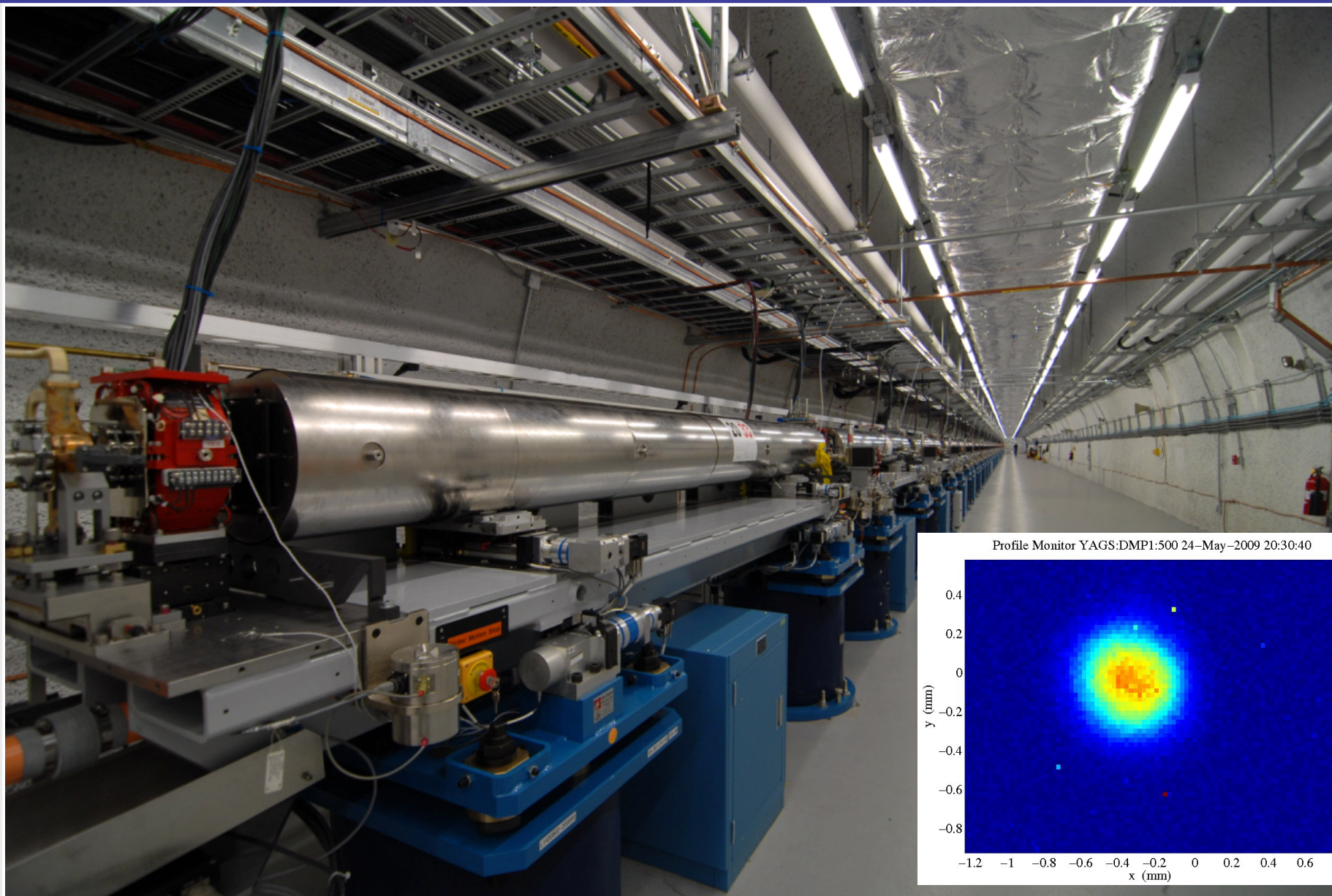
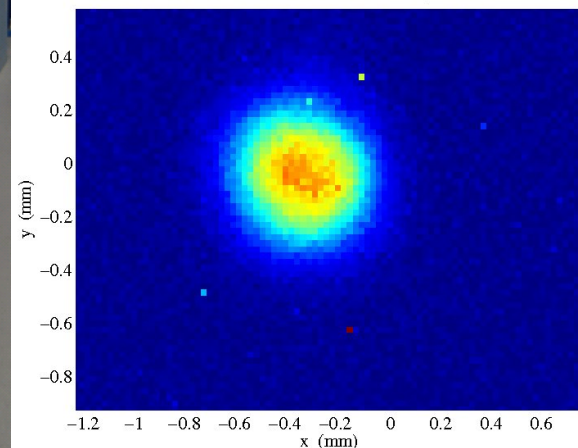


Commissioning Status and Plans

**Josef Frisch for the LCLS Commissioning Team
June 08, 2009**



Profile Monitor YAGS:DMP1:500 24-May-2009 20:30:40



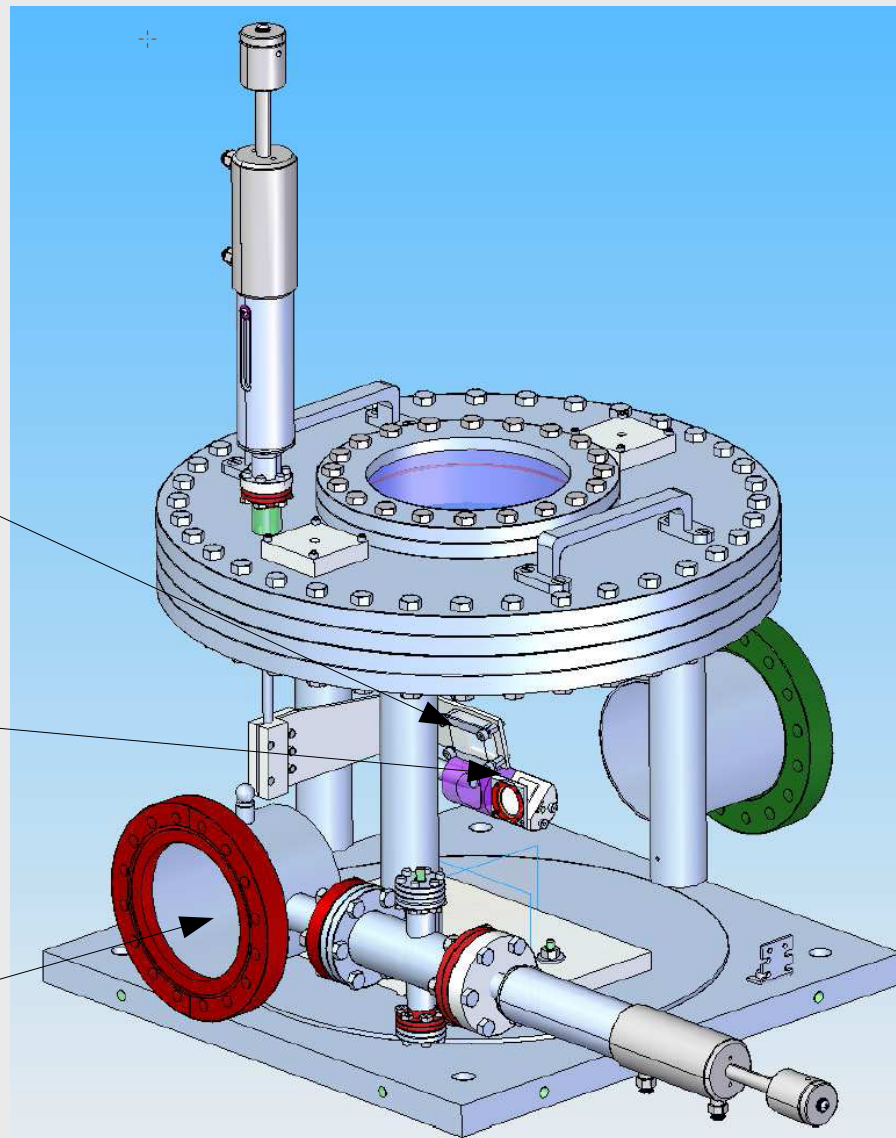
- Laser heater commissioned December 10, 2008
- First lasing at 1.5A April 10, 2009
- Saturation at 1.5 A April 14
- Observe transverse coherence April 23
- Operation with 20pC short pulse April 24
- Operation with FEL taper April 26
- Operation at 15A May 14

