

Digital and Sustainable Construction

Our motivation

» It is not the strongest species that survives, nor the most intelligent, it is the one most able to adapt to change «

Charles Darwin





Das Team

Jung und interdisziplinär

Digital and Sustainable Construction

Unser interdisziplinäres Team



Dietmar Siegele

*Head of Unit
Civil engineer and
domotronician*



Cinzia Slongo

*GIS & Infrastructure
Civil engineer*



Eliana Bortot

*Material
Civil engineer*



Vincenzo Orlando

*Automation
Mechatronics engineer*



Giancarlo De Marco

*BIM in Public
Architect*



Elias Niederwieser

*Digital Twin
Physicist*



Mariana Ataide

*Building Permit
Architect*



Orjola Braholli

*Sustainability
Architect*



Julius Emig

*Interoperability
Civil engineer*



Ilaria Di Blasio

*Environment
Environmental engineer*



BIM im Hochbau

Was passiert?

Open BIM? Fortschritt?



Praktische Nutzung: 2008



AUTODESK
Revit 2023

Objektorientierte Bauwerkmodellierung

Entwicklungsbeginn: 1998

Open BIM? Fortschritt?

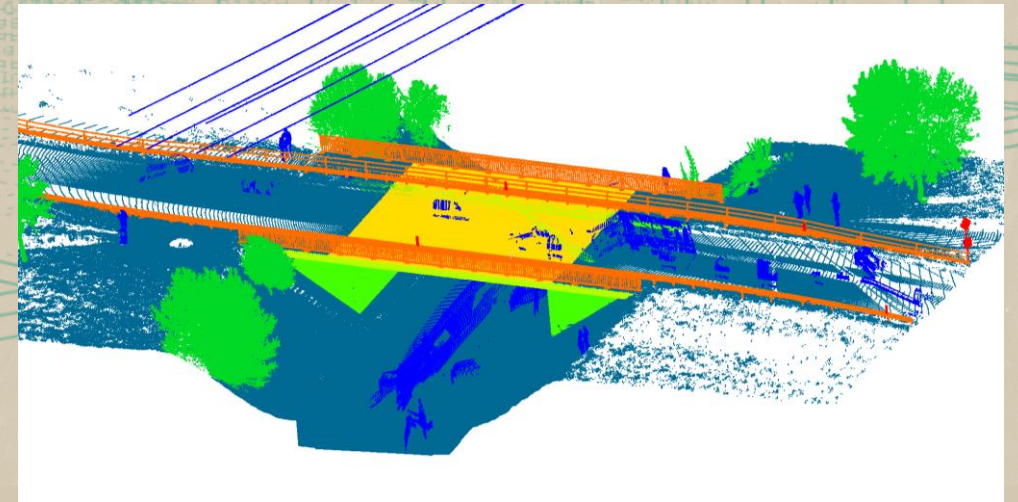
| IFC-Version | Veröffentlichung | Verwendung |
|---------------|------------------|--|
| 1.0, 1.5, 2.0 | 2000 | Frühe Prototypen |
| 2x, 2x2 | 2002 | Für Early Adopters |
| 2x3 | 2008 | In praktischer Anwendung |
| IFC4 | 2013 | In praktischer Anwendung |
| IFC4 Add1 | 2015 | |
| IFC4 Add2 | 2016 | |
| IFC4 Add2 TC1 | 2017 | |
| IFC4.1 | 2018 | zurückgezogen |
| IFC4.2 | 2019 | zurückgezogen |
| IFC4.3 | 2021 | Ergänzungen für Rail and Infrastructure, im ISO-Verfahren ^[3] |

Wo sind die Anwendungsfälle?

Wo ist der echte Nutzen und Mehrwert?

Annette Schmitt, M.Sc. | Fraunhofer Institute for Physical measurement techniques IPM

Construction Surveying of Infrastructure building using 3D measurement techniques

