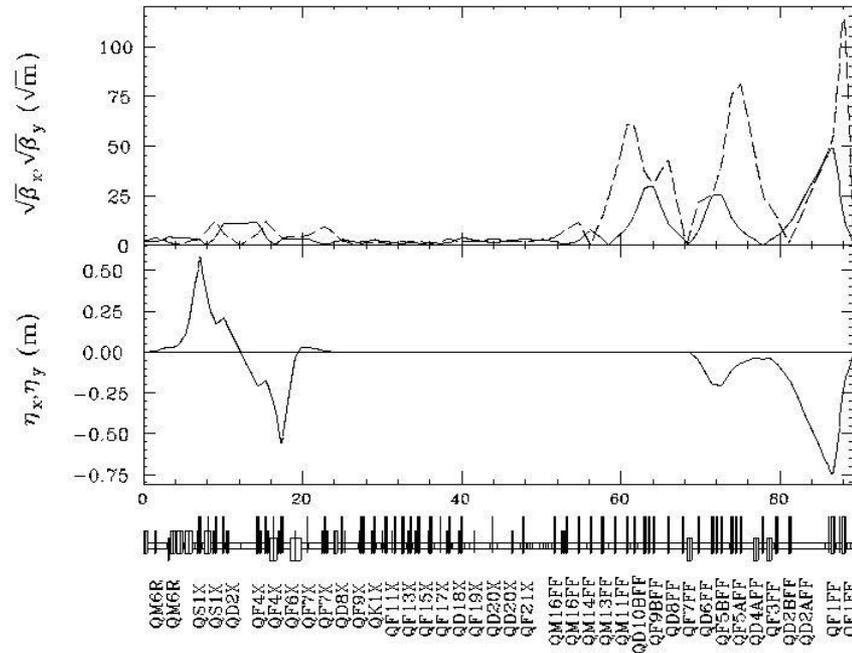


FFS Issues
in the 2011 autumn continuous operation

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1/13/2011
The 11th ATF2 project meeting
SLAC, USA

FFS Beam Optics

Beam Optics was used for Edu's optimized FFS optics
 ($\beta_x^* = 1\text{cm}$, $\beta_y^* = 0.1\text{mm}$, β_x at QF1FF was 2/3 to original)



Beam Sizes at MSPIP Evaluated beta functions at IP

$$\sigma_x = 330\mu\text{m} \rightarrow \beta_x^* = 1.32\text{cm} \quad (\epsilon_x = 1.8\text{nm}, \alpha_x^* = 0)$$

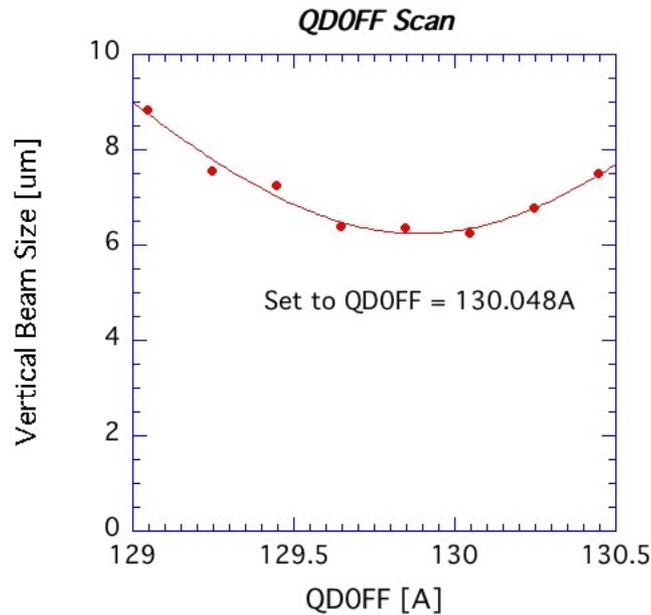
$$\sigma_y = 440\mu\text{m} \rightarrow \beta_y^* = 0.12\text{mm} \quad (\epsilon_y = 28\text{pm}, \alpha_y^* = 0)$$

IP beta functions were confirmed by measuring the IP divergence with MSPIP.

