

Modelica test cases

Speaker:

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Overview

1. General info
2. Model template
3. Test case 1: residential case
4. Test case 2: school building
5. Extra's

General info

- Dymola 2024 (Windows)
- Modelica Standard Library - version 4.0.0

- IDEAS - version 3.0.0 (envelope, weather)
- Buildings - version 11.0.0 (technical systems)

Model template

- based on IDEAS template for building model

File Graphics Documentation Text Simulation Tools

Recent Back Forward Icon Diagram 100% Fit Window

Undo Redo Cut Copy Paste Delete Duplicate Select All

Line Rectangle Ellipse Polygon Text Bitmap

Line Style Fill Style Arrange

Align Order Annotation

Split Model Check Attributes

Toggle Grid Connector Names

Find Find Connection Diagram Filter

Insert Variable Selections Create Local State

Variables

Package Browser

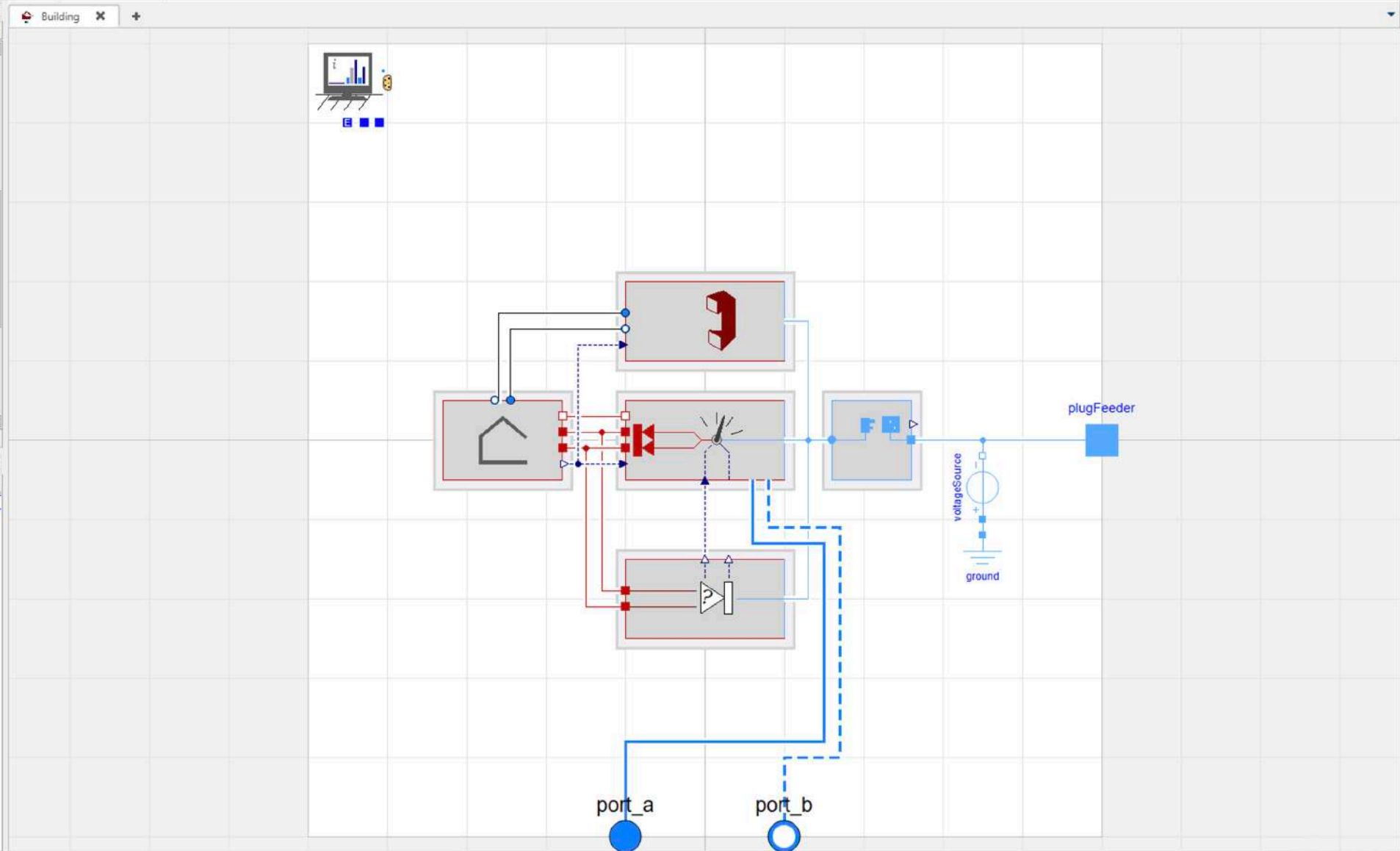
Model name...

- Interfaces
 - Building
 - Controls
 - Fluid
 - LIDEAS
 - Media
 - Templates
 - Heating
 - Structure
 - Ventilation
 - Examples
 - Interfaces
 - Building
 - Medium = IDEAS.Media.Water(...)
 - MediumAir = IDEAS.Media.Air(...)
 - BaseClasses

Component Browser

Component name...

- IDEAS.Templates.Interfaces.Building
 - Medium = IDEAS.Media.Water
 - MediumAir = IDEAS.Media.Air
 - sim
 - building
 - heatingSystem
 - occupant
 - inHomeGrid
 - ventilationSystem
 - plugFeeder
 - voltageSource
 - ground
 - port_a
 - port_b





Model_Borgerskolen_MultiPID - Dynsysbuildings_MVH.Model_Borgerskolen_MultiPID - [Diagram]

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Toggle Grid Find Find Connection Diagram Filter Insert Variable Selections Create Local State

