Linac4 source control system

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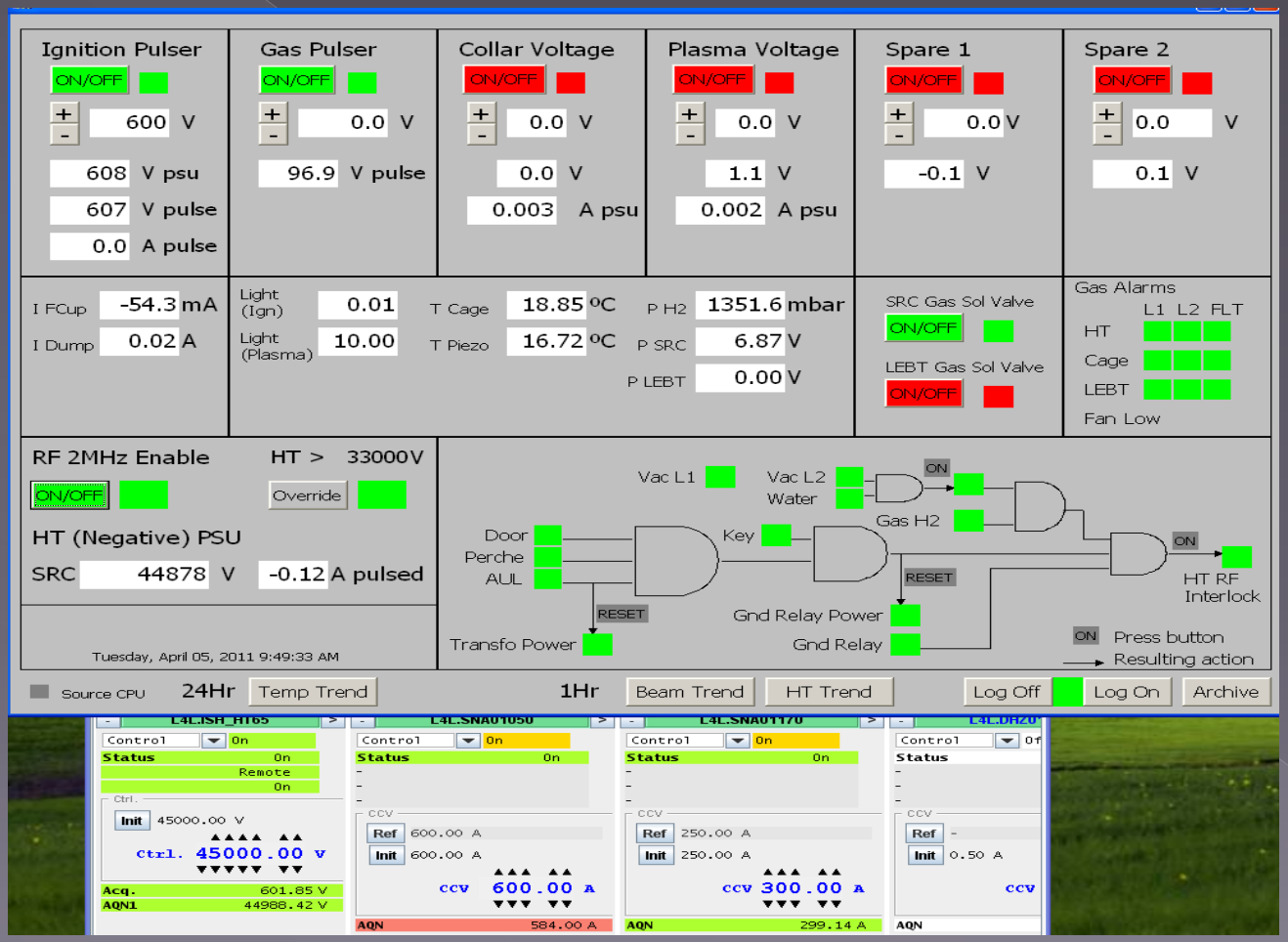
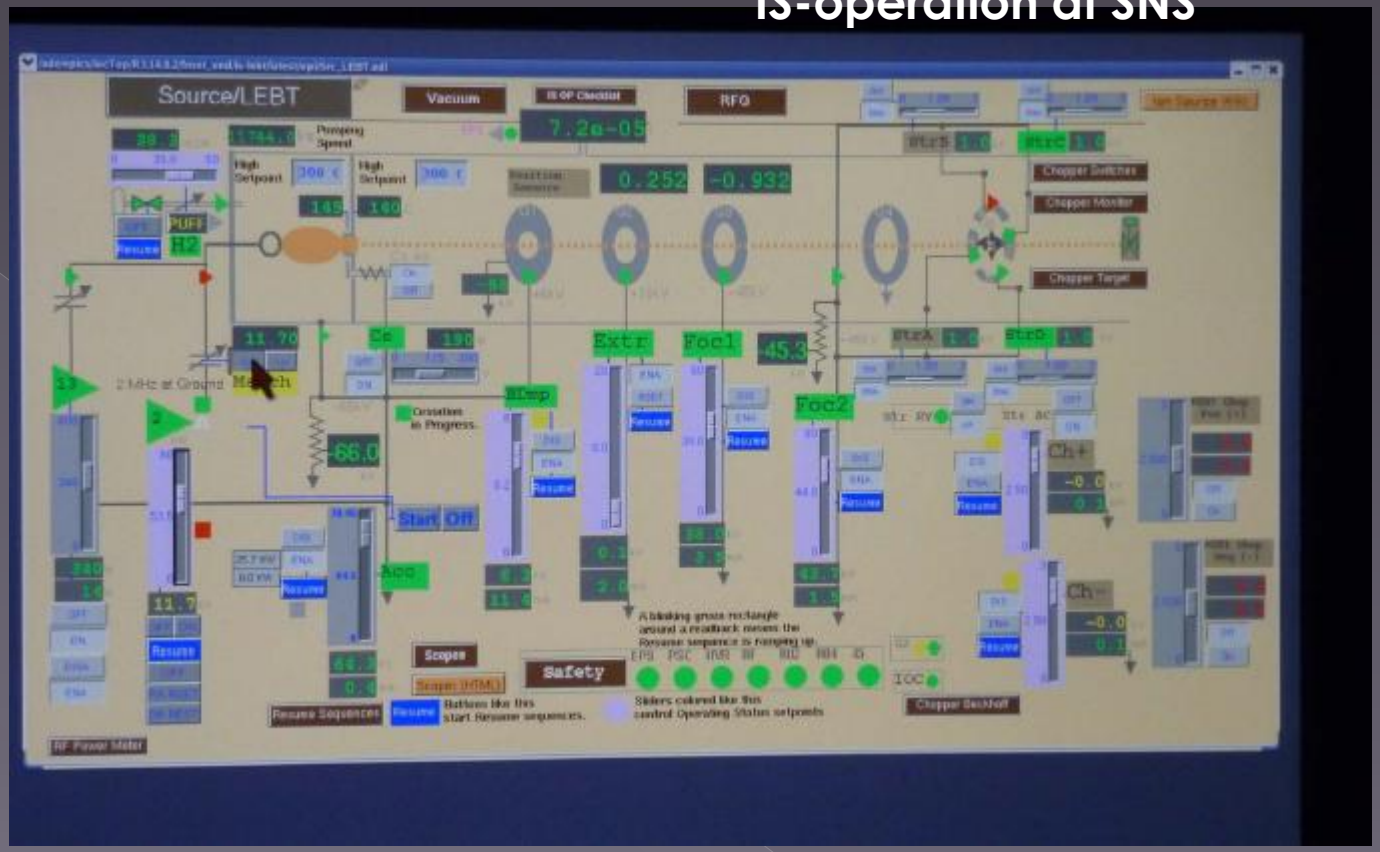
Starting point



