Introduction
X-ray optical components, such as multilayer mirrors or scatterless apertures, are used as beam conditioning devices in nearly all state-of-the-art X-ray analytical equipment, either in the home lab or at synchrotron beamlines. In this contribution, we will give an overview of current developments in multilayer optics and scatterless beam components, and show their benefit in combination with high-brightness microfocus X-ray sources for typical applications in small angle scattering and crystallography.

Multilayer Mirrors for Home Lab sources
Montel Multilayer Optics for 2D Beam Shaping
Montel optics are two mirrors mounted side-by-side in an L-shape enabling a 2-dimensional beam shaping. The mirrors comprise multilayer coatings that are typically deposited with a precision within ±1% of the d-spacing by physical vapor deposition techniques. For high-brightness laboratory sources, such as the latest Incoatec Microfocus Source IµS or the recently introduced liquid metal jet X-ray source, optics with similarly low shape errors are used delivering a well-shaped beam with a Gaussian-like intensity profile. A Montel optics with two elliptically shaped mirrors is point focusing (for e.g. single crystal diffraction), whereas two parabolic mirrors enable a collimated beam (for e.g. small angle scattering). Nowadays, Montel optics are also used at synchrotrons, where they substitute the KB (Kirkpatrick-Basset) mirrors achieving a more compact design.

SCATEX Pinholes for Home Lab Sources and Synchrotrons

Comparison of Scatterless Slits 2.0 and SCATEX Pinholes
The measurements were performed by C. Gollwitzer at the PTB four-crystal monochromator beamline at BESSY II at 8 keV with typical photon fluxes of ~10^{10} ph/s.

Deduced scattering intensity vs. q-plots (3D-integration) for the various tested apertures.

New generation SCATEX pinholes
- up to 4 times less parasitic aperture scattering compared to Scatterless Slits 2.0
- up to 19 times less parasitic aperture scattering compared to old generation SCATEX Pinholes
- faster aperture scattering decay below the background at considerably smaller q-values

Comparison of a SCATEX 2-Pinhole Setup and a Standard 3-Pinhole Setup
SAXS Image of a thin fiber of a rat tail tendon, measured on a Bruker NANOSTAR with an IµS.

Advantages of a SCATEX 2-Pinhole Setup
- higher flux and smaller \(q_{\text{min}}\) possible due to a larger beam defining pinhole and a smaller beamstop
- faster data acquisition possible
- smaller footprint due to less pinholes and shorter beam path

Upgrading Existing Diffractometers
Incoatec supports the adaptation and full integration of our mirrors, SCATEX pinholes and IµS sources on almost all existing diffractometers.