

Commissioning Status of Shintake Monitor (IP-BSM)

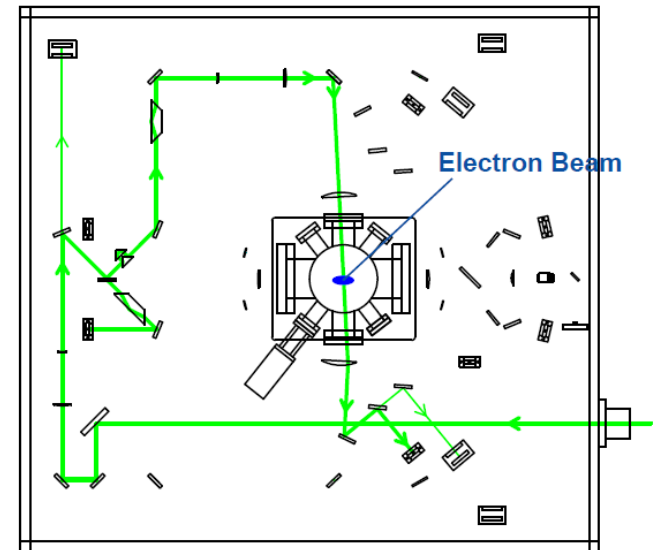
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Horizontal Measurement

- To measure horizontal beam size, laserwire method is used.
- First Compton signal was observed in end of February.
- The laser and electron beam positions are adjusted on the screen monitor, MS1IP.

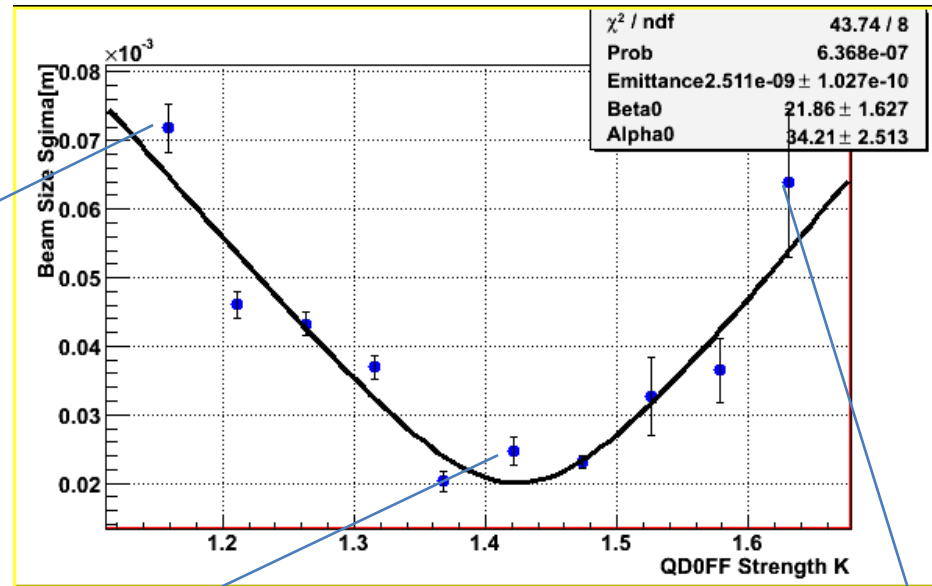


laserwire mode optics
(horizontal measurement)

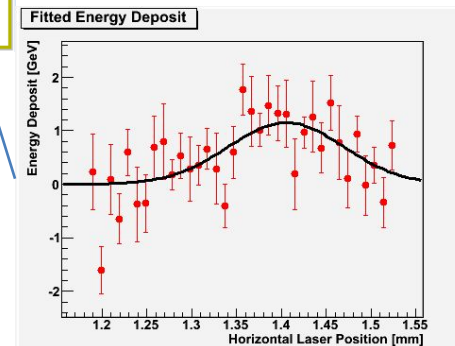
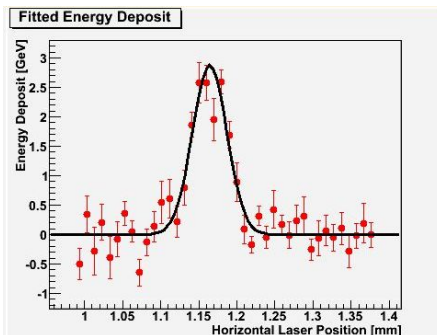
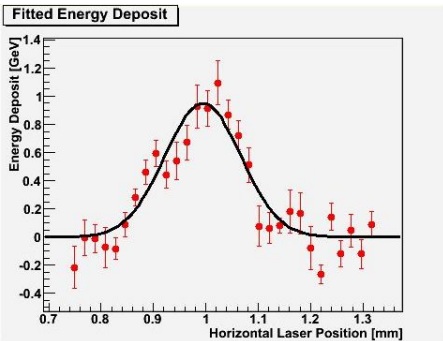
Q-Scan

