



SPEAR Control System Architecture

- Who
 - is responsible for this mess?
- Why
 - are we implementing it this way?
- What
 - are we installing?
- When
 - will it be available?
- Where
 - can I find useful links?

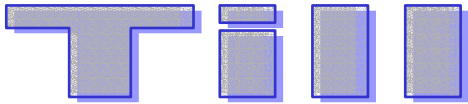


Our crack software team...

Clemens
Wermelskirchen



- Fearless leader
- History buffers (+ Save/Restore)
- Bitbus, GPIB drivers
- TSP, QMS control
- Knob utility, configurations
- Curmon
- VMS system management
- CAMAC
 - Ion gauges, BSOICS, thermocouples



Straumann



- BPM Data acquisition
 - Echotek and Bergoz
- MCOR drivers
- Fast feedback
- Fast realtime system/timestamps
- Orbit interlock interfaces
- Open software maven
 - Linux, RTEMS, Scilab, etc.
- EPICS guru



Stephanie Allison



- Keeps us all organized
- CANbus, EtherNetIP ports
- Save/restore utility
- Ethernet/GPIB
- DCCT
- Low level rf
- Alarm handler
- Logging



Harvey Rarback



- Computing infrastructure
 - System management
 - Windoze
 - Unix (prymatt and zantar)
 - Alarms and logging
- Insertion device control
- Operator interfaces
- SPEAR and beamline MPS
- Kickers

