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A monitoring system for the beam-based feedbacks in the LHC

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The system for the beam-based feedbacks in the LHC is one of the most complex in CERN's accelerator complex. It is an essential system for the operation of the LHC and is routinely used to simultaneously control the beam orbit, machine tune, and radial-loop adjusting the beam energy. The system handles the input of over 2'000 measurements, and controls the current in over 1'000 superconducting dipole correction magnets, over 200 quadrupole correction magnets as well as the RF frequency used to generate the electric field accelerating the particle beams. Recently, a new team was charged with maintaining, documenting and upgrading the software in order to meet the requirements for LHC's 2nd run. The team identified several requirements: 1) gather statistics on the relative offsets of the arrival of measurement data, 2) inspect RT I/O in a user-friendly way, 3) display summarized status information on the synchronism and content of the input data, 4) have the means to rapidly diagnose problems with the feedbacks during commissioning and operation in a non-intrusive way (i.e. without compromising the feedback system's real-time behavior).

This paper documents the design, integration and use of the resulting monitoring suite for the LHC beam-based feedback systems. The set-up comprises a FESA (framework for real-time systems developed at CERN)-based real-time server and a JavaFX-based graphical interface integrated into CERN's operational software infrastructure. Concrete examples are given on how this system has contributed to a better understanding of the overall feedback behavior and aided in diagnosing operational problems. The paper will also summarize envisaged requirements for future releases.

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