

DYNAPLUGIN

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DYNAPLUGIN OVERVIEW

Dynaplugin is an import plug-in for 3D Studio Max that imports LS-Dyna database as 3D Studio Max entities that supports importing of solids, shells, thick shells, beams, and SPH particle data from LS-Dyna.

ANIMATION SUPPORT

The latest release supports 2 different methods of input and animation. The purpose of this is to support a variety of input at varying complexity.

The first is the original Dynaplugin which imports and animated an entire simulation in one 3D Studio Max scene. The changes of the chosen elements through the different states of the database are represented as 3D Studio Max animation, thus allowing one to visualize the scientific data. This mode is recommended for less complex simulations.

The newest plug-in only supports out-of-core animation. In this mode, a single frame of simulation at a time is imported into a 3D Studio Max file. This allows for out-of-core, or flipbook style, animation, which supports more complex scenes.

- Standard Dynaplugin
 - Solids as triangular mesh
 - Shells as triangular mesh
 - Beams as 3D splines
 - Thick shells as triangular mesh
 - SPH particles as spheres
- Out-of-core Dynaplugin
 - Solids as triangular mesh
 - Shells as triangular mesh
 - Beams as triangular mesh
 - SPH particles as a pseudo mesh

REQUIRED RESOURCES

- 3D Studio Max 7.0 or 9.0 on the Windows Operating system.
 - The plug-in may work, but has not been tested for, other versions of 3D Studio Max
- At least 512 MB of RAM (recommended).

HOW TO INSTALL THE PLUG-IN

The plug-in comes with the following files:

- **dyna.dli** - This runtime file for the standard Dynaplugin.
- **lsdImport.dli** - The runtime file for the out-of-core version of Dynaplugin.
- **dynaplugin.pdf** - This document you are reading now.

Just copy the “dyna.dli” and “lsdImport.dli” files to the plug-in folder of 3D Studio Max to install the plug-in and restart 3D Studio Max if it is already running.

HOW TO INVOKE THE PLUG-IN

The plug-in should be invoked from within 3D Studio Max.

- Standard Dynaplugin
 1. Choose the “File->Import” item from the menu bar. This brings up the open dialog box.
 2. Change the “File of type” field to “LS-DYNA (*.dat)”
 3. Navigate to the location which contains the LS-Dyna files.
 4. Choose the ‘Root File’ (the first file of the database, usually “d3plot”)
 5. This automatically invokes the plug-in and launches the options dialog box.
- Out-of-core Dynaplugin
 1. Choose the “File->Import” item from the menu bar. This brings up the open dialog box.
 2. Change the “File of type” field to “LS-Dyna Import Script (*.dyna)”
 3. Navigate to the location which contains the LS-Dyna script file.
 4. Choose the ‘Script File’
 5. This automatically invokes the plug-in. Formatting the script is described in further detail later in this document.

