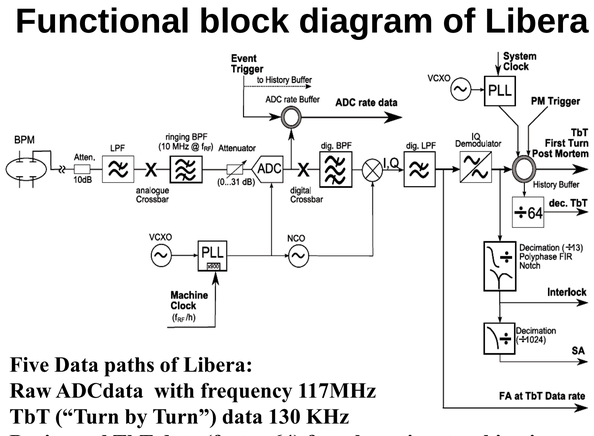
Control System Integration of the PETRA III BPM System based on Libera Brilliance

Piotr Karol Bartkiewicz, Igor Krouptchenkov, Gero Kube, Frank Schmidt-Foehre, Josef Wilgen, Franziska Wedtstein and Honggong Wu, DESY MCS, Hamburg, Germany

Abstract

The PETRA III Storage Ring has recently successfully commissioned the new BPM System based on ~230 Libera Brilliance [1] modules. This is at present the largest full installation of these modules. This paper presents the complete BPM system from the control aspect. The distributed Libera Brilliance modules are connected via the control system internet. A dedicated middle-layer Linux PC running in a multithreaded environment communicates with all modules using the CSPI package provided by the vendor of the Libera Brilliance modules. This middle layer processes runs in the framework of the TINE [2] control system and services requests from the user applications. In this case, the middle layer server is heavily multithreaded and deals with hundreds of Brilliance modules and is therefore unique, as all the other Libera installations run in a one-process-to-one-Libera mode. Several well designed user applications written in Java and MATLAB® are used for commissioning, testing and operating the BPM system. An automation procedure has also been developed for remote installing and updating software packages, as well as restarting and rebooting the CSPI server running on the Libera modules.

Functional block diagram of Libera Brilliance



- Five Data paths of Libera:
- Raw ADCdata with frequency 117MHz
- TbT ("Turn by Turn") data 130 KHz
- Decimated TbT data (factor 64) for a long time tracking interval,
- Around 10 Hz slow acquisition (SA) data
- Fast acquisition data (FA) with 10KHz.
- Linux running on SBC, Software Release 1.83 for PETRA III

Integrating Libera into TINE Control System

Other integrations: Control software embedded in the Libera Brilliance module. Model 1 to 1

PETRA III:

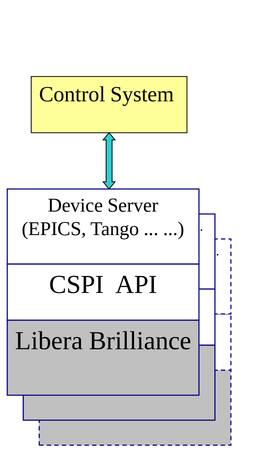
Vendor provided Generic server running in the Libera Brilliance is used as a device server.

Middle-layer BPM Server running on LINUX PC to interface all 227 Liberas, Model 1 to N, for laboratory testing or real operation

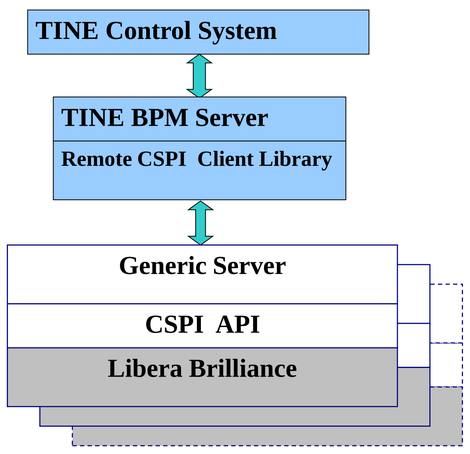
Advantages:

- Save extra layer programming, implementation is easy and straightforward because of good example of libera utility source code
- No any control relevant software deploying into the Libera Brilliance modules, prevent any future need for control-system specific updates, etc. Vendor software upgrading would be decoupled with the control software.

