

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 = **S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition 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,

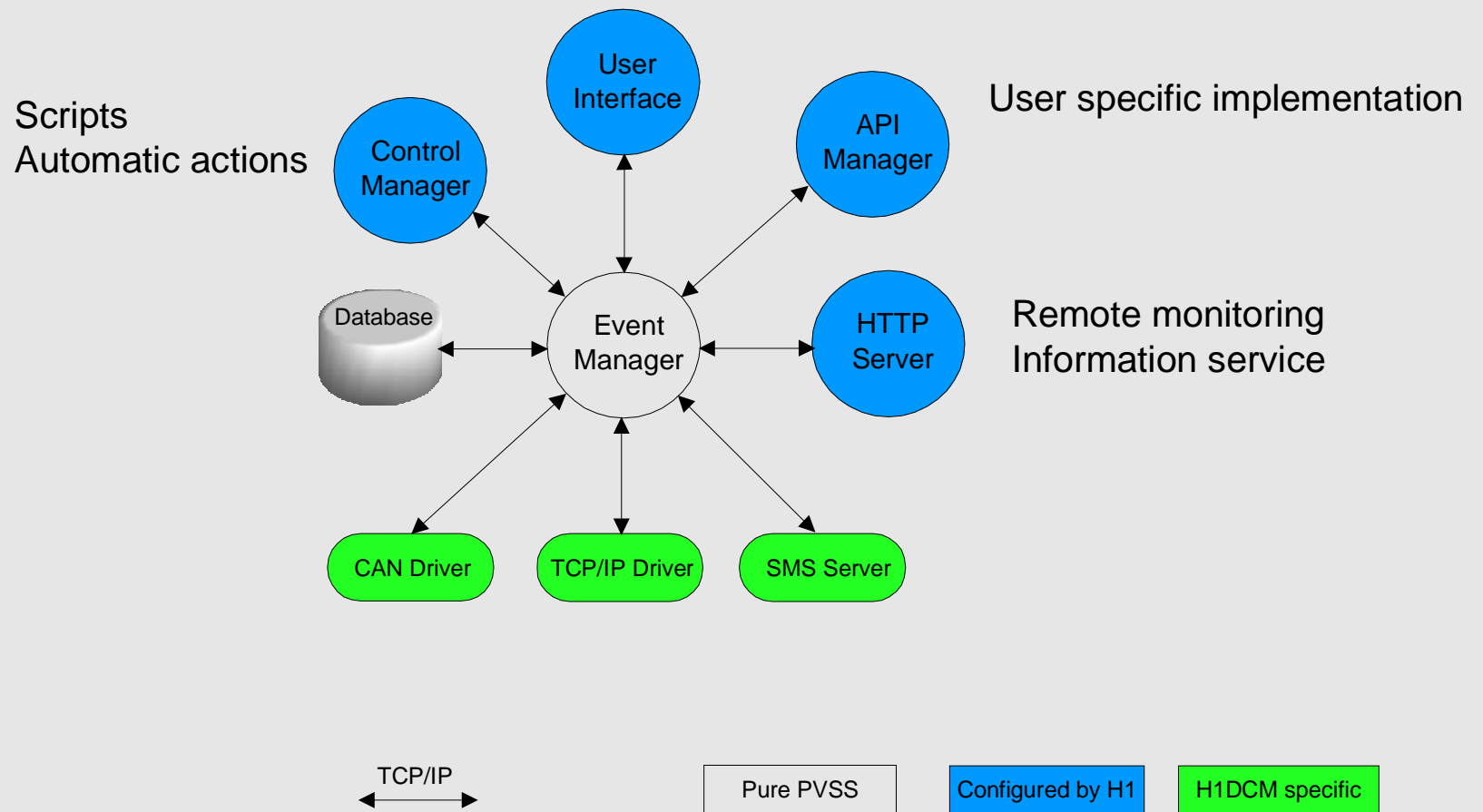
open architecture (API to include custom software)

