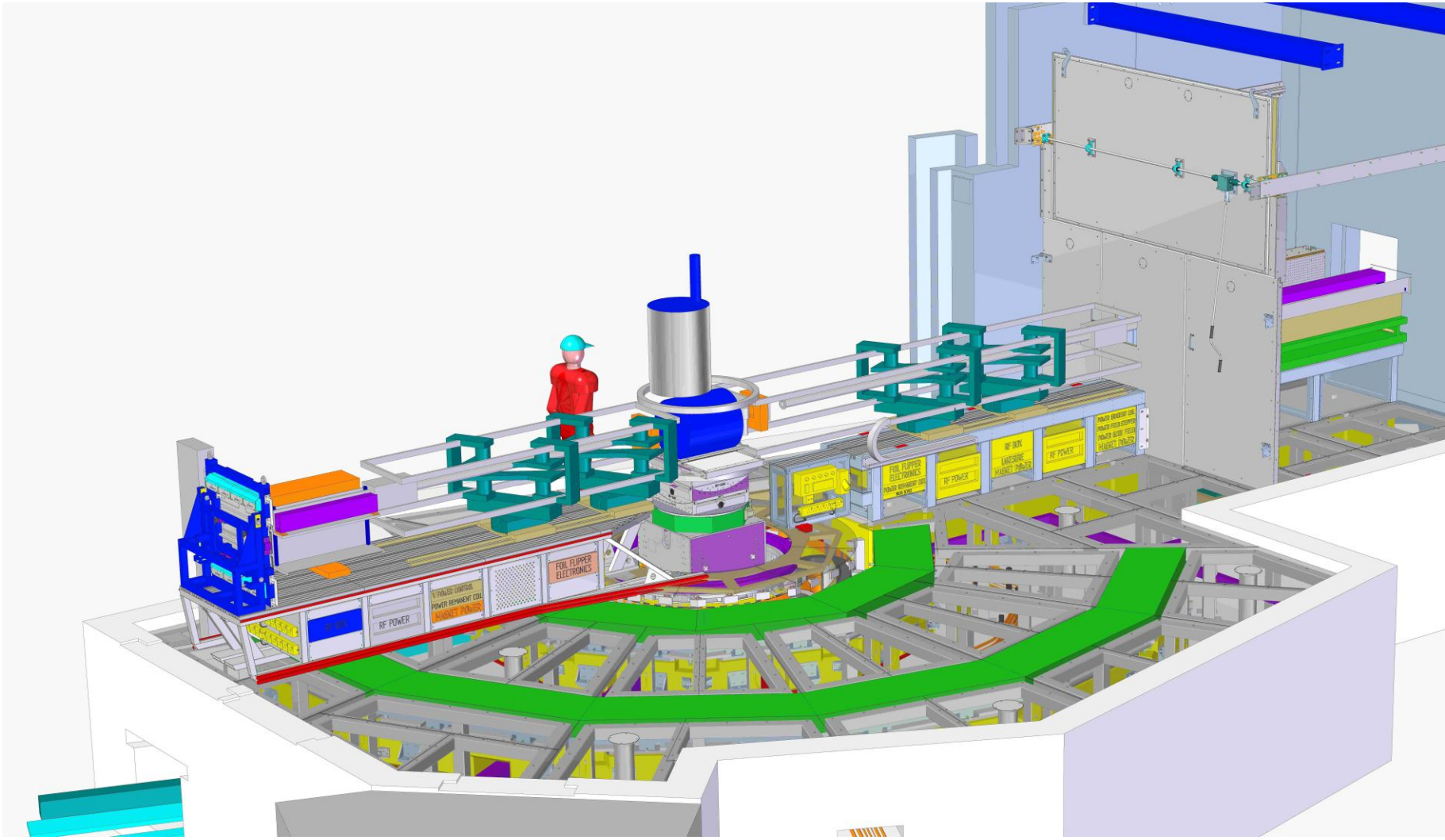
Technical case LARMOR

Jeroen Plomp
Delft University of Technology

LARMOR kick-off meeting, Utrecht, 2 October 2012



Design, Nick Webb

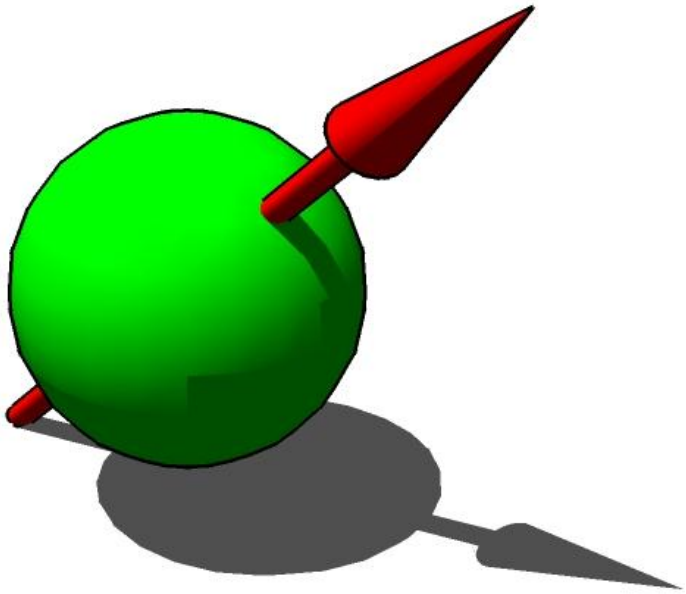
Choice of modes

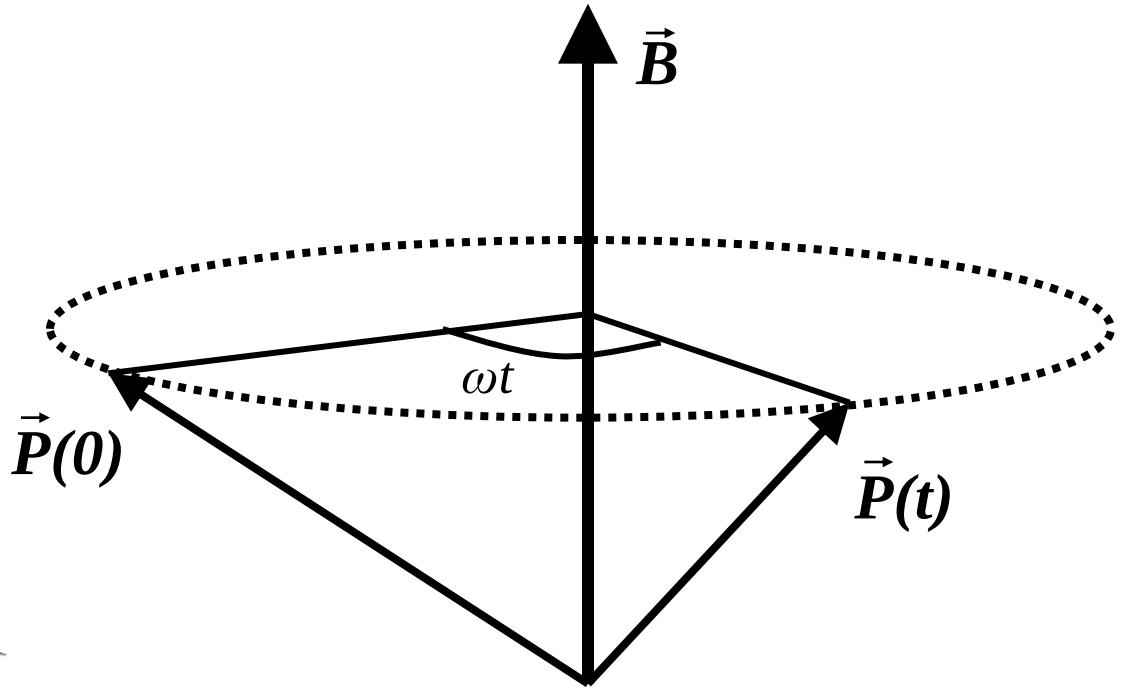
Choice of technical issues

Choice of flexibility

Science case

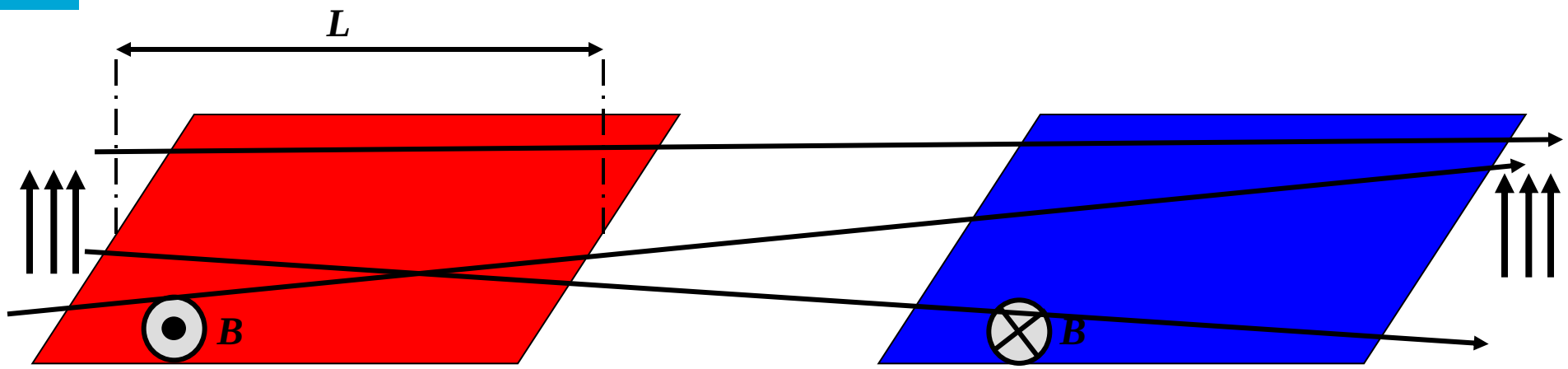
The magnetic moment of the neutron provides a solution to a higher resolution!