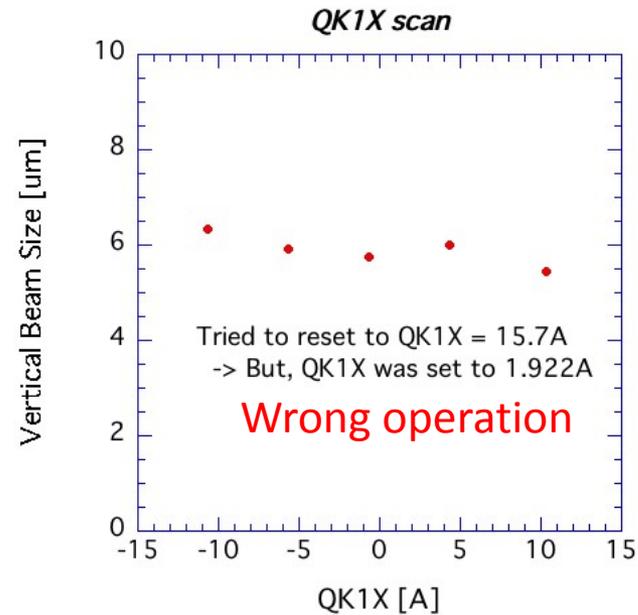
IP Beam Size Tuning

- Horizontal dispersion correction was done by changing QF1FF strength (-0.5A).
- Horizontal dispersion was reduced to be less than 2mm.
 - Horizontal beam size was reduced to be 7-8 μ m.

Vertical beam size, however, was also 6 μ m.



No response for waist scan



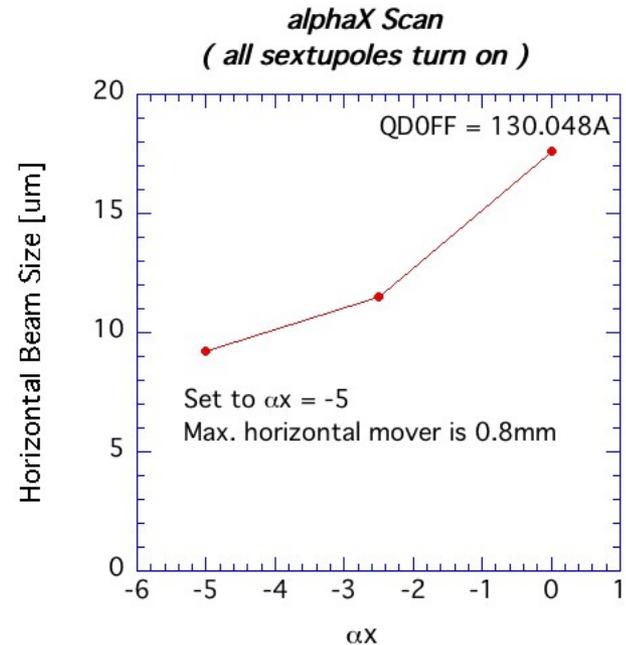
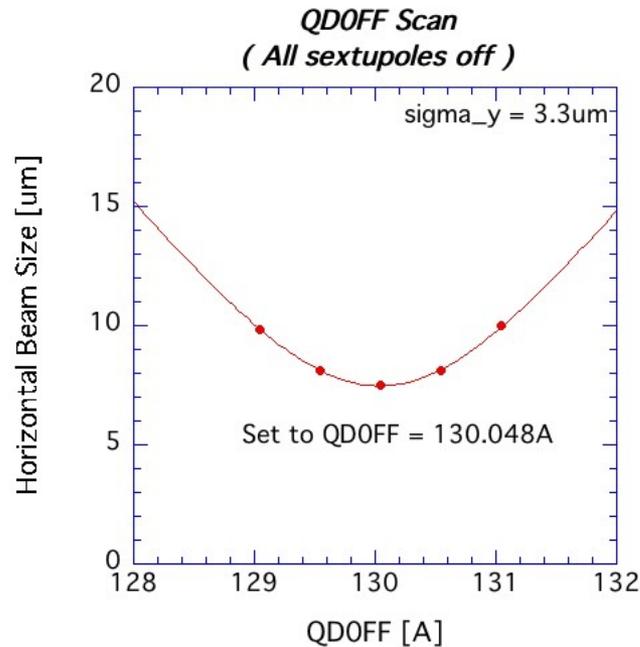
No response for coupling (QK1X)

Orbit Correction (SD4FF)

The vertical offset around SD4FF was 1mm (coupling source).