STANDARD PLUG-IN USAGE

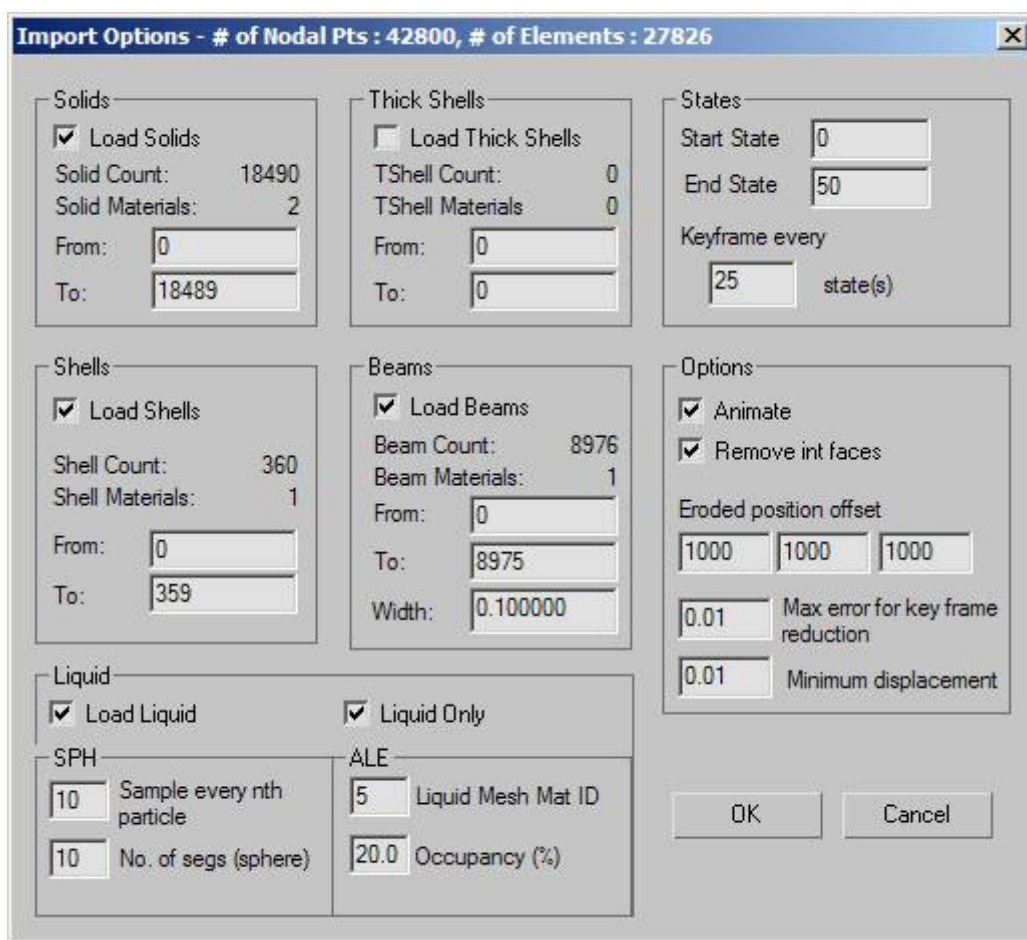
IMPORT OPTIONS DIALOG BOX

The import options dialog box has the following sections:

- Solids
- Shells
- Thick Shells
- Beams
- Liquid
- States
- Options

The title also gives the total number of nodal points and elements in the database.

The “OK” button starts the importing and the “Cancel” button cancels the importing and returns you to the 3D Studio Max interface.



Screen Shot of a typical Import Options dialog box

SOLIDS

This section can be used to control the importing of solid elements. If you want to import solid elements then “Load Solids” needs to be checked.

The next two labels give the number of solid elements and the number of materials used for solid elements.

You can filter the solids by specifying the starting and ending element numbers in the “From” and “To” text boxes. (The element numbering starts from 0 to n where n is the number of solid elements printed in the previous label mentioned).

SHELLS

This section can be used to control the importing of shell elements. The options are similar to the options in the Solids section.

THICK SHELLS

This section can be used to control the importing of thick shell elements. The options are similar to the options in the Solids section.

BEAMS

This section can be used to control the importing of beam element. The options are similar to the Solids section. Here there is an addition field for specifying the width of the beam.

LIQUID

This section can be used to control the importing of both ALE (Arbitrary Lagrange Eulerian) and SPH (Smooth Particle Hydrodynamic) liquid data.

The following options are provided:

- The Load Liquid option should be checked for loading either of the two liquid types.
- The Liquid Only Option overrides all the other ‘Load <element>’ options and imports only liquid data and prevents the importing of other elements (solid, beams, shells, thick shells)

NOTE: For loading the ALE liquid, the ‘Load Solid’ option should be checked since the ALE liquid is represented as a solid element.

SPH Options

§ The “Load every nth particle” loads only every nth SPH particle instead of all the particles where n is the number entered. It is advised that you use this feature to import every 5th or 10th particle before trying to import all the particles.

