

## Adding an E-Stack unit to an IES model

This document will provide a comprehensive step-by-step guide to adding our e-stack passive ventilation units to an existing IES VE model. Should you have any further questions please contact Joe Clawley or Matthew Waterson at joe.clawley@breathingbuildings.com / matthew.waterson@breathingbuildings.com, or call the office at 01223 450 060.

### Contents

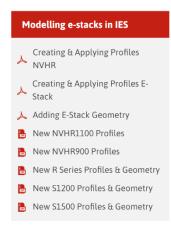
Download and unzip the e-stack geometry file	2
Importing the geometry into your project	2
Identifying e-stack units within GEM file	4
Attaching an e-stack unit to your model	4
Attaching an e-stack unit to a Room with a Pitched Roof	8
Using the Rotation Method	8
Using the Upstand Method	.9



## Download and unzip the e-stack geometry file

#### www.breathingbuildings.com/products/modelling-e-stacks-in-ies-or-tas

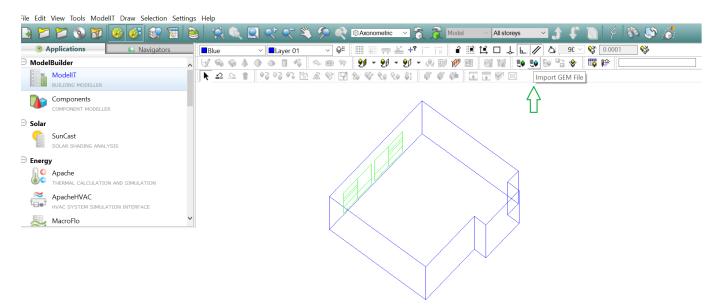
Follow the above link to our dedicated help page, and download the relevant E-stack Unit Profiles and Geometry:



Download the file, right-click on the folder and extract the contents into an appropriate location for your project. It is important the files are extracted from their initial zipped state for IES to be able to import the geometry of the e-stacks.

### Importing the geometry into your project

Open your project file in IES and click on the 'Import GEM File' button as shown below:



Click the *'import'* button, locate the folder where the geometry is saved, and open the *'GEM files.gem'* file as shown below (Shown here for the S1500 e-stack unit):

CALCULATION AND SIMULATION				Import GEM File		
Load GEM File			×			OK
IES	- e-st > S1500 - New Profiles	✓ ບ Search S1500 - New Prof	iles 🔎			Guile
Organize - New folde	er	•	. 0			
Quote ^	Name	Date modified	Туре	·		
Word document:	📜 radiance	14/08/2018 14:33	File fold			
OneDrive	Regs	14/08/2018 14:32	File fold			
	Reports	14/08/2018 14:32	File fold			
🧢 This PC	texture	14/08/2018 14:32	File fold			
🁆 3D Objects	Value	14/08/2018 14:32	File fold			
🖢 Desktop	BB S1500.gem	03/07/2017 09:06	GEM Fi	1		
				Not loaded		Impor
File n	ame: BB S1500.gem	GEM Files (*.gem)	$\sim$			
		Open C	ancel	Room Attributes	default	
		open	ancer	Constructions	default	
				MacroFlo Opening Types	default	
				Thermal Conditions	Room (ApSys, metric)	

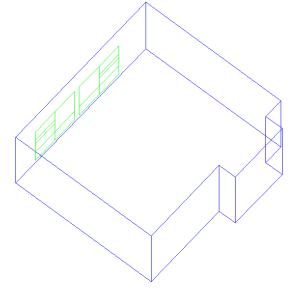
The geometry is for one of our e-stack units, in this example the S1500 has been selected, click the 'OK' button, and the units will be placed beside your model in the IES file as shown below:

Import GEM File	$\times$
	OK Cancel
.gem	Import

## Identifying e-stack units within GEM file

Delete the units which will not be required for your model; the units modelled are labelled below:





# Attaching an e-stack unit to your model

In this example the room will be fitted with one of our R-Series units, as is typical with IES VE there are multiple ways to do this, here is just one example.

Change to a side view of the room, the idea will be to align the unit to the correct plane (height) to fit into the model. The image below shows the same model from a *front* view, as opposed to the *axonometric* view in the image above.

