



# Gamefest

MICROSOFT GAME TECHNOLOGY CONFERENCE 2 0 0 8



Microsoft

# NVIDIA

## Graphics Performance and Authoring Tools for Direct3D 10

Daniel Horowitz  
Manager, Content Tools  
NVIDIA Corporation

Jeff Kiel  
Manager, Graphics Tools  
NVIDIA Corporation



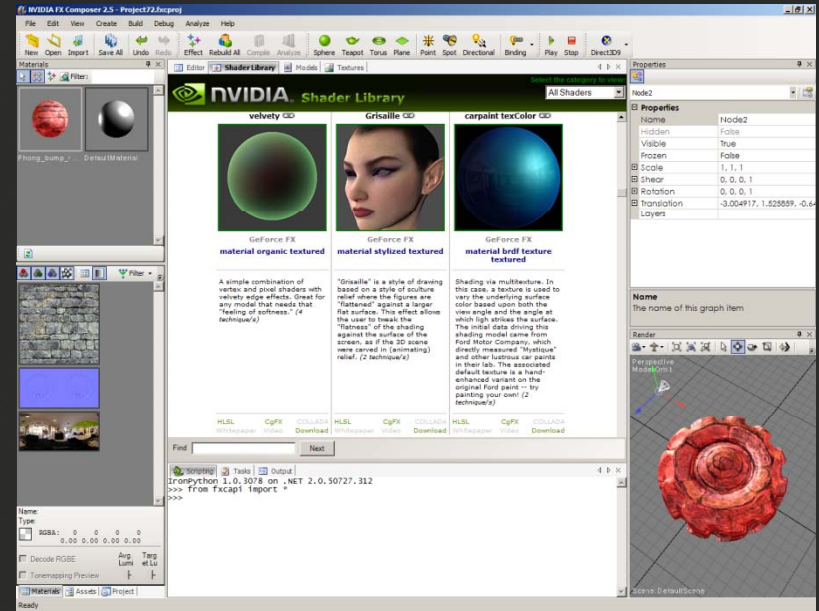
# Agenda

- FX Composer 2.5
- Shader Debugger
- PerfHUD 6.1



# FX Composer 2.5

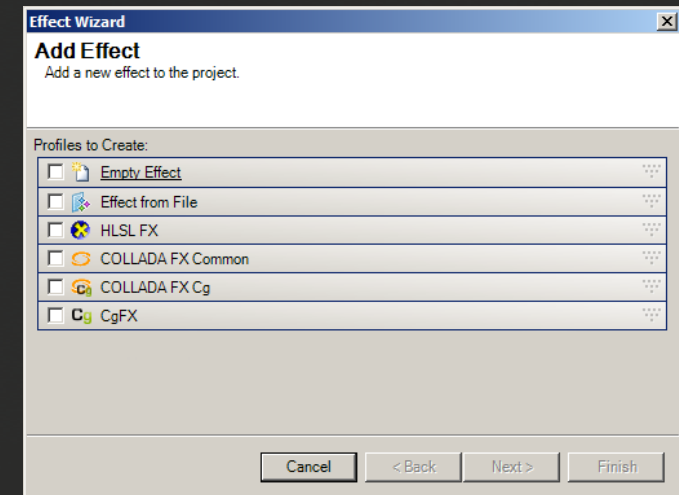
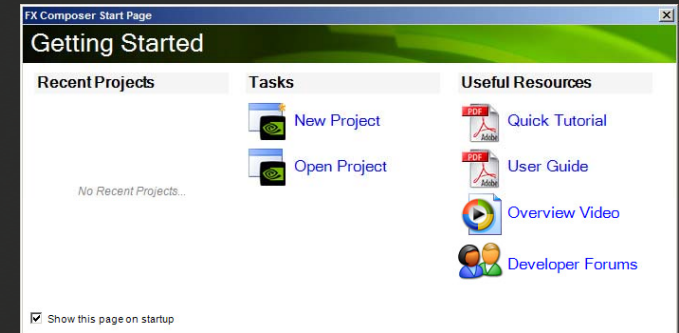
- Increase productivity
- Refine usability
- Improve stability
- Improve performance
- Enable Direct3D10
- First host for the NVIDIA Shader Debugger





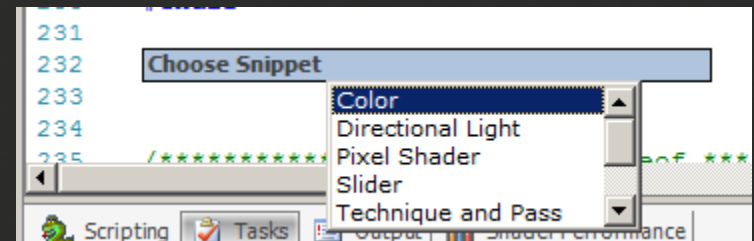
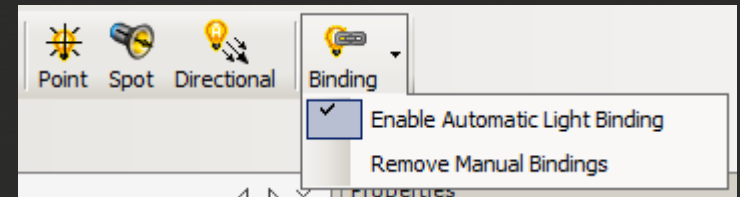
# Usability & Productivity

