
open
Source
days '24
#ASWF
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open source days '24

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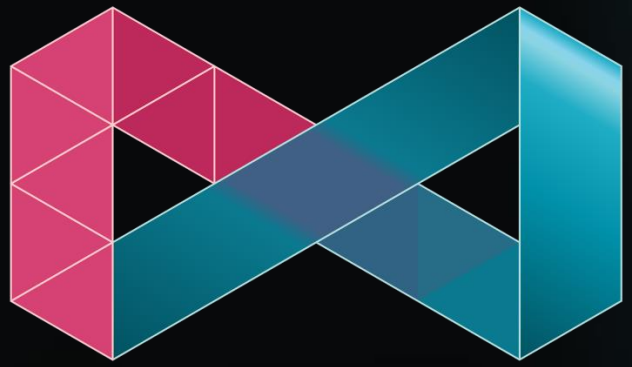
Virtual Town Hall Series



MATERIALX

MaterialX and OpenPBR Town Hall

July 23rd, 2024

#ASWF

MaterialX Project Updates 2024 – Jonathan Stone (ASWF, Lucasfilm)

OpenPBR Project Updates 2024 – Adrien Herubel (Autodesk), Peter Kutz (Adobe)

MaterialX in OpenUSD and Hydra – Karen Lucknavalai (Pixar)

MaterialX and OpenPBR in Omniverse – Frankie Liu (NVIDIA)

LookdevX in Maya – Nikola Milosevic, Orn Gunnarsson (Autodesk)

MaterialX in V-Ray – Mihail Djurev (Chaos)

MaterialX in Houdini 20.5 – Chris Rydalch (SideFX)

MaterialX Project Updates 2024

MaterialX 1.38.8 Release

- Autodesk and SideFX contributed a rich set of new pattern nodes
- Apple contributed support for MaterialX on iOS
- Added support for MaterialX Python installation through PyPI
- Improved GGX importance sampling in real-time shading

ASWF Dev Days 2023

- Provided dedicated mentorship to new contributors over two days
- 14 new MaterialX contributors, including developers from Wētā, ILM, and Autodesk
- Dev Days 2024 will be in September, see https://www.aswf.io/dev-days-2024/ for details

Alliance for OpenUSD

- Launched in 2023 to develop a normative specification for USD
- Formed a Materials Working Group in 2024
- New group is focused on the MaterialX integration in USD
- See https://aousd.org/ for details

AOUSD

Alliance for OpenUSD

MaterialX 1.39.0 Release

- Major updates to the specification and codebase
- Adds support for the OpenPBR Surface shading model
- Updates the Physically Based Shading and pattern nodes
- Significant optimizations to real-time shading

Join the Conversation

- Visit www.materialx.org to learn more about the project
- Visit https://www.aswf.io/get-involved/ to join the conversation
- Visit https://www.aswf.io/dev-days-2024/ to join Dev Days 2024

open Source days '24

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Virtual Town Hall Series

OpenPBR Project Update 2024

Adrien Herubel, Autodesk
Peter Kutz, Adobe

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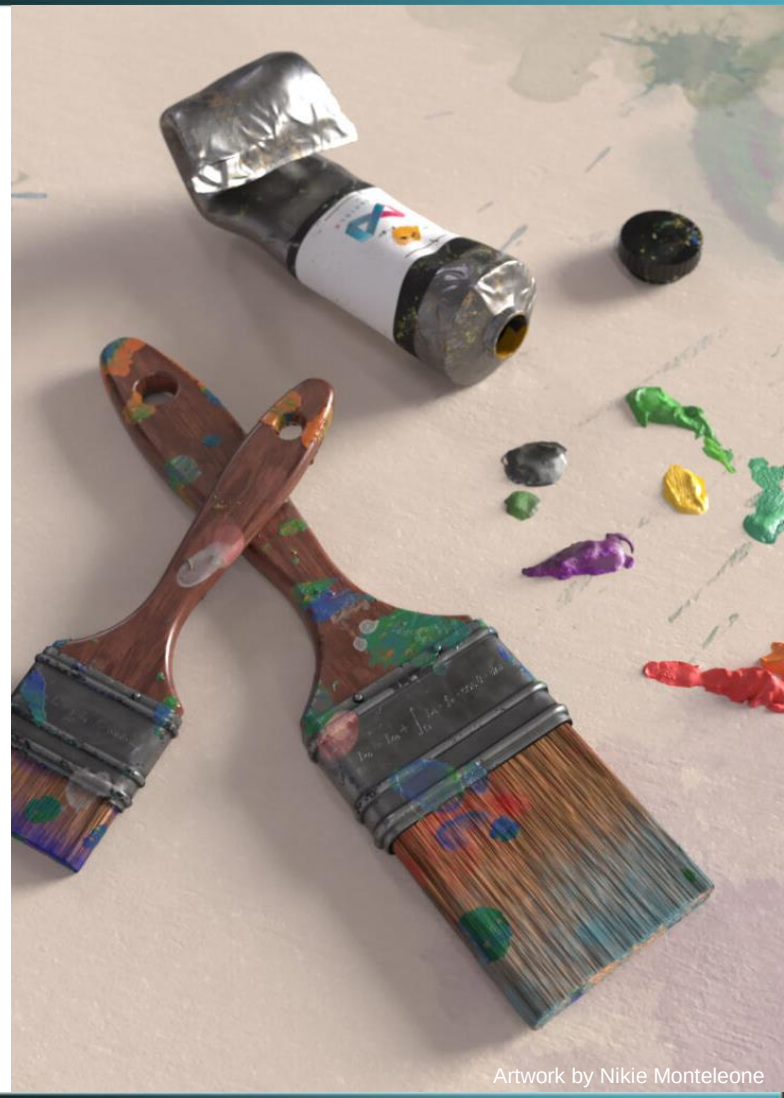
OpenPBR update

- State of OpenPBR
- Overview of new features
- Integrations
- Future work

Artwork by Nikie Monteleone

OpenPBR: A new standard

- Merging Standard Surface and Standard Material
  - Autodesk and Adobe share a user base
  - Facilitate asset exchange between vendors
- Physically based
- Artist friendly
- Open governance to drive consensus and adoption
- Reference implementation

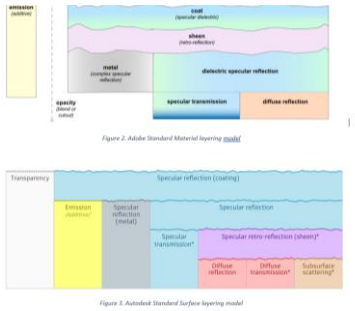


Artwork by Nikie Monteleone

OpenPBR project timeline

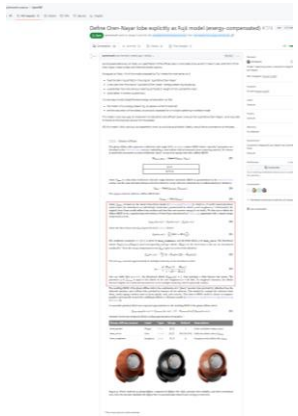
Nov 2022

Common ground



Apr 2023

New specification



Jun 2023

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Aug 2023

Announce and private reviews

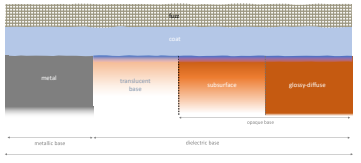
NVIDIA · PIXAR ANIMATION STUDIOS · SONY PICTURES imageworks · Industrial Light & Magic · EPIC GAMES · chaos · blender · SideFX

Oct 2023

Public preview

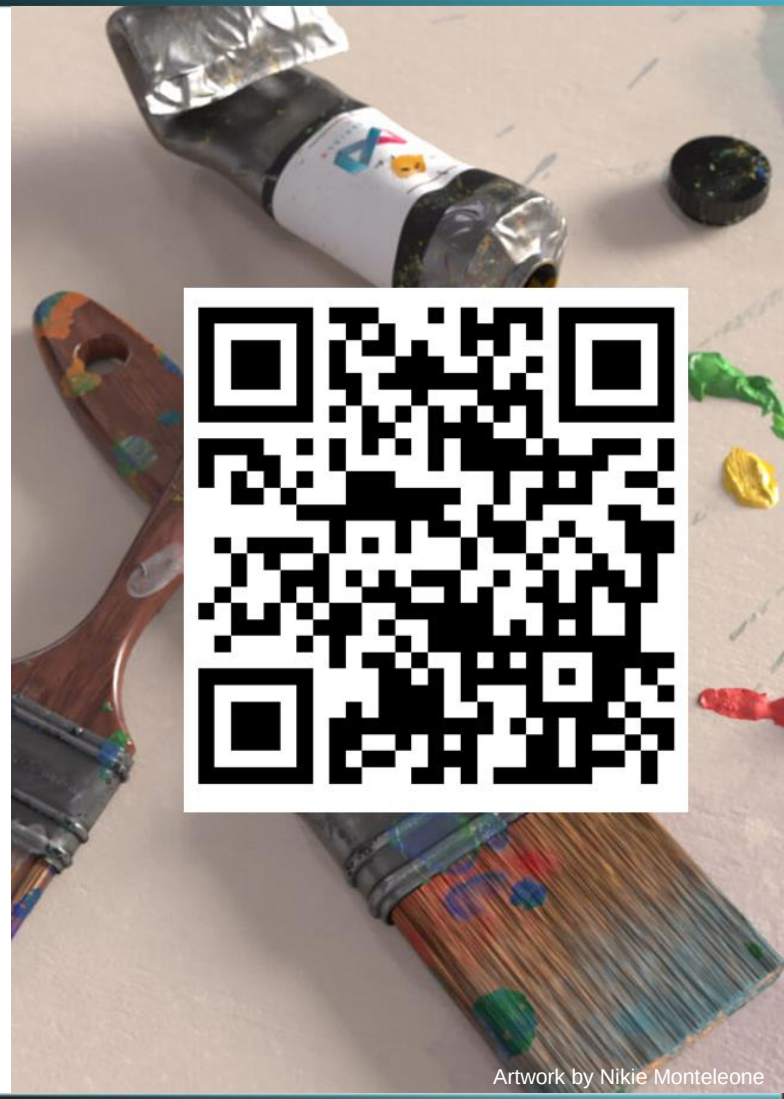
Now

1.0 release



OpenPBR project outcomes

- Finalized specification
- Unifies Autodesk Standard Surface and Adobe Standard Material, with some enhancements
- MaterialX reference implementation
- ASWF governance model
- Major interest from end-users and vendors



Open source repo and specification

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AcademySoftwareFoundation / OpenPBR

Code | Issues 22 | Pull requests 2 | Actions | Security | Insights

OpenPBR Public

Edit Pins | Unwatch 33 | Fork 18 | Star 406

main | 2 Branches | 6 Tags | Go to file | Add file | Code

jstone-lucasfilm Merge v1.1 development to main (#222) b212785 · 3 weeks ago 149 Commits

examples	Merge v1.1 development to main (#222)	3 weeks ago
images	Initial specification cleanup for 1.0 (#191)	2 months ago
reference	Merge v1.1 development to main (#222)	3 weeks ago
style	Slightly shift TOC closer to teaser image (#194)	2 months ago
GOVERNANCE.md	Small fixes (#18)	last year
LICENSE	Initial commit	last year
README.md	Merge v1.1 development to main (#222)	3 weeks ago
index.html	Merge v1.1 development to main (#222)	3 weeks ago
openpbr.bib	Update BibTeX citation (date, and capitalization) (#213)	2 months ago
parametrization.md.html	Merge v1.1 development to main (#222)	3 weeks ago

README | Apache-2.0 license

OpenPBR Surface

Shader Playground, rendered in Arnold for Maya, using OpenPBR Surface. Artwork by Nikie Monteleone.

OpenPBR Surface is a specification of a surface shading model intended as a standard for computer graphics. It aims to provide a material representation capable of accurately modeling the vast majority of CG materials used in practical visual effects and feature animation productions.

OpenPBR Surface is an open standard hosted by the Academy Software Foundation (ASWF), and is organized as a subproject of MaterialX.

Specification

- White paper
- Parameter reference
- Reference implementation – written in MaterialX
- BibTeX citation

Resources

- MaterialX Web Viewer - WebGL rasterization renderer using MaterialX implementation of OpenPBR
- OpenPBR-viewer - self-contained example implementation in a WebGL pathtracer (run here)
- #openpbr - public Slack channel for discussions, hosted by ASWF

About

Specification and reference implementation for the OpenPBR Surface shading model

computer-graphics | vfx | 3d-graphics | physically-based-rendering | materialx | real-time-rendering

Readme | Apache-2.0 license | Activity | Custom properties | 406 stars | 33 watching | 18 forks | Report repository

Releases 6

Version 1.1 Latest — 3 weeks ago

+ 5 releases

Packages

No packages published

Contributors 9

Deployments 153

github-pages 3 weeks ago

+ 152 deployments

Languages

CSS 94.0% | TeX 6.0%

OpenPBR Surface

Specification v1.1, 2024-06-28. ASWF

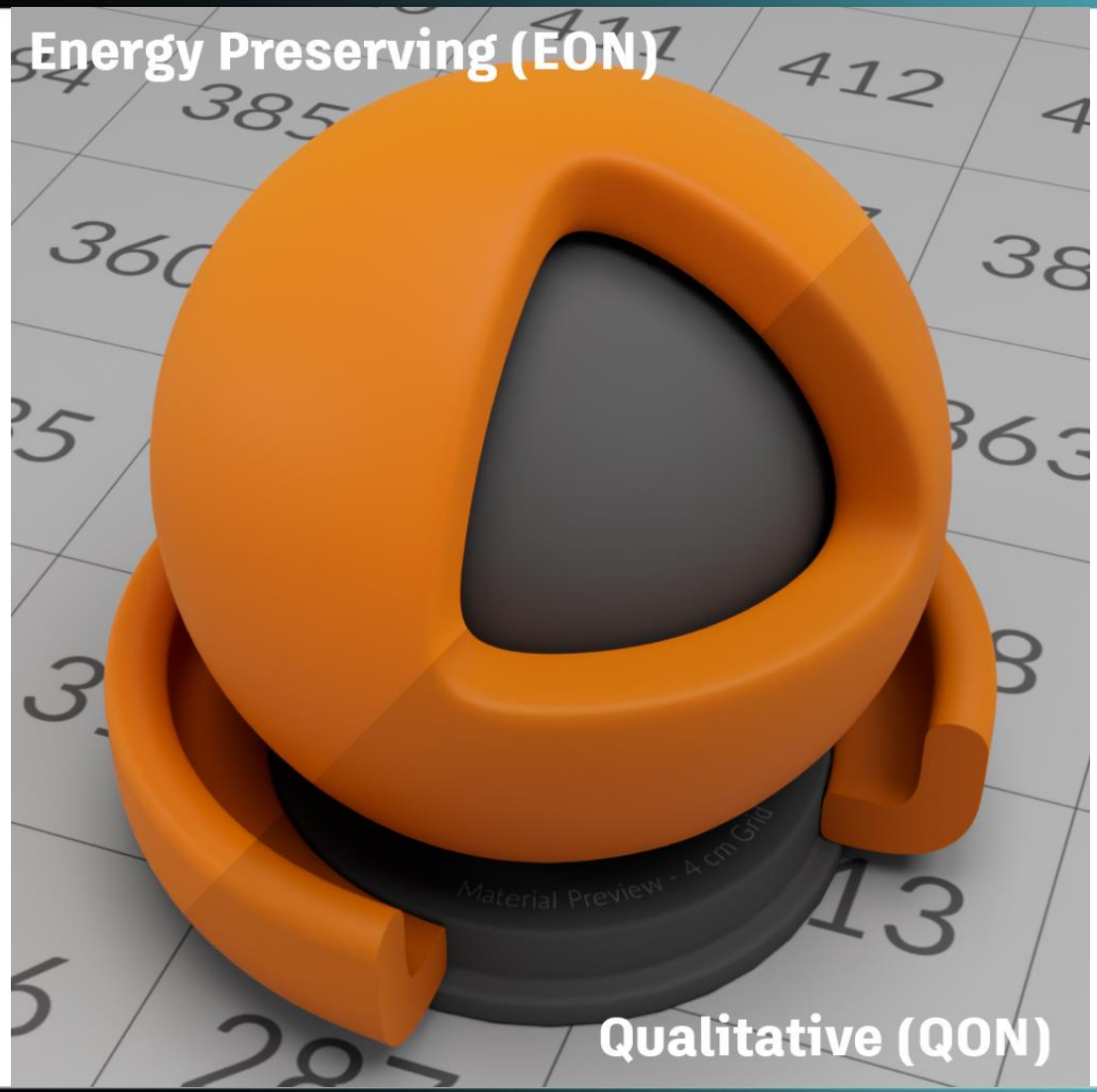
This document is a specification of a surface shading model intended as a standard for computer graphics: the OpenPBR Surface model. Designed as an über-shader, it aims to be capable of accurately modeling the vast majority of CG materials used in practical visual effects and feature animation productions. The model has been developed as a synthesis of the Autodesk Standard Surface and the Adobe Standard Material models.

Shader Playground, rendered in Arnold for Maya, using OpenPBR Surface.

