Improving the Performance of a Fusion Neutron Science Facility

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Two major modifications to the existing steady state Fusion Neutron Science Facility (FNSF) [1] concept are investigated with the aim of determining whether or not the predicted performance can be substantially improved. The modifications are high magnetic field and pulsed operation. We find that high field leads to major improvements in a steady state FNSF, although at the expense of lowering the engineering gain. Pulsed operation replaces the problems associated with low current drive efficiency, with hopefully more manageable engineering problems. Here, however, high field is not helpful, and low field is more desirable. Pulsed FNSFs also have a reduced engineering gain. Further modifications lead to FNSF designs satisfying the additional constraint of engineering gain equal to unity. For these designs there is a large cost penalty for the steady state FNSF but only a modest penalty for the pulsed FNSF. All of our modified designs show modest to large potential improvements over the existing design. Overall, our conclusion is that it may be desirable to carry out a more detailed analysis of one of our improved designs, the choice depending upon which issue in the existing design is most important.

References

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