

# Steps to Map Variability

## 1 BVR

### 1.1 Mapping a Feature to Model Elements

Number of required steps: 18

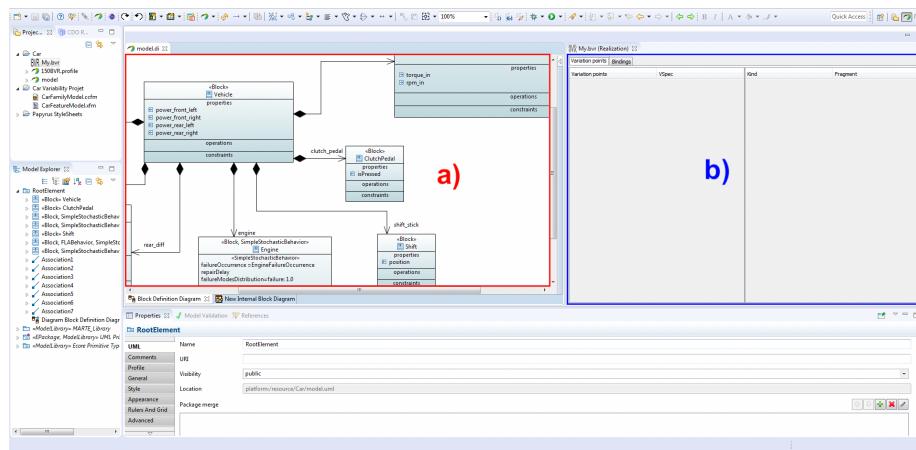


Figure 1: BVR Environment and its a) graphical editor of the targeting modeling language and b) Realization view

- i. In the graphical editor of the targeting modeling language e.g., SysML, select the model elements that should be removed from the model when the feature is selected;

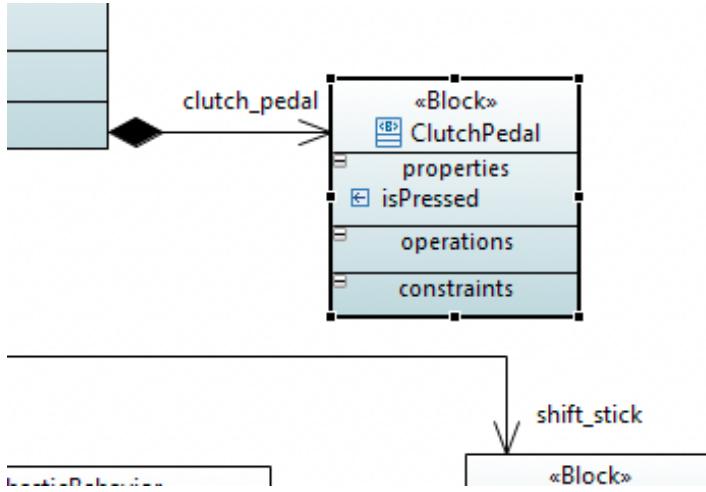


Figure 2: Step i

ii. Move to the BVR realization view:

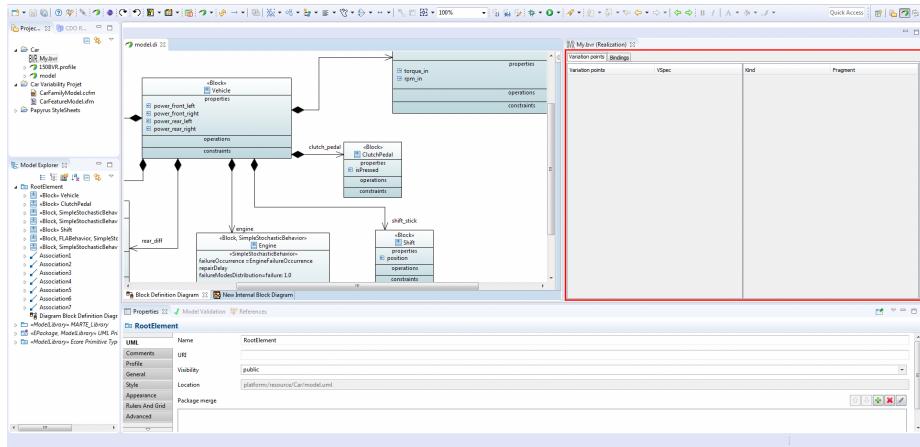


Figure 3: Step ii

iii. Right mouse click in the right side of the canvas:

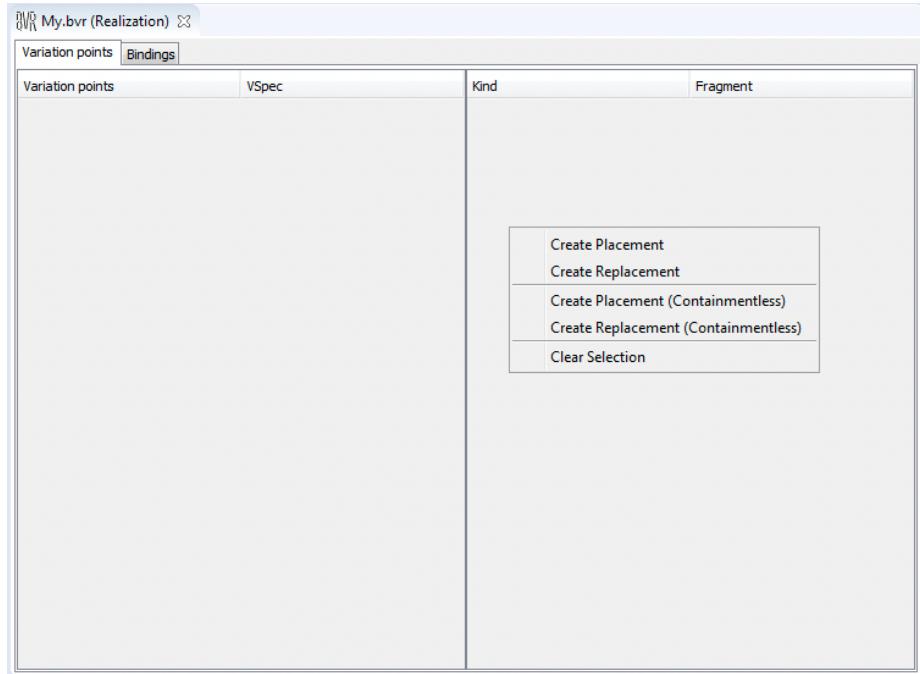


Figure 4: Step iii

iv. Select the option 'Create Placement':

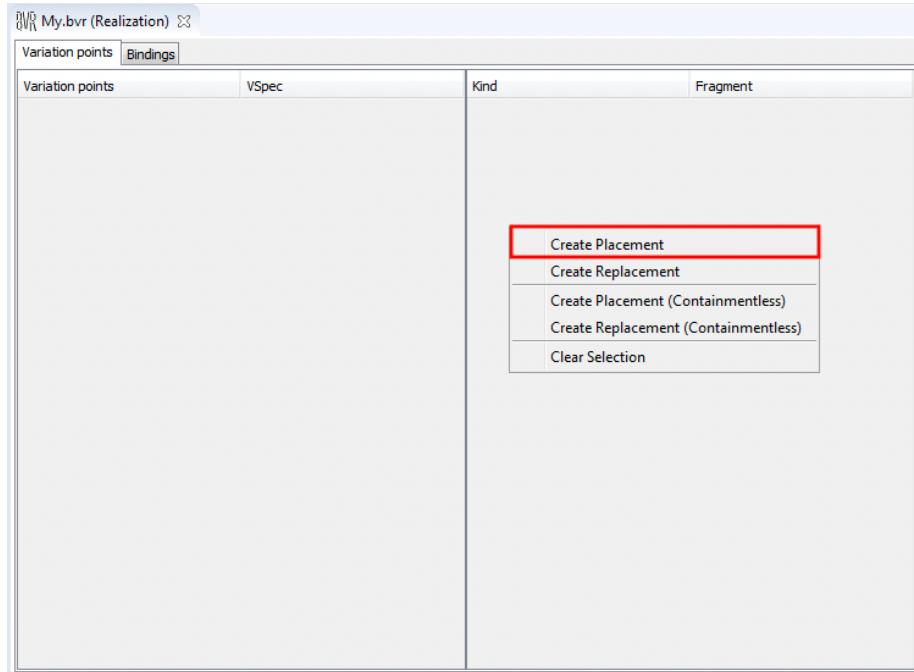


Figure 5: Step iv

v. Move to the editor of the targeting language;

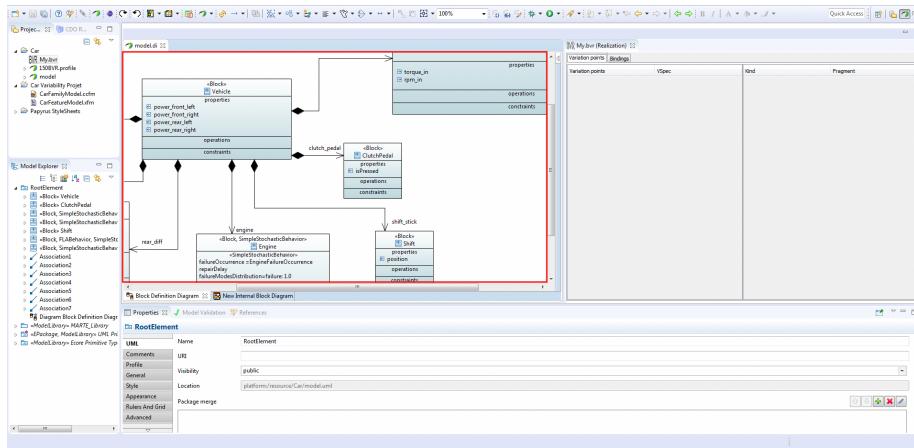


Figure 6: Step v

vi. Select the model elements that should be included (0..\*) in the product when the feature selected;

vii. Move to the BVR realization view:

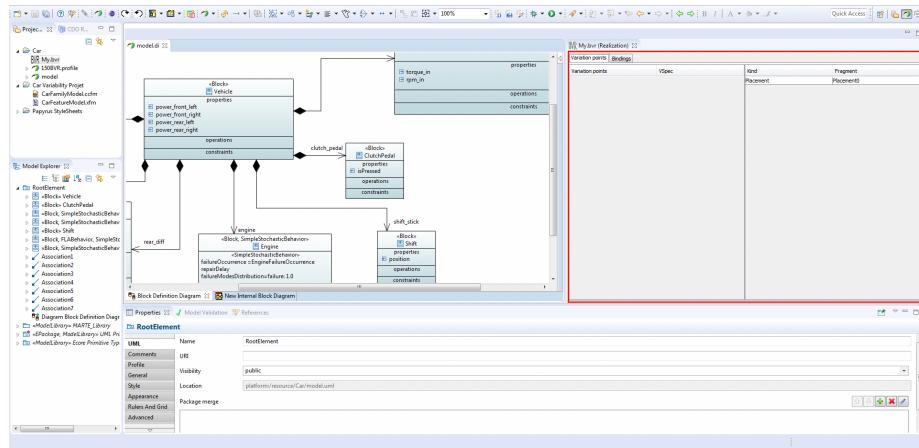


Figure 7: Step vii

viii. Right mouse click in the right side of the canvas:

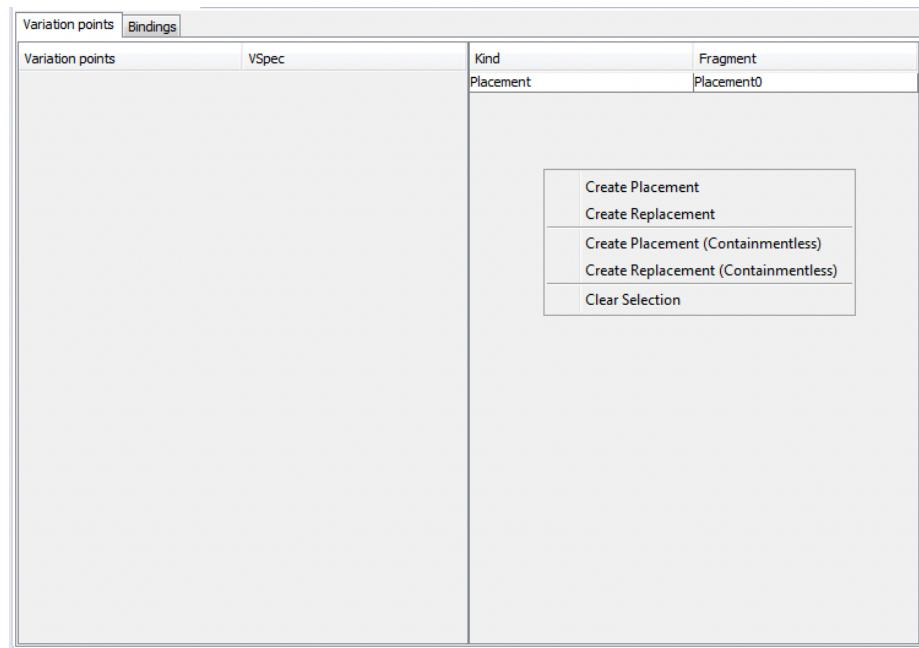


Figure 8: Step viii

ix. Select the option 'Create Replacement':

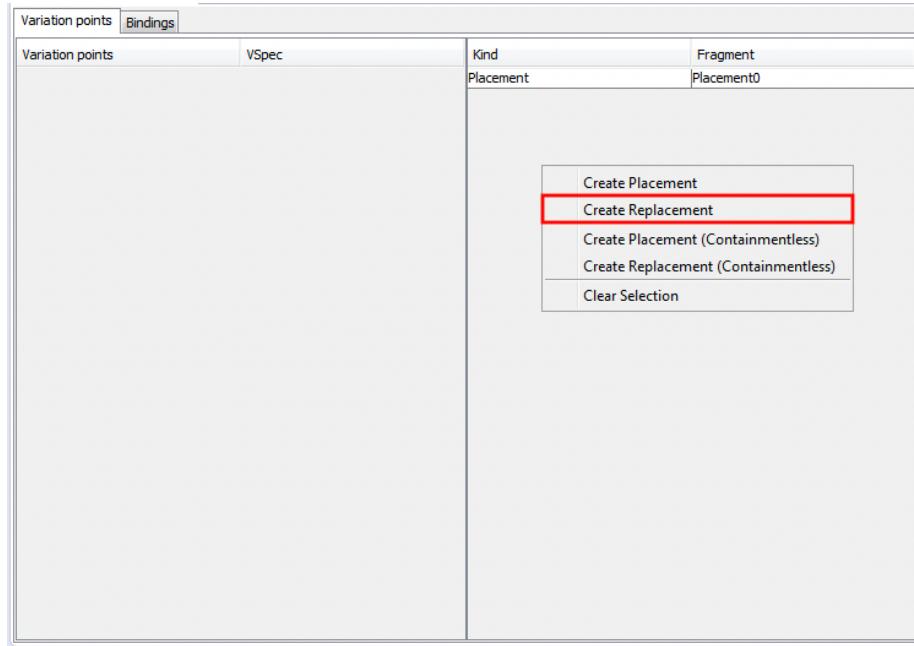


Figure 9: Step ix

- x. Select the Placement created in Step iv;
- xi. Select the Replacement created in Step ix;

