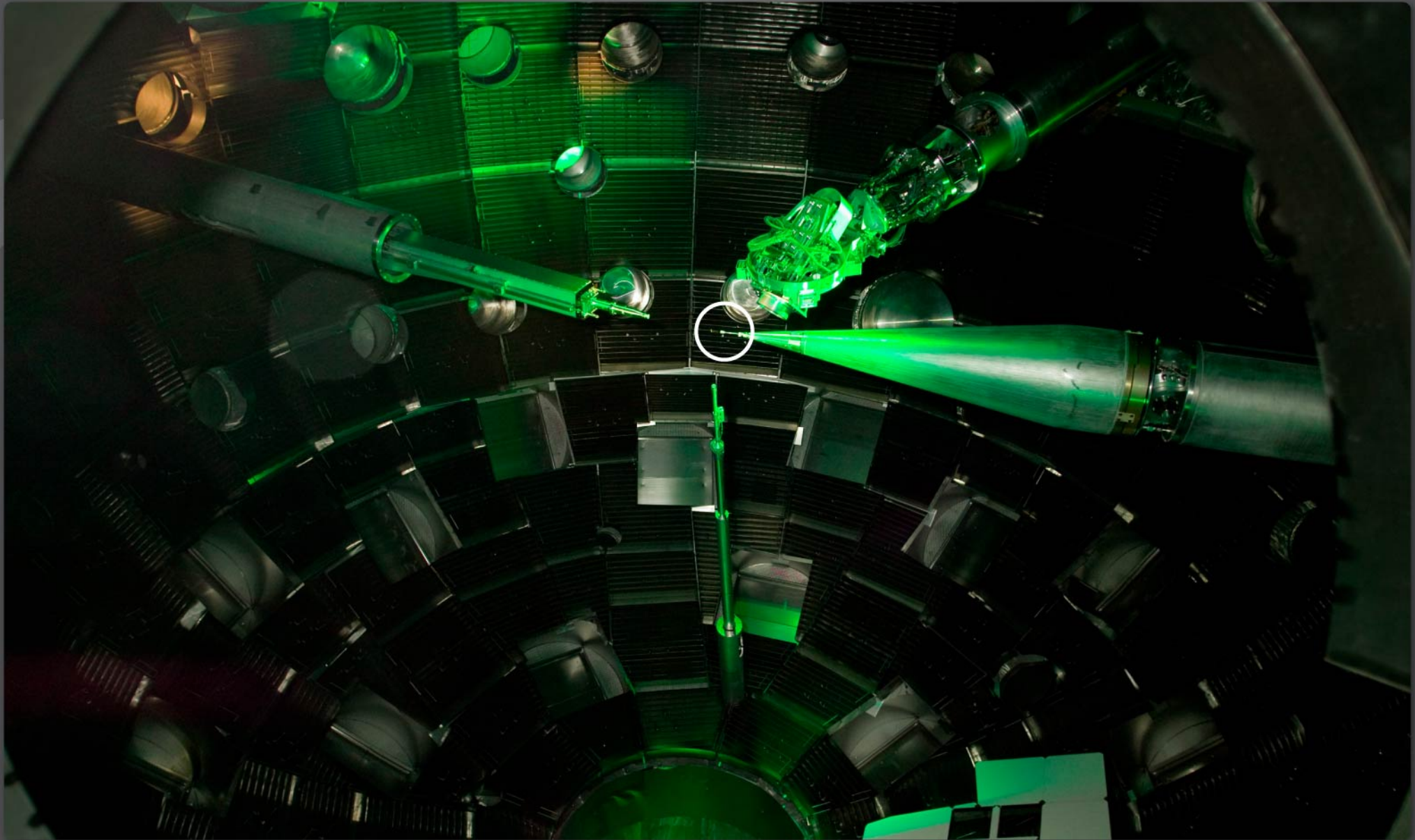




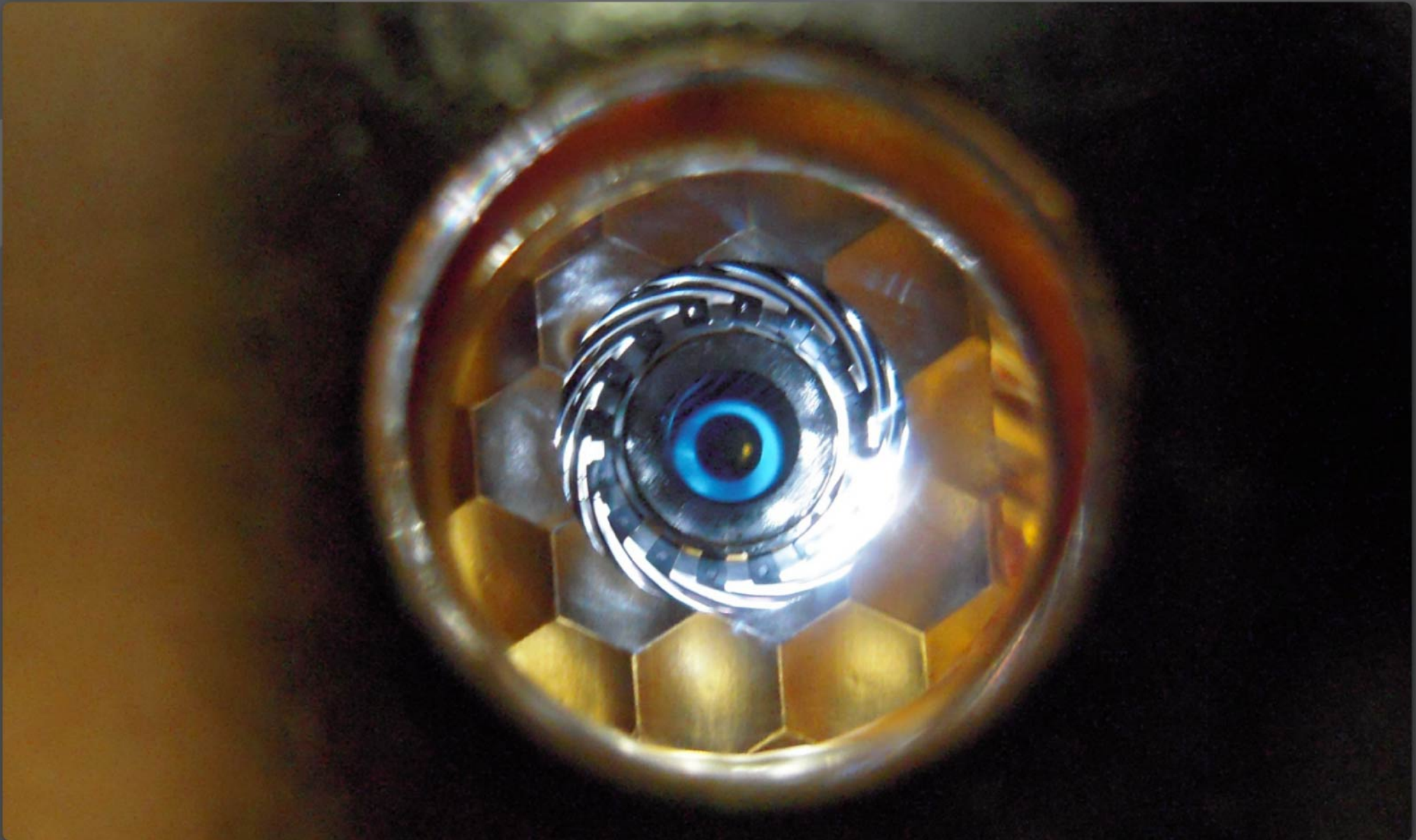




...In the target chamber

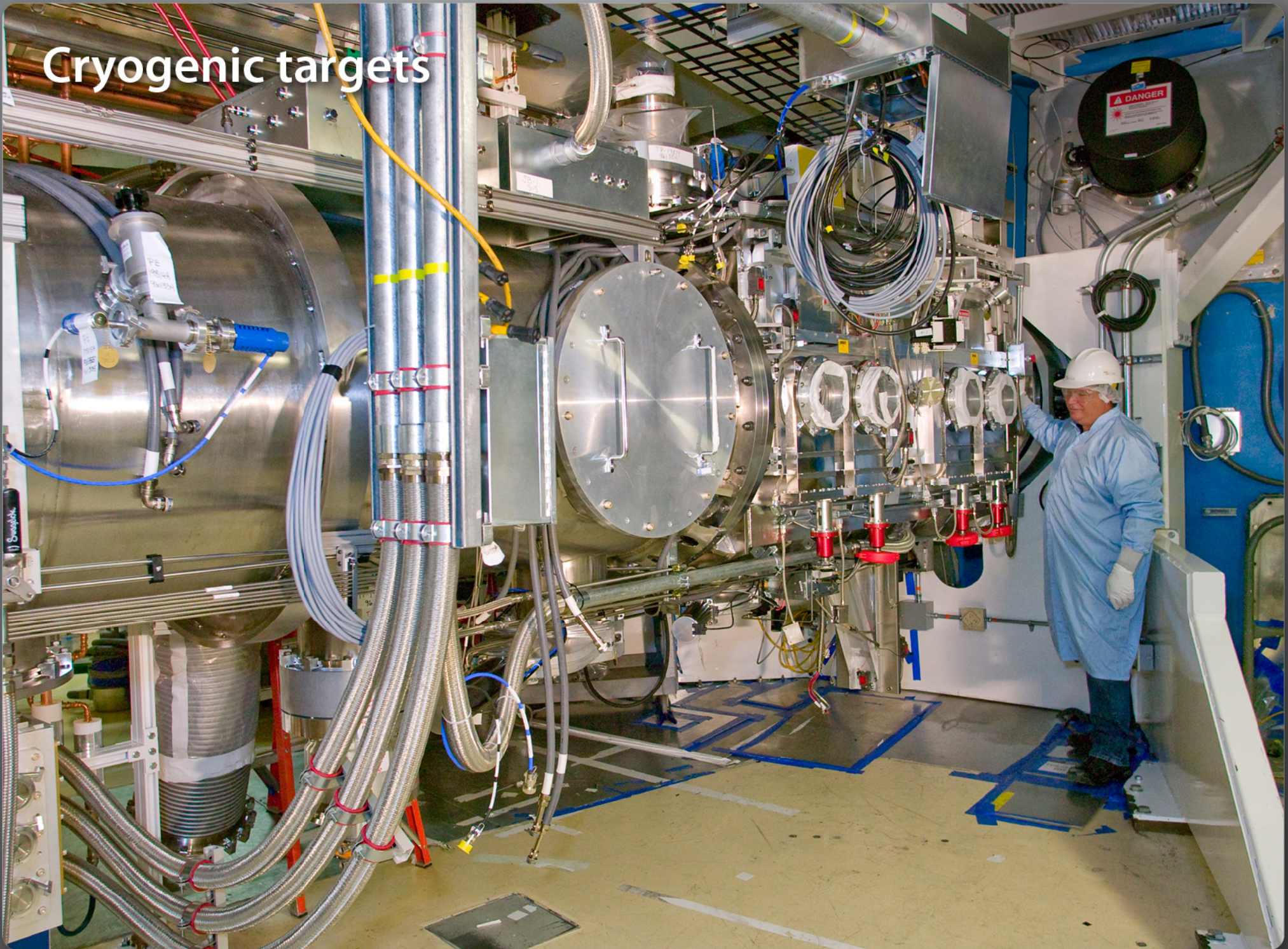


