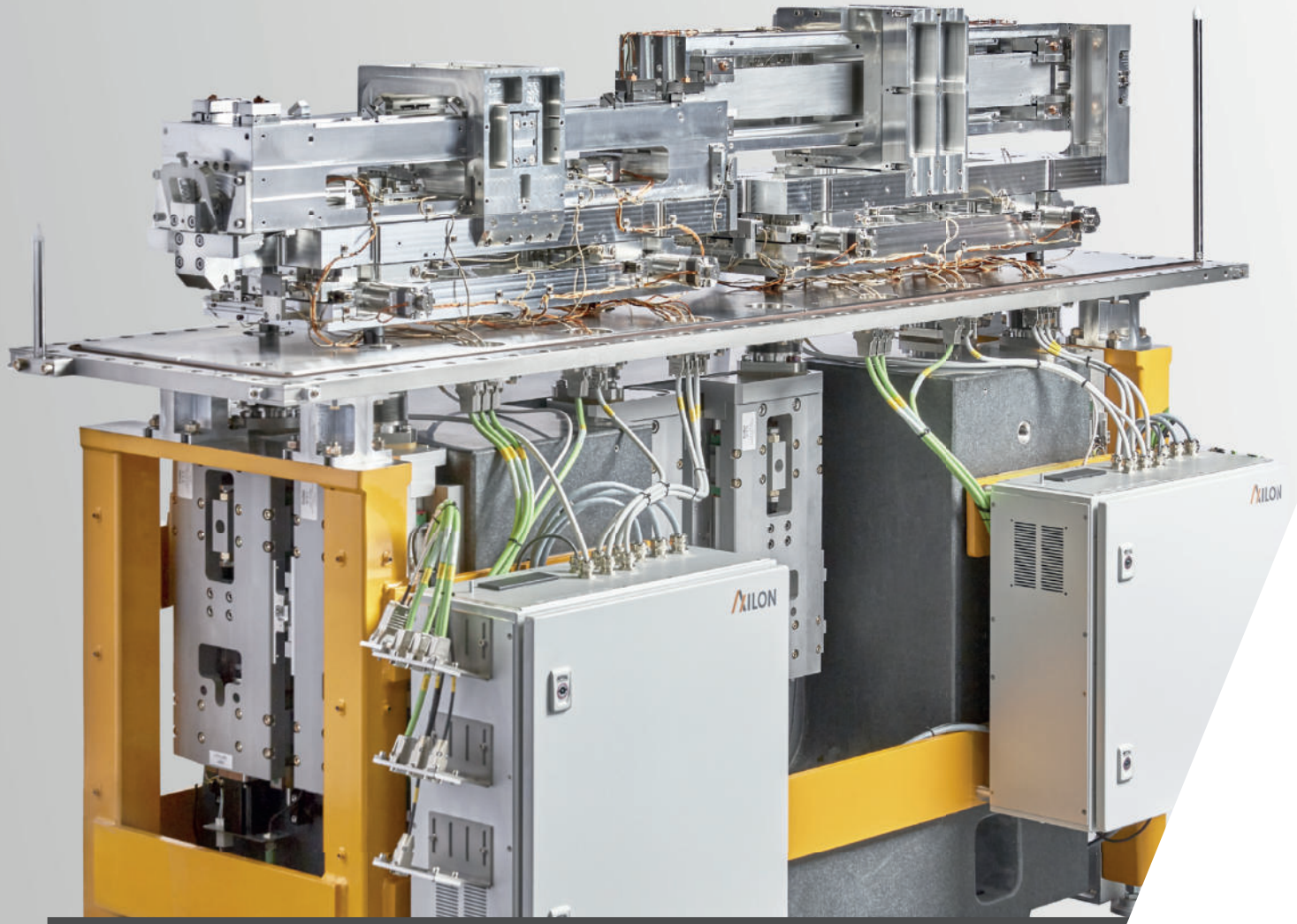


Data Sheet

Mirror Systems

Meeting the challenges of ultimate x-ray sources

XILON

Introducing…

AXILON's mirror mechanics designed and developed to deliver ultimate performance. With todays' brilliant high power-density sources, the spectrum of beam focusing requirements is very broad. With our long term experience in beamline optics instrumentation we are able to provide you with a concept matched to your insertion device, energy range, beam size and geometry.Our mirror system solutions have been developed considering every critical aspect pertaining to optical performance:

- finite element analysis with structural and thermal calculations
- optimized mirror mounts to achieve minimum deflection and stick slip effects on a nm scale
- rigid and stable support structures and manipulating stages for maximum static and dynamic stability and minimum thermal drift and vibration
- cooling schemes, such as GaIn eutectic cryo-cooling, side-clamp or end cooling interfaces

We maintain excellent cooperation with reputed optical element suppliers to identify and integrate the best performing optics for your application.

HRM for NSLS2, HOMS for LCLS
MID mirror for XFEL.EU

Product range

Our engineering expertise and scientific background cover the whole variety of focusing options. If your specific application is not on the list, come and talk to us, we will find a solution.

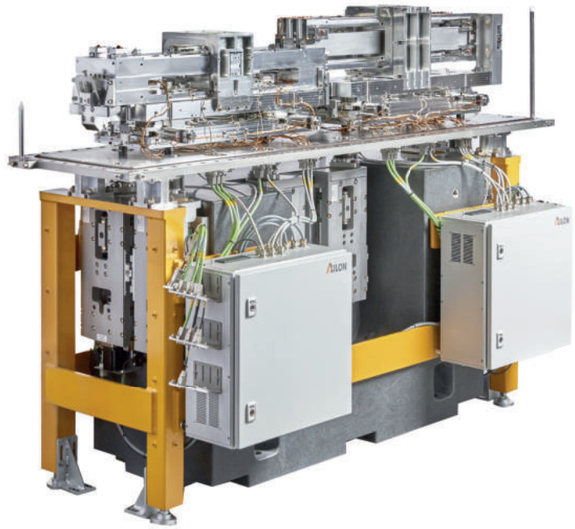
Type	ver/hor deflecting, focusing, KB, harmonic rejection, customized solutions
Shape	flat, mechanically bent, prefigured, toroidal, elliptical, parabolic, cylindrical
Cooling	cryogenic, water cooled, eutectic heat transfer
Integration	turnkey, smaller and large scale upgrades
Services	design, FEA, metrology, testing, clean-room installation, commissioning, service agreements
Options	gravity-compensation, cryo and water chillers, feedback system, interferometry, motion control

Transfocators

CRLs are a favoured choice for flexibility in focusing over wide energy ranges and achieving varying focal lengths. The CRLs are housed in a transfocator to be precisely inserted/retracted into the beam. Transfocators can be customized to meet your focusing and spatial requirements.

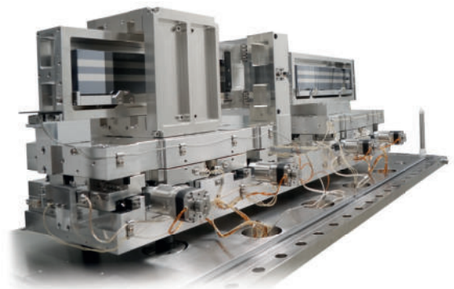
Focusing mirrors

Focusing mirrors can be used either singly or in a Kirkpatrick-Baez configuration to yield a 1D or 2D focused beam downstream. Using a mechanical bender the focus position can be varied to the preferred position along the beamline (e.g. sample, detector or secondary source aperture). High stability mechanics and reproducible and true bending are critical to the quality of the focused beam. The parameters of the optical element are chosen to match the requirements in beam size and coherence.



