

Setting up experiments with variable bandwidth and B1 for sequential shapes and spinlocks.

Eriks K., 29/05/2020

1. Experiments with variable bandwidth

Pulse sequence: seq_bw

Au-program: seq_bw

Setup:

- a) The variable bandwidth and frequencies are obtained from the integrals.txt list that are created in a separate 1D experiment (see Fig. 1).

- b) The following wvm command must be present in userA1:

```
sp55(p55):wvm:seq180:f1 sinc180(1 kHz; np=5000)
```

Check with wvm-x that it works OK.

Note: “1 kHz” setting is used for calibration and should not be changed. Other parameters (spXX, pXX, shapefile name - seq180, shape function - sinc180, channel - f1) can be set as needed.

- c) Pulse program modifications are minor (Fig. 2). Examples are included in this package.
- d) Once the integrals.txt file is created use the “seq_bw expno” command to set up the experiment. This will make the shapelist (.sp) and pulsewidth (.vp) lists (Fig. 3 and 4).
- e) Start the experiment (“go”).

2. Spinlocks with variable B1 and spinlock duration

Pulse sequence: seq_SL

Au-program: seq_sl

Setup:

- a) Create a peaklist in a separate experiment (fig. 5).
- b) The following wvm command must be present in userA1:

```
sp55(p34):wvm:seq_cw:f1 cw_i(500 ms; B1max=100 Hz, np=10000)
```

Enter the required spinlock duration and B1max here (can be constants). Check with wvm-x that it works OK.

Note: A rather large np is needed for longer spinlocks. TopSpin will complain if the np is insufficient. Other parameters (spXX, pXX, shapefile name – seq_cw, channel - f1) can be set as needed.

- c) The B1max is changed using multiplier list expected in lists/va directory. The B1 field multipliers are stored in lists/va directory with the same name as the shapefile except with the .va extension. If the .va file is missing a constant amplitude spinlocks are used. Note that VALIST parameter is set to the shape list with extension .sp and the multiplier list .va remains invisible to the user. An example is shown in Fig. 6.
- d) Pulse program modifications are minor (Fig. 7). Examples are included in this package. A variable spinlock duration can be added, if needed. This will require a list of spinlock durations in list/vp directory that should be created manually and the VPLIST parameter set accordingly. If the VP list is not set a constant duration as specified in userA1 is used.
- e) Start the experiment ("go").

