

ATF2 Goal-1 Plan

201803

K.KUBO

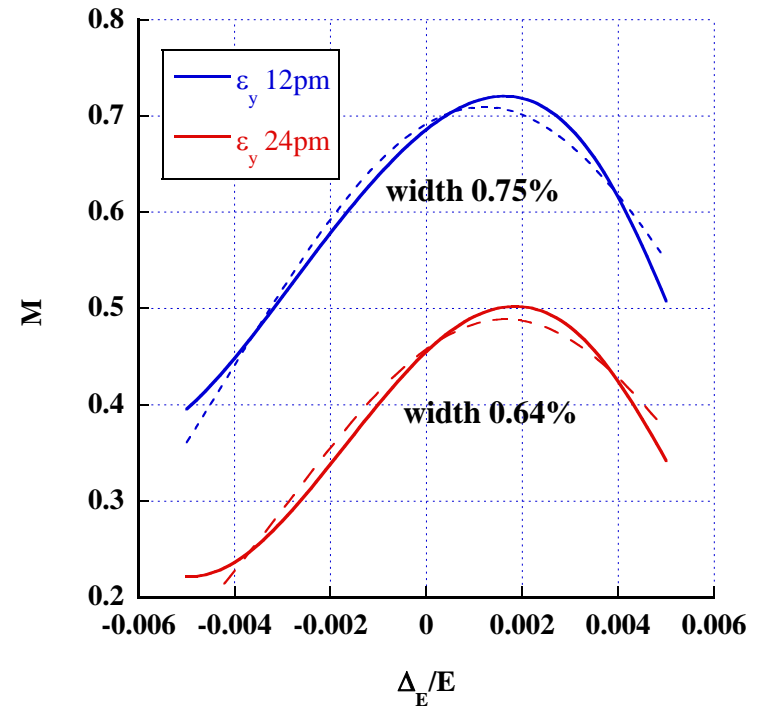
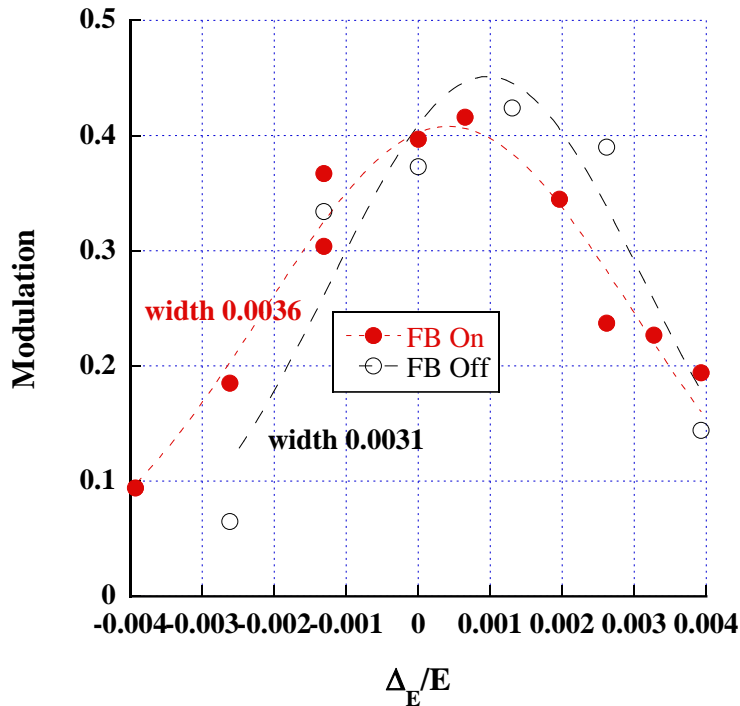
Past 2~3 years

- Smallest beam size observed in 2014-2015 (~40nm)
 - Only with low beam intensity
- We have tried to understand
 - Nonlinear aberrations
 - Intensity dependence
 - Wakefield effects

Residual chromatic aberration (energy band width) (2015)