THE LUIG	VIEW TOOIS INTOUGHT DIAW SElection Set	ings	Tielb																									
2	1 🗁 🕥 😿 🥝 🖉 🗐	٥	1	2		2	्रे	7 🖏	5	•	GFron	it		2	3	Mo	del	×	All st	xeys	~	t,		I A	8	<b>S</b>	<u>;</u>	
	Applications 😡 Navigators		Blu	e		~	Laye	r 01		/ QE			i K	+? ႞	- D	×	2	Ì,		Ϋ́	11 4	90	∕ 💖	0.000	1	Š.		
	elBuilder	~	$\mathbb{G}$	n) 💡	4	0	•	46	s (	ማ 🍄	91	- 98	- (	- 0	.9.	BP 🖗	1	8	112	.€ø	👥 🖓 👘	6 🔶		1				
	ModelIT BUTLDING MODELLER		k.	0 0	1	9	9 69 6	6 12	4R (	8 12	\$ \$	e 9.6	୍ତ	ĝ:	Ø (	6 0	13		Y	E								
	Components COMPONENT MODELLER																											,
$\ominus$ Solar																												
	SunCast																											
🖯 Energ	у																											
18	Apache THERMAL CALCULATION AND SIMULATION																											
~	ApacheHVAC HVAC SYSTEM SIMULATION INTERFACE																											
	MacroFlo	~																										
							<u> </u>																					
				Ļ			_J .																					

Select the e-stack unit, and click the 'move selection set' button as shown below:

3 📁	🔁 🕥 😿 😣 🐼 🖫	2				९ ९	<b>S</b>	۶ ج	() From	ıt	×	<b>S</b> .	<u> </u>	Model		∼ Al	storeys	,	t 1	¢		Å	6	5	6	
🛞 A	pplications 😡 Navigators		Blue		×	Layer 01		✓ QE			ĸ	P8 🕂	$\overline{1\times}$	î	1	ŝ 🗆	46	_ //	$\Delta$	90 ~	8	0.0001		<del>&amp;</del> r		_
⊖ Model	Builder	^	6/ 💊	💊 🎄	. 🕚	o 🛛 🔦	; <	N 🚳 😜	91	- 98	- 9	l = 🧕	1	19	đ	82 Y	2 3	E0	60 8	8	1	1				
	ModelIT BUILDING MODELLER		<b>k</b> ≏	<u></u>	•	Move se			<b>%</b>	* <b>Q</b>	<b>₹</b> • \$	Ø	ø	Ø	÷	• 👻	ľ									
	COMPONENT MODELLER					$\Lambda$		_																		
∋ Solar																										
	SUNCAST SOLAR SHADING ANALYSIS																									
∋ Energy	/																									
<u>∫</u> ∫Q	Apache THERMAL CALCULATION AND SIMULATION																									
	ApacheHVAC HVAC SYSTEM SIMULATION INTERFACE																									
~	MacroFlo	~																								
			Ţ	- 0		-0																				
			q	9										+												

Use the 'type in' box in IESVE as change the height of the unit to be equal to the height of the roof. For example if the roof is at 3m, type x=0,3 to move the unit to be at the same height as the roof.

Fi File Edit	View Tools ModelIT Draw Selection Sett	ings	Help																	
I 🖪 😕	🔁 😒 😿 🔕 🐼 🐨	0			Q Q	t 💎 🆏	۶	🕲 Fror	nt	× 🏠	A Mo	del	<ul> <li>All stor</li> </ul>	eys	<b>*</b> 👌	£ 1		🚯 🦃	6	
A 🛞	Applications 🙀 Navigators		Blue		~	Layer 01	~ 6	)= IIII I	#i 🕶 🛦	- +° ;	- ix I	2 11 1	\$ D J	- L. /	4	90 🖂 🔇	0.0001	<b>\$</b> 7		
E⊖ Mode	lBuilder	~	6/ 6	<b>⊗</b> 4	00	• 🛯 🍫	s 🛛 '	99 <b>9</b> 1	- 98 -	20 -	& 10 W		81 19	E. E.	60 °G	۲ 😵	ö 😰 🗌			
	ModelIT BUILDING MODELLER		<b>▶</b> 2	<u>0</u>	69 1	93 93 🛐	<u>⊿R' %</u> [	9 😣 🕅	° <b>₹</b> ₽ ₹₽	81	Ø Ø Ø		💽 🧡 D	3						
	Components COMPONENT MODELLER							nD	<u> </u>											
∃⊖ Solar																				
<b>F</b>	SunCast SOLAR SHADING ANALYSIS					2		8		8		1	3							
E 🖂 Energ	y																			
	Apache THERMAL CALCULATION AND SIMULATION												2							
<b>*</b>	ApacheHVAC HVAC SYSTEM SIMULATION INTERFACE												18							
2	MacroFlo	~																		
			3		-	8	8	2	42	20	-	8								

