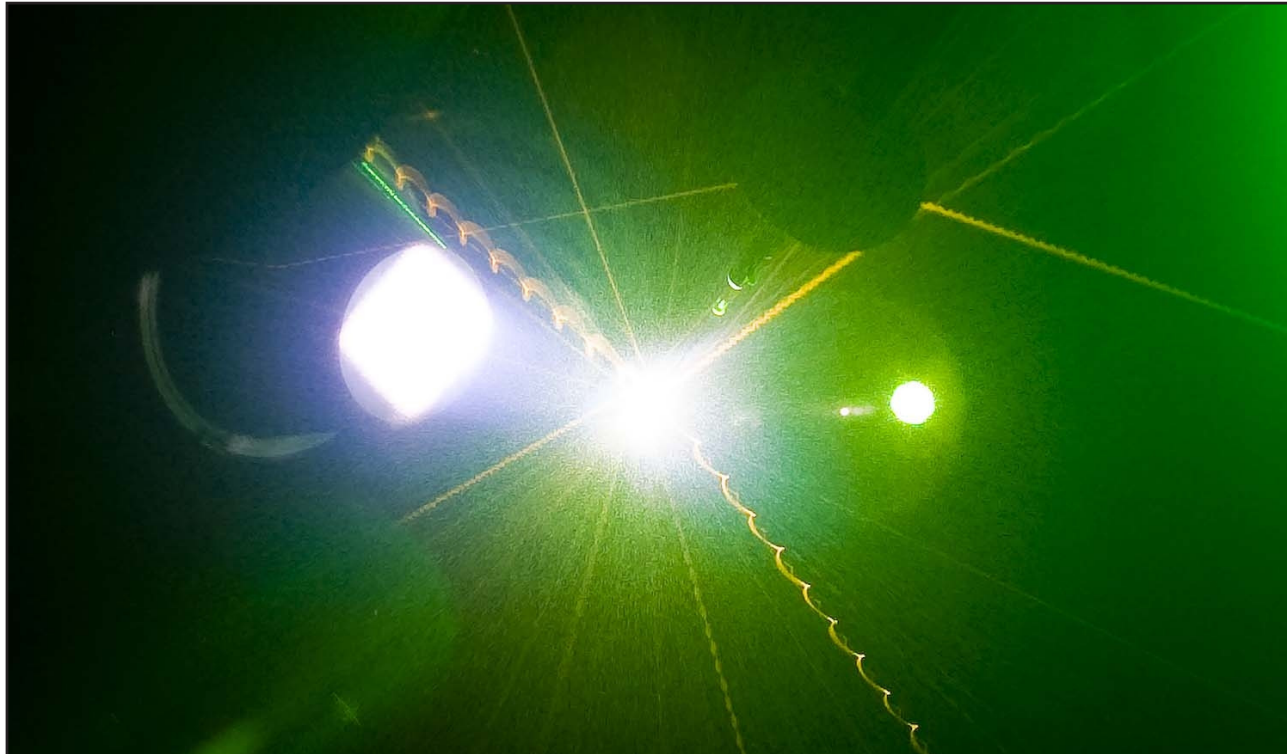


# Status of OMEGA EP: An Experimentalist's Perspective



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**University of Rochester**  
**Laboratory for Laser Energetics**

**Omega Laser Facility**  
**Users' Group Workshop**  
**Rochester, NY**  
**29 April – 1 May 2009**

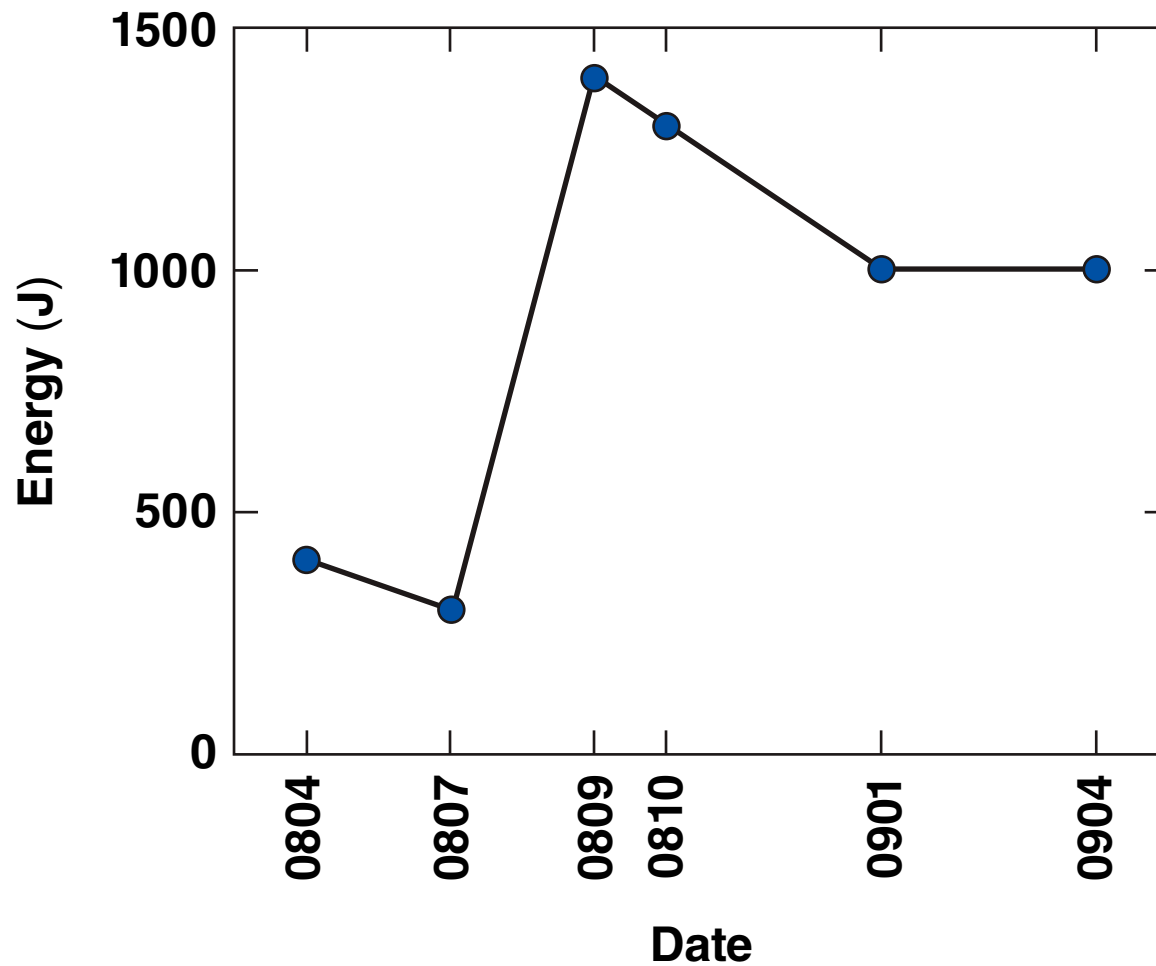
## Summary

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



- **Energy**
  - from 400 J to 1400 J
- **Pointing**
  - stability  $<50\text{-}\mu\text{m}$  rms long term
- **Cross-timing**
  - OMEGA to OMEGA EP  $<10$  ps
  - OMEGA EP long–short  $\sim 100$  ps
- **Focusing**
- **Diagnostics**
  - UFXRSC ps x-ray streak camera
  - DC-HOPG, ZVH, XRS3  $<10\text{-keV}$  time-integrated spectrometers
  - DCS  $<100\text{-keV}$  time-integrated spectrometer
  - PFP, WRF, TPIE proton imager and spectrometer
  - Activation  $>100\text{-keV}$  time-integrated spectrometer
  - HERIE, XRCCDBUB static x-ray imagers

