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P2.010 REMAINING USEFUL LIFE ESTIMATION OF CRITICAL DIII-D SUBSYSTEMS

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DIII-D plays a vital role in the development of the physics basis for fusion energy and the ITER design. Designed in the 1970's and built in the early 1980's, the system started operations in 1986 and has provided a reliable platform for fusion experiments for over 30 years. A hallmark of DIII-D operations has been its ability to adapt to the changing needs of the fusion research community and support a wide range of tokamak experiments for various stakeholder's.
An important factor in ensuring continued reliable operations is gaining a thorough understanding of the remaining useful life (RUL) of the DIII-D facility. Developing quantitative assessments of RUL requires a complex set of analyses to evaluate failure modes and effects, life models, operating history and present condition. General Atomics has conducted a pilot RUL assessment project to develop and refine a set of RUL estimation tools applicable to various DIII-D systems.
The pilot assessment categorized DIII-D systems as either repairable/replaceable or facility-life-critical and developed a multi-factor, quantitative assessment of RUL for a facility-life- critical system, the F8-coils. In contrast to repairable/replaceable systems, facility-life-critical systems perform essential DIII-D functions and are expected to last the life of the facility. The F8-coil RUL assessment included life estimates based on conductor and insulation fatigue, insulation ageing, conductor corrosion and material degradation due to radiation exposure.
The pilot F8-coil RUL assessment project showed that under typical operating conditions seen to date, the F8-coil may be expected to achieve a life of ~50 years or >106 shots. The pilot project further demonstrated that employing reliability engineering techniques coupled with modern analytical tools, quantitative estimates for RUL can be developed with reasonable investment. A description of the methodology employed and results will be presented.

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