

# PhysX and APEX Overview

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## What is PhysX?

*PhysX is a scalable multi-platform game physics solution supporting a wide range of devices, from iPhone to high-end multicore CPUs.*

## What kind of technology is PhysX?

*An SDK. Libraries, solvers, debugger, profiler.*

PhysX is an SDK for game developers that provides:

- Discrete and continuous collision detection.
- Rigid body, fluid, particle and cloth solvers.
- Raycasting and shape sweeps.
- Vehicle and character controllers.
- PhysX Visual Debugger / profiler.
- DCC tool plugins.
- Samples...and support.

## Does PhysX only run on GPUs?

*No!*

- PhysX runs on PS3, Xbox 360, Wii, Win32/64, Mac... plus iPhone and Android devices.
  - GPU-accelerated PhysX is found *only* on Win32/64.
  - PhysX pipeline uses CPU even when GPU acceleration is enabled.
- All features that run on GPU are also available on PC-CPU and console implementations.

# Debugging & Profiling



- **Unified debugging and profiling tool – PVD**
  - All-in-one tool to develop PhysX applications
  - Also for major platforms



## What else is new and better about PhysX-3?

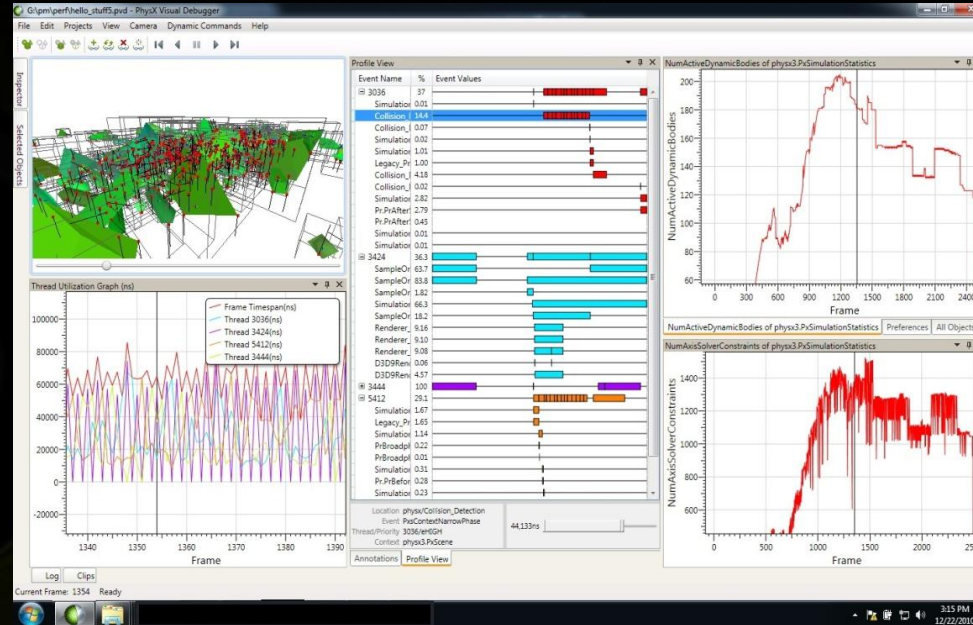
*It is a unified cross-platform solution:*

Windows, PS3, Xbox 360,

OSX, Linux, Android and iOS from ONE codebase.

# What else is new and better about PhysX-3?

*Event Profiling for all platforms within PhysX Visual Debugger.*



# What else is new and better about PhysX-3?

*Support for large levels & streaming:*

- Broadphase clustering
- Binary In-place serialization
- Out-of-scene actor creation

## What's the bottom line about PhysX?

PhysX helps developers to make better games.

- PhysX is a complete physics solution.
- PhysX is a core component for game-play *and* effects.
- PhysX is highly competitive on all major platforms: consoles, mobile devices...and PCs, with or without GPU acceleration.

