Status of ITER Diagnostic Modelling

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Abstract

The Integrated Modelling & Analysis Suite (IMAS) is the software infrastructure that is being developed to support the execution of the ITER Research Plan [1]. It is built around a standardised representation of data described by a Data Dictionary that is both machine independent and extensible. The use of standardised Interface Data Structures (IDSs) fosters the creation of modular physics components and (sub-)workflows that can be flexibly re-used to address different needs. The inclusion of Machine Description data allows the development and application of analysis software that not only works for any configuration of the ITER machine, but also for other machines which adopt the same self-describing data model. This allows software to be extensively validated within the ITER Members' programmes before it is deployed on ITER.

There are two main focuses of ITER integrated modelling programme: the development of high-fidelity predictive plasma simulation capabilities to allow the detailed assessment of plasma scenarios in ITER; and the creation of high-performance off-line data processing pipelines to robustly infer plasma properties and their uncertainties.

Forward models of diagnostics that emulate a measurement signal from a plasma simulation, so-called synthetic diagnostics, have an important role to play in both the interpretation of diagnostic measurements and in predictive plasma simulations where they provide the input to actuator controllers.

ITER's strategy for diagnostic data analysis is to extract the maximum possible information from the available diagnostics at each phase of ITER operation. As is common on today's machines, a hierarchy of approaches will be taken for the processing of diagnostic signals. These will cover interpretation and parameter inference and include simple scalings using calibration factors, sophisticated physics analysis including the generation of kinetically constrained equilibria and interpretive transport analyses, to a rigorous inference approach in which as few, but explicitly stated, prior assumptions as possible are made in order to have the most objective interpretation of the measurements.

Acknowledgements:

The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.

References:

[1] ITER Research Plan within the Staged Approach: https://www.iter.org/technical-reports