Until FEE is ready, we have been using a simple diagnostic with limited capabilities

Ni or B4C

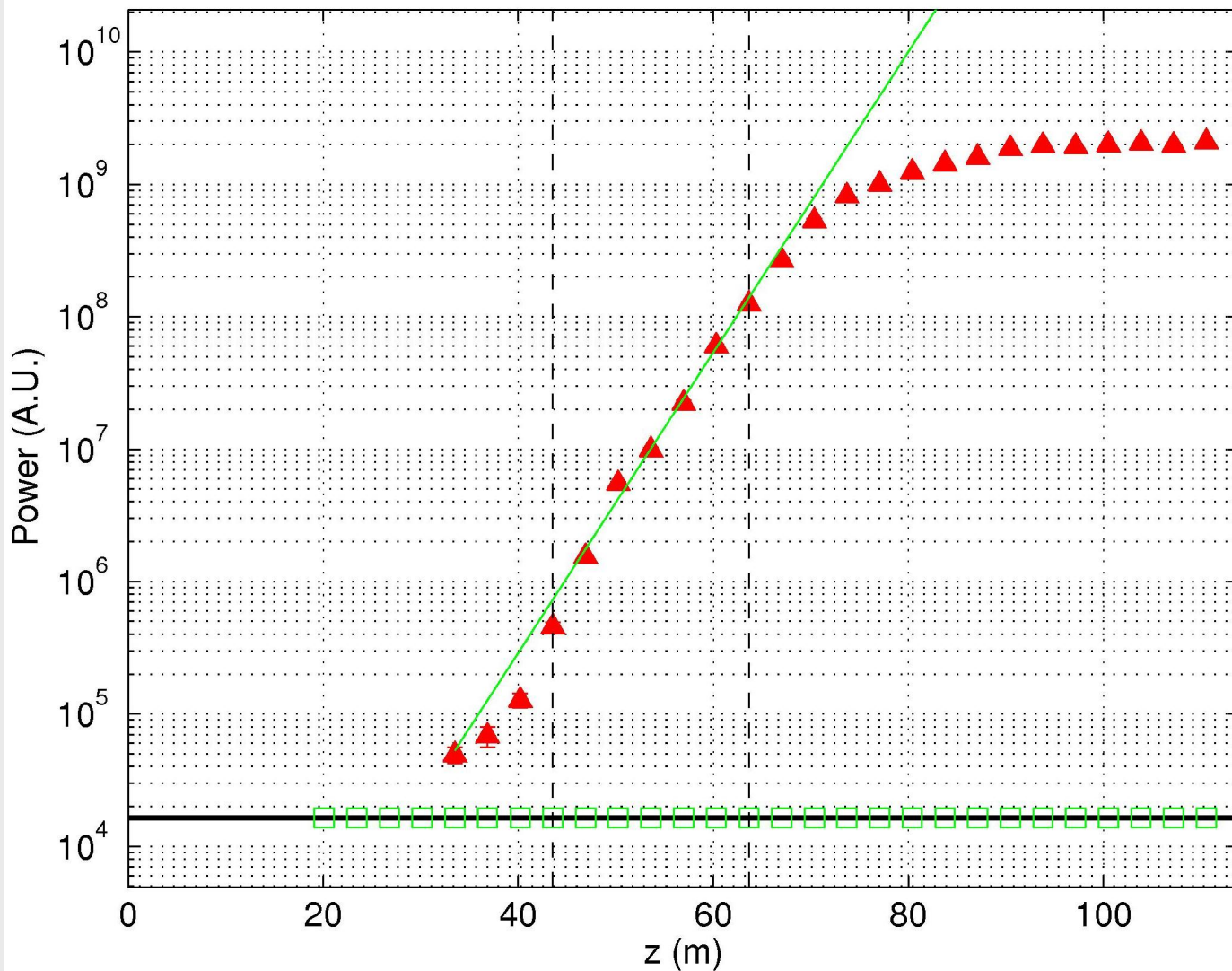
YAG screen

Be Coherent visible radiation blocking foil



GL=3.83m,Und:6to33,13.5GeV,Xcorr,GainLength--2009-05-31-100839.mat

250pC, 3 kA
 13uJ heater
 Linear Taper
