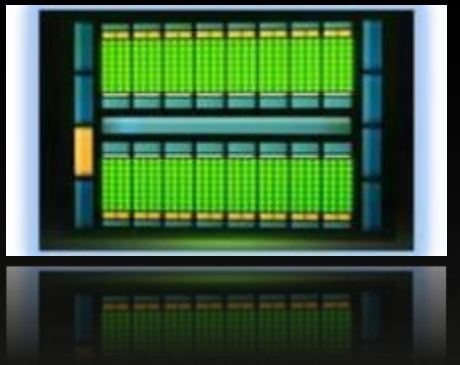
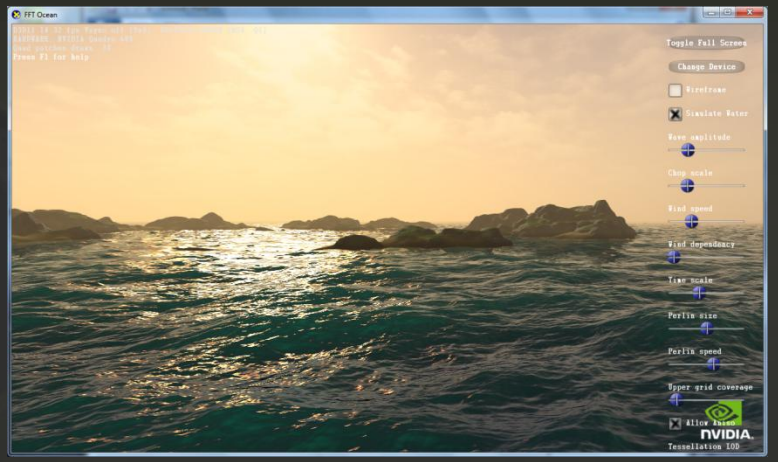
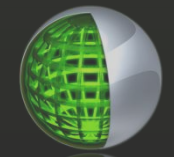

NVIDIA Parallel Nsight™ 2.0 and
CUDA 4.0 for the Win!
Jeff Kiel, Manager of Graphics Tools
NVIDIA Corporation, SIGGRAPH 2011
NVIDIA

Agenda

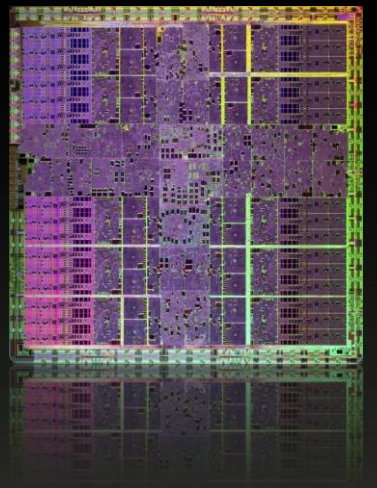


- CUDA Update
- NVIDIA Parallel Nsight
  - CUDA Debugging and Profiling
  - Graphics Debugging and Profiling
  - Application Analysis





CUDA Update: New in 4.0



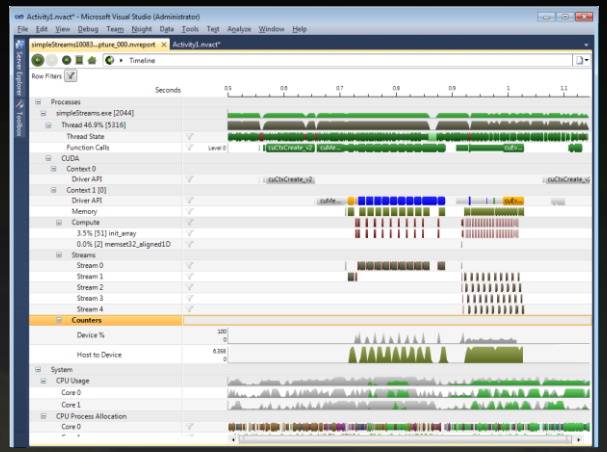
- Easier Programming
  - Use any GPU on any thread
  - C++ new/delete and support for virtual functions
  - Inline PTX assembly
  - Thrust C++ Template Performance Primitives Libraries (sort, reduce, etc.)
  - NVIDIA Performance Primitives library (image/video processing)
- Faster Multi-GPU Programming
  - Unified Virtual Addressing (UVA)
  - GPU Direct 2.0: GPU peer-to-peer communication technology
- Developer Tools for Linux and MacOS
  - CUDA-GDB
  - Visual Profiler with Automated Performance Analysis

Visual Studio with Parallel Nsight

Integrated development for CPU and GPU

Microsoft Visual Studio PARTNER

NVIDIA Parallel Nsight for Graphics & Compute



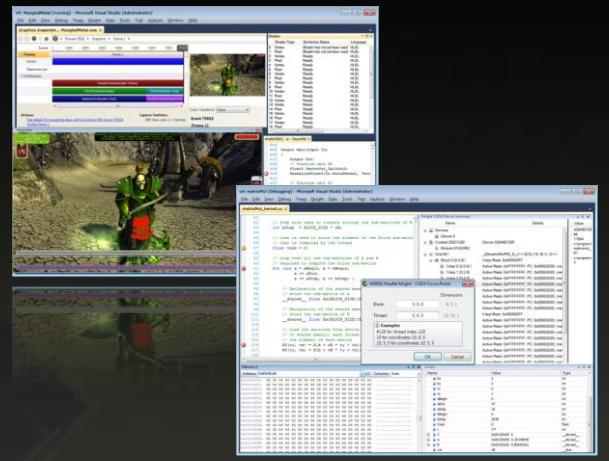
System Analysis

View CPU & GPU events on a single timeline

Examine workload dependencies

CUDA, Direct3D, and OpenGL API Trace

Profile CUDA kernels using performance counters



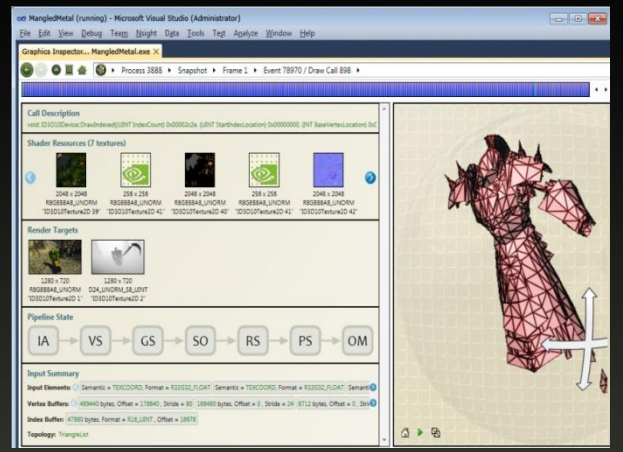
CUDA/Graphics Debugger

Visual Studio debugging environment

GPU Accelerated CUDA and HLSL debugging

Examine code executing in parallel

Conditional breakpoints, memory viewer, etc.



Graphics Inspector

Real-time inspection of Direct3D API calls

Investigate GPU pipeline state

See contributing fragments with Pixel History

Profile frames to find GPU bottlenecks

Free License!

One computer, one NVIDIA GPU

Host + Target (32/64 bit)

- ✓ System Analysis
- ✓ Graphics Inspector

- Install appropriate NVIDIA driver
- Install Parallel Nsight Host and Monitor

One computer, two NVIDIA GPUs

Host + Target (32/64 bit)

- ✓ System Analysis
- ✓ Graphics Inspector
- ✓ CUDA Debugger

- Install appropriate NVIDIA driver
- Install Parallel Nsight Host and Monitor
- Configure Local Headless Debugging (see User's Manual)

Two computers, one with NVIDIA GPUs

Host (32/64-bit)

Target (32/64-bit)

- ✓ System Analysis
- ✓ Graphics Inspector
- ✓ CUDA Debugger
- ✓ Graphics Debugger

- Install appropriate NVIDIA driver on the Target System
- Install Parallel Nsight Monitor on the Target System
- Install Parallel Nsight Host on the Development System

One computer, two NVIDIA GPUs

Host + Target (32/64-bit)

- ✓ System Analysis
- ✓ Graphics Inspector
- ✓ CUDA Debugger
- ✓ Graphics Debugger

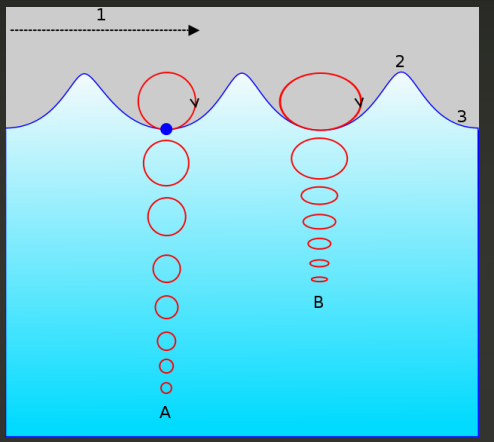
- Install Parallels Desktop and guest OS
- Install appropriate NVIDIA drivers
- Install Parallel Nsight Host and Monitor

