

## Import/Export Radiation Model

You can import and export radiation models from and to ESARAD<sup>TM</sup>, TSS<sup>TM</sup> and Thermica<sup>TM</sup>. The import or export will preserve elements, their position and orientation, their material properties, and their thickness.

ESARAD, TSS and Thermica Primitives are imported as TMG Primitives made up of thin shell (2-D) elements. Loads, constraints and similar modeling entities are not imported.

TMG Primitives are exported as primitives recognized by the other solver code, while shell elements and beam elements that are not part of any TMG Primitive are each exported as individual primitives. TMG entities such as boundary conditions are not exported.

For individual unrelated primitives, the same import-export functionality applies regardless of which radiation code you are importing or exporting. However, for related primitives, such as shell combinations (in ESARAD), assemblies (in TSS) and shapes related by an identifier (in Thermica), different limitations apply for each different radiation code. The import and export of these related primitives are discussed separately for each radiation code near the end of this article.

**A note on terminology:** Primitives in TMG correspond to "shells" in ESARAD, "primitives" in TSS and "shapes" in Thermica. In this article, for the sake of brevity, we will use the word "primitive" to refer globally to all of these entities. There is one exception, however. In sections devoted to and labeled with a particular radiation code, that code's terminology will be used.

### Importing Primitives

TMG imports primitives defined in ESARAD, TSS and Thermica, preserving (in I-DEAS terminology) translation and rotation, relative element position and sequence, material properties, element thickness, element order (linear or parabolic) and active (radiating) element faces. Each primitive is imported into the current FE Model as a TMG entity called a Primitive, having the same name as it did in its code of origin. The elements comprising the primitive will be grouped in I-DEAS, and the group will also have the same name. You can use the TMG Model Manager to modify or position the Primitive. See the article on *Using Primitives* for details.

### Features Supported for Import

Feature	Imported as
Primitive	Primitive, a TMG Entity
Primitive created by parameters	Primitive created by parameters
Primitive created by points	Primitive created by points
Primitive translations and rotations	Primitive translations and rotations
Element label, position and sequence	Same label, position and sequence
Most element material properties	Element Material Properties
Element thickness	Physical Property: Thin Shell Thickness
Units (for length and material properties)	Units (for length and material properties)
Related Primitives (shell combinations in ESARAD, assemblies in TSS and shapes related by an identifier in Thermica)	Element Groups and Primitives named similarly (details under individual radiation code sections below)

## Features NOT Supported for Import

Unsupported Feature	Notes
Primitives created by boolean operations	All primitives used in boolean operations are imported (rather than the resultant primitive).

## Exporting Primitives

TMG exports Primitives to formats readable by ESARAD, TSS and Thermica, preserving (in I-DEAS terminology) translation and rotation, relative element position and sequence, optical material properties, element thickness and active (radiating) element face. All elements are exported as linear elements. All Primitives in the current FE model are exported. Shell elements in the FE model that are not part of a Primitive are exported individually as separate primitives. Once exported into the other code, primitives originating in TMG behave the same as native primitives. They can be modified using the tools in the other radiation code.

## Features Supported for Export

Feature	Exported as
Primitive, a TMG Entity	Primitive
Primitive created by parameters	Primitive created by parameters
Primitive created by points	Primitive created by points (not supported by TSS)
Primitive translations and rotations	Primitive translations and rotations
Element label, position and sequence	Same label, position and sequence
Element optical material properties	Element optical material properties
Element Physical Property, Thin Shell Thickness	Element thickness
Units (length and material properties)	Converted to SI Units before export
Shell elements not included in a TMG Primitive	Each element exported as an individual primitive
Beam elements	Cylinder primitives with appropriate diameter
Primitives named according to conventions detailed below under individual radiation code	Related Primitives (shell combinations in ESARAD, assemblies in TSS and shapes related by an identifier in Thermica)

## Features NOT Supported for Export

Unsupported Feature	Notes
Mass elements and solid elements	Not exported
Element Color	Not exported
Parabolic elements	Exported as linear elements

## Shell Combinations For ESARAD

### Import

As mentioned previously, individual ESARAD Shells are imported as Primitives in TMG

with the elements that comprise the Primitive grouped under an identical name. When importing a Shell Combination from ESARAD, all the elements contained in the combined Shells are also grouped. The name of this larger group is identical to the name Shell Combination, plus the prefix "ASY\_". Thus the ESARAD Shell Combination *shell\_comb\_1* will generate an I-DEAS element group called *ASY\_shell\_comb\_1*, containing all the elements in all the Primitives that were imported from the Shell Combination.