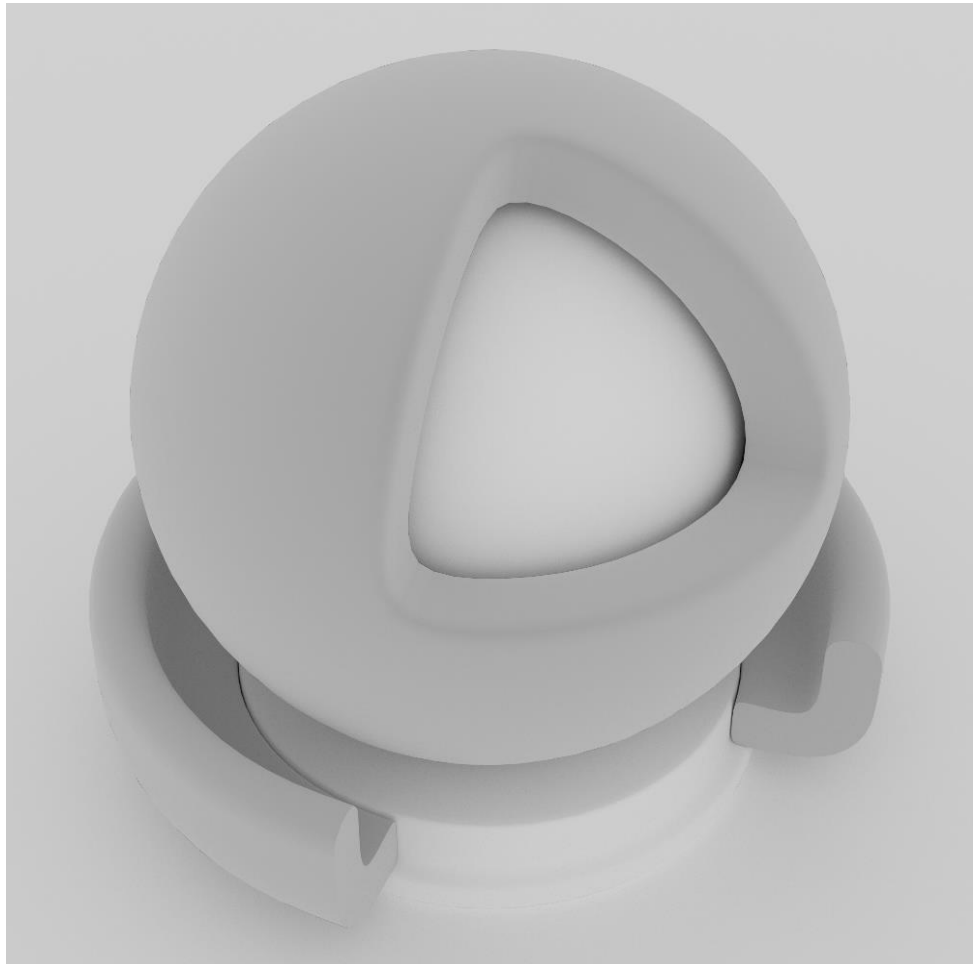
Contents

Energy-preserving Oren–Nayar

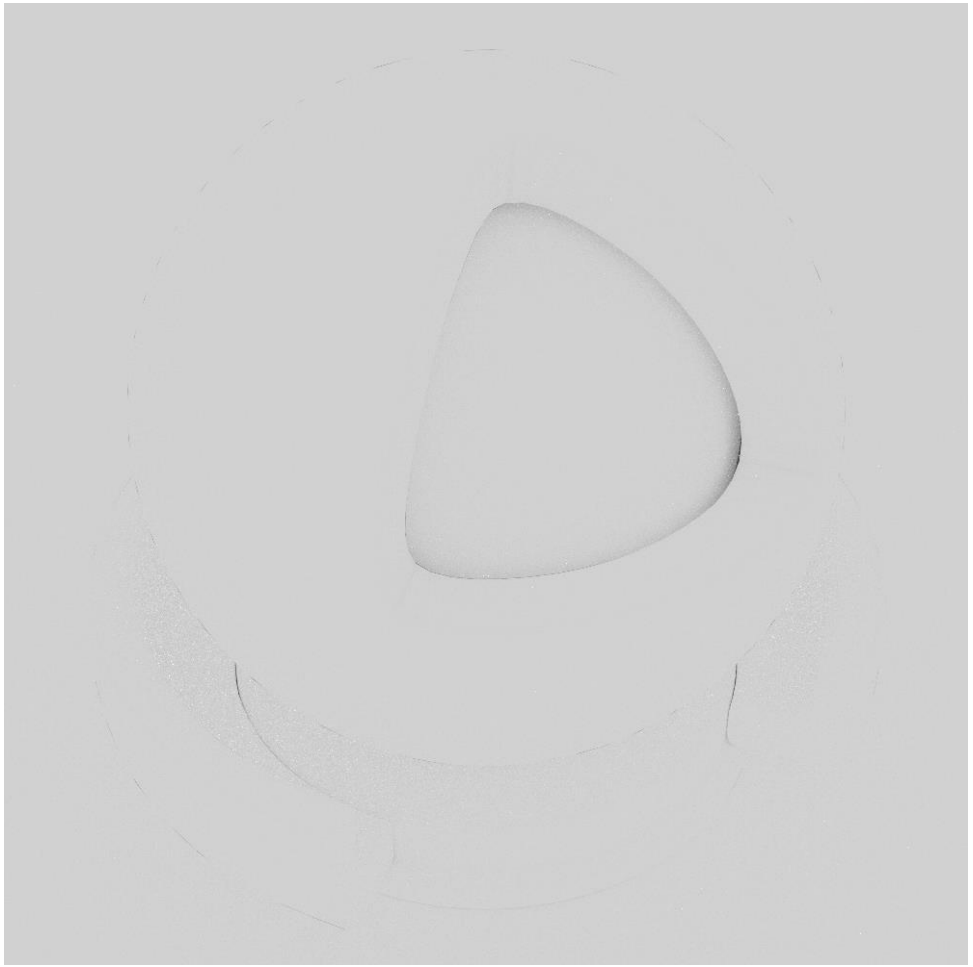
Energy-preserving Oren–Nayar



Energy-preserving Oren–Nayar

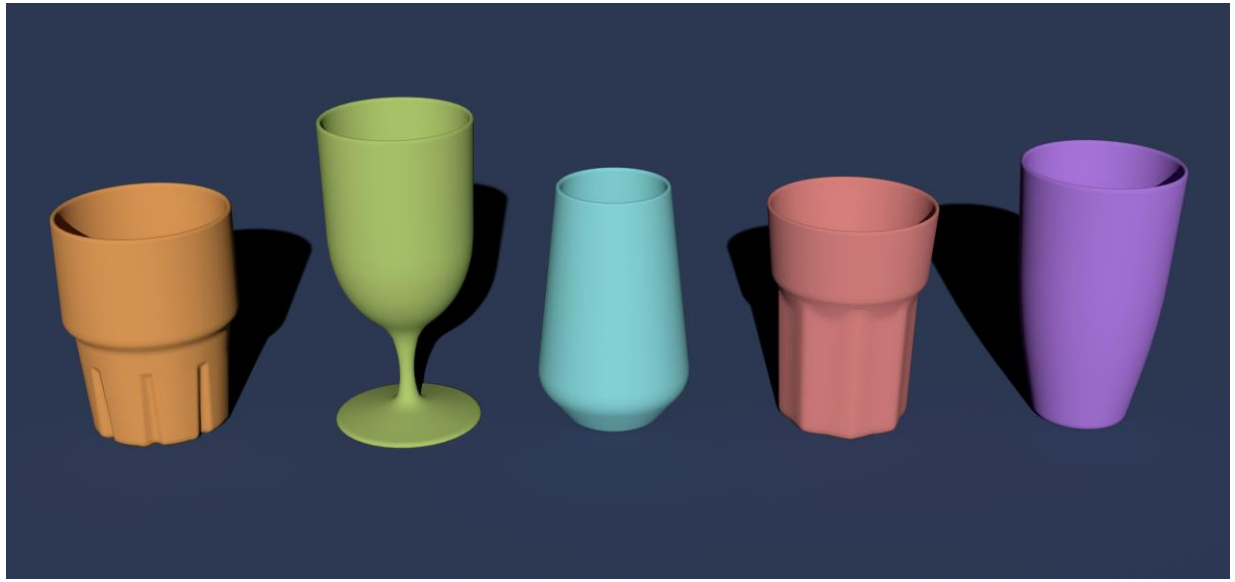


QON



EON

Energy-preserving Oren–Nayar

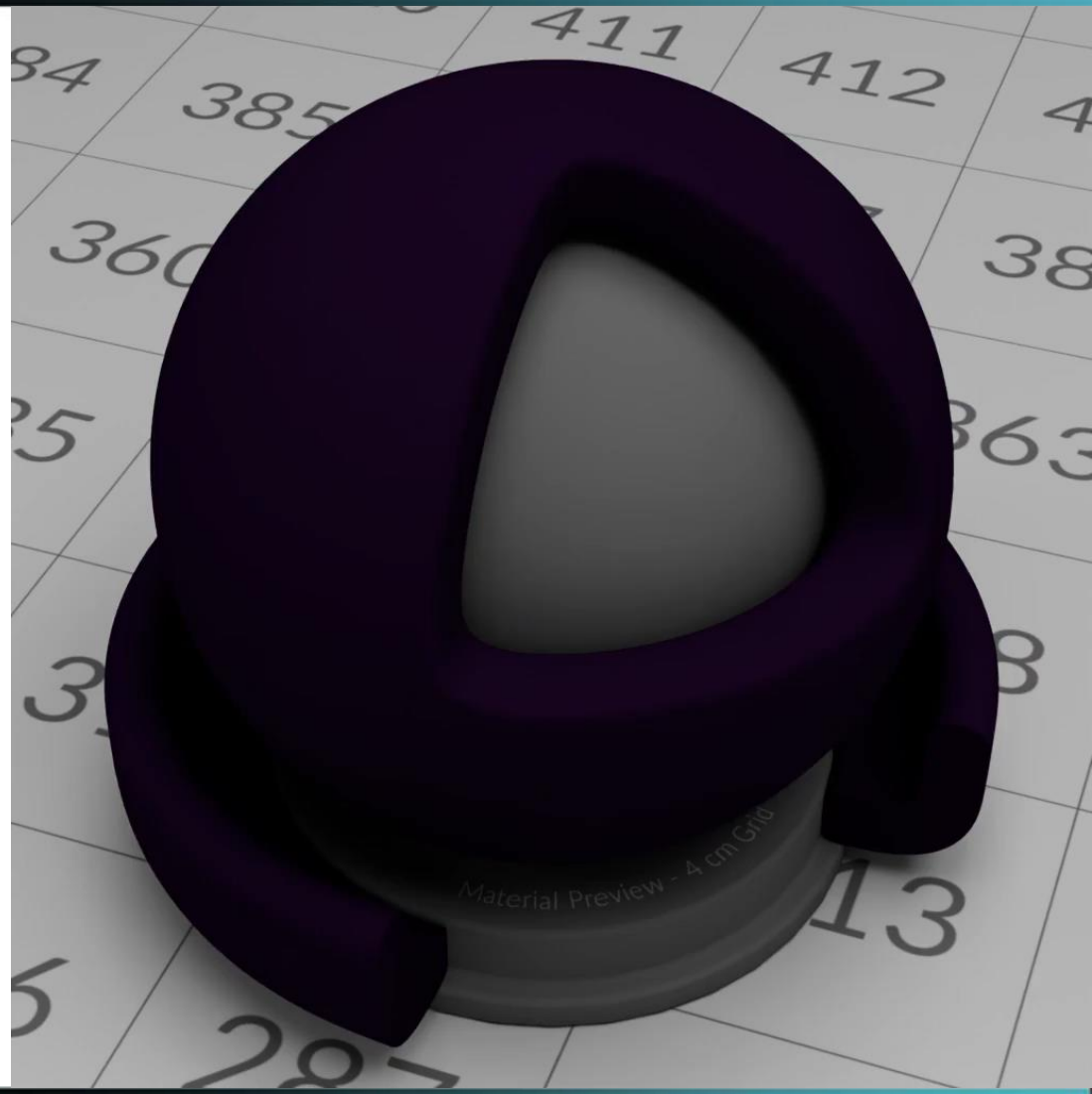


smooth

rough

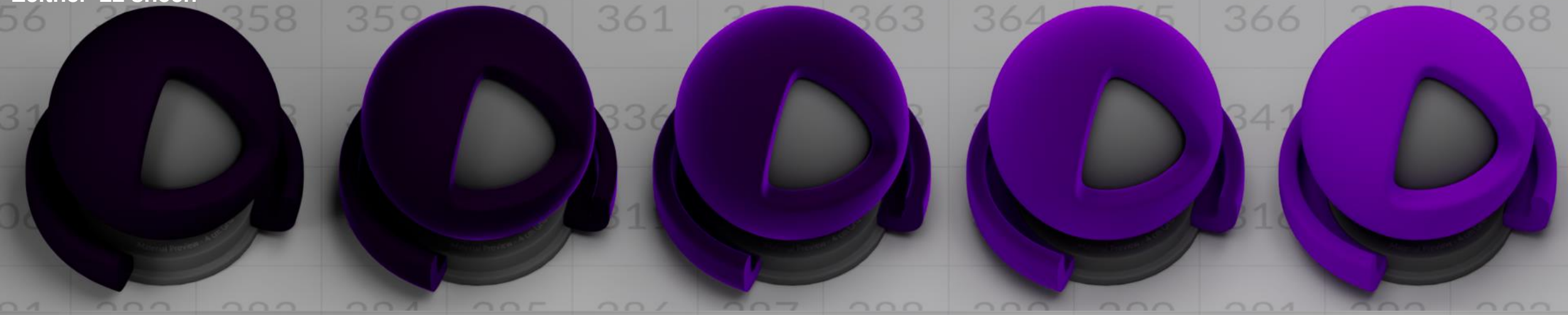
New fuzz model

- New Fuzz model using Zeltner '22
- Based on energy-conserving microflake multiple scattering
- Perfect importance sampling
- Improved range over popular microfacet models

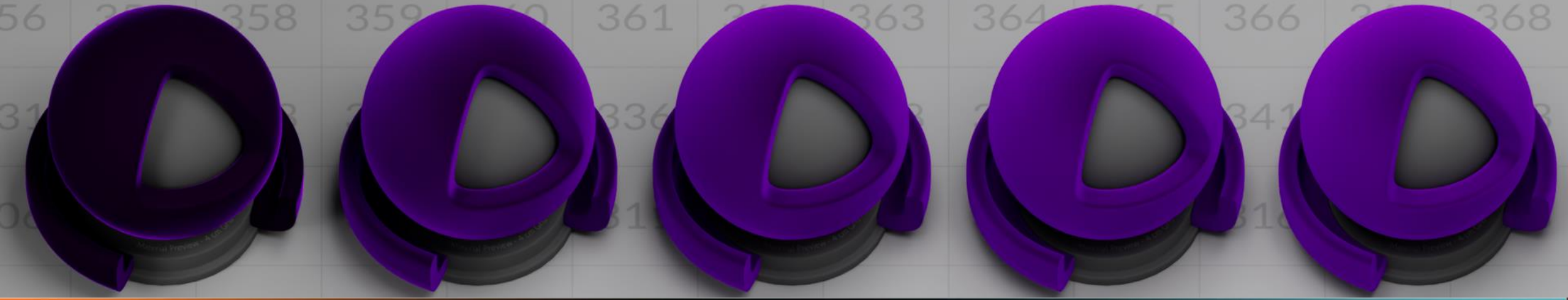


New fuzz model

Zeltner '22 sheen

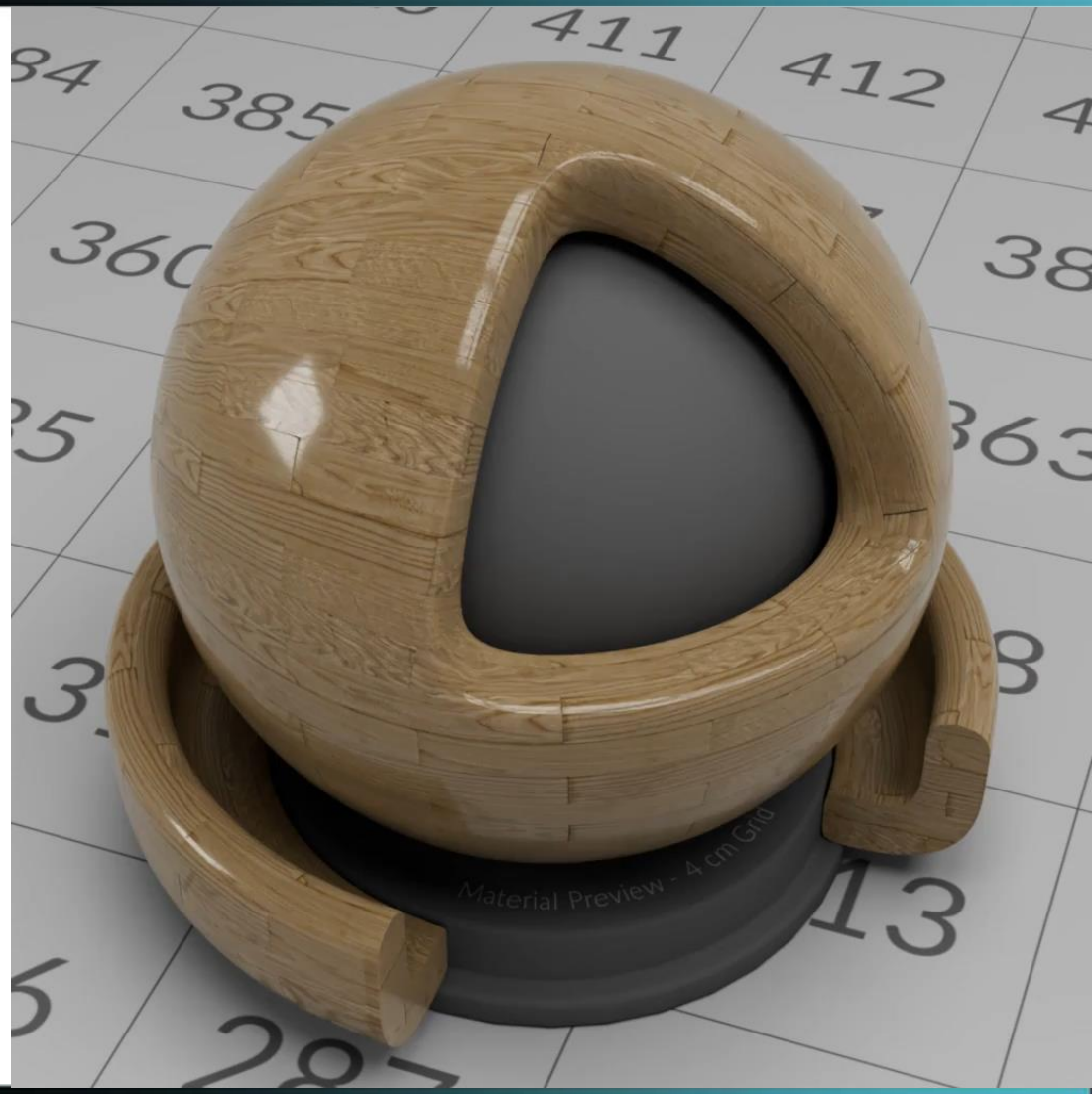


SPI sheen



Coat darkening

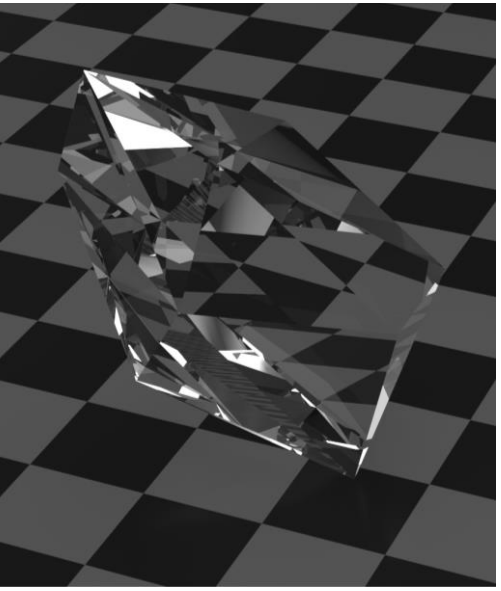
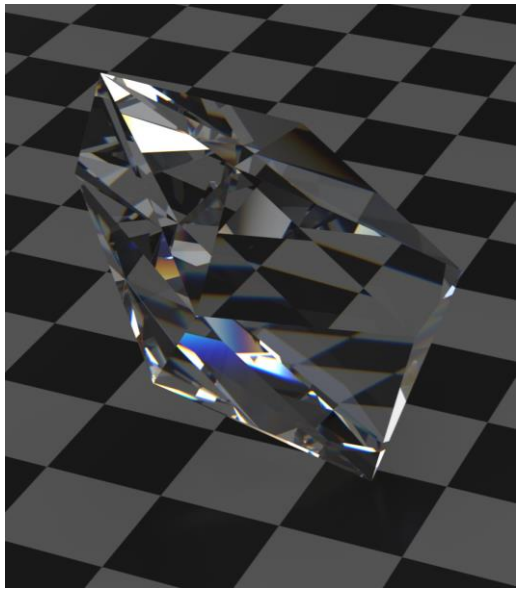
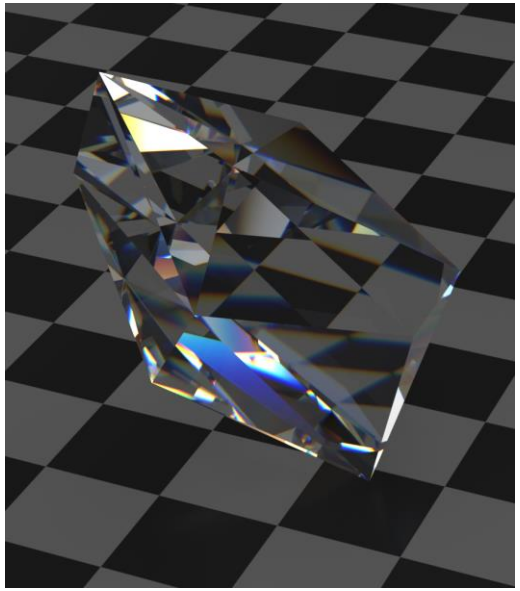
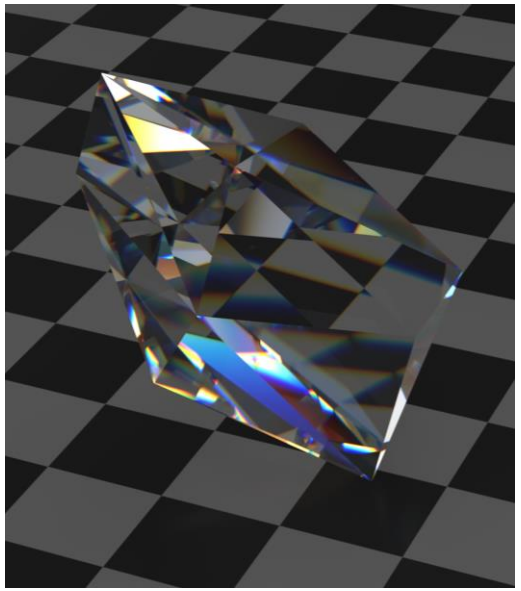
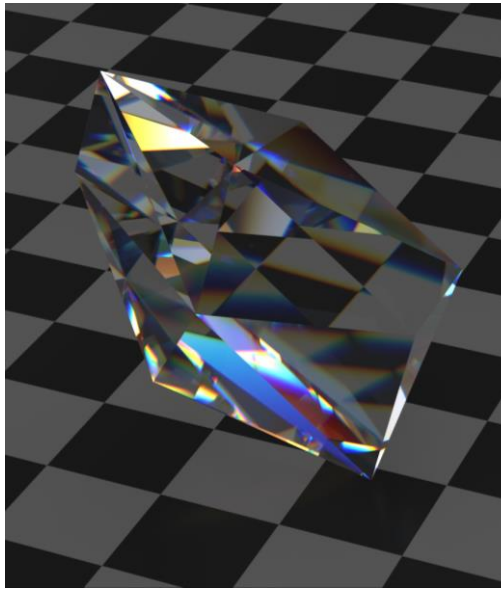
- New base color darkening
- Based on real internal reflection and re-absorption
- Opt-out



