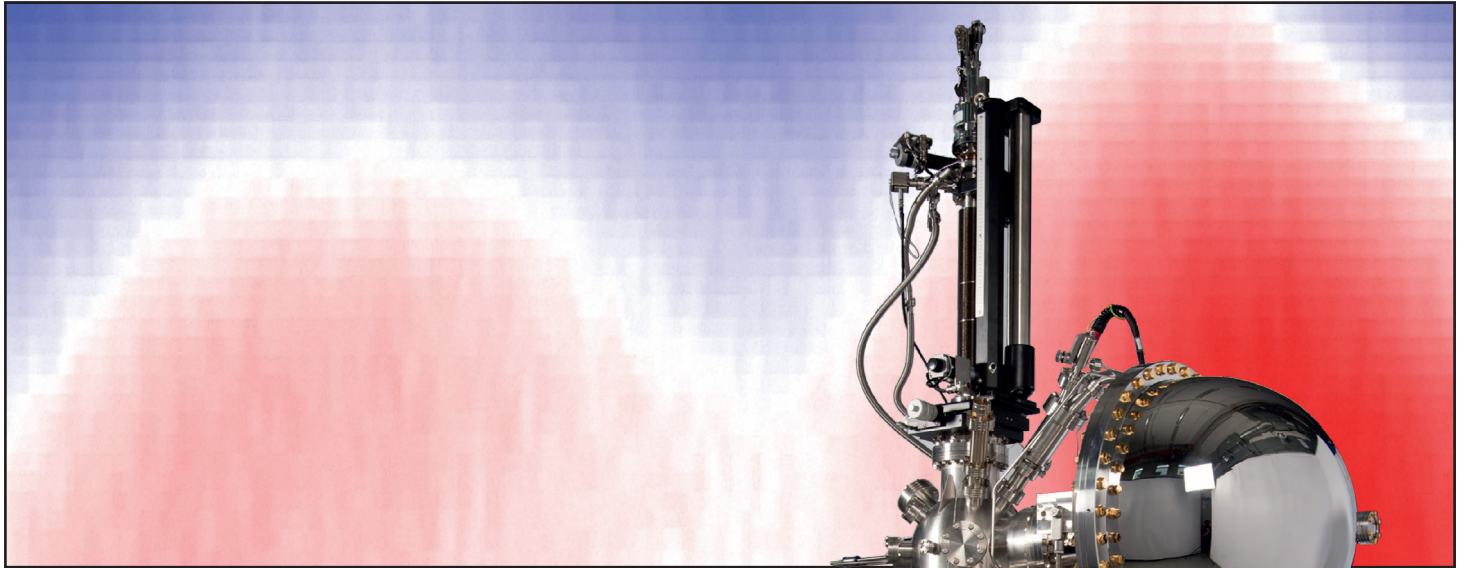


ARPES-LAB

The Expert Solution for Angle Resolved Photoemission Spectroscopy



- Comprehensive ARPES solution by the market leader
- Expert integration of the best technologies
- Smart system and measurement automation
- Expert support for configuration and design
- Fast help by world-wide service teams

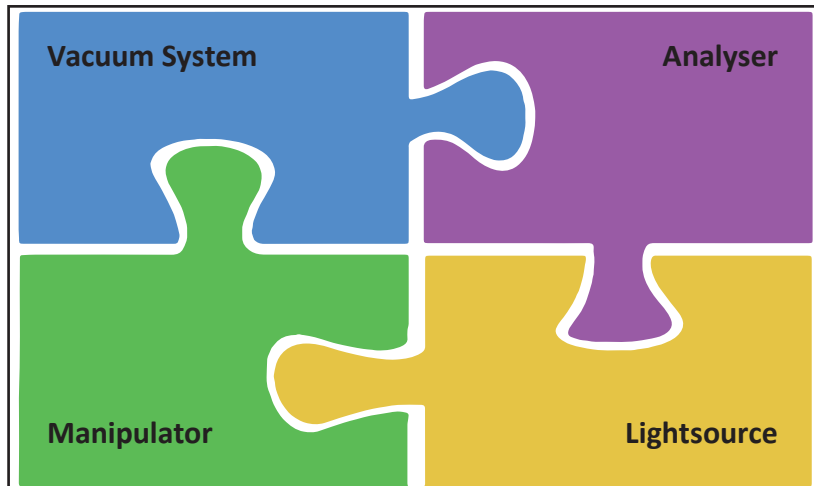


What is state of the art in ARPES?

