

# Drawing range and voxel emission characteristics of volumetric display with femtosecond-laser excitation of air

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A volumetric display generates voxels in three-dimensional physical space. A user can directly observe the volumetric image. A volumetric display with the voxels generated by a focused pulsed laser in air is developed. It achieves touch interaction using a seamless relationship between the user and the image. The first objective of our study is to enlarge the display size.

In this presentation, we demonstrate the evaluation of the image rendering range and the voxel emission characteristics of the volumetric display when the image size of centimeter order is realized by reconstructing the optical system.

Figure 1 shows the experimental system for the volumetric display. Mainly it consists of a femtosecond laser with a central wavelength of 1030 nm, a repetition rate of 1k-100 MHz, and a pulse width of 155 fs, a galvano scanner to adjust the light focusing position in the lateral direction, a varifocal lens to adjust the light focusing position in the optical axis, and an F $\theta$  lens. The luminescence generated by the focused femtosecond laser irradiation was observed by a CCD image sensor.

Figure 2 shows drawing range of the display system. The voxels were generated in most areas of the operating range of the device, no voxel generation was observed at the corner position around  $z = 4.2$  cm. This is because the variable focus lens acts as a concave lens, causing some of the laser incident on the galvanometer scanner to be larger than the mirror, and due to the lower NA.

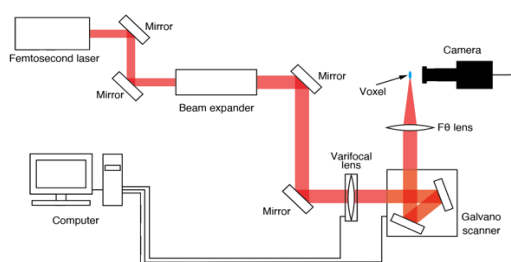


Fig. 1 Experimental setup.

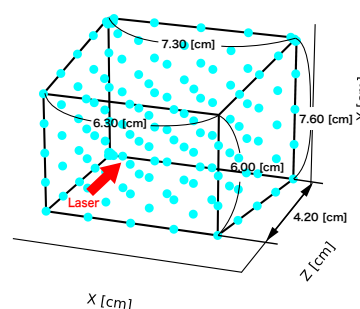


Fig. 2 Drawing range of volumetric display.

## Short biography:



Tatsuki Mori received bachelor's degree in Utsunomiya University (UU), Japan, in March 2018. He is a master course student in UU. Now he is belonging in Optical System Design Laboratory (Hayasaki Lab) in Center for Optical Research and Education, UU. His study is a volumetric display based on femtosecond laser excitation. He is a vice president of The Japan Society of Applied Physics (JSAP) UU Student Chapter and a member of OPTICA UU Student Chapter.