TWL-System NITRO Intermediate File Plug-In for Maya

User's Guide

2011/04/13

The content of this document is highly confidential and should be handled accordingly.

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Revision History

Version	Revision Date	Description
1.6.0	2011/04/13	Added support for plug-in version 1.6.0.2011-04-13. Added support for Maya 2011 (Windows 32-bit version). Ended support for Maya 8.5.
	2010/03/31	Added support for plug-in version 1.6.0.2010-03-31. Added support for Maya 2010 (Windows 32-bit version).
	2009/07/08	Added support for plug-in version 1.6.0 2009/07/08. Ended support of Maya 8.0.
	2009/03/04	Added support for plug-in version 1.6.0 2009/03/04. Added the Remove Namespace option to the export plug-in. Added the Remove Namespace option to the NITRO Rename Over 16 Characters plug-in. Changed so that the **Output Folder** selection dialog box size can be changed with the **Output Option** window.
	2008/10/31	Added support for Maya 2009. Added support for plug-in version 1.6.0 2008/10/31. Changed Table 1-1 List of Supported Features. Changed “texture pattern animation” to add animation layers.
	2008/10/08	Changed Maya 2008 operating environment to Maya 2008 Service Pack 1 or Maya 2008 Extension 2. Made revisions to reflect the NITRO-System name change (NITRO-System has been renamed TWL-System). Ended support for Maya 7.0. Added support for plug-in version 1.6.0 2008/10/08. Changed “Values Exported to the IMD File” to add texture pattern animation.
	2008/04/08	Changed format of Revision History. Changed cover sheet title and subtitle.
	2008/03/24	Bug fixes: • Revised the **Search Animation** button in the **Export Options** window to not search on node animations that will not be exported. Manual fixes: • Added Chapter 1 Supported Features. • Added a note in section 3.7.4 Instances regarding model instances that have skins configured. • Added support for plug-in version 1.6.0 2008/03/24. • Added “List of Supported Features.” • Changed note relating to model instances that have skin configured.
	2007/10/10	Added support for Maya 2008 (no support for features that use multiple bind poses). Manual fixes: Revised precautions for skinning.

Version	Revision Date	Description
		Added support for plug-in version 1.6.0 2007/10/10. Changed note about skinning.
	2007/09/10	Changed so that when creating a new project, a Nintendo NITRO System folder will not be created. Removed export functionality from **File → Export All / Export Selection**. Changed plug-in main menu name to NITRO-System. Changed the Export Options window so that it is displayed from the NITRO Export with Settings menu. Changed so that errors and warnings when exporting will be displayed in Script Editor as well. Added "=" and "`;`" to the characters that may not be used in the Output Options for exporting. Added support for plug-in version 1.6.0 2007/09/10.
	2007/05/18	Bug fixes: • Fixed a bug that caused the plug-in for Maya 8.5 not to function, depending on the Windows environment. • Added support for plug-in version 1.6.0 2007/05/18.
	2007/04/23	Additions/changes: • Added support for Maya 8.5. • Added support for when Driven keys and expressions are used with texture pattern animation. • Changed so that the material name is displayed in the window with NITRO Set Material Attribute plug-in. • Changed so that the material connected to the appropriate shading group is also selected with the NITRO Show Lighting plug-in and the NITRO Show Display Face plug-in. • Combined the NITRO Set Render Priority plug-in and the NITRO Show Render Priority plug-in and added a feature to set list format. Bug fixes: • Revised so that the current scene export option settings are not overwritten when a scene is imported or referenced. • Added support for texture file extension name numbers that begin with 0, for example "01," "001," or "0001," with texture pattern animations. • Revised so that a warning rather than an error is displayed when a texture file corresponding to a Frame Extension does not exist in texture pattern animations. However, if there are no texture files corresponding to a Frame Extension, an error is generated. • Added support for plug-in version 1.6.0 2007/04/23.
	2007/01/29	Additions/changes: • Removed support for Maya 5.0.1, Maya 6.0.1, and Maya 6.5. • Added the Search Animation button to the Output File Selection column in the Output Options window. • Added a feature to batch export so that an N3BE file specifies a portion of the output options (the N3BE file format was changed). Bug fixes: • Fixed a bug in which the volume min/max of the <`polygon`> in an IMD file was not

Version	Revision Date	Description
		being output correctly. • Added support for plug-in version 1.6.0 2007/01/29.
	2006/10/03	Additions/changes: • Added support for Maya 8.0. Bug fixes: • Fixed the problem of unnecessary output option configuration nodes sometimes accumulating in the scene. • Added support for plug-in version 1.6.0 2006/10/03.
	2006/04/17	Bug fixes: • Fixed the problem with the incorrect display of normal lines when a non-uniform scale value (X, Y, Z values are not the same) is configured in the node. • Fixed the problem of option settings no longer being able to save to scene once a scene with a saved setting of the output plug-in is imported. • Added support for plug-in version 1.6.0 2006/04/17.
	2005/11/28	Bug fixes: • Corrected the IMD file's `<box test>` to output correctly. • Added support for plug-in version 1.6.0 2005/11/28.
	2005/09/12	Added support for Maya 7.0. Added a caution to section 2.7.3 Vertex Color regarding Maya 7.0. Added support for plug-in version 1.6.0 2005/09/12.
	2005/06/20	Bug fixes: • Revised the software so that it outputs material color animations and texture SRT animations that use character sets. • Fixed problem with color becoming dark in some places when 4x4 texel-compressed textures were created from texture files with names ending in `cmp4` and without additional information. (The palette data may be larger than in the previous version in some cases.) • Added support for plug-in version 1.6.0 2005/06/20.
	2005/03/24	Bug fixes: • Scene containing reference file was not saved correctly because of influence from output plug-in. This problem was fixed. • Added support for plug-in version 1.6.0 2005/03/24.
	2005/02/28	Added support for Maya 6.5. Added support for plug-in version 1.6.0 2005/02/28.
	2005/02/02	Added support for the Intermediate File Format Version 1.6.0. Updated the following data creation plug-ins: • NITRO Set Material Attribute. Added the Texture Effect Matrix. Deleted the Tex Gen ST. Added support for plug-in version 1.6.0 2005/02/02.
1.5.0	2005/01/14	Added the batch export feature of intermediate files. Added support for plug-in version 1.5.0 2005/01/14.

Version	Revision Date	Description
	2004/12/13	Functions added/changed: • Added support for Intermediate File Format Version 1.5.0. • Added warning. Updated the following data creation plug-in: • NITRO Set Material Attribute: Added attribute that can be set. Added the following data creation plug-ins: • NITRO Set Render Priority: NITRO Show Render Priority: Revisions only in the manual. Added section 2.7.9 Polygon Rendering Priority. Revised the description of section 3.2.2 General Options, Unite and Combine Polygon. Revised the description of section 3.2.5 Animation Options, Interpolation. Added support for plug-in version 1.5.0 2004/12/13.
1.4.2	2004/10/25	Updated the following data creation plug-ins: • NITRO Set Material Attribute Added attribute that can be set. Changed the name Lighting to Light0. • NITRO Show Lighting Made changes to check four lights separately. Revised the description of section 2.7.3, Vertex Color. Revised the description of the intermediate file output plug-in option Interpolation. Added support for plug-in version 1.4.2 2004/10/25.
	2004/08/30	Functions added/changed: • Added support for Maya 6.0.1 • In the IMD file, the scale_compensate attribute of <node> is now exported only when the scaling_rule attribute of <model_info> is maya. • Added support for plug-in version 1.4.2 2004/08/30. Bug fixes: • Corrected the bug that prevented the texture that is connected to the top layer of a layered texture from being exported. • In NITRO, when an attempt is made to rename over 16 Characters, a warning is now generated when a texture file cannot be opened. • Added a note to the manual to note that the differences in the IMD file vertex data depends on the Maya version. • Added a note to the manual regarding texture pattern animation in Maya 6.0.1. • Added an explanation to the manual regarding envelopes in Nintendo NITRO-System.
1.4.1	2004/07/26	Added a warning when a name for export to an intermediate file exceeds 16 characters (section 3.6). Added “element name character string replace (NITRO-Replace Character)” and “rename element names that exceed 16 characters (NITRO Rename Over 16 Characters)” to the data creation plug-in (Table 4.1, section 4.9, section 4.10). Added warnings about the unit to be used for vertex coordinates and Translate values. (section 2.2). Added support for plug-in version 1.4.1 2004/07/26.
1.4.0	2004/06/30	Changed the naming convention for <polygon> element in the IMD file to “polygon +

Version	Revision Date	Description
		serial number.” Several errors and warnings for intermediate file output were added. Added support for plug-in version 1.4.0 2004/06/30.
1.3.0	2004/05/24	Added support for TGA and PIC files that contain additional Nintendo NITRO-System information (section 2.11.2). Added functionality to input and output the option settings for intermediate file output plug-ins as N3ES files (section 3.1). Added scaling rule to ICA file <node_anm_info>. Added support for plug-in version 1.3.0 2004/05/24.
1.2.0	2004/04/20	Corrected the version of the intermediate file that can be output from version 1 1.0 to version 1.2.0 in Chapter 1 Intermediate File Types
	2004/04/12	Functions added/changed: • Changed to allow output of intermediate files from NITRO Export in the Nintendo NITRO-System menu. • Added functionality to transfer data to the 3D Material Editor. • Added functionality to store intermediate file output plug-in option settings in a scene. Bug fixes: • In IMD file, changed <material> polygon mode from “toon hilight” to “toon highlight.” • Added support for plug-in version 1.2.0 2004/04/12.
1.1.1	2004/03/25	Bug fixes: • Made corrections to indicate that <polygon> with vertex color does not combine with <polygon> without vertex color when Compress Node is Unite and Combine Polygon or Compress Material is Compress. • Made corrections so that the Merge Useless Node process is the same as the manual algorithm. (In the previous version, when the root node for the exported IMD file was world_root, there were occasions when it changed to another node. Because the total number of nodes and the layer structure did not change, there is no need to re-export the ICA and IVA files.) • Made corrections so that pos_scale in <box_test> is not larger than necessary. • Added support for plug-in version 1.1.1 2004/03/25.
1.1.0	2004/03/01	Functions added/changed: • Added Use Primitive Strip to the Imd Options output options. • Added support for the A3I5 translucent texture. Bug fixes: • Made a correction so that for textures other than translucent textures, if the alpha of the texture file is 128 or larger the texel is considered to be opaque. • Made a correction so that in the color index format, TGA files with alphas are processed correctly. • The volume_min, volume_max, and volume_r attribute values included in the <node> element were being unnecessarily multiplied with (2 to the power of pos_scale). This has been corrected. • Added support for plug-in version 1.1.0 2004/03/01. • Changed restriction on the maximum number of characters in names (node names, material names, texture names and palette names) from 15 to 16 characters when using the Nintendo NITRO-System library.

Version	Revision Date	Description
		• Added section 2.12.5 Polygon Shapes Output to the IMD File. • Changed code in section “5.3 Texture Matrices in Maya.”
1.0.2	2004/02/12	Functions added/changed: • Made a change to stop the division into triangular polygons and output of quadrilateral polygons and concave quadrilateral polygons for which all vertices are not on the same plane. In Maya, all quadrilateral polygons will now be output as quadrilateral polygons. If this does not display properly on the production device, divide into appropriate polygons in Maya. • Support for changing the number of faces after skinning. Division into triangles is now possible after skinning. However, as before the number of vertices cannot be changed. Bug fixes: • Changed so that if the 4 x 4 texel compressed texture palette exceeds 32786 colors, the image quality drops and the palette is compressed to less than 32786 colors. • Added support for plug-in version 1.0.2. 2004/02/12.
1.0.1	2004/02/02	Functions added/changed: • Changed the valid digits of the Magnify and Tolerance output options to the 4th decimal place. Bug fixes: • Fixed a bug where Maya would crash if, when the Texture SRT Animation is set, another animation file is output without outputting the ita. • Added support for plug-in version 1.0.1. 2004/02/02.
1.0.0	2004/01/23	Initial version.

1 Supported Features

The following table shows the status of this plug-in's support for major Maya features. "O" indicates that the item is supported, and "X" indicates that it is not supported.

Table 1-1 Supported Features

Feature		Support Status	Notes
Modeling			
Hierarchy-related	Hierarchical structure output	O	
	Segment Scale Compensate	O	
Visibility	Visibility for transform nodes	O	Affects child nodes
	Visibility for mesh nodes	O	Does not affect child nodes
Polygon modeling	Vertex coordinates	O	
	Normals	O	
	Vertex colors	O	One per one vertex (vertex phase)
	UV values	O	One per one vertex (vertex phase)
NURBS modeling	NURBS surfaces	X	
	NURBS curves	X	
Subdivision surface modeling	Subdivision surfaces	X	
Materials	Color	O	Diffuse
	Transparency	O	Polygon alpha
	Ambient Color	O	
	Incandescence	O	Emission
	Diffuse	O	Scale to apply to Diffuse
	Specular Color	O	
Textures	UV mapping	O	
	Environment mapping	X	
	Projection mapping by a projection utility	X	UV projection mapping is possible
	Multi-texture	X	
	Wrap and Mirror	O	
	Translate Frame	O	

Feature		Support Status	Notes
	Rotate Frame	O	
	Repeat UV	O	
	Color Gain	O	Valid when a texture is connected to Color for a material
	Alpha Gain	O	Valid when a texture is connected to Transparency for a material
Animation			
General	Key frame animation	O	Bake and export
	Mute animation	O	
	Expressions	O	
	Nonlinear animation	O	
	Animation layer	O	
Character	IK animation	O	Bake and export
	Constrained animation	O	
	Path animation	O	
	Animation with dynamics	O	
Visibility	Visibility animation for transform nodes	O	Affects child nodes
	Visibility animation for mesh nodes	O	Does not affect child nodes
Material	Color animation	O	Material color animation
	Transparency animation	O	
	Ambient Color animation	O	
	Incandescence animation	O	
	Specular Color animation	O	
Texture	Translate Frame animation	O	Texture SRT animation
	Rotate Frame animation	O	
	Repeat UV animation	O	
	Frame Extension animation	O	Texture pattern animation
	Color Gain animation	O	Valid when a texture is connected to Color for a material
	Alpha Gain animation	O	Valid when a texture is connected to

Feature		Support Status	Notes
			Transparency for a material
Skinning	Smooth skinning animation	O	
	Rigid skinning animation	X	
	Muscle animation	X	
Deformer	Deformer animation	X	
Miscellaneous	Animations with keys in control points	X	
Camera		X	
Light		X	
Fog		X	
Particles		X	
Fluid effects		X	
Hair		X	
Cloth		X	
Fur		X	

2 Intermediate File Types

The following table shows the different types of intermediate files that can be output from this plug-in.

