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Reflectometer(s) for the ESS
suggestions by the Danish-Swiss working group

workshop on WP 2
Lund, 29. 04. 2011

selene approach: focusing in the scattering plane

– concept

– principle lay-out of a full instrument

– tests on Amor

– to be done for ESS

soft matter

medium resolution, horizontal sample plane

⇒ short instrument, moderate focusing in the sample plane

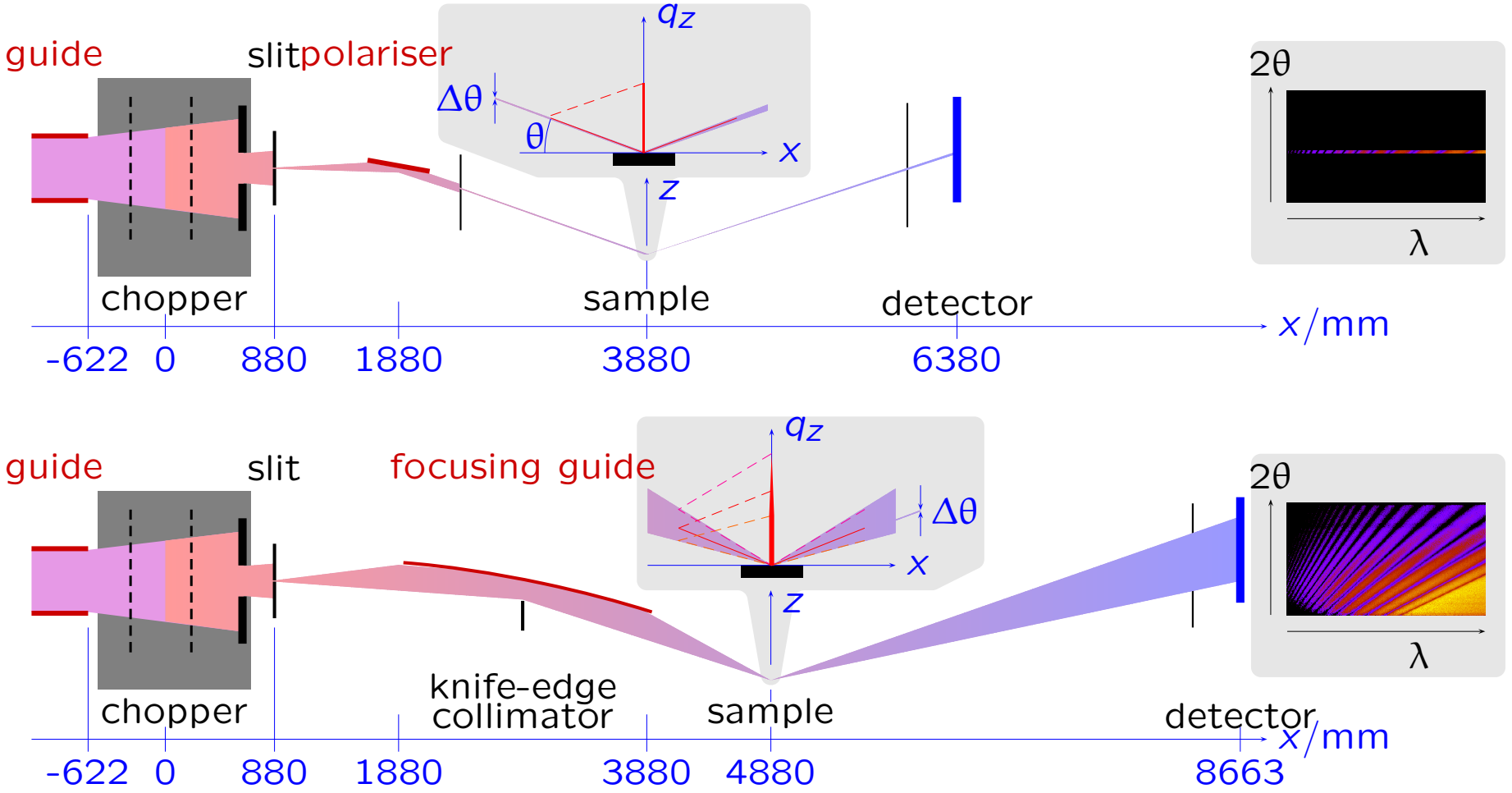
(GISANS: strong focusing to the detector)