...Laser-eye view





# Cryogenic targets





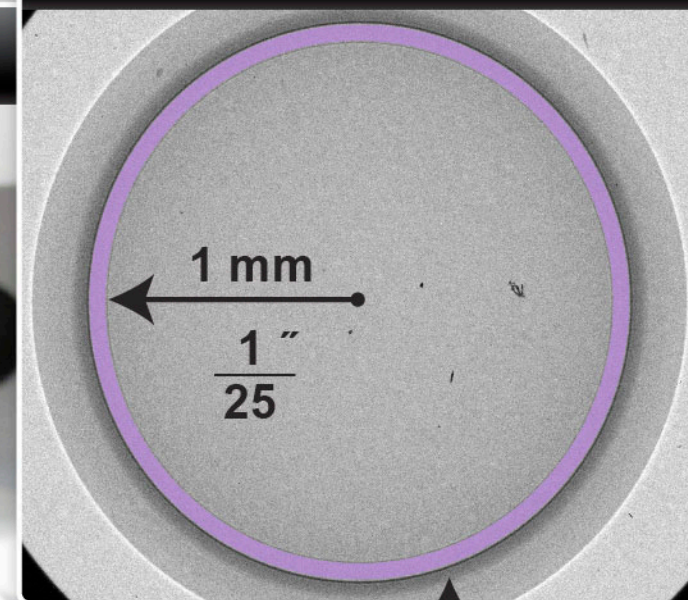
On May 4, 2011 NIC conducted the first cryo-layered DT target experiment on NIF