Package Browser

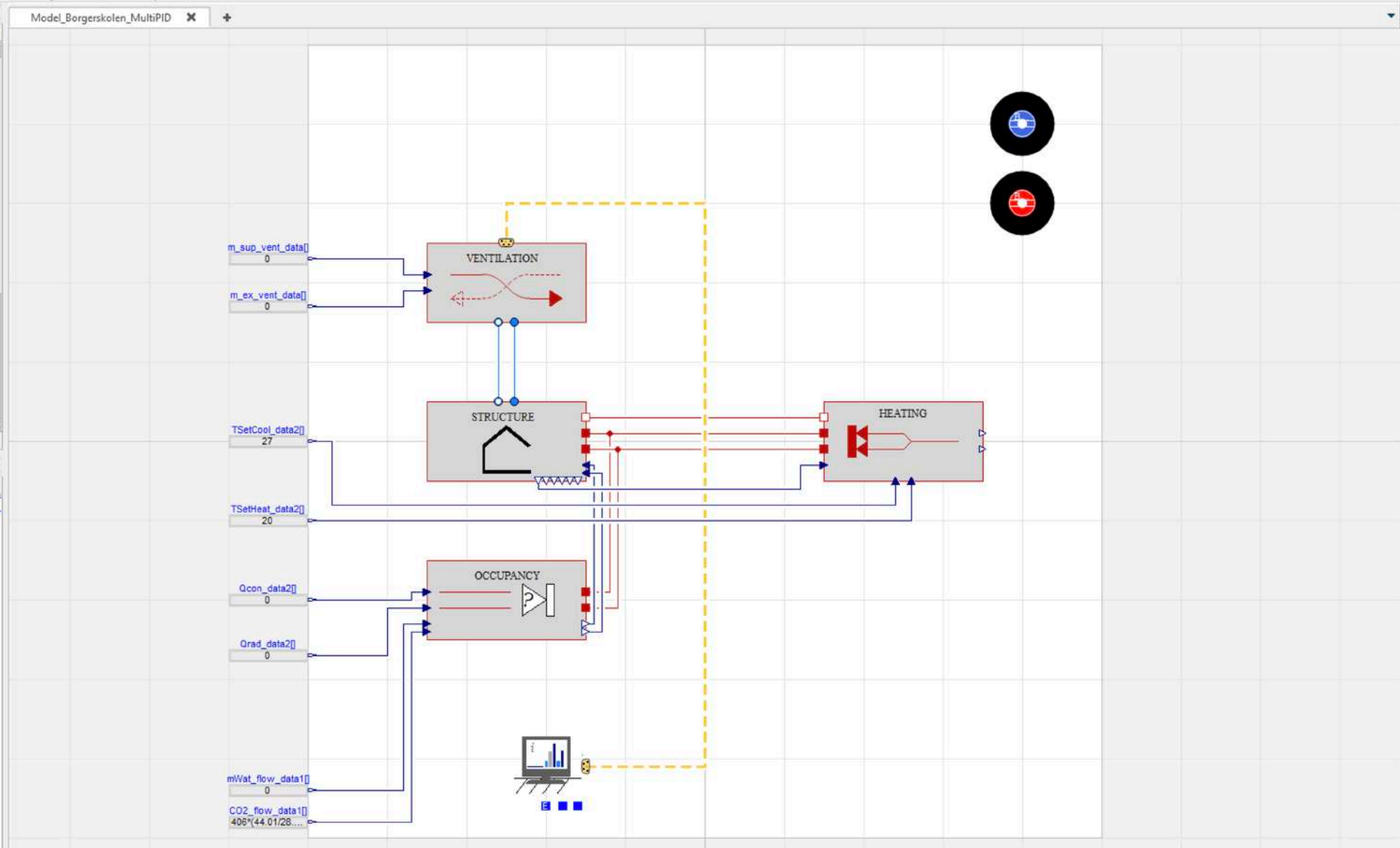
Model name...

- MediumAir = IDEAS.Media.Air(...)
- Model_Sovej_MultiPID
- MediumAir = IDEAS.Media.Air(...)
- Model_Sovej_MultiPIDval
- MediumAir = IDEAS.Media.Air(...)
- Model_Borgerskolen_MultiPID**
- MediumAir = IDEAS.Media.Air(...)
- Envelope
- Records
- Heating
- Ventilation
- Occupancy
- WeatherData
- Model_3
- Model4
- Model_Sovej_MultiPIDval2

Component Browser

Component name...

- Dynsysbuildings_MVH.Model_Borgerskolen_MultiPID
 - MediumAir = IDEAS.Media.Air
 - mVH_SimInfoManager
 - structure_Borgerskolen_Multi
 - ideall-Heating
 - ventilation
 - occupancy
 - m_sup_vent_data
 - m_ex_vent_data
 - mWat_flow_data1
 - CO2_flow_data1
 - BuildingZones
 - BuildingEnvelope
 - Qrad_data2
 - Qcon_data2
 - TSetHeat_data2
 - TSetCool_data2

