



REVIT for Tertiary buildings

CAD Forum #1

Yoann OBRY

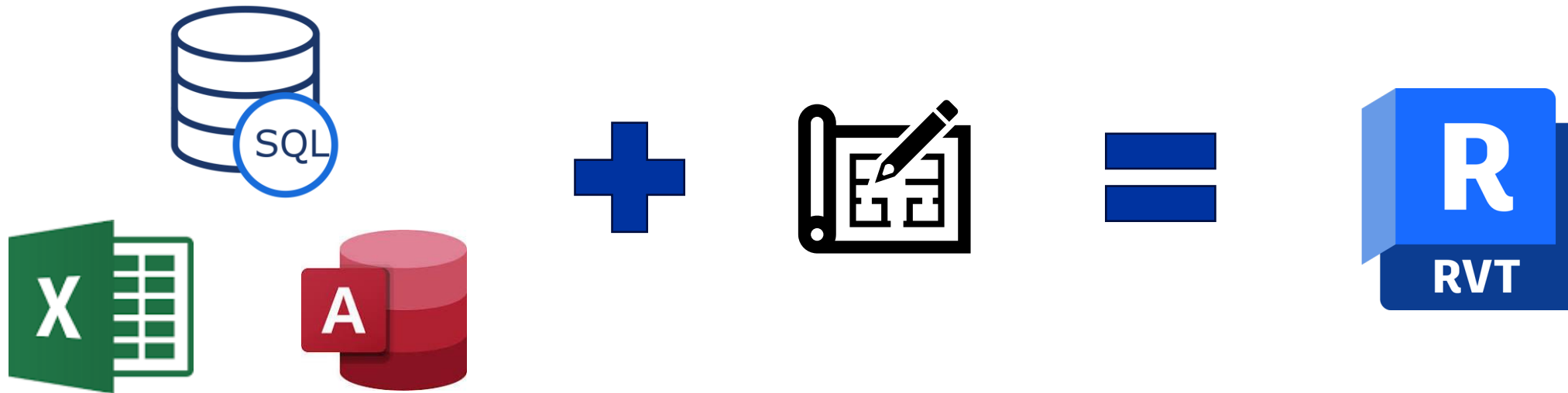
08/11/2023

Introduction of Revit software

- ▶ **My job according to Revit**
- ▶ **Autodesk software created in 2000**
- ▶ **BIM : Building Information modeling**
- ▶ **Multitask construction software (Architecture, Structure, Electricity, HVAC...)**

Introduction of Revit software

► Database with 3D interface

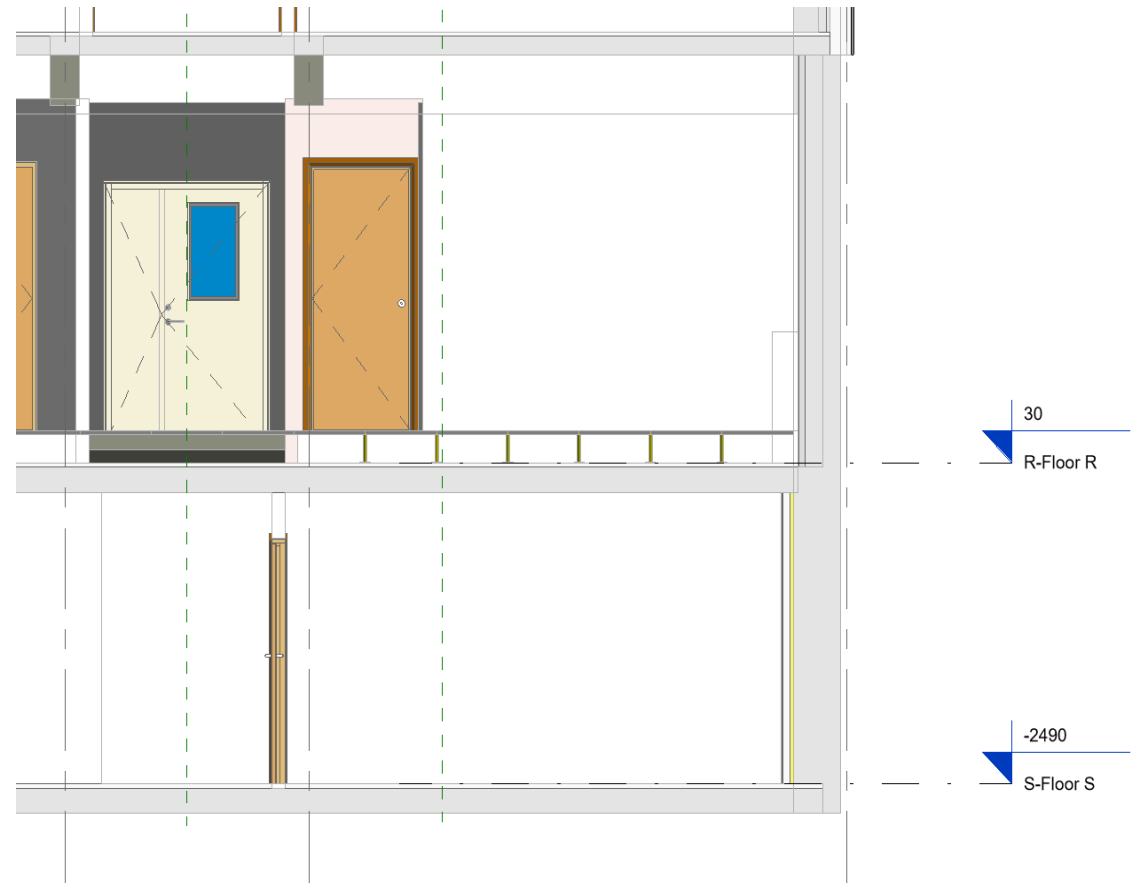


- 1/ Modeling concepts**
- 2/ Engineering concepts**
- 3/ Advanced concepts**



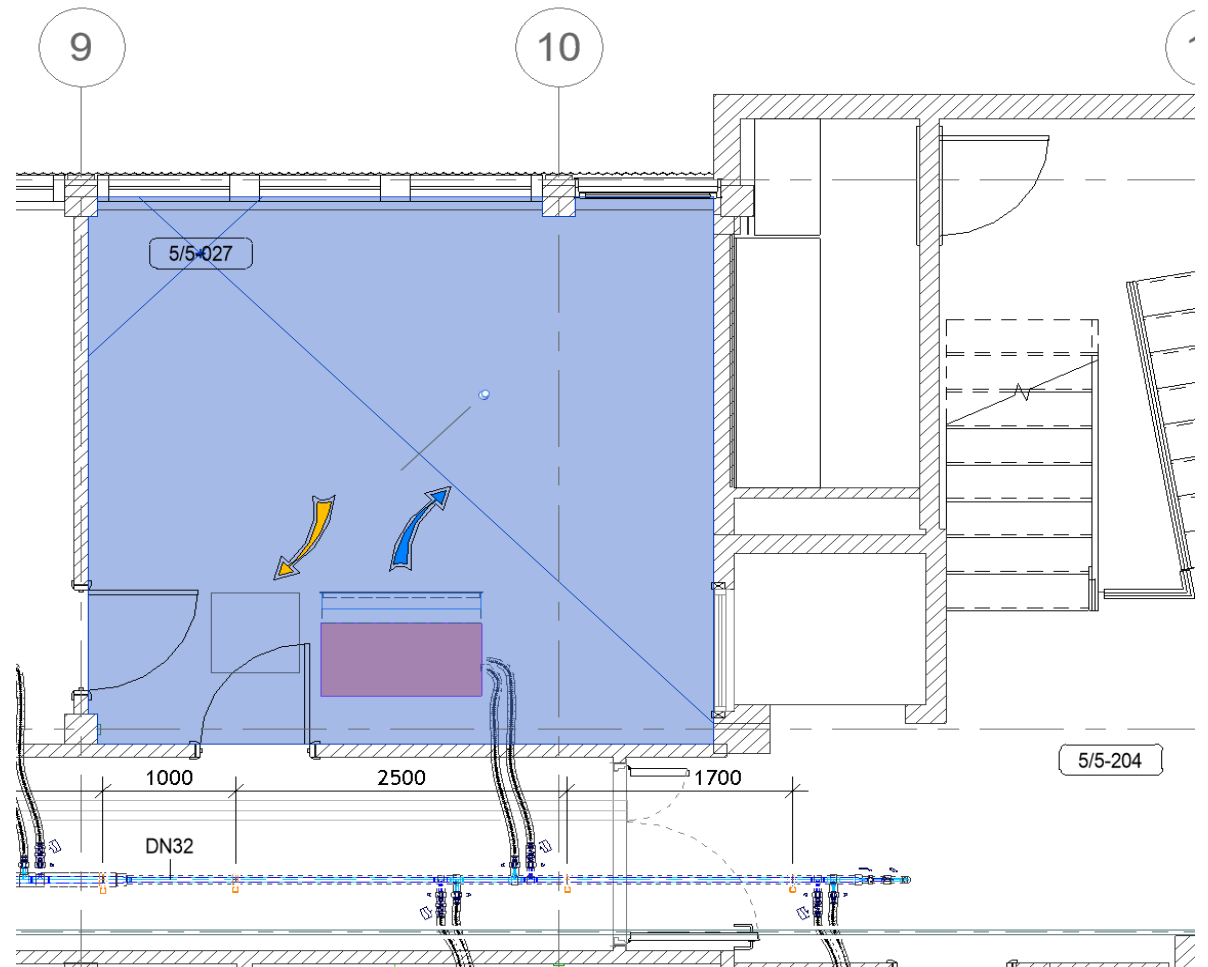
1/ Modeling concepts

- ▶ Each construction element is hosted by a unique level



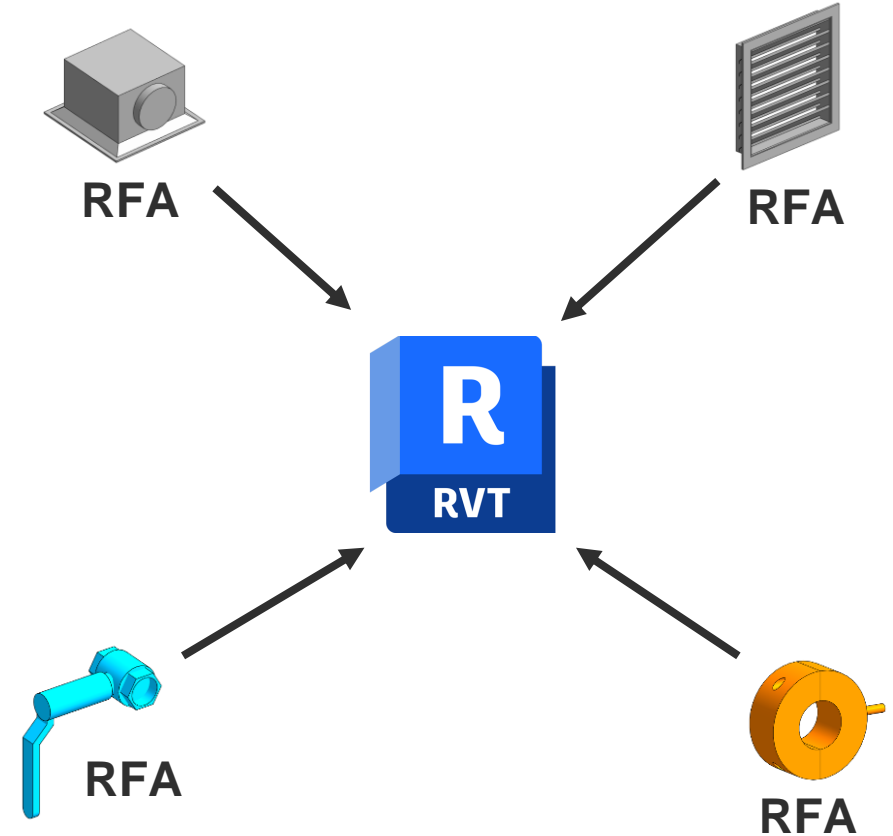
1/ Modeling concepts

- An element can also be hosted by a Room (Archi) or a Space (MEP)



