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PROJECT: SMART ADAPTIVE MATERIAL AND PROCESSES MODELLING FOR EMERGING DIGITAL PRODUCTION SCHEMES (SAMPLE)

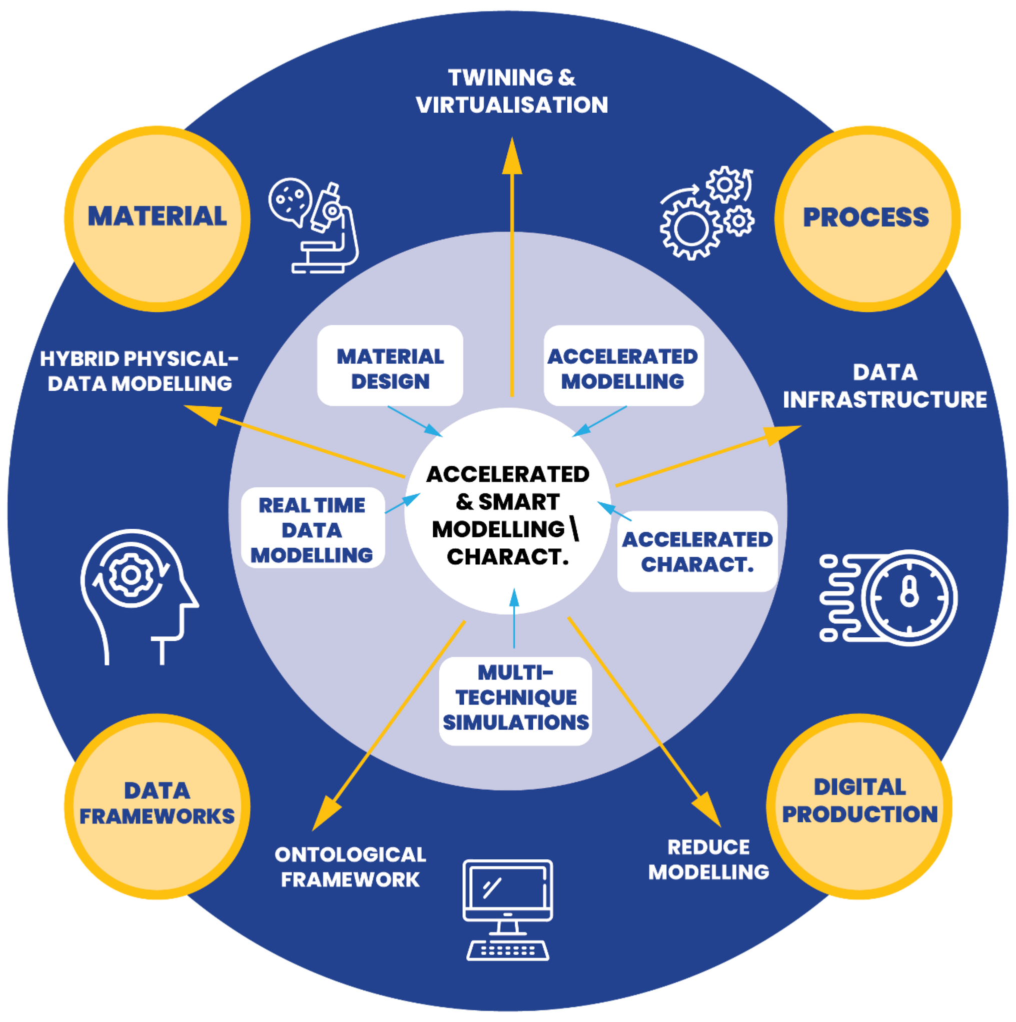
AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

PROJECT OBJECTIVES

SAMPLE's main objective is to accelerate the development of new advanced materials by interlocking experimental characterization with digitally integrated modelling to improve the environmental impact of the processing industry. In line with that objective, the project will contribute to the development and employment of data science techniques into material modelling and characterization schemes by implementing the Reduced Ordered Models (ROM) and Machine Learning routines within multidimensional data search spaces.

