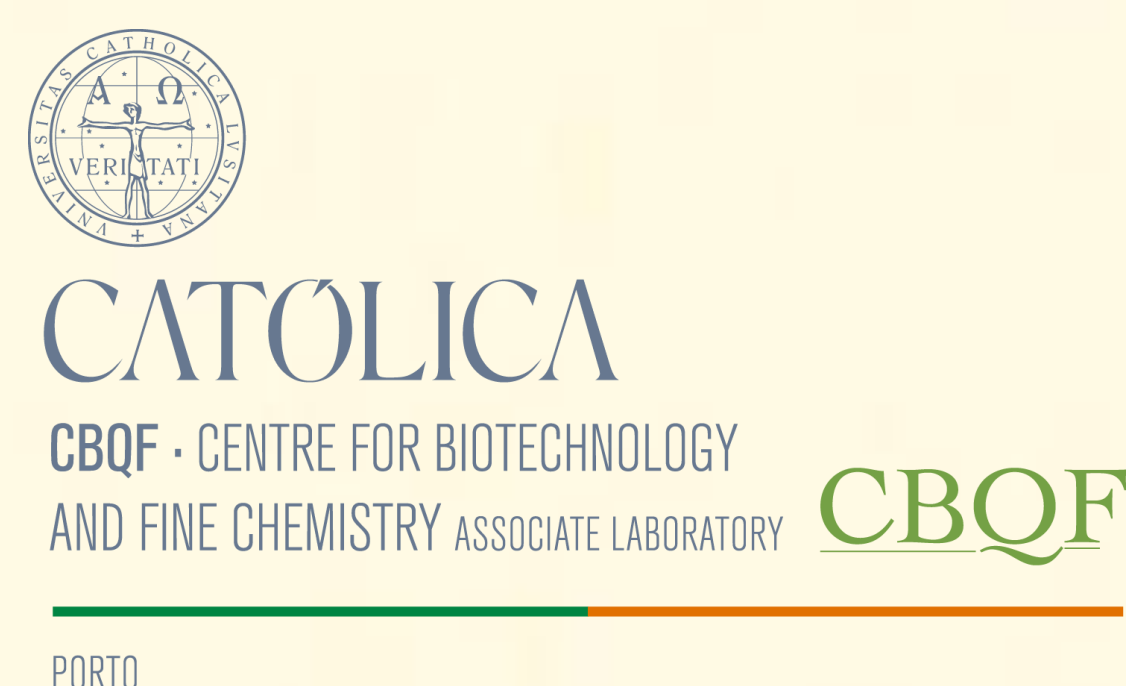


Smart Solar Cooking with a Box Oven: Modelling and Early Validation with the SUNRISE Project

