

***Beam Optics and Tuning
for the Shintake Monitor Commissioning***

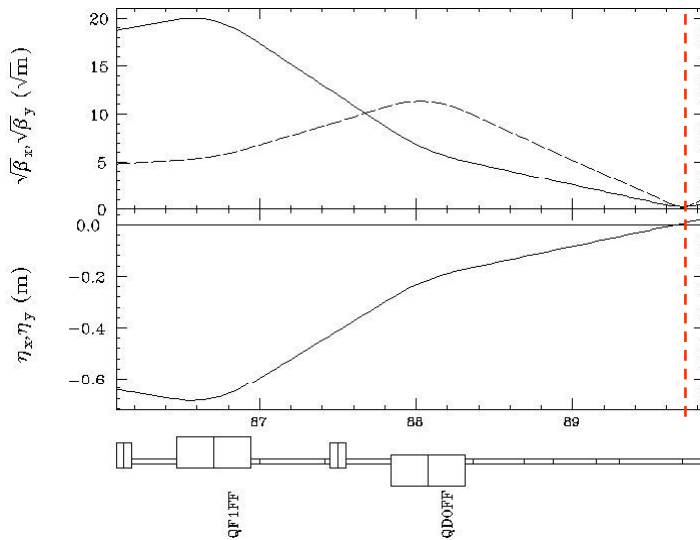
Toshiyuki OKUGI (KEK)

8th ATF2 project meeting

2009 / 6 / 8

Beam tuning procedures

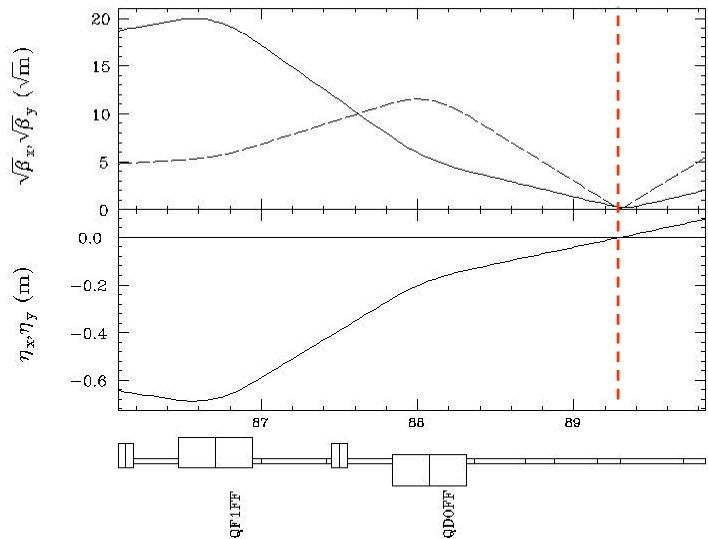
- **Beam orbit tuning with respect to the quadrupole center.**



- **Final doublet was set to focus the beam to MW1IP.**

- **Betatron matching with matching quads (QMs).**

- **Dispersion matching with QF6X and QS2X.**



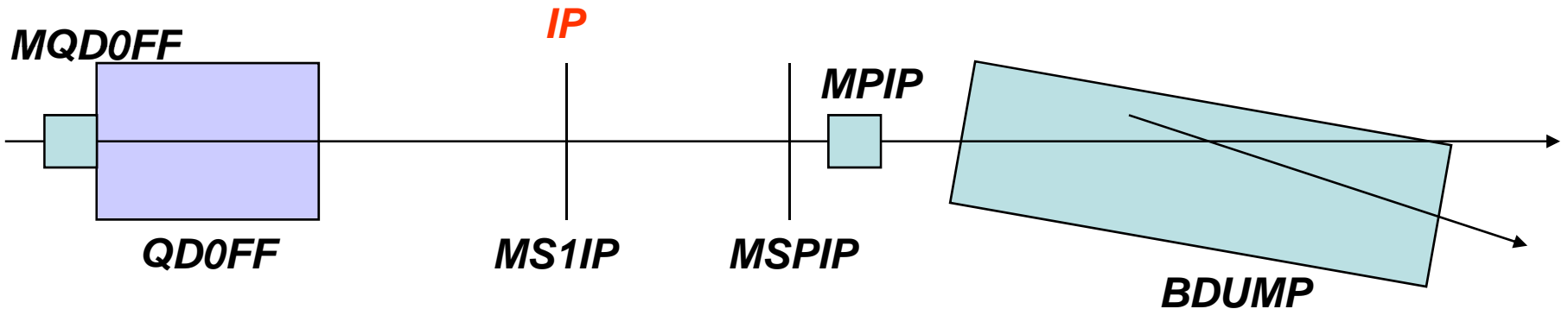
- **Final doublet was set to focus the beam to IP.**

