H1DCM

Network based Detector Control and Monitoring for the H1 Experiment

Seminar on Computing in High Energy Physics

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(H1 Collaboration)

- Motivation
- Requirements
- Design
- Examples
- Experiences
- Conclusion

http://www-h1.desy.de/h1det/h1dcm

Motivation

- H1 a typical HEP Experiment (Pre-LHC)

  22 subdetectors, 150 VME crates, ~3K slow control items

  each subsystem has its own control software (DAQ and SC)

  custom build hardware

- Operation for more then 10 years now

  experts left H1 after initial phase (years ago)

  main documentation : code !

  spare components rare in some systems.

  -> maintenance is not easy !

Motivation

- HERA/H1 luminosity upgrade 2000/2001

  new subdetectors for H1

  modification on old subdetectors needed

  -> new control system or modify old control system ?

- Large effort in maintaining old systems

  2nd or 3rd generation of "experts"

  10 year old hardware has to be replaced in some systems

  no remote access, no common control system, ...

  5 more years to go (starting from 2001) -> new control system

Requirements

- Common control system for H1

  new subsystem with one common control system from the start

  old subsystems should to be included (smooth transition !)

- Reduce effort for development & maintenance

  use standard software for new systems

  minimize custom code development

- Reduce person power needed during running

  easy access for experts (remote monitoring and control)

  enable automatic actions for standard situations

  reduce number of persons needed during data taking (3 -> 2)

Design Goals

- Common look and feel

  easy overview panels for shift persons

  detailed expert panels

- Platform independent

  Windows and Linux support

  use communication standards (TCP/IP)

  remote monitoring via HTTP

- Maintainability

  use commercial software to minimize own developments

  use “object oriented” device and panel designs

Choice of the Software

- Commercial software or write it in C++/Java ?

  SCADA = Supervisory Control And Data Acquisition Systems are used in industry to control processes and large systems

  C++ / JAVA development would require big efforts in getting functionality that a SCADA system has built in

  SCADA systems offer all control functionality needed

- Which SCADA software ?

  Market survey done by the JCOP project at CERN for LHC

  PVSS-II looked most promising for our requirements

  CERN choose same product. Share tools and experience !

PVSS-II

What is that ?

What is PVSS-II

- Prozess Visualisierungs und Steuerungs System

PVSS–II is a SCADA system used in industry :

HVV (Vossloh), ABB (Airport Athens), Stadt Wien

software tool to write and run device controls

running on Linux and Windows

graphical user interface, scripting, alarm handling, ...

open architecture (API to include custom software)

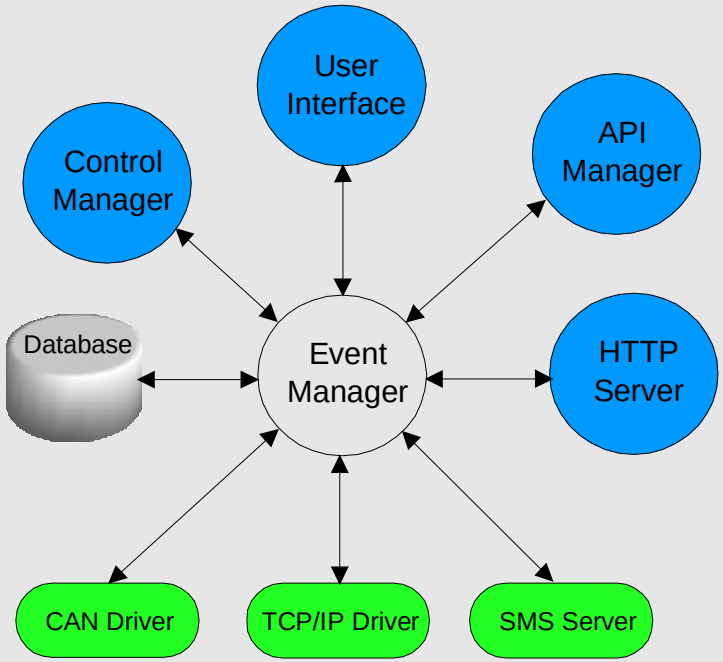
it is network based and

device oriented (not an unstructured list of control items !)

