

# Innovative Concept for Process Control with Distributed Microwave Feeding Systems

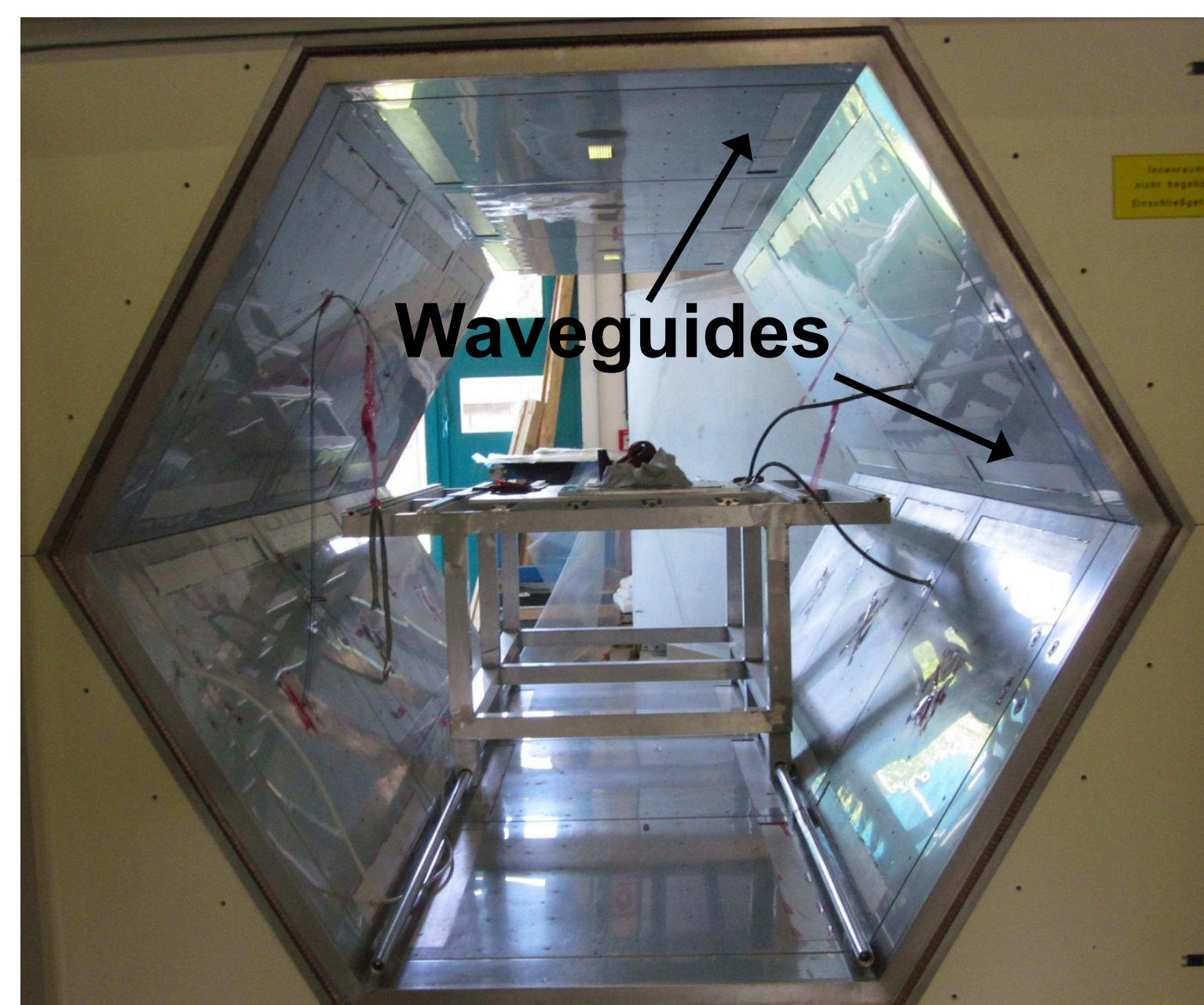
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## MOTIVATION

