SIMULATED COMMISSIONING OF SPEAR 3 STORAGE RING

A. Terebilo, D. Keeley, J. Corbett, G. Portmann, SLAC, Stanford, CA 94309, USA

Abstract

In preparation for the commissioning and operations of SPEAR3 we developed a number of high-level accelerator control applications. We also developed a test platform that simulates the physics of a storage ring. To any application using EPICS Channel Access protocol it appears as a real storage ring: measurable parameters such as orbits and tunes change in response to the changes in the accelerator hardware setpoints.

BACKGROUND

SPEAR3 synchrotron light source will be commissioned soon at SSRL. New EPICS control system software will make most of the existing high-level applications obsolete. It is challenging to commission a new facility with this many new software applications most of which were never tested on a real machine.

Many simple applications such as operator menus, panels, live data and history displays present less of a challenge because they are built using standard EPICS toolkit components and they can be tested against dummy CA servers.

Accelerator physics applications that implement measurement functions or control algorithms are inherently more complex and require *realistic behavior* of the simulated variables in order for the tests to be meaningful.

COMPONENTS

We developed a platform for testing such accelerator physics applications, the Model Server. Figure 1 shows the component diagram of the Model Server.

Portable channel access server

A Basic EPICS portable channel access server (PCAS) [1] serves Process Variables (PV's) commonly used by accelerator physics applications:

- Orbits (Beam Position Monitor readings)
- Corrector magnets
- Magnet setpoints (quadrupoles and sextupoles)
- RF frequency and voltage
- Betatron tunes

Physics Simulator

Physics simulator is a MATLAB [2] program. It uses Matlab Channel Access (MCA) Toolbox [3] to communicate with PCAS. It uses Accelerator Toolbox (AT) [4] to make accelerator physics calculations. We run MATLAB on the same CPU as the PCAS but it is not a requirement since all communications with PCAS go through channel access.

The physics simulator performs the following tasks:

- Maintains connections to PV's in PCAS
- Sets and maintains EPICS monitors on the PV's that may be modified by tested applications
- Maintains an AT model of a storage ring. The model updates when test applications change the values of corresponding PV's on the PCAS
- Periodically computes the close orbits, betatron tunes, synchrotron frequency and posts them to PCAS

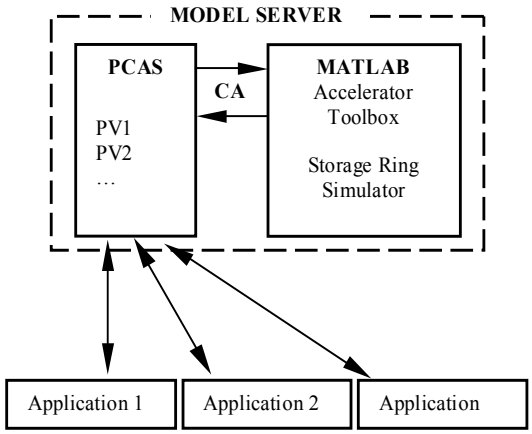

Figure 1: Model server – an application testing platform.

Random noise and systematic errors may be optionally added to computed closed orbits and frequencies. A delay can be introduced beyond the required computation time to simulate processing delays in the control system

Tested applications

An application under test communicates with the Model Server as if it was a real machine. The behavior of orbits and tunes is completely physical.

Most of the SPEAR3 accelerator physics applications are also MATLAB programs that use Channel Access Toolbox, Accelerator Toolbox, and Accelerator Control Middle Layer [5].

REFERENCES

[1] J. Hill, "Channel Access Portable Server Reference Guide", available at http://lansce.lanl.gov/lansce8/Epics/

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[4] www-ssrl.slac.stanford.edu/at/

[5] J. Corbett, "Accelerator Control Middle Layer", these proceedings

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Stanford Linear Accelerator Center, Stanford University, Stanford, California, 94309