FFT Ocean Demo Overview

FFT Ocean Demo Overview

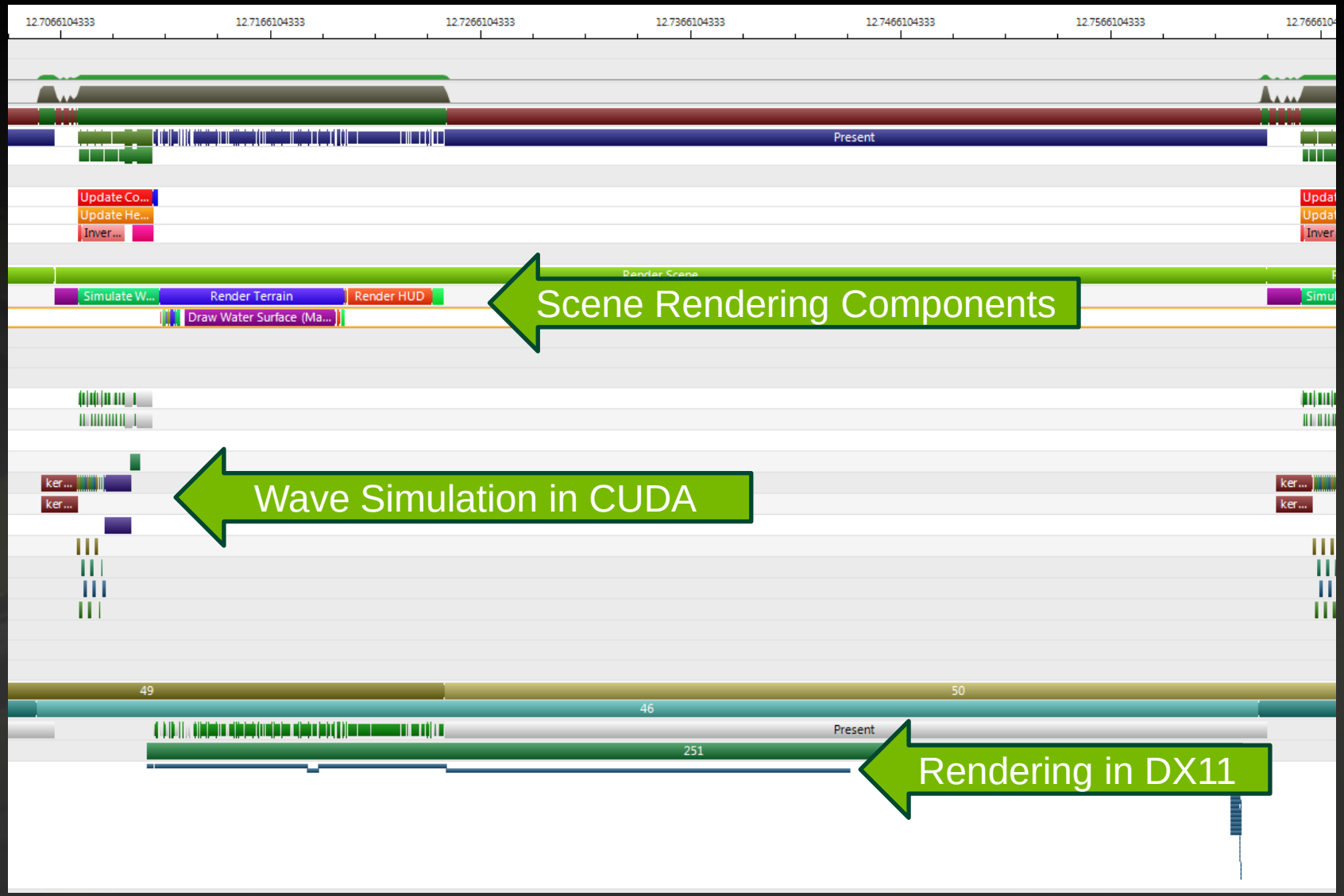
- Based on “Simulating Ocean Water” by Jerry Tenssendorf
  - Statistical model, not physics based
  - Generates wave distribution in frequency domain on GPU
  - Inverse FFT on GPU

- Movies: Large height map (2048x2048)
- Games on CPU: Small height map (64x64)
- GPU Based: Medium height map (512x512)



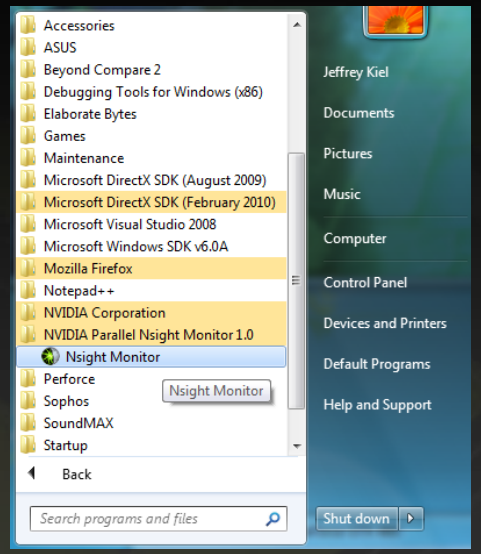
- The ocean surface is composed by enormous simple waves
- Each simple wave is a hybrid sine wave (Gerstner wave)
  - A mass point on the surface is doing vertical circular motion

FFT Ocean Demo Overview

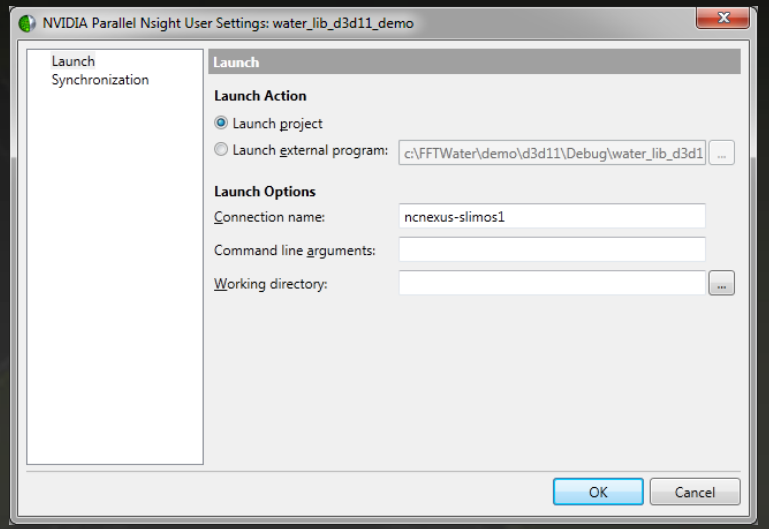


Demo: Launching…

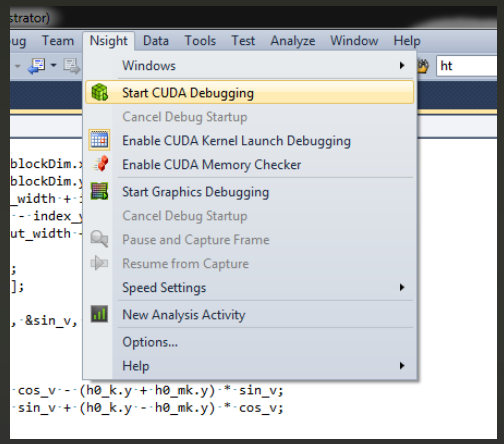
Start Nsight Monitor



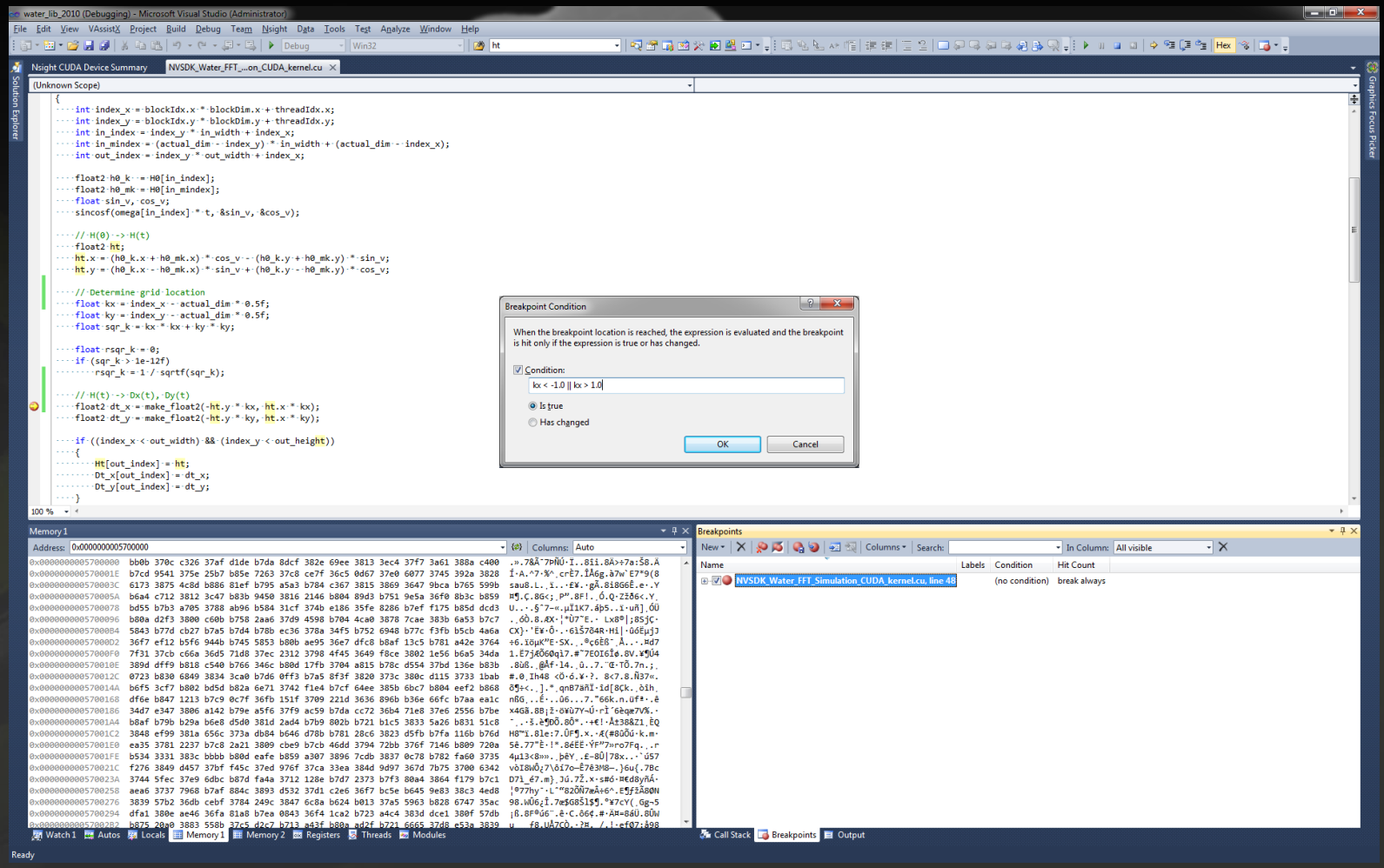
Configure Parallel Nsight Project Settings