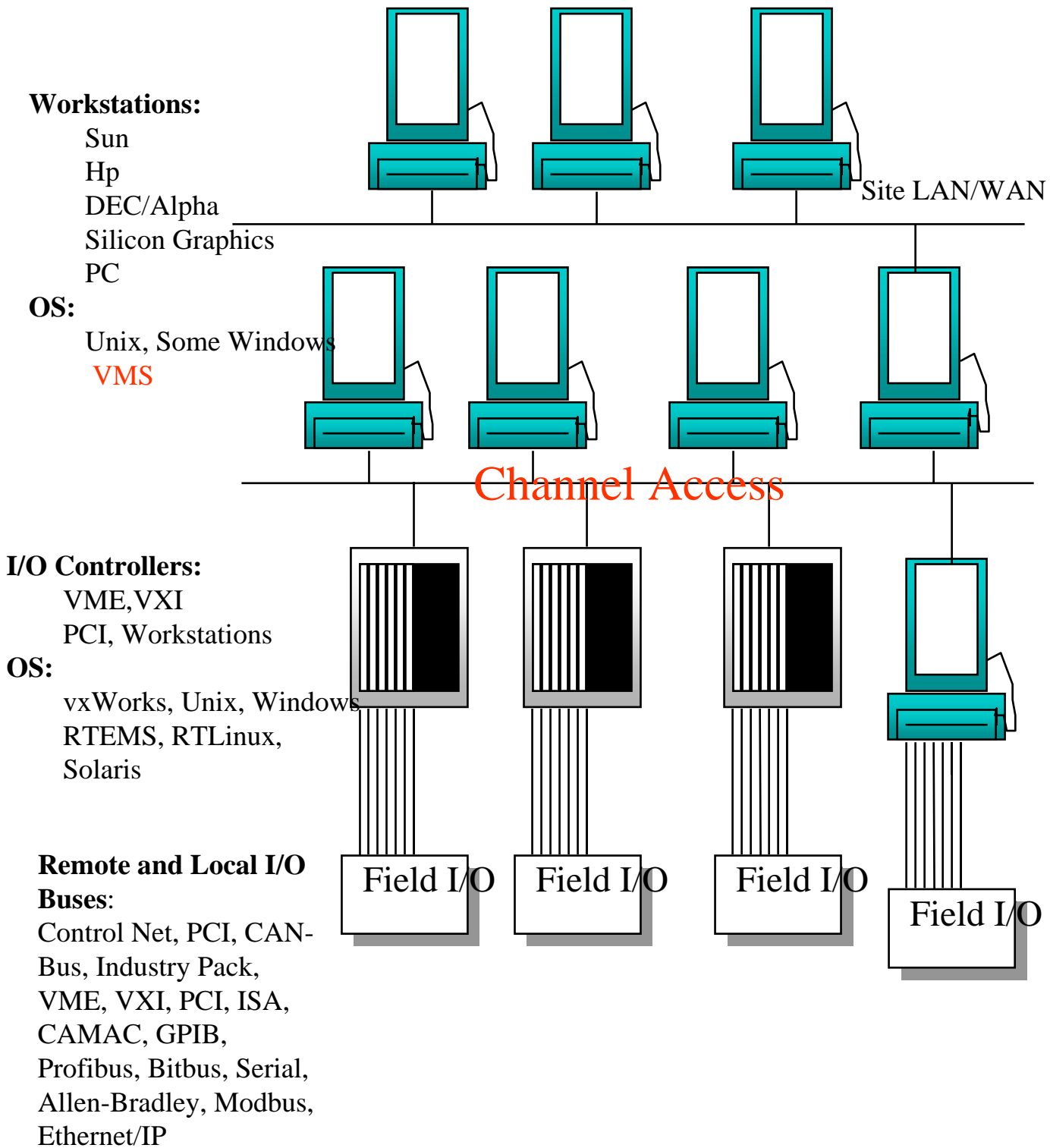
The EPICS Collaboration

- Over 90 independent projects in North America, Europe and Asia
- Applications in accelerator control, particle physics, astronomy, and industrial control
- Distribute software over the network
- Independent development, co-development and incremental development of code done by members
- Problem reporting and resolution via e-mail exploders
- Documentation available on WWW sites
- Large collaboration meetings to report new work, discuss future directions, explore new applications, and explore new requirements for existing codes
- Small design groups from multiple labs meet to discuss design issues on significant codes: Channel Access, CDEV, Archiving and MMI

Accelerator Programs Using EPICS

- The Advanced Photon Source and Beamlines @ ANL
- The Advanced Light Source
- The Thomas Jefferson National Accelerator Facility @ Newport News, Va.
- Proton Storage Ring @ LANSCE
