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# TAMK FieldLab as one SIE/SIX Pilot Line

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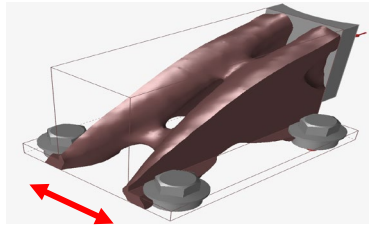
# TAMK's Design & Manufacturing in Industry –RDI team connected to FieldLab Pilot line



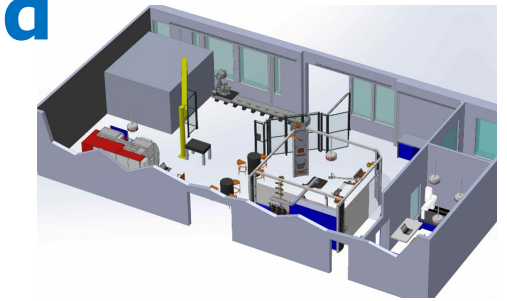
## Key sector competences

- Structural design and optimization
- Design for AM
- Additive manufacturing: 3D printing & welding with industrial robots
- Industry 4.0 technologies
- Sustainable manufacturing
- Value chain in Industry

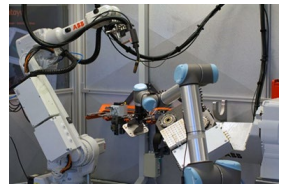
**Example project**: Kataja, Business Finland: Kataja -project concentrated to develop and manufacture a 3D printed large-scale construction using cellulose plastic bio composite material with a robot. As the result of this project, a large-scale 3D printer system, integrating industrial robot and self-made heating able 3D printing head for the bio composite material, was developed and validated to TRL 4 in TAMK RDI - environment, Fieldlab. Kataja- Footbridge, 3D robot printed from bio composite, was validated by FEM simulation and physical tests to TRL 6 and released in Pori accommodation exhibition with honor. (https://www.upm.com/news-and-stories/articles/2018/04/a-3d-printed-bridge-naturally-with-upm-formi/)

Rakennusinsinööriliitto 2019 vuoden silta:

# FieldLab one Pilot line in SIE – Testbed and Capability Creation for Industry 4.0



**TAMK's FieldLab acts for the impact of learning and R&D&I activities in Industry 4.0 and provides:**



- **Learning environment and living lab for skills and capabilities in Industry 4.0:** Experimentations to learn **cross sectional skills**, such as factory level connectivity, digital trust and data-based intelligence, integrated together with the **manufacturing specific hard engineering skills**, such as robotics, automation, AM and machine tools. FieldLab is a member of **ENOLL**.

- **Demonstrator for Smart Industry:** Industrial demos and **technology flashes** to increase SMEs' mindset towards competitive investments in manufacturing.
- **Industrial RDI -pilot and test environment:** Pilots and tests related to development and new innovations to address market needs for smart digital manufacturing solutions.

- **Platform for multi-disciplinary applied research:** FieldLab is now ramping up co-operation (Connected Factories) with TAU's HRC Pilot Line and Fastems' manufacturing training center, hopefully in near future also with other SIE/SIX Pilot lines, all together accelerating the use of digital emerging technologies in manufacturing.

