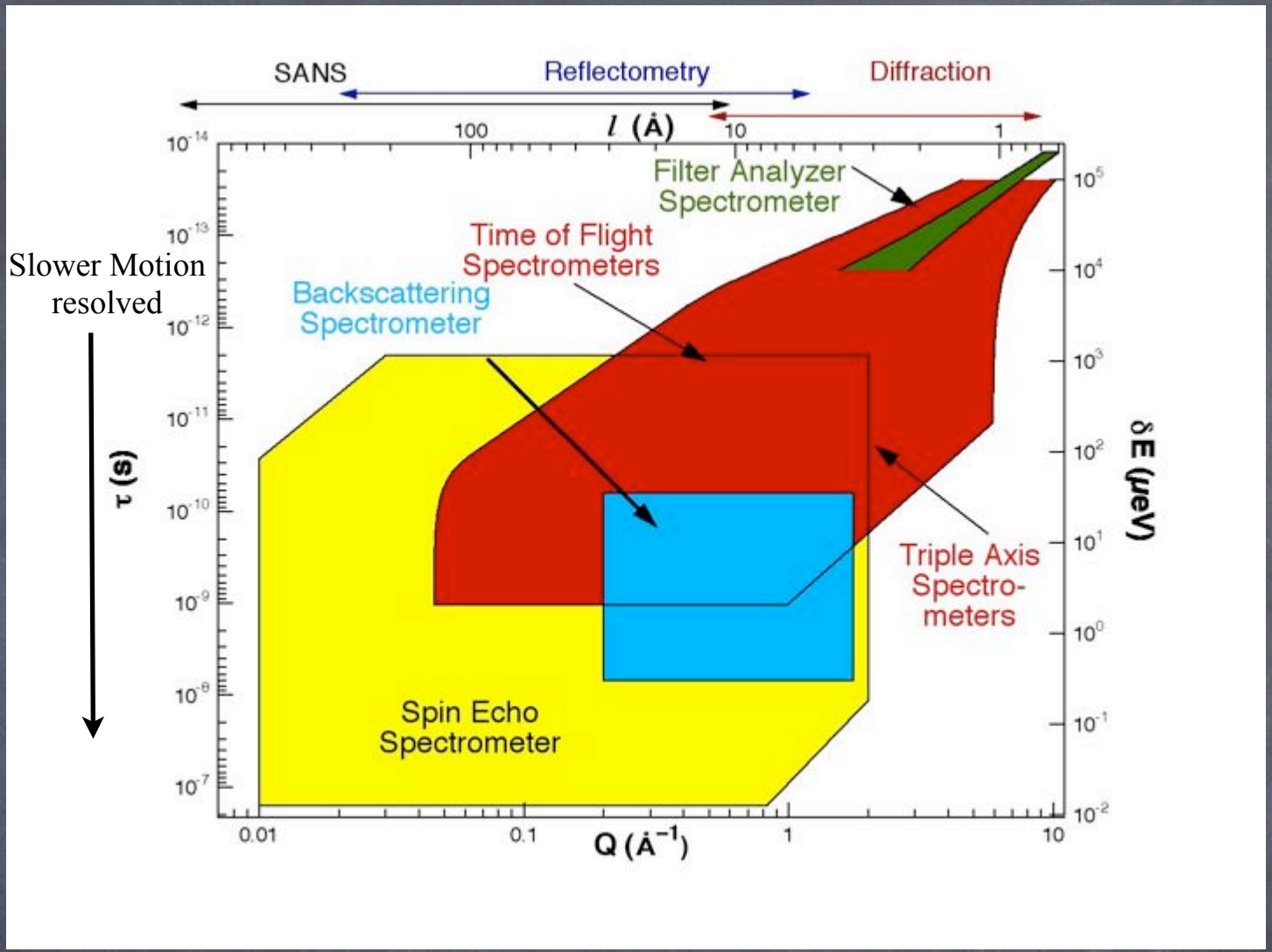
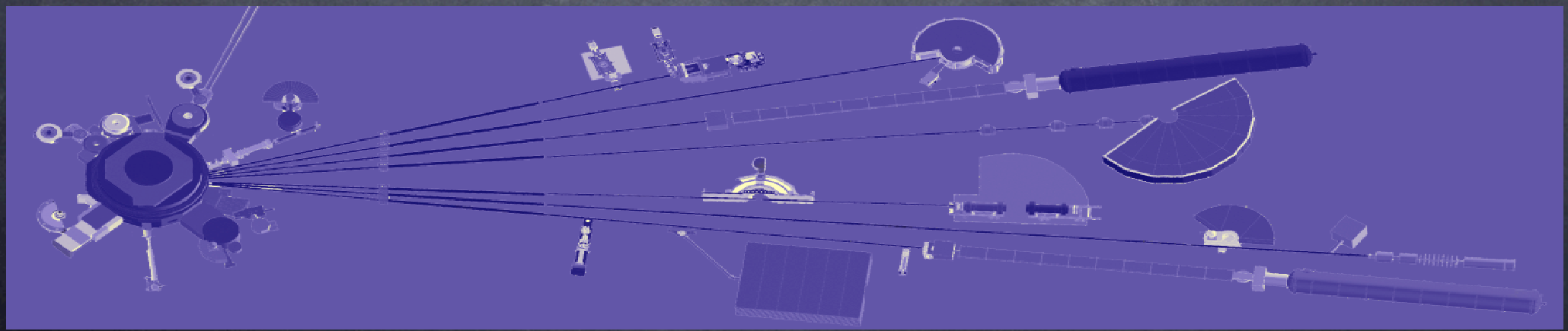
Neutron Spin Echo

