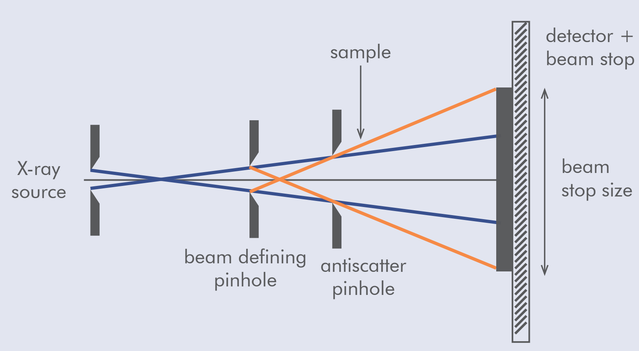
Upgrading SAXS setups with Incoatec´s scatterless pinholes and/or microfocus source IμS

Andreas Kleine[1], Christopher Umland[1], André Beerlink[1], Jürgen Graf[1], Christian Gollwitzer[2], Christina Krywka[3]

[1] *Incoatec GmbH, Max-Planck-Str. 2, 21502 Geesthacht, Germany*
[2] *Physikalisch Technische Bundesanstalt, Abbestr. 2-12, 10857 Berlin, Germany;* [3] *Helmholtz-Zentrum Geesthacht, Max-Planck-Straße 1, 21502 Geesthacht, Germany*

SCATEX - Incoatec´s Scatterless Pinholes

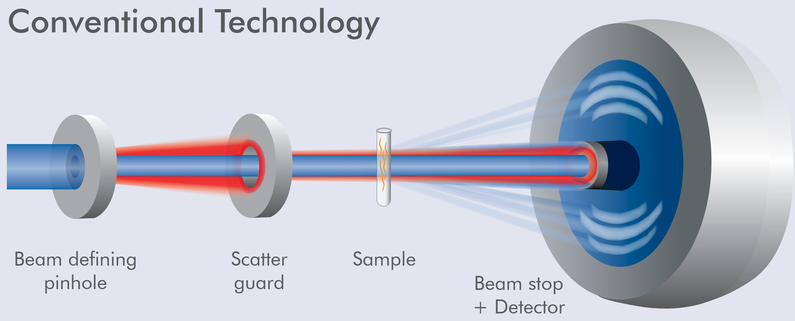
Parasitic scattering caused by apertures is a well-known problem in X-ray analytics, which forces users and manufacturers to adapt their experimental setups to this unwanted phenomenon. Increased measurement times due to lower photon fluxes, a lower resolution caused by an enlarged beam stop, a larger beam defining pinhole-to-sample distance due to the integration of a scatter guard and generally a lower signal-to-noise ratio leads to a loss in data quality.
The new SCATEX pinholes produce almost no parasitic scattering and overcome the aforementioned problems: hence, antiscatter pinholes become dispensable, system sizes shrink, resolution and photon flux increase, data quality improves.



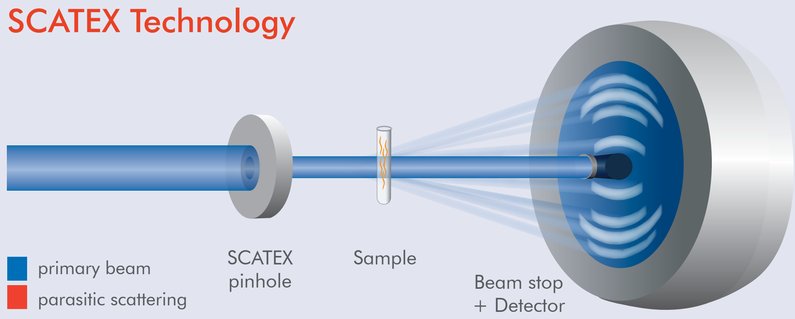
A SAXS setup with a typical 3-pinhole collimation system. This illustration clearly shows that even with an antiscatter pinhole the beam stop needs a large diameter due to the parasitic scattering. With SCATEX pinholes the antiscatter pinhole becomes dispensable and the beam stop only needs to have the size of the primary beam. This enables a higher resolution and photon flux.

