BRIGHTER & FASTER GRAPHICS WITH NVIDIA® NSIGHT™ VSE 4.5™

Jeff Kiel, Manager Graphics Tools
Russ Kerschner, Sr. SW Engineer

AGENDA

Developer Tools: NVIDIA GameWorks™

Introducing NVIDIA® Nsight™ Visual Studio Edition 4.5™

Profiling Infiltrator from Epic Games

Sneek Peek at DirectX12 support in 5.0!

Thanks for our friends at EPIC GAMES

Developing on modern GPUs can be a cloudy business...

NVIDIA DEVELOPER TOOLS

BUILD. DEBUG. PROFILE.

Microsoft DirectX | OpenGL | NVIDIA CUDA | OpenGL ES | Android NDK | GNU C/C++

IDE INTEGRATION

Visual Studio

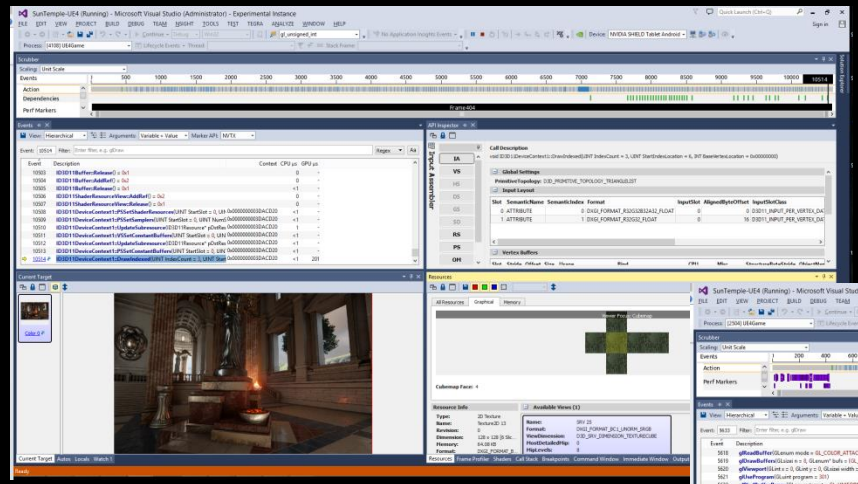
eclipse

STANDALONE TOOLS

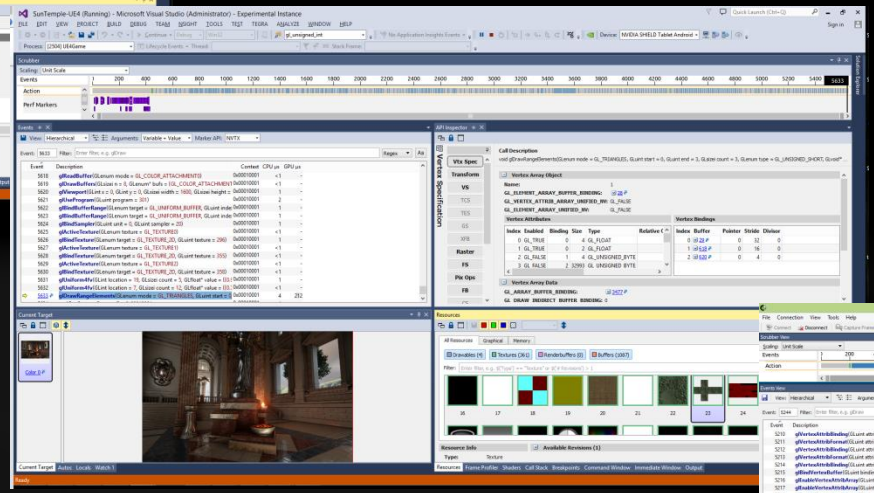
HARDWARE SUPPORT
CPU AND GPU DEBUGGING & PROFILING

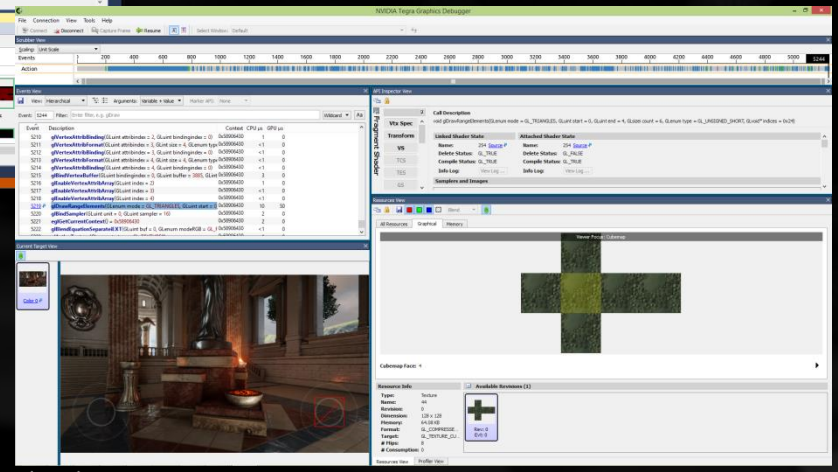
NVIDIA GAMEWORKS™

PICK A PLATFORM/API



Microsoft® DirectX®





OpenGL

Android

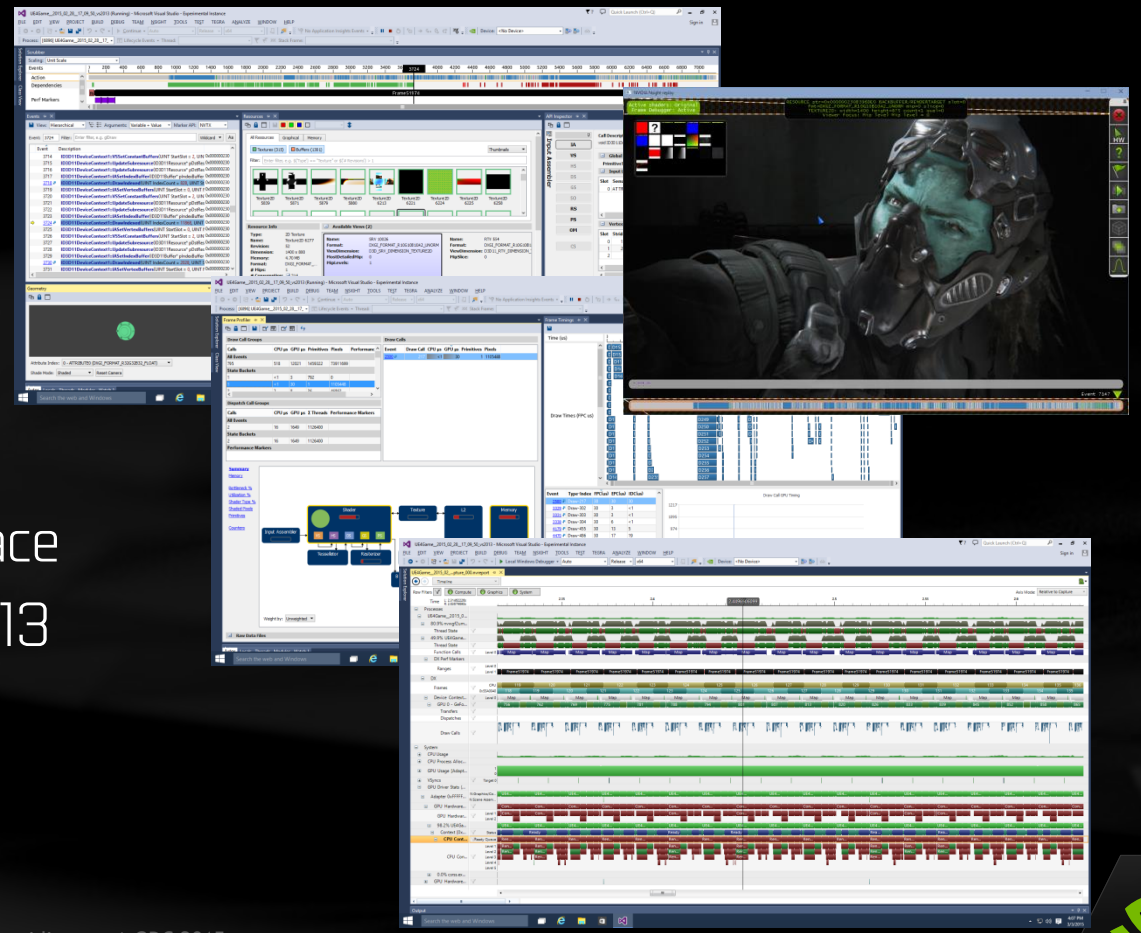
OpenGL

OpenGL|ES

NVIDIA® NSIGHT™ VISUAL STUDIO EDITION

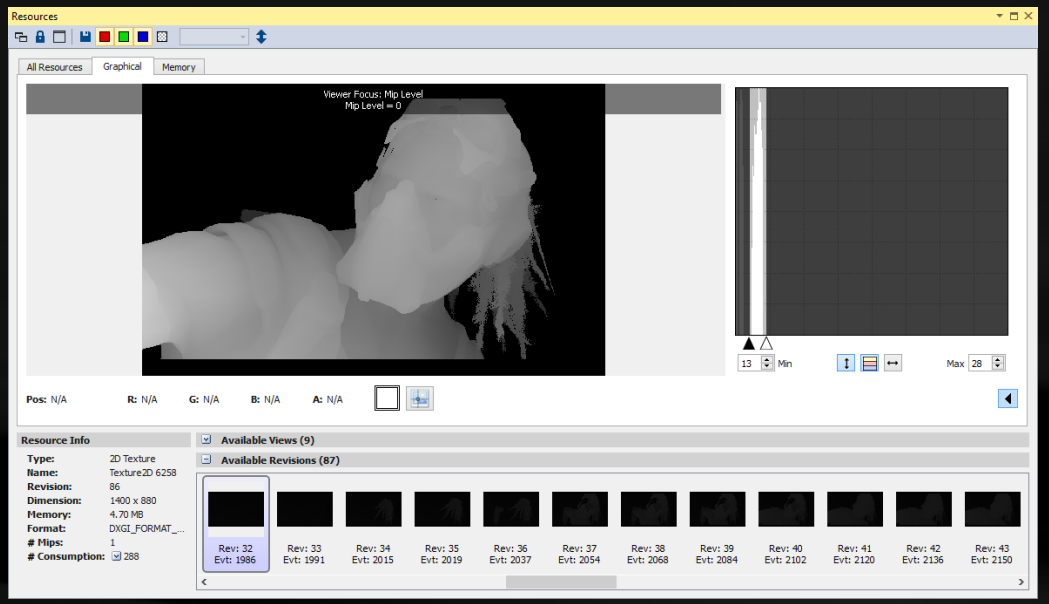
Accelerating Visual Computing Development

