



Source : La tribune, *L'agrivoltaïque, comment ça marche ?*

LIÈGE université
Gembloux
Agro-Bio Tech

ENGIE
Laborelec

Development and validation of a framework allowing the evaluation of photovoltaic and photosynthetic productions of agrivoltaic systems

Candidate : **Roxane Bruhwylér**

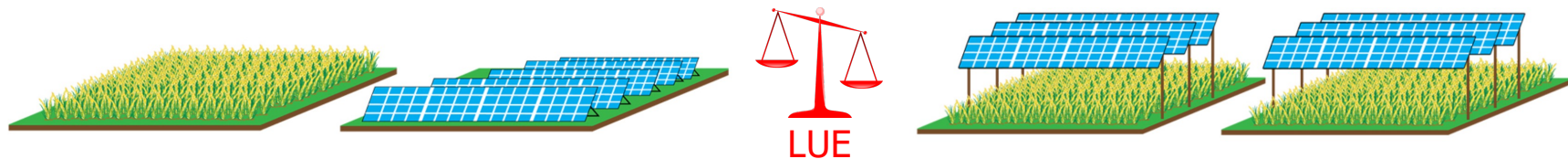
Promoter : **Frédéric Lebeau**

October 2020

Agrivoltaics (AV)

Agricultural and photovoltaic (PV) production on the same land

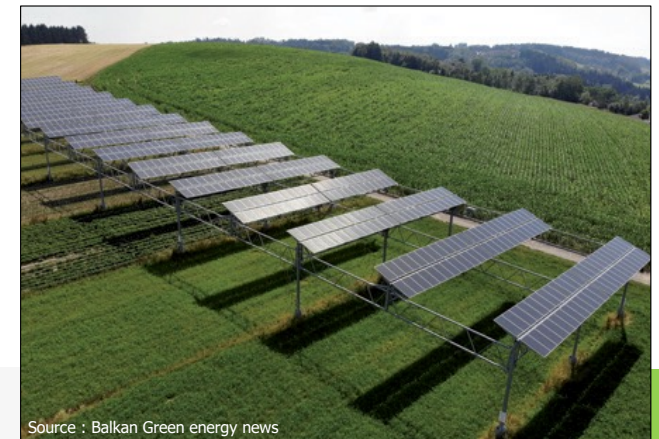
→ ↗ land use efficiency (LUE)



- PV structures → mechanized farming operations ✓
→ fraction of incident radiation on crops ✓

Agrivoltaic systems benefits

- Supports renewable En. development in countries with heavy land pressure
- Mitigates the adverse effects of climate
- Diversifies and increases incomes

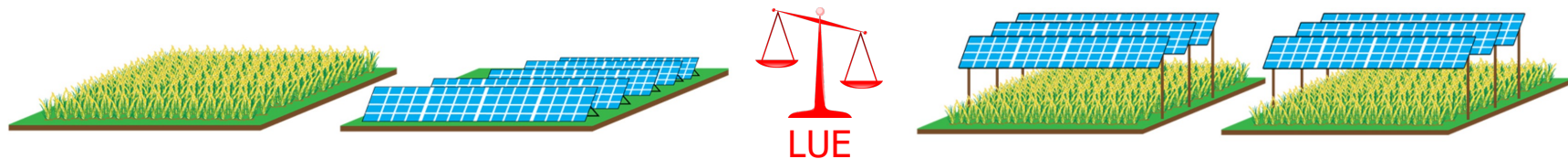


Source : Balkan Green energy news

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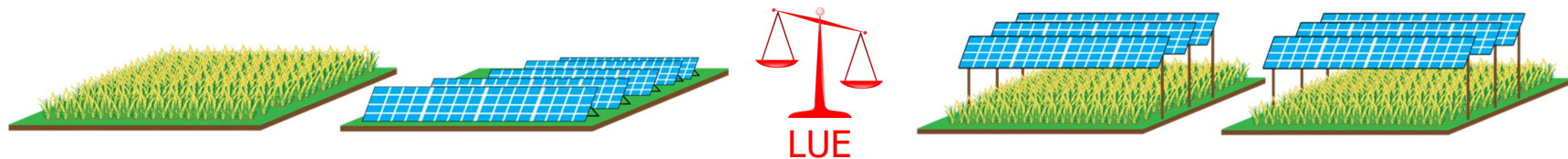
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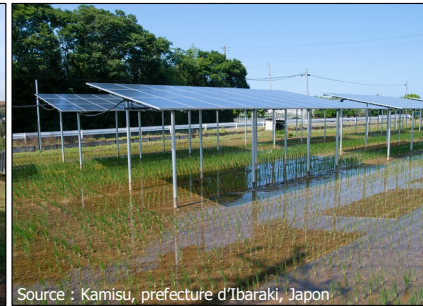
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Driving parameters of the synergy

- **Farming system**

→ Type of crop



- **Location**

→ Environmental conditions (radiation, pluviosity, temperature, soil properties, ...)

