

Longitudinal Instabilities in BEPC-II Positron Ring

Yue Junhui¹, Dmitry Teytelman³, et al.

¹IHEP, Beijing, China

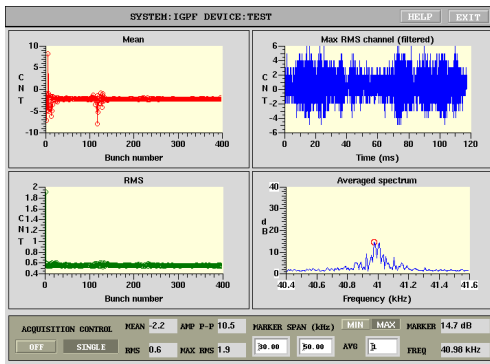
³Dimtel, Inc., San Jose, CA, USA

November 7, 2008

Outline

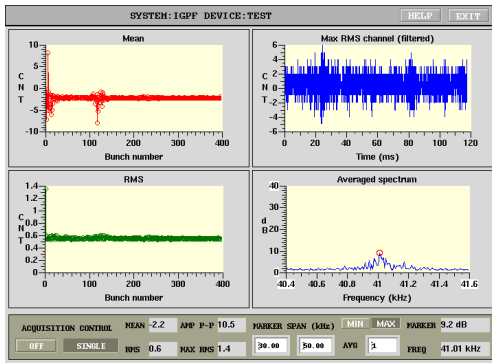
- 1 System Setup
- 2 Grow/Damp Measurements

Single Bunch Setup



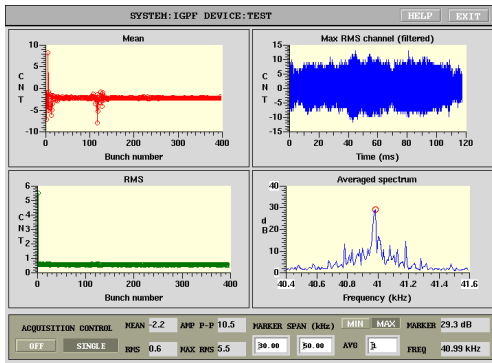
- Start from timing front and back-ends;
- Beam is excited by RF system noise in the open loop;
- Applying negative feedback we reduce the noise level;
- Positive feedback excites the beam.

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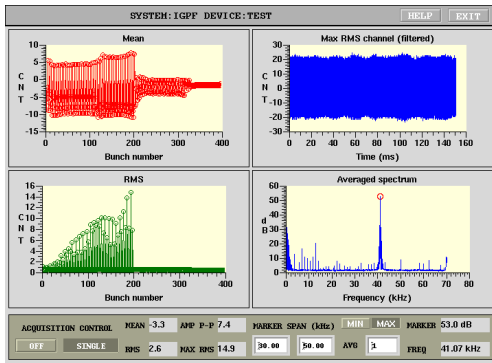
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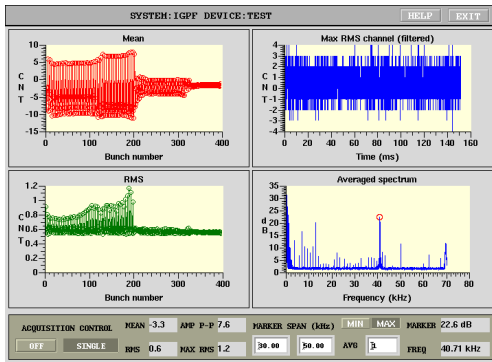
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Multibunch Test



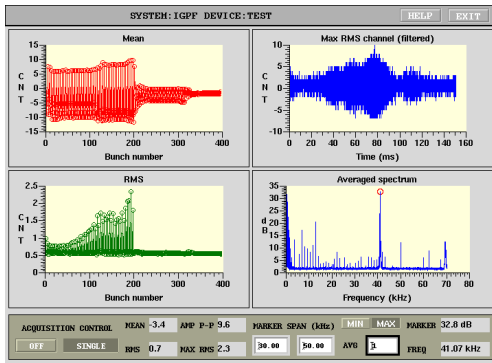
- At 60 mA the beam is unstable longitudinally;
- Feedback damps the motion;
- Can also perform grow/damp measurements.