Measured Width
DE/E 0.31~0.36%

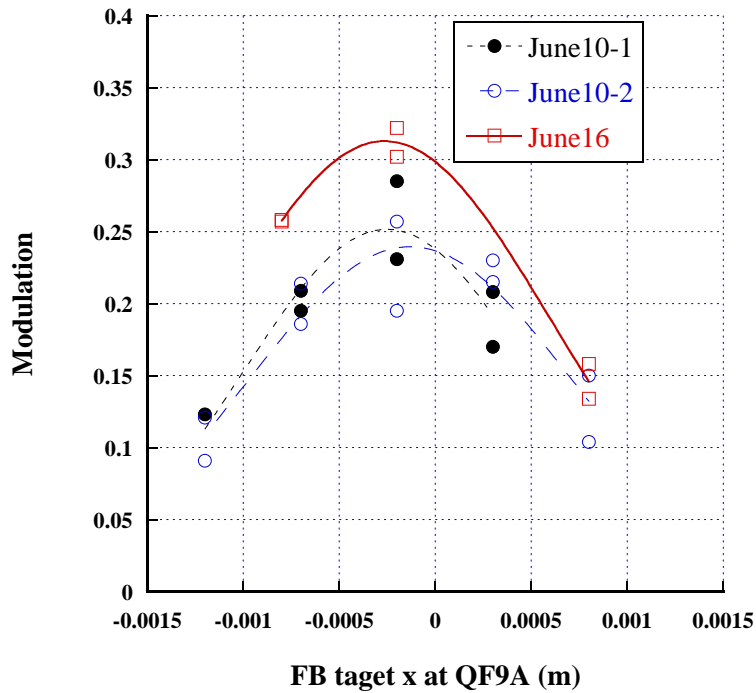
Simulated Width
DE/E ~0.7%



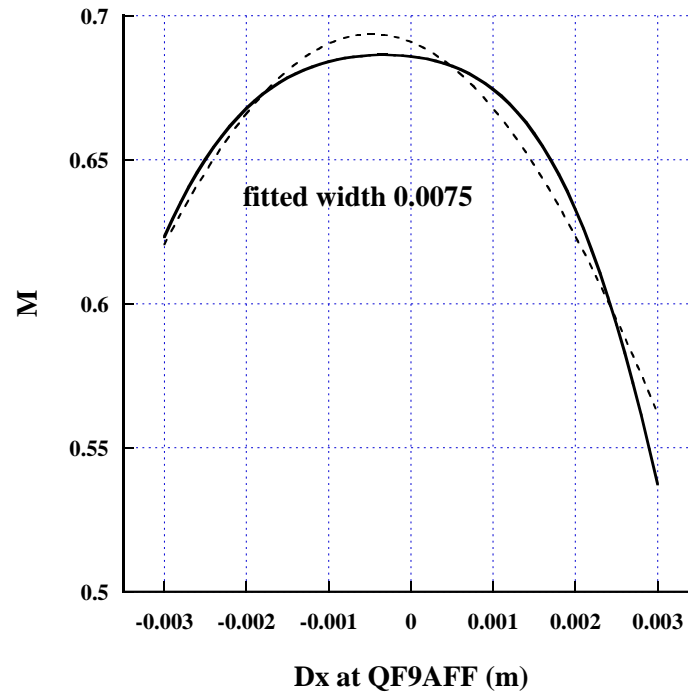
Measured 2015.5.22

Horizontal Orbit Dependence (higher order x-y coupling) Experiment: feedback target position change (2015)

Measured Width 1.1~1.2 mm



Simulated Width 7.5mm



Nonlinear aberration

Energy bandwidth

(IP beam size vs. DR RF frequency (energy change))

Orbit dependence

(IP beam size vs. offset at feedback)