§ You can control the complexity of the spheres generated by the “No. of segs (sphere)” value. Enter a low value for greater performance and higher value for greater visual appeal (of the spheres).

ALE Options

§ The ALE liquid can be identified by the “Liquid Mesh Mat ID”. You need to enter the material id of the liquid in this field.

§ Occupancy is the minimum fractional occupancy of an ALE cell for it to be considered. Enter this value in percentage.

STATES

You can import only selective states from the database by entering the starting state, ending state and the frequency of states to consider in the “Start State”, “End State” and “Key frame every” text boxes.

For example, if the database has 100 states and you want to import states 25, 30, 35...75, you can specify 25 as the start state, 75 as the end state, and 5 as for the “Key frame every” field.

OPTIONS

The options section has the following fields:

- The “Animate” box has to be checked for importing all the state and animating the changes. If this is off then only the initial state is imported.
- The “Remove int faces”, if checked, will check for internal faces in the triangular meshes generated and removes them. This will greatly reduce the complexity of the geometry for improved performance. However this will take more time during the importing.
- “Eroded Position Offset” specifies a 3D position where the eroded elements are placed in the scene.
- The “Max key frame error” specifies the maximum error for the key frame reduction. A key frame for a given state is eliminated with respect to an element if the position of the element is linearly between the surrounding two states. The value entered here specifies the maximum error that can be considered as linear. (Refer to Fig.1)
- Two positions corresponding to consecutive states of an element are considered to be the same if the distance between these positions is less than the “Minimum Displacement” value specified. (Refer to Fig.2)

