Avance Lab Guide

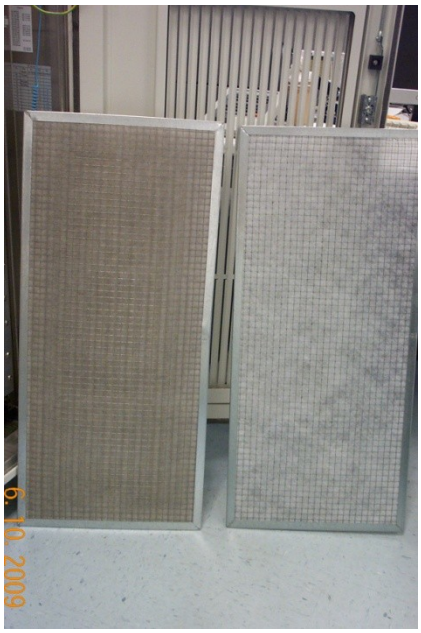
Console overview

Avance III 2 Bay console.

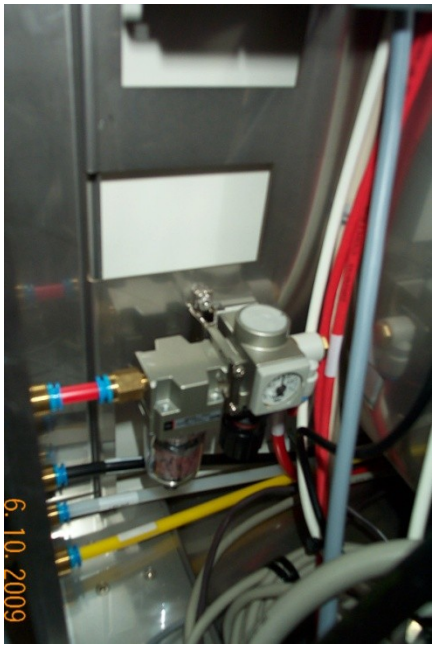
Avance III 2 bay console opened.

Doors should remain closed for normal operation for good filtering of console air.
Constant air pressure and temperature are important considerations for high performance operation. Ideally, an **absolute room temperature** must be selected from a range of 17-25°C. The room temperature must then be kept within +/- 1°C for 300-500 MHz systems and +/- 0.5°C for 600 MHz and above.

Replacing air filter in door



Old vs. New air filter (new on right)



Air regulator and gauge in Nano-Bay

Air regulator and gauge in Single bay

Air pressure should be min 4 bar and should be at least 0.5 bar lower than supply for good regulation.
General Requirements **Compressed gas line**: The standard AVANCE system requires one compressed gas line with two regulated outputs. Two additional secondary connectors are preferred.
Regulators: Watts Regulator R119-03C (Watts Fluid Air Company), pressure range 0-8.6 bar (0 - 125 psi), with gage head included.

• Compressed nitrogen gas needed for temperature control with extremely low VT experiments (using the liquid nitrogen exchanger).
• The BCU-05 or BCU I cooling unit requires compressed gas with a Dew point of -50°C (-60°F).
• The BCU-X or BCU II cooling unit requires compressed gas with a Dew point of -80°C (-110°F). A secondary dryer (p/n 1808577) is available to achieve that level of dryness. Note: All tubing after the dryer should be HDPE.
• Compressed air or nitrogen gas, with Dew point below -50°C, for spinning.
• Compressed air or nitrogen gas, with Dew point below -50°C, for sample ejection, Probe flush gas, shim cooling gas, and for the magnet's vibration isolation units.
• Compressed air or nitrogen gas, with Dew point below -50°C, for the optional CryoProbe system.

