

# Bunch-by-bunch Feedback Status

Alessandro Drago<sup>1</sup>, Dmitry Teytelman<sup>2</sup>

<sup>1</sup>LNF-INFN, Frascati, Italy

<sup>2</sup>Dimtel, Inc., San Jose, CA, USA

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# Outline

- 1 Work summary
- 2 Measurements
  - Noise Spectra
  - Synchronous Phases
  - Grow/Damps
  - Tune Measurements



# iGp12 Updates

- **New FPGA gateway and software;**
- Dual data acquisition engines;
- Pre-trigger acquisition mode;
- Fractional tune readout;
- Amplifier pre-distortion filter in the FPGA.



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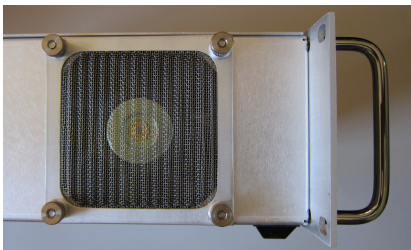


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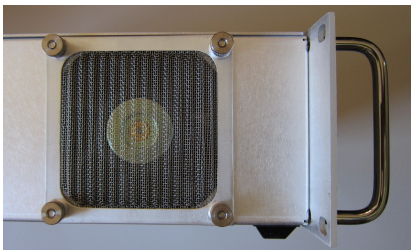


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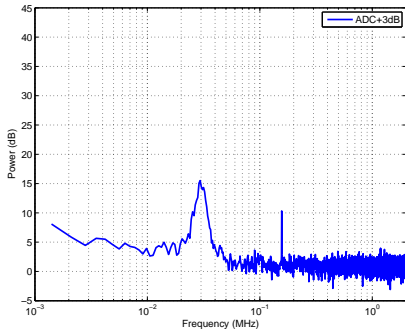
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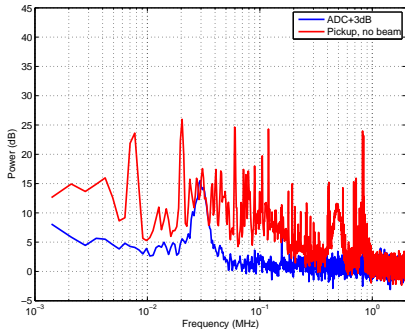
# Positron Vertical



- ADC spectrum with 3 dB attenuator (noisier than real terminator);
- Cable from the hybrid connected - no beam, no RF;
- Remove 100 kHz high-pass filter;
- Cable disconnected from the hybrid and terminated;
- All of the noise lines around 500 kHz are driven directly on the beam...

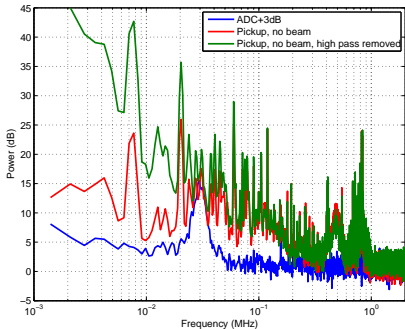


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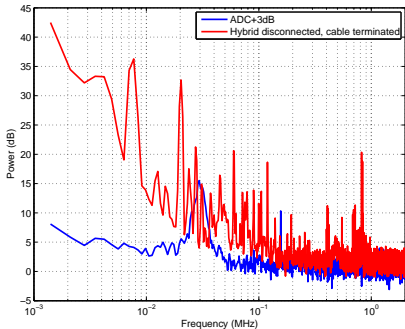
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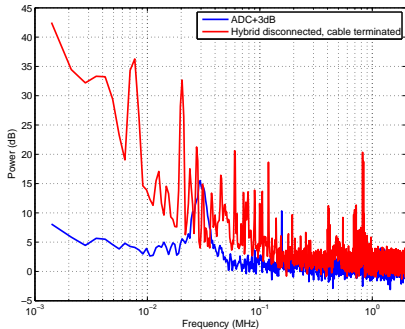
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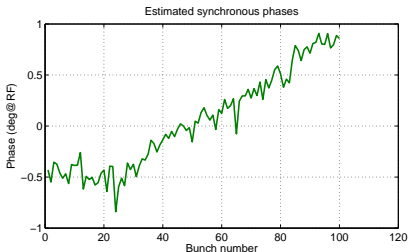
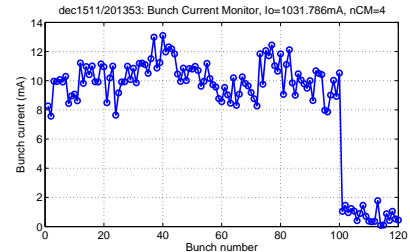


