

## 1 EFNMR2 (1.5h)

### 1.1 Relaxation measurements with paramagnetic ions

#### Parameters

Shimming values	x = 10.11 mA; y = 20.88 mA; z = 20.07 mA
Tuning the probe	Kapazität: 13.8 nF; Polarisationsstrom: 6A; Receiver gain: 2; transmit gain (B1): 2.5
Setting B1 to lamor frequency	1837 Hz
duration 90 and 180 pulse	90 Grad: 1.35 ms; 180 Grad: 2.7ms

Benutze Probe:

CuSO<sub>4</sub> doped water (3000 $\mu$ M) of CUSO<sub>4</sub>

**Durchführung**

- 1.1 Pulse and Collect (EFNMR menu):  
water sample (FID und Spektrum) Polarisationszeit 4s
- 1.2 Pulse and Collect (EFNMR menu):  
water sample (FID und Spektrum) kürzere polarisationszeit (500ms)
- 2.1 Pulse and Collect (EFNMR menu):  
doped water sample (FID und Spektrum) Polarisationszeit 4s
- 2.2 Pulse and Collect (EFNMR menu):  
doped water sample (FID und Spektrum) kürzere polarisationszeit (500ms)
- 3.1 T2 Messung: 250  $\mu$  M in 500ml Wasser
- 3.2 T1 Messung (Polarisationsfeld): 250  $\mu$  M in 500ml Wasser
- 3.3 T1 Messung (Erdfeld): 250  $\mu$  M in 500ml Wasser
- 4.1 T2 Messung: 550  $\mu$  M in 500ml Wasser
- 4.2 T1 Messung (Polarisationsfeld): 550  $\mu$  M in 500ml Wasser
- 4.3 T1 Messung (Erdfeld): 550  $\mu$  M in 500ml Wasser
- 5.1 T2 Messung: 1000  $\mu$  M in 500ml Wasser
- 5.2 T1 Messung (Polarisationsfeld): 1000  $\mu$  M in 500ml Wasser
- 5.3 T1 Messung (Erdfeld): 1000  $\mu$  M in 500ml Wasser
- 6.1 T2 Messung: 2000  $\mu$  M in 500ml Wasser
- 6.2 T1 Messung (Polarisationsfeld): 2000  $\mu$  M in 500ml Wasser
- 6.3 T1 Messung (Erdfeld): 2000  $\mu$  M in 500ml Wasser
- 7.1 T2 Messung: 4000  $\mu$  M in 500ml Wasser
- 7.2 T1 Messung (Polarisationsfeld): 4000  $\mu$  M in 500ml Wasser
- 7.3 T1 Messung (Erdfeld): 4000  $\mu$  M in 500ml Wasser

**1.2 1D Magnetic Resonance Imaging (0.75h)****Parameters**

Shimming values	x = 10.11 mA; y = 20.88 mA; z = 20.07 mA
Tuning the probe	Kapazität: 13.8 nF; Polarisationsstrom: 6A; Receiver gain: 2; transmit gain (B1): 2.5 Polarisationszeit: 4s; Repetition time: 15s; Number of scans: 1
Setting B1 to lamor frequency	1837 Hz
duration 90 and 180 pulse	90 Grad: 1.35 ms; 180 Grad: 2.7ms

**Durchführung**

- 8.1 Setzte Parameter in "Common Parameters" auf unsere Werte
- 9.1 GradEchoImaging: Wähle "1D" in Image parameters; Wähle "X"-Achse; FOV Matrix size startwert 32; FOV: 200mm
- 9.2 Wähle Anfangswerte für water tube: phase gradient duration = 270 ms, band width 64 Hz, number of scans = 4;  $G = 7.5 \frac{\mu T}{m}$   
echo time calculated: 0.54s with acquisition delay 0.02s
- 9.3 GradEchoImaging: Wähle "1D" in Image parameters; Wähle "Y"-Achse; FOV Matrix size startwert 32; FOV: 200mm
- 9.4 Wähle Anfangswerte für water tube: phase gradient duration = 270 ms, band width 64 Hz, number of scans = 4;  $G = 7.5 \frac{\mu T}{m}$   
echo time calculated: 0.54s with acquisition delay 0.02s
- 9.5 Falls mehrere Phantome vorhanden, dann wiederhole Schritt 9.1 - 9.4

**1.3 J-Kopplung (1h)****Paramters**

Shimming values	x = 10.11 mA; y = 20.88 mA; z = 20.07 mA
Tuning the probe	Kapazität: 13.8 nF; Polarisationsstrom: 6A; Receiver gain: 2; transmit gain (B1): 2.5 Polarisationszeit: 4s; Repetition time: 15s; Number of scans: 1
Setting B1 to lamor frequency	1837 Hz
duration 90 and 180 pulse	90 Grad: 1.35 ms; 180 Grad: 2.7ms

