Motion Vector Visualization on UC-win/Road

for assessing VR toward preventing VR sickness

July 10

11th VR Summer WS Final presentation

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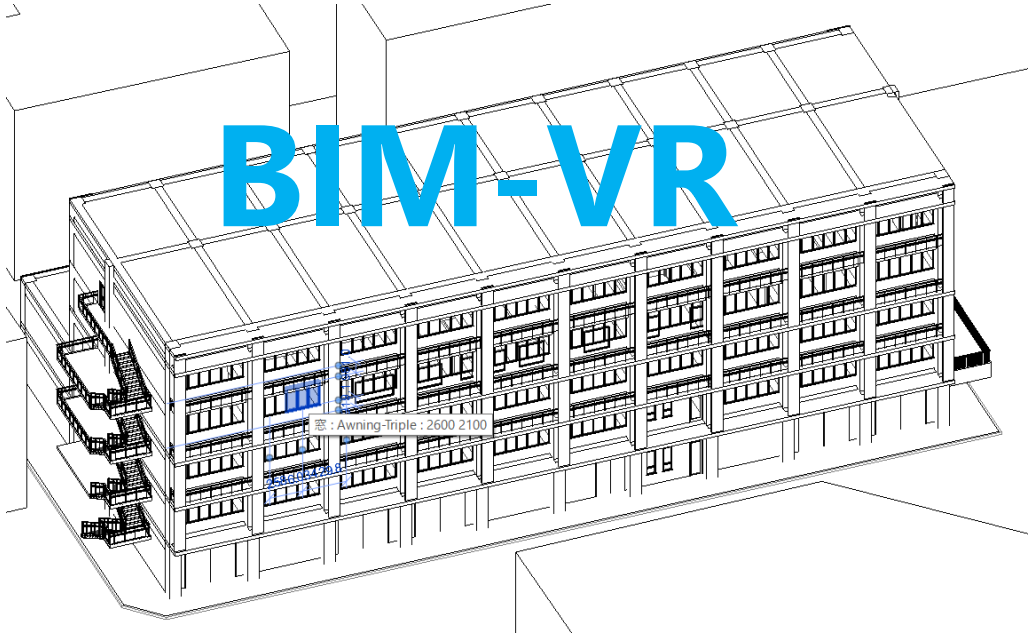
Motivation

- Inexpensive head-mounted displays have become commercially available, allowing general users to easily experience VR content.
- Creation of VR content by using BIM and 3D CAD software has become increasingly popular owing to lower prices and improved production environments.
- However, increased use of VR has resulted in a higher incidence of VR sickness. VR sickness develops because the visual and vestibular inputs do not match. The severity of VR sickness varies depending on the velocity and direction of the movement within the VR space.



