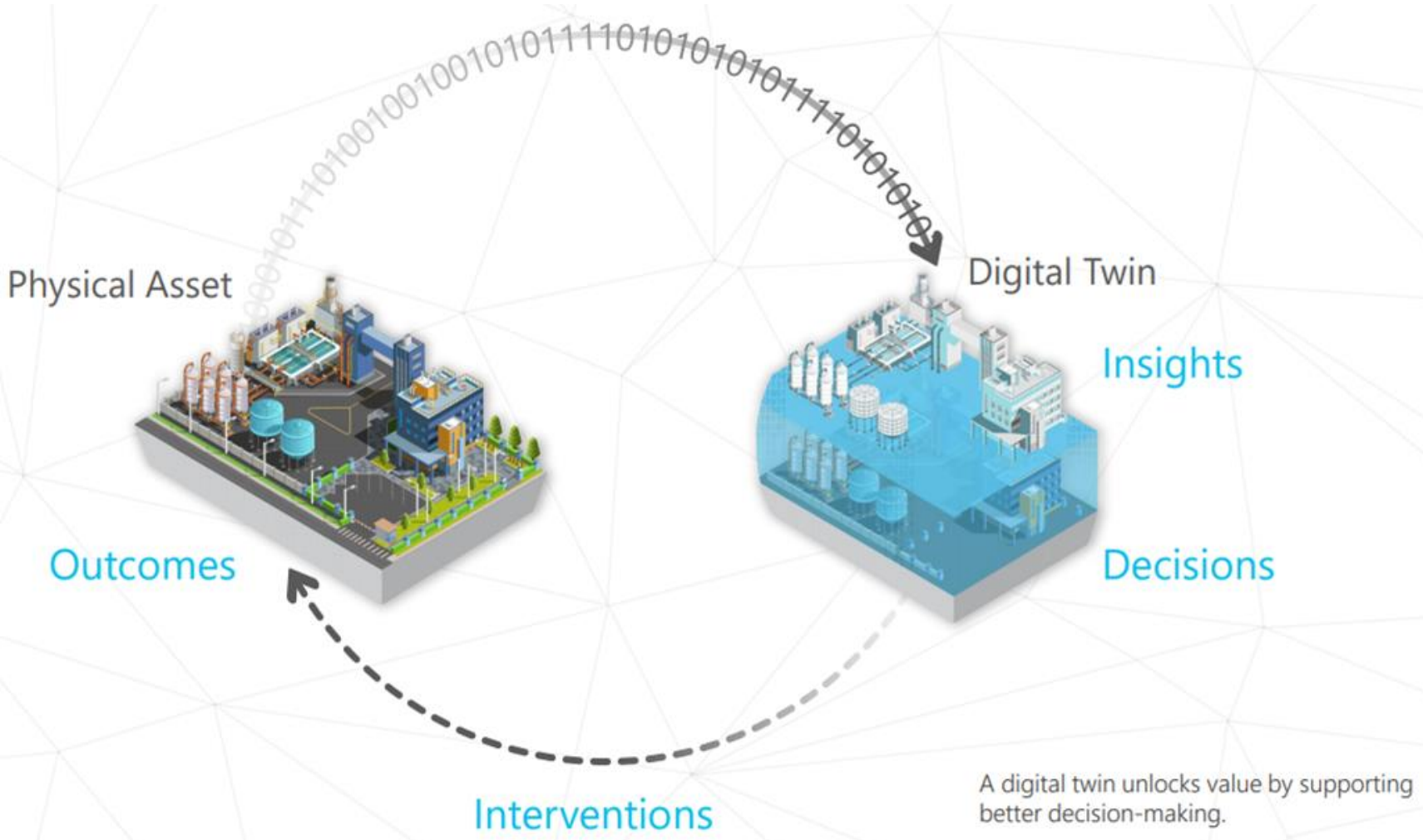
ktu
1922

Išmaniųjų miestų
ir infrastruktūros
centras

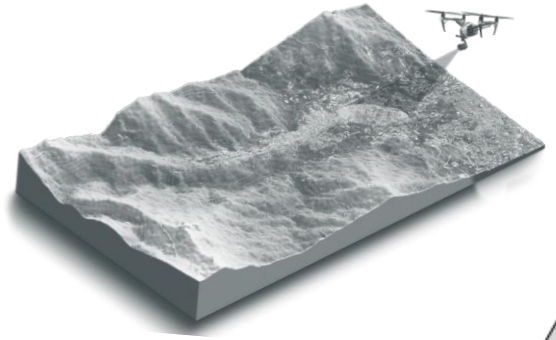
Užstatytos aplinkos skaitmeniniai dvyniai

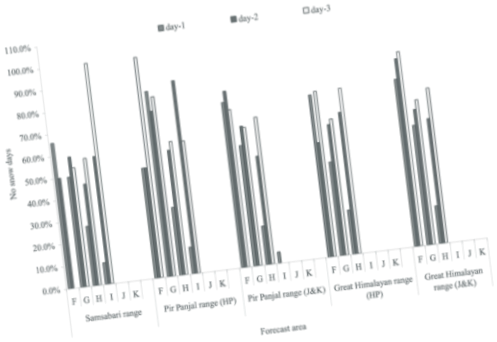
dr. Darius Pupeikis

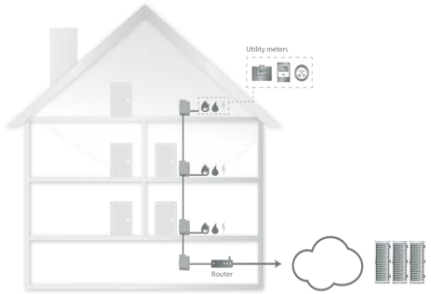
Skaitmeninis dvynys - virtuali ir sinchronizuota užstatytos aplinkos reprezentacija.

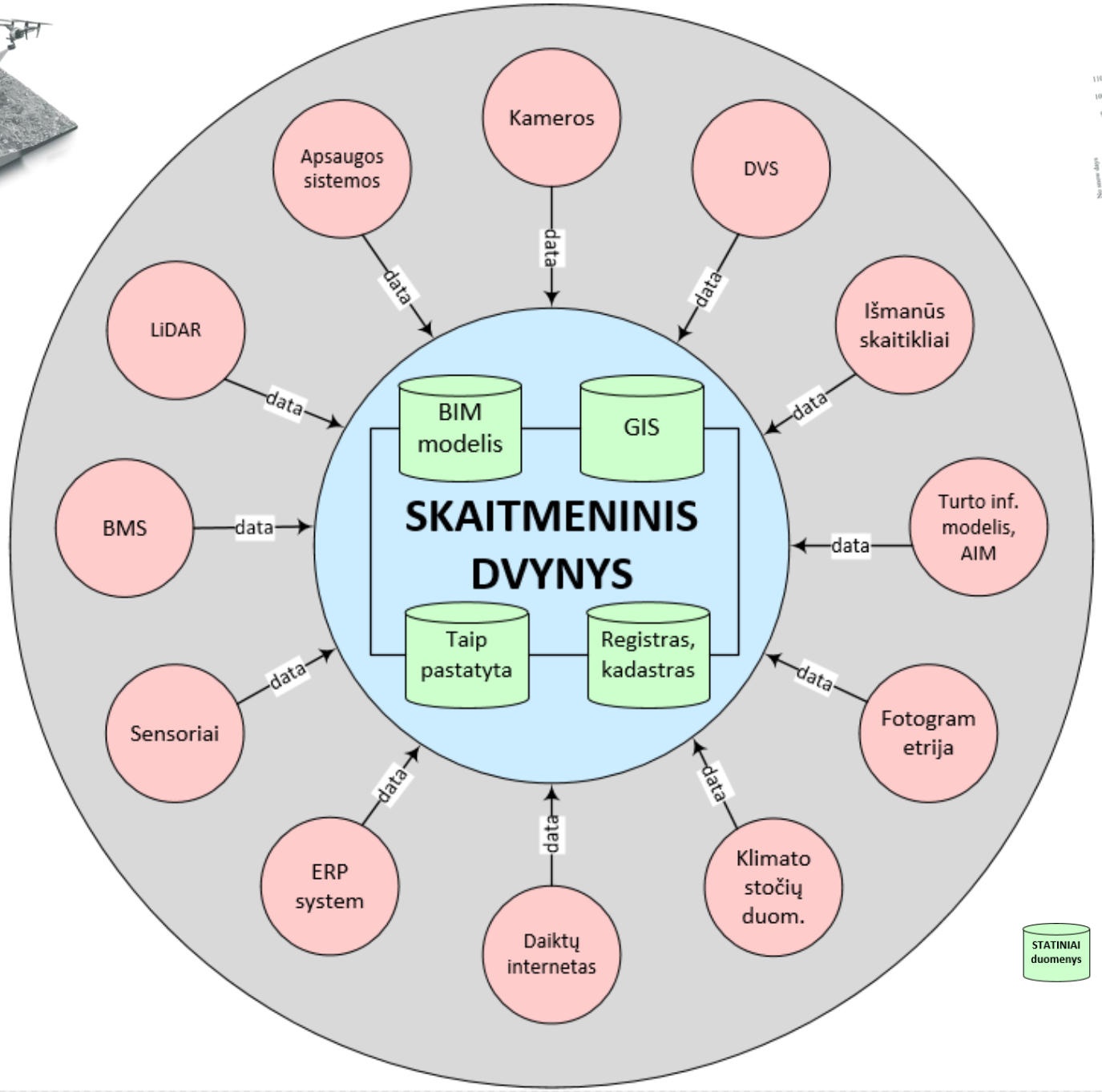


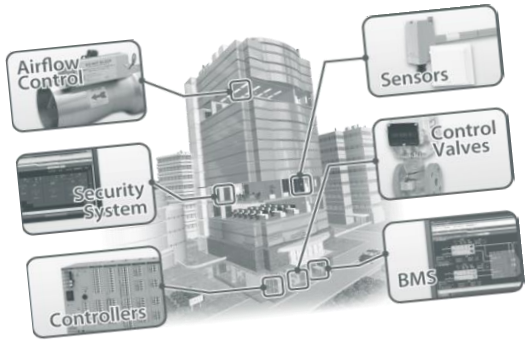
Šaltinis: Bentley Systems









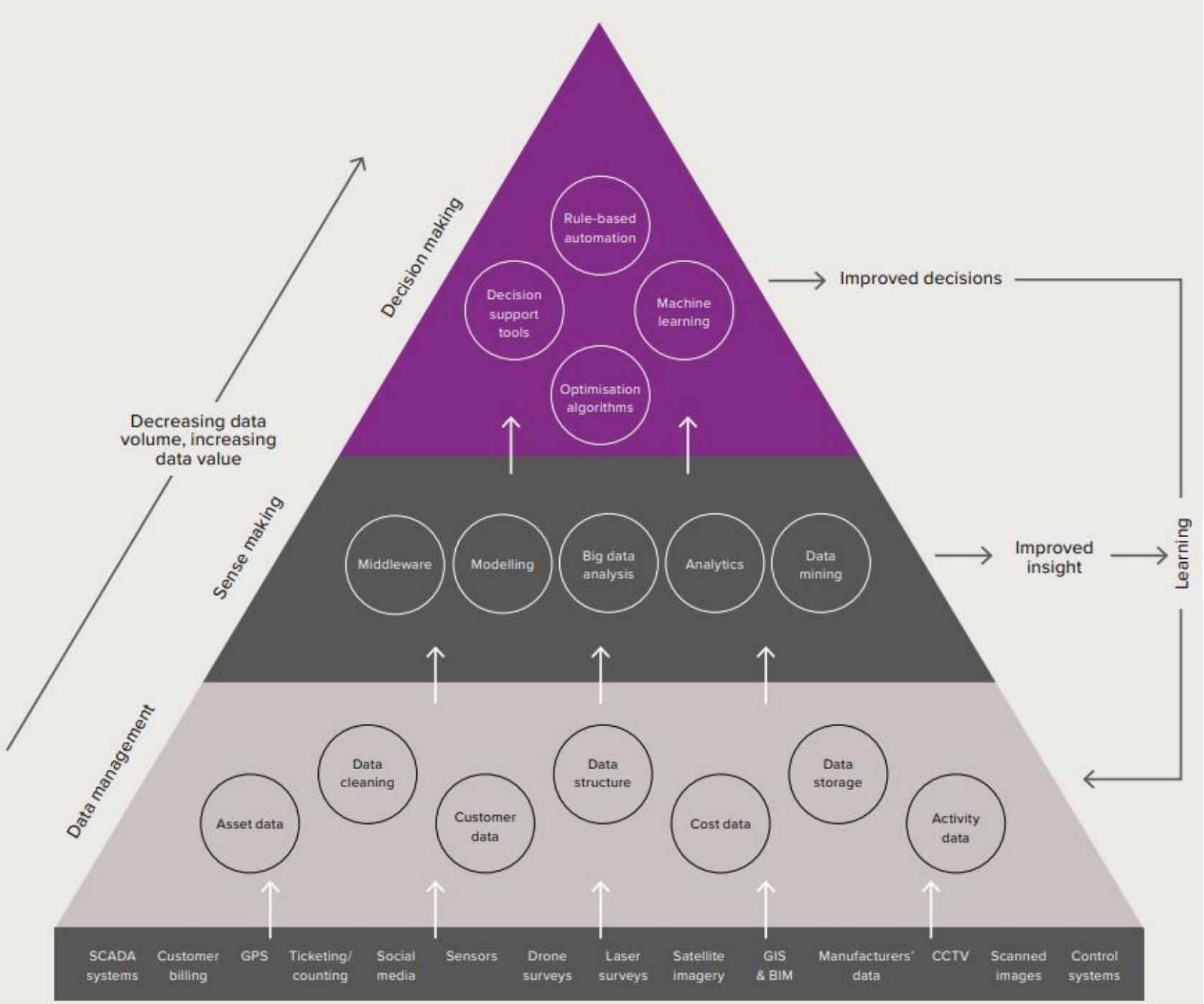


STATINIAI duomenys

DINAMINIAI duomenys

Fizinis objektas

Skaitmeninis dvynis



Skaitmeninių dvynių brandos lygiai

Source: cdbb " The gemini principles"

Kauno miesto skaitmeninio dvynio projektas

https://eu.opencitiesplanner.bentley.com/www_ktu_edu/kaunasdigitalcity-stage1

Kaunas city Digital Twin project
2020-2022

Stage 3
Nemunas river island /
Science museum project

Stage 1
Kaunas University of
Technology campus

Stage 2
Digital Twin of FCEA building

Stage 2
Energy 3D project – energy
data + reality mesh

Stage 2
YIT Lietuva Residential
Development PILIAMIESTIS

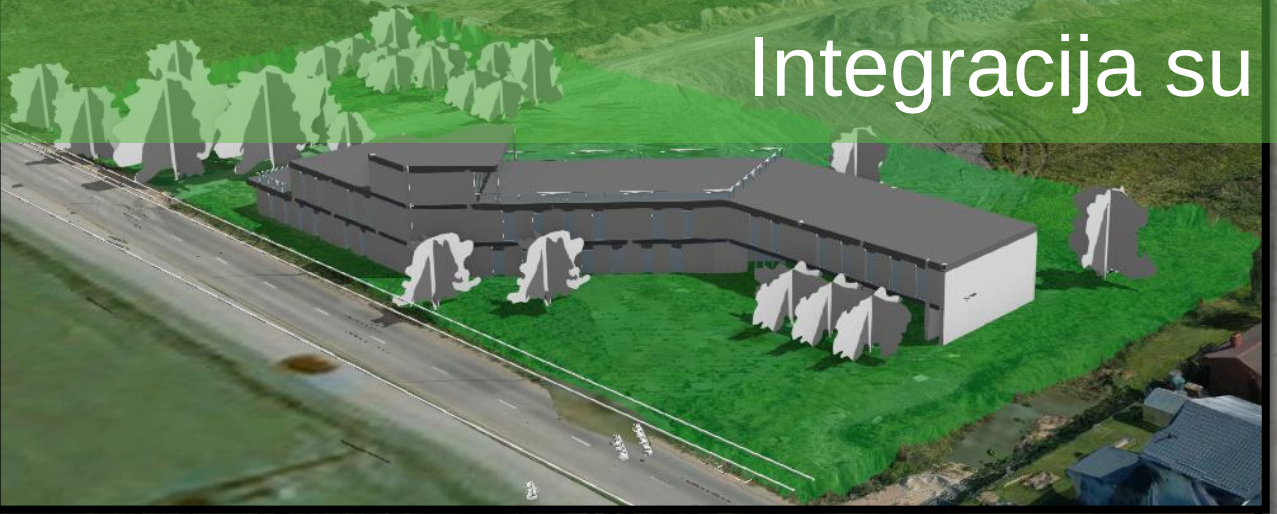
Stage 1
Kaunas city centre area /
heritage buildings project

Stage 3
GENIUS LOCI project: urbanisation
and society

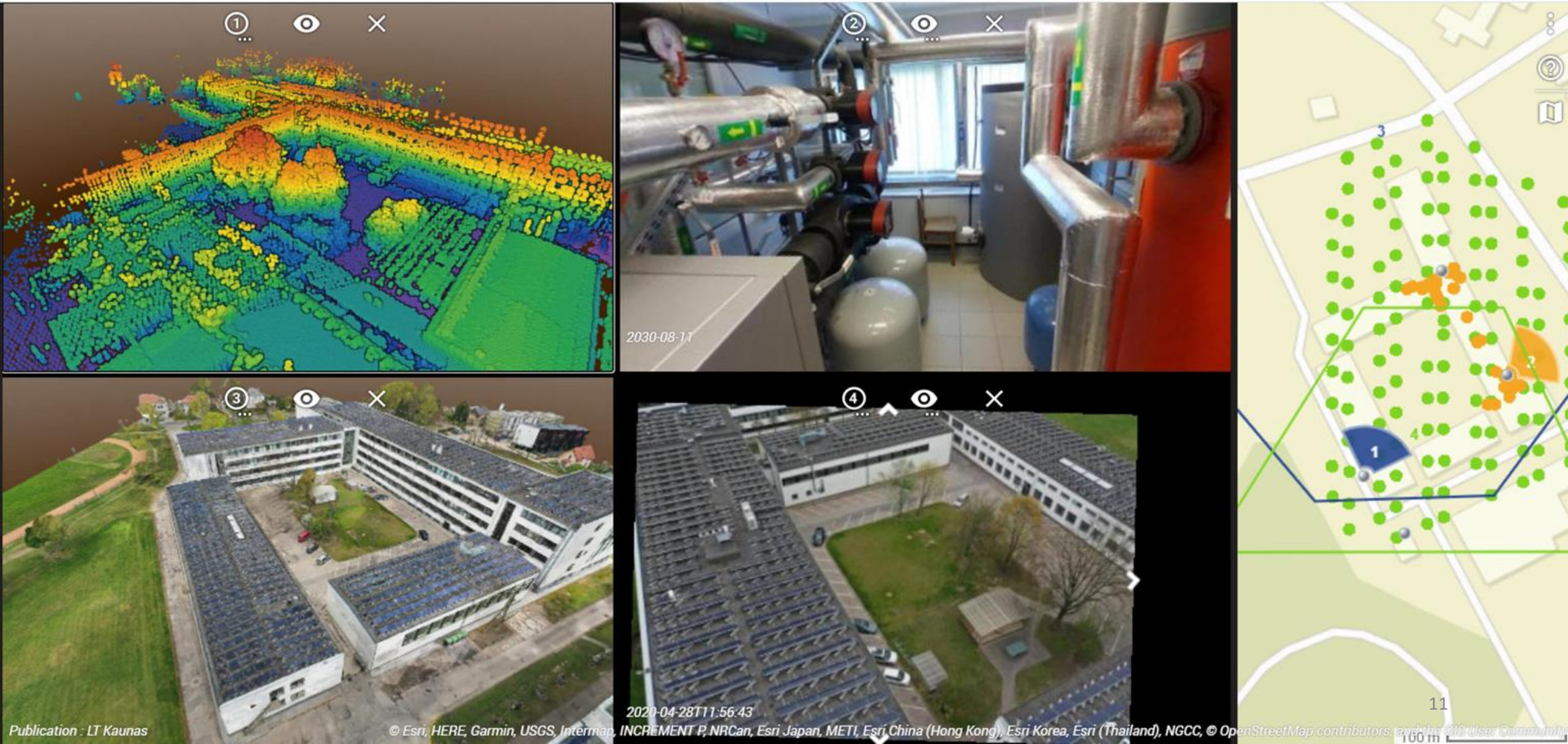
Centre for
Smart Cities and
Infrastructure