Variation points	Bindings		
Variation points	VSpec	Kind	Fragment
		Replacement	Replacement1
		Placement	Placement0

Figure 10: Steps x and xi

xii. Right mouse click in in left side of the BVR realization view:

Variation points	Bindings		
Variation points	VSpec		
		Kind	Fragment
		Replacement	Replacement1
		Placement	Placement0
	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <a href="#">Create FragmentSubstitution</a>  <a href="#">Clear Selection</a> </div>		

Figure 11: Step xii

xiii. Select the option create a fragment substitution:

Variation points	Bindings		
Variation points	VSpec	Kind	Fragment
		Replacement	Replacement1
		Placement	Placement0
<a href="#">Create FragmentSubstitution</a> <a href="#">Clear Selection</a>			

Figure 12: Step xiii

xiv. Open the VSpec combobox to see the available features that can be mapped to the created Fragment Substitution:

Variation points	Bindings		
Variation points	VSpec	Kind	Fragment
FragmentSubstitution0	RWD	Replacement	Replacement1
	AWD	Placement	Placement0
<input type="button" value="DifferentialManufacturer"/> <input type="button" value="ManufacturerA"/> <input type="button" value="ManufacturerB"/> <input type="button" value="Gear"/> <input type="button" value="Automatic"/> <input type="button" value="Manual"/> <input type="button" value="Car"/>			

Figure 13: Step xiv

xv. Select the feature to be mapped to the created Fragment Substitution:

Variation points	Bindings		
Variation points	VSpec	Kind	Fragment
FragmentSubstitution0	RWD	Replacement	Replacement1
	AWD	Placement	Placement0
	DifferentialManufacturer		
	ManufacturerA		
	ManufacturerB		
	Gear		
	Automatic		
	Manual		
	Car		

Figure 14: Step xv

xvi. Select the created Fragment Substitution:

Variation points	Bindings		
Variation points	VSpec	Kind	Fragment
FragmentSubstitution0	Automatic	Replacement	Replacement1
		Placement	Placement0

Figure 15: Step xvi

xvii. Right mouse click:

Variation points	Bindings		
Variation points	VSpec	Kind	Fragment
FragmentSubstitution0	Automatic	Replacement	Replacement1
	Create FragmentSubstitution	Placement	Placement0
	Clear Selection		
	Generate Bindings		
	Delete FragmentSubstitution		

Figure 16: Step xvii

xviii. Select the option "Generate bindings":

Variation points	Bindings		
Variation points	VSpec	Kind	Fragment
FragmentSubstitution0	Automatic	Replacement	Replacement1
	Create FragmentSubstitution	Placement	Placement0
	Clear Selection		
	Generate Bindings		
	Delete FragmentSubstitution		

Figure 17: Step xviii

## 2 CRITVAR

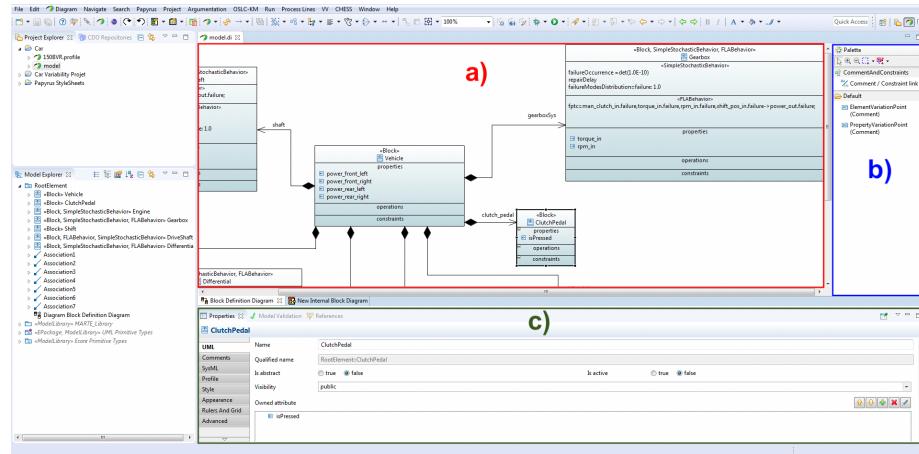


Figure 18: CRITVAR Environment and its a) graphical editor of the targeting modeling language, b) palette and c) properties view

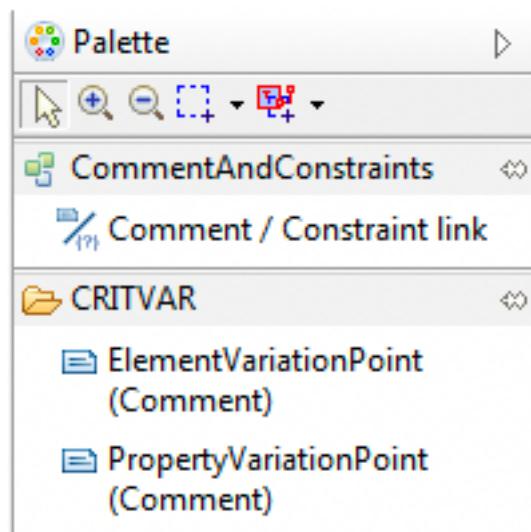


Figure 19: CRITVAR Palette



Figure 20: Properties View

## 2.1 Steps for Mapping Features to a Model Element (single)

Number of required steps: 9

- i. Select the ElementVariationPoint element on the palette:

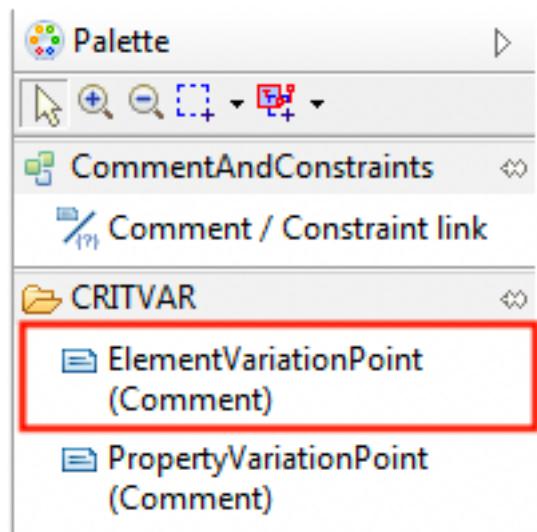


Figure 21: Window 1

- ii. Click on the graphical editor of the targeting modeling language e.g., SysML:

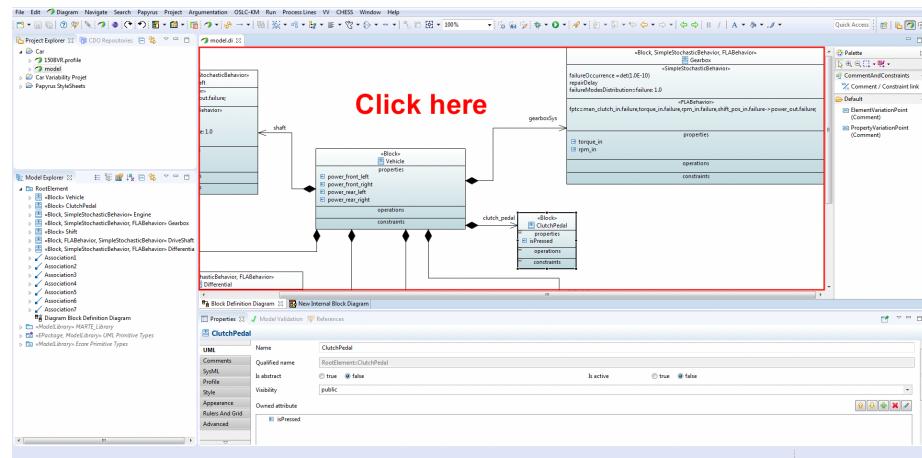


Figure 22: Step ii

- iii. Double click the featureExpr parameter in the window that just opened (Window 1):

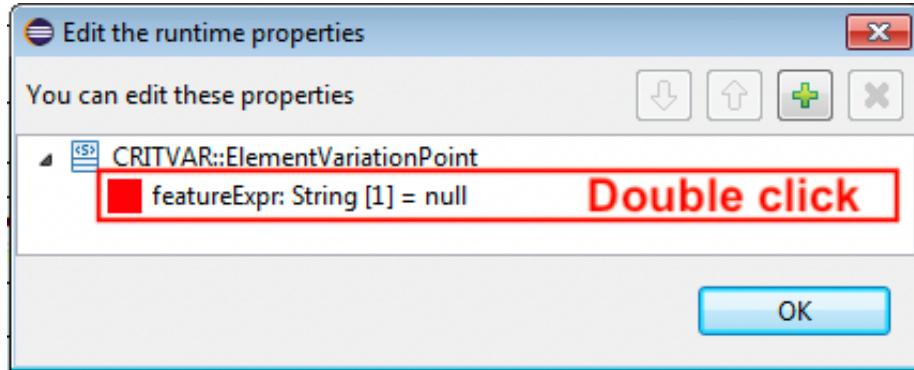


Figure 23: Window 1

- iv. Enter the desired feature expression in the window that just opened (Window 2):

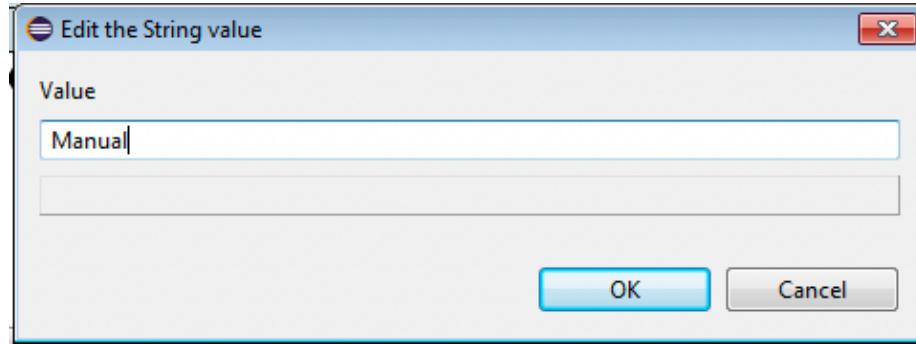


Figure 24: Window 2

v. Select 'OK' on Window 2:

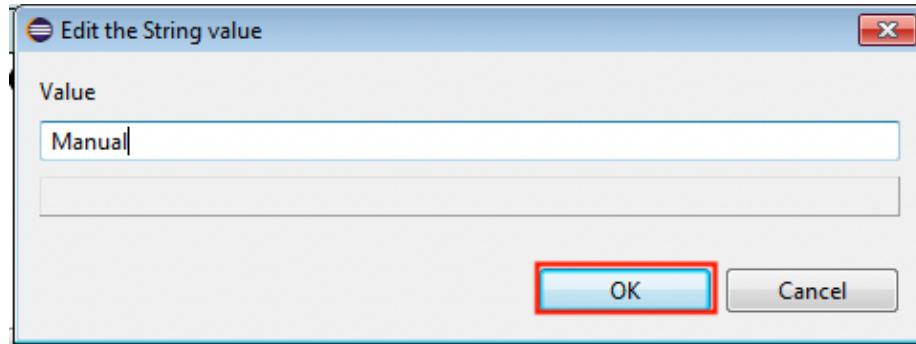


Figure 25: Step v

vi. Select 'OK' on Window 1 (Figure 23);

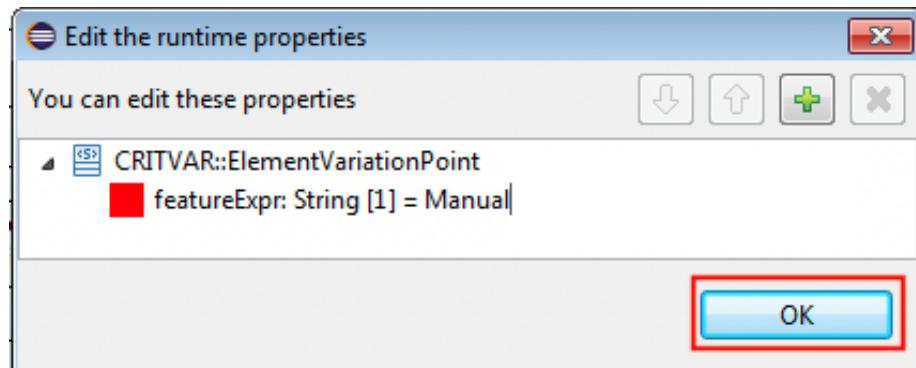


Figure 26: Step vi

vii. Select the 'Comment Link' element on the palette (Figure 19):

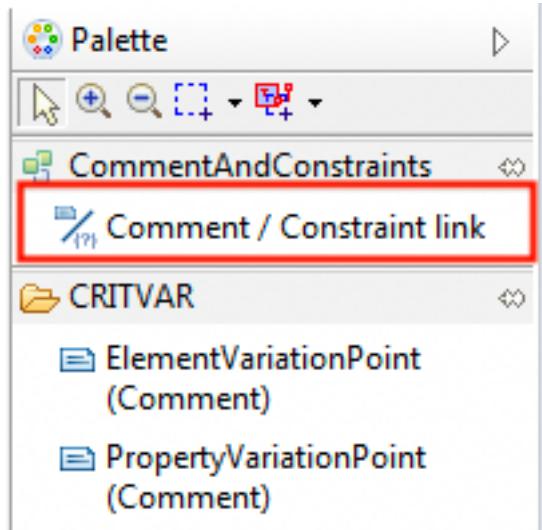


Figure 27: Step vii

viii. Click on the ElementVariationPoint created in step ii;

