

## 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 1 (FID und Spektrum) Polarisationszeit 4s
- 2.2 Pulse and Collect (EFNMR menu):  
doped water sample 1 (FID und Spektrum) kürzere polarisationszeit (500ms)
- 2.3 Pulse and Collect (EFNMR menu):  
doped water sample 2 (FID und Spektrum) Polarisationszeit 4s
- 2.4 Pulse and Collect (EFNMR menu):  
doped water sample 2 (FID und Spektrum) kürzere polarisationszeit (500ms)
- 3.1 doped water sample 1: T2 Messung: 250  $\mu$  M in 500ml Wasser
- 3.2 doped water sample 1: T1 Messung (Polarisationsfeld): 250  $\mu$  M in 500ml Wasser
- 4.1 doped water sample 1: T2 Messung: 550  $\mu$  M in 500ml Wasser
- 4.2 doped water sample 1: T1 Messung (Polarisationsfeld): 550  $\mu$  M in 500ml Wasser
- 5.1 doped water sample 1: T2 Messung: 1000  $\mu$  M in 500ml Wasser
- 5.2 doped water sample 1: T1 Messung (Polarisationsfeld): 1000  $\mu$  M in 500ml Wasser
- 6.1 doped water sample 1: T2 Messung: 2000  $\mu$  M in 500ml Wasser
- 6.2 doped water sample 1: T1 Messung (Polarisationsfeld): 2000  $\mu$  M in 500ml Wasser
- 7.1 doped water sample 1: T2 Messung: 4000  $\mu$  M in 500ml Wasser
- 7.2 doped water sample 1: T1 Messung (Polarisationsfeld): 4000  $\mu$  M in 500ml Wasser
- 7.3 doped water sample 1: T2 Messung: 250  $\mu$  M in 500ml Wasser
- 7.4 doped water sample 2: T1 Messung (Polarisationsfeld): 250  $\mu$  M in 500ml Wasser
- 7.5 doped water sample 2: T2 Messung: 550  $\mu$  M in 500ml Wasser
- 7.6 doped water sample 2: T1 Messung (Polarisationsfeld): 550  $\mu$  M in 500ml Wasser
- 7.7 doped water sample 2: T2 Messung: 1000  $\mu$  M in 500ml Wasser
- 7.8 doped water sample 2: T1 Messung (Polarisationsfeld): 1000  $\mu$  M in 500ml Wasser
- 7.9 doped water sample 2: T2 Messung: 2000  $\mu$  M in 500ml Wasser
- 7.10 doped water sample 2: T1 Messung (Polarisationsfeld): 2000  $\mu$  M in 500ml Wasser
- 7.11 doped water sample 2: T2 Messung: 4000  $\mu$  M in 500ml Wasser
- 7.12 doped water sample 2: T1 Messung (Polarisationsfeld): 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 Um mal eine und mal die andere Röhre zu sehen,  
muss die echo time oder polarisation time variiert werden

### 1.3 J-Kopplung (1h)

#### 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

#### 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

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

- 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

CPMG

Pulse sequence parameters

Polarising current (A)6

Polarizing duration (ms)4000

B1 frequency (Hz)1837

Capacitance (nF)13.8

Transmit (B1) gain2.5

Receive gain2

90 pulse duration (ms)1.35

90 pulse phase (deg)0

180 pulse duration (ms)2.47

180 pulse phase (deg)90

Number of Echoes30

Echo time (ms)100

Number data points1024

Dwell time (us)100

Number of scans1

Integration width (Hz)20

Display range (Hz)200

Zero-filling factor4

Run

Stop

Audio

Shims

Load

Help

Close

Output location

Working directoryC:\Users\EFNMR\Desktop\Daten\SoSe20\sk\Wneu

Experiment nameCPMG\_12

Time domain filter

Average

Constant 180 pulse phase

Alternating 180 pulse phase

Abbildung 1.1: 1

PGSE

Pulse sequence parameters

Polarizing current (A)6

Polarizing duration (ms)4000

B1 frequency (Hz)2202

Capacitance (nF)10.5

Transmit (B1) gain2.5

Receive gain2

Pulse width step size (ms)5

Number of steps10

Gradient current (A)2

90 pulse duration (ms)1.6

180 pulse duration (ms)3.2

Echo time (ms)200

Number data points16384

Acquisition time (s)2

Repetition time (s)10.2

Number of scans2

Integration width (Hz)15

Display range (Hz)50

Include first point

Filter

Magnitude

Average

Output location

Working directoryC:\Users\Craig\Data

Experiment namePGSE

Run

Stop

Load

Shims

Help

Close

Abbildung 1.2: 2