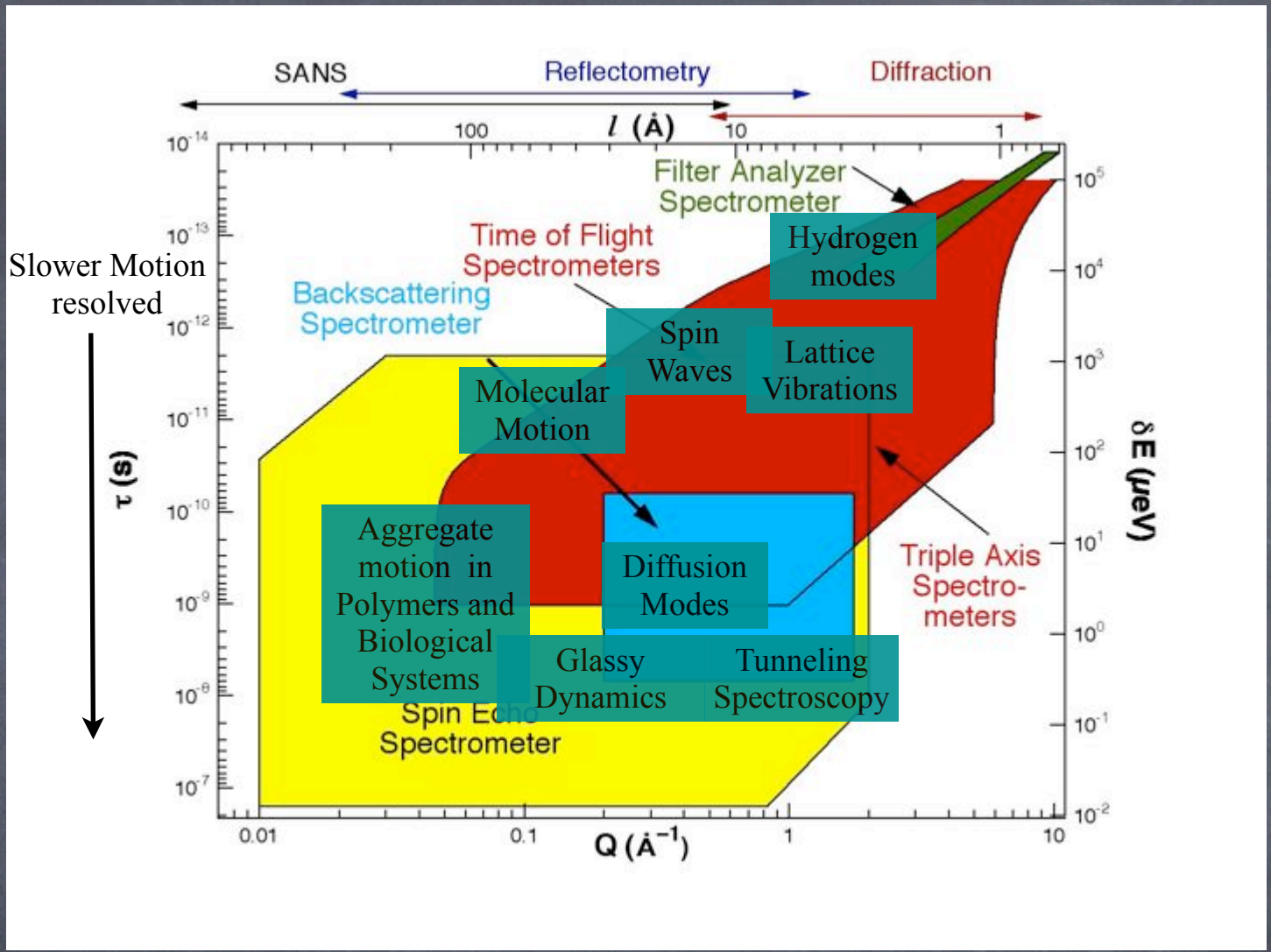
NCNR Summer School on Methods

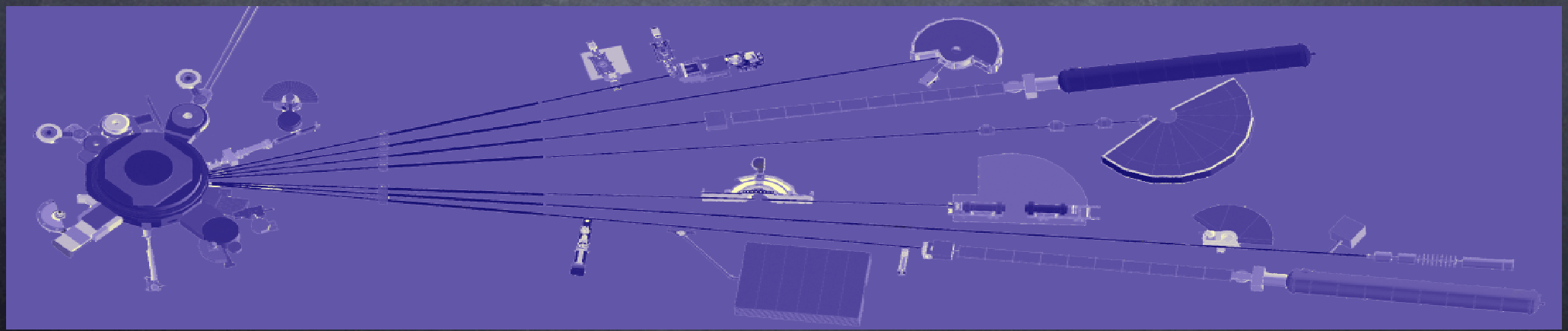
and Applications of Neutron Spectroscopy

June 25-29, 2007


SANS
Reflectometry
Diffraction
l (Å)
100
10
1
Filter Analyzer Spectrometer
Time of Flight Spectrometers
Backscattering Spectrometer
Triple Axis Spectro-meters
Spin Echo Spectrometer
Slower Motion resolved
τ (s)
δE (μeV)
Q (Å⁻¹)
0.01
0.1
1
10

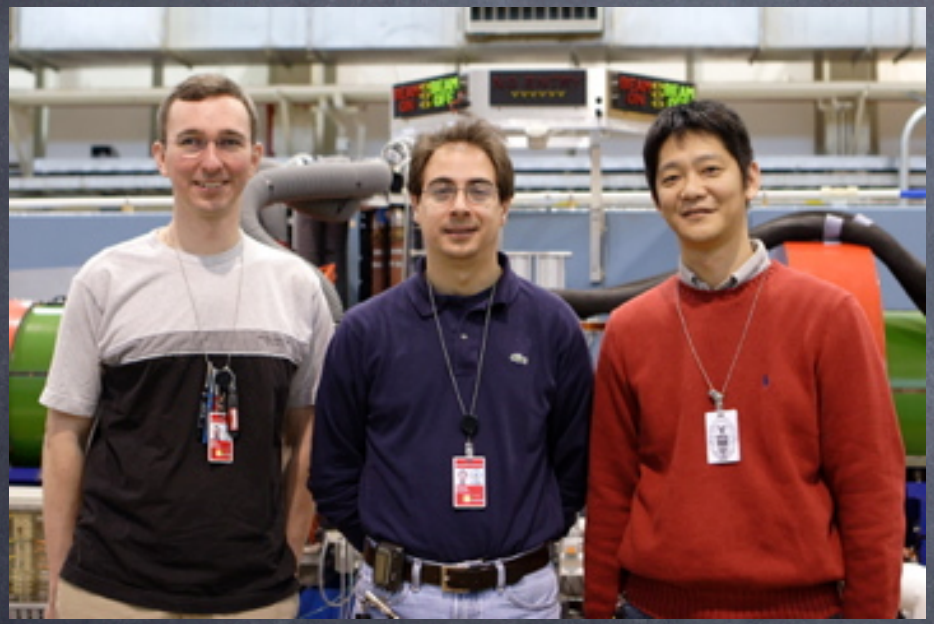



SANS
Reflectometry
Diffraction
l (Å)
100
10
1
Slower Motion resolved
τ (s)
Filter Analyzer Spectrometer
Time of Flight Spectrometers
Backscattering Spectrometer
Hydrogen modes
Spin Waves
Lattice Vibrations
Molecular Motion
Aggregate motion in Polymers and Biological Systems
Diffusion Modes
Triple Axis Spectro-meters
Glassy Dynamics
Tunneling Spectroscopy
Spin Echo Spectrometer
δE (μeV)
Q (Å⁻¹)
0.01
0.1
1
10

