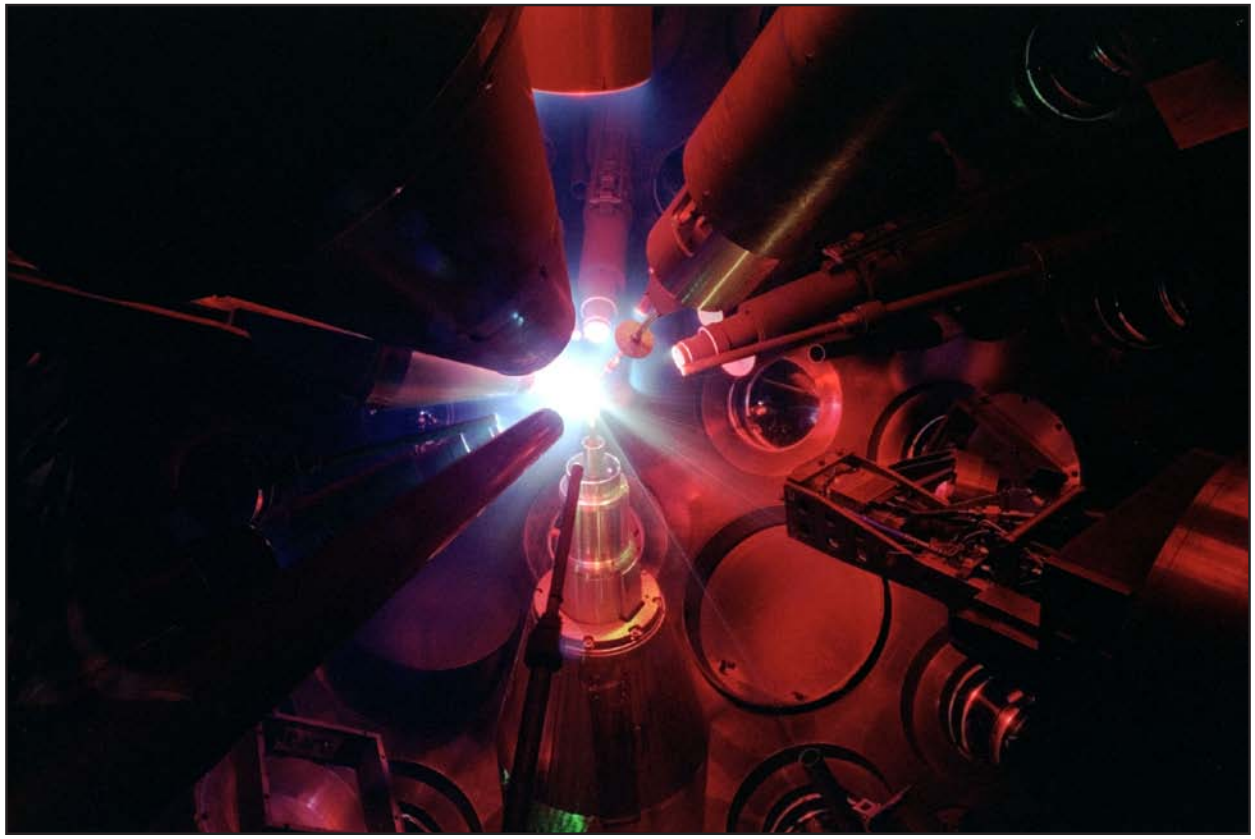
OMEGA Experimental Operations
2011 OLUG Status Report



Greg Pien
University of Rochester
Laboratory for Laser Energetics

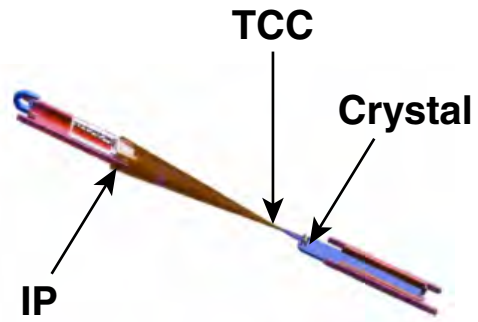
Omega Laser Facility
Users' Group Workshop
Rochester, NY
27–29 April 2011

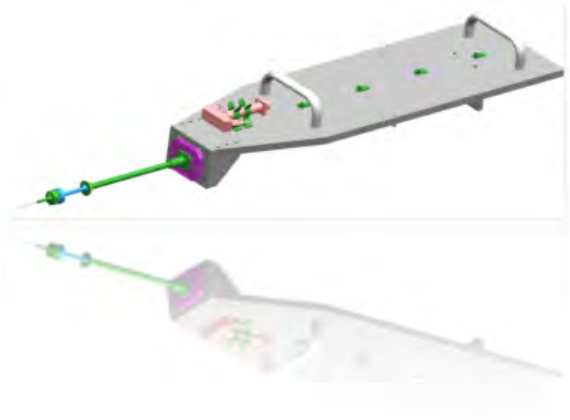
Summary

LLE is responding to the 2010 OLUG findings

- Diagnostic information availability has been improved
- New diagnostics are available
- Expect continued enhancements in the future


