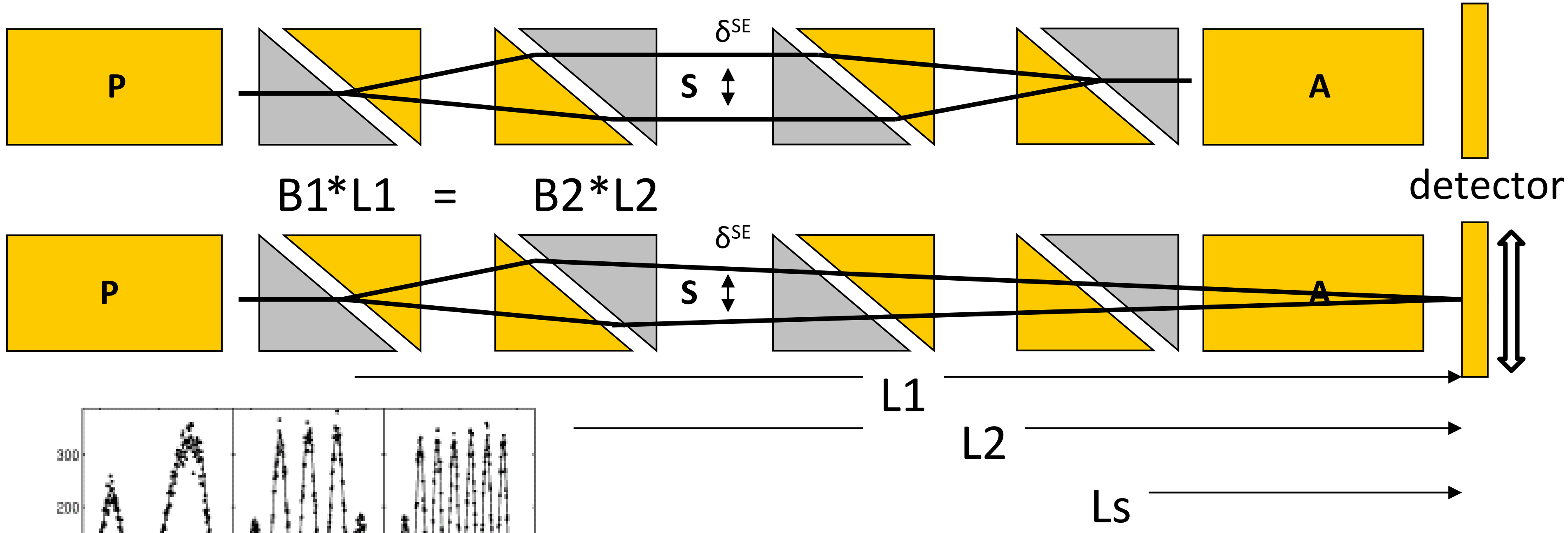
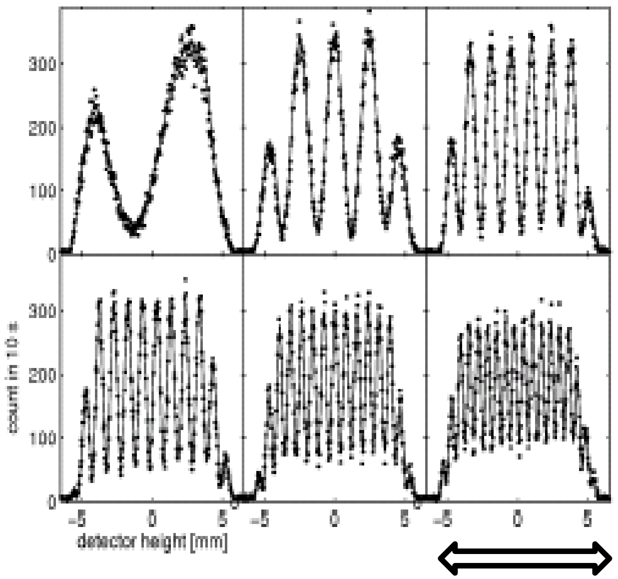
M. Strobl - Neutron Imaging & Activation Group :: Paul Scherrer Institut

Neutron Imaging with Larmor Labelling and SEMSANS

SESANS -> SEMSANS





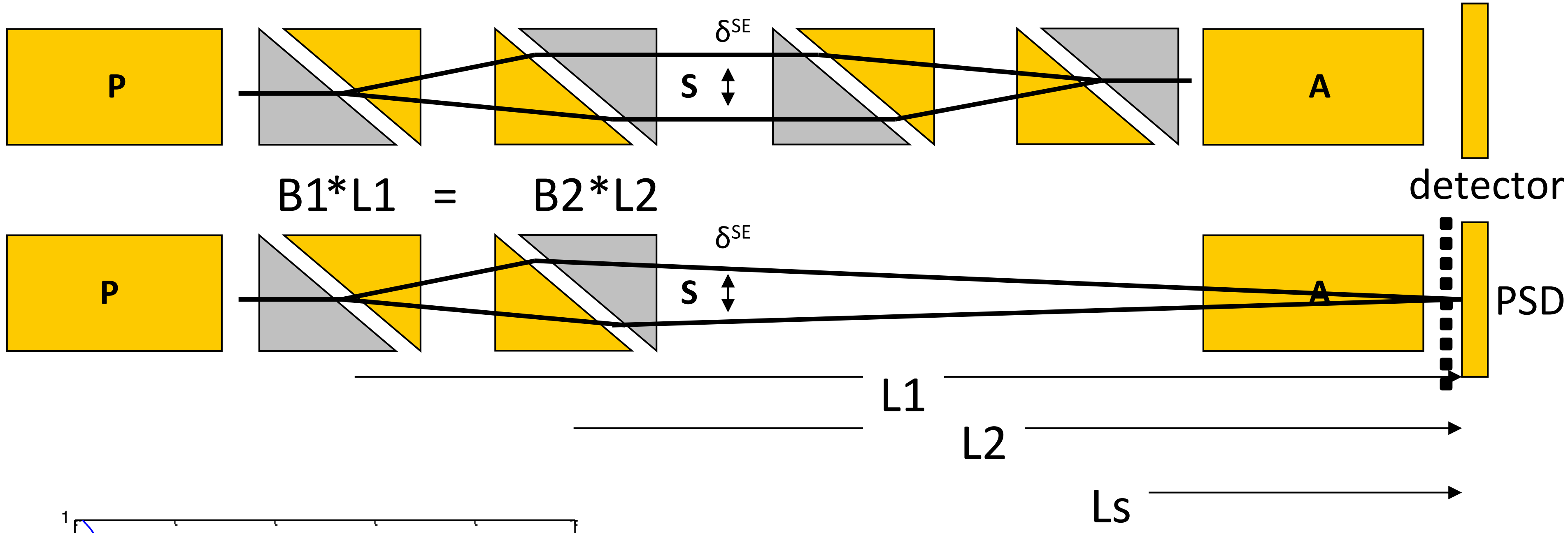
$\zeta = \pi \tan\theta_0/(c\lambda(B2-B1))$ period