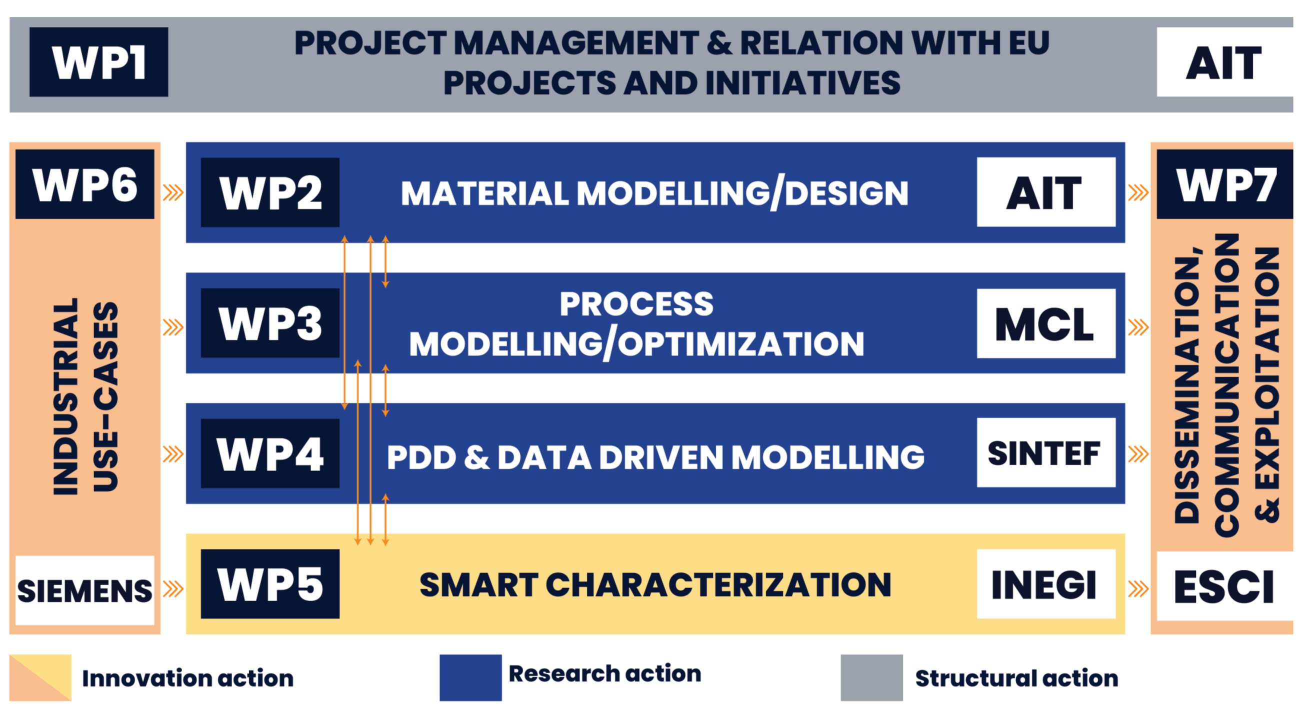
The SAMPLE project will deliver:

- efficient and automatized characterization methods,
- streamlined data acquisition and interfaces to ontological framework,
- automatic material card generation from experimental data,
- a physical-data driven (PDD) multi-scale modelling framework,
- smart material data management using machine learning (ML),
- reduced material models incorporated into digital twin concepts,
- concepts of integrating data science into process simulation models.



