Findings and Recommendations of the 2016 OLUG Workshop

Summary of Recommendations

1. Make a two-step upgrade of the magnetic-field capability on OMEGA: first, to increase the magnetic field to 30 T within the next two years; second, a future enhancement to bring it up to 50 T.
2. Investigate the "straight-through" issue with the streaked x-ray spectrometer (SXS)–six-inch manipulator streak camera A (SSCA), including the option of replacing the SSCA by another streak camera for use with SXS.
3. Make a second x-ray streak camera available on OMEGA with capabilities similar to those of SSCA.
4. Implement a Rochester optical streak system (ROSS) streak camera on OMEGA for the particle and x-ray temporal diagnostic (PXTD).
5. Use charge-coupled–device detectors with the x-ray framing cameras on OMEGA EP.
6. Implement a standardized calibration procedure of the OMEGA optical Thomson-scattering system.
7. Implement faster framing cameras for Thomson-scattering measurements on OMEGA.
8. Undertake the necessary modifications on frequency conversion, final focusing optics, and distributed phase plates to enable a 2ω operation on one of the long-pulse beams of OMEGA EP.
9. Implement near-backscatter–imager (NBI) and time-integrated scatter calorimeter (SCAL) diagnostics on OMEGA EP.
10. Reconfigure the spherical-crystal-imager (SCI) diagnostic hardware on OMEGA EP to a design similar to the SCI operational on OMEGA, where the line-of-sight block is a component held by the same ten-inch manipulator (TIM) and the detector is outside of the TIM.
11. Improve the projection capability of the OLUG Workshop conference room so that material being used in the discussion sessions can be projected from any Windows laptop or Macbook in the room.
12. Make several improvements to OMEGA's capability to measure low-energy neutron spectra in a DT background.
13. Enhance the active shock breakout/streaked optical pyrometer diagnostic.
14. Install a planar cryogenic system on OMEGA EP to provide an additional capability that could complement the National Ignition Facility capability and significantly broaden the possibilities for experiments in this area of study.
15. Consider adding plasma sacrificial mirrors to OMEGA EP.
16. Investigate the implementation of an enhanced laser pulse-shaping capability on OMEGA.
17. Allocate more resources to the CR39 etch/lab group to better support the increasing demand of this detector system on OMEGA and OMEGA EP experiments.
18. Consider making available gas jet targets for OMEGA and OMEGA EP.
19. Consider the development of a high-spectral-resolution x-ray spectrometer for OMEGA.

20. If possible, avoid parallel OLUG Workshop sessions in the future. OLUG recommends that next year's evening session focus on x-ray imaging techniques. OLUG appreciates the reinstatement of the national labs session on Friday and recommends additional opportunities for career-oriented interaction between young researchers and representatives of the labs—for example, during lunch or by creating an employment-opportunities board. The student/postdoc representative will organize these events at the 2017 workshop in consultation with the rest of the executive committee.
21. Continue the effort to improve and modernize OLUG-based resources. OLUG also recommends that LLE commits resources to development in two new areas. First, enhance the data downloading capability: exporting shot request form configuration data as a "parseable file" (e.g., XML), providing diagnostic characterization information, and moving all results and analysis to the Principal Investigator computer. Second, overhaul the data access permissions so that they are more reliable and potentially more granular, rather than blanket institution-based access.

Discussion of Findings and Recommendations

1. [G. Fiksel, University of Michigan (UM)] Magnetized high-energy-density physics (HEDP) is a growing area of research at OMEGA as well as in other facilities in the U.S. and abroad. To support current and upcoming experiments and to be competitive in magnetized HEDP research, the magnetic-field capabilities of OMEGA must be enhanced.