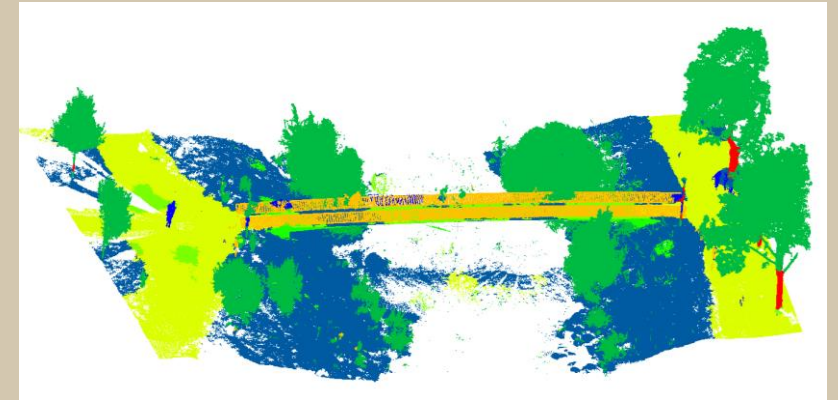


Data analysis

Deep Learning for 3D Point clouds

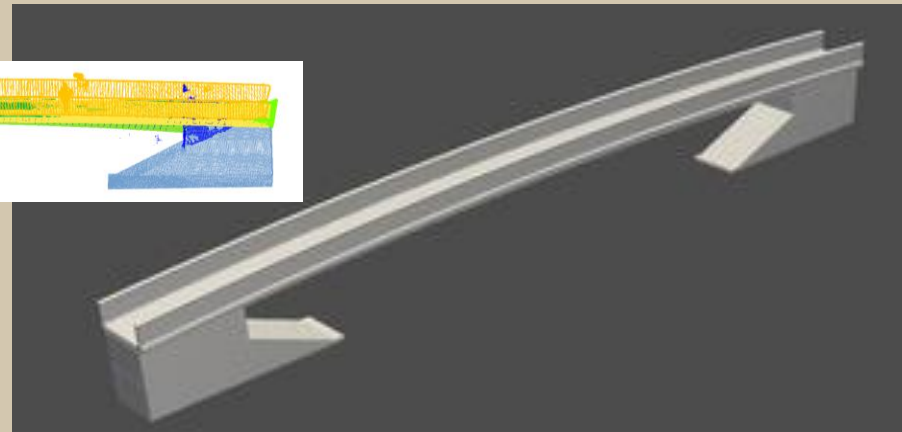


Preprocessing of the pointcloud



Semantic segmentation of the point cloud

Data capturing



Unsupervised Methods to extract the geometry



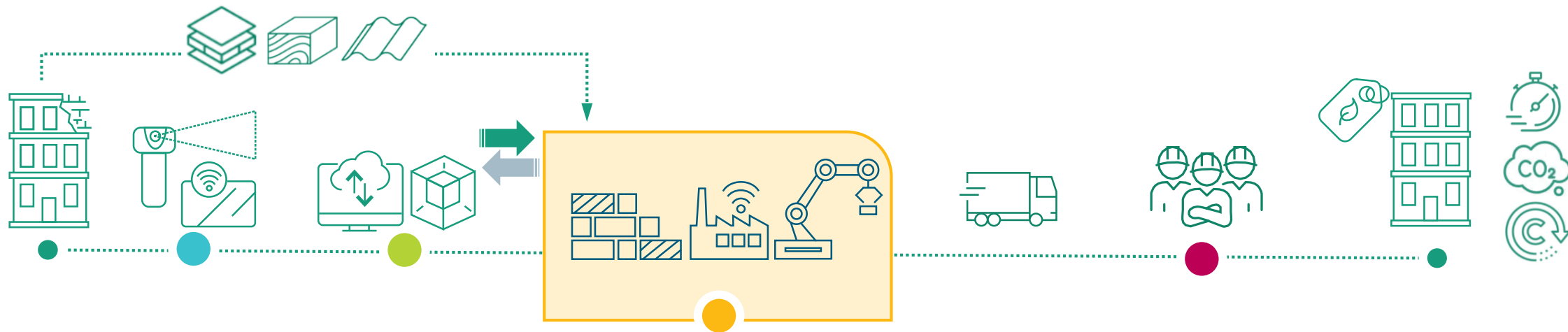
Derivation of polygons or plans with enrichment of additional properties

<https://doi.org/10.1002/bate.202200013>
<https://doi.org/10.1117/12.2635845>
<https://doi.org/10.1117/12.2634711>
<https://doi.org/10.3390/rs12162530>



Bortot Eliana, Ph.D. | Fraunhofer Italia IEC

SHOWCASE BAU-DNS



Automated Construction Surveying

Parameterized Planning

Automated Prefabrication

Integrated Logistics

Assisted (Dis)assembly

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BAU-DNS SHOWCASE

What are we going to see

1. Parametrized planning

- Laser scan and point cloud generation
- Automatic plane identification
- Automatic panelization

