

EPICS MySQL Archiver – Integration between EPICS and MySQL

Presenter

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Why an *Archiver*?

Ultimate Aim.....

**Stable operation
with desired
performance**



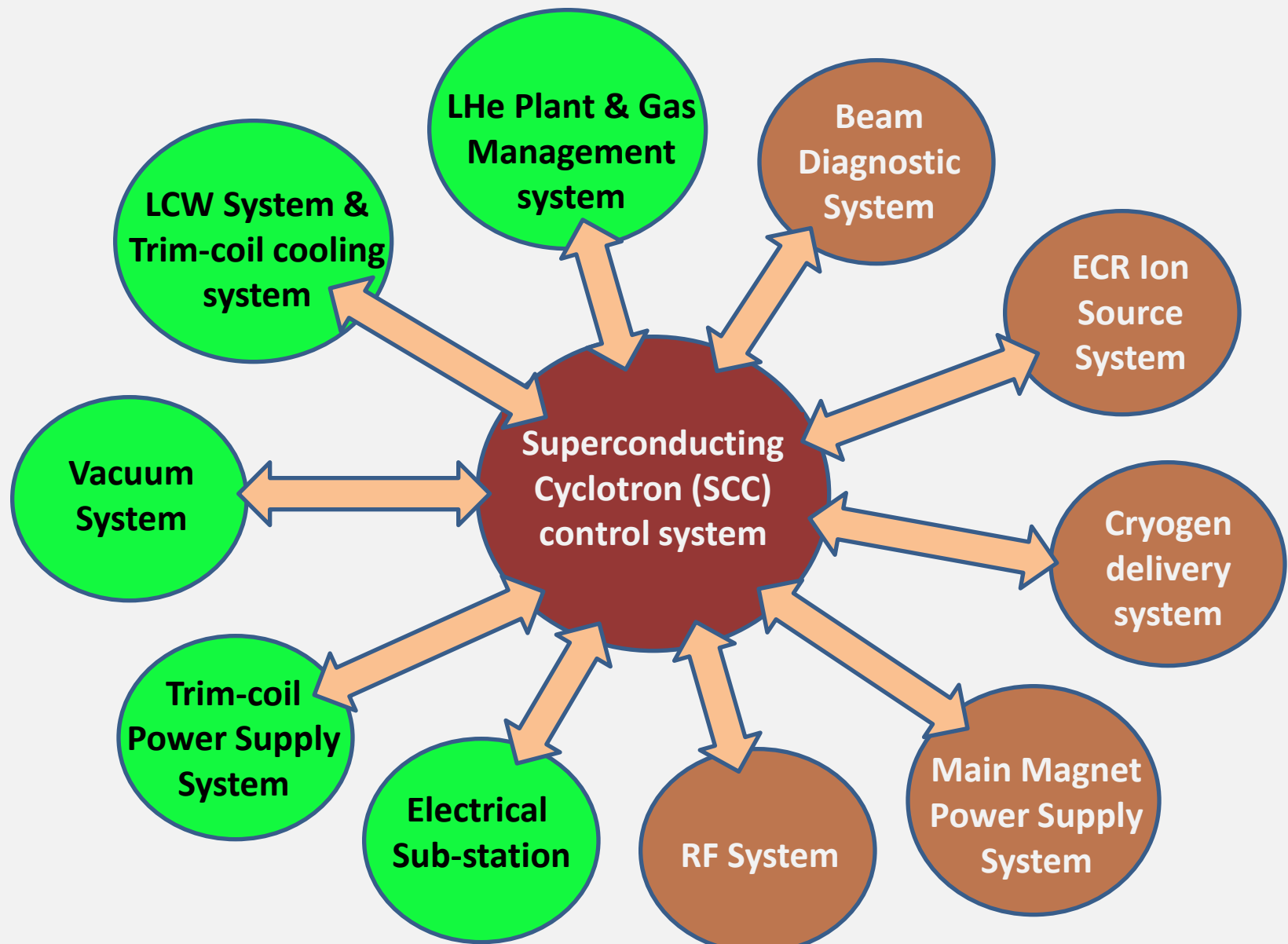
**Better tuning of
machine
parameters**



Data archiver.....