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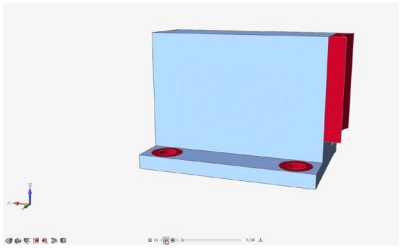
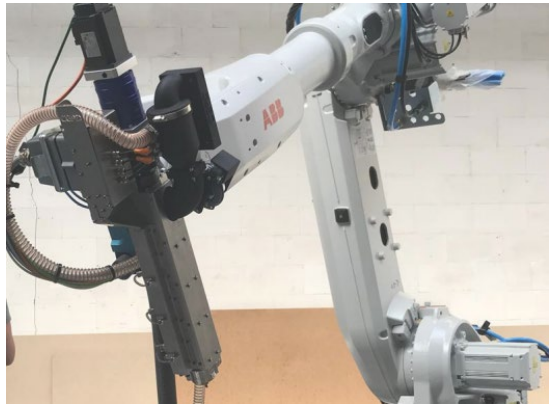
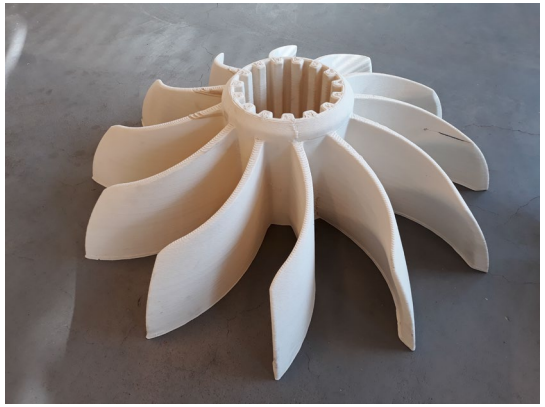
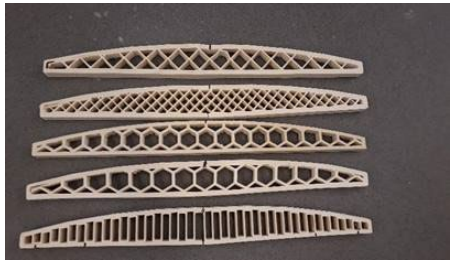
# TAMK FieldLab's specific Pilot line on 3D printing of large bio composite structure with an industrial robot

- Digital design and manufacturing of "free of shape" products
- Optimized designs for 3D printing
- Ability to 3D -print large (5x2x2m) optimized structures with an industrial robot, which is connected to an IoT server according to Industry 4.0.
- The extruder print head enables efficient 3D printing using plastics or bio composite material in granulate form
- Many national projects and now partner in some resent EU Horizon Calls in AM production method development, operation mainly from TRL 4 to TRL 6 (technology validated in lab -> technology demonstrated in relevant environment)