Angular resolved photoemission spectroscopy (ARPES) has emerged as the most powerful technique to understand the electronic structure of materials and what can influence their physics and chemistry.

Revealing the band-structure of the valence band and the Fermi-level is fundamental to understanding electron transport, band-gap phenomena and spin-related effects. The progress of new technologies and the development of emergent materials rely more than ever on the ARPES technique to provide a precise understanding of the inherent properties of complex material systems. This powerful method is now being extended to time-resolved ARPES experiments yielding direct dynamical information during the evolution of electronic band structure. Scientia Omicron, provider of the world leading electron spectrometers to specialists in the field, also offers turn-key automated ARPES measurement systems with guaranteed performance and local expert support.

The Scientia Omicron ARPES Lab performs band structure mapping measurements faster, more precisely, yielding data sets with fewer variables for simplified data analysis than any other system available. Magnetically shielded chambers and cryogenic sample manipulators that are the standard for many advanced synchrotron endstations are the building blocks of the ARPES Lab. Intelligently integrated with superior automatization and software control from data acquisition reaching through vacuum control, makes high-end ARPES measurements accessible and reliable. A pumping system optimized to lowest working pressures even when operating with He-discharge lamps extends sample lifetime and integrity.



The key to ultimate ARPES performance is the optimal integration of high class components to a comprehensive system. The energy and angular resolution of a measurement depends on the analyzer as well as on the light source, the manipulator cooling and the manipulation precision. Advanced measurements of sensitive samples need a powerful vacuum system and an effective shielding.

Best technology concept

The ARPES Lab is designed to maximize the advantages gained from the revolutionary DA30-L hemispherical high-resolution analyzer with its patented in-lens deflector. The analyzer measures the full 3D surface cone of a band-structure without sample tilt by deflecting the electron trajectories perpendicular to the analyzer entrance slit, which allows for:

- Improved ky accuracy at shorter measurement times
- Maintaining near constant matrix elements by keeping the sample angle fixed
- Reliable measurement position on a fixed sample point necessary for exploring dichroic effects and measuring very small samples and/or multi-domain samples

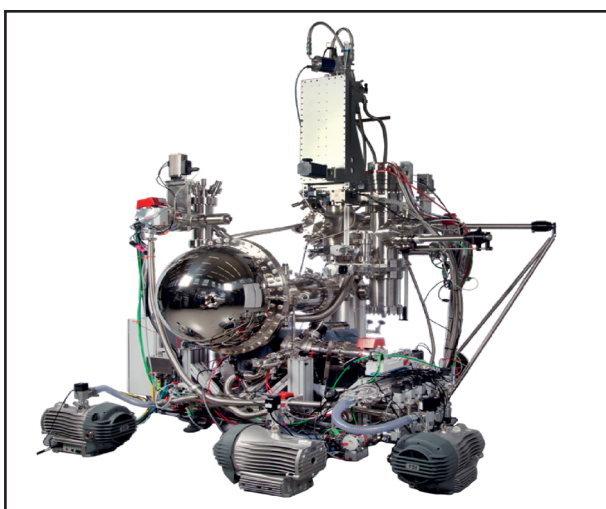
For wide range Brillouin zone scans the motorized sample manipulator is integrated into the measurement (SES) and system software (MISTRAL).

The software driven adjustment of the manipulator allows for:

- Precise sample movement during scans
- Automatic movement of the sample between different measurement positions (ARPES, LEED, etc.)
- Security interlocks for manipulator movement

All manipulators (4, 5 or 6-axes) reach very low temperatures (<10 K) to allow for high energy resolution ARPES measurements accessible and reliable.