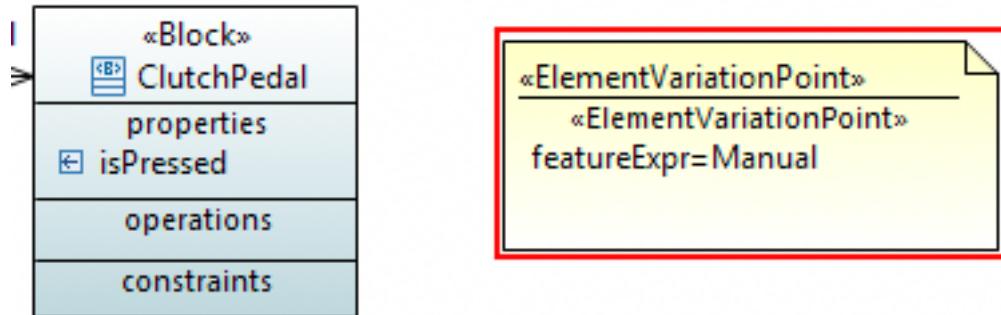


Figure 28: Step viii

ix. Click on the desired element in the canvas to set it as an annotatedElement:

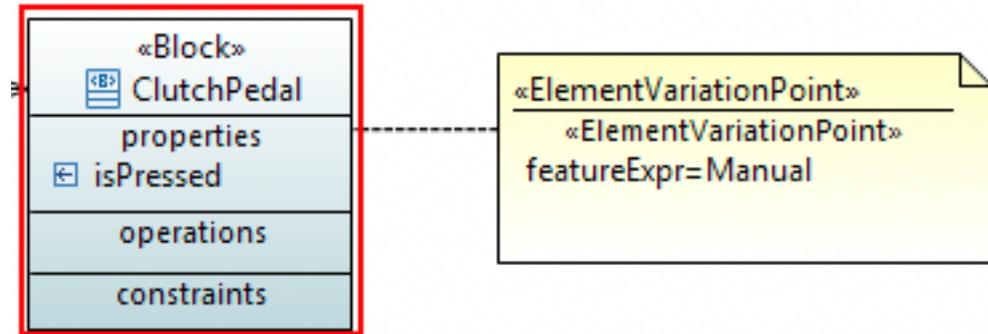


Figure 29: Window 2

## 2.2 Steps for Mapping Features to Model Elements (Multiple)

Number of required steps: 13

i-vi Follow steps i through vi from **Section 2.1 - Steps for Mapping Features to a Model Element (single)**;

vii. Highlight the newly created ElementVariationPoint on the canvas;

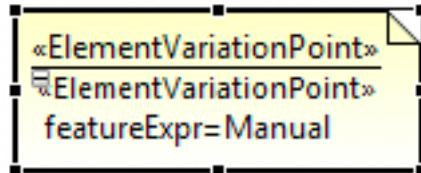


Figure 30: Step vii

viii. Move to the properties view;

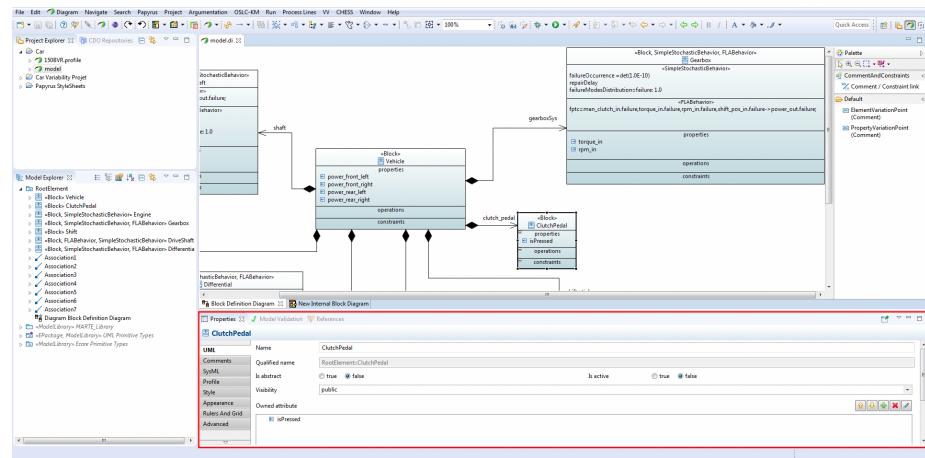


Figure 31: Step viii

ix. Select the 'UML' tab:

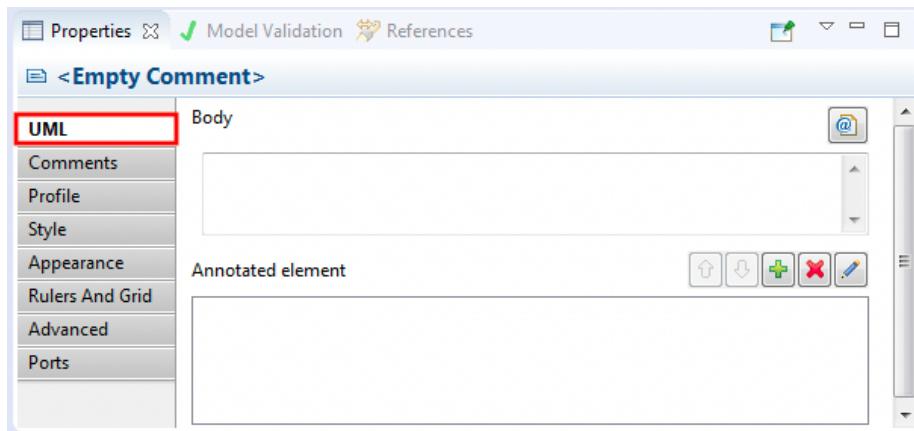


Figure 32: Step ix

x. Select '+':

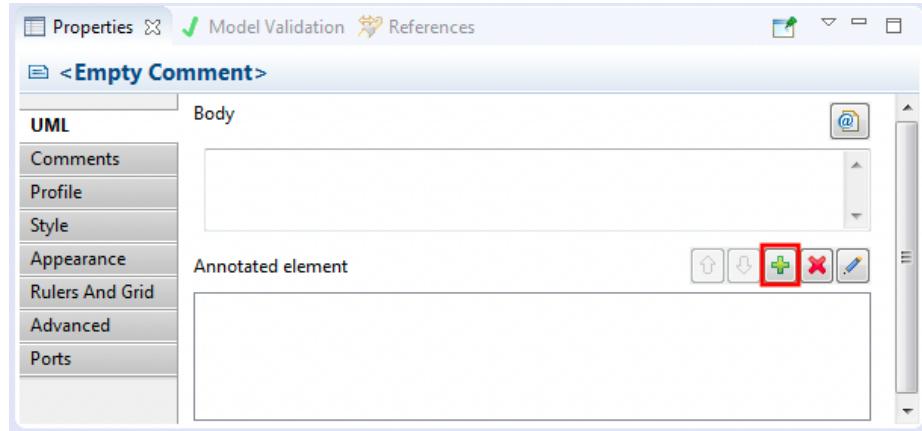


Figure 33: Step x

xi. Select the desired model elements in the window that just opened (Window 3):

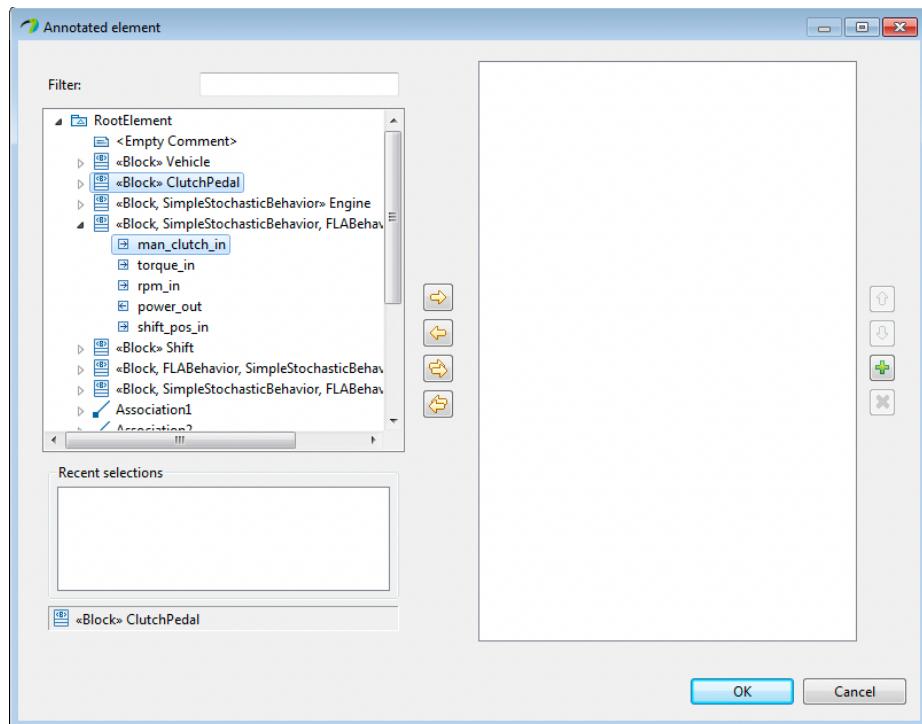


Figure 34: Window 3

xii. Select the '→' button on Window 3;

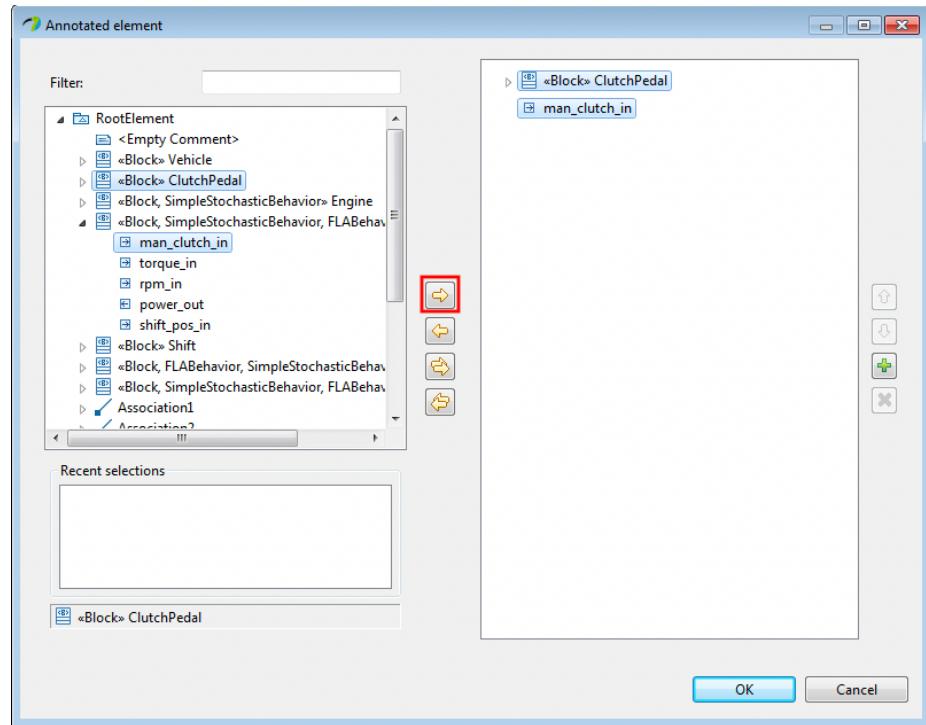


Figure 35: Step xii

xiii. Select 'OK' on Window 3:

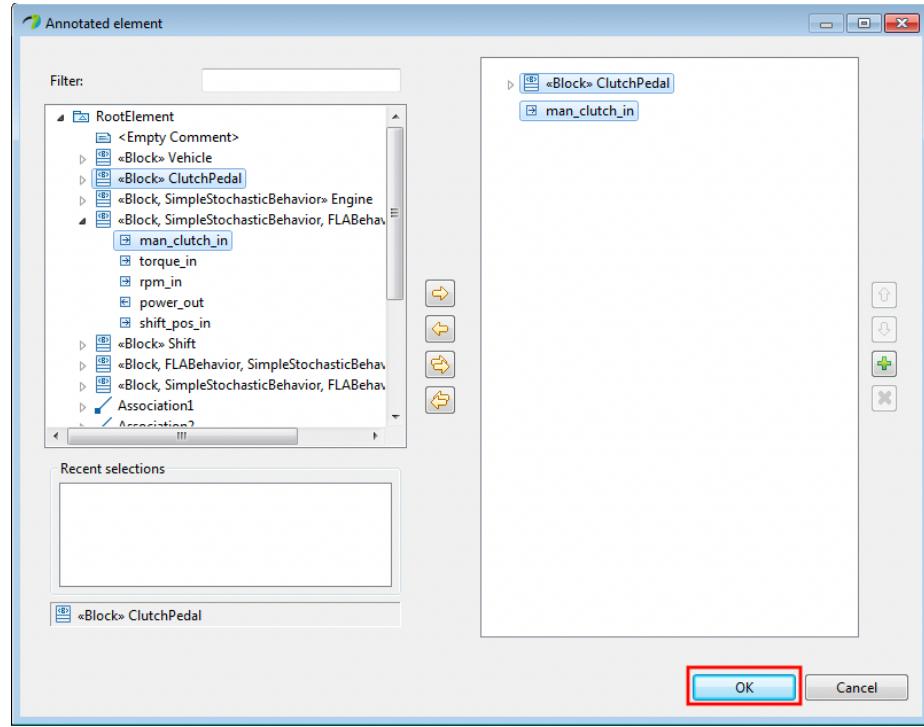


Figure 36: Step xiii

### 2.3 Steps for Mapping Features to Safety Annotations Without a PropertyVariationPoint Comment)

Number of required steps: 6

- i. Select the desired element on the graphical editor of the targeting modeling language (Figure 18 a));

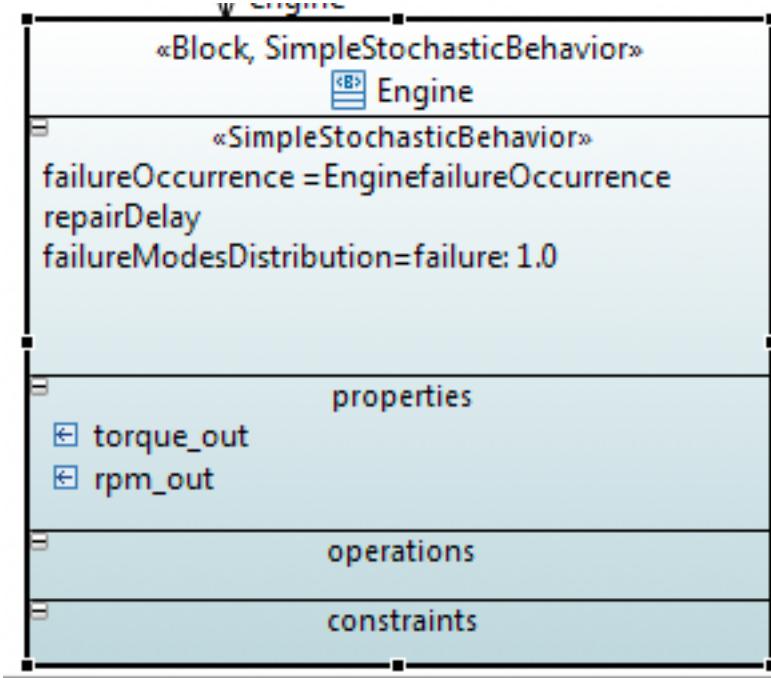


Figure 37: Step i

ii. Move to the 'Properties' view;