Current 3 MeV proton source application.

Goal

IS-operation at SNS



- A single working set/GUI to allow control of all pieces of source-related equipment ("source central") – similar to SNS model
- Expert-level application of as simple access as possible (transparent to operators' use)
- Delivery date by 03/2013

Signals to be monitored

Component, measurement system	*parameters*	*units*	
Power supplies*	U(t), I(t), U_{eff}, I_{eff}	V, kV, A, mA	
Sparks counter	$I>I_{peak}$	min^{-1}	
H_2 injection and Pumping systems (extraction, Einzel lens, LEBT)	P(t), P_{max}, P_{eff}	mbar	
H_2 density regulation (density, thickness)	$\rho(t)$, ρ_{eff}, X_{eff}	At/cm^2	
Residual gas mass analysis spectrum and follow up of H, H_2, N, N_2, O, O_2, OH, H_2O, CO_2, CO, Ar	Mass spectrum, I(M,t)	At/s	
Optical emission spectroscopy: spectrum and $H\alpha$, $H\beta$, $H\gamma$, relevant impurities	I(200-900 nm) Hi(t), Hi_{eff}	Photon/s	
Timing and delays	to_i, dt_i	ms, μs	
Temperatures	T_i	°C	
RF scope	f, $U_F(t)$, $U_R(t)$		→ M Paoluzzi's talk
Vacuum controls (PVSS or simpler approach?)			→ P Chiggiato's talk
Interlocks & safety systems (BIC) – dedicated app			