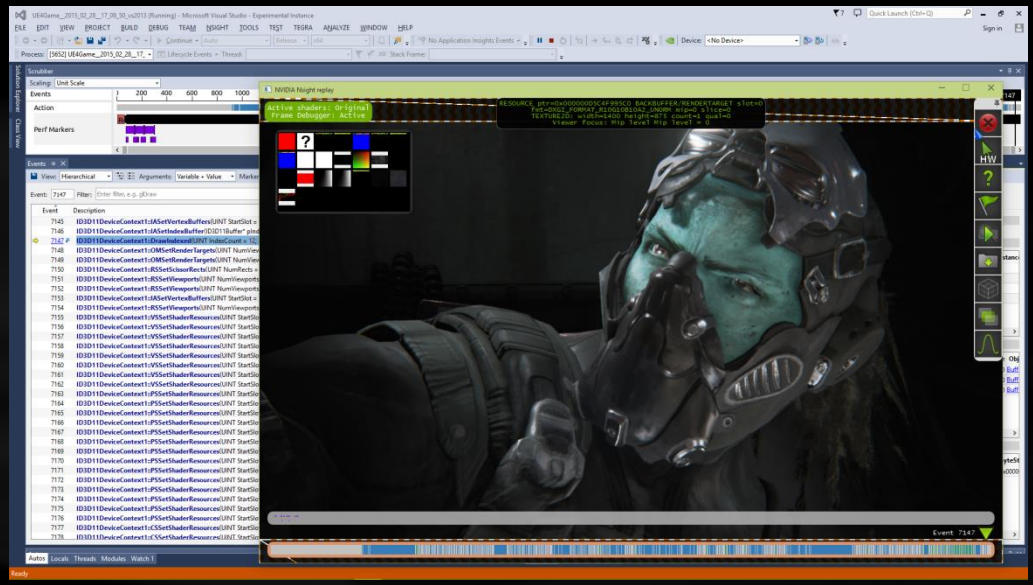
- Supports DirectX 9/11 and OpenGL
- Debug and profile graphics workloads
- Debug HLSL and GLSL shaders
- Debug and profile CUDA kernels
- Platform level profiling with system trace
- All in Visual Studio 2010, 2012 and 2013



NEW IN VERSION 4.5

- Maxwell architecture support (minus shader debugging)
- OpenGL 4.4 (minus ARB_sparse_texture)
- OpenGL capture with source code generation
- Texture histogram and range remapping
- CUDA 7.0 support

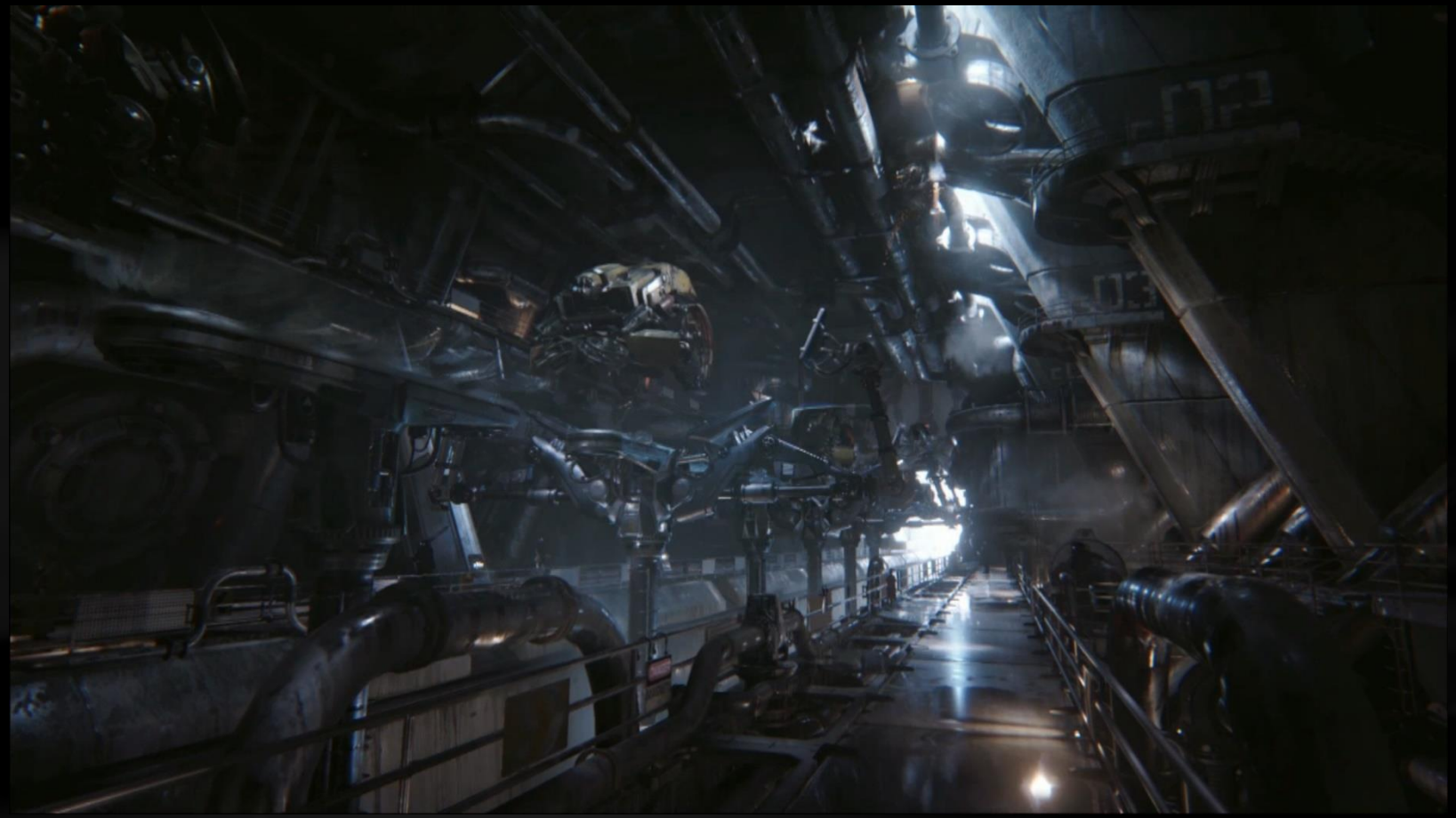




PROFILING INFILTRATOR

PROFILING INFILTRATOR

View Infiltrator at https://www.youtube.com/watch?v=dO2rM-l-vdQ



PROFILING INFILTRATOR – CPU BOUND

UE4Game__2015_02_28__17_09_50_vs2013 - Microsoft Visual Studio (Administrator)

FILE EDIT VIEW PROJECT BUILD DEBUG TEAM NSIGHT TOOLS TEST ANALYZE WINDOW HELP

Local Windows Debugger | Auto | Release | x64 | boss | No Breakpoint

Activity1.nvact* | InfiltratorDemo150...apture_000.nvreport

Application Settings Conn: localhost App: UE4Game__2015_02_28__17_09_50.exe Args: Sync: True

Connection Name: localhost

Application: C:\Users\jkiel\Desktop\GDC2015\Infiltrator_Capture_GPUBound\x64\Release\UE4Game__2015_02_28__17_09_50.exe

Arguments:

Working Directory: C:\Users\jkiel\Desktop\GDC2015\Infiltrator_Capture_GPUBound\

Remote Options

Triggers and Actions Start: On Process Launch Stop: Manually

Activity Type Trace Process Tree

- **Trace Application** — Collects events from the target application. The analysis session and data collection are stopped when the launched application exits.
- **Trace Process Tree** — Collects events from the target application and all native child processes of the target application. The analysis session and data collection are not stopped when the launched application exits. The session and data collection must be stopped manually.
- **Profile CUDA Application** — Collects counters, statistics and derived values for given CUDA kernel launches.
- **Profile CUDA Process Tree** — Collects counters, statistics and derived values for given CUDA kernel launches from the target application and all native child processes of the target application. The analysis session and data collection are not stopped when the launched application exits. The session and data collection n