Target ready to be cooled



Frozen DT layer

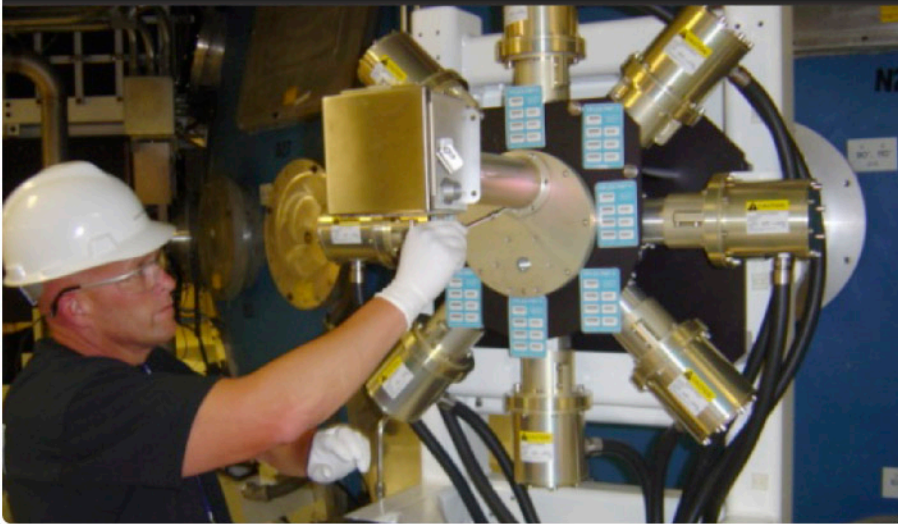


“Cryo DT ice layer”  
at ~19 deg K

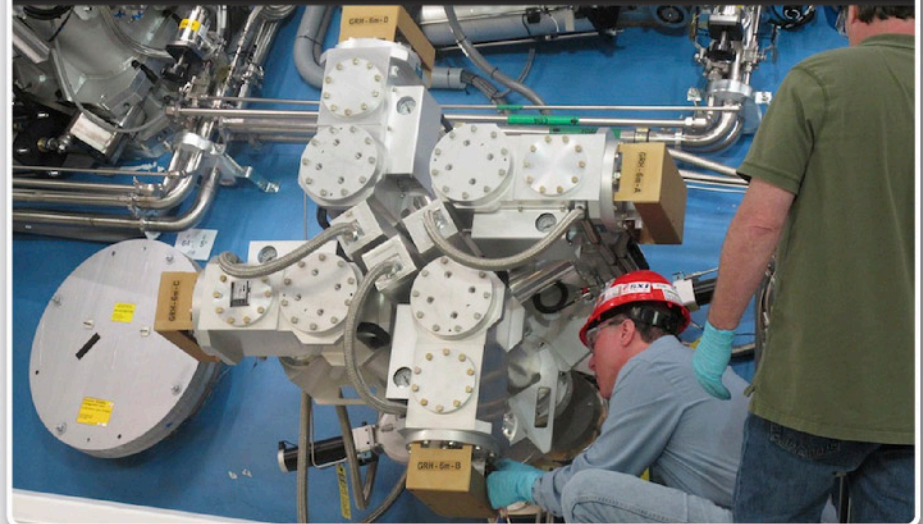


# Growing NIF diagnostic capabilities

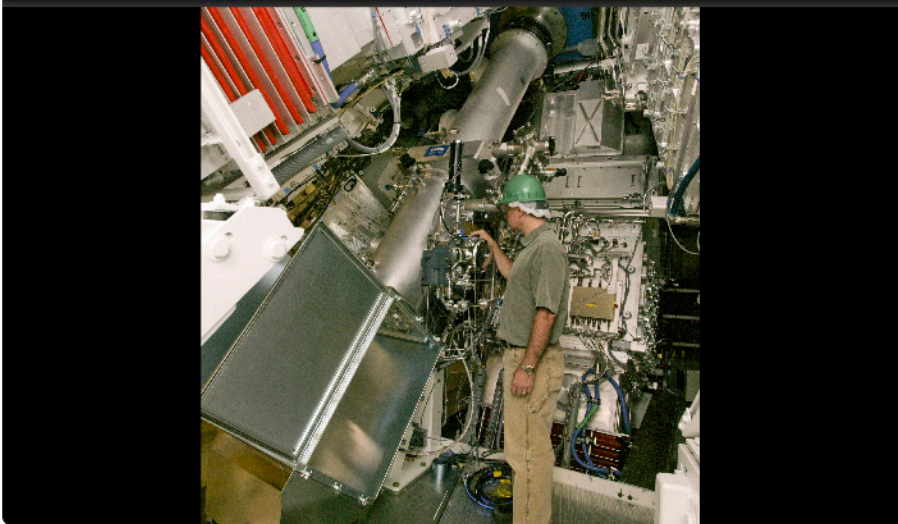
## Hot Electron diagnostic



## Gamma Reaction History diagnostic



## Dante 1



## Magnetic Recoil Spectrometer





# An international program to field NIF diagnostics is executed via the National Ignition Campaign (NIC)

## LLNL

- FABS, NBI
- Dante I & II
- VISAR
- DISC
- RAGS
- hGXI
- ARIANE
- DIXI
- NAD

## NSTec

- Calibration
- NToF

## LBNL

- Calibration
- Rad. Chem.

## LLE

- NToF
- 4  $\omega$  fidu system
- MRS, NADS
- SPBT
- HEXRS
- PSBT

## AWE

- FFLEX



## MIT

- MRS
- WRF
- PSBT

United States

## LANL

- GXD
- $\gamma$  burn
- Rad. Chem. II
- n imaging

## SNL

- SPIDER
- DISC
- NAD (Cu)
- NToF

## Duke

- Calib.