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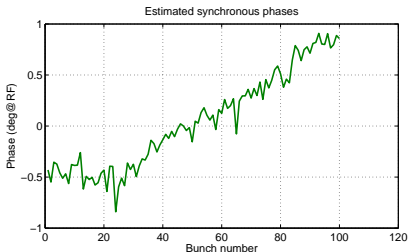
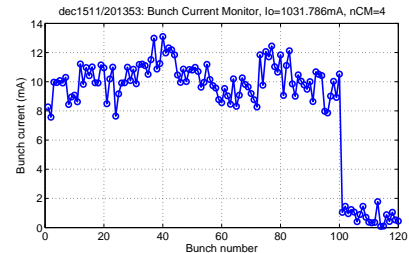
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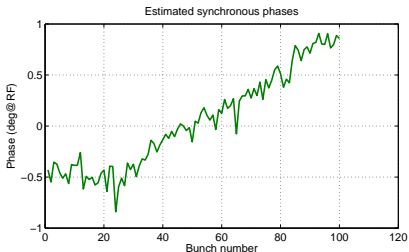
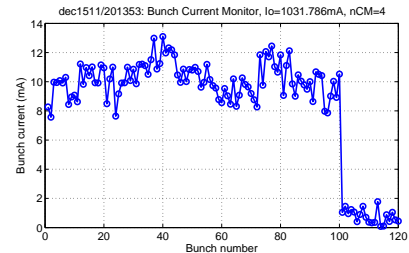
- Performed single-bunch longitudinal front-end calibration;
- Can estimate bunch-by-bunch synchronous phase transient (gap transient);
- With 20 bunch gap transient is quite small ( $1.8^\circ$ ) at 1 A.

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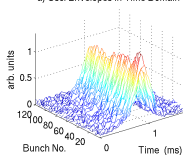


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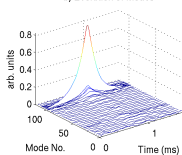
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# Longitudinal Grow/Damp, Electron Ring

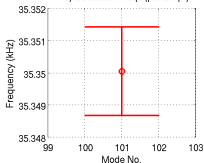
a) Osc. Envelopes in Time Domain



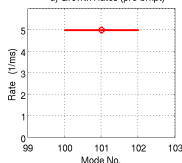
b) Evolution of Modes



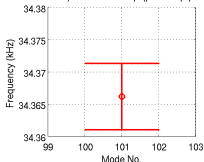
c) Oscillation freqs (pre-brkpt)



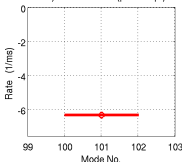
d) Growth Rates (pre-brkpt)



e) Oscillation freqs (post-brkpt)



f) Growth Rates (post-brkpt)

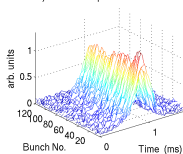


- Clean growth and damping;
- Feedback is somewhat reactive — 1 kHz frequency shift.