... see www.pvss.com for more

PVSS-II Structure

Scripts
Automatic actions



User specific implementation

Remote monitoring
Information service

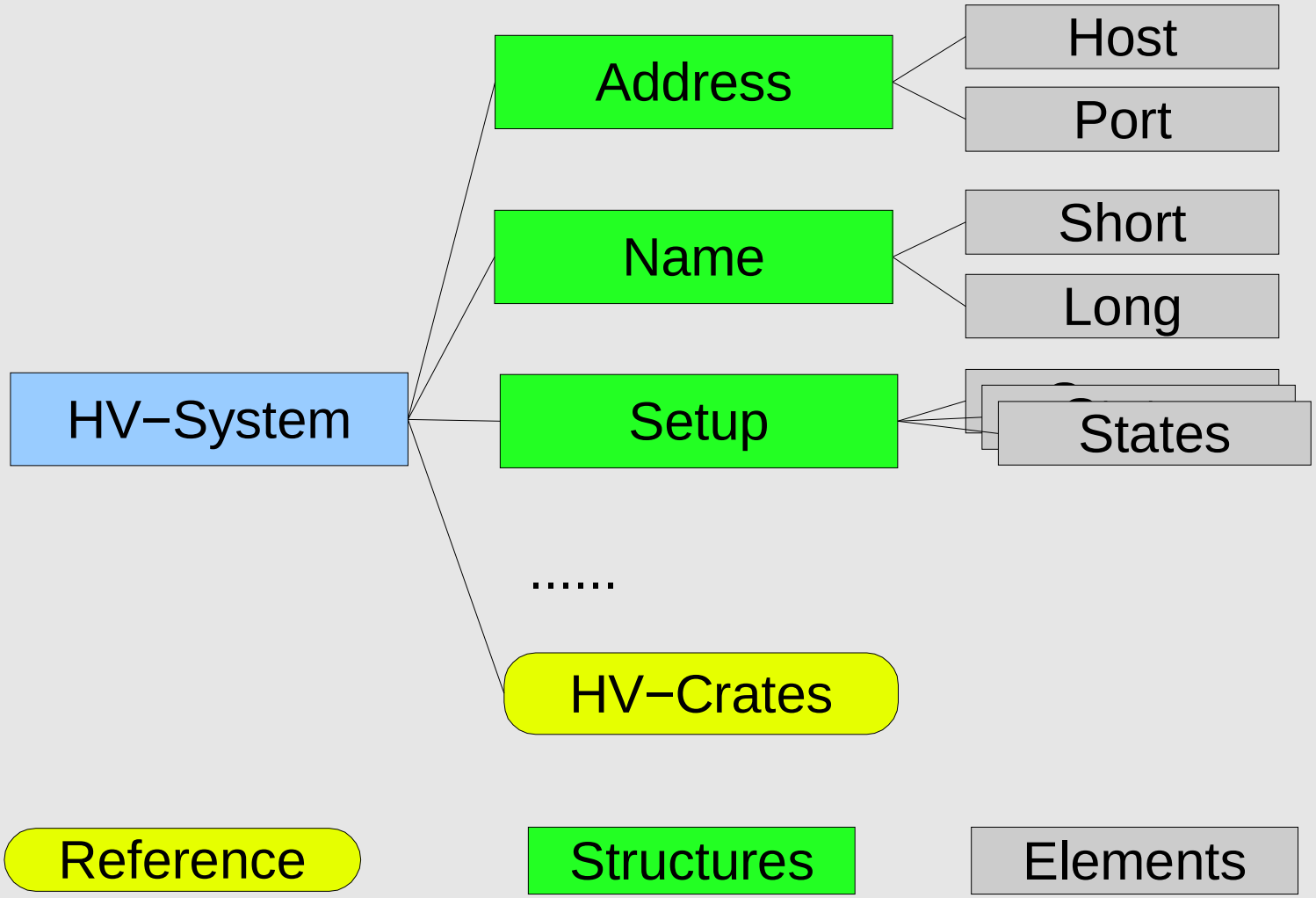
TCP/IP

Pure PVSS