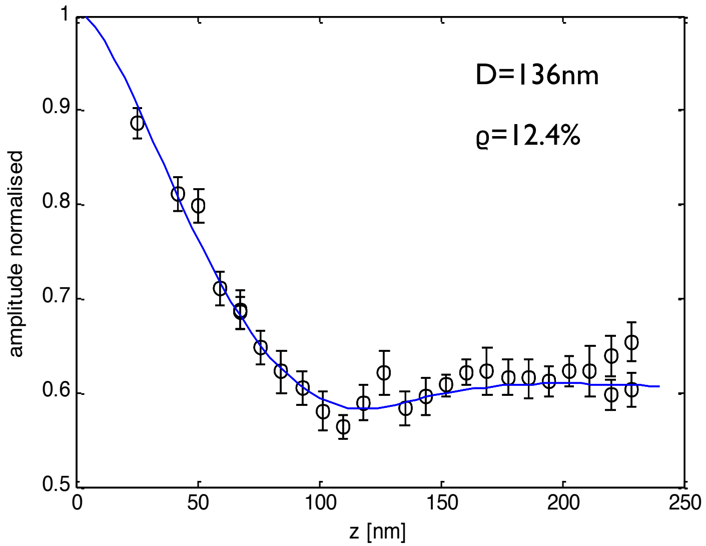
$\delta^{SE} = \lambda L_s/\zeta$ SE-length

W. Bouwman et al. Physica B 406 (2011) 2357–2360

Proposed by R. Gähler @ PNCMI 2006 in analogy to NSE&MIEZE

SESANS -> SEMSANS





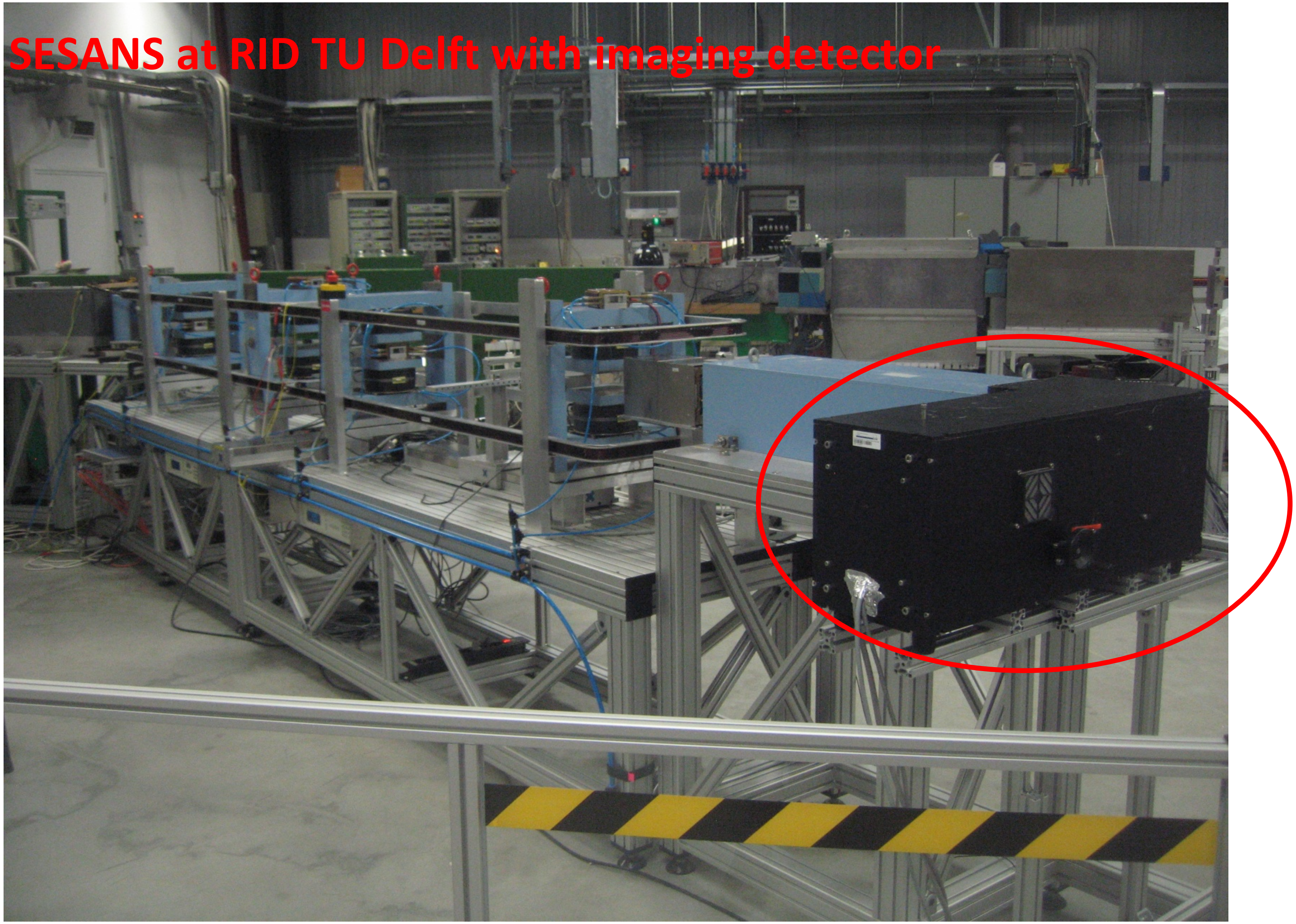
M. Strobl et al. Phys. B (2012)

$\zeta = \pi \tan\theta_0/(c\lambda(B2-B1))$ period

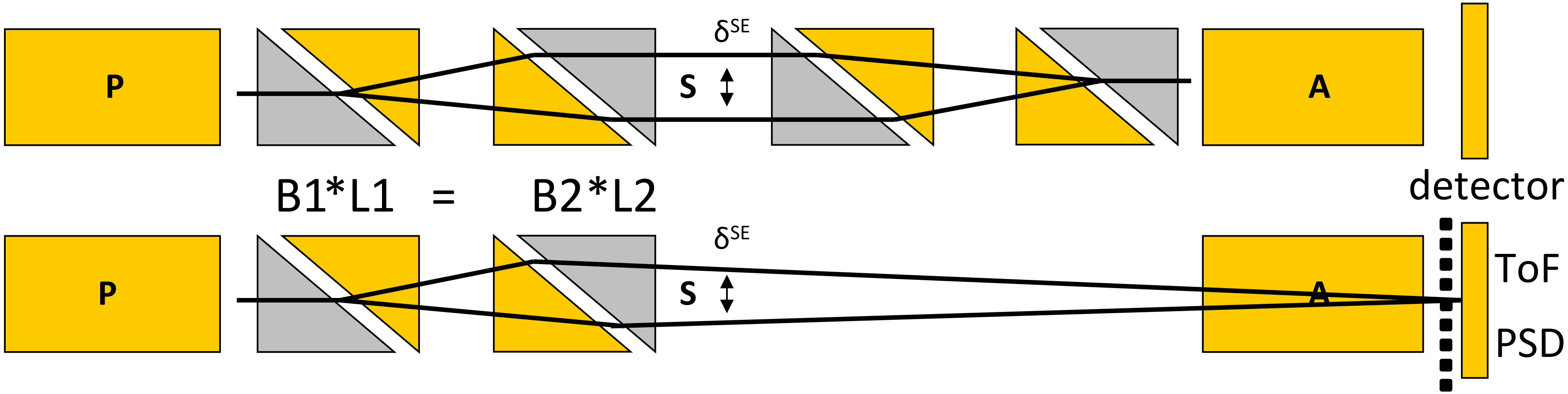
$\delta^{SE} = \lambda L_s/\zeta$ SE-length