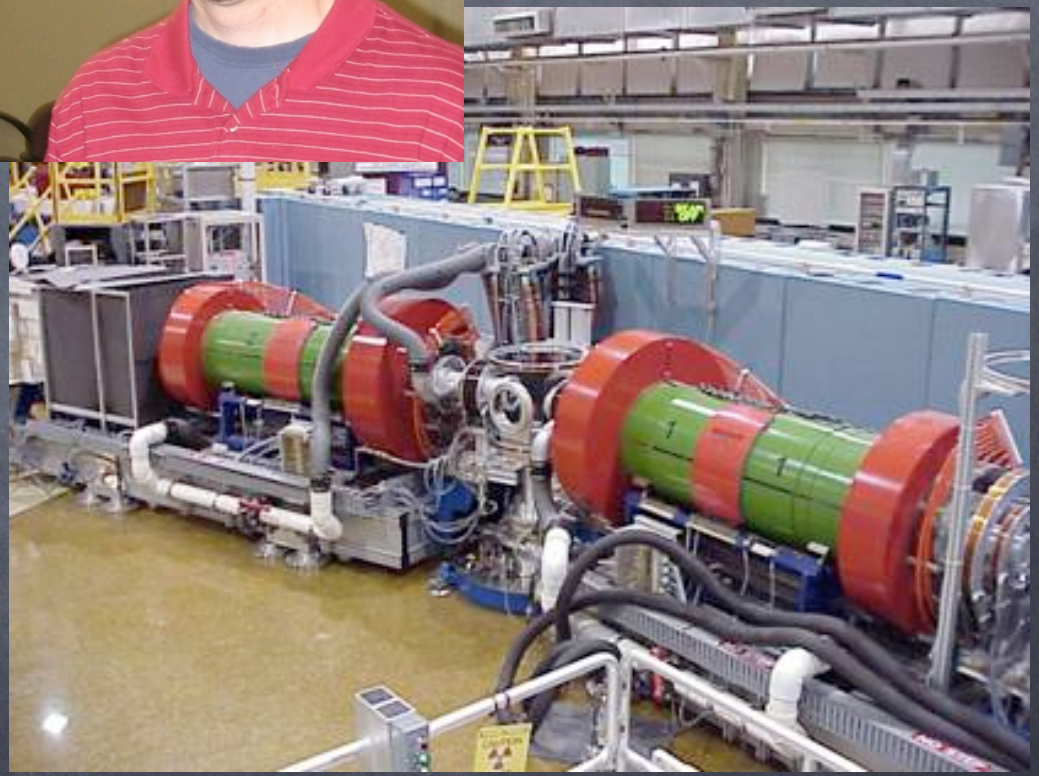


Neutron Spin Echo Team

Jason S Gardner
Antonio Faraone
Michihiro Nagao



Larry Kneller



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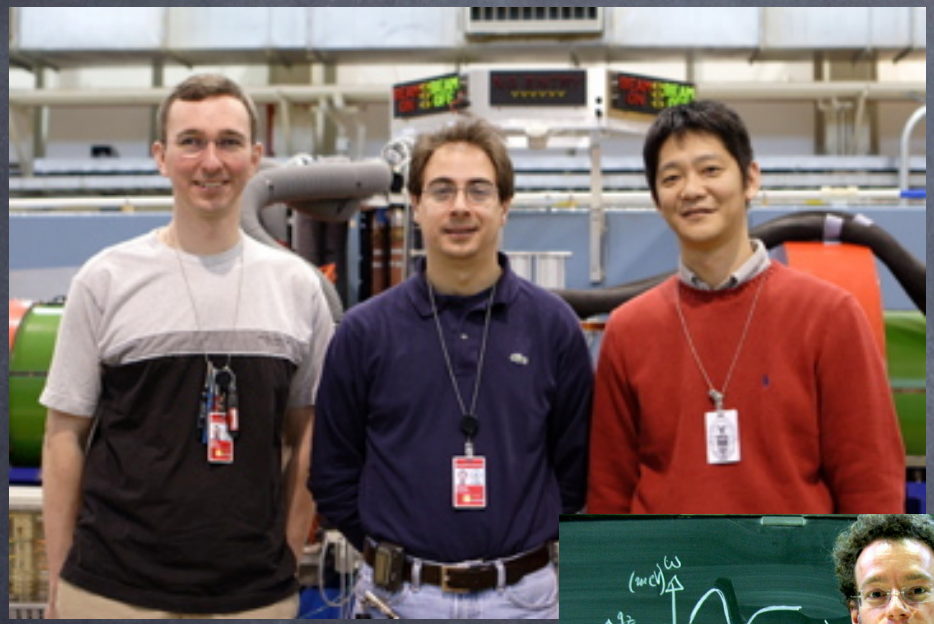
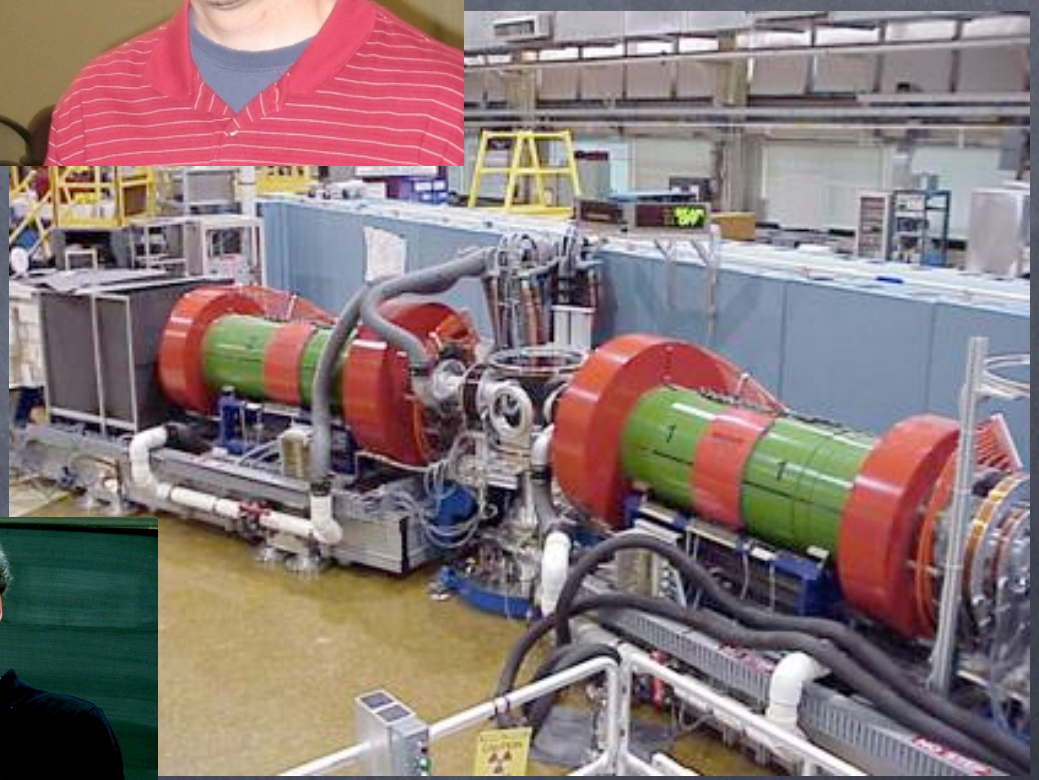
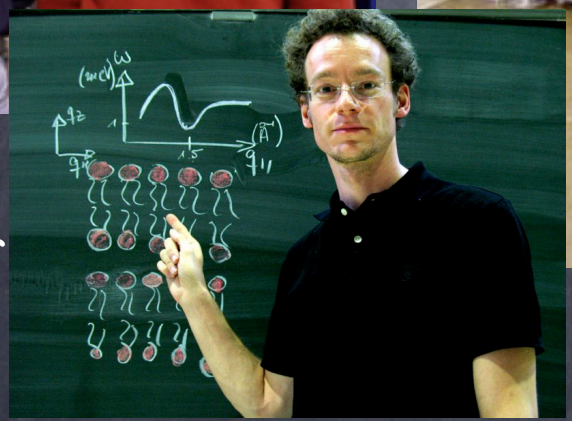




Special Guest
Maikel Rheinstädter
(Missouri)



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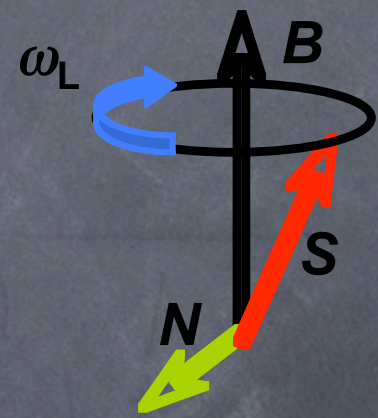
SPIN ECHO PRINCIPLE

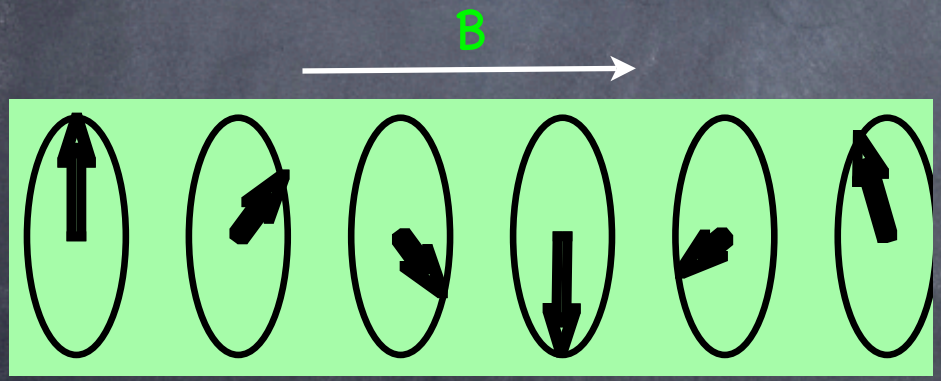
Neutrons posses spin and magnetic moment. They precess in magnetic fields with the Larmor frequency that depends on the strength of the magnetic field only. (g =1.83x10^{8} s^{-1}T^{-1})

$$N = S \times B$$

$$\omega_L = gB$$



The neutron spin (**S**) experiences a torque (**N**) from a magnetic field (***B***) perpendicular to its spin direction



