Status of IP beam size tuning in Feb. and Mar. 2012

2012.03.19.

Kiyoshi KUBO (KEK)

Data shown here are preliminary.

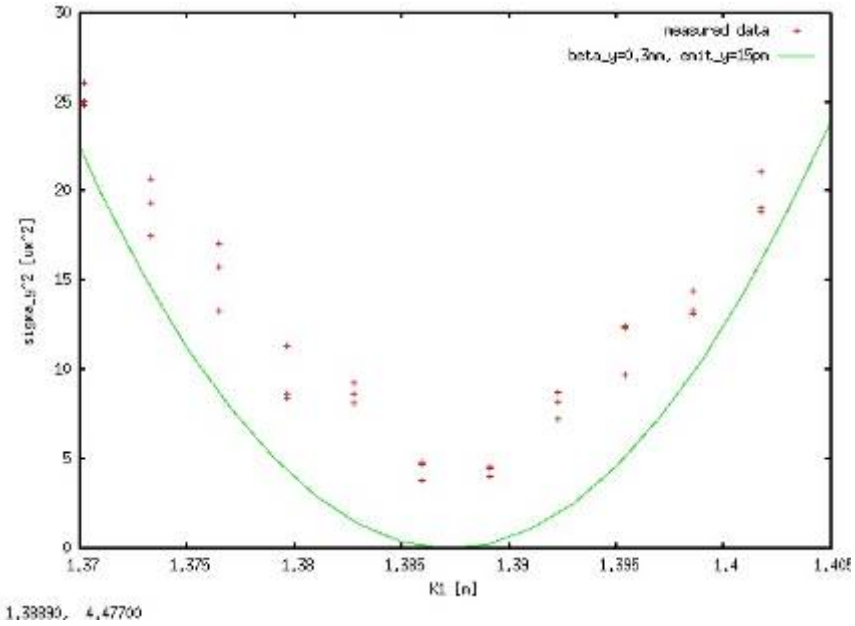
Do not quote figures without permission.

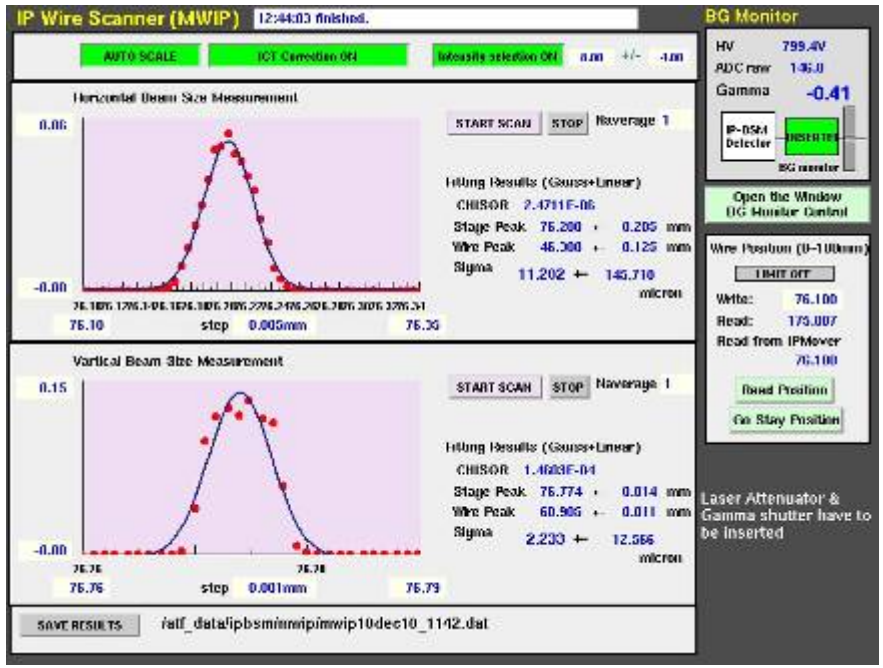
Procedure of IP beam size tuning -1

- IP tuning started after DR and EXT (upstream part, QMs) tuning.
  - Emittance and optics measured by multi OTR monitor.
- Using IP wire scanner
  - Minimize h-size
    - QF1FF strength scan
    - Ex, Ax knobs (? if necessary ?)
  - Minimize v-size
    - QD0FF strength scan
    - Vertical dispersion (Ey) knob
    - x'y (Coup2) knob
    - Waist (Ay) knob
- For further steps, beam size should be smaller than limit of wire scanner measurement, or can be measured by IPBSM (~ 1um)