2. Automated prefabrication

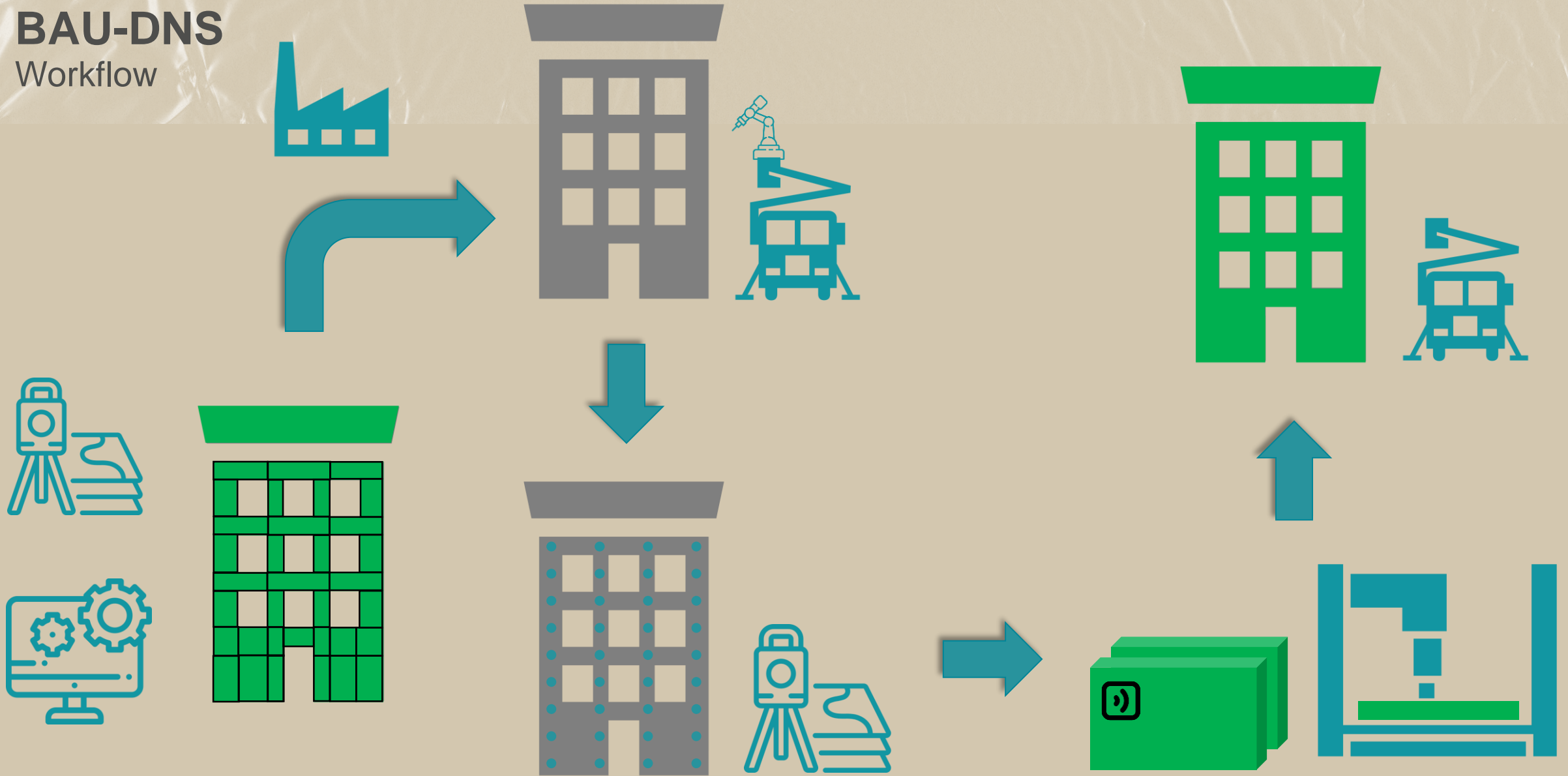
- Prototype of a prefabricated panel ready to be mounted on site