**Logging of machine
parameters for
analysis**

Control System of Superconducting Cyclotron (*evolving...*)



Why another Archiver?

Option – I: EPICS Channel Archiver – the default option

- ✓ Best option for EPICS based control system
- **Lack of support for Non-EPICS based / third party system**
- Configuration and maintenance of database **demands expertise specialized in EPICS Tool set.**

..... Hence **NOT SUITABLE** in hybrid system e.g. SCC

Option – II: Industry standard relational database

- ✓ Readily supported by third party system
- ✓ Standard support, may be incorporated into, in-house system
- ✓ Availability of expertise and support – plenty in industry
- ✓ Ease of maintenance
- ✓ **No support for EPICS based system**

.....**SUITABLE** for hybrid system, only **if integrated with EPICS**

Selection of database

Many in the industry i.e. Oracle, PostgreSQL, MySQL.....

➤ Oracle –

- ✓ Best in industry
- ✓ Not FREE
- ✓ Need expertise for commissioning, maintenance, upgradation

➤ PostgreSQL –

- ✓ Open source, hence free access
- ✓ Performance wise in between Oracle & MySQL
- ✓ Lack of familiarization to the developers

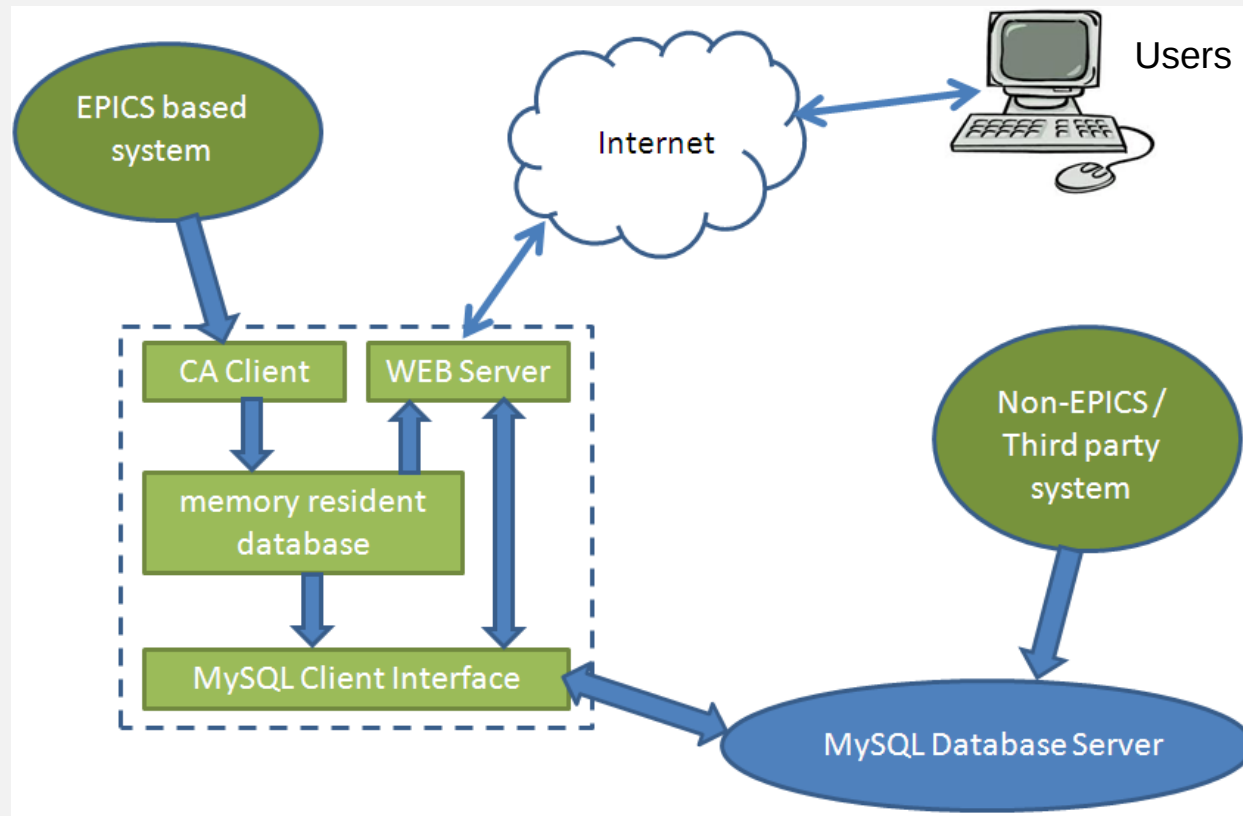
➤ MySQL –

- ✓ Open source, hence free access
- ✓ Industry proven.....most popular
- ✓ Simplicity of commissioning and maintenance for small systems
- ✓ Performance wise.....no issue till now, at least for our system

Application architecture

➤ Three tier architecture

- Top layer – CA Client & Web Server
- Middle layer – a memory resident database
- Lowest layer – MySQL Client interface



The *Archiver*

- Designed to log data along with time stamp
 - ✓ **SCAN mode** (Scan time ≥ 1 sec)
 - ✓ **MONITOR mode**
- Dedicated threads for managing
 - ✓ MySQL client interface for data insertion and retrieval,
 - ✓ CA connection managements, CA callback,
 - ✓ Command prompt interface
 - ✓ Scan mechanism
 - ✓ Web server