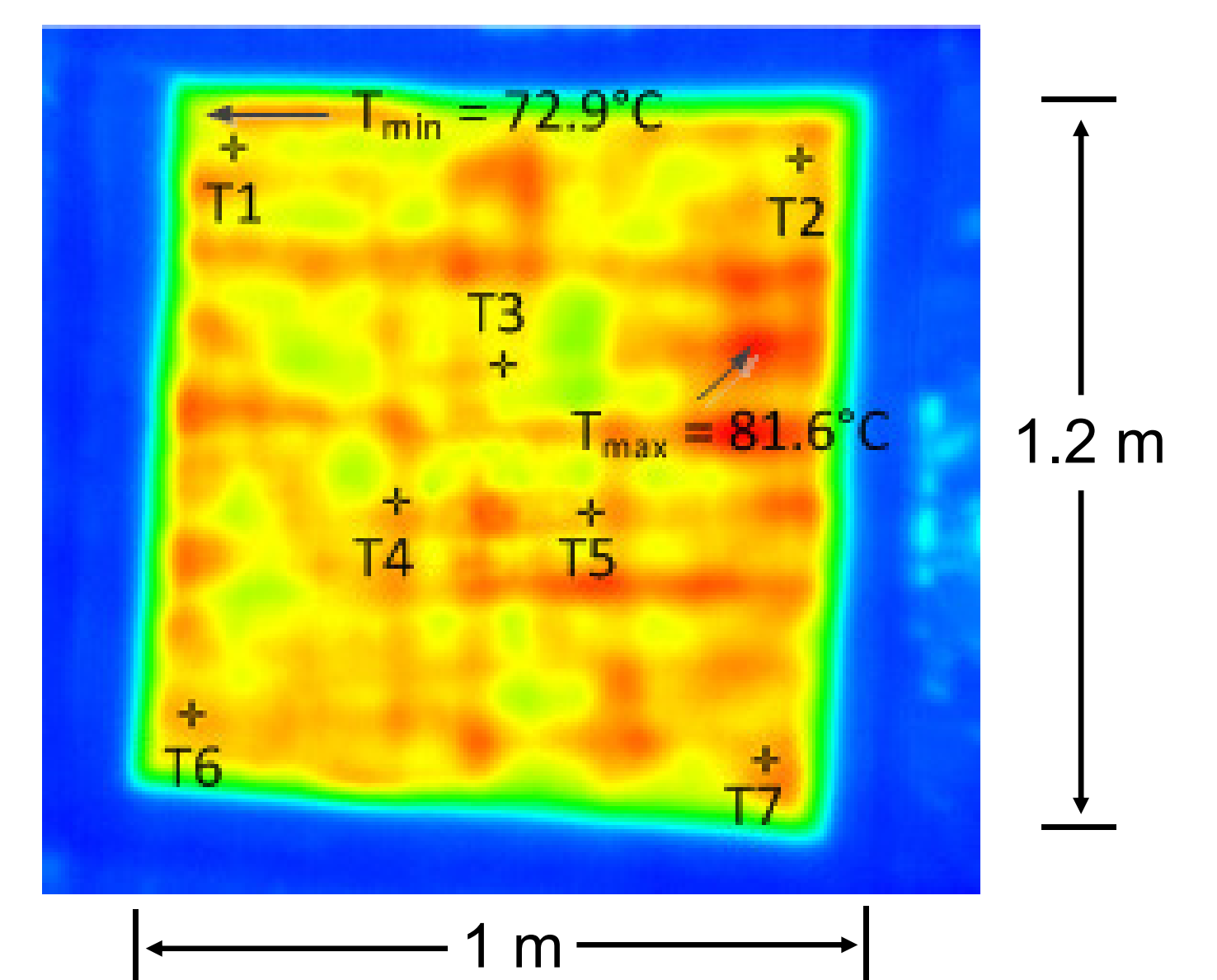
- The use of microwave heating in composites processing attracts more interest from industry areas.
- To improve the temperature distribution during the heating process is a significant challenge.
- The unique HEPHAISTOS system improves the heating homogeneity in a great extent.
- By influencing the EM field distribution, advanced control algorithms can help HEPHAISTOS to achieve a better heating homogeneity and make it adaptive to different materials/geometry structures.