- Injection Linac for KEKB Factory @ KEK
- Advanced Free Electron Laser @ LANL
- Duke Free Electron Laser and Mark III Laser @ Duke University
- Heavy Ion Fusion Test Stand @ LBL
- Intense Pulsed Neutron Source @ ANL
- HERA Cryogenic Plant and Tesla Test Facility @ DESY
- **RF and Beamline Control for the B-Factory @ SLAC**
- Bates Linear Accelerator @ Bates MIT
- Racetrack Microtron @ University of Athens
- BESSY II @ BESSY
- **SPEAR3**

EPICS Supports a Standard Control System Architecture





What is a PV?

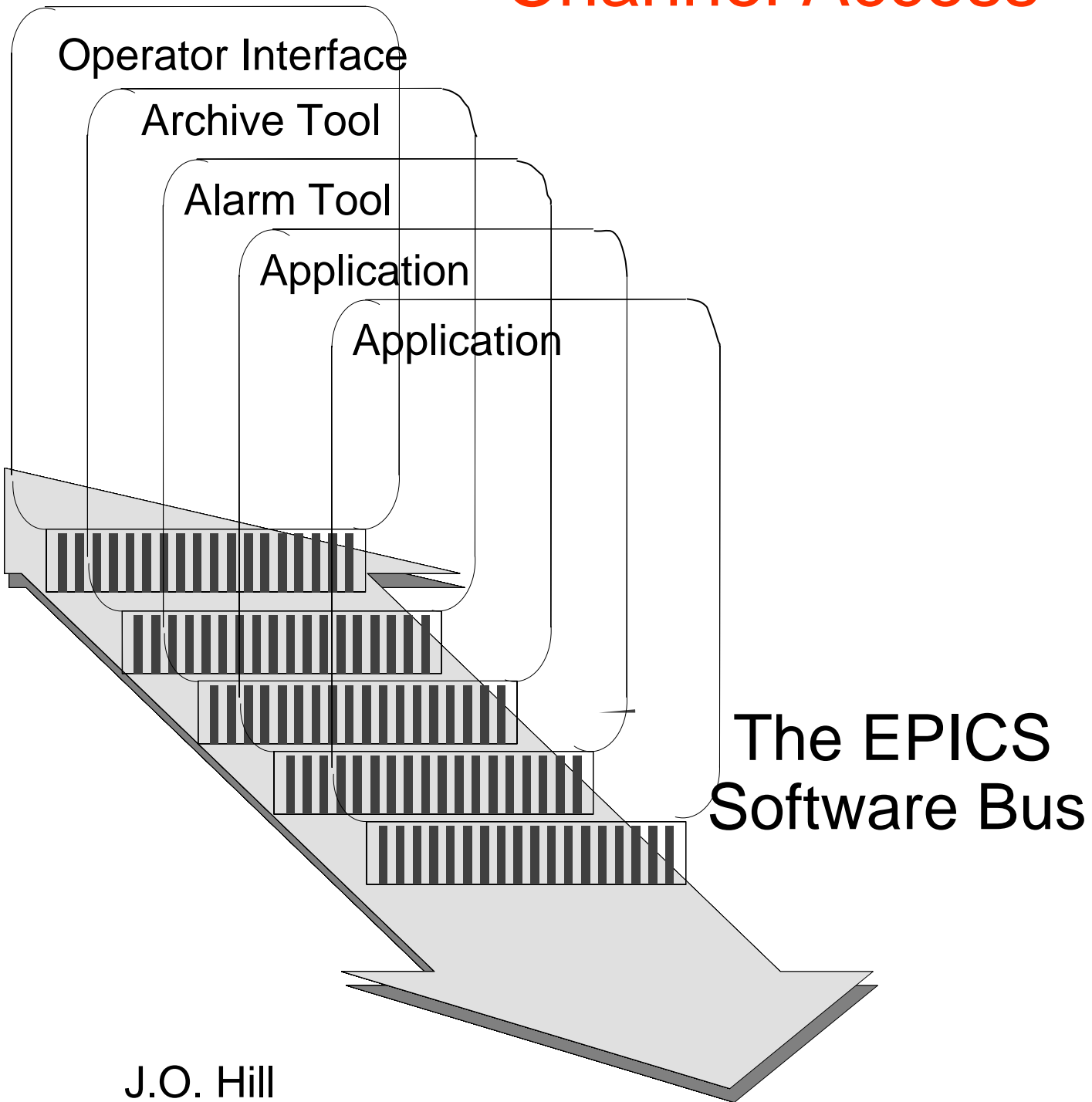
- What is an EPICS record?
 - “Black box” of ioc processing
 - Includes data and processing
 - record types like analog input, binary output
- SPEAR record name convention:
 - <http://www.slac.stanford.edu/~spear/epics/RecNameConv.html>
 - **COMPONENT:Signal**
 - Examples:
 - MS1-BD:CurrSetpt
 - setpoint for bend magnet (MS1 is a magnet string)
 - spr:EPBU1/AM1
 - BSOIC radiation (on VMS)



