

# Module 1: Basics



Fluid Dynamics

Structural Mechanics

Electromagnetics

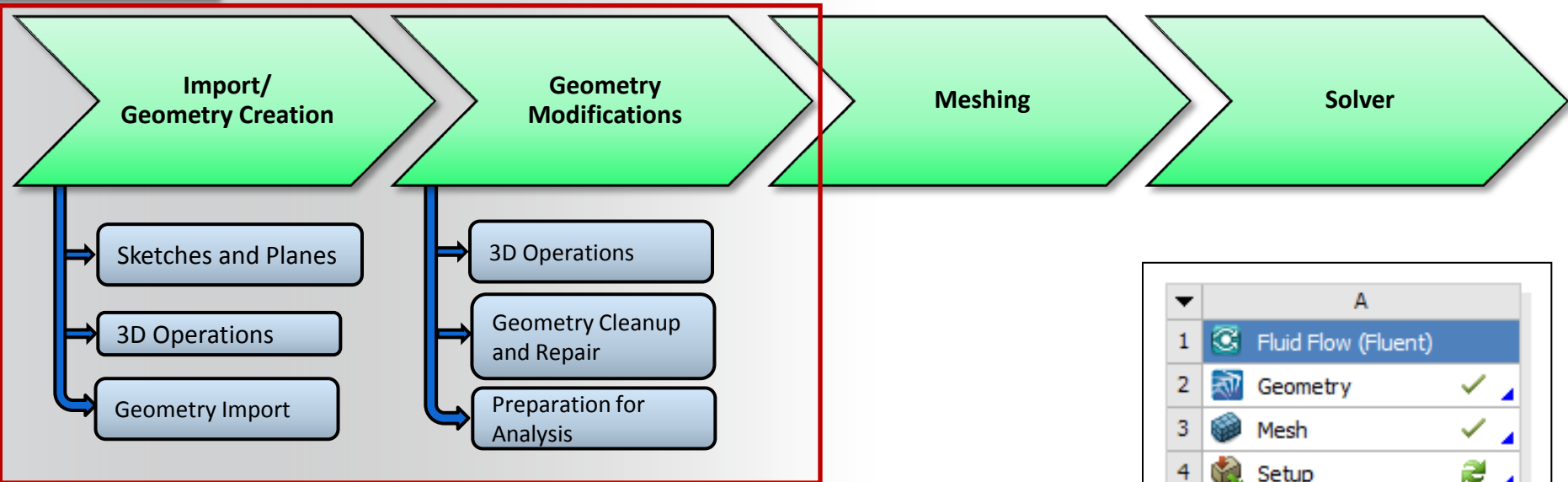
Systems and Multiphysics

## Introduction to ANSYS SpaceClaim Direct Modeler

**In this module we will learn about:**

- **Pre-processing Workflow using ANSYS WB tools**
- **What is SpaceClaim Direct Modeler (SCDM)?**
- **Launching SCDM**
- **Interface**
- **File Operations**

