

HZB TECHNOLOGY TRANSFER PRIZE 2021

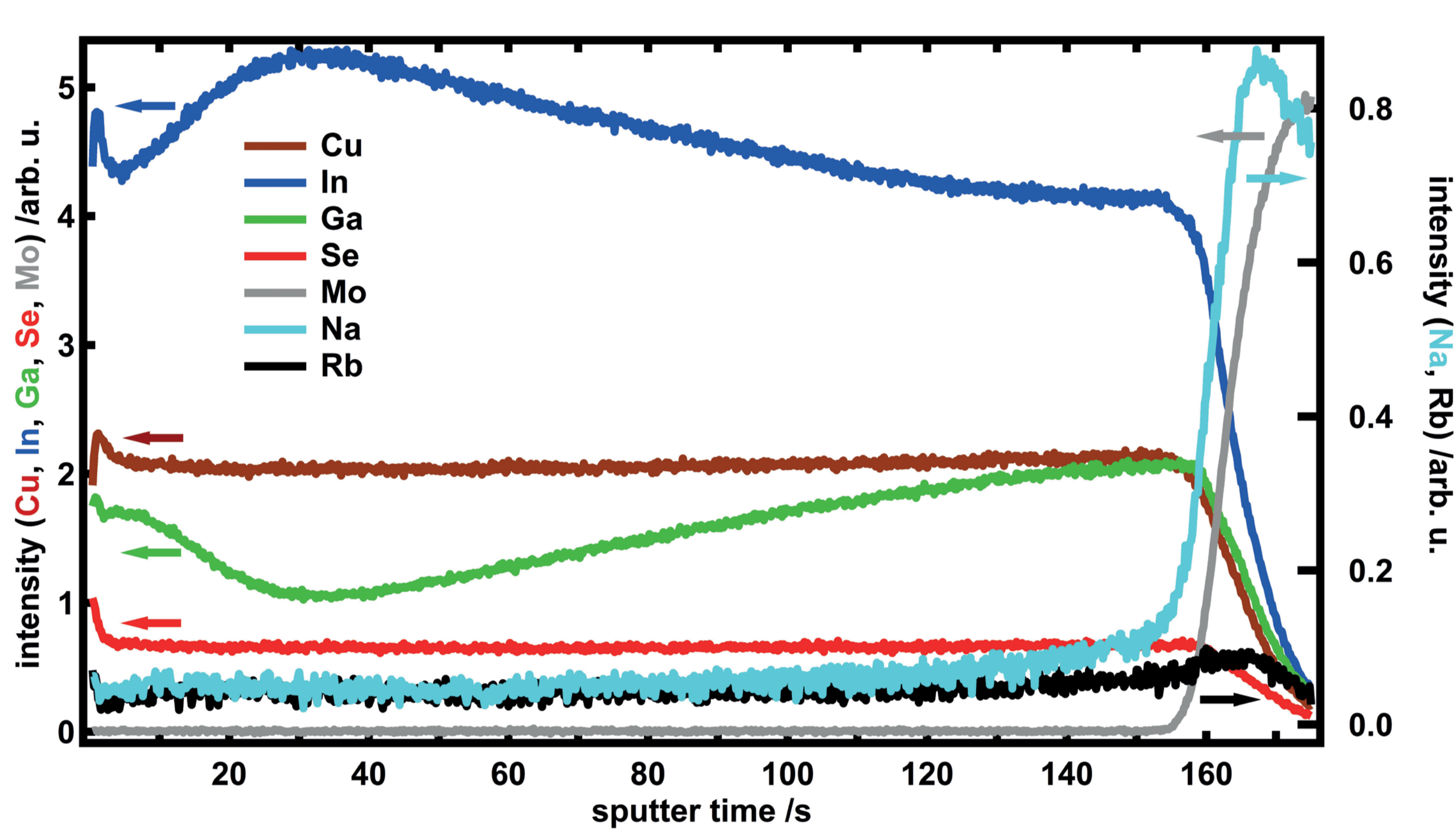
Quantifying the bandgap profile of CIGS absorber layers via GD-OES

New method to evaluate GD-OES data to enable more accurate quantification of material composition throughout the whole device

