



TRESSFX 3.0 

PART OF THE GPUOPEN INITIATIVE
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HIGH-LEVEL AGENDA

- ▲ Brief TressFX overview
- ▲ TressFX 3.0 library
 - Update to AMD's TressFX example implementation
 - Maya plugin
 - Viewer and runtime library (with full source)
 - Fur support
 - Skinning
 - Future optimizations



A BRIEF HISTORY

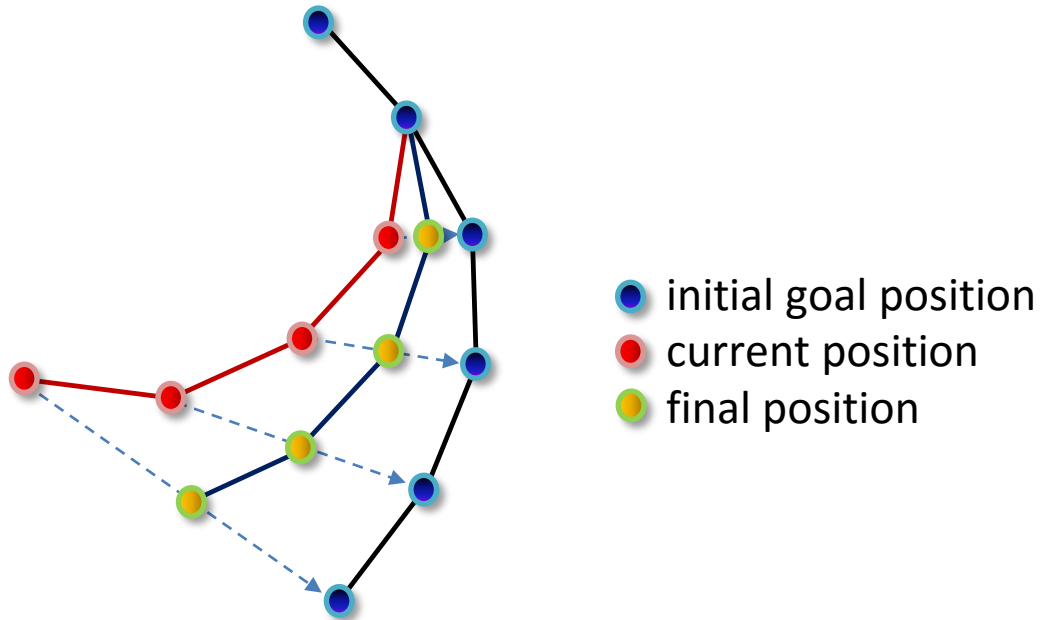
- ▲ TressFX began as a collaboration between AMD and Crystal Dynamics
- ▲ First used in Tomb Raider
 - PC and consoles
 - Set new quality bar for hair in games
- ▲ Optimized for AMD GCN architecture
 - Radeon HD 7000 or later
 - Consoles
- ▲ AMD is now also collaborating with Eidos-Montréal
 - Started with Tomb Raider code
 - Improvements and additions integrated into Dawn Engine™
 - Will be used in future Deus Ex Universe projects

**CRYSTAL
DYNAMICS**
SQUARE ENIX



TRESSFX OVERVIEW

- ▲ Two parts to TressFX
 - Physics simulation on the GPU using compute shaders
 - High-quality rendering
- ▲ Simulates and renders individual hair strands