# Preprocessing Workflow



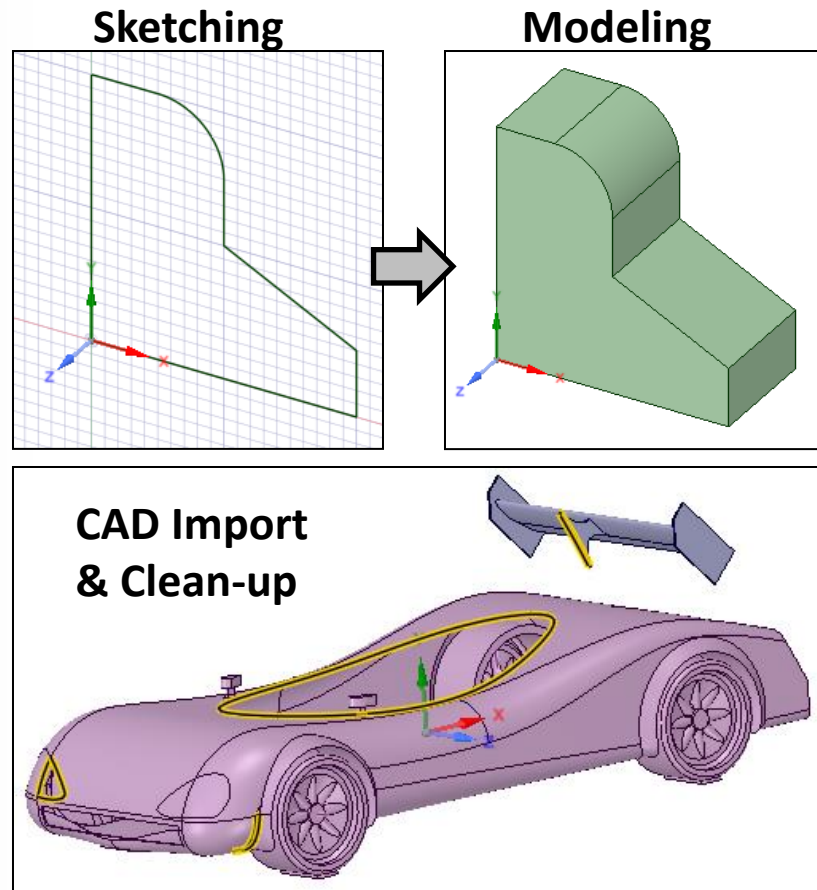
ANSYS SpaceClaim Direct Modeler

A	
1	Fluid Flow (Fluent)
2	Geometry <span style="float: right;">✓</span>
3	Mesh <span style="float: right;">✓</span>
4	Setup <span style="float: right;">↻</span>
5	Solution <span style="float: right;">?</span>
6	Results <span style="float: right;">?</span>

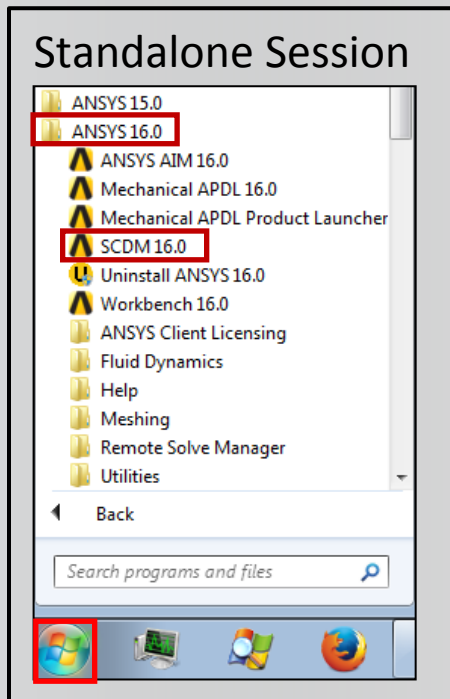
Fluid Flow (Fluent)

# What is SpaceClaim Direct Modeler?

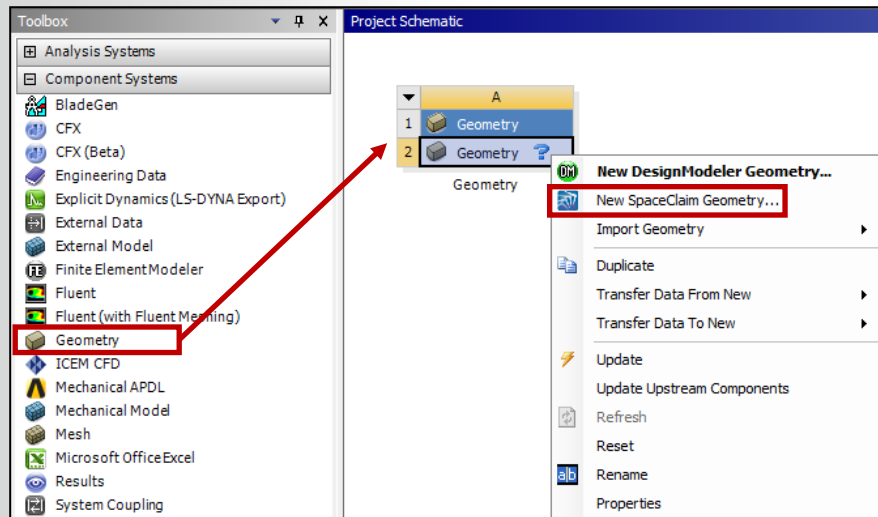
- Industry leading direct modeling tool for rapid concept design and geometry manipulation
- Analysis-focused tools to repair, prepare, and optimize models
- Computer-Aided Design (CAD) – like approach to create new models OR Import CAD models without CAD connection
- Dead model parameterization
  - No need of native CAD data for parameterization
    - Freedom to explore solutions without relying on CAD team
  - More flexibility to make unplanned and local changes
    - No features + No constraints = No regeneration failures
- Short learning curve for engineers without CAD background



## Standalone Session



## From Geometry cell of any System



- ANSYS SCDM is launched within Workbench
- Right click on “Geometry” and select “New SpaceClaim Geometry”