## CEA

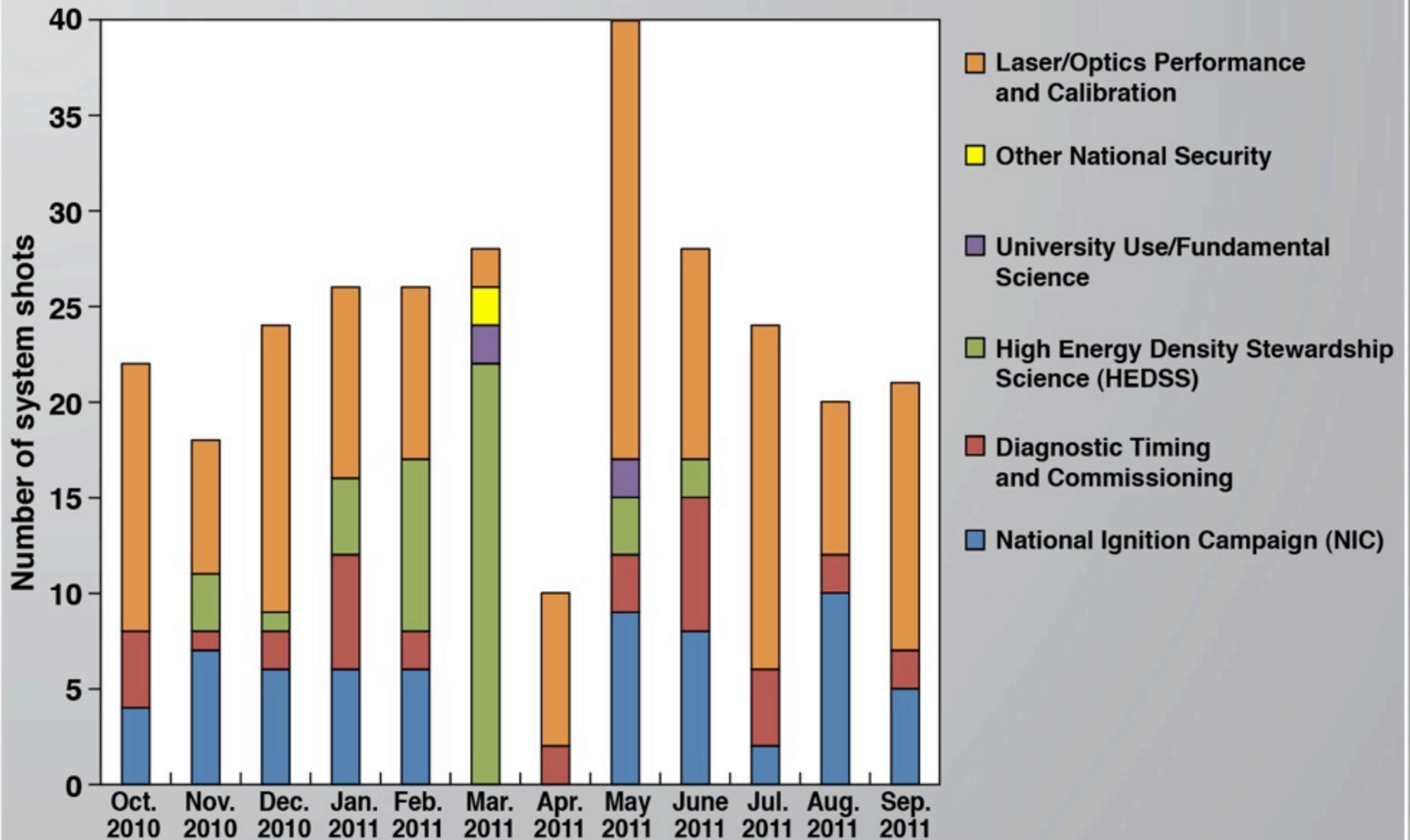
- N imaging



Opportunities with NIF diagnostics attract scientists



# NIF fired 287 system shots for FY2011



# NIF now meets nearly all of the specifications needed for all its missions

## Ensuring National Security



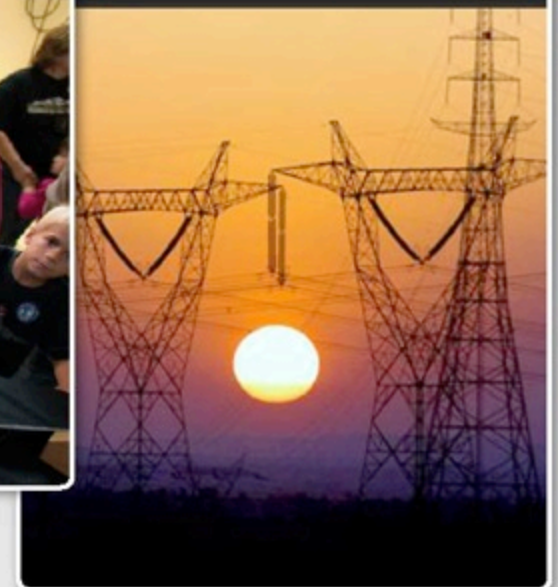