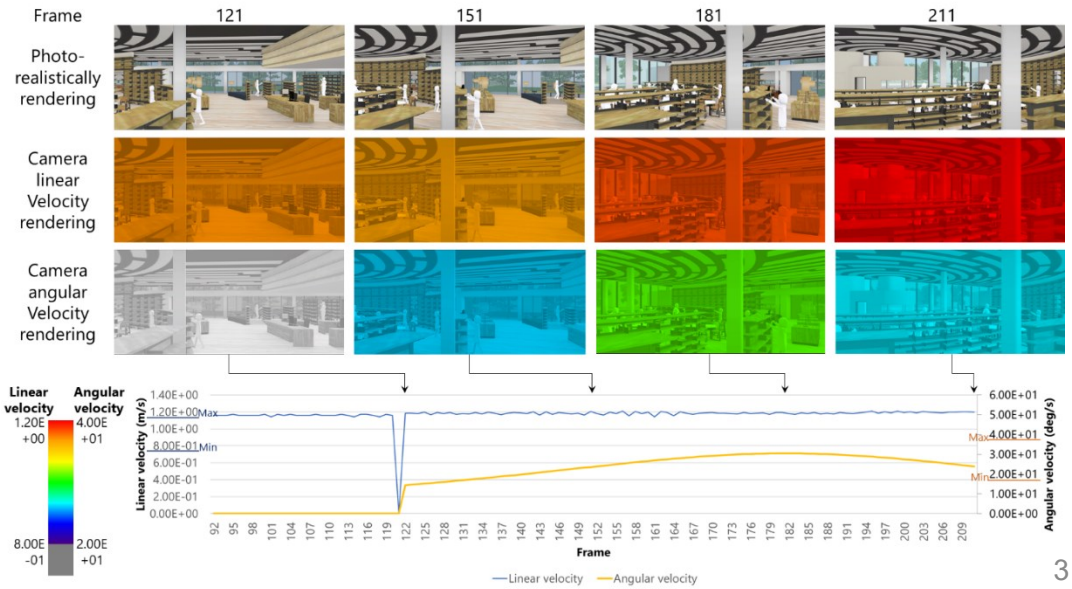
Motivation

- VR applications allow users to explore freely. On the other hand, the presenter can perform automatic navigation with a predetermined VR camera path based on the scenario. VR sickness is more likely to occur in the latter case.
- To ensure the quality of VR content and prevent VR sickness, it is necessary to have a function that can visualise movement within VR space during the VR production process.

Objective

- We have visualized of absolute velocity of the VR camera in the first half of 2020.
- In this WS, we have studied visualization of relative velocity.

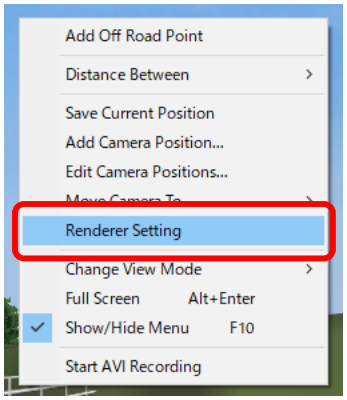
-> Motion Vector Visualization Shader on UC-win/Road



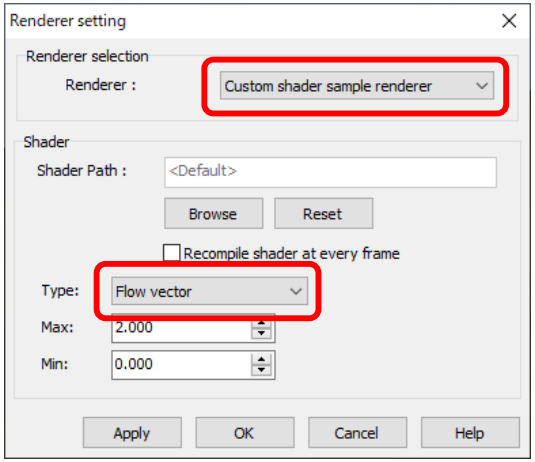
Overview

- The developed plug-in calculates the amount of motion vectors of coordinates on the UC-win/Road screen and visualizes them by means of a heat map.
- In addition, we implemented a motion blur using the motion vectors.

Operation



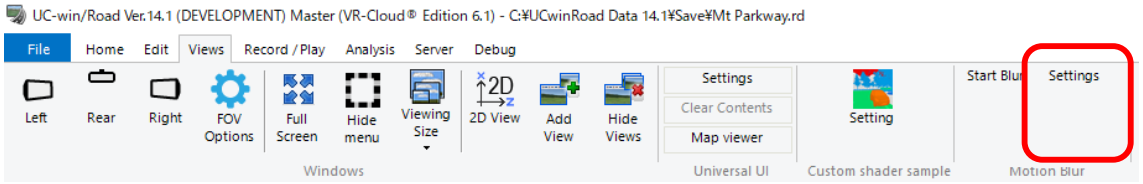
1. Right-click on the main 3D screen to open the renderer settings.