Kauno skaitmeninio dvynio projektas. Saugomų teritorijų duomenys

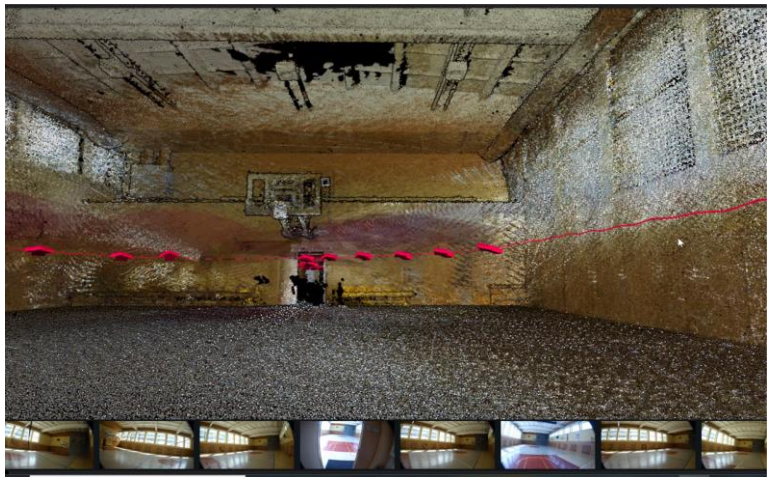
Integracija su BIM modeliais



Pastato Studentų g. 48, skaitmeninio dvynio projektas. Orbit 3D

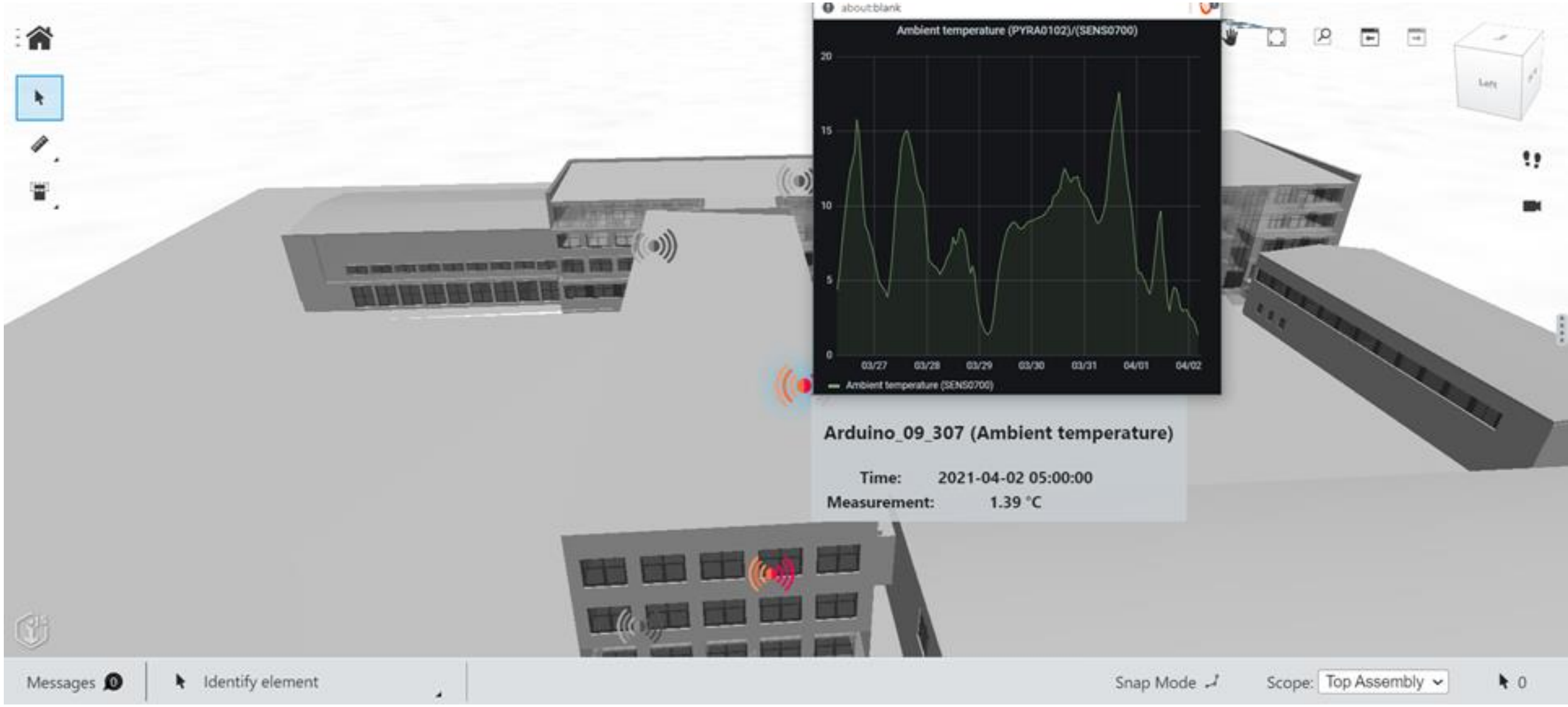


Studentų g.48 pastato skaitmeninio dvynio projektas. Lidar

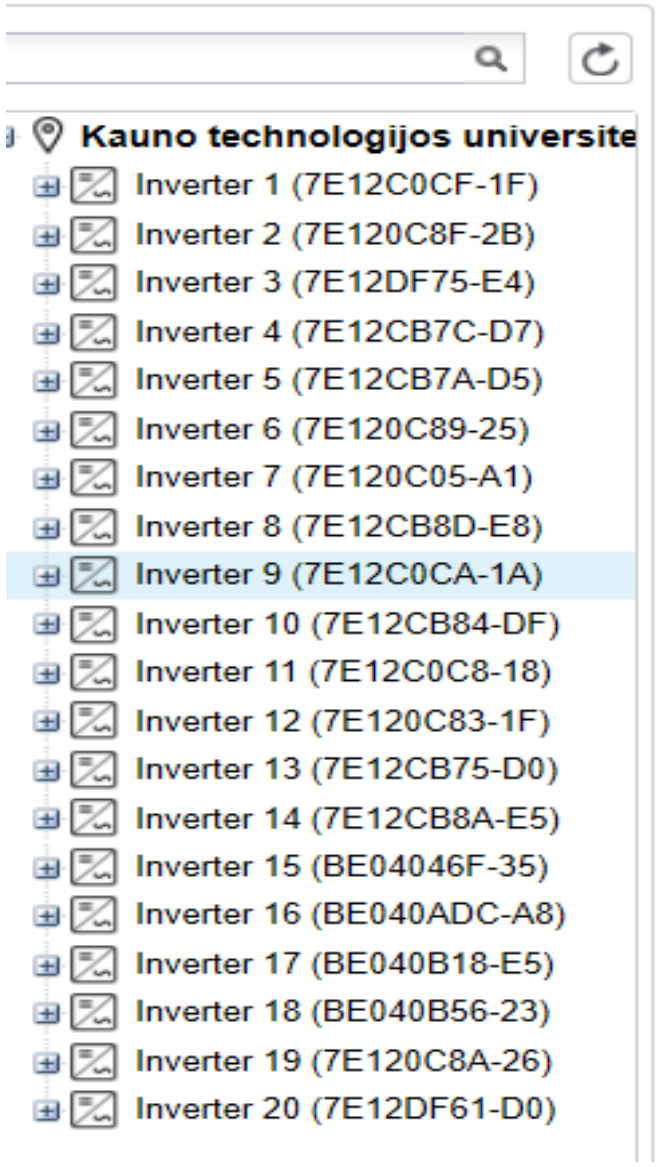


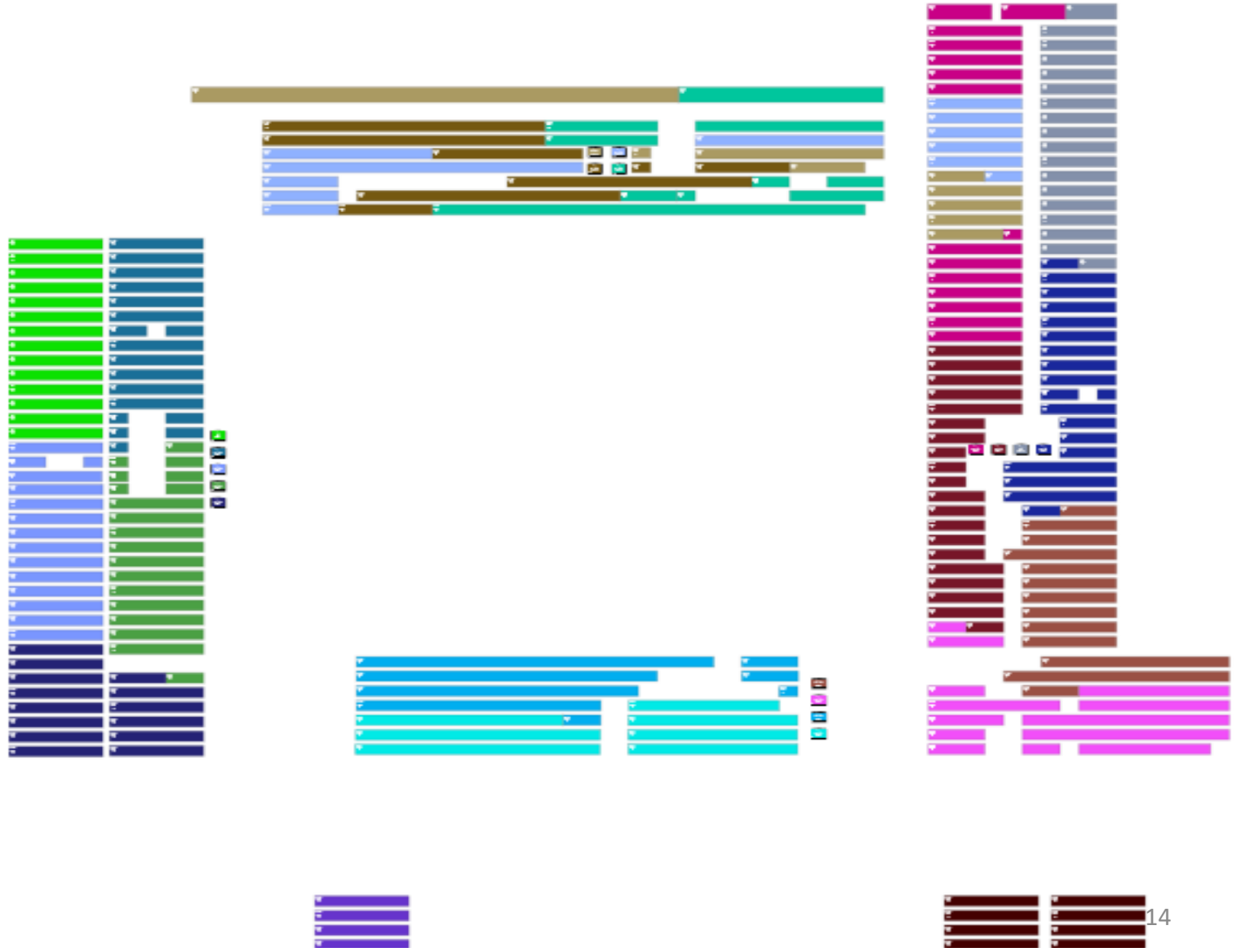
Išmaniųjų miestų
ir infrastruktūros
centras

Studentų g.48 pastato skaitmeninio dvynio projektas. iTWIN platform



Studentų g.48 pastato skaitmeninio dvynio projektas. SolarEDGE





Studentų g.48 pastato skaitmeninio dvynio projektas. SolarEDGE

ZABBIX Monitoring Inventory Reports

Dashboard Problems Overview Web Latest data Graphs Scree

Latest data

Host groups: type here to search

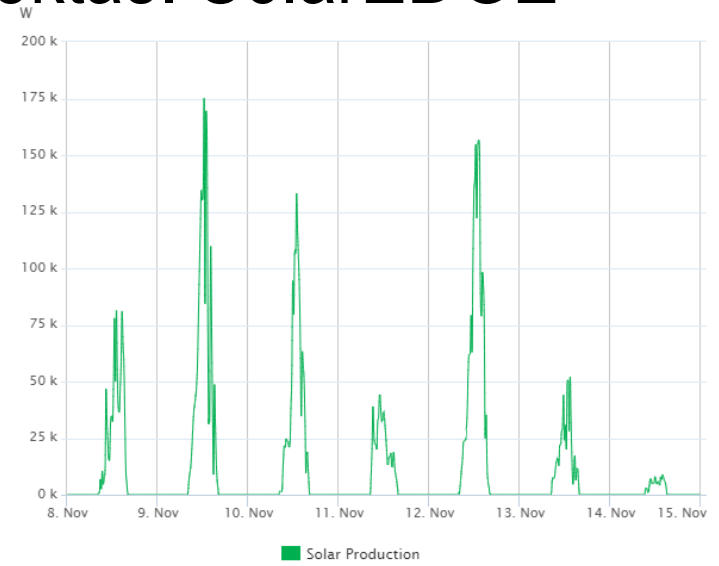
Hosts: SAF_solar_PV ×

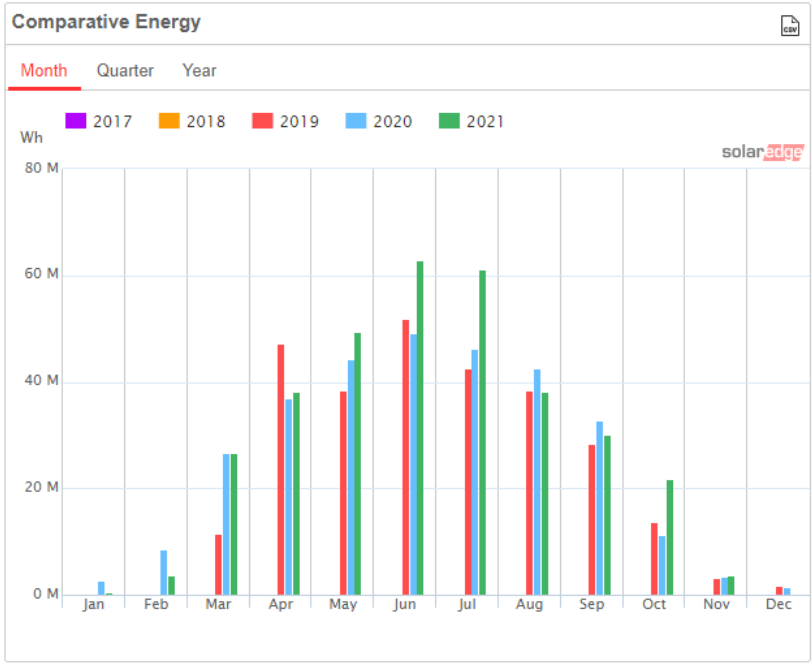
type here to search

Application:

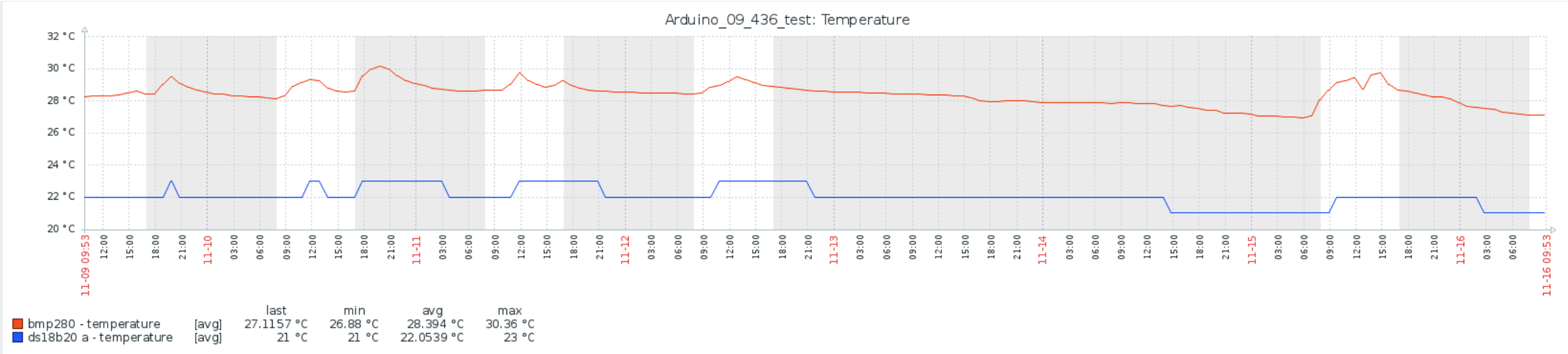
Host	Name ▲
SAF_solar_PV	**Inverter.01** (13 Items)
	Solar PV 01 CosPhi
	Solar PV 01 DC I
	Solar PV 01 DC P
	Solar PV 01 DC U
	Solar PV 01 F
	Solar PV 01 Ia
	Solar PV 01 Ib
	Solar PV 01 Ic

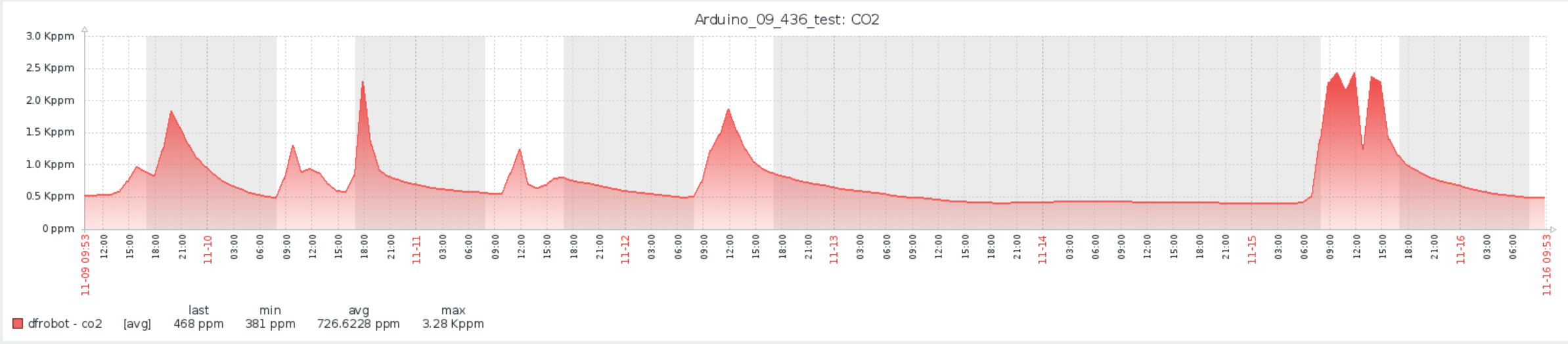
ID	993237
Name	Kauno technologijos universit...
Address	Studentų gatvė 48, Kaunas,Lithuania,Lithuania
Installed	02/06/2019
Last Updated	11/16/2021 12:49
Peak Power	380 kWp





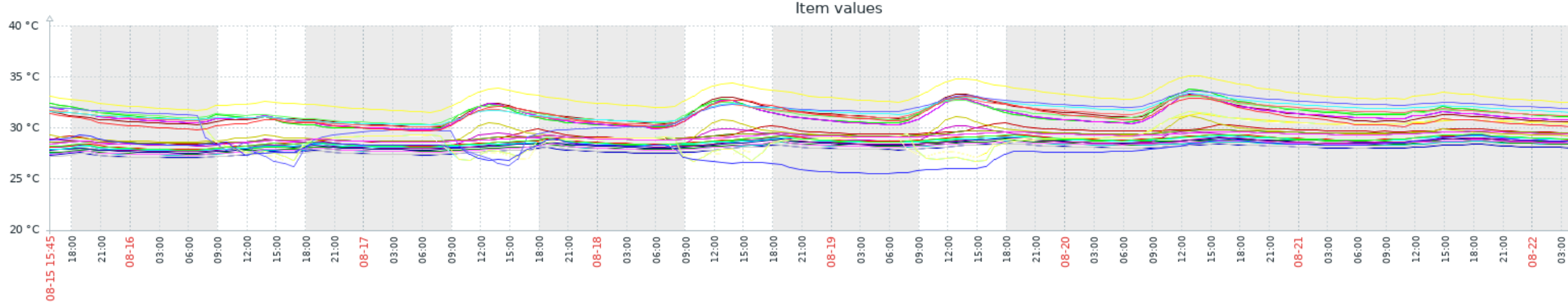
Studentų g.48 pastato skaitmeninio dvynio projektas. ZABBIX, IoT





This year so far

Item values



		last	min	avg	max
Efento gateway 70B3D51BBBB1: Temperature (S300_P)	[avg]	29.05 °C	27.8 °C	28.4725 °C	29.1 °C
Efento gateway 70B3D51BBBB1: Temperature (S301_P)	[avg]	29.6 °C	28.4 °C	29.3717 °C	30.6 °C
Efento gateway 70B3D51BBBB1: Temperature (S302_SP)	[avg]	28.45 °C	27.1 °C	27.8781 °C	28.5 °C
Efento gateway 70B3D51BBBB1: Temperature (S303_SP)	[avg]	29.575 °C	28.1 °C	28.8626 °C	30.2 °C
Efento gateway 70B3D51BBBB1: Temperature (S304_SP)	[avg]	28.625 °C	27.3 °C	28.1391 °C	28.8 °C
Efento gateway 70B3D51BBBB1: Temperature (S307_P)	[avg]	30.2 °C	28.6 °C	29.406 °C	31.2 °C
Efento gateway 70B3D51BBBB1: Temperature (S308_P)	[avg]	28.475 °C	27 °C	27.896 °C	28.6 °C
Efento gateway 70B3D51BBBE7: Temperature (S310_P)	[avg]	29.05 °C	27.4 °C	28.218 °C	29.2 °C
Efento gateway 70B3D51BBBE7: Temperature (S311_P)	[avg]	32.2 °C	30.1 °C	31.297 °C	33.3 °C
Efento gateway 70B3D51BBBE7: Temperature (S312_P)	[avg]	28.9 °C	27.5 °C	28.3882 °C	29.1 °C
Efento gateway 70B3D51BBBE7: Temperature (S313_P)	[avg]	28.975 °C	27.7 °C	28.4702 °C	29.1 °C
Efento gateway 70B3D51BBBB1: Temperature (S400_P)	[avg]	29.7 °C	28.5 °C	29.2159 °C	29.8 °C
Efento gateway 70B3D51BBBE7: Temperature (S400_P)	[avg]	29.7 °C	28.5 °C	29.2159 °C	29.8 °C
Efento gateway 70B3D51BBBB1: Temperature (S403_SP)	[avg]	33.125 °C	29.8 °C	31.3281 °C	33.9 °C
Efento gateway 70B3D51BBBE7: Temperature (S403_SP)	[avg]	33.125 °C	29.8 °C	31.3281 °C	33.9 °C
Efento gateway 70B3D51BBBB1: Temperature (S404_SP)	[avg]	29.2 °C	27.8 °C	28.7353 °C	29.4 °C
Efento gateway 70B3D51BBBB1: Temperature (S405_SP)	[avg]	32.975 °C	29.8 °C	31.1364 °C	33.4 °C
Efento gateway 70B3D51BBBE7: Temperature (S405_SP)	[avg]	32.975 °C	29.8 °C	31.1364 °C	33.4 °C
Efento gateway 70B3D51BBBB1: Temperature (S406_SP)	[avg]	29.15 °C	27.8 °C	28.6097 °C	29.3 °C
Efento gateway 70B3D51BBBB1: Temperature (S407_SP)	[avg]	27.775 °C	26.5 °C	28.9446 °C	32 °C
Efento gateway 70B3D51BBBE7: Temperature (S407_SP)	[avg]	27.775 °C	26.5 °C	29.2894 °C	32 °C
Efento gateway 70B3D51BBBB1: Temperature (S408_SP)	[avg]	28.8 °C	27.3 °C	28.1903 °C	28.8 °C
Efento gateway 70B3D51BBBB1: Temperature (S409_SP)	[avg]	27.125 °C	26.5 °C	29.2822 °C	31.8 °C
Efento gateway 70B3D51BBBE7: Temperature (S409_SP)	[avg]	27.1 °C	26.5 °C	29.2838 °C	31.8 °C
Efento gateway 70B3D51BBBE7: Temperature (S411_P)	[avg]	32.675 °C	30.3 °C	31.4765 °C	33.2 °C
Efento gateway 70B3D51BBBE7: Temperature (S413_SP)	[avg]	32.5 °C	30.1 °C	31.4331 °C	33.3 °C
Efento gateway 70B3D51BBBE7: Temperature (S415_SP)	[avg]	27.675 °C	25.9 °C	31.1088 °C	33.7 °C
Efento gateway 70B3D51BBBB1: Temperature (S416_SP)	[avg]	29.6 °C	28.3 °C	29.1076 °C	29.7 °C
Efento gateway 70B3D51BBBE7: Temperature (S416_SP)	[avg]	29.6 °C	28.3 °C	29.1076 °C	29.7 °C
Efento gateway 70B3D51BBBE7: Temperature (S417_SP)	[avg]	32.65 °C	30.3 °C	31.6331 °C	33.4 °C
Efento gateway 70B3D51BBBE7: Temperature (S419_ST)	[avg]	34.5 °C	31.5 °C	33.0254 °C	35.2 °C
Efento gateway 70B3D51BBBE7: Temperature (S420_SP)	[avg]	29.3 °C	27.8 °C	28.7144 °C	29.4 °C
Efento gateway 70B3D51BBBE7: Temperature (S423_P)	[avg]	32.2 °C	29.7 °C	31.021 °C	33.1 °C
Efento gateway 70B3D51BBBE7: Temperature (S426_SP)	[avg]	26.8 °C	25.5 °C	27.8365 °C	29.4 °C

