ARPES-Lab

The expert solution for Angle Resolved Photoemission Spectroscopy

- Comprehensive ARPES solution by 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
ARPES-Lab
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 abilities of complex material systems. This powerful tool is now being extended to time-resolved ARPES experiments yielding direct dynamical information during the evolution of electronic band structure. Scienta Omicron, the provider of the world leading electron spectrometers to specialist in the field, also offers complete turn-key automated ARPES measurement systems with guaranteed performance and expert local support as one of our “Materials Innovation Platforms”.

ARPES-Lab advantages:
- Comprehensive solution from one 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 with 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

The key to ultimate ARPES performance is the optimal integration of high class components to a comprehensive system. The ultimate 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.

Intelligently integrated with superior automatization and software control from data acquisition reaching through vacuum control, the ARPES-Lab brings the powerful ARPES technique into an accesable and reliable measurement tool. A pumping system optimized to lowest working pressures even when operating with He-discharge lamps extends sample lifetime and integrity.

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 \( k \) accuracy in shorter measurement times
- Maintains near constant matrix elements by keeping sample angle fixed
- Ensures reliable measurement position on a fixed sample point necessary for exploring dichroic effects in ARPES 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 axis) reach very low temperatures (< 10 K) to allow for high energy resolution.

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 investigation of all class of materials. The renown VUV5k high intensity monochromatic light source can be paired with new laser sources providing selectable energies and polarization 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.

Designs incorporating the latest techniques are available; additionally Scienta Omicron can custom tailor the system to enable your unique ideas.
### Technical Data

**ARPES-Lab UPS/XPS**

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Target Specification</th>
</tr>
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<tbody>
<tr>
<td>Energy resolution, analyzer*</td>
<td>1.8 meV</td>
</tr>
<tr>
<td>Energy range</td>
<td>3 - 1500 eV (angular mode)</td>
</tr>
<tr>
<td>Angular resolution, analyzer*</td>
<td>0.1°</td>
</tr>
<tr>
<td>Angular resolved range</td>
<td>+ 15° full cone</td>
</tr>
<tr>
<td>Deflector mode for full cone detection</td>
<td>yes</td>
</tr>
<tr>
<td>Magnetic shielding, chamber</td>
<td>&lt; 500 nT</td>
</tr>
<tr>
<td>Base pressure, analysis chamber</td>
<td>&lt; 1E-10 mBar</td>
</tr>
<tr>
<td>Pressure during operation</td>
<td>&lt; 5E-10 mBar</td>
</tr>
<tr>
<td>Fast He pumping (tandem turbo pump)</td>
<td>yes</td>
</tr>
<tr>
<td>VUV photon flux density</td>
<td>&gt; 1E12 ph/s/mm²</td>
</tr>
<tr>
<td>VUV beam spot size</td>
<td>&lt; 600 µm</td>
</tr>
<tr>
<td>VUV energy-resolution</td>
<td>1 meV (He I)</td>
</tr>
<tr>
<td>XPS excitation energy</td>
<td>1487 eV (Al), 1254 eV (Mg)</td>
</tr>
<tr>
<td>Manipulator axis</td>
<td>x, y, z, polar, azimuthal</td>
</tr>
<tr>
<td>Measurement axis motorization</td>
<td>all</td>
</tr>
<tr>
<td>Manipulator temperature range</td>
<td>&lt; 6 K .. 400 K</td>
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<tr>
<td>Super stable electronics</td>
<td>yes</td>
</tr>
<tr>
<td>MISTRAL System Control</td>
<td>yes</td>
</tr>
<tr>
<td>SES Analysis Software</td>
<td>yes</td>
</tr>
</tbody>
</table>

**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 Laser ports
- Monochromatized x-ray sources

**DA30-L 8000 analyzer**

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

**Vacuum Chamber**

- Improved magnetic shielding double chamber design with preparation capabilities

- Counter heating for temp stabilization

**Manipulators**

- 4-, 5-, and 6- axes, upgradable
- Closed cycle He cooling
- Base temperatures 3.5 K–10 K, depends on model for all models

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

**These set-up is an example configuration. Please contact us for your personal configuration.