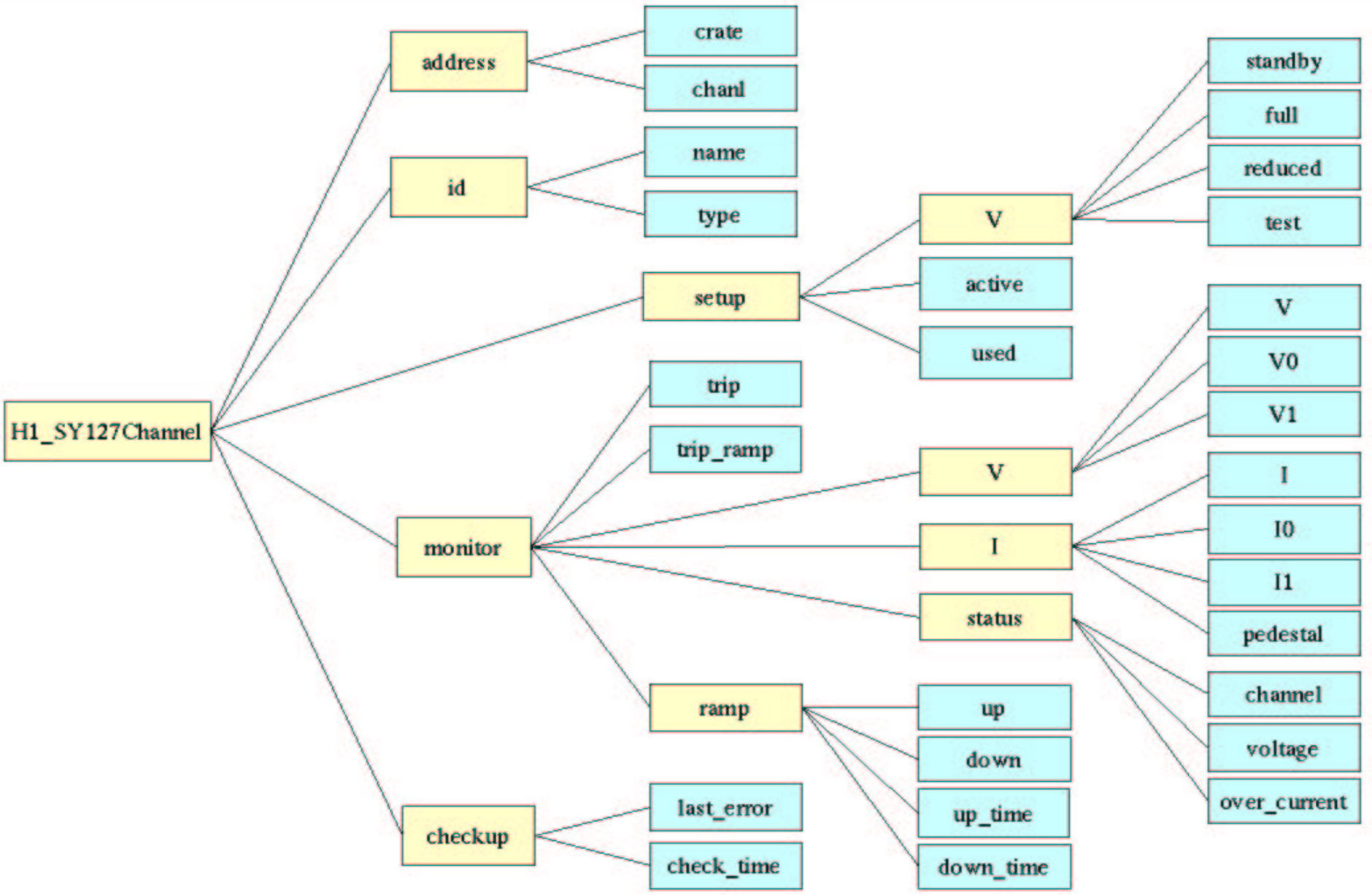
Configured by H1

H1DCM specific

Data Point Types



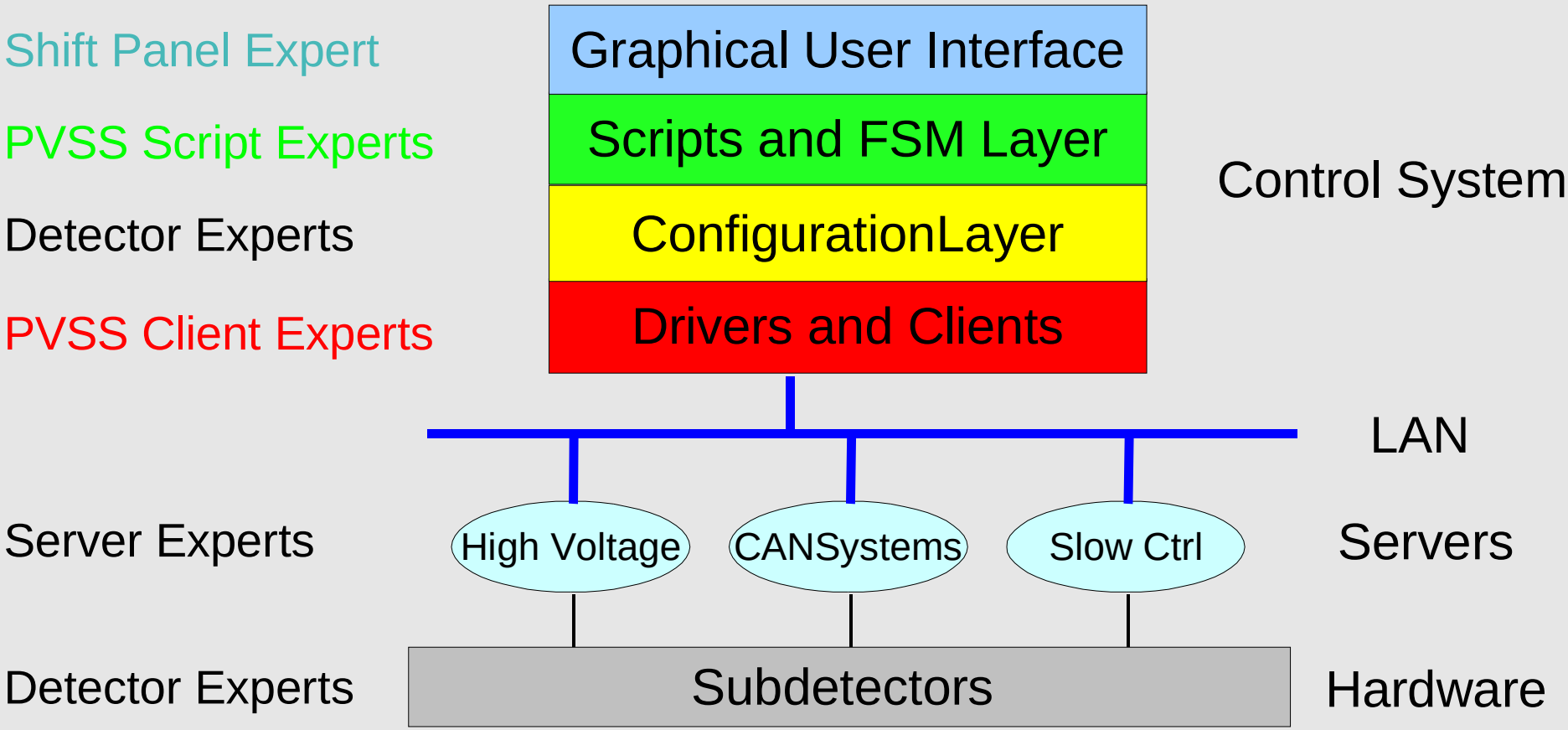
HV Data Point Example



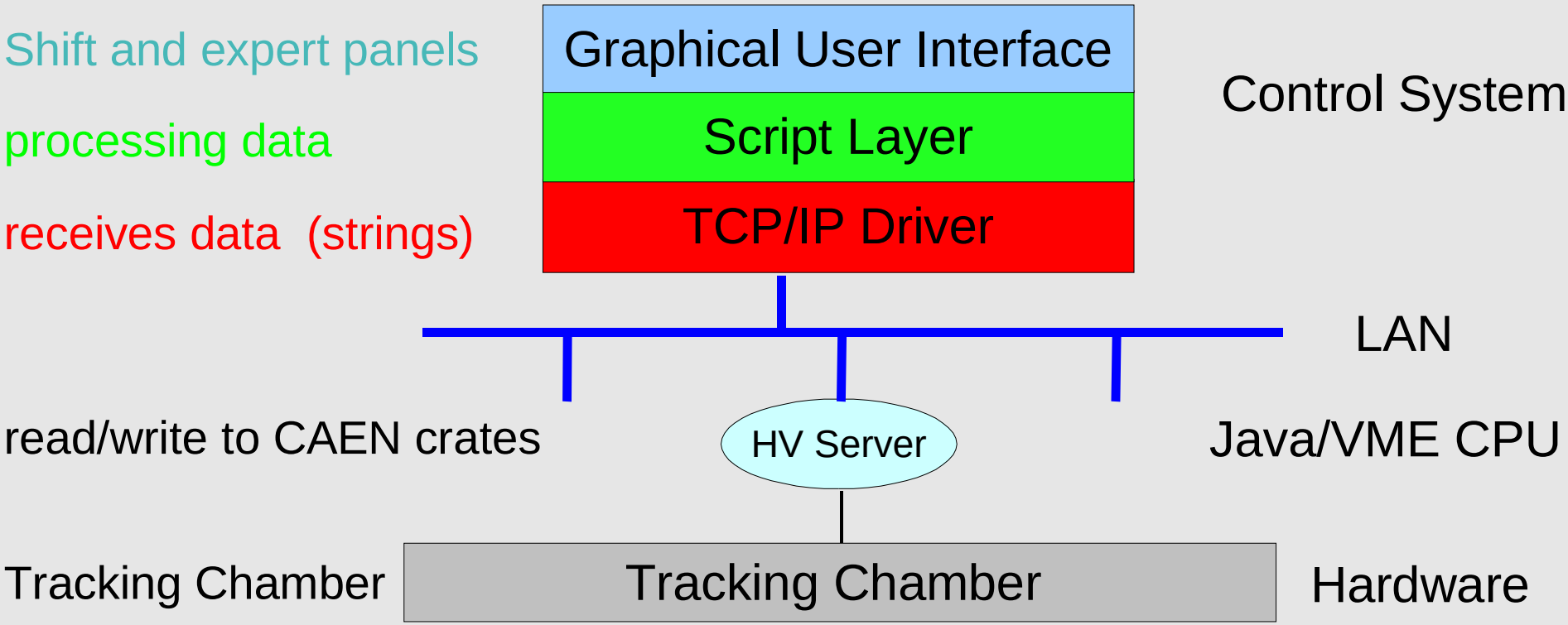
The H1DCM Design

How is is built ?

