

## **Shared Display Wall Based Collaboration Environment in the Control Room of the DIII-D National Fusion Facility**

G. Abl<sup>a</sup>, G. Wallace<sup>b</sup>, D.P. Schissel<sup>a</sup>, S.M. Flanagan<sup>a</sup>, Q. Peng<sup>a</sup>, and J.R. Burruss<sup>a</sup>

<sup>a</sup>*General Atomics, P.O. Box 85608, San Diego, California 92186-5608*

<sup>b</sup>*Department of Computer Science, Princeton University*

Corresponding author e-mail: [abla@fusion.gat.com](mailto:abla@fusion.gat.com)

The DIII-D National Fusion Facility carries out complex scientific research activities on the DIII-D tokamak. The tokamak operates in a pulsed mode producing plasmas of up to 10 seconds duration every 10-20 minutes, with 25-35 pulses per day. Each pulse produces hundreds of megabytes of data acquired from up to 10,000 separate measurements. Rapid analysis needs to be completed using the acquired data within the approximate 20-minute between-pulse interval in order to prepare new machine parameter configurations for the next pulse. Decisions for parameter changes are collective results of discussions amongst the members of the large experimental team, comprised of 20-50 people, which are not only collocated within the control room but also participating remotely.

Due to the complex nature of fusion control room operations, successful research depends on effective communication and collaboration during the experiment. Multiple aspects of experiment status and group activity need to be readily available so that all team members can maintain awareness and collaborate with each other. Each team member has different skills and responsibilities that need to be shared effectively during the between-pulse interval so that the best decisions are made based on a collective data analysis effort. Finally, since the role of remote team members is as important as on-site team members, the communication between local and remote participants needs to be efficient.

A wall-size shared display system has potential benefits for the collaboration activities of a large fusion experimental team working towards a common goal. Its high-pixel resolution not only enables the scientific team to study the fine details of density-rich visual information without losing the overall picture, but also creates a space for simultaneously visualizing the multiple aspects of experimental operations. It is large in size so that the displayed information can be easily seen by a large group of people in the control room. By functioning as a public presentation space, a shared display system fosters group activity awareness and improves the interaction effectiveness among experimental team members.

At the DIII-D National Fusion Experiment Facility control room, a 150-in. (3840x1024 pixels) large tiled shared display is being used to support routine collaborative scientific investigation during experimental operations. Under the National Fusion Collaboratory Project, an observational study has been conducted in order to

identify the best ways of utilizing the shared display for control room collaborations. The findings of the study motivated the deployment of shared display-based software tools in three categories: 1) visualization tools that provide up-to-date information about multiple experiment status and group activity, 2) data analysis sharing tools that enable researchers to move the information from personal desktop screens into the large shared display wall, 3) advanced video conferencing tools that present the life-size video of remotely participating core team members. As a result, the shared display wall system has become one of the most important building blocks of the “collaborative control room” and has been well received by fusion researchers. Fig. 1 is a photograph of DIII-D control room environment and Fig. 2 is the screen shot of the shared display wall being used during the experiment.

In the full paper, we will describe the shared display-based software tools developed for the fusion control room environment. We will also present the lessons learned from deploying and using a high-resolution shared display in DIII-D control room.

This work was supported by the SciDAC program and at General Atomics under US Department of Energy cooperative agreement DE-FC02-04ER54698.



Fig. 1. The DIII-D control room environment including shared display wall system.

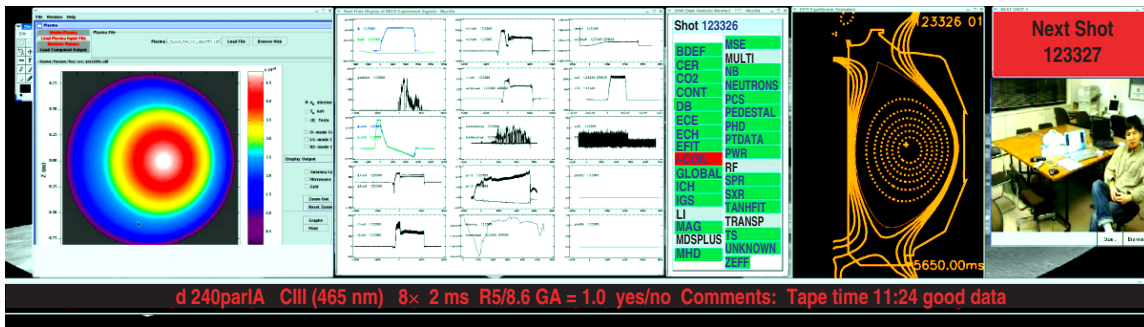


Fig. 2. Partial screen snapshot of DIII-D shared display wall. Displayed are (left to right) a data analysis result being shared, the real time plasma control signals, Data Analysis Monitor report, the plasma shape movie player, and an Access Grid video image of a collaborating scientist from a remote site. Displayed on the bottom is the electronic log ticker application.