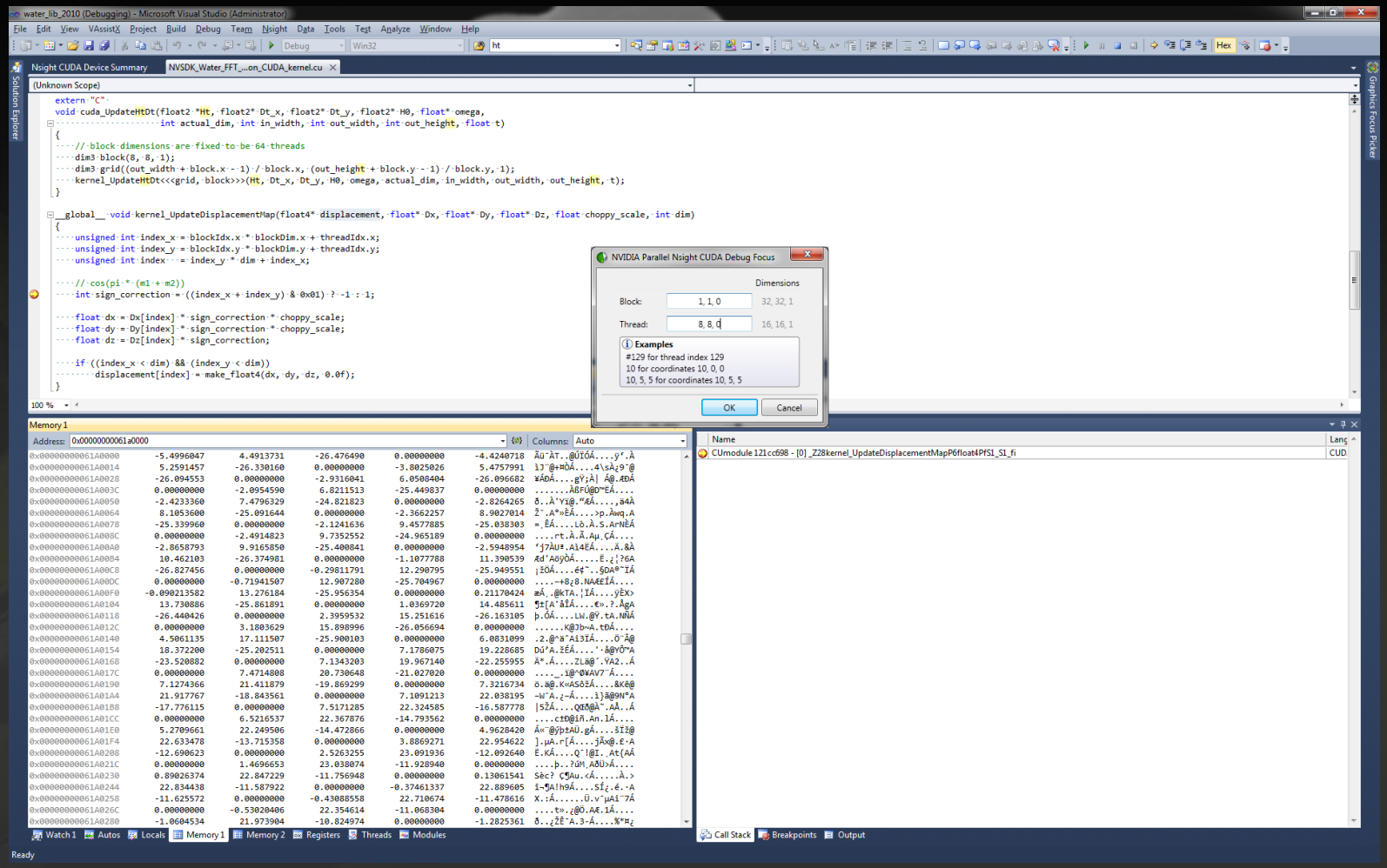
Launch Your Application



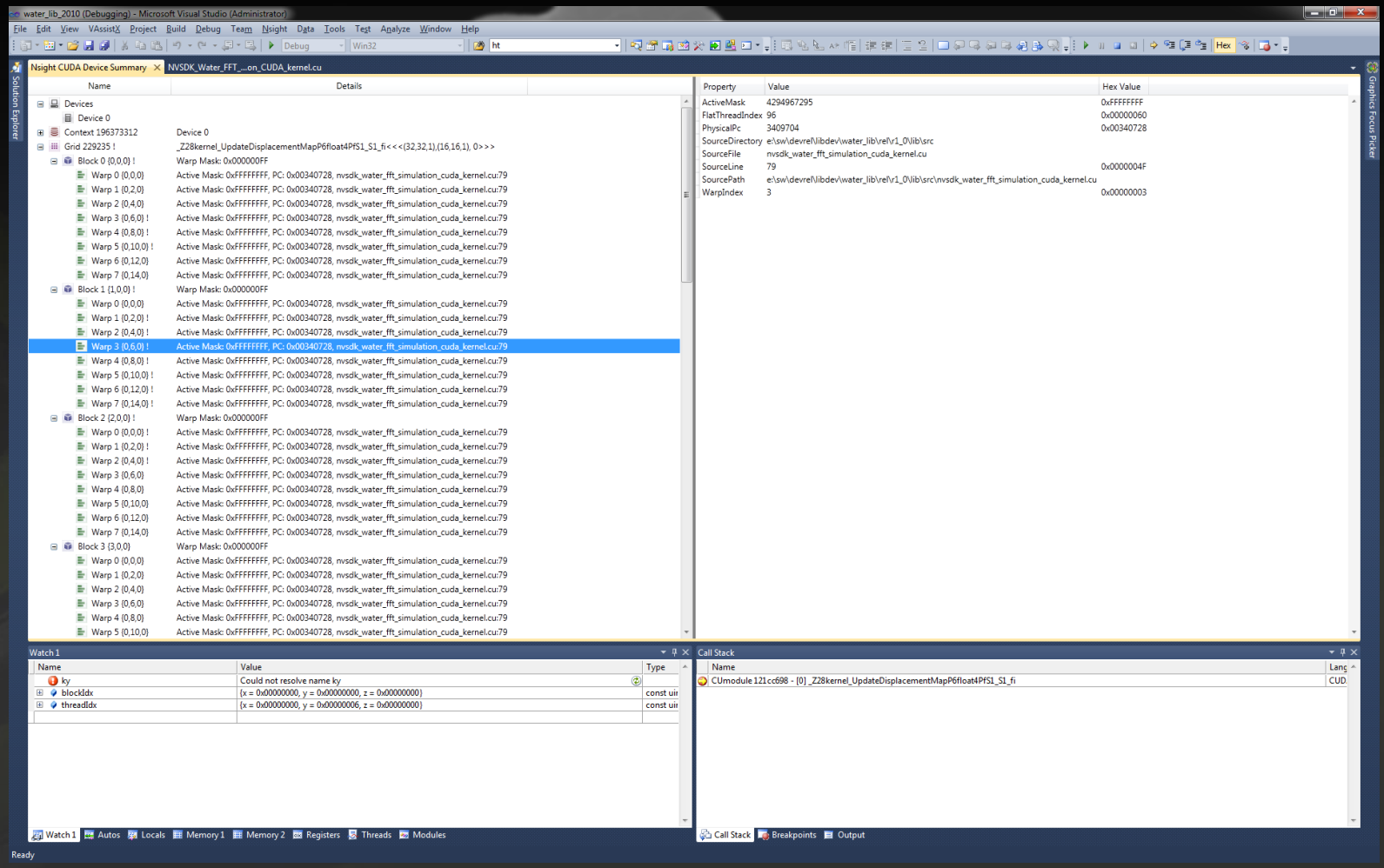
Demo: CUDA Debugging



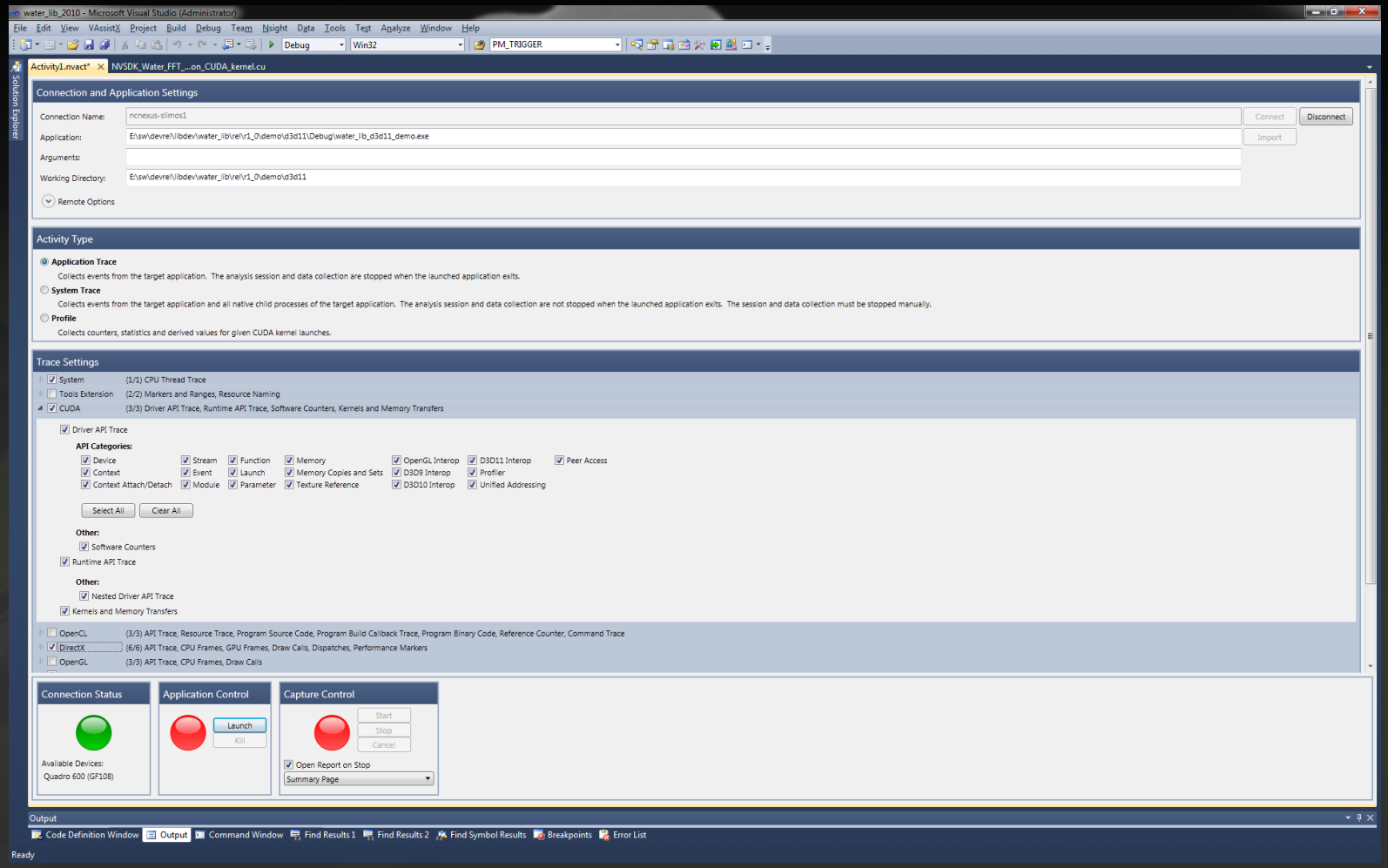
Demo: CUDA Debugging