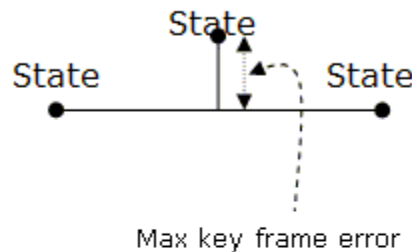


Fig 1

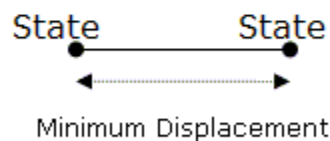
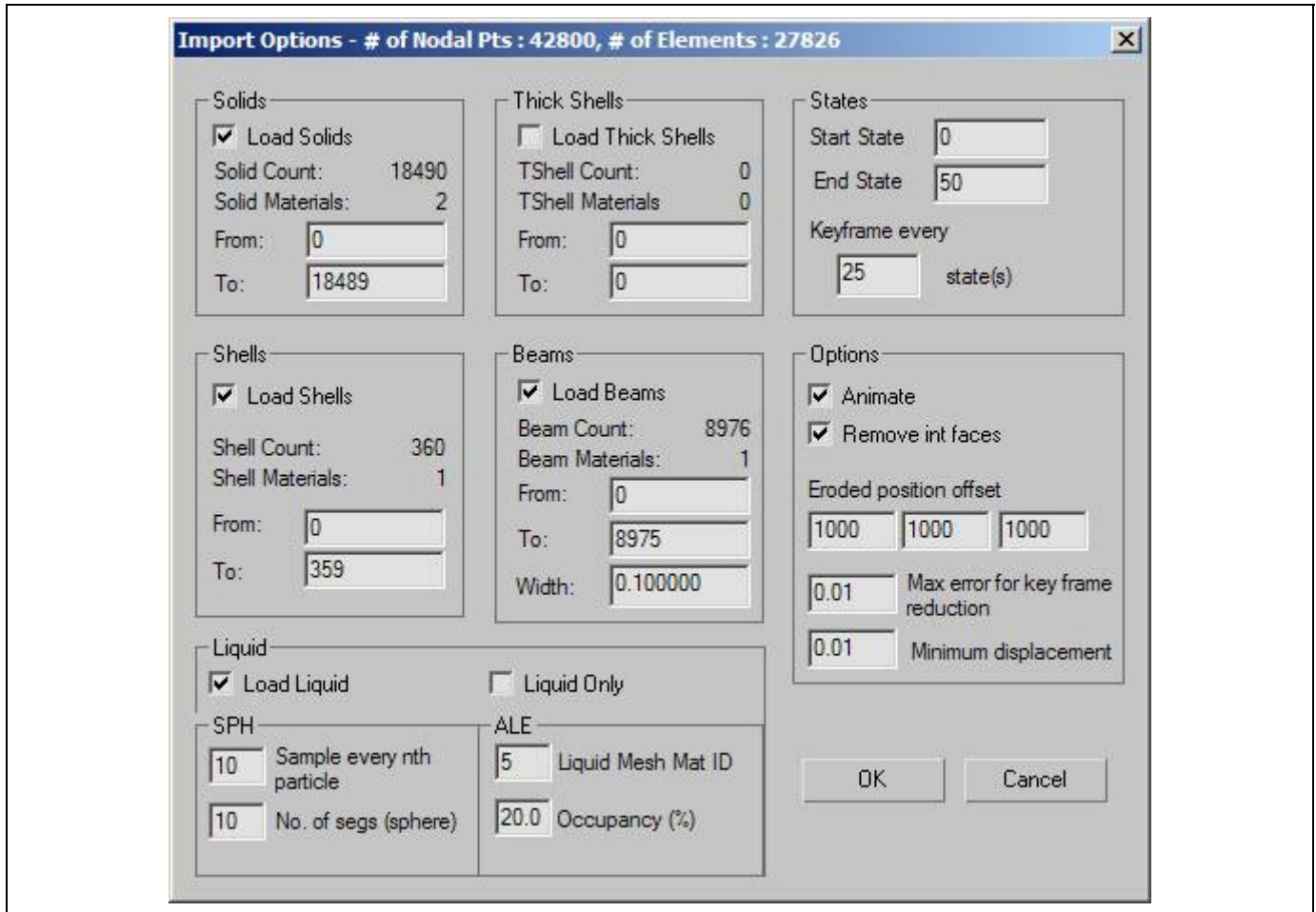


Fig 2

EXAMPLE

We shall see how to import the solids and SPH particles from a Dyna database containing the data for a clay test.

1. First we need to choose File->Import from the 3D Studio Max menu bar.
2. Then we have to navigate to the location where the Dyna files are located. Let us say this is “C:\Dyna\Claytest\”.
3. Now we will enter the name of the root file “d3plot”, and click on Open.
4. After this, the Import Options dialog box is displayed.



5. Not that the title gives the number of nodal points and the elements in the database.
6. All of the sections are filled with default values (either read from the header of the database or pre-determined values. For e.g. the ‘From’ and ‘To’ fields contain the first and last element numbers of the elements of each type which is read from the header whereas the ‘start state’, ‘end state’ and ‘keyframe every’ are filled in arbitrarily.)

7. Since we want to import only solids and SPH liquid, we will first uncheck 'Load Shells' and 'Load Beams' which are already checked.

