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National Ignition Facility, High-Energy-Density and Inertial Confinement Fusion, Peer-Review Panel (PRP) Final Report

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National Ignition Facility
High-Energy-Density and Inertial Confinement Fusion
Peer-Review Panel (PRP) Final Report

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1. NIF Governance Overview

The National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL) is operated as a National Nuclear Security Administration (NNSA) user facility in accordance with Department of Energy (DOE) best practices, including peer-reviewed experiments, regular external reviews of performance, and the use of a management structure that facilitates user and stakeholder feedback. NIF facility time is managed using processes similar to those in other DOE science facilities and is tailored to meet the mix of missions and customers that NIF supports.

The NIF Governance Plan describes the process for allocating facility time on NIF and for creating the shot schedule. It also includes the flow of responsibility from entity to entity. The plan works to ensure that NIF meets its mission goals using the principles of scientific peer review, including transparency and cooperation among the sponsor, the NIF staff, and the various user communities.

The NIF Governance Plan, dated September 28, 2012, was accepted and signed by LLNL Director Parney Albright, NIF Director Ed Moses, and Don Cook and Thomas D'Agostino of NNSA. Figure 1 shows the organizational structure for NIF Governance.

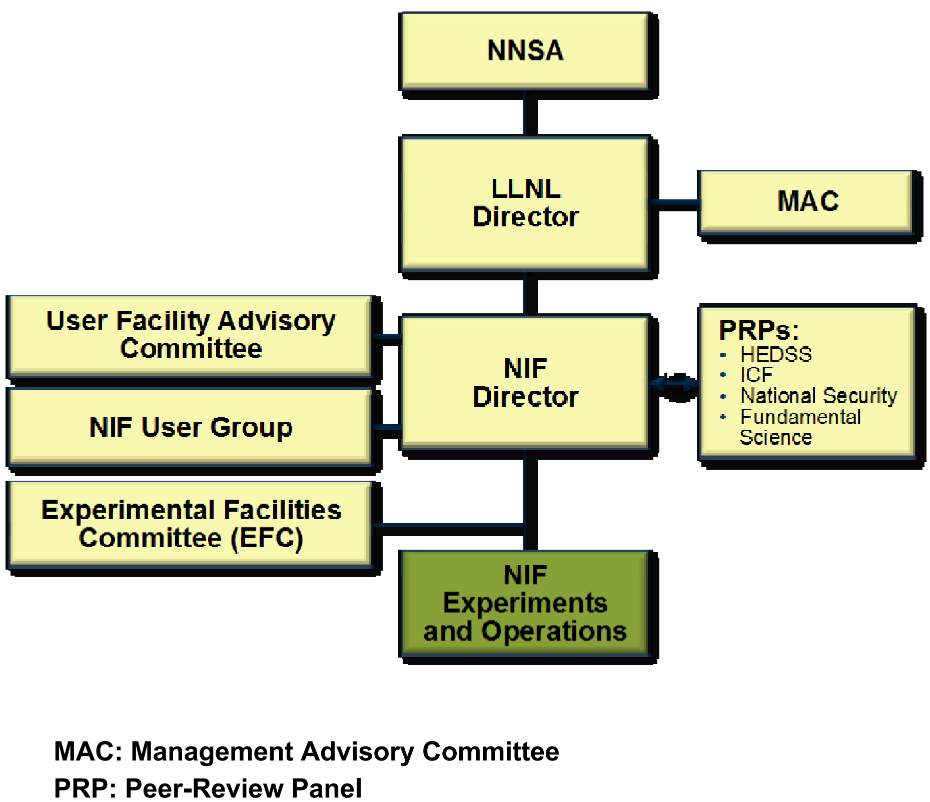


Figure 1: Organizational structure for NIF Governance.

NNSA and the LLNL Director provide top-level guidance to NIF and oversee the overall mission performance of the facility. The Management Advisory Committee (MAC) provides senior-level advisory input to the LLNL Director. The User Facility Advisory Committee (UFAC) includes leaders of other major U.S. and international scientific research facilities and advises the NIF Director on operating NIF as a user facility. The NIF User Group is self-organized and represents the user community to the NIF Director and other individuals or organizations, as appropriate.

The NIF Director is responsible for generating the NIF multi-mission Facility Use Plan. The use plan includes target physics experiments in support of the NNSA Stockpile Stewardship Program (SSP) and other missions, facility capability development and maintenance, laser performance tests, and other activities. The Experimental Facilities Committee (EFC) and Peer-Review Panels (PRPs) support the NIF Director in developing the use plan as discussed below.

Target physics experiments are conducted in four program areas:

- Stockpile Stewardship: High-Energy-Density Science (SSP-HED)
- Stockpile Stewardship: Inertial Confinement Fusion (SSP-ICF)
- National Security Applications (NSA)
- Fundamental Science (FS)

Experiments to be conducted in all four of these areas are determined via a call for proposals process shown in Figure 2.

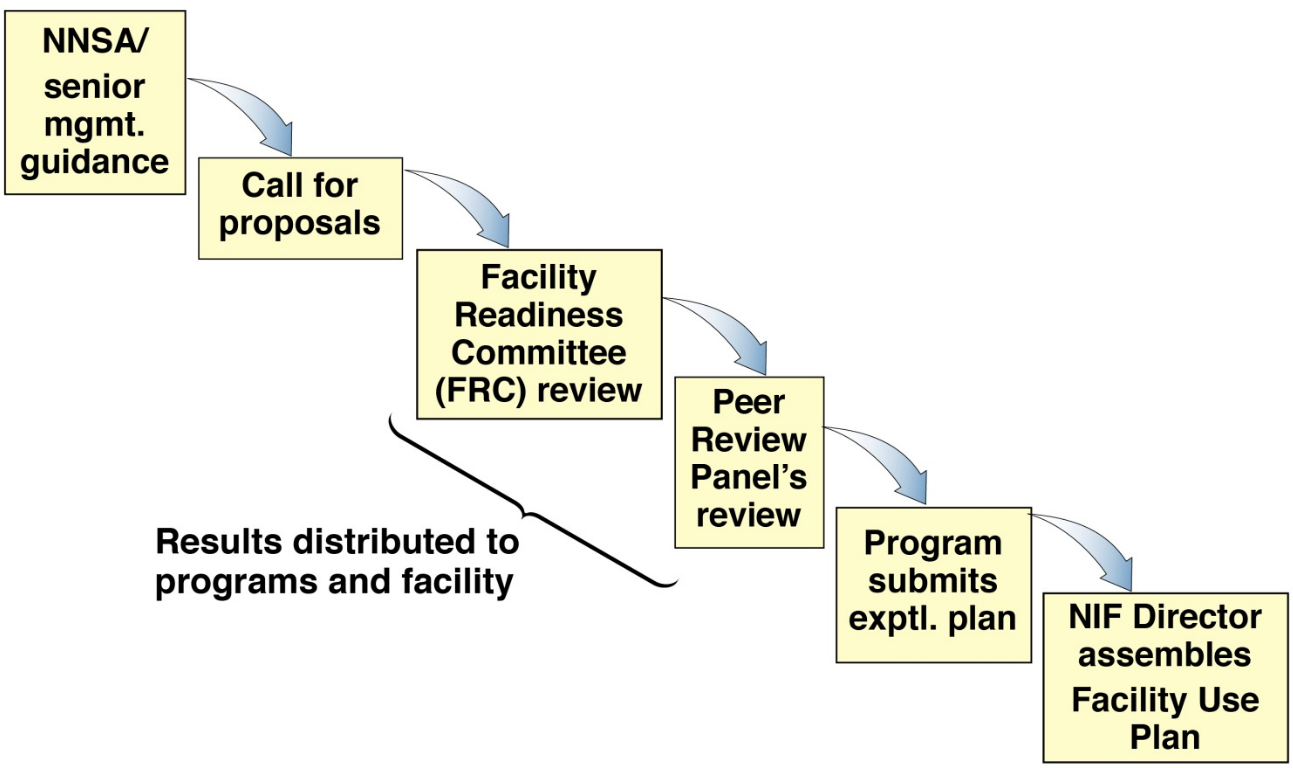


Figure 2: Process for proposal and review of NIF experiments and generation of the NIF Facility Use Plan.