1/ Modeling concepts

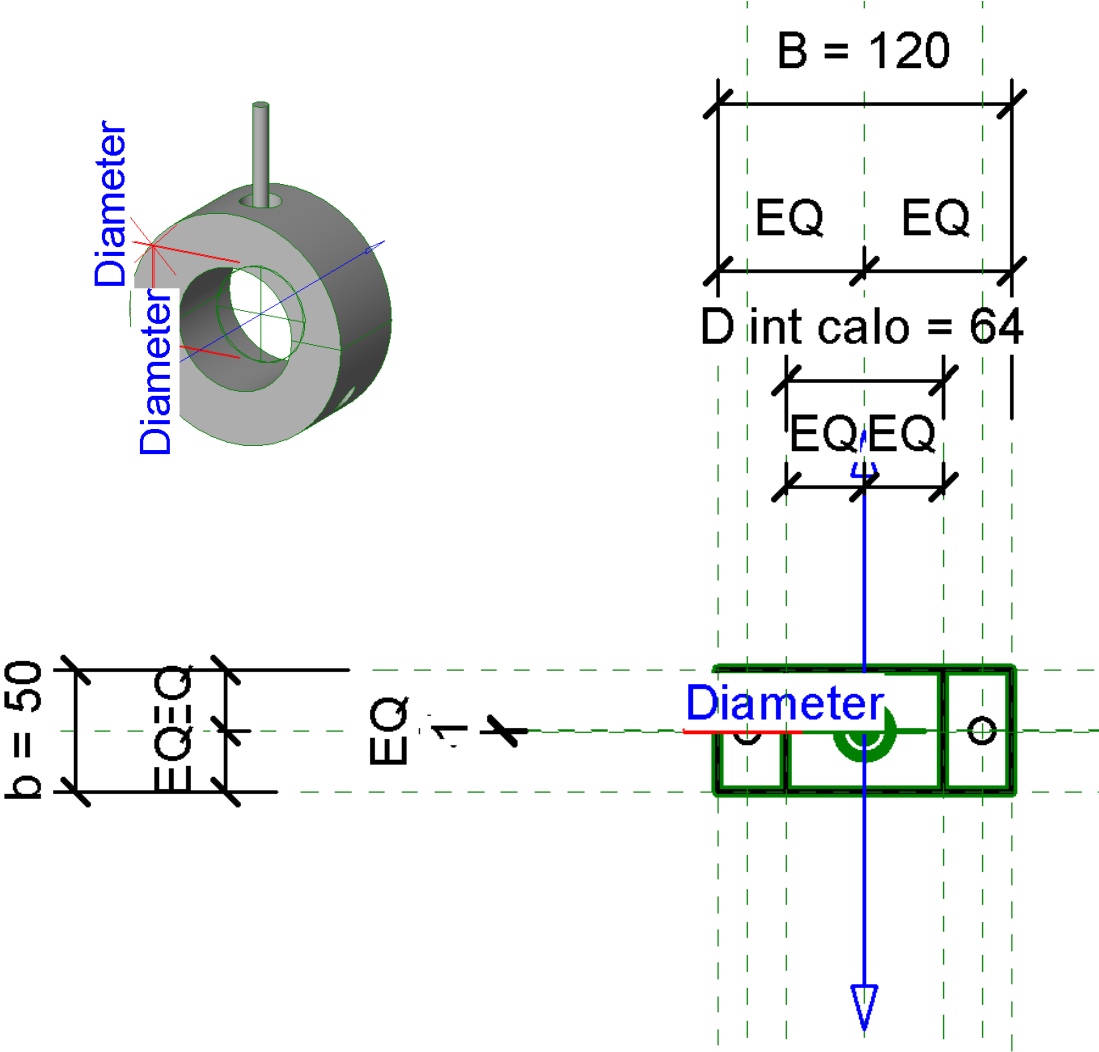
- ▶ **Families** : The equipment are modeled in some separate files with a different extension name .rfa
- ▶ This families can be parametric and contains some metadatas. For exemple by default there is the parameters “Manufacturer”, “Model” and “Cost” in each family template
- ▶ You have to choose a category when you create a family : Pipe accessories, Mechanical equipment, Lighting device...



1/ Modeling concepts

Analogy with human body

- ▶ Reference planes : skeleton
- ▶ Dimensions : muscles
- ▶ 3D shapes : skin



1/ Modeling concepts

► Parameters interface

► Family type

Family Types

Type name: _____

Search parameters

Parameter	Value	Formula	Lock
Constraints			
Default Elevation	0.0	=	<input type="checkbox"/>
Graphics			
Use Annotation Scale (default)	<input type="checkbox"/>	=	
Text			
TAB1	SUP_Collier eau glacée	=	
Dimensions			
DN (default)	50.0 mm	=	<input type="checkbox"/>
D ext tube (default)	60.3	= size_lookup(TAB1, "D ext tube", 0 mm, DN)	<input type="checkbox"/>
B (default)	120.0	= size_lookup(TAB1, "B", 0 mm, DN)	<input type="checkbox"/>
Diamètre Tige filetée (default)	8.0	= if(M8, 8 mm, if(M10, 10 mm, 21.3 mm))	<input type="checkbox"/>
L Tige filetée (default)	50.0	=	<input type="checkbox"/>
b (default)	50.0	= size_lookup(TAB1, "b", 0 mm, DN)	<input type="checkbox"/>
h embase (default)	60.0	= B / 2	<input type="checkbox"/>
D int calo (default)	64.3	= D ext tube + 4 mm	<input type="checkbox"/>
Mechanical			
Loss Method		=	
K Coefficient Table		=	
K Coefficient		=	
Mechanical - Loads			
Charge maximale (N) (default)	720	= size_lookup(TAB1, "Charge maximale", "erreur", DN)	
Espacement supports (default)	2700.0	= size_lookup(TAB1, "Espacement supports", 0 mm, DN)	<input type="checkbox"/>
IFC Parameters			
Type IFC Predefined Type		=	
Export Type to IFC As		=	
Other			
M8 (default)	<input checked="" type="checkbox"/>	=	
M10 (default)	<input type="checkbox"/>	=	
1_2p (default)	<input type="checkbox"/>	= not(or(M8, M10))	
Identity Data			
Type Image		=	
Keynote		=	
Model	MRP-KF	=	
Manufacturer	Hilti	=	
Type Comments	not(or(M8, M10))	=	
URL		=	
Description	Cooling pipe clamp	=	
Assembly Code		=	
Cost		=	

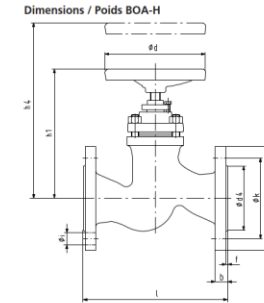
Manage Lookup Tables

OK Cancel Apply

[How do I manage family types?](#)

1/ Modeling concepts

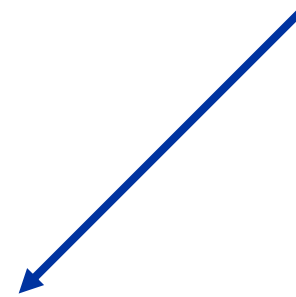
► Look up table with .csv format



Ill. 4: Plan en coupe BOA-H

Cotes / poids

PN	DN	l	ø D	ø k	Nombre de trous	Trou ø l	ø d, x f	b	h ¹⁾	h ²⁾	Course	ø d	(kg)
		[mm]	[mm]	[mm]	z	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
25/40	10	130	90	60	4	14	40 x 2	16	140	210	4,0	125	3,8
	15	130	95	65	4	14	45 x 2	16	140	210	4,0	125	3,3
	20	150	105	75	4	14	58 x 2	18	165	260	6,5	125	4,8
	25	160	115	85	4	14	68 x 2	18	165	260	6,5	125	5,4
	32	180	140	100	4	18	78 x 2	18	190	290	8,0	160	9,1
	40	200	150	110	4	18	88 x 3	18	200	300	10,0	160	10,2
	50	230	165	125	4	18	102 x 3	20	220	330	12,5	160	13,2
	65	290	185	145	8	18	122 x 3	22	270	420	16,5	200	19,8
	80	310	200	160	8	18	138 x 3	24	305	480	20,0	200	27
	100	350	235	190	8	22	162 x 3	24	345	550	25,0	250	41,7
	125	400	270	220	8	26	188 x 3	26	395	580	31,5	315	66
	150	480	300	250	8	26	218 x 3	28	430	620	37,5	315	88
25	200	600	360	310	12	26	278 x 3	30	500	760	47,5	400	144,6
40	200	600	375	320	12	30	285 x 3	34	500	760	47,5	400	175



AutoSave Off SUP_Collier eau glacée.csv Search Yoann Obry

File Home Insert Page Layout Formulas Data Review View Automate Help Power Pivot PDF-XChange