The number of magnetized plasma campaigns at OMEGA has been steadily growing from two to three shot days in 2009 to 15 shot days in 2016. The nature of the experiments is extremely broad, ranging from inertial confinement fusion (ICF)-related applications [such as magnetized implosions, magnetic-field compression, and magnetized liner inertial fusion (MagLIF)] to astrophysical applications (such as magnetic-field reconnection, magnetized shocks and jets, and accretion disks). Almost all of these applications, as evidenced from the Omega users' input and suggestions, would greatly benefit from magnetization by a field of approximately 30 T in a volume of several cubic centimeters.

Currently, all magnetized campaigns at Omega are supported by the magneto-inertial fusion electrical discharge system (MIFEDS). MIFEDS is able to create a magnetic field of approximately 10 T in a volume of about 1 to 2 cm^3. Further increase in magnetic field is limited by the amount of stored energy. To enhance the magnetizing capability of OMEGA campaigns, a significant redesign of the MIFEDS power supply is required, including a large (more than a factor of ten) increment in stored energy. In addition, a complete redesign of the current magnetic coils is required to accommodate the significant increase of magnetic stress and heating caused by larger power dissipation. Several approaches for a new power supply and coils design have been presented and discussed at the MIFEDS mini-session held during the OLUG workshop.

We recommend a two-step upgrade of the magnetic-field capability on OMEGA: first, to increase the magnetic field to 30 T within the next two years; second a future enhancement to bring it up to 50 T.

2. [R. Mancini, University of Nevada, Reno (UNR)] Time-resolved x-ray spectra recorded on OMEGA with the SXS-SSCA streaked spectrometer shows "straight-through" light. This is typical for the SXS configurations used to record argon and titanium K-shell line transitions in the photon energy range from 3 to 6 keV in OMEGA implosion experiments that include argon and/or titanium tracers in the target. This issue usually compromises the data and can even make it unusable for quantitative spectroscopic analysis.

We recommend that the "straight-through" issue with the SXS-SSCA streaked spectrometer be investigated including the option of replacing the SSCA by another streak camera for use with SXS.

3. [R. Heeter and M. Schneider, Lawrence Livermore National Laboratory (LLNL)] Various high-energy-density (HED), ICF, Laser Basic Science (LBS), and National Laser Users Facility (NLUF) experiments are currently constrained by the limited x-ray streak availability on OMEGA. The SSCA diagnostic has been a reliable workhorse, but it

cannot be taken from service for proper calibration since it is the only working x-ray streak camera and it is used nearly every week (total of ~100 uses from CY14 through first half of CY16). Several OMEGA campaigns would benefit from having two x-ray streak cameras available, e.g., one for imaging and another for emission/absorption spectroscopy, or two for dual-axis imaging or to obtain continuous time-resolved data instead of gated data. Other campaigns would benefit from having sweep speed, pincushion, and response uniformity characterizations completed on a single streak camera.

We recommend that a second x-ray streak camera be made available on OMEGA with capabilities similar to those of SSCA.

4. [H. Sio and R. Petrasso, Massachusetts Institute of Technology (MIT) and R. Mancini, UNR] It is important to have a reliable time correlation between particle and x-ray diagnostics on OMEGA based only on measurements. This correlation is needed to experimentally study the relative timing between neutron and x-ray bang times and to develop an understanding of what plasma conditions are sampled by particle and by x-ray diagnostics during the deceleration and stagnation phases of OMEGA implosions. Currently, establishing the time-correlation between particle and x-ray diagnostics requires the help of a hydrodynamic numerical simulation of the implosion. The goal, however, is to have this time-correlation determined independently of a hydrocode simulation. The particle x-ray temporal diagnostic (PXTD) recently developed by MIT is an important step in achieving this goal. However, PXTD has been using a "blue-box" Livermore streak camera that is ~30 years old. We note that an engineering design already exists for coupling PXTD to a ROSS streak camera.

We recommend that a ROSS streak camera be implemented on OMEGA for the PXTD.