Java and MATLAB user applications for operating



Other Control System



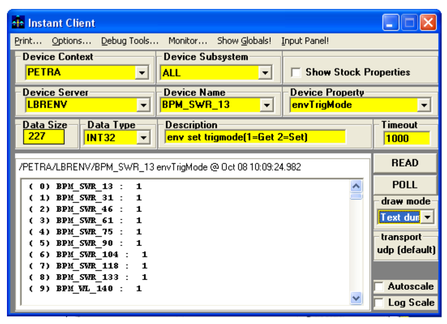
PETRA III in Desy

The Middle layer server provided following data access:

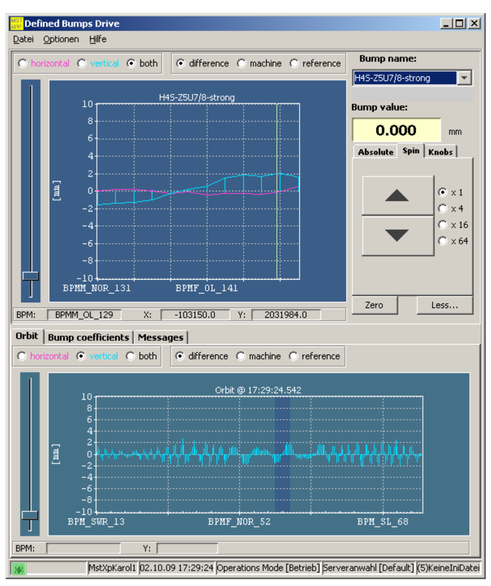
- On demand ADC raw data @ 117MHz, 1024 samples per module, with trigger frequency
- First turn data synchronized by injection trigger, with trigger frequency 6Hz
- Maximum 65K samples of TBT data per module (Maximum decimation factor 64) synchronized by injection trigger or direct access
- 16k samples of Post mortem TBT data per module are stored after Post Mortem trigger
- 10Hz Slow acquisition data, orbit measurement
- Health parameters (Temperature, Fan speed… …), interlock status, clock status read with 1 Hz
- All settable Parameters of Libera Brilliance, interlock, Clock or General parameters can be addressed with one command to all modules

- Event notification by Multicast from gerneric server: trigger, Interlock …
- Data Achieve and Alarms are handled by TINE services

Up to ~1000 threads running parallel (5 threads per Libera module).
Linux PC with 100 Mbit Ethernet



General client application in the TINE CS, accessing all server programs, is used for testing Liberas

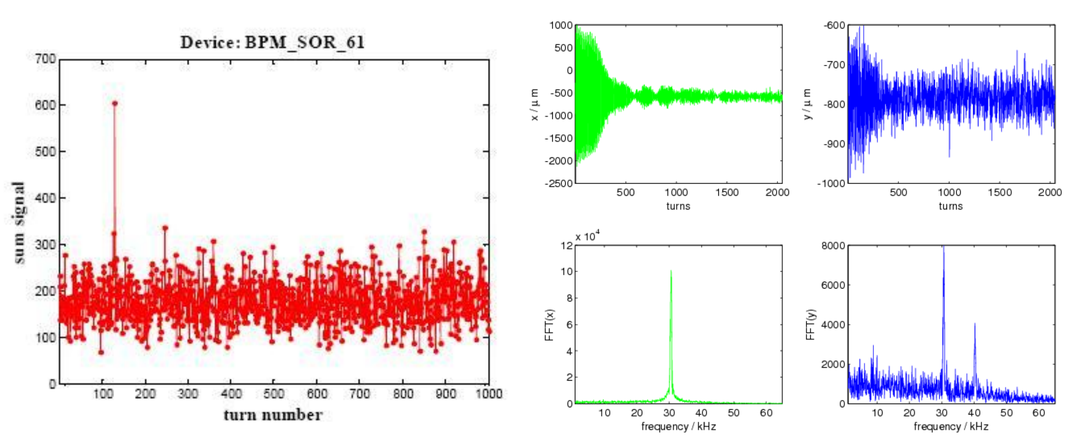


The Slow Orbit Stabilizer Client application

The core of the system is a Slow Orbit Stabilizer, a middle-layer server code, running on the Linux PC, getting orbit data from BPM server and sending correction decisions to Central Magnet Control Server.

