LINUX PC CLUSTER — A SOLUTION FOR BETWEEN-PULSE ANALYSES AT DIII–D*

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Supercomputers and their recent low cost version Beowulf are traditionally used for modeling, very detailed, and time-consuming analyses in the fusion community. Some of the analyses that survey experimental data take on the order of ten minutes or more to complete on a single fast workstation. Since they do not fit in the narrow window between pulses, they are typically carried out at a sparse sample rate between-pulse and/or as a batch job overnight. Scientists therefore miss the opportunity to use detailed results to guide experiments quickly. Many of these analyses can easily be parallelized or distributed over the time dimension or the spatial dimension or both. With a dedicated Beowulf cluster at a cost less than that of a workstation, these analyses can be accomplished between pulses and the analyzed data can be made available for the research team during the tokamak operation. Such a Linux PC cluster comprised of 24 processors has been installed at DIII–D. It automatically performs between-pulse magnetic equilibrium reconstructions using the EFIT code written in Fortran, CER analyses using CERQUICK code written in IDL and full profile analyses (T_e, T_i, n_e, V_r, Z_{eff}) using IDL code ZIPFIT. The system calculates equilibria eight times faster than the previous system yielding a complete equilibrium time-history on a 25 ms time-scale four minutes after the pulse ends. CERQUICK analyses can be completed between five and six minutes and complete profiles are available at around ten minutes after the pulse ends. This work has laid the groundwork for Kinetic EFIT or ONETWO power balance analyses between-pulses. This paper reports the status of the system and discusses some problems and concerns raised during the design and implementation.

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Topic: Operating system requirements for present and future fusion experiments