5. (G. Fiksel, UM) Currently, only film is used in the x-ray framing cameras (XRFC's) on OMEGA EP. Waiting for film processing to assess the data recorded with XRFC slows down PI feedback, and decision-making about possible changes to the settings of the framing cameras. It may also introduce shot delays.

We recommend that CCD detectors be used with the x-ray framing cameras on OMEGA EP.

6. (H. G. Rinderknecht, L. Divol, C. S. Goyon, S. LePape, J. Moody, S. Patankar, B. Pollock, J. S. Ross, and G. Swadling, LLNL; C. Kuranz and M. Manuel, UM; G. Gregori and A. Rigby, U. Oxford; and R. Follett, D. Froula, and J. Katz, LLE) Several pieces of calibration information are required for accurate interpretation of optical Thomson-scattering system (TSS) data. Currently these calibrations are communicated by word-of-mouth only. We request a standardized procedure to record and distribute the necessary TSS calibration data for each shot day that the system is used. Requested calibrations are described in Table I. Daily calibrations (rows 1 and 2 of Table I) could appear in the Shot Images and Reports as an additional shot number. Measurements that

are stable over time (Rows 3, 4, and 5 of Table I) could be documented, put in an accessible location on the OMEGA operations website, and updated when necessary, similar to the procedure for XRFC flat-fielding data.

Table I: Requested TSS calibrations to be standardized.

	Calibration	Frequency	Notes
1	Central wavelength pixel	Each shot day	Requested beginning and end of each day and when grating is changed.
2	Instrument function	Each shot day	Requested when pinhole is changed.
3	Grating dispersion	Each part/ annually	
4	Streak-camera distortion	Each part/ annually	Probably stable, but lacking up-to-date measurements.
5	Spectral sensitivity	Each part/ annually	Seems to change over time, possibly resulting from damage.

We recommend the implementation of a standardized calibration procedure of the OMEGA optical Thomson-scattering system.

7. (P. Drake, UM) Current framing cameras for Thomson scattering on OMEGA have a 3-ns framing window. This gating time is too long and represents a real limitation for recording image data from dynamic systems that change on a shorter time scale.

We recommend that faster framing cameras be implemented for Thomson-scattering measurements on OMEGA.

8. [C. Krauland, University of California, San Diego (UCSD) and M. Wei, General Atomics (GA)] Currently all four long-pulse beams on OMEGA EP operate at 3ω. A new 2ω capability on OMEGA EP would make it possible to compare the differences in the laser heating of gas-filled liner targets between 2ω and 3ω beams, which is of great interest to the MagLIF program. A 2ω operation will have similar specifications on beam energy, pulse duration, and distributed phase-plate size (e.g., 750 μm) to the 3ω beams. Utilizing the existing MagLIF preheating platform on OMEGA EP with a suite of x-ray, optical, and particle diagnostics, the effect of laser wavelength and power/intensity on laser beam burnthrough of laser entrance hole (LEH) windows and subsequent propagation and heating of D_2 gas in full-scale MagLIF targets can be assessed. The wavelength-dependence of MagLIF preheat is a key issue in integrated MagLIF experiments on Z that use the 2ω Z-Beamlet laser. In addition, the 2ω capability would also benefit studying the physics of laser–plasma instabilities (LPI's) and hot-electron generation in shock-ignition–relevant conditions.

We recommend that LLE undertake the necessary modifications on frequency conversion, final focusing optics, and distributed phase plates to enable a 2*ω* operation on one of the long-pulse beams of OMEGA EP.

