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Synchronization and phase locking of resonant magnet power supplies for Mu2e experiment at Fermilab

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The Mu2e Experiment has stringent beam structure requirements; namely, it requires short (~ 200 ns) proton bunches separated by $1.5\text{--}2.0\ \mu\text{s}$. This beam structure will be produced using the Fermilab 8 GeV Booster, the 8 GeV Recycler Ring, and the Delivery Ring, which was formerly part of the antiproton accumulator system.

Out of time beam is limited to a fraction of level of no more than 1×10^{-10} , a requirement known as “extinction”. Achieving this level of extinction requires a system of resonant magnets and collimators, phased such that only in time particles will pass through. The Mu2e magnet system involves two components: a 300 kHz component, timed such that the 600 kHz beam will pass through the collimators at the nodes, and a 4.5 MHz system to reduce the slewing of the in-time beam. These two systems must be precisely phase locked to the bunch rate coming from the Delivery Ring, which itself must be phased to match beam transfers coming from the Recycler.

This poster describes the control system for the magnets, which is based on an Intel Arria FPGA, which handles phase locking of the magnets to the Delivery Ring, including the phase jumps required to match transfers from the Recycler.

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Footnotes

I have read and accept the Privacy Policy Statement

Yes

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