Table 2-1 Intermediate File Types

Extension	Type of Data	Description
.imd	Model data	Model information, including vertex, polygon, hierarchy, material and texture data
.ica	Character animation data	Animation information for controlling node matrices
.iva	Visibility animation data	Animation information for controlling node visibility (show / hide)
.ima	Material color animation data	Animation information for controlling material color
.itp	Texture pattern animation data	Animation information for substituting numerous textures
.ita	Texture SRT animation data	Animation information for controlling texture matrices

The version of the intermediate file output from this plug-in is 1.6.0.

3 Cautions When Creating Data for TWL and NITRO

3.1 Maya Version

This plug-in is for Maya 2008 Service Pack 1, Maya 2008 Extension 2, Maya 2009, Maya 2010, and Maya 2011 for 32-bit Windows. Operation is not guaranteed for any other version of Maya.

This plug-in operates whether Maya is used in an English language environment or a Japanese language environment.

However, the menus and dialogs for this plug-in are displayed in English even when used in a Japanese language environment (some portions use the Maya standard UI and are displayed in Japanese).

Maya menu names and attribute names in this manual are denoted as "display in Japanese language environment (display in English language environment)."

3.2 Preference Settings

In **Settings**, set **Up axis** to **Y**.

We recommend that in **Settings** you set **Linear** to **centimeter**.

Vertex coordinates and Translate values are always output to intermediate files and automatically converted to centimeters.

Note that if linear is not set to **centimeter**, the coordinate values and the **Translate** values in Maya will differ from those in the intermediate files.

In **Settings**, set **Angular** to **Degrees**.

3.3 Nodes

3.3.1 Root Node

Intermediate files always have a single root node.

If a number of root nodes have been created in Maya, the plug-in groups all of them together into a single node called *world_root* and adds this to the intermediate file that gets exported.

3.3.2 Nodes Not Exported

- *Transform* nodes and *joint* nodes are not exported when the Template attribute is selected and the Display Layer makes them invisible. (The exception is for influence objects.)
- When a node is not exported, none of its child nodes are exported either.
- *Transform* nodes that do not possess child nodes (such as *locator* and *empty group*) are not

exported.

- When the *mesh* node's Template attribute or Intermediate Object attribute is selected, the parent *transform* node is exported as a node without a *mesh* node (polygon data is not exported).
- Nodes are not exported if the Shading attribute of their Display Layer is cleared (always wireframe display).

Note: Nodes are always exported, regardless of the above conditions, if the node-culling disable flag is set by the NITRO Set No Cut Node plug-in.

3.3.3 Culling Nodes Not Needed for Model Display

In addition to the previously mentioned nodes that are not exported, you can specify to cull and not export nodes that are not required for model display. This is done using the Intermediate File Plug-in option Compress Node and selecting **Cull Useless Node** or **Merge Useless Node**.

Also, in situations where node hierarchy is not necessary such as for topographic data, you can select **Unite** or **Unite and Combine Polygon** in this **Compress Node** option to merge multiple nodes into a single node for export.

3.3.4 Node Names

Note: If you are using the Nintendo TWL-System library, node names should be no longer than 16 characters.

You need to be careful with node names because Maya will accept nodes with the same name as long as they have different parent nodes. If multiple nodes with the same name exist, the node that is shallowest in the hierarchy will be exported with its original name, and all other nodes will be exported with node names appended with a suffix of underscore number combinations (_1, _2, and so on). If you are using the Nintendo TWL-System library, be aware that the node name must be no larger than 16 characters, including this suffix.

If multiple nodes with the same name exist at the same depth in the hierarchy, the node that is exported with its original name will be the node that is displayed at the top when **Sort Order** is set to **Scene Hierarchy** in the **Outliner**.

3.4 Animation

3.4.1 Time Axis

All of the Intermediate file's animation data are exported in values of integer frames.

Be aware that when a key with a connection type of Stepped is played for a small number of frames, the timing may deviate from that in Maya during slow play on NITRO.

3.4.2 Values Exported to the IMD File

When an attribute is animated, the value that is exported to the IMD file is the **Start** frame as specified in the **Export Options**. For the **Translate**, **Rotate**, and **Scale** attributes of nodes that are affected by skinning, the value that is exported is the state of the bind pose. The value specified by the image name attribute in the file node is output for the texture pattern animation.

Be aware that the value that is exported is not the value for the current frame in Maya.

3.5 Transform Node

The following attributes of the *transform* node can be animated: **Translate**, **Rotate**, **Scale**, and **Visibility**.

Attributes that require special care are explained below.

- Pivot

  Set **Rotate Pivot** and **Scale Pivot** to the same value. If they are different, the volume of animation data could increase.

  When data is exported, **Scale Pivot** is treated as the origin in local coordinate space.

  If **Pivot** is not the same in every frame, data cannot be output correctly. Do not animate **Pivot**.

- Shear

  Set all **Shear** values to 0. Otherwise, data cannot be output correctly.

- Rotate Order

  Set **Rotate Order** to xyz. If it is set to anything else, the volume of animation data could increase.

- Rotate Axis

  Set all **Rotate Axis** values to 0. Otherwise, the volume of animation data could increase.

- Inherits Transform

  Select **Inherits Transform** to On. If cleared, data cannot be output correctly.

- Visibility

  If the transform node Visibility is cleared, all levels of nodes below that will not be displayed. If you want a non-display for the polygon models of only specific levels, clear the *mesh* node Visibility.

3.6 Joint Node

The following attributes of the *joint* node can be animated: **Translate**, **Rotate**, **Scale**, and **Visibility**.

Attributes that require special care are explained below.

- Rotate Order

  Set the **Rotate Order** to xyz. If it is set to anything else, the volume of animation data could increase.

- Rotate Axis

  Set all the **Rotate Axis** values to 0. Otherwise, the volume of animation data could increase.

- Inherits Transform

  Select **Inherits Transform**. If cleared, data cannot be output correctly.

- Joint Orient

  Set all the **Joint Orient** values to 0. Otherwise, the volume of animation data could increase.

- Segment Scale Compensate

  Do not change the **Segment Scale Compensate** value when exporting IMD files and ICA files.

3.7 Polygon Models

3.7.1 Polygon Shapes

NITRO cannot display certain polygon shapes, as listed below, correctly. In Maya, first divide these shapes into triangles and then export.

- Polygons whose vertices do not all lie in the same plane
- Concave polygons with internal angles of 180 degrees or larger
- Polygons with openings

As a result of deformations from skinning, polygons with these shapes must also be divided into triangles before output. In Maya, quadrilateral polygons can all be output as quadrilateral polygons. For all polygons with five or more sides, divide into triangles before outputting.

3.7.2 Setting the Display Face

The display face (front face, back face, or both faces) is set as a shading group attached to the polygons. To set the display face, select either a shading group (*shadingEngine* node) or a material node (*Lambert* node, for example), and then execute the NITRO Set Material Attribute plug-in. Note that the process is not reflected on Maya.

To check the display face, use the NITRO Show Display Face plug-in.

The *mesh* node's **Backface Culling** attribute and **Shading** → **Back Face Culling** are only set for display on Maya and are not reflected in the intermediate file.

3.7.3 Vertex Color

If you have created a model for which vertex color has been specified and you want to display the model without doing a light calculation, use the NITRO Set Material Attribute plug-in to turn off all of the lights that affect the shading group attached to the polygons. (By default, Light 0 is selected.)

When the light that is affected is selected by the NITRO Set Material Attribute plug-in, the model can be displayed using a combination of vertex color and light calculations. (However, it remains undecided

whether the Nintendo TWL-System library will support this feature.)

When multiple color sets are set, the colors of the current color set are output.

3.7.4 Instances

When using instancing, export is the same as when the instance is substantiated.

However, there is no support for model instances that have skin configured.

3.7.5 Limitations of Combine

If Combine is applied to a skinned object when history is enabled, the skinning animation will display on Maya, but it will not be output on NITRO. As a rule, you should delete history after applying Combine.

3.7.6 Control Point Animation Prohibition

Animations with control points that have been keyed cannot be exported.

3.7.7 Proxy Shapes

Deform animations (such as skinning) that use proxy shapes created with Subdivision Proxy cannot be exported.

3.7.8 Number of Valid *mesh* Nodes

Under each *transform* node there should be only one valid *mesh* node that has its Intermediate **Object** attribute cleared. Normally there is only one valid *mesh* node, but a number of them exist when **Edit Deformers** → **Display Intermediate Objects** has been executed for a model with skinning configured.

3.7.9 Polygon Rendering Priority

When multiple materials are associated with a single mesh model (equivalent to the `<node>` element in the IMD file) in a 3DCG tool, the multiple polygons that constitute the *mesh* model are divided into multiple polygon groups (equivalent to the `<polygon>` element in the IMD file). In such a case, you can control the order in which polygon groups are rendered with respect to each material in the 3DCG tool by setting the **rendering priority** (equivalent to the `priority` attribute of the `<display>` element in the IMD file). Rendering priority is used when transparent polygons are displayed overlapping each other or when decal polygons are displayed.

Note: The rendering order mentioned here is the order in which render commands are sent to the TWL or NITRO geometry engine. According to these hardware specifications, translucent polygons are always rendered after opaque polygons. Therefore, even if you set priority so that translucent polygons are rendered before opaque polygons, rendering on TWL or NITRO will always start from opaque polygons.

If you want to manage rendering order for a polygon group, order it by setting a rendering priority of at least 1 (the lower the value, the earlier it is rendered).

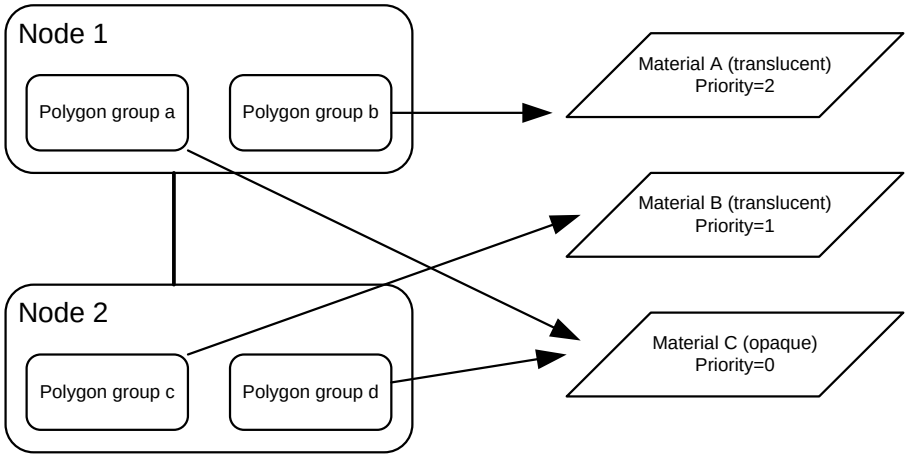
If there is no need to specify rendering order for a polygon group, set the rendering priority to **Don't care**. The rendering routine will determine the rendering timing for polygon groups that have a rendering priority of **Don't care**. If there are multiple polygon groups with the same rendering priority, the rendering routine will determine which polygon group to render from.

```
<rendering priority>
Don't care: No order specified (rendering timing is indeterminate).
        * Intermediate files handle Don't care as a render priority 0.
1 or more: Render in order from the one with the smallest value.
```

The rendering routine determines whether to control rendering order inside each node or in the overall model.

In the following example, rendering order changes according to whether control is done inside each node or for the model overall.

Figure 3-1 Rendering Priority Example



- Controlling rendering order in each node (equivalent to IMD file <node> element:

Uses a rendering routine that employs generic Push/Pop matrix calculation. When rendering in order from the parent node, it renders the polygon groups on a node basis. Therefore, the overall model sends render commands in the following order.

"(polygon group **a**) → **b** → (**a**) → (**d**) → **c** (**d**)" (either **a** or **d**)

- Controlling rendering order over the entire model (IMD file)

In the case of a rendering routine that first does the required matrix calculations and then collectively sends render commands, there is no need for the rendering order to depend on the parent/child relationship. Therefore, it is possible to render all of the polygon groups in the model according to the rendering priority. In a node configuration like that shown above, render commands would be sent as shown below.

"(polygon group **a**,**d**) → **c** → (**a**,**d**) → **b** → (**a**,**d**)" (either **a** or **d**)

Because the rendering priority for polygon groups a and d is **Don't care**, the rendering routine will determine when to render each.

Note: The rendering routine in the G3D library that is supplied with the TWL-System controls rendering order using the latter: overall model rendering order.

The NITRO Set Render Priority plug-in sets rendering priority. If you do not set rendering priorities for materials with the NITRO Set Render Priority plug-in, the materials will be handled as render priority=**Don't care**. Use the NITRO Show Render Priority plug-in to check the priorities that have been set.

- The material compression feature and polygon groups

  If two different materials within the same node have the same content and the same rendering priority, when you use the material compression feature in the intermediate file export plug-in, the materials and the polygon groups will each be combined into one.

  If two materials are the same but their rendering priorities are different, the materials will be combined into one, but the polygon groups will not because their rendering priorities are different.

  If different nodes contain the same materials and the same rendering priorities, the polygon group will be combined into one only if Unite and Combine Polygon is specified when culling nodes.

3.8 NURBS Models

NURBS surfaces and NURBS curves cannot be exported. NURBS surfaces should be converted into polygons for export using **NURBS to Polygons**.

When you convert an animated NURBS model into polygons, the polygon model will also be animated on Maya, but on NITRO it will be fixed in the state of the **Start** frame. You need to first delete the polygon model's history and then configure animation for it.

3.9 Subdivision Surfaces

Subdivision surfaces cannot be exported. Subdivision surfaces should be converted into polygons for export using **Subdivision to Polygon**.

3.10 Materials

3.10.1 Material Types and Attributes

Use a Lambert shader if you are not using **Specular**. Otherwise, use a Blinn, Phong, or Phong E shader. All three of these shaders output data the same way.

These attributes get reflected in the intermediate file that is exported:

- Color → diffuse

- Transparency (R value) → alpha
- Ambient Color → ambient
- Incandescence → emission
- Diffuse → Scale multiplied by diffuse
- Specular Color → specular

You can configure attributes for TWL and NITRO using the NITRO Set Material Attribute plug-in.

When a *file* node is attached to the **Color** attribute, the *file* node's **Color Gain** attribute gets reflected in `diffuse`, but the *file* node's **Color Offset** attribute does not. When a *layeredTexture* node is attached to the **Color** attribute, it is the **Color Gain** attribute of the *file* node attached to the top layer that gets reflected in `diffuse`.