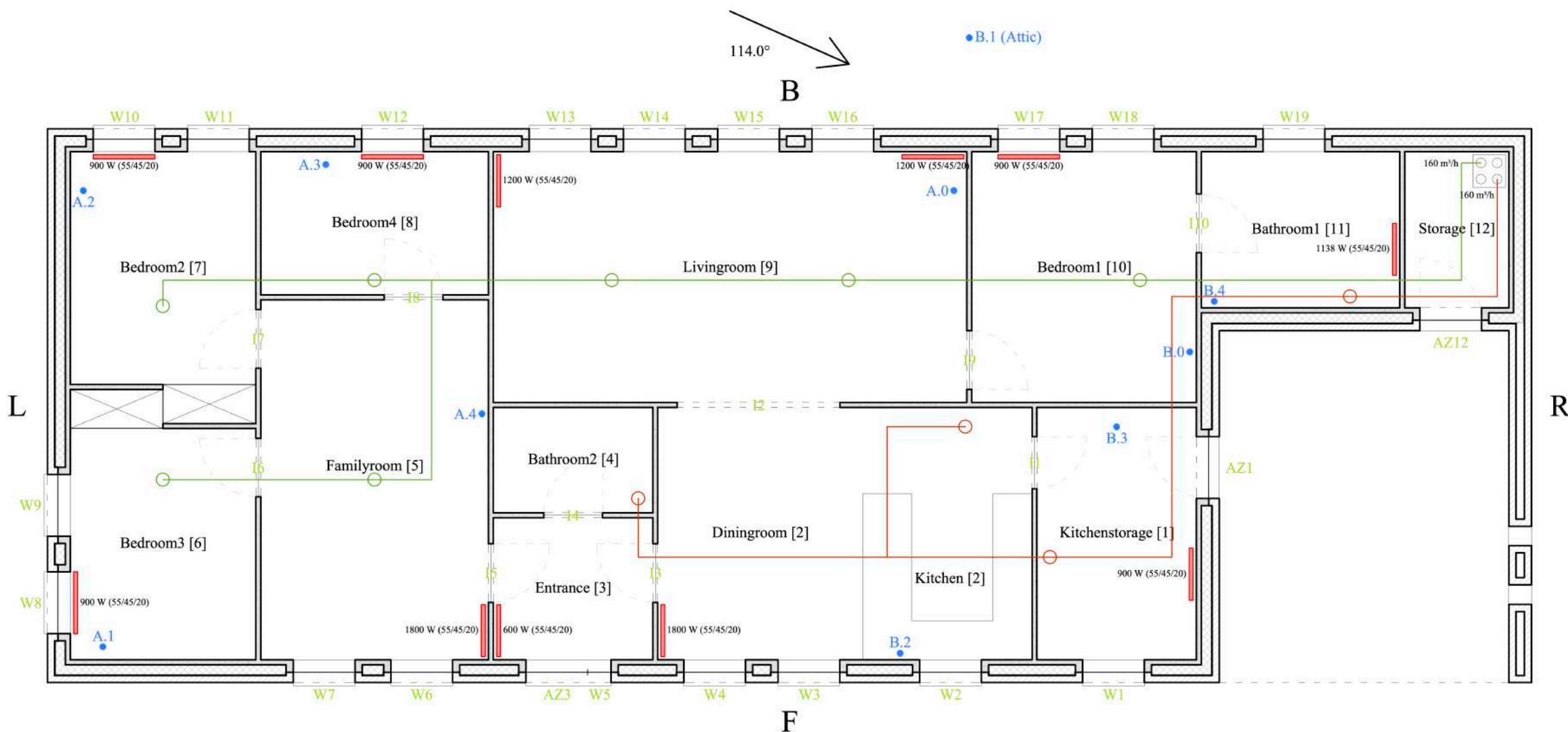


Test case 1: residential house

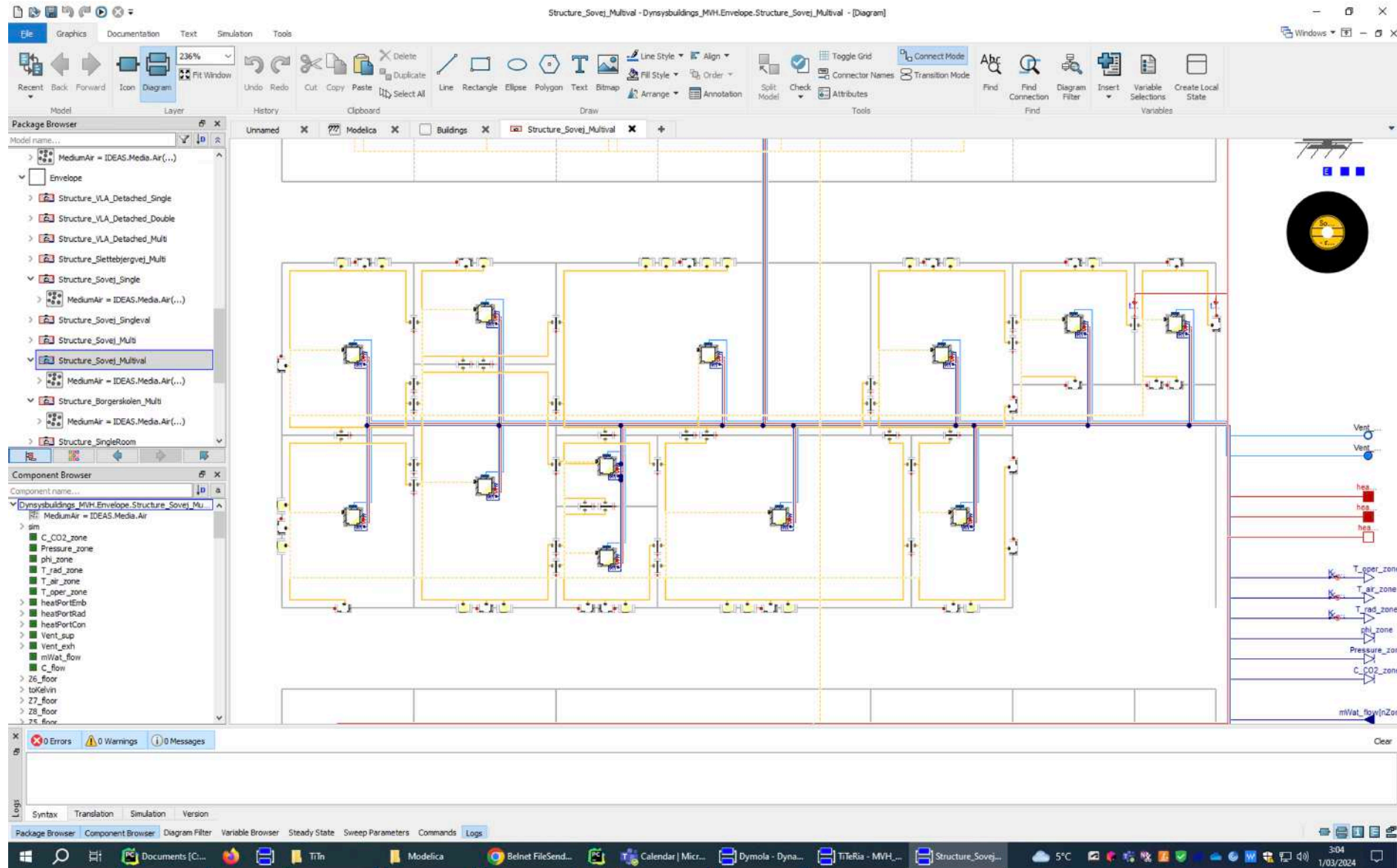
- real building
- detached single-family house in Høje Taastrup (Denmark)
- test case for MPC control in our research group



