INTEGRATED BAYESIAN EXPERIMENTAL DESIGN

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Abstract

The design of diagnostics experiments for fusion devices is of major concern to meet the requirements for answering the physical questions necessary to design next generation fusion devices. Wendelstein 7–X, presently under construction, will be a magnetic fusion device providing data from complementary and redundant diagnostic measurements. The Bayesian Integrated Data Analysis (IDA) concept of linking interdependent measurements to provide a validated data base and to exploit synergetic effects will be used to design meta-diagnostics. The concept of Integrated Bayesian Experimental Design (IBED) aims in finding optimal experimental settings for groups of heterogeneous diagnostics.

Applying BED to individual diagnostics results in experimental settings different from settings obtained from applying IBED to a set of diagnostics. Whereas the former procedure tries to obtain redundant optimal diagnostics, e.g., with respect to profile reconstruction, the latter exploits interdependencies to strengthen the experimental complementarity. An example is given by the Thomson scattering (TS) and the interferometry (IF) diagnostics. TS provides excellent information about the shape of temperature and density profiles and poor information about density absolute values. IF provides reliable absolute values for line-integrated density profiles whereas the reconstruction of the profile shape poses an ill-posed inversion problem. In finding the optimal experimental design for the set of TS and IF diagnostics the strengths of both experiments can be combined to synergistically increase the reliability of results.

References:

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Key Words: Bayesian Experimental Design, Integrated Data Analysis, fusion diagnostics