For the transparency attribute, of the RGB values, only the R value is reflected in alpha in the intermediate file. The G and B values are ignored.

When a *file* node is attached to the **Transparency** attribute, the *file* node's **Alpha Gain** attribute gets reflected in `alpha`, but the *file* node's **Alpha Offset** attribute does not.

TWL and NITRO display the wireframe when the alpha value is 0. However, in TWL-System, when the alpha value is 0, no render command is sent for the polygon to which the material is allocated, and thus it is not displayed. You can set wireframe display with the NITRO **Set Material Attribute** plug-in.

3.10.2 Material Names

If you are using the Nintendo TWL-System library, material names should be no longer than 16 characters.

One material name is output to intermediate files for each shading group.

If one material name is linked to multiple shading groups, the name used by the first exported node will be exported, name unchanged. However, other materials will be exported with as a suffix underscore number combinations (such as "`_1`" or "`_2`") appended as a suffix after the material name.

When using the Nintendo TWL-System Library, make sure that material names, including the underscore and number, do not exceed 16 characters.

3.10.3 Material Color Animation

Animation can be set for the following attributes: **Color**, **Transparency** (R value), **Ambient Color**, **Incandescence**, and **Specular Color**. Do not set animation for **Diffuse**.

When a *file* node is attached to the **Color** attribute, the animation set in the *file* node's **Color Gain** attribute gets reflected in `diffuse`.

For the **Transparency** attribute, of the RGB values, only the animation that is set in the R value is reflected in the intermediate file. Animation set in the G and B values is ignored.

When a *file* node is attached to the **Transparency** attribute, the animation set in the *file* node's **Alpha**

Gain attribute gets reflected in `alpha`.

3.11 Textures

3.11.1 Texture Nodes

Only *file* nodes can be used as textures. Procedural textures like `checker` and `ramp` cannot be exported. Use **Convert to File Texture** to convert them to *file* node and export them. Connect the file node to the material's **Color** attribute. When a Layered Texture is used, only the texture of the *file* node that is attached to the top layer gets exported.

PSD File textures (*psdFileTex* nodes) cannot be exported.

3.11.2 Texture Files and Format

When you use TGA or PIC files that contain additional Nintendo TWL-System information (called additional information below), the additional information, such as the texture format, palette name, texel data, and palette data, that is recorded is reflected in the intermediate files.

Currently you can make TGA and PIC files that contain additional information with the Nintendo TWL-System Photoshop plug-ins. For information on using Nintendo TWL-System Photoshop plug-ins, see the *Nintendo TWL-System Photoshop Plug-in Manual*.

You can also use all texture file types supported by file nodes in files other than TGA (PIC) files that have additional information. However, in that case multiple textures will not be able to share palette data.

When a texture is exported, it is output using the same filename without the extension. Do not use double-byte characters or katakana characters in filenames.

The maximum height and width for texture images is 1024 texels. If the height or width is not of a size used by TWL and NITRO (8, 16, 32, 64, 128, 256, 512, 1024), then texel color is added to the right side or the bottom side in order to export the texture image in a size that is used by TWL and NITRO.

In the case of TGA and PIC files that have additional information, the texture format will be the one specified in the additional information.

In the case of texture files that do not contain additional information, the texture format is determined automatically based on the following rules. For textures other than translucent textures, alpha values (8-bit) of 128 or greater are considered to be opaque.

1. When the filename without extension ends in `_cmp2`
   → 4x4 texel compressed texture (use linear interpolation with maximum 2 palettes for every 4x4 texels)
2. When filename without extension ends in `_cmp4`
   → 4x4 texel compressed texture (maximum 4 palettes for every 4x4 texels)
3. When neither of above, translucent texels and 8 or fewer colors are used
   → A5I3 translucent texture

4. When none of above, translucent texels and 32 or fewer colors are used
   → A3I5 translucent texture
5. When none of the above, the format is determined based on the number of colors used.
   - Number of colors is 4 or less — 4-color palette texture
   - Number of colors is 16 or less — 16-color palette texture
   - Number of colors is 256 or less — 256-color palette texture
   - Number of colors is 257 or more — Direct color texture

With the exception of the direct color texture format, palette data is also exported.

In the case of TGA and PIC files that have additional information, the palette name will be the one that is specified in the additional information. If the palette name that is specified in the additional information is blank, `_pl` will be appended to the end of the filename (the extension remains unchanged).

In the case of texture files that do not have additional information, `_pl` will be appended to the end of the filename (the extension remains unchanged). If you want multiple textures to share palette data, when you make TGA or PIC files that have additional information, specify the same palette name. However, notice that if you give the same palette name to palettes that have different palette data, an error will occur when you output intermediate files.

Note: If you are using the TWL-System library, texture names (excluding the extension) and palette names must not exceed 16 characters (including non-alphanumeric characters).

3.11.3 Texture Attributes

The following *place2dTexture* node attributes get reflected in the Intermediate file: **Translate Frame**, **Rotate Frame**, **Mirror U**, **Mirror V**, **Wrap U**, **Wrap V**, and **Repeat UV**.

You should set the *place2dTexture* node's **Coverage** attribute to (1, 1), the **Offset** attribute to (0, 0), and the **Rotate UV** to (0).

When the **Wrap U** attribute or the **Mirror U** attribute is selected, texture images will not display properly if the image width is not equal to 8 or a greater power of 2. Similarly, when the **Wrap V** attribute or the **Mirror V** attribute is selected, texture images will not display properly if the image height is not equal to 8 or a greater power of 2.

The TWL and NITRO texture matrix becomes an identity matrix (without texture SRT) under this specific set of conditions: the **Translate Frame** attribute is (0,0), the **Rotate Frame** attribute is (0), and the **Repeat UV** attribute is (1,1). When the texture matrix is not an identity matrix, it will output as **TexCoord** even if **Tex Gen Mode** has been set to NONE by the NITRO Set Material Attribute plug-in.

3.11.4 UV Limitations

In Maya, textures are not displayed on surfaces without UV, but TWL and NITRO do not have this feature. Set the UV for all polygons to which textures are pasted.

The sizes of UV values must fulfill the following conditions:

–2048 <= U Value x Texture Width < 2048

–2048 <= V Value x Texture Height < 2048

When there are no default **Translate Frame**, **Rotate Frame**, or **Repeat UV** values, the resulting UV values applied to their attributes must fulfill the conditions indicated above. Be careful that **Repeat UV** and so on do not become too large.

3.11.5 Texture Pattern Animation

For texture pattern animation, set the *file* node's **Use Frame Extension** attribute to On and animate the **Frame Extension** attribute. Driven keys, expressions and animation layers can also be used. However, when using expressions and animation layers, the export texture list must be set with the NITRO Set Frame Extension List plug-in.

Note: With the Attribute Editor, the **Use Frame Extension** attribute is displayed as **Use Image Sequence**, and the **Frame Extension** attribute is displayed as **Image Number**.

When the **Use Image Sequence** (**Use Frame Extension**) attribute is selected, an expression is automatically connected to the **Image Number** (**Frame Extension**) attribute. When a key is set, delete the expression.

Set the **Frame Offset** attribute to 0.

The texture files are prepared with names that have a numeral in front of the extension corresponding to the **Frame Extension** (`name.1.tga`, `name.2.tga`, `name.3.tga`, and so on). Numbers starting with 0, such as `name.01.tga` or `name.001.tga`, are also supported (a maximum of four digits for numbers starting with 0). When both `name.1.tga` and `name.01.tga` exist, the texture of the one without the zero is exported. Make the width and height of each texture file the same.

Note: By default, the only textures exported in the IMD file are textures specified with a *file* node **Image Name** attribute and textures that correspond to keyed **Frame Extension** attributes.

For example, consider a texture with the Image Name `name.1.tga`. If this texture has only two set keys, one at the Start frame with Frame Extension = 1 and one at the End frame with Frame Extension = 4, only two texture files are exported to the `IMD` file: `name.1.tga and name.4.tga`. The files `name.2.tga and name.3.tga` are not exported even if linear tangents are specified for the animation curve. If no texture corresponding to the animation curve's Frame Extension is exported, the texture that most closely corresponds to the Frame Extension is used as the pattern animation data.

Note: You can forcibly export textures to the IMD file by specifying them using the NITRO Set Frame Extension List plug-in.

Thus, for example, if you set the Frame Extension range to "1-4" (1 through 4) for forced export, then all four can be exported with linear tangents specified for the animation curve, even though only two keys are set: one at the Start frame with Frame Extension = 1 and one at the End frame with Frame Extension = 4.

If multiple ITP files are being used with a single IMD file, you must use the NITRO Set Frame Extension List plug-in to make the necessary setting so that all required textures are exported in the IMD file.

3.11.6 Texture SRT Animation

For texture SRT animation, the **Repeat UV**, **Rotate Frame**, and **Translate Frame** attributes of the *place2dTexture* node are animated.

3.12 Skinning

3.12.1 Skinning Settings

Smooth skinning is supported. Rigid skinning is not supported.

Smooth skinning is set with: **Skin** → **Bind Skin** → **Smooth Bind**

Note: Do not perform the following types of operations after **Bind Skin**.

- Changing the number of vertices
- Changing **Rotate Order** or **Segment Scale Compensate** of a *joint* node that affects skinning

If you want to perform any of the above operations, first execute **Detach Skin**. When the number of vertices is changed, you can also use **Edit** → **Delete by Type** → **Non-Deformer History** to end up in an exportable state.

You can change the location of a vertex even after **Bind Skin**. However, the *tweak* node must be upstream from the *skinCluster* node. (The *tweak* node is usually created upstream from the *skinCluster* node. But in the window that opens from **Inputs** → **All Inputs** on the popup menu, the *tweak* node may be downstream from the *skinCluster* node in some situations, for example, when the order of the Deformers has changed.)

If skinning has been specified, the IMD file's translate, rotate, and scale are exported in the bind pose state.

If you specify skinning for a model that has a parent node, do not change the parent node's **Translate**, **Rotate**, and **Scale** values after **Bind Skin**. If you want to translate the entire model, do so by translating the highest-order skeleton.

Do not change the name of an original *mesh* node (~Orig) that has been created after **Bind Skin**.

The total skinning weight on a single vertex should be 1.0.

Note: Do not use multiple bind poses. Use a common bind pose when binding multiple objects to the same skeleton.

3.12.2 Delete Skinning

The History option for Detach Skin should usually be set to Delete History. If you set the option to Keep History you can maintain weight values, but when you detach, you will only disable the skinCluster node, not detach it completely.

Note: If you Detach with the option set to **Keep History**, do not perform any operations afterward that change the number of vertices.

Certain operations can be performed even after the option is set to **Keep History**. These include changing the bind pose.

3.12.3 Influence Objects

Influence objects are exported as *transform* nodes. (Polygons are not output.)

The **Add Influence** option **Use Geometry** should be set to Off.

3.12.4 Skinning and Projection Mapping

If you are going to perform projection mapping (**Planar Mapping**, **Cylindrical Mapping**, **Spherical Mapping**, **Automatic Mapping**) after **Bind Skin**, you should set the projecting mapping option **Insert Before Deformers** to On.

3.12.5 Polygon Shapes Output to the IMD File

When setting up skinning, the polygons for the bind pose shape are output to the IMD file.

However, when using the **Unite Compress Node** or **Unite** and **Combine** options of the Intermediate File Output Plug-in, the shape of the polygon in the start frame is output. If these functions are used, the same shapes as in Maya can be used with the standalone IMD file. (Since there will be one node, character animation and visibility animation is not possible).

3.12.6 Envelopes in Nintendo TWL-System

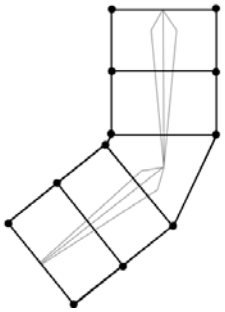
The deformation process called “skinning” in Maya is called “envelope” in the Nintendo TWL-System.

In the Nintendo TWL-System, there are two types of envelopes: fully weighted and weighted.

- Fully weighted envelopes

  A fully weighted envelope is an envelope in which each vertex is fully weighted toward a single node. If all the vertices in a polygon mesh use fully weighted envelopes, the model is called a fully weighted envelope model.

Figure 3-2 Example of a Fully Weighted Envelope Model

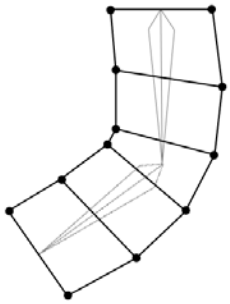


- Weighted envelope

  A weighted envelope is an envelope in which each vertex is associated with two or more nodes and the total weighting toward these nodes is 100%. If at least one vertex of a polygon mesh is a weighted envelope vertex, then the model is called a weighted envelope model.

  A weighted envelope model allows you to create smooth curved surfaces by, for example, increasing the number of nodes that are associated with each vertex or increasing the variety of weighting values. However, this increase will result in a greater amount of calculation during rendering.

Figure 3-3 Example of a Weighted Envelope Model



Note: For information on support for weighted envelope models in the G3D library provided by the Nintendo TWL-System, see the *G3D Library Release Notes*.

3.13 Visibility Animation

There are two ways to configure visibility animation: by animating the **Visibility** attribute of the *transform* node and by animating the Visibility attribute of the *mesh* node.

- When the *transform* node's Visibility attribute is animated, the Visibility On/Off state affects all nodes lower in the hierarchy.
- When the *mesh* node's Visibility attribute is animated, the Visibility On/Off state only affects polygons in the same level of the hierarchy. In order to set keys for the *mesh* node's Visibility attribute, select *mesh* node, open Channel Control, and then set Visibility to Keyable.

The visibility animation settings are configured in regard to nodes. So if you have set the Compress Node intermediate file export plug-in option to either **Cull Useless Node** or **Merge Useless Node**, be sure not to delete nodes for which visibility animation has been set. (You can use the NITRO Set No Cut Node plug-in to prevent deletion of specified nodes.) When exporting visibility animation, do not set **Compress Node** to either **Unite** or **Unite and Combine Polygon**.

3.14 Billboard

Billboard is set for the *transform* node using the NITRO Set Billboard plug-in. However, this is not reflected on the Maya screen. You can check the billboard using the NITRO Show Billboard plug-in.

4 Intermediate File Export Plug-In

4.1 How to Use

To only export specified nodes (including nodes at lower hierarchical levels), select the node that you want to output. If you are exporting the entire scene, you do not need to select nodes.