Example of beam size measurement and tuning using IP wire

QD0FF strength scan



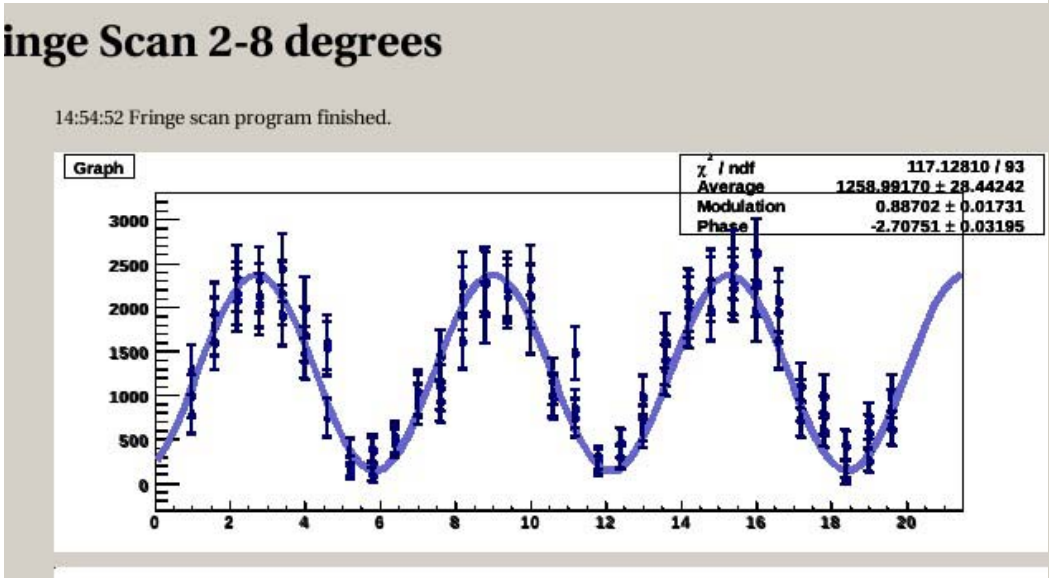


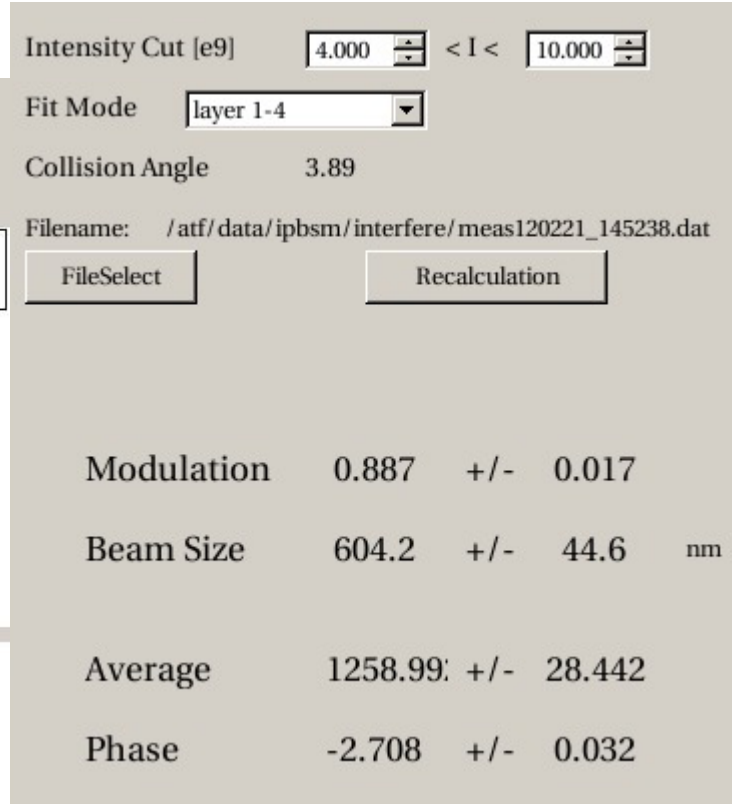
Procedure of IP beam size tuning -2

- Using IPBSM 2-8 deg, minimize v-size scanning ‘Linear knobs‘
  - Vertical dispersion (Ey) knob
  - x’y (Coup2) knob
  - Waist (Ay) knob
- Change IPBSM laser angle, if modulation becomes large (~0.8?)
- Using IPBSM 30 deg, minimize v-size scanning ‘Linear knobs‘
  - Then, non-linear knobs (see next slide) ?
  - (What is the correct criteria for switching 30 deg to 174 deg is not clear.)