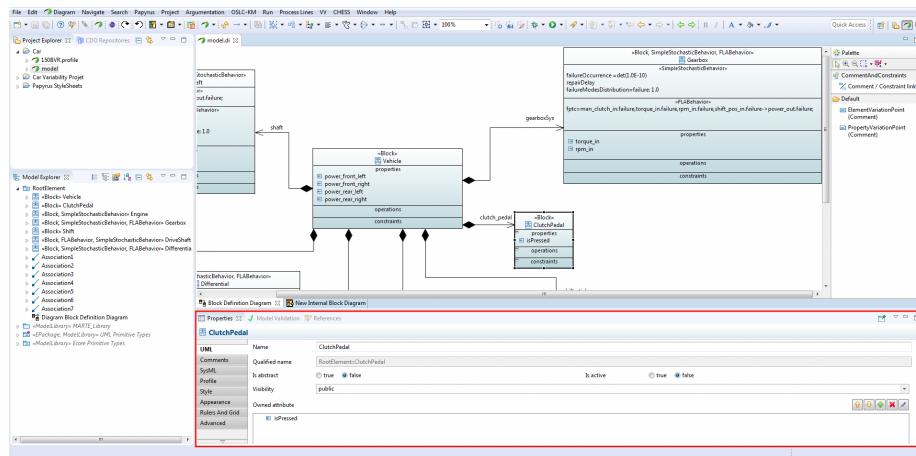


Figure 38: Step ii

iii. Select the 'Profile' tab:

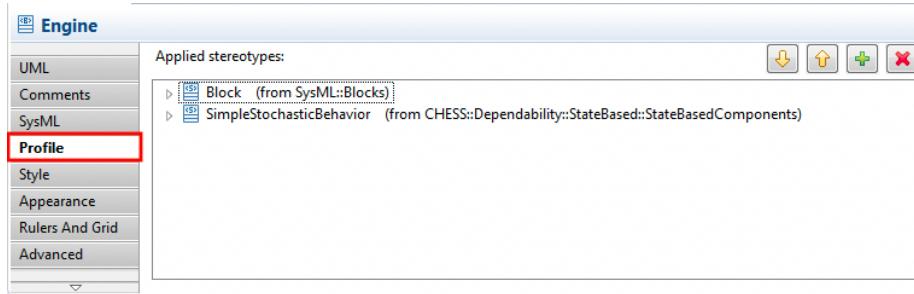


Figure 39: Step iii

iv. Select the desired stereotype;

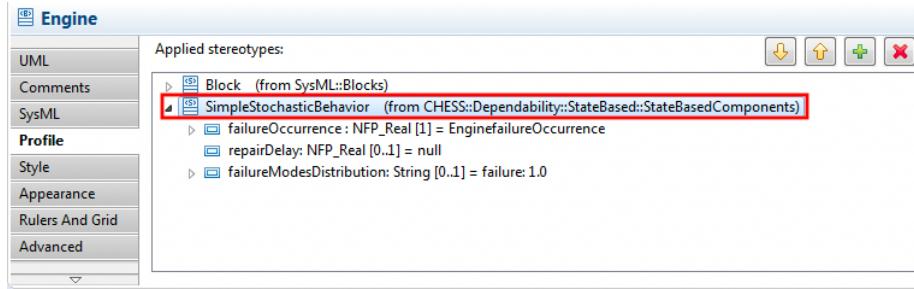


Figure 40: Step iv

v. Select the desired property within the selected stereotype;

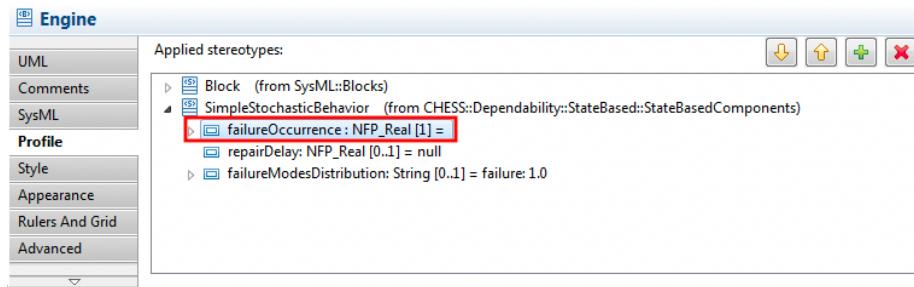


Figure 41: Step v

vi. Enter the appropriate variability expressions on the text box that opens on the right:

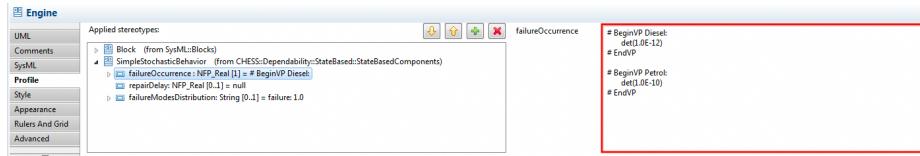


Figure 42: Step vi

## 2.4 Steps for Mapping Features to Safety Annotations With a PropertyVariationPoint Comment)

**Number of required steps: 15**

- Select the PropertyVariationPoint element on the palette:

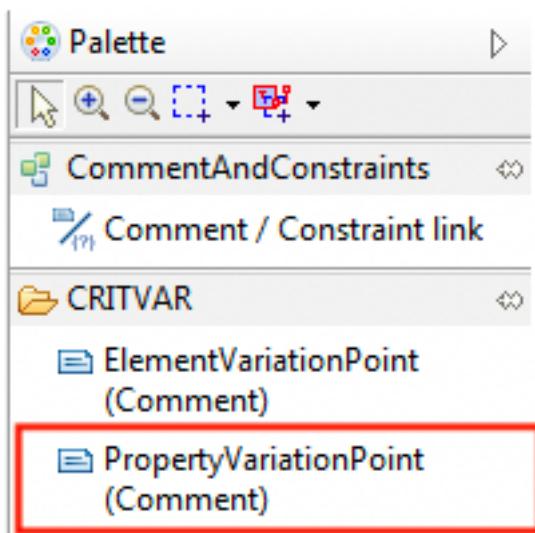


Figure 43: Step i

- Click on the graphical editor of the targeting modeling language to create the new PropertyVariationPoint;

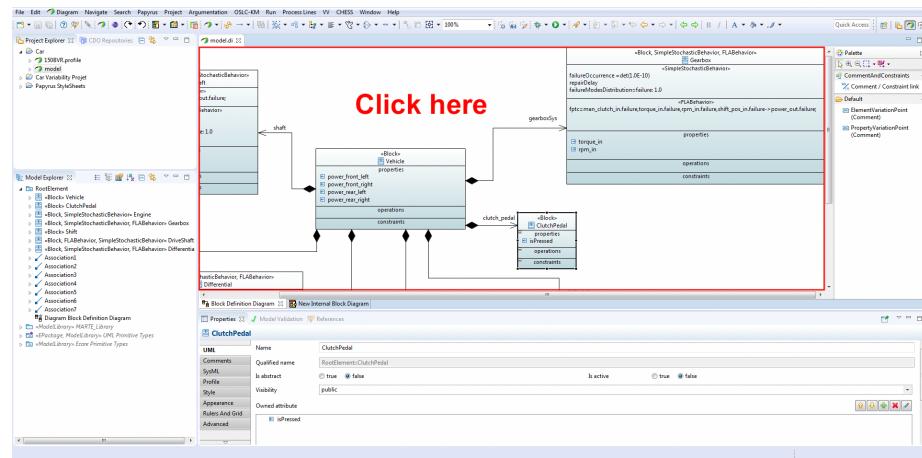


Figure 44: Step ii

- iii. Double click the 'stereotype' parameter in the window that just opened (Window 1):

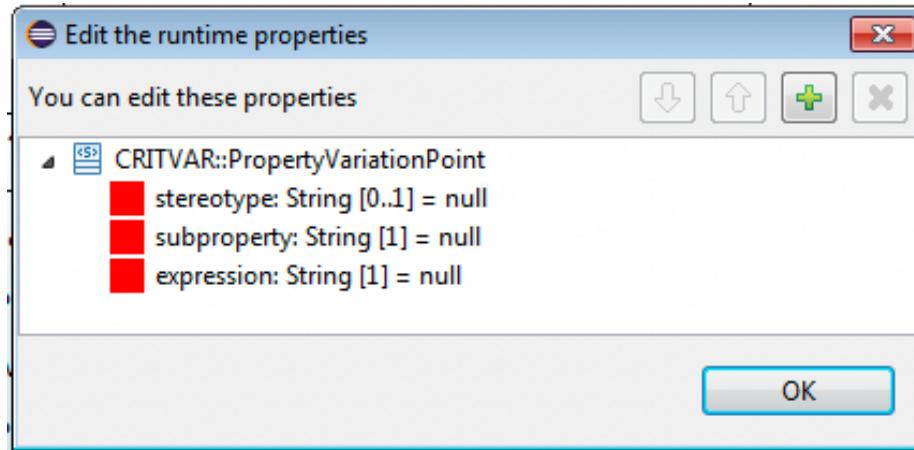


Figure 45: Window 1

- iv. Enter the desired stereotype name in the window that just opened (Window 2):

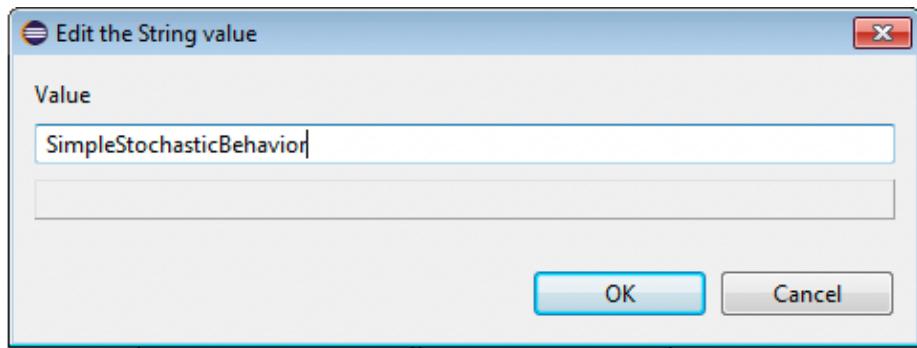


Figure 46: Window 2

v. Select 'OK' on Window 2;

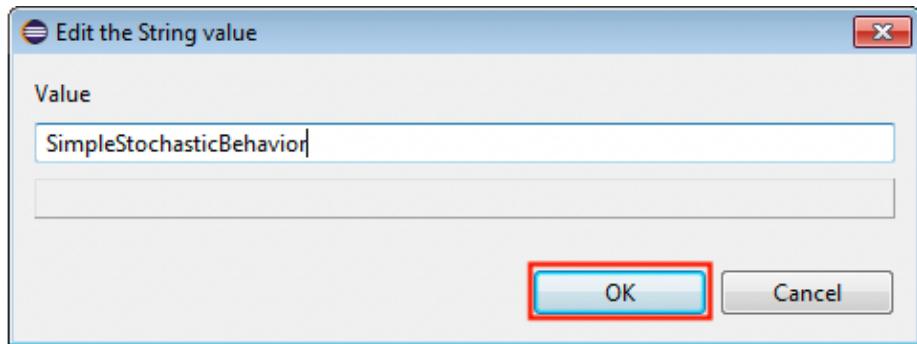


Figure 47: Step v

vi. Double click the 'subproperty' parameter on Window 1:

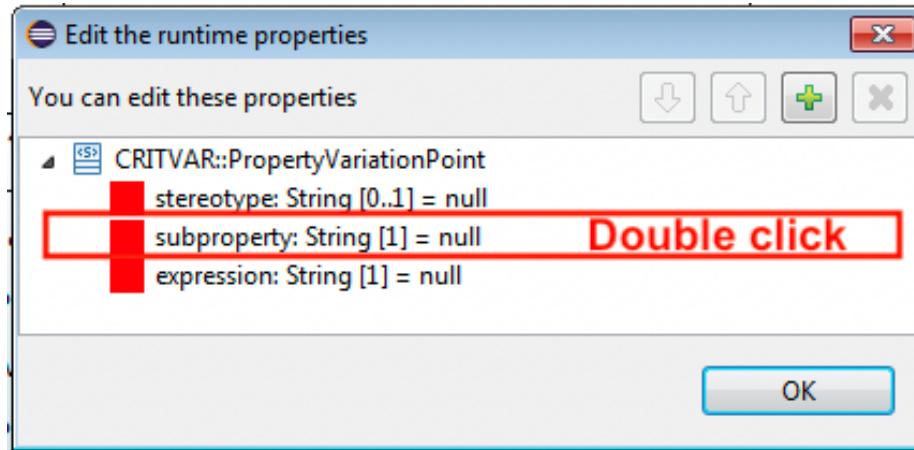


Figure 48: Step vi

- vii. Enter the desired subproperty name e.g., 'failureOccurrence' or 'fptc', in the window that just opened (Window 3);

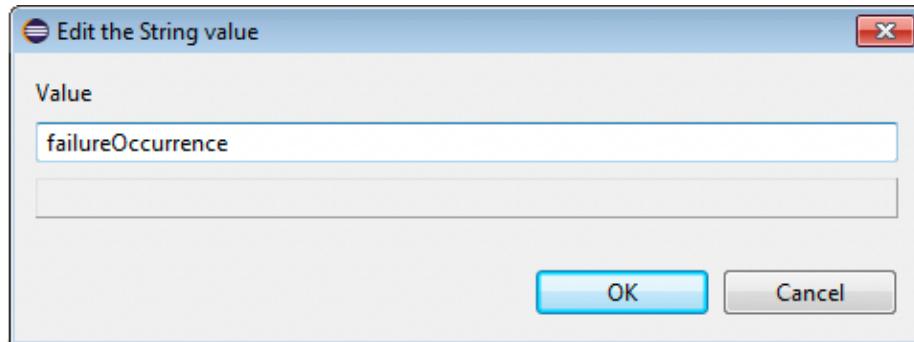


Figure 49: Window 3

- viii. Select 'OK' on Window 3 (Figure vii);