ANSYS SpaceClaim Direct Modeler is supported only on the ‘Windows’ platform

# ANSYS<sup>®</sup> SCDM Interface

Quick Access Toolbar

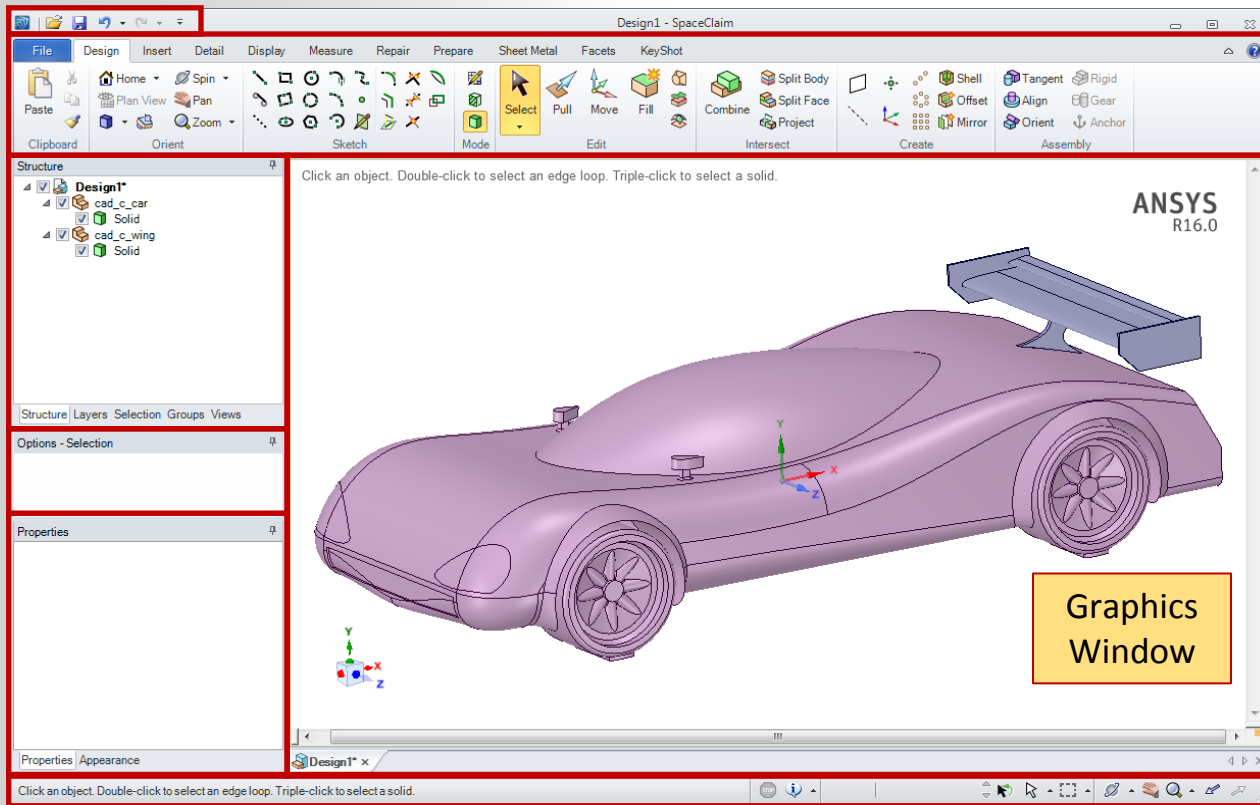
Ribbon Toolbar

Structure Panel

Options Panel

Properties Panel

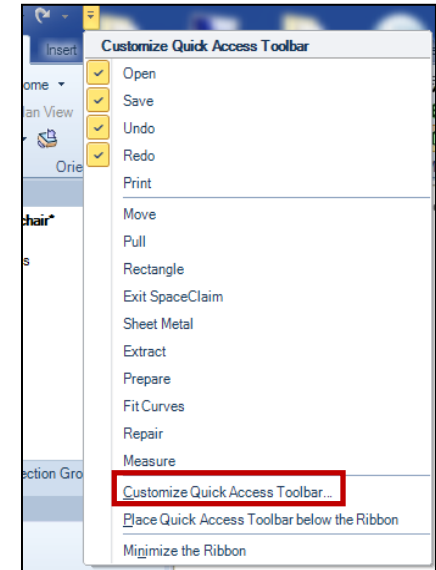
Status Bar

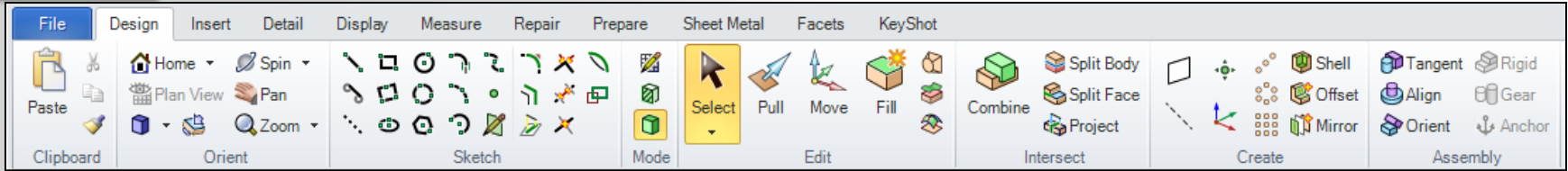


Graphics Window

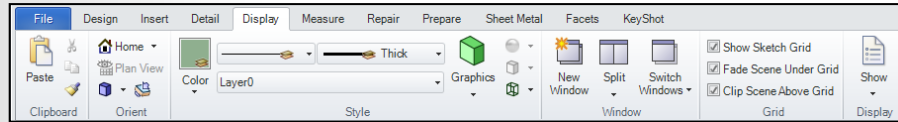
# Quick Access Toolbar (QAT)

- Open, Save, Undo, Redo options available by default on the QAT
- **Undo (CTRL-Z)** can be used to undo your last action. **Redo (CTRL-Y)** can be used to repeat it.
- Frequently used tools can be added to the QAT
  - Select the down arrow to the right of the Quick Access Toolbar (QAT)
  - Choose “Customize Quick Access Toolbar” from the drop down list

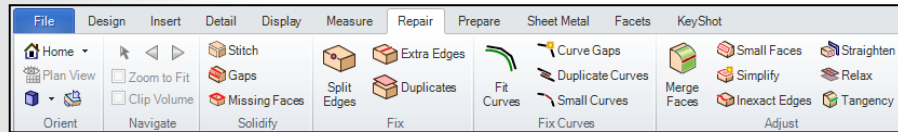




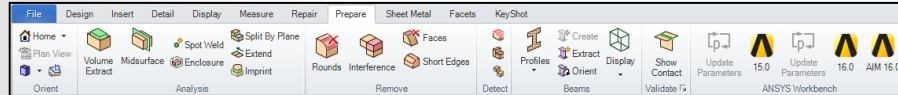
- Familiar ribbon UI design