## Advancing Frontier Science



## Building Future Generations of HED Scientists

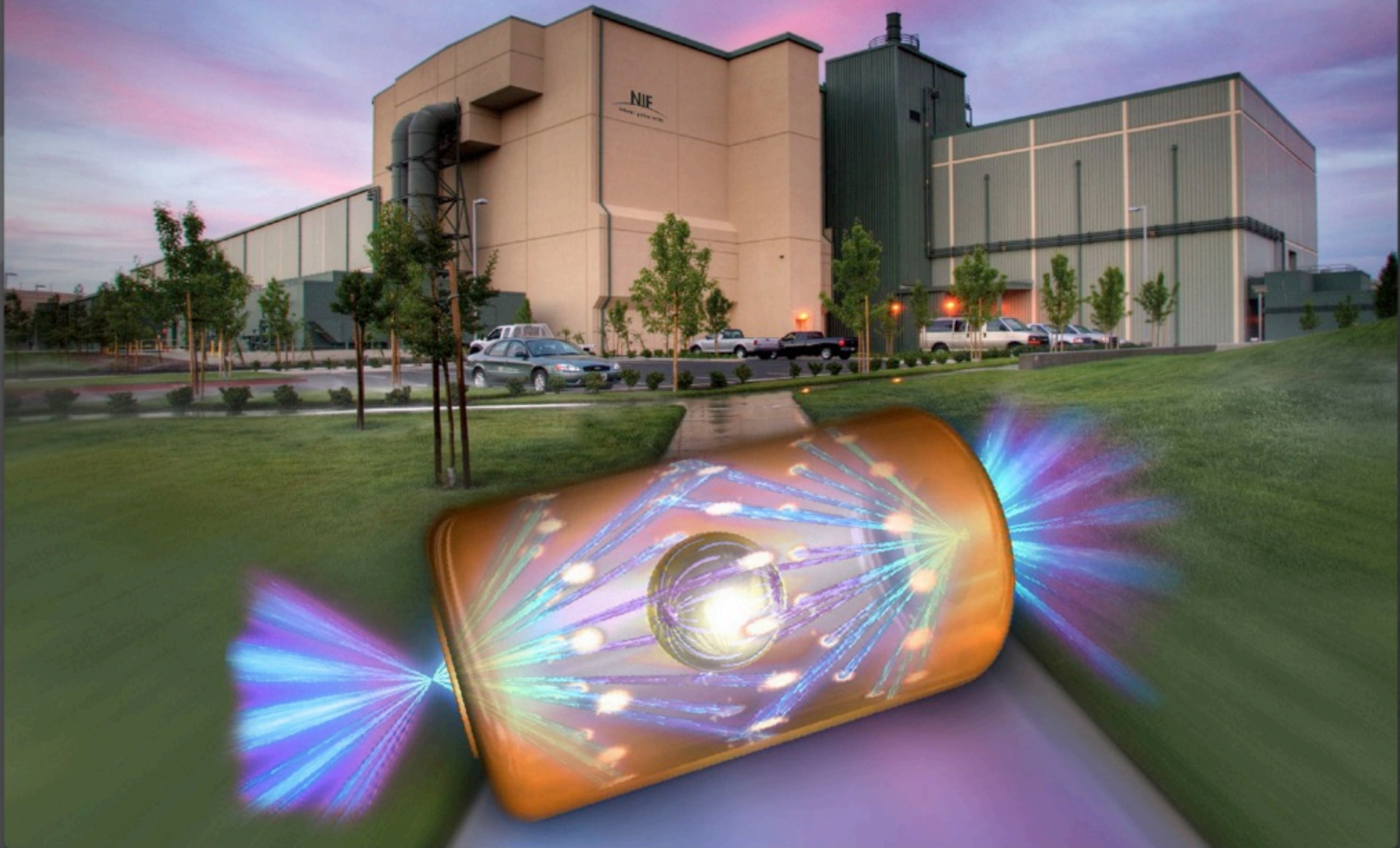


## Enabling Clean Energy



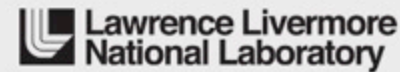


# NIF is preparing for fusion gain experiments



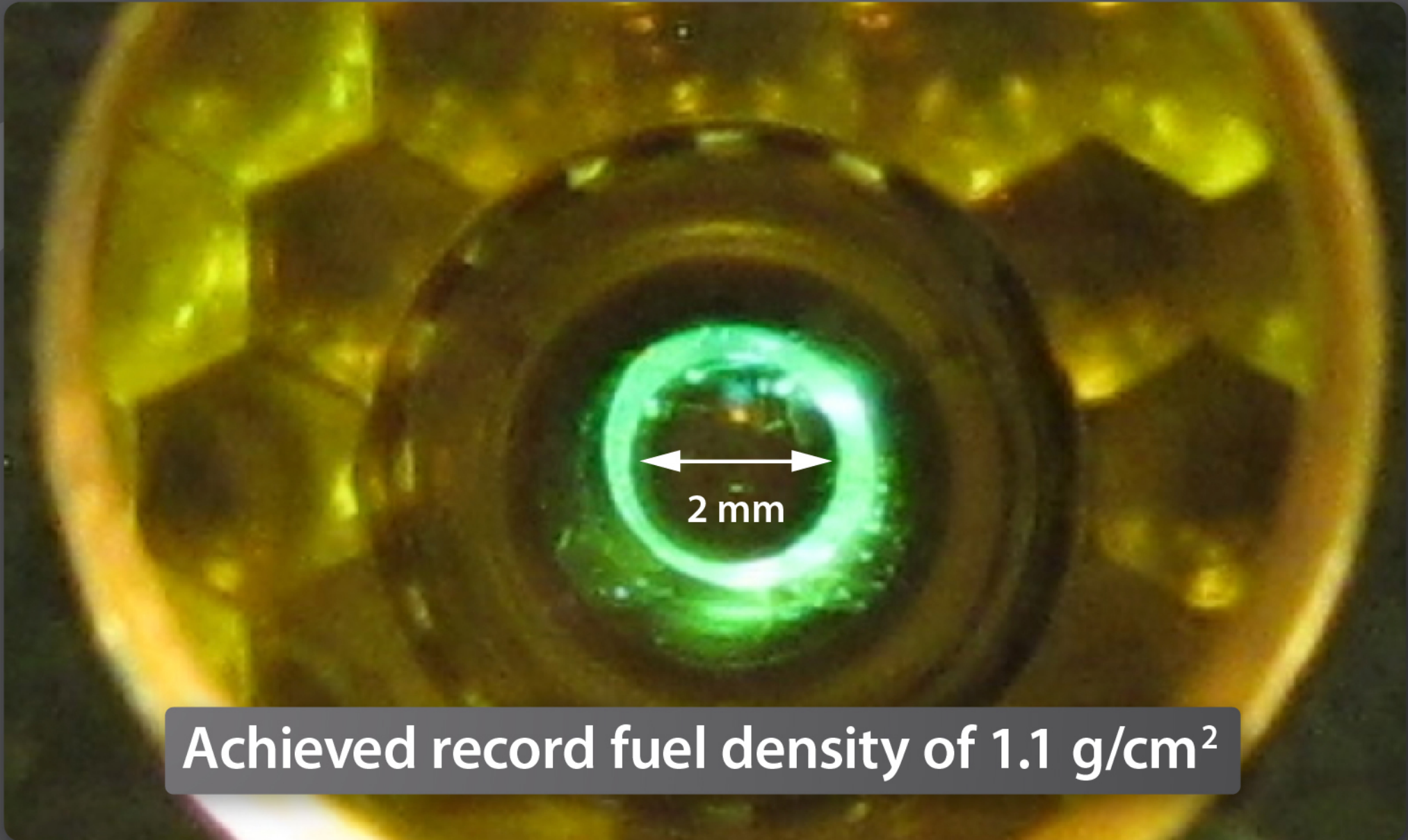