The call for proposals for SSP-HED experiments is issued to the NNSA Science Executives and the HED Council, while the call for ICF experiments is issued to the ICF Executives and the ICF Working Group leaders. For the review discussed in this report, the NIF Director issued a single call for SSP-HED and SSP-ICF experiments. The Joint National Security Applications Council (JNSAC) and the NIF Director jointly issue the call for NSA experiments to the appropriate program leaders in the Department of Defense, NNSA, and other agencies. The NIF Director issues the call for proposals for FS experiments directly to the scientific community.

Proposed experiments submitted to NIF are reviewed by the Facility Readiness Committee (FRC) and the appropriate PRP. The FRC, staffed by subject-matter experts (SMEs) in lasers, targets, diagnostics, user optics, and other areas, reviews proposed experiments from the perspective of facility capability and operational impact. Further information on FRC ratings for this call is available in the corresponding FRC report. The PRP reviews proposed experiments from a technical perspective, with a primary focus on assessing the likelihood that the proposed campaign will successfully meet its technical objectives. The PRPs consist of SMEs drawn from both the program under review and the broader technical community.

PRP and FRC outputs are used by leaders of the four major program areas to develop their planned NIF experimental programs. These programs are then submitted to the NIF Director. Based on these inputs, NIF staff develops a recommended Facility Use Plan and associated rolling 18-month schedule for consideration by the EFC. The EFC, composed of user program and facility leadership, meets approximately every other month and is the primary vehicle for management-level communication between the facility and the user community. Following discussion with the EFC, the NIF Director prepares a Facility Use Plan for final approval by the LLNL Director. Changes to the NIF Facility Use Plan are managed via a change-control process outlined in the NIF Governance Plan.

NIF has completed two proposal call and review cycles prior to the SSP-ICF/SSP-HED PRP review reported here. Proposals for facility time for the fundamental science community were solicited in fall 2009 and reviewed in summer 2010. The first NSA community call for proposals and review process was executed between March and May 2013. Further information on these reviews is available from the NIF User Office.

2. Proposal Submission and PRP Review Process

On April 12, 2013, NIF Director Ed Moses issued a call for proposals for NIF SSP-HED and SSP-ICF experiments to be performed in quarters 1 and 2 (Q1/Q2) of fiscal year (FY) 2014 (see Appendix A). A total of 228 Tier 1 and Tier 2 shots in 15 individual campaigns and 59 sub-campaigns were requested. Table 1 summarizes the proposals received. Appendix B provides a complete list of proposals by campaign and sub-campaign.

Table 1: Summary of SSP-HED and SSP-ICF proposals received for FY 2014 Q1/Q2.

			Number of		
Program	**Site**	**Campaign**	**Sub-campaigns**	**Tier 1 Shots**	**Tier 2 Shots**
HED	LLNL	Burn	3	0	0
	LLNL	Code Validation	2	20	18
	LLNL	Hydrodynamics	2	6	0
	LLNL	Materials	3	32	0
	LANL	DIME	1	6	0
	LANL	Radiation Flow	4	12	0
	LANL	Hydrodynamics	1	4	0
ICF	LLNL	One-Dimensional Studies	8	22	14
	LLNL	Hohlraum	13	22	10
	LLNL	Hydrodynamics/Mix	5	26	0
	LLNL	Shape	9	12	0
	LLNL	Ablator/Shock Physics	4	3	6
	LLNL	Facility Capability	2	15	1
	LANL	Facility Capability	1	7	0
	LLE	Polar Drive	1	4	0
Totals			**59**	**191**	**49**

A standard six-page template was submitted for each sub-campaign considered. Appendix C provides an example of the template. In addition to the six-pager, each site was requested to provide information to address the questions outlined in the scoring criteria. These one-page summaries are included in Appendix D.

For this initial review of SSP-HED and SSP-ICF experiments, the NIF Director established an “interim” PRP. Table 2 identifies the members of this panel. The PRP reviewed proposed experiments according to the criteria discussed in Appendix E. As an interim PRP, the committee also considered the most effective way for PRPs to function in support of future calls for proposals.

Table 2: Interim HED/ICF PRP Members.

Panel Member	Affiliation	Contact Information
Mordy Rosen (Chair)	LLNL	rosen2@llnl.gov 925-422-5427
Warren Garbett	AWE	Warren.J.Garbett@awe.co.uk 44 118 985 6058
Peter Graham	AWE	PETER.GRAHAM@awe.co.uk
Jim Hammer	LLNL	Hammer2@llnl.gov 925-423-9709
Don Haynes	LANL	dhaynes@lanl.gov 505-665-7783
Mark Herrmann	Sandia	mherrma@sandia.gov 505-284-0236
Robert Kauffmann	LLNL	kauffman2@llnl.gov 925-422-0419
Mike Key	LLNL	key1@llnl.gov 925-424-2175
Jim Knauer	LLE stationed at LLNL	knauer1@llnl.gov 925-423-9785
Justin Wark	University of Oxford	wark@physics.ox.ac.uk 44 1865 272251

The interim PRP met on June 13, 2013, to review the submitted proposals (see Appendix B for a list of proposals). Proposals were reviewed at the campaign level, with discussion frequently dealing with sub-campaign issues. Each campaign was assigned a lead reviewer who was responsible for performing a preliminary assessment of the campaign and leading discussion of the campaign at the PRP meeting. At the end of the meeting, panel members briefed the program leaders on the PRP's major conclusions.

3. PRP Results

This section summarizes the PRP findings, followed by a more-detailed review of the 13 campaigns considered. In general, the panel's recommendations are unanimous. There were disagreements in some details, as delineated in the detailed paragraphs. As this was the panel's first meeting, a lessons learned section is included in this report, with recommendations on how to help the PRP process add more value in future meetings.

Summary of Findings

The ICF and HED program leaders, as well the NIF Director, have much to be proud of. There is a flowering of ideas, and there is good progress on the execution of those ideas. These campaigns can produce valuable data (and design challenges) that will

- Contribute to achieving program goals;
- Produce valuable applied science discoveries;
- Excite and vitalize the workforce; and
- Train students and postdoctoral researchers.

This flowering of ideas is so pronounced, there might even be a sense that the pendulum has swung a bit too far. It would be no surprise, then, that focus and down-selecting to some degree may be required in these tight fiscal times. Luckily, the PRP saw several possible opportunities to meld ICF and HED efforts in areas of near overlap.

In short: Stockpile Stewardship, writ large, is alive and well at NIF.

This was the first time for this PRP process. The panel appreciates the effort by the programs to provide the required information. Unfortunately, an enormous amount of information is needed for the PRP to properly add value in this process, and that amount of information would be too much to digest all in one day. As such, the PRP dealt with campaigns, and not, in general, with sub-campaigns. In the future, the panel's goal is to provide more value-added by examining many activities at the sub-campaign levels. Thus, for now, comments in *this* report are **not** a blanket endorsement of all sub-campaigns within a given campaign.