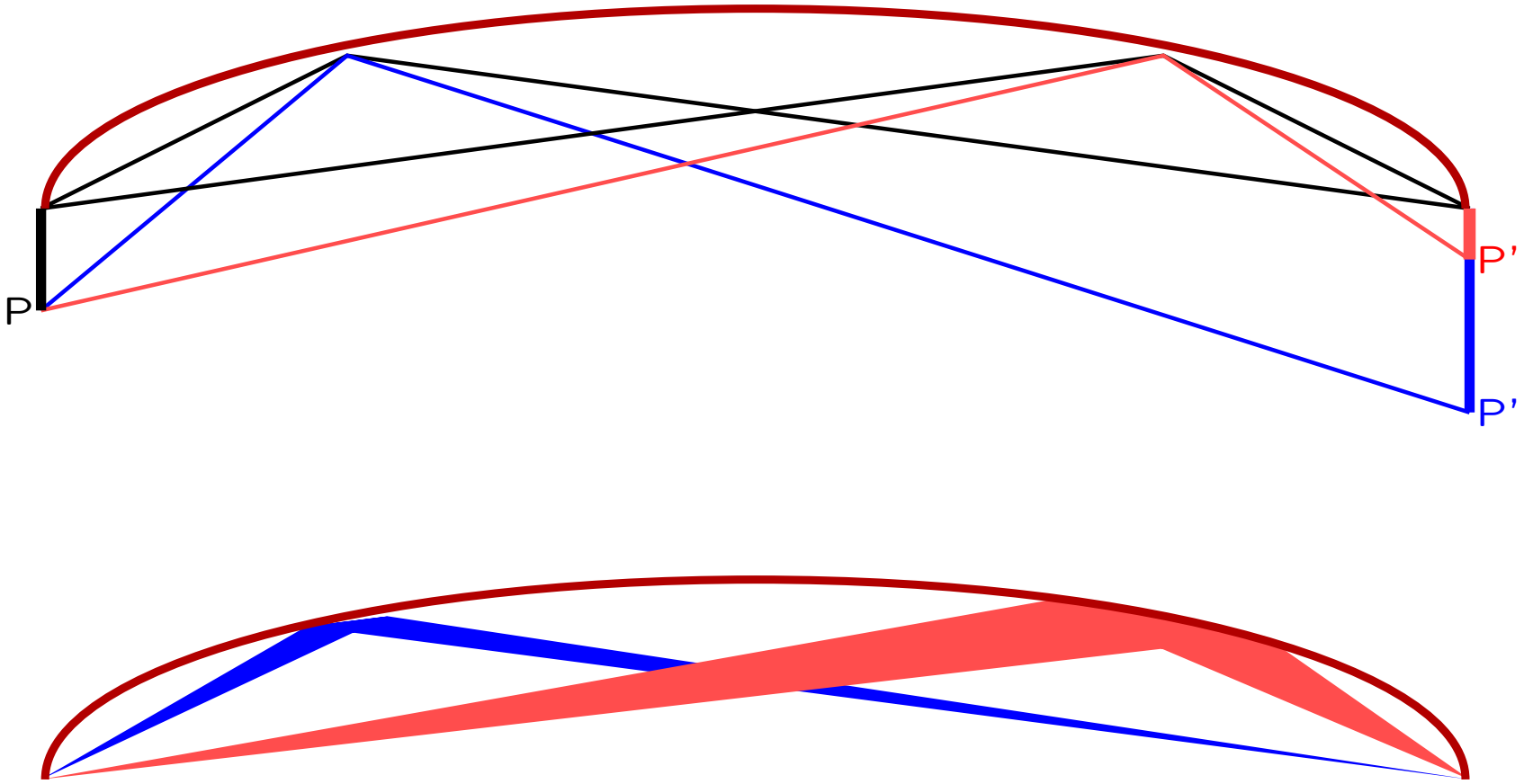
small samples

magnetic layers, variable resolution, vertical sample plane