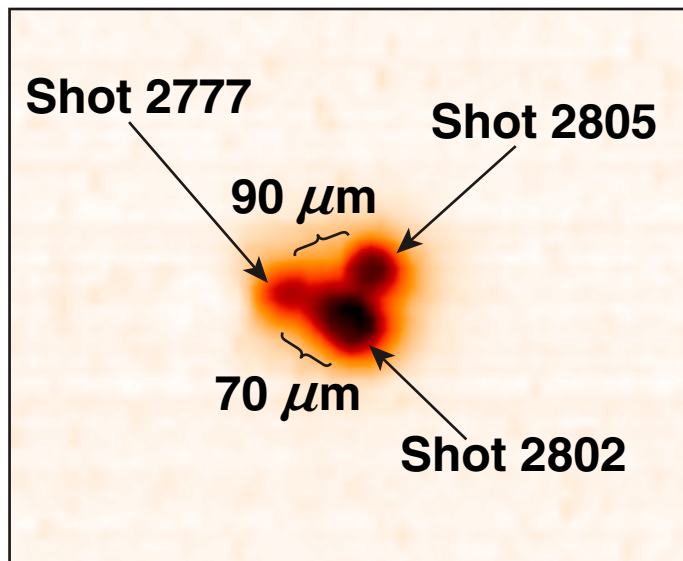
The energy available in the short-pulse beam improved quickly and has stayed approximately constant



# Pointing stability in the OMEGA EP target chamber is better than $50 \mu\text{m}$

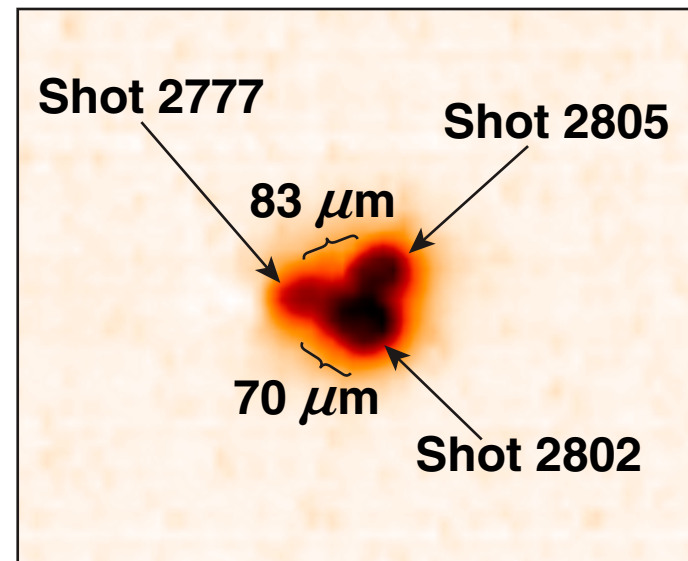
Results of three shots with x-ray images from fixed x-ray pinhole cameras superposed

