

# 48-749 Parametric Modeling

## Lecture 6

Carnegie Mellon University  
School of Architecture

# Lecture 5

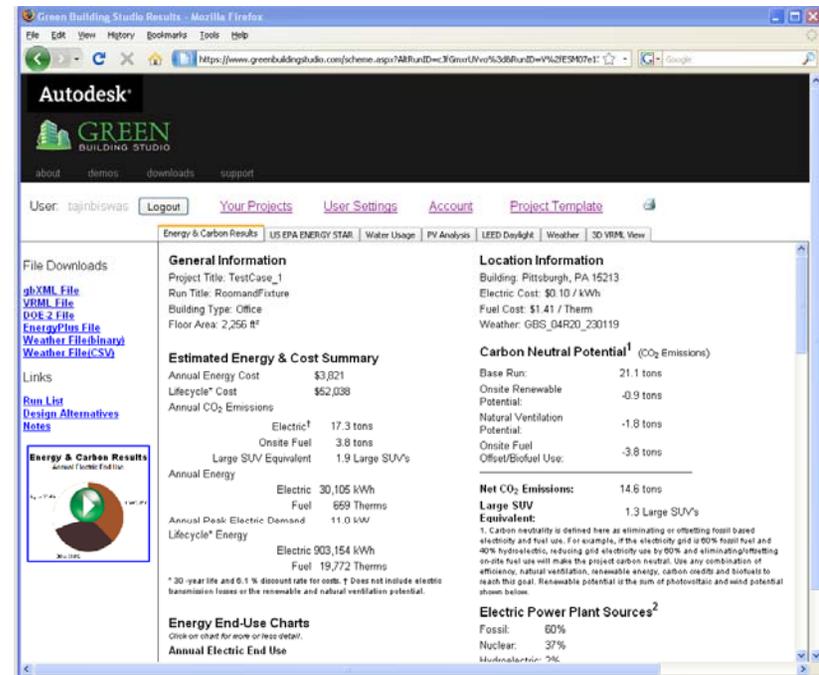
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- ▶ Bim used in Energy Simulation
  - ▶ Green Building Studio
- ▶ Families Continued
- ▶ 3D Families
  - ▶ Nested Family
  - ▶ Linking Parameters
- ▶ Curtain Wall System
  - ▶ Mullion
  - ▶ Grid
  - ▶ Panel



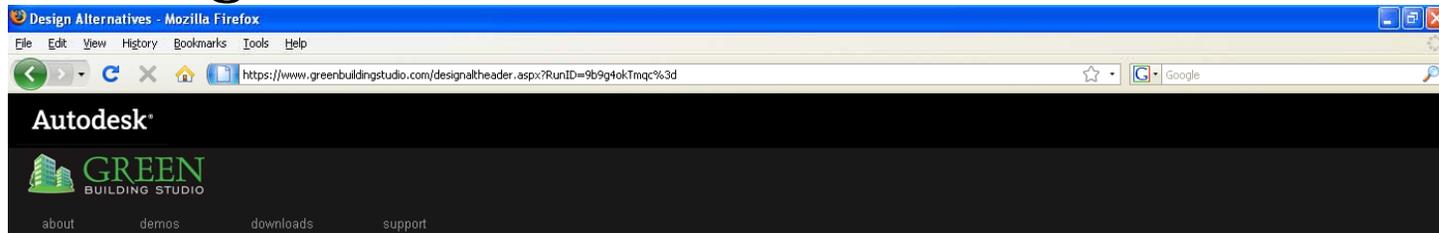
# Energy Calculation in GBS- Report

- Annual energy cost.
- Lifecycle energy costs (30 year).
- Annual energy consumption (electric and gas).
- Peak electric demand (kW).
- Lifecycle energy consumption (electric and gas).
- CO2 emissions are based on the on-site fuel use and the fuel sources for the electricity in the region.



# Energy Calculation in GBS- Report

## ► Design Alternatives



### Design Alternatives

Select parameters from tabs below, enter alternative name, then Add. After all alternatives added, click Submit to run them.



Project: TestCase_1		<a href="#">Run List</a>		Base Run: RoomandFixture_1, Energy Cost: \$3,828		<a href="#">Project settings</a>	
General	Lighting	Roof	Northern Walls	Southern Walls	Western Walls	Eastern Walls	
Rotation 0	Lighting Efficiency No change	Construction No Change	Construction No Change	Construction No Change	Construction No Change	Construction No Change	
HVAC No Change	Lighting Control No change		Glazing Type No Change	Glazing Type No Change	Glazing Type No Change	Glazing Type No Change	
			Glass Amount No change	Glass Amount No change	Glass Amount No change	Glass Amount No change	

1. Select Changes Below. 2. Enter Alternative Name:  3. Add Alternative 4. Run Added Alternatives

General	Lighting	Roof	Northern Walls	Southern Walls	Western Walls	Eastern Walls
Alternative	Annual Energy Cost	Rotation	HVAC			
	U	U	No Change			

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# Families Nested – Creating a louvered Window

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- ▶ Nest Families
- ▶ Linking Parameters
- ▶ Use formula to lock in design intent