it is network based and

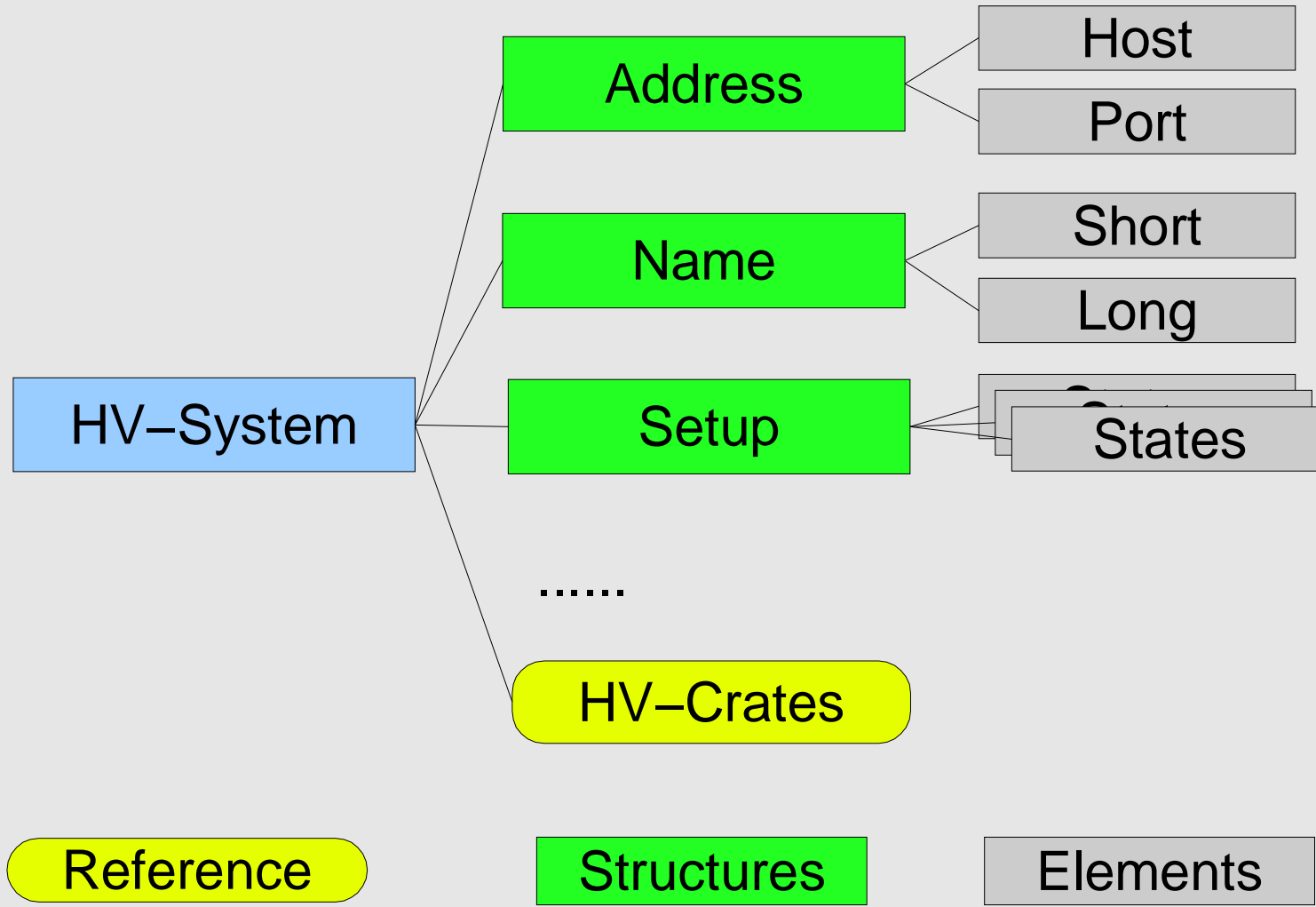
device oriented (not an unstructured list of control items !)

