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PRODUCT LIFECYCLE MANAGEMENT COMPETENCY CENTRE

Functional Modeling

By

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Topics

What is functional design & why is it important?

Core concepts of functional modeling

- Role of functional volumes
- Characteristics of functional features
- Role of functional bodies

Example: Modeling of Hair Dryer Using FM

Functional Modeling

Traditionally,

- The design process takes place on paper or on a whiteboard
- Resulting design decisions are recorded by building a 3D CAD model.
- The difficulties associated with updating this model when design changes occur can have a serious impact on cost & schedules.

In Functional design,

- Capture design constraints as early as possible in the design process.
- By modifying the constraints, you can quickly & easily optimize your design, as well as react to external changes.

Functional Modeling

Why is functional design better than traditional 3D solid modeling?

You become a detective when you have to modify other people's models. And sometimes you even have to become a detective when you open your own models, especially if you created them a long time ago.

- Important advantage of functional design is that the resulting functional models are generally easier to understand.
- They contain fewer features & the 3D shape does not depend on the order in which the features were created.
- In addition, functional modeling records much more of the design intent by leveraging the dependencies between the components that exist in any product.

With functional modeling, you spend more of your time thinking about design issues & less time as a detective.

Functional Volumes

Functional Volumes

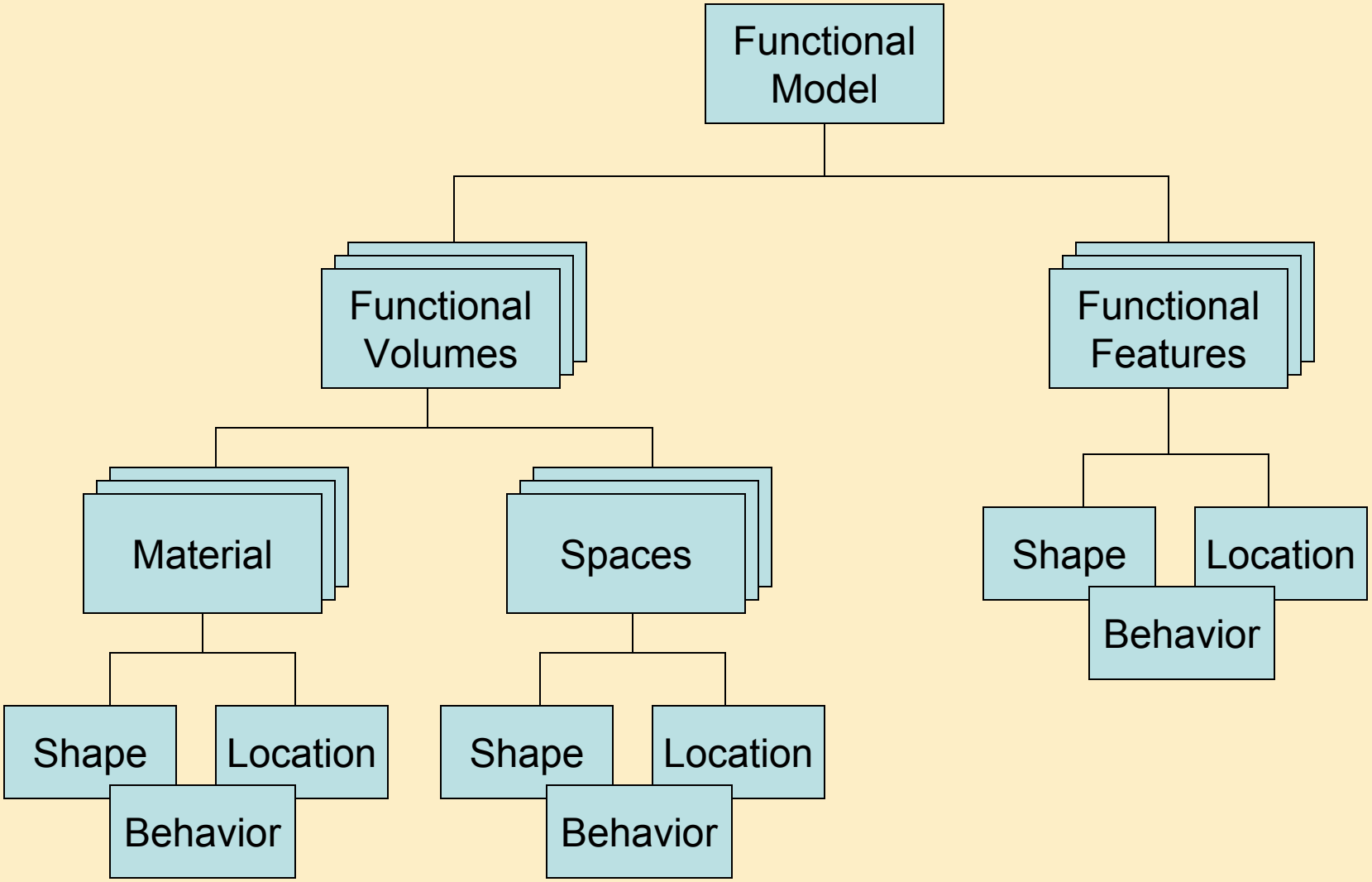
Exterior surfaces

Shape & support requirements of internal components

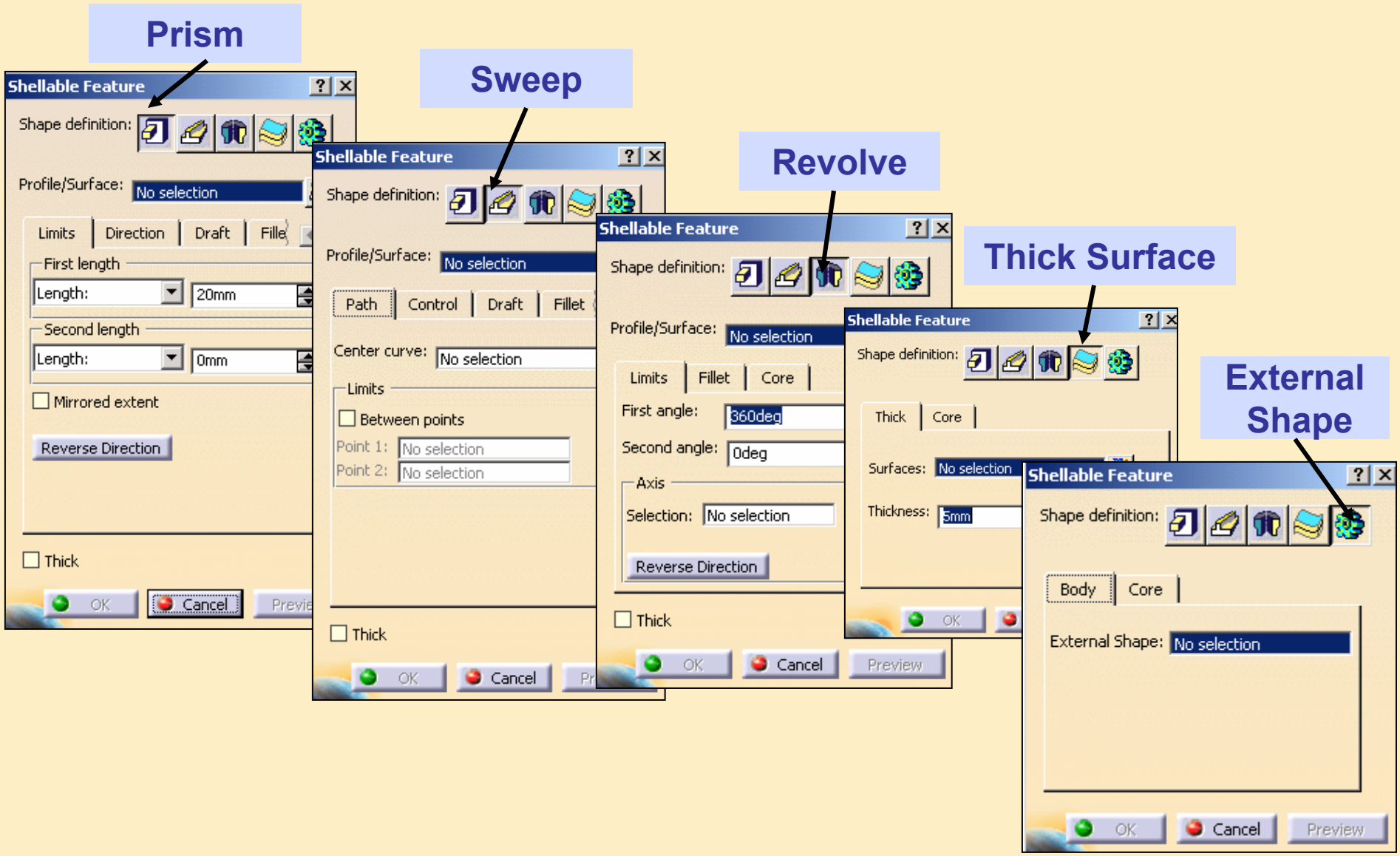
Structural requirements

Assembly & fastening requirements

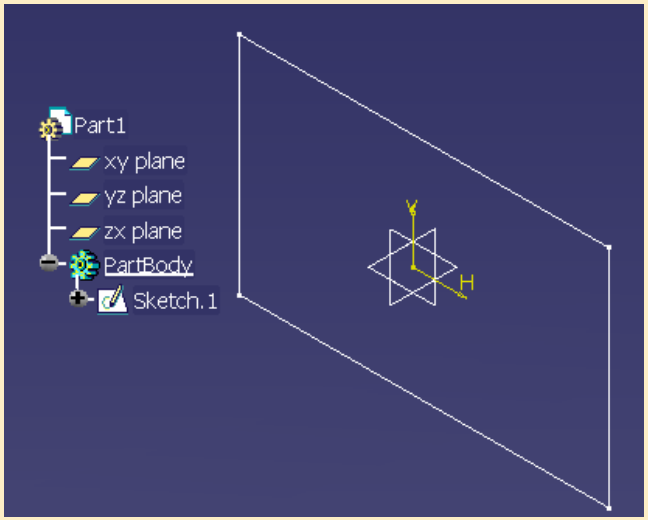
Functional Modeling Diagram



Defining the Shape of Functional Volume



Working with Functional and Solid Bodies

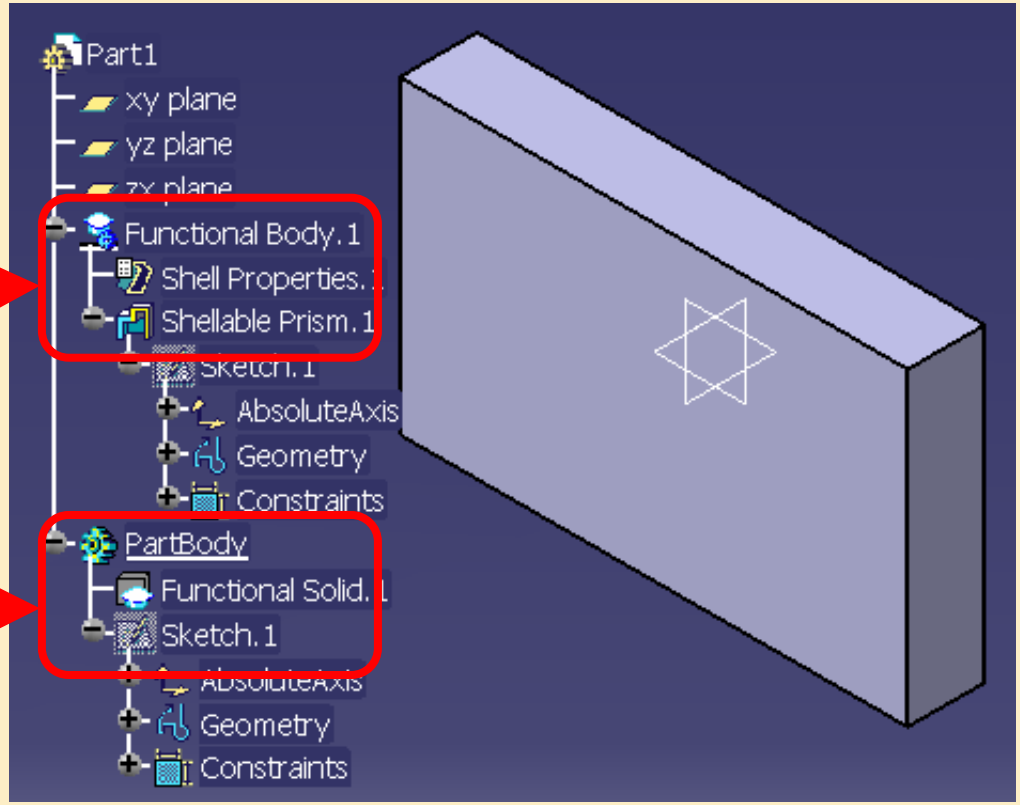


Functional Body

- Contains functional volumes & functional features
- Appears with first functional operation

Part Body

- Contains functional & part geometry



Functional Features

Characteristics of Functional Features

Represent common engineering constructs

Add functional details to the design

Behaviors

They Know how to create themselves in the presence of the shelled volume and other functional features.