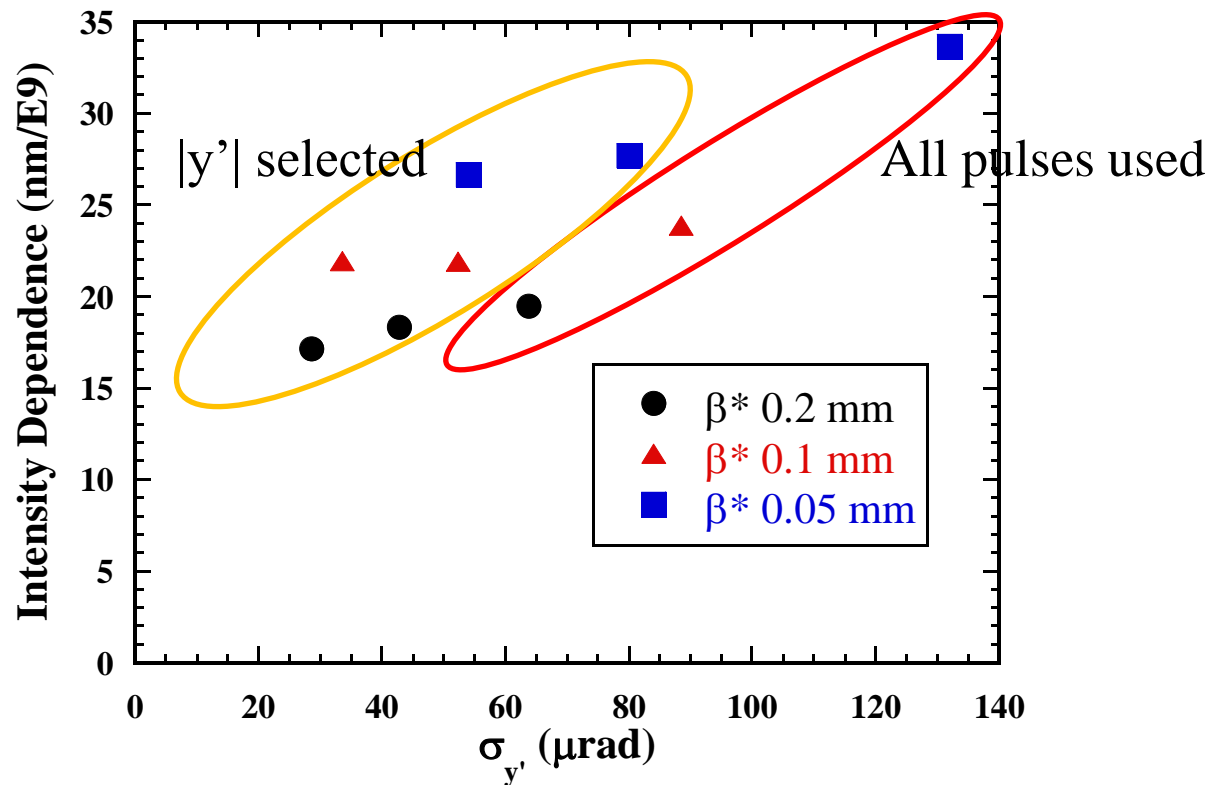
- Both widths were narrower than expected.
- Linear couplings ($y-E$, $y-x'$) could be corrected by linear tuning knobs.
- Nonlinear knobs ???

Need to understand

Wakefield

Part (not all) of intensity dependence could be explained by orbit jitter + wakefield.

