



NVIDIA's latest advancement in VR

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NVIDIA



Agenda

- VRWorks Audio
- VRWorks 360 Video
- Project Holodeck



NVIDIA VRWorks

Comprehensive SDK For VR Developers

GRAPHICS



**LENS MATCHED
SHADING**



**SINGLE PASS
STEREO**



**MULTIRES
SHADING**



VR SLI

HEADSET



**CONTEXT
PRIORITY**



**DIRECT
MODE**



**FRONT BUFFER
RENDERING**

PHYSICS & TOUCH



PHYSX

PROFESSIONAL



**WARP &
BLEND**



SYNCHRONIZATION



**GPU
AFFINITY**

AUDIO



**VRWORKS
AUDIO**

360 VIDEO



**VRWORKS
360 VIDEO**



**GPUDIRECT
FOR VIDEO**



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VRWorks Audio



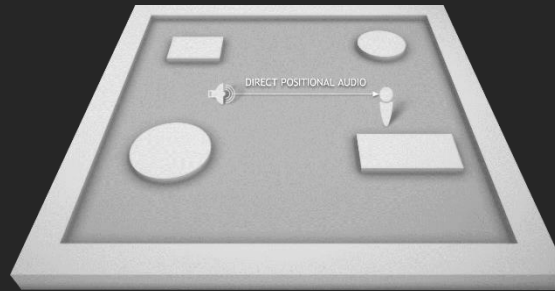
Simulating Audio in VR

SYNTHESIS



Creation of Source Sounds