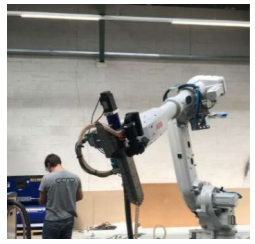


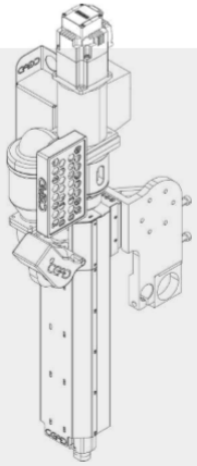




# TAMK Fieldlab's Pilot line on 3D printing of large bio composite structure with an industrial robot

- **Pellet printing head extruder and material possibilities (by CEAD)**





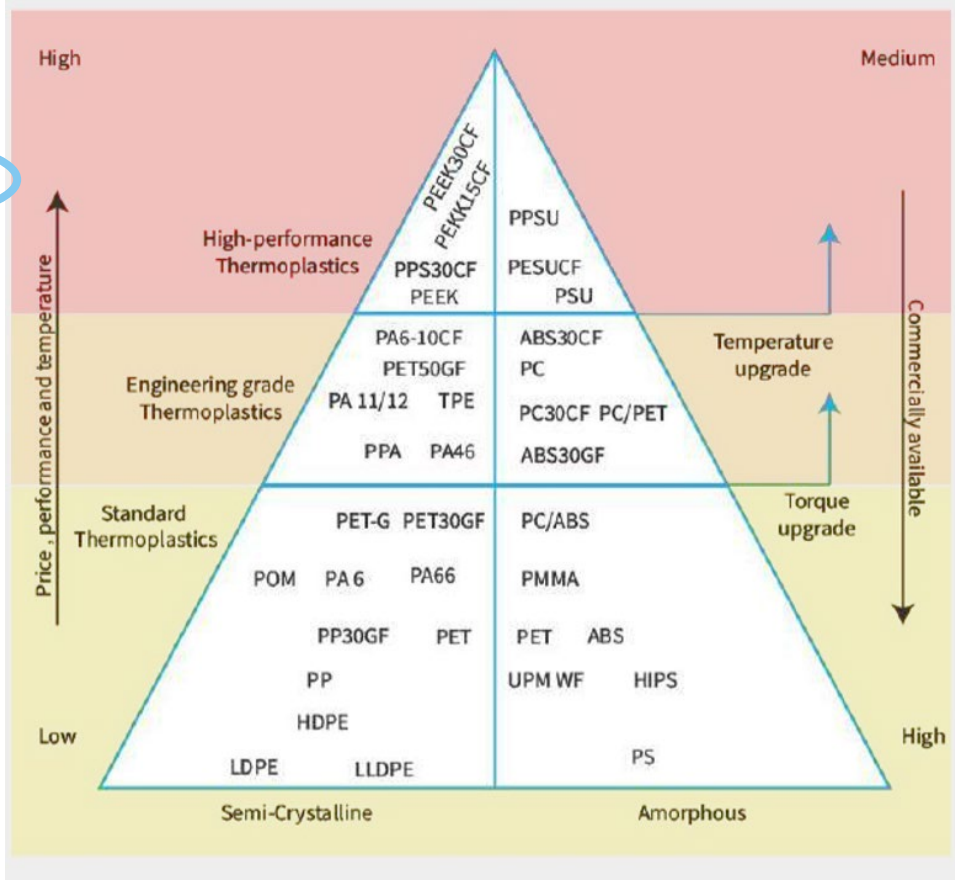
Temperature 400°C

| | |
|---|---|
| Weight extruder head | < 29kg |
| Total height | 980mm |
| With | 230mm |
| Depth | 340mm |
| Screw diameter | 25mm |
| Compression ratio | 1:3 |
| Mounting on robot | Aluminium bracket, according to your design |
| Height nozzle to mounting bracket | 435mm |