EFENTO

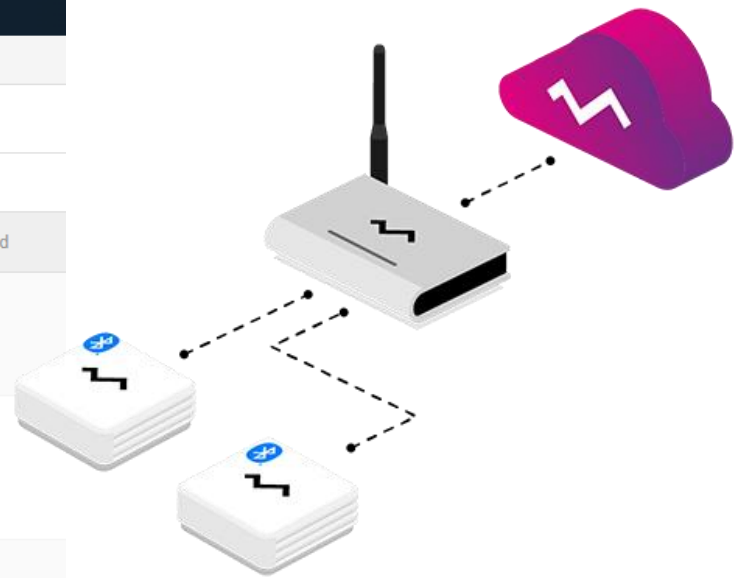
Status

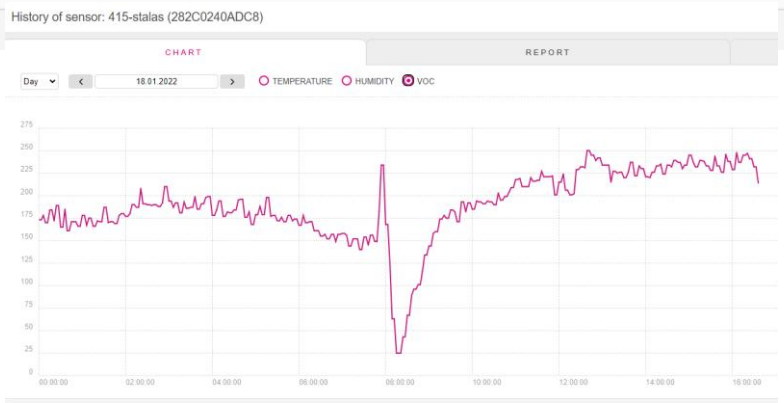
Sensors

Settings

Sensors list

Serial number↑	Status	Values	Signal	Period
415-laukas 282C0240ADC4	✓	3.4 °C 47 % 71 IAQ	-62 dBm	3m
415-stalas 282C0240ADC8	✓	26.4 °C 16 % 232 [IAQ] (not calibrated)	-38 dBm	3m
417-Jurgitos 282C0240ADC9	✓	26.7 °C 21 % 236 IAQ	-69 dBm	3m
415-spinta 282C0240ADD1	✓	25.9 °C 18 % 200 IAQ	-49 dBm	3m
416-Egles 282C0240ADD3	✓	25.9 °C 28 % 240 [IAQ] (not calibrated)	-68 dBm	3m

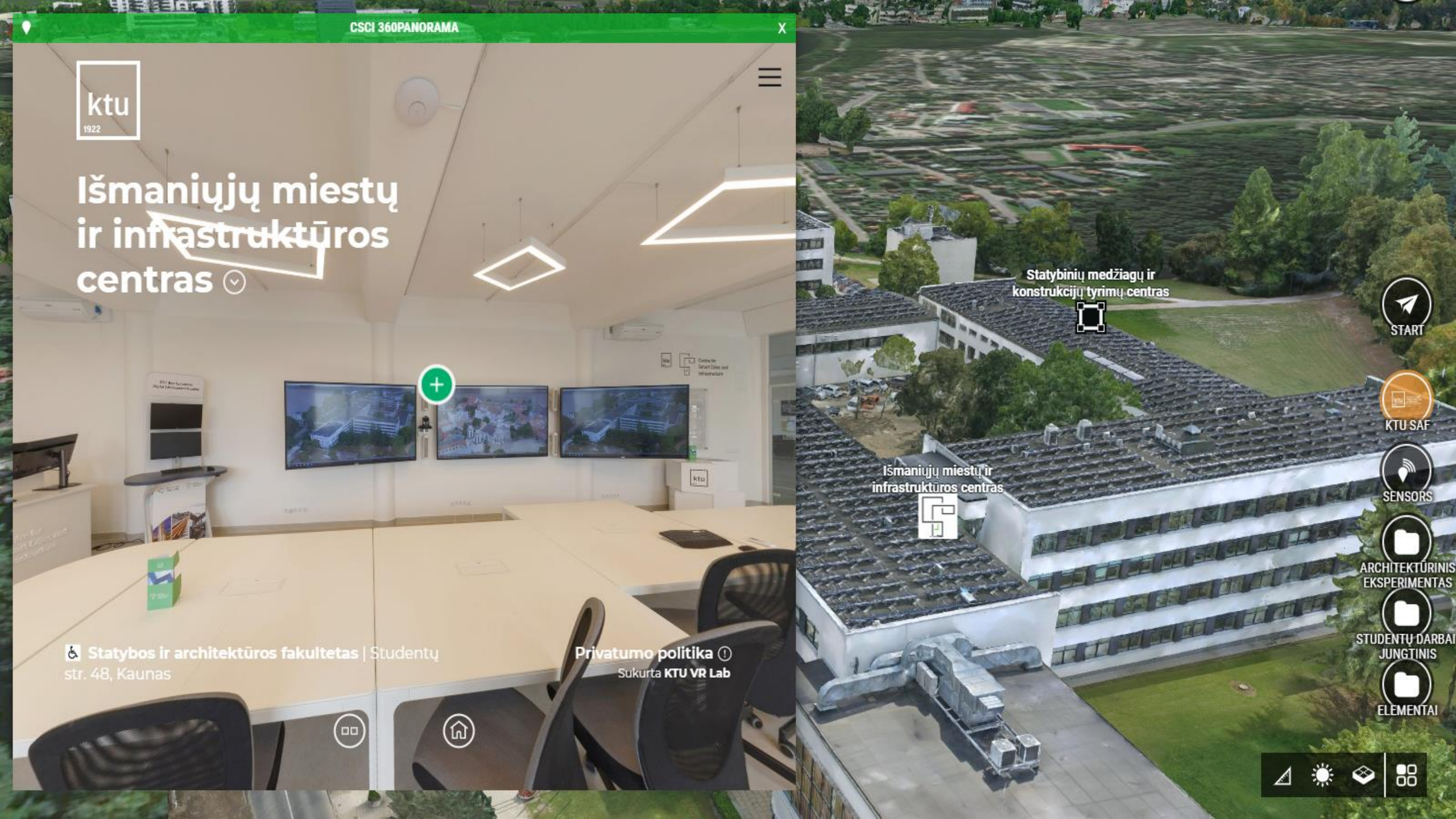




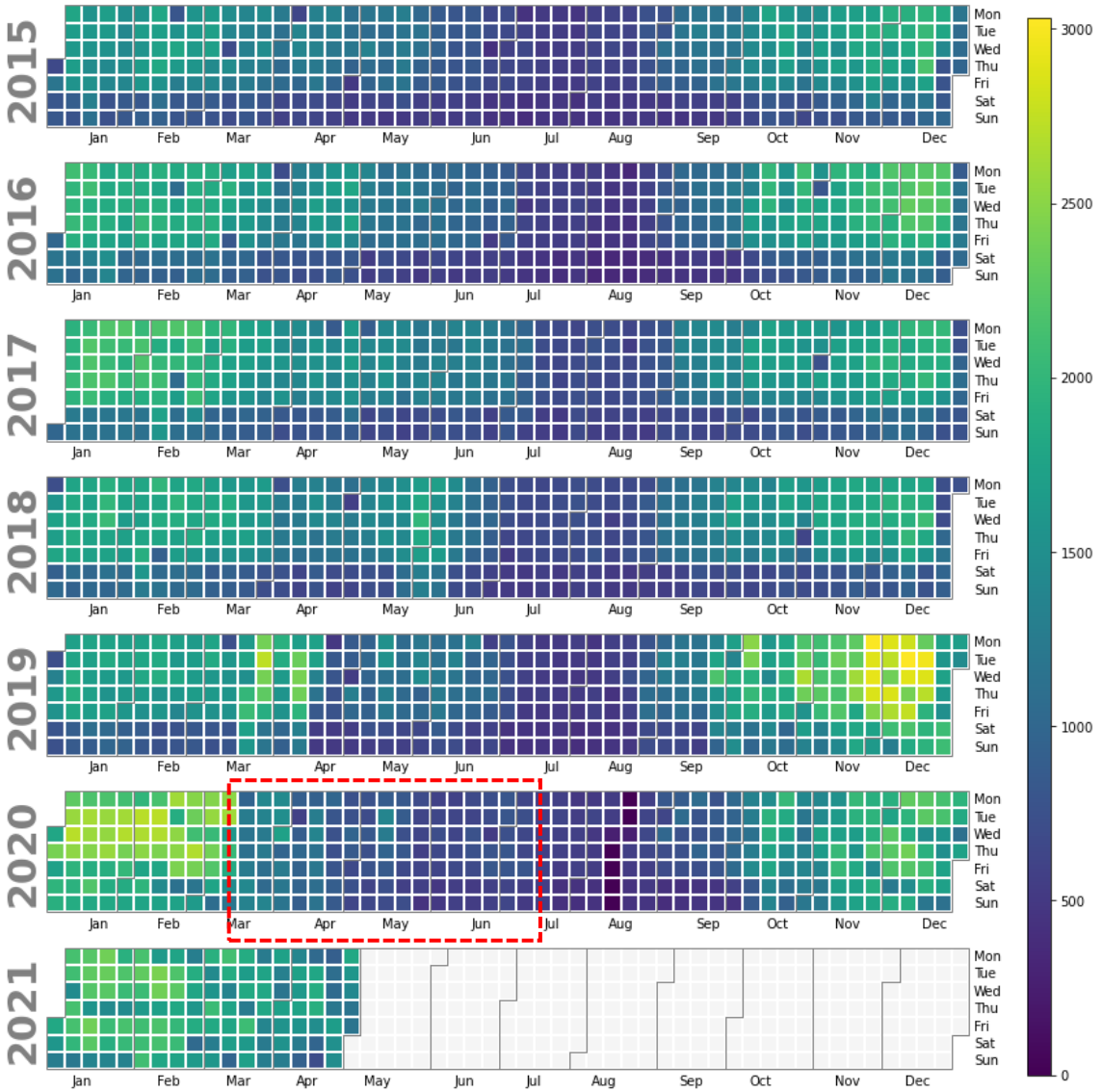
Mlab iModel in iTwin

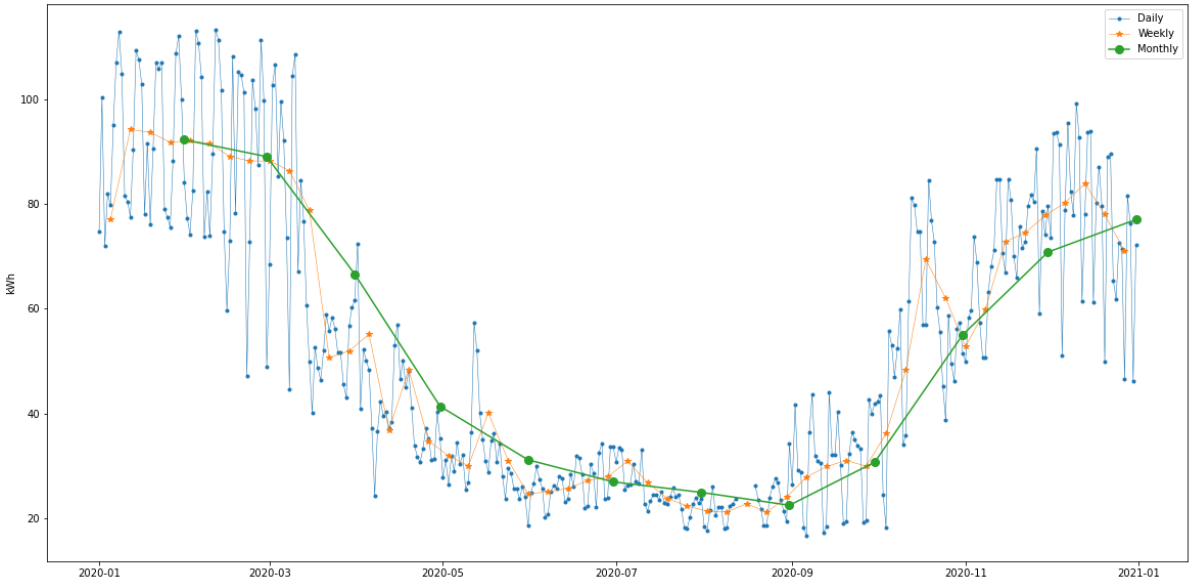
CO2, PPM _ 436 CLASSROOM
X
KTU CSCI CO2
2021-03-26 06:32:11 to 2021-04-02 06:32:11
PV
All
dfrobot - co2
540
520
500
480
460
440
420
400
03/27
03/28
03/29
03/30
03/31
04/01
04/02
dfrobot - co2

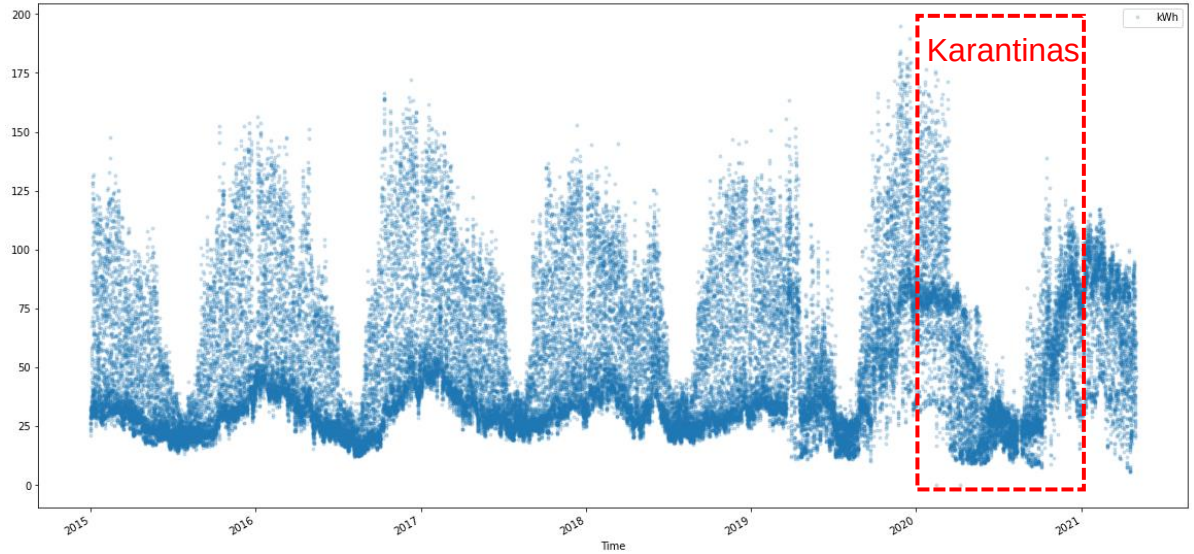
Solar radiation
CO2_class-436
Atmospheric pressure
Temperature


CSCI 360PANORAMA
X
ktu
1922
Išmaniųjų miestų ir infrastruktūros centras
Statybos ir architektūros fakultetas | Studentų str. 48, Kaunas
Privatumo politika
Sukurta KTU VR Lab
Statybinių medžiagų ir konstrukcijų tyrimų centras
Išmaniųjų miestų ir infrastruktūros centras
START
KTU SAF
SENSORS
ARCHITEKTŪRINIS EKSPERIMENTAS
STUDENTŲ DARBAI JUNGTINIS
ELEMENTAI

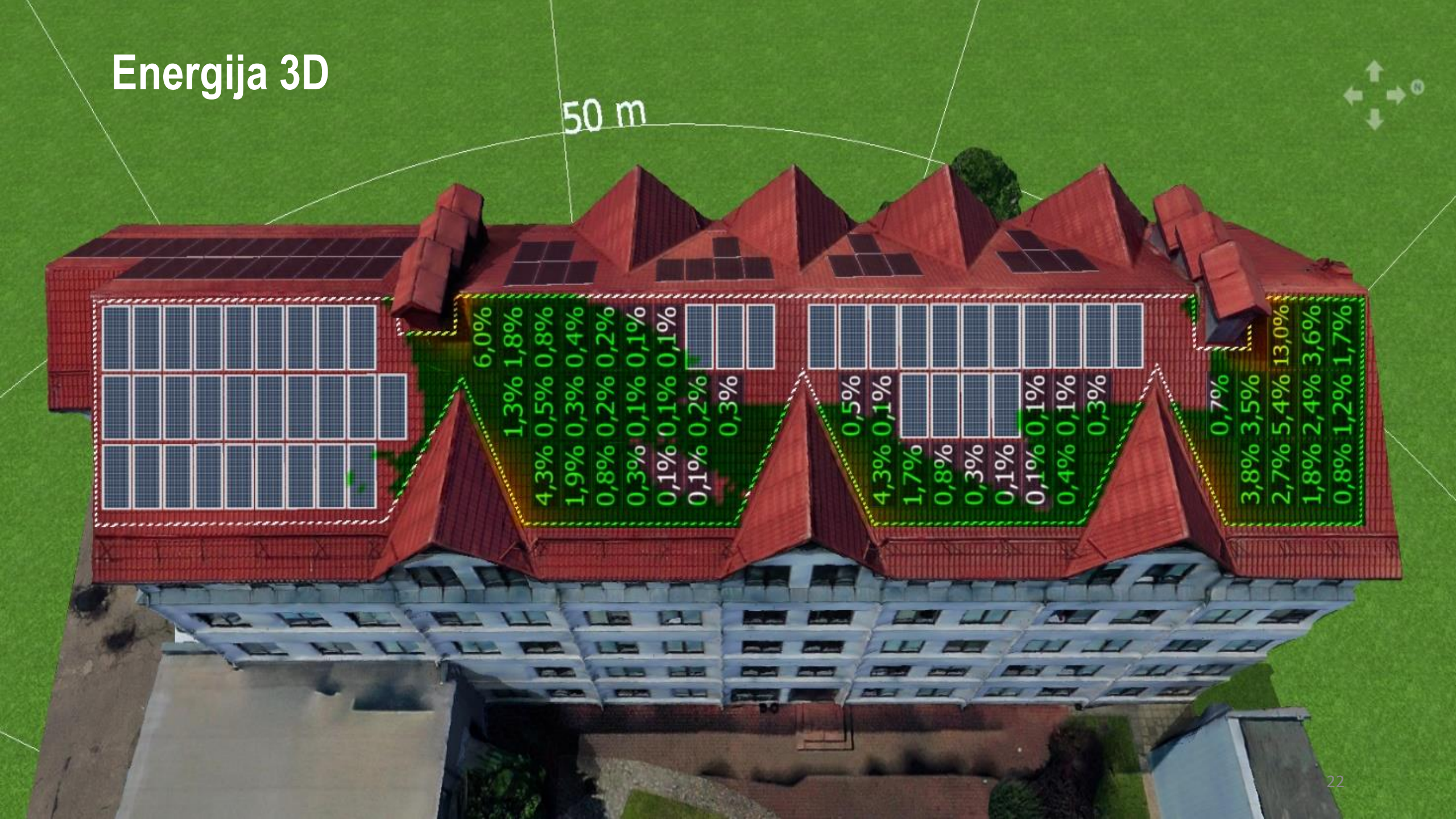
Studentų g.48 pastato skaitmeninio dvynio projektas. Duomenų analitika



