***Tutorial on XOP and SHADOW***
***( x-ray optics simulations and ray-tracing )***

# Course description

Optics simulation software is increasingly used for the design, optimisation and general understanding of x-ray instruments, in particular synchrotron beamline components. This tutorial is an introduction to the use of general optics tools and ray-tracing calculations for hard x-ray applications. The course will be based on the freely available computer codes XOP and SHADOW, and will be presented as practical hands-on tutorials.
A two days course is organized with the aim of giving a complete overview of these codes and their applications. The course is mainly practical, and is divided in four half-day sessions. Each session starts with an introduction. Then, most of the time will be dedicated to practical exercises to discuss and solve some problems on-line with the computer.

The course is divided in four complementary sessions. Although it is highly recommended to participate in all session, people with some experience with the codes or interested in some particular items can follow a single session, or skip some sessions. For example, people interested only in a general introduction to XOP should follow session 1. Those interested in ray-tracing should follow session 3 and 4. Finally, people willing only to apply XOP to data analysis tool should follow session 2

Tutorials will be performed in a PC running Microsoft Windows. The number of attendants is limited to 16. The programme of the course is subject to small modifications, depending on the particular interests of the audience.

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For registration and additional information contact XXX.

Dates: 8 and 9 March 2001 and 12 and 13 March 2001
Place: ESRF, Grenoble

# Programme

Session 1 –: **Introduction to XOP**

- emission characteristics of synchrotron radiations sources
  - 1 - Bending magnets
  - 2 - Conventional wigglers
  - 3 - Asymmetric wiggler (id20)
  - 4 - Undulator sources (angular distribution)
  - 5 - Undulator sources (flux and spectral density)
- 6.- Filters and mirrors: effect on source: absorbed and transmitted power by mirrors and attenuators
- 7.- Crystal monochromators: diffraction profiles of a single and multiple reflections. Rocking curves. Harmonic rejection.
- 8.- Bent crystals: diffraction profiles. Transition from dynamical to kinematical theory
- 9.- Compute reflectivity curves of multilayers
- 10.- Quick tour to other applications

Session 2 –: **Data analysis with XOP**

- 1 - Data visualization
- 2 - Working with SPEC files
- 3 - Data analysis
- 4 - Modeling data: Curve Fitting
- 5 - Advanced manipulation of SPEC data

Session 3 –: **Introduction to ray-tracing**

- 1 - Geometrical source. Learning reference frames
- 2 - Synchrotron sources: Bending magnets
- 3 - Insertion devices
- 4 - Beam propagation (phase space (z,z') ellipses)
- 5 - Focusing with grazing incidence mirrors: effect of aberrations
- 6 - Kirkpatrick-Baez system
- 7 - Double crystal monochromator
- 8 - Sagittal focusing
- 9 - Simulation of a complete beamline

Session 4 –: **Advanced ray-tracing**

- 1 - slope errors
- 2 - thermal bump
- 3 - Curved crystal monochromators: Rowland and off-Rowland configurations
- 4 - Crystals in Laue geometry
- 5 - Macros: loops, grid-patterns, ad-hoc ray-tracing and post-processing.