

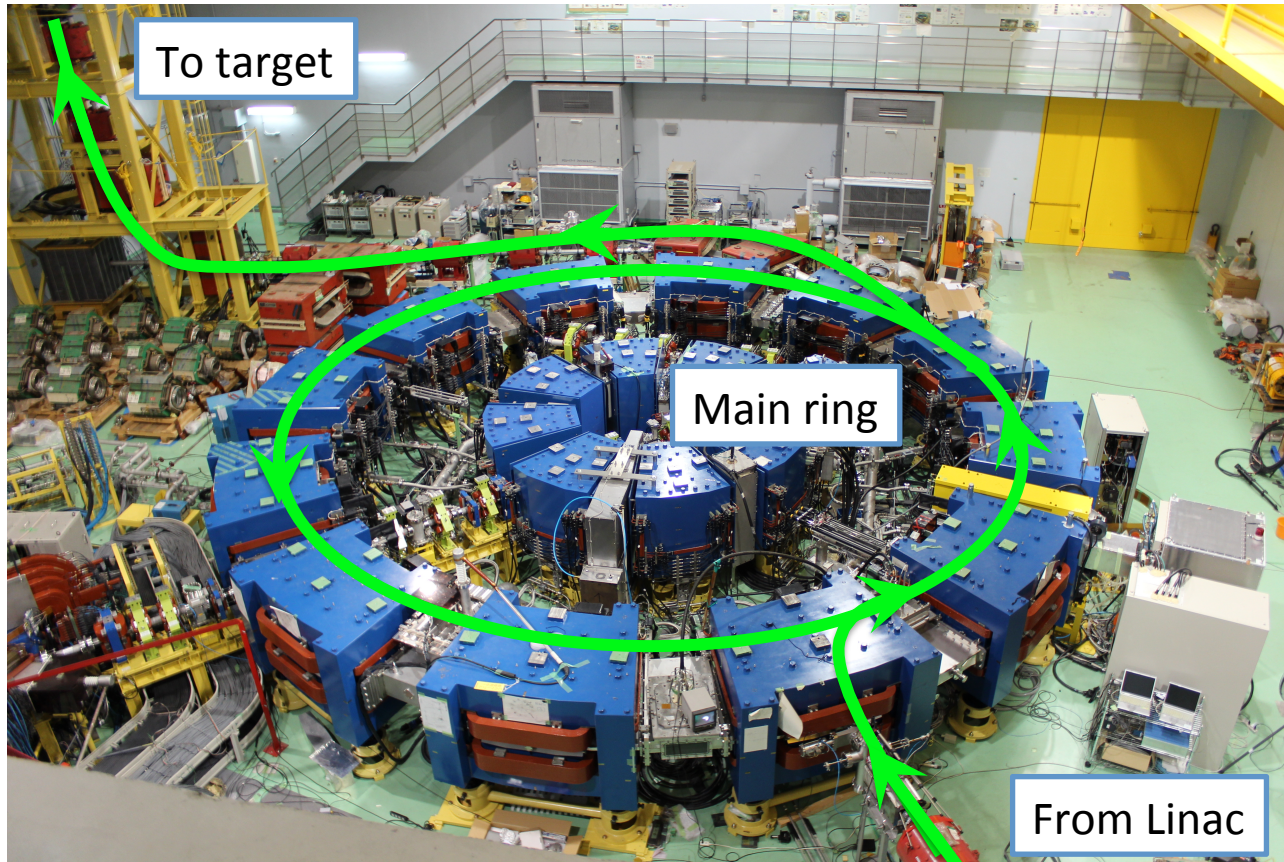
Measurement of betatron tunes

Mao Takabatake
Fukui University

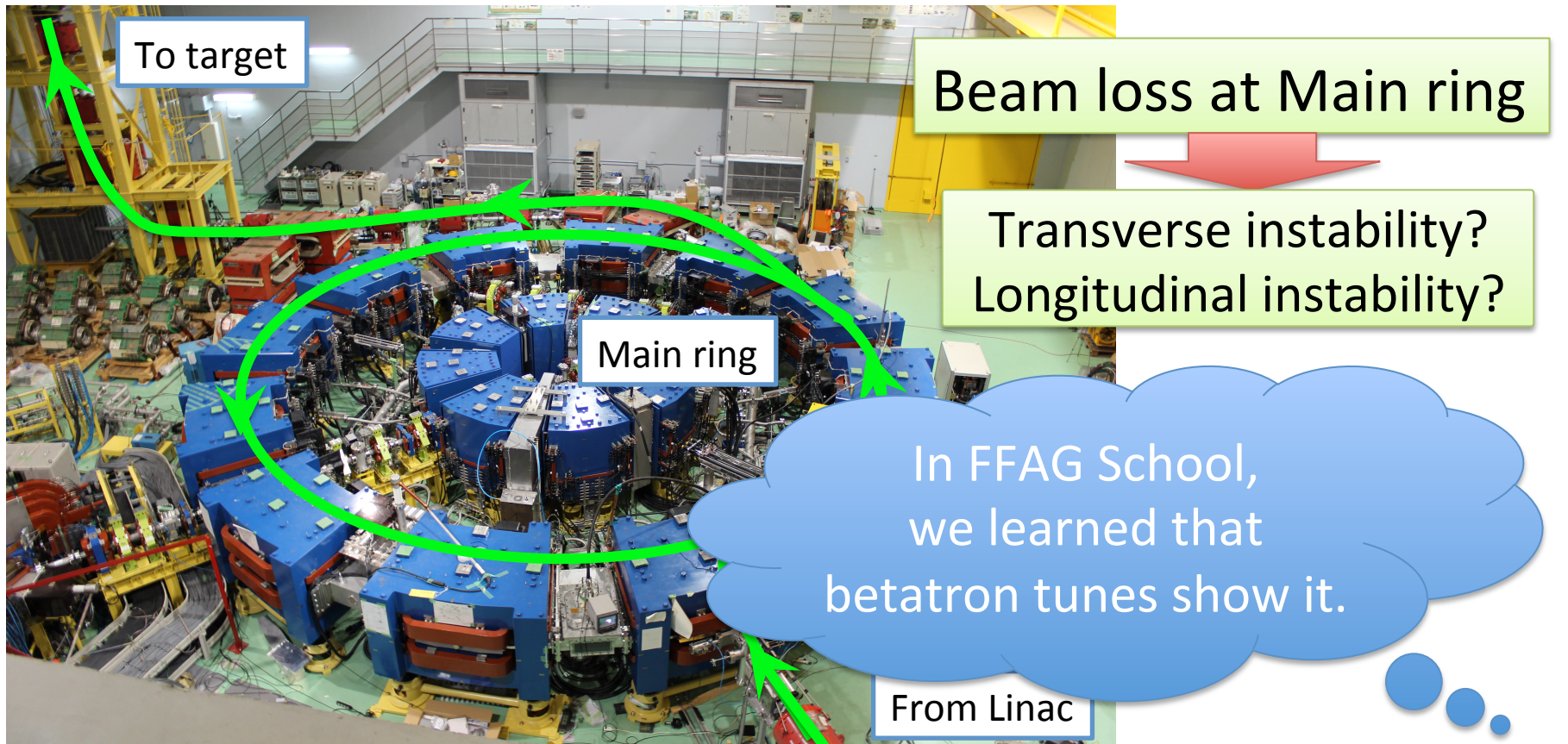