XPHC port 39



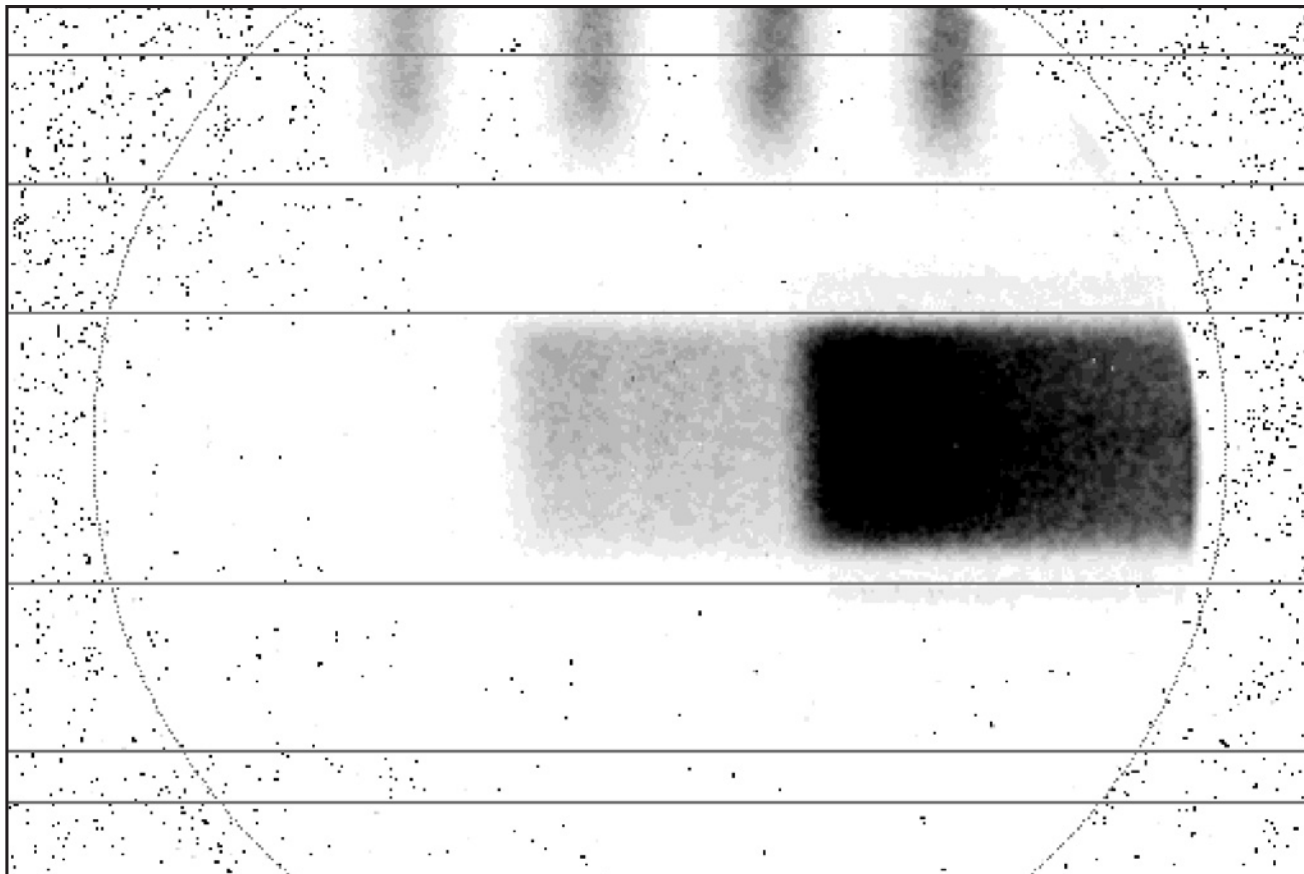
View angle =  $32^\circ$

XPHC port 52

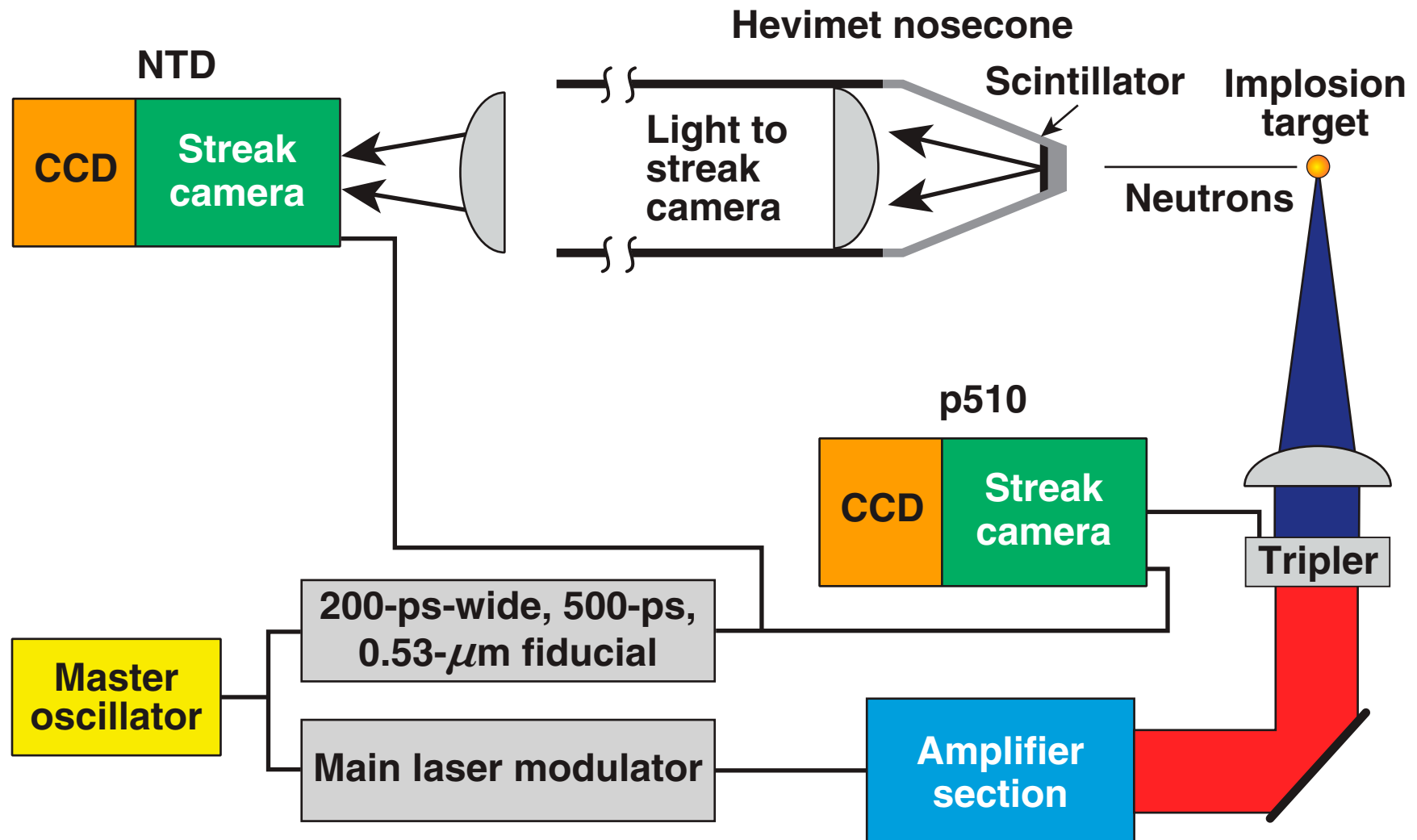


View angle =  $15^\circ$

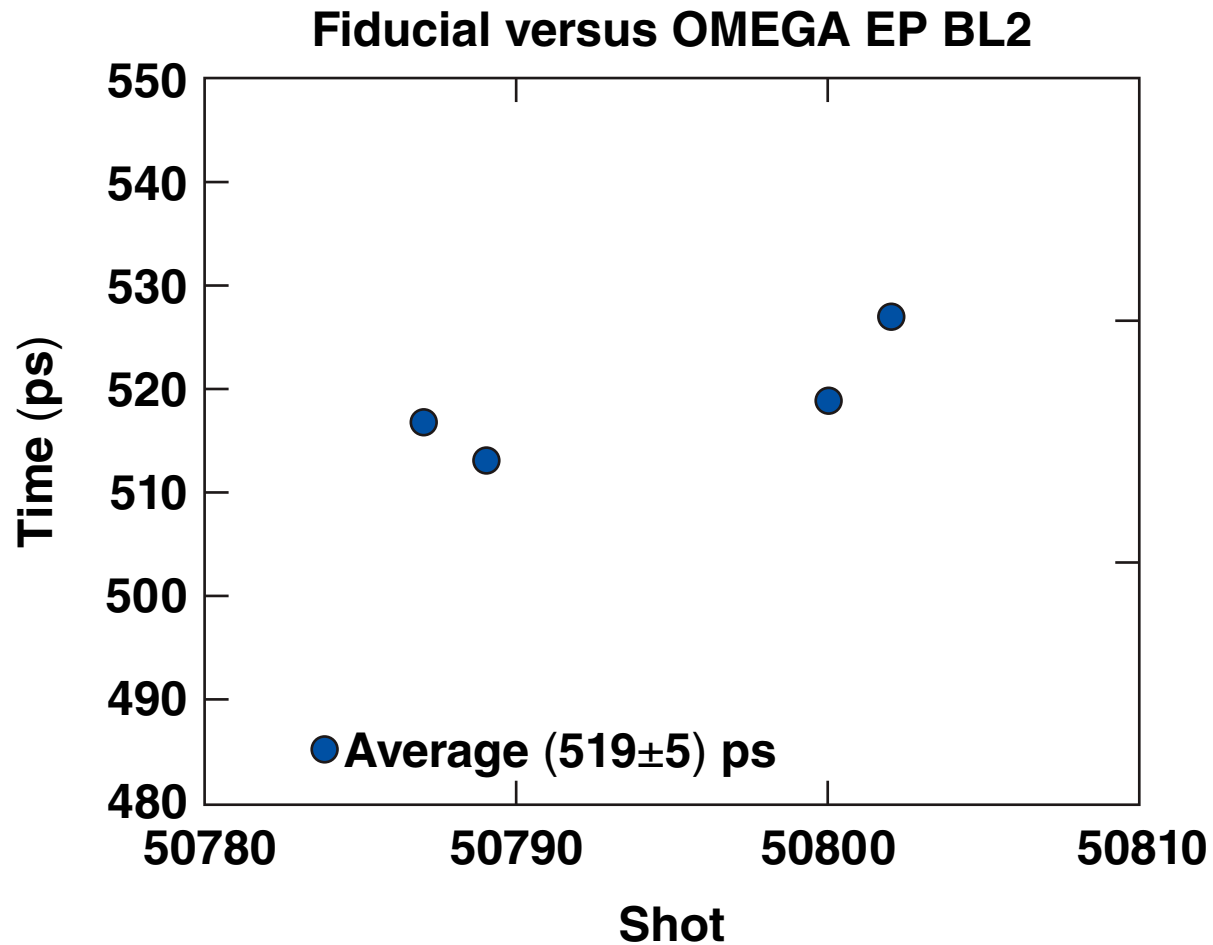
# NTD/PTD was used for cross-timing OMEGA and OMEGA EP to better than 10-ps rms