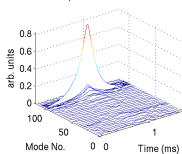
DAFNE E- (IGp):dec1511/201928: Io= 588.153mA, Dsamp= 5, ShifGain= 3, Nbu= 120,  
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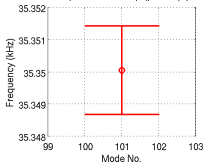
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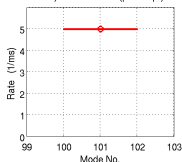
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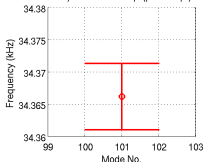
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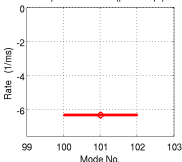
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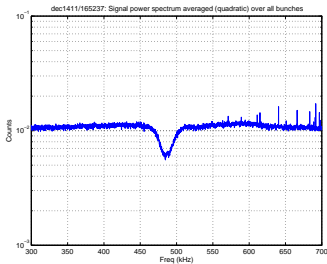
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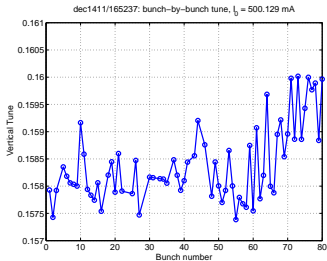


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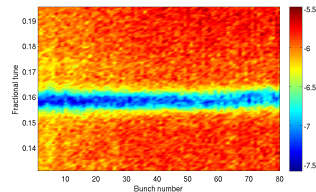
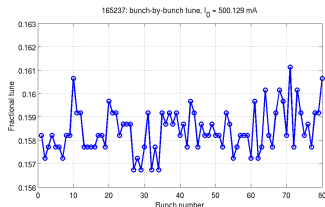
- Averaged spectrum of 80 bunches, in collision, 500 mA;
- Bunch-by-bunch tunes estimated by fitting proper loop response:
  - Tricky to do reliably;
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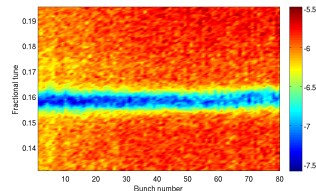
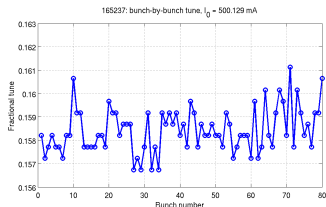
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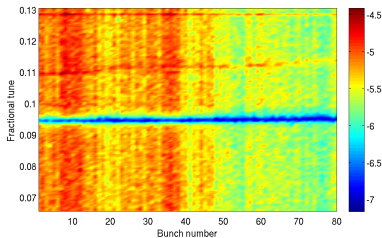
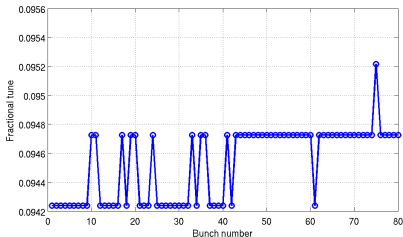
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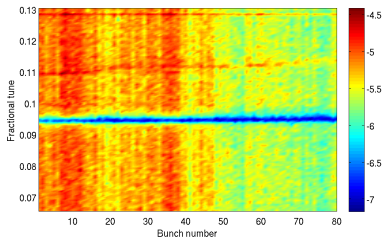
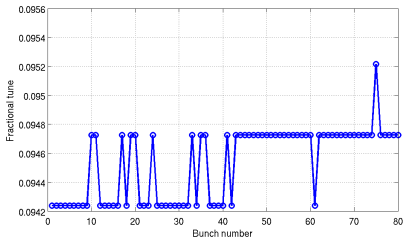