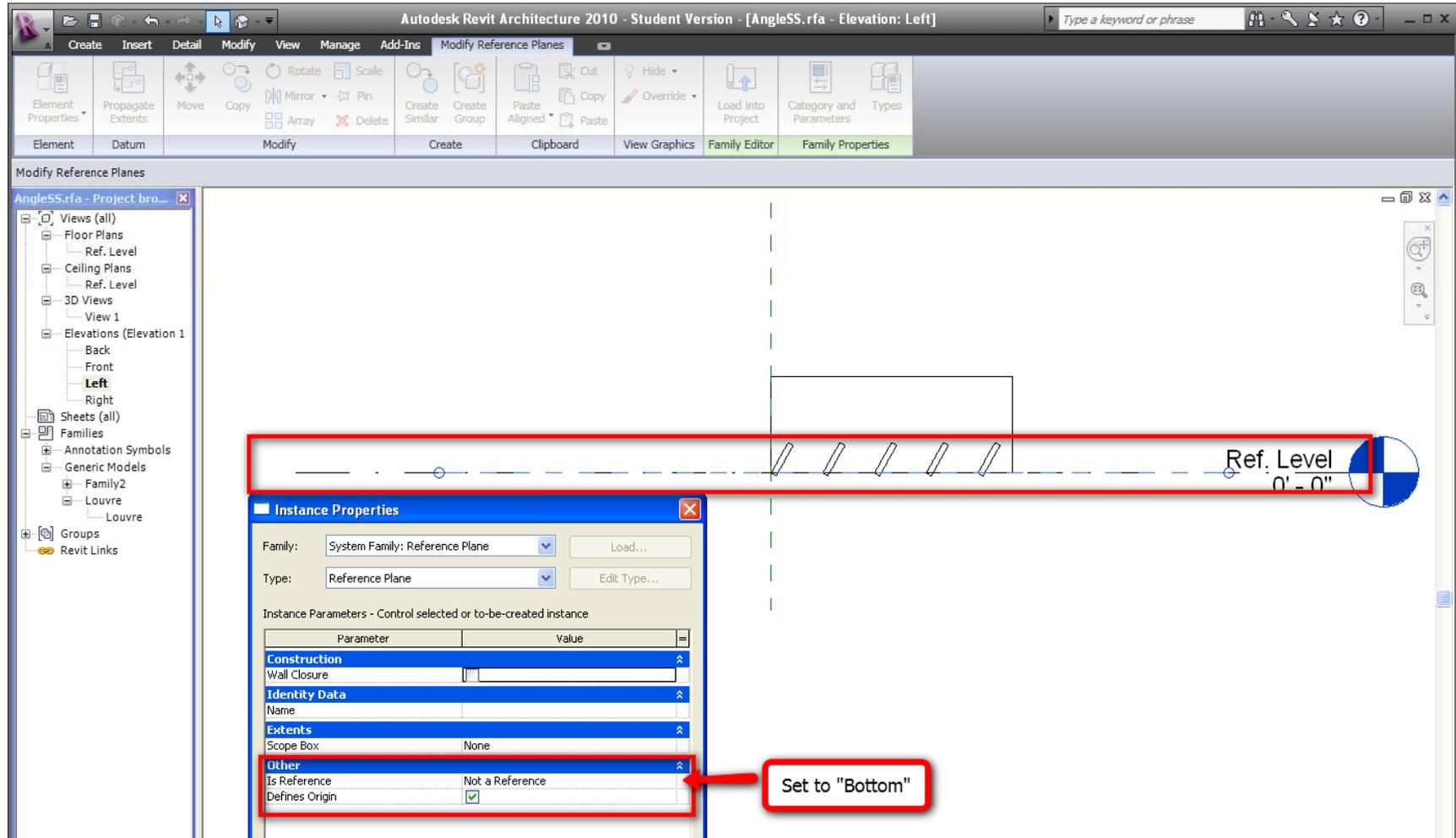
# Families Nested – Points to remember

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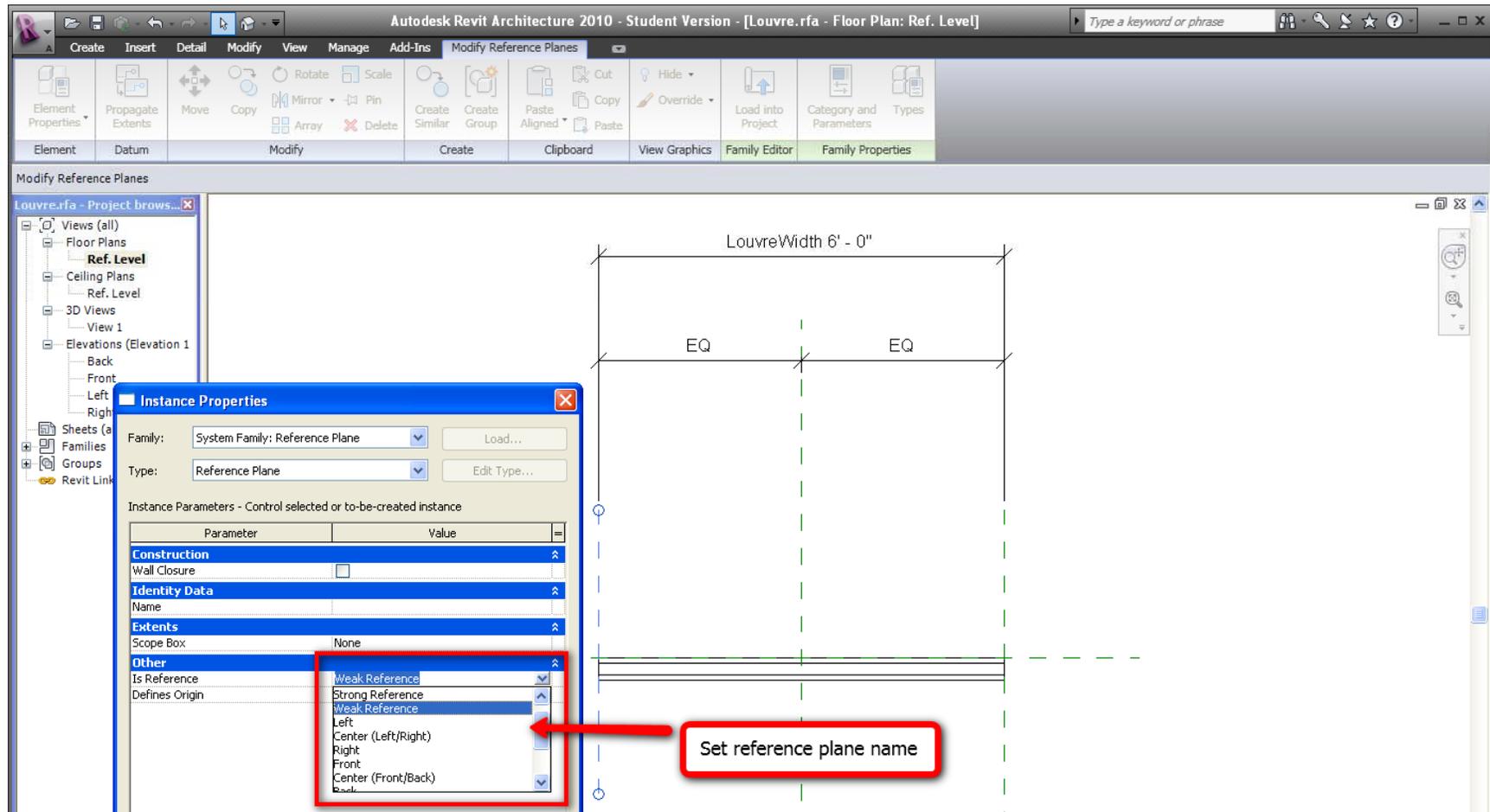
- ▶ Use Nested families when using arrays
- ▶ Always constrain the two defining elements of the array in all 3 axes. (*Defining elements are both the first and second or first and last depending on which option you've selected when creating your array*).
- ▶ The bottom reference plane is set to be “Not a Reference” by default. This needs to be set to be reference “bottom” when using nested families otherwise you'll have difficulties constraining the element in elevation.