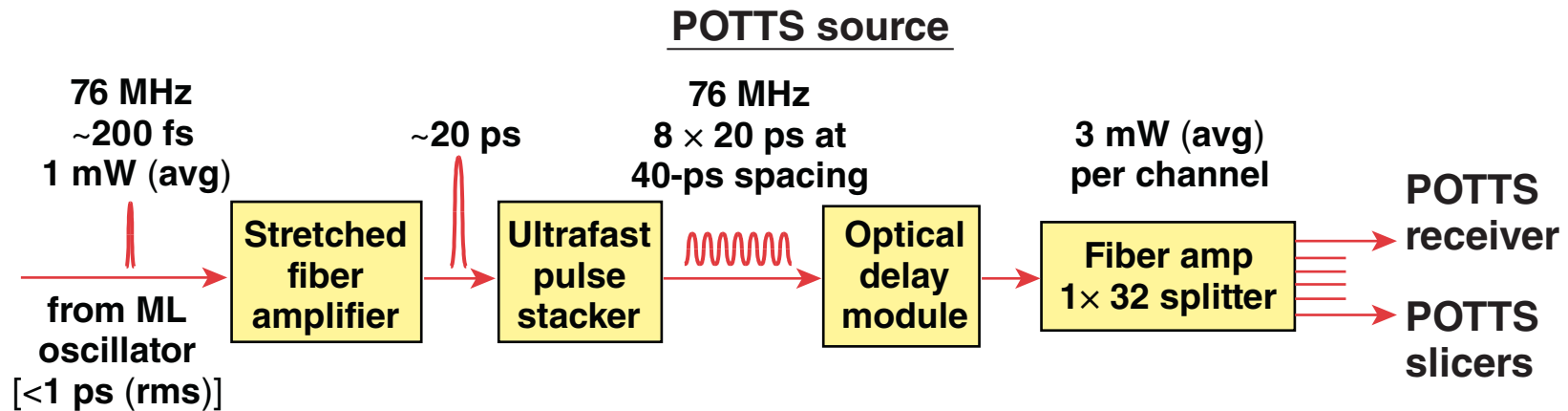
# Setup of the neutron temporal diagnostic (NTD)\*



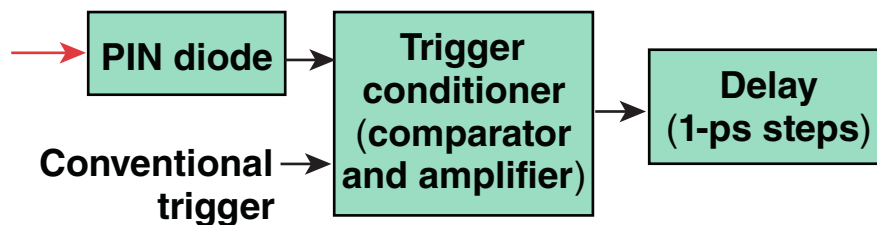
# Cross-timing stability of OMEGA and OMEGA EP is below the measurement uncertainty of 5 ps



# The POTTs system provides low-jitter trigger and timing-fiducial signals



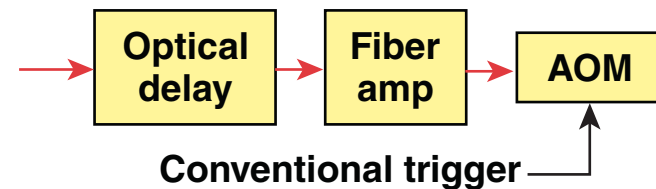
## POTTs receiver (electrical triggers)



### Measured performance

- jitter < 1.5 ps (rms)
- drift = 55 fs/°C/m

## POTTs slicer (optical-timing fiducials)

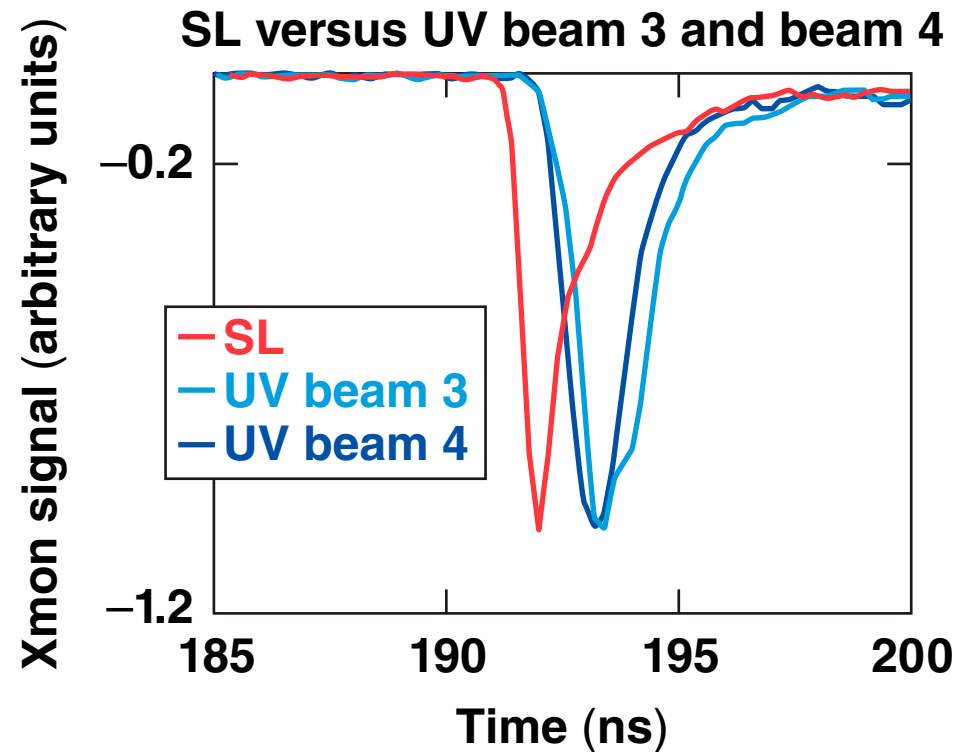
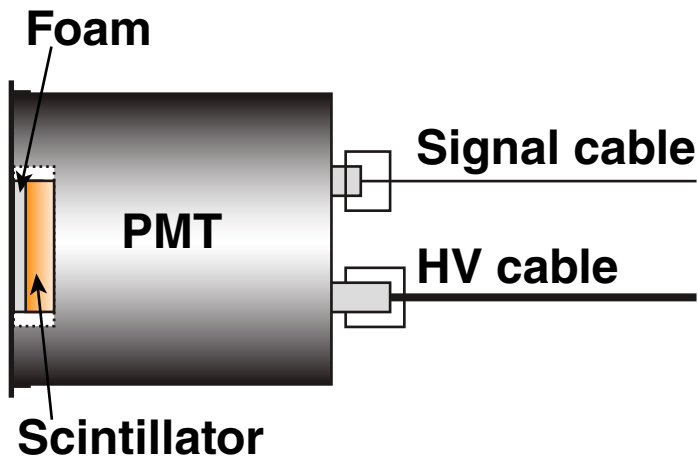


