P64 at PETRA III – XAFS.

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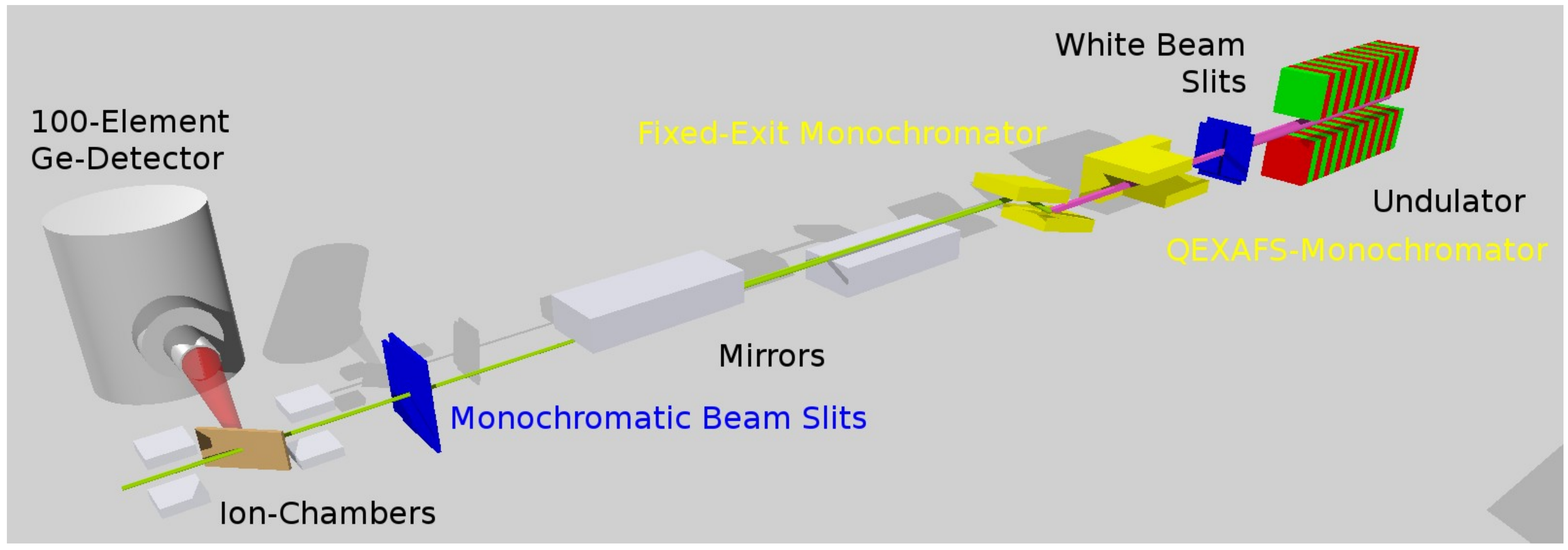
Applications: Flux-hungry experiments

- EXAFS of highly-diluted samples like proteins
- QEXAFS: less than 0.1s per EXAFS-scan
- Resonant X-Ray Emission Spectroscopy

Research

- Chemistry: Catalysis
- Materials Sciences: Batteries, Sensors
- Condensed Matter Physics: Correlated Electron Systems
- Biology: Proteins, Lipids, Peptides
- Environmental Sciences: Trace-element speciation

Optical Layout



Source: U32.8 Undulator

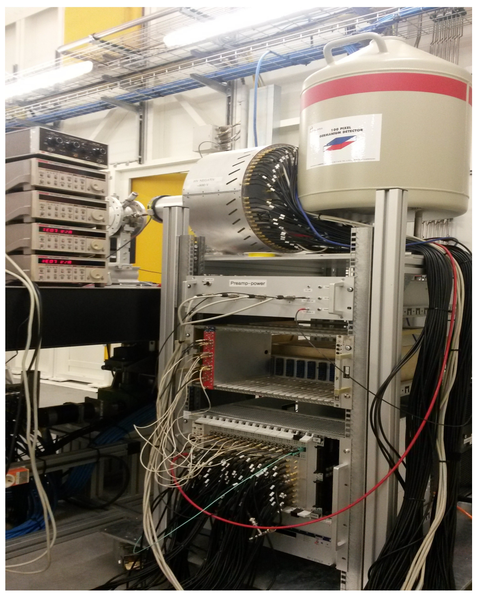
Period	32.8mm
Minimum gap	9.5mm
K_{max}	2.7