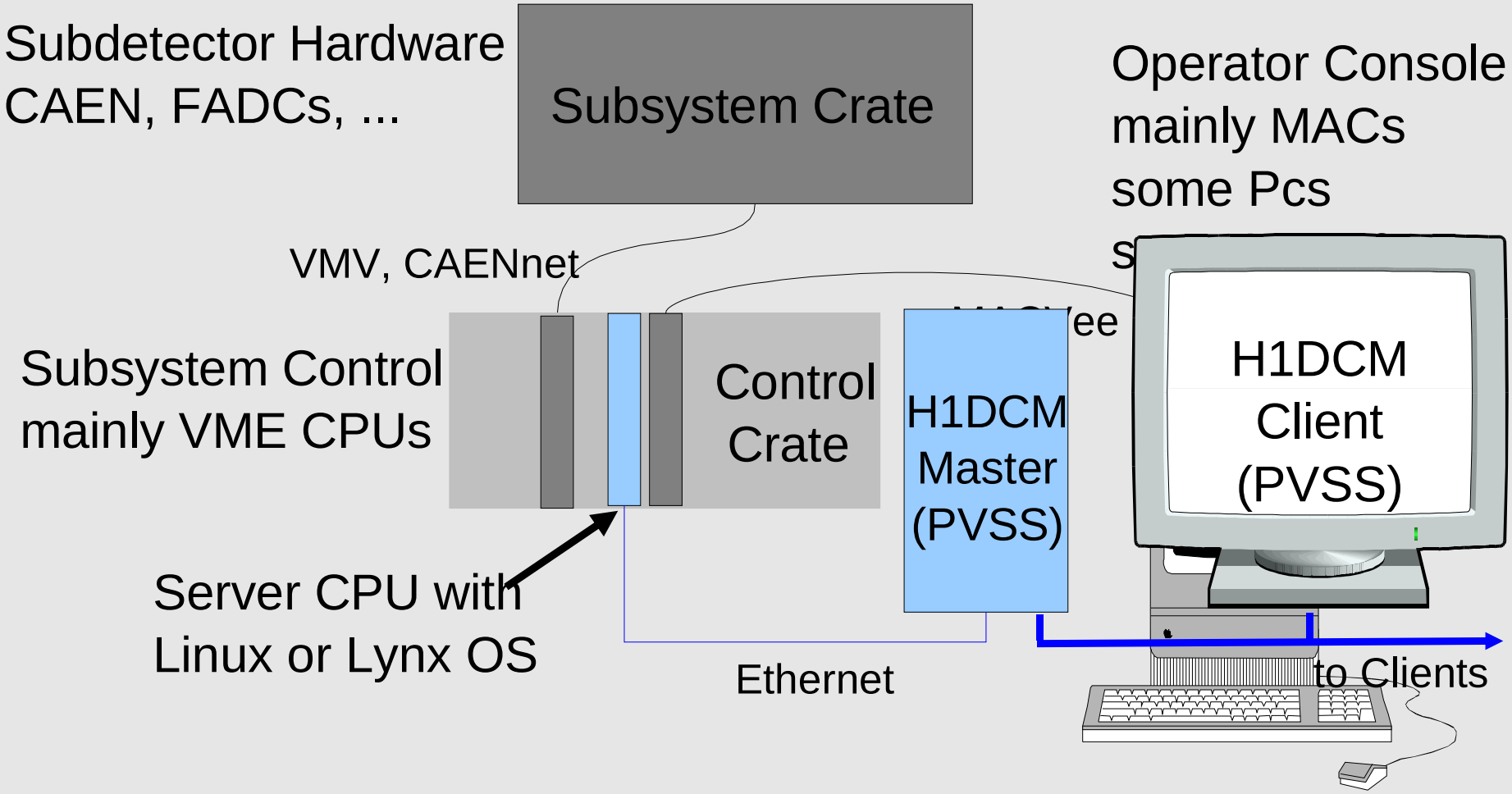
H1DCM Design



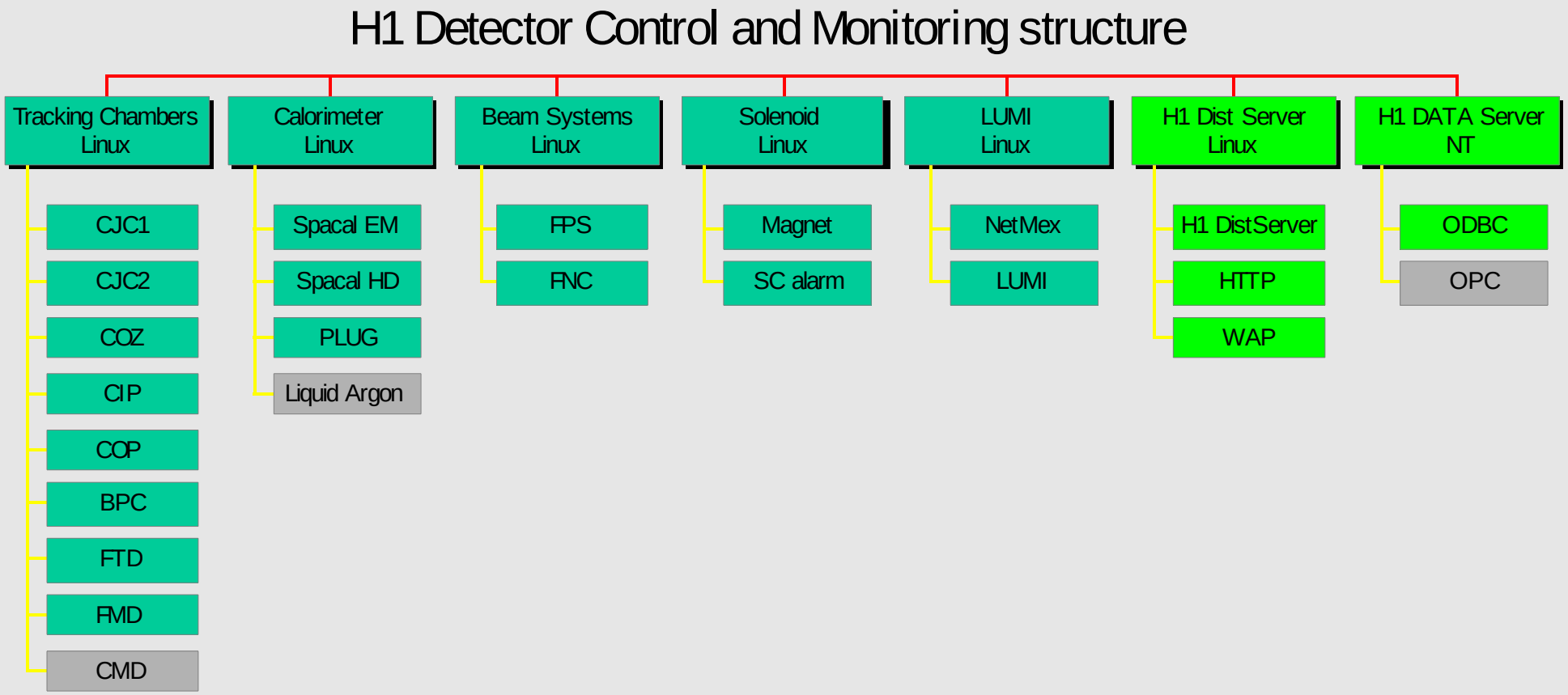
Example HV
Server (Java) - Client (PVSS)