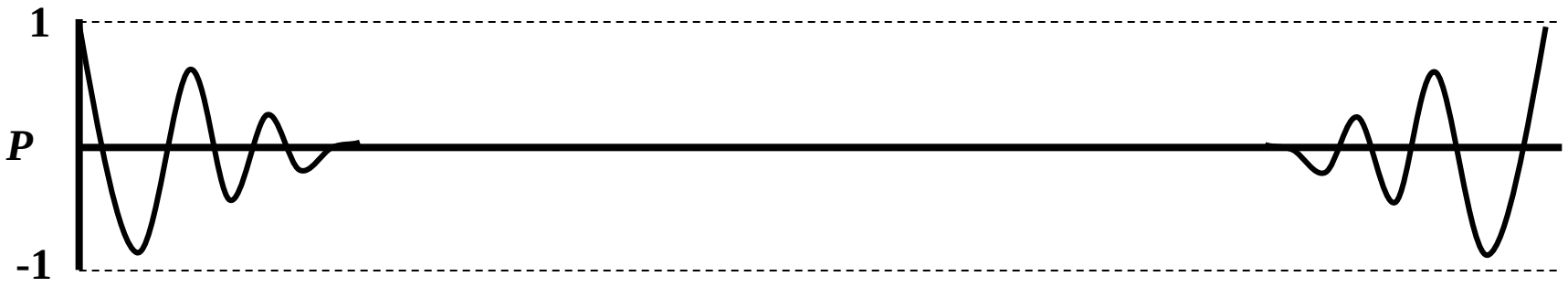




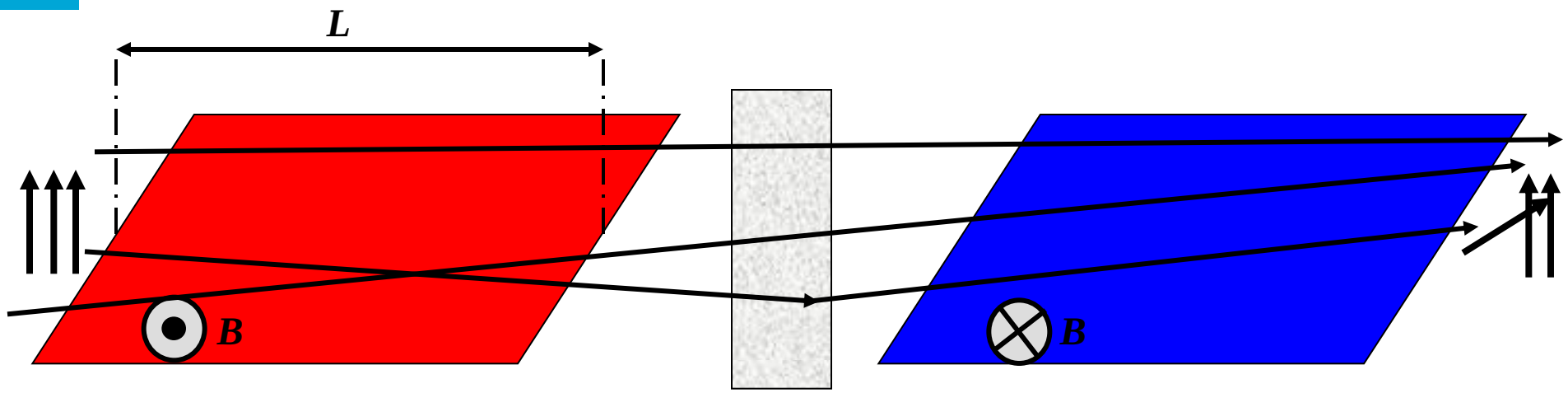
$$\varphi \approx B \lambda L$$

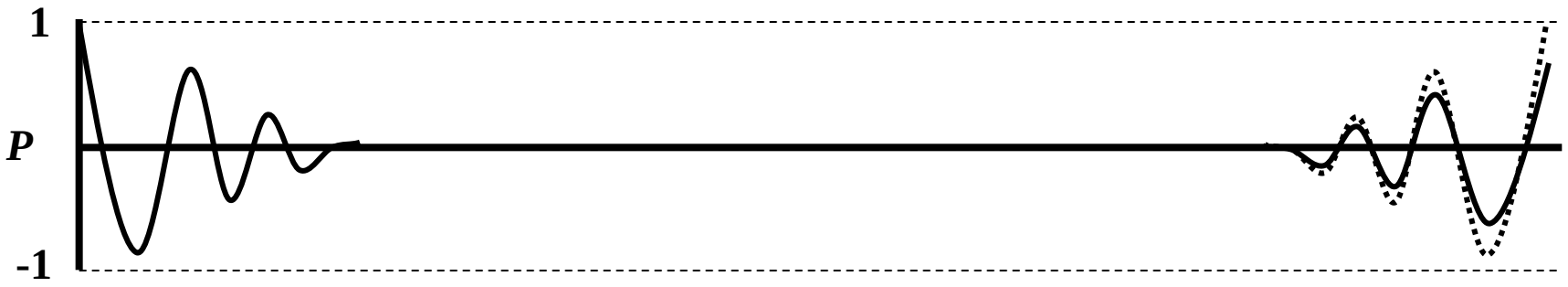
Larmor precession and spin-echo



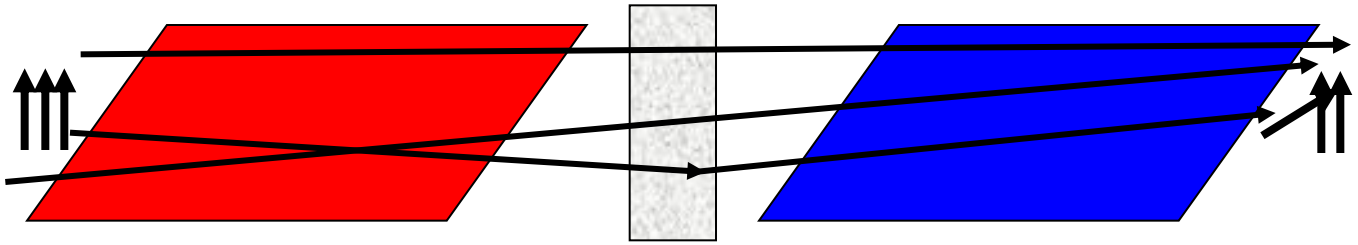


Larmor precession and spin-echo





Elegant decoupling for "intensity – resolution" problem



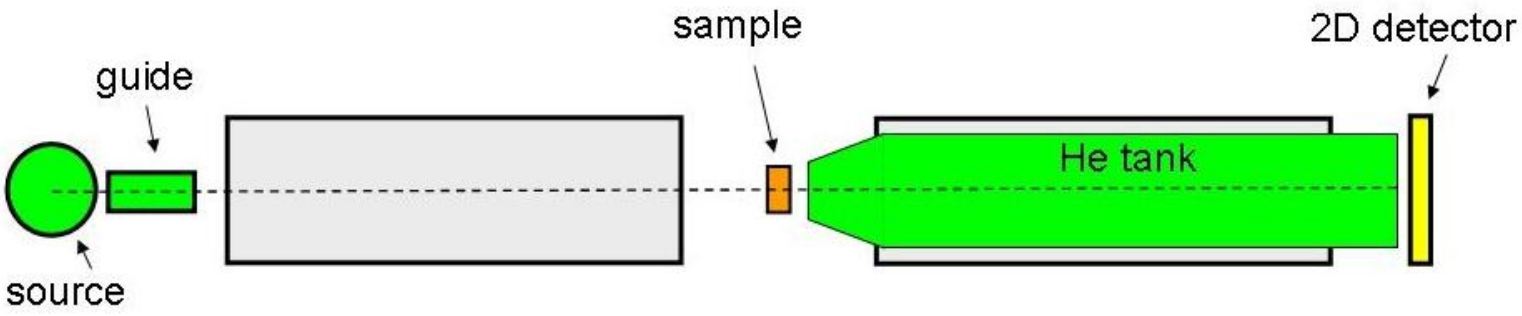
Counter intuitive

With high beam divergence still high resolution

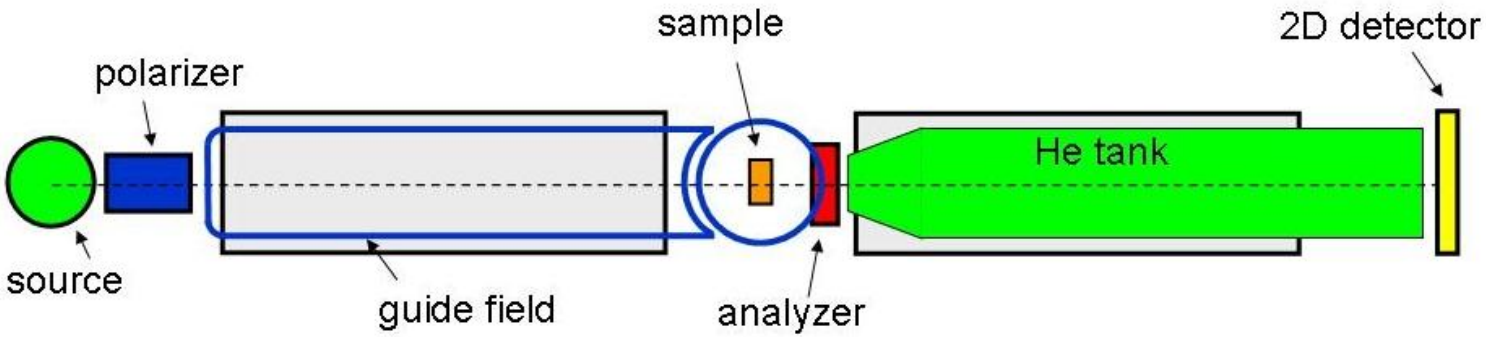
with *mrad* beam divergence scattering angles of *µrad* can be measured

This because we look at the difference !

