Longitudinal Instabilities in BEPC-II

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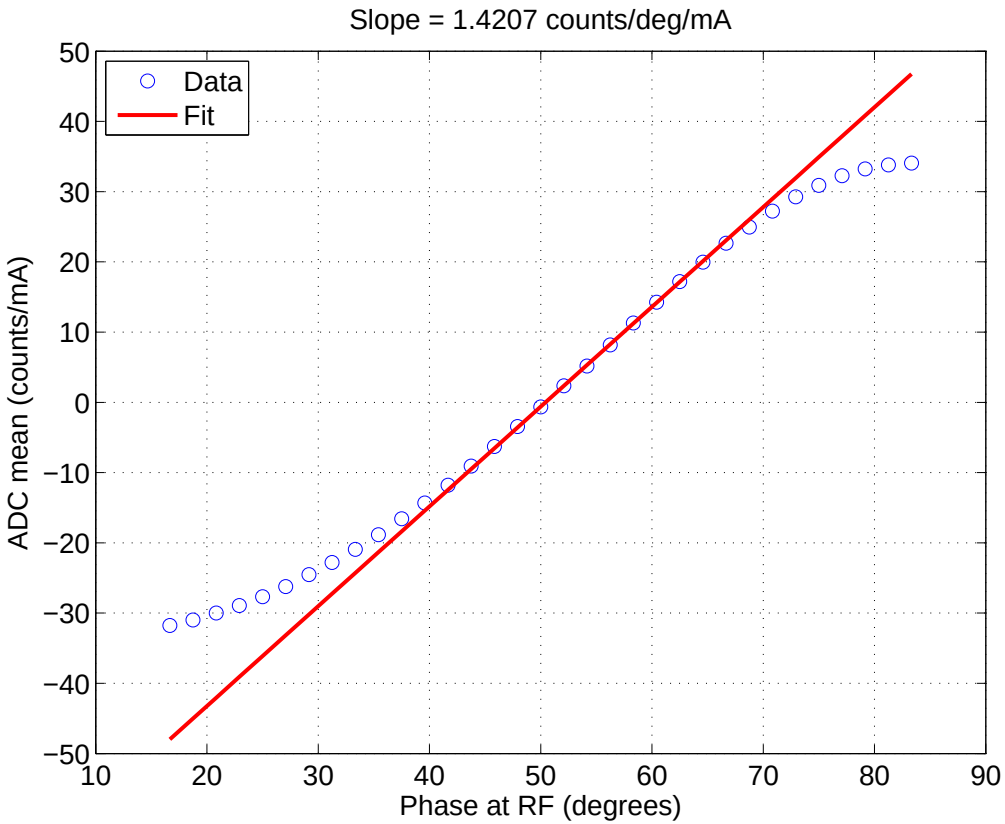
November 9, 2008

Outline

1. Saturated Oscillation Amplitudes
2. Electron Ring Measurements
3. Positron Ring Measurements
4. Observed Differences

Calibration Example: Electron Ring



- Move front-end phase shifter;
- Record average of the filled bunch;
- Performed automatically using "sweep" script;
- Slope around zero crossing is our calibration factor.

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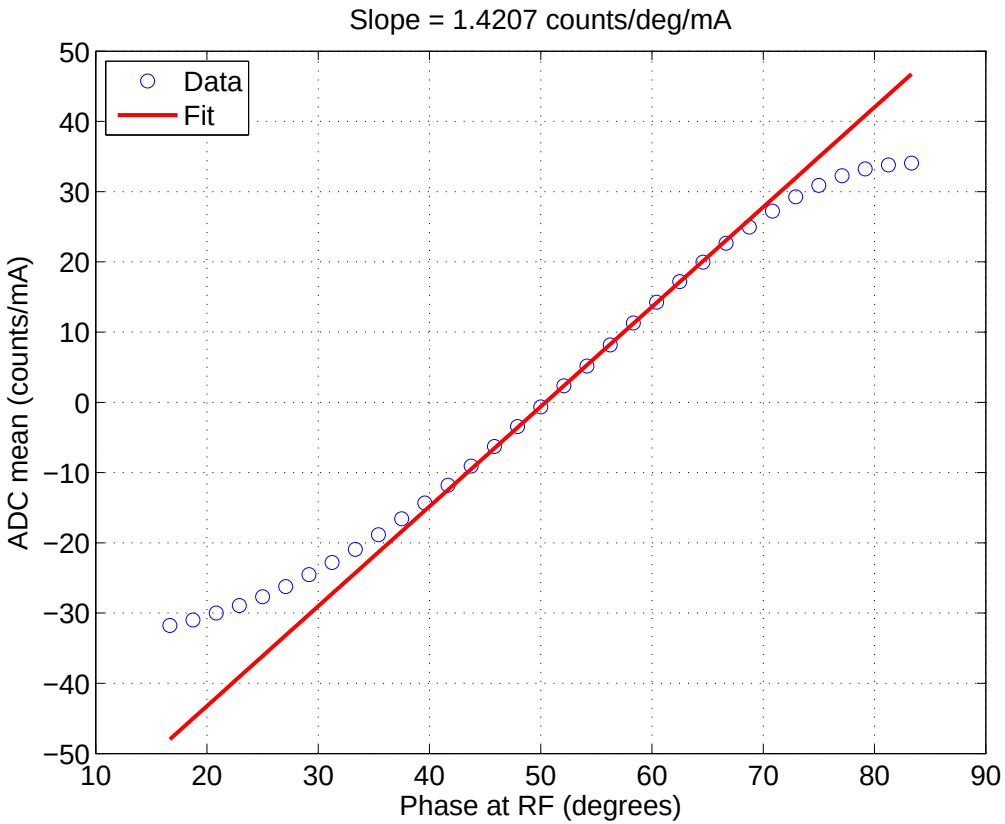

