EPICS MySQL Archiver – Integration between EPICS and MySQL

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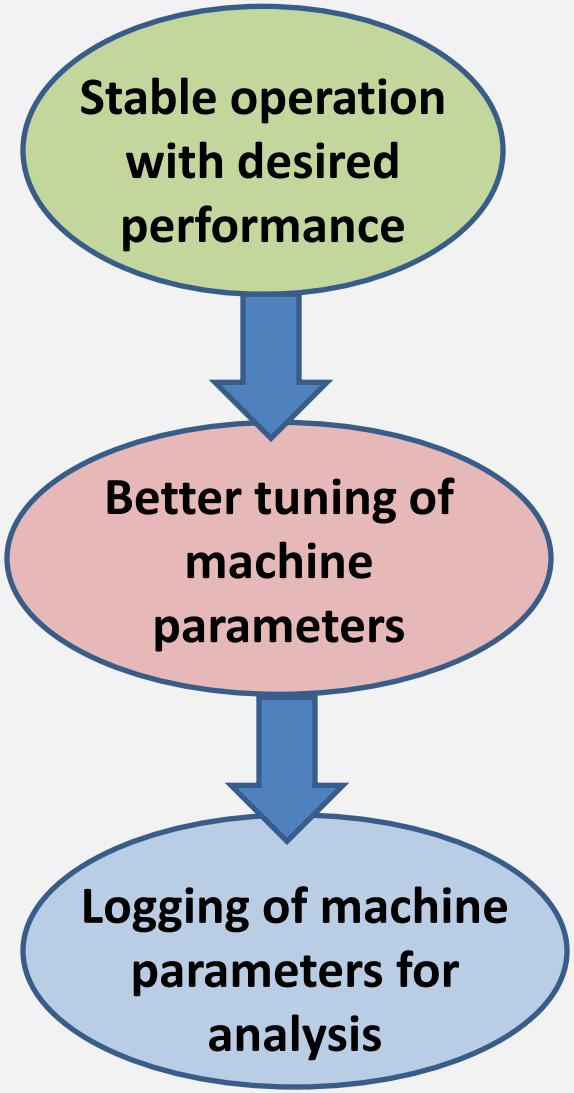
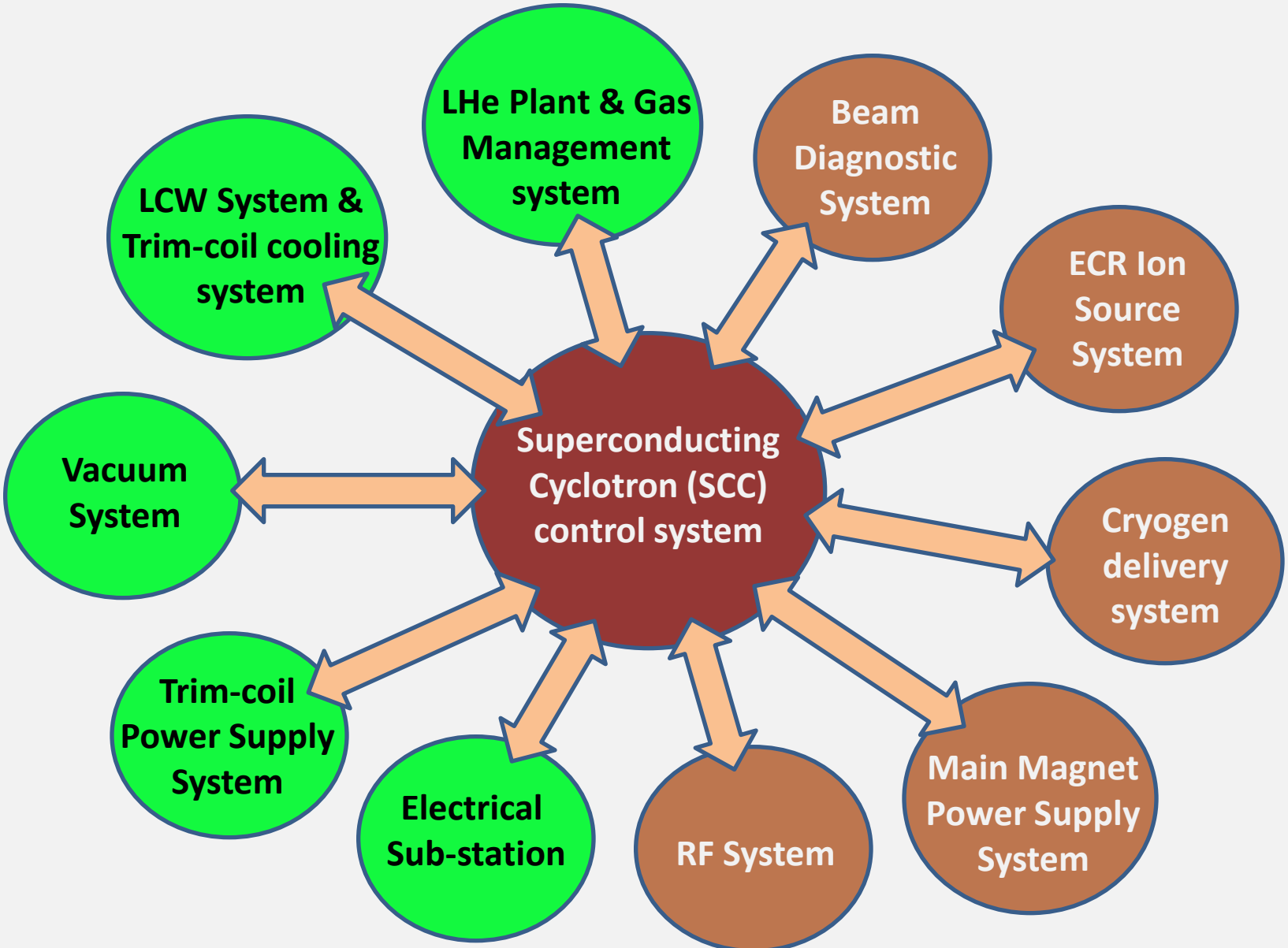