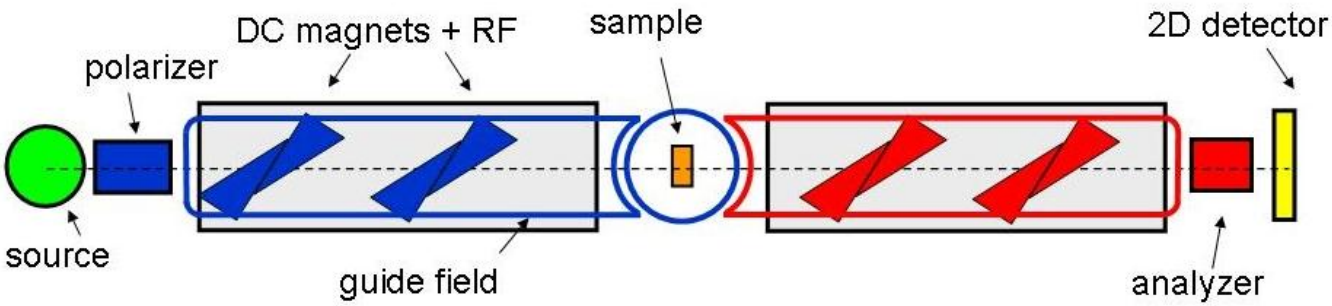
SANS



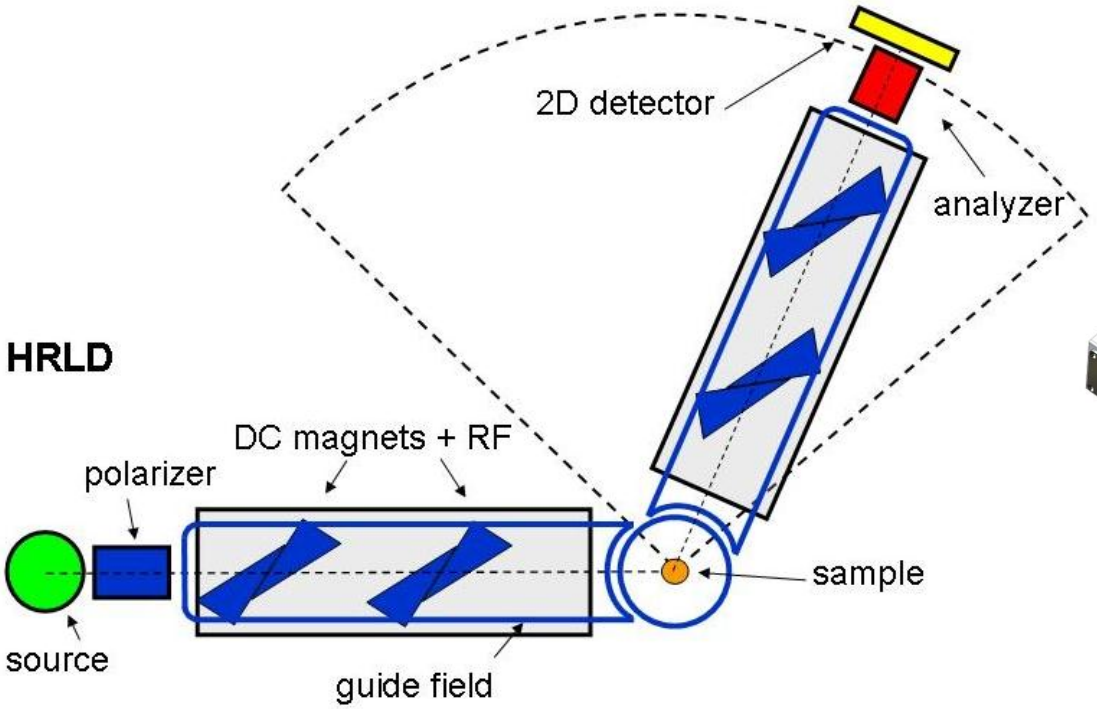
Polarized SANS

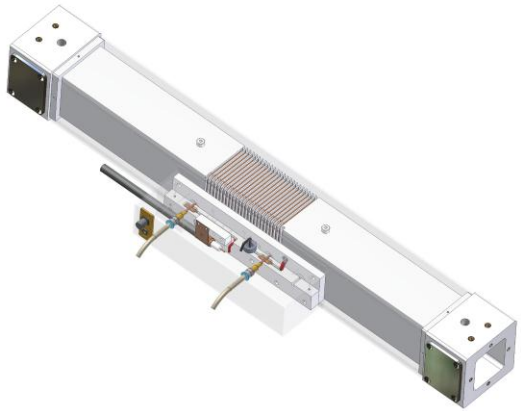


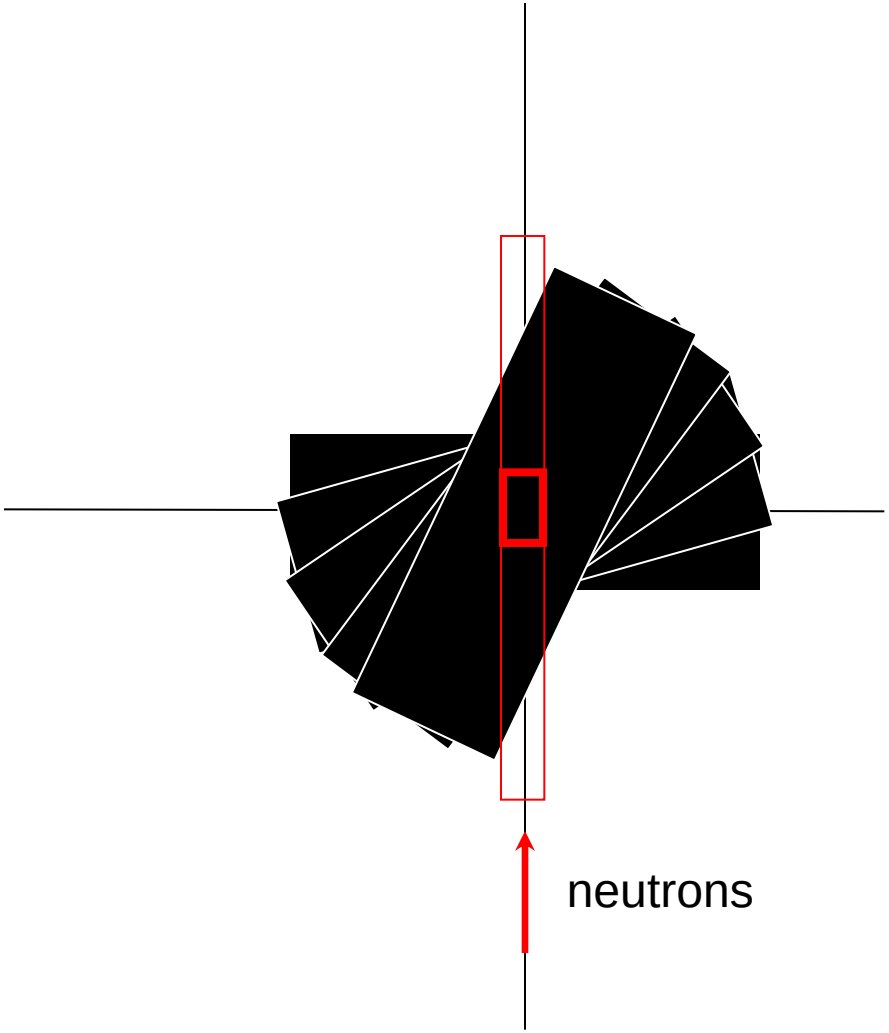
SESANS


DC magnets + RF
sample
2D detector
polarizer
source
guide field
analyzer

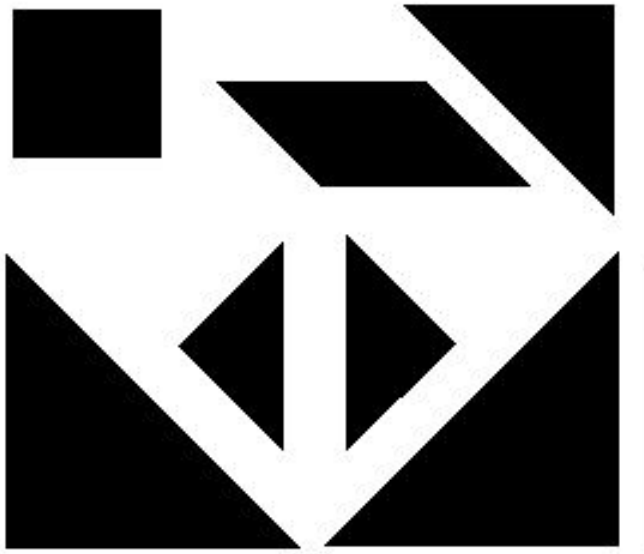
HRLD

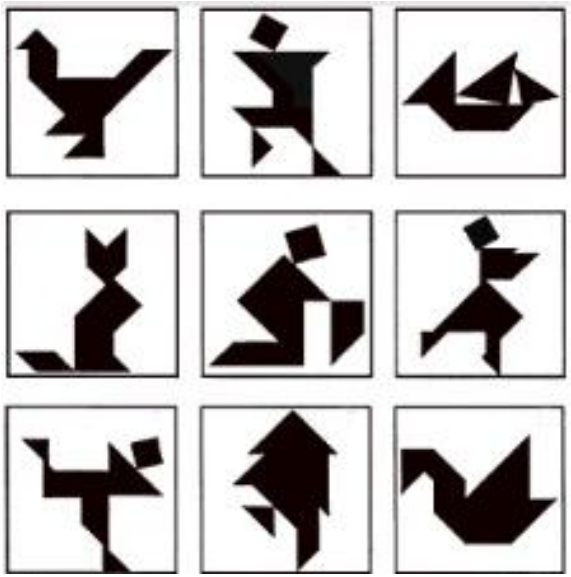

2D detector
analyzer
DC magnets + RF
polarizer
sample
source
guide field

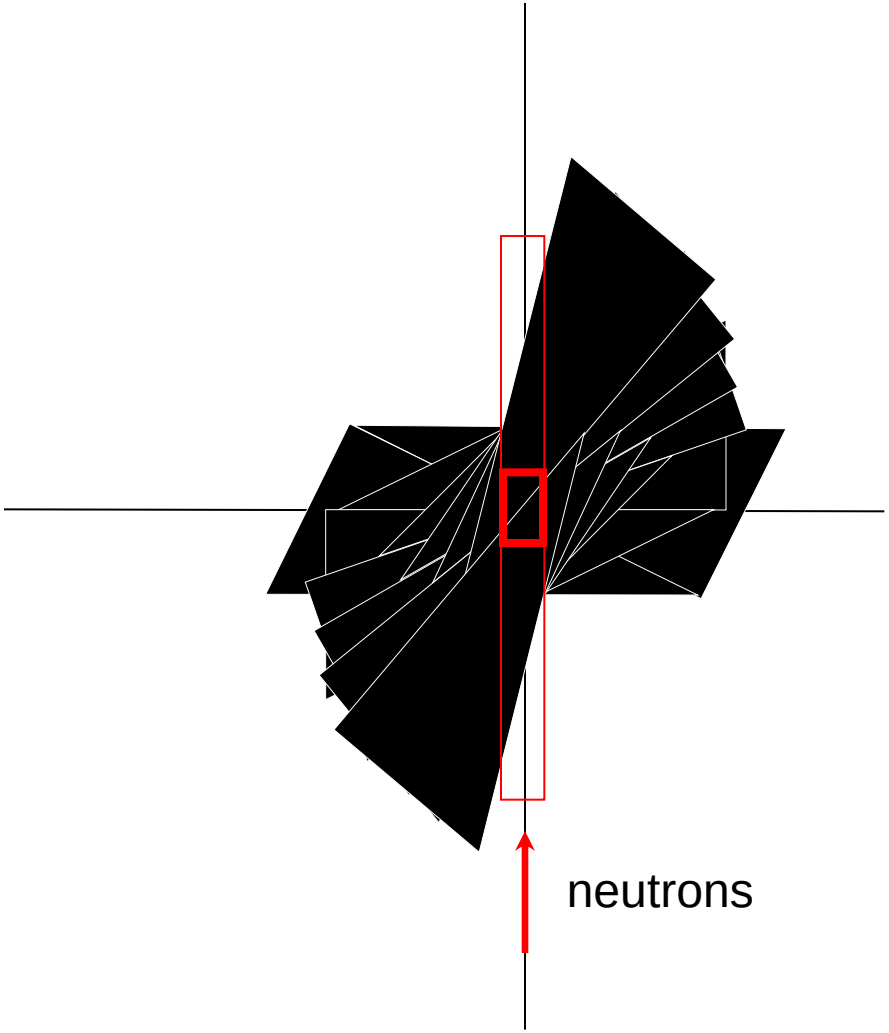



neutrons

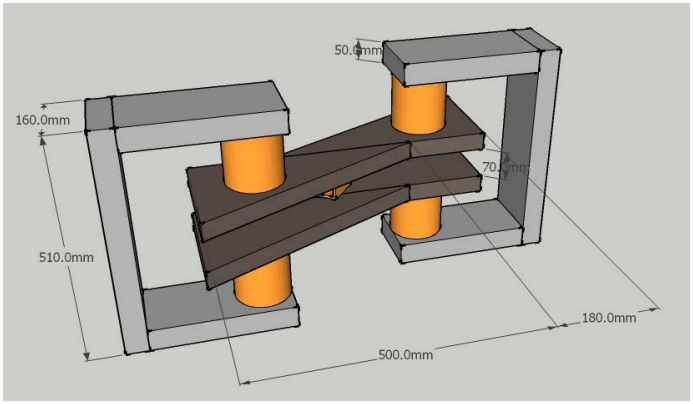
Tangram magnet

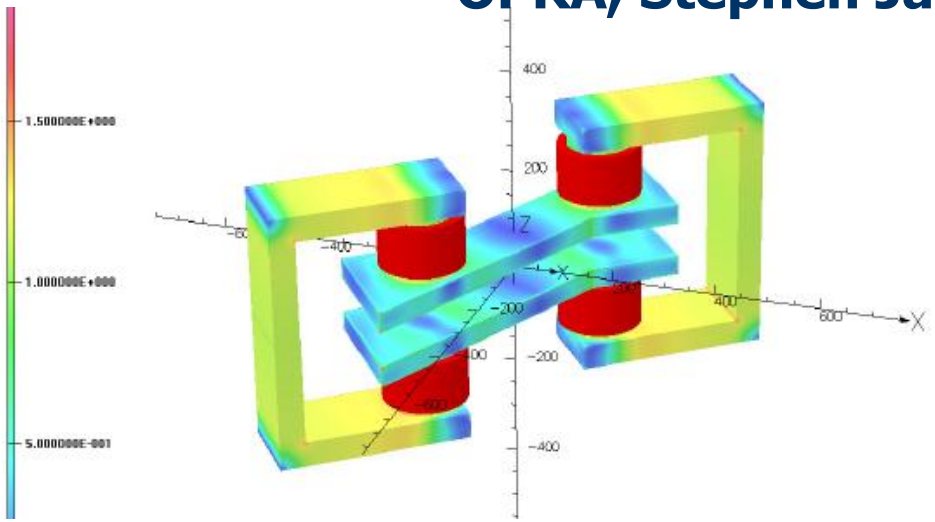