Coat darkening

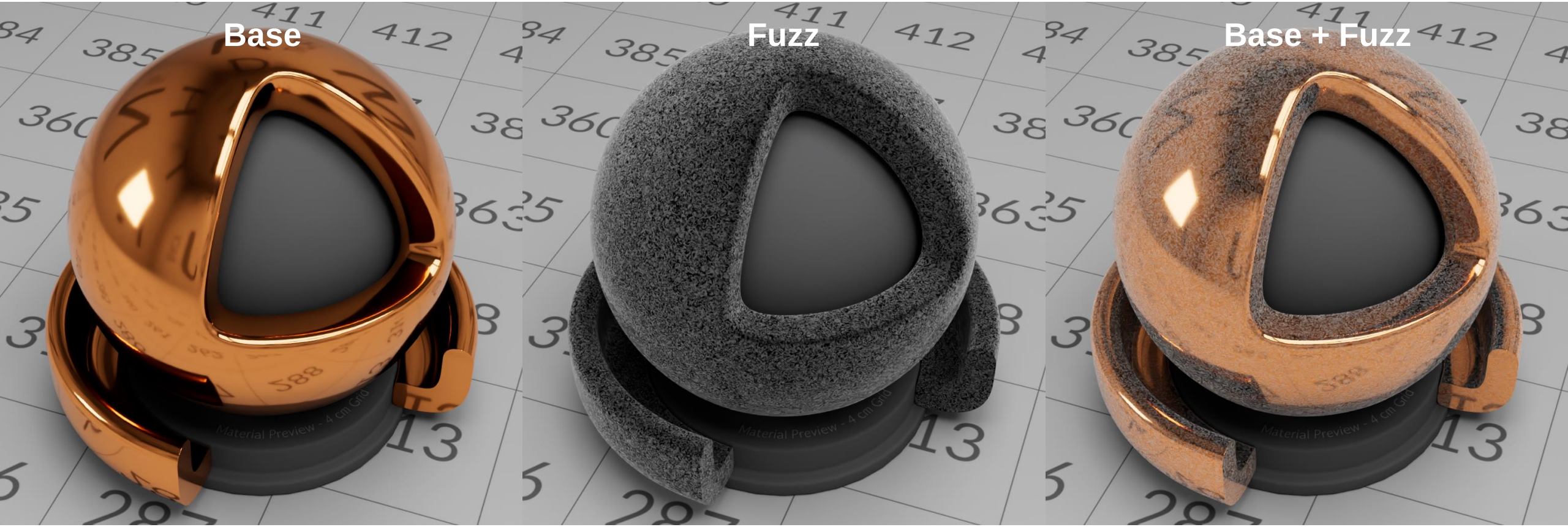
0.00 0.25 0.50 0.75 1.00

Dispersion scale

0.0 0.5 1.0 1.5 2.0

More expressive layer ordering



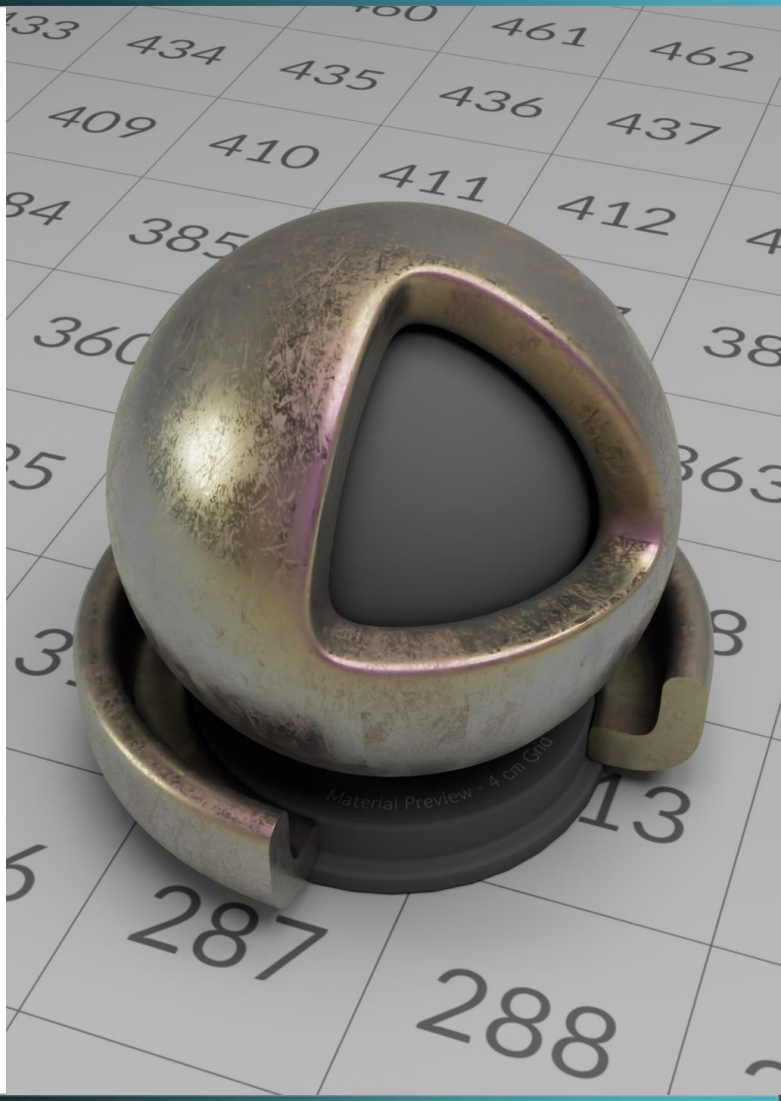
Art-directable metal model

Gulbrandsen

F82-Tint

Other user-friendly tweaks

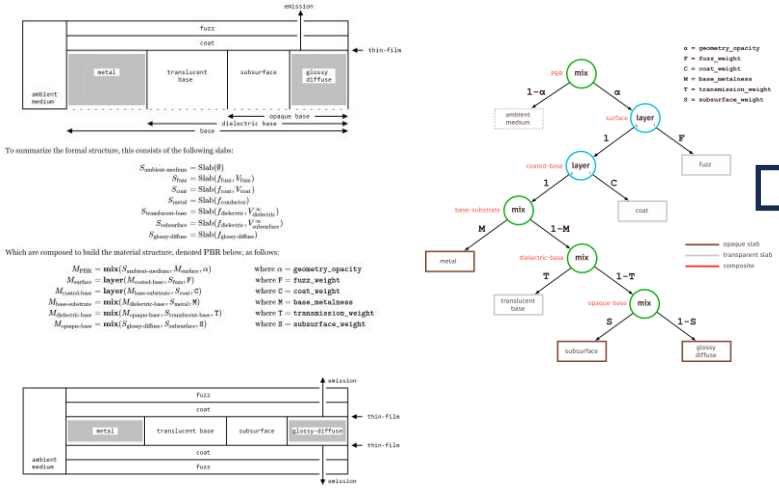
- More intuitive thin-film parameterization
- More natural specular weight



OpenPBR integrations

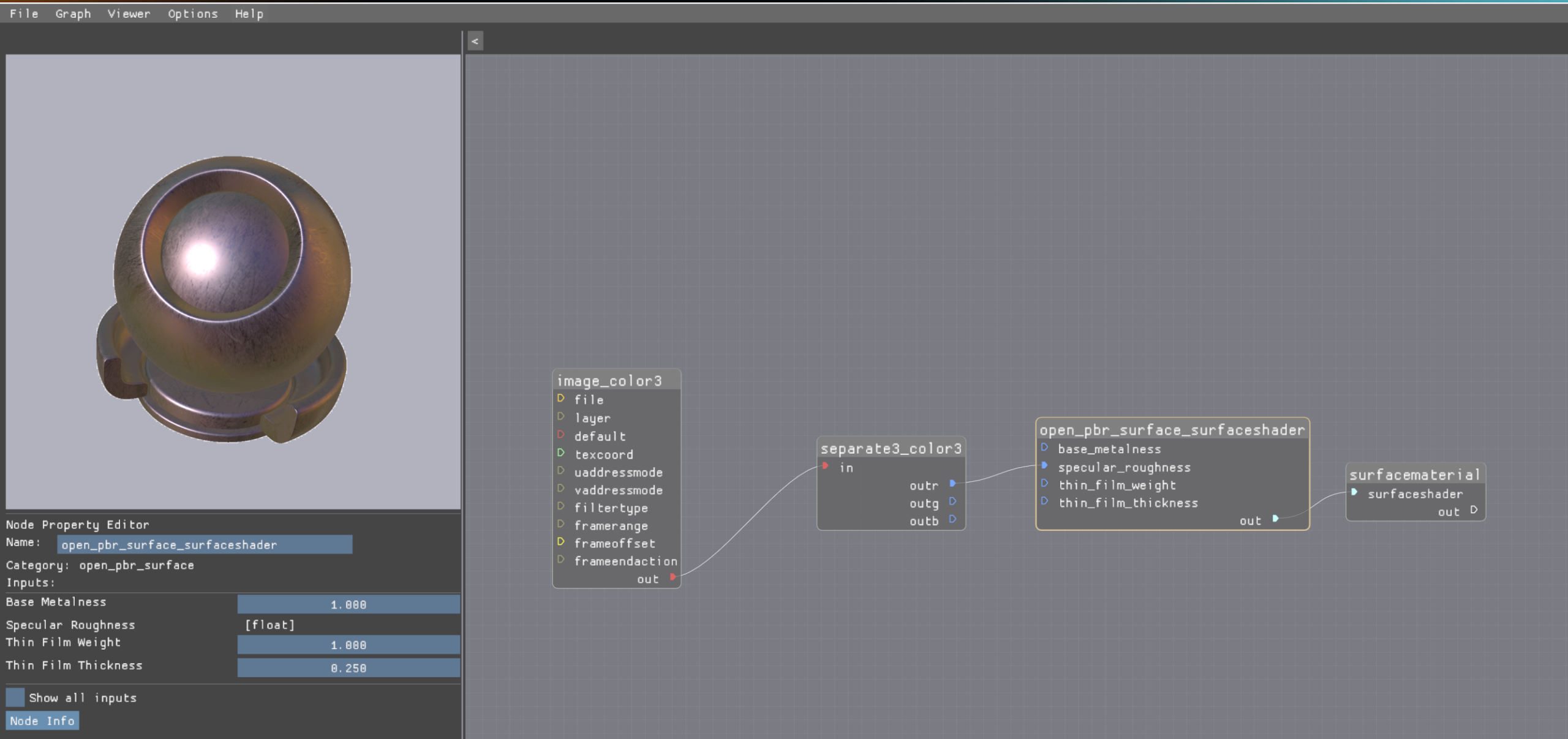
- MaterialX 1.39
- Adobe Substance
- Arnold
- Maya
- 3ds Max
- Omniverse
- Houdini Karma

Formal structure



Implementations

OpenPBR integration: MaterialX 1.39



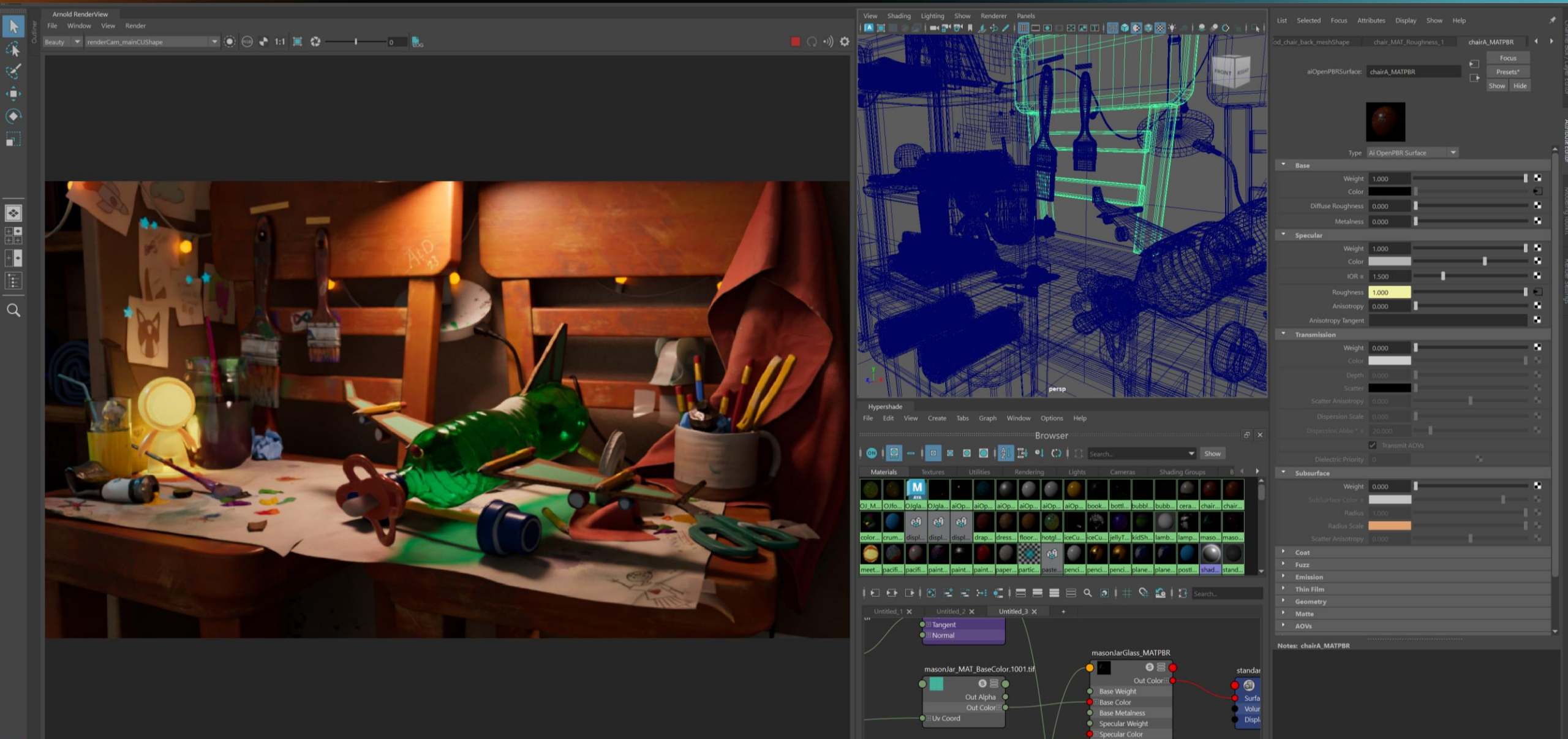
OpenPBR integration: Adobe Substance

Dragon Warrior | Ming Dynasty Gunner
Concept Artist: Ningbo Jiang
3D Character Artist: Anastasia Kukosh
OpenPBR Conversion: Nikie Monteleone

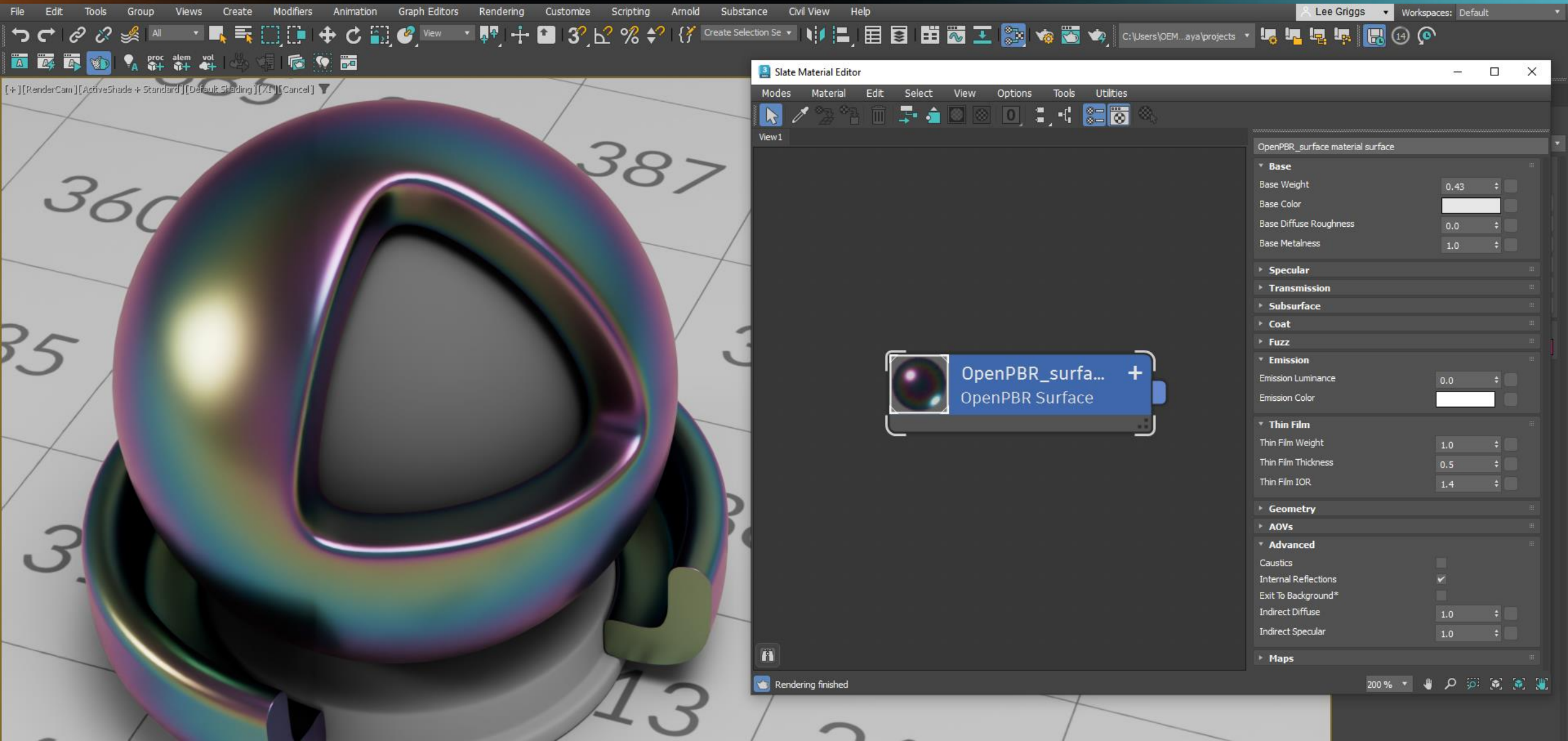
OpenPBR integration: Arnold

Artwork by Nikie Monteleone

OpenPBR integration: Maya



OpenPBR integration: 3ds Max



OpenPBR integration: Omniverse

Artwork by Nikie Monteleone

OpenPBR integration: Karma

OpenPBR: Future work

- Increase OpenPBR and MaterialX 1.39 adoption
- Continuously review feedback and new ideas
- Shader translation graphs from/to Standard Surface
- Extending OpenPBR
  - Volumes
  - Hair

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Virtual Town Hall Series

MaterialX in OpenUSD & Hydra

Karen Lucknavalai, Pixar

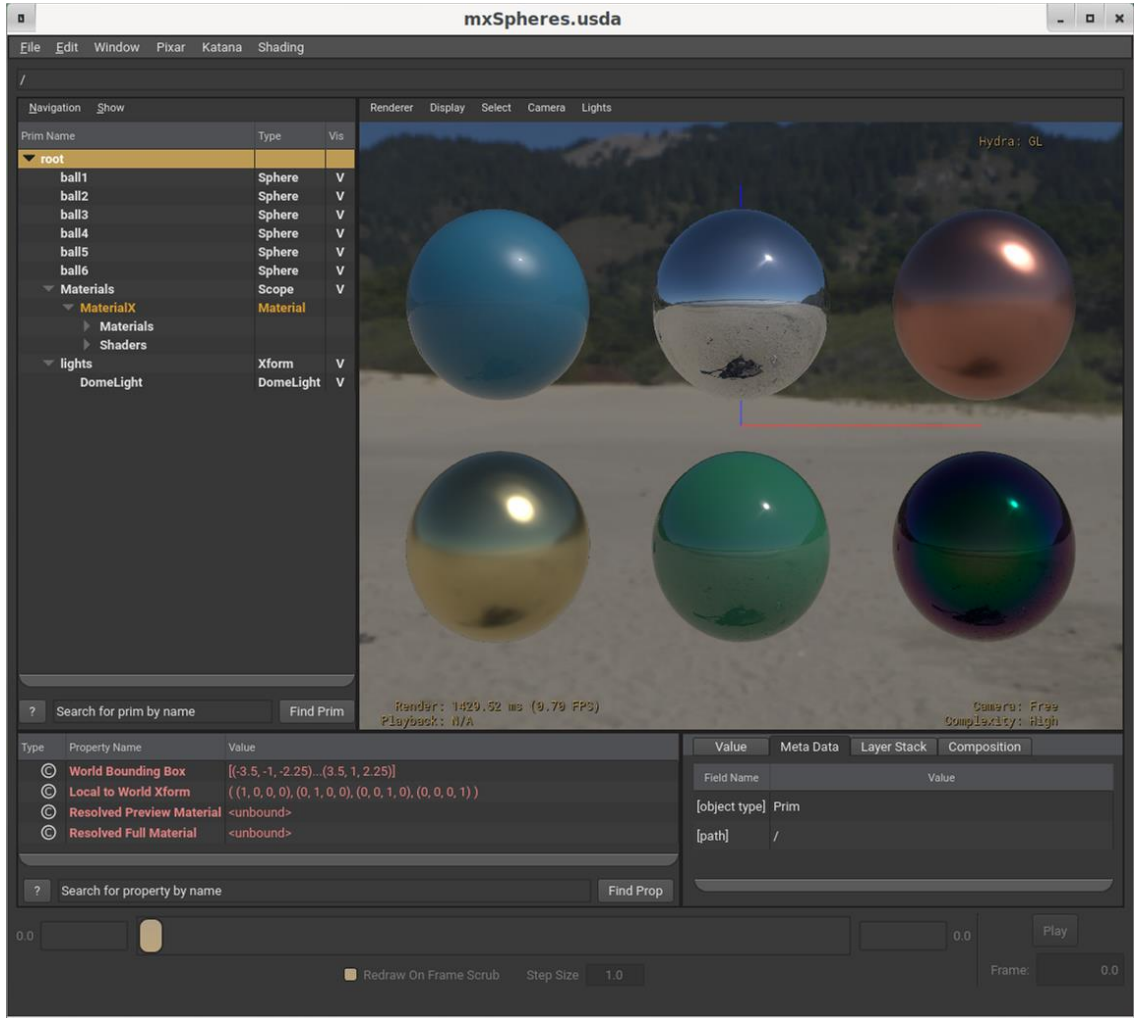
July 23, 2024

#ASWF

MaterialX in USD/Hydra - Updates

Dev branch changes

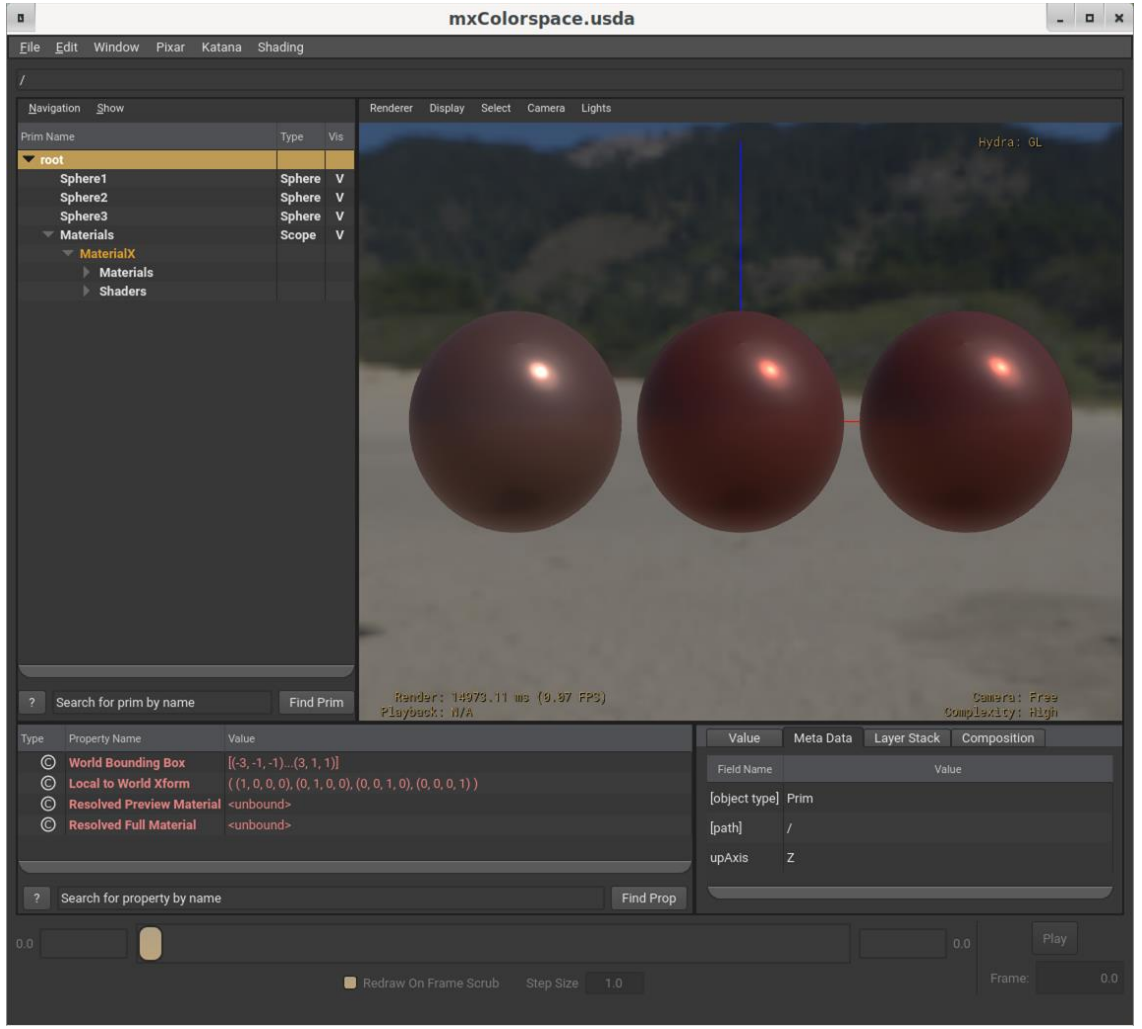
- Support for MaterialX v1.38.10
- Vulkan ShaderGen support
- Material Tag detection fixes
- MaterialX in Hydra USD [Developer Guide]
- Improved glslfx shader caching



