Shaders : the sky is the limit

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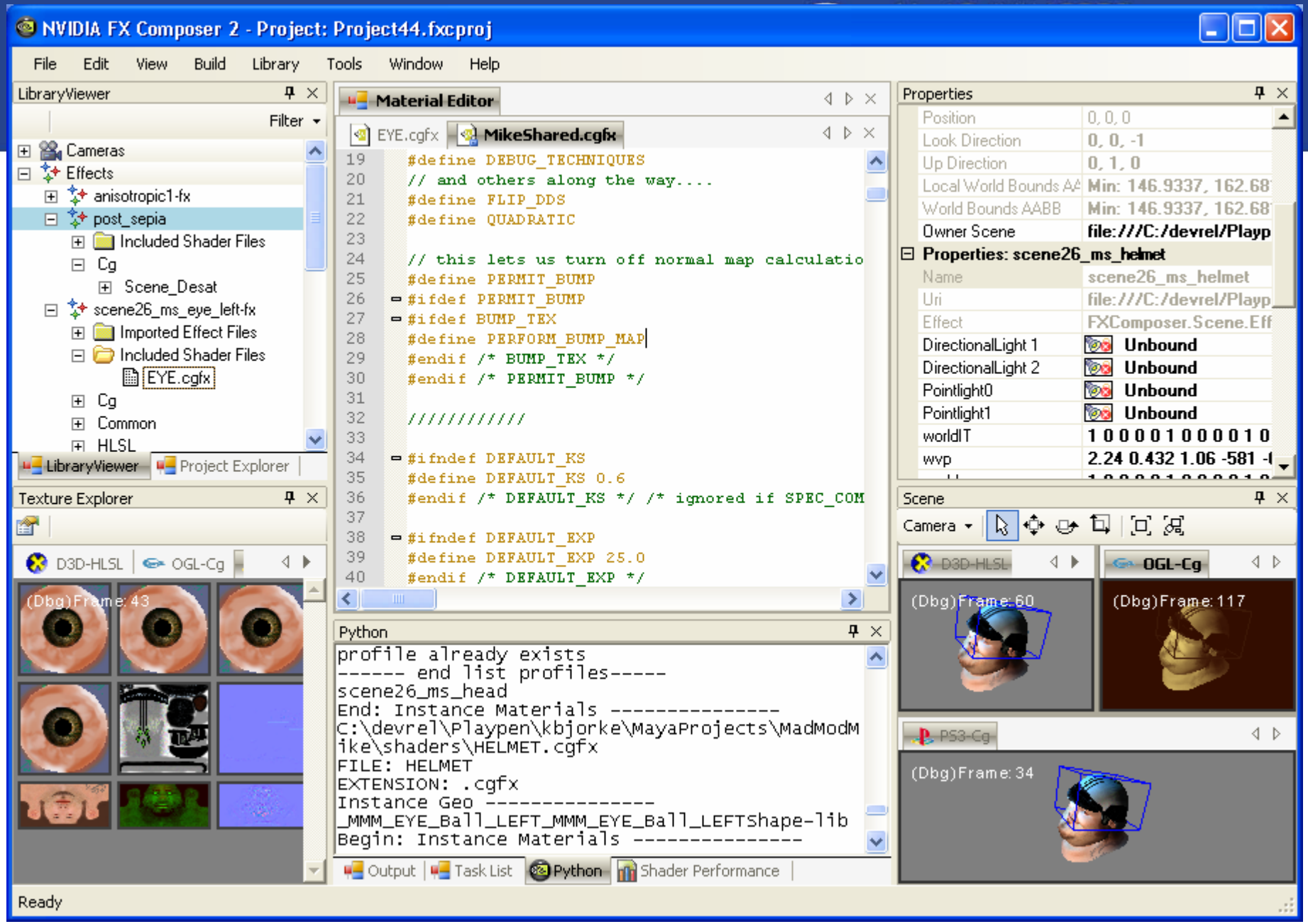
11–14 JULY 2006
DEVELOP IN BRIGHTON

Agenda

11–13 JULY 2006
DEVELOP IN BRIGHTON

- FX Composer 2.0 Introductions
- Cross-Platform Shader Authoring
- FX Composer 2.0 and Production Pipelines
- PLAYSTATION 3 Production Pipeline and Developer Tools
- Conclusion
- Q&A


NVIDIA FX Composer 2 - Project: Project44.fxcproj
File Edit View Build Library Tools Window Help
LibraryViewer
Filter
Cameras
Effects
anisotropic1-fx
post_sepia
Included Shader Files
Cg
Scene_Desat
scene26_ms_eye_left-fx
Imported Effect Files
Included Shader Files
EYE.cgfx
Cg
Common
HLSL
LibraryViewer
Project Explorer
Texture Explorer
D3D-HLSL
OGL-Cg
(Dbg)Frame: 43
Material Editor
EYE.cgfx
MikeShared.cgfx
19 #define DEBUG_TECHNIQUES
20 // and others along the way....
21 #define FLIP_DDS
22 #define QUADRATIC
23
24 // this lets us turn off normal map calculatio
25 #define PERMIT_BUMP
26 #ifdef PERMIT_BUMP
27 #ifdef BUMP_TEX
28 #define PERFORM_BUMP_MAP
29 #endif /* BUMP_TEX */
30 #endif /* PERMIT_BUMP */
31
32 ////////////
33
34 #ifndef DEFAULT_KS
35 #define DEFAULT_KS 0.6
36 #endif /* DEFAULT_KS */ /* ignored if SPEC_COM
37
38 #ifndef DEFAULT_EXP
39 #define DEFAULT_EXP 25.0
40 #endif /* DEFAULT_EXP */
Python
profile already exists
------ end list profiles-----
scene26_ms_head
End: Instance Materials ---------------
C:\devrel\Playpen\kbjorke\MayaProjects\MadModMike\shaders\HELMET.cgfx
FILE: HELMET
EXTENSION: .cgfx
Instance Geo ---------------
_MMM_EYE_Ball_LEFT_MMM_EYE_Ball_LEFTShape-lib
Begin: Instance Materials ---------------
Output
Task List
Python
Shader Performance
Properties
Position 0, 0, 0
Look Direction 0, 0, -1
Up Direction 0, 1, 0
Local World Bounds AA Min: 146.9337, 162.68
World Bounds AABB Min: 146.9337, 162.68
Owner Scene file:///C:/devrel/Playp
Properties: scene26_ms_helmet
Name scene26_ms_helmet
Uri file:///C:/devrel/Playp
Effect FXComposer.Scene.Eff
DirectionalLight 1 Unbound
DirectionalLight 2 Unbound
Pointlight0 Unbound
Pointlight1 Unbound
worldIT 1 0 0 0 0 1 0 0 0 0 1 0
wvp 2.24 0.432 1.06 -581
Scene
Camera
D3D-HLSL
(Dbg)Frame: 60
OGL-Cg
(Dbg)Frame: 117
PS3-Cg
(Dbg)Frame: 34
Ready

FX Composer 2.0
Who is it for?