- **Photovoltaic system**

→ Geometry (density, inclinaison, height, ...)

→ Technology (semi transparent, bifacial, tubes, ...)

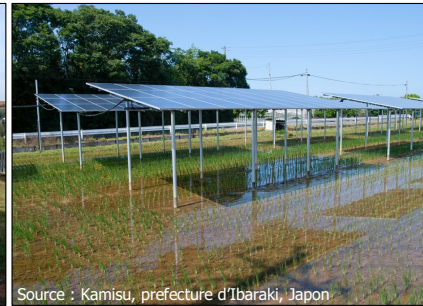
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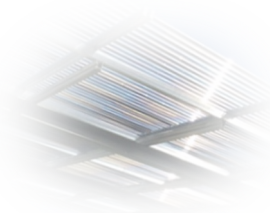
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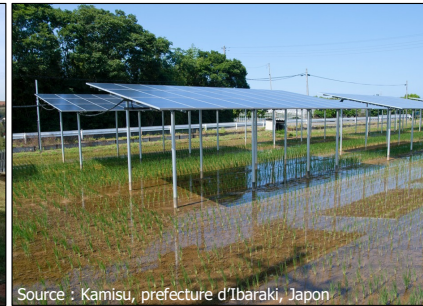
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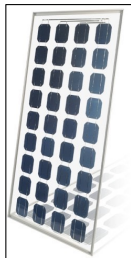
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Source : SolarConstructions

Source : Renewable Energy World

Source : Tube Solar AG

Aim of the thesis

Develop et validate a general framework

→ evaluate photovoltaic and agricultural productions of agrivoltaic systems

❖ Integer → Diversity of systems

→ Spatio-temporal variation of environment

→ Complexity of phenomena involved

→ Giving an assessment and optimization tool to the actors of the agrivoltaic field (energy experts, public authorities, farmers, ...)

