Developer Tools Showcase

Randy Fernando
Developer Tools Product Manager

NVISION 2008

The NVIDIA Developer Toolkit

Content Creation

- FX Composer
  - mental mill Artist Edition
  - NVIDIA Shader Library
- Photoshop Plug-ins
- Texture Tools
- Melody
- PhysX Plug-Ins

Software Development

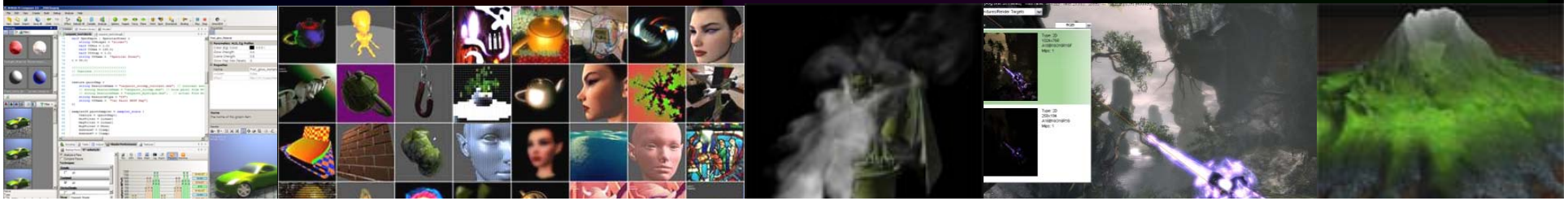
- Shader Debugger
- Direct3D SDK
- OpenGL SDK
- CUDA SDK
- Cg Toolkit
- NVSG
- PhysX SDK
- PhysX VRD

Performance

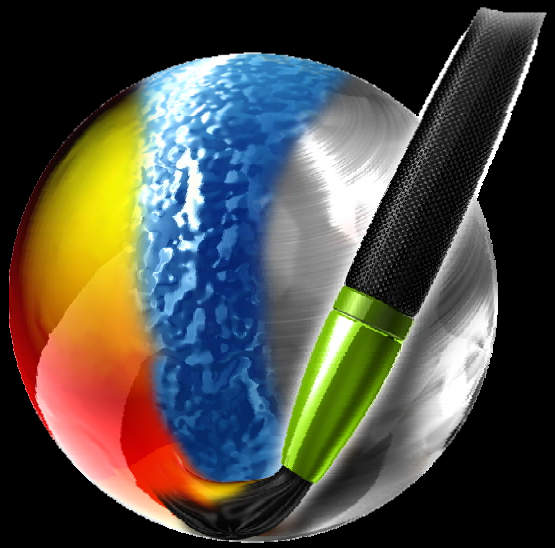
- PerfKit
  - PerfHUD
  - PerfSDK
  - GLExpert
  - NV PIX Plug-in
  - gDEBugger
- ShaderPerf
- PhysX Tools

Education

- Conference Presentations
- Whitepapers
- GPU Programming Guide
- Videos
- Books
  - *GPU Gems 3*
  - *GPU Gems 2*
  - *GPU Gems*
  - *The Cg Tutorial*



FX Composer 2.5

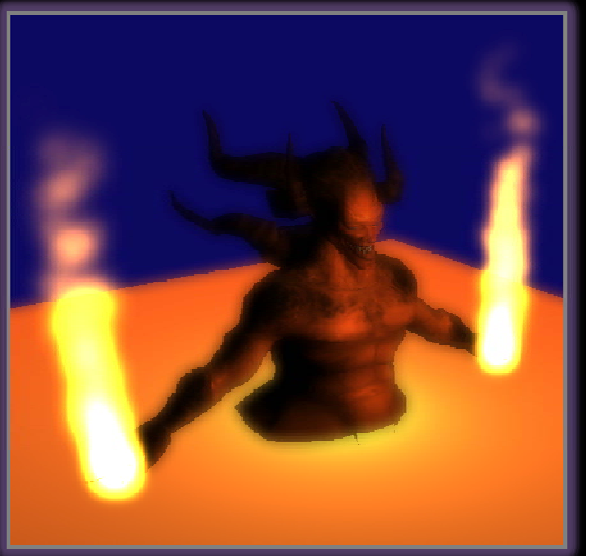


www.fxcomposer.com

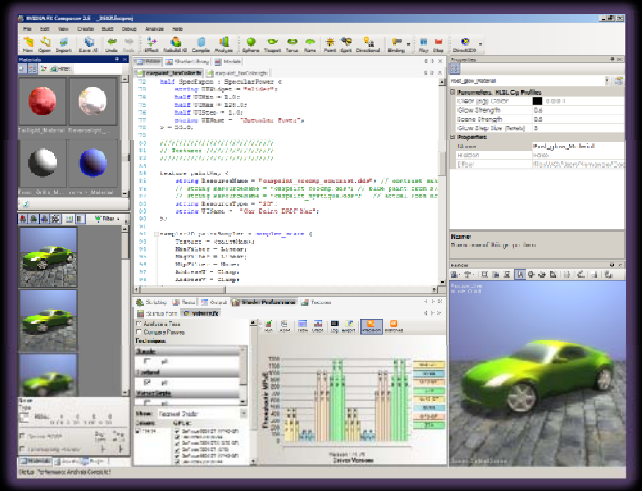
NVIDIA FX Composer 2.5

The World's Most Advanced Shader Authoring Environment

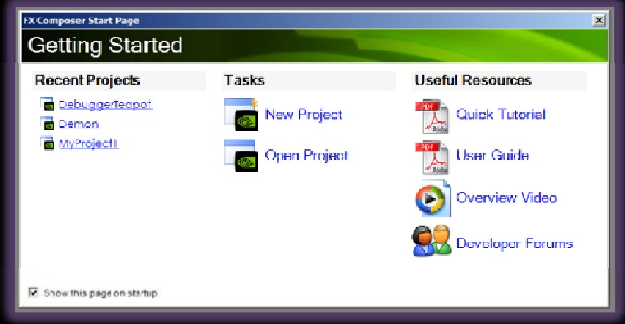
- DirectX 10 Support
- NVIDIA Shader Debugger Support
- ShaderPerf 2.0 Integration
- Visual Models & Styles
- Particle Systems
- Improved User Interface



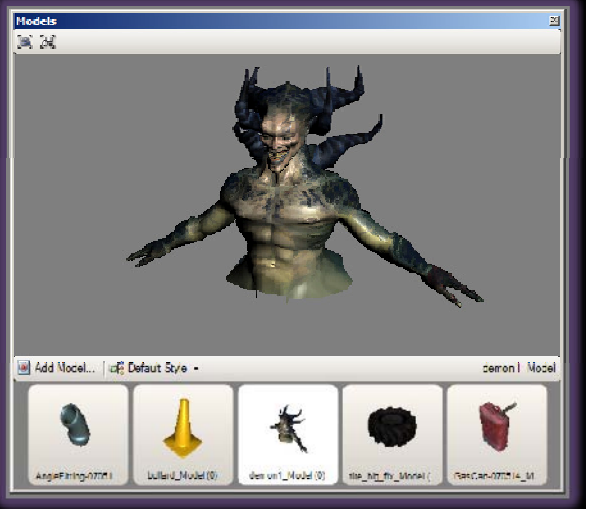
Particle Systems



350Z Sample Project

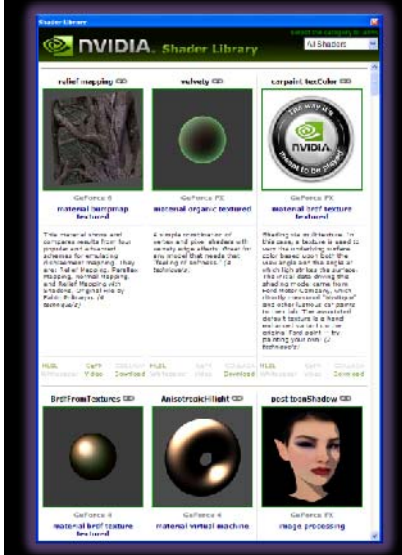


All-New Start Page



Visual Models & Styles

Other Major Features

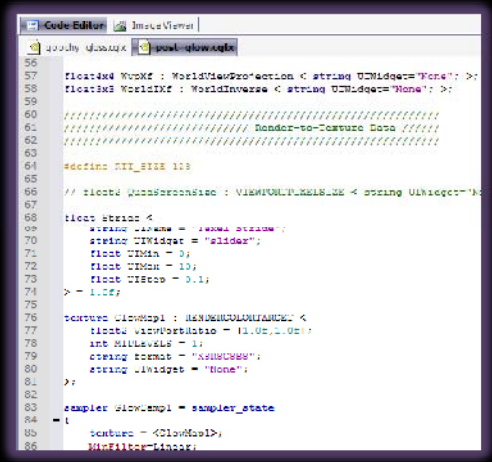


Shader Library

Hundreds of samples

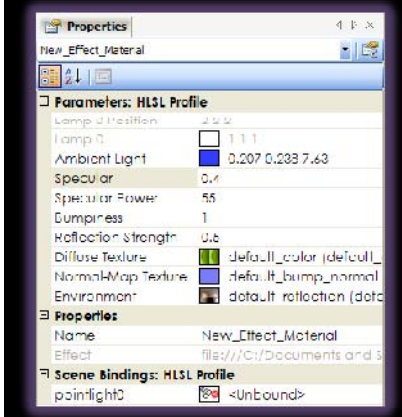
Shader Creation Wizard

Quickly create common shaders

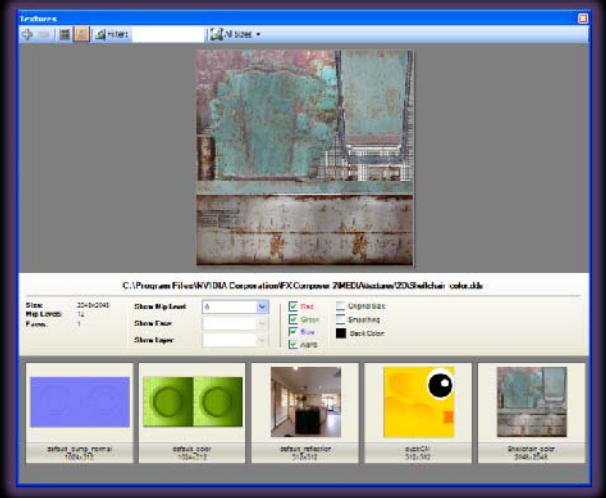


Code Editor

Full editor with assisted code generation

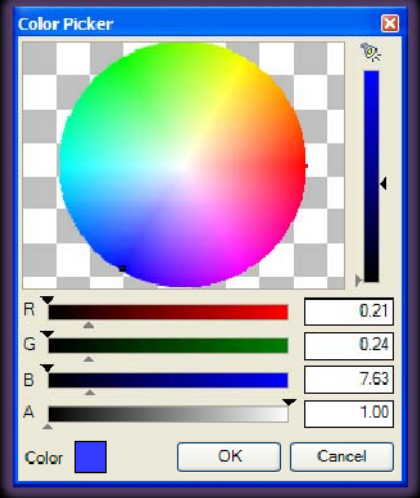


Properties Panel

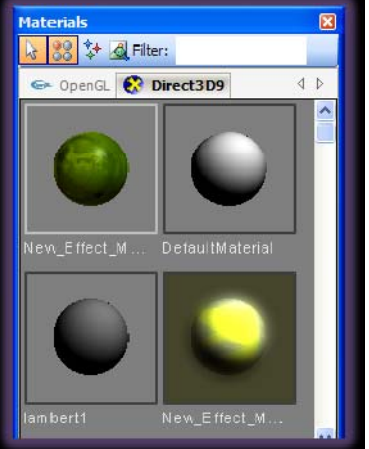


Texture Viewer

View, organize, and apply textures



HDR Color Picker



Materials Panel

Even More Features

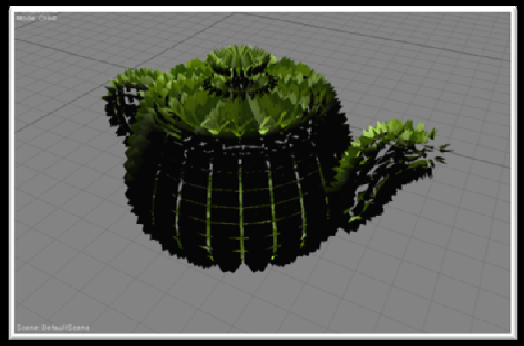
- Automatic Light Binding
- Complete Scripting Support
- Support for DirectX 10
  (Geometry Shaders, Stream Out, Texture Arrays)
- Support for COLLADA, .FBX, .OBJ, .3DS, .X
- Extensible Plug-in Architecture with SDK
- Customizable Layouts
- Semantic and Annotation Remapping
- Vertex Attribute Packing
- Remote Control Capability