# Families Nested – Set Reference planes



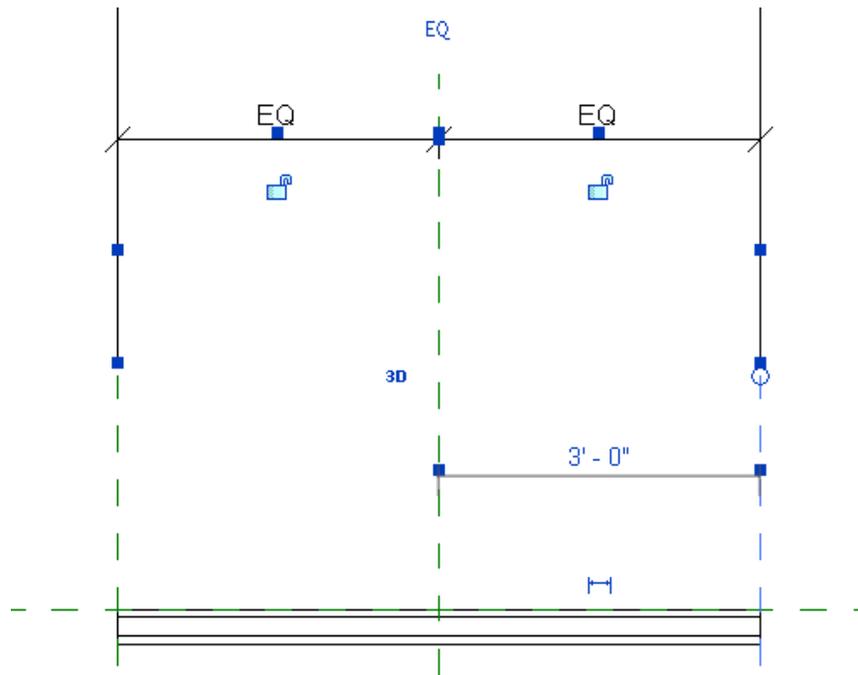
# Families Nested – Set Right/Left ref planes



# Families Nested –

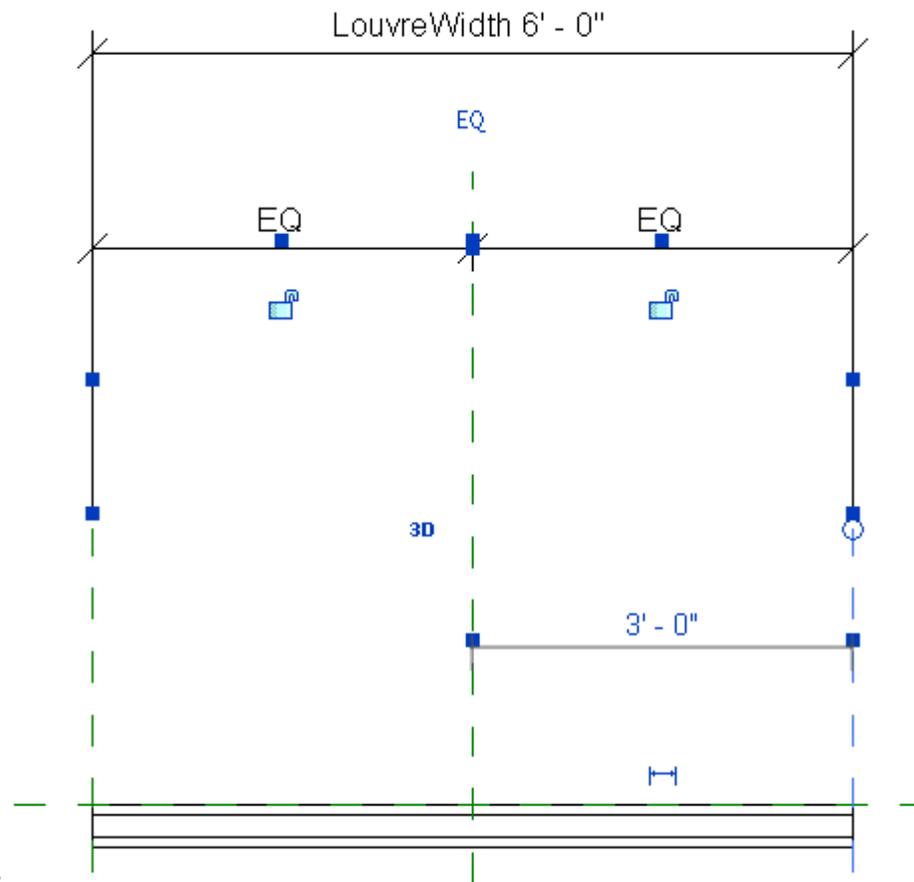
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- ▶ Begin by Opening Revit select FILE>NEW>FAMILY>Generic Model.rft
- ▶ Place two reference planes left and right of center reference plane and assign the names
- ▶ With the dimension tool dimension in one string and then equalize.



# Families Nested –

- ▶ Add Parameter with the dimension tool called LouvreWidth
- ▶ Create Solid with Sweep on the center line



