Introduction

• Two prototypes of new DBPM processor were initiated at SINAP since 2008.
• The first algorithm evaluation prototype is based on commercial ADC board to evaluate signal processing blocks.
• The second prototype is home-made from chips level to build a hardware frame.
• Two prototypes merged together after lab test.
• Online evaluation has been carried on to verify the performance of hardware and software of this new DBPM processor.

Spatial resolution evaluation

• Few microns resolution at TBT and sub microns resolution @ 50kHz achieved in lab test.
• Better than 2 microns @ TBT when beam current larger than 100 mA.
• Better than 1.4 microns @ TBT.
• Better than 0.38 microns @ 50 kHz.
• Better than 0.21 microns @ 10 Hz.

Fast application (50 kHz) data interface

• 50 kHz fast application data interface with a 500k samples FIFO buffer is implemented.
• The energy oscillation, narrow band electronics noise from LLRF, 50 Hz power line noise probably coupled from magnet PS, and noise from gird vibration have been recorded precisely. The functionality and quality of FA data interface are confirmed.
• Sub Hz frequency resolution and sub micron spatial resolution makes FA interface to be a very powerful diagnostics tools for orbit analyzer.

Slow application (10 Hz) data interface

• The real orbit movement has been recorded precisely before, during and after injection. The functionality and quality of SA data interface are confirmed.
• The linearity of SA sum signal is good enough for beam current and lifetime measurement.
• Some low frequency narrow band noise (0.22Hz) is observed. It is not clear yet that the noise comes from beam, hardware or software of processor. More study and optimization need to be done.

Turn-by-turn (694 kHz) data interface

• Turn-by-turn (694 kHz) data interface with a 500k samples FIFO buffer is implemented.
• Demonstration of fabric tune measurement has been performed. Tune shifts and betatron oscillation peak splitting were recorded precisely. Beam impedance could be retrieved from this measurement. The functionality and quality of TBT data interface are confirmed.
• Frequency resolution of Hz level and spatial resolution of micron level makes TBT interface to be a very powerful diagnostics tools for machine study.

Thermal loading investigation

• The first three major thermal producers are ADC, RF amplifier and PS chips.
• The cooling fan is very helpful for ADC module; the temperatures of ADC chips decrease from 60 degree to 42 degree; the average temperature of PCB board decreases from 43 degree to 32 degree.
• Air cooling is not a critical issue for RF front-end module in this case.

Conclusion

A prototype of new digital BPM processor has been evaluated online at SSRF storage ring. Major signal processing blocks including TBT, FA and SA have been tested. Thermal loadings of RF and ADC module were investigated. Evaluation results show that the functionality and performance are comparable with commercial products and satisfied the requirements of operation and machine study. Evaluation results confirmed the current design. The next technical prototype will be built soon.

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