To display the **NITRO Export Option** window, execute **NITRO-System → NITRO Export with Settings.**

To output an intermediate file, set the appropriate options, and then click either **Export** or **Apply**. Unlike **Export**, clicking **Apply** does not close the option window after output. The option settings at the time of output will be recorded in Maya as the current options. You can also save the option settings in a scene, or input and output them as an N3ES (NITRO 3D Export Settings) file. For details, see section 4.3 Managing Option Settings.

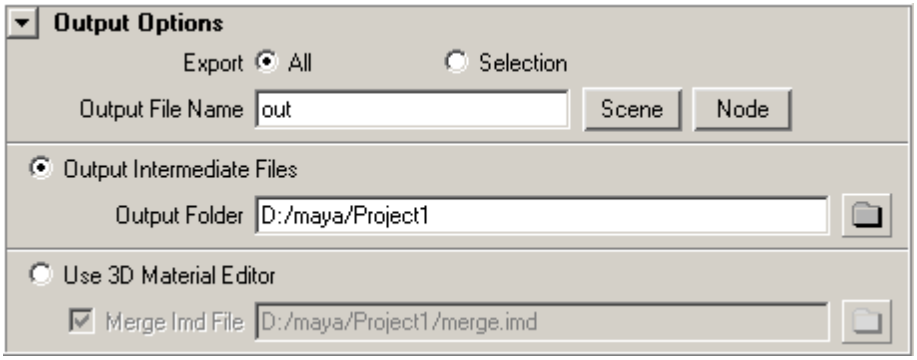
To output with current options without displaying the option window, execute **NITRO-System → NITRO Export.**

4.2 Options

4.2.1 Output Options

These options relate to methods of outputting intermediate files.

Figure 4-1 Output Options



- Export

  To output the entire scene, click **All**. To only output the selected node and those below it, click **Selection**.

  An exception is when you select a model that is set for skinning and click **Selection**. In that case, nodes that are influenced by the skinning, and nodes at a hierarchical level higher than the model that is set for skinning, will also be output.

- Output File Name

  This sets the intermediate filename (but not the extension). Do not use full-width or half-width kana characters, = (equals sign) or ; (semicolon).

  If you click **Scene**, the current scene name will be set. If you click **Node**, the selected node name (the node at the highest hierarchical level) will be set. If you click **Node** without selecting a node, the name of the first node (in alphabetical order) will be set.

- Output Intermediate Files

  Click to output intermediate files to a specified folder.

  In the **Output Folder** box specify the folder to which you want to output intermediate files**.** Do not use full-width or half-width kana characters, = (equals sign) or ; (semicolon).

- Use 3D Material Editor

  Click to transfer intermediate file data to the 3D Material Editor. You cannot select both **Output Intermediate Files** and **Use 3D Material Editor** at the same time.

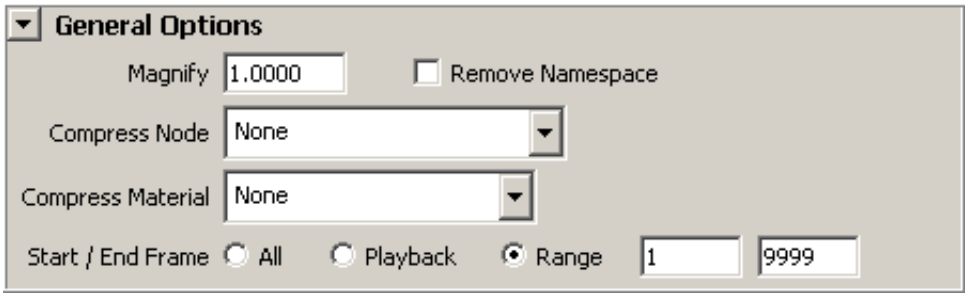
  If you select the **Merge Imd File** check box and specify the IMD file path name, after the data has been transferred, the 3D Material Editor will automatically merge-load the specified IMD file. Do not use full-width or half-width kana characters, = (equals sign) or ; (semicolon) in the IMD file path name.

  For information on using the 3D Material Editor, see the *Nintendo TWL-System 3D Material Editor* manual.

4.2.2 General Options

The following general options apply to all Intermediate files.

Figure 4-2 General Options



- Magnify

  The power to which to multiply the model's vertex coordinates and **Translate** value.

- Remove Namespace

  When selected, the namespace portion for the node name and material name are deleted for export. When cleared, the namespace portion is exported.

  For example, when the node name on Maya is “model:final:head,” the name is exported as “head” when this option is selected and as “model:final:head” when it is cleared.

  If a name is duplicated as a result of deleting the namespace portion, the name is changed with the same restrictions as when multiple nodes (materials) with the same name exist.

- Compress Node

  This specifies the node-culling mode. By reducing the number of nodes you ease the processing load for matrix calculations and use less memory.

  The culling involves the nodes exported to the Intermediate file and does not change the data on Maya.

Table 4-1 Node Culling Modes

Mode	Explanation
None	Nodes are not culled. The hierarchical structure created on Maya is exported as is.
Cull Useless Node	Data are output after culling nodes that are not needed for model display. Effective for models that use skinning.
Merge Useless Node	In addition to the Cull Useless Node process, nodes that can compose a matrix are so composed for export. This extra process usually results in even fewer nodes than with just Cull Useless Node, but the following restriction applies to the Scale value: For nodes with children you must configure a non-uniform Scale (that is, one where the Scale x, y, z values are not the same). The model may not display properly if you cull nodes that do not comply with this restriction and their children nodes. If the Scale value is animated, all frames must conform to the above restriction.
Unite	Nodes are combined into a singe node and all polygons are output in global coordinates. (The node takes the name `world_root`**)** Polygons that belonged to separate nodes (the IMD file's <`polygon`> elements) are output separately even if the material is the same. Do not select this mode when you are using character animation or visibility animation.
Unite and Combine Polygon	In addition to the Unite process, polygons with the same material are combined. However, polygons with vertex color will not be combined with polygons with no vertex color, and polygons with different render priorities will not be combined even if the material is the same. This boosts display speed over “Unite” but you lose the capacity for detailed clipping. Do not select this mode when you are using character animation or visibility animation.

Note: If the node-culling disable flag is set for a node by the NITRO Set No Cut Node plug-in, then it will not be culled even if you have selected **Cull Useless Node** or **Merge Useless Node**.

For details about the **Cull Useless Node** and **Merge Useless Node** algorithms, see section 6.2 Node-Culling Algorithms.

- Compress Material

  Sets the material compression. **None** specifies no compression.

  Compress Same Material specifies that all materials which have the same attributes are compressed for export as a single material. Note that no compression takes place on materials configured for material color animation, texture pattern animation, and texture SRT animation.

Note: Using the NITRO Set Material Attribute plug-in, if **Compress** has been set to **Don't compress,** materials will not be compressed, even if **Compress Same Material** is specified.

- Start / End Frame

  The range of animation (start frame to end frame) to export.

  If **All** is selected, the entire range of animation in Maya (Animation Start / End) will be output.

  If **Playback** is selected, the playback range of animation in Maya (Playback Start / End) will be output.

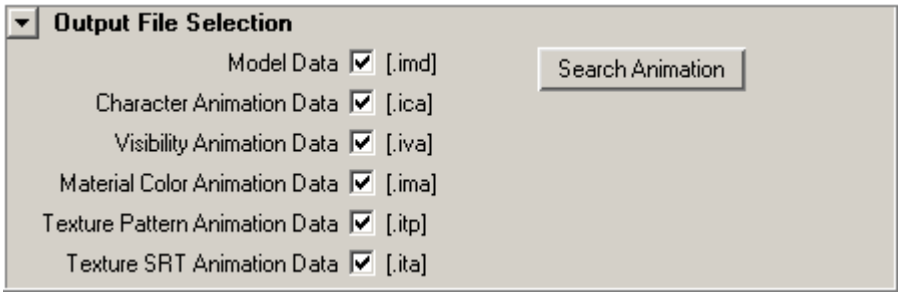
  If **Range** is selected, the start and end frames can be specified via input of a numeric value. However, if the input value for the start frame is smaller than the Animation Start frame in Maya, the Animation Start frame will become the start frame. If the input value for the end frame is larger than the Animation End in Maya, the Animation End frame will become the end frame.

  If an attribute is animated, the value in the start frame will be output to the IMD file.

4.2.3 Output File Selection

Following are the options for specifying the type of intermediate file to output.

Figure 4-3 Output File Selection



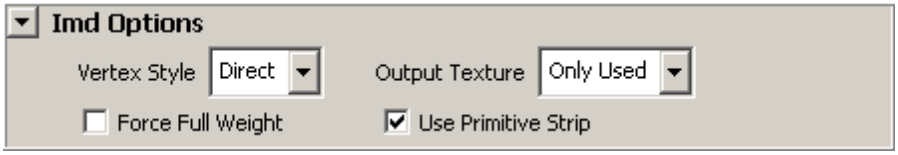
If **Search Animation** is clicked, it will turn on only the intermediate file corresponding to the animation configured to the output target. When that happens, if an animation curve has been connected, the

animation will be considered to be configured even if there are no value changes. When the Export setting is **Selection**, be sure to click **Search Animation** after selecting the nodes.

4.2.4 IMD Options

The following are the options for IMD files.

Figure 4-4 Options for IMD Files



- Vertex Style

  Sets the export format for vertex coordinates and vertex color.

  Direct specifies direct output of vertex coordinates and vertex color values to the `<polygon>` element.

  Index specifies that the matrix of vertex coordinate values is output to the `<vtx_pos_data>` element and the matrix of vertex color values is output to the `<vtx_color_data>` element. The index values for all these matrices are output to the `<polygon>` element.

  The Index format is an extended format included for a future time when shape animation and vertex color animation can be supported. Normally you should use the Direct format, which is optimized for the TWL and NITRO geometry engines.

- Output Texture

  This specifies the conditions for exporting textures to the IMD file.

  Only Used specifies output of only those textures that are used in the model.

  All specifies output of all textures corresponding to the *file* nodes in the scene.

- Force Full Weight

  When this is selected, the node with the largest weight value is forcibly exported with full weight (100% weight) even if the skinned model's vertex weight value is distributed among numerous nodes. If multiple nodes have the same weight value, then the node that gets exported with full weight is the node with the smallest index when the Compress Node option is **None**. When the **Force Full Weight** check box is cleared, the weight value for each node is exported as is.

- Use Primitive Strip

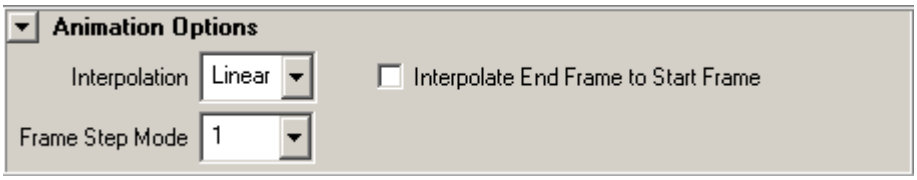
  When selected, polygon strips are not used, and polygons are output either as triangular or quadrilateral polygons.

When selected, use triangular and quadrilateral polygon strips if possible, and output as triangular or quadrilateral polygons only the polygons that could not be made into strips. Selecting this option allows for a reduction in the number of processing vertices.

4.2.5 Animation Options

The following options apply to animation in general.

Figure 4-5 Animation Options



- Interpolation

  Specifies a method of animation playback by obtaining a value in decimal frames.

  To round up decimal frames to handle as integer frames for the playback, use **Frame** without discarding the decimal frames. To use linear interpolation for the values in decimal frames, specify **Linear**.

  Notes:

  - With the current TWL-System G3D library, it is possible to play in-between frames by setting interpolation to Linear. However, compared to Frame, linear interpolation will slightly increase the CPU calculation process.
  - If animation data does not require setting interpolation to Linear, be careful to output with interpolation set to frame to lighten the above-mentioned CPU processing load.
  - As of October 2008, the G3D library only supports Linear for ICA files. IMA files and ITA files will play as Frame, even if Linear is specified. For information on the status of support for Linear with IMA and ITA files, see the G3D library release notes.

- Interpolate End Frame to Start Frame

  When this check box is selected, interpolation is conducted between the End frame and the Start frame when animation is played.

  When cleared, the animation stops in the End frame state after the End frame.

- Frame Step Mode

  Sets the extent of animation data culling.

  1 Do not cull; output the data from all frames.

  2 Output the data from every other frame (this reduces data volume to ½ original).

  4 Output the data from every fourth frame (this reduces data volume to ¼ original).

Auto Output the data after determining the optimal amount of culling automatically for each animation curve based on the settings of the **Tolerance** options.

Table 4-2 Frames Output According to Frame Step Mode

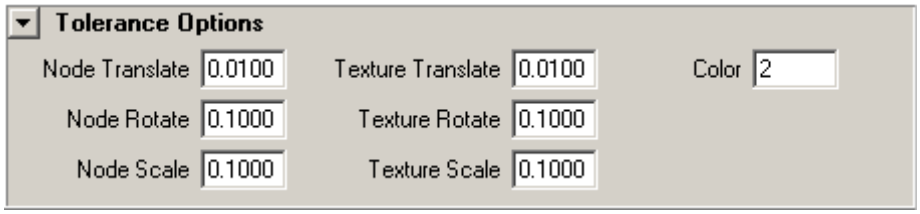
Frame Step Mode	Index of Frames That Get Output															
1	0	1	2	3	4	5	6	7	8	9	0	11	12	13	14	15
2	0		2		4		6		8		10		12		14	15
4	0				4				8				12	13	14	15

When the cull number does not divide evenly (total number of frames - 1), all remainder data is output.

4.2.6 Tolerance Options

These settings define the amount of error to tolerate when optimizing the animation data.

Figure 4-6 Tolerance Options



If the largest differences in values between the Start frame and the various frames fall within the specified tolerable levels set here, then the animation values are considered to be uniform and only the Start frame value is exported.

These specified tolerances are also used as the yardstick for the amount of error to tolerate when the **Animation** option **Frame Step Mode** is set to **Auto** and the decision on how much animation data to cull is determined automatically. The determined amount of culling is such that the maximum errors from linear interpolation fall within the tolerable values set here. The smaller the tolerable error, the higher the precision of the animation, but because there is less culling there is also a greater volume of data.

- Node Translate, Node Rotate, Node Scale

  The tolerable error for the **Translate**, **Rotate**, and **Scale** values of character animation.

  Node Rotate is expressed in units of degrees.

  Node Translate sets the tolerable error for the value after being multiplied by **Magnify**. If the Linear unit is not set to centimeters, this is will be the error tolerance of a value that is first converted to centimeters and then **Magnified**.

