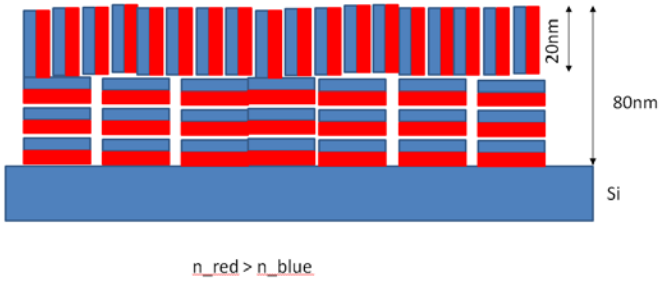
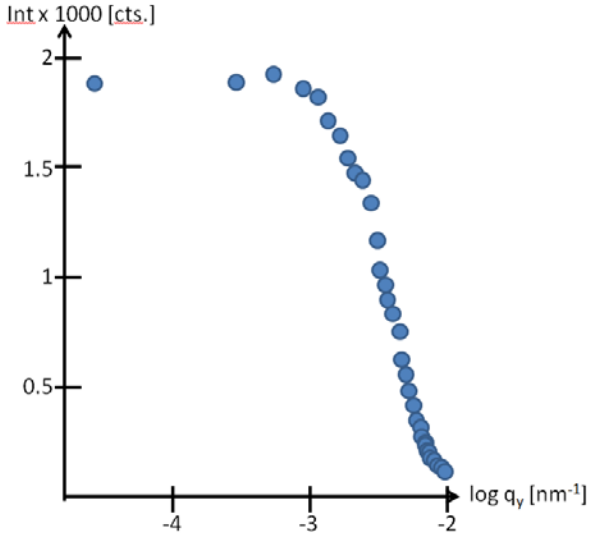
Exercise 7.6.2016

1) Calculate the form factor of a cylinder.
2) Calculate the Porod constant Q for a two phase system (density ρ_M, ρ_P, and concentration of the particles Φ).
3) SAXS resolution
   a) Show how the SAXS resolution depends on wavelength, beam size and SDD.
   b) Assume a perfectly collimated beam and perfect slits, which is the remaining parameter (not considered in a)) which determines the SAXS resolution? Hint: Consider focusing on the detector.
4) Consider the following sketch of a thin polymer film. Red and blue sketch two polymer materials, e.g. PS and PMMA.



   a) Calculate the approximate critical angle for the typical polymers mentioned. We assume λ= 1 Å.
   b) Vary the incident angle and sketch qualitatively the corresponding GISAXS pattern for three characteristic situations.
   c) Concerning the SAXS resolution, what do you expect for SDD=1m, 4m, 13m? Sketch the corresponding GISAXS pattern for the same detector.
5) The following figure sketches schematically part of the GISAXS signal of a distribution of polymeric droplets on a surface [adapted from Müller-Buschbaum et al. J. Appl. Cryst. (2007). 40, s341–s345]. The size of a droplet is approximately 13 µm.



   a) Draw a guide to the eye to the data.
   b) Determine approximatively the GISAXS resolution. Assume, that the beam size corresponds to one detector pixel.
   c) A second structure is present. Determine its length scale.
   d) Draw a sketch of the polymer thin film in real space.