New Sample Projects

350Z

Visual Styles

Atmospheric Scattering

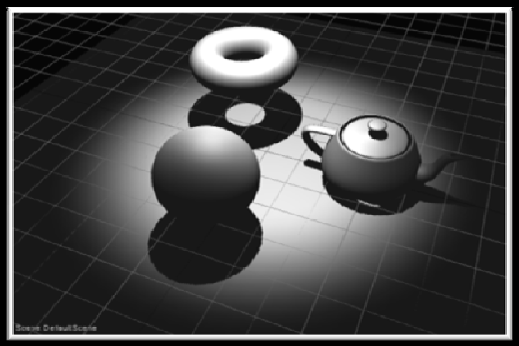


DirectX 10

PCSS Soft Shadows

Materials

Post-Processing



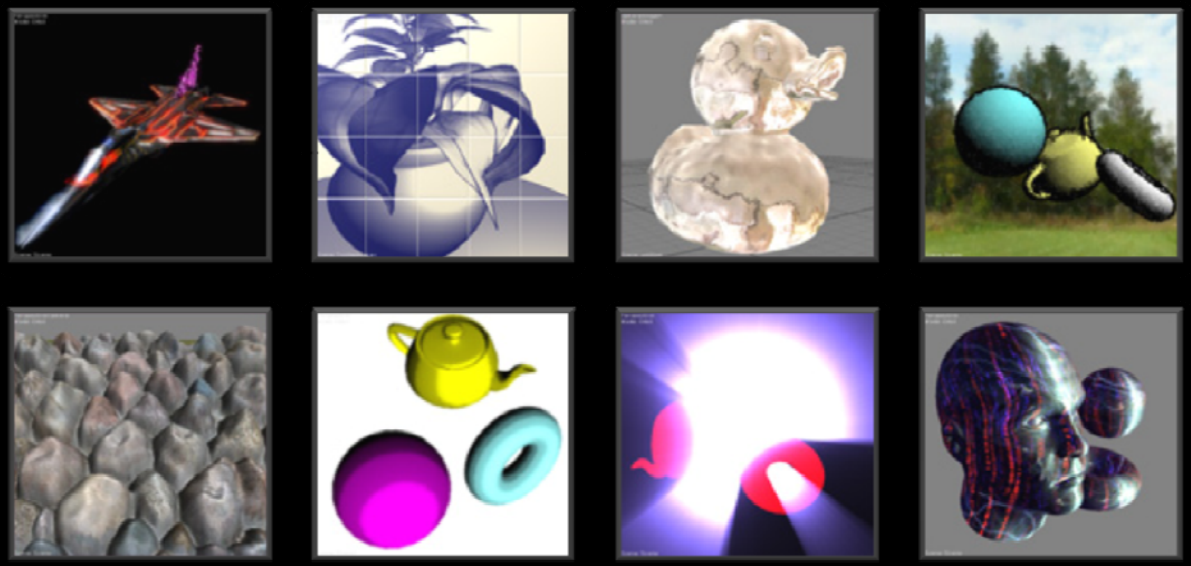
Simple Shadows

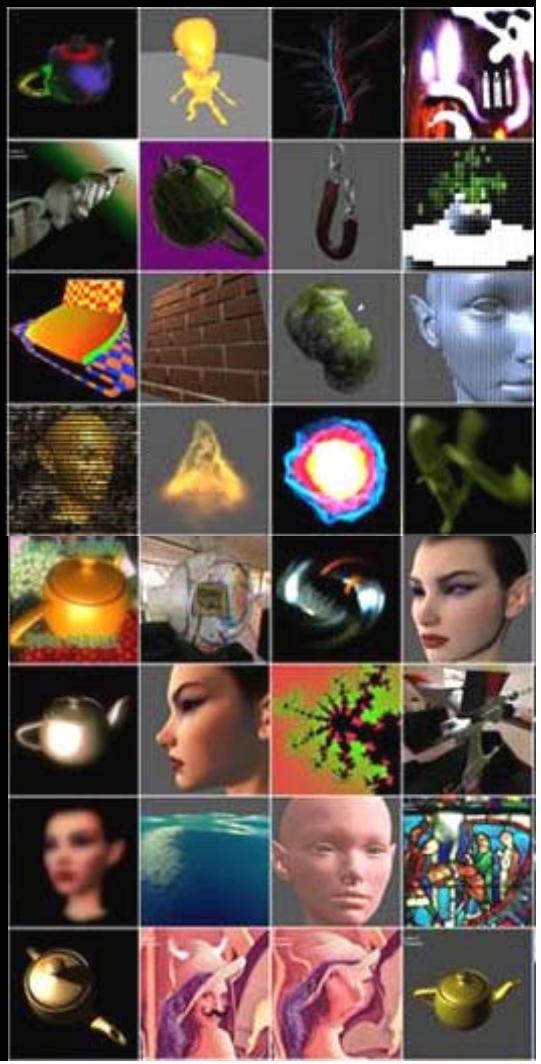
Ninja

NVIDIA Shader Library

The world's largest shader collection

- Over 150 different HLSL & CgFX shaders
- Integrated into FX Composer
- External submissions allowed

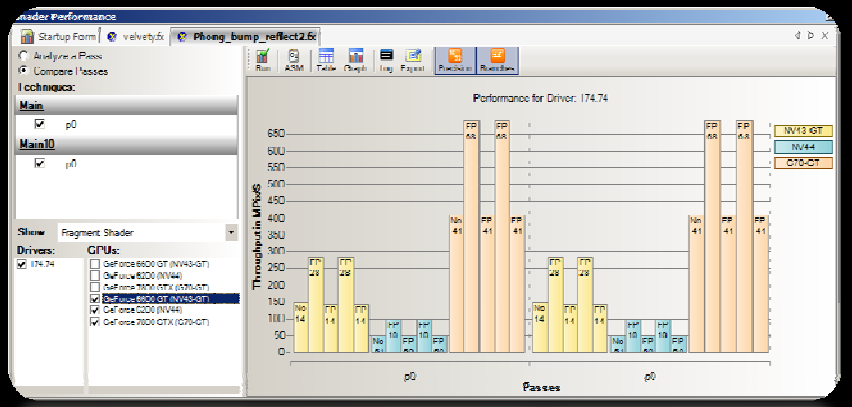


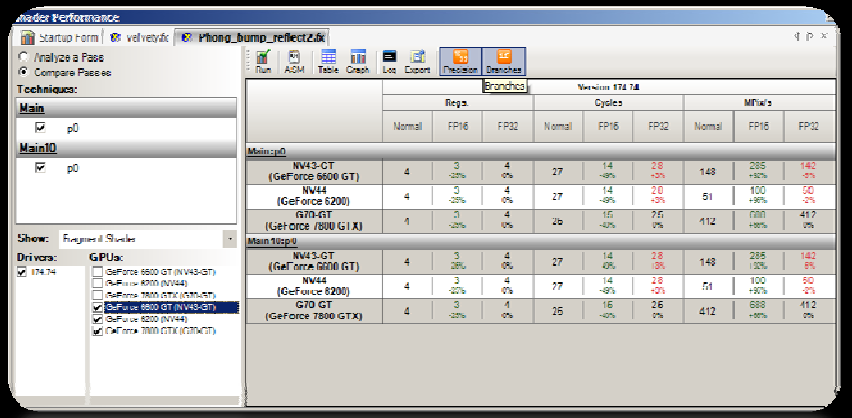


ShaderPerf 2.0

Making shader performance tuning easy

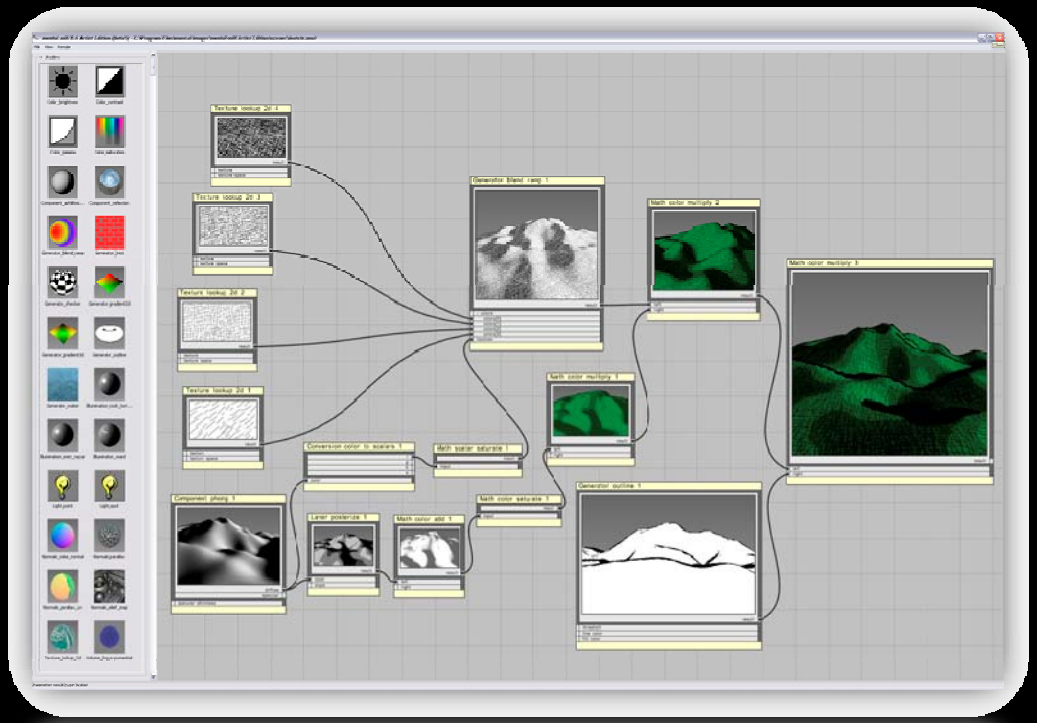
- ***New!*** **GeForce 8 Series support**
- ***New!*** **API for programmatic access**
- ***New!*** **Fragment program differencing**
- **Vertex and pixel shader analysis**
  (No OGL vertex shader analysis on GPUs older than GeForce 8 Series)
- **Many supported shader formats**
- **Compare different techniques**
- **See shader throughput, register usage, instruction counts, and branching performance**
- **Integrated in FX Composer 2.5**
- **Also available as standalone command-line tool**





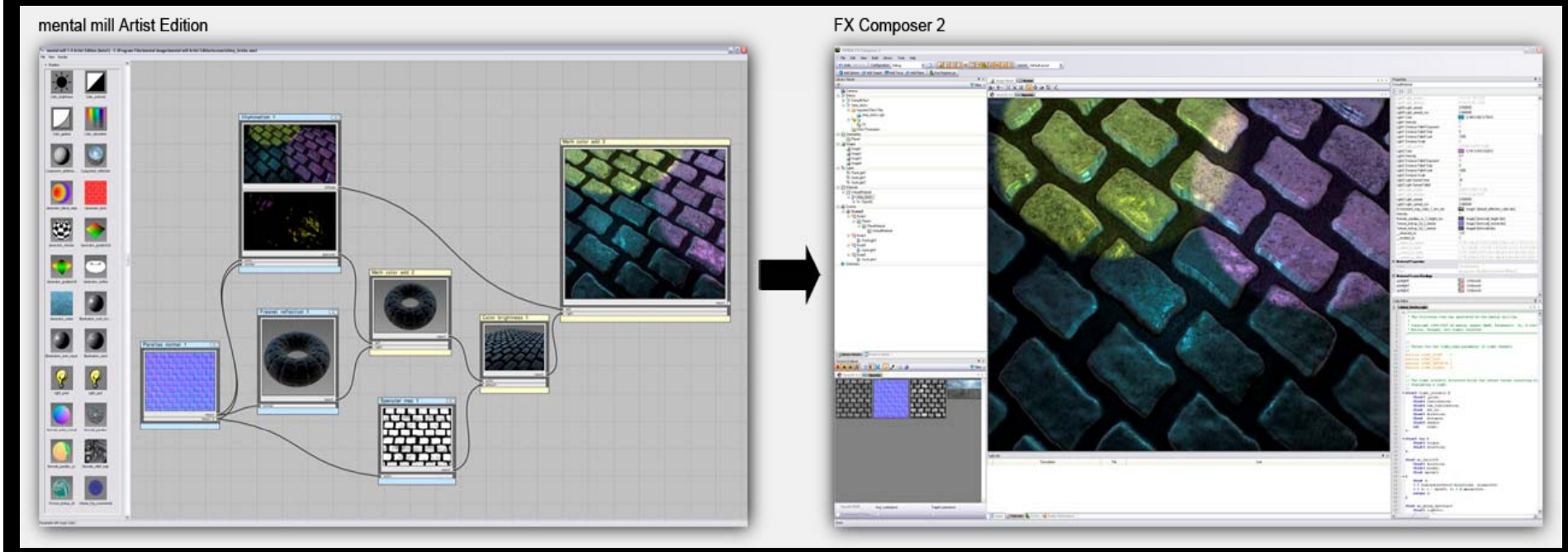
mental mill™ Artist Edition

- Enables artists to quickly and easily develop and prototype new looks within a fast, flexible GUI.

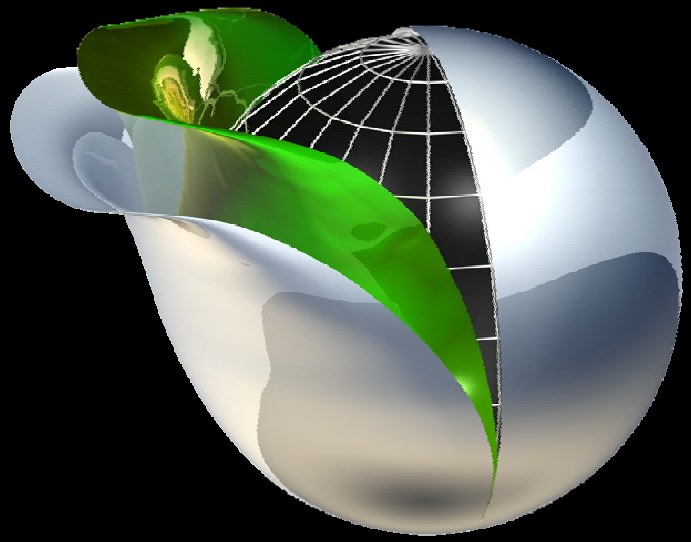


mental mill Artist Edition and FX Composer

- **The best of both worlds.** More power for artists plus optimization abilities for programmers and shader specialists.
- **Smooth interoperability with FX Composer.** A shader exported from mental mill can be seamlessly imported into FX Composer.
- **Better collaboration.** Dramatically reduced iteration time.