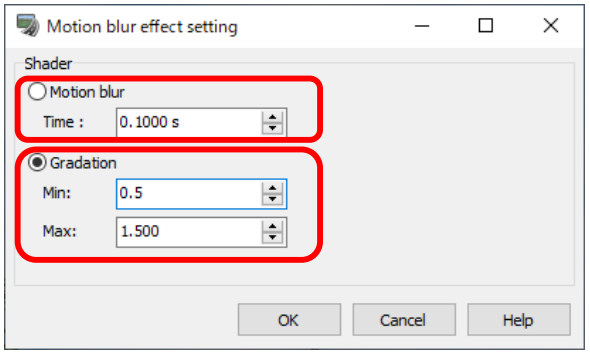


2. Select "Custom shader sample renderer" as the renderer, select "Flow vector“ type and click the OK button.

Operation

3. Click Views > Motion Blur > Settings in the ribbon menu.

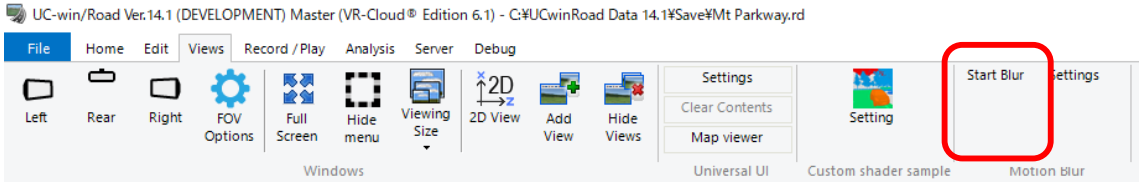




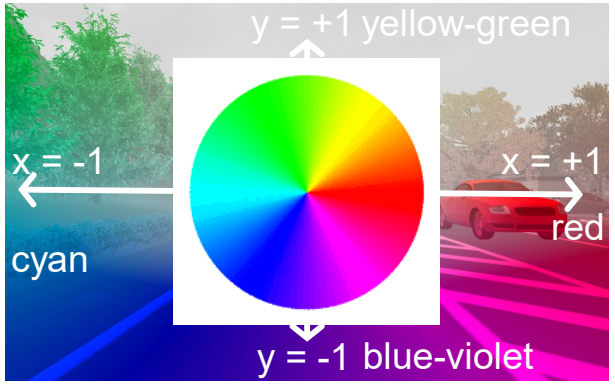
4-1. To visualize the motion blur, check the “Motion blur” checkbox and set the Time (about 0.01 seconds to 0.1 seconds).

4-2. To visualize the motion vector, check the "Gradation" checkbox and set the min. and max. values.

5. To start, click on Views > Motion Blur > Start Blur in the ribbon menu.



Definition



- The min. and max. values are currently the movement per second in the OpenGL screen coordinate system.
- Send the amount of change in camera posture and the change in object posture between a previous frame and the current frame to the shader and calculate which screen coordinates the frame to be drawn corresponds to in one previous frame.
- The amount of screen coordinate movement per second (i.e. screen coordinate speed) is calculated by dividing the amount of screen coordinate movement in both frames by the number of seconds between frames.
- Coloring calculates the length and direction (r, θ) from the two-component vectors of screen coordinate velocity (x, y) on a monochromatized image, and then coloring it in the HSV color space, where:
  - Direction (θ) : hue
  - Length (r) : brightness
  - Saturation : 100%

Application

- We applied the developed tool to a building design project. The building complex includes a library, a hall, a foyer, a cafe, conference rooms, and a Japanese-style tatami room.
- The building design project was supported by joint research funding from the Sakaiminato City Office and Osaka University in 2019. Using UC-win's 360° rendering function, we created a 360° panoramic VR based on the scenario and made it available exclusively on Youtube.
- The construction project is ongoing and care should be taken in handling the material after this slide (sharing WS presentation only).