DIRECTION



Location of Incoming Sound

PROPAGATION



How Sound Moves in Space



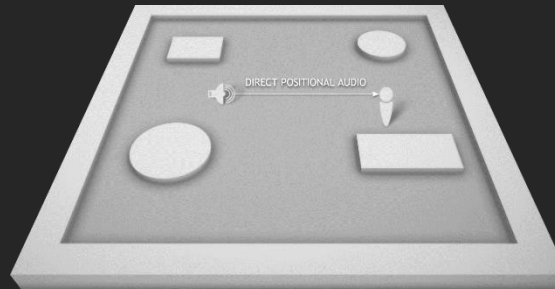
Simulating Audio in VR

SYNTHESIS



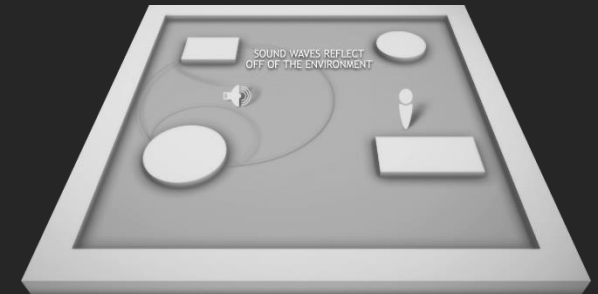
Creation of Source Sounds

DIRECTION



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How Sound Moves in Space

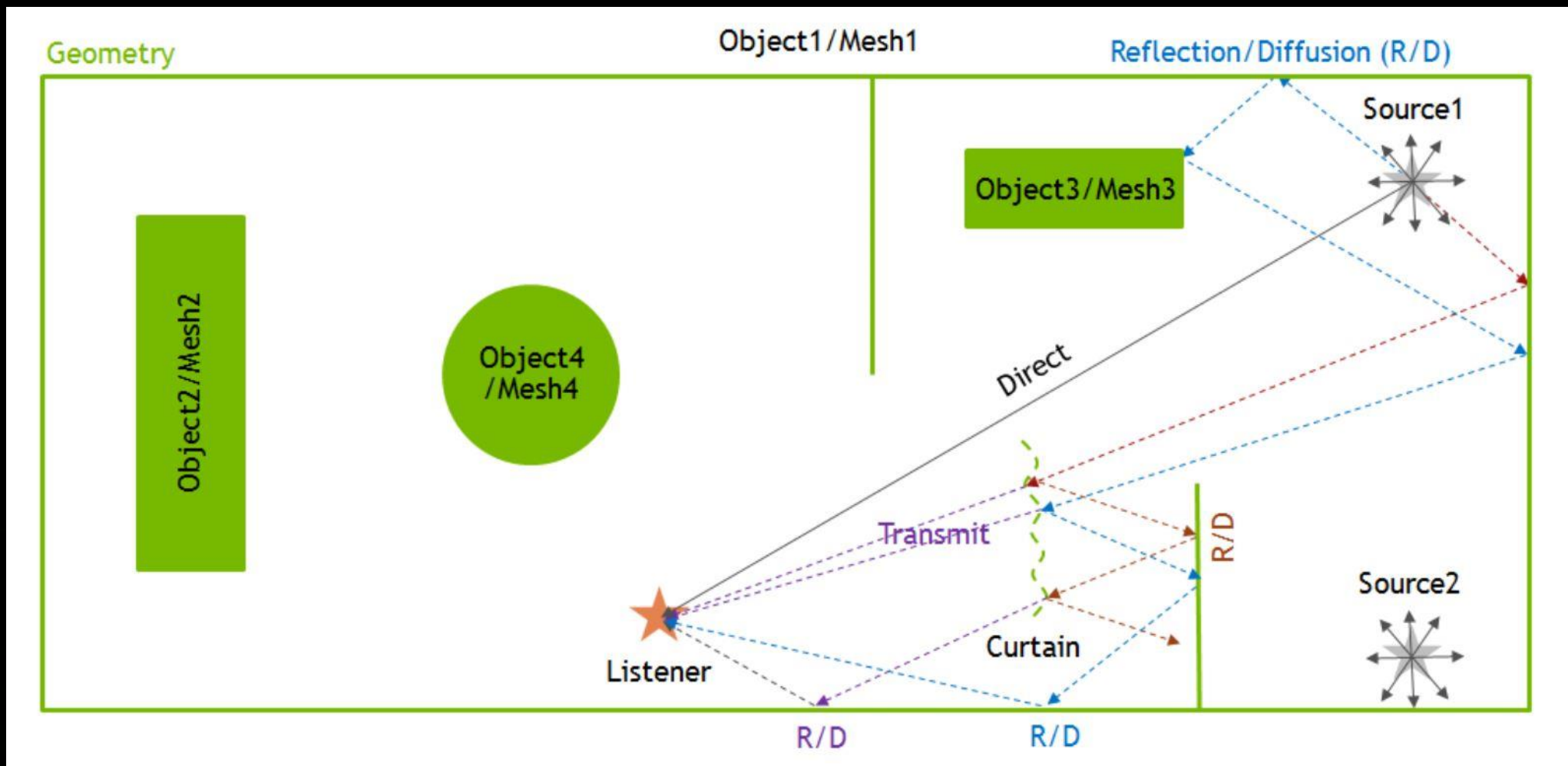


NVIDIA VRWorks Audio

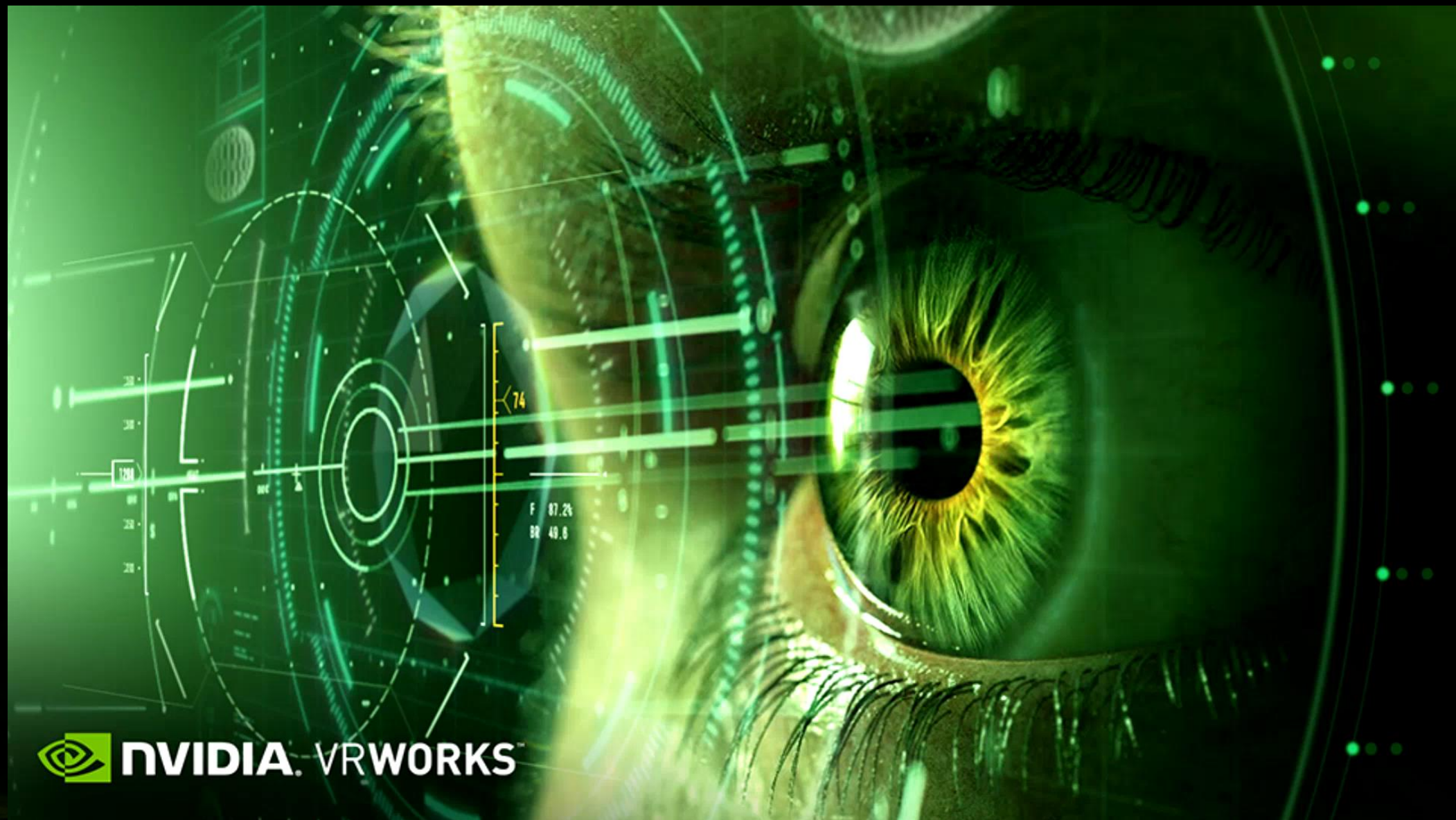
- The only fully hardware-accelerated and path-traced audio solution
- Create a complete acoustic image of the environment in real-time
 - Without requiring any “pre-baked” knowledge of the scene
 - Reduce game developing workload
- NVIDIA Acoustic Raytracer / NVAR
 - Written using CUDA and NVIDIA OptiX Ray Tracing Engine