 13.5 GeV

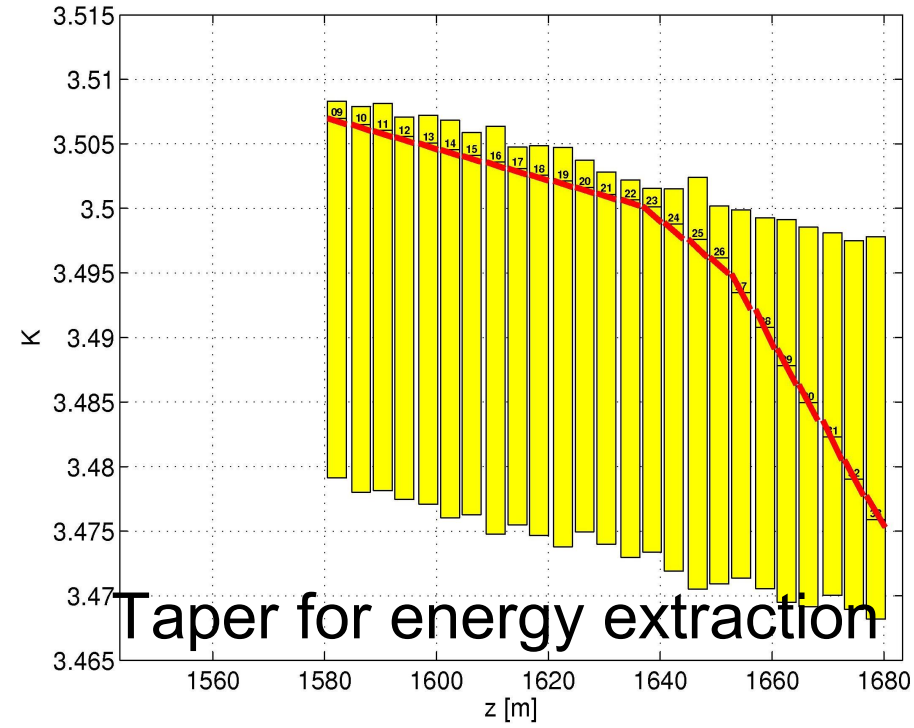
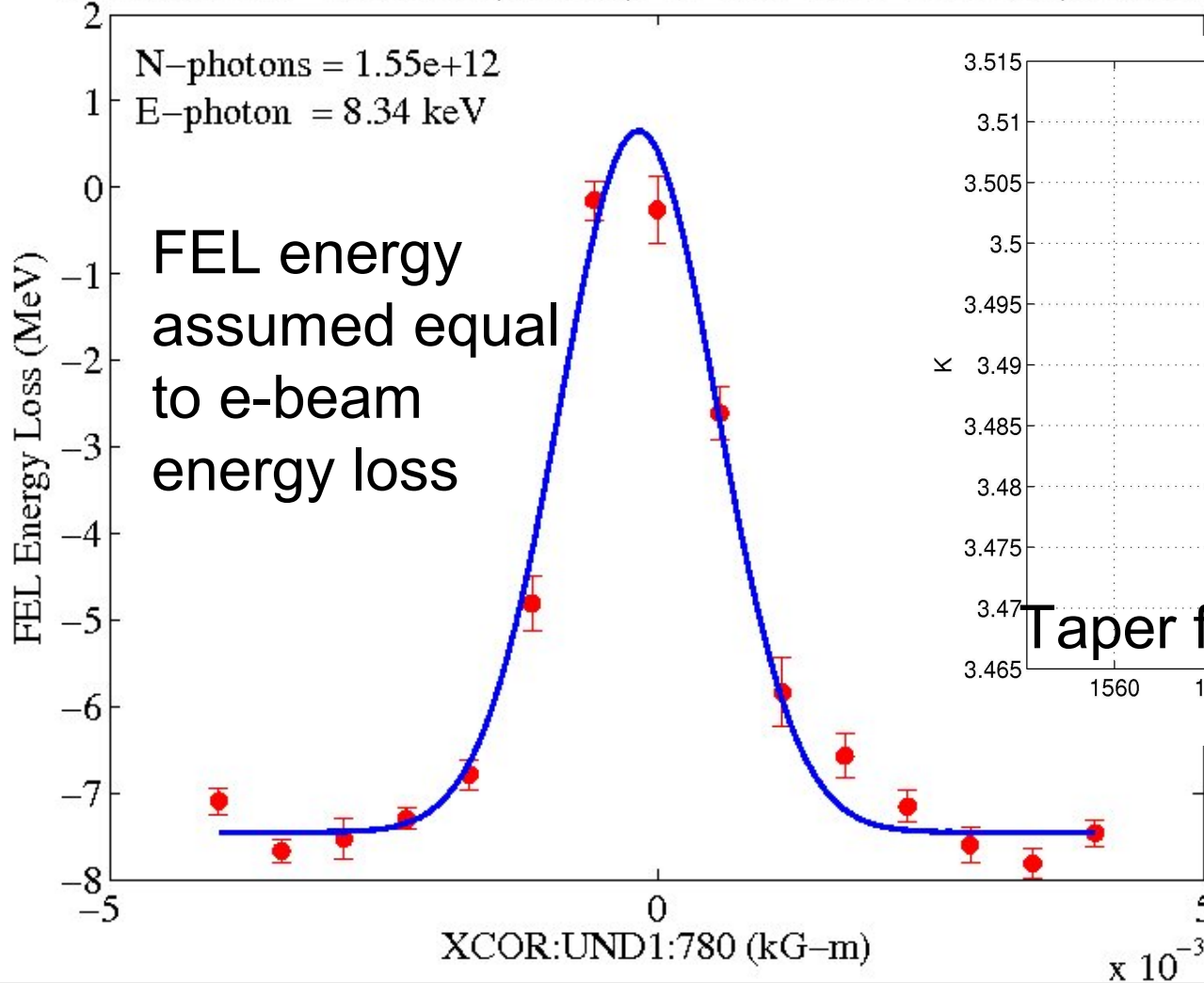


E-Loss=8.11±0.24 MeV (2.06 mJ), 01-JUN-2009 02:39:47 (13.70 GeV)

N-photons = 1.55e+12

E-photon = 8.34 keV

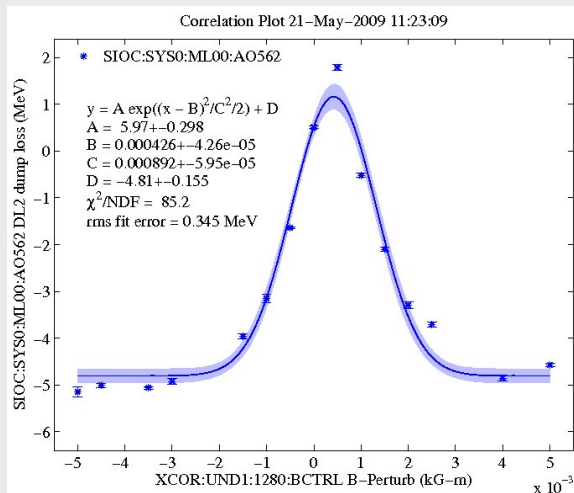
FEL energy
assumed equal
to e-beam
energy loss



