Development Towards a Fast Kicker Pulsed Power Supply for the muEDM Experiment

J. Alt[1], M. Sack[1], T. Hume[2], P. Schmidt-Wellenburg[2], G. Müller[1]

[1] *Karlsruhe Institute of Technology, Institute for Pulsed Power and Microwave Technology, Karlsruhe, Baden-Württemberg, Germany*
[2] *Paul Scherrer Institute, Laboratory for Particle Physics, Villigen, Aargau, Switzerland*

The muEDM experiment aims to set a new sensitivity limit for measuring the muon's electrical dipole moment. Part of this experiment is an anti-Helmholtz coil pair, which needs to be supplied with a fast current pulse. The corresponding pulse generator is currently being developed. It needs to be able to achieve a 12 kV and 800 A pulse with a 33 ns to 66 ns FWHM, a 2 kHz continuous pulse rate, and up to 50 kHz burst pulse rate. The pulse must start at the generator output ≤ 70 ns after a TTL trigger signal arrives at the generator's control unit. Additionally, good damping is required so that the measurements after the end of the pulse are not disturbed by the current oscillating through the anti-Helmholtz coil pair. The generator output will be connected to the non-matched inductive load via four parallel electrically long transmission lines. The current status of the generator design considers 16 stages in series, and each stage has eight modules in a parallel configuration and can be operated up to 800 V. Gate-boosted SiC-MOSFETs are used as closing switches to achieve a short delay between trigger arrival and pulse start and a rapid rise time. A test module including options for an electrically short and electrically long impedance-matched configuration was designed and produced. A rise-time below 4 ns with 800 V charging voltage and a matched load was achieved in single-stage operation. Between the optical fiber output of the preliminary control unit and the pulse start, a delay below 45 ns was measured. The test stages were operated in a single-stage and a multi-stage configuration up to the nominal operation. The multi-stage operation was performed using electrically short and long configurations. This contribution will present the main results of these measurements and selected design details.

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