Erdfeld-NMR Remote

Physikalisches Fortgeschrittenenpraktikum an der Universität Konstanz

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Abstract

TEXT

Alle Autoren haben zu jedem Abschnitt wesentliche Beiträge geleistet. Die Autoren bestätigen, dass sie die Ausarbeitung selbstständig verfasst haben und alle genutzten Quellen angegeben wurden.

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3 Noisemeasurement

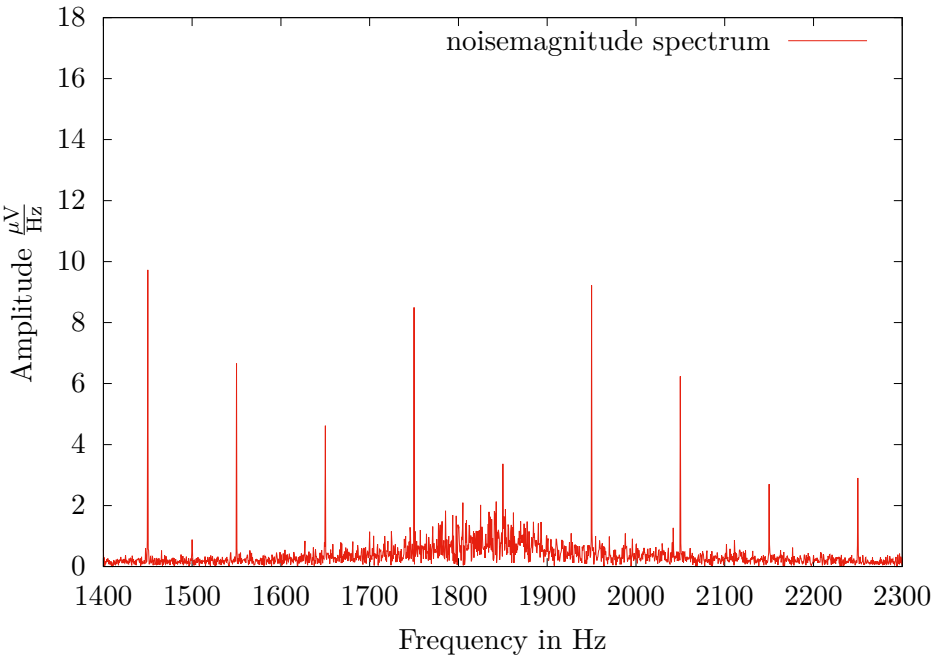

Figure 3.1: ask: which range should we plot -> y:12;
why is there an maximum at around 1850 Hz-> resonance frequency -> 50 Hz is electric noise; why 1550 stronger than 1500 (harmnoic): instrument sensitvity because lamorefrequency is nearby and here its most sensitive
sharp peaks come from electric noise. how exactly? Johnson-Noise or shot noise? ->50 Hz is electric noise
in comparison to 14.2 nF capacity the magnitude doesn´t change. Is this important?
Noise level of 14.2 nF is 7.6 μV and of 13.8 nF it is 7.5 μV. Is that the reason? What is noise level?