Highest energy demonstrated: 8.66 KeV

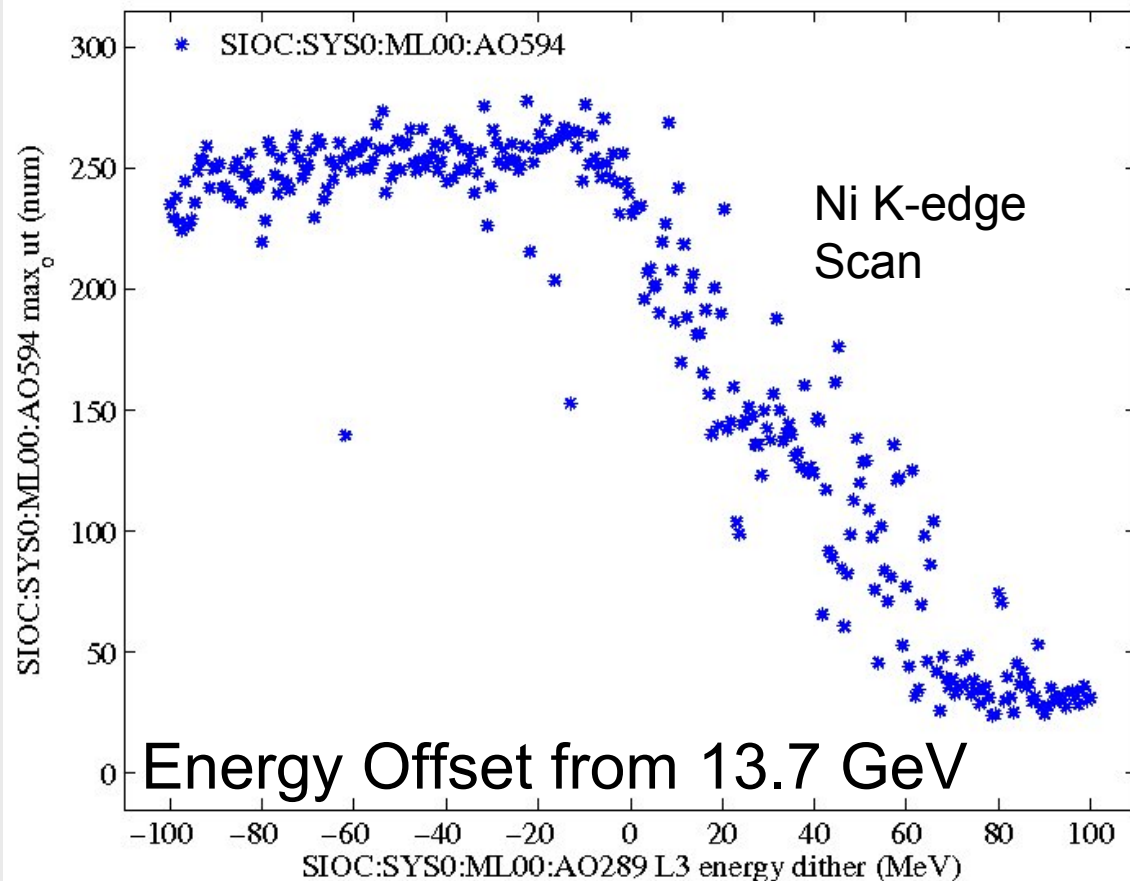
Lowest energy demonstrated: 820 eV
(wavelength not measured)

FEL Power



FEL energy at 820 eV
6 MeV loss, 1.5 mJ

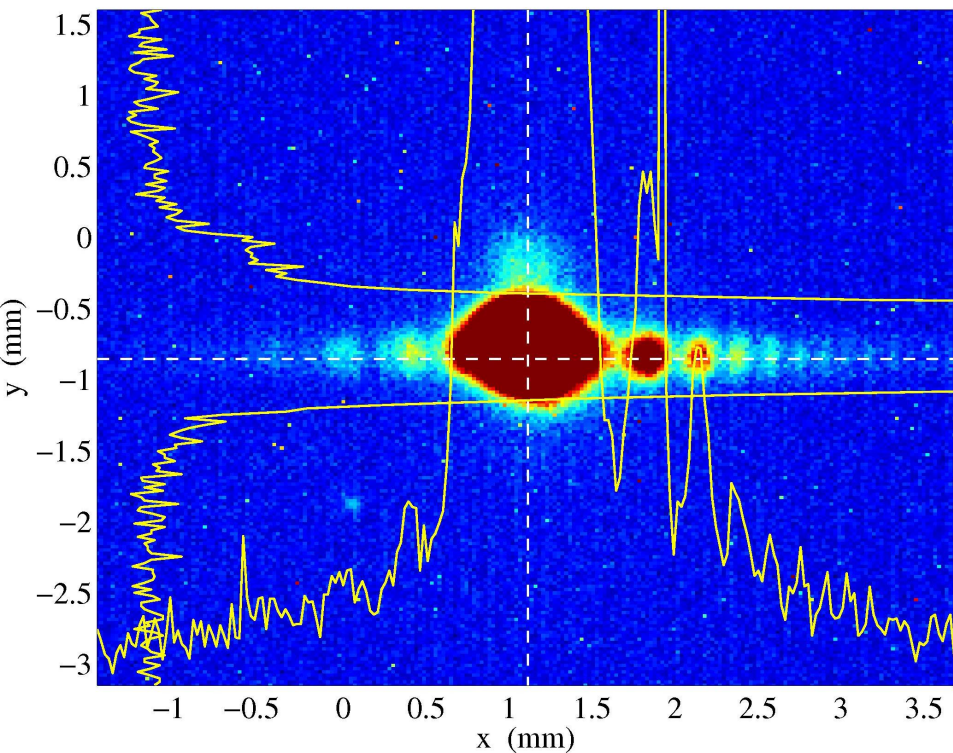
Correlation Plot 01-Jun-2009 06:44:06



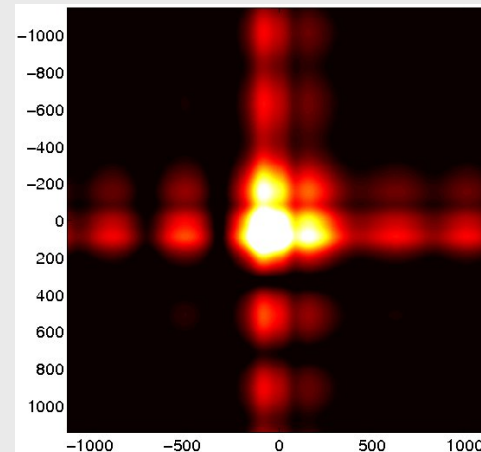
Measure YAG intensity behind Ni foil.
Ni K-edge is at 8.333 KeV corresponds to 13.72 GeV
Linewidth $\sim 7 \times 10^{-3}$ FWHM. Jitter 1.5×10^{-3} RMS

Put Carbon beam finder wire in FEL beam, look on YAG screen
 See interference fringes – data still needs to be analyzed