- Tools categorized in a series of Tabs
  - File handling
  - Designing
  - Displaying
  - Repairing
  - Etc.
- Each Tab displays relevant tools in organized sections



Display Tab



Repair Tab

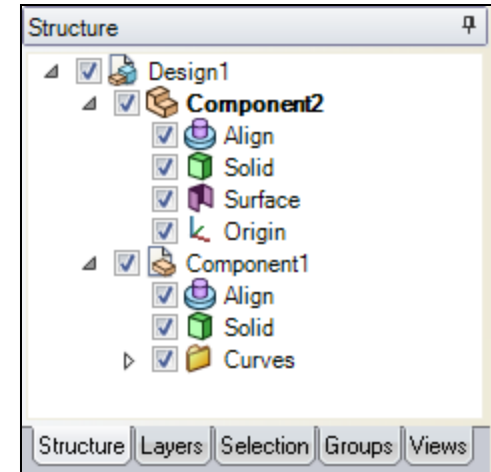


Prepare Tab



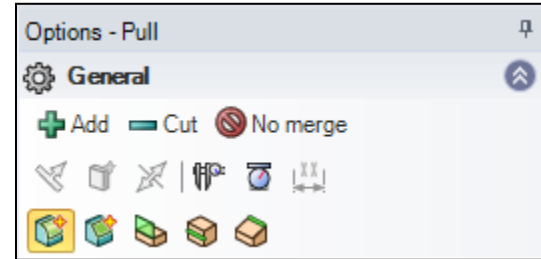
SpaceClaim **Direct** Modeler is not a feature-based modeler

- Operations are not stored under Structure Tree
  - This is characteristic of **history-based** or **feature-based** modelers
- Structure Tree shows the objects/entities
  - Bodies (solid, surface)
  - Curves (sketch curves, 3D curves)
  - Assembly constraints
  - Origin
  - Plane



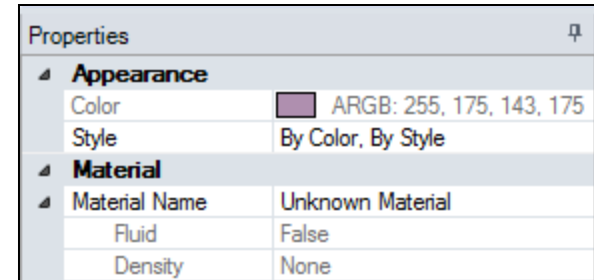
## Option Panel

- Displays options for modifying functions of active SpaceClaim tool
  - E.g., Pull tool contains option for add material, subtract material, create fillet, chamfer, etc.



