

Logging and DAQ

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What we learnt at String 1

How we built on this experience

Approach

Solutions

Value added

Problems encountered

Where we go from here: lessons for LHC controls

String 2: we did not start from scratch

Good DAQ & SCADA

Web-based data extraction interface

FACTS

No instrumentation database

Ad-hoc run configuration

Data analysis slow and tedious

People developing own tools

PROBLEMS

Identify experiment phases

Inventory

What we have

What is missing

Propose solutions to fill the holes



Instrumentation



Configuration



Storage



Extraction



strict
STRING2 INSTRUMENTATION
AND CONFIGURATION TOOL



Instrumentation



Configuration

stride
STRING2 DATA EXTRACTOR



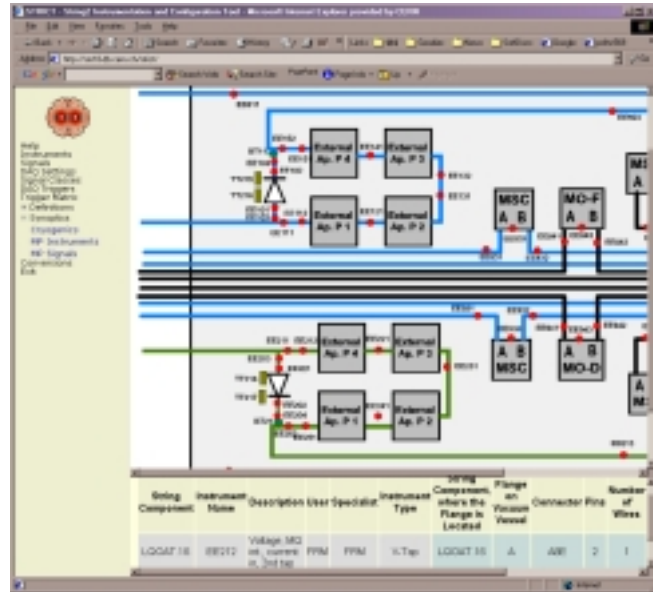
Storage



Extraction

strict
STRING2 INSTRUMENTATION
AND CONFIGURATION TOOL

String Component	Instrument Name	Description	User	Operator	Instrument Type	String Component where the Flange is Located	Flange or Vessel	Connector
LSA-BIS	DH11	Original water SWV	JCC	JCC	C-Header	LSA-B15	A	AA
LSA-BIS	TH41	Valve temperature middle front	JCC	JCC	CX	LSA-B15	A	AA
LSA-BIS	TH41	Valve temperature middle rear	JCC	JCC	CX	LSA-B15	A	A12C
LSA-BIS	PTD1	Return vessel pressure, front	JCC	TR	Pres. Cap	LSA-B15	A	A12C
LSA-BIS	PTD1	Return vessel pressure, rear	JCC	TR	Pres. Cap	LSA-B15	A	A12C
LSA-BIS	TTD1	Dode heat sink temperature 1	DH	FRK	PTT	LSA-B15	A	A12D
LSA-BIS	TTD2	Dode heat sink temperature 2	DH	FRK	PTT	LSA-B15	A	A12D
LSA-BIS	STD1	Dode by pass control	DH	FRK	Half probe	LSA-B15	A	A12D



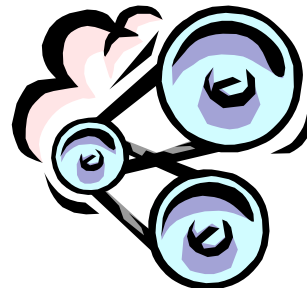
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Run Specific Class	Signal Class	Freq.1 [Hz]	Freq.2 [Hz]	Pre Trig.1 Time [s]	Post Trig.1 Time [s]	Post Trig.2 Time [s]	Trigger Expand	Holdy
BB	100	10	10	20	20			
OL	1000	100	0	0	0			
Buttons	1000	10	0	0	0	100		
LBA015	1000	100	0	0	0			
LBA016	1000	100	0	0	0			
LBA019	1000	100	0	0	0			
Interlock Signals	1000	1000	0	0	0			
UWSC_000	10	10	0	0	0			
BTxxx	10	10	0	0	0			
GF_01	1000	100	0	0	0			
GF_02	1000	100	0	0	0			
GF_09	1000	10	0	0	0	10		
GF_00	1000	10	0	0	0	10		
GF_15	1000	10	0	0	0	10		
GF_16	1000	10	0	0	0	10		
GF_25	1000	10	0	0	0	10		
GF_28	1000	10	0	0	0	10		
HSCB_10	100	100	15	10	10			

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Generated configuration ...