They know how to behave.

Order independence

Features don’t care when they are made

Rib + Cutout = Cutout + Rib

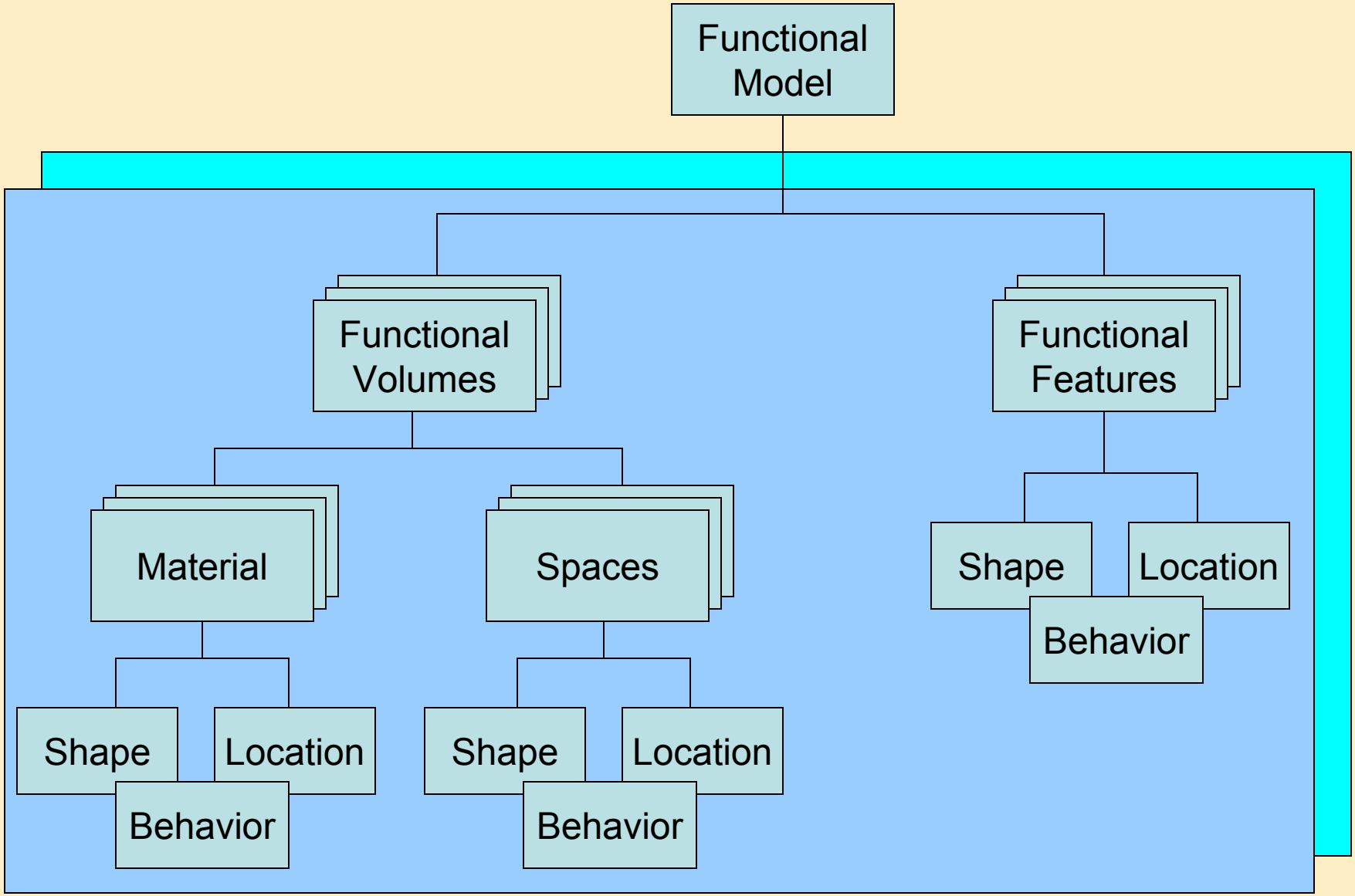
Inherently editable

Changing feature parameters causes an automatic update to the resulting geometry

Parameter Driven

Functional Bodies

Functional Bodies



Purpose of Bodies

A body is a collection of volumes and features that defines an entity such as a part. By default, all of the volumes in a body may interact only with other volumes in the same body.

