



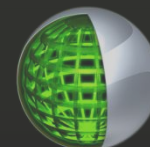
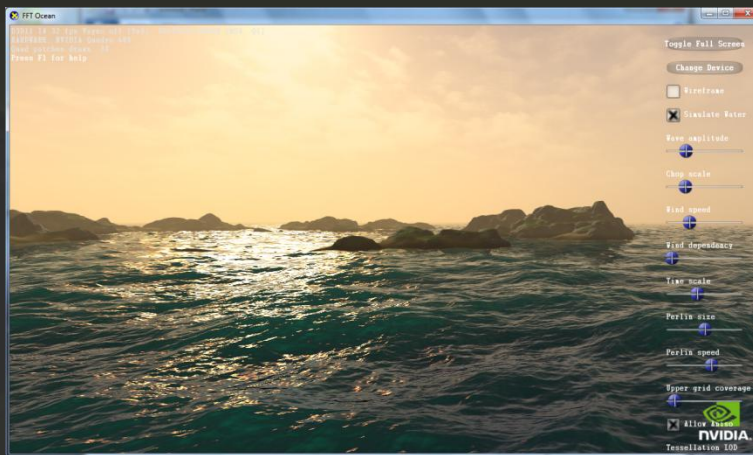
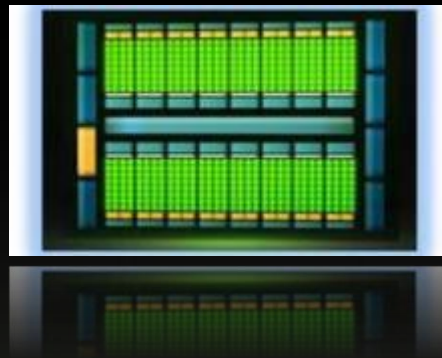
# **NVIDIA Parallel Nsight™ 2.0 and CUDA 4.0 for the Win!**

**Jeff Kiel, Manager of Graphics Tools  
NVIDIA Corporation, SIGGRAPH 2011**



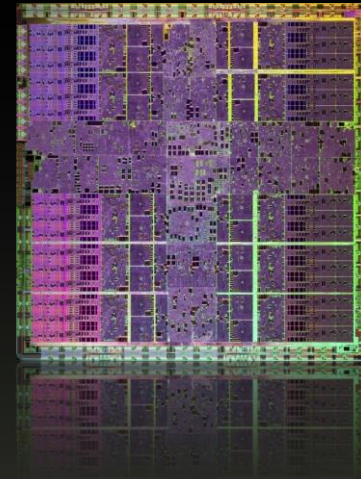
# Agenda

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

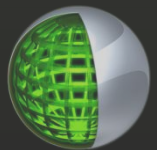




# CUDA Update: New in 4.0



- **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

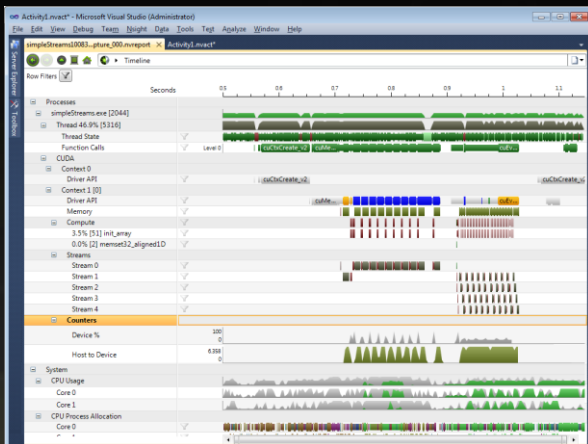


# Visual Studio with Parallel Nsight

Integrated development for CPU and GPU

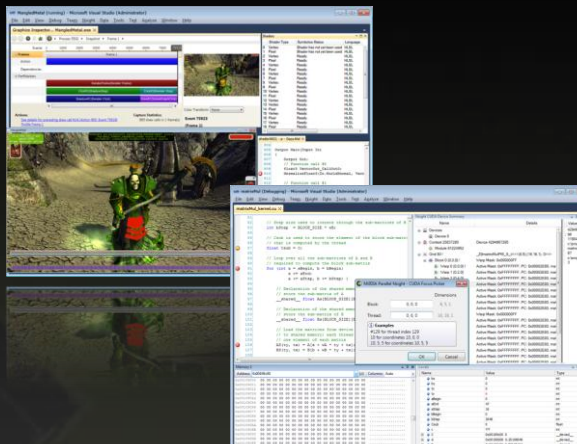


# NVIDIA Parallel Nsight for Graphics & Compute



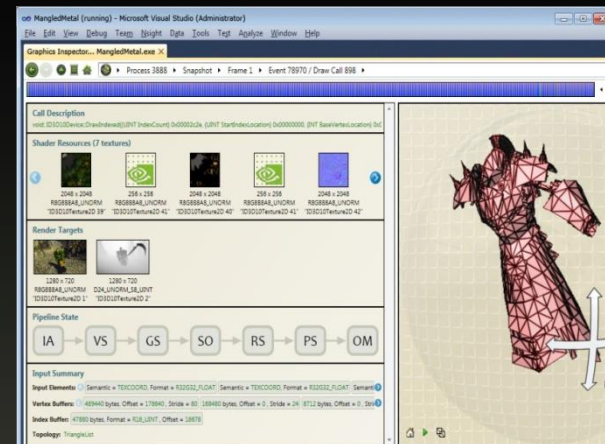
## System Analysis

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

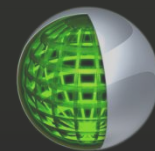


## Host + Target (32/64 bit)



- ✓ System Analysis
- ✓ Graphics Inspector

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



# One computer, two NVIDIA GPUs

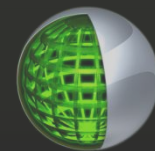


## Host + Target (32/64 bit)



- ✓ 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)**

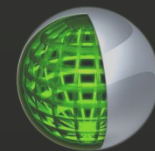


**Target (32/64-bit)**



- ✓ 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





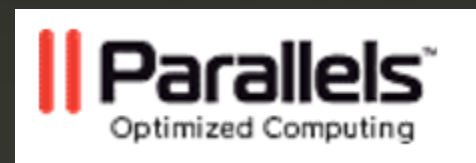
# One computer, two NVIDIA GPUs



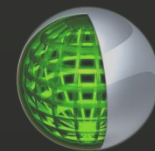
## Host + Target (32/64-bit)



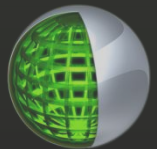
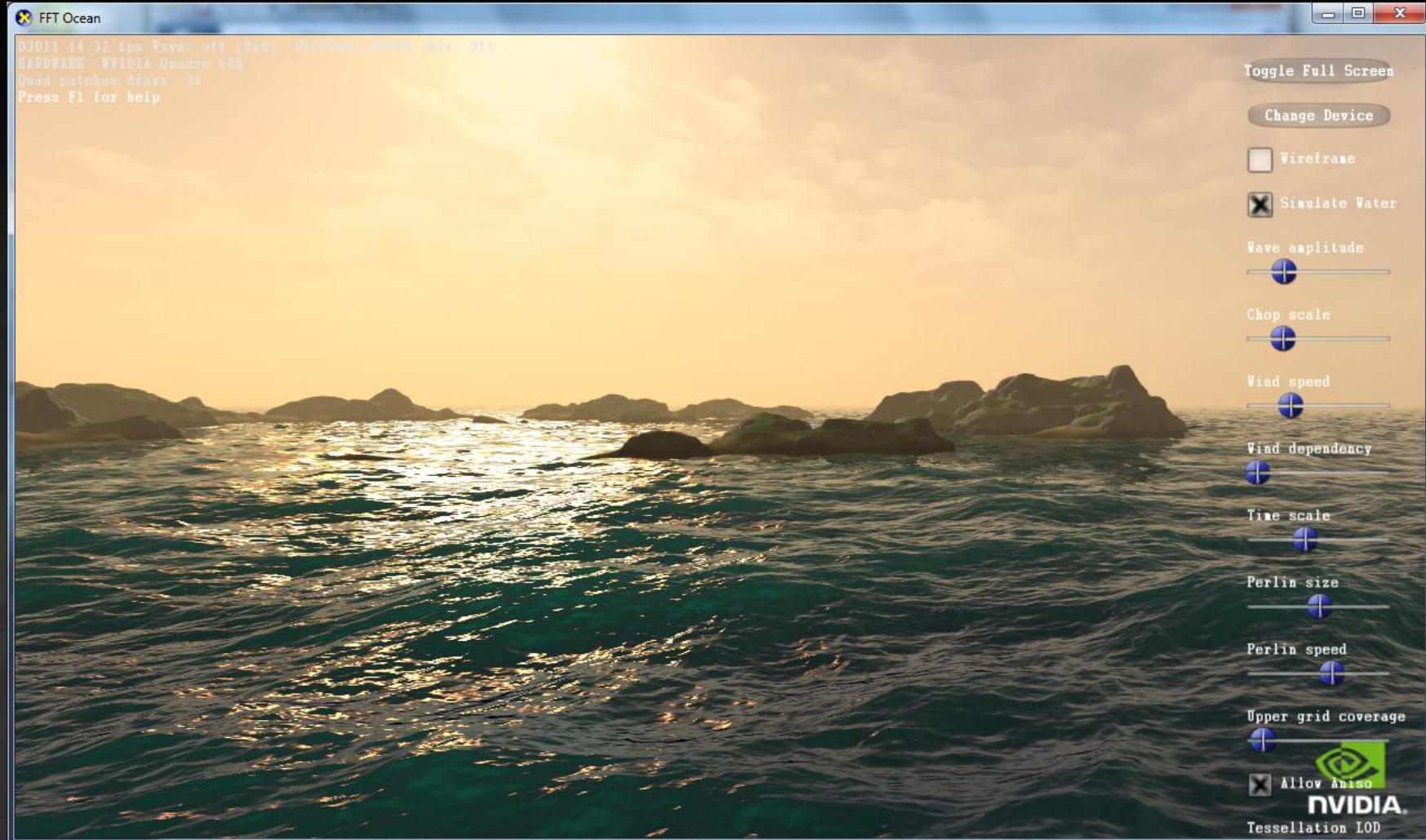
- ✓ System Analysis
- ✓ Graphics Inspector
- ✓ CUDA Debugger
- ✓ Graphics Debugger