Outline

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Motivation



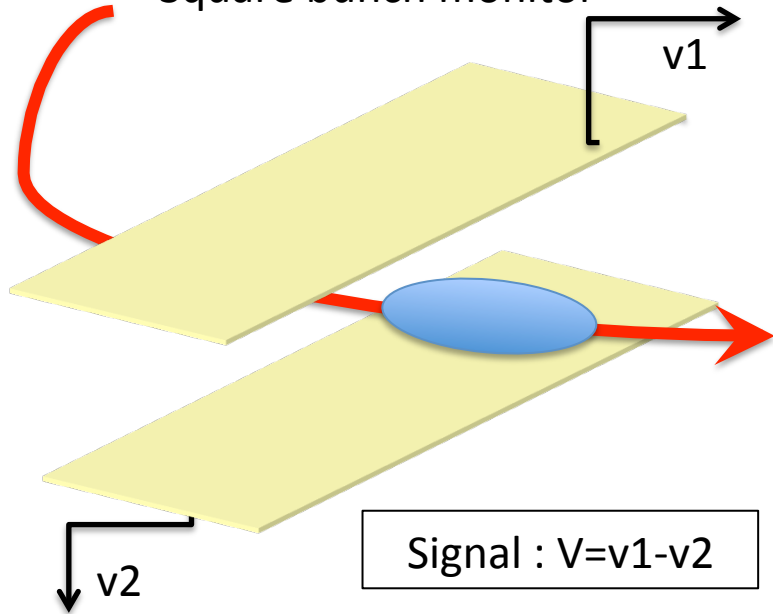