- Texture Translate, Texture Rotate, Texture Scale

  The tolerable error for the **Translate**, **Rotate**, and **Scale** values of texture SRT animation.

  Texture Rotate is expressed in units of degrees.

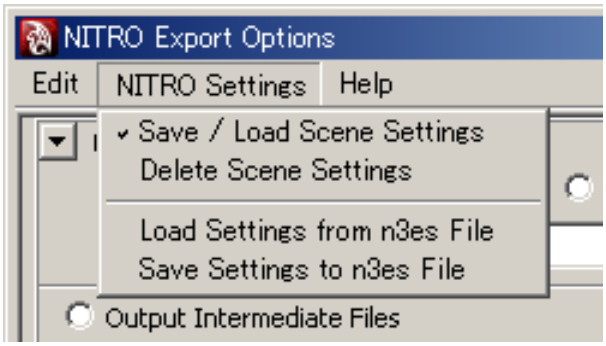
- Color

  The tolerable error for the `diffuse`, `ambient`, `specular`, `emission`, and `polygon_alpha` values of material color animation.

4.3 Managing Option Settings

To save option settings in a scene, or input and output them as an N3ES (NITRO 3D Export Settings) file, use the items on the **NITRO Settings** menu in the **NITRO Export Options** dialog box.

Figure 4-7 NITRO Settings Menu



4.3.1 Saving Option Settings in a Scene

When you save a scene and **Save / Load Scene Settings** is selected (default), the options that were set the last time you output intermediate files will be saved in the scene data. (Internally, they will be saved in a script node named `nnsExpDialog_Setting1`.) These same options will be loaded when you open the scene (select the **Open Scene** option **Execute Script Nodes**). However, if the option settings are not saved in the scene data, the current option settings will remain.

When **Save / Load Scene Settings** is not selected, the options that were set the last time you output intermediate files will not be saved in the scene data. Also, the option settings will not be loaded when you open the scene data.

If you click **Delete Scene Settings**, the script node that holds the option settings will be deleted.

4.3.2 Inputting and Outputting Option Settings as an N3ES File

To output option settings to an N3ES file, click **Save Settings to N3ES File**. You can specify an output filename in the file selection window. If the output file's extension is not `.n3es`, N3ES will be added automatically.

To input option settings from an N3ES file, click **Load Settings from n3es File**. You can specify an input filename in the file selection window. If **Save / Load Scene Settings** on the **NITRO Settings** menu is selected, the script node that saves option settings during a scene will also be updated.

4.4 Errors During Export

When errors occur during export operations, error messages are displayed in the **Output** window and in Script Editor. The following is an alphabetical list of errors that warrant special attention.

- 3D Material Editor is not found

  The 3D Material Editor has not been properly installed. If environment variables are not set properly, fix them and then restart Maya.

- Can’t open file

  The file does not exist, cannot be opened, or cannot be overwritten.

- Frame extension list is not set for animation layer

  This occurs when the texture list exported by the NITRO Set Frame Extension List plug-in is not configured when using the animation layer with texture pattern animation. If using an animation layer, always set the texture list exported by the NITRO Set Frame Extension List plug-in.

- Frame extension list is not set for expression

  This occurs when expressions are used with texture pattern animation and an export texture list is not set with the NITRO Set Frame Extension List plug-in. When using expressions, always set the export texture list with the NITRO Set Frame Extension List.

- Influence object is not outputted

  Nodes affected by skinning are not exported. This error occurs when the **Template** attribute of a node affected by skinning is selected, or when a node is made invisible by the Display Layer.

- Multiple bind poses are not supported

  Multiple bind poses are being used. Detach the skin and re-bind each object with a common bind pose.

- No effective node

  This occurs when there is not even one valid node exported. If you only want to output `locator`, use the NITRO Set No Cut Node plug-in to set the cut-disable flag.

- No shading group

  There is no shading group attached to the model. You must assign a material.

- Texture palette data is not identical

  More than one texture is using palettes that have the same name, and the palette data in the palettes is different. When creating TGA and PIC files that have additional data, if the palette data content differs, specify different palette names.

- Vertex number is different from original mesh

  As a result of performing operations that change the number of vertices, the number of vertices for the model for which skinning was configured differs from the number of vertices in the original mesh node (Orig). Either detach, delete the history, and then rebind, or execute **Edit** → **Delete by Type** → **Non-Deformer History**.

- Wrong weighted vertices exist

  There are vertices with a total weight that is not 1.0. Adjust the weight value. If the **Normalize Weights** attribute of the *skinCluster* node is selected, the total weight will automatically adjust to 1.0 when weights change.

4.5 Warnings During Export

Warnings are displayed in the **Output** window and in Script Editor when they occur during export operations. Following is an alphabetical list of warnings that require special attention.

- Can't get UV

  No UV coordinates have been set for a texture-mapped face. UV coordinates for each of the face's vertices will be exported as U=0, V=0.

- Frame offset is not zero

  There is a frame with a file node **Frame Offset** attribute that is non-zero. Note that the texture pattern animation will not be exported correctly.

- Length of name over 16 characters

  A name to be exported to an intermediate file (node name, material name, texture image name, or texture palette name) exceeds 16 characters. Problems may occur when these files use the Nintendo TWL-System Library.

- Material name changed

  A material name that will be exported to an intermediate file has been changed because there are duplicate material names, for example, when one material is linked to multiple shading groups.

- Mtx_prim_size of <polygon> is over 1

  The value of an IMD file `<polygon> mtx_prim_size` exceeds 1. This is generated by an envelope model in which more than 31 matrices are required to render a polygon group.

Note: As of October 2008, it is not possible to display this type of IMD file with the Nintendo TWL-System G3D library (binary conversion is not possible). For information on the latest G3D libraries, see the *G3D Library Resource List*.

- No shader

  There is no material attached to the shading group. When this occurs, the plug-in automatically adds the default material to the Intermediate file for export.

- Node named changed

  Several nodes with the same name exist, and hence the node name output to the Intermediate file has changed.

- Procedural texture is ignored

  Procedural textures like `checker` and `ramp` are not exported as is (they are ignored). Use **Convert to File Texture** to convert these procedural textures into files and export them.

- PSD file texture is ignored

  PSD file textures (*psdFileTex* nodes) are not exported. The PSD file textures will be ignored.

- Same named texture file exists

  There are two or more texture files that have the same name, but they are in different folders or have differing file extensions. If two texture files have the same name, they will be treated as different files if they are in different folders or have differing file extensions. Note that this will output more than one `<tex_image>` with the same name.

- Shear is not zero

  The transform node's Shear attribute has a non-zero value so it cannot be exported correctly. If this warning displays, execute **Freeze Transformations**, or set all Shear attribute values to 0.

- Size of texture is wrong

  The width or height of the texture is not usable by TWL or NITRO. (It should be 8, 16, 32, 64, 128, 256, 512, or 1024.) The plug-in will automatically add the texel color to the right or bottom edge of the image so that it becomes an acceptable size for TWL and NITRO.

- Texture file for texture pattern animation is not found

  There is no texture file corresponding to the **Frame Extension** with texture pattern animation. From the exported texture files, the one with a **Frame Extension** value that is the closest is used as the pattern animation data.

- Texture height must be power of 2 for repeat/flip

  If the *place2dTexture* node's **Wrap V** attribute or **Mirror V** attribute is selected, the texture will not display properly if the image height is not equal to 8 or a greater power of 2 (8, 16, 32, 64, 128, 256, 512, 1024). If this message occurs, change the texture's height, or clear the **Wrap V** and **Mirror V** check boxes.

- Texture pattern animation invalid frame extension

  The texture that corresponds to the **Frame Extension** value in a specific frame is not output.

  Of the textures that are going to be output, the one closest to the **Frame Extension** value is output to the `itp` file.

  To avoid this warning, correct the animation curve or specify the texture to be forcibly output by the NITRO Set Frame Extension List plug-in.

- Texture width must be power of 2 for repeat/flip

  If the *place2dTexture* node's **Wrap U** attribute or **Mirror U** attribute is selected, the texture will not display properly if the image width is not equal to 8 or a greater power of 2 (8, 16, 32, 64, 128, 256, 512, 1024). If this message occurs, change the texture's width, or clear the **Wrap U** and **Mirror U** check boxes.

- The number of matrix for displaying this model is over 31

  More than 31 matrices are required to render this model. The number that follows the warning message is the current number of matrices.

- Total polygon size over

  The total number of polygons has exceeded the size of the TWL or NITRO polygon list RAM. This means you will not be able to display all of the polygons at the same time. The maximum number of polygons is 2048 triangles or 1706 quadrangles.

  If triangles and quadrangles are mixed, the following condition must be met:

  The number of triangles × 20 + the number of quadrangles × 24 ≤ 40960.

- Total vertex size over

  The total number of Vertex commands has exceeded the size of the TWL or NITRO vertex RAM (6144 vertices). This means you will not be able to display all of the polygons at the same time.

- UV range over

  The texture coordinate (UV value) exceeds the limitations of TWL and NITRO. Change the UV value so that it matches the conditions explained in 3.11.4 UV Limitations.

- Zero normal exist

  There is a normal vector whose length is 0. This means that lighting will not perform correctly.

4.6 Batch Exporting Intermediate Files

4.6.1 Batch Export

Besides the usual method of outputting intermediate files by opening a scene in Maya, intermediate files can be output to one or more scenes at once by starting up Maya in a mode that does not display a user interface.

This is called *batch export*.

4.6.2 How to Run a Batch Export

1. Prepare the N3BE file.

   The N3BE file is a file that specifies which intermediate file to output to which scene under what conditions. Prepare a file according to the separate document `NITRO_n3beFileFormat.pdf`.

2. Run a batch export using `NNS_Batch_Export_Maya**.bat` and `N3BE` files in `NNS_Maya**_Plugin` folder. (`**` is a number corresponding to the version of Maya.)

   Note: `NNS_Batch_Export_Maya**.bat` needs to be corrected according to `Setup_MayaPlugin.pdf`.

   At the command prompt, enter the following to run the batch export:

   ```
   NNS_Batch_Export_Maya**.bat  sample.n3be  [Enter]
   ```

   You can also run the batch export by dragging and dropping an N3BE file to `NNS_Batch_Export_Maya**.bat`.

   If the batch export completes properly, the following message will appear at the end:

   ```
   Batch Export is finished. Total [number of scenes] scenes.
   ```

   If there is a problem with the description of the N3BE file, an error message appears and the process is aborted (terminated) at that point.

   Major error messages are shown below.

   ```
   Error: "***" is not specified.
   Error: "***" is wrong.
   ```

   If an error occurs with the output of the intermediate file while the batch export is running, the following error message appears:

   ```
   Error: Failed to export
   ```

   The process is aborted (terminated) at that point.

   A description of errors and warnings for the output of intermediate files is output to the log file specified with the N3BE file.

4.6.3 Supplemental Remarks on Batch Export

To run a batch export, an N3ES file is required.

To specify which options to use to output intermediate files, specify an N3ES file in the N3BE file. Even if the output option setting is saved in the scene file, the batch export will not reference it and will always use the setting in the N3ES file.

5 Data Creation Plug-Ins

The Data Creation plug-ins assist in the creation of data for TWL and NITRO.

These plug-ins are primarily used on Maya nodes to configure and check the attributes for use with TWL and NITRO. All components of this Data Creation plug-in can be executed from the NITRO-System menu.

The following table lists data creation plug-ins.

Table 5-1 Data Creation Plug-Ins

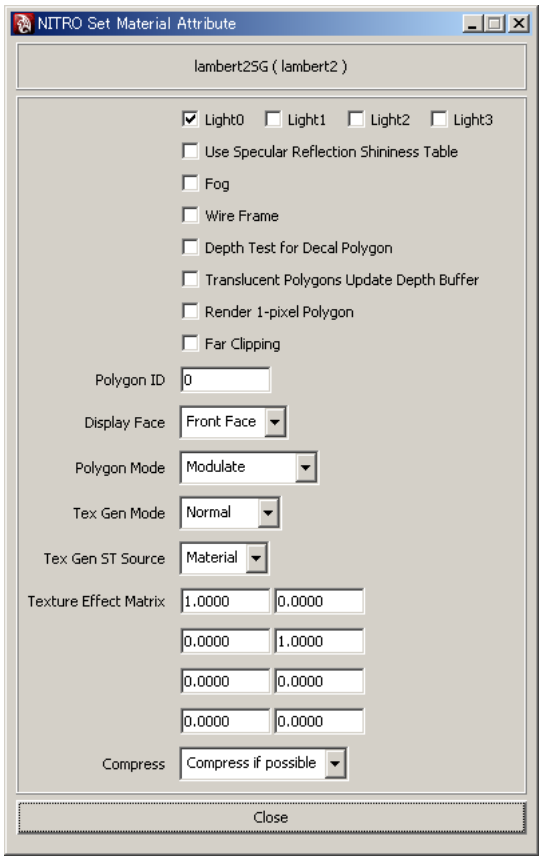
Plug-In Name	Description
NITRO Set Material Attribute	Sets TWL and NITRO attributes in a material
NITRO Show Lighting	Checks lighting settings
NITRO Show Display Face	Checks polygon display face settings
NITRO Set Render Priority	Sets polygon rendering priority
NITRO Set Billboard	Sets the billboard
NITRO Show Billboard	Checks billboard settings
NITRO Set No Cut Node	Sets the flag that disables node cutting
NITRO Show No Cut Node	Checks the setting of the flag that disables node cutting
NITRO Set Frame Extension List	Sets the texture to be output by texture pattern animation
NITRO Replace Character	Searches and replaces element name character strings
NITRO Rename Over 16 Characters	Searches for and renames element names that exceed 16 characters

5.1 Setting Material Attributes (NITRO Set Material Attribute)

The TWL and NITRO attributes for polygons and such things as the texture coordinates transform mode are exported to the Intermediate file in the form of material attributes. These material attributes for TWL and NITRO are configured for individual shading groups using the NITRO Set Material Attribute plug-in. Note that these settings are not reflected on the Maya screen.

Execute **NITRO-System → NITRO Set Material Attribute** to display the window.

Figure 5-1 NITRO Set Material Attribute Window



When a shading group (*shadingEngine* node) or a material node (*Lambert* node, etc.) is selected (multiple nodes can be selected), the selected node's current settings are displayed. If you select multiple nodes, the window displays the settings of the first node that was selected.

Operate the various items in the window to change different attributes. If you select multiple nodes, you can change them all at once (reflected only in the changed items).

You can close this window and select a different node to configure the attributes of that node.