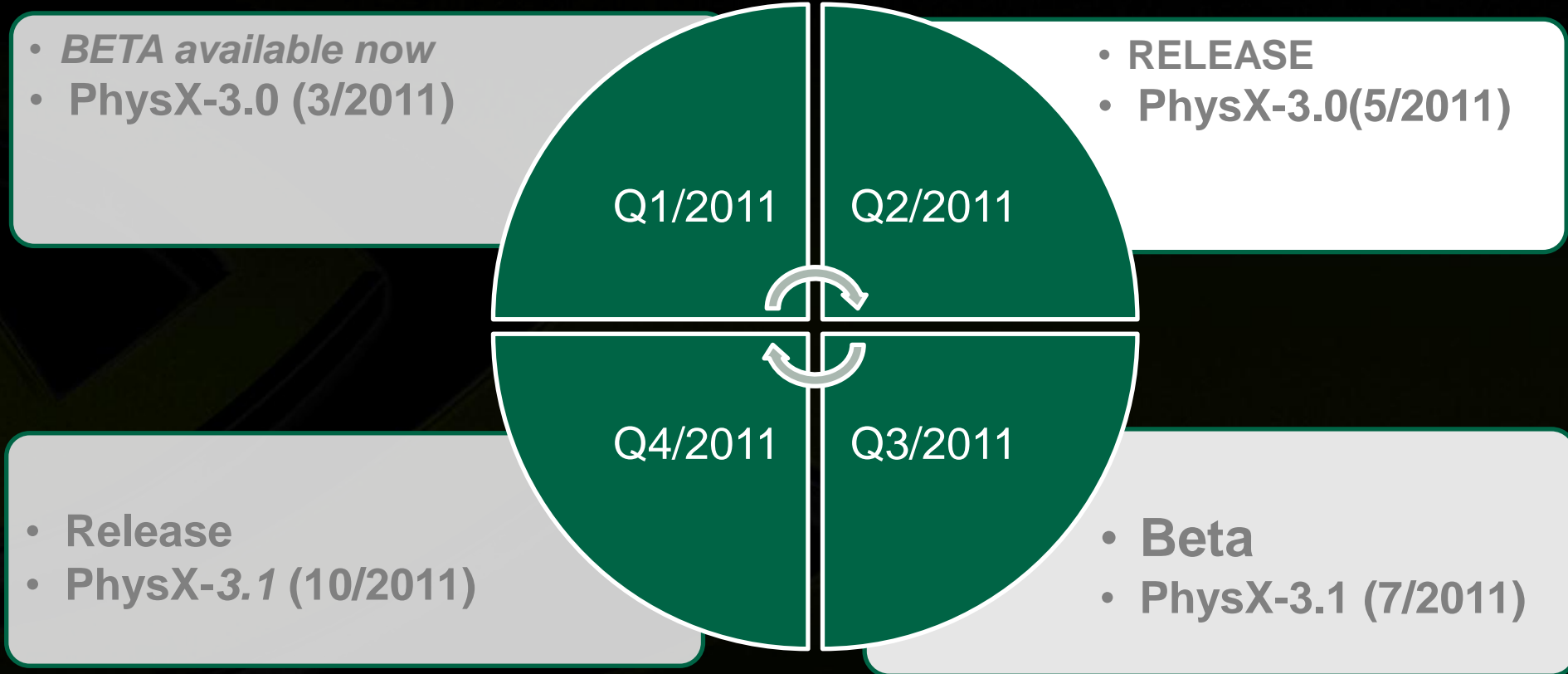
## PhysX SDK 2.8.4 Status

- PhysX-2 is being replaced by PhysX-3.
- PhysX SDK 2.8.4 is the last of the 2.x series.
- There will be no major new features introduced on PhysX-2.8.4.
- We will continue to support 2.8.4 for all customers still using it.
  - Bug fixing.
  - Performance improvements where practical.
- Nearly all customers will move to PhysX-3 within 2 years.