 - ✓ Retrieval latest data for non-EPICS systems logging data independently.
- Use of Open source libraries
 - ✓ EPICS CA library – CA functionalities
 - ✓ MySQL client library – interfacing database
 - ✓ GD Graphics library – creating dynamic image

The *Archiver*

- Simple to configure – text based configuration file
 - Parameter name
 - System name
 - System type (EPICS / non-EPICS)
 - Sub-system name
 - Logging mode
 - Logging interval (if SCAN mode)
- Creates independent table for individual systems
- Configure ‘date’ as index to accelerate search
- Provide monitoring of non-EPICS systems

```
system Vacuum ca
sub Main_machine
pv VAC_MM_BC2 ca monitor 1
pv VAC_MM_BC3 ca monitor 1
pv VAC_MM_OVC ca monitor 1
pv VAC_LOLINER ca scan 1
pv VAC_UPLINER ca scan 1
sub Vault_beam_line
pv VAC_BTS_GL1 ca scan 1
system CRYO_DEL_SYS nc
sub PRESSURE
pv PI1 nc monitor 20
pv PT3 nc monitor 20
```

User interface

An **important part** of the Archiver

- **Integrated part** of the Archiver
- **Web server** based – easy access
- **Multilayered navigational** user interface
- Provides **facilities** e.g.
 - Views of system / sub-system
 - Historic analysis
 - Addition / modification / deletion of parameter
 - Downloading of archived data

System Overview

Information about system e.g. number of sub-system / parameter
Navigational links to individual system / historic plot etc.

MySQL Archiver's Web Server - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Print Mail WWW Go

Address http://172.24.4.80/ Go

EPICS MySQL Archiver

[Historic plot](#)

System	No of subsystem	No of parameter
Vacuum	2	10
RF	1	11
Power sup	1	2
CRYO DEL SY	7	66

[Add / Modify / Remove](#)

Done Internet

Start SCC MAIN MACHINE VA... VAC_joc OP-Manual-SCC.pdf - ... MySQL Archiver's We... 3:37 PM

Sub-system overview

Information about sub-system

Navigational links to individual sub-system / historic plot etc.