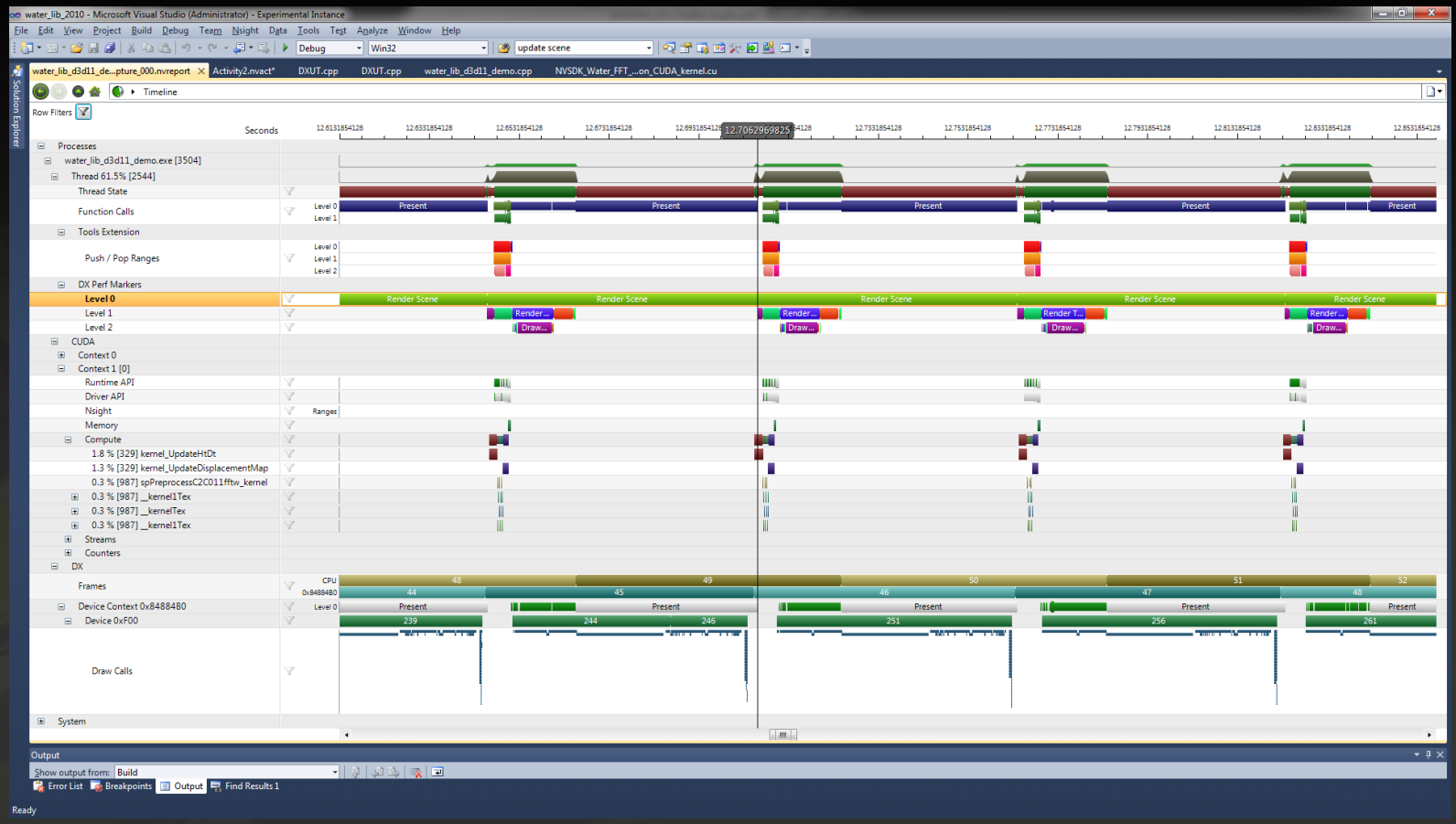
Demo: CUDA Debugging



Demo: Analysis

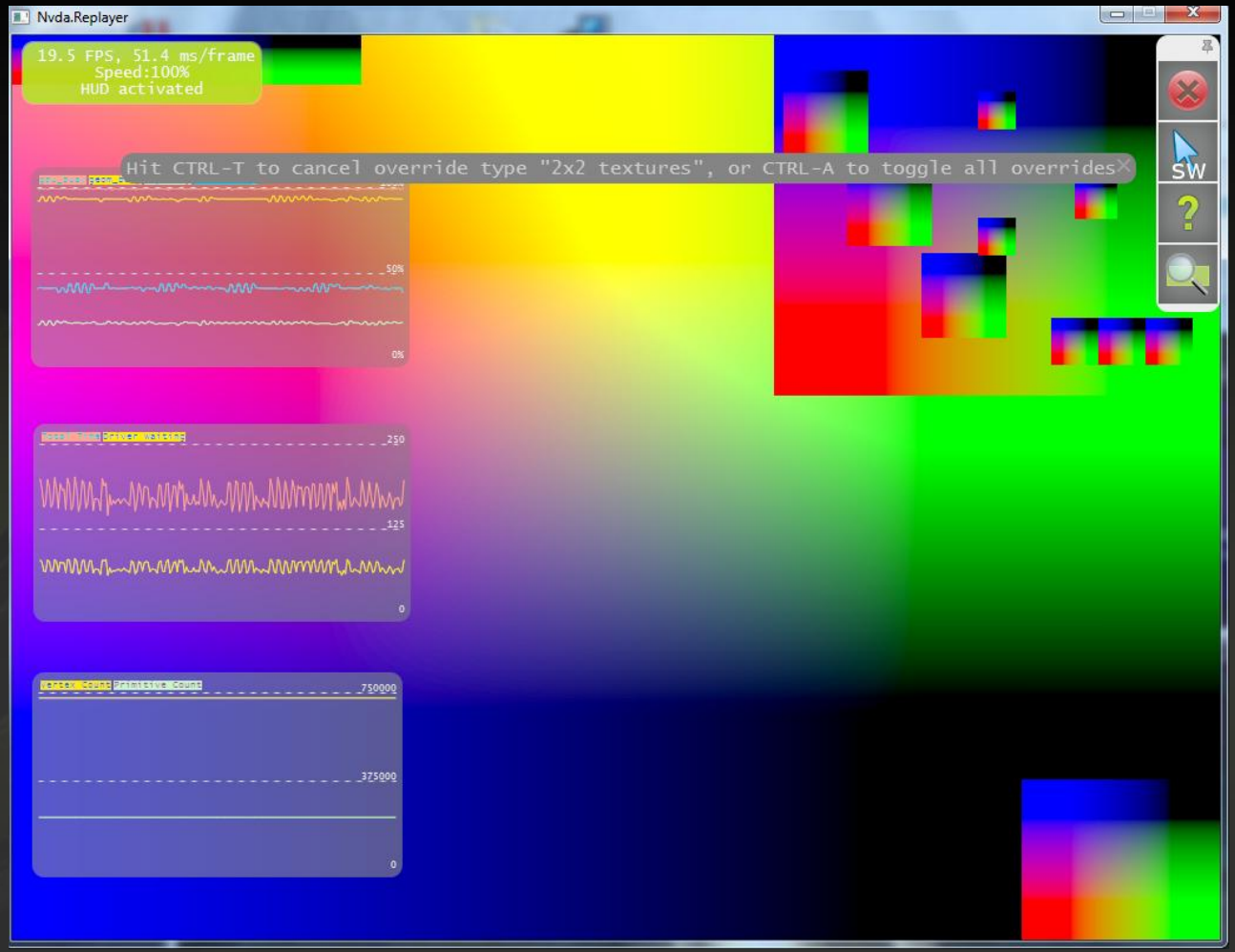


Demo: Analysis

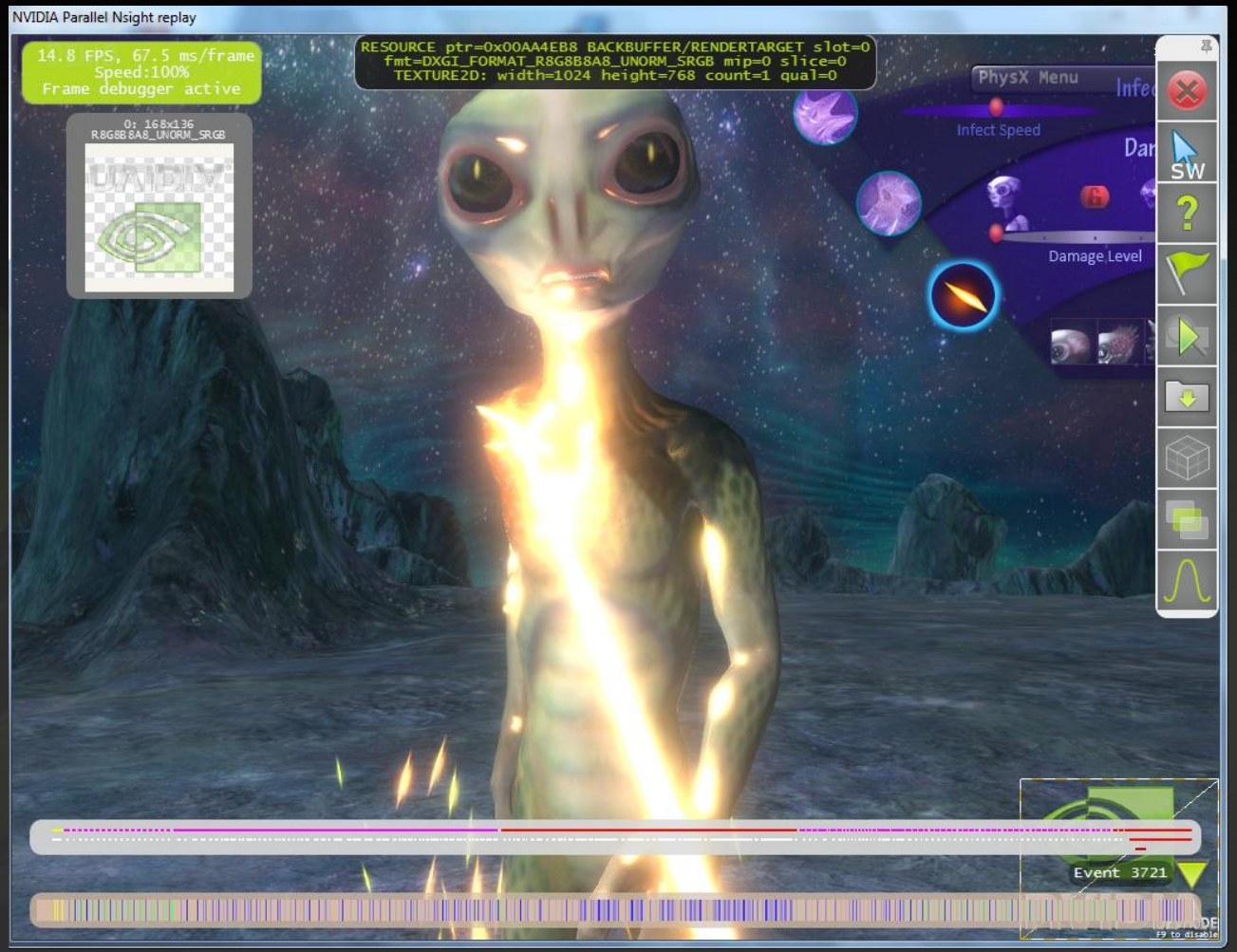


Demo: Graphics Debugging - HUD