Motivation



Measure betatron tunes

How to measure

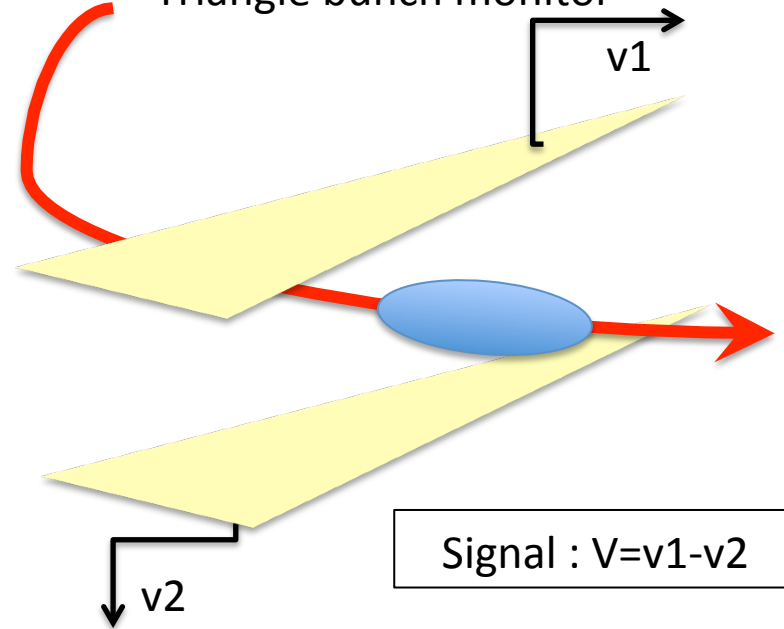
Square bunch monitor