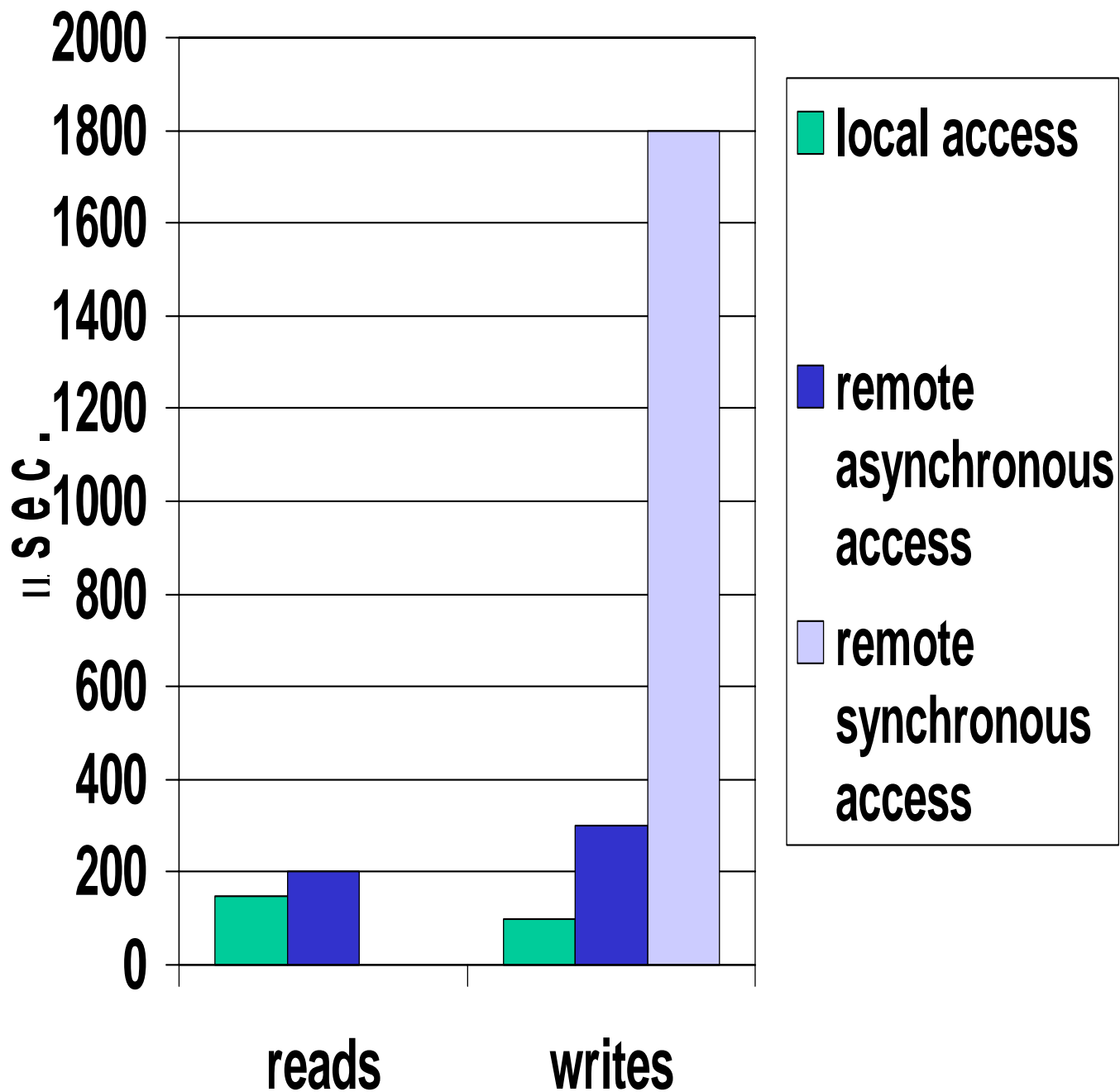
What is a PV? (cont'd)