- > Orbit correction was done.
- > Vertical beam size was reduced to be 3.3 μm .
- > But, horizontal beam size was increased to be 18 μm , η_x^* was still 1.5mm.

- > When we turned off the sextupoles, horizontal beam size was reduced to 9 μm .
- > Main source of the horizontal beam size was horizontal offset of sextupoles.
- > Horizontal beam size was squeezed by using α_x knob (sext. Movers) .



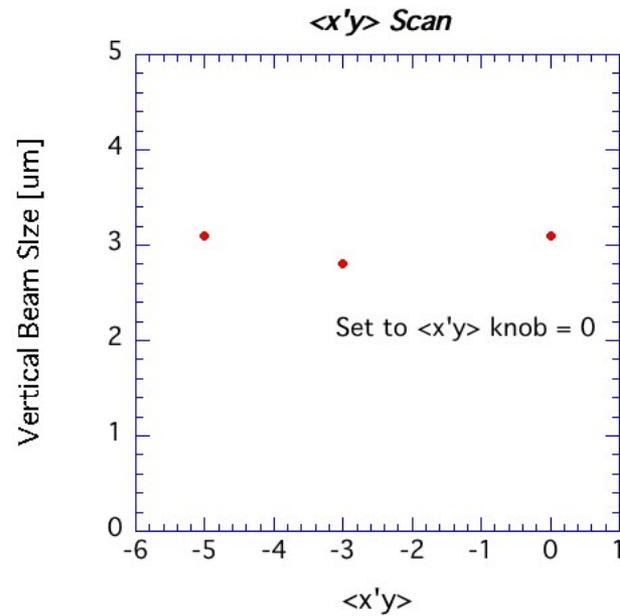
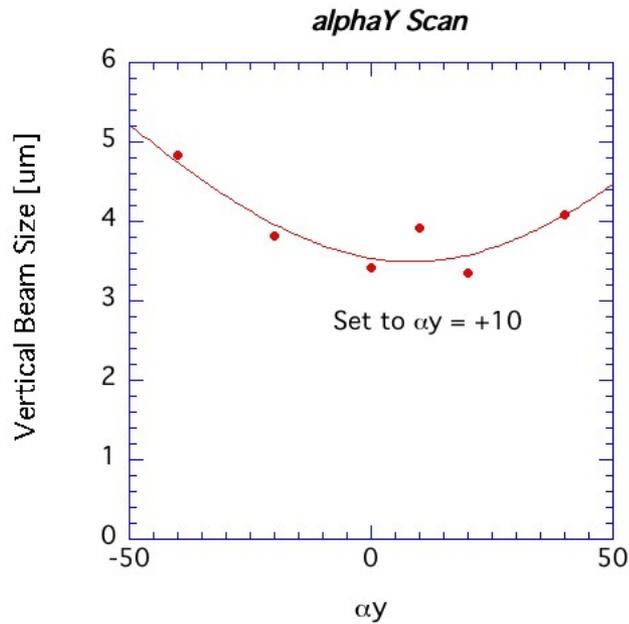
Horizontal beam size was reduced to be 8 μm .

Beam size minimization with Carbon Wire

Vertical beam size tuning with carbon wire scanner.

-> $\langle x'y \rangle$ and αy knobs were tested.