Example of IPBSM Fringe scan

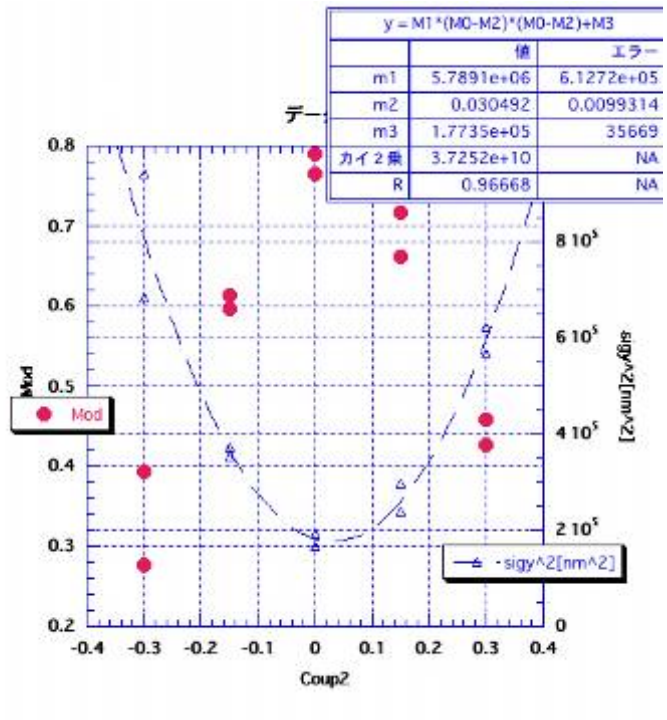
Modulation was large with small crossing angle.



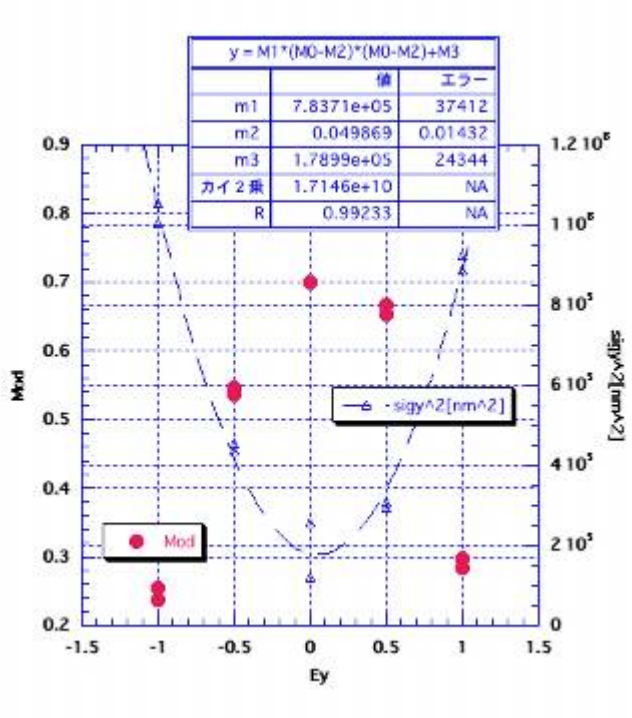


Example of linear knob scan

Coup2 (x'y)



Ey (dispersion)