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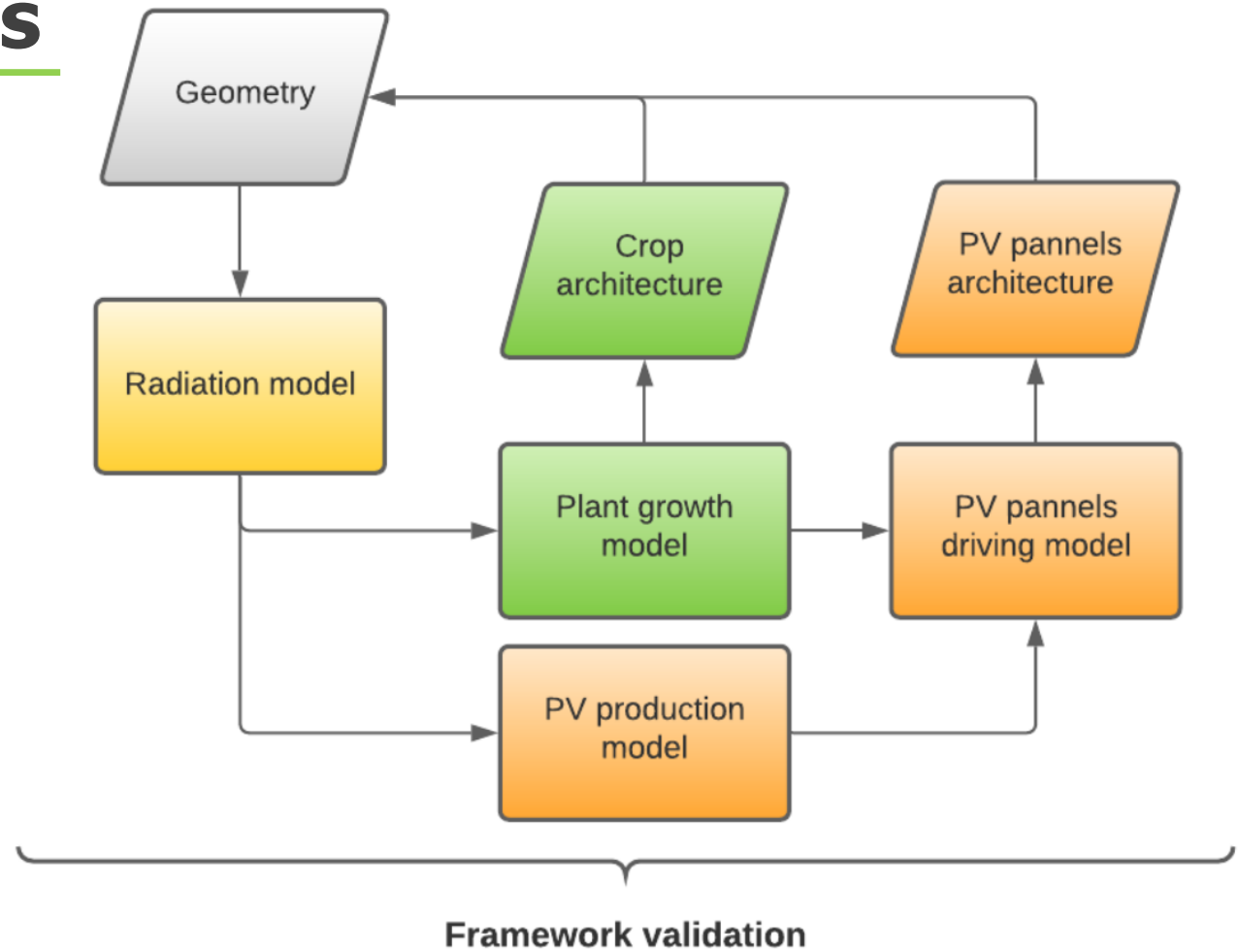