MaterialX in USD/Hydra - Updates

Release branch changes

- Colorspace support to HdMtlx and Storm *
- Update imaging tests
- Normal map fixes for Storm and Prman



* full colorspace support in USD is still IP

MaterialX in USD/Hydra - Updates

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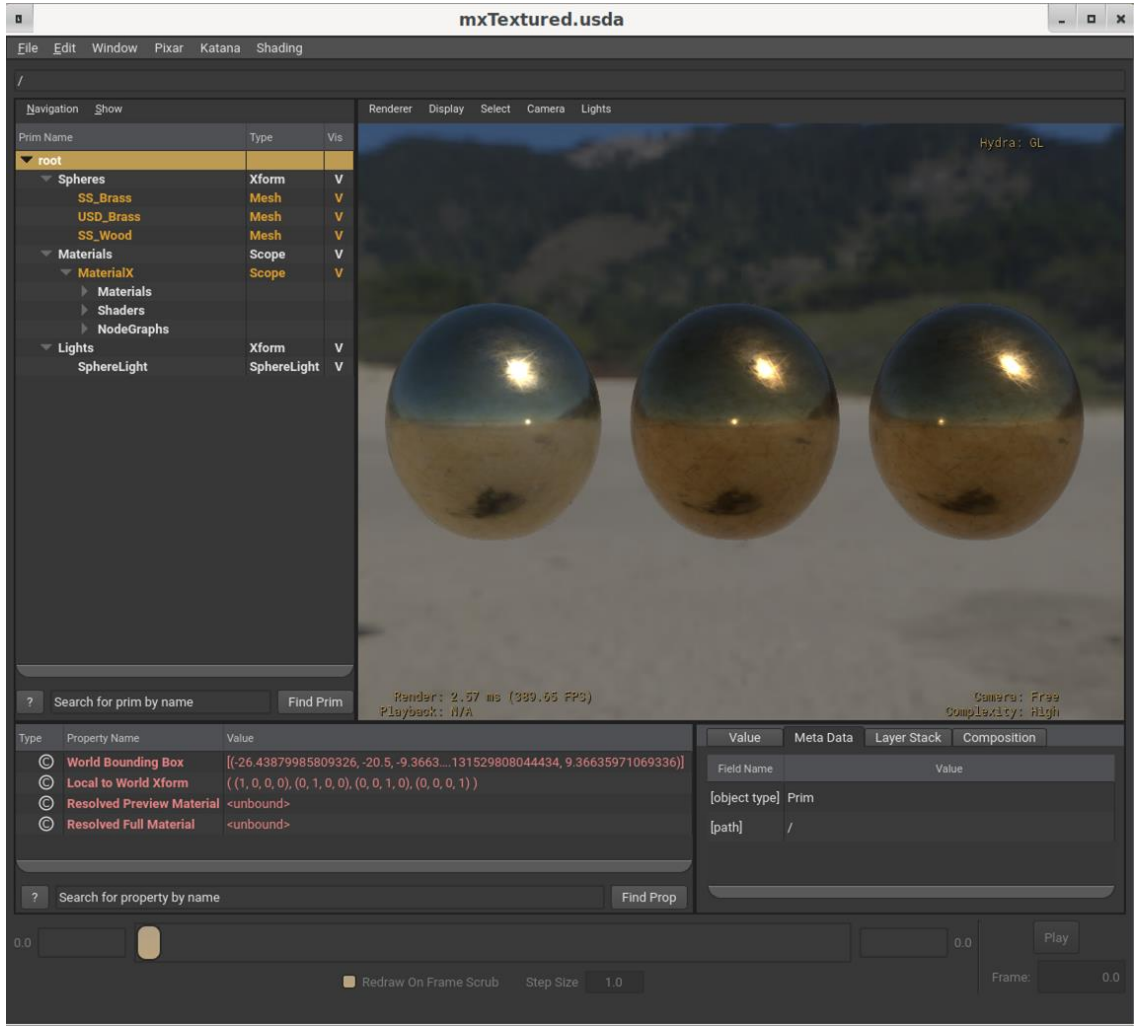
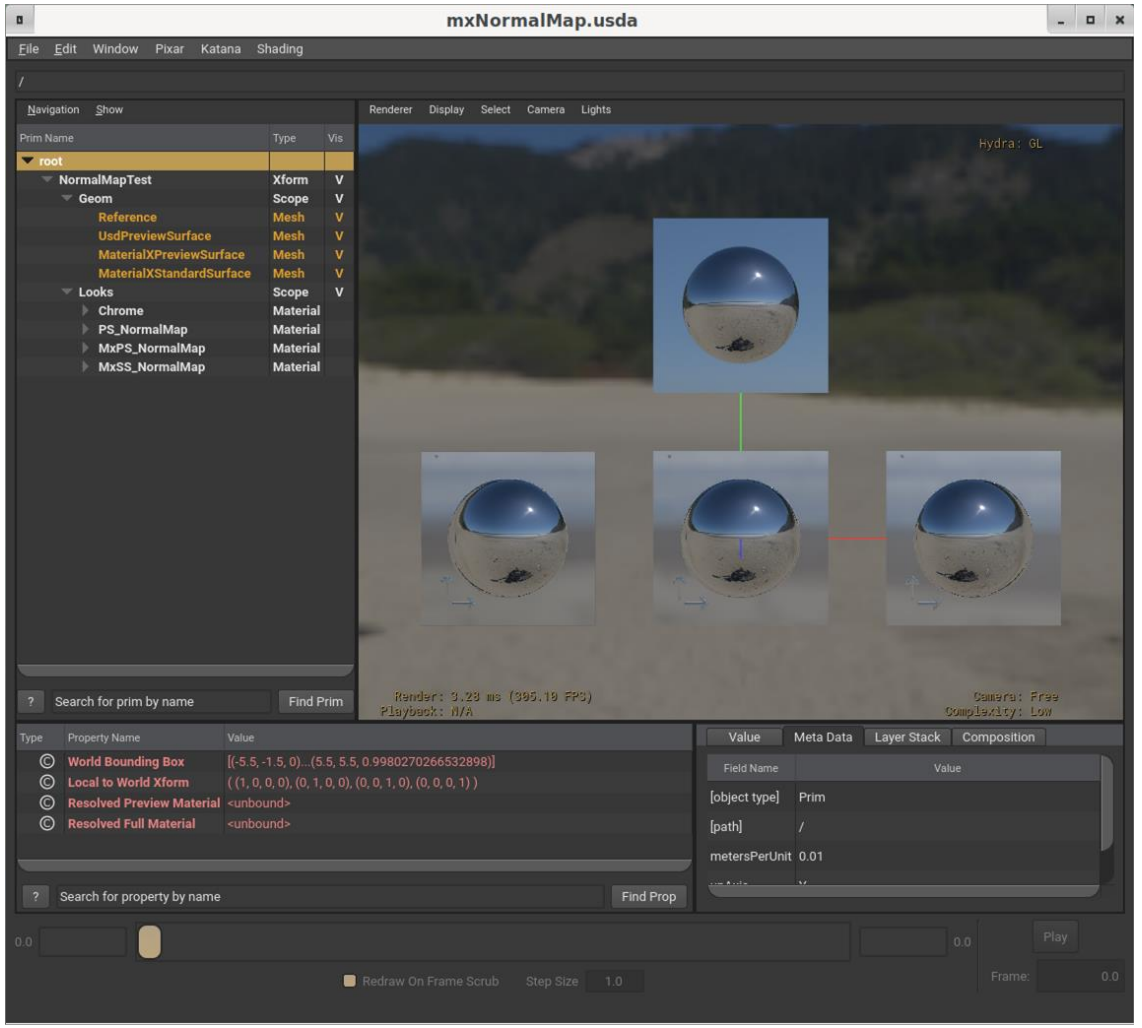


* full colorspace support in USD is still IP

MaterialX in USD/Hydra - Updates

Bug Fixes

- Name collision with inputs and built-in uniforms in Storm
- OIT fix for Metal
- Shader compile fix when using `heighttonormal` nodes
- `fileprefix` appropriately applied to `filenames`



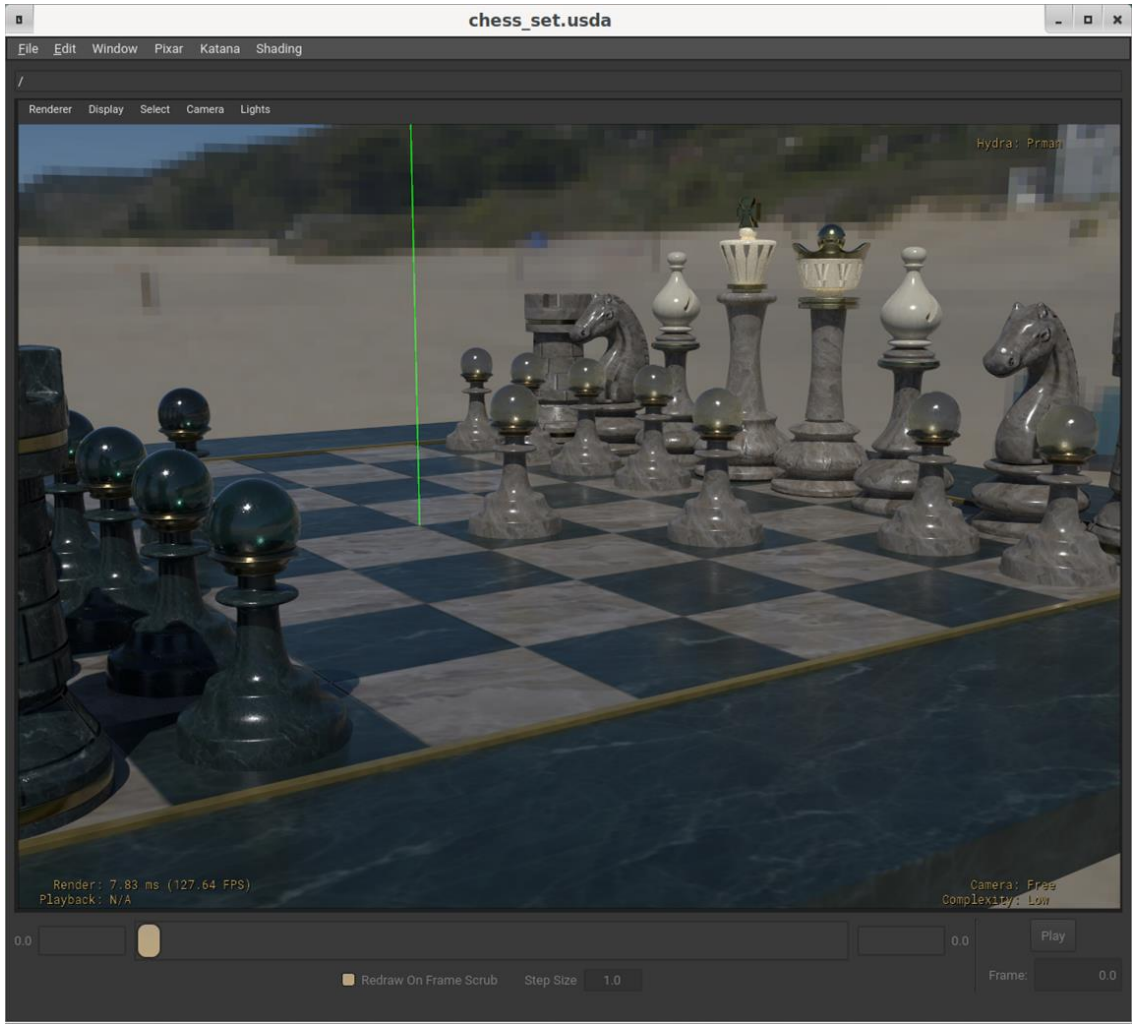
MaterialX in USD/Hydra - Updates

Prman bug fixes

- Nodes used in multiple places within a material
- Correct search paths

More information about Renderman, OSL and MaterialX:

OSL Virtual Town Hall
Today at 4p MDT



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Virtual Town Hall Series

Material Exchange in Omniverse with MaterialX and OpenPBR

Charles Anderson, Derek Haase, Jan Jordan, Minjae Lee, Frankie Liu, Kai Rohmer,
Masuo Suzuki and the NVIDIA Team

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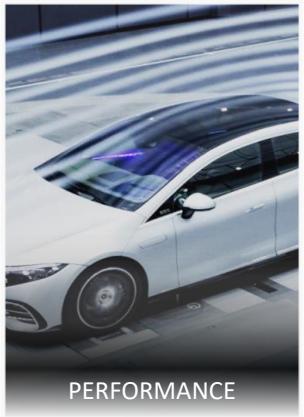
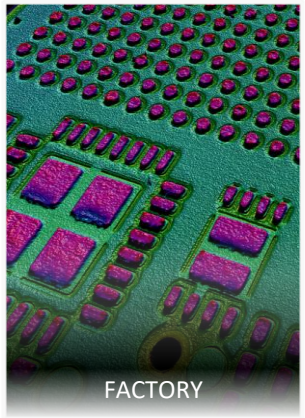
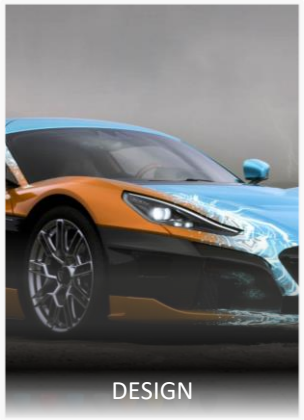
NVIDIA Omniverse Platform