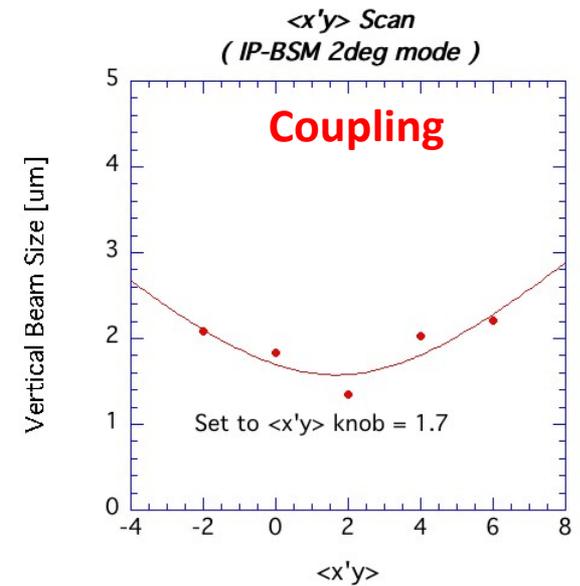
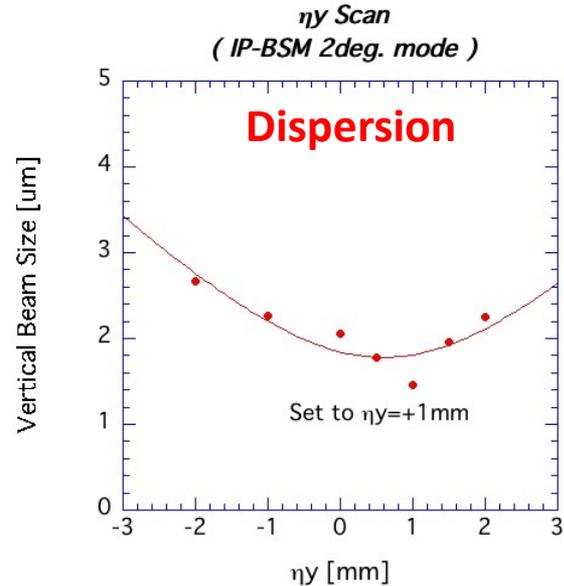
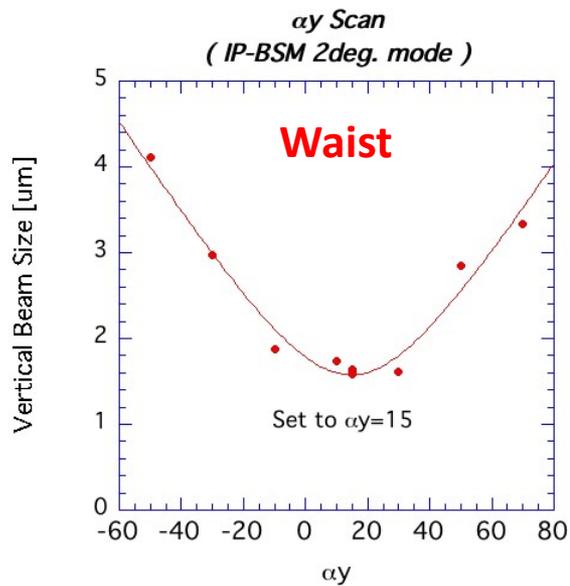
-> **carbon wire was cut** at the vertical beam size scanning.



Therefore, we switched to **the beam size measurement with IP-BSM**.