## RESEARCH APPROACH AND RESULTS

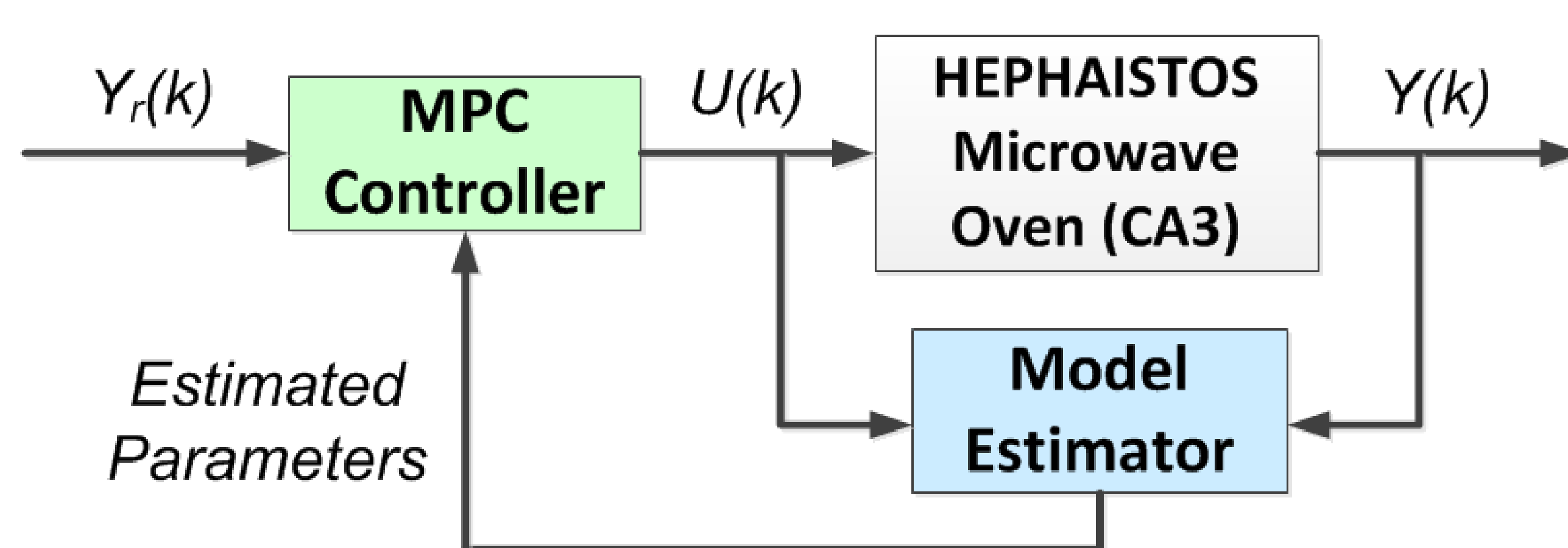
- Distributed microwave feeding system HEPHAISTOS
  - Unique hexagonal cavity structure
  - Multiple magnetrons as heating sources
  - Homogeneous EM field distribution
- Flexible temperature measurement methods
  - Fiber optic sensor / Thermocouple
  - Thermal camera