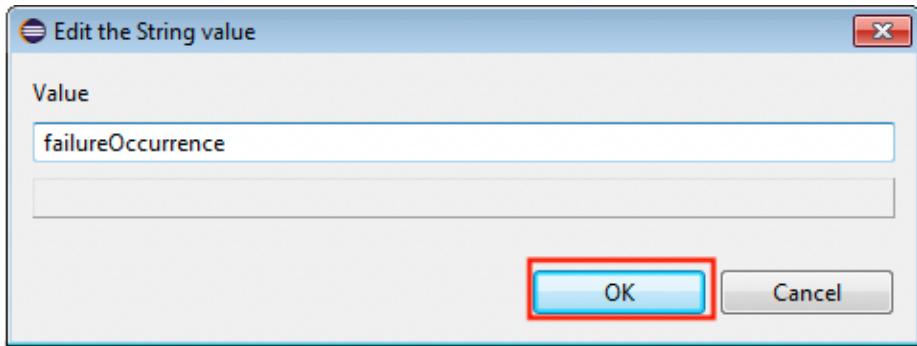


Figure 50: Step viii

ix. Double click the 'expression' parameter on Window 1:

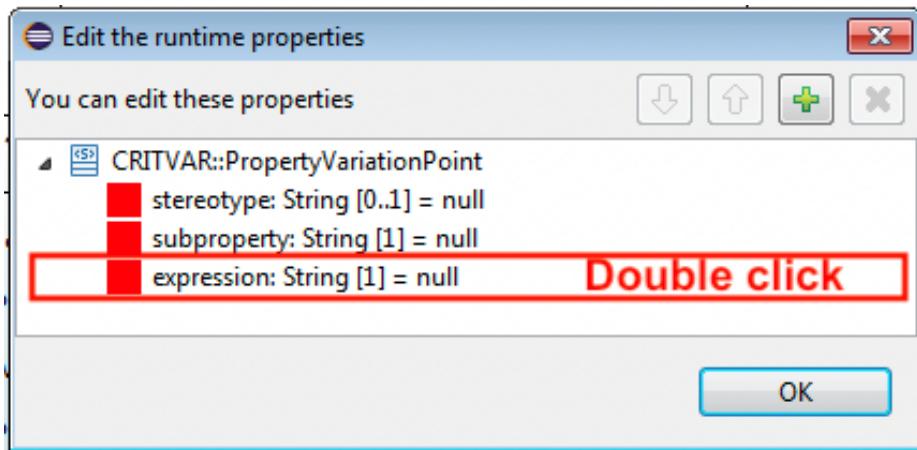


Figure 51: Step ix

x. Enter the desired expression in the window that just opened (Window 4);

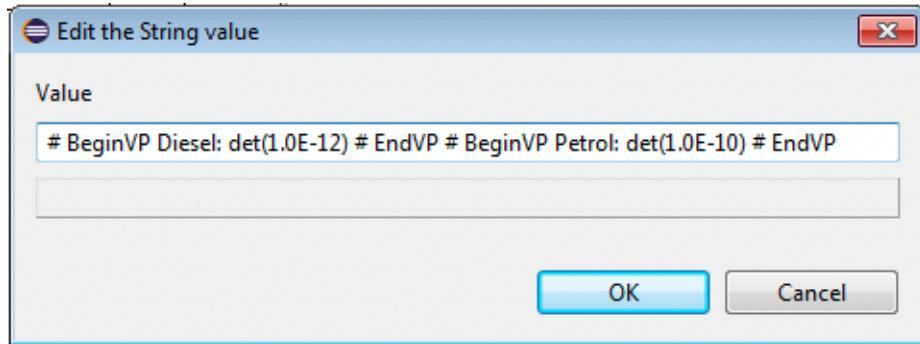


Figure 52: Window 4

xi. Select 'OK' on Window 4 (Figure x);

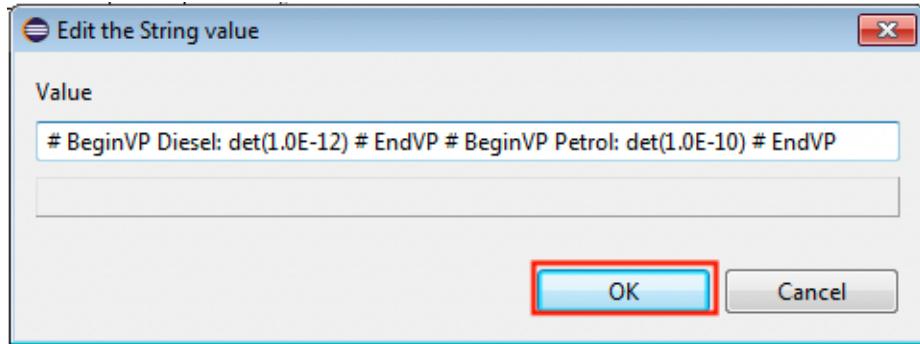


Figure 53: Step xi

xii. Select 'OK' on Window 1;

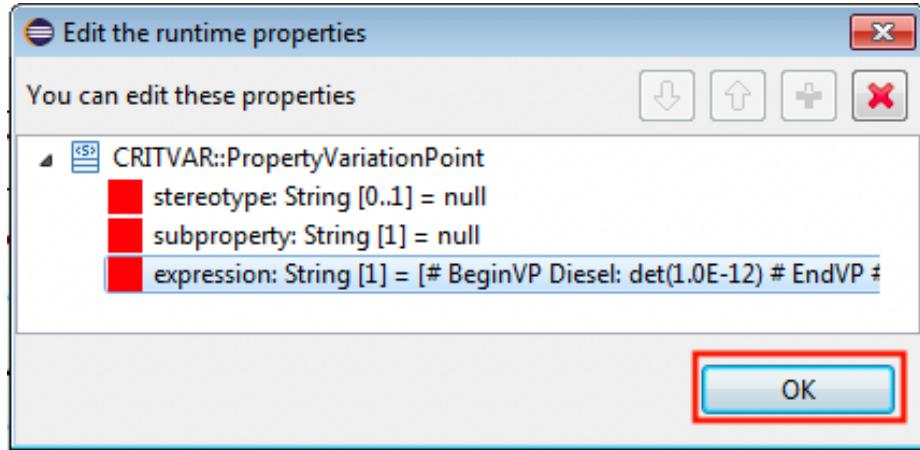


Figure 54: Step xii

xiii. Select the 'Comment Link' element on the palette;

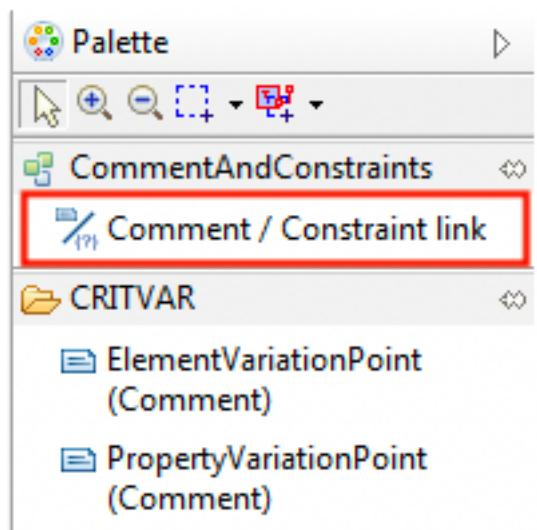


Figure 55: Step xiii

xiv. Click on the PropertyVariationPoint comment created in step ii;

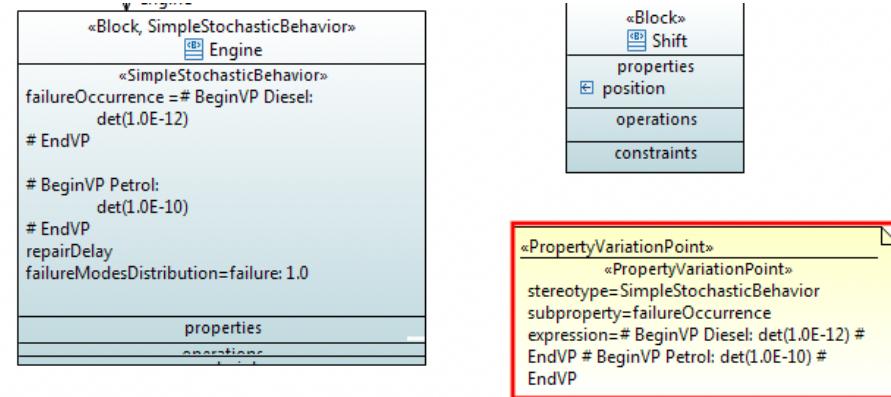


Figure 56: Step xiv

- xv. Click on the desired element on the canvas to set it as an annotatedElement.

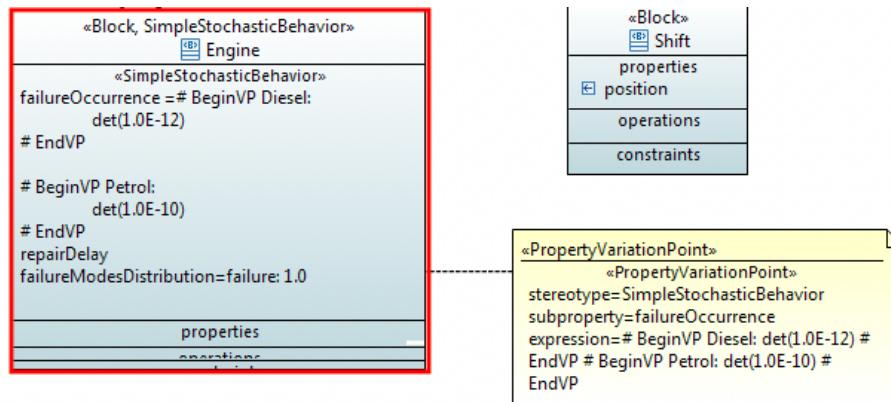


Figure 57: Step xv

### 3 pure::variants

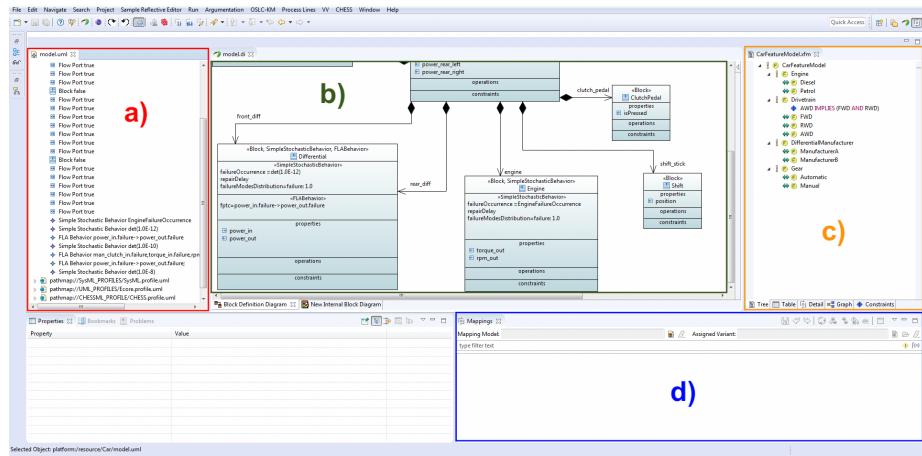


Figure 58: pure::variants Environment and its **a)** tree model editor of the targeting modeling language, **b)** graphical editor of the targeting modeling language, **c)** feature model view and **d)** mappings view

#### 3.1 Steps for Mapping Features to Model Elements

Number of required steps: 9

- Right click in the Mappings view (Figure 58 **d**);

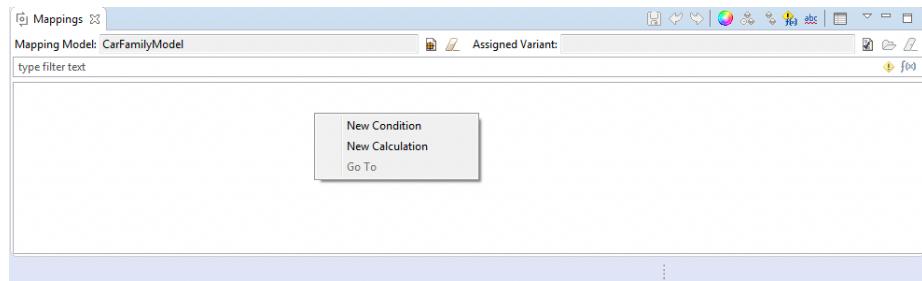


Figure 59: Step i

- Select 'New Condition';

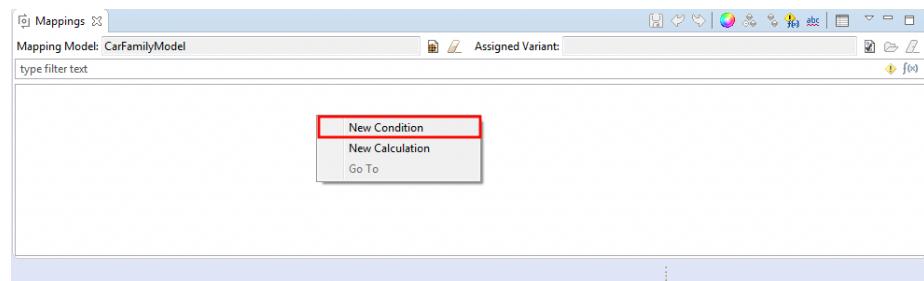


Figure 60: Step i

- iii. Enter the desired feature expression in the window that just opened (Window 1);