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



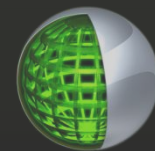
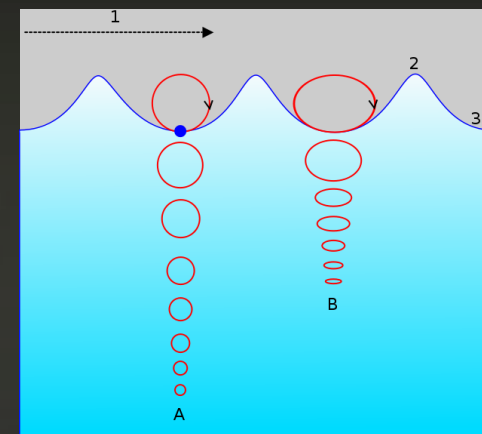
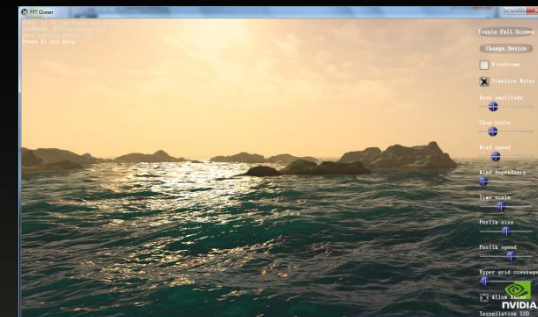
# FFT Ocean Demo Overview



# FFT Ocean Demo Overview

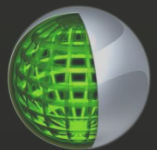
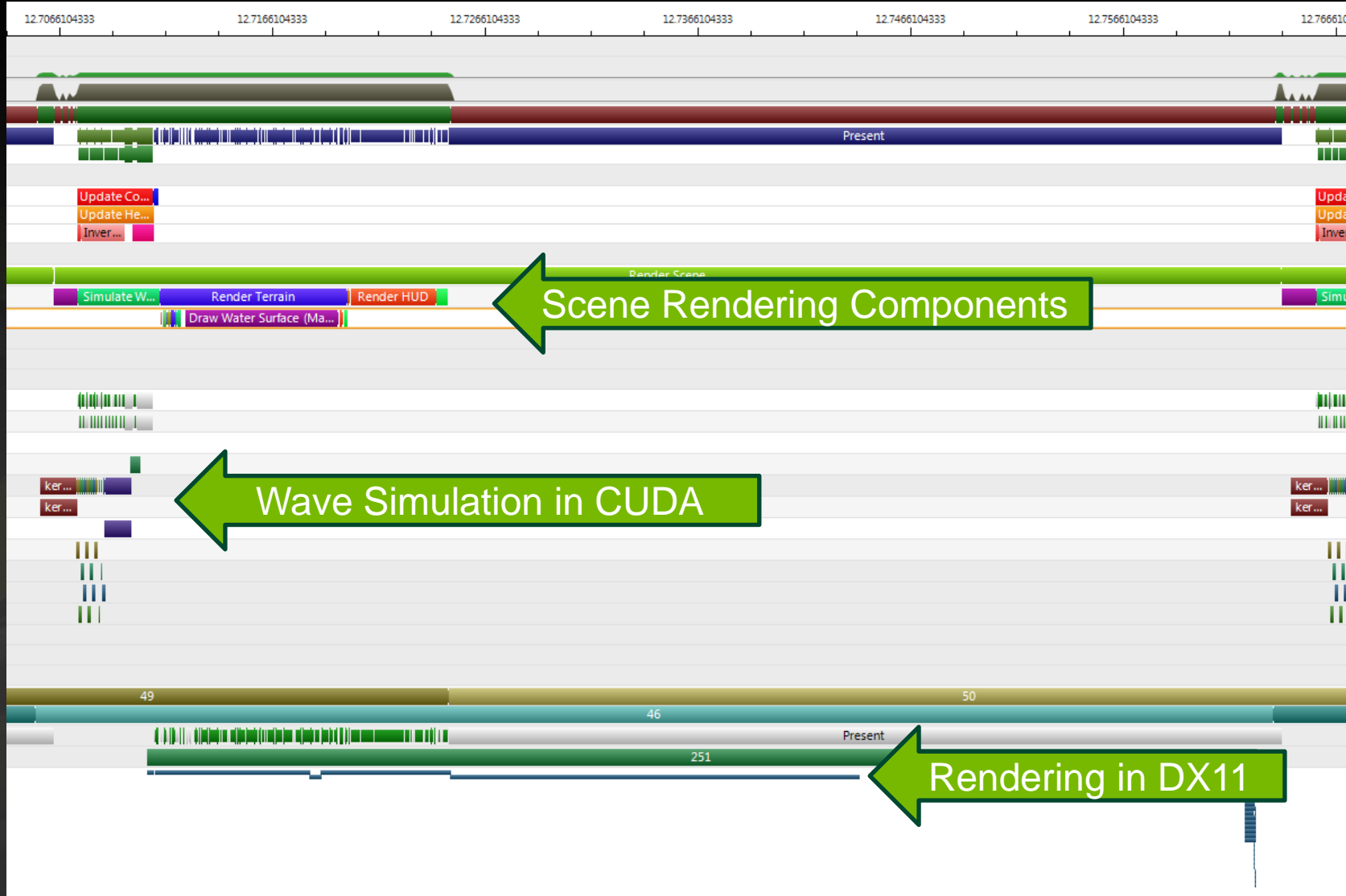


- Based on “Simulating Ocean Water” by Jerry Tenssendorf
  - Statistical model, not physics based
  - Generates wave distribution in frequency domain on GPU
  - Inverse FFT on GPU
- Movies: Large height map (2048x2048)
- Games on CPU: Small height map (64x64)
- GPU Based: Medium height map (512x512)
- 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





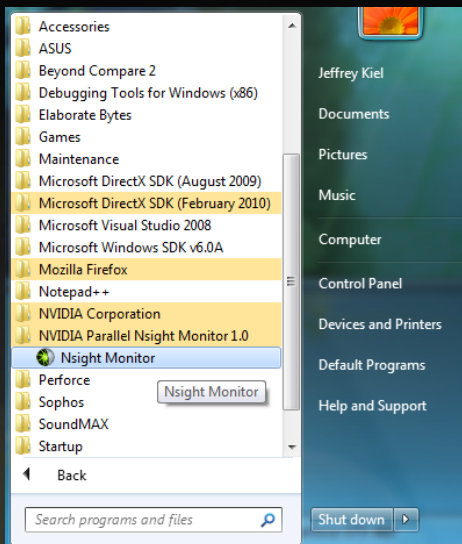
# FFT Ocean Demo Overview



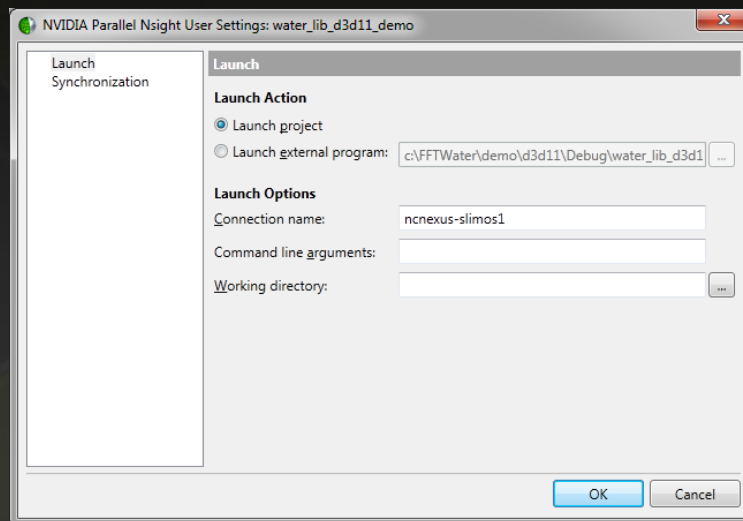
# Demo: Launching...



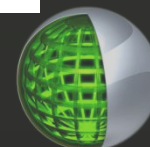
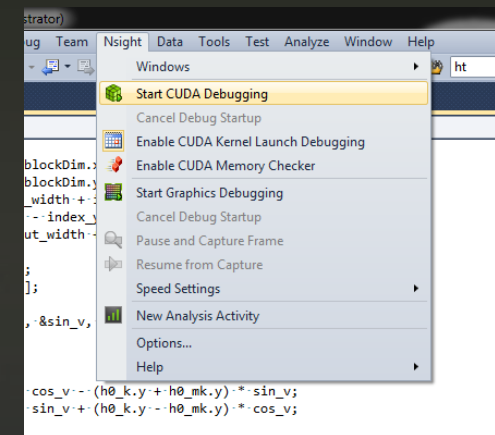
## Start Nsight Monitor



## Configure Parallel Nsight Project Settings



## Launch Your Application



# Demo: CUDA Debugging



water\_fft\_2010 (Debugging) - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Night Data Tools Test Analyze Window Help

Debug Win32

Night CUDA Device Summary NVSDK\_Water\_FFT\_simon\_CUDA\_kernel.cu

(Unknown Scope)

```
{
    int index_x = blockIdx.x * blockDim.x + threadIdx.x;
    int index_y = blockIdx.y * blockDim.y + threadIdx.y;
    int in_index = index_y * in_width + index_x;
    int in_index = (actual_dim - index_y) * in_width + (actual_dim - index_x);
    int out_index = index_y * out_width + index_x;

    float2 h0_k = H0[in_index];
    float2 h0_mk = H0[in_index];
    float sin_v, cos_v;
    sincosf(omega[in_index] * t, &sin_v, &cos_v);

    // H(0) -> H(t)
    float2 ht;
    ht.x = (h0_k.x + h0_mk.x) * cos_v - (h0_k.y + h0_mk.y) * sin_v;
    ht.y = (h0_k.x - h0_mk.x) * sin_v + (h0_k.y - h0_mk.y) * cos_v;

    // Determine grid location
    float kx = index_x - actual_dim * 0.5f;
    float ky = index_y - actual_dim * 0.5f;
    float sq_k = kx * kx + ky * ky;

    float rsqr_k = 0;
    if (sq_k > 1e-12f)
        rsqr_k = 1 / sqrtf(sq_k);

    // H(t) -> D_x(t), D_y(t)
    float2 dt_x = make_float2(-ht.y * kx, ht.x * kx);
    float2 dt_y = make_float2(-ht.y * ky, ht.x * ky);

    if ((index_x < out_width) && (index_y < out_height))
    {
        Ht[out_index] = ht;
        Dt_x[out_index] = dt_x;
        Dt_y[out_index] = dt_y;
    }
}
```

Breakpoint Condition

When the breakpoint location is reached, the expression is evaluated and the breakpoint is hit only if the expression is true or has changed.