Bodies also support different views of the design

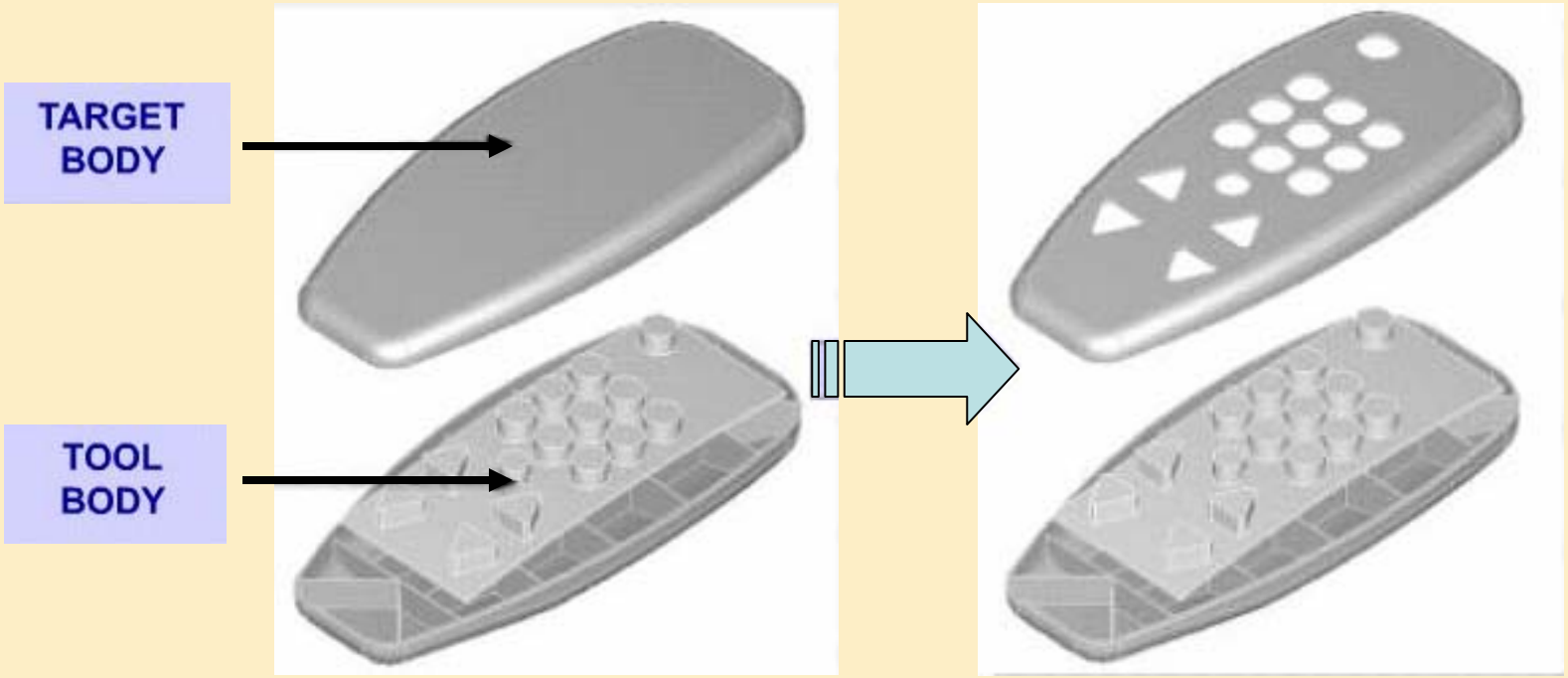
For Example

An ***Industrial designer*** can work on a solid, or unshelled, representation of the design at the same time the ***Project Engineer*** is defining details of the internal structure

Because of order independence, the results of this parallel work – in – progress can be successfully combined at the appropriate time. This type of collaboration is unique to functional modeling.

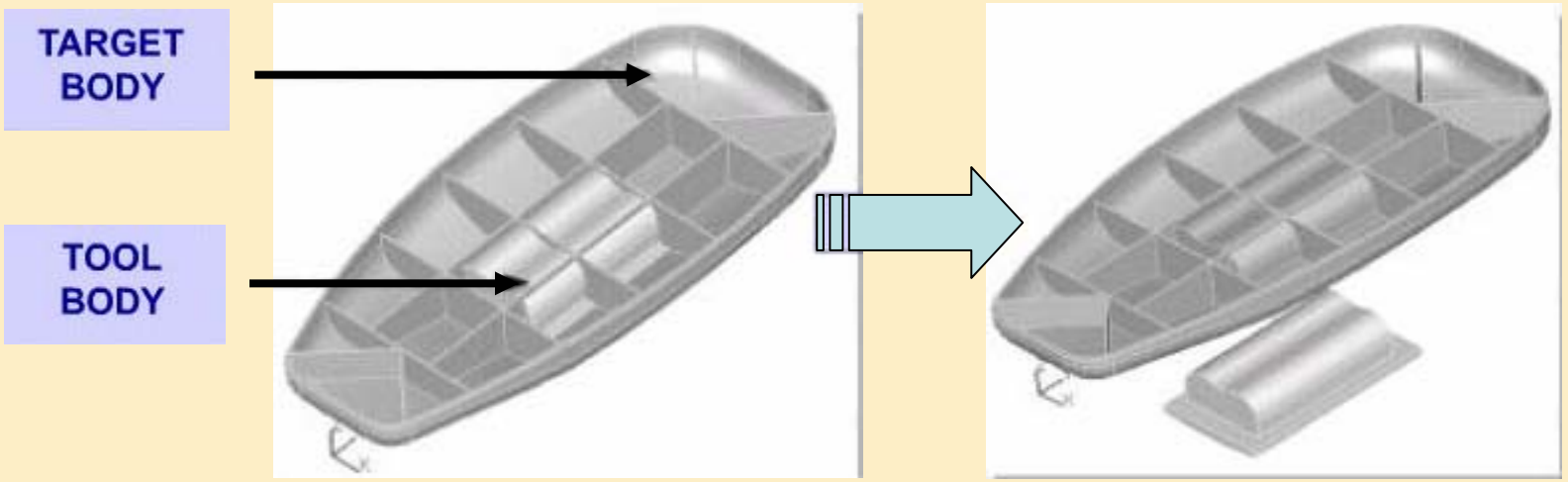
Last, but no means least, you can establish interactions between volumes in different bodies by using certain multi body.

Multiple Body Operation Using Fit



Fitting feature has created complex geometry in a single operation

Multiple Body Using Push



Push feature has created complex modifications to the internal ribs to accommodate the new shape

Using Functional Features

Design Intent

Select the functional feature that provides the best solution to the engineering need

Define input design parameters

Profile, lengths, directions, etc.

Active Body

Existing functional volumes and functional features*

Existing boundary geometry

FM Engine

Active Body (Updated)

Updated functional volumes

Updated boundary geometry

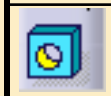
BEHAVIORAL RULES

Define how feature is constrained

Combining functional volumes and Functional features

Options In Functional Molded Part

Functional Features

	Cutout
	Pocket
	Boss
	Rib
	Rest
	Grill
	Reinforcement
	Push, Pull, Fitting
	Hole

Functional Modifiers

	Cut (Feature)
	Remove Feature
	Intersect Feature
	Transformation
	Mirror
	Pattern
	Edge Fillet

