ITER MACHINE AVAILABILITY & FLUENCE OBJECTIVES

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ITER operation will not be able to provide full operational availability demonstration for the future Fusion Reactor due to its different design concepts, functional materials and operating parameters but several areas such as reliability and inherent availability of main sub-systems contributing to produce, control and measure the plasma will be studied and optimized..
One of the main challenges for ITER will be to demonstrate that its operation under a nuclear environment with a sufficient high availability and neutron fluence is possible. A functional analysis of the overall ITER machine from highest level functions down to main operational functions has been developed. The Inherent Availability* ($\mathbf{A_I}$) objective of ITER, based on a bottom-up approach and using the results of **RAMI**[#] analyzes [1], has been defined. The reduction of the time to repair and the failure rate of sub-systems ensuring the main operational functions are the main handles available to increase the reliability and the inherent availability. Unfortunately this increase is limited, the associated cost could become prohibitive and the inherent availability is not the only input for fluence performance. The scheduled downtime for preventive maintenance and updates, and the ratio of plasma burn duration to potential operation time will be dominant for the estimate of ITER fluence capability. Subsequently the ITER strategy in term of Operational availability** ($\mathbf{A_O}$) objective is not only to improve reliability by optimizing the design but also to gain the maximum of operation time by increasing the operational function maintainability thus decreasing the time to maintain or/and to repair.
Regarding the burn availability ($\mathbf{A_B}$) and the neutron fluence, several additional factors have to be taken into account such as the duty cycle, the frequency and the recovery time of plasma disruptions and superconducting magnet fast discharges, and the heating & current drive and control (diagnostics and actuators) system availability.
The ITER objective is to reach an inherent availability of 60% and an operational availability of between 23 and 32% with two or three 8 hours-plasma shifts operating mode and typically an 8 month-major shutdown after each 16 month-experimental campaign. The estimation of all the characteristic times associated to the ITER inherent and operational availability objectives and an estimation of the achievable ITER burn availability and its neutron fluence will be presented and discussed in this paper.

[1] D. van Houtte et al., Fusion Engineering and design, 2010, RAMI approach for ITER

[#] **RAMI: R**eliability, **A**vailability, **M**aintainability, **I**nspectability

***Ai = MTBF/(MTBF+MTTR) = MOT/(MOT+ $\mathbf{MDT_{NS}}$)**

[**] **Ao = MOT / (MOT + $\mathbf{MDT_S}$ + $\mathbf{MDT_{NS}}$)**

where MOT is the Mean Operation Time, MTBF is the Mean Time Between Failure, MTTR is the Mean Time To Repair, MDT_{NS} is the Mean Not-Scheduled Down Time and MDT_S is the Mean Scheduled Down Time.

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