



VORTEX: Design and Implementation of an Interactive Volumetric Display



Projector

- Projects volume slice data through optical guide onto diffuser.
- Projector parameters limit display parameters of display.

Display Parameters

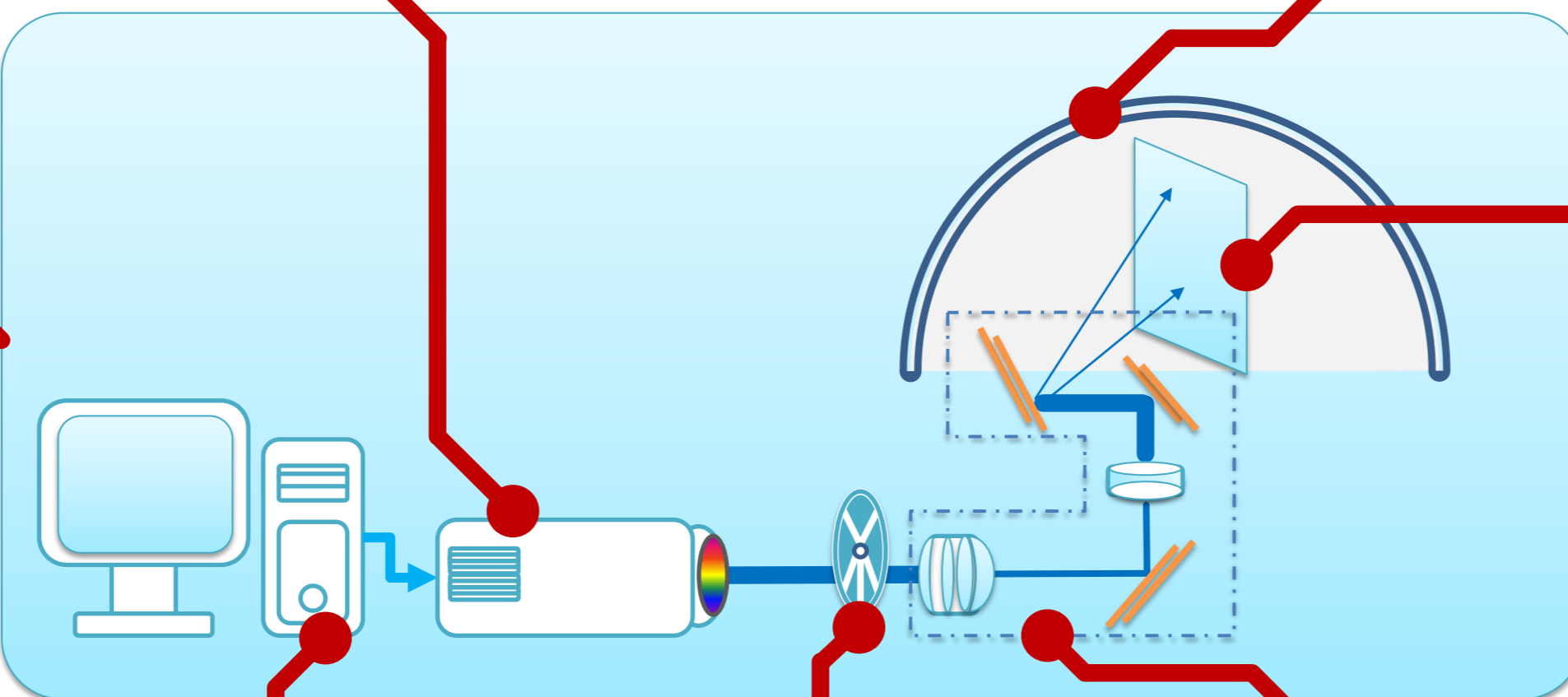
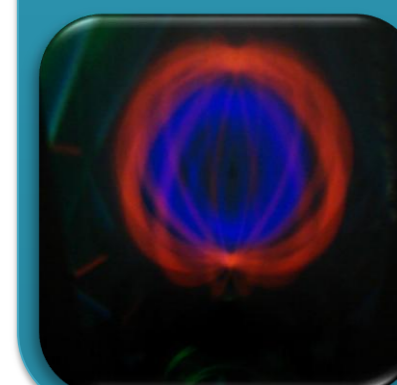
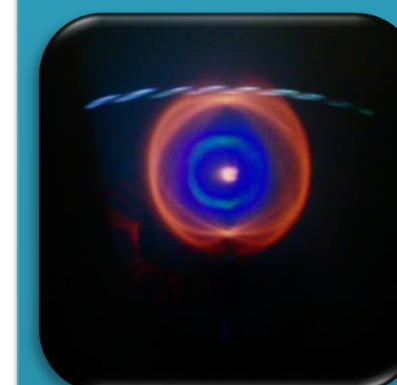
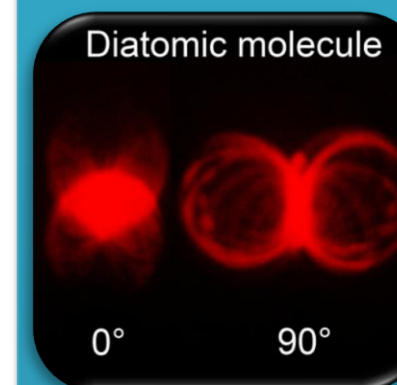
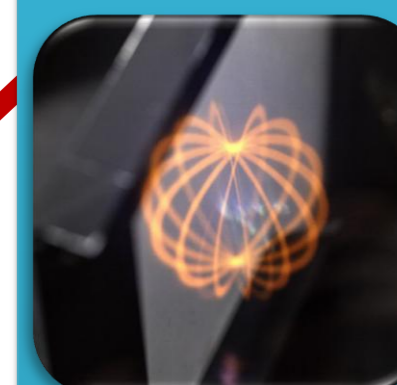
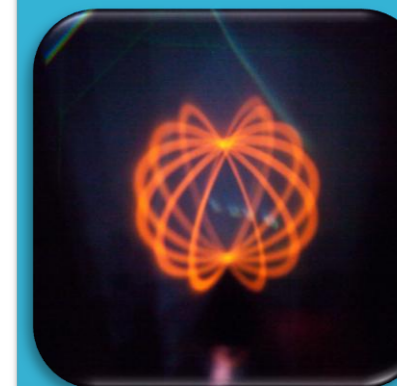
- Limited by these parameters:
- Bandwidth: Voxel data to be transferred from PC.
 - Vertical Refresh Rate : Maximum fps & slices/s.
 - Color Depth: Reduce to increase voxels or refresh/s.

