Seminar

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Institute for Plasma Research

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Title: Physics and Engineering Considerations for a Gross Electricity Producing Pilot Plant

Speaker: Dr. P.N. Maya
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Date: 23rd December 2024 (Monday)

Time: 03:30 PM

Venue: Seminar Hall, IPR

Abstract

In a recent paper we have shown that a gross electricity producing moderate sized pilot plant is absolutely essential to bridge the technology gap between current day machines including ITER to a net electricity producing DEMO power plant [1,2]. In this talk we discuss the physics and engineering considerations of the feasibility of such a pilot plant which is approximately ½ to 2/3rd the size of ITER and is capable of producing a fusion power of 300 MW with a fusion gain of 5 and an electric gain of about 0.8. Such devices would naturally require HTS magnets for compaction, long pulse operation for the steady-state heat extraction and energy storage systems for steady-state power delivery to the grid.

We elucidate the physics and engineering constraints for such a configuration of 3.6 m major radius and an aspect ratio of 2.5 for an hour-long pulsed operation with non-inductive current drive [1, 3]. The configuration is derived using the PSCOPE module of the SARAS code for tokamak physics and reactor design [4,5]. We discuss the challenges and gaps in the physics and engineering assumptions.

References:

[1] P.N. Maya, S.P. Deshpande, P. Prajapati, P. Sharma et al., A case for gross electricity producing fusion pilot plants, Nuclear Fusion (2004) https://doi.org/10.1088/1741-4326/ad9938

[2] S.P. Deshpande and P.N. Maya, A staged approach to Indian DEMO, Nuclear Fusion 63 (2023) 126060 (14pp)

[3] P.N. Maya et al., Compact Fusion Pilot Plant: Drivers for Nuclear Analysis Requirements, ITER Neutronics workshop 8th April 2024, submitted for internal review (November 2024)

[4] P.N. Maya and S.P. Deshpande, Parameter Space Constraints for Compact Spherical Tokamak Fusion Reactors, Fusion Sci. and Technology, 80, p. 741-765 (2024)

[5] P.N. Maya and S.P. Deshpande, "SARAS: A Workflow-Based Multi-Physics Simulator for Tokamak Physics and Reactor Design", 29th IAEA-FEC Conference, IAEA-CN-316-2374 (2023)