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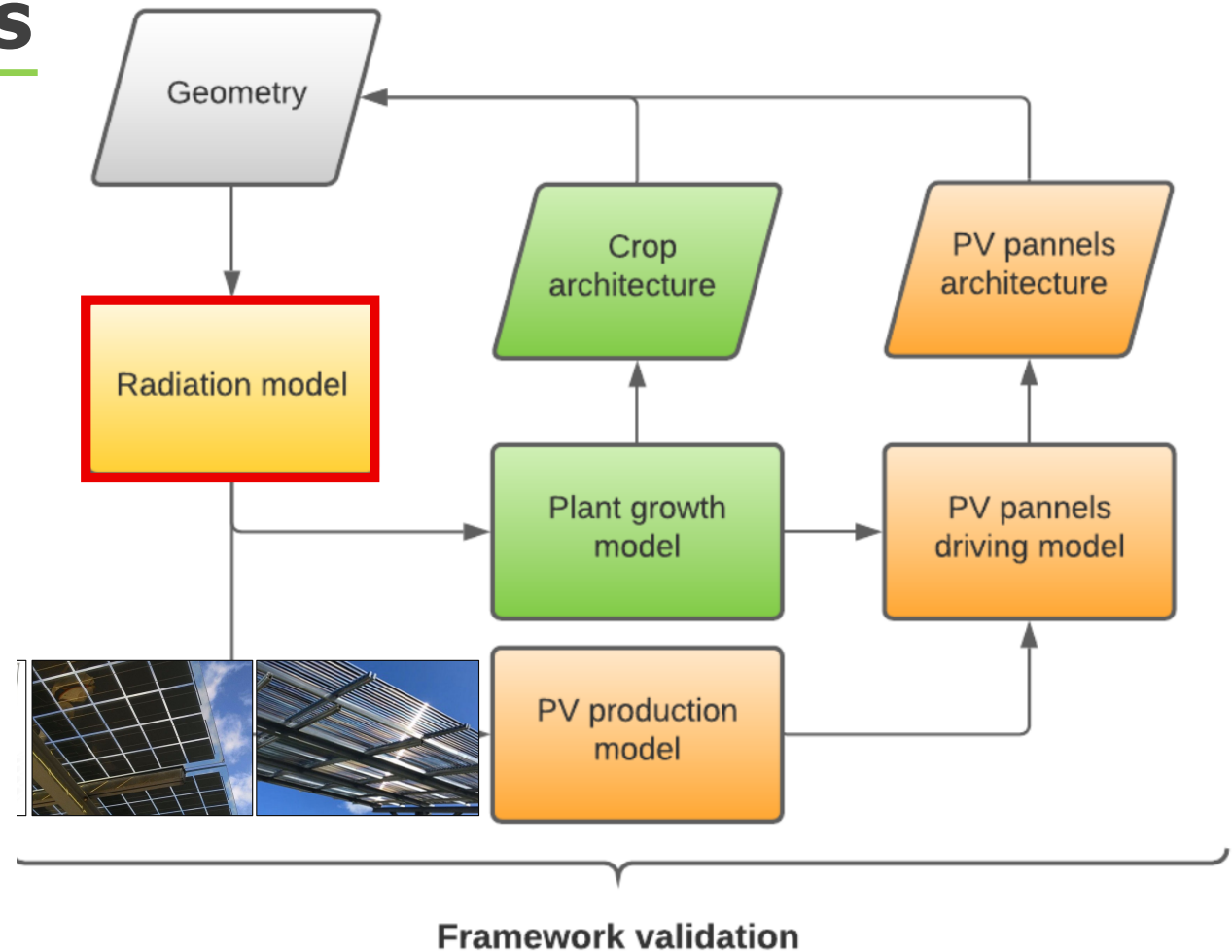
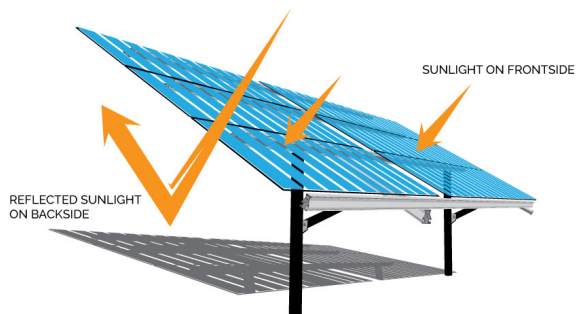