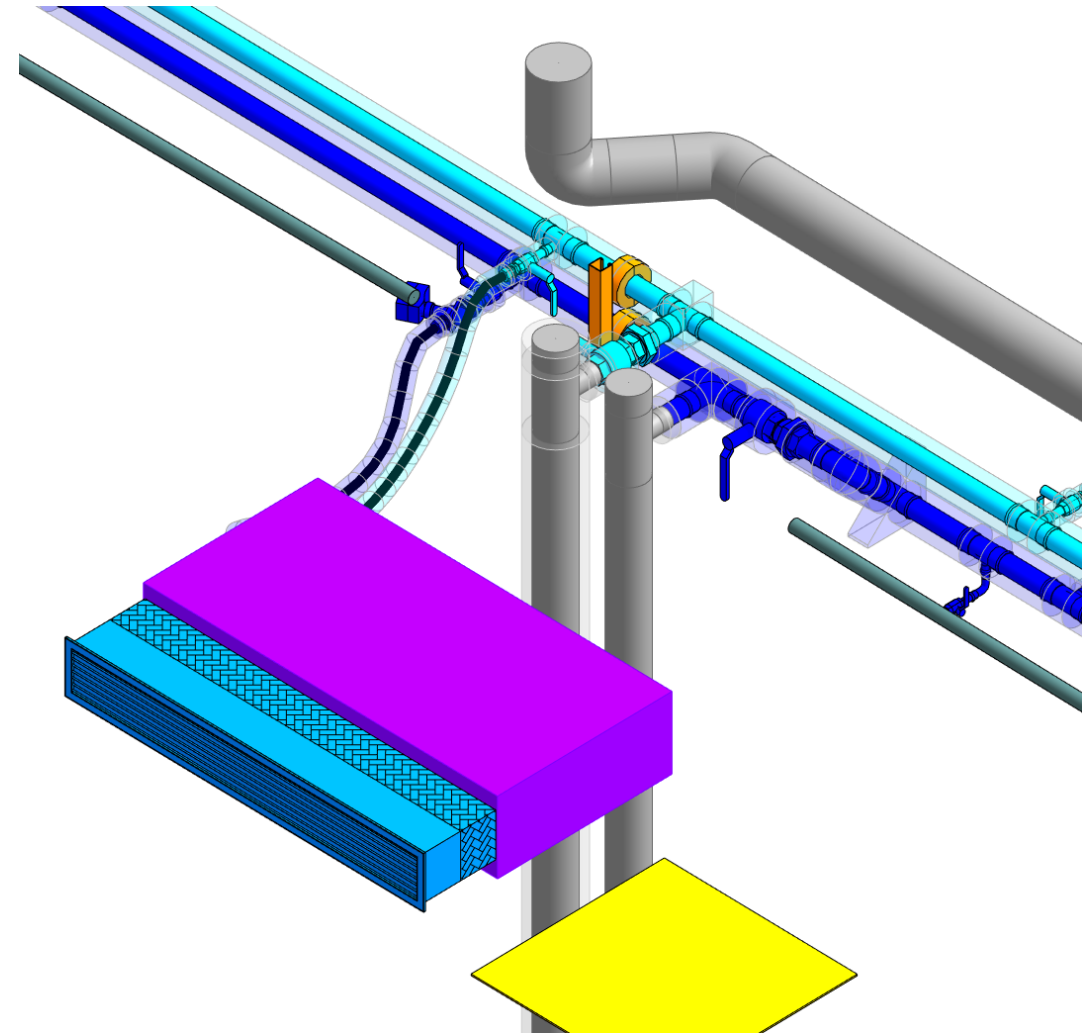
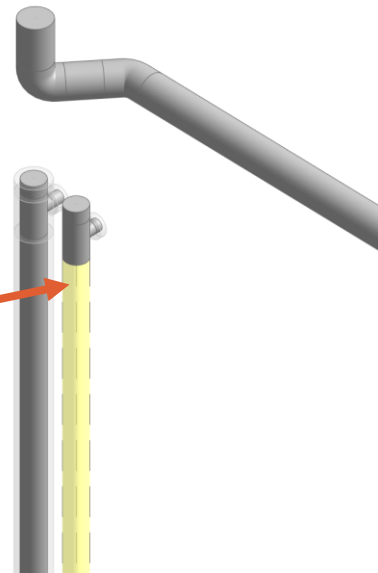
F19

	A	B	C	D	E	F	G	H
		DN##pipe_size##millimeters	D ext tube##length##millimeters	B##length##millimeters	b##length##millimeters	Model##other##	Charge maximale##other##	Espacement supports##length##millimeters
1								
2	DN15	15	21.3	87	40 MRP-KF 21		260	1800
3	DN20	20	26.9	87	40 MRP-KF 27		320	1800
4	DN25	25	33.7	98	40 MRP-KF 33		400	2400
5	DN32	32	42.4	103	40 MRP-KF 42		510	2400
6	DN40	40	48.3	108	40 MRP-KF 48		580	2700
7	DN50	50	60.3	120	50 MRP-KF 60		720	2700
8	DN65	65	76.1	136	50 MRP-KF 76		1370	3000
9	DN80	80	88.9	149	50 MRP-KF 89		1600	3000
10	DN100	100	114.3	200	60 MRP-KF 114		2740	3000
11	DN125	125	139.7	219	60 MRP-KF 139		3350	3600
12	DN150	150	168.3	248	60 MRP-KF 168		4040	4000
13	DN200	200	219.1	340	100 MRP-KF 219		5260	4000
14								

1/ Modeling concepts

- ▶ Phases
- ▶ Existing in grey
- ▶ New in colors
- ▶ Number of phases illimited

Phasing	
Phase planning	
Phase Created	New
Phase Demolished	None
Energy Analysis	Existing
FMF_Débit eau	New
Puissance Thermique F...	None



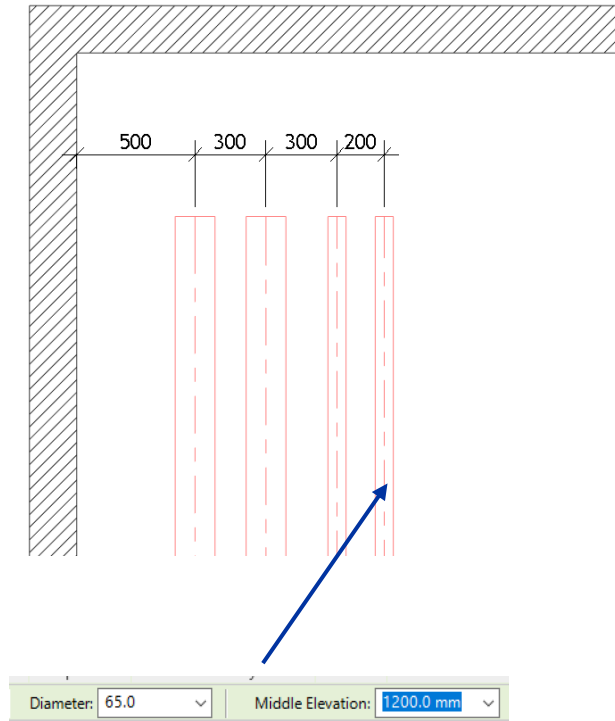
1/ Modeling concepts

► Modeling

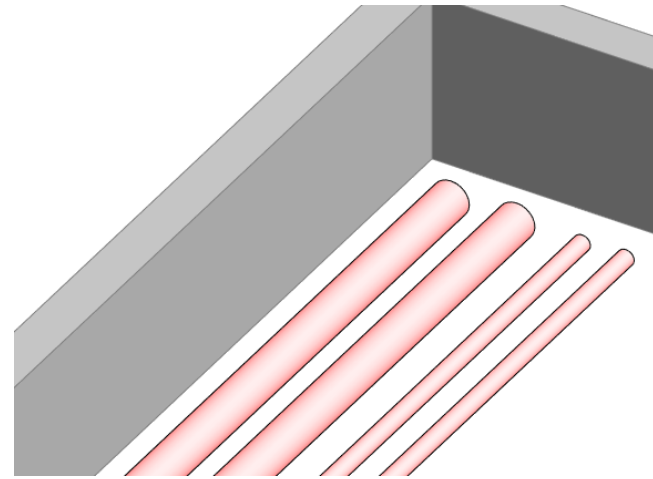
► 2D view rather than 3D view ?

► Click element to move it by modify the dimension

Floor drawing



3D view



Properties

Properties panel showing pipe parameters:

Constraints	
Horizontal Justification	Center
Vertical Justification	Middle
Reference Level	R-Floor R
Upper End Top Elevat...	1238.1
Middle Elevation	1200.0
Lower End Bottom El...	1162.0
Lower End Invert Elev...	1164.9
Slope	0.0000%

Dimensions	
Outside Diameter	76.1
Inside Diameter	70.3
Size	DN65
Length	1880.0

Mechanical	
System Classification	Hydronic Return
System Type	Secondary Heating W...
System Name	C-SHWR 4
System Abbreviation	C-SHWR
Pipe Segment	Acier - NF EN 10216-1
Diameter	65.0
Connection Type	Generic
Roughness	0.04572 mm
Material	Acier
Schedule/Type	NF EN 10216-1
Segment Description	
Section	1
Area	0.384 m²
PN	

Mechanical - Flow	
Additional Flow	0.0000 m³/h
Flow	Not Computed
Reynolds Number	Not Computed
Relative Roughness	0.000650
Flow State	
Friction Factor	Not Computed
Velocity	Not Computed
Friction	Not Computed
Pressure Drop	Not Computed

Project Browser

Project Browser - Project1

- Views (FMF)
 - BIM_Vue de démarrage
 - LIVRABLES - COUPES
 - LIVRABLES - RESEAUX
 - Floor Plans
 - Floor R**
 - Drafting Views
 - TRAVAIL - CONCEPTION
 - Floor Plans
 - 00-Mass
 - 1-Floor 1
 - R-Floor R
 - S-Floor S
 - 3D Views
 - Scope boxes
 - TZ
 - TZ Bat transparent
 - TZ Réseaux seuls
 - TZ Sans isolant
 - TZ Wireframe (3D)
 - Elevations
 - East
 - North
 - South
 - West
 - Sections
 - 00_Section A
- Legends
- Schedules/Quantities (FMF)
- Sheets (FMF)
- Families
- Groups
- Revit Links

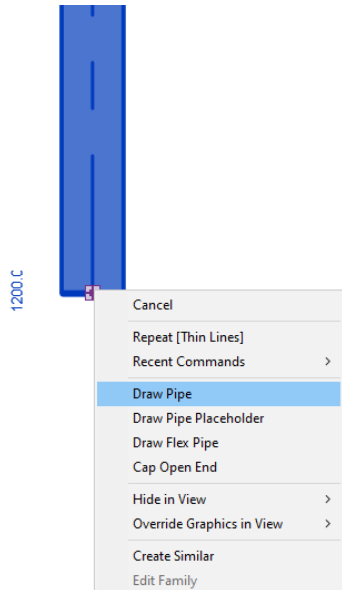
1/ Modeling concepts

► Fast modeling

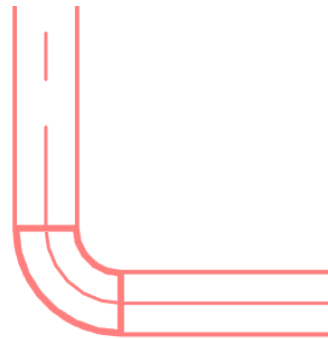
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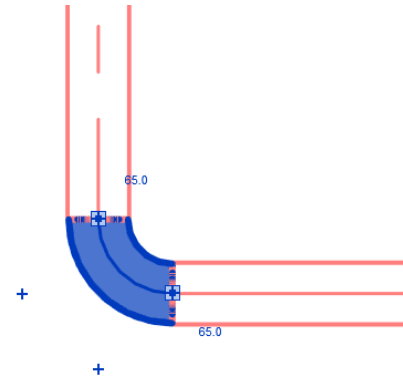
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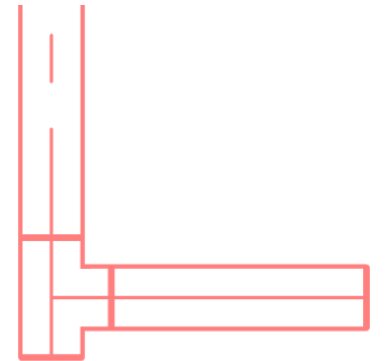
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4