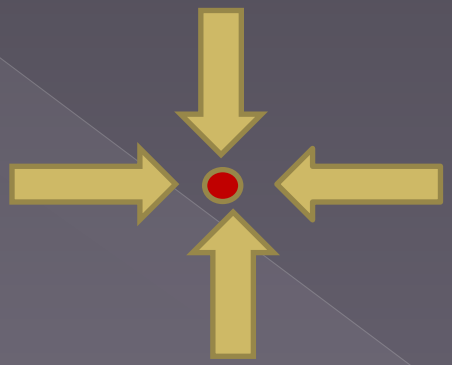
*Pulsed power supplies: monitor flat top mean value and sigma of excursions

Preliminary list : further iterations needed to specify detailed requirements (logging needs, filtering, RTAs etc...)

Organisation

BE/ABP
Setting requirements
& specifications

OP group,
application
programming



Individual equipment groups ,
Front End
Software
Architecture

BE/CO
Control systems,
HW infrastructure ..

Use **off-the-shelf CERN solutions** where available → SW configuration rather than development work

Front End Software Architecture (FESA)

A comprehensive framework for designing, coding and maintaining LynxOS/Linux equipment-software in C++. Each FESA equipment publishes an interface as a collection of get/set properties. Operators control the equipment through remote invocation of these properties across the controls system middleware.

Request-handling: it provides access to the underlying hardware device (simple read / write access to device variables, read/ write access attached to specific cycle or filtering conditions etc.)

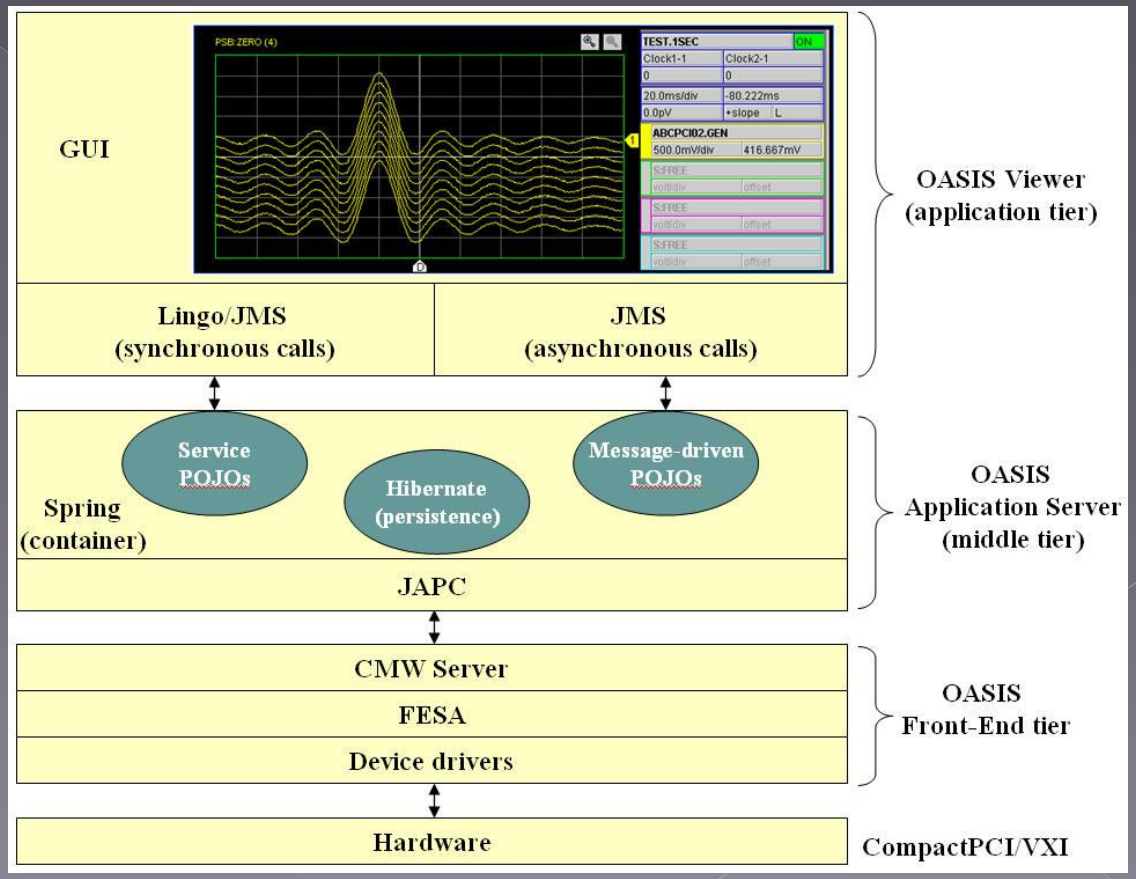
Real time behaviour: ensures that SW abstraction and its underlying HW device continuously reflect each other's state at runtime