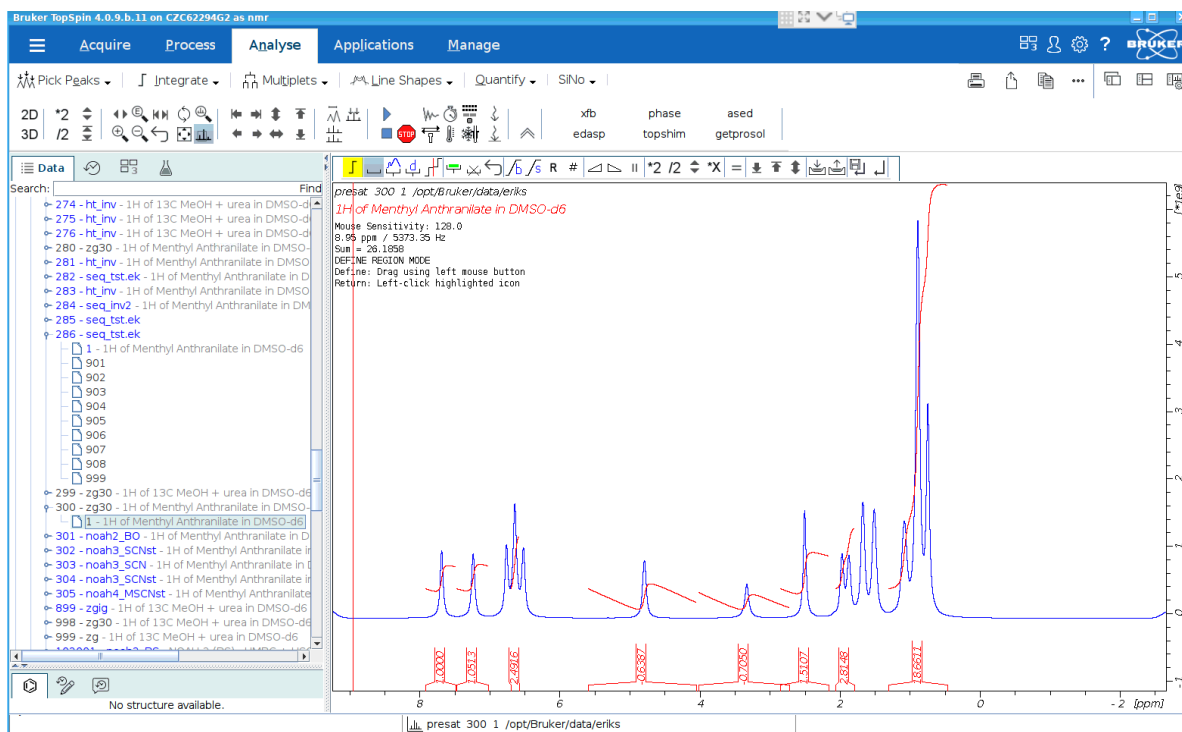


Fig. 1. The excitation bandwidth and frequencies are obtained from the integrals.txt file. Use the integration button to define bandwidth and frequencies of the excitation pulses.

```

10  ; 01. High Level: V0, 100 (1000)
11
12  #include <Avance.incl>
13
14
15  define list<shape> SPL=<${VALIST}>
16  define list<pulse> VPL=<${VPLIST}>
17
18  "l0=1"
19
20
21  1 ze
22  2 30m
23  d1
24  4u pl0:f1
25  ; "p34=VPL"
26  (VPL:SPL ph1):f1
27  4u
28  4u pl1:f1
29  (p1 ph2)
30  go=2 ph31
31  30m mc #0 to 2 F1QF(SPL.inc, VPL.inc) ; SPL incremented
32  exit
33
34
35  ph1=0 2
36  ph2=0 0 2 2 1 1 3 3
37  ph31=0 0 2 2 1 1 3 3
38

```

Fig. 2. Pulse program modifications are minor.