parasitic scattering
primary beam

Conventional Technology



SCATEX Technology

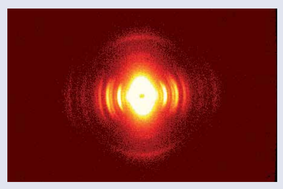


Main SCATEX features:
- Germanium pinholes for lower and Tantalum pinholes for higher photon energies
- available sizes: 20-2000 μm

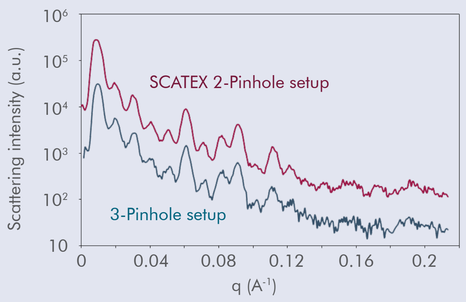
Your benefits:
- strongly reduced parasitic aperture scattering
- resolution and photon flux enhancement
- easier and faster pinhole alignment
- no scatter guard needed
- system size shrinks
- data quality improves

SCATEX Pinholes for SAXS Home-Lab Systems

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 with a Bruker NANOSTAR equipped with an IμS.

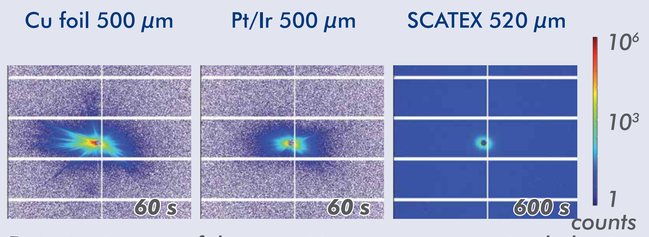


Scattering intensity vs. q-plot, measured with a 3-pinhole high resolution NANOSTAR and a modified 2-pinhole NANOSTAR equipped with SCATEX pinholes. With a similar resolution the SCATEX setup gives a considerably higher scattering intensity.

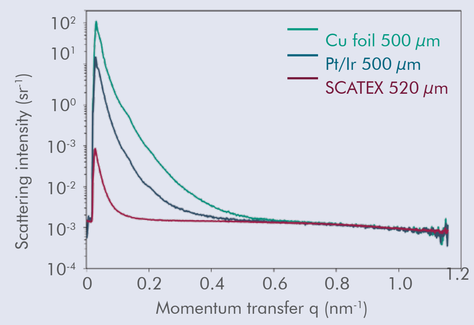
Advantages of a SCATEX 2-pinhole setup
- higher flux and smaller q_{min} possible due to a larger beam defining pinhole and a smaller beamstop
- faster data acquisition possible
- smaller footprint due to less pinholes and shorter beam path

Comparison of Different 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.



Detector images of the parasitic aperture scattering behavior of different pinholes at 8 keV.



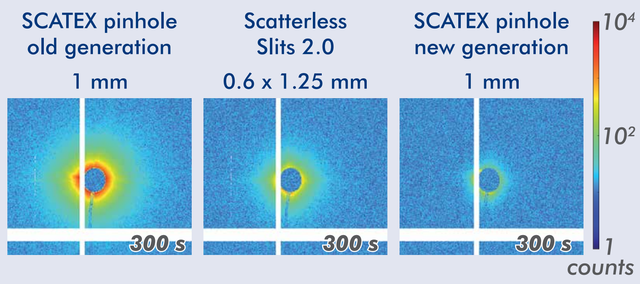
Scattering intensity vs. q-plot deduced (360° azimuthal integration) from the detector images. The data is corrected for the different measurement times and normalized to the photon flux upstream of the tested aperture.

SCATEX pinholes
- allow 10 times longer exposure time
- 2-3 orders of magnitude less parasitic scattering than conventional pinholes
- much less scattering into the q-space
- scattering pattern is circular, thus showing the high overall structural quality of the pinhole

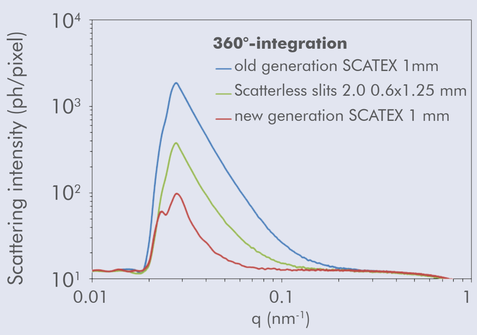
SCATEX Pinholes for Synchrotrons

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.