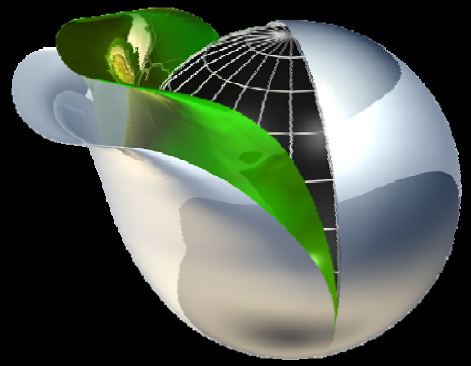
The NVIDIA Shader Debugger



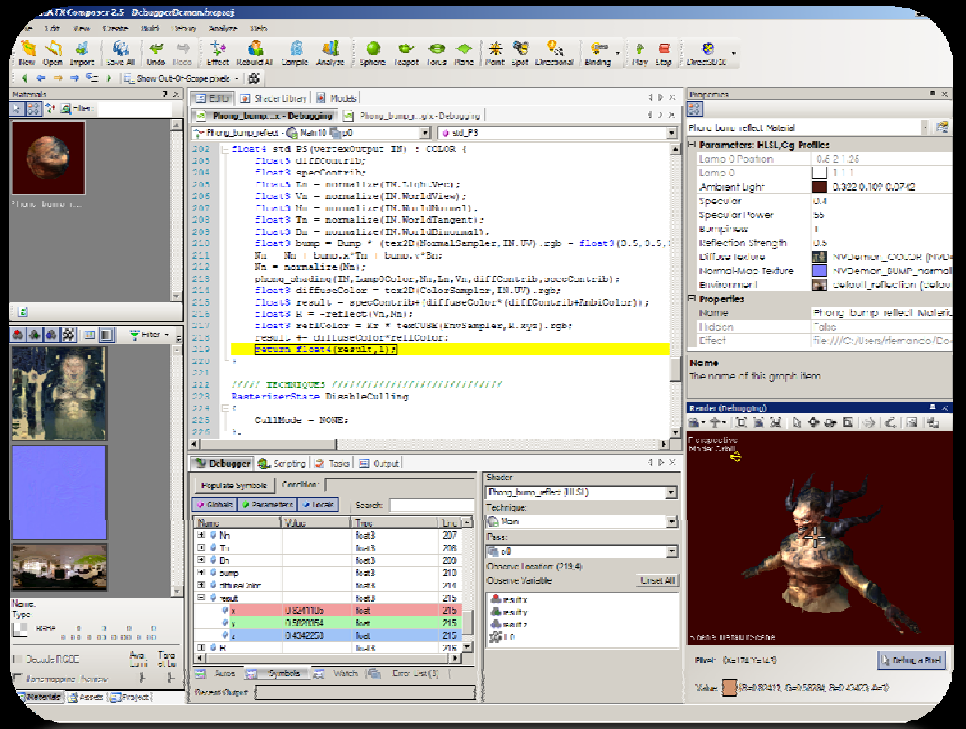
www.shaderdebugger.com

NVIDIA Shader Debugger

Visualize your shaders, step by step



- Broad Language Support
  - HLSL10/9
  - CgFX
  - COLLADA FX Cg
- Step through shader source code
- Visualize variables across your geometry
- Plug-in for FX Composer 2.5



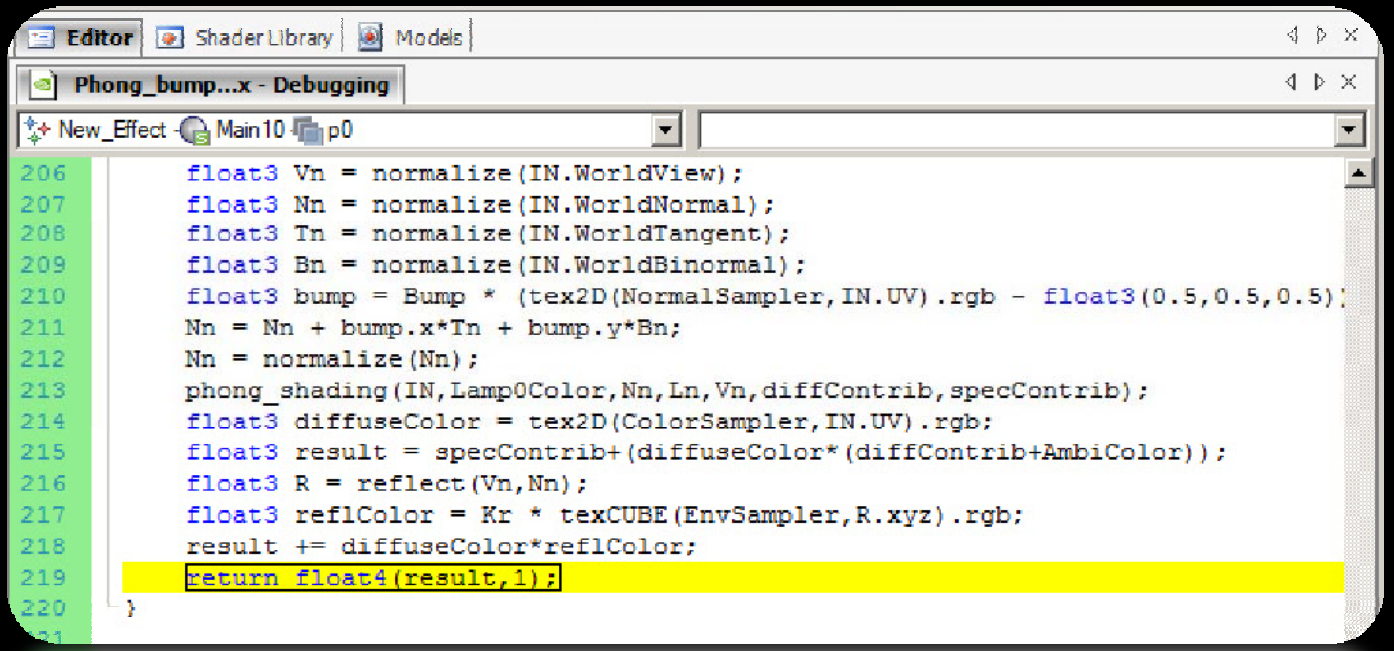
Run Control

Full control of shader execution

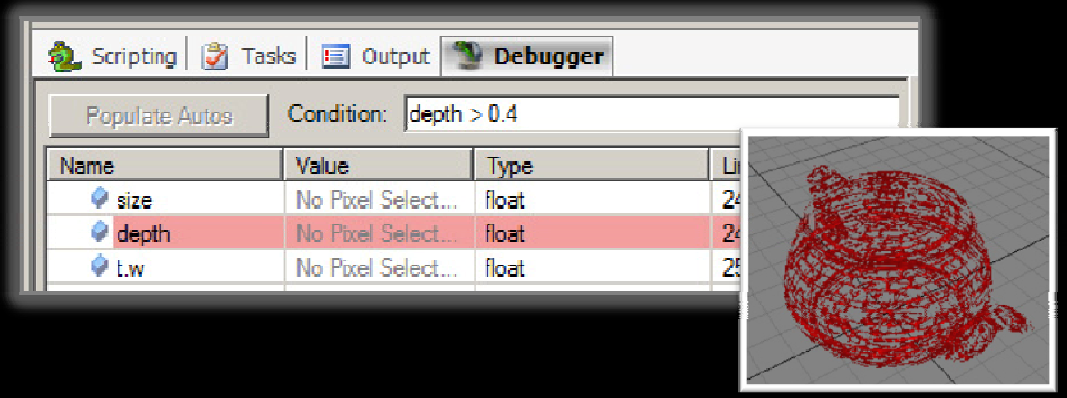
Next/Previous Statement

Run to Cursor

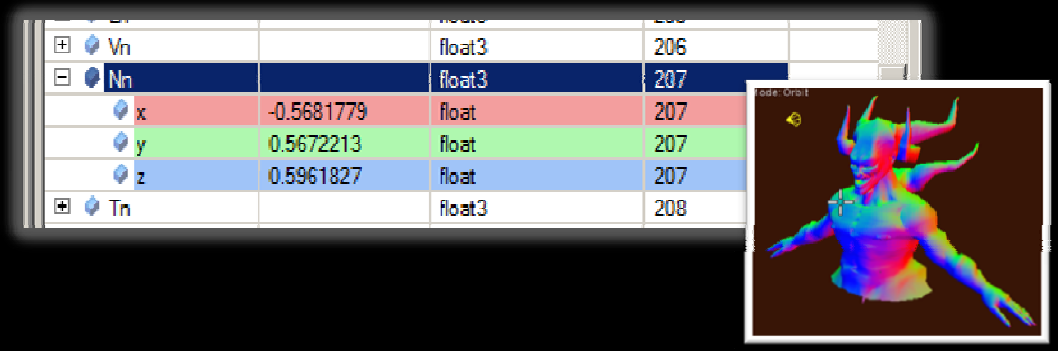
Run to Bookmark



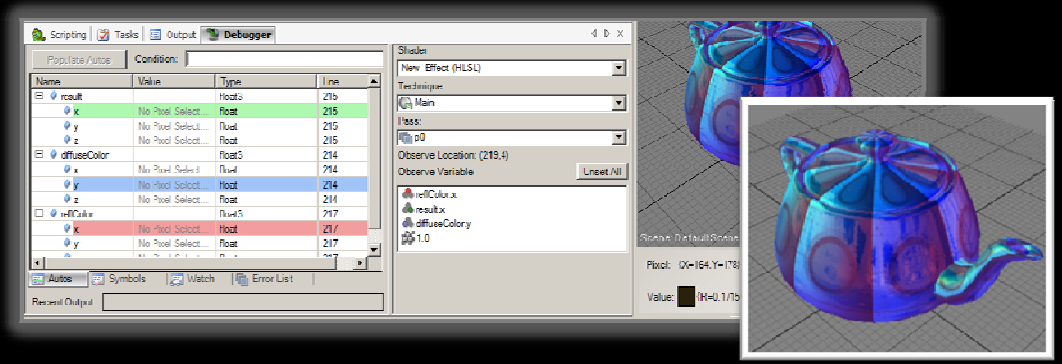
More Shader Debugger Features



Conditionally Kill Fragments



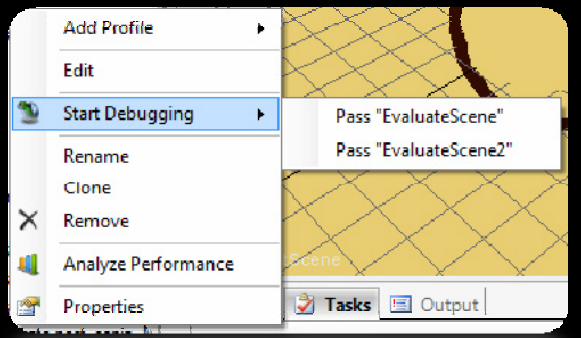
Visualize Any Variable

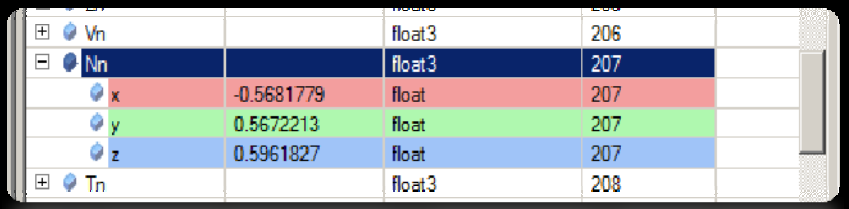


Create Custom Output Mappings

More Shader Debugger Features

Debug multi-pass/full scene effects.

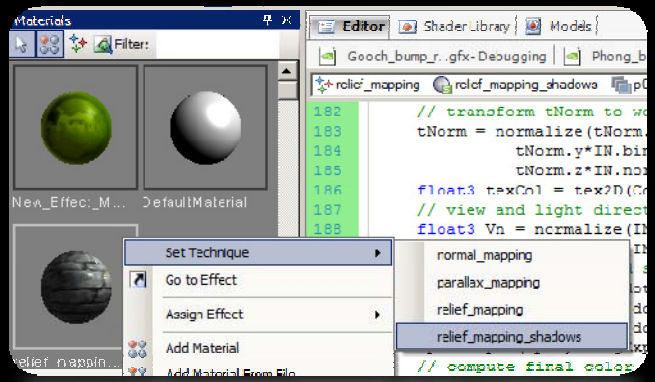




Vn		float3	206
Nn		float3	207
x	-0.5681779	float	207
y	0.5672213	float	207
z	0.5961827	float	207
Tn		float3	208

Examine pixels individually or in parallel.

