ELECTRON SPECTRO-MICROSCOPY (ESM) BEAMLINE

SCIENTIFIC SCOPE

The technical scope of ESM is to prepare a high-flux, high resolving power beam covering the energy range 15–1,500 eV and serving two electron-microscopy end-stations: µ-ARPES and AC-XPEEM. Specific performance parameters for the two beams are:

<table>
<thead>
<tr>
<th>TECHNIQUES:</th>
<th>ARPES</th>
<th>XPEEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photon energy range:</td>
<td>15–1,500 eV</td>
<td>15–1,500 eV</td>
</tr>
<tr>
<td>Flux:</td>
<td>&gt;10^10 ph/s @ 100,000 resolving power</td>
<td>&gt;10^10 ph/s @ 10,000 resolving power</td>
</tr>
<tr>
<td>Resolving Power:</td>
<td>~1 meV up to 70 eV photon energy; &lt;30 meV up to 1,000 eV</td>
<td>~1 meV up to 70 eV photon energy; &lt;30 meV up to 1,000 eV</td>
</tr>
<tr>
<td>Spot Size:</td>
<td>&lt;1 µm &gt;60 eV (diffraction limited at lower energies)</td>
<td>40 µm</td>
</tr>
<tr>
<td>Light Polarization:</td>
<td>horizontal, vertical, left/right-circular above ~30 eV</td>
<td>horizontal, vertical, left/right-circular above ~30 eV</td>
</tr>
</tbody>
</table>

TECHNIQUES:
- A-branch
  - ARPES, SARPES, µ-ARPES
  - XPS, XAS, XMCD
- P-branch
  - AC-PEEM, AC-LEEM

ENDSTATION DETAILS:
- A-branch
  - Smaract micro-scanning stage
  - Scienta DA30
  - Closed cycle LHe cryostats
- P-branch
  - Elmitec AC-LEEM III
    (Aberration-Corrected Low Energy Electron Microscope)

µ-SARPES
- High resolution (energy and momentum) electronic structure of solids;
- Spin-polarized electronic bands of magnetic materials and non-magnetic materials with large spin-orbit interaction;
- Scanning spectro-microscopy with 1 mm lateral resolution for chemical maps (core levels) or electronic structure maps (valence electrons)

AC-XPEEM
- Energy filtered-XPEEM for chemical maps and (k_x,k_y) band mapping;
- Aberration-correction for higher lateral resolution and higher transmission;
- Non-destructive, fast-imaging technique allowing simultaneous surface sensitive microscopy and spectroscopy

SCIENTIFIC APPLICATIONS

- ARPES from spatially inhomogeneous samples, as well as artificially formed hetero-structures
- ARPES from polycrystalline or micro-crystal materials
- SP-ARPES from inside a magnetic domain
- XPEEM: fast, full-field probe for spatially resolved topographic, structural and spectroscopic measurements

Overview

PORT: 21-ID
SOURCE: 2 undulators (EPU105, EPU57)
ENERGY RANGE: 15 – 1000 eV
ENERGY RESOLUTION: ΔE/E = 10^{-5} – 10^{-4}
SPATIAL RESOLUTION: 1 µm / 40 µm
CONSTRUCTION PROJECT: NEXT
BEAMLINE STATUS: Construction
AVAILABLE TO USERS: Spring 2017

Beamline Team

STAFF
- Elio Vescovo: lead beamline scientist
- Andrew Walter: beamline scientist
- Yi Zhu: mechanical engineer
- Sal Pjerov: designer
- Jun Ma: controls engineer
- Gary Nintzel: technician

ADVISORS
- Peter Johnson, Tony Valla (CMMSD)
- Jurek Sadowski, Peter Sutter (CFN)
- Francois Polac (Soleil), Rolf Follath (SLS)
- Tony Caruso (UMKC), Rudolf Tromp (IBM)
- Maya Kiskinova (ELETTRA)

The use of micro-structured substrates for out-of-plane alignment allows for the sympathetic investigation of magnetic structure and interaction. The highly tunable beamline allows for the examination of a “fixed sample” where the size of the beam can be varied. 

* Images from the study of magnetic structures and interaction in a “fixed sample” allow for the examination of a “fixed sample” where the size of the beam can be varied. 

* Images from the study of magnetic structures and interaction in a “fixed sample” allow for the examination of a “fixed sample” where the size of the beam can be varied.