- focus at IP (QD0FF=130.34A, QF1FF=70.84A)
- change the QD0FF current and measure horizontal beam size

- laser beam size 10 μm assumed
- fitted horizontal emittance was 2.5 nm

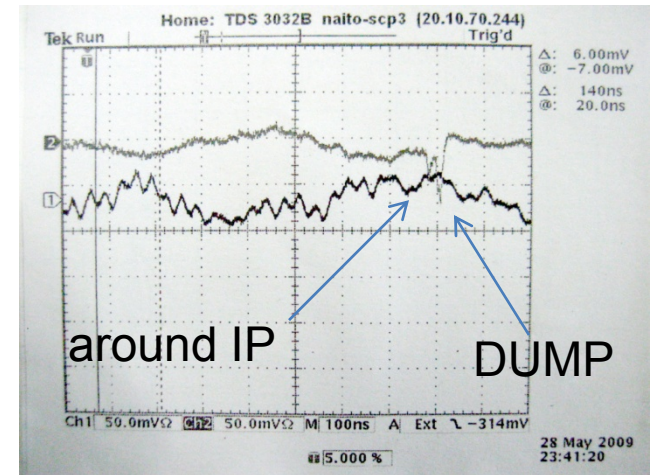
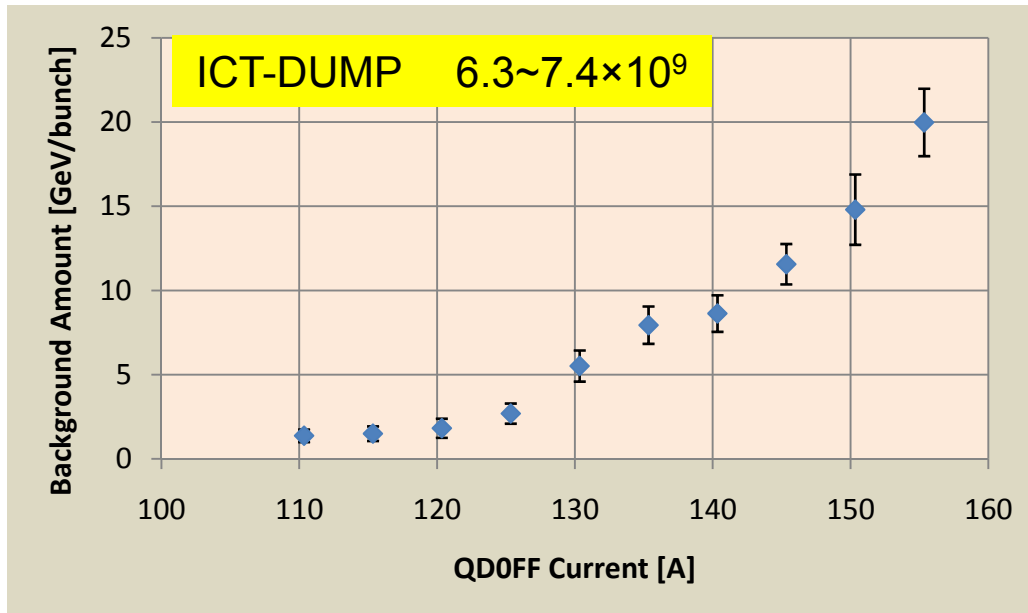


horizontal beam size at MW1IP was 20 μm => almost consistent



Background Source

- During the Q-scan on May 29, the change of background amount was observed.
- On this optics, the main background source is expected to be around IP.