3. Performance assessment

- Energetic analysis
- Life Cycle Cost (LCC) analysis



BAU-DNS Workflow



Chat Bot

Upload File

Plane Detection

Panelization

Energy Analysis

LCC Analysis

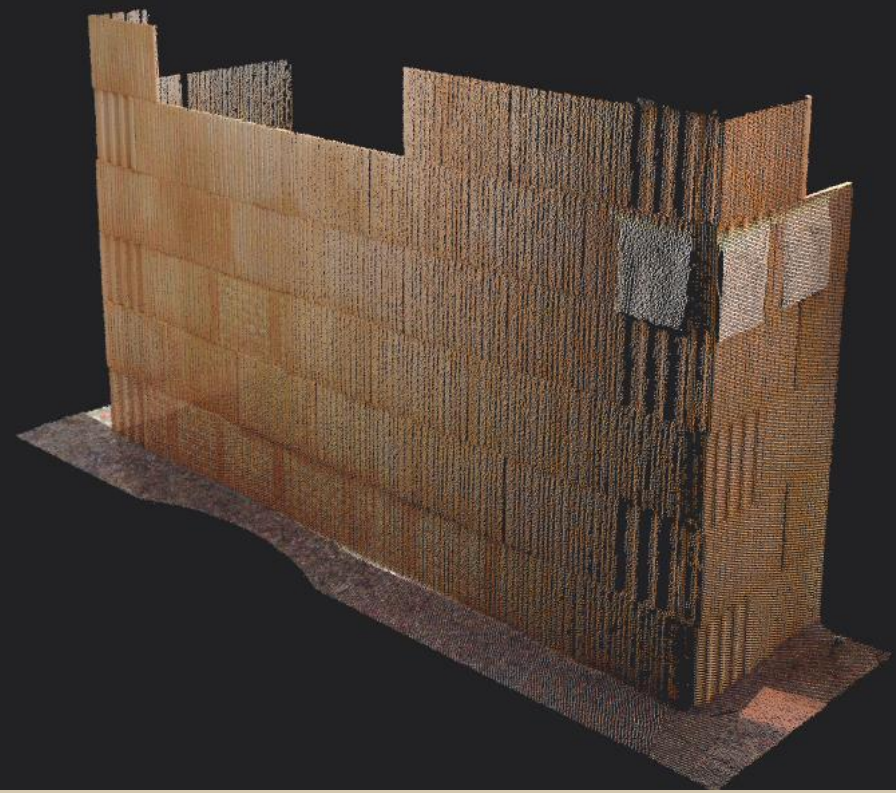
Export

PROJECT LAYERS

- Point Cloud 1
- Planes 1
- Distance Map 1
- 3D Panels 0

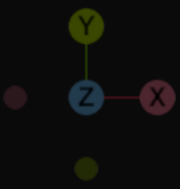
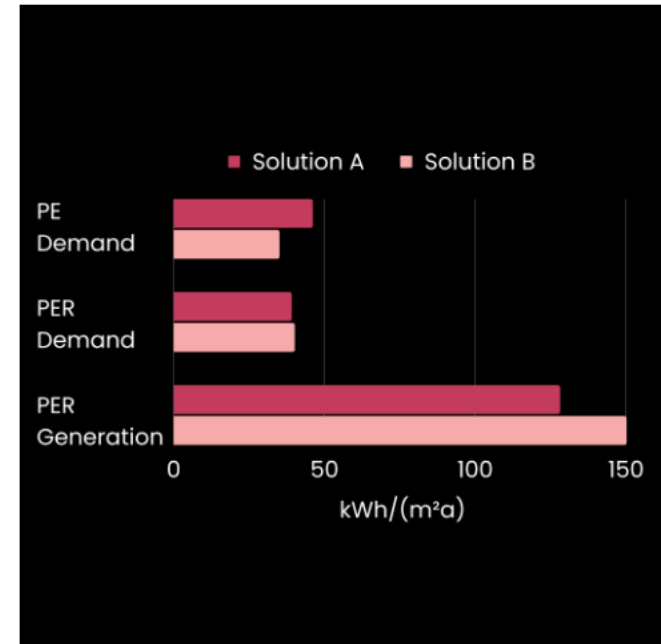
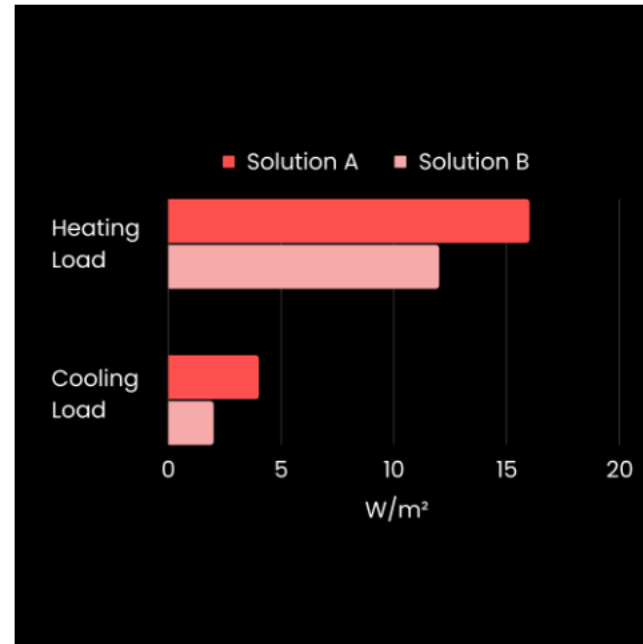
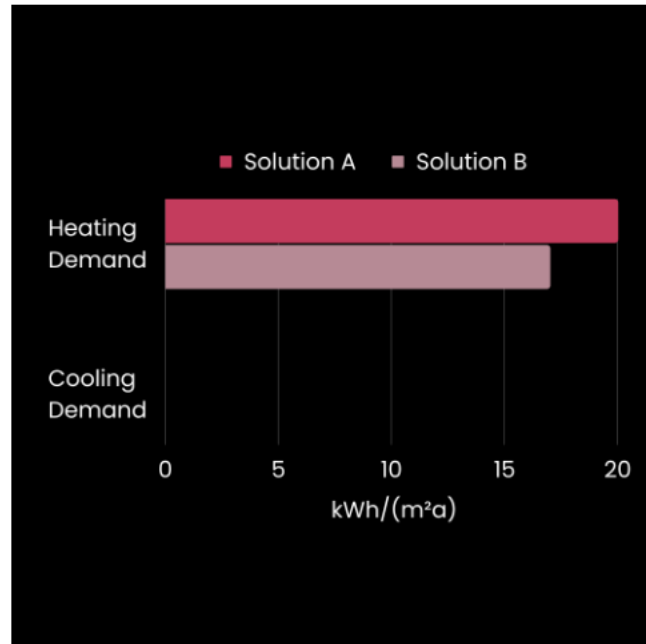
Create New User