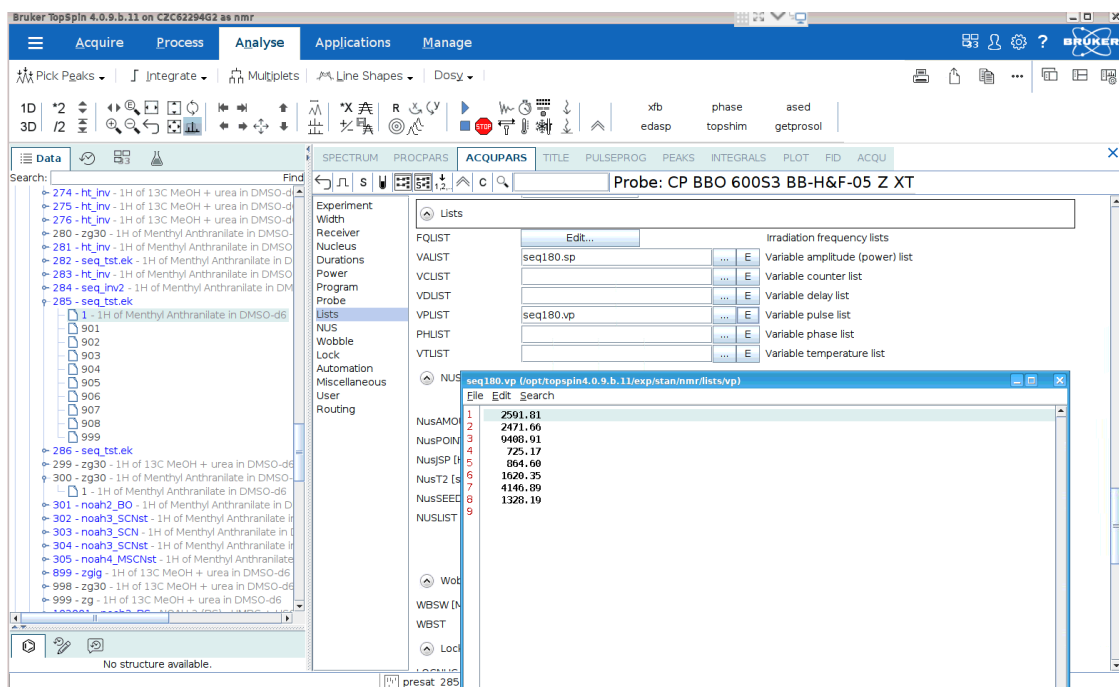


Fig. 3. Pulsewidth list, shapename.vp stored in VPLIST parameter (lists/vp directory).

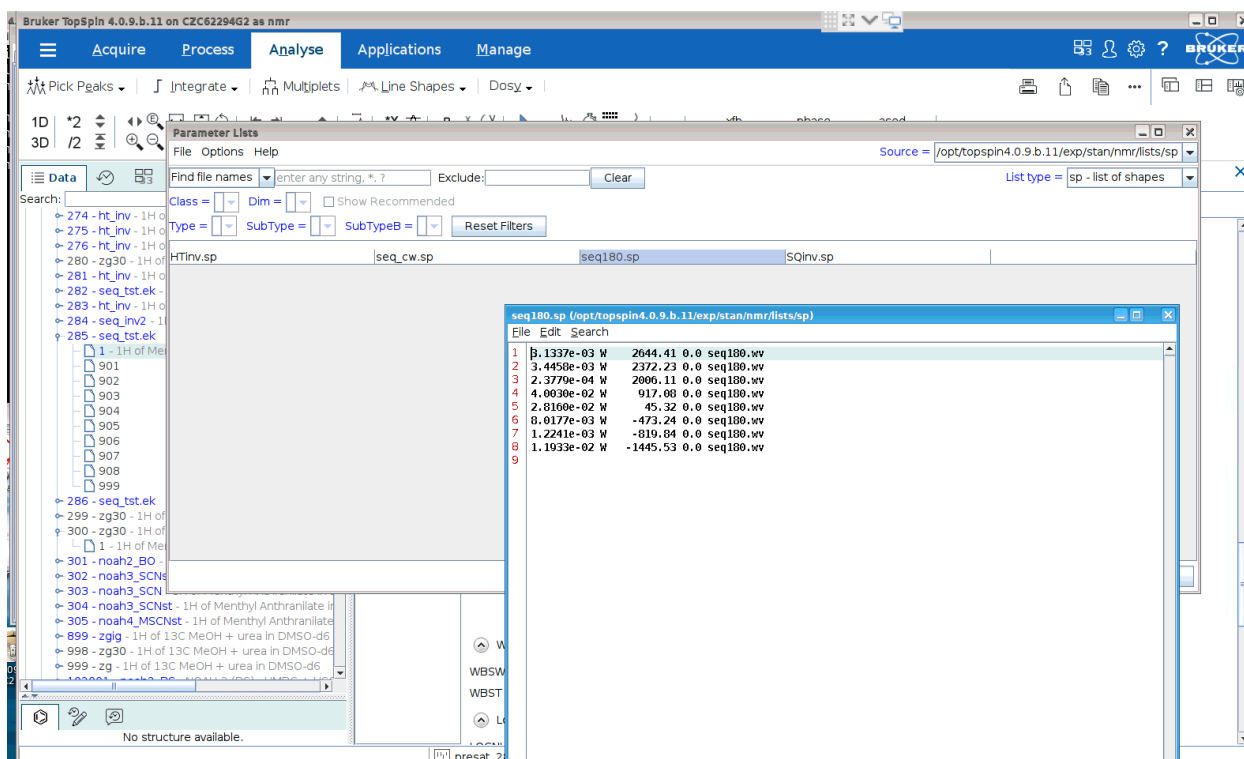


Fig. 4. Shapelist file, shapename.sp is stored in the VALIST parameter (lists/sp directory).