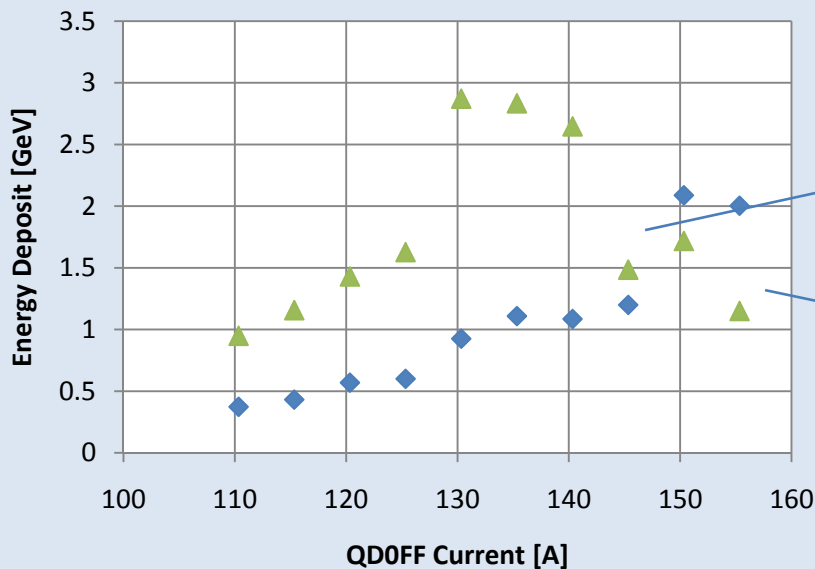


Loss Monitor Signal

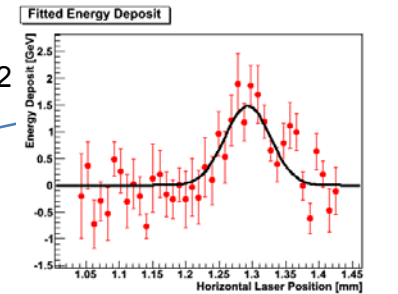
upstream ← horizontal beam waist → downstream

Background Tolerance

- Signal detection capability depends on the background jitter rather than total amount of background.
- Even in a large background jitter condition signal detection is possible but to obtain a good profile, signal to RMS background ratio need to be larger than one
 - although this condition depends on the measurement time
 - 5 average for 1 position and 5 minutes for one measurement is assumed