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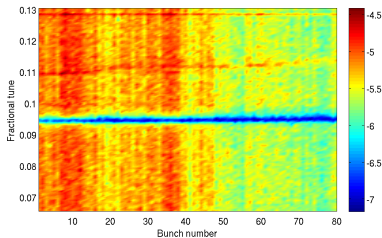
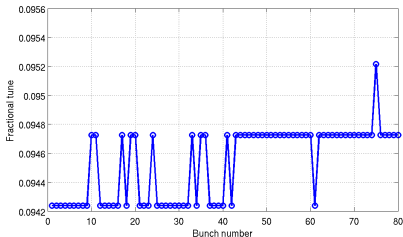
- All four data sets acquired within 90 seconds;
- In collision around 500 mA in each ring;
- Electron ring: horizontal;
- Electron ring: vertical;
- Positron ring: horizontal;
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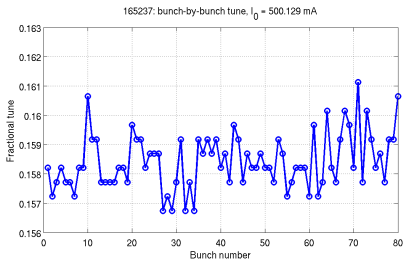
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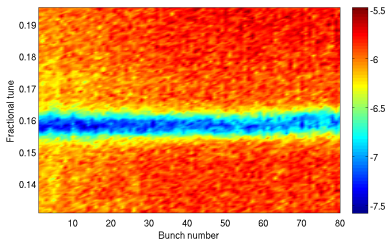


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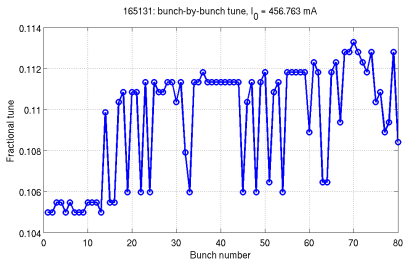
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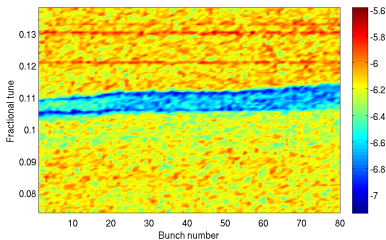
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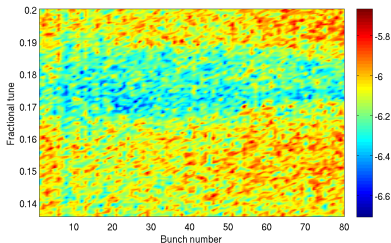
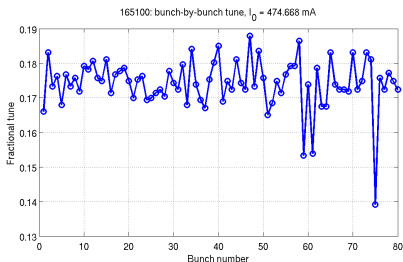
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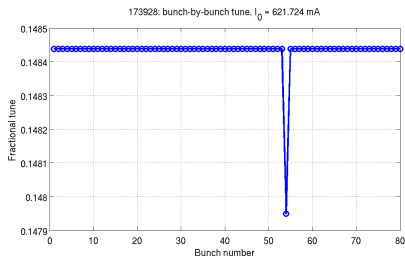


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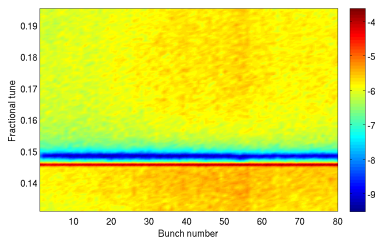


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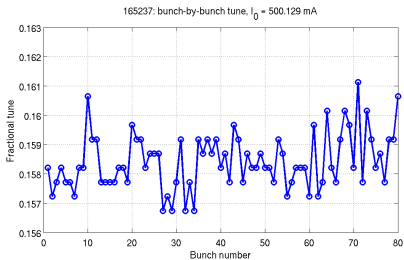
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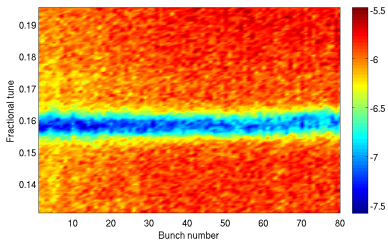
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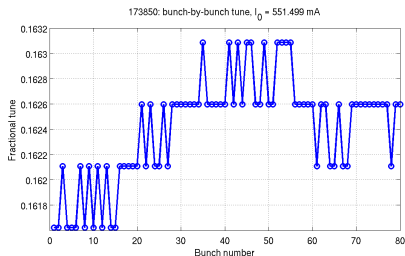