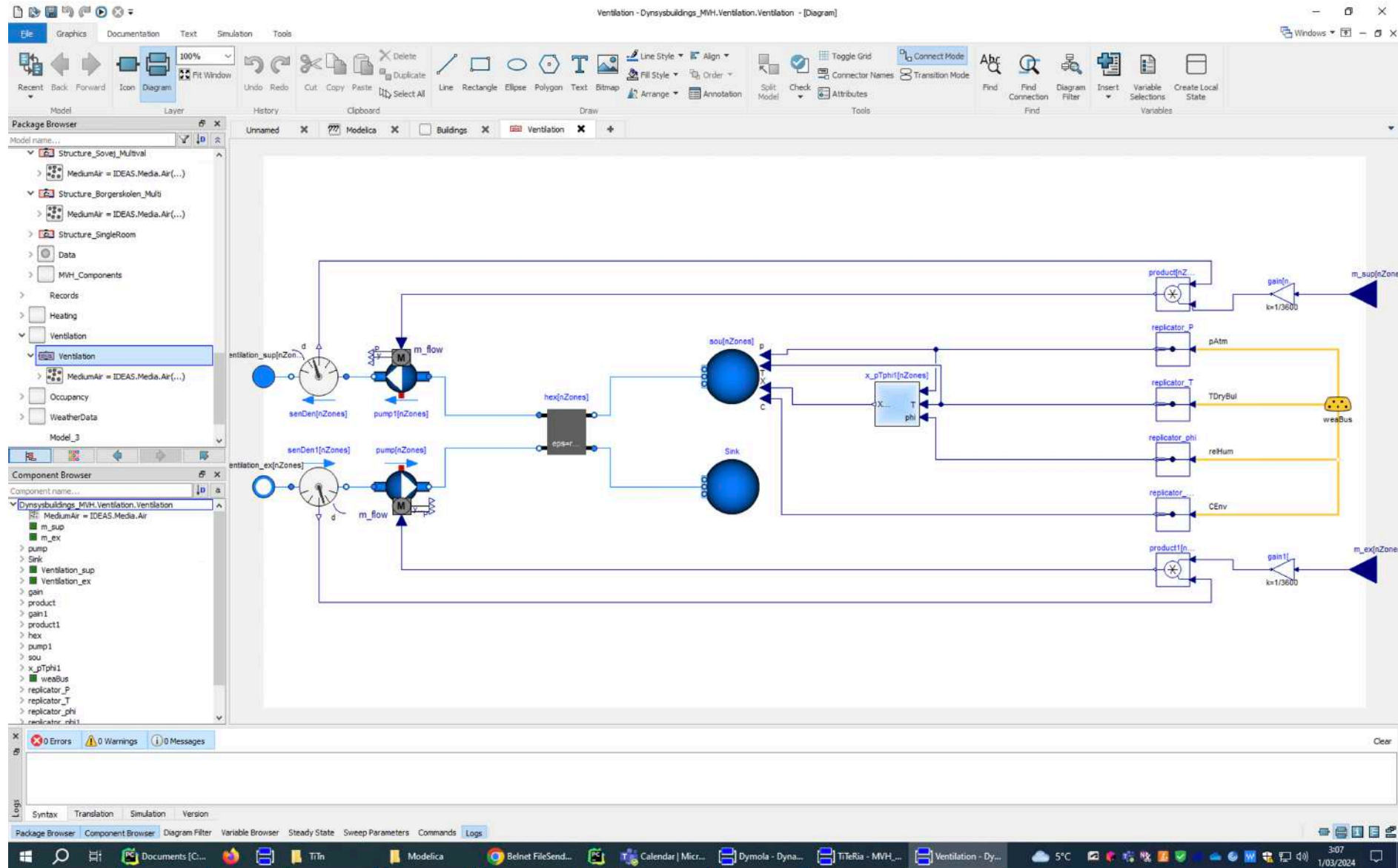
Test case 1: Floor plan



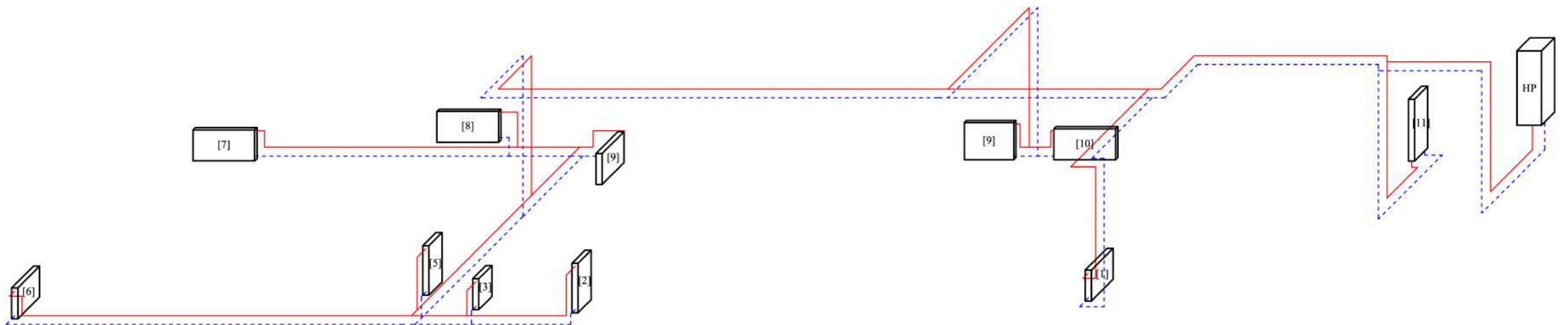
Test case 1: Envelope in modelica



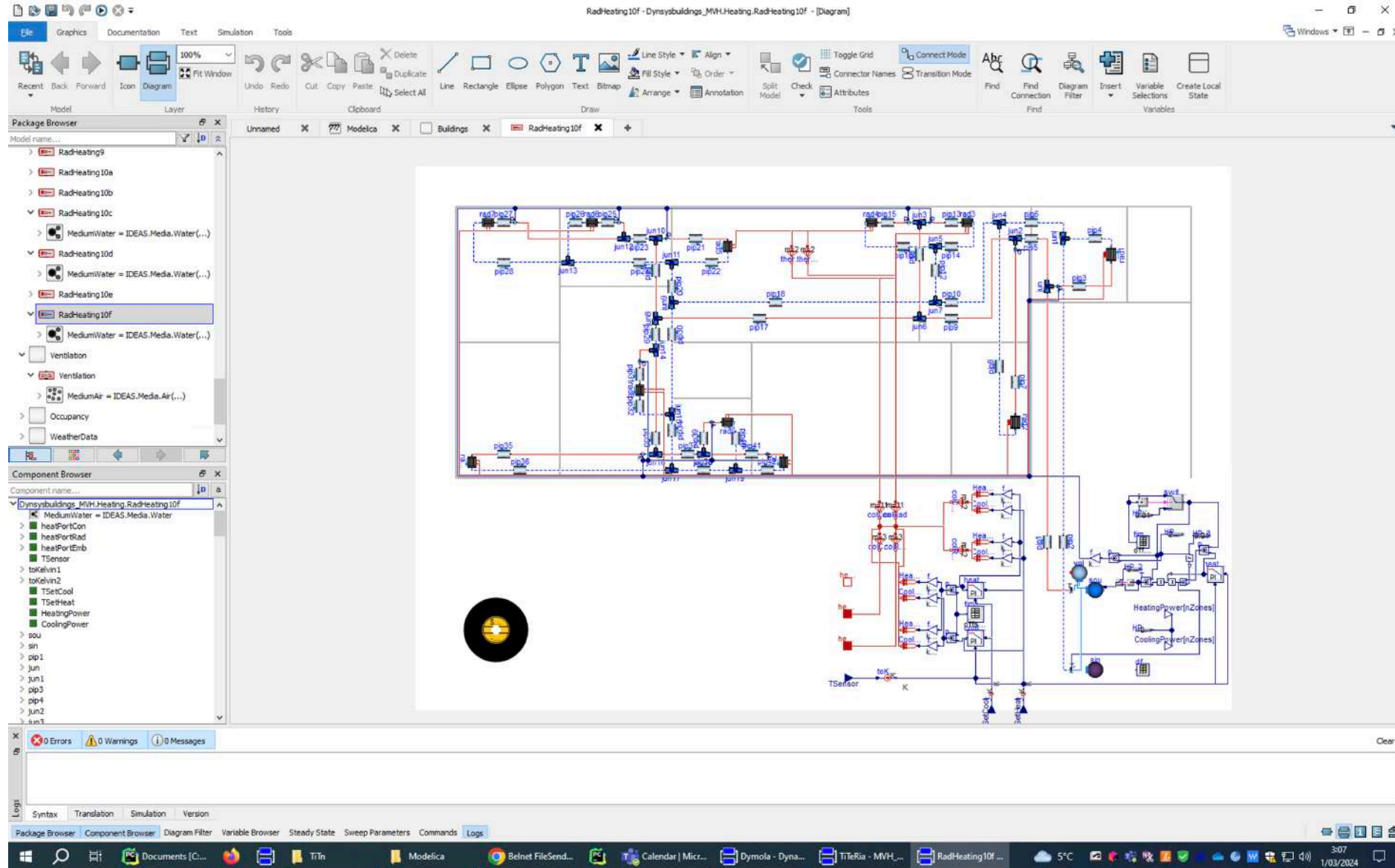
Test case 1: Ventilation system



Test case 1: Hydraulic system



Test case 1: Hydraulic system



Test case 1: notes

- libraries: IDEAS (envelope, weather), Buildings (technical systems)
- weather file type: .TMY (siminfomanager)
- weather: 2023 weather in Høje Taastrup
- envelope: no furniture
- envelope/inter-zone: buoyancy-driven flow (infiltration)
- occupancy: StROBe/EROB => convective/radiative heat, water vapor, CO2 from people and appliances
- building characteristic data: stored together in a record
- model 15min./year (ideal heating), 10h/year (radiator network)

Test

- libr
- we
- we
- env
- env
- occ
- and
- bui

```

C:\Users\mvaho\Documents\Modelica_project\Sovej 16a 2880\Data\0_Weather\0_Sovej16a_202324_weather.txt - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
QUICKSRT.CSV x DK_2023_Tset.txt x Mathias_newsetpoints_check_001.csv x 001.csv x Mathias_newsetpoints_check_001.csv x
1 #1
2 double tabl(105121,30)
3 #LOCATION,Sovej 16a weather file,SJ,Denmark,TMY3,123456789,55.767028,12.455685,1.0,22
4 #0: C1-time
5 #1: C2-dry bulb temp
6 #2: C3-dew bulb temp
7 #3: C4-rel humid
8 #4: C5-patm
9 #5: C6-ext hor rad
10 #6: C7-ext dir nor rad
11 #7: C8-hor inf rad
12 #8: C9-glo hor rad
13 #9: C10-dir nor rad
14 #10: C11-dif hor rad