# NATIONAL IGNITION CAMPAIGN



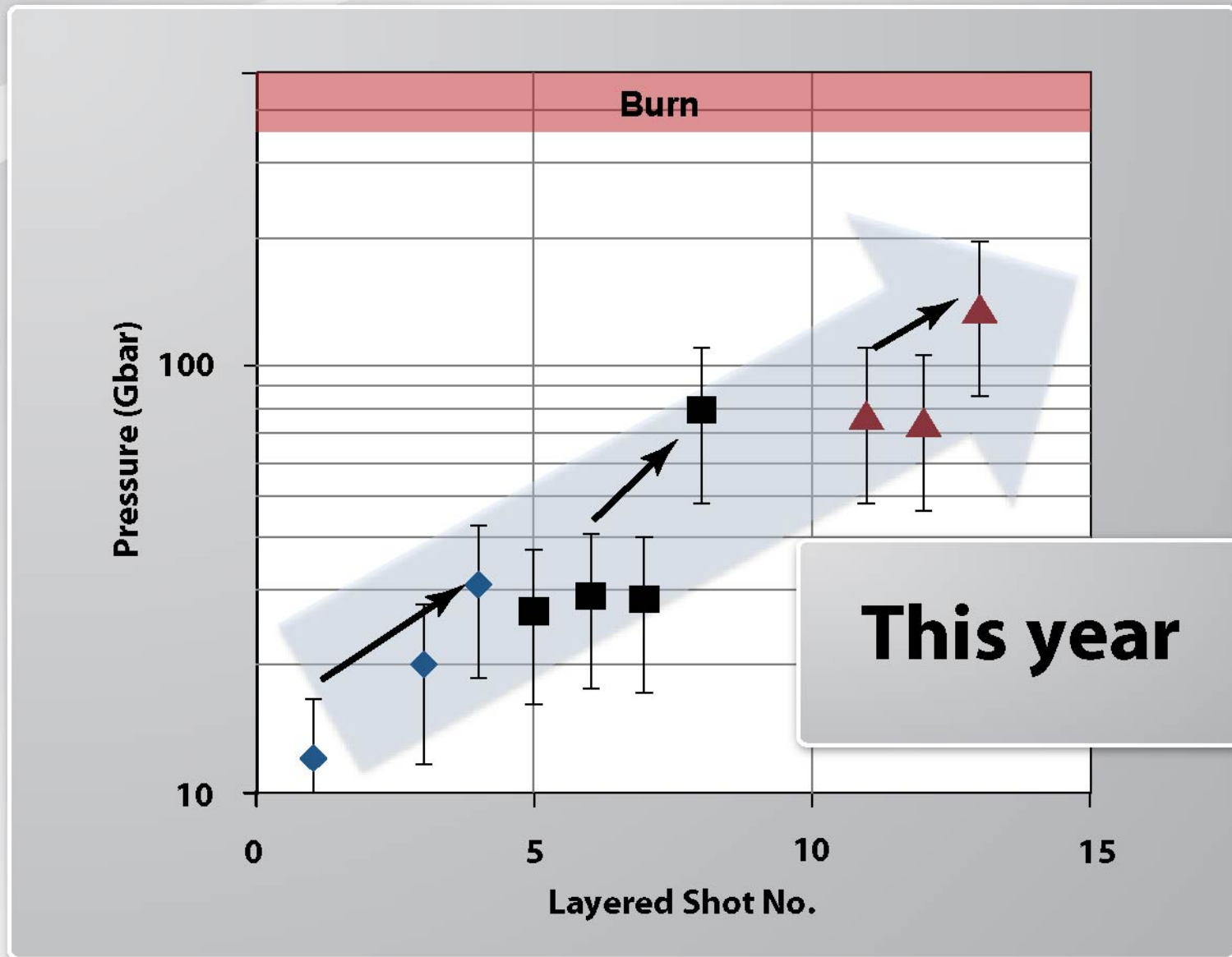


# NIF Team conducts record-setting 1.6 megajoule experiment 9/14/2011



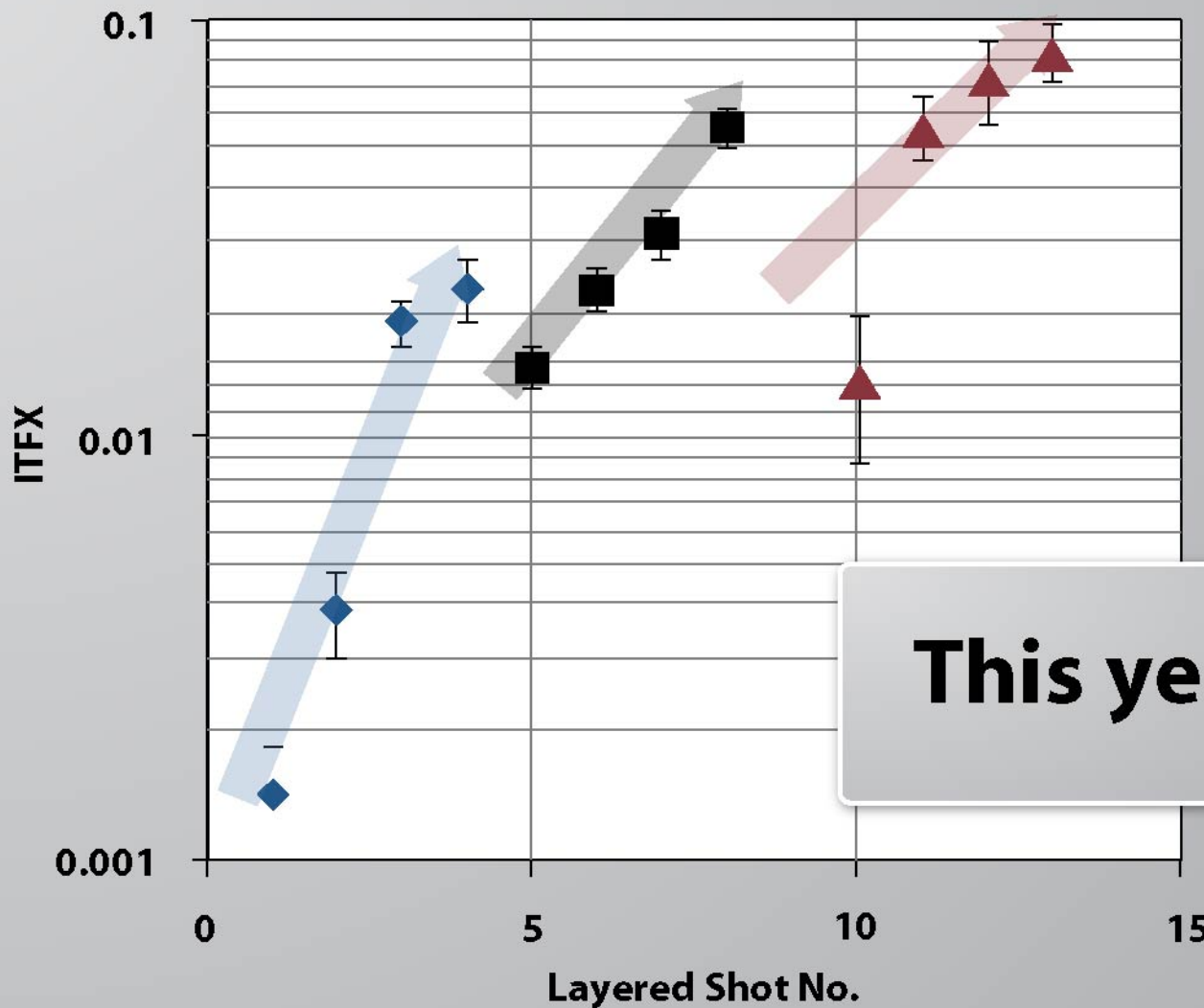
Achieved record fuel density of  $1.1 \text{ g/cm}^2$