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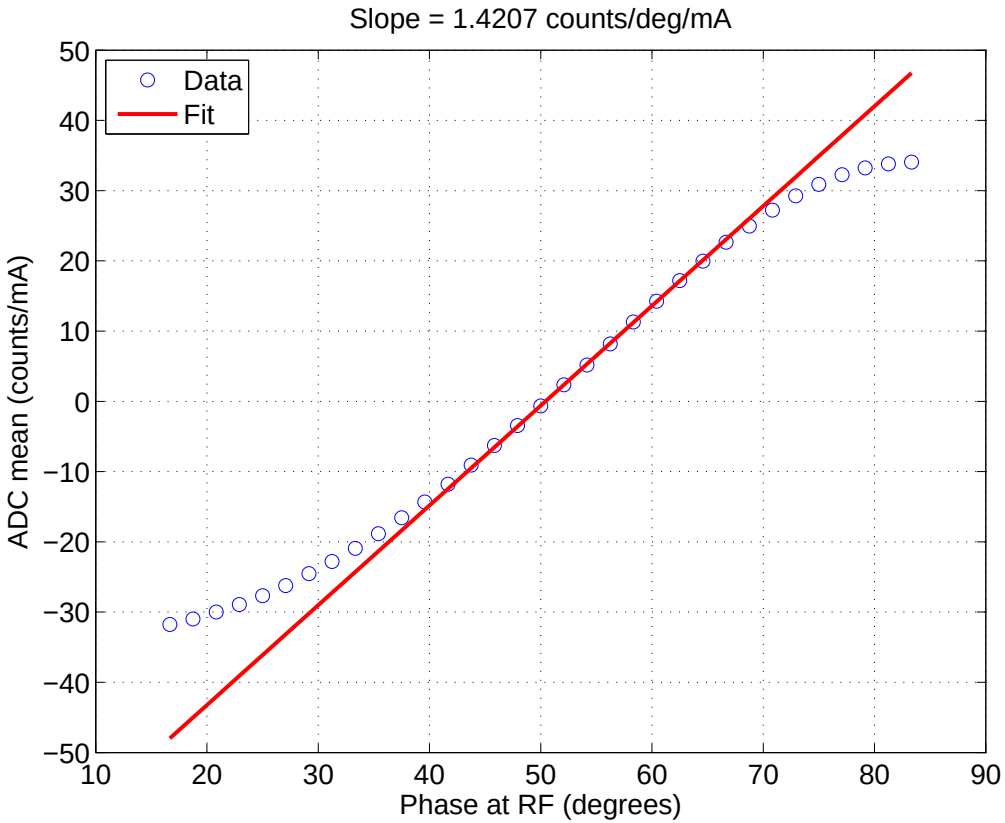

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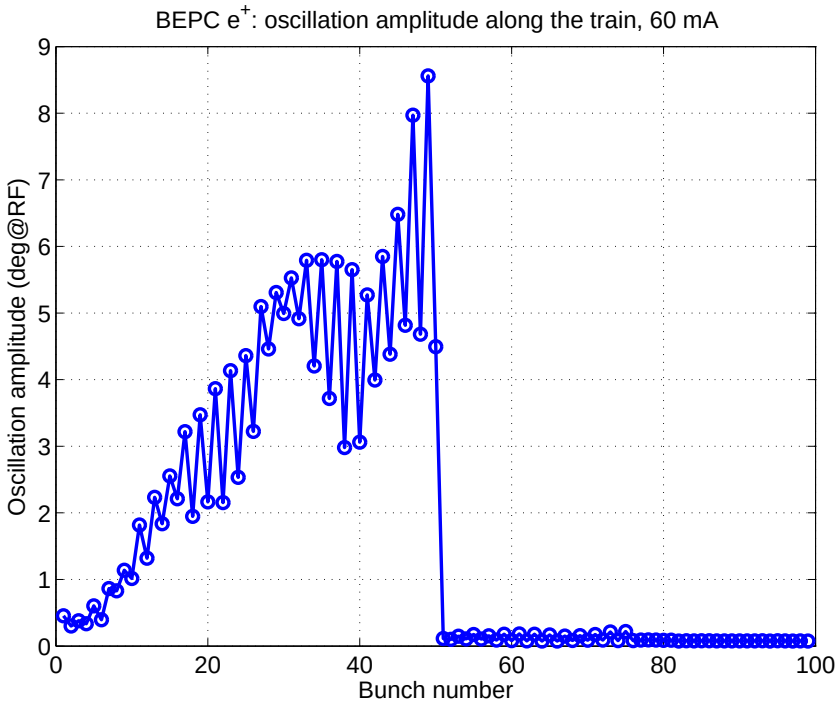
Oscillation Amplitudes



Positron ring:

- Oscillation amplitudes of 9° at RF;
- 100 ps peak-to-peak.

Electron ring:

- Oscillation amplitudes of 22° at RF;
- 244 ps peak-to-peak.

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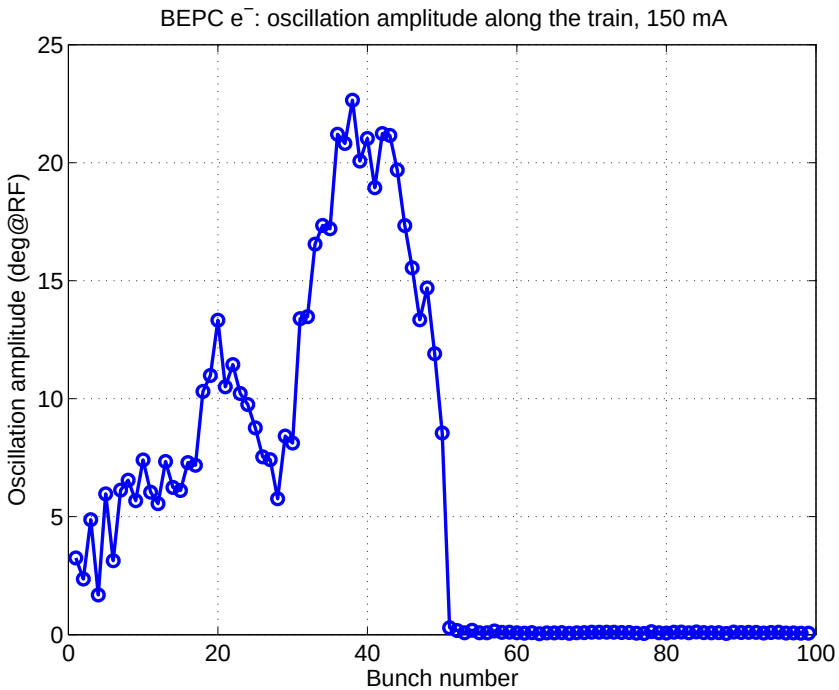