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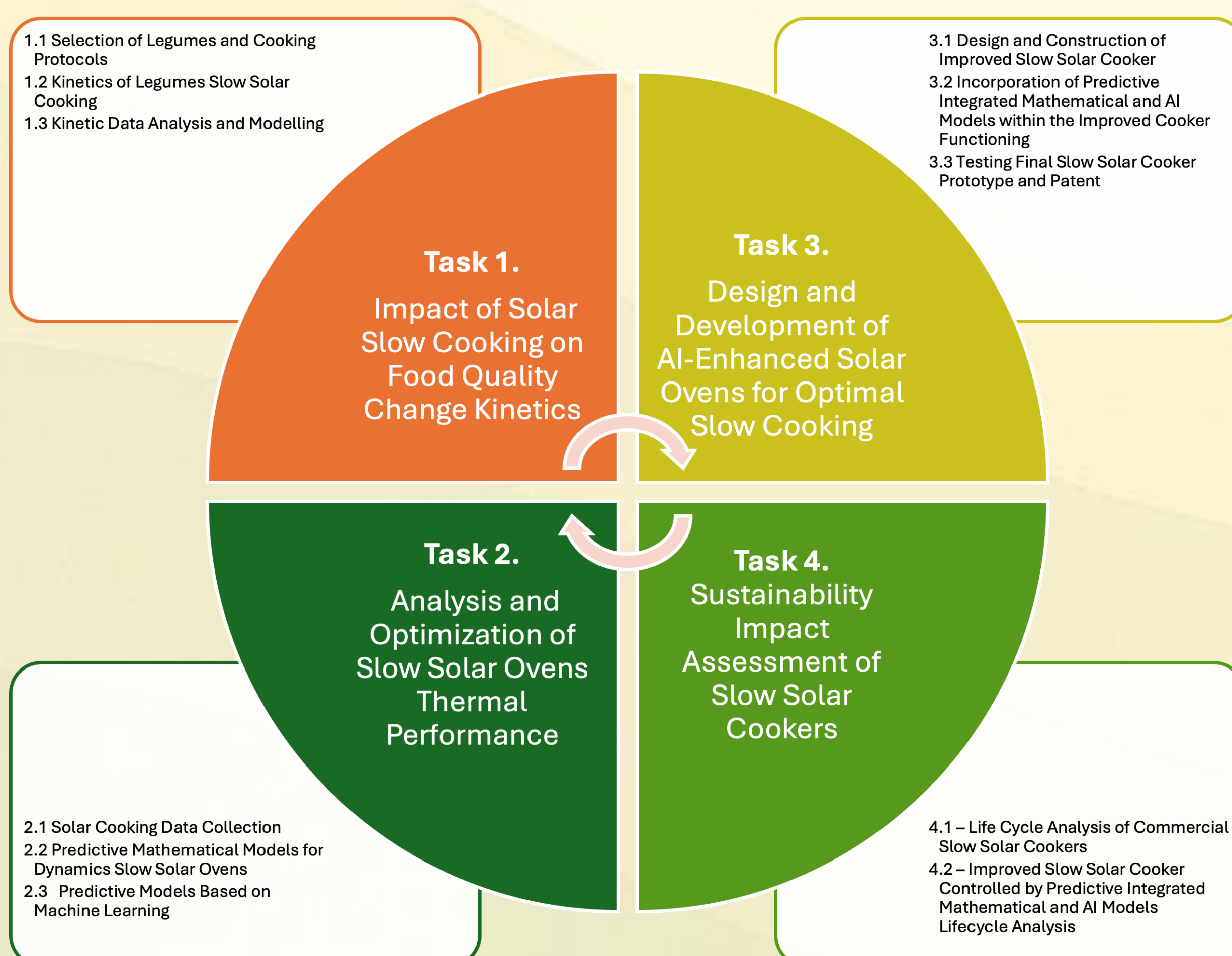


Introduction

- Solar energy is a clean, free, and abundant source, with high potential for sustainable cooking applications, even in low ambient temperature conditions.
- Despite their environmental and nutritional benefits, solar cookers remain underutilized in developed economies.
- The SUNRISE project supports the energy transition in food systems by leveraging solar radiation and artificial intelligence to develop smart, low-energy, and sustainable slow-cooking solutions.