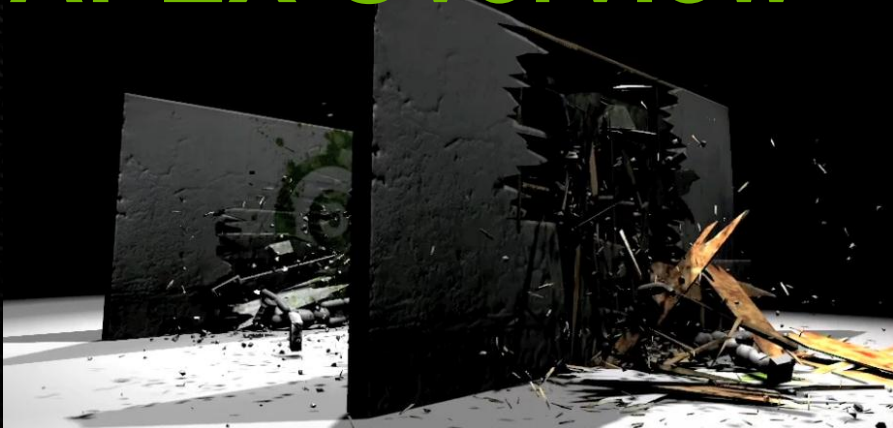
# PhysX-3 Status and Roadmap

- PhysX-3 is in beta now. Binary packages and source licensing are available.
- New features and major optimizations will appear in *minor revisions* (3.0, 3.1, 3.2)
- PhysX-3 will adhere to a 6-month release schedule for minor revisions:
  - PhysX-3.0 is **now** in beta in Q1/2011, will be released in Q2/2011.
  - PhysX-3.1 will be in beta in Q3/2011, will be released in Q4/2011.
  - PhysX-3.2 will be in beta in Q1/2012, will be released in Q2/2012.
  - PhysX-3.3 will be in beta in Q3/2012, will be released in Q4/2012.
  - Etc.
- Patch releases (bug fixes, e.g. 3.0.1, 3.0.2, etc.) will appear as needed.
  - Probably 3x per quarter for recent releases (once per month).
  - For mature releases, expect 1x per quarter.

# PhysX-3 SDK: Annual Development Cycle



# APEX Overview



# APEX in Games



**MAFIA II**

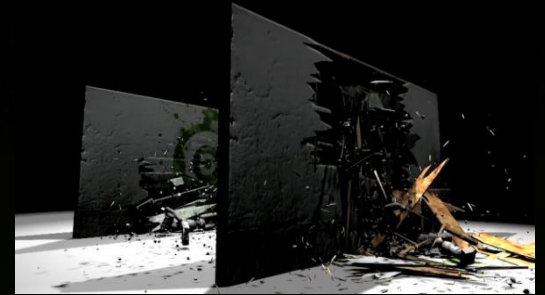


*and more games in development ...*

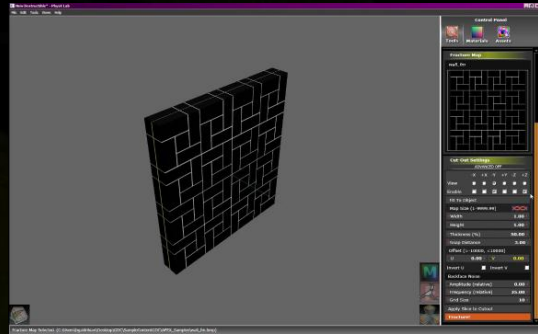
# What is APEX ?



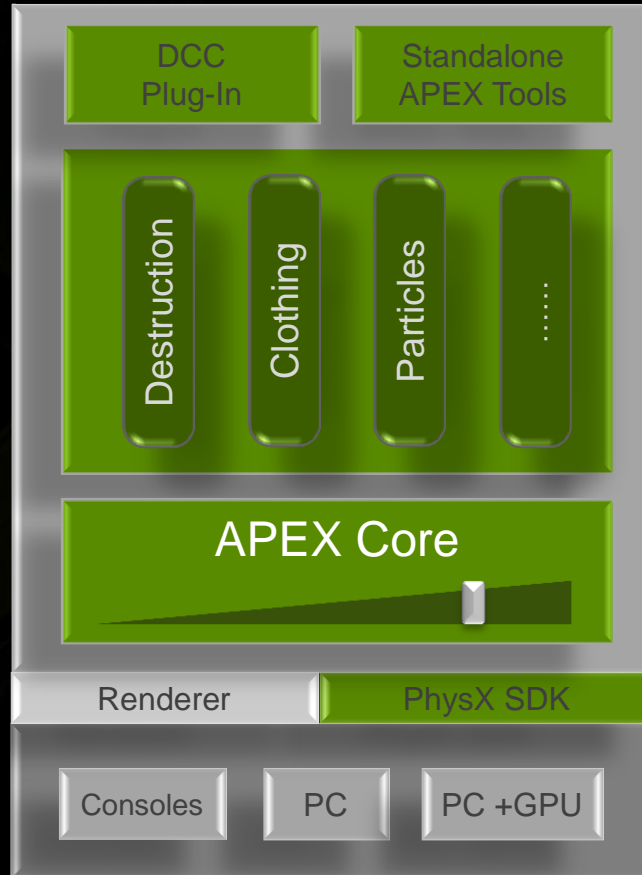
- **APEX is a “Scalable Dynamics Framework”**
  - *Scalable*: Content adapts to different hardware capabilities
  - *Dynamics*: The way things move and interact
  - *Framework*: A structured environment
- **APEX consists of two major components:**
  - **Authoring:**
    - High-level authoring of dynamic systems
    - DCC plugins, standalone tools, and game engine plug-ins
  - **Runtime:**
    - A modular SDK – minimal integration into game engine
    - Leverages PhysX for simulations



