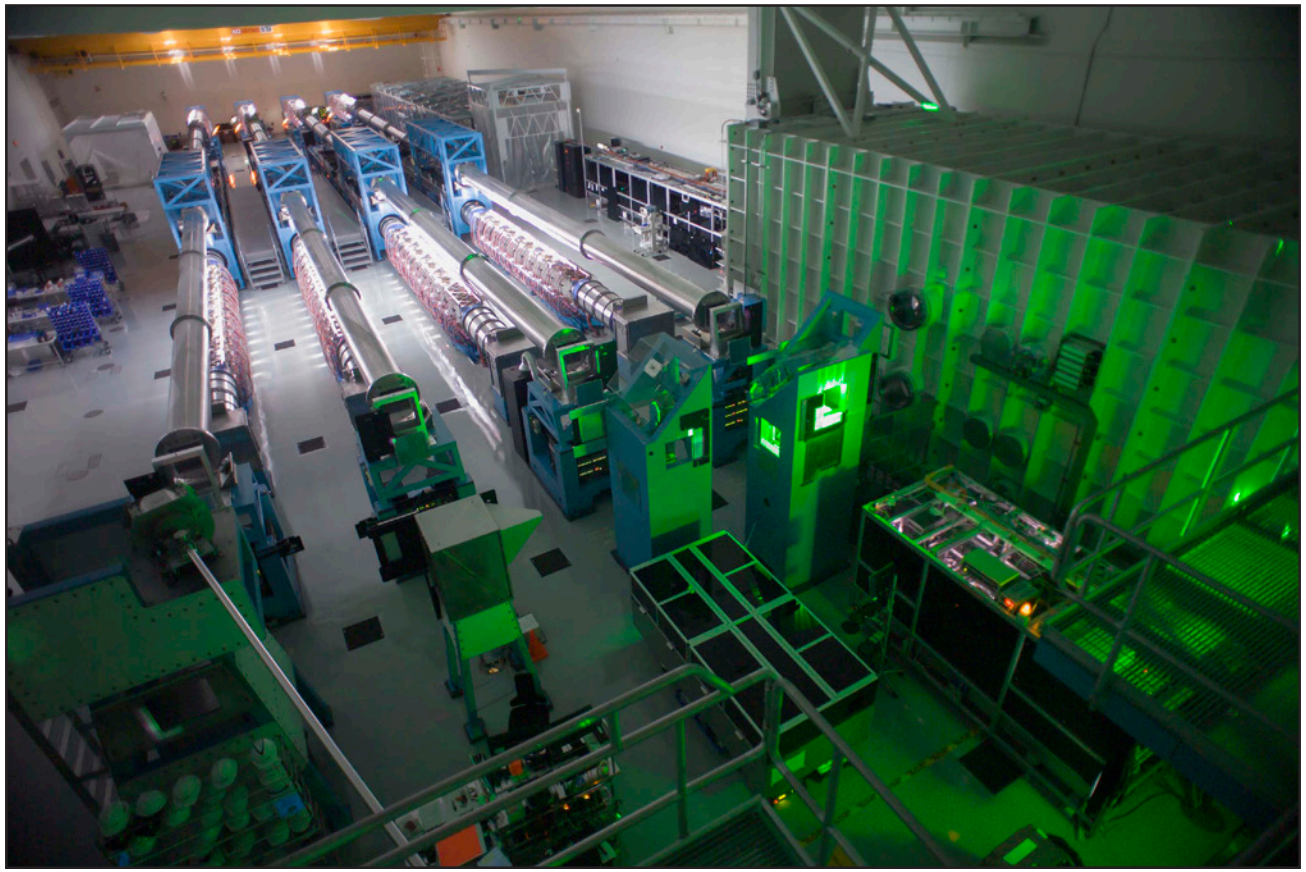
Omega Laser Facility Update: 2013 Progress on OLUG Recommendations



S. F. B. Morse
University of Rochester
Laboratory for Laser Energetics

Omega Laser Facility
Users Group Workshop
Rochester, NY
24–26 April 2013

Summary

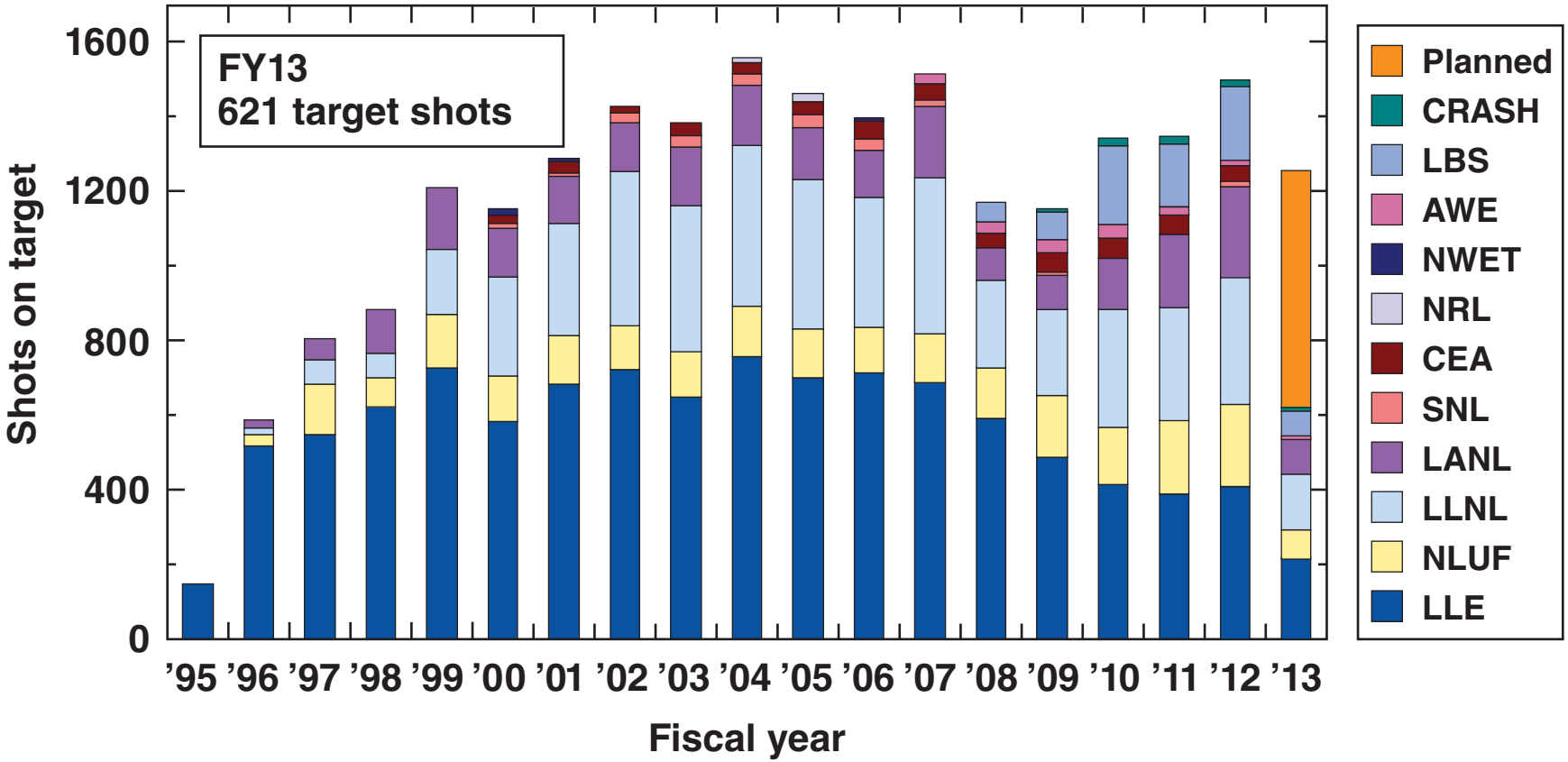
OLUG inputs continue to influence LLE priorities

UR LLE

- The Omega lasers continue to be operated with high productivity
- New features expand the irradiation conditions available
- The fourth-harmonic probe, an OLUG request from 2009, has been completed
- Progress continues on isotope separation and high-resolution spectroscopy
- Highlights of recent progress and new capabilities will be presented

Many of these items will be covered in depth in the poster session to follow.