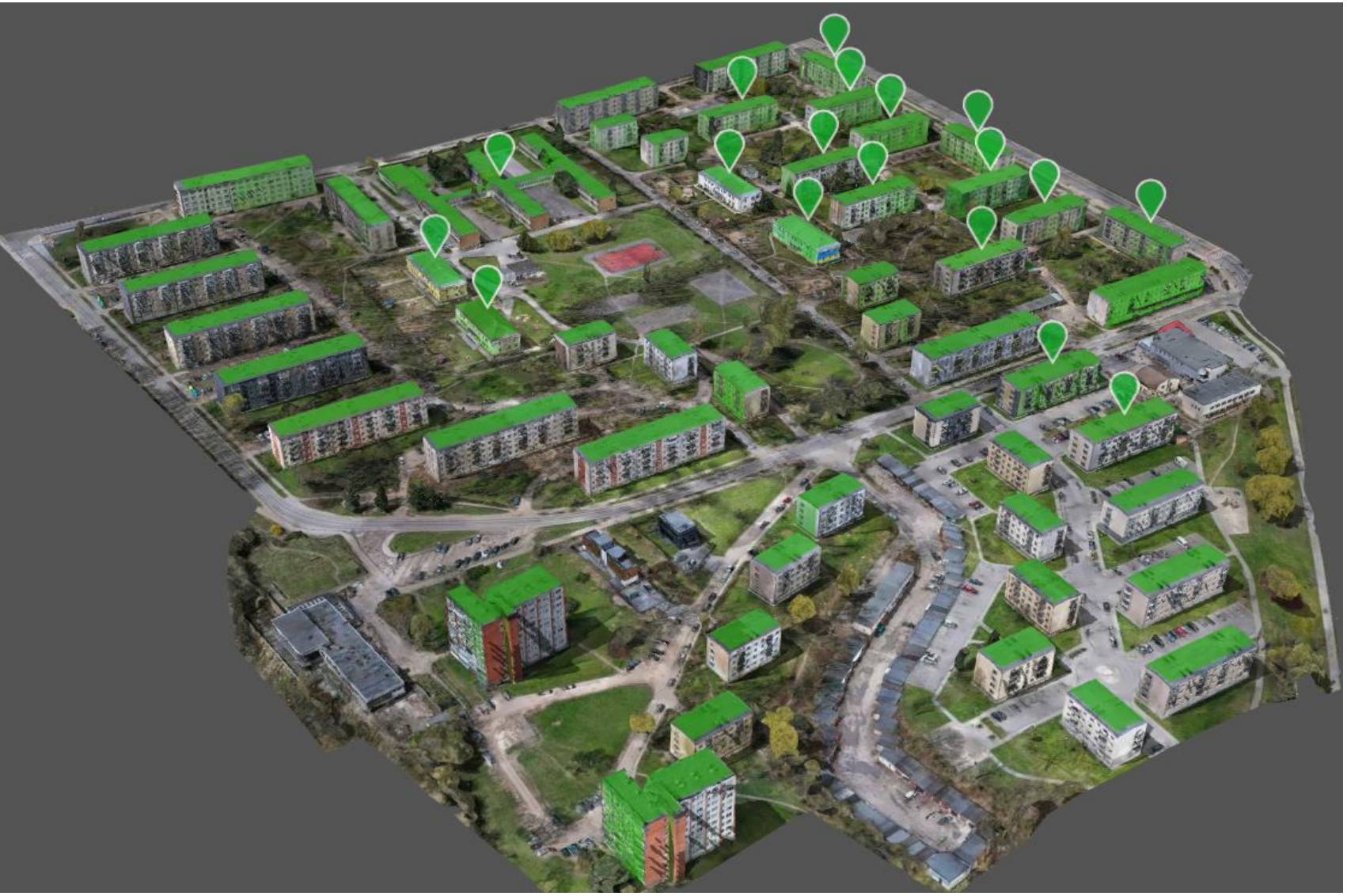


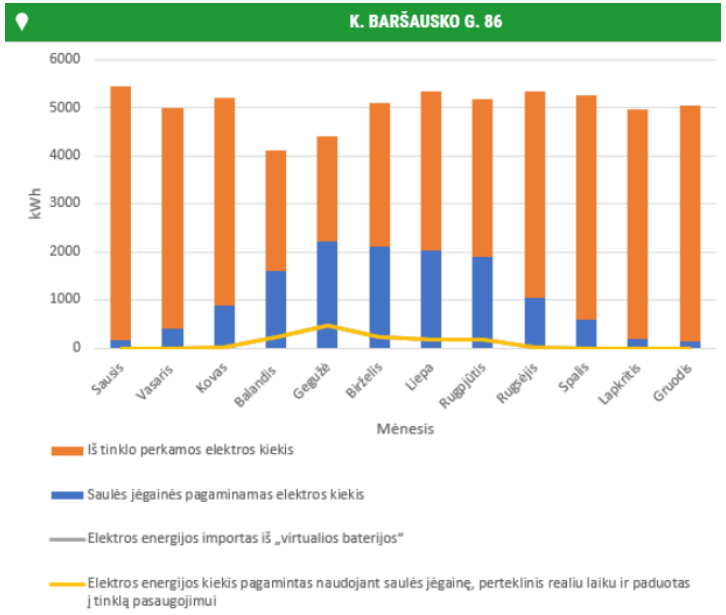


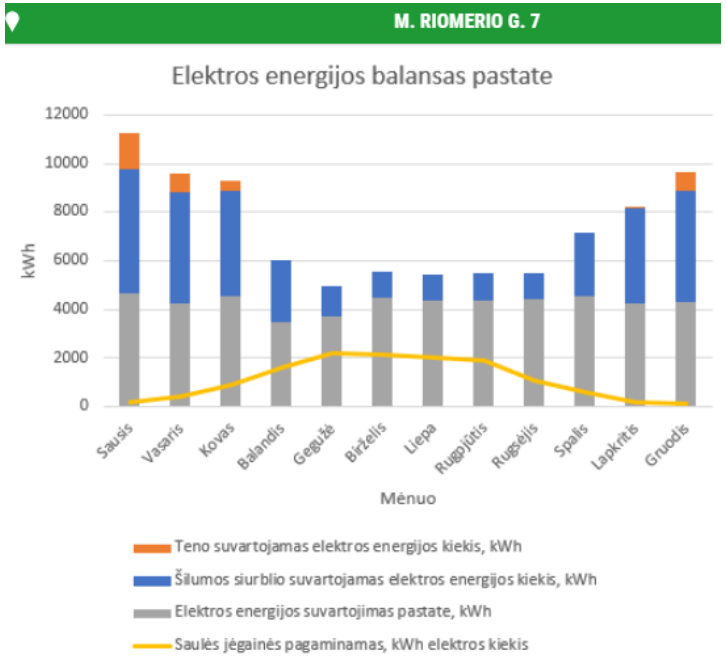
Energija 3D


50 m
6,0% 1,8% 0,8% 0,4% 0,2% 0,1% 0,1%
1,3% 0,5% 0,3% 0,2% 0,1% 0,1% 0,2% 0,3%
4,3% 1,9% 0,8% 0,3% 0,1% 0,1%
0,5% 0,1% 1,7% 0,8% 0,3% 0,1% 0,1% 0,4% 0,1% 0,3%
4,3%
0,7% 3,8% 3,5% 2,7% 5,4% 13,0% 1,8% 2,4% 3,6% 0,8% 1,2% 1,7%

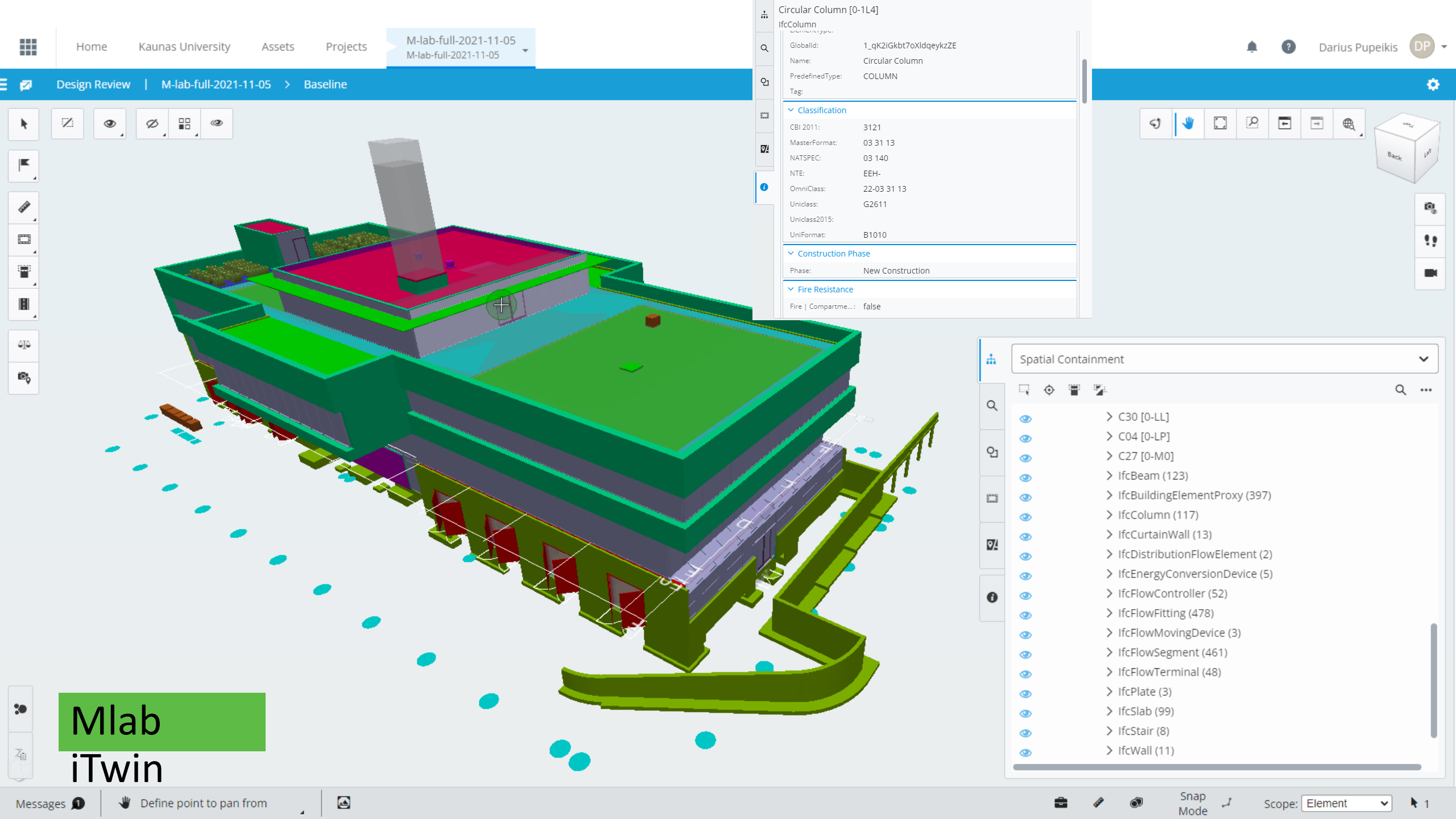
E-modernization



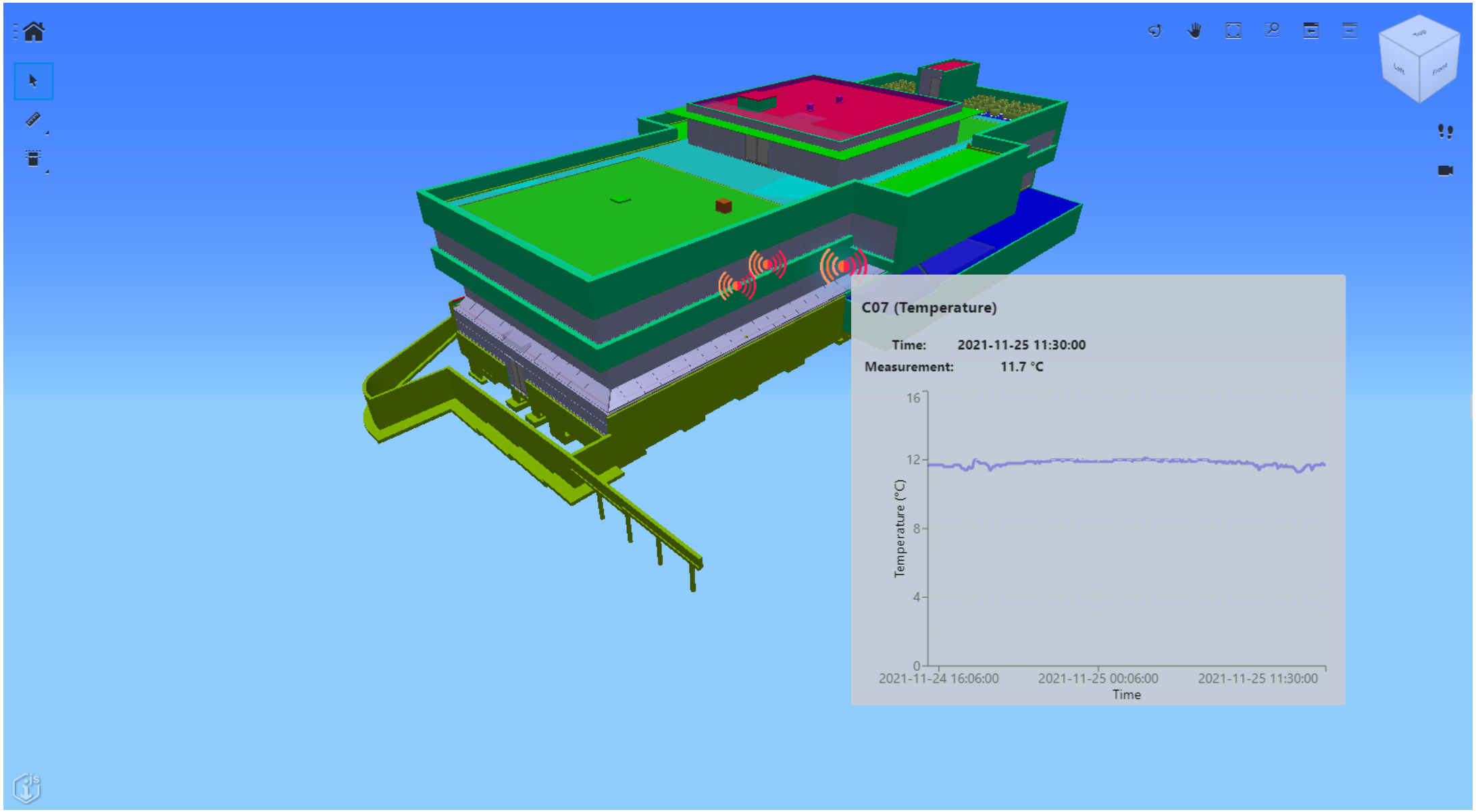




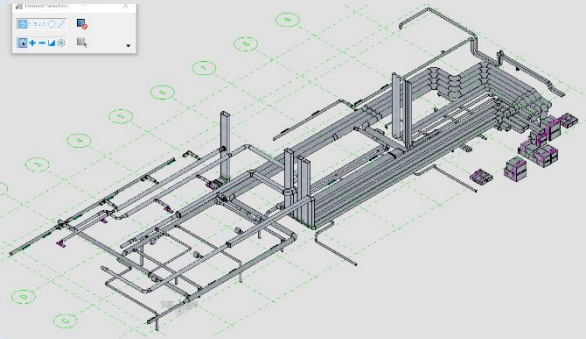
https://eu.opencitiesplanner.bentley.com/www_ktu_edu/e-modernizacija

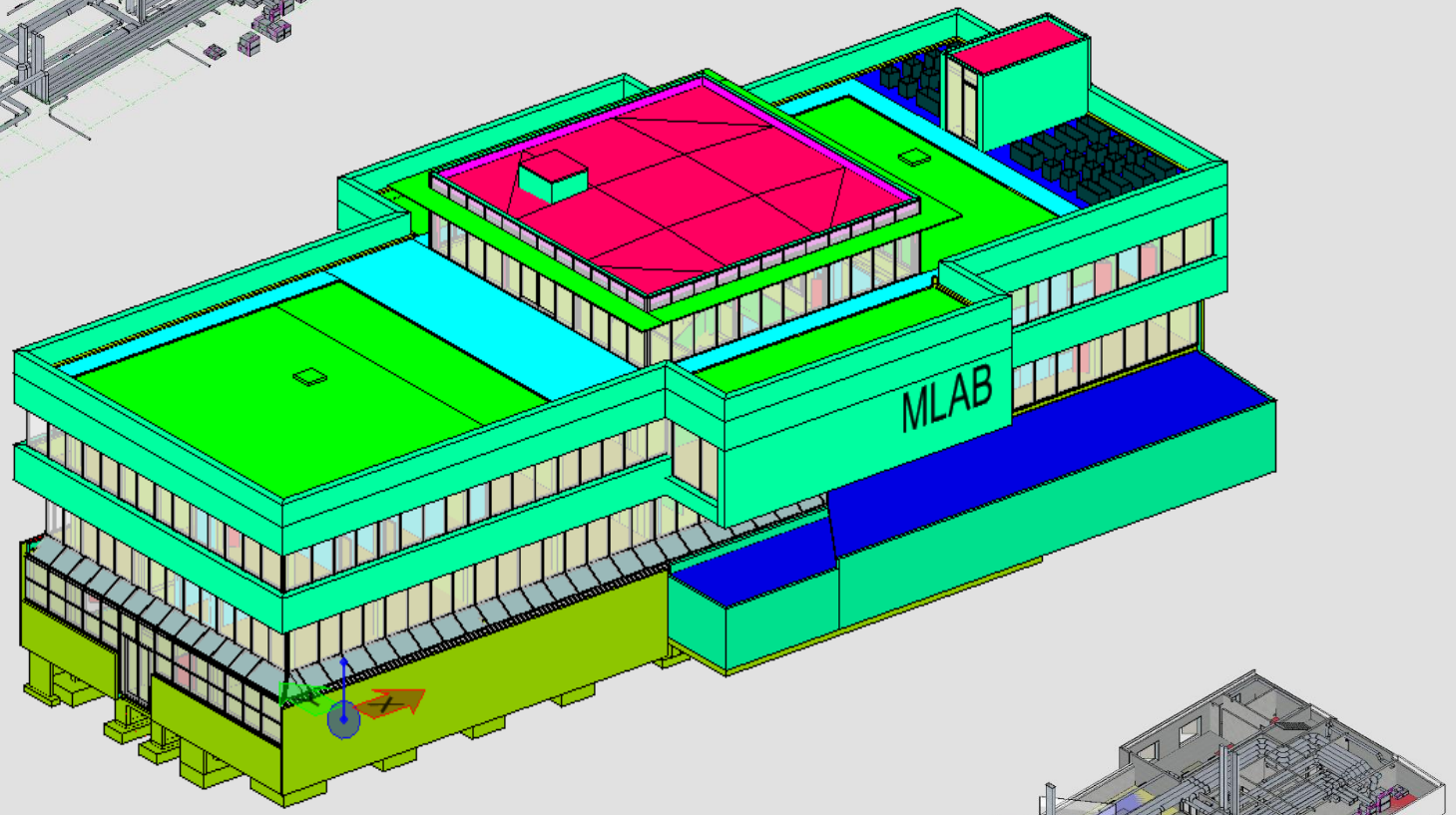

Home
Kaunas University
Assets
Projects
M-lab-full-2021-11-05
M-lab-full-2021-11-05
Darius Pupeikis
Design Review | M-lab-full-2021-11-05 > Baseline
Circular Column [0-1L4]
IfcColumn
GlobalId: 1_qK2iGkbt7oXldqeykzZE
Name: Circular Column
PredefinedType: COLUMN
Tag:
Classification
CBI 2011: 3121
MasterFormat: 03 31 13
NATSPEC: 03 140
NTE: EEH-
OmniClass: 22-03 31 13
Uniclass: G2611
Uniclass2015:
UniFormat: B1010
Construction Phase
Phase: New Construction
Fire Resistance
Fire | Compartme...: false
Spatial Containment
C30 [0-LL]
C04 [0-LP]
C27 [0-M0]
IfcBeam (123)
IfcBuildingElementProxy (397)
IfcColumn (117)
IfcCurtainWall (13)
IfcDistributionFlowElement (2)
IfcEnergyConversionDevice (5)
IfcFlowController (52)
IfcFlowFitting (478)
IfcFlowMovingDevice (3)
IfcFlowSegment (461)
IfcFlowTerminal (48)
IfcPlate (3)
IfcSlab (99)
IfcStair (8)
IfcWall (11)
Mlab
iTwin
Messages
Define point to pan from
Snap Mode
Scope: Element

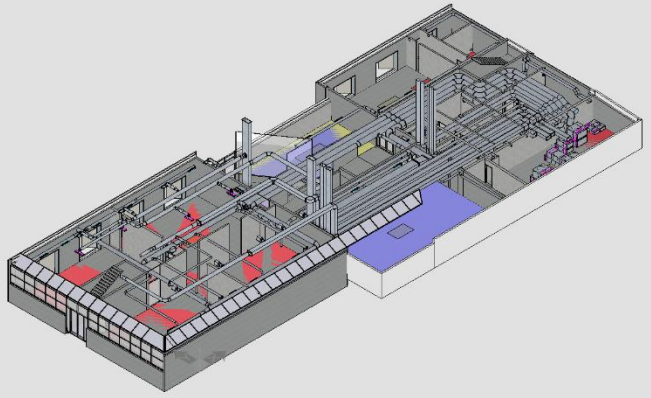
MLAB project. Live IoT data from Efento sensors in iTwin

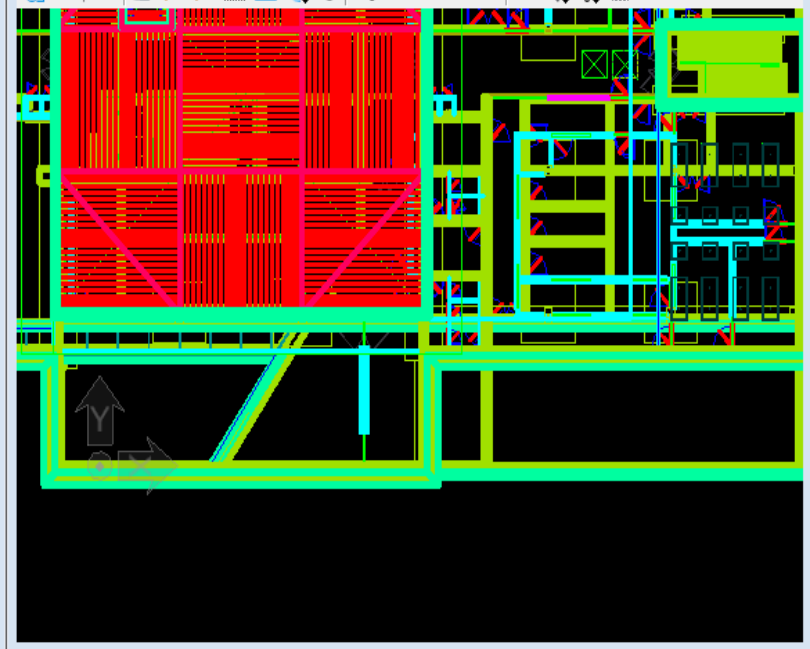


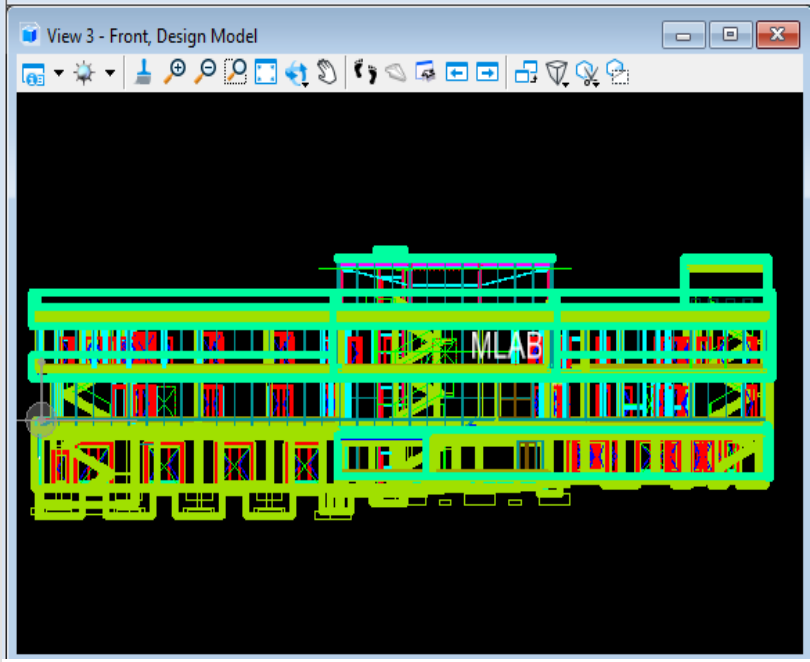
Mlab projektas – Studentų g. 63A, KTU studentų miestelis