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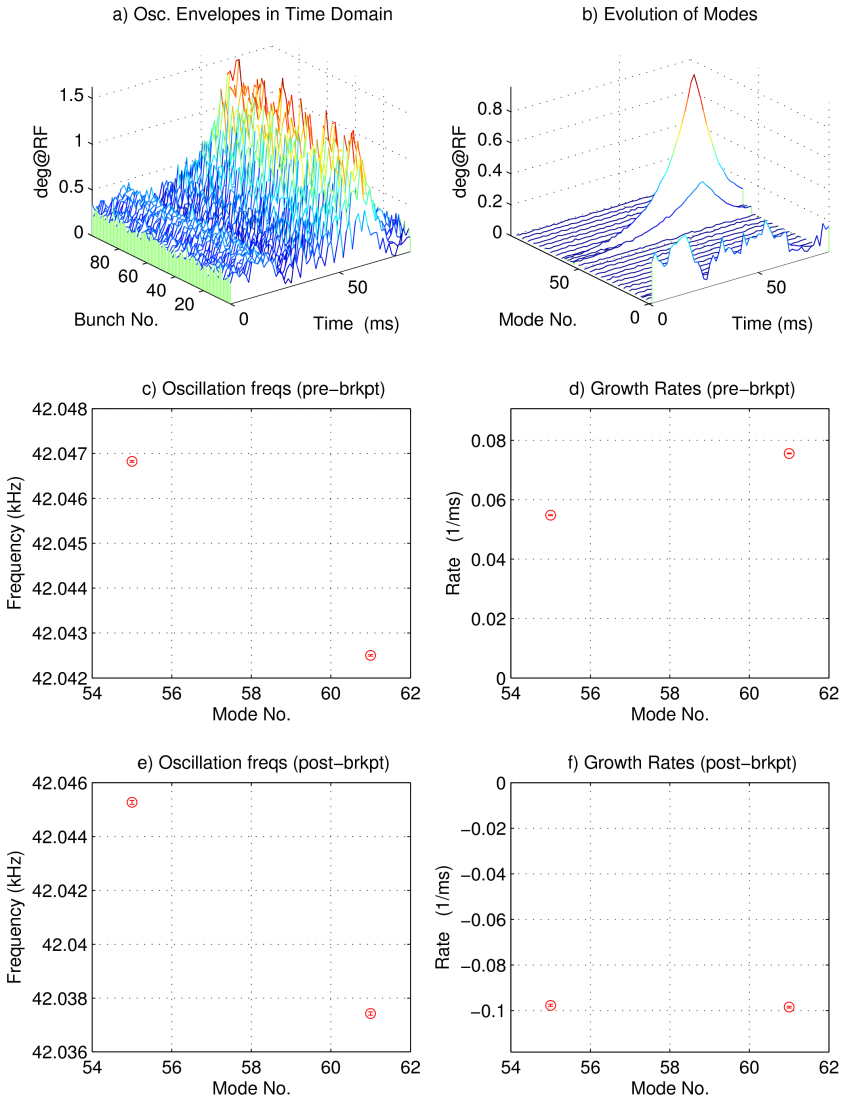
Grow/damp Measurement



BEPC−II E−:nov0708/024925: Io= 273.063mA, Dsamp= 10, ShifGain= 4, Nbun= 99,
At Fs: G1= 6.3492, G2= 0, Ph1= −62.2095, Ph2= 0, Brkpt= 8000, Calib= 1.4207.

- Reached 275 mA with feedback;
- Stopped due to lack of time;
- Two dominant modes: 55 and 61;

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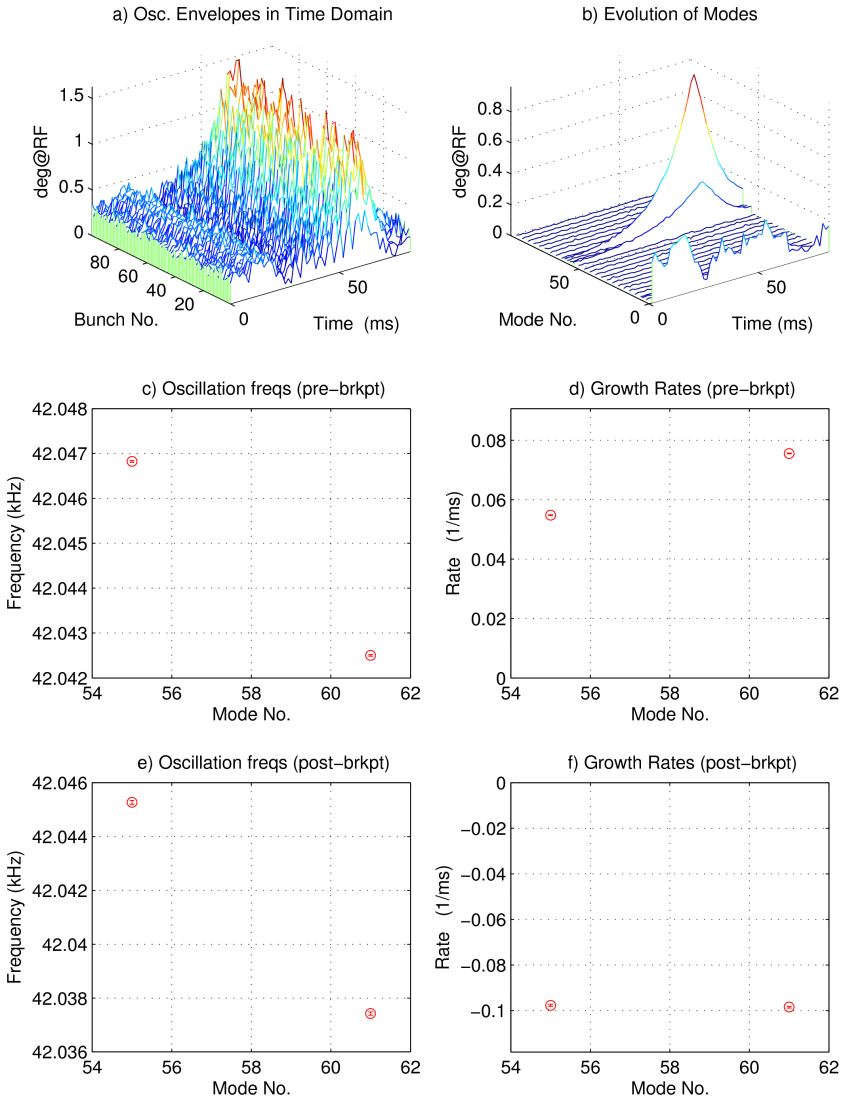