Tobias Bertram

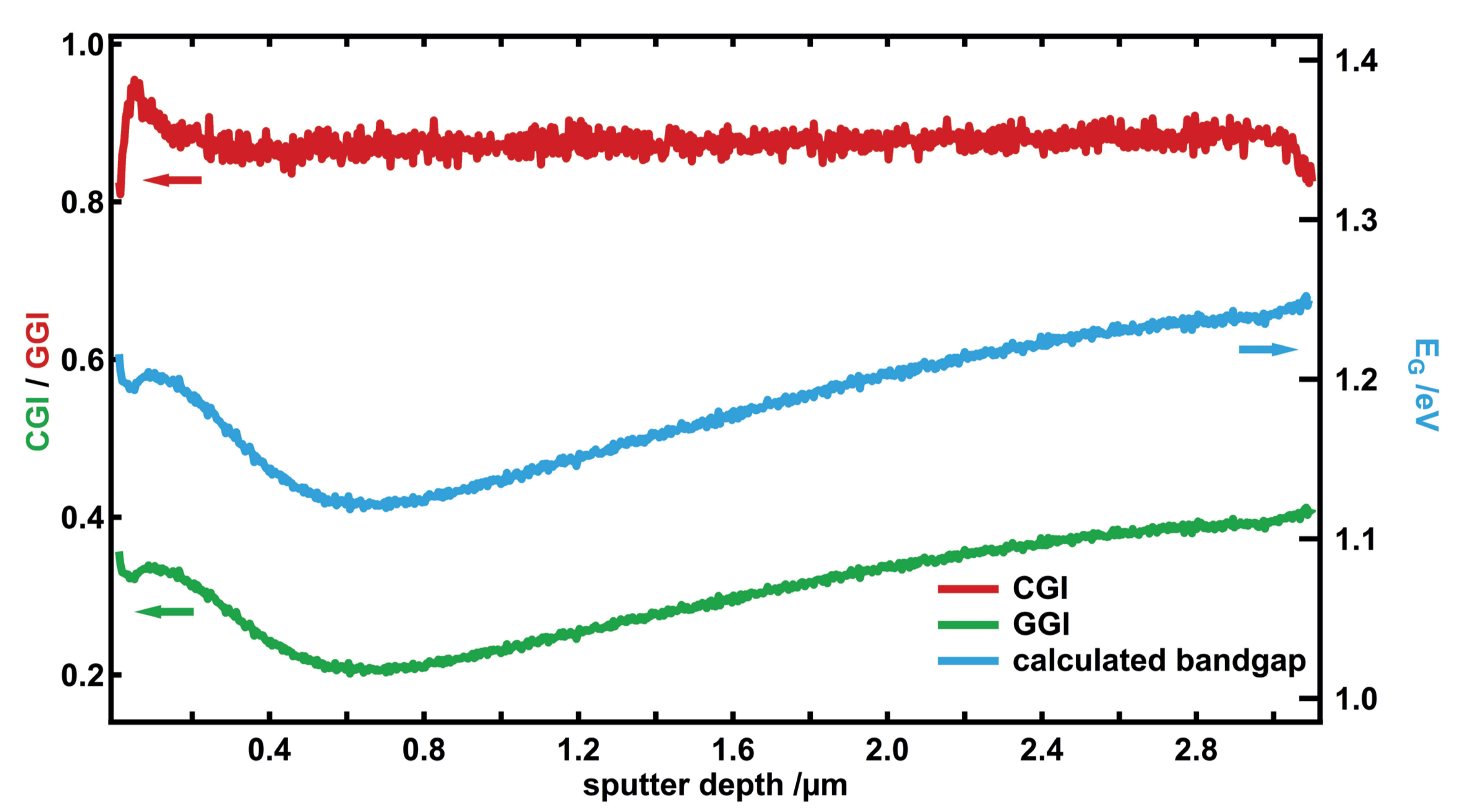
Tim Kodalle

Dieter Greiner



Graphic: Tobias Bertram

Unquantified data of a Mo/CIGSe layer - intensities vs. sputter time is plotted as given by the GD-OES measurement setup



Graphic: Tobias Bertram

The presented method allows to extract band grading profiles as a function of sputter depth, which is not accessible with optical methods

INNOVATION

Thin film solar cells, based on CIGS absorbers are versatile, durable and constitute a candidate for applications, not achievable by conventional Si technology. Especially the utilization of flexible substrates allows innovative ways to use solar technology, e.g. solar façades and foldable modules for space.

Furthermore, it has the added advantage of a in a wide range tunable bandgap, by adjustment of the Ga content. To fully realize the potential of the CIGS technology it is crucial to be able to minutely set the bandgap energy throughout the absorber.

The here presented innovation is a Matlab-based evaluation routine, that enables to quantify the measured GD-OES spectra into elemental composition as function of depth. Which allows the characterization of the whole absorber, not just the optical bandgap.

Furthermore, a newly acquired CuSe:Rb reference sample allows for quantification including the important dopant Rb, which piqued new interest from our industrial partners. With the routine it is possible to accurately quantify:

Comments from our partners

„Since 2015, PVcomB regularly carries out GD-OES measurements for us. The quantified depth profiles are an important foundation for the optimization of our CIGSse absorbers.“
Dr. Alfons Weber, project leader, Avancis GmbH

„The GD-OES quantification method developed at HZB is integral to our Process optimization. The direct access to the change in bandgap in CIGSe enables correlation with other methods and more accurate device simulation.“
Nikolaus Weinberger, process development, Sunplugged GmbH

Industrial Cooperation and Contracts

1. Significant interest of industrial partners exhibited by multiple cooperation contracts (AVANCIS GmbH, Bosch Solar CISTech GmbH, Flisom AG, NICE Solar, Sunplugged GmbH)
2. More than 80.000 € in revenue since 2015 for HZB for contracted measurements
3. Integral part in multiple projects with strong industrial support