Trace Settings Domains: DirectX

System	(2/5) CPU Thread Trace, Module Trace
Tools Extension	(4/4) Markers, Push/Pop Ranges, Start/End Ranges, Resource Naming
CUDA	(4/4) Driver API Trace, Runtime API Trace, Software Counters, Kernel Launches and Memory Operations, Host Callback Trace
OpenCL	(3/3) API Trace, Resource Trace, Program Source Code, Program Build Callback Trace, Program Binary Code, Reference Cou
DirectX	(7/9) API Trace, CPU Frames, GPU Frames, Push Buffers, Shader Compiles, Performance Markers, Performance Ranges

API Trace

API Categories:

All Categories Call Stack Trace: None

Workload Trace:

CPU Frames
GPU Frames
Push Buffers
Draw Calls
Dispatches
Transfers

Connection Status — Available Devices: Graphics Device (GM206)

Session Control — Start / Stop — Kill Application on Stop

Capture Control — Start / Stop / Cancel — Open Report on Stop — Summary Report

Output | Find Results 2

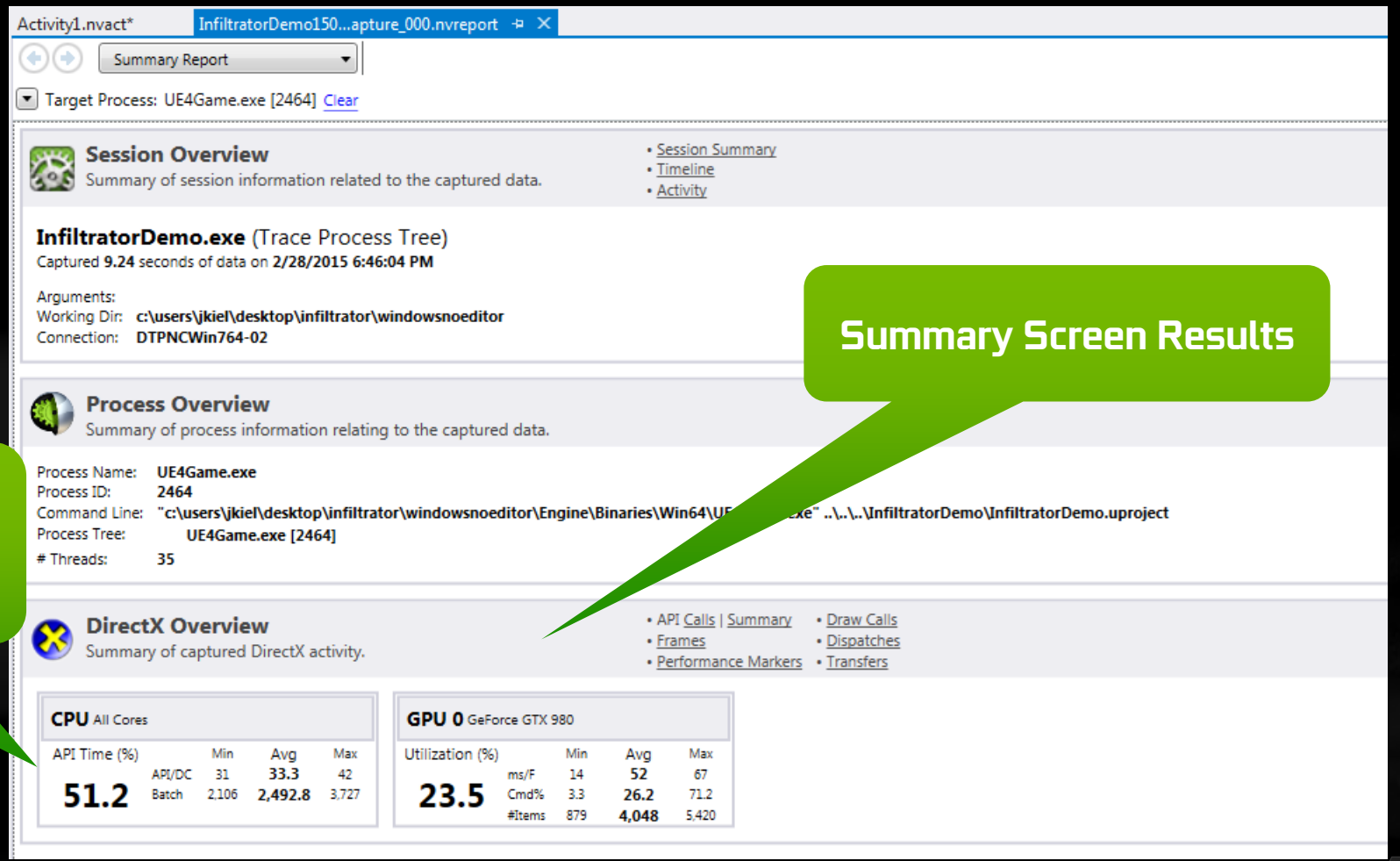
Ready

Application Settings

Trace System & DirectX

Launch!

