

RR RF Calibration

by Measuring the Synchrotron Frequency in Linear Bucket

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RR Group Meeting

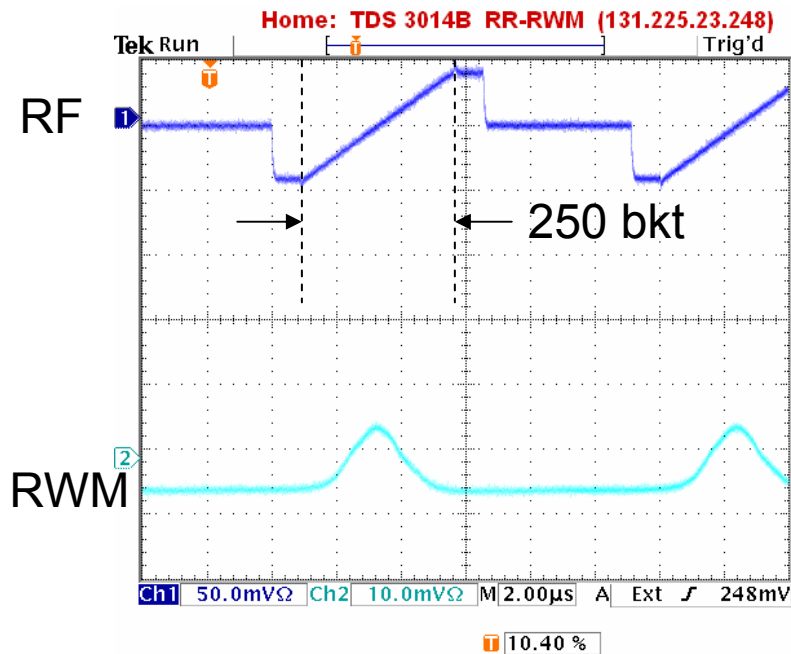
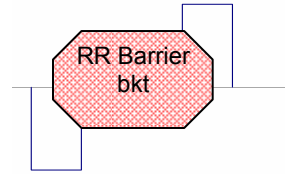
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(Preliminary)

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Linear Bucket and the Measurement of Synchrotron Frequency



$$f_s = \sqrt{\frac{|\eta| \frac{dV}{dt}}{4\pi^2 \beta_s^2 E_s T_0}}$$

$\eta = -0.0085$ Slip factor of the RR

$\beta_s =$ Relativistic Velocity = 0.9945

$E_s =$ Synchronous Energy = 8.938 GeV

$T_0 =$ Revolution Period = 1.11E - 05 sec

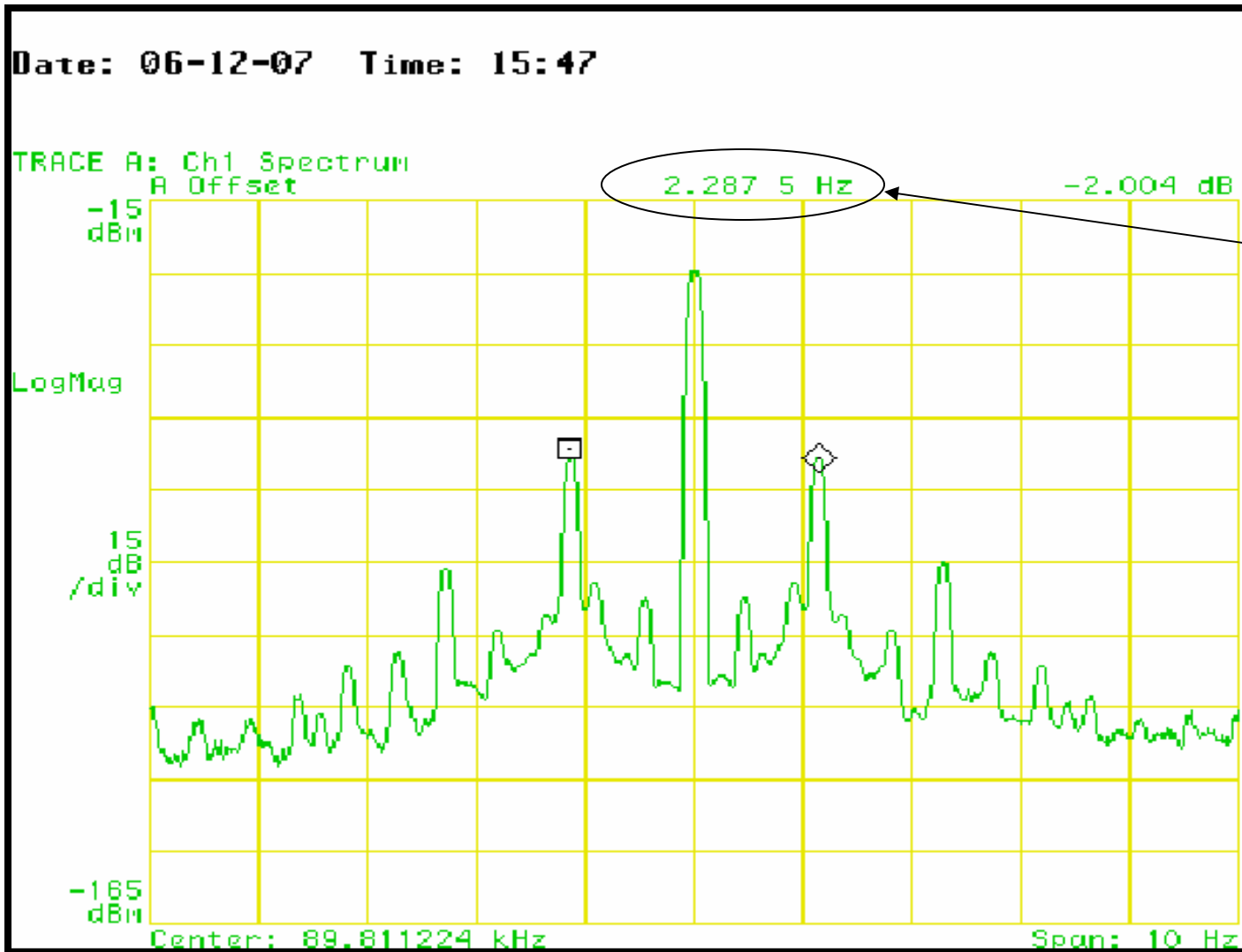
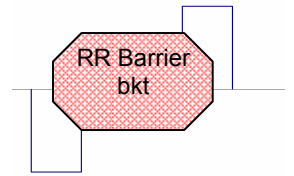
The synchrotron oscillation frequency of the beam in the linear bucket is measured as a function of different gain on R:FARBG3 using

