Invidia
For the second seco

Iray in Omniverse New Features for Light Transport Simulation and Rendering (S31739)

Carsten Wächter

April, 2021



What is *lray*?

Production Rendering on CUDA

Bring ray & path tracing based production / simulation quality rendering to GPUs

New paradigm: *Push Button* rendering (open up new markets)

Without sacrificing artistic freedom: Full Material Definition Language (MDL) support

Plugins for Maya Rhino 3ds Max SketchUp

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> 5M active users install base with even more active users in the cloud

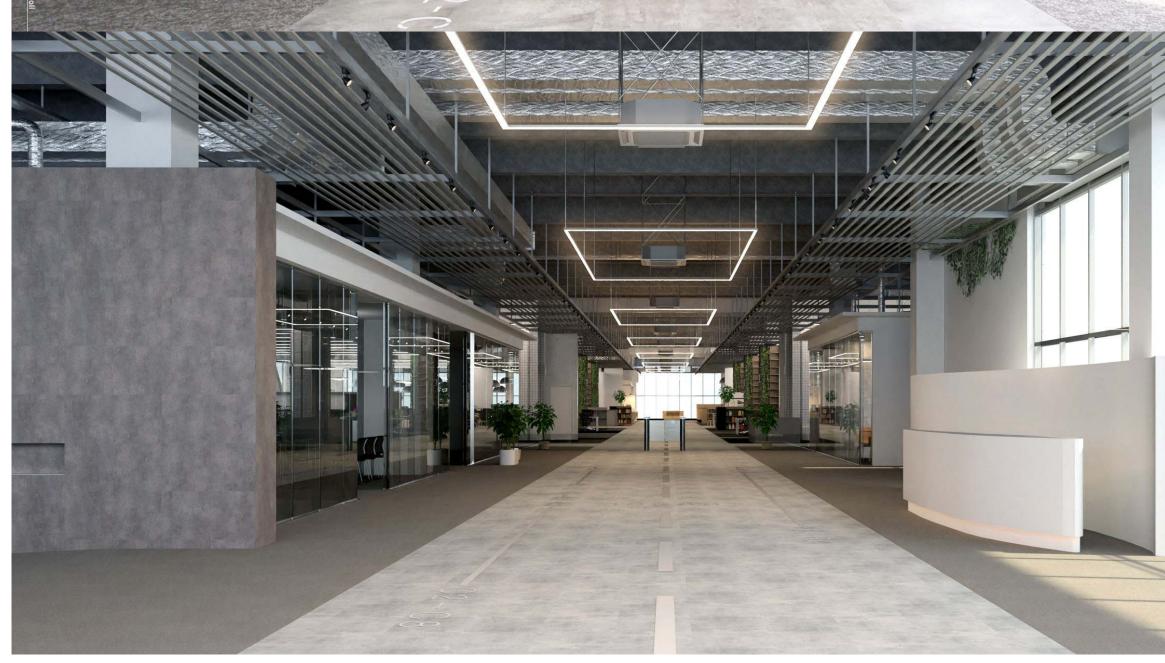








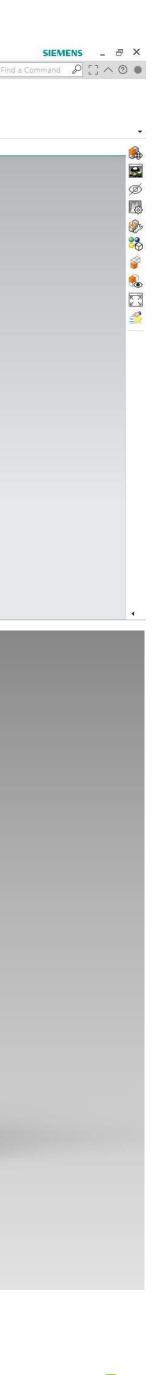
街に思いを巡らせたか。人と暮らしを考え抜い7 社会の未来を想像したか。常識を乗り越えたか。 建築は、人と社会と生きていくから。 企画に、ロマンを。設計に、提案を。 実施に、実直さを。監理に、徹底を。 今日も、この世にたったひとつしかないデザインを実現する。 つくり手の温度を伝えながら。



Images courtesy of Luminova Japan / Siemens Digital Industries Software (NX Ray Traced Studio)











Images courtesy of Zhelongxu (zhelongxu.com) / Floorplanner / [Ox1] (Iray for Maya) / Siemens Digital Industries Software (NX Ray Traced Studio) / Luminova Japan



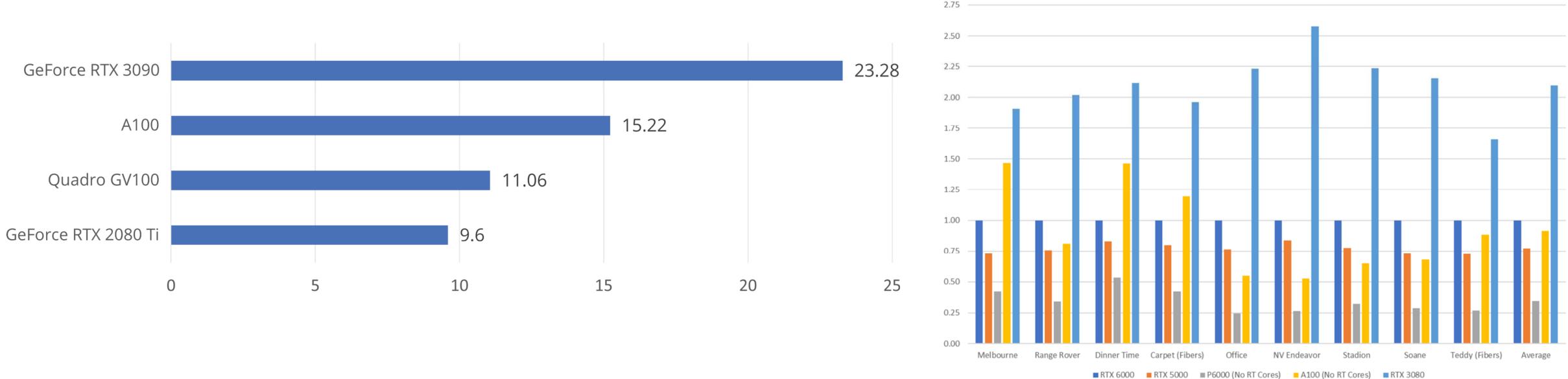
NVIDIA Ampere Native support for SM 8.x GPUs

PTC benchmark

"... Ampere is giving around a 1.4x speedup over Volta when comparing similar cards (the Tesla V100 and the NVIDIA A100) and an even larger speedup of around 2.4x over Turing with a similar generation card (e.g. the GeForce RTX 2080 Ti compared to the GeForce RTX 3090)."