- PV==Process Variable
 - Transaction unit of channel access
 - PV name is
 - **Record_name.FIELD**
 - Field names depend on record type
- Examples:
 - MS1-BD:CurrSetpt.**DESC**
 - Text Description of record
 - MS1-BD:CurrSetpt.**VAL**
 - Value of record
 - MS1-BD:CurrSetpt is shorthand for this PV
- Some EPICS tools manipulate PVs without explicit typing of names

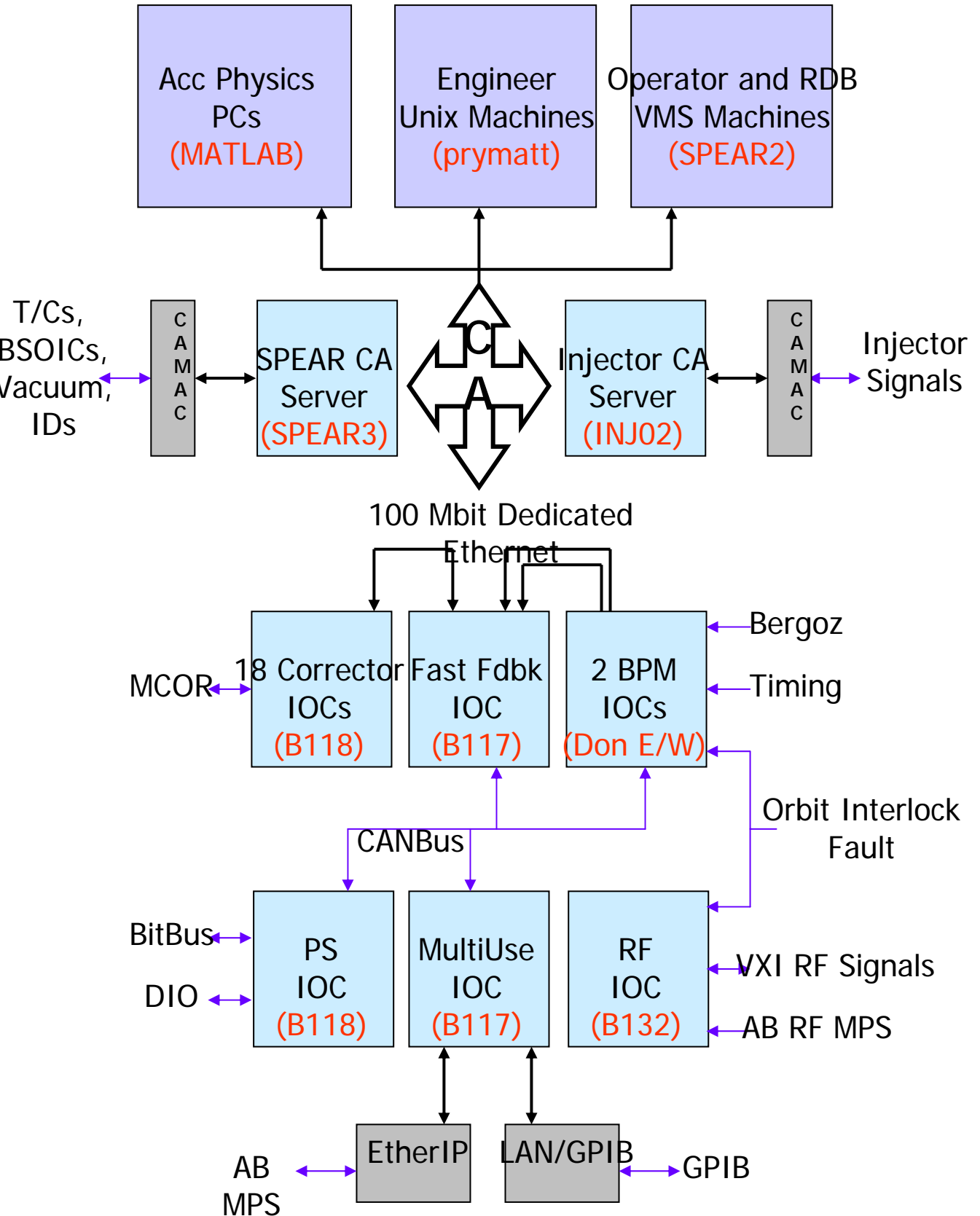
Channel Access



Channel Access Performance for Simple, Unconverted I/O Channel Reads and Writes



EPICS at SPEAR



IOC Hardware



- PPCs (~25): Synergy VME VGM, Kinetics VXI V152
- Crates: Wiener VME 64X, Elma VXI, SLAC/PEP-II MCOR
- Perle Terminal Servers
- Crate I/O:
 - Echotek ECDR-814 Digital Receivers for parallel first/single/multi-turn BPMs
 - Fast ADCs (General Standards 16AI64SS PMC or Hytec 8401 IP) for MUXed multi-turn BPMs
 - INCAA VEBB BitBus Controllers for PEP-II DC Power Supplies
 - SLAC MCOR Interface Modules for PEP-II Corrector Power Supplies
 - Acromag 9670 IP Carriers with TIP/Acromag IPAC Modules
 - SLAC/PEP-II RF VXI Modules
 - AB VME Scanner
 - Hardware timing module