# Families Nested –

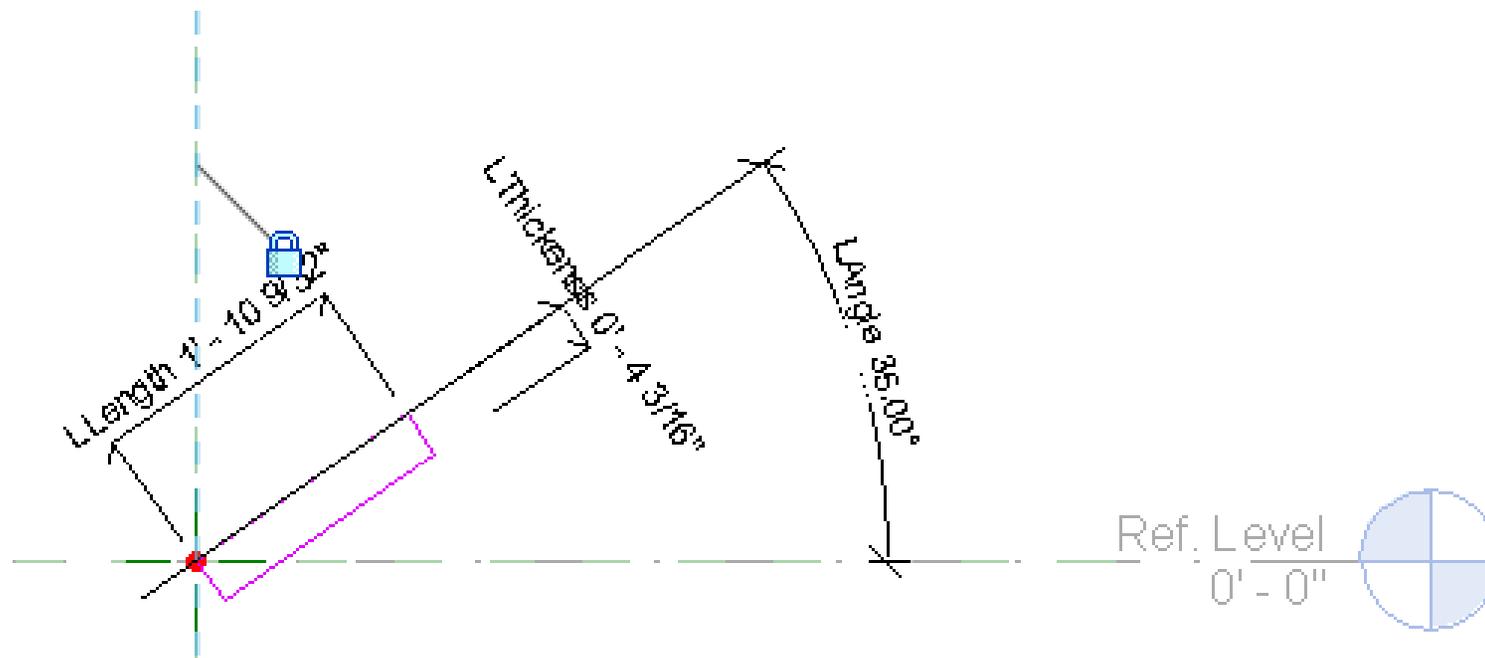
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- ▶ Select “sketch 2D path”. Now draw a horizontal line for the path going from the left to right reference plane on top of the centre (front/back) reference plane as seen in the picture below
- ▶ By using align lock the path to the right and left ref planes before finishing path



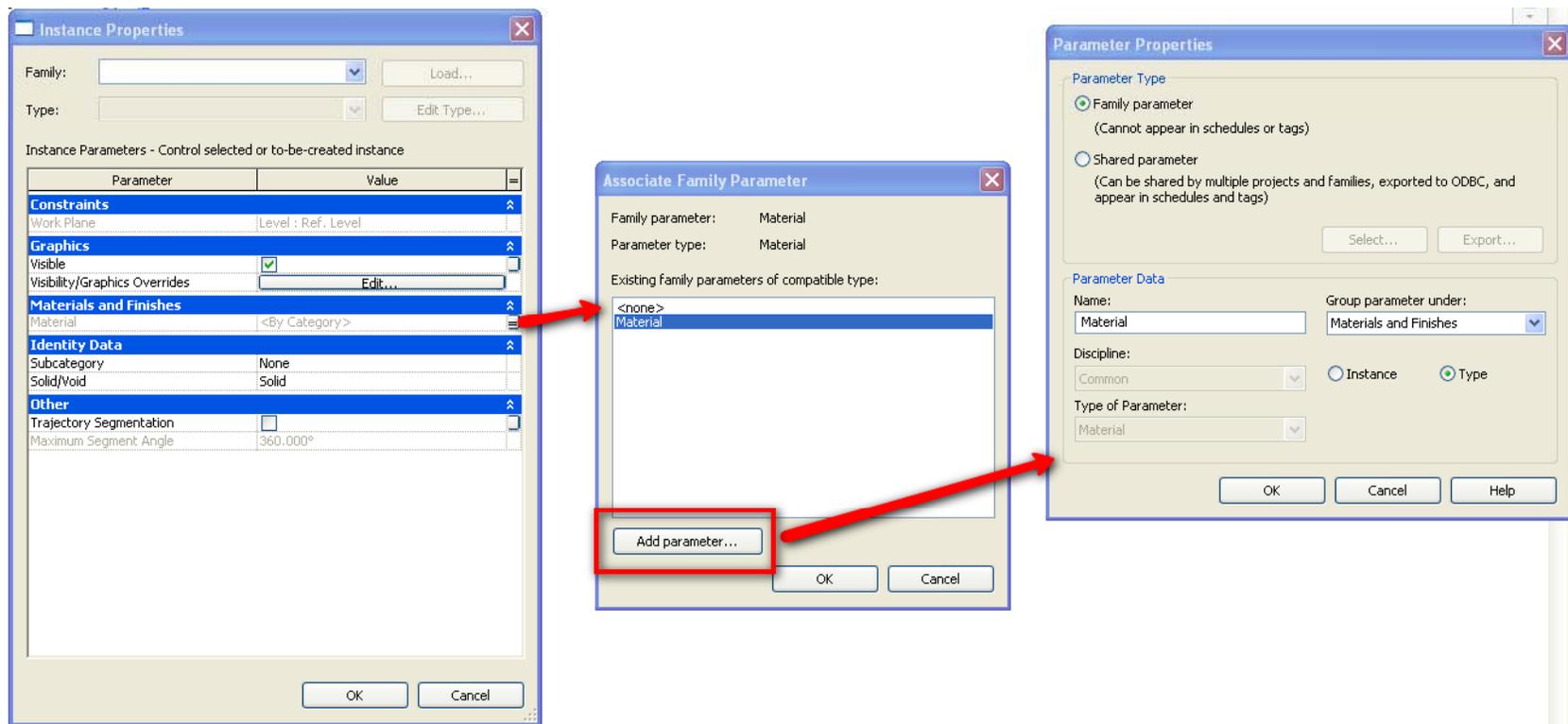
# Families Nested –

- ▶ Draw profile from the left/right view and before finishing profile, add dimensions and lock rotation point to origin of reference planes by using the align tool
- ▶ Finish sweep, test the parameters