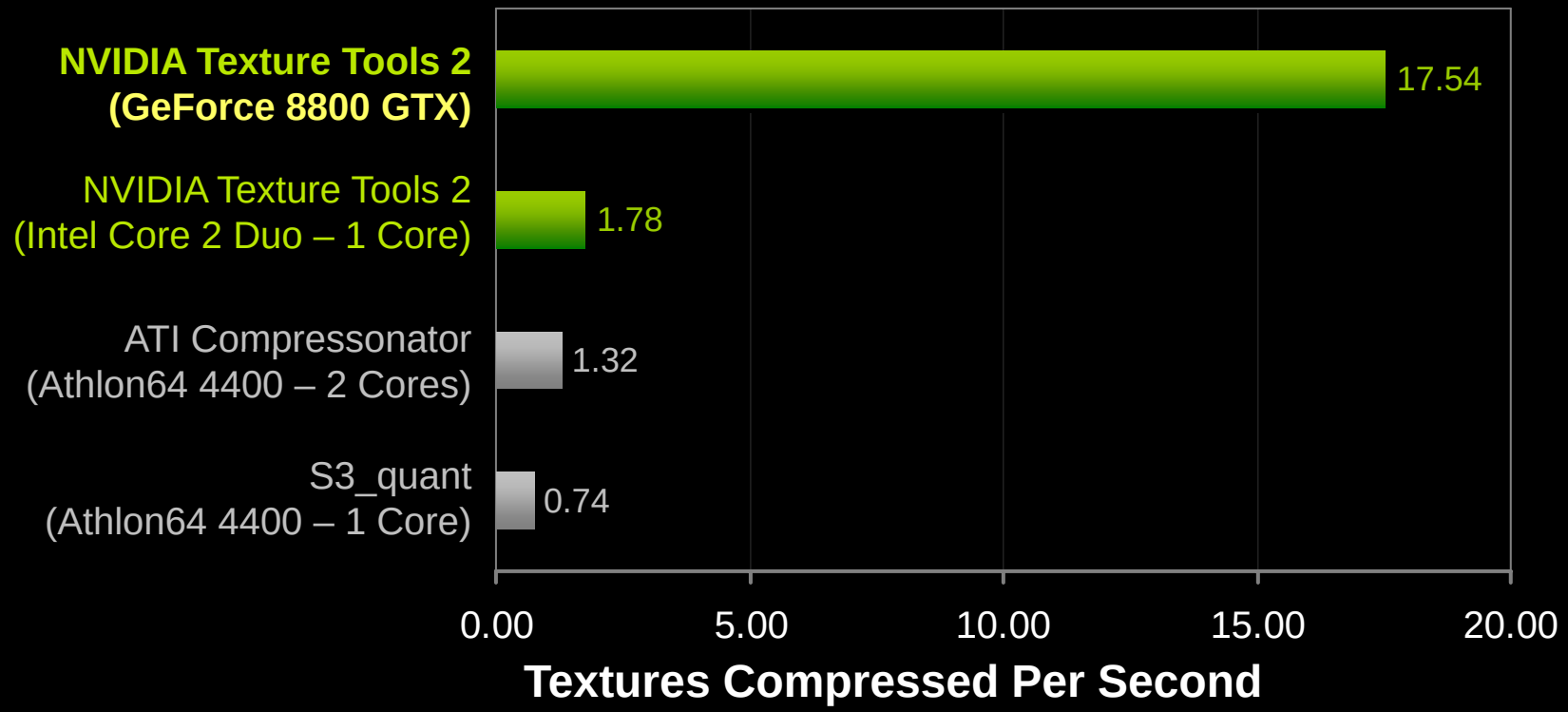
Pick any technique in your shader to debug.



GPU-Accelerated Texture Tools

10x faster, high-quality texture compression

- GPU-accelerated via CUDA
- Support for DirectX 10 texture formats
- Includes complete source code
- Amazing performance without sacrificing quality

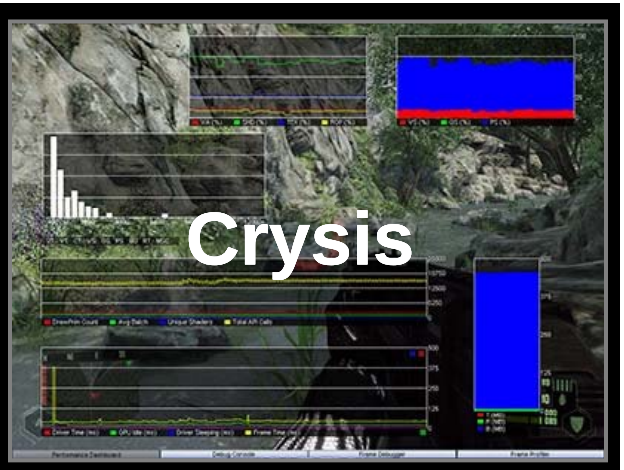


NVIDIA PerfKit 6

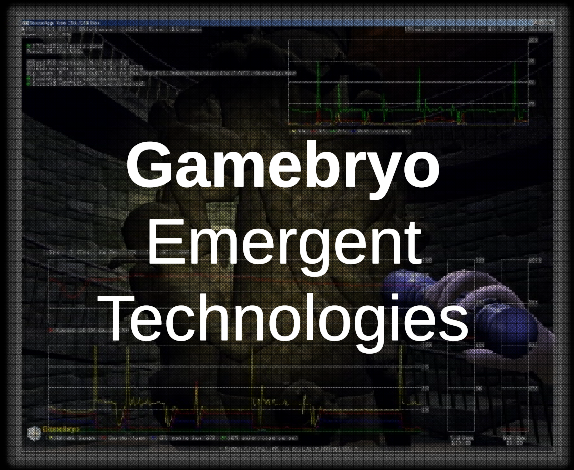
NVIDIA PerfHUD 6.1

More convenient and powerful than ever

- G8X & GT200 support
- Comprehensive SLI support
- No More “Instrumented Driver”
- Frame Capture (coming soon)
- Advanced texture and render target debugging & analysis
- API Data Mining & Analysis
- Debug Break capability
- Many other convenient features…



Top Game Developers Use PerfHUD
(Games shown with PerfHUD running on them)

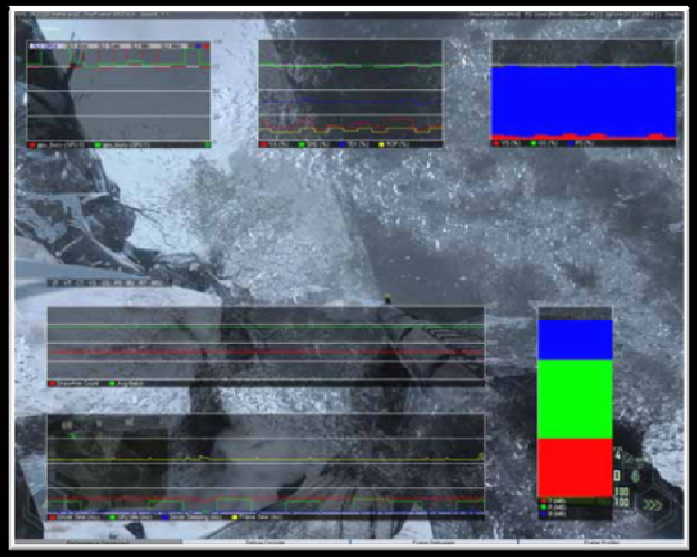


Over 300 surveyed PerfHUD 5 users reported an average speedup of 37%, and as much as 400%!

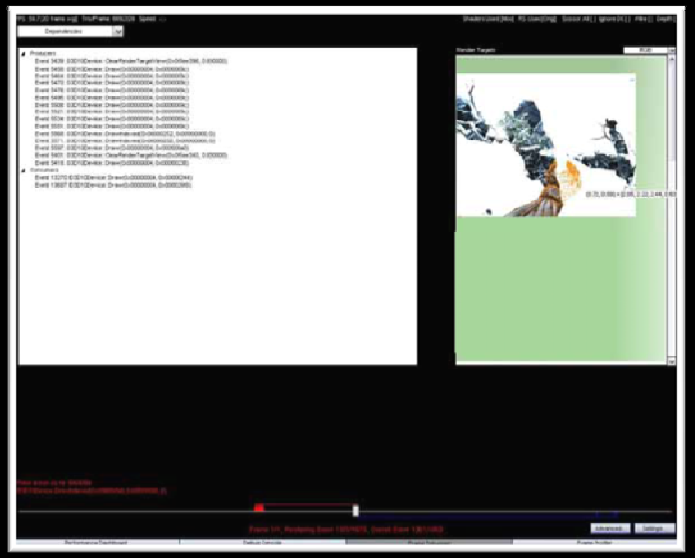
NVIDIA PerfKit 6: The World's Most Advanced GPU Performance Suite

- PerfHUD 6
  - *New!* GeForce 8800GT, 9600GT, 9800GX2, GTX 280 support
  - *New!* Use stock NVIDIA drivers with PerfHUD (on Windows Vista)
  - *New!* Multi-GPU Support
  - *New!* More real-time signals, including SLI signals
  - *New!* API Call List
  - *New!* Draw Call Dependency Analysis
  - *New!* Advanced Texture Visualization
  - *New!* Texture Overrides
  - Real-time performance analysis and debugging
  - Automated bottleneck determination
- PerfSDK
  - *New!* GeForce 8800GT, 9600GT, 9800GX2, GTX 280 support
  - API for accessing GPU and driver counters
  - Supports DirectX 9 & 10, as well as OpenGL
- NVIDIA Plug-in for Microsoft PIX for Windows
- GLExpert

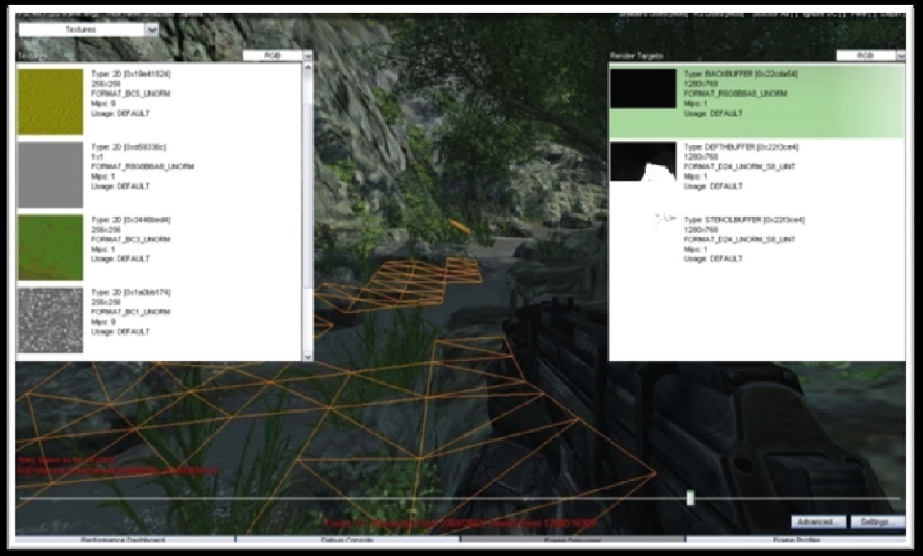
PerfHUD 6



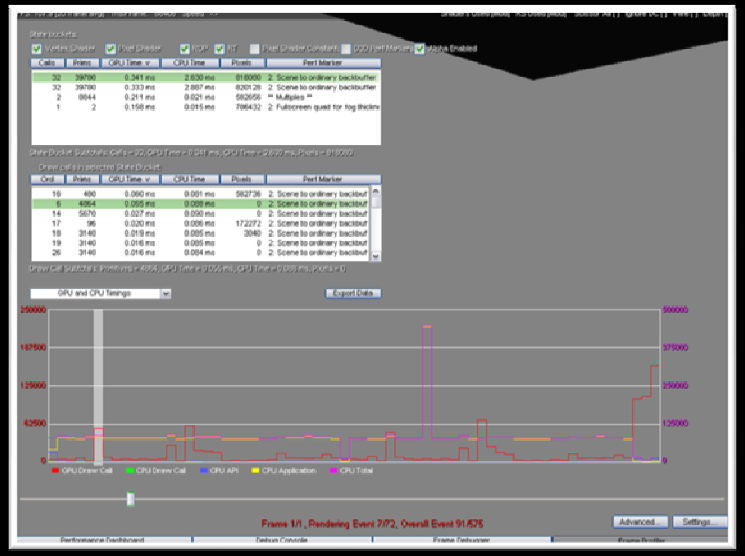
Multi-GPU Support



Advanced Data Mining



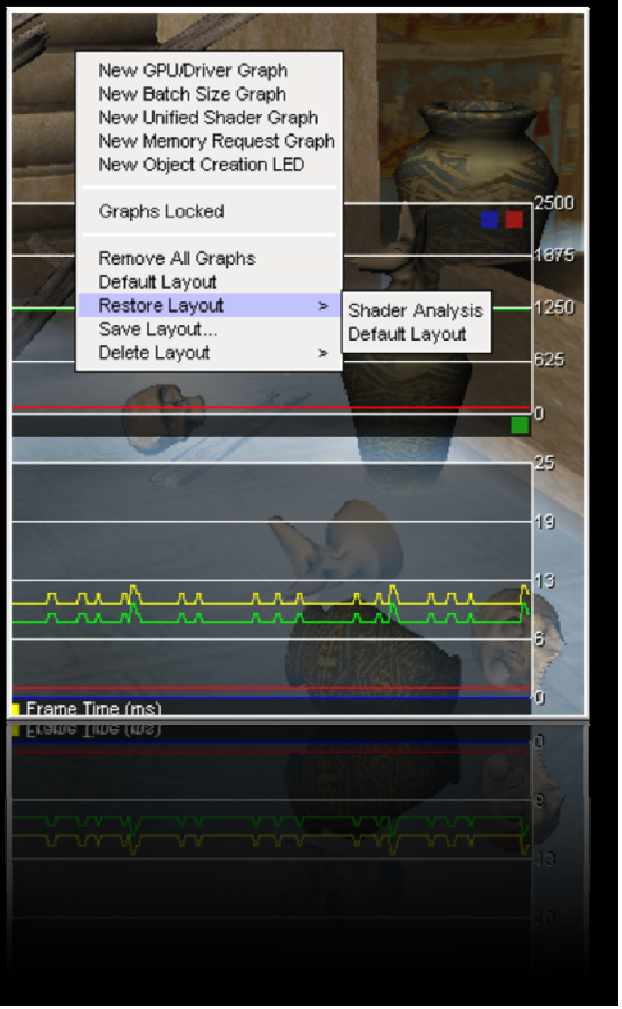
Powerful Texture Visualization



Combined CPU/GPU Timing Graph

Tons of other improvements!