15 #11: C12-av glob hor ill
16 #12: C13-dir nor ill
17 #13: C14-dif hor ill
18 #14: C15-zen lum
19 #15: C16-wind direction
20 #16: C17-wind speed
21 #17: C18-tot sky cover
22 #18: C19-opa sky cover
23 #19: C20-vis
24 #20: C21-ceiling height
25 #21: C22-pres wea obs
26 #22: C23-pres wea cod
27 #23: C24-prec water
28 #24: C25-aer opt depth
29 #25: C26-snow depth
30 #26: C27-day last snow
31 #27: C28-alb
32 #28: C29-liq prec depth
33 #29: C30-liq prec quant
34 0.0 9.0 8.9 99 99550 0 0 0 0.00 0.00 0.00 0 0 0 0 181 1.5 0.9 0.9 600 80 0 0 0 0 0 0 0 0 0 0
35 600.0 9.0 8.9 99 99550 0 0 0 0.00 0.00 0.00 0 0 0 0 181 1.5 0.9 0.9 600 80 0 0 0 0 0 0 0 0 0 0
36 1200.0 9.0 8.9 99 99550 0 0 0 0.00 0.00 0.00 0 0 0 0 181 1.5 0.9 0.9 600 80 0 0 0 0 0 0 0 0 0 0
37 1800.0 9.0 8.9 99 99550 0 0 0 0.00 0.00 0.00 0 0 0 0 181 1.5 0.9 0.9 600 80 0 0 0 0 0 0 0 0 0 0
38 2400.0 9.0 8.9 99 99550 0 0 0 0.00 0.00 0.00 0 0 0 0 181 1.5 0.9 0.9 600 80 0 0 0 0 0 0 0 0 0 0
39 3000.0 9.0 8.9 99 99550 0 0 0 0.00 0.00 0.00 0 0 0 0 181 1.5 0.9 0.9 600 80 0 0 0 0 0 0 0 0 0 0
40 3600.0 9.0 8.9 99 99550 0 0 0 0.00 0.00 0.00 0 0 0 0 181 1.5 0.9 0.9 600 80 0 0 0 0 0 0 0 0 0 0
41 4200.0 8.9 8.8 99 99540 0 0 0 0.00 0.00 0.00 0 0 0 0 179 1.8 0.9 0.9 400 80 0 0 0 0 0 0 0 0 0 0

```

m people

Test case 2: School building

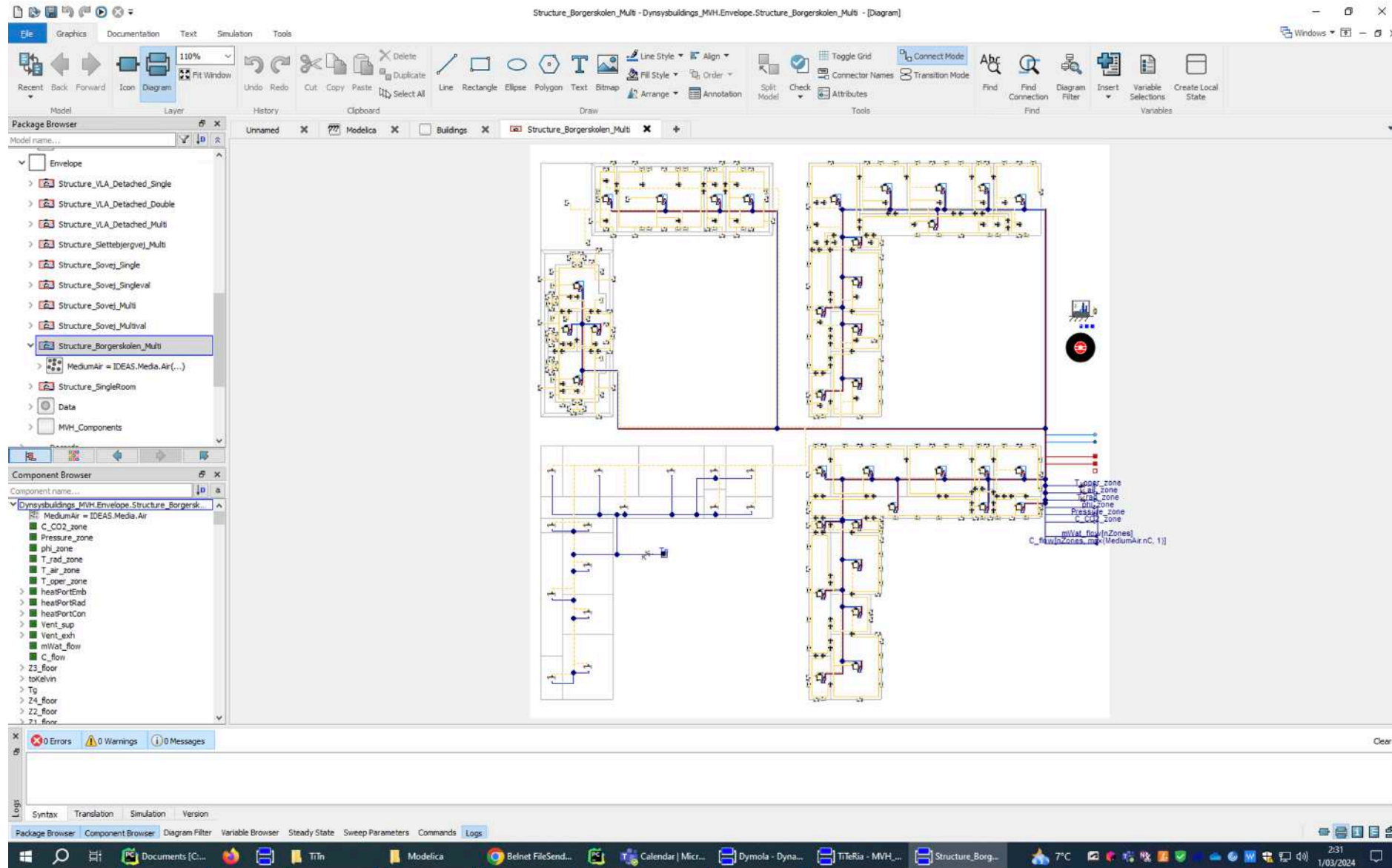
- real building
- detached school building in Høje Taastrup (Denmark)
- test case for MPC control in our research group



