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Virtual Reality Visualization of the Large Helical Device Simulation with Head-Mounted Display

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Virtual reality (VR) devices enable us to see three-dimensional objects in three dimensions. The use of them has been considered effective for the visualization of three-dimensional plasma simulations because it is essential to visualize vector and scalar fields with complex structures. The CAVE systems [1] have been used for VR visualization. The CAVE systems provide fairly good visualization environments. We have developed Virtual LHD [2] for the CAVE systems. Virtual LHD is a visualization software for data output by HINT code [3], namely Large Helical Device (LHD) simulation results. This software is written in C language using OpenGL and CAVELib. It can visualize pressure isosurfaces, magnetic field lines, and particle trajectories in the CAVE systems. Visualization parameters such as isosurface level can be interactively determined by users with the wand, a 3D mouse of the CAVE systems. It has been used not only to visualize simulation results but also to display experimental results [4].

Head-Mounted Displays (HMD), which are VR devices for personal use, have begun to spread recently, and these devices can provide the same visualization environment as the CAVE systems. We have successfully developed Virtual LHD for HMDs (Fig.1-3) on Unity [5], a game engine. The computational part of the visualization, such as isosurface generation and particle trajectory calculation, was created by rewriting the original Virtual LHD source code in C#. Although this software is executable with a PC and an HMD, it has the same visualization capabilities as the Virtual LHD for the CAVE systems and provides an interactive VR visualization environment. We are planning to apply this software to various plasma researches in the future.

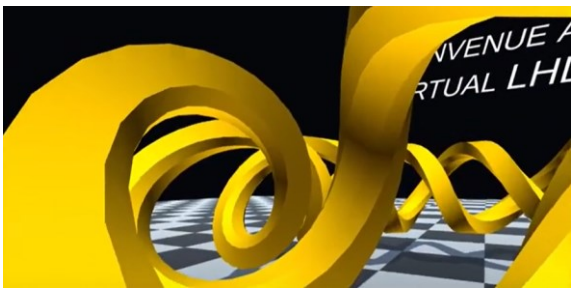

Figure 1. The initial screen of Virtual LHD. The golden objects express LHD's helical coils.

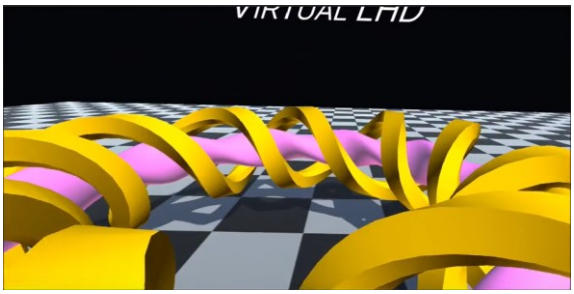

Figure 2. Isosurface visualization. The pink surface is a pressure isosurface.

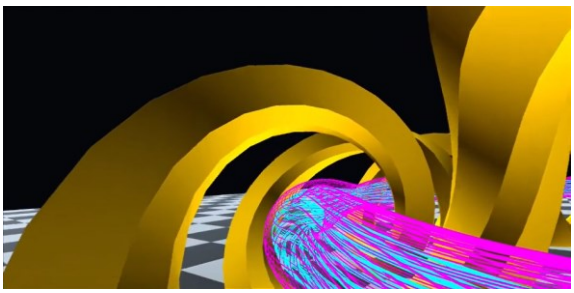

Figure 3. Magnetic field lines. Cyan and magenta lines are magnetic field lines.

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[5] Unity: https://unity.com/ (Accessed 24 July 2023)