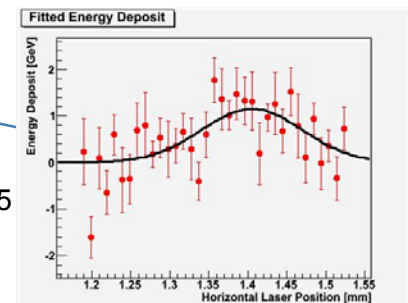
S/BG RMS = 1.2



◆ Background RMS

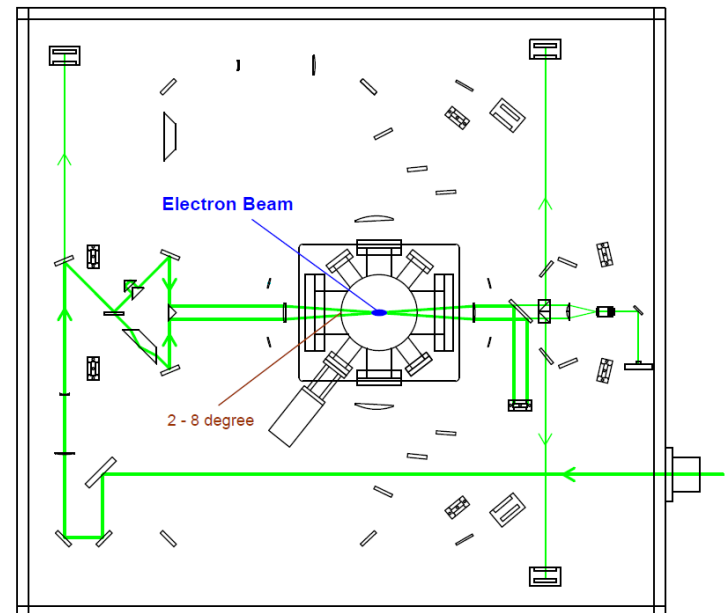
▲ Signal Peak

S/BG RMS = 0.5



Vertical Measurement

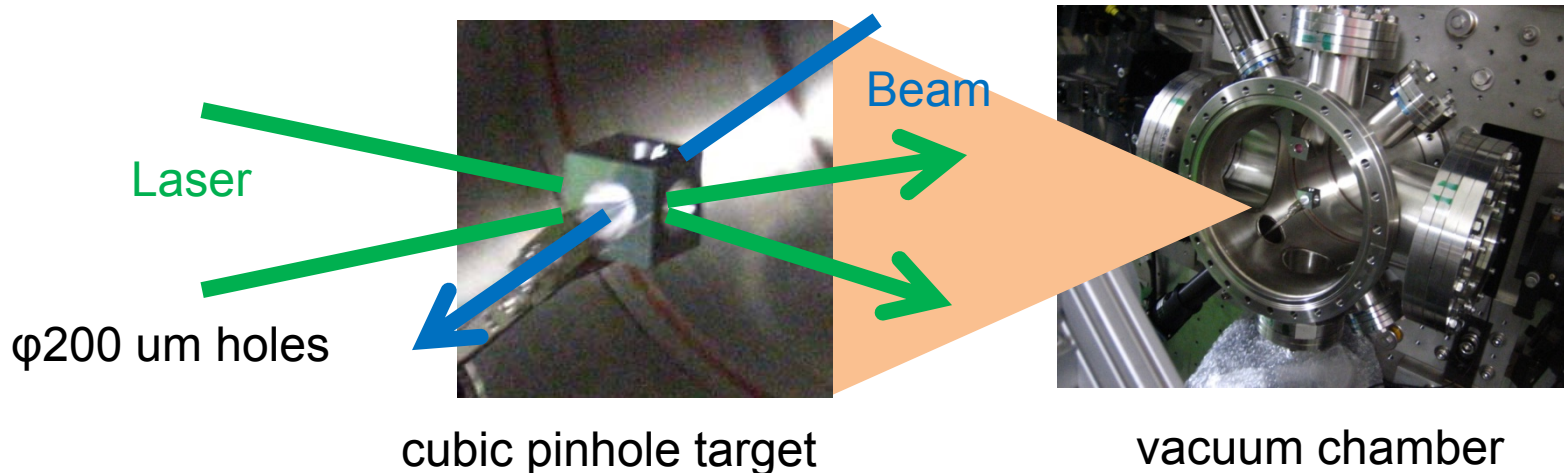
- To measure the vertical beam size, interferometer (Shintake Monitor) mode is used.
- To make an interferometer optics, two laser beams need to collide with the electron beam => vertical scan
- Also two laser beams need to cross => beam direction scan
- 2 - 8 degree crossing angle was used to measure several μm vertical beam size so far.



low crossing angle interferometer optics (vertical measurement)

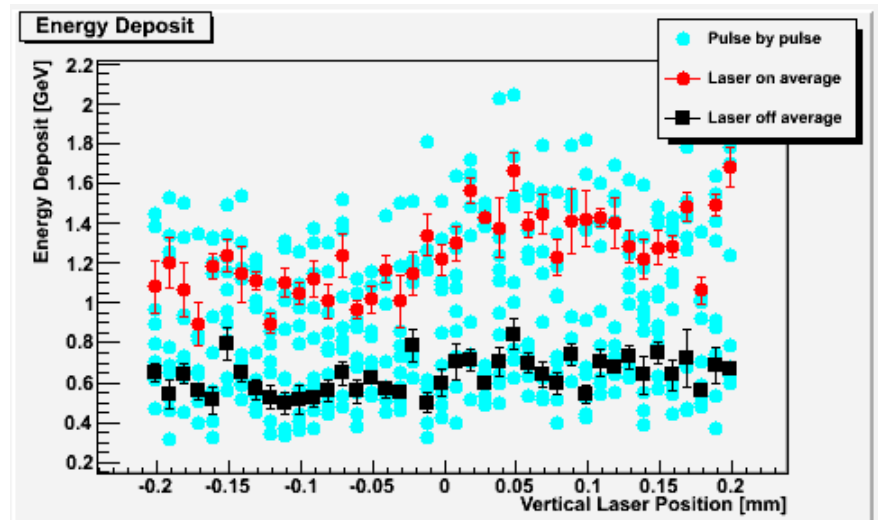
Laser Alignment

- Cubic pinhole target which has 3 through-holes is used for the interferometer mode alignment
- 1 hole for e^- beam alignment and 1 hole for low crossing angle interferometer mode alignment
- Absolute position of the pinhole was aligned by the laser passed through the beam pipe in March