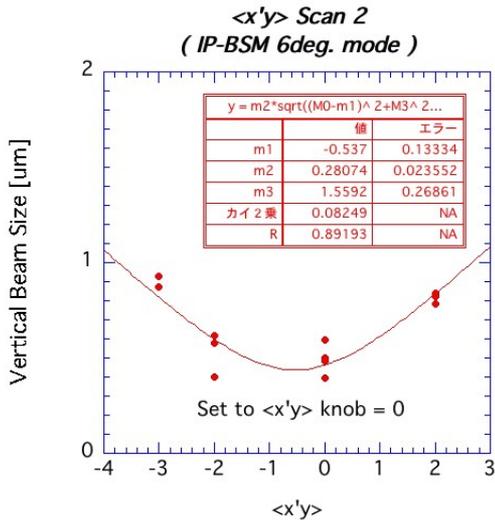
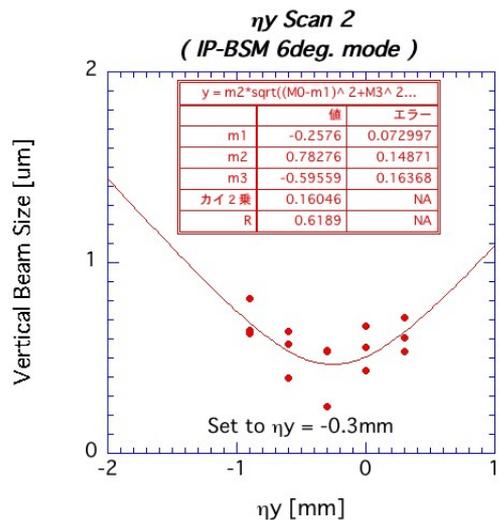
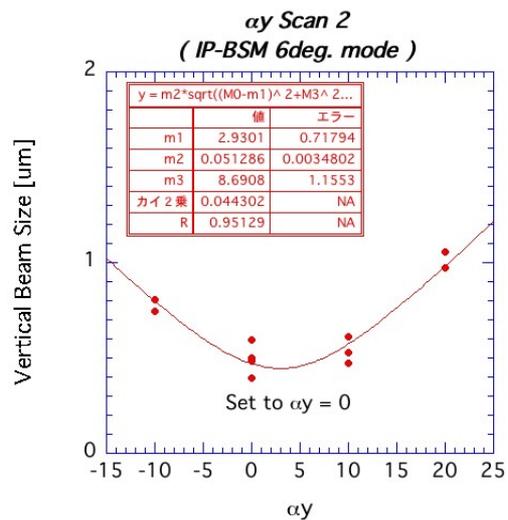
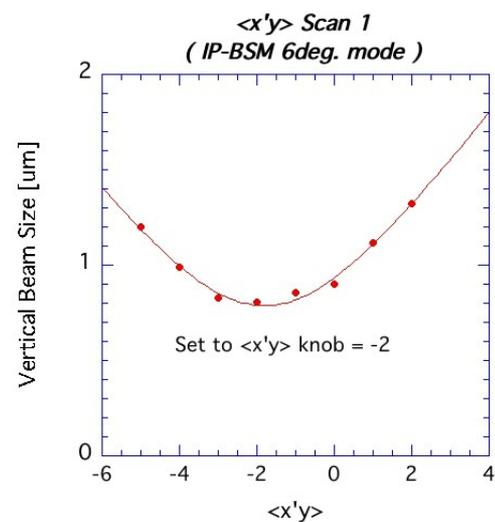
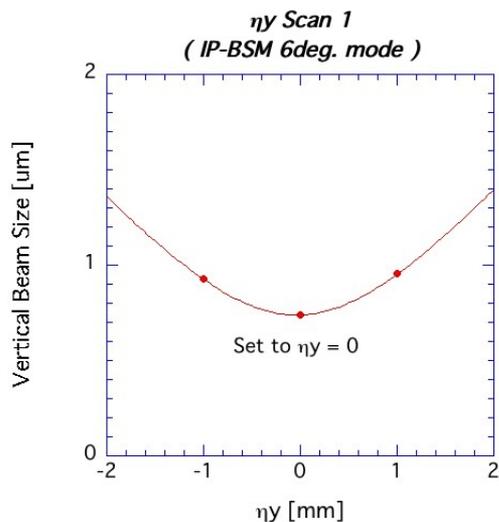
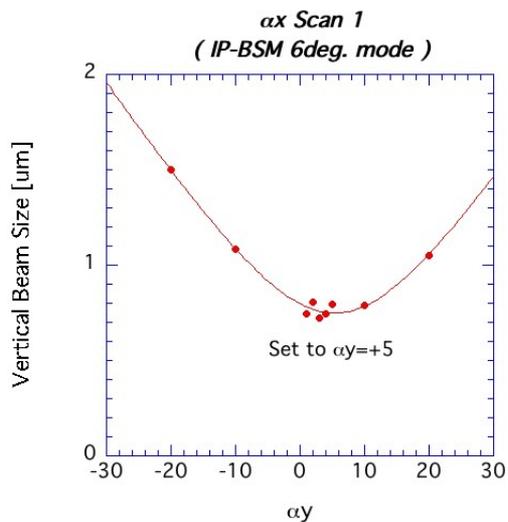
IP-BSM 2 degree mode

At first, we found the minimum beam size point by using 2 degree mode of IP-BSM.



Since the beam size was roughly set to the optimum values, we switched to the 6 degree mode.