- Start Page
- Effect Wizard
- Toolbar
  - Large icons
  - More menu access
- Graphics API Toggle



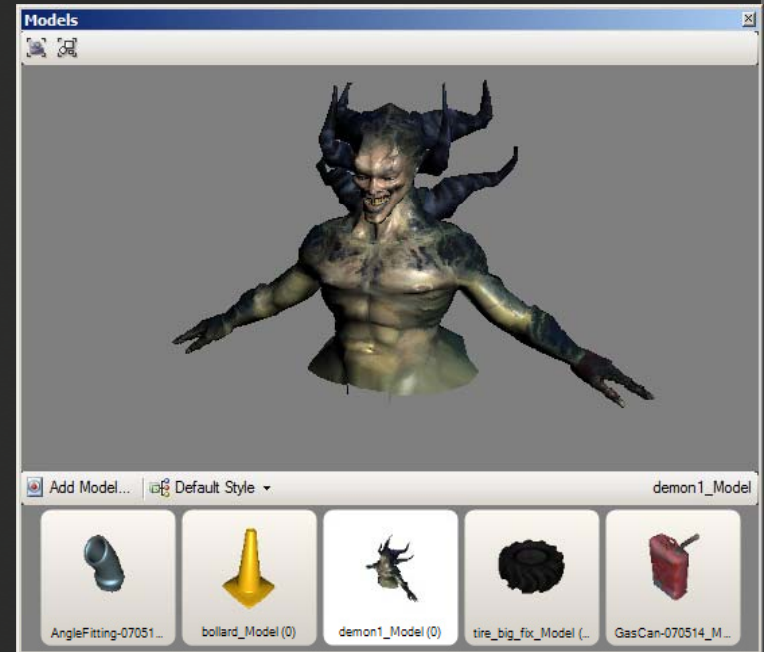
# Usability & Productivity

- Automatic light binding
  - Bind to nearest light
  - SAS driven
- Code Snippets
  - Commonly used code
  - User-extensible
  - Examples
    - Textures and samples
    - Techniques and passes
    - Render state blocks



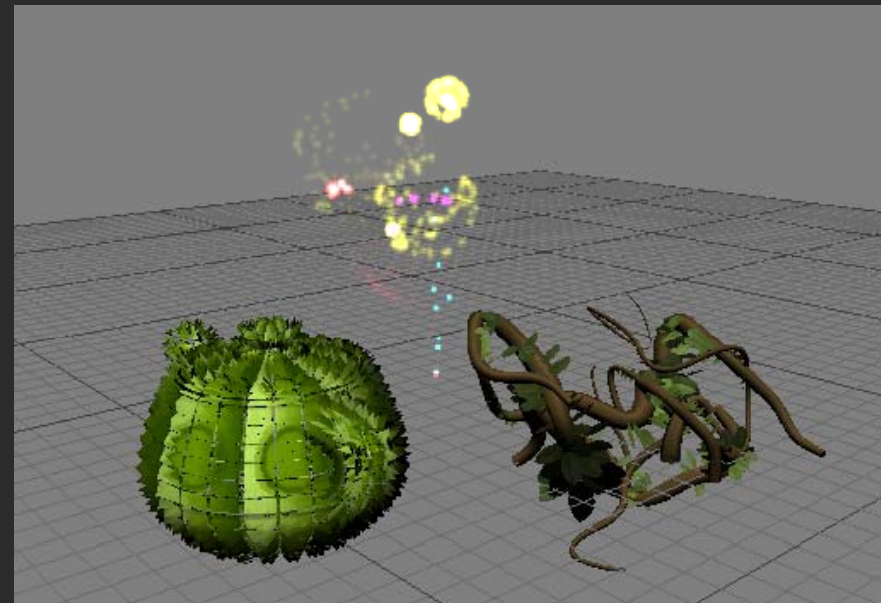
# Models & Styles

- Models are complete files DAE, FBX, etc.
- Styles are collections of material for a model
- Update your model without fear of losing styles
- Use models many times
  - In a scene
  - With different styles



# DirectX 10

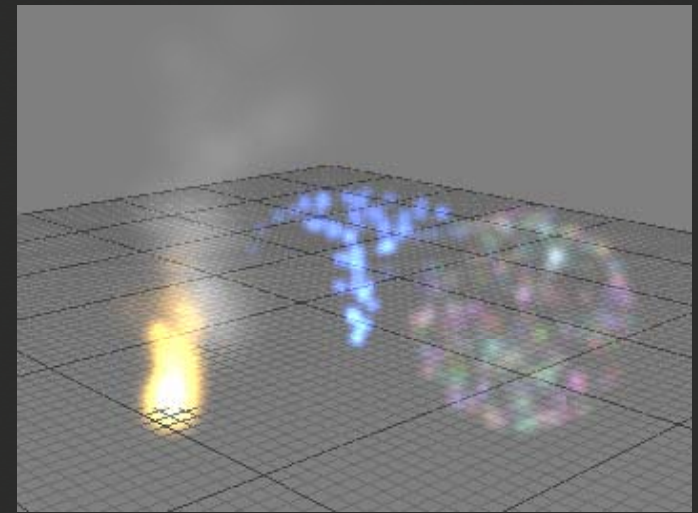
- Geometry shaders
- Texture arrays
- Stream out
  