NVIDIA benchmark

Comparing RTX 6000 to the RTX 3080: 1.7x up to 2.6x speedup! (average 2.1x)





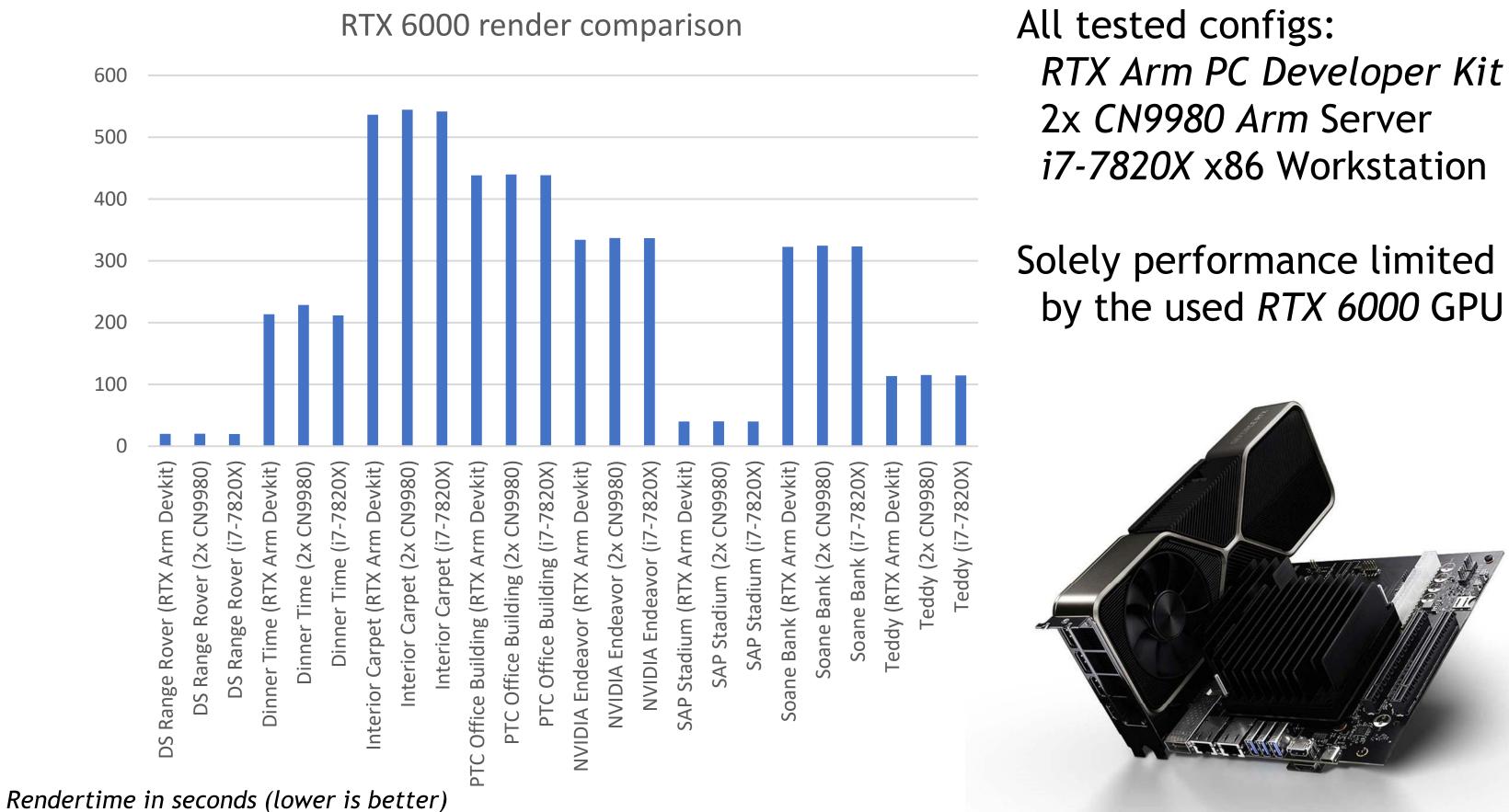


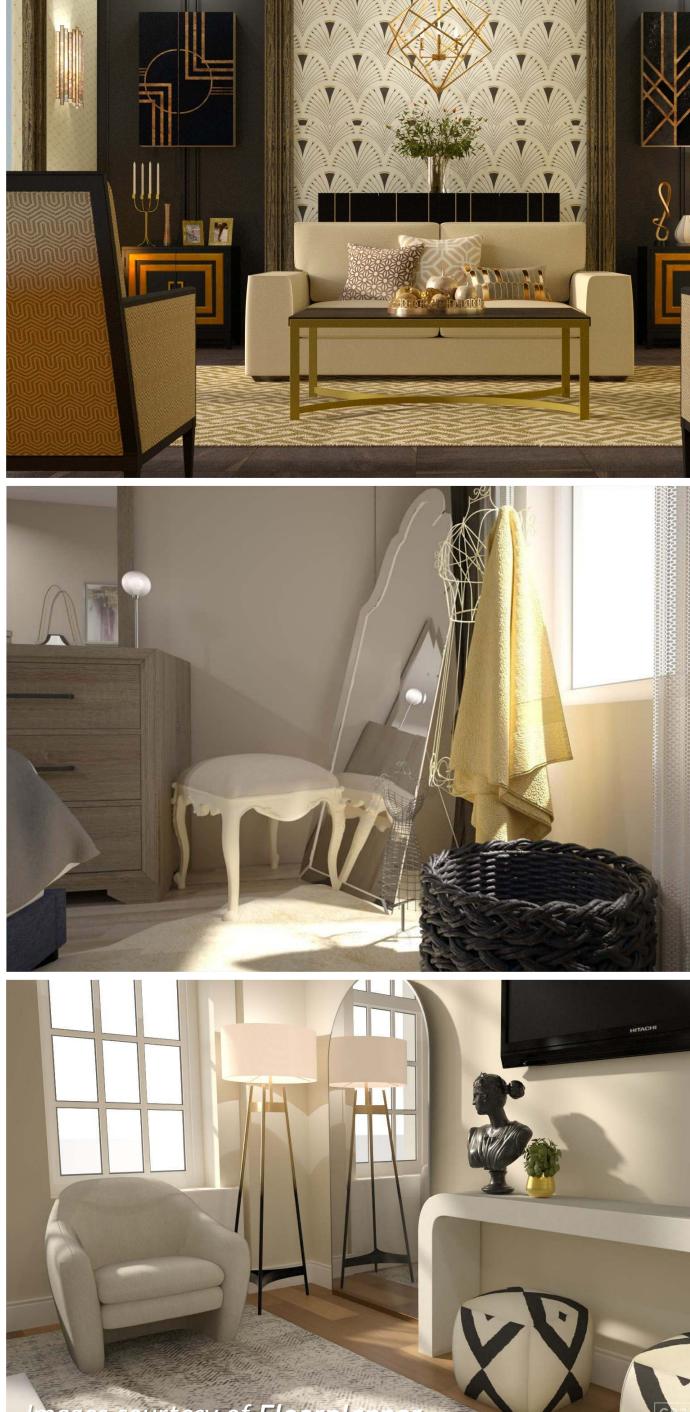
Arm

Native support incl. NVIDIA RTX Arm PC Developer Kit

CUDA, OptiX, IndeX just work

Also see https://developer.nvidia.com/arm





mages courtesy of Floorplanner



Performance Improvements RTX accelerated interactive rendering accelerates even more

Improved interactivity at the cost of slight *temporary* bias

Turntable (and similar) scenes: ~5% faster

Wavefront-rendering-architecture-unfriendly scenes: up to ~50% faster

In addition, many many improvements all over the place, e.g.