**Werte**

1732.24	Lamorfrequenz für Fluor (Hz)
1841.40	Lamorfrequenz für Wasserstoff (Hz)
20.2	Kapazität getuned für Fluor (theoretisch) (nF)
15.6	Kapazität getuned für Fluor (empirisch)(Kapazität Wasserstoff 13.8nF) (nF)
13.8	Kapazität getuned für Wasserstoff (empirisch) (nF)
17.9	Kapazität getuned für Wasserstoff (theoretisch) (nF)
1786.82	Mittelwert Frequenzen
19.05	Kapazität Mittelwert (theoretisch)
14.7	Kapazität Mittelwert (empirisch)

**Durchführung**

- 10.1 Tunen System auf Wasserstoffwerte (Kapazität und Frequenz)
- 10.2 Run Pulse and collect experiment
- 11.1 Tunen System auf Fluorwerte (Kapazität und Frequenz)
- 11.2 Run Pulse and collect experiment
- 12.1 Tunen Werte auf Mittelwerte von H und F
- 12.2 Run Pulse and collect experiment
- 12.3 Tune auf gute Werte der Frequenzen und run pulse and collect

**1.4 2D Messung (1.5h)****Durchführung**

- 13.1 Measure T1 for only tap water
- 13.2 Measure T2 for only tap water
- 13.3 Measure T1 for only doped water
- 13.4 Measure T2 for only doped water
- 14.1 T1: Open "GradientEchoImaging": 2D mode; "YZ" Orientation;  
FOV: 120mm; matrix: 32\*16 (zero-filled to 64\*64);  
B1 frequency: 1837 Hz, phase gradient duration: 50ms; echo time: 200ms;  
bandwidth: 64Hz; number of scans: 4 with filtering;
- 14.2 (TR: 50%! Ca. 4s) polarisation time gleich wie kleinste gemessene T1
- 14.3 (TR: 50%!) polarisation time Mittelwert aus T1's
- 14.4 (TR: 50%! Ca 8 s) polarisation time gleich wie größte gemessene T1
- 14.5 (TR: 50%!) polarisation time doppelt so lange wie größte T1
- 15.1 T2: Open "GradientEchoImaging": 2D mode; "YZ" Orientation;  
FOV: 120mm; matrix: 32\*16 (zero-filled to 64\*64);  
B1 frequency: 1837 Hz, phase gradient duration: 50ms; echo time: 200ms;  
bandwidth: 64Hz; number of scans: 4 with filtering;  
polarizing duration aus Schritt 14.5
- 15.2 kürzest mögliche echo time (ca. 200ms)
- 15.3 echo time (ca. 250 ms)
- 15.4 echo time (ca. 300ms)
- 15.5 echo time (ca. 450ms)

## 1.5 PGSE (0.75h)

### Durchführung

- 16.1 Open PGSE dialog
- 16.2 Parameter einstellen wie auf Abb. 4.1 + pulse width step size 5 ms und Number of steps 10 siehe Abb. 4.2

The screenshot shows the CPMG dialog box with the following parameters and settings:

Pulse sequence parameters					
Polarising current (A)	6	90 pulse duration (ms)	1.35	Number data points	1024
Polarizing duration (ms)	4000	90 pulse phase (deg)	0	Dwell time (us)	100
B1 frequency (Hz)	1837	180 pulse duration (ms)	2.47	Number of scans	1
Capacitance (nF)	13.8	180 pulse phase (deg)	90	Integration width (Hz)	20
Transmit (B1) gain	2.5	Number of Echoes	30	Display range (Hz)	200
Receive gain	2	Echo time (ms)	100	Zero-filling factor	4

**Output location**

Working directory: C:\Users\EFNMR\Desktop\Daten\SoSe20\sk\Neu

Experiment name: CPMG\_12

**Time domain filter** ☒  
**Average** ☒  
**Constant 180 pulse phase** ☒  
**Alternating 180 pulse phase** ☐

**Buttons:** Run, Stop, Audio, Shims, Load, Help, Close

Abbildung 1.1: 1

The image shows a software window titled "PGSE" with a standard Windows-style title bar (minimize, maximize, close buttons). The window is divided into two main sections: "Pulse sequence parameters" and "Output location".

**Pulse sequence parameters:**

Parameter	Value
Polarizing current (A)	6
Polarizing duration (ms)	4000
B1 frequency (Hz)	2202
Capacitance (nF)	10.5
Transmit (B1) gain	2.5
Receive gain	2
Pulse width step size (ms)	5
Number of steps	10
Gradient current (A)	2
90 pulse duration (ms)	1.6
180 pulse duration (ms)	3.2
Echo time (ms)	200
Number data points	16384
Acquisition time (s)	2
Repetition time (s)	10.2
Number of scans	2
Integration width (Hz)	15
Display range (Hz)	50

Below the parameters are four checkboxes: "Include first point" (unchecked), "Filter" (checked), "Magnitude" (unchecked), and "Average" (checked).

**Output location:**

Working directory: C:\Users\Craig\Data (with a browse button "...")

Experiment name: PGSE (with a save button icon)

**Buttons:**

- Run (highlighted in blue)
- Load
- Help
- Stop
- Shims
- Close

Abbildung 1.2: 2