Elias Niederwieser

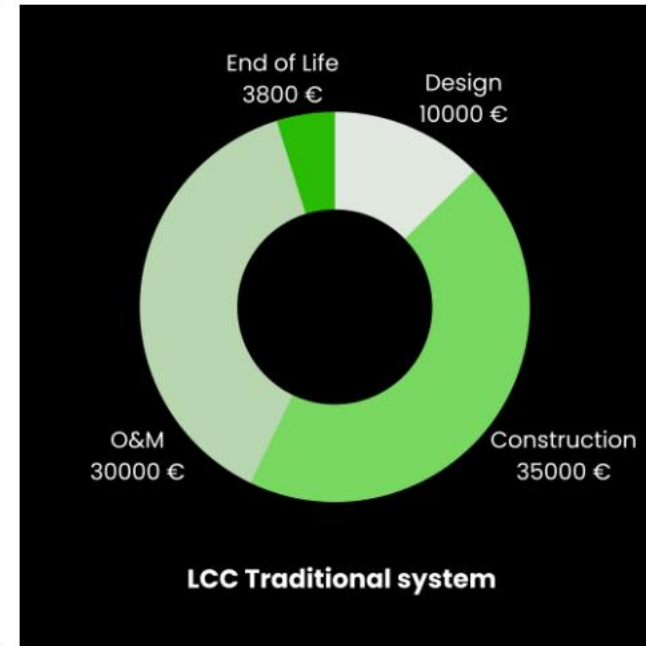
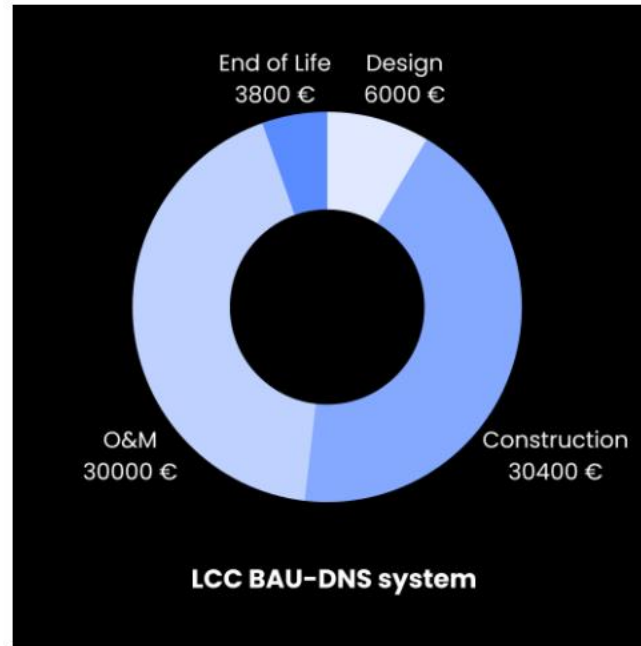
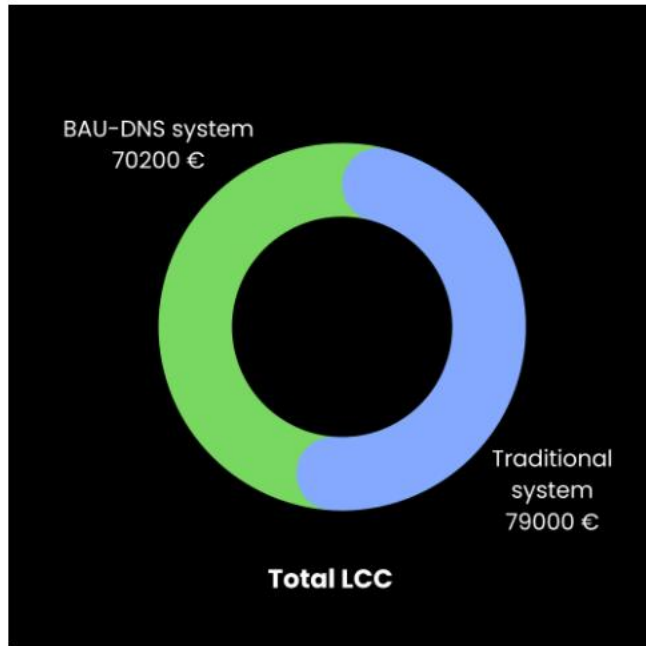




Energy Analysis



Life Cycle Cost Analysis



BAU-DNS PANEL

How is it designed?