Profile Monitor YAGS:DMP1:500 24-Apr-2009 13:16:57

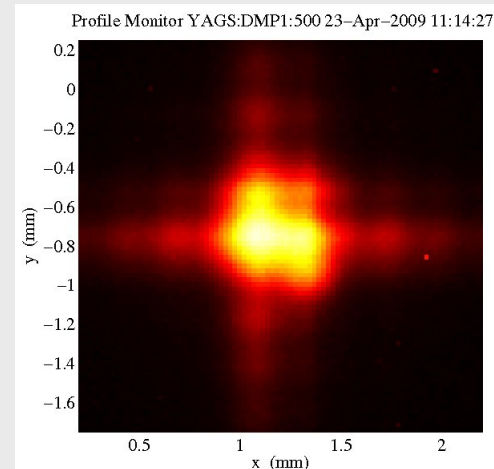


Simulated
 Diffraction
 Image



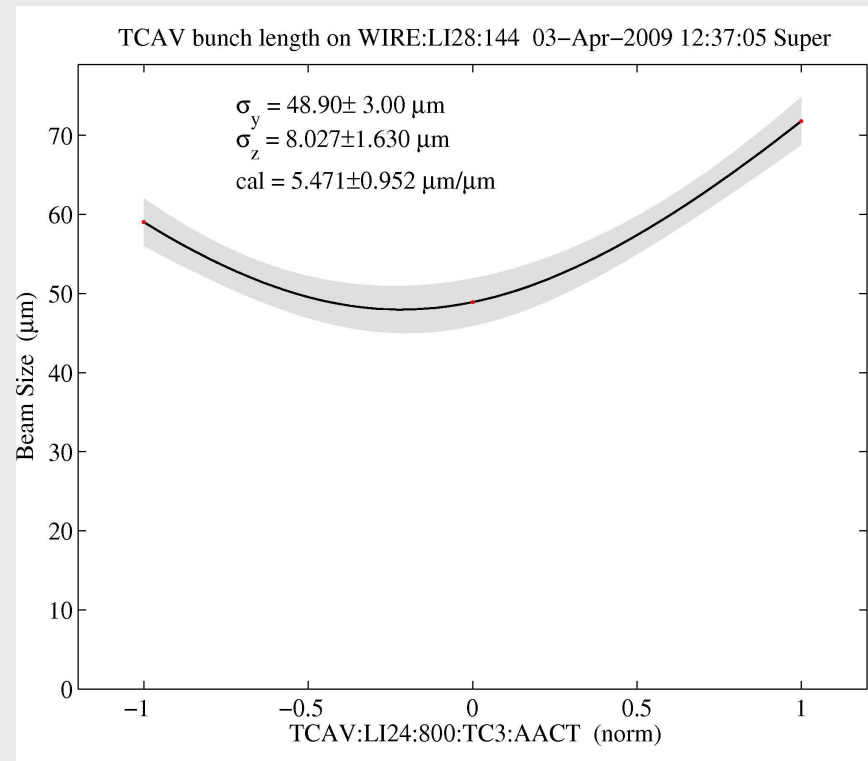
Yiping Feng

Real
 Diffraction
 Image

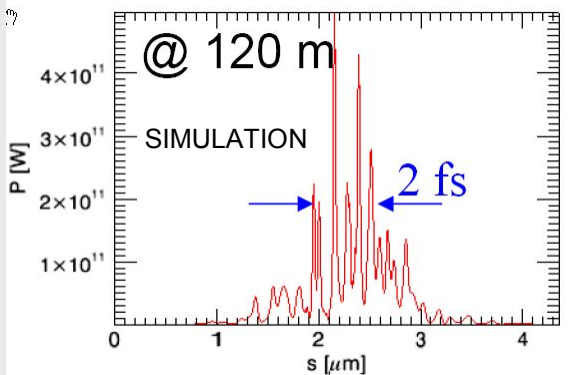


- YAG screen saturates, underestimates the jitter on the FEL intensity
- Measured intensity jitter $\sim 5\%$, real jitter probably $< 10\%$
 - 11% observed with low charge, YAG unsaturated
- Measured position jitter $< 20\%$ of spot sigma
- Energy stability at DL2 0.06% RMS, wavelength stability $\sim 0.12\%$
 - K-edge measurement gives similar wavelength jitter measurement

- For normal 250pC operation can measure bunch length using transverse cavity
- 8 micron (24 fs) RMS bunch length for electron beam
- Expect FEL to be similar but no measurement

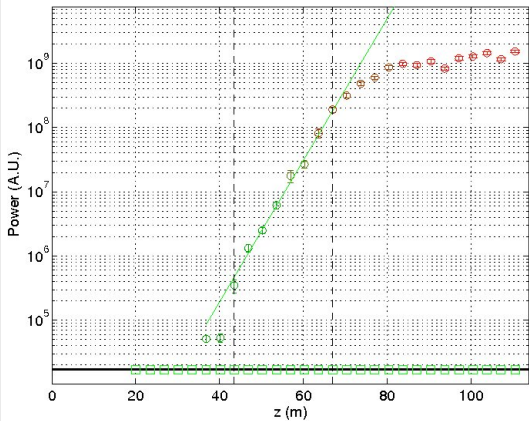


Bunch length
measurement with TCAV3
and wire scanner



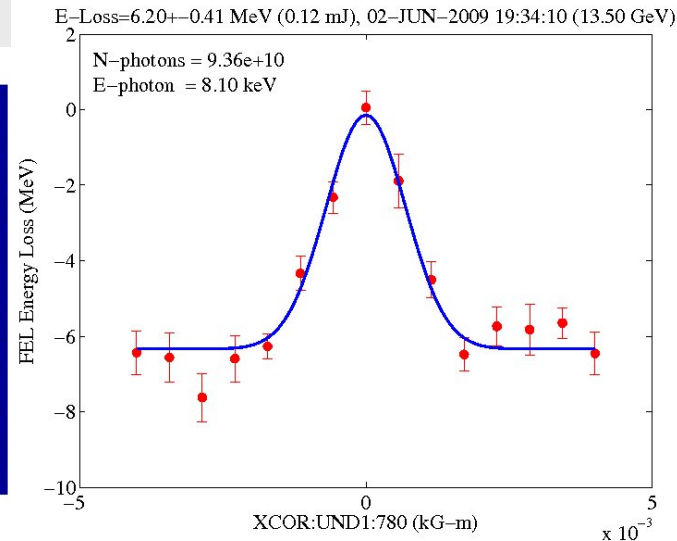
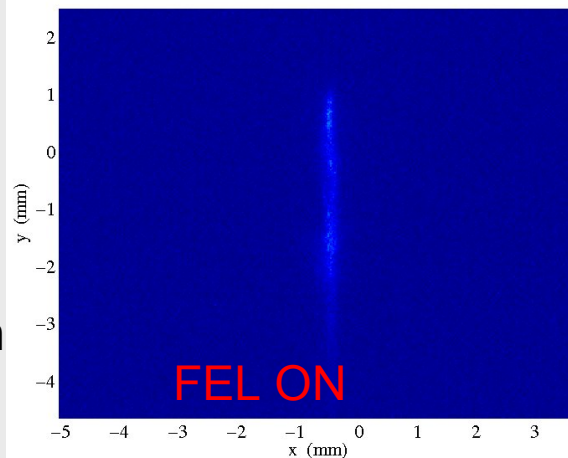
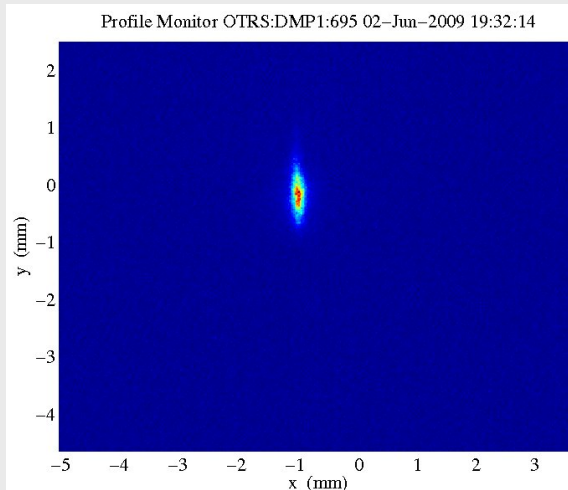
Simulation of FEL with 20pc Electron bunch (Y. Ding)