- **Multiple, named Performance Dashboard Layouts**
  - Save separate layouts for each of your monitoring scenarios.
- **Sampler State Editing**
  - Edit and override any property of a sampler in your application
- **New Real-time Experiments**
  - Minimize Geometry (Replaces all geometry with a single primitive)
- **Improved Compatibility and Stability**
  - Rewritten interception layer requires less cooperation from the application.
  - Now compatible with applications that include frame-limiting logic.
  - Now compatible with applications which send non-deterministic graphics workloads.
  - Many bug fixes and performance improvements.
- **Improvements to Frame Profiler**
  - New CPU/GPU Timings Graph lets you directly see and compare utilization in the CPU, the driver, and the GPU.
- **User Interface Improvements**
  - Navigation hotkeys for every major tool
- **Compatibility, stability, and reliability improvements**
  - Extensive testing on a wide range of applications
  - Minor bug fixes

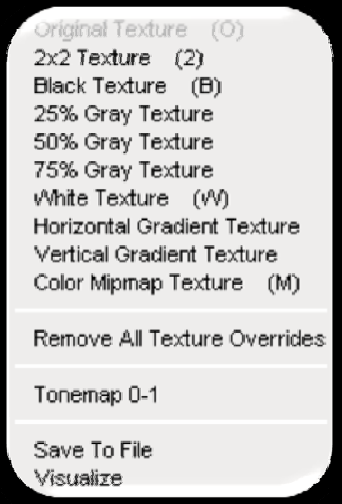


How to Think of PerfHUD's Main Modes

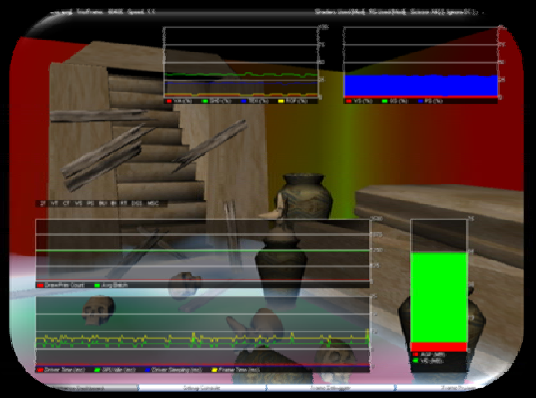
- **Performance Dashboard**
  Real-time Holistic Analysis
- **Frame Debugger**
  Rendering Debugging
- **Advanced Screens**
  Shader and Render State Inspection and Modification
- **Frame Profiler**
  Automated Bottleneck Detection
  Per-Draw Call Performance Graphs

New! Advanced Texture Overrides

- Override any texture in your application with a variety of useful texture overrides
- 2x2 Texture: Reduces texture bandwidth usage by using the smallest texture possible.
- Black, 25% Gray, 50% Gray, 75% Gray, White, Horizontal gradient, Vertical Gradient: Each of these can be useful as debug input to your shaders.
- Color Mipmap Texture: Visualize your mip levels quickly and easily
- Use with shader edit and continue to quickly diagnose and correct bugs.



Texture Context Menu



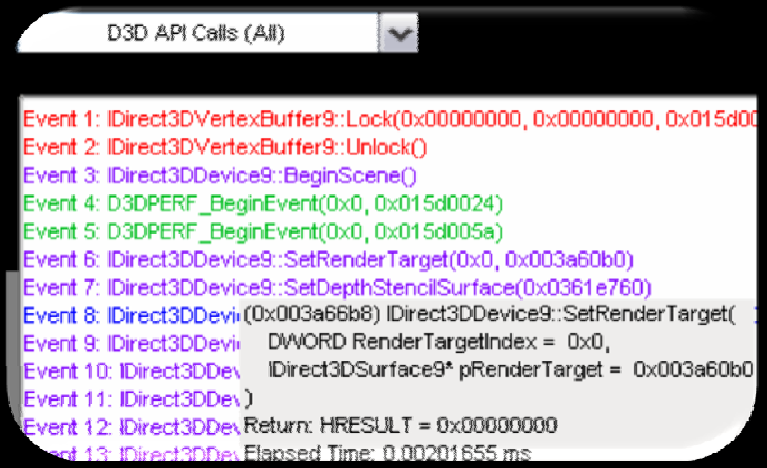
Mipmap Visualization

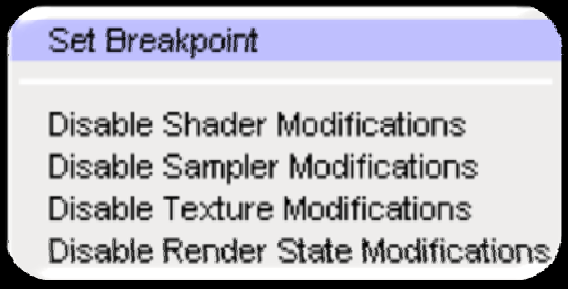
New! API Call List and Perf Event View

New! API Call List

A full list of all D3D API calls, colorized by call type

One click jumps you to the corresponding draw call.





New! Perf Event List

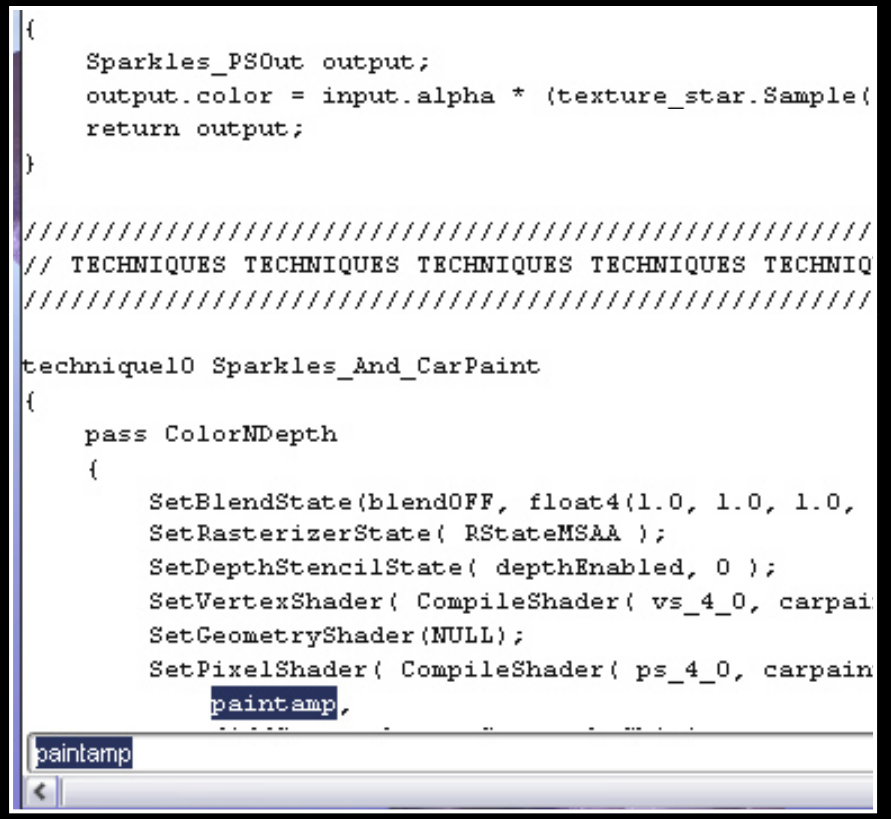
Navigate your scene using D3D Perf Events to annotate sections of the frame.

Use Perf Events to selectively disable state overrides for portions of the scene.

Set a debug break (_int 3) to occur on a Perf Event to help debug your CPU code.

Shader Edit and Continue

- Edit & Continue for:
  - DirectX 9 HLSL and .fx
  - DirectX 10 HLSL and .fx
  - Vertex, geometry, and pixel shaders
- Code editing
  - Standard keyboard and mouse interaction
  - Search bar
- Easily toggle between original and modified shaders
  - Discard Current Edits
  - Restore Original Shader
  - Controlled via hotkey



Editing Shaders

How is PerfHUD Different from Other Performance Tools?

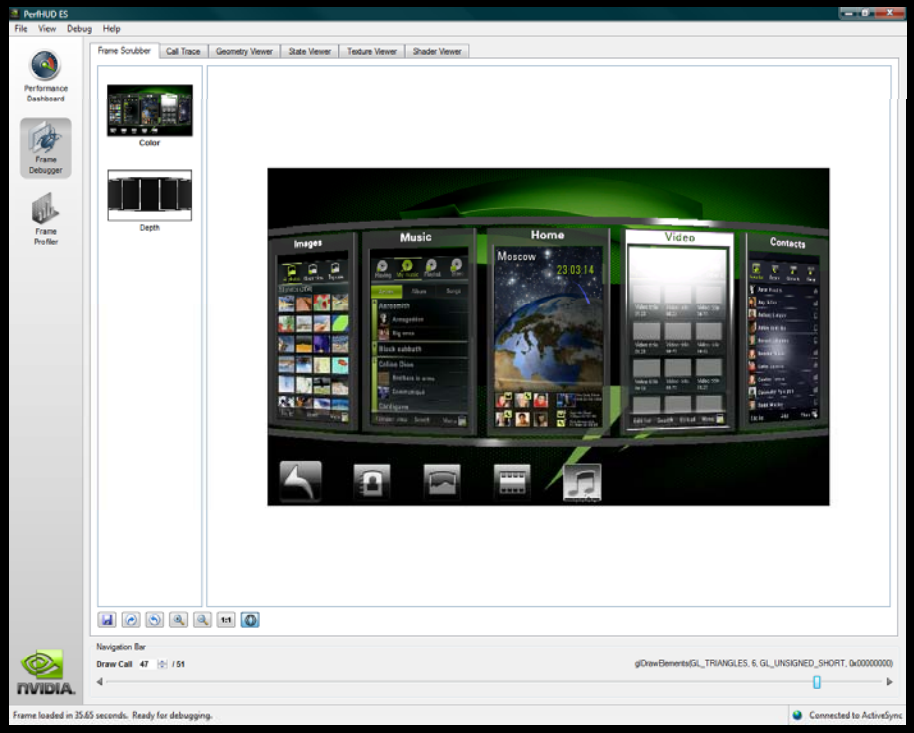
- **It works in real-time on your application.** Other tools require out of context, offline analysis. PerfHUD allows you to debug and tune your application in the most natural place: within your application!

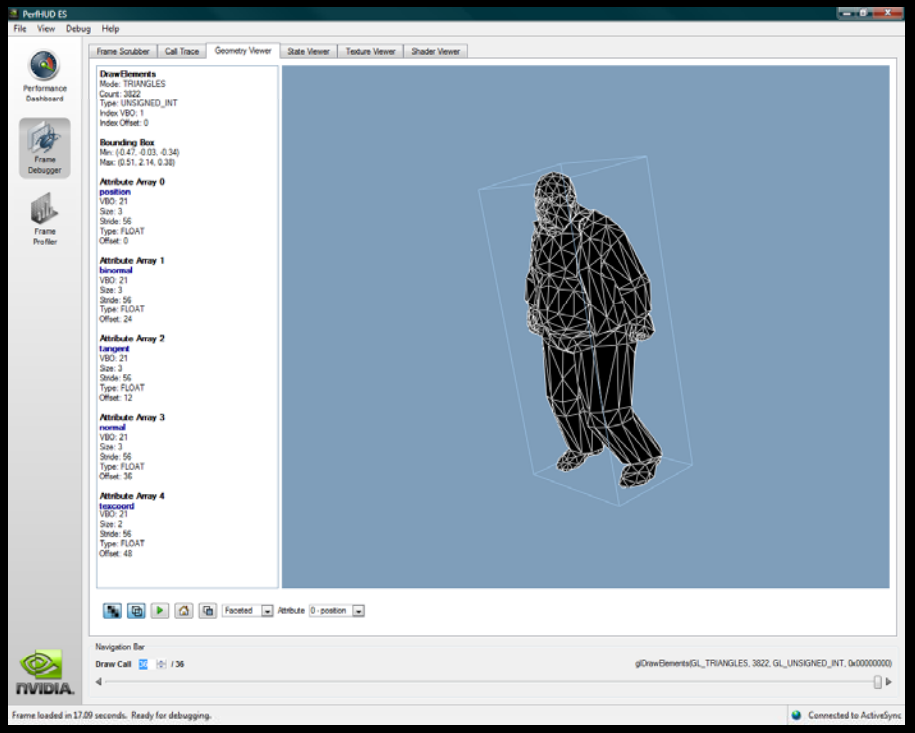
- **One key press provides a list of draw calls (grouped by bottleneck and sorted by duration) to work on.** Running experiments and collecting data from individual pipeline units is difficult and easy to misjudge. PerfHUD automatically tells you exactly where your bottlenecks are so you can fix them quickly.

- **Real-time frame scrubbing.** Modern engines have thousands of draw calls per frame. PerfHUD lets you decompose the scene, stepping through each draw call to find any problems.

- **Edit-and-continue.** Modifying shader code and render states can be time consuming. PerfHUD allows you to make changes while your application is running – allowing you to quickly try our ideas and get immediate feedback.