XRS Spectrometer





Takeaways from OLUG 2010

UR LLE

User oriented documentation for target diagnostics

- **Users' guides for diagnostics**
  - **photos for reference**
  - **performance space**
  - **options and features**
- **Access to diagnostic qualification packages**
- **Up to date Target Chamber port assignment lists**
- **Access to Ph.D. theses**

Takeaways from OLUG 2010 (continued)

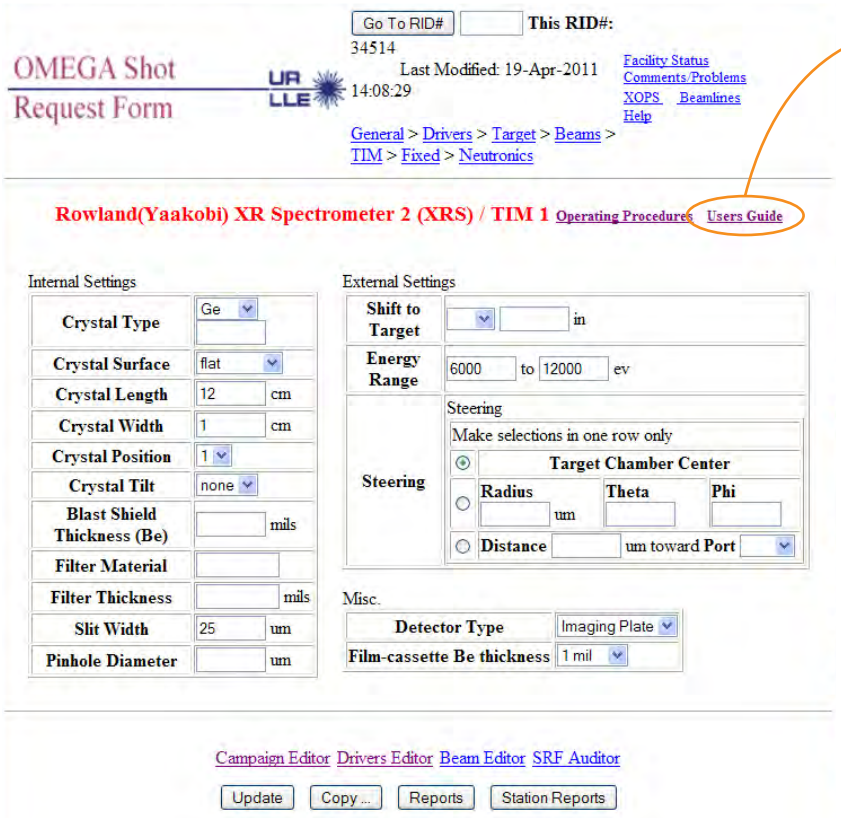
UR LLE

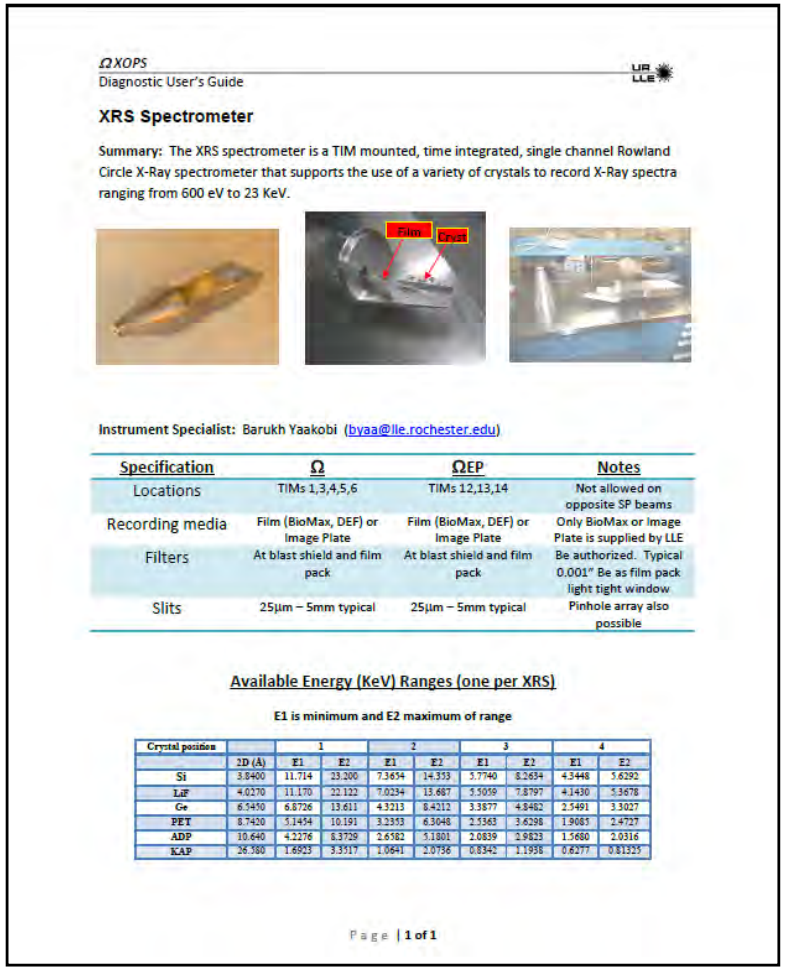
Enhanced diagnostics suite

- **Spherical crystal imagers**
- **Electron spectrometers**
  - **additional units of current LLNL design**
- **OMEGA EP 4ω probe beam**
- **OMEGA EP planar cryogenic target capability**
- **OMEGA EP gas jet target capability**
- **20-MeV gamma spectrometer**