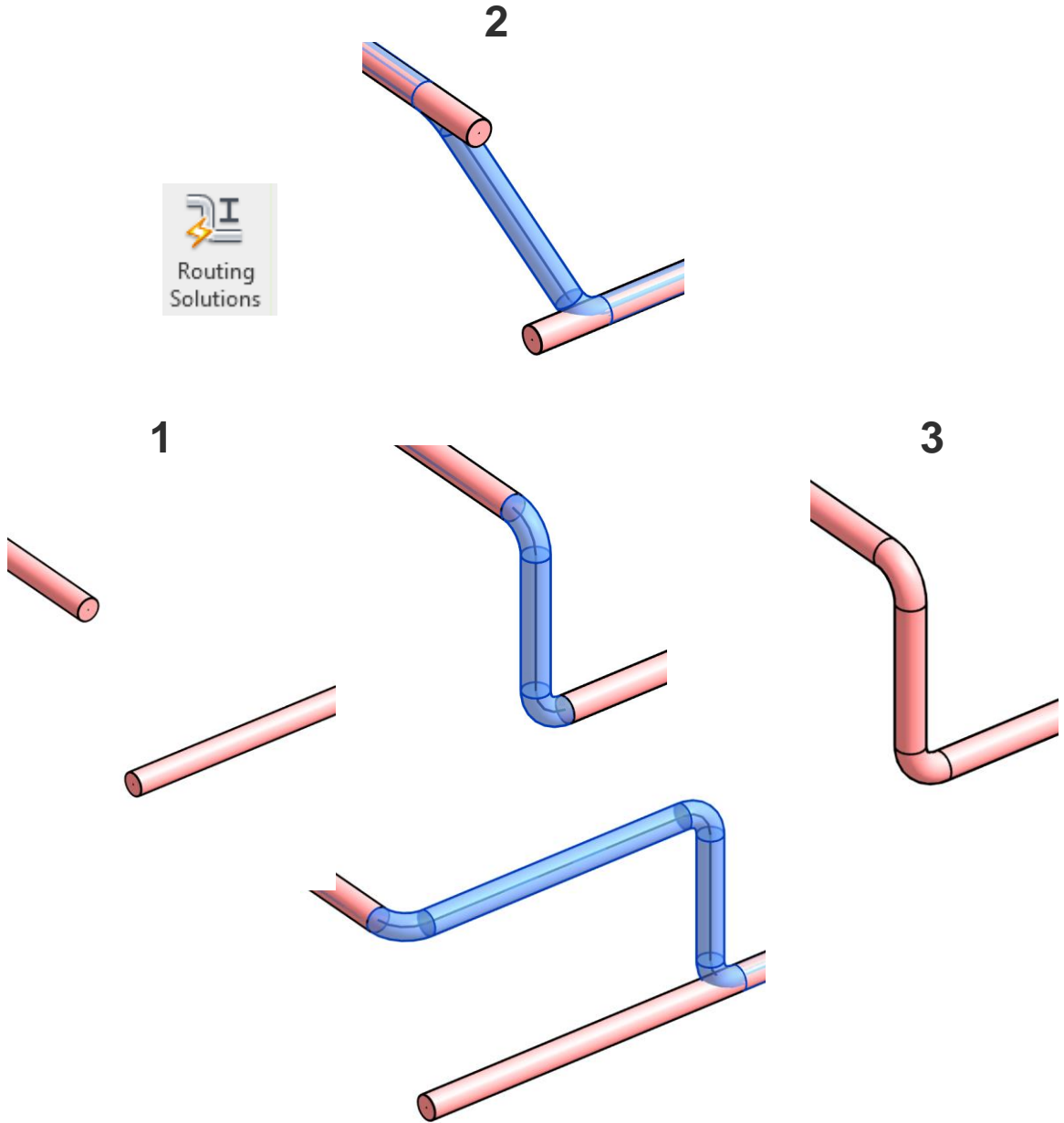
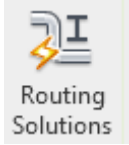
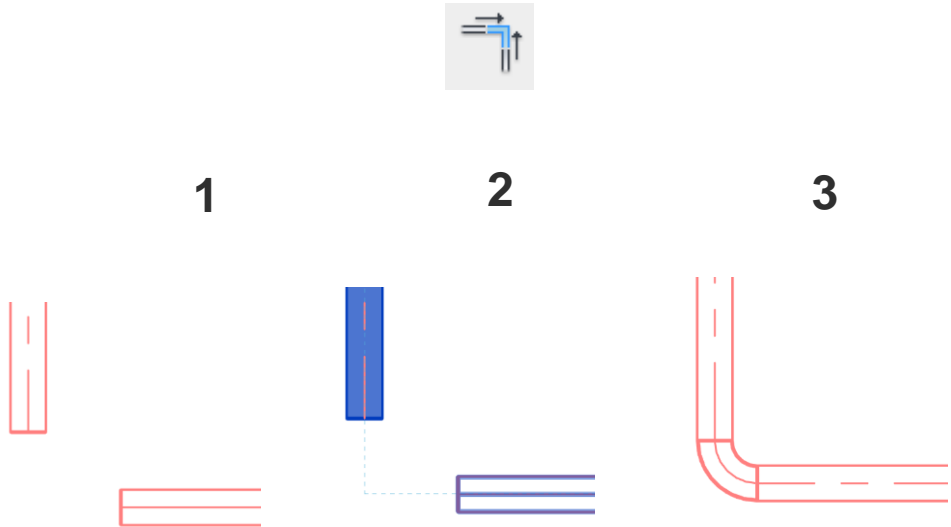


5



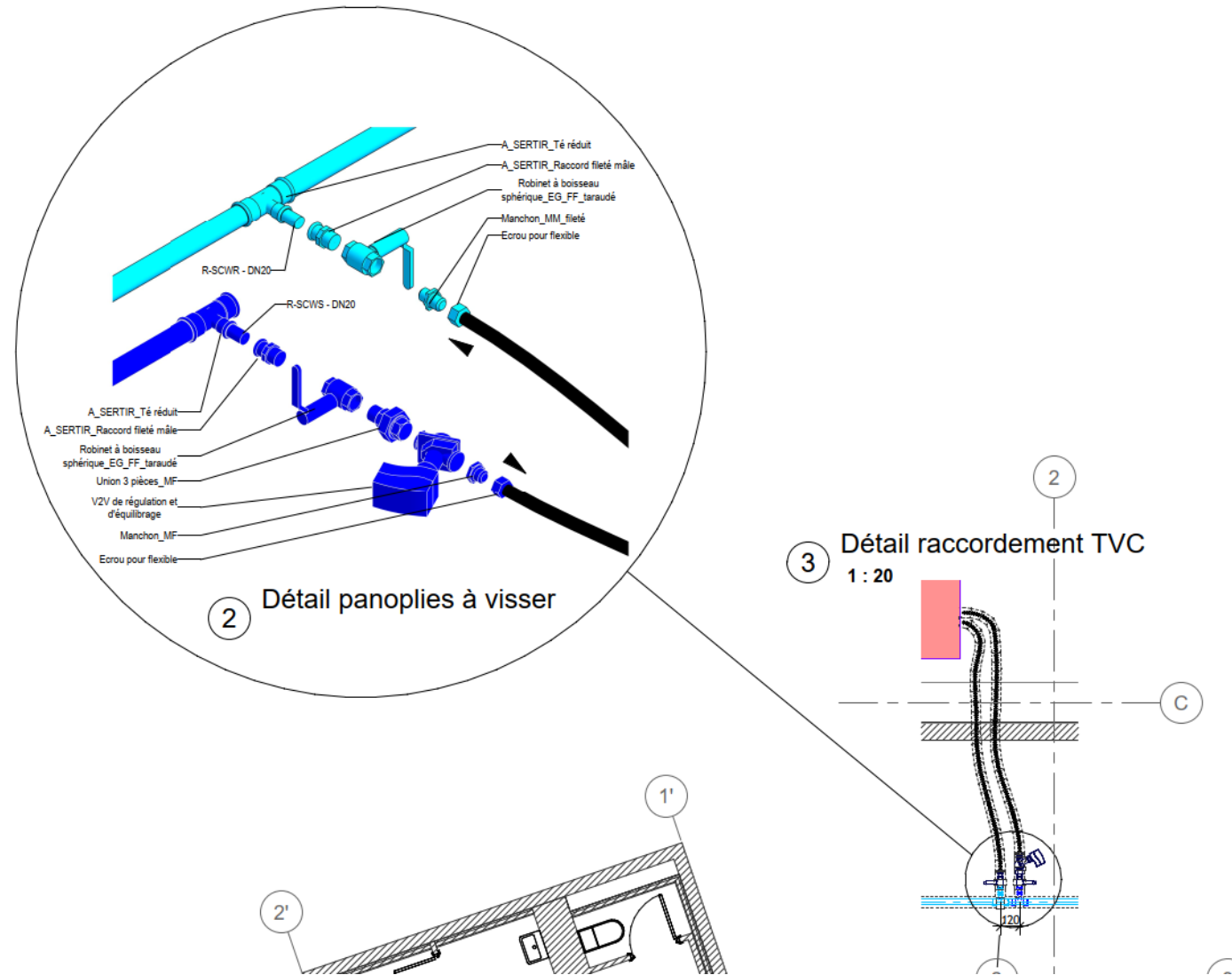
1/ Modeling concepts

► Fast modeling



1/ Modeling concepts

- ▶ Displace elements tool
- ▶ Ability of displace the elements in a view without move them in the real model
- ▶ Useful for showing assemblies