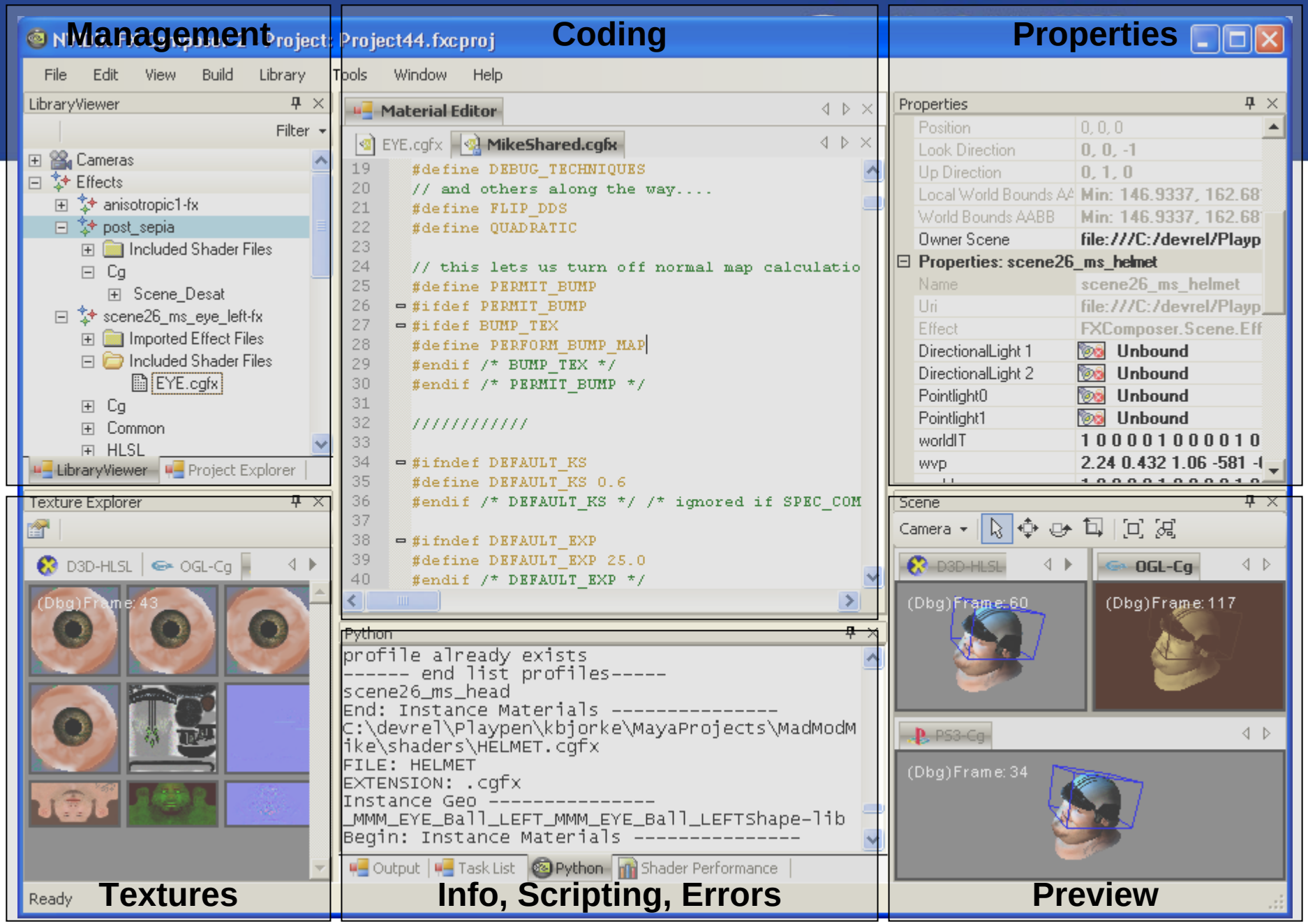
- Graphics Programmers
- Technical Directors
- Technical Artist
- Artist

FX Composer 2.0 Requirements

- Handling of complex rendering
- Extensible via Plug-in-Based Software Architecture
- Advanced UI
- Scriptable
- Highly customizable (Layout management)
- Shader Profiling

FX Composer Overview

- Project Explorer and Library Viewer
- Properties Panel
- Shader Editor and Effect Authoring
- 3D Panels
- Scripting and Debugging Panels
- Texture Explorer
- Shader Performance Panel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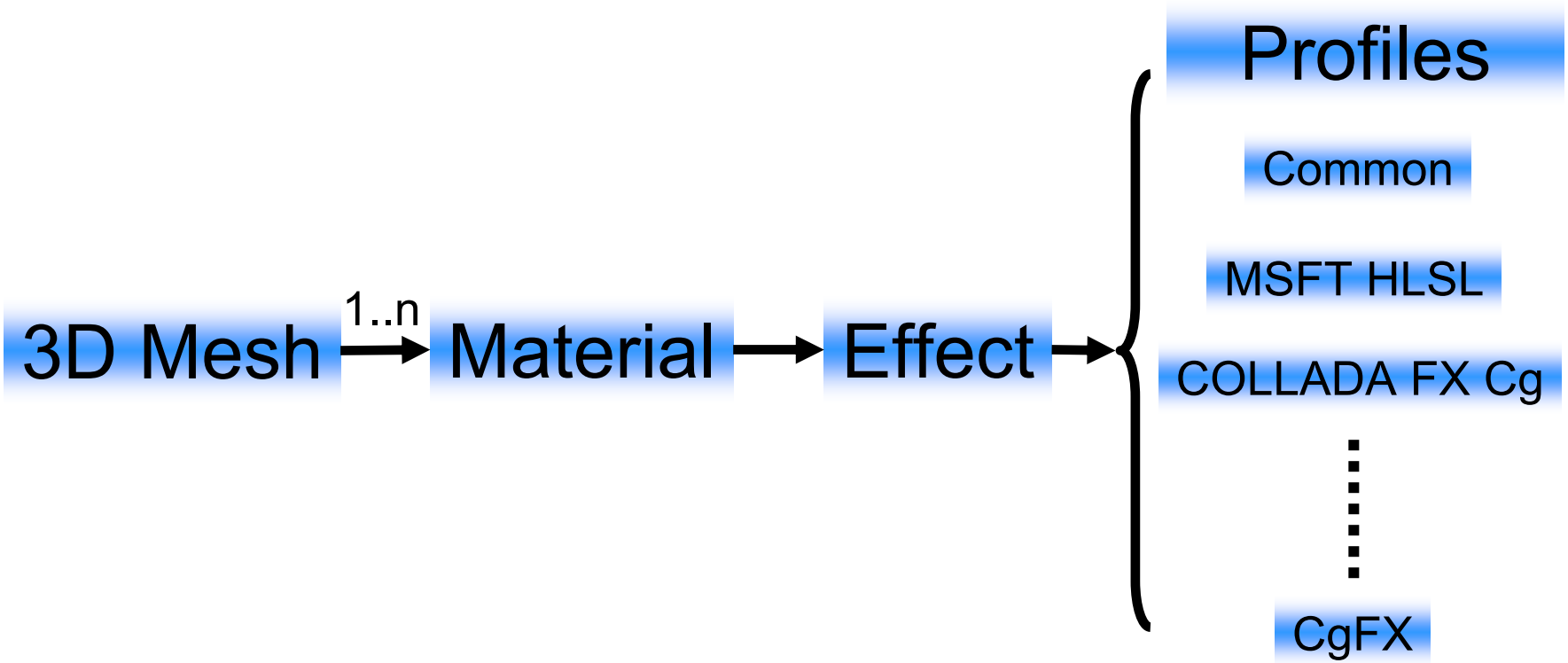
PS3-Cg
(Dbg)Frame: 34
Textures
Info, Scripting, Errors
Preview