☒ Condition:

☒ Is true

☐ Has changed

OK Cancel

Memory 1

Address: 0x0000000057000000

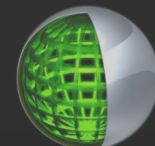
Columns: Auto

Breakpoints

New Columns Search: In Column: All visible

Name	Condition	Hit Count
NVSDK_Water_FFT_Simulation_CUDA_kernel.cu, line 48	(no condition)	break always

Ready





# Demo: CUDA Debugging



water\_ib\_2010 (Debugging) - Microsoft Visual Studio (Administrator)

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Debug Win32

Solution Explorer

Night CUDA Device Summary NVSDK\_Water\_FFT...on\_CUDA\_kernel.cu

(Unknown Scope)

```
extern "C"
void cuda_UpdateH0t(float2* Ht, float2* Dt_x, float2* Dt_y, float2* H0, float* omega,
    int actual_dim, int in_width, int out_width, int out_height, float t)
{
    // block dimensions are fixed to be 64 threads
    dim3 block(8, 8, 1);
    dim3 grid((out_width + block.x - 1) / block.x, (out_height + block.y - 1) / block.y, 1);
    kernel_UpdateH0t<<grid, block>>>(Ht, Dt_x, Dt_y, H0, omega, actual_dim, in_width, out_width, out_height, t);
}

__global__ void kernel_UpdateDisplacementMap(float4* displacement, float* Dx, float* Dy, float* Dz, float choppy_scale, int dim)
{
    unsigned int index_x = blockIdx.x * blockDim.x + threadIdx.x;
    unsigned int index_y = blockIdx.y * blockDim.y + threadIdx.y;
    unsigned int index_z = index_y * dim + index_x;

    // cos(pi * (m1 + m2))
    int sign_correction = ((index_x + index_y) & 0x01) ? -1 : 1;

    float dx = Dx[index] * sign_correction * choppy_scale;
    float dy = Dy[index] * sign_correction * choppy_scale;
    float dz = Dz[index] * sign_correction;

    if ((index_x < dim) && (index_y < dim))
        displacement[index] = make_float4(dx, dy, dz, 0.0f);
}
```

100 %

Memory 1

Address: 0x0000000000000000

Address	Value	Value	Value	Value	Value
0x0000000000000000	-5.4996047	4.4913731	-26.476490	0.00000000	-4.4240718
0x0000000000000001	5.2591457	-26.330160	0.00000000	-3.8025026	5.4757991
0x0000000000000002	-26.094553	0.00000000	-2.9316041	6.0808404	-26.096822
0x0000000000000003	0.00000000	-2.0954590	6.8211513	-25.449837	0.00000000
0x0000000000000004	-2.4233360	7.4796329	-24.821823	0.00000000	-2.8264265
0x0000000000000005	8.1053600	-25.091644	0.00000000	-2.3662257	8.9027014
0x0000000000000006	-25.339960	0.00000000	-2.1241636	9.4577885	-25.038303
0x0000000000000007	0.00000000	-2.4914823	9.7352552	-24.965189	0.00000000
0x0000000000000008	-2.0658793	9.5155501	25.400841	0.00000000	-2.5948954
0x0000000000000009	10.462103	-26.374981	0.00000000	-1.1077788	11.390539
0x000000000000000A	-26.827456	0.00000000	-0.29811791	12.290795	-25.949551
0x000000000000000B	0.00000000	-0.71941507	12.907280	0.00000000	-25.704967
0x000000000000000C	-0.090213582	13.276184	-25.956354	0.00000000	0.21170424
0x000000000000000D	13.730886	-25.061891	0.00000000	1.0369720	14.405611
0x000000000000000E	-26.440426	0.00000000	2.3959532	15.251616	-26.163105
0x000000000000000F	0.00000000	3.1803629	15.898996	-26.056694	0.00000000
0x0000000000000010	4.5061135	17.111507	-25.900103	0.00000000	6.0831099
0x0000000000000011	18.372200	-25.202511	0.00000000	7.1786075	19.228605
0x0000000000000012	-23.520082	0.00000000	7.1342083	19.967140	-22.255955
0x0000000000000013	0.00000000	7.4714008	20.730648	-21.027020	0.00000000
0x0000000000000014	7.1274366	21.411879	-19.869299	0.00000000	7.3216734
0x0000000000000015	21.917767	-18.843561	0.00000000	7.1091213	22.038195
0x0000000000000016	-17.776115	0.00000000	7.5171285	22.324585	-16.587778
0x0000000000000017	0.00000000	6.5210537	22.367876	-14.793562	0.00000000
0x0000000000000018	5.2789661	22.249596	-14.472866	0.00000000	4.9628420
0x0000000000000019	22.633478	-13.715358	0.00000000	3.8869271	22.954622
0x000000000000001A	-12.690623	0.00000000	2.5263255	23.091936	-12.092640
0x000000000000001B	0.00000000	1.4696653	23.038074	-11.928940	0.00000000
0x000000000000001C	0.89026374	-22.847229	-11.756948	0.00000000	0.13061541
0x000000000000001D	22.634438	-11.587922	-0.37461337	22.890605	-0.37461337
0x000000000000001E	-11.625572	0.00000000	-0.43085558	22.710674	-11.478616
0x000000000000001F	0.00000000	-0.53020406	22.354614	-11.068304	0.00000000
0x0000000000000020	-1.0604534	21.973904	-10.824974	0.00000000	-1.2825361

Columns: Auto

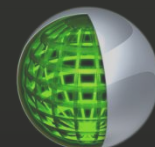
Name

C:\module 121cc698 - [0] \_Z28kernel\_UpdateDisplacementMapP6float4PFS1\_S1\_fi

Lang: CUD

Call Stack Breakpoints Output

Ready



# Demo: CUDA Debugging



water\_lib\_2010 (Debugging) - Microsoft Visual Studio (Administrator)

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Debug Win32

Night CUDA Device Summary NVSDK\_Water\_FFT...on\_CUDA\_kernel.cu

Name	Details	Property	Value	Hex Value
Devices		ActiveMask	4294967295	0xFFFFFFFF
Device 0		FlatThreadIndex	96	0x00000060
Context 196373312		PhysicalPc	3409704	0x00340728
Grid 229235		SourceDirectory	e:\sw\dev\ref\libdev\water_lib\refv1_0\lib\src	
Block 0 [0.0.0]		SourceFile	nvskd_water_fft_simulation_cuda_kernel.cu	
Warp 0 [0.0.0]		SourceLine	79	0x0000004F
Warp 0 [0.0.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79	SourcePath	e:\sw\dev\ref\libdev\water_lib\refv1_0\lib\src\nvskd_water_fft_simulation_cuda_kernel.cu	
Warp 1 [0.2.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79	WarpIndex	3	0x00000003
Warp 2 [0.4.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 3 [0.6.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 4 [0.8.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 5 [0.10.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 6 [0.12.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 7 [0.14.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Block 1 [1.0.0]	Warp Mask: 0x0000000F			
Warp 0 [0.0.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 1 [0.2.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 2 [0.4.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 3 [0.6.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 4 [0.8.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 5 [0.10.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 6 [0.12.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 7 [0.14.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Block 2 [2.0.0]	Warp Mask: 0x0000000F			
Warp 0 [0.0.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 1 [0.2.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 2 [0.4.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 3 [0.6.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 4 [0.8.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 5 [0.10.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 6 [0.12.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 7 [0.14.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Block 3 [3.0.0]	Warp Mask: 0x0000000F			
Warp 0 [0.0.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 1 [0.2.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 2 [0.4.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 3 [0.6.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 4 [0.8.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			
Warp 5 [0.10.0]	Active Mask: 0xFFFFFFFF, PC: 0x00340728, nvskd_water_fft_simulation_cuda_kernel.cu:79			

Watch 1

Name	Value	Type
ky	Could not resolve name ky	
blockidx	(x = 0x00000000, y = 0x00000000, z = 0x00000000)	const unsigned int
threadidx	(x = 0x00000000, y = 0x00000000, z = 0x00000000)	const unsigned int

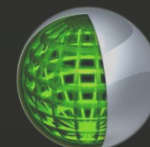
Call Stack

Name	Lang
C:\module\121\cc698 - [0] _Z28kernel_UpdateDisplacementMapP6float4PS1_S1_fi	CUD

Ready

Watch 1 Autos Locals Memory 1 Memory 2 Registers Threads Modules

Call Stack Breakpoints Output



# Demo: Analysis



water\_lib\_2010 - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Insight Data Tools Test Analyze Window Help

Debug Win32 PM\_TRIGGER

ActivityLiveact\* NWSDK\_Water\_FFT...on\_CUDA\_kernel.cu

### Connection and Application Settings

Connection Name: ncnnexus-slimos1 Connect Disconnect

Application: E:\sw\dev\libdev\water\_lib\rel\1\_0\demo\d3d11\Debug\water\_lib\_d3d11\_demo.exe Import

Arguments:

Working Directory: E:\sw\dev\libdev\water\_lib\rel\1\_0\demo\d3d11

Remote Options

### Activity Type

☒ **Application Trace**  
Collects events from the target application. The analysis session and data collection are stopped when the launched application exits.

☐ **System Trace**  
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**  
Collects counters, statistics and derived values for given CUDA kernel launches.

### Trace Settings

☒ System (1/1) CPU Thread Trace

☐ Tools Extension (2/2) Markers and Ranges, Resource Naming

☒ CUDA (3/3) Driver API Trace, Runtime API Trace, Software Counters, Kernels and Memory Transfers

☒ Driver API Trace

**API Categories:**

<input checked="" type="checkbox"/> Device	<input checked="" type="checkbox"/> Stream	<input checked="" type="checkbox"/> Function	<input checked="" type="checkbox"/> Memory	<input checked="" type="checkbox"/> OpenGL Interop	<input checked="" type="checkbox"/> D3D11 Interop	<input checked="" type="checkbox"/> Peer Access
<input checked="" type="checkbox"/> Context	<input checked="" type="checkbox"/> Event	<input checked="" type="checkbox"/> Launch	<input checked="" type="checkbox"/> Memory Copies and Sets	<input checked="" type="checkbox"/> D3D9 Interop	<input checked="" type="checkbox"/> Profiler	
<input checked="" type="checkbox"/> Context Attach/Detach	<input checked="" type="checkbox"/> Module	<input checked="" type="checkbox"/> Parameter	<input checked="" type="checkbox"/> Texture Reference	<input checked="" type="checkbox"/> D3D10 Interop	<input checked="" type="checkbox"/> Unified Addressing	

Select All Clear All

**Other:**

☒ Software Counters

☒ Runtime API Trace

**Other:**

☒ Nested Driver API Trace

☒ Kernels and Memory Transfers

☐ OpenGL (3/3) API Trace, Resource Trace, Program Source Code, Program Build Callback Trace, Program Binary Code, Reference Counter, Command Trace

☒ DirectX (6/6) API Trace, CPU Frames, GPU Frames, Draw Calls, Dispatches, Performance Markers

