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Design of a 5.5MJ Charge Dump Power Supply for the PPPL FLARE Experiment

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The Facility for Laboratory Reconnection Experiments (FLARE) [1] is an intermediate laboratory experiment currently under construction at Princeton University by a consortium of five universities and two Department of Energy (DoE) national laboratories, located at the PPPL. The goal of FLARE is to provide experimental accesses to new regimes of the magnetic reconnection process and related phenomena directly relevant to heliophysics, astrophysics, and fusion plasmas. The device comprises a vacuum chamber and 9 coils sets that are independently programmable to provide the poloidal and toroidal magnetic fields required to form plasma and study the effects of magnetic reconnection. Each of these 9 coil sets requires a separate pulsed power system, it is the design of the power systems that is reported here. The 9 separate pulsed power systems combine to produce over 5.5MJ of energy to the experiment and each presented their own unique challenges. The most energetic power system is a 3.4MJ, 19.2mF capacitor bank charged to 20kV that provides the guide field, with a rise time of approximately 12ms it delivers an average peak current of 40kA over 5.3ms to 12 coils wired in series. The poloidal field coils consist of two separate coilsets each requiring 540kA peak current which is produced by two 20kV, 2.64mF capacitor banks. The design of the two driver coilsets each charged to 60kV will also be presented. Work supported by NSF Grant Number: PHY-1337831 Title: "MRI Consortium: Development of a Large Plasma Device for Studies of Magnetic Reconnection and Related Phenomena"under subcontract from PPPL under PO94088 [1] H. Ji et al Status and Plans for the Upcoming FLARE, Bulletin of the American Physical Society DPP 2015

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