$$\text{Signal : } V=v_1-v_2$$

Signal height depends on **vertical** oscillation

Triangle bunch monitor

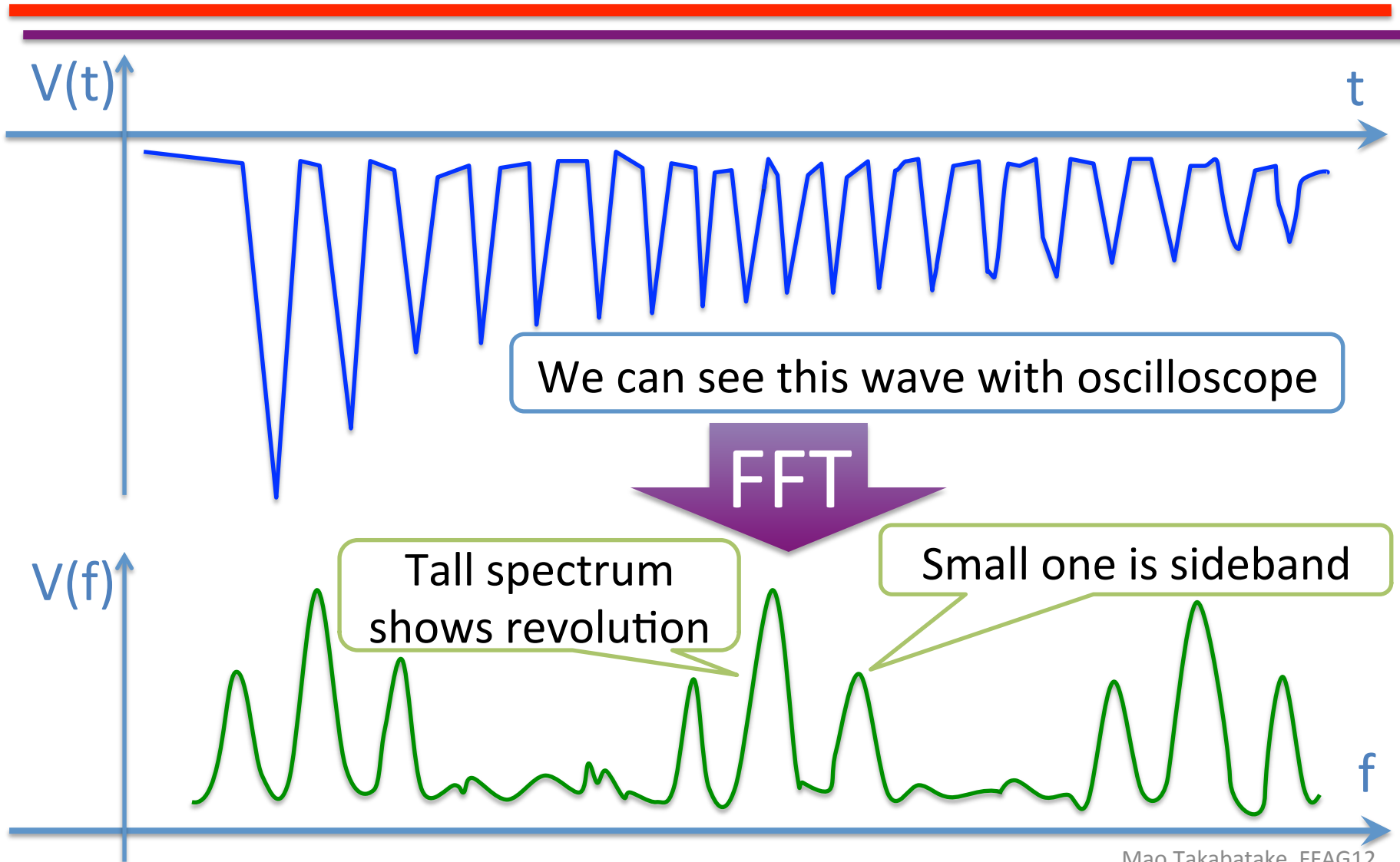


