

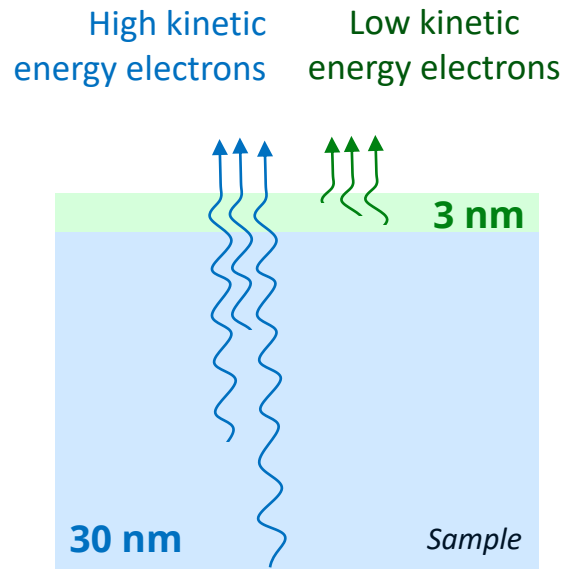
A Spectroscopy Beamline Supporting Materials Science for Sustainability

With input from the HAXPES Expression of Interest

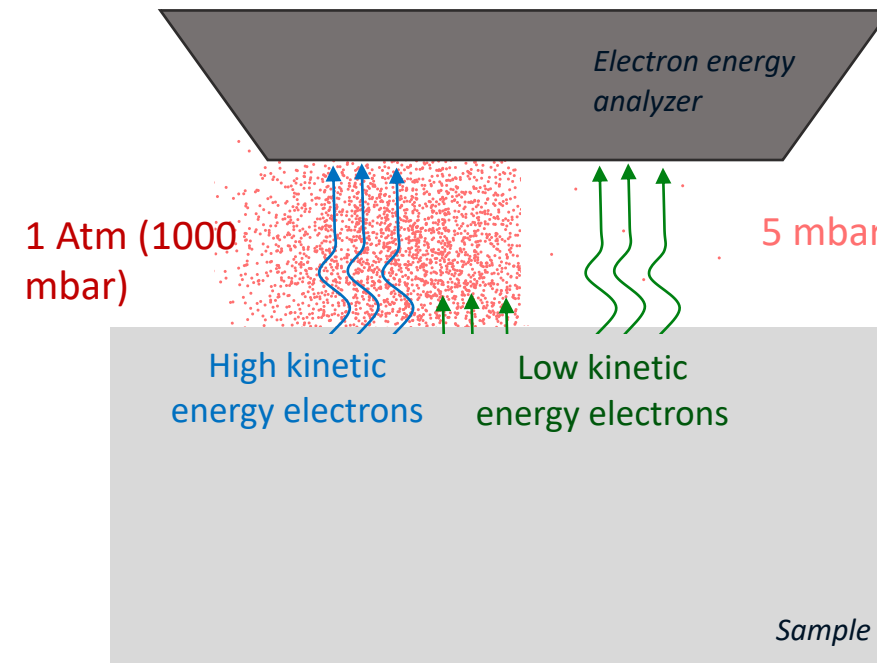
Scientific Background: Hard X-ray Photoemission Spectroscopy (HAXPES)

Soft X-rays -> low kinetic energy electrons (hundreds eV)
Hard X-rays -> high kinetic energy electrons (thousands eV)