# APEX Architecture



Authoring

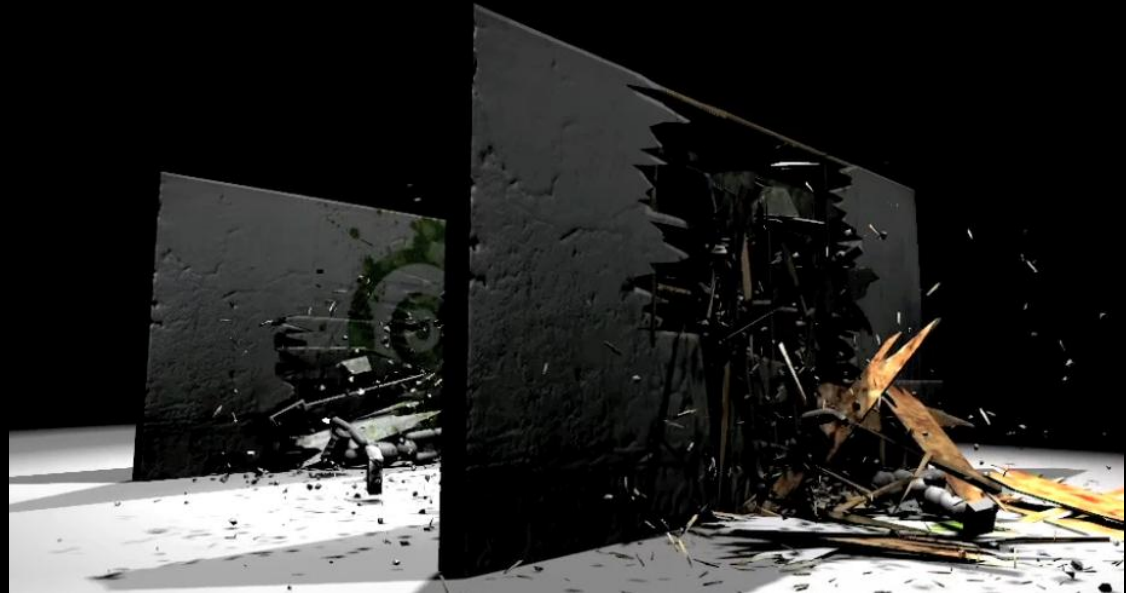


Run-time



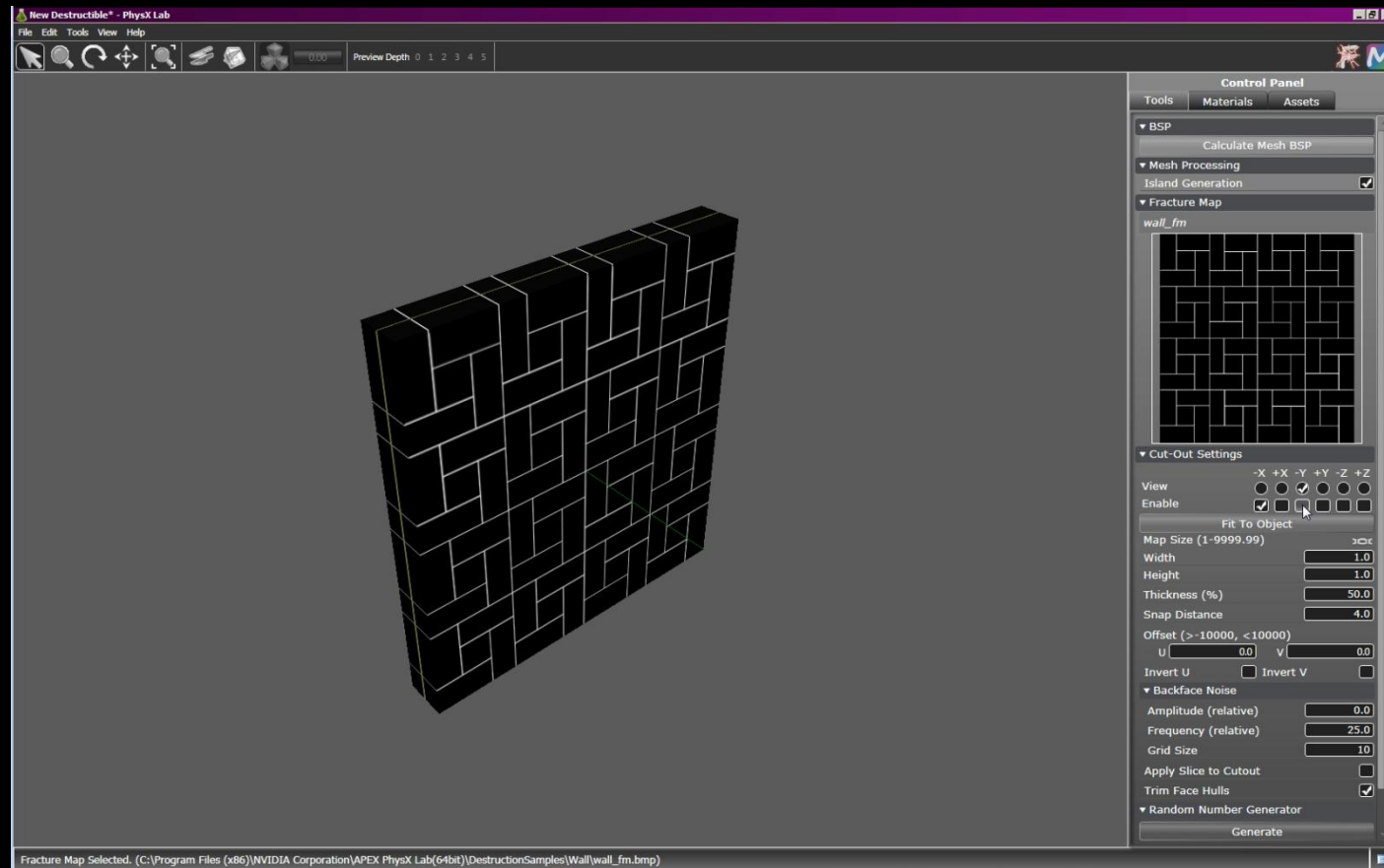
# APEX Destruction

- Fully and partial destructible environments
- PhysXLab tool with preview functionality
- Fully integrated with APEX Particles
- Fracture with noise
- Hierarchical destruction
- Plastic deformation
- Level of Detail
- Scalability



