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Remote Experiment with WEST from ITER Remote Experiment Centre

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Remote experiment with WEST tokamak in CEA Cadarache France from the ITER Remote Experiment Centre (REC) in Japan was successfully carried out on November 2018. The construction of the REC was carried out at the Fusion Energy Research Centre (IFERC) under the agreement between the Government of Japan and the European Atomic Energy Community for the joint implementation of the Broader Approach (BA) activities in the field of fusion energy research.
First, WEST and REC sites were connected via broad band networks, that are SINET5 (Tokyo-London: 20 Gbps), GÉANT (London-Paris: 100 Gbps) and RENATER (Paris-Cadarache: 10 Gbps), over about 10000 km of transmission path length. The partners network (Partners Zone) for remote participants was used on the WEST side. It is accessible through a firewall and is separated from WEST internal networks by a second firewall. The WEST Portal in the Partners Zone allows accessing a set of information and tools such as the machine status and the experiment logbooks. The Pulse schedule editor is also available by login onto the Partner Zone server (Altair). The remote experiment was devoted to test the ITER plasma-facing components and their shaping under high heat flux. It started by the pulse preparation in REC, where the remote session leader edited the pulses schedule based on the communication between REC and WEST control room via VC system. After the approval of the Pulse Schedule by Engineer in Charge in WEST, discharges were successfully executed repeatedly with modified scenario based on intershot analysis. The large video wall (LVW) in the REC room, displayed the near-real time countdown of the plasma discharge, a video of plasma generated in WEST tokamak, the live data of the time trace of the main parameters of the plasma, such as the current and the plasma density, in addition to the view of the video conference system. In the intershot period, data analyses were carried out on Applications server located in the Partner Zone.
Full functions required for the remote experiment were successfully demonstrated, which are the pulse preparation, communications between local and remote sites, live monitoring of the data and post-pulse data view and analyses. In order to become more effective for these functions, it was clarified that adequate data transferring methods and system are required, especially for the live data and the large volume result data. It was also clarified that the LVW in the REC was very effective to share the information between REC and WEST.
The first test of remote experiment with WEST, ˜10000 km away from REC, like ITER, has been successfully completed. By this test, technical requirements emerged for more effective remote participation. Those are how to get the near real time data to show the live data in REC, how to view and analyze the large volume data through the limited network capability, and how to communicate with the on-site colleagues. This paper will discuss these issues.

Primary author: TOKUNAGA, Shinsuke (National Institutes for Quantum and Radiological Science and Technology (QST), Japan)

Co-authors: MOREAU, Philippe (CEA, IRFM, France); SIGNORET, Jacqueline (CEA, IRFM, France); IMBEAUX, Frédéric (CEA, IRFM, France); TSITRONE, Emmanuelle (CEA, IRFM, France); LOARER, Thierry (CEA, IRFM, France); SALMON, Thierry (CEA, IRFM, France); HUTTER, Thierry (French Alternative Energies and Atomic Energy Commission); GIRUZZI, Gerardo (IRFM, CEA); SARTORI, Filippo (Fusion for Energy); FARTHING, Jonathan (Fusion for Energy); NAKANISHI, Hideya (National Institute for Fusion Science); OZEKI, Takahisa (QST, Japan); ASAKURA, Nobuyuki (QST, Japan); SAKAMOTO, Yoshiteru (QST, Japan); OHTSU, Hideo (QST, Japan); SUGIE, Yoshihiko (QST, Japan); SUZUKI, Satoshi (QST, Japan); FUKUDA, Makoto (QST, Japan); NAKANO, Tomohide (QST, Japan); SANO, Ryuichi (QST, Japan); ISHII, Yasutomo (QST, Japan); CLEMENT LORENZO, Susana (Fusion for Energy); NAKAJIMA, Noriyoshi (National Institute for Fusion Science); THE WEST TEAM (CEA, IRFM, France)

Presenter: TOKUNAGA, Shinsuke (National Institutes for Quantum and Radiological Science and Technology (QST), Japan)

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