

Instrumentation systems

Long slit geometry

Kratky camera

Bonse-Hart setup

Others

Simple pinhole camera

Huxley Holmes camera

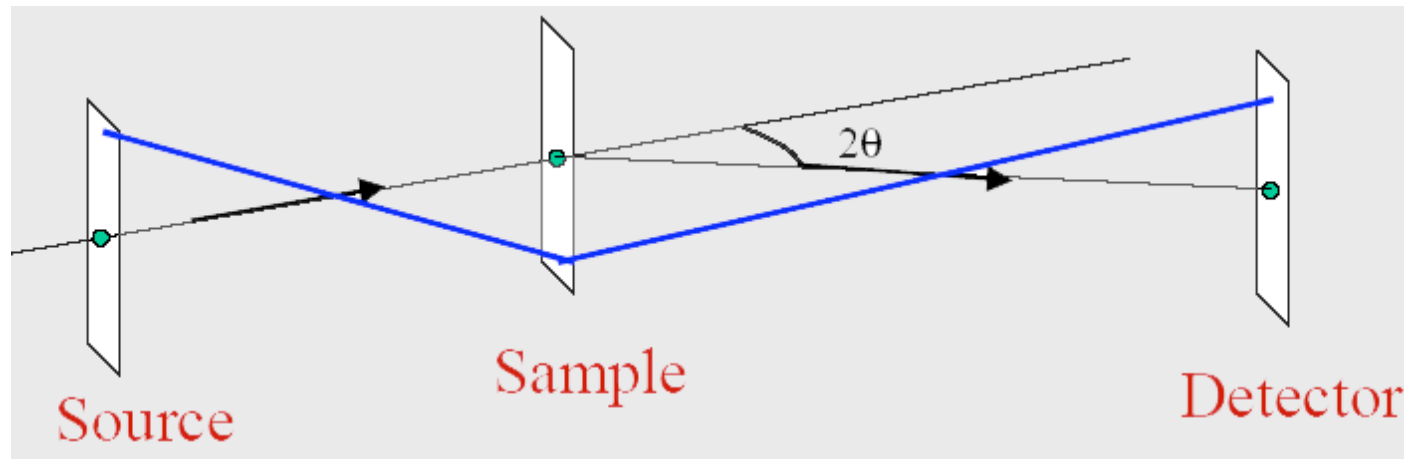
Franks setup

NanoSTAR with Göbel mirrors

+ many others

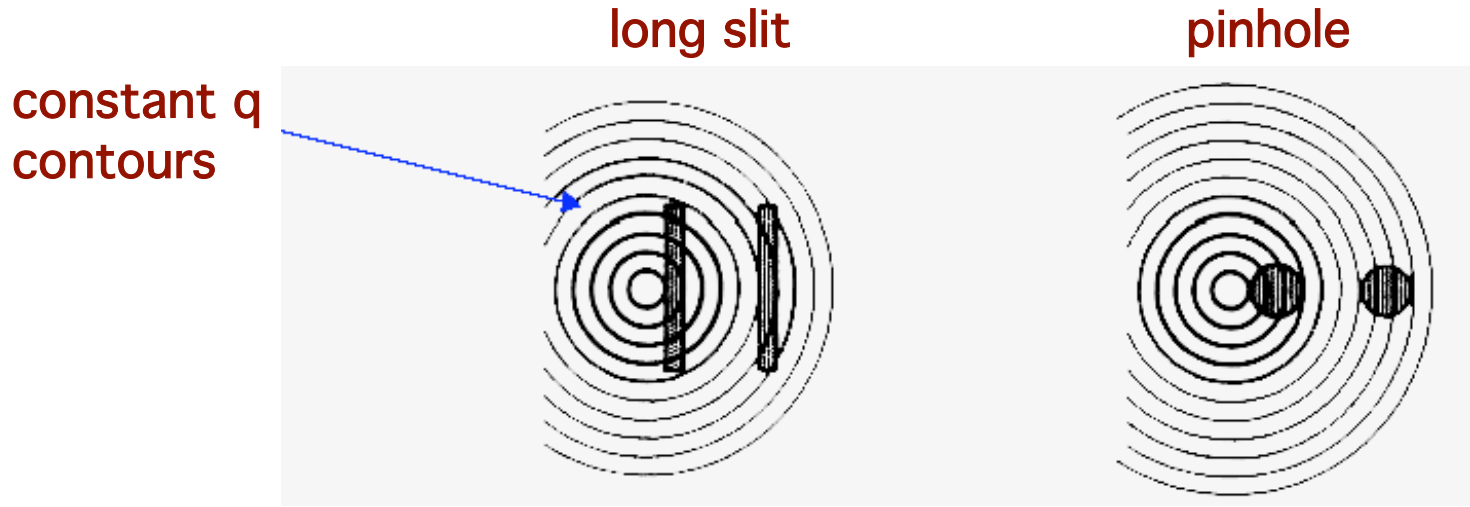
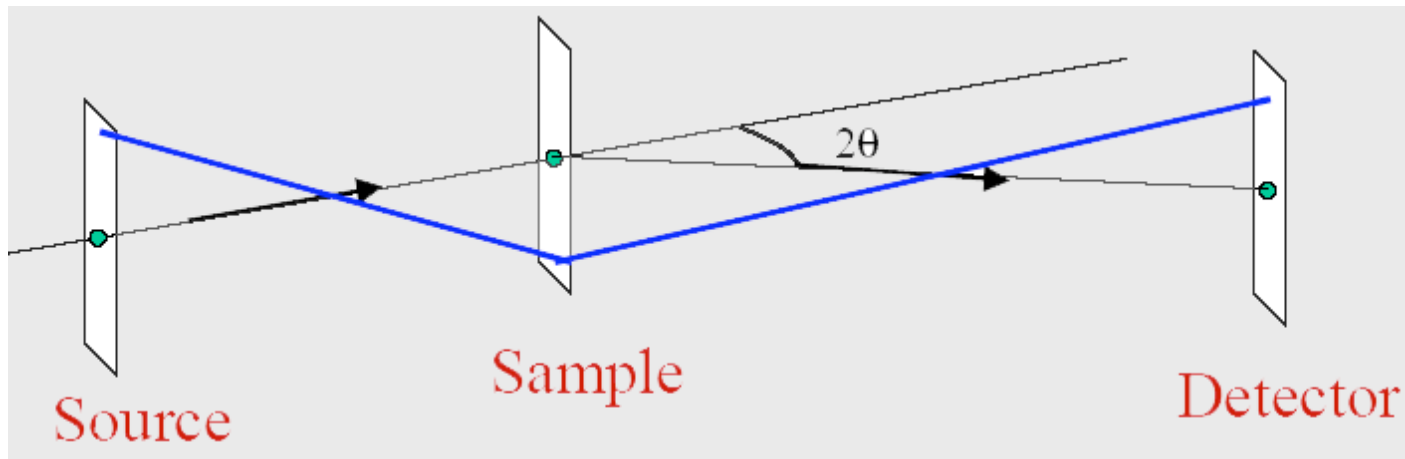
Instrumentation systems