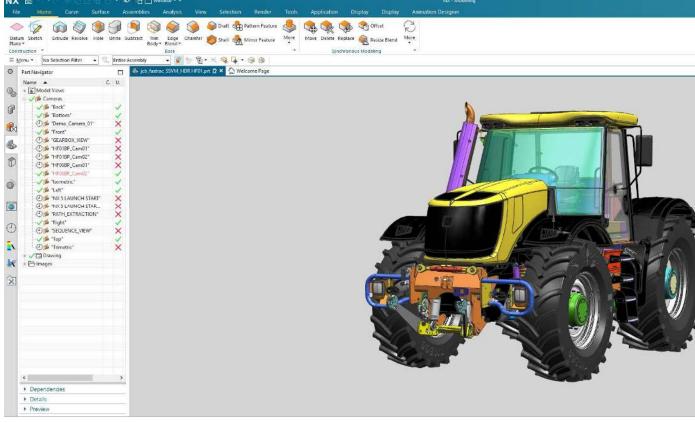
Preprocessing time of scenes with a large amount of instanced geometry or lots of different materials

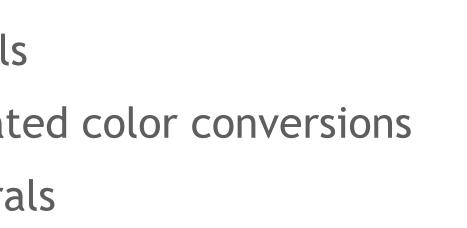
Instance transformation changes especially in combination with many materials

Rendering performance of JIT compiled *MDL* materials

Full CUDA and OpenGL canvas support, incl. accelerated color conversions

Interacting with IBL/environment maps and procedurals







Images courtesy of Siemens Digital Industries Software (NX Ray Traced Studio) GTC²¹







Improved Fiber support

New OptiX 7.3 RTX accelerated curve intersector

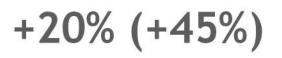
Improved Performance, comparing overall Rendertime

Experimental, i.e. not productized yet performance in () (hopefully gained via upcoming driver updates)

Also see OptiX Advanced Topics [S31752] & What's New in OptiX [S31736]

Also upcoming: Native support in Omniverse

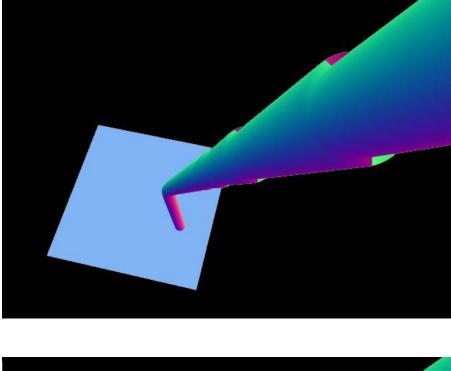
+8% (+85%)



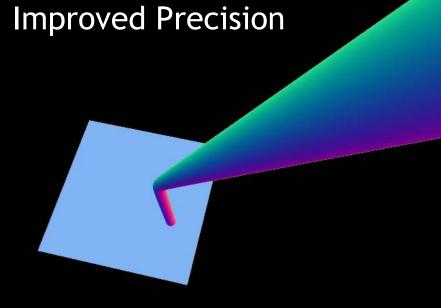


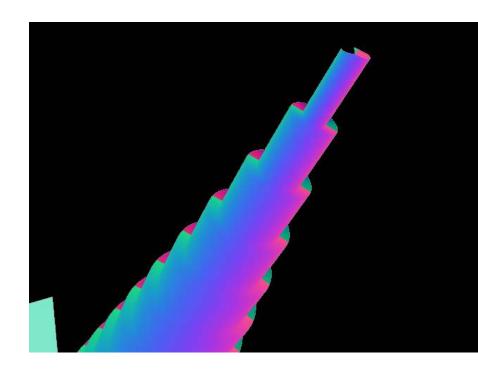
+2% (+3%)

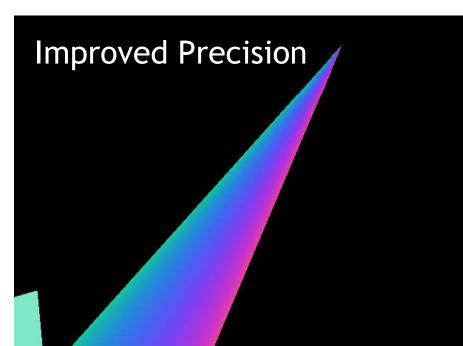
Image courtesy of [0x1] (Iray for Maya)











Al Denoiser

Improved performance and quality

AI Denoiser library is now employed via the OptiX driver i.e. reduced size of the Iray SDK and always state of the art quality Due to improvements now able to use the Normal auxiliary/AOV buffer Work ongoing to include new *OptiX* 7.3 temporal mode better quality while interacting and when rendering animations

Also see OptiX Advanced Topics [S31752] & What's New in OptiX [S31736]

No Normals

+Normals

Reference

















T

Same time GPU A6000 (16spp) + Temporal AI Denoiser





Same time GPU A6000 (16spp) + Static AI Denoiser

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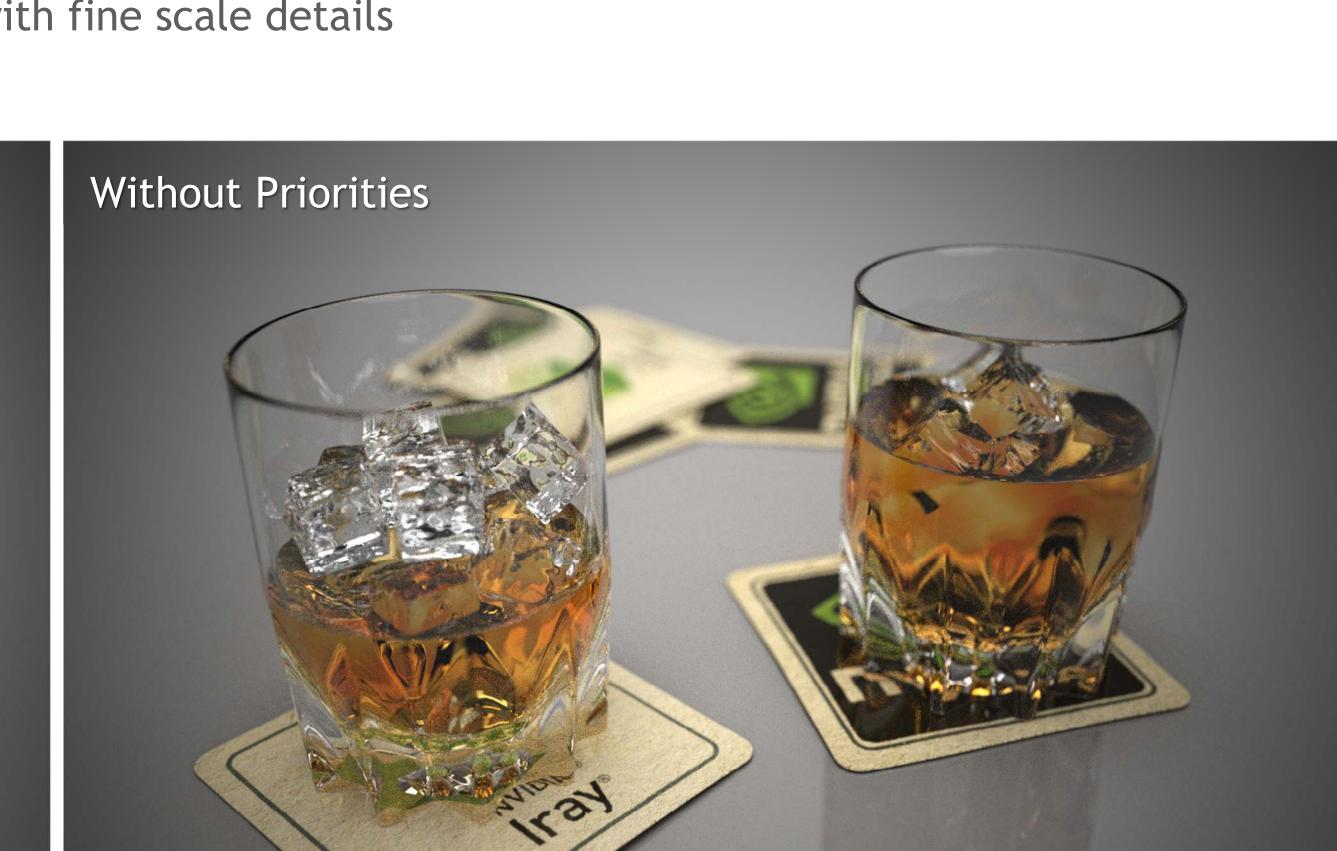
Optional Volume Priorities

