Adrian Johnson Senior Operations Technician Diamond Light Source





Overview of Diamond

- 3rd Generation Light Source.
- Opened for Users in 2007.
- Currently 26 operational Beamlines.
- 4 Beamlines currently under construction.
- Total of 32 Beamlines by 2017.









Overview of Diamond Accelerators





Archive Data Available

- Diamond uses EPICS Control System & Data Archive.
- Over 110,000 Process Variables (PV's) are Archived.
- Not all of them are of interest.
- Interested in things such as;
 - Water Flows,
 - Temperatures,
 - Pressures,
 - Voltages,
 - Currents,
 - Beam Diagnostics.



Archive Data Available

- Just looking at Storage Ring Temperatures, as an example.
 - Approx. 1300 temperature pvs are Archived.
 - 336 Water Temperatures
 - 360 Vessel Temperatures
 - 288 PLC Temperatures
 - 192 Vessel Thermocouples
 - 96 Control Cabin Temperatures
 - 24 Tunnel Air Temperatures →

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- Using Archive viewer to examine 1300 PVs is impractical.
- Using a system that rolls this data up into 6 displays, much easier and quicker.



- Software Overview.
 - Provide early indication/warning of potential problems.
 - Read archive data on weekly basis
 - Beam conditions tend to change weekly.
 - Provide indication of:
 - Rising / Falling trends,
 - 'Out of character' data.
 - Requests 250 data points per pv.
 - Number actually returned depends on archiving method
 - Takes ~30s to retrieve data for ~300 pvs.

Written in python.



PV Array

• Set-up GUIs

Form1	
Run Dates - Set up for Trending	
Select year: 2015	Save
Select run: Run 1 No. of MD days: 7 (excluding Start up days)	Enter Dates
Last MD day of Start Up (dd/mm/yy): 12/01/15	
Machine Development Date (dd/mm/yy) 20/01/15	
Machine Development Date (dd/mm/yy) 27/01/15	
Machine Development Date (dd/mm/yy) 03/02/15	
Machine Development Date (dd/mm/yy) 10/02/15	
Machine Development Date (dd/mm/yy) 17/02/15	
Machine Development Date (dd/mm/yy) 24/02/15	
Machine Development Date (dd/mm/yy) 03/03/15	
End Date of User beam (dd/mm/yy): 09/03/15	Save Dates

Form1		×
PV Set up for Tr	ending	
Select Area: MPS New A	rea	Save
Select File to Edit: SR Vessel Temperatures		▼ LOAD
Enter New Filename: SR Vessel Temperatures		SAVE
☑ Delete data from beam trips? Stabilisatio	n time after beam	trip (hrs): 5
ADD pv Enter a list of PVs.	🔽 Enter an Array	of PVs
PV	From Cell	To Cell
SRxxC-MP-FLNGE-11:TEMP	01	24
SRxxC-MP-EBPM-11:TEMP	01	24
SRxxC-MP-FLNGE-21:TEMP	01	24
SRxxC-MP-CRTCH-21:TEMP	01	24
SRxxC-MP-CRTCH-22:TEMP	01	24
SRxxC-MP-CRTCH-23:TEMP	01	24
SRxxC-MP-FLNGE-22:TEMP	01	24
SRxxC-MP-EBPM-22:TEMP	01	24
SRxxC-MP-EBPM-23:TEMP	01	24
SRxxC-MP-XRAY-31:TEMP	01	24
SRxxC-MP-XRAY-32:TEMP	01	24
SRxxC-MP-CRTCH-31:TEMP	01	24
SRxxC-MP-CRTCH-32:TEMP	01	24
SRxxC-MP-VESSL-31:TEMP	01	24
SRxxC-MP-FLNGE-31:TEMP	01	24

PV List

Form1	×										
PV Set up for Trending											
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Select File to Edit: SR RF Sys 2 IOT Cooling	LOAD										
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SR-RF-IOT-22:TEMP1											
SR-RF-IOT-23:TEMP1											
SR-RF-IOT-24:TEMP1											
SR-RF-RACK-21:TEMP											
SR-RF-RACK-22:TEMP											
SR-RF-RACK-23:TEMP											
SR-RF-RACK-24:TEMP											
SR-RF-RFPGU-21:FLOW											
SR-RF-RFPGU-22:FLOW											
SR-RF-RFPGU-23:FLOW											
SR-RF-RFPGU-24:FLOW											



• Main GUI



PV Array															
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? Cal				Ops - PV Trending											
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SRxxC-MP-CRTCH-32:TEMP															
SRxxC-MP-VESSL-31:TEMP															
SRxxC-MP-FLNGE-31:TEMP															
Comments:															



• Clicking on an Indicator opens Archive data for that one PV



• Mouseover Left Indicator Shows % Change of linear fit



Mouseover Right Indicator Shows % Spread in data



• Not always as obvious as previous example.

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• Hide increasing % change.

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SRxxC-MP-CWATR-20:FLOW	
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• Hide % spread.

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• Show % Spread only.

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SRxxC-MP-CWATR-20:FLOW	
SRxxC-MP-SWATR-20:FLOW	
SRxxC-MP-BWATR-20:FLOW	
SRxxC-MP-QWATR-20:FLOW	
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SRxxC-MP-DWATR-30:FLOW	
SRxxC-MP-SWATR-30:FLOW	
SRxxC-MP-QWATR-30:FLOW	
SRxxC-MP-VWATR-30:FLOW	
SRxxC-MP-BWATR-30:FLOW	
Comments:	



• Show % Spread only.



Where Next

- Currently the analysis is done manually on Sun or Mon
 - To gather enough data during the week.
 - Repairs / further investigation can be done during Machine Development Tuesdays.
 - Only gets done by One Operator,
 - Depending on shift patterns / leave it might not get done.
 - Write a script only 'gui-less' version that is scheduled to run every Monday morning.
 - E-mail results for further investigation.



Summary

- The trend analysis software enables large arrays of archive data to be assessed:
 - Quickly,
 - For rising / falling trends,
 - For noisy / failing / failed sensors.
- Thereby providing early indication of potential problems.