1. Sandwich element

- Standard insulation
- Standard plaster
- Glass fiber net

2. On-site customizable fastening system

- Automated customization by an CNC machine on the construction site
- Wall distance by screw depth with automated device

3. Sizeable and customizable

- Large and small-size production possible





Julius Emig, Dipl.-Ing. | Fraunhofer Italia IEC

SHOWCASE

Simulation-Based Planning

BIM-2-FEM – An open-source-based workflow



Extracting Geometry and Materials from IFC-Model
(IfcOpenshell)

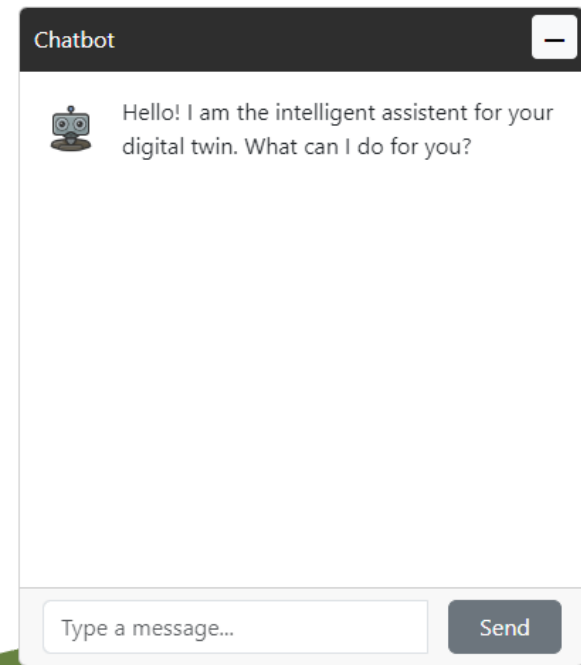
Meshing extracted geometry
(Gmsh)

Thermal simulation with automated boundary detection (ElmerFEM)

AI-Assistant

- **Accesses GPT 3.5 / 4** Large language models from OpenAI
- **Interprets human language** in text form
- **Execution of tasks** within given restrictions based on human input