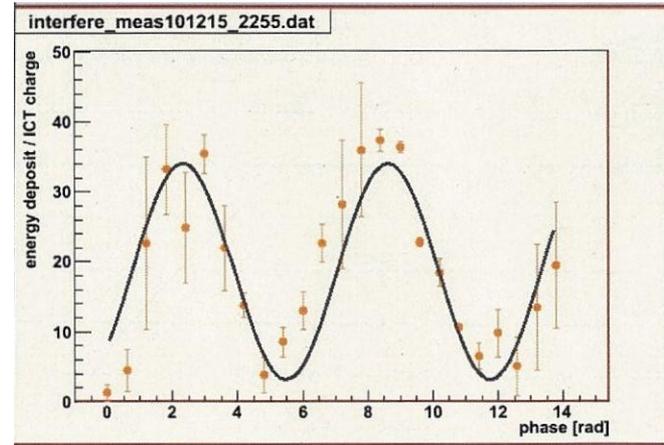
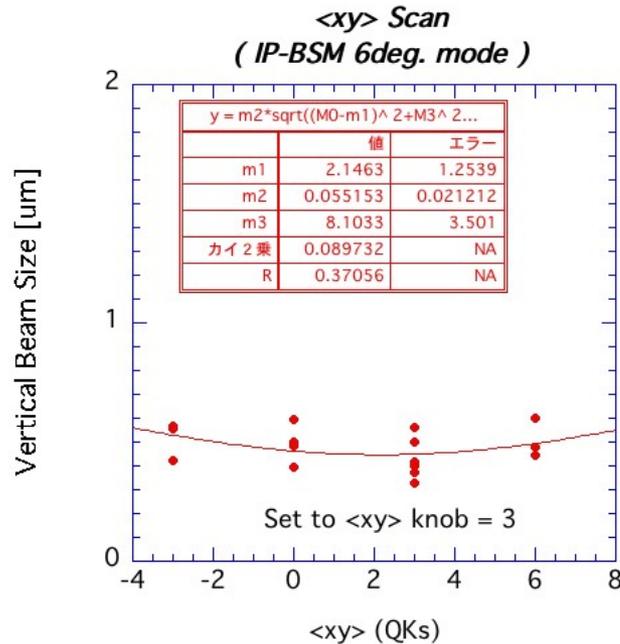
IP-BSM 6 degree mode



Wait, dispersion and coupling were scanned twice.

<xy> knob

We also applied the <xy> knob (combination of QK magnets).



At <xy>=+3,	Ave.	Rms.
modulation	0.860	0.047
vertical beam size	431nm	77nm

IP-BSM was most stable condition in these scanning.

The minimum beam size in this operation was 247nm (M=0.950) at 2nd η scan.

Since the knobs were optimized,
we switched to the **30 degree mode**.

IP-BSM 30 degree mode

This should be quick check wheter we can observe clear modulation with 30 degree mode.

Unfortunately, we have a lot of IP-BSM troubles in the measurement in 30 degree mode.

It spent about 1 days for the 30 degree mode measurement and IP-BSM troubles.

The detail will be presented by Oroku-san and Jackie-san in the following presentation.

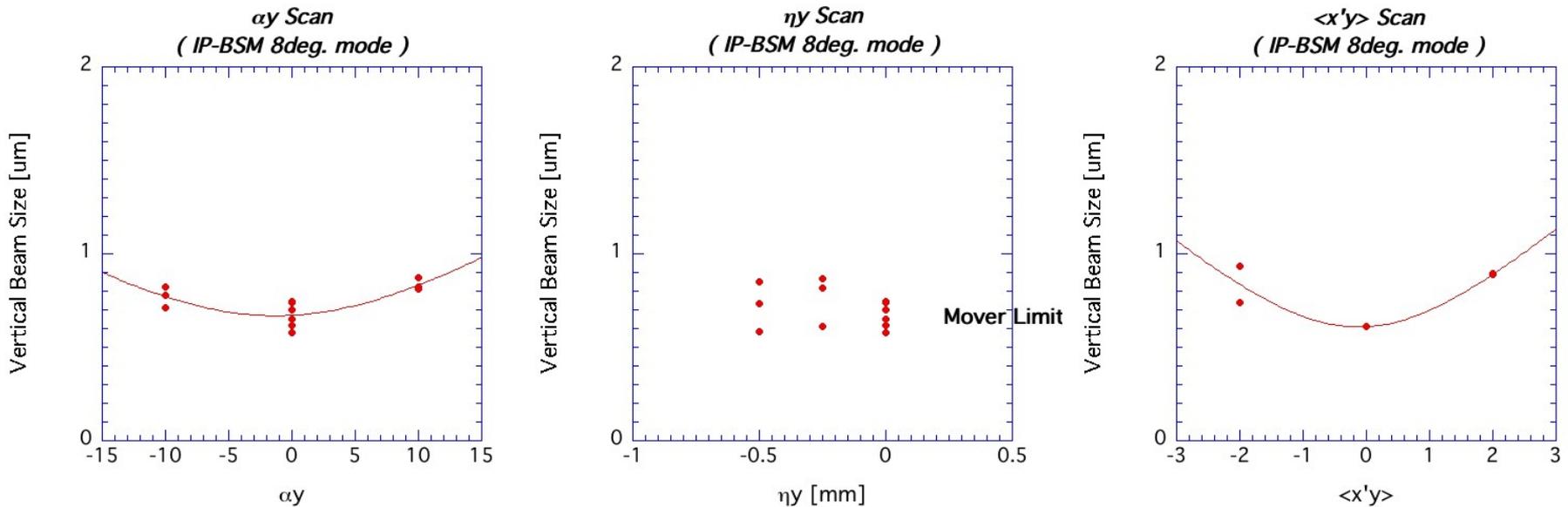
Finally, we concluded not to be able to find clear modulation signal with 30 degree mode.

