Menu for the conference dinner

Menu A

- Gazpacho
- Paella
- Chorizo
- Rioja

Menu B

- Sauerkraut
- Potatos
- Bratwurst
- Beer

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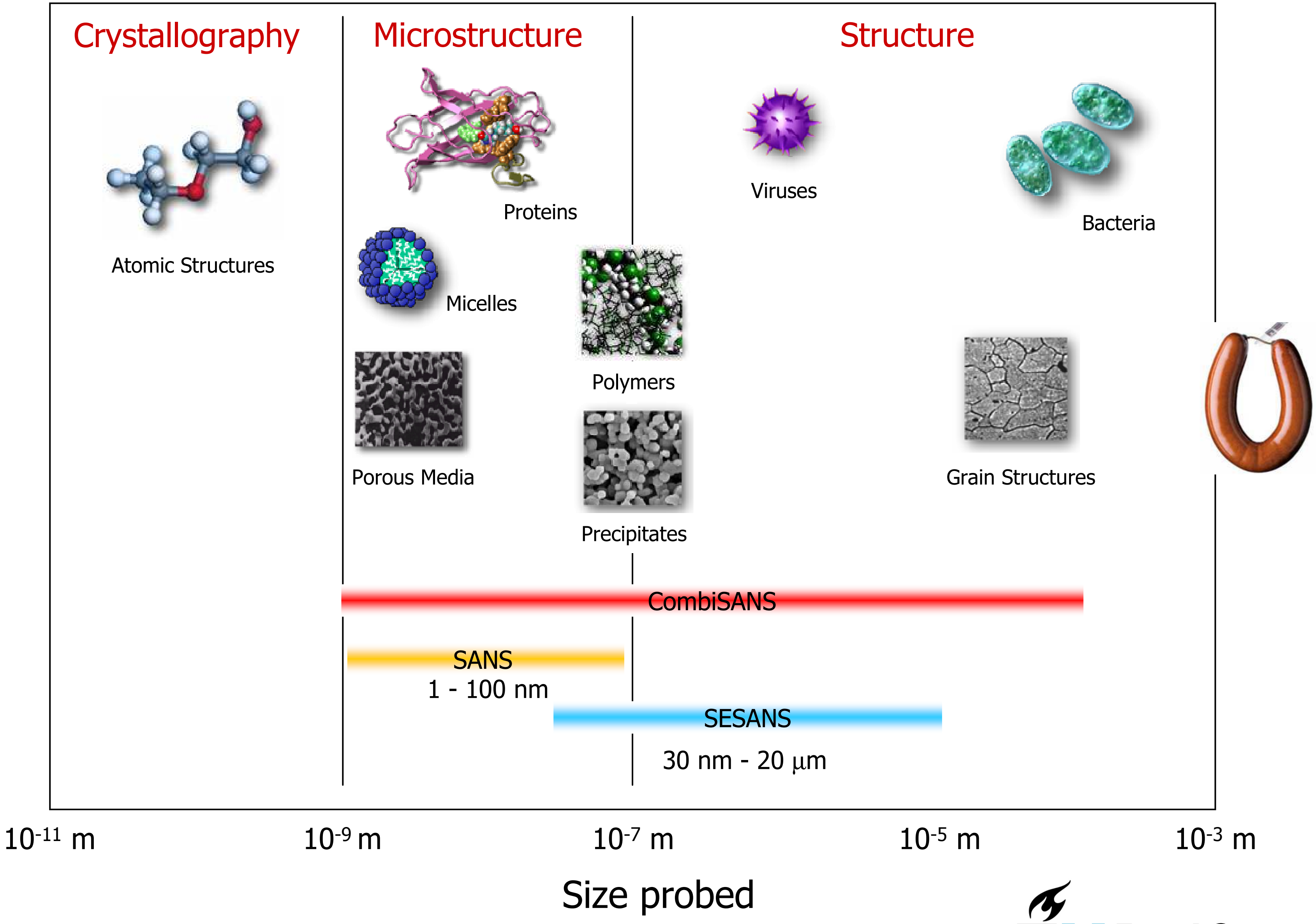
1 nm – 100 μm in one instrument



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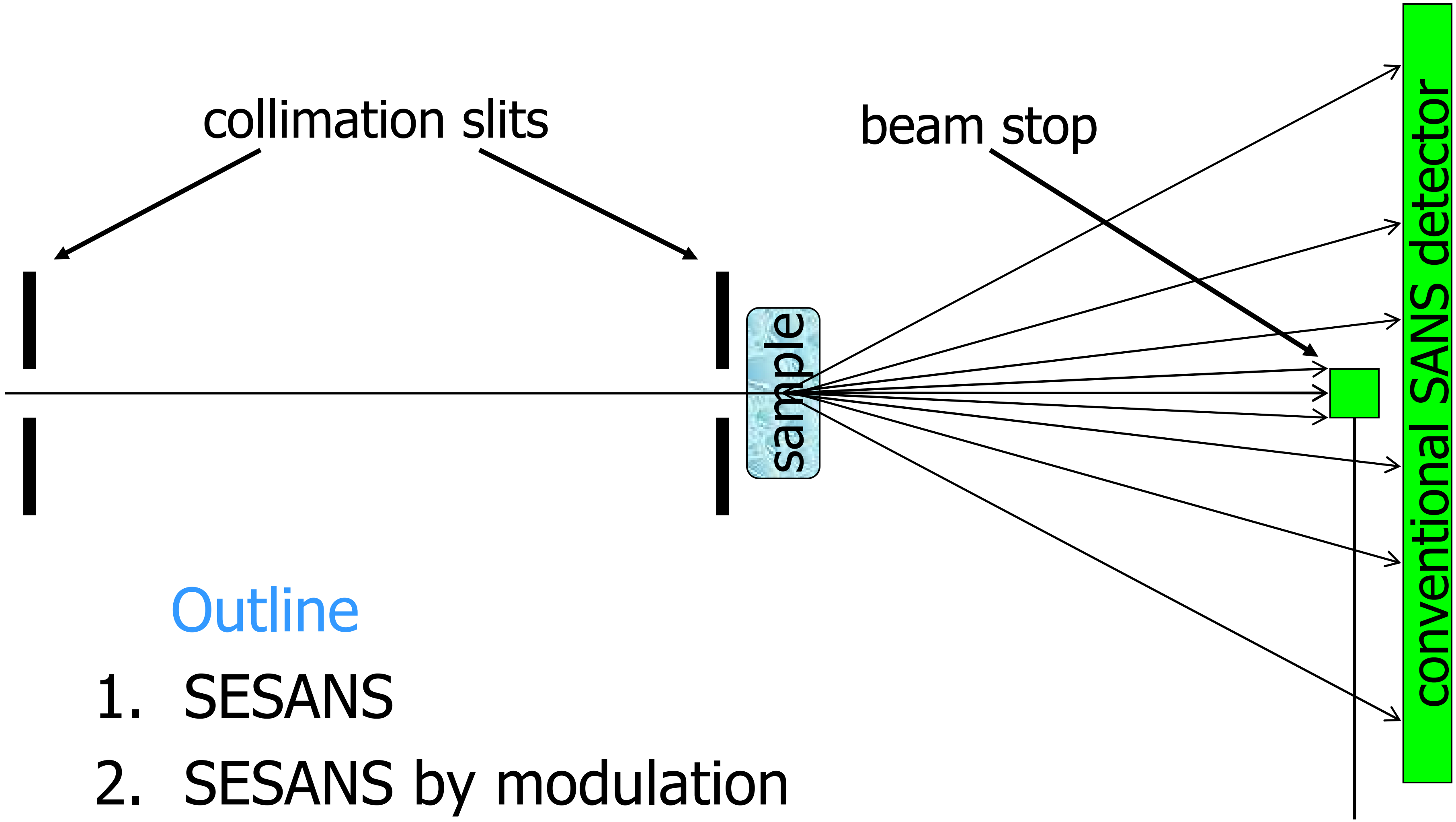
SANS