☐ OpenGL (3/3) API Trace, CPU Frames, Draw Calls

#### Connection Status

Available Devices:  
Quadro 600 (GF108)

#### Application Control

Launch  
Kill

#### Capture Control

Start  
Stop  
Cancel

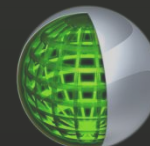
☒ Open Report on Stop

Summary Page

Output

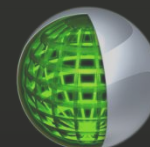
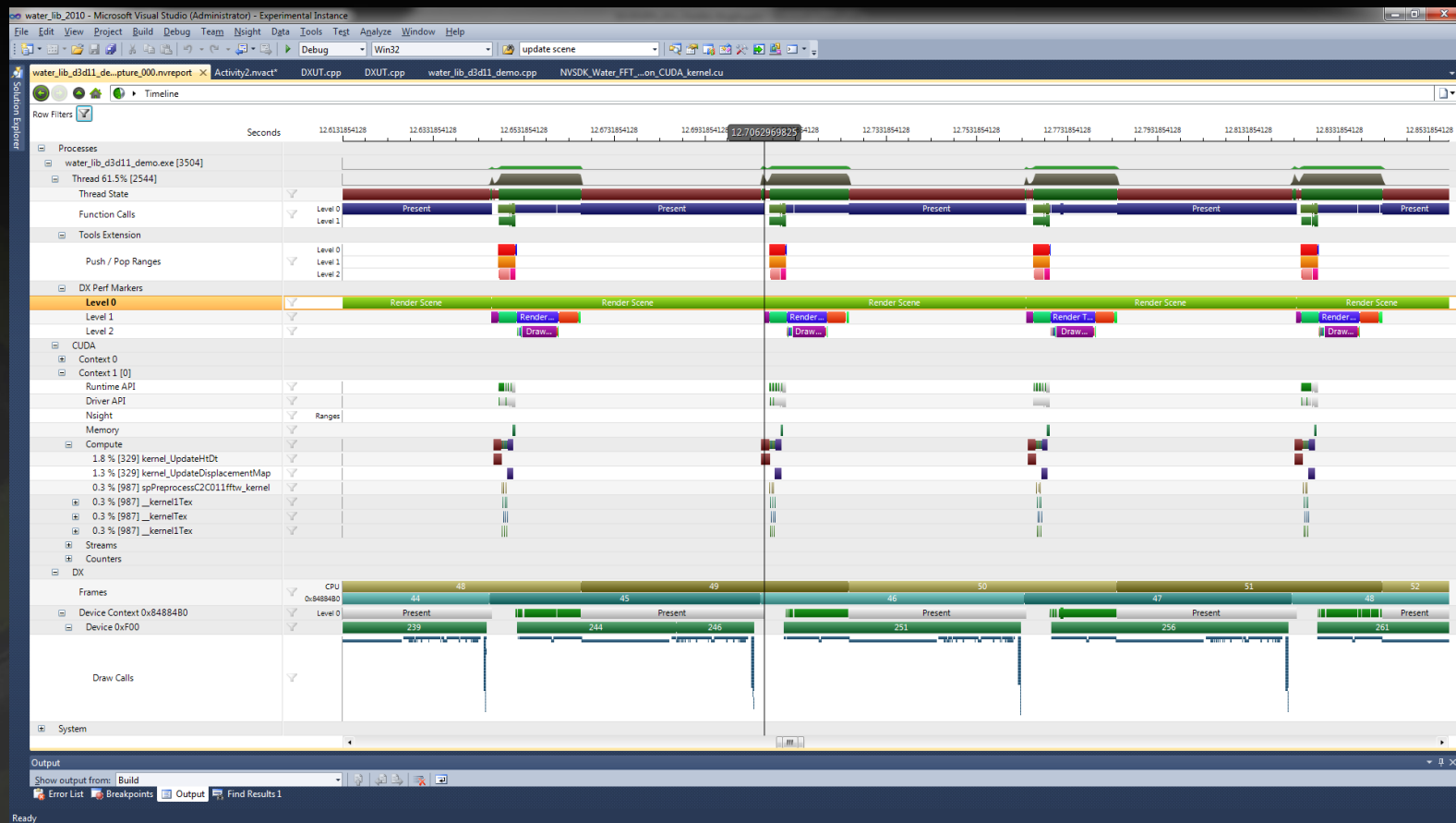
Code Definition Window Output Command Window Find Results 1 Find Results 2 Find Symbol Results Breakpoints Error List

Ready

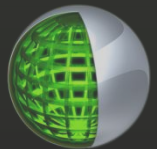




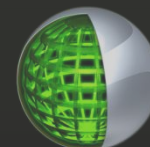
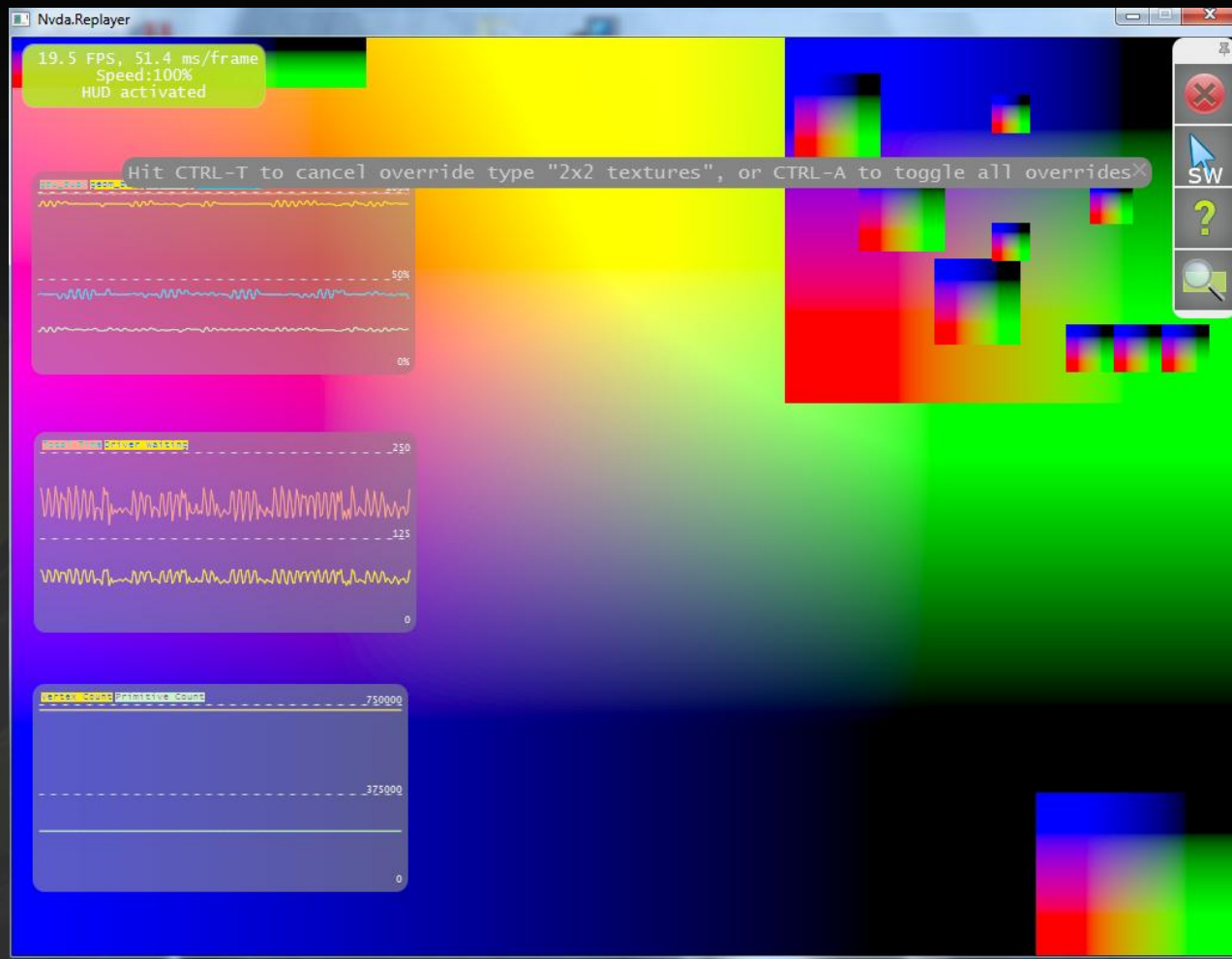
# Demo: Analysis



# Demo: Graphics Debugging - HUD

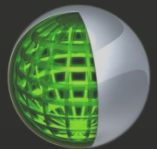
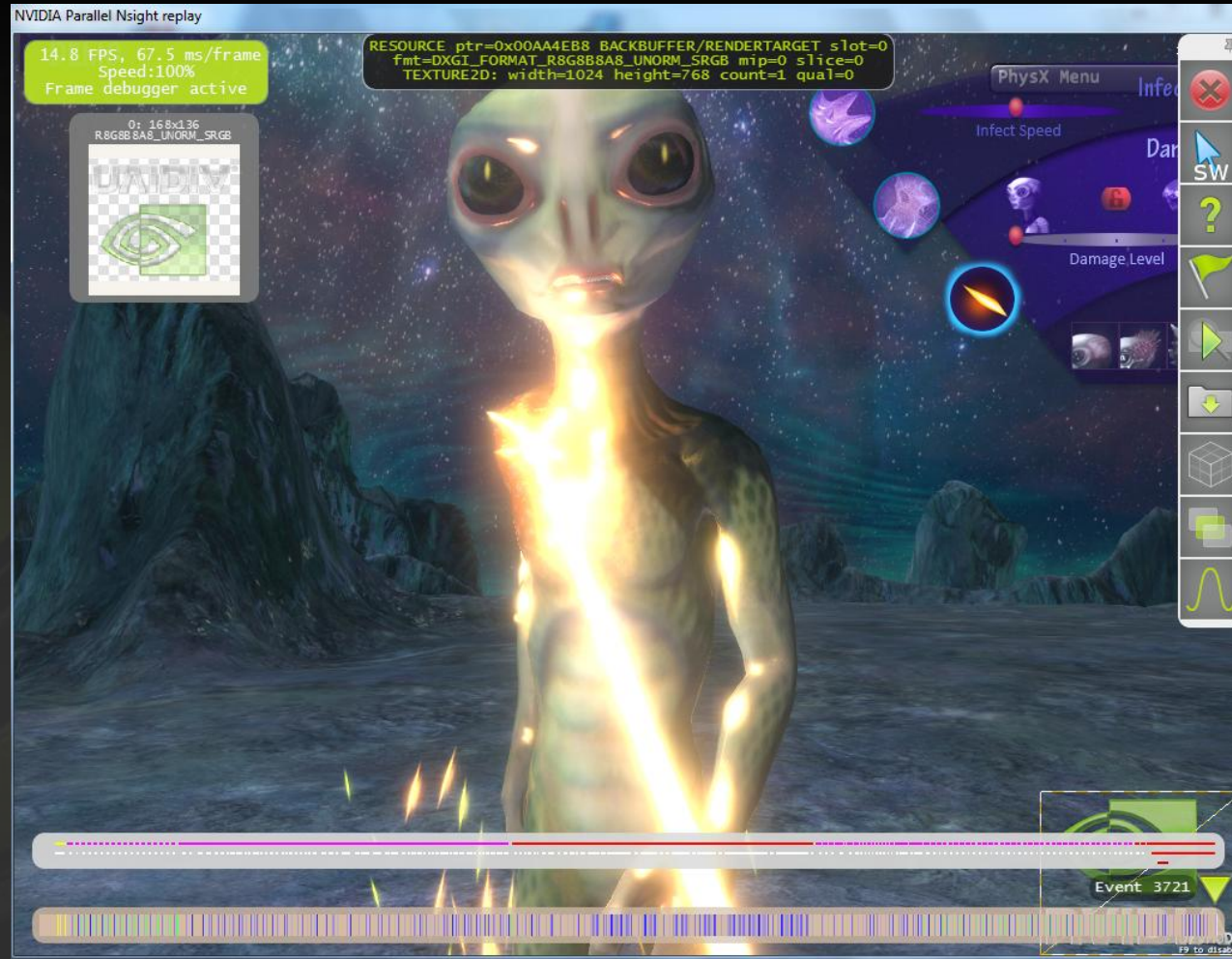