OMEGA operations in FY13 are focused on conducting target shots, 22,000 to date

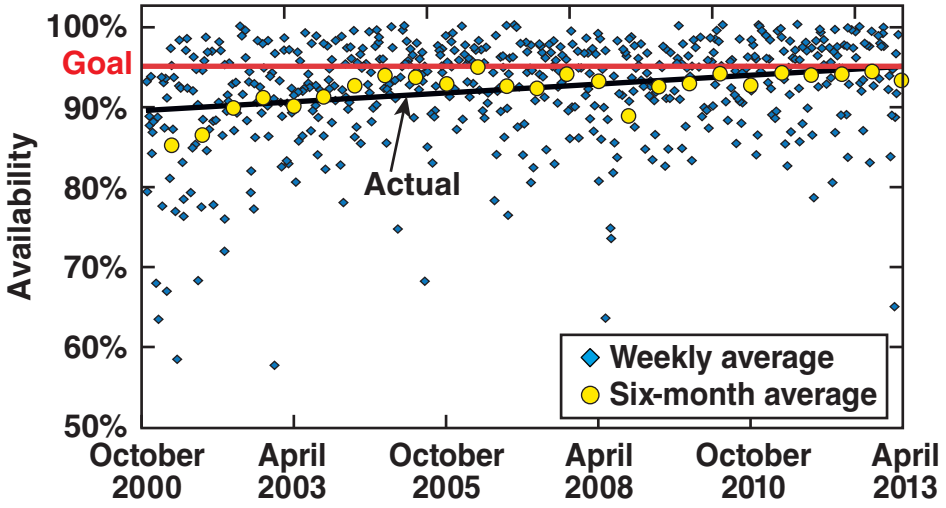


G9528b

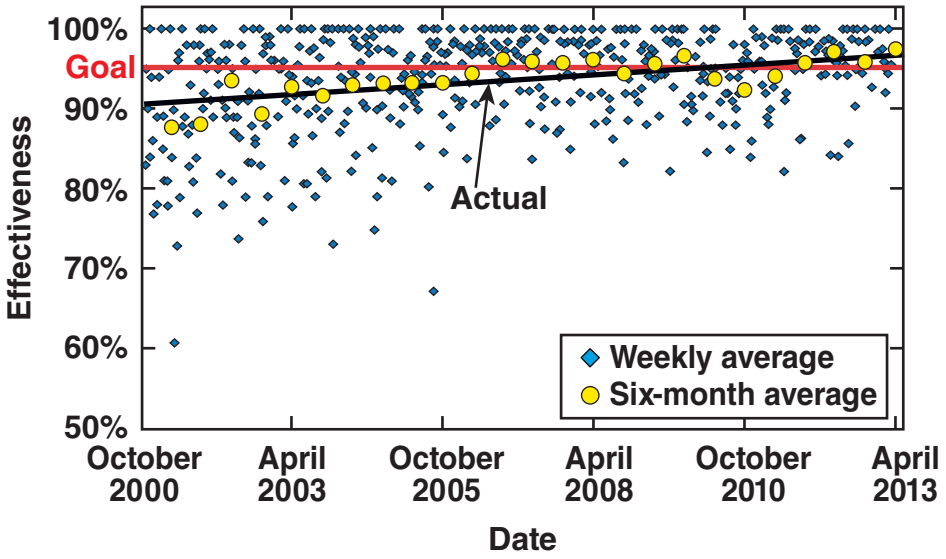
OMEGA Availability and Effectiveness continue to indicate high reliability and productivity

UR LLE

- **Availability average over past year was 94.7%**



- **Effectiveness average for the past year was 98.5%**



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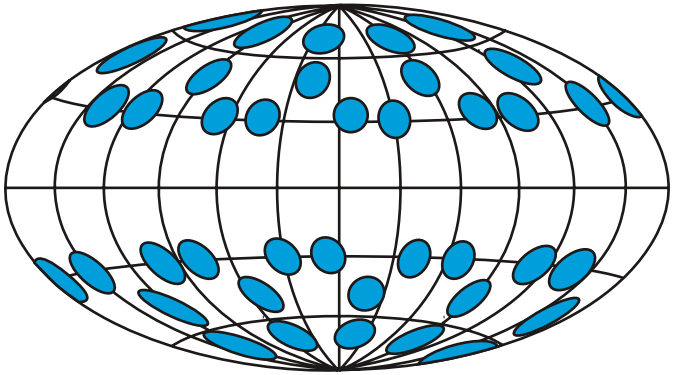
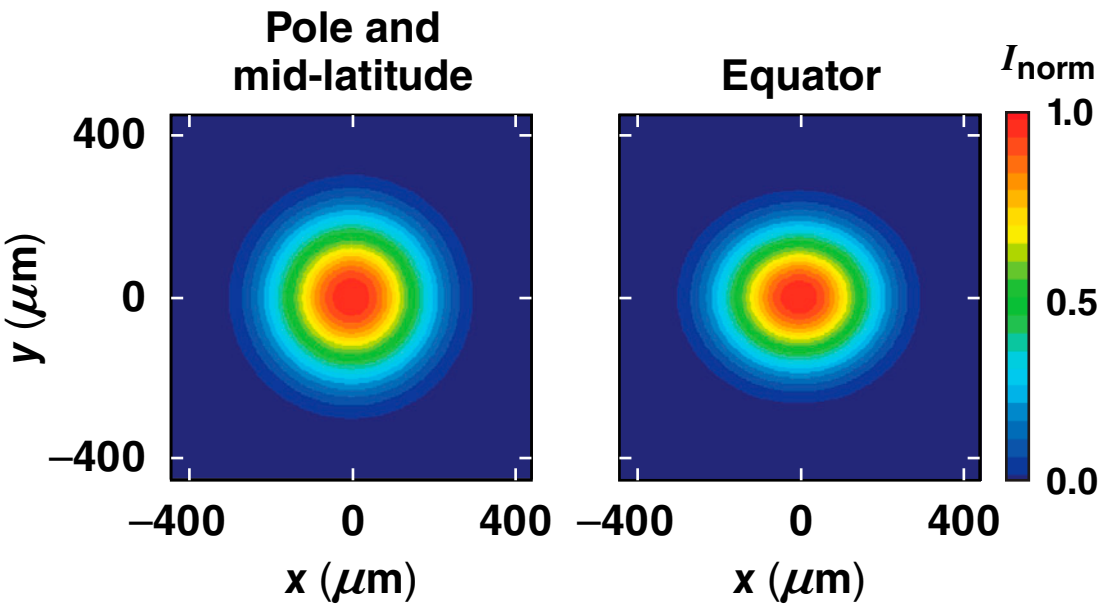
60 circular and 20 elliptical polar-drive distributed phase plates (DPP's) were completed in Q1 FY13 for OMEGA

UR LLE

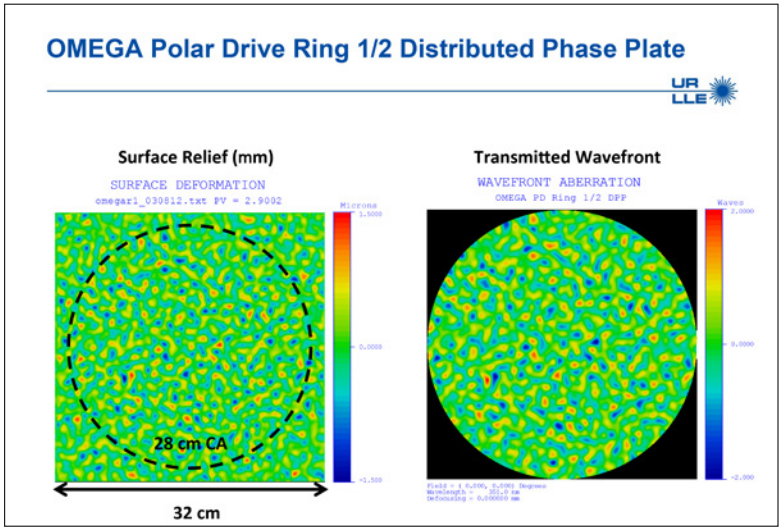
OMEGA PD configuration
(40 beams)

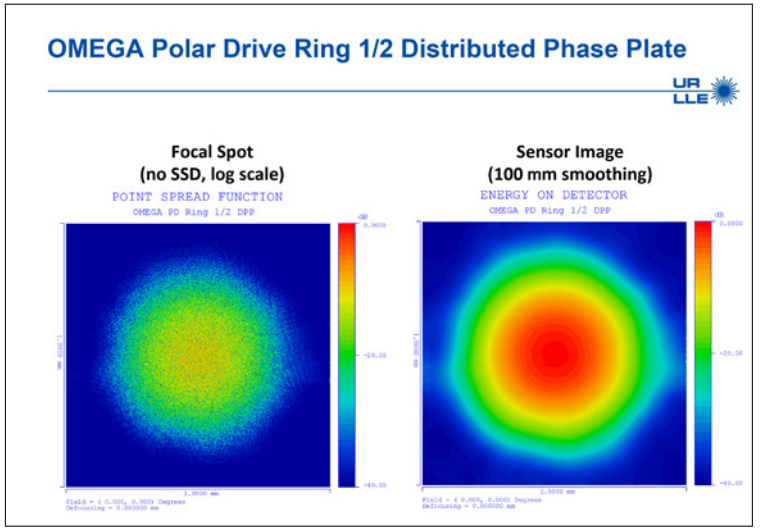


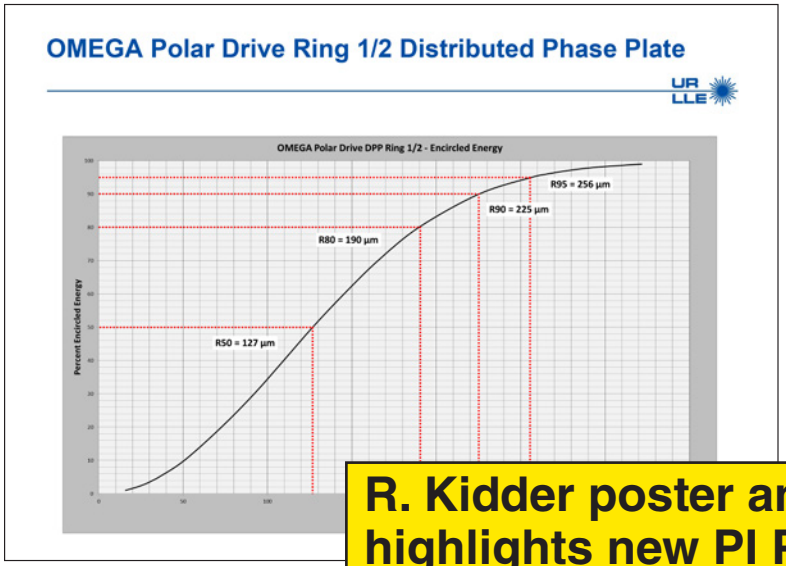


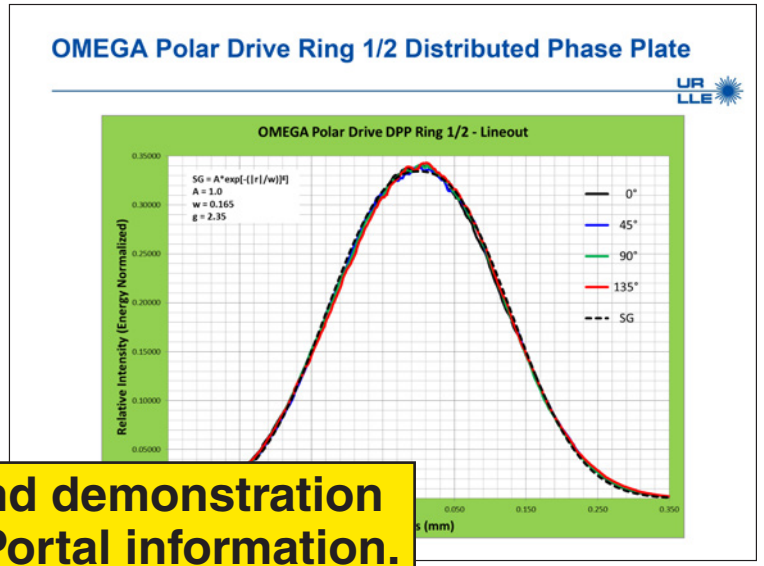
- 60 circular DPP's will allow for symmetric-drive experiments for baseline high-uniformity comparison
- 20 elliptical profile DPP's are used on the equatorial beams for polar-drive experiments