Outline

1. SESANS
2. SESANS by modulation
3. SANS + SESANS combined

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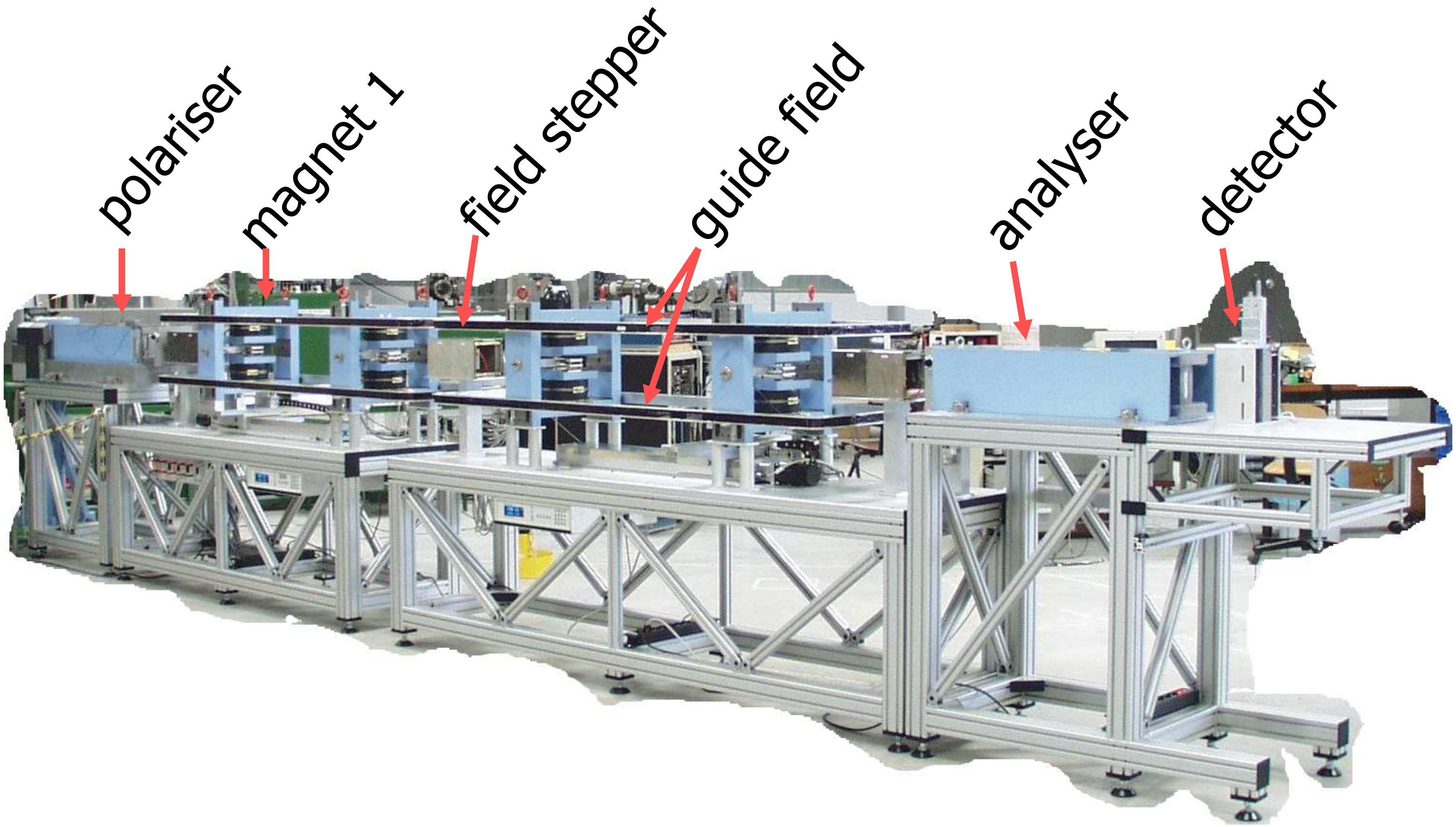
SESANS