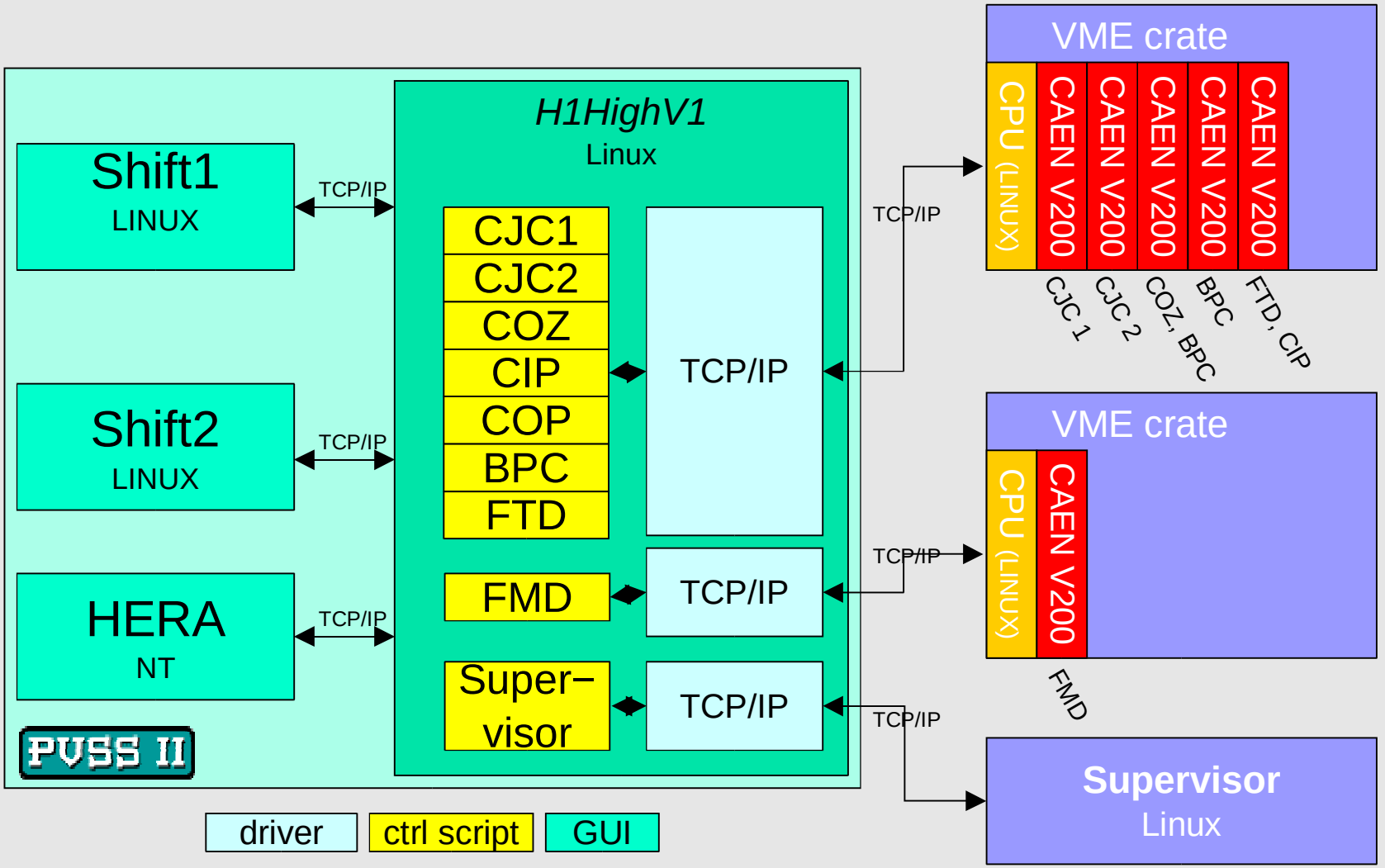
Modify Old Detector Controls



H1DCM Structure



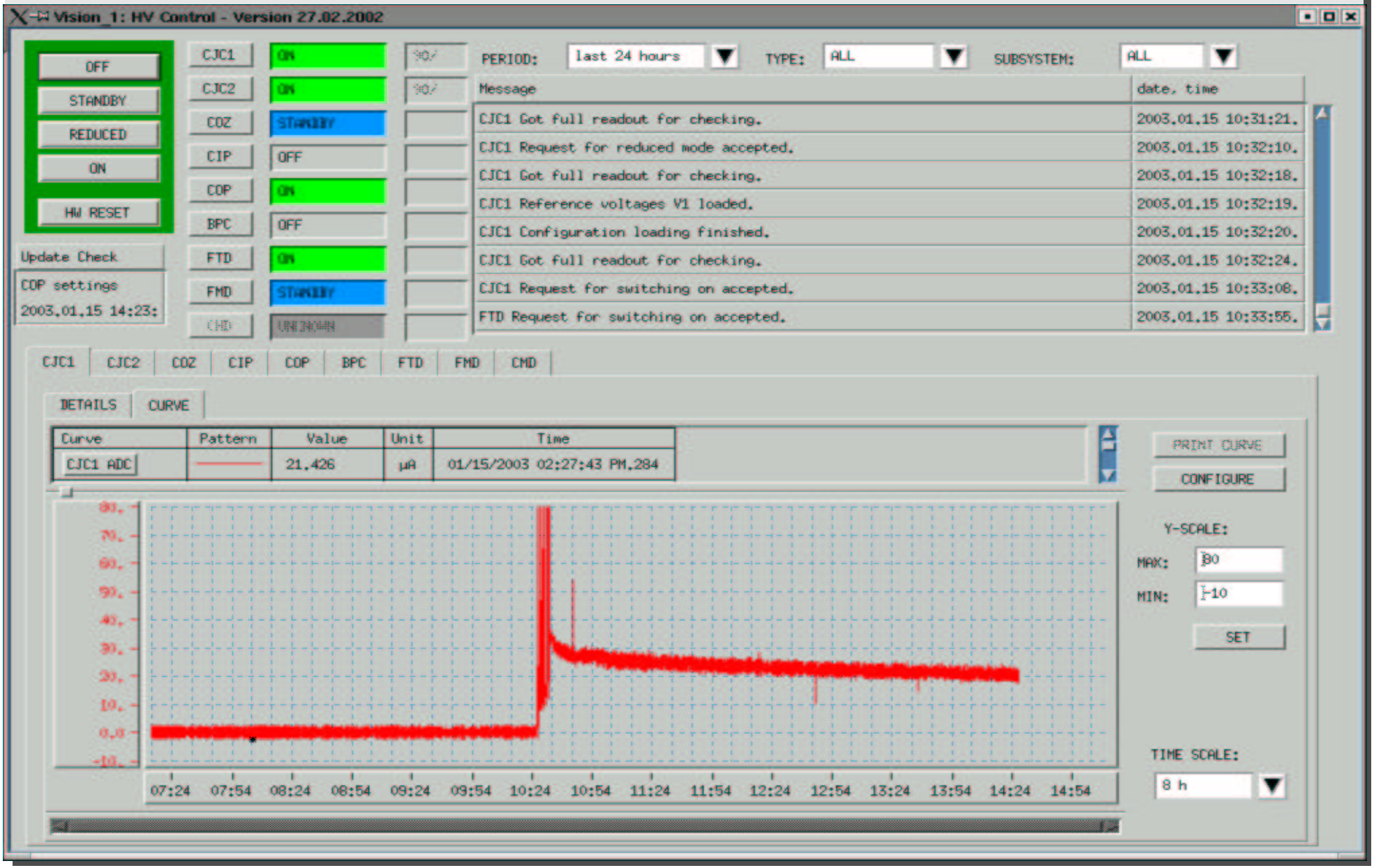
Tracking HV


Shift1
LINUX
Shift2
LINUX
HERA
NT
PVSS II
TCP/IP
TCP/IP
TCP/IP
H1HighV1
Linux
CJC1
CJC2
COZ
CIP
COP
BPC
FTD
FMD
Super−
visor
TCP/IP