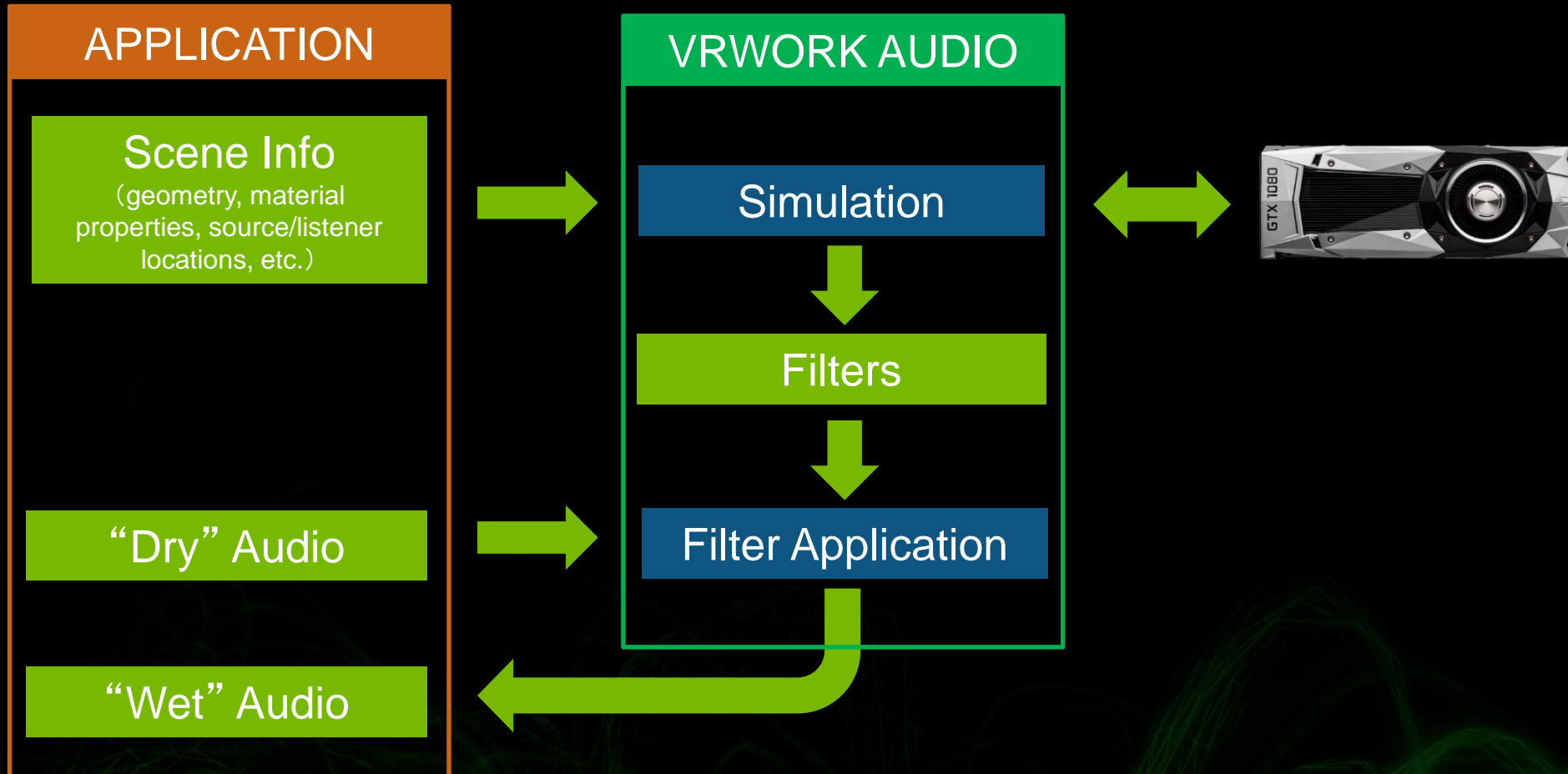
Audio Path-tracing



Video: <https://youtu.be/Ozhywx2YbzM>



VRWorks Audio Pipeline






VRWorks Audio Filters

- Convolution Filters, one for each ear
- 1 filter per VR audio source/listener pair
- Represent directionality, reverbs, transmission, diffraction, occlusion effects in one filter



