Status of OMEGA EP:
An Experimentalist’s Perspective

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The experimental capabilities of OMEGA EP have significantly evolved since April 2008

- **Energy**
  - from 400 J to 1400 J

- **Pointing**
  - stability <50-μm rms long term

- **Cross-timing**
  - OMEGA to OMEGA EP <10 ps
  - OMEGA EP long–short ~100 ps

- **Focusing**

- **Diagnostics**
  - UFXRSC ps x-ray streak camera
  - DC-HOPG, ZVH, XRS3 <10-keV time-integrated spectrometers
  - DCS <100-keV time-integrated spectrometer
  - PFP, WRF, TPIE proton imager and spectrometer
  - Activation >100-keV time-integrated spectrometer
  - HERIE, XRCCDBUB static x-ray imagers
The energy available in the short-pulse beam improved quickly and has stayed approximately constant.
Pointing stability in the OMEGA EP target chamber is better than 50 \( \mu m \)

Results of three shots with x-ray images from fixed x-ray pinhole cameras superposed.

- **XPHC port 39**
  - Shot 2777
  - Shot 2805
  - View angle = 32°
  - Diameter: 90 \( \mu m \)
  - Diameter: 70 \( \mu m \)

- **XPHC port 52**
  - Shot 2777
  - Shot 2805
  - View angle = 15°
  - Diameter: 83 \( \mu m \)
  - Diameter: 70 \( \mu m \)
NTD/PTD was used for cross-timing OMEGA and OMEGA EP to better than 10-ps rms
Setup of the neutron temporal diagnostic (NTD)*

200-ps-wide, 500-ps, 0.53-μm fiducial

Cross-timing stability of OMEGA and OMEGA EP is below the measurement uncertainty of 5 ps.
The POTTS system provides low-jitter trigger and timing-fiducial signals. The design performance includes:
- pulse energy ~ 10 nJ
- contrast ~ 50 dB

The measured performance is:
- jitter < 1.5 ps (rms)
- drift = 55 fs/°C/m
Cross-timing between the OMEGA EP short- and long-pulse beams is established using a scintillator detector.
The OMEGA EP focal spot typically has \( R_{80} < 25 \, \mu m \) and is improving.

\[ R_{80} = 22.7 \, \mu m \]

BL1 to OMEGA EP sidelighter indicated, shot 4800.
A 2-ps time-resolution, ultrafast x-ray streak camera has been tested and is available.

Specifications
- 10-lp/mm spatial resolution
- 2-ps temporal resolution
- 0.5-ns and 2-ns streak window
- 10-ps rms trigger jitter
The experimental capabilities of OMEGA EP will continue to expand in the near future

- **Energy**
  - 2.6 kJ ramp in FY09

- **Pointing**
  - stability verification in FY10

- **Cross-timing**
  - UV-SP with streak camera by FY10

- **Focusing**

- **Diagnostics**
  - SPC May 2009
  - HXRD May 2009
  - ASBO May 2009
  - $4\omega$ probe laser December 2009
  - Streaked spectrometer December 2009
  - Crystal Imager May 2010
Cross-timing will be transferred to the UROSS and UVROSS streak cameras

- Ultrafast ROSS (UROSS)
  - 2.5-ps resolution
  - fast fiducial (FY10)
  - comb generator (FY10)

- UV ROSS (UVROSS)
  - 20-ps resolution
  - OMEGA fiducial
  - 2-GHz comb generator
A modern 20-ps-resolution x-ray streak camera is available for UV short-pulse cross timing (PJX)
An x-ray CCD camera is mounted in an air bubble for insertion into the target chamber (XCCDBUB)
An x-ray CCD in single-photon-counting mode is an attractive option for x-ray spectroscopy up to ~40 keV
The mechanical design of the OMEGA EP single-photon-counting spectrometer is complete.
The experimental capabilities of the OMEGA EP facility have significantly evolved since April 2008

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