Challenges to address

Challenge n°1 : Explicitly know the spatio-temporal variability of light environment

→ integration :

- Direct and diffuse components
- Optical properties of objects
- Physical behaviour of light



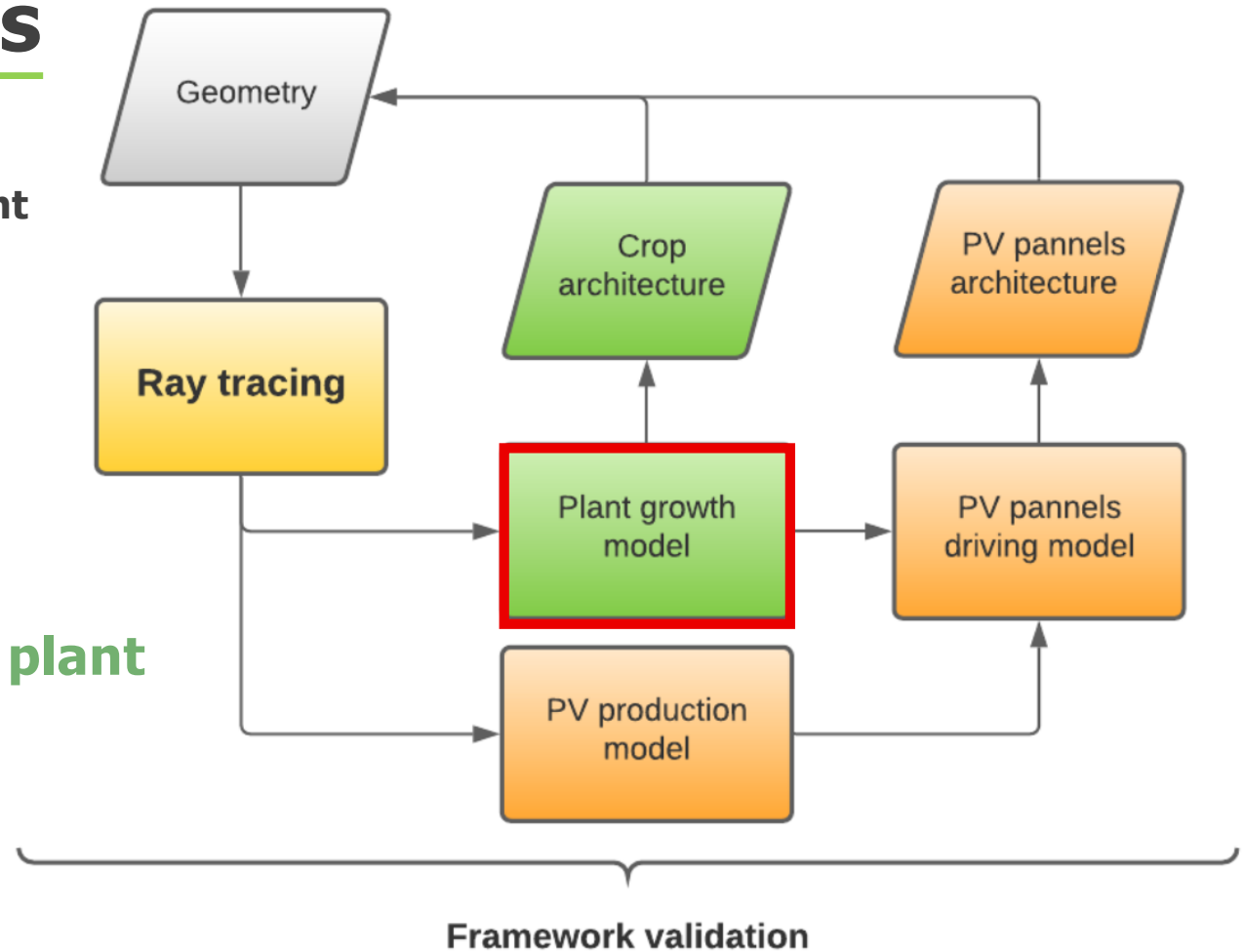
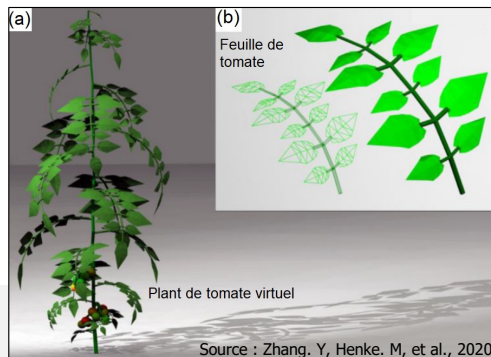
Challenges to address