- **Beam waist and dispersion check with screen at IP**

- **Beam angle to IP-BSM detector was adjusted by using MS1IP and MSPIP.**

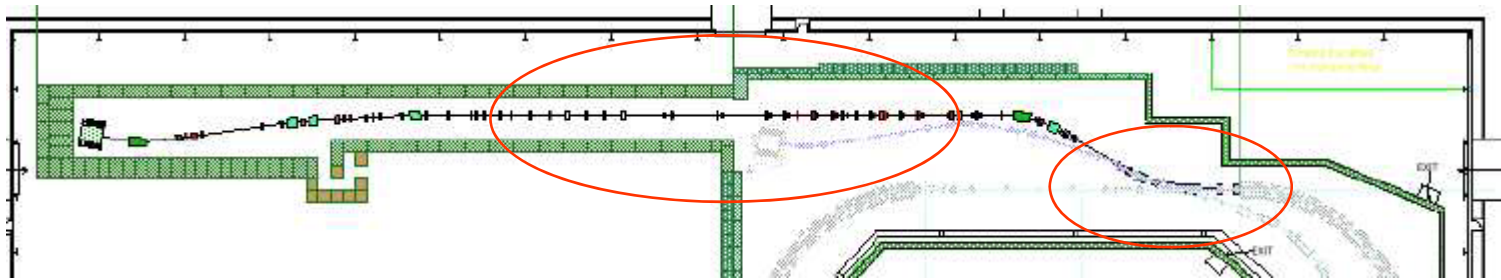
For the monitor to use beam tuning

- The beam angle to the IP-BSM detector was adjusted with two screen.
- Since the coordinate for MS1IP is complex, we checked the beam angle with Polaroid film after beam angle adjustment.



- It is no problem for the commissioning stage for IP-BSM, but the beam position and angle will be changed in beam tuning frequently.
- The beam angle and beam position at IP (if possible) should be monitor with BPMs (MQD0FF, MPIP or IP-BPMs) for the monitor to use beam tuning,

Beam background for IP-BSM detector



From 2008 Dec. to 2009 March

We concentrate to reduction of the beam background from upstream of beam line.

- The main background source was at the entrance of extraction line and long straight section.
- We can reduce the background with normal BBA procedure, it spend 2-3 hours.

From 2009 spring run

We observed the strongly background dependence for the final doublet setting.