# APEX Destruction

## Authoring Pipeline



# APEX Destruction

Realtime example of authored destruction asset

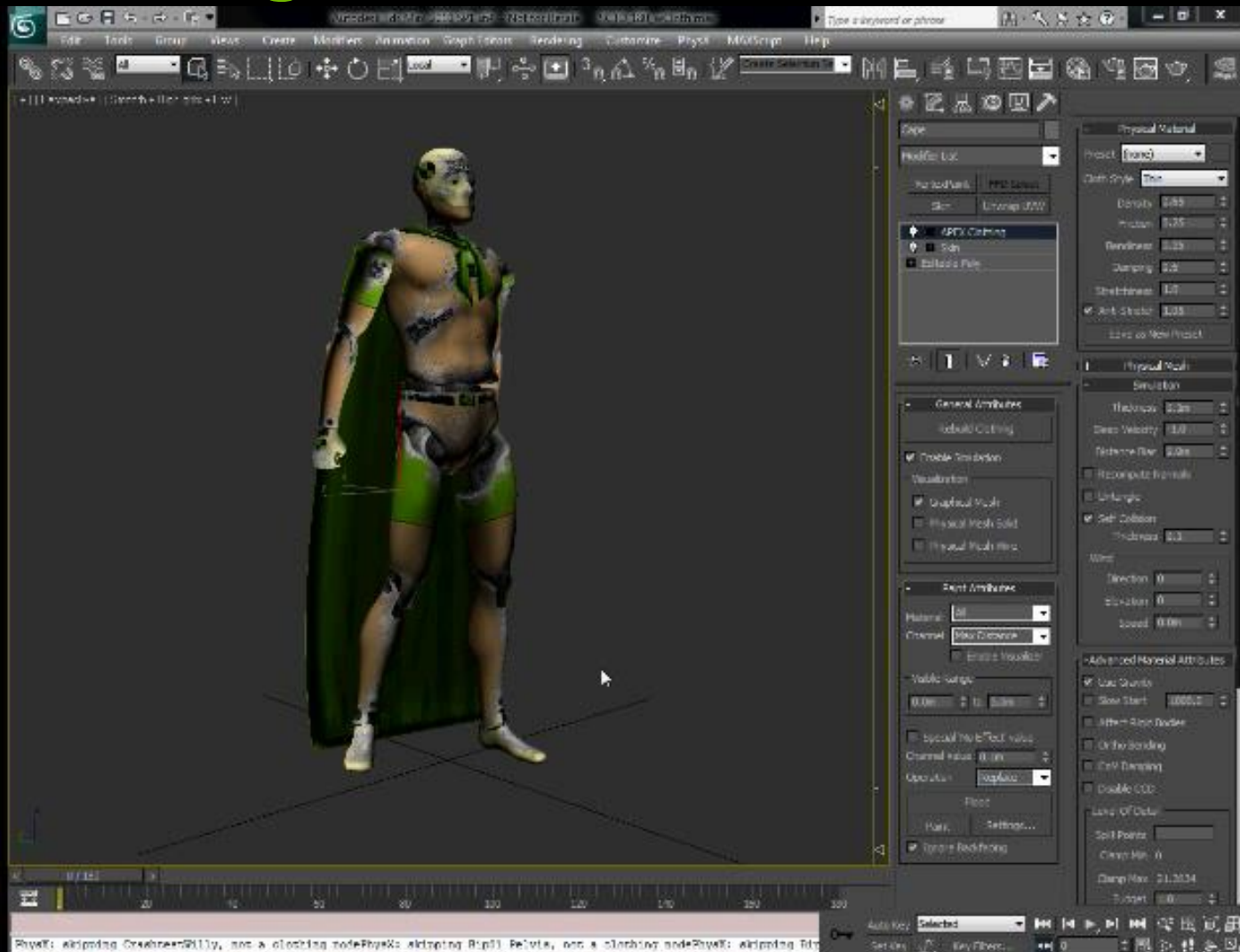


# APEX Clothing

- Hybrid of simulated and skinned clothing
- DCC tools with preview functionality
- Level of Detail (physical simulation and graphics)
- Animation blending
- Clothing constraints
- Scalability