9. (C. Krauland, UCSD and M. Wei, GA) A near-backscatter imager (NBI) on OMEGA EP to measure the near-backscatter light outside the full-aperture backscatter (FABS) aperture on Beam 4 in the stimulated Brillouin scattering (400- to 700-nm) and stimulated Raman scattering (351±10-nm) ranges would be very useful. In addition, time-integrated scatter calorimeters (SCAL's) are also desired on OMEGA EP to obtain information on the overall laser energy coupled to targets. The setup of the NBI system can be identical or similar to those already available on OMEGA or the National Ignition Facility (NIF). The suite of optical diagnostics would be beneficial for a broad range of HED science experiments on OMEGA EP, where characterization of LPI's via measuring reflected, scattered, and refracted light spectra and energies is critical for understanding laser energy coupling to the target. Laser–plasma instabilities occur at a range of plasma densities up to the critical density, and they affect laser–plasma energy coupling and are sources for hot electrons and back- and sidescattered light. The thresholds of those instabilities depend on laser intensity, wavelength, beam smoothing, as well as plasma temperature and density spatial scale. For advanced laser-fusion schemes such as shock ignition (SI), the intensity (of the order of 10^{16} W/cm^2 achievable on OMEGA EP with multiple kJ energy in a single beam either UV or IR) of the SI spike pulse is significantly above the thresholds of various instabilities. Measuring back- and sidescattered light in SI- relevant conditions is crucial for the underlying physics of energy coupling and hot-electron generation. Another benefit of the enhancements requested to the suite of optical diagnostics is the laser-preheat study on OMEGA EP for the MagLIF fusion scheme. A laser beam must efficiently couple energy through a thin plastic window at the laser entrance hole and into a high-pressure D_2 gas contained in a cylindrical liner. Laser propagation and heating of ~cm long D_2 gas could be further subject to the filamentation instability that will scatter incident light, create localized spots of increased intensity, and inhibit energy coupling to the fuel. Light scattering outside the focusing lens is evidence of filamentation. The proposed NBI diagnostic combined with the OMEAG EP FABS diagnostic would enable a detailed study of the laser-absorption process and the effects of laser parameters (power, wavelength, beam smoothing, etc.), LEH plasma, and fuel density on energy coupling.

We recommend that NBI and time-integrated SCAL diagnostics be implemented on OMEGA EP.

10. (M. Wei, GA and C. Krauland, C. McGuffey, and B. Qiao, UCSD) The growing community of OLUG members that field the spherical crystal imager (SCI) on OMEGA EP would benefit from a re-engineering of the line-of-sight (LOS) block that the diagnostic and the detector placement require in the TIM. While the SCI on OMEGA EP can currently provide valuable data for specific experimental configurations, the hardware to block direct emission from reaching the image plate is far less than optimal and prohibitive for other configurations. This LOS block is at the end of an extension arm that is attached to the crystal assembly in TIM-10, while the detector

hardware is alone in TIM-13. This configuration causes physical hardware interference issues as well as reduced shielding. Additionally, the location of the detector inside the TIM limits focusing accuracy during alignment.

This diagnostic reconfiguration is of interest to the many SCI users for the following reasons:

- The removal of the extended arm for the LOS block reduces the chances of multiple diagnostic hardware interferences. This has shown to be an issue in the past when fielding SCI with the bremsstrahlung MeV x-ray spectrometers (BMXS) or the near-target-arm (NTA) diagnostics since they occupy the same chamber space.
- The LOS block attachment to the detector-held TIM would allow for better positioning of shielding further from emission sources, leading to a significant reduction in background.
- Better focusing of the diagnostic during alignment would be possible with a proposed redesign ability to hold the detector outside of the TIM. With the current design of having the detector ~1 m inside the TIM, the camera used during the alignment procedure must monitor the focusing of a 100-μm-diam image from a meter distance without an optimal objective. Moving the detector outside of the TIM would make it possible to reduce this distance, giving more-resolvable alignment imaging and therefore more-confident focusing of the diagnostic.
- The new placement of the detector may also benefit achievable resolution with an increase in magnification.

We recommend that the SCI diagnostic hardware on OMEGA EP be reconfigured to a design similar to the SCI operational on OMEGA, where the LOS block is a component held by the same TIM and the detector is outside of the TIM.