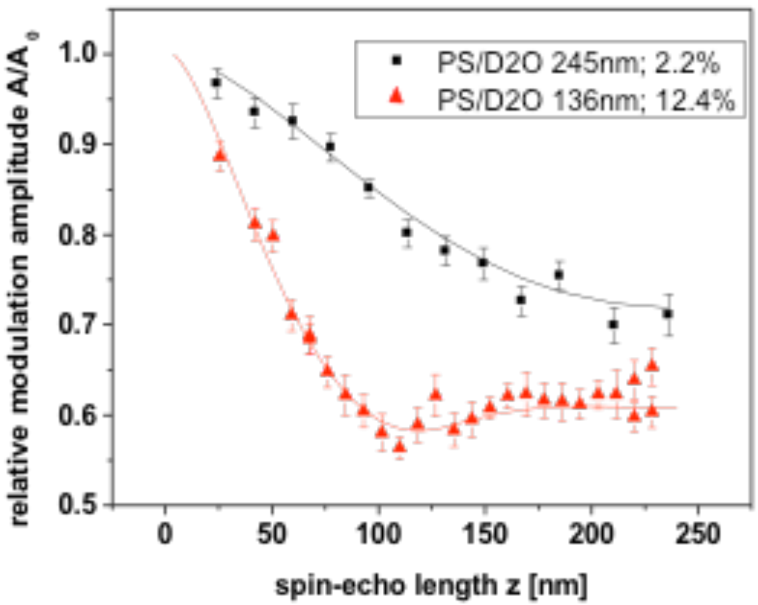
$$P_s(\delta^{SE}) \big/ P_0(\delta^{SE}) = e^{\Sigma t(G(\delta^{SE})-1)}$$

SESANS -> SEMSANS -- reality



SESANS -> SEMSANS & ToF





M. Strobl et al. J. Appl. Phys. (2012).

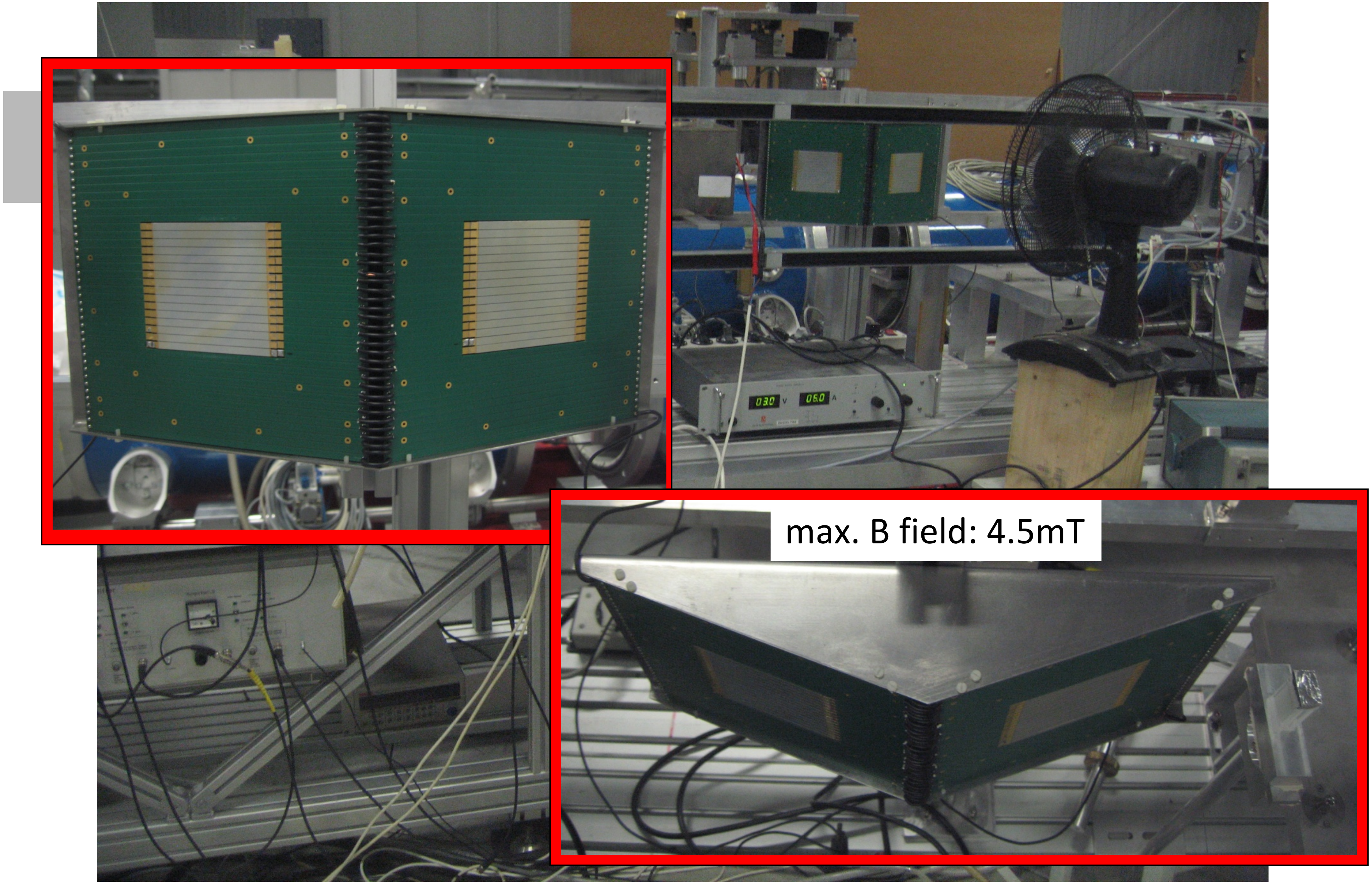
→ToF

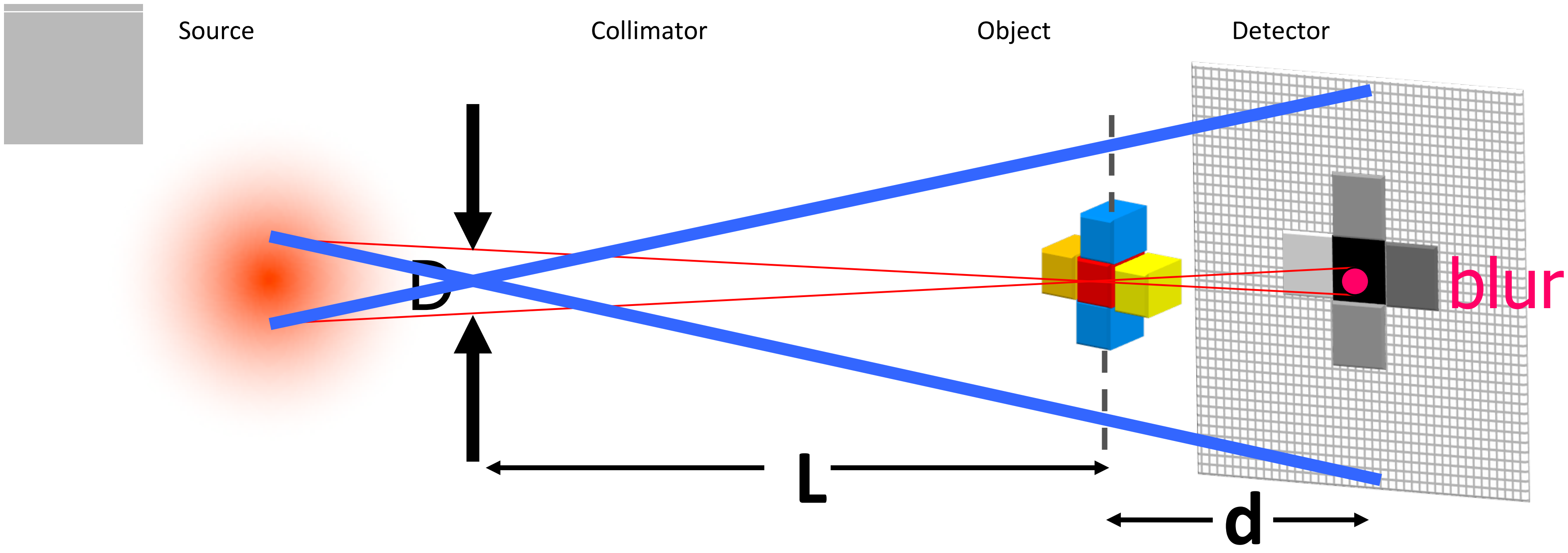
$\zeta = \pi \tan\theta_0 / (c\lambda(B2-B1))$ period