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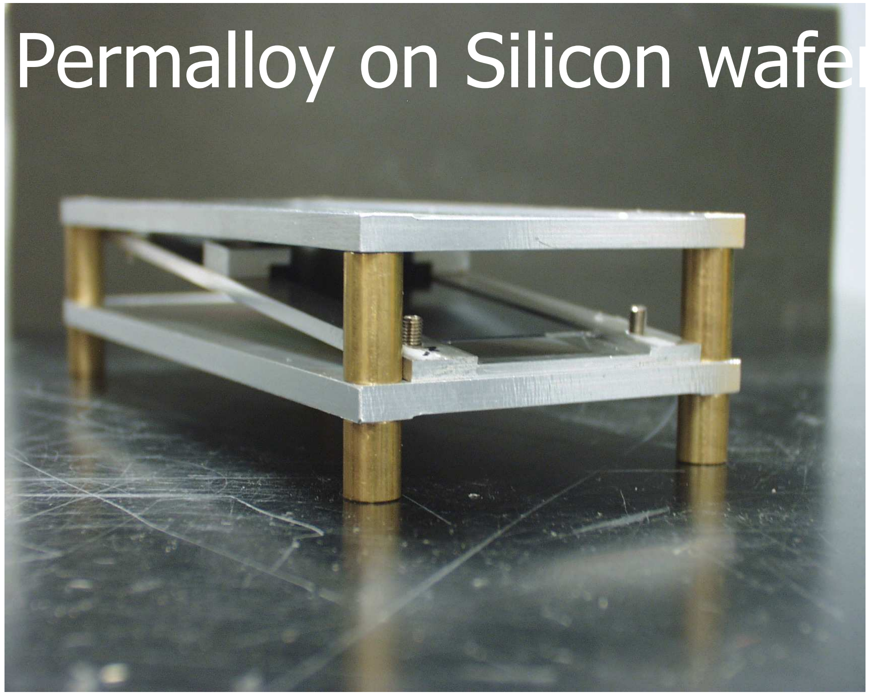
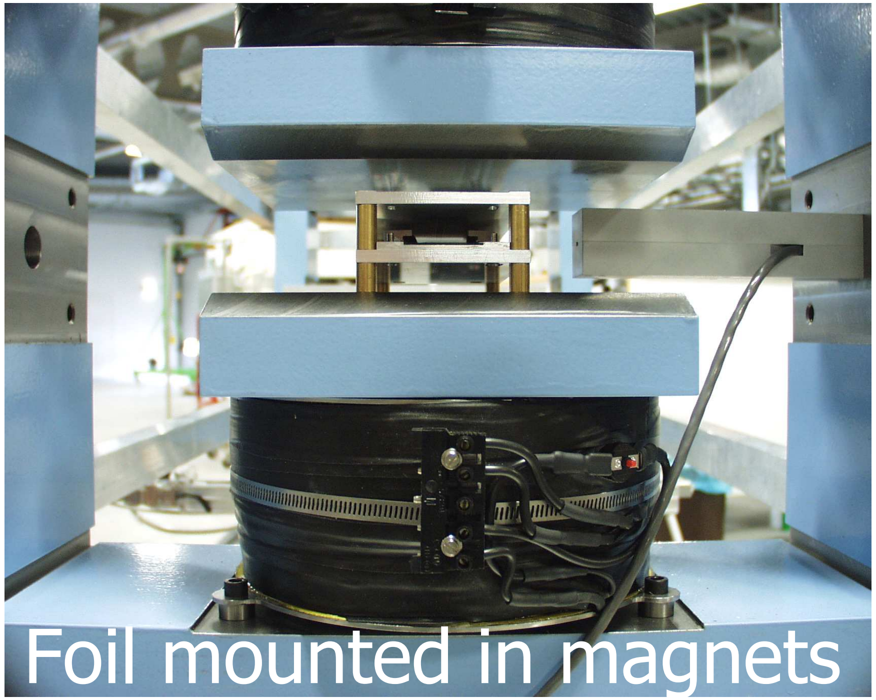
Magnetised foils tuned for π-flip: can be considered reversal field

3 μm permalloy film





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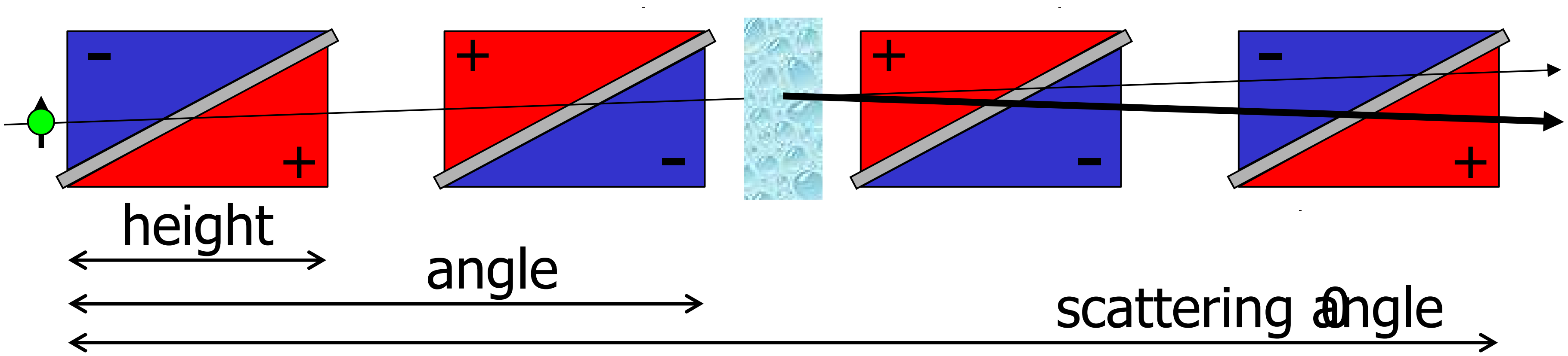
Classical explanation with Larmor precession