GL=3.94+-0.11m, Und:6to33, 13.5GeV, Xcorr, GainLength--2009-06-02-180253.mat



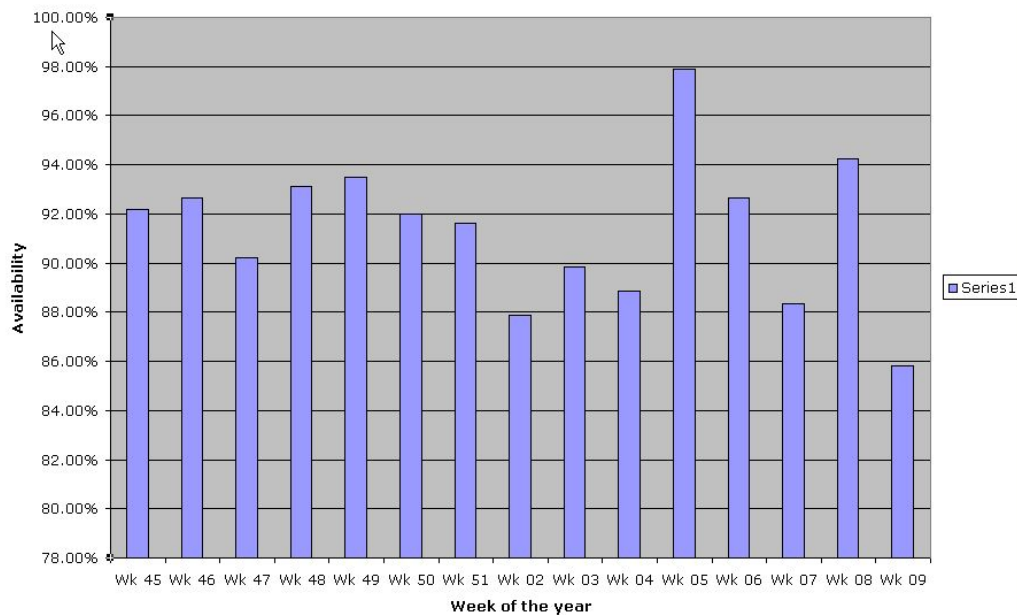
Measured gain length 3.94M at 20pc full compression High gain implies short bunch

Dump Screen, Dispersion vertical

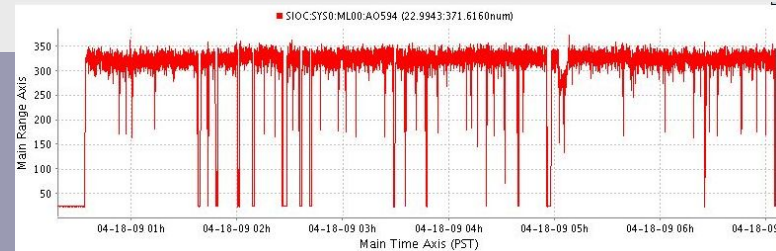


Energy loss 6.2 MeV at full compression
 $\sim 10^{11}$ Photons at 8.3 KeV

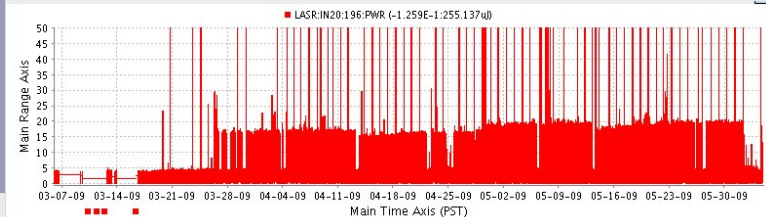
So far no way to measure bunch length.



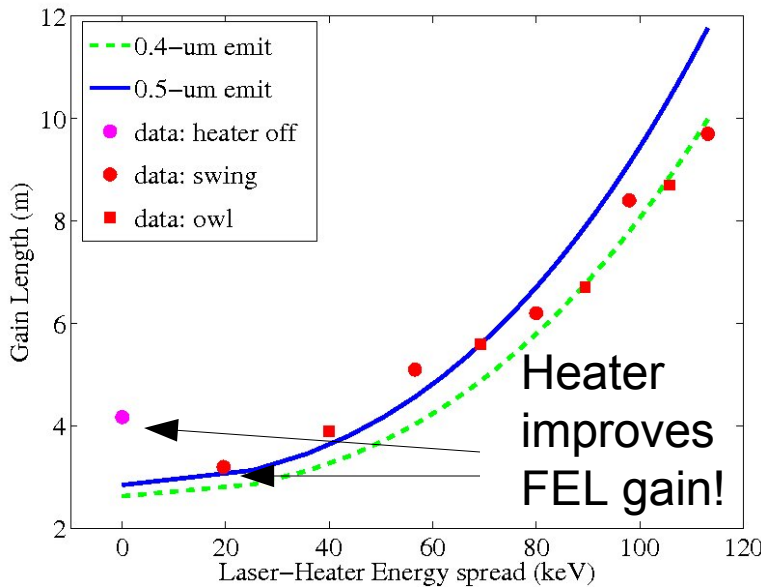
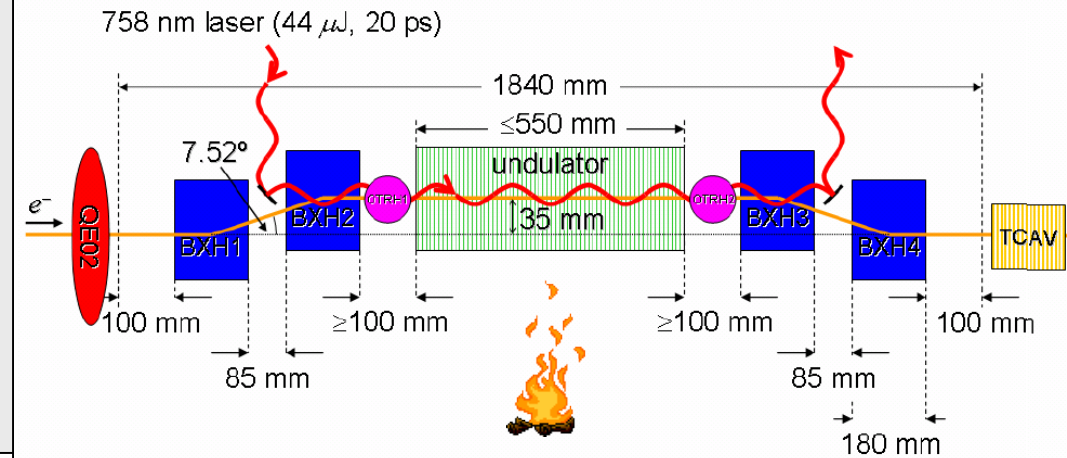
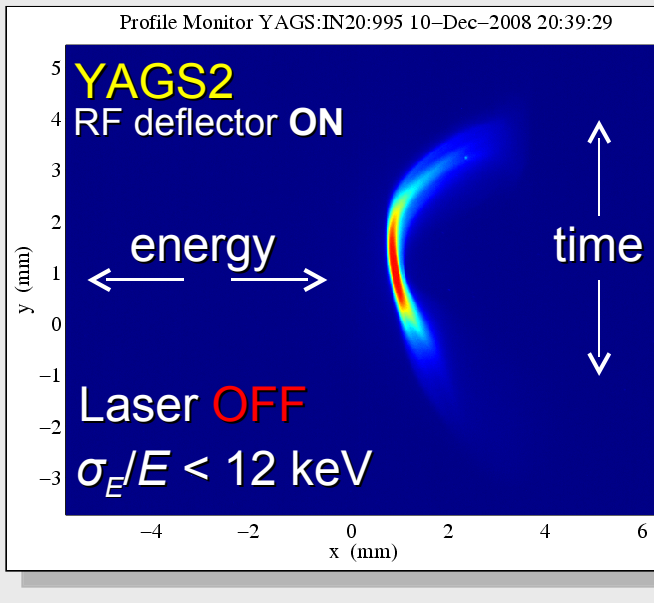
90% uptime during commissioning – but commissioning isn't the same as user beam