$\delta^{SE} = \lambda^2 L_s c(B2-B1) / \pi \tan\theta_0$ SE-length

$$P_s(\delta^{SE}) \Big/ P_0(\delta^{SE}) = e^{\Sigma t (G(\delta^{SE}) - 1)}$$

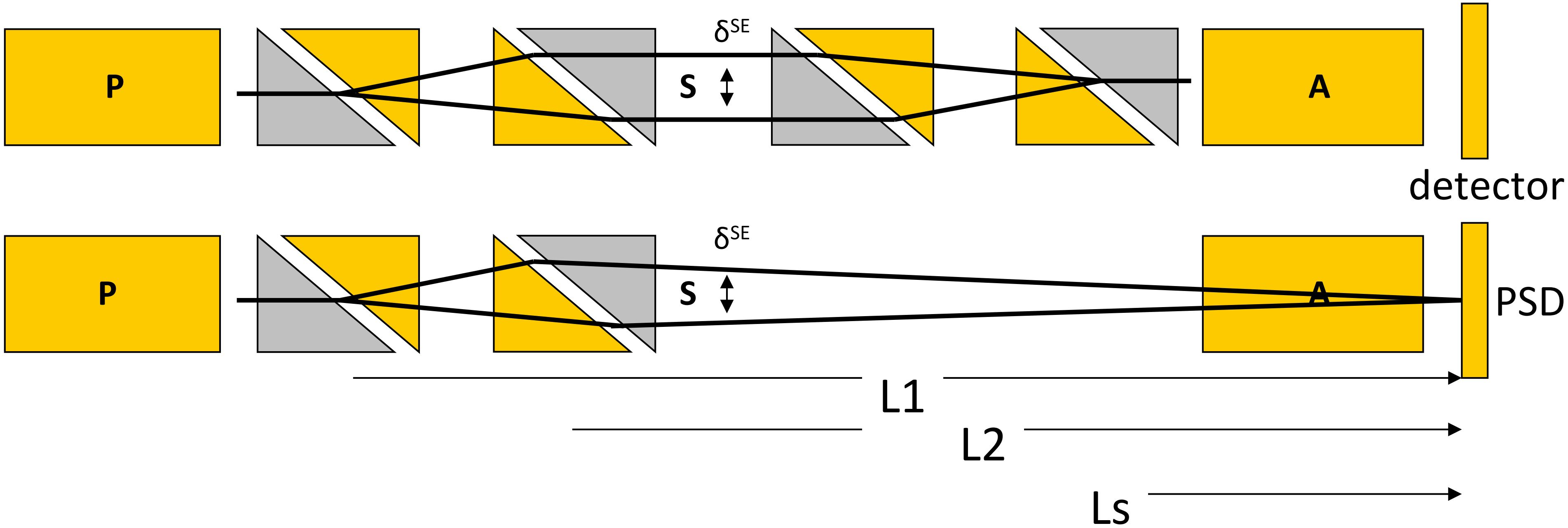
SESANS -> SEMSANS -- reality





Geometric spatial resolution limit: $$b = \frac{d}{L/D}$$

SEMSANS -> Imaging



Sample no more influence on polarisation

Beam can be totally depolarized before sample

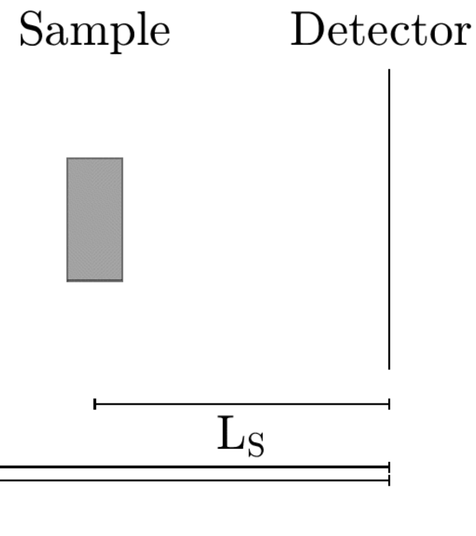
So:

$$?? \quad P_S(\delta^{SE}) \Big/ P_0(\delta^{SE}) = e^{\Sigma t (G(\delta^{SE}) - 1)} \quad ??$$

SEMSANS -> Imaging

Forget about SE and polarisation!

Whatever kind of modulation source!



Sample no more influence on polarisation

Beam can be totally depolarized before sample

So:

$$?? \quad P_s(\delta^{SE}) / P_0(\delta^{SE}) = e^{\Sigma t (G(\delta^{SE})-1)} \quad ??$$

V=(I^{max}-I^{min})/(I^{max}+I^{min})

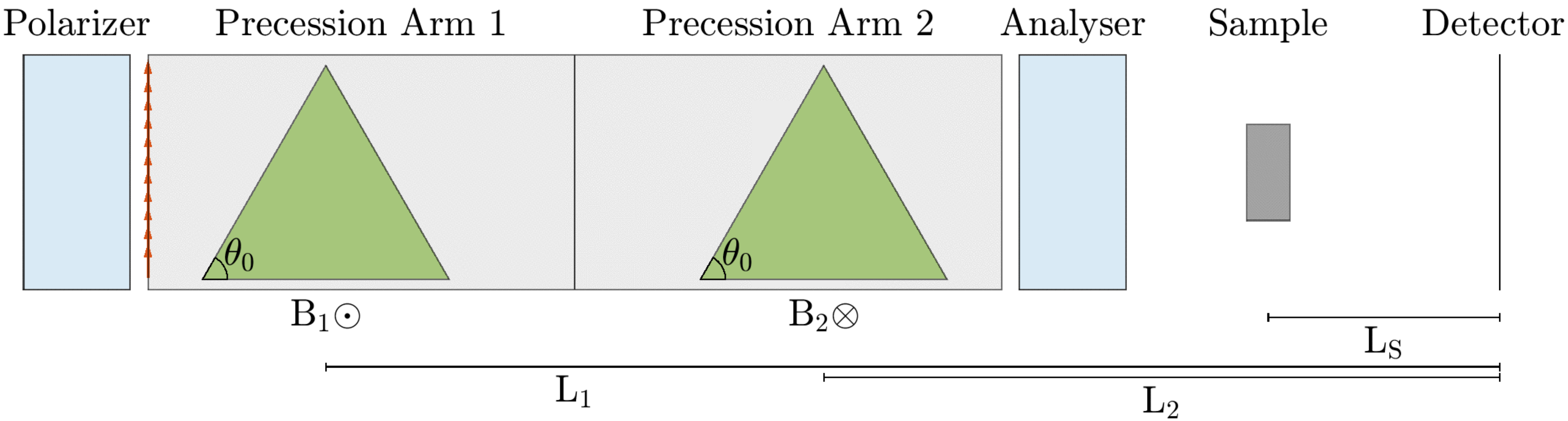
V=(I^{+}-I^{-})/(I^{+}+I^{-})