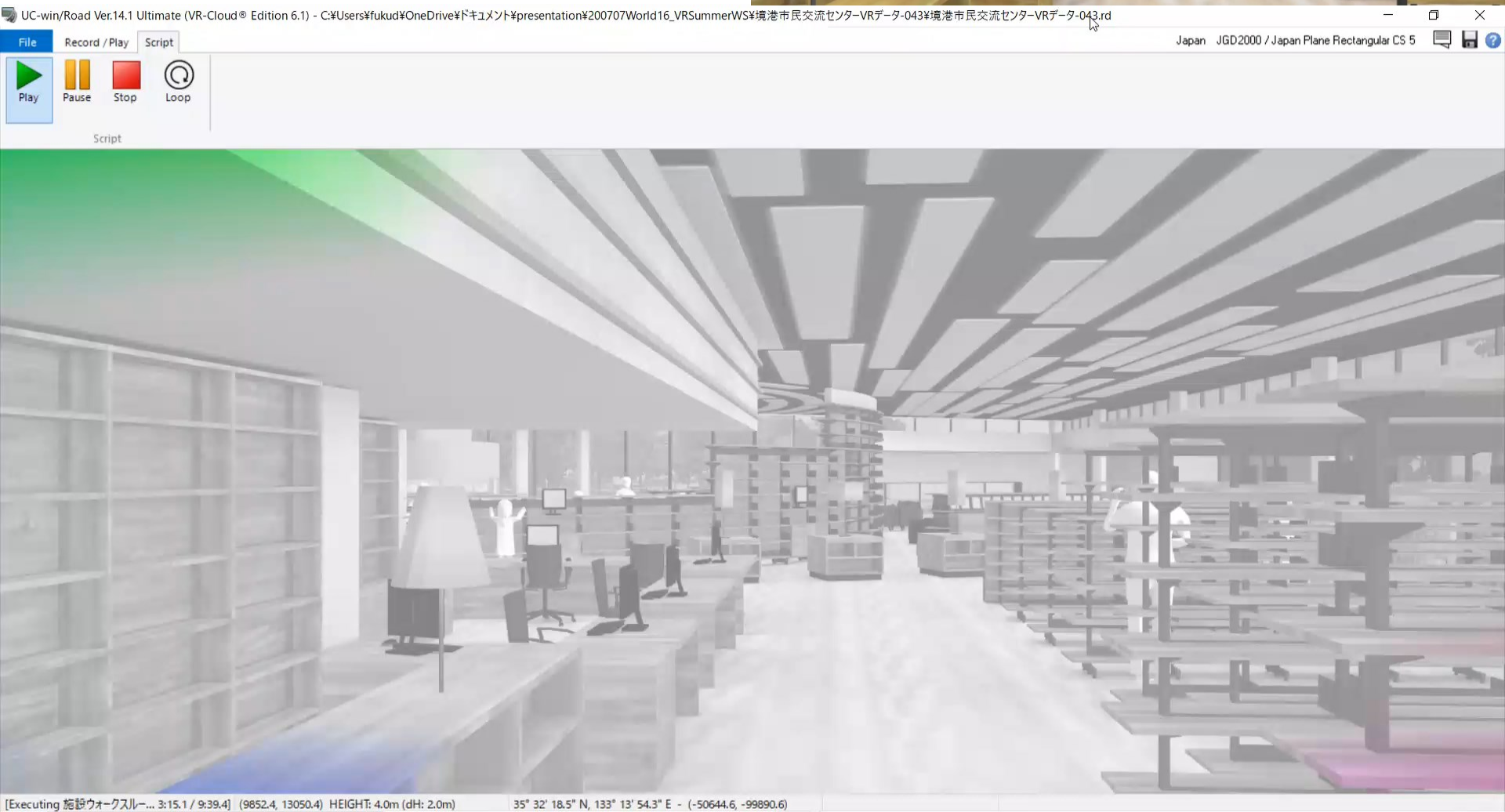


Motion Vector Visualization Shader

Gradiation

Motion Vector Visualization Shader

Gradiation



Motion Vector Visualization Shader

