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# P1.1093 Impact of shape and plasma physics constraints on performance of a tokamak fusion system

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See the full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P1.1093.pdf

An optimal radial build and system parameters of a tokamak reactor were found by utilizing a new simulation method which couples a conventional tokamak plasma analysis and a radiation transport analysis. Neutron impacts on shielding and tritium breeding capability were self-consistently incorporated, together with plasma physics and tokamak engineering constraints, which were moderately extrapolated from the ITER model. In a low-aspect ratio tokamak reactor, the minimum major radius to produce a desired fusion power was mainly determined by the shielding requirements, while in a normal aspect ratio tokamak reactor, it was determined not only by the requirements on the shielding, but also by the requirements on the tritium breeding and the magnetic flux density at the toroidal field (TF) coil. As the aspect ratio increased, the minimum major radius and the system size decreased as long as the tritium self-sufficiency was satisfied with only an outboard blanket, but they began to increase as the inboard blanket thickness increased to meet the requirements for tritium self-sufficiency and the TF coil bore radius increased to meet the requirements for the magnetic flux density at the TF coil. The fusion energy gain Q increased as the fusion power increased and as the confinement characteristics improved. For the aspect ratio A = 1.5, Q > 20 was possible for fusion power levels > 1,500 MW with the confinement enhancement factor H = 1.4. For A = 2.0, Q > 20 was not possible with fusion power < 2,000 MW. When A = 3.0, Q > 20 was possible for fusion power > 1,900 MW with H = 1.3, and fusion power > 1,500 MW with H = 1.4. When A = 4.0, it was not possible to have Q > 20.

## pppo

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