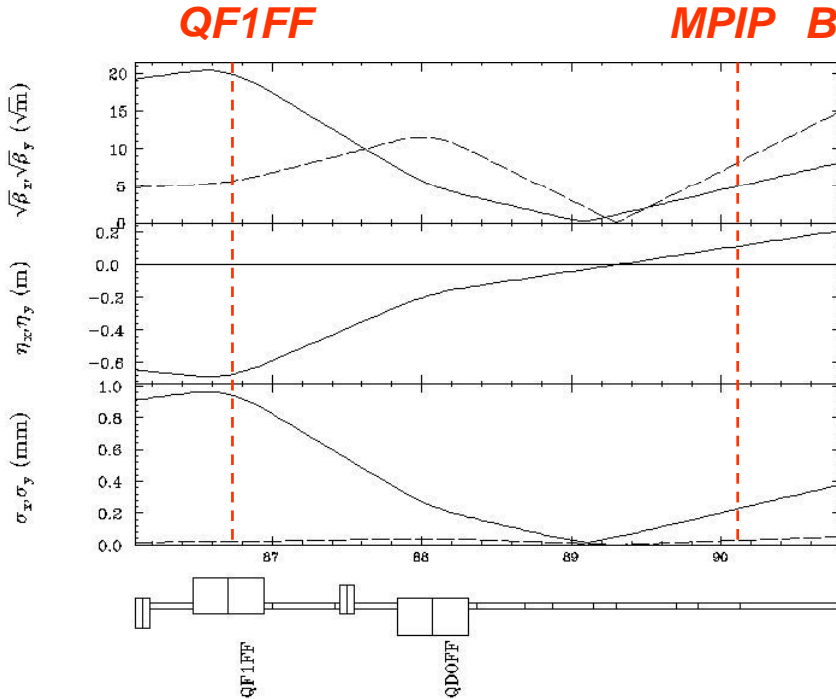
Background for 5/21 beam time

Observations

- Beam optics had a large mismatch at IP and post-IP wire scanner*
- Background level was 3 times larger than nominal
(6GeV / 0.3e10)*
- Background level was sensitive to the Final Doublet setting
-> Background source was downstream of QD0FF*

Beam Optics for 5/21 (mismatched optics)

- Horizontal waist ($\beta_x=0.08m$) at MS1IP for QD0FF=115.25A
- Vertical waist ($\beta_x=0.01m$) at MS1IP for QD0FF=105.25A

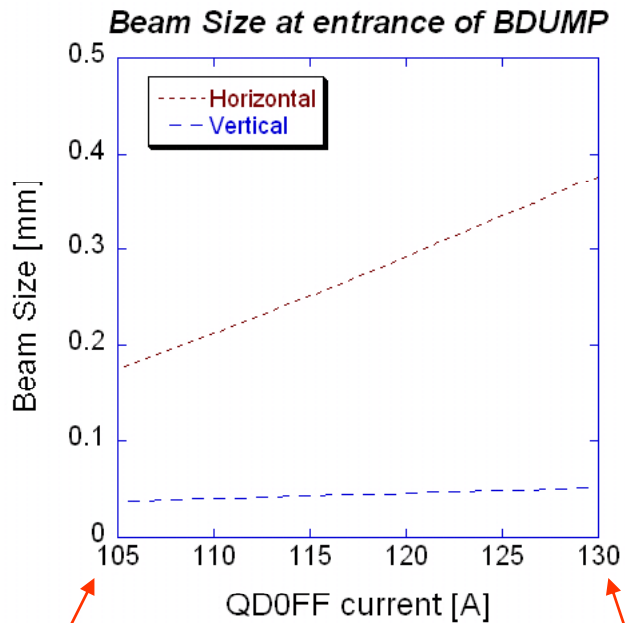


QF1FF	D	40mm ϕ
	σ_x	0.949mm (0.829mm)
	σ_y	0.019mm
	D / σ_x	42 (48)
MPIP	D	20mm ϕ
	σ_x	0.168mm (0.094mm)
	σ_y	0.019mm
	D / σ_x	119 (213)
BDUMP	D	24mm ϕ
	σ_x	0.381mm (0.256mm)
	σ_y	0.052mm
	D / σ_x	63 (94)

() ; Design High Beta

Background dependence of beam waist

- Background was larger for stronger QF1FF and QD0FF
- Beam size at post-IP is larger for stronger QF1FF and QD0FF



