



Contribution ID: 720

Type: Poster

Upgradation of Aditya Tokamak with Limiter Configuration to Aditya Upgrade Tokamak with Divertor Configuration

Wednesday, 19 October 2016 14:00 (4h 45m)

It is a well-known fact that small / medium-sized tokamaks have enormously contributed in design and development of large size tokamaks such as ITER for building fusion reactors in terms of physics, engineering and diagnostics. Small / medium-sized tokamaks are very convenient to develop and test new ideas, technologies and materials, which because of the risky nature cannot be done in large machines without preliminary studies, such as disruption studies, runaway studies, etc. The worldwide effort on magnetic fusion is devoted to the present generations of large tokamaks like DIII-D, TCV, EAST, SST-1 etc., which are operational emphasizing on divertor and tungsten wall ITER-like operation. However, there are very few (2 –3) small / medium-sized tokamaks operational around the world with divertor facility and technical capabilities to provide able support for operation and trouble shooting of these big tokamaks. Therefore, it has been planned to upgrade the existing ADITYA tokamak ($R_0 = 75$ cm, $a = 25$ cm) successfully operated over 2 decades with more than 30,000 discharges into a state-of-art machine with divertor operation and very good plasma control to support the future Indian Fusion program.

The scientific objectives of Aditya tokamak Upgrade include Low loop voltage plasma start-up with strong Pre-ionization having a good plasma control system. The upgrade is designed keeping in mind the experiments, disruption mitigation studies relevant to future fusion devices, runaway mitigation studies, demonstration of Radio-frequency heating and current drive etc. This upgraded Aditya tokamak will be used for basic studies on plasma confinement and scaling to larger devices, development and testing of new diagnostics etc. This machine will be easily accessible and will be very useful for generation of technical and scientific expertise for future fusion devices.

The installation of Aditya Upgrade tokamak is completed and plasma discharges will be initiated soon. In this paper, especial features of the upgrade including various aspects of designing and fabrication of new components for Aditya Upgrade tokamak along with preliminary results of plasma operations will be presented.

Paper Number

FIP/P4-46

Country or International Organization

India

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Session Classification: Poster 4

Track Classification: FIP - Fusion Engineering, Integration and Power Plant Design