Evaluation at the Campaign Level

The SSP-HED campaigns tiered into three categories (A, B, and C), based on the scoring criteria, with B being slightly below A, and C decidedly below B:

A. LLNL Code Validation, LANL Hydrodynamics, LLNL Materials

B. LLNL Hydrodynamics, LANL Radiation Flow, LLNL Burn

C. DIME

The SSP-ICF campaigns achieved similar scores across their campaigns, with those scores at about the level of category A for the SSP-HED campaigns, with the exception of LLNL Ablator/Shock Physics, which placed even higher than the rest because of its importance and focus.

Other Comments

The quality of the teams is high. However, the panel saw many overlapping names across campaigns and sub-campaigns, which leads to a strong concern about adequate staffing.

Many synergies exist along with opportunities to develop common platforms, for example, by consolidating the mix campaigns and possibly melding the planar ablation work as well as the two-step, two-shock work. In the spirit of more joint ICF/HED pursuits, the PRP suggests that both programs consider a joint "new opportunities" call for competitive innovative proposals, similar to the successful December 2012 call by the Indirect-Drive Ignition Working Group.

Lessons Learned

The PRP found scoring at the campaign level to be difficult because it did not permit differentiation between more mature sub-campaigns and allow the panel to adequately comment on the merit of individual sub-campaigns. The programs expressed frustration with the flood of requests for supplemental information from both the PRP and the FRC. Creating more concise four-page templates that provide the correct level of input would be helpful. Communication points of contact would alleviate version-control issues and frustration on the part of the programs.

The panel would prefer to receive a three- or four-page written document in addition to the FRC six pagers. These short write-ups should basically provide information at the level of the introductory viewgraphs used by many of the presenters but supplemented with some overview pictures. In particular, the panel needed more detail than provided in the overview talks, so the sub-campaigns (or some rational sub-clustering) can be dealt with effectively. The panel realizes that this request will lead to increased review time. The PRP thus recommends having weekly meetings for 4–6 weeks instead of a one-day meeting, which is consistent to the FRC procedure. A lead reviewer for each campaign is still an anticipated part of the PRP process. The panel was hampered somewhat in discussing some of the HED work that was presented in an uncleared environment and thus recommends that future HED deliberations be conducted in secure locations.

Detailed Report by Campaign

HED: DIME

Several issues arose when evaluating DIME. The point design is being redone, probably with a pulse shape (two-step), and thus was not ready for presentation. Will the convergence be small enough to avoid high convergence shape issues and still be large enough to enter the turbulent mix regime? Will polar direct drive (PDD) with its many challenges (e.g., crossbeam energy transfer [CBET] and its probable non-spatial uniformity and difficult-to-predict temporal history) be an acceptable platform for symmetry and for higher mode instability seeds? Will the NIF beam have the smoothing required to separate laser imprint from imposed imprint? Otherwise, how will controlled experiments on mix be done? Given that other efforts are underway to study mix, it might be a prudent use of resources to combine forces on a more mature platform (indirect drive). There is a general sense among panel members that much work still needs to be done on DIME and that shaking out all of these issues on NIF is not an optimal use of the facility.

HED: LANL Hydrodynamics

The LANL hydrodynamics experiments build on the largely successful campaigns at OMEGA. A remaining question is whether imprint from the foam microstructure affects mixing. The LANL team has experience in handling foam issues in other campaigns, but it is not clear whether the campaign team has yet considered this issue. NIF will allow larger scale experiments probing both longer time and space scales, potentially into the turbulent mix regime. Another issue is an effective backlighter, which is currently under development. The first-choice target incorporates a Be tube, which may be problematic for the facility. Tests with CH tubes may show Be is unnecessary. Edge effects remain an issue. The review panel encourages the team to consider designs with the tracer layer, or at least the dominant optical depth of the tracer layer, localized away from the tube edges.

HED: LANL Radiation Flow

The shots for the Pleiades I experiments are designed to complete the data set for silica and Cl-doped foams. A different set of experiments, Pleiades II, explores foams at different densities. Calibration of material properties is seen as a major goal to be achieved. Yet another experiment, Menkar, was reviewed only recently, and it would be beneficial to have the results of those reviews made available to the PRP, so that the panel can make a more fully informed evaluation. The panel discussed the merits of experiments that provide code normalization and validation as opposed to a first-principles test of radiation transport. Despite these reservations, the PRP scored the campaign relatively high because of its relevance to HED physics issues. The point-projection backlighting experiment that is a follow-on to the Fanbolt experiment received a lower rating and should be placed at a lower priority.

HED: LLNL Burn

The panel considers the LLNL burn team to be strong, but is concerned that several key members of the team may be spread too thin. There is particular concern about the number of staff available for VISAR data reduction. The panel noted that some of the ablator characterization work could be done on OMEGA, although the panel agrees that NIF is the only place to explore the characterization of ablators through the entire parameter space of the indirect drive. There seems to be redundancy between the Planar Ablator and Crystal Ball platforms, though the panel did not reach a consensus on which platform should be preferred. Those who did express an opinion favor raising the planar shots to Tier 2. The format of the review did not allow the team to fully explain how these experiments would distinguish between different hypotheses concerning the drive/coupling issues seen during and after the National Ignition Campaign (NIC). One panelist, at least, questions the value of “measuring” drive multipliers as an efficient and fruitful approach to gaining understanding and suggests the team consider less-integrated and code-dependent approaches. (Note that the Te/Ti experiment alluded to in the proposal packet was not briefed, and the panel did not consider nor evaluate it.)

HED: LLNL Code Validation

The reviewers strongly supported the high-foot proposal. This campaign uses the ignition tuning platforms and has already been demonstrated in FY13, with very promising results. The campaign will deliver code validation and has potential as a route to ignition. It must be performed on NIF. The team has a proven record and includes members of NIC. Reviewers were more divided on the two-shock campaign, which has reduced the average scores of the code validation proposal. Several reviewers felt that the arguments for two-shock need to be further developed. Some reviewers thought the two-shock design was not sufficiently mature to be fielded in Q1 or Q2. Members of this team have experience at successfully delivering NIF experiments. The panel suggests that this campaign explore options for collaborating with the ICF two-shock proposal or look at options for OMEGA.

HED: LLNL Hydrodynamics

The LLNL HED hydrodynamic effort consists of two experimental efforts: the TOTO shots and the buried layer shots. Both campaigns were well planned and presented to the panel. Experiments associated with the TOTO campaign incorporate results from the OMEGA experiments and thus increase confidence of success on larger devices, namely NIF. Moving from OMEGA to NIF will also check scaling methodologies. The experimental team has experience with the OMEGA shots and should be able to bring this experience to the NIF shot planning and execution. In short, the PRP believes that this effort is ready to do experiments at NIF laser energies. Possible remaining issues are some uncertainties in materials properties and a need for a plan to rigorously test some issues of modeling methodology versus the data.

The deuterated plastic (CD) buried-layer experiment was also well planned and presented. This effort has had a series of successful shots on NIF, and the data collected to date are high quality. This “mix platform” development is well underway and should enable capsule mixing to be studied. The panel has two recommendations. First, an x-ray signature of mix can be added to the nuclear signature by adding dopants at different depths to the ablator. Second, a series of experiments to study mix once this platform has been developed should be planned. Possible issues involve the role of low-mode asymmetries.

HED: LLNL Materials

The LLNL materials team has engaged in extensive work both at LLNL and throughout the broader HED materials community to focus their efforts on the near-term goal of conducting a high-Z experiment on NIF in FY15. As part of that concerted push, the team held a community-wide workshop in May 2013, building on a series of Laboratory-wide internal workshops over the last few months. The goal of the workshop was to inform the path forward to a high-Z experiment. The plans presented at the workshop were well developed and well thought out by an experienced, qualified team. Based on the feedback from the workshop, the team narrowed the scope of the materials effort to increase focus on the FY15 goal.