Test case 2: Floor plan



Test case 2: Envelope in modelica



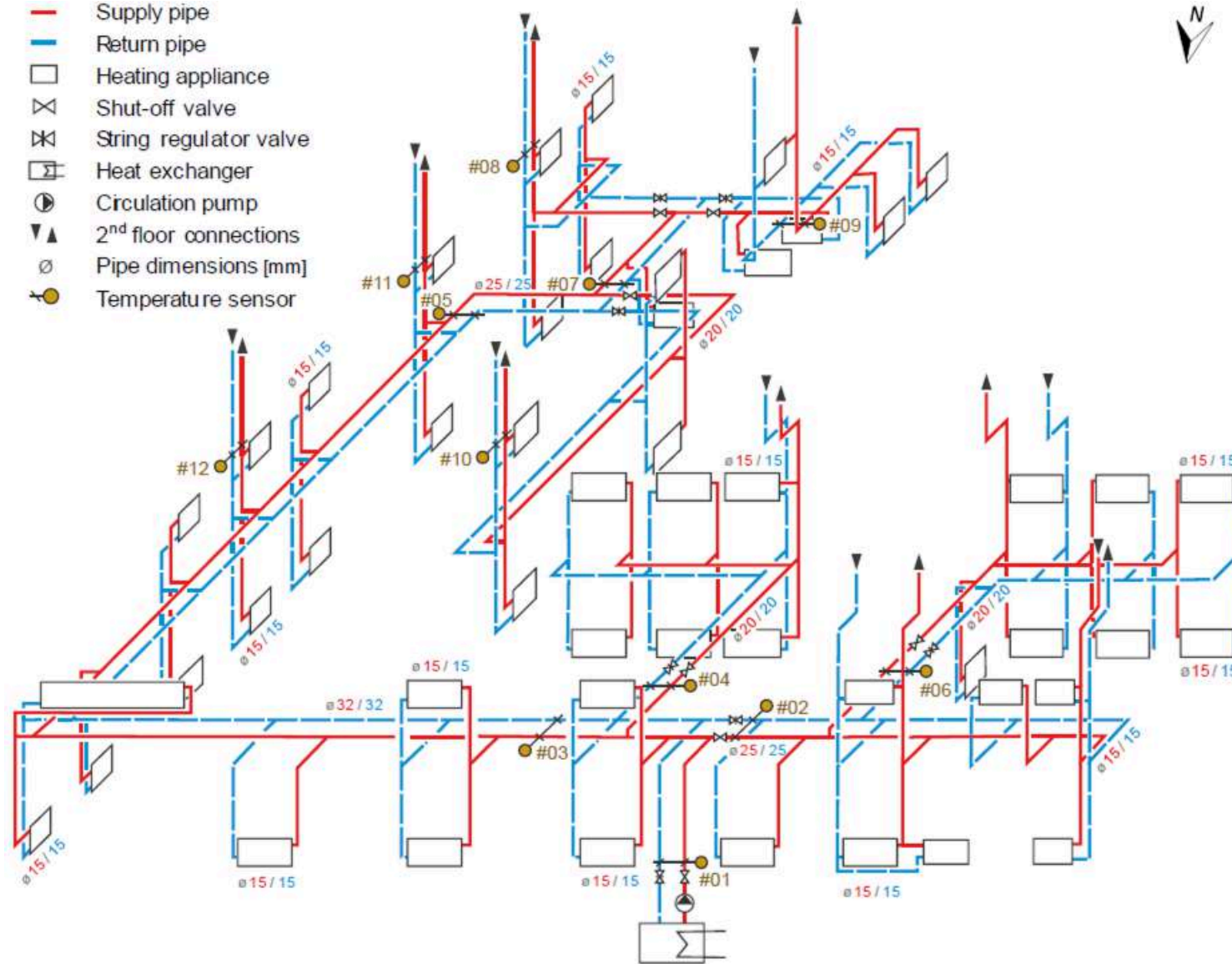
The screenshot displays the Modelica IDE interface for a simulation project titled "Structure_Borgerskolen_Multi - Dynsysbuildings_MVH.Envelope.Structure_Borgerskolen_Multi". The main workspace shows a detailed schematic of a building's thermal envelope, including floor plans, walls, and various zones connected by a network of pipes and valves. The diagram uses color-coding: yellow for walls and floors, blue for air flow paths, and red for water flow paths.

On the left side, the Package Browser shows a hierarchical tree of components. The selected package is "Structure_Borgerskolen_Multi", which includes sub-packages like "MediumAir = IDEAS.Media.Air(...)", "Structure_SingleRoom", and "Data". Below it, the Component Browser lists the specific components used in the model, such as "C_CO2_zone", "Pressure_zone", "pH_zone", "T_rad_zone", "T_air_zone", "T_oper_zone", "heatPortEmb", "heatPortRad", "heatPortCon", "Vent_sup", "Vent_exh", "mWat_flow", "C_flow", "Z3_floor", "toKelvin", "Tg", "Z4_floor", "Z2_floor", and "Z1_floor".

At the bottom of the IDE, a status bar indicates "0 Errors", "0 Warnings", and "0 Messages". The Windows taskbar at the very bottom shows the system tray with a temperature of 7°C and the date 1/03/2024. Other open applications include "Documents [C:...]", "TIn", "Modelica", "Belnet FileSend...", "Calendar | Micr...", "Dymola - Dyna...", "TiteRia - MVH...", and "Structure_Borg...".