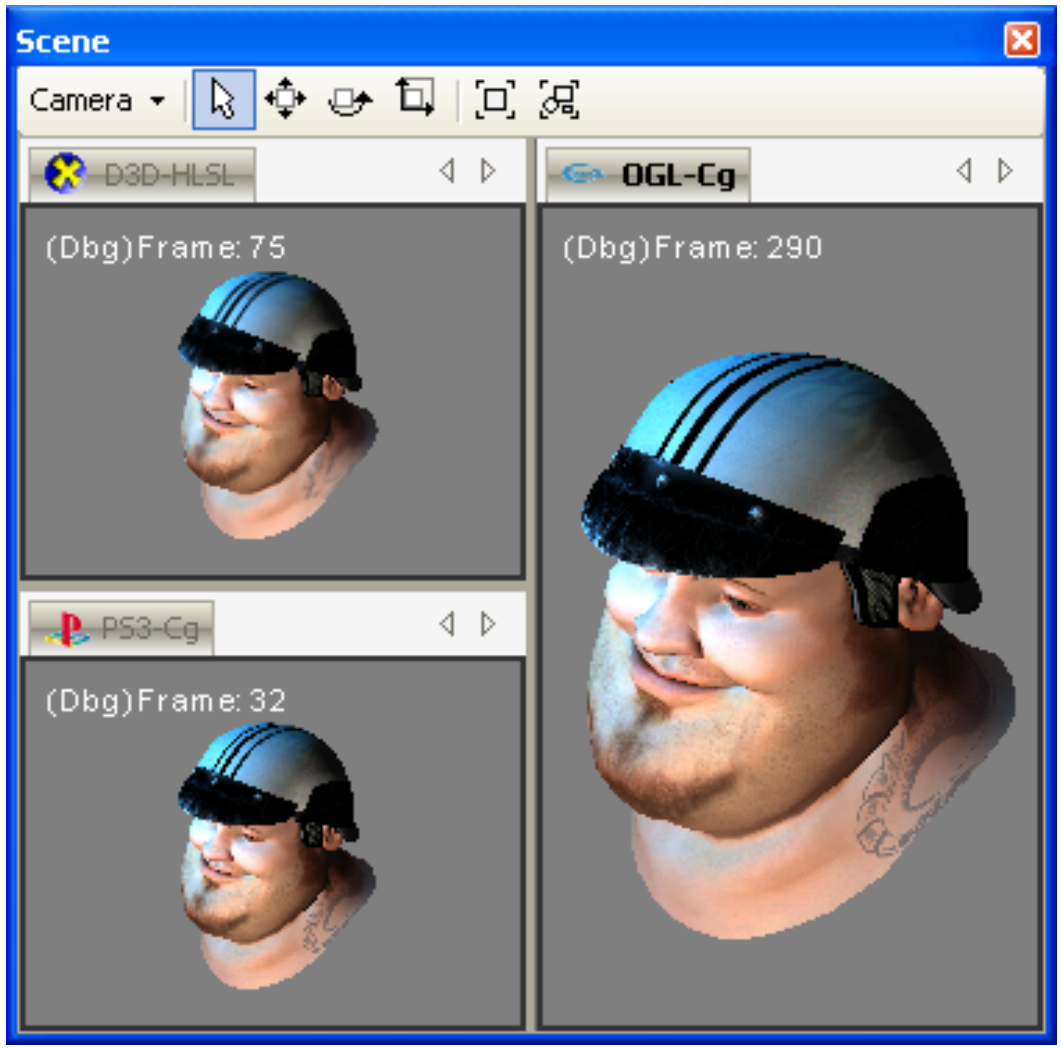
Cross-Platform Shader Authoring

- **Multi-Platform Multi-Language IDE**
  - Microsoft HLSL FX
  - OpenGL CgFX
  - COLLADA FX Cg
  - COLLADA FX Cg PS3
  - COLLADA FX GLSL**
  - OpengGL ES 2.0**
- **A device can support many languages**

Cross Platform Shader Authoring – Object Model

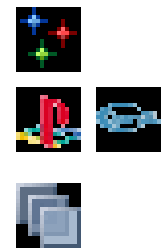


Cross Platform Shader Authoring

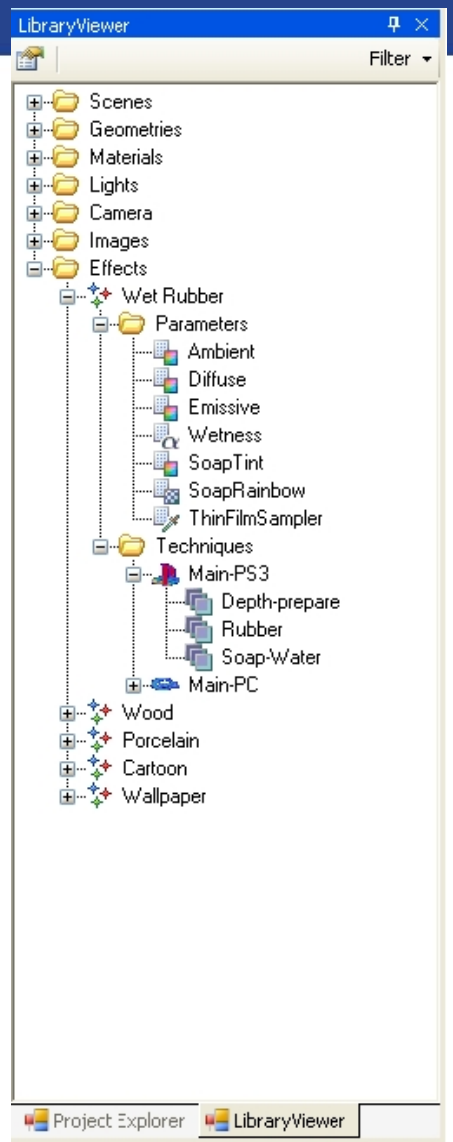


COLLADA FX

- **View effect structure**
  - Effects
  - Techniques
  - Passes
  - Parameters



- **Select node for properties**
- **Right-click to for menus**
  - Add children
  - Remove children
  - Advanced options



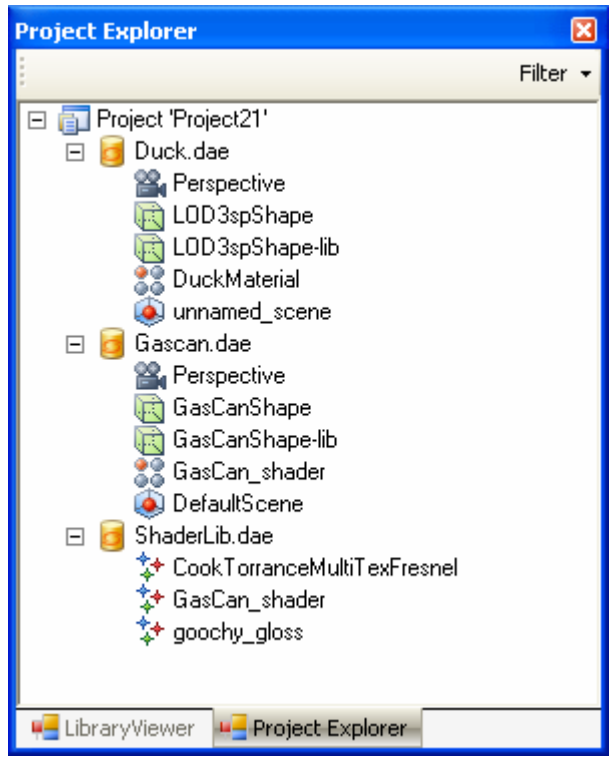
COLLADA FX with CG vs. CGFX

- **COLLADA FX for CG authoring**
  - Most user friendly experience
  - Fully editable via user interface
  - Less hand coding
    - **Zero XML**
    - **Cg, GLSL only when writing the GPU shader code**