φ = 0 φ = π φ = gB(L/v)

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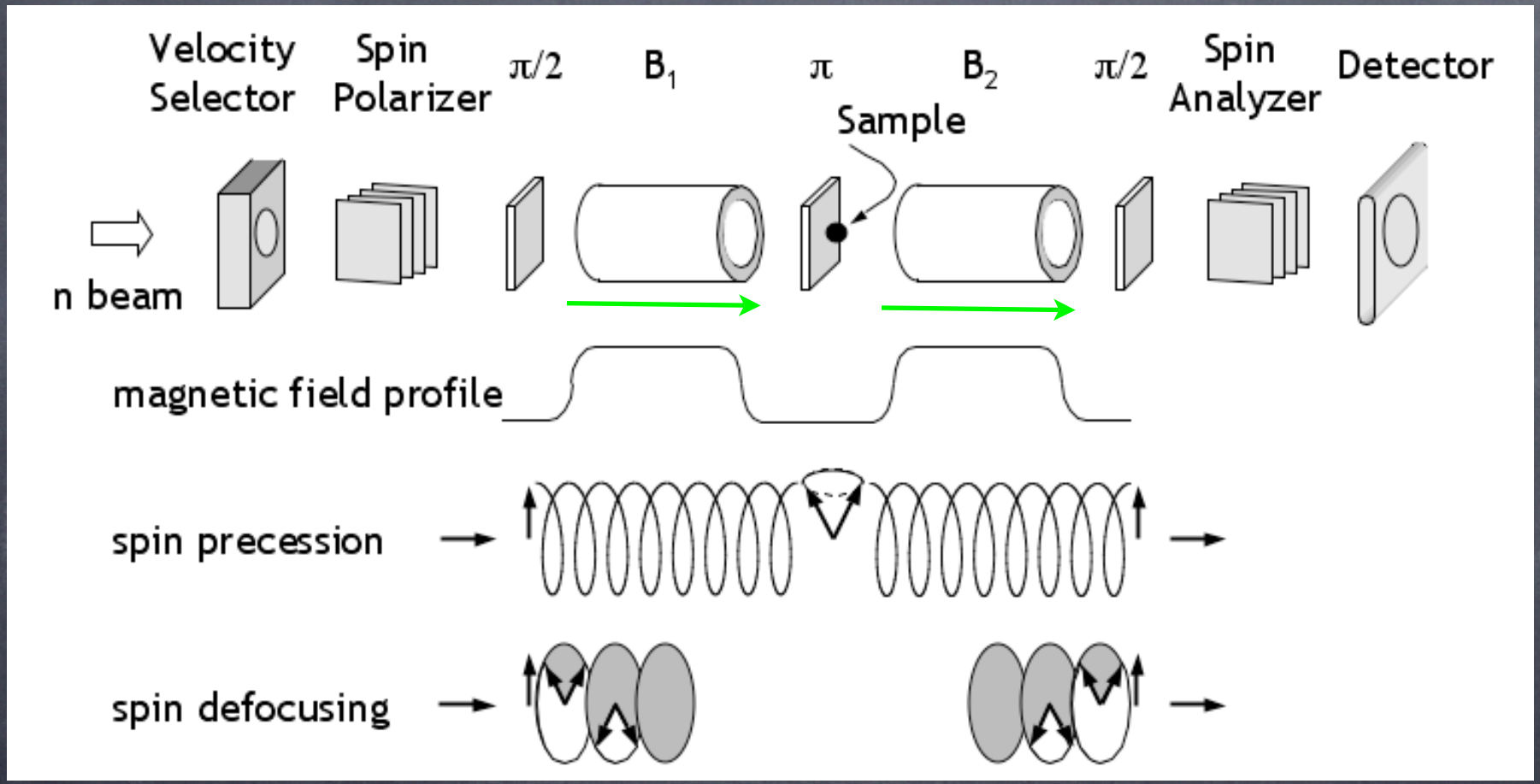
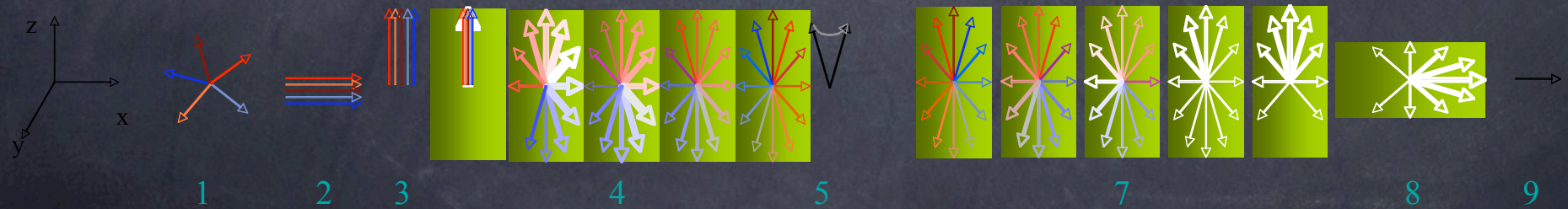
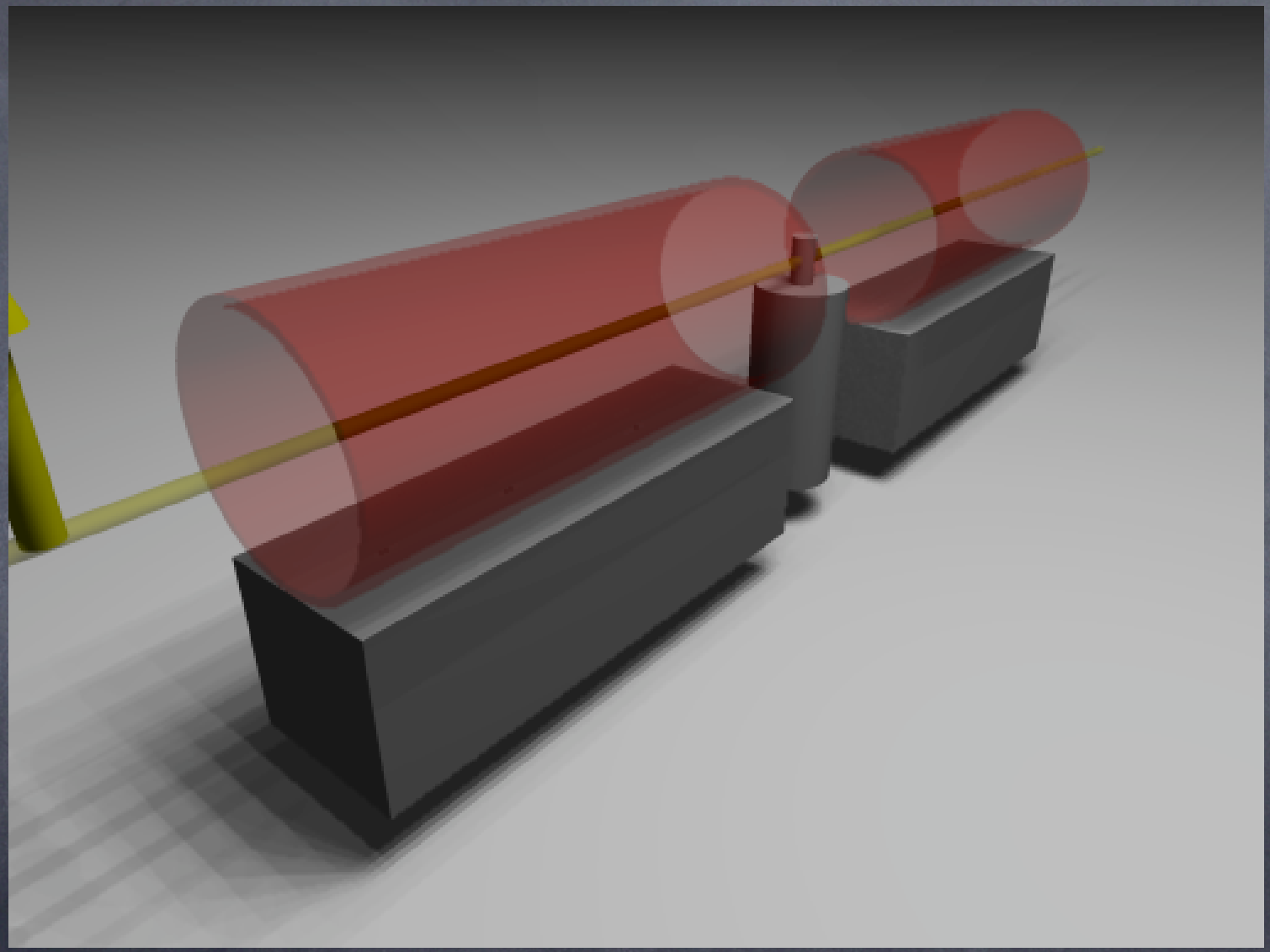
SPIN ECHO PRINCIPLE