1. VSA. The VSA was in scalar mode, centered at 89811.224 Hz, span 10 Hz, resolution bandwidth 100 mHz.
2. R:VDQ28 (phase detector)

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VSA data with R:FARBG3= 1.0

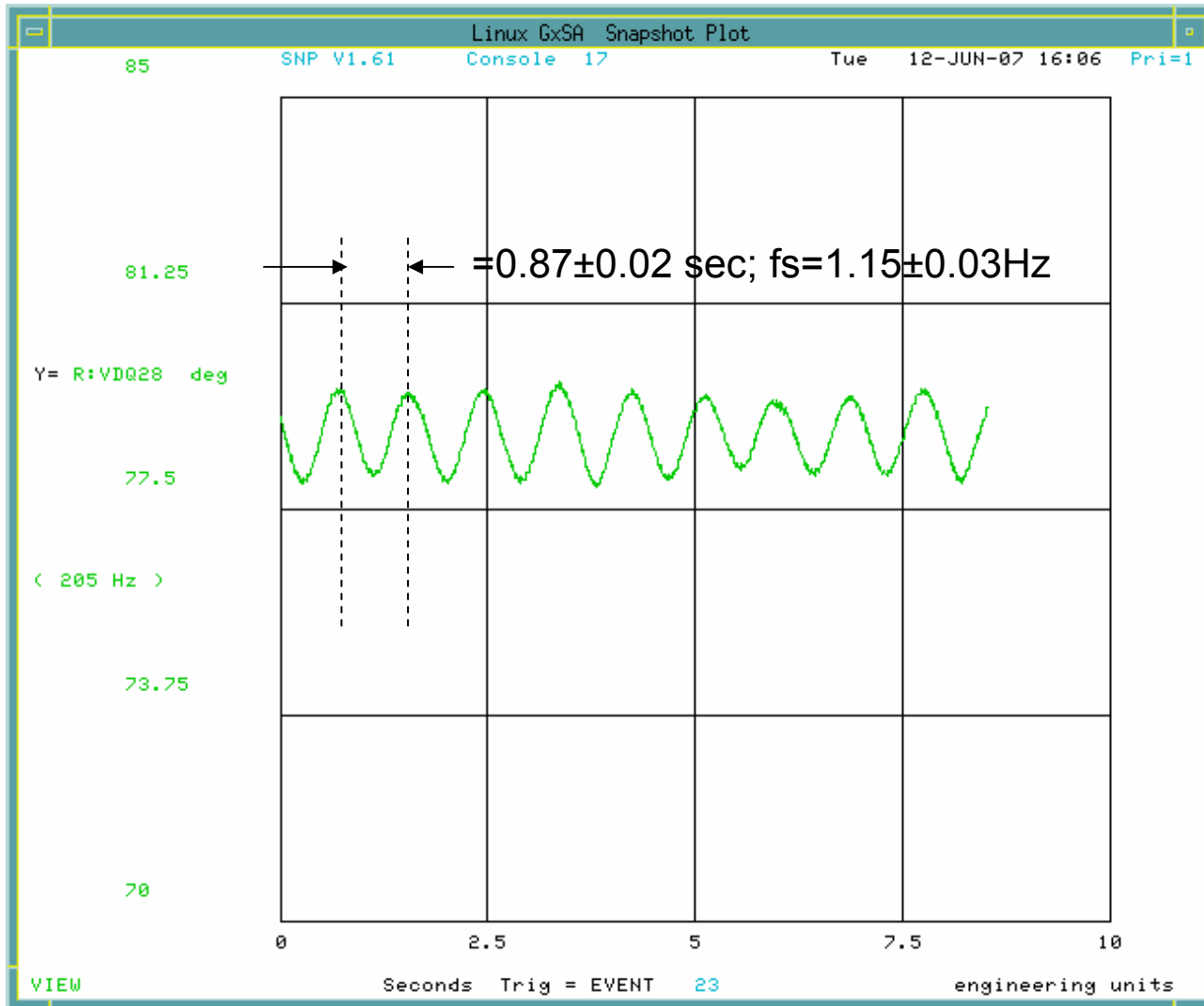
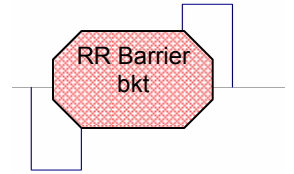