Precession angle proportional to:



$$\phi \propto \int B dL$$

$$P = \cos(\phi) = \cos(Q_z \delta_z)$$

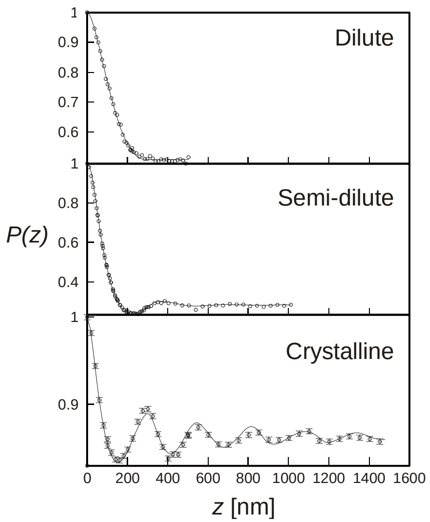
$$G(\delta_z) = \frac{1}{k_0^2} \int \frac{d\sigma(\vec{Q})}{d\Omega} \cos(Q_z \delta_z) d\vec{Q}$$

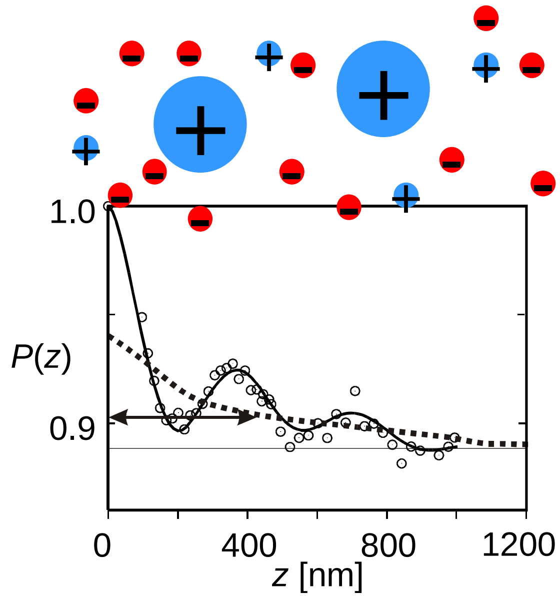
$$P(z) = e^{(G(z) - G(0))}$$

Keller *et al.* Neutron News **6**, (1995) 16
Rekveldt, NIMB **114**, 366 (1996).

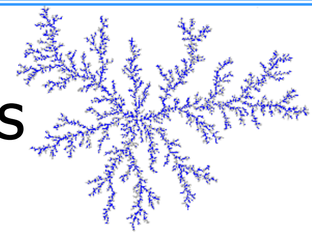
Applications of SESANS
real space, range 30 nm – 18 μm, no collimation