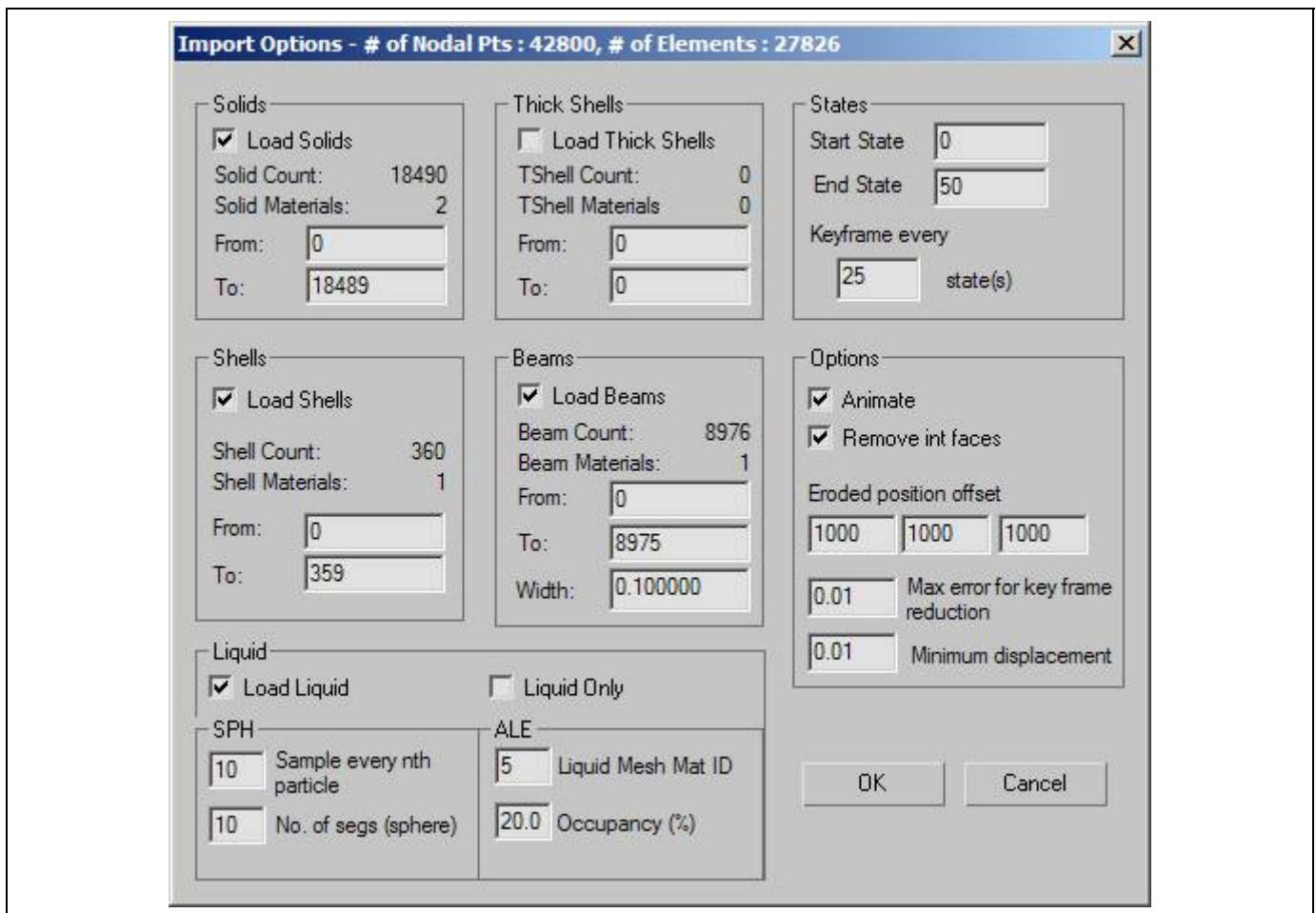
8. Next we specify how we want to sample the particles. Let us say we want to read every 5th particle and each sphere generated should have 8 segments, we enter these values in the SPH options section.

Also, the options for the ALE sections will not affect the import since this file does not contain ALE liquid, so we do not have to worry about the values in this section.

9. Let us assume, we have only a few files from the database; say the root file and every 25th file till the 100th state file. So we will have d3plot, d3plot25, d3plot50, d3plot75 and d3plot100.