TCP/IP
TCP/IP
TCP/IP
VME crate
CPU (LINUX)
CAEN V200
CAEN V200
CAEN V200
CAEN V200
CAEN V200
CJC 1
CJC 2
COZ, BPC
BPC
FTD, CIP
VME crate
CPU (LINUX)
CAEN V200
FMD
Supervisor
Linux
driver
ctrl script
GUI

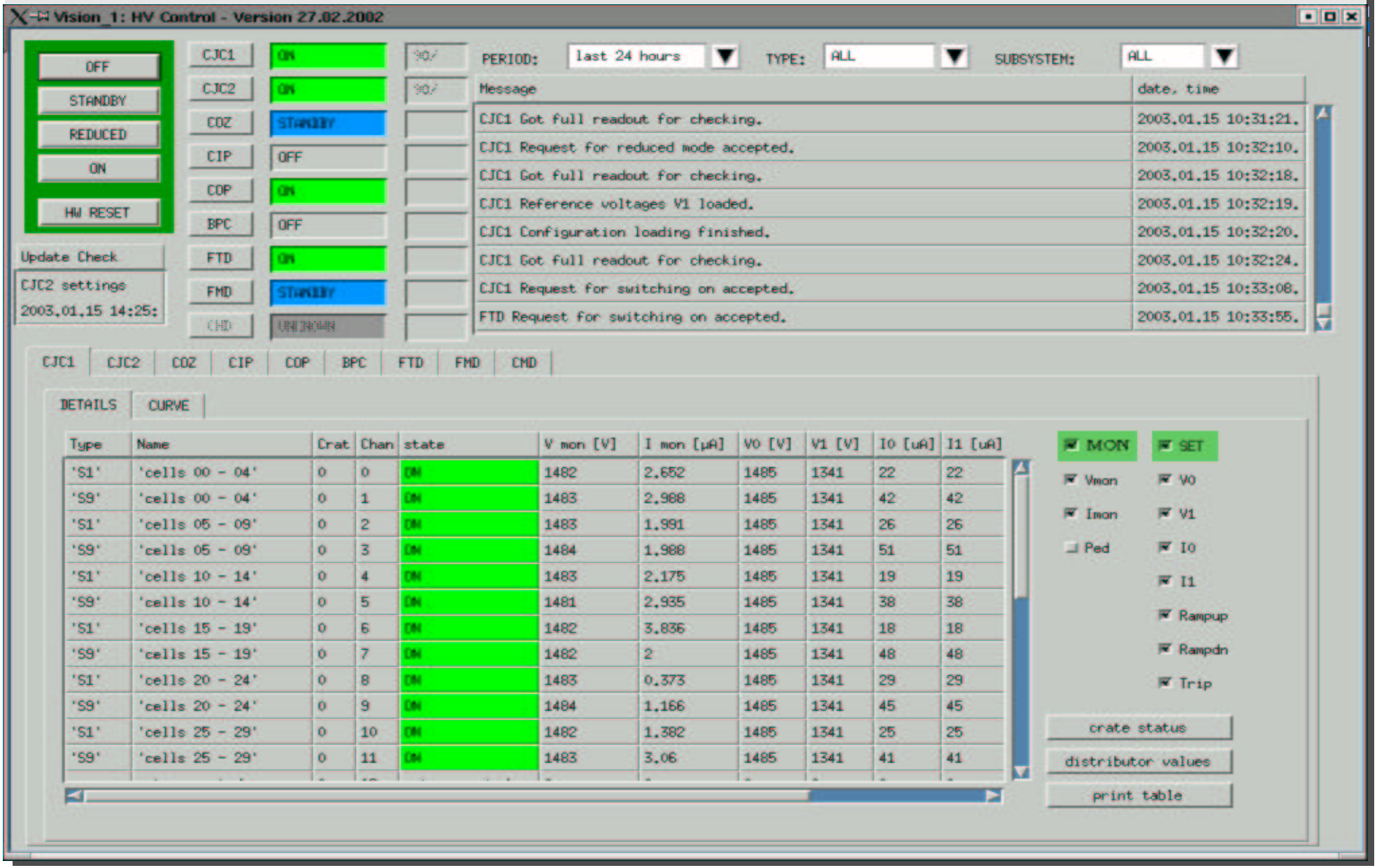
Examples

a few screen shots....