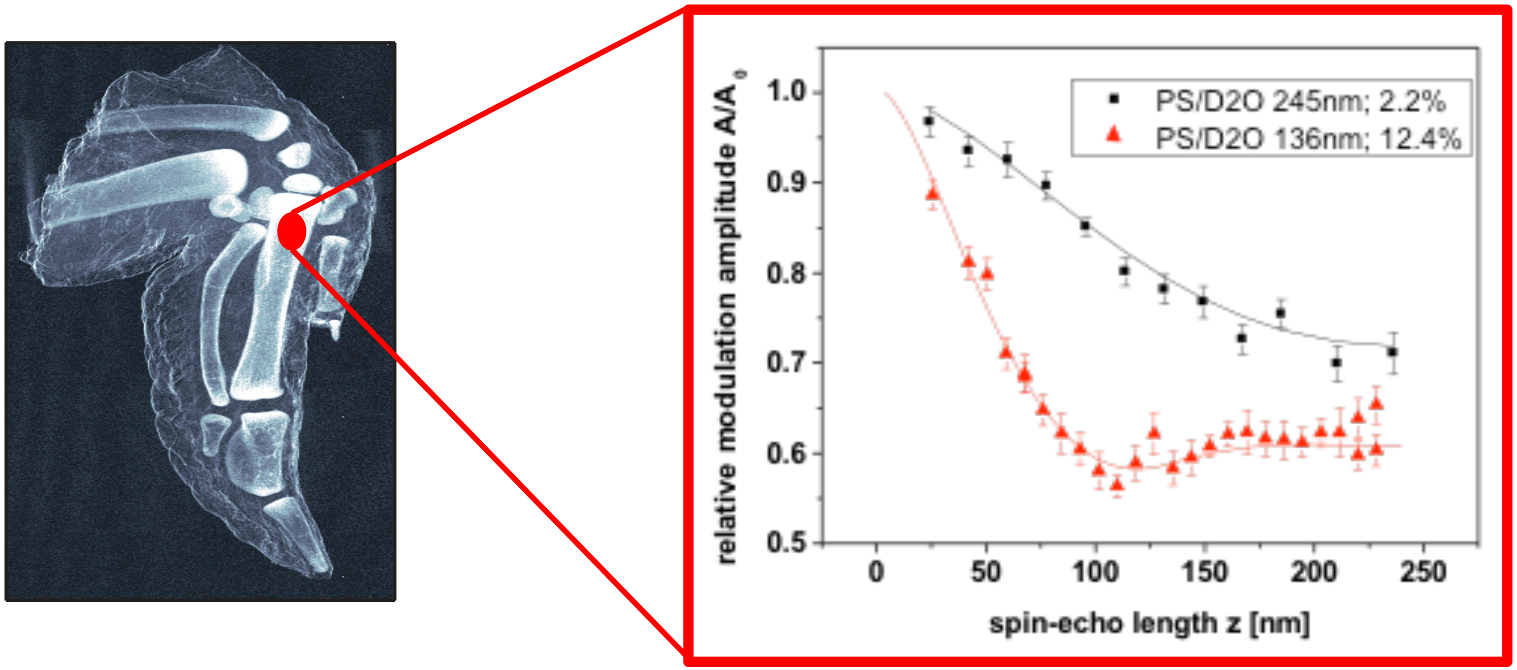
→

$$V_s(\xi_{GI}) / V_0(\xi_{GI}) = e^{\Sigma t (G(\xi_{GI})-1)}$$

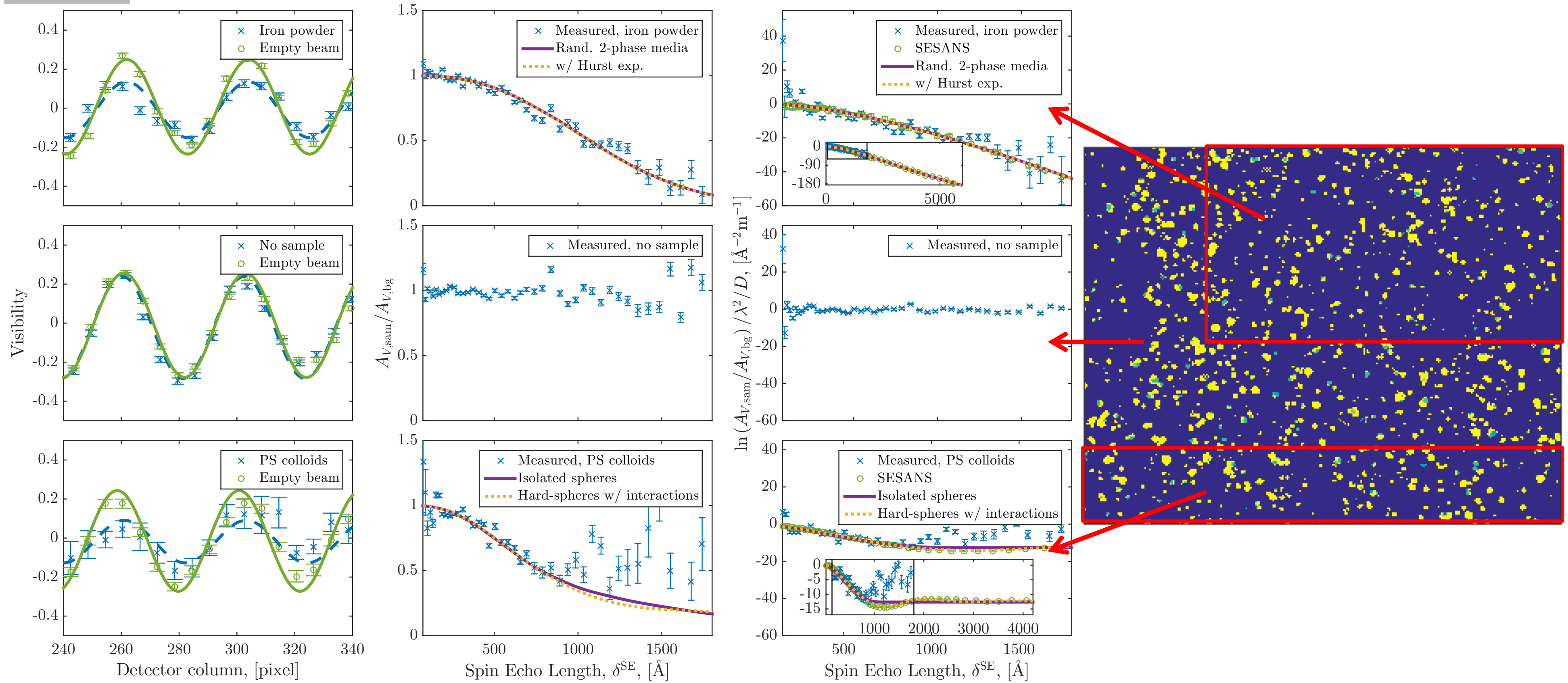
M. Strobl Scientific Reports 4 7243 (2014)