The e-stack unit is now at the correct height, but as can be seen from a plan view, its position is still not quite correct. In the plan view use the same *'move selection'* set button to drag the e-stack unit to its correct position.

THE LOL M	ew loop modelli plaw pelecuoli pela	nyə	neip																																
🖪 🗁	🔁 😒 😿 😣 🗺	2	3	į G	Q [		<b>र</b> †	<u> </u>	Tu)	S.		2 🔝	Pian			× 1	ìí	<u>7</u> I	Model		~	All sto	reys	_	~	<b>)</b>	Ç			ę	<u>s</u> (	<b>S</b> ,	Ő.		
🛞 App	plications 😡 Navigators		Blue			~	La	yer 0'	1	,	- 💚				n 144	+?	<b>†</b>	×	î		LL I		ե հ	_ //	6	9	9C ~	83	0.00	01	8	;			
∃⊖ ModelBu	uilder	^	6/ 6	6	• 4	0	•	•	Ş   -	<b>~</b> (	9 9	2	۰ ال	- 96	1 -	• 19	- 😣	ÐØ	1	Ē	82	12		. 89	Eø	-	\$	1	P					]	
	IndellT		<b>▶</b> ∠	2 04	1	Ŷ	ş 93	<b>9</b> 3	2	⊿R (	8	2 %	\$	Q	୧୍ଢ	₿ţ	ø	ø	Ø	Ŧ	÷	<b>V</b> 1	I												
	omponents OMPONENT MODELLER						-	Mov	e sele	ction	set .				Ĺ								Ľ												
🗄 🖂 Solar																																			
🧰 Si	unCast Olar shading analysis																																		
∃⊖ Energy																							<u> </u>												
<u>ј</u> 🖉 А	pache HERMAL CALCULATION AND SIMULATION																						-												
	pacheHVAC																																		
, ≥	MacroFlo	~																		÷		1	1												
																	. [	<u>de</u>	ģ																
																	. [	۳°																	

It is important that the unit does not intersect the ceiling, and that there is also no gap between the two parts. When the unit has been properly attached to the building there will be a line which appears along the surface of the ceiling, indicating the unit has merged properly.

Once in the correct position as shown below, select the e-stack unit and click the 'connect spaces' button as shown below:

M Ap	plications 🙀 Navigators		Blue			~	Lay	ver 0	1	83					<u>K</u> +	.1	1x	î		Î, I	Ξ.	4 6	. 11	1	9	)C ~	8	0.00	/01	Ş.	
ModelB	uilder	~	61 6		4	•			Ş	s (	9 9		1 -	20	- 20	- 6	94 BB	1 10	e	02	Yg		80	E0 1	-	8	1	12			
DEP N	AodelIT VILDING MODELLER		k :	2 🕰	1	93	93	<b>9</b> 3	12:	AR 9	8 6		-	<b>e</b> space		e e	\$ \$	Ø	Ŧ		<b>V</b> 1 [	3									
	Components COMPONENT MODELLER												4	8	_		2	2	75	2		133									
Solar												Ц									602										
2424	OLAR SHADING ANALYSIS																					æ									
Energy																						8									
AP A	Apache HERMAL CALCULATION AND SIMULATION														3		F	ip-a	E C		-										
CD-T	ApacheHVAC																2	2			8	2									
	MacroFlo																				8.	32									