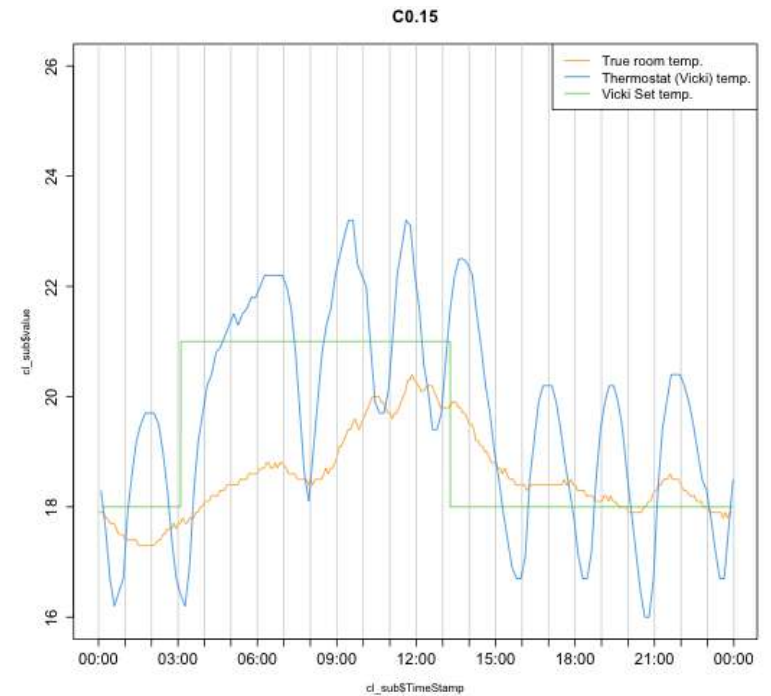
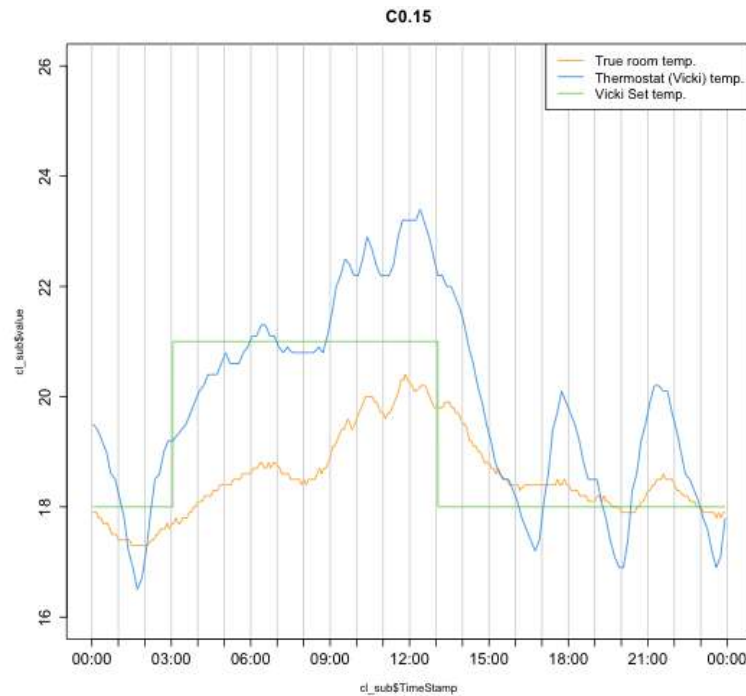
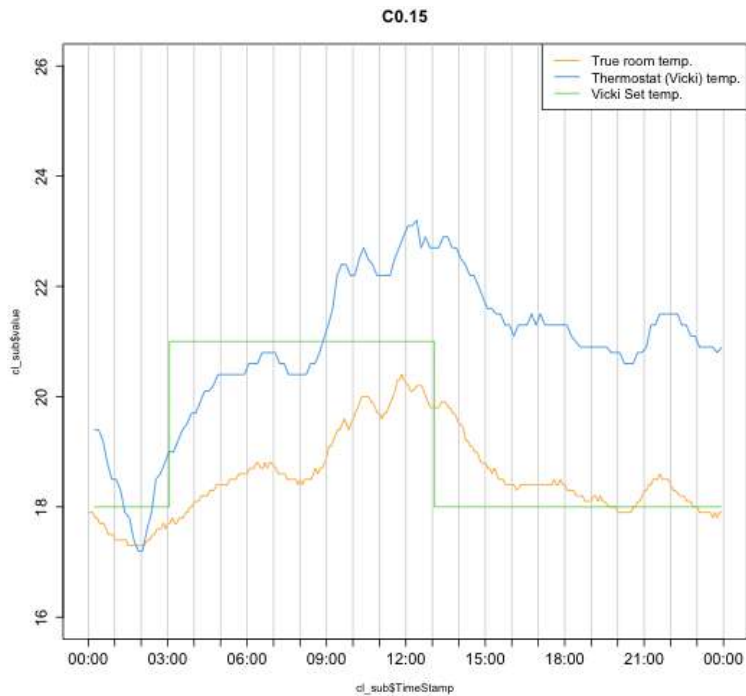
Test case 2: Hydraulic system

- Supply pipe
- Return pipe
- Heating appliance
- X Shut-off valve
- X String regulator valve
- X Heat exchanger
- P Circulation pump
- ▼▲ 2nd floor connections
- ∅ Pipe dimensions [mm]
- Temperature sensor