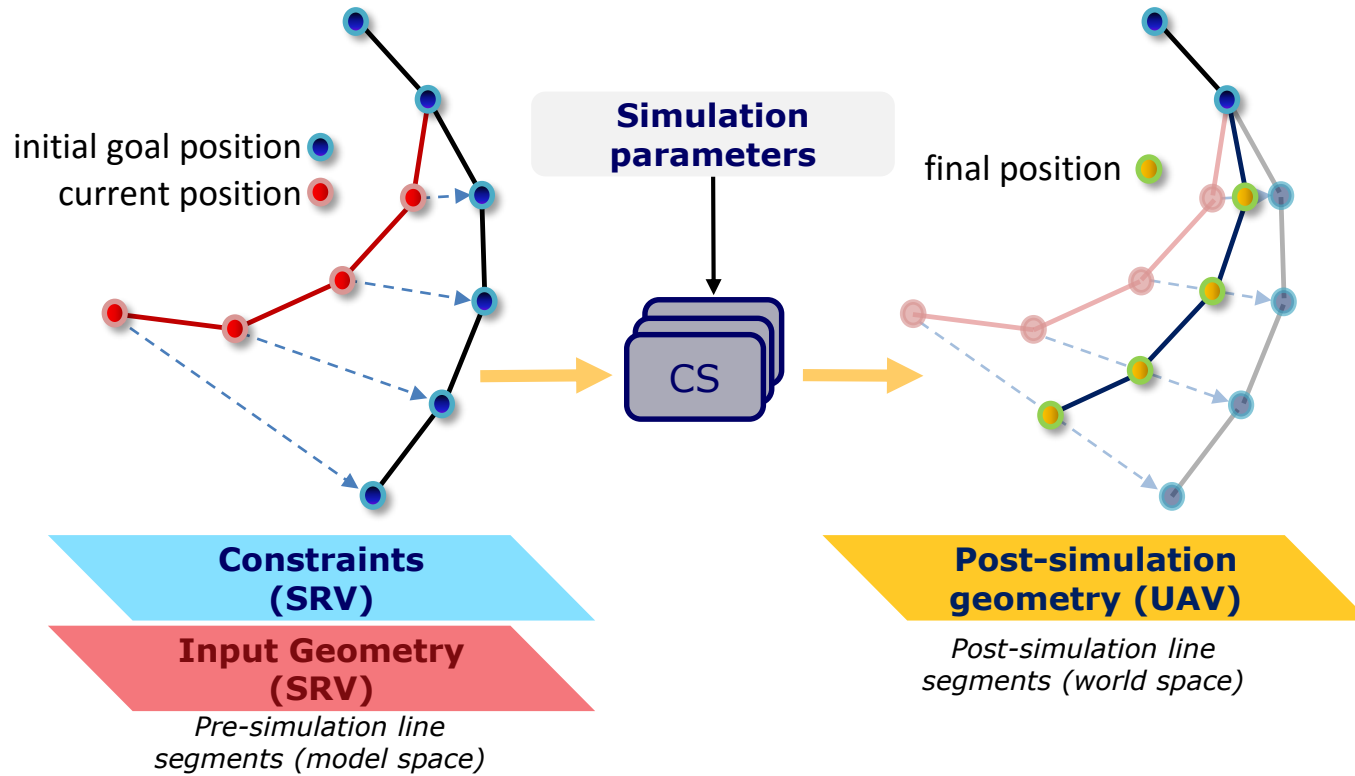


SIMULATION



RENDERING

TRESSFX SIMULATION



- ▲ **SIMULATION COMPUTE SHADERS**
- Edge length constraint
 - Local shape constraint
 - Global shape constraint
 - Model Transform
 - Collision Shape
 - External Forces (wind, gravity, etc.)



Good Lighting + Anti-Aliasing

+ Volume Shadows

+ Transparency



TRESSFX 3.0 LIBRARY

TRESSFX SAMPLE HISTORY

▲ TressFX 1.0

- Example implementation (with full source)

▲ TressFX 2.x

- Simulation performance improvements
 - Master and slave strands
 - Compute shader optimizations
 - 1.6 ms → 0.3 ms
- Rendering performance improvements
 - Deferred rendering
 - Distance adaptive LOD
 - Pixel shader optimizations
 - 1.7 ms → 1.2 ms
 - With LOD, 0.3 ms (or lower) at a distance



