Wir schaffen Wissen – heute für morgen

# Cern Accelerator School
# High Power Hadron Machines

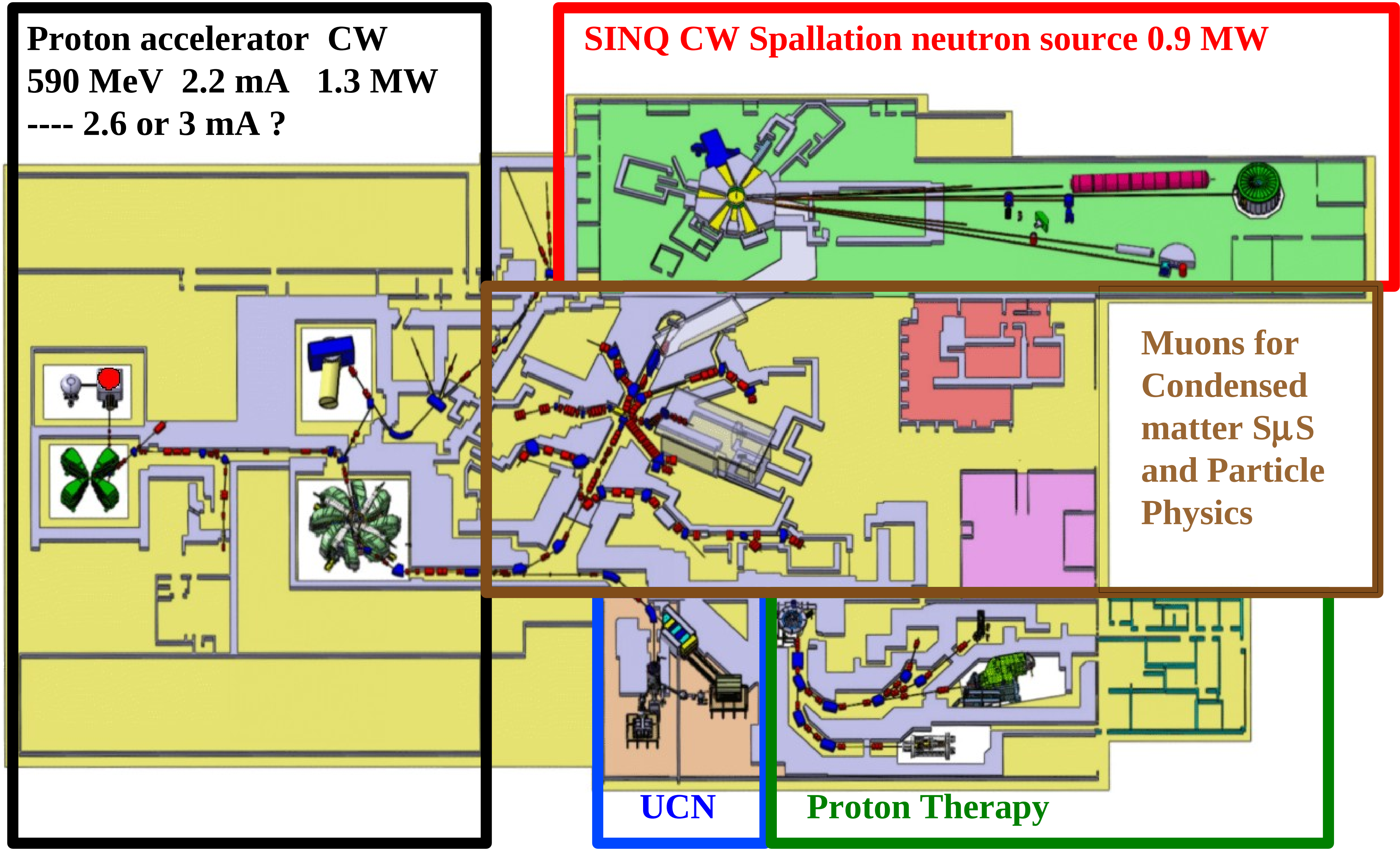
Bilbao, Spain 24 May – 2 June

## Introduction II – short version

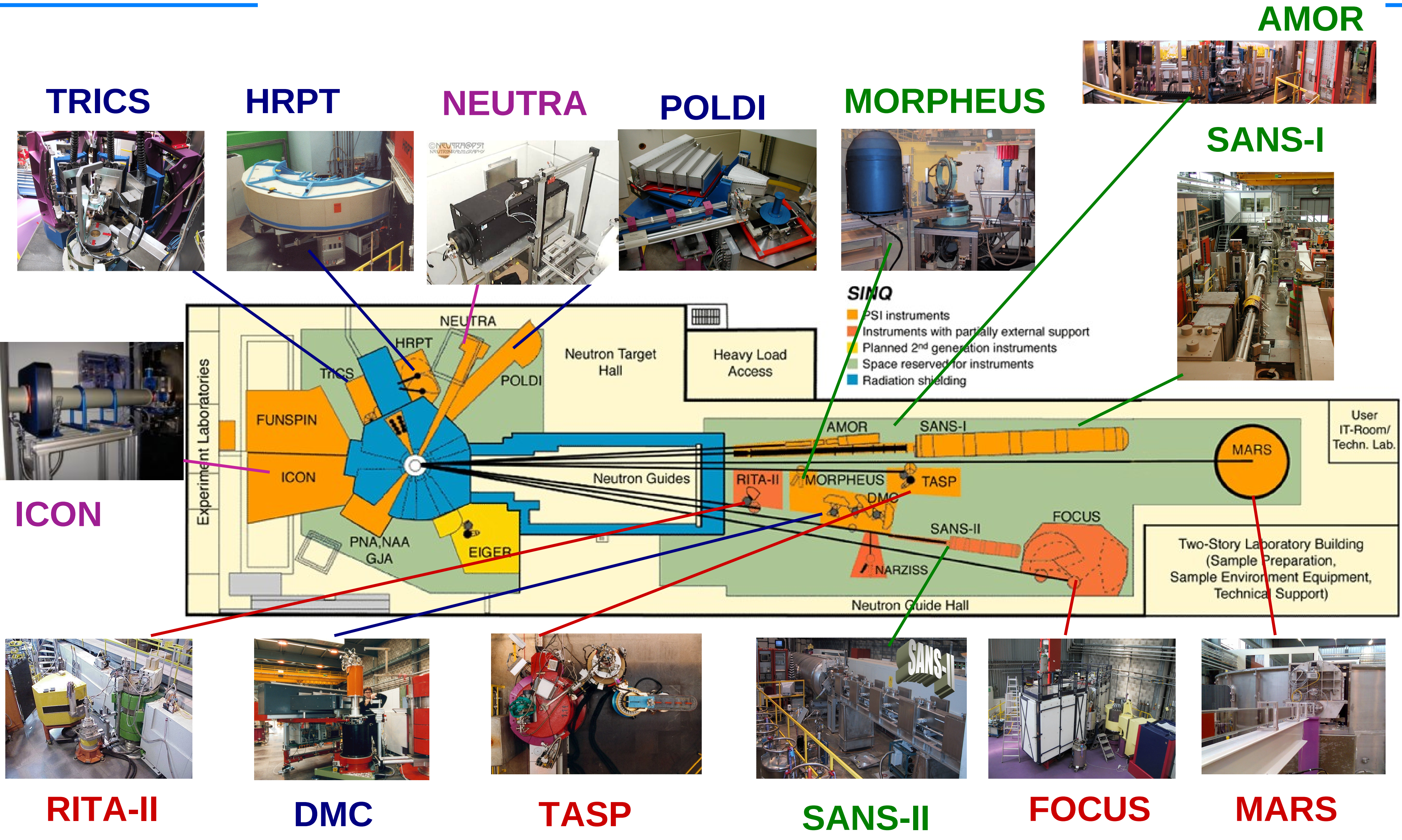
25 May 2011