... see www.pvss.com for more

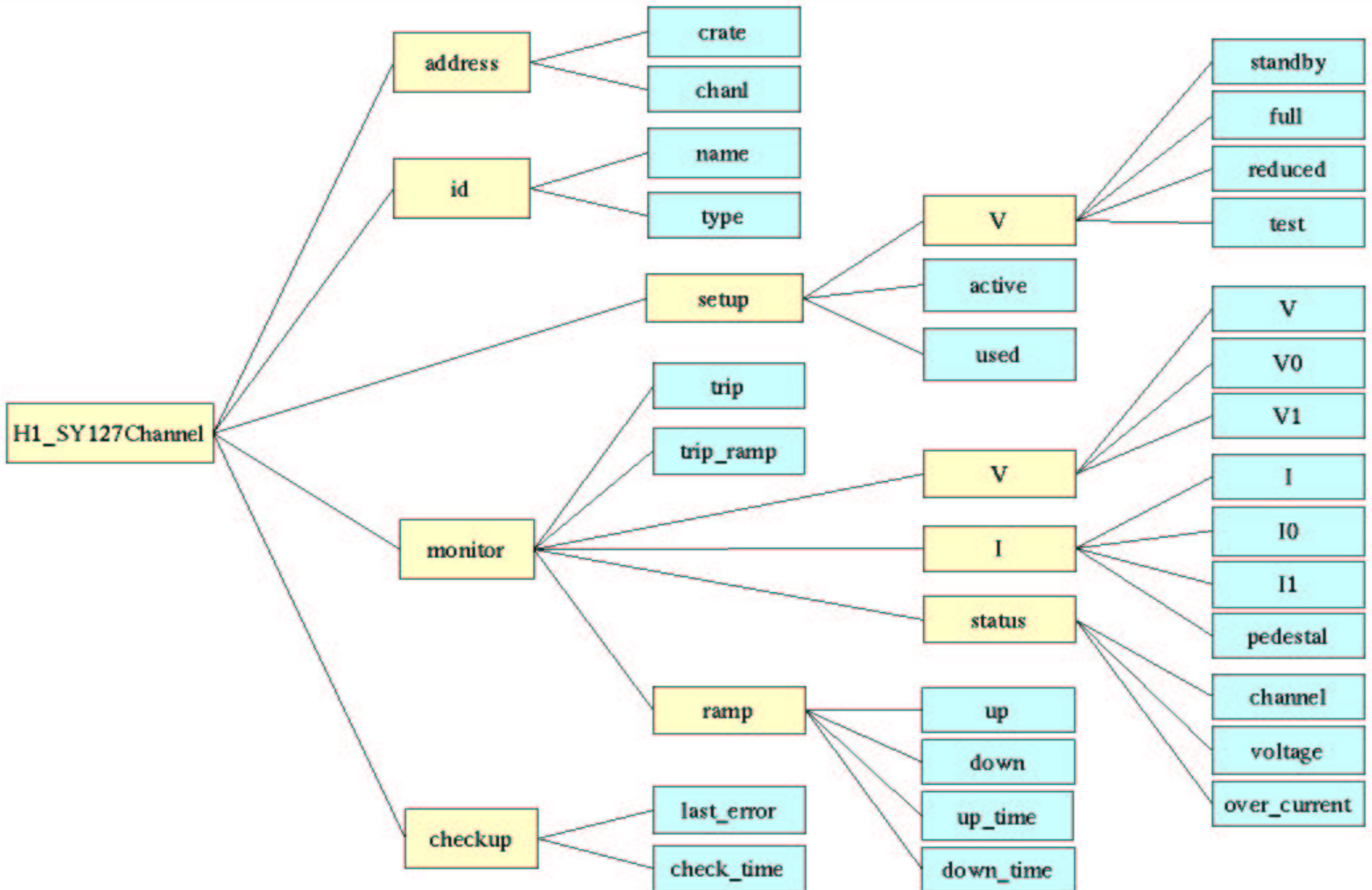
PVSS-II STRUCTURE



DATA POINT TYPES



HV DATA POINT EXAMPLE



THE H1DCM DESIGN

How is it built ?