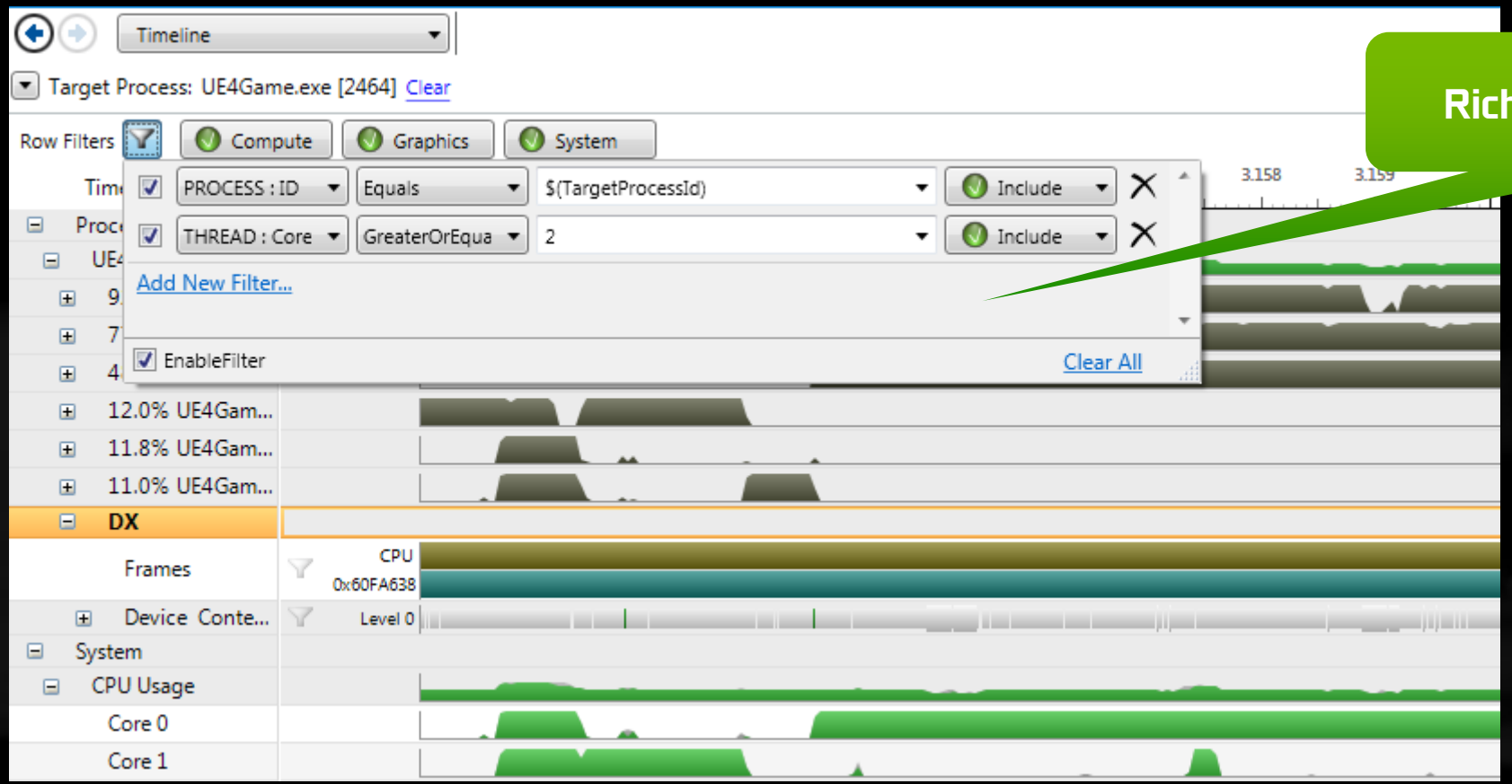
PROFILING INFILTRATOR – CPU BOUND



Summary Screen Results

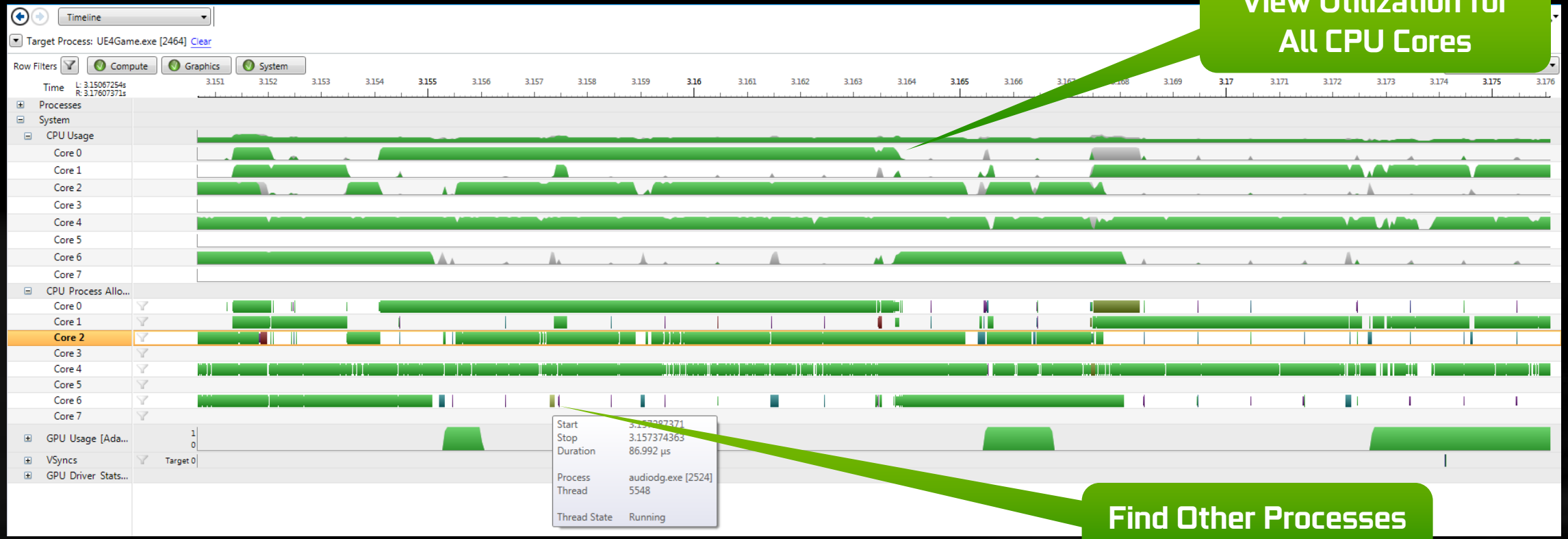
Runtime/Driver Consumes CPU Time...Next Generation APIs Should Help!