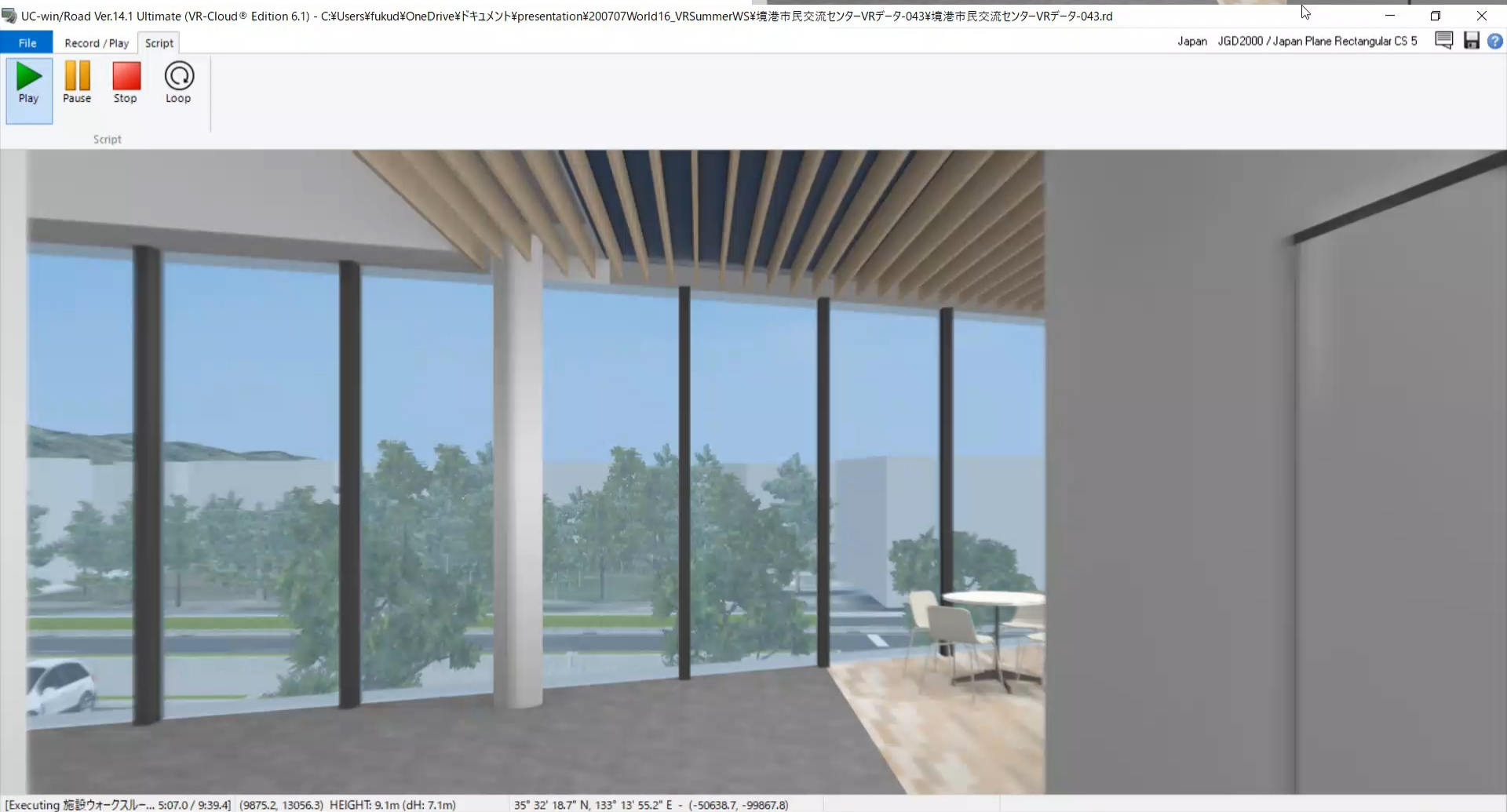
Gradiation

Motion Vector Visualization Shader

Motion blur

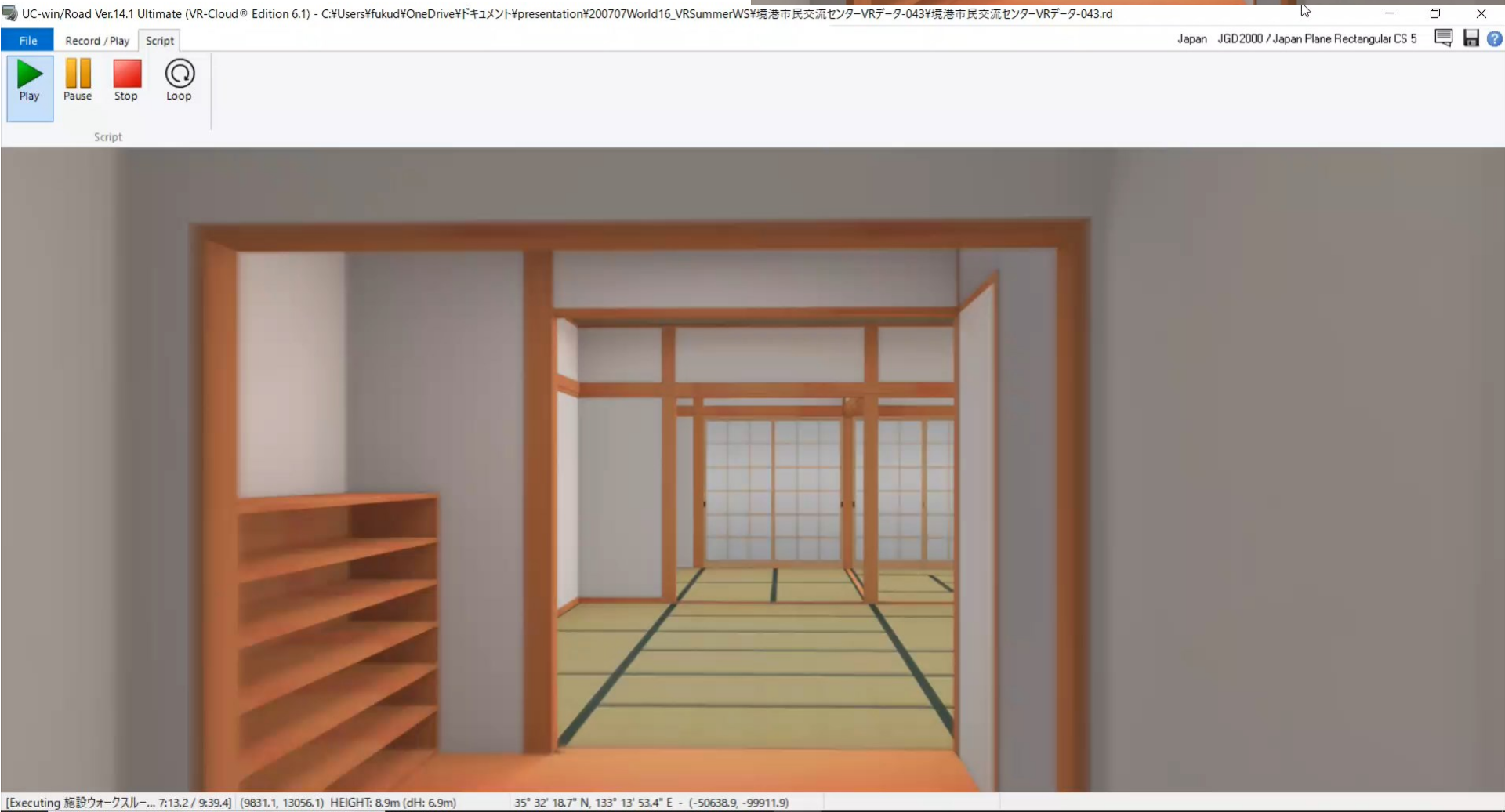
Motion Vector Visualization Shader

Motion blur