Monochromators

- Cryogenically cooled
- Double-crystal monochromator for fixed-exit
- Channel-cut monochromator for QEXAFS
- Each Si(111) and Si(311)

Detectors

- Ion-chambers
- PIPS-detector (TFY)
- Lytle-detector (TFY)
- 100-element Ge-Detector



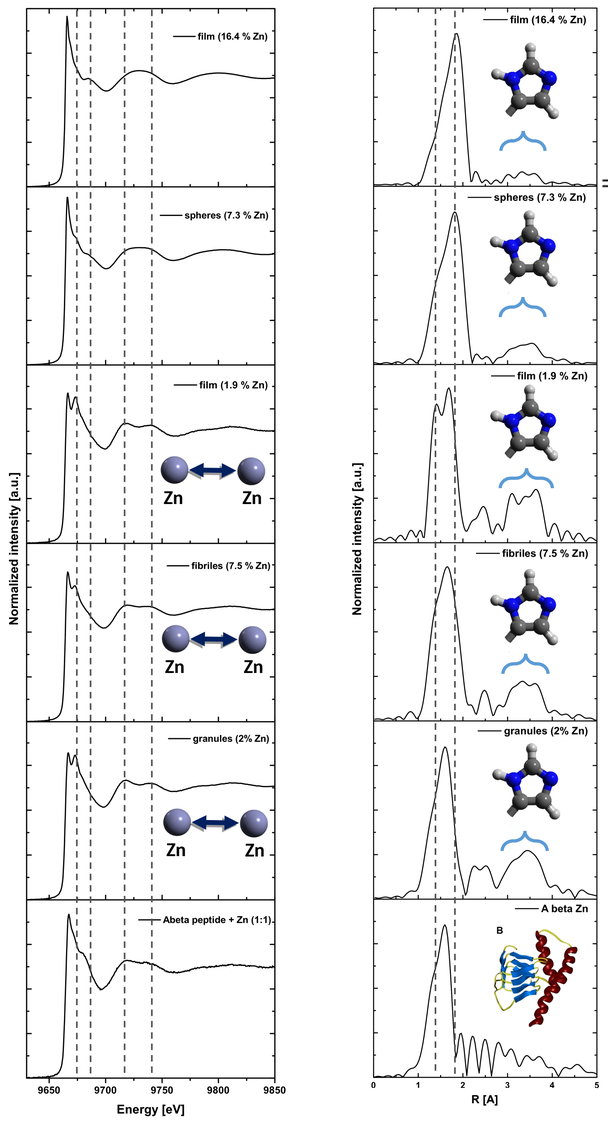
Mirrors

1. mirror
- 3 flat stripes: Si, Pt, Rh
- 2 cylinders (Si, Rh) for horizontal focus

2. mirror
- 3 stripes: Si, Pt, Rh
- Bendable for vertical focus

Beam Parameters

Energy Range	4-44keV
Energy resolution	$1.4 \cdot 10^{-4}$ or $0.5 \cdot 10^{-4}$
Flux	~10^{11} -10^{13} ph/s
Beamsize	2mm x 1mm (unfocused) 100µm x 20µm (focused)



XANES (left) and Re|χ(R)| EXAFS (right) signal for PrP^{C}-Zn(II) complexes and Aβ peptide. Vertical lines indicate most important differences in spectra.