ToF SEMSANS -> Imaging



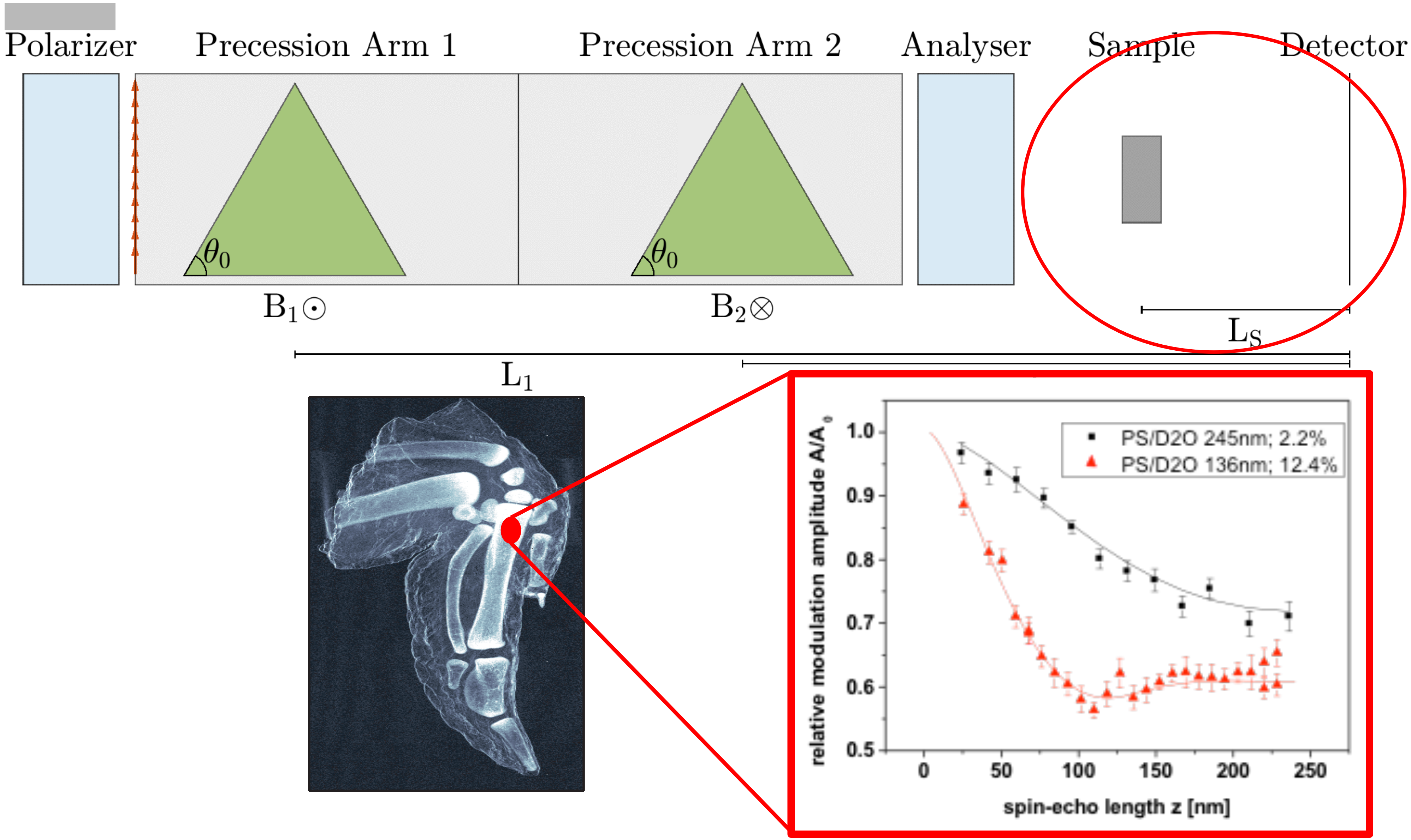


ToF SEMSANS -> Imaging

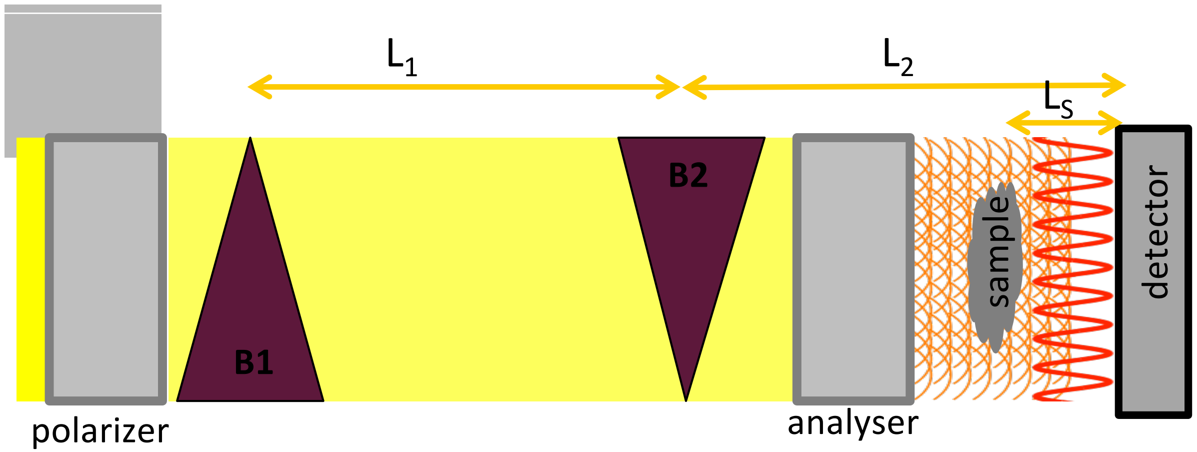


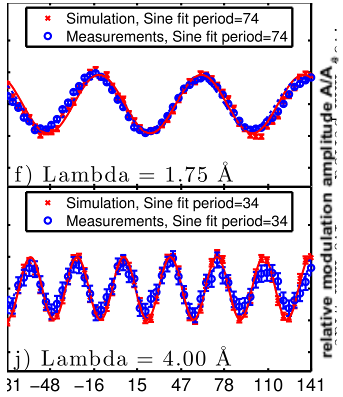
M. Strobl et al. Scientific Reports (2015)