Using VRWorks Audio in Application

- VRWorks Audio SDK
 - A set of library, APIs, documentation and sample apps

✓ VRWorks Audio	1.0.1	2017/06/29
<p>VRWorks Audio SDK is a set of library, APIs, documentation and sample applications aimed at game and application developers for creating a fully immersive audio experience in 3D space. With support for effects such as directionality, reverbs, occlusion, transmission etc., VRWorks Audio allows the developers to add real-time, GPU-accelerated path-traced audio to their applications, games, and virtual reality experiences.</p> <p>More Information ></p>	<p>DOWNLOADS</p> <ul style="list-style-type: none"> VRWorks Audio 1.0.1 VRWorks Audio SDK Overview Documentation	



Using VRWorks Audio in Application

- Unreal Engine 4 Plugin (based on UE4 4.15)
 - <https://developer.nvidia.com/nvidia-vrworks-and-ue4>

Access UE4 GameWorks Integration:

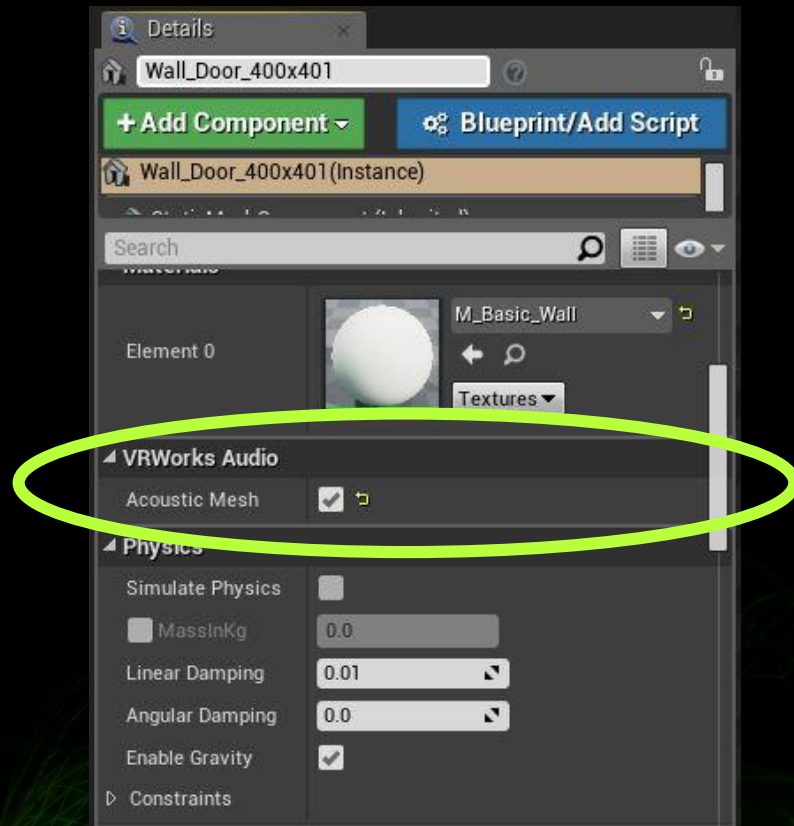
In order to access the UE4 GameWorks integrations, you will need a [UE4 / GitHub subscription](#).

- Multi-Res Shading UE4.11
- Multi-Res Shading UE4.12
- Full VRWorks Graphics UE4.12 (Includes Multi-Res shading, VR SLI, Single Pass Stereo and Lens Matched Shading)
- Multi-Res Shading UE4.13
- Full VRWorks Graphics UE4.13 (Includes Multi-Res shading, VR SLI, Single Pass Stereo and Lens Matched Shading)
- Full VRWorks Graphics UE4.14 (Includes Multi-Res shading, VR SLI, Single Pass Stereo and Lens Matched Shading)
- Full VRWorks Graphics UE4.15 (Includes Multi-Res shading, VR SLI, Single Pass Stereo and Lens Matched Shading)
- Full VRWorks Graphics UE4.16 (Includes Multi-Res shading, VR SLI, Single Pass Stereo and Lens Matched Shading)
- VRWorks Audio UE4.15