$$\text{Signal : } V=v_1-v_2$$

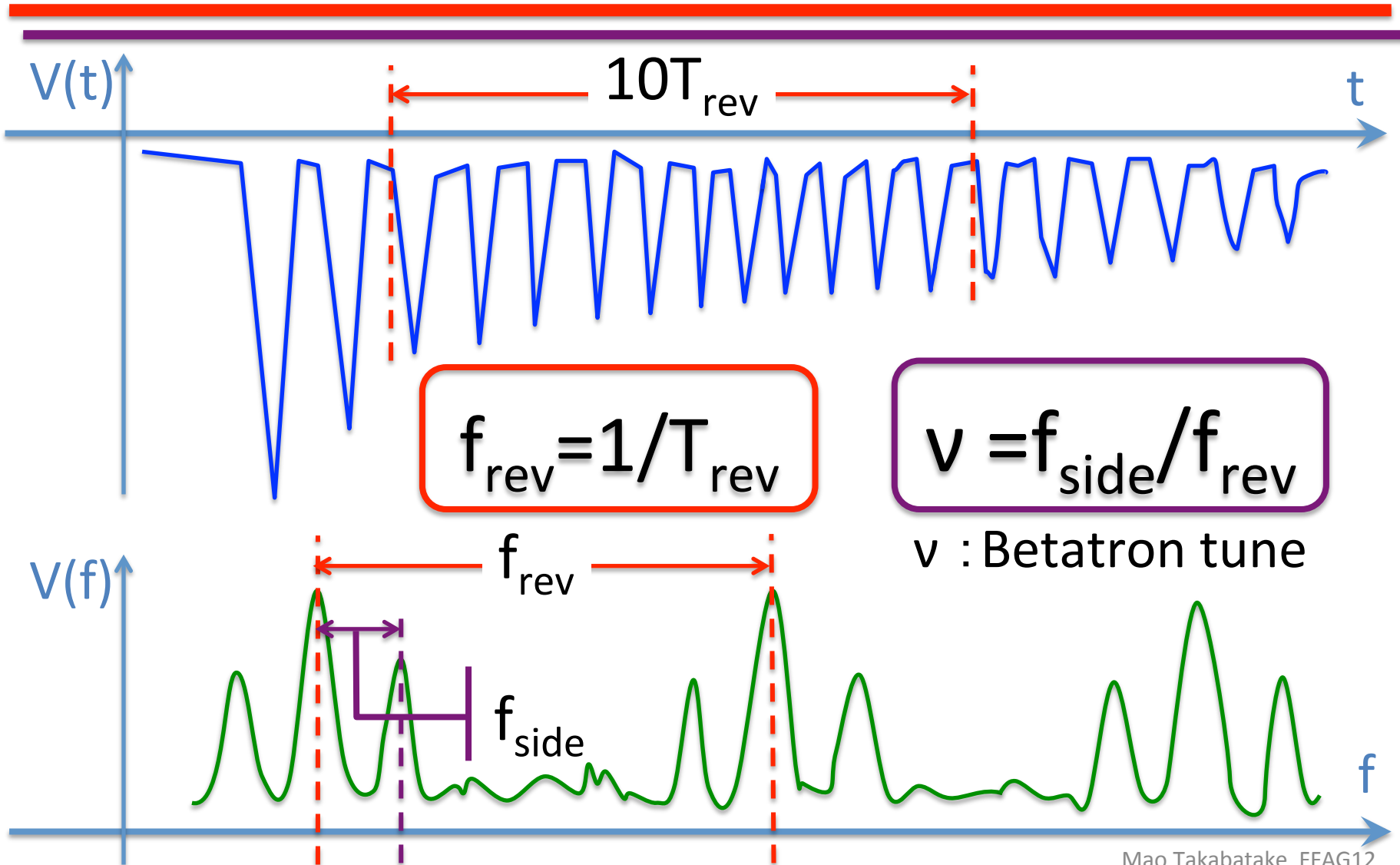
Signal height depend on **both** oscillations