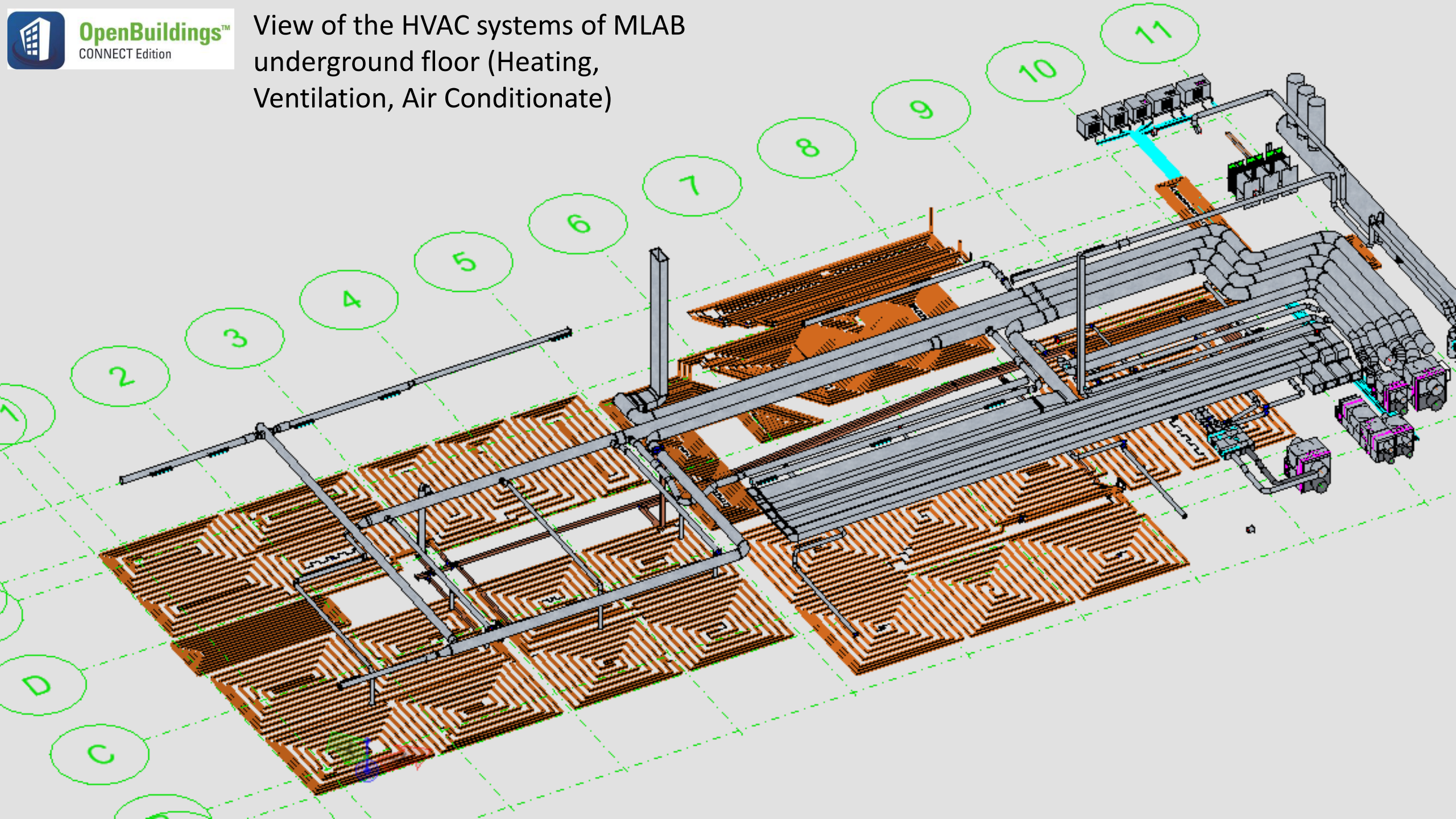




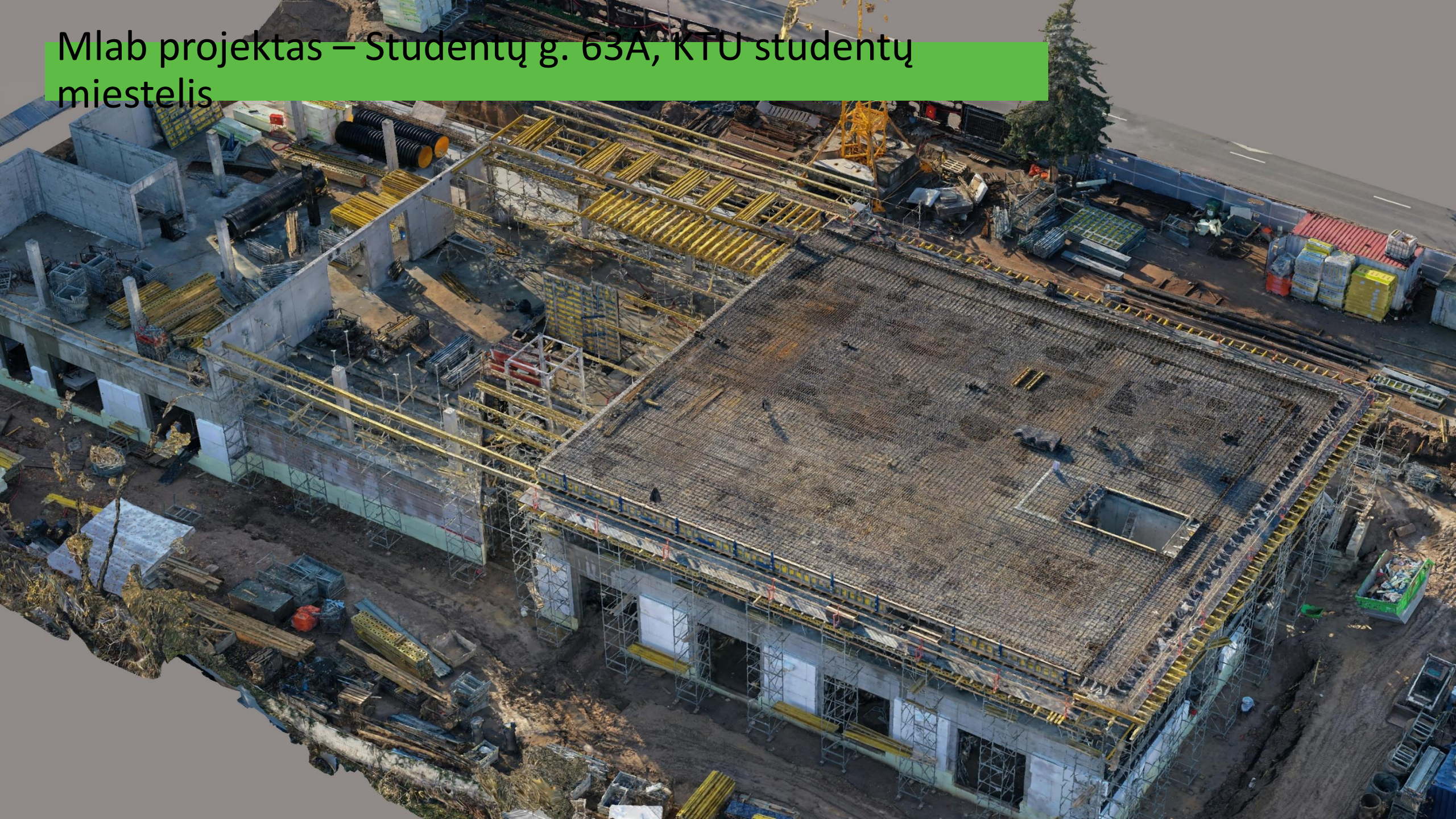


OpenBuildings™ CONNECT Edition

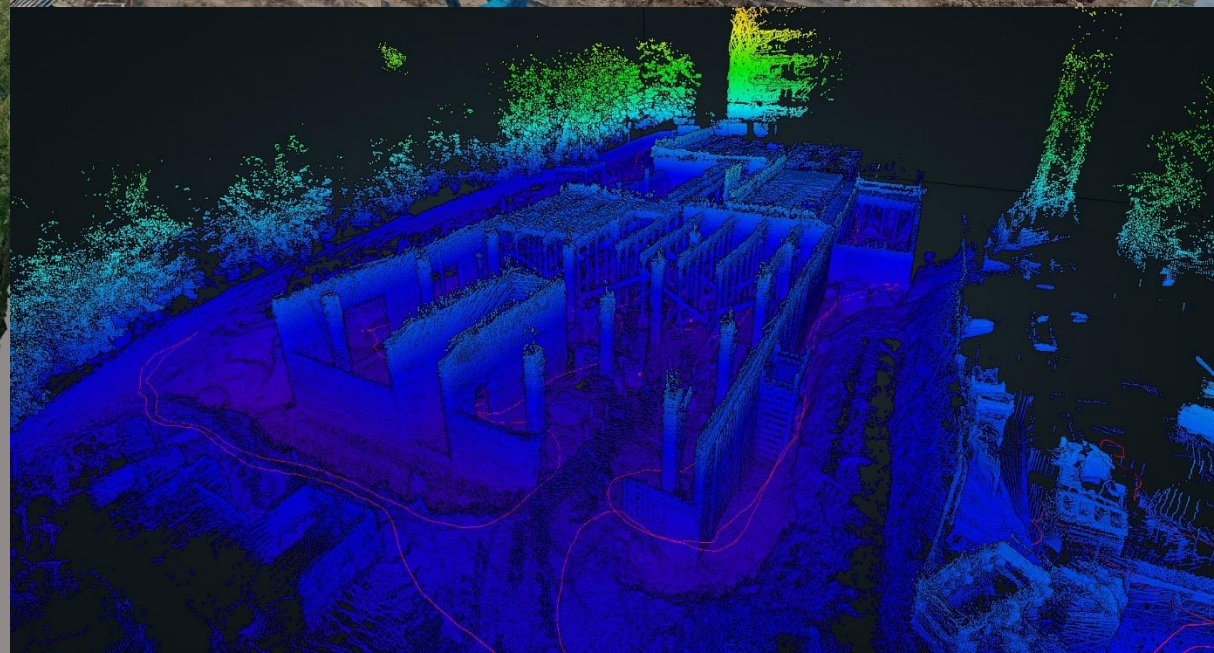
View of the HVAC systems of MLAB underground floor (Heating, Ventilation, Air Conditionate)



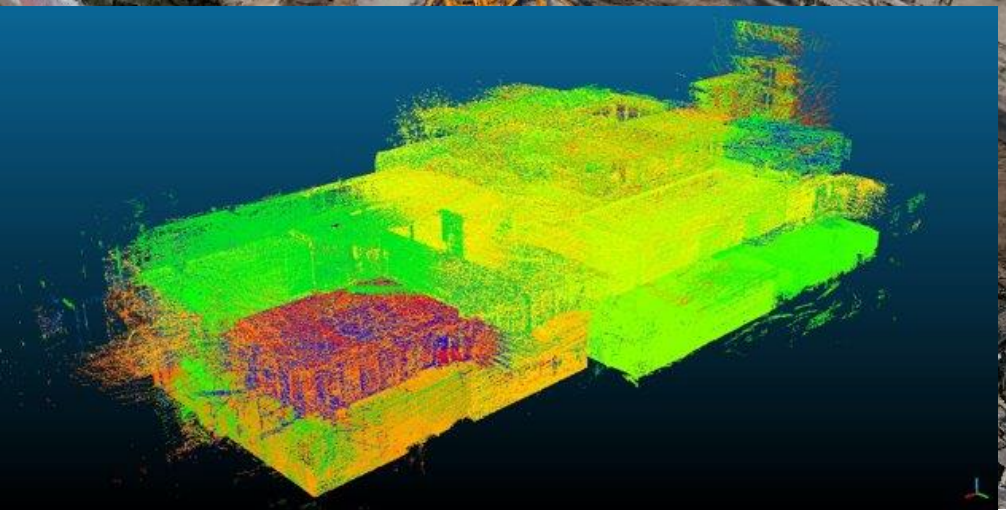
Mlab projektas – Studentų g. 63A, KTU studentų miestelis



Mlab projektas – Studentų g. 63A, KTU studentų miestelis

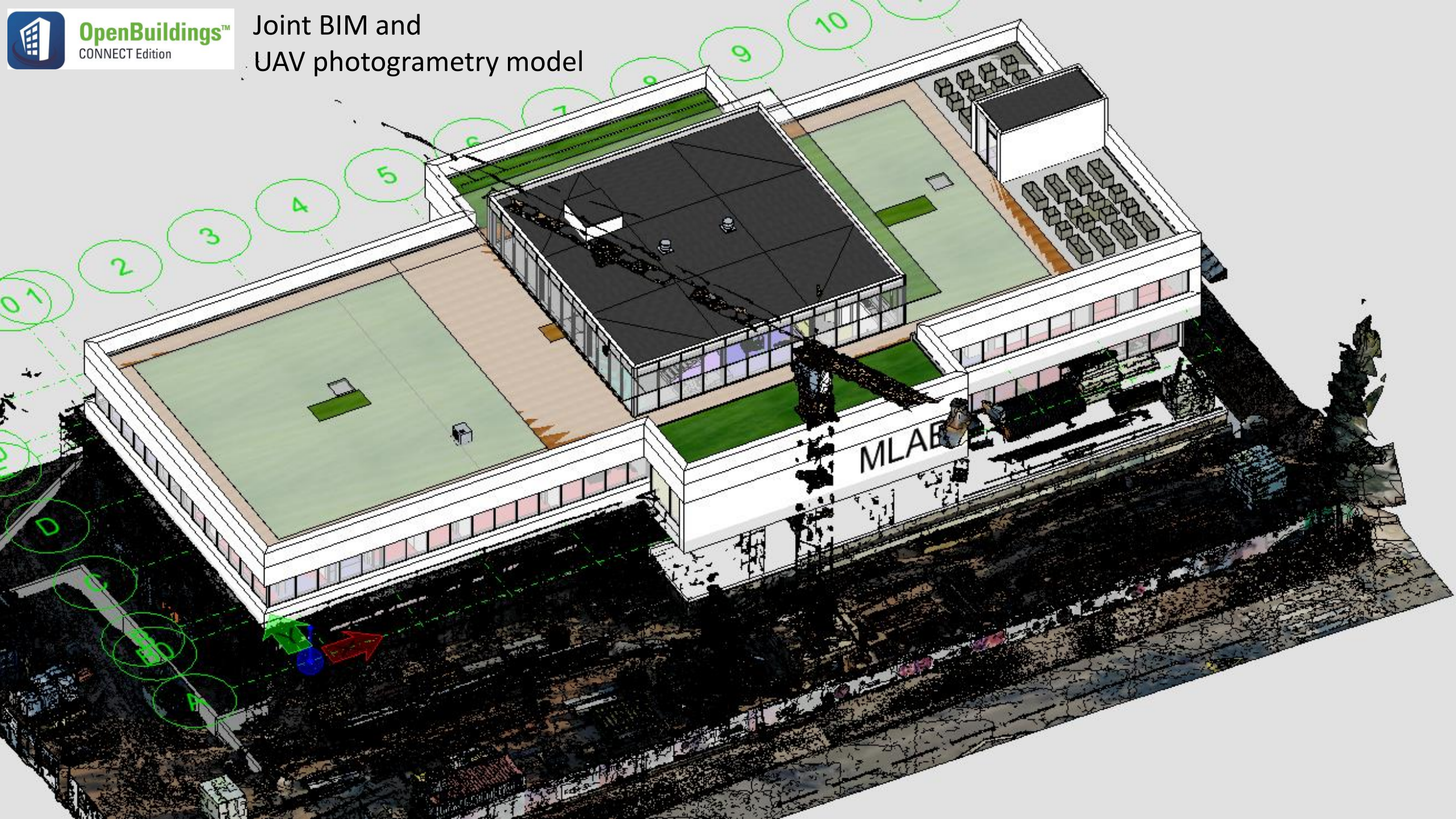


MLAB project – Studentų str. 63A, KTU Campus



OpenBuildings™ CONNECT Edition

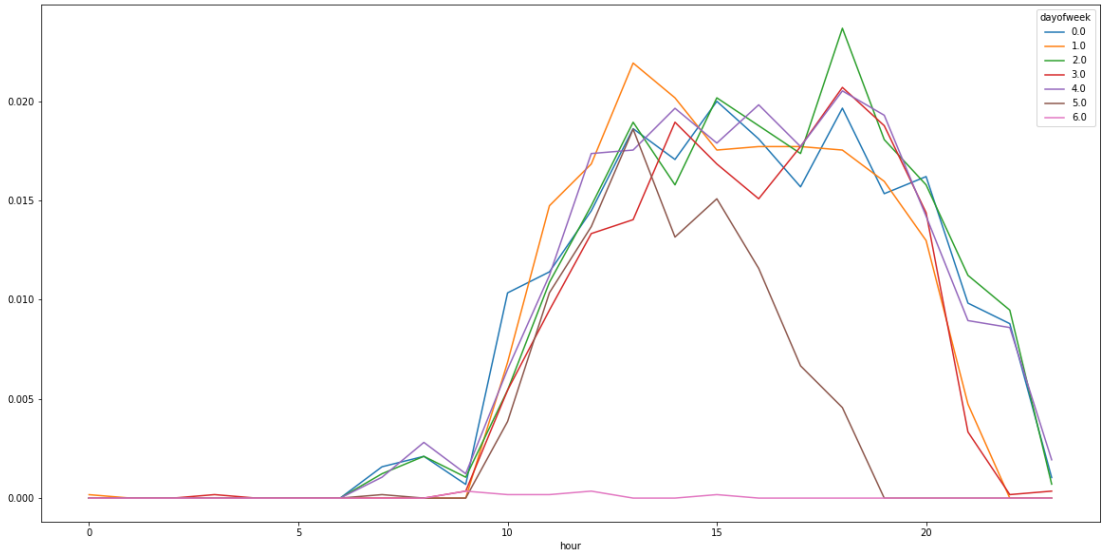
Joint BIM and UAV photogrametry model

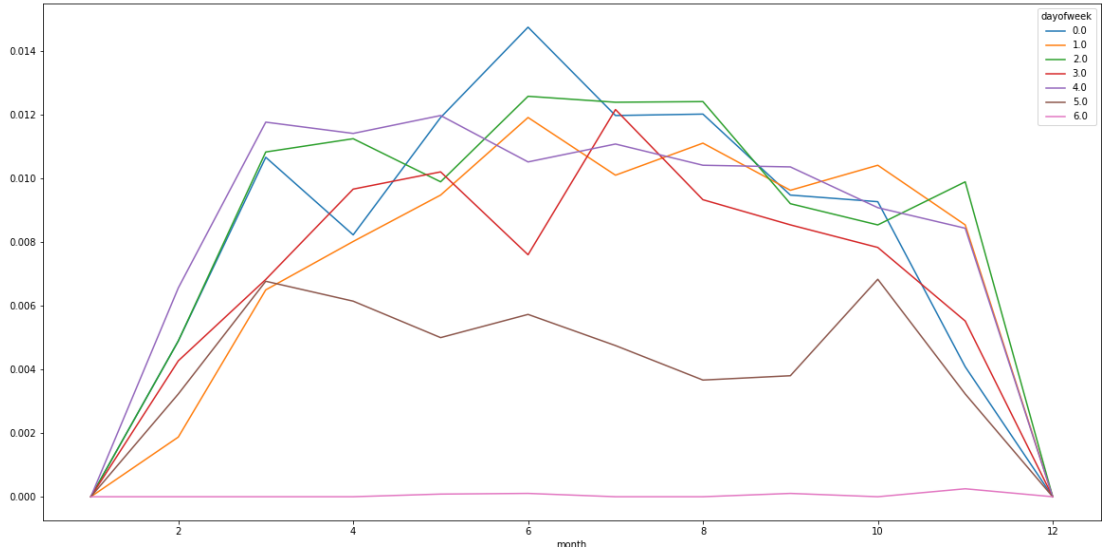


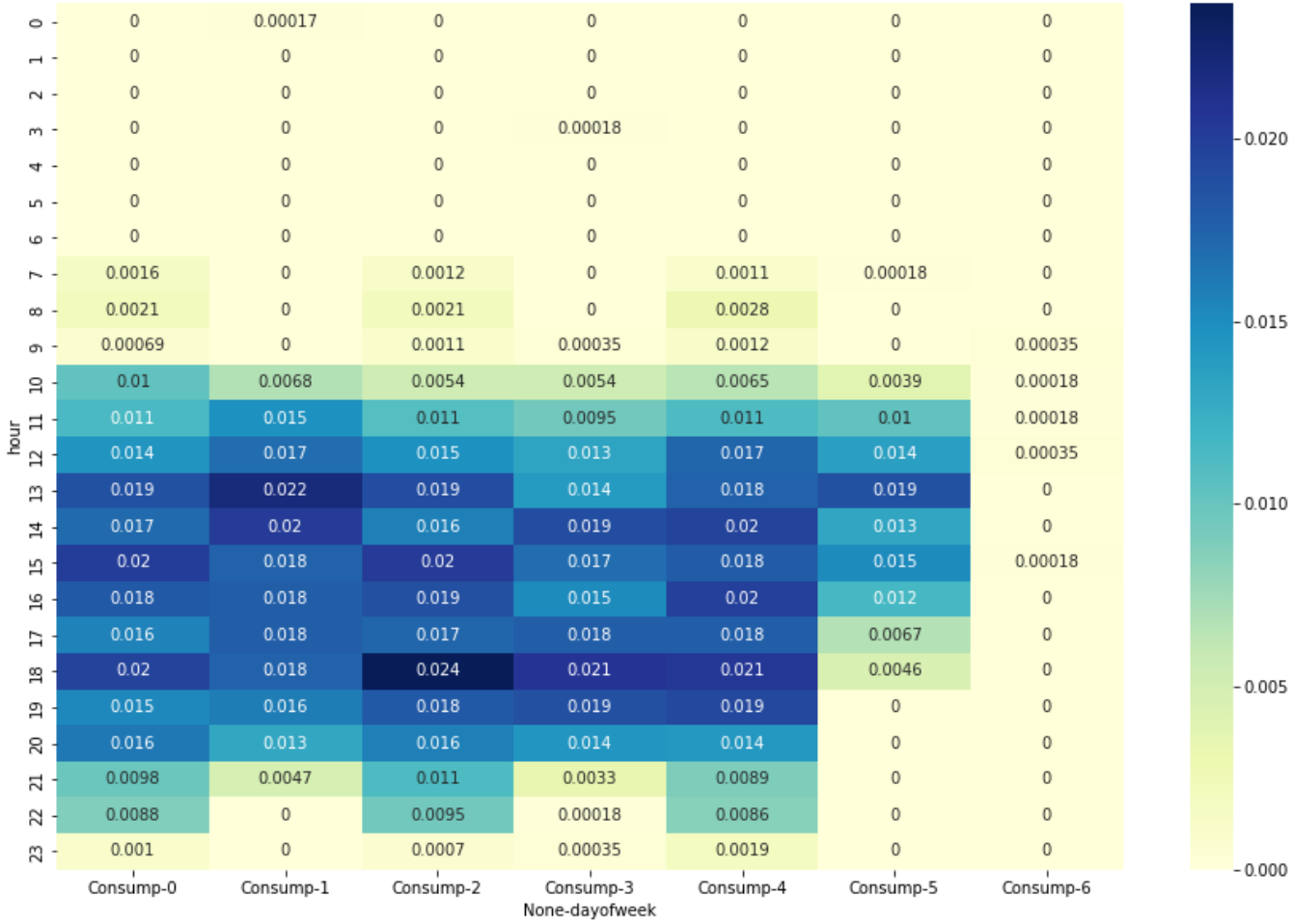
Taškų debesies grupavimas

Daugiabučiai gyv. pastatai
K. Baršausko g. Kaune

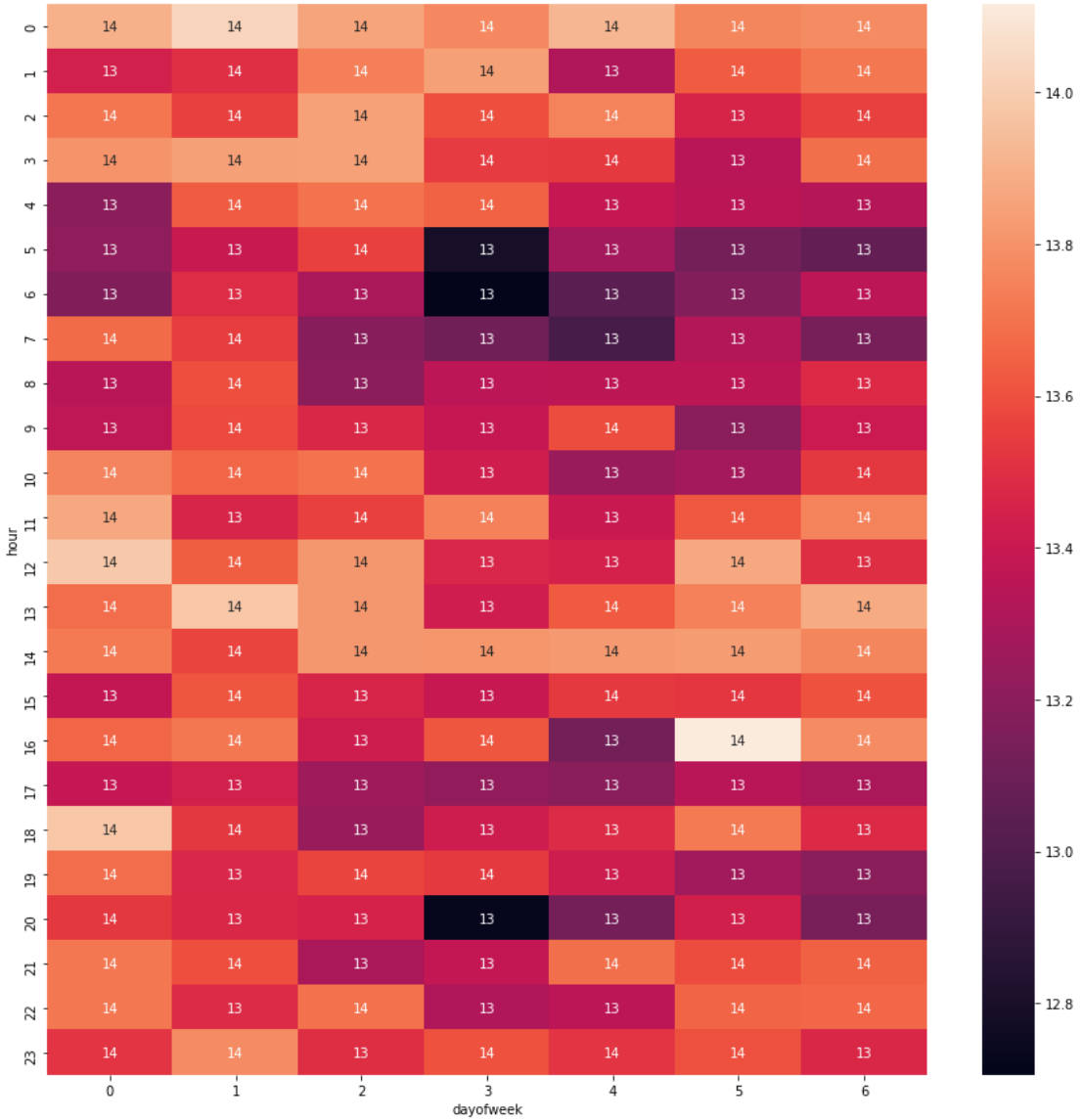
Administracinio pastato Jonavos g. Kaune. Vandens suvartojimas