Kurt Clausen, Paul Scherrer Institut, CH

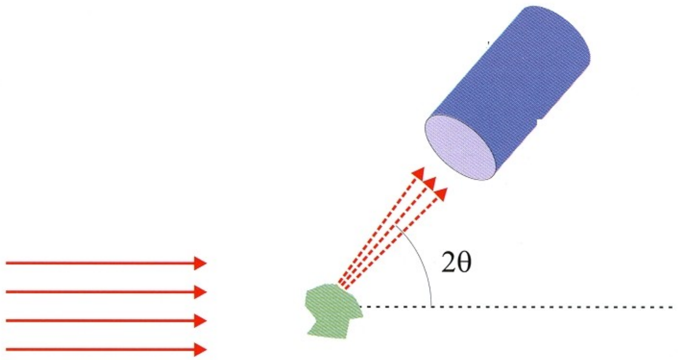
# Proton accelerator at PSI



# Neutron Scattering and Imaging Instruments at SINQ



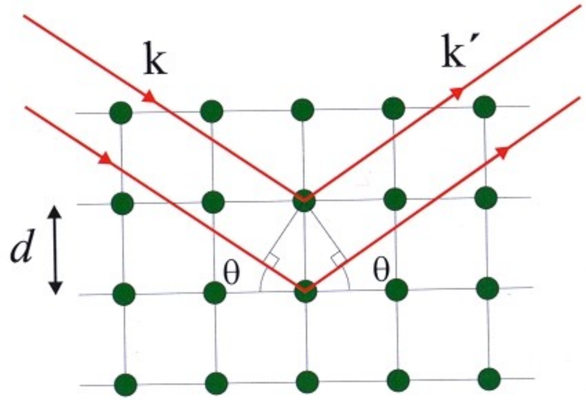
# Diffraction from crystals - structure




1. Neutrons see the Nuclei
2. Neutrons see Elementary Magnets
3. Neutrons see light Atoms next to Heavy Ones
4. Neutrons measure the Velocity of Atoms
5. Neutrons penetrate deep into Matter
6. Neutrons are Elementary Particles

Bragg's law:

$$m\lambda = 2d\sin\theta$$

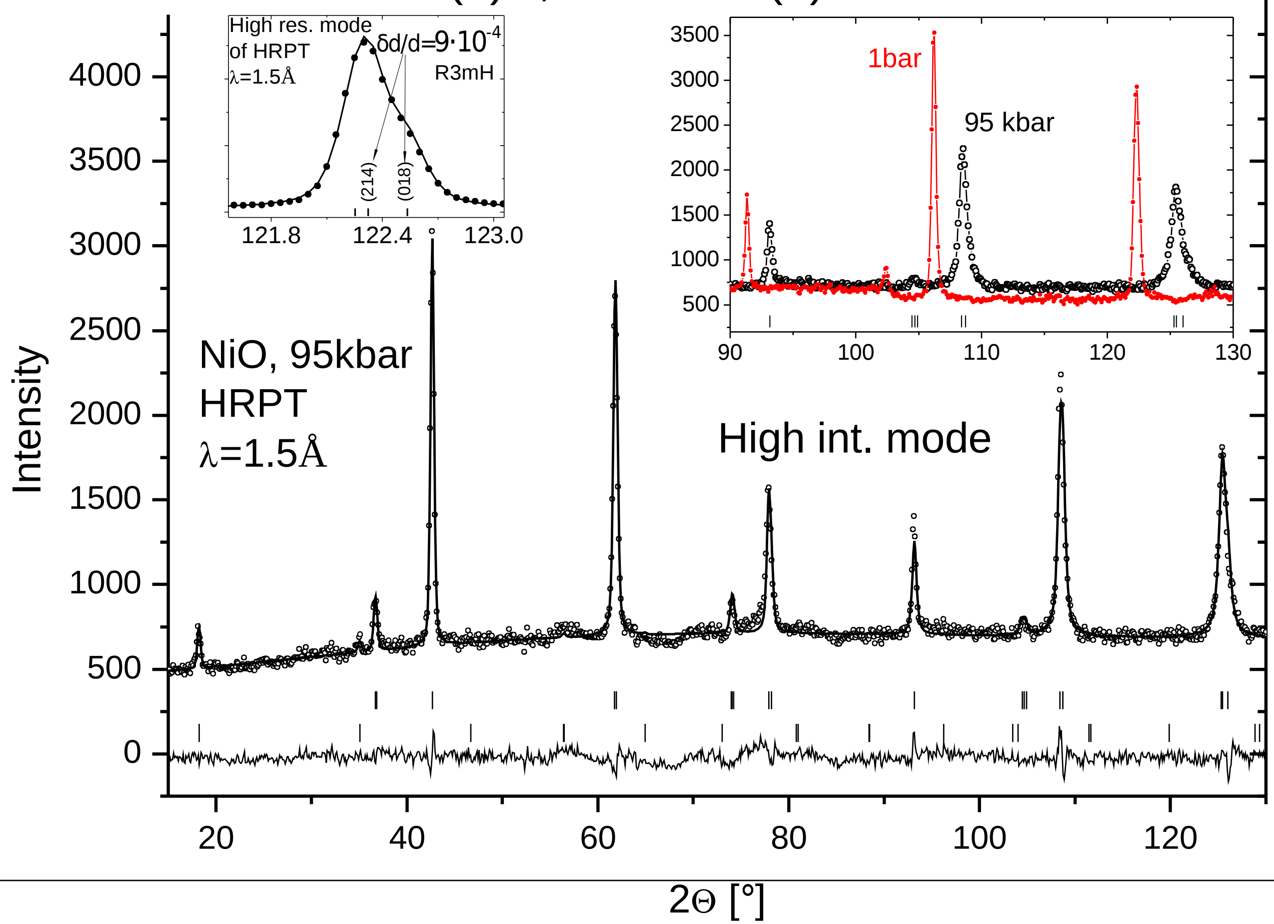



$$k = 2\pi / \lambda$$

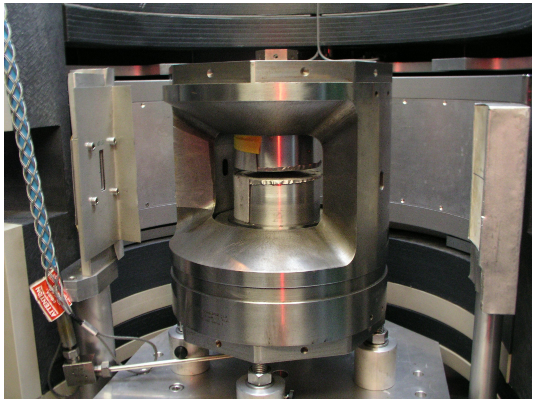
## Lattice distortion and magnetic structure in NiO under high pressures (up to 130kbar)