Improvements to OMEGA/OMEGA EP online information

Online Users' Guides





Improvements to OMEGA/OMEGA EP online information (continued)

Online access to operating procedures

Go To RID#

This RID#: 34682

Last Modified: 08 -Feb-2011 11:23:09

OMEGA EP Shot Request Form

Facility Status
Comments/Problems
Help

General > Select Beam/Source > Set up Beam/Source > Target > TIM > Fixed > Neutronics

Proton Film Pack II 12 (PFP) / TIM 12 Operating Procedures

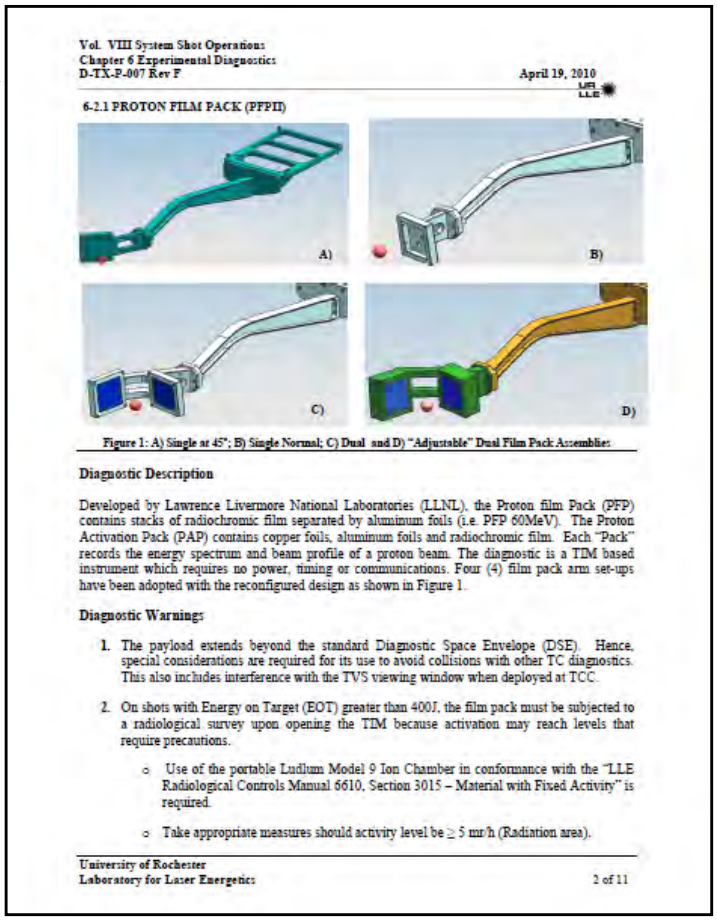
Setup

Film Pack Configuration	Dual pack - Near Normal	
	Film Pack 1 (Normal)	Film Pack 2 (Orthogonal)
Film Pack Assembly	60MeV	60MeV
Distance to Target	80 mm	

Comments/Requirements

Steering

Make selections in one row only			
	Target Chamber Center		
	Radius um	Theta	Phi
	Distance um toward Port		



Vol. VIII System Shot Operations
Chapter 6 Experimental Diagnostics
D-TX-P-007 Rev F

April 19, 2010

6-2.1 PROTON FILM PACK (PFPII)

Figure 1: A) Single at 45°; B) Single Normal; C) Dual and D) "Adjustable" Dual Film Pack Assemblies

Diagnostic Description

Developed by Lawrence Livermore National Laboratories (LLNL), the Proton film Pack (PFP) contains stacks of radiochromic film separated by aluminum foils (i.e. PFP 60MeV). The Proton Activation Pack (PAP) contains copper foils, aluminum foils and radiochromic film. Each "Pack" records the energy spectrum and beam profile of a proton beam. The diagnostic is a TIM based instrument which requires no power, timing or communications. Four (4) film pack arm set-ups have been adopted with the reconfigured design as shown in Figure 1.

Diagnostic Warnings

1. The payload extends beyond the standard Diagnostic Space Envelope (DSE). Hence, special considerations are required for its use to avoid collisions with other TC diagnostics. This also includes interference with the TVS viewing window when deployed at TCC.
2. On shots with Energy on Target (EOT) greater than 400J, the film pack must be subjected to a radiological survey upon opening the TIM because activation may reach levels that require precautions.
   - Use of the portable Ludlum Model 9 Ion Chamber in conformance with the "LLE Radiological Controls Manual 5610, Section 3015 – Material with Fixed Activity" is required.
   - Take appropriate measures should activity level be ≥ 5 mr/h (Radiation area).