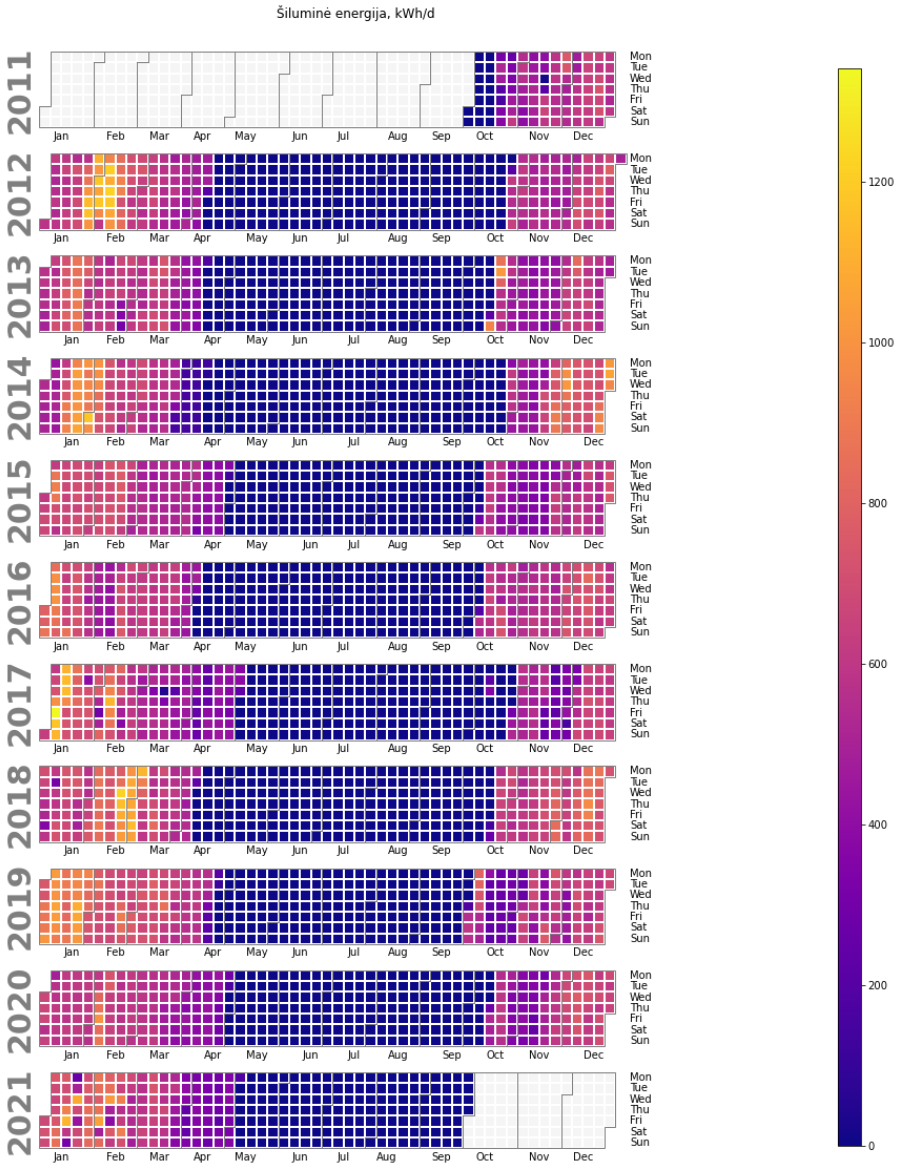




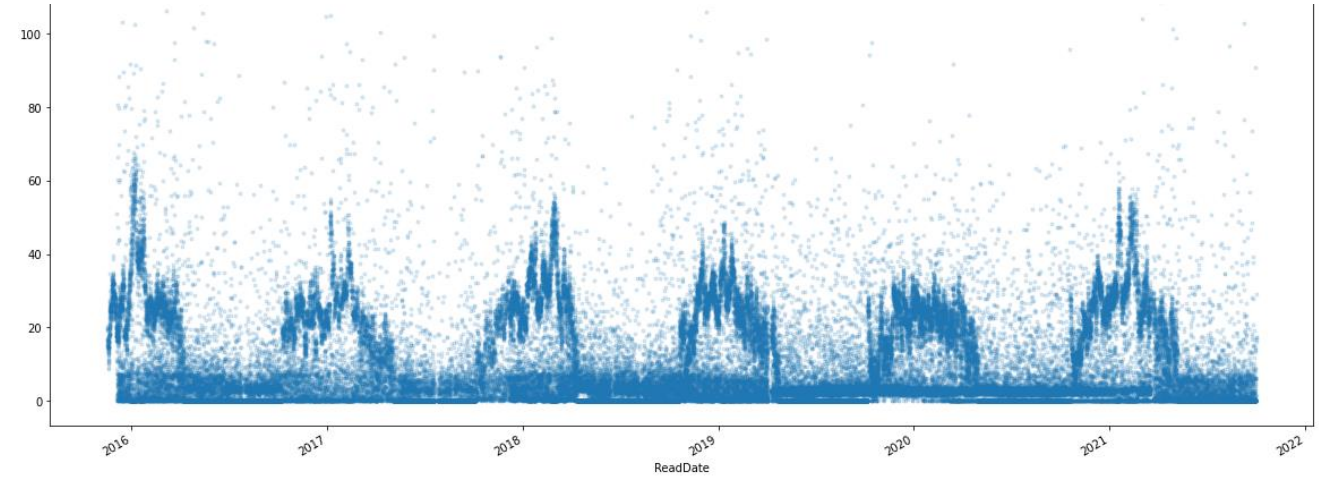


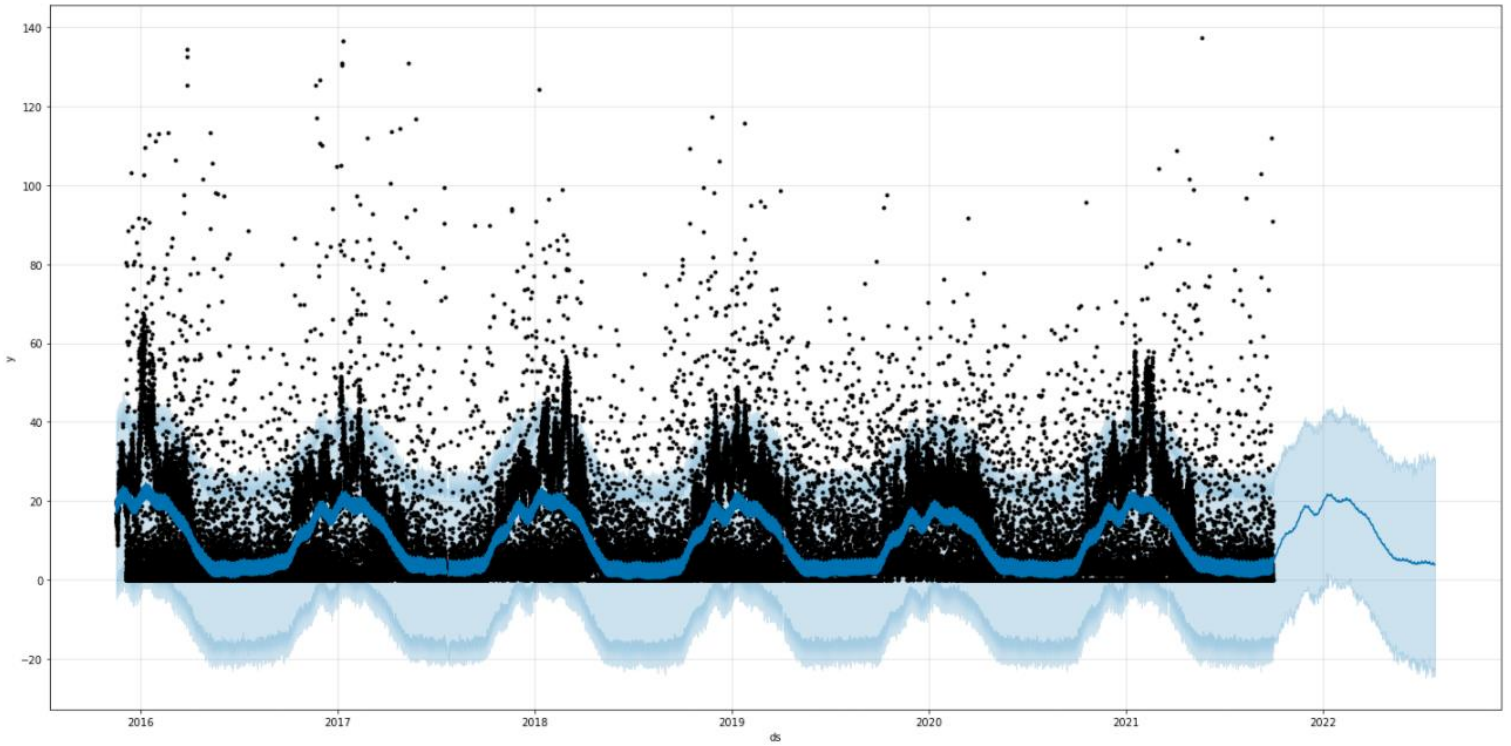
Daugiab. gyv. Past. K. Baršausko g. Kaune. Šiluminė energija šildymui

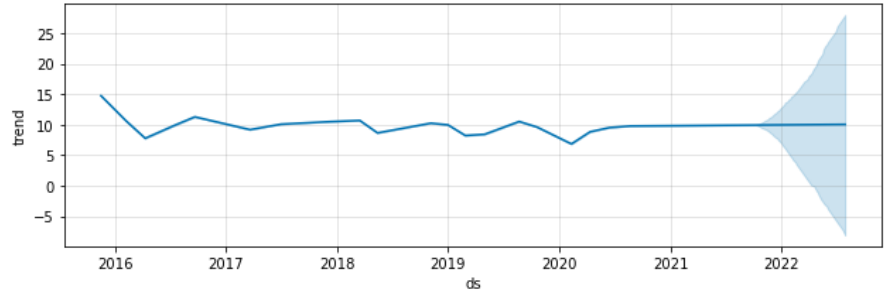


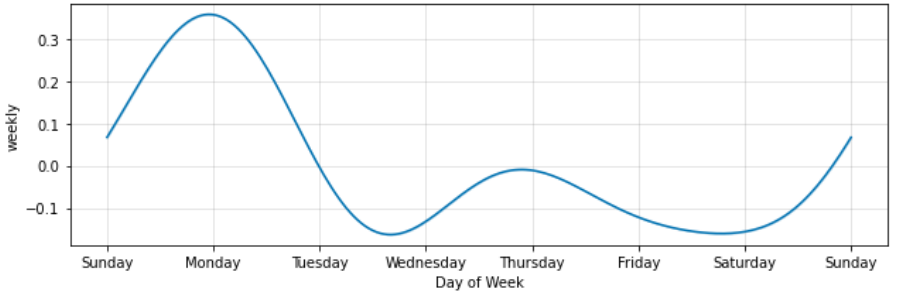


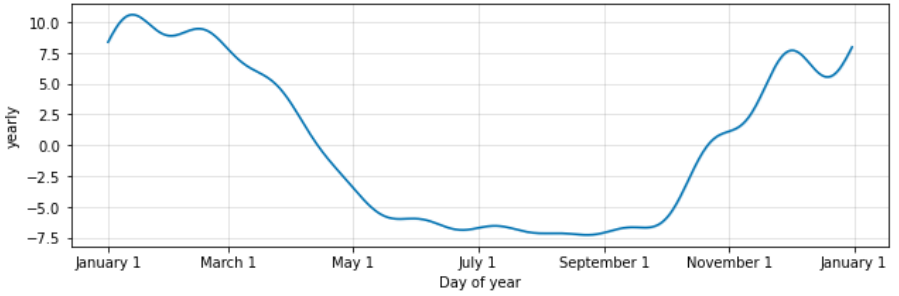
Daugiab. gyv. Past. K. Baršausko pr. Kaune. Šiluminė energija šildymui + KV

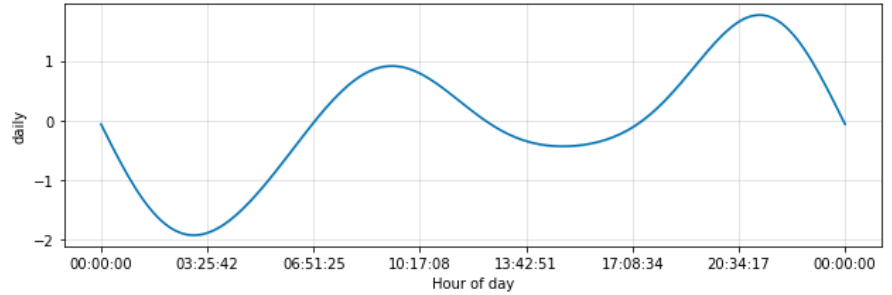




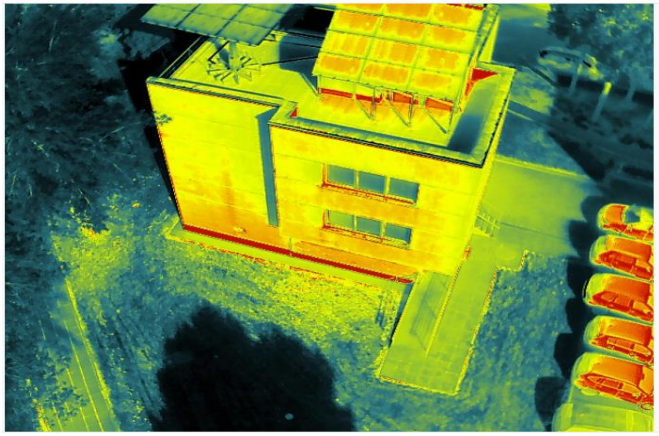




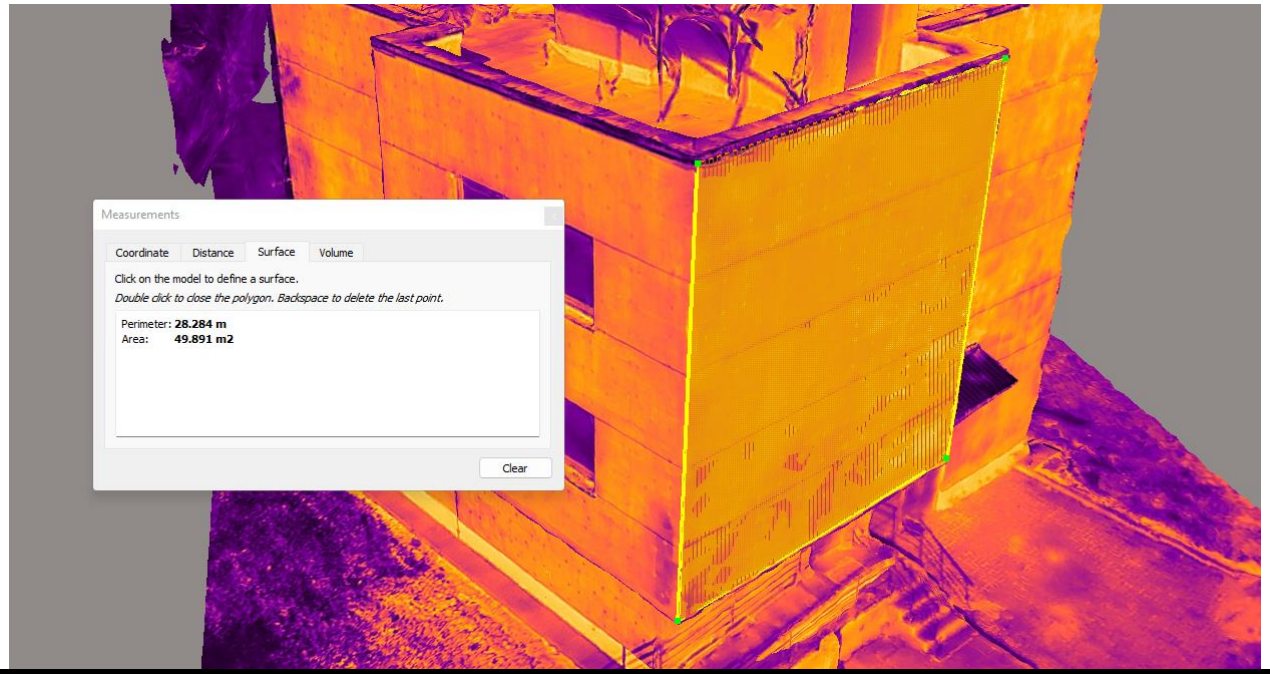


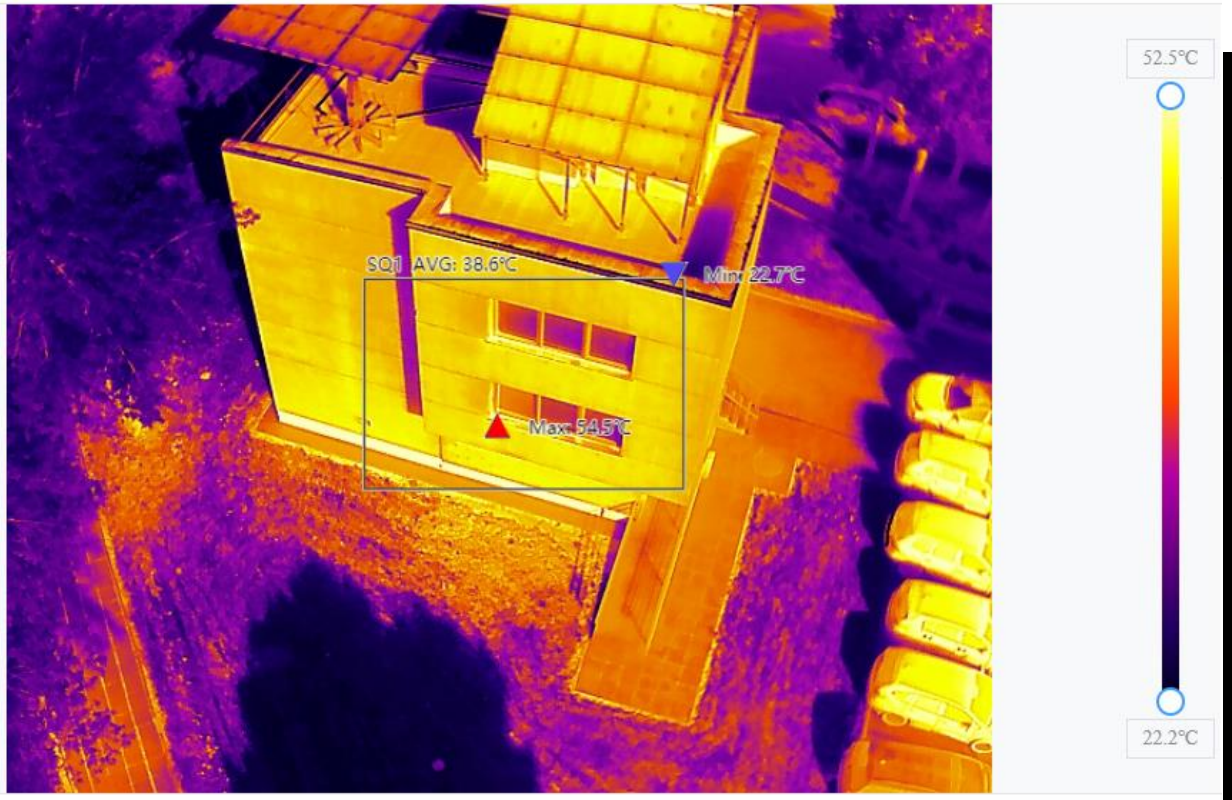


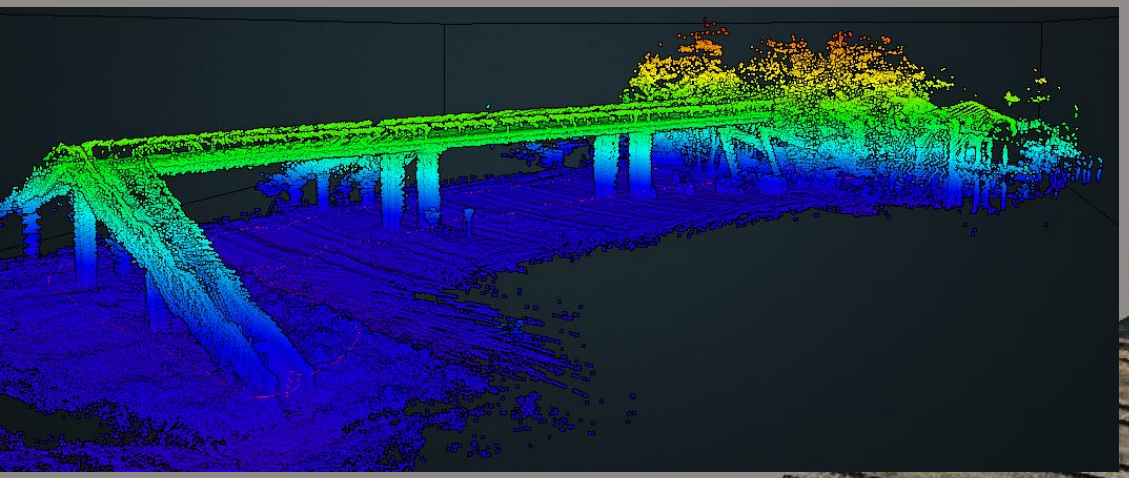
RailBaltica. Tilto per Nerį Jonavoje rekonstrukcija. 3D santvarų matavimai.