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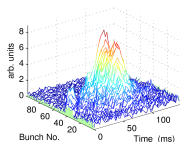
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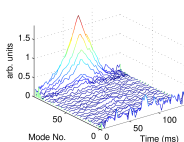
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Longitudinal Grow/damp

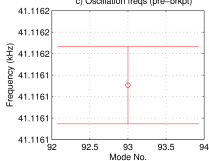
a) Osc. Envelopes in Time Domain



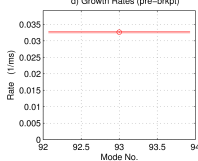
b) Evolution of Modes



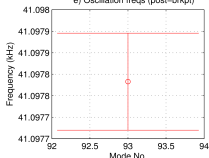
c) Oscillation freqs (pre-brkpt)



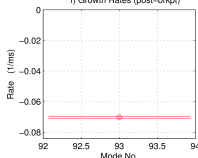
d) Growth Rates (pre-brkpt)



e) Oscillation freqs (post-brkpt)



f) Growth Rates (post-brkpt)

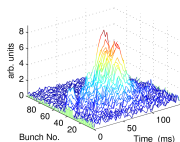


BEPC-2:nov0608/162011: Io= 57.8376mA, Dsamp= 9, ShfGain= 4, Nbun= 99,
At Fs: G1= 3.8123, G2= 0, Ph1= 130.3313, Ph2= 0, Brkpt= 13450, Calib= 1.

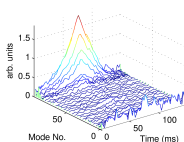
- Very clean growth and damping;
- Mode -6(93) dominates;
- Impedance at $124.95 \times n - 7.57$ MHz;
- Growth rate of 0.03 ms^{-1} ;
- Damping rate of 0.07 ms^{-1} ;

Longitudinal Grow/damp

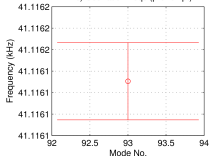
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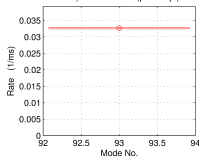
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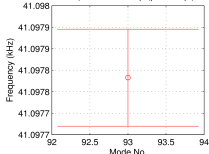
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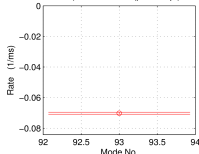
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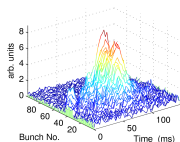


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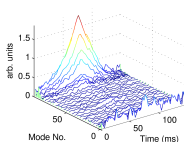
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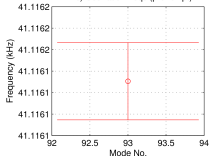
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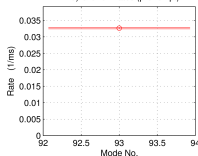
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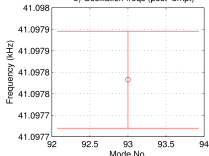
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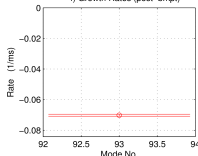
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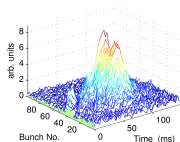


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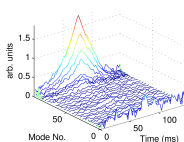
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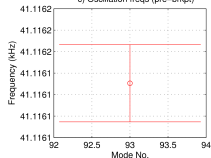
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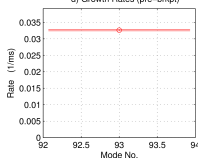
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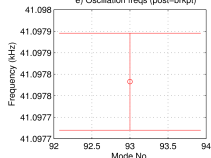
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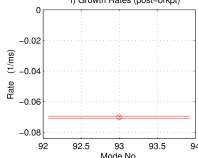
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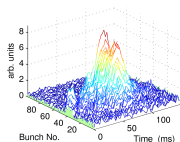