- Ethernet I/O:
 - Agilent GPIB LAN Boxes
 - Master Oscillator, Frequency Meter, Kicker timing, etc.
 - AB EtherIP Modules



RTEMS IOC Boot

- System image loaded
- Initialization task
 - Also loads symbol file
 - Runs common non-EPICS startup script to load other unbundled apps, set time zone, start tasks, etc
 - Then runs EPICS app startup script identified in NVRAM which loads app image and initializes EPICS
 - **Setpoints are restored**
- Left at Cexp prompt – at this point, can log into ioc and use Cexp tools



Some IOC Applications

- Corrector PS (108) Control
- Quad/Main PS (70) Control
- Parallel-Button BPM (36) Processing
- MUXed BPM (54) and Beamline Photon Monitor (22) Digitization
- RF System, RF Frequency Control
- MPS Monitoring
- Orbit Interlock Monitoring
- Beam Current/Lifetime
- Kicker Timing
- Booster Injection Timing
- Relay Switching (QMS and TSP)
- Wiener Crate Monitoring



IOC Applications (Later)

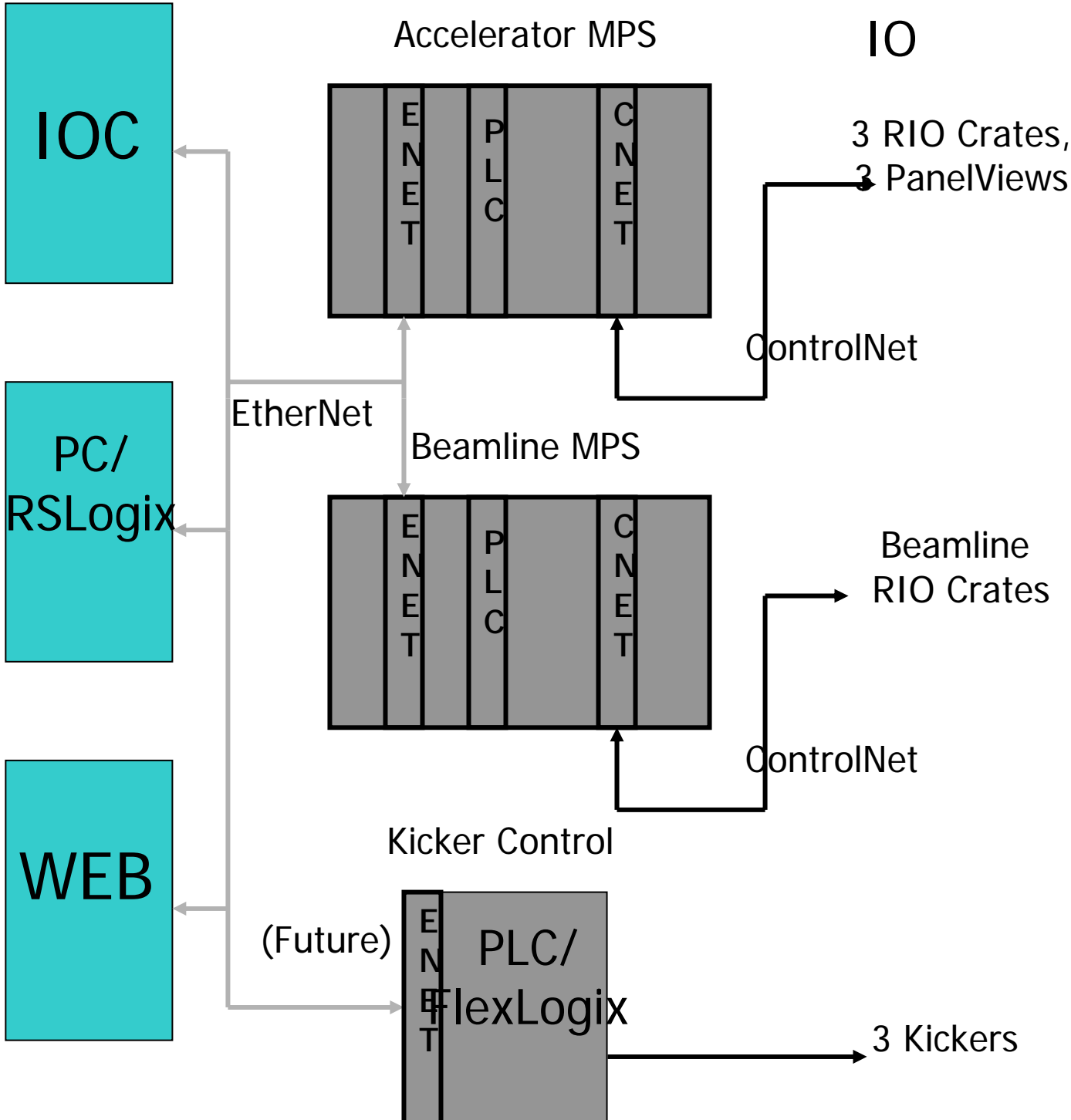
- Fast Orbit Feedback (4kHz)
- Control System Timing
- Synchrotron Light Monitor
- Tune Monitor and Driver Interface
- More GPIB Apps