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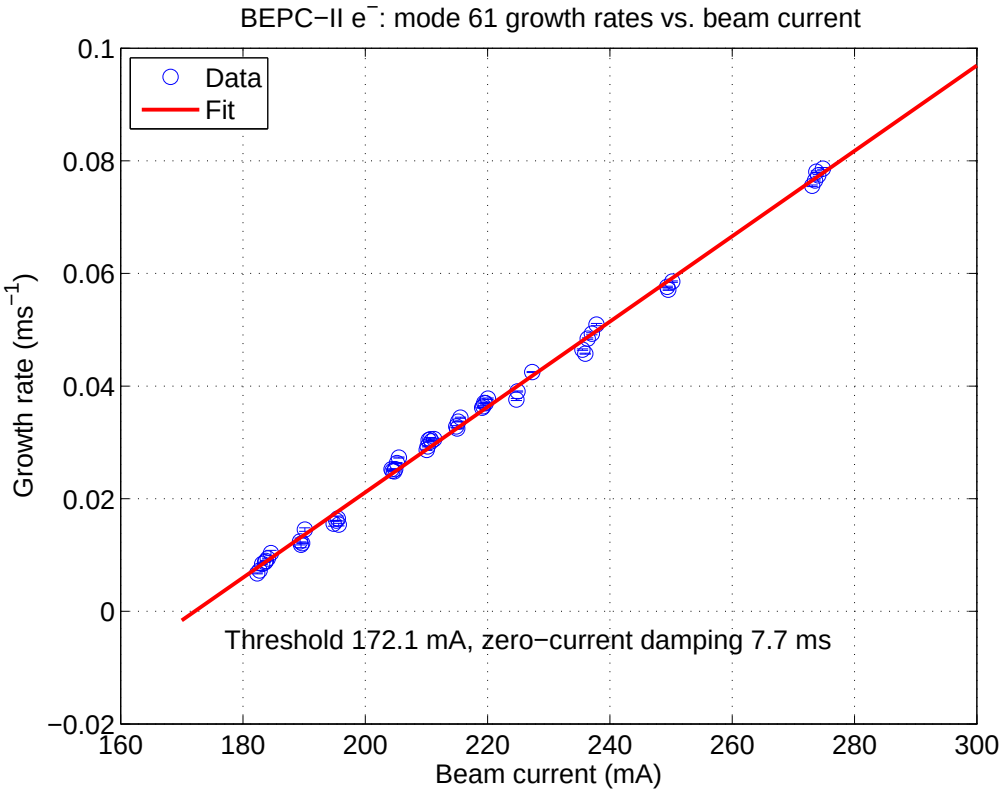
Mode 61 Growth Rates vs. Beam Current



- 52 data sets;
- Nice linearity;
- At 1 A estimated growth rate is $0.62\ \mathrm{ms}^{-1}$.

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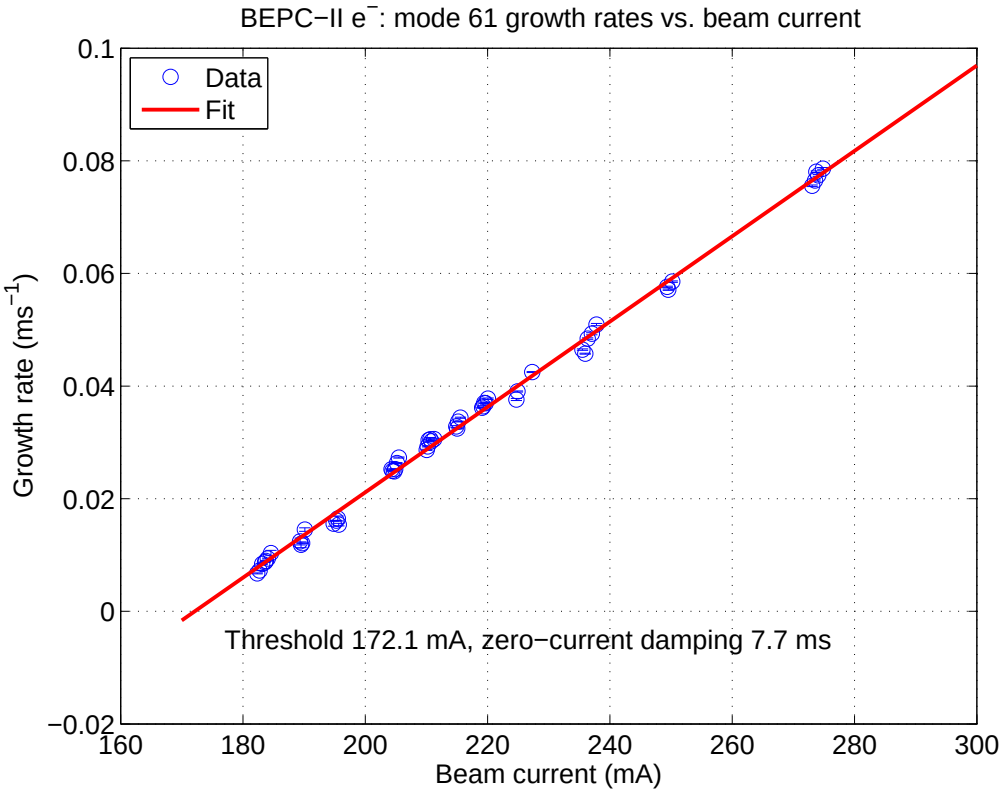