PROFILING INFILTRATOR – CPU BOUND

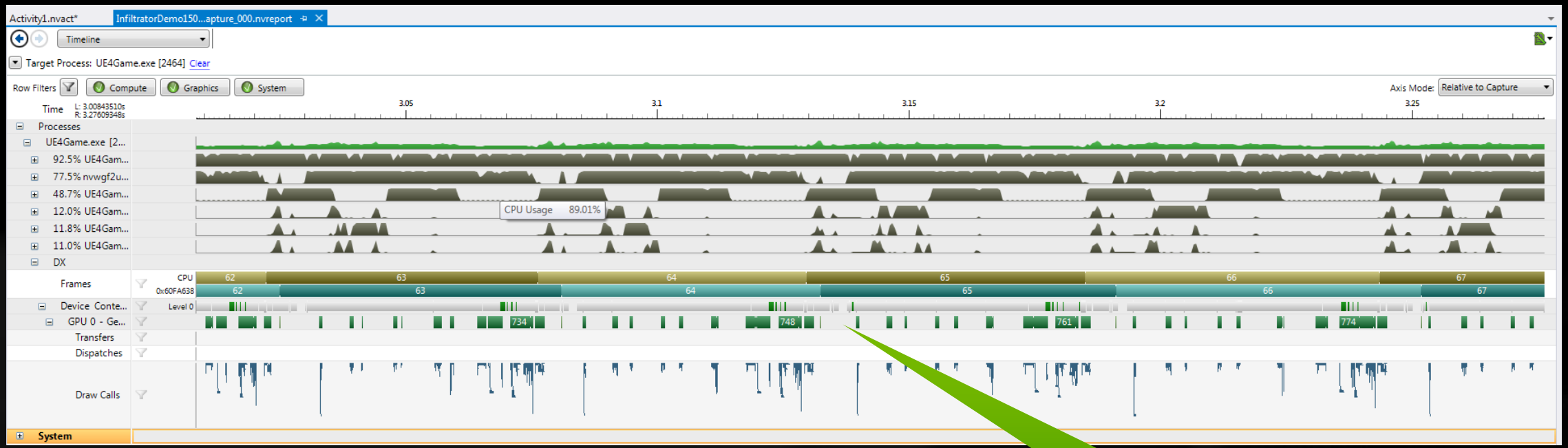


Rich Filtering Capabilities

PROFILING INFILTRATOR – CPU BOUND

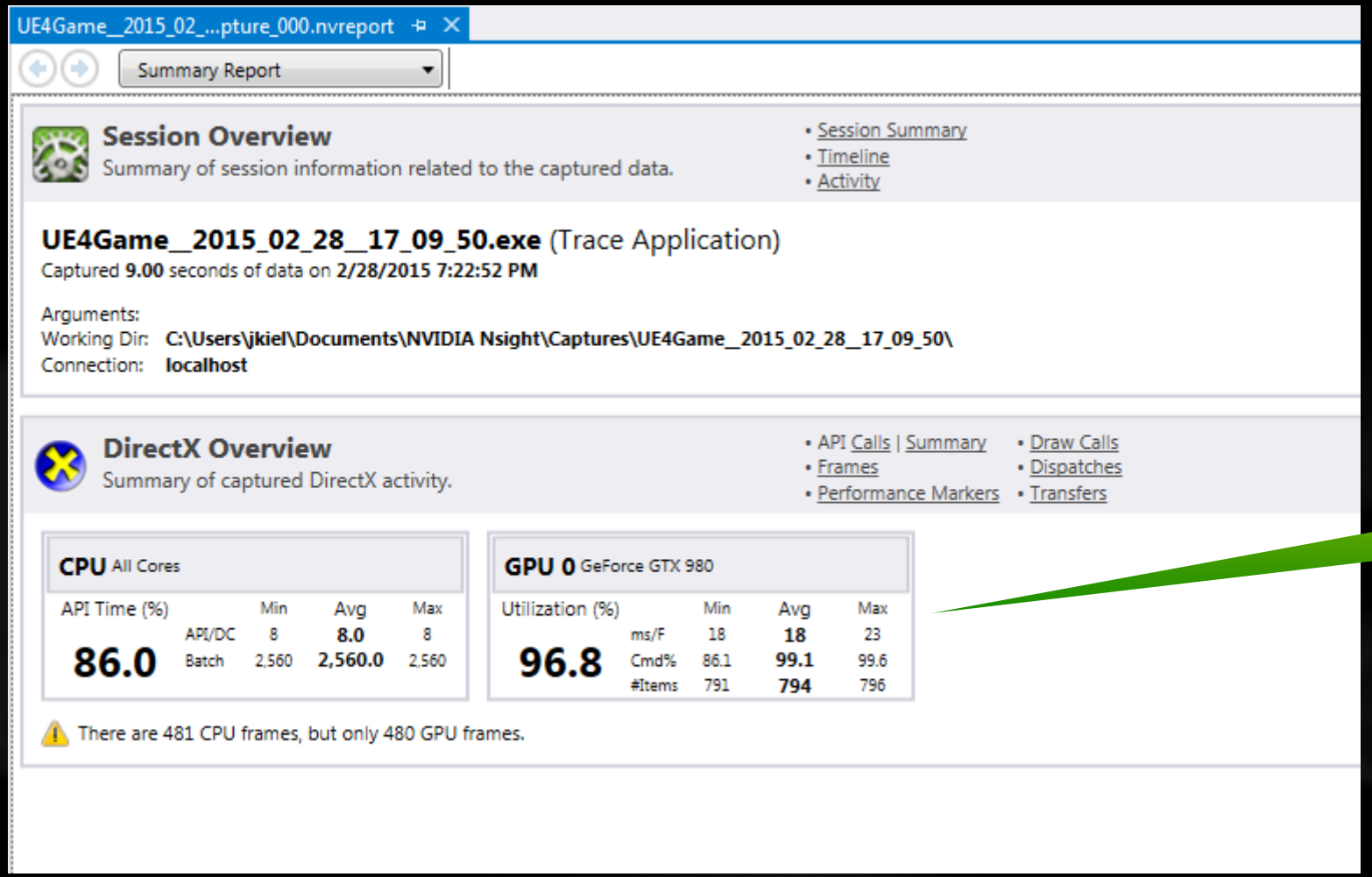


PROFILING INFILTRATOR – CPU BOUND



Gaps In GPU Workloads = CPU Bound

PROFILING INFILTRATOR – GPU BOUND

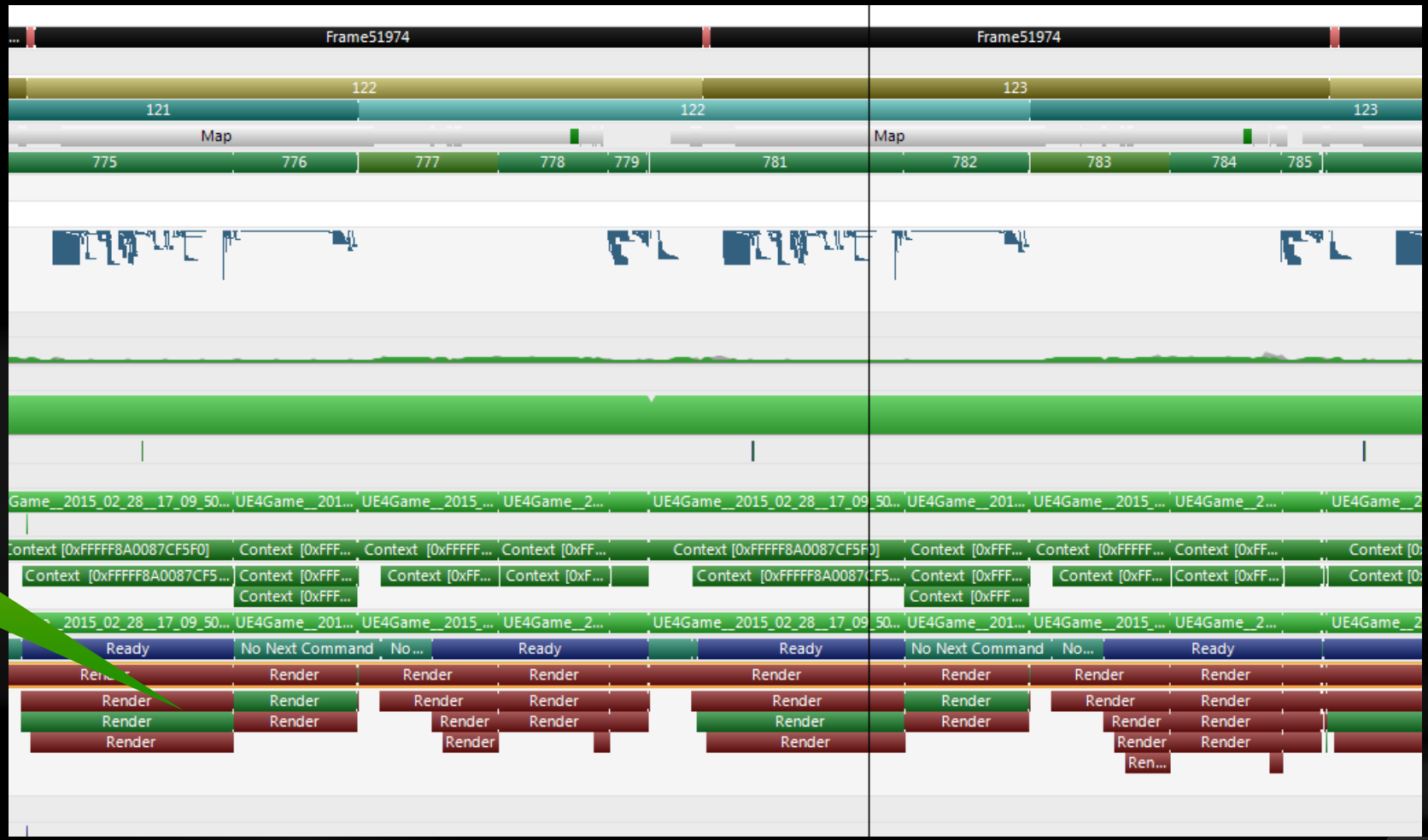


Summary Results: Lots Of GPU Work!