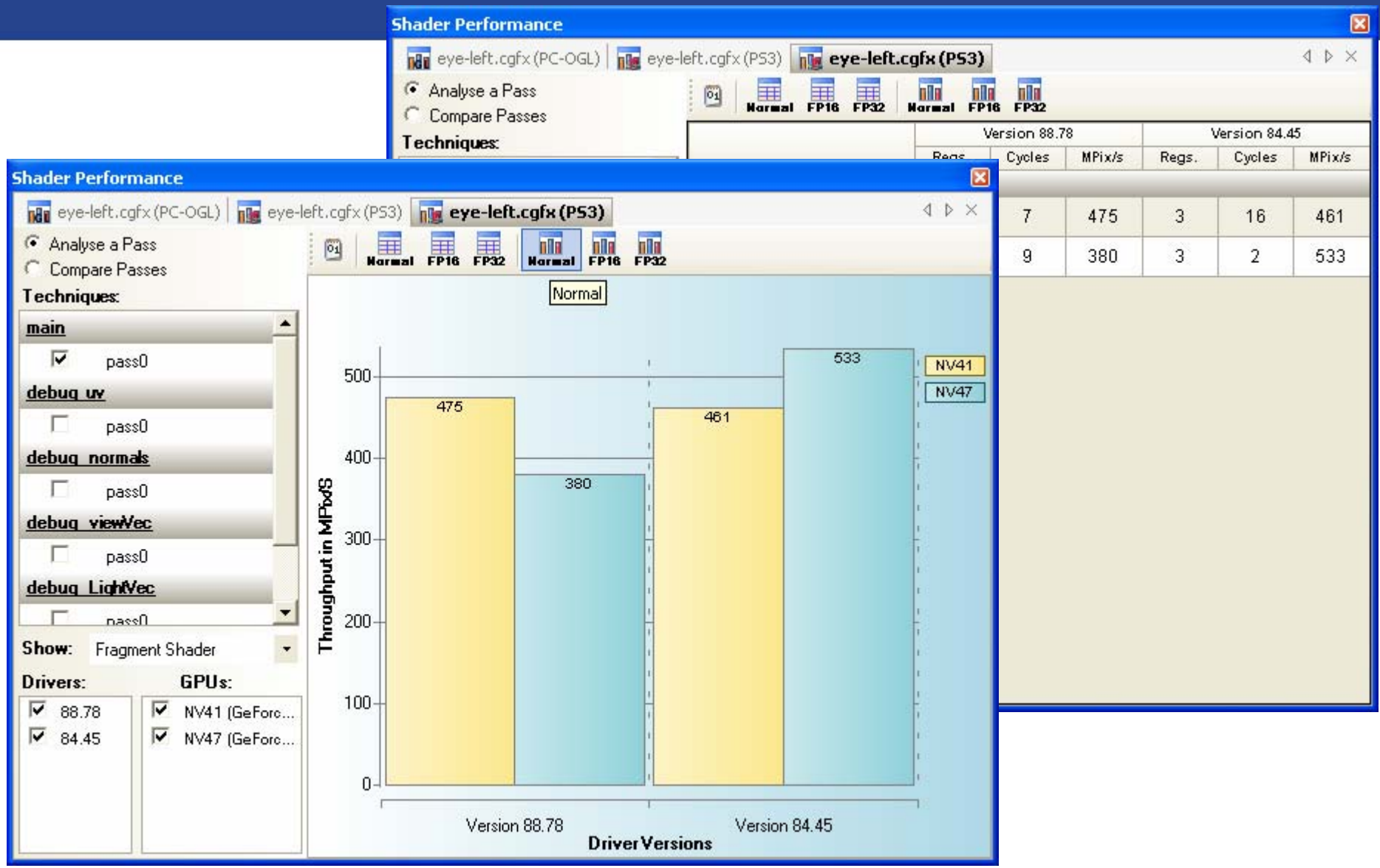
- **CGFX import**
  - Hand coded
  - Cannot be edited from Library Viewer because:
    - **Macros: #define foo replacement_code**
    - **Expressions: int foo = bar*3;**

Shader Asset Management

- FXC2 allows for Managing Shader Libraries
- COLLADA-based material and effect management
- Uses Project Explorer to move, copy and organize shaders across COLLADA documents
- Handles CgFX and FX



Shader Performance Simulation



FX Composer 2.0 and Production Pipelines

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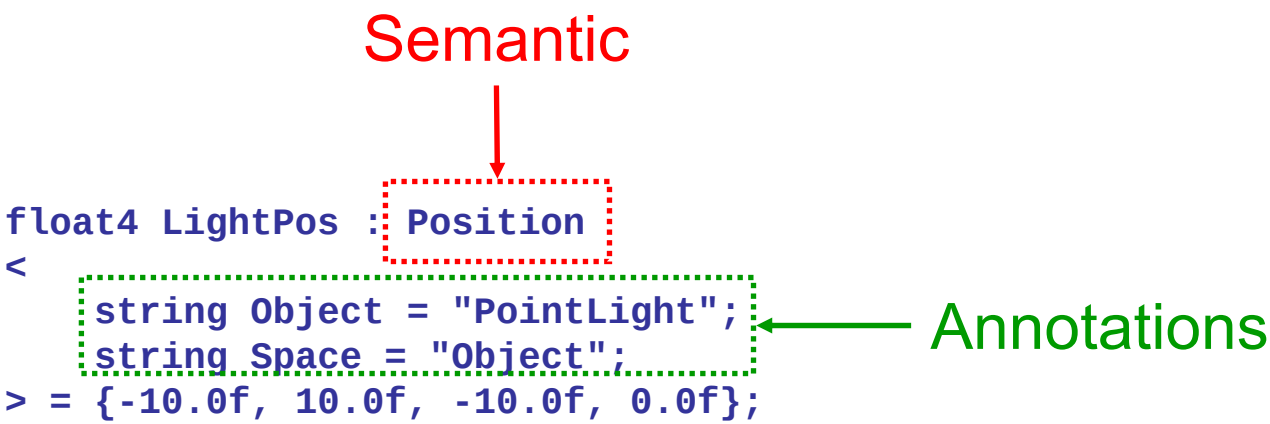
- Support for Heterogeneous Production Pipelines
- Custom Production Pipeline Samples
- COLLADA-Based Production Pipeline

Support for heterogeneous Production Pipelines

- Semantic and Annotations
- Custom Plug-in
- Automation of tasks via scripting
- Source Control Integration

Semantic and Annotations



Semantics and Annotations Remapper

- **Programmable data streaming of FXC internal data**
- **Graph-based Evaluation of Semantics via xml configuration file**
- **Extended Library of Operators**
  - dot & cross products, mux, demux, matrix ops, ...
- **Custom Operators via Plug-in**

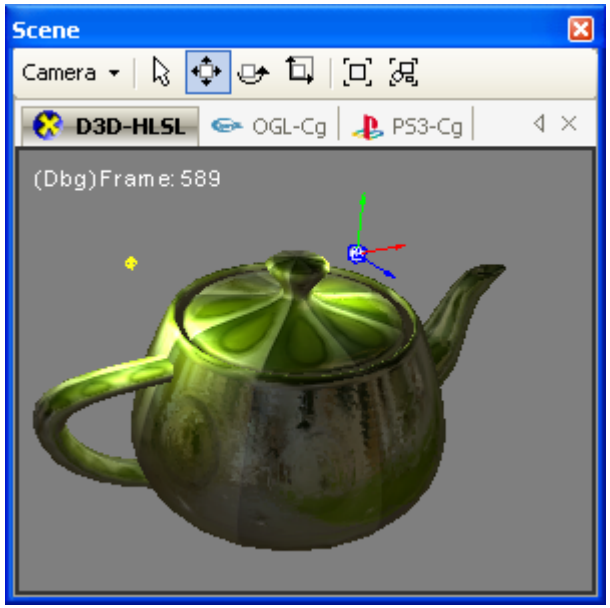
```
1 :<RemappedSemantic name="myWorldView">
2 :      <MatrixMultiply description="World * View">
3 :               <input type="internalsemantic" value="world"/>
4 :               <input type="internalsemantic" value="view"/>
5 :      </MatrixMultiply>
6 :</RemappedSemantic>
```

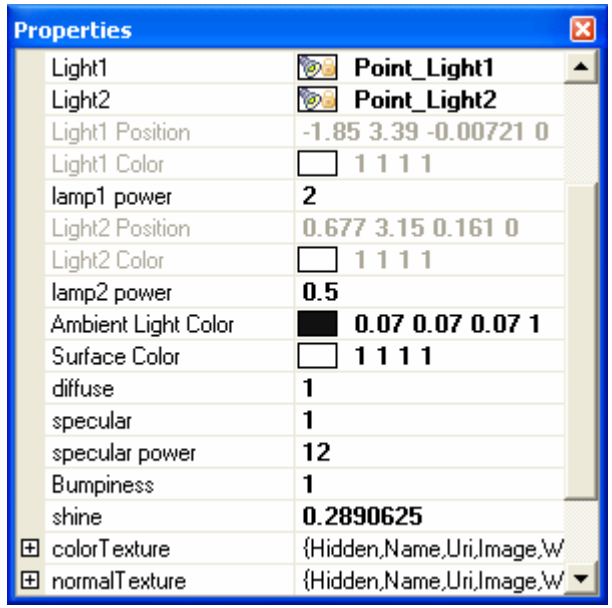
Shader Parameter Binding to Scene Objects


```
float4 LightPos : Position
<
    string Object = "Light0";
    string Space = "Object";
> = {-10.0f, 10.0f, -10.0f, 0.0f};

float3 LightColor : Diffuse
<
    string Object = "Light0";
    string UIName =  "Bright Surface Color";
    string UIWidget = "Color";
>   = {0.8f, 0.5f, 0.1f};

float4 SecondaryLightPos : Position
<
    string Object = "Light1";
    string Space = "Object";
>   = {-10.0f, 10.0f, -10.0f, 0.0f};

...
```