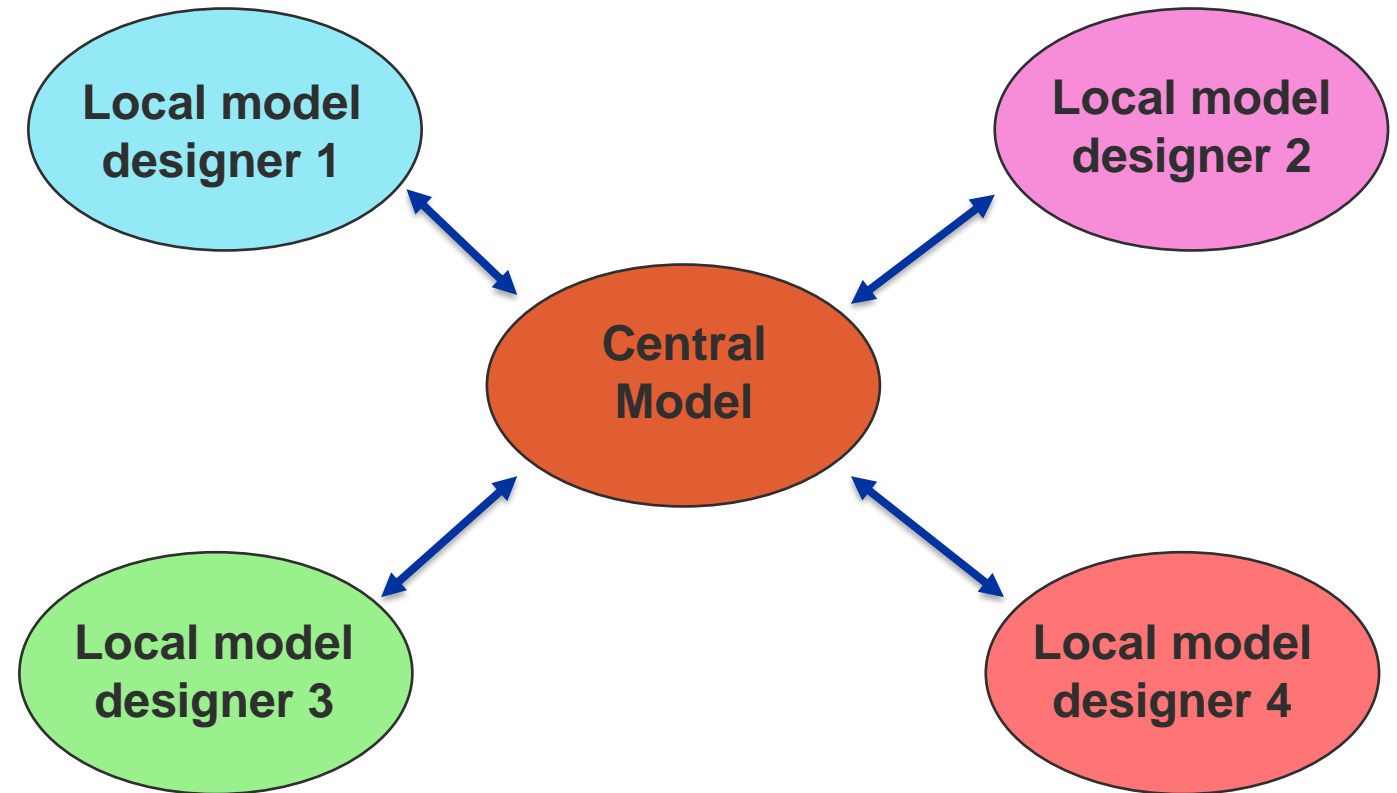


1/ Modeling concepts

- ▶ Collaborate

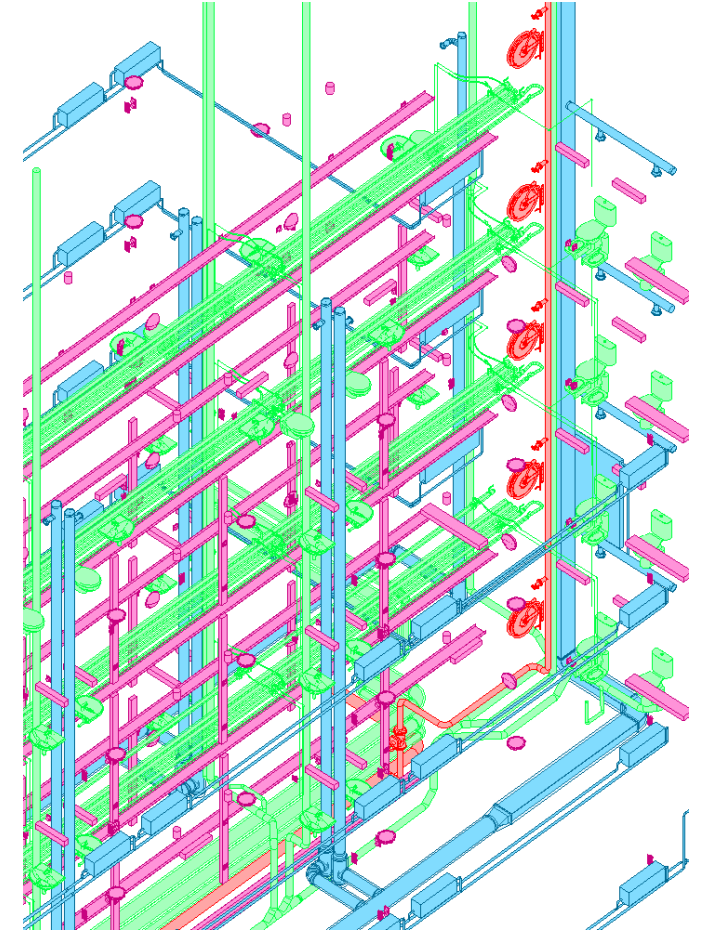
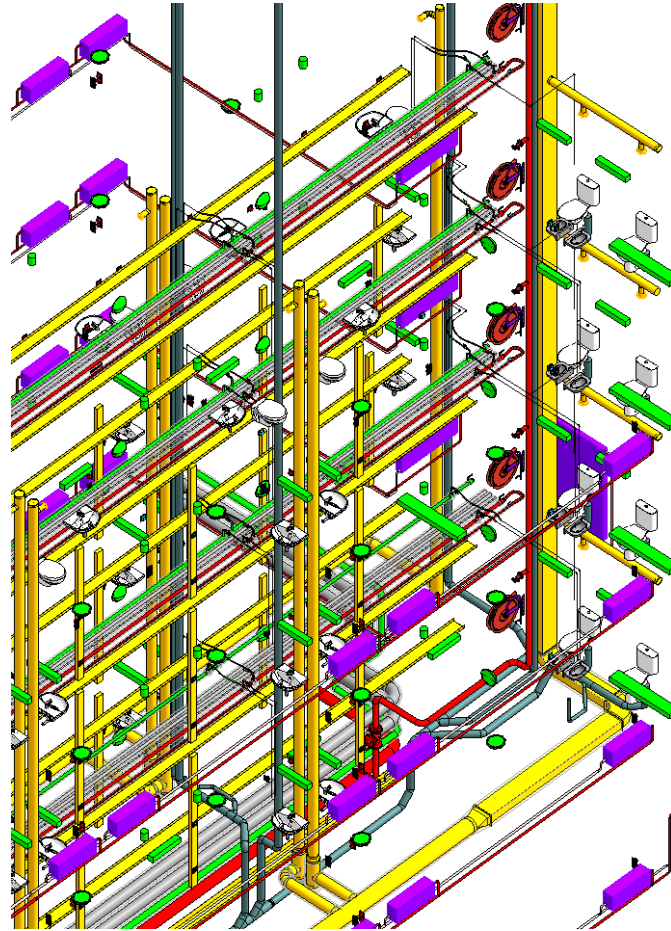
- ▶ Several designers / engineers can work on the same project simultaneously

- ▶ Synchronization button for updating the files



1/ Modeling concepts

► Worksets



1/ Modeling concepts

► File history

History ✕

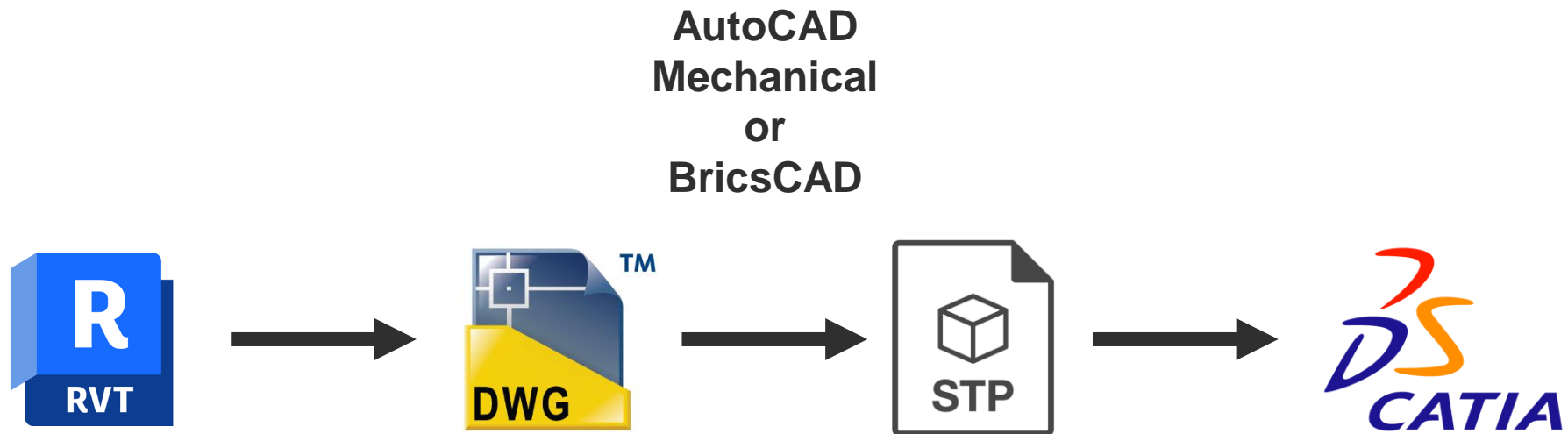
Click on a column heading to sort by that column.

Date/Time Stamp	Modified by	Comments
18/09/2023 08:34:19	cmizrahi	
18/09/2023 08:07:00	cmizrahi	
15/09/2023 11:35:58	yobry	HVAC mis à jour
15/09/2023 11:02:09	yobry	
15/09/2023 10:50:23	yobry	
15/09/2023 10:20:12	yobry	Mise à jour pour consultation BE
03/03/2023 11:37:02	yobry	
03/03/2023 11:33:35	yobry	
03/03/2023 11:31:38	cmizrahi	
03/03/2023 11:24:03	yobry	
03/03/2023 11:22:05	yobry	
03/03/2023 10:51:17	yobry	
02/03/2023 15:43:03	yobry	
02/03/2023 13:44:59	yobry	
01/03/2023 16:58:07	yobry	
01/03/2023 14:37:55	yobry	
01/03/2023 13:52:57	yobry	
01/03/2023 12:41:21	yobry	
01/03/2023 12:29:54	yobry	
01/03/2023 12:15:31	yobry	Supression curtain wall LT
28/02/2023 17:44:56	yobry	
28/02/2023 15:32:50	tduverge	