11. (P. Drake, UM) The conference room where the OLUG workshop is held has limited projection capabilities in the sense that files and slides must be moved around between computers in a memory stick in order to be projected onto the screen. Since the volume of information that is produced, discussed, and projected onto screen of the OLUG Workshop in real-time is large, it would benefit and simplify the logistics of the workshop to increase the versatility of the conference room so that material can be projected from any Windows laptop or Macbook used during the discussion sessions.

We recommend that the projection capability of the OLUG Workshop conference room be improved so that material being used in the discussion sessions can be projected from any Windows laptop or Macbook in the room.

12. (M. Gatu Johnson, MIT) Several improvements to the existing capability to measure low-energy neutron spectra in a DT background on OMEGA can benefit many science campaigns including cryogenic implosions. These measurements are currently done with a neutron time-of-flight (nTOF) oxygenated xylene scintillator detector on a collimated line-of-sight in LaCave at 13.4m from target chamber center (TCC). While this detector is capable of providing high-resolution measurements of, e.g., DD, TT, or

down-scattered DT neutrons in a DT background, there are a number of factors that limit its usefulness for experimental campaigns with an interest in such measurements:

- Proper operation of this detector requires clear LOS in TIM-6, precluding the use of TIM-6 for other diagnostics such as neutron imaging and x-ray crystal spectroscopy, which can also only operate in TIM-6.
- Impact of scattering background must be considered when fielding the detector. A substantial impact from scattering (~1.2× signal increase) on the measured low-energy signal has been observed when a diagnostic is fielded in the opposing TIM-4, essentially meaning that both TIM-4 and TIM-6 must be reserved to properly make this measurement.
- Oxygenated xylene has the advantage of a very fast response, but the drawback is variations in response over time as the oxygen gradually diffuses out of the xylene. It has been found that detailed analysis of data requires an x-ray impulse response function measured when the fluid is about the same age as on the shot when the physics data are collected. Additionally, the scintillator light output as a function of energy for oxygenated xylene has never been measured—the impact of this on systematic uncertainties in the measurements has yet to be characterized.

We recommend the following improvements to the capability to measure low-energy neutron spectra in a DT background on OMEGA:

1. **Dedicated, reoccurring x-ray and low-ρR DT and DD neutron-producing shots to determine the response of the detector and track sensitivity changes over time. (In parallel, the Multi-Terawatt laser could also be used to characterize the time dependence of the detector response.)**
2. **An effort to validate signal output versus neutron energy, in particular with regard to (i) the simulated correction required for material in the LOS, which varies by more than 25% as a function of energy and is highly structured in the important region below E_n = 2 MeV and (ii) the light-output of the scintillator material as a function of energy, which, to the best of our knowledge, has never been measured for oxygenated xylene.**
3. **The implementation of a second detector on a non-TIM–based LOS for complementary measurements, and to allow for simultaneous measurements with other important diagnostics in TIM-4 and TIM-6.**
4. **An optimization of the capability to measure the neutron spectrum below 2 MeV. This will require an evacuated LOS, low background in the measurement, and high detection efficiency.**

13. (P. M. Celliers, LLNL) The active shock breakout (ASBO)/streaked optical pyrometer (SOP) diagnostic is and has been producing high-quality data for a variety of fundamental science and programmatic activities with exceptional support, reliability, and accuracy. Additional improvements would further enhance the spatial and temporal resolution of ASBO/SOP and allow for absolute temperature measurements on OMEGA EP. Various LBS and NLUF science campaigns as well as ICF and HED programmatic activities would benefit from these improvements. Absolute timing accuracy is of particular importance when ASBO is fielded together with other x-ray or

visible diagnostics such as the powder x-ray diffraction image plate (PXRDIP), broadband x-ray diffraction diagnostic (BBXRD), extended x-ray absorption fine structure (EXAFS), and x-ray Thomson scattering (XRTS).