# Demo: HUD Showing 2x2 Texture

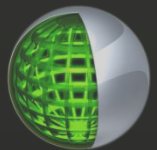
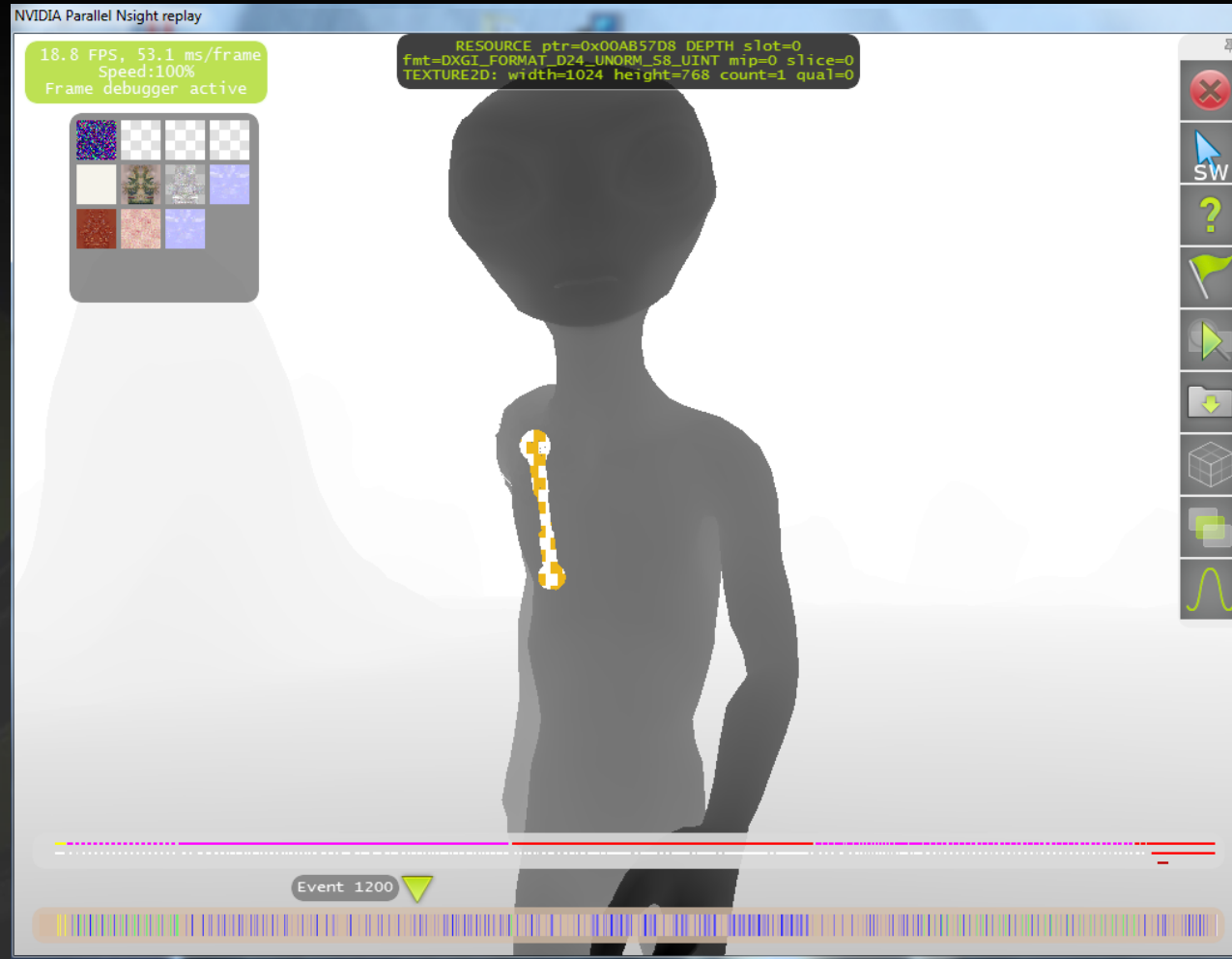




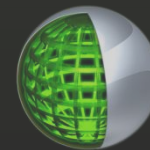
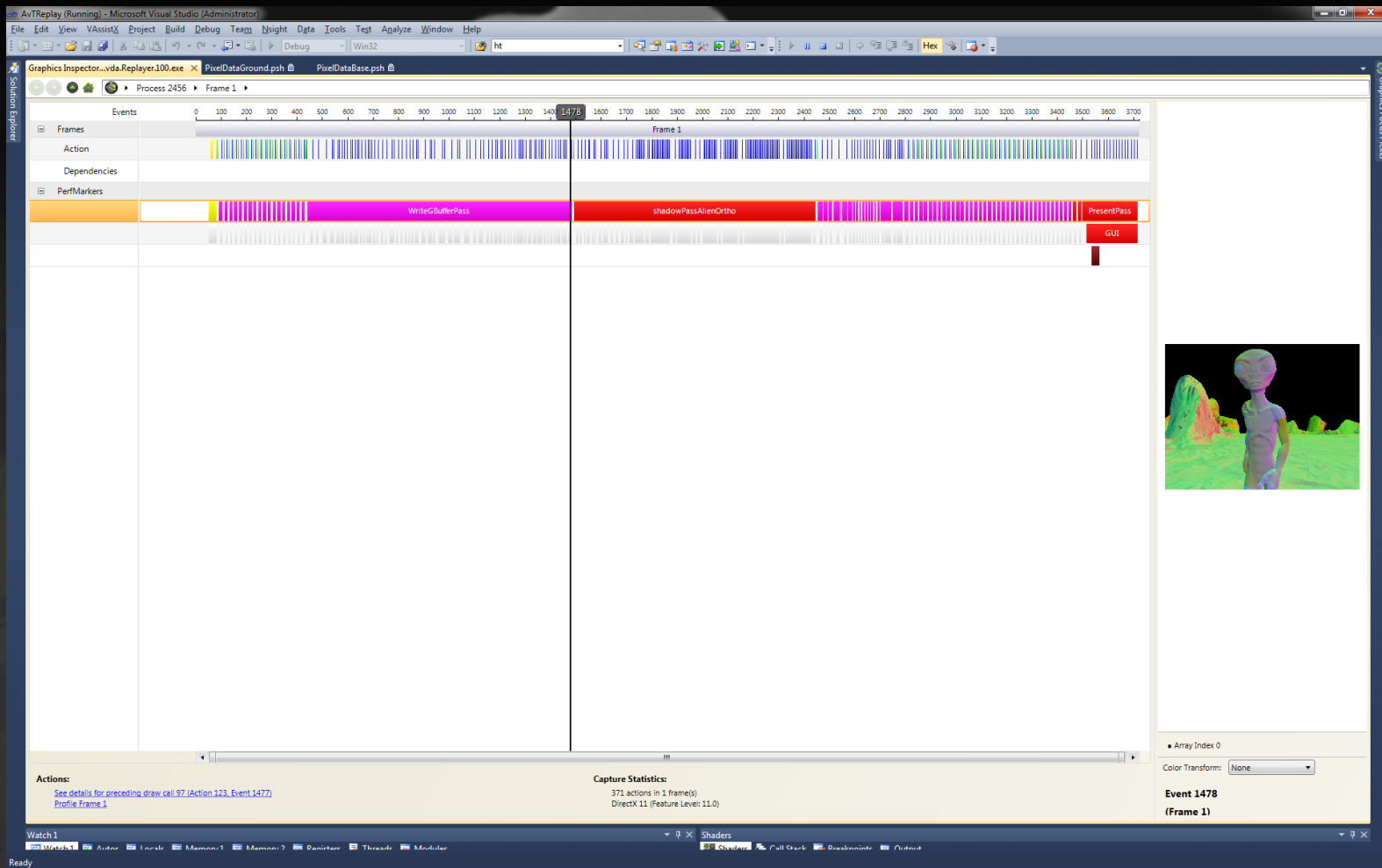
# Demo: HUD in Graphics Inspector



# Demo: HUD Render Target, Depth & Stencil



# Demo: Host Frames Page



# Demo: Draw Call Page



AviReplay (Running) - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Insight Data Tools Test Analyze Window Help

Graphics Inspector - vda.Replayer.100.exe PixelDataGround.psh PixelDataBase.psh

Process 2456 Frame 1 Event 1477 / Action 123

**Call Description**  
void ID3D11DeviceContext::DrawIndexed(UINT IndexCount = 0x00000240, UINT StartIndexLocation = 0x00000000, INT BaseVertexLocation = 0x00000000)

**Shader Resources (14 textures)**

Texture	Format	Dimensions
V51	R16G16B16A16_FLOAT	128 x 128
V52	R16G16B16A16_FLOAT	128 x 128
V53	R16G16B16A16_FLOAT	128 x 128
P50	BCT_UNORM_SRGB	512 x 512
P51	R16G16B16A16_FLOAT	128 x 128
P52	R16G16B16A16_FLOAT	128 x 128
P53	R16G16B16A16_FLOAT	128 x 128
P54	R16G16B16A16_FLOAT	512 x 512