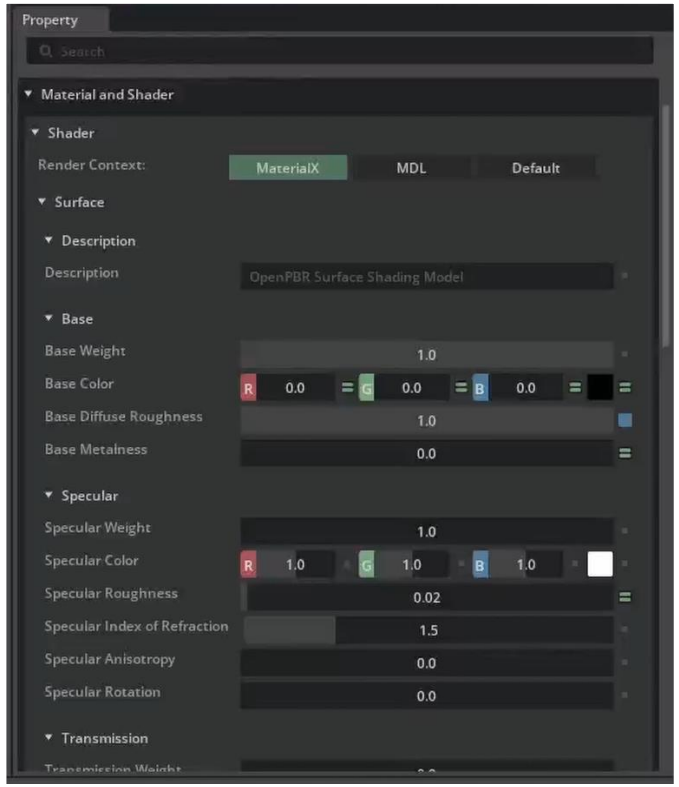
Design, Build, Optimize - Virtually

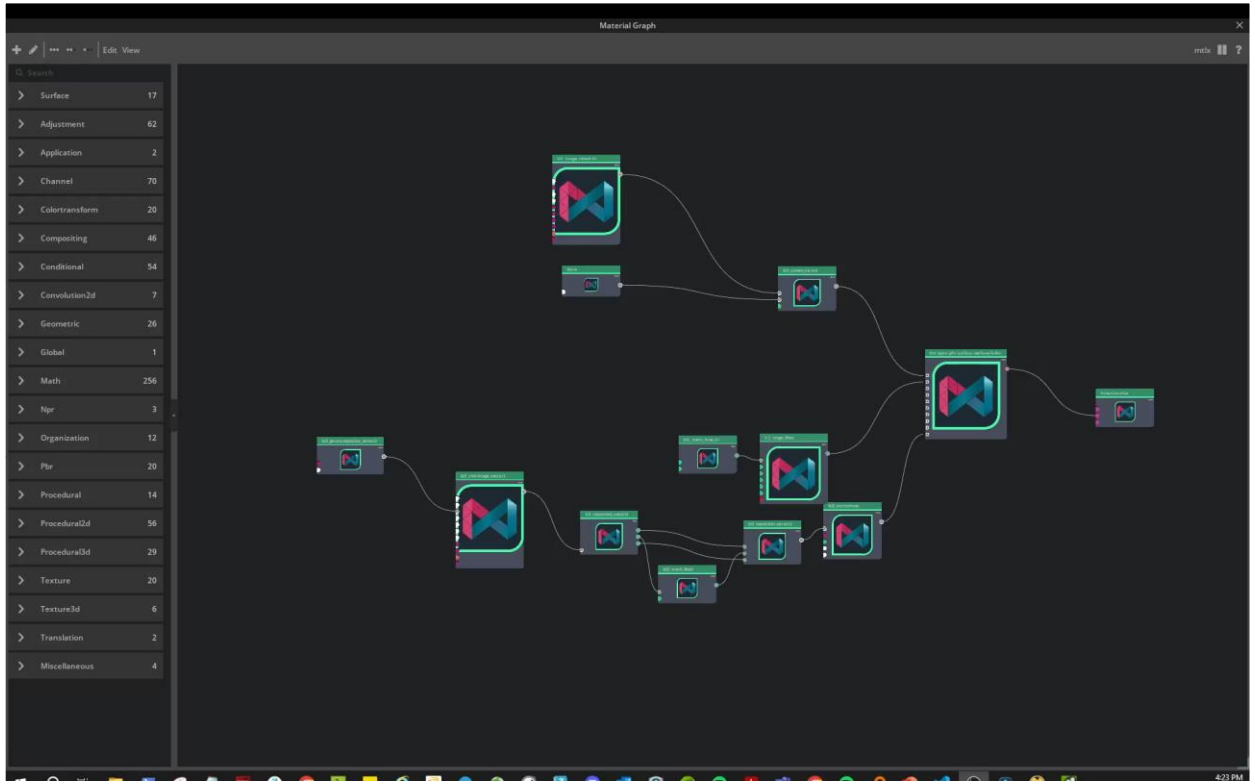






First Class MaterialX Support





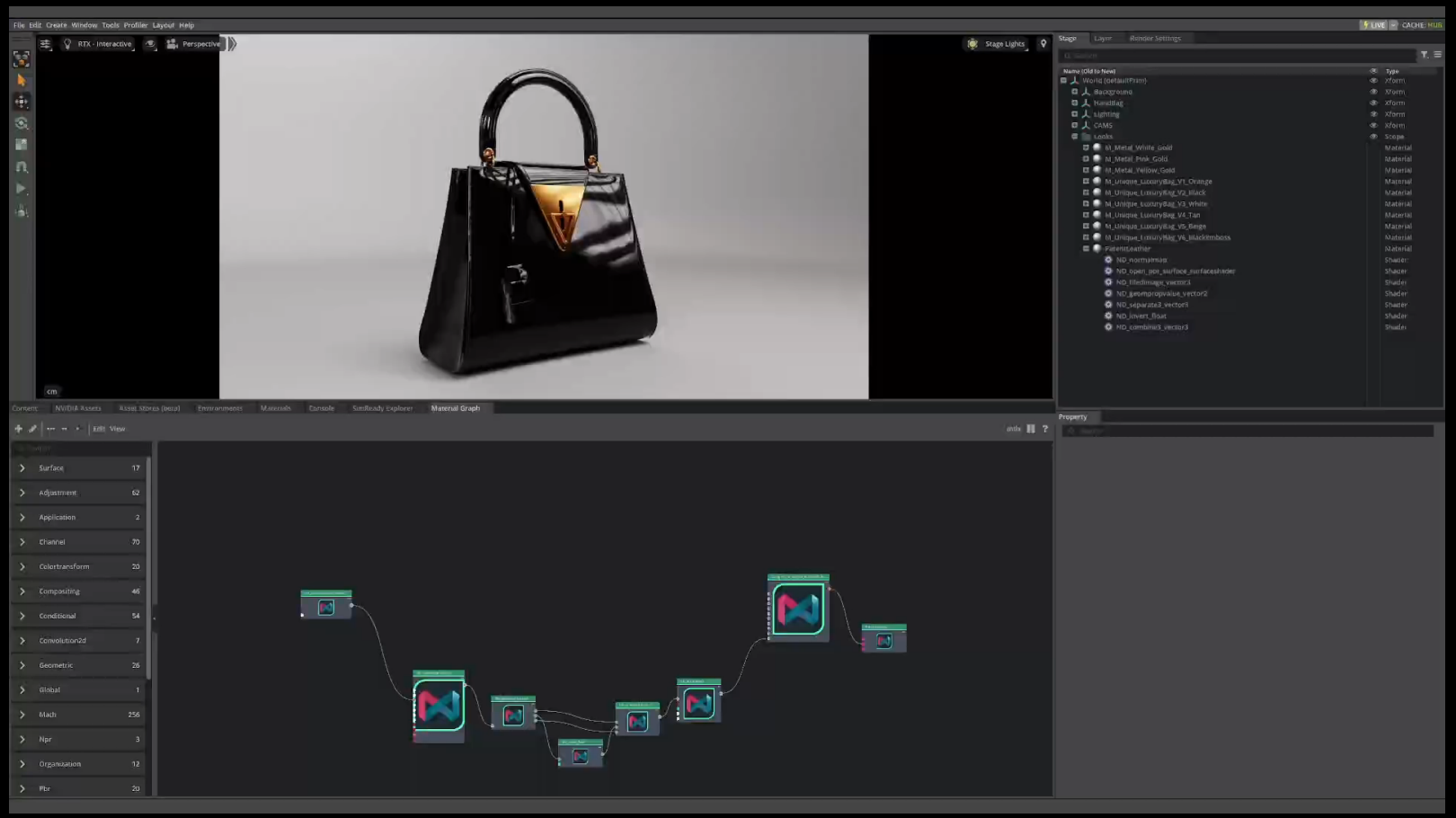
OpenPBR Library

OpenPBR Library

USD SmartMaterials NIM

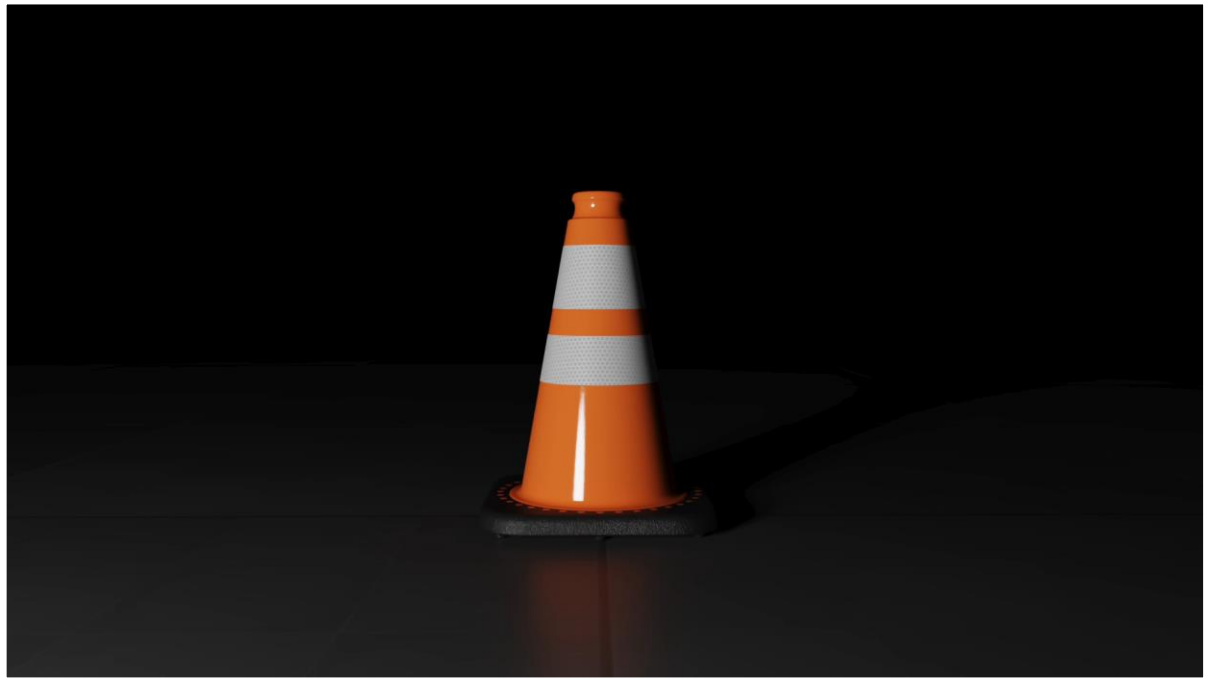

```
describe_model
{
    "model_name": "Luxury HandBag",

    "description": "The 'Luxury HandBag' typically features a combination of high-end, durable and
              aesthetically pleasing materials. It is usually a fashion accessory with a structured
              body, a handle for carrying, and various decorative and functional components such as
              rings,legs, a lock, and sometimes a clochette for keys or decoration.
              Common materials for its components include:

              Cover: Leather (such as cowhide, lambskin or exotic skins) or high-quality
              synthetic materials designed to mimic leather.

              Handle: Leather wrapped around a sturdy core material such as metal or hard plastic, or
              entirely made of these materials.

              Body: Premium leathers, vegan leathers, or structured textiles often reinforced with an
              internal frame made of metal or hard plastic.

              Ring: Metal alloys such as brass, gold-plated metal, or stainless steel for structural
              support and decorative elements.

              Legs: Metal to protect the bottom of the bag and to provide stability when placed on
              surfaces.
              Handle Rings: Metal, often the same as the rings for design consistency and durability.
              Lock: Metal such as brass, nickel, or gold-plated components; may include a small amount
              of plastic or rubber for the locking mechanism.

              Clochette: Leather or a high-quality synthetic material, occasionally with metal
              hardware.

              These materials are selected for their quality, longevity, and to provide a luxurious
feel          and appearance to the handbag."
}
```

MaterialX Authoring



Future Work

Future Work



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LookdevX in Maya

Nikola Milosevic, Product Manager
Orn Gunnarsson, Sr. Dev Manager

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SAFE HARBOR STATEMENT

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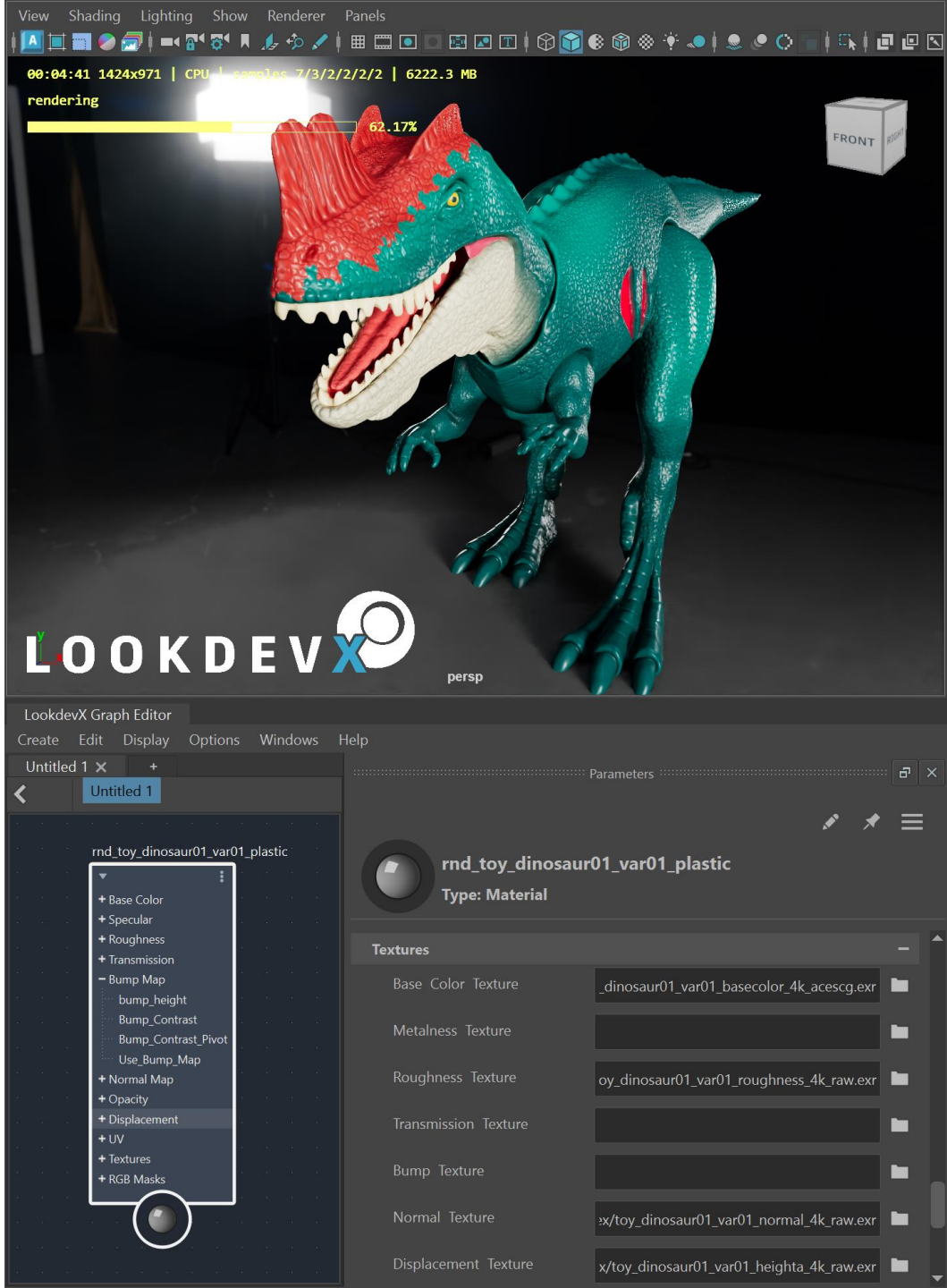
LOOKDEVX
Agnostic Material Authoring
USD
MATERIALX

LookdevX | Agnostic Material Editor

- Native USD & MaterialX authoring
- Open Rendering
- Enabled for DCC portability



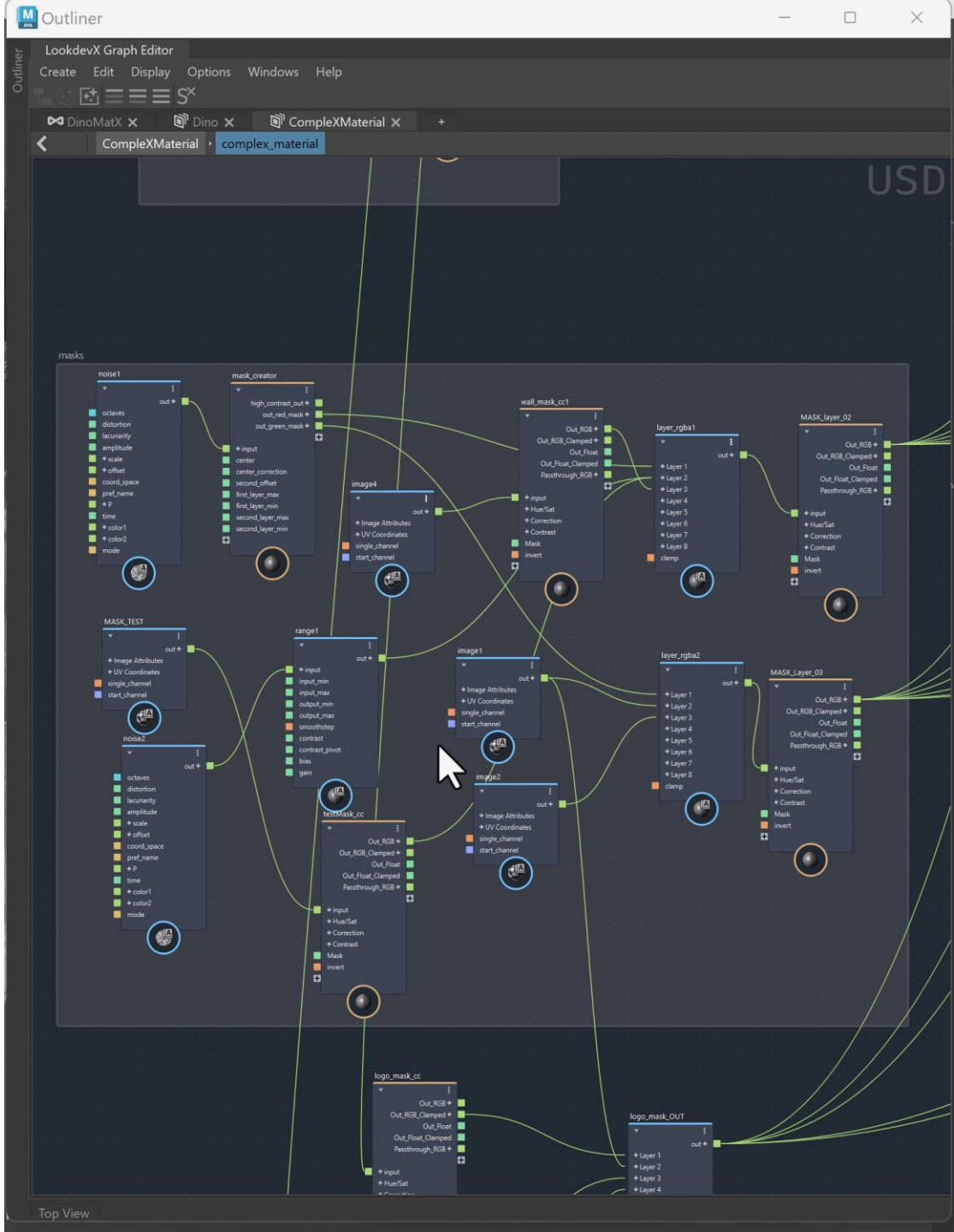
LookdevX | Release Highlights

2024 Native USD Material Support

2024.2 Workflow improvements

2025 Native MaterialX Support

2025.x Workflow improvements




LOOKDEVX
Maya 2025
USD
MATERIALX

MaterialX | LookdevX

Enabling MaterialX Workflows

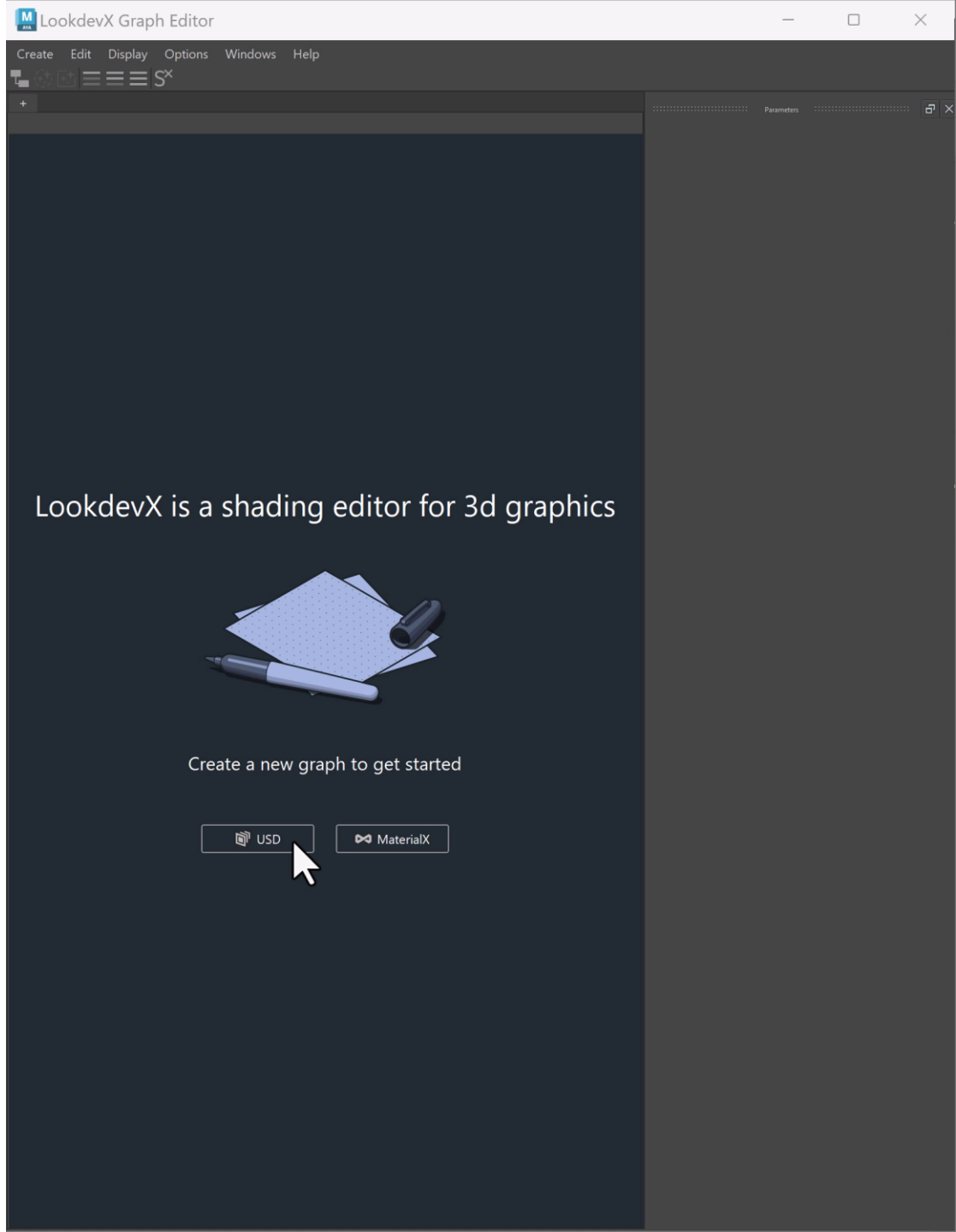
Natively Authoring MaterialX Graphs in Maya using LookdevX as agnostic authoring shader toolset.

Assign materials to **Maya geometry** and manage it through known direct material assignments workflows.


Demo_01.mb* - Autodesk MAYA Preview Release 153: L:\OneDrive - autodesk_Render_MaterialX_ShaderX\BetaForum\Beta_151\Demo_01.mb
File Edit Create Select Modify Display Windows Mesh Edit Mesh Mesh Tools Mesh Display Curves Surfaces Deform UV Generate Cache Arnold Help
Workspace: General*
Modeling
No Live Surface
Symmetry: Off
Outliner
Display Show Help
Search...
persp
top
front
side
geo_rnd_toy_dinosaur02_var01_01
materialXStack1
materialXStackShape1
NativeMaterialX
StS_Dino
SM_Dino
basecolor
normal
normalmap2
roughness
swizzle2
range1
Dino_normal_disp
Dino_normalize
Dino_multiply_disp
range3
Dino_displacement
Dino_height
brick_flemish_subtract
Displacement
Specular
Bump_Normal
stage1
stageShape1
geo_rnd_toy_dinosaur02_var01_01
mtl
rnd_toy_dinosaur02_var01_plastic1
shadow_matte
standard_surface1
pPlane1
aiSkyDomeLight1
CameraMain
defaultLightSet
defaultObjectSet
USD Layer Editor
Create Option Help
USD Stage: stageShape1
sessionLayer*
beta152.usd*
mdl1_render.usd
View Shading Lighting Show Renderer Panels
ACES 1.0 SDR-video (sRGB)
USD
AYA
CameraMain
MEL

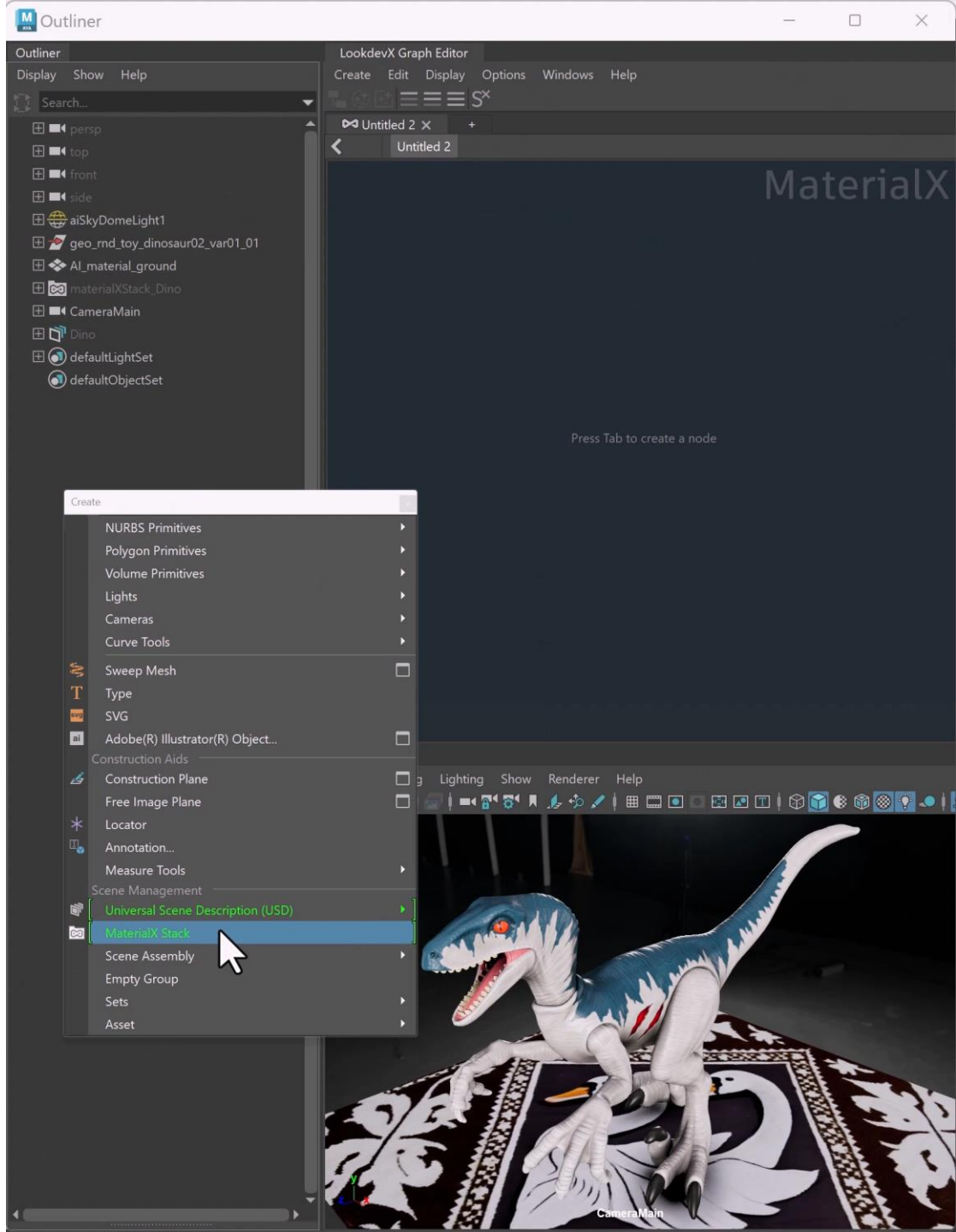
Maya 2025 | LookdevX

- Unifying different datatype workflows
  - Introducing Multiple runtimes
- Enable LookdevX as Agnostic Editor
  - Choose your shading data - Starting screen
  - Creating Shading data models per specific Tabs
    - Graph, Tabs, Nodes