Images of the parasitic aperture scattering at 8 keV with the test apertures being the beam defining element. No scatter guard inserted. The downstream photon flux was the same (variation < 1%) for all compared test apertures.

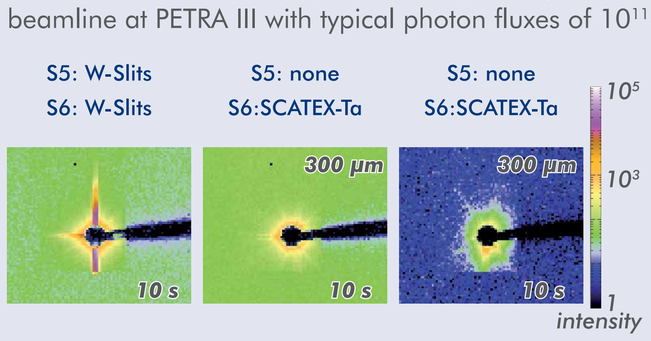


Deduced scattering intensity vs. q-plots (360°-integration) for the various tested apertures.

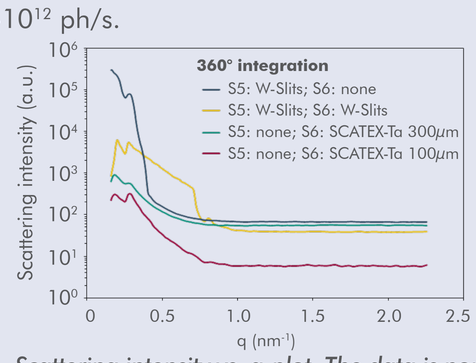
New generation SCATEX pinholes
- up to 4 times less parasitic aperture scattering compared to Scatterless Slits 2.0
- up to 19 times less parasitic aperture scattering compared to old generation SCATEX Pinholes
- faster aperture scattering decay below the background at considerably smaller q-values

Comparison of Tungsten Slits and SCATEX-Ta Pinholes

The measurements were performed by C. Krywka at 13 keV at the Nanofocus Endstation P03 beamline at PETRA III with typical photon fluxes of 10^{11}-10^{12} ph/s.



Detector images of the parasitic aperture scattering at 13 keV. In the standard beamline setup S5 denotes the position of the beam defining aperture and S6 the position of the antiscatter aperture.

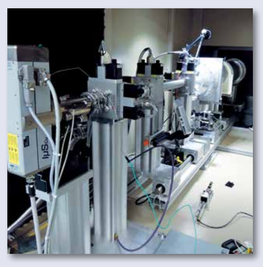


Scattering intensity vs. q-plot. The data is normalized to the number of summed up pixel. Various apertures were tested at position S5 (beam definition) and S6 (scatter guard).

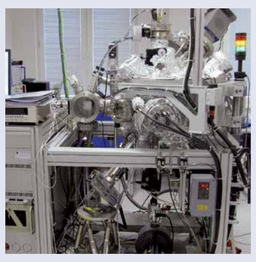
- a single SCATEX-Ta pinhole replaces both beam defining slit S5 and antiscatter slit S6
- the beam-defining SCATEX-Ta aperture can be positioned closer to the sample
- one order of magnitude less parasitic aperture scattering with SCATEX pinholes
- pinhole sizes down to 10 - 20 μm possible

Upgrading Existing Diffractometers with the microfocus source IμS

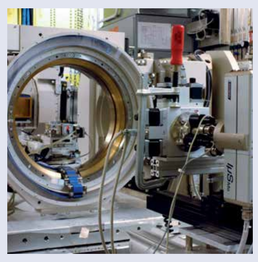
Examples of IμS and SCATEX upgrades on SAXS systems



IμS and SCATEX upgrade on a customized SAXS setup in Hamburg



Adaptation to UHV deposition chamber for in-situ GISAXS studies in Bratislava, Slovakia



HRXRD and GISAXS setup at synchrotron beamline (Petra III, DESY) in Hamburg

Huber system for SAXS in Tamkang, Taiwan

You have a Bruker AXS, Marresearch, Nonius, Rigaku, Huber or some other system?
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- Full integration into existing safety circuits, new safety concept development on request
- Full compliance with European Machinery Directive 2006/42/EC

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- Dual wavelength setup by adding IμS as complementary source
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