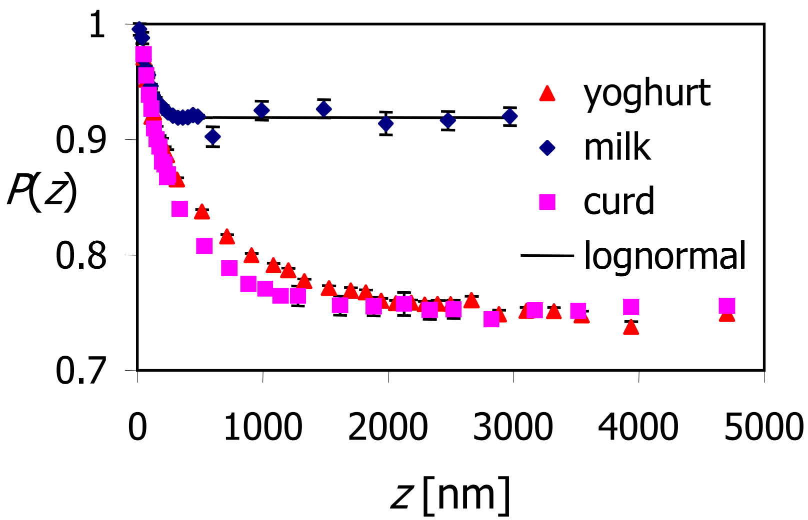
Colloidal interaction

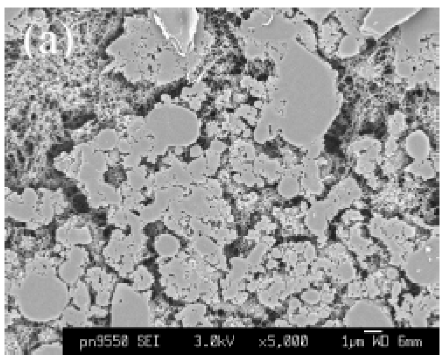




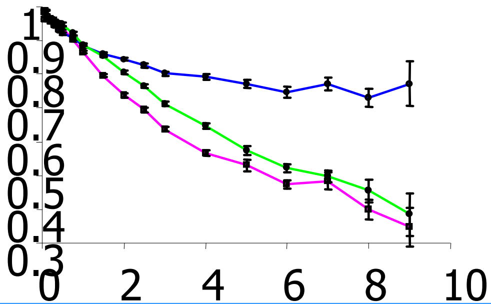
Dairy products







μ-emulsions



- Granular materials
- Drug delivery systems

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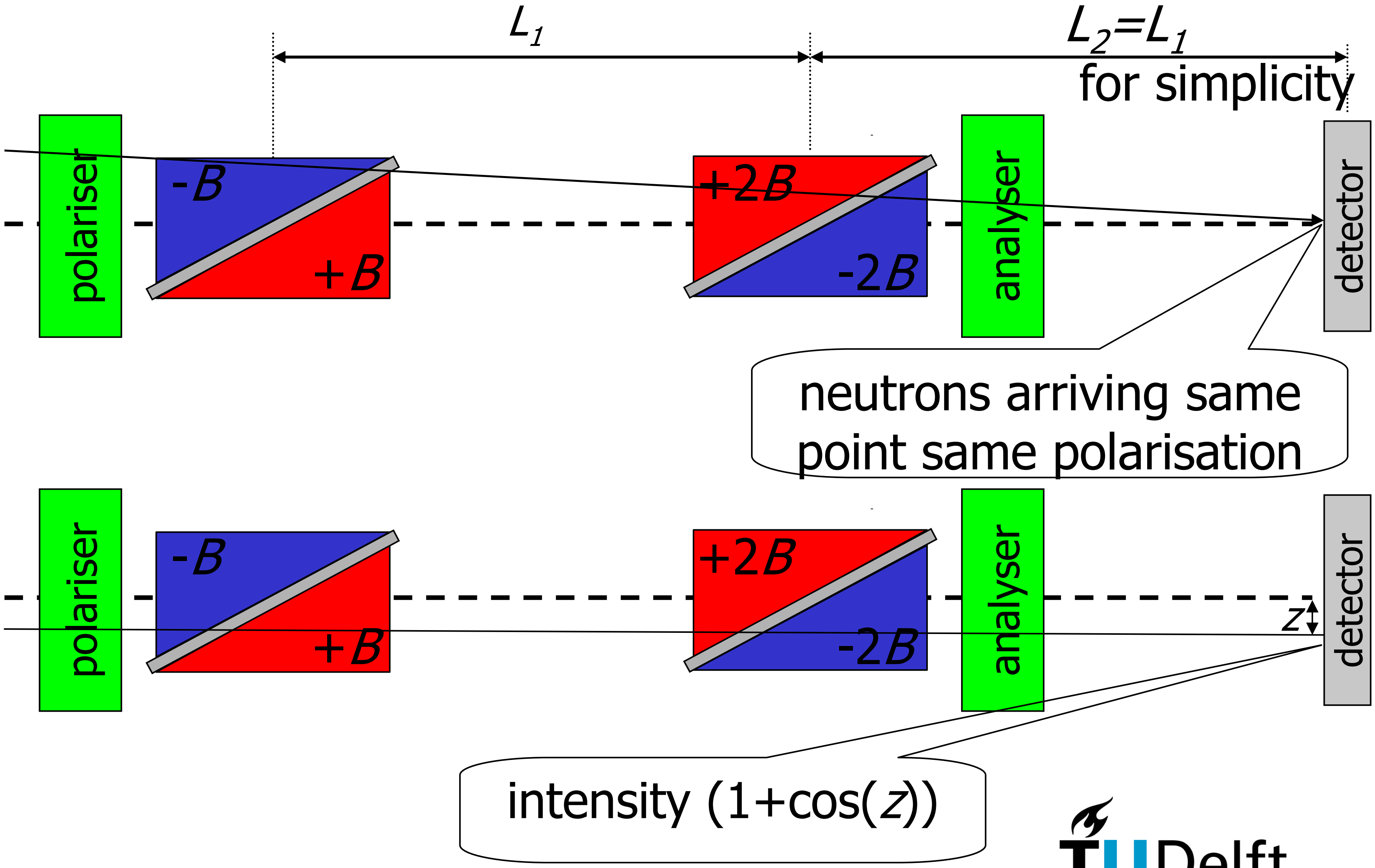
Beam modulation by Larmor precession
Even for large divergent beam