University of Rochester
Laboratory for Laser Energetics

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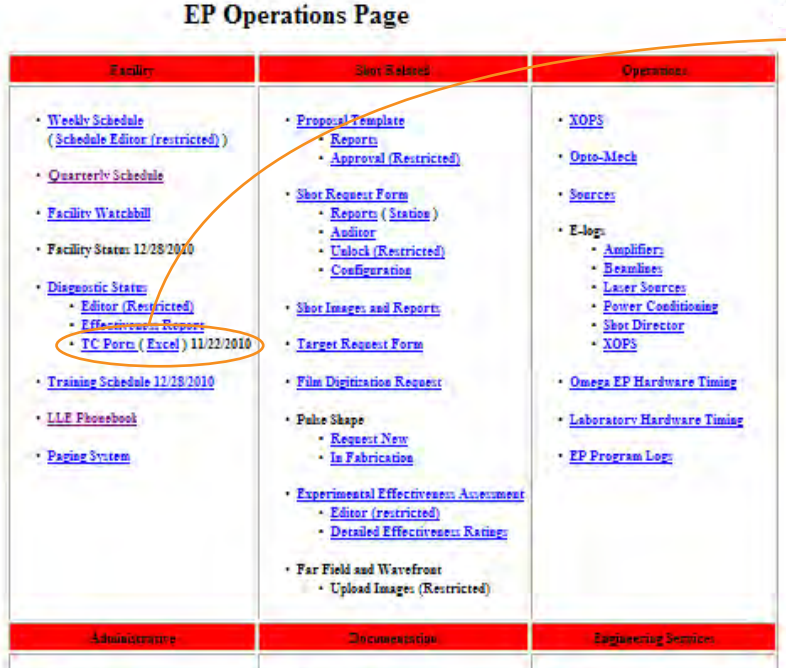
Improvements to OMEGA/OMEGA EP online information (continued)