Challenge n°2 : Explicitly know the anatomic and physiological development of plants

→ integration :

- Physiological phenomenons
- Spatio-temporal variability of environment
- Plant architecture

→ **Functionnal and structural plant modelling (FSPM)**

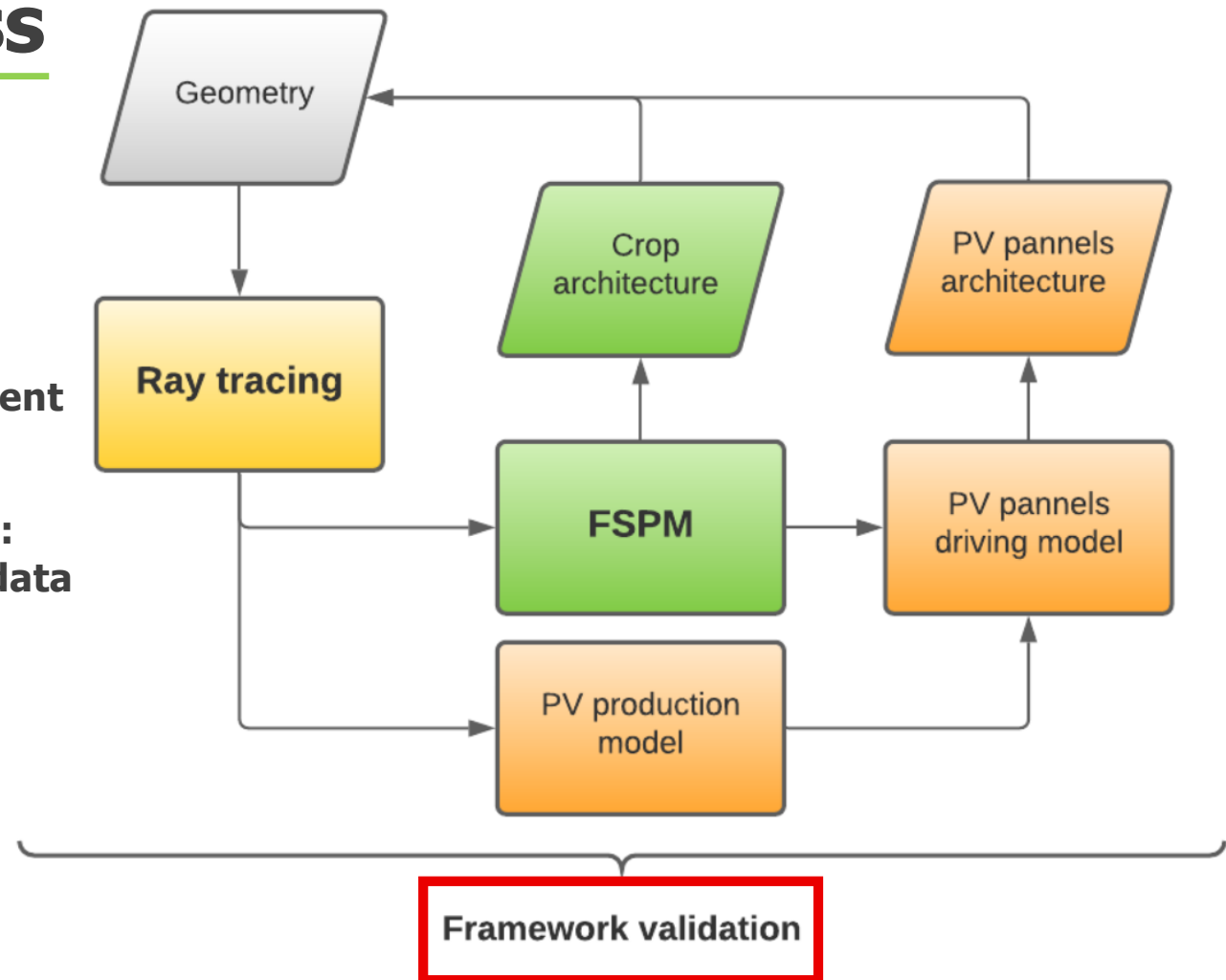


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Challenge n°3 : Framework validation against experimentations

→ Experimental prototypes (with different associations of parameters)