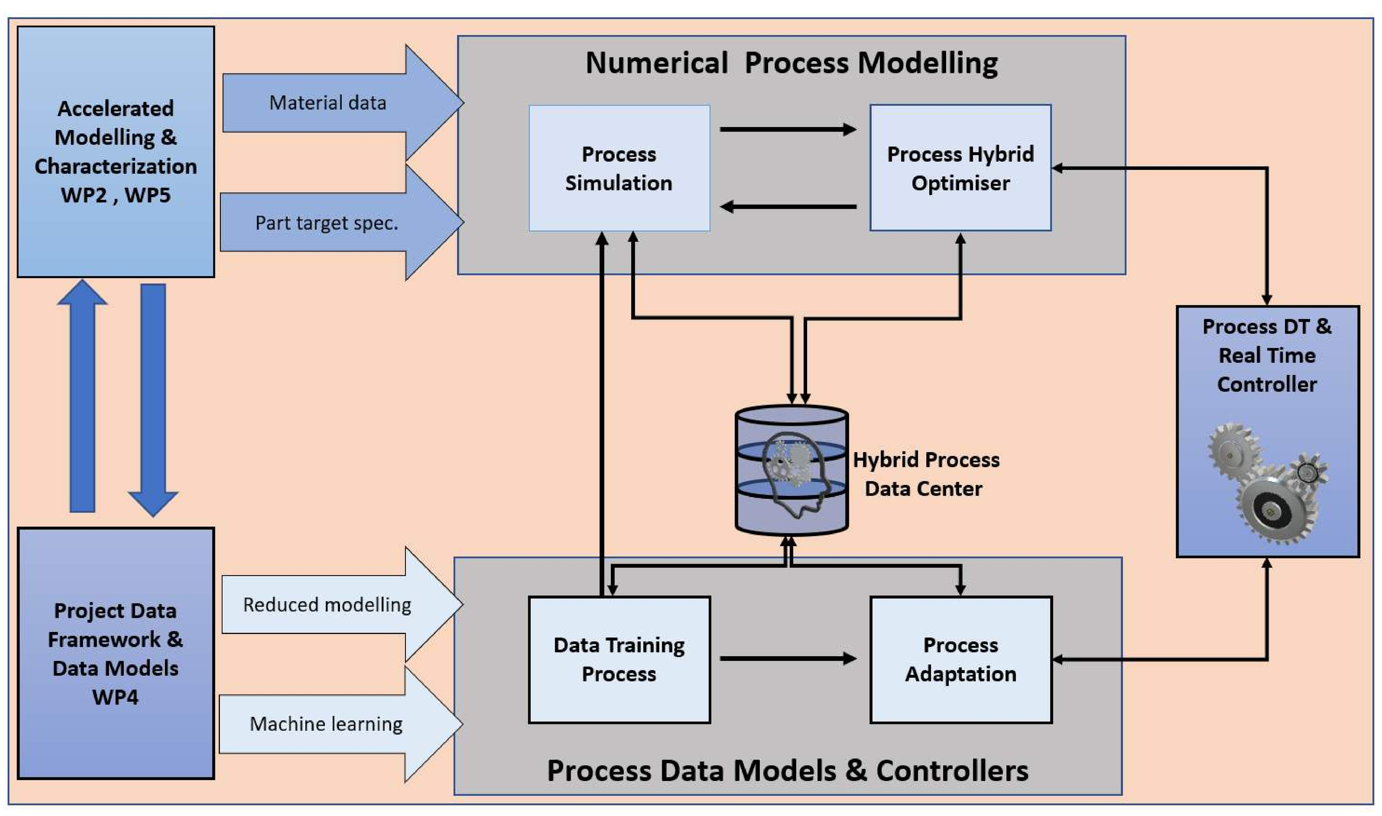
SAMPLE SETUP AND WORKPACKAGE STRUCTURE

- The project is organized in seven workpackages (WP) where three are research actions, three are innovation actions and WP1 is a structural action.
- The workpackages are strongly interconnected and thus organized in 5 workstreams.
- Although WP leaders are given in the figure below, almost all partners are working together, especially in the research actions.
- WP6 is divided into 2 use-cases, both concern H2 tanks, one lead by Siemens, the other by AIT (LKR).