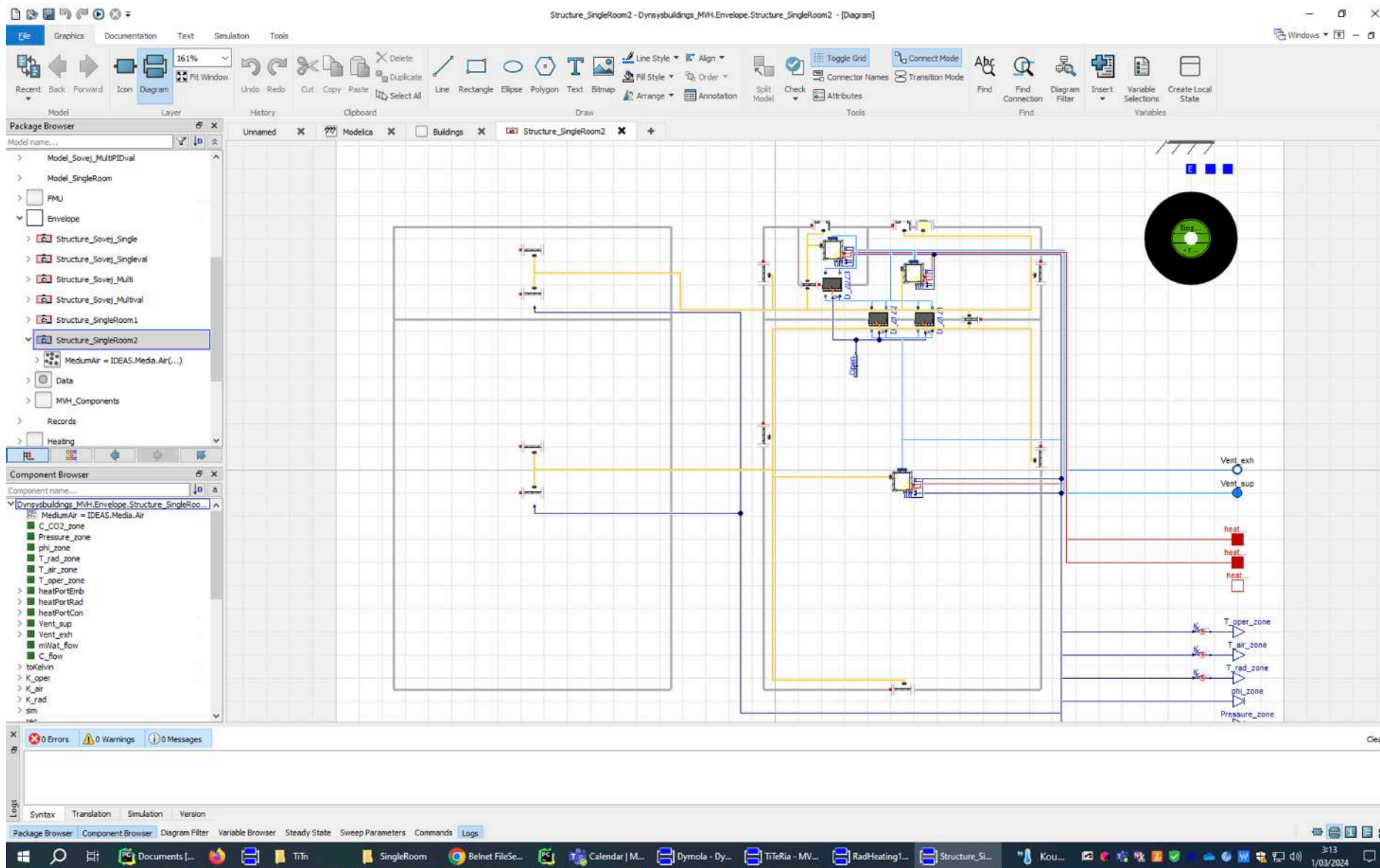


Varia: room model

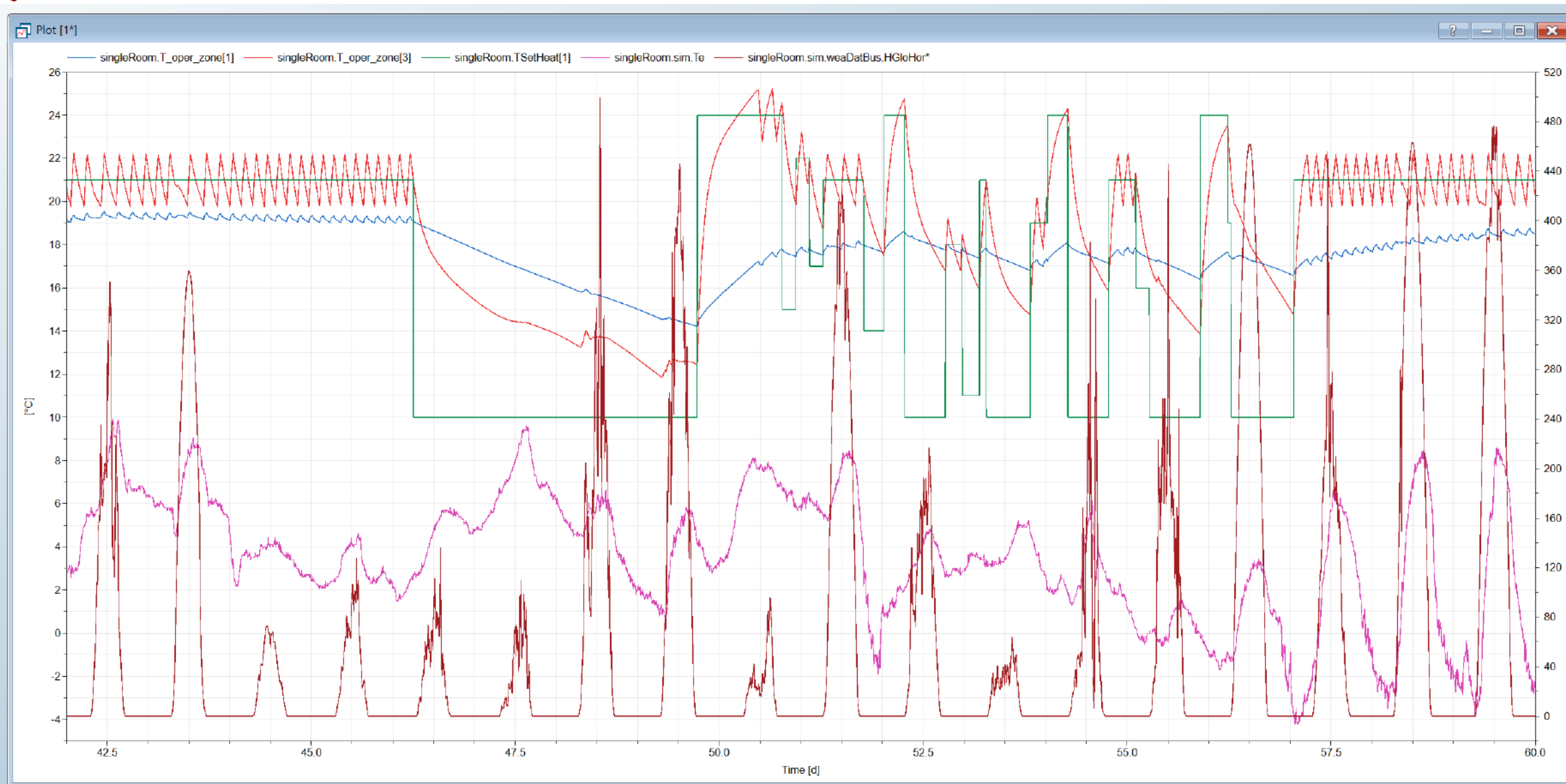
- Measurements show temperature difference between radiator thermostat and room
- MPC to reach setpoint in room by correcting thermostat



Varia: room model



Varia: room model



Varia: new test cases next winter

- 5 real dwellings in Høje Taastrup (Denmark)
- test case for MPC control by Dynsys
- measurement campaigns next winter in all 5



Varia: Validated model of a case study



Science and Technology for the Built Environment



ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/uhvc21>

In-situ empirical validation of common indoor climate parameters in an inhabited multizone dwelling

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