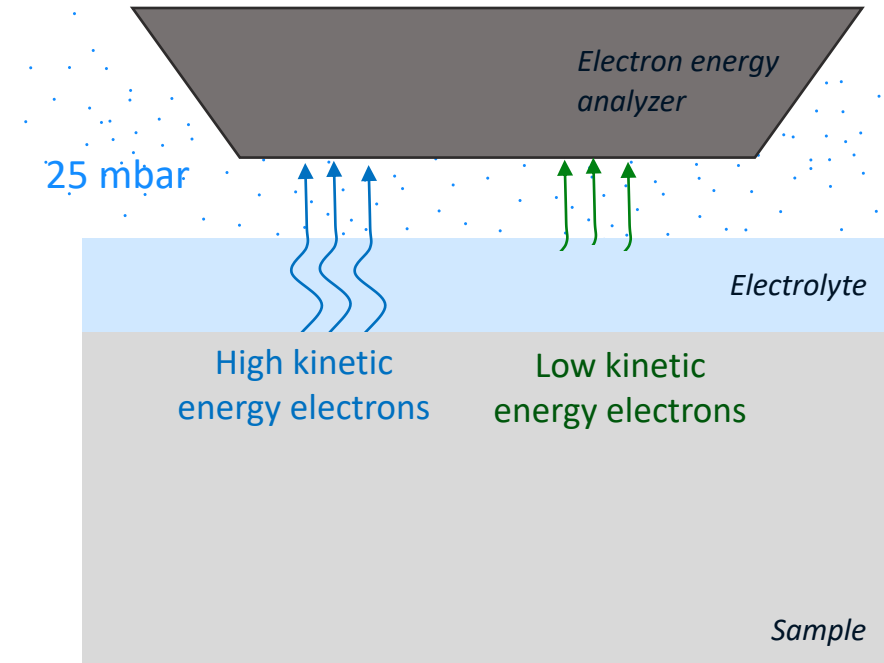
Increased probing depth



Increased pressure



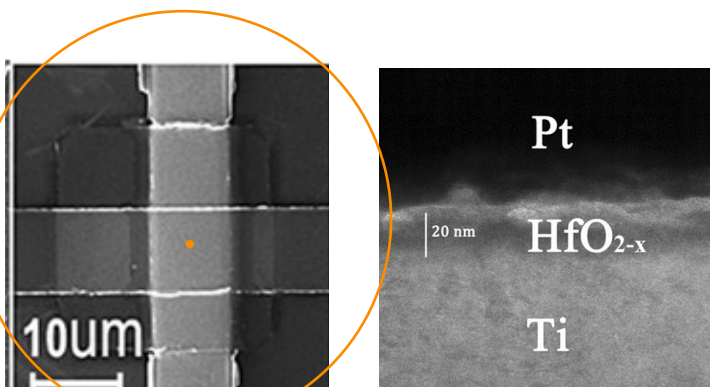
Access to the solid-liquid interface



Scientific Background

Characterization of heterogeneous materials

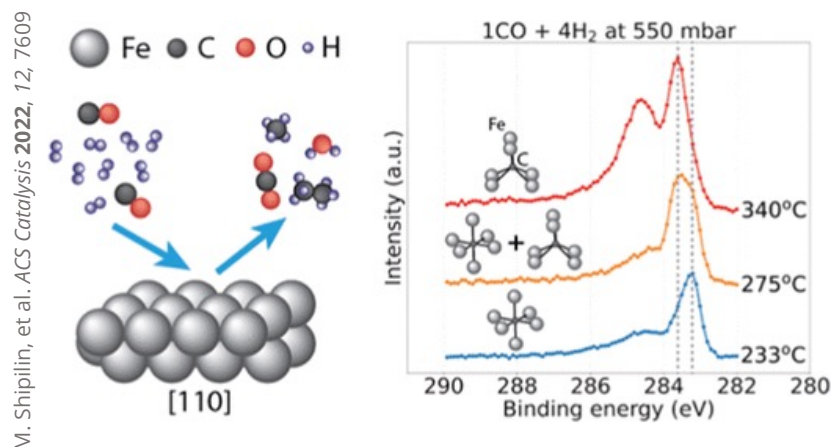
- ✓ Study of degradation mechanisms in multilayered solar cells
- ✓ Synthesis and stability of materials for low-power electronics



High-speed highly-stable customizable HfO_{2-x}-based memristor

Heterogeneous catalysis under industrial conditions

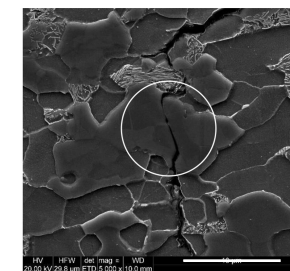
- ✓ Improving the performance of existing catalysts for high-volume chemical production
- ✓ Discovery of novel materials made of abundant elements with high catalytic activity for Power-to-X.



Investigation of iron carbide formation during Fischer-Tropsch synthesis

Electrochemical systems

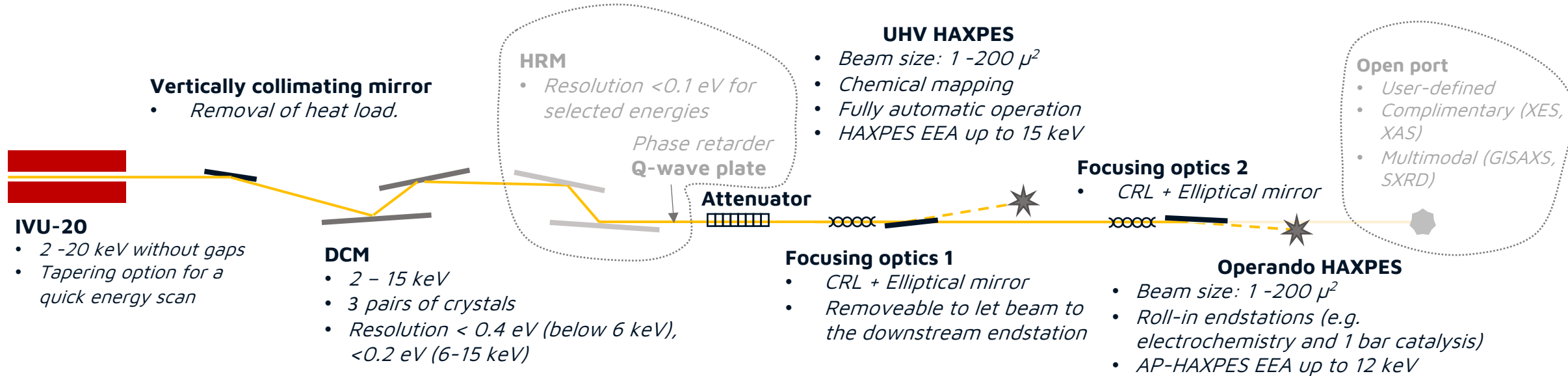
- ✓ Investigation of passivation film breakthrough in multicomponent metallic alloys during corrosion
- ✓ Energy storage mechanisms in novel battery materials