Close
Export...
Help

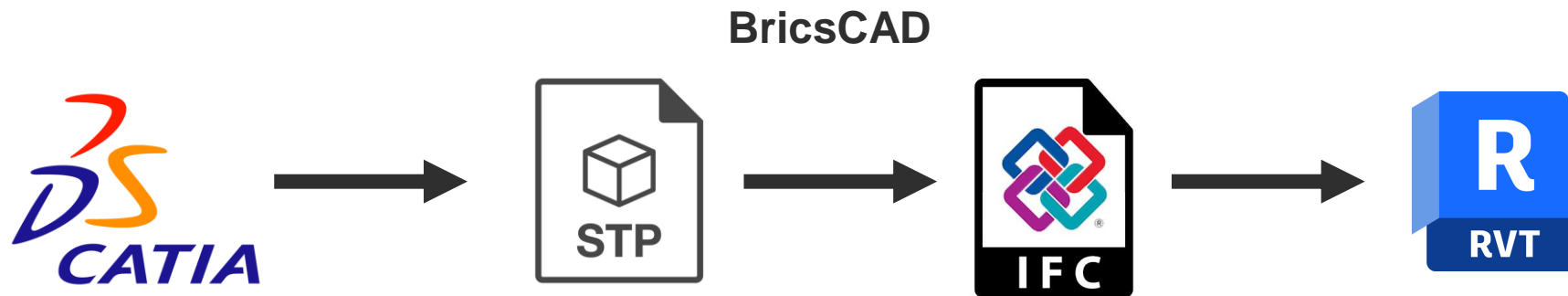
1/ Modeling concepts

- ▶ Conversion from Revit to Catia
- ▶ Loss of the metadatas



1/ Modeling concepts

- ▶ Conversion from Catia to Revit
- ▶ IFC import allow better visualization than DWG import
- ▶ This process create some unclassified object in Revit
- ▶ You can resolve this by using the open-source software Blender BIM which allows you to classify the elements (one step again)



2/ Engineering concepts

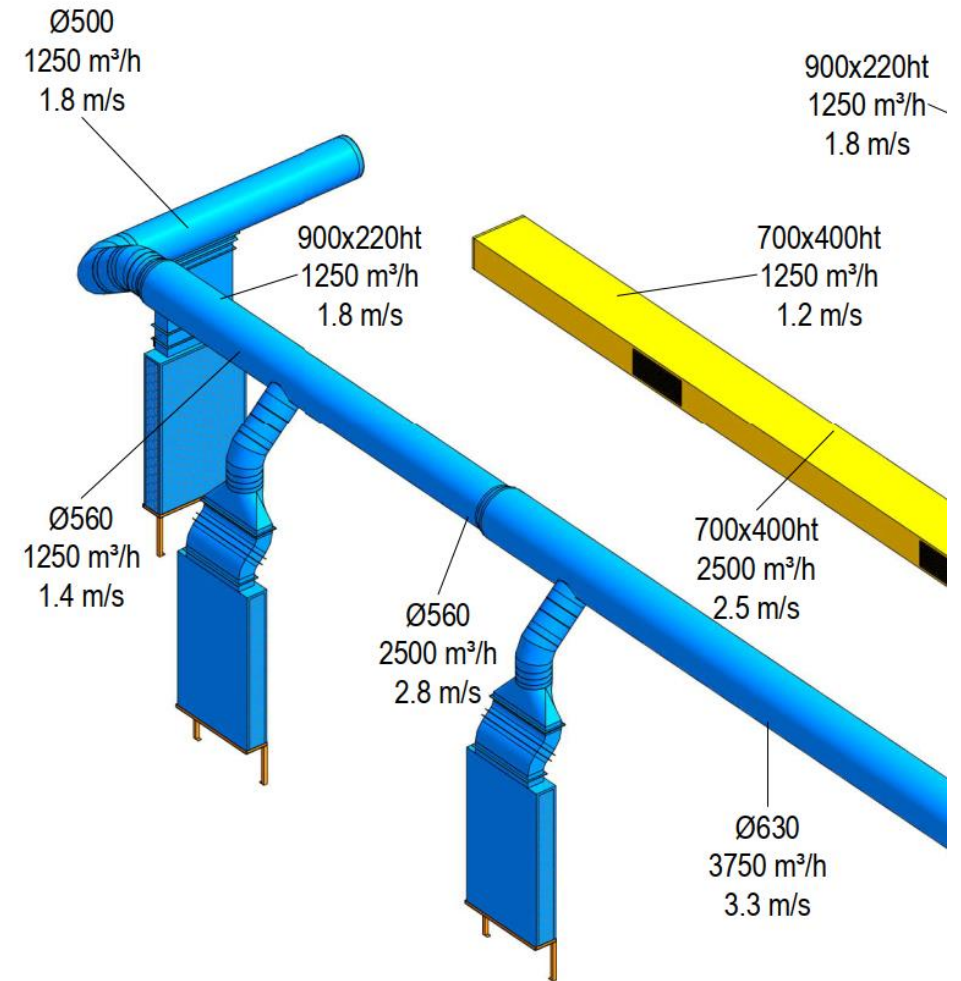
► Schedules

► Real time database linked to 3D equipment

Bouches de soufflage par espaces				
Space data		Airflow data		
Number	Name	Specified Supply Airflow	Actual Supply Airflow	Marge d'erreur
Size	System Abbreviation	Count	FMF_Débit air	
184/1-003	Common Room	749 m³/h	760 m³/h	1%
Ø160	V-SUP	1	190 m³/h	
Ø160	V-SUP	1	190 m³/h	
Ø160	V-SUP	1	190 m³/h	
Ø160	V-SUP	1	190 m³/h	
184/1-005	Operational Supervisors	216 m³/h	216 m³/h	0%
Ø125	V-SUP	1	72 m³/h	
Ø125	V-SUP	1	72 m³/h	
Ø125	V-SUP	1	72 m³/h	
184/1-106	WC	0 m³/h	0 m³/h	
184/1-107	WC	0 m³/h	0 m³/h	
184/1-208	Couloir	40 m³/h	40 m³/h	0%
Ø125	V-SUP	1	40 m³/h	
184/1-209	Couloir	32 m³/h	32 m³/h	0%
Ø125	V-SUP	1	16 m³/h	
Ø125	V-SUP	1	16 m³/h	

2/ Engineering concepts

- ▶ If the ducts are well connected they will distribute and calculate the flow in the network
- ▶ Same for pressure loss



2/ Engineering concepts

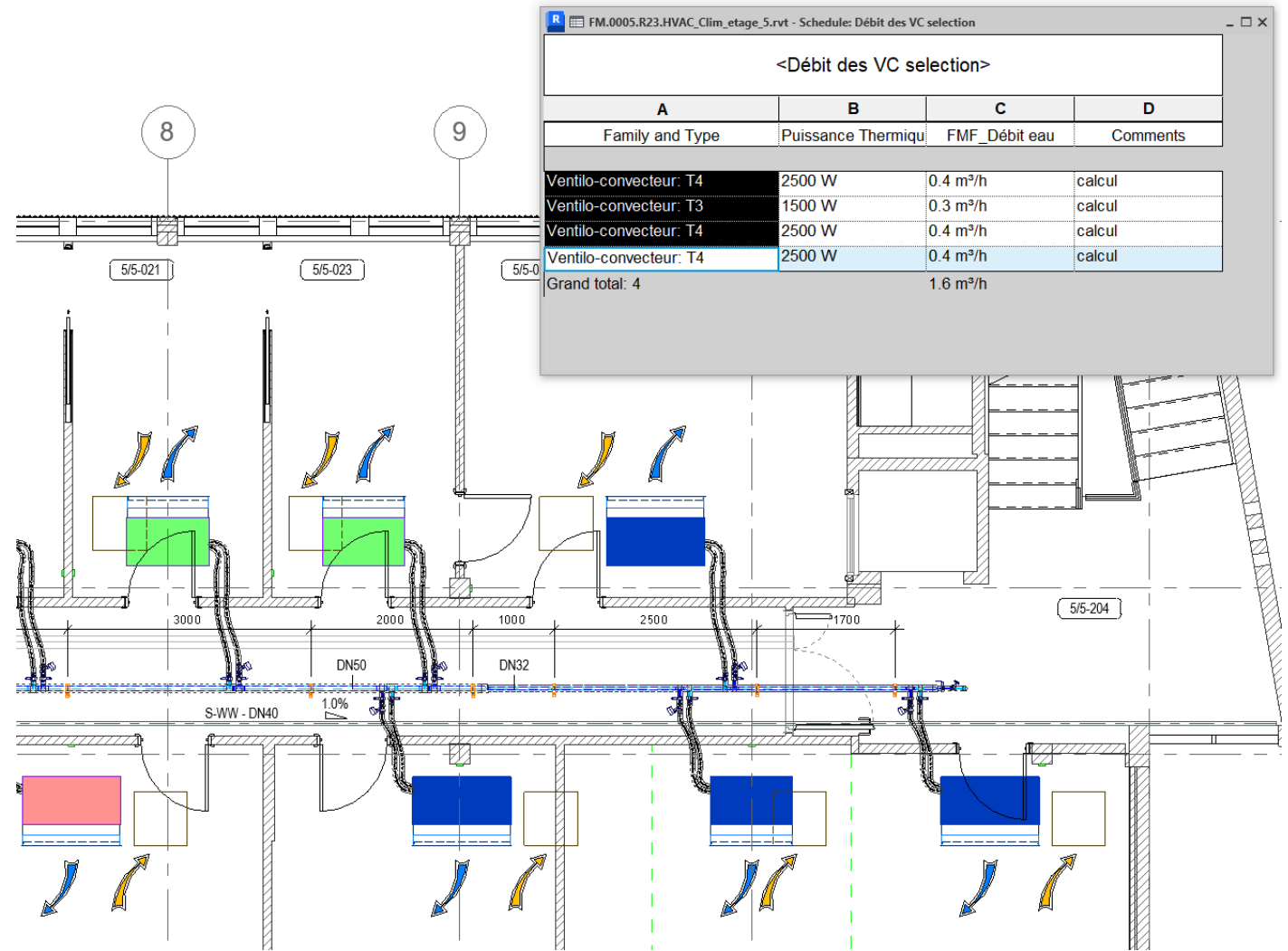
► Energy analysis

► We deployed the SIA 2024 Swiss standard into Revit



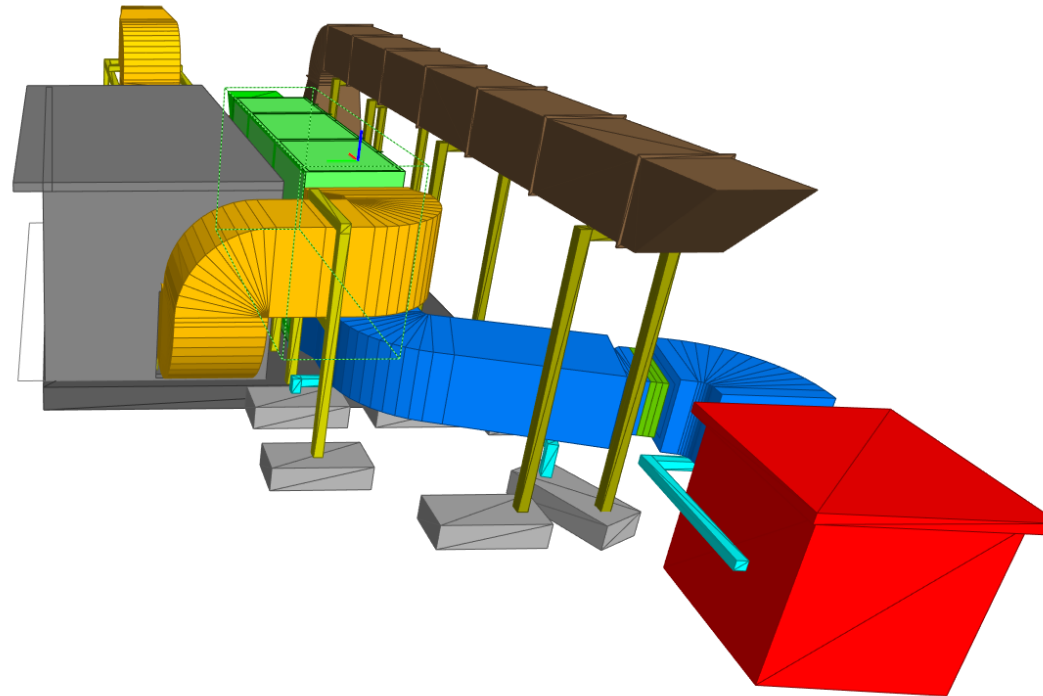
2/ Engineering concepts

- ▶ Network dimensioning
- ▶ Select equipment and add the flow or power



2/ Engineering concepts

- ▶ Export IFC
- ▶ Standard AEC exchange format
- ▶ Many software can import IFC files (Energy calculation, Structure calculation...)