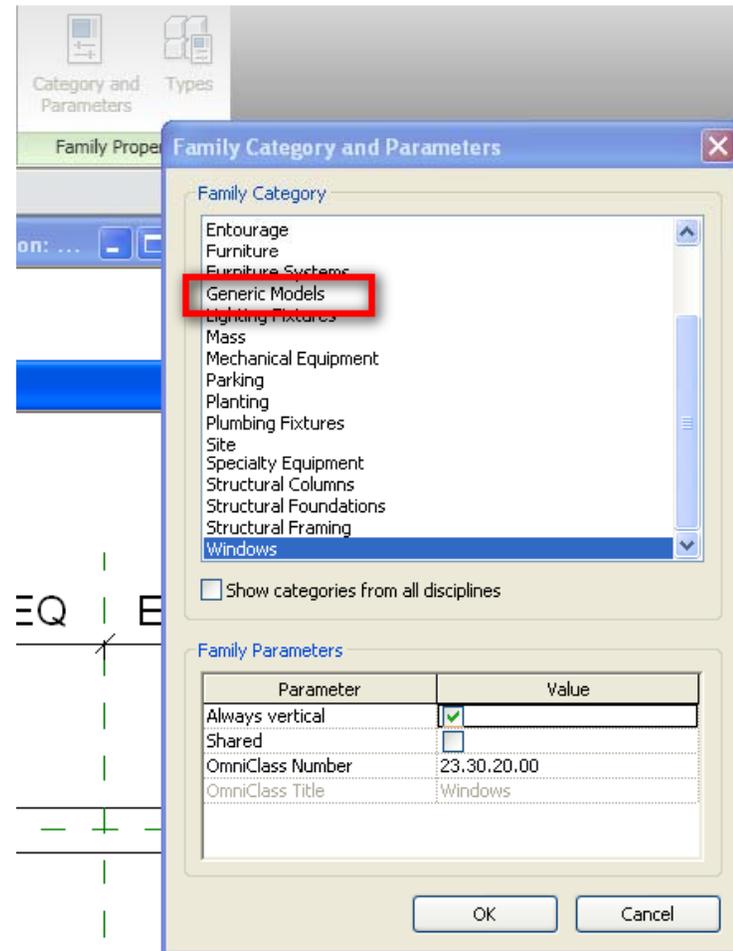
# Families Nested –

- ▶ Adding a material parameter
- ▶ Next open a window.rft template as a host to put in the louvers



# Families Nested –

- ▶ Select Category and Parameters to set Family Category, this is how the it will show in a schedule



# Families Nested –

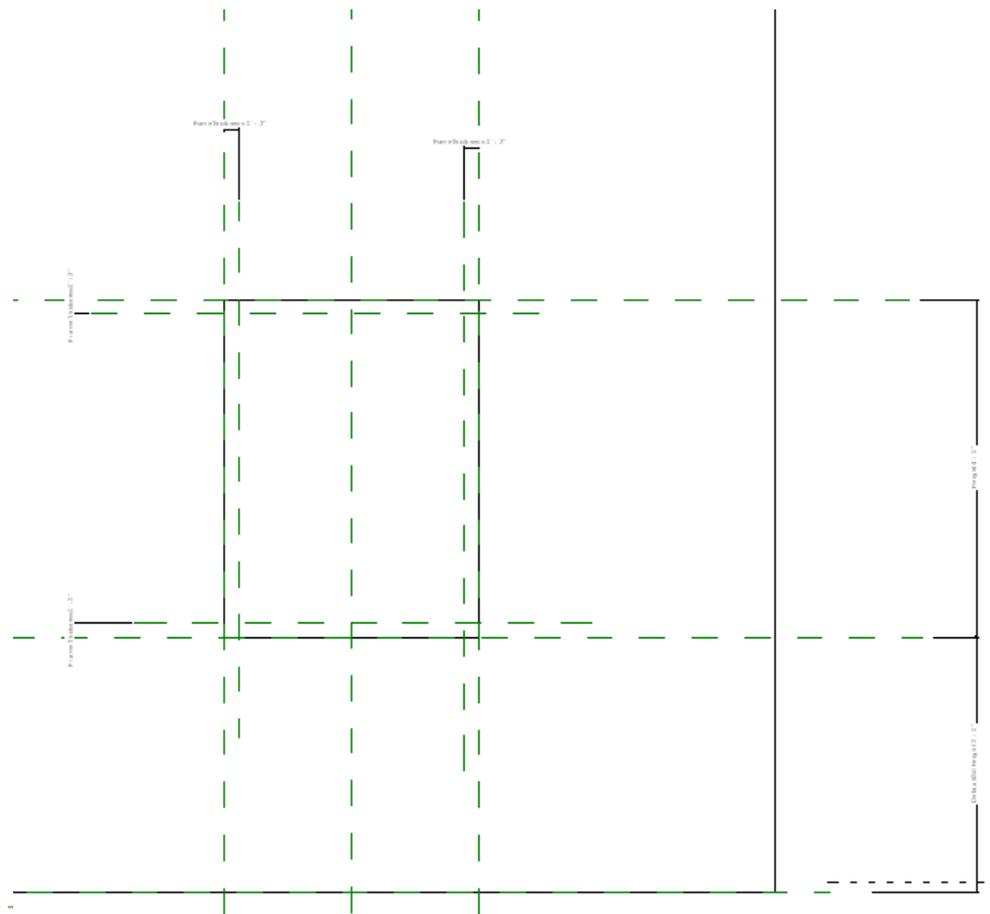
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- ▶ As a general rule always create parameters off reference planes then constrain geometry to the reference planes.
  - ▶ This tends to be the most reliable method for creating families and usually results in a reduced number of parameters.



# Families Nested –

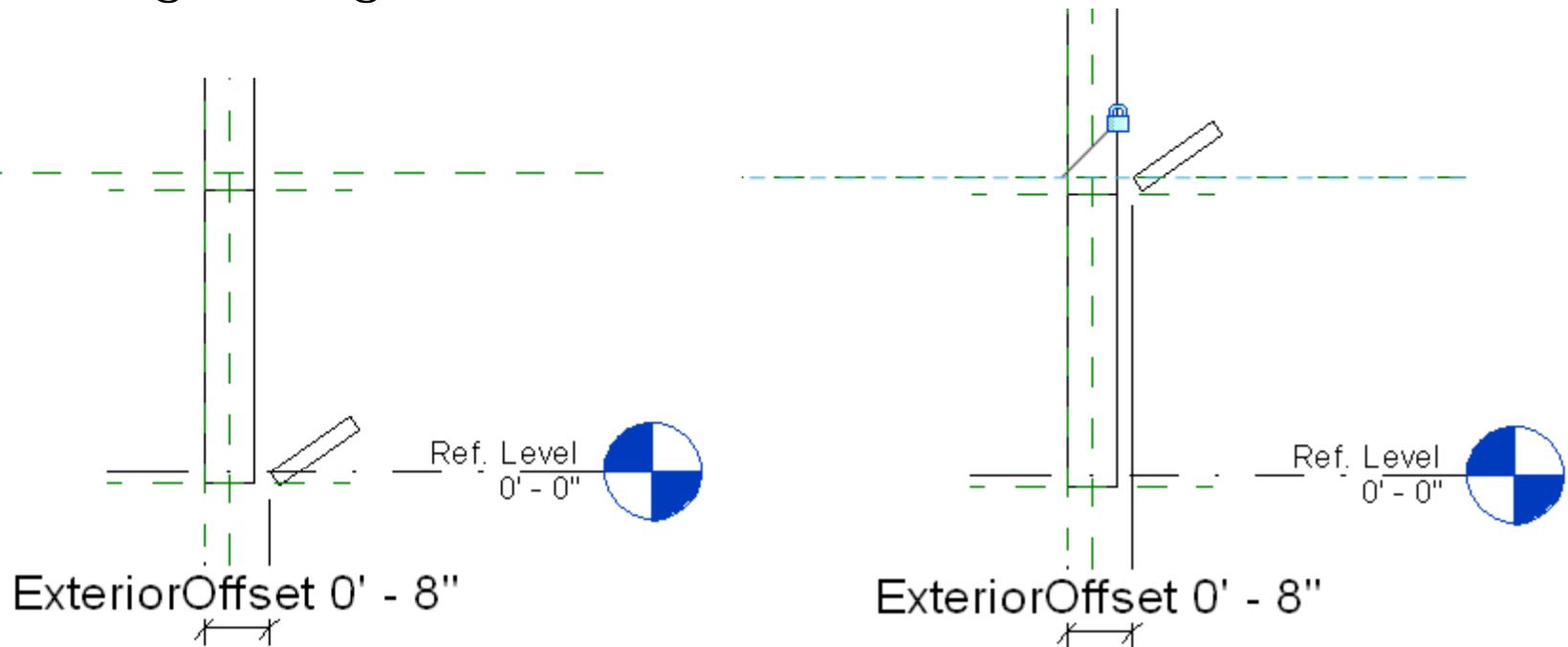
- ▶ Begin with the interior elevation and add the reference planes, dimension them and add parameter for frame width