Why an *Archiver*?

Ultimate Aim…….



Data archiver……

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

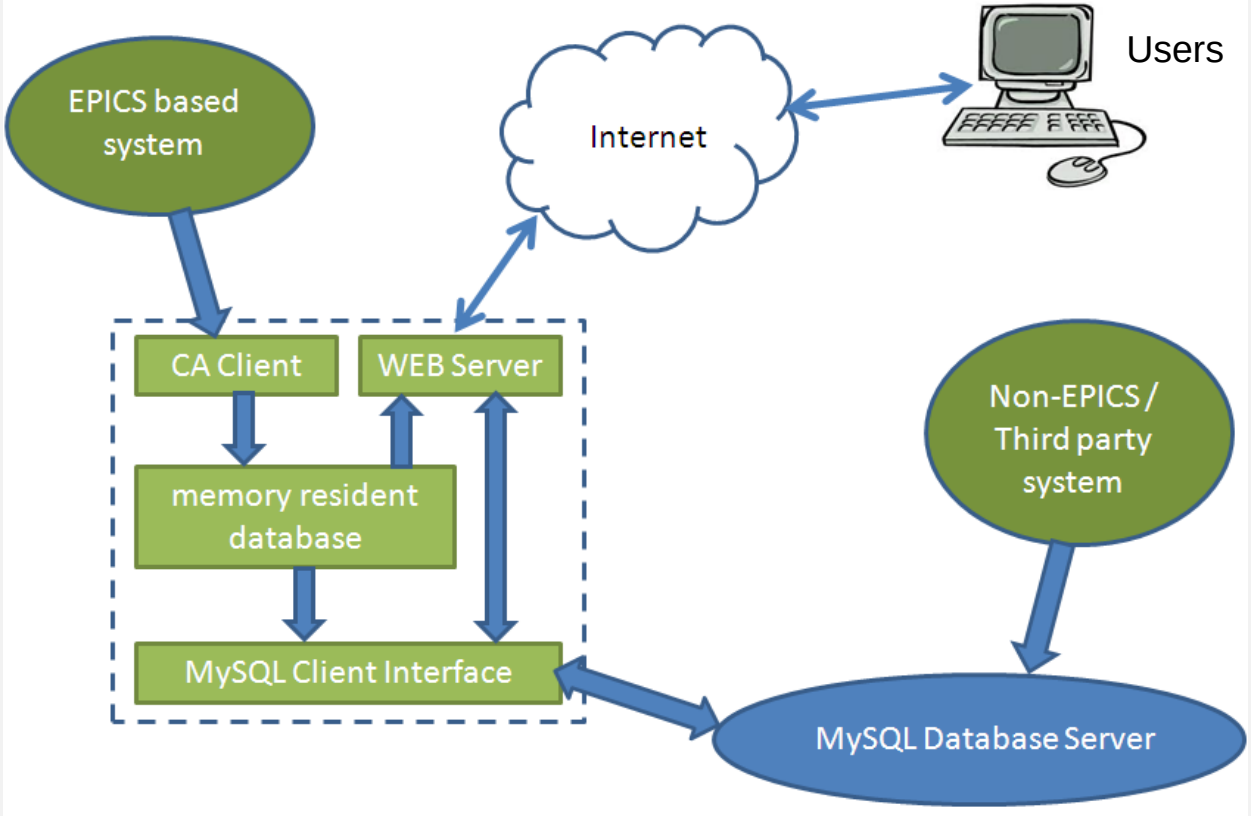