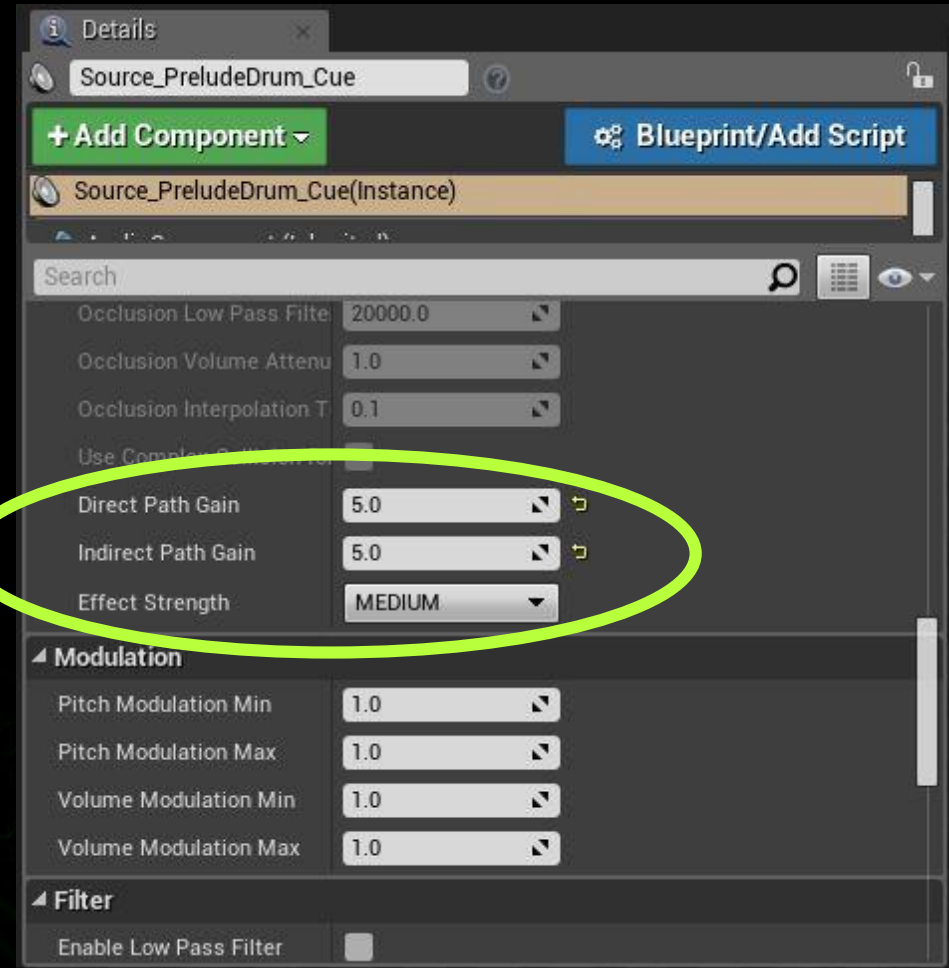
VRWorks Audio UE4 Plugin

- Set geometry meshes are to be used for audio simulation as well as the material properties
 - Typically, walls, floors, ceilings, doors, furniture, etc.



