§9. 3D Visualization of LHD Plasma with Dusts

Ohtani, H., Ishiguro, S., Suzuki, Y., Shoji, M., Kanno, R., Kageyama, A. (Kobe Univ.), Ohno, N. (Univ. Hyogo), Tamura, Y. (Konan Univ.)

In 1997, the National Institute for Fusion Science (NIFS), Japan, installed the CompleXcope virtual-reality (VR) System based on CAVE system[1)] as an instrument for scientifically analyzing simulation results. NIFS has developed new software, such as VFIVE, AVS for CAVE, a sonification system, and a reactor design aid tool.

As one of the scientific VR visualizations using CompleXcope system, we introduced a method to display both simulation results and experimental device data integrally in the VR world[2,3,4)]. We had succeeded in visualizing the data of HINT2 code[5,6)] by a visualization software *Virtual LHD*[7)], and in drawing punctures of sampled field lines on a Poincare section in VR space in order to characterize the structure of magnetic field. In this paper, we report the integrated scientific visualization of experimental observation data with simulation results and device data in the VR space.

The fast framing cameras installed in the Large Helical Device (LHD) observed the dust trajectories [8)]. By using the stereoscopic image data, the information of the dust trajectories was obtained as time-history data of three-dimensional positions. In the last fiscal year, we developed the interface function of reading the data and the visualization tool of the dust trajectories in the VR space for the software Virtual LHD. Since the dust position was visualized as a point by GL_POINTS, it was difficult to grasp the three-dimensional position relation. In this fiscal year, we adopt the point-sprite method to show the position. With point sprites it is possible to place a 2D textured image anywhere on the screen by drawing a single 3D point. This method enables the high-performance rendering of points. In the CAVE system, many particles can be displayed smoothly.

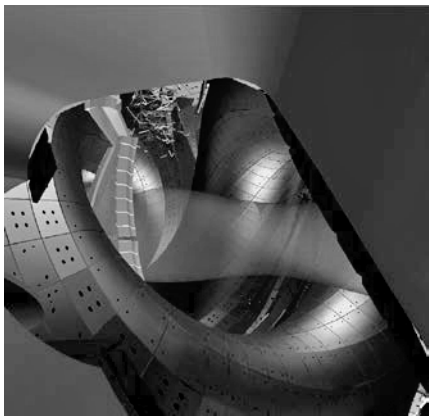

Fig.1. VR visualization of dust trajectories with the isosurface of plasma pressure (deep red) from the outer port of LHD.

Figures 1, 2 and 3 show VR visualizations of dust trajectories by the point sprite method. The different trajectories are stained with different colors. Figure 1 displays the field of vision from the outer observation of LHD vessel, and Figure 2 shows the same as Fig.1 but inside view of the vessel with the single magnetic field line. The dust particles are located near the antenna. Figure 3 exhibits the other dust particles near the closed divertor.

VR technology is powerful equipment for analyzing simulation and experimental data. We believe that the buildup in this paper will boost up the research of the plasma physics and fusion plasmas.

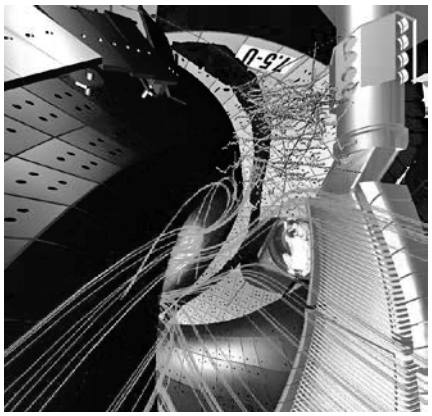

Fig.2. The same as Fig.1 but inside view of LHD vessel with the single magnetic field line.

Fig.3. The same as Fig. 2 but from the other view point near the closed divertor.

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