Customisation : a set of base classes exists that encapsulate Essential front-end software. Operators need to customize these base classes into concrete versions to suit specific needs.

Open Analogue Signal Information System

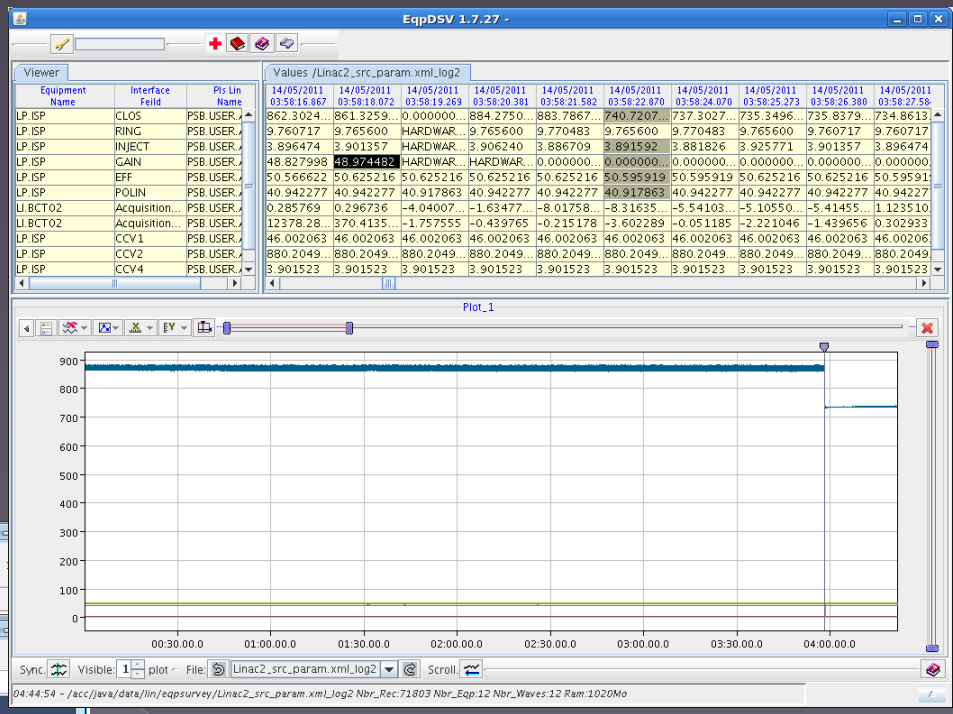
System for the **acquisition and display of analogue signals** in the accelerator domain. The signals, distributed all around the accelerators, are digitalised by **oscilloscopes** sitting in front-end computers (FEC). The acquired data is sent through the Ethernet network and displayed on a workstation running a dedicated application Virtual oscilloscope abstraction (Vscope). A Vscope is a software oscilloscope that takes its data from different hardware oscilloscopes and displays it as if it came from the same module.