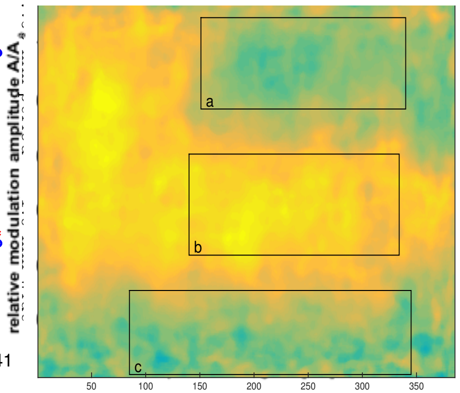
SEMSANS DFI Imaging Resolution

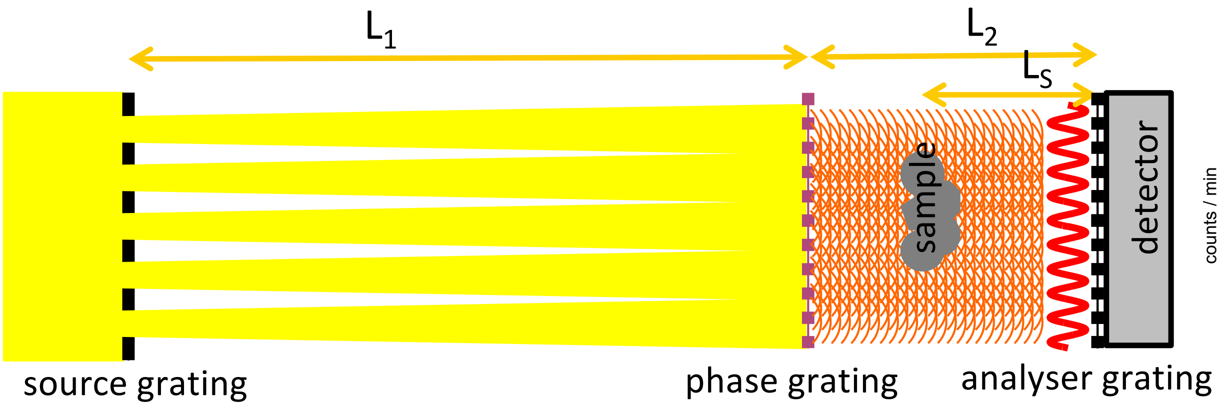


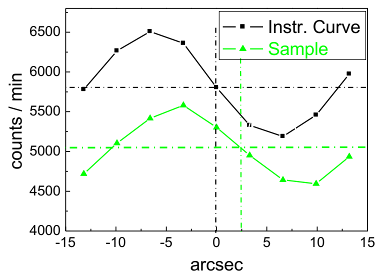
SEMSANS DFI Imaging Resolution

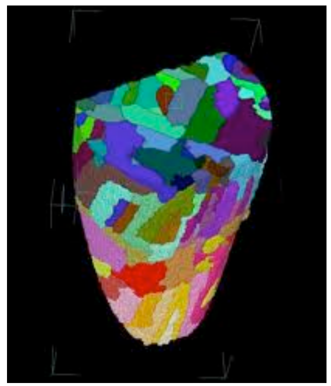




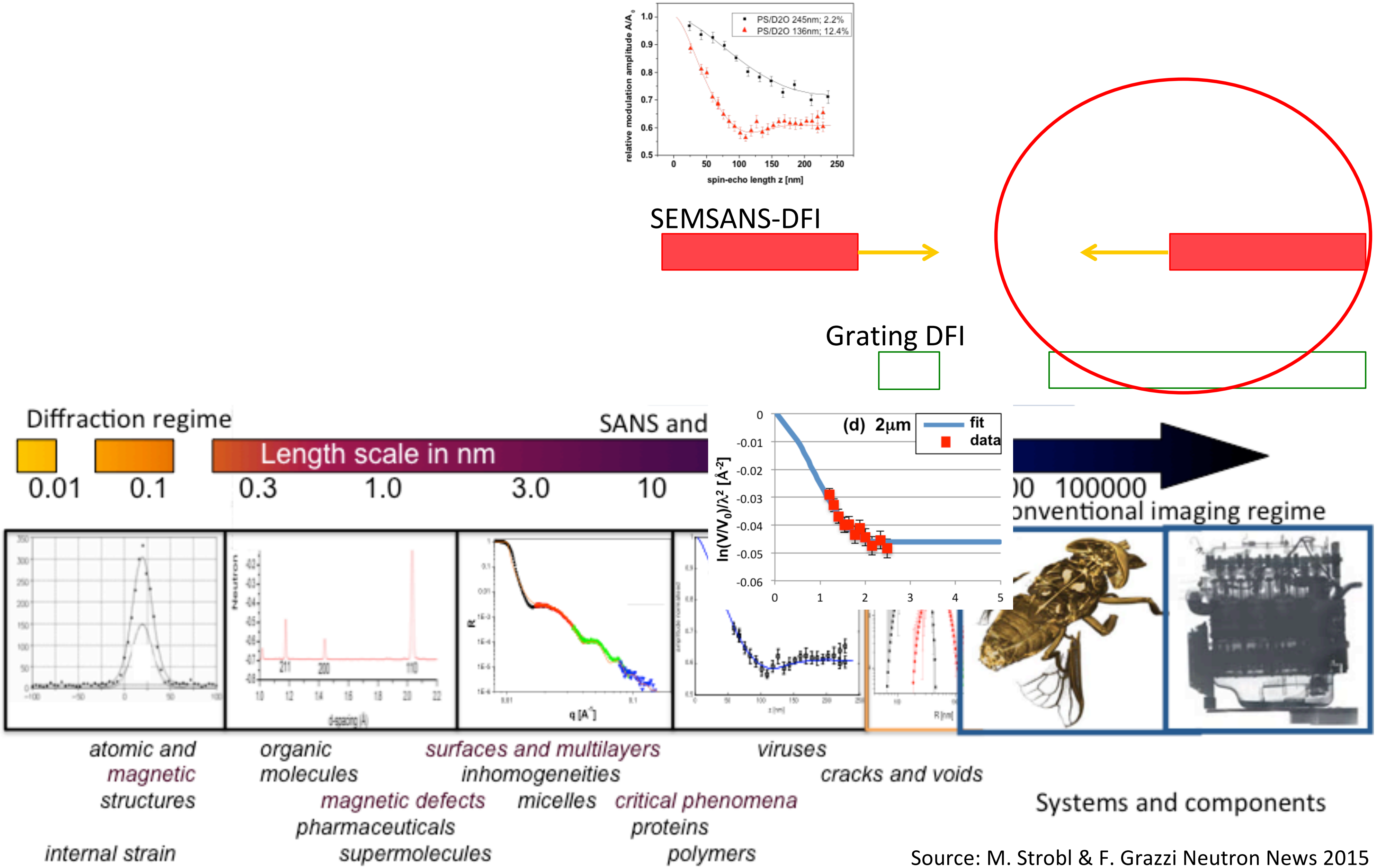






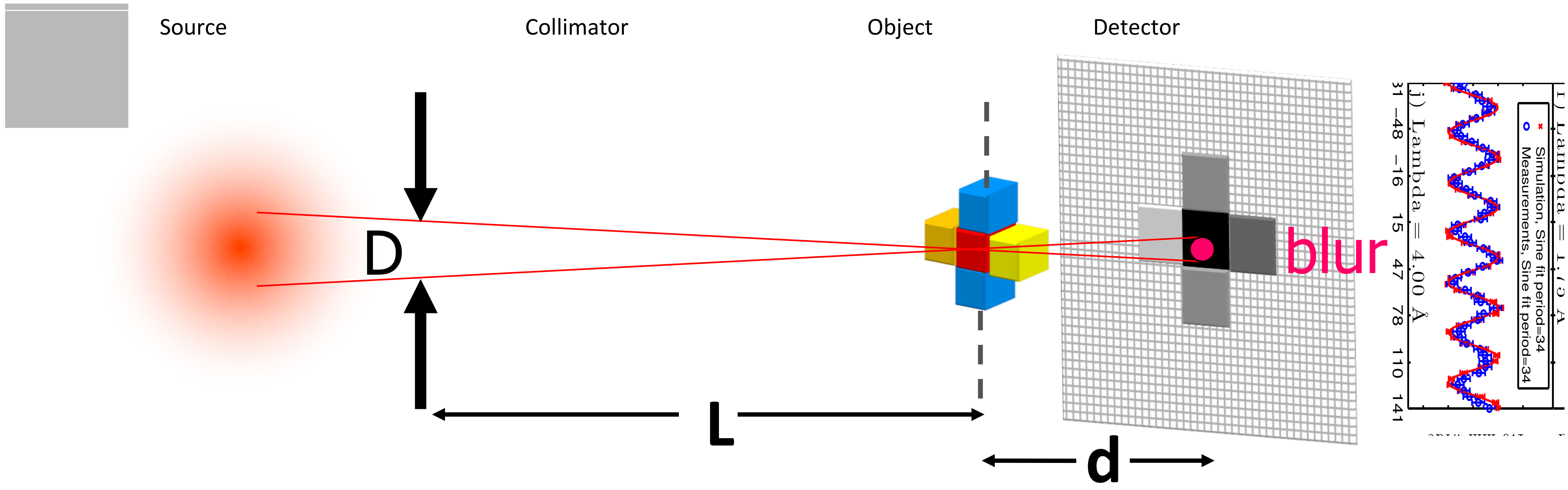


SEMSANS DFI Imaging Resolution



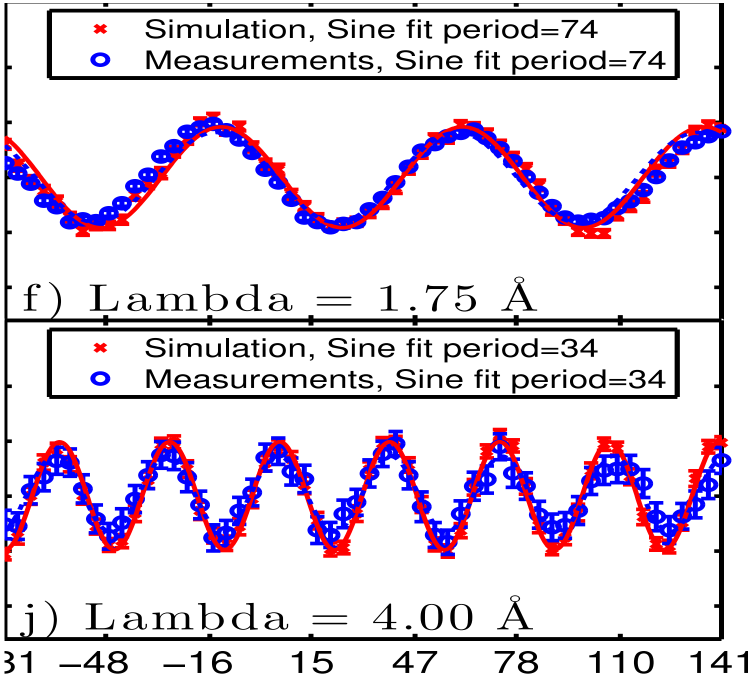
Source: M. Strobl & F. Grazzi Neutron News 2015

SEMSANS DFI Imaging Resolution



Geometric spatial resolution limit: $b = \frac{d}{L/D} \ll \zeta = \pi \tan\theta_0/(c\lambda(B2\text{-}B1))$

SEMSANS DFI Imaging Resolution



$V=(I^{+}-I^{-})/(I^{+}+I^{-})$ can in principle be extracted for (nearly)every pixel, but meaningful only over at least one period!

Resolution dependent on relevant width of scattering function!