## Properties Panel

- Displays properties of selected entity in Graphics window or Structure panel
- Modify property values
  - Color

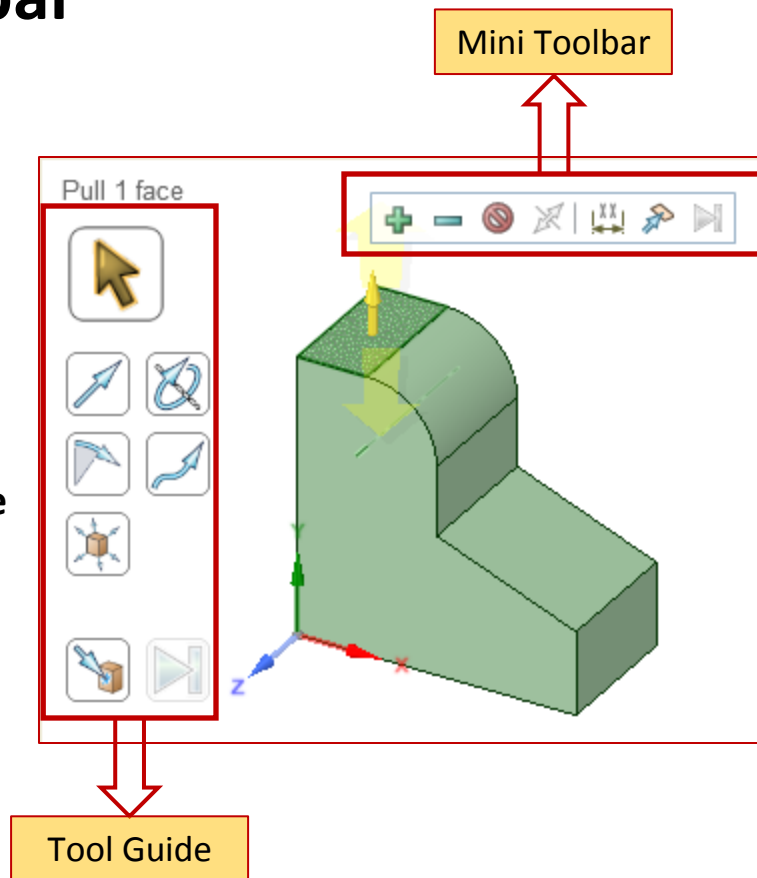


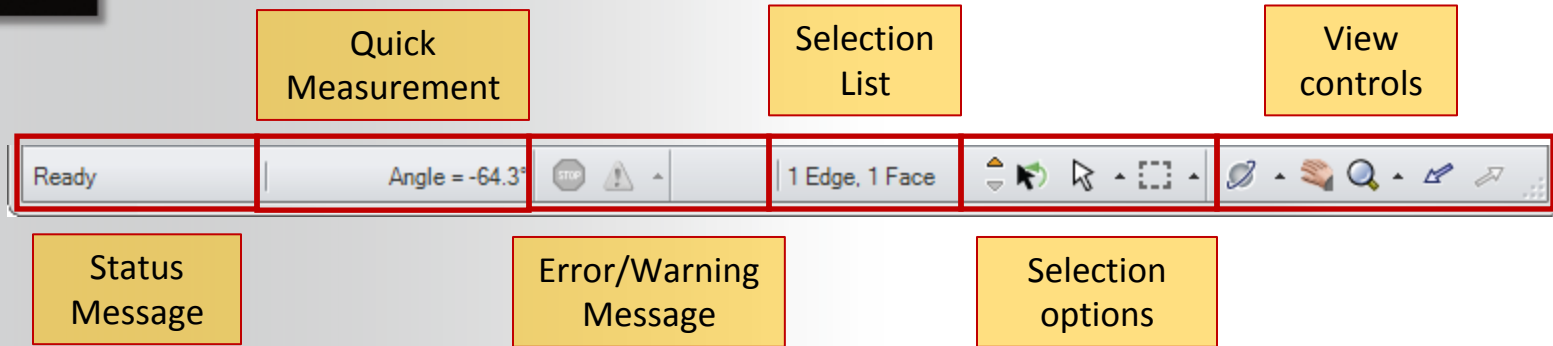
## Mini Toolbar

- Contains frequently used options of active tool

## Tool Guide

- Contains different options to change behavior of active tool
  - E.g., Tool guide of “Pull” tool contains option for Revolve, Sweep, Scale, etc.