- Picture includes
  - Explosion(GS)
  - Particles(GS,SO)
  - Pipes(GS,TA,SO)





# Particle Systems

- Simple emitters for designing effects
  - Not for complex simulation
- Predefined templates to start
  - Fire
  - Smoke
  - Fireworks
  - Water fountain
- Customizable parameters



# Shader Debugger

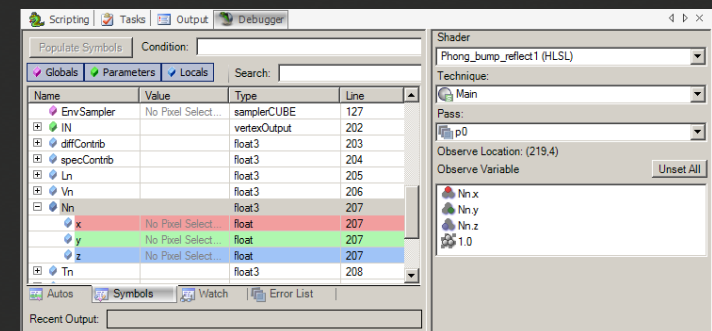
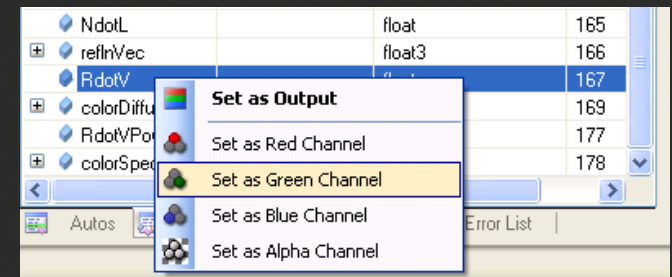
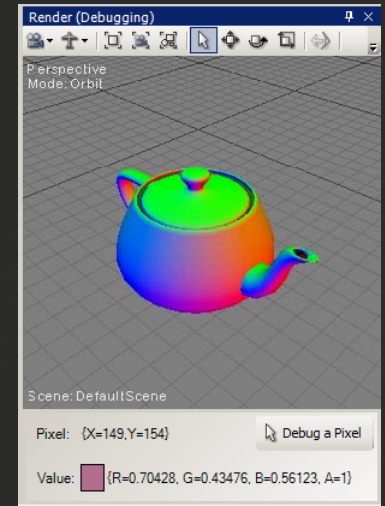
- Most desired feature in user surveys
- Debugging is not trivial
  - Constantly modifying shaders
  - Understanding rendered output
  - Distinguishing between materials
- Supports HLSL (current & legacy), Cg
- Debug single and multiple pixels
- Available as a plug-in to FX Composer 2.5





# Shader Debugger

- Stepping through code
  - Run to cursor
  - Next Statement
  - Next Bookmark
- Visualize variables
  - Single or multiple pixel
- Conditional kill
- Watch expressions



*demo*



**Gamefest**  
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# Introducing PerfHUD 6.1!

- Unified Driver on Windows Vista: use any release driver!
- Comprehensive SLI Support
  - Graphs for SLI specific data
  - Insight into SLI performance gotchas
- Powerful new debugging features
  - Texture visualization modes
  - API call data mining and analysis
  - Shader visualization



# Introducing PerfHUD 6.1!

- Usability Features
  - All new hot key support
  - Rich use of Direct3D PerfMarkers
- Input module rewrite
- Additional API checks
- Bug fixes





