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Requirements for Super-XAS beamline (X10DA) at SLS

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Philosophy:

- The optical design of the beamline should be optimized towards maximizing the photon flux at the sample (3D-XAS, EXAFS of diluted samples) and towards a high energy resolution

Operation Modes:

A. Stable conventional bulk EXAFS from 4 - ~50 keV, $< \Delta E/E = 2.10^{-4}$)
B. Quick-EXAFS for time-resolved studies (4 - ~50 keV, $< \Delta E/E = 2.10^{-4}$)
C. 3D-XAS by means of a fast scanning monochromator and dynamic focusing
   - beam size to be achieved: ~ 5 x 5 μm^2

Schemes:

- Optics hutch vs 'front-end optics'

Beam Characteristics

- Spectral range: 4- ~50 keV
- Energy resolution: $< \Delta E/E = 2.10^{-4}$ (high flux, high resolution mode)
- Higher harmonic rejection: $< 10^{-3}$
- Horizontal divergence: < 7 mrad, tunable
- Beam size: 5 x 5 μm to a few mm^2
- Allowed beam fluctuations during measurements (constant beam):
  - Beam position: < 10% of beam size
- Allowed beam fluctuations during measurements (with bigger energy changes in monochromatic mode):
  - Horizontal beam position: < 5 μm
  - Vertical beam position: < 5 μm

(Potential) important beamline components (to be evaluated by design study)

- Frontend (diaphragm, absorber, fast valves, shutter, stopper)
- Be window (diamond window developed by PSI)
- Conventional DCM with two or three pairs of crystals
- Piezo-EXAFS monochromator (for quick scanning EXAFS)
- Optics: pre-focusing?
- Focusing devices:
  - Focusing up to 50 keV
- Pb-shielded hutches (layout + thickness of wall will be given)
  - Optics hutch
  - Experimental hutch providing space for two optical tables

Beamline components provided by SLS

- Superbend
- Experimental set-up in experimental hutch

Superbend characteristics:

Location: X10DA (circumference of beamline on SLS floor-plan included)

Machine Parameters:

Ring energy:	2.4 GeV
Ring current:	400 mA
Gamma value:	4697

Source Parameters:

Magnetic field:	3.1 Tesla
Critical energy:	11.9 keV (1.04 Å)
Emittance (ε_x, ε_y):	5 nm, 5 pm
Beta functions (β_x, β_y):	0.43 m, 10 m
Photon source size (Σ_x, Σ_y):	53 μm, 16 μm
Photon source divergence vertical:	0.6 mrad (Calculated with FWHM (=2.35*sigma))
Photon source acceptance horizontal:	< 7 mrad

Total integrated power: 143.682 Watt (for an emission angle of 2mrad H)