Options In Functional Molded Part Cont…

Multi – Body Features

	Divide
	Lip

Design Properties

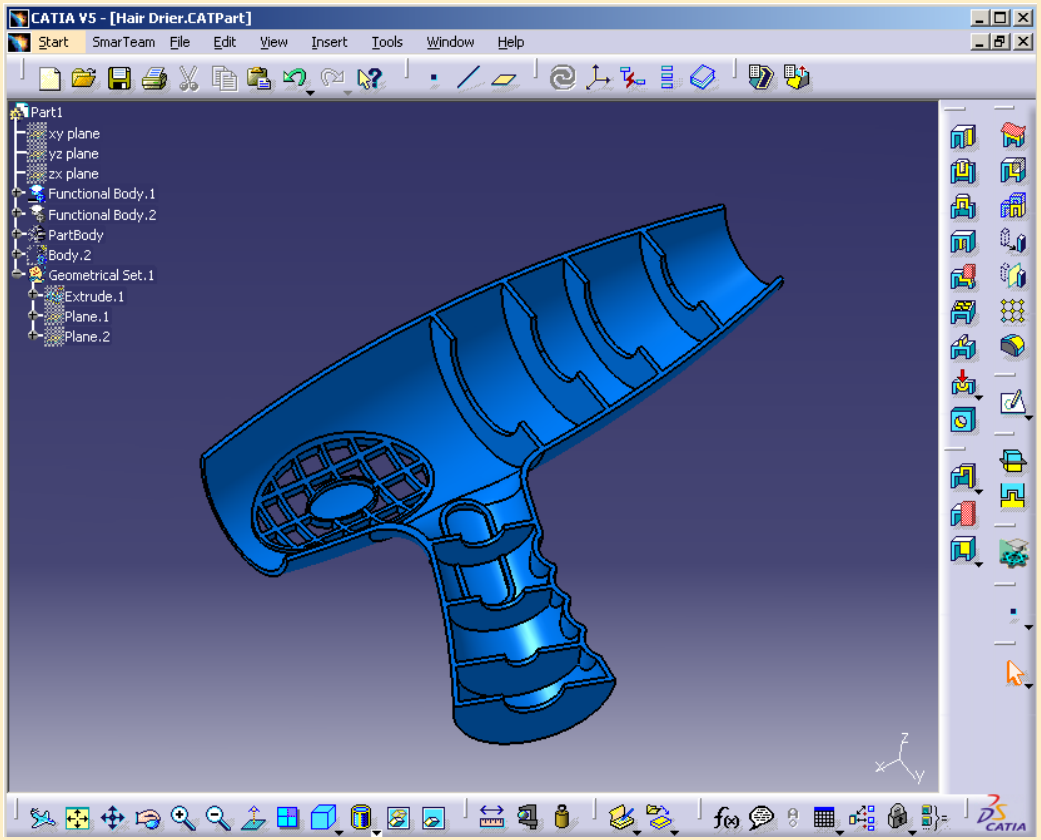
	Shell Property
	Draft Property

Shape Features

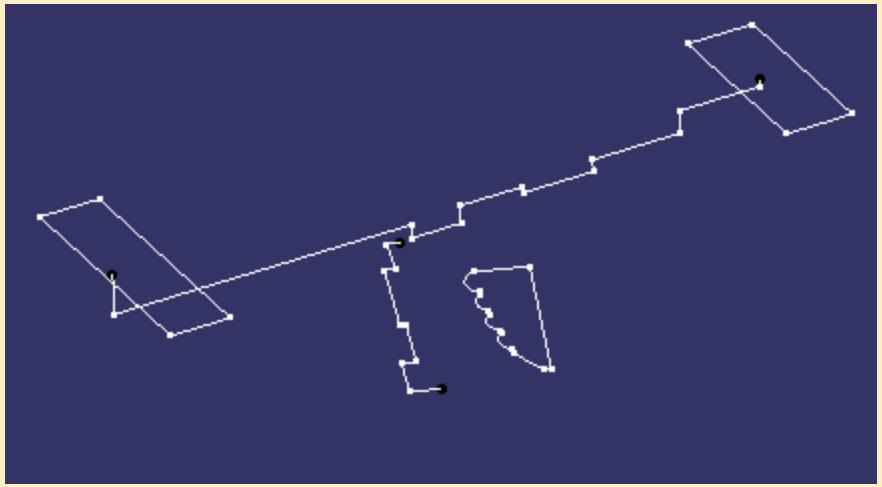
	Shellable, Cavity ,Added feature
	Protected Feature
	Internal , Core Feature.

How to design a Hair Dryer

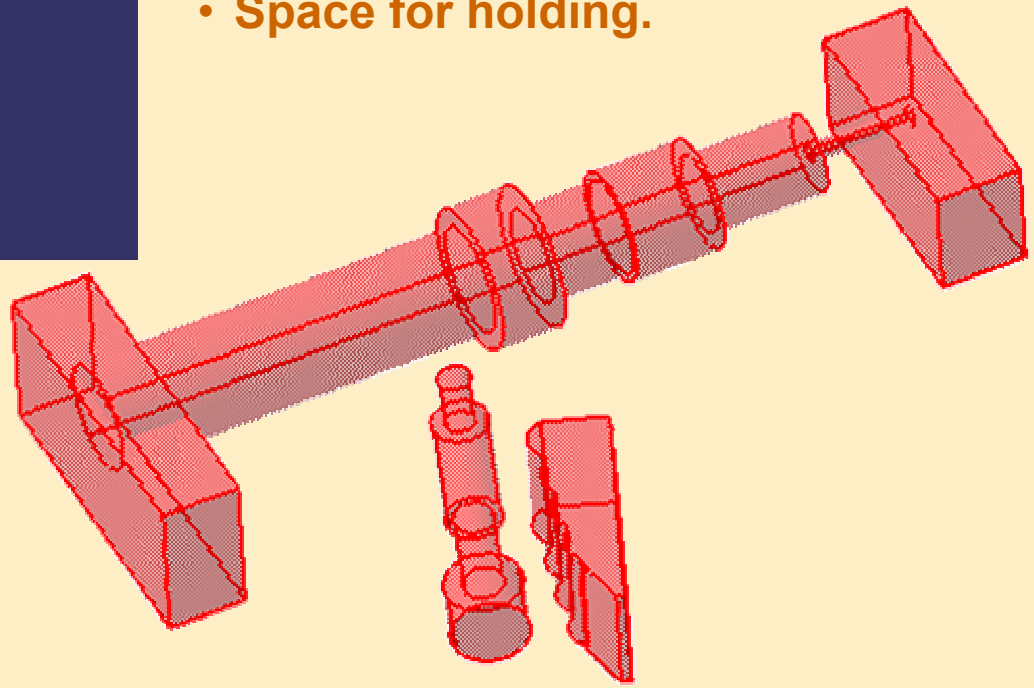
With
Functional
Molded Part



STEP 1 **Before we start the modeling we have to have the inner details**

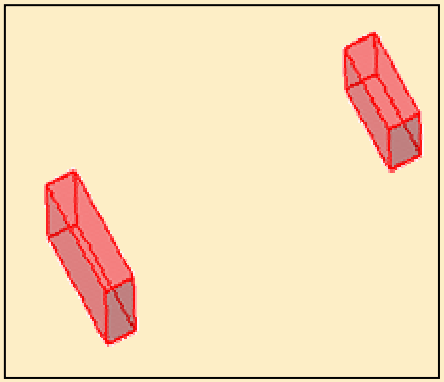


- Internal Details.
- Total Length.
- Space for holding.

