

# Enabling visualization of large telemetry datasets

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**In spacecraft operations, it is often necessary to analyze long-term trends in telemetry and find correlations over extended periods of time. This is done in a multitude of situations, such as when searching for the root cause of on-board anomalies or relaxing current operational constraints based on past telemetry readings.**

**Many tools exist at ESA for supporting this process, including rich clients for displaying telemetry in visual charts. However, telemetry time series, due to potentially very high sampling rates (and consequently very large amounts of data), are challenging to plot in a performing and dependable manner with the currently available tools. Moreover, the behavior over time of telemetry can vary among different parameter categories, rendering visualization techniques that show potential for some types not so efficient for others.**

**In this paper, we present a selection of techniques developed to enable visualization of large telemetry data sets, and analyze their benefits and disadvantages through a series of tests and benchmarks. These techniques include aggregation of data over fixed intervals of time, compression and more advanced methods such as Viewport Resolution Aggregation, a visually lossless aggregation algorithm. The use of these techniques brings advantages such as rendering speed improvements, network bandwidth savings and removes limitations on the user when attempting to visualize years of data. The validation and feedback provided by the ESA spacecraft operators is included as part of the assessment of these techniques.**

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