PerfHUD ES

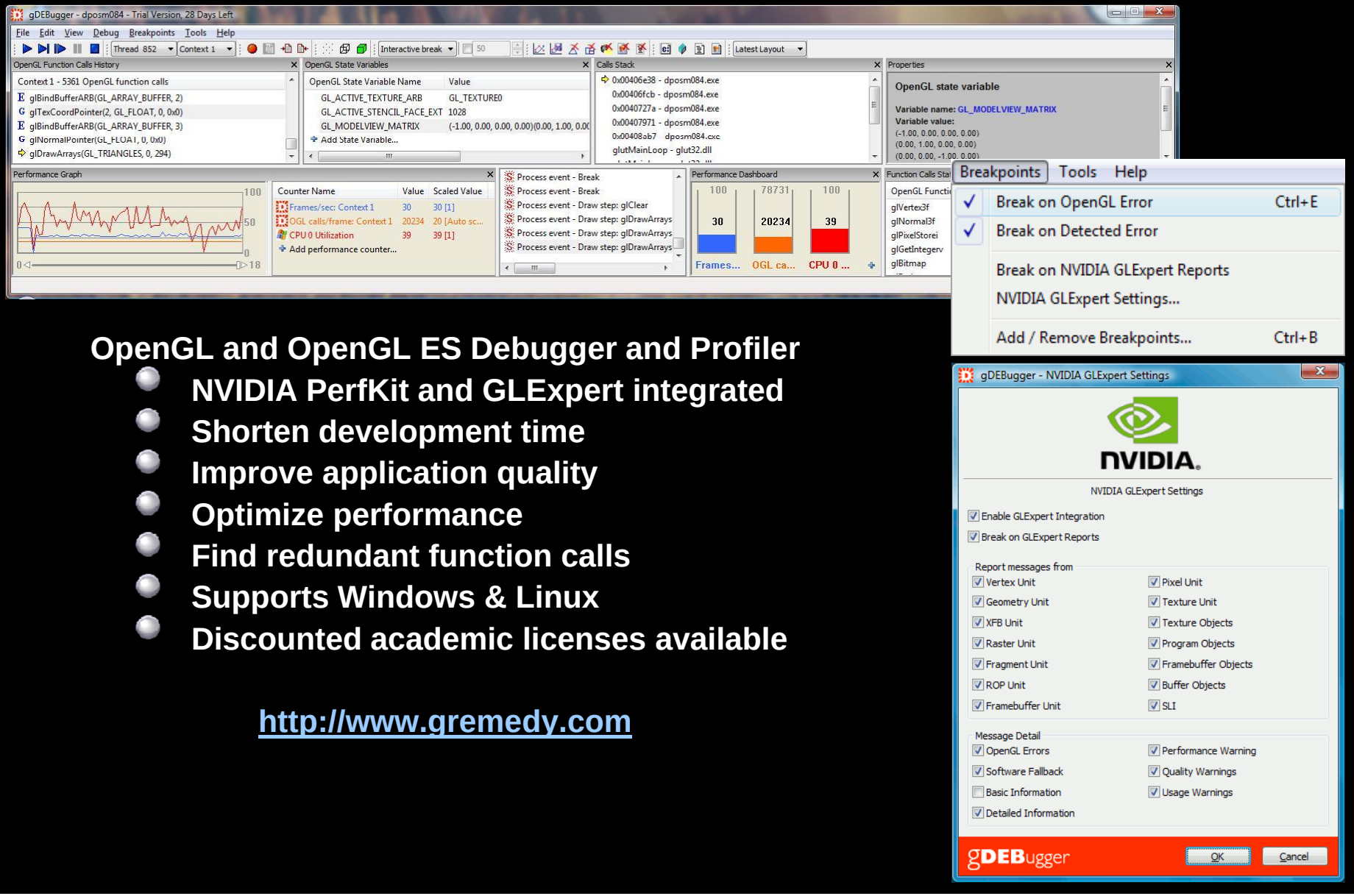




Similar functionality to PerfHUD PC for OpenGL ES

(For example, for Tegra development)

Graphic Remedy's gDEBugger

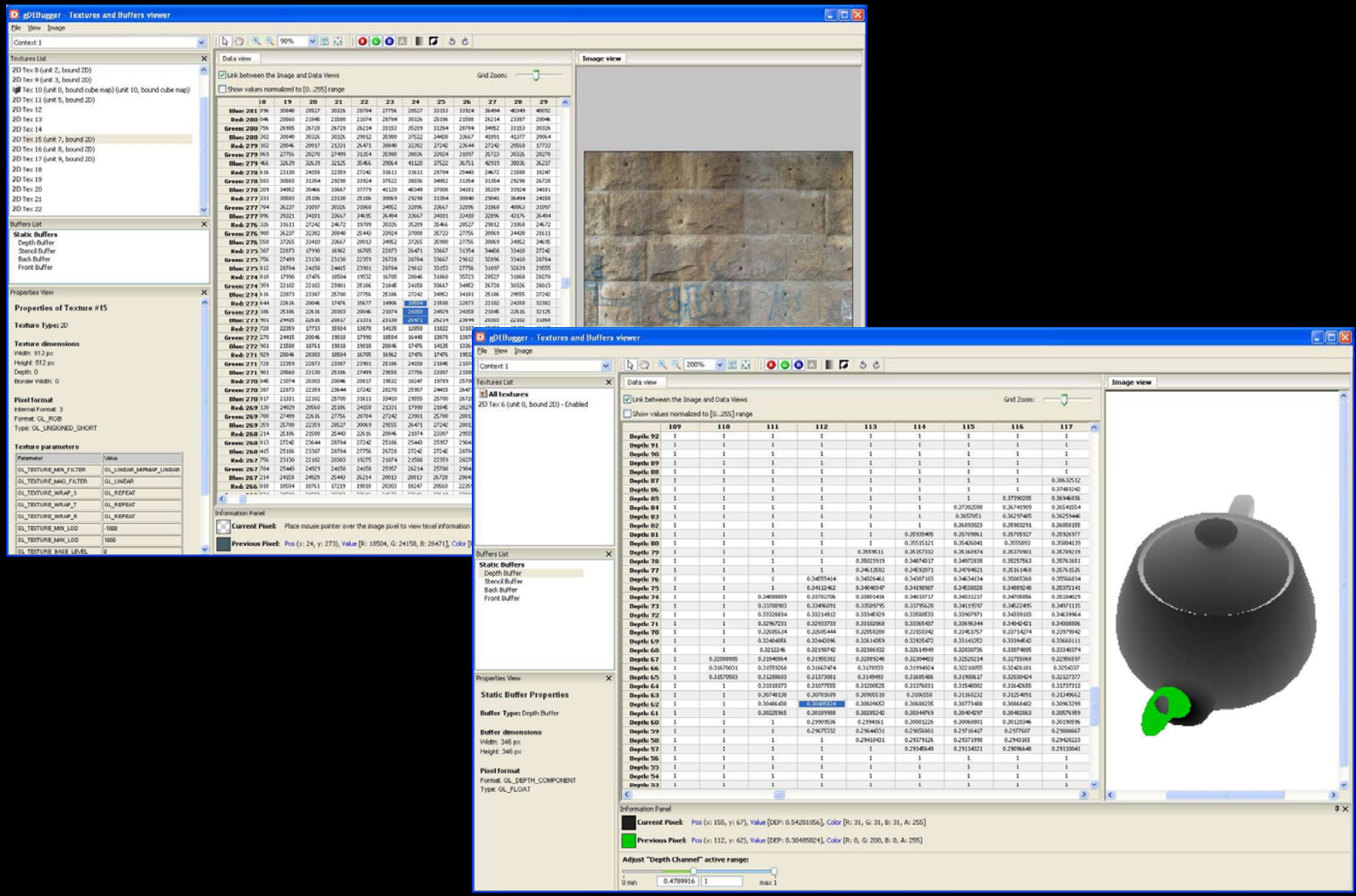


OpenGL and OpenGL ES Debugger and Profiler

- NVIDIA PerfKit and GLExpert integrated
- Shorten development time
- Improve application quality
- Optimize performance
- Find redundant function calls
- Supports Windows & Linux
- Discounted academic licenses available

http://www.gremedy.com

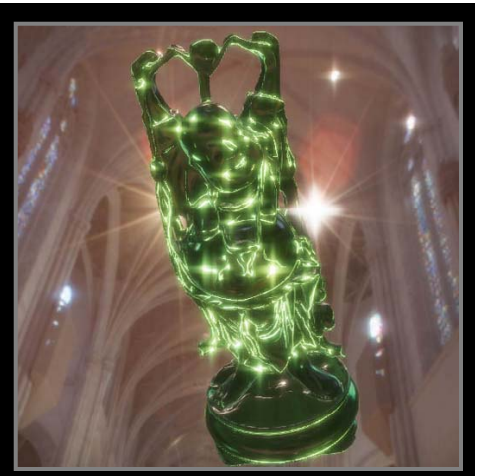
Graphic Remedy's gDEBugger

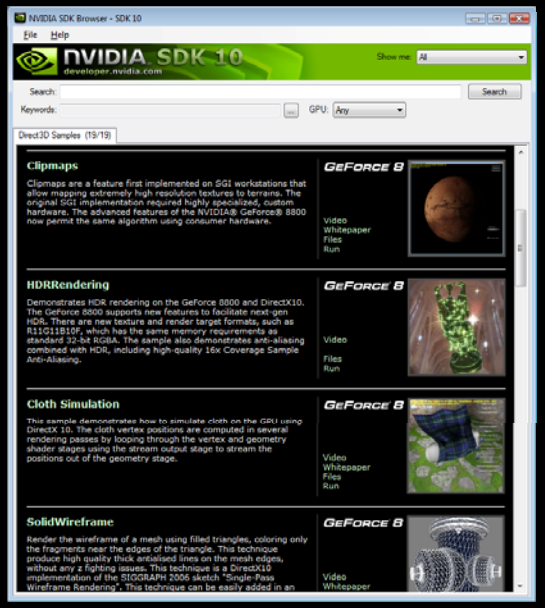


SDK 10.5

The latest DirectX and OpenGL code samples

- Teaches developers how to take advantage of new DirectX 10-class GPUs
- Browser with clear code samples, detailed whitepapers, and videos



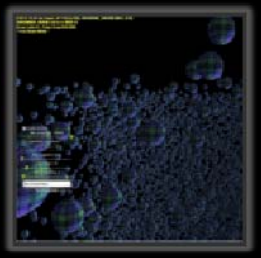


Selected SDK 10.5 Direct3D Samples


Tessellation


Screen-Space Ambient Occlusion

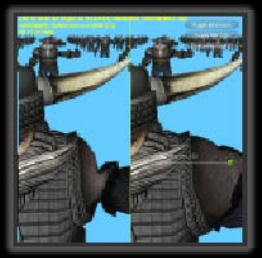

PCSS (Soft Shadows)


Instancing Tests

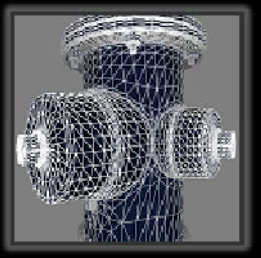

Parallax Mapping


Volume Light


Stencil-Routed K-Buffer


Advanced Skinning


Clipmaps


HQ Wireframe


Texture Arrays


MetaBalls


Smoke


Skinned Instancing

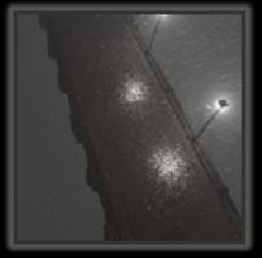

HDR Rendering


Soft Particles


Denoising


CSAA


Lightning


Rain

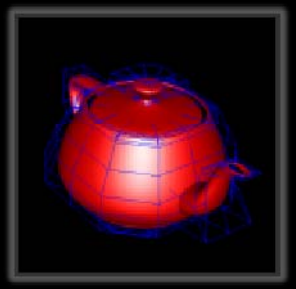

Fur

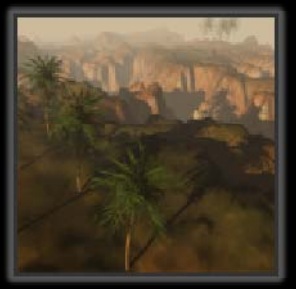

GPU Blendshapes


Perlin Fire


Soft Shadows

Selected SDK 10.5 OpenGL Samples


Tessellation

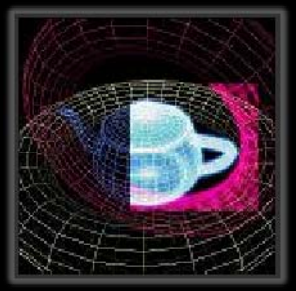

Cascaded Shadow Maps

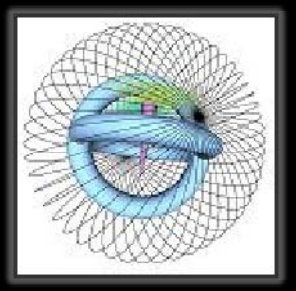

Dual Depth Peeling


Compress Normal-DXT

Compress YCoCg-DXT


Texture Buffer Object

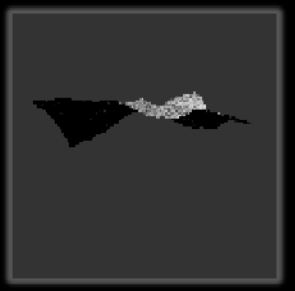

Glow


HQ Antialiasing


Christmas Tree


Render to 3D Texture


Render to 3D Texture


Transform-Feedback Fractal


Texture Array


Geometry Program


Framebuffer Object


Depth Float


HDR

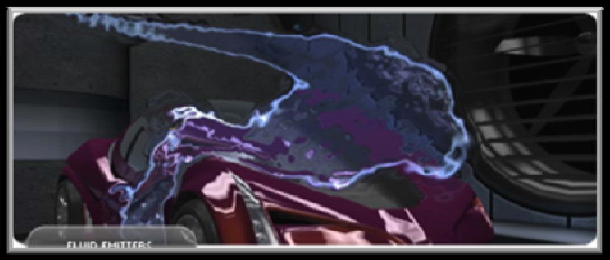

Isosurface

CUDA Toolkit & SDK

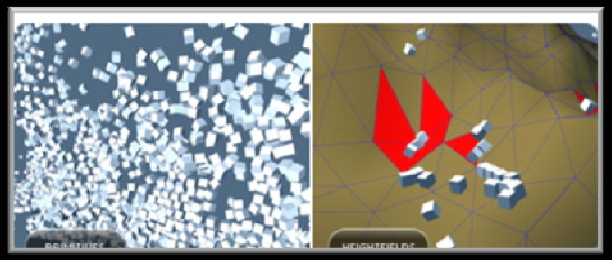
- Complete software development solution for programming CUDA-enabled GPUs
- Includes:
  - Standard FFT and BLAS libraries
  - C-compiler for the NVIDIA GPU
  - Runtime driver
- SDK Samples:
  - Parallel bitonic sort
  - Matrix multiplication
  - Matrix transpose
  - Performance profiling using timers
  - Parallel prefix sum (scan) of large arrays
  - Image convolution
  - 1D DWT using Haar wavelet
  - OpenGL and Direct3D graphics interoperation examples
  - CUDA BLAS and FFT library usage examples
  - CPU-GPU C- and C++-code integration
  - Binomial Option Pricing
  - Black-Scholes Option Pricing
  - Monte-Carlo Option Pricing
  - Parallel Mersenne Twister (random number generation)
  - Parallel Histogram
  - Image Denoising
  - Sobel Edge Detection Filter