# Families Nested –

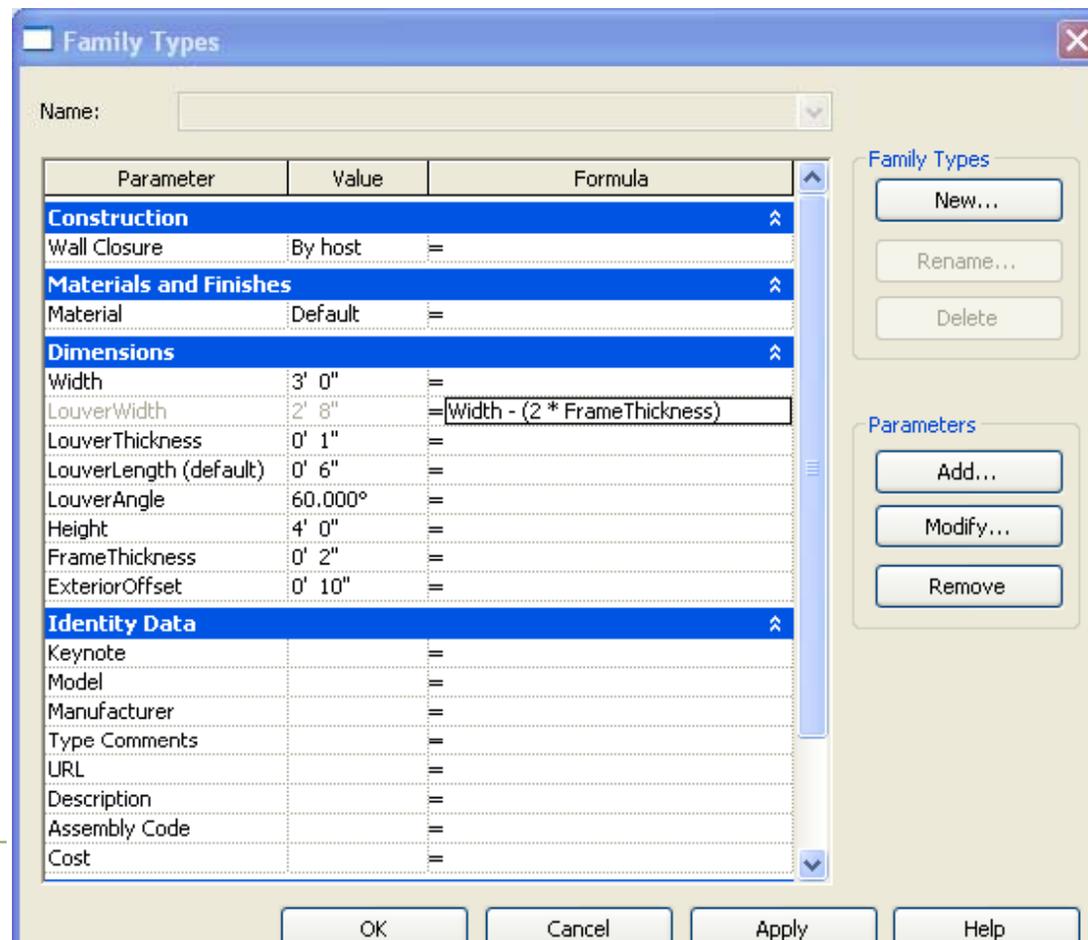
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- ▶ Add Exterior reference plane and add parameter ExteriorOffset
- ▶ Note where the Louver is located, it must be aligned to the sill level using the align tool and locked



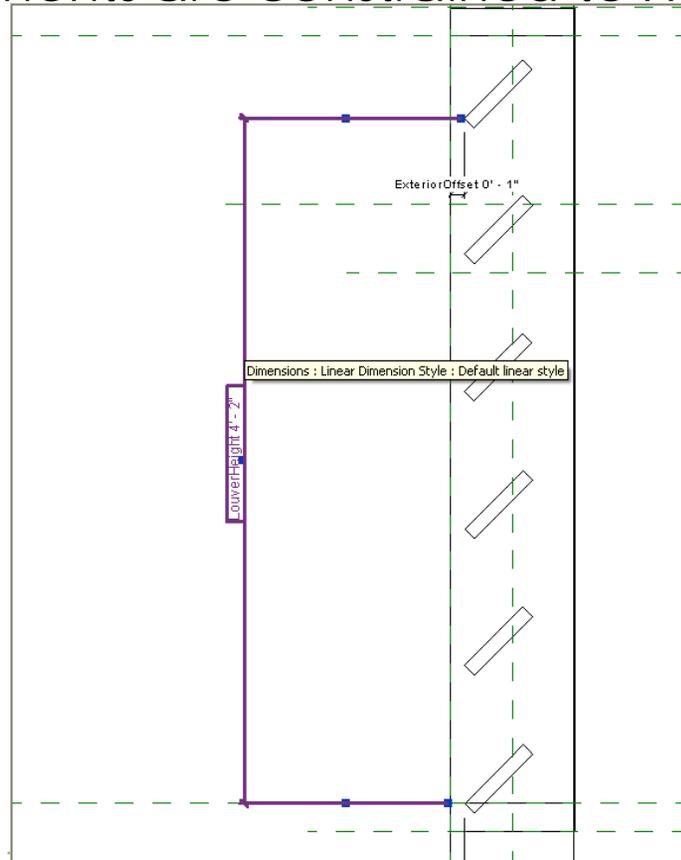
# Families Nested –

- ▶ Add parameters and link the parameters of the louver component
- ▶ Add formula for Louver width