Online target chamber port assignment lists

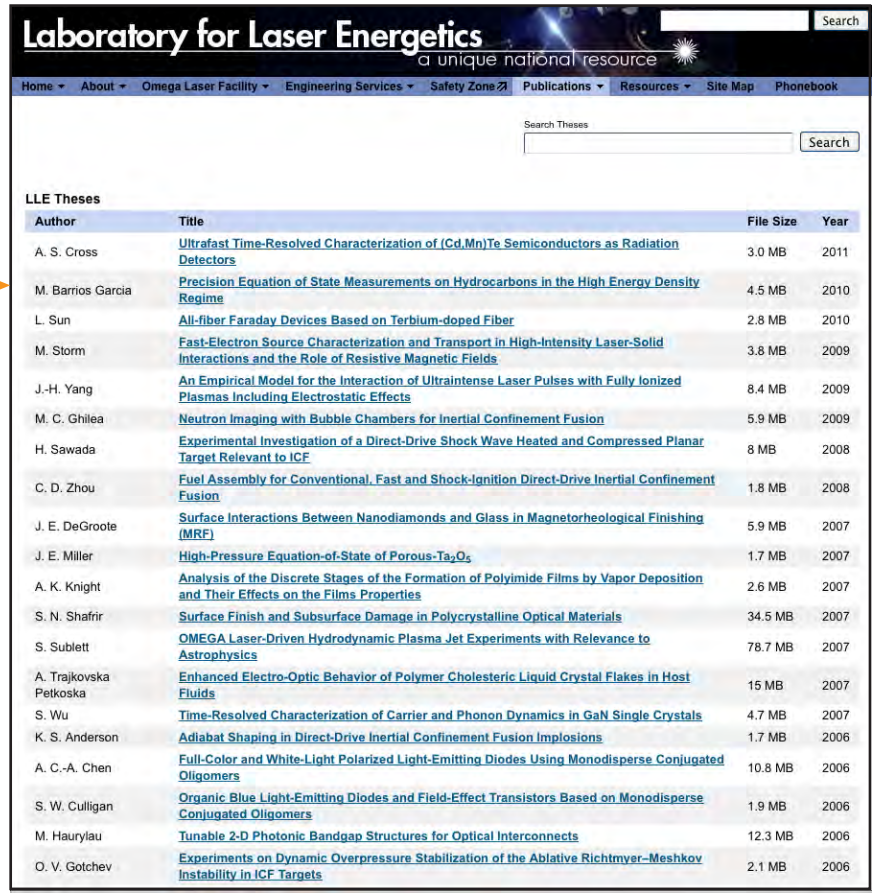


OMEGA EP - Target Chamber Port Assignments
11/22/10

Port ID	Assignment	Port Diameter (inches)	Radius (inches)	Theta (degrees)	Phi (degrees)	Opposite Port	Comments
1	CTHS CRYO UPPER	18	64.02	0	0	90	
2	TIM # 10	18	64.02	27	0	87	D-TA-C-40
3	Unassigned	18	64.02	27	45	88	
4	Unassigned	18	64.02	27	90	X	
5	Unassigned	18	64.02	27	135	89	
6	Unassigned	18	64.02	27	225	85	
7	TPS-7	18	64.02	27	270	x	D-TA-C-13
8	Unassigned	18	64.02	27	315	86	
9	PORT CENTER	36	61.80	41	180	82	B-DM-C-469
9A	TIM # 11	18	66.00	39	189		
9B	TC vacuum gauge #1						Does not point to TCC
9C	TC vacuum gauge #2						Does not point to TCC
9D	Unassigned						Does not point to TCC
9E	Unassigned	NW40	65.05			NA	Does not point to TCC
9F	RGA						Does not point to TCC
9G	Unassigned						Does not point to TCC
9H	Unassigned						Does not point to TCC
10	Unassigned	12	64.45	43	11.25	81	
11	Unassigned	12	64.45	43	33.75	X	10" Maximum Envelope beyond flg.
12	Unassigned	12	64.45	43	56.25	X	
13	Unassigned	12	64.45	43	78.75	X	Not Available - Upper deck interference
14	Unassigned	12	64.45	43	101.25	X	Not Available - Upper deck interference
15	Unassigned	12	64.45	43	123.75	X	
16	Unassigned	12	64.45	43	236.25	X	
17	Unassigned	12	64.45	43	258.75	X	Not Available - Upper deck interference
18	Unassigned	12	64.45	43	281.25	X	Not Available - Upper deck interference
19	Unassigned	12	64.45	43	303.75	X	
20	Unassigned	12	64.45	43	326.25	X	10" Maximum Envelope beyond flg.
21	Unassigned	12	64.45	43	348.75	80	
22	THVL - Laser Plate Absorption	12	64.45	58	142	79	
23	TC Viewport 1	12	64.45	58	218	x	
24	TC Viewport 2	12	64.45	58	322	77	
25	PORT CENTER	18	64.02	60	0	73	
25 A	HFES						
25 B	BMXS		66.00			NA	
25 C	BMXS						
26	Unassigned	18	64.02	60	60	74	
27	X TVS Illuminator	18	64.02	60	90	75	D-TA-C-082
28	Unassigned	18	64.02	60	120	76	
29	Unassigned	18	64.02	60	240	X	
30	Unassigned	18	64.02	60	270	71	
31	TIM # 15	18	64.02	60	300	72	
32	Y TVS Illuminator	12	64.45	69	180	68	D-TA-C-083
33	BACKLIGHTER ENTRY	26	63.20	70	37.5	x	

Improvements to OMEGA/OMEGA EP online information (continued)

Online access to experiment configuration relevant Ph.D. theses



Author	Title	File Size	Year
A. S. Cross	Ultrafast Time-Resolved Characterization of (Cd,Mn)Te Semiconductors as Radiation Detectors	3.0 MB	2011
M. Barrios Garcia	Precision Equation of State Measurements on Hydrocarbons in the High Energy Density Regime	4.5 MB	2010
L. Sun	All-fiber Faraday Devices Based on Terbium-doped Fiber	2.8 MB	2010
M. Storm	Fast-Electron Source Characterization and Transport in High-Intensity Laser-Solid Interactions and the Role of Resistive Magnetic Fields	3.8 MB	2009
J.-H. Yang	An Empirical Model for the Interaction of Ultraintense Laser Pulses with Fully Ionized Plasmas Including Electrostatic Effects	8.4 MB	2009
M. C. Ghilea	Neutron Imaging with Bubble Chambers for Inertial Confinement Fusion	5.9 MB	2009
H. Sawada	Experimental Investigation of a Direct-Drive Shock Wave Heated and Compressed Planar Target Relevant to ICF	8 MB	2008
C. D. Zhou	Fuel Assembly for Conventional, Fast and Shock-Ignition Direct-Drive Inertial Confinement Fusion	1.8 MB	2008
J. E. DeGroote	Surface Interactions Between Nanodiamonds and Glass in Magnetorheological Finishing (MRF)	5.9 MB	2007
J. E. Miller	High-Pressure Equation-of-State of Porous-Ta_2O_5	1.7 MB	2007
A. K. Knight	Analysis of the Discrete Stages of the Formation of Polyimide Films by Vapor Deposition and Their Effects on the Films Properties	2.6 MB	2007
S. N. Shafrir	Surface Finish and Subsurface Damage in Polycrystalline Optical Materials	34.5 MB	2007
S. Sublett	OMEGA Laser-Driven Hydrodynamic Plasma Jet Experiments with Relevance to Astrophysics	78.7 MB	2007
A. Trajkovska Petkoska	Enhanced Electro-Optic Behavior of Polymer Cholesteric Liquid Crystal Flakes in Host Fluids	15 MB	2007
S. Wu	Time-Resolved Characterization of Carrier and Phonon Dynamics in GaN Single Crystals	4.7 MB	2007
K. S. Anderson	Adiabat Shaping in Direct-Drive Inertial Confinement Fusion Implosions	1.7 MB	2006
A. C.-A. Chen	Full-Color and White-Light Polarized Light-Emitting Diodes Using Monodisperse Conjugated Oligomers	10.8 MB	2006
S. W. Culligan	Organic Blue Light-Emitting Diodes and Field-Effect Transistors Based on Monodisperse Conjugated Oligomers	1.9 MB	2006
M. Haurylau	Tunable 2-D Photonic Bandgap Structures for Optical Interconnects	12.3 MB	2006
O. V. Gotchev	Experiments on Dynamic Overpressure Stabilization of the Ablative Richtmyer–Meshkov Instability in ICF Targets	2.1 MB	2006