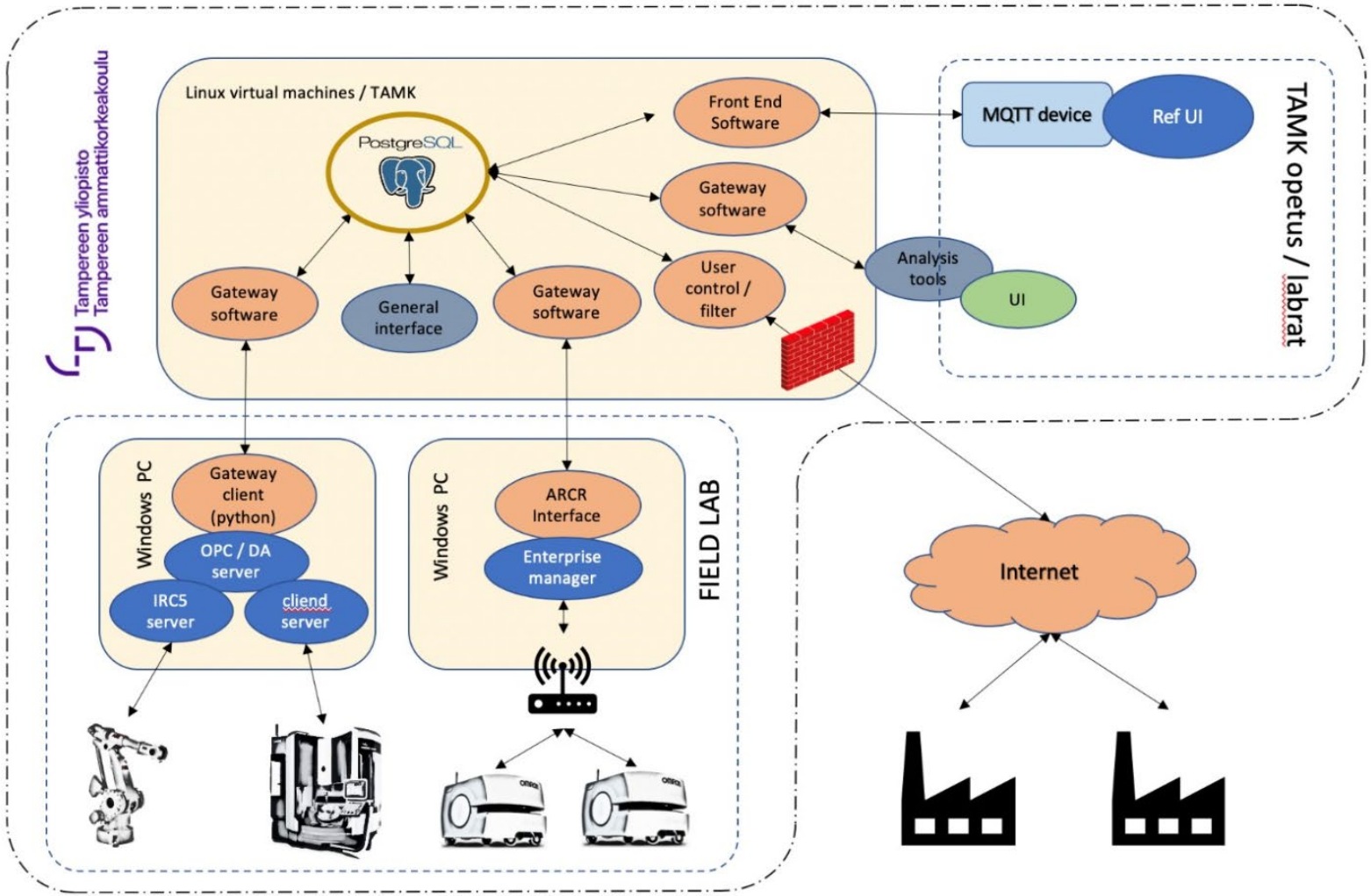
| | |
|---|---|
| Temperature | 310°C standard, 400°C optional |
| Heat zones | 4 |
| Cooling zone | 1, (resin inlet) |
| Heat control | Siemens pid controlled |
| Material inlet Cooling | Water cooled |
| Control system | Siemens s7-1200 |
| Human machine interface | Siemens ktp 700 |
| Software | CEAD custom software |

| | |
|---|---|
| Drive system | Siemens servo motor |
| Electric heating power | 2,45kw |
| Rpm control | Internal hmi user input and external 0-10v or external 4-20ma (other options on request) |

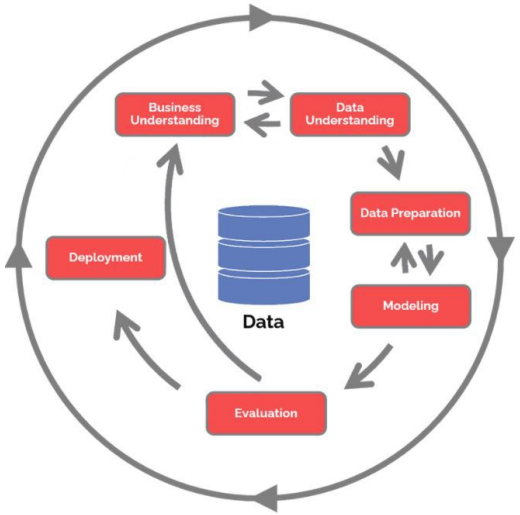
| | |
|---|---|
| Power | 3 Phase 400v 50-60hz |
| Connector type: | 3P+N+PE CEE 16A plug |
| Incoming air pressure: | 6-10 Bar (87-145 Psi) |



# FieldLab Industry 4.0 interfaces (Sensor layer, Connectivity layer, Database layer, UI layer)




## How to collect and exploit data in SMEs' different manufacturing systems?




CRISP-DM Diagram. Inspired by WikiMedia

# Thank you!
# Questions/Comments?