# Families Nested –

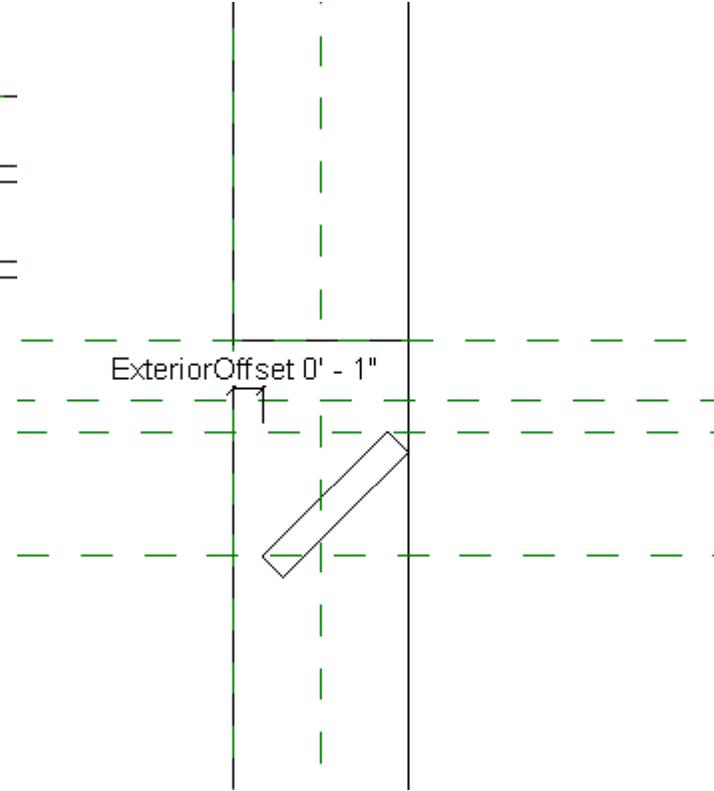
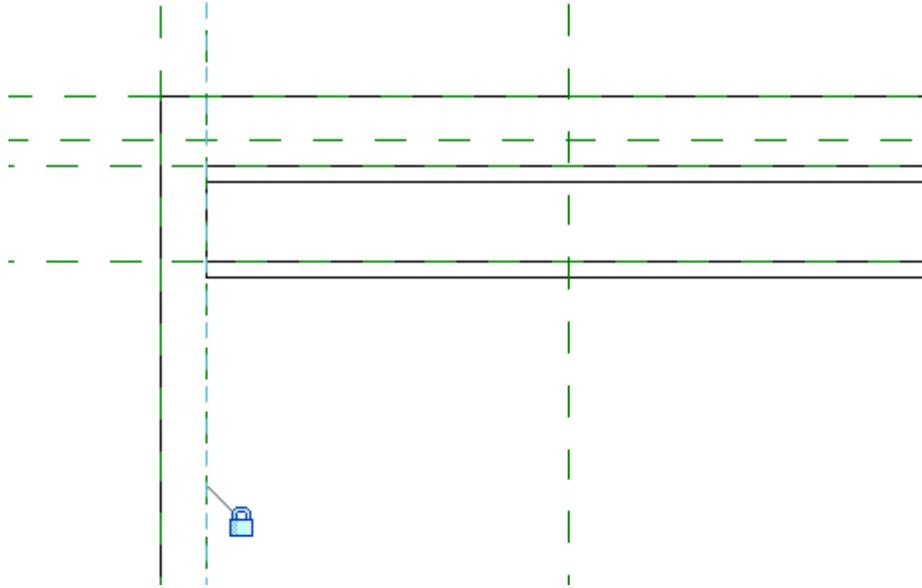
- ▶ Array the louver component
- ▶ Create two reference planes and call it LouverHeight
- ▶ Make sure the components are constrained to X Y and Z axis



# Families Nested –

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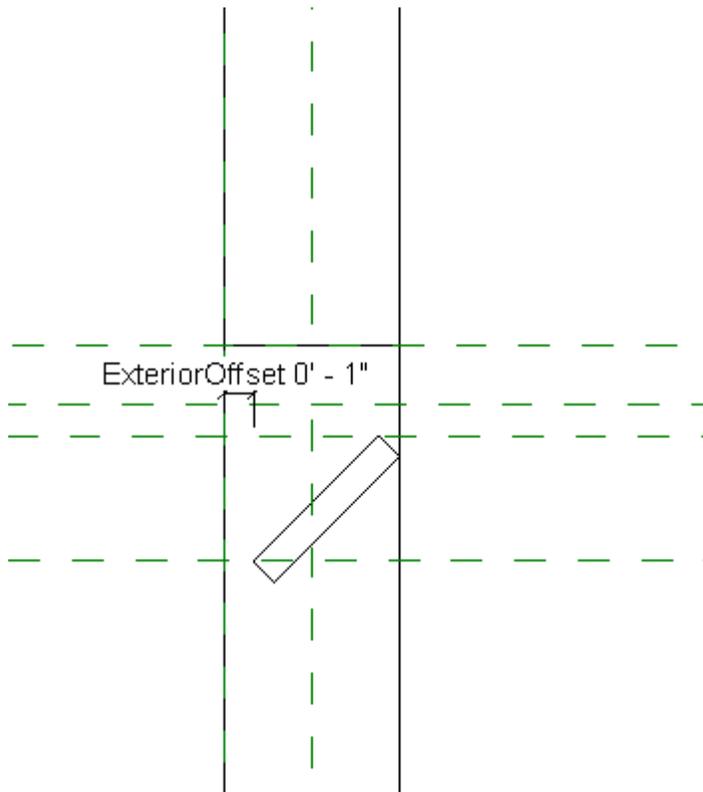
- ▶ Go to interior elevation to lock X axis



# Families Nested –

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- ▶ Go to left view and add dimension and parameter ExteriorOffset , this constrains the Y axis



# Families Nested –

- ▶ Create Number of Louvers parameter and also add Spacing parameter, add formula to control LouverNumber and LouverHeight

Family Types

Name:

Parameter	Value	Formula
<b>Constraints</b>		
LouverNumber	6	$= (\text{Height} - (2 * \text{FrameThickness})) / (\text{LouverSpacing})$
LouverHeight	4' 2"	$= \text{Height} - (2 * \text{FrameThickness} + \text{LouverLength})$
<b>Construction</b>		
Wall Closure	By host	=
<b>Materials and Finishes</b>		
Material	Wall Material	=
<b>Dimensions</b>		
Width	3' 0"	=
LouverWidth	2' 8"	$= \text{Width} - (2 * \text{FrameThickness})$
LouverThickness	0' 1"	=
LouverSpacing	0' 9"	=
LouverLength	0' 6"	=
LouverAngle	45.000°	=
Height	5' 0"	=
FrameThickness	0' 2"	=
ExteriorOffset	0' 1"	=
<b>Identity Data</b>		
Keynote		=
Model		=
Manufacturer		=

Family Types

New...