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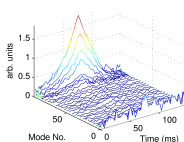
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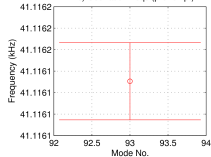
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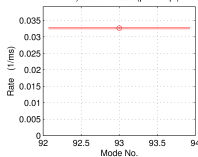
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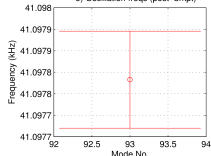
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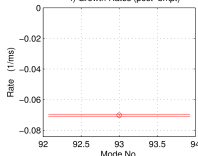
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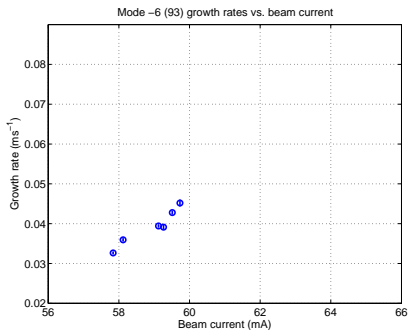
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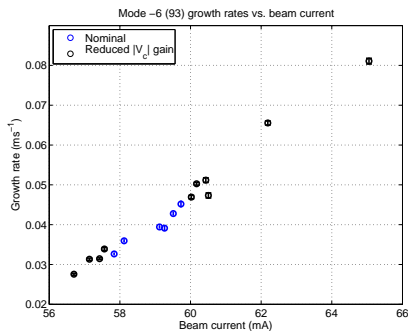
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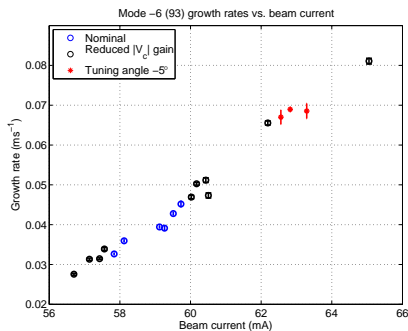
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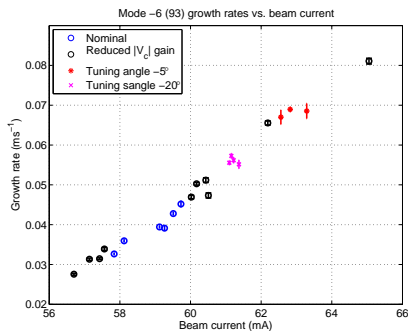
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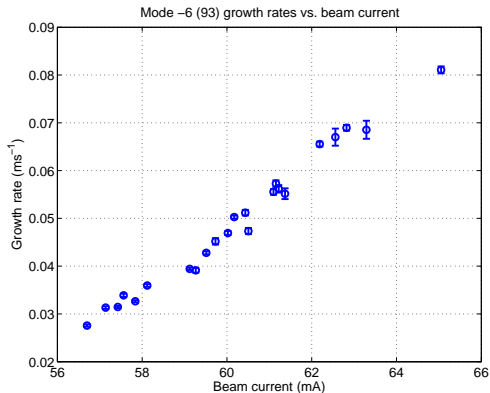
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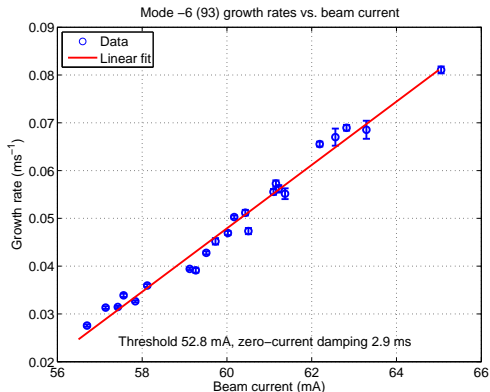
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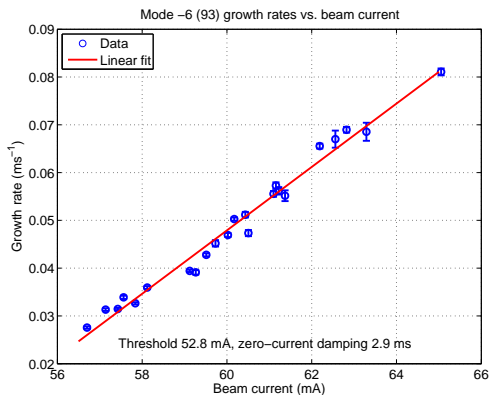
- Combine all measurements;
- Reasonably linear;
- Zero-current damping over-estimated.

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- Observed longitudinal motion is driven by an instability with ~ 53 mA threshold;
- Have not found any link to RF configuration;
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