Single Scene Object Binding to multiple parameters

Shader Parameter Binding to Scene Objects

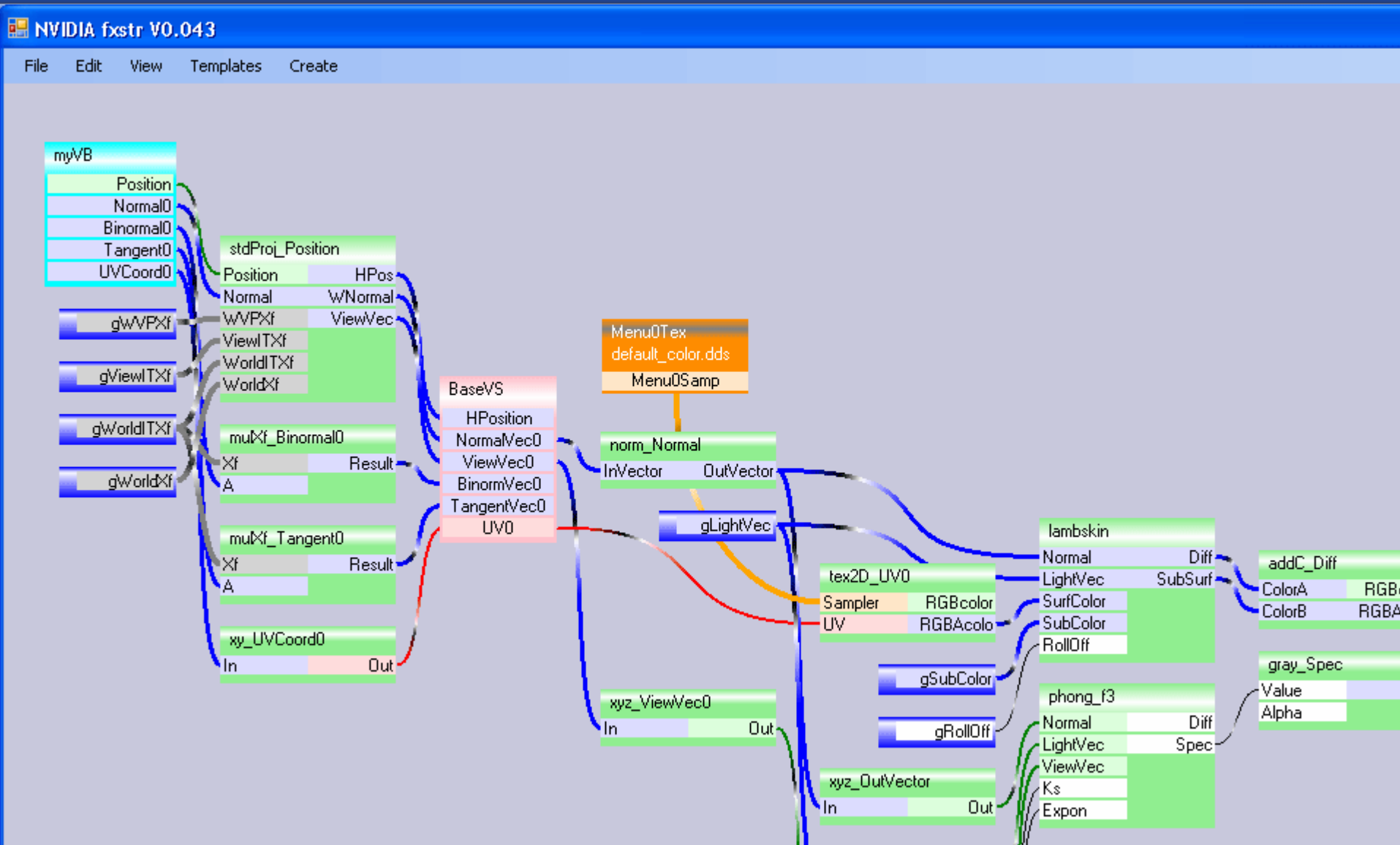




Custom Plug-ins for Production Pipeline Integration

- Import and Export Plug-ins
- Semantic and Annotation Remapper Operator Plug-ins
- Custom Device Back-end Plug-ins
- Procedural Geometry Plug-ins (fins, hair, etc...)
- Custom Authoring Environment

Custom Plug-ins for Production Pipeline Integration



Automation Tasks Via Scripting

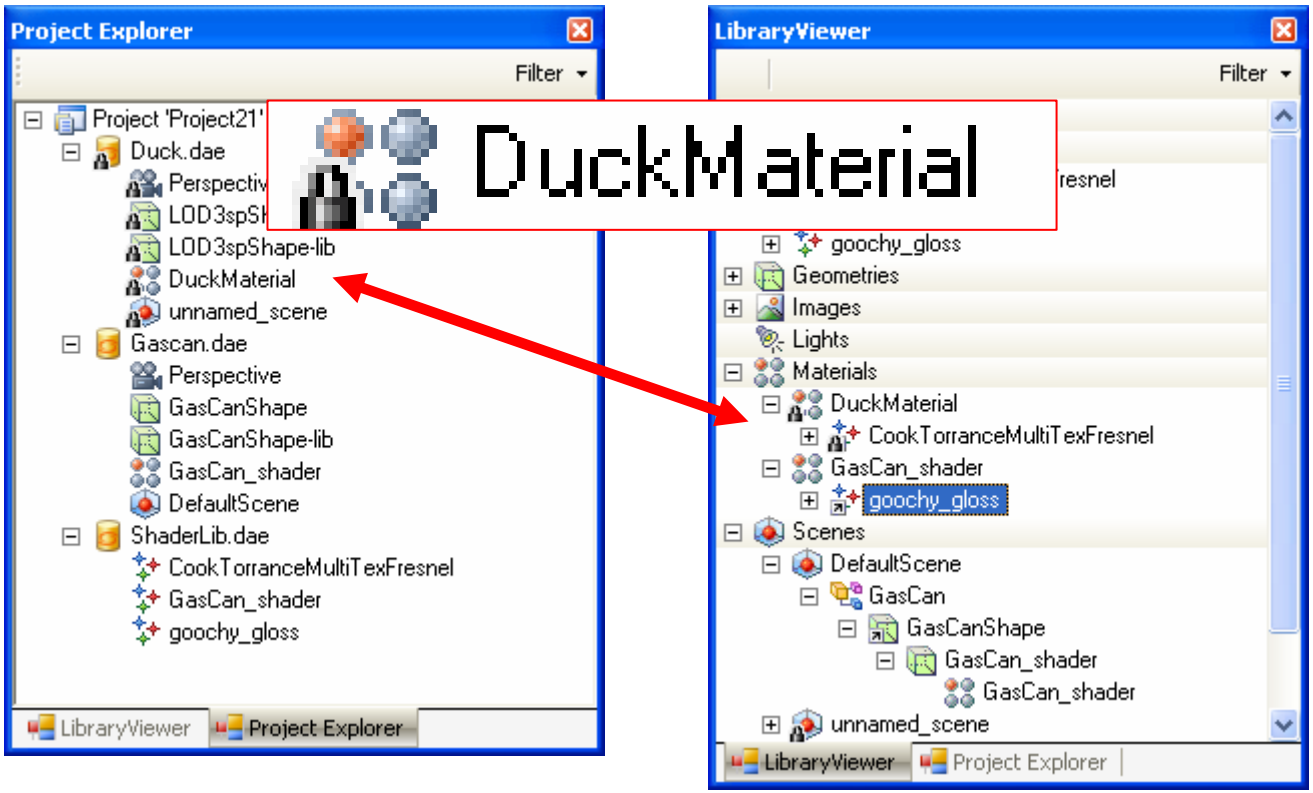
- **Automatic Assignment of**
  - Shaders and Effects to Material
  - Shader Parameters values (numerics, textures,...)
  - Shader Parameters to Scene Objects (Lights, Cameras, etc...)
- **Common Tasks Toolbar (a la Maya/MEL)**