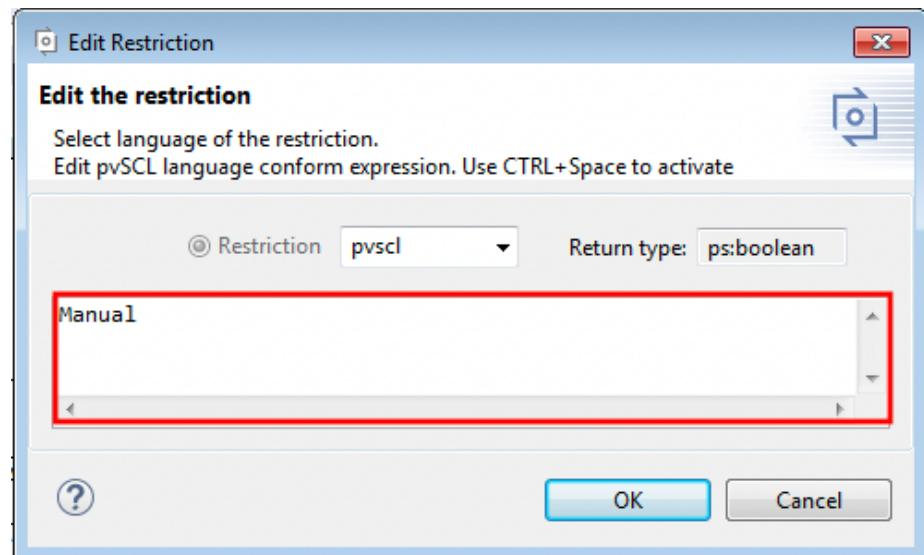


Figure 61: Window 1

- iv. Select 'OK' on Window 1;

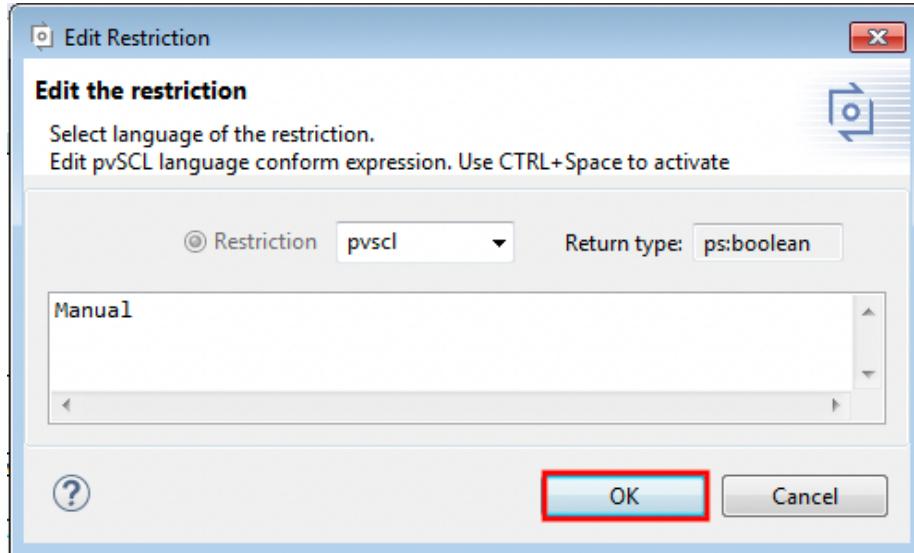


Figure 62: Step iv

- v. Move to the graphical editor of the targeting modeling language e.g. SysML:

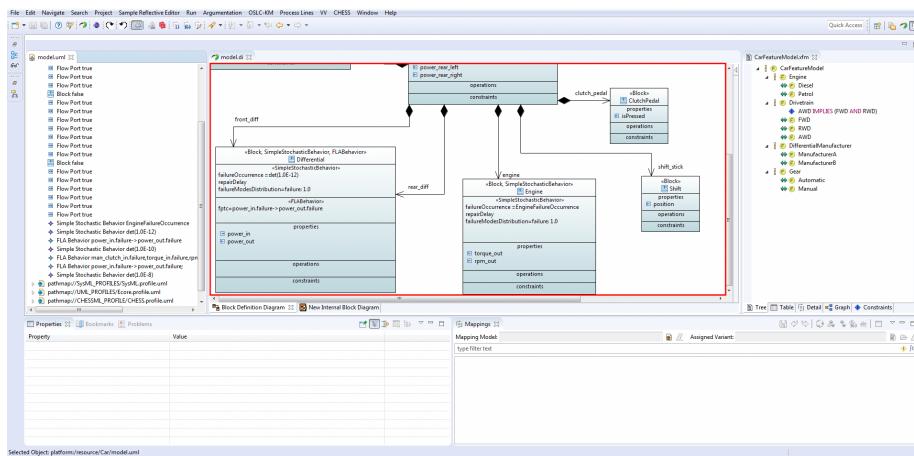


Figure 63: Step v

- vi. Select the desired model element(s) that will be kept in the model when the feature expression defined in Step iii is satisfied;

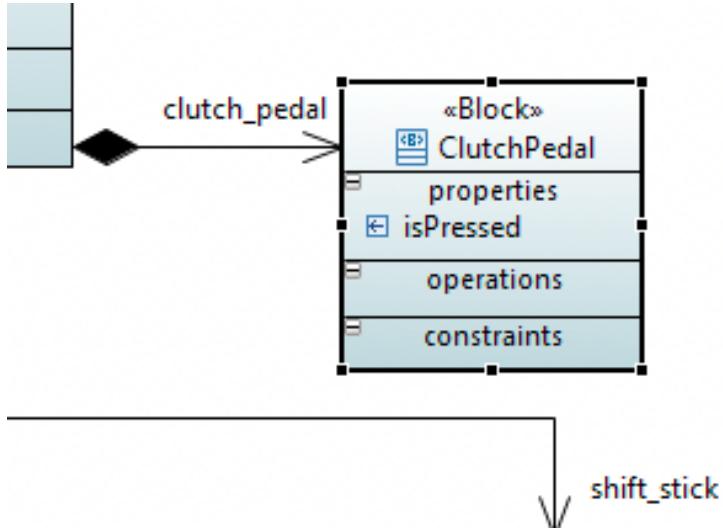


Figure 64: Step vi

vii. Move to the Mappings editor (Figure 58 d));

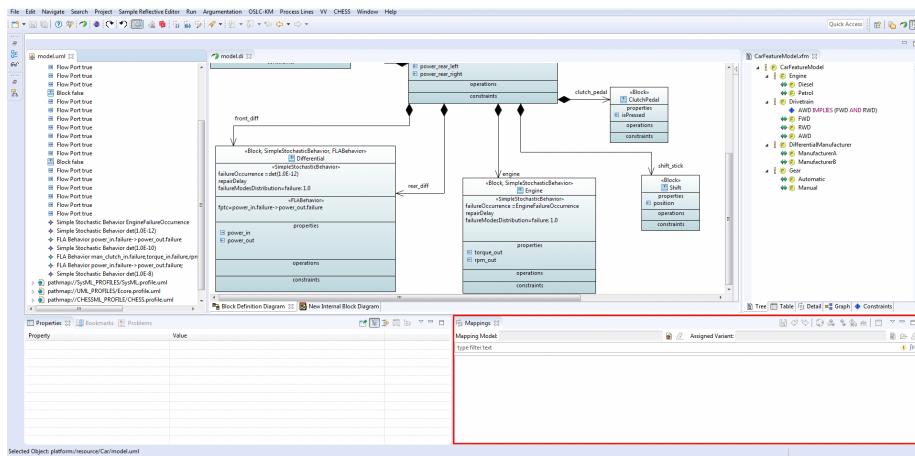


Figure 65: Step vii

viii. Right click in the condition created in step i;

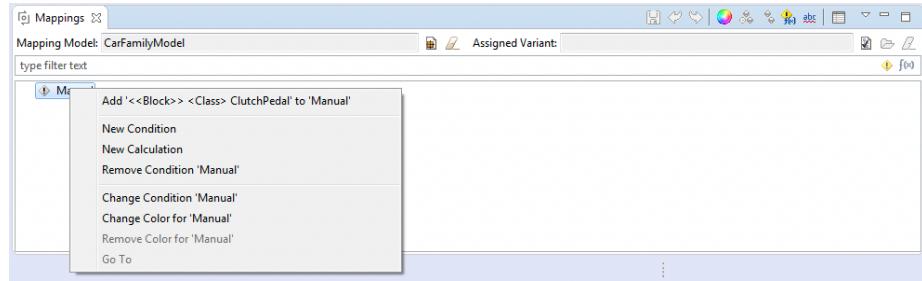


Figure 66: Step viii

ix. Select Add [Element] to [Condition].

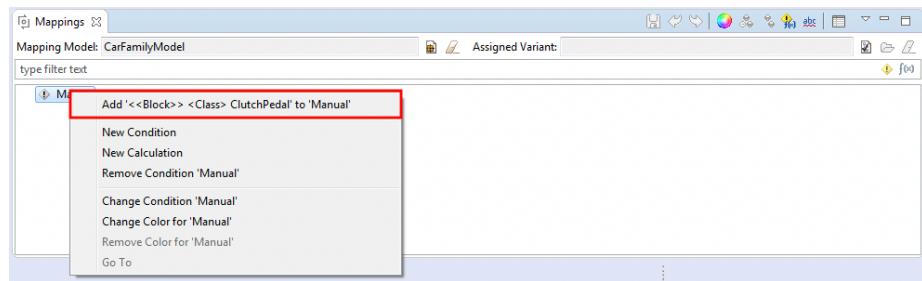


Figure 67: Step ix

### 3.2 Steps for Mapping Features to Safety Annotations

Number of required steps: 20

- i. Right click on a feature within the Feature Model editor;

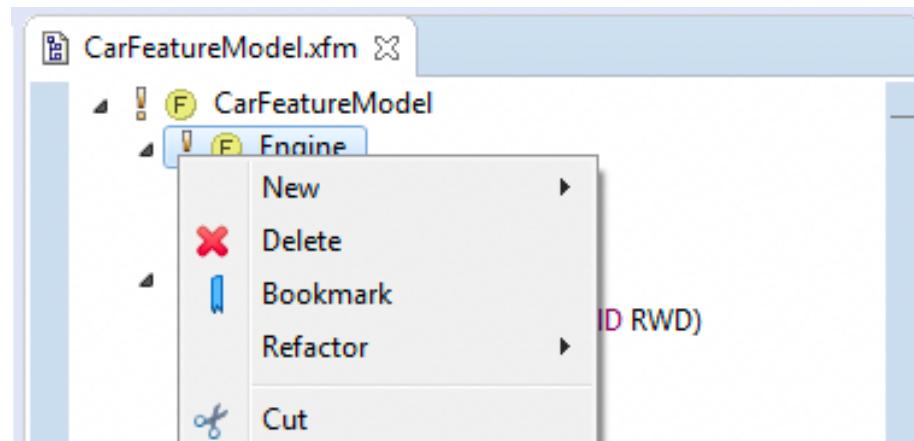


Figure 68: Step i

ii. Select New → Attribute;

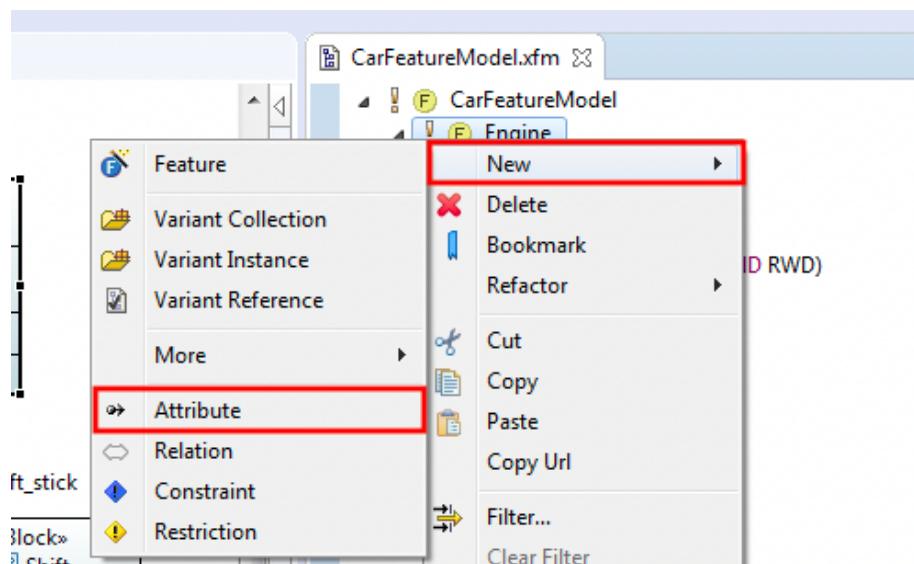


Figure 69: Step ii

iii. Enter a name for the newly created attribute in the window that just opened (Window 1):

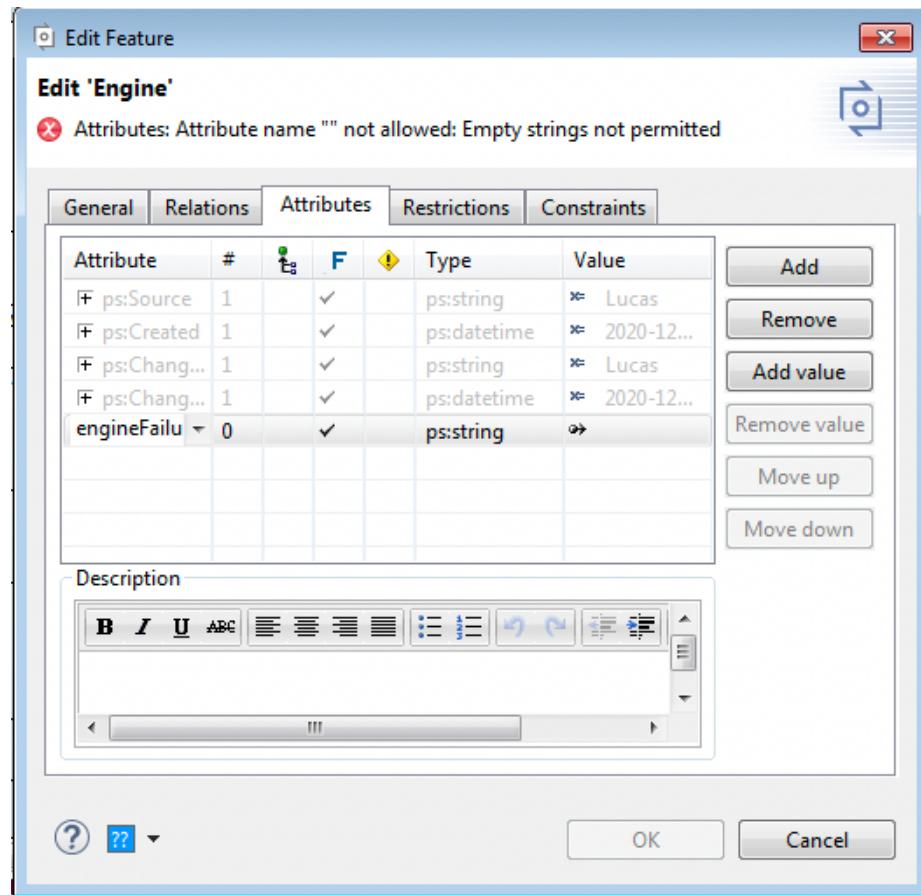


Figure 70: Window 1

iv. Select the 'Value' parameter on Window 1:

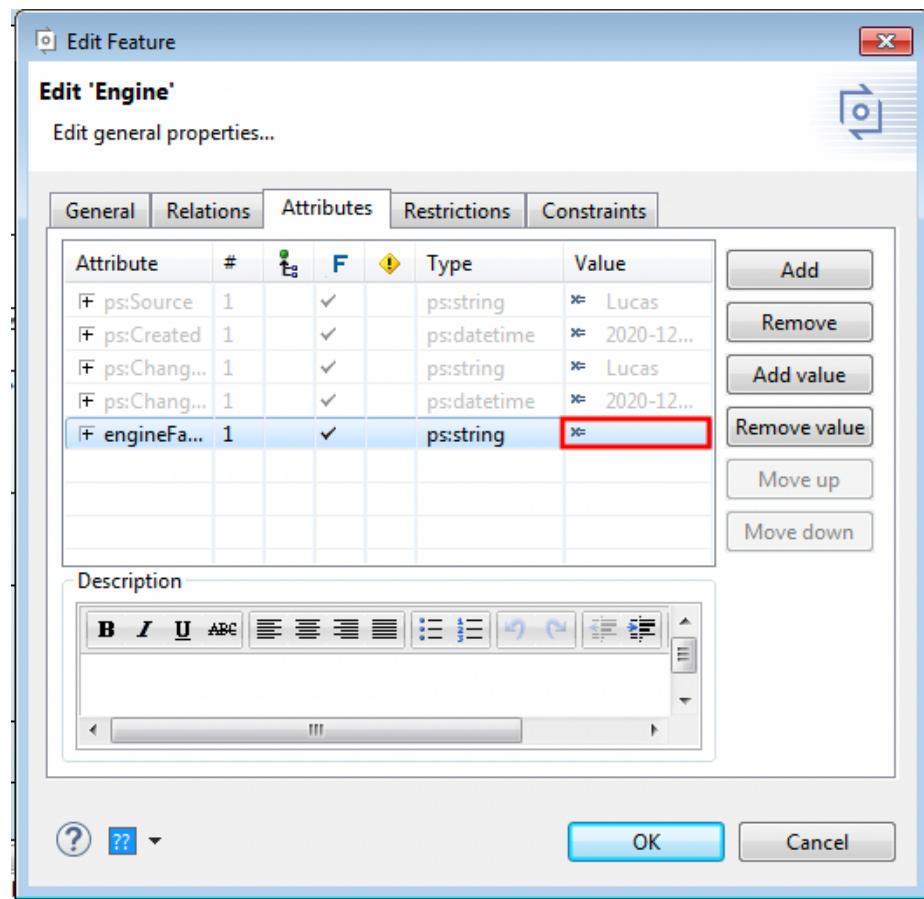


Figure 71: Step iv

v. Click on the '...' button:

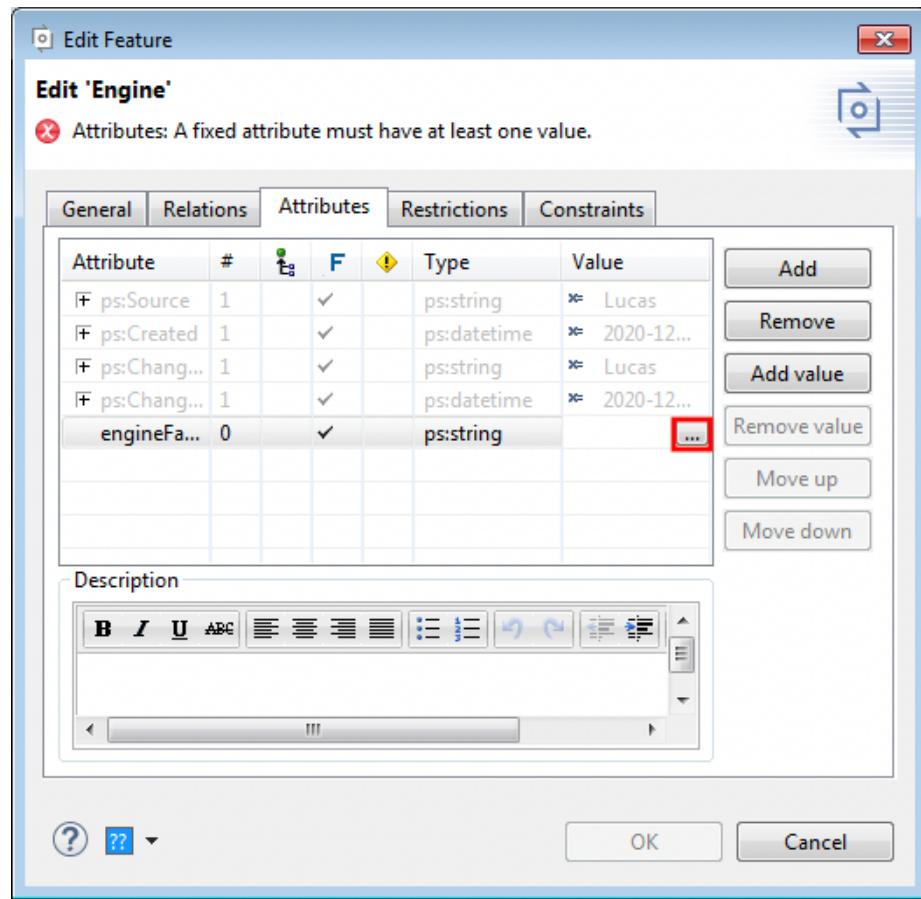
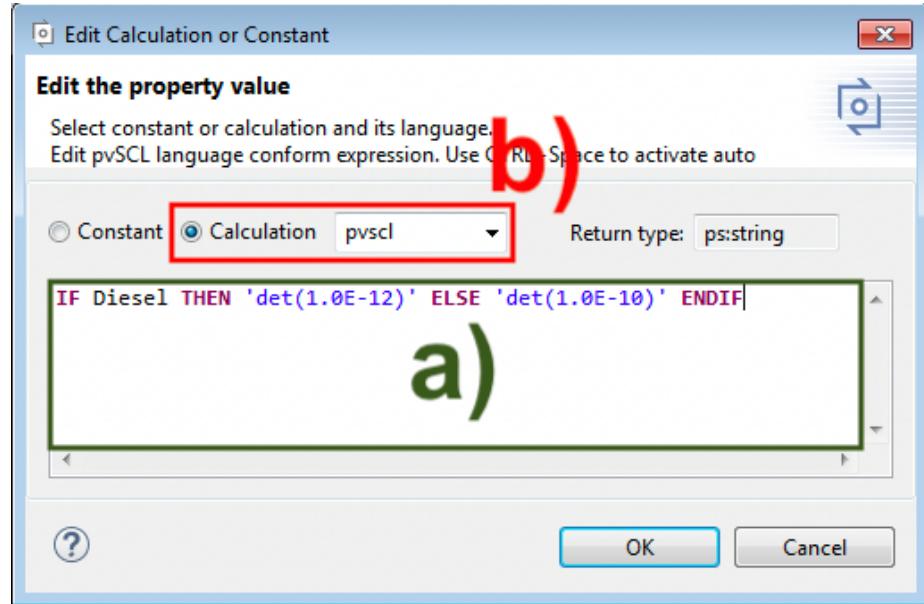
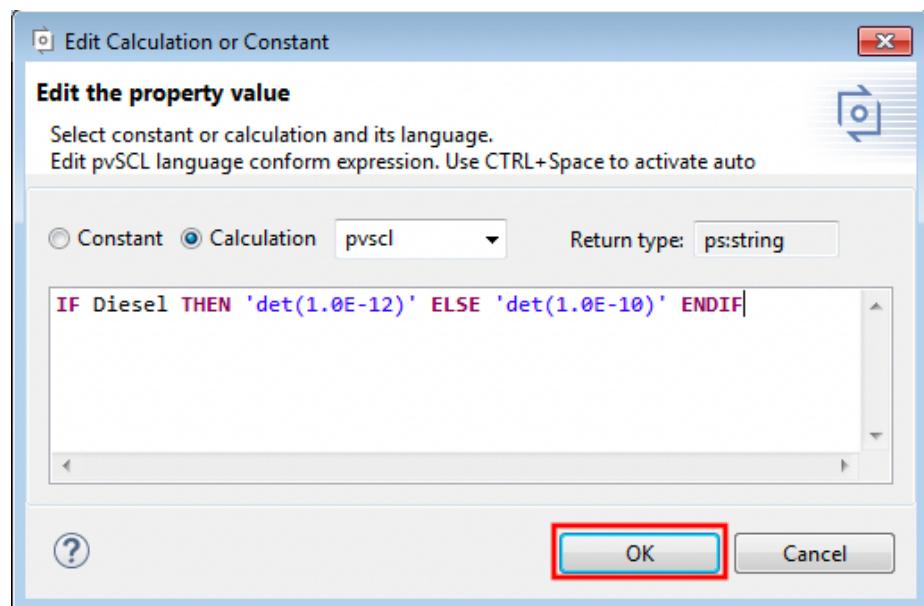


Figure 72: Step v

- vi. Enter the desired property variability expression **a)** on the window that just opened (Window 2) and make sure that the 'Calculation' option and the pvscl parameter is selected **b)**:



vii. Select 'OK' on Window 2:



viii. Select 'OK' on Window 1:

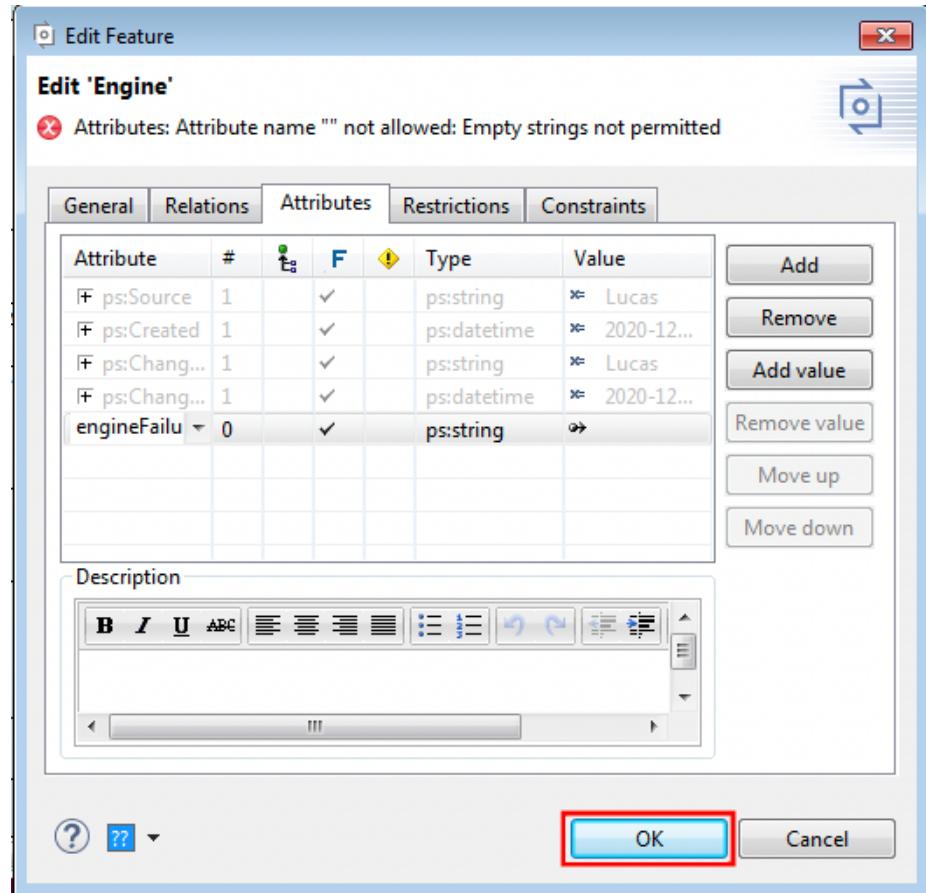


Figure 75: Step viii

ix. Move to the Mappings editor:

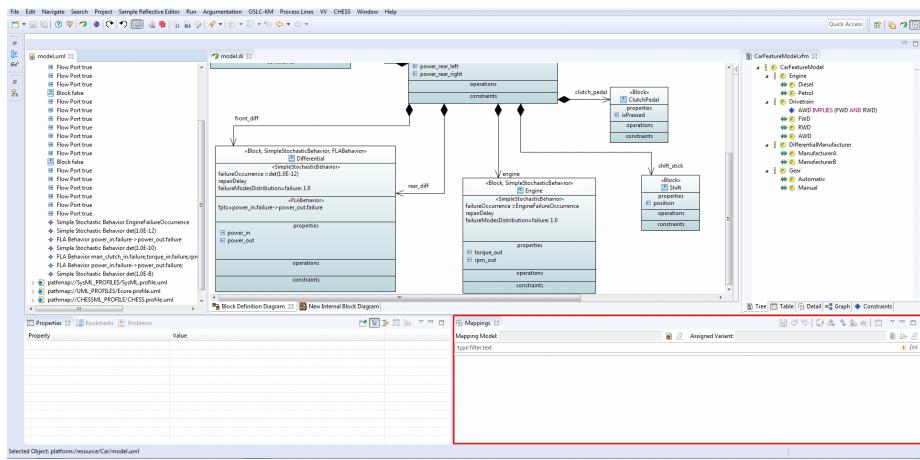


Figure 76: Step vii

x. Right click on the Mappings editor;

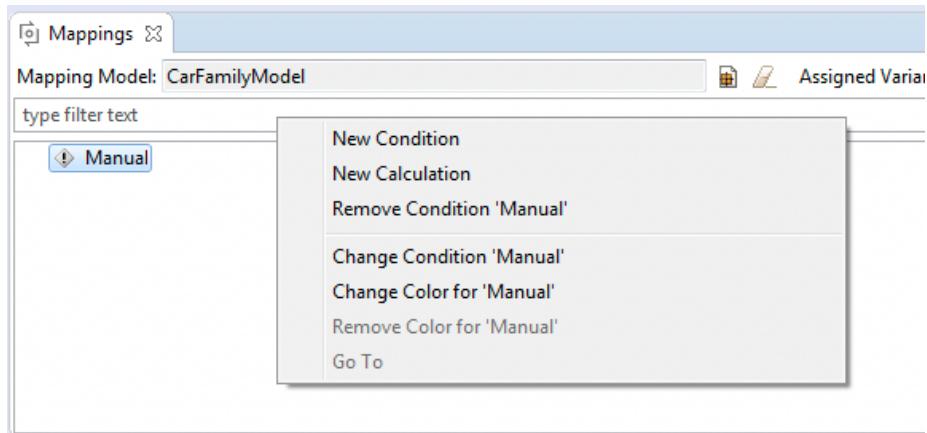


Figure 77: Step x

xi. Select 'New Calculation';