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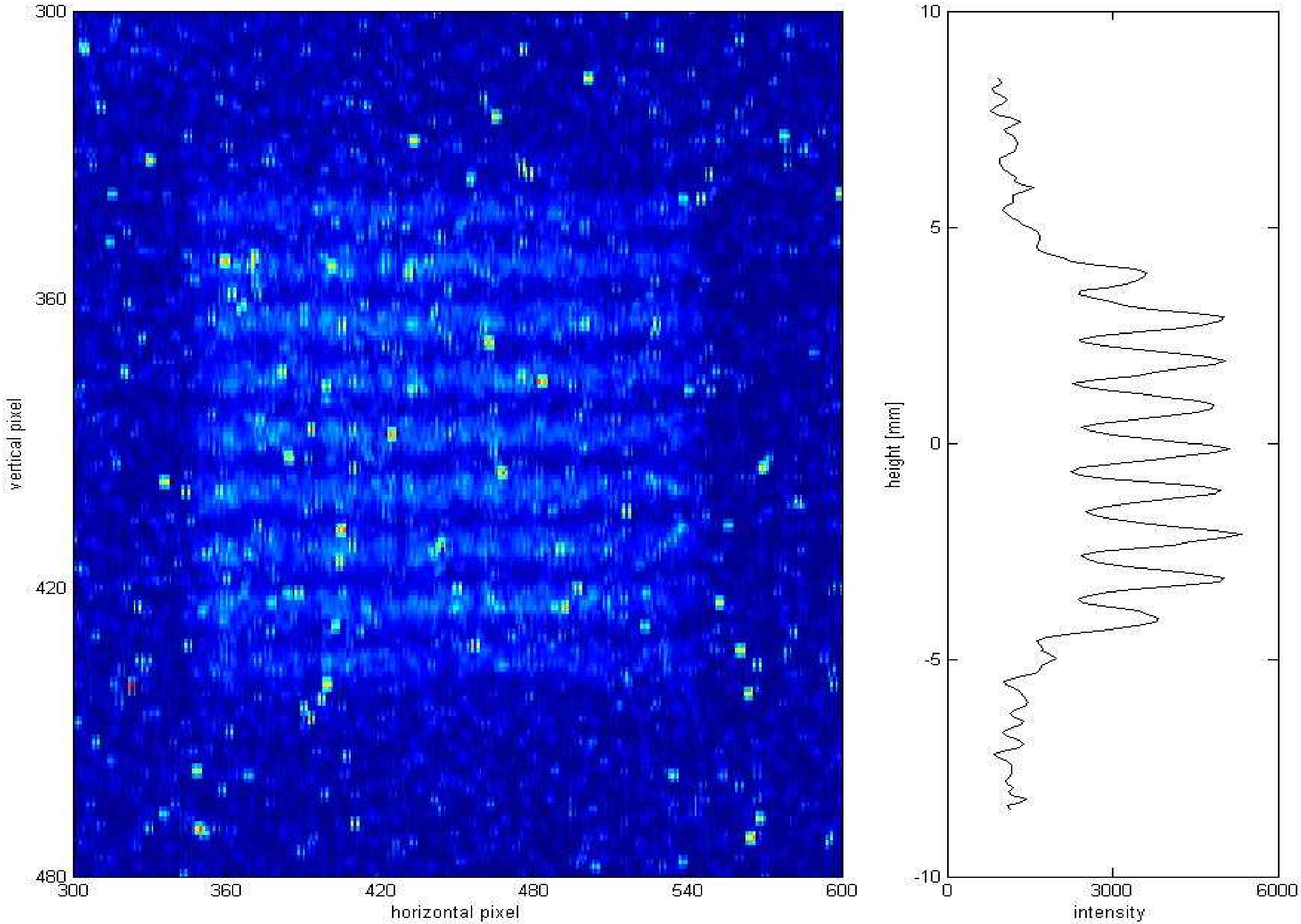
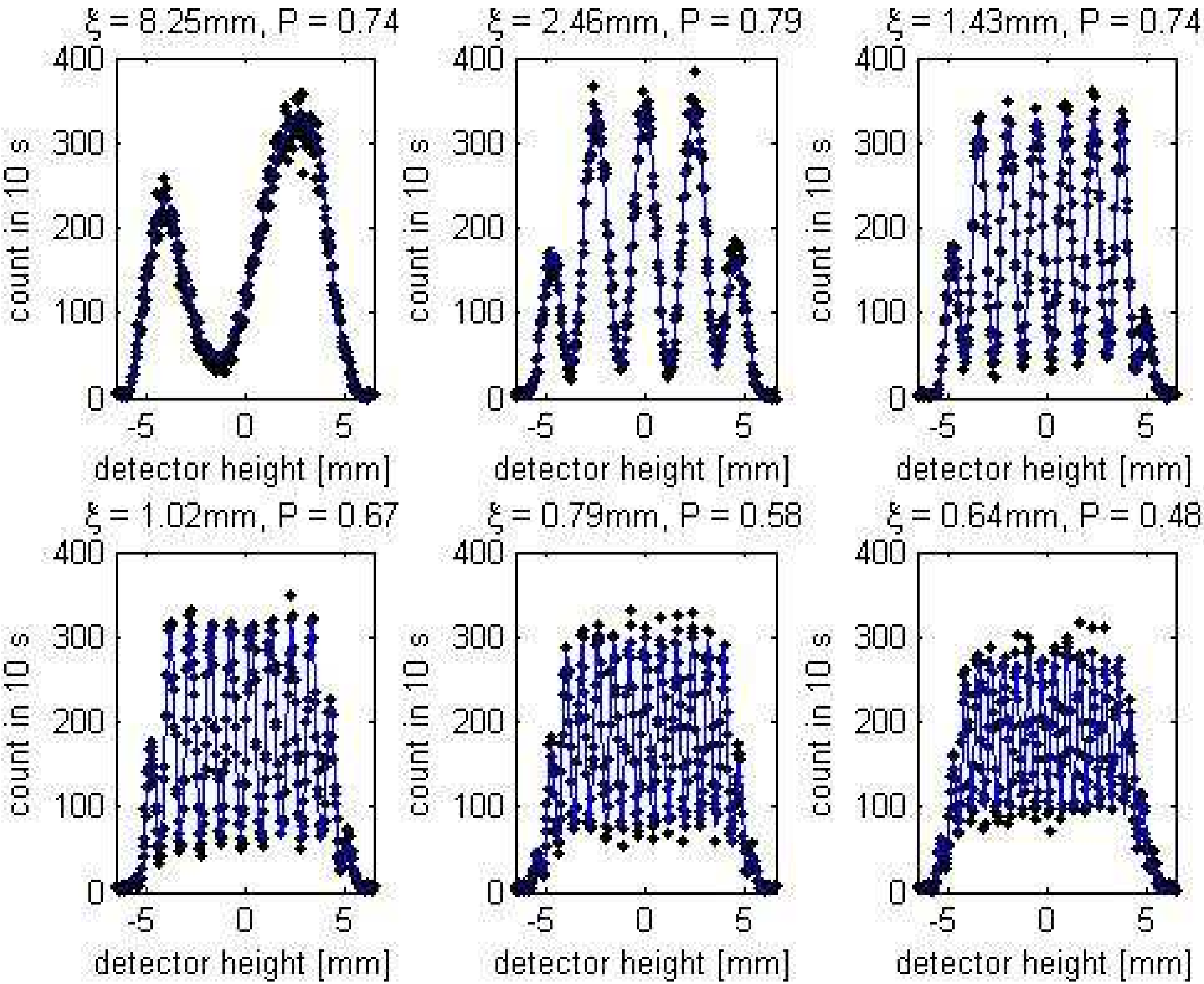
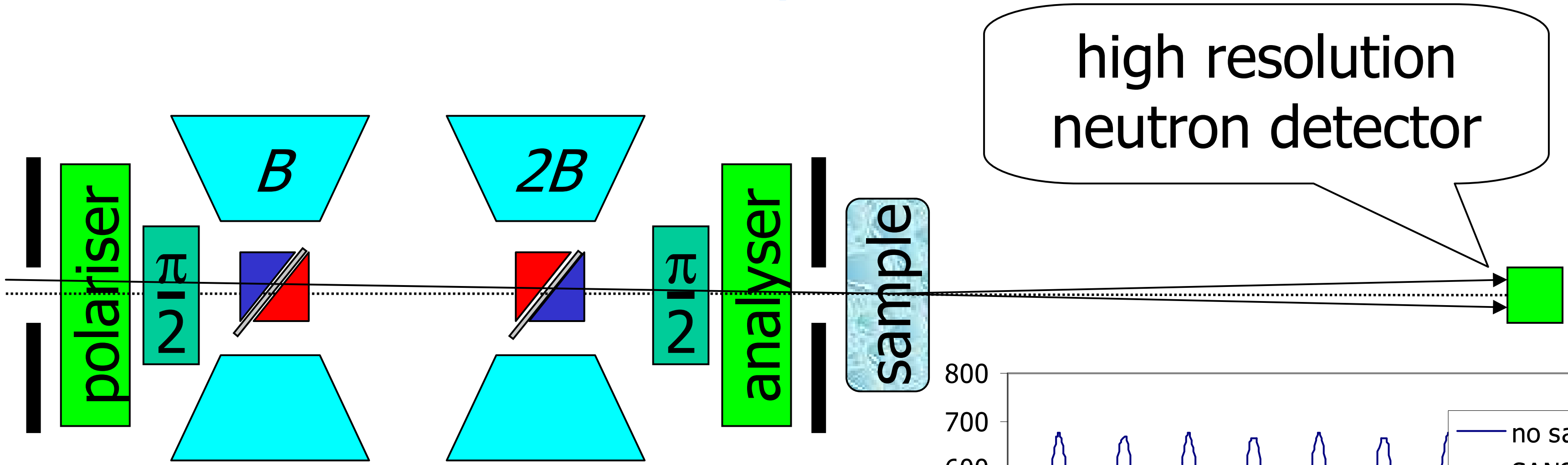
Measured with neutron camera