Input System

- Protective dome acts as input surface.
- FTIR on a curved surface.
- Allows for 'walk-up & play'.
- Interactions to manipulate displayed objects.

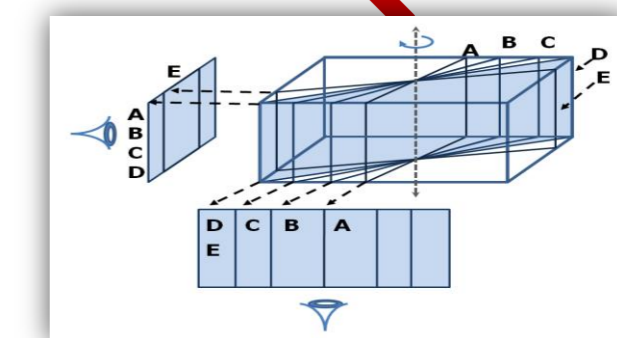


Results



Isotropic Diffuser

- Every voxel can be seen from all viewpoints.
- Autostereoscopic and 360° accessible.
- 'Translucent skin' effect due to lack of perfect occlusion.



Technical Specifications:

- Voxel count: 10,584,000
- Voxel angular width: 3°
- Volume refresh rate: 2 / sec
- Color depth: 24-bit color

Future work:

- Increase volume refresh rate.
- Explore dynamic diffuser option.
- Dome based interaction techniques allowing 'walk-up and play'.
- Hybrid Multi Display Environment:
 - Object behaviour across displays.
 - Interaction techniques.
 - Real world deployment.

Render Engine

- Converts 3D scene into series of slices.
- Outputs slice as per the position of the screen.
- Affected by the inter-frame gap.

Shutter Disc

- If diffuser follows projector fps, it rotates too slowly.
- Shutter disc decouples the two frequencies.
- Diffuser can run faster without blurring of image.

Optical Guide

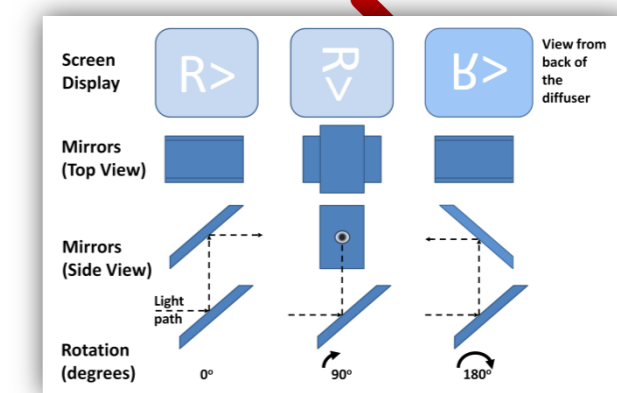
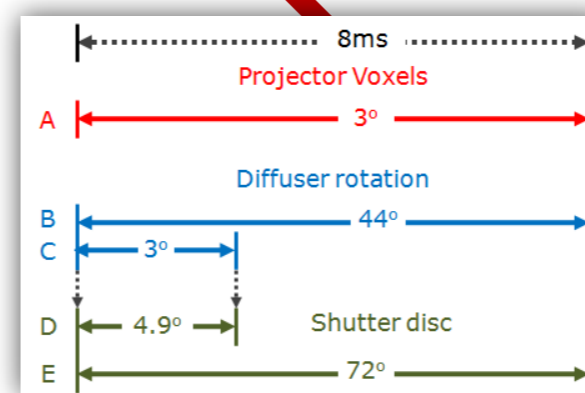
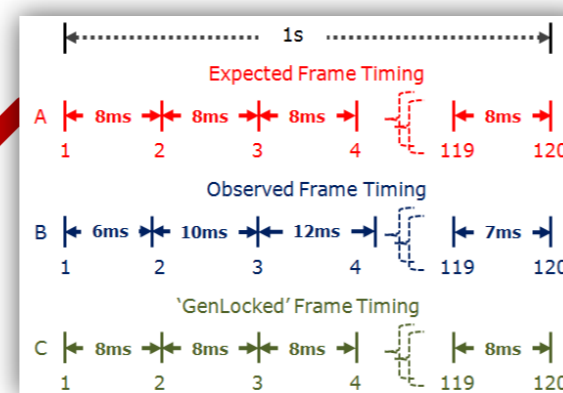
- Channels the image from projector to diffuser.
- Uses step-down / step-up stages for controlling focus & image size on diffuser.
- Requires optical correction.

Optical Correction

- Relative rotation of optical guide elements results in rotation of image.
- Diffuser rotation also causes another rotation artifact.
- Software corrects artifacts by rotating/revolving view.

Inter-frame Gap

- At 120 fps, a new frame should be output every 8ms.
- Practically, this inter-frame gap time varies significantly.
- Requires output to be locked to an external 'GenLock' signal through specialized hardware.



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