NVIDIA PhysX SDK

Cloth

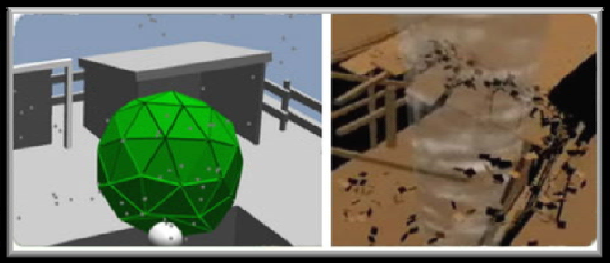


Fluid Simulation

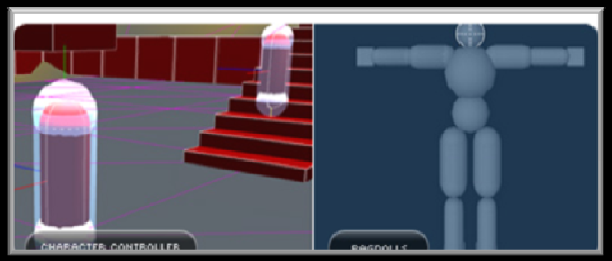


Particles

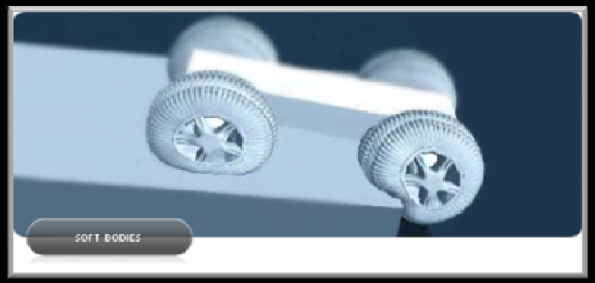
Vehicle Dynamics



Force Fields

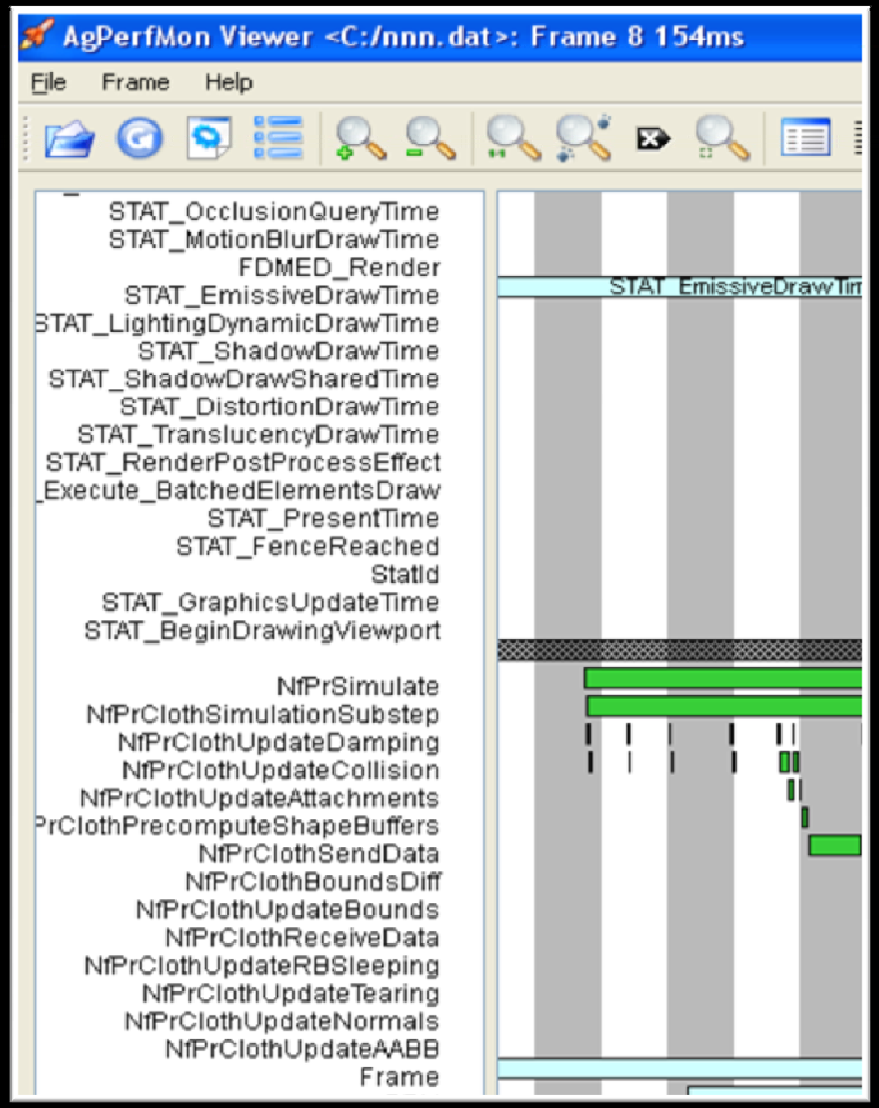


Ragdolls

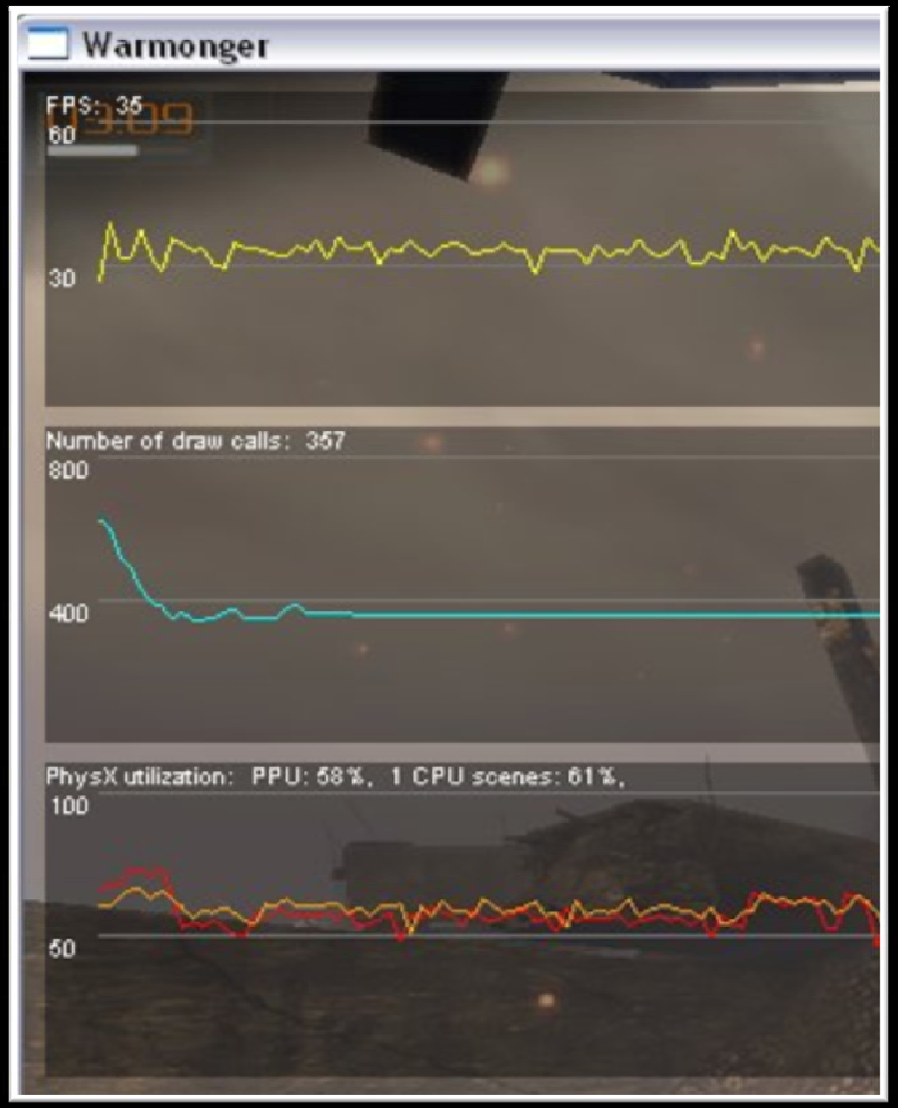


Soft Bodies

NVIDIA Platform Analyzer Components

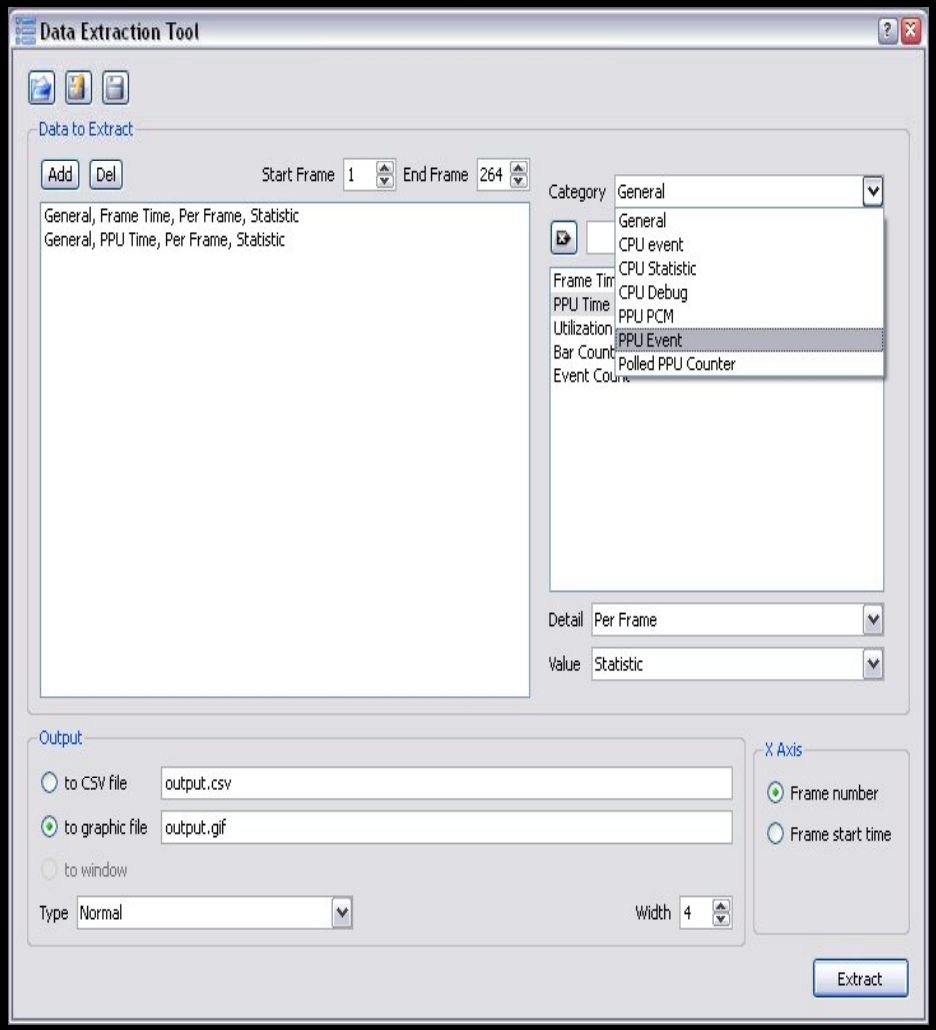


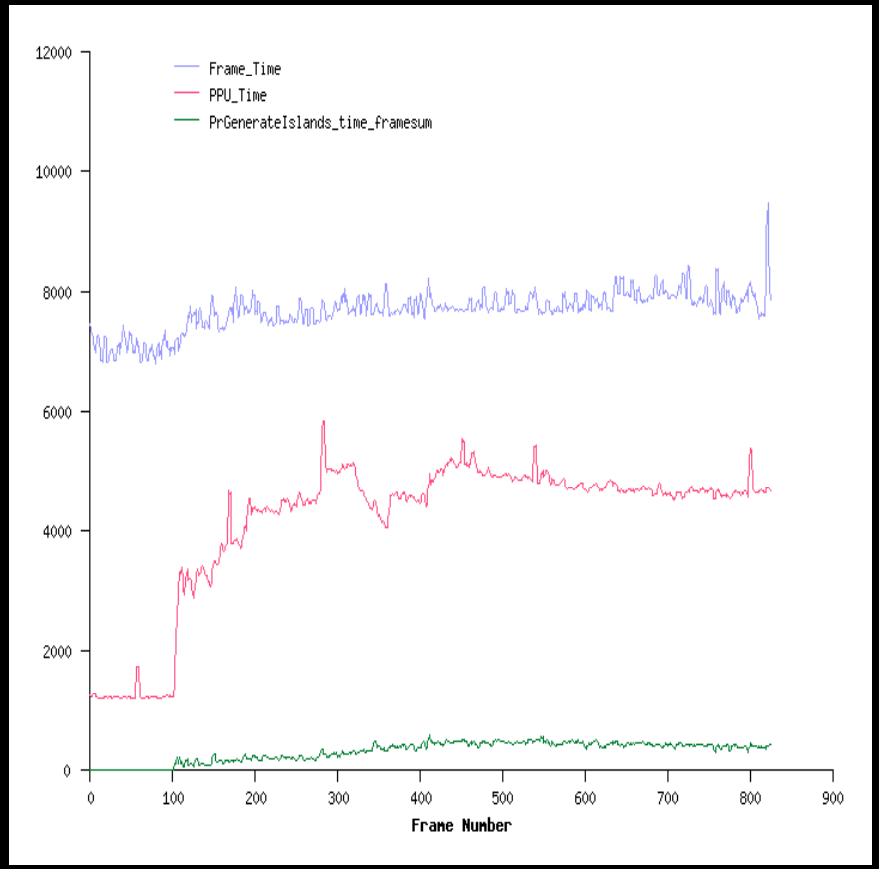
Event Viewer



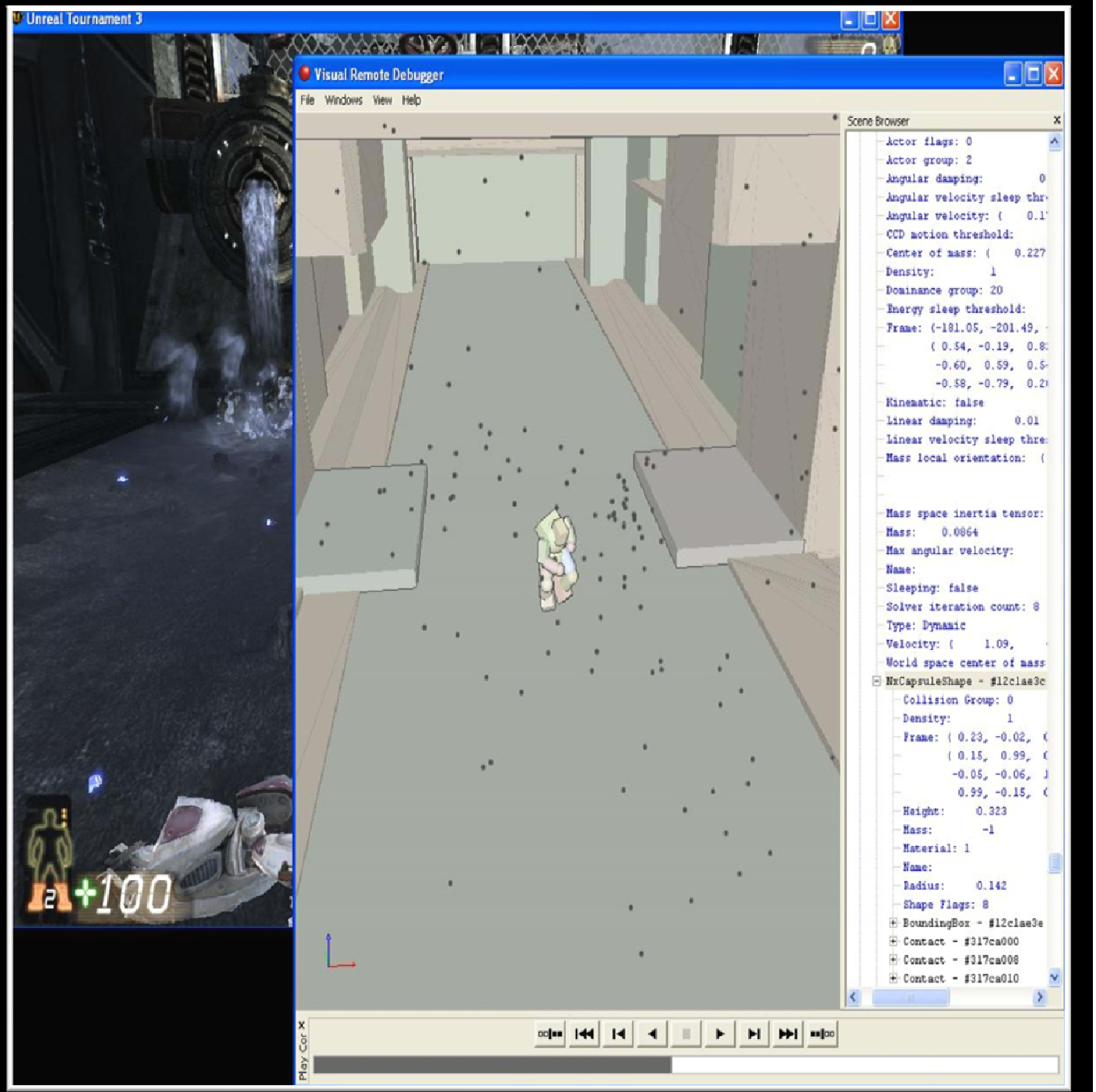
Real-Time Performance Monitoring

Data Extraction Tool

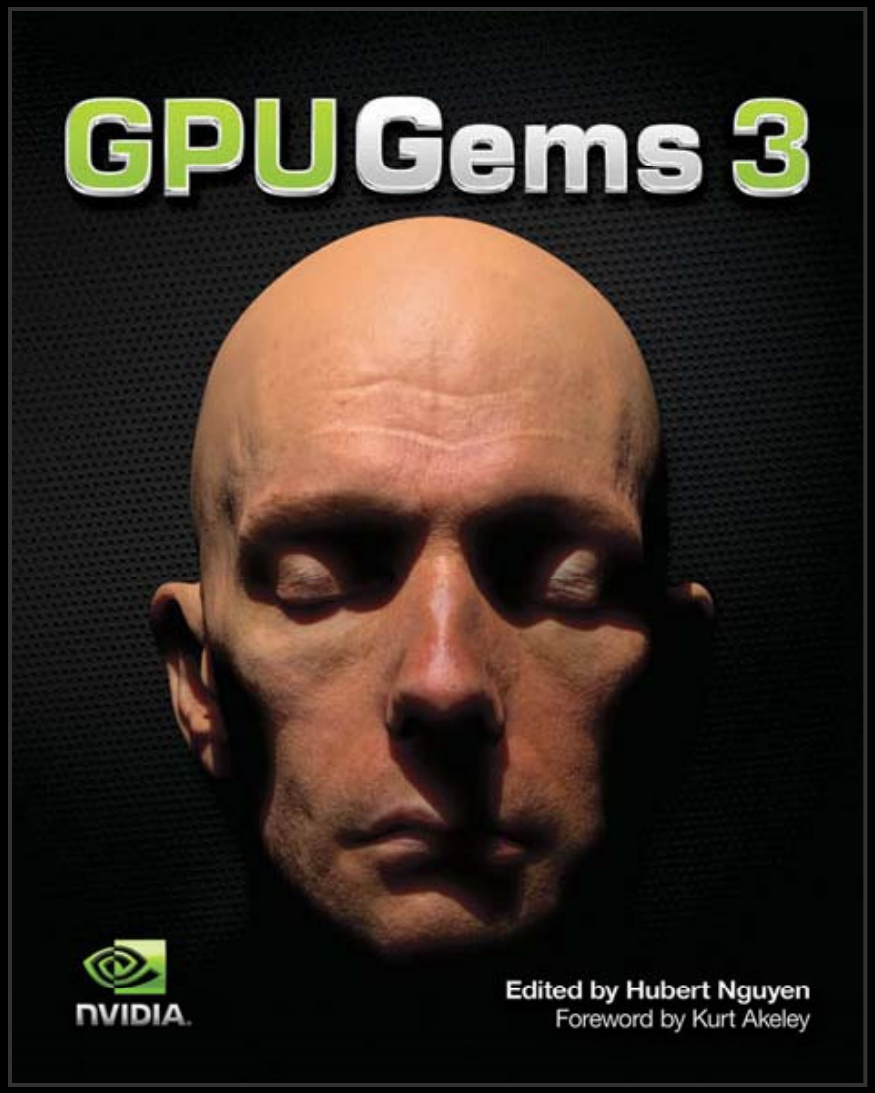


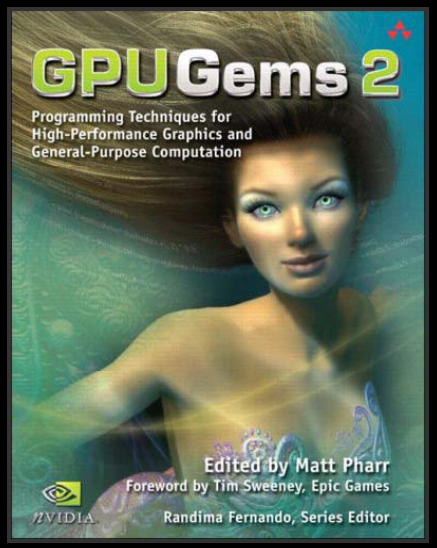


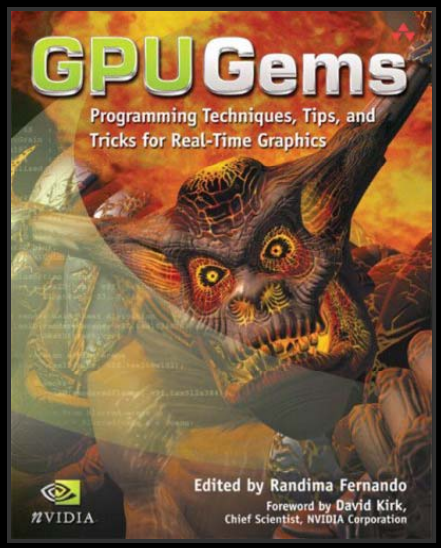
Visual Debugger

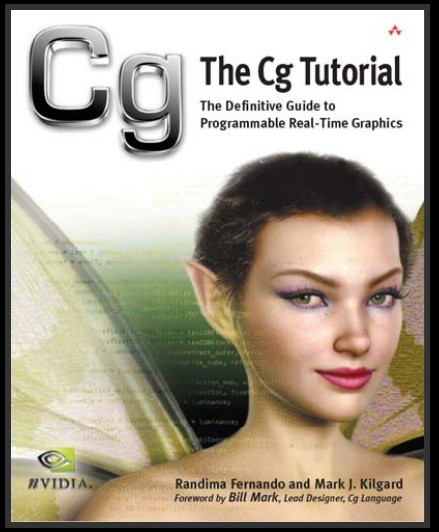


Award-Winning Books









Game Developer Magazine Front Line Awards

GPU Gems 3 Wins in Books (2007)

PerfHUD 5 Finalist in Programming (2007)

Our products have won several prestigious Front Line Awards* from Game Developer Magazine:

PerfHUD	2007 Finalist, 2006 Finalist – Programming
GPU Gems 3	2007 Winner – Books
FX Composer	2005 Finalist, 2004 Finalist – Art Tool
GPU Gems 2	2005 Finalist – Books
SDK	2004 Winner – Programming
GPU Gems	2004 Winner – Books
Cg	2002 Winner – Art

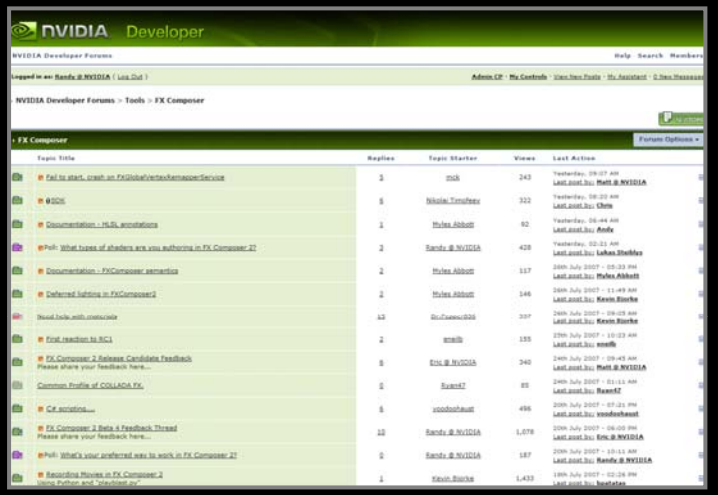
