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Methodology for reverse engineering analysis of ITER as-built integrated systems

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The ITER machine consists of a large number of highly integrated and complex systems, with critical functional positional requirements (e.g. accurate positioning of magnets to minimize error fields and location of plasma facing components with respect to magnetic axis) and reduced design clearances to maximize Tokamak performances and limit costs. Deviations from specified part tolerances and product assembly processes/accuracies could have a critical impact on assembly feasibility and achievement of final performances, compromising plasma operation. The assessment of potential deviations on as-manufactured and as-assembled systems, together with early mitigation of non-compliances with Tokamak dimensional requirements, are critical activities during the ongoing manufacturing and Tokamak construction phases.
This paper describes the detailed methodology implemented within ITER for the assessment of as-built integrated systems, based on Reverse Engineering (RE) techniques. The procedure includes the identification of construction needs (at system and assembly levels), the acquisition of metrology data based on defined needs, the post-processing and alignment of data and the reconstruction and management of 3D as-built configuration models. A detailed description of the assessment of non-conformities and tolerance risks/opportunities based on this methodology is included. Predictive clash detection and assembly process assessment/optimization are also described. RE techniques are a basic tool for the management of dimensional risk and opportunity for mitigation or recovery during ITER Construction phase.
ITER is a Nuclear Facility INB-174. This paper describes a Protection Important Activity (PIA) for safety

Co-authors: Dr FUENTES, Francisco Javier (Central Integration Office, ITER Organization); Dr CORDIER, Jean-Jacques (Central Integration Office, ITER Organization); Dr LEONARD, Pierric (Central Integration Office, ITER Organization); Dr SCHERRER, Lucas (Central Integration Office, ITER Organization); Dr WILSON, David (Construction Department, ITER Organization); Dr GAGUECHE, Hani (Central Integration Office, ITER Organization); Dr POPA, Tudorel (Central Integration Office, ITER Organization)

Presenter: Dr FUENTES, Francisco Javier (Central Integration Office, ITER Organization)

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