Automation Tasks Via Scripting

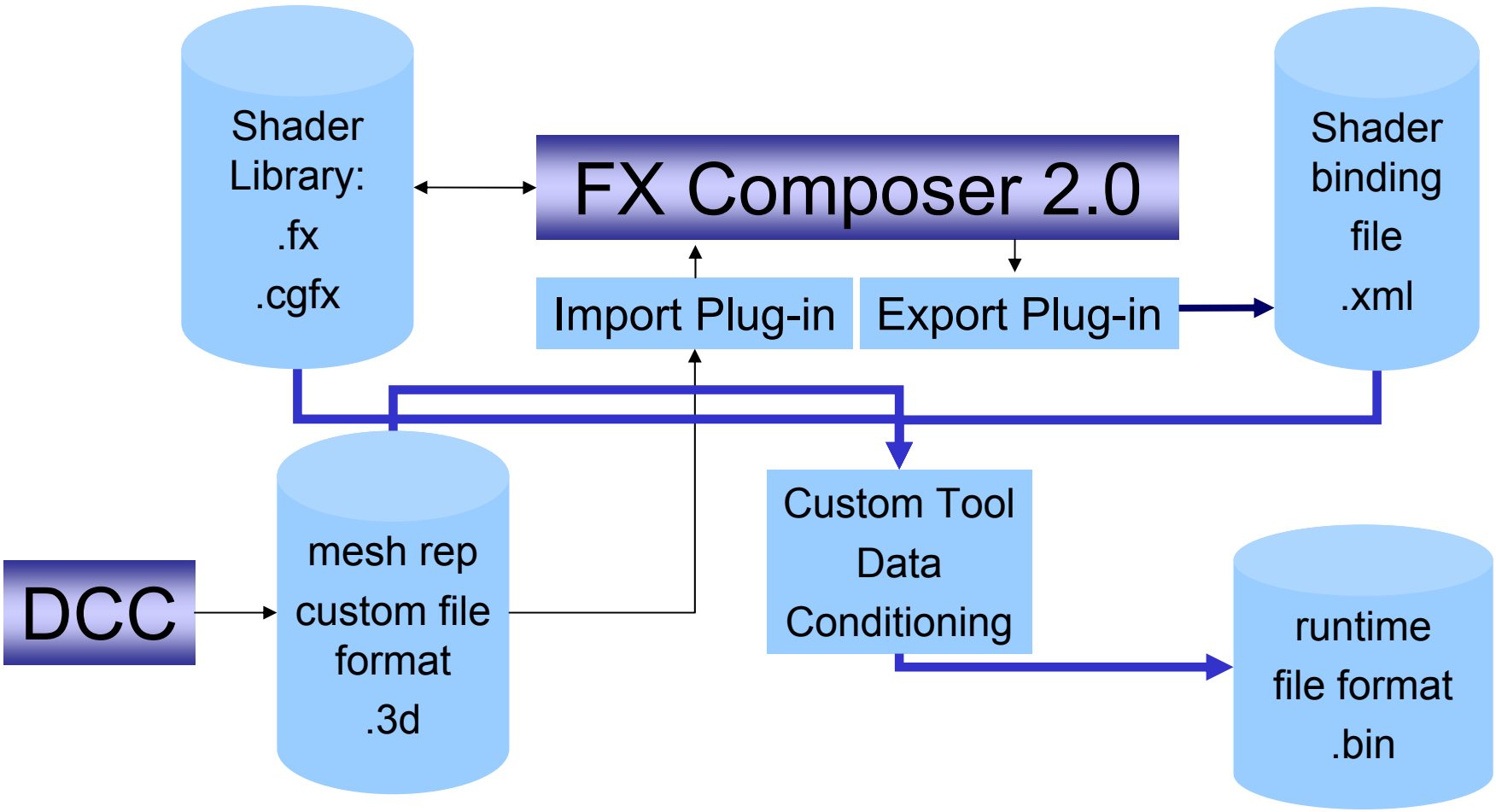

```
# Convert any Possible Profile to COLLADA FX
def ConvertToCOLLADA():
    effects = FXRuntime.Instance.Library.FindLibraryItems(FXEffect)
    for effect in effects:
          for profile in effect.Profiles:
                if profile.CanConvertToColladaFX() == True:
                      profile.ConvertToColladaFX()

# Create an effect
def bindMMM():
    CmdGroupBegin.Do("script: assign cgfx files to MMM ")

    SelectRenderPort("OGL-Cg")
    ForceRedraw()

    CmdGroupEnd.Do()

    # get the cgfx files to assign to MMM

    files = FXEffectUtils.GetEffectFiles()
    for pathname in files:
...
```

Source Control Integration

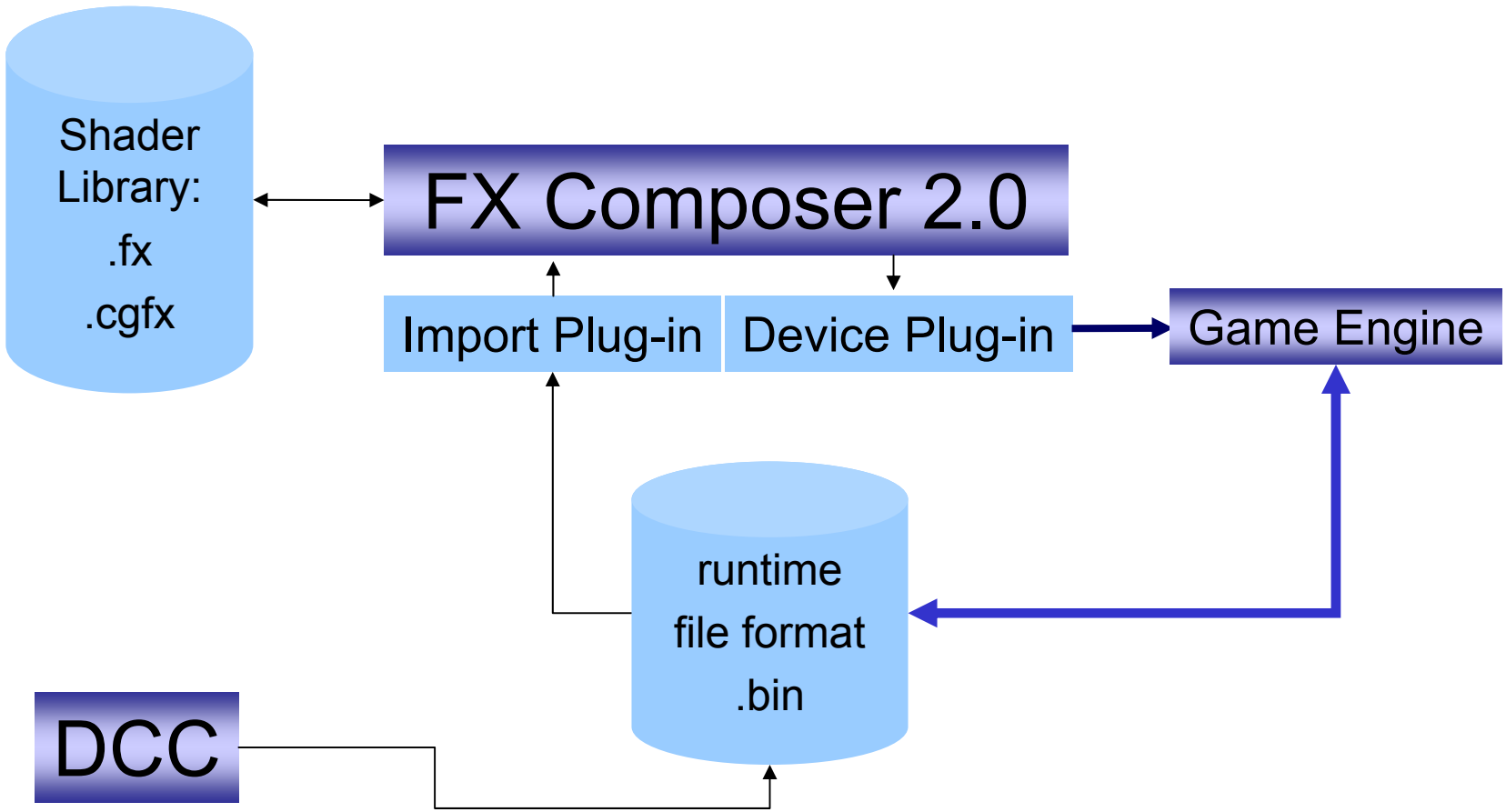
- Seamless integration into source control software
- File-based reflection of Art Asset States