We recommend the following enhancements of the ASBO/SOP diagnostic:

1. **"Plug 'n' play" spatial calibration "ten-comb" system that could be fielded on ASBO/SOP streak cameras in the Target Bay relatively easily (~1 to 2 h) to allow regular spatial calibration data at full sweep speed.**
2. **Field an additional 4- or 6-GHz timing comb generator in addition to the 5000 MHz and 2 GHz.**
3. **Develop eight sweep cards to allow for more options to optimize/customize the sweep window for the duration of each experiment.**
4. **Improved optical design of the OMEGA EP telescope to enhance achromaticity.**
5. **Evaluate the performance/feasibility of new Photek streak tubes having better point-spread function over the entire field of view.**
6. **Timing shots as part of the maintenance cycle (quarterly or bi-annually).**
7. **Regular dynamic calibrations to provide higher spatial and temporal resolution.**
8. **Absolute calibration of SOP on OMEGA EP.**
9. **Create a wiki-page for ASBO/SOP to provide easy access to the most-recent spatial calibration files, information on the diagnostic, and timing shot data reduction details and results.**
10. **Systematic investigation of speckle quality and illumination uniformity as a function of injection optics settings: develop alignment procedures optimized to reduce speckle modulations.**

14. (P. M. Celliers and G. W. Collins, LLNL) The planar cryostat capability on OMEGA has provided the means to perform a number of experiments relevant to ICF, including measurements of the principal Hugoniot of deuterium, developing the shock-timing technique for the NIF, performing shock-timing studies for direct-drive ICF, and studies of deuterium in the warm-dense-matter regime using x-ray Thomson scattering. However, the OMEGA platform is primarily optimized for driving strong shocks owing to the relatively short pulse duration; it is much less capable for driving extended duration low-entropy compression experiments. The OMEGA EP is better suited to long-pulse-duration drives, and would enable a new class of long-duration ramp and reverberation compression experiments to study light-element fluids such as liquid deuterium along low-entropy compression paths.

We recommend having a planar cryogenic system on OMEGA EP to provide an additional capability that could complement the NIF capability and significantly broaden the possibilities for experiments in this area of study.

15. [W. Garbett, Atomic Weapons Establishment (AWE)] Enhancing the contrast of a high-intensity short pulse (especially in 1ω operation) by use of a single- or double-plasma mirror is a proven technique in use routinely at many laser facilities. The addition

of this capability on OMEGA EP would provide greater flexibility in short-pulse pointing and, potentially, focusing if nonplanar sacrificial optics are used. Sacrificial optics can significantly modify the *f* number of the short pulse without interfering with the main off-axis parabola, offering fresh scientific possibilities for little engineering overhead. While OMEGA EP has an excellent short pulse contrast already, very thin foils (<1 μm) and other nanostructured targets are exceptionally sensitive to accumulated on-target energy ahead of the main laser pulse, and 2ω conversion is an expensive and engineering-intensive option to suppress this. A single-plasma mirror could be expected to enhance the on-target intensity contrast for the short-pulse pedestal by a factor of ~100, with energy loss from the main pulse variable depending on the incident angle and polarization.

We recommend that plasma sacrificial mirrors be considered for OMEGA EP.

16. (R. Krauss, LLNL) Shockless compression experiments are becoming increasingly important and rely on precise drive shaping. This may be achieved with the "reservoir drive" or shaped laser pulses. Generally speaking, the longer the drive pulse the higher the pressure that can be reached in a given target before a shock forms, or the thicker a target can be for a given pressure. This results in better accuracy in isentrope measurements, possibly higher x-ray scattering efficiency, reduced sensitivity to reverberations and less chance of windows shocking and affecting VISAR (velocity interferometer system for any reflector) data. Other types of experiments may also benefit from longer pulses. OMEGA is currently limited to 3.5-ns-long pulses, but longer ones can be produced by stacking up beams in time. However, this has several disadvantages including inflexibility and susceptibility to errors in timing—which produce dips or spikes in power if successive beams are not overlapped correctly—and to varying energy on some of the beams, which would change the pulse shape. Modern technology should allow almost arbitrary pulse-shape generation before the preamplifier stage, and modern modeling codes can account for the main amplifier chain temporal gain profile, allowing back-calculation of the injected pulse necessary to give a required full-energy pulse shape.

