

deimos

Dichroism Experimental Installation for Magneto-Optical Spectroscopy

The soft X-rays beamline for magnetic and electronic properties studies at Synchrotron SOLEIL

ASSOCIATES

Loïc Joly
Bernard Muller
Fabrice Scheurer

IPCMS

IAZ
Philippe Saintavit

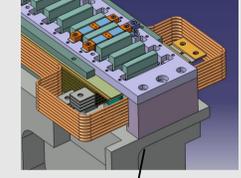
The X-ray SOURCES

SOURCE BRIGHTNESS: $2 \cdot 10^{15}$ photons/s/0.1% bandwidth

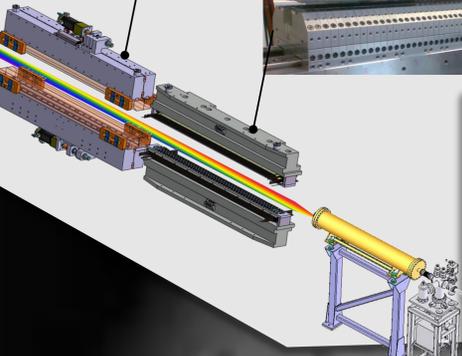
POLARISATION: Circular right, left and Linear, variable from 0° to 90°

POLARISATION SWITCHING RATE (EMPHU only): 5Hz

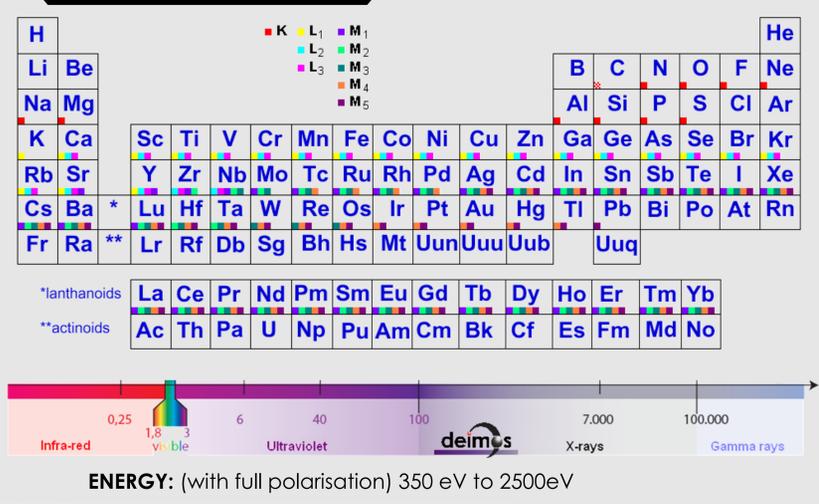
ElectroMagnetic-Permanent magnet Hybrid Undulator (EMPHU) with a 65 mm period



Apple II Undulator with a 52 mm period



ABSORPTION EDGES ACCESSIBLE



TECHNIQUES

- X-ray Absorption Spectroscopy (XAS)
- X-ray Magnetic Circular Dichroism (XMCD)
- X-ray Natural Circular Dichroism (XNCD)
- X-ray (Magnetic) Linear Dichroism (XMLD)

CroMag END STATION



Sample environment:

- ± 7 Tesla along the beam
- ± 2 Tesla perpendicular to the beam
- variable temperature from 1.5K to 370K
- vapor pressure $< 10^{-10}$ mbar

Samples and substrates (~8x8 mm):

- powder on carbon tape
- drop cast on Si wafer
- Omicron plate
- evaporation on membrane, single-crystal, HOPG, etc...



Detection mode:

- TEY
- FY (UHV diode)
- transmission (UHV diode)

Beam spot size:

- $80 \times 80 \mu\text{m}^2$
- $800 \times 800 \mu\text{m}^2$

MK2T END STATION

Sample environment:

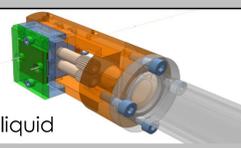
- ± 2 Tesla along the beam
- vapor pressure $< 10^{-10}$ mbar

Beam spot size:

- $500 \times 500 \mu\text{m}^2$
- $2 \times 2 \text{ mm}^2$



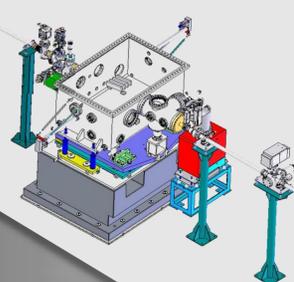
3 Inserts:

	Sample:	Detection:
• High temperature: from 10K to 1000K	Omicron plate	TEY, FY (SDD)
• Multiferroic VTI: 12 electric leads	dedicated chip	TEY, FY (SDD)
• Liquid cell: static & dynamic		TEY, FY (SDD), Transmission (UHV diode)

MONOCHROMATOR

The monochromator vessel host up to 4 gratings and 4 mirrors. At the moment 2 gratings are available:

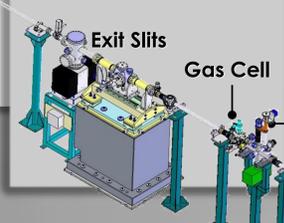
- a **Variable Groove Depth (VGD)** grating (1600 lines/mm) in the Petersen type geometry, optimised for the energy range **350eV - 1500eV**
- an **Alternated MultiLayer (AML)** grating (2400 lines/mm) in fixed deviation geometry, optimised for the energy range **1000 - 2500 eV**



EXIT SLITS

ENERGY RESOLUTION

$E/\Delta E = 5000$ nominal and up to 20 000



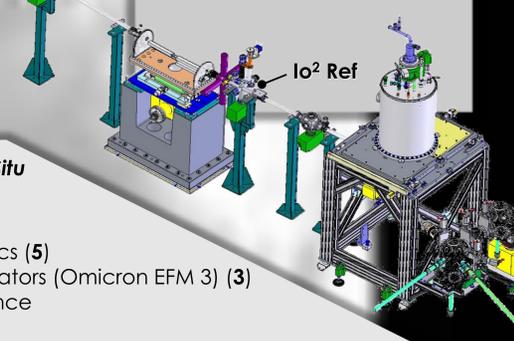
DEIMOS is a surface sensitive beamline highly optimized for energy and polarization stability (1 meV/h) with a photo flux $\sim 10^{12}$ photon/s on the sample.

SCIENTIFIC COMMUNITIES

- PHYSICS**
- Condensed matter, material science, surface and interface magnetism...
- CHEMISTRY**
- Molecular magnet and nanomagnet, hybrid magnetic material, spintronics...
- BIOLOGY**
- Metalloenzyme, biocompatible magnet...
- MINERALOGY**
- Environmental science, paleo-magnetism...

REFOCALISATION DEVICE

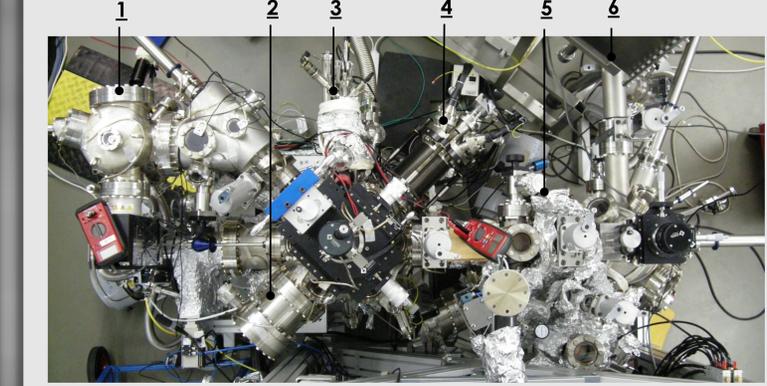
Defines the beam spot size; 2 spot size are available for each end station



Sample Preparation Environment



- Preparation:**
- 2 Knudsen cells
 - 2 effusion cells for organics (5)
 - 2 electron beam evaporators (Omicron EFM 3) (3)
 - quartz crystal microbalance
- Treatment:**
- Ion sputtering
 - Oven 1000°C
- Analysis:**
- Auger analyser(4)
 - LEED (Low Energy Electron Diffraction) (2)
 - STM, variable temperature (50K \rightarrow 500K) (1)
- Glove Box:**
- Inert Atmosphere (< 0.5 ppm H_2O , O_2) (6)



SAMPLE PREPARATION Ex Situ



Transportable UHV Suitcase:
150 x 70 x 100 cm (LxIxH)

Access

Beamline access is granted via a peer review committee; twice per year, prospective users are requested to submit a research proposal via the online form available on the SOLEIL Users Net. Users are strongly encouraged to contact the beamline scientists prior to their proposal submission to discuss the feasibility of their experiments.