# PerfHUD 6: Performance Dashboard

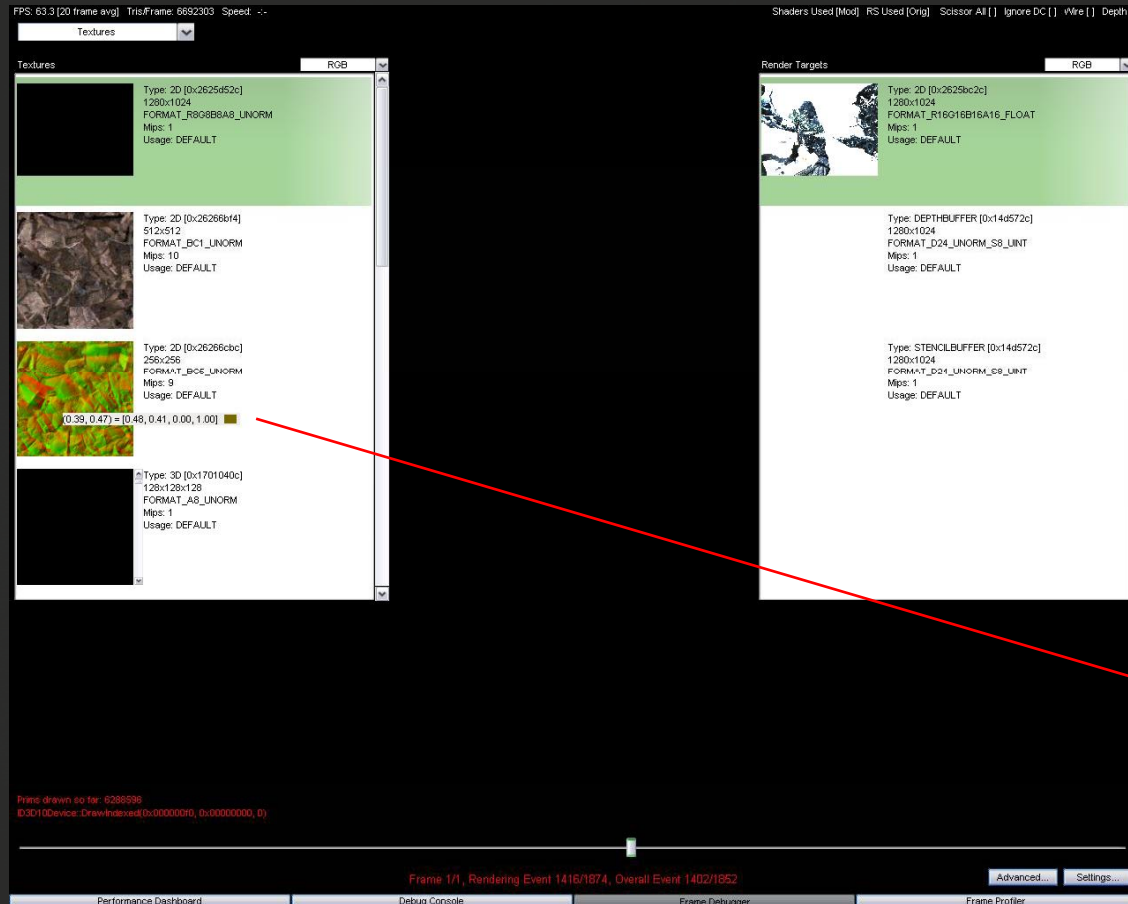


- Graph GPU and driver data
- Edit to suit your needs
- SLI Graph for multi-GPU
- API usage statistics

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# PerfHUD 6: Frame Debugger



- Scrub through scene
- Visualize draw call info
- Textures and RTs
- Tooltips on buffers

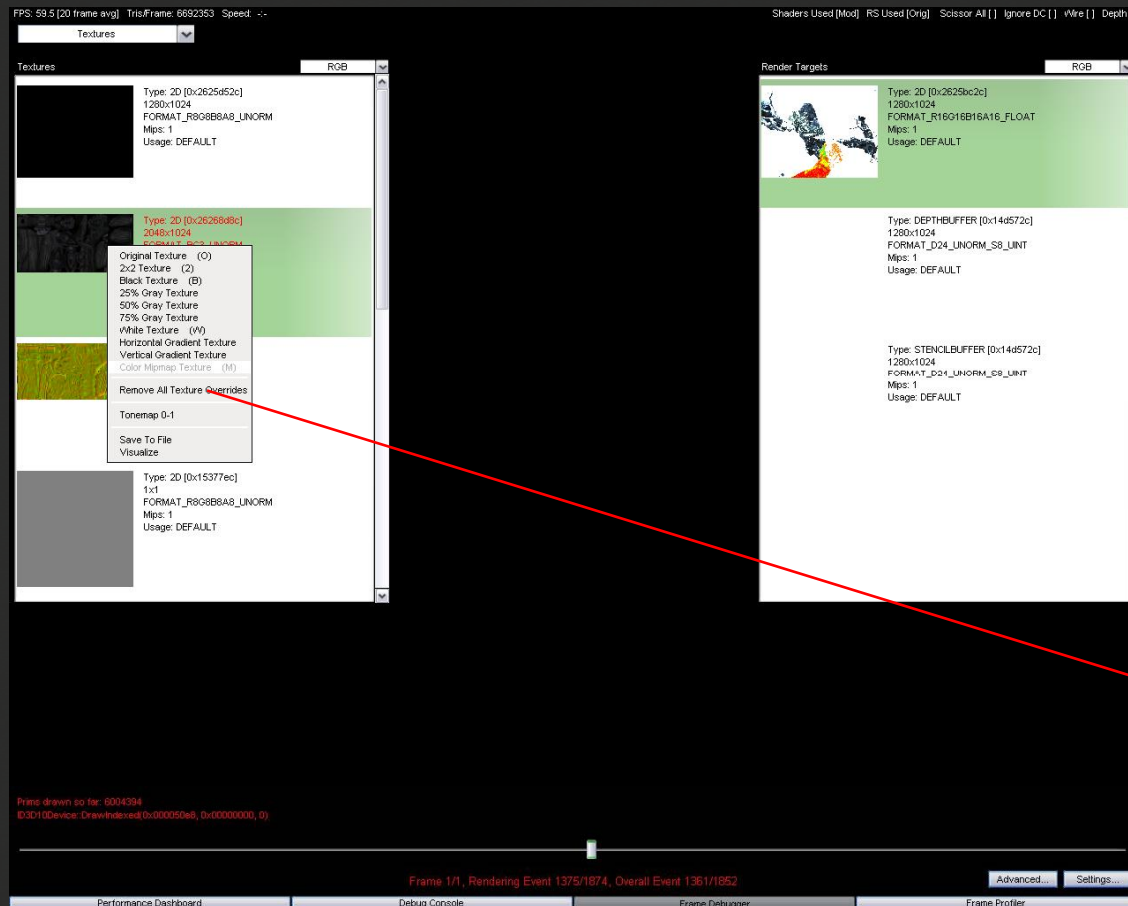
[0.39, 0.47] = [0.48, 0.41, 0.00, 1.00]