Waist at MW1IP

Waist at IP

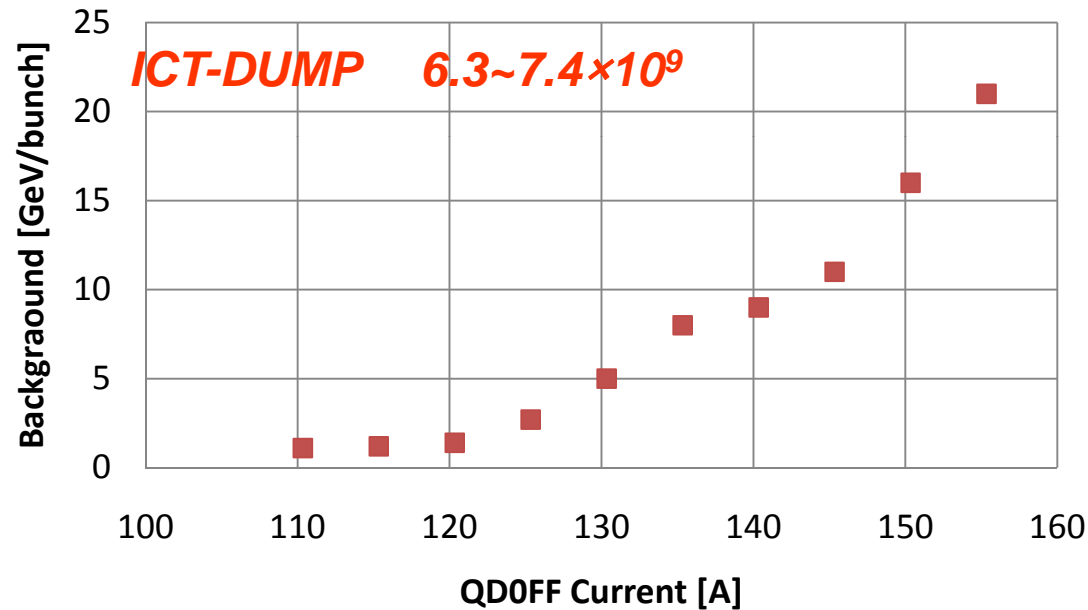
QF1FF was changed with QD0FF

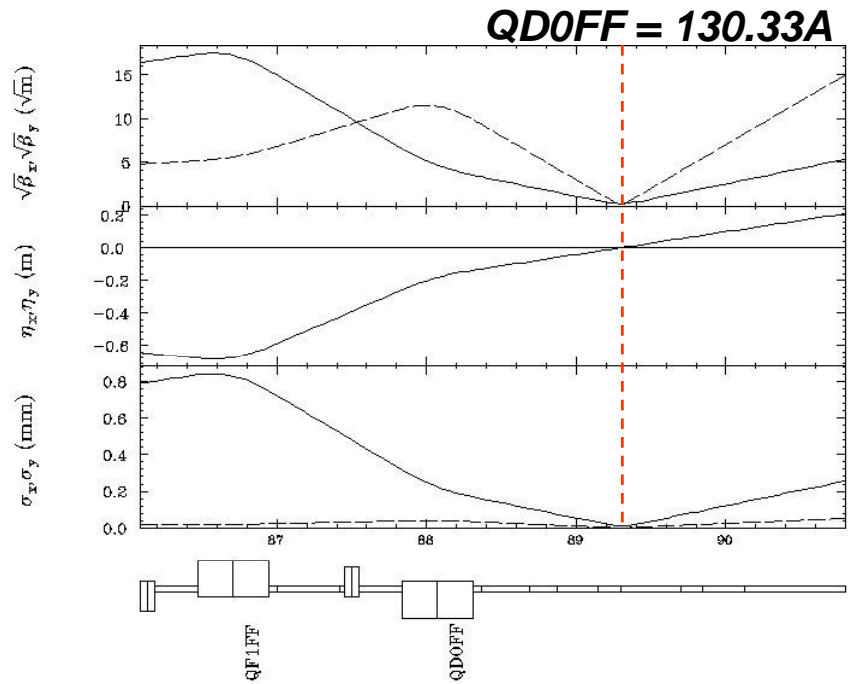
Background sources
were located at post-IP ??

- Background was not changed,
when MPIP was removed from beamline
(observed at 5/26)
- At the entrance of BDUMP ??