Data courtesy by Michal Nowakowski

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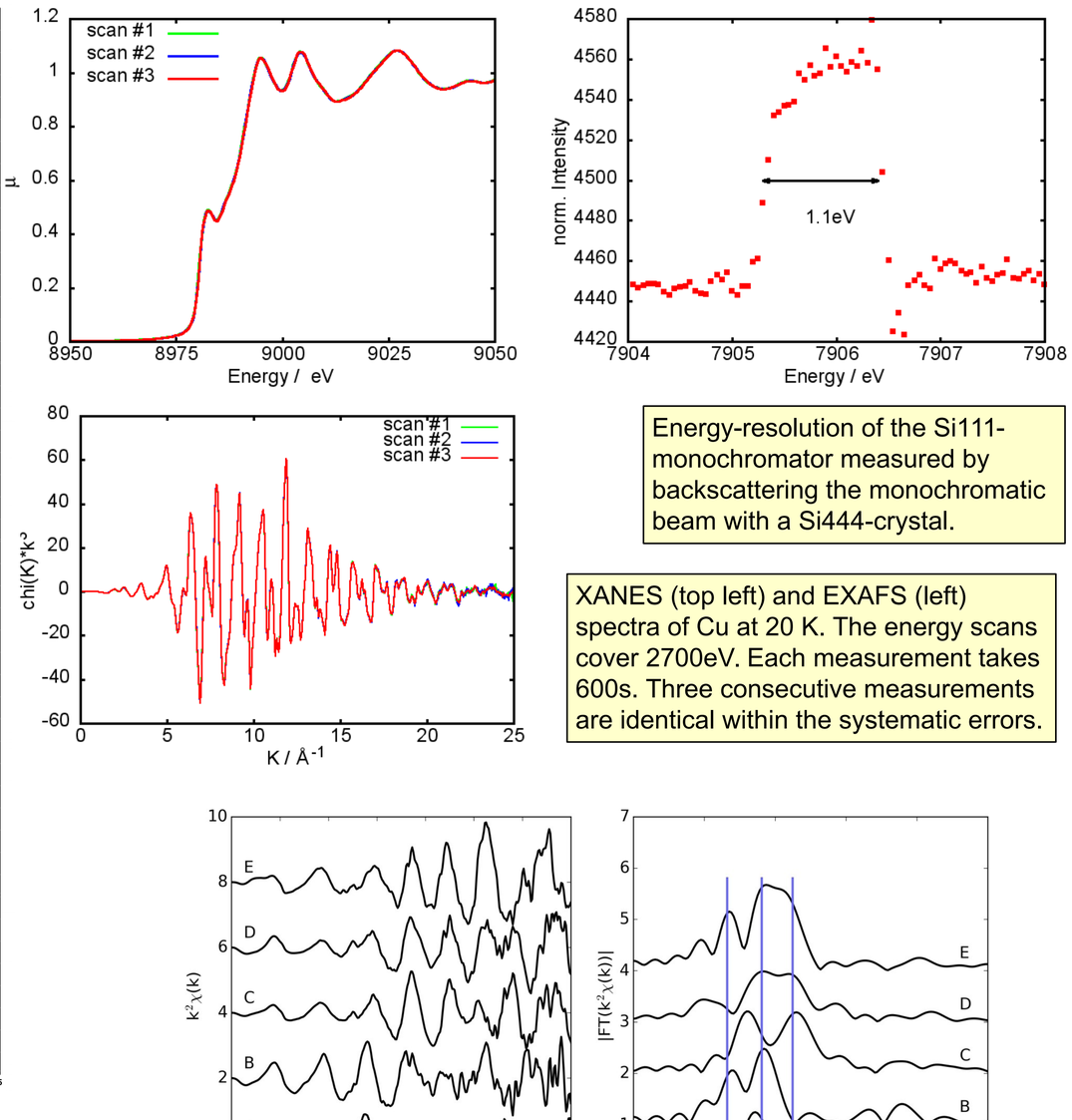

Energy-resolution of the Si111-monochromator measured by backscattering the monochromatic beam with a Si444-crystal.

XANES (top left) and EXAFS (left) spectra of Cu at 20 K. The energy scans cover 2700eV. Each measurement takes 600s. Three consecutive measurements are identical within the systematic errors.

K^2-weighted EXAFS functions (left) and corresponding Fourier transforms (right) of Metal-peptides in frozen water solution in different molar ratio (A-E). (metal-ion concentration: 230ppm)

Data courtesy by Lukasz Szyrwiel

Sample Environment (shared with P65)

- Liquid He flow cryostat
- Closed-cycle cryostat
- Furnace (Pool)
- Tilt-table

Infrastructure

- Sample preparation Lab
  - Chemical hood
  - Glove box
  - Basic equipment
- 4 gas-cabinets for different types of gases
- External lab for off-line tests and measurements

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