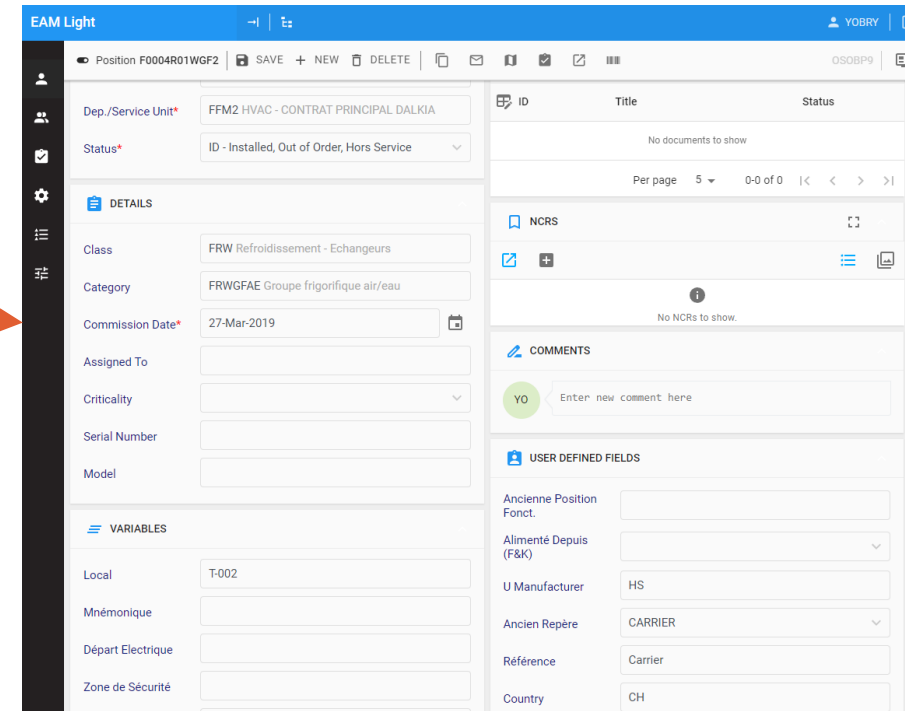
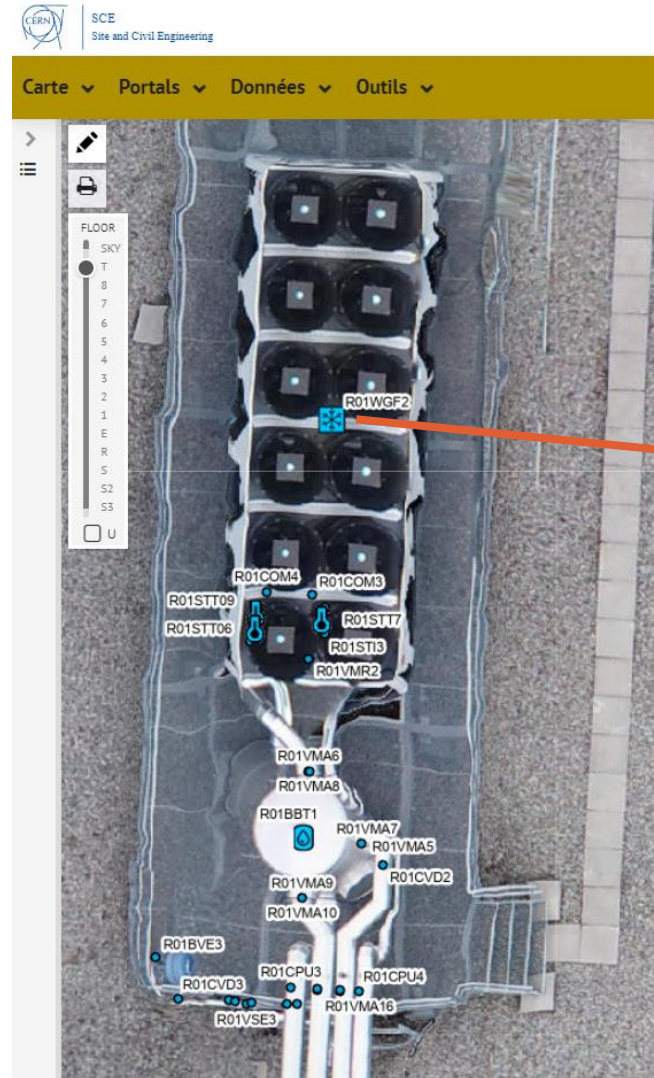
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<input checked="" type="checkbox"/>	IfcDuctSegment	Duct	
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<input checked="" type="checkbox"/>	IfcDuctSegment	Duct	
<input checked="" type="checkbox"/>	IfcDuctSegment	Duct	
<input checked="" type="checkbox"/>	IfcDuctFitting	Duct Fitting	
<input checked="" type="checkbox"/>	IfcDuctFitting	Duct Fitting	
<input checked="" type="checkbox"/>	IfcDuctFitting	Duct Fitting	
<input checked="" type="checkbox"/>	IfcDuctFitting	Duct Fitting	
<input checked="" type="checkbox"/>	IfcDuctSegment	Duct	
<input checked="" type="checkbox"/>	IfcAirTerminal	Multi-View Part	
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<input checked="" type="checkbox"/>	IfcFilter	Multi-View Part	
<input checked="" type="checkbox"/>	IfcDamper	Multi-View Part	
<input checked="" type="checkbox"/>	IfcDamper	Multi-View Part	
<input checked="" type="checkbox"/>	IfcDuctSegment	Multi-View Part	
<input checked="" type="checkbox"/>	IfcDuctSegment	Duct	
<input checked="" type="checkbox"/>	IfcFilter	Balise_GMAO_Duct_A...	
<input checked="" type="checkbox"/>	IfcFilter	Balise_GMAO_Duct_A...	
<input checked="" type="checkbox"/>	IfcFilter	Balise_GMAO_Duct_A...	
<input checked="" type="checkbox"/>	IfcFilter	Balise_GMAO_Duct_A...	
<input checked="" type="checkbox"/>	IfcFilter	Balise_GMAO_Duct_A...	
<input checked="" type="checkbox"/>	IfcFilter	Balise_GMAO_Duct_A...	
<input checked="" type="checkbox"/>	Footings		
<input checked="" type="checkbox"/>	Columns		
<input checked="" type="checkbox"/>	Walls		
<input checked="" type="checkbox"/>	Others		
<input checked="" type="checkbox"/>	IfcUnitaryEquipment	Multi-View Part	
<input checked="" type="checkbox"/>	IfcUnitaryEquipment	Subentity	

Properties	Location	Classification	Relations	Name	Value	Unit
Element Specific						
Guid		2M1WUastz36AD30yM87Yd				
IfcEntity		IfcUnitaryEquipment				
Name		Subentity				
PredefinedType		AIRCONDITIONINGUNIT				
Tag		3824495				
Identity Data						
Code circuit		V21				
Code GMAO		F0375V21TTA1				
Code GMAO_bat		F0375				
Code GMAO_court		V21TTA1				
Mark		77				
Other						
Category		Mechanical Equipment				
Phasing						
Phase Created		Existing				
Pset_EnvironmentalImpactIndicators						
Reference		Subentity				
Pset_UnitaryEquipmentTypeCommon						
Reference		Subentity				

