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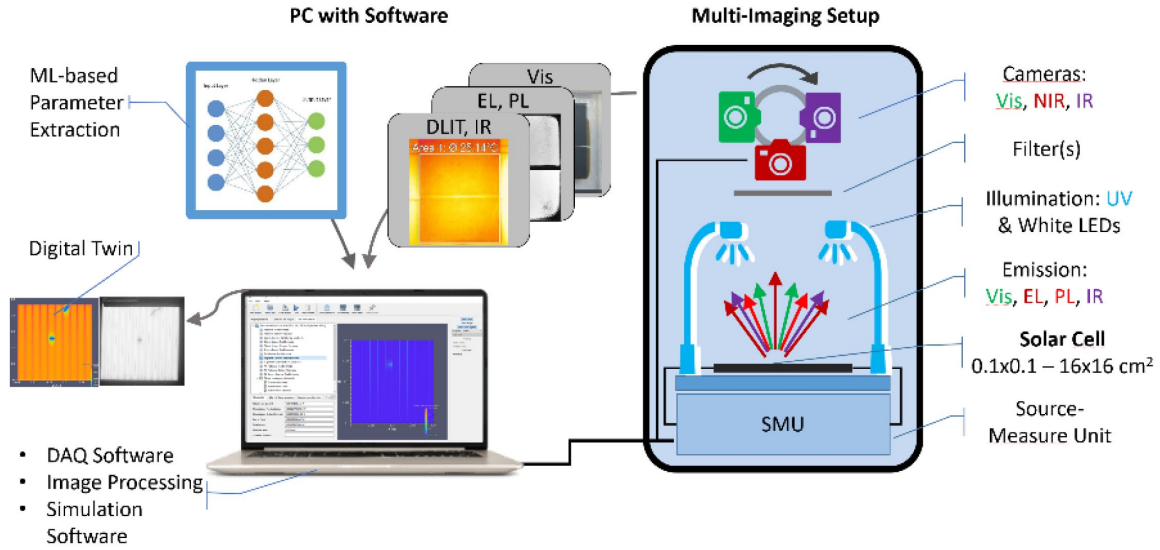
Advanced Imaging and Machine Learning for PV Quality Assurance

Next generation solar cell technologies are researched intensively to further increase efficiency and reduce cost of photovoltaic energy production. For accelerating the transfer from lab-scale cell research to industry-scale module development and production, reliable characterization methods are crucial. With their spatially resolved information, imaging methods allow for a more detailed characterization of defects and non-uniformities in novel solar cells. Existing imaging methods are often not carried out simultaneously and correlated to investigate a particular cell, moreover, the processing of the image is rarely done with a physical modeling approach but with traditional feature detection routines. In this project, we aim at building a multi-image setup for characterizing perovskite solar cells in the visual, near-infrared and infrared range. The solar cell is placed on the stage of the setup and multiple images from the different cameras are acquired as shown in the Figure below. In a next steps, the images are analyzed on a PC and defects detected and classified. As a final result, we wish to create a digital twin of the solar cell. The solar cell parameters of the models are determined by using physics-informed machine learning. This Innosuisse-funded project is a collaboration with Fluxim AG and Solaronix SA.



Possible tasks include:

- Building an imaging setup
- Implementing or using cell analyzing tool
- Modelling perovskite solar cells
- Inverse modelling with physics-based machine learning

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