**Status Message:** Displays message and progress information about current tool

**Quick Measurement:** Displays simple measurement of selected entities (distance, angle)

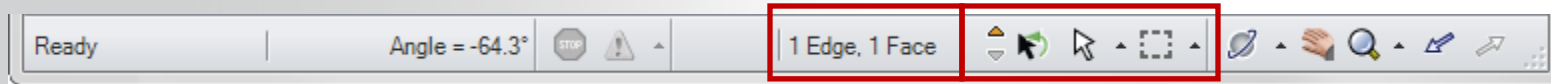
**Error/Warning Message:** Displays error and warning messages

**Selection List:** Displays list of currently selected objects

**Selection Options:** Hosts various options for selection

**View Controls:** Controls for spin, pan, zoom, and switch to previous or next views

- You can select vertices (including centers of circles and ellipses, midpoints of lines, and points on splines), edges, planes, axes, faces, surfaces, rounds, solids, and components.
- Most commonly used selection methods are:
  - Click to select an object.
  - Double-click to select an edge loop. (Double-click again to cycle through alternate loops.)
  - Triple-click to select a solid.
  - Drag to create a selection Box (can also use Lasso, Polygon, and Paint). **If you draw the box from left to right, all objects fully enclosed within the box will be selected. If you draw the box from right to left, all objects touching the box will be selected.**
  - Press CTRL+A to select all similar objects, such as faces, edges, or points on the same solid or surface part.
  - Hold CTRL and select to add or remove items from the selection. Ctrl with box-selection toggles the selection; Shift with box-selection adds to the selection.

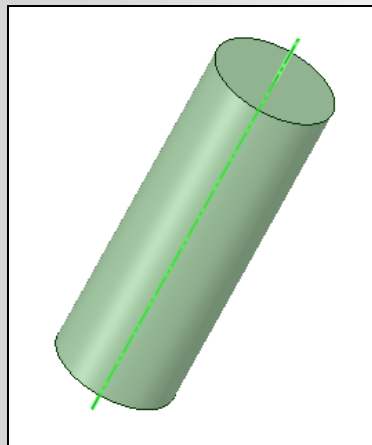
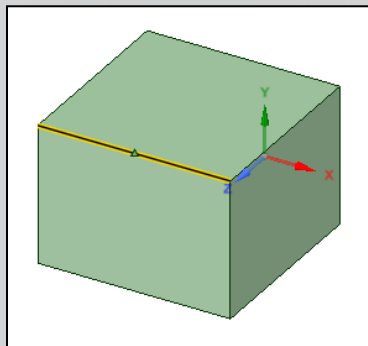


Selection  
List

Selection  
options

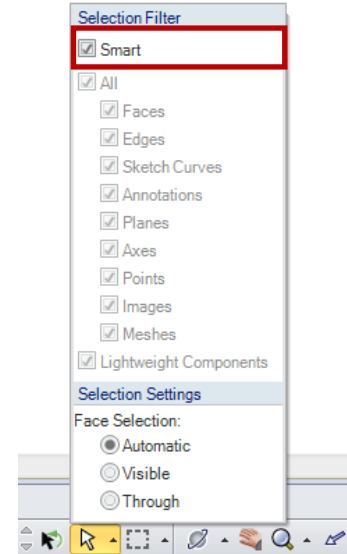
## Selecting entities

- Select vertices (including centers of circles and ellipses, midpoints of lines, and points on splines), edges, planes, axes, faces, surfaces, rounds, solids, and components.

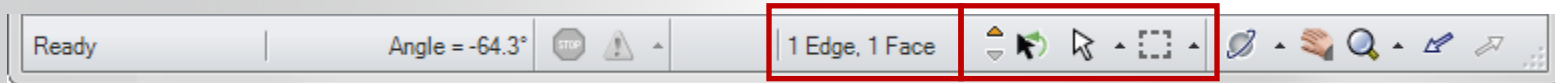


Click once to select a face:	
Double-click to select and cycle through chains of similar, connected faces (face loops):	
Triple-click to select a solid:	
Click once to select an edge:	
Double-click to select and cycle through chains of connected edges (edge loops):	

- Most commonly used selection methods are:
  - Click to select an object.
  - Double-click to select an edge loop. (Double-click again to cycle through alternate loops.)
  - Triple-click to select a solid.
  - Drag to create a selection Box (can also use Lasso, Polygon, and Paint). **If you draw the box from left to right, all objects fully enclosed within the box will be selected. If you draw the box from right to left, all objects touching the box will be selected.**
  - Press CTRL+A to select all similar objects, such as faces, edges, or points on the same solid or surface part.
  - Hold CTRL and select to add or remove items from the selection.
- Toggle off 'Smart Selection' Filter to limit selection to desired entity types



