ADVANCES IN REMOTE PARTICIPATION FOR FUSION EXPERIMENTAL FACILITIES*

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Magnetic fusion experiments keep growing in size and complexity resulting in a concurrent growth in collaborations between experimental sites and laboratories worldwide. In the U.S., fusion experimental research is centered on three large facilities involving over 1000 researchers covering 37 states. In the European Union, fusion research is coordinated by EFDA, encompassing some 25 laboratories and several major facilities, including JET. Similar large collaborative activities exist in China, Japan, South Korea, and Russia. Collaborative research within each group, combined with collaboration between groups is presenting new and unique challenges in the field of remote participation technology.

These challenges are being addressed by the creation and deployment of advanced collaborative software and hardware tools. Grid computing, the secure integration of computer systems over high-speed networks to provide on-demand access to data analysis capabilities and related functions, is being deployed as an alternative to traditional resource sharing among institutions. Utilizing public-key based security that is recognized worldwide, the TRANSP transport analysis and simulation code and the GATO MHD stability code are securely available worldwide. These services include secure remote data access as well as advanced web-based monitoring capabilities. Traditional audio teleconferencing is being augmented by more advanced capabilities including videoconferencing, instant messaging, presentation sharing, applications sharing, tiled display walls, and the virtual-presence capabilities of Access Grid, with its potential for remote control room presence. With these advances, remote real-time experimental participation has begun as well as remote seminars, working meetings, and design review meetings. Work continues to focus on reducing the variety of remote participation methods, on improving interoperability between the different approaches, on ease of use, and on improved security.

The collaborative technology being deployed is scalable to fusion research beyond the present programs, in particular to the ITER experiment that will require extensive collaboration capability worldwide. The final design, engineering, and construction phases will be worldwide collaborations and will need the ability to richly interact with their distant colleagues, just as their physics colleagues will need when ITER is operational. This paper will compare approaches, review the present state-of-the-art in remote participation capability, and identify areas of work required for the success of future large-scale experiments.

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