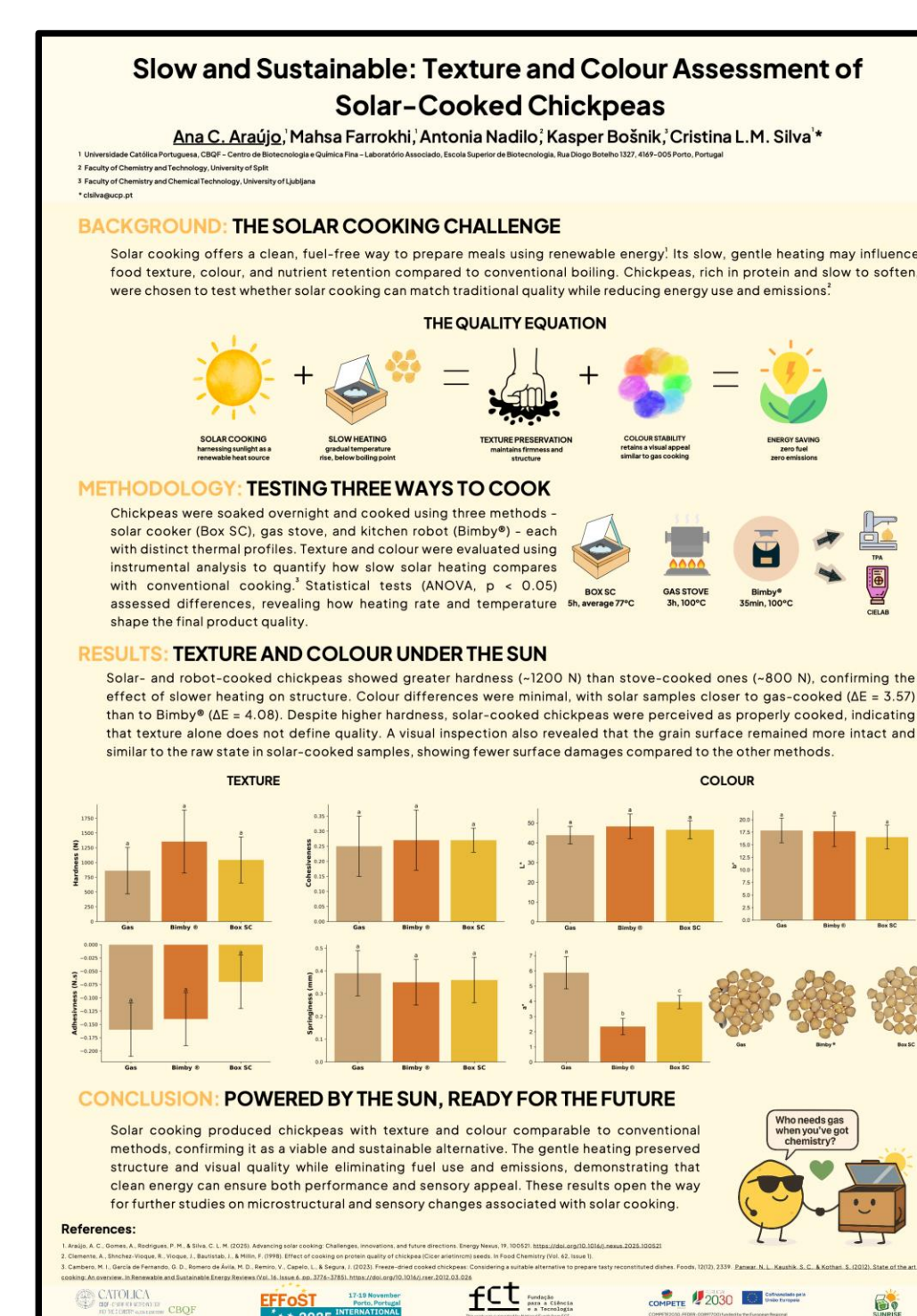
Objectives

- To develop and refine a dynamic thermal simulator based on energy balances, capable of incorporating real solar radiation patterns to predict internal temperature profiles and cooking durations.
- To conduct experimental trials using the SunTaste® solar oven, assessing cooking performance under natural sunlight conditions.
- To evaluate the quality of solar-cooked chickpeas, including texture, visual, and sensory characteristics, and compare them with conventionally cooked samples.