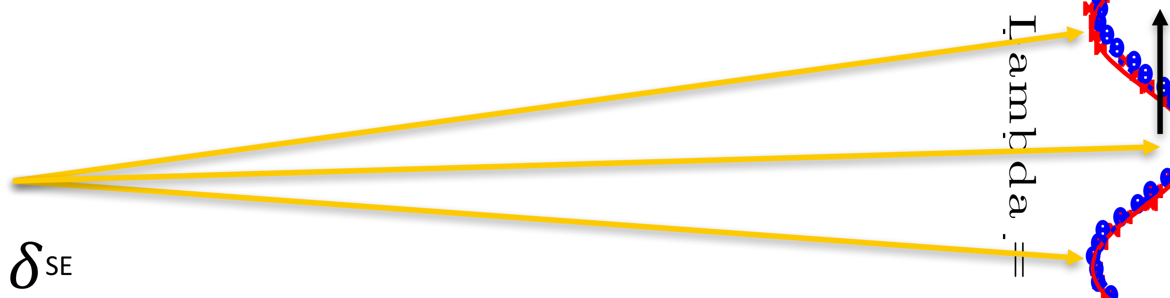
Distinguish spatial resolution wrt scattering signal and attenuation!

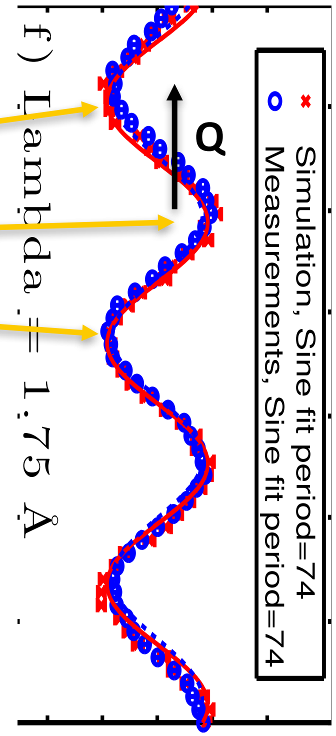
Geometric spatial resolution limit: $b = \frac{d}{L/D} \ll \zeta = \pi \tan\theta_0/(c\lambda(B2-B1))$

Visibility is a characteristic of a modulated function (here in space)

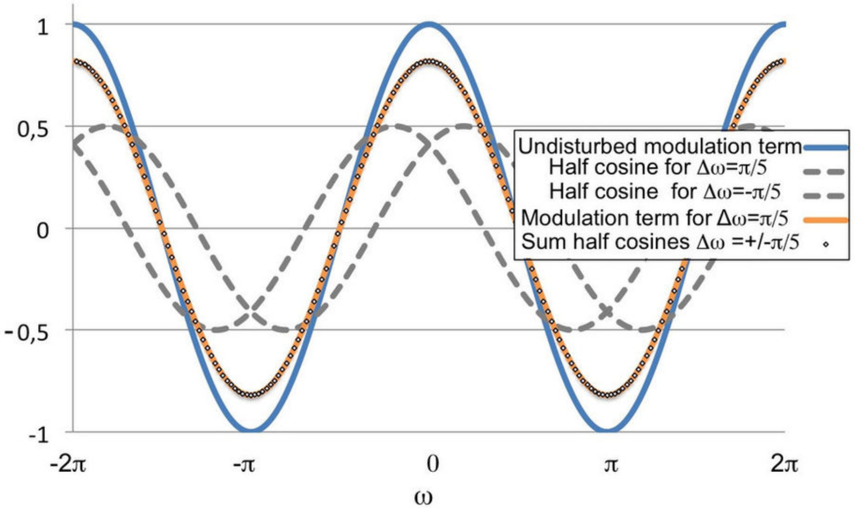
$V=(I^{max}-I^{min})/(I^{max}+I^{min})$

SEMSANS DFI Imaging Resolution





Hence any smaller definition of the spatial resolution of scattering not useful



→

$$V_s(\xi_{GI}) / V_0(\xi_{GI}) = e^{\Sigma t (G(\xi_{GI}) - 1)}$$

Open for discussion

Alternative:

- Dark-field contrast a correct term for this?
- Coherence and scattering resolution in this case (and USANS)

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