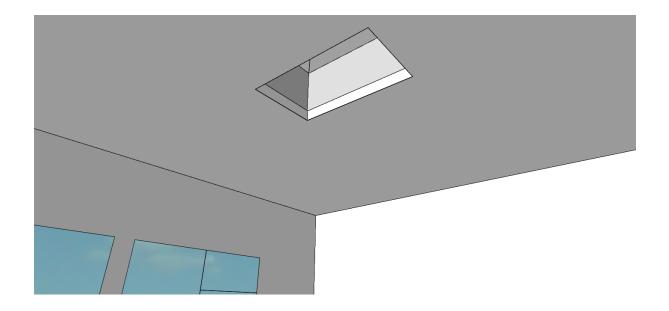
Doing so will reveal the selection box:

Connect Spaces	? ×	
e-stack R-series	Select spaces to connect to the current space using the mouse	<u></u>
Retain partitions ~	or the Space List on the Model Browser.	
Add spaces:	Use the Adjacency combo box to define adjacencies between	
	constituent spaces.	
	Click on the Connect button to	
	add the selected spaces to the currently selected space.	
	Trim	
	Merge	
	Subtract	
	Connect	
	Close	

While open simply select the room to which the e-stack unit is to be connected, and it will appear in the 'Add spaces' box:

Connect Spaces	? ×	
e-stack R-series	Select spaces to connect to the current space using the mouse	
Retain partitions ~	or the Space List on the Model Browser.	
Add spaces:	Use the Adjacency combo box to define adjacencies between	
F/001 - Classroom	constituent spaces.	
	Click on the Connect button to add the selected spaces to the	
	currently selected space.	
	Trim	
	Merge	
	Subtract	
	Connect	
	Close	

Click the 'merge' button, and the two parts connect.



## Attaching an e-stack unit to a Room with a Pitched Roof

In practice, it is important that Breathing Buildings E-Stack systems are installed horizontally on a weathered upstand, however this can be somewhat time consuming to implement in IES VE. Whilst not a recommended installation arrangement in practice, for the purposes of IES modelling it may be easier to simply rotate the terminal geometry to the pitch of the roof (described below) and connect with the room as described above. Using this 'shortcut' is unlikely to significantly alter the modelled airflow through the terminal in IES and could save considerable time and effort in the modelling approach.

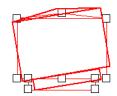
#### Using the Rotation Method

1. Select the imported roof terminal geometry and click the "Rotate Selection Set" button in ModelIT.

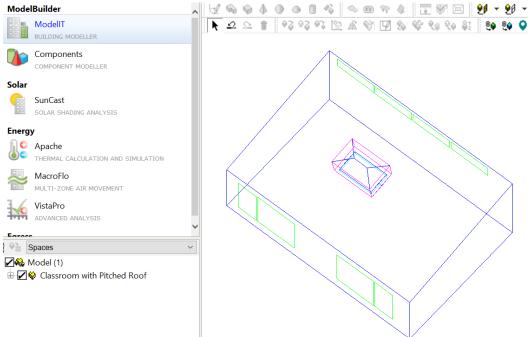
💐   💌	• 🔄 🗠 🤜 🔺	🥍 🤍 🕅 Kight	<b>I</b>
Blue	∽ Layer 01	~ 🖗 📖 🏥 🚎 🚣	+? 📩 🕅
5/ 💊 🧇	4 🧿 🕘 🖪 🦓 💊	😰 🌳 🌒 📅 💕 🖂	91 - 98
▶ <u>∽</u> <u>∽</u>	💼 🛛 🕹 🖓 🖓 😭 💼	😵 🛂 🎭 💖 🍕 🥹	\$t <b>€</b> \$ <b>€</b> \$ (

2. Select the rotation angle to match the pitch of the roof and use the mouse to rotate the terminal to the correct angle, click to finalise this new position.