Similarly, if the ESARAD model contains a hierarchy of Shell Combinations within Shell Combinations, an I-DEAS element group will be created for each level of Shell Combination, containing all the elements at or below that point in the hierarchy.

## Export

To export two or more TMG Primitives as an ESARAD Combined Shell, create an I-DEAS element group containing all the elements in all the Primitives you want to combine. This can be easily done with the Simulation icon *Groups*, using the boolean operator OR to combine the groups representing the individual Primitives. Name this larger group with the prefix "ASY\_".

For example, to export related Primitives as a Combined Shell:

1. Create a TMG model with Primitives named *shell\_x* and *shell\_y* (element groups named *shell\_x* and *shell\_y* are automatically generated).
2. Create an element group named *ASY\_combined\_shell\_01* containing all the elements in groups *shell\_x* and *shell\_y*.

The exported ESARAD model will contain a Combined Shell with the name *combined\_shell\_01*, made up of Shells named *shell\_x* and *shell\_y*.

If the TMG model contains a hierarchy of ASY\_\* element groups, a corresponding hierarchy of Shell Combinations will be generated. To combine two primitives into a new SHELL you must create a group whose name starts with the string ASY\_ and include all elements of the two primitives in the group. You must ensure that the hierarchy conforms to ESARAD rules, that is, that primitives can only be combined once and cannot be common to two ASY\_ groups. For example, if you have four primitives E1, E2, E3 and E4, you can create assembly groups to produce:

```
SHELL ASY_1 ;
ASY_1 = E1 +E2 ;
SHELL ASY_2 ;
ASY_2 = ASY_1 +E3 ;
SHELL ASY_3 ;
ASY_3 = ASY_2 +E4 ;
```

but you cannot produce:

```
SHELL ASY_5 ;
ASY_5 = E1 + E2 + E3 + E4 ;
```

## Primitive Assemblies For TSS

### Import

As mentioned previously, individual TSS Primitives are imported as Primitives in TMG with the elements that comprise the Primitive grouped under an identical name. When importing a TSS Assembly all the elements of all the Primitives in the Assembly will also be grouped. The name of this larger group will be identical to the name of the TSS Assembly, plus the

prefix "ASY\_". Thus the TSS Assembly *assembly\_1* will generate an I-DEAS element group called *ASY\_assembly\_1*, containing all the elements in all the Primitives that were imported from the TSS Assembly.

## Export

To export two or more TMG Primitives as a TSS Assembly, create an I-DEAS element group containing all the elements in all the Primitives you want to assemble. This can be easily done with the Simulation icon *Groups*, using the boolean operator OR to combine the groups representing the individual Primitives. Name this larger group with the prefix "ASY\_".

For example, to export related Primitives as a TSS Assembly:

1. Create a TMG model with Primitives named *primitive\_x* and *primitive\_y* (element groups named *primitive\_x* and *primitive\_y* are automatically generated).
2. Create an element group named *ASY\_assembly\_01* containing all the elements in groups *primitive\_x* and *primitive\_y*.

The exported TSS model will contain an Assembly with the name *assembly\_01*, made up of Primitives named *primitive\_x* and *primitive\_y*.

## Related Shapes For Thermica

### Import

The import of related Thermica Shapes is not supported. All Shapes are imported individually.

### Export

To export two or more TMG Primitives as Shapes related by an identifier, create an I-DEAS element group containing all the elements in all the Primitives you want to relate. This can be easily done with the Simulation icon *Groups*, using the boolean operator OR to combine the groups representing the individual Primitives. Name this larger group with the prefix "ASY\_".

For example, to export Primitives as related Shapes with the identifier <001>:

1. Create a TMG model with Primitives named *shape\_x* and *shape\_y* (element groups named *shape\_x* and *shape\_y* are automatically generated).
2. Create an element group named *ASY\_001* containing all the elements in *shape\_x* and *shape\_y*.

The exported Thermica model will contain an identifier <001>, containing *shape\_x* and *shape\_y*.

Hierarchies of identifiers (identifiers containing identifiers) cannot be created for export in TMG. Each TMG Primitive can be exported to only one identifier. Different groups named in the ASY\_\* format cannot share any element.