### Design performance

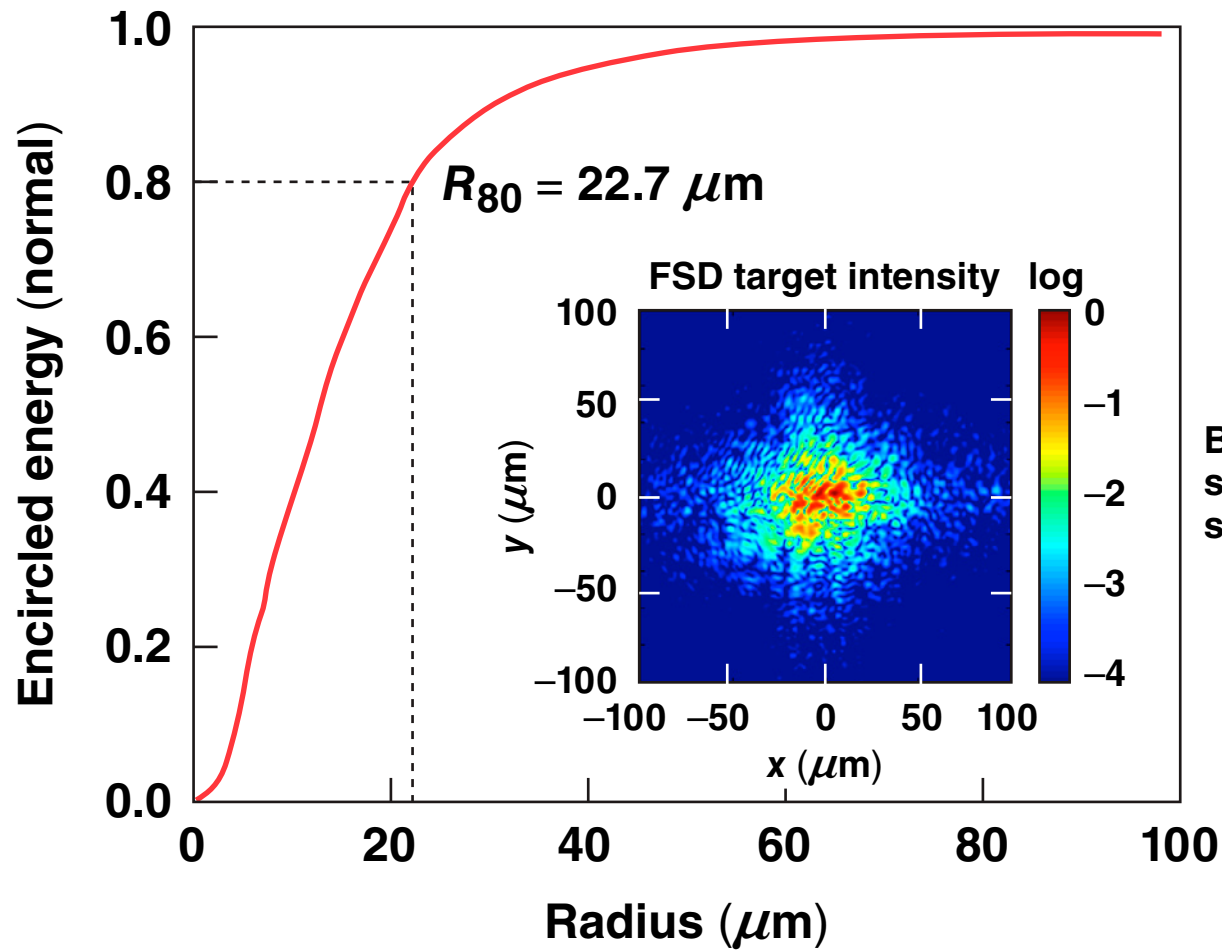
- pulse energy ~ 10 nJ
- contrast ~ 50 dB