H1 DCM DESIGN

Shift Panel Expert

PVSS Script Experts

Detector Experts

PVSS Client Experts

Graphical User Interface

Scripts and FSM Layer

Configuration Layer

Drivers and Clients

Control System

Server Experts

Detector Experts

High Voltage

CAN Systems

Slow Ctrl

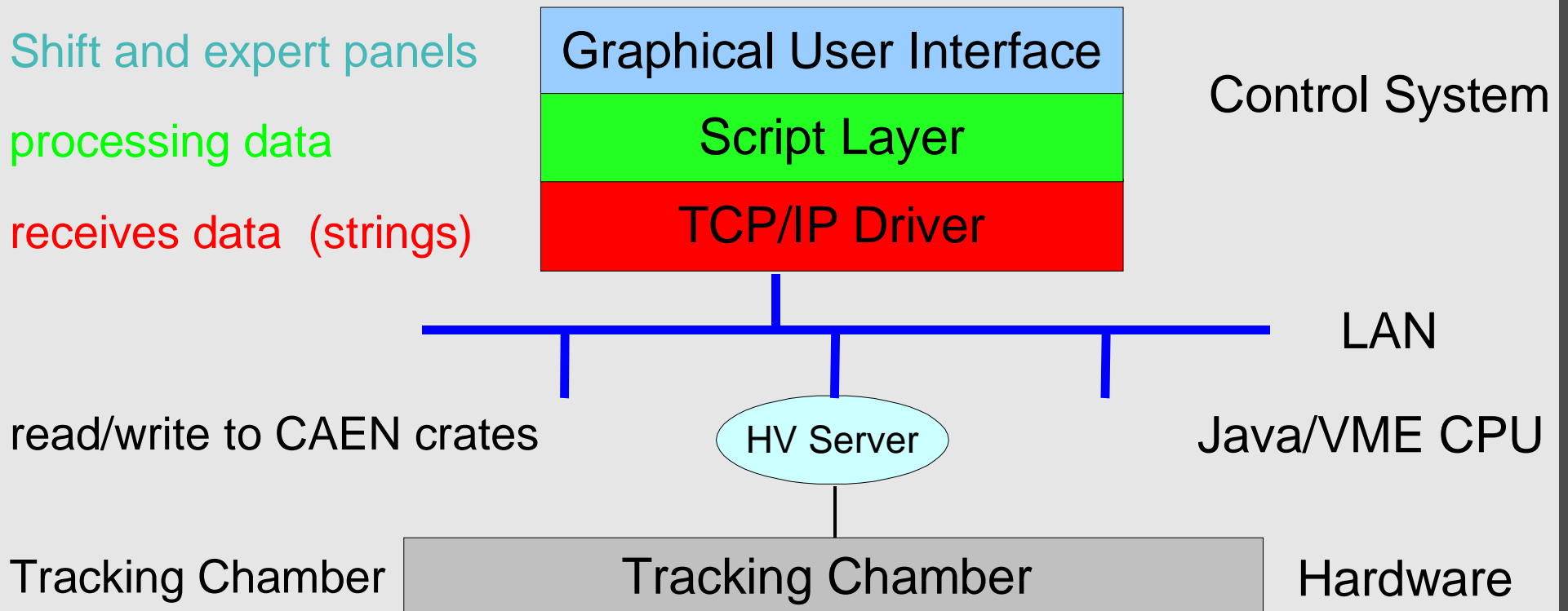
LAN

Servers

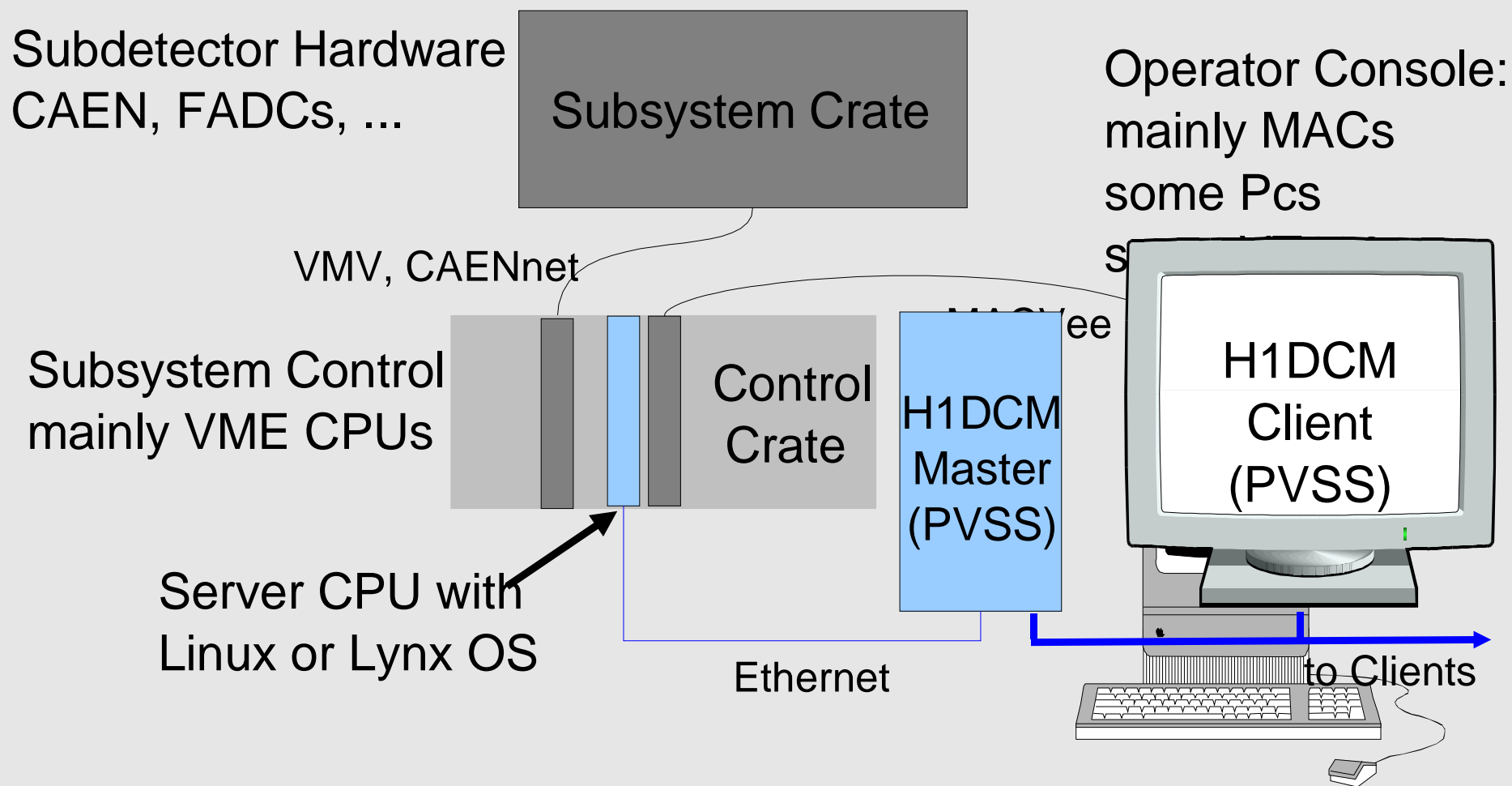
Subdetectors

Hardware

EXAMPLE HV SERVER (JAVA) - CLIENT (PVSS)

