EMIL (**E**nergy **M**aterials **I**n-Situ **L**aboratory Berlin) - a novel research platform for next generation solar energy materials at BESSY II

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One of the main challenges for today's global society is a reliable, cost-effective and environmentally-friendly supply of energy. According to many energy scenarios, renewable energies will carry the major load within a future sustainable energy system. An important role in the scenarios play solar cells which convert sunlight directly into electricity. Technology development and mass production have pulled down the costs of photovoltaics (PV) during the past decades. However, in order to accommodate the necessary economic constraints to massively implement PV on a global scale, substantial cost reductions are further needed and the integration of PV in a supply system tackling the fluctuating availability of solar radiation is a must. This calls for economically suitable solutions for energy storage.

To achieve these ambitious goals, a more knowledge-based approach to material research will become necessary with a fast and direct feedback between sophisticated analytics and state-of-the-art deposition systems which are capable to process complete devices. A promising approach is the coupling of synchrotron-based X-ray characterization techniques with up to 20 different deposition and post-treatment capabilities in one dedicated vacuum system allowing devices and materials fabrication on substrate sizes of up to 6". The X-ray spectroscopic possibilities span (conventional as well as near-ambient pressure) X-ray photoelectron spectroscopy and -microscopy (XPS/XPEEM), as well as X-ray absorption (XAS) and emission/fluorescence (XES/XRF) spectroscopy, thereby providing the unique possibility to map the electronic and chemical structure of thin layers and interface regions with high lateral and in-depth resolution.

In a concerted effort, the Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (HZB) and the Max Planck Society (MPG) are developing *EMIL* (Energy Materials In-situ Laboratory), a world-wide unique facility at the BESSY II synchrotron light source, dedicated to the in-situ and in-system X-ray analysis of materials and devices for photovoltaic (PV) applications and of (photo)catalytic (CAT) processes (see Fig. 1). EMIL will be taken into operation in 2015 and is designed such that it can serve up to three experimental end-stations that each can simultaneously access soft and hard X-rays in an energy range of 80 eV – 10 keV. The end-stations will also be available to users from academic research and industry.

In this presentation we will present the capabilities of the novel EMIL research infrastructure and discuss how it will tackles some of the very important challenges of solar energy material research. EMIL will serve as an important characterization and material growth platform for solar energy research within the international research community.

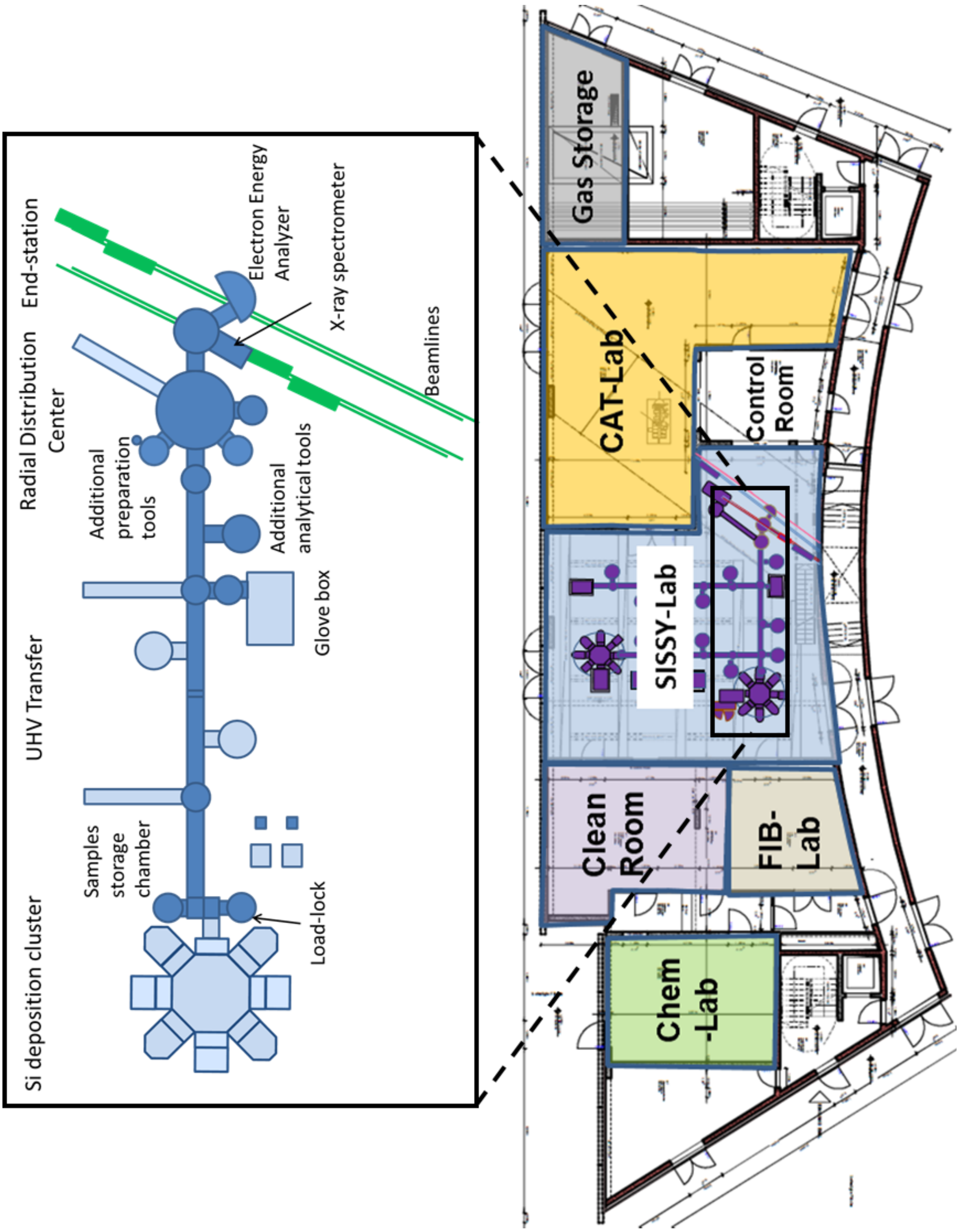

Figure 1: Layout of the first stage of expansion of the EMIL facility which has a total area of 2000qm. Enlarged: sketch of the deposition, analytics and UHV-transfer tool of the SISSY-lab.