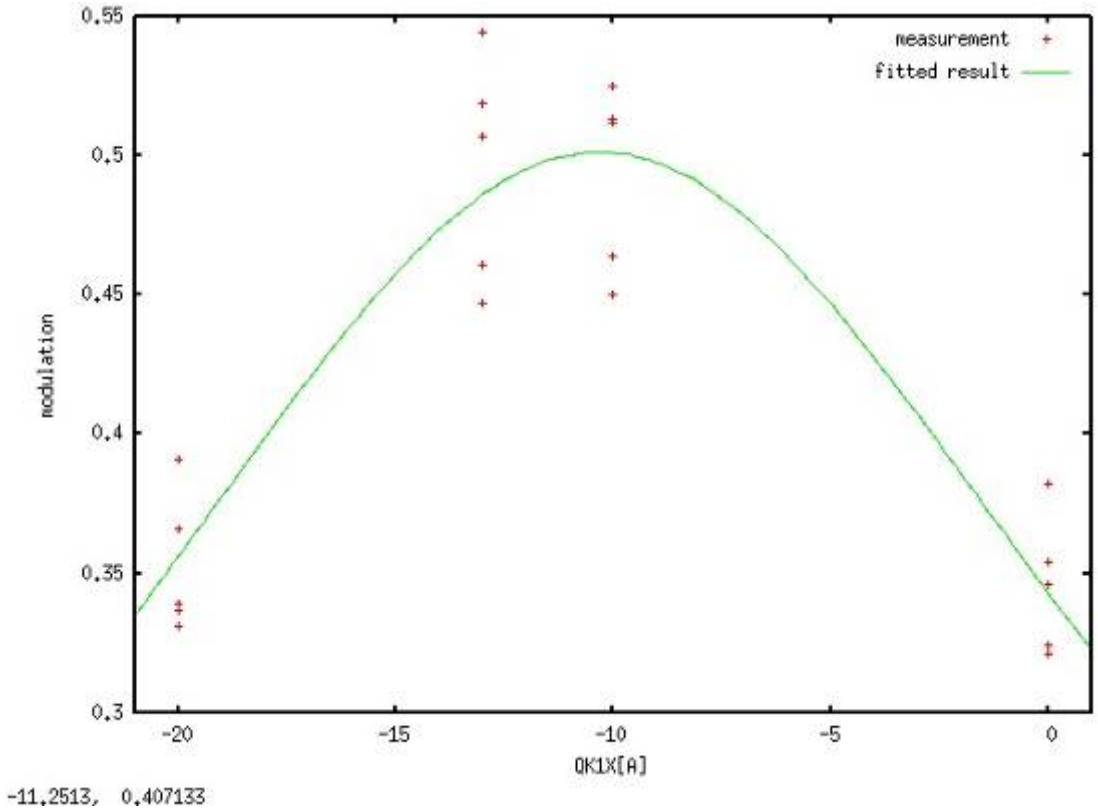
Procedure of IP beam size tuning -3

- Using IPBSM 30 deg, we tried
  - QK1X~QK4X (skew 4-pole) strength scan
    - Find optimum set of 3 ‘linear knobs’ for each setting.
  - SK1F (skew 6-pole) strength scan
  - S(FD)*FF Strength + position scan

  (It is not clear what is the optimum order of these scans.)