Therefore, we switched back to 8 degree mode in Friday morning.

IP-BSM 8 degree mode

In the measurement of 30 degree mode, we tuned the beam orbit with ZV1FF and ZH1FF in order to be close to the original orbit.

Therefore, we checked whether the beam size drift exists or not by scanning the nominal waist, dispersion and coupling knobs at first.



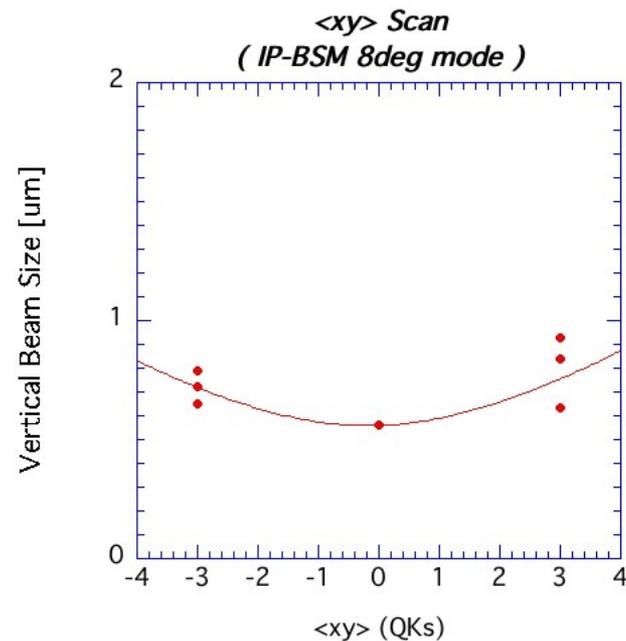
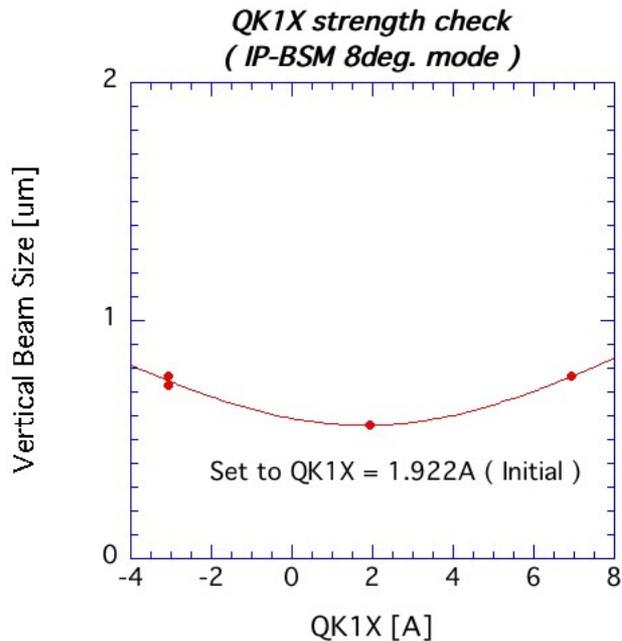
Since the optimized knob amplitudes were not changed, we found the beam size drift was not so large within 1 day period.

Strength of QK magnets

Since we found the QK1X was wrong setting, we applied QK1X scan.

-> The minimum beam size was 1.922A.