...sets up the DAQ

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stride
STRING2 DATA EXTRACTOR

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SCADA and DAQ post
XML data files ...



...to **stride** database

NAME	DESCRIPTION	OWNER	ACTIONS
LB 4 Dynamics	Cold mass temperature + level signals in the lb tube prepared by E. Maron	ncpnt	+ detailed info + paste to signal list
OK screen 503		ncpnt	+ detailed info + paste to signal list
OP HV water temperatures		ncpnt	+ detailed info + paste to signal list
OPM A125-02		ncpnt	+ detailed info + paste to signal list
OPM CL 0208 TT021 902		ncpnt	+ detailed info + paste to signal list
TSK screen 5003		ncpnt	+ detailed info + paste to signal list
TSK screen 5004		ncpnt	+ detailed info + paste to signal list
All interconnects	V_Taps placed in the interconnect of the 11.5k HV armit	ncpnt	+ detailed info + paste to signal list
All interconnects	V_Taps placed in the interconnect of the 11.5k HV armit	ncpnt	+ detailed info + paste to signal list
Subsies JT	Subsies voltages 06	ncpnt	+ detailed info + paste to signal list
C.L. Row LS	17 A4 current leads flow	ncpnt	+ detailed info + paste to signal list

stride DAQ Archiver Data Extractor

Signals:

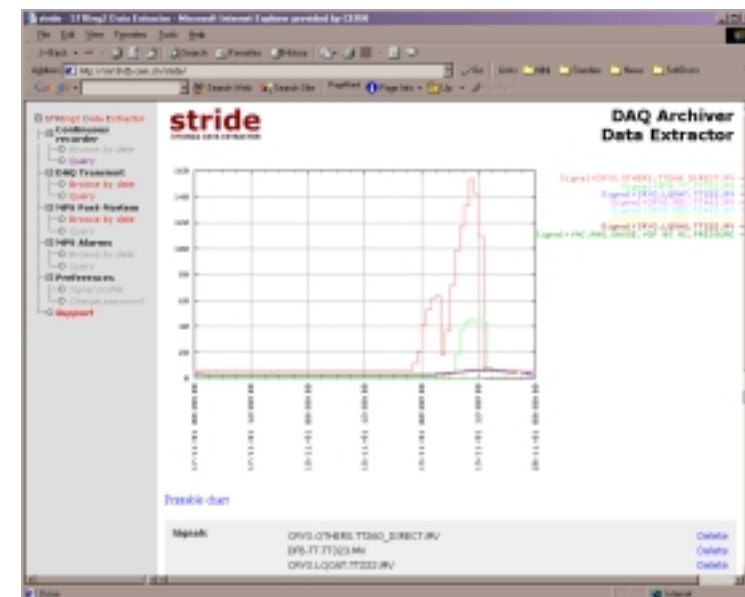
- OPV.OTHERLTDAG_DIRECT JV
- OPV.FT.TT023.MI
- OPV.LQ08.TT023.JV
- OPV.MI.TT463.MI
- OPV.MI.TT463.MI
- OPV.MI.TT463.MI
- OPV.LQ08.TT023.MI
- MAC.MAG.CALISE.VIS.OPV.MI.PRESSURE

Start date: [Date] [Time] [Day]

End date: [Date] [Time] [Day]

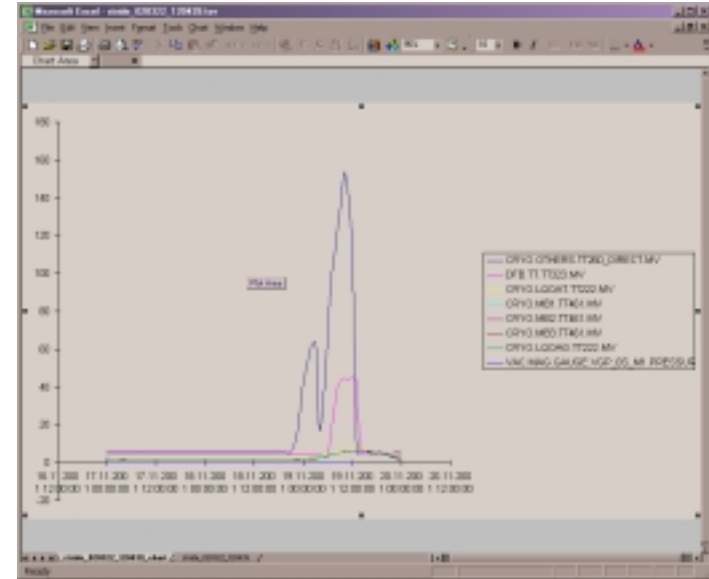
Output: [File] [Chart] [Log scale]