→ Instrumentation of the prototypes : agronomic, climatic and photovoltaic data



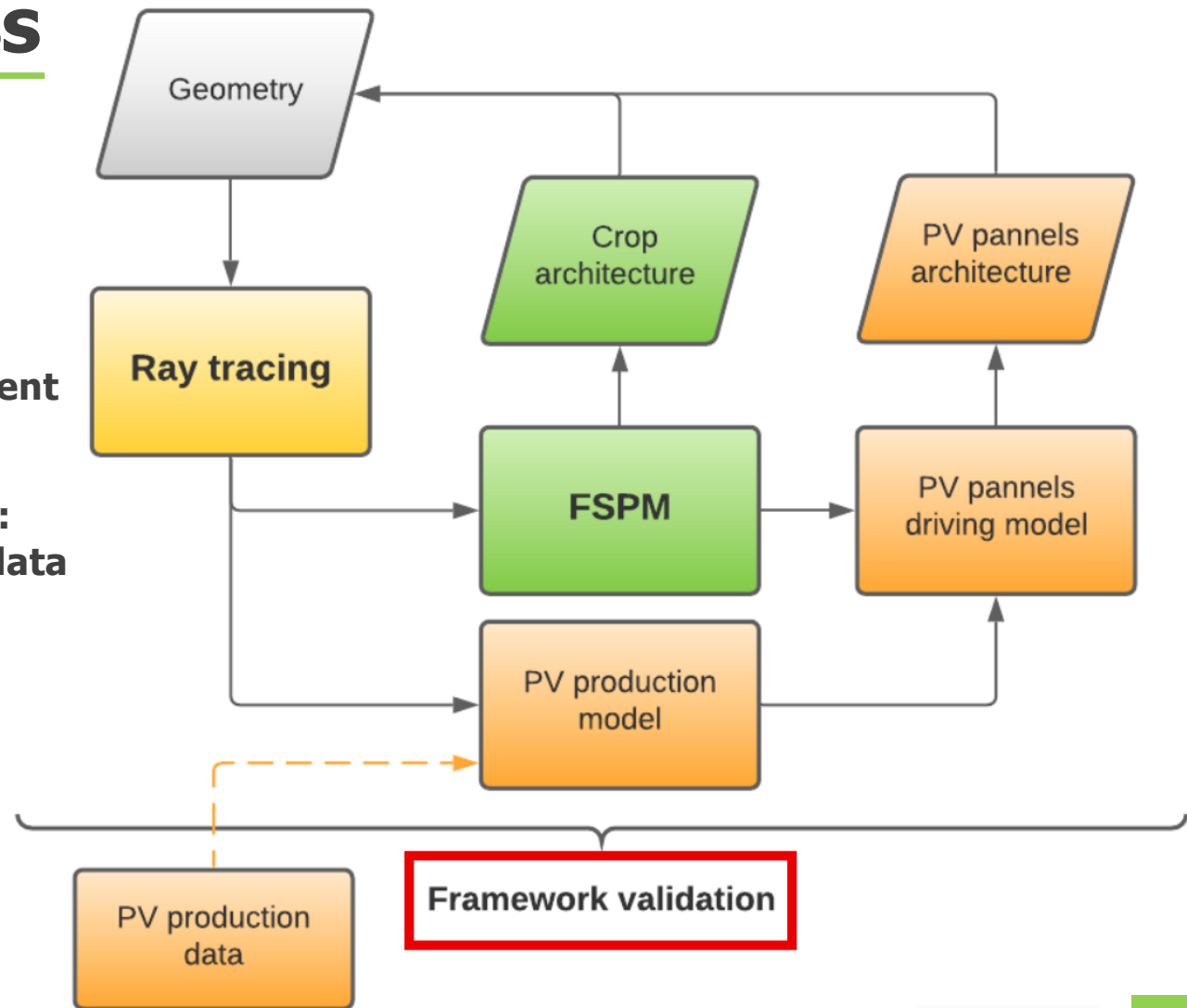
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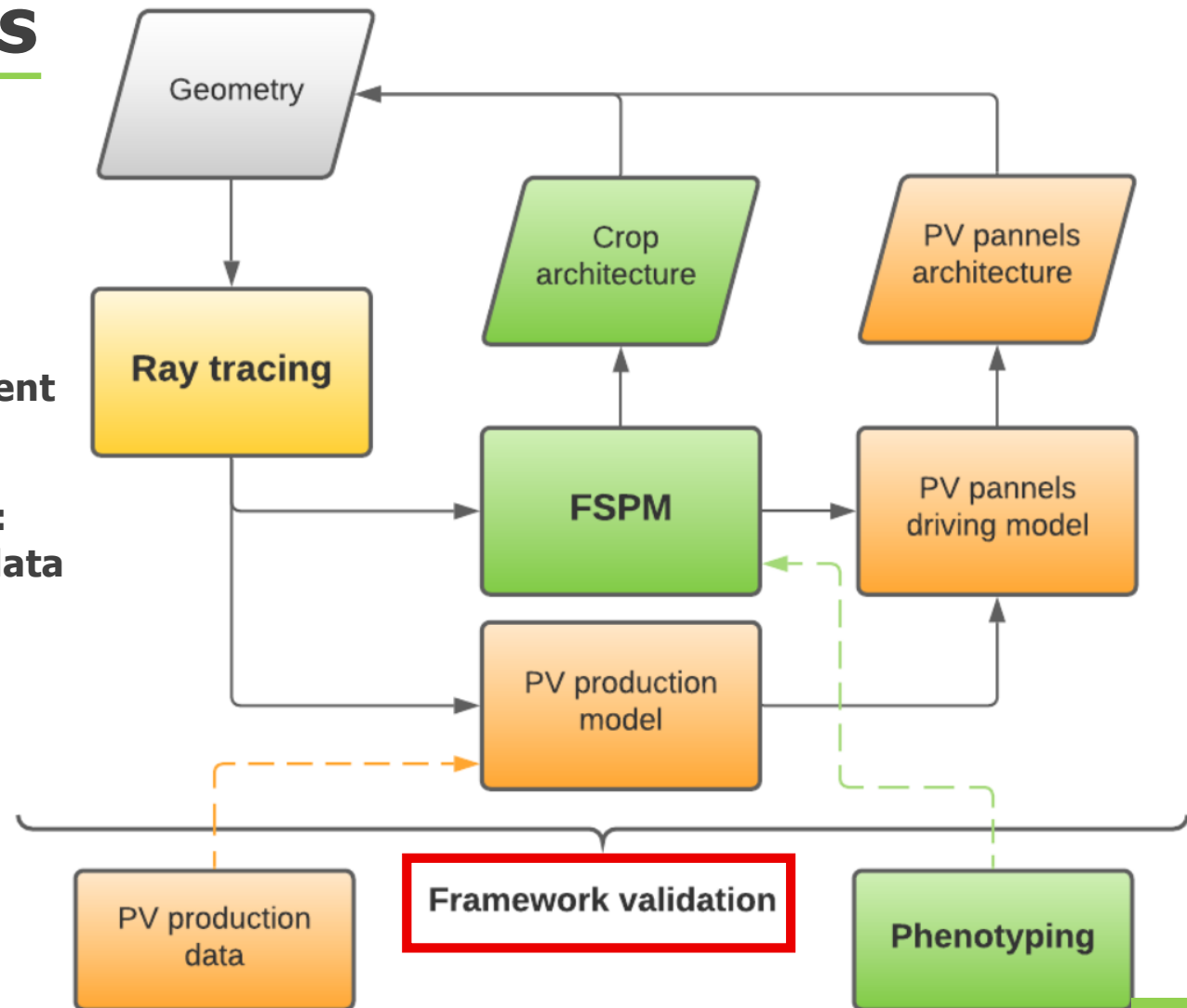
