Preparing Slow Controls at BESSY for Fast Orbit Feedback

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Abstract

The CAN field bus based control system interface to the BESSY power supplies was designed with emphasis on robustness, long-term stability, reproducibility and precision, relying on the basic idea that intrinsic beam stability is achievable at any required level. In preparation for the first phase of a fast orbit feedback system installation, a number of steps at different levels have been taken to enable the existing interface for fast, parallel, synchronized distribution of set point values to corrector power supplies. The design goal was achieving the maximum update rate and a minimum jitter, without major and/or expensive changes to the control system design or hardware. The paper discusses the shortcomings found, the measures taken, and the achievements made.

Motivation

BESSY's power supply controls concept was based on:

- Long-term stability
- Precision
- Robustness
- Reproducibility

After some years, a Fast Orbit Feedback system became necessary, which will require replacement of all power supplies and their controls interface.

First preparing step:
Develop the current system to reach its performance limits.

Limitations

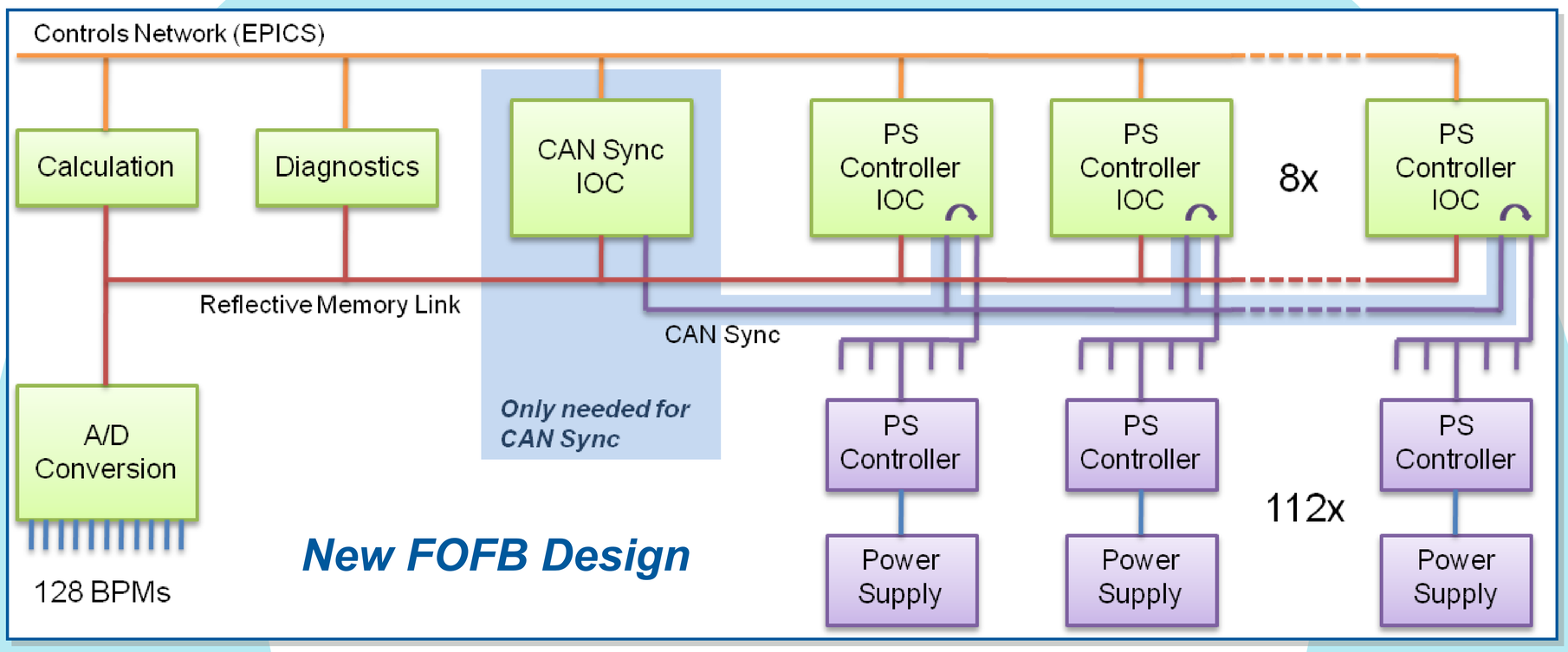
- In-deterministic behavior of IP/Ethernet causes jitter of up to 100 ms
- CAN field bus serializes communication to power supplies, using up to 3.4 ms, achievable minimum jitter 1.5 ms (10 PS on one segment)
- VxWorks network thread blocks I/O every 5 s for 10 ms while querying the Ethernet chip for link status

Calculation

- Rack-mounted PC running RTLinux
- SVD algorithm implemented in Matlab2007

Set Point Data Distribution

- UDP multicast approach was skipped due to VxWorks network block problems
- Reflective Memory link is used to distribute set point data to power supply IOCs



BPM Data

- Hardware trigger derived from revolution clock
- Pre-processed analog signals from all 128 BPMs are connected to one rack
- A/D conversion in single VME crate (max. rate 2.4 kHz)
- Data is transferred to calculation and diagnostics boxes via Reflective Memory

CAN Communication

- New unacknowledged CAN service to speed up set point data transfer (now 1.8 ms for 10 PS)
- Broadcast CAN message triggers writing set point data to the D/A converter for all PS on a segment

D/A Conversion Trigger

Three options:

- Sync message on global "slow" CAN segment is mapped to local "fast" PS segments
- Sync event on Reflective Memory link causes local CAN sync message
- Hardwired trigger signal to all converter cards

Project Status

- All components tested in laboratory
- Integration and testing in production under way
- Results from laboratory tests are promising

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