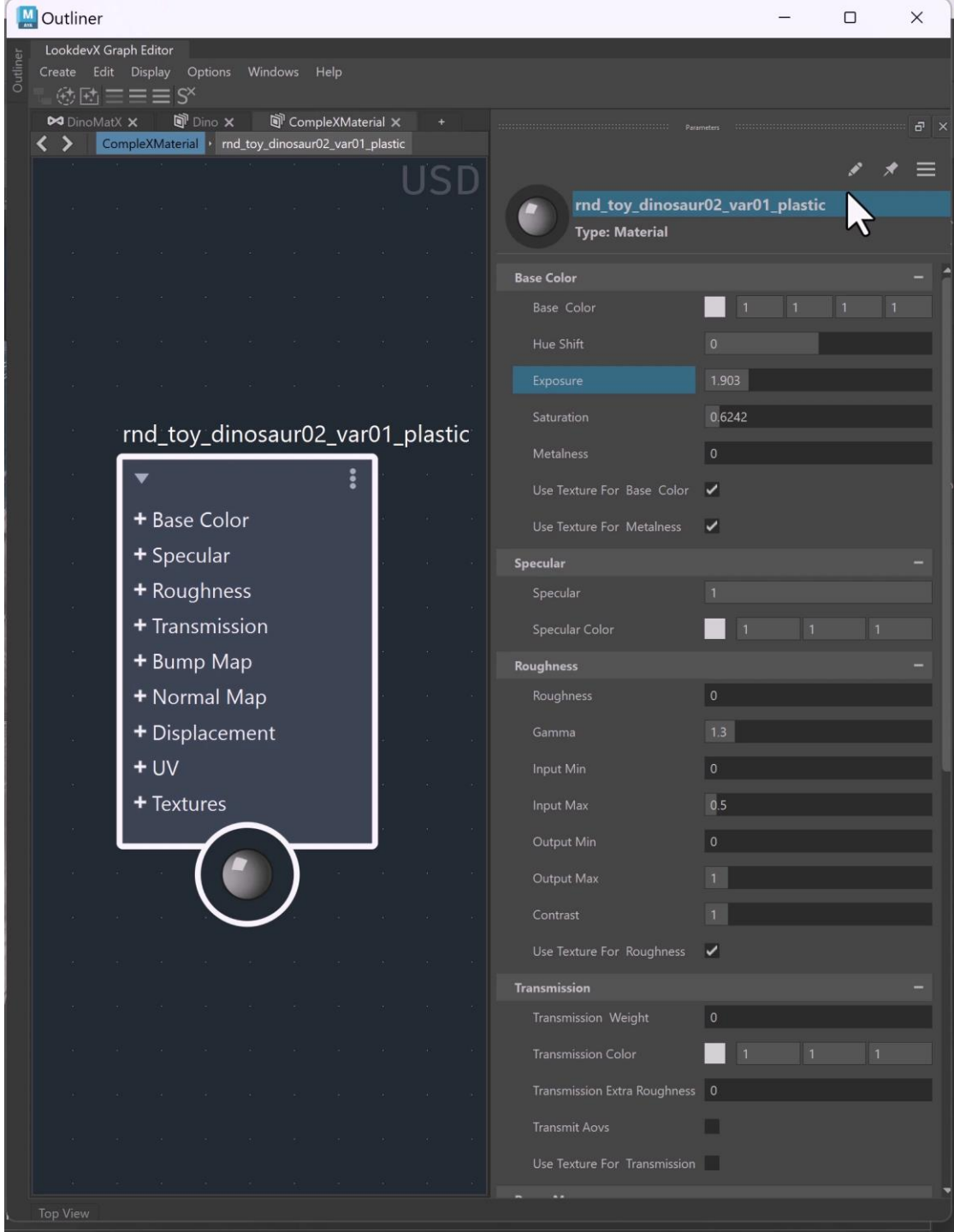
Maya 2025 | LookdevX

- MaterialX Document Stack I/O
- MaterialX Document I/O
- Native Maya MaterialX Assignment
  - Outliner, VP, LookdevX



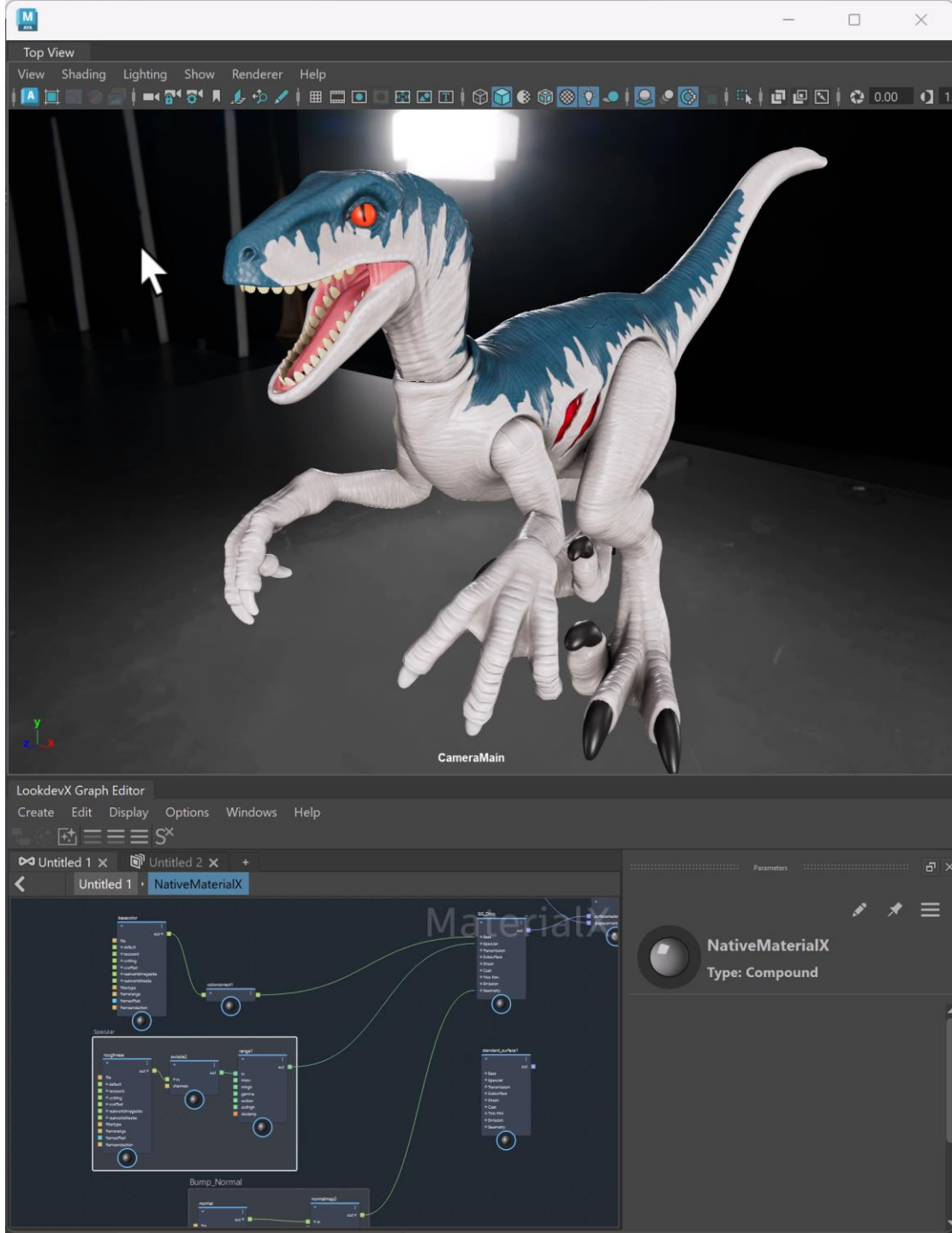
Maya 2025 | LookdevX

- Graph Creation Improvements
- Material Authoring enhancements
- Toolbar – Icon shelf
- Improving workflows Performance



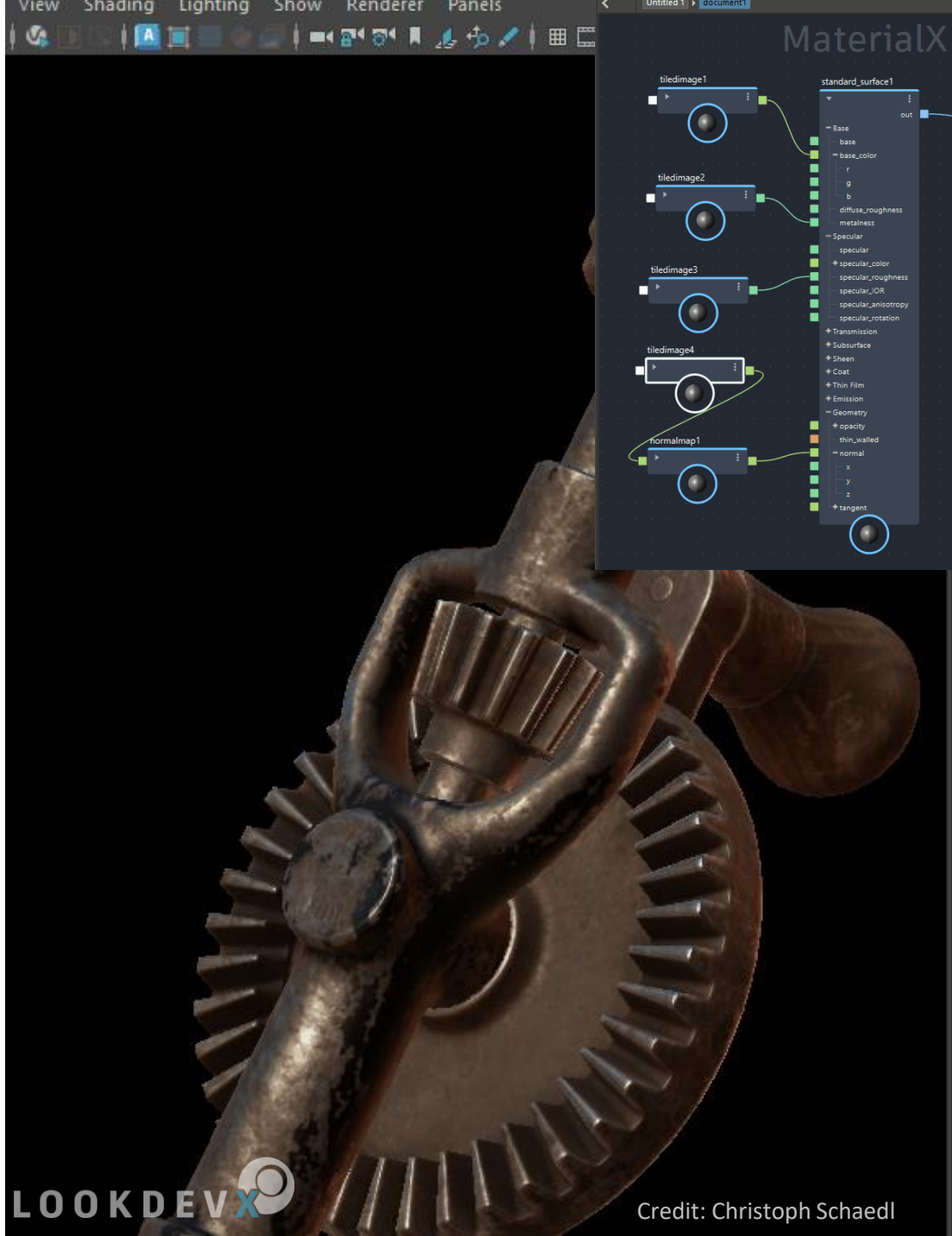
Maya 2025 | Arnold support

- Exposed Arnold Materials Through MatX
- Supporting Maya MaterialX Library
- Arnold Icons



LookdevX | Open rendering

- Third party renderers can express their graphs through LookdevX
  - Shader discovery through USD schemas and MaterialX node definitions
  - Leveraging LookdevX UX features
    - Solo, Node icons, Icons, Node graphs ..etc

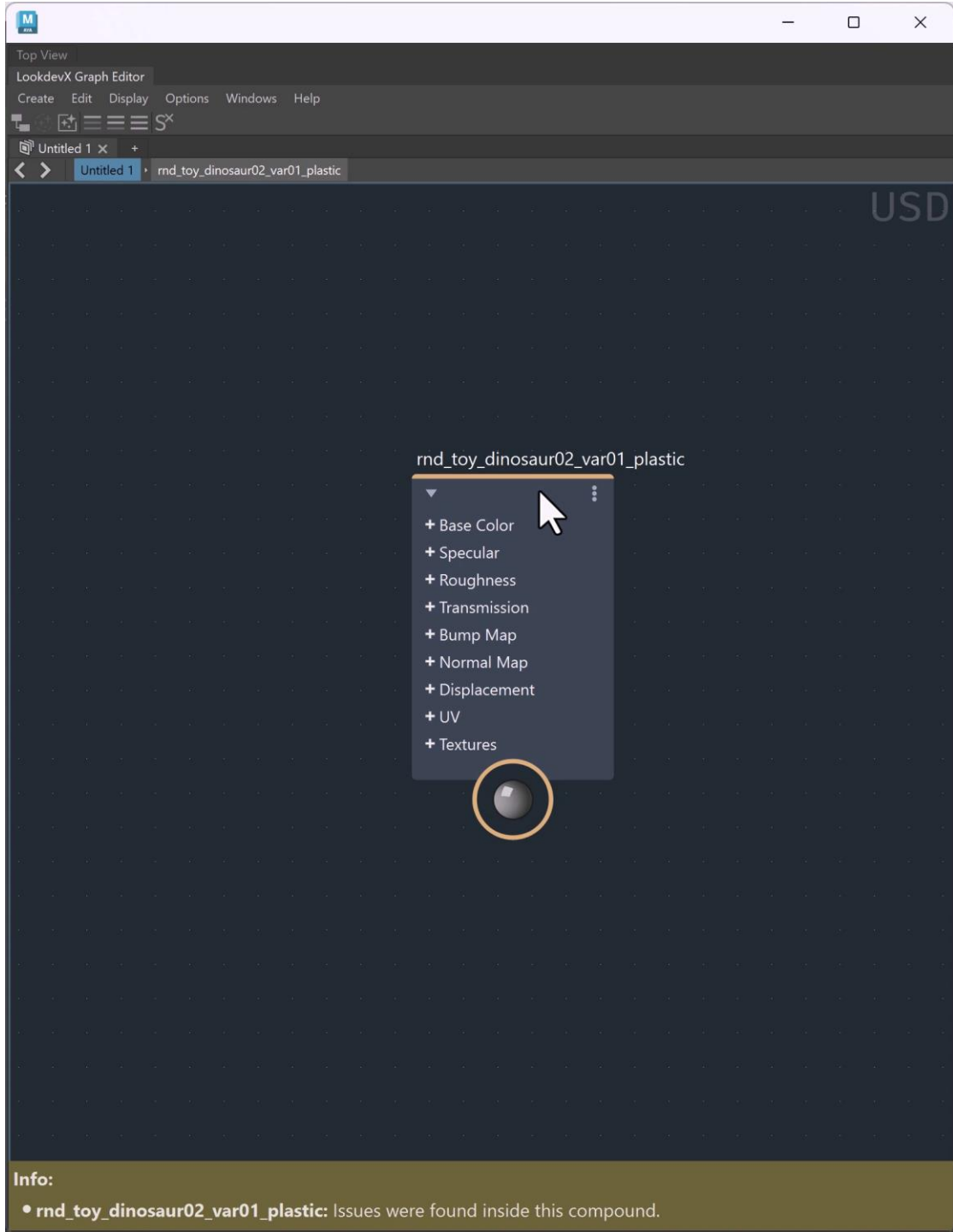



LOOKDEVX
Road map - Maya 2025.X
USD
MATERIALX

Maya 2025.1 | LookdevX

Key Features

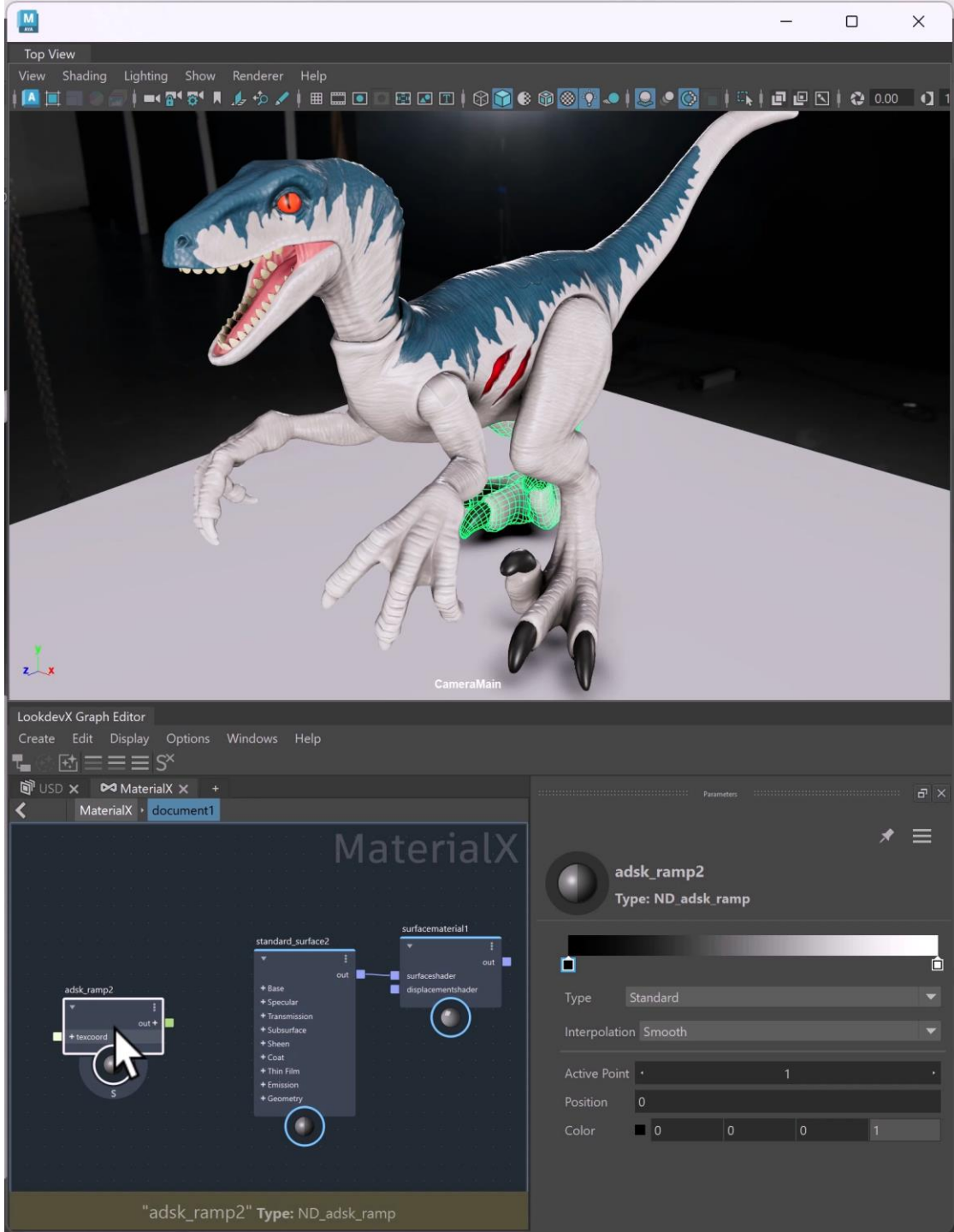
- Hide input Nodes
- Assigning New & Existing Materials
- Node Library UI
- Supporting Volume Shaders
- VP support for Arnold materials through MaterialX