⇒ moderate length, strong focusing in the sample plane

selene — the concept




P
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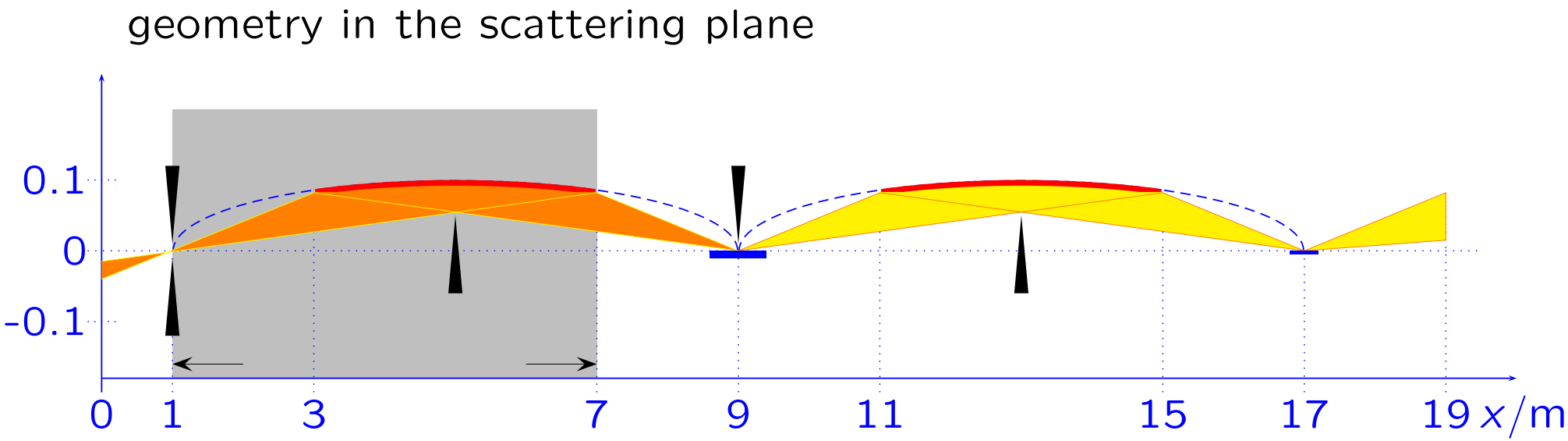
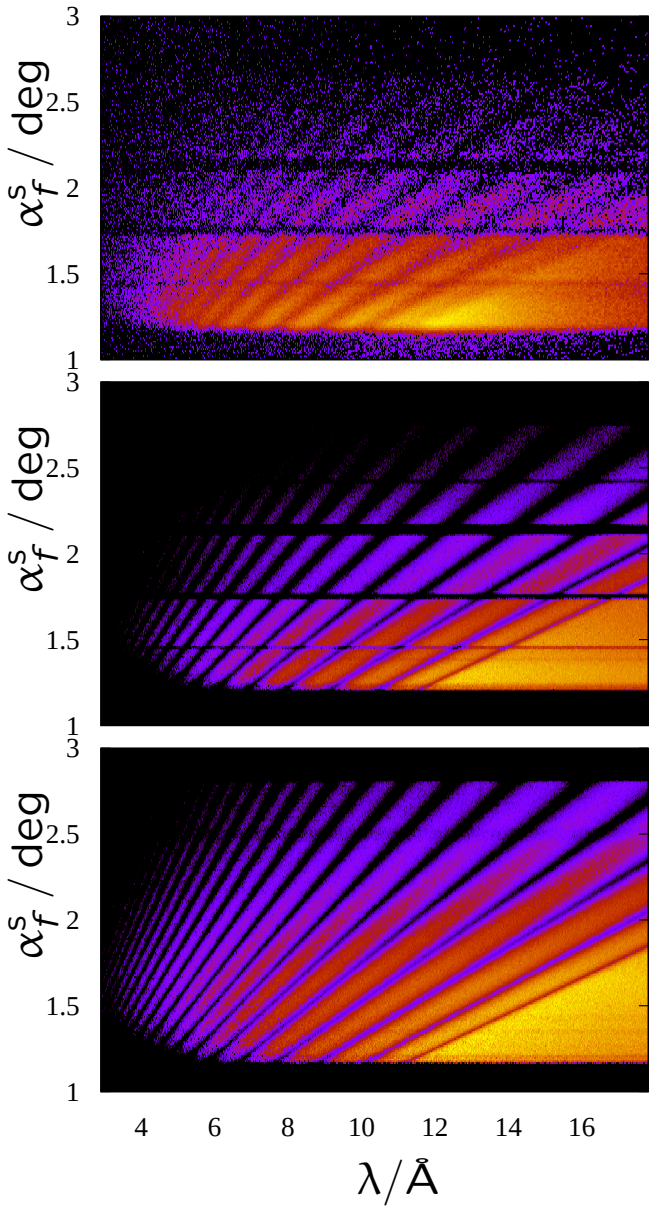
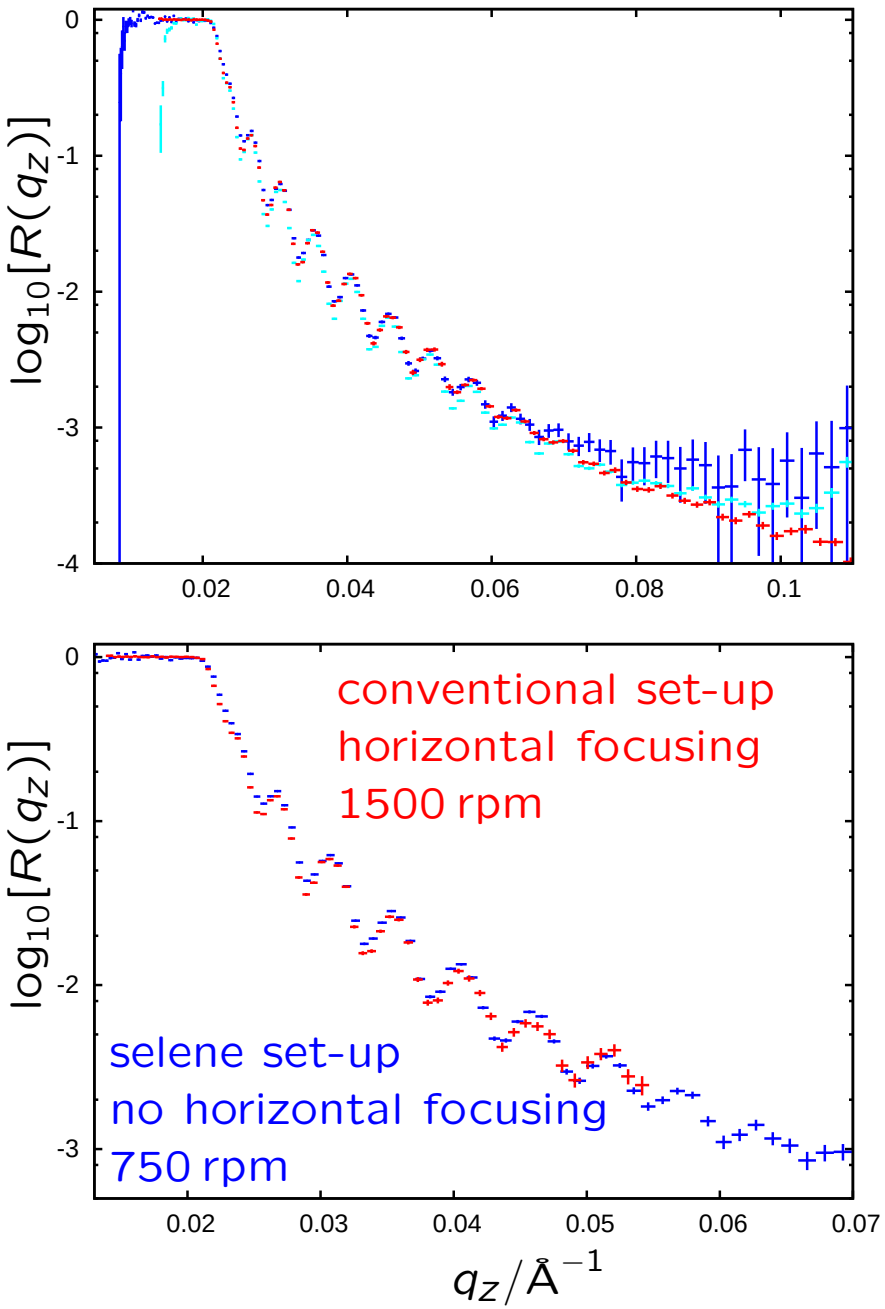
(Amor prototype scaled by 2)