Phase-plate design files have been posted to the Omega website







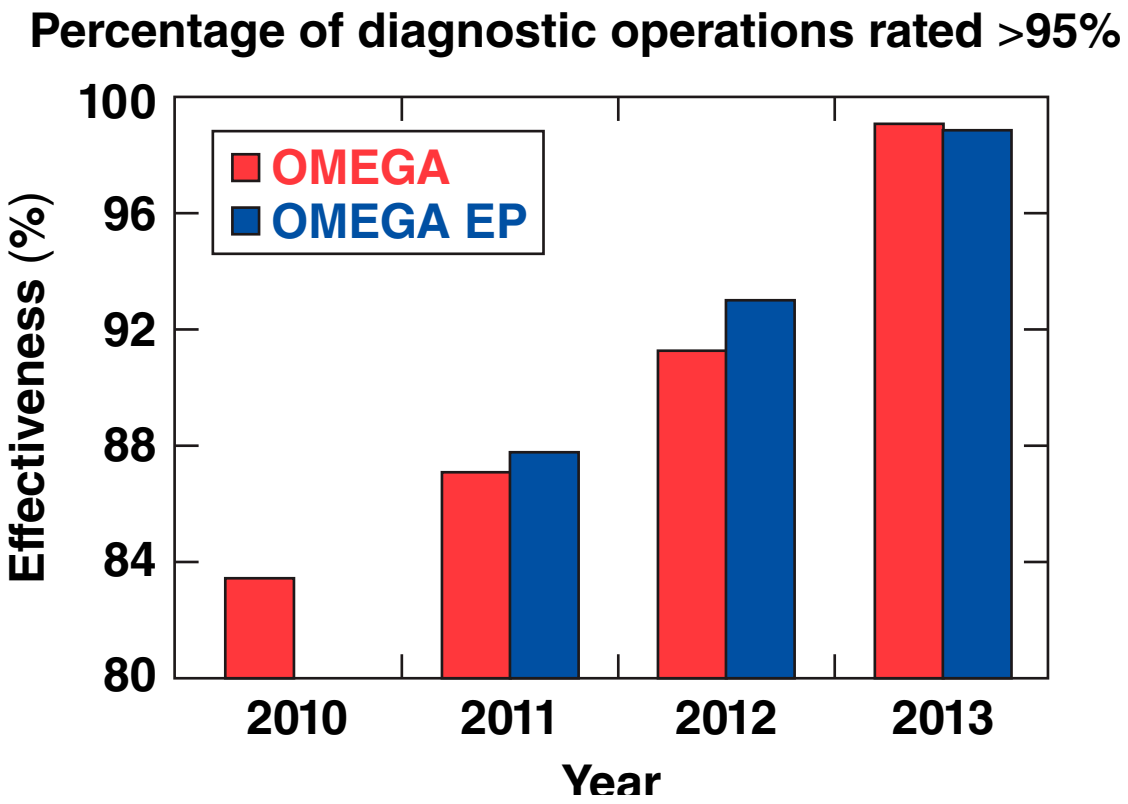


R. Kidder poster and demonstration highlights new PI Portal information.

G9869

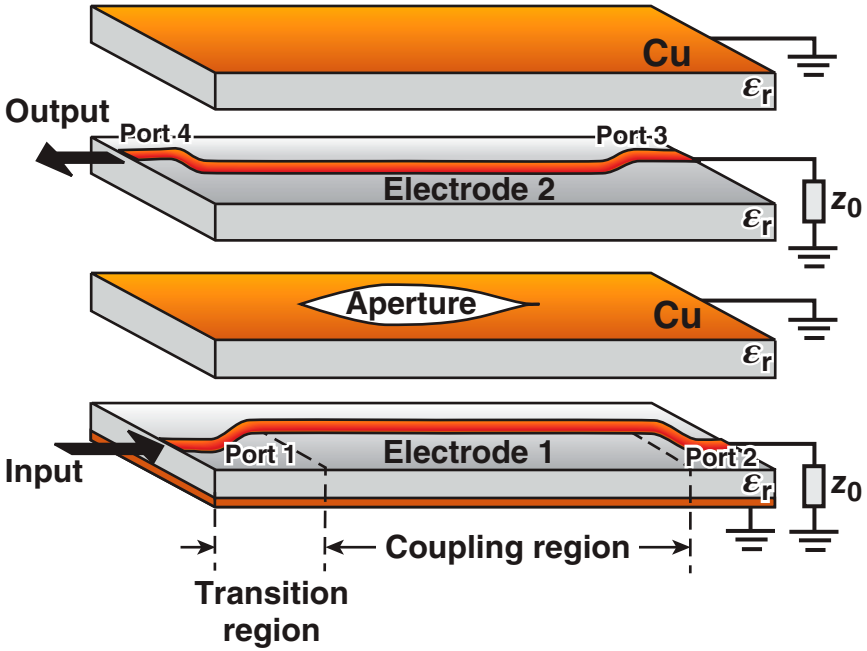
Diagnostic performance reflects ongoing efforts to ensure that primary diagnostics acquire data on every shot

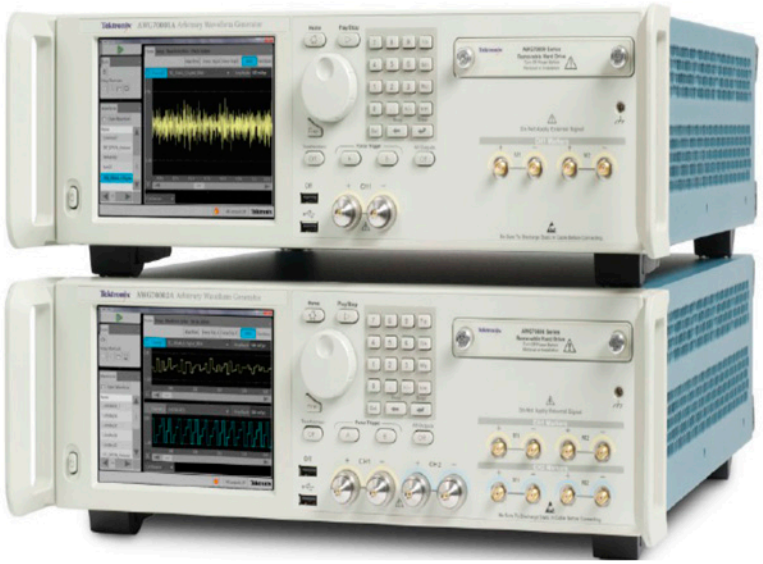
- Primary diagnostic effectiveness is rated at ~98% on OMEGA and OMEGA EP
- 99% of all diagnostics have exceeded 95% effectiveness
- Experimental Support, Engineering, and Operations each have contributions that result in these statistics



G. Pien poster highlights the progress in achieving higher effectiveness.

OMEGA pulse shapes will be generated by an arbitrary waveform generator in FY14





Current system

- Analog striplines cut for every shape
- Pickets added with rudimentary electronics and picket changes impact drive pulse shape

Future system

- Waveforms uploaded to 50-G sample/s generator
- Picket timing and amplitude independently adjustable without impacting drive pulse

