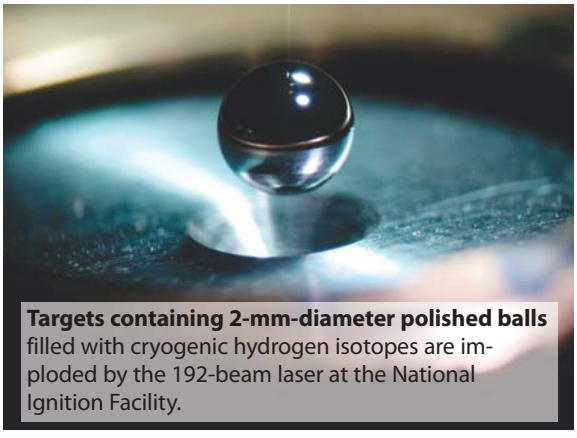
Ignition effort may be slowed as Livermore facility misses milestone



LAWRENCE LIVERMORE NATIONAL LABORATORY

Targets containing 2-mm-diameter polished balls filled with cryogenic hydrogen isotopes are imploded by the 192-beam laser at the National Ignition Facility.

Falling short of achieving its namesake milestone after two years, the National Ignition Facility will now have to share more of its beam time with other weapons science and fundamental research experiments. The $3.5 billion NIF, completed in 2009, was built to create ignition, in which the energy released by fusion exceeds the energy input. Scientists at Lawrence Livermore National Laboratory were expected to have accomplished that by 30 September, the end of the fiscal year. But an external review team reported in July that the milestone almost certainly won't be met even by the end of calendar year 2012.

A Department of Energy official says that DOE's National Nuclear Security Administration will not extend the National Ignition Campaign, which formally began in October 2010, into fiscal year 2013. Instead, it's expected that NIF will "serve other interests equitably, as opposed to ignition over all else," says the official. Planning for such an experimental program is under way, but it has been made difficult because of congressional dithering over the FY 2013 budget.

Although NIF's 192-beam laser is now firing at 2 megajoules, exceeding its 1.8-MJ design, "the coupling of the laser through the radiation inside the hohlraum to the [fuel] capsule is less efficient than expected," says a DOE review panel report dated 19 July. In particular, the material known as the ablator, which surrounds the cryogenic fuel, either has failed to implode the fuel with sufficient velocity or has mixed with the fuel itself to create instabilities.

Despite the difficulties, a progress report by a second review committee urges that the ignition campaign continue. "A deadline imposed on an experimental discovery science program to achieve a particular result by a particular time at a particular cost is often unrealistic!" states that review panel, chaired by retired Oak Ridge National Laboratory director Alvin Trivelpiece. "Given the time and effort dedicated to building NIF, the value of using it as a platform to explore the ability to create extreme states of matter that are predicted to lead to ignition, [and] the quality of the results achieved so far, it is not appropriate to cut the program should it not meet the goal of ignition by the end of September."

Edward Moses, LLNL principal associate director of NIF and photon science, concurs. "The whole idea of science delivery on a schedule is not the normal way things are done," he says. "We haven't come to anything we know of that precludes ignition. We've sev-

eral times in this campaign come to things that made us think, but in each case we've figured it out and moved on." In ignition experiments, "we've gone up about a factor of 100 in the ignition quality. . . . We're only a factor of two in pressure away from the place where we should start seeing alpha heating and burn." Alpha heating occurs when helium nuclei generated by fusion raise the plasma temperature significantly higher than does the implosion alone.

Moses says there are plenty of users in the weapons program and in basic science who want experimental time. "The facility is booked for experiments for the next five years already. The user community is voting with its feet and is running to NIF," he says. "Everyone would like more time on the machine, that's clear." Other non-ignition users have already received some time on the machine, he notes.

"We've done science experiments that have brought carbon to 80 megabars, [the pressure equivalent to] the center of Saturn," Moses says. "There's going to be a lot of publications coming [out] on that," and some of the experiments, he adds, have been monitored by as many as 50 diagnostic instruments.

David Kramer

news notes

Physics graduates at work. The employment sectors, job satisfaction, and salaries of physics bachelor's degree recipients in the US who joined the workforce are detailed in *Physics Bachelor's Initial Employment*, a new report by the Statistical Research Center at the American Institute of Physics.

From the classes of 2009 and 2010, 60% enrolled in graduate programs. Of the 40% who entered the workforce, just over half found work in the private sector. Three quarters of those were in science, technology, engineering, and mathematics (STEM) fields, with typical annual salaries ranging from $39 000 to $60 000. Private-sector jobs in non-STEM fields were in such areas as finance, food service, sales, and manual labor and paid from $20 000 to $52 000 a year.

Among other graduates entering the workforce, 13% worked in colleges and universities and earned $25 000–$40 000; 11% became high school teachers with salaries between $31 000 and $44 000; 10% took jobs in civilian government and national laboratories and made $37 000–$58 000; 8% entered the military with incomes of $33 000–$47 000; and 5% found work in other areas.

More than 80% of physics bachelors working in the private sector in STEM fields reported overall satisfaction with their jobs; in non-STEM fields, 71% said the same, but only one-third said they were satisfied with the degree of intellectual challenge demanded of them. Approximately 90% of graduates working in the military, in government labs, and as high school teachers reported being satisfied.

The full report can be downloaded at http://www.aip.org/statistics/trends/emptrends.html. TF ■