**Render Targets**

RenderTarget	Format	Dimensions
RT0	R16G16B16A16_FLOAT	1024 x 768
RT1	R16G16B16A16_FLOAT	1024 x 768
RT2	R16G16B16A16_FLOAT	1024 x 768
RT3	R16G16B16A16_FLOAT	1024 x 768
DS	D24_UNORM_S8_UINT	1024 x 768

**Pipeline State**

IA → VS → HS → DS → GS → SO → RS → PS → OM → CS

**Input Summary**

Input Elements: [Semantic = INPUT, Format = R32\_SINT] [Semantic = POSITION, Format = R32G32B32\_FLOAT] [Semantic = INPUT, Format = R32G32B32\_FLOAT] [Semantic = INPUT, Format = R32G32B32\_FLOAT]

Vertex Buffers: [1776 bytes, Offset = 0, Stride = 4] [5328 bytes, Offset = 0, Stride = 12] [5328 bytes, Offset = 0, Stride = 12] [5328 bytes, Offset = 0, Stride = 12] [5328 bytes, Offset = 0, Stride = 12]

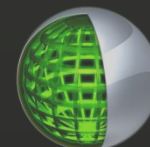
Index Buffers: [1152 bytes, Format = R16\_UINT, Offset = 0]

Topology: TriangleList

**Watch 1**

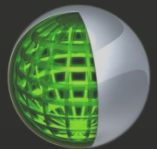
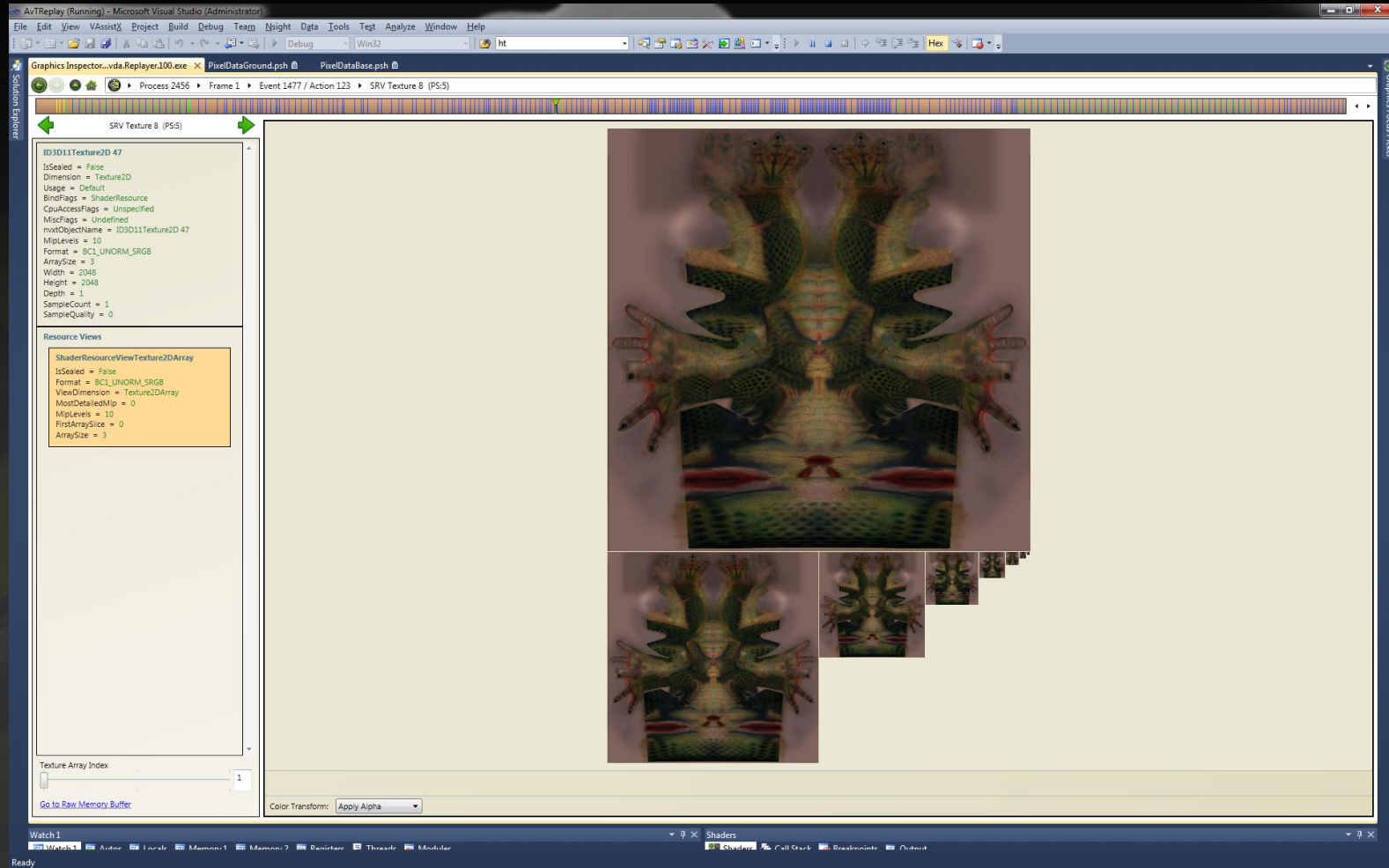
Shaders: [Shader Name]

Ready





# Demo: Texture Viewer



# Demo: Pixel Shader State Inspector



AviReplay (Running) - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Night Data Tools Test Analyze Window Help

Graphics Inspector - vdaReplayer.100.exe | PixelDataGround.psh | PixelDataBase.psh

Process 2456 | Frame 1 | Event 1477 / Action 123 | Pixel Shader

Pixel Shader

Call: void ID3D11DeviceContext::DrawIndexed(UINT IndexCount = 0x00000240, UINT StartIndexLocation = 0x00000000, INT BaseVertexLocation = 0x00000000)

Function: main | Profiler: Flags1: 0x0 | Flags2: 0x0

Instance and Bind Information

Constant Buffers

Usage	BindFlags	CpuAccessFlags	MiscFlags	ByteWidth	StructureByteStride	ObjectName
0 Dynamic ConstantBuffer Write	Undefined	352	0	0	ID3D11Buffer 1142	
1 Dynamic ConstantBuffer Write	Undefined	96	0	0	ID3D11Buffer 1404	
2 Dynamic ConstantBuffer Write	Undefined	16	0	0	ID3D11Buffer 1405	
3 Dynamic ConstantBuffer Write	Undefined	16	0	0	ID3D11Buffer 1288	

Shader Resource Views

View Dimension	Format	Dimension	Usage	Bind	CPU	Misc	Width	Height	ObjectName
0 Texture2D	BC1_UNORM_SRGB	Texture2D	Immutable ShaderResource	Undefined	Undefined	512	512	ID3D11Texture2D 45	
1 Texture2D	R16G16B16A16_FLOAT	Texture2D	Default ShaderResource, RenderTarget	Undefined	128	128	ID3D11Texture2D 33		
2 Texture2D	R16G16B16A16_FLOAT	Texture2D	Default ShaderResource, RenderTarget	Undefined	128	128	ID3D11Texture2D 24		
3 Texture2D	R16G16B16A16_FLOAT	Texture2D	Default ShaderResource, RenderTarget	Undefined	128	128	ID3D11Texture2D 21		
4 Texture3D	R8G8B8A8_UNORM	Texture3D	Immutable ShaderResource	Undefined	Undefined	512	512	ID3D11Texture3D 2	
5 Texture2DArray	BC1_UNORM_SRGB	Texture2D	Default ShaderResource	Undefined	Undefined	2048	2048	ID3D11Texture2D 47	
6 Texture2DArray	BC1_UNORM_SRGB	Texture2D	Default ShaderResource	Undefined	Undefined	2048	2048	ID3D11Texture2D 54	
7 Texture2DArray	R8G8B8A8_UNORM	Texture2D	Default ShaderResource	Undefined	Undefined	2048	2048	ID3D11Texture2D 53	
8 Texture2DArray	BC1_UNORM_SRGB	Texture2D	Default ShaderResource	Undefined	Undefined	2048	2048	ID3D11Texture2D 48	
9 Texture2DArray	BC1_UNORM_SRGB	Texture2D	Default ShaderResource	Undefined	Undefined	2048	2048	ID3D11Texture2D 51	
10 Texture2DArray	R8G8B8A8_UNORM	Texture2D	Default ShaderResource	Undefined	Undefined	2048	2048	ID3D11Texture2D 50	

Samplers

Filter	AddressU	AddressV	AddressW	MipLODBias	MaxAnisotropy	ComparisonFunc	MinLOD	MaxLOD	BorderColor
0 MinMagMipLinear Wrap	Wrap	Wrap	Wrap	0	0	Never	0	999	(1,1,1)
1 MinMagMipLinear Wrap	Wrap	Wrap	Wrap	0	0	Never	0	999	(1,1,1)
2 MinMagMipLinear Wrap	Clamp	Clamp	Clamp	0	0	Never	0	999	(1,1,1)
3 MinMagMipLinear Clamp	Wrap	Clamp	0	0	0	Never	0	999	(1,1,1)

Class and Type Information

Input Parameters

SemanticName	SemanticIndex	Register	SystemValueType	ComponentType	Mask	RWMask	Stream
0 SV_Position	0	0	Position	Float32	0x0F	0x00	0
1 TEXCOORD	0	1	Undefined	Float32	0x0F	0x0F	0
2 TEXCOORD	1	2	Undefined	Float32	0x07	0x07	0
3 TEXCOORD	2	3	Undefined	Float32	0x07	0x00	0
4 TEXCOORD	3	4	Undefined	Float32	0x07	0x00	0
5 TEXCOORD	4	5	Undefined	Float32	0x0F	0x03	0

Output Parameters

SemanticName	SemanticIndex	Register	SystemValueType	ComponentType	Mask	RWMask	Stream
0 SV_Target	0	0	Target	Float32	0x0F	0x00	0
1 SV_Target	1	1	Target	Float32	0x0F	0x00	0
2 SV_Target	2	2	Target	Float32	0x0F	0x00	0
3 SV_Target	3	3	Target	Float32	0x0F	0x00	0
4 SV_Depth	0	4294967295	Depth	Float32	0x01	0x0E	0

Resource Binding Slots

Name	Type	BindPoint	BindCount	uFlags	ReturnType	Dimension	NumSamples
0 s_TriLinearRepeat Sampler	0	1	0x0	None	Unknown	0	
1 specNoiseTex	Texture	1	0xC	Float	Texture2D	-1	

Constant Buffer Slots

Watch 1

Shaders

Ready

# Demo: Buffer Inspector



AviReplay (Running) - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Insight Data Tools Test Analyze Window Help

