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Quasi-Helically Symmetric Stellarator Optimization with Poloidal Field Coils[1] HALEY WILSON, ANDREW WARE, University of Montana, AARON BADER, CHRIS HEGNA, University of Wisconsin-Madison — Quasi-symmetry provides a pathway for improved neoclassical confinement in stellarators. Recent work has indicated that combining optimization of quasi-helical symmetry and minimization of the radial drift velocity can lead to configurations with improved neoclassical confinement and improved confinement of energetic particles [A. Bader, et al., J. Plasma Physics **85**, 905850508 (2019)]. An effort is underway to develop coil configurations that both optimize the physics and meet engineering constraints. The FOCUS code was developed to flexibly explore the configuration space in coil optimization [C. Zhu, et al., Plasma Phys. Contr. Fusion **60**, 065008 (2018)]. In this work, the FOCUS code will be used to develop and analyze coil configurations for five-field period configurations with quasi-symmetry and enhanced energetic particle confinement. We will examine modular coil configurations with and without a set of poloidal field coils and analyze the effects of different coil configurations on Ideal MHD stability, neoclassical transport and energetic particle confinement. This work will include optimization of a coil set for a midscale stellarator experiment and the development of a coil set for a reactor scale device.

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