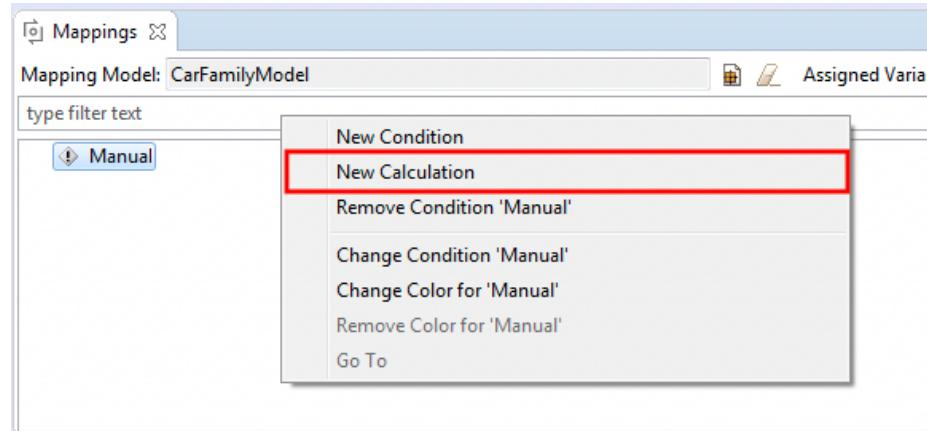


Figure 78: Step xi

- xii. Enter the attribute name specified during step iii on the window that just opened (Window 3);

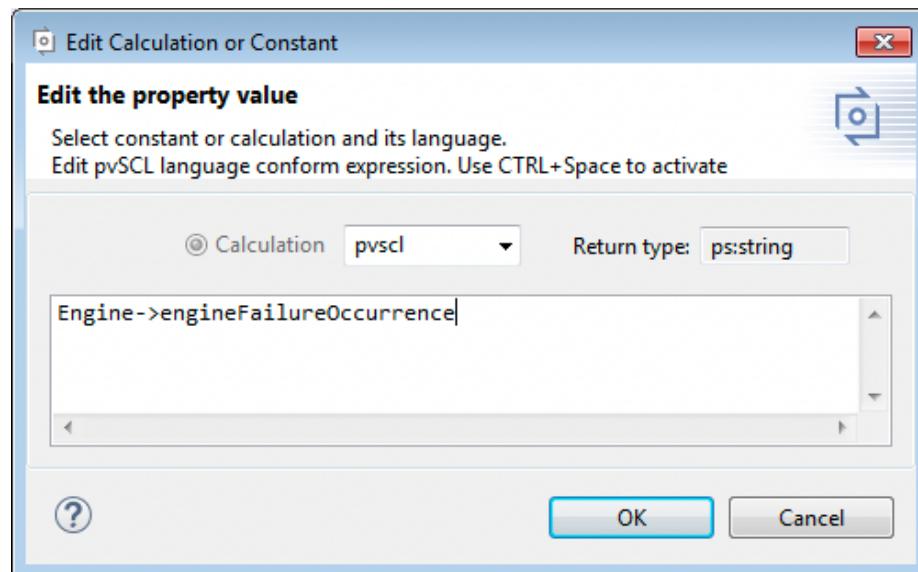


Figure 79: Window 3

- xiii. Select 'OK' on Window 3;

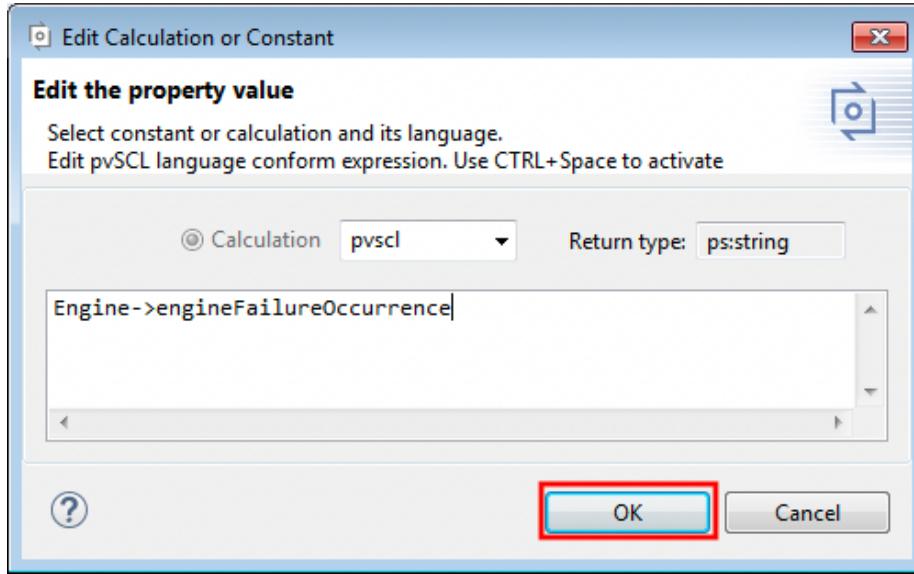


Figure 80: Step xiii

xiv. Move to the tree view model editor:

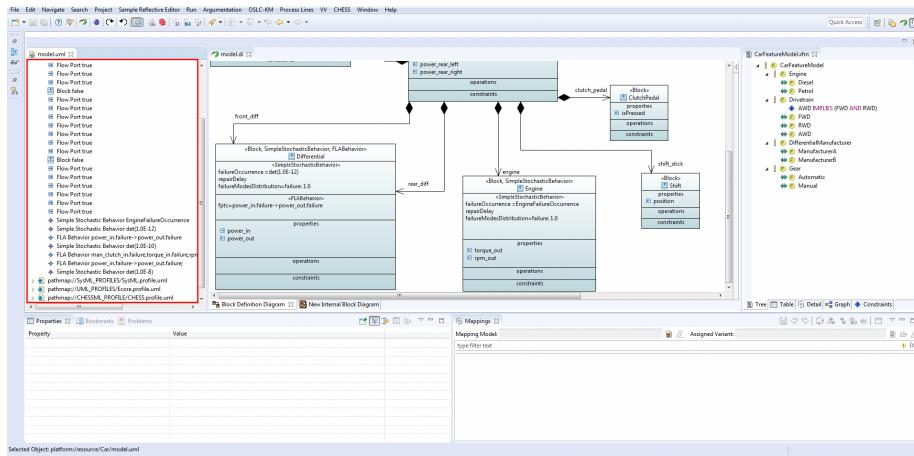


Figure 81: Step xiv

xv. Select the desired property (can be either within a stereotype or not);

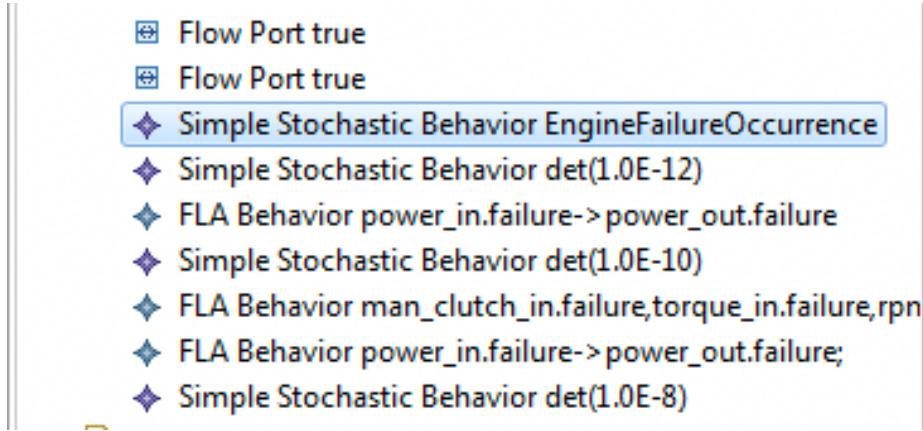


Figure 82: Step xv

xvi. Move to the Mappings editor (Figure 58 d));

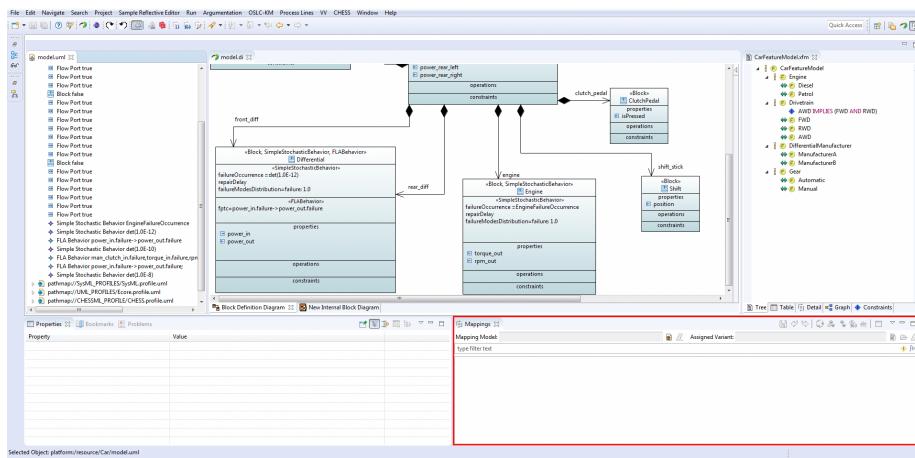


Figure 83: Step vii

xvii. Right click on the calculation created in step xi;

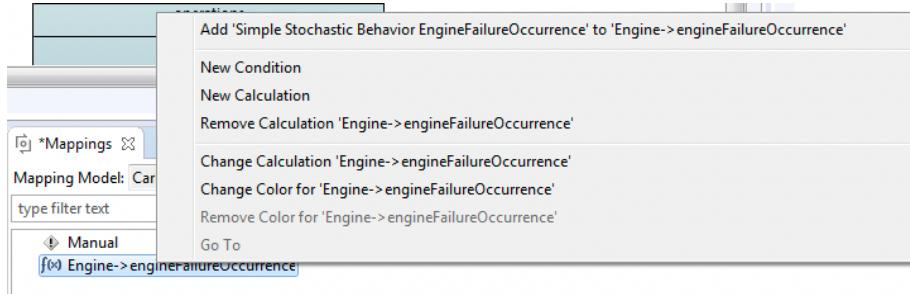


Figure 84: Step xvii

xviii. Select 'Add [Selected Property] to [Calculation Label]';

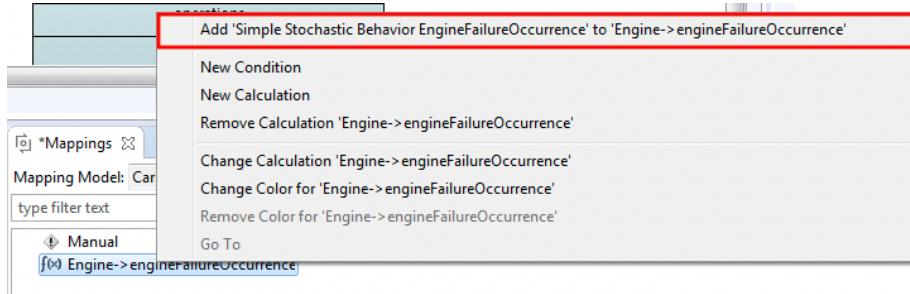


Figure 85: Step xviii

xix. Select the desired sub property on the window that just opened (Window 4);

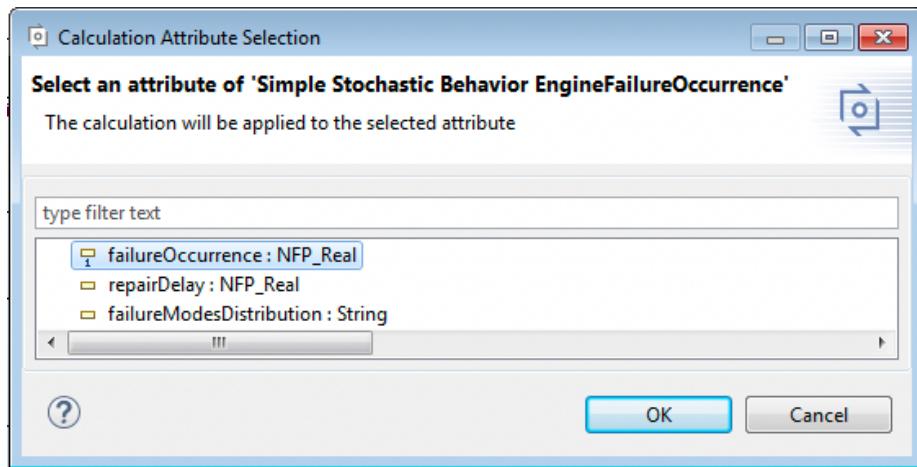


Figure 86: Window 4

xx. Select 'OK' on Window 4.

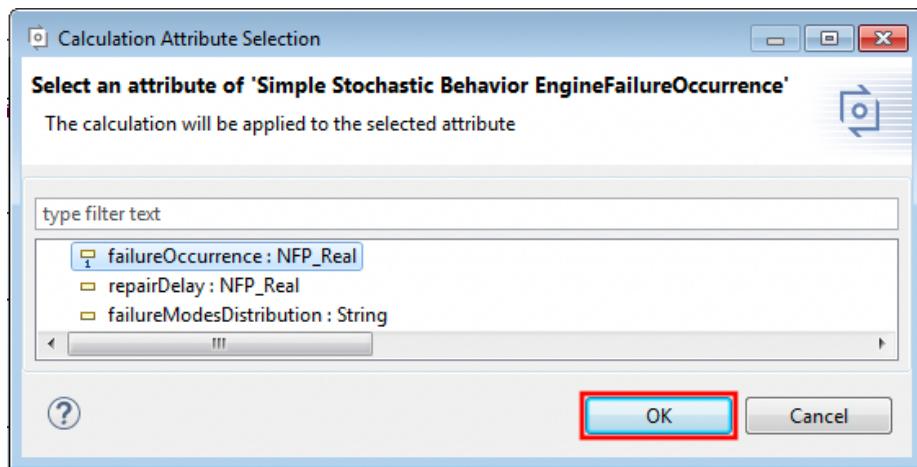


Figure 87: Step xx