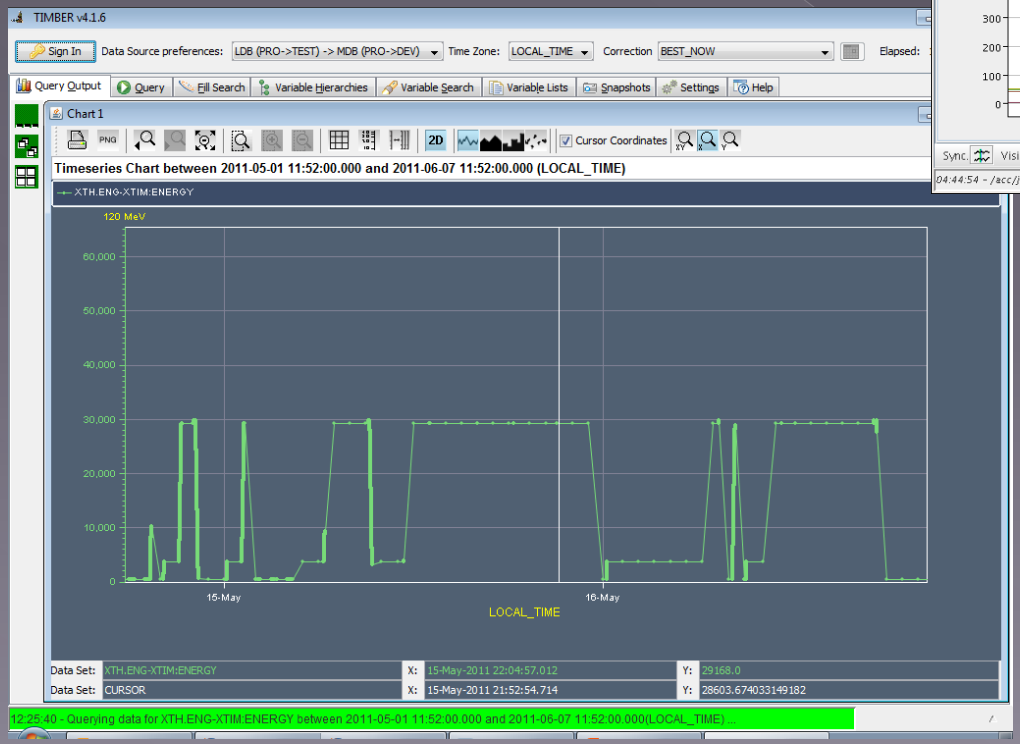
2 OASIS systems x 16channels (8x10MHz bandwidth , 8x100MHz bandwidth)