Signal in the Vertical Scan

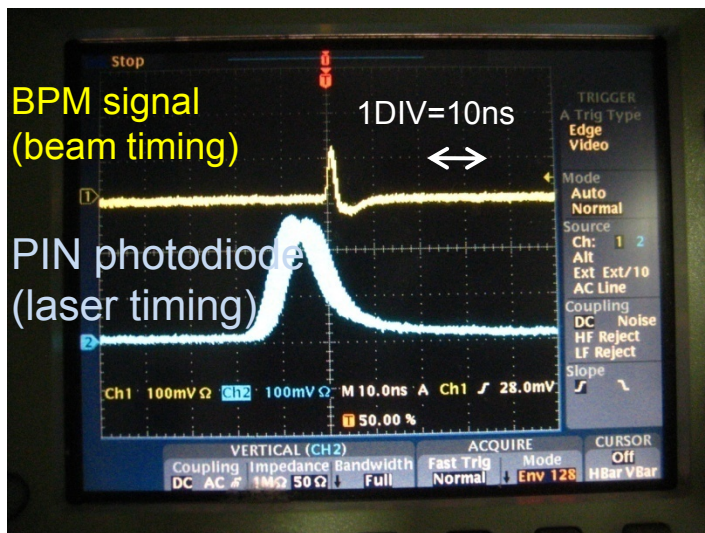
- Signal (excess of energy deposit when laser is on) was detected in the first week of April.
- However, the clear peak was not observed and the signal was missed out at that time.



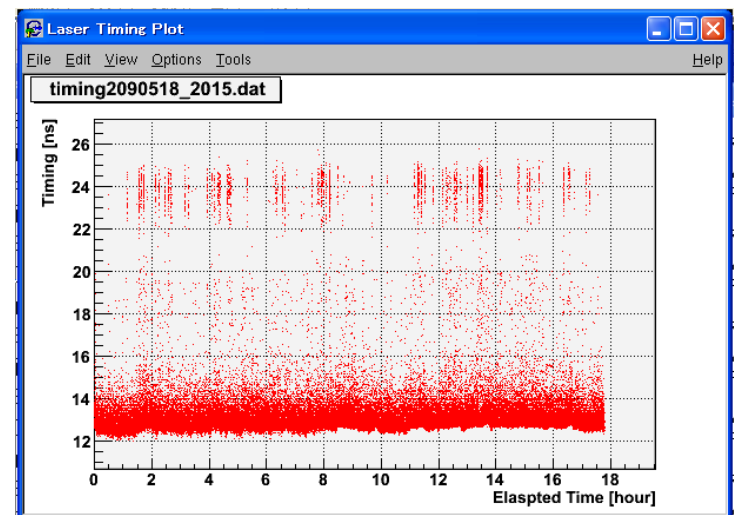
measured on 9 April, 2009

Hardware Trouble

- Laser timing jitter
 - Sometime, laser output timing jitters about 10 ns.
 - It was due to the misalignment of the injection seeder
 - After the alignment timing jitter is contained in 2 ns window (sometimes seeding is failed and timing is jumped)



laser timing jitter on an oscilloscope



laser timing after the alignment

Checked Items

- Timing adjustment
 - Stripline BPM signal for electron beam timing
 - PIN photodiode signal for laser light timing
 - ➡ Signal peak is observed at the timing adjusted on an oscilloscope
- Beam angle alignment
 - By using two screen monitors, MS1IP and MSPIP the beam orbit after the IP is aligned
 - ➡ Gamma-ray comes within several mm from the center of the detector
- Position adjustment
 - electron beam and laser light positions at the IP is adjusted on the screen monitor, MS1IP
 - ➡ Signal peak is observed at the adjusted position within several tens of micron accuracy

Tasks in Summer Shut Down

- Horizontal measurement (laserwire mode)
 - insert the beam expander into the laser line and focus the laser light to smaller size (5 μm is aimed)
- Vertical measurement
 - install screen monitor
- Laser width measurement
 - install knife edge target
- Background reduction
 - prepare smaller aperture collimator to enhance S/N ratio
 - perform collimator scan => do not use Polaroid any more
 - insert intermediate collimator
 - replace the chamber in the final bending magnet
- Another laser
 - make transport line of the laser from EXT laserwire

Summary

- Horizontal measurement
 - established the collision scheme for the laserwire mode
 - the screen monitors on the IP straight section play key roles
- Vertical measurement
 - signal was observed but not a clear peak in vertical scan
- Background
 - becomes a severe condition in present optics
 - displacement of an electron beam orbit can be tuned
 - but beam divergence cannot be eliminated