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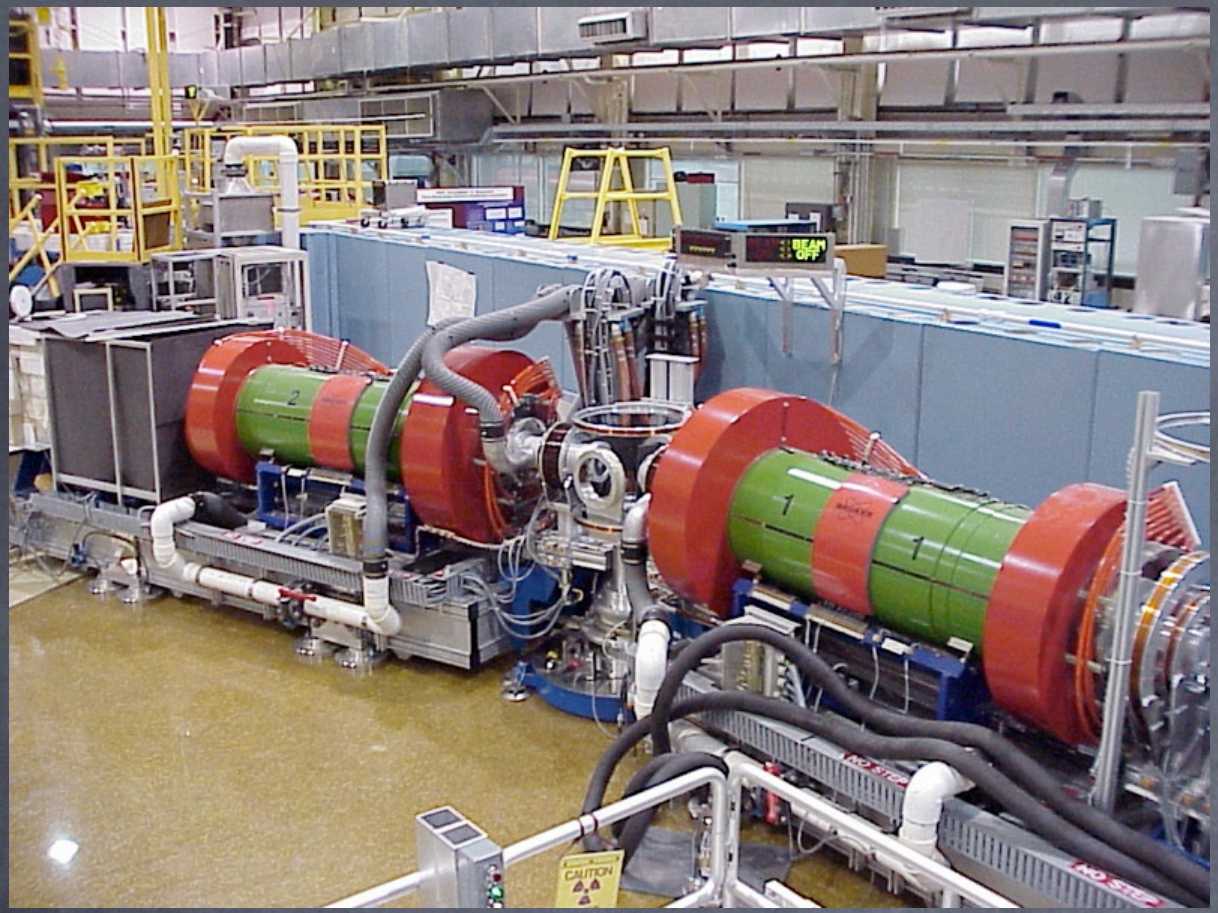