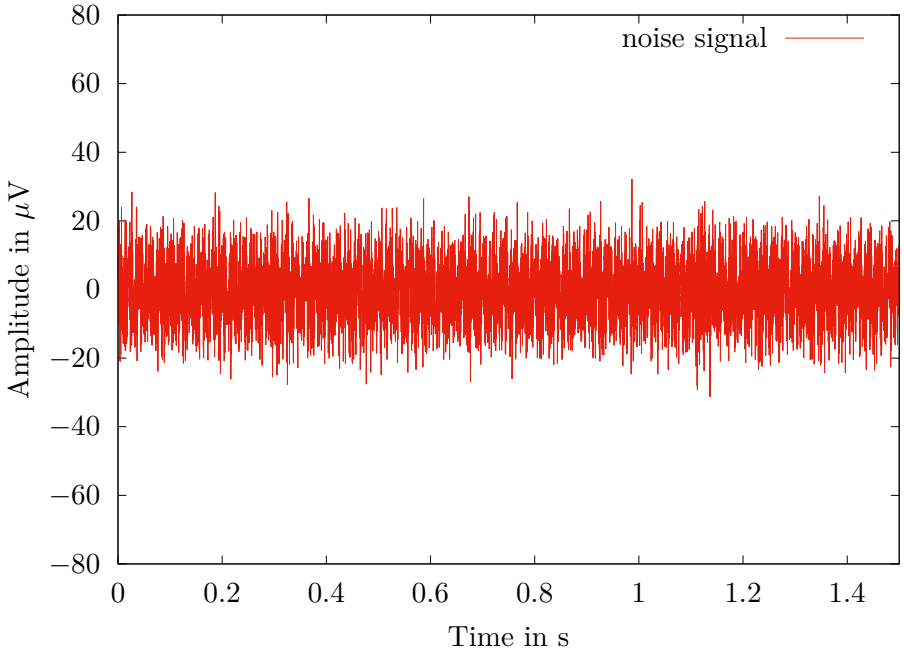

Figure 3.2: average cero, root square -> flip it positive

4 Coil Analysis

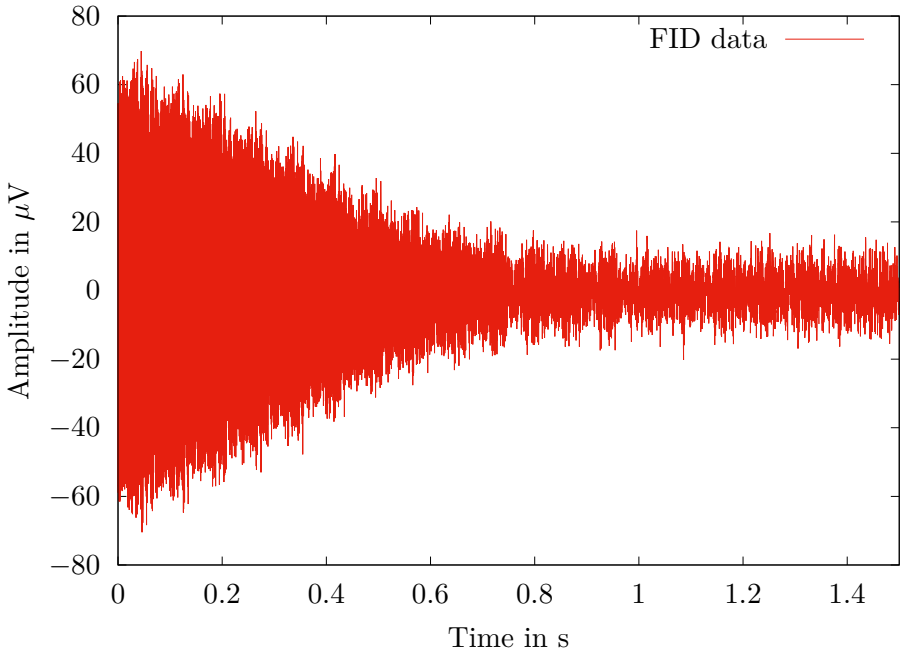

Figure 4.1: ask: is it ok to plot examplarly one signal and explain how it works and later on there will just be the spectra

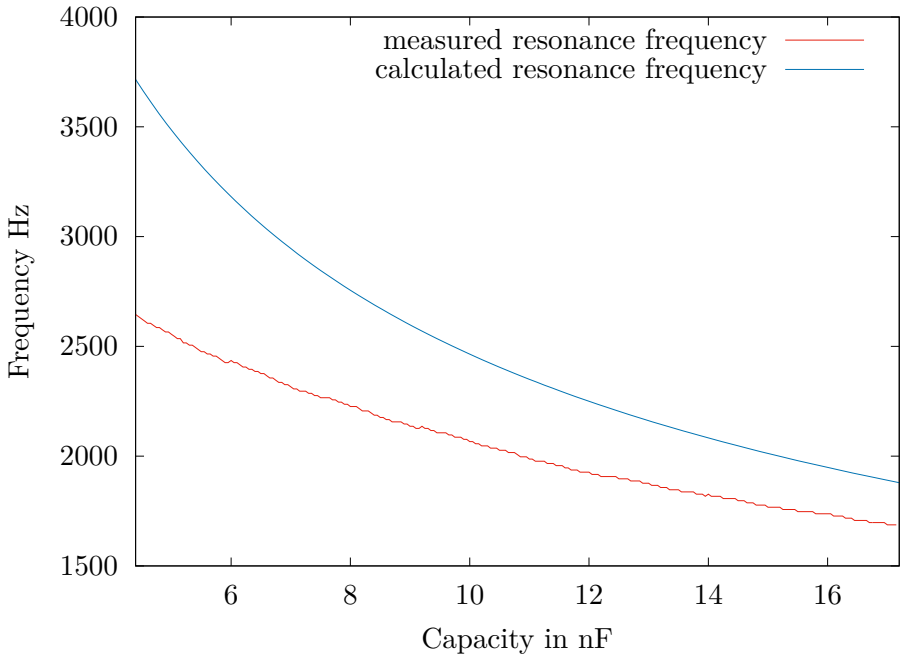

Figure 4.2: ask: who do we calculate lamorfrequency (1834) -> show excel. Vertical compnent? -> yes
why is calculated curve different to measured curve? maybe L is wrong or something else. -> L probably changes with C -> discuss it; try corrections (increase current -> heating effects; L changes)

5 Optimization and Characterisation of FID in water sample

insert previous values

ask: is it ok to explain what autoshim does and don´t plot any graphs at all? We don´t have data for an example plot -> yes