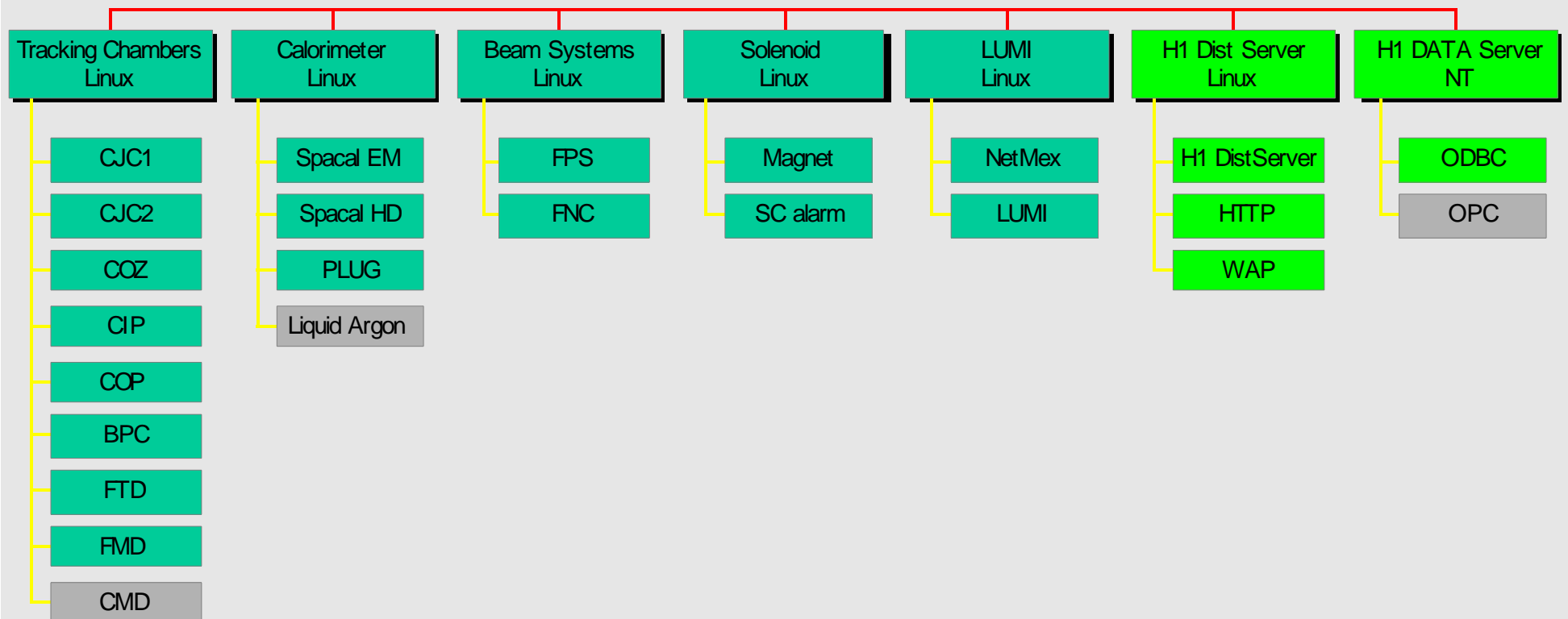


MODIFY OLD DETECTOR CONTROLS

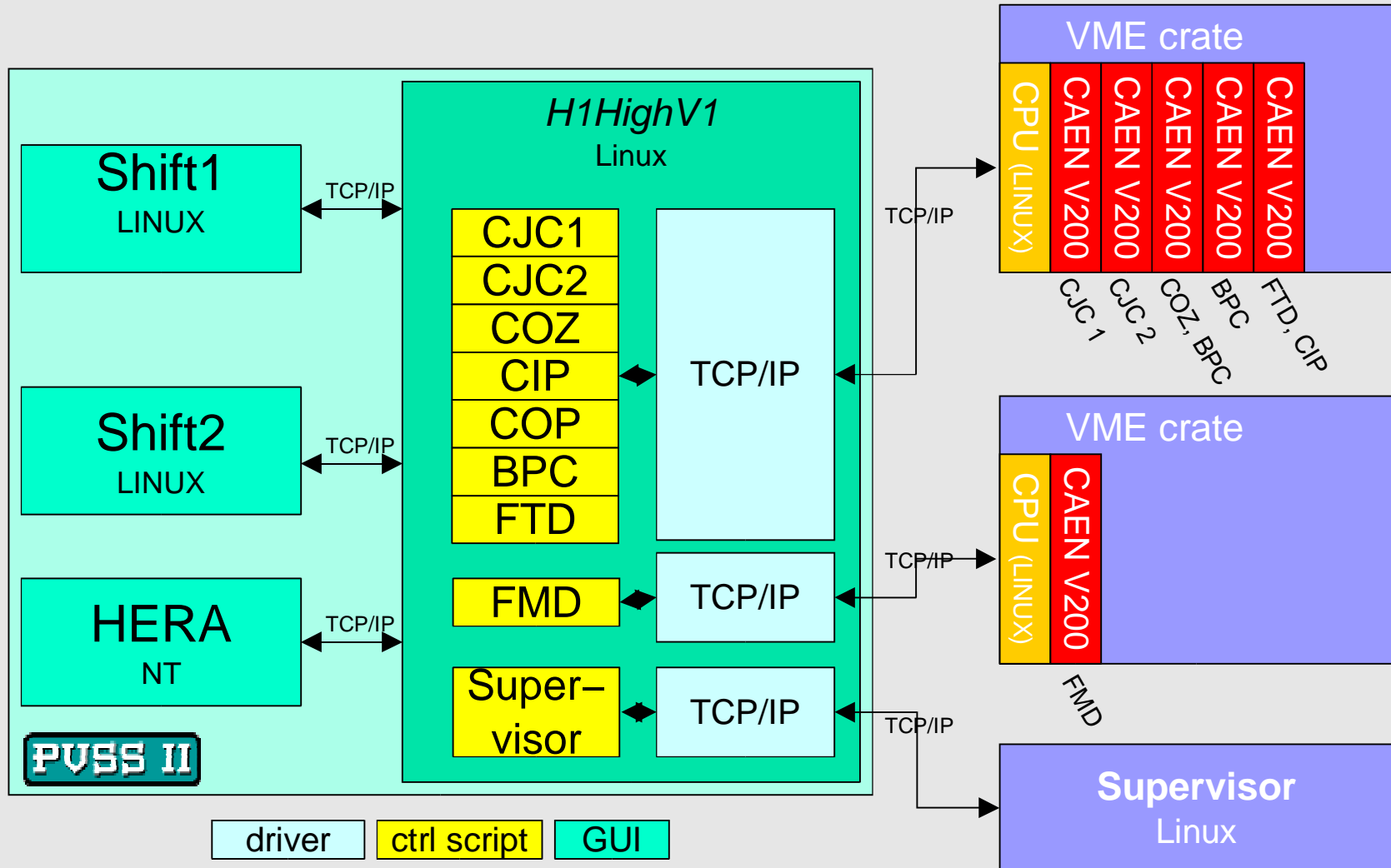


H1 DCM STRUCTURE

H1 Detector Control and Monitoring structure



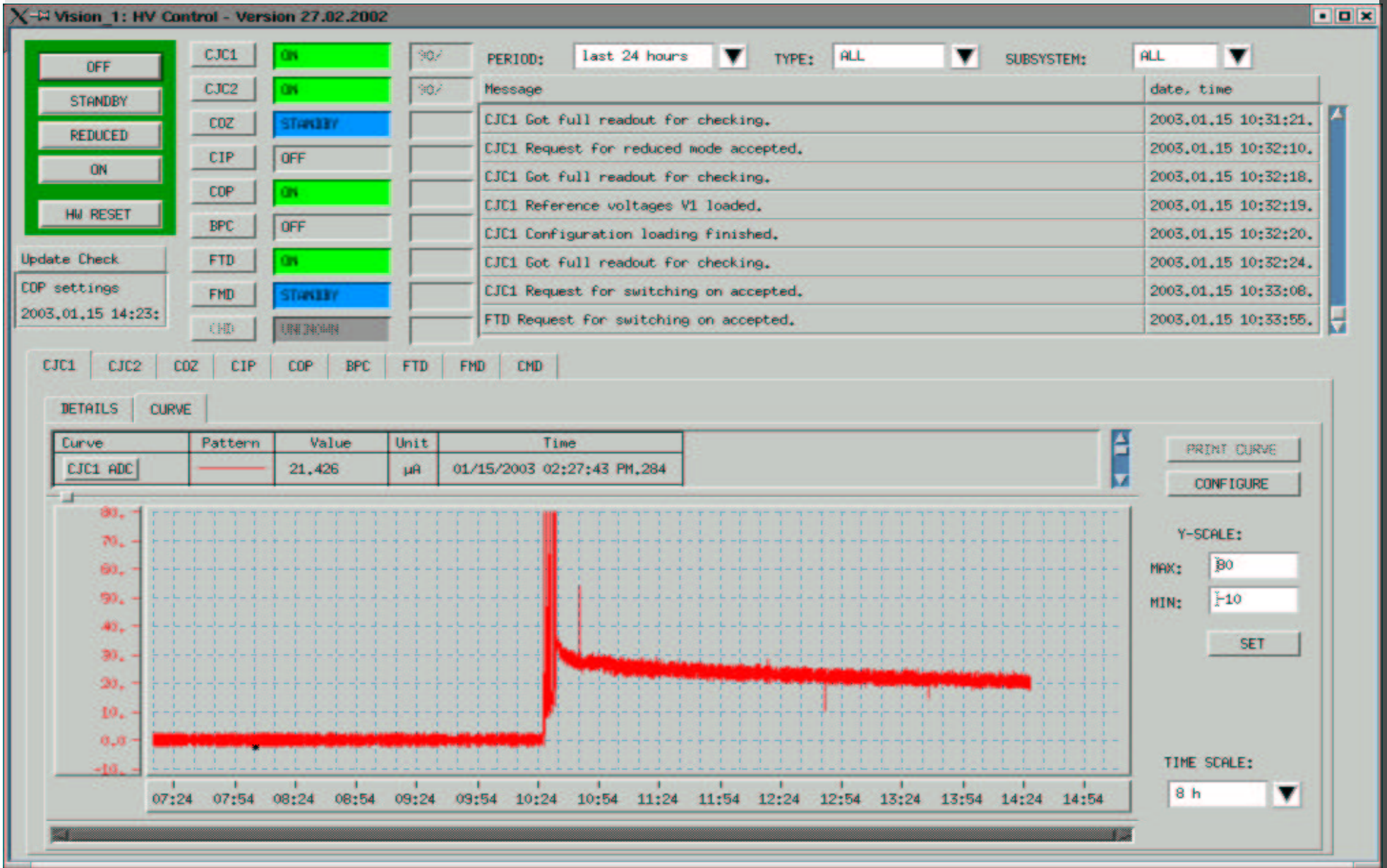
TRACKING HV



EXAMPLES

a few screen shots....

HV CONTROL (SHIFT)



HV MONITORING DETAIL

OFF STANDBY REDUCED ON HW RESET

Update Check
 CJC2 settings
 2003,01,15 14:25:

CJC1	ON	90%
CJC2	ON	90%
COZ	STANDBY	
CIP	OFF	
COP	ON	
BPC	OFF	
FTD	ON	
FMD	STANDBY	
CMD	UNKNOWN	

PERIOD: last 24 hours TYPE: ALL SUBSYSTEM: ALL

Message	date, time
CJC1 Got full readout for checking.	2003,01,15 10:31:21.
