# ENHANCED ARPES EXPERIMENTS WITH PEAK AT SSRL

## Seamless system integration using PEAK API

The ARPES beamline 5-2 (BL 5-2) in Stanford Synchrotron Radiation Lightsource (SSRL) in the US has been operating for four years after upgrading to a fully integrated control system using PEAK application programming interface (API). The PEAK API is specifically designed for seamless integration of the analyser with external hardware like beamline and manipulator. The integrated control system makes it easier to conduct various experiments that involve the control and synchronization of external hardware for enhanced experiments.

At BL 5-2, all the instruments related to photoelectron spectroscopy measurements can be fully controlled and synchronized from the integrated control system through graphical interface. External parameters are highly configurable to set up measurement scans and sequences, for example: 2D real-space mapping, temperature or excitation energy scan. Researchers can operate fully remote experiments without visiting the synchrotron, with the onsite help of the beamline staffs to transfer samples. Measured spectra are saved in an in-house HDF5 format, which includes metadata from the analyser and other hardware to facilitate data analysis.

The integrated control system at BL 5-2 is based on python, interfacing with Scienta Omicron analyser control (PEAK) and the beamline motion control (SPEC). The integrated control system controls hardware including the analyser, the low-temperature manipulator, the sample temperature controller, the beamline, and several cameras for the manipulator and the sample.

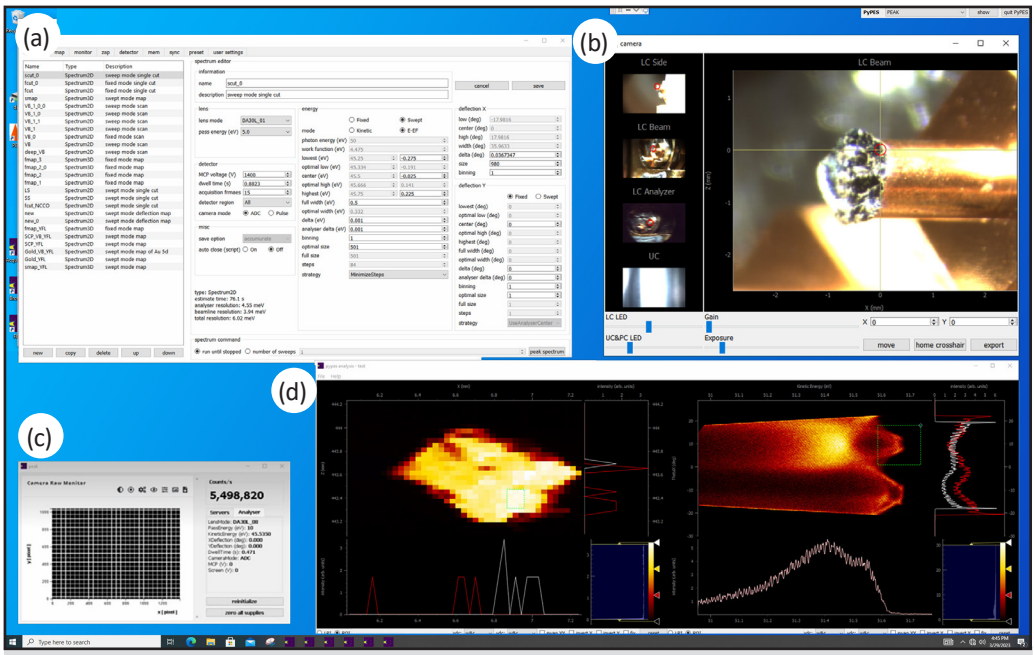


Figure: Graphical user interface of the integrated control system at BL 5-2 at SSRL. PEAK API enables seamless integration with external hardware. (a) Configuration of measurement scans and sequences. (b) Live camera image of a sample during measurements. (c) Live photoelectron spectra. Dummy image is shown in the figure. (d) 2D real-space µARPES intensity map (left), and band dispersion (right).

**Beamline scientist Dr. Makoto Hashimoto:**

– The users of our beamline experience the measurements at BL 5-2 to be efficient, thanks to the 2D real-space mapping and automated sample position optimization routines. It takes less than 30 minutes to find a good position on a sample and align the sample orientation before data acquisition.

– PEAK API enables such combination of analyser and manipulator control. PEAK API is very flexible, reliable, and stable. The python example code and the course provided by PEAK software development kit (SDK) are comprehensive and crucial for the efficient development of the software.

BL 5-2 at SSRL is designed for high-resolution ARPES in the energy range of 20-200 eV with full polarization control. The best spot size of the excitation source is 0.035 (H) X 0.007 (V) $mm^2$. The dedicated experimental end station is equipped with a DA30-L deflection analyser. This setup can perform ARPES experiments with a total energy resolution of a few meV and an angular resolution of ~0.1° while keeping the experimental geometry fixed to avoid matrix element effects.

PEAK SDK & Training Course supports analyser integration using PEAK API by providing software training course by the developers of PEAK, python example code, and PEAK demo license for development without analyser.