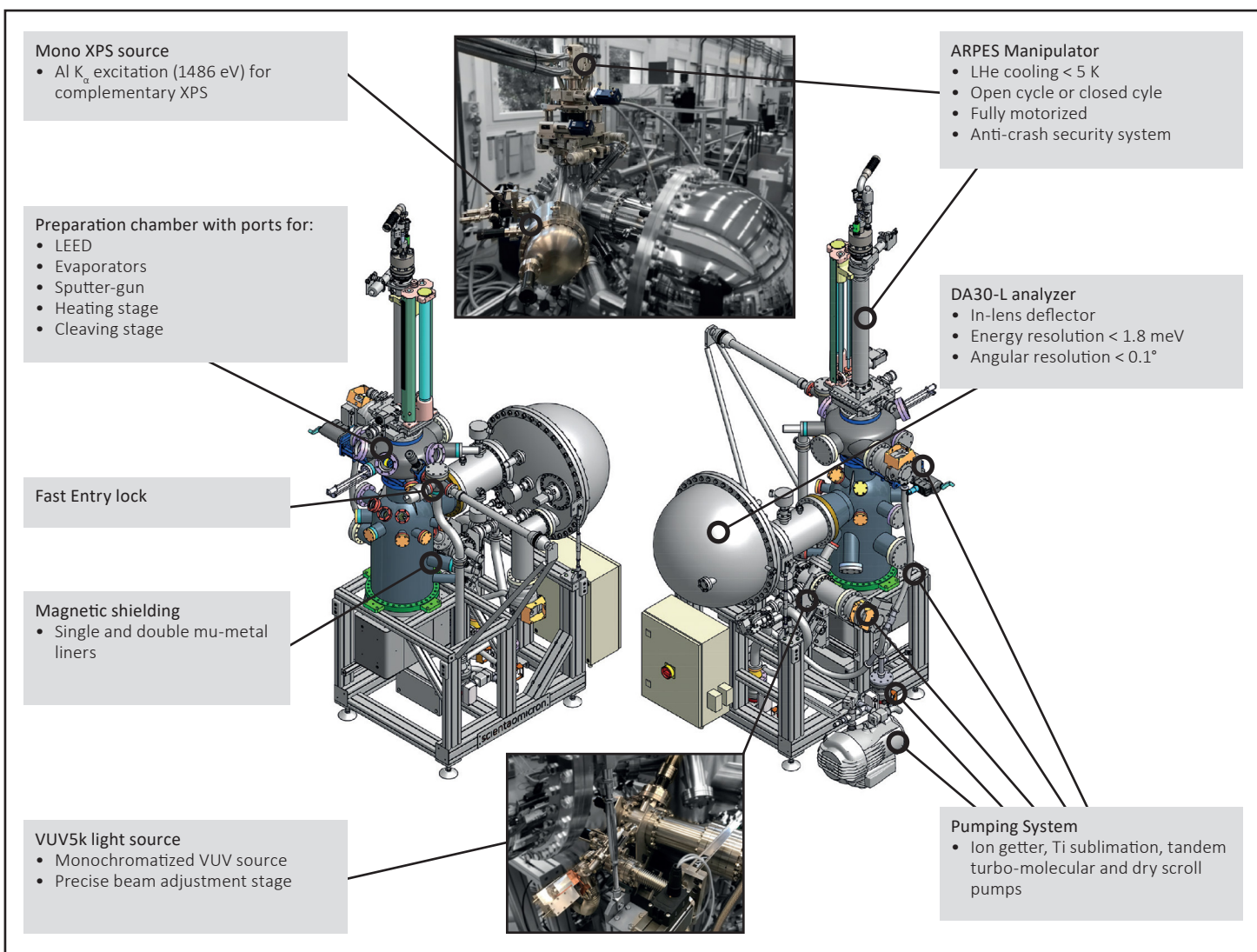
A pumping system optimized to lowest working pressures even when operating with He-discharge lamps extends sample lifetime and integrity.



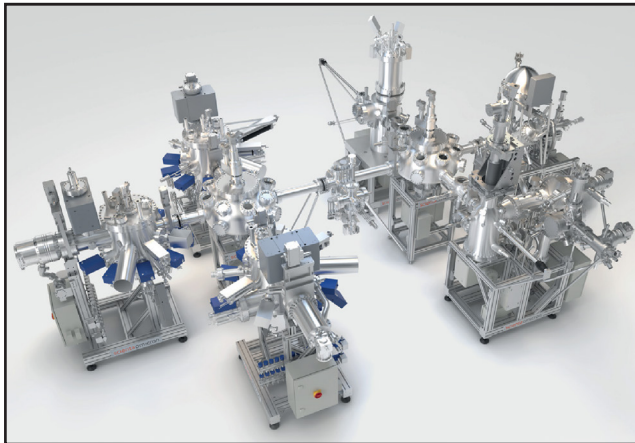
Example for a customized ARPES Lab.