Selection of database

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 PI3 nc monitor 20
```

User interface

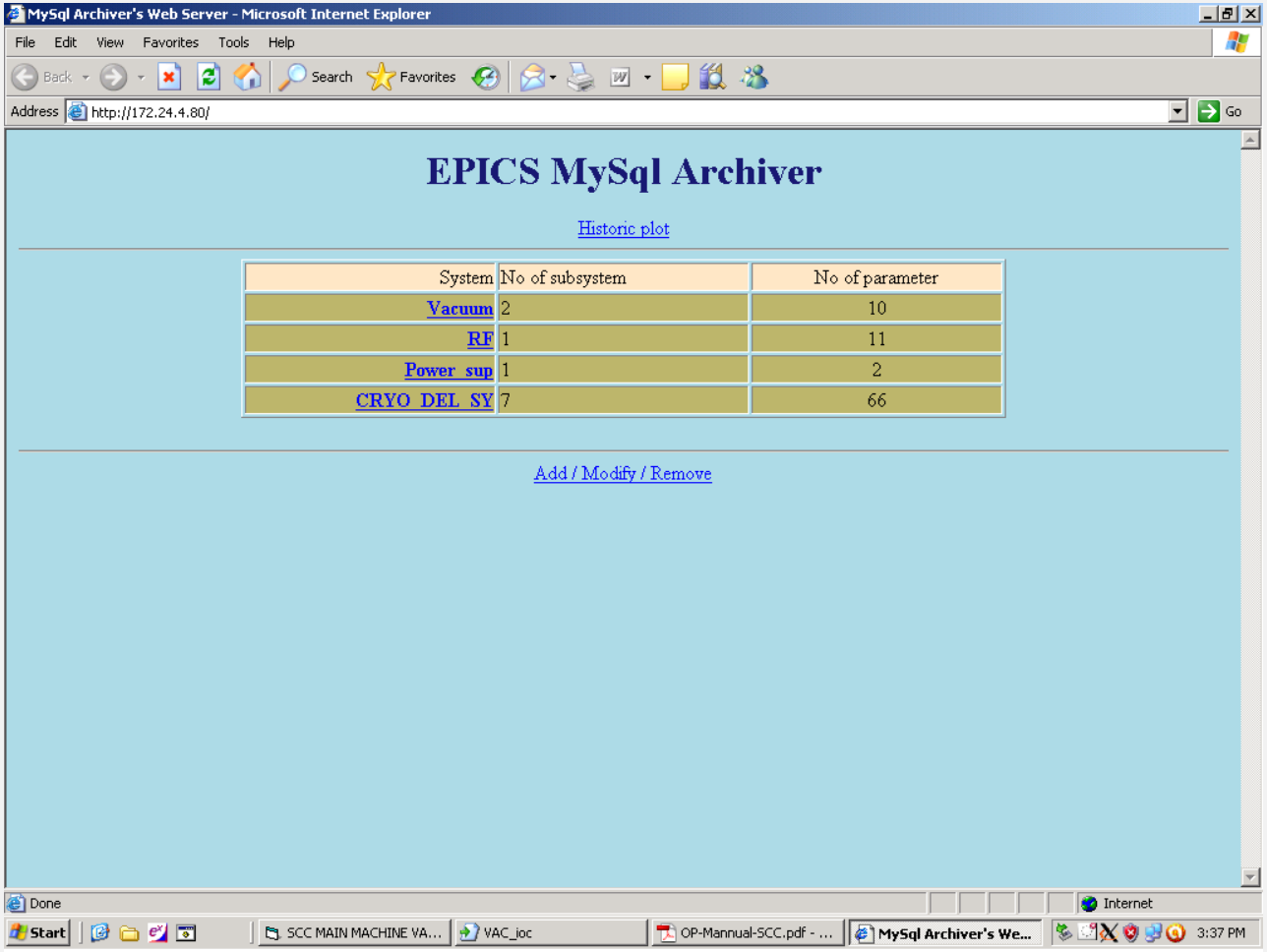
An **important part** of the Archiver