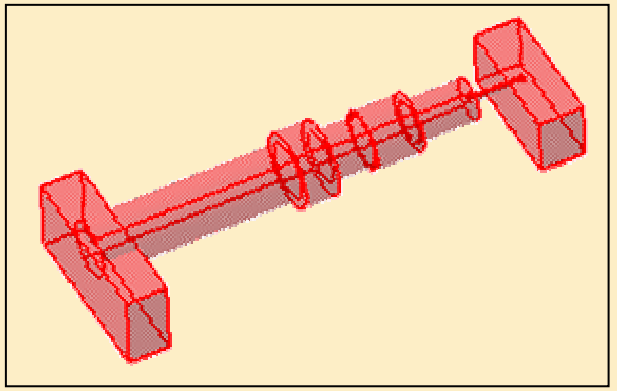


Example: Hair Dryer

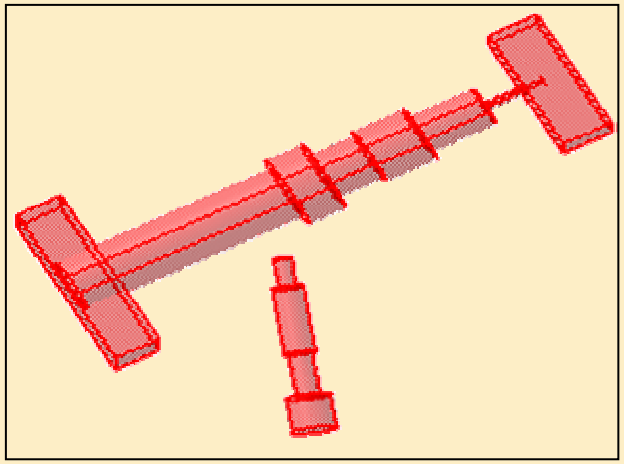
1 **Total Length constraint**



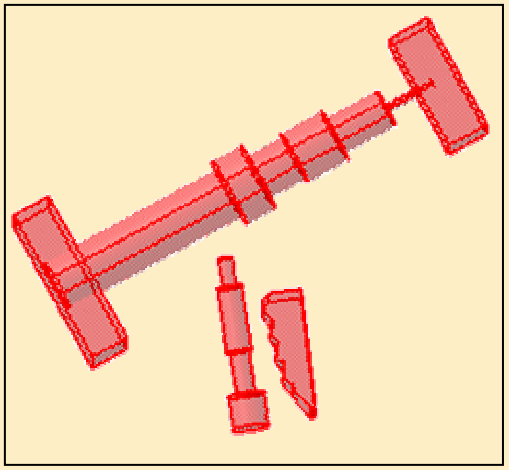
2 **Internal constraint Details**



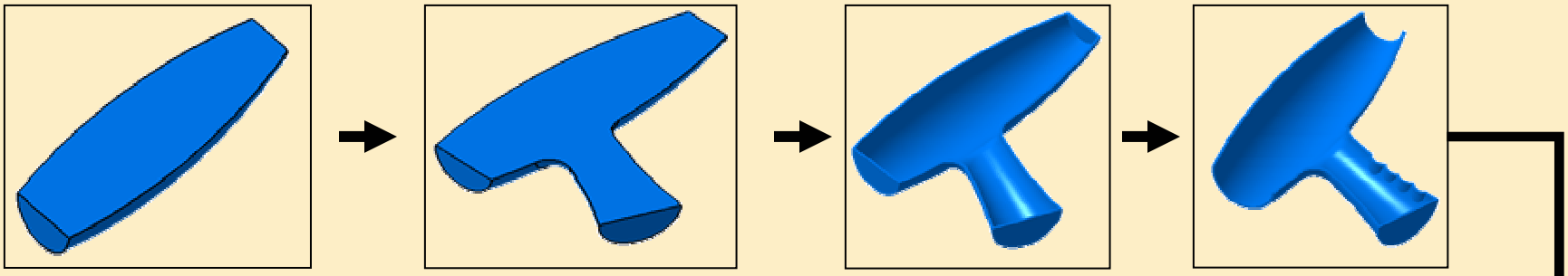
3 **Internal constraint Details**



4 **Space constraint for Holding**

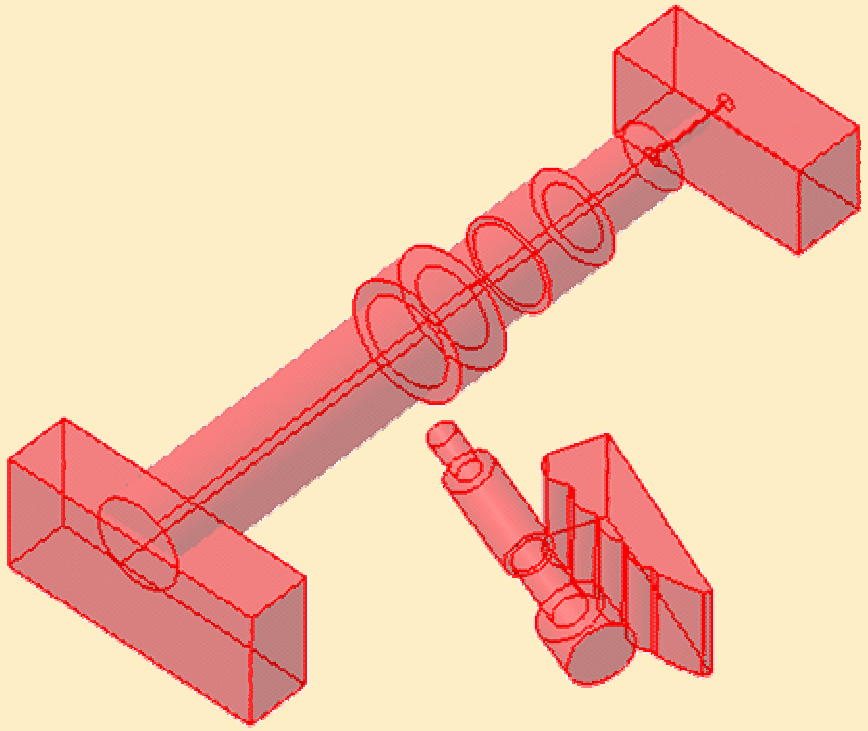


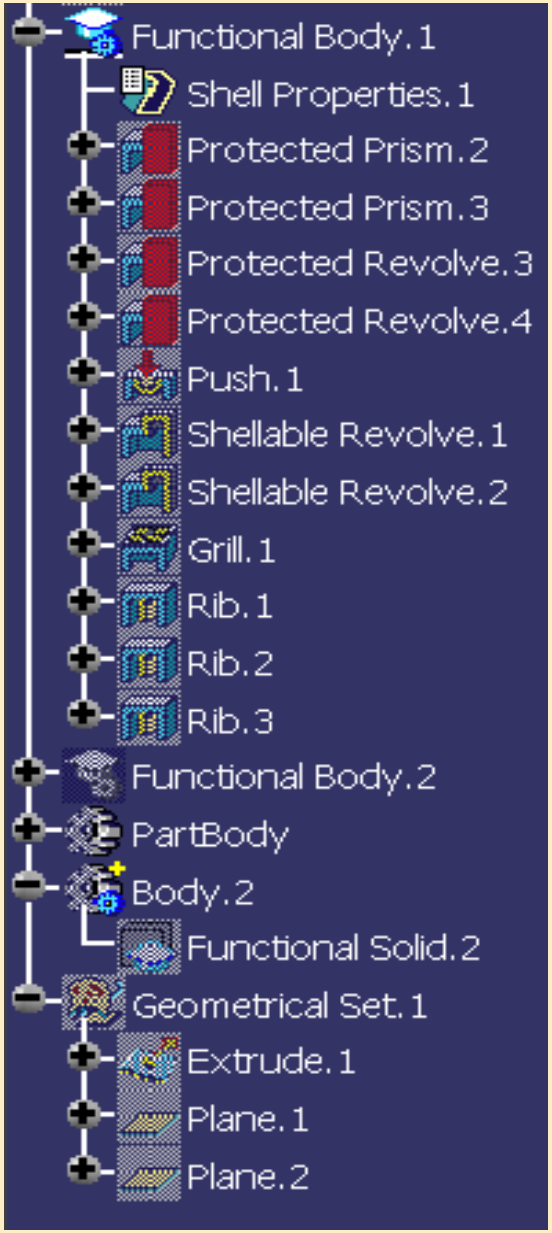
How to design a complete outer body of a Hair Dryer, Using Functional Modeling….