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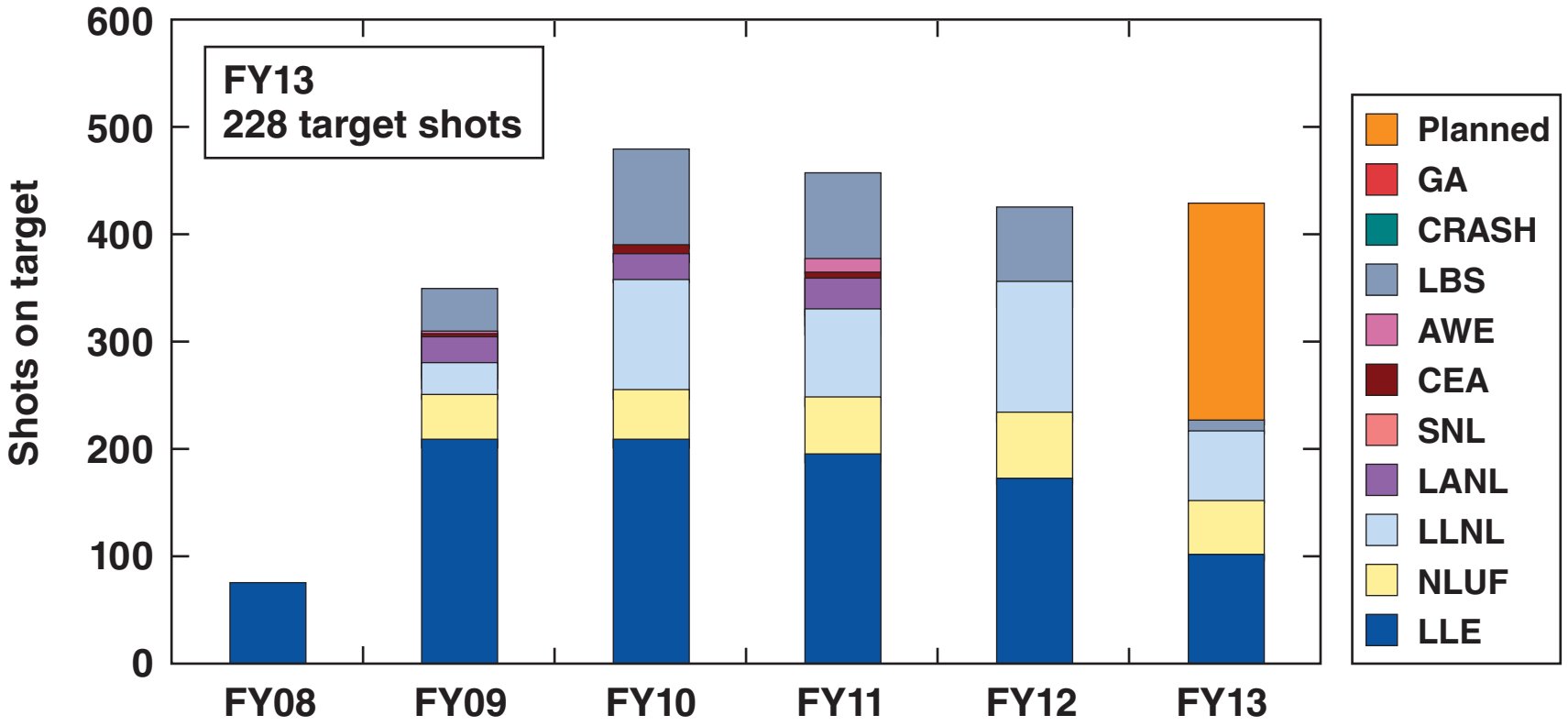
OMEGA EP has completed ~1800 target shots to date



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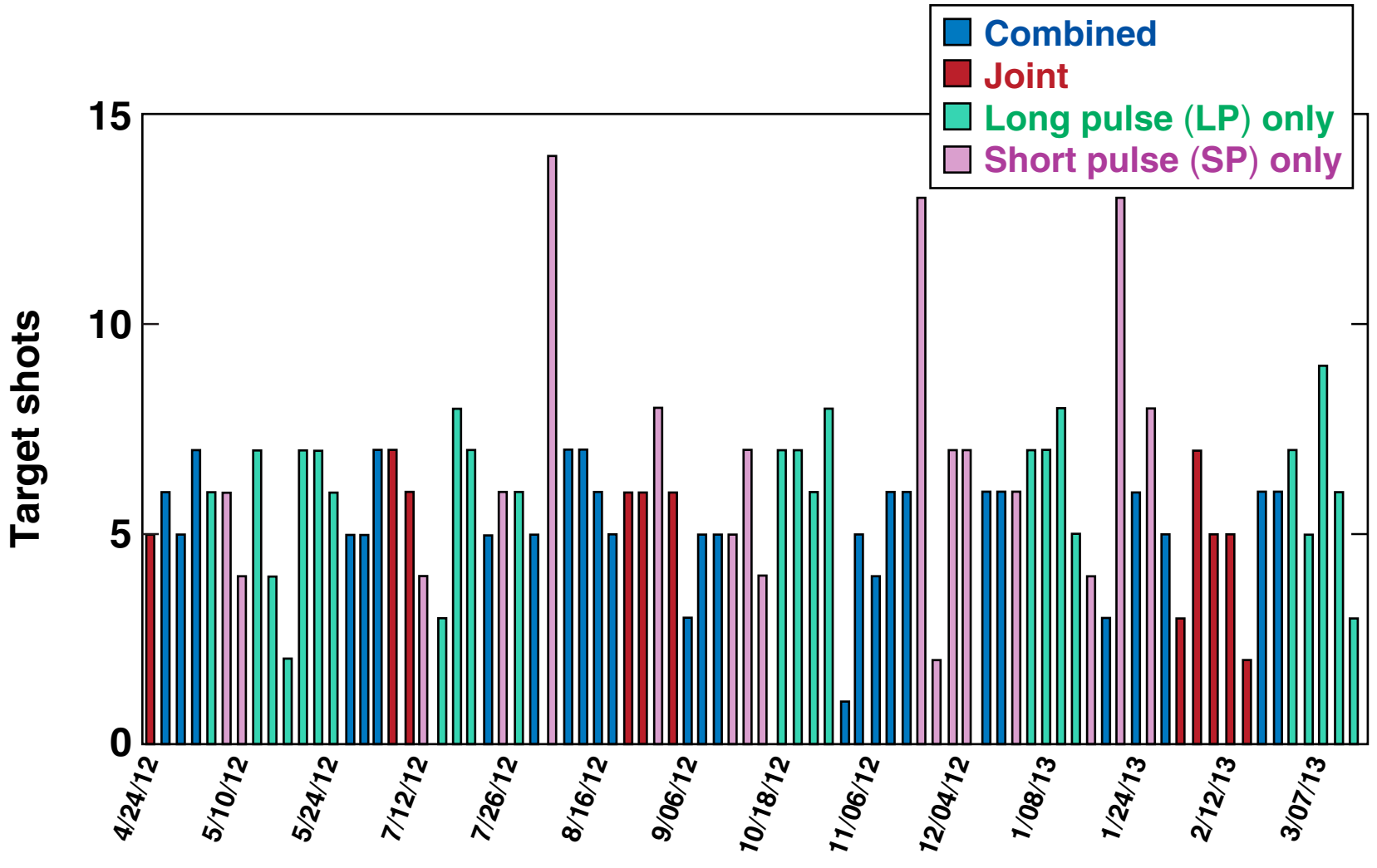
OMEGA EP shot rate has improved as campaign platforms mature



The number of shots per day increased from 5.8 to 6.1 shots/day.