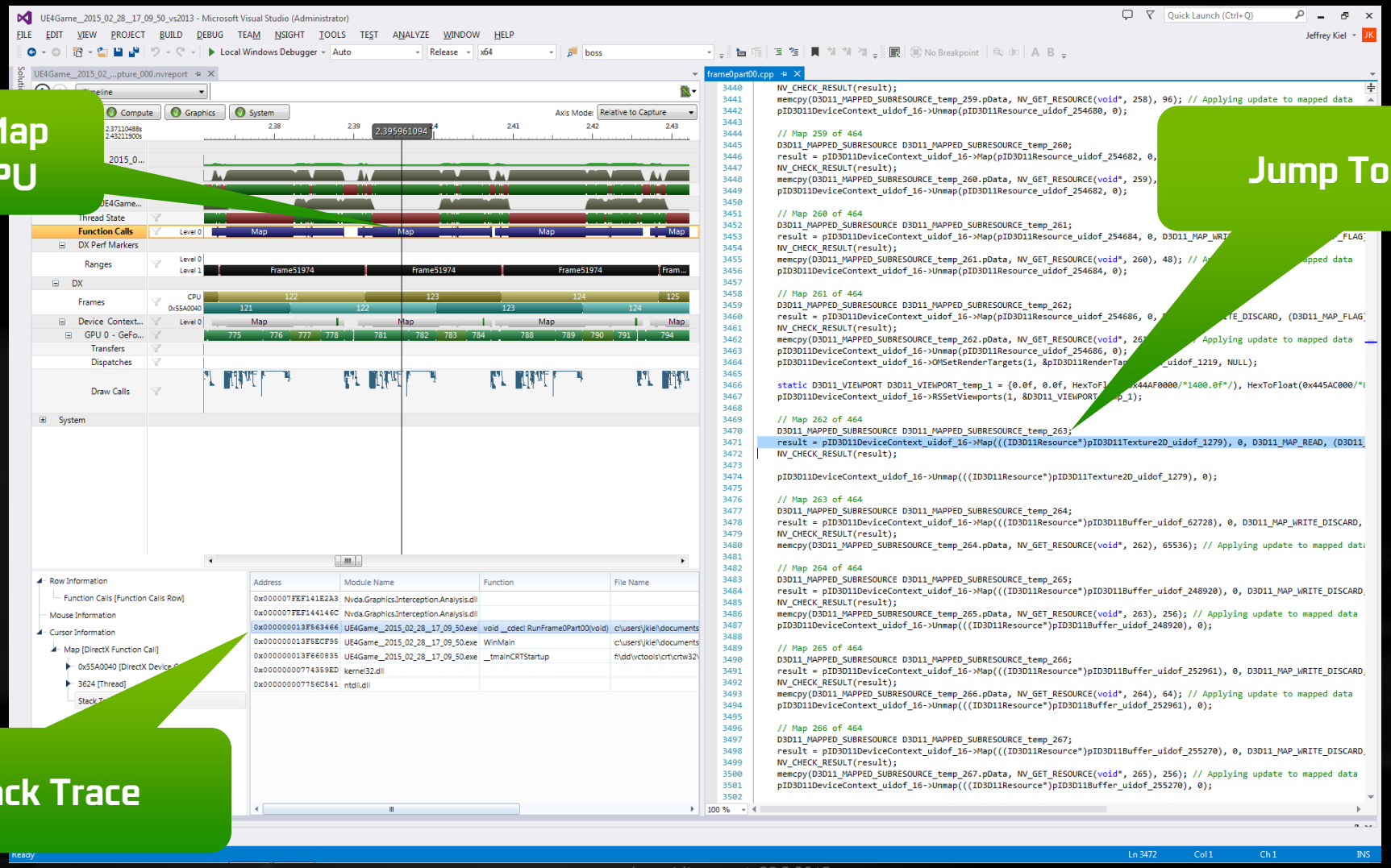
PROFILING INFILTRATOR – GPU BOUND

PROFILING INFILTRATOR – GPU BOUND

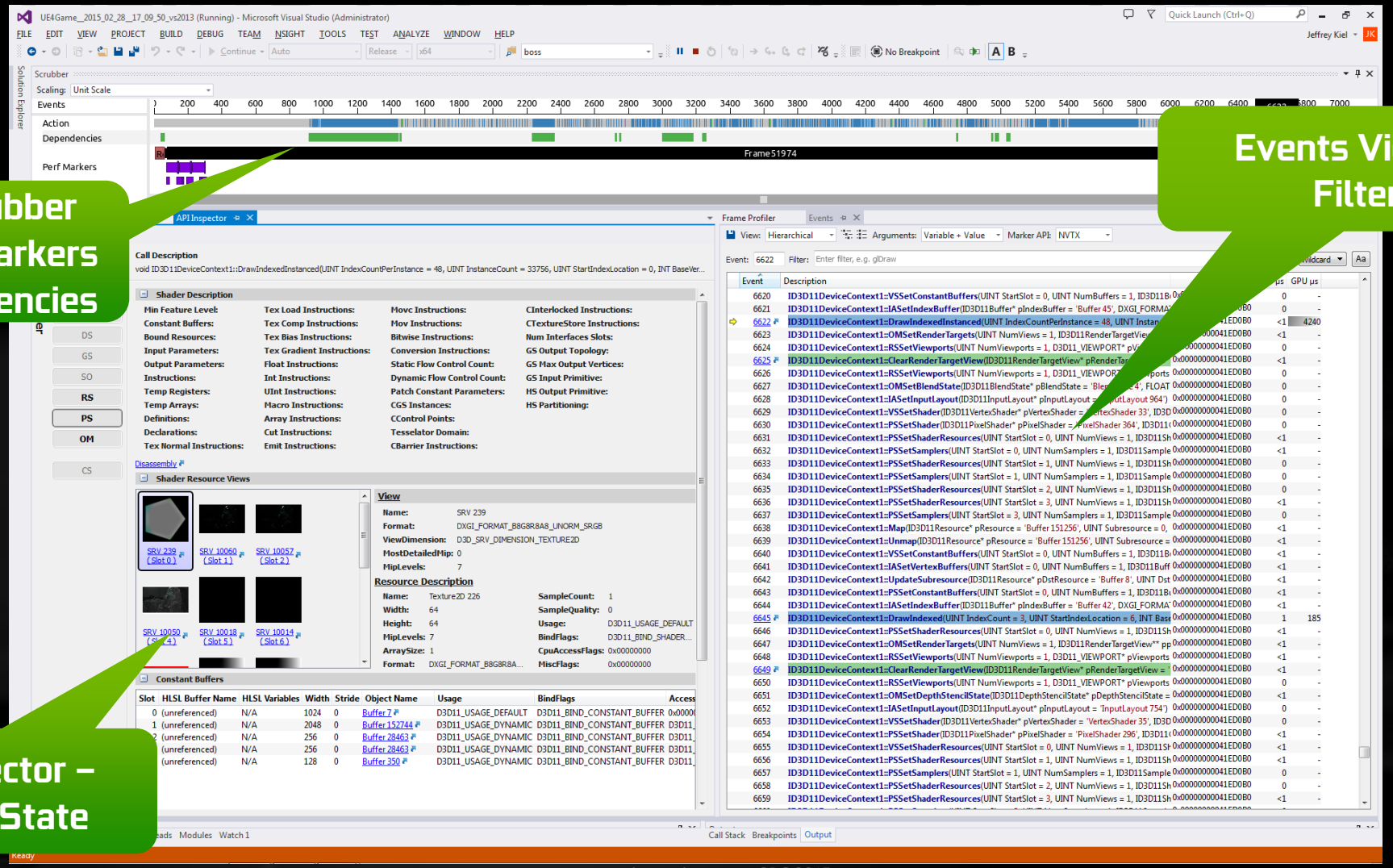
Correlate With GPUView ETW Data



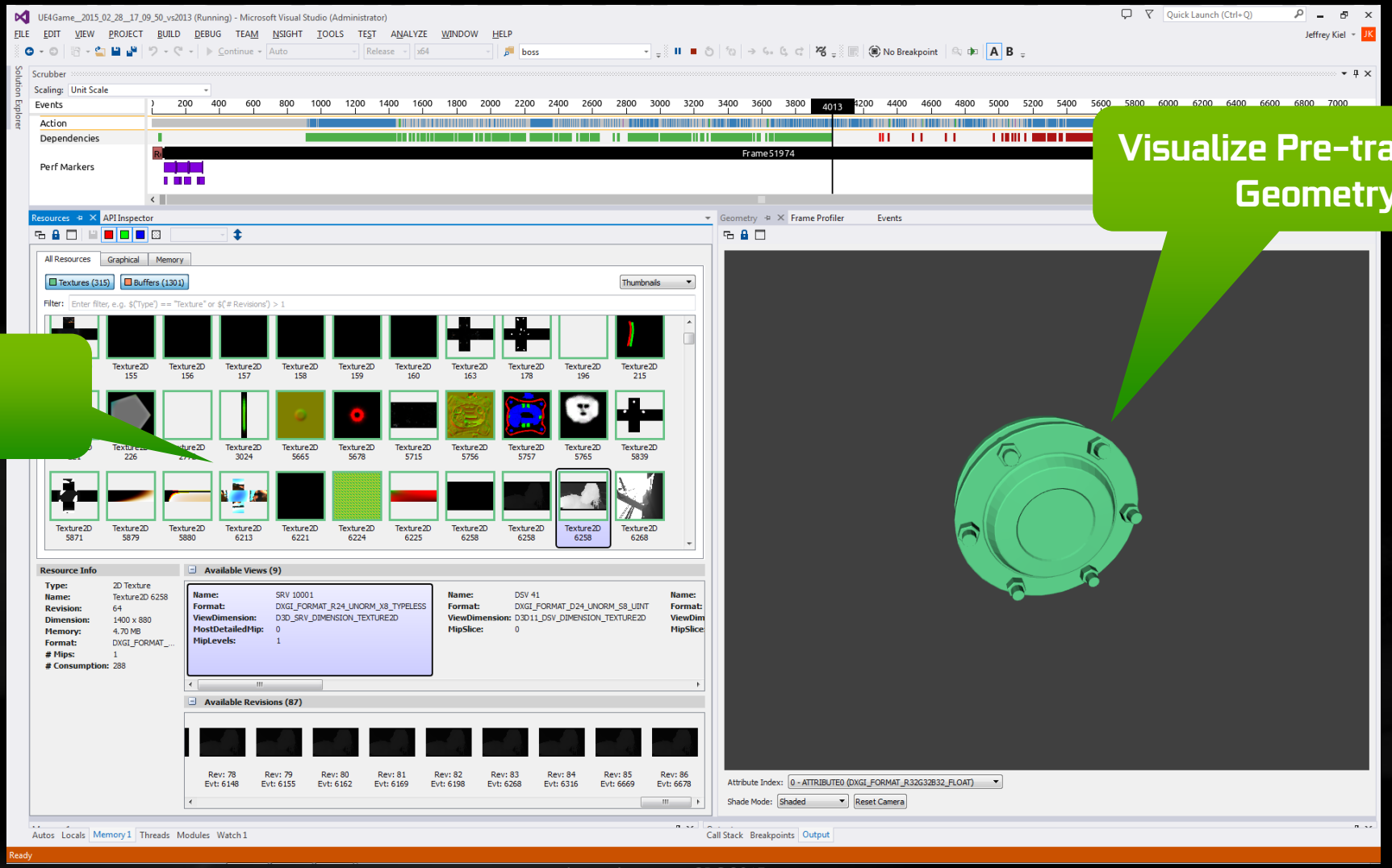
PROFILING INFILTRATOR – GPU BOUND



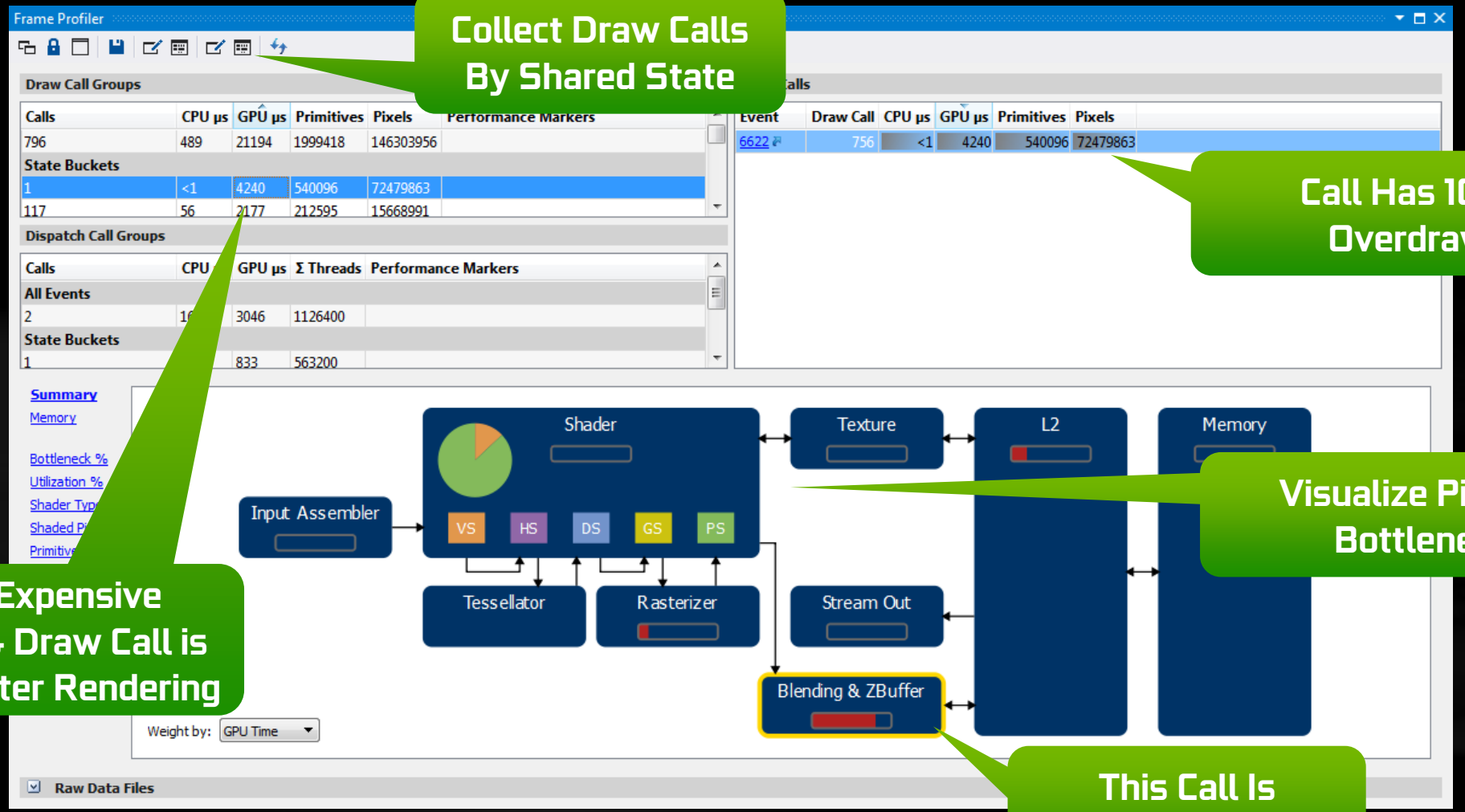
PROFILING INFILTRATOR – PROFILING



PROFILING INFILTRATOR – PROFILING



PROFILING INFILTRATOR – PROFILING



Collect Draw Calls By Shared State

Call Has 100X Overdraw!