Intensity dependence vs. RMS of y' at IP

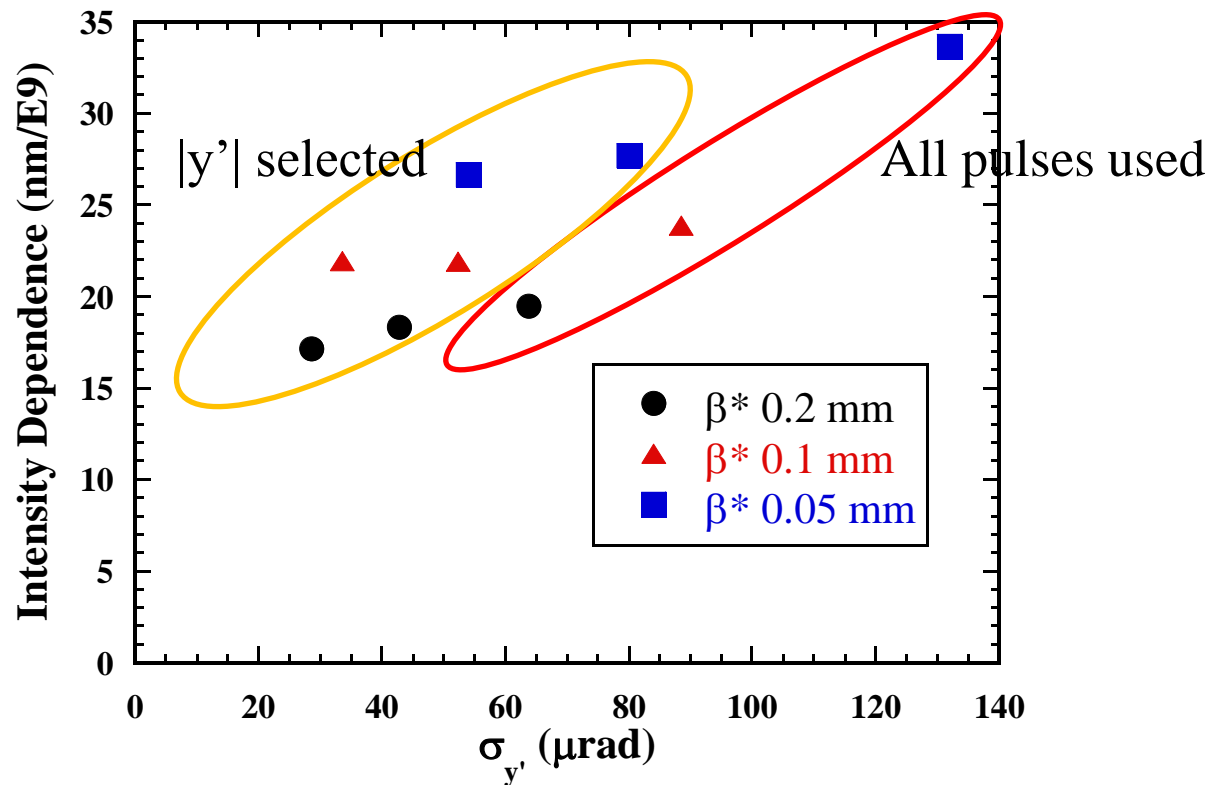


Assuming $\sigma_y^2(q) = \sigma_y^2(0) + w^2 q^2$

Use w as intensity dependence parameter (nm/nC or nm/1e9)

Part (not all) of intensity dependence could be explained by orbit jitter + wakefield.

Intensity dependence vs. RMS of y' at IP

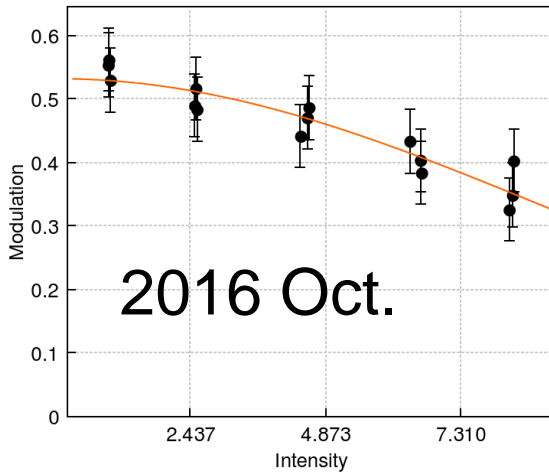


Wakefield reduced

Reduction reported (2016)

Intensity scan

Date: 2016/10/26 Time: 16:12:20



Fit results: $A \cdot \exp(-(x/B)^{2/2})$
Modulation: 0.533 +/- 0.021
Center: 0.000 +/- 0.000
Sigma: 9.048 +/- 0.944
Chi2/ndf: 3.4652e+00 / 13

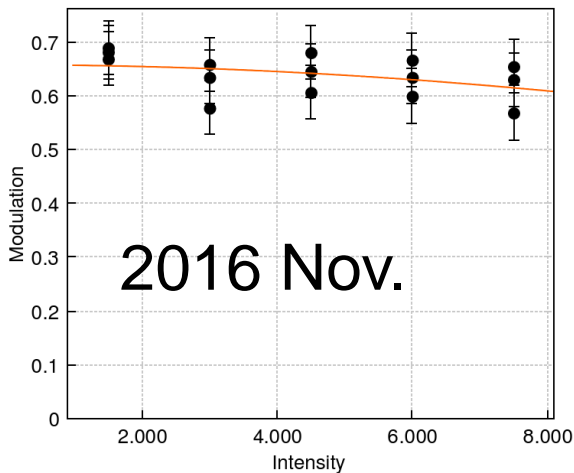
Data file:

Intensity_fringe_
161026_161220.dat

Removing some Cavity BPMs
Shielding flange gaps
Etc.

Intensity scan

Date: 2016/11/23 Time: 20:30:36



Fit results: $A \cdot \exp(-(x/B)^{2/2})$
Modulation: 0.658 +/- 0.021
Center: 0.000 +/- 0.000
Sigma: 20.482 +/- 9.037
Chi2/ndf: 6.6394e+00 / 13

Data file:

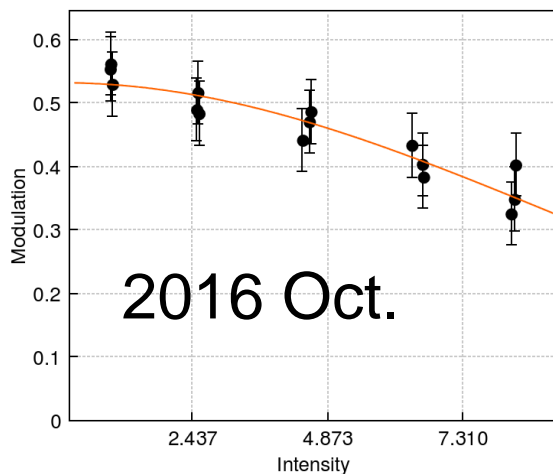
Intensity_fringe_
161123_203036.dat

Intensity dependence increased ?