= 2*fs

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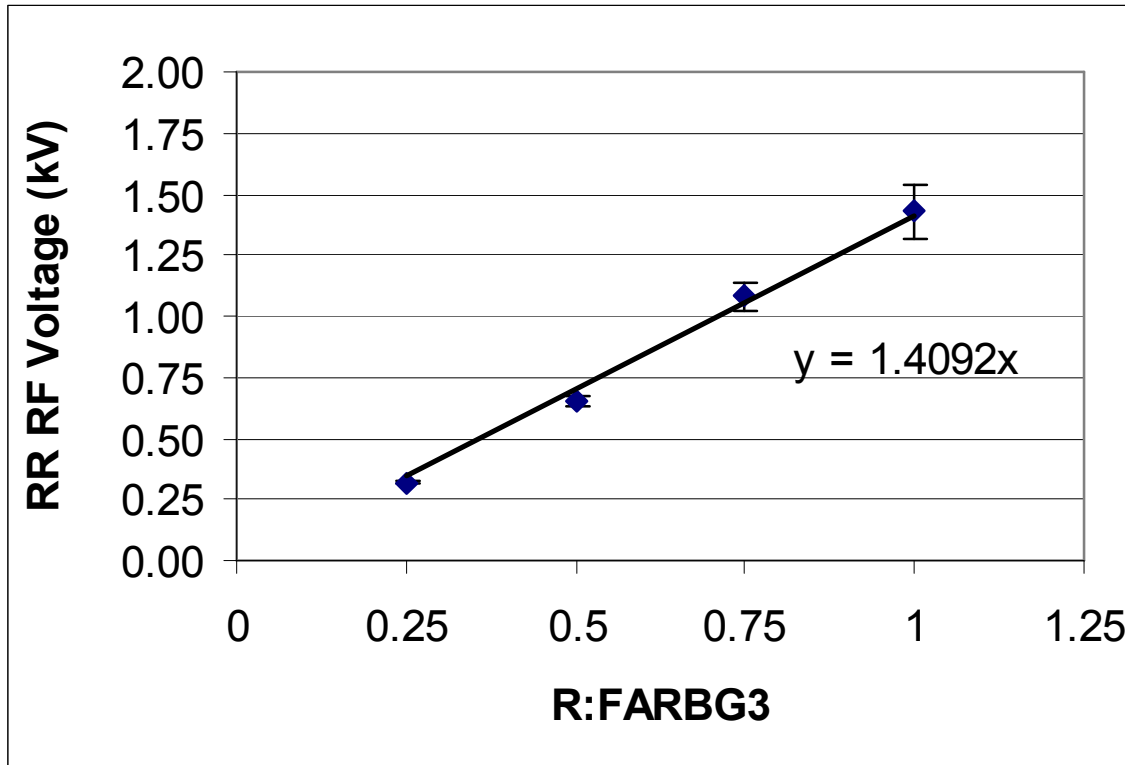
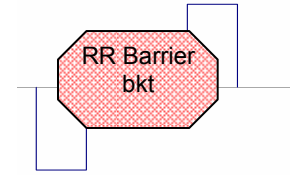
R:VDQ28 data with R:FARBG3= 1.0



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Voltage Calibration



$$V = \frac{\text{Bucket Width}}{2} \times \frac{dV}{dt}$$
$$= 2.3668\text{us} \frac{4\pi^2 \beta_s^2 E_s T_0 f_s^2}{|\eta|}$$

Conclusions:

1. Preliminary analysis shows that the VSA and R:VDQ28 data agree within about 2%
2. With ARB gain of 1 the available RR RF voltage is $1.43 \pm 0.11\text{kV}$