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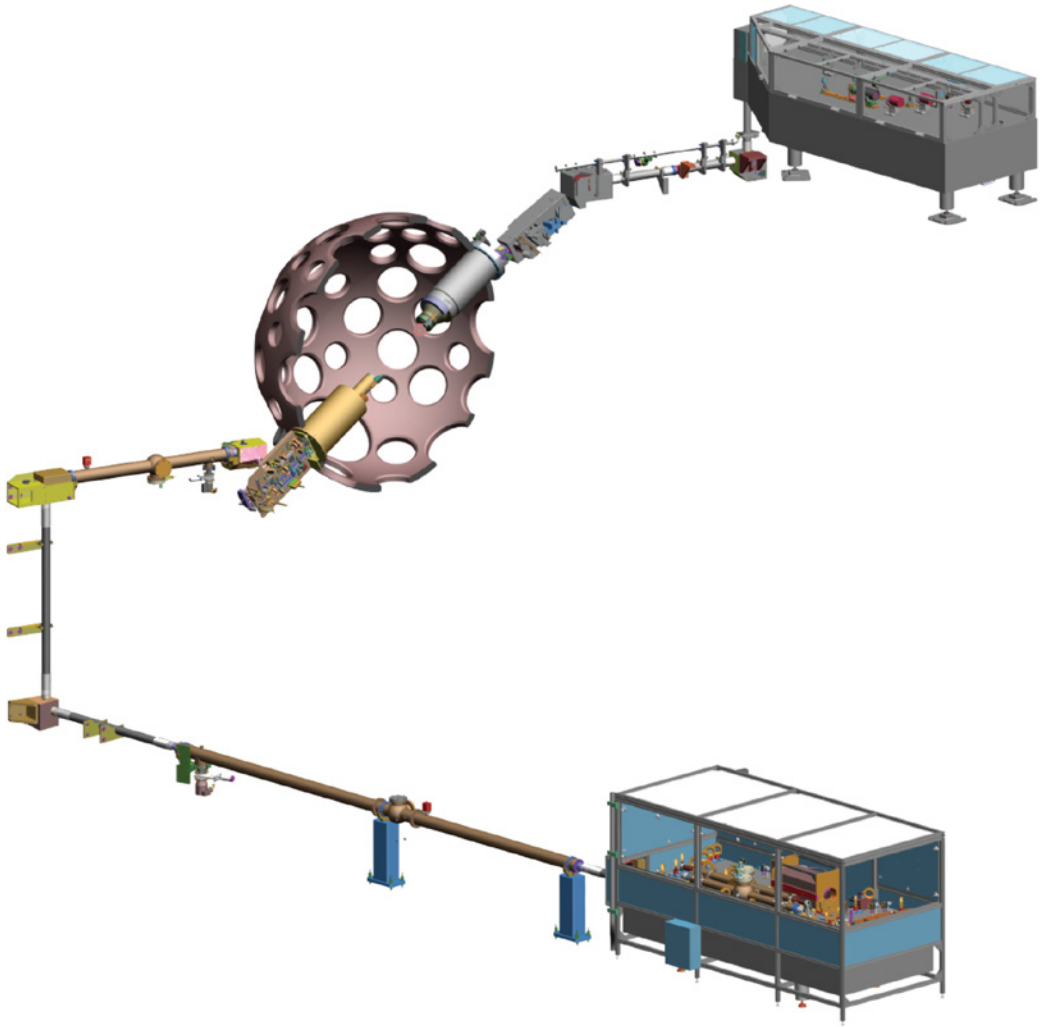
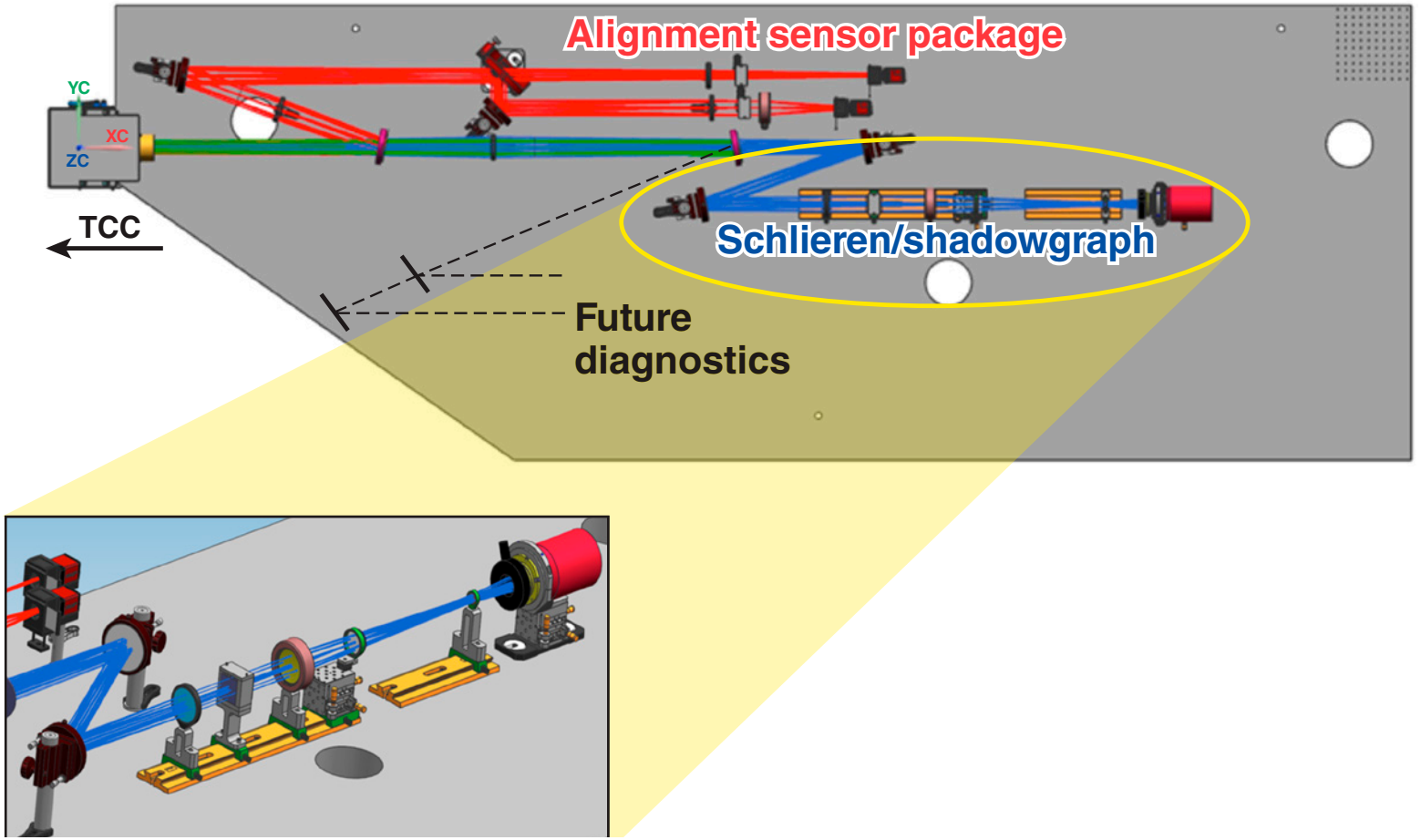
The OMEGA EP fourth-harmonic probe completion in December 2012 concluded three years of development



D. Haberberger will present the broader 4ω probe status.

The fourth-harmonic beam and initial diagnostics are complete as of the end of Q1 FY13

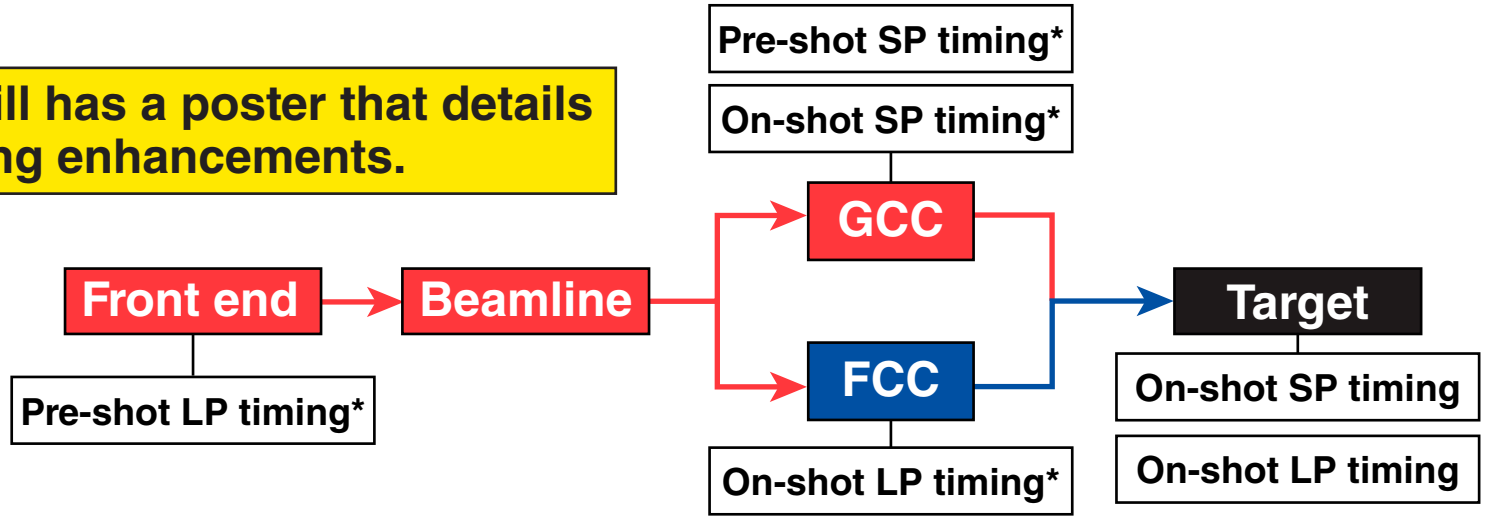


The system included numerous projects of high complexity and contributions from many people.

OMEGA EP timing diagnostics are employed to meet beam-to-beam timing accuracy requirements

- Pre-shot timing is set using diagnostics that have been calibrated to on-shot target diagnostics
  - to determine absolute on-shot timing, a time-resolved target diagnostic must be used
- Beam-to-beam timing on the first target shot of the day can be expected to be within 100 ps for UV beams and 50 ps for SP beams
- Beam-to-beam timing can be improved on subsequent shots, but only if an on-shot target diagnostic such as the UFXRS or PJX is deployed