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# PerfHUD 6: Frame Debugger



- Texture analysis: substitute precomputed textures
- Controllable through Perf Markers

Original Texture (O)  
2x2 Texture (2)  
Black Texture (B)  
25% Gray Texture  
50% Gray Texture  
75% Gray Texture  
White Texture (W)  
Horizontal Gradient Texture  
Vertical Gradient Texture  
Color Mipmap Texture (M)

Remove All Texture Overrides

Tonemap 0-1

Save To File  
Visualize

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# PerfHUD6: Frame Debugger

## Buffer Visualization



- Visualize any buffer full screen
- 2D/3D/Cube/Arrays
- Pan/Zoom
- Change mipmap level

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# PerfHUD6: Frame Debugger

## API Call List

The screenshot displays the PerfHUD6 Frame Debugger interface. On the left, a 'Call List' window shows a sequence of GPU API calls, including `DrawIndexed`, `Map`, `Unmap`, `OMSetBlendState`, `PSSetShader`, `PSSetShaderResources`, `VSSetShader`, `IASetVertexBuffers`, `IASetIndexBuffer`, `VSSetConstantBuffer`, and `DrawIndexed`. A red arrow points from a specific event in the list to a detailed tooltip on the right. The tooltip, titled 'Render Targets', shows a small preview of a rendered scene and lists the target's properties: Type (e.g., DEPTHBUFFER, STENCILBUFFER), Format, Mip levels, and Usage. Below the tooltip, a detailed view of the selected API call is shown, including its parameters and return values.

- Based on a frame capture
- See frame events, including parameters
- Tooltips for details
- Connected to scrubber

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# PerfHUD 6: Frame Debugger

## Draw Call Dependencies

The screenshot displays the PerfHUD 6 Frame Debugger interface. At the top, it shows performance metrics: FPS: 59.7 [20 frame avg], Tris/Frame: 6692329, and Speed: --. Below this, there are several tabs: Dependencies, Shaders Used (Mod), RS Used (Orig), Scissor All [], Ignore DC [], Wire [], and Depth []. The main area is divided into two panels. The left panel, titled 'Dependencies', shows a tree view of draw call events. It is expanded to show 'Producers' and 'Consumers'. The 'Producers' list includes events such as 'Event 5439: ID3D10Device::ClearRenderTargetView(0x015ee398, 0, 0, 0, 0, 0)', 'Event 5464: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5470: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5476: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5495: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5508: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5521: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5534: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5551: ID3D10Device::Draw(0x00000004, 0x0000009c)', 'Event 5568: ID3D10Device::DrawIndexed(0x00000252, 0x00000000, 0)', 'Event 5571: ID3D10Device::DrawIndexed(0x00000252, 0x00000000, 0)', 'Event 5597: ID3D10Device::Draw(0x00000004, 0x0000009d)', 'Event 5401: ID3D10Device::ClearRenderTargetView(0x015ee340, 0, 0, 0, 0, 0)', and 'Event 5416: ID3D10Device::Draw(0x00000004, 0x00000238)'. The 'Consumers' list includes 'Event 13270: ID3D10Device::Draw(0x00000004, 0x00000244)' and 'Event 13687: ID3D10Device::Draw(0x00000004, 0x000029f8)'. The right panel, titled 'Render Targets', shows a 3D scene with a green background and a white foreground. A red bounding box highlights a specific area in the scene, with coordinates (0.72, 0.59) = [2.05, 2.22, 2.44, 0.63]. At the bottom, there is a timeline showing the sequence of draw calls. The status bar at the bottom indicates 'Frame 1/1, Rendering Event 1375/1875, Overall Event 1361/1853'. There are also buttons for 'Advanced...' and 'Settings...'.