On top of existing automatic Stack handling

Optional volume_priority can be set to define which object's volume properties take precedence in case of an overlap Helps solving the "icecube-problem" and volume hulls with fine scale details

With Priorities







Heterogeneous Volume Support

via IndeX Direct

Includes OpenVDB & NanoVDB support

Support for *Flow* (& other volume/simulation data) within *OV* (WIP)

Strong focus on simulation quality

Features

Heterogeneous (Oil/Water) & Inhomogeneous (Density variation, e.g. Clouds) volumes supported

Nested volumes

Additive Mix of volumes

Mesh Clipping Support (both ways)

Limitations

- No support for giant datasets (yet)
- No emission (yet)



Parts of the scene courtesy of Daz 3D



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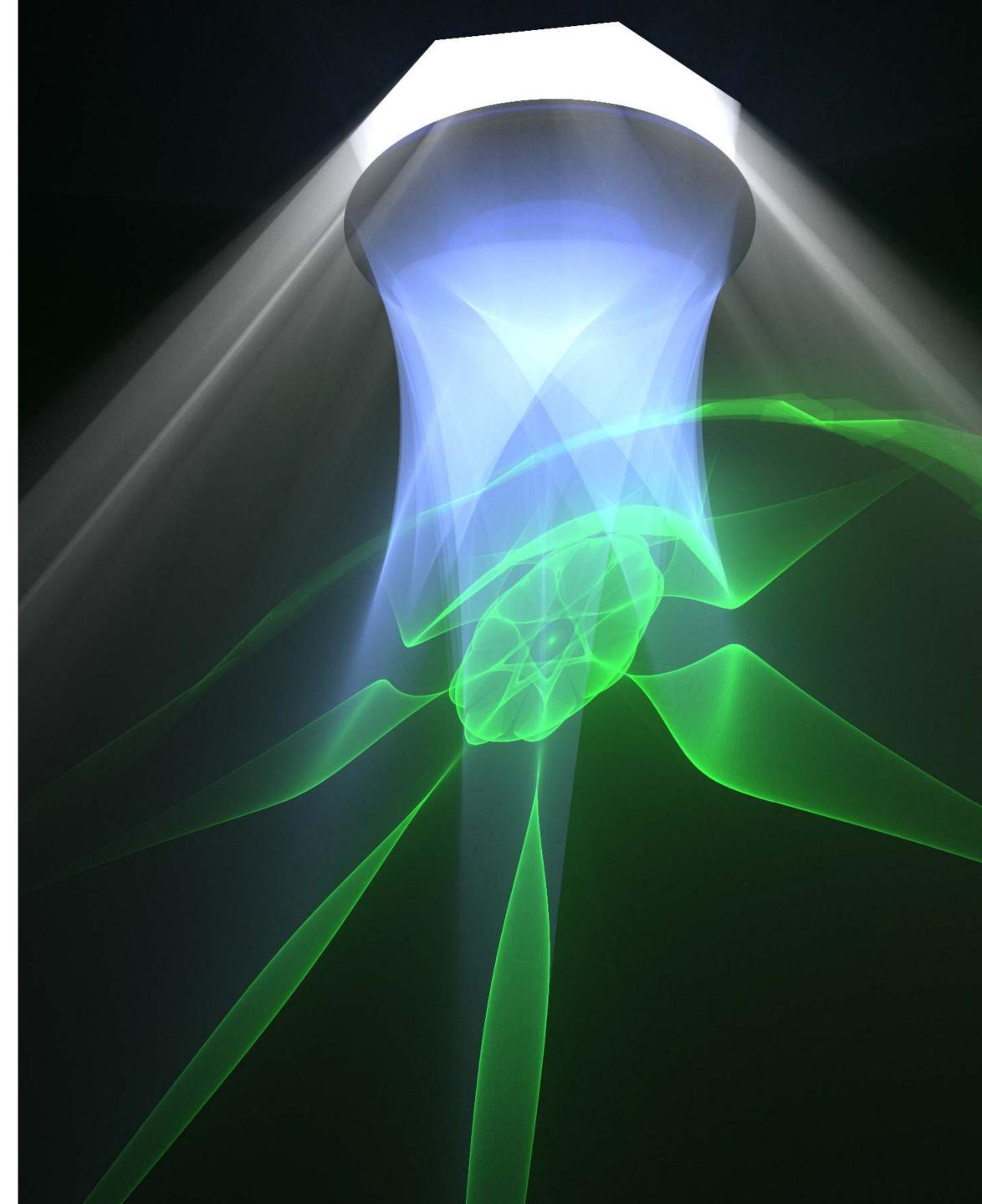
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Prominent MDL 1.7 Features

Improved volume support

- **OpenVDB** support as 3D texture
- Add a tint modifier for volumes (effectively changing scattering coefficient)
- Volume mixing



Prominent MDL 1.7 Features Backscatter BSDF (Sheen) revised as modifier

Can have a multi-scatter component now for "sheen" coatings on arbitrary base materials

"Revisiting Physically Based Shading at Imageworks" (Christopher Kulla and Alejandro Conty)