Regarding the proposal for FY14 Q1/Q2 shots, while the Rayleigh-Taylor (RT) strength platform is the most mature platform for high-Z experiments on NIF and has the clearest path to near-term programmatic impact, it has target fabrication and facility fielding challenges that could present problems for the FY15 goal. The diffraction platform is less mature, and the path to programmatic impact is longer; however, it has considerably easier target fabrication and facility requirements. Thus, the strategy outlined for FY14 Q1/Q2 experiments is to continue to pursue the critical path experiments for both RT strength and diffraction, while more fully assessing the target fabrication and facility impacts, in preparation for a Q2 FY14 downselect. While the number of shots requested is high (12 per quarter), the team has extensive experience on NIF, and the experimental platforms have been developed over many years. A concern to be addressed is the ability of the team to handle this number of shots.

ICF: Polar Direct Drive

The PDD campaign is one of two alternate paths to ignition that NNSA outlined in the path-forward document to Congress. The path-forward document calls for a high-level FY15 review of the ICF program. Obtaining PDD data on NIF is a critical part of preparing for that milestone. Important issues that require experimental data are the level of laser-plasma interactions (LPI) at NIF-scale lengths and intensities. Another critical issue is the level of hot electrons. Initial data from PDD experiments on NIF have been high quality and have revealed important information on LPI, hot electrons, implosion symmetry, and the overall coupling efficiency of laser energy to kinetic energy. The proposed experiments would increase intensity and look at target variations that could mitigate or change LPI, hot electron generation, and CBET. A concern raised in the PRP discussions is that the bandwidth of NIF is known to be insufficient for the ultimate PDD application; therefore, the PRP questions whether the data obtained in FY14 Q1/Q2 experiments on LPI, CBET, hot electrons, and implosion symmetry will be generally useful. For example, would imprint-seeded growth affect coupling? In addition, the point design for PDD is incomplete, which further complicates the question of which experiment will be the most effective.

ICF: One-Dimensional Studies

The 1D campaign team is excellent and very experienced in ICF physics, but team members are stretched too thin to cover all the proposed areas in 1D physics. The PRP thought the highest priority was the high-density carbon (HDC) three-shock experiment because it represents a second major avenue toward ignition or alpha heating. The Be ablator is a sensible backup for the HDC ablator but should be approached serially rather than in parallel to provide a manageable workload. The one- and two-shock platforms have given exciting results, although they are less relevant to ignition. They do serve as a useful platform to scan for convergence ratio (CR) effects and to see where in CR the team can no longer match the data with reasonable simulations.

ICF: Hohlraum Drive

The hohlraum drive campaign has a strong team and is attempting to progress along several fronts. In general, the PRP endorses the approaches, as well as the ordering of experiments. The team and its leadership have sufficient expertise and wisdom to properly tier a large wish list, and team members appreciate the subtle difficulties of some proposals (e.g., any change in hohlraum can induce a change in CBET). The view factor is a proven platform, and the quartraum represents the next step in studying CBET. A time-dependent static x-ray imager (SXI) would be a very useful diagnostic tool, as well. The rugby-shaped hohlraum holds great potential as a platform, and its results may provide much more about modeling deficiencies. The PRP encourages the team to pursue initial steps (probably on other lasers such as OMEGA) to progress with hotter hohlraums via B fields and various high-Z implantations, as well as characterizing said plasma conditions via Thomson scattering and dot spectroscopy, and their cross calibration. The proton radiography project seems to require a longer development time, with more data analysis needed from OMEGA hohlraum probing, in order to assess whether quantitative information would result from such experiments on NIF.

ICF: Hydrodynamics/Mix

The panel unanimously recognizes the hydrodynamics/mix team as world class and the facility uniqueness as having been inarguably demonstrated. The hydrodynamic growth radiography (HGR) platforms for two convergence ratios received strong support from the panel, and the team is encouraged to try to directly connect experimental data from these experiments to the previous validation data on this topic from Nova and OMEGA. The mix symmetry capsules are promising and are supported by the panel, although some PRP members encourage the team to consider how to use the platform for A/B experiments on, say, the effect of defects or the effect of asymmetry. The panel questions the readiness of the low-rho ice platform and recommends more design work and simulations be performed before shot time is allocated.

ICF: Shape

The goal of the shape experiments is to improve the low-order shape of ignition implosions. The experiments use one- and two-dimensional x-ray backlighting to measure the shape of the in-flight dense cold fuel and self-emission to measure the shape of the imploded core. The experiments include layered DT implosions to measure performance improvements due to improved shape. Shots are also included to develop Compton radiography to measure the cold fuel shape at peak implosion time using both conventional backlighters and NIF's Advanced Radiography Capability (ARC). These experiments address a key physics issue for ignition targets, and the PRP gave them a high ranking. As proposed, the experiments will use the CH low-adiabat point design. The panel recommends reviewing the point design target and alternative designs such as high-adiabat implosions and HDC capsules and possibly redirecting the experiments to these alternative designs.

ICF: Ablator/Shock Physics

The shock campaign is focused on the properties of shocked DT ice and surrogacy of the liquid D_2 keyhole experiments. Differences in observed timing of the fourth shock of DT layers versus liquid D_2 call into question much of the ignition capsule hydrodynamic modeling, so it is important to chase down these differences. The Tier 1 shots are consistent with that goal. The Tier 2 equation-of-state experiments would also be useful; however, the wide-angle VISAR needs development. This campaign requires a modest number of shots but makes efficient use of resources by building on proven platforms. The experiments therefore have a high probability of successful data return. The program should be thinking about using this technique on designs relevant to the high-foot or HDC campaigns.

4. Acknowledgments

In closing, the PRP thanks Chris Keane of the NIF User Office and his staff for their excellent guidance and logistical support for this first, very challenging, exercise of NIF peer review. They rose nobly to the challenge, and the day ran remarkably smoothly. A special thank you goes to Lynn Kot and to Warren Hsing, (and, by extension, to the entire FRC team of reviewers) for staying with the panel throughout the long day and providing expert opinion on Facility Readiness issues on all the campaigns and, admirably, at the sub-campaign level.

Appendix A: Call for Proposals

NIF

NIF-0175230

April 12, 2013

To: Distribution
From: Director, National Ignition Facility
Subject: Call for Proposals for Stockpile Stewardship Program (SSP) Experiments

This is a call for proposals for experiments on NIF supporting High Energy Density (HED-SSP) and Inertial Confinement Fusion (ICF-SSP) programs for the period Q1FY2014-Q2FY2014.

Proposal subject areas:

- **HED-SSP Program:** NIF is soliciting proposals for SSP experiments from the Weapons Program leaders at LANL LLNL, and SNL. Weapons Program leaders, or their designees, are responsible for coordinating proposals from their respective institutions into a single, prioritized submission. LLE and NRL may submit proposals through LANL, LLNL, or SNL.
- **ICF-SSP Program:** NIF is soliciting proposals from the ICF Program leaders at LANL, LLE, LLNL, NRL, and SNL for SSP experiments to support ICF programs. ICF Program leaders, or their designees, are responsible for coordinating proposals from their respective institutions into a single, prioritized submission.

Eligible applicants: Principal Investigators may be associated with the national laboratory, academic, or private sectors, and may be from the US or abroad. All researchers involved in NIF experiments will be required to follow LLNL policies and procedures regarding site access, computer use, security, and other topics.