AQS Chassis

Powering the console off and on; General guide:

To power the console off:

- make sure that acquisitions are stopped and sample is ejected
- Turn off VT heater and allow probe to reach Room temperature
- Warm Cryo-Probe up (if applicable)
- Turn off main power switch
- Turn off switches on BSMS, and amplifiers (if applicable)
- Stop any programs on workstation and power it off

To power the console on:

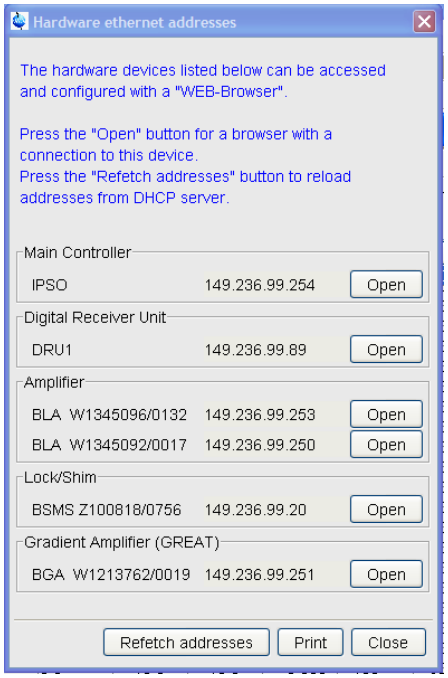
- Wait at least 3 minutes after power off
- Turn on main power to console
- Turn PC on immediately
- Turn on AQS rack and IPSO (if applicable)
- When IPSO POST code reaches “C0” the IPSO applies for an IP address and FTP’s its operating system file
- Turn on any other units that were powered off (BSMS, amps, etc.)
- When POST code on IPSO reaches “94” or “98” start TopSpin
- Select a data set, and type “ii”. If “ii” finishes you are ready to work

If the IPSO does not boot:

- Check power supply LED’s to be sure everything is powered on
- If IPSO POST code did not reach “C0”, there is a problem with the IPSO
- If IPSO POST code is stuck on “C0”, there is a problem with the workstation:
    - DHCP not running or “spect” Ethernet card not initialized
    - Re-start DHCP. If it doesn’t start, re-boot computer, then restart IPSO.
    - If nothing else works, call Bruker Center

IPSO Service Web site:

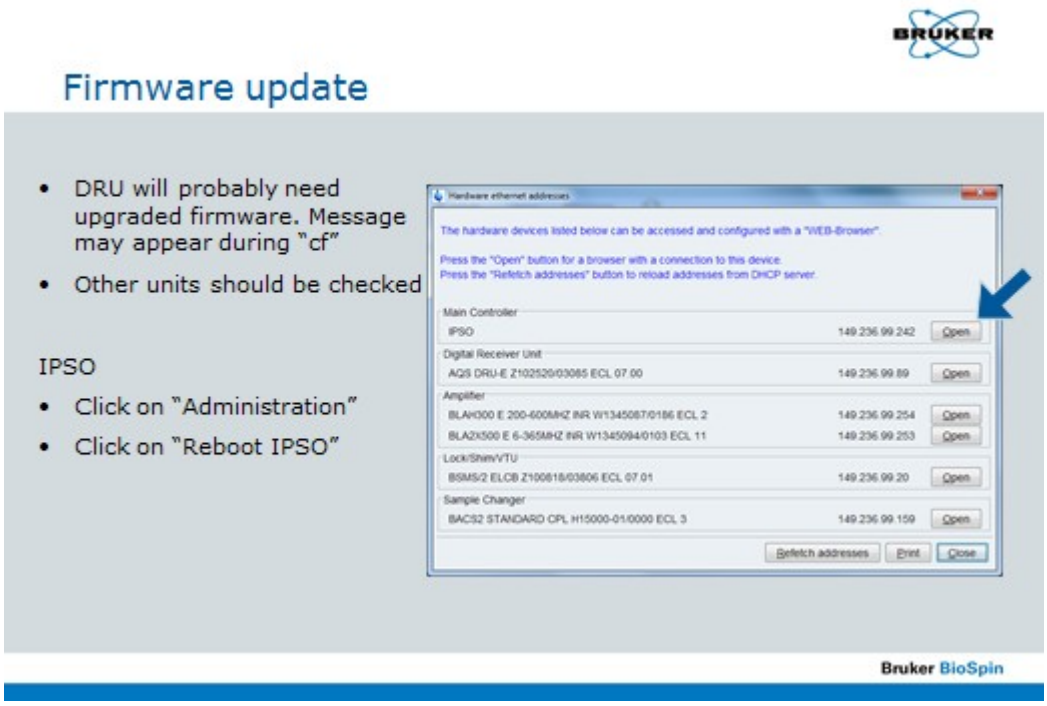
To get to IPSO Service Web site:



- Start TopSpin program
- Type “ha” in command line
- Select “open” next to IPSO

Functions of IPSO web site:

- Information: Get information on the IPSO hardware, IPSO sanity check
- Administration: Power off, re-boot, Stop IPSO servers, etc.
- RS devices: Administration of RS232 ports
- Function Test: Long and short functions tests (IPSO servers must be stopped)
- Help: General help for web site



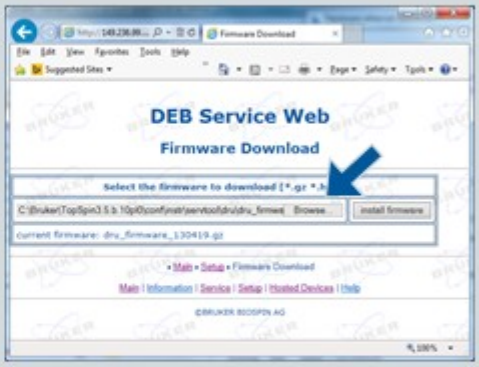
DRU

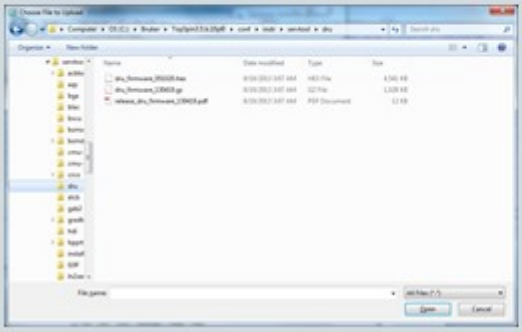
- Click on "AQS Firmware Setup"

- Click on "Program new DRU firmware"

DRU firmware update

- Firmware download window shows current DRU firmware.
- Check for newer DRU firmware in: [topspinhome]/conf/instr/servtool/dru
- File for new DRU is .gz



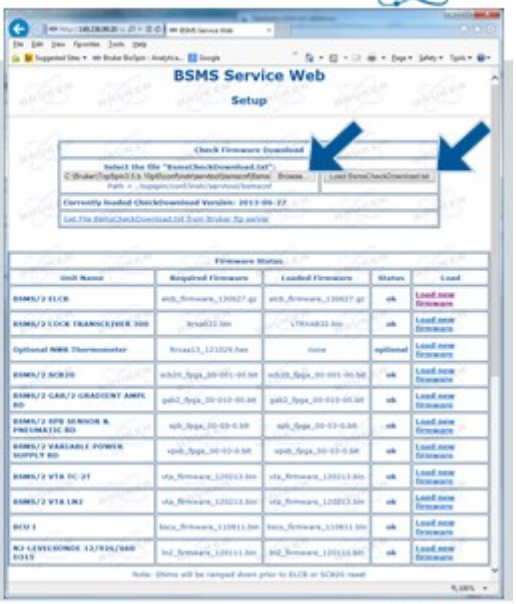


AQS Device Firmware

- From AQS firmware page, select "Download new firmware into AQS devices"
- Page shows RXAD/2 and SGU current firmware
- Use "select RXAD/2 or SGU/3 Firmware" and browse to see if there is newer firmware
- New RXAD/2 and SGU/3 firmware is in [topspinhome]/conf/instr/servtool /aqs
- Older RXAD and SGU are in [topspinhome]/conf/instr/servtool /Unitool/files.. /rxs and /sgu2
- For SGU/2 many also need "dds"

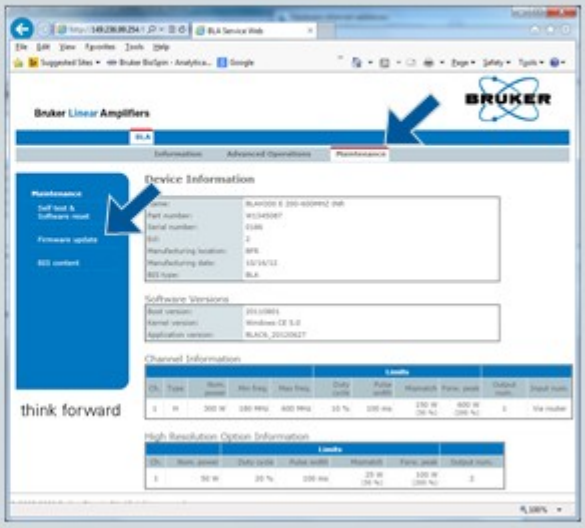
BSMS firmware

- From main BSMS/ELCB menu, select Setup
- Select current BsmsCheckDownload.txt file with Browse
- Load BsmsCheckDownload.txt file and check for any required upgrades
- For systems with BSVT: Be sure to connect any VTA devices that are not being used at the time and recheck for needed updates