- Show **producers** & **consumers** dependencies for each call
- These can hurt single GPU and SLI performance

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# PerfHUD 6: Adv Frame Debugger

## Vertex Assembly

FPS: 29.4 [20 frame avg] Tris/Frame: 6892353 Speed: --

Shaders Used [Mod] RS Used [Orig] Scissor All [ ] Ignore DC [ ] Wire [ ] Depth [ ]

Vertex Assembly Vertex Shader Geometry Shader Pixel Shader Raster Operations

M/Frame

Index / Vertex Buffer

Call type: DrawIndexed  
IndexCount: 20712  
StartIndexLocation: 0  
BaseVertexLocation: 0  
Topology: TRIANGLELIST

Index Buffer:

Pointer: 0x261f9bb4, Format: R16\_UINT, Offset: 0

Vertex Buffers:

0) Pointer: 0x261f9aac, Stride: 24, Offset: 0  
1) Pointer: 0x26266fd4, Stride: 16, Offset: 87104  
3) Pointer: 0x261f9a24, Stride: 20, Offset: 0  
5) Pointer: 0x1700c7ec, Stride: 28, Offset: 84500

Input Layout:

Bounding box:  
Max: (0.310541, 0.000000, 0.000000)  
Min: (-0.310541, -0.823588, -0.378402)  
Scissor Rect[0] = (1, 1, 1023, 1023)

Frame 1/1, Rendering Event 1375/1874, Overall Event 1361/1852

Performance Dashboard Debug Console Frame Debugger Frame Profiler

- Geometry preview
- Vertex and index buffer setup

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# PerfHUD 6: Adv Frame Debugger

## Vertex, Geometry and Pixel Shaders

FPS: 54.7 [20 frame avg] Tris/Frame: 6892353 Speed: -- Shaders Used (Mod) RS Used (Orig) Scissor All[] Ignore DC[] Wre[] Depth[]

Vertex Assembly    Vertex Shader    Geometry Shader    Pixel Shader    Raster Operations

Textures

- Type: 2D [0x2625d52c] 1280x1024 FORMAT\_R8G8B8A8\_UNORM Mps: 1 Usage: DEFAULT
- Type: 2D [0x2626848c] 2048x1024 FORMAT\_BC3\_UNORM Mps: 12 Usage: DEFAULT
- Type: 2D [0x26268e54] 1024x512 FORMAT\_BC5\_UNORM Mps: 11 Usage: DEFAULT
- Type: 2D [0x15377ec] 1x1 FORMAT\_R8G8B8A8\_UNORM Mps: 1 Usage: DEFAULT

Pixel Shader Samplers

PS Sampler 0

Filter: Anisotropic    Anisotropic

AddressU: Wrap    MinPointMagMipLinear

AddressV: Wrap    MinLinearMagMipPoint

AddressW: Wrap    MinLinearMagPointMipL

MipLODBias: 0.000000    MinMagLinearMipPoint

MaxAnisotropy: 8    MinMagMipLinear

ComparisonFunc: Never    Anisotropic

BorderColor[0]: 0.000000    (0.000000)

BorderColor[1]: 0.000000    (0.000000)

BorderColor[2]: 0.000000    (0.000000)

BorderColor[3]: 0.000000    (0.000000)

MipLOD: 0.000000    (0.000000)

MaxLOD: 1120403456.000000    (100.000000)

Generated by Microsoft (R) HLSL Shader Compiler

Buffer Definitions:

cbuffer PER\_FRAME

```
{
float4 g_PS_SkyColor;           // Offset:  0 Size: 16
float4 g_PS_SunColor;          // Offset: 16 Size: 16
float4 g_PS_SunLightDir;       // Offset: 32 Size: 16
float4 g_PS_FogColor;          // Offset: 48 Size: 16 (unused)
}
```

cbuffer PER\_MATERIAL

```
{
float4 MatDiffColor;           // Offset:  0 Size: 16
float4 MatSpecColor;           // Offset: 16 Size: 16
float4 __OpuzynessSaturation__1_FuzynessStrength__2_FuzynessSmootherness__3_FuzynessSpread; // Offset: 48 Size: 16
float3 __ODiffuseExponent__1_SpecularMultiplier__2_AnisotropicShane__3; // Offset: 64 Size: 12
float4 __MetallicAmount__1_DeflectionAmount__2_FresnelBias__3_FresnelScale; // Offset: 80 Size: 16
float __OpresnelScaleShadowBias__1__2__3; // Offset: 96 Size: 4
float3 __Opresh_DiffExponent__lprsh_LuminanceAdjustment__2prsh_SpecMulFinal__3; // Offset: 112 Size: 12
}
```

cbuffer PER\_LIGHT

```
{
float4 lDiffuses0;             // Offset:  0 Size: 16
float4 WorldLightaPos0;        // Offset: 16 Size: 16 (unused)
float4 ShadowChanMask0;        // Offset: 32 Size: 16 (unused)
float4 lSpecular0;             // Offset: 48 Size: 16 (unused)
float4 lDiffuses1;             // Offset: 64 Size: 16 (unused)
}
```