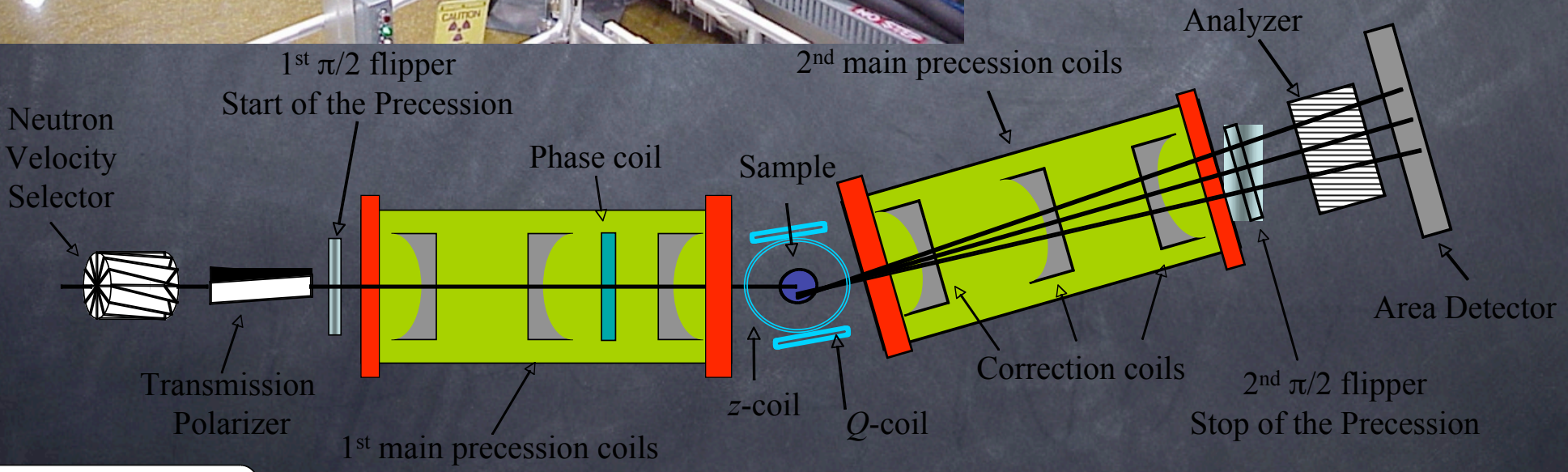

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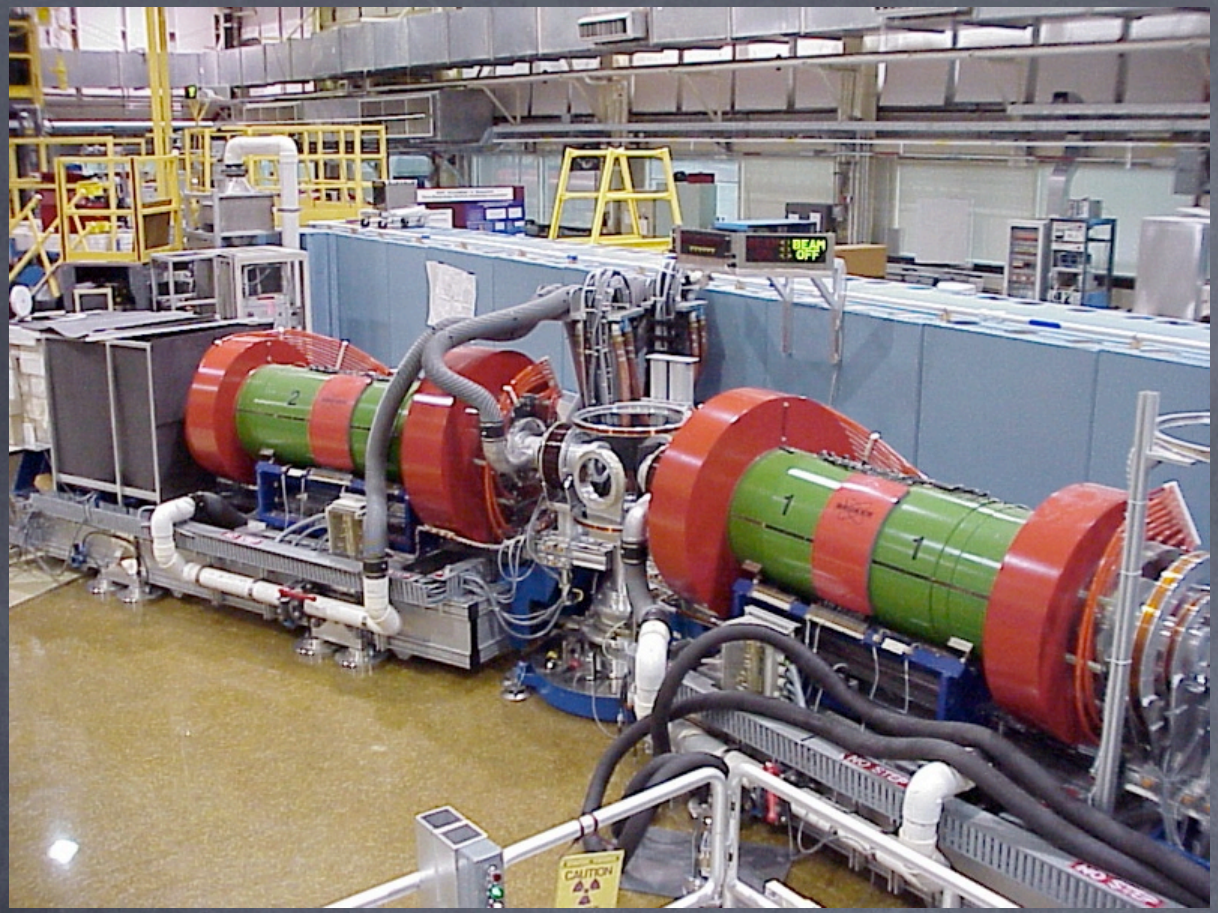