HV Control (Shift)



HV Monitoring Detail



HV Setup File

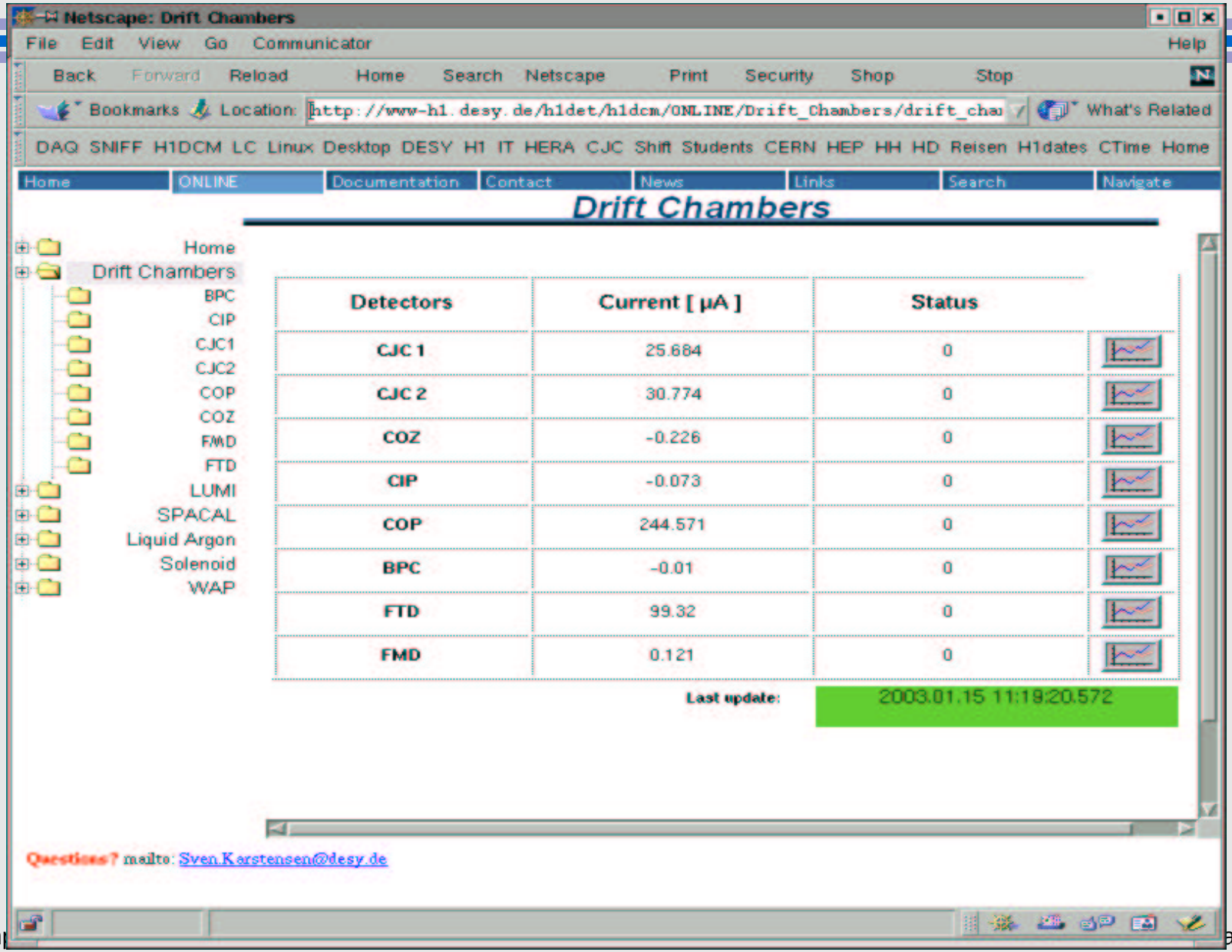
Konsole

File Sessions Settings Help

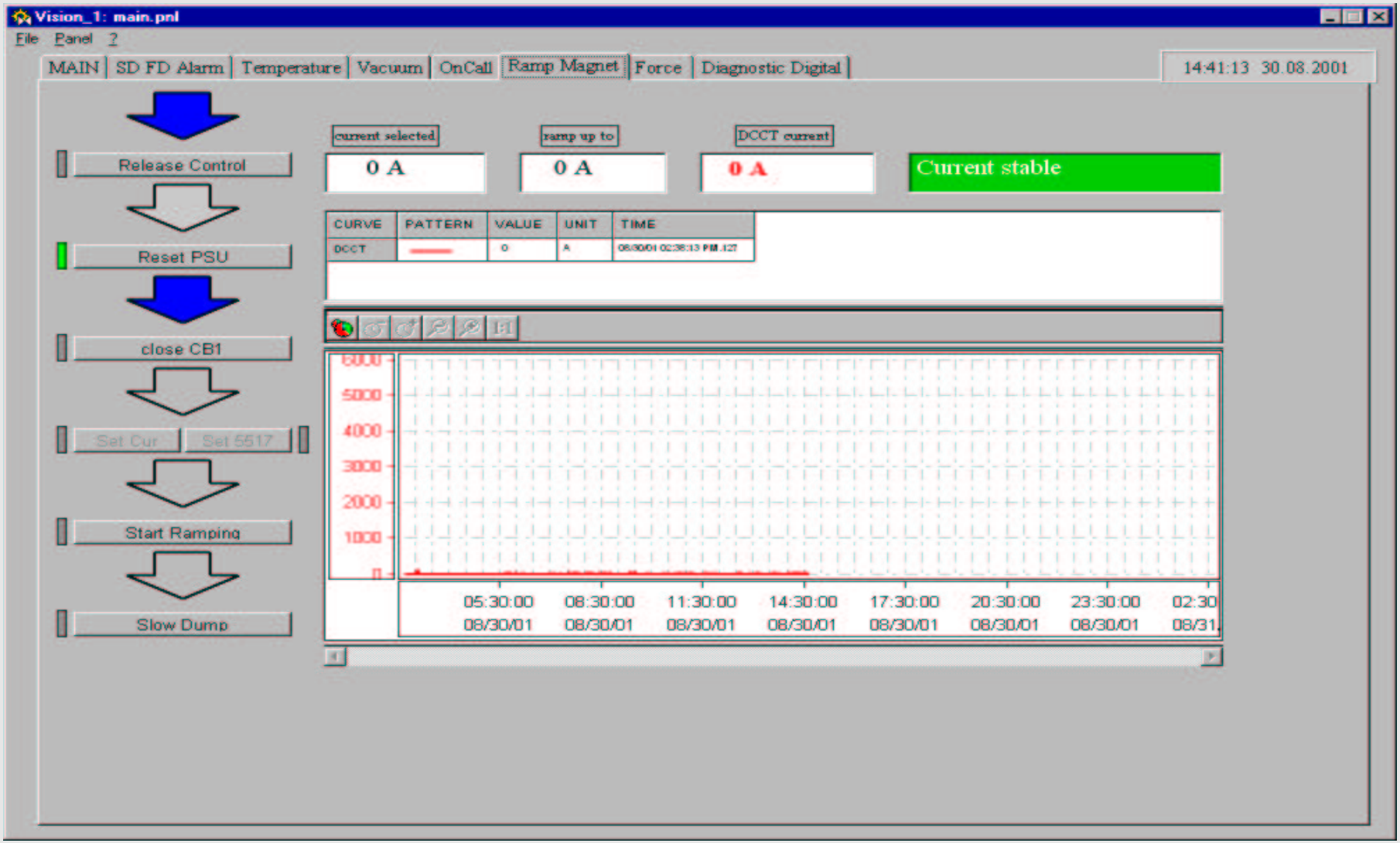
```
/* High Voltage Setup File /afs/desy.de/user/f/franke/hvFiles/hv_COZ
 * Saved at Mon Jul 16 18:16:07 CEST 2001
 */
detector    'COZ'    'Central Outer Z-Chamber'

/*          Type of    Stby    Rampup   Rampdw   Trip    Trip Ticks    I1/I0    Sense
 *         Channels   -> V1    Time     Time     Ticks   Ramping                Wires
 */
SY127_Type   'SW'        0      250.0     40.0      1          1         2.00    1
SY127_Type   'CS'        1      250.0    100.0   9999       9999         1.00    0
SY127_Type   'FS'        1      250.0    100.0   9999       9999         1.00    0
SY127_Type   'CA'        1      250.0    100.0      0          0         1.00    0

RelVoltWarn    0.01    /* Relative Voltage Checking Parameter: abs(Vmon - V0) < RelVoltWarn * V0    */
AbsVoltWarn    10.0    /* Absolute Voltage Checking Parameter: abs(Vmon - V0) < AbsVoltWarn * Vresol   */
Overwrite_Default_File        1

/* Isel signal on or off during Reduced and Standby states
 *                  Isel On
 */
SY127_Isel_Reduced     0
SY127_Isel_Standby     0

SY127_Crate     4     /* CAEN crate address for the following SY127_Channel lines */

/*             Type of    Wires, Cells,                        Channel    Module   V0          V1          I0
 *            Channels    Sectors, Segments                               ID       [Volt]      [Volt]      [microAmp]
 */
SY127_Channel   'SW'      'sw ring 00'                           0          11       2370.0      2340.0       20.0
SY127_Channel   'SW'      'sw ring 01'                           1          11       2370.0      2340.0       20.0
SY127_Channel   'SW'      'sw ring 02'                           2          11       2360.0      2330.0       20.0
hv_COZ lines 1-31/136 13%
```

New Konsole

HV Monitoring via WWW



Solenoid Control



Experience

Did it work ?

Experience in the Design Phase

- PVSS functionality and design

  well designed and consistent architecture

  graphical interface not always intuitive but one gets quickly used to it

  large functionality built in

  specific functionality easily added via API and scripts (c–like)

- Design of the controls and data structure

  we had to learn how to model our system best (2^{nd} revision now)

  use of reference to panels and data point types very useful

  better graphics on NT, but Linux is OK

Experience during running

- **Operation**

  mainly well accepted from the start by shift and experts

  few additional requirements and complaints

  additional functionality was easy to implement

