Fast Orbit Feedback implementation at Alba Synchrotron

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Alba is a 3GeV synchrotron light source with 268m perimeter divided in 16 sectors. The FOFB target is to stabilize the electrons in a 10% beamsize window. To achieve the objetive 104 Libera electron xBPM read the position of the beam at 10kHz and 176 correction magnets to do the corrections. The xBPMs are connected in a nested ring network and in each sector there is a CPU with FPGA boards to read from xBPM and write to PSU.

Looking for the simplest solution of a complex problem

Software

- Fexibility
- Cost
- Fast development

The Software approach:

- Use of a quad core CPU
- Reserve a CPU core for correction algorithm
- Disable as much as possible IRQs

Latency of the process achieved <100µs

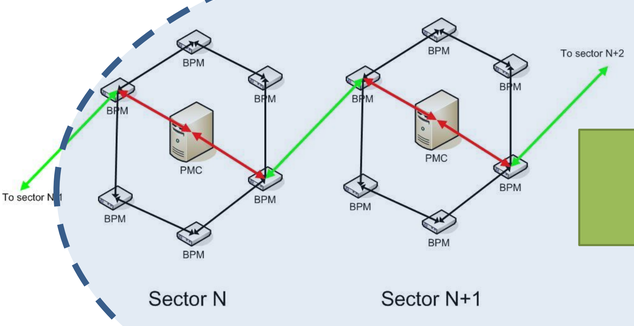
Hardware

- Low Lattency and jitter
- Real Time

Hardware approach FPGA board:

- A new FPGA board needed to read data from fiber optics and to write to the PSUs
- The tests performed shows that the implementation of the algorithm in a CPU is possible.
- FPGA have enough resources to implement the algorithm if necessary

Data Reading → Processing → PSU writing



eBPM

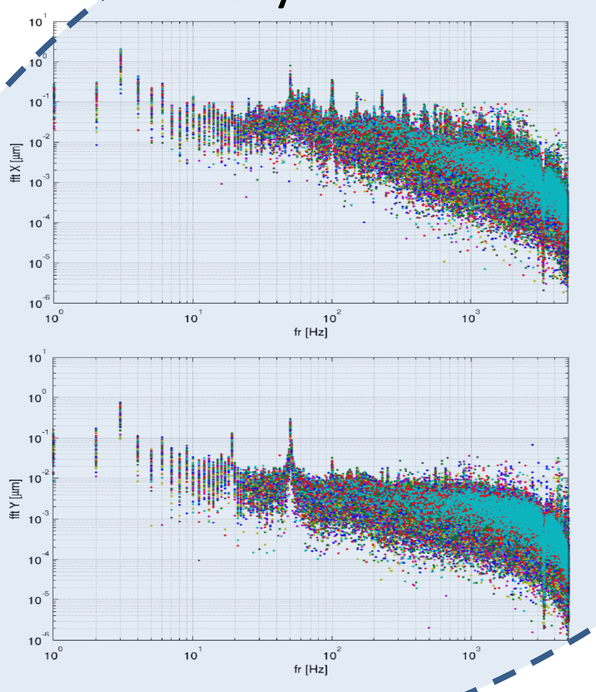
Top Loop

Bottom Loop

PSU

e-

Very unnoise machine

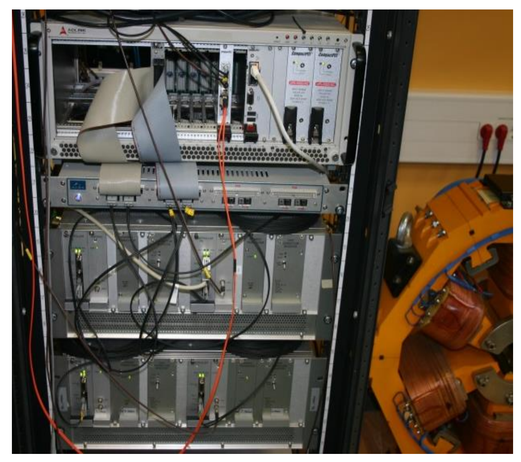


Vacuum chamber

Magnets

The aluminium vacuum chamber acts as a low-pass filter with pole around 200Hz.

Tests done in Storage Ring confirm that beam get stabilized around 3ms, when a change of 50mA in PSU is applied



Next Steps

- Tests in electronics lab are done, confirming that cycle of 10kHz can be achieved.
- September 2nd, Tender of FPGA board were closed
- Autumn 2013 tests in the Storage Ring are being done
- In 2014 is forseen to have a fully operative FOFB