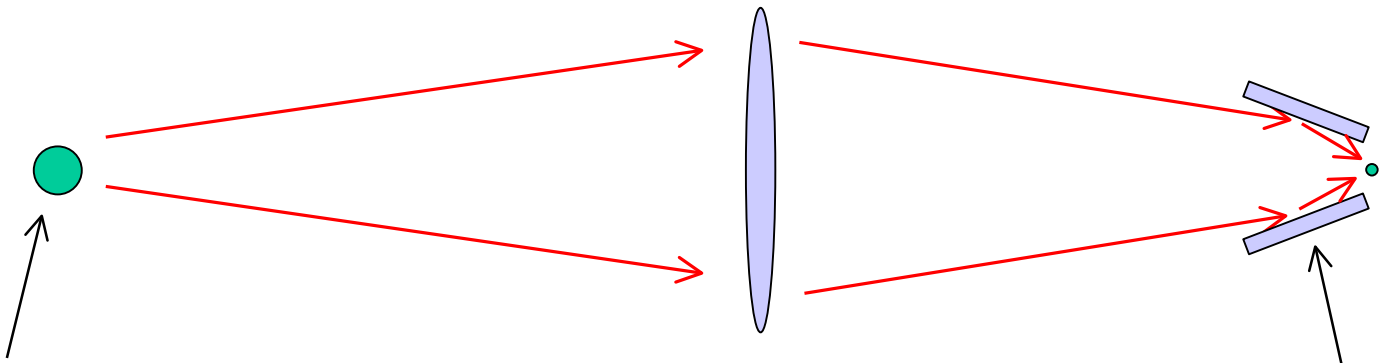
Making Nanobeams of 10 nm diameter at 8 keV with tapered leaded glass capillary

Abstract: it may be possible to overcome the slope error limits and aberrations of x-rays optics to choose a tandem set of optics to compress an x-ray beam to 10 nm beamsize. The first set need to be fairly good at preserving brilliance with large demagnification ratios. Suitable elements are zone plates, KB mirrors, refractive lenses, etc. The final stage of compression could utilize leaded glass as a) aperture, or after more development, b) a low gain, multibounce condensing capillary. Since x-rays can not travel far in leaded glass, the beam size is determined largely by the exit hole diameter and not by the aberrations in the optic.

Make nanobeams of 10 nm diameter at 8 keV with capillary

Schematic only, not to scale

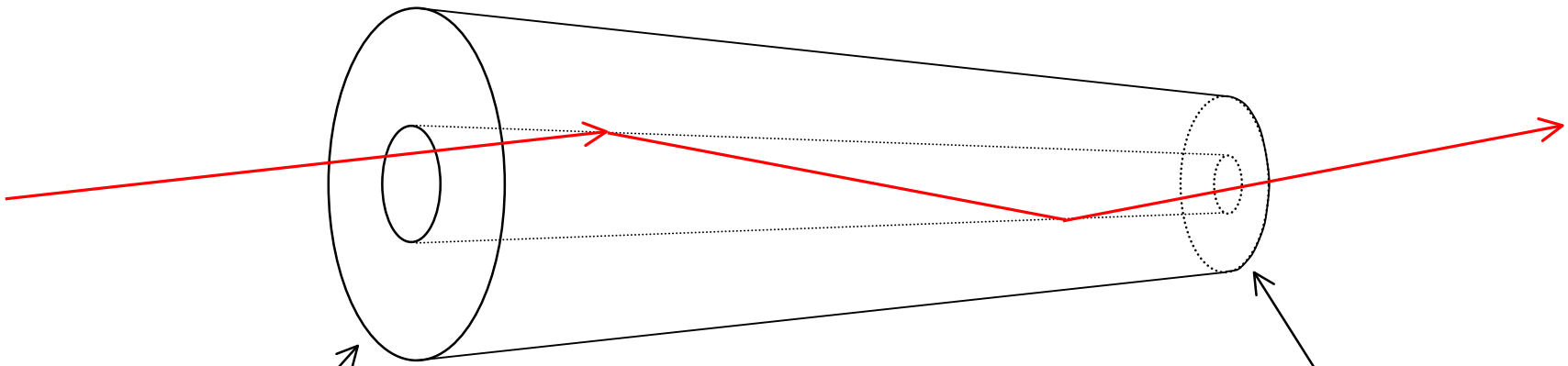


Round ERL
source of
3 to 10 microns
diameter

Zone Plate
KB Mirrors
Refractive Lens, etc.
for first compression

Tapered
leaded glass
capillary
for final
compression

Tapered Capillary to Squeeze X-rays to 10 nm diameter



Schematic only, not to scale

Material: Pb glass, density 5.3
g/cm**3, 40 micron atten. length at 12 keV
Length of 0.2 mm to 2 mm
Metal coating for interior?

Base end
OD=10 micron
ID=0.2 micron
=2000Angstroms

Tip end
OD=1 micron
ID=0.02 micron
=200Angstroms
FWHM=1/2 tip dia