28 diagnostics have qualified since OLUG 2010

OMEGA

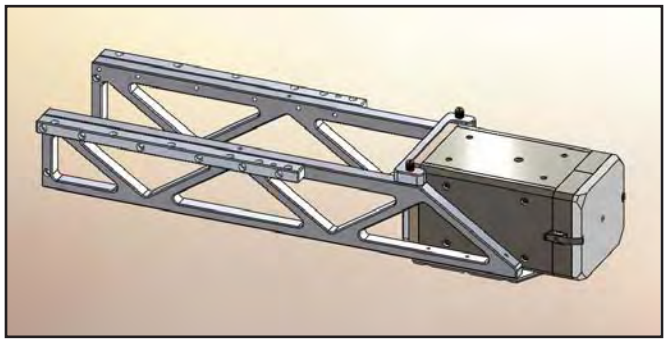
- LLNL Electron–positron proton spectrometer (EPPS)
- LLNL hardened gated x-ray imager (hGXI)
- LLE NIF 4.5 neutron bang time detector (NBt4.5-O)
- LLE 5.3 m CVD neutron detector platform (H10CVD)
- LANL gamma reaction history diagnostic phase V (GRH)
- LANL NIS pinhole manipulator upgrade (NIS-PHM-O)
- CEA NIS pinhole manipulator upgrade (NIS-PHM-O)
- LLE MCTC7 cryostat upgrade
- LLNL rSPCA pinhole camera
- LANL Thompson parabola ion energy analyzer (TPIE)
- CEA XCCS crystal spectrometer
- LLE hard x-ray diode spectrometer upgrade (HXRD)
- LLNL zinc von hamos spectrometer II
- SNL PCD array
- LLE wedge range filter upgrade
- LLE neutron diagnostic inserter (NDI)
- LLE MCTC dock 5
- LLE CVD TIM platform (CVDTIM)
- LLE D_2 NTOF
- LANL gas cerenkov detector 2 (GCD2)
- LLE/LANL PXRDIP compatible ASBO upgrade

OMEGA EP

- LLNL Electron–positron proton spectrometer II
- LLNL BBXRD spectrometer
- LLNL rSPCA pinhole camera
- LLE spherical crystal imager I (SCI)
- ARTEP/NRL electronic readout EP crystal spectrometer
- Oxford University B-dot probe
- LLNL/NRL gamma crystal spectrometer

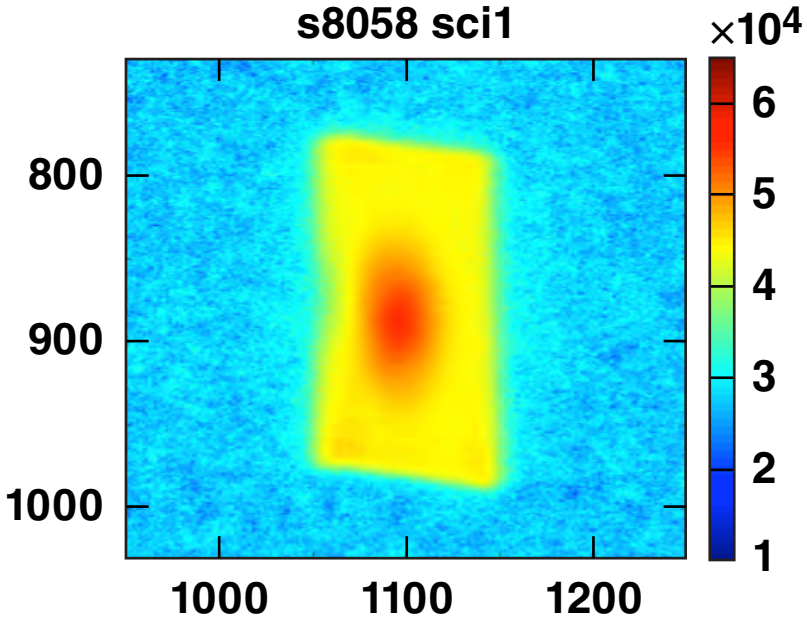
New diagnostics are available

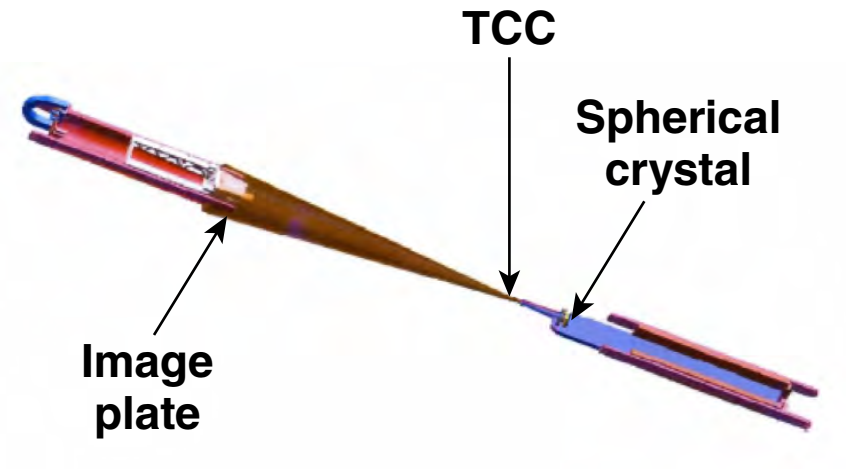
- **Electron–Positron Proton Spectrometer (LLNL)**
  - **1-MeV to 100-MeV design**
  - **now qualified for use on OMEGA**
  - **two units are currently based at LLE**
  - **expect two additional improved units at LLE in FY11**



New diagnostics are available (continued)

- Spherical Crystal Imager (LLE)
  - prototype design unit deployed
  - time integrated 8-KeV imaging
  - production design in FY11