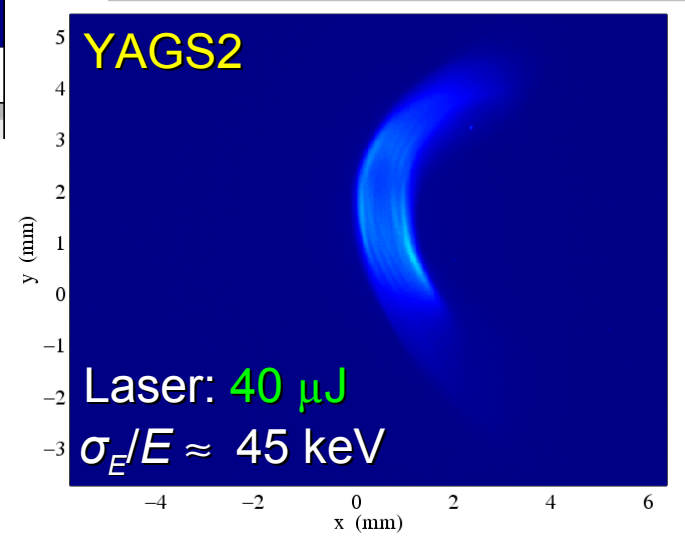
6 Hour run – so far no attempts at long term operation



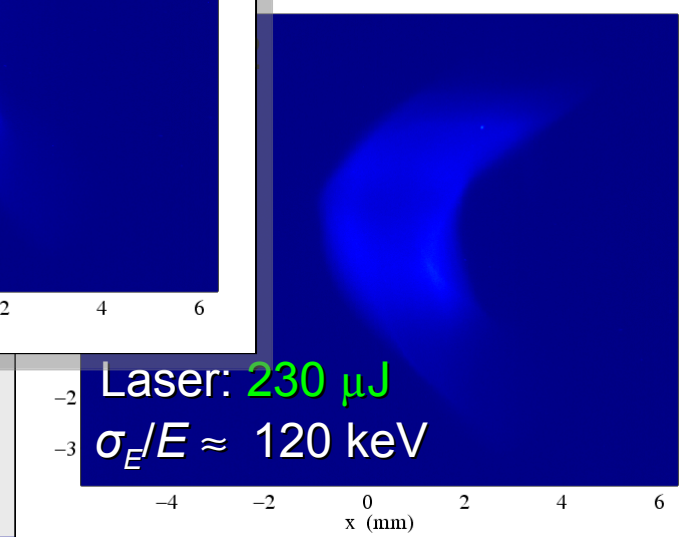
Source laser power – cathode is not degrading over last 3 months

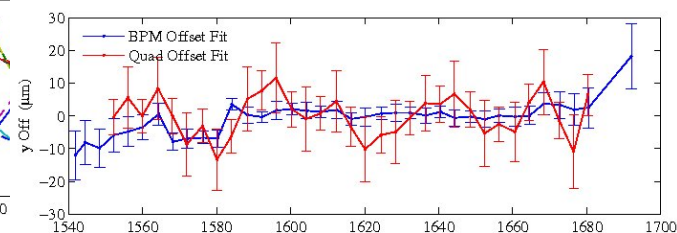
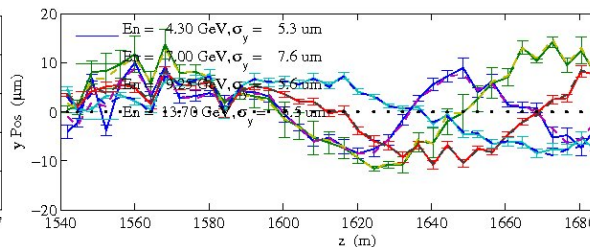
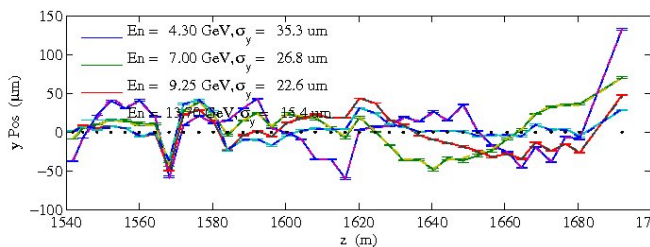
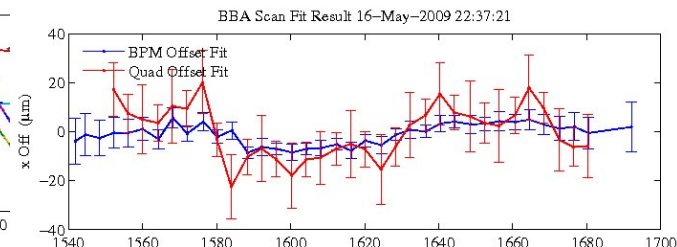
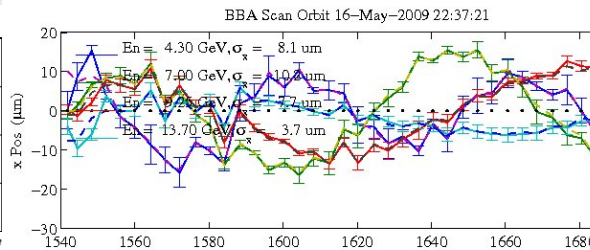
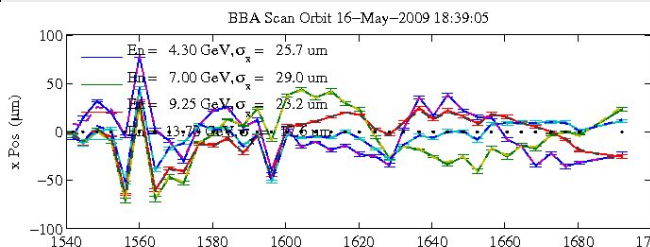