 Rotate Object	?	2	×
Angular increment (°):	9.46		

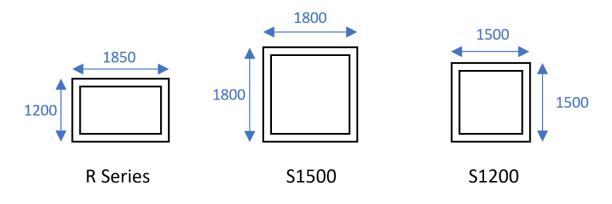


3. The rotated roof terminal can now be moved onto the roof and connected to the space as described above.



#### Using the Upstand Method

The figure below shows the overcurb dimensions for the R Series, S1500 and S1200 units, we also recommend a minimum height of 150mm for the upstand to guard against splash-back during inclement weather.

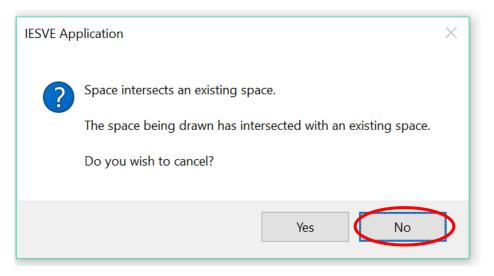


Adding an upstand to the roof can be done in a number of different ways, one such method is shown here:

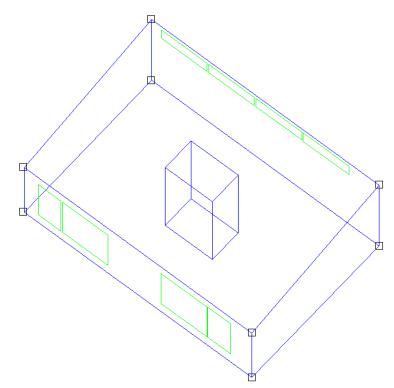
1. Go into plan view and select the "draw prism" button in ModelIT and enter value for plane and height/depth such that the new shape will intersect the roof where you would like the roof terminal placed.

Blue	~	Layer 0	1	~	₽		+ +	K.
🛛 🖗 🖗 🕽	) 🕕 🤇	) 🛛 🖉	8	<b>XY</b> (	ip 🁔	iiiiiiii ÿ	Y3	E
🕨 🖸 🖬 🚺	69 I	03 03	le ar	8	9	\$5 Q		lo i
Shape Settings							×	
Reference:	Upstan	d					]	
Object T	ype:	Building	Space			~~~		
Sub-type	e:	Room				~~~		
Placement								
Plane (m):					0.000	00		
Height/dept	h (m):				3.500	00		
Segments:					100			
Create inner	volume						]	

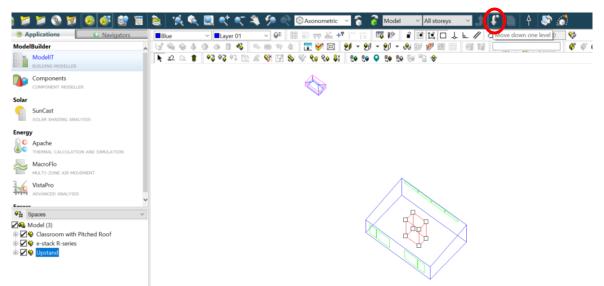
2. Click "No" when an error message appears once you have drawn an upstand to the correct dimensions.



3. You should have achieved something like the below, with a prism intersecting the roof.



4. Select the newly-created prism and move down one level.

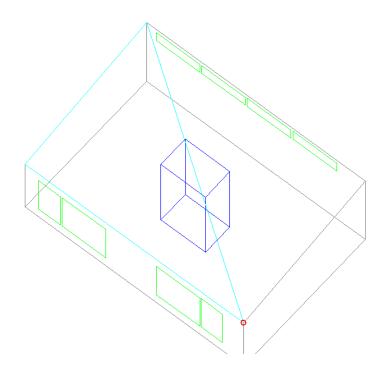


5. In the dropdown menu, select 'Edit'

onometric 🖂 🛜 👔	Surface 🛛 🖂	All storeys
	Surface Edit	
VI 🖂 🖭 - 🗐 -	Component	
	<b>≅∳ ≅∲</b> ⊡	i (*

6. Click the 'Set Cutting Plane' button in the popup window which appears and set the coordinates so that the cutting plane matches the plane of the pitched roof.