- Light0, Light1, Light2, Light3

  Specifies the light that is affected when it is displayed on TWL and NITRO. It is not reflected on the Maya display. The default is that the Light0 check box is selected, and the Light1, Light2, and Light3 check boxes are cleared.
  When any of these light options are selected, the normal data of the polygon that belongs to the shading group is output. When all of the light options are not selected, the normal data is not output.

- Use Specular Reflection Shininess Table

  Specifies whether to use the Specular Reflection Shininess Table when calculating specular components. The default is cleared.

When the Light0, Light1, Light2, and Light3 check boxes are all not selected, this attribute cannot be changed, and in the intermediate file it is output as Off.

- Fog

  Specifies whether to apply fog. The default is cleared.

- Wire Frame

  This check box toggles the wireframe display on or off. The default is cleared.

- Depth Test for Decal Polygons

  This specifies whether to do a depth test for decal polygons. When selected, there will be a depth test for decal polygons. When the depth value of a fragment is the same as the depth in the depth buffer, it will be rendered. When this check box is cleared, there will be a normal polygon depth test: when the depth of a fragment is less than the depth in the depth buffer it will be rendered. The default is cleared.

  Render decal polygons after the polygons on which they will be mapped. You can control polygon group rendering order with the NITRO Set Render Priority plug-in.

- Translucent Polygons Update Depth Buffer

  This specifies whether to update the depth buffer when rendering translucent polygons. The default is cleared.

- Render 1-pixel Polygon

  This specifies whether to render one-pixel (dot) polygons. The default is cleared.

- Far Clipping

  This specifies whether to do FAR clipping. When selected, polygons that intersect the far plane will be clipped. When cleared, polygons that intersect the far plane will be deleted. The default is cleared.

- Polygon ID

  Sets the polygon ID. Specify a value between 0 and 63. The default is 0.

- Display Face

  This specifies the polygon's display face.

  Front Face = Display the front face only
  Back Face = Display the back face only
  Both Faces = Display both faces

  The default is **Front Face**.

- Polygon Mode

  Sets the polygon mode.

  Modulate = Modulation mode

Decal = Decal mode
Toon/Highlight = Toon/highlight shading
Shadow = Shadow polygons

The default is **Modulate**.

- Tex Gen Mode

  Sets the texture coordinates transform mode.

  None = Do not transform the texture coordinates
  TexCoord = TexCoord source
  Normal = Normal source
  Vertex = Vertex source

  The default is **None**.

  When performing environmental mapping, use **Normal**. When performing projection mapping, use **Vertex**.

  If the attribute is set to **None**, the data nevertheless will be exported as **TexCoord** if the material is attached to a texture whose texture matrix is not an identity matrix. (If the mode is set to **Normal** or **Vertex**, the texture matrix will not affect what is exported.)

- Tex Gen ST Source

  When the texture coordinate conversion mode is **Normal** or **Vertex**, specify whether or not the texture coordinates of the corresponding polygons will be output.

  Polygon outputs the texture coordinates of the polygons. Special mapping expressions are possible, such as transformation of standard attached textures via normal vectors or vertex coordinates.

  Material does not output the texture coordinates of the polygon. The Maya attachment method is ignored, and the texture coordinates are determined from the normal vector or the vertex coordinates. When performing general environmental or projection mapping, use **Material**.

  The default selection is **Material**.

- Texture Effect Matrix

  When the texture coordinate conversion mode is **Normal** or **Vertex**, specify a 4x2 matrix that influences the texture coordinate conversion. When performing environmental or projection mapping, this matrix can be used in adjusting the position, direction, and size of the texture.

  Inputting a numeric value and pressing the ENTER key converts it to a value that TWL and NITRO can use (a multiple of 1/4096). The following table describes each component of the matrix.

Table 5-2 Texture Effect Matrix Components

The influence of the X coordinate on the S coordinate	The influence of the X coordinate on the T coordinate
The influence of the Y coordinate on the S coordinate	The influence of the Y coordinate on the T coordinate
The influence of the Z coordinate on the S coordinate	The influence of the Z coordinate on the T coordinate
The amount of the S coordinate offset	The amount of the T coordinate offset

Note: A 4x4 matrix outputs the Intermediate File, but since the third and fourth lines have no influence on the texture coordinate conversion, with the plug-in this in effect becomes a 4x2 matrix where only the first and second lines can be configured.

Note: When the Tex Gen ST Source is Polygon, the component on the fourth line has no effect.

Cautions for the Nintendo TWL-System G3D Library

With the G3D library, the XYZ coordinates that multiply to the Texture Effect Matrix are as follows:

- Environmental Mapping (Tex Gen Mode = Normal)

  The coordinates where a normal vector was converted to a view-coordinate type.

- Projection Mapping (Tex Gen Mode = Vertex)

  The coordinates where the vertex coordinates were converted to a world-coordinate type.

After applying these coordinates to the Texture Effect Matrix, the coordinates that were applied to the Matrix for Aligning the Center and Position of the Mapping and the Texture Scale and Rotate Matrix Designated by the Material become the final texture coordinates.

For environmental mapping, the fourth line of the Texture Effect Matrix has no effect.

Environmental and projection mapping cannot display properly for the envelope model.

- Compress

  This sets the flag indicating whether to compress when the Compress Material option is set to **Compress**.

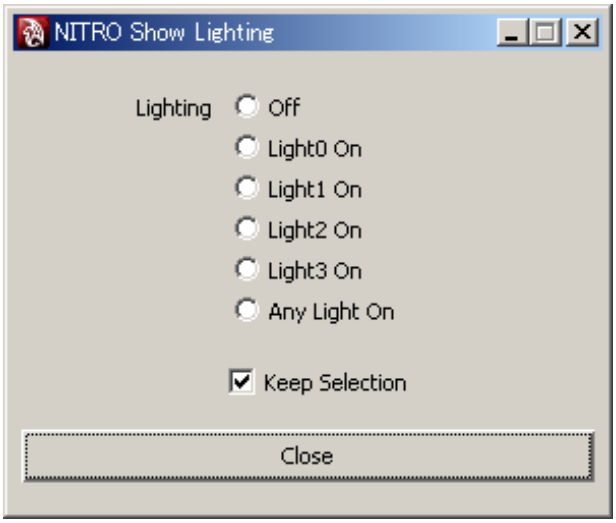
  Compress if possible = Compress if the attributes are the same as those of other materials. This is the default setting. Note that even when this setting is selected the material will not be compressed if material color animation, texture pattern animation, or texture SRT animation has been configured.

  Don’t compress = Export as an independent material without compression, even if its attributes are the same as those of other materials.

5.2 Checking the Lighting (NITRO Show Lighting)

Execute **NITRO-System** → **NITRO Show Lighting** to display the window.

Figure 5-2 NITRO Show Lighting Window



Select one of the following options to display a shading group and its associated materials and polygons.

Off	Not affected by any light
Light0 On	Affected by Light0
Light1 On	Affected by Light1
Light2 On	Affected by Light2
Light3 On	Affected by Light3
Any Light On	Affected by any light

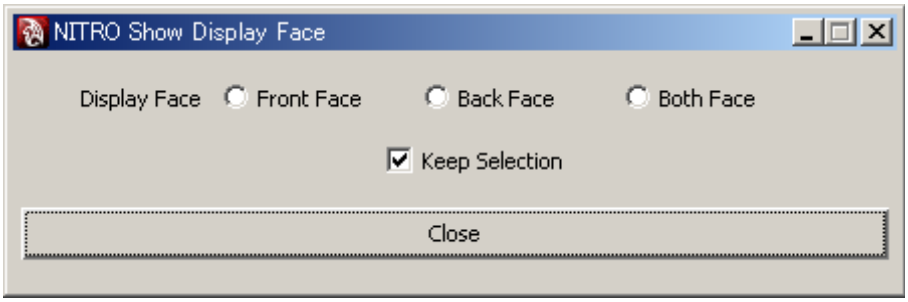
To get a better idea of the results, select **Rendering** → **Show ShadingGroups in Hypergraph**.

When **Keep Selection** is selected, the pertinent shading groups, materials, and polygons can be maintained in their selected state after the window is closed. When it is not selected, the selection state reverts to what it was prior to the execution of **NITRO Show Lighting**.

5.3 Checking the Polygon Display Surface (NITRO Show Display Face)

Execute NITRO-System → NITRO Show Display Face to display the window.

Figure 5-3 NITRO Show Display Face Window



Click a polygon Display Face mode to display the shading groups set for that mode and their associated materials and polygons.

To get a better idea of the results, select **Rendering** → **Show ShadingGroups** in Hypergraph.

When **Keep Selection** is selected, the pertinent shading groups, materials, and polygons can be maintained in their selected state after the window is closed. When it is not selected, the selection state reverts to what it was prior to the execution of **NITRO Show Display Face**.

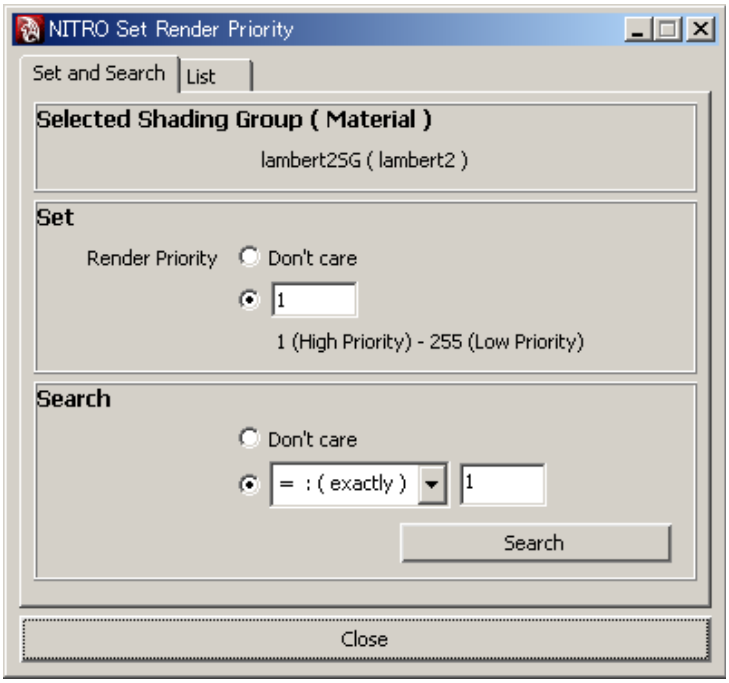
5.4 Polygon Rendering Priority Setting (NITRO Set Render Priority)

Sets the polygon rendering priority in shading groups. A settings search can be also performed.

For information on polygon rendering priority, see section 3.7.9 Polygon Rendering Priority.

To open the window, execute **NITRO-System** → **NITRO Set Render Priority**.

Figure 5-4 NITRO Set Render Priority Window (Set and Search)



Selection Method

Click the **Set and Search** tab.

When a shading group (*shadingEngine* node) or a material node (Lambert node, for example) is selected (multiple selections are possible), the current settings for the selected node are displayed under **Set**. For multiple selections it shows the settings for the node that was selected first.

For **Render Priority**, click **Don't care** (no rendering priority specification) or enter a numerical specification. If you specify a number, enter an integer from 1 to 255 and then press ENTER. Polygons that belong to shading groups with lower numbers will be rendered first. If multiple shading groups have the same number, the first shading group's polygons to be rendered is undefined (depends on the rendering routine).

For multiple sections, the selected nodes are changed in a batch.

If you select another node without closing the window, you will be able to set that node.

Search Method

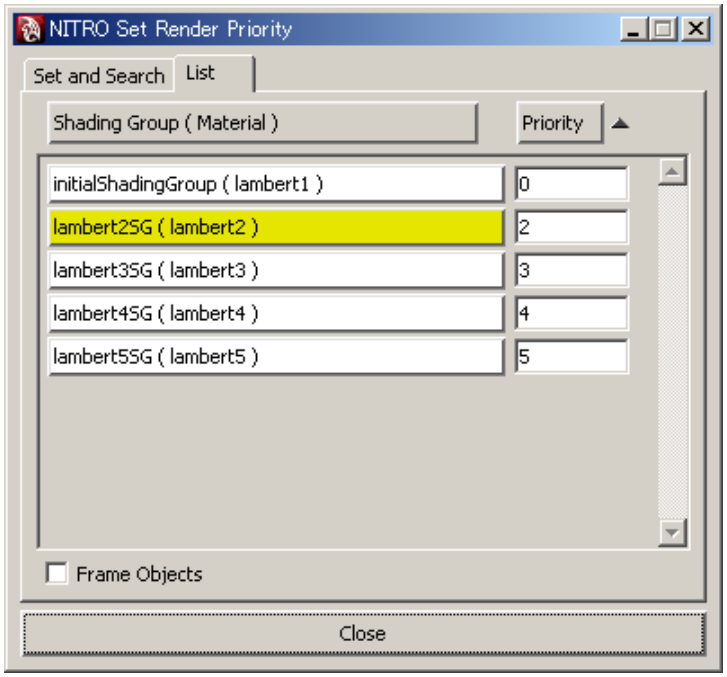
Click the **Set and Search** tab.

Under **Search**, either click **Don't Care** (no rendering priority specification) or enter conditions. Click **Search** to select the corresponding shading group and its associated materials and polygons. If **Rendering** → **Show Shading Groups** is selected in Hypergraph, the results are easy to interpret.

For the conditions option you can set the following conditions: less than (< under), less than or equal to (<= below), equal to (**=** exactly), greater than or equal to (>= above), or greater than (> over). Specify integers greater than or equal to 1, and less than or equal to 255.

List Format

Figure 5-5 NITRO Set Render Priority Window (List)



On the **List** tab, the render priority for all the shading groups in the scene is displayed in list format. **Don't care** is displayed as 0 here. The render priority for each of the shading groups can be changed by entering numerical values.

To display a shading group and its associated materials and polygons, click the name of the shading group in the list. In this case, if **Frame Objects** is selected, the corresponding polygon is displayed maximized in the view. To add it to the current selection, press SHIFT+Left-Click. The names of selected shading groups display with a yellow background.

When you click **Shading Group** or **Priority**, items are sorted according to the material names or the render priority (click again to invert the sort order). By default, items are sorted in ascending order of the render priority.

The render priority value can be replaced by dragging and dropping a shading group name using the middle mouse button. However, when the render priority of the shading group that is dragged is the same as that for where the shading group is dropped, the render order does not change.