# APEX Clothing



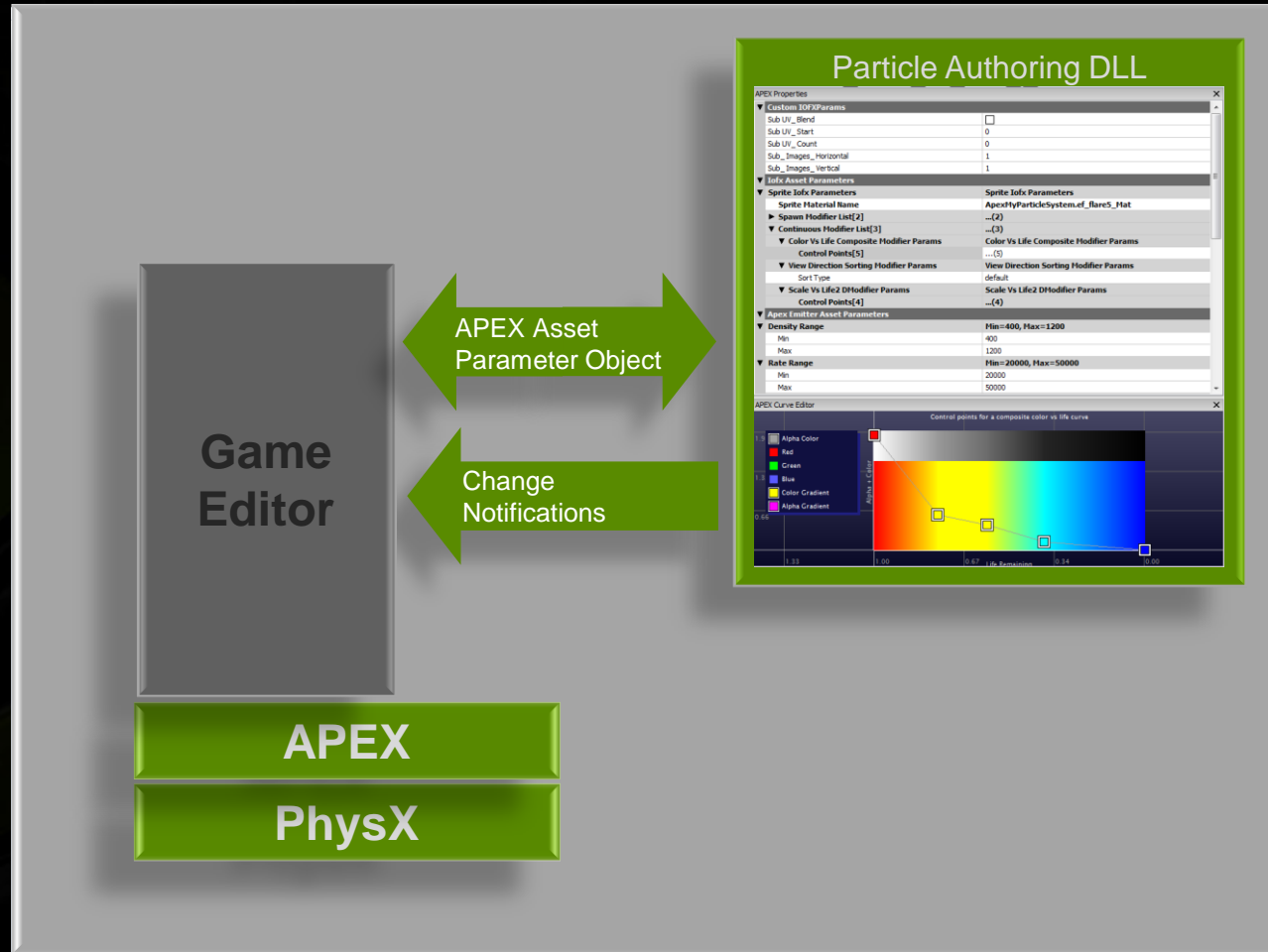
# APEX Particles

- Full Collision with PhysX environment
- Force fields (wind, explosions)
- Authorable behavior and effect modifiers
- Renderable as sprites or meshes (with orientation)
- Generic emitter
- Special purpose emitters
  - Air/Ground emitter
  - Weapon emitter



# APEX Particles

Particle Authoring DLL



# APEX Particles

## Authoring Pipeline



The screenshot displays the Unreal Engine interface for authoring an APEX particle system. The main viewport shows a particle system with a color gradient from red at the top to blue at the bottom. The right-hand side features the 'APEX Properties' panel, which is organized into several sections:

- Custom IOFXParams:** A table of parameters for the IOFX system.

Sub UV_Blend	<input type="checkbox"/>
Sub UV_Start	0
Sub UV_Count	0
Sub_Images_Horizontal	1
Sub_Images_Vertical	1
- IOFX Asset Parameters:** A dropdown menu for selecting the IOFX asset.
- Sprite IOFX Parameters:** Parameters for the sprite IOFX system, including the material name and spawn modifiers.
  - Spawn Modifier List[2]:**
    - Random Rotation Modifier Params:** Min Rotation: 0, Max Rotation: 360.
    - Random Scale Modifier Params:** Min Scale Factor: 0.2, Max Scale Factor: 20.
  - Continuous Modifier List[3]:** A dropdown menu for selecting continuous modifiers.
  - Color Vs Life Composite Modifier:** A dropdown menu for selecting color vs life composite modifiers.
  - View Direction Sorting Modifier:** A dropdown menu for selecting view direction sorting modifiers.
  - Scale Vs Life2 DModifier Params:** A dropdown menu for selecting scale vs life2 dmodifier params.
- Apex Emitter Asset Parameters:** A table of parameters for the apex emitter asset.