BLA Amplifier firmware

- From main BLA page, select "maintenance" tab
- There, select "Firmware update"
- Firmware is located in: [topspinhome]/conf/instr/servtool/blac



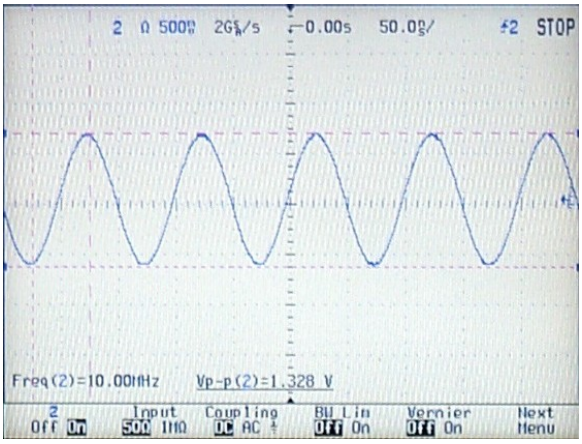
Firmware locations

- Firmware is all located in: [topspinhome]/conf/instr/servtool/

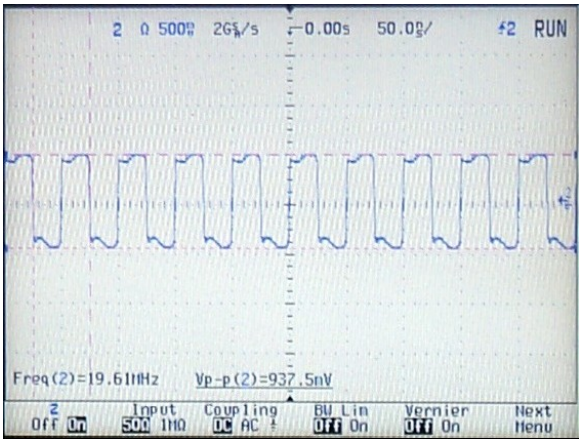
aqs – for SGU/3 and RXAD/2
bga – for GREAT amplifier
blac – for BLA amplifiers
dru for DRU
elcb - for ELCB
gab2 - for GAB/2
l19f - for 19F lock board
ln2sense - for new Nitrogen level sensor
mas2 - for MAS unit
nmrthermometer - for nmr thermometer
scb20 - for Shim Current Boards
spb - for Sensor Pneumatic board
vpsb – for Variable Power Supply
vta - for BSVT adapters
UniTool/files/birds - for SGU/2 and RXAD

RF generation

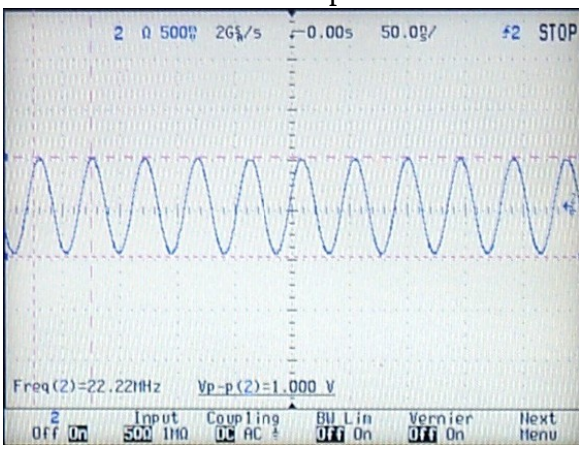
- To check the signals coming from the REF board, no pulse programs are required.
  - 10 MHz Out REF J2 & J3