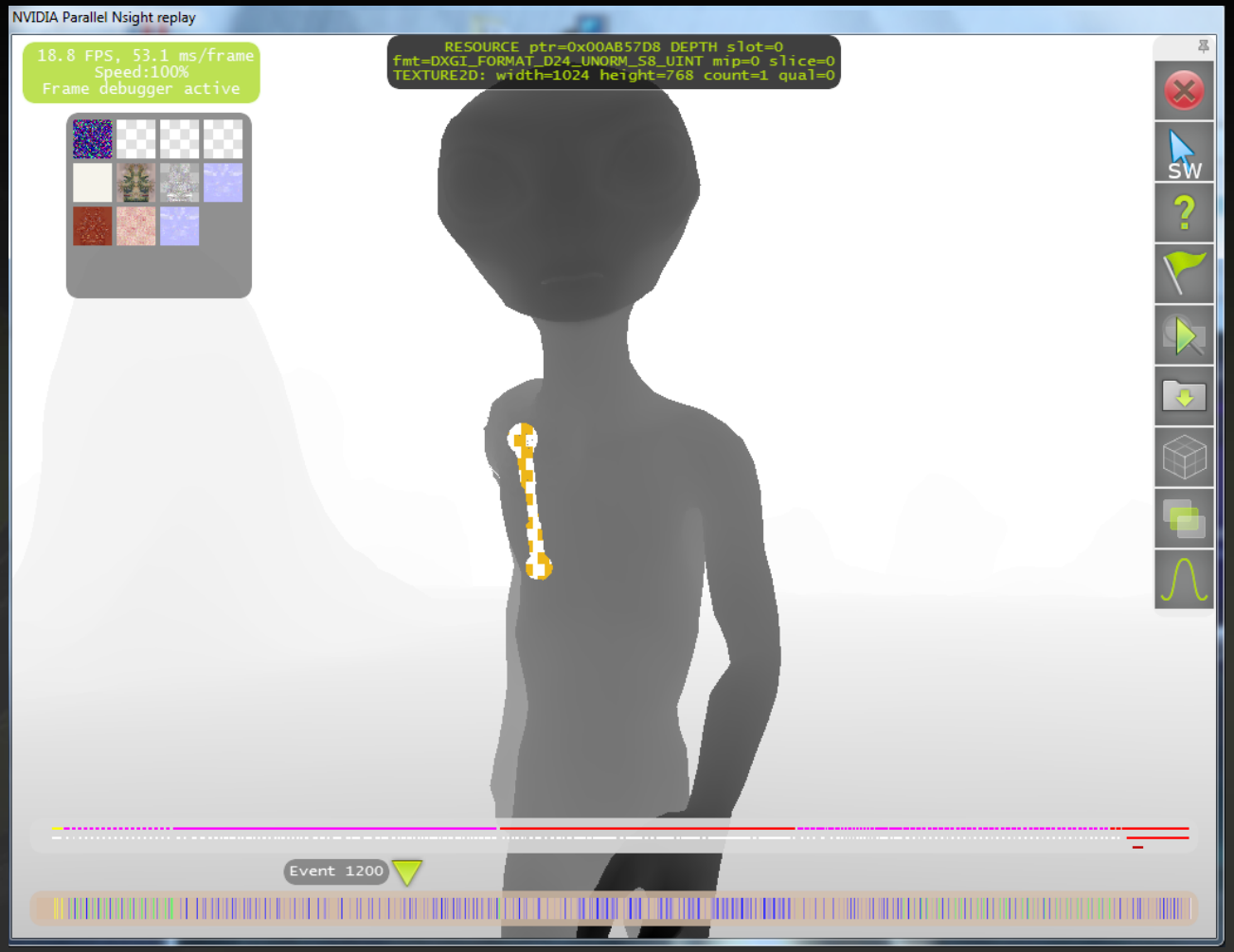
Demo: HUD Showing 2x2 Texture



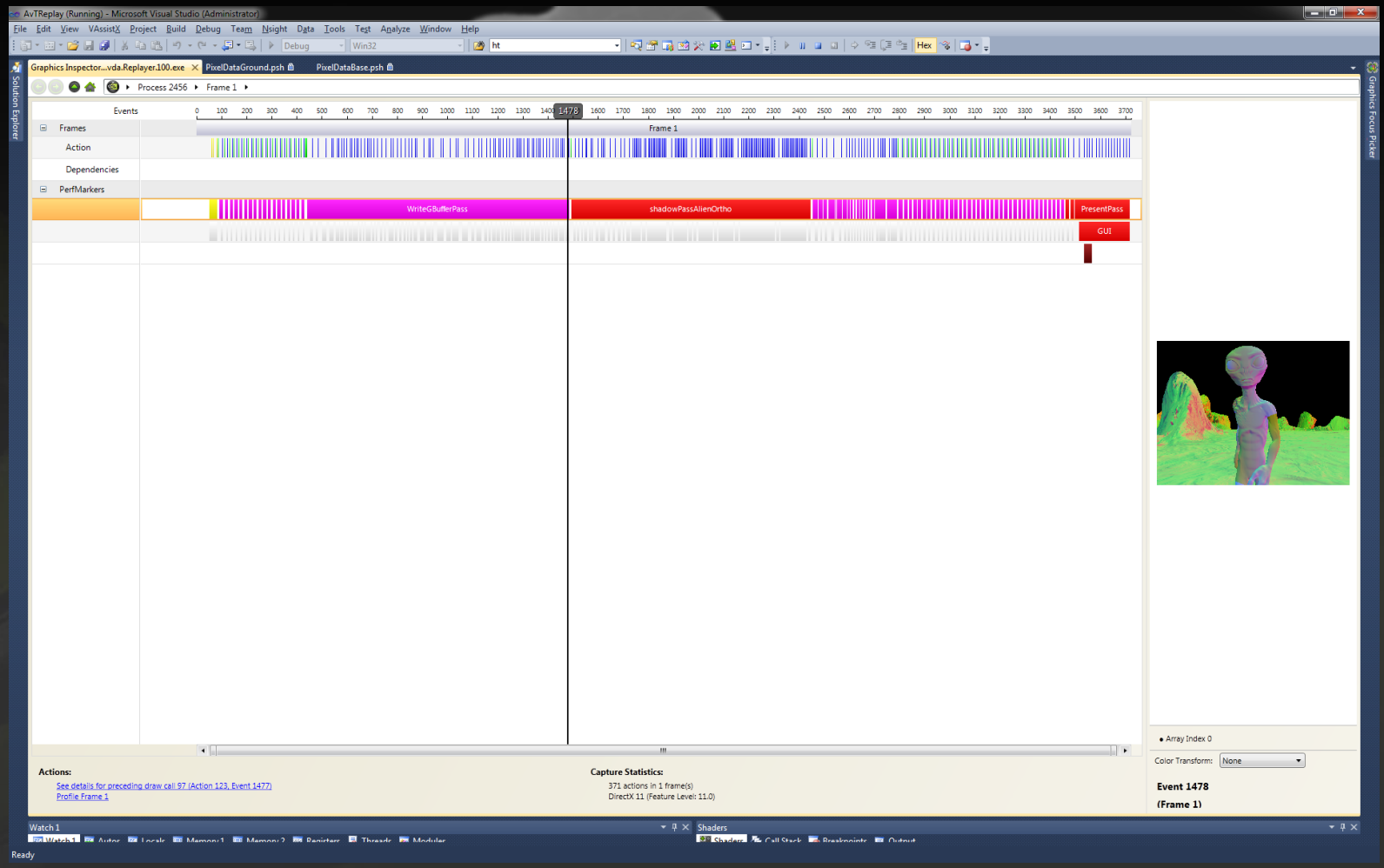
Demo: HUD in Graphics Inspector



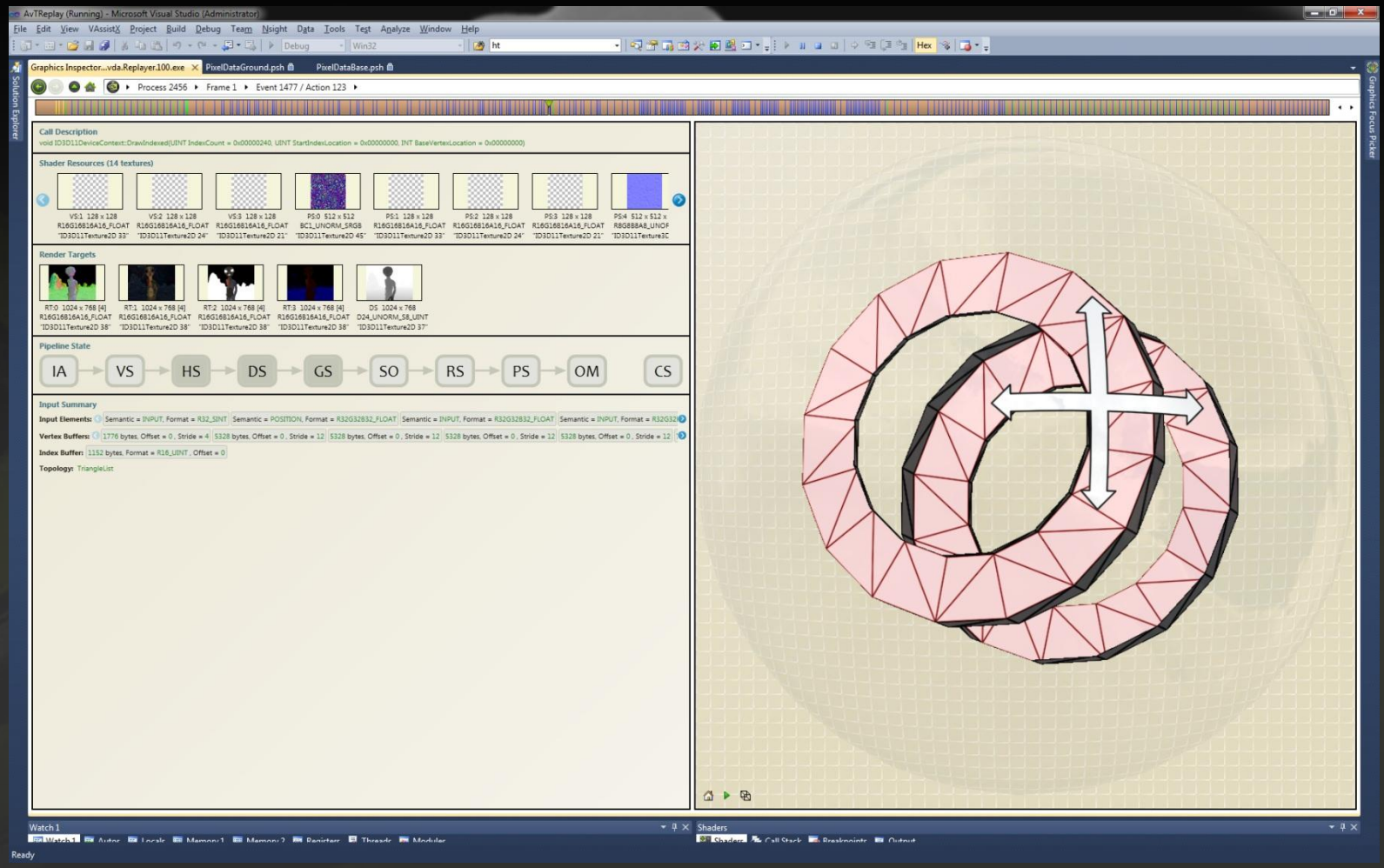
Demo: HUD Render Target, Depth & Stencil