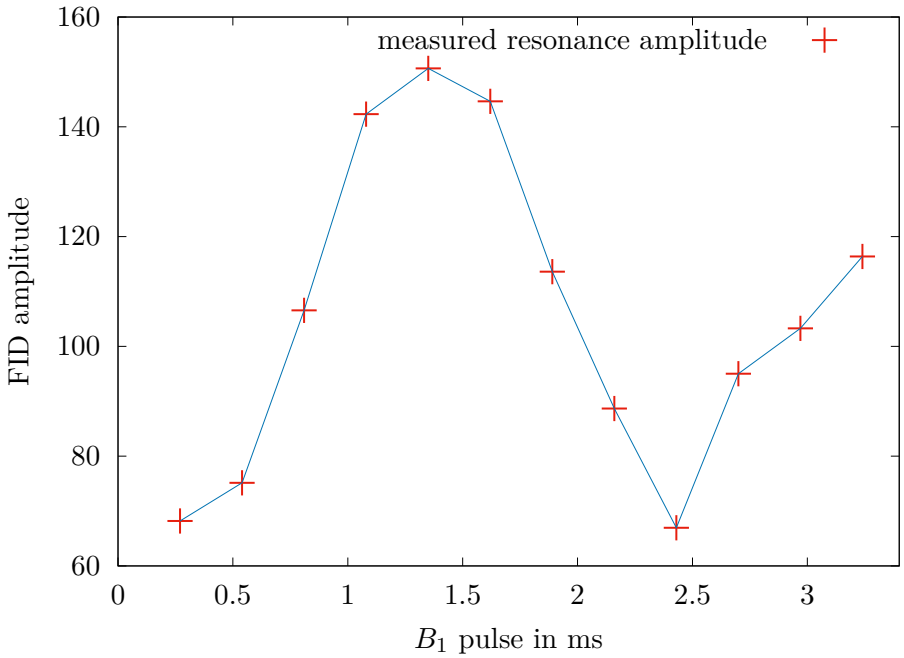

Figure 5.1: ask: periodicity due to duration of B_1, 0° -> 90° -> 180° -> 270°? -> yes