Long slit geometry

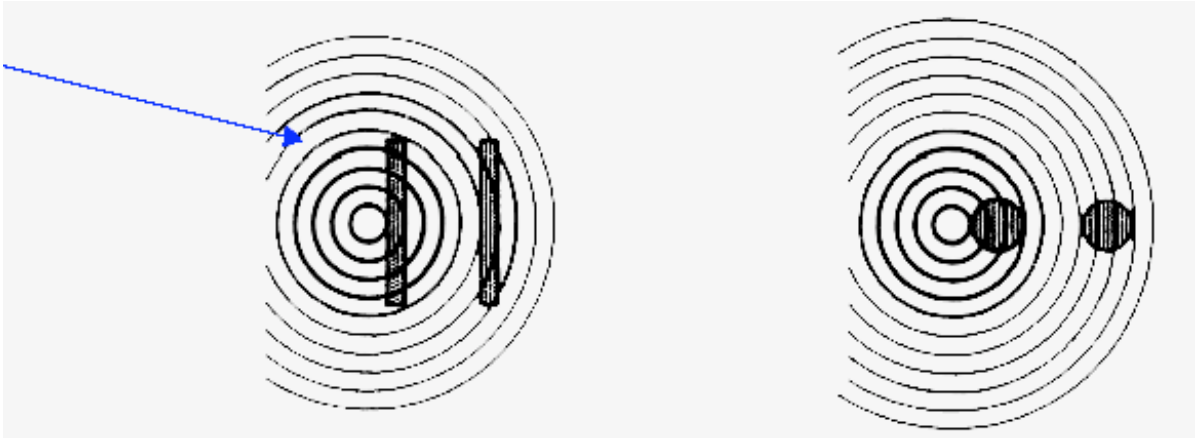


Instrumentation systems

Long slit geometry



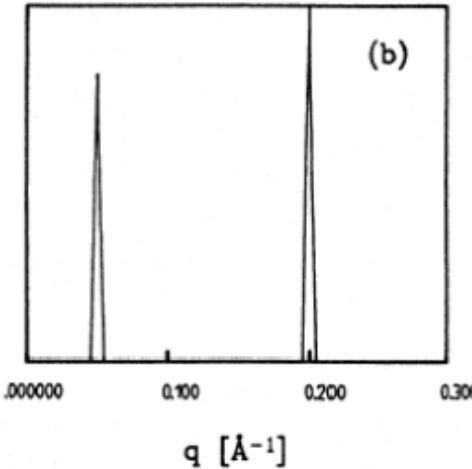
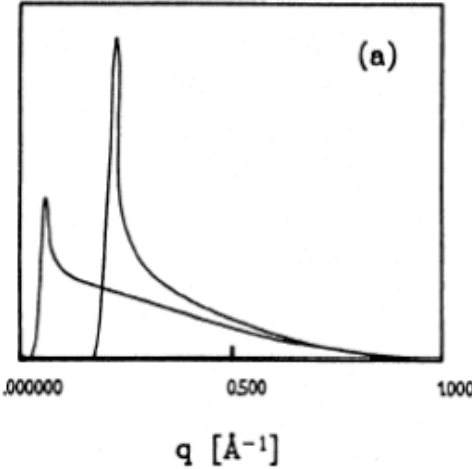
Instrumentation systems



long slit

pinhole

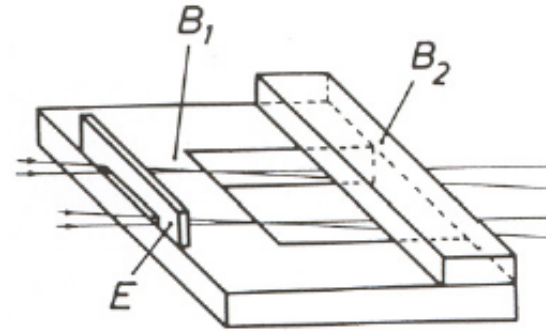
q distributions



Instrumentation systems

Kratky instrument

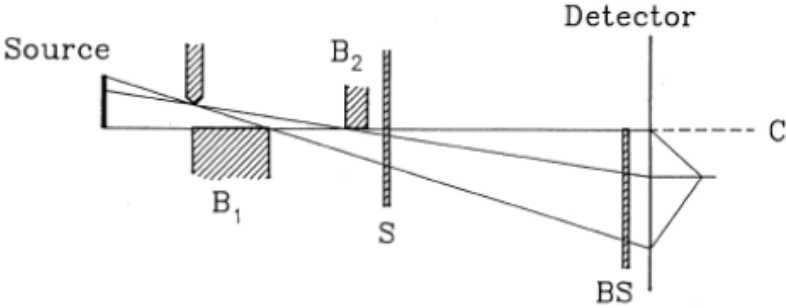
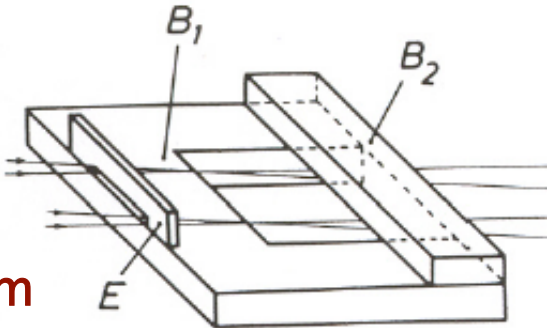
incident beam
slit system