EPICS MySql Archiver

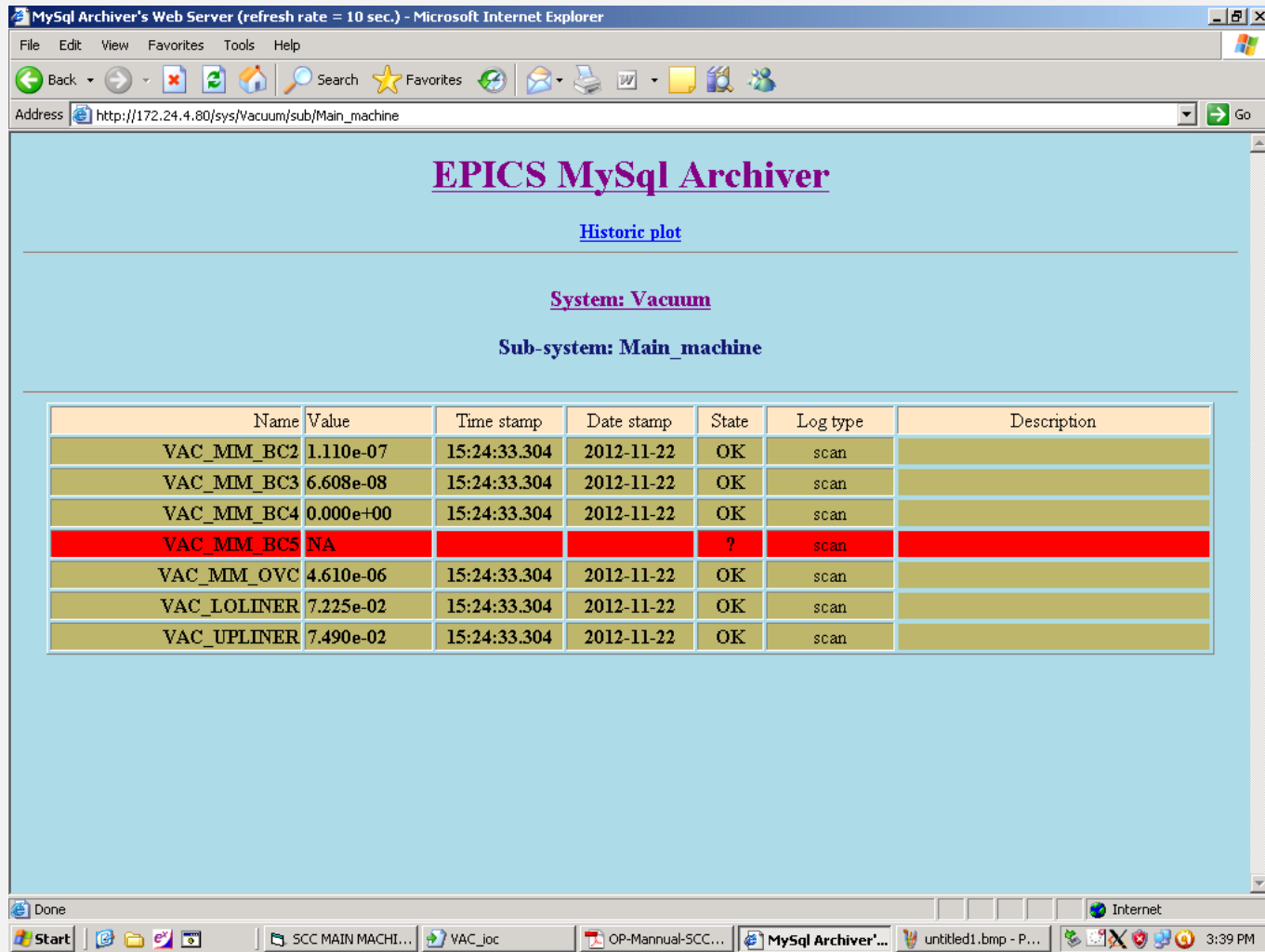
[Historic plot](#)

System: CRYO_DEL_SY

Sub system	No of parameter
PRESSURE	7
TEMPERATURE	14
LINK FORCE	13
LEVEL	7
CY	4
FLOW	3
He Plant View	18

On-line monitoring of system parameters

Displaying latest value, time stamp and status of individual parameter
Navigational links to individual system / historic plot etc.