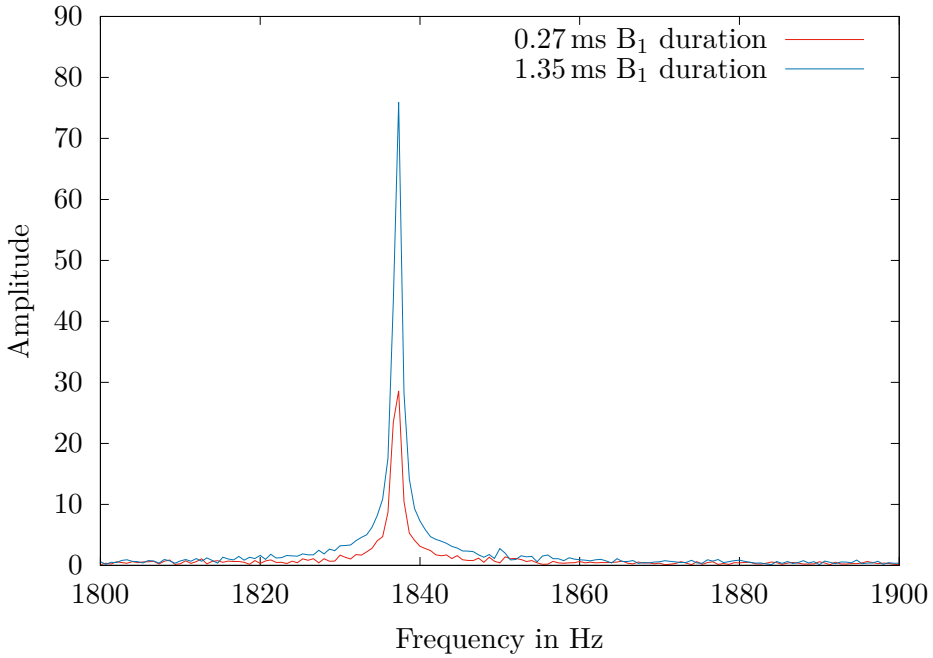

Figure 5.2

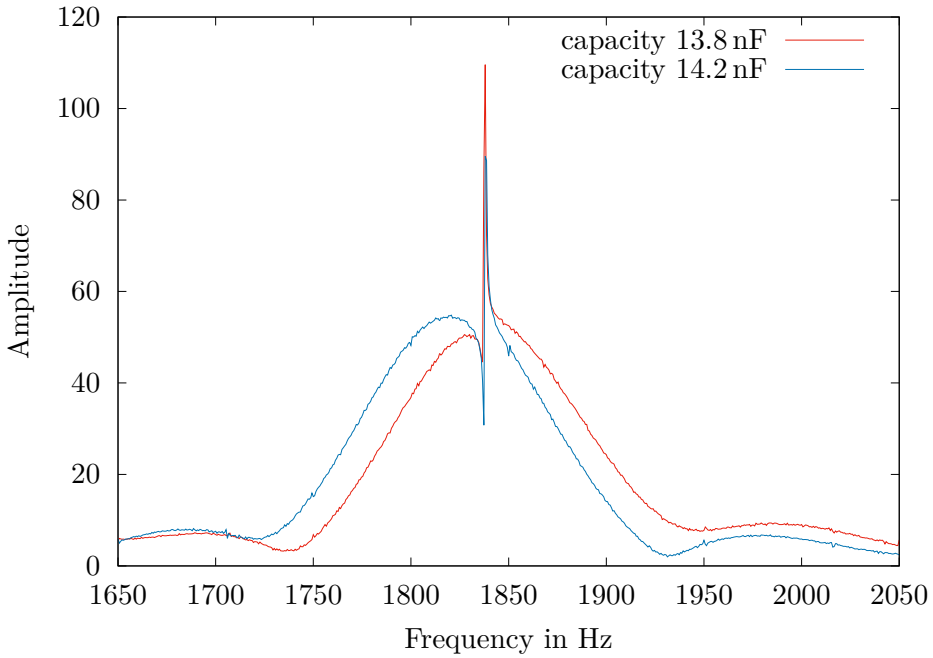

Figure 5.3: ask: what is the peak corresponding? hydrogen signal? -> yes

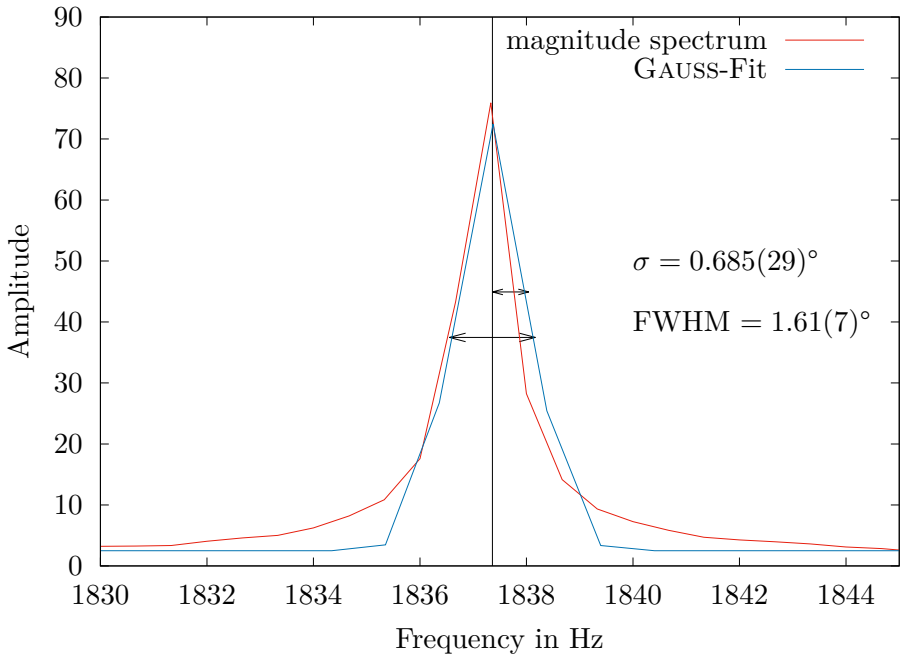

Figure 5.4: ask: gauss or voigt. this is gauss -> both
longer acquisition 25 ms -> only hydrogen siganal? is the peak the same than in the previous diagramm? -> yes
integral under curve with our measured fit? -> try to find soemthing, try shorter range and more points
signal to noise ratio: what to do? -> magnitude, which unit is the amplitude, tutor will send us an email, try back fouriertransform (only keep real values)
calculate: amplitude; crossbar for datapoints
sometimes 1/e sometimes 1/2 -> definition