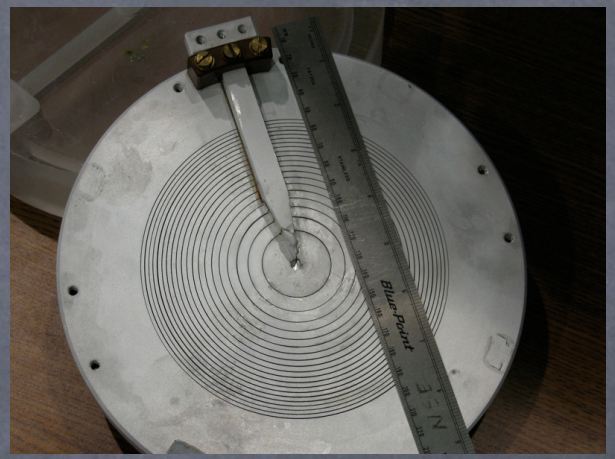

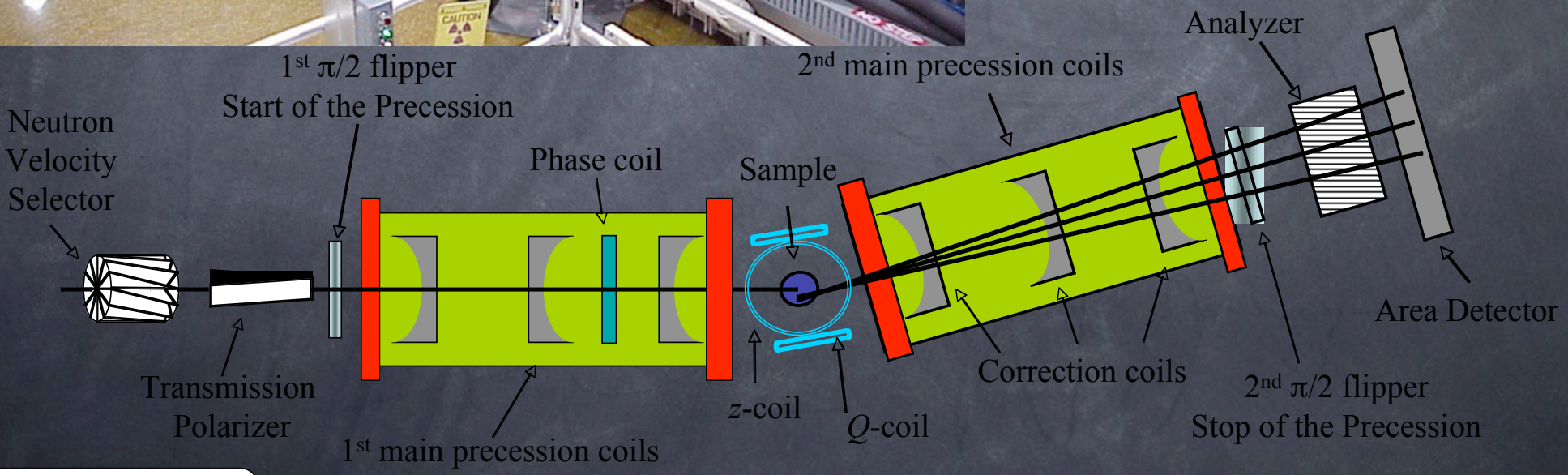

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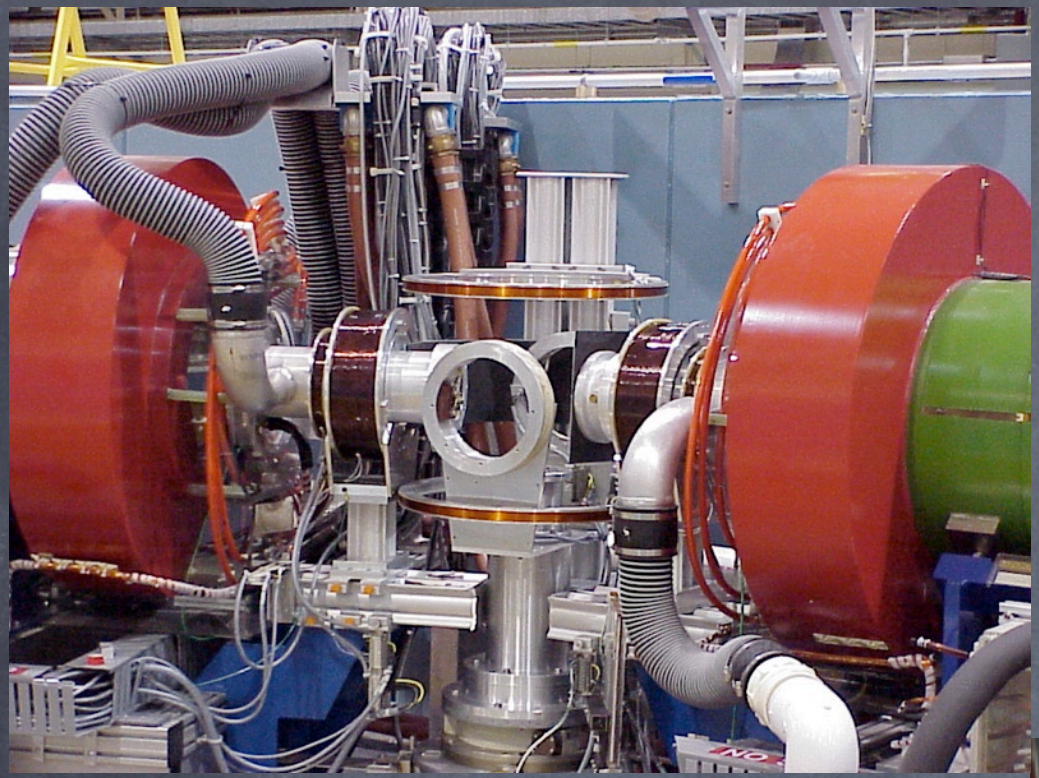
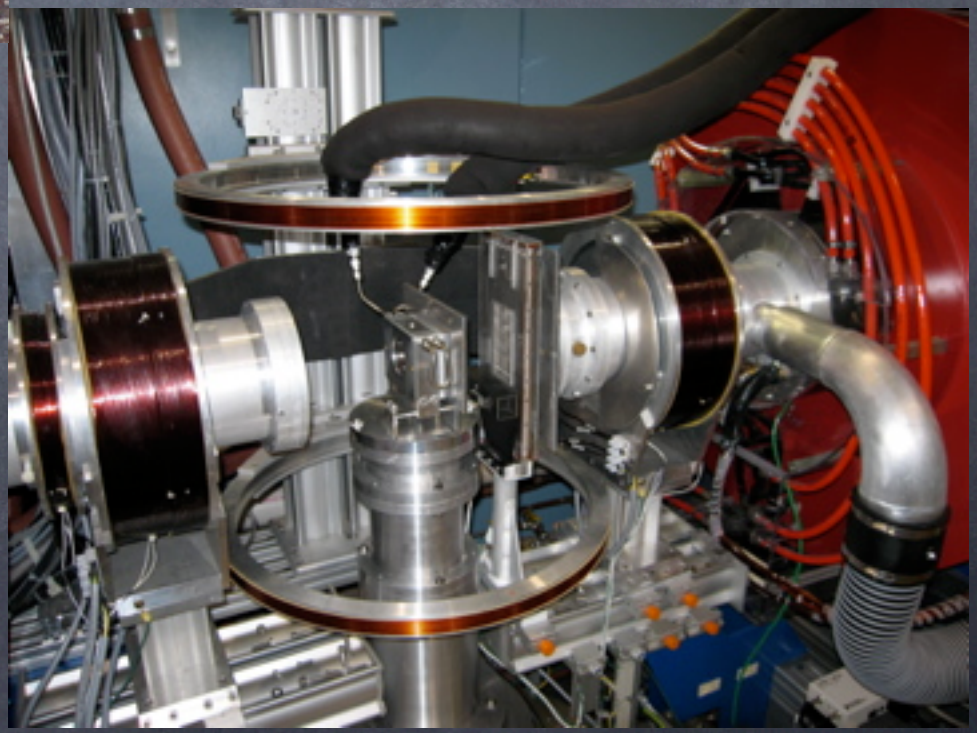


Sample position



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flipper (π or π/2)

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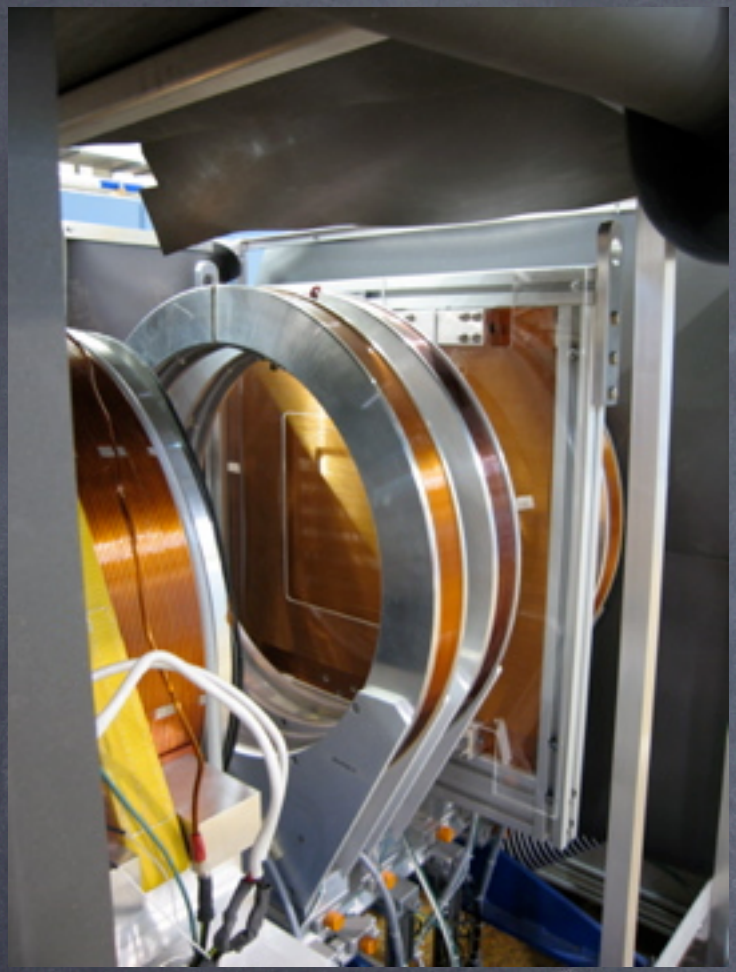