Rename...

Delete

Parameters

Add...

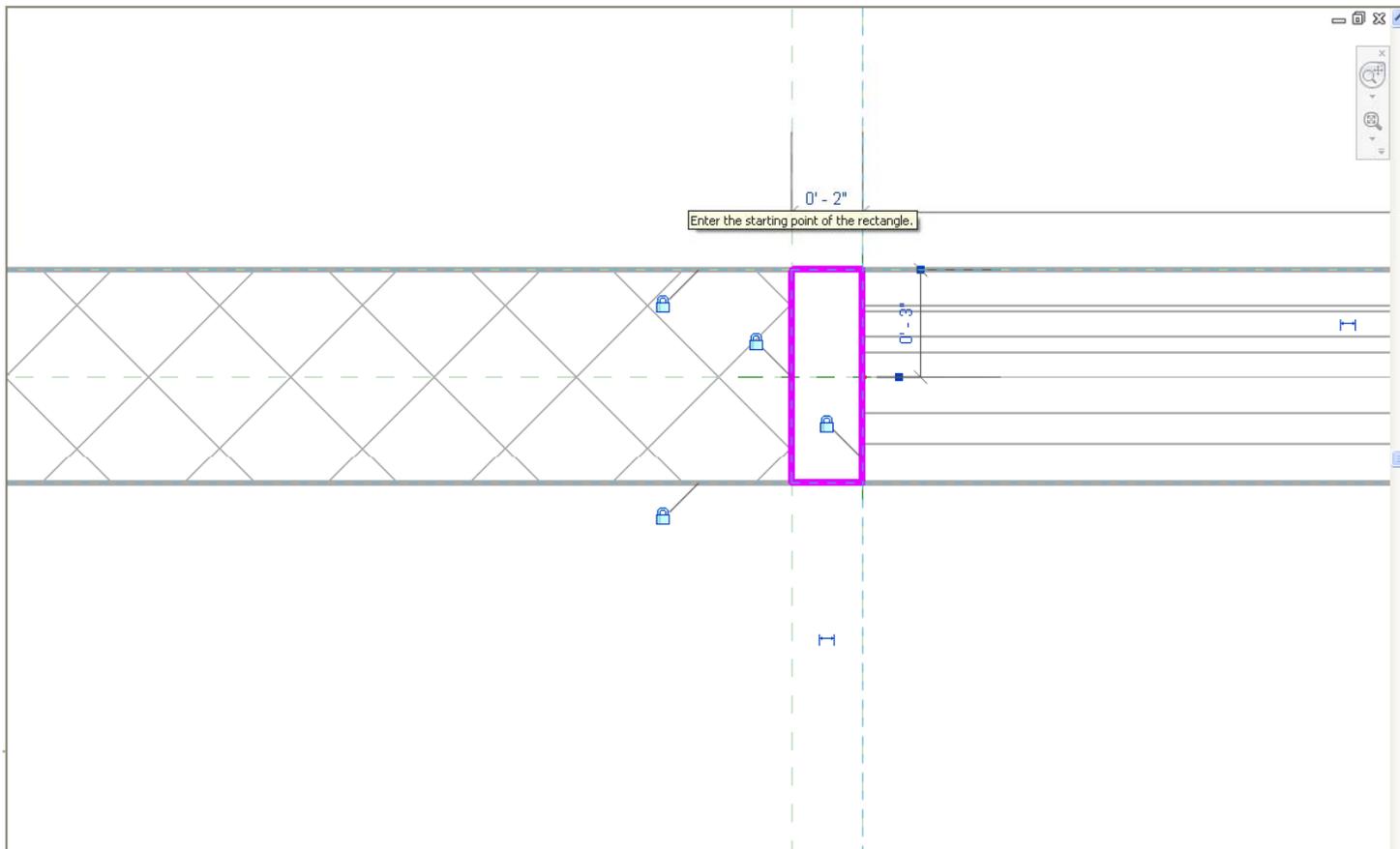
Modify...

Remove

OK Cancel Apply Help

# Families Nested –

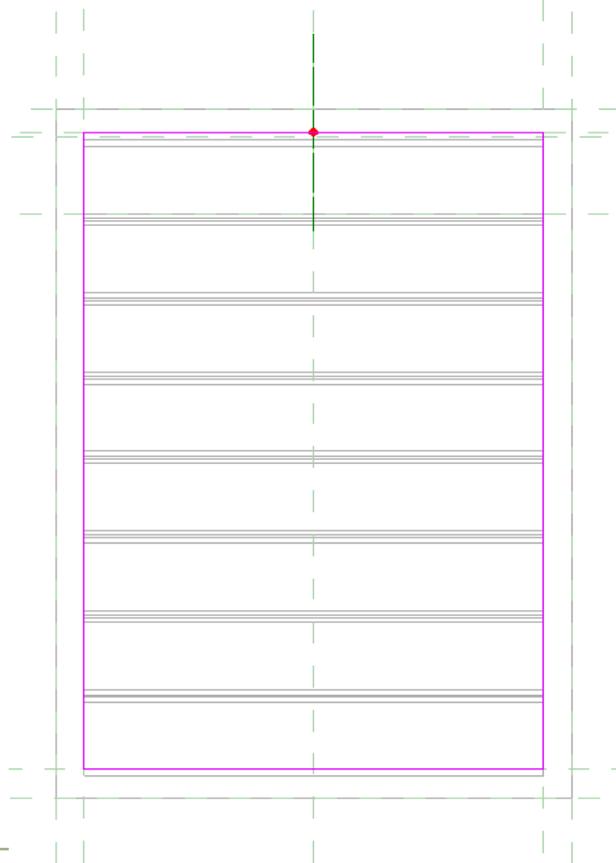
- ▶ Relocate the sweep reference plane by dragging it to a vertical line
- ▶ Draw the profile and constrain them, finish the sweep



# Families Nested –

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- ▶ Create Solid Sweep for the frame and constrain it to all reference planes
- ▶ Relocate the sweep reference plane by dragging it to a vertical line



# Families Nested –

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- ▶ Change wall thickness to flex model and check