Termofotogrametrija

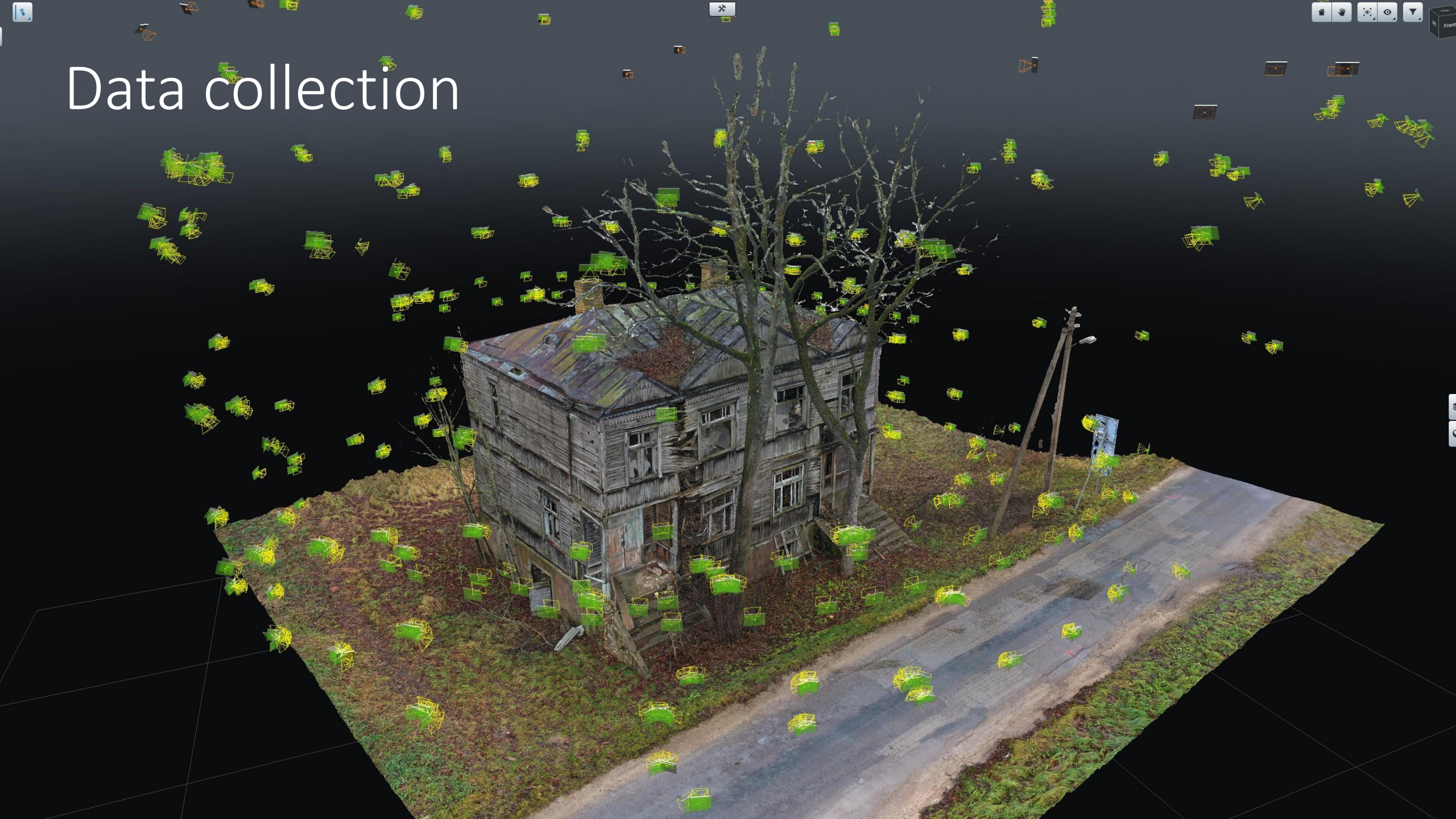




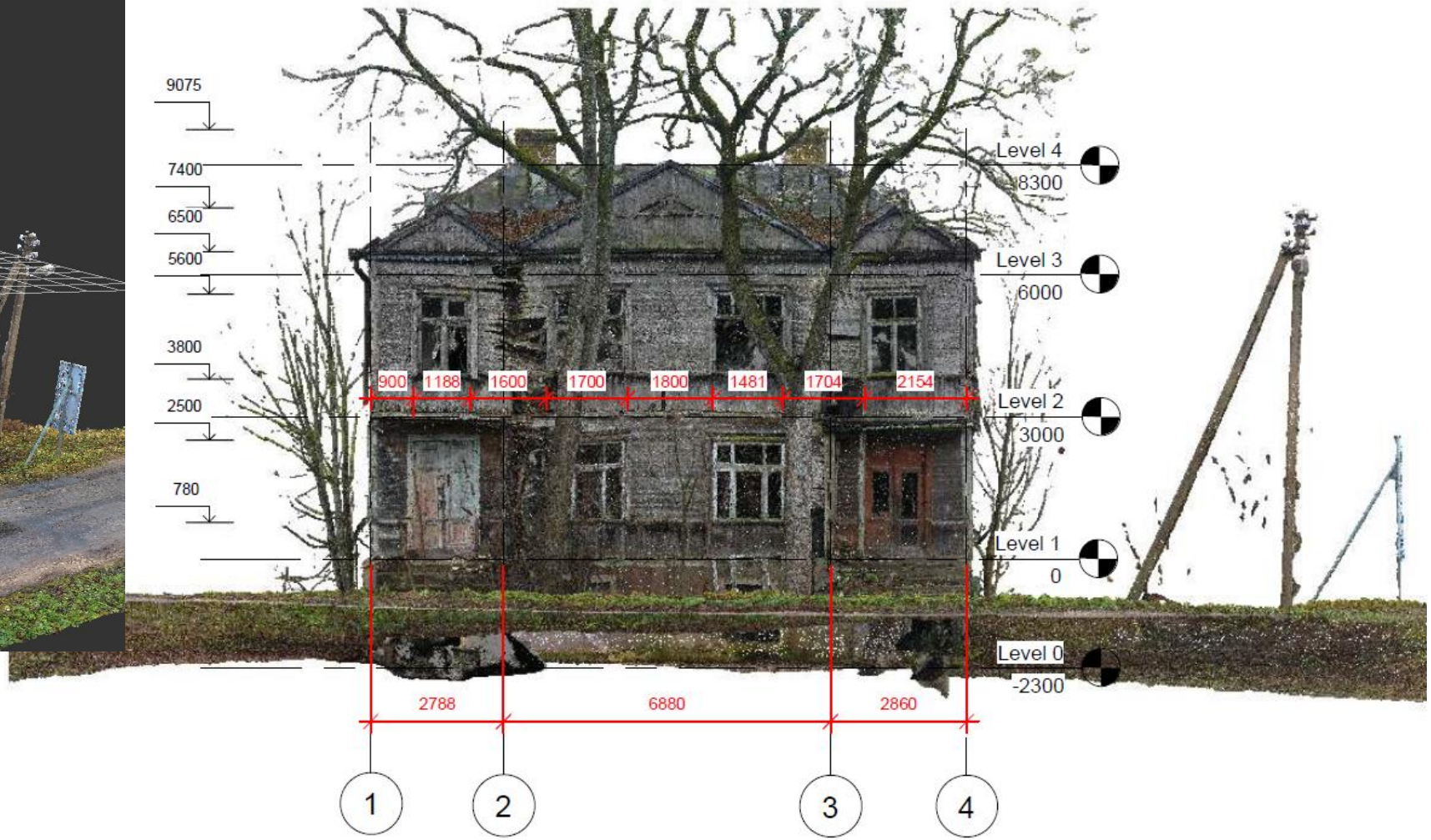


Gaižiūnų geležinkelio tiltas. Konstrukcijų pažaidų detekcija

Data collection



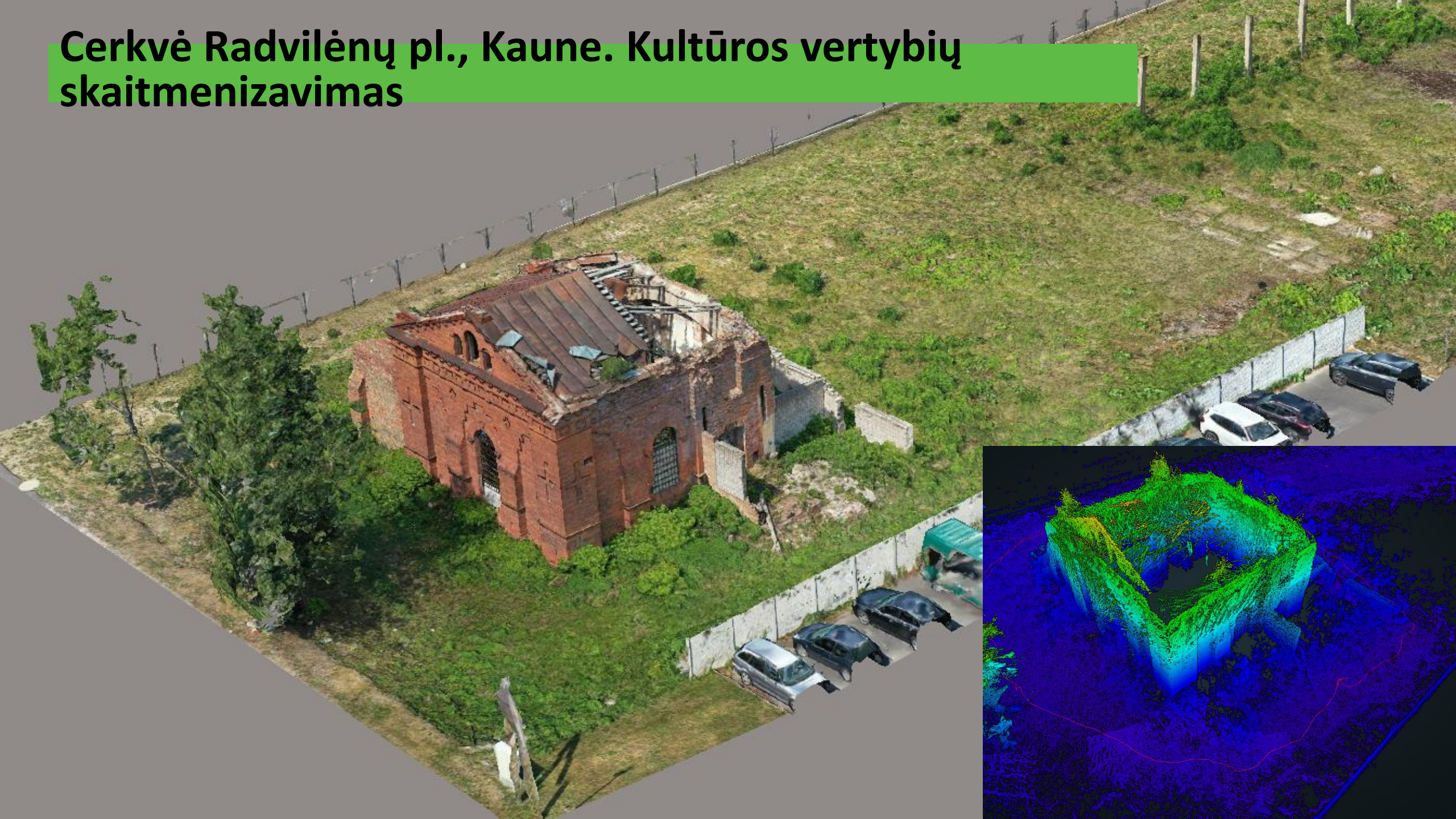
Digi Heritage: Historic Lithuanian customs building at Latvian border



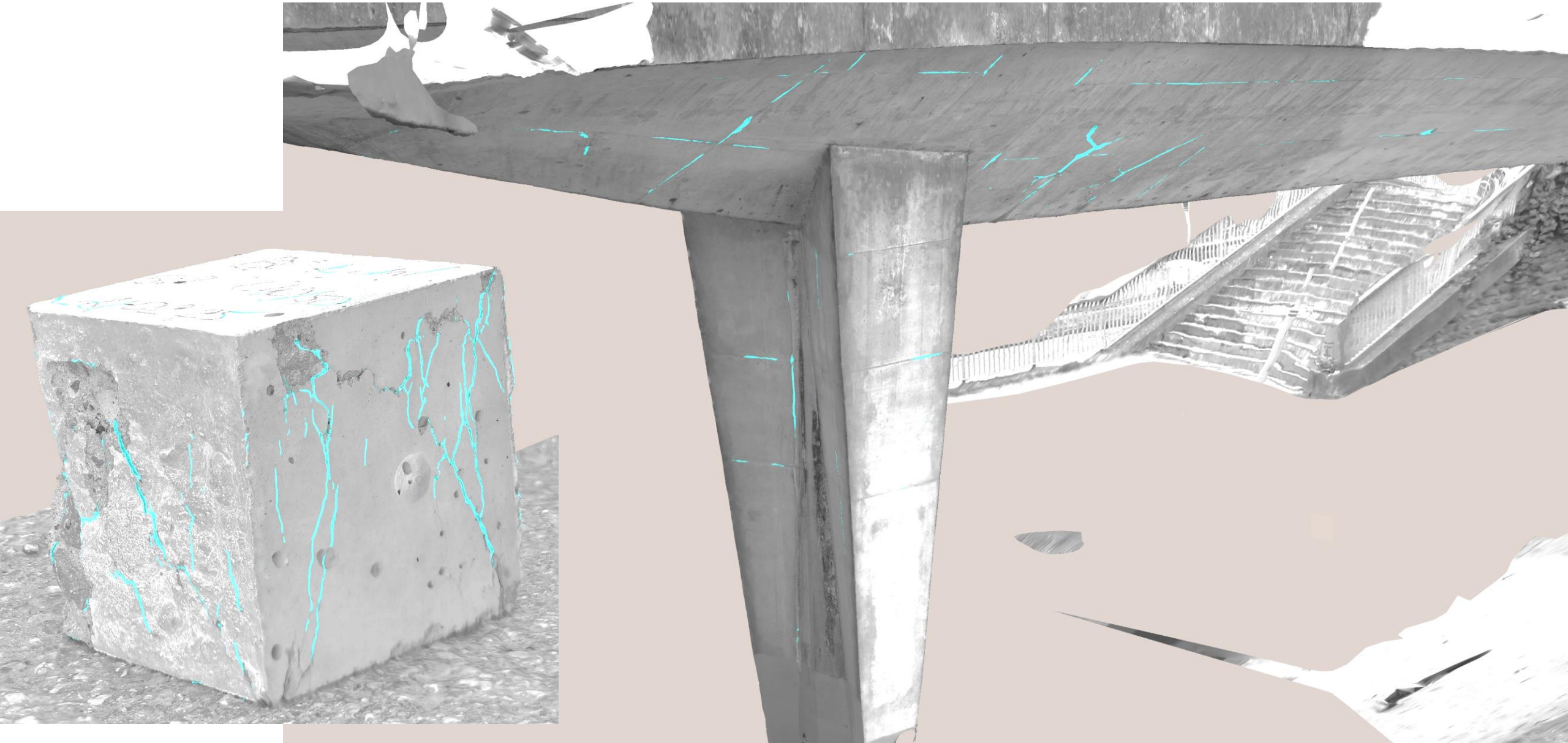
1 Pietūs

1 : 100

Cerkvė Radvilėnų pl., Kaune. Kultūros vertybių skaitmenizavimas



Betono plyšių detekcija DI metodais (CC Insight). Pėsčiųjų tiltas į Nemuno salą.



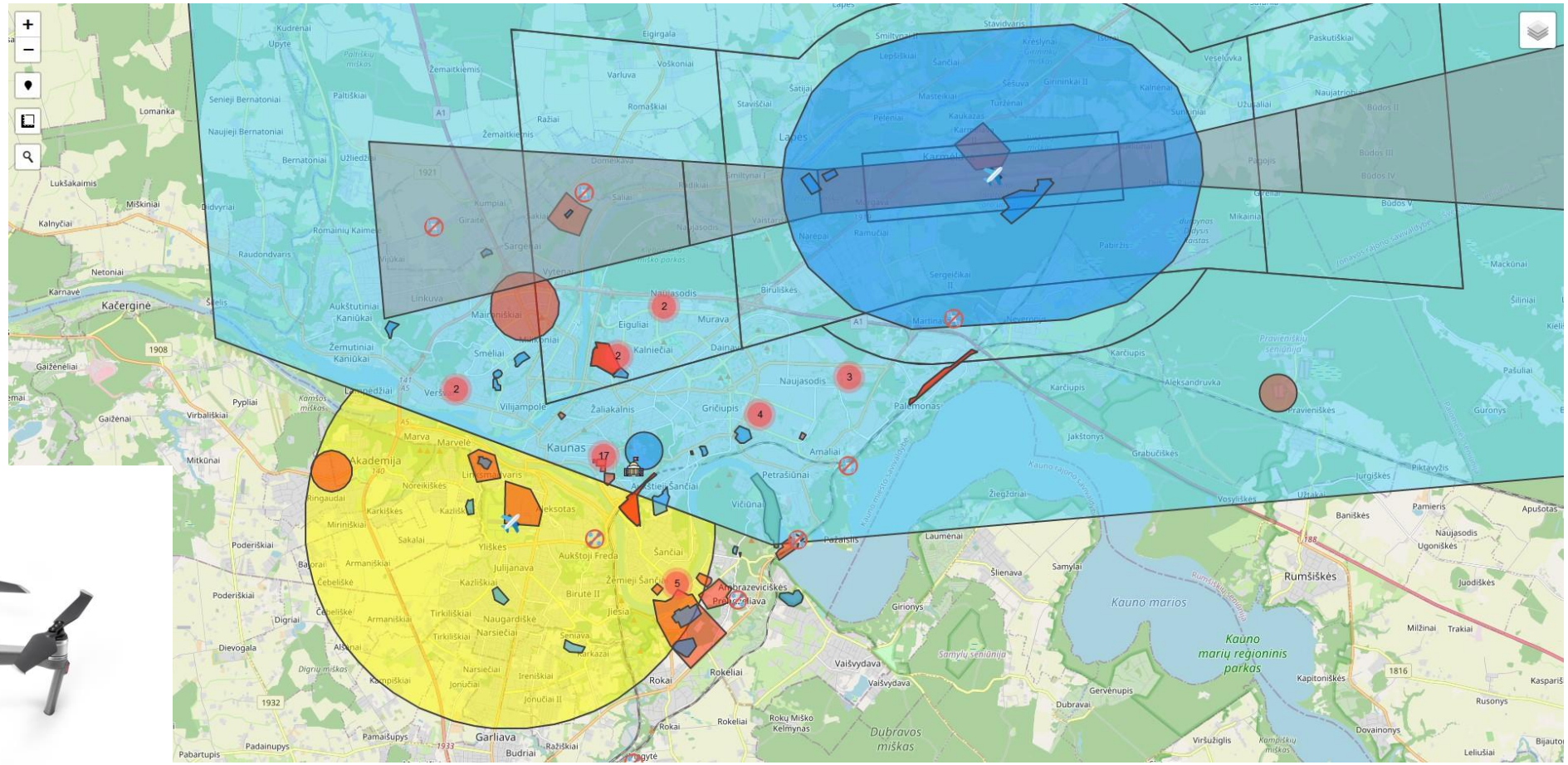
Apleistų pastatų konstrukcijų būklės tyrimai