  - 20 MHz Out REF J4

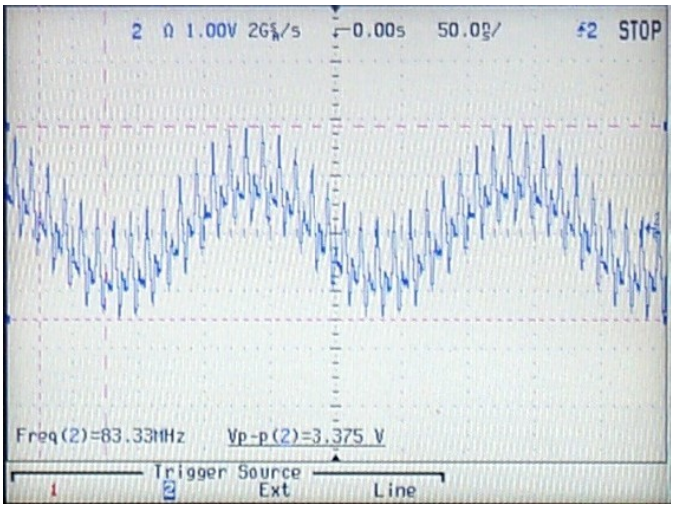


  - Receiver IF reference output REF LO2 J5

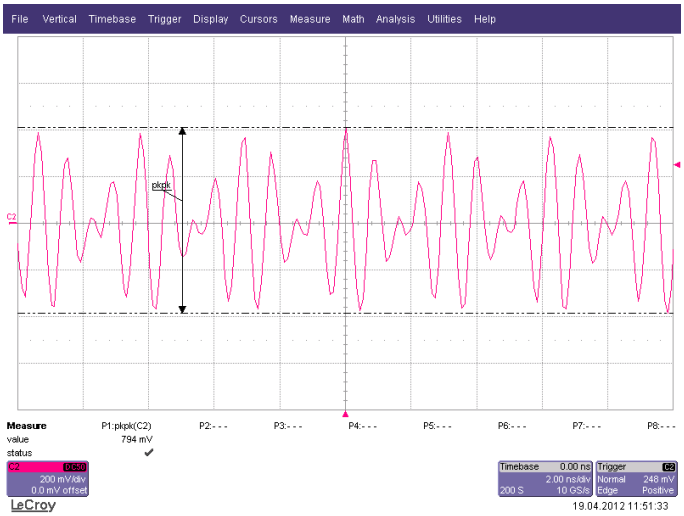


For AV1: 22 MHz. for AVII & AVIII: 720 MHz.

- SGU reference frequencies output REF J6, J7, J8, J9



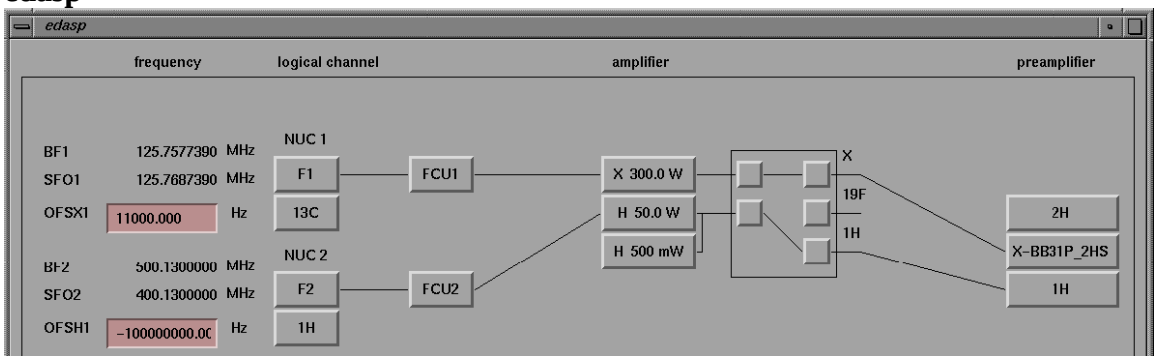
For AV I, II, III Combination of 5, 80, 160, 320, 720, 1280 MHz.



For AV IIIHD Combination of 960 and 1280 MHz.