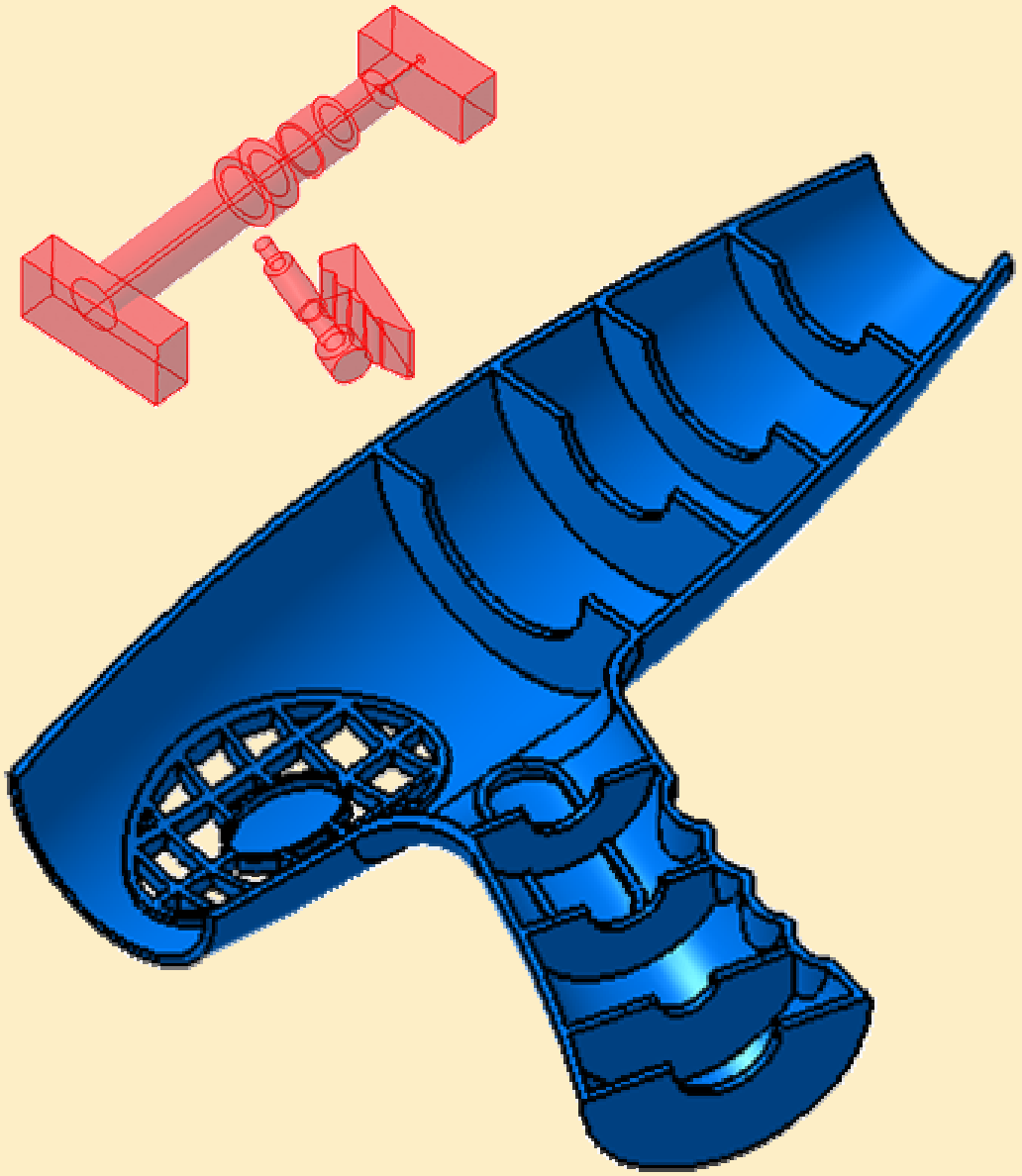


1. Shellable Revolve
2. Shellable Revolve for handle
3. Shelled Portion
4. Handle Portion
5. Add Grill
6. Add Ribs
7. Finish the Hair Dryer