- **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

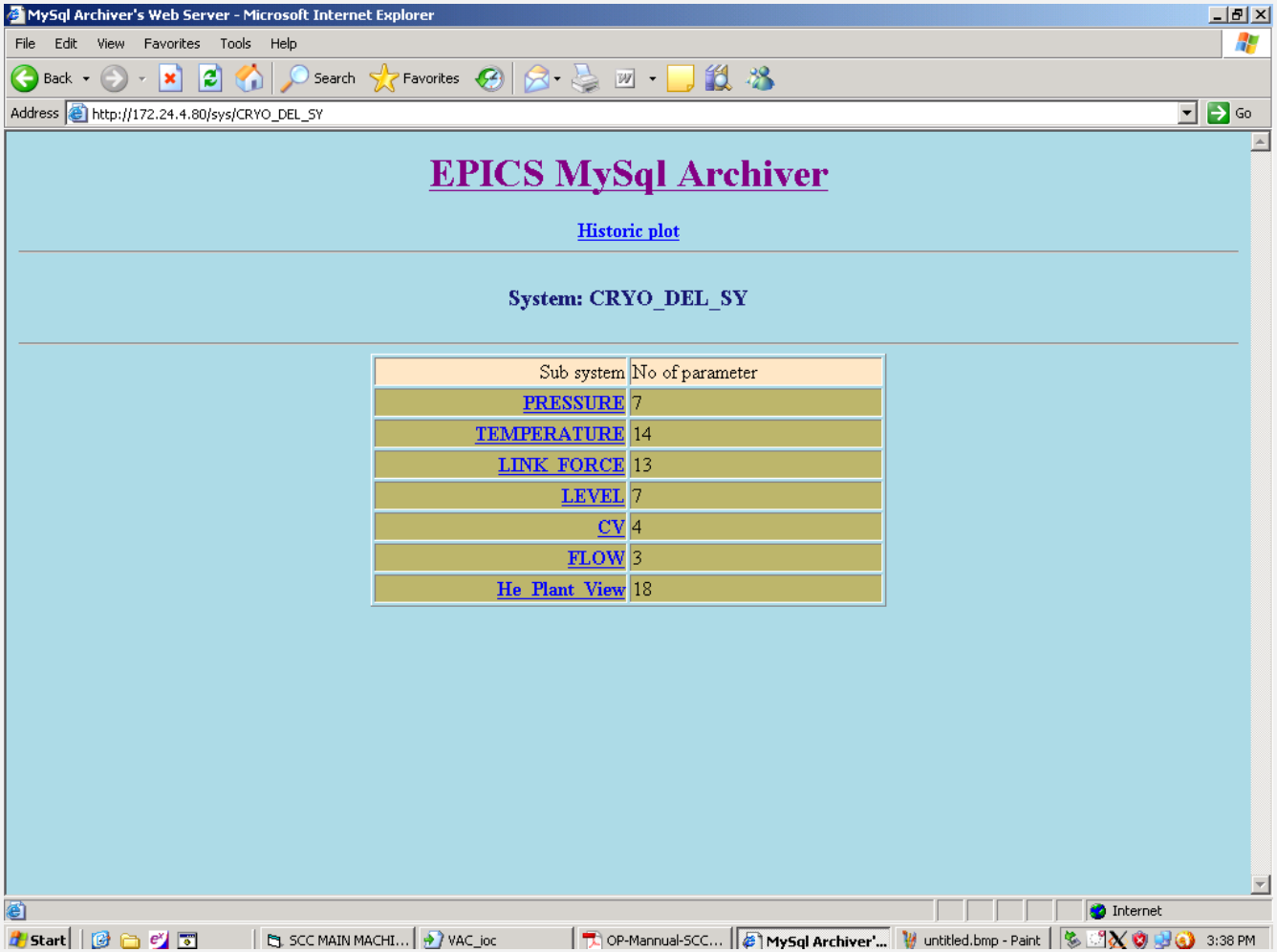
Navigational links to individual system / historic plot etc.