- To check signals from SGU, you can set up a test data set and write a test pulse program:
  - With the **edc** or **new** command, name a new dataset for testing
  - Read in a standard one pulse parameter set: **rpar PROTON all**
  - Setup the F1 (observe) and F2 nuclei in **edasp**
    - For F1, choose an X nucleus like 13C or 15N
    - For F2, choose 1H

edasp -



- Modify the zg pulse program so that it pulses both nuclei at two different power levels and save as Multipulse

:

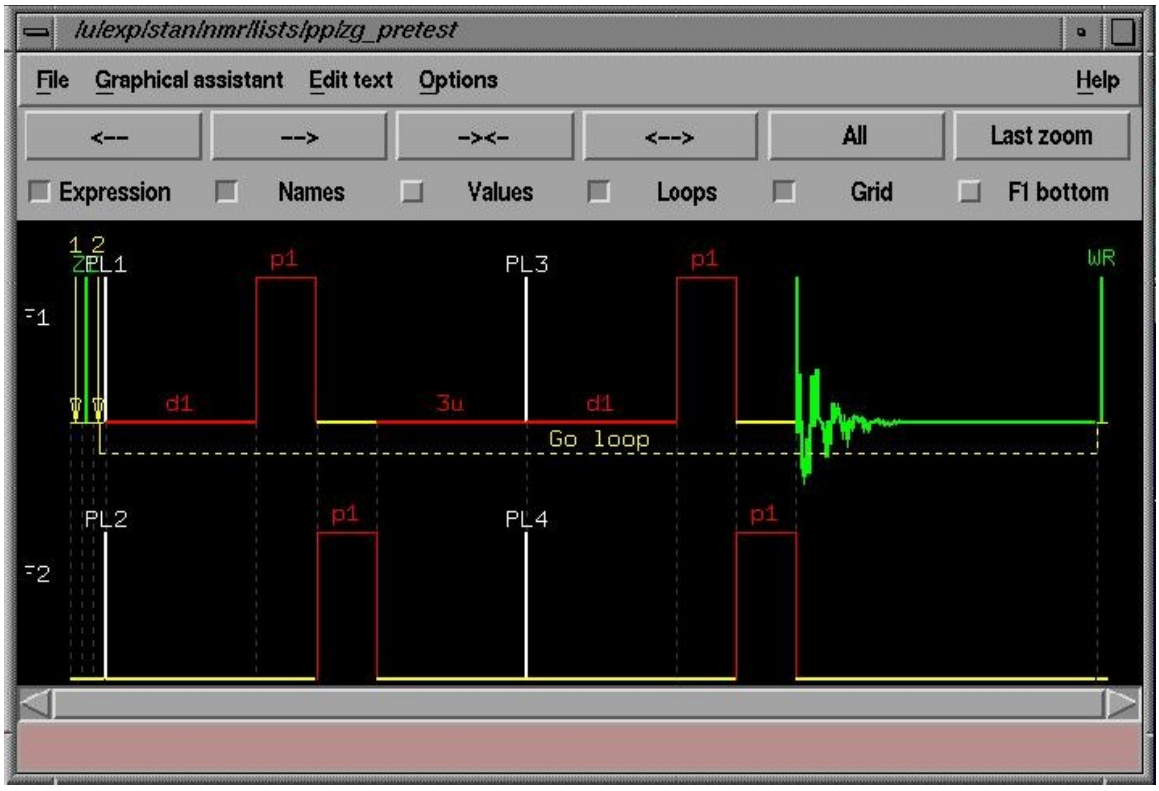
PULPROG: Multipulse

```
1 ze
2 d1 pl1:f1
        p1:f1
        p1:f2
        30u pl3:f1 pl4:f2
        p1:f1
        p1:f2
        go=2
        30m mc #0 to 2 F0 (zd)
    exit
; pl1 and pl3 : high and low power levels for f1 channel (-6 and 14)
; pl2 and pl4 : high and low power levels for f2 channel (-6 and 14)
; p1 : Transmitter pulse length for f1 and f2 (10 usec)
;d1 ;  relaxation time (100msec)
```

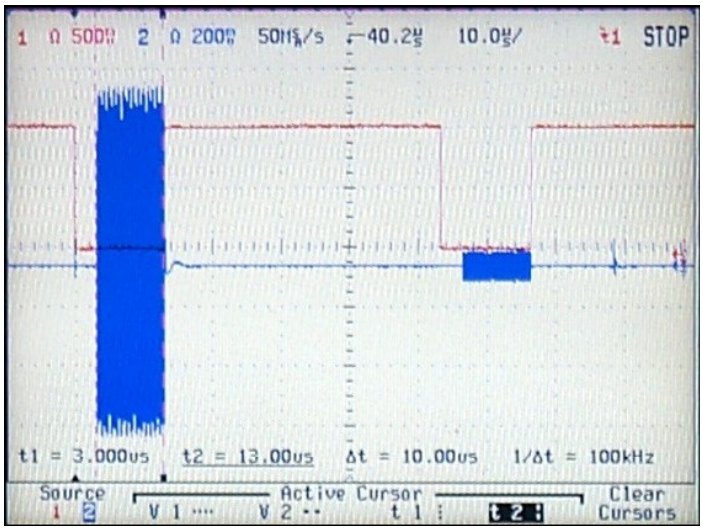
- Set up parameters in ased:

PULPROG :	Multipulse
AQ :	.05 sec
p1 :	10 usec
d1	100 msec
pl1 :	-6 dB (0 dB if power check is on)
pl2 :	-6 dB (0 dB if power check is on)
pl3 :	14 dB (20 dB if power check is on)
pl4 :	14 dB (20 dB if power check is on)
ns :	64k

- Graphical display of pulse program: **spdisp**

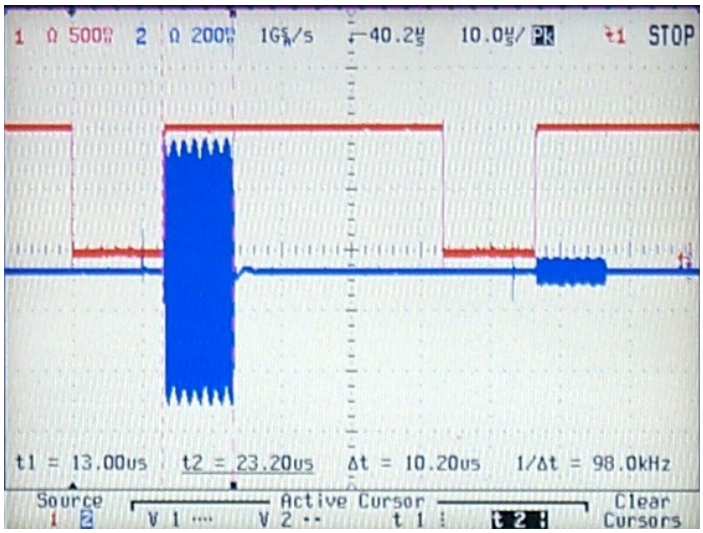


- Remove output cables from SGU's to protect amplifiers
- Connect scope channel 1 to SGU 1 J2 (use 50 ohm input of scope)
- Connect channel 2 to blanking pulse for X amp
- Sync scope to channel 2 and negative trigger
- Start acquisition with **zg**



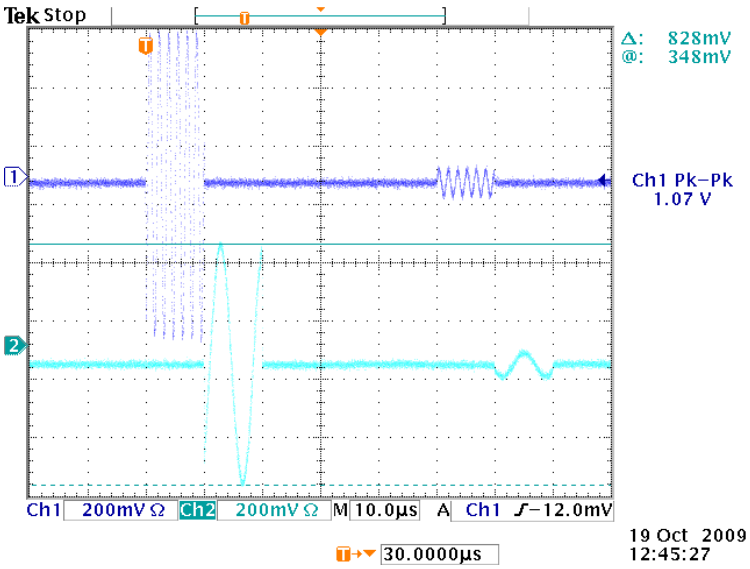
Blanking pulse goes negative 3 usec before the RF pulse starts.

- Connect scope channel 1 to SGU 2 main output:



1H pulse occurs after blanking pulse goes high.