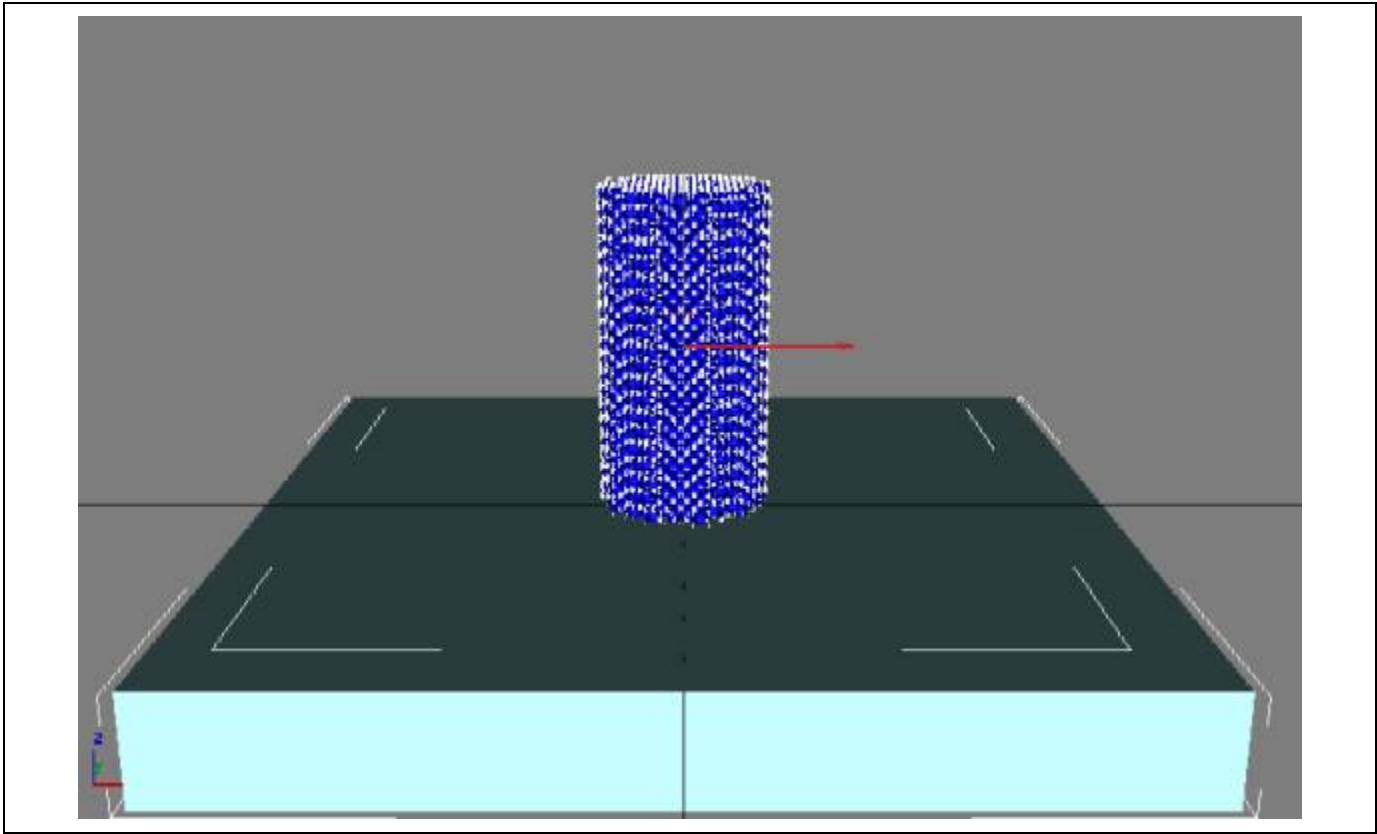
In order to specify this in the 'States' section, we will give, 0 for the starting state, 100 for the ending state (this determines the range of states to be imported.) Then we specify 25 for the 'Keyframe every' textbox. This will sample every 25th file beginning from the 0th file up to the 100th file. (NOTE: we can also specify 50 in this field which will sample every 50th file. i.e. we do not have to sample all the files we have.)