Stress Corrosion Cracking Observed in Ex-service Gas Pipelines

Beamline Overview

Beamline design is based on HAXPES beamlines: ESRF-SPLine, Soleil-Galaxies, Petra III – P22, Diamond-I09, ALBA – 3SBar, and BL09XU due to high power load from the IDs and high energy resolution.

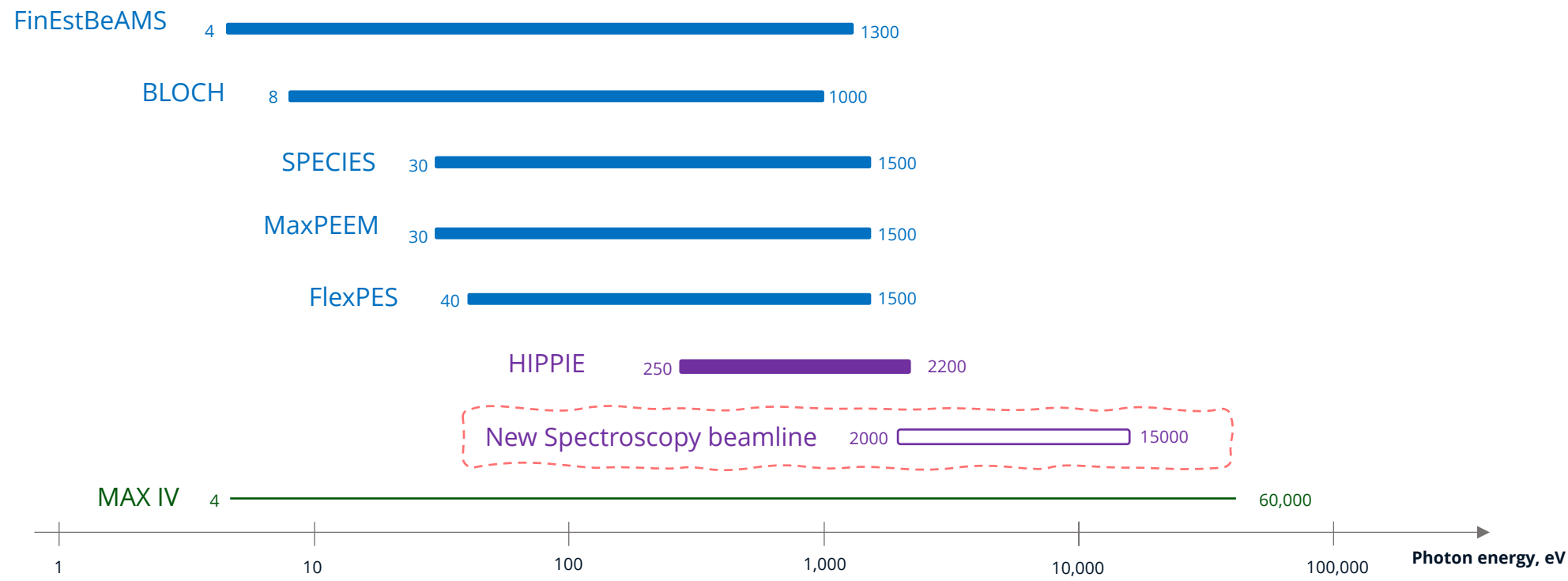


Beamline characteristics

- 2 – 15 keV energy range
- Energy resolution: < 400 meV (2-6 keV), < 200 meV (6-15 keV)
- High flux on the sample ($> 10^{12}$ ph/s) in the entire energy range

- **Short beamline**
- **2 focal points**
- **1 branch**

Beamline in the MAX IV Portfolio of Photoemission instruments



Comparison to existing beamlines



* Full-field photoelectron microscopy
^o Microfocus beamline

Strategic Relevance

- Sweden is among the five largest national HAXPES users
- The largest interest of the research community in HAXPES
- All HAXPES research is done somewhere else

Contributions to the scientific case, technical requirements, and EoI from the nordic Universities

