Optical beamline modelling for ALS-U

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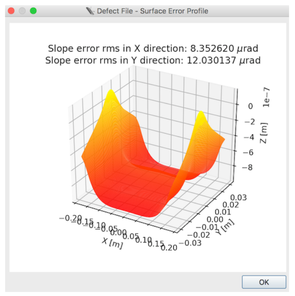
ALS-U

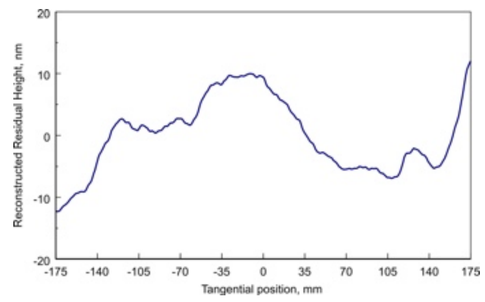
dlsr.org/dlsrw_2018/alsu_poster.pdf
github.com/awojdyla/ALS-U_Examples

Optical simulations

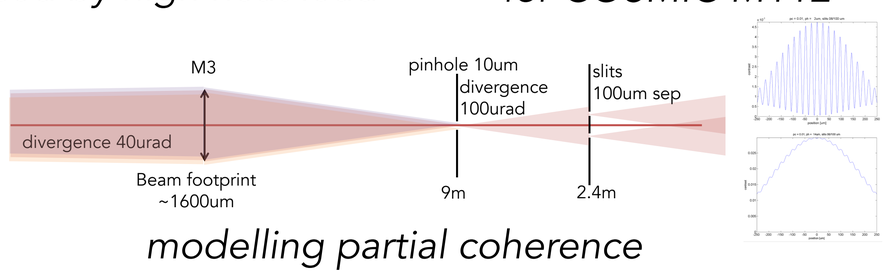
We are using **optical beamline simulation tools** (Shadow/OASYS, SRW) to design new beamlines and study the effect of reduced photon emittance on current beamlines using the available **metrology data**.
We simulate the effect of **thermal deformations** on mirrors under high heatload using FEA to predict the aberrations, and we develop **new tools** to model wavefront sensors and adaptive optics for their mitigation.
We aim to include **partial coherence** using wavefront propagation and few modes decomposition to refine mirror specifications and examine these effects on endstation. We also explore **free form shapes** (*e.g.* ellipsoids, diaboloïds) to leverage new mirror manufacturing techniques (ion beam figuring) and cancel geometric aberrations.



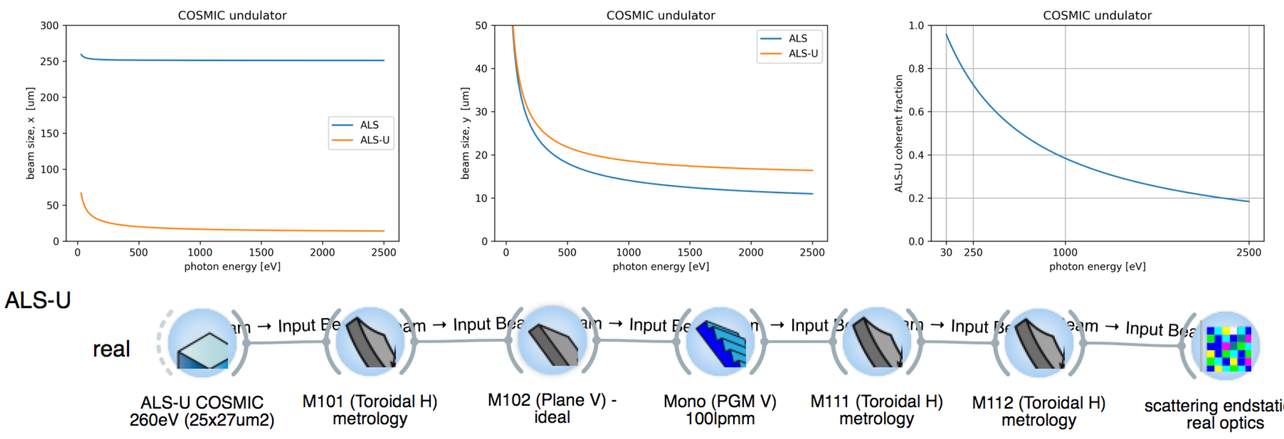
Thermal deformations caused by high heat load



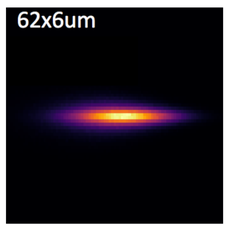
metrology data (LTP) for COSMIC M112



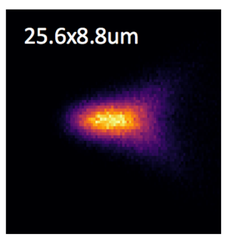
modelling partial coherence



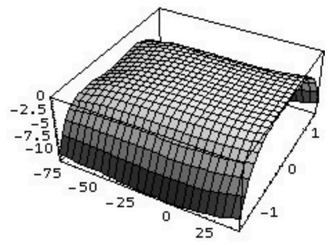
modelling current beamlines using raytracing and metrology data