10. We will leave the other options at their default values and click on OK.



11. The import begins and the status bar gives information about the progress.

12. Finally we will see the imported objects in 3D Studio Max's viewport.



OUT-OF-CORE PLUG-IN USAGE

SCRIPT FILE SETUP

The out-of-core plug-in uses an extremely simple script file to describe the scene. The script file is a text file and is formatted as follows. It must be present in the same directory as the d3plot output files.

The following is an example input file...

simulation_states	4
simulation_substates	10
import_state	1
import_substate	0

Parameters

- simulation_states – The total number of states in the LS-Dyna simulation
- simulation_substates – Desired interpolated states. The plug-in is able to calculate additional interpolated states.
- import_state – The state number with which to import.
- Import_substate – The substate to import.

The plug-in automatically imports all beams, shell, solid, and SPH elements for the desired state. Any elements not desired, must be deleted by the user in 3D Studio Max.

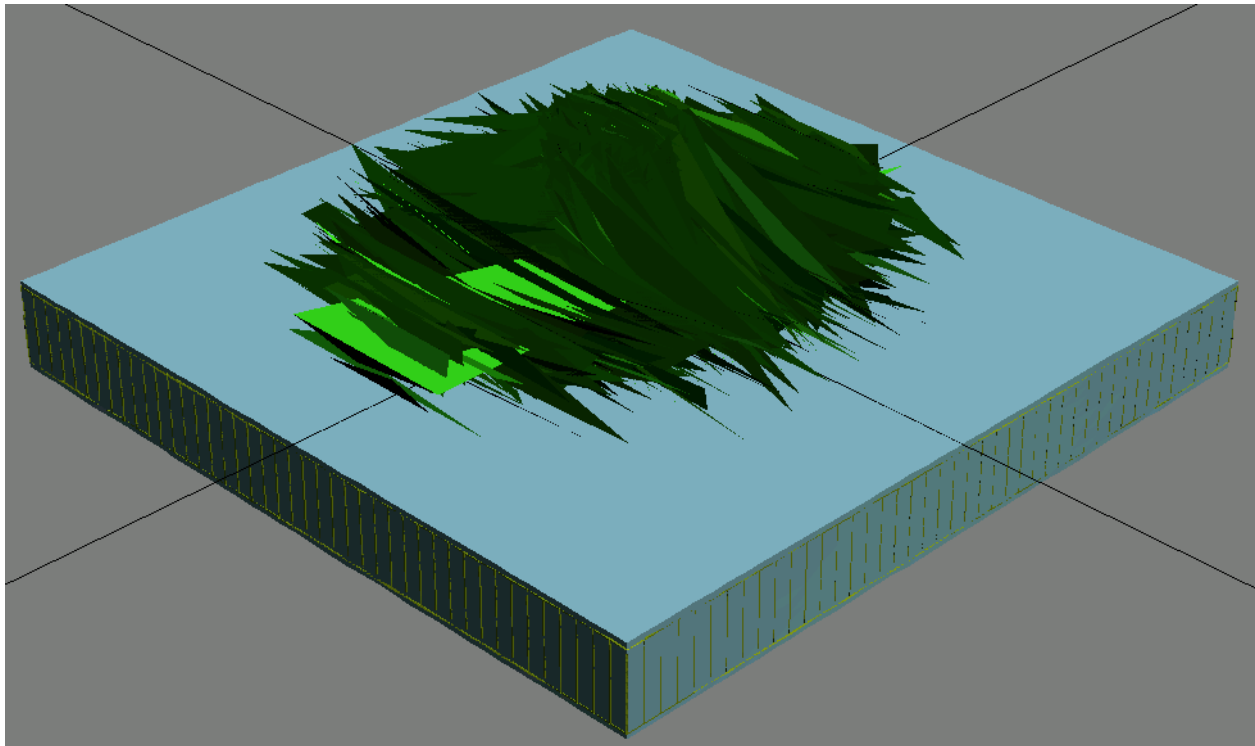
EXAMPLE

This is our example scene, named import_1.0.dyna in the claytest example.