@ p=1bar: $\mu_{Ni}$=1.73(9) $\mu_B$, k =[½ ½ ½] in *Fm3m*

*R3-m*: a=2.9534(2)Å, α=60.061(2)°

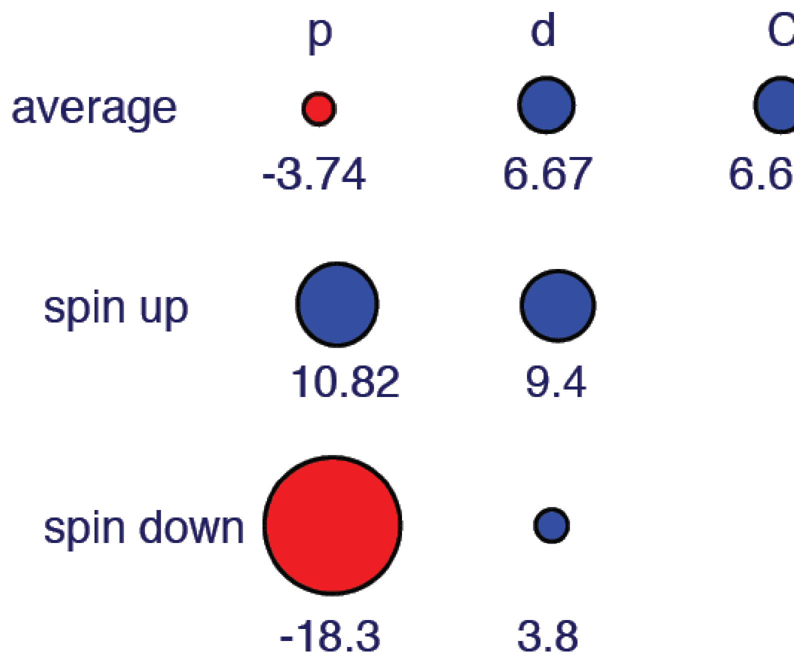



S. Klotz, Th. Strässle, G. Rousse, G. Hamel, V. Pomjakushin, *APL 2005*.

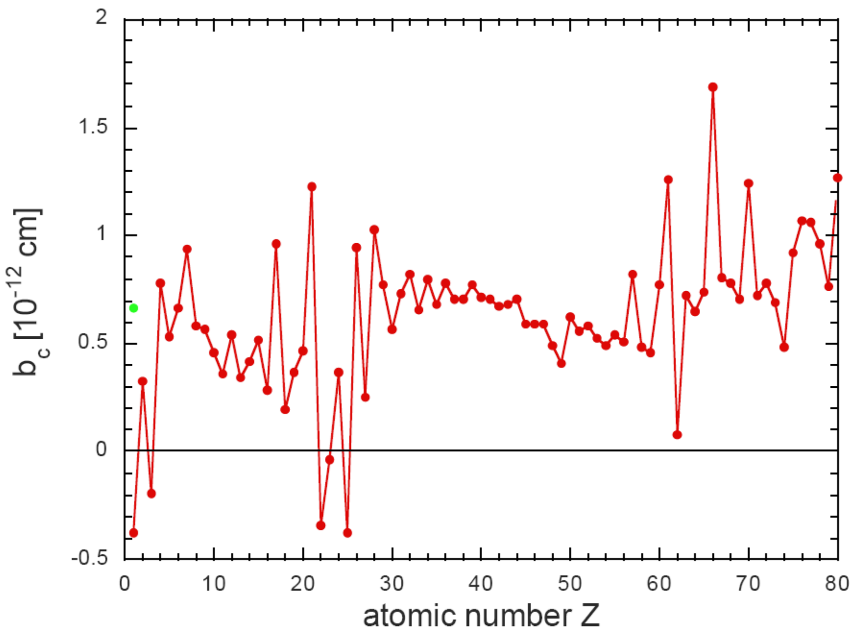


**V. Pomjakushin PSI**

# Neutron Scattering Length [fm]



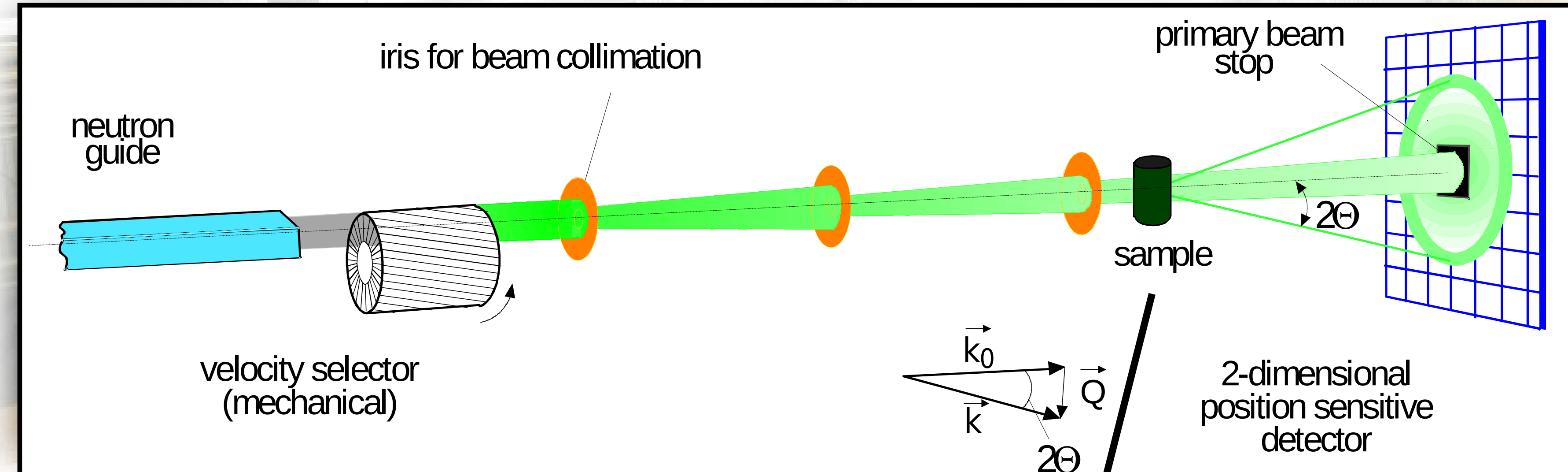

***Spin-dependent scattering lengths***




1 fm = $0.1 \times 10^{-12}$ cm

# Small Angle Neutron Scattering

J Kohlbrecher PSI

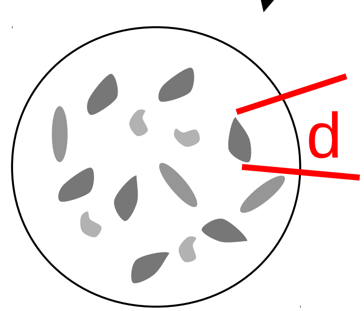


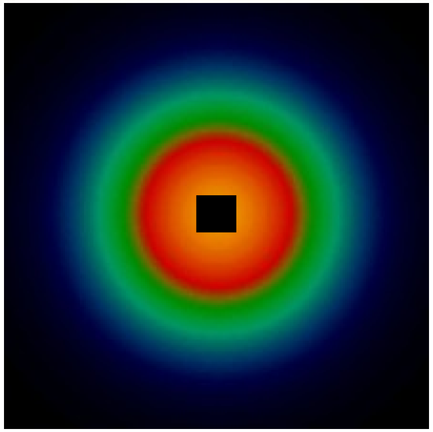

$$\frac{2\pi}{d} = Q = \frac{4\pi}{\lambda}\sin\left(\theta/2\right)$$

$\lambda \approx 0.5$ nm

d $\approx 10$ nm

} ➡ $\theta \approx 3$ deg



NANO LETTERS

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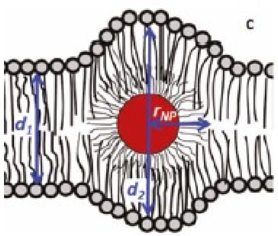
Nano Letters 2011, 11, 1664–1670

# Triggered Release from Liposomes through Magnetic Actuation of Iron Oxide Nanoparticle Containing Membranes

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# Tomography (Video)


**Florian Schmid, PSI**

# Thank you for listening

**Final commengs ......**

The two introductory lectures – Introduction I and II today were not about Hadron machines or  Acellerators – but about the use of these facilities!

The intention was through a series of examples to demonstrate why Hadron Machines provide such attractive tools for a very broad spectrum of science and technology, and why the users of these machines cry for ever increasing performance.

The introduction was by no means comprehensive of neither science at hadron machines nor the different centres operating hadron machines, but was dominated by examples of work done by members of the NUM (Neutron and Muon) Department at PSI, using the facilities at PSI and Cern.

Acknowledgements: I would like to acknowledge my colleagues at PSI for providing material for this presentation – and the Cern acellerator school for inviting me.

Cern Acellerator School