Visualize Pipeline Bottleneck

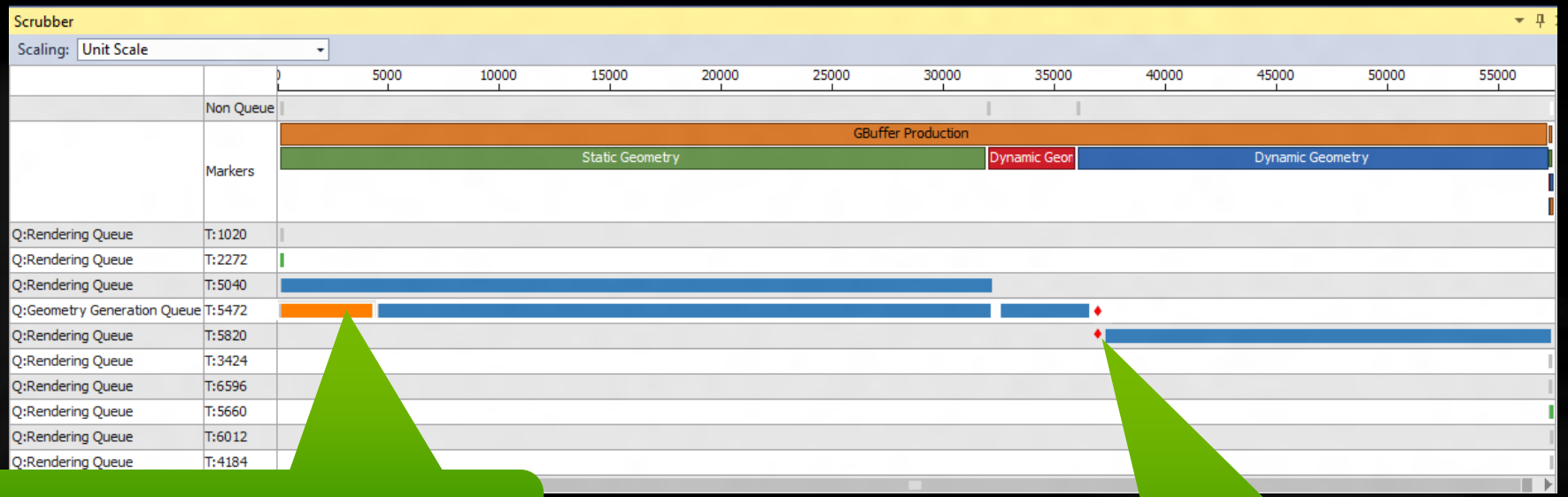
Most Expensive Bucket & Draw Call is Bokeh Filter Rendering

This Call Is Blending Bound

DirectX 12

NEW API, NEW CHALLENGES

- More parallelism!
  - Multi-thread : parallel CPU work…more parallel than D3D11
  - Multi-queue: parallel, potentially asymmetric, GPU work



Conceptually parallel queues: nothing to prevent concurrency

D3D12 fence blocks the final batch of GPU work

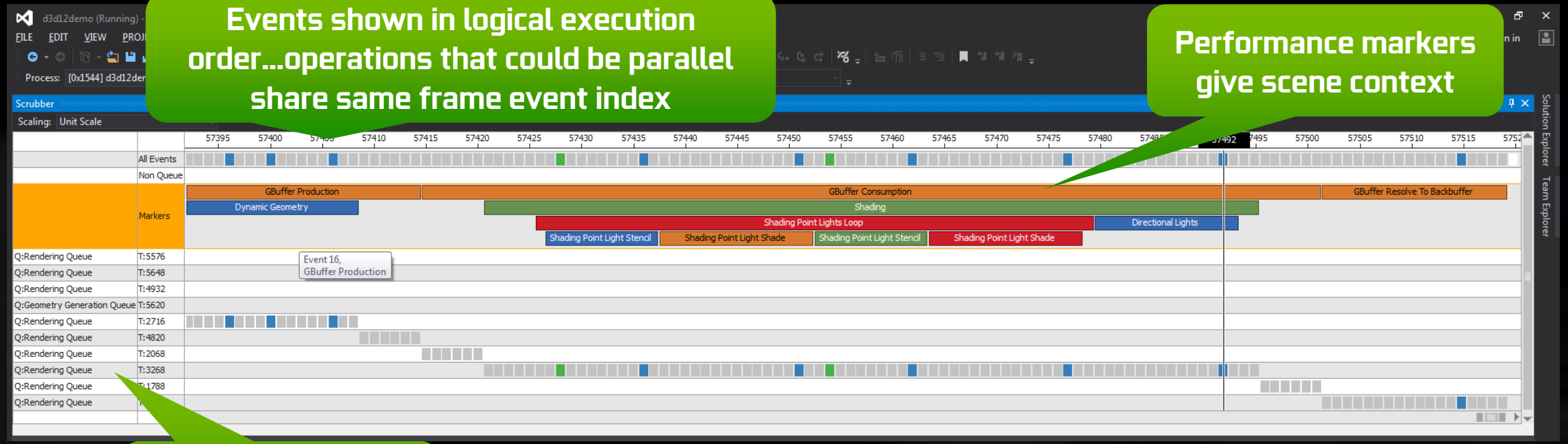
DirectX 12

NEW API, NEW CHALLENGES

- Application is now responsible!
  - CPU/GPU synchronization
  - Usability state of resources via barriers
  - Memory heaps via placed resources
  - SRVs, UAVs, constants, samplers, all opaque at runtime
  - Root description table for binding, another layer of indirection

DIRECT3D12 SNEEK PEEK (DEMO)

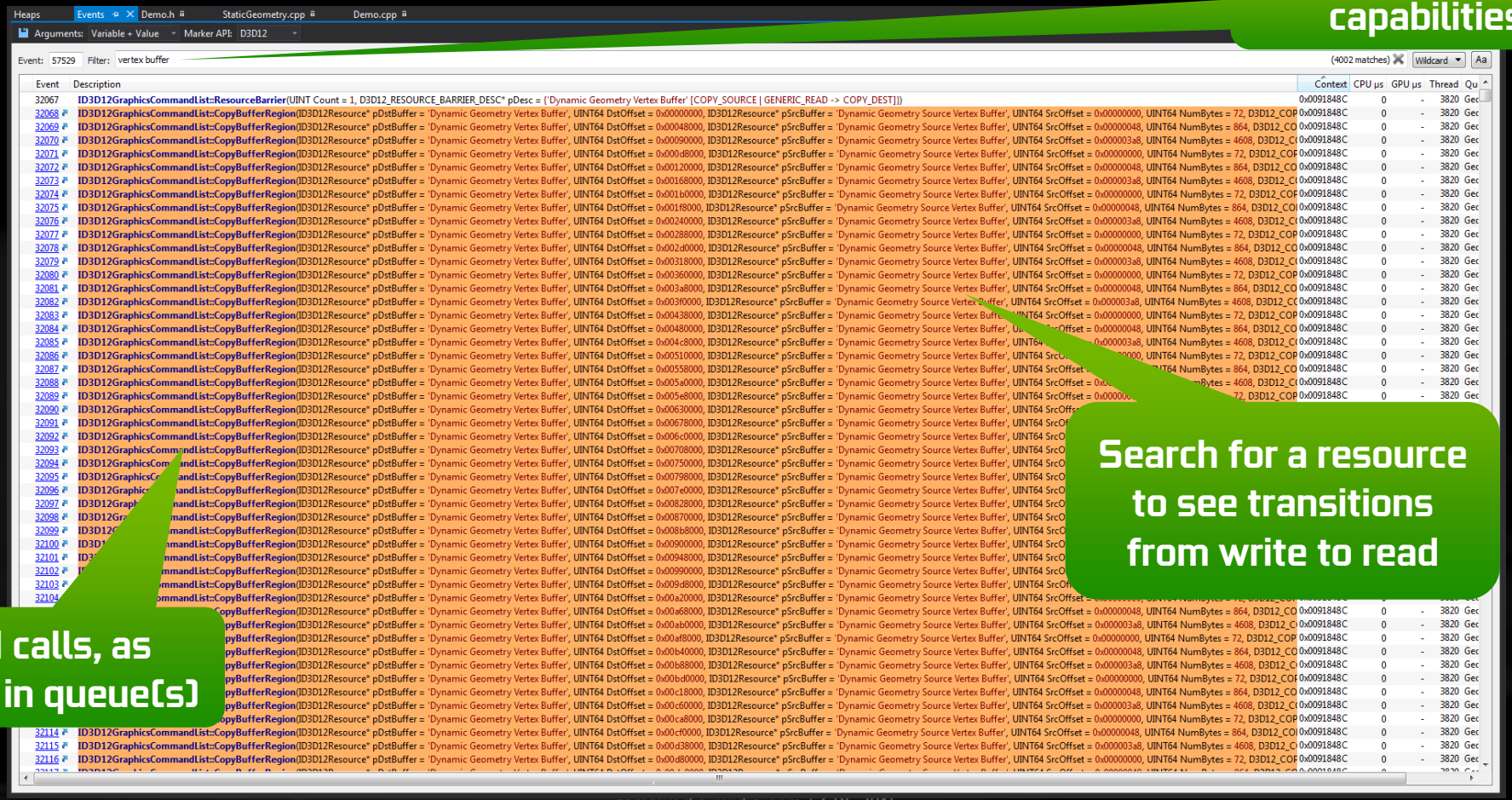
Multi-queue Event Scrubber



DIRECT3D12 SNEEK PEEK (DEMO)