The Slow Orbit Stabilizer uses the SVD algorithm (singular value decomposition) to calculate current changes of corrector magnets.

Communication between Slow Orbit Stabilizer and the BPM server as well as the Central Magnet Server is provided by the TINE control system.

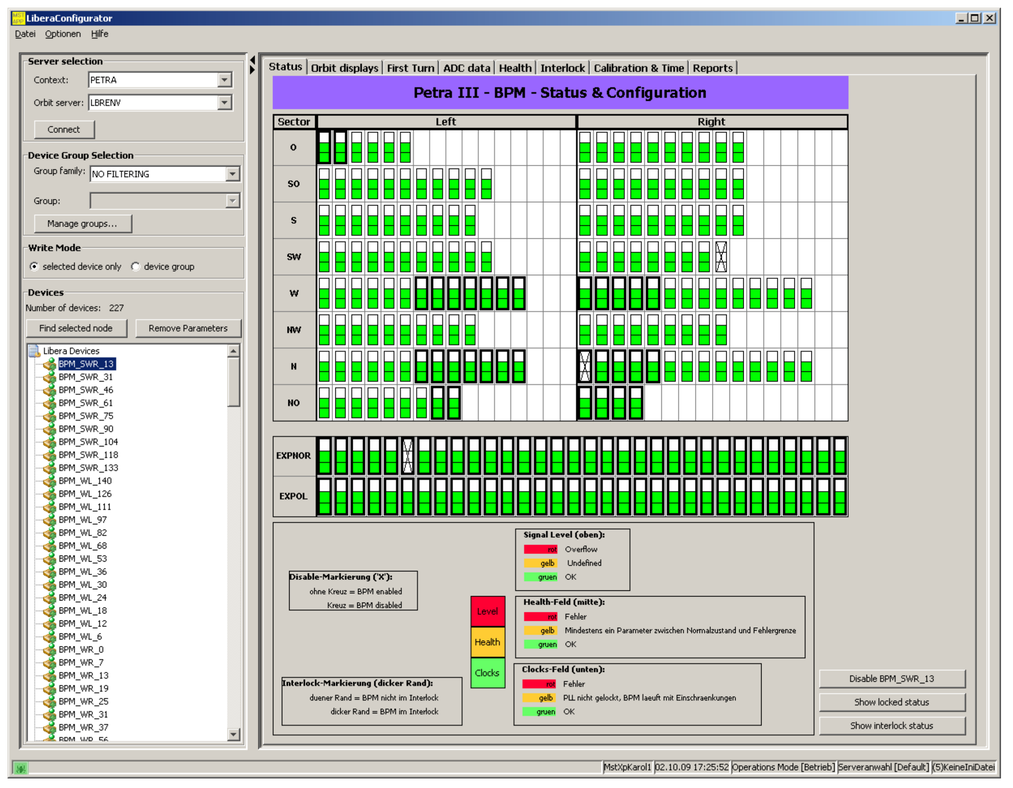


Examples of MATLAB application for commissioning

=> first beam at PETRA III, response of single BPM near injection

=> Horizontal and vertical TbT data together with FFT for tune measurement

A Java orbit correction application makes use of the local bump method to correct orbits.



Libera Configurator: Status, Clock, Interlock, Overview and data display (All in One), allow experts to perform the initial setup as well as any general maintenance tasks

Summary and Conclusion

The BPM system based on 227 Libera Brilliance modules has been successfully integrated into the PETRA III TINE control environment. The vendor-provided interface package, the remote CSPI has been working reliably with the Linux heavily multithreaded BPM middle layer server. Numerous user applications have proven invaluable for the commission and orbit measurement.

References:

[1] Instrumentation Technologies, Slovinia, http://www.i-tech

[2] http://tine.desy