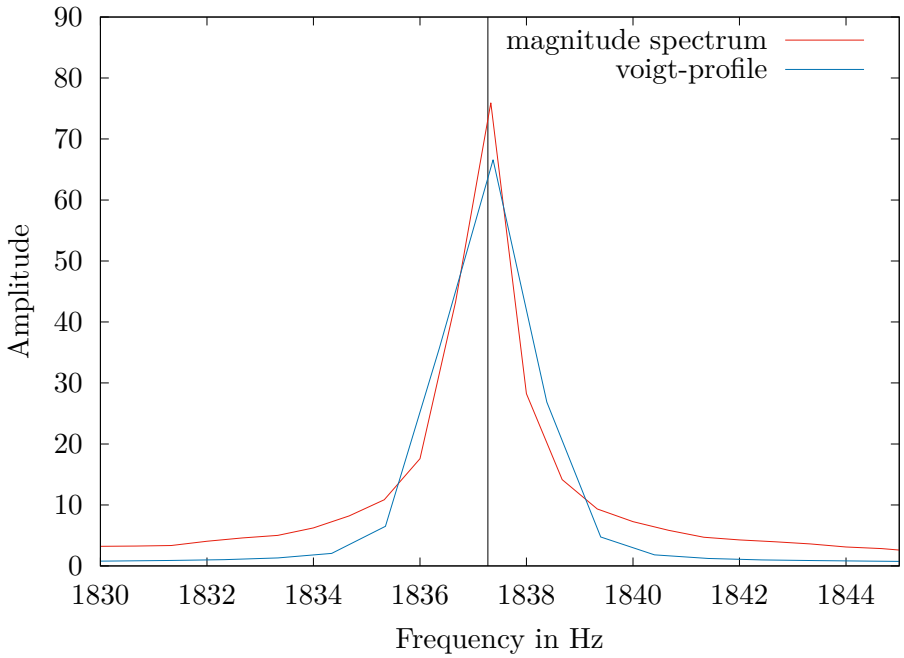

Figure 5.5: ask: gauss or voigt. this is voigt

real and imaginary signal -> explain it

6 Longitudinal relaxation measurements T1

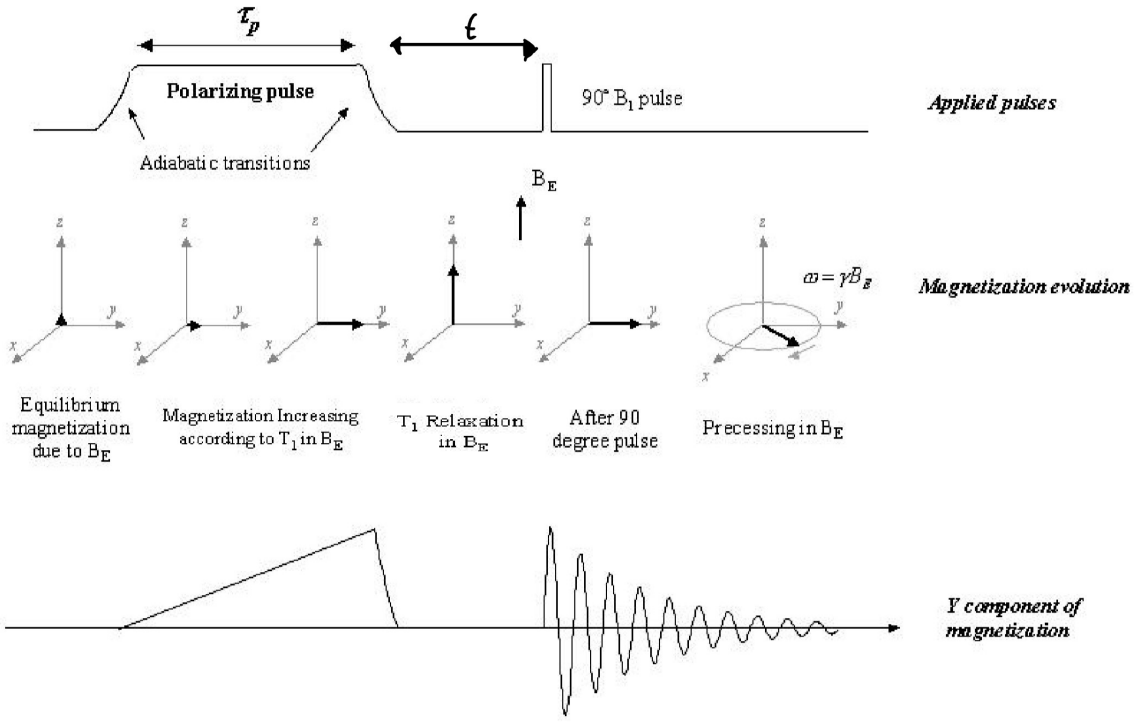

Figure 6.1: Anleitung von T Messung [**?**]

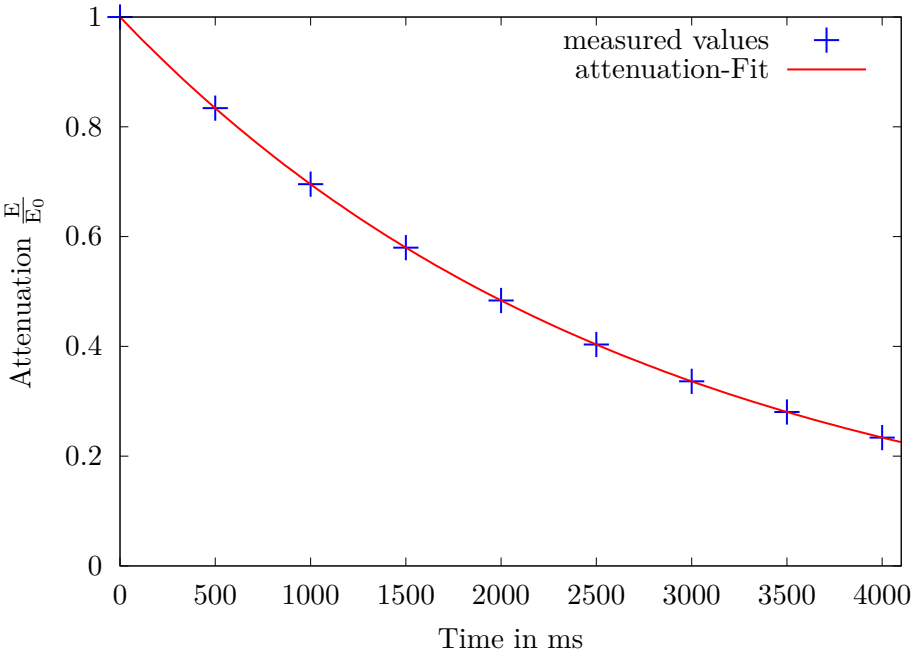

Figure 6.2: explain what happens; $S_0 * exp(-x/T_1)$ mit $T_1 = 2753.05\,\text{ms}$