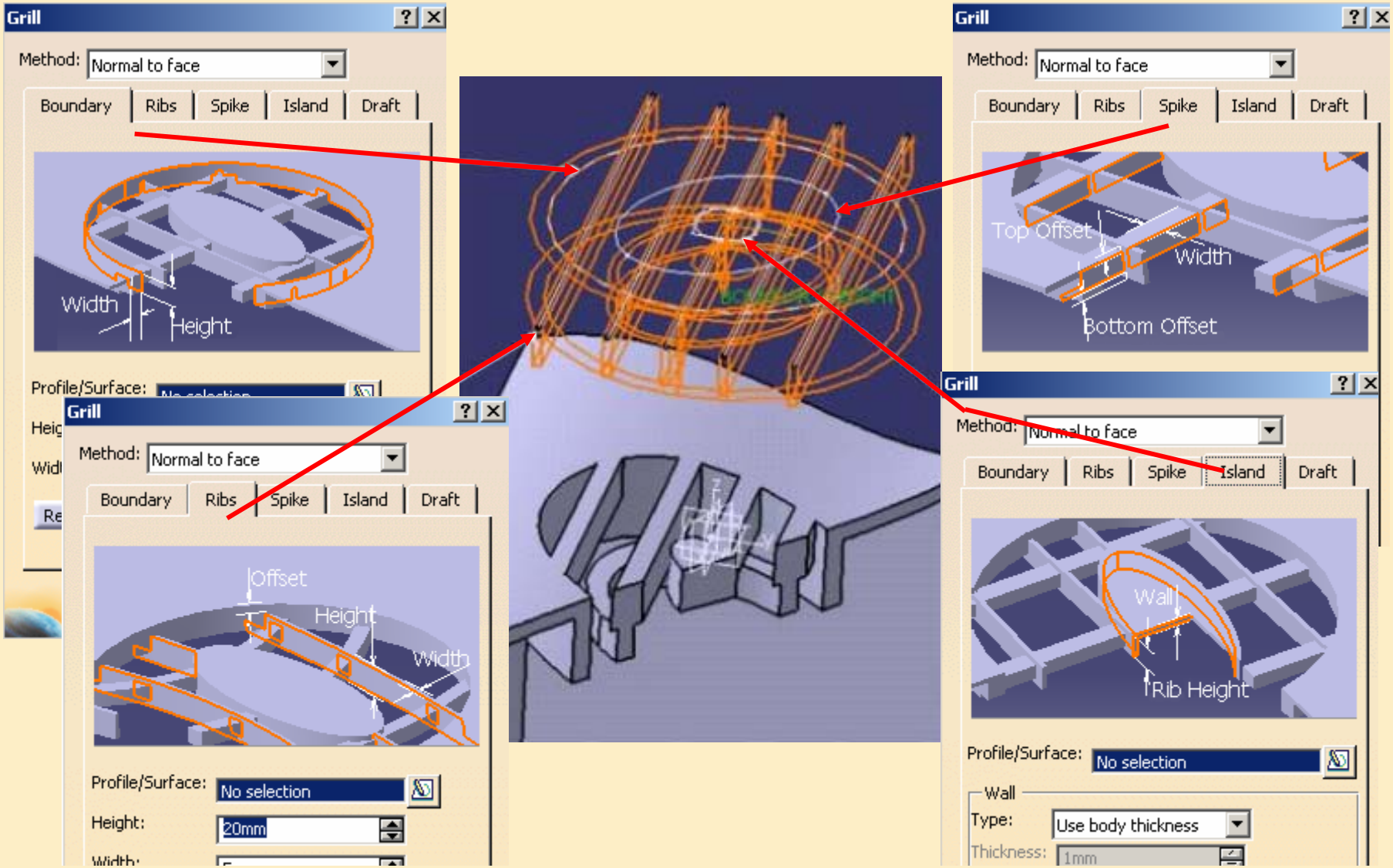
Functional Body.1
Shell Properties.1
Protected Prism.2
Protected Prism.3
Protected Revolve.3
Protected Revolve.4
Push.1

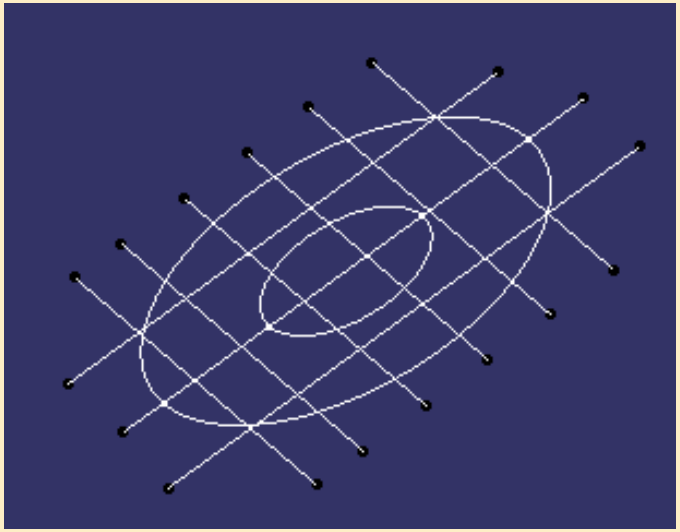


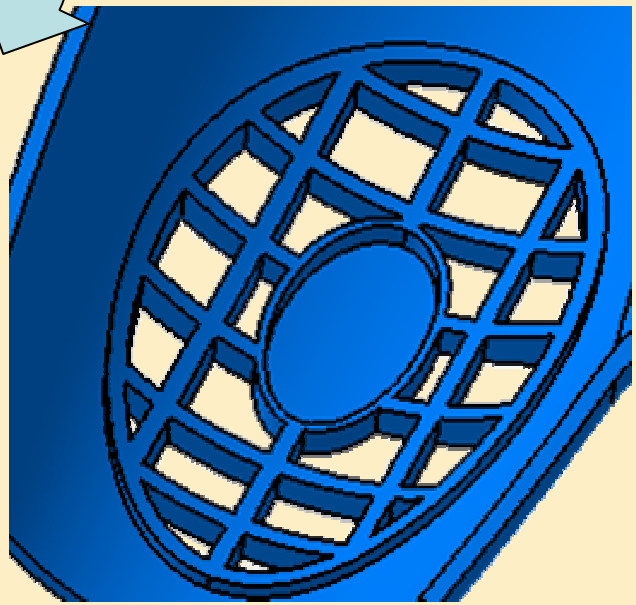

Functional Body.1
Shell Properties.1
Protected Prism.2
Protected Prism.3
Protected Revolve.3
Protected Revolve.4
Push.1
Shellable Revolve.1
Shellable Revolve.2
Grill.1
Rib.1
Rib.2
Rib.3
Functional Body.2
PartBody
Body.2
Functional Solid.2
Geometrical Set.1
Extrude.1
Plane.1
Plane.2



The Grill


Grill
Method:
Normal to face
Boundary
Ribs
Spike
Island
Draft
Width
Height
Profile/Surface:
Offset
Height
Width
No selection
20mm
Top Offset
Width
Bottom Offset
Wall
Rib Height
Type:
Use body thickness
Thickness:
1mm





Functional Molded Part

Functional Molded Part (FM1) is dedicated to the design of molded and Plastic parts. It's a new generation of non-history based 3D modeling.

Functional Molded Part builds behavioral knowledge into every design feature so that models are built faster and modified more easily

Functional Molded Part (FM1) provides a collection of industry – specific functional features dedicated to the design of molded and plastic parts. the application provides direct access to a collection of intuitive functional features that are the most useful for designing molded parts: Shell, Reinforcement, Pocket , Boss , Rib, Grill and so on.

TRADITIONAL

Solid geometry is constructed by building on to or extending existing geometry.

Features are construction tools that add or remove material.

Solid geometry goes where the user puts it.

Solid geometry is dependent on order it was created in.

FUNCTIONAL

Solid geometry is defined by the solid volume resulting from the interaction of Functional Volumes and Functional Features.

Functional Features are self-contained packages of volumetric behavior defined by the required design function.

Features geometry adapts to the presence of shelled volume.

It's completely order independent

THANK YOU