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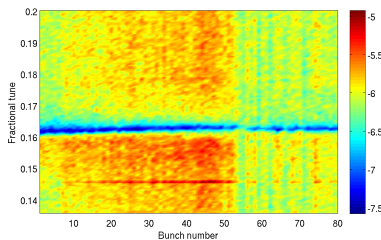




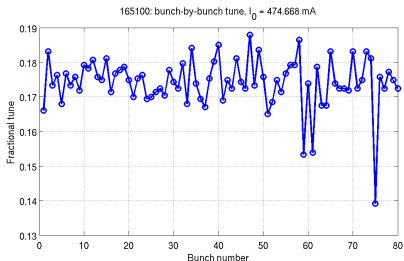
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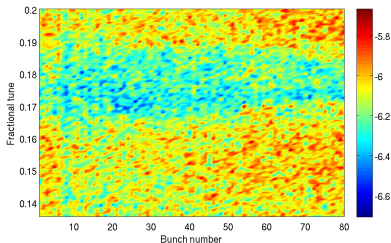
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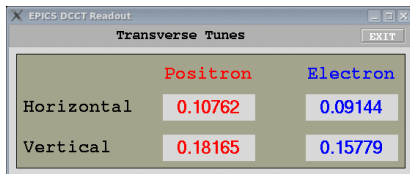
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# Real-time Tune Monitoring

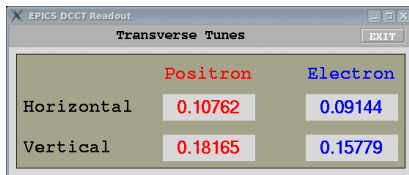


The screenshot shows a window titled "EPICS DCCT Readout" with a sub-header "Transverse Tunes" and an "EXIT" button. The window displays a table of tune estimates for Positron and Electron beams.

	Positron	Electron
Horizontal	0.10762	0.09144
Vertical	0.18165	0.15779

- Tune estimate from the minimum-tracking spectral marker;
- Updated at 2 Hz, averaging time constant 2.5–5 seconds.

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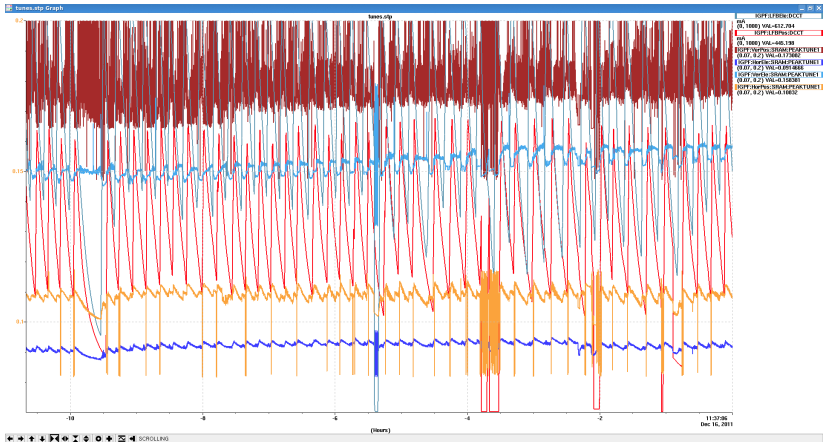
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# Real-time Tune Monitoring, Continued



# Summary

- All feedback systems have been updated to the newest hardware, gateware and software;
- Low frequency noise sources need to be investigated;
  - A low-noise front-end would help with both noise and sensitivity;
- Synchronous phase transients are small with 100 bunches at 1 A;
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