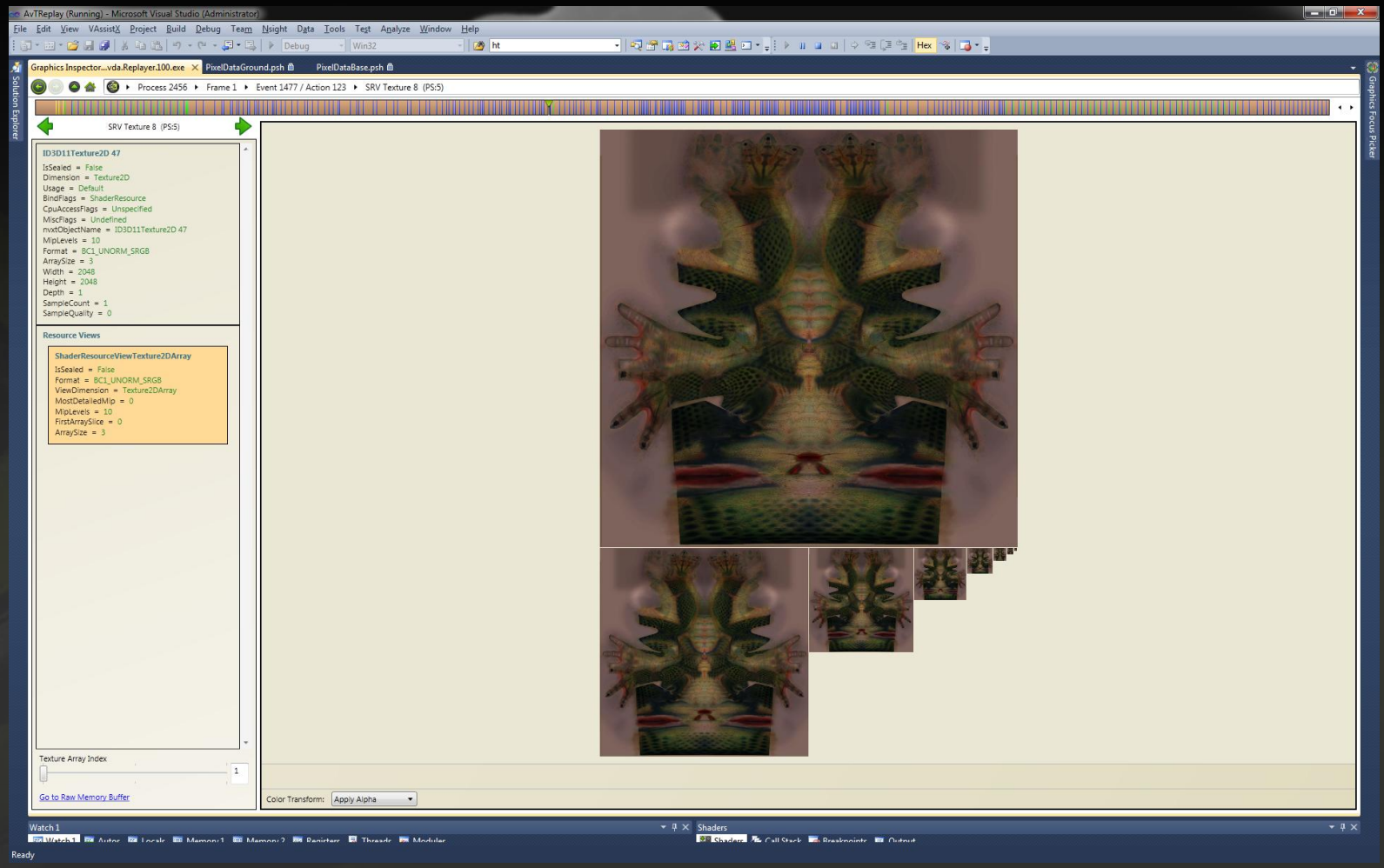
Demo: Host Frames Page



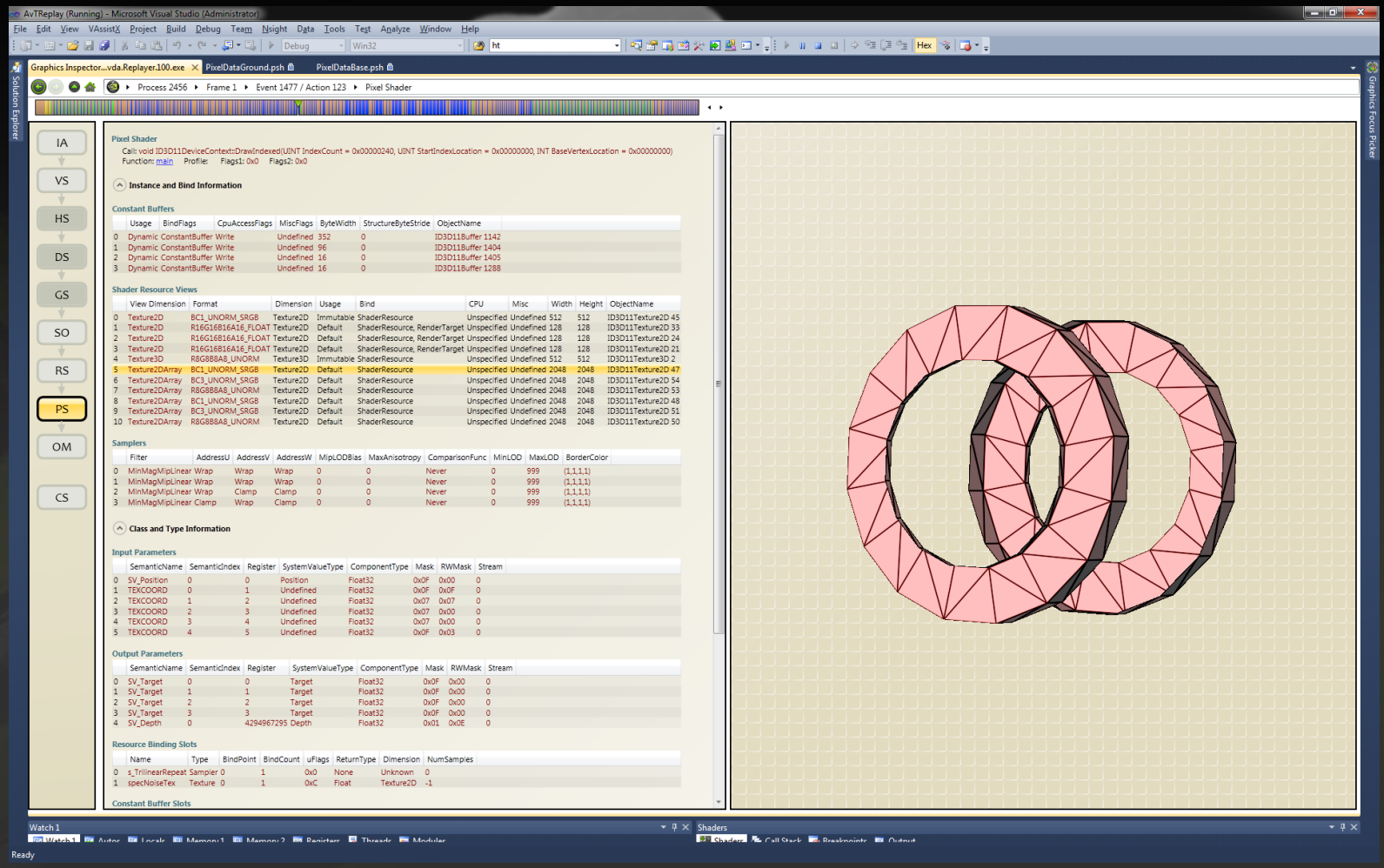
Demo: Draw Call Page



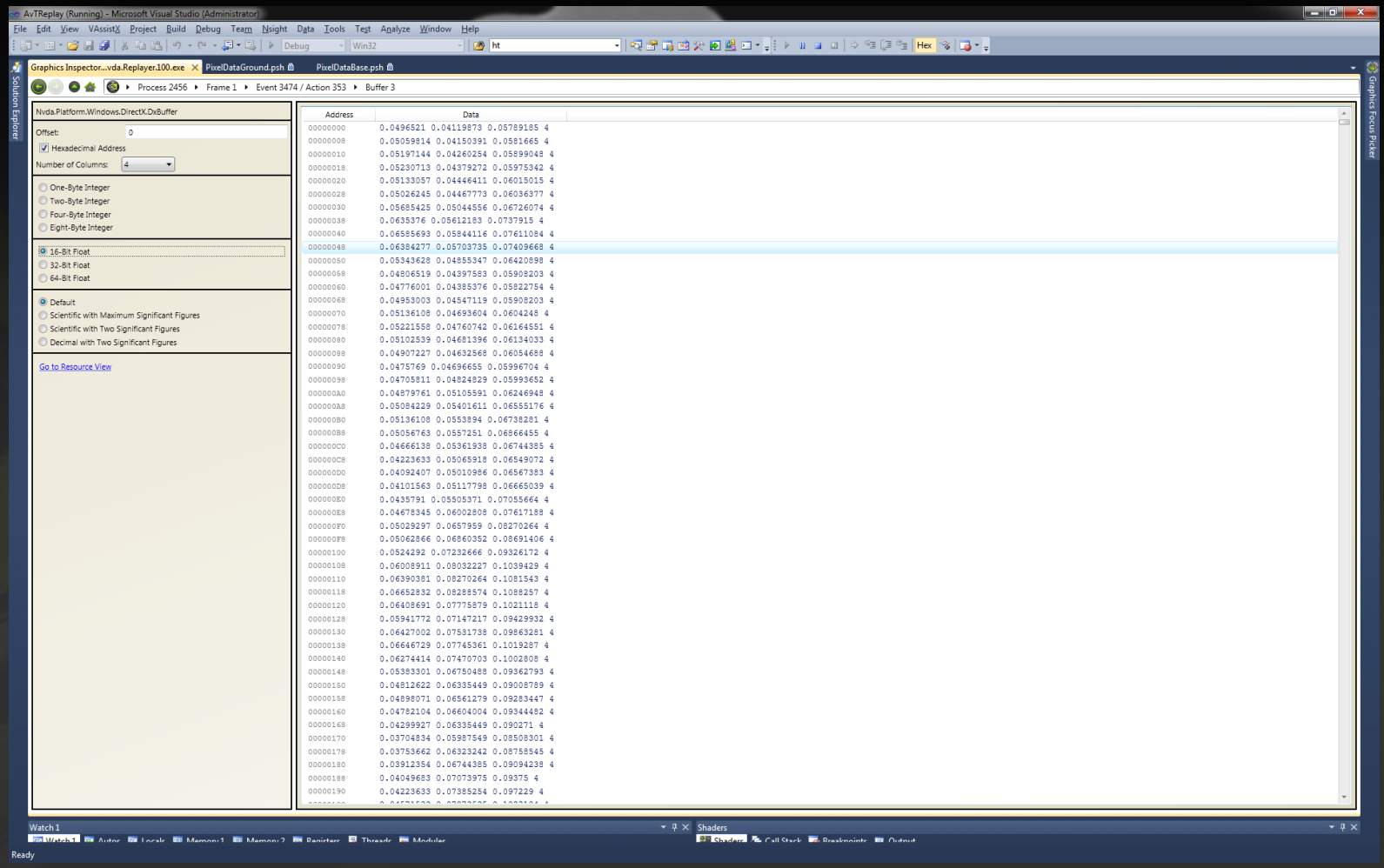
Demo: Texture Viewer



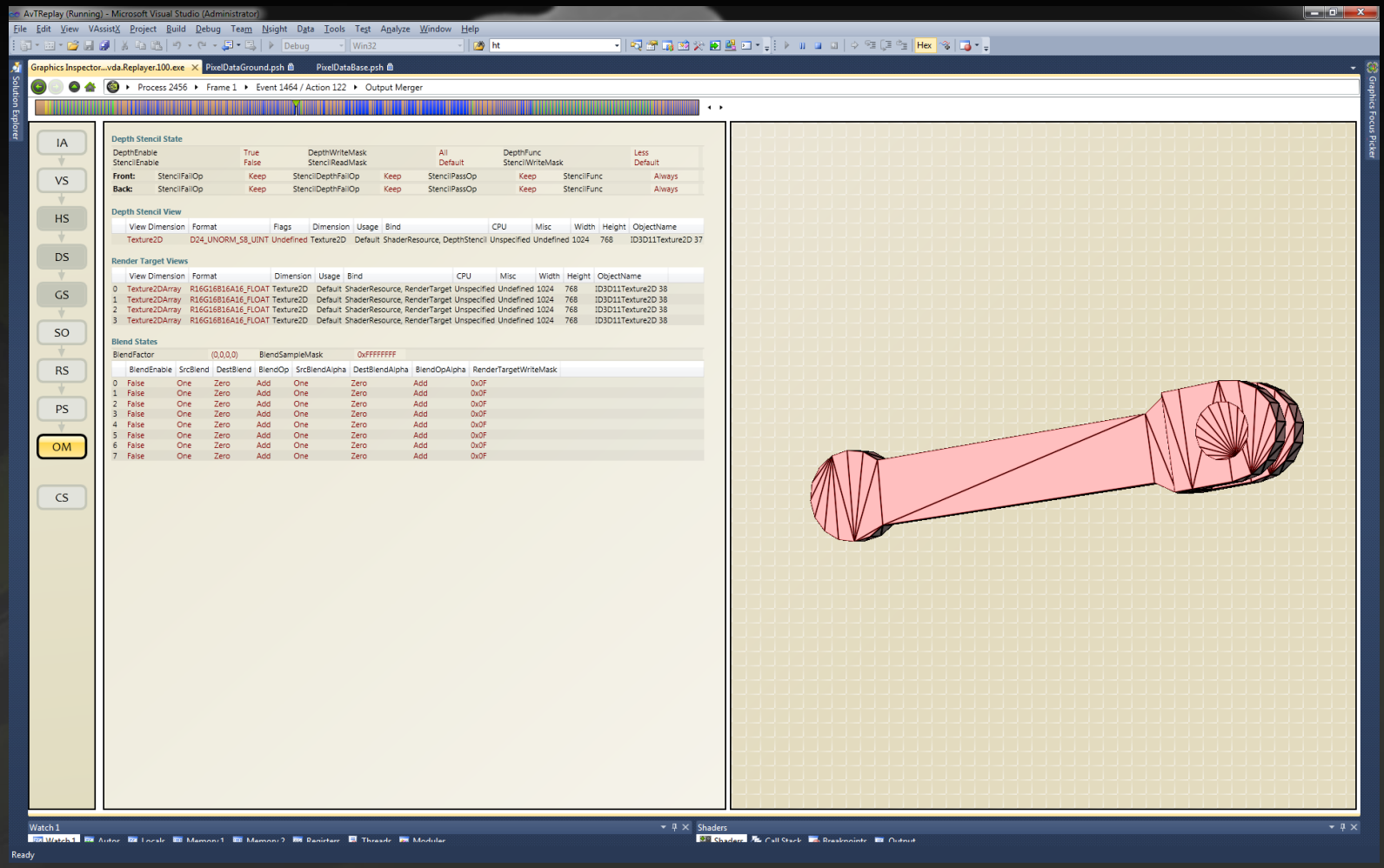
Demo: Pixel Shader State Inspector



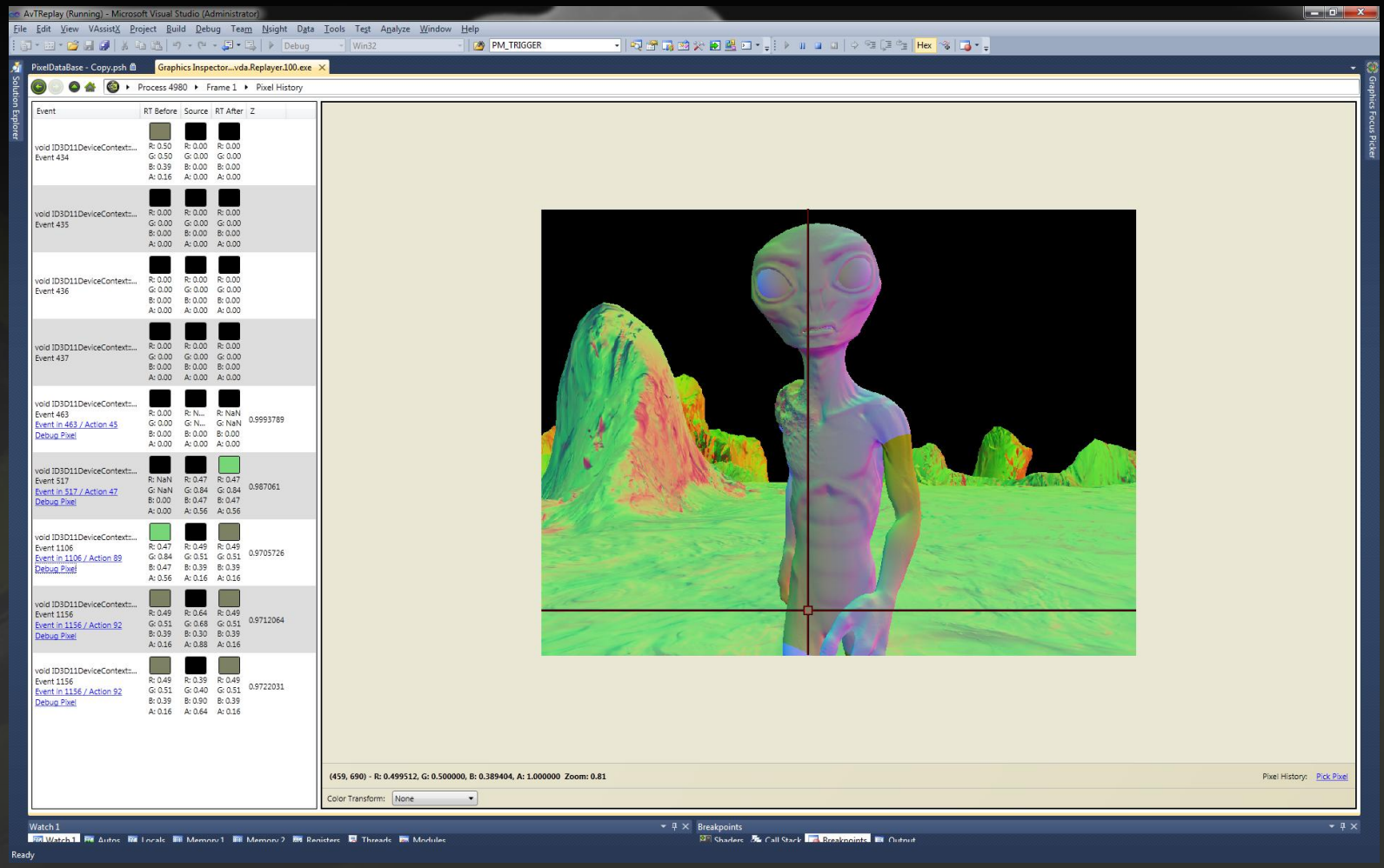
Demo: Buffer Inspector



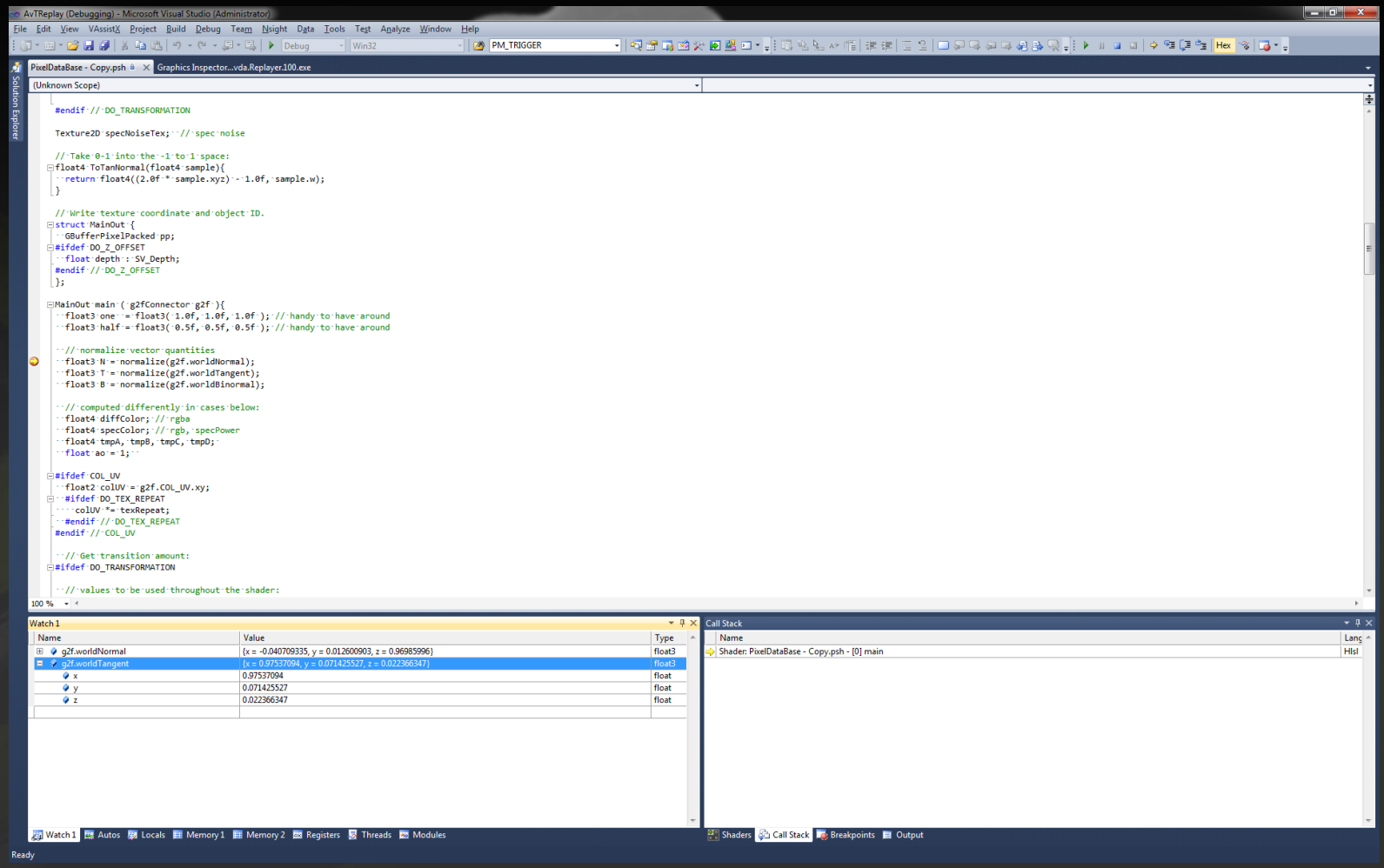
Demo: Output Merger Inspector



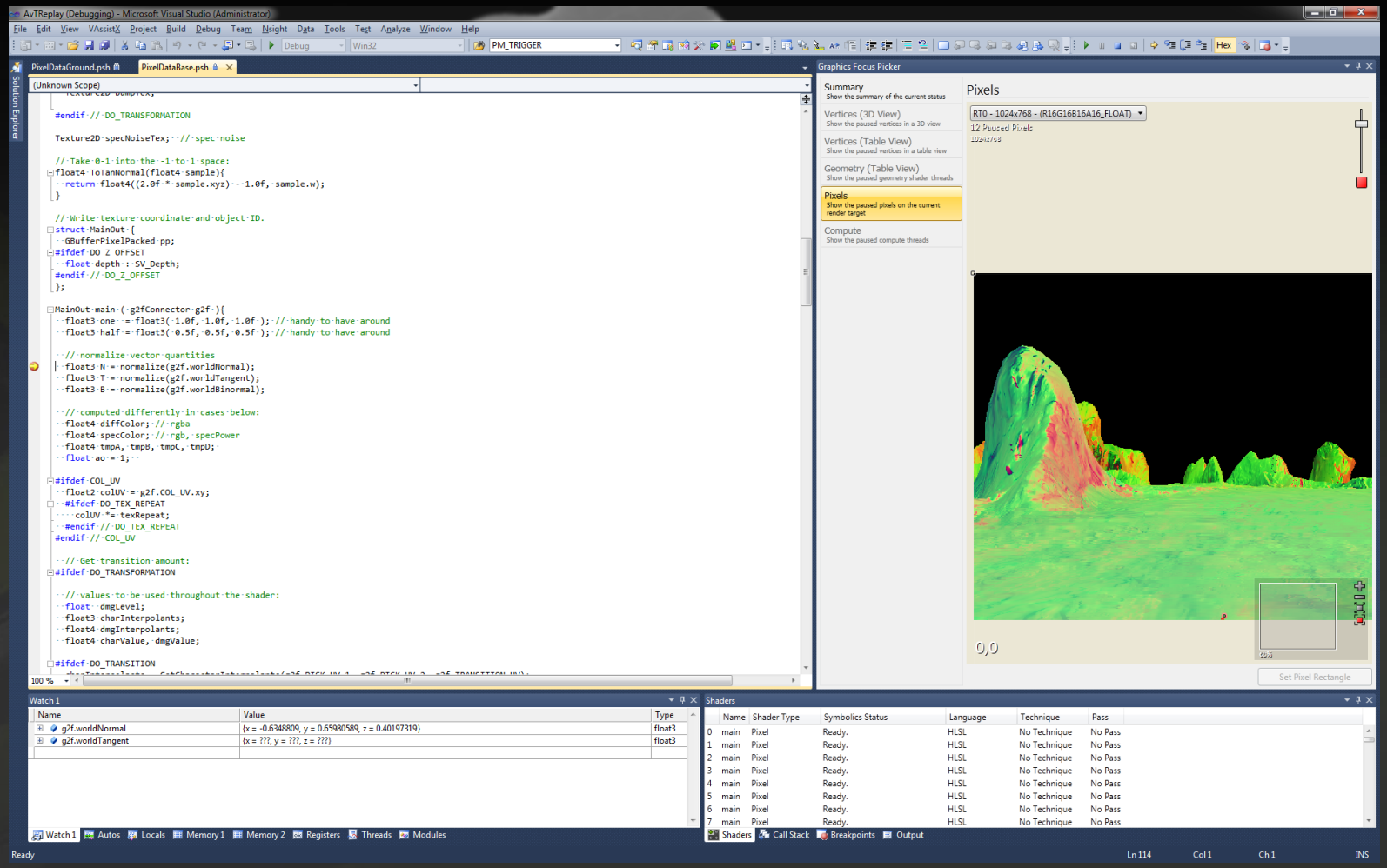
Demo: Pixel History



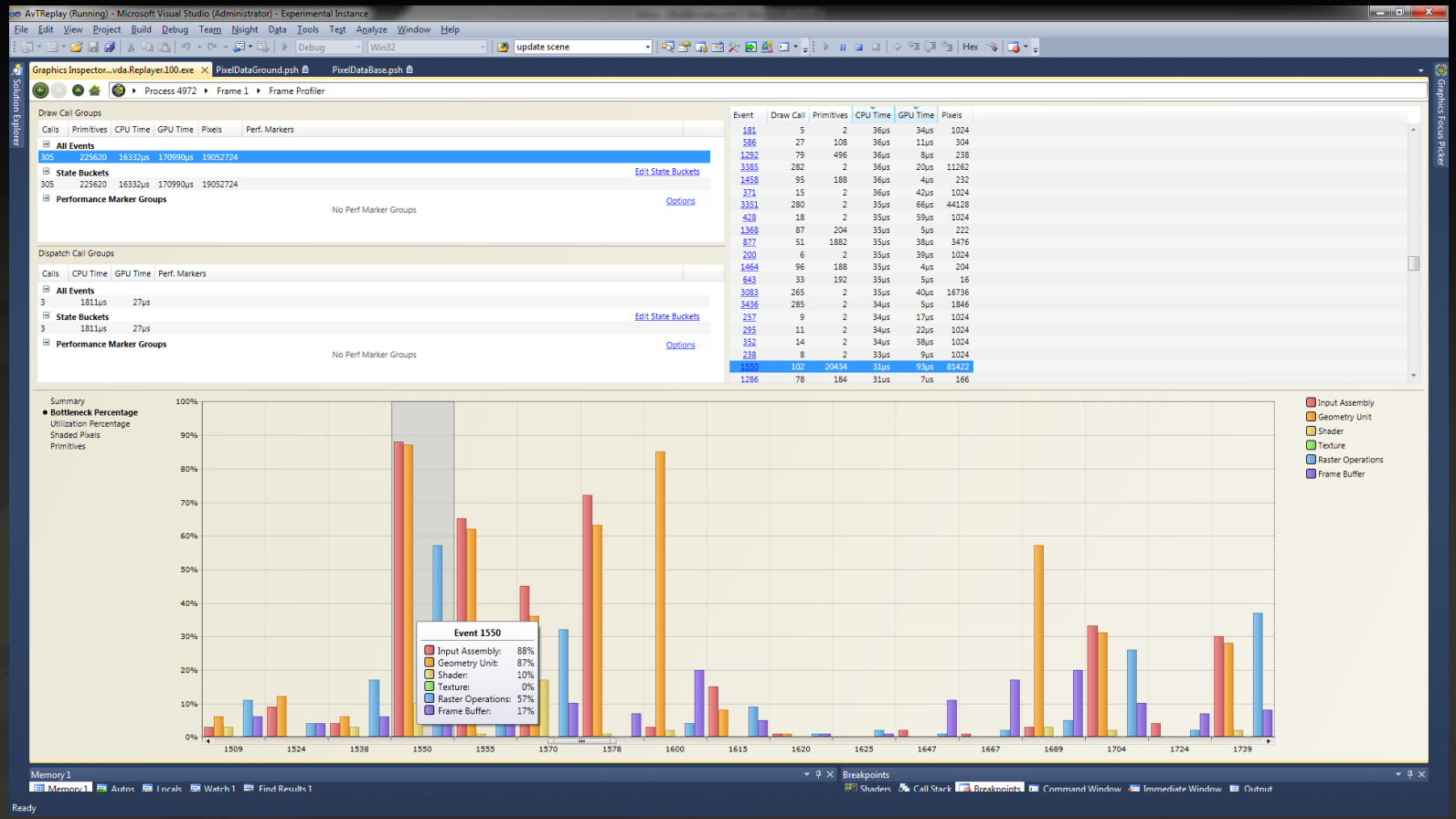
Demo: Shader Debugger Breakpoint



Demo: Focus Picker



Demo: Frame Profiler



NVIDIA Parallel Nsight: Graphics Features

Version 2.0

- View all graphics resources at a glance
- Numerous usability and workflow improvements
- Graphics profiler performance and accuracy
- Driver independence
- Stability improvements
- Support for latest drivers and hardware

NVIDIA Parallel Nsight: Compute Features

Version 2.0

- CUDA Toolkit 4.0 Support
- Full Visual Studio 2010 Platform Support
- Tesla Compute Cluster (TCC) Analysis
- PTX Assembly Debugging
- Attach to Process
- Derived Metrics and Experiments
- Concurrent Kernel Trace
- Runtime API Trace
- Advanced Conditional Breakpoints
- Support for latest drivers hardware

Wrap Up…Thank You!

- Call to action!
  - Download Parallel Nsight and try it out
  - Send us feedback on what features you find important
- Come talk to us here at SIGGRAPH
- Contact us on the NVIDIA Developer Forums
  http://forums.nvidia.com/index.php?showforum=191