2/ Engineering concepts

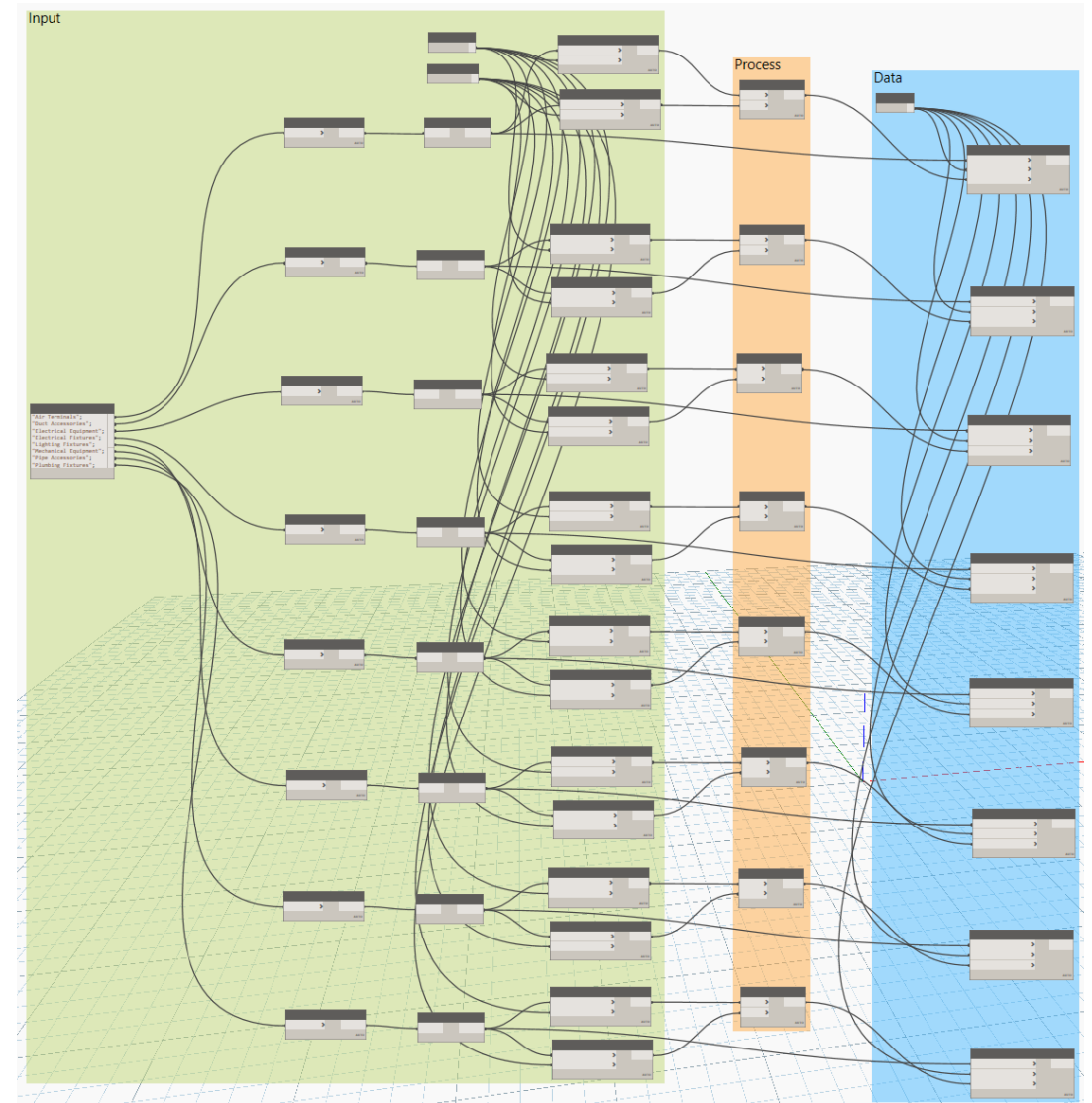
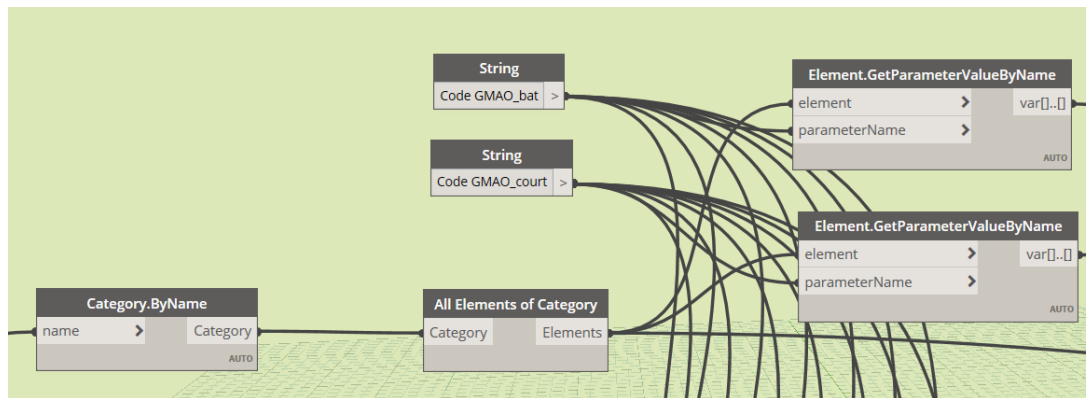
► IFC from Revit to Gis Portal Infrastructure

► Maintenance codification linked to EAM



3/ Advanced concepts

- ▶ **Dynamo : Visual programming**
- ▶ **Accessible for non-programmer**



3/ Advanced concepts



► PyRevit

► Access API Revit (C#) using Python

► Tab custom tool for SAM-IN CAD Team

► Faster process and shortcut

► BOM to Excel tool instead of having several schedules by category

```

### PF : Création d'un BOM de PIPE FITTINGS sous forme de liste de tuple

#Collecte les Pipe Fittings
PFs = FilteredElementCollector(doc).OfCategory(BuiltInCategory.OST_PipeFitting).WhereElementIsNotElementType().ToElements()

#Créer des listes vides
PF_code_circuit = []
PF_family_name = []
PF_type_name = []
PF_size = []
PF_angle = []
  
```

```

for PF in PFs:

    ## Get Type Parameter value
    PF_type = doc.GetElement(PF.GetTypeId())

    # Element ID - Instance Parameter
    #print PF.Id

    # Code circuit - Instance Parameter (Shared)
    code_circuit = PF.get_Parameter(code_cir)
    PF_code_circuit.append(code_circuit.AsString())

    # Family Name - Type Parameter
    family_name = PF_type.get_Parameter(
        BuiltInParameter.SYMBOL_FAMILY_NAME)
    PF_family_name.append(family_name.AsString())

    # Type Name - Type Parameter
    type_name = PF_type.get_Parameter(
        BuiltInParameter.SYMBOL_NAME)
    PF_type_name.append(type_name.AsString())

    # Size - Instance Parameter
    size = PF.get_Parameter(
        BuiltInParameter.RBS_CALCULATED_SIZE)
    PF_size.append(size.AsString())

    # Angle - Instance Parameter (Shared Parameter)
    angle_coude = PF.get_Parameter(angle)
    if angle_coude:
        PF_angle.append(angle_coude.AsDouble())
    else:
        PF_angle.append(0)
  
```

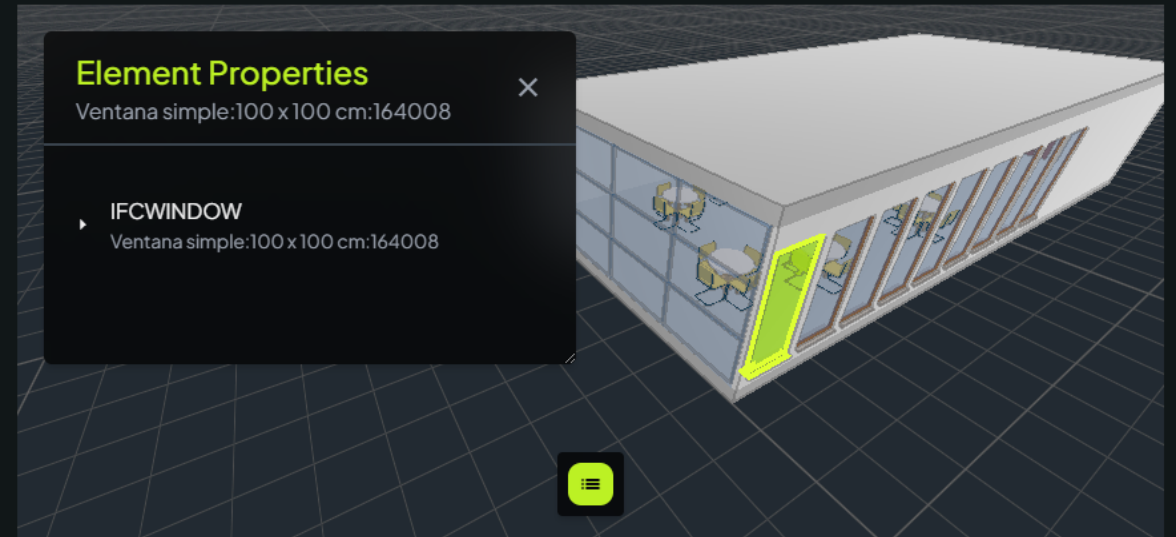
Code	Description	Unité	Quantité	Volume (m³)	Poids (kg)
1	Circuit - R02				
1.1	Robinetterie et instrumentation				
	Manchon_MF DN20-DN20	u	20	0	0
	Manchon_MM_fileté DN20-DN20	u	20	0	0
	Robinet à boisseau sphérique_EG_FF_taraudé Manual isolating valve DN15-DN15	u	5	105.93	529.65
	Robinet à boisseau sphérique_EG_FF_taraudé Manual isolating valve DN20-DN20	u	40	147.03	5881.2
	Robinet à boisseau sphérique_EG_FF_taraudé Manual isolating valve DN50-DN50	u	2	302.58	605.16
	Union 3 pièces_MF 3 pieces union MF DN20-DN20	u	20	0	0
	Union 3 pièces_MF 3 pieces union MF DN50-DN50	u	2	0	0
	VZV de régulation et d'équilibrage 2 way regulation valve DN20-DN20	u	20	363.5	7270
	Vanne de réglage fileté_DN15_50 Manual regulating valve DN15-DN15	u	2	111.7	223.4
	Vanne de vidange Drainage DN15-DN15	u	1	136.1	136.1
				0	0
1.2	Canalisations				
	FMF_Acier inoxydable à sertir DN15	m	1.4	80.03	112.042
	FMF_Acier inoxydable à sertir DN20	m	2.7	87.66	236.682
	FMF_Acier inoxydable à sertir DN32	m	26.4	132.01	3485.064
	FMF_Acier inoxydable à sertir DN50	m	40	173.35	6934
	Flexible inox DN20	m	60.2	0	0
				0	0
1.3	Raccords				
	A_SERTIR_Coude Acier Inox DN15-DN15 90°	u	4	59.71	238.84
	A_SERTIR_Coude Acier Inox DN50-DN50 90°	u	2	159.32	318.64
	A_SERTIR_Raccord fileté mâle Acier Inox DN20-DN20	u	40	0	0
	A_SERTIR_Réduction Acier Inox DN32-DN15	u	4	94.38	377.52
	A_SERTIR_Réduction Acier Inox DN50-DN32	u	4	143.37	573.48
	A_SERTIR_Tê réduit Acier Inox DN32-DN32-DN20	u	14	101.32	1418.48
	A_SERTIR_Tê réduit Acier Inox DN50-DN50-DN15	u	1	156.29	156.29
	A_SERTIR_Tê réduit Acier Inox DN50-DN50-DN20	u	26	156.29	4063.54
	A_SERTIR_Tê égal Acier Inox DN15-DN15-DN15	u	1	63.55	63.55
	A_SERTIR_Tê égal Acier Inox DN50-DN50-DN50	u	2	156.29	312.58
				0	0
1.4	Isolation				
	Coquille PIR λ<0.03 W/(m.K) DN15 ep. 20 mm	m	1.3	55.71	72.423
	Coquille PIR λ<0.03 W/(m.K) DN32 ep. 20 mm	m	26.4	58.27	1538.328
	Coquille PIR λ<0.03 W/(m.K) DN50 ep. 30 mm	m	40	63.79	2551.6
	Mousse élastomère (Armaflex) 0.03λ<0.05 W/(m.K) DN20 ep. 19 mm	m	63	32.54	2050.02
				0	0
1.5	Supportage				
	SUP_Collier eau glacée Cooling pipe clamp DN32-DN32	u	14	0	0
	SUP_Collier eau glacée Cooling pipe clamp DN50-DN50	u	18	0	0
	SUP_Console MQ-41 Lg=300mm	u	16	0	0
ST1					39'148.59

3/ Advanced concepts

- ▶ “That Open Company” website
- ▶ IFC custom web software
- ▶ Open source
- ▶ If you know web languages you can create your own application with an IFC viewer and some data you want to display (real time sensor, coloring element by type, experiment process...)

```
const mainToolbar = new OBC.Toolbar(components);  
components.ui.addToolbar(mainToolbar);  
mainToolbar.addChild(propsProcessor.uiElement.get("main"));
```

This is it! Congratulations, now you can see and navigate the properties of any IFC model you load in your apps. Now, let's continue navigating these docs for more cool open BIM tools!





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