Multi-bunch Feedback System at PF-AR

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A single-bunch is stored during the 6.5GeV operation in the PF-AR whereas a demand for the several-bunch operation exists under the 5.0GeV operation which is used for the clinical applications. Because the maximum number of the stored bunches are limited up to 2 due to the limitation of the present feedback damper system, we developed a new feedback system which can store many number of bunches.
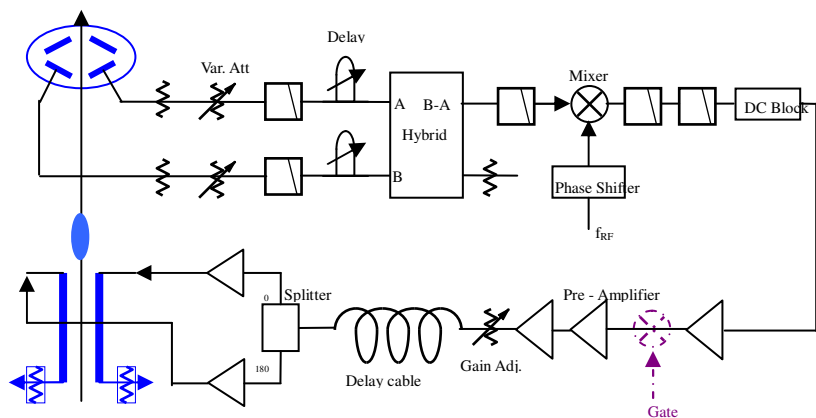

Figure 1. PF-AR transverse multi-bunch feedback block diagram

Analog multi-bunch feedback loop has been built at AR west hall; the block diagram is show in Figure.1. The whole system bandwidth is limited by the final amplifier, which is 25 MHz, 16 bunches and the maximum beam current of 90 mA at the injection energy has been achieved with this system.

Figure 2 shows the signal from the button pick-up when 16 bunches have been filled in the ring. At high beam current, longitudinal instability was very strong which may limit the maximum current and the number of the bunch during injection. Figure 3 shows the FFT spectrum with feedback ON and OFF. It's very clear that the horizontal sideband was suppressed while the feedback system turns ON.
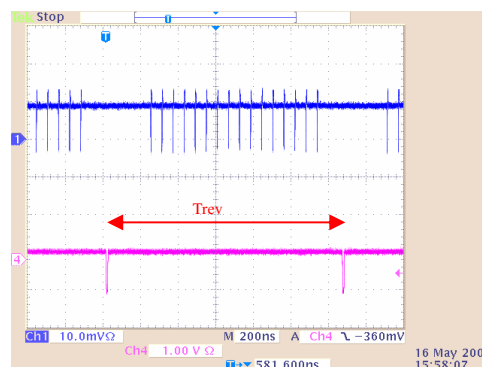

Figure 2. 16 bunches filled

A digital based feedback system is under consideration. For this control loop, we adopt the ADC with maximum sampling rate of 100MSPS, FPGA chip used for filter and digital delay. Both horizontal and vertical plane feedback will be implemented in near future for user operation, more bunches storage can be realized.
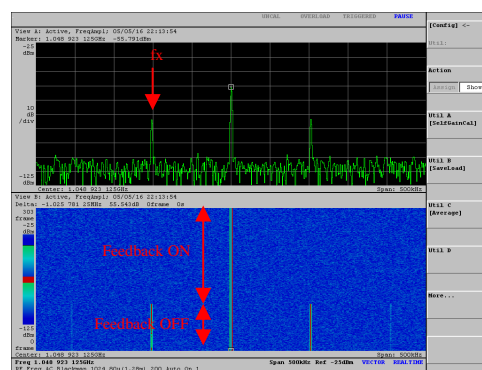

Figure 3. Spectrum with feedback ON and OFF