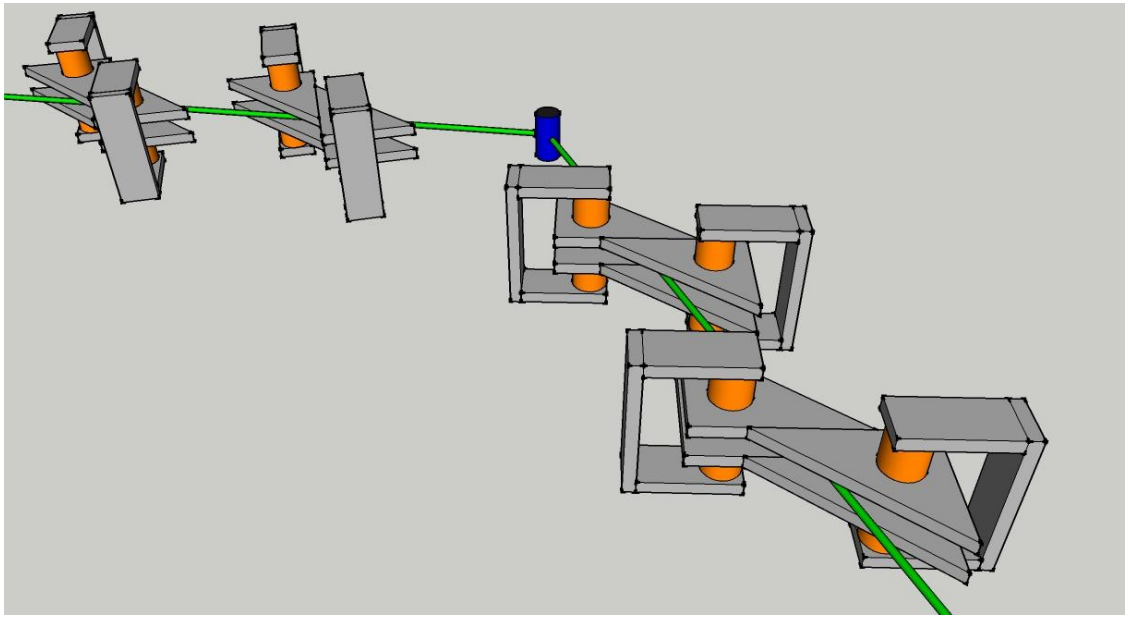


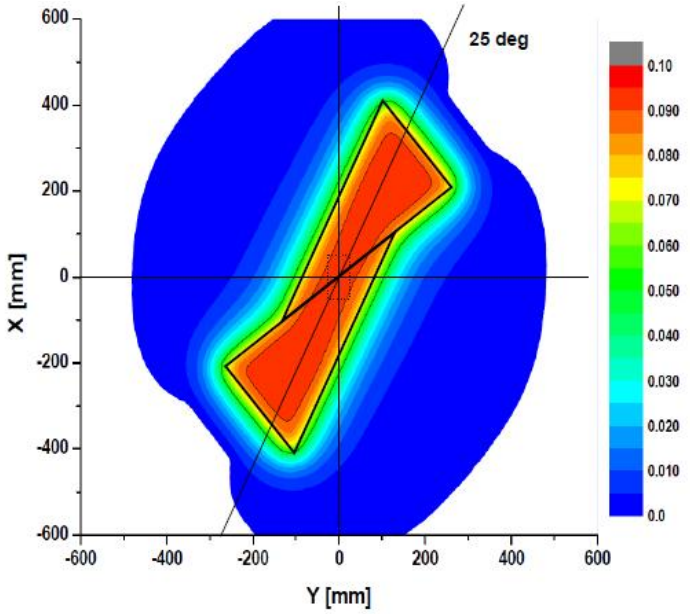

neutrons

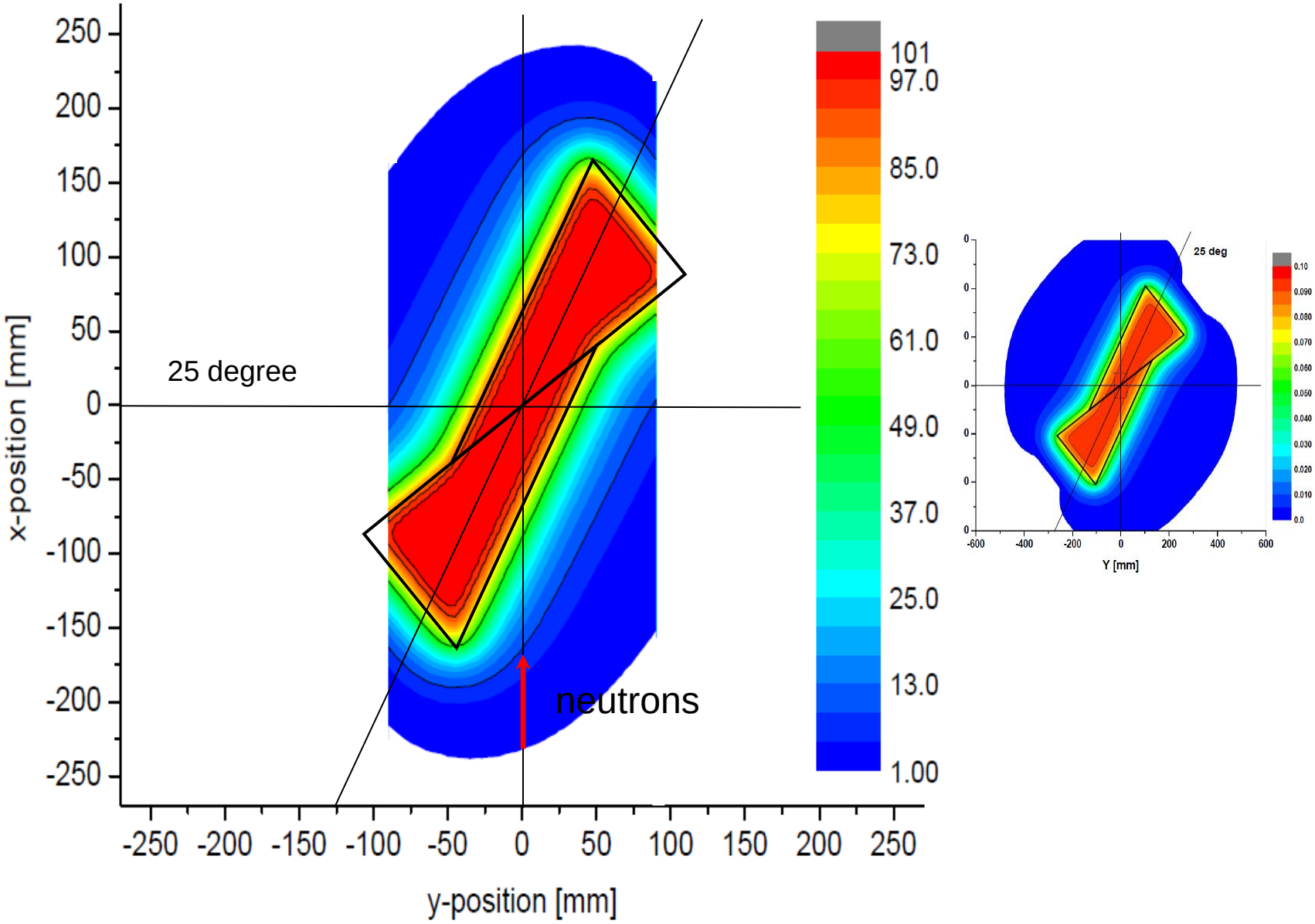
OPRA, Stephen Jago

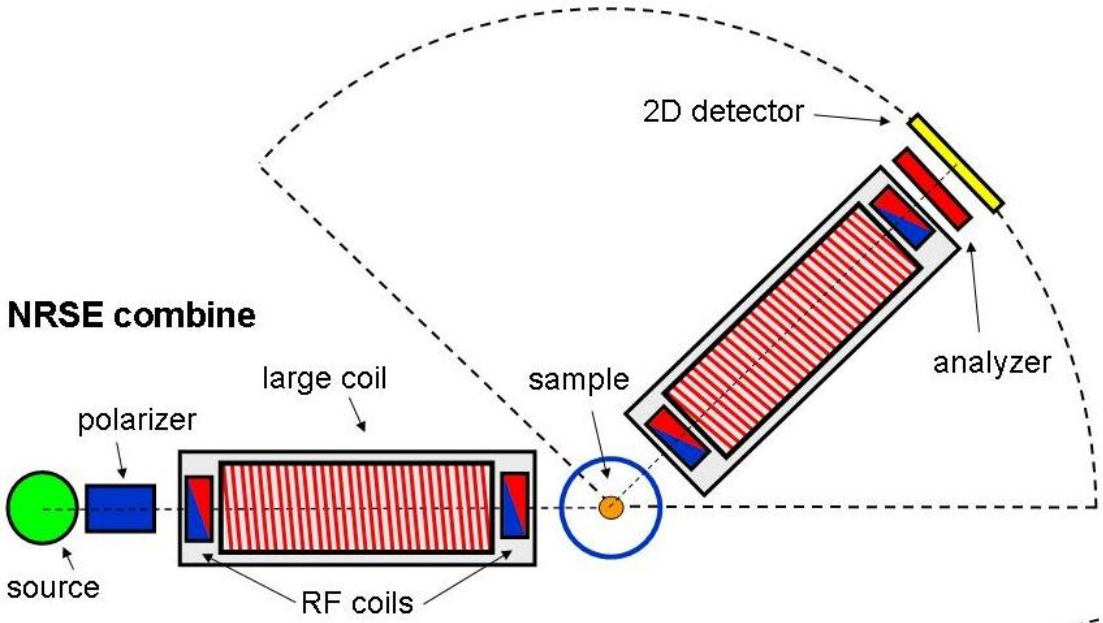


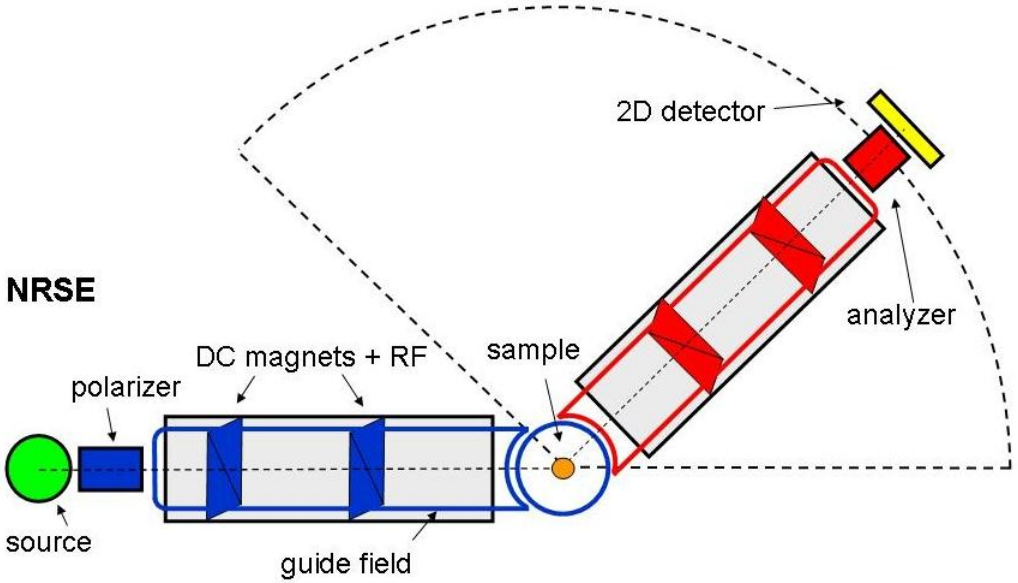




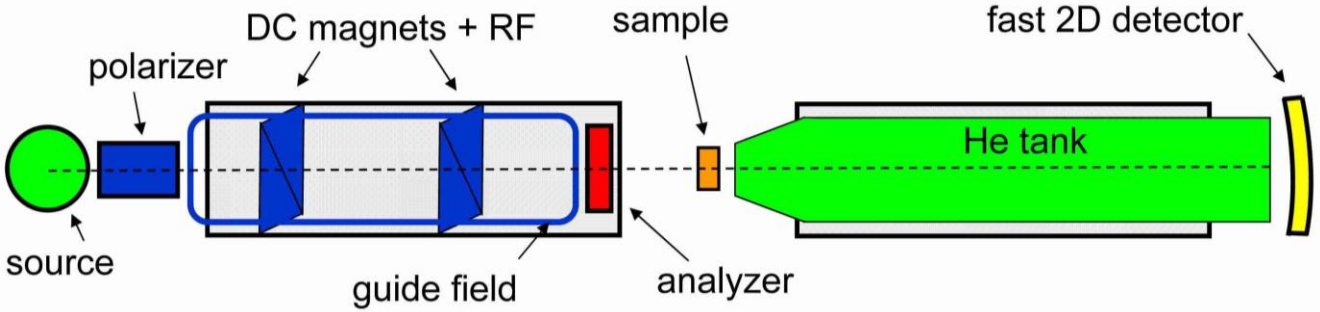



25 degree
neutrons
x-position [mm]
y-position [mm]
250
200
150
100
50
0
-50
-100
-150
-200
-250
-250 -200 -150 -100 -50 0 50 100 150 200 250
101
97.0
85.0
73.0
61.0
49.0
37.0
25.0
13.0
1.00
25 deg
Y [mm]
-600 -400 -200 0 200 400 600
0.10
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.0