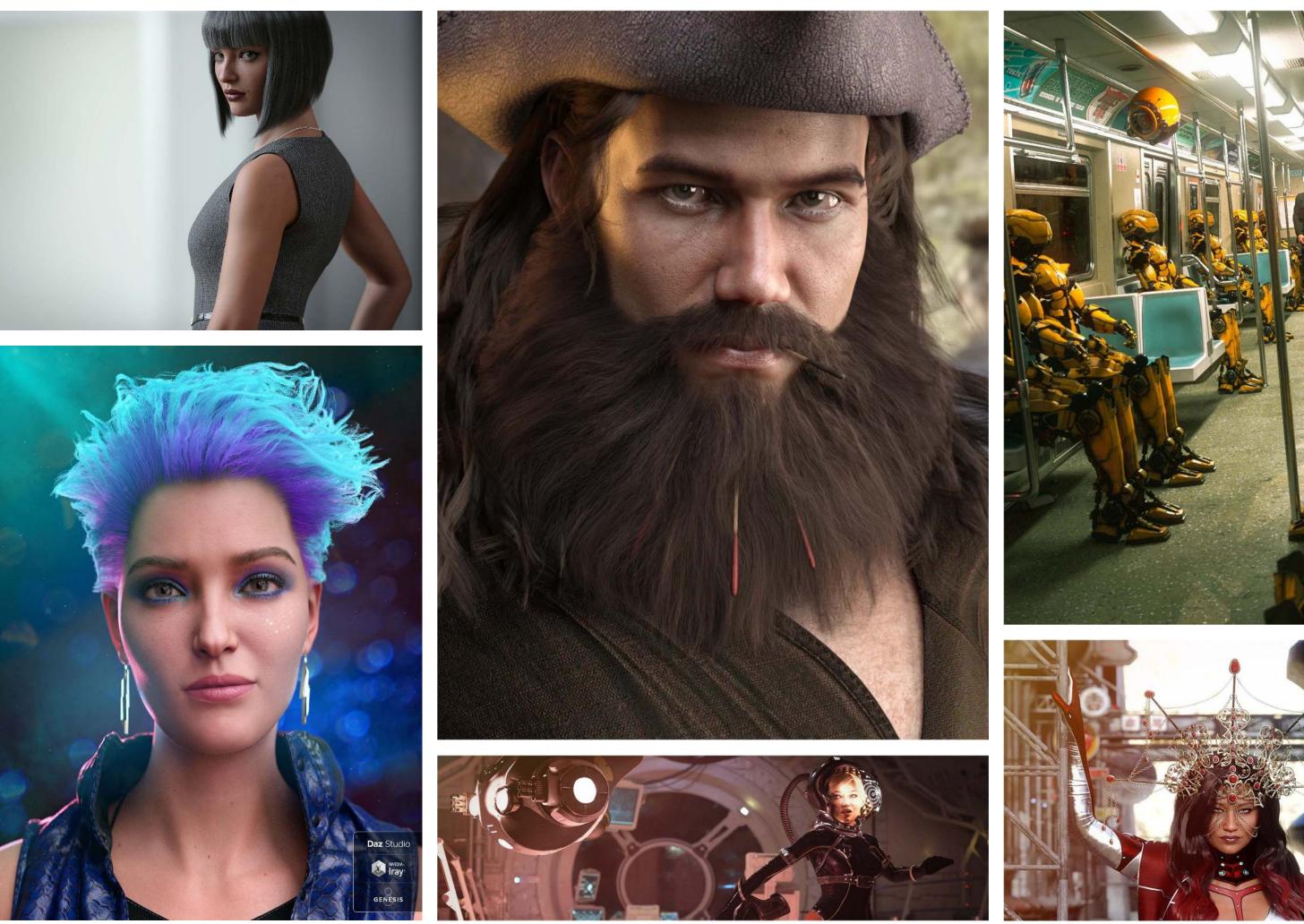


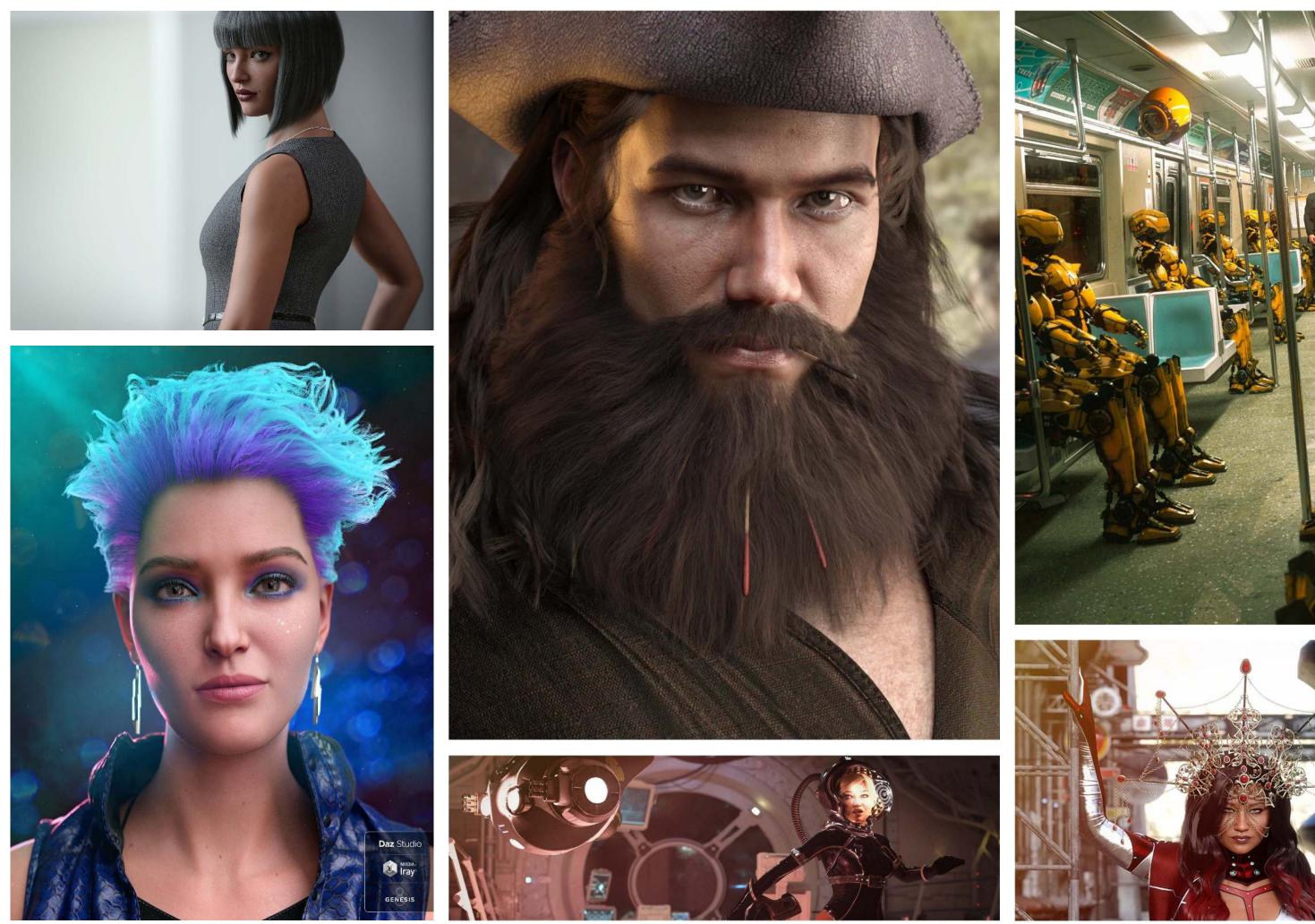


















Measured Materials / Spectral Textures Digital Twin examples scanned with the X-Rite TAC7