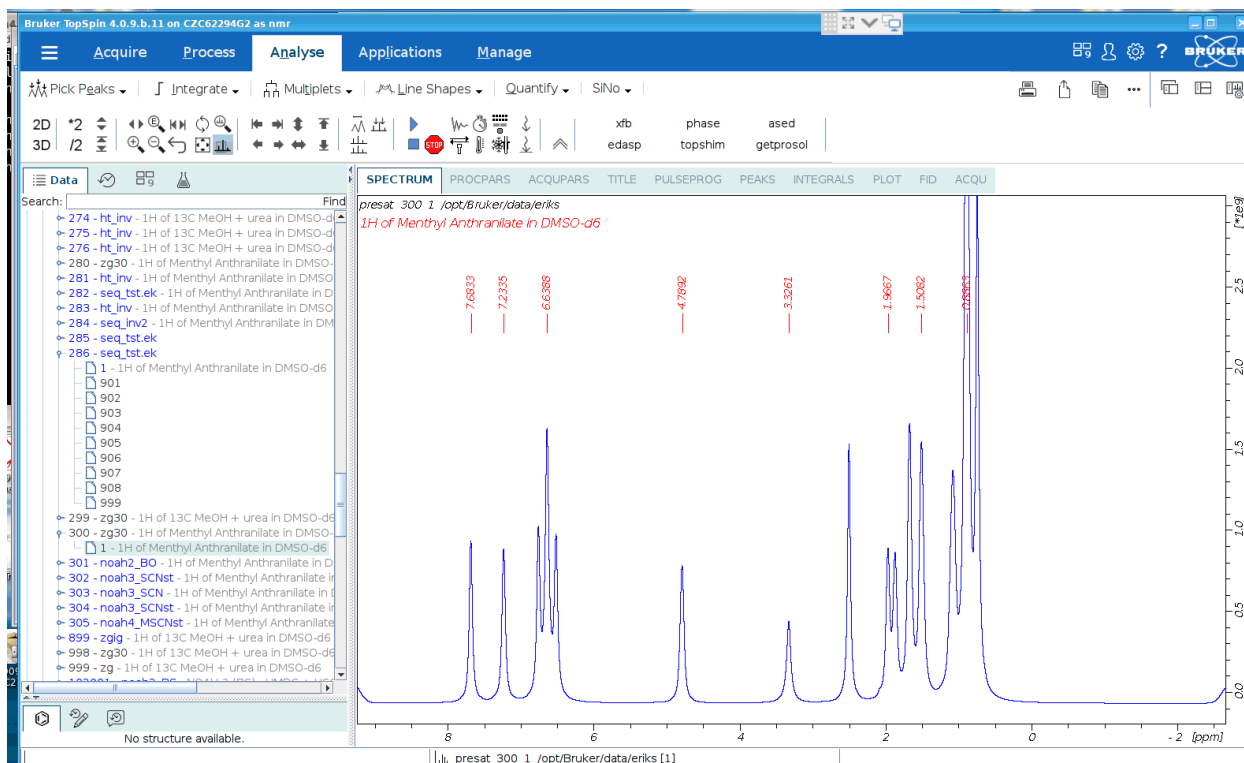


Fig. 5. Make the peak list as usual.