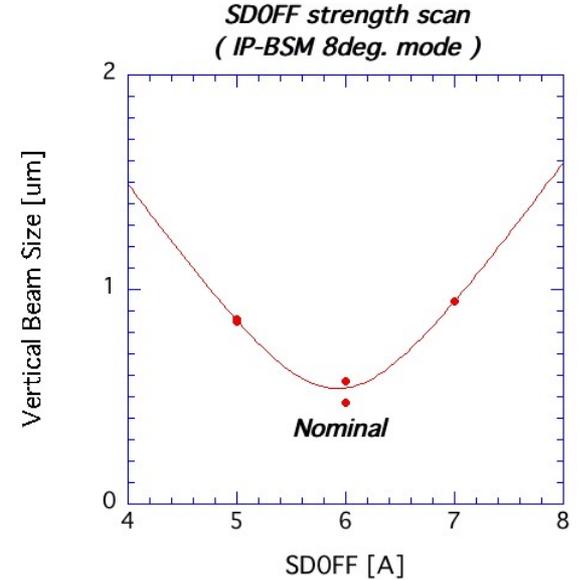
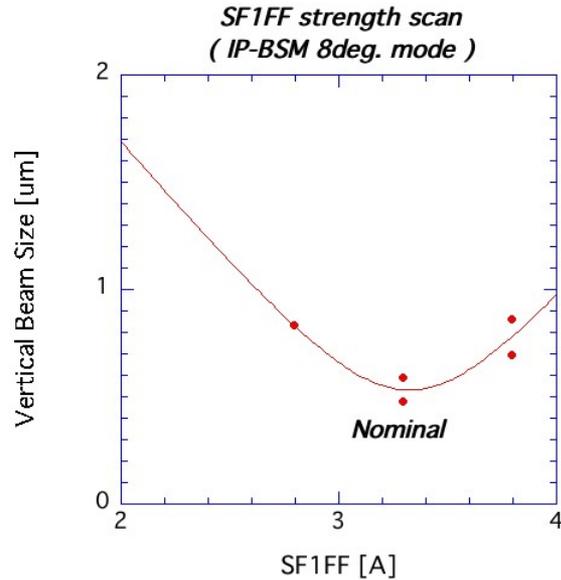
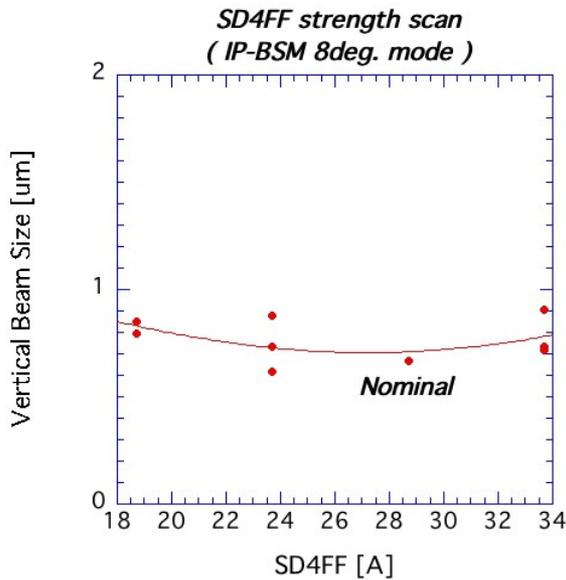
-> The coupling correction was optimized for QK1X=1.922A.



We checked <xy> knob, <xy> knob also was not drifted within 1day .

Sextupole Strength Scan

We also applied the sextupole strength scan in order to check the performance of the chromaticity correction.



The optimum strengths were nominal ones.

Summary of FFS Issues for 2010 autumn continuous operation

- We used the Edu's optimized FFS optics
($\beta_x^* = 1\text{cm}$, $\beta_y^* = 0.1\text{mm}$, β_x at QF1FF was 2/3 to original)
- The beta matching at IP seemed to be good from the beam profile at MSPIP.
- Carbon wire was cut at $\sigma_x=10\mu\text{m}$, $\sigma_y=2\mu\text{m}$.
- Vertical IP beam size was minimized with a_y , h_y , $\langle x'y \rangle$ and $\langle xy \rangle$ (QKs) knobs by the IP-BSM 6 degree mode, the maximum modulation of 6degree mode was clearly exceed 0.8.
- We could not find clear IP-BSM modulation signal with 30 degree mode.
- Since the optimized knob amplitudes were not changed,
we found the beam size drift was not so large within 1 day period.
- Even though we did the wrong operation of QK1X .
But, since the coupling correction was optimized by the QKx setting,
it seemed small effect to the vertical beam size at IP.
- We also applied the sextupole strength scan.