Blue Semi-Trans. Plastic Step-Chip Blue Alcantara







Dark Green Car Effect Paint

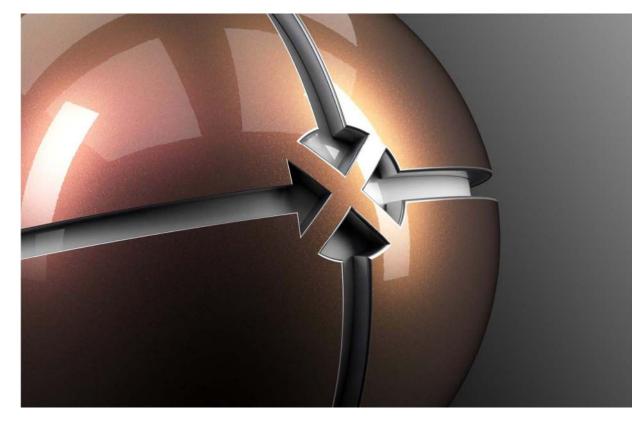


Blue Car Effect Paint

Red Fine Grain Leather







Color Flop Car Effect Paint



Hounds Tooth Textile

Images courtesy of X-Rite GTC²¹



Measured Materials / Spectral Textures Digital Twins

Iray supports both X-Rite AxF 1.8.1 caddon AIX 1.6.2 spectral textures

New AxF 1.7 and 1.8.1 feature support EPSVBRDF representation (Energy Preserving Spatially Varying BRDF) & refracting clearcoats (via SDK provided conversion to SVBRDF) SVBRDF representation with color transmission Spectral color and texture data in SVBRDF, carpaint, and volumetric representations

Measured, but still able to create variants of AxFs

Or to combine only certain aspects of different scans e.g. Surface structure, color, coating layer

On top: Full flexibility of MDL



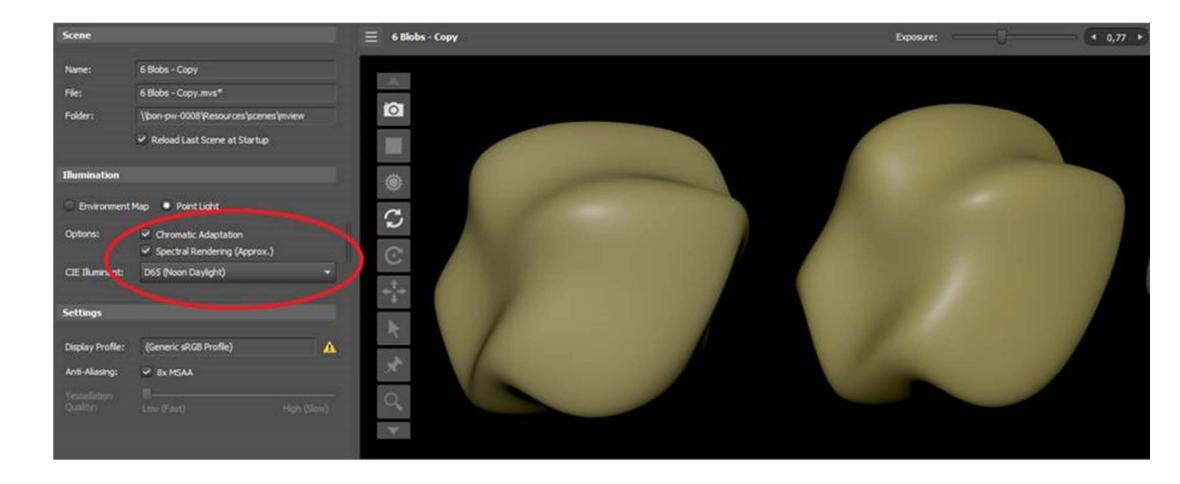


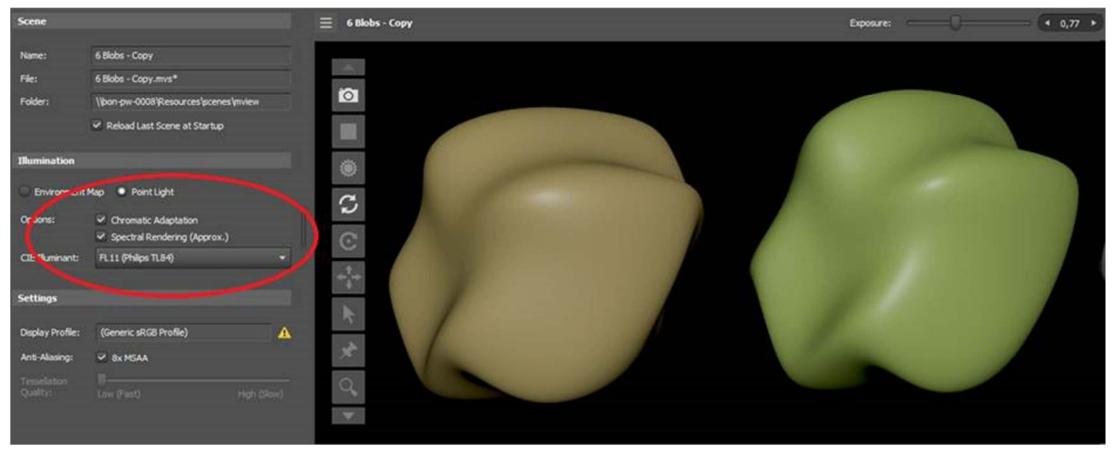
Measured Materials / Spectral Textures **Digital Twins**

Spectral Rendering extremely important to reliably judge and select both lighting conditions and materials

Example: Pantone D65 Lighting Indicator Sticker 2 regions with different colors Using D65 (6500K daylight) both regions "match" Other lighting setups will result in visible differences







Images courtesy of **Pantone** GTC²¹





Iray in NVIDIA Omniverse Light transport simulation quality in *Create* & *View*

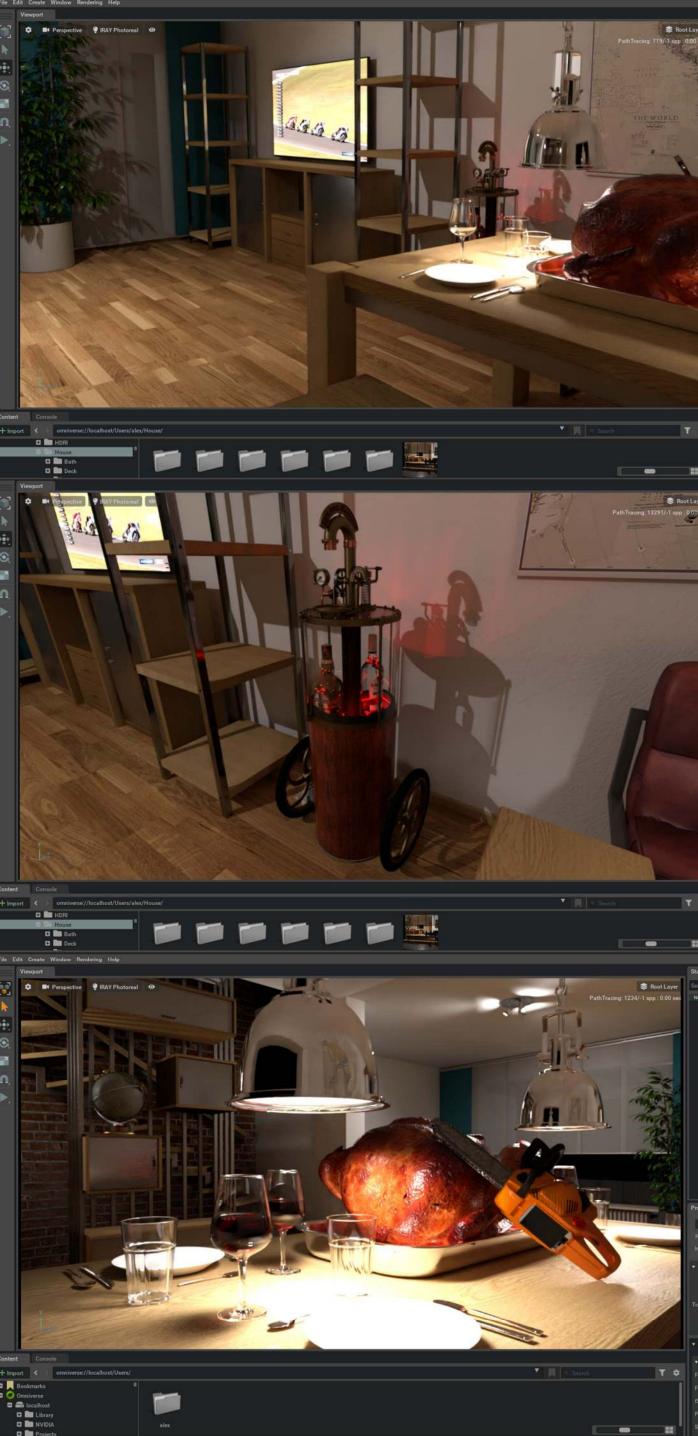
Current OV Create release still needs Iray to be enabled externally next major releases of OV Create and View: on by default along with vastly improved integration into OV (features & performance)