EtherIP at SPEAR



AB ControlLogix Crates

AB
Remote
IO





Host Hardware

- OpenVMS AlphaServer (3)
 - SPEAR2, SPEAR3, INJ02
- Tru64 Unix AlphaServer (NFS, ioc boot server)
 - zantar
- Solaris 8 SunBlade-100
 - prymatt
- SLAC Solaris/Linux Servers on other subnets
- Various PCs (Windows and Linux)
- UPS
 - on all important hosts

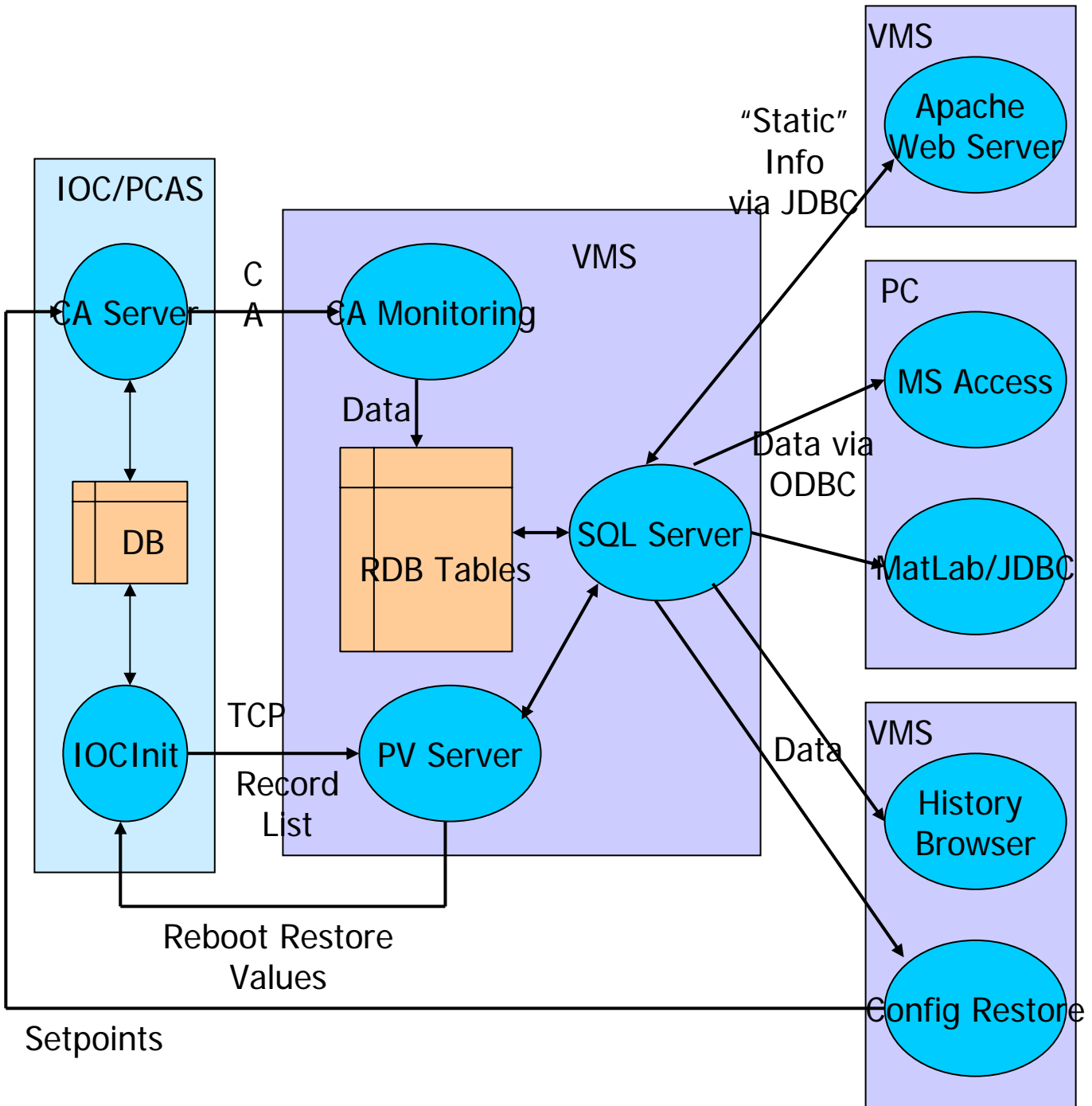


Host Applications

- EDM Operator Displays
- StripTool
- Data Archiver (to RDB)
- Data Browser (from RDB, X-Windows)
- Event Monitor and Messaging (RDB)
- Configuration Save/Restore (RDB)
- Knobbing (X-Windows)
- Insertion Device Control (IDL)
- SciLab Apps
- RF Apps (MatLab, DM, CMLOG, ALH, CW)
- Acc Physics Lattice Control and Orbit Monitor and Control Apps (MATLAB)



RDB System



SPEAR EPICS PV Database



05G-QD1:Curr

12-JUN-2003 12:58:06

PVID 1638

----- History data recording information -----

Recording

Table READBACK

Column T05G_QD1\$CURR

----- History plot display information -----

Display group

Display parameter

Parameter order

Display name

Units

----- PV information -----

Record type ai

VAL data type DBF_DOUBLE

Description Current

Dtyp Bitbus

In/Out Link #L2 N4 P0 S33 @

EGU A

[Back to PV list](#)

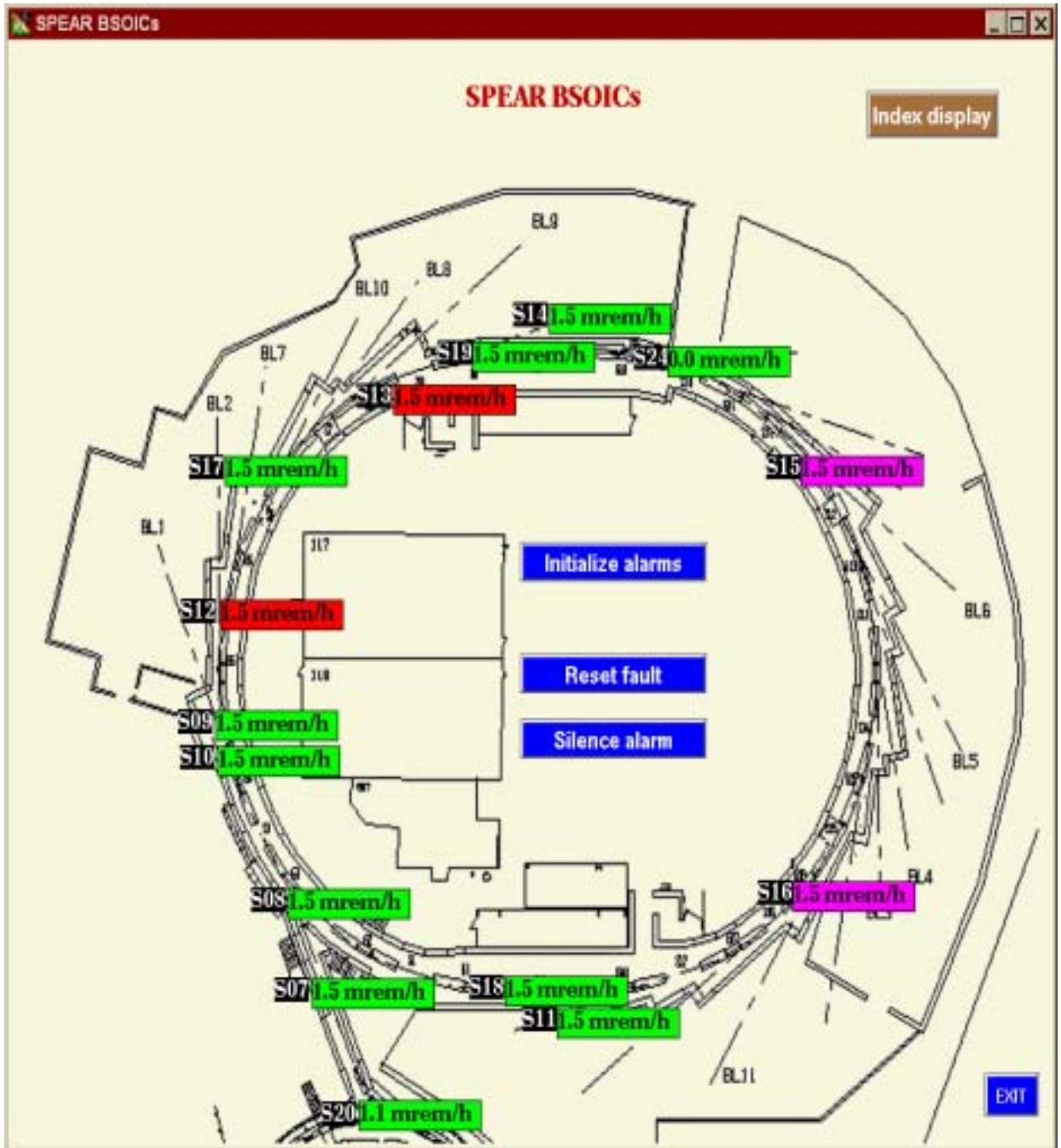
[Show modification history](#)