Maya 2025.next | LookdevX

Key Features

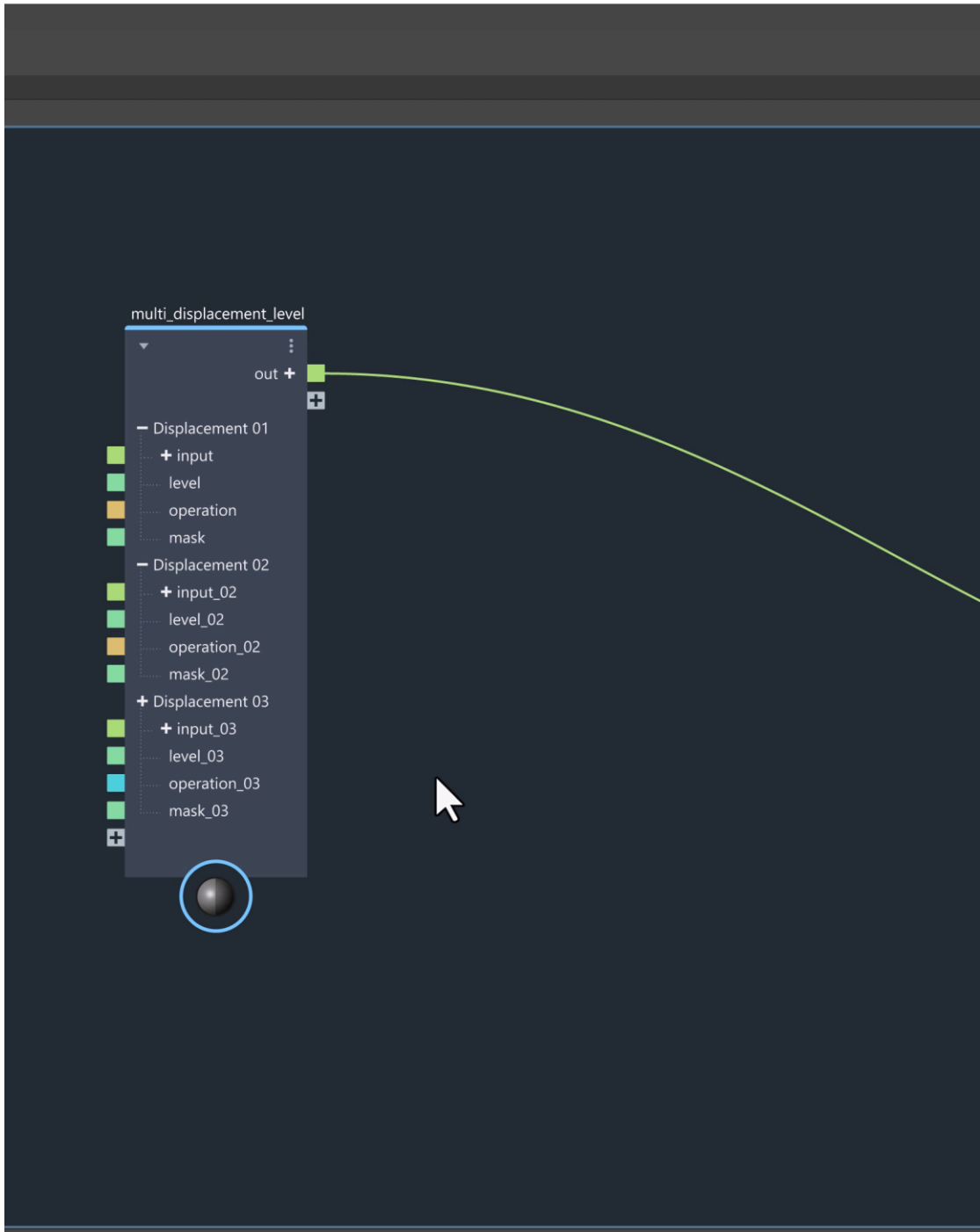
- Ramp node
- Dynamic Port Workflow – Smart Connections
- Exposed Material Binding and Inheritance in AE
- VP support for Arnold materials through MaterialX



Maya 2025.X | LookdevX

Key Features

- Publishing workflows (Phase I) - MaterialX
- USD Referencing MaterialX graphs – Cleanup
- Relative path support – MaterialX
- Component Tag’s MaterialX support
- Automation tools (Python bindings)



OpenPBR Material

Maya 2025 | LookdevX

- Exposed through MaterialX from Arnold library

Now | Maya Beta

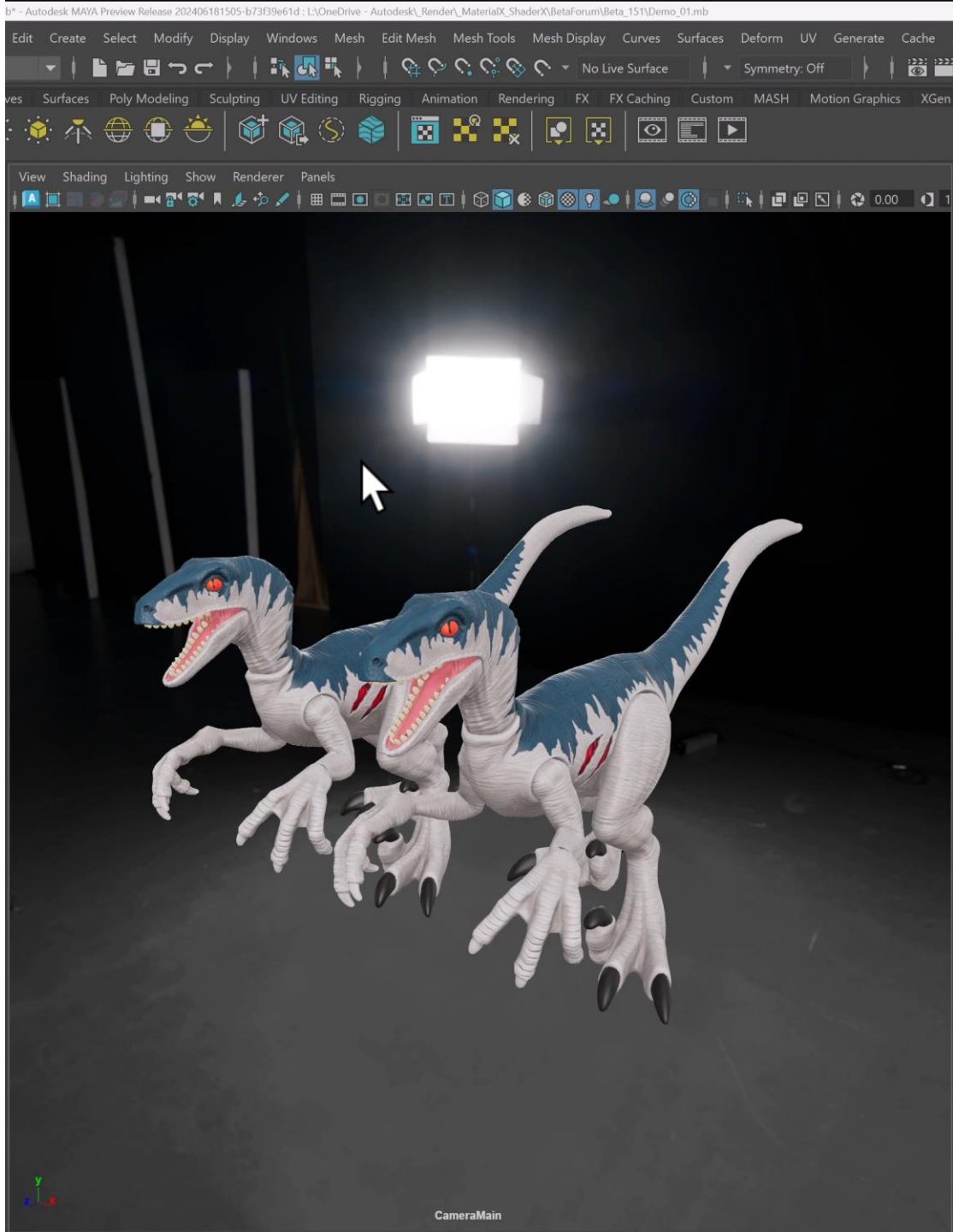
- Exposed in LookdevX and Maya Hypershade

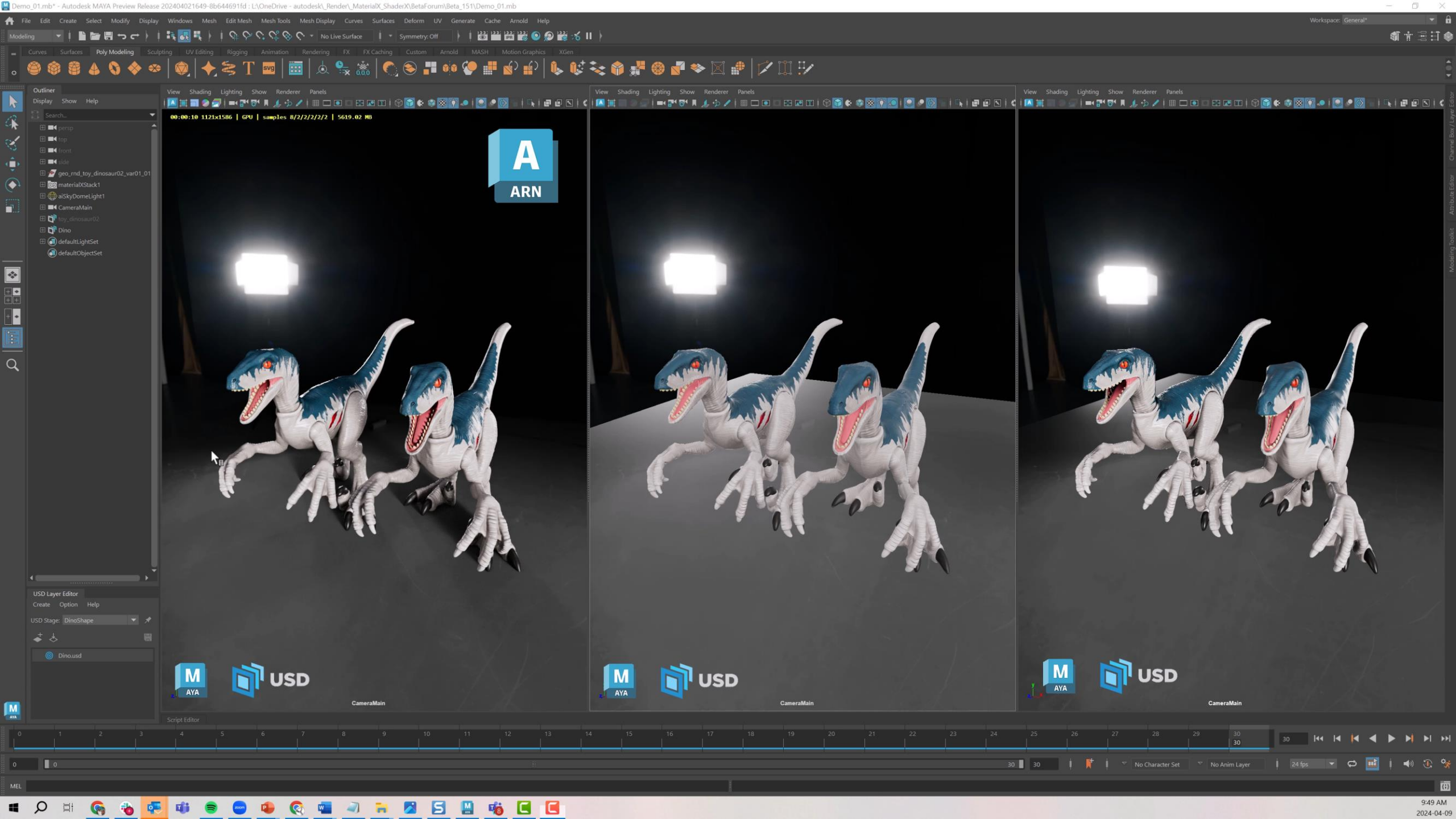
Next | Maya & 3ds Max

- Open PBR material Native DCC Integration

Hydra | LookdevX

- Hydra support
  - Material graphs can be accurately represented in Storm and Arnold delegate

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Workspace: General*
Modeling
No Live Surface
Symmetry: Off
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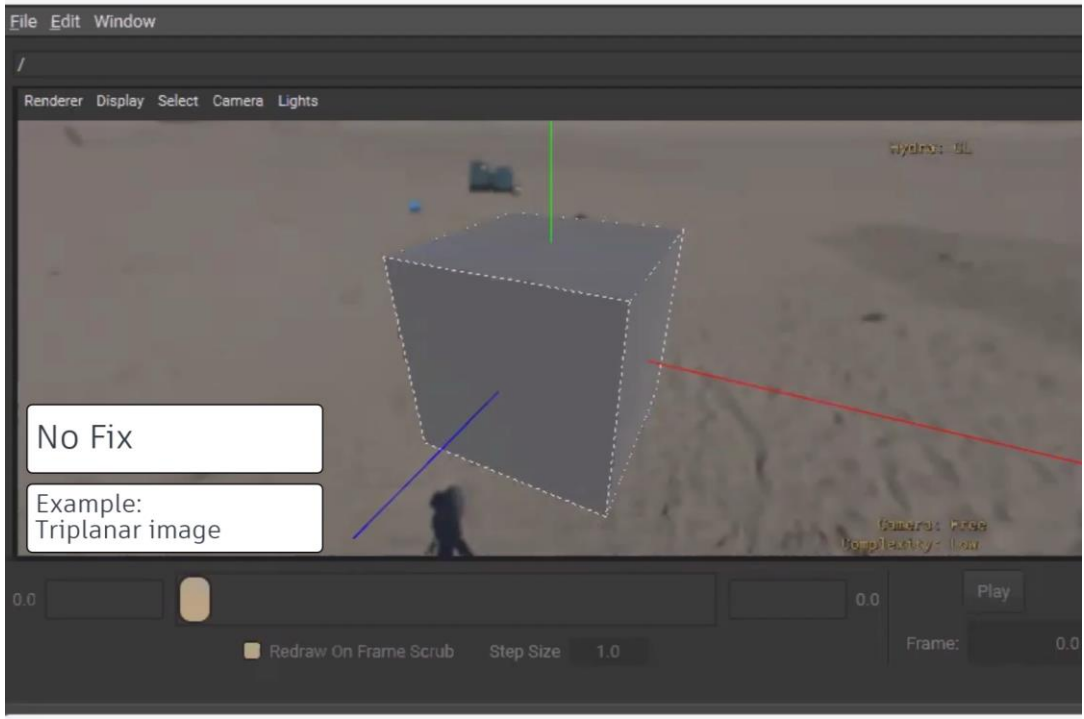
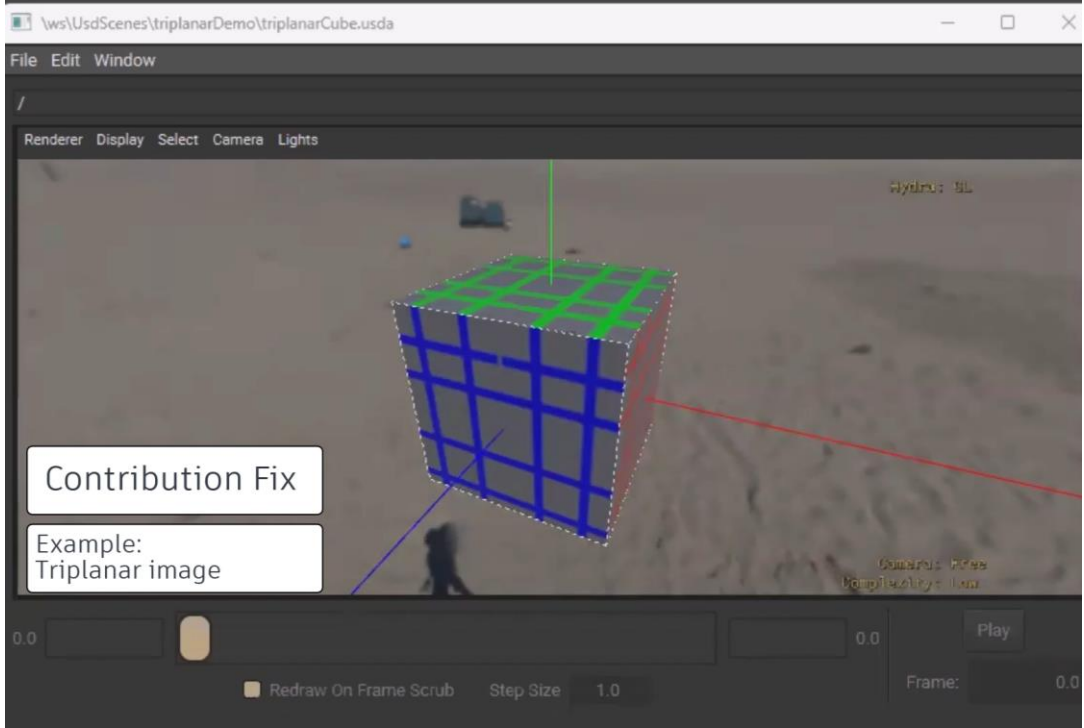
2024-04-09

LookdevX | Contributions

- Image node's fixes – MaterialX
  - Triplanar, gltf_image, UsdUVTexture
- Loading Material graphs optimization
  - Smart shader generation
- MaterialX OCIO plugin
  - Enable OCIO or OCIO-Nano for color conversions





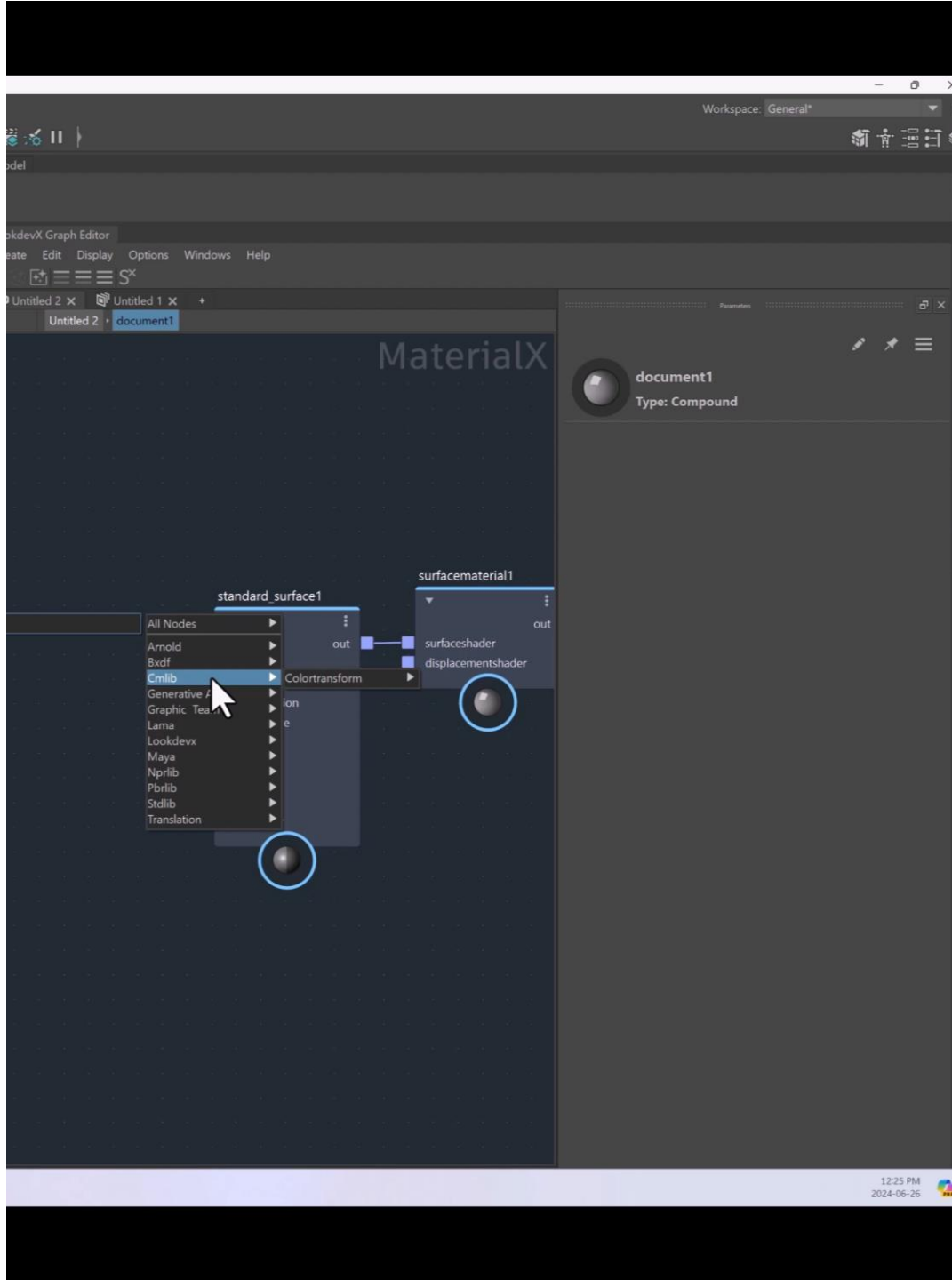
LookdevX | Planned Contributions

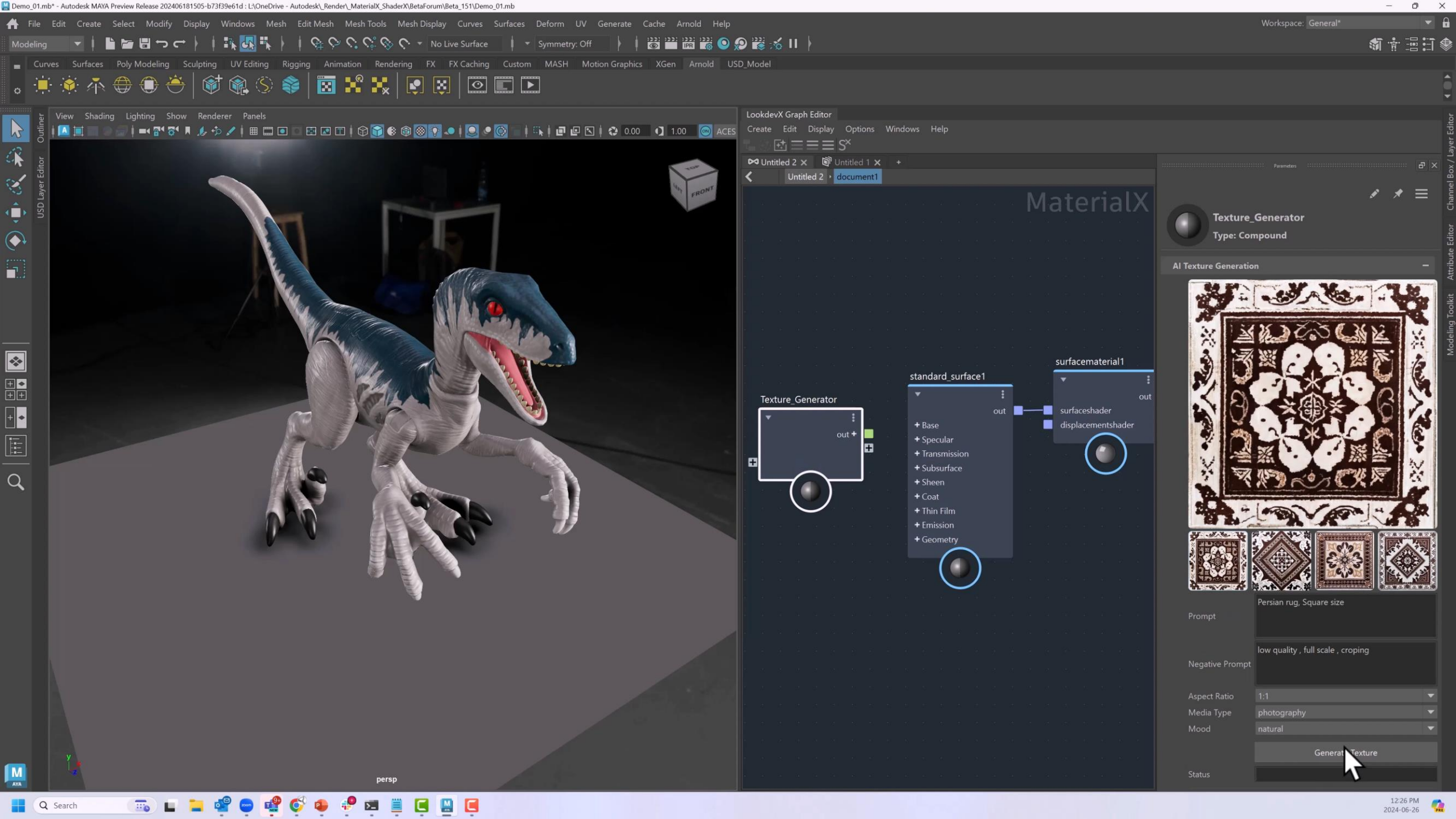
- Ramp node
- Conversion nodes
- Bias and Gain nodes