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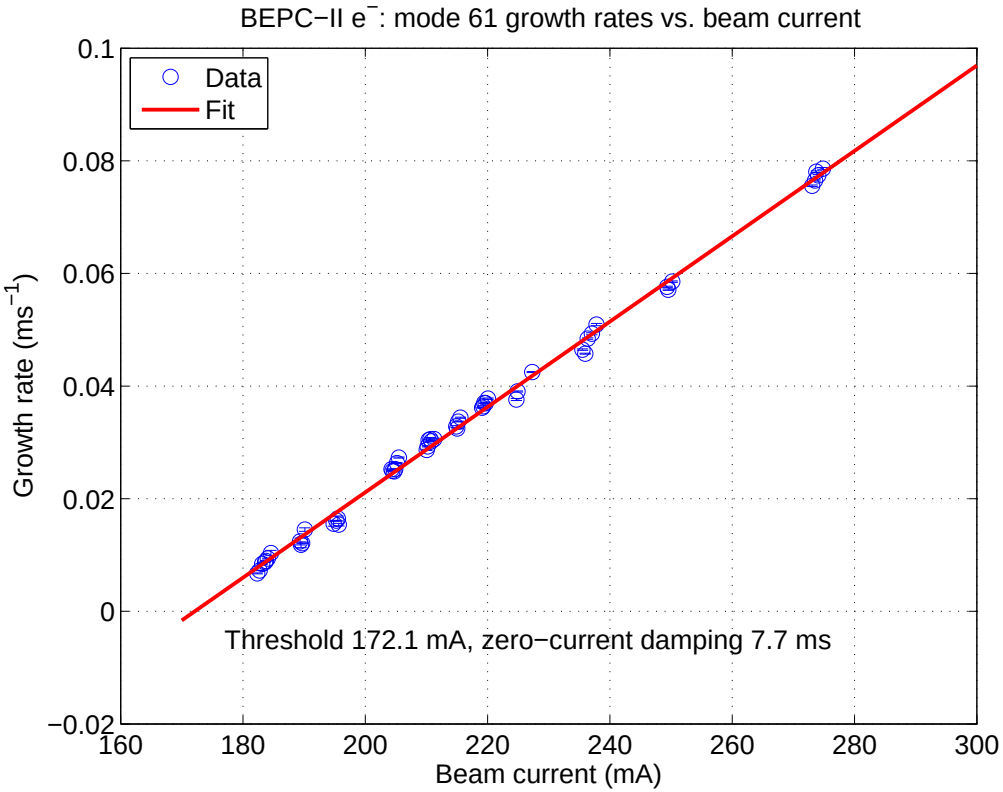

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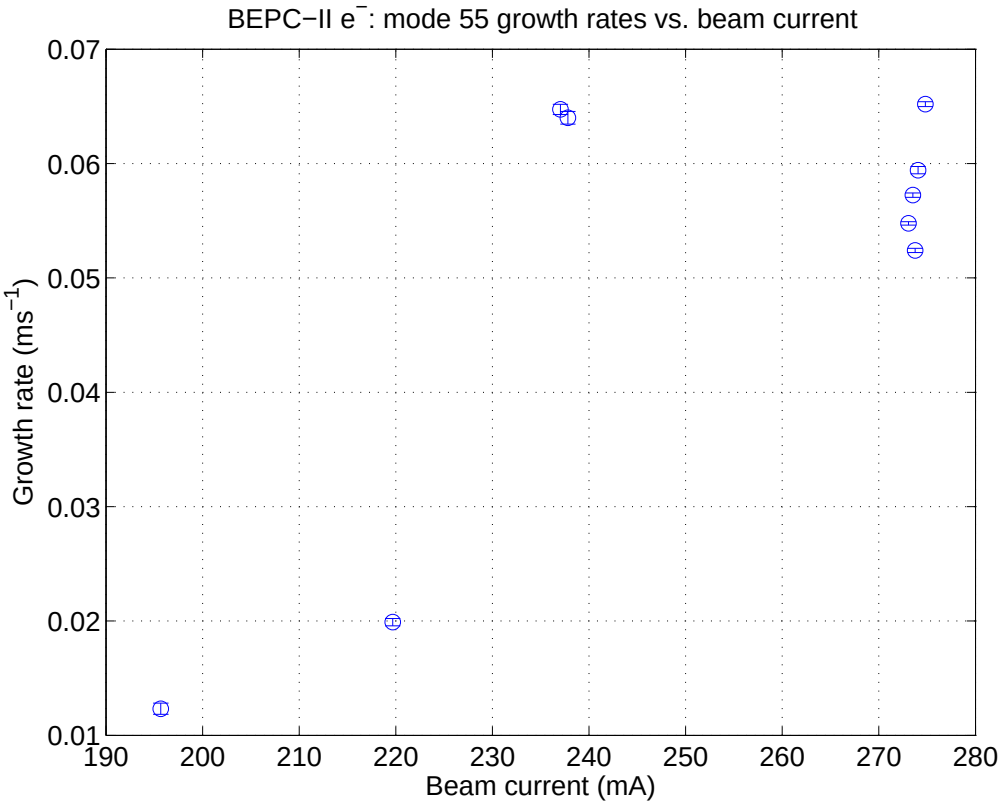