E. Hill has a poster that details timing enhancements.



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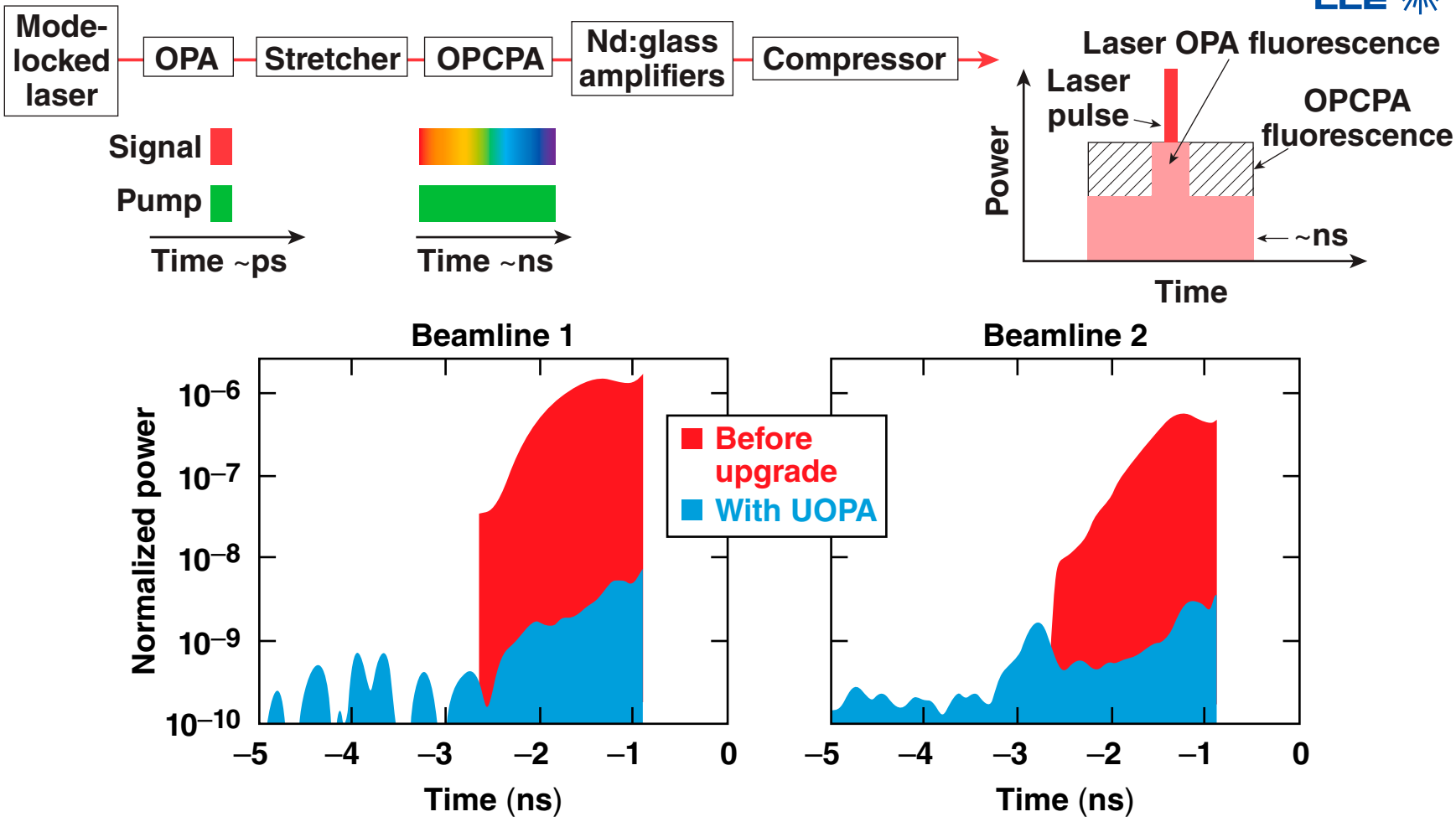
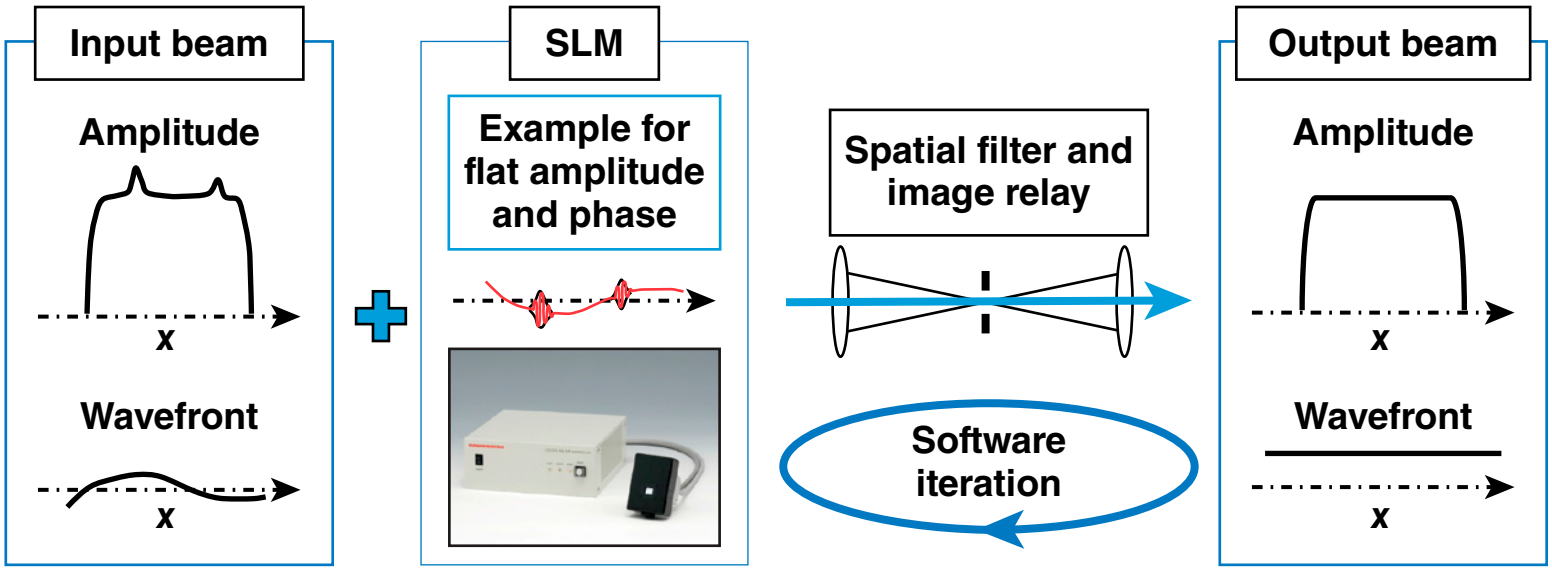
*Calibrated to target on-shot timing diagnostics

Ultrafast optical parametric amplifiers were added to both OMEGA EP short-pulse sources at the end of FY12



On-shot power contrasts higher than 10^9 at best compression have been measured, translating into intensity contrasts higher than 10^{10}.

Programmable spatial light modulators are being tested on the long-pulse beamlines of OMEGA EP

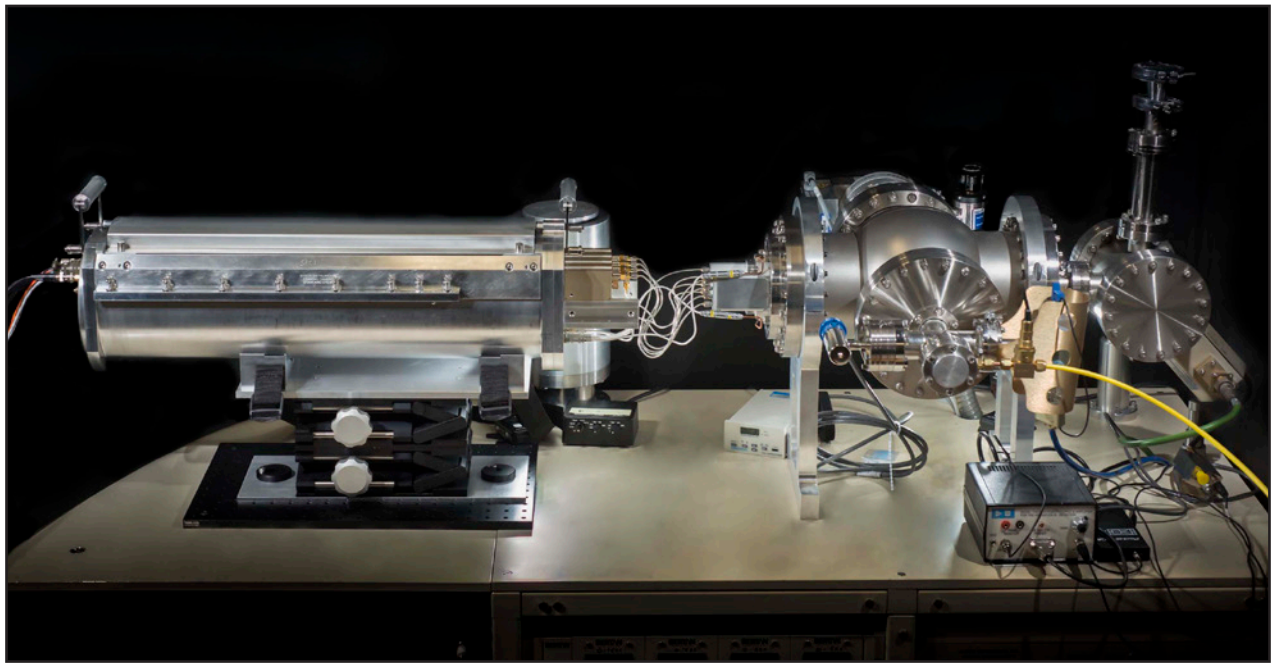


- Fluence amplitude is controlled by the modulation depth of the fast component of the SLM phase and spatial filtering
- Wavefront is controlled by the slow component of the SLM phase

See M. Barczys poster for details.

*V. Bagnoud and J. D. Zuegel, Opt. Lett. 29, 295 (2004).
**S.-W. Bahk *et al.*, Opt. Express 18, 9151 (2010).

Two new framing cameras will be available for users starting in Q4 FY13



- Manufactured by Sydor Instruments in collaboration with LLE, LLNL and Kentech
- 200-ps, 400-ps, and 1-ns pulse-forming modules are available
- The cameras feature enclosed GXD Electronics modules and can be used on DT shots since surface contamination can be removed
- Will use film initially; CCD camera capability will follow

An exploded CAD view of a Sydor Instruments framing camera shows major components