MySql Archiver's Web Server (refresh rate = 10 sec.) - Microsoft Internet Explorer

Address: http://172.24.4.80/sys/vacuum/sub/Main_machine

EPICS MySql Archiver

[Historic plot](#)

System: Vacuum

Sub-system: Main_machine

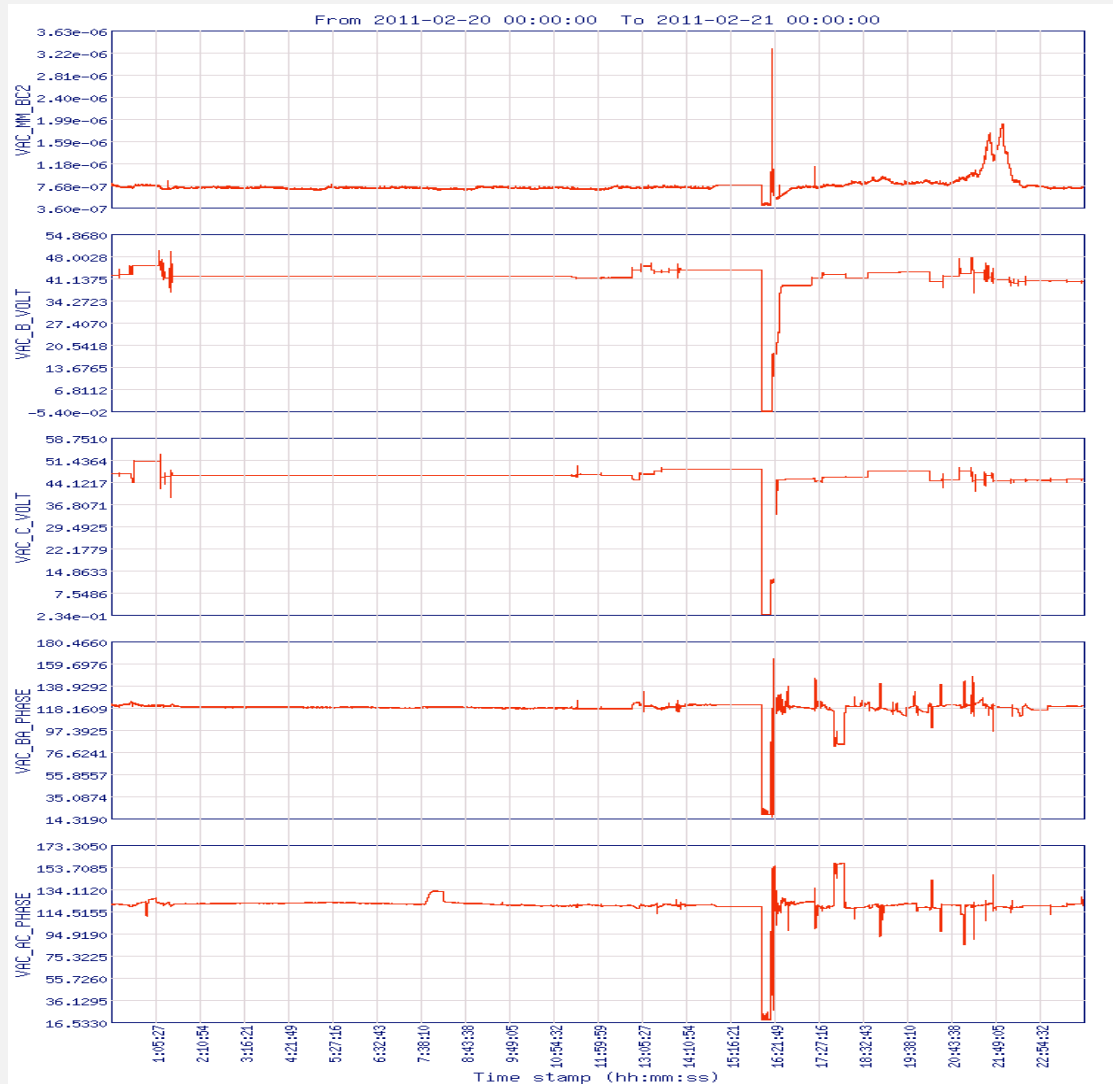
Name	Value	Time stamp	Date stamp	State	Log type	Description
VAC_MM_BC2	1.110e-07	15:24:33.304	2012-11-22	OK	scan	
VAC_MM_BC3	6.608e-08	15:24:33.304	2012-11-22	OK	scan	
VAC_MM_BC4	0.000e+00	15:24:33.304	2012-11-22	OK	scan	
VAC_MM_BCS	NA			?	scan	
VAC_MM_OVC	4.610e-06	15:24:33.304	2012-11-22	OK	scan	
VAC_LOLINER	7.225e-02	15:24:33.304	2012-11-22	OK	scan	
VAC_UPLINER	7.490e-02	15:24:33.304	2012-11-22	OK	scan	

