

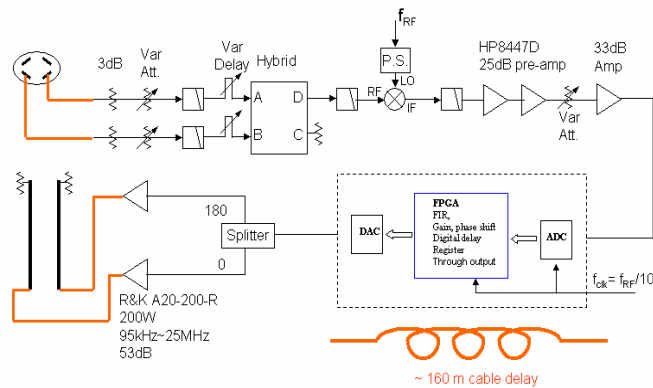
Multi-bunch Feedback Activities at Photon Factory Advanced Ring

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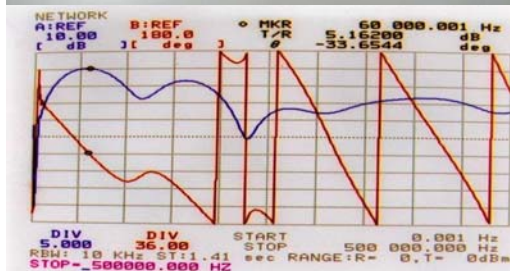
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The photon factory advanced ring (PF-AR) is a dedicated single bunch light source at KEK, however, some users require multi-bunch operation for high intensity x-ray beams. The old transverse damping system can suppress only one (or two) bunches, while new multi-bunch feedback system has been successfully tested to a maximum of 64 bunches.

Both analog and digital transverse feedback loop has been tested at AR to store multi-bunches. Long cables are used to delay the bunch position error signal from BPM buttons for analog feedback control loop. Betatron phase advance between stripline kicker and BPM are selected to be around 90 deg. For digital feedback loop, it based on a FPGA test board, which include 2 channels 105MSPS 14 bit ADC, Xilinx Virtex4 XC4VVSX35 FPGA chip and 2 channels 14 bit DAC. Bunch position error signal sampled by ADC, filtered by 10-tap FIR filter implemented in FPGA and send to DAC output for correction. Phase shifter in the FIR filter can be adjusted depend on the kicker and BPM betatron phase advance, FIR filter will cut



Block diagram of PF-AR multi-bunch feedback



XtremeDSP and 10-tap filter implemented

the DC components and pass through the betatron oscillation signal which increase the system dynamic range a lot. Digital delay can also be implemented inside FPGA instead of long cable delays.

Maximum beam current of 97mA has been achieved for several bunches' storage, betatron oscillation of the stored beam can be suppressed well.