TRESSFX 3.0

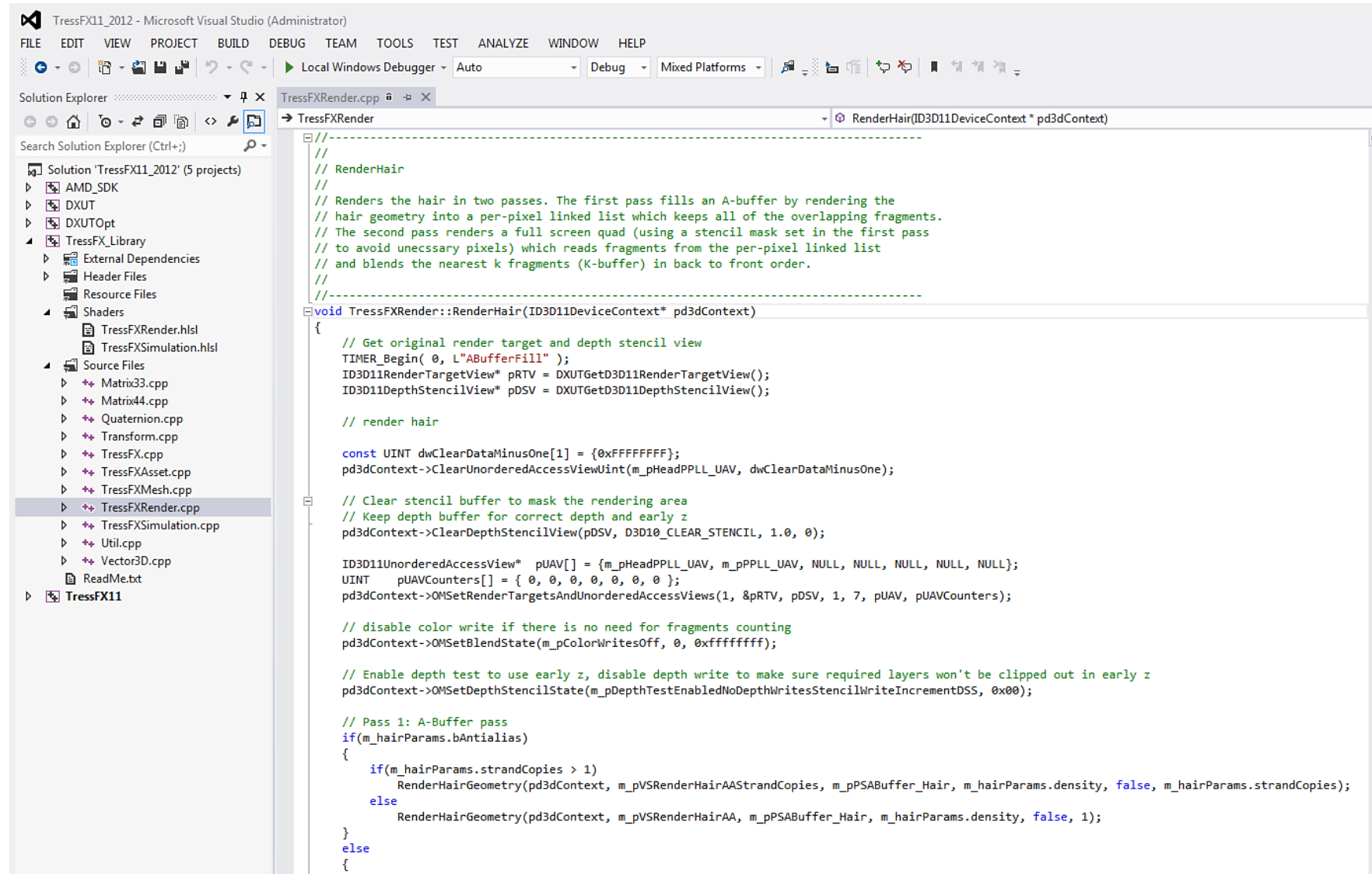
▲ TressFX 3.0

- Maya plugin
 - with full source
- Viewer and runtime library
 - with full source
- Fur support
- Skinning
- Free



TRESSFX 3.0 VIEWER AND RUNTIME LIBRARY

- ▲ Viewer provided
 - Preview TressFX assets
- ▲ Runtime reorganized into a library
 - Easier integration
- ▲ Full source
 - Free
 - No black boxes