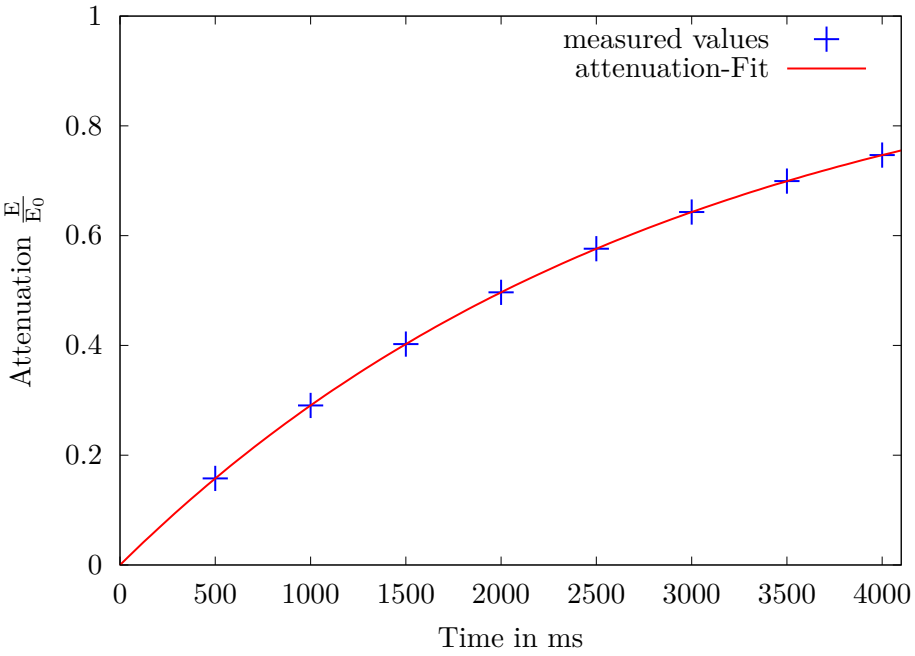

Figure 6.3: explain what happens. wieso 0.2 überall unterschied -> longer x-Axes, more datapoints; $S_0 * [1 - exp(-x/T_1)]$ with $T_1 = 2912\,88ms$

7 Hahn echo

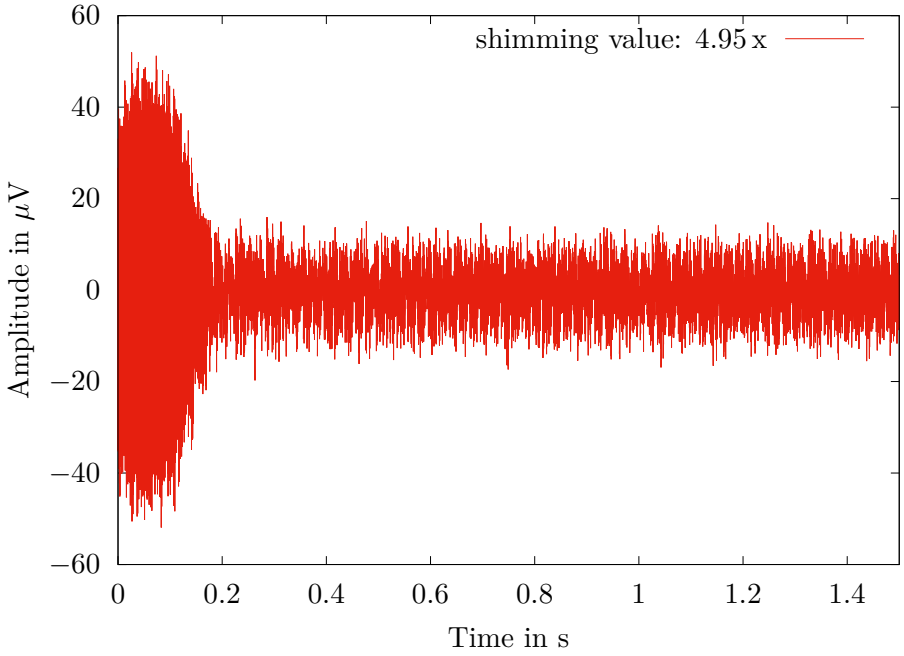

Figure 7.1: ask: wie safed no data for differnet τ, is it ok just to explain it that the amplitude will decrease and the maximum will be shifted to a different time? -> yes

this is an example for a hahn echo with shimming value 4.95 x.