Demonstration



Cinzia Slongo, Ph.D. | Fraunhofer Italia IEC

SHOWCASE BAUcontainer

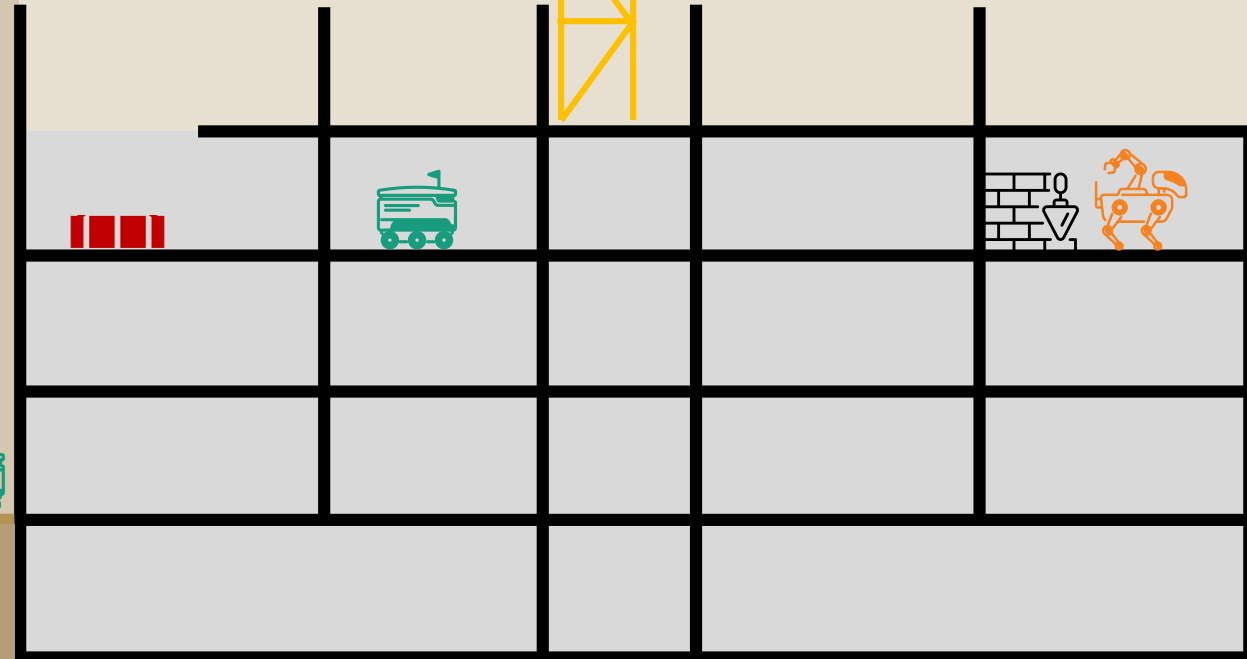
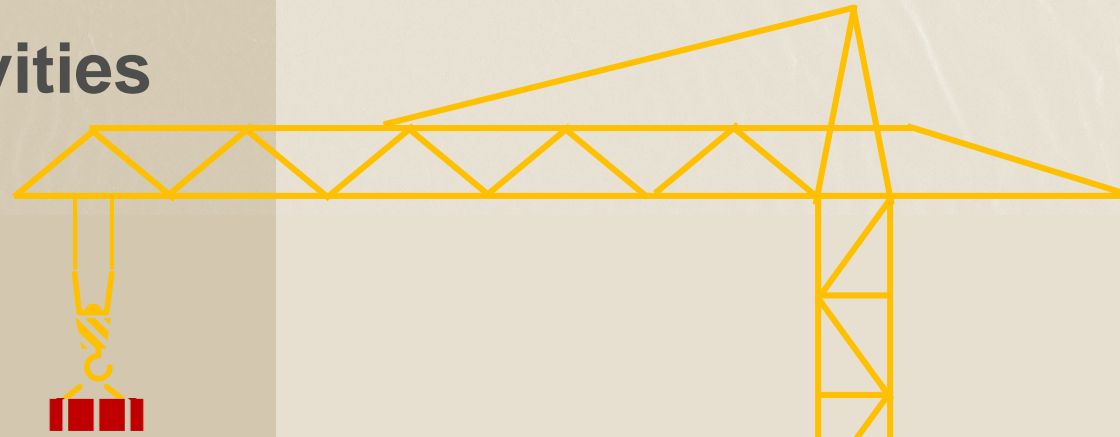
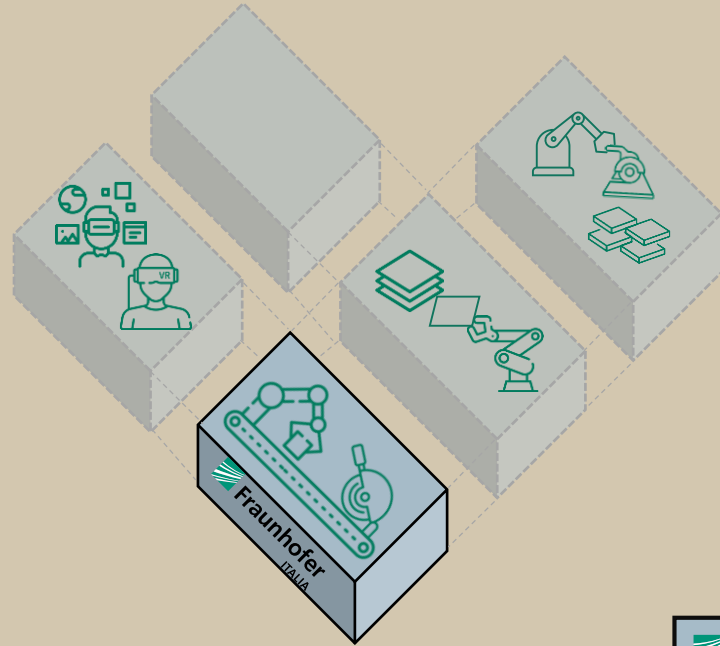
Rethinking Work Preparation