Sub-system overview

Information about sub-system

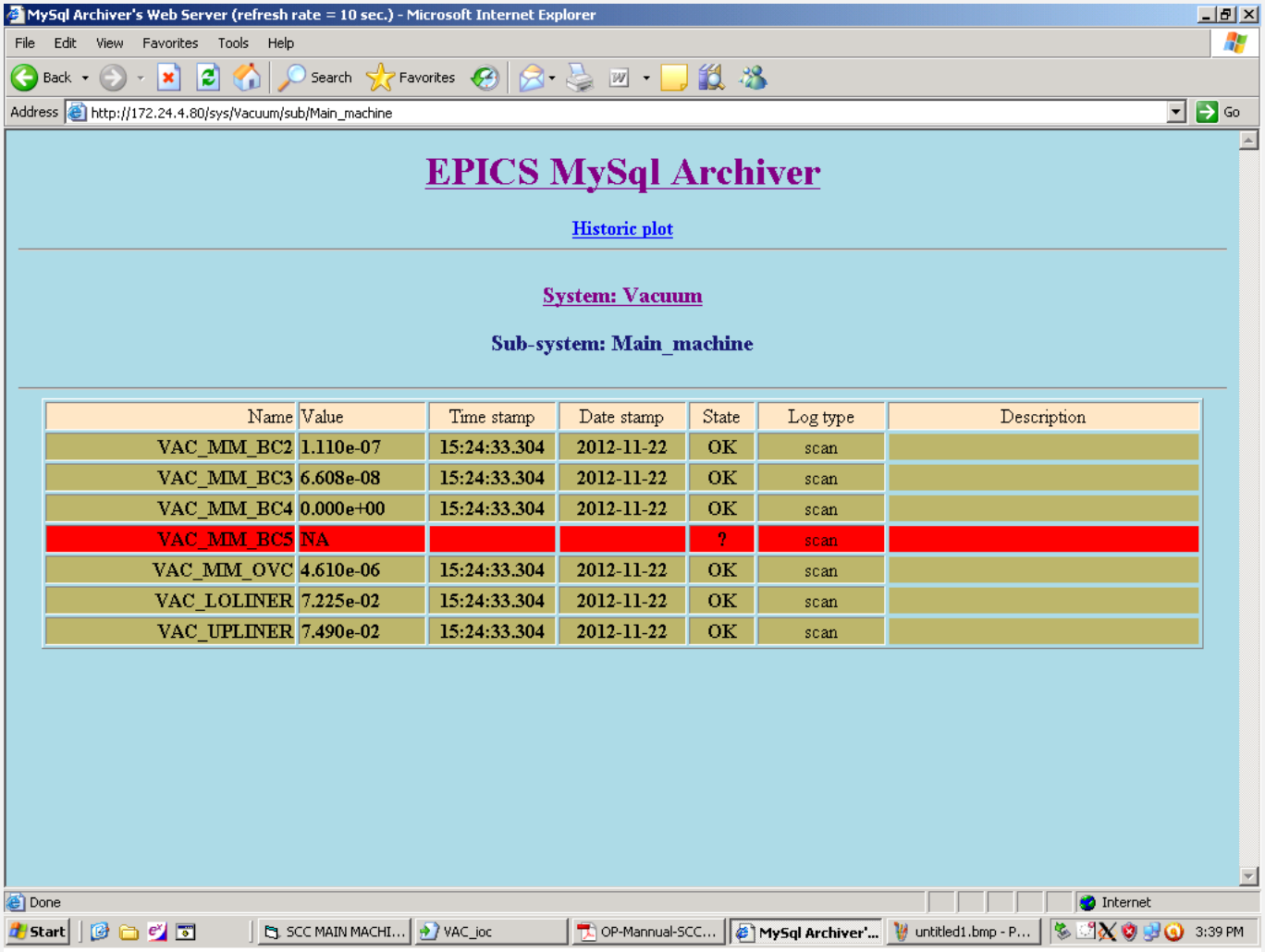
Navigational links to individual sub-system / historic plot etc.