- **Stability**

  very few crashes of the final configured system

  did not use built in redundancy yet (was not needed so far)

  but watch your configuration (memory and disk usage)

  few crashes of GUI under Linux during design of large panels

Experience in Detail

- HV Control System

  basic control system was running successfully from the start

  including subdetectors into the control was as easy as expected

- Slow Control of the Superconducting Solenoid

  running perfectly from the start

  configuration of the system resources had to be optimized

  automatic expert call system(via SMS) worked perfect ! ;–)

- H1 Luminosity Slow Control

  was running from the start without major problems

- Easily maintained and improved since July 2001

Some Other Aspects

- **Database**

  use Oracle DB to store some selected monitoring data

- **Information service for HERA and others**

  HTTP server for monitoring (Chamber currents, Solenoid, etc)

  interface to HERA specific information service (NETMEX)

- **On call service**

  SMS and WAP interfaces

Some Comments

- basic design of the data structure crucial

  especially if you want to

  extend the system
  change or add functionality
  maintain it easily

- a common look and feel has to be enforced

  the SCADA system still allows to built different flavors

  large functionality does not always help....

- -> good SCADA tool helps with guidelines

Achievements

- Controlled systems

  HV controls for all CAEN HV systems in H1 (new & old systems)

  (LAr and Central Muon will be included this year)

  Slow Controls for

  H1 Solenoid (incl. new hardware)

  H1 Luminosity System

  H1 Calorimeters (LAr, Spacal, Plug)

- The H1DCM allowed 2 persons to run H1 !

  (Even in the sometimes difficult startup phase)

Outlook

- Even more systems to add

  LeCroy HV Power Supplies (partly done)

  Slow Controls for VME crates (IEC Bus)

- Database

  use Oracle DB for configuration and Slow Control DB

- Information service for HERA and others

  HTTP server for monitoring (pages for HV systems in test phase)

  interface to HERA specific information service (NETMEX)

- Automatic detector control

  use a finite state machine

Contacts

- ask the H1DCM group members

Sven Karstensen	Solenoid controls, CAN-driver, HTTP
Igor Cheviakov	LUMI controls, Netmex, TCP/IP driver
Marion Hensel	HV clients, panels, scripts
Guenter Franke	HV servers, SC servers (Java based)
Lena Bystritskaya	HV controls for LeCroy based FNC
Frantisek Krivan	Slow Control and HV for Calorimeters

Nick Malden, Nicole Werner, Vladimir Jemanov, and others....

- or ETM/Austria

M. Koller and the support team of ETM (www.etm.com)