Messages

Shader Constants

Constant Buffer: PER\_FRAME

Variable Name: g\_PS\_SkyColor    2.864870 2.835405 3.751359 0.000488

Variable Name: g\_PS\_SunColor    4.053259 4.171427 4.364197 0.000391

Variable Name: g\_PS\_SunLightDir    0.369124 -0.203358 0.906959 0.000000

Variable Name: g\_PS\_FogColor    3.354500 4.011651 4.702496 0.150197

Constant Buffer: PER\_MATERIAL

Frame 1/1, Rendering Event 1375/1874, Overall Event 1361/1852

Performance Dashboard    Debug Console    Frame Debugger    Frame Profiler

- Edit & continue shaders
- Visualize input textures
- Constants
- Sampler overrides

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# PerfHUD 6: Adv Frame Debugger

FPS: 44.0 [20 frame avg] Tris: 6892329 Speed: --

Vertex Assembly Vertex Shader Geometry Shader Pixel Shader Raster Operations

Render States

- Renderizer State
  - FillMode: Solid
  - CullMode: None
  - FrontCC: True
  - DepthBias: 0
  - DepthBiasClamp: 0.000000
  - SlopeScaledDepthBias: 0.000000
  - DepthClipEnable: True
  - ScissorEnable: False
  - MultisampleEnable: False
  - AALineEnable: False
- Depth/Stencil State
  - DepthEnable: True
  - DepthWriteMask: Zero
  - DepthFunc: Equal
  - StencilEnable: False
  - StencilReadMask: 0xFF
  - StencilWriteMask: 0xFF
  - StencilOpFrontFaceFail: Keep
  - StencilOpFrontFaceDepthFail: Keep
  - StencilOpFrontFaceFunc: Keep
  - StencilOpFrontFaceFunc: Always
  - StencilOpBackFaceFail: Keep
  - StencilOpBackFaceDepthFail: Keep
  - StencilOpBackFaceFunc: Keep
  - StencilOpBackFaceFunc: Always
  - StencilRef: 0x00000000
- Blend State
  - AlphaToCoverageEnable: False
  - BlendEnabled0: False
  - BlendEnabled1: False
  - BlendEnabled2: False
  - BlendEnabled3: False
  - BlendEnabled4: False
  - BlendEnabled5: False
  - BlendEnabled6: False
  - BlendEnabled7: False
  - SrcBlend: One
  - DstBlend: Zero
  - BlendOp: Add
  - SrcBlendAlpha: One
  - DstBlendAlpha: Zero
  - BlendOpAlpha: Add
  - RTWriteMask0: 0xF
  - RTWriteMask1: 0xF
  - RTWriteMask2: 0xF

Render Targets

RGB

Frame 1/1, Rendering Event 1295/1875, Overall Event 1281/1853

Simple... Settings...