API Analysis With Events View

Rich filtering capabilities

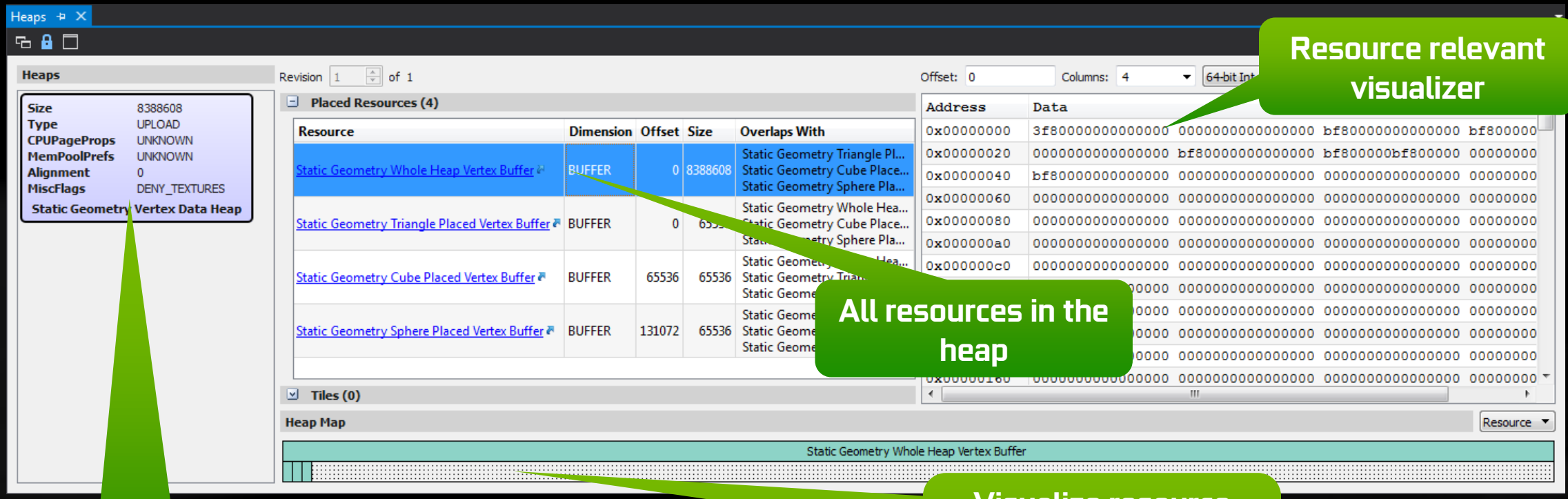


Search for a resource to see transitions from write to read

All API calls, as executed in queue(s)

DIRECT3D12 SNEEK PEEK (DEMO)

Heaps View Improves API Transparency



Resource relevant visualizer

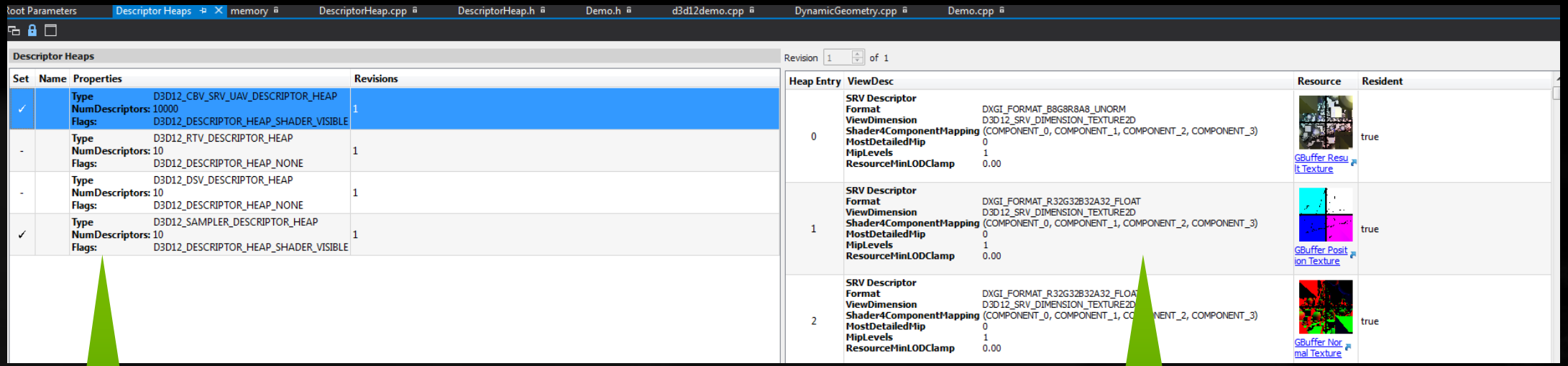
All resources in the heap

All available heaps

Visualize resource overlaps and heap usage by type

DIRECT3D12 SNEEK PEEK (DEMO)

Descriptor Heap View Improves API Transparency

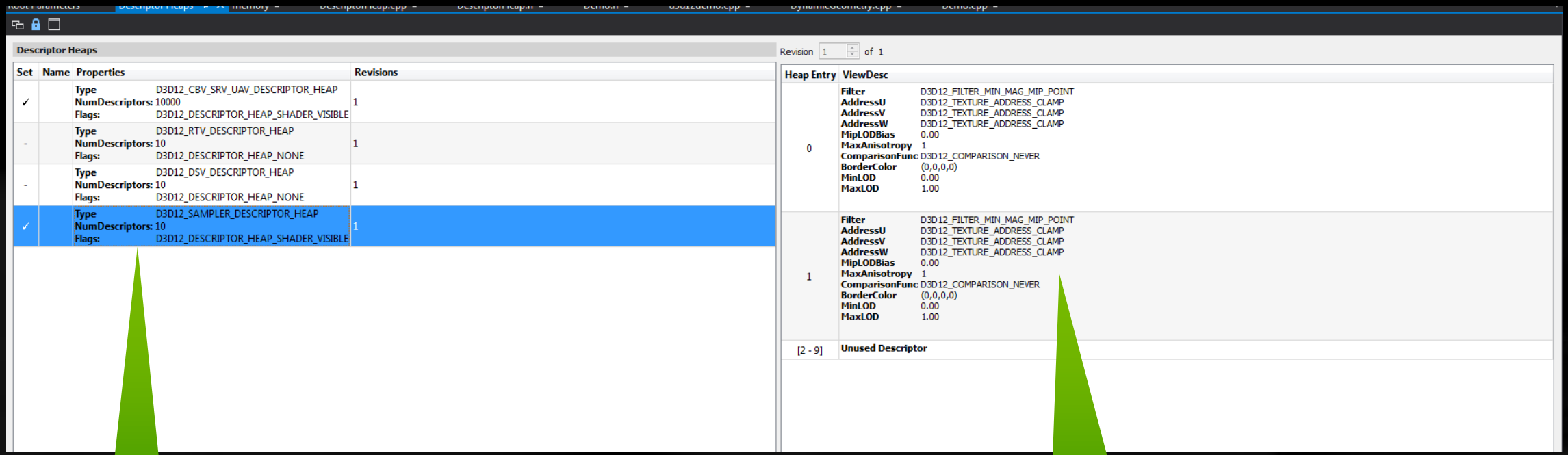


All descriptor heaps

Heap specific details (SRVs)

DIRECT3D12 SNEEK PEEK (DEMO)

Descriptor Heap View Improves API Transparency

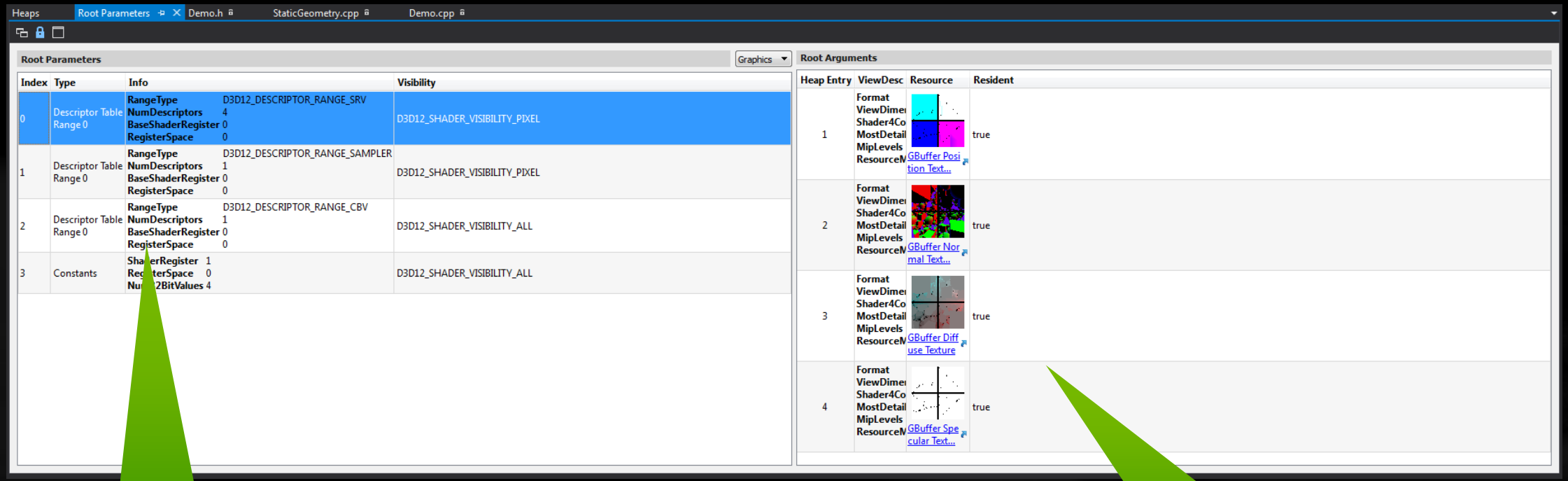


All descriptor heaps

Heap specific details (Samplers)

DIRECT3D12 SNEEK PEEK (DEMO)

Root Parameters View Improves API Transparency



Root signature layout and population

Type specific details for parameter entry

NVIDIA GAMEWORKS™

Links…

Web: http://gameworks.nvidia.com

Latest info and download options

Survey: https://developer.nvidia.com/developer-tools-survey-201503

YouTube: https://www.youtube.com/user/nvidiaGameWorks

Tools, effects, and game integration videos

Twitter: https://twitter.com/nvidiadeveloper

Catch up on up to the minute happenings