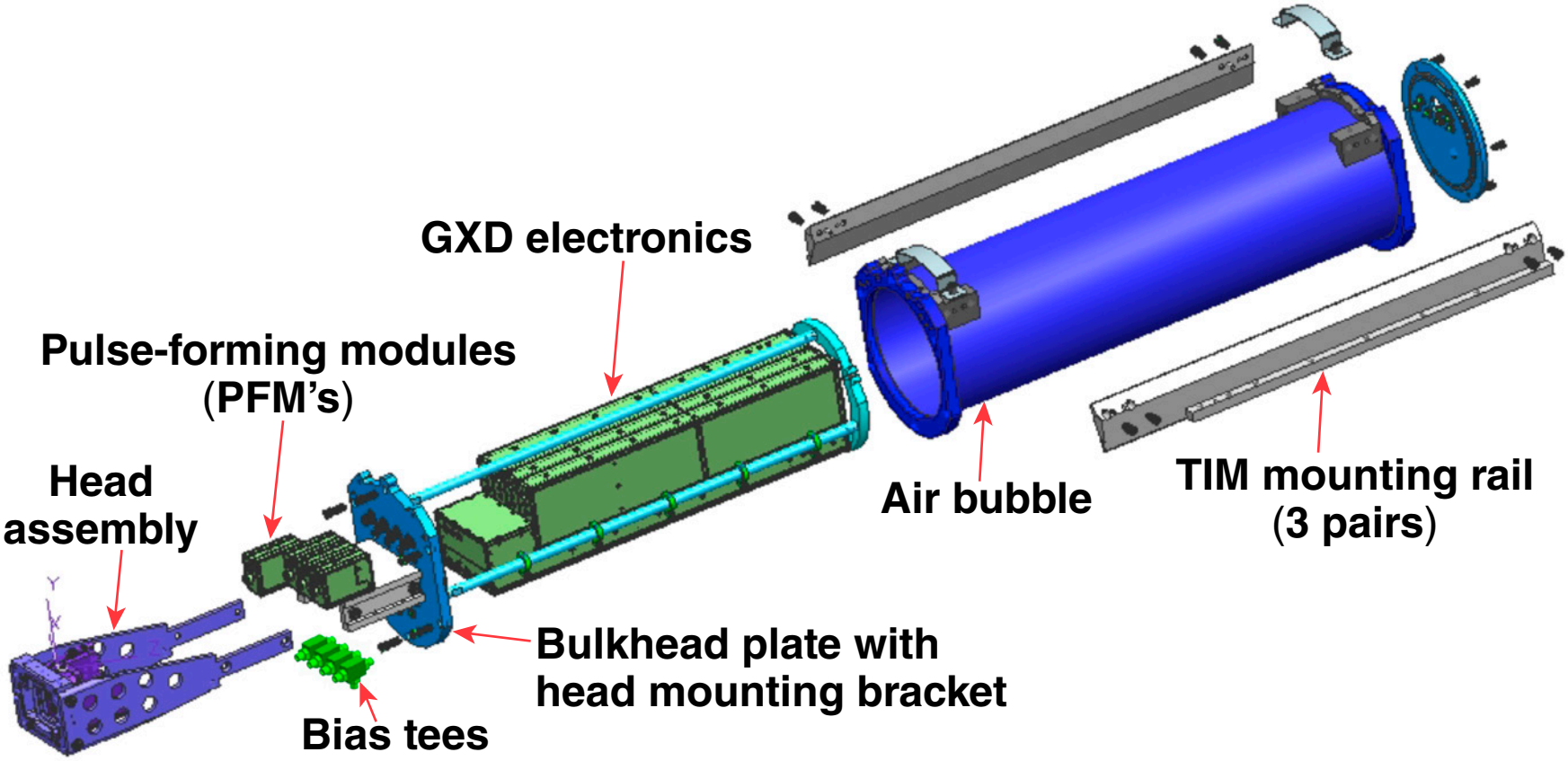
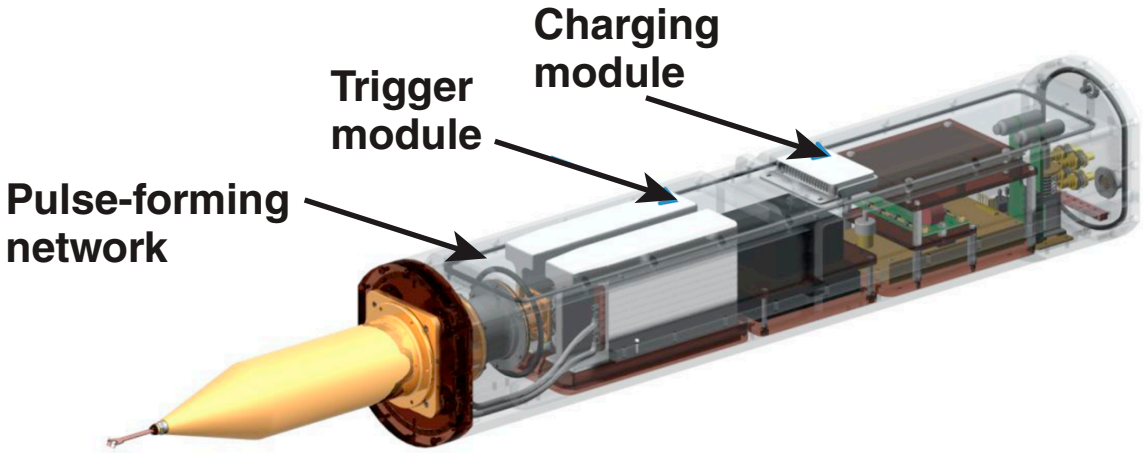
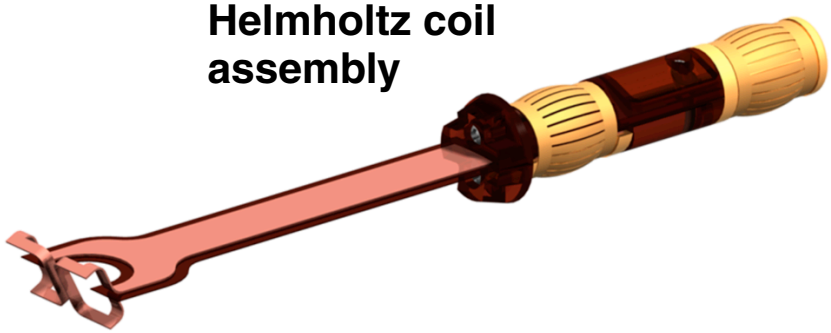


Image provided by:
Sydor instruments

The MIFEDS field generator is now in routine use on OMEGA and OMEGA EP





- Coils are long lead items, design cycle >3 months
- Contact the instrument PI, G. Fiksel, to coordinate use

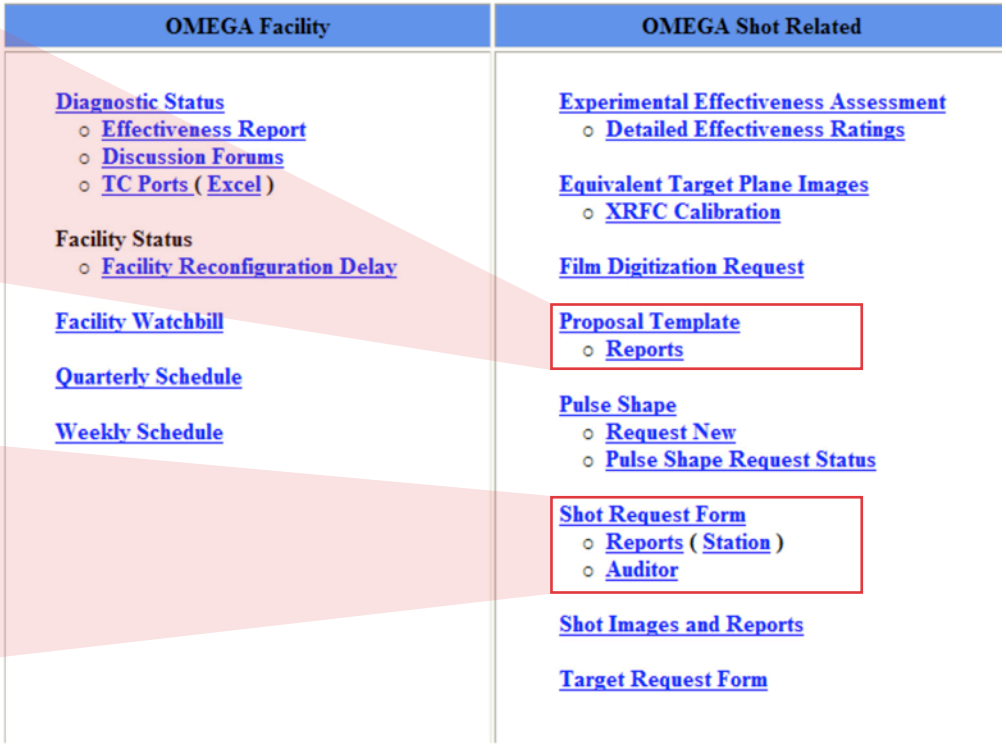
The Instrument Specialist/Technician and guest worker policies have been improved

- The training modules have been condensed to a single file for most visitors
- Access rules are clarified
- The IS/T qualification card and process is simplified
  - Instrument Principal Investigator—system expert, normally the developer of the instrument
  - Instrument Specialist—qualified by PI to handle alignment and repairs in addition to nominal operations
  - Instrument Technician—qualified by PI or IS to install/remove and operate the instrument

S. Stagnitto poster includes highlights of the evolved process.

Shot request form (SRF) features have evolved in response to user input

- Proposal reports are expanded to include views that the scheduling committee uses in assessing campaigns
- Tools to edit groups of SRF's have been improved
- SRF auditor reports are integrated into the proposal submission process
- User input is strongly encouraged

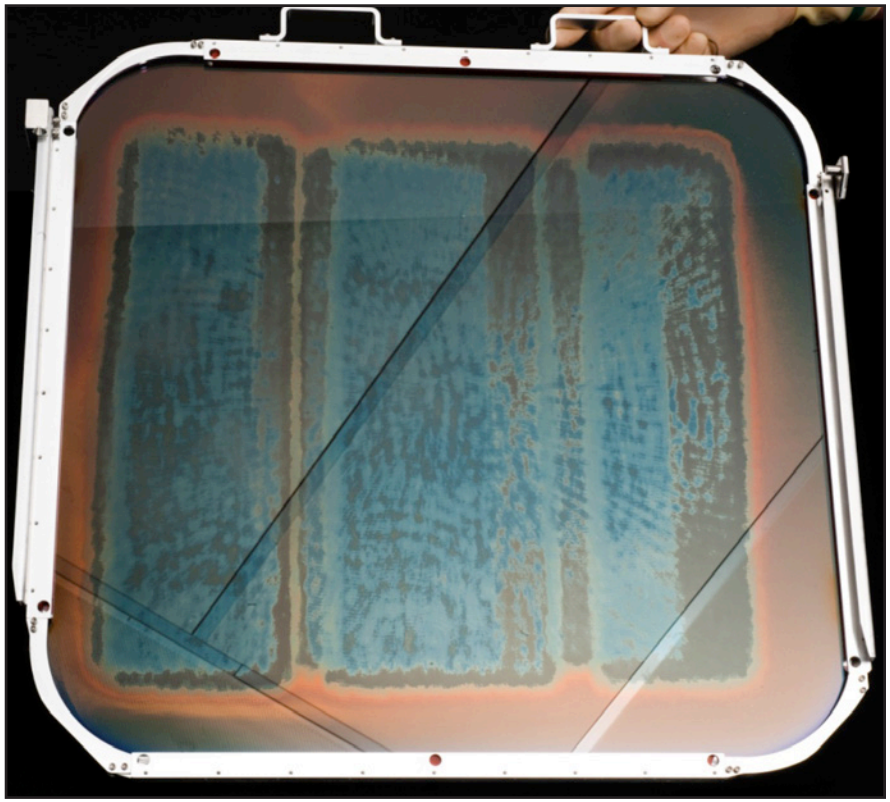


OMEGA Facility	OMEGA Shot Related
Diagnostic Status ○ Effectiveness Report ○ Discussion Forums ○ TC Ports (Excel) Facility Status ○ Facility Reconfiguration Delay Facility Watchbill Quarterly Schedule Weekly Schedule	Experimental Effectiveness Assessment ○ Detailed Effectiveness Ratings Equivalent Target Plane Images ○ XRFC Calibration Film Digitization Request Proposal Template ○ Reports Pulse Shape ○ Request New ○ Pulse Shape Request Status Shot Request Form ○ Reports (Station) ○ Auditor Shot Images and Reports Target Request Form