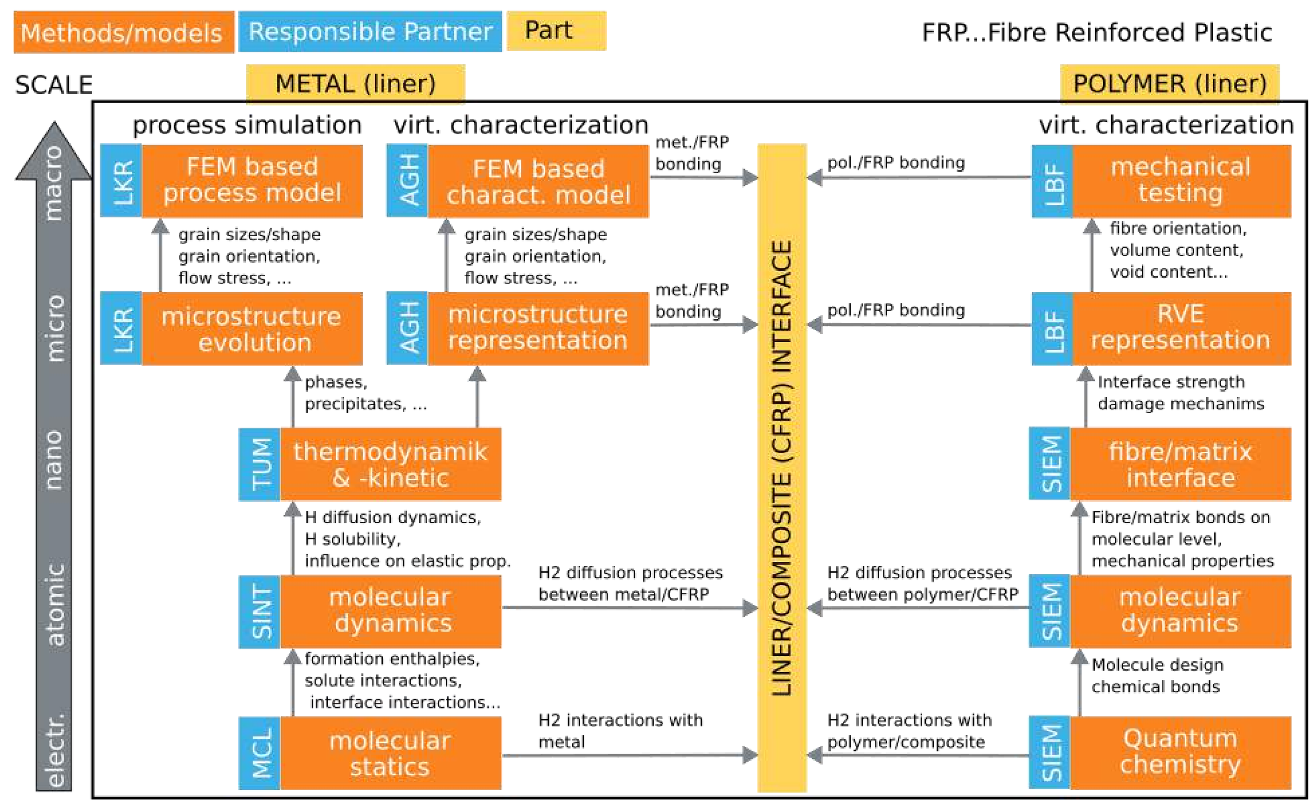


SAMPLE FRAMEWORK FOR MODELLING AND CHARACTERIZATION

- Development of benchmarked, integrated suites of models and characterization methods.
- Implementation of Reduced Order Models (ROM) and Machine Learning (ML) routines within multi-dimensional data search spaces.
- Physically-based material models enhanced by data science techniques.
- Hybrid (experimental/numerical) process data center.