ARPES Lab advantages:

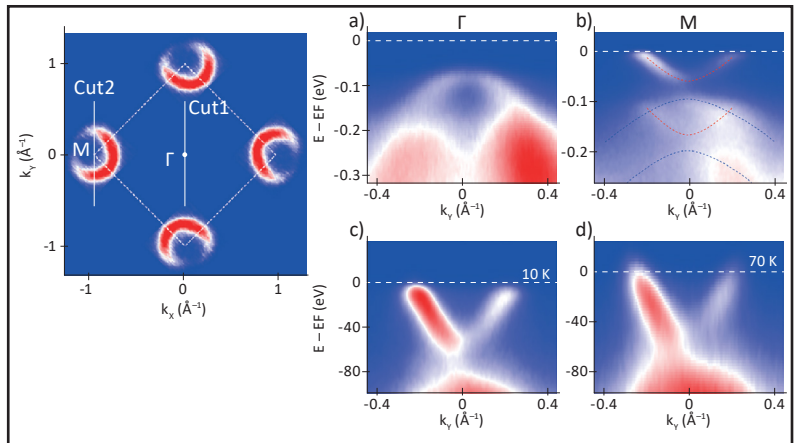
- Comprehensive solution from a single supplier
- DA30-L deflector technology for precise ARPES results
- High photon density VUV sources with small beam spots
- He I and He II monochromators for minimal photon bandwidth
- Ease of use by interplay of system and measurement software
- User-friendly adjustment of light-source and manipulator
- Expert support for configuration and design
- World-wide local Sales and Service-Support



Experts in magnetic shielding design have perfected the chamber to achieve the highest performance from the combination of analyzer and excitation sources. The ARPES Lab can support multiple light sources covering a broad energy range to enable the investigation of many material classes. The VUV5k high intensity monochromatic light source can be paired with new laser sources providing selectable energies and polarisation exhibiting extremely narrow line width and/or ultra fast pulse width for time-resolved ARPES. The ARPES Lab can additionally support a monochromatic X-ray source for core level chemical state analysis.



3D model illustrating a materials innovation platform (MIP) that connects thin film deposition by MBE with surface analysis by ARPES and scanning probe microscopy (SPM). Such systems solutions significantly reduce the risk of contamination during the various steps of thin film deposition and surface analysis. The ARPES Lab is designed to be easily interfaced to the transfer backbones of the MIP.



M. Yang et al. studied the light-induced switching of superconductivity in a single layer FeSe on a SrTiO₃ substrate. The shown ARPES measurements were used to understand the electrical properties of this heterostructure before modifying it with a FeTe capping layer. The spectra (A,B) were taken across the Γ -point and the M-point along the directions indicated in the 2D intensity plot (Insert). Figures (C, D) show the spectra across the M-point for different temperatures (10K, 70K).
Figure taken from 'M.Yang et al., Nature Comm (2019) 10: 85', CC by 4.0

Technical Data

ARPES Lab UPS/XPS:

Stainless steel chamber with mu-metal liner, DA30-L analyzer, VUV5k VUV source, XPS source, LHe 5-axes manipulator open cycle **

Property

Energy resolution, analyzer*
Energy range
Angular resolution, analyzer*
Angular resolved range
Deflector mode for full cone detection
Magnetic shielding, chamber
Base pressure, analysis chamber
Pressure during operation
Fast He pumping (tandem turbo pump)
VUV photon flux density
VUV beam spot size
VUV energy-resolution
XPS excitation energy
Manipulator axes
Measurement axes motorization
Manipulator temperature range
Super stable electronics
MISTRAL System Control
SES Analysis Software

Target Specification

1.8 meV
3 - 1500 eV (angular mode)
0.1°
+ - 15° full cone
Yes
< 500 nT
< 1E-10 mBar
< 5E-10 mBar
Yes
> 1E12 ph/s/mm²
< 600 μ m
1 meV (He I)
1487 eV (Al), 1254 eV (Mg)
x, y, z, polar, azimuthal
All
< 6 K .. 400 K
Yes
Yes
Yes

Options:

A wide range of options allow for tailoring the system to the specific needs of individual research. For example:

Light sources

HIS 14 HD for small beam spots < 300 μ m
Laser ports Yes
Monochromatized X-ray sources Yes

DA30-L 8000 analyzer

Energy resolution, analyzer* 1.0 meV
Energy range 0.5 - 12 eV (angular mode)

Vacuum Chamber

Improved magnetic shielding < 100 nT
Double chamber design with preparation capabilities Yes

Manipulators

4-, 5-, and 6-axes, upgradeable Yes
Closed cycle He cooling Yes
Base temperatures 3.5 K - 10 K, depending on model
Counter heating for temperature stabilization for all models

* Component specification, total performance depends on component configuration. Please contact us for details.

** Example configuration, please contact us for your individual configuration.

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