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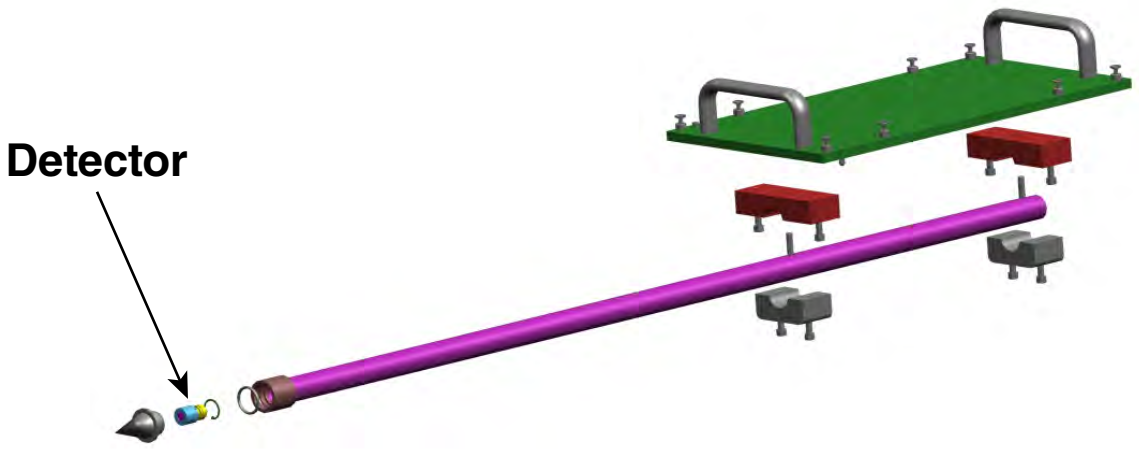
New diagnostics are available (continued)

- TIM-Based Time Resolved Neutron Detector Platform (LLE)
  - deploys new CVD or DDRIC detectors
  - minimizes qualification requirements for new detectors



Improvements have been implemented to increase availability and sustainability

- A second image plate reader has been deployed
- Enhanced beryllium management and monitoring
- Improved diagnostic storage systems

More improvements are planned for the upcoming year

- Online access to Equipment Qualification Document packages
- Diagnostic Users' Guides for more instruments
- Integrated diagnostic-timing management system

Many new diagnostics are in the queue today for FY11

UR LLE

OMEGA

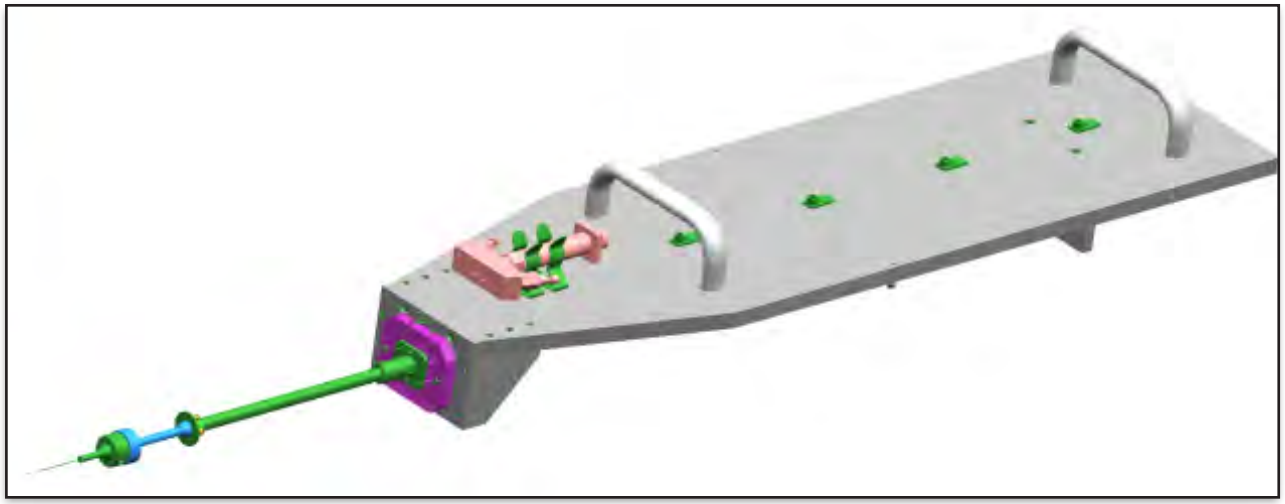
- LANL imaging Thomson spectrometer
- Evolved proton film pack (NTA)
- CEA XCCS collimator
- Sydor vacuum CCD
- Thomson alignment cart
- Spherical crystal imager for OMEGA
- DEMIN II
- EMI resistant TIM cabling
- SGEMP solar array diagnostic
- SPCA upgrade
- PTD ROSS upgrade
- P10.8S15 XRFC frame II
- Cryogenic proton radiography module
- Diamond XR detector
- PJX upgrade
- LLE TIM TPS

OMEGA EP

- 2nd generation spherical crystal imager
- 4ω probe beam laser
- 4ω diagnostics system
- Evolved proton film pack (NTA)
- Flower test object collimator modification
- CEA XCCS spectrometer
- CIVH spectrometer
- EMI resistant TIM cabling
- Pulsed calibration system for NBI
- nTOF liquid scintillator
- TC light timing diagnostic
- Optical Transition Diagnostic
- OSAKA University electron spectrometer
- LLE TIM TPS

