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Study of the electronics architecture for the mechanical stabilization of the quadrupoles of the CLIC linear accelerator

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To reach a sufficient luminosity, the transverse beam sizes and emittances in future linear particle accelerators should be reduced to the nanometer level. Mechanical stabilization of the quadrupole magnets is of the utmost importance for this. The piezo actuators used for this purpose can also be used to make fast incremental orientation adjustments with a nanometer resolution.
The main requirements for the CLIC stabilization electronics is a robust, low noise, low delay, high accuracy and resolution, low band and radiation resistant feedback control loop. Due to the high number of controllers (about 4000) a cost optimization should also be made. Different architectures are evaluated for a magnet stabilization prototype, including the sensors type and configuration, partition between software and hardware for control algorithms, and optimization of the ADC/DAC converters. The controllers will be distributed along the 50 km long accelerator and a communication bus should allow external control. Furthermore, one might allow for an adaptive method to increase the S/N ratio of vibration measurements by combining seismometer measurements of adjacent magnets. Finally a list of open topics, the current limitations and the plans to overcome them will be presented.

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