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Heat load observer studies on SPIRAL2 data

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We present works on heat load neural observers for the SPIRAL2 superconducting linear accelerator at GANIL. This virtual diagnostic focuses on superconducting (SC) radiofrequency (RF) cavities, which accelerate the particle beam. The cavities are housed in cryomodules, structures that ensure their cryogenic and radiofrequency operation in a superconducting state. Actuators control the pressure and the level of the liquid helium baths. Along with additional process measurements such as temperatures, liquid helium levels and pressures, these provide valuable information that normally is not accessible during beam operation : the heat load dissipated by the RF cavities. In addition to the RF data from the low-level radio frequency system, dynamic heat loads would enable to get a continuous indirect estimation of their quality factor Q_0, to monitor the SC state and anticipate on potential efficiency degradation of the accelerator. In order to achieve this target, we apply neural networks using multivariate time series. Several architectures have been studied (multilayer perceptron, convolutional, recurrent), as well as a stacked generalization method. Work is in progress to improve and test the generalization of these models for different dynamics and/or cryomodules by adding additional information such as the cryomodule identifier. Subsequently, and with the aim of making the installation more reliable for experimenters, work will be carried out on anomaly detection, using RF and high-sampling pressure data.

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