Debug Win32 Hex

Graphics Inspector...vda.Replayer.100.exe PixelDataGround.psh PixelDataBase.psh

Process 2456 Frame 1 Event 3474 / Action 353 Buffer 3

NvidiaPlatform.Windows.DirectX.DxBuffer

Offset: 0

☒ Hexadecimal Address

Number of Columns: 4

☐ One-Byte Integer

☐ Two-Byte Integer

☐ Four-Byte Integer

☐ Eight-Byte Integer

☒ 16-Bit Float

☐ 32-Bit Float

☐ 64-Bit Float

☒ Default

☐ Scientific with Maximum Significant Figures

☐ Scientific with Two Significant Figures

☐ Decimal with Two Significant Figures

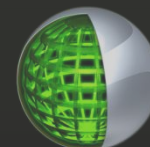
[Go to Resource View](#)

Address	Data
00000000	0.0496521 0.04119873 0.05789185 4
00000008	0.05959814 0.04150391 0.0581668 4
00000010	0.05197144 0.04260354 0.05899048 4
00000018	0.05230713 0.04379272 0.05975342 4
00000020	0.05133057 0.04446411 0.06015015 4
00000028	0.05026245 0.04467773 0.06036377 4
00000030	0.05685425 0.05044556 0.06726074 4
00000038	0.0635376 0.05612183 0.0737915 4
00000040	0.06555693 0.05844116 0.07611084 4
00000048	0.06384277 0.05703735 0.07409668 4
00000050	0.05343628 0.04855347 0.06420598 4
00000058	0.04806519 0.04397583 0.05908203 4
00000060	0.04776001 0.04385376 0.05822754 4
00000068	0.04953003 0.04547119 0.05908203 4
00000070	0.05136108 0.04693604 0.0604248 4
00000078	0.05221558 0.04760742 0.06164551 4
00000080	0.05102539 0.04681396 0.06134033 4
00000088	0.04907227 0.04632568 0.06054688 4
00000090	0.0475769 0.04696655 0.05996704 4
00000098	0.04705811 0.04624829 0.05993652 4
000000A0	0.04879761 0.05105593 0.06246942 4
000000A8	0.05084229 0.05401611 0.06555176 4
000000B0	0.05136108 0.0553894 0.06738281 4
000000B8	0.05056763 0.0557251 0.06866455 4
000000C0	0.04666138 0.05361938 0.06744385 4
000000C8	0.04223633 0.05065918 0.06549072 4
000000D0	0.04092407 0.05010986 0.06567383 4
000000D8	0.04101563 0.05117798 0.06665039 4
000000E0	0.0435791 0.05505371 0.07055664 4
000000E8	0.04678345 0.06002808 0.07617188 4
000000F0	0.05029297 0.0657959 0.08270264 4
000000F8	0.05062866 0.06860352 0.08691406 4
00000100	0.0524292 0.07232666 0.09326172 4
00000108	0.06008911 0.08032227 0.1039429 4
00000110	0.06390381 0.08270264 0.1081543 4
00000118	0.06852832 0.08288574 0.1088297 4
00000120	0.06408691 0.07775879 0.1021118 4
00000128	0.05941772 0.07147217 0.09429932 4
00000130	0.06427002 0.07531738 0.09863281 4
00000138	0.06646729 0.07745361 0.1019287 4
00000140	0.06274414 0.07470703 0.1002808 4
00000148	0.05383301 0.06750488 0.09362793 4
00000150	0.04812622 0.06335449 0.09008789 4
00000158	0.04898071 0.06561279 0.09283447 4
00000160	0.04782104 0.06604004 0.09344482 4
00000168	0.04299927 0.06335449 0.090271 4
00000170	0.03704834 0.05987549 0.08508301 4
00000178	0.03753662 0.06323242 0.08758545 4
00000180	0.03912354 0.06744385 0.09094238 4
00000188	0.04049683 0.07073975 0.09375 4
00000190	0.04223633 0.07385254 0.097229 4

Watch1

Shaders

Ready



# Demo: Output Merger Inspector



AviReplay (Running) - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Insight Data Tools Test Analyze Window Help

Graphics Inspector - vda.Replayer.100.exe | PixelDataGround.psh | PixelDataBase.psh

Process 2456 | Frame 1 | Event 1464 / Action 122 | Output Merger

IA  
VS  
HS  
DS  
GS  
SO  
RS  
PS  
OM  
CS

Depth Stencil State

DepthEnable	StencilEnable	DepthWriteMask	StencilReadMask	All	Default	DepthFunc	StencilWriteMask	Less	Default
True	False	DepthWriteMask	StencilReadMask	Keep	StencilPassOp	Keep	StencilFunc	Always	Always
Front:	StencilFailOp	Keep	StencilDepthFailOp	Keep	StencilPassOp	Keep	StencilFunc	Always	Always
Back:	StencilFailOp	Keep	StencilDepthFailOp	Keep	StencilPassOp	Keep	StencilFunc	Always	Always

Depth Stencil View

View	Dimension	Format	Flags	Dimension	Usage	Bind	CPU	Misc	Width	Height	ObjectName
Texture2D	D24_UNORM_S8_UINT	Undefined	Texture2D	Default	ShaderResource, DepthStencil	Undefined	Undefined	1024	768	ID3D11Texture2D 37	

Render Target Views

View	Dimension	Format	Dimension	Usage	Bind	CPU	Misc	Width	Height	ObjectName
0	Texture2DArray	R16G16B16A16_FLOAT	Texture2D	Default	ShaderResource, RenderTarget	Undefined	Undefined	1024	768	ID3D11Texture2D 38
1	Texture2DArray	R16G16B16A16_FLOAT	Texture2D	Default	ShaderResource, RenderTarget	Undefined	Undefined	1024	768	ID3D11Texture2D 38
2	Texture2DArray	R16G16B16A16_FLOAT	Texture2D	Default	ShaderResource, RenderTarget	Undefined	Undefined	1024	768	ID3D11Texture2D 38
3	Texture2DArray	R16G16B16A16_FLOAT	Texture2D	Default	ShaderResource, RenderTarget	Undefined	Undefined	1024	768	ID3D11Texture2D 38

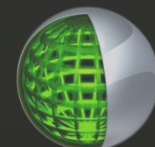
Blend States

BlendFactor	(0,0,0)	BlendSampleMask	0xFFFFFFFF	RenderTargetWriteMask				
BlendEnable	SrcBlend	DestBlend	BlendOp	SrcBlendAlpha	DestBlendAlpha	BlendOpAlpha	RenderTargetWriteMask	
0	False	One	Zero	Add	One	Zero	Add	0x0F
1	False	One	Zero	Add	One	Zero	Add	0x0F
2	False	One	Zero	Add	One	Zero	Add	0x0F
3	False	One	Zero	Add	One	Zero	Add	0x0F
4	False	One	Zero	Add	One	Zero	Add	0x0F
5	False	One	Zero	Add	One	Zero	Add	0x0F
6	False	One	Zero	Add	One	Zero	Add	0x0F
7	False	One	Zero	Add	One	Zero	Add	0x0F

Watch 1

Shaders

Ready





# Demo: Pixel History



AviReplay (Running) - Microsoft Visual Studio (Administrator)

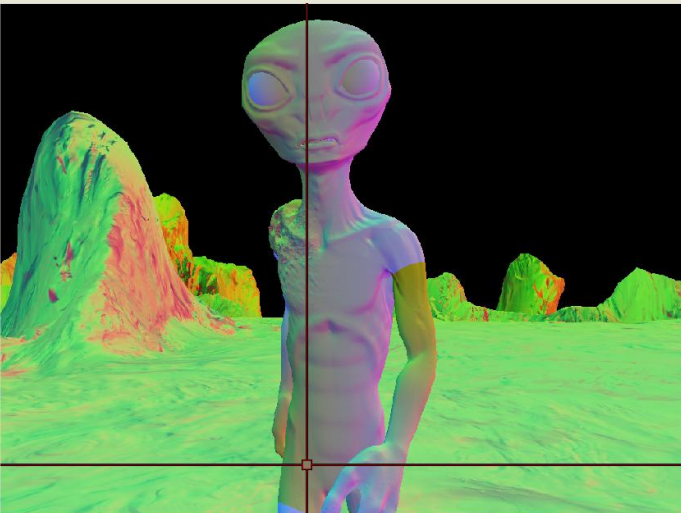
File Edit View VAssist Project Build Debug Team Insight Data Tools Test Analyze Window Help

Debug Win32 PM\_TRIGGER Hex

Solution Explorer PixelDataBase - Copy.psh Graphics Inspector - vda.Replayer.100.exe

Process 4980 Frame 1 Pixel History

Event	RT Before	Source	RT After	Z
void ID3D11DeviceContext... Event 434	R: 0.50 G: 0.50 B: 0.39 A: 0.16	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: 0.00 G: 0.00 B: 0.00 A: 0.00	
void ID3D11DeviceContext... Event 435	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: 0.00 G: 0.00 B: 0.00 A: 0.00	
void ID3D11DeviceContext... Event 436	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: 0.00 G: 0.00 B: 0.00 A: 0.00	
void ID3D11DeviceContext... Event 437	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: 0.00 G: 0.00 B: 0.00 A: 0.00	
void ID3D11DeviceContext... Event 463 <a href="#">Event in 463 / Action 45</a> <a href="#">Debug Pixel</a>	R: 0.00 G: 0.00 B: 0.00 A: 0.00	R: NaN G: NaN B: NaN A: 0.00	R: NaN G: NaN B: NaN A: 0.00	0.9593789
void ID3D11DeviceContext... Event 517 <a href="#">Event in 517 / Action 47</a> <a href="#">Debug Pixel</a>	R: NaN G: NaN B: 0.00 A: 0.00	R: 0.47 G: 0.84 B: 0.47 A: 0.56	R: 0.47 G: 0.84 B: 0.47 A: 0.56	0.987061
void ID3D11DeviceContext... Event 1106 <a href="#">Event in 1106 / Action 89</a> <a href="#">Debug Pixel</a>	R: 0.47 G: 0.84 B: 0.47 A: 0.56	R: 0.45 G: 0.51 B: 0.39 A: 0.16	R: 0.49 G: 0.51 B: 0.39 A: 0.16	0.9705726
void ID3D11DeviceContext... Event 1156 <a href="#">Event in 1156 / Action 92</a> <a href="#">Debug Pixel</a>	R: 0.49 G: 0.51 B: 0.39 A: 0.16	R: 0.64 G: 0.68 B: 0.39 A: 0.16	R: 0.49 G: 0.51 B: 0.39 A: 0.16	0.9712064
void ID3D11DeviceContext... Event 1156 <a href="#">Event in 1156 / Action 92</a> <a href="#">Debug Pixel</a>	R: 0.49 G: 0.51 B: 0.39 A: 0.16	R: 0.39 G: 0.40 B: 0.50 A: 0.64	R: 0.49 G: 0.51 B: 0.39 A: 0.16	0.9722031



