The last few months have been very productive!
We’ve established an efficient, stable operating point on NIF over the past 3 years

- Demand for NIF experiments significantly exceeds capacity and will remain high due to SSP requirements
- Over 80 efficiency improvement projects completed; on track to double the shot-rate
- Increased shot-rate has provided important data for Stockpile Stewardship Program and diversified the usage of NIF
- New experimental capabilities such as Be, Pu, new targets, new diagnostics, ARC

We are on track to meet the goals laid out in the 120 day study thanks to community support and tremendous teamwork!
NIF is supporting a wide diversity of users

<table>
<thead>
<tr>
<th>User</th>
<th>FY14 Total</th>
<th>FY15 Total</th>
<th>FY16 Total</th>
</tr>
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<tbody>
<tr>
<td>LLNL</td>
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<td>195</td>
<td>220</td>
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<tr>
<td>LANL</td>
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<td>51</td>
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<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>AWE</td>
<td>4</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>LLE</td>
<td>8</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>DTRA, MDA, Navy, C7, ...</td>
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<td>30</td>
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<tr>
<td>Academic Users</td>
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<tr>
<td>Facility</td>
<td>18</td>
<td>30</td>
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<td><strong>Grand Total</strong></td>
<td><strong>191</strong></td>
<td><strong>356</strong></td>
<td><strong>434</strong></td>
</tr>
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</table>
The FASC met last week to baseline FY17 Q1&Q2

- We are completing the scheduling process for Q1&Q2 FY17. Programs have requested ~comparable experimental rate in Q1&Q2 of FY17 as in FY16. Scheduling will be very similar to FY16.

- Current draft schedule has ~230 experiments for first 6 months of FY17.

- Significant efficiency improvements continue to take place. For example ATLAS and TANDM will be completed and implemented over the next FY and begin to impact shot rate.

- We are issuing the call for experimental capability development in the near future. Will be very similar to last year’s call.
Beam-Line Integrated Performance (BLIP) group overview

Presented to NIF user forum


4/25/2016
Outline

- Brief introduction of BLIP group
- Over-view of BLIP shot setup review process
- Discuss common laser setup issues
- Clarify BLIP shot setup review time-line
Beam Line Integrated Performance (BLIP) group is part of the NIF expert group

Primary mission of expert group is to ensure that experiments are conducted at NIF in a safe and sustainable way so that it is available for all users.
BLIP on-call group is made up of laser and optics experts
BLIP works in conjunction with TALIS and NOL to ensure safe and sustainable operation of NIF laser

BLIP group’s primary responsibilities include:

- **Ensure NIF laser machine safety**
  - Perform review and approval of laser shot setup

- **Provide on-call support to facility for issues related to shot setup, machine safety and laser performance**

- **Ensure NIF laser meets performance requirements**
  - Maintains a calibrated laser model (LPOM)
  - Perform post-shot review and monitor laser performance

- **Extend NIF laser capabilities to meet new experimental needs and to improve NIF operational efficiency**
  - Example: ARC, low explosion fraction amplifier configurations
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LPOM is BLIP’s primary tool to ensure laser setup is achievable and within safe operating limits

BLIP shot review checklist items:

**Machine Safety Check**
- Check if LPOM shows any red alerts on optics damage, delta-B, peak power, filamentation
- Check maximum energy in case of impulse
- Check MIXED beam fate

**Laser Performance Check**
- Check QoS matrix / convergence of LPOM solve
- Check amplifier configuration is appropriate for energy request and does not violate Counter Propagating (CP) light restrictions

**Laser Configuration Check**
- Check wavelength is consistent with facility plan
- Check SSD BW / insertion of SSD grating
- WF configuration matches with amplifier configuration
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Laser Configuration Check
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- WF configuration matches with amplifier configuration
A “dummy” shot has been set up on LPOM development machine to illustrate common laser set up issues (M. Shaw)

Errors introduced in dummy shot:

1) Requested energy exceeds optics damage limits
   - B254 exceeds peak power limit
   - B442 exceeds filamentation limit

2) Amplifier configuration chosen cannot meet energy request
   - Request 5.8 kJ $3\omega$ but chose 7-5 amplifier configuration (Bu11)

3) Amplifier configuration chosen violates Counter-Propagation (CP) light restriction
   - Request 1.8 kJ/beam $3\omega$ energy but chose 9-5 amplifier configuration (Q12B & Q14T)
Mistake #1: requested energy exceeds optics damage limit