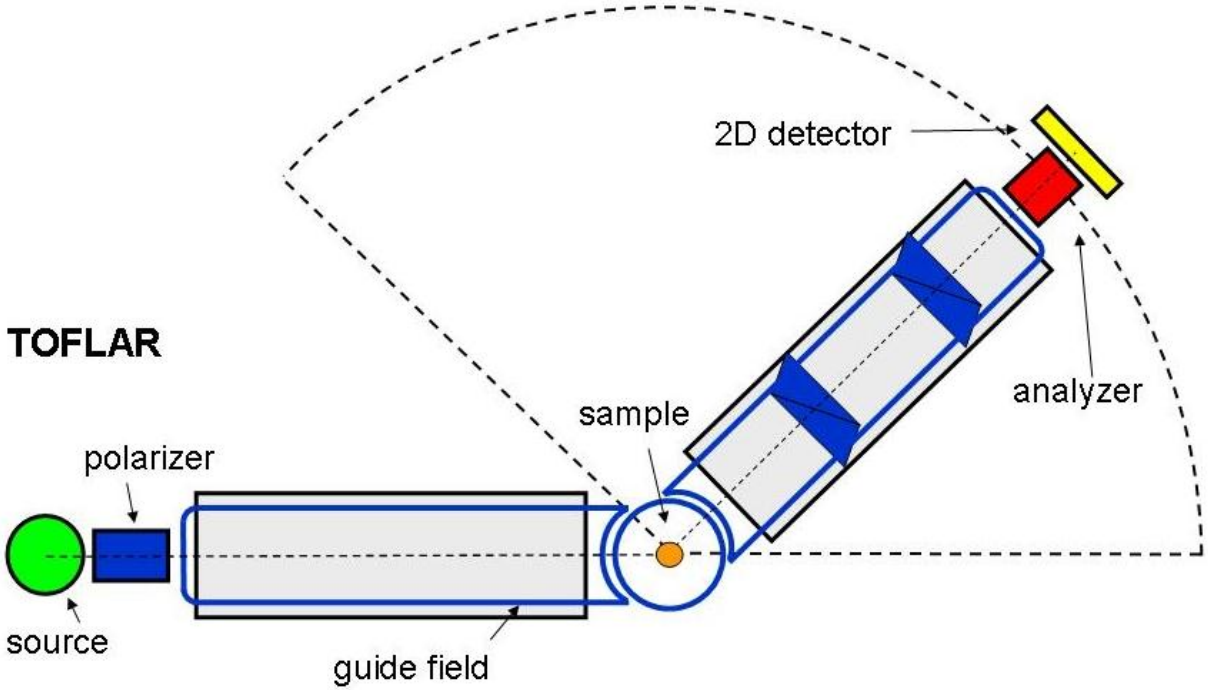

NRSE combine
2D detector
analyzer
large coil
sample
polarizer
source
RF coils


NRSE
2D detector
analyzer
sample
DC magnets + RF
polarizer
source
guide field

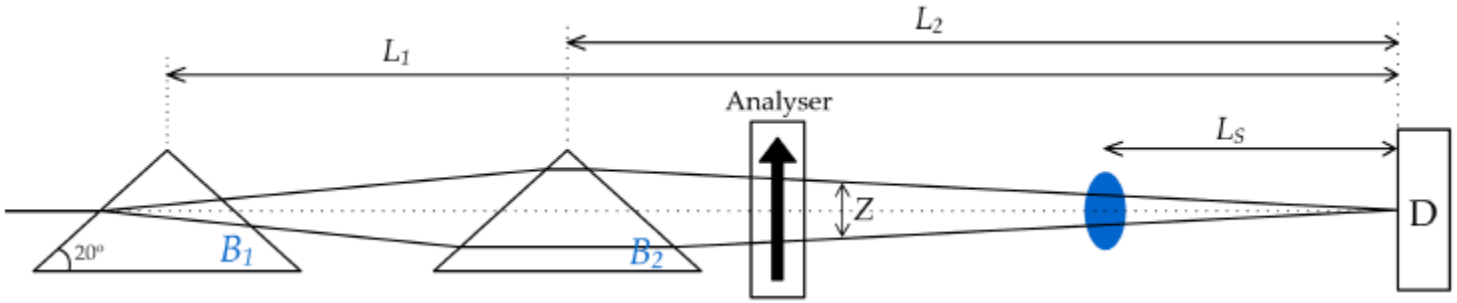
MISANS

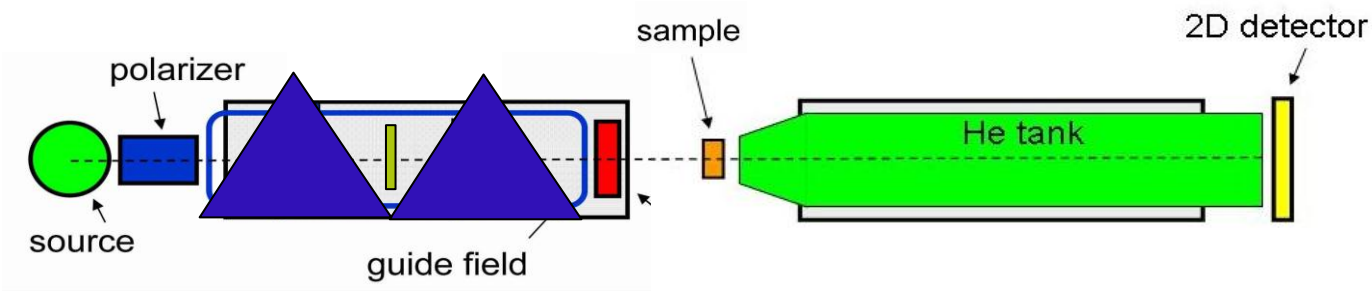


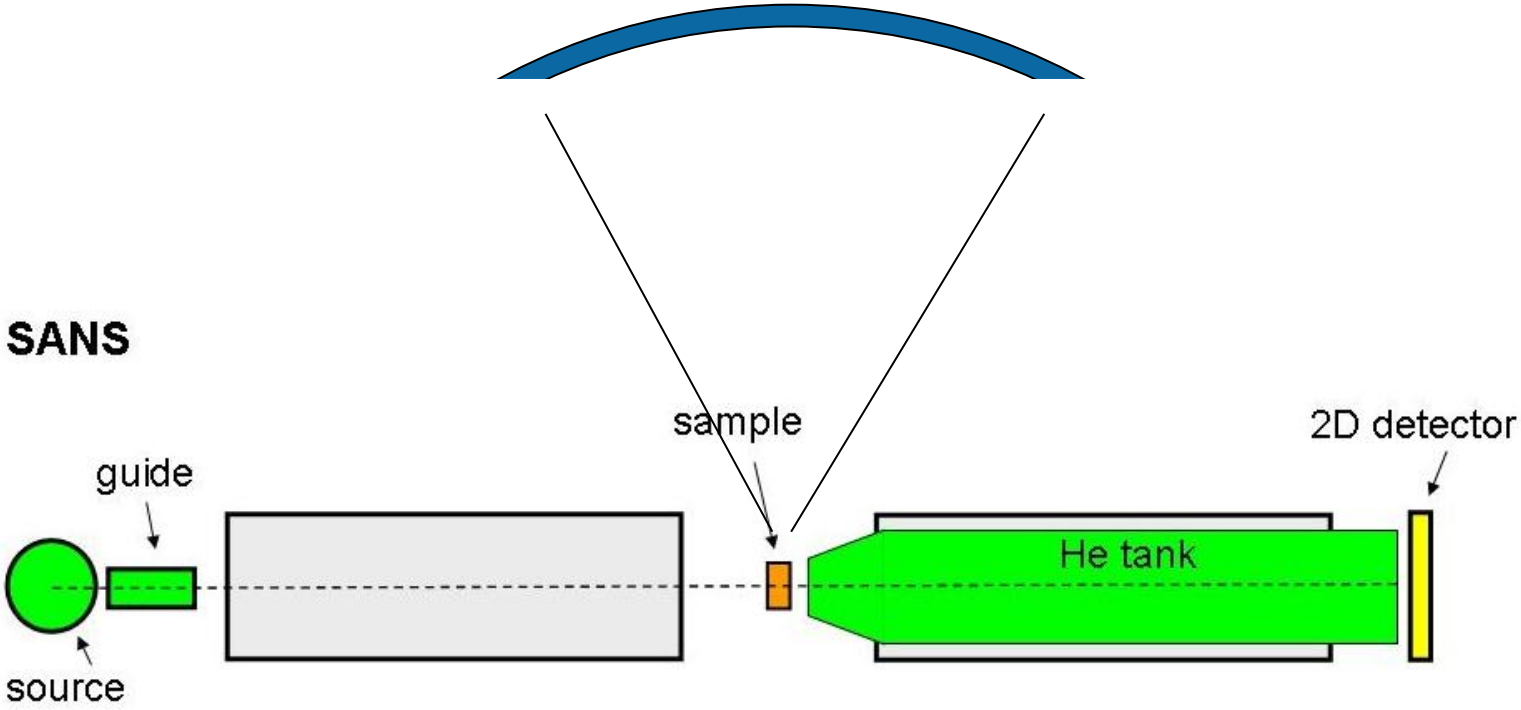
TOFLAR



New, modulated spin-echo SANS





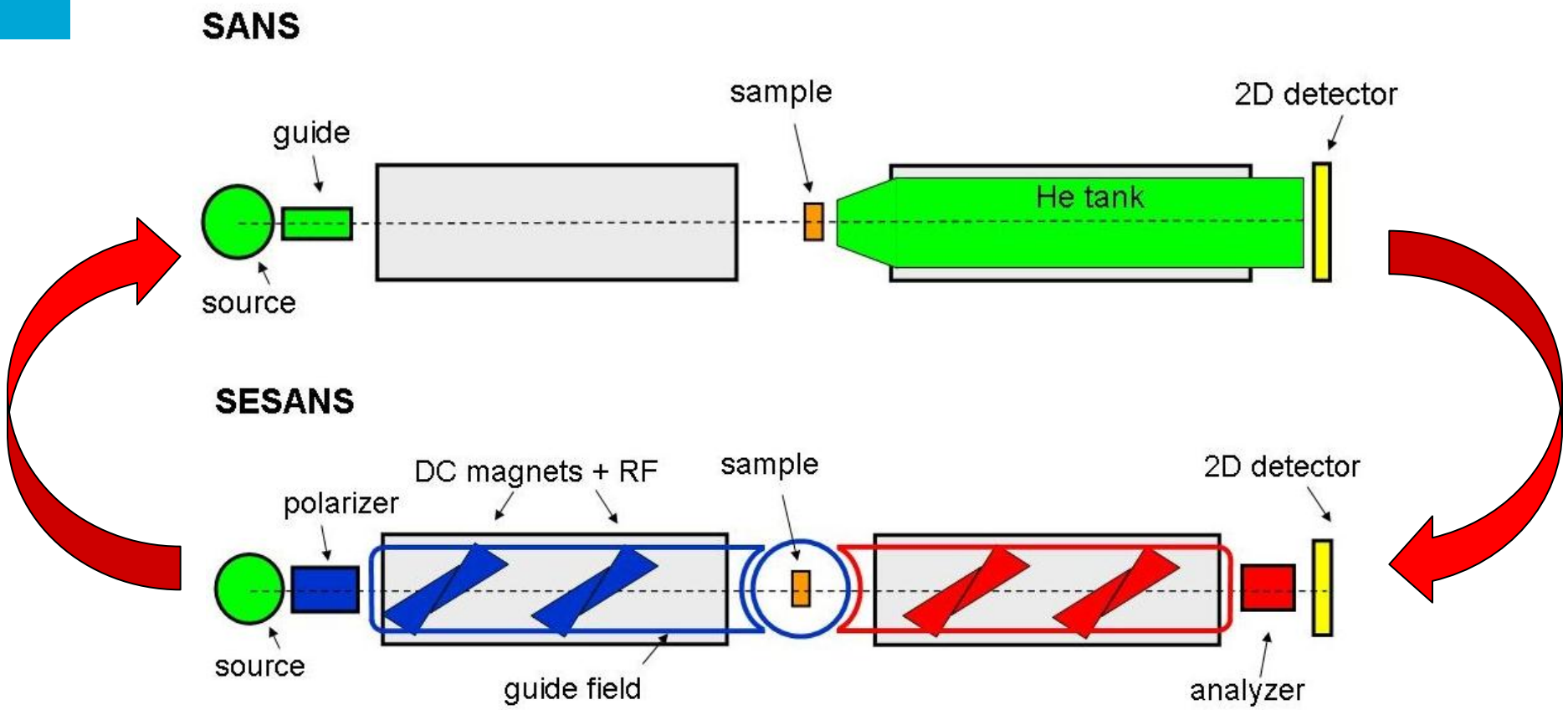


And/or, diffraction combined with SANS

Technical challenges…

Example SESANS

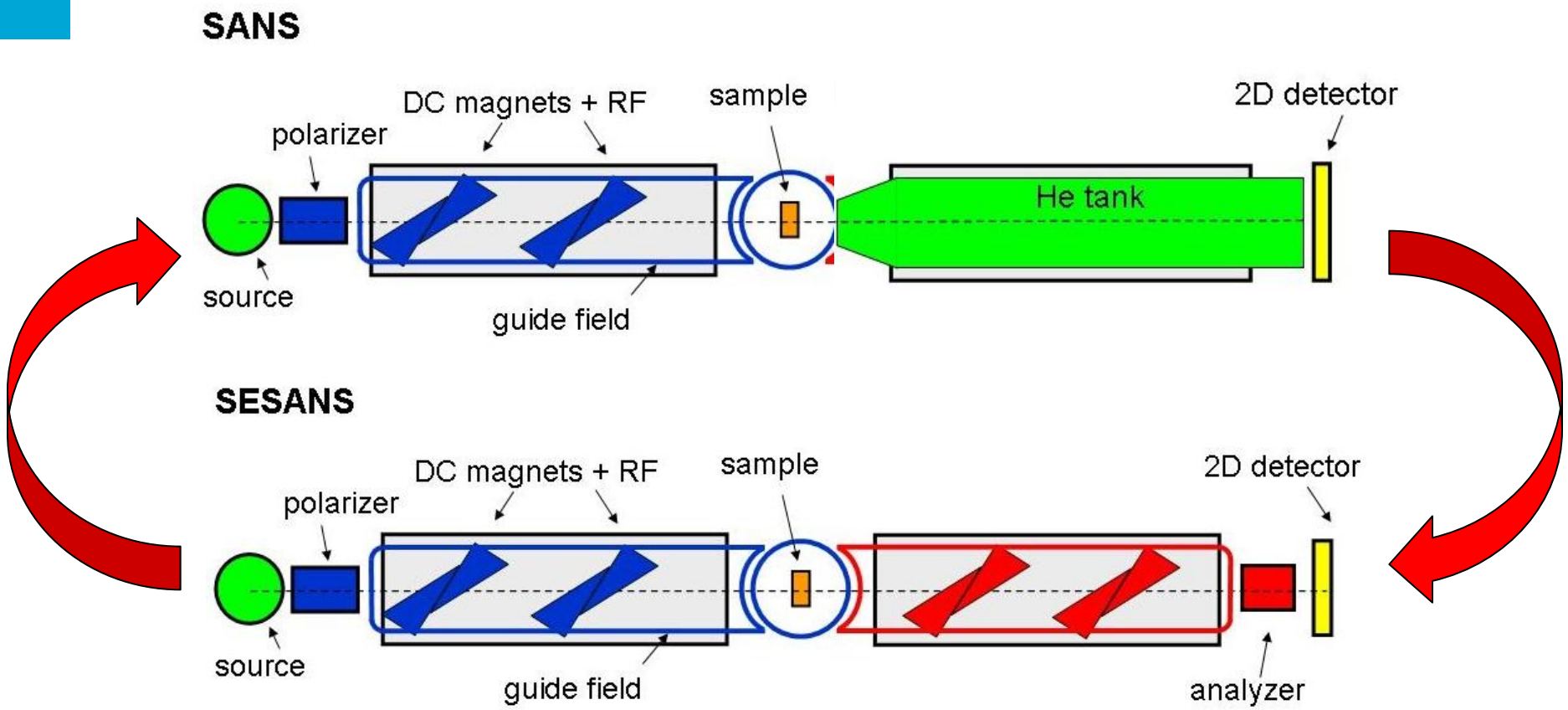
Plan A



Technical challenges…

Example SESANS

Plan A