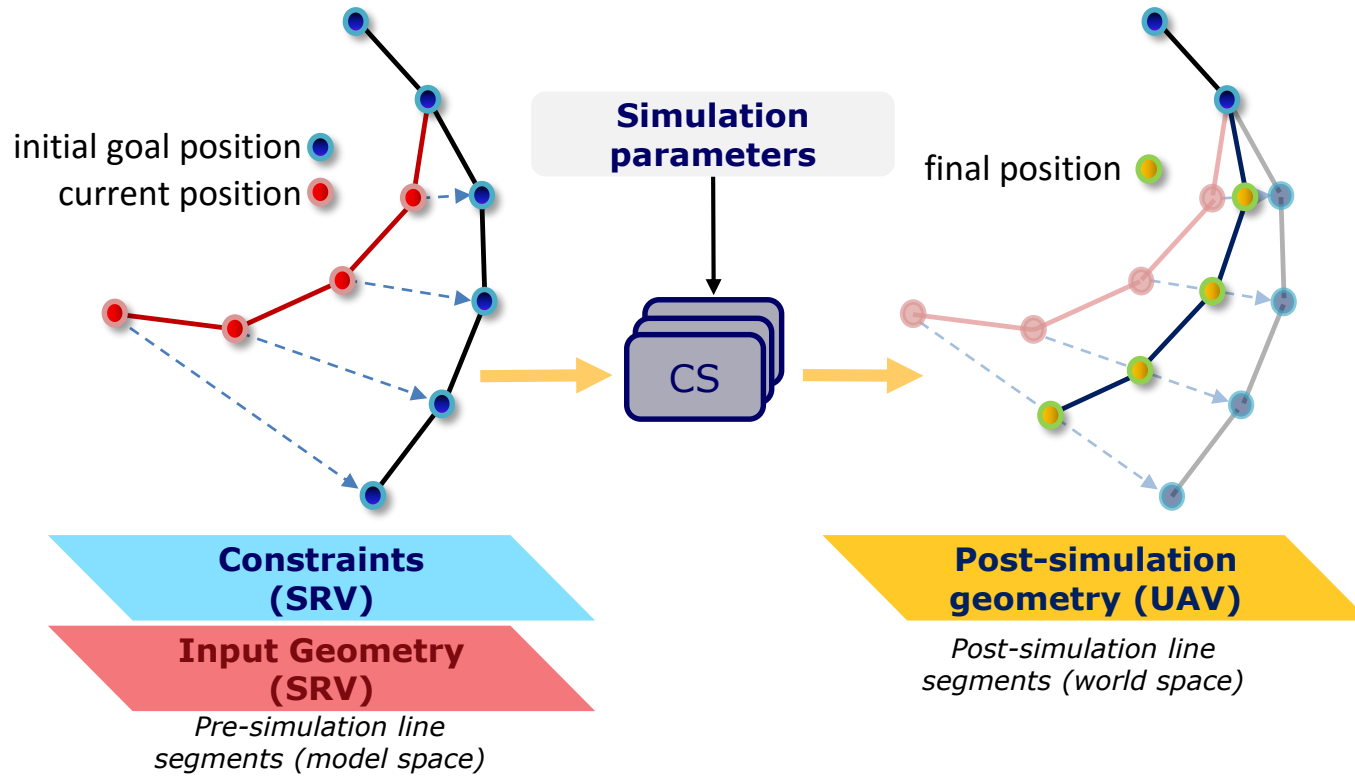


TRESSFX 3.0 FUR SUPPORT

- ▲ Core principles are the same
 - Simulation on GPU using compute
 - Good lighting
 - Anti-aliasing
 - Volume shadows
 - Transparency
- ▲ Texture coordinates
 - Allows variation in fur color
- ▲ Skinning
 - A simple head transform was enough for human hair
 - Fur requires skinning support