CJC1 Request for reduced mode accepted.	2003,01,15 10:32:10.
CJC1 Got full readout for checking.	2003,01,15 10:32:18.
CJC1 Reference voltages V1 loaded.	2003,01,15 10:32:19.
CJC1 Configuration loading finished.	2003,01,15 10:32:20.
CJC1 Got full readout for checking.	2003,01,15 10:32:24.
CJC1 Request for switching on accepted.	2003,01,15 10:33:08.
FTD Request for switching on accepted.	2003,01,15 10:33:55.

CJC1 | CJC2 | COZ | CIP | COP | BPC | FTD | FMD | CMD

DETAILS | CURVE

Type	Name	Crat	Chan	state	V mon [V]	I mon [μ A]	V0 [V]	V1 [V]	I0 [μ A]	I1 [μ A]
'S1'	'cells 00 - 04'	0	0	ON	1482	2,652	1485	1341	22	22
'S9'	'cells 00 - 04'	0	1	ON	1483	2,988	1485	1341	42	42
'S1'	'cells 05 - 09'	0	2	ON	1483	1,991	1485	1341	26	26
'S9'	'cells 05 - 09'	0	3	ON	1484	1,988	1485	1341	51	51
'S1'	'cells 10 - 14'	0	4	ON	1483	2,175	1485	1341	19	19
'S9'	'cells 10 - 14'	0	5	ON	1481	2,935	1485	1341	38	38
'S1'	'cells 15 - 19'	0	6	ON	1482	3,836	1485	1341	18	18
'S9'	'cells 15 - 19'	0	7	ON	1482	2	1485	1341	48	48
'S1'	'cells 20 - 24'	0	8	ON	1483	0,373	1485	1341	29	29
'S9'	'cells 20 - 24'	0	9	ON	1484	1,166	1485	1341	45	45
'S1'	'cells 25 - 29'	0	10	ON	1482	1,382	1485	1341	25	25
'S9'	'cells 25 - 29'	0	11	ON	1483	3,06	1485	1341	41	41