# Implosions have made steady progress towards ignition goal: Pressure





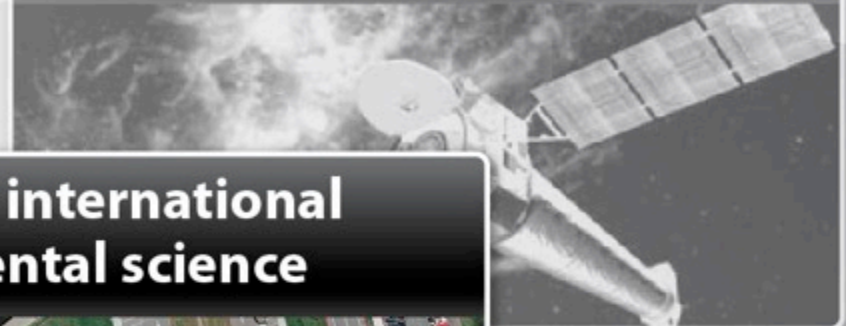
# Implosions have made steady progress towards ignition goal: Implosion quality



**CERN**



**Chandra x-ray observatory**



**NIF will be a premier international center for experimental science**



**APS**



**SLAC**





DOE Workshop:  
Science on NIF  
May 10-12, 2011

Science on NIF Workshop  
Washington, D.C.  
May 10-12, 2011

Sponsored by:  
the National Nuclear Security Administration  
Hyatt Crystal City, May 10 - 12, 2011



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science



# Compelling scientific questions that are being addressed at the NIF

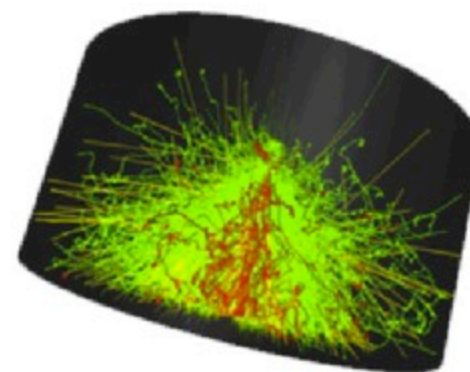
**How do supernovae explode?**



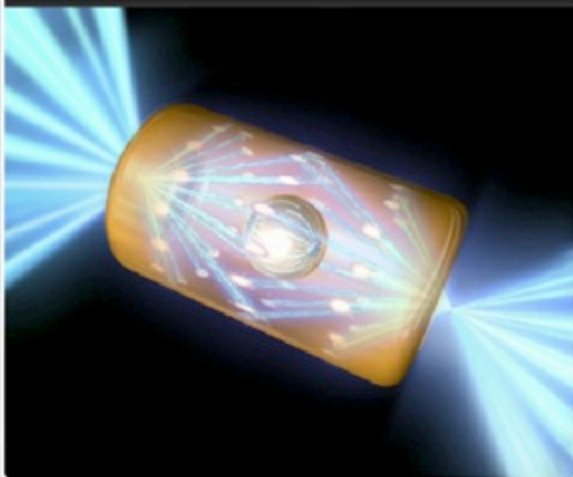
**How do dust-filled nebulae (stellar nurseries) evolve?**



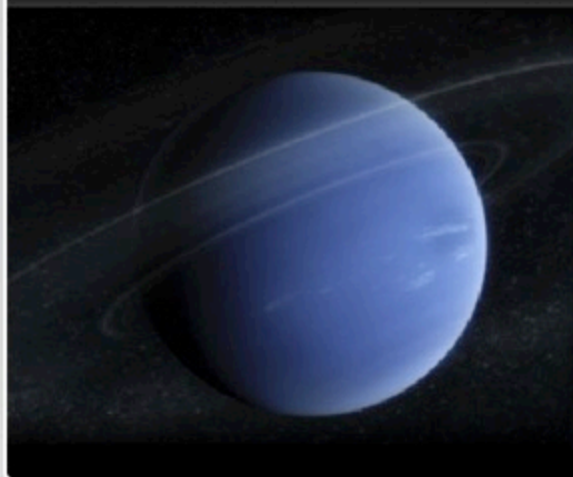
**How do gamma-ray bursts occur?**



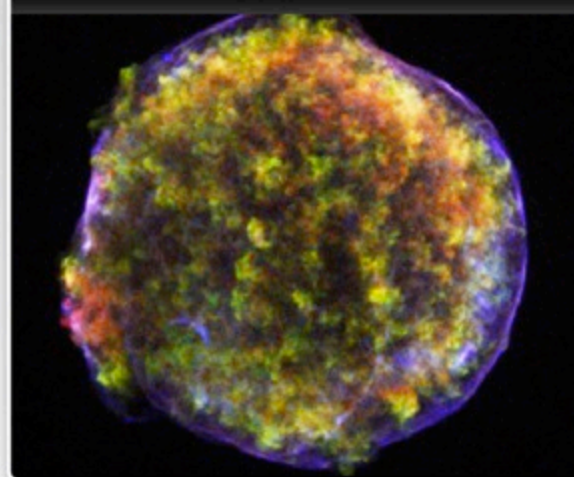
**Can we demonstrate laboratory ignition?**



