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Electrical and Mechanical Interactions between Component Coils of Multi-Plex Pulsed Magnet Systems

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To distribute the mechanical load and to reduce the driving voltages, ultra-high field pulsed magnets are usually designed as a group of nested, concentric coils driven by separated power sources. Since the magnet operated in a fast transient mode, there will be strong and complicated electromagnetic and mechanical couplings between the component coils. The high eddy currents generated in the reinforcement shells of those component coils during the pulses also strongly affect the couplings between them. The total Lorentz forces on a component coil will be zero if it is installed so that its field center is perfectly aligned with the field centers of other coils. However this condition is extremely difficult to be achieved in reality. Therefore understanding the electromagnetic and mechanical couplings between the component coils will allow safer and more optimized operation of our magnets. This presentation will focus on our finite element modeling and experimental results for the electromagnetic and mechanical interactions between the component coils of the 100 T nondestructive magnet and 80 T duplex magnet at our facility.

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