

# OU44 building

Candidate emulator for MPC benchmarking

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27-28 February 2018

# Quick facts

- Teaching building with several offices on the top floor
- 8500 m<sup>2</sup>, 4 stories (incl. basement), around 100 zones connected to BMS
- Balanced ventilation with heat recovery (4 AHUs)
- Hydronic heating
- **Weather sensors:**  
temperature, solar radiation, wind speed, illuminance
- **Sensors in all rooms:**  
temperature, CO<sub>2</sub>, VAV damper, radiator valve, illuminance, PIR
- **Additional sensors in 4 rooms:**  
occupancy counting cameras, heat supply, plug loads
- Many data acquisition issues encountered in 2017, but we have at least **1 month of high quality data for 2-4 rooms and 4-6 months for building-level data**



Figure: OU44 building



Figure: BMS web interface

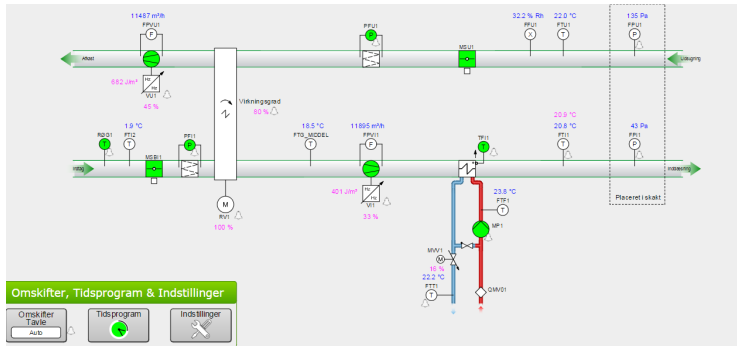
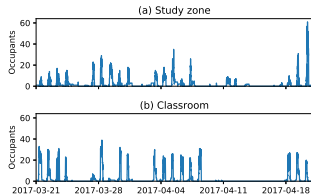
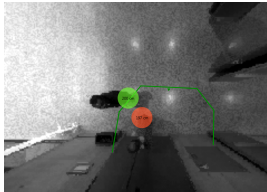
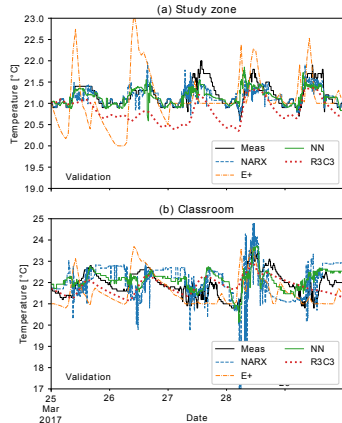


Figure: AHU view in BMS

AHUs are equipped with rotary wheel heat exchangers and heating coils. Room VAV dampers are controlled based on CO<sub>2</sub> concentration (stepwise function).



**Figure:** Occupancy counting camera view (top) and collected data (bottom)

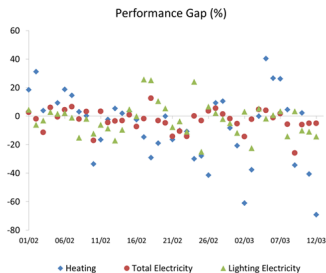


**Figure:** Indoor temperature simulation using various models

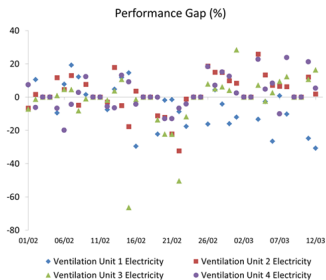
# Complex control rules = challenging modeling

The building is controlled according to complex rules defined in the BMS, e.g.:

- Shading curtains position based on indoor and outdoor illuminance, wind speed, and occupant control
- Indoor lights based on manual control and PIR sensors
- Ventilation based on indoor CO<sub>2</sub> and PIR, but there is also free cooling mode in summer



(a)

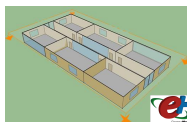


(b)

Figure: EnergyPlus model accuracy<sup>1</sup>

<sup>1</sup>M. Jradi et al. (2018): <https://doi.org/10.1016/j.enbuild.2018.02.005>

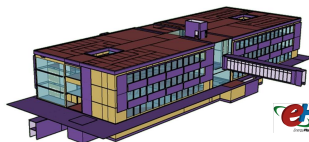
a)



Simplified building with similar HVAC system

MPC tests ongoing

b)



Detailed model

MPC tests planned in 2018

c)



Zone models and/or single zone building model

Models could be developed within IBPSA P1

# Zone model example

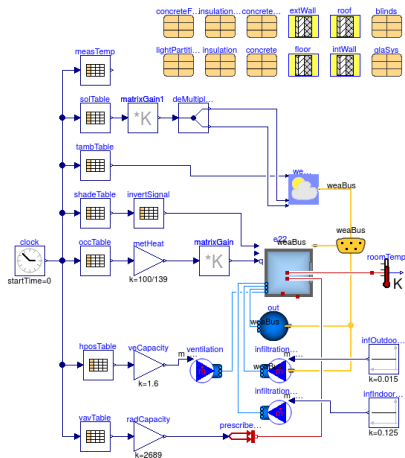


Figure: Zone model implemented using Buildings library

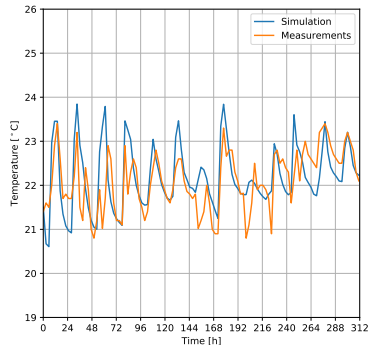


Figure: Zone model results compared with measurements