On-line monitoring of system parameters

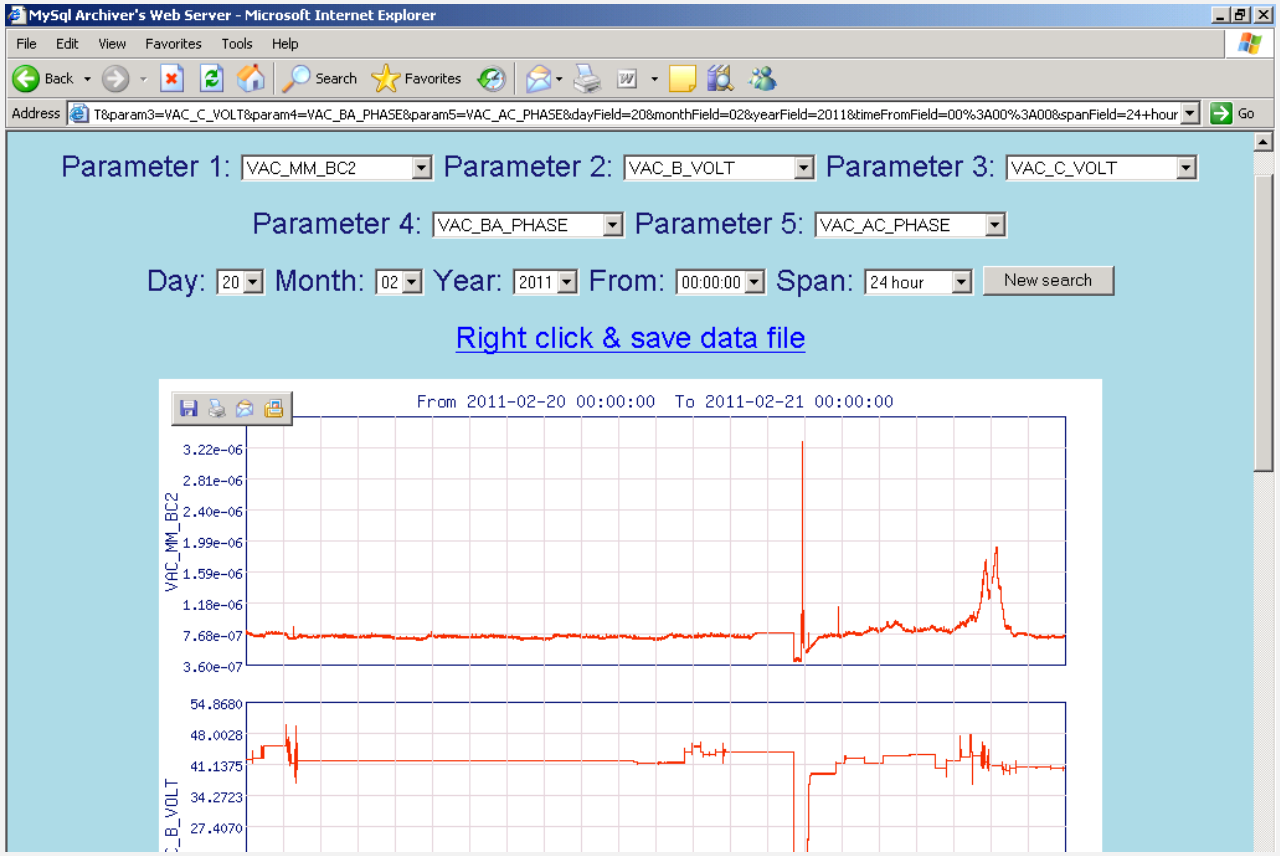
Displaying latest value, time stamp and status of individual parameter

Navigational links to individual system / historic plot etc.