Proposal timeframe and review process schedule: The specific timeframe for this call is Q1FY2014-Q2FY2014. A follow-on 18-month call for the period Q3FY2014-Q2FY2015 will be issued early in Q3FY2013. The timeline for this proposal solicitation and review process is shown in the table below.

Action	Date
Call for Q1/Q2 FY2014 proposals issued	April 12, 2013
Six-page templates due to NIF User Office	April 30, 2013
EFC meeting: Program leadership briefs proposals submitted to User Office	June 1, 2013
Facility review by NIF Feasibility/Readiness Committee (FRC) complete	June 11, 2013
Peer Review Panel (PRP) review complete	June 18, 2013
HED Council/IDI/PDD Working Groups provide prioritized recommendations	July 3, 2013
EFC meeting: NIF staff provides a draft integrated facility use plan to EFC	July 15, 2013
EFC Chair provides recommended integrated facility use plan to the NIF Director	July 22, 2013
NIF Director issues Q1/Q2 FY2014 guidance; Facility issues Q1/Q2 working schedule	August 1, 2013

Feasibility/Readiness Committee (FRC) reviews and interactions with PRPs: For each proposal, the relative complexity of requested facility capabilities and operational support that will be evaluated.

- The benefit to the users of this evaluation is to provide feedback at an early stage in the design process, potential facility and implementation issues, and recommendations how they may be mitigated.
- The benefit to the NIF of this evaluation is the identification of new capabilities required and potential operational issues that will need to be addressed. This evaluation will address the following areas: laser configuration, targets and diagnostic engineering, facility operations, Target and Laser Interaction Sphere (TaLIS), computational simulation (facility perspective), and experimental and diagnostic needs from a scientific/technical perspective, as well integration of these campaigns into the overall shot plan.

Following the FRC review, the interim ICF-SSP and HED-SSP Peer Review Panels (PRPs) will review the NIF FRC evaluations. The PRPs will look at the integrated set of FRC evaluations and provide feedback to users regarding achievement of their technical objectives consistent with safe, efficient facility operation, facility capabilities, and available resources.

How to apply: ICF and Weapons Program Leaders should submit a single, prioritized submission package using the sample NIF "six-pager" template attached to this solicitation. Completed proposal packages should be submitted to the NIF User Office via email (nifuseroffice@llnl.gov) **by midnight CA time April 30, 2013.** Submissions containing Official Use Only (OUO) information should be password protected. Please contact the User Office regarding any submission of classified information.

Questions: For information on the proposal submission and review process, contact the NIF User Office (Dr. Christopher Keane, 925-422-2179, keane1@llnl.gov). Technical questions on NIF experiments should be referred to the FRC Chair (Dr. Warren Hsing, 925-423-2849, hsing1@llnl.gov).

Appendix B: List of Proposals by Sub-Campaign

HED ICF PRP TRACKING
June 13, 2013

Program	Site	Campaign	PRP file	Subcampaign (6-pager) tracking #	Proposal	# Tier 1 shots (Q1/Q2)	# Tier 2 shots (Q1/Q2)
ICF	LLNL	1D	FY14_01_I_LLNL_1D_4jun13			22	14
				1	FY14_01_I_LLNL_1D_001a_1Shock.pdf	4	2
				2	FY14_01_I_LLNL_1D_002_2Shock.pdf	2	4
				3	FY14_01_I_LLNL_1D_003a_HDC.pdf	9	2
				4	FY14_01_I_LLNL_1D_004a_Be.pdf	7	
				5	FY14_01_I_LLNL_1D_005a_HugCH.pdf	0	1
				6	FY14_01_I_LLNL_1D_006a_HugEOS.pdf	0	1
				7	FY14_01_I_LLNL_1D_007_DTRel.pdf	0	2
				8	FY14_01_I_LLNL_1D_008a_REIPQ.pdf	0	2
ICF	LLNL	Hohlraum	FY14_01_I_LLNL_Hohlraum_4jun13			22	10
				9	FY14_01_I_LLNL_Hohl_001a_CBET.pdf	2	
				10	FY14_01_I_LLNL_Hohl_002a_SBSAuB.pdf	2	
				11	FY14_01_I_LLNL_Hohl_003a_Rugby.pdf	5	
				12	FY14_01_I_LLNL_Hohl_004a_Hydro.pdf	1	
				13	FY14_01_I_LLNL_Hohl_005a_HohlMod.pdf	8	0
				14	FY14_01_I_LLNL_Hohl_006a_Glint.pdf	0	2
				15	FY14_01_I_LLNL_Hohl_007a_NonLTE.pdf FRC OT REQD, no Q1/Q2 shots	0	
				16	FY14_01_I_LLNL_Hohl_008_CapRat.pdf	0	2
				17	FY14_01_I_LLNL_Hohl_009_HotE.pdf NOT FRC NOT REQD, no Q1/Q2 shots	0	
				18	FY14_01_I_LLNL_Hohl_010a_CFTune.pdf	0	6
				19	FY14_01_I_LLNL_Hohl_011a_ProtRad.pdf	1	
				56	FY14_01_I_LLNL_Hohl_012-NEW_CBETWP.pdf	1	
				57	FY14_01_I_LLNL_Hohl_013-NEW_ProtRad2.pdf	2	
ICF	LLNL	Hydro/Mix	FY14_01_I_LLNL_Mix_4jun13			26	0
				20	FY14_01_I_LLNL_Mix_001a_LowDen.pdf	1	
				21	FY14_01_I_LLNL_Mix_002a_HGR1.pdf	10	
				22	FY14_01_I_LLNL_Mix_003a_HGR2.pdf	5	0
				23	FY14_01_I_LLNL_Mix_004a_MixSym.pdf	8	
				58	FY14_01_I_LLNL_Mix_005-NEW_HGRBL.pdf	2	
ICF	LLNL	Shape	FY14_01_I_LLNL_Shape_4jun13			12	0
				24	FY14_01_I_LLNL_Shap_001_CR.pdf	2	
				25	FY14_01_I_LLNL_Shap_002_CRadv.pdf	0	0
				26	FY14_01_I_LLNL_Shap_003_CRARC1.pdf FRC NOT REQD, no Q1/Q2 shots	0	
				27	FY14_01_I_LLNL_Shap_004_CRARC2.pdf FRC NOT REQD, no Q1/Q2 shots	0	
				28	FY14_01_I_LLNL_Shap_005_Inflgt.pdf	2	
				29	FY14_01_I_LLNL_Shap_007_TimeD.pdf	2	
				30	FY14_01_I_LLNL_Shap_008_HignConv.pdf	5	
				31	FY14_01_I_LLNL_Shap_009_Low Conv.pdf	1	
				32	FY14_01_I_LLNL_Shap_010_TrSym.pdf FRC NOT REQD, no Q1/Q2 shots	0	