# Cross-timing between the OMEGA EP short- and long-pulse beams is established using a scintillator detector

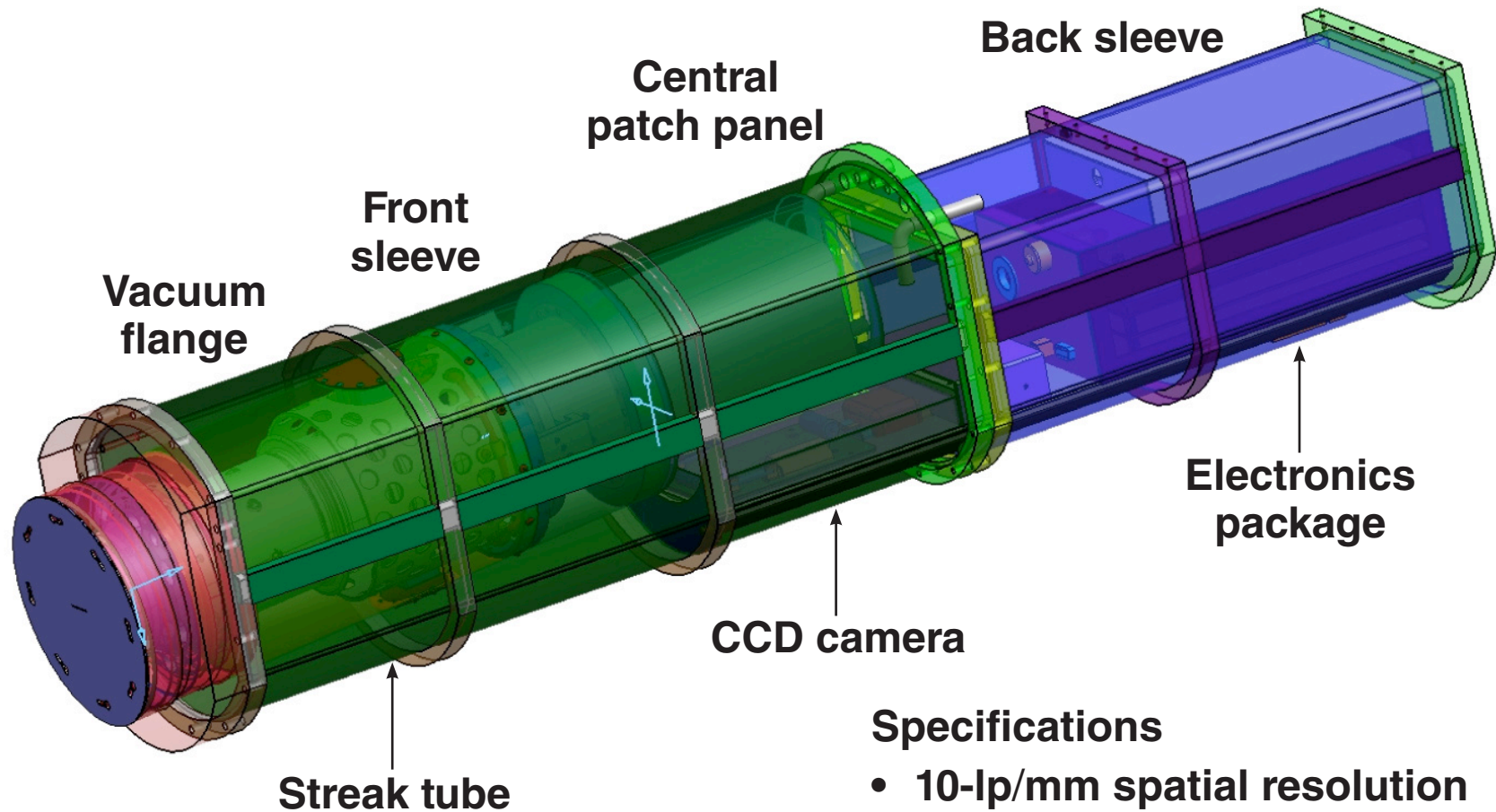


The OMEGA EP focal spot typically has  $R_{80} < 25 \mu\text{m}$  and is improving



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

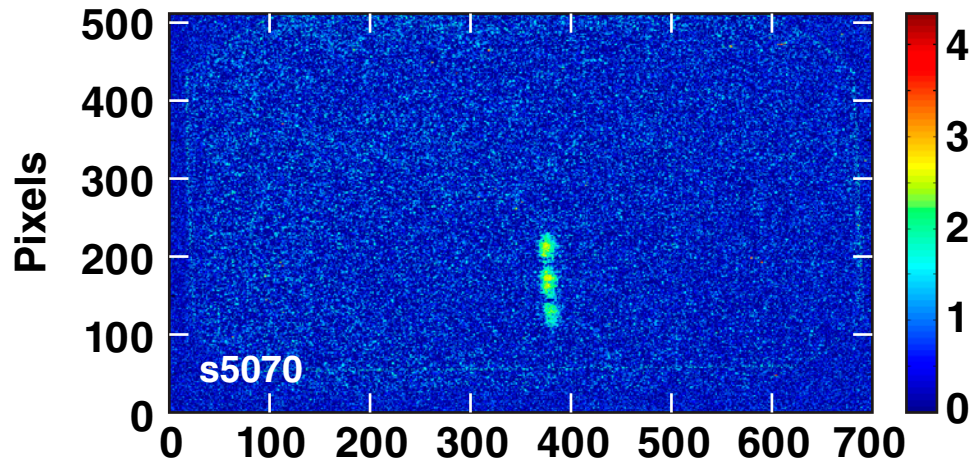
# The experimental capabilities of OMEGA EP will continue to expand in the near future

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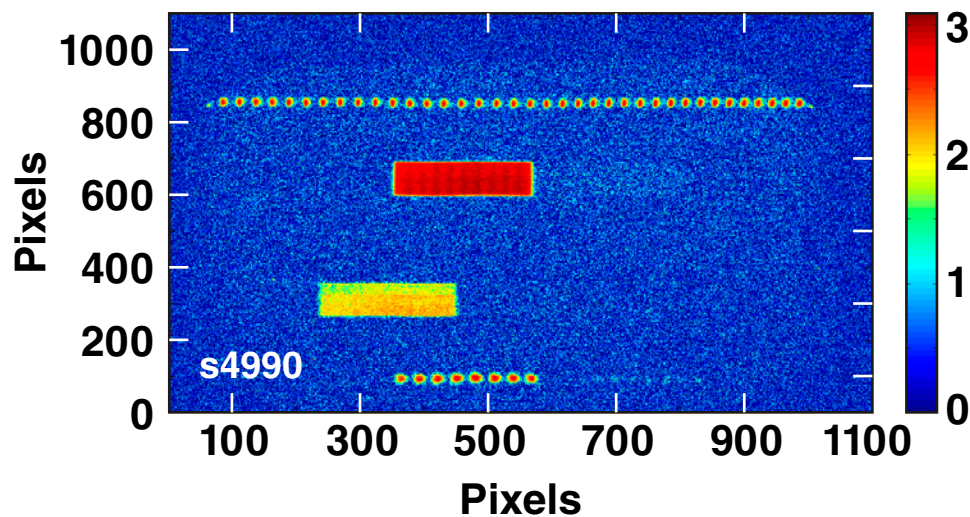


- **Energy**
  - 2.6 kJ ramp in FY09
- **Pointing**
  - stability verification in FY10
- **Cross-timing**
  - UV-SP with streak camera by FY10
- **Focusing**
- **Diagnostics**
  - SPC May 2009
  - HXRD May 2009
  - ASBO May 2009
  - $4\omega$  probe laser December 2009
  - Streaked spectrometer December 2009
  - Crystal Imager May 2010