- A slower growing mode;
- Two outliers - need further checking;
- Without the outliers estimate 8.9 ms zero-current damping;
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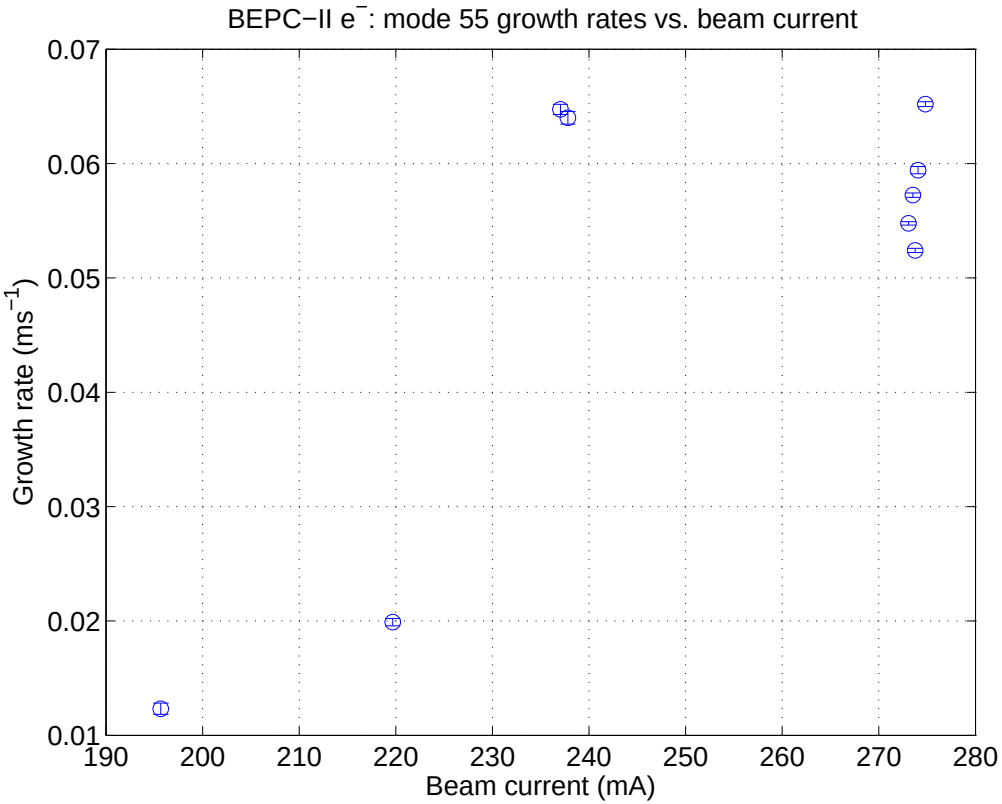

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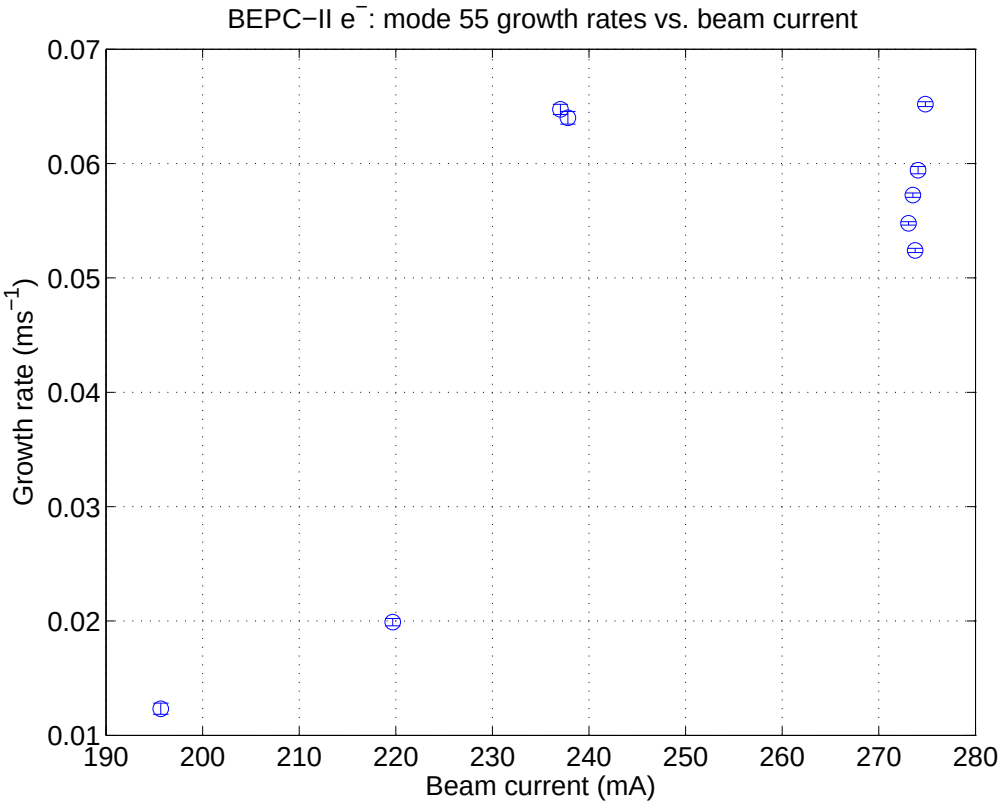