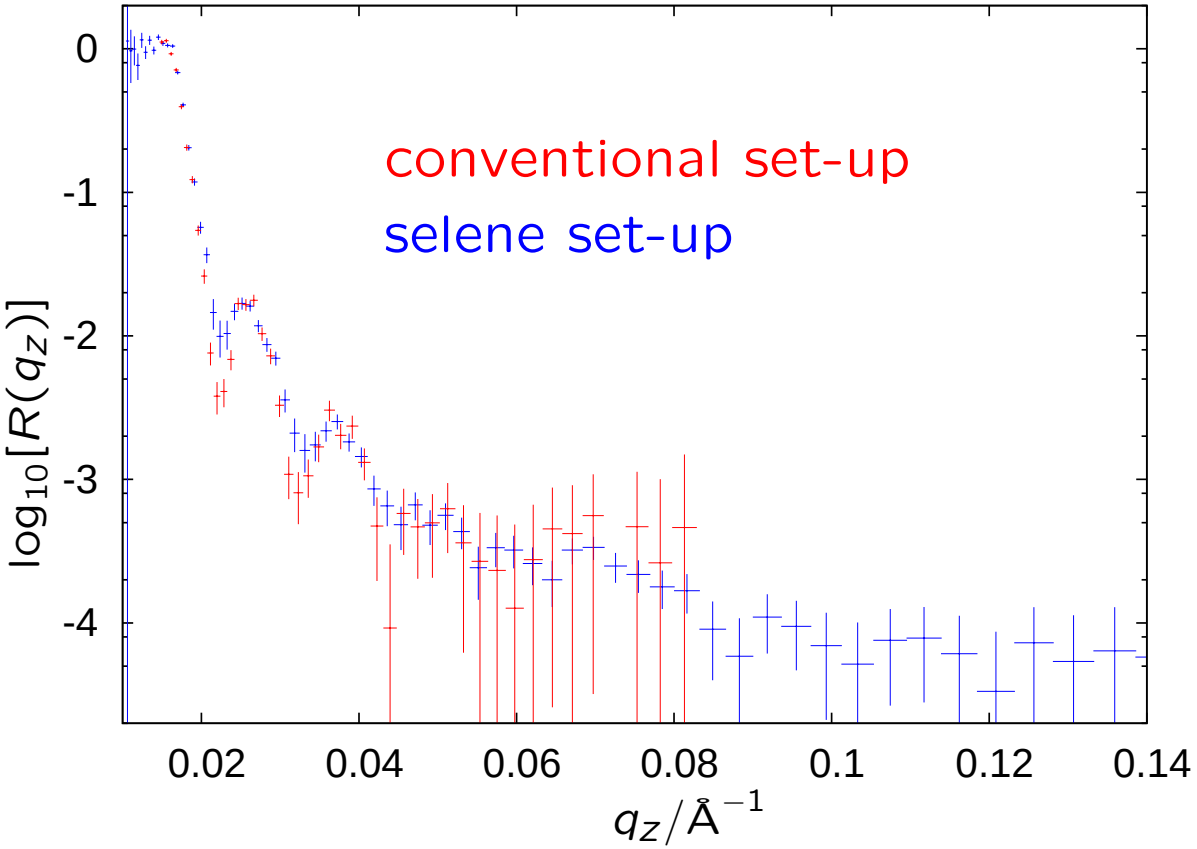
selene — tests on Amor

sample: 1000 Å Ni on glass





sample: $La_{2/3}Sr_{1/3}MnO_3/SrTiO_3$ - multilayer on NGO
sample-size: $4 \times 4\,mm^2$
no focusing in sample plane
measurement time: 1 h
chopper frequency: 750 rpm / 1500 rpm



selene — to be done for the ESS

1 simulation of an instrument with 2 guide elements

+ check of options like polarisation, band-width filter, chopper

2 construction of the prototype instrument and tests on BOA

+ experiments with *real* samples

+ horizontal and vertical geometry

3 adaption of the design to the needs of the ESS

splitting into
– a horizontal soft matter instrument, and
– a vertical hard condensed matter instrument for small samples

$\Rightarrow$ deliverables:
– report on tests on BOA
– complete simulation of the instruments for the ESS

optimised for liquid/air interface

$\Rightarrow$ horizontal sample plane, large q_z-range with one setting

optimised for short counting times

$\Rightarrow$ no use of long wavelengths

$\Rightarrow$ conflict short vs. long instrument!

GISANS focusing to the detector in the sample plane

compatibility with selene-concept has to be checked!

(astigmatic focusing might spoil the correction for coma aberration)

aim for small samples ($< 10 \times 10\,\mathrm{mm}^2$)

$\Rightarrow$ strong focusing to the sample in the sample plane

$\Rightarrow$ initial aperture of $1 \times 10\,\mathrm{mm}^2$ ideally!

variable resolution (1 to 20% required):

$\Rightarrow$ variable sample-detector distance (to tune $\Delta\alpha$)

moderate source/detector distance (30 to 50 m)

or use a multilayer monochromator to get an angle/wavelength encoding for high resolution

(no chopper, Frédéric's REFocus approach)

– TOF gives off-specular resolution

– ML gives specular resolution

(to be evaluated)

task		pm	k€
programming	2.1, 2.2		
– off-specular scattering (from guide/sample)		3	22
– gravity in elliptic guides		6	44
simulations			
– full set-up on BOA (several options)	2.3, 2.4	5	36
– analysis of experiments (real effects)	2.3, 2.4	5	36
– adaption for ESS, soft matter	2.1	9/12	66/88
– adaption for ESS, hard matter	2.2	9/12	66/88
hard-ware, investment	2.4		
– second guide element			50
– diaphragms, rotation and translation stages			50
consumables			
– computation time			10
– misc. for BOA experiment			10
conception / experiments	2.3, 2.4		
– full set-up on BOA		6+9	160