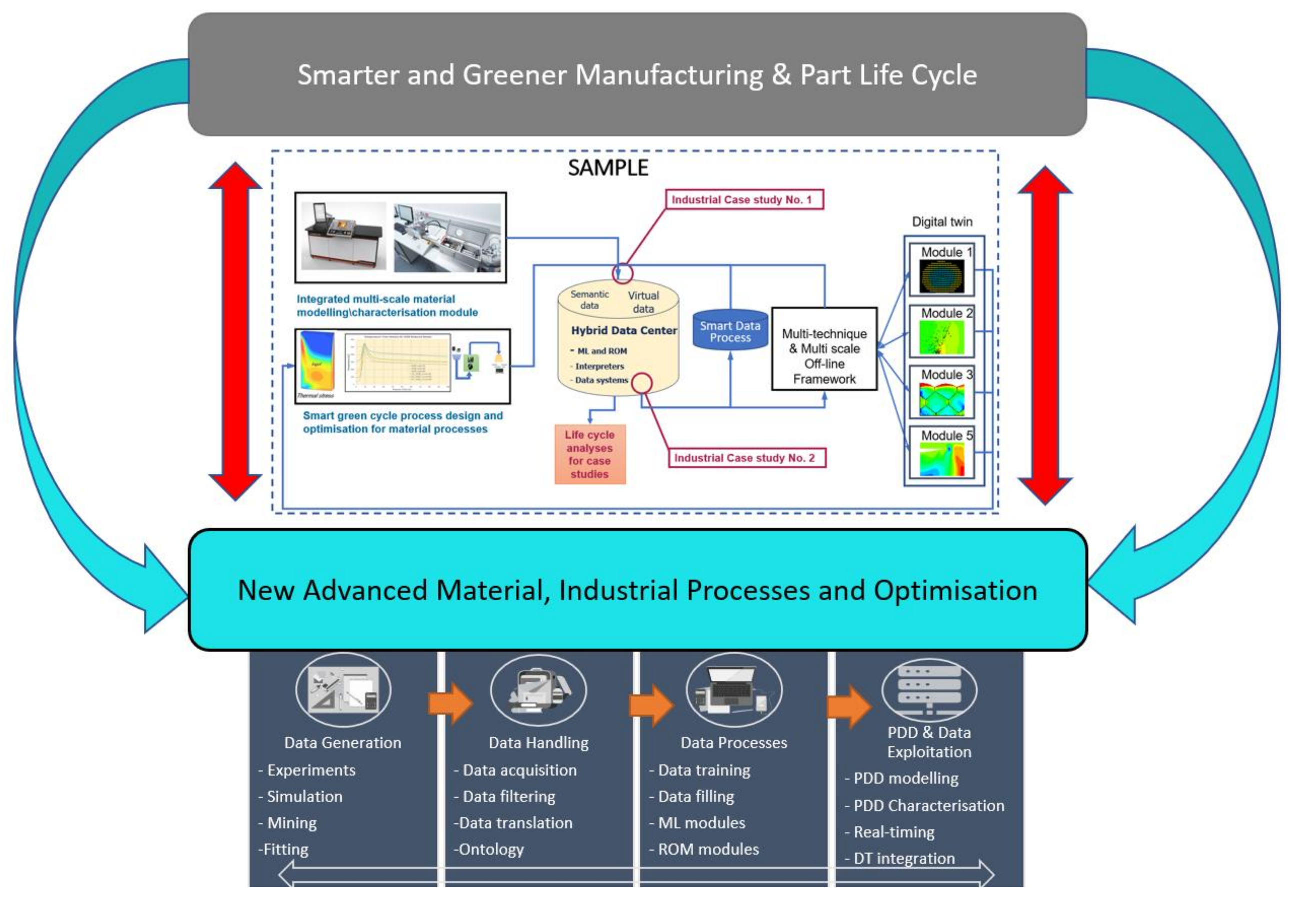
MULTI-SCALE MATERIAL MODELLING



Scale bridging from electronic to macro scale

- Physical modelling (multi-physical/scale) of industrial processes (Wire Additive Manufacturing)
- Physical/virtual characterization for metal (aluminum) and polymer materials.
- Modelling of interfaces between inner liner and CFRP wrapping at multiple scales.
- Investigation of H2 influence on liner and Interfaces.

PHYSICAL-DATA DRIVEN MATERIAL\PROCESS MODELLING FRAMEWORK



- Acceleration of material development by applying full SAMPLE framework.
- Seamless integration of characterization and modelling into ontology-base databases.

INDUSTRIAL USE CASES: HIGH PRESSURE / CRYOGENIC H2 TANKS

Two industrially relevant use-cases: one polymer and one additively manufactured aluminum inner layer. Both have a CFRP wrapping around them.

1. Light-weight high pressure H2 tank for mobility applications with polymer inner layer (Siemens) and CFRP wrapping.
2. Pressurized cryogenic H2 tank for aerospace applications with additively manufactured aluminum inner layer (AIT) and CFRP wrapping.