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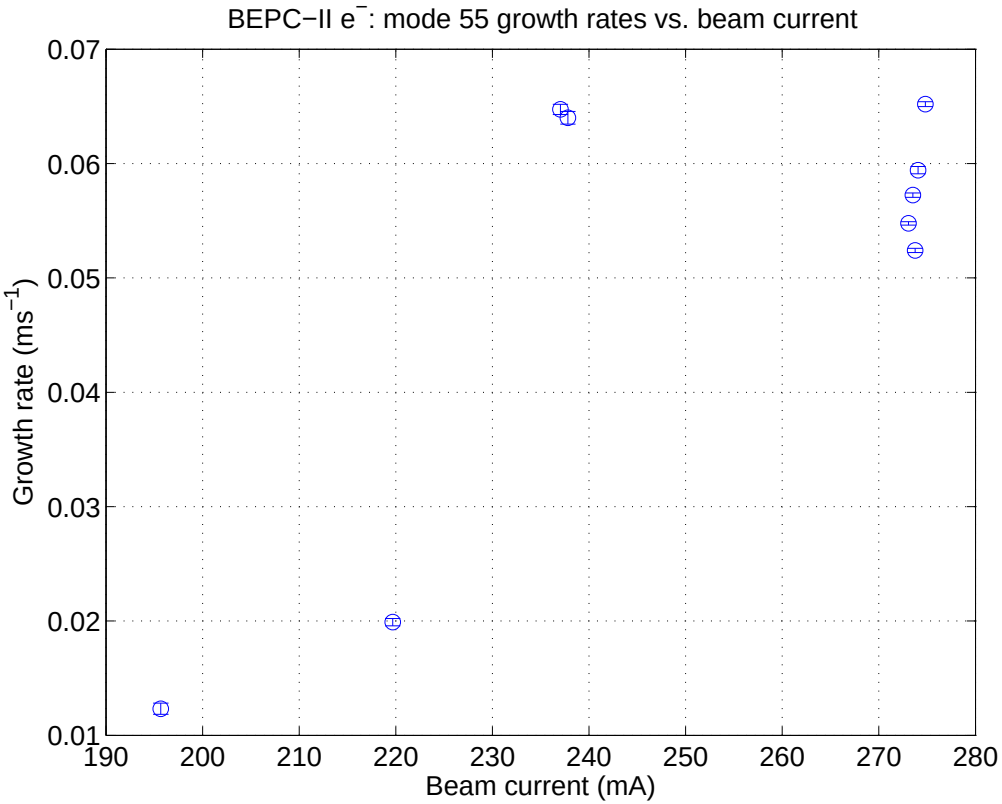

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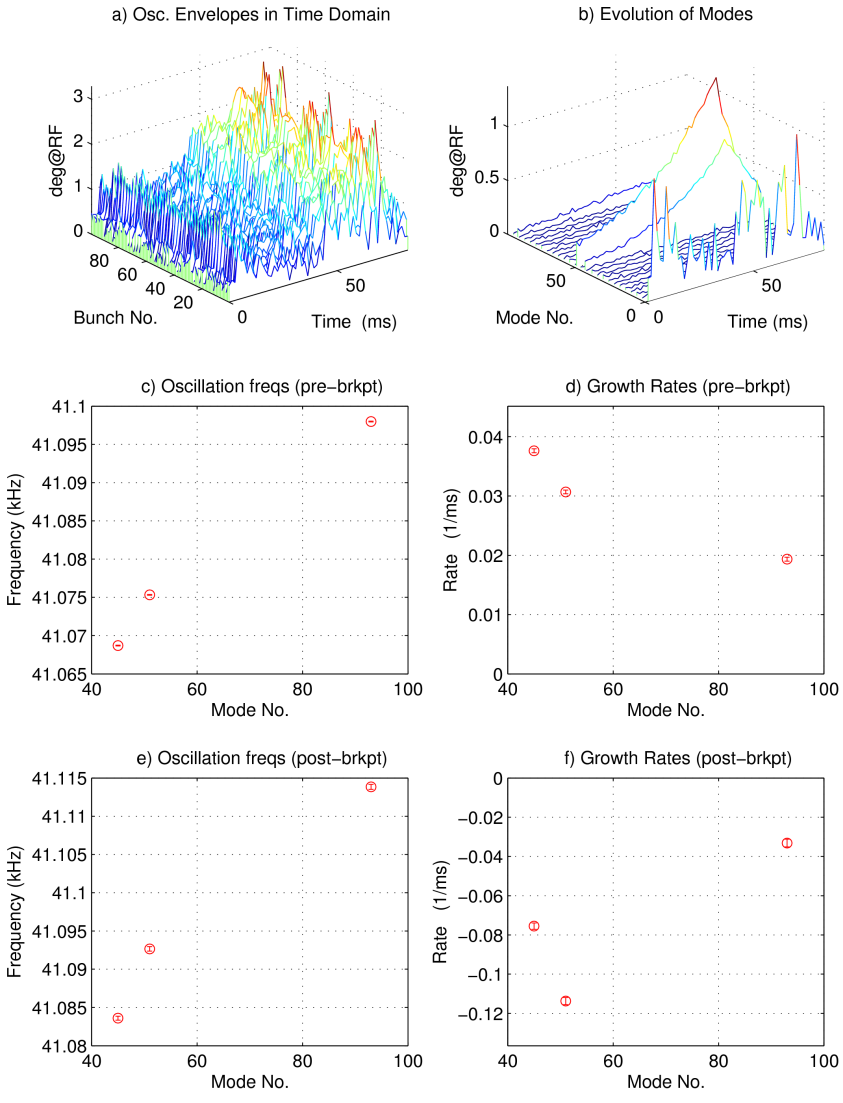

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- Even fill shows 3 distinct modes: 45, 51, and 93;
- Modes 45 and 51 are faster than 93;
- In 50-bunch fills mode 93 dominated due to coupled excitation from mode 0;