HED ICF PRP TRACKING
June 13, 2013

Program	Site	Campaign	PRP file	Subcampaign (6-pager) tracking #	Proposal	# Tier 1 shots (Q1/Q2)	# Tier 2 shots (Q1/Q2)
ICF	LLNL	Ablator/Shock Physics	FY14_01_I_LLNL_Shock_4jun13			3	6
				33	FY14_01_I_LLNL_Shoc_001_4thShock.pdf	1	
				34	FY14_01_I_LLNL_Shoc_002_ShockStag.pdf	2	
				35	FY14_01_I_LLNL_Shoc_003_WideFOV.pdf	0	4
				36	FY14_01_I_LLNL_Shoc_004a_DTRel.pdf	0	2
ICF	LLNL	Fac. Cap.	FY14_01_LLNL_Facility_Cap_4jun13			15	1
				54	FY14_01_C_LLNL_FaCa_001_Warm.pdf	13	
				55	FY14_01_C_LLNL_FaCa_002_Be.pdf	2	1
ICF	LANL	Fac. Cap.				7	
				59	FY14_01_C_LANL_FaCa_001_Be	7	
ICF	LLE	Polar Drive	FY14_01_I_LLE_PDD_4Jun13			4	
				37	FY14_01_I_LLE_PDD_001_Shape.pdf	4	
HED	LLNL	Burn	FY14_01_H_LLNL_Burn_4jun13			0	0
				38	FY14_01_H_LLNL_Burn_001a_KeyCB.pdf FRC NOT REQD, Tier 3	0	
				39	FY14_01_H_LLNL_Burn_002a_PlanAbl.pdf FRC NOT REQD, Tier 3	0	
				40	FY14_01_H_LLNL_Burn_003a_XPTeTi.pdf FRC NOT REQD, Tier 3	0	
HED	LLNL	Code Validation	FY14_01_H_LLNL_CodeVal_4jun13			20	18
				41	FY14_01_H_LLNL_CVal_001a_HiFt.pdf	14	12
				42	FY14_01_H_LLNL_CVal_002a_2Shock.pdf	6	6
HED	LLNL	Hydrodynamics	FY14_01_H_LLNL_Hydro_4jun13			6	0
				43	FY14_01_H_LLNL_Hydr_001a_Toto.pdf	6	
				44	FY14_01_H_LLNL_Hydr_002a_CDMix.pdf NOT REQD, no Q1/Q2 shots	0	
HED	LLNL	Materials	FY14_01_H_LLNL_Materials			32	0
				45	FY14_01_H_LLNL_Mat_001a_EOS.pdf NOT REQD, no Q1/Q2 shots	0	
				46	FY14_01_H_LLNL_Mat_002a_Strength.pdf	19	
				47	FY14_01_H_LLNL_Mat_003b_TARDIS.pdf	13	
HED	LANL	DIME	FY14_01_H_LANL_DIME_4jun13			6	0
				48	FY14_01_H_LANL_DIME_005_Burn.pdf	6	
HED	LANL	Rad. Flow	FY14_01_H_LANL_Rad_4jun13			12	0
				49	FY14_01_H_LANL_Rad_006_PPBL.pdf	2	
				51	FY14_01_H_LANL_Rad_002_Pleid1.pdf	4	
				52	FY14_01_H_LANL_Rad_003_Pleid2.pdf	2	
				53	FY14_01_H_LANL_Rad_004_Menkar.pdf	4	
HED	LANL	Hydrodynamics	FY14_01_H_LANL_Hydro_4jun13			4	0
				50	FY14_01_H_LANL_Hydro_001_Shear.pdf	4	
TOTAL						191	49

Appendix C: Six-Page Template

Program (ICF, HEDSS, Fund. Sci, Natl. Sec. Appl.): **Campaign (e.g. Shape, …):**

NIF

Experiment Name: RT Calorimetry
Scope Overview

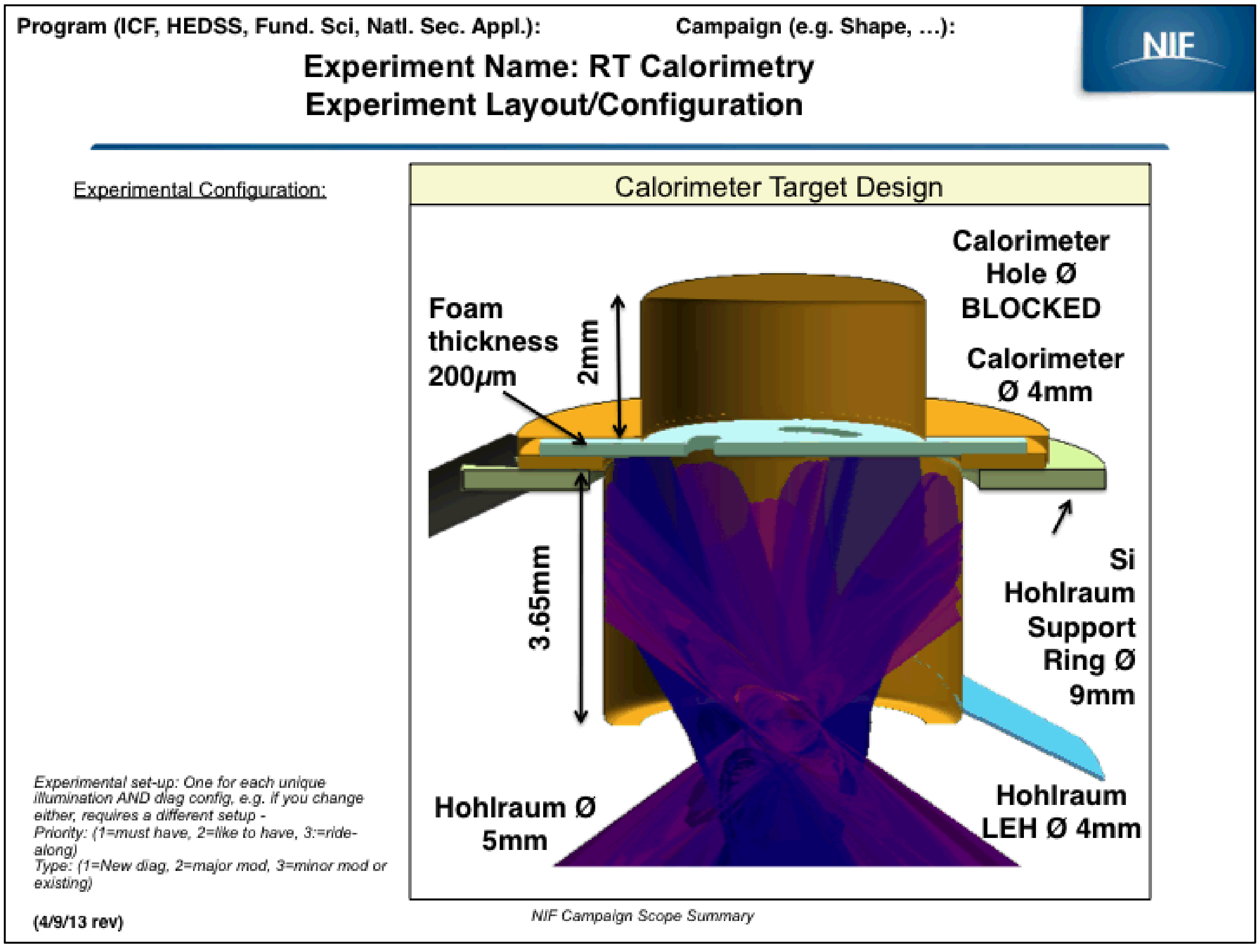
- **Purpose:**
  - *Measure radiation transport through different samples*
- **Quantitative Goal of this set of experiments:**
  - *Dante-1 drive measurements and Dante-2 calorimeter measurements ± 3% in Tr*
- **What would we do with results:**
  - *Complete project*

Shot RI/Designer: Campaign ID, Campaign Name, Shot Name, Date (when available)
- *Moore, Cooper, Schneider/Maclaren*

Campaign RI:
Major issues/Impacts: *Laser energy must be reproducible to 5% shot-to-shot, GXD in DIM 90-78 is being implemented as FMEA diagnostics*

Summary Table	Q3FY14	Q4FY14	Q1FY15	Q2FY15	Notes:
Total shots	3				
Target #1	2				
Target #2	2				