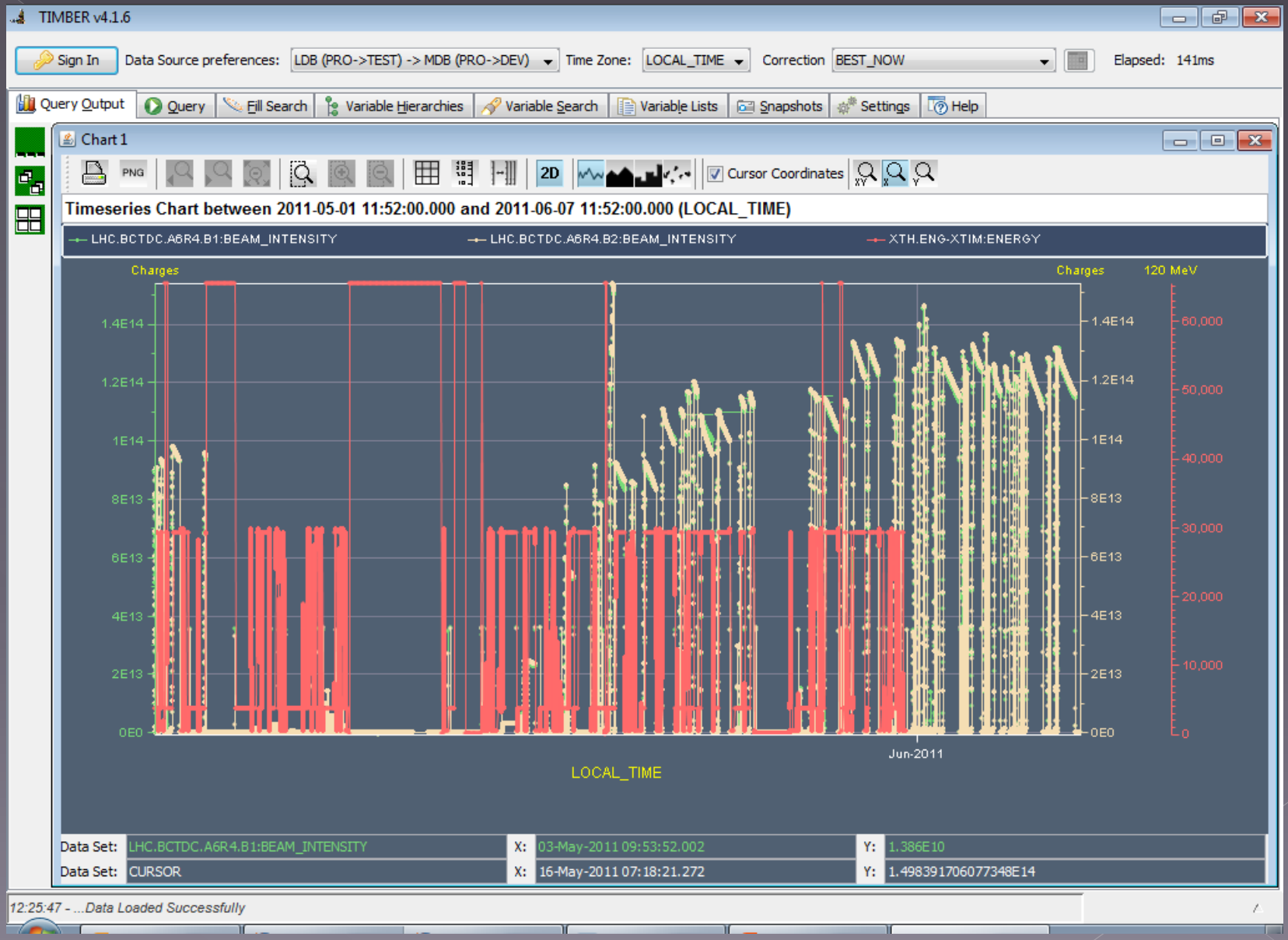
Logging

Eqp Survey – last 7 days history





Timber : longer term history

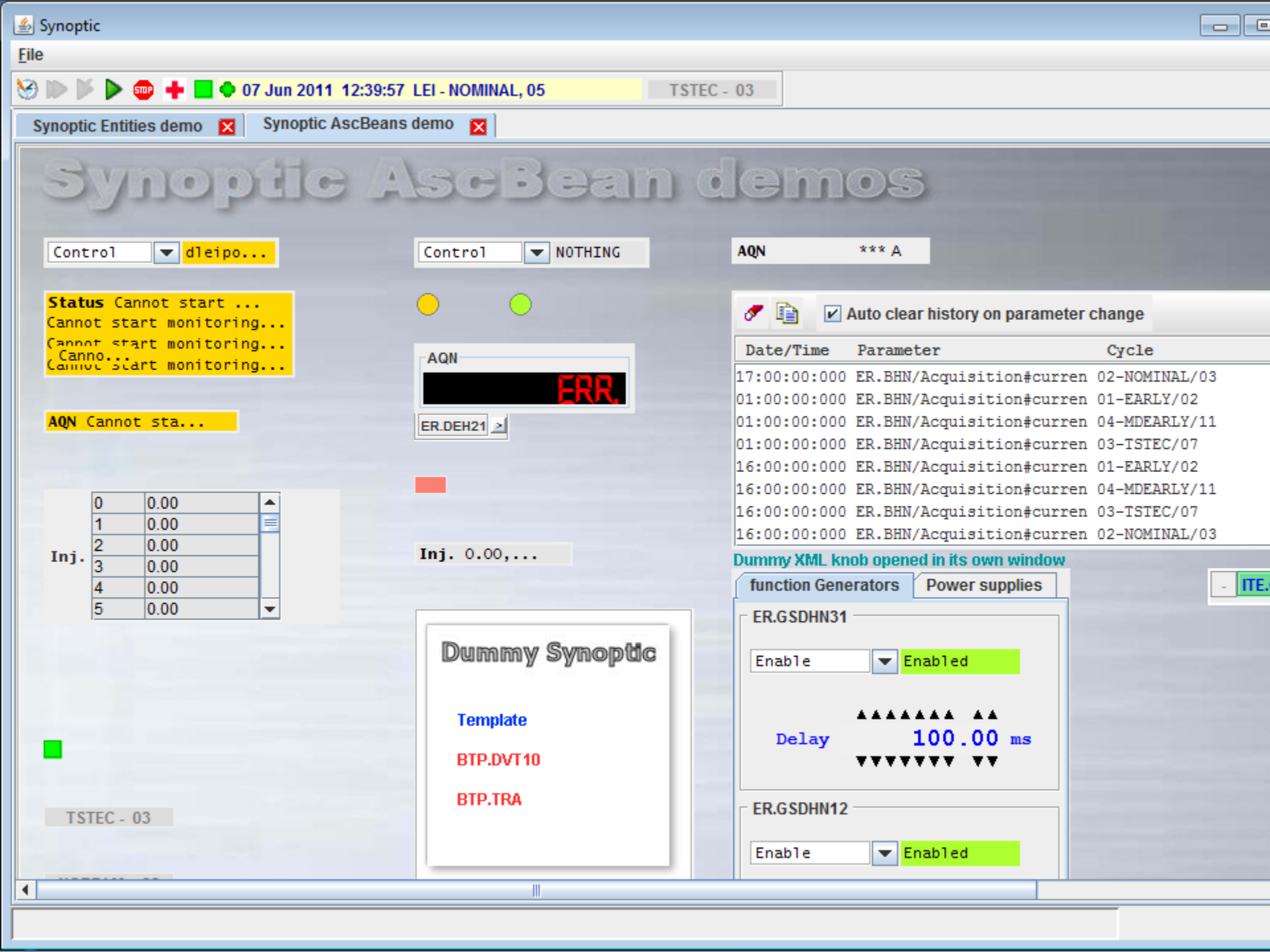

TIMBER v4.1.6
Sign In
Data Source preferences:
LDB (PRO->TEST) -> MDB (PRO->DEV)
Time Zone:
LOCAL_TIME
Correction
BEST_NOW
Elapsed: 141ms
Query Output
Query
Fill Search
Variable Hierarchies
Variable Search
Variable Lists
Snapshots
Settings
Help
Chart 1
PNG
2D
Cursor Coordinates
Timeseries Chart between 2011-05-01 11:52:00.000 and 2011-06-07 11:52:00.000 (LOCAL_TIME)
LHC.BCTDC.A6R4.B1:BEAM_INTENSITY
LHC.BCTDC.A6R4.B2:BEAM_INTENSITY
XTH.ENG-XTIM:ENERGY
Charges
Charges
120 MeV
1.4E14
1.2E14
1E14
8E13
6E13
4E13
2E13
0E0
60,000
50,000
40,000
30,000
20,000
10,000
0
Jun-2011
LOCAL_TIME
Data Set: LHC.BCTDC.A6R4.B1:BEAM_INTENSITY X: 03-May-2011 09:53:52.002 Y: 1.386E10
Data Set: CURSOR X: 16-May-2011 07:18:21.272 Y: 1.498391706077348E14
12:25:47 - ...Data Loaded Successfully