Profile Monitor YAGS:IN20:995 10-Dec-2008 20:39:11



Profile Monitor YAGS:IN20:995 10-Dec-2008 20:41:46





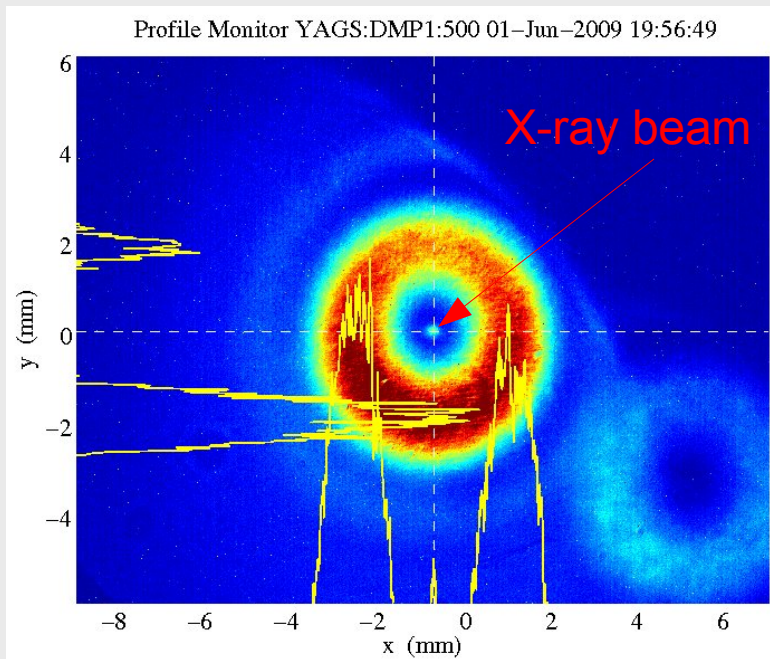
BBA round 1
Scale 100um

BBA round 1
Scale 20um

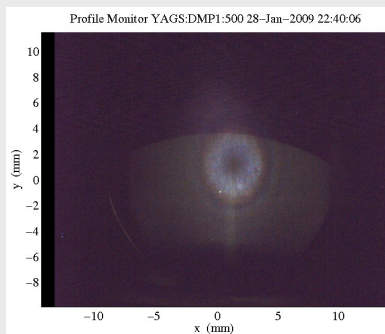
BBA Corrections
Scale 50um

Take orbit data in undulator at 13.6, 9.25, 7.0 and 4.3 GeV, Correct Quad positions and BPM offsets

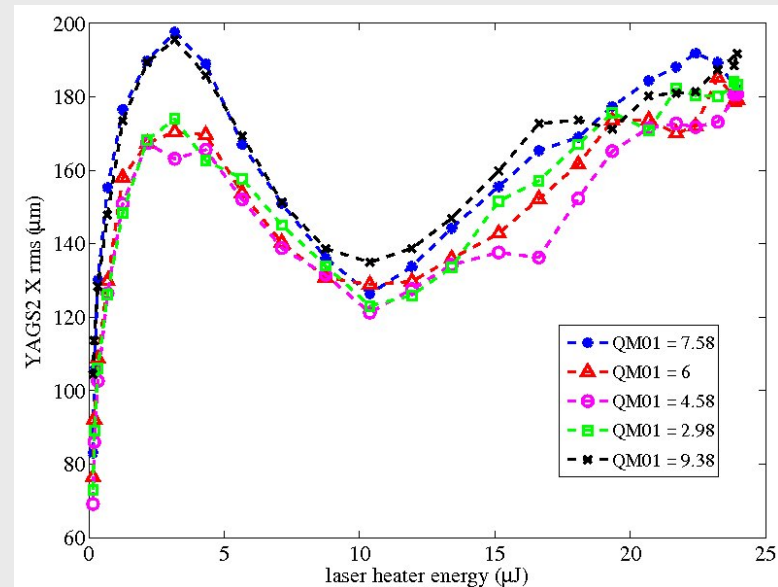
So far have been doing BBA about 1/week.



Coherent Optical radiation ring on YAG screen with X-ray beam centered



True-color coherent optical ring image (blue-white)



Laser heater “trickle heat” mode
Increased energy spread at very low energies (coherent effect?)

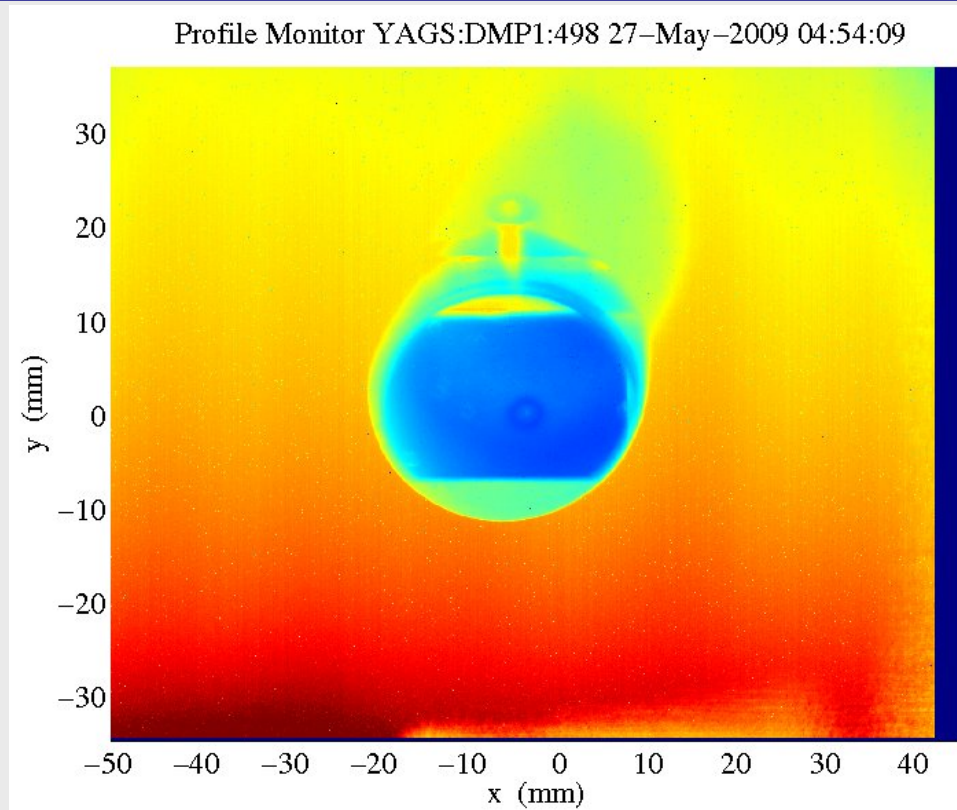
Not well understood

Due to YAG saturation, no good spot size measurements yet

B4C stopper expose to 4M pulses at 820 eV, max power.

Dark area looks like deposit on surface, not material damage

Sample has been removed, testing with SEM, profilometer, visible microscope



We will have a B4C shutter with a camera to monitor, interlocked to MPS to protect the downstream PPS stoppers.

If we do see damage we can switch to a Beryllium shutter – but with obvious toxicity problems

- FEE X-ray diagnostics
 - Expect start operation July 2009
- User Operations
 - Expect September 2009
 - Far Hall first light April 2010
 - Project Complete July 2010
- LCLS Operational issues
 - Wavelength tuning still slow – need to improve automation
 - Lots of “physicist” software still in use
- 120 Hz Operation - Controls