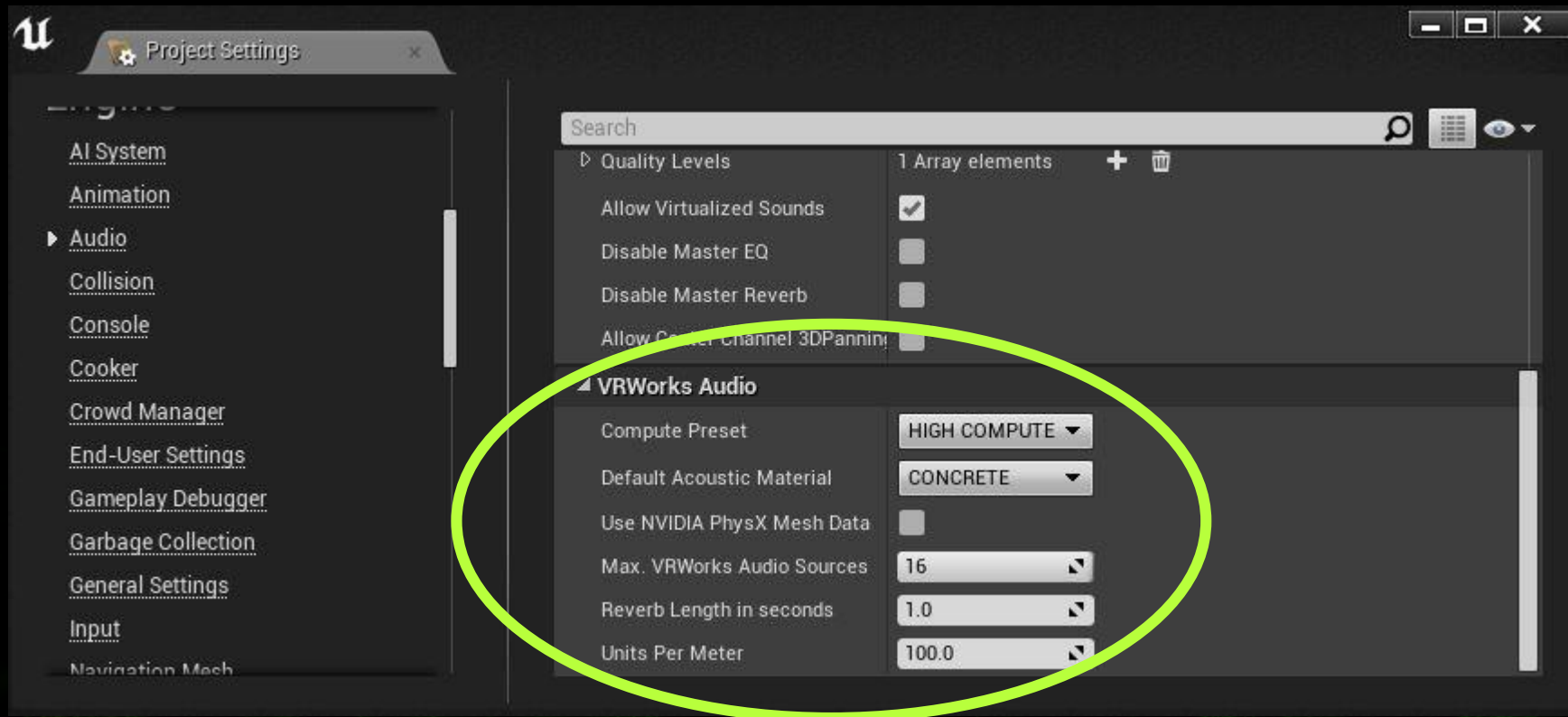
VRWorks Audio UE4 Plugin

- Set audio properties
 - Include the strength of the sound, and direct/indirect path gains



VRWorks Audio UE4 Plugin

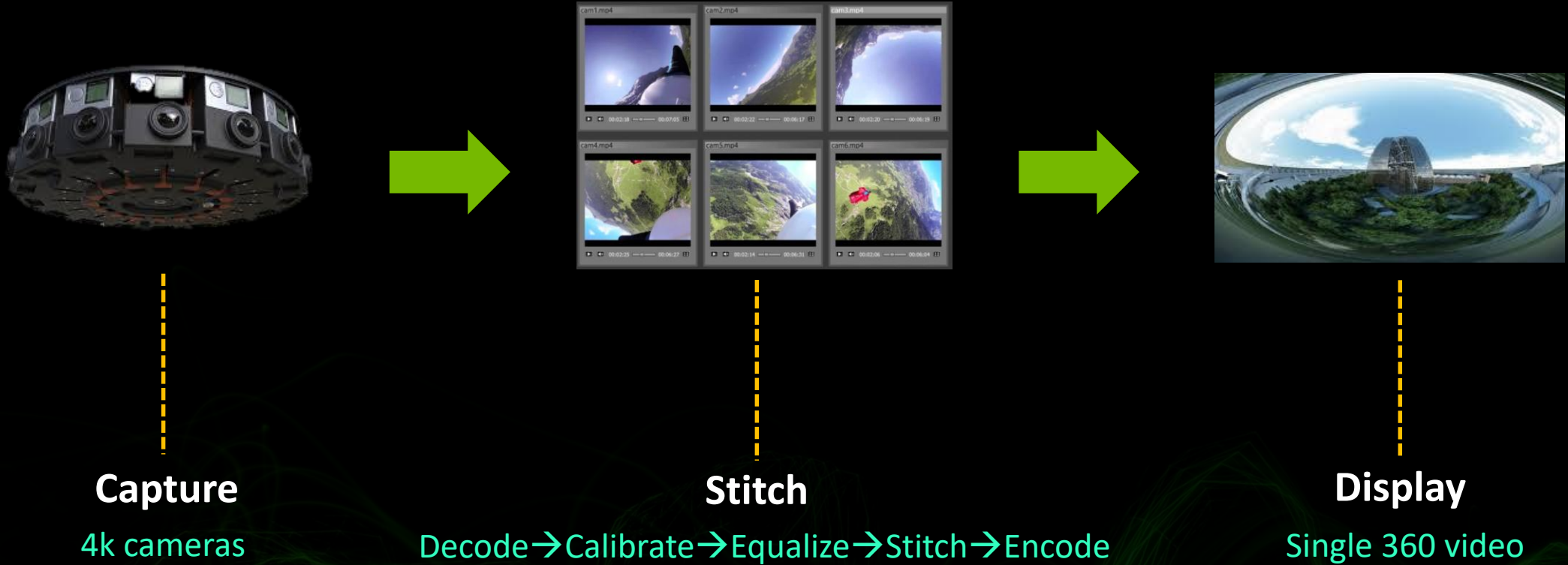
- Set properties in Project Settings



VRWorks 360 Video



Significant computation required to deliver 360 video



Introducing VRWORKS 360 VIDEO

Capture, Stitch, & Stream
360° Videos in real-time

- Real-time and offline stitching from 4k camera rigs
- GPU-accelerated video decode, calibration, equalization, stitching, and encode
- 360 projection onto cube-map and equi-rectangular panorama
- Works with GPUDirect for Video for low latency video ingest

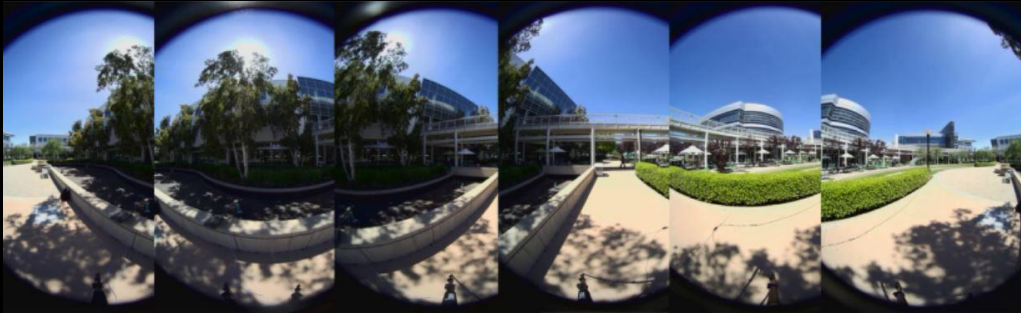


“Capturing and stitching 360 video is time consuming and computationally demanding. NVIDIA’s VRWorks 360 Video SDK will help accelerate STRIVR’s workflows, delivering real-time, high quality 360 video.”