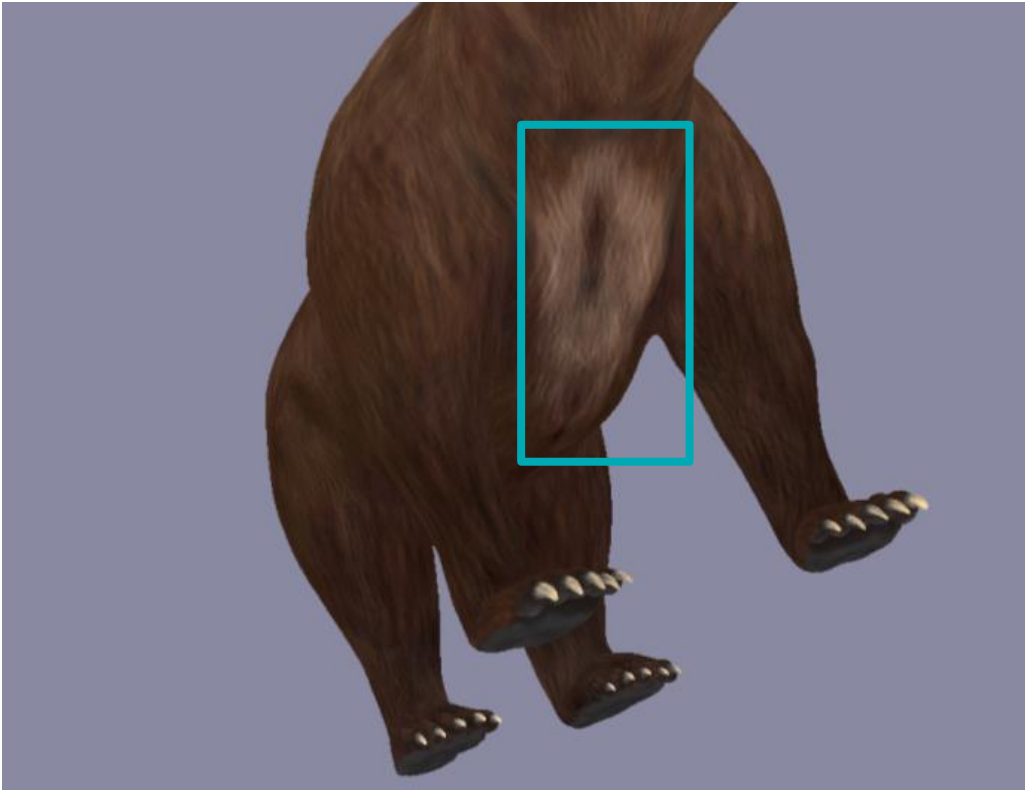


TRESSFX 3.0 FUR SIMULATION

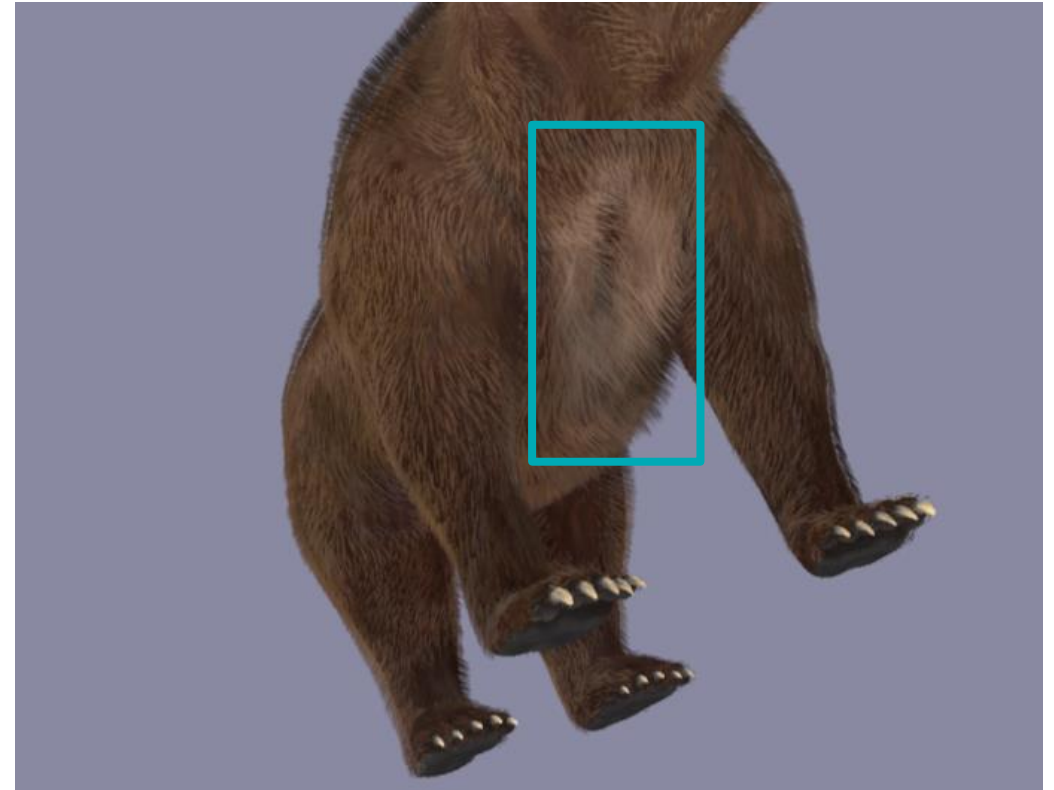


- ▲ **SIMULATION COMPUTE SHADERS**
- Edge length constraint
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 - Collision Shape
 - External Forces (wind, gravity, etc.)