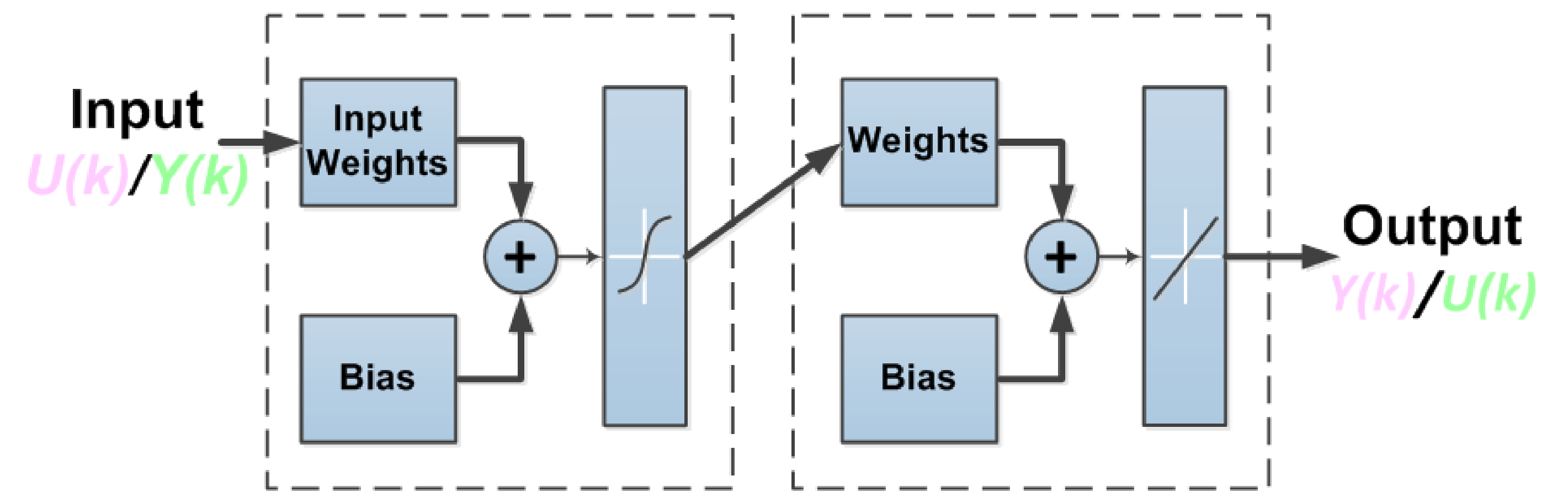
Thermo Camera Measurement



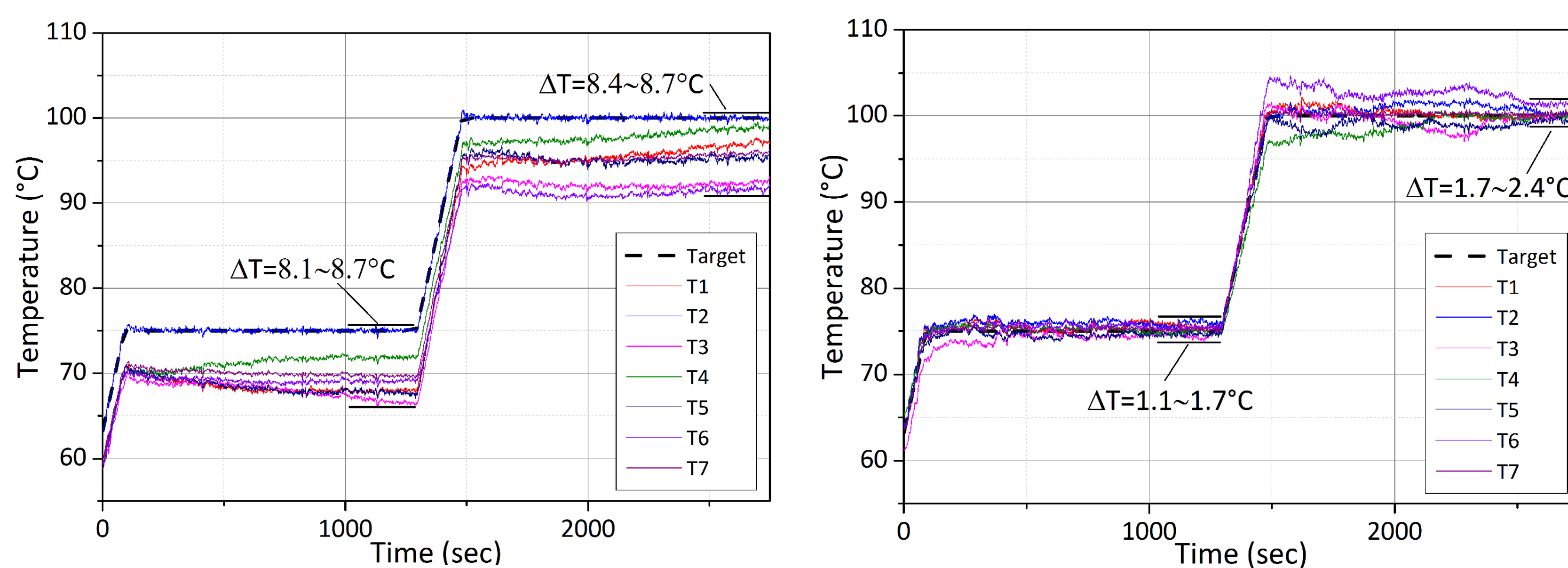
Model Predictive Control (MPC) System



NN System Identification/Control



Control performance of PID (left) and MPC (right)



- Development of Matlab/LabView based control system
- Optimization and comparison of different system identification and control methods
  - PID Controller
  - Model Predictive Controller
  - Neural Network (NN) Controller

## OUTLOOK

- New control method (e.g. neural network based intelligent control) has been already under test.
- The hybrid HEPHAISTOS system with combined microwave/hot air heating and moving conveyor belt will be finished within this year, leading to even more challenging control tasks.
- Based on simulations and experiments, the whole control approach shows great potential to be implemented in practical industry applications.