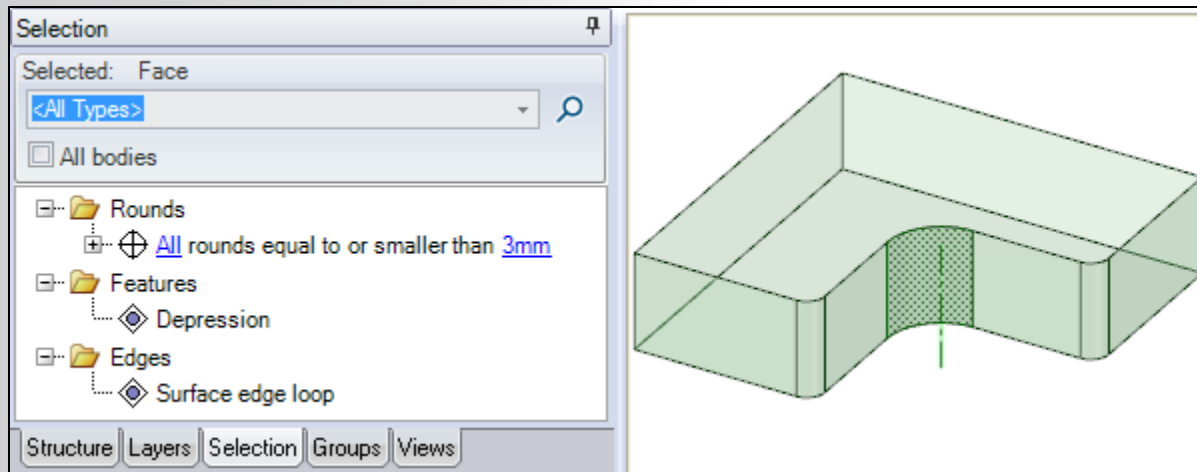
Smart  
Selection




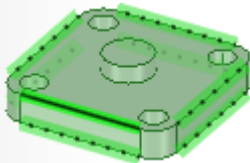
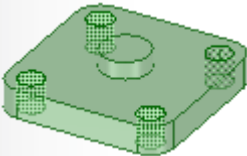
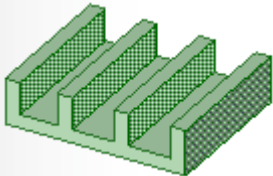
Selection  
List

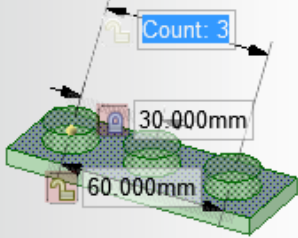
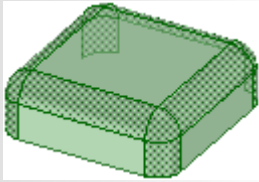
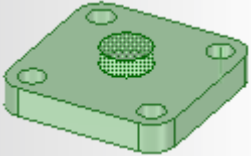
Selection  
options

- Selection Panel: Use the Selection panel to select objects in the same part that are similar or related to the object currently selected. The results list is based on the geometry you select for the search.
- The relations available are displayed in the Selection window as per the item selected and items





Category	Description	Example	Selection types
Coaxial Faces	Objects with the same axis		<ul style="list-style-type: none"> <li>• Coaxial Hole, Protrusion, Cylinder</li> <li>• Coaxial protrusion</li> <li>• Coaxial cylinder</li> <li>• Coaxial surfaces</li> </ul>
Edges	Edges that are like the currently selected edge		<ul style="list-style-type: none"> <li>• Edges with same length</li> <li>• Edges with same length and same orientation</li> <li>• Edges with same length in same face</li> <li>• Surface edge loop</li> <li>• Hard sheet metal edges</li> </ul>
Features	Groups of faces that form protrusions, depressions, inner faces, or that enclose other faces		<ul style="list-style-type: none"> <li>• Protrusion</li> <li>• Depression</li> <li>• Inner faces</li> <li>• Enclosed by</li> </ul>
Offset faces	Faces that have an offset relationship defined		<ul style="list-style-type: none"> <li>• All offset baseline faces</li> <li>• All offset faces</li> <li>• Faces with same offset</li> <li>• All coincident faces</li> </ul>

Category	Description	Example	Selection types
Patterns	Pattern members, entire patterns, or recognized patterns		<ul style="list-style-type: none"> <li>• Pattern member</li> <li>• Recognized pattern</li> <li>• All pattern members</li> </ul>
Rounds	Rounds and chamfers		<ul style="list-style-type: none"> <li>• Equal radius rounds</li> <li>• Equal or smaller radius rounds</li> <li>• Equal or smaller-sized chamfers</li> <li>• Variable radius round</li> <li>• Faces and chains of faces even if they are composed of a mix of constant and variable faces</li> </ul>
Same size	Faces that have the same radius or area		<ul style="list-style-type: none"> <li>• Equal radius cylinder</li> <li>• Equal radius hole</li> <li>• Equal radius protrusion</li> <li>• Faces with the same area</li> <li>• Holes equal to or smaller than</li> </ul>

# Mouse and View Controls

- Easy-to-use Mouse and View controls to speed up operations and manipulate graphics
- Controls listed in “Quick Reference Card”
- “Quick Reference Card” can be accessed during SCDM launch