Current EPICS/OS Versions

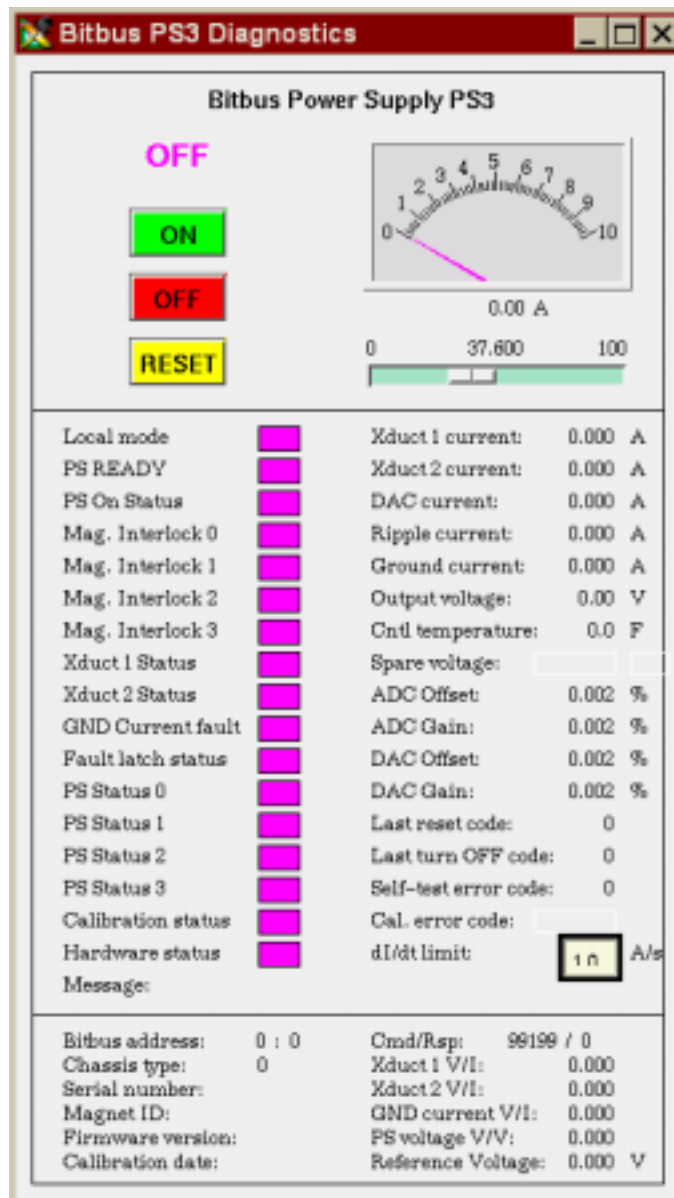
- New IOCs: 3.14.1/RTEMS4.6.0
- RF IOC: 3.13.6/Tornado 2.0.2
- SPEAR/Inj CA Servers: 3.13.1/OpenVMS 7.3-1
- Operator Tools, RDB System: 3.13.1/OpenVMS 7.3-1
- RF Engineer Tools: 3.13.6/Solaris 8
- Developer Tools: 3.13.6 and 3.14.1/
Linux and Solaris
- Acc Phys MatLab Applications: 3.13.4/Windows

Example EDM display





Bitbus supply diagnostic panel





Software Schedule

- Priority 1 Software: Oct 1, 2003
- Commission w/o Beam: Nov 1, 2003
- Commission with Beam: Dec 8, 2003
- Photon Beam to Exp: Early 2004
- Priority 2 Software: Mid 2004

EPICS 2010

- We are currently strong to make incremental steps
 - EPICS has reached a mature state (this way)
 - Nobody wants to change this!

But

- Let's start to think about the long term future of EPICS
- Not: What is currently necessary?
- But:
 - What is necessary on the long run?
 - How can we get prepared for future technical trends?

God smiles on SPEAR...



SPEAR3 Wed Apr 2 17:23:03 2003





Some useful links



- EPICS home page
 - <http://epics.aps.anl.gov/epics/>
- SLAC EPICS home page
 - <http://www.slac.stanford.edu/comp/unix/package/epics/index.html>
- SPEAR EPICS home page
 - <http://www.slac.stanford.edu/~spear/epics/>
- SPEAR EPICS PV Database
 - <http://www.ssrl.slac.stanford.edu/speardb/pv.jsp>