TRESSFX 3.0 TEXTURE COORDINATES

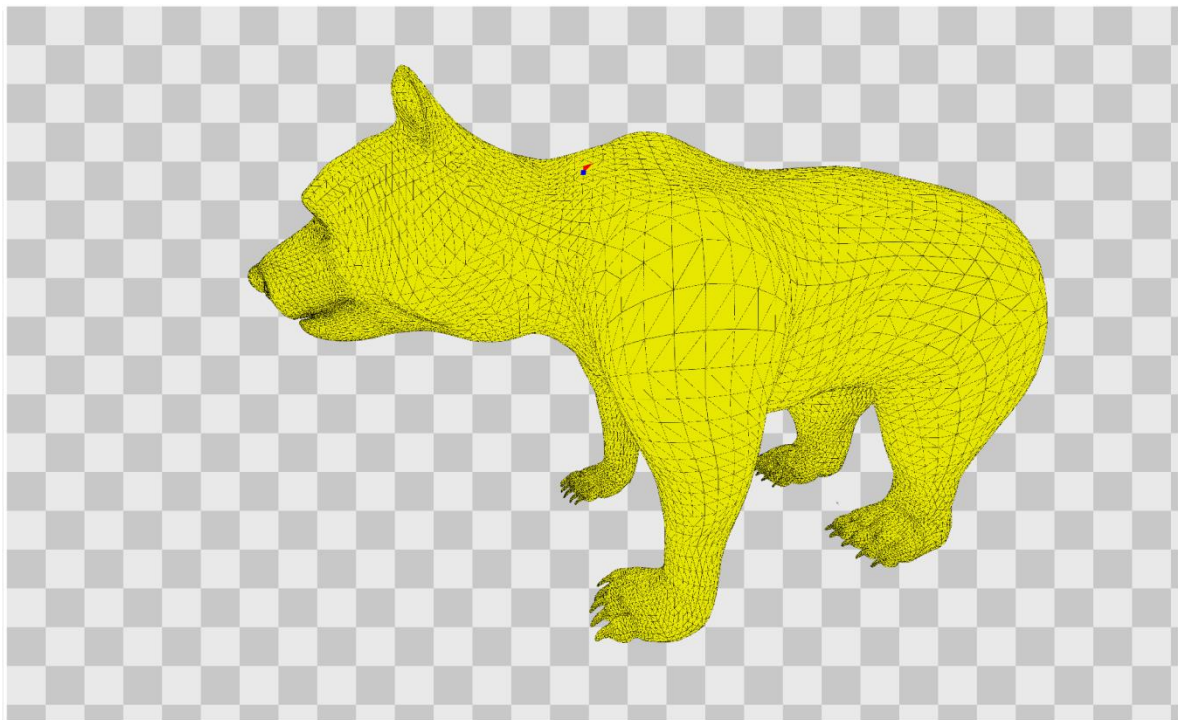


TEXTURED MESH



FUR PICKS UP COLOR VARIATION FROM TEXTURE

TRESSFX 3.0 SKINNING



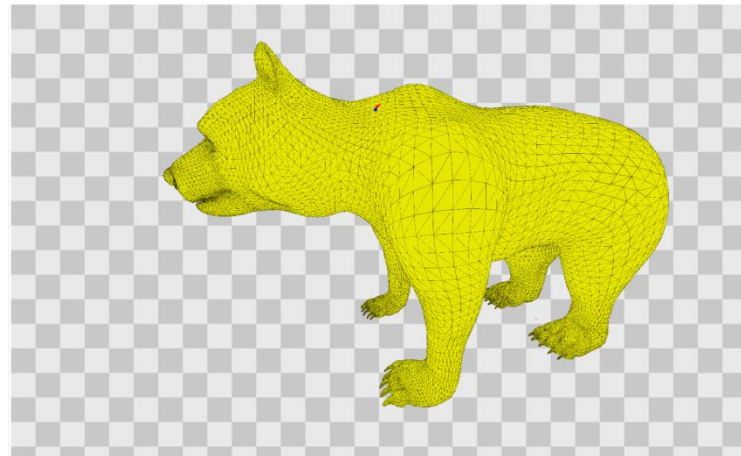
BIND POSE



SKINNED

TRESSFX 3.0 SKINNING

- ▲ How to get skinned vertex position data to TressFX library?
- ▲ Up to you
- ▲ TressFX viewer currently uses Stream Out
 - DirectX 11
 - No geometry shader
 - See “Getting Started with the Stream-Output Stage” on MSDN
- ▲ UAVs at vertex shader stage
 - DirectX 11.1
 - DirectX 12

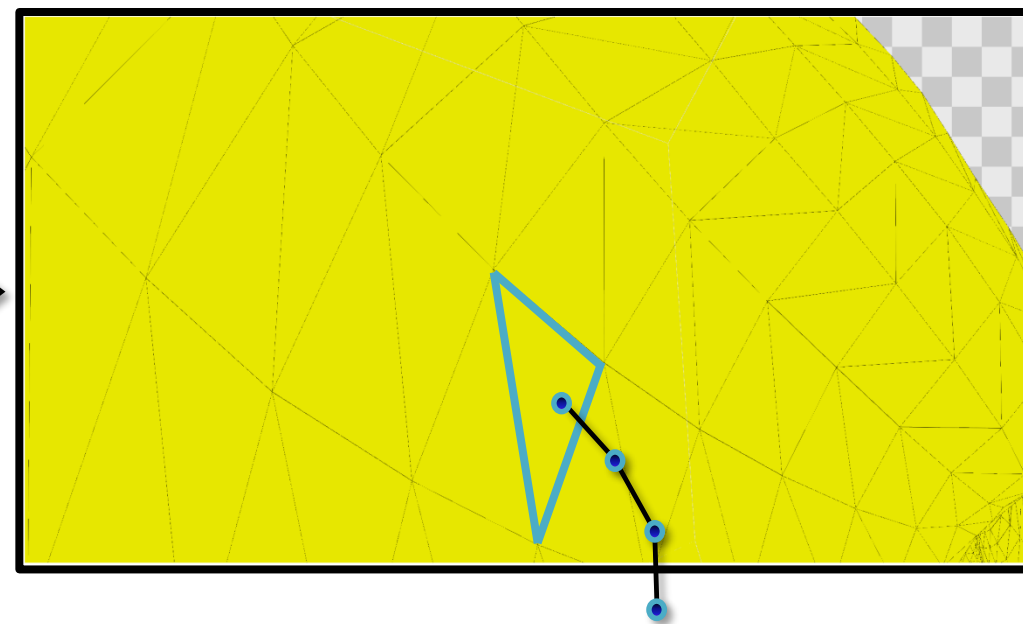
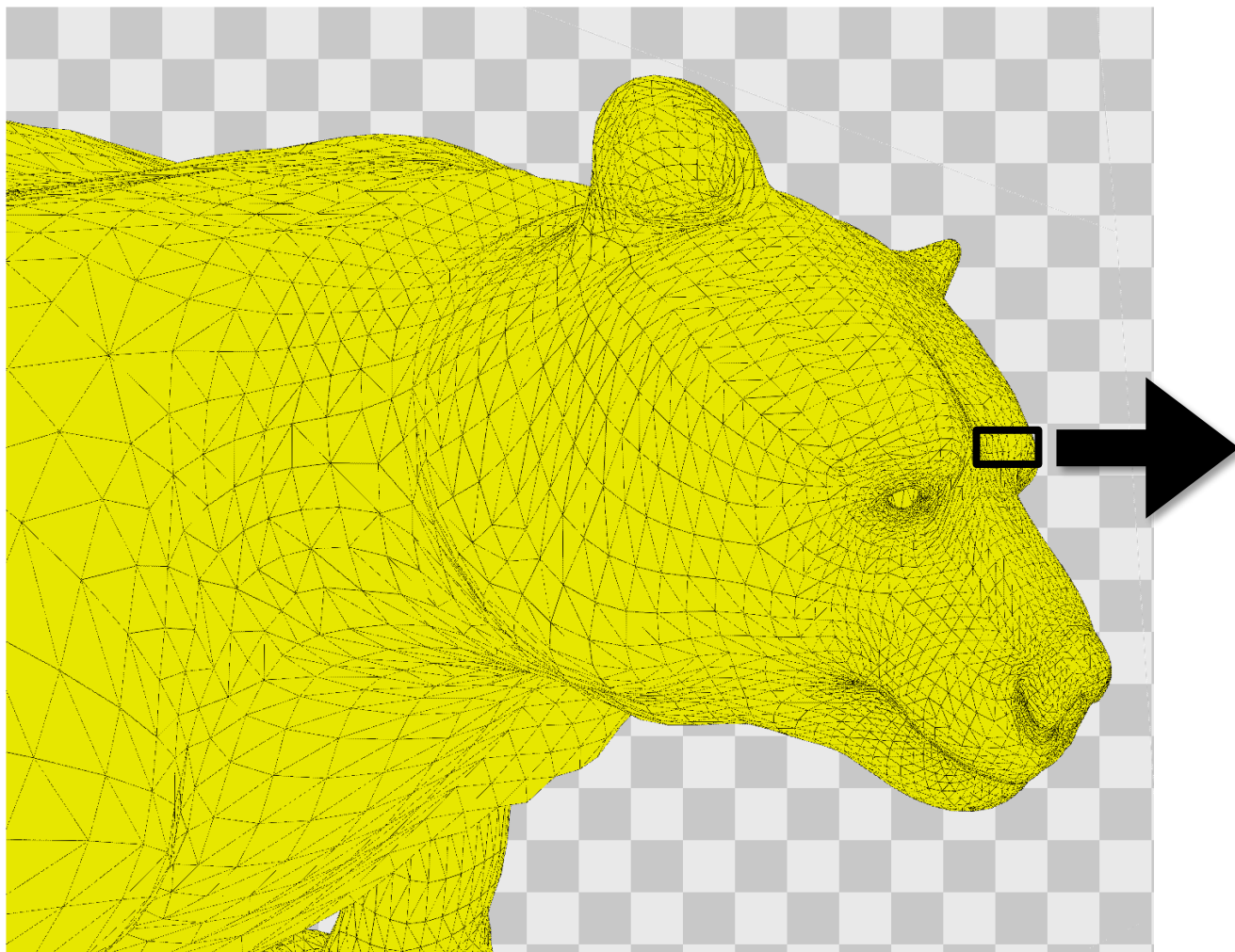