(4/9/13 rev) *NIF Campaign Scope Summary*

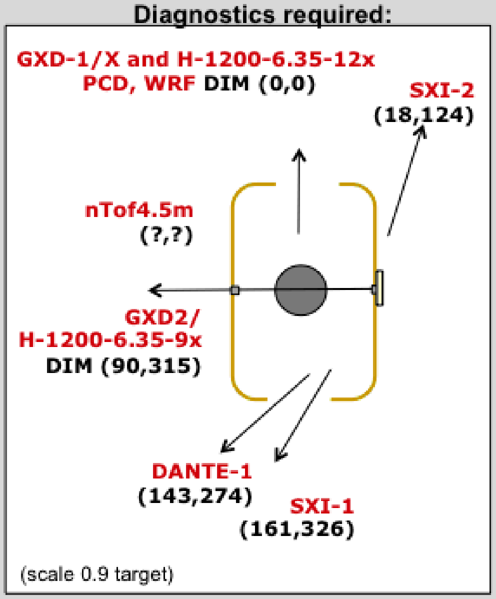

Program (ICF, HEDSS, Fund. Sci, Natl. Sec. Appl.):
Campaign (e.g. Shape, ...):
NIF
Experiment Name: RT Calorimetry
Experiment Layout/Configuration
Experimental Configuration:
Calorimeter Target Design
Calorimeter Hole Ø BLOCKED
Foam thickness 200µm
2mm
Calorimeter Ø 4mm
3.65mm
Si Hohlraum Support Ring Ø 9mm
Hohlraum Ø 5mm
Hohlraum LEH Ø 4mm
Experimental set-up: One for each unique illumination AND diag config, e.g. if you change either, requires a different setup -
Priority: (1=must have, 2=like to have, 3:=ride-along)
Type: (1=New diag, 2=major mod, 3=minor mod or existing)
(4/9/13 rev)
NIF Campaign Scope Summary

Program (ICF, HEDSS, Fund. Sci, Natl. Sec. Appl.): **Campaign (e.g. Shape, ...):**

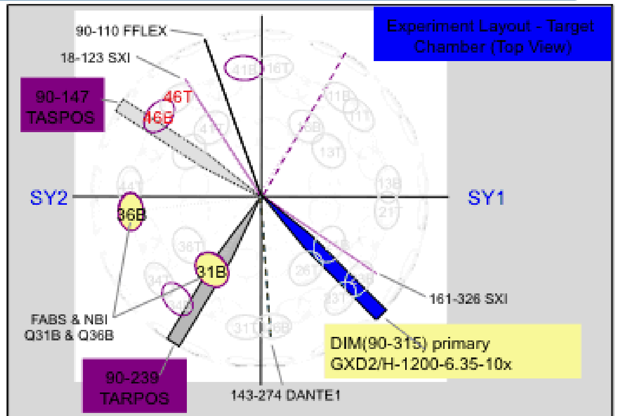
NIF

Experiment Name: RT Calorimetry
Diagnostic Configuration

Diagnostics required:



Experimental set-up: One for each unique illumination AND diag config, e.g. if you change either, requires a different setup
Priority: (1: must have,2:like to have , 3: ride-along) Type: (1:New diag, 2:major mod, 3: minor mod or existing)



Diag	Location	Pri.	Type	Calib
GXD2/H-1200-6.4-9x	DIM 90-315	1	3	Post-shot
DANTE-1	143, 274	1	3	Pre-shot
SXI 1	161, 326	2	3	
FFLEX	90, 110	2	3	Pre-shot
FABS/NBI	Q31B, Q36B	2	3	Pre-shot
SXI 2	18, 124	2	3	
GXD1/X, H-1200-6.35-12x	DIM 0-0	2	1	Pre-shot

(4/9/13 rev) *NIF Campaign Scope Summary*

Program (ICF, HEDSS, Fund. Sci, Natl. Sec. Appl.): Campaign (e.g. Shape, ...):

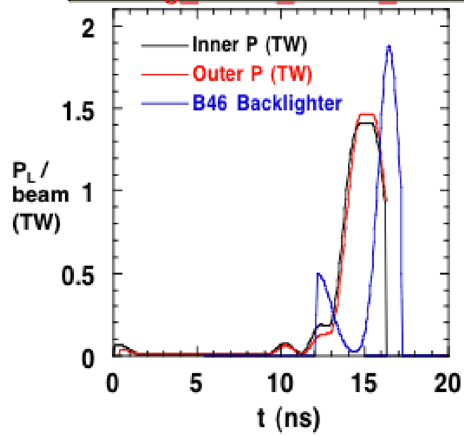
NIF

Experiment Name: RT Calorimetry
Laser Requirements

Laser Parameter	Value	Tolerance
1) Energy range per quad	*15.1 kJ - Drive*	*± 0.5 kJ*
- 184 Drive Beams	*710 kJ total*	*Inner = 252 kJ, Outer = 456.5 kJ*
- 8 Backlighter Beams, B46	*26 kJ in 1.5 ns Gaussian + 1ns Gaussian prepulse*	*(See note below)*
2) Pulse length	*NIC Ignition*	*±100 ps*
3) Pulse shape (Note: Provide File/ Plot if shaped pulse)	*NIC Ignition*	*200 ps rise time*
4) PB - Provide expected 2ns power balance as a function of time (Expectation is 8% nominal, for 50:1 contrast)	*Nominal, NIC Ignition*	*Same as Hohl_Energ_P2 _S19 N091116*
5) *Peak Power Cone Fraction/phi*	*0.325*	
6) SSD bandwidth (Options 0 to 90 GHz).	*60 GHz*	
7) CPP design (Options: None, Scale 0.7, 1, or 1.2, or other)	*Scale 1 and 1.07 CPPs*	
8) Pulse delays (All beams in a quad must have the same delay)	*none; shoot at t =0*	*±100 ps*
9) 2-color wavelength offset (Nominal is 1.9angstroms.	*TBD (<5 Å)*	
10) Beam pointing	*NIC Ignition*	
11) Beam focus	*NIC Ignition*	*+/- x.x mm*
12) Post Pulse energy upper limit	*NIC Ignition*	*Debr & Shrap*

Experiment Layout/Configuration #1 of 1

Laser Pulse Shapes
Energ_rev41_750kJ_cf325



Same as Hohl_Energ_P2_S19 N091116

Backlighter pulse is 0.5 TW 2 ns FWHM Gaussian followed by 1.9 TW 1.5 ns FWHM Gaussian 4.3 ns later, chopped in front and back

(4/9/13 rev) NIF Campaign Scope Summary

Program (ICF, HEDSS, Fund. Sci, Natl. Sec. Appl.): **Campaign (e.g. Shape, ...):**

NIF

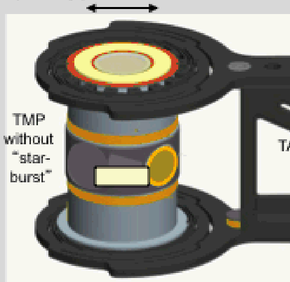
Experiment Name: RT Calorimetry
Target & Component Details

Target #1: Type C, gas-filled hohlraum with TMP and capsule

LEH: 2.94 mm unlined

8.4 mm

TMP without "star-burst"



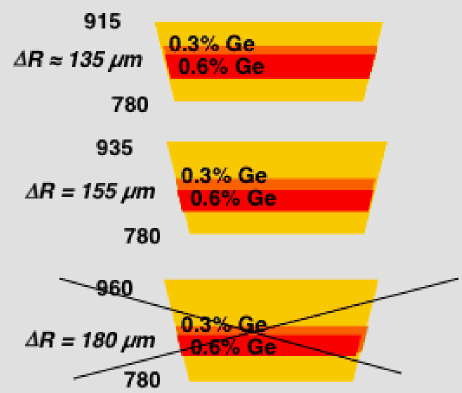
TARPOS 90-239

4.58 mm

Scale 0.9 Au cryo gas-filled symcap hohlraum with alignment "features", 64% unlined LEH, 1.2 by 0.10 (0.15) mm slots at 90, 135 (315) tamped by 150 μm thick diamond

Use aluminum TMP without "starburst" patterns. Cryo "clam-shell" shroud opens as part of shot sequence.