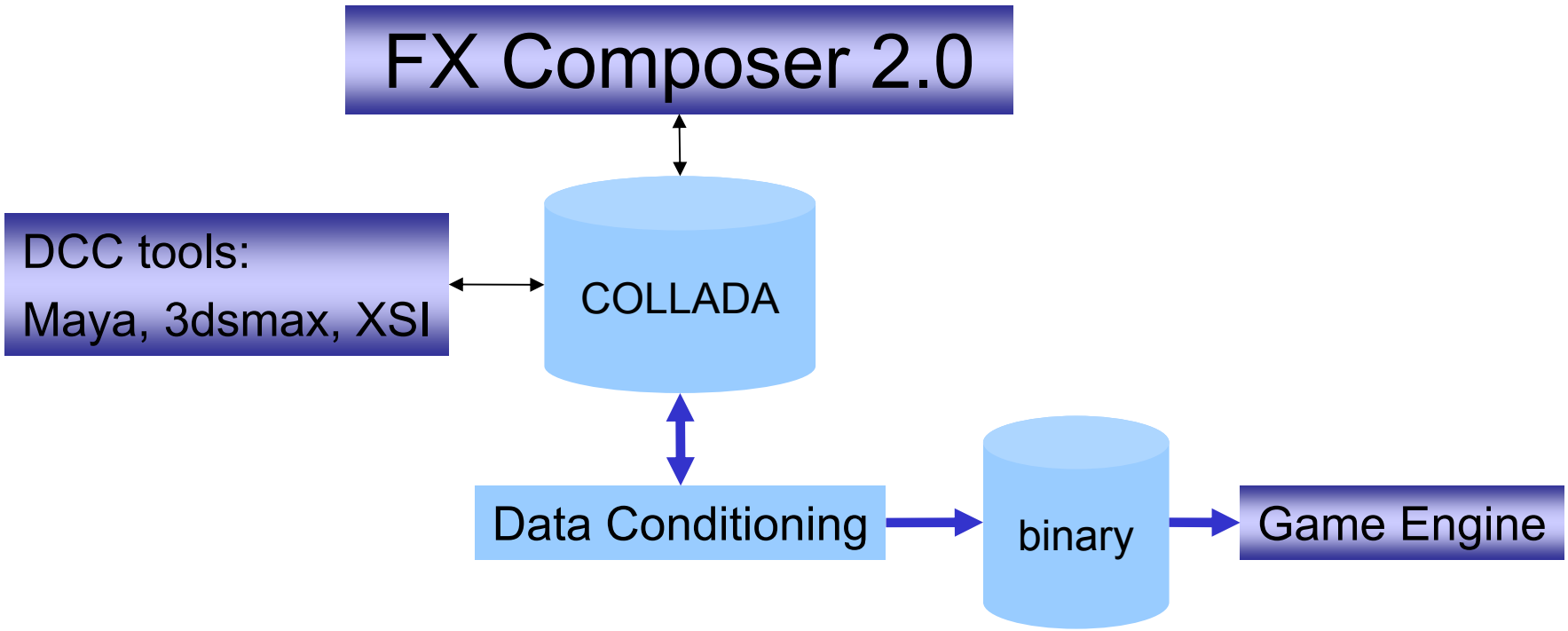
Custom Production Pipeline Example 1



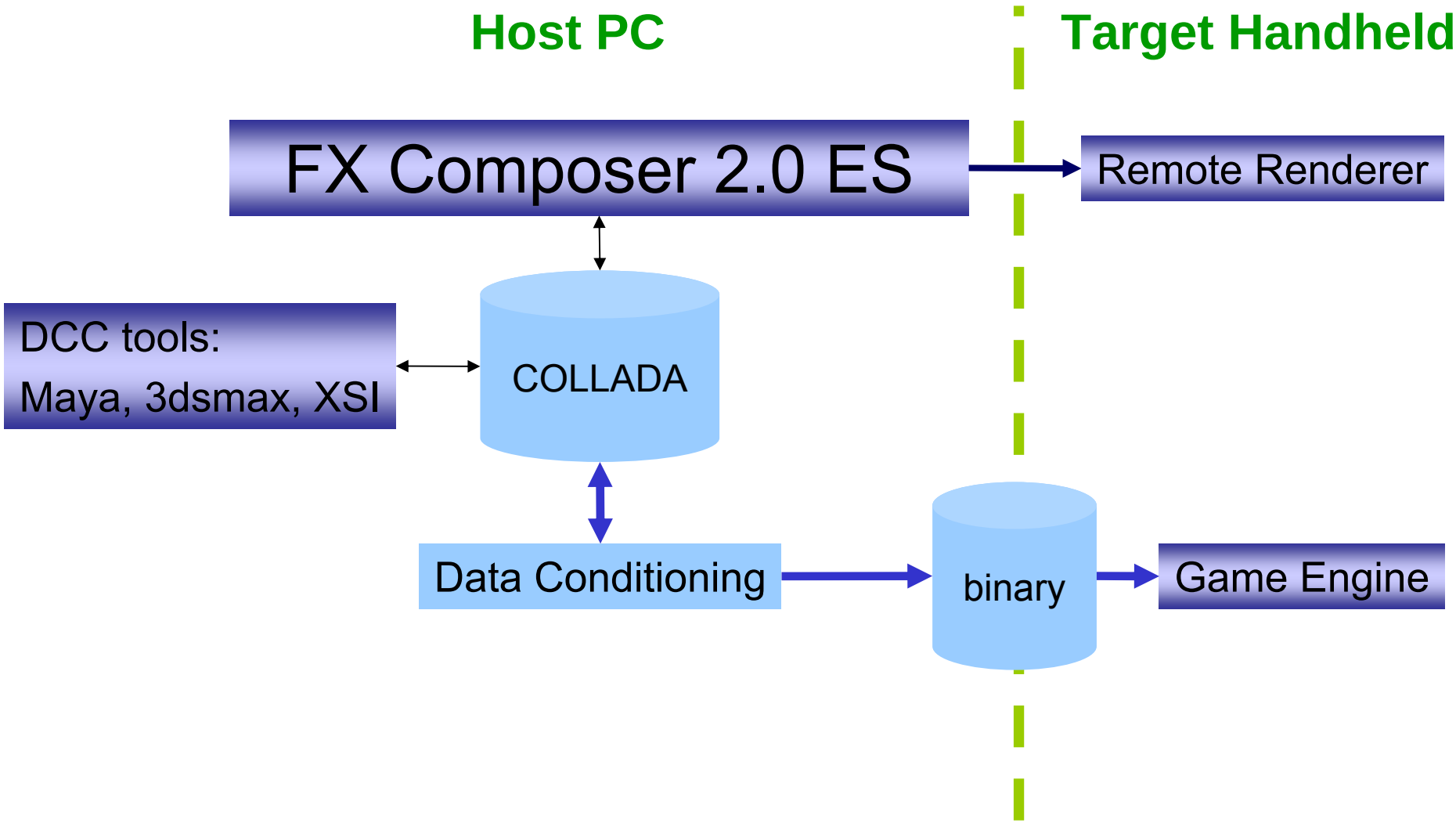
Custom Production Pipeline Example 2



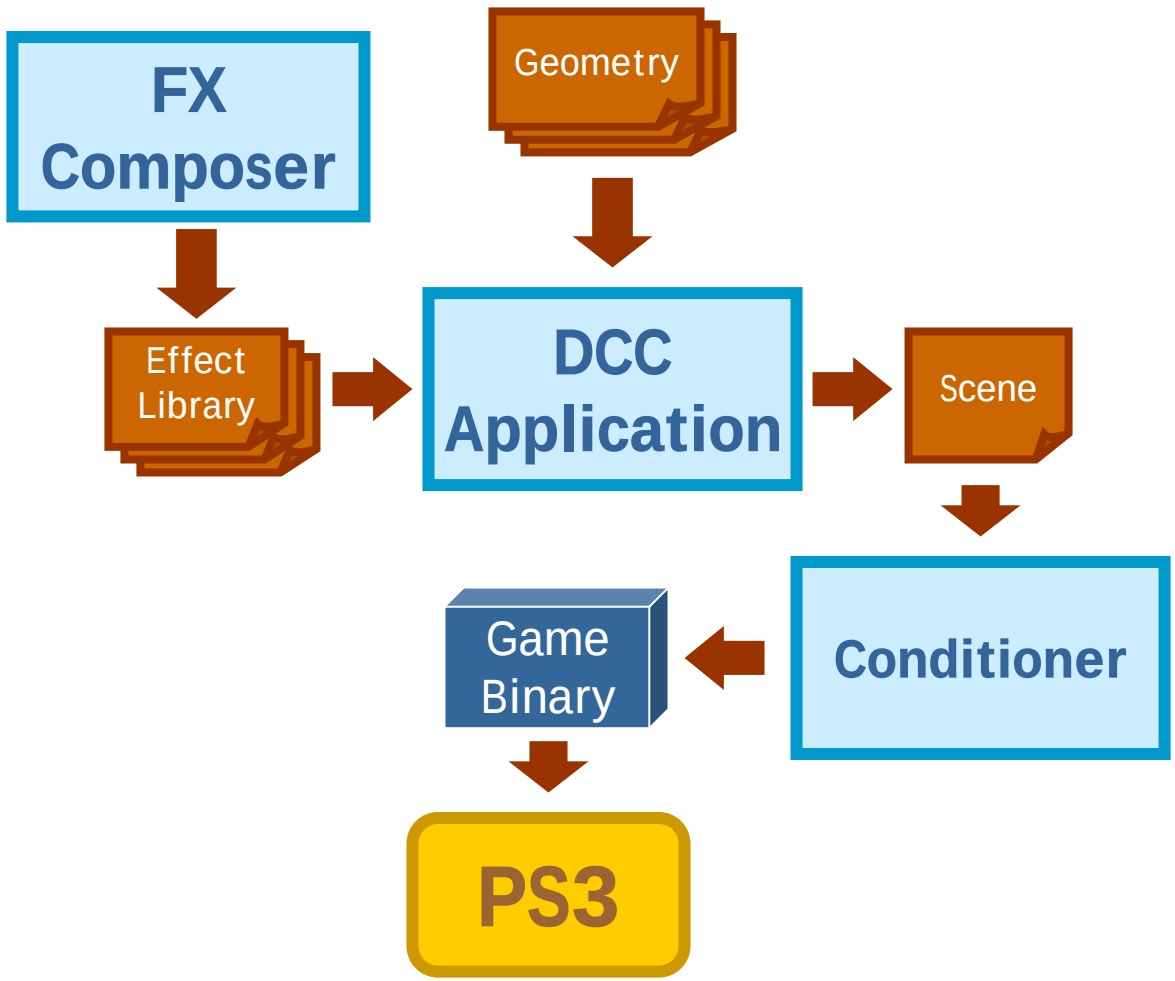
COLLADA Production Pipeline



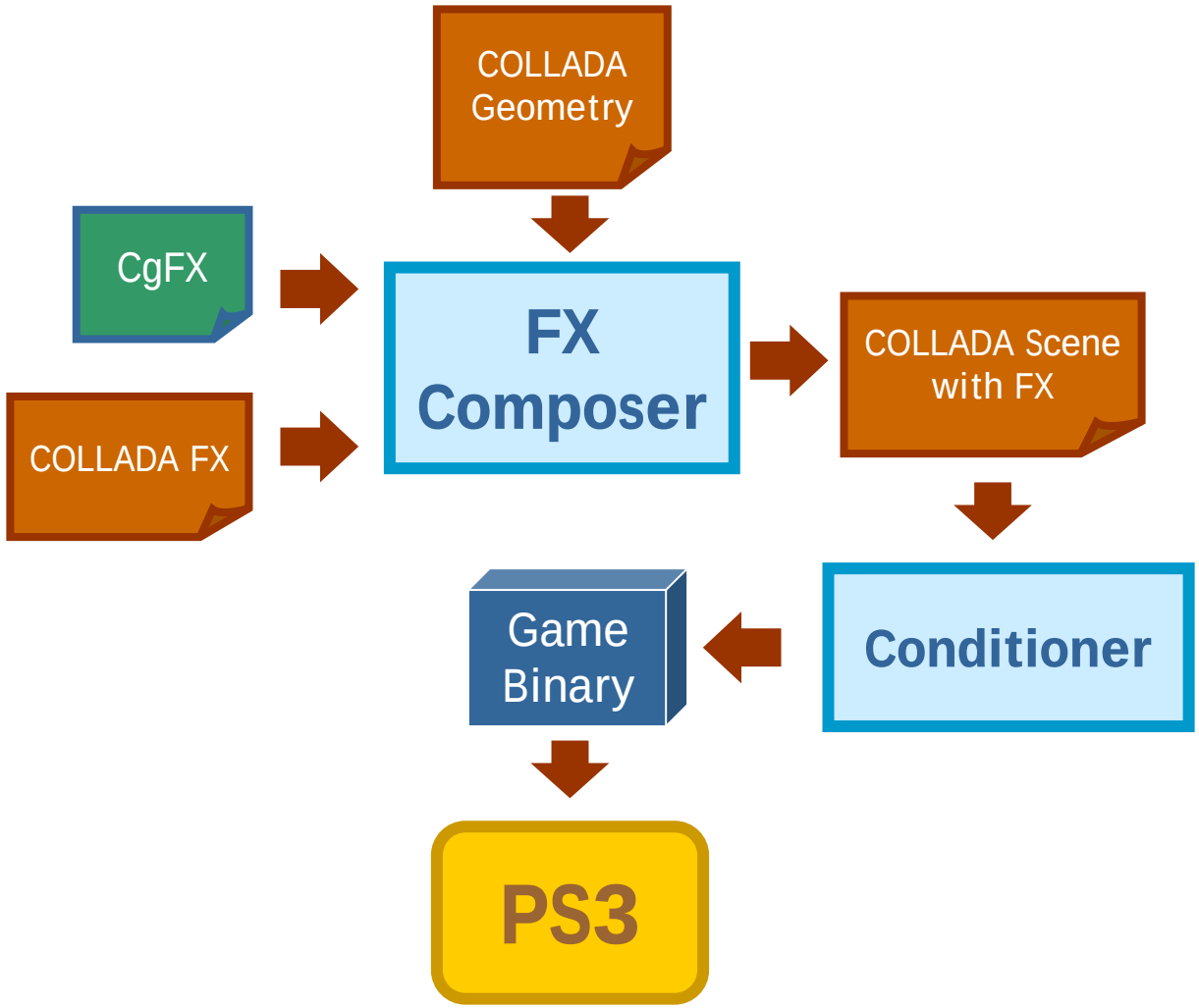
COLLADA Production Pipeline Handheld



PLAYSTATION 3 Pipeline



PLAYSTATION 3 Pipeline



- **COLLADA XML file format**
  - Freely available file specification
  - Freely available XML Schema
  - Open Source COLLADA DOM
- **Importer and Exporters**
  - Max
  - Maya
  - XSI
  - Others

PLAYSTATION 3 Developer Tools

- **Registered PS3 developers have extra tools**
  - PSGL (OpenGL | ES for PS3)
  - Cg 1.5 API
  - COLLADA RT
  - COLLADA FX Loader

Demo Data

- Geometry Modeled in Maya
- Exported to COLLADA
- Imported in to FXComposer
- CgFX Effects imported and converted to COLLADA FX
- Effects assigned and parameters tweaked
- Exported again as COLLADA with FX for PS3.
- Data Driven Shader Pipeline for PS3!

FX Composer 2.0 Alpha 5

- Full COLLADA Project support
- Native COLLADA FX Cg Authoring
- COLLADA FX Parameter Scene Binding
- Full Custom Semantic and Annotation support
- Undo/Redo for all authoring functionalities
- Full Python scripting support

- Alpha5 Release ETA End of Summer ’06
- Beta Release ETA End of Fall ‘06

Conclusion

- Next-generation of Shader IDE is on its way
- Production-ready with powerful features
- NVIDIA is closely working with Sony and others to deliver a professional-grade authoring tool

Q&A

- **Send us emails if you want to get early alpha and beta releases**

fxcomposer@nvidia.com