Performance Dashboard Debug Console Frame Debugger Frame Profiler

- Display and modify all render state settings
- Render targets displayed

AALineEnable: False

Depth/Stencil State

DepthEnable: True

DepthWriteMask: Zero

DepthFunc: Equal

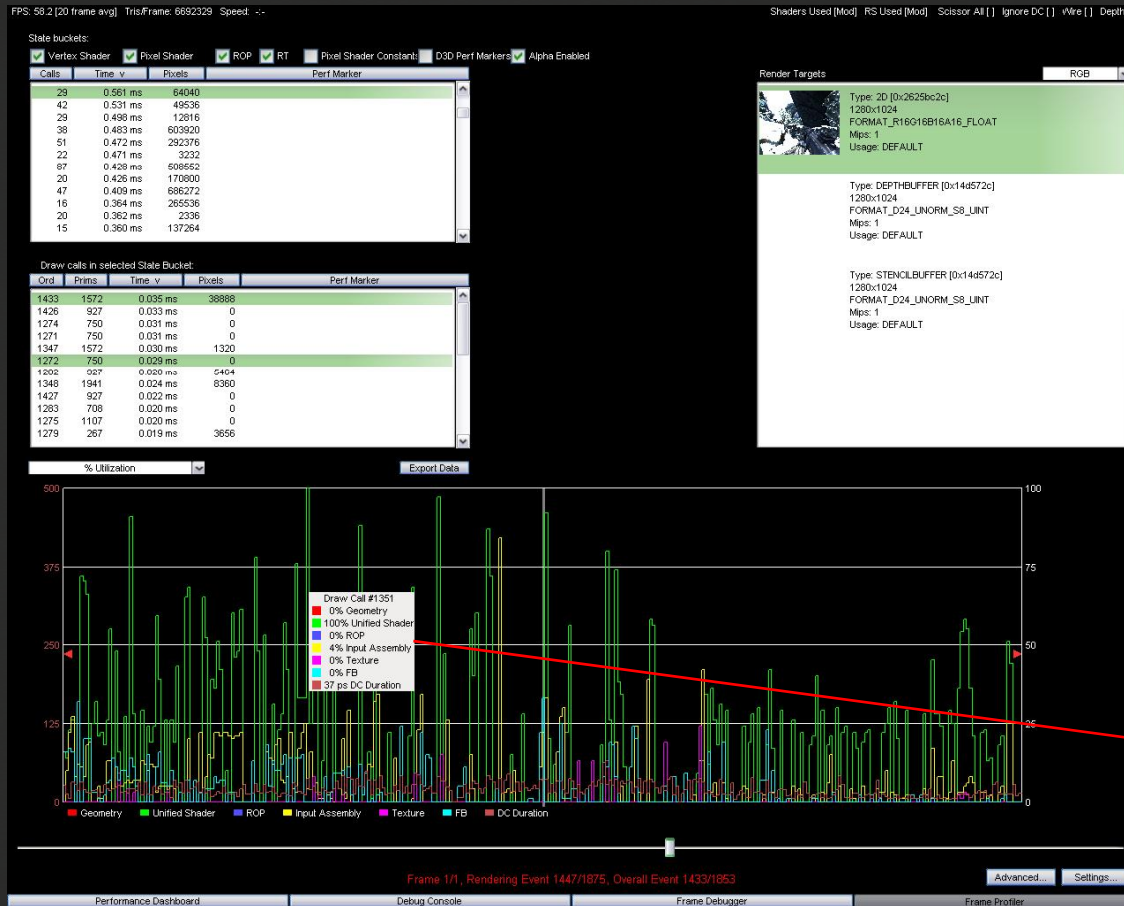
StencilEnable: False

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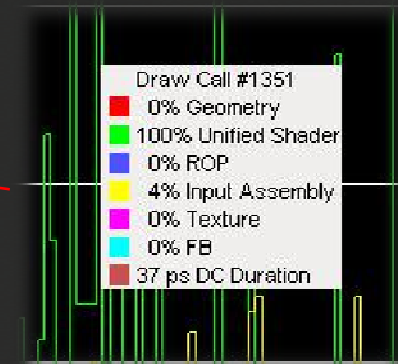


# PerfHUD 6: Frame Profiler

## One button bottleneck determination



- All draw calls profiled
- Draw calls grouped by state buckets: multiply performance optimizations
- Multiple result graphs



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# PerfHUD 6: Adv Frame Profiler

FPS: 24.8 [20 frame avg] Tris/Frame: 6892329 Speed: -- Shaders Used [Mod] RS Used [Mod] Scissor All [ ] Ignore DC [ ] Wire [ ] Depth [ ]

Draw Calls: 1 Time: 24.305 ns Pixels: 180248

Time: 0.043 ms Pixels: 0

Vertex Assembly Vertex Shader Geometry Shader Pixel Shader Raster Operations

Wireframe

Index / Vertex Buffer

Call type: DrawIndexed  
IndexCount: 1572  
StartIndexLocation: 1404  
BaseVertexLocation: 0  
Topology: TRIANGLELIST

Index Buffer:

Pointer: 0x260357ac, Format: R16\_UINT, Offset: 0

Vertex Buffers:

0) Pointer: 0x17098c1c, Stride: 24, Offset: 26160  
1) Pointer: 0x2611b12c, Stride: 16, Offset: 197988

Input Layout:

Bounding box:  
Max: (2.468308, 1.968731, 2.468471)  
Min: (-1.031386, -2.786492, -0.227281)  
Scissor Rect[0] = (1, 1, 1023, 1023)

Frame 1/1, Rendering Event 1447/1875, Overall Event 1433/1853

Simple... Settings...

Performance Dashboard Debug Console Frame Debugger Frame Profiler

- Same advanced features now in the profiling context

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# Questions ?

- Downloads

- <http://www.fxcomposer.com>

- <http://www.perfhud.com>

- Forums

- <http://developer.nvidia.com/forums>

- Email

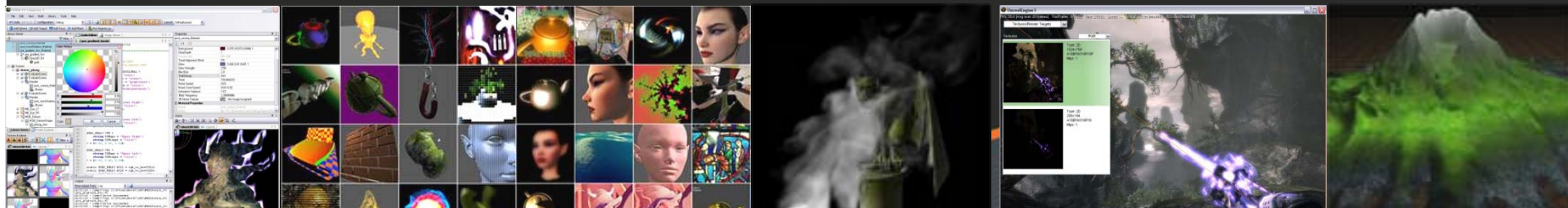
- [fxcomposer@nvidia.com](mailto:fxcomposer@nvidia.com)

- [perfhud@nvidia.com](mailto:perfhud@nvidia.com)



# The NVIDIA Developer Toolkit

Content Creation	Software Development	Performance	Documentation
FX Composer 2.5 mental mill Artist Edition	SDK 10	PerfKit 6	Conference Presentations
Texture Tools 2	Cg Toolkit	PerfHUD 6	GPU Programming Guide
Melody	NVSG	PerfSDK	Videos
		GLExpert	Books
		NV PIX Plug-in	
		gDEDebugger	
		ShaderPerf 2	







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