MON SET

Vmon V0
 Imon V1
 Ped I0
 I1
 Rampup
 Rampdn
 Trip

crate status
 distributor values
 print table

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   I1/I0   Sense
 *      Channels  -> V1   Time     Time     Ticks  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%
```

HV MONITORING VIA WWW

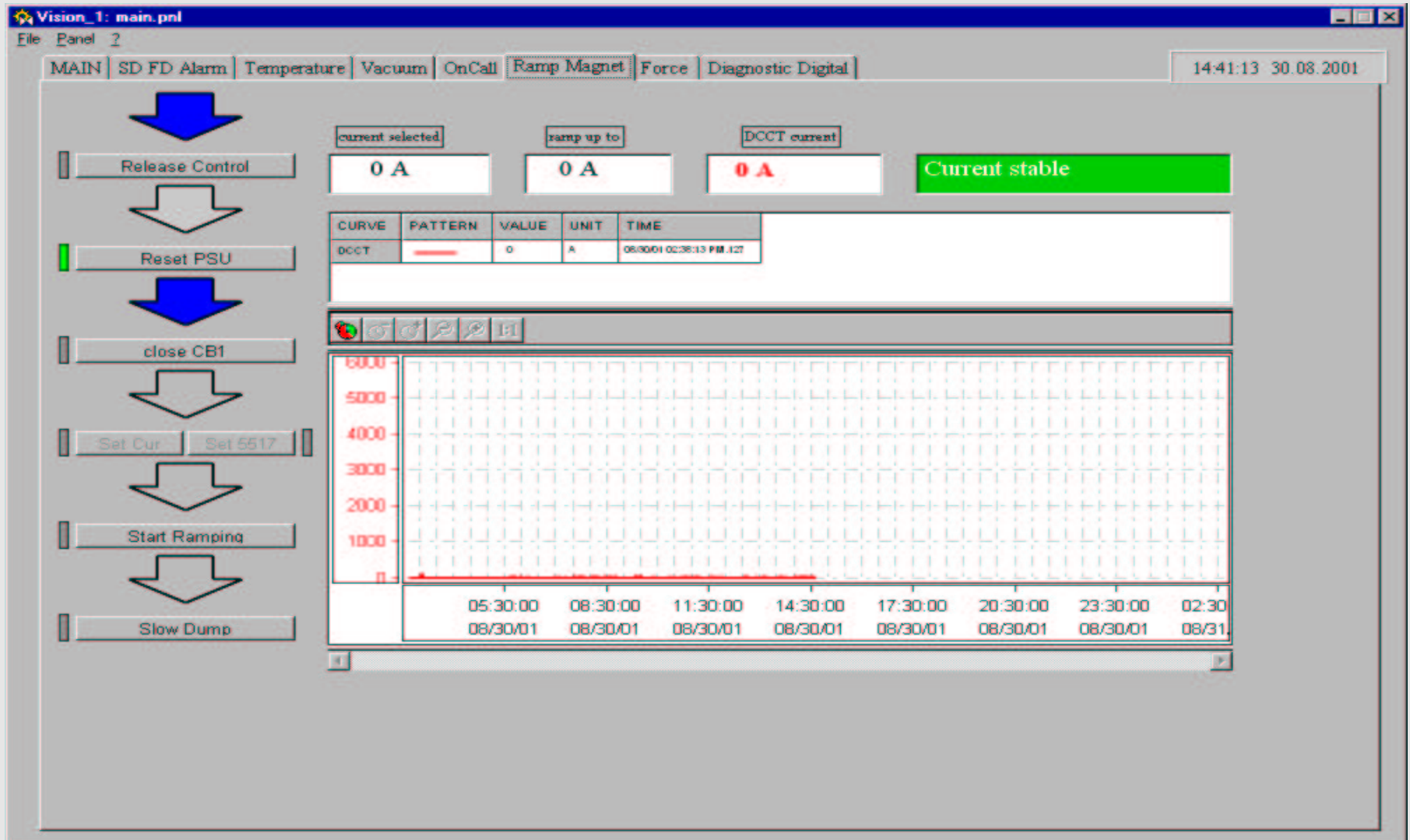
The screenshot shows a Netscape browser window titled "Netscape: Drift Chambers". The address bar displays the URL: http://www-h1.desy.de/hidet/hidcm/ONLINE/Drift_Chambers/drift_cha/. The browser interface includes a menu bar (File, Edit, View, Go, Communicator, Help) and a toolbar with buttons for Back, Forward, Reload, Home, Search, Netscape, Print, Security, Shop, and Stop. A bookmarks bar is visible below the toolbar. The main content area features a navigation menu with links: Home, ONLINE, Documentation, Contact, News, Links, Search, and Navigate. The title of the page is "Drift Chambers".

On the left side, there is a directory tree showing folders for Home, Drift Chambers, BPC, CIP, CJC1, CJC2, COP, COZ, FMD, FTD, LUMI, SPACAL, Liquid Argon, Solenoid, and WAP. The main content area contains a table with the following data:

Detectors	Current [μ A]	Status	
CJC 1	25.684	0	
CJC 2	30.774	0	
COZ	-0.226	0	
CIP	-0.073	0	
COP	244.571	0	
BPC	-0.01	0	
FTD	99.32	0	
FMD	0.121	0	

Below the table, a green bar indicates the last update time: **Last update: 2003.01.15 11:19:20.572**. At the bottom of the page, there is a link: [Questions? mailto: Sven.Karstensen@desy.de](mailto:Sven.Karstensen@desy.de). The browser's status bar at the bottom shows the system tray with various icons.

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 (2nd 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)