- RTX Realtime & RTX Path tracing rendering modes sacrifice reliability and quality/precision for progressive performance more (non-physical) knobs to tweak
- Iray Photoreal rendering simulation mode brings trusted & CIE 171:2006-verified light transport simulation to OV at the Push of a Button





Awards received by **BLOOM LINIT**.



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Iray in NVIDIA Omniverse Light transport simulation quality in *Create* & *View*

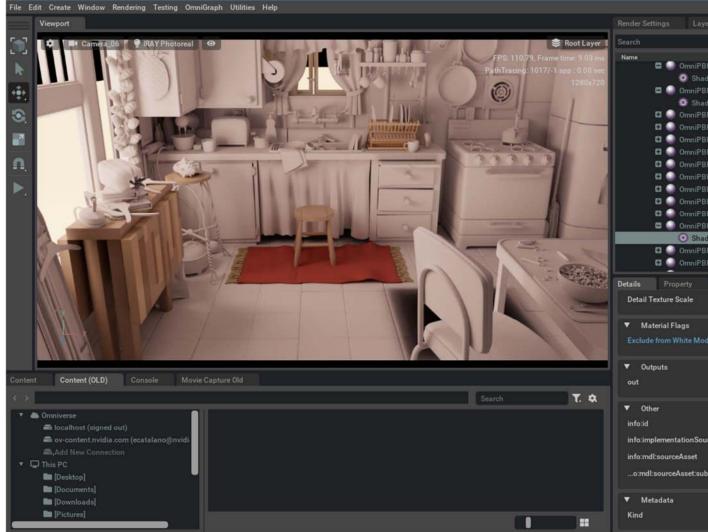
Current OV Create release still needs Iray to be enabled externally next major releases of OV Create and View: on by default along with vastly improved integration into OV (features & performance)

- RTX Realtime & RTX Path tracing rendering modes sacrifice reliability and quality/precision for progressive performance more (non-physical) knobs to tweak
- Iray Photoreal rendering simulation mode brings trusted & CIE 171:2006-verified light transport simulation to OV at the Push of a Button
- But, as with all other *Iray* integrations, not limited to only light transport simulation features





Awards received by **BLOOM LINIT**.





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...and even more new stuff

Iray 2020.1.1++ and 2021.0

Al quality prediction / automatic stopping criterion

Primitive Variables support (Vertex Colors, etc.)

Motion Vectors auxiliary buffer / AOV

Improved normal/bump mapping support incl. optional high quality B-spline interpolation

CUDA render targets (and improved support for OpenGL targets) incl. CUDA color conversions

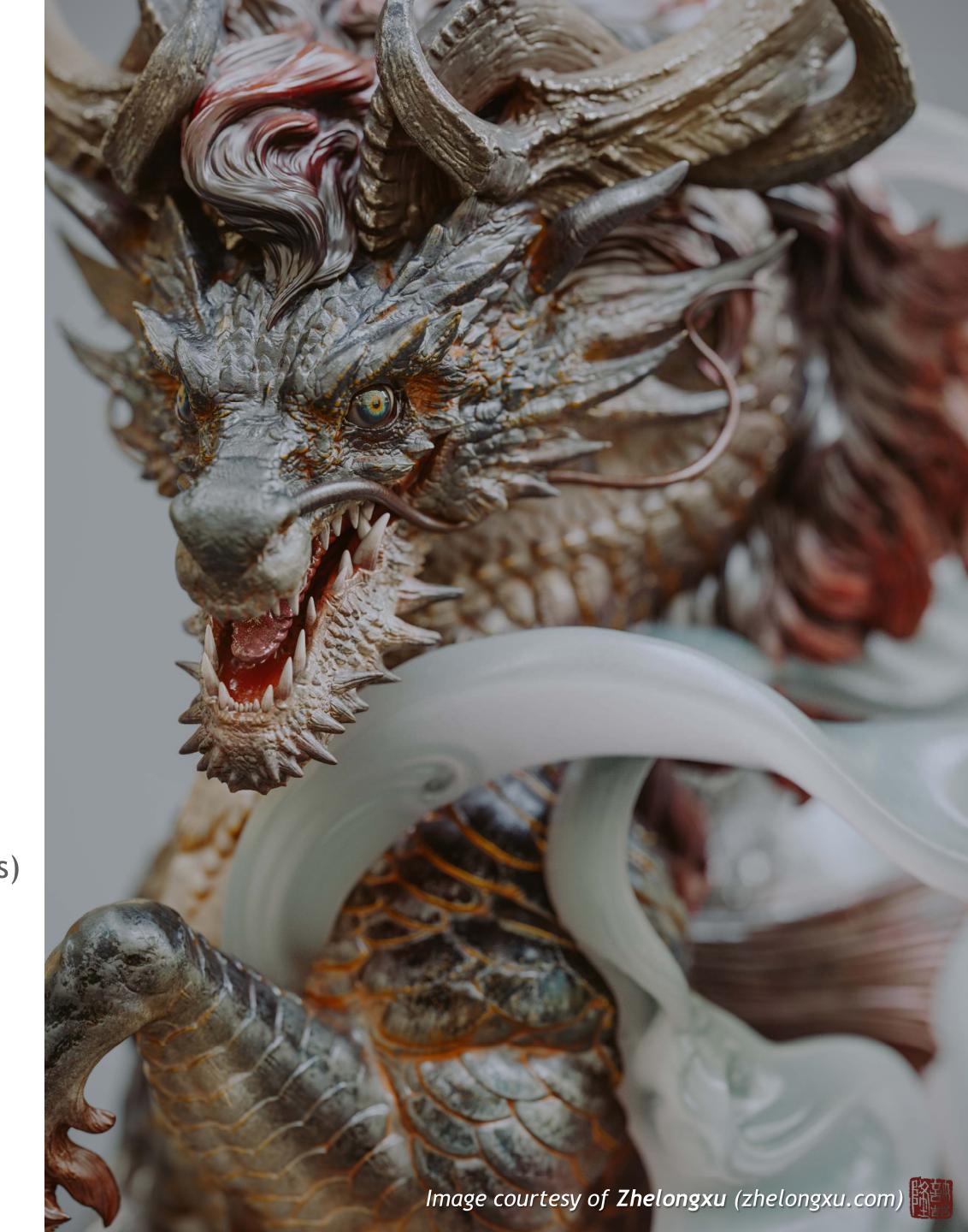
Improved DDS compressed image support

Extended message tagging functionality

Via MDL 1.7, Unbounded mix: Convenient for EDFs & VDFs, user needs to ensure energy conse