Drone flights

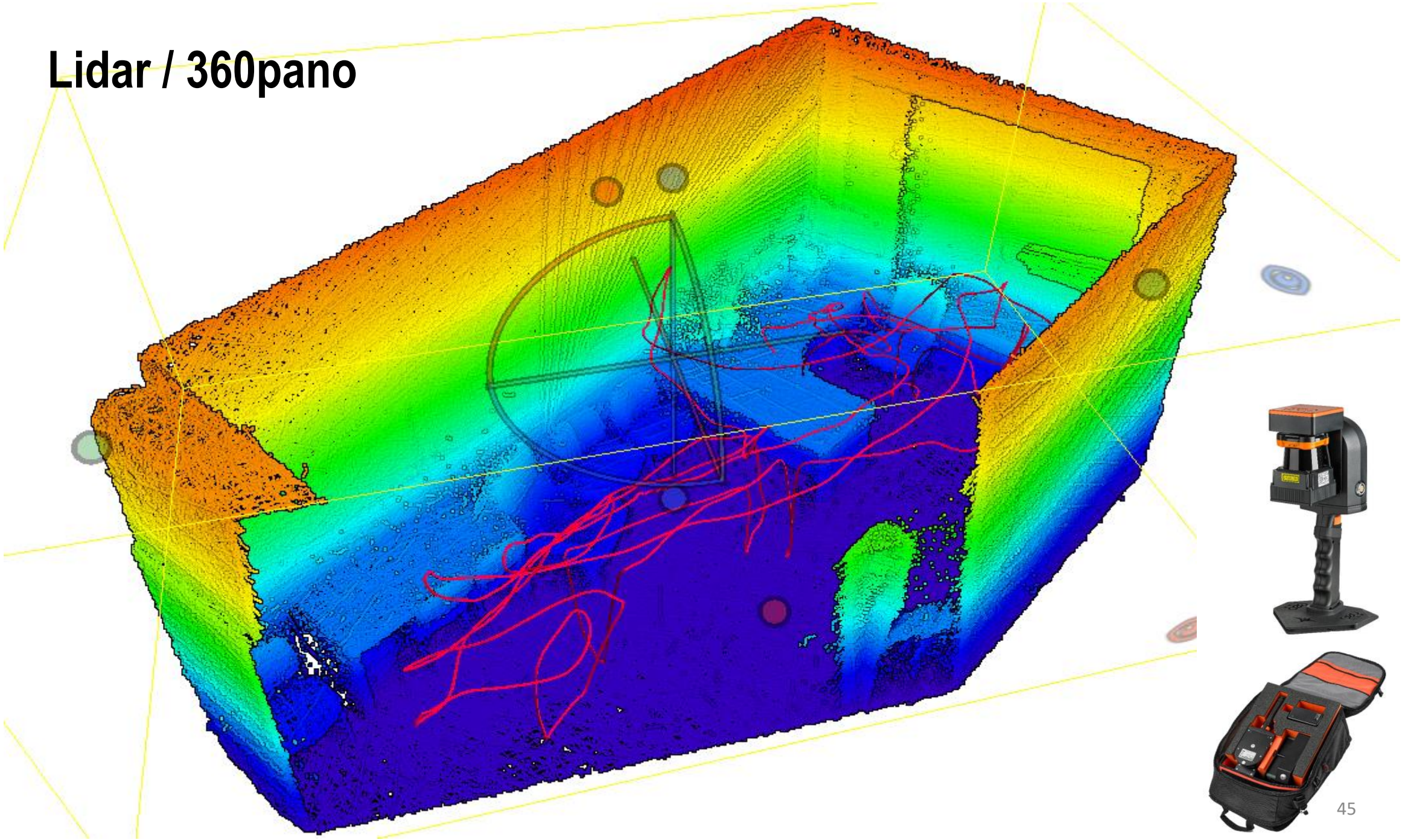
LTU

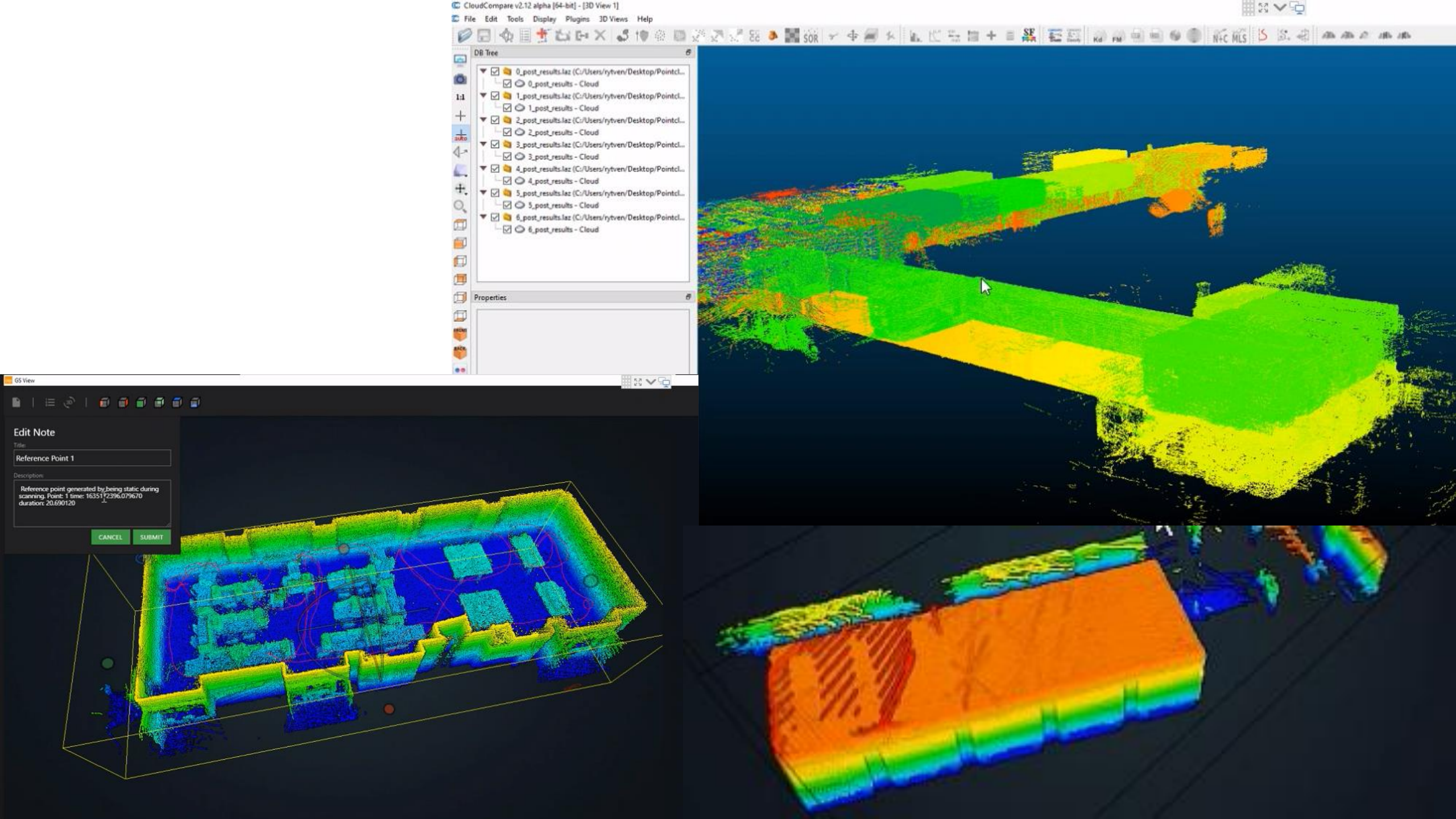
A1/A3
OPEN SUB CATEGORY

A2
OPEN SUB CATEGORY



Lidar / 360pano




CloudCompare v2.12 alpha [64-bit] - [3D View 1]
File Edit Tools Display Plugins 3D Views Help
DB Tree
0_post_results.laz (C:/Users/rytven/Desktop/Pointcl...
0_post_results - Cloud
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Properties
GS View
Edit Note
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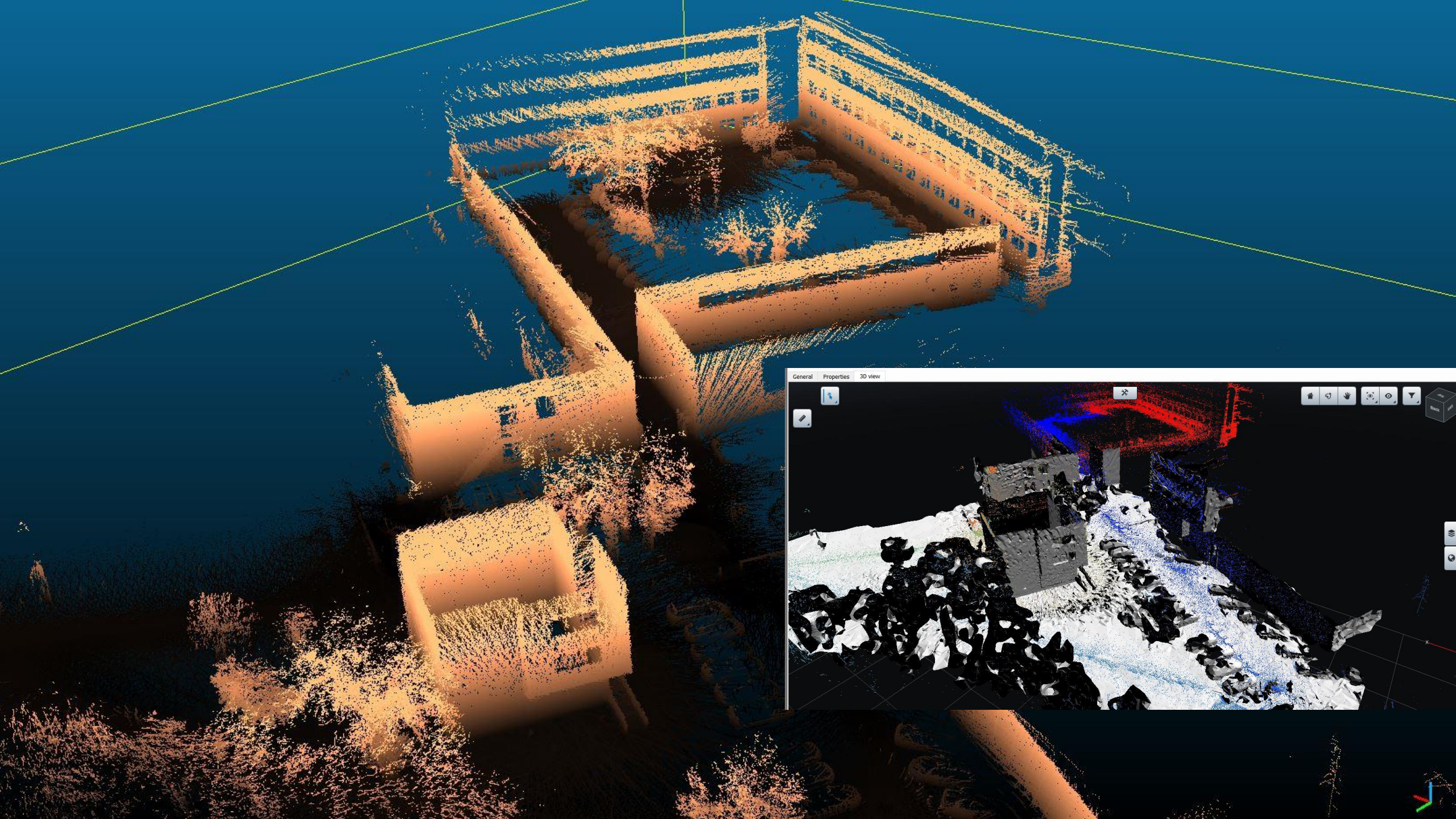
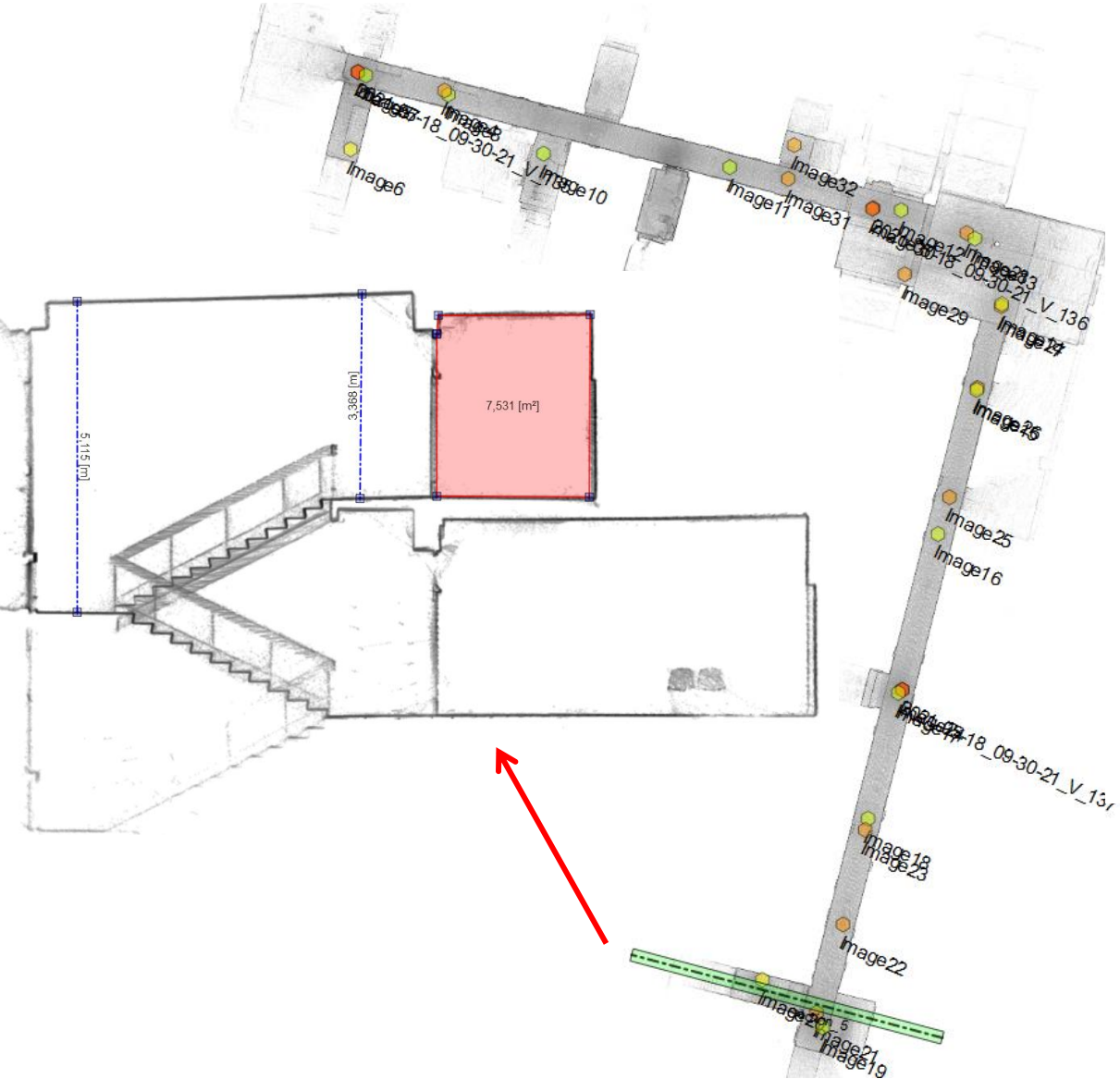
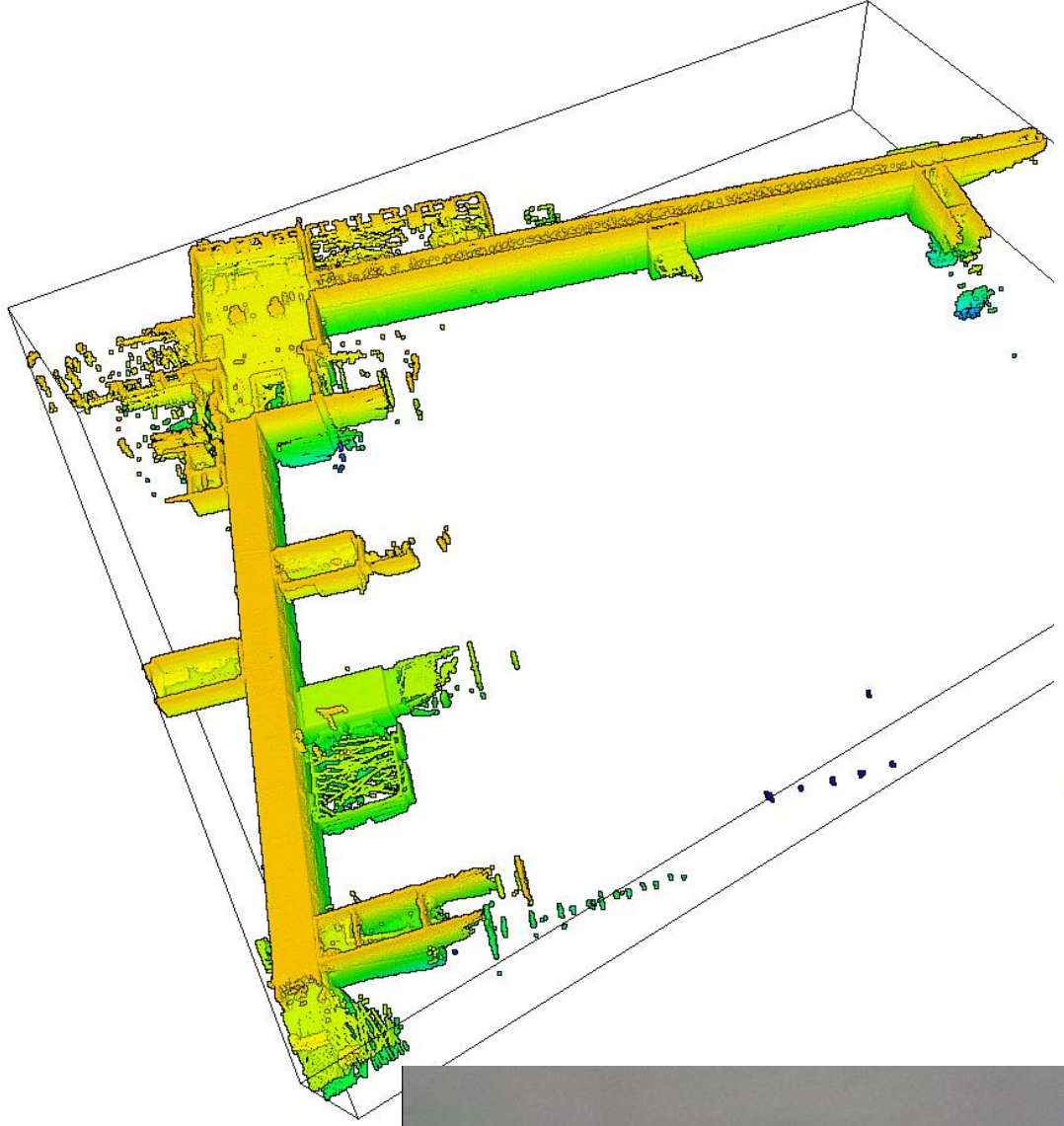
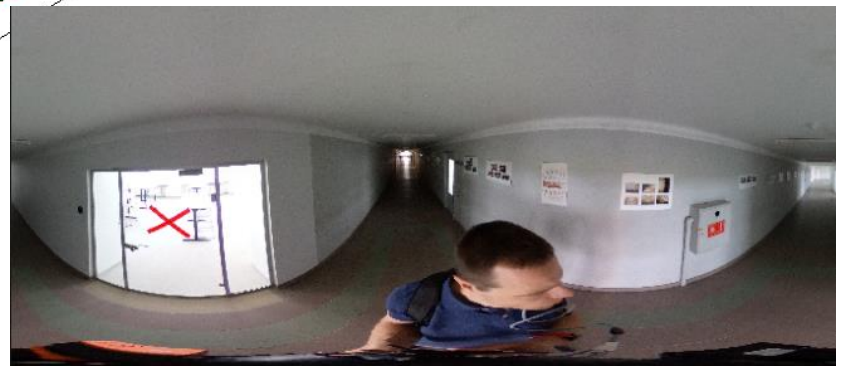
CANCEL
SUBMIT


General
Properties
3D view

Lidar / 360pano







ES Horizonto projektai

Next-generation Dynamic Digital EPCs for Enhanced Quality and User Awareness (D^2EPC)

Tikslas: sukurti naujos kartos skaitmeninę dinaminę pastatų energinio naudingumo sertifikavimo sistemą įvertinančią vartotojų sąmoningumą ir kokybės didinimą.

IMIC komandos įnašas:

- Skaitmeninių dvynių ir BIM koncepcijos apžvalga ir analizė D^2EPC kontekste;
- Aplikacijų programavimas sąsajos (IFC analizatoriaus) skirtos D^2EPC rodikliams sukūrimas.

PRECEPT: A novel decentralized edge-enabled PREsCriptivE and ProacTive framework for increased energy efficiency and well-being in residential buildings

Tikslas: sukurti novatorišką, decentralizuotą daiktų internetą integruojančią sistemą, leidžiančią padidinti gyvenamųjų pastatų energijos vartojimo efektyvumą ir gyventojų gerovę.

IMIC komandos įnašas:

- 6D BIM modeliavimas PRECEPT sistemai;
- Skaitmeninių dvynių vystymas apjungiant BIM, energetinio efetyvumo simuliavimo ir realybės skenavimo technologijas.

Development of Utilities Management Platform for the case of Quarantine and Lockdown – eUMaP

Tikslas: sukurti statinių priežiūrai skirtų komunalinių paslaugų valdymo platformą, karantino ir mobilumo apribojimų metu.

IMIC komandos įnašas:

- Realaus laiko ir istorinių duomenų apie statinių inžinerines sistemas integracija į skaitmeninį dvynį ir eUMaP platformą.

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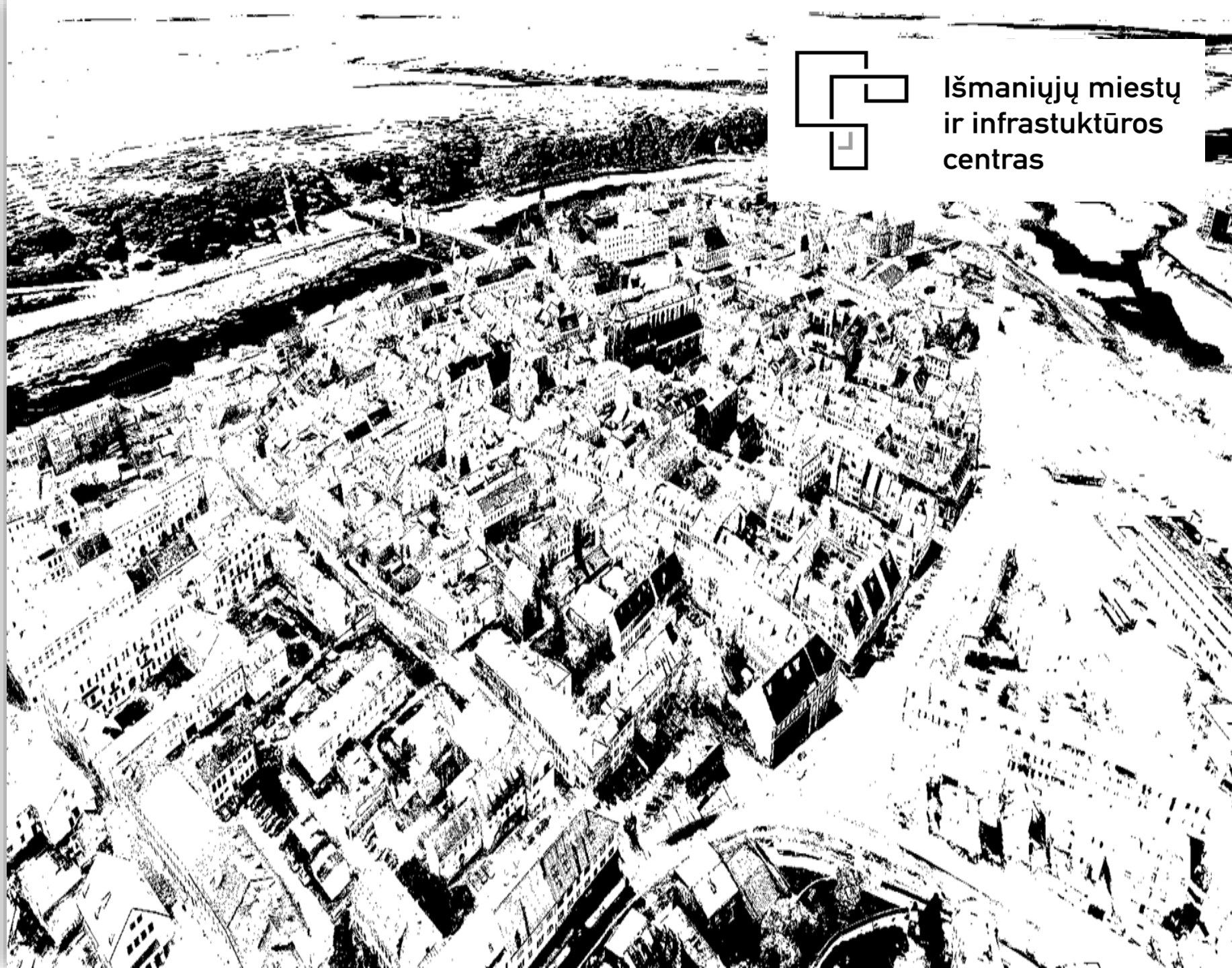
STATICUS

Skaitmeninė Statyba

KAUNAS

kauno rajonas



Išmaniųjų miestų ir infrastuktūros centras