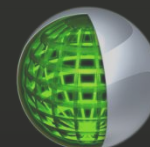
(459, 690) - R: 0.499512, G: 0.500000, B: 0.389404, A: 1.000000 Zoom: 0.81

Color Transform: None

Pixel History: [Pick Pixel](#)

Watch 1 Breakpoints

Ready



# Demo: Shader Debugger Breakpoint



AviReplay (Debugging) - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Night Data Tools Test Analyze Window Help

Debug Win32 PM\_TRIGGER

Solution Explorer

PixelDataBase - Copy.psh Graphics Inspector...vda.Replayer.100.exe

(Unknown Scope)

```
#endif // DO_TRANSFORMATION

Texture2D specNoiseTex; // spec:noise

// Take 0-1 into the -1 to 1 space:
float4 ToTanNormal(float4 sample){
    return float4((2.0f * sample.xyz) - 1.0f, sample.w);
}

// Write texture coordinate and object ID.
struct MainOut {
    GBufferPixelPacked pp;
#ifdef DO_Z_OFFSET
    float depth: SV_Depth;
#endif // DO_Z_OFFSET
};

MainOut main ( g2fConnector g2f ){
    float3 one = float3( 1.0f, 1.0f, 1.0f ); // handy to have around
    float3 half = float3( 0.5f, 0.5f, 0.5f ); // handy to have around

    // normalize vector quantities
    float3 N = normalize(g2f.worldNormal);
    float3 T = normalize(g2f.worldTangent);
    float3 B = normalize(g2f.worldBinormal);

    // computed differently in cases below:
    float4 diffColor; // rgb
    float4 specColor; // rgb, specPower
    float4 tmpA, tmpB, tmpC, tmpD;
    float ao = 1;

#ifdef COL_UV
    float2 colUV = g2f.COL_UV.xy;
#ifdef DO_TEX_REPEAT
    colUV *= texRepeat;
#endif // DO_TEX_REPEAT
#endif // COL_UV

    // Get transition amount:
#ifdef DO_TRANSFORMATION

    // values to be used throughout the shader:

```

100 %

Watch1

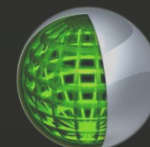
Name	Value	Type
g2f.worldNormal	{x = -0.040709335, y = 0.012600903, z = 0.96985996}	float3
g2f.worldTangent	{x = 0.97537094, y = 0.071425527, z = 0.022366347}	float3
x	0.97537094	float
y	0.071425527	float
z	0.022366347	float

Call Stack

Name	Lang
Shader: PixelDataBase - Copy.psh - [0] main	Hls

Shaders Call Stack Breakpoints Output

Ready



# Demo: Focus Picker



AviReplay (Debugging) - Microsoft Visual Studio (Administrator)

File Edit View VAssist Project Build Debug Team Night Data Tools Test Analyze Window Help

PixelDataGround.psh PixelDataBase.psh PM\_TRIGGER

Graphics Focus Picker

Summary  
Show the summary of the current status

Vertices (3D View)  
Show the paused vertices in a 3D view

Vertices (Table View)  
Show the paused vertices in a table view

Geometry (Table View)  
Show the paused geometry shader threads

Pixels  
Show the paused pixels on the current render target

Compute  
Show the paused compute threads

Pixels  
RT0 - 1024x768 - (R16G16B16A16\_FLOAT)  
12 Paused Pixels  
1024x768

0,0

Set Pixel Rectangle

```
#ifndef DO_TRANSFORMATION
// ...
#endif // DO_TRANSFORMATION

Texture2D specNoiseTex; // spec noise

// Take 0-1 into the -1 to 1 space:
float4 ToTanNormal(float4 sample){
    return float4((2.0f * sample.xyz) - 1.0f, sample.w);
}

// Write texture coordinate and object ID.
struct MainOut{
    GBufferPixelPacked pp;
    #ifdef DO_Z_OFFSET
    float depth : SV_Depth;
    #endif // DO_Z_OFFSET
};

MainOut main ( g2fConnector g2f ){
    float3 one = float3(1.0f, 1.0f, 1.0f); // handy to have around
    float3 half = float3(0.5f, 0.5f, 0.5f); // handy to have around

    // normalize vector quantities
    float3 N = normalize(g2f.worldNormal);
    float3 T = normalize(g2f.worldTangent);
    float3 B = normalize(g2f.worldBinormal);

    // computed differently in cases below:
    float4 diffColor; // rgb
    float4 specColor; // rgb, specPower
    float4 tmpA, tmpB, tmpC, tmpD;
    float ao = 1;

    #ifdef COL_UV
    float2 colUV = g2f.col_UV.xy;
    #endif DO_TEX_REPEAT
    colUV *= texRepeat;
    #endif // DO_TEX_REPEAT
    #endif // COL_UV

    // Get transition amount:
    #ifdef DO_TRANSFORMATION
    // values to be used throughout the shader:
    float dngLevel;
    float3 charInterpolants;
    float4 dngInterpolants;
    float4 charValue, dngValue;
    #endif DO_TRANSITION
    // ...
}
```

Watch 1

Name	Value	Type
g2f.worldNormal	(x = -0.6348809, y = 0.65980589, z = 0.40197319)	float3
g2f.worldTangent	(x = ???, y = ???, z = ???)	float3

Shaders

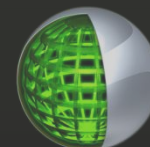
Name	Shader Type	Symbolics Status	Language	Technique	Pass
0 main	Pixel	Ready.	HLSL	No Technique	No Pass
1 main	Pixel	Ready.	HLSL	No Technique	No Pass
2 main	Pixel	Ready.	HLSL	No Technique	No Pass
3 main	Pixel	Ready.	HLSL	No Technique	No Pass
4 main	Pixel	Ready.	HLSL	No Technique	No Pass
5 main	Pixel	Ready.	HLSL	No Technique	No Pass
6 main	Pixel	Ready.	HLSL	No Technique	No Pass
7 main	Pixel	Ready.	HLSL	No Technique	No Pass

Watch 1 Autos Locals Memory 1 Memory 2 Registers Threads Modules

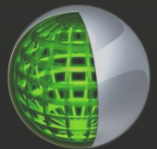
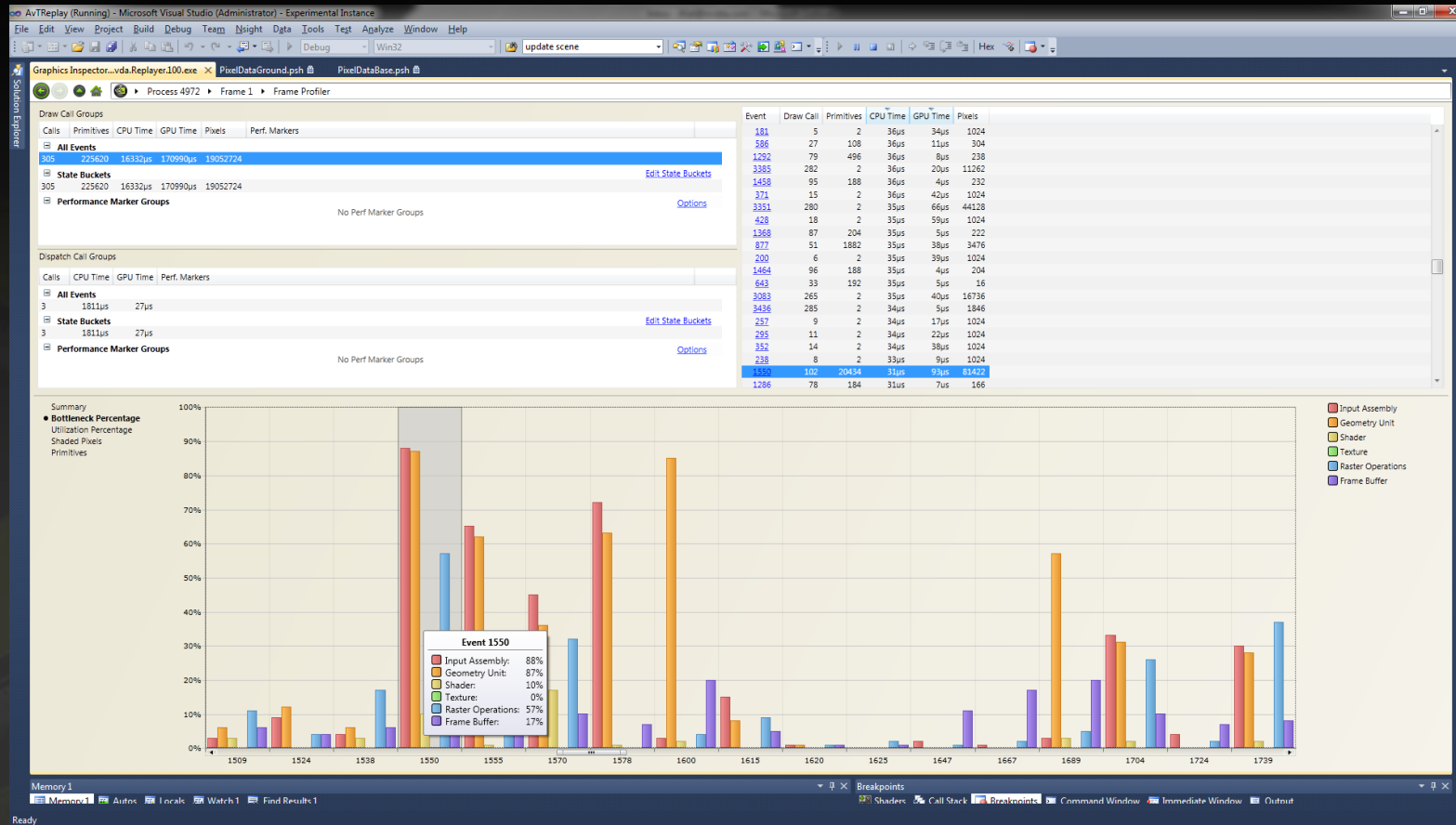
Shaders Call Stack Breakpoints Output

Ready

Ln 114 Col 1 Ch 1 DNS



# Demo: Frame Profiler



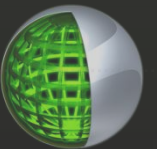


# NVIDIA Parallel Nsight: Graphics Features



**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

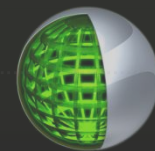
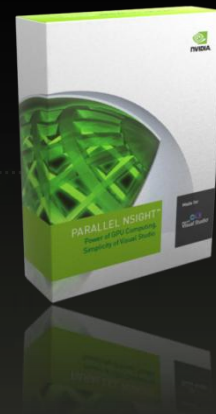


# NVIDIA Parallel Nsight: Compute Features



**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>