C. Sorce poster will be accompanied by a live web demonstration and Q/A session.

The short-pulse disposable debris shield (DDS) protects the off-axis parabola focusing optic

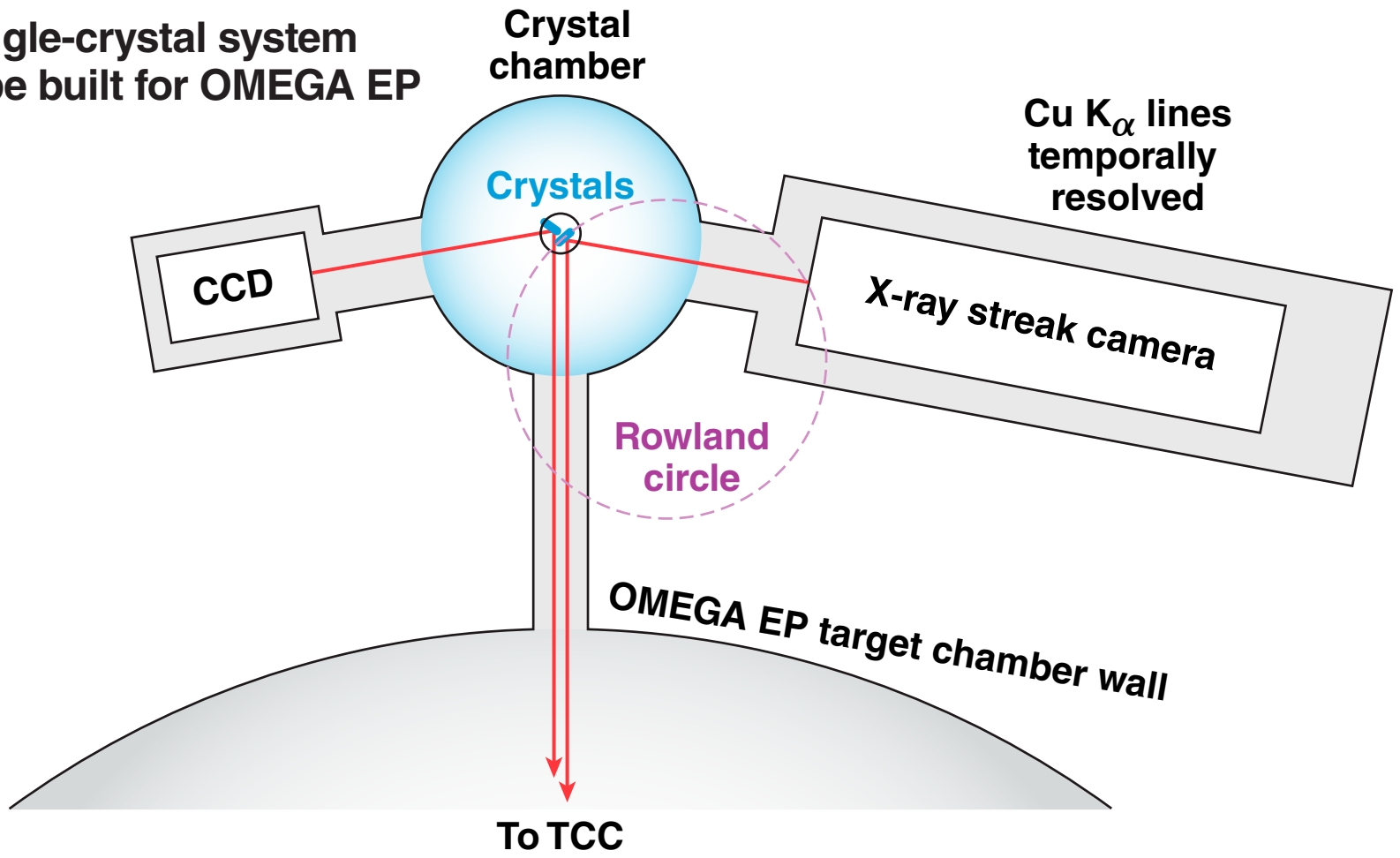
- Many campaigns are required to use a DDS on OMEGA
- LLE is averse to putting a quantitative metric behind the decision criteria
- The FASC reviews every experiment proposal and makes a judgment based on experience



A DDS after one day of shots on high-mass targets is visibly degraded.

LLE is committed to a high-resolution streaked x-ray spectrometer for OMEGA EP in FY14

- A single-crystal system will be built for OMEGA EP

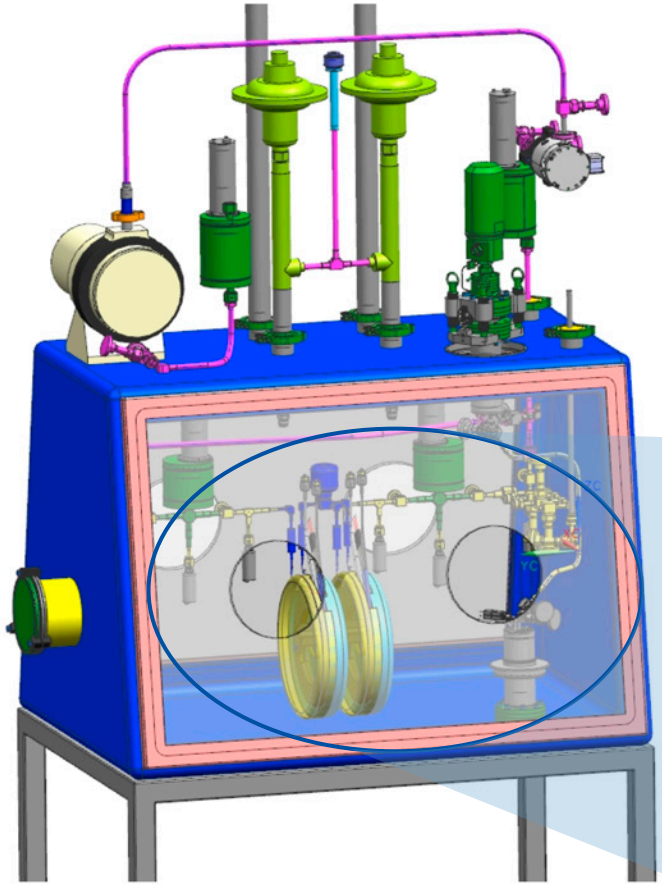


Short-pulse target interaction allows for imaging of spectral shifts in multi-keV lines.

PI P. Nilson

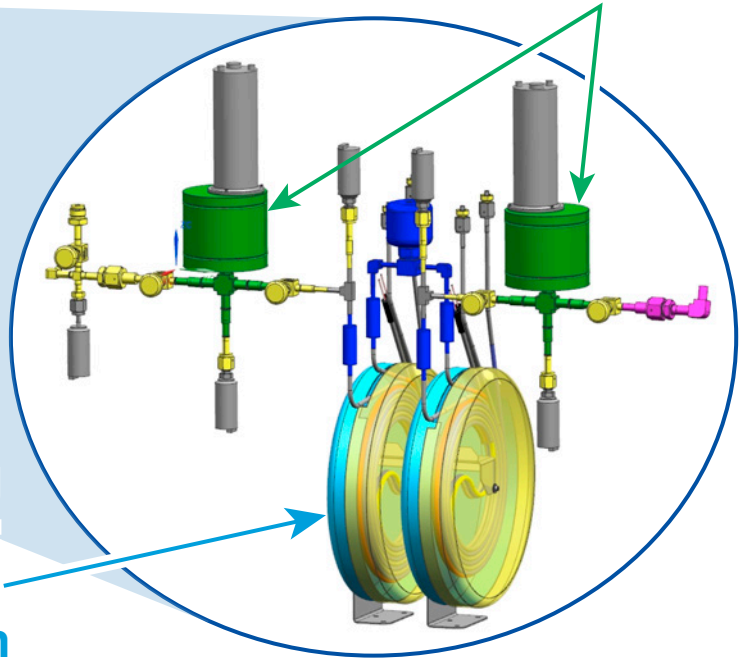
The LLE isotope separator will be complete in early FY14 and will be capable of purifying the LLE tritium supply

UR LLE



High-purity tritium and non-equimolar isotopic ratios will be accessible after this equipment is commissioned.

High-pressure tritium monitors



Isotope separation columns; gas is shuffled between hot and cold palladium and molecular sieve medium

G9879

Summary/Conclusions

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