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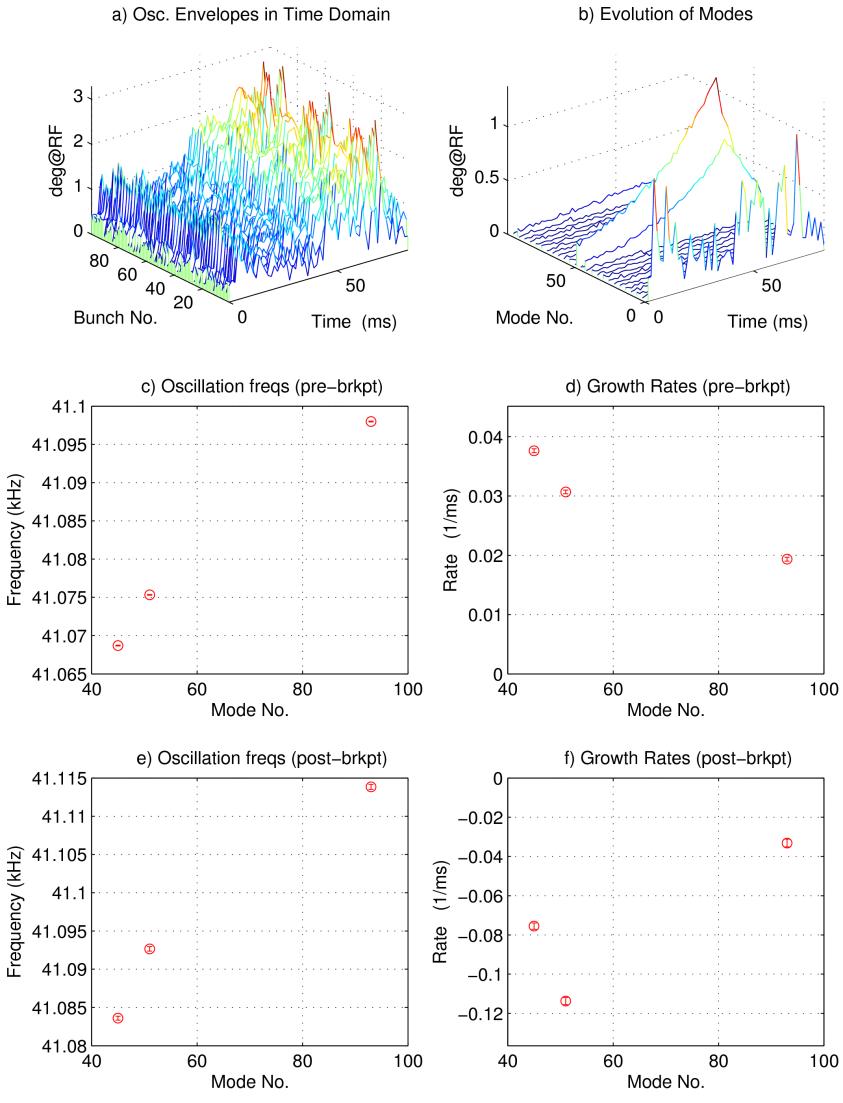

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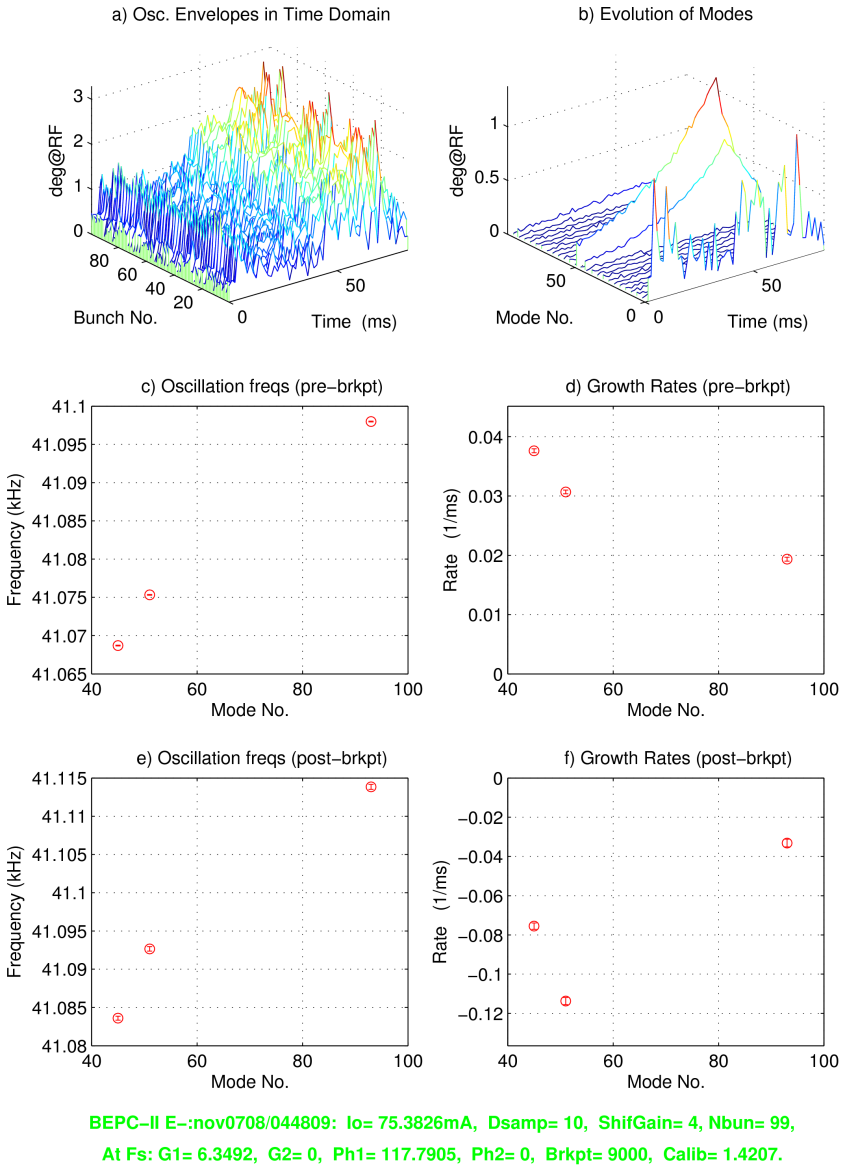

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- Driven noise is 0.2° in the electron ring, 0.4° in the positron ring;
- Amplitude of the sum signal differs by 18 dB between positron and electron rings;
- Striplines used as a longitudinal kicker are more effective in the electron ring.

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- Above the threshold instabilities saturate at 10–20 degrees at RF;
- Many active modes: two in electron ring, three in positron;
- Other modes might be hiding - masked by faster growing modes.

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