Their difference shows **horizontal** oscillation

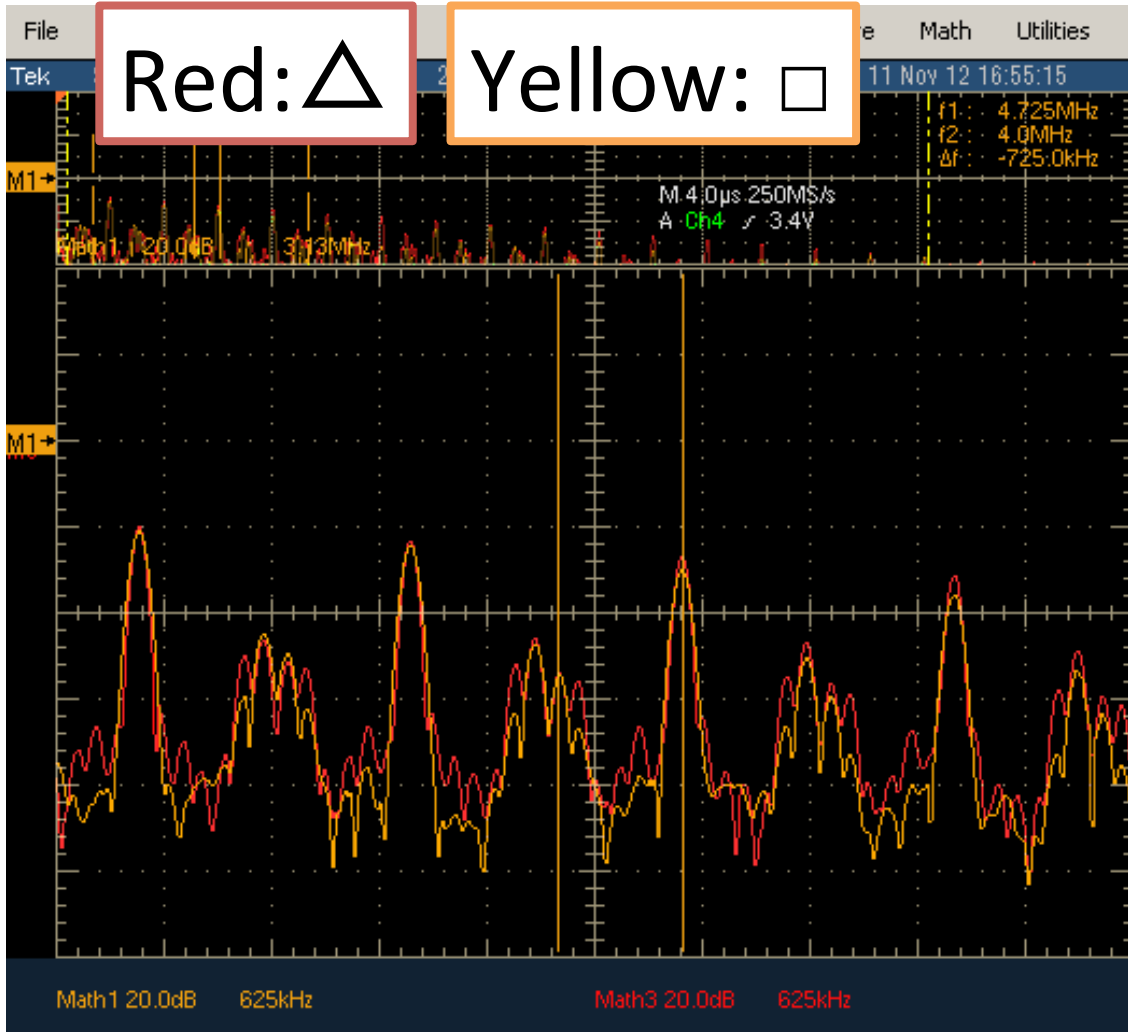
How to measure



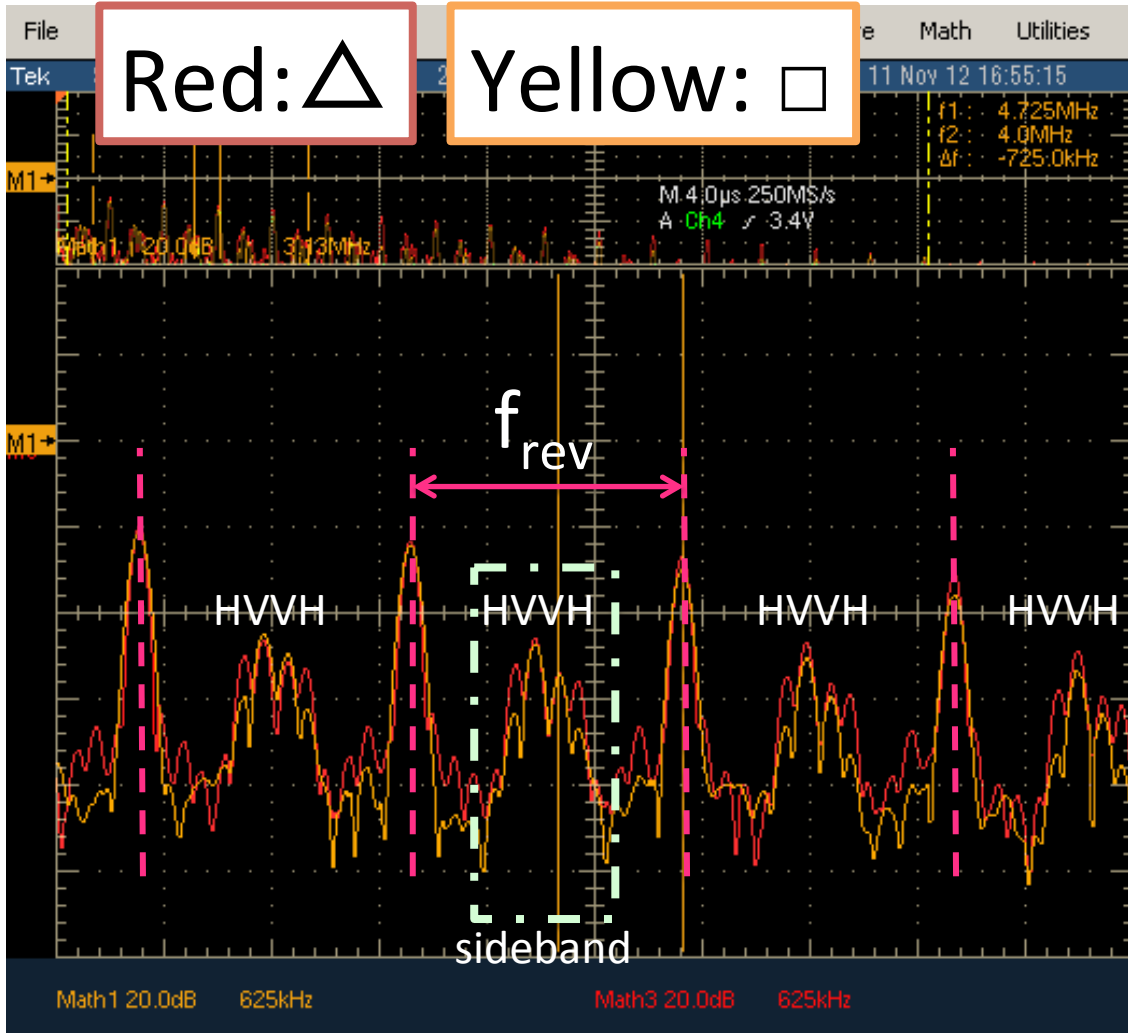
How to measure



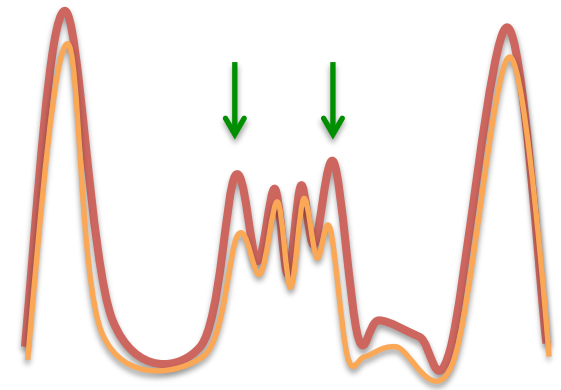
Experiments



Experiments



H: horizontal
V: vertical



These difference show horizontal position

We want to make it more surely...