Scale 0.9 Symcap
Use 155 μm and 135 μm



Tolerances: OD: ± 10 μm
ΔR: ± 5 μm

Same gas fill as symcaps
8 mg/cc 7% D + 93% ^{4}He. then
6 mg/cc 7% D + 93% ^{3}He

- *Type A: Developmental e.g. never been made before*
- *Type B: Complex e.g. produced before but has some schedule risk due to complex processes involved*
- *Type C: Routine/Simple e.g. hohlraums, witness plates, backlighter disks, ...*

(4/9/13 rev) *NIF Campaign Scope Summary*

Program (ICF, HEDSS, Fund. Sci, Natl. Sec. Appl.): Campaign (e.g. Shape, ...):

Experiment Name: RT Calorimetry
Other capabilities/requirements

New capabilities requested:

Area	Requirement	Date needed	Est cost	Funding source	NIF responsibility	Other org responsibility	Notes:
Diagnostics	VISAR comb	*Q1FY14*	*?*	*$? C2*	*Design, build, OQ*	*Provide high level requirements, review functional requirements, PQ capability*	*No requirement exists for mid-pressure*
Diagnostics	*DIM instrument designed by external org*	*Q2FY14*	*?*	*?*	*Interface DIM instrument to NIF; hold IPRB, design reviews, IQ, OQ*	*Provide high level requirements, review functional requirements, PQ capability*	
Facility operations		*Q1FY14*	*?*	*?*	*Field classified shot*	*Provide high level requirements, review functional requirements*	
Facility operations		*Q1FY14*	*?*	*?*	*Field classified shot*	*Provide high level requirements, review functional requirements*	
Data analysis							

Milestones impacted
Milestone date:
Milestone type: (PEP, NNSA L2,...)
Completion criteria:

(4/9/13 rev) *NIF Campaign Scope Summary*

Appendix D: One-Page Summary Template

Program Name:

Site:

Campaign Name:

Submitted by:

Please answer the following in paragraph format:

1) Please provide a brief summary description of campaign:

2) Please provide a top level description of goals for experiments to be conducted in FY14 Q1/Q2:

3) Please identify any student or postdoctoral involvement in the campaign:

Appendix E: Scoring Criteria

NIF Proposal Evaluation Criteria
SSP-HED and SSP-ICF PRP

1. Quality of the Proposed Campaign

- What is the likelihood the proposed campaign will successfully meet its technical objectives, including measurement of the required parameters with the specified uncertainties and errors, and extend our scientific and technical knowledge base?
- Evaluation Criteria:
  - **5** The team understands the challenges and there is high confidence the proposed campaign will succeed.
  - **4** The team understands the challenges and there is reasonable confidence the proposed campaign will succeed.
  - **3** The team understands the general nature of the problem and with assistance the proposed campaign could succeed.
  - **2** The team lacks a full understanding of the problem and the proposed campaign requires significant modifications to succeed.
  - **1** The proposed campaign is highly unlikely to succeed.

2. Quality of the PI/Team

- Is the PI/team qualified (in breadth and depth) to conduct the proposed campaign?
  - a) Does the team possess the leadership, track record and appropriate experience in high energy laser experiments as evidenced by a record of publications (or equivalent) and scientific accomplishments?
  - b) Does the team include the full complement of the scientific and technical staff needed to successfully undertake the proposed campaign?
  - c) Does the makeup of the proposed team (experienced researchers, postdocs, students, etc.) contribute to workforce development and general advancement of the field?
- Evaluation Criteria:
  - **5** Team is world class and highly recognized, includes the full complement of expertise needed, and is very well suited to perform the proposed campaign.
  - **4** Team is solid and recognized and should be able to execute the proposed campaign.
  - **3** Team likely will be able to do the proposed campaign with modest assistance or augmentation.
  - **2** Team has significant gaps in capability—major strengthening of the team is required to execute the proposed campaign.
  - **1** Team does not have the capability to execute the proposed campaign.

3. Facility Uniqueness

- Is NIF the best venue for conducting this campaign?
  - a) Does NIF represent unique capabilities not available at other facilities?
  - b) Does the proposed campaign build effectively on work conducted at other facilities?
  - c) Is there another facility (e.g., Jupiter, Z, or OMEGA) where the objectives, fully or partially, could be more effectively achieved?

- Evaluation Criteria:
  - **5** NIF is uniquely suited to perform this campaign—the use of NIF will enable progress not possible elsewhere.
  - **4** NIF offers major advantages for this campaign—NIF will enable major progress compared with conducting the campaign at another facility.
  - **3** NIF offers significant advantages for this campaign—NIF will enable significant progress compared with conducting the campaign at another facility.
  - **2** NIF offers minor advantages for this campaign—NIF will enable modest additional progress compared with conducting the campaign at another facility.
  - **1** NIF offers no advantage over other facilities.

Appendix F: PRP Agenda

Agenda
HED/ICF PRP Meeting
June 13, 2013

Thursday, June 13, 2013

PLENARY (VTC- by invitation only)

7:30 a.m.	Gather (B131, 2019)	
8:00	Welcome	E. Moses
8:10	NIF Update and Review Process	J. Atherton/C. Keane
HED		
8:30	*LLNL HED Program*	
	Introduction	A.Wan
	Material Properties	T. Arsenlis/B. Remington
	Burn	O. Hurricane/S. MacLaren
	Hydrodynamics	T. Dittrich/B. Remington
	Code Validation	O. Hurricane/T. Dittrich/S. MacLaren
	Facility Readiness Committee (FRC) Scoring	W. Hsing
10:00	Executive Session- Scoring	M. Rosen
10:20	*LANL HED Program*	
	Objectives: DIME, Radiation Flow, Hydrodynamics	D. Haynes/A. Moore
HED		
10:40	Transportation to B481/2005	
11:00	*LANL HED Program*	
	DIME	R Kanzleiter
	Radiation Flow	J. Workman/A. Moore
	Hydrodynamics	F. Doss
	FRC Scoring	W. Hsing
11:55	Executive Session- Scoring	
12:10	Lunch/Executive Session	
ICF		
12:45	*UR/LLE ICF Submission*	
	Polar Direct Drive	C. Sangster/R.Bahukutumbi
	LLNL ICF Submission	
	Introduction	J. Edwards
	Hohlraum Physics	D. Callahan
	Hydrodynamics/Mix	H. Robey

Lawrence Livermore National Laboratory

	FRC Scoring	W. Hsing
1:55	Executive Session- Scoring	
2:10	Shape One-dimensional Studies Ablator/Shock Physics New Facility Capabilities FRC Scoring	R. Town R. Collins H. Robey R. Collin W. Hsing
3:40	Executive Session- Scoring	
4:00	Break	
4:10	Discussion/Executive Session	M. Rosen
PLENARY		
5:30	Briefout	All
6:00	Adjourn	

Host:	Chris Keane, Director, NIF User Office
Administrative Contact:	Sarah Camarillo (925) 423-4768
Clearance:	SRD clearance is required for portions of the meeting, under JAIEG-2 Restrictions
Agenda date:	June 13, 2013