LPOM recommendation

FILAMENTATION RISK ISSUE
****** ****** ******
BL442 EXCEEDS FILAMENTATION LIMIT (107.2%), ENERGY MUST BE REDUCED
BL444 EXCEEDS FILAMENTATION LIMIT (100.2%), ENERGY MUST BE REDUCED
****** ****** ******
PEAK POWER ISSUE
****** ****** ******
BL254 EXCEEDS PEAK POWER LIMIT (103.6 %) of 450.0 TW, ENERGY MUST BE REDUCED
BL444 EXCEEDS PEAK POWER LIMIT (100.7 %) of 536.0 TW, ENERGY MUST BE REDUCED
Mistake #2: wrong amplifier configuration results in front-end exceeding limits

NIF laser layout

Q11B LPOM setup

<table>
<thead>
<tr>
<th>Predicted</th>
<th>Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regen</td>
<td>ISP</td>
</tr>
<tr>
<td>(MJ)</td>
<td>(J)</td>
</tr>
<tr>
<td>6.95721</td>
<td>4.54828</td>
</tr>
<tr>
<td>4.5846</td>
<td>2.82517</td>
</tr>
<tr>
<td>5.42986</td>
<td>2.96152</td>
</tr>
<tr>
<td>4.75246</td>
<td>2.84872</td>
</tr>
</tbody>
</table>

Bu11 Amplifier Banks Configuration: 7.5 21%

LPOM error

Warning! Q11B Regen output and waveplates at maximum. Low output energy.
Warning! Q11B Input and output waveplates at maximum.
Warning! Q11T Regen output and waveplates at maximum. Low output energy.
Warning! Q11T Input and output waveplates at maximum.

LPOM recommendation

Equipment Protection

<table>
<thead>
<tr>
<th>NIF Max Optic Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage 124.38% Amp Rod B111</td>
</tr>
</tbody>
</table>
Counter propagating (CP) light originates from refraction at target’s vicinity and presents a danger to NIF laser front-end.

Example showing that small amount of refracted light can enter opposed far-wall port.

Refraction model through under-dense plasma.

Chamber port for lower hemisphere quad (34B).

Residual 1ω light from upper hemisphere quad (11T) refracted through a plasma.

300 mJ of 1ω light propagating back to front-end presents damage risk for PABTS VRT.
Minimizing residual gain in mitigating CP light risk is an important consideration in choosing appropriate amplifier configuration.

Amplifier selection rule

<table>
<thead>
<tr>
<th>OSP energy range</th>
<th>Amp config.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_{OSP} \leq 3kJ$</td>
<td>7-5 21%</td>
</tr>
<tr>
<td>$2kJ &lt; E_{OSP} \leq 6kJ$</td>
<td>9-3 21%</td>
</tr>
<tr>
<td>$5kJ &lt; E_{OSP} \leq 13kJ$</td>
<td>9-5 21%</td>
</tr>
<tr>
<td>$10kJ &lt; E_{OSP} \leq 22kJ$</td>
<td>11-5 20%</td>
</tr>
</tbody>
</table>
Mistake #3: chosen amplifier configuration violates Counter Propagating (CP) light restriction

Target Shot CPL Rules of Engagement: **Warning (click to see details)**

**LPOM error**

Q12B 9-5 21% not recommended for 1-w energy < 5 kJ due to CPL restrictions. Quad OSP avg = 4.3915975
Q14T 9-5 21% not recommended for 1-w energy < 5 kJ due to CPL restrictions. Quad OSP avg = 4.35128

**LPOM recommendation**

CPLight Warning : AMP CONFIGURATION MISMATCH FOR REQUESTED ENERGY
****** ****** ******
Q12B : 9-5 21% not recommended for OSP Energy of 4.4 kJ ; recommend configuration of 9-3, 21%
Q14T : 9-5 21% not recommended for OSP Energy of 4.4 kJ ; recommend configuration of 9-3, 21%
Mixed beam fate can potentially cause damage in front-end due to Counter Propagating (CP) light.