Time scaling: Frequency: [Value] Algorithm: [Scale Down Histogram]



	CRYPTO	MULTI	CRYPTO
1	07.11.2001 00:00:00	5.00007	4.00075
2	07.11.2001 01:00:00	5.40000	4.00049
3	07.11.2001 02:00:00	6.80006	4.00086
4	07.11.2001 03:00:00	8.10004	4.00062
5	07.11.2001 04:00:00	6.00040	4.00047
6	07.11.2001 05:00:00	5.30000	4.00246
7	07.11.2001 06:00:00	4.30000	4.00087
8	07.11.2001 07:00:00	6.00000	4.00020
9	07.11.2001 08:00:00	5.40015	4.00020
10	07.11.2001 09:00:00	5.70040	4.00002
11	07.11.2001 10:00:00	6.30000	4.00069
12	07.11.2001 11:00:00	6.80078	4.00078
13	07.11.2001 12:00:00	5.41506	4.00025
14	07.11.2001 13:00:00	5.40040	4.00044
15	07.11.2001 14:00:00	6.60007	4.00070
16	07.11.2001 15:00:00	6.80011	4.00000
17	07.11.2001 16:00:00	6.30040	4.00001
18	07.11.2001 17:00:00	5.44520	4.00025
19	07.11.2001 18:00:00	5.00007	4.00019
20	07.11.2001 19:00:00	6.80007	4.00001
21	07.11.2001 20:00:00	6.80000	4.00001
22	07.11.2001 21:00:00	5.30000	4.00042
23	07.11.2001 22:00:00	5.00007	4.00040
24	07.11.2001 23:00:00	6.30040	4.00000
25	08.11.2001 00:00:00	6.00000	4.00000
26	08.11.2001 01:00:00	5.42040	4.00202
27	08.11.2001 02:00:00	5.00000	4.00000
28	08.11.2001 03:00:00	6.00000	4.00000
29	08.11.2001 04:00:00	6.70007	4.00021
30	08.11.2001 05:00:00	5.42004	4.00042
31	08.11.2001 06:00:00	5.47100	4.00040
32	08.11.2001 07:00:00	6.70000	4.00000
33	08.11.2001 08:00:00	6.00007	4.00011
34	08.11.2001 09:00:00	5.40006	4.00000
35	08.11.2001 10:00:00	5.04700	4.00045
36	08.11.2001 11:00:00	6.02000	4.00000

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How we benefited?

What did not work as expected?

Phase-by-phase analysis



Central instrumentation database
Homogeneous instrument naming convention



Clickable synoptics

Scalable

String 2 – 115m, LHC – 27 km

Number of monitored signals – similar order of magnitude (currently 3872)

FACTS



Signal/DAQ channel

Naming and conversion problems

Fuzzy responsibility

PROBLEMS

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String 2

Configuration



Grouping signals into classes
Aggregate operations applied to classes

Assigning triggers, setting acquisition parameters



One-click DAQ configuration file generation

Network independent

Rapid DAQ configuration switching

FACTS



Not applicable to SCADA

Complex conversions from physical to engineering values not compatible with web interface

PROBLEMS



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String 2

Storage



Central data archive

Local buffering: no data loss



Standard based data exchange mechanism

XML, HTTP

FACTS



Performance: slow parsing

Non-continuous loading

In-house software on DAQ/SCADA side

No filtering of noisy/useless data

PROBLEMS



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String 2

Extraction



Fast and versatile data extractor
Common interface to DAQ and SCADA data



Historical configuration browser

Not an analysis tool

Rudimentary visualization capabilities provided

FACTS



Complex conversions not available in the beginning

Transient data not available on time

PROBLEMS



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String 2

What we learnt

The overall system provided a prototype functionality of what will be required to observe events like beam loss, quenches, etc.

Used naturally by people – no training required

Unlike String 1, where people developed their tools
Careful UI design very important

A powerful diagnostic tool

Easy configuration switching

Selective extraction of signal data

FACTS

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The system has benefited from

- Uniformisation of naming of signals

- Definition of interfaces between the different DAQs and the system

This could mean for LHC (CP) that a thorough definition of this is required

Software technology choices proved good

- Oracle, PHP, XML

FACTS

Resources for the development

- Delays in providing required functionality

Responsibilities on signal ownership

- Naming, conversions

Non-integration of SCADA configuration

PROBLEMS

String 2 Phase II

<http://sm18-db.cern.ch>

LHC Logging project

<http://cern.ch/lhc-logging>