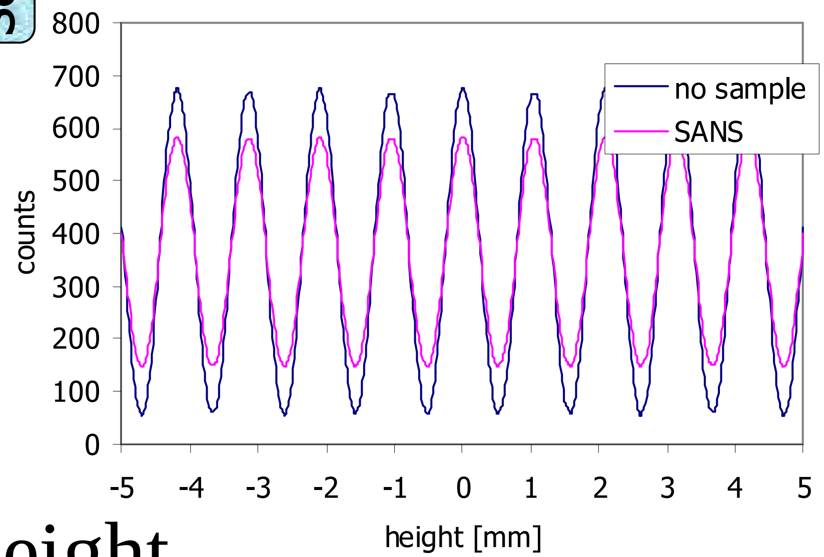


Measured with 0.1 mm high slit



SESANS by modulation





SANS by sample decreases amplitude modulation

$$\delta_z = \text{spin-echo length},\ Q_z \propto \text{height}$$

$$I(\delta_z, Q_z) = I_0(1 + A(\delta_z)\cos(\delta_z Q_z))$$

$$A(\delta_z) = e^{\sigma t(G(\delta_z)-1)}$$

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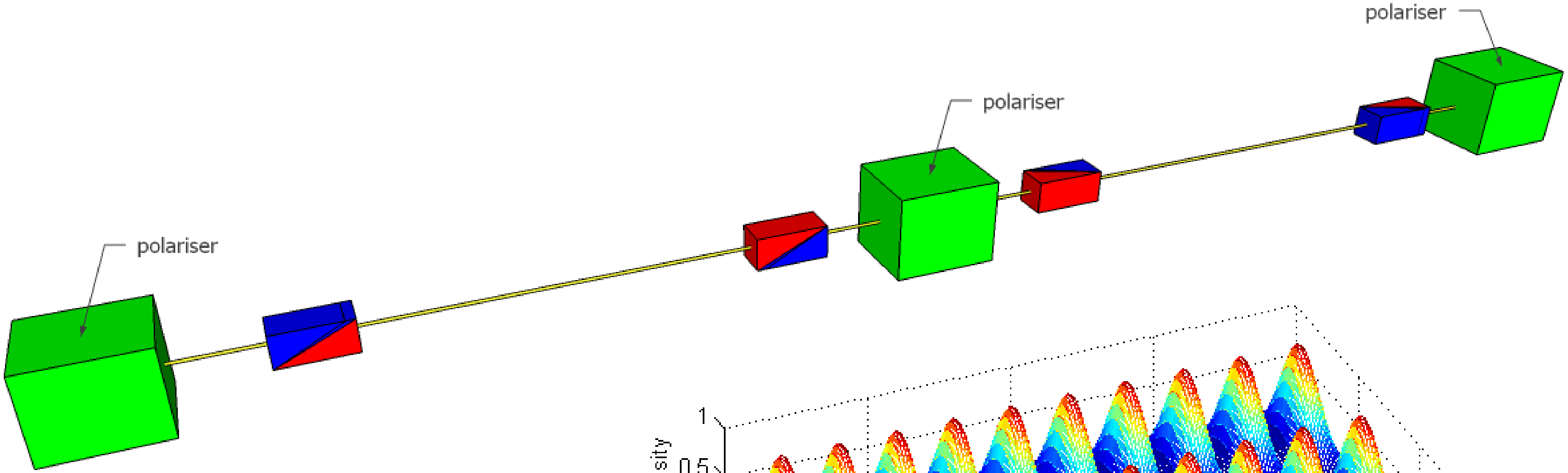
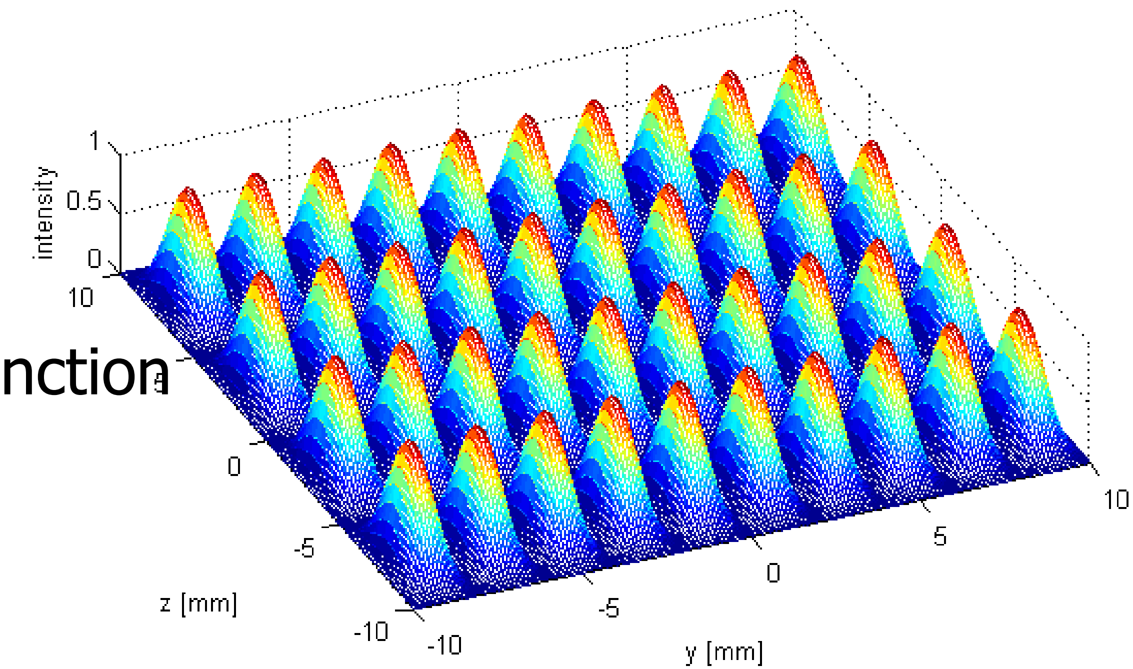
2D with crossed magnetic fields