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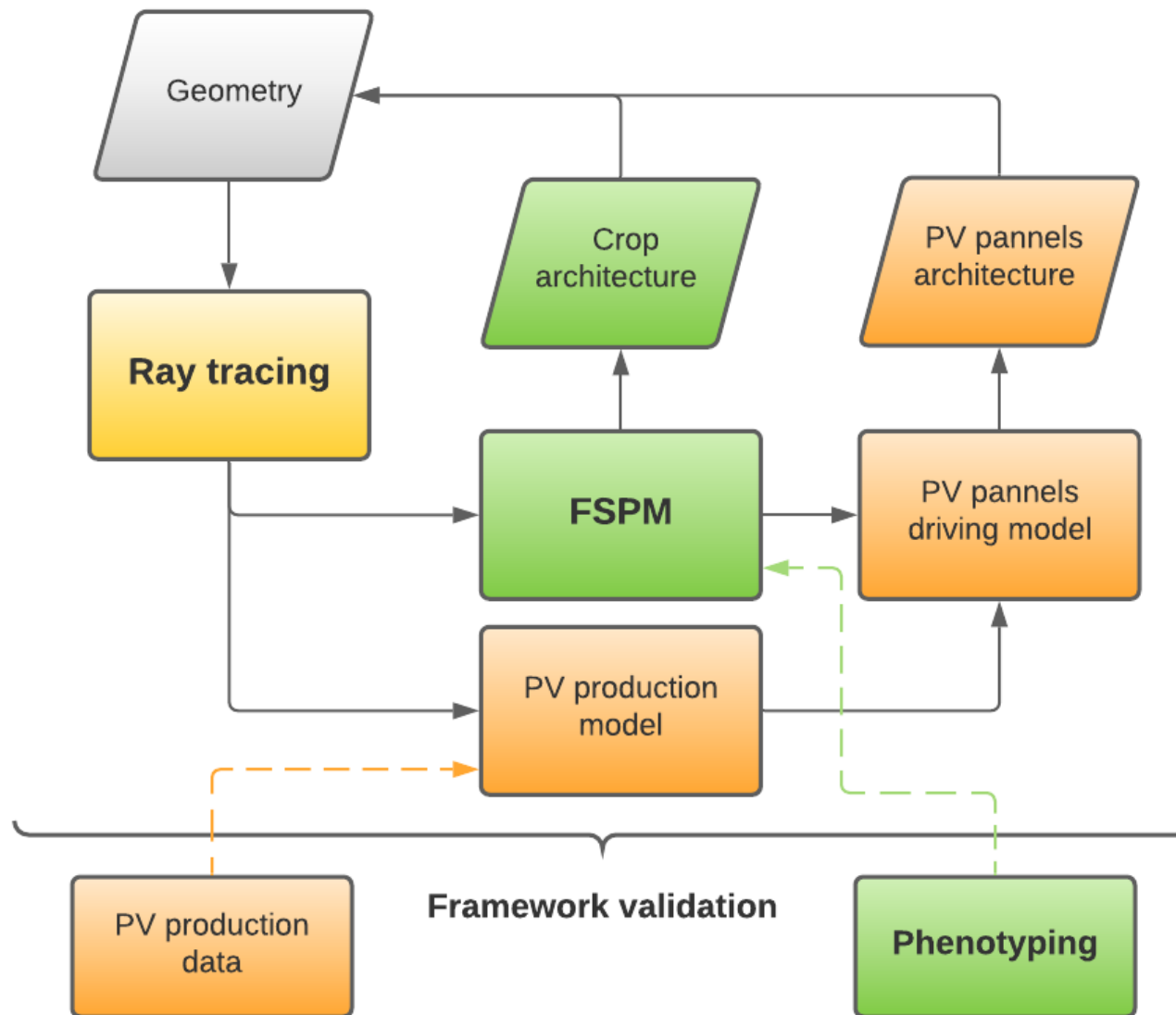
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Thank you for your attention !

👤 **Roxane BRUHWYLER**

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