Motion Vector Visualization Shader

Motion blur



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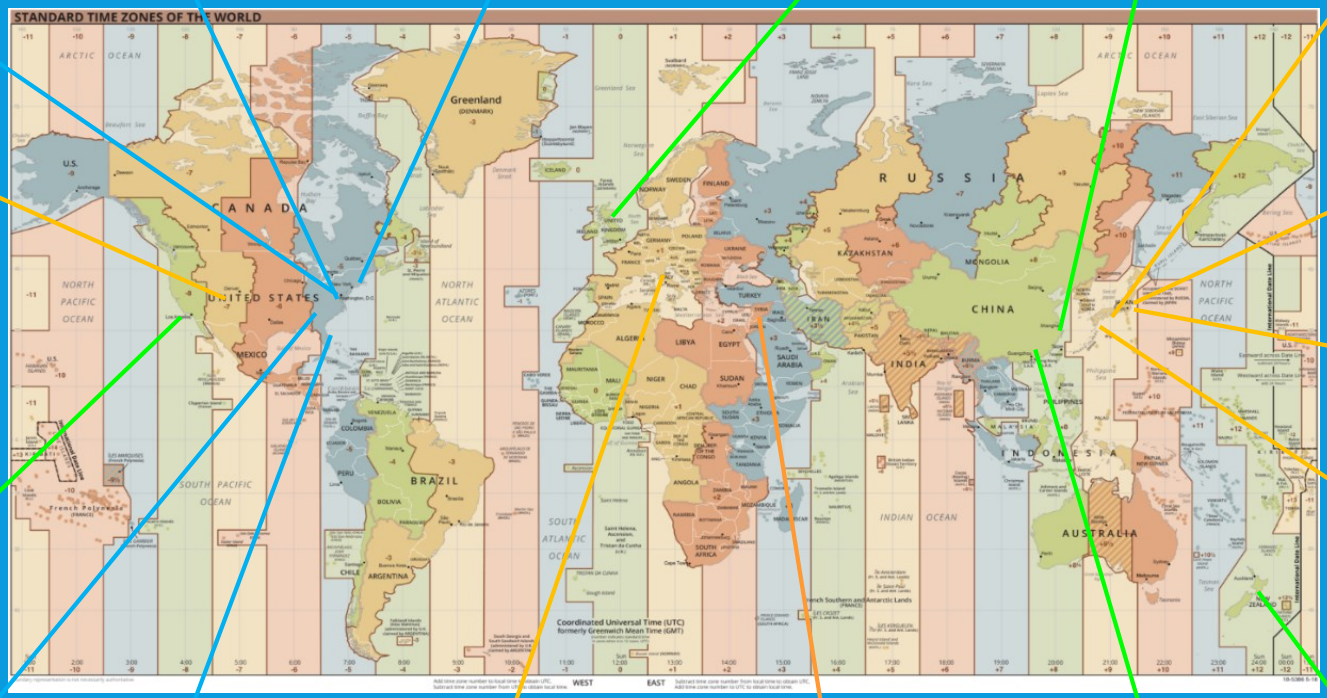

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