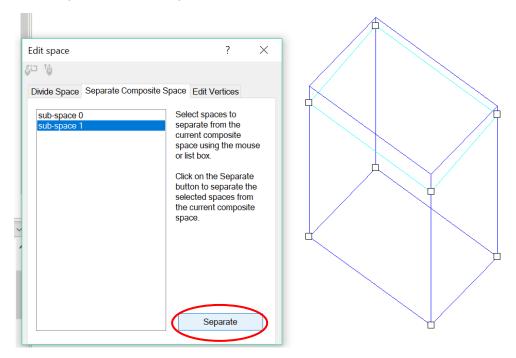
et space ?   et Cutting Plane ate Composite Space Edit Vertices   Initial Cutting Plane Position 0.92   X Axis Distance from lower left corner of bounding box (m): 0.92   Initialise Cutting Plane Locator 0.92   Cutting Plane Locator Coordinates 1.40000   Coord 4.50000 1.40000   Coord 4.50000 4.50000   Coord 3 4.50000   Coord 3 4.50000   Coord 3 4.50000   Coord 3 4.50000   Coord 4.50000 4.50000   Coord 4.50000 4.50000   Coord 5 4.50000   Coord 4.50000 4.50000   Coord 6 4.50000   Coord 4.50000 4.50000					
Initial Cutting Plane Position X Axis  Distance from lower left corner of bounding box (m): 0.92 Initialise Cutting Plane Locator Cutting Plane Locator Coordinates Cutting Plane Locator Coordinates Coord, 1 4,50000 1,40000 -1,000000 Coord, 2 4,500000 1,400000 4,500000 Coord, 3 4,500000 4,600000 4,500000 Generate Cutting Plane Divide without partitions	space			?	
Initial Cutting Plane Position X Axis  Distance from lower left corner of bounding box (m): 0.92 Initialise Cutting Plane Locator Cutting Plane Locator Coordinates Cutting Plane Locator Coordinates Coord, 1 4,50000 1,40000 -1,000000 Coord, 2 4,500000 1,400000 4,500000 Coord, 3 4,500000 4,600000 4,500000 Generate Cutting Plane Divide without partitions	<u>i</u> ĝ				
X Axis       Distance from lower left corner of bounding box (m):       0.92         Initialise Cutting Plane Locator       Initialise Cutting Plane Locator         Cutting Plane Locator Coordinates       X (m) Y (m) Z (m)         Coord. 1       4.500000       1.400000       -1.000000         Coord. 2       4.500000       1.400000       4.500000         Coord. 3       4.500000       4.600000       4.500000         Divide without partitions       ~	et Cutting Pla	ne ate Compos	site Space E	dit Vertices	
X Axis         Corner of bounding box (m):         0.92           Initialise Cutting Plane Locator           Cutting Plane Locator Coordinates           X (m)         Y (m)         Z (m)           Coord. 1         4.500000         1.400000         -1.000000           Coord. 2         4.500000         1.400000         4.500000           Coord. 3         4.500000         4.600000         4.500000           Divide without partitions	nitial Cutting P	lane Position			
Cutting Plane Locator Coordinates           × (m)         Y (m)         Z (m)           Coord. 1         4.500000         1.400000         -1.000000           Coord. 2         4.500000         1.400000         4.500000           Coord. 3         4.500000         4.600000         4.500000           Generate Cutting Plane           Divide without partitions					
×(m)         Y(m)         Z(m)           Coord. 1         4.500000         1.400000         -1.000000           Coord. 2         4.500000         1.400000         4.500000           Coord. 3         4.500000         4.600000         4.500000           Generate Cutting Plane           Divide without partitions	Initialise Cutting Plane Locator				
Coord. 2         4.500000         1.400000         4.500000           Coord. 3         4.500000         4.600000         4.500000           Generate Cutting Plane           Divide without partitions	Cutting Plane L			<i>Z</i> (m)	
Coord. 3     4.500000     4.600000       Generate Cutting Plane       Divide without partitions     ~	Coord, 1	4.500000	1.400000	-1.000000	
Generate Cutting Plane Divide without partitions	Coord. 2	4.500000	1.400000	4.500000	
Divide without partitions	Coord. 3	4.500000	4.600000	4.500000	
	Generate Cutting Plane				
	Divide without partitions				
Divide Space	Divide Space				