Instrumentation systems

Kratky instrument

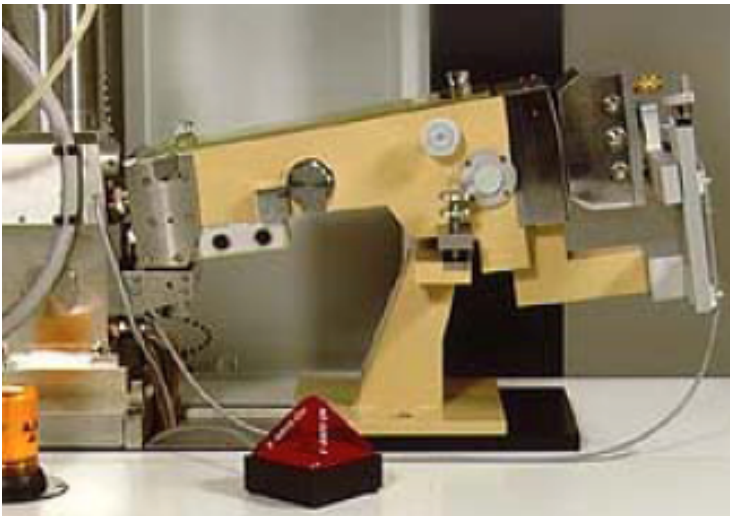
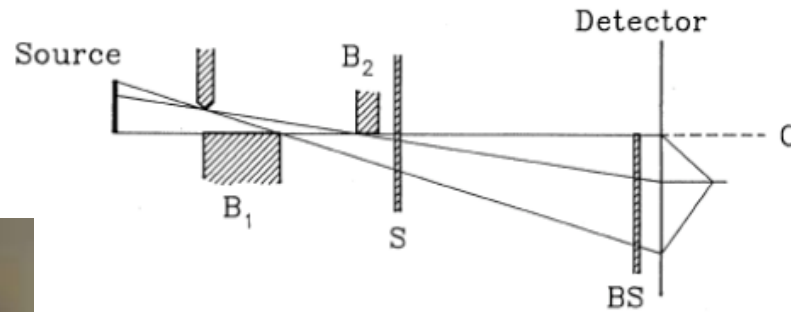
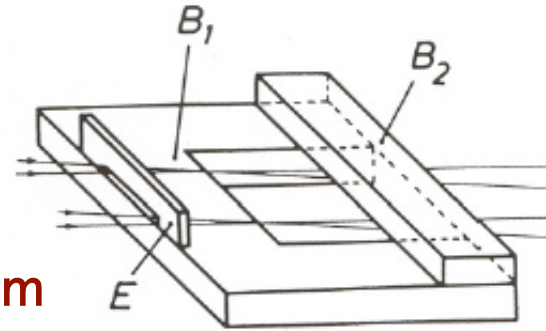
incident beam
slit system



Instrumentation systems