Example of mixed beam fate

Mixed beam fate is allowed in following situations:
1. No target present - No CP light risk
2. Single hemisphere (either upper or lower) participating - no CP light risk
3. Bundles use 7-5 amplifier configuration - no CP light risk
4. BLIP verifies that CP light risk is minimal (based on calculations or prior shots)
5. If none of the above applies, unused beamlines must terminate on RMDA calorimeters by setting beam fate to “RMDA”
Machine safety risks and expected performance quality are assessed through the ‘Expert Group’ review process.

**Experiment Scheduling** (over 6-month period)

**Experimental Planning & Implementation**

- **Pre-Review**
- **EG Assessment**
- **Setup Review**
- **Final Approval**
- **Target Review**
- **Diagnostic Review**

**Time Relative to Shot Date**

- T-6 months
- T-3 months
- T-10 weeks
- T-6 weeks
- T-3 weeks
- T-1 week

*Start of EG Review chosen at Pre-Review*
Adherence to deadlines will ensure a smooth and timely BLIP approval of shot setup

From: Beam Line Integrated Performance Readiness
Sent: Monday, April 11, 2016 8:43 AM
To:
Cc: Beam Line Integrated Performance Readiness
Subject: NIF Experiment / BLIP Readiness of Experiment xx_yy_zz

Your experiment xx_yy_zz is scheduled for 6/2/2016.

On 4/21/2016 it will be (or was) at the T-6 weeks point. Due on that date, the laser setup must be viewable in LPOM with either the final setup or a close proxy that has the same energetics (Peak Power and Total Energy within 10% of final, pulse contrast (Peak Power/Lowest Power) within 25% of final for each beam).

Please deploy the setup (by clicking "Run LPOM & Submit to BLIP for Review" in CMT) as either final or proxy and annotate Appman with a statement as to the finality of the setup or the schedule for the final laser setup. These actions enable the process of preparing the laser to support your experiment to proceed.

Thanks BLIP Team
Adherence to deadlines will ensure a smooth and timely BLIP approval of shot setup

- **Initial laser setup due in AppMan:**
  - **T- 6 wks:** Initial laser setup due in AppMan
  - **T- 4 wks:** BLIP performs initial setup check

- **Pulse shape finalized:**
  - **T- 21 days:** BLIP performs initial setup check
  - **T- 10 days:** Shot pulse shape finalized

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**From:** Beam Line Integrated Performance Readiness  
**Sent:** Monday, March 14, 2016 9:04 AM  
**To:**  
**Subject:** NIF Experiment / Verified Pulse Shape Final xx_yy_zz

Automated email from the BLIP Readiness Tracker

Your experiment xx_yy_zz is scheduled for 3-31-2016 and is now due for a BLIP approval.

Experiment xx_yy_zz does not have the laser setup approved as final in AppMan. This is prohibiting BLIP from completing its shot approval process. Please finalize the pulse shape and approve the laser setup in AppMan or add an annotation in AppMan with the expected date of pulse shape finalization. Apologies if this is a duplicate e-mail or if you have already completed this task.

Thanks,  
The BLIP Team
Adherence to deadlines will ensure a smooth and timely BLIP approval of shot setup

- **Shot RI**
  - Initial laser setup due in AppMan
  - Pre-approve if using proxy pulse shape

- **BLIP**
  - BLIP performs initial setup check
  - Laser performance expectation & ISP ROE due
  - BLIP pre-approval of shot setup
  - Calculate loop & $T_3\omega$ model corrections
  - BLIP final approval due
  - BLIP post-shot review

**SCR permitted if laser setup is not substantially different than proxy pulse originally submitted**

**SCR permitted for shots that have been previously approved but deferred**

**No SCR approval beyond this point**

- **T- 6 wks**
- **T- 4 wks**
- **T- 21 days**
- **T- 10 days**

Provide feedback to RI

Shot
BLIP is committed to working with the shot RIs to maximize their experiments’ chance of success while ensuring sustainability & availability of NIF laser

- BLIP review of shot setup ensures that NIF laser is set up in a correct and safe manner to deliver the required performance

- Choosing appropriate amplifier configuration is an important consideration in laser setup

- Strict adherence to shot setup submittal deadlines will ensure a smooth and timely BLIP approval of shot setup

- Please send an email to Steven Yang (yang9@llnl.gov) and J-M Di Nicola (dinicola2@llnl.gov) for any questions relating to laser setup for your experiment

- BLIP group is available to meet with you daily at 9:30AM after our 9AM meeting at B482 R2304 (please drop us a line at least a day before to give us a heads-up)