Experiments



They differ in the current
of defocus magnet

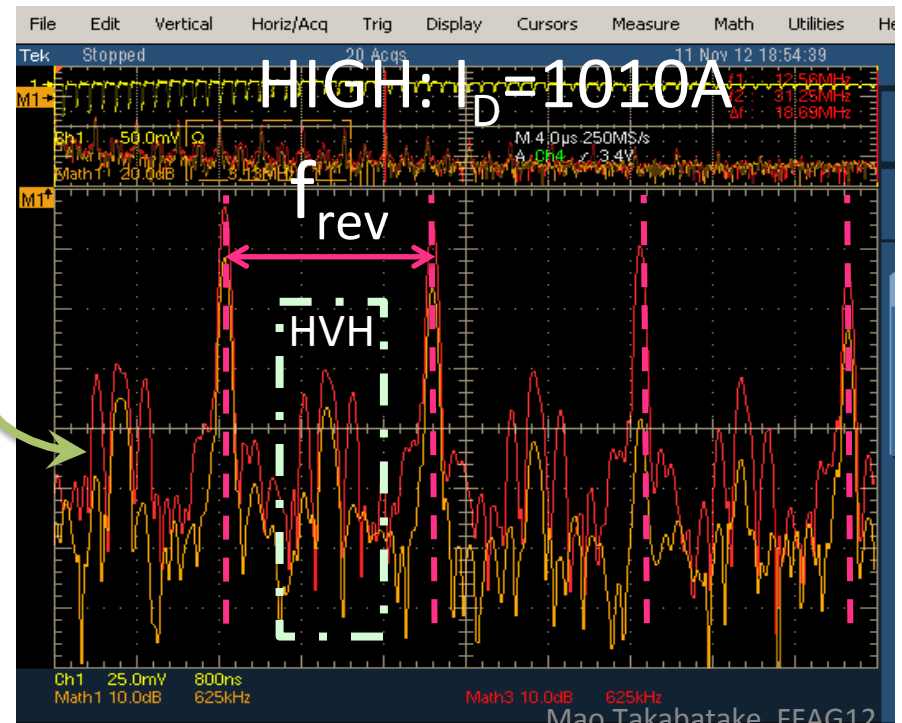
Red: Δ

$$v_x^2 \approx 1 + k$$

$$v_y^2 \approx -k + F^2(1 + 2 \tan^2 \varepsilon)$$

Yellow: \square

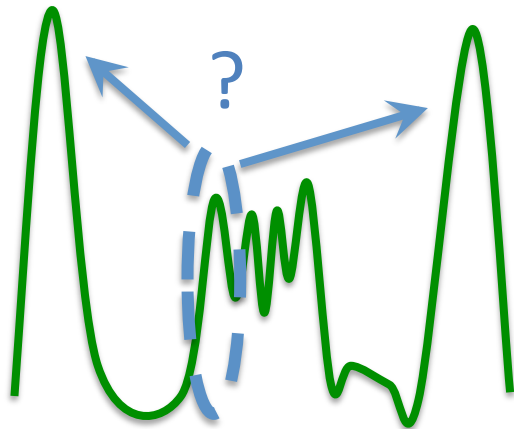
$$F^2 = \frac{\langle (B - B_{ave})^2 \rangle}{B_{ave}^2}$$



The spectrum of V unites!

Result

I_D [A] (F/D)	970 (814/970)	1010 (814/1010)
f_{rev} [MHz]	1.575	1.575
f_{side} [MHz] : horizontal	0.6125	0.6094
f_{side} [MHz] : vertical	0.725	0.740
v : horizontal	0.388 OR 0.612	0.386 OR 0.614
v : vertical	0.460 OR 0.540	0.470 OR 0.530



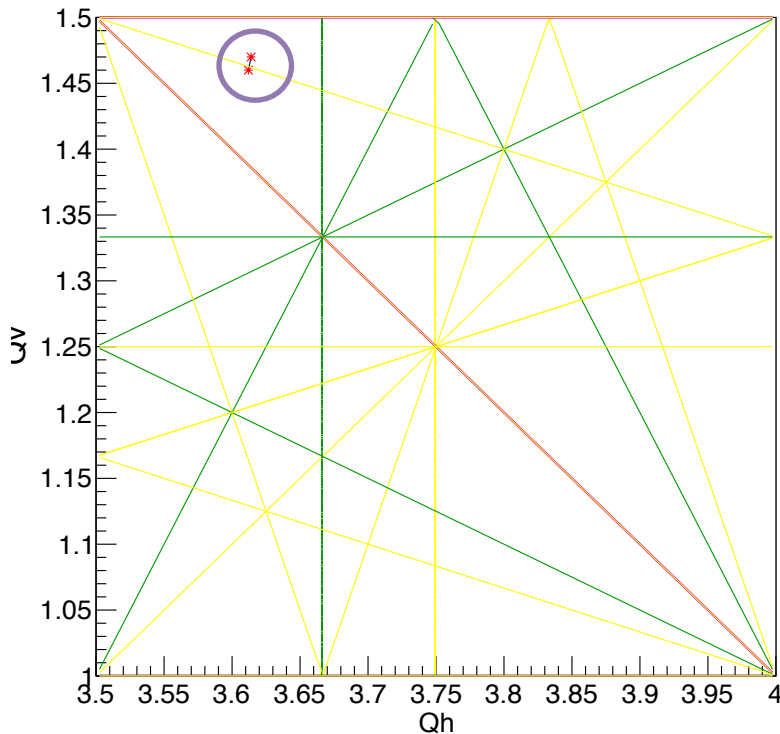
We **cannot** judge only by experimental result which harmonic of the spectrum is master.

Estimation

- How to judge which is master?

→ We must check design of this ring

tune diagram



I_D [A] (F/D)	970 (814/970)	1010 (814/1010)
v : horizontal	0.612	0.614
v : vertical	0.460	0.470



Summary

- We measured betatron tunes for 2 different F/D ratios.
- We estimate betatron tunes.
- Betatron tunes is ...

I_D [A] (F/D)	970 (814/970)	1010 (814/1010)
ν : horizontal	0.612	0.614
ν : vertical	0.460	0.470