Kratky instrument

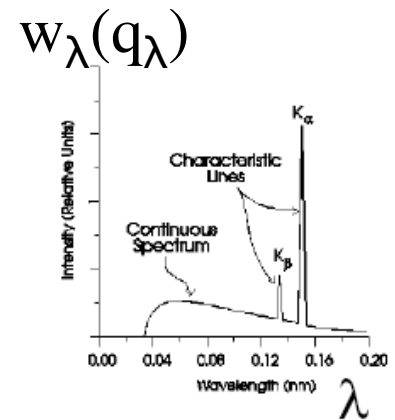
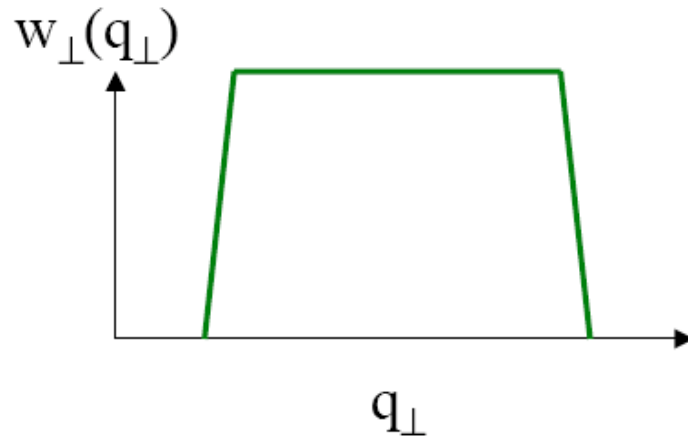
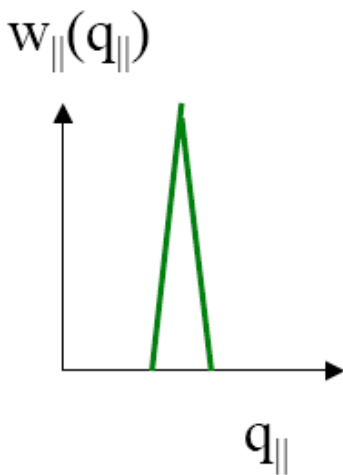
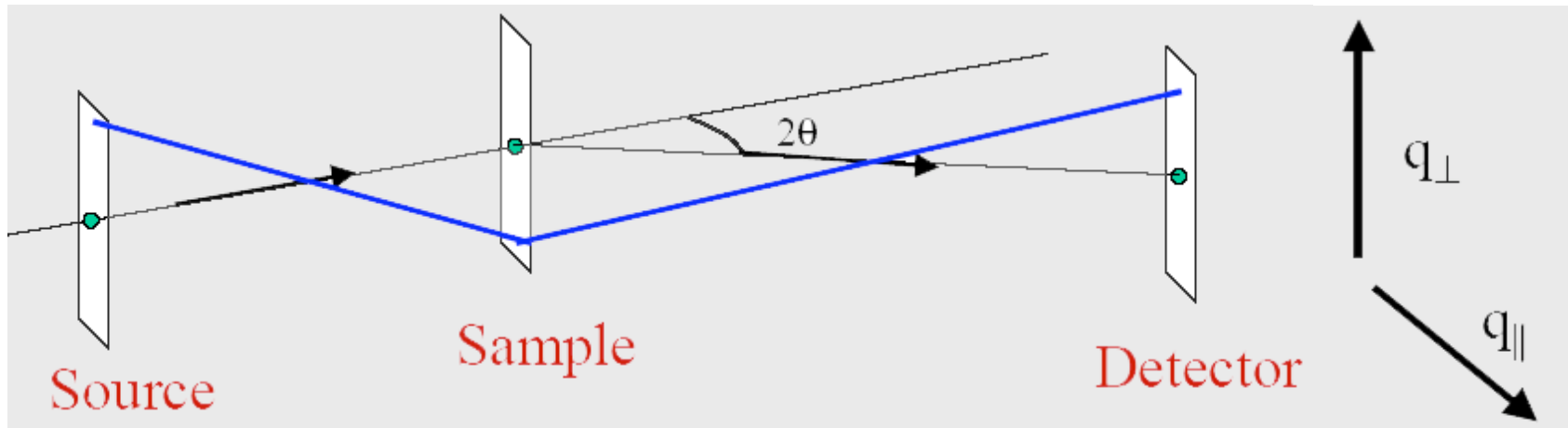
incident beam
slit system