π/2 flipper in front of the detector

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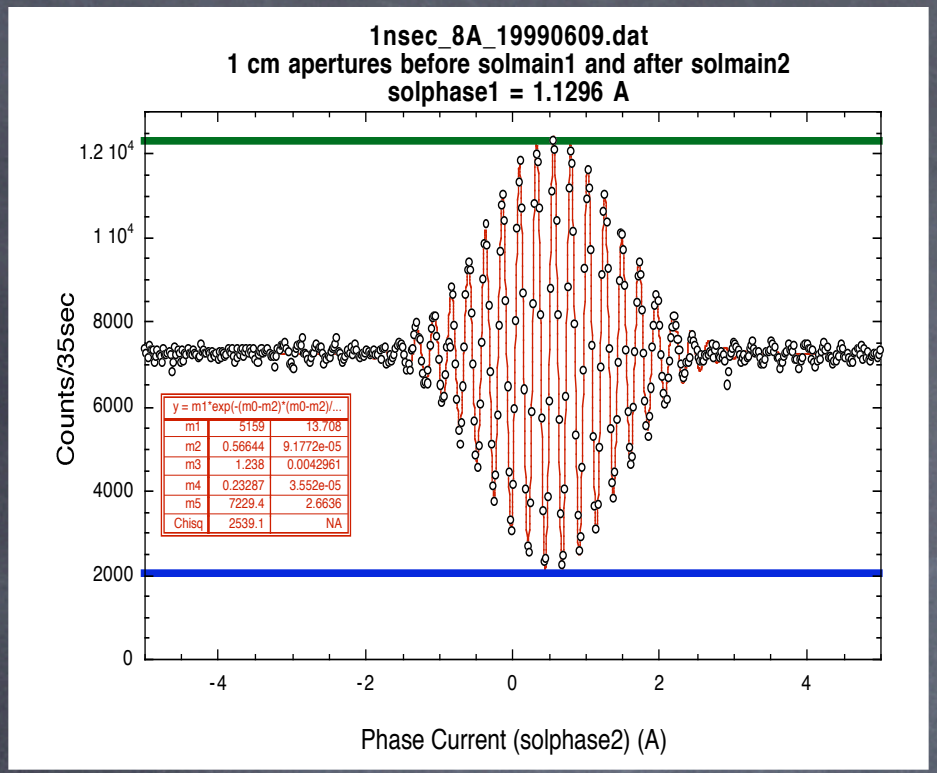
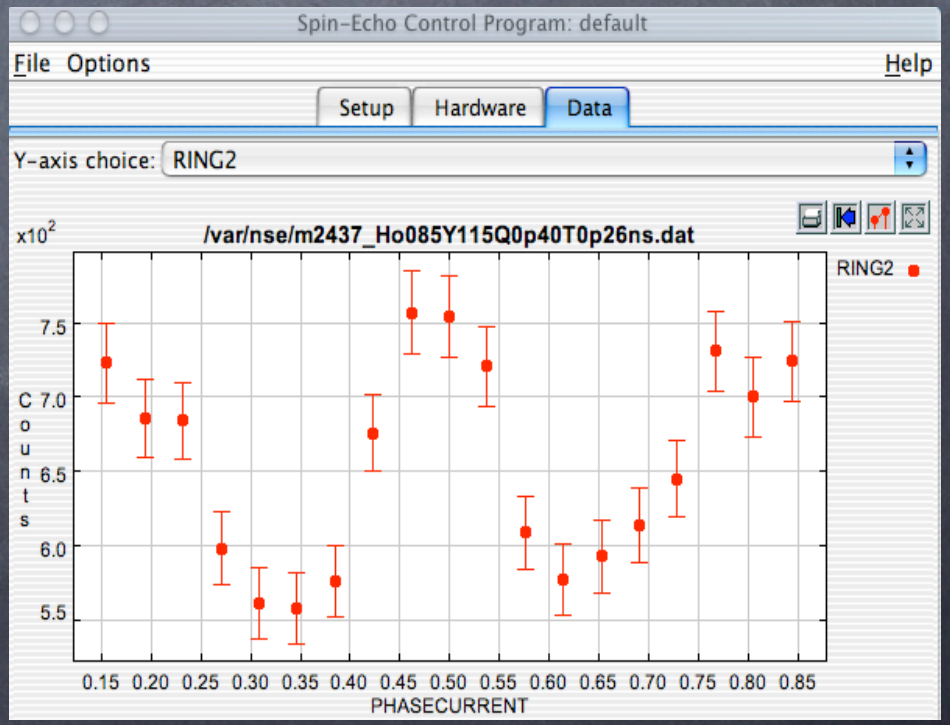
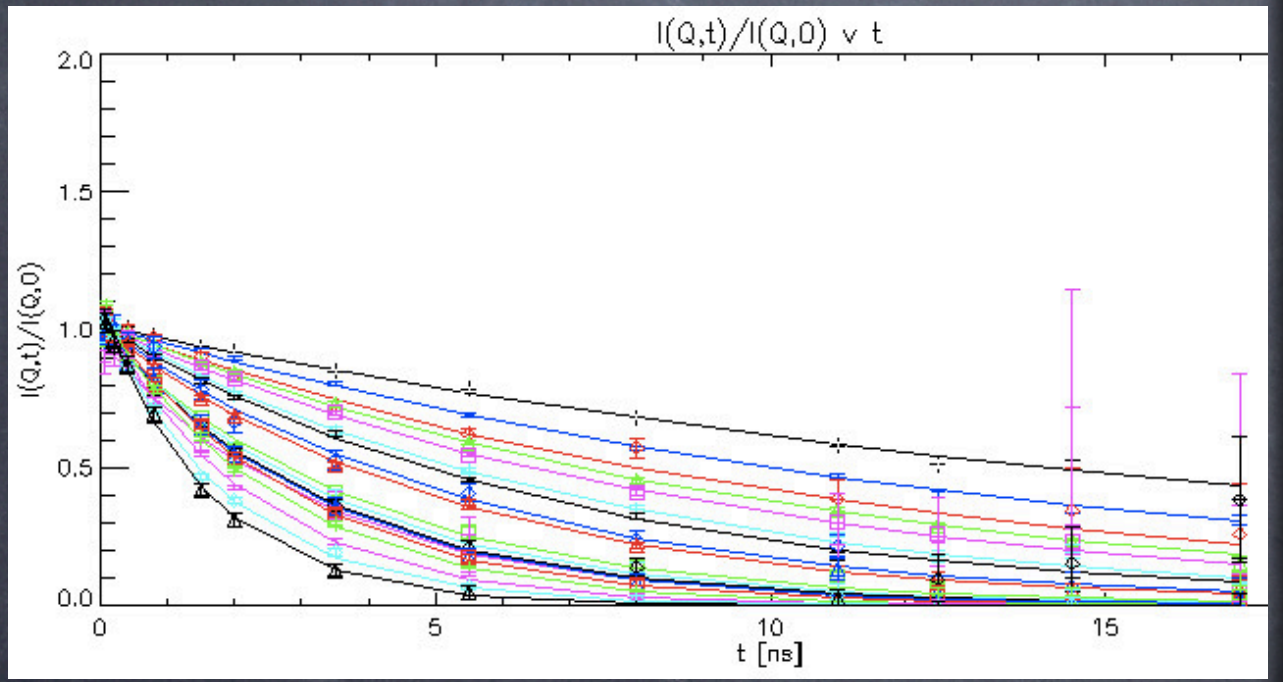
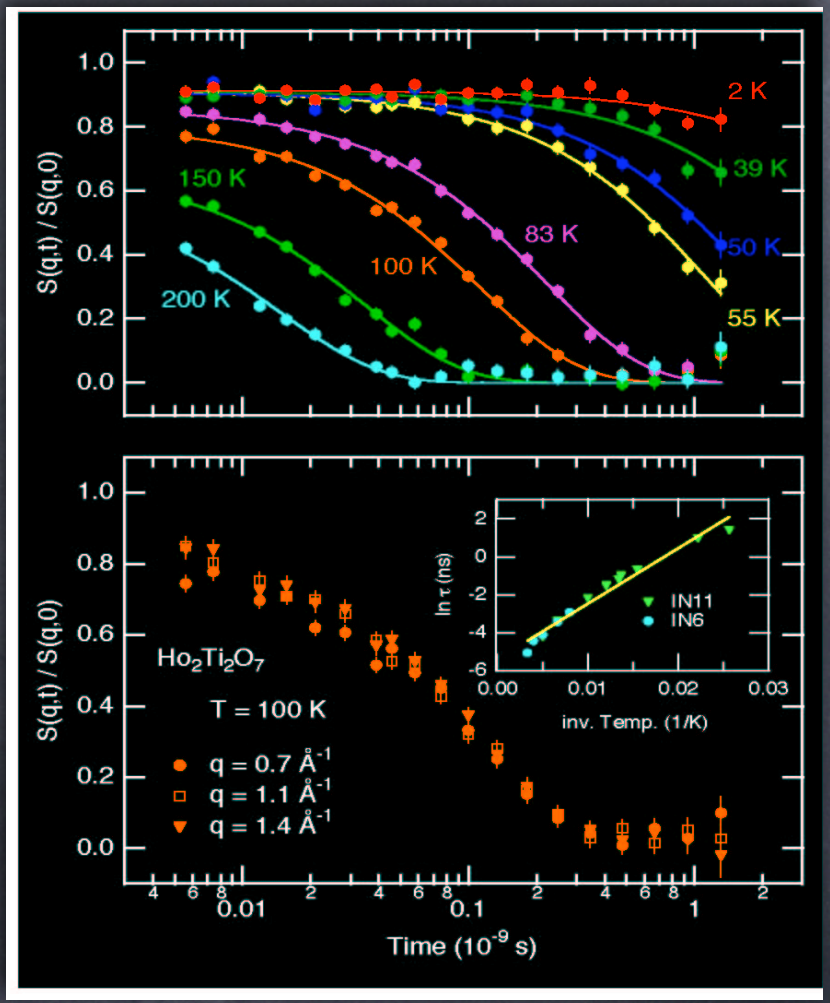

1nsec_8A_19990609.dat
1 cm apertures before solmain1 and after solmain2
solphase1 = 1.1296 A
Counts/35sec
Phase Current (solphase2) (A)
y = m1*exp(-(m0-m2)*(m0-m2)/...
m1 5159 13.708
m2 0.56644 9.1772e-05
m3 1.238 0.0042961
m4 0.23287 3.552e-05
m5 7229.4 2.6636
Chisq 2539.1 NA

Echo-point†


Spin-Echo Control Program: default
File Options
Help
Setup
Hardware
Data
Y-axis choice: RING2
x10^2
/var/nse/m2437_Ho085Y115Q0p40T0p26ns.dat
RING2
Counts
PHASECURRENT

NSE Results


I(Q,t)/I(Q,0) v t
I(Q,t)/I(Q,0)
t [ns]


S(q,t) / S(q,0)
2 K
39 K
150 K
83 K
50 K
100 K
55 K
200 K
Ho2Ti2O7
T = 100 K
q = 0.7 Å-1
q = 1.1 Å-1
q = 1.4 Å-1
ln τ (ns)
IN11
IN6
inv. Temp. (1/K)
Time (10-9 s)

GOOD LUCK AND ENJOY

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