<b>Density Range</b>	Min=400, Max=1400
Min	400
Max	1400
<b>Rate Range</b>	Min=20000, Max=50000
Min	20000
Max	50000
<b>Lifetime Range</b>	Min=0.2, Max=1.2
Min	0.2
Max	1.2
<b>Velocity Range</b>	Min=(X=-100, Y=-200, Z=-2000), Ma
Min	X=-100, Y=-200, Z=-2000

The bottom of the interface shows the 'APEX Curve Editor', which is a graph with a color gradient on the x-axis and numerical values on the y-axis. The y-axis has markers at 0.67, 1.33, and 2.00. The graph shows a curve that starts at a high value on the left and decreases towards the right. A legend on the left side of the editor identifies the different elements: Alpha Color (red square), Red (red square), Green (green square), Blue (blue square), Color Gradient (yellow square), and Alpha Gradient (pink square).

# APEX Turbulence



# APEX 1.0 Features

(currently in public beta)

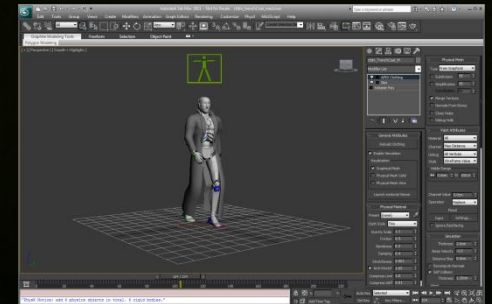


## - APEX SDK (Destruction, Clothing, Particles)

- Improved Level of Detail (LoD)
- Debug Visualization (Destruction, Clothing, Particles)
- Serialization enhancements (console specific binary)
- Destruction memory improvements
  - support for compressed vertex buffer format
  - mesh optimizations
- Clothing performance improvements
- PhysX 2.8.4 support
- APEX Samples

## - APEX Authoring Tools

- Improved 3ds Max/Maya Clothing plug-ins
  - Stability, Ragdoll enhancements
- Improved PhysXLab
  - UI, Stability, different slice settings at different depth



# APEX 1.1 Features

(currently closed beta; public beta planned for October)



- APEX SDK (everything from APEX 1.0 plus)
  - APEX Destruction with GPU Rigid Bodies (GRBs)
    - Accelerated rigid bodies simulation on GPUs with support for more than 10,000 chunks
    - Seamless integration into APEX Destruction
- APEX Clothing
  - Clothing mesh-mesh skinning authoring improvements
  - Clothing morph target support
- Improved console performance





# APEX 1.2 Features

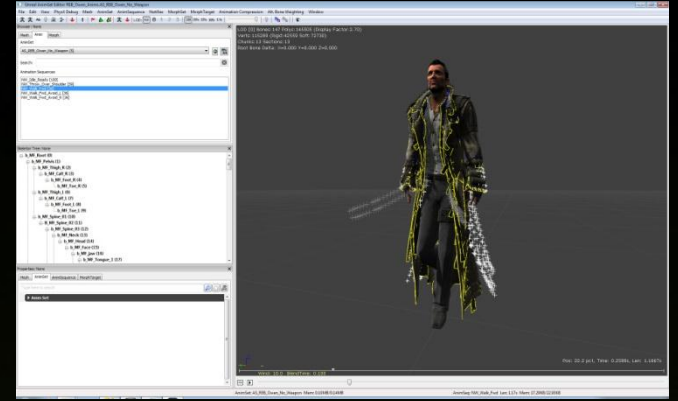
(closed beta September 2011; public beta in November)

- **APEX SDK** (everything from APEX 1.1 plus)
  - Support for PhysX SDK 3.1
    - New Clothing Solver
  - More console memory/performance improvements
  
- **APEX Authoring Tools**
  - Support for PhysX 3.1

# APEX 1.0 available NOW in UE3



- March 2011 QA
  - APEX Clothing
    - Simulates in AnimsetViewer / AnimTree
    - Physical and Graphical LOD
    - DCC tools: 3dsMax/Maya Clothing plug-in
  - APEX Destruction
    - Standalone tool: PhysXLab
  - Support all PhysX and APEX Debug Visualization
- <https://udn.epicgames.com/Three/APEXOverview>
- <http://developer.nvidia.com/object/apex.html>



# From where can I get APEX ?

Register at NVIDIA Developer Zone and request access for APEX SDK and APEX Tools

<http://developer.nvidia.com/object/apex.html>





THANK YOU

Questions?