Preliminary Results

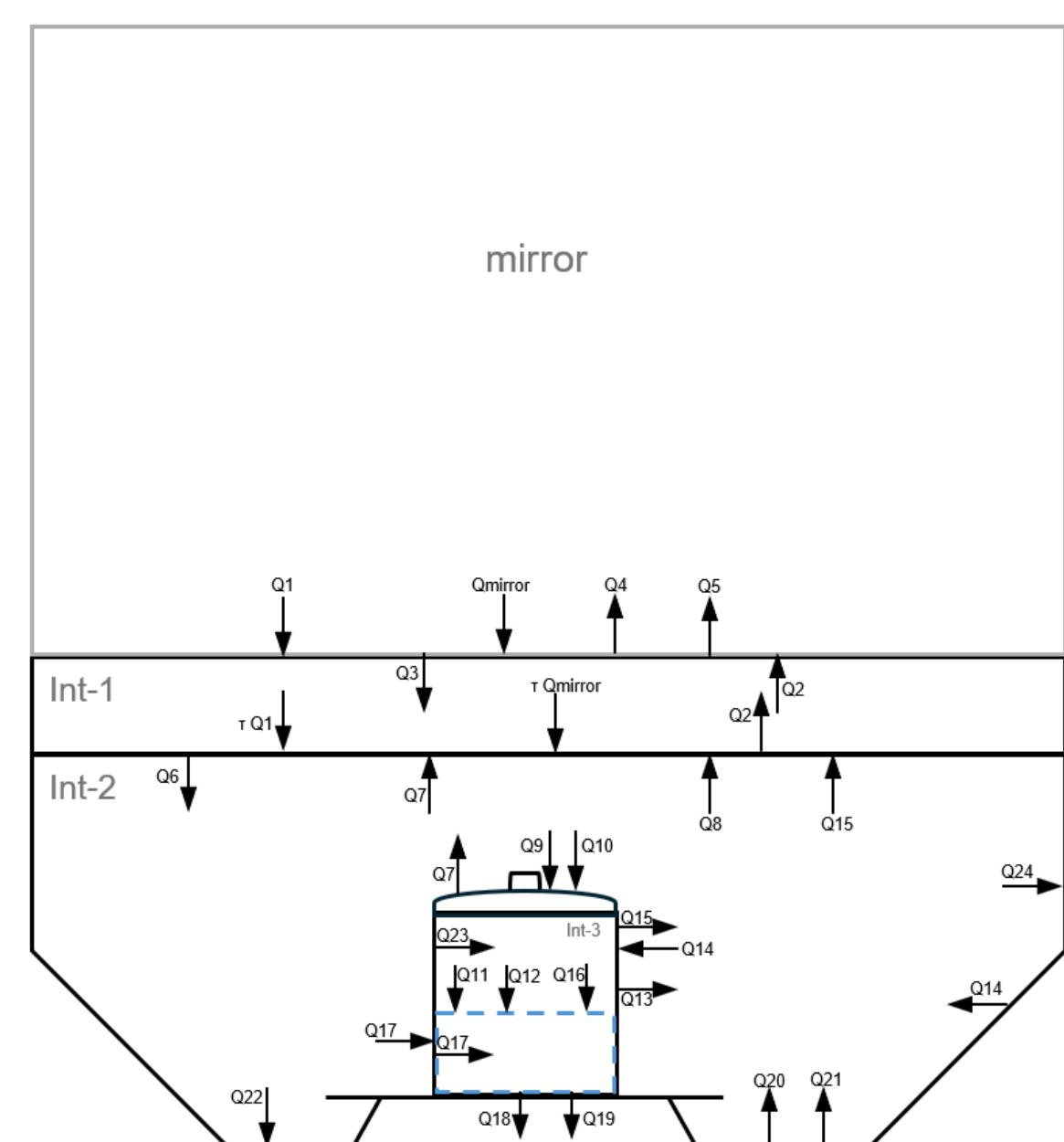
- Our poster "Slow and Sustainable: Texture and Colour Assessment of Solar-Cooked Chickpeas" — show that solar-cooked chickpeas achieve texture and colour comparable to conventional methods, confirming solar cooking as a viable and sustainable alternative.