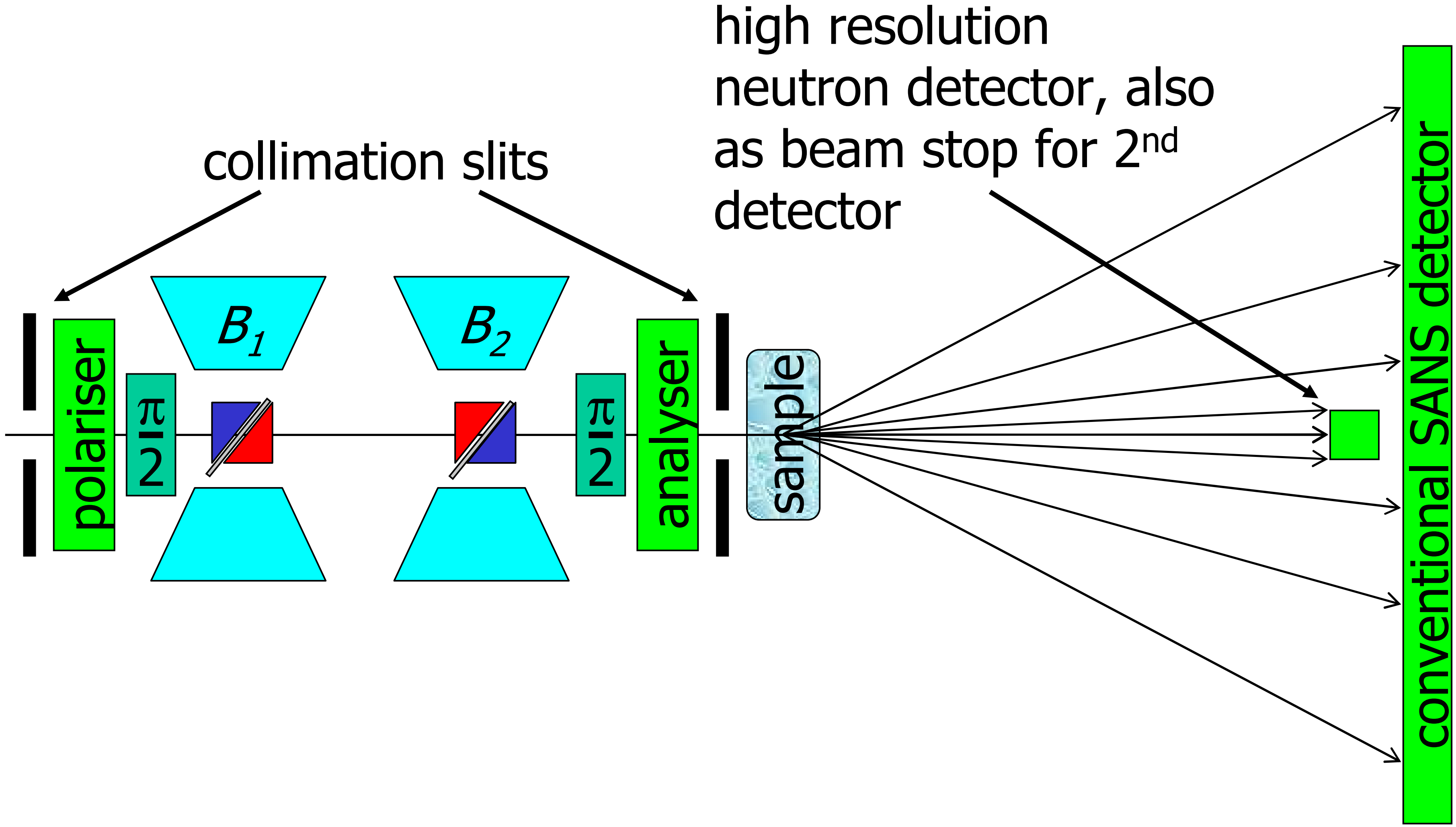


Measures 2D correlation function

$$G(\delta_y, \delta_z) =$$

$$\frac{1}{k_0^2} \int \frac{d\sigma(\vec{Q})}{d\omega} \cos(Q_y \delta_y) \cos(Q_z \delta_z) d\vec{Q}$$

SANS + SESANS



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Combined SANS-SESANS instrument

Wim Bouwman, Chris Duif, Jeroen Plomp,
Roland Gähler (ILL)

1. SESANS like measurements with sample outside Larmor region
2. 2D measurement correlation function possible
3. Combined: sensitive 1 nm – 100 μm
4. Requires better detectors

Sensitivity 1 nm - 160 μm

$$L_1 \approx L_2 \approx L_s \approx 20 \text{ m} \quad \lambda = 0.6 \text{ nm}$$

$$\vartheta_0 = 5.5^o \Rightarrow \tan(\vartheta_0) = 0.1$$

$$B_{\max} = 30 \text{ mT}, B_2 - B_1 = 15 \text{ mT}$$

Extrapolated from present SESANS

$$\zeta_y = \frac{\pi \tan(\vartheta_0)}{c\lambda(B_2 - B_1)} = 80 \text{ μm}$$

Modulation period on detector: good detector needed!

$$\delta_y = \frac{c\lambda^2(B_2 - B_1)}{\pi \tan(\vartheta_0)} = 160 \text{ μm}$$

Spin-echo length