q range to 0.003 \AA^{-1}
sealed tube 10^7 - 10^8 ph/s
non-oriented oriented sample
- or perfectly oriented

Instrumentation systems

Slit smearing



Instrumentation systems

Slit smearing

$$I(q) = \iiint \frac{d\sigma}{d\Omega} \left(\frac{\lambda_0 \sqrt{(q - q_{\parallel})^2 + q_{\perp}^2}}{\lambda} \right) W_{\parallel}(q_{\parallel}) W_{\perp}(q_{\perp}) W_{\lambda}(\lambda) dq_{\parallel} dq_{\perp} d\lambda$$

$\frac{d\sigma}{d\Omega}(q)$ is desired cross section

Instrumentation systems

Slit desmearing

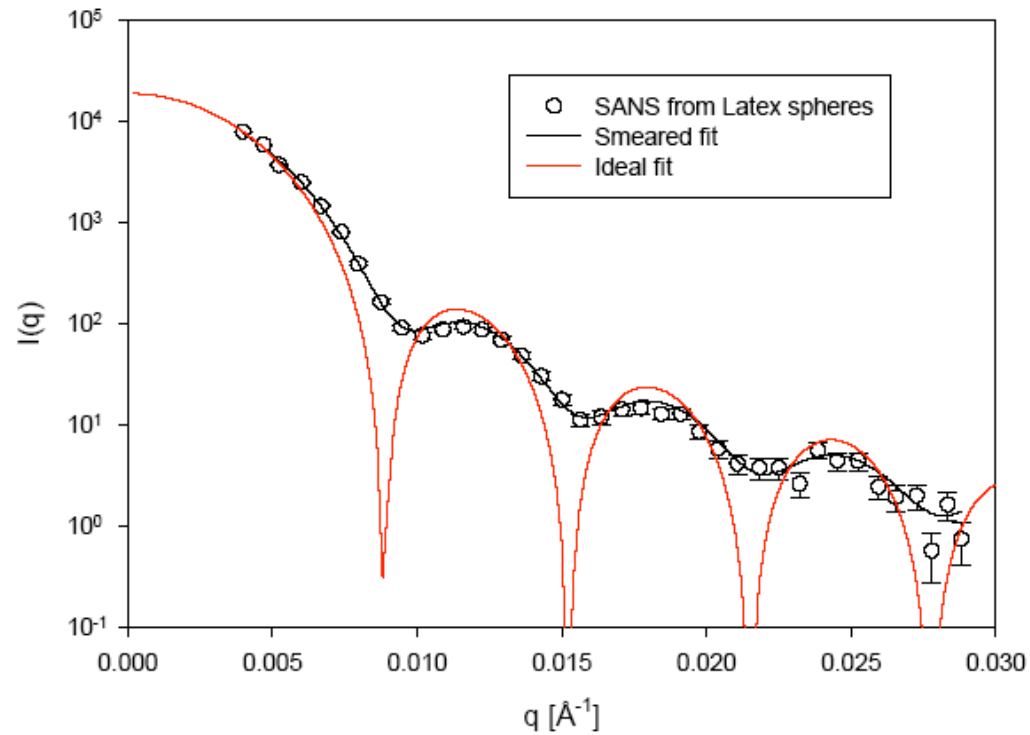
(Read Roe, Section 5.6)

- a. Measure slit-length weighting fcn w/ no specimen or beam stop
- b. Calculate this fcn from slit geometry - then invert relationship betwn measured smeared data and unsmearred results (desired)
- c. Don't desmear - use infinite slit approx.