Example of QK scan

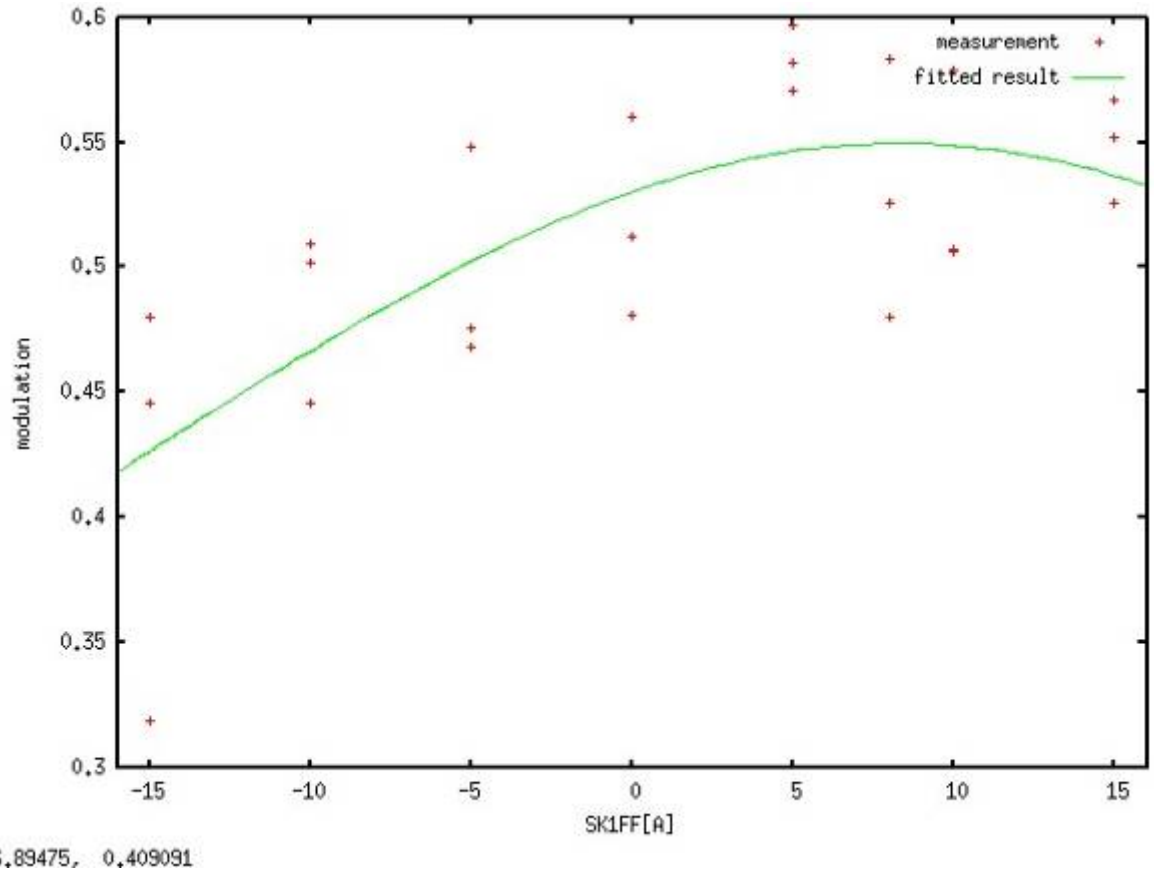
Modulation vs. QK1X strength



-11.2513, 0.407133

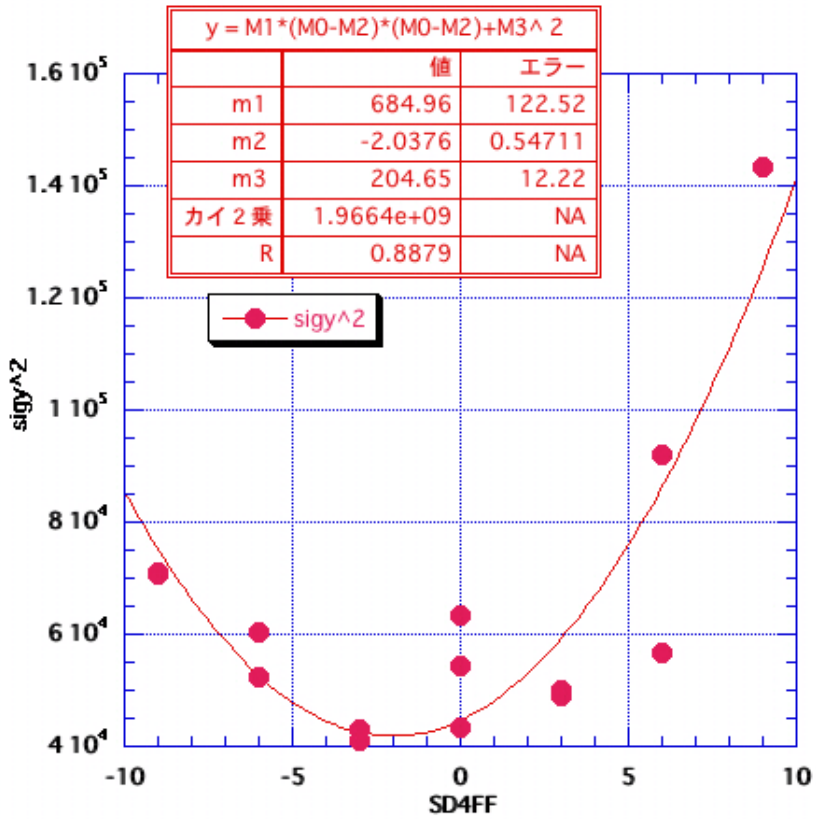
Example of non-linear knob scan

Skew 6-pole strength scan



Example of non-linear knob scan

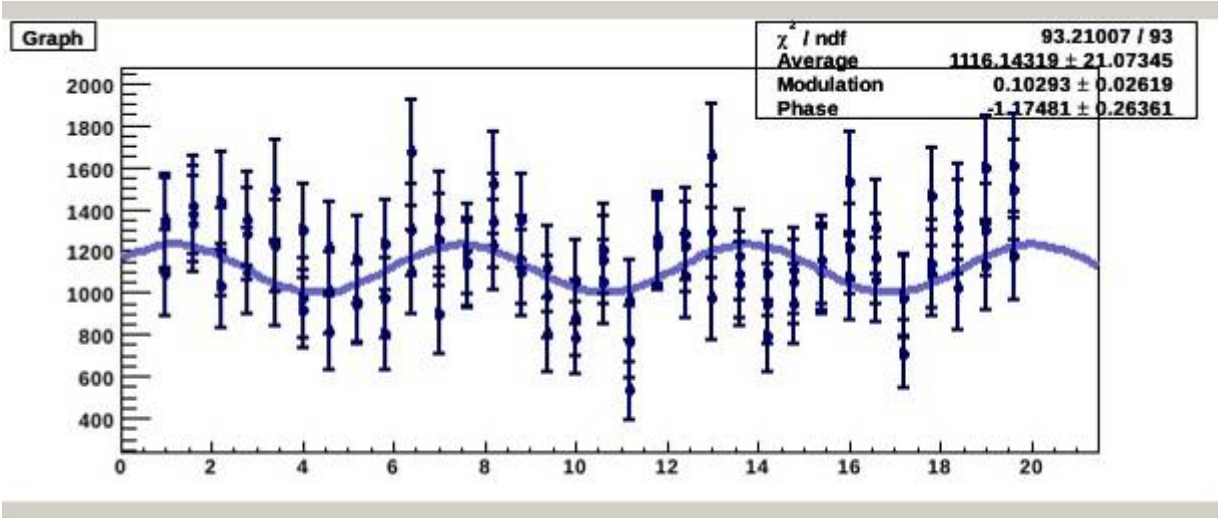
SD4FF strength (+ position)

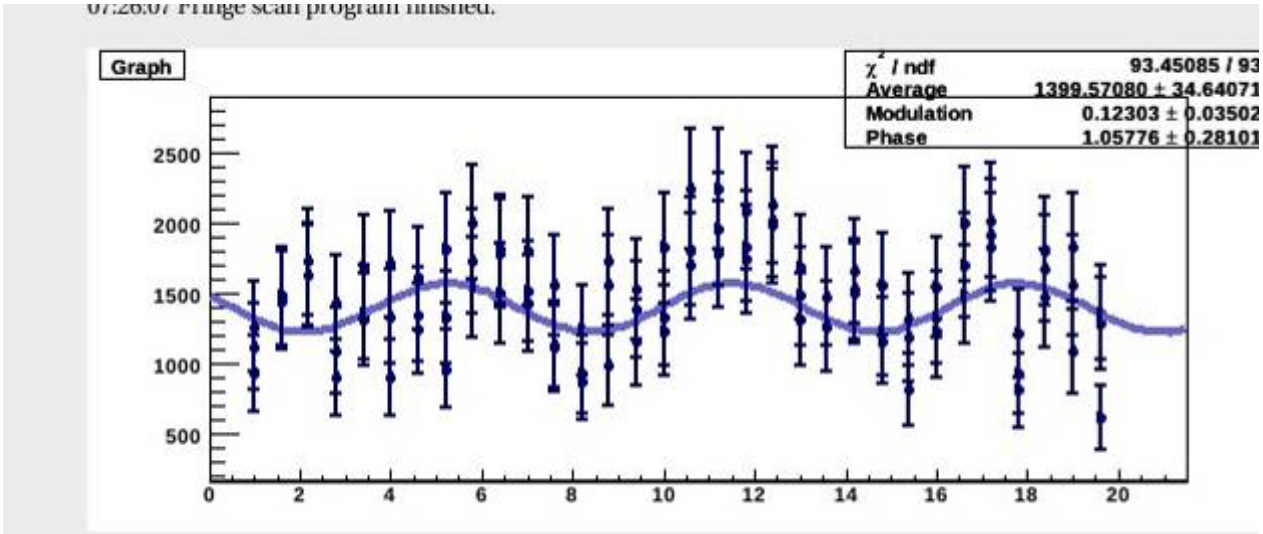


Procedure of IP beam size tuning -4

- We set IPBSM laser angle 174 deg. on Feb. 23 - 24 when modulation becomes ~0.6(?) with 30 deg.
  - It has not been confirmed if the beam size was really small enough for 174 deg.
- There seemed to be some modulations, but could not be confirmed (?).

Examples of 174 deg mode measurement





Summary

- We achieved < 1um beam size, every week.
- We achieve large modulation (~0.8)with 2-8 deg mode of IPBSM, every week.
- We achieved large modulation (~0.5) with 30 deg mode of IPBSM in different two weeks (Feb.23, Mar.9).
- There might be small modulation with 174 deg mode (Feb.23-24), but not confirmed.
- In March operation, measured beam size was larger than in February.
  - Because of many troubles with the laser system of IPBSM.
  - Could not have enough time for beam tuning.
- Tuning knobs
  - Many iterations of three linear knobs (Ay, Ey, x'y) were performed.
  - xy coupling tuning (QK magnets) is also tried.
  - Some non-linear knobs were tried.