AI Enabled Workflows | LookdevX

Available for testing in upcoming Maya Beta

- Ethically Collected Data AI Models
- Working with multiple service providers
- Authentication using Autodesk SSO
- **API enabled extendable custom Data model**

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File Edit Create Select Modify Display Windows Mesh Edit Mesh Mesh Tools Mesh Display Curves Surfaces Deform UV Generate Cache Arnold Help
Workspace: General*
Modeling
No Live Surface
Symmetry: Off
Curves Surfaces Poly Modeling Sculpting UV Editing Rigging Animation Rendering FX FX Caching Custom MASH Motion Graphics XGen Arnold USD_Model
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Untitled 2
Untitled 1
Untitled 2 document1
MaterialX
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+ Transmission
+ Subsurface
+ Sheen
+ Coat
+ Thin Film
+ Emission
+ Geometry
surfacematerial1
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surfaceshader
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Parameters
Texture_Generator
Type: Compound
AI Texture Generation
Prompt
Persian rug, Square size
Negative Prompt
low quality , full scale , croping
Aspect Ratio
1:1
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Status
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Attribute Editor
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open source days '24

/* ACADEMY SOFTWARE FOUNDATION

Virtual Town Hall Series

MaterialX in V-Ray

Mihail Djurev, Chaos Software

#ASWF

Chaos V-Ray

- Architectural visualization

Chaos V-Ray

- Architectural visualization
- Product design

Chaos V-Ray

- Architectural visualization
- Product design
- VFX

V-Ray ecosystem in a nutshell

- Has integrations with many DCCs
- Extensible through plugins
- Supports OSL, GLSL and MDL
- V-Ray GPU
  - Most of V-Ray's functionality reimplemented to run fast on GPUs
  - Used in production
- Vantage
  - Standalone real-time renderer

Why MaterialX?

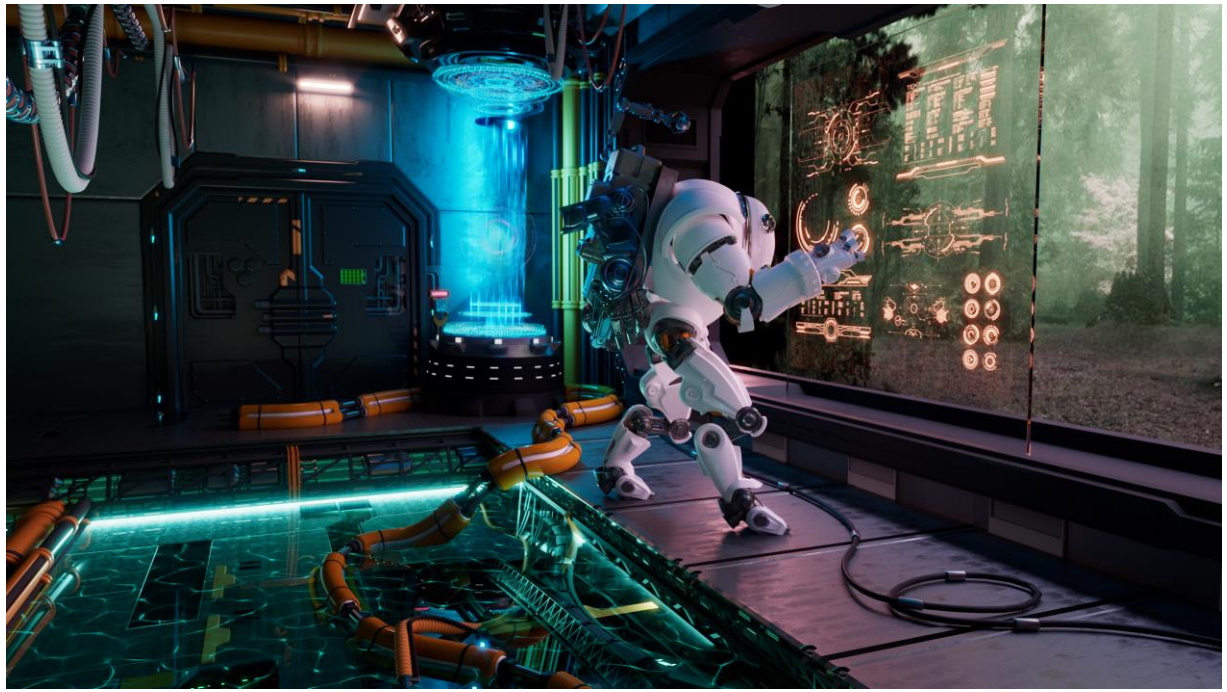
- Every DCC has its own material nodes
- V-Ray supports them through native nodes or translation
- Exporting is easy, importing is hard
- A common, restricted, complete set of nodes
- Nodegraph implementation

MaterialX in V-Ray implementation

- Writing renderer integrations is hard
- Native V-Ray implementation for each MaterialX node
- Same node and attribute name in V-Ray and MaterialX
- Minimize translation
- Native integration solves compilation time

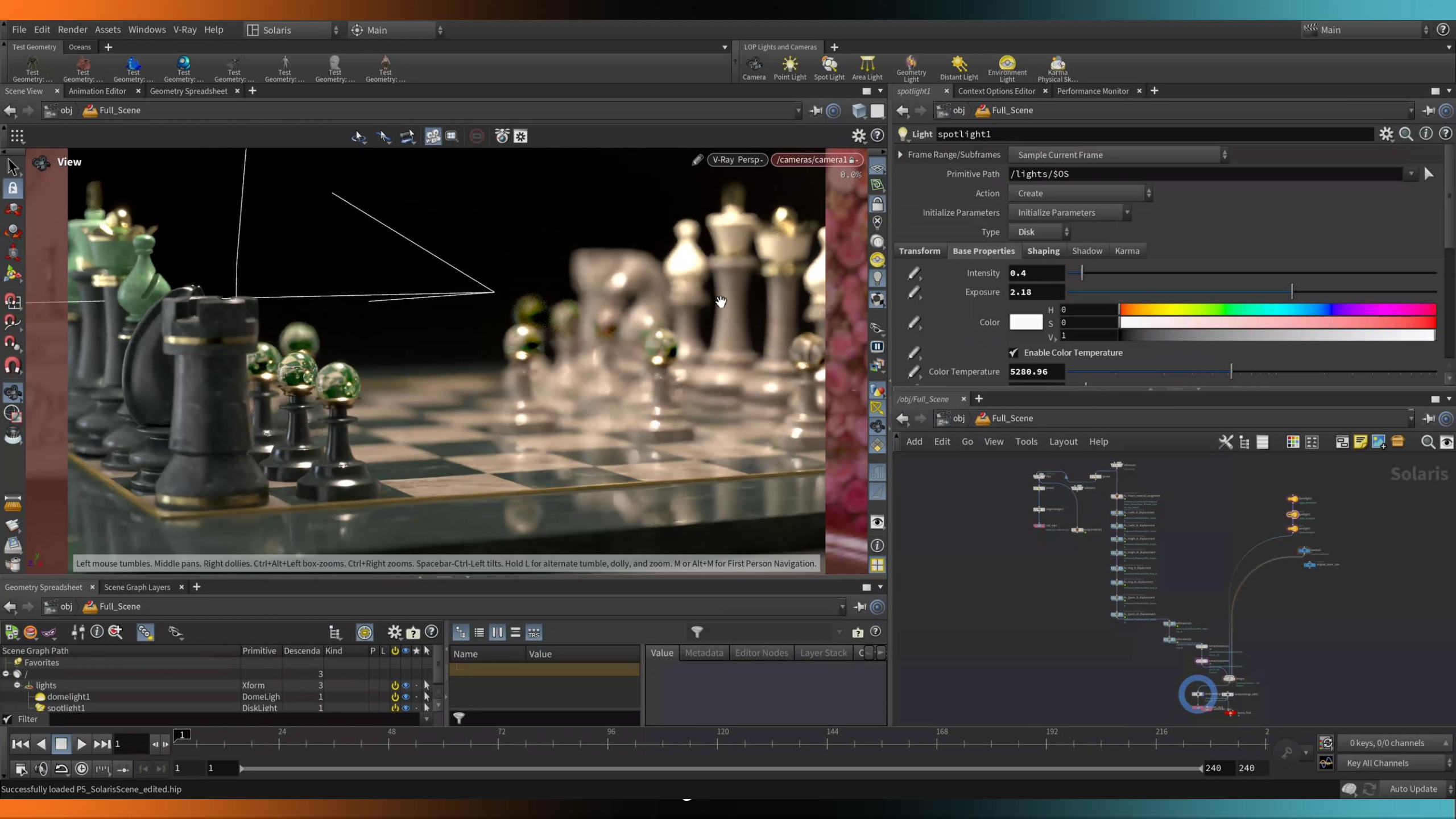
MaterialX nodes in V-Ray

- Used code generation
  - Mapped existing V-Ray nodes to MaterialX nodes when possible
  - Present as a single node
- Support MaterialX node graph definitions internally
- Transpiled OSL & MDL code for procedural textures



Future plans

- OpenPBR support
- V-Ray material nodegraph definition
  - Allows us to display V-Ray material in other MaterialX applications
- MaterialX support in Vantage


File Edit Render Assets Windows V-Ray Help
Solaris
Main
Test Geometry
Oceans
LOP Lights and Cameras
Camera
Point Light
Spot Light
Area Light
Geometry Light
Distant Light
Environment Light
Karma Physical Sk...
Scene View
Animation Editor
Geometry Spreadsheet
spotlight1
Context Options Editor
Performance Monitor
obj
Full_Scene
View
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/cameras/camera1
Light spotlight1
Frame Range/Subframes
Sample Current Frame
Primitive Path
/lights/$OS
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Initialize Parameters
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Type
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Base Properties
Shaping
Shadow
Karma
Intensity
0.4
Exposure
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S 0
V 1
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Add Edit Go View Tools Layout Help
Solaris
Left mouse tumbles. Middle pans. Right dollies. Ctrl+Alt+Left box-zooms. Ctrl+Right zooms. Spacebar-Ctrl-Left tilts. Hold L for alternate tumble, dolly, and zoom. M or Alt+M for First Person Navigation.
Geometry Spreadsheet
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MaterialX in Houdini 20.5

Chris Rydalch, SideFX

July 23, 2024

MaterialX in Houdini 20.5

- Overview
- Quick Surface Materials
- Copernicus

Overview

MaterialX in Houdini 20.5

- MaterialX first included with H19.0
- Initial adoption motivated by Karma XPU
  - Need to build materials for both Karma delegates
- Takes a “MaterialX-as-Spec” approach
  - Renderers ingest shading graphs on-the-fly
  - No reliance on MaterialX code-gen
- Focused on USD-encoded MaterialX materials
- Super-set of Karma-specific nodes where needed

MaterialX in Houdini 20.5

- **Houdini**
  - H20.5 released July 10th
- **USD**
  - 24.03 (from 23.08)
- **MaterialX**
  - 1.38.10 (from 1.38.8)

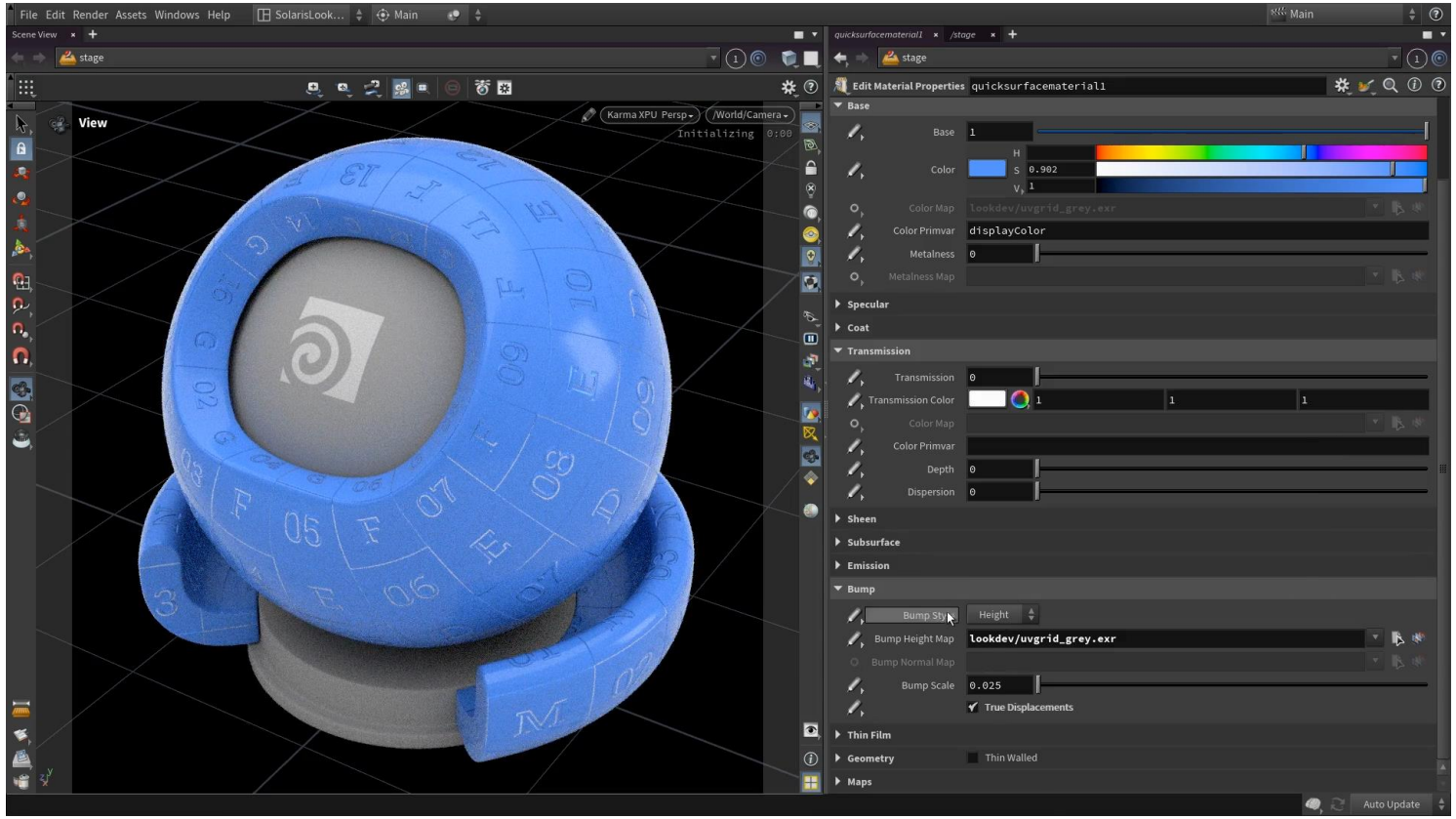
	USD	MtlX	VFX
H20.5	24.03	1.38.10	CY2024
H20.0	23.08	1.38.8	CY2023
H19.5	*22.05*	*1.38.4*	*CY2022*
H19.0	*21.08*	*1.38*	*CY2021*

https://www.sidefx.com/docs/houdini20.5/licenses/index.html

Quick Surface Material

MaterialX in Houdini 20.5

- Quick Surface Material
  - Uses standard MaterialX nodes
  - Based around mtlxstandard_surface*
- Referenced from USD layer
  - Users adjust public interface
  - Instanceable references by default
- Shared materials/prims = more efficient scenes
- Less context diving/switching for artists
- Initial workflow/pipeline possibilities with UsdShade

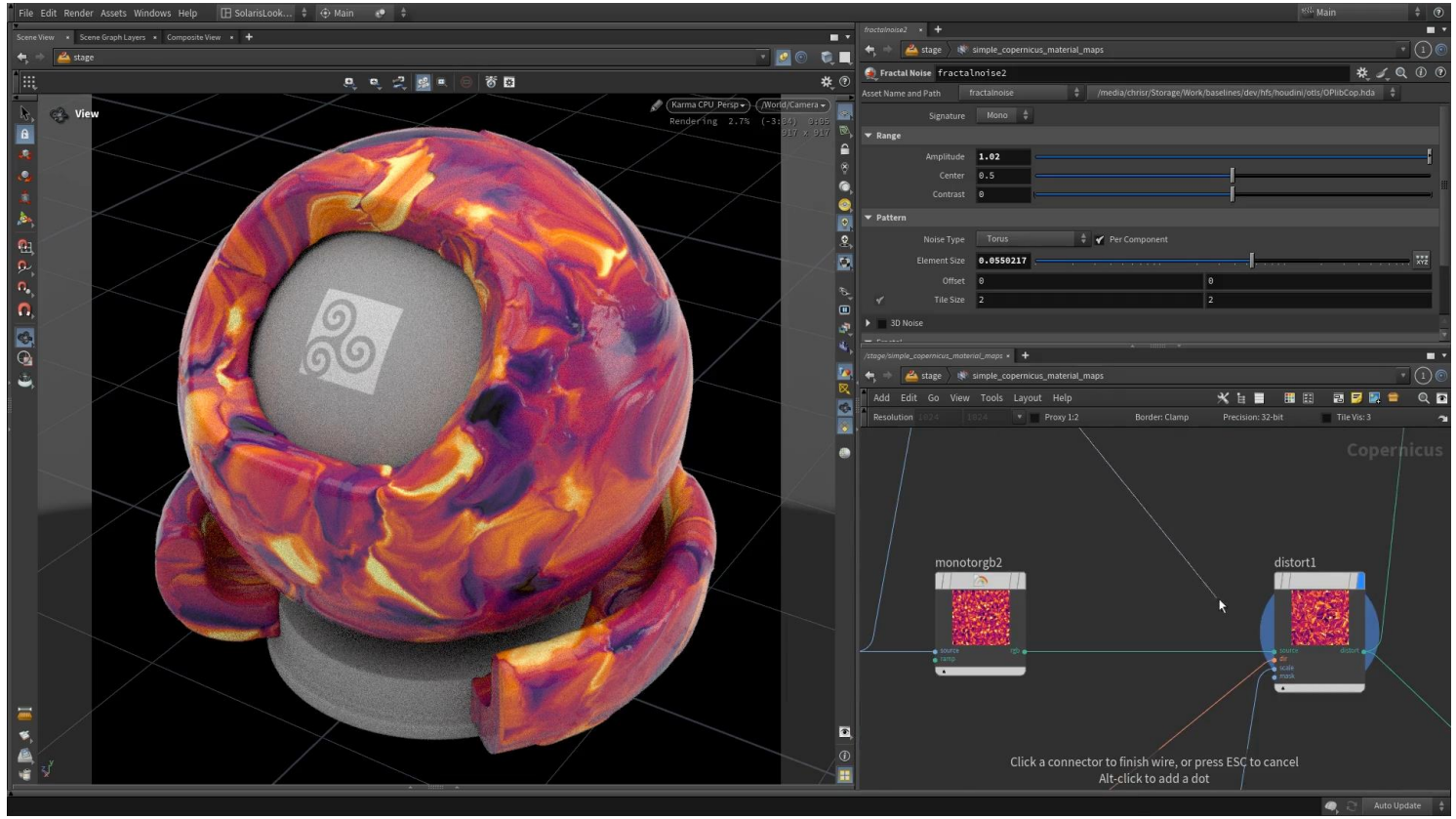


** OpenPBR planned for future releases*

Copernicus

MaterialX in Houdini 20.5

- New, Fast Image-Processing Engine and Context in Houdini
- Embraces open standards
  - OpenCL for most nodes
  - OpenFX plugin support
- Copernicus maps via MaterialX texture nodes, update live in Solaris
- Many workflows are still in-progress (i.e. it's beta!)




Thank You!
Questions?