VI. ADJUSTING THE MAGNETIC FIELD HOMOGENEITY (SHIMMING)

There are three shim pots (Z1, Z2, Z3) on the console. These should be left at 500. Shimming can be done with these commands: SK, LD and AH. SK and LD are used only for manual (knob) shimming, while AH can be used for manual or computer shimming (auto-shim).

A) **SK**. (shim with knobs): When SK is entered, the user will be presented with the following shim "map":

<table>
<thead>
<tr>
<th>Z1</th>
<th>Z2</th>
<th>Z3</th>
<th>Z4</th>
<th>Z5</th>
<th>X</th>
<th>Y</th>
<th>XZ</th>
<th>YZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>XY</td>
<td>R2</td>
<td>Z2X</td>
<td>Z2Y</td>
<td>X3</td>
<td>Y3</td>
<td>ZXY</td>
<td>ZR2</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>W</td>
<td>E</td>
<td>R</td>
<td>T</td>
<td>Y</td>
<td>U</td>
<td>I</td>
<td></td>
</tr>
</tbody>
</table>

No more than two shims can be accessed at a time. The user types the two keys corresponding to the two shims to be adjusted. After the second key is pressed, the values of the selected shims are displayed and are placed under knob control. Knob A controls the first shim and knob B the second shim. While in SK, the lock receiver gain is controlled by knob C (if homogeneity improves a large amount, knob C can be used to reduce the gain and thus bring the lock level back on scale). Shimming Z1 and Z2 by hand in any of these routines will be sufficient for most samples. At this point the following SK subcommands are active:

- **T** - Display the current shim settings on the screen
- **C** - Coarse shim access (Z1, Z2, Z3, X and Y only)
- **F** - Fine shim access (all shims)
- **S** - Select other shims for knob control
- **Q** or **<** return> - Exit SK

Under normal conditions, only fine shim adjustments need to be made (subcommand **F**). Note: If the last parameters set up in the AH routine (see VIII.C) selected the FID as the shimming function, the SK routine will enable shimming on the FID, using parameters selected for the current pulse sequence.

B) **LD**. (lock display): When in LD, the subcommand **K** will enable knob shimming as in the SK routine (see section VIII.A). However this command sequence will allow you to shim on either the lock level meter display or the lock dispersion display (the last display mode toggled by the **S** subcommand is used).

C) **AH**. (adjust homogeneity): This command can be used for manual or computer shimming (auto-shim). Subcommands available within the AH routine are listed below:

- **A** - Adjust spinner air (works like the AA command)
- **D** - Set adjustment delay time
- **E** - Select equal or unequal step sizes
- **F** - Select lock or FID for shimming function
- **I** - Set the initial step size
- **K** - Shim manually with knobs (works like the SK command)
L - Enter the shim library routine
   <return> List shim sets (called probes) in library
D - Delete a probe from the library
L - Load shims for a probe
N - Define new probe for library
A - Update library for a probe with current values
Q - Exit library routine, return to AH
N - Set NA for shimming
P - Set predelay before measurement
R - Turn on/off spin rate monitor
S - Select shims and start shimming (auto-shim using the Simplex method)
   S - Adjust "spin" shims
   N - Adjust "nonspin" shims
   R - Adjust randomly selected shims
   L - Set up a list of shims to adjust
      S - Add "spin" shims to list
      N - Add "nonspin" shims to list
      R - Add "randomly" selected shims to list
      <return> - signals end of current list
   Q - The first Q will quit the set up and start shimming at the top of the list
   Q - The second Q will Quit the shimming
T - Display current fine shim settings on the screen
U - Set up shimming parameters
W - Double the weight of the ZO region
X - Exit AH (if auto-shimming on the lock level, this will continue in the background)
<control> Z - Zero all shim currents
3 - Allow keyboard entry of Z3. If entry is terminated by "I", the current Z3 value will be
   increased by the entry value. If terminated by "D", it will be decreased.
4 - Allow keyboard entry of Z4 as above

Before using the autoshim routine, the user should shim Z1 and Z2 manually (subcommand K). The following
sequence is then recommended for optimizing Z1, Z2 and Z3 with the computer shimming on the FID. This
operation usually takes 3-5 minutes. You may modify this sequence for your own sample (see the software
manual). Before starting, make sure that the block size is correctly set to give a response >300 (check by taking
1 scan, type SU).

1) Type R
   SPIN RATE MONITOR ON OK? Y
   UPPER SPIN RATE = 40 <return>
   LOWER SPIN RATE = 7 <return>
   (Once on, this remains on until shut off. This will keep the spin rate between 7 and 40 by computer control
   of the air flow rate.)
2) Type U
   INITIAL STEP SIZE = 100 <return> (25-50 is faster; 100 more accurate)
   PREDELAY (SEC) = 2 <return> (1-2 seconds, depending on relaxation time)
   ADJUSTMENT TIME PER 100 UNITS (SEC) = 10 <return>
   SHIM ON LOCK (L) OR FID (F)? F
   NA FOR SHIM = 1 <return>
3) Type S
   SPIN, NONSPIN, RANDOM SHIMS, OR LIST? L
   SPIN, NONSPIN, RANDOM SHIMS, OR QUIT? R
   SPINNER ON? Y
(At this point the screen will display the shim "map". Type 1 2 3 <return>. These numbers are not echoed.
SPIN, NONSPIN, RANDOM SHIMS, OR QUIT? Q Q

4) Type X
Type LI = AH
Type AU = 1

The program will display the current shim settings and latest response on the screen as the shimming proceeds. When a convergence is reached, the best values will be printed, and the program will stop.

The AH command also allows the user to save shim settings in a shim library. Up to 33 shim settings can be saved. However, because these are stored only on the operating disk, no changes should be made in this library without permission from lab personnel. For a print out of your own shim settings, exit AH (type X), type <control> T, AH, T, X, <control> S. The coarse shim settings must be accessed via SK and written down.
These same values can be used as a starting point when you operate the spectrometer again using similar samples.