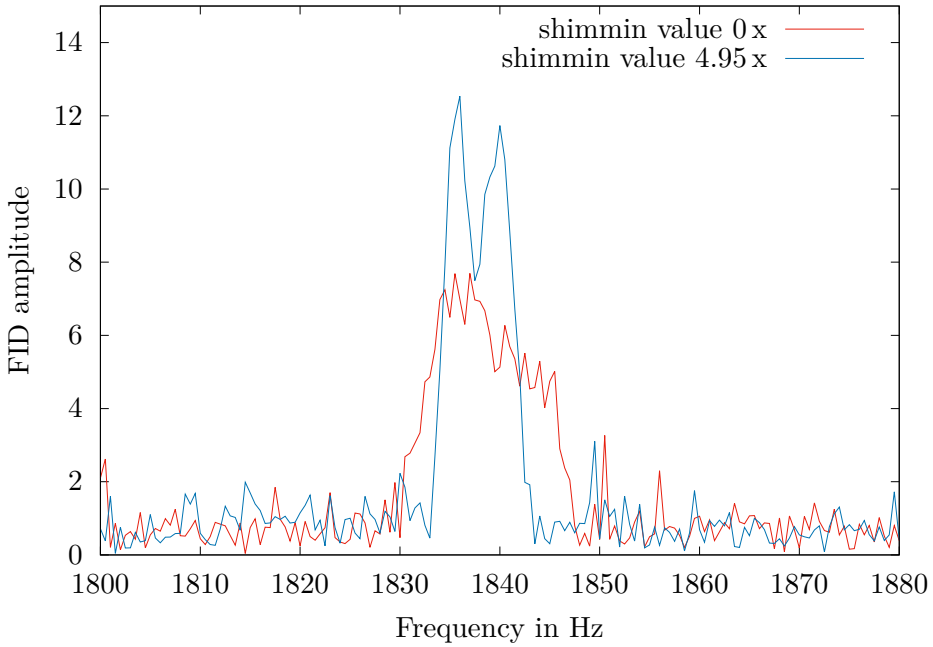

Figure 7.2: ask: why are there different peaks a different shimming values?-> more frequency is sean (random) depends on position
which formula should we use to fit it? -> area under normalized spectrum should be the same; just discuss it -> narinder will send email

for us: wieso signal schwächer-> mehr abweichung beim shimming (ursprünglich 10.11)-> abschwächung. integrale bei unterschiedlichen shimming; echo time 300ms bei beiden.

We can measure T_2 when we don´t change the shimming values, because T_2^* is dependent on a field inhomogeniousity. -> CPMG, Spin Hahn echo

8 Multiple echo sequences

explain timedomain -> short discussion: fucntion (sine-bell-squared function? Section 5.5.3.2) to smoothen (because it doesnt change physics)

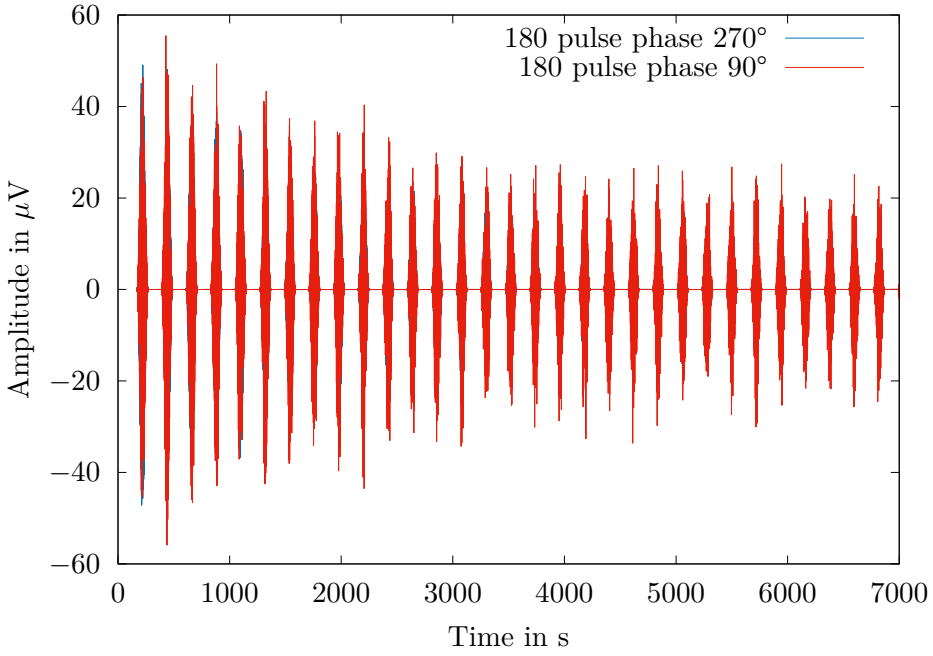

Figure 8.1: ask: what does pulse phase degree between 90° and 180° (or also between 180° and 180°) mean (Anleitung 9.)? -> minimize term of inhomogeniuos magnetic field; it is not the time between the pulses; phases
difference between alternating and constant 180° pulse phase-> alternating phase: computer does change phase degree; constant: manual change of phase degree-> look up manual for alternating; explain it
we only have data for 180 pulse phase degrees in 270° and 90°, but those two are the same and this is good, but we don´t hae values for 180° example. -> ask pther group for measuremtns at about 180 degree
we didn´t make measurements about 90 pulse phase degree