# Cross-timing will be transferred to the UROSS and UVROSS streak cameras



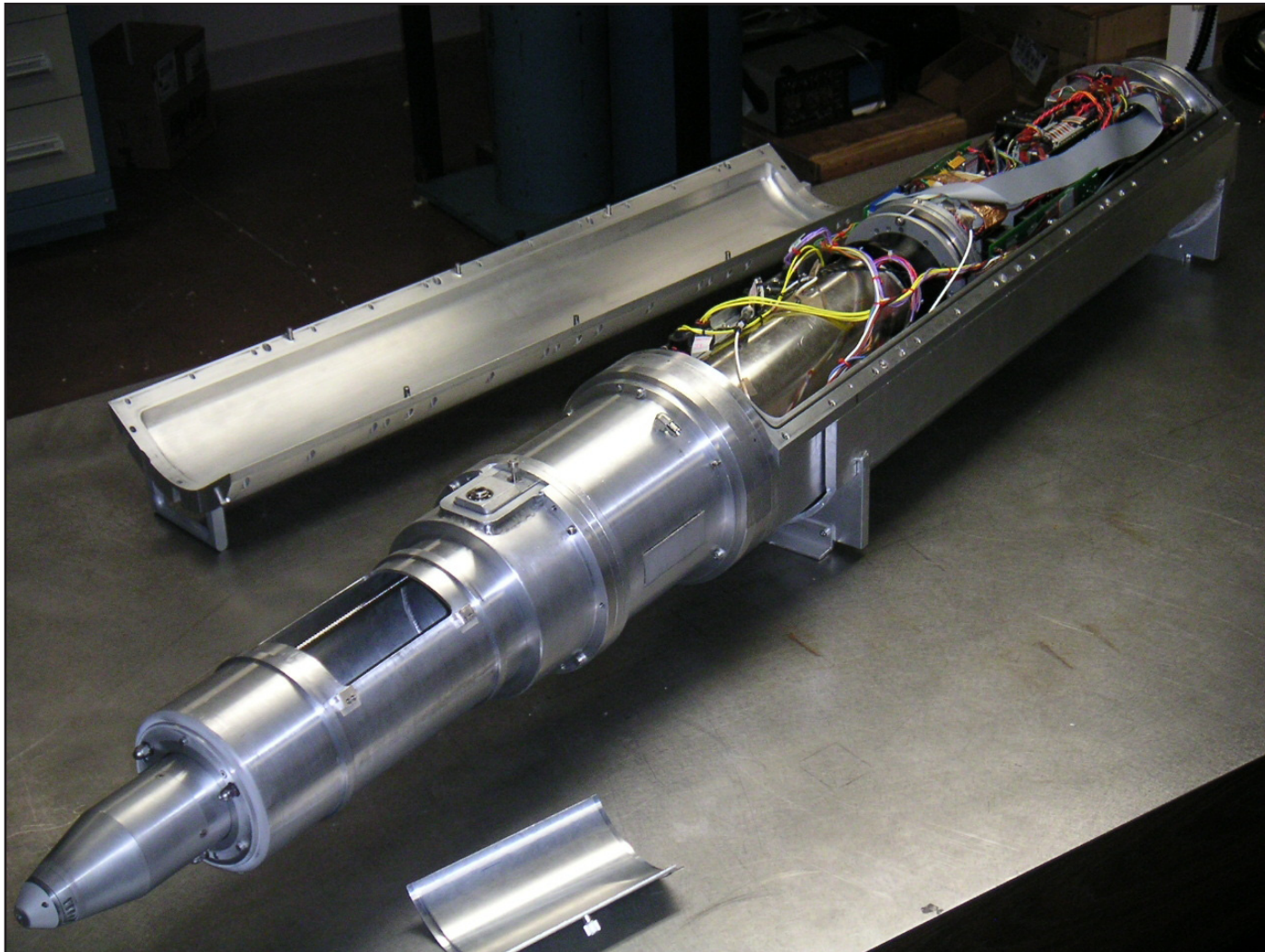
- **Ultrafast ROSS (UROSS)**
  - 2.5-ps resolution
  - fast fiducial (FY10)
  - comb generator (FY10)



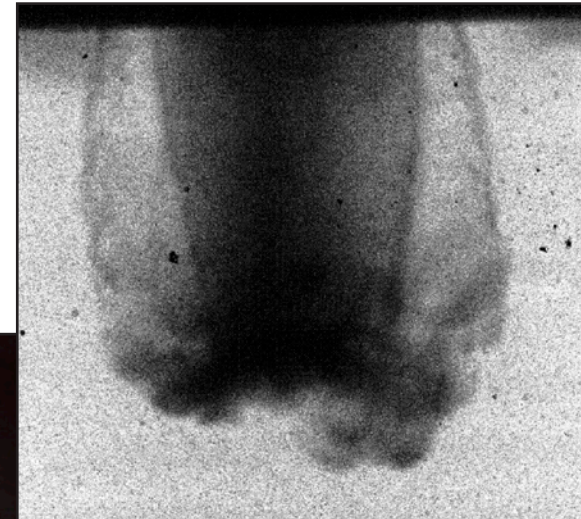
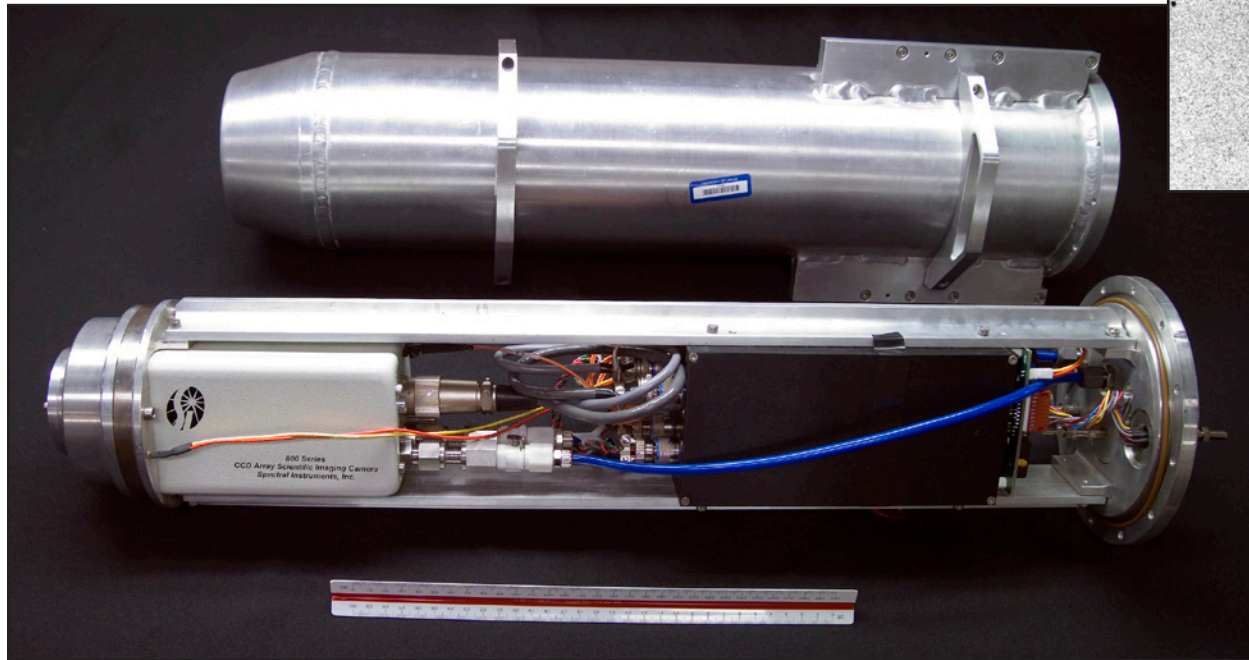
- **UV ROSS (UVROSS)**
  - 20-ps resolution
  - OMEGA fiducial
  - 2-GHz comb generator



