Simulation Data Analysis by Virtual Reality System

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Since NIFS Virtual Reality (VR) System "CompleXcope" was installed in 1997, it has been developed continuously (Fig.1). Developments of new software such as, VFIVE, AVS for CAVE, sonification and automatic speech recognition system have been performed. By using these new tools CompleXcope has been made use for scientific investigation such as analysis of MHD simulation results for MHD dynamo and spherical tokamak, analysis of molecular dynamics simulation results for chemical sputtering of plasma particle on diverter, analysis of particle simulation of magnetic reconnection, analysis of fluid simulation of turbulence, and analysis of satellite observation data of solar, and so on.

For scientific VR visualization using the CAVE system, we develop several pieces of new software to analyze the results of the plasma simulation, and show both simulation results and experimental device data (ex. CAD data) simultaneously in the VR world.

One of the new software is for the plasma particle simulation [1]. We can trace the trajectories of plasma particles in the electromagnetic field obtained by the particle simulation. The orbit of a single particle is calculated by integrating the Newton-Lorentz equation. We can point the initial position of particle by the 3-D mouse "Wand." The initial velocity is obtained by the Box-Muller method with the flow velocity which is given by simulation data. Using this software, it is clearly shown that the meandering motion of particles is related to the reconnection mechanism (Fig.2). Recently we advance this software for analyzing the particle trajectories in the time-evolution of electromagnetic fields, which is obtained by simulation data.

It is demanded that both of simulation results and experimental device data (or only experimental device data) are visualized by the VR System to analyse directly the simulation results in the device. Recently, we succeed in the visualization of both simulation and device data in the VR world (Fig.3). It is possible to grasp intuitively the distance between the surrounding plasmas and the device in the vessel, and to simulate operations in the vessel, and so on. This success breaks a new path in contribution to the experiment.

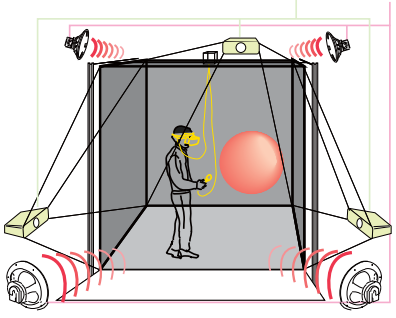

Fig. 1 CompleXcope.

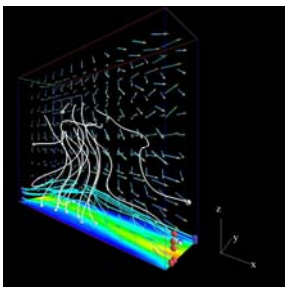

Fig. 2 Visualization of particle trajectories in VR world.

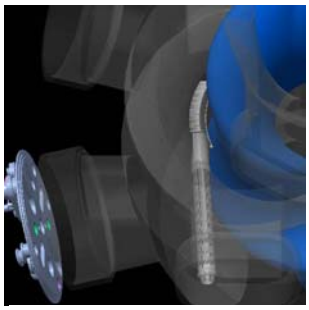

Fig. 3 Visualization of both simulation and device data in VR world.

[1] H.Ohtani and R.Horiuchi, Plasma Fusion Res. 3 (2008) 054.