9 Transversal relaxation measurements

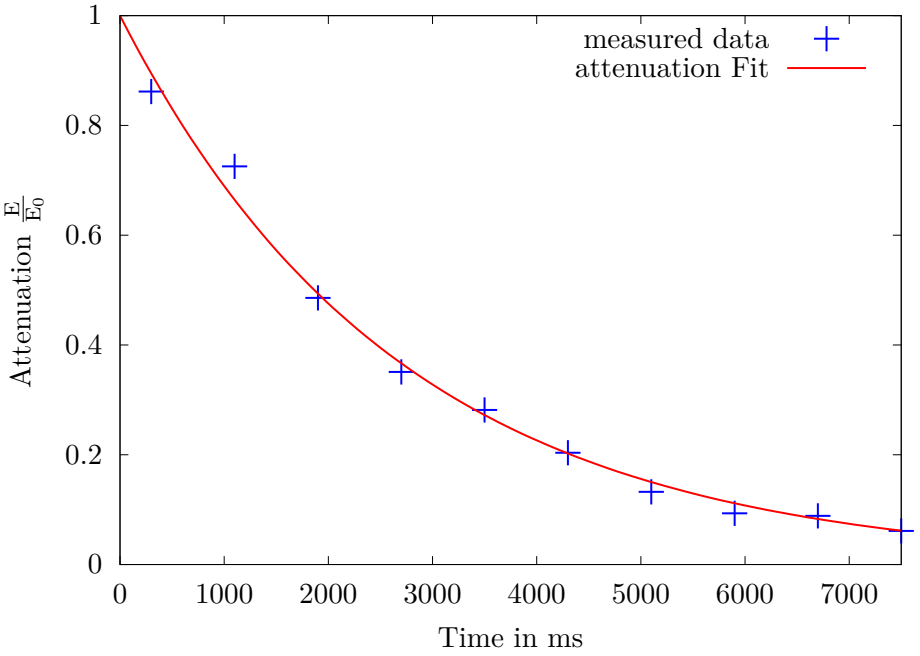

Figure 9.1: ask: why are two peaks visible in the magnitude spectrum?
normal FID-> T_2
$M(x) = M_0 \cdot exp(-x/T_2)$ with $T_2 = 2691\,06ms$

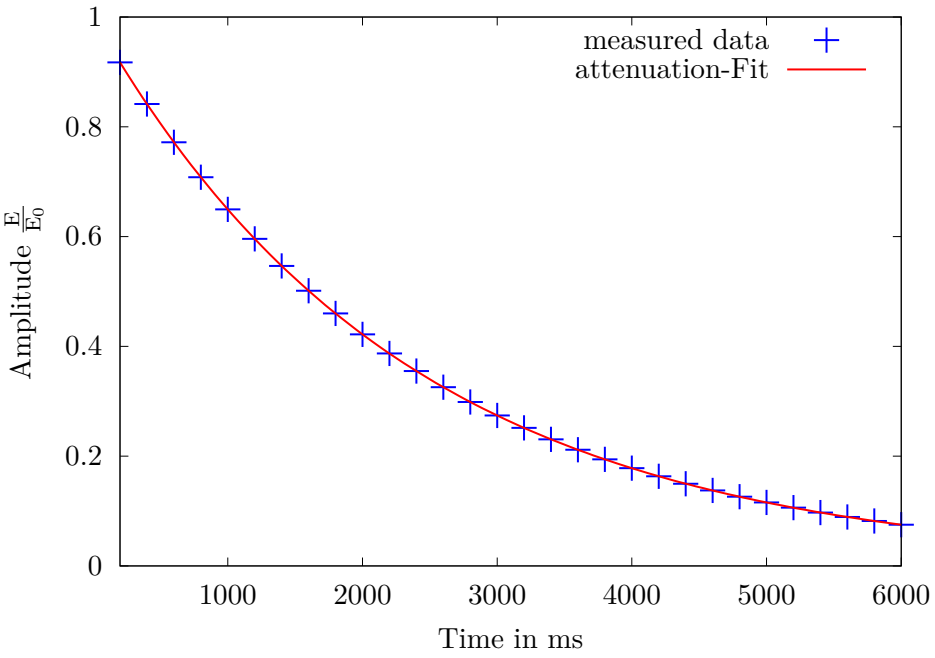

Figure 9.2: This is an CPMG with changeed values in the shimming; shimming value 0.45 x -> T_2^*.
Good to see that the T_2^* is here shorter than in the previous picture, due to inhomogeniousity of the magnetic field.
$M(x) = M_0 \cdot exp(-x/T_2)$ with $T_2 = 2317.76\,\text{ms}$

10 Fehlerdiskussion und Fazit

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