**A modern 20-ps-resolution x-ray streak camera  
is available for UV short-pulse cross timing (PJX)**

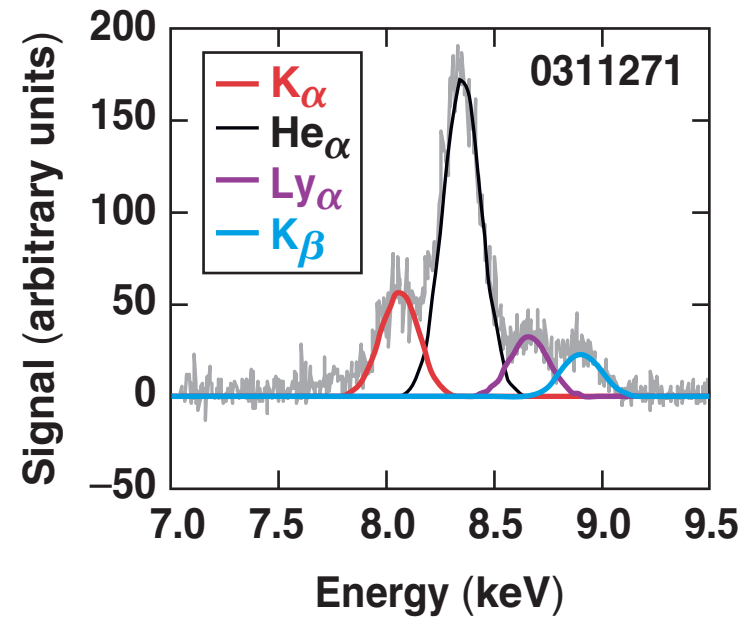
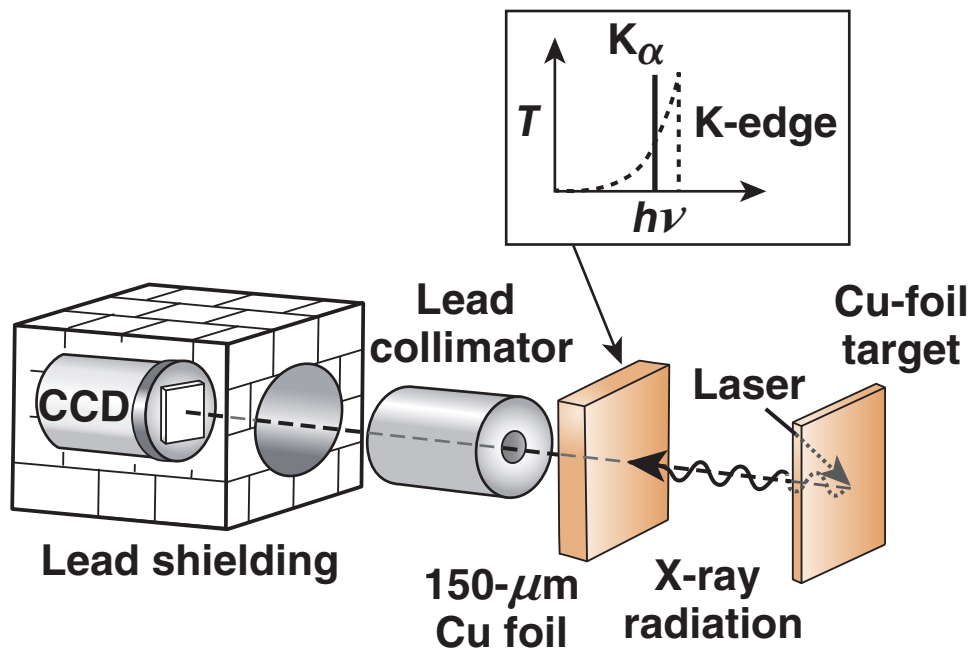


# An x-ray CCD camera is mounted in an air bubble for insertion into the target chamber (XCCDBUB)



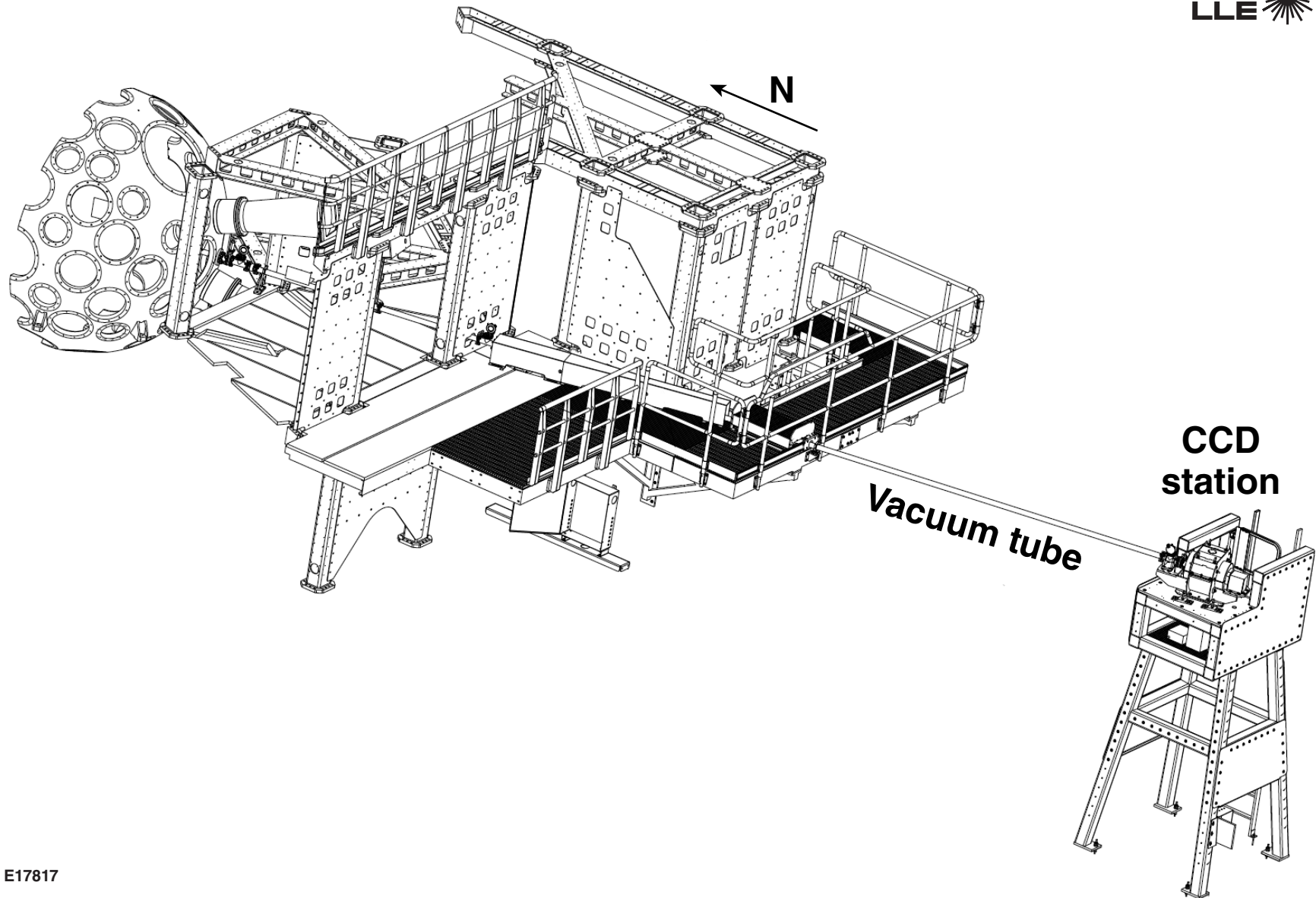
**Astrophysical Jet  
experiment**

# 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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