Convenient for EDFs & VDFs, user needs to ensure energy conservation (BSDFs) Via MDL 1.7, Textured EDF mixer weights, more freedom for textured lights: More than just a single EDF is supported, any EDF hierarchy will work Spectral values everywhere (not just the intensity slot) Texturing of EDF parameters will work

Via MDL 1.7, Directional factor for EDF: allows for "under-coat emission"



..upcoming attractions

Iray 2021.1 ++

Improved sampling for many of the used algorithms resulting in faster convergence (at least) when batch rendering and less visible noise in interactive use

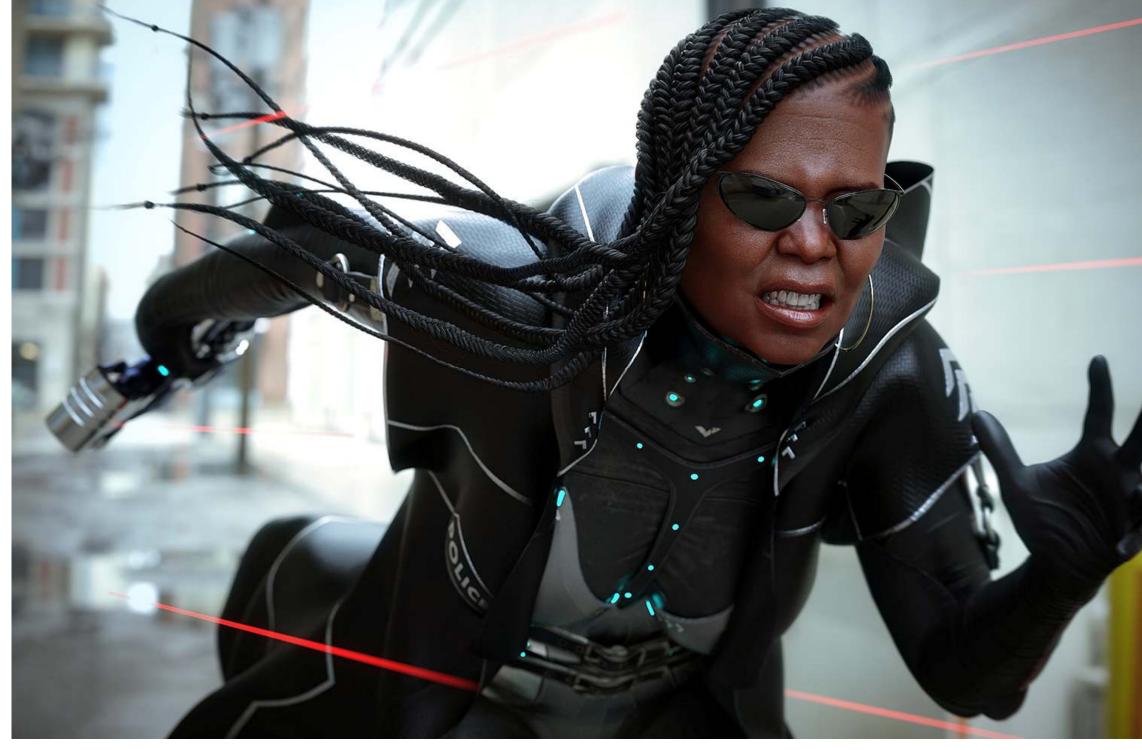
Improved interactivity / optimized preprocessing

Even better Omniverse integration

Native use of GPU texture compression (hopefully)

More optimal Arm CPU usage

Quite some more secret things ;)



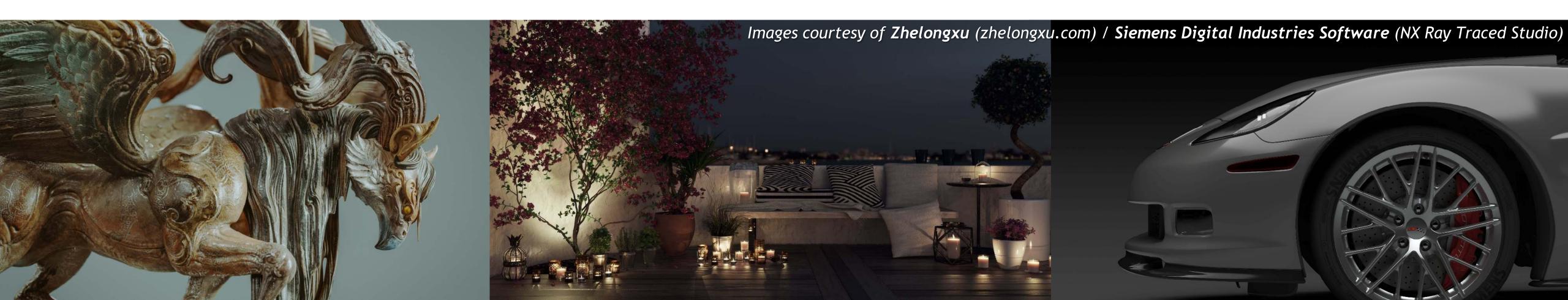


Questions?

More Information Acknowledgments

The Iray Team / NVIDIA ARC Berlin

- Techreport: The Iray Light Transport Simulation and Rendering System https://arxiv.org/pdf/1705.01263.pdf
- https://raytracing-docs.nvidia.com/iray/index.html



https://www.nvidia.com/en-us/design-visualization/iray



Invidia GTC 21



Other sessions featuring *Iray* tech

SOLIDWORKS Visualize: Recent Developments [S31988] Mike Sande, Sr. Tech. Sol. Consul. Dassault Systèmes

Learn how NVIDIA Iray Physically-Based Rendering and *RTX* is Driving Enhancements to Consumer Products & Retail [S31751] David Hutchinson, Product Manager Siemens NX Vis.

Rendering Realistic Figures: A Detailed Look at Skin Shaders Using Iray and MDL [S31893] Christopher Jones, Daz 3D

Sharing Physically Based Materials Between Renderers with *MDL* [S31207] Lutz Kettner & Jan Jordan, NVIDIA

Integrating the NVIDIA Material Definition Language in Your Application [S31241] Sandra Pappenguth & Joachim Reichel & Moritz Haenke de Cansino, NVIDIA

Real-Time, High-Fidelity Visual Experience of Large-Scale Scientific Simulations in *Omniverse* using NVIDIA IndeX [S32064] Marc Nienhaus, NVIDIA