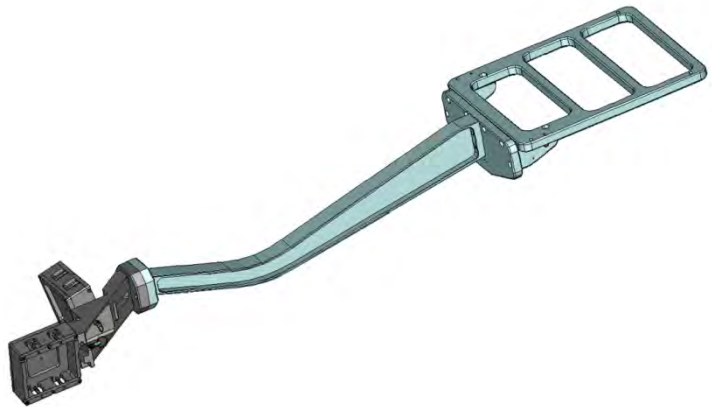
Diagnostics now in qualification

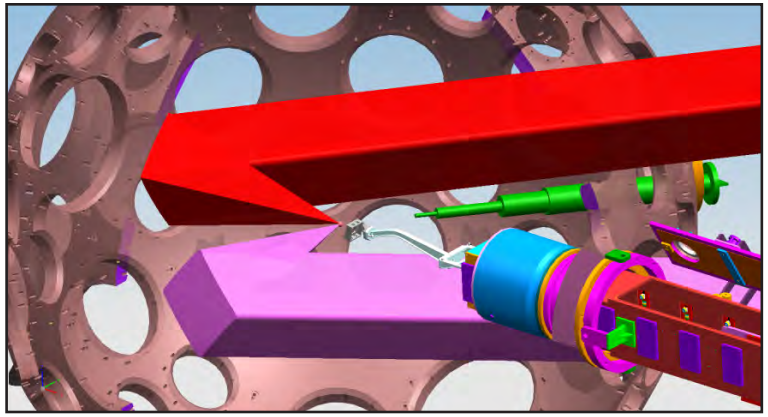
- LLE TIM based Target Positioner
  - will deploy on OMEGA and OMEGA EP
  - compatible with LLE and LLNL-Nova target mounts
  - will support LLNL pressure transducer system

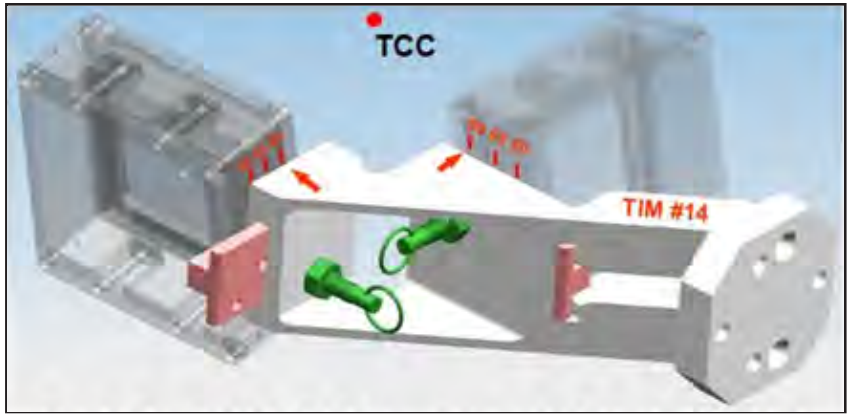


Diagnostics now in qualification (continued)

- **LLE Evolved Proton Film Pack (near target arm)**
  - **will deploy on OMEGA EP**
  - **replaces LLNL PFP 2**
  - **improved geometry**
  - **increased filter capacity**
  - **more configurations**
  - **improved operating economies**







OLUG recommendations for high-complexity projects are being addressed

- Planar cryogenic target capability on OMEGA EP
  - expect implementation in FY13
- Gas-jet target capability on OMEGA EP
  - expect implementation in the FY13+ period
- 20-MeV gamma spectrometer
  - expect implementation in the FY13+ period

Summary/Conclusions

LLE is responding to the OLUG 2010 findings

- Diagnostic information availability has been improved
- New diagnostics are available
- Expect continued enhancements in the future


XRS Spectrometer

Summary: The XRS spectrometer is a TIM mounted, time integrated, single channel Rowland Circle X-Ray spectrometer that supports the use of a variety of crystals to record X-Ray spectra ranging from 600 eV to 23 KeV.

Instrument Specialist: Baruch Yaakobi

Specification	Ω	OEP	Notes
Locations	TIMs 1,3,4,5,6	TIMs 12,13,14	Not allowed on opposite IP beams
Recording media	Film (BioMax, DEF) or Image Plate	Film (BioMax, DEF) or Image Plate	Only BioMax or Image Plate is supplied by LLE
Filters	At blast shield and film pack	At blast shield and film pack	Be authorized. Typical 0.001" Be as film pack light tight window
Slits	25μm – 5mm typical	25μm – 5mm typical	Pinhole array also possible

Available Energy (KeV) Ranges (one per XRS)

E1 = minimum and E2 maximum of range