Historic analysis

- ✓ maximum 5 parameters on same time scale
- ✓ upto 24 hours data
- ✓ facility for downloading data as spread sheet
- ✓ historic plot, an image (png), available for downloading



Historic analysis (*an example*)



Add / Remove / Modify parameter

- ✓ facility for adding / removing / modifying archived parameter
- ✓ changing archiving mode (SCAN to MONITOR or vice-versa)
- ✓ changing archiving interval
- ✓ User authenticated facility for protection

The screenshot shows a web browser window titled "MySql Archiver's Web Server (refresh time = 10 sec) - Microsoft Internet Explorer". The address bar shows the URL: `http://172.24.4.80/password?user=administrator&password=mySqlArch`. The main content area has a light blue background and displays the title "EPICS MySql Archiver" in blue underlined text. Below the title, a note in bold black text states: "(*For Addition all fields are mandatory)". The form contains the following fields and controls:

- Parameter name*:** A text input field.
- System name*:** A text input field.
- Sub-system name*:** A text input field.
- Log type*:** A dropdown menu with "scan" selected.
- Log interval*:** A text input field containing "60" followed by the unit "sec".
- Operation*:** A dropdown menu with "Add" selected.
- Submit:** A button located below the form fields.

The Windows taskbar at the bottom shows the Start button, several open applications including "SCC MAIN MACHINE VA...", "VAC_loc", and "OP-Mannual-SCC.pdf", and the system clock indicating "4:06 PM" on "December 6, 2012".

Example System overview

Hardware: Dell PowerEdge 2950 server
dual Intel Xeon E5320 (2 x 4MB cache)
Intel 5000X chipset
4 x Hot swappable SAS drive with RAID 5 configuration

Software: RedHat ES 4.0 Linux
MySQL server, Version 5.0.22
GD image library, Version 2.0.33
EPICS base version 3.14.8.2

Performance

- ✓ Around 100 control parameters of various systems e.g.
Vacuum, RF, Main magnet, Cryogen Delivery System (CDS), LHe plant
- ✓ An average of 50 parameters per second
- ✓ third party system e.g. CDS logs parameter data directly into database
- ✓ All parameters are logged with time stamp available at archiver
Hence users get a snapshot view of system parameters
- ✓ Running satisfactorily for a considerable period of time resulting into a data volume around 200GB.
- ✓ Helps to resolve important inter-system dependancy related issues

Future development

- ✓ ideally.....no limit
- ✓ More advanced dynamic features in user interface part i.e. web pages
- ✓ Facility for incorporating user defined mathematical operation on archived data
- ✓ User requirements may come in future
..... So on.....

Thank you