On-site prefabrication



Construction Site Daily Activities

On-site prefabrication



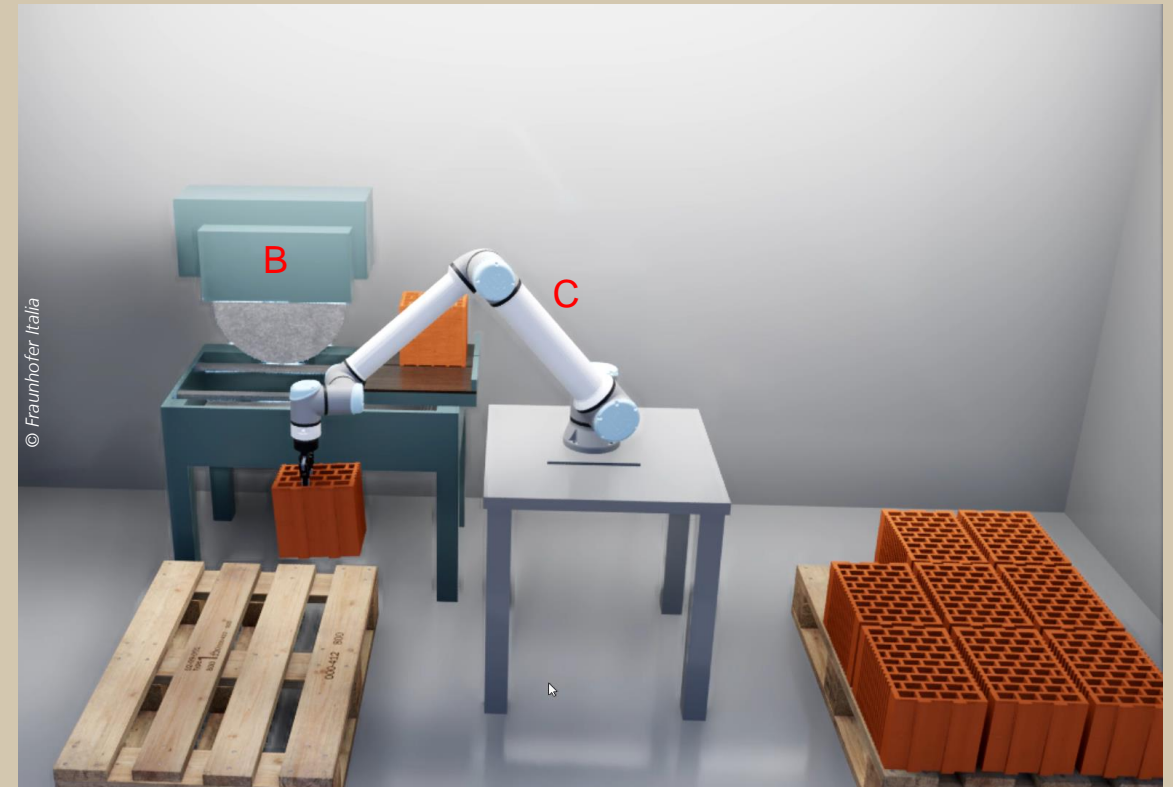
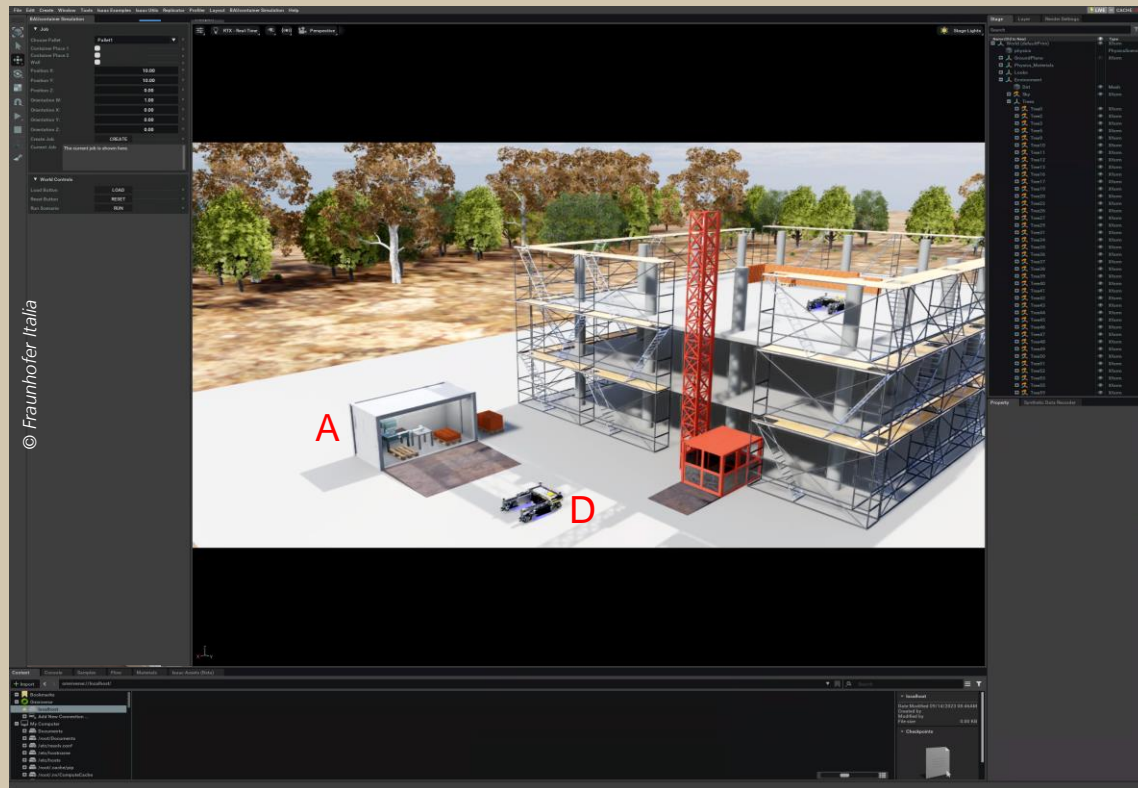
Construction Site Daily Activities

Automated On-site Prefabrication



BAUcontainer

Agent-based concept Interface and Simulation



BAUcontainer

How does it work? Use case cutting bricks.



*Vielen Dank für Ihre
Aufmerksamkeit*



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