* The Front Line Awards recognize those software and hardware companies whose tools enable faster and more efficient game creation for advancing the state of the art. www.frontlineawards.com

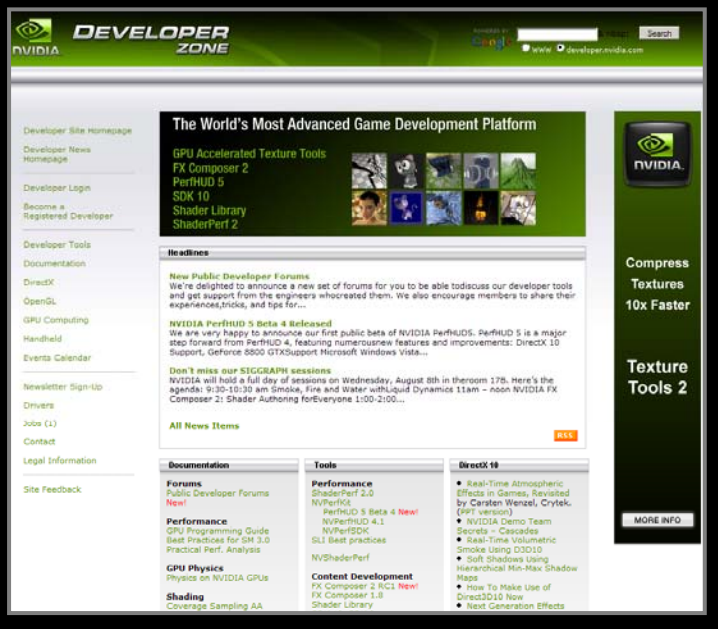
The NVIDIA Software Improvement Program (SIP)

- Goal: Better meet developer needs
  - Simplify common usage patterns
  - Expand on popular features
  - Highlight powerful but underutilized features
  - Remove unwanted features
- Instant Feedback allows user to press F4 and directly send a comment to NVIDIA
- Developer opts in to the SIP to participate – we encourage you to do so
- Only information about product features used is gathered, as well as GPU and driver version.
- No personally identifiable data, shaders, textures, scripts, geometry, or information about other applications is ever collected.

NVIDIA Developer Zone

- Developer Forums
  developer.nvidia.com/forums
- RSS feed at developer.nvidia.com
- Registered Developer Program
  - Pre-Release Drivers
  - Early Access to Developer Tools
  - Secure Online Forums & Bug Submission
  - Apply from developer.nvidia.com





Useful Links

- Developer Web Site
- Developer Tools Forums

- SDK 10

- PerfHUD
- PerfHUD Overview Video

- FX Composer
- FX Composer Overview Video

- PhysX

- CUDA Zone