Beam background at 5/29

We can detect the gamma-ray signal by IP-BSM detector,
but still large background dependence of QD0FF was observed.



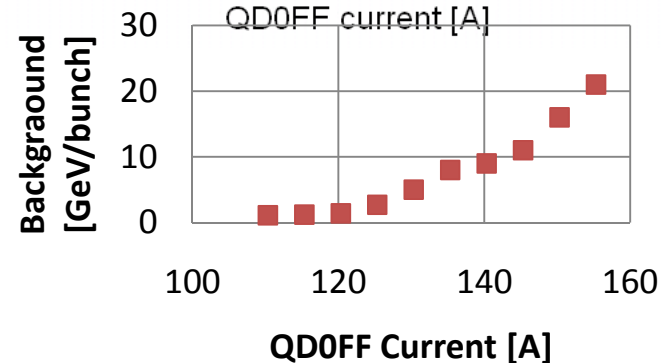
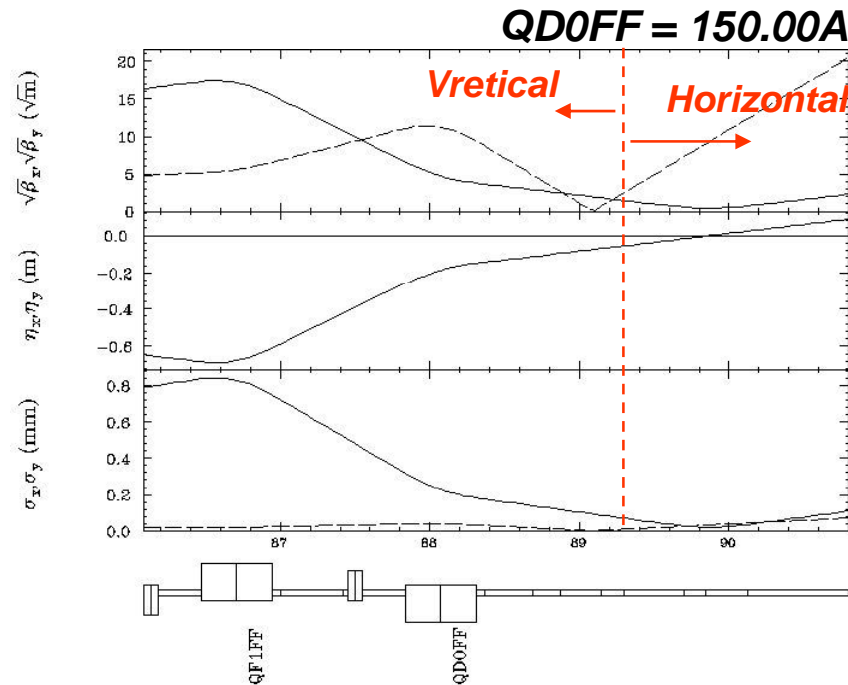
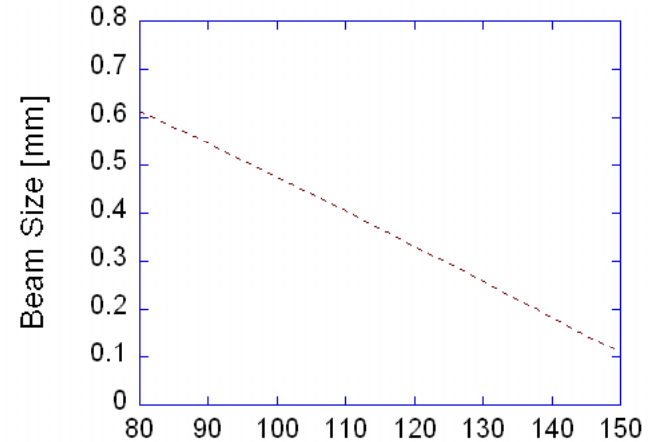


Since we change the waist position only by changing QD0FF in 5/29, horizontal waist was closer for stronger QD0FF.

But, the background was larger for stronger QD0FF.

Are background sources at post-IP ??