BIND POSE



SKINNED

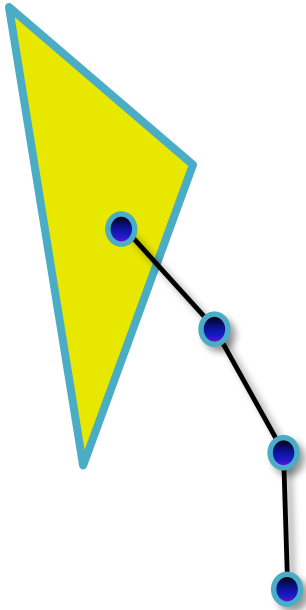
TRESSFX 3.0 SKINNING



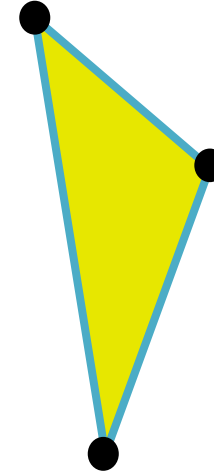
- ▲ Hair-to-mesh mapping
 - Exported from Maya plugin

TRESSFX 3.0 SKINNING

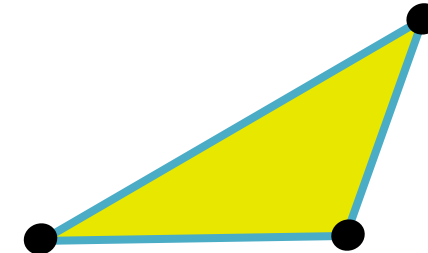
- ▲ Use hair strand index to get triangle index