— Masaki Miyanohara, CTO, STRIVR

VRWorks 360 Video

- Input: MP4 files, RGBA files, or RGBA CUDA arrays
- Stitch: Feathering and Multiband blending



Multiband blending



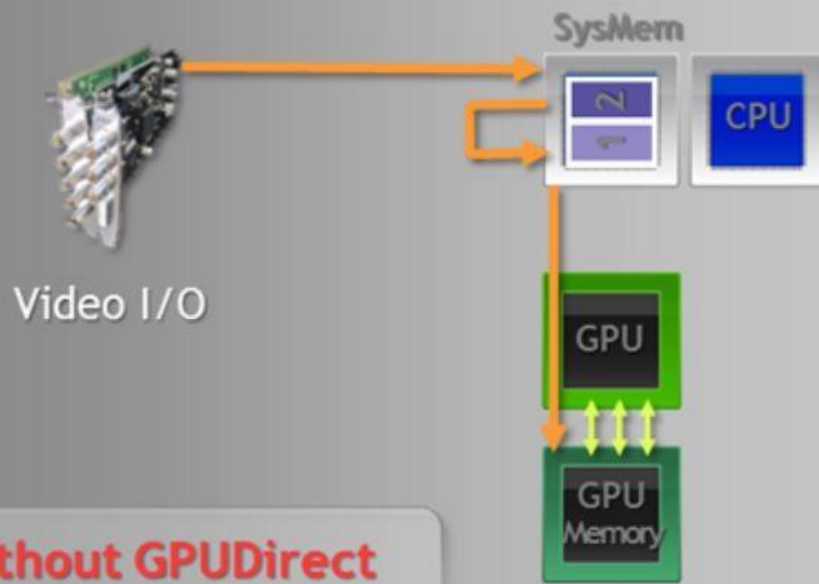
VRWorks 360 Video

- Output: MP4 files, RGBA files, or RGBA OpenGL textures

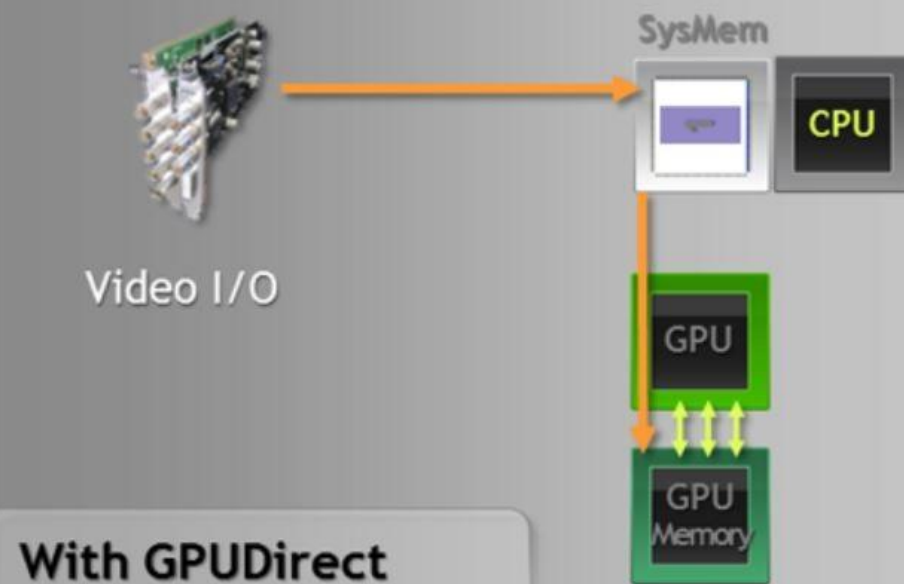


GPUDirect For Video

- CPU Manages Data Transfers Between Devices
- No Synchronization Between Devices
- Smallest Transfer Size is a Field



- CPU overhead is Minimized
- Transfers are Synchronized
- Smallest Transfer Size Smaller than a Field



GPUDirect For Video

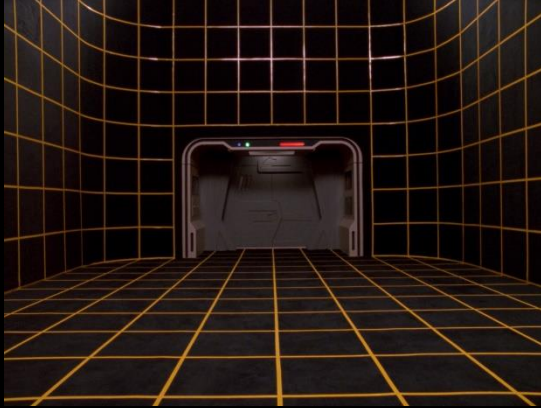
- Enable low latency video transfer
- IO devices are fully synchronized with the GPU and the CPU
 - Minimize wasting cycles copying data between device drivers
- Used in conjunction with the 360 Video SDK for fast ingest of multiple camera streams
- Available for Quadro GPU