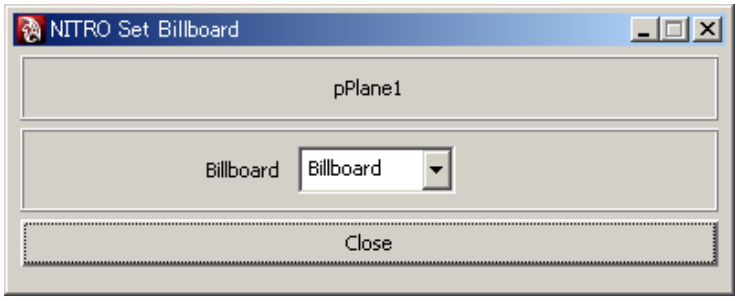
Sorting does not occur when entering numerical values for render priority or when dragging and dropping shading group names. To sort again, click **Shading Group** or **Priority**.

5.5 Setting the Billboard (NITRO Set Billboard)

Billboard is set for *transform* nodes and *joint* nodes using the NITRO Set Billboard plug-in. Note that the settings are not reflected on the Maya screen.

Execute **NITRO-System → NITRO Set Billboard** to display the window.

Figure 5-6 NITRO Set Billboard Window



When the transform node or the joint node is selected (multiple selections are possible), the current settings of the selected node are displayed. If you have selected multiple nodes, the window shows the settings of the last selected node.

Click the **Billboard** box to change the billboard mode. If multiple nodes are selected, all selected nodes can be changed at the same time.

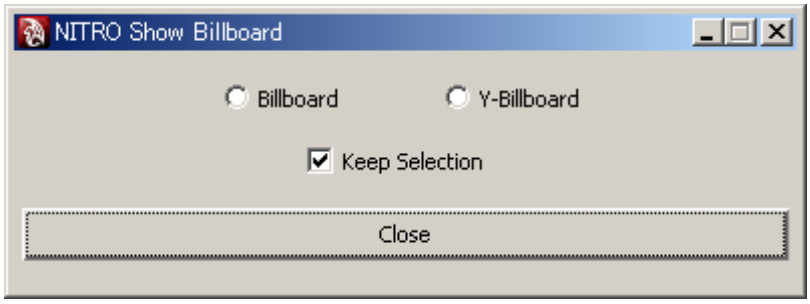
No Billboard = No billboard
Billboard = Always display in the direction of the camera
Y-Billboard = Display in the direction of the camera, centered along the global Y-axis

If you select another node without closing the window you can set that other node.

5.6 Checking the Billboard (NITRO Show Billboard)

Execute **NITRO-System → NITRO Show Billboard** to display the window.

Figure 5-7 NITRO Show Billboard Window



Click a billboard mode to display the transform nodes and joint nodes that have been set to that mode in the selected state.

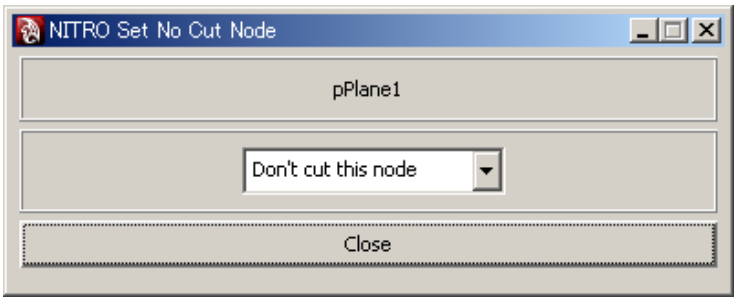
To maintain the pertinent nodes in their selected state after the window is closed, select **Keep Selection**. Deselecting **Keep Selection** reverts the selection state to what it was prior to the execution of **NITRO Show Billboard**.

5.7 Setting the Node-Culling Disable Flag (NITRO Set No Cut Node)

The NITRO Set No Cut Node plug-in sets the flag for *transform* nodes and *joint* nodes such that even when the node-culling feature is enabled the nodes are not culled when the Intermediate file is output.

Execute **NITRO-System → NITRO Set No Cut Node** to display the window.

Figure 5-8 NITRO Set No Cut Node Window



To display the current settings of the selected node, select the transform node or the joint node (multiple selections are possible). If you select multiple nodes, the settings of the last selected node are displayed in the window.

Click the combo box to change the flag that disables node culling. If multiple nodes are selected, all selected nodes can be changed at the same time.

Cut this node if possible = When the node-culling feature is enabled, cull nodes that can be culled. This is the default setting.

Don't cut this node = Do not cull nodes even if the node-culling feature is enabled.

If you select another node without closing the window, you can set that other node.

5.8 Checking the Node-Culling Disable Flag (NITRO Show No Cut Node)

Execute **NITRO-System → NITRO Show No Cut Node**.

When this executes, the *transform* nodes and *joint* nodes with the flag that disables node culling set to **Don't cut this node** are shown in the selected state.

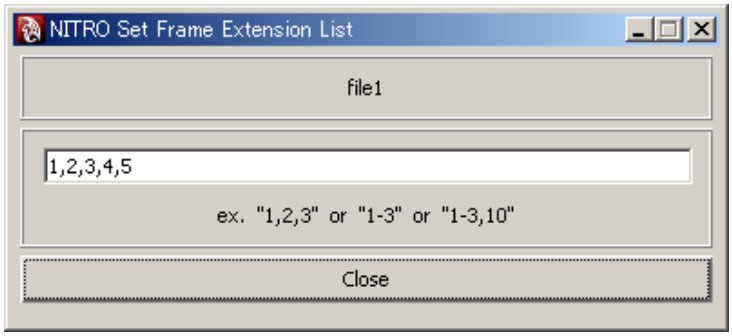
5.9 Setting the Textures Exported with Texture Pattern Animation (NITRO Set Frame Extension List)

By default, the only textures that are exported to the Intermediate file for texture pattern animation are those textures specified with a *file* node Image Name attribute, and textures that correspond to keyed Frame Extension attributes. However, you can use the NITRO Set Frame Extension List plug-in to forcibly export textures corresponding to specific frame extensions.

When connecting an expression or an animation layer to a Frame Extension, the texture list to export must be set using this plug-in.

Select only one *file* node (or *material* node) and then execute **NITRO-System → NITRO Set Frame Extension List** to display the window.

Figure 5-9 NITRO Set Frame Extension List Window



Enter a list of texture numbers (Frame Extension) to export to the intermediate file.

The format is 1,2,3... Separate each number with a comma. If the *file* node's Image Name is `name.1.tga`, the three textures `name.1.tga`, `name.2.tga`, and `name.3.tga` will be exported even if they do not correspond to keyed Frame Extension attributes.

If no corresponding texture exists for a specified number, an error will be generated when data are exported. A negative number cannot be specified for a texture number.

A series of numbers (for example, "1,2,3,4,5") can be written as a range separated using a hyphen (for example, 1-5).

For example, "3-6,10" is the same as entering "3,4,5,6,10."

You can use a space in place of a comma to separate numbers.

Entries made in the following formats will generate errors.

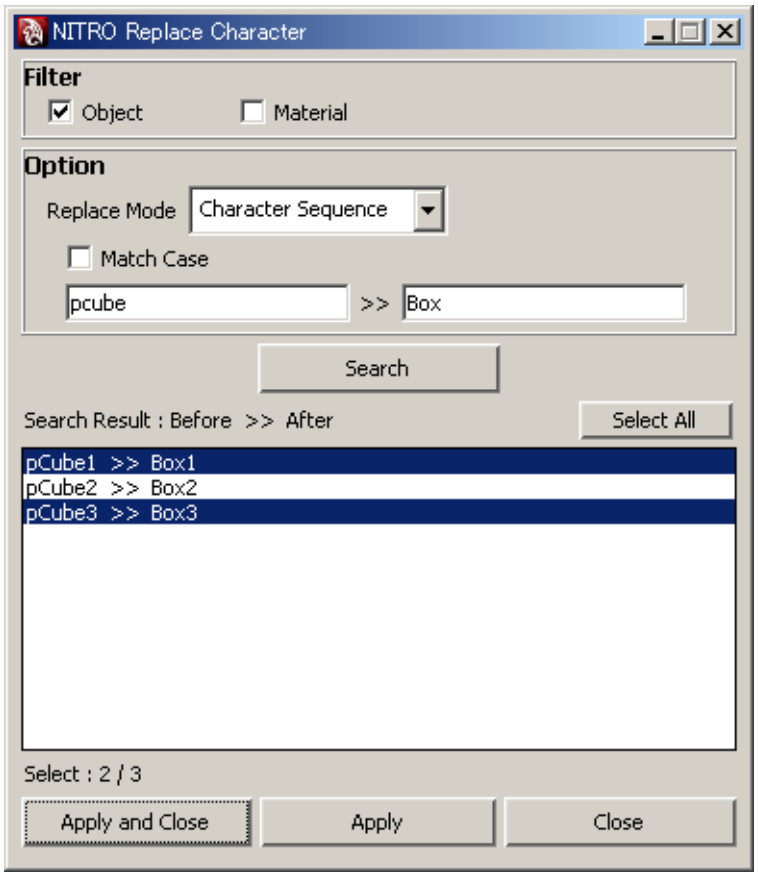
1-3-5	Error because two or more values are separated using hyphens
-3	Error because value begins with a hyphen
5-	Error because value ends with a hyphen

5.10 Replace Element Name Strings (NITRO Replace Character)

This plug-in collectively replaces element name strings (object name, material name). You can also change element name characters from uppercase to lowercase, or from lowercase to uppercase.

Execute **NITRO-System → NITRO Replace Character** to display the window.

Figure 5-10 NITRO Replace Character Window



Use the Filter check boxes to select an element type (you may select more than one).

Use **Option** → **Replace Mode** to select a replace mode.

- Character Sequence

  Replaces the search string in the text box on the left with the replace string in the text box on the right.

  When Match Case is selected, the plug-in only returns exact, case-sensitive matches. When this option is deselected, it returns any (and all) items that match the search string.

  Use the following symbols at the beginning of the search string to limit the search and replace to the beginning or end of the element name.

  - "**^**"

    Indicates the beginning of the target element name. If you only enter "**^**" in the search field, the replace string is appended before the target element name. For example:

    [**^cube**] >> [**box**] only replaces instances of [**cube**] to [**box**] when "**cube**" exists at the beginning of an element name.

    [**^**] >> [**cube**] appends the string, [**cube**], to the front of the target element name.

- "**$**"

  Indicates the end of the element name. If you only enter "**$**" in the search field, the replace string is appended at the end of the targeted element name. For example:

  [**$ test**] >> [ ] will delete [**test**] from any element name that ends with [**test**].

  [**$**] >> [**test**] appends [**test**] to the end of the target element names.

- Lowercase to Uppercase

  Converts all lowercase letters to uppercase letters.

- Uppercase to Lowercase

  Converts all uppercase letters to lowercase letters.

When you click **Search**, the results of the search (current element names and the element names after replacement) appear in the **Search Result** box. However, elements whose names cannot be changed (`lambert1`, for example) will not be listed.

From the list, select the element names that you want to replace (will also be selected by Maya). After you click **Search**, all the elements in the list will be selected. Hold down CTRL and click the left mouse button to switch the select status of individual elements. Click **Select All** to select all of the elements in the list.

Note: If an element name is not displayed in the **After** column, a blank replace string causes all of the characters in the filename to be deleted, resulting in an element with no filename. These will not be replaced, even if selected; you must redo the settings.

Replacement actually occurs when you click **Apply**. A warning dialog appears if either the new name already exists in the scene or if it is an element name that cannot be used by Maya.

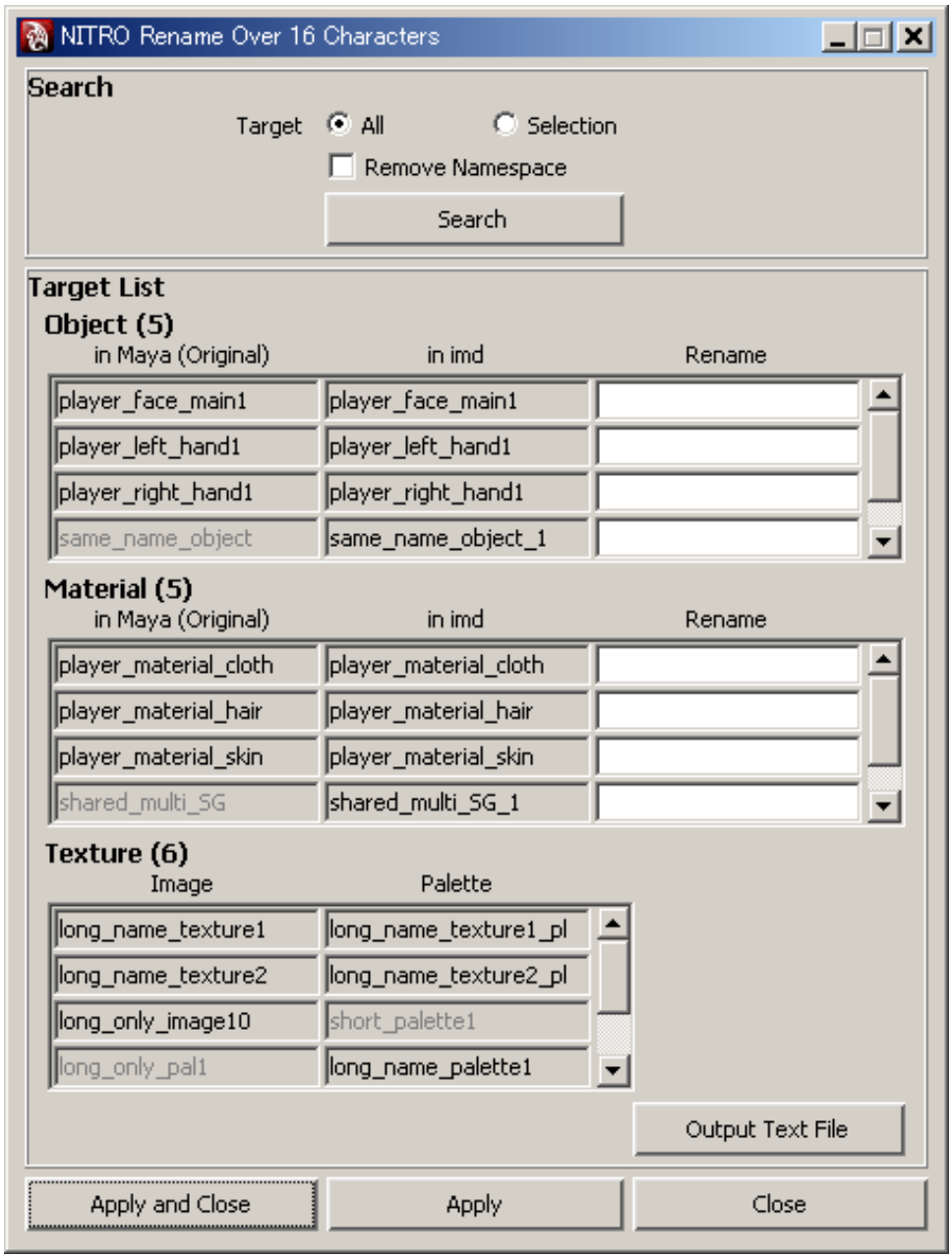
Note: Although an error or warning appears, if you can still click **Apply** while the **Attribute Editor** is open, the string will be properly replaced.