Visit Poster
P1.2.017

Thermal Simulator

Dynamic thermal model of the SunTaste® solar oven



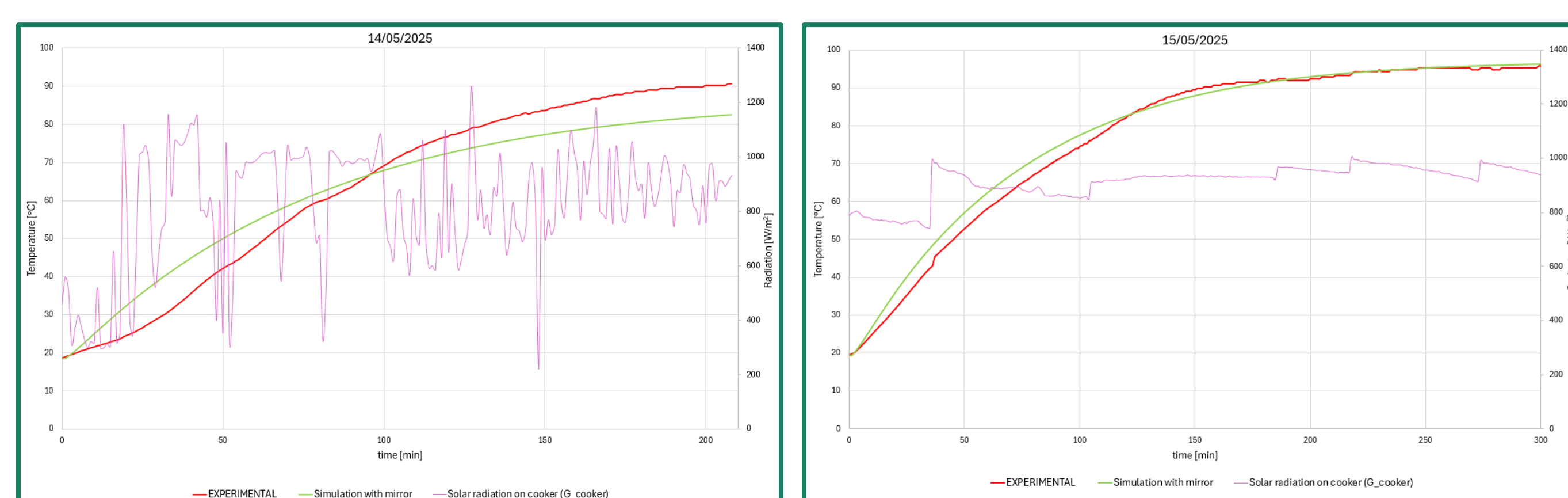
Heat flow	Description
Q1	solar radiation over glass 1
Q2	radiation of glass 2 toward glass 1
Q3	convection of glass 1 toward the int-1
Q4	radiation of glass 1 toward the sky
Q5	convection of glass 1 toward the ambient
Q6	convection of glass 2 toward int-1
Q7	radiation from lid toward glass 2
Q8	convection of the int-2 toward glass 2
Q9	convection of int-2 toward the lid
Q10	radiation from the sun absorbed by the lid
Q11	convection of the lid toward int-3
Q12	radiation of the lid toward int-3
Q13	convection from the pot to int-2
Q14	reflection of incident radiation on the reflectors
Q15	radiation of pot toward glass 2
Q16	radiation of pot toward the fluid
Q17	convection of pot toward bottom panel
Q18	convection of bottom of the pot toward bottom panel
Q19	radiation of the bottom of the pot toward bottom panel
Q20	convection of the bottom panel toward int-2
Q21	radiation of the bottom panel toward int-2
Q22	radiation from the sun absorbed by the bottom panel
Q23	convection of pot toward int-3
Q24	conduction from int-2 toward the ambient
Qmirror	reflection of the incident radiation on the mirror

Energy balances to: glass 1, glass 2, lid, pot, fluid, bottom panel

Energy input from solar radiation: cooker & mirror

- The thermal simulator is able to predict the temperature of a fluid inside the pan of the solar box oven.

- Preliminary results are particularly favourable when solar radiation intensity is more stable.



Experimental and Predicted Time Temperature Profiles inside the pan of a solar box oven – Impact of environmental radiation conditions.



Acknowledgements



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