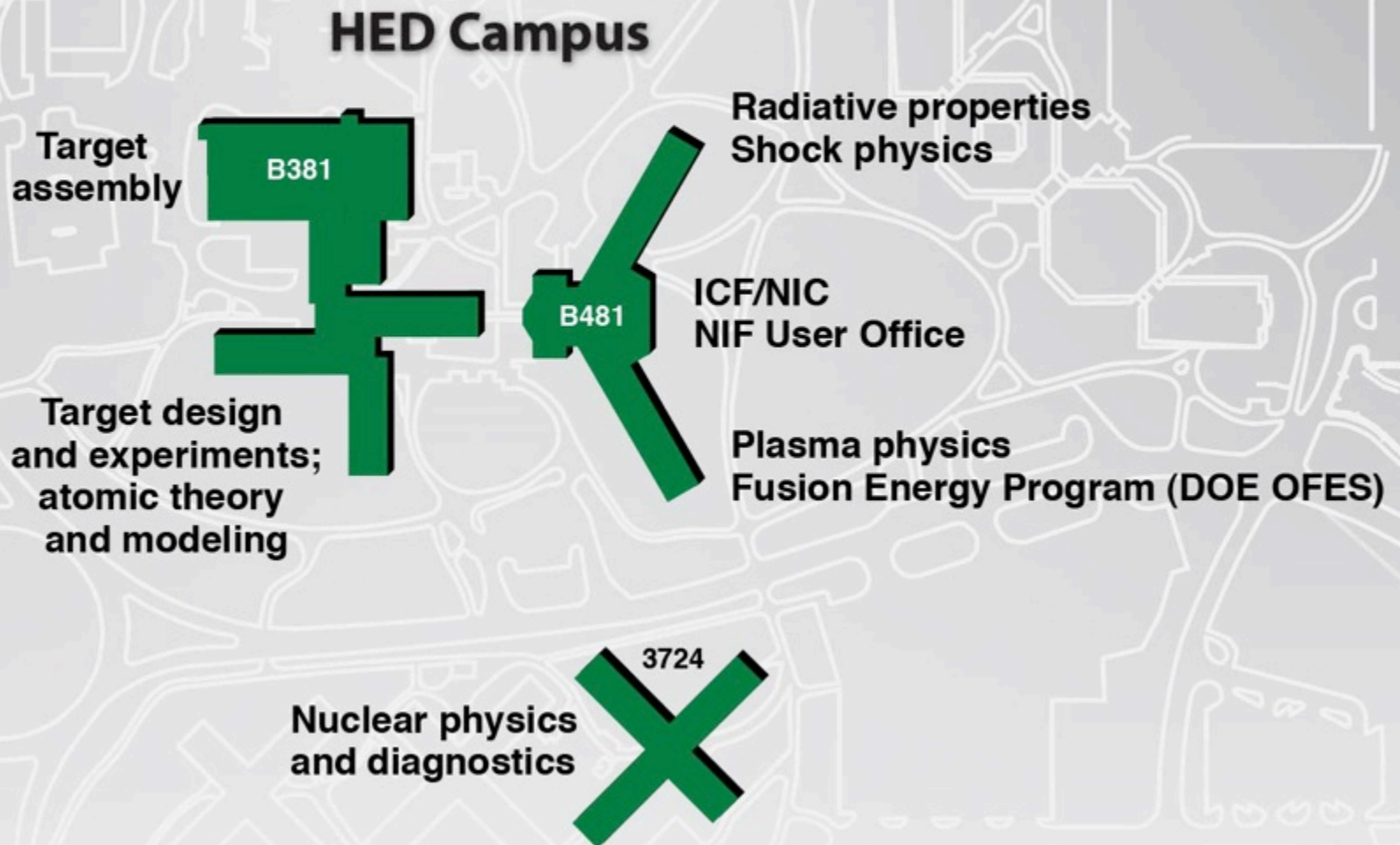
**Do giant planets contain "oceans of diamonds"?**



**What is the source of the highest-energy cosmic rays?**



# Scientific and technological capabilities located on the HED Campus





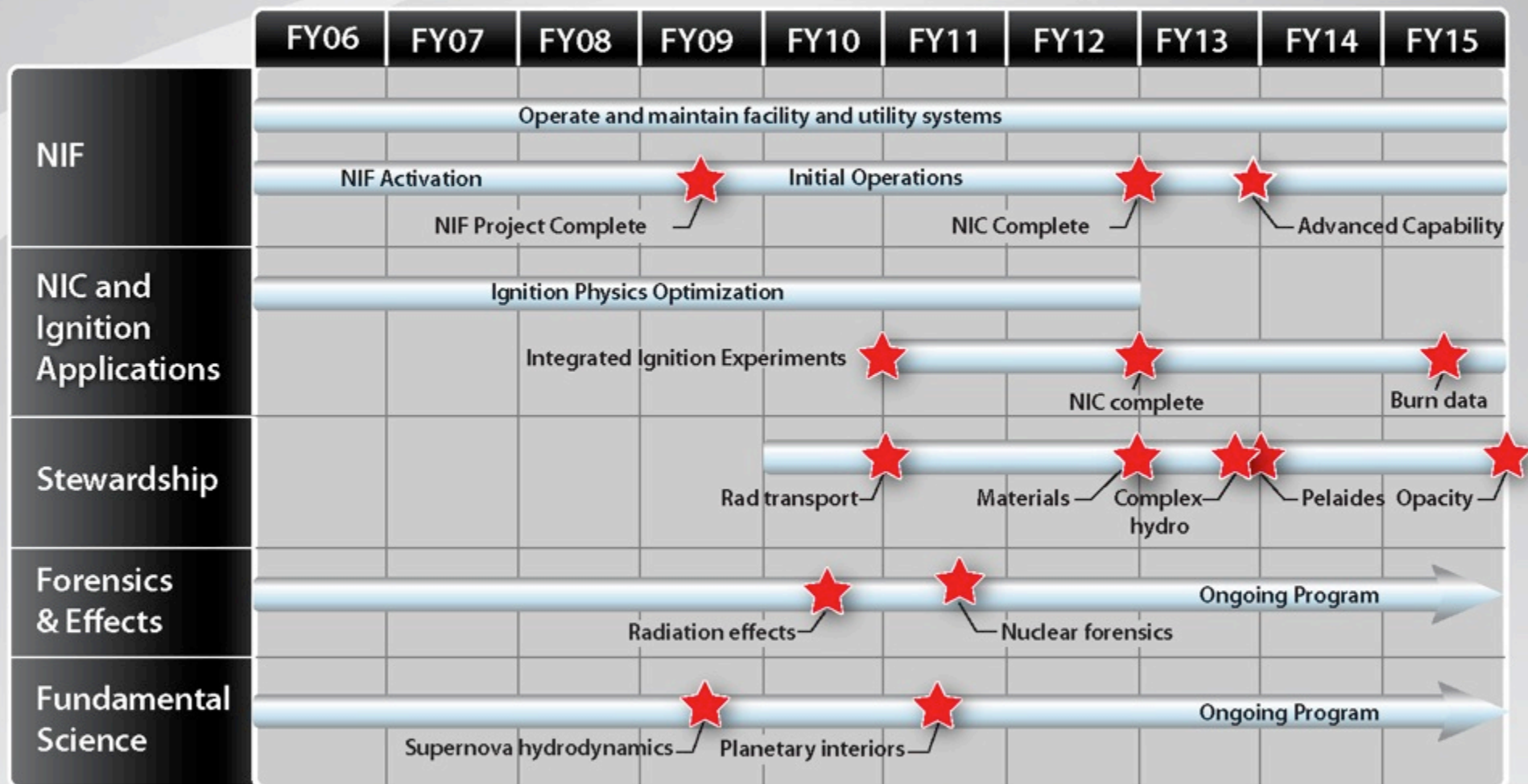
# HED Campus will be integrated with the Livermore Valley Open Campus (LVOC)

**LVOC Objective: Create an open, inviting environment for academic and international collaboration**

- **First decision on investment is for High Performance Computing Center Interim Facility**
- **Facility will be available for our industrial partners – October 1, 2010**



# NIF will provide a unique experimental platform for multiple missions





**NIF**