Select		
	Click to select one object	
	Double-click to cycle through Face / Edge / Curve loops	
	Triple-click to select all the faces of a body	
	Add or remove an object from the selection	
	Select all objects between the original selection and this object	
	Select a driving or alternate object for many tools (in blue)	
	Select all objects completely within the box	Ctrl + Drag toggles selection Shift + Drag adds to selection
	Select all objects partially within the box	
	Select other objects under the cursor	
	<ul style="list-style-type: none"> <li>• Click to get command menus</li> <li>• Drag to invoke gesture shortcuts</li> </ul>	
	Use the Select-Bounds toolguide to stop the propagation of selected faces and edges	
	Revert to the last set of selected items	
	To exit current tool and return to selection	

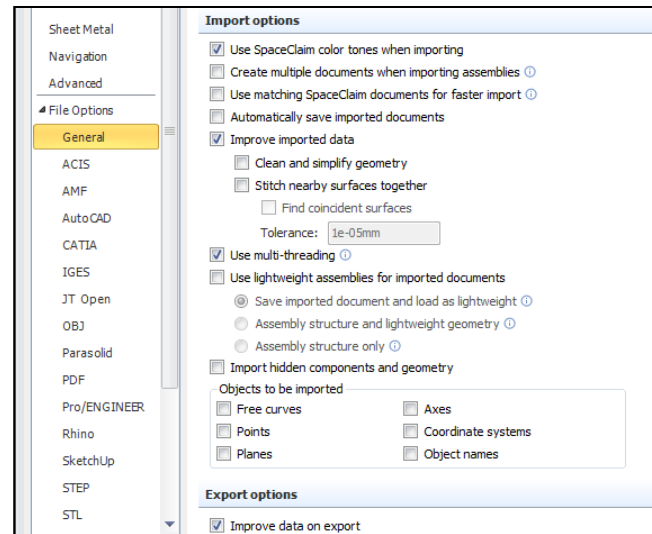
Orient	
	Spin
	Zoom
	Pan
	Snap View
	Double-click
	Home View
	Plan View
	Zoom Fit selection
	Previous view
	Next view

- Supports import from major CAD packages (CATIA, Pro/E, NX, Solid Works, etc.)
  - Separate license not required
- Neutral file formats like STEP and Parasolid are also supported
- Additional options for controlling import/export of file formats available in SpaceClaim Options panel

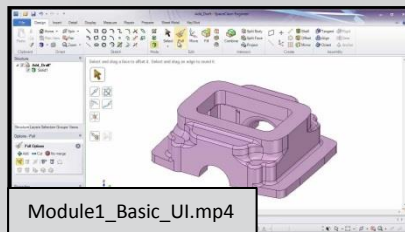
## File Formats

SpaceClaim files (\*.scdoc)  
 ACIS files (\*.sat;\*.sab)  
 AMF files (\*.amf)  
 AutoCAD files (\*.dwg;\*.dxf)  
 CATIA V4 files (\*.model;\*.exp)  
 CATIA V5 files (\*.CATPart;\*.CATProduct;\*.cgr)  
 CATIA V6 files (\*.3dxml)  
 DesignModeler files (\*.agdb)  
 DesignSpark Files (\*.rsdoc)  
 ECAD files (\*.idf;\*.idb;\*.emn)  
 IGES files (\*.igs;\*.iges)  
 Inventor files (\*.ipt;\*.iam)  
 JT Open files (\*.jt)  
 NX files (\*.prt)  
 OBJ files (\*.obj)  
 OSDM files (\*.pkg;\*.bdl;\*.ses;\*.sda;\*.sdp;\*.sdc;\*.sdpc)  
 Parasolid files (\*.x\_t;\*.xmt\_bt;\*.x\_b;\*.xmt\_bin)  
 PDF files (\*.pdf)  
 Pro/ENGINEER files (\*.prt;\*.xpr;\*.asm;\*.xas\*)  
 Rhino files (\*.3dm)  
 SketchUp files (\*.skp)  
 Solid Edge files (\*.par;\*.psm;\*.asm)  
 SolidWorks files (\*.sldprt;\*.sldasm)  
 SpaceClaim Template Files (\*.scdot)  
 STEP files (\*.stp;\*.step)  
 STL files (\*.stl)  
 VDA files (\*.vda)  
 All Files (\*.\*)

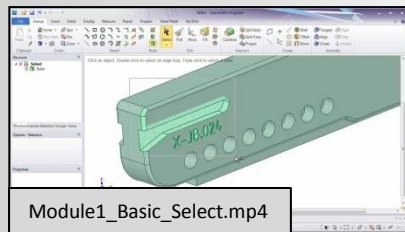
## SpaceClaim Options



# Videos available (look for separate directory)



Demo of Basic UI  
(10:38)



Demo of Selection  
(10:38)