Reduction reported (2016)

Intensity scan

Date: 2016/10/26 Time: 16:12:20



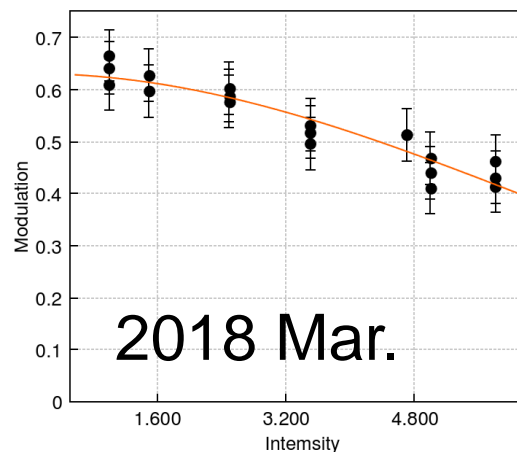
Fit results: $A \cdot \exp(-(x/B)^2/2)$
Modulation: 0.533 +/- 0.021
Center: 0.000 +/- 0.000
Sigma: 9.048 +/- 0.9
Chi2/ndf: 3.4652e+00

Data file:

Intensity_fringe_
161026_161220

Intensity scan

Date: 2018/03/13 Time: 00:37:41



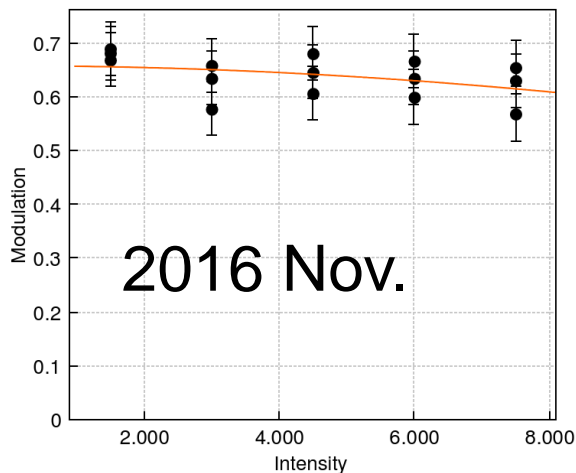
Fit results: $A \cdot \exp(-(x/B)^2/2)$
Modulation: 0.633 +/- 0.020
Center: 0.000 +/- 0.000
Sigma: 6.386 +/- 0.514
Chi2/ndf: 5.5366e+00 / 17

Data file:

Intensity_fringe_
180313_003741.dat

Intensity scan

Date: 2016/11/23 Time: 20:..



Fit results: $A \cdot \exp(-(x/B)^2)$
Modulation: 0.658 +/- 0.021
Center: 0.000 +/- 0.000
Sigma: 20.482 +/- 9.037
Chi2/ndf: 6.6394e+00 / 13

Data file:

Intensity_fringe_
161123_203036.dat

Misalignment?
Orbit?
Something changed?

Intensity dependence

May be from many different effects

- a) Wakefield + misalignment/orbit distortion
- b) Wakefield + orbit jitter
- c) Emittance growth in DR (Intra-beam scattering) + couplings (probably nonlinear)

→ need more study

Old Plan (Nov. 2015)

Non-linear aberrations

- a) Systematic measurement of dependence of IP vertical beam size on
 - Energy (Δf), Orbit (feedback target), β_{x^*}
- b) Study (check) effect of non-linear knobs

Intensity dependence (wakefield)

- c) Try to see effect of y' at IP phase orbit jitter by using BPM-IPBSM synchronized data (need many pulses data)
- d) Check effects of positions of wakefield sources on mover (both in vertical and horizontal directions)

Plan not changed

Non-linear aberrations

- a) Systematic measurement of dependence of IP vertical beam size on
 - Energy (Δf), Orbit (feedback target), β_{x^*}
- b) Study (check) effect of non-linear knobs

Intensity dependence (wakefield)

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No conclusions of a), b) and d) could be obtained. These items are still important.

Past problem

- Most studies needed reasonably small beam size (large modulation with IPBSM 174 degrees mode).
But, such conditions were rarely obtained.

What to do

- Have longer consecutive beam time (and man power)
- Probably (not confirmed), need tuning from upstream
 - Damping ring
 - Extraction (mOTR)
- Tuning and Stability of IPBSM is also essential
 - Take time if necessary

Future beam time schedule

- More Goal1 dedicated weeks
 - No other studies changing conditions in the weeks
- Include Ultra-low beta study
 - Efficiently use manpower and tuning time

Changes (?)

- Movers for skew sextupoles
 - One (out of four) is being prepared.
- Recover multi-OTR system for emittance measurement
- Other wakefield sources on mover?
 - e.g. bellows
- , , ,
- ???

Discussions?