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PSB Q-MEASUREMENT BY FFT FOR LHC TEST

A. Chapman-Hatchett, S. Johnston

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1. Hardware

During normal operation the PSB Q values are calculated from the measured magnet currents. For the LHC test it was necessary to raise the PSB energy to 1.4 GeV. As the machine had never been used at this energy, it was decided to check the Q values by direct measurement.

To make the measurement an electrostatic pick-up was used which provided horizontal position, vertical position, and a sum signal. The horizontal and vertical signals were amplified and selected by a multiplexer. They were then low-pass filtered before being sampled by the A.D.C. The sum signal was also low-pass filtered, and then amplified by an A.G.C. amplifier. The signal was then processed to provide the A.D.C. sample clock. The measurement timing was generated by a pulse generator, in burst mode, triggered from the start of the machine cycle. All settings for Gain and Timing were adjusted manually.

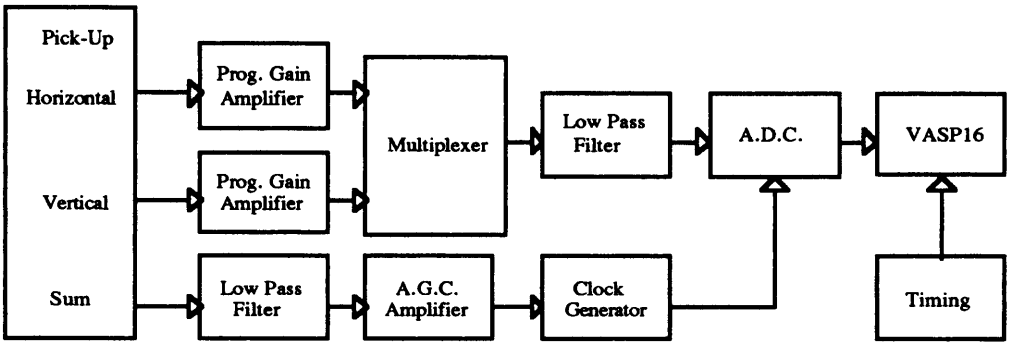

Figure 1. Hardware requirement for the FFT Q-measurement systems.

2. Q-measurement by FFT

As part of the on-going controls conversion project, the PS FFT Q-measurement [1] has been developed for LynxOS [2]. For the LHC test it was required that the system worked as a stand-alone unit in the PSB also.

A PC-based graphics program was written to display the results of the Q-measurement. This program used a TCP/IP socket connection to the DSC in which the Q-measurement was housed (see Figure 2). A simple menu driven control program, running on the DSC but viewed from the PC screen, allowed measurement requests to be made.

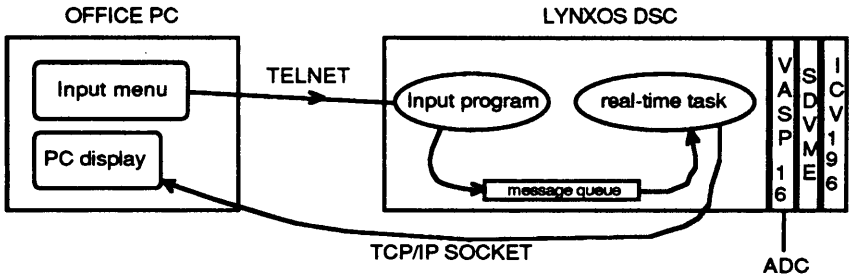

Figure 2. Because no application program already existed, a PC-based display was developed. A simple menu driven program running on the DSC interfaced with the real-time software in place of the equipment module.

Figure 3 shows a series of Q-measurements by FFT analysis in both planes. The measurements in the vertical plane were performed a few cycles after the measurements in the horizontal plane.

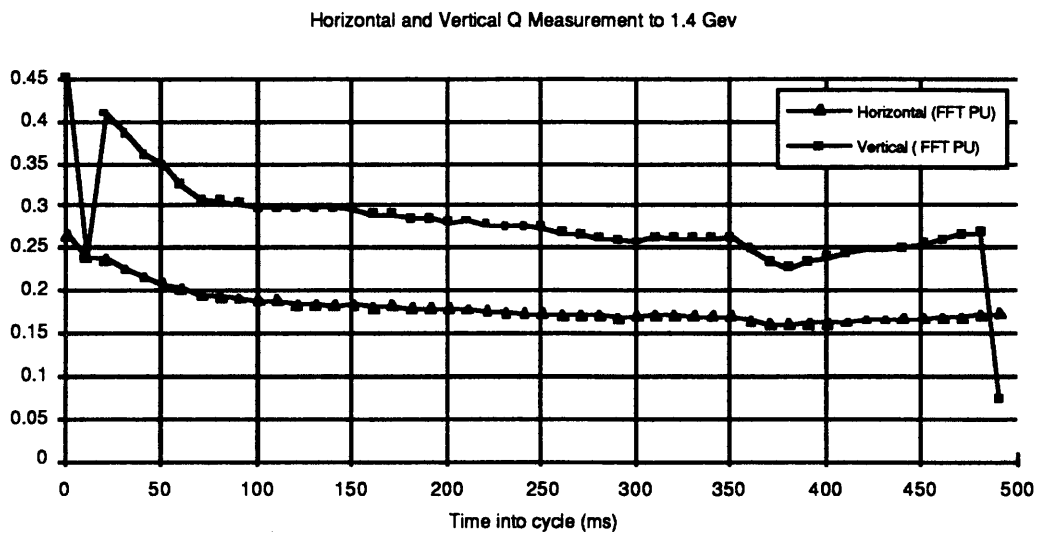

Figure 3. PSB Q-measurement during the LHC MD test cycles. Note that Q_v at 10 ms and 490 ms are errors.

The development of a make-shift display program for the PC and the network communications required 10 weeks of work. However, the experience gained from the software development has been useful for providing advice to the developers of the MCR application program. The code used to program the GPPC modules is actually included in the final version of the real-time program, and the LHC test provided a valuable opportunity to test the system.

The FFT Q-measurement is, as the time of writing, going through final tests between BD and CO groups. The application program is currently under development by OP group, and will become operational in the near future.

3. References

[1] S. Johnston, "Performance of the PS FFT Q-measurement system", CERN/PS/BD/Note 92-8, November 1992.

[2] S. Johnston, "Real-time program for the PS FFT Q-measurement", CERN/PS/BD/Note 94-2, January 1994.