Simulation_states	4
simulation_substates	10
import_state	1
import_substate	0

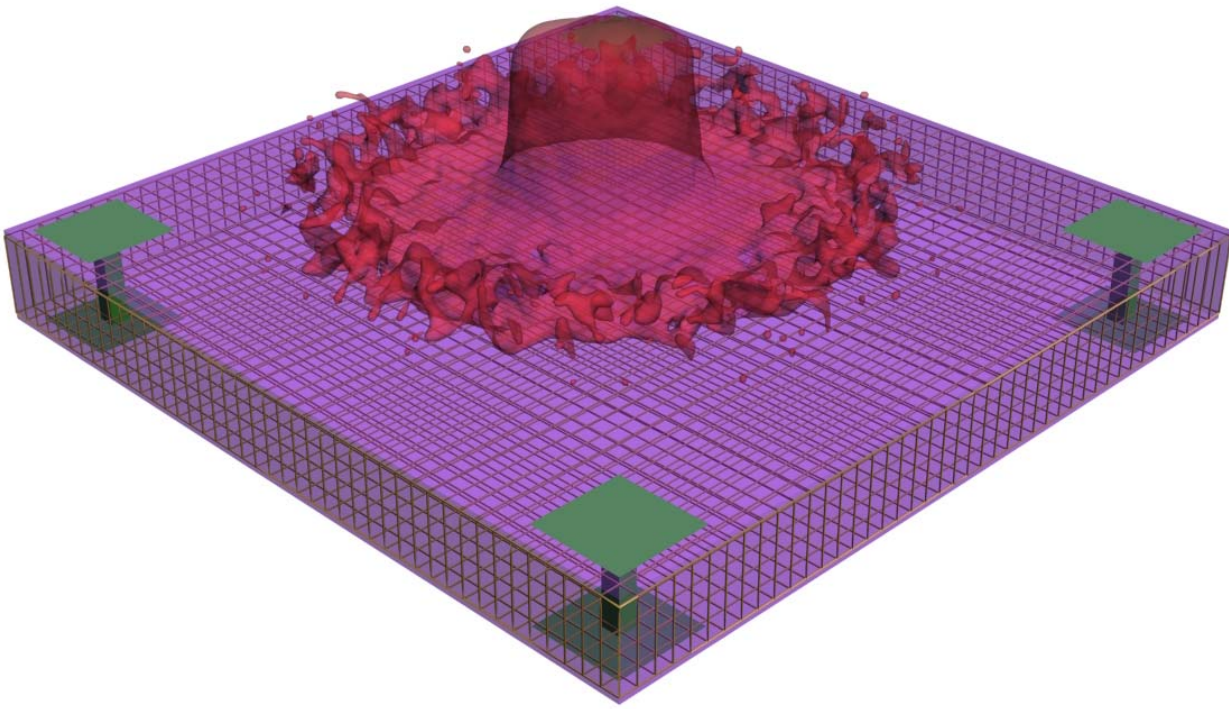
This input file tells the plug-in that there are 4 states and potentially 10 interpolated states, giving a total of 30 animation states. The input file specifies that state 1, substate 0, will be imported. This is equivalent to animation state 0. If the state were 1 and the substate 5, this would be equivalent to animation state 5.

After the script file is loaded, the simulation is loaded and will appear in the 3D Studio Max viewport.



Claytest simulation loaded into 3D Studio Max. The green is the psuedomesh representing the SPH elements. The vertices of this mesh are the locations of the SPH elements. In blue you see the region containing the solid, shell, and beam elements.

After the scene is loaded into 3D Studio Max, material may be applied to the scene.



Materials applied to the scene loaded into 3D Studio Max. Here, a blobmesh object was applied to the SPH psuedomesh. Partially transparent materials were applied to both the SPH blobmesh and the solid elements, shown in purple.