ALS with mirror figure error



ALS-U with mirror figure error



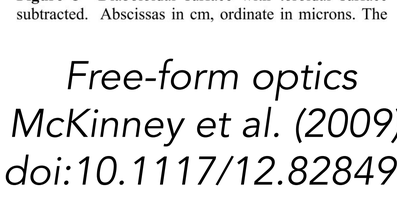
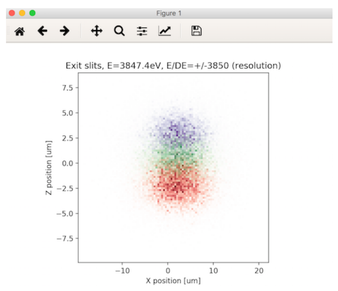


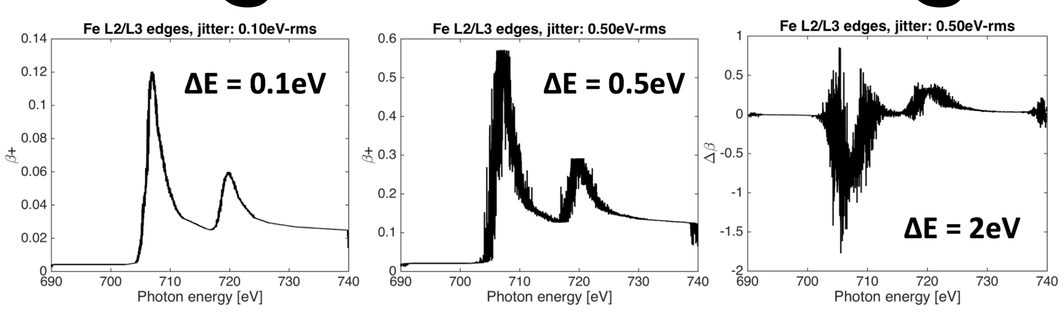
Figure 5 Diaboloidal surface with toroidal surface subtracted. Abscissas in cm, ordinate in microns. The

Free-form optics
McKinney et al. (2009)
doi:10.1117/12.828490

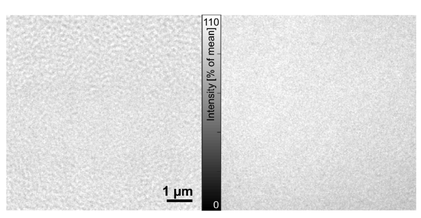


study of energy resolution for VLS

Design & Tolerancing



coherent illumination



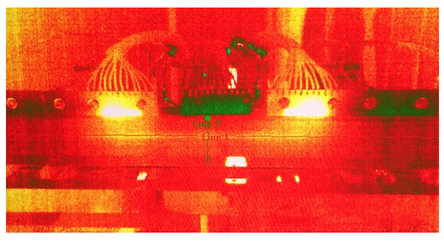
incoherent illumination

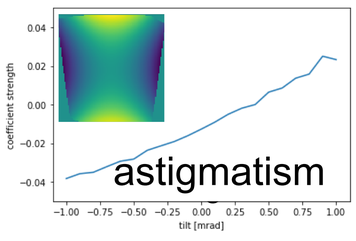
We are gathering information from beamline scientists and users to best optimize beamline performances according to their needs.
We study the effect of static (calibration) and dynamic (vibrations) errors on **energy resolution** and **partial coherence**, and solutions to reduce these degradations.
We look at the **photon transport/endstation interface** to ensure maximize performances over the nominal energy range (varying source size), and ways to **enable new capabilities** such as illumination diversity (*e.g.* dark-field or incoherent illumination.)

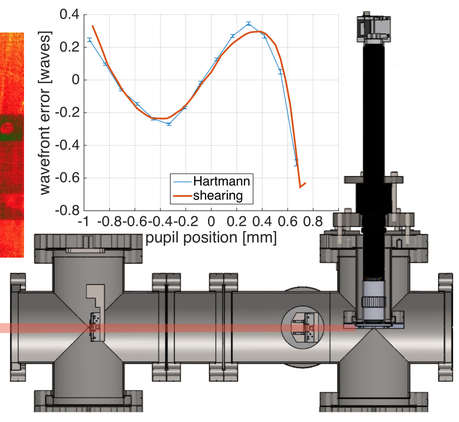
Wavefront sensing & Adaptive Optics

We are using optical modelling to **design wavefront sensors** and study how they can be used for **fine alignment of optics**.
We also want to build forward models for **adaptive optics** in order to correct aberrations (*e.g.* XDM influence functions.)

fine alignment of optics using wavefront sensors







adaptive optics (REAL mirror)

Acknowledgments

We would like to thank **Luca Rebuffi** for his help with raytracing simulations, to **Ruben Reininger** for his advice regarding beamline design, and Manuel **Sanchez del Rio** for the helpful discussion regarding coherent fraction. Thanks also to **Lahsen Assoufid**, **Xianbo Shi** and **Walan Grizolli** (ANL); **Daniele Cocco**, **May Ling Ng**, **Corey Hardin** and **Daniel Morton** (SLAC); **Mourad Idir**, **Lei Huang** (BNL); **Tony Warwick**, **Diane Bryant**, **Grant Cutler**, **Weilun Chao**, **Sharon Oh** (LBNL) for their help. This work is supported under DOE contract **DE-FOA-0001414** and performed by the University of California, Lawrence Berkeley National Laboratory under the auspices of the U.S. Dept of Energy, Contract No. **DE-AC02-05CH11231**

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