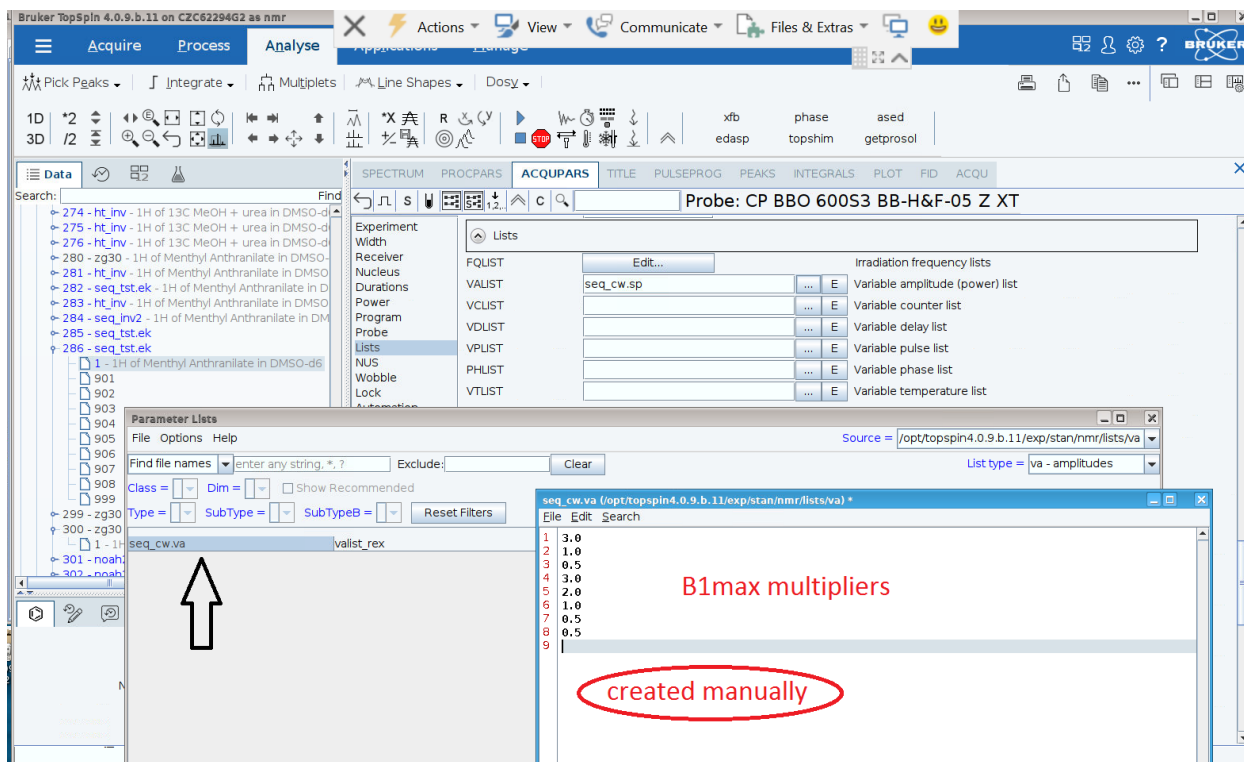


Fig. 6. A list of B1max multipliers is created manually and stored in lists/va directory. The filename must be the same as shapefile name, but with .va extension, e.g. shapename.va.

```
seq_sl.ek (/opt/topspin4.0.9.b.11/exp/stan/mmr/lists/pp/user)
File Edit Search
Graphical_Edit Set PULPROG

5 ;
6 ;C.J. Bauer, R. Freeman, T. Frenkiel, J. Keeler & A.J. Shaka,
7 ; J. Magn. Reson. 58, 442 (1984)
8 ;H. Kessler, H. Oschkinat, C. Griesinger & W. Bermel,
9 ; J. Magn. Reson. 70, 106 (1986)
10
11
12 #include <Avance.incl>
13
14
15 define List<shape> SPL=<${VALIST}>
16 ;define List<pulse> VPL=<${VPLIST}>
17
18 "l0=1"
19
20
21 1 ze
22 2 30m
23 d1
24 4u p10:f1
25 ; "p34=VPL"
26 (p34:SPL ph1):f1
27 4u
28 4u p11:f1
29 (p1 ph2)
30 go=2 ph31
31 30m mc #0 to 2 F1QF(SPL.inc) ; , VPL.inc
32 exit
33
34
35 ph1=0 2
36 ph2=0 0 2 2 1 1 3 3
37 ph31=0 0 2 2 1 1 3 3
38
39
40 ;p10: 120dB
41 ;p11: f1 channel power level for pulse (default)
```

← not used, but can be

← all spinlocks of same duration, p34

← not used, but can be

Fig. 7. Pulse program modifications are minor. Variable spinlock duration (VPL) can be added, but the duration list will have to be created manually because durations are molecule dependent and we have no knowledge how the durations are chosen.