- ▲ Use triangle index to get bind-pose verts and skinned verts



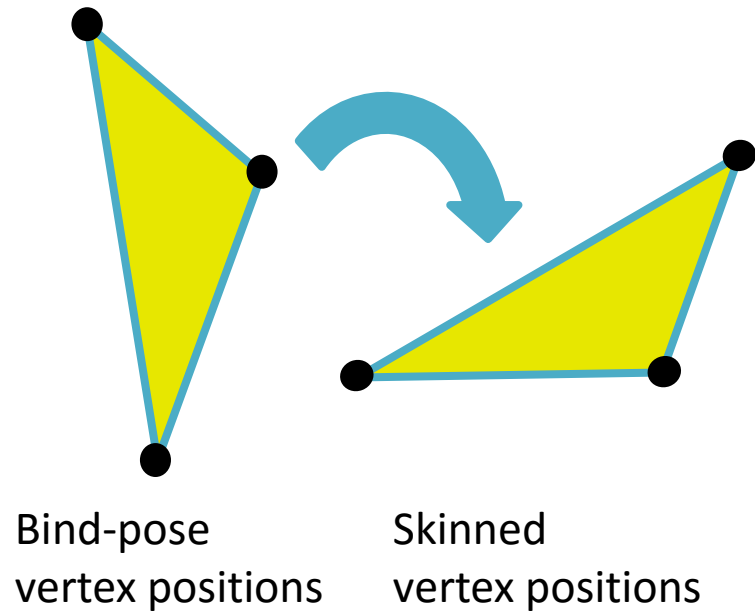
Bind-pose
vertex positions



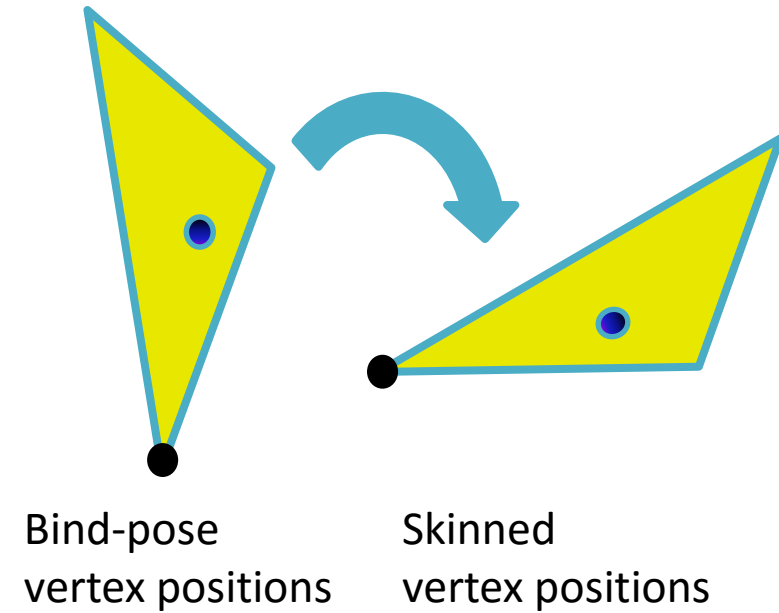
Skinned
vertex positions

TRESSFX 3.0 SKINNING

- ▲ Calculate transform from bind-pose to skinned

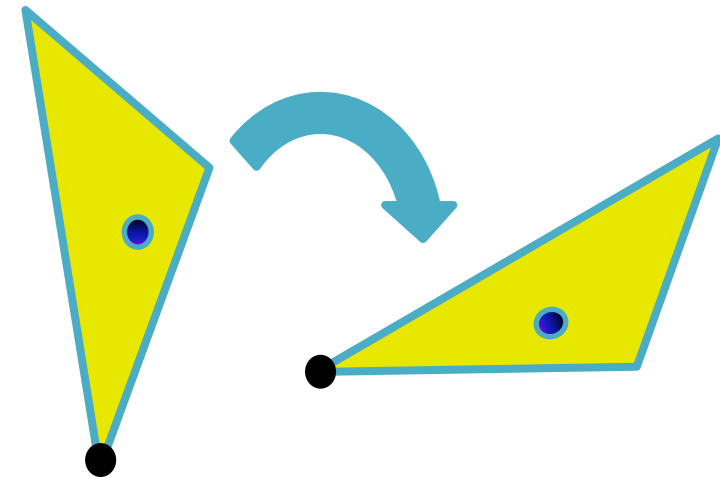


- ▲ Use barycentric coordinates for hair root to calculate final hair transform



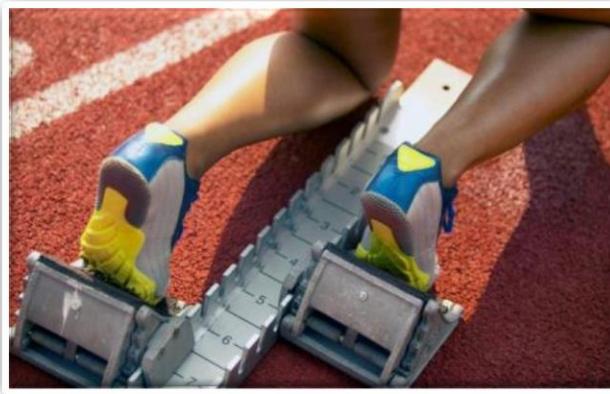
TRESSFX 3.0 SKINNING

- ▲ Yeah, okay, but why not just skin the hair directly?
- ▲ This way doesn't impose any requirements on how the game engine does the animation update
 - Morph targets/blend shapes
 - Whatever, we just need the updated vertex positions
- ▲ But may code a fast path for ordinary skinning with max 4 bones



TRESSFX 3.X OPTIMIZATIONS

- ▲ Already in TressFX 2.2
 - Master and slave strands
 - Distance adaptive LOD
 - Deferred rendering
 - Lots of shader optimizations
- ▲ Coming in TressFX 3.x
 - Depth pre-pass
 - Adjust K_{overdraw}
 - More shader optimizations



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