KB-focusing mirror system for GMCA at the APS, Chicago

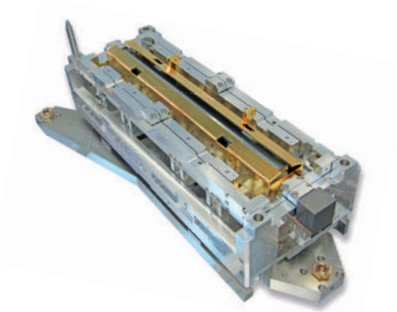
parameter	value
Number of stripes	1 to 4 (e.g. Si/Pt/Rh/Cr etc)
Optical element dimensions	up to 1400 mm length
Bender	Radius: 1 km to ∞
Resolution	0.02% of radius
Repeatability	0.2% of radius
Positioners	horizontal, vertical, pitch, yaw, roll
Vacuum	10^{-10} mbar
Stability (mounted)	≤25 nrad rms



Horizotnal deflectiong Double Mirror System

Customised mirror solutions

To utilize the unique properties of an FEL beam, special mirror solutions are needed. AXILON has delivered the double mirror system for the MID instrument at the European XFEL. This system consists of two cryogen-free-cooled vertical deflection mirrors which face each other, allowing for different operational modes of the beamline.



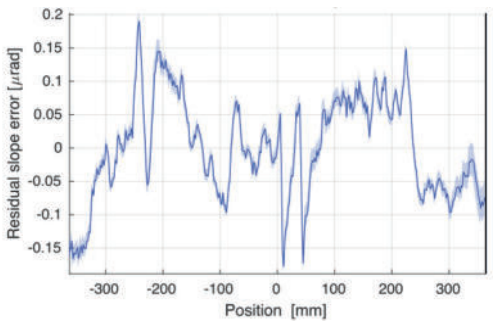
Cryo cooled double mirror for the MID experiment at XFEL.EU

Mirror Bender Metrology

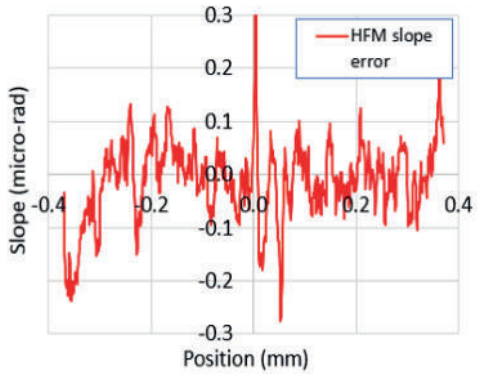
AXILON's in-house testing capabilities enables the verification of mechanical specifications of each component in the factory, prior to shipment. For mirror metrology we cooperate with different facilities to conduct slope error and roughness measurements of mirrors.

The below shown metrology results demonstrate the ultimate performance of our mechanical mirror bending system. A 700mm long flat mirror was characterized by the manufacturer achieving a slope error of around 70 nrad rms. After assembly into the mechanical bender and bending the mirror to the final elliptical curvature (~ 3km bending radius) the slope error was still measured to be around 75nrad rms. This characterisation was performed at differnt metrology labs and after multiple assembly steps.

parameter	slope error results
flat mirror at manufacturer	~ 70 nrad rms
mirror in bender bent to ~ 3km	~75nrad rms



Slope error measurement with NOM at ALBA

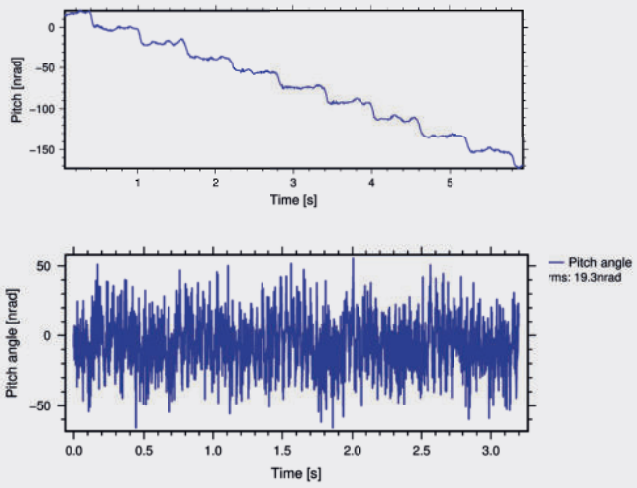


Slope error measurement with NOM at APS

Discuss with us a full characterization of your mirror system prior to installation.

Mirror Mechanics - Stability Results

result	timescale
< 25 nrad rms	1 ms - 1 hours
< 100 nrad rms	1 - 12 hours



Resolution and pointing stability measurements of the six mirror systems for LCLS at SLAC

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