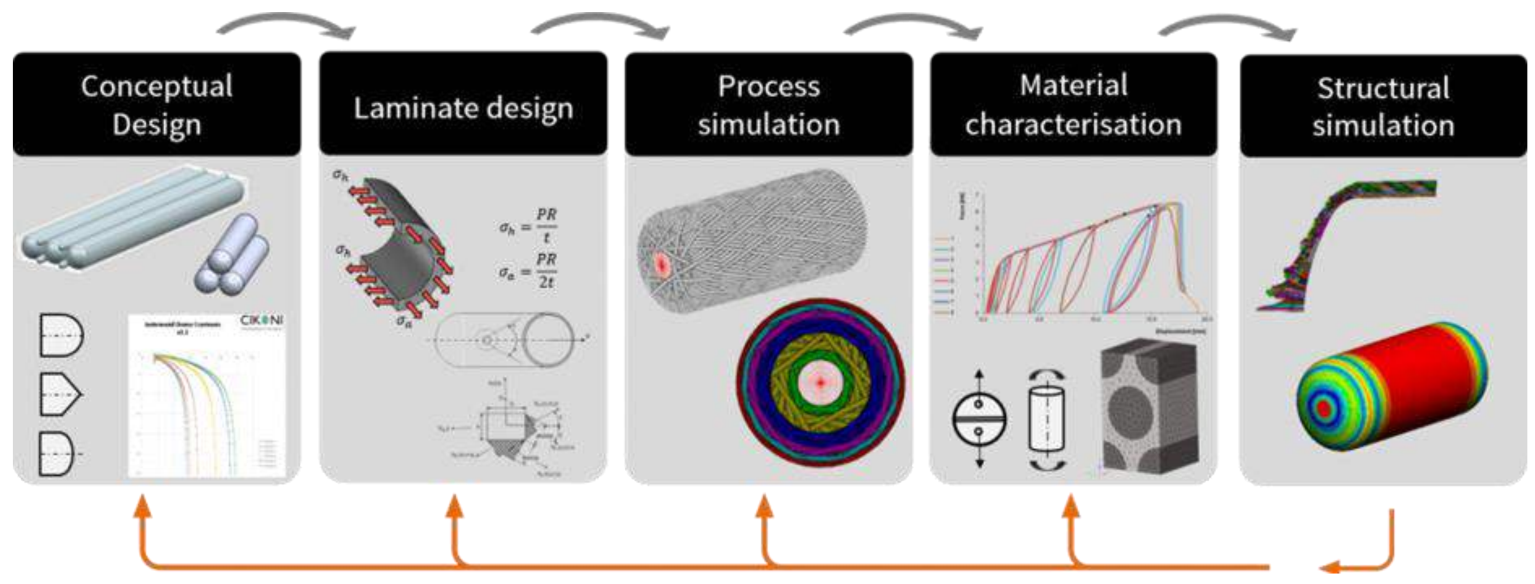


Figure 6. Virtual thread

INDUSTRIAL/COMMERCIAL INVOLVEMENT

Our consortium has members that will include SAMPLE technology in their value chains leveraging on their networks, operational capabilities and commercial channels to bring SAMPLE to the next level of development in the future. This will ensure results uptake and technology transfer, and adoption by the market. Their role is essential to steer the project's developments towards industrial needs.

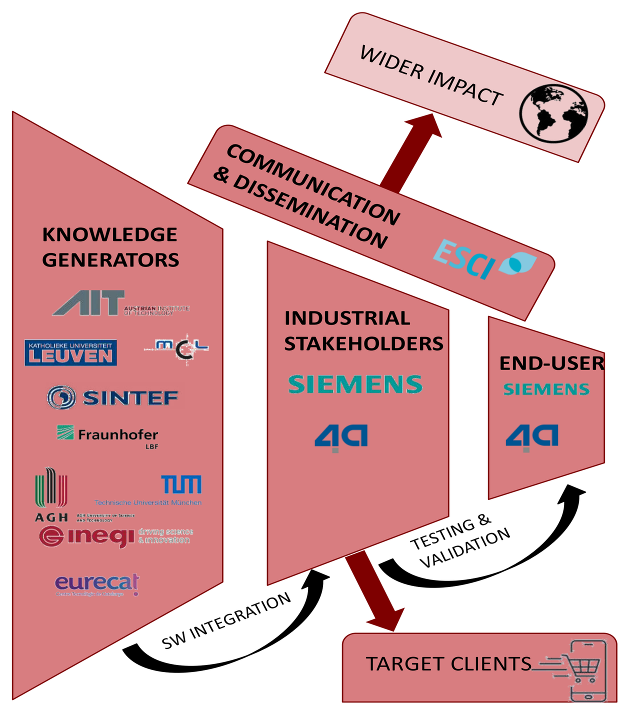


Figure 3-3 SAMPLE VALUE CHAIN

Acknowledgment:

The technical/financial support by the Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, Federal State of Upper Austria and also the Austrian Institute of Technology (AIT) are gratefully appreciated. Author would also like to thank Dr Amir Horr for his technical input.