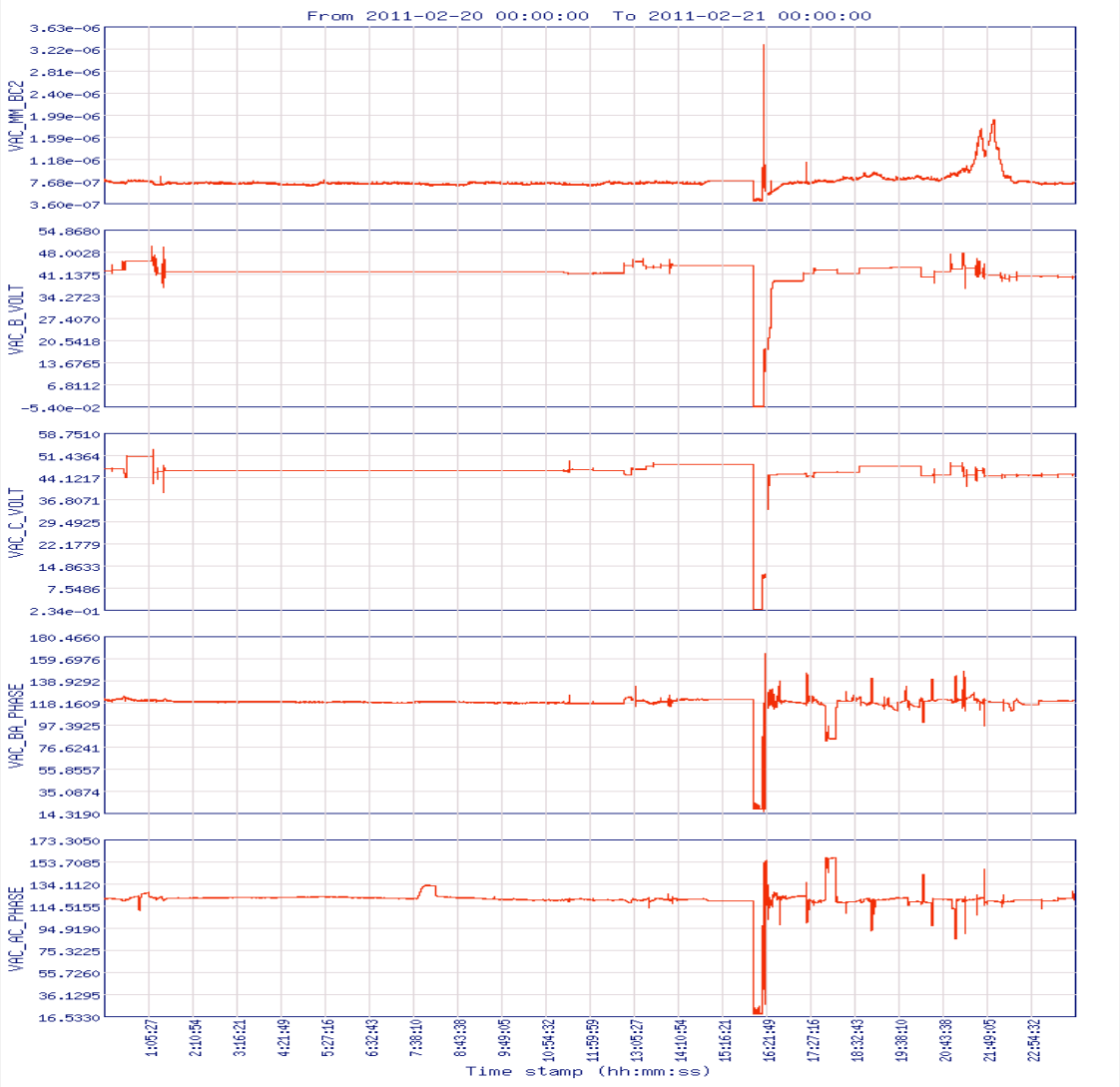


Historic analysis

- ✓ 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

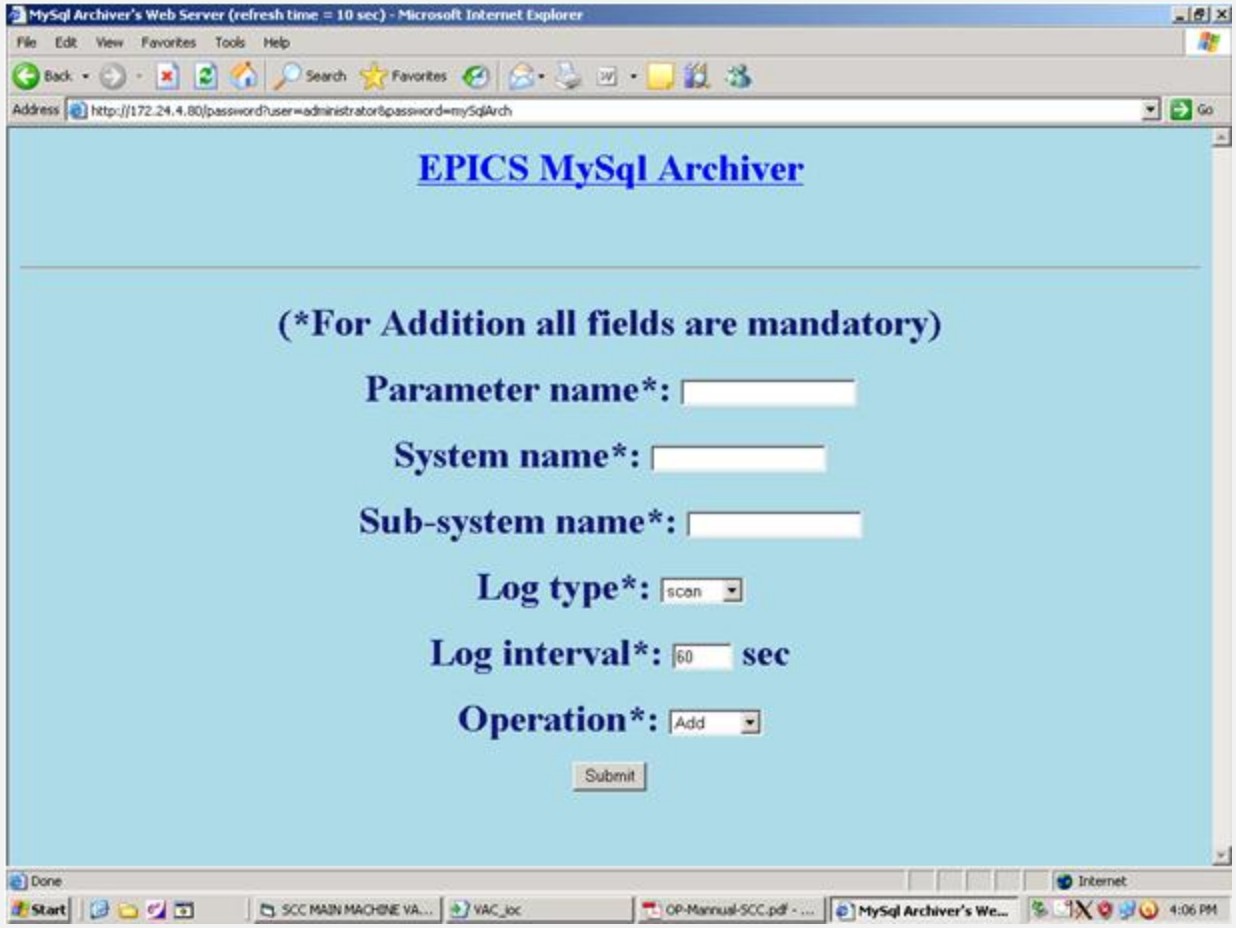


Historic analysis *(an example)*



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



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