Technical challenges…

Example SESANS

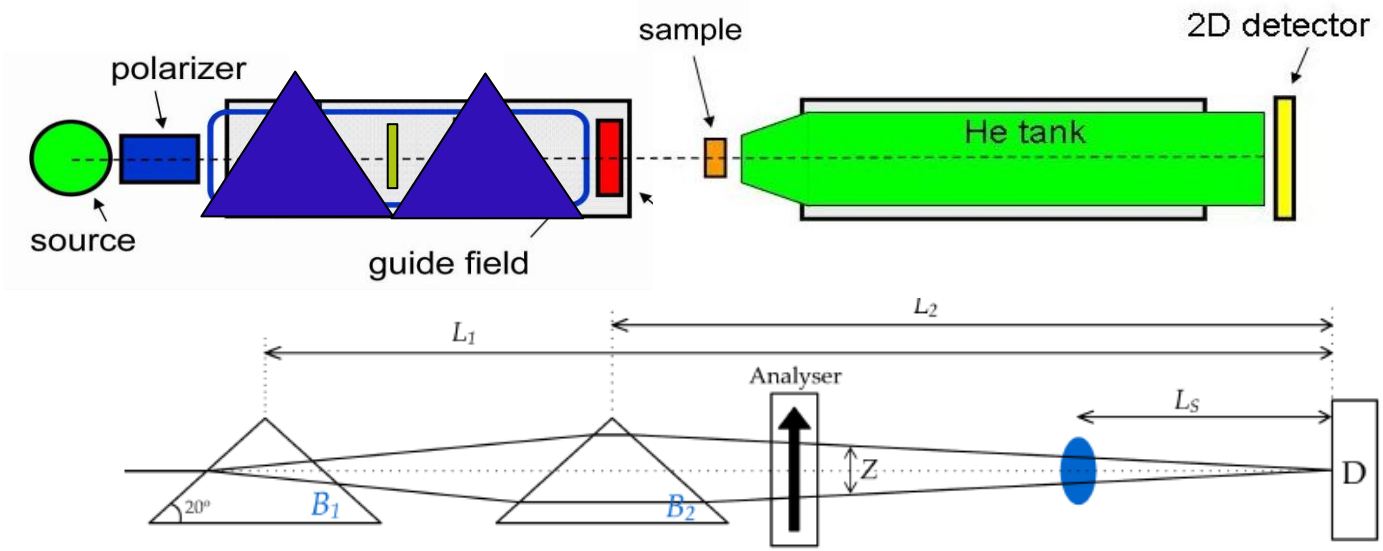
Plan A

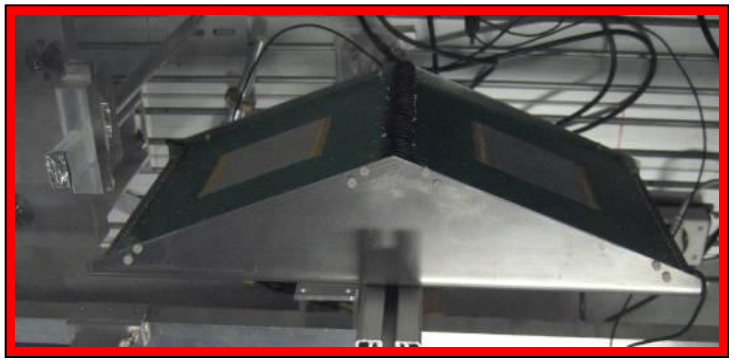
Movie….

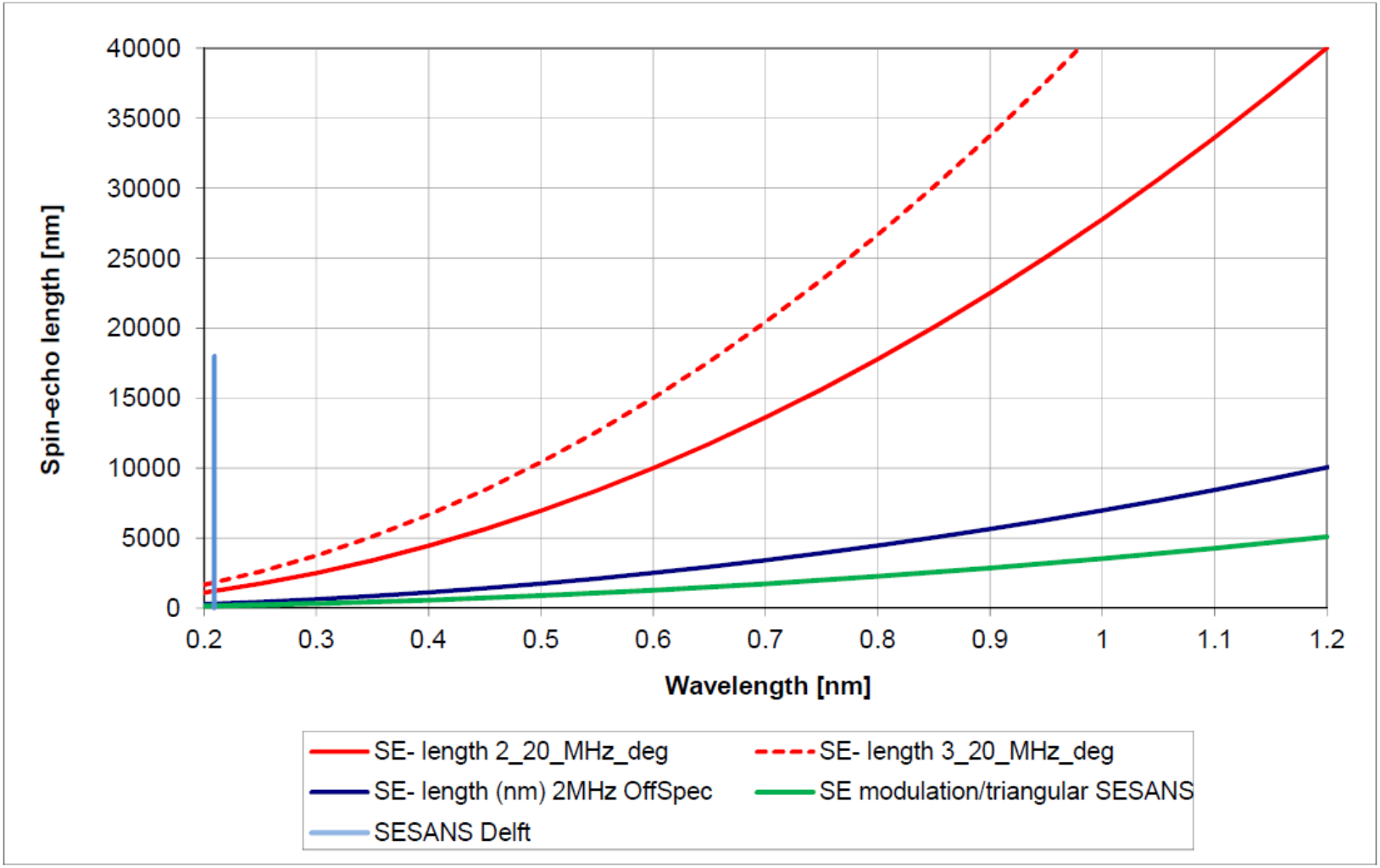
Technical challenges…

Example SESANS

Plan B






40000
35000
30000
25000
20000
15000
10000
5000
0
Spin-echo length [nm]
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
Wavelength [nm]
SE- length 2_20_MHz_deg
SE- length 3_20_MHz_deg
SE- length (nm) 2MHz OffSpec
SE modulation/triangular SESANS
SESANS Delft

Choice of modes

Choice of technical issues

Choice of flexibility

Science case

No end and no conclusion…