Project Holodeck



Holodeck in science fiction

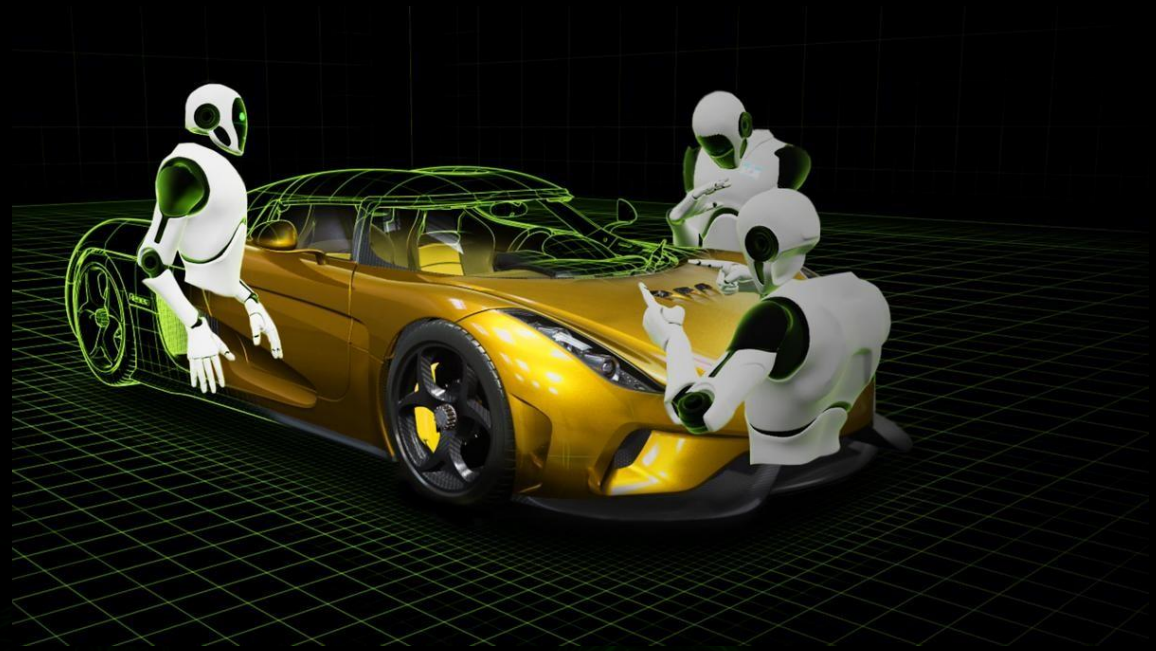


* Pictures from Google images



NVIDIA Holodeck

- A photorealistic, collaborative virtual reality environment that incorporates the feeling of real-world presence through sight, sound and haptics
- Allow creators to import high-fidelity, full-resolution models into VR to collaborate and share with colleagues or friends — and make design decisions easier and faster



Video: <https://youtu.be/hUsP7fsjrdg>



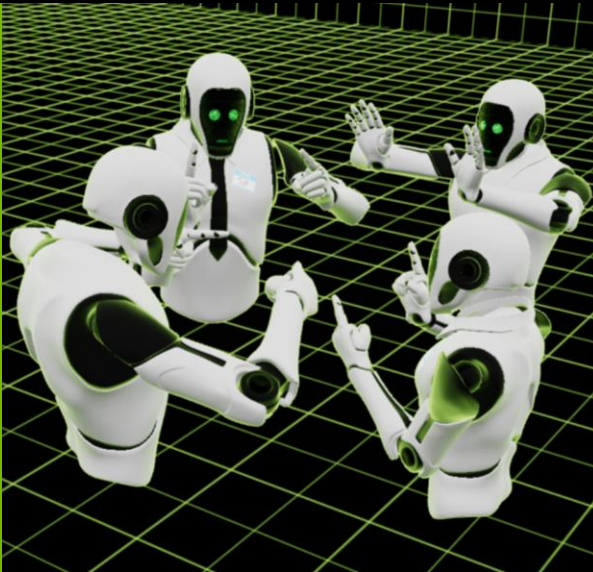
NVIDIA Holodeck

- Built on an enhanced version of Epic Games' Unreal Engine 4
- Include NVIDIA GameWorks, VRWorks and Design Works

PHOTOREALISTIC MODELS



COLLABORATION



INTERACTIVE PHYSICS



Summary



Summary

- VRWorks Audio helps the developers to create a more realistic VR environment from auditory
 - Not limited for VR games, normal 3D games can also benefit from it
- VRWorks 360 Video enables VR developers and content creators to capture, stitch, and stream 360° videos in real-time or offline
- NVIDIA Project Holodeck creates a new environment for design and collaboration using NVIDIA cutting-edge technologies, bringing the holodeck from science fiction to reality
- NVIDIA has been continuing the research, “to boldly go where no man has gone before”



Thank you !

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