Instrumentation systems

Slit desmearing

$$I(\langle q \rangle) = \int R(\langle q \rangle, q) \frac{d\sigma(q)}{d\Omega} dq \quad \frac{d\sigma}{d\Omega}(q) = \Delta\rho^2 V^2 \left[\frac{3[\sin(qR) - qR \cos(qR)]}{(qR)^3} \right]^2$$



Instrumentation systems

SAXSess

Improved Kratky camera
Rotating anode + Göbel mirrors
--> 10^{10} ph/s
Monochromatic beam
Short acquisition times
(deadtime effects)
Image plate detector
 ≤ 0.1 mm resolution



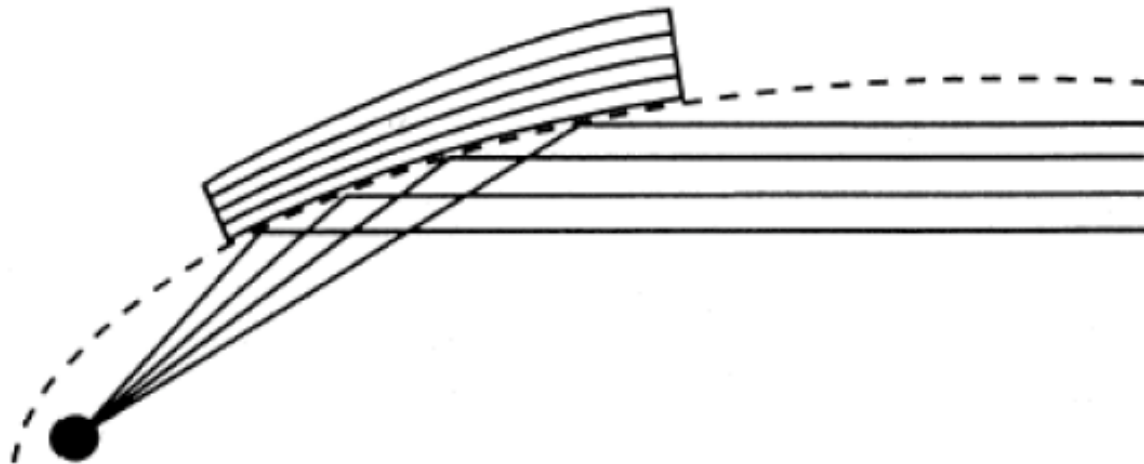
Instrumentation systems

Göbel mirrors

Si-W multi-layers on parabolic substrate

**Multilayer spacing varies w/ position -
divergent beam comes out parallel**

Length - about 5 cm - Bragg angle a few degrees



Instrumentation systems

Simple pinhole camera

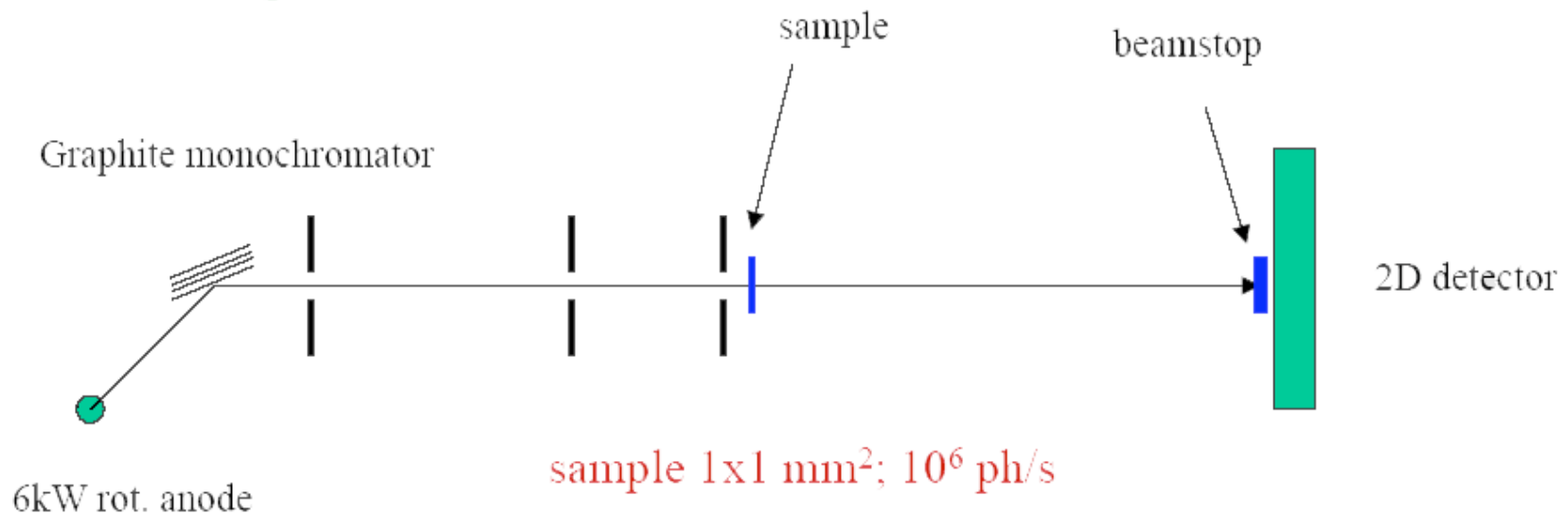
Lower flux - use 2D detector

$q_{\min} = 0.01 - 0.005 \text{ \AA}^{-1}$ at lab sources

$q_{\min} = 0.001 \text{ \AA}^{-1}$ at synchrotron sources

Any specimen configuration

Oak Ridge 10 m camera:

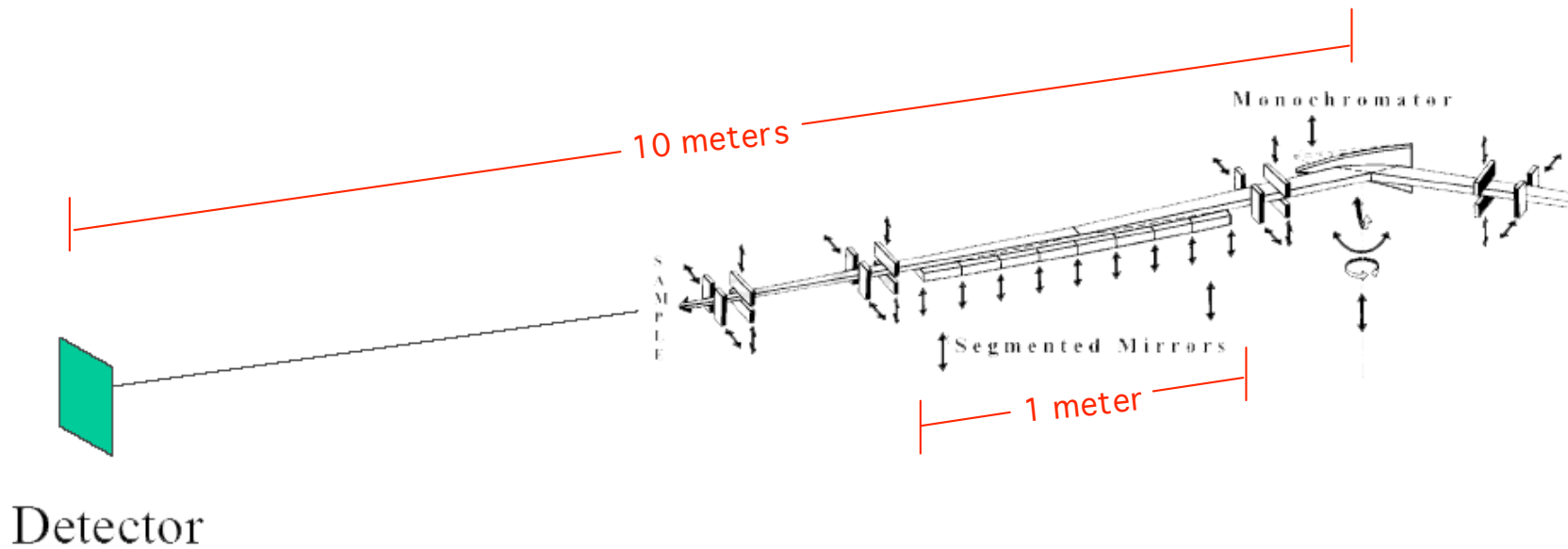


Instrumentation systems

Huxley-Holmes SAXS

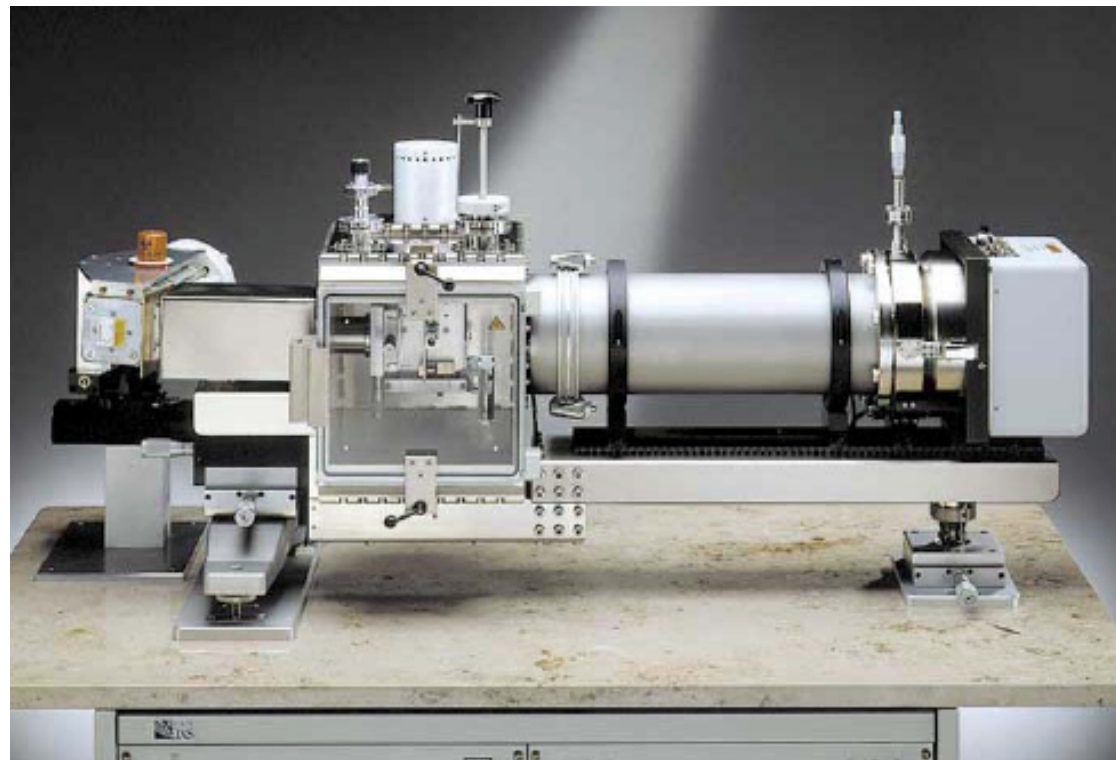
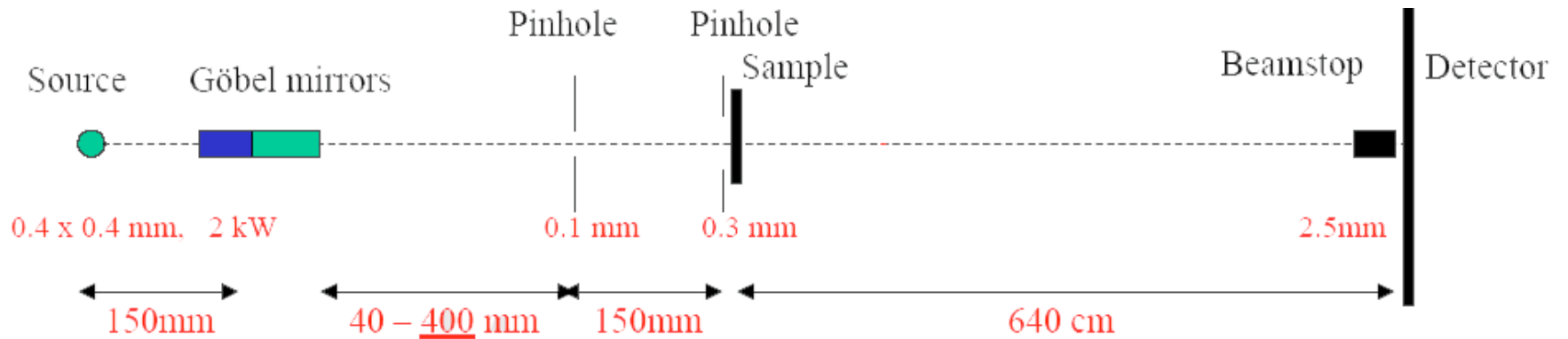
EMBL Hamburg, bending magnet, $100 \text{ mA} - 10^{12} \text{ ph/sec}$
Rotating anode - 10^7 ph/sec

2 mm x 5 mm specimen



Instrumentation systems

Bruker/Paar SAXS



Instrumentation systems

Bruker NanoSTAR SAXS