Technical challenges…

Plan A or Plan B or even C ?

Bootstrap systems, some examples
Grenoble

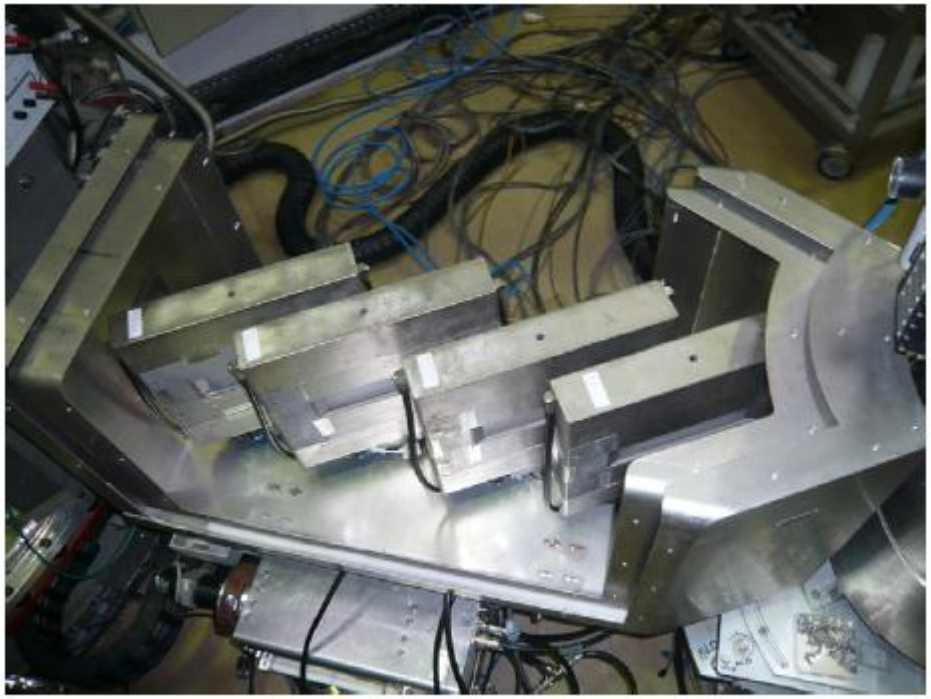


Fig. 2. View of the first "arm" of ZETA in the absence of the double μ–metal shielding. The two pairs of RF flipper coils are tilted w.r.t. the beam axis by an angle of 70°, showing the high flexibility of the setup.

monochromatic

N. Martin, L.P. Rewgnault, S. Klimko, J.E. Lorenzo, R. Gahler, Physica B **406** (2011) 2333

Bootstrap systems, some examples
Munich

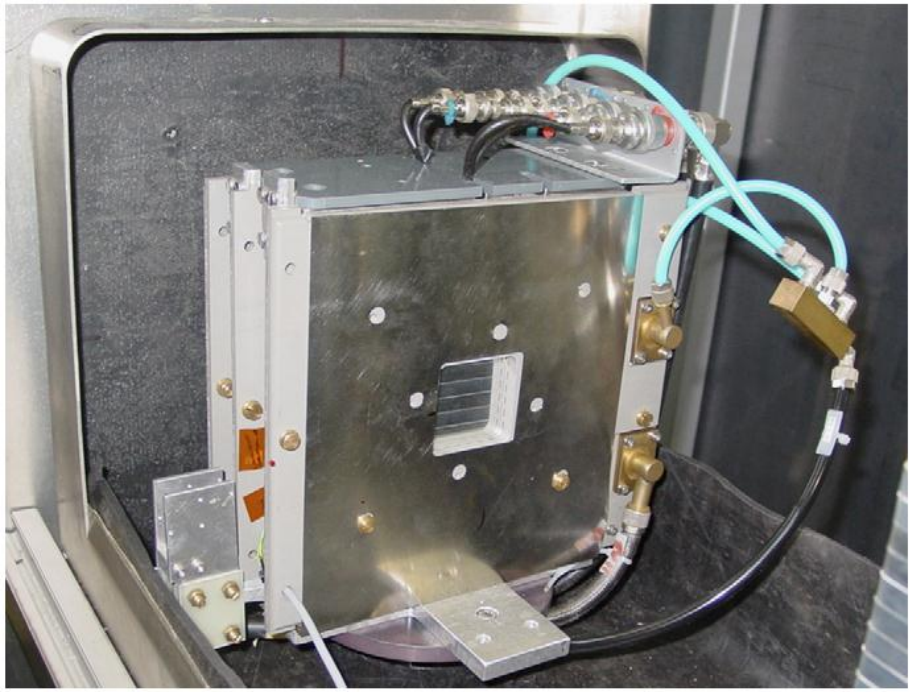
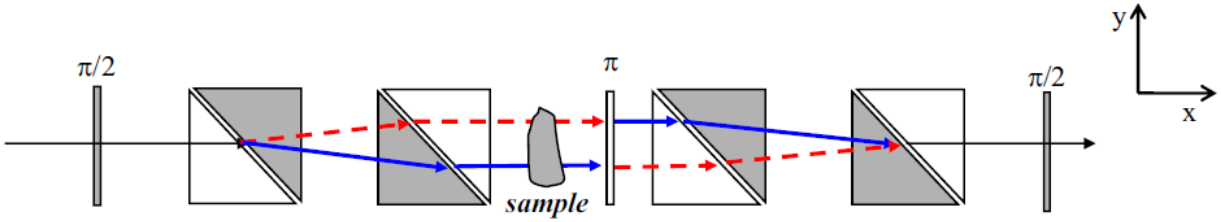