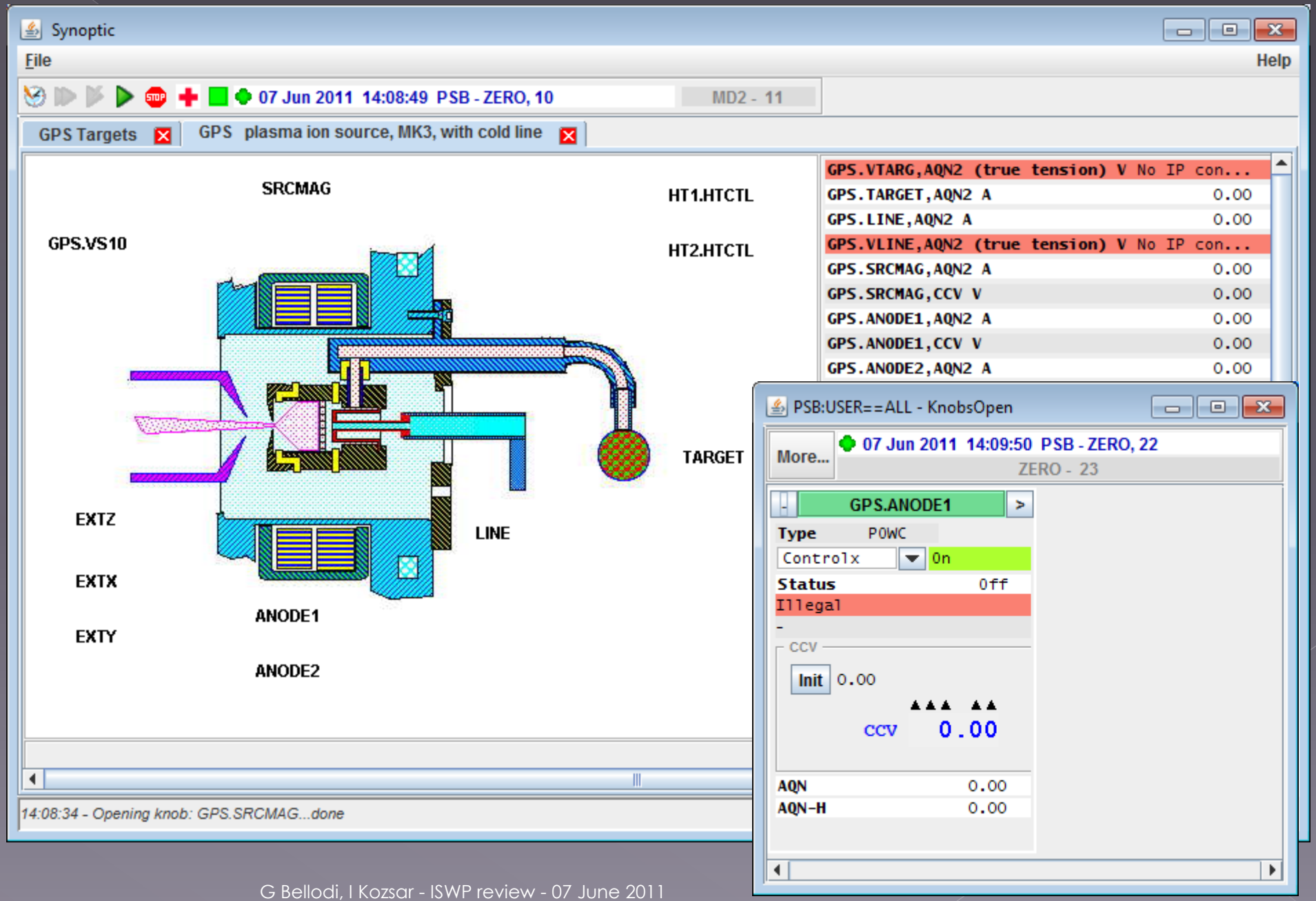
GUI

- Specific application
  - Longer development time, more resources needed
  - Ergonomically: exact match
- Synaptic Editor, XML Knob
  - Much faster development
  - Requirements: FESA (like) interface to equipments
  - Ergonomically: very good approximation of user requirements

Time/cost/resources

- HW – 100 kCHF
  - FECs
  - Scopes
  - Timing, trigger distribution
- SW – 1mm
  - Configuration
  - Support and maintenance
- OP: 12 man*months needed in 2012 and 2013, 3 available


Synoptic
File
07 Jun 2011 12:39:57 LEI - NOMINAL, 05
TSTEC - 03
Synoptic Entities demo
Synoptic AscBeans demo
Synoptic AscBean demos
Control
dleipo...
Control
NOTHING
AQN
*** A
Status Cannot start ...
Cannot start monitoring...
Cannot start monitoring...
Canno...
Cannot start monitoring...
AQN
ERR.
ER.DEH21
AQN Cannot sta...
Auto clear history on parameter change
Date/Time Parameter Cycle
17:00:00:000 ER.BHN/Acquisition#curren 02-NOMINAL/03
01:00:00:000 ER.BHN/Acquisition#curren 01-EARLY/02
01:00:00:000 ER.BHN/Acquisition#curren 04-MDEARLY/11
01:00:00:000 ER.BHN/Acquisition#curren 03-TSTEC/07
16:00:00:000 ER.BHN/Acquisition#curren 01-EARLY/02
16:00:00:000 ER.BHN/Acquisition#curren 04-MDEARLY/11
16:00:00:000 ER.BHN/Acquisition#curren 03-TSTEC/07
16:00:00:000 ER.BHN/Acquisition#curren 02-NOMINAL/03
Inj.
0 0.00
1 0.00
2 0.00
3 0.00
4 0.00
5 0.00
Inj. 0.00,...
Dummy XML knob opened in its own window
function Generators
Power supplies
ER.GSDHN31
Enable
Enabled
Delay
100.00 ms
ER.GSDHN12
Enable
Enabled
Dummy Synoptic
Template
BTP.DVT10
BTP.TRA
TSTEC - 03


Synoptic
File
Help
07 Jun 2011 14:08:49 PSB - ZERO, 10
MD2 - 11
GPS Targets
GPS plasma ion source, MK3, with cold line
SRCMAG
HT1.HTCTL
GPS.VS10
HT2.HTCTL
TARGET
EXTZ
LINE
EXTX
EXTY
ANODE1
ANODE2
GPS.VTARG,AQN2 (true tension) V No IP con...
GPS.TARGET,AQN2 A 0.00
GPS.LINE,AQN2 A 0.00
GPS.VLINE,AQN2 (true tension) V No IP con...
GPS.SRCMAG,AQN2 A 0.00
GPS.SRCMAG,CCV V 0.00
GPS.ANODE1,AQN2 A 0.00
GPS.ANODE1,CCV V 0.00
GPS.ANODE2,AQN2 A 0.00
14:08:34 - Opening knob: GPS.SRCMAG...done
PSB:USER==ALL - KnobsOpen
More...
07 Jun 2011 14:09:50 PSB - ZERO, 22
ZERO - 23
GPS.ANODE1
Type POWC
Controlx On
Status Off
Illegal
CCV
Init 0.00
CCV 0.00
AQN 0.00
AQN-H 0.00