We recommend that an enhanced laser pulse-shaping capability be investigated for implementation in OMEGA.

17. (A. Park, LLNL) Many experiments are using D^3He gas-filled capsules to produce a proton backlighter and CR39 as the detector. This is a very powerful diagnostic currently being employed in many campaigns. However, the CR39 processing takes more than four weeks, and sometimes it can take many months. Reducing CR39 processing time will enable data return in a timely fashion; therefore, scientific results will be delivered more promptly. Faster CR39 processing will also make it possible to plan the follow-up campaigns more efficiently.

We recommend that LLE allocate more resources to the CR39 etch/lab group in order to better support the increasing demand of this detector system on OMEGA and OMEGA EP experiments.

18. (A. Park, LLNL) Gas jet targets on OMEGA and OMEGA EP would create low-density ambient plasmas useful for many HED experiments. The low-density ionized plasma environment is ideal to study plasma interactions relevant to ICF kinetics, laboratory astrophysics, and high-altitude plasma physics. Gas bags can be an option to produce similar systems. However, they tend to be expensive and more importantly, very often the membrane mass generates a plasma with more mass than the required gas, thereby creating undesirable conditions and compromising/complicating data interpretation. Gas jets are being used at many other laser facilities such as in Janus and Vulcan as well as in many small-scale laser experiments. Experiments with gas jets have produced important scientific results. This capability will make it possible to study magnetized and unmagnetized background plasma interactions with various piston/pusher plasmas. These studies are important to ICF, HED, and astrophysical phenomena.

We recommend that LLE consider making available gas jet targets in OMEGA and OMEGA EP.

19. (Y. Ping, LLNL and R. Mancini, UNR) X-ray spectroscopy is a powerful diagnostic for HED science that has been widely used in OMEGA and OMEGA EP campaigns. There are a variety of x-ray spectrometers available at LLE. However, none of them is designed to achieve high resolution $E/\Delta E > 3000$ in 3- to 20-keV range. This level of high spectral resolution is required for XANES (x-ray absorption near edge structure) and detailed spectral line profiles and shift measurements. Such a diagnostic will have a high impact on HED science and ICF campaigns at LLE. We commend the recent development of a high-spectral-resolution spectrometer for OMEGA EP, and recommend a high-resolving-power spectrometer for OMEGA.

We recommend that LLE consider the development of a high-spectral-resolution x-ray spectrometer for OMEGA.

Findings and Recommendations from Student and Postdoc Panel

20. This year was the third workshop with a Wednesday evening "tutorial" session; the panel and community have a strong interest in continuing this. This year was the first with parallel sessions.

We recommend that, if possible, the workshop avoids parallel sessions in the future. The panel recommends that next year's evening session focus on x-ray imaging techniques. We appreciate the reinstatement of the national labs session on Friday and recommend additional opportunities for career-oriented interaction between young researchers and representatives of the labs, for example during lunch or by creating an employment-opportunities board. The student/postdoc representative will organize these events at the 2017 workshop in consultation with the rest of the executive committee.

21. The panel recognizes the continuing effort by LLE to improve and modernize several aspects of the web-based resources available to users.

We strongly recommend that this work continues. We also recommend that LLE commit resources to development in two new areas. First, enhanced data downloading capability: exporting shot request form configuration data as a "parseable file" (e.g., XML), providing diagnostic characterization information, and moving all results and analysis to the PI computer. Second, we recommend that LLE overhaul the data access permissions so that they are more reliable and potentially more granular, rather than blanket institution-based access.