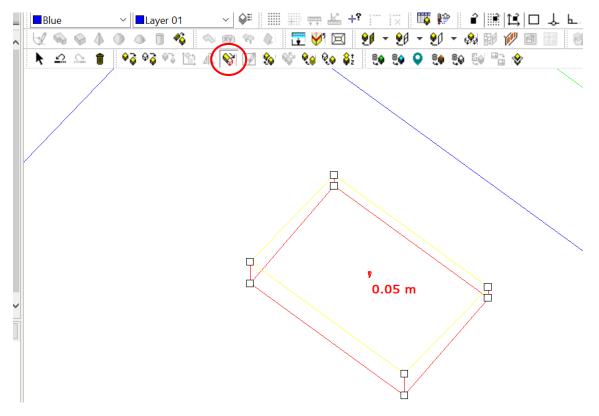
7. Once the cutting planes is set, first click 'Generate Cutting Plane' then click 'Divide Space'

Image: Separate Composite Space       Edit Vertices         Initial Cutting Plane Position       Initial Cutting Plane Position         X Axis       Distance from lower left corner of bounding box (m):       0.92         Initialise Cutting Plane Locator       Initialise Cutting Plane Locator         Cutting Plane Locator Coordinates         Image: Separate Composite Space       Edit Vertices         Initial Cutting Plane Position       0.92         Initialise Cutting Plane Locator       0.92         Coord. 1       9.000000       0.000000         Coord. 2       -0.000000       -0.000000	X					
Initial Cutting Plane PositionX AxisDistance from lower left corner of bounding box (m):Initialise Cutting Plane LocatorInitialise Cutting Plane LocatorCutting Plane Locator Coordinates $X (m)$ Y (m)Z (m)Coord. 19.0000000.0000002.700000						
X AxisDistance from lower left corner of bounding box (m):0.92Initialise Cutting Plane LocatorCutting Plane Locator Coordinates $\times$ (m) $Y$ (m) $Z$ (m)Coord. 19.0000000.0000002.700000	Divide Space Separate Composite Space Edit Vertices					
X Axis $\checkmark$ corner of bounding box (m):       0.92         Initialise Cutting Plane Locator         Cutting Plane Locator Coordinates         X (m)       Y (m)         Z (m)         Coord. 1       9.000000         0.92	Initial Cutting Plane Position					
Cutting Plane Locator Coordinates           X (m)         Y (m)         Z (m)           Coord. 1         9.000000         0.000000         2.700000	$X \Delta v_{ic} \vee (192)$					
X(m)         Y(m)         Z(m)           Coord. 1         9.000000         0.000000         2.700000	Initialise Cutting Plane Locator					
Coord. 1 9.000000 0.000000 2.700000	Cutting Plane Locator Coordinates					
Coord 2 =0.000000 =0.000000 2.700000						
Coord. 3 -0.000000 6.000000 3.700000						
1. Generate Cutting Plane						
Divide without partitions $\sim$						
2. Divide Space						

8. In the 'Separate Composite Space' tab of the 'Edit space' window select one of the subspaces and click 'Separate'.



- 9. The bottom section of the upstand (below roof level) can then be deleted.
- 10. The upstand height can now be adjusted, if necessary, to give a minimum height for the upstand of 150mm (to prevent splashback).



11. The upstand can now be merged with the room by selecting the room and using the 'Connect/Merge Spaces' button as documented earlier in this document.

Connect/Merge Spaces	? ×			
Classroom with Pitched Roof	Select spaces to connect to the current space using the mouse or the Space List on the Model			
Retain partitions ~	Browser.			
Add spaces:	Use the Adjacency combo box to define adjacencies between constituent spaces.			
	Click on the Connect button to add the selected spaces to the currently selected space.			
	Trim			
	Merge			
	Subtract			
	Connect			
	Close			

12. The roof terminal can now be connected to the upstand using the method as described in the 'Attaching an e-stack unit to your model' section of this document.