5.11 Rename Element Names That Exceed 16 Characters (NITRO Rename Over 16 Characters)

This plug-in searches for and replaces the names of elements (node, material, texture image, and texture palette names) that exceed the 16-character limit so that you can export them to intermediate files.

Execute **NITRO-System** → **NITRO Rename Over 16 Characters** to display the window.

Figure 5-11 NITRO Rename Over 16 Characters Window



Under **Search**, designate the range parameter by selecting the **All** or **Selection** option.

- **All**: Select this option if you are going to export an entire scene as intermediate files.
- **Selection**: Select this option if you are going to export only a node and its sub-nodes.

If you choose **Selection** as your target, use Maya to select the export target node. If you chose **All**, you do not need to select a node.

Turn **Remove Namespace** on to search for names when the namespace portion was deleted for export.

When you click **Search**, a list of the elements set for export to intermediate files whose names exceed 16 characters appears in the **Target List** section (will be selected in Maya). The displayed results are the cases in which the intermediate file export options **Compress Node** and **Compress Material** are set to **None**, and the option **Output Texture** is set to **Only Used**. If a file node's texture filename is blank, a warning is displayed if the texture file cannot be opened.

For objects and materials, the **in Maya** column lists the names as they are in Maya, and the **in imd** column lists the filenames as they are in the intermediate file. For textures, the **Image** column lists the texture image names, and the **Palette** column lists the texture palette names. Items that do not exceed 16 characters are dimmed (unavailable) in the display.

In the **Object** section, hovering over an item (moving your pointer over an item and leaving it there momentarily) in the **in Maya** column displays its full pathname in a ToolTip (displayed in a temporary pop-up box). Likewise, hovering over an item in the **Image** or **Palette** column in the **Texture** section also results in the full pathname being displayed in a ToolTip.

Next, type a new name in the **Rename** column. You can *not* use the following names:

- Names that cannot be used as Maya node names
- Names that exceed 16 characters
- Names that are already used as node names in the scene
- Names that duplicate other Rename names

When you click **Apply**, the names change. However, elements whose **Rename** names would become blank are not changed. Entries whose names have changed will be selected in Maya and removed from the Target List.

When you click **Output Text File**, the current Target List is written to a text file. In the case of textures, the texture file path name is also included in the output. This feature is useful when, for example, you later wish to collectively revise texture file and palette names. It is also useful for later confirming element names before and after changing.

6 Information for Programmers

6.1 Node Matrices in Maya

Maya has two types of nodes that correspond to the IMD file's <node> element. These are the *transform* node and the *joint* node.

With coordinates multiplied starting from the left, the *transform* node matrix is:

- [S] * [R] * [T]
- [S] = Scale matrix
- [R] = Rotate matrix
- [T] = Translate matrix

Maya's *joint* node has what is known as a **Segment Scale Compensate** attribute. When the **Segment Scale Compensate** attribute is Off, the *joint* node matrix is the same as the *transform* node matrix. But when the **Segment Scale Compensate** attribute is On, the *joint* node matrix is as follows.

- [S] * [R] * [IS] * [T]
- [IS] = the parent's Scale inverse matrix

The parent's **Scale** only affects the child's **Translate**.

When you execute the Intermediate File Output plug-in, the `scale_compensate` attribute, which defines whether to perform scale compensation, is exported to the IMD file's <node> elements. Because of this, the program that calculates matrices must select one or the other of these two methods in accordance with this attribute for each <node> element.

If the `scale_compensate` attribute is set to On for even one <node> element, then the IMD file <model_info> element's `scaling_rule` attribute will be set to `maya`. Otherwise, the `scaling_rule` attribute will be set to `normal`.

6.2 Node-Culling Algorithms

6.2.1 Algorithm for the Cull Useless Node Specification

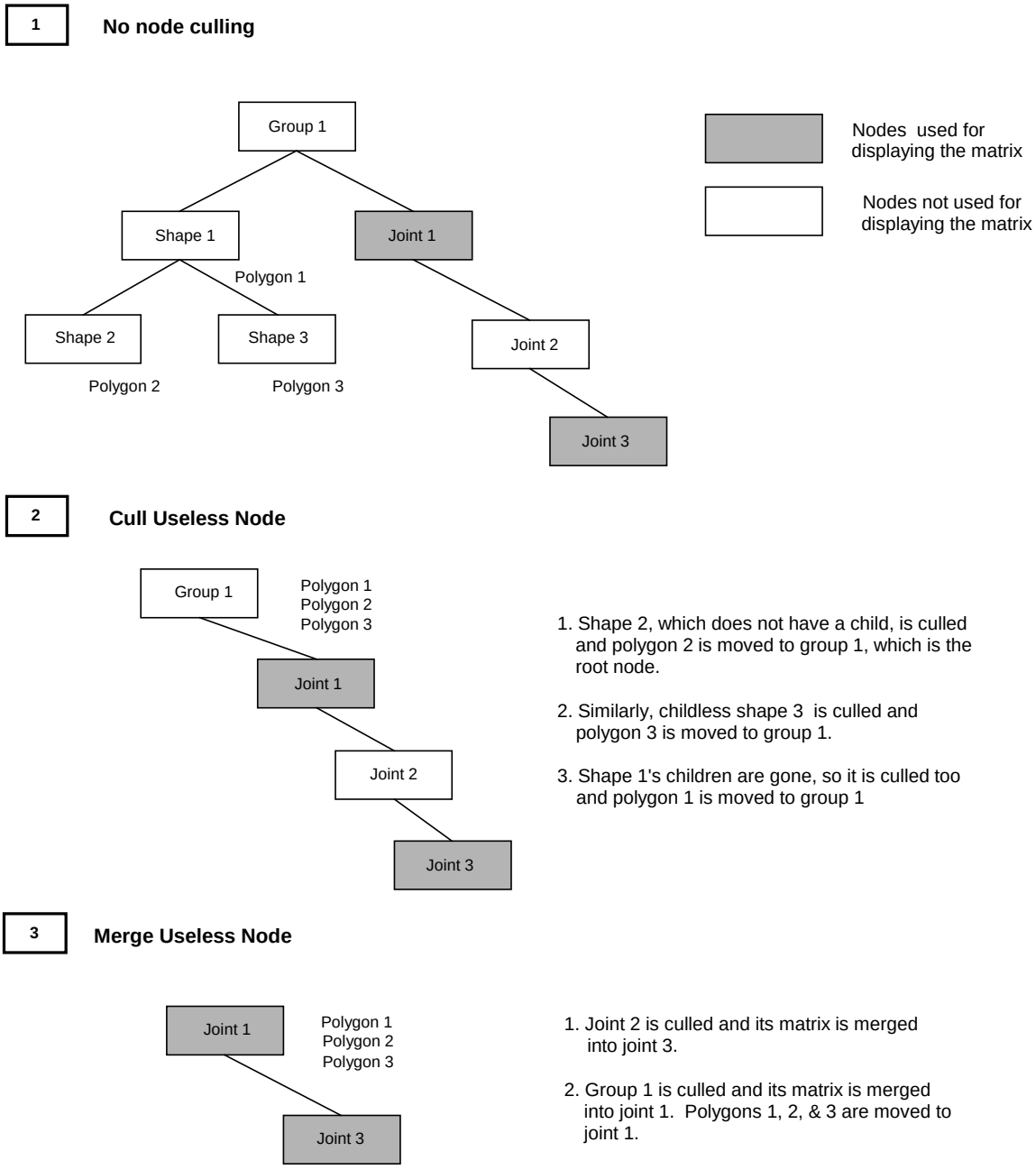
1. Cull a node if it does not have children and is not used in display of matrix (that is, the node is not used in the envelope). If the node holds polygons, move them to the root node.
2. Repeat step 1 until there are no more nodes to cull.
3. Finally, if the root node `world_root` added by the plug-in has one child node, cull `world_root` as well and move any polygons held by `world_root` to its child node.

6.2.2 Algorithm for the Merge Useless Node Specification

1. First perform the same steps taken by the Cull Useless Node algorithm.
2. Look at the nodes that remain (other than the root node). If a node's parent node's matrix is not used for display, merge that node's matrix with its parent node matrix and cull the parent node. If that parent node has multiple child nodes, do this merging process for each child node. If the parent node holds polygons, move those polygons to the root node.
3. Repeat step 2 until there are no more nodes to cull.
4. Finally, also cull the root node if it has one child node and its matrix is not being used for display. Move the root node's polygons to the child node.

6.2.3 Examples of Node Culling

Figure 6-1 Examples of Node Culling



6.3 Texture Matrices in Maya

Code 6-1 shows the method used for creating the texture coordinate transformation matrix for TWL and NITRO from the texture Scale value, Rotate value, and Translate value exported from Maya.

Code 6-1 Texture Matrix

```
// For this texture matrix, the Scale values of ST are Ss, St
// The Rotate value is R, sin(R) is sinR, cos(R) is cosR
// The Translate values of ST are Ts, Tt
// The Texture's image width is W (<tex_image> @ original_width)
// The Texture's image height is H (<tex_image> @ original_height)

const int MTX_SHIFT = 12;
s32 ss_sin = (s32)((s64)Ss * sinR >> MTX_SHIFT);
s32 ss_cos = (s32)((s64)Ss * cosR >> MTX_SHIFT);
s32 st_sin = (s32)((s64)St * sinR >> MTX_SHIFT);
s32 st_cos = (s32)((s64)St * cosR >> MTX_SHIFT);

m[ 0] = ss_cos;
m[ 1] = st_sin * (-H) / W;
m[ 2] = 0
m[ 3] = 0
m[ 4] = ss_sin * W / H;
m[ 5] = st_cos;
m[ 6] = 0
m[ 7] = 0
m[ 8] = 0
m[ 9] = 0
m[10] = 0
m[11] = 0
m[12] = ((-ss_sin - ss_cos + Ss) * W << 3)
        - (s32)((s64)Ss * Ts >> MTX_SHIFT - 4) * W;
m[13] = (( st_sin - st_cos - St + (2 << MTX_SHIFT)) * H << 3)
        + (s32)((s64)St * Tt >> MTX_SHIFT - 4) * H;
m[14] = 0;
m[15] = 1 << MTX_SHIFT;
// ss, st, sinR, cosR, ts, tt are 12-bit fixed-point decimals
// W and H are integers with no decimal
```

6.4 Extra Attributes

The Intermediate File Export Plug-in uses a number of extra attributes. These "custom" attributes all have `nns_` at the start of their name.

Table 6-1 Extra Attributes

Type	Node Type	Attribute Name	Attribute Type	Meaning of Values
Light0 enable flag	`shadingEngine`	`nns_lighting`	`bool`	0 = Not affected by Light0 1 = Affected by Light0
Light1 enable flag	`shadingEngine`	`nns_lighting1`	`bool`	0 = Not affected by Light1 1 = Affected by Light1
Light2 enable flag	`shadingEngine`	`nns_lighting2`	`bool`	0 = Not affected by Light2 1 = Affected by Light2
Light3 enable flag	`shadingEngine`	`nns_lighting3`	`bool`	0 = Not affected by Light3 1 = Affected by Light3
Specular Reflection Shininess Table enable flag	`shadingEngine`	`nns_shininess_table`	`bool`	0 = Does not use Specular Reflection Shininess Table 1 = Use Specular Reflection Shininess Table
Fog enable flag	`shadingEngine`	`nns_fog`	`bool`	0 = Does not apply fog 1 = Apply fog
Wireframe display flag	`shadingEngine`	`nns_wire_mode`	`bool`	0 = Wire Frame display ON 1 = Wire Frame display OFF
Decal polygon depth test flag	`shadingEngine`	`nns_depth_test_decal`	`bool`	0= Does not do depth test for decal polygons 1= Does depth test for decal polygons
Translucent polygon depth value update flag	`shadingEngine`	`nns_xlu_update_depth`	`bool`	0= Does not update depth buffer when rendering translucent polygons 1= Updates depth buffer when rendering translucent polygons

Type	Node Type	Attribute Name	Attribute Type	Meaning of Values
1-dot polygon rendering flag	shadingEngine	nns_render_1_pixel	bool	0= Does not render 1-dot polygons 1= Renders 1 dot polygons
FAR clipping flag	shadingEngine	nns_far_clip	bool	0= Deletes if intersects FAR plane 1= Clips if intersects FAR plane
Polygon ID	shadingEngine	nns_poly_id	short	Polygon ID value (0—63)
Polygon's display face	shadingEngine	nns_disp_face	enum	0 = Display front face 1 = Display back face 2 = Display both faces
Polygon mode	shadingEngine	nns_poly_mode	enum	0 = Modulation mode 1 = Decal mode 2 = Toon / Highlight shading 3 = Shadow polygon
Texture coordinates transform mode	shadingEngine	nns_tex_gen_mode	enum	0 = Do not transform texture coordinates 1 = TexCoord source 2 = Normal source 3 = Vertex source
Texture coordinate output flag for when the texture coordinate conversion mode is Normal or Vertex	shadingEngine	nns_tex_gen_st_src	enum	0 = Output polygon's texture coordinates 1 = Do not output polygon’s texture coordinates.
Matrix that influences texture coordinate conversion	shadingEngine	nns_tex_effect_mtx	matrix	4x4 matrix
Material compression-disable flag	shadingEngine	nns_no_compress	bool	0 = Compression OK 1 = No compression
Use polygon rendering priority flag	shadingEngine	nns_use_render_priority	bool	0= Does not use rendering priority (Don’t care) 1= Uses rendering priority
Polygon rendering priority	shadingEngine	nns_render_priority	short	Rendering priority value (1-255)

Type	Node Type	Attribute Name	Attribute Type	Meaning of Values
Billboard	transform	nns_billboard	enum	0 = None 1 = Billboard 2 = Y-axis billboard
Node culling-disable flag	transform	nns_no_cut	bool	0 = Culling OK 1 = Do not cull
Frame Extension list for texture pattern animation	file	nns_fe_list	string	List of numbers to forcibly export