Horizontal Beam Size at entrance of BDUMP



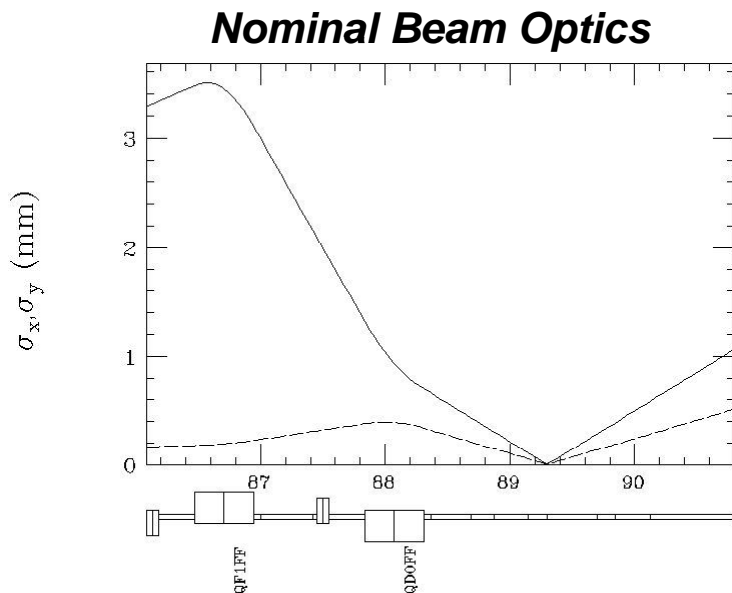
We did not yet understand the source of BG.

What we can do in summer shutdown

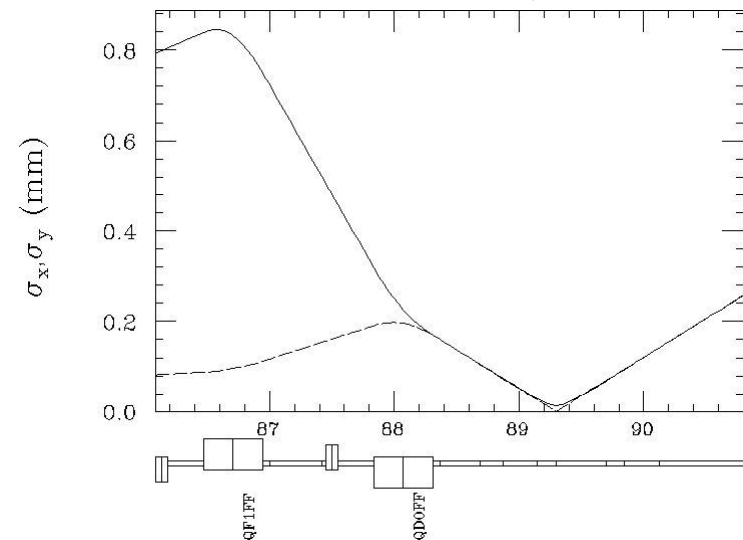
- Careful observation of misalignment and realignment of vacuum chamber in between QDOFF and BDUMP
- Additional shielding for gamma detector

If the background will be too high to measure the beam size in the 2009 autumn run, we should operate with high beta_x optics

- We can reduce the beam size down to 100nm with same horizontal and vertical beam divergence.



**High Beta_x Optics
($\beta_x=0.08m$, $\beta_y=0.0004m$)**



Summary

- We have the routine procedure to orbit correction to reduce the background from the upstream beam line.***
- We could adjust beam angle to the IP-BSM detector, but we need to improve.***
- We could adjust beam waist and dispersion by changing matching and extraction quads.***
- In the 2009 spring run, large background was generated after QD0FF, but the background source was not yet perfectly understood.***
- In order reduce the background, we need careful observation of misalignment and realignment of vacuum chamber in between QD0FF and BDUMP.***
- If the background will be too high to measure the beam size, we should decide to operate with high beta_x optics in the 2009 autumn run.***