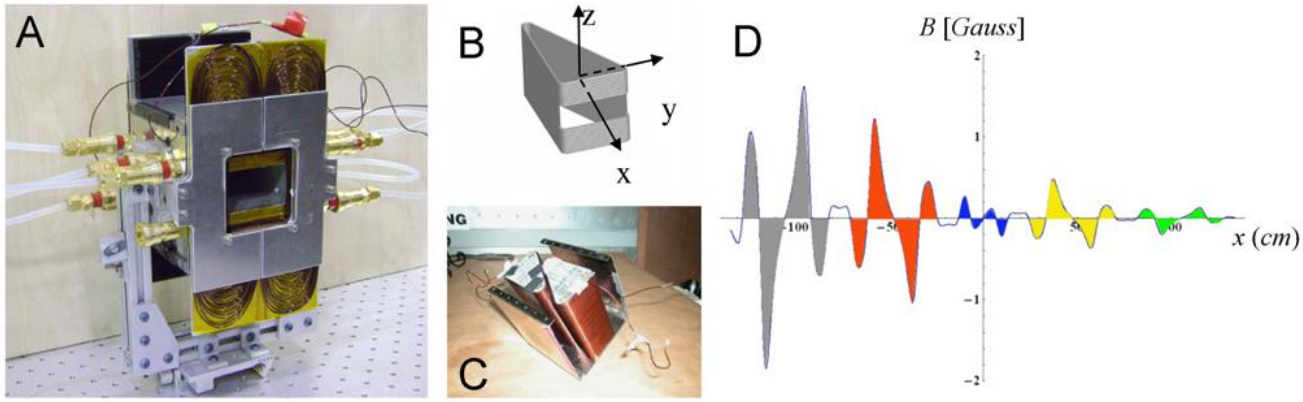
Fig. 2. NRSE bootstrap coil pair mounted inside the mumetal shielding. At the top and bottom, mumetal yokes provide constant magnetic field flux through the coils of the bootstrap pair.

monochromatic

W. Haeussler, B. Gohla-Neudecker, R. Schwikowski, D. Streibl, P. Boeni, Physica B **397** (2007) 112

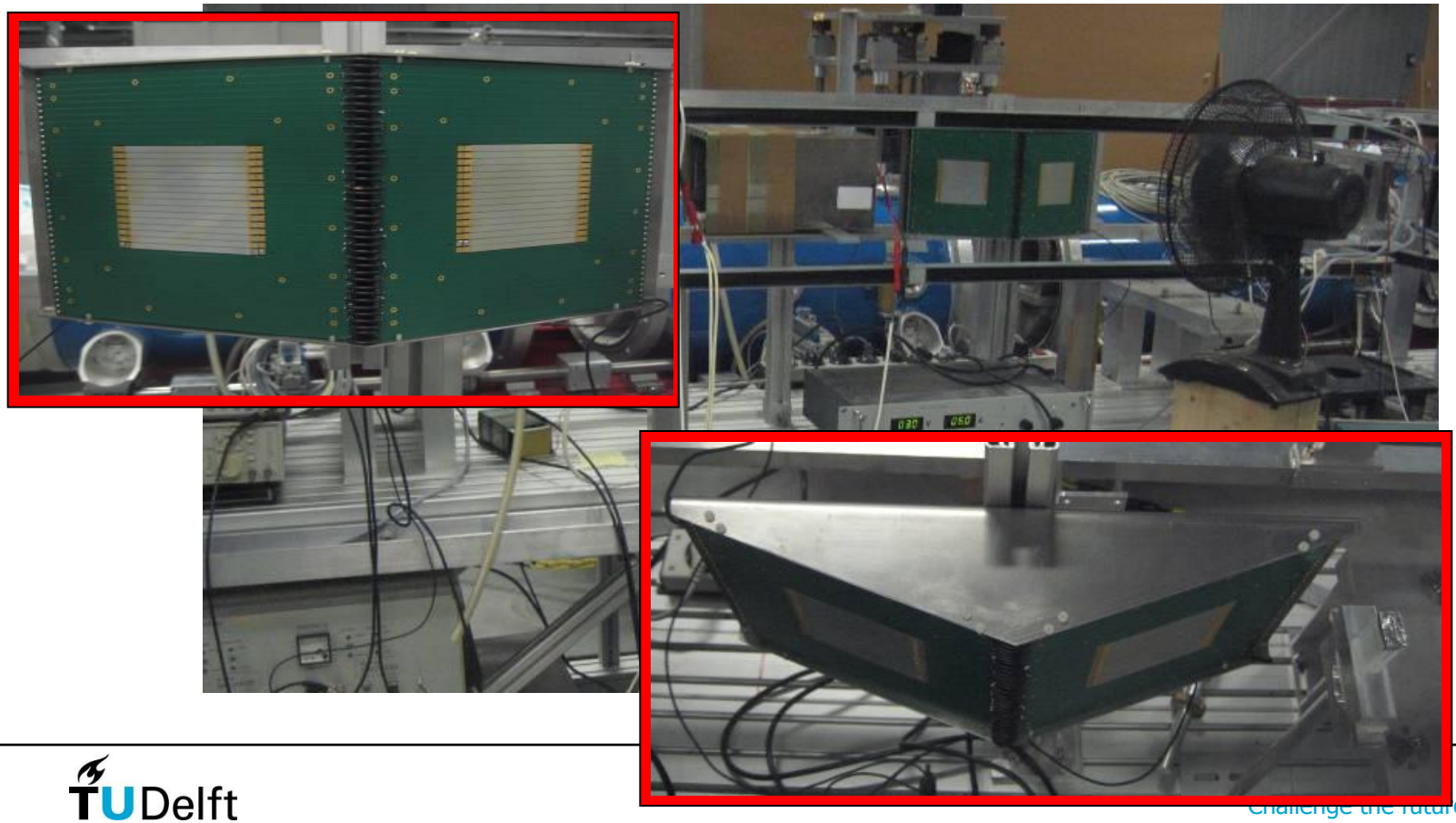
Triangular coil systems
Indiana

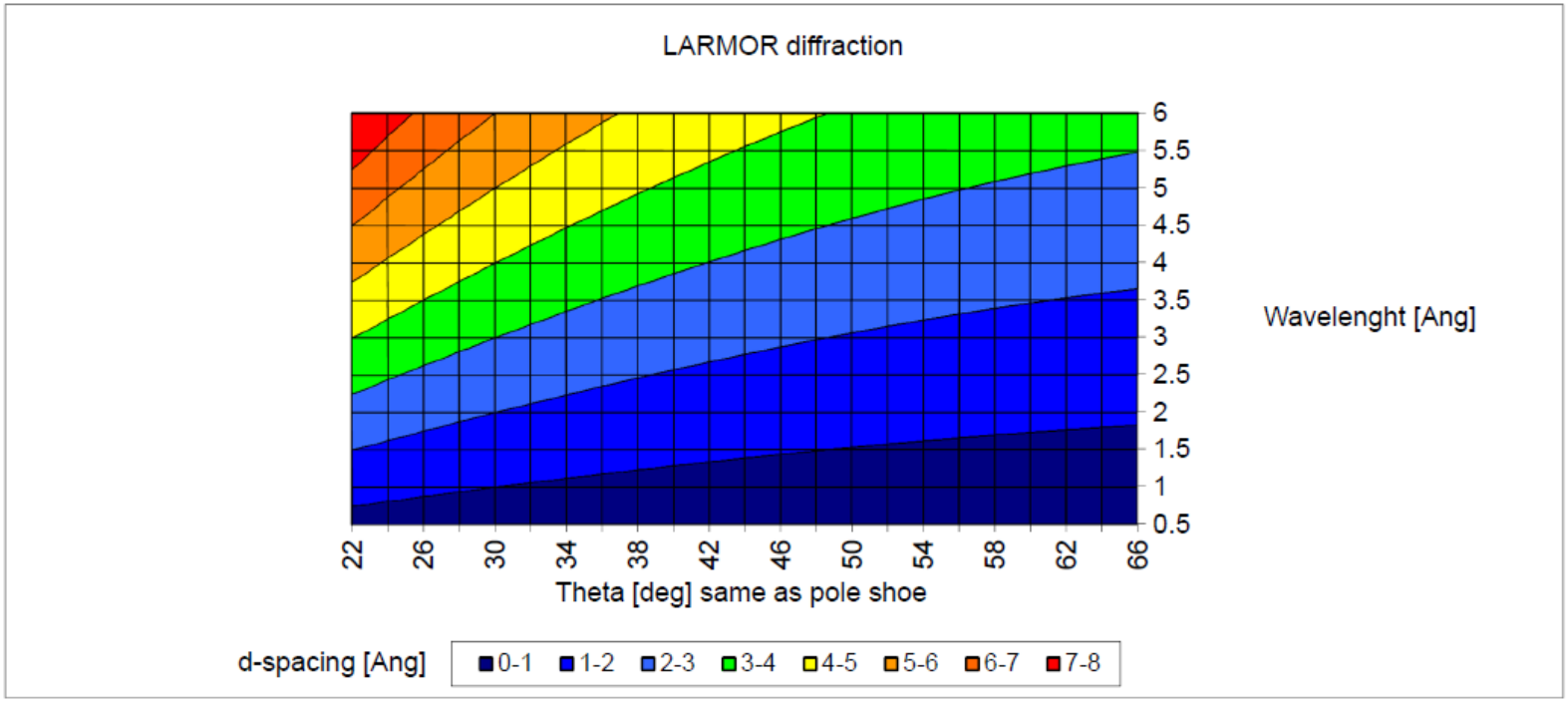




R. Pynn, R. Ashkar, P. Stonaha. A.L. Washington, Physica B **406** (2011) 2350

Triangular coil systems
Delft




LARMOR diffraction
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
Wavelenght [Ang]
22
26
30
34
38
42
46
50
54
58
62
66
Theta [deg] same as pole shoe
d-spacing [Ang]
0-1
1-2
2-3
3-4
4-5
5-6
6-7
7-8