Comparison of Three Dataloggers

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The Detector Support Group (DSG) has developed a local EPICS datalogger (Leda), which permits changing archival parameters quickly so that crucial, small changes of instrumentation sensor values are recorded—a capability necessary to ensure that instrumentation sensors are working correctly. DSG has been using Leda [1] for the interlock system of the Ring Imaging Cherenkov (RICH) detector and the Silicon Vertex Tracker, archiving temperature and humidity data. This note compares data archived by accelerator division's MySQL-based EPICS archiving system (MYA), DSG's hardware interlock analysis package (HIAP) [2], and Leda

Temperature data of RICH interlock EPICS PV B_DET_RICH_INTLK_TEMP11 was archived over a two hour period by Leda and then compared to the MYA and the HIAP archived data. In Fig. 1, data archived by MYA indicate that the temperature is a constant for the entire two hour period (red line), but both the HIAP (black) and Leda (blue) show a downward trend in temperature.

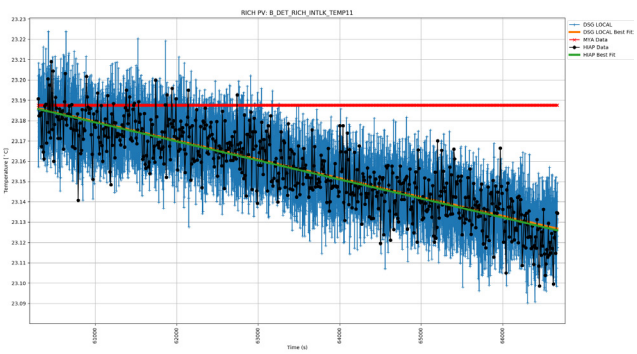

FIG. 1. Temperature data collected by the MYA archiver (red), HIAP archiver (black), and Leda (blue). A downward trend in temperature can be seen in both the HIAP (green line) and Leda (orange line) data, while MYA data show one value for the two hour period. The x-axis shows time in seconds since midnight. The y-axis shows the temperature in degrees centigrade. MYA data shows one value, 23.19°C, for the entire two hour period. Both HIAP and Leda data start at 23.19°C and end two hours later at 23.13°C.

MYA archiver's data is different from the other two archivers due to differences in monitoring deadband and archiving deadband. The monitoring deadband, which should be set at the sensitivity of the sensor (±0.01°C for the RICH temperature sensor), determines which absolute value changes of the sensor get evaluated by the archiving deadband. If the PV's absolute value change is less than or equal to the monitoring deadband value, the archiver ignores the change. If the PV's absolute value change is outside of the monitoring deadband, but within the archiving deadband value, the new value is not recorded by the archiver. Finally, if the absolute value change is outside of the archiving deadband, the new value is logged.

MYA ignores the sensitivity of the sensor, i.e. no monitoring deadband is applied. HIAP and Leda, whereas, have the monitoring deadband set at ±0.01°C. The archiving deadband is ±0.1°C for the MYA archiver (to save disk space) and 0°C for HIAP and Leda, which means that HIAP and Leda dataloggers record every temperature change indicated by the sensor. To save disk space, HIAP samples the data once every 10 s, regardless of how many times the temperature value changes within the 10 s interval. Leda records every temperature value change with no regard for saving disk space. Table I shows the monitoring deadband, archiving deadband, and number of data points acquired by each archiving system. All three archival systems have the same scan rate.

Parameter	MYA	HIAP	Leda
Monitoring deadband [°C]	not available	±0.01	±0.01
Archiving deadband [°C]	±0.1	0	0
# of data points	1	638	7854

TABLE I. Differences between data collection methods for EPICS PV B_DET_RICH_INTLK_TEMP11. The only difference between HIAP and Leda is that HIAP was designed to only retrieve a value once every 10 s.

The monitoring dead band could be set to -1, which would log a value even if it does not change from the previous scan.

For the MYA archiver, the monitoring deadband and archiving deadband can be changed, but they must be changed by the accelerator division after a change request is made. For crucial instrumentation sensors whose PV values change in very small increments per scan, it is important that DSG have control over these parameters to be able to note small changes as soon as possible. This allows determination of whether the sensors are working correctly, which is the motivation for developing HIAP and Leda.

In summary, after archiving EPICS temperature and humidity PV data for RICH interlocks using Leda, the collected data was compared to two other data archiving methods, HIAP and MYA. Based on this comparison, for sensitive instrumentation, it is clear that Leda is able to give a more accurate account of how a sensor is behaving.

[1] A. Brown, et al., *Local EPICS Data Logger*, DSG Note 2020-03, 2020.
[2] M. A. Antonioli, et al., *Monitoring Software for RICH Aerogel Dry Boxes*, DSG Note 2020-06, 2020.