- Connect channel 2 of scope to SGU2 J2 (50 ohm input)
- Sync on channel 1

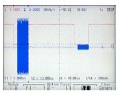
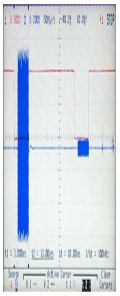


Note: On digital scopes, the frequency of channel 2 can be folded so it appears as a low frequency. Amplitude for 1H may appear lower than 1Vpp due to frequency response of scope.

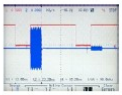
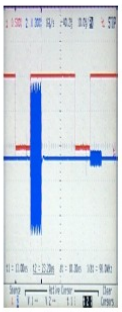
The ratio of the larger to the smaller pulse might not be 10:1 due to cortab correction. If the appropriate cortab table is temporarily renamed, the pulses should have a 10:1 ratio.

Amplifier output

- Connect SGU outputs back to amplifier inputs.
- Connect blanking pulse to X amp with tee going to scope input 1
- Connect X amp output to 20dB attenuator and from there to input 2
- Sync scope to input 1 negative trigger

HF X	**BLAXH100/50**		1 Vpp/ 50Ω 0.1 Vpp/ 50Ω	.....V/50Ω V/50Ω
DANGER	**20 dB ATTENUATOR ! !**			
X QNP	**BLAXH100/50**		200 Vpp/ 50Ω 20 Vpp/ 50Ω	.....V/50Ω V/50Ω
		pl1= 0dB pl1= 6dB pl1=12dB	100 V/50Ω 50 V/50Ω 25 V/50Ω	.....V/50Ω .....V/50Ω V/50Ω
		pl3=20dB pl3= 26dB pl3= 32dB	10 V/50Ω 5 V/50Ω 2.5 V/50Ω	.....V/50Ω .....V/50Ω V/50Ω

- Remove connection to X amp output, and connect 20dB attenuator from H amp output to scope

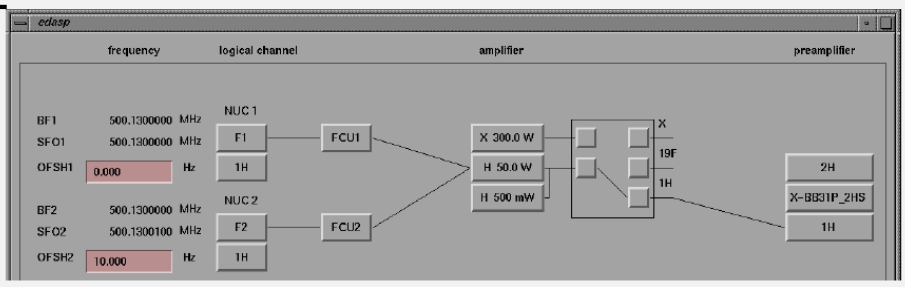
HF HHIGH	BLAXH100/50		1 Vpp/ 50Ω 0.1 Vpp/ 50Ω	.....V/50Ω V/50Ω
DANGER	20 dB ATTENUATOR ! !			
^{1}H OUTPUT	BLAXH100/50		140 Vpp/ 50Ω 14 Vpp/ 50Ω	..... V/50Ω V/50Ω
pl2= 0 dB pl2= 6 dB pl2=12 dB			70 V/50Ω 35 V/50Ω 17 V/50Ω	..... V/50Ω ..... V/50Ω V/50Ω
pl4= 20dB pl4= 26dB pl4= 32dB			7 V/50Ω 3.5 V/50Ω 1.7 V/50Ω	..... V/50Ω ..... V/50Ω V/50Ω

Note: The measured output power depends on the type of amplifier. For high power amplifiers (BLAX100 or BLAH100) a 40dB attenuator may be required to protect the scope.

The ratio of the first pulse to second should be 10:1 if the cortab table is used. The pulses can also be measured at the output of the respective preamplifiers. The output will be 1 to 2 dB less, depending on the preamp and cable length.

- Checking SGU or amplifier output without a scope (o1-o2 beating):
    - With the **edc** or **new** command, name a new dataset for testing
    - Read in a standard one pulse parameter set: **rpar PROTON all**
    - Setup the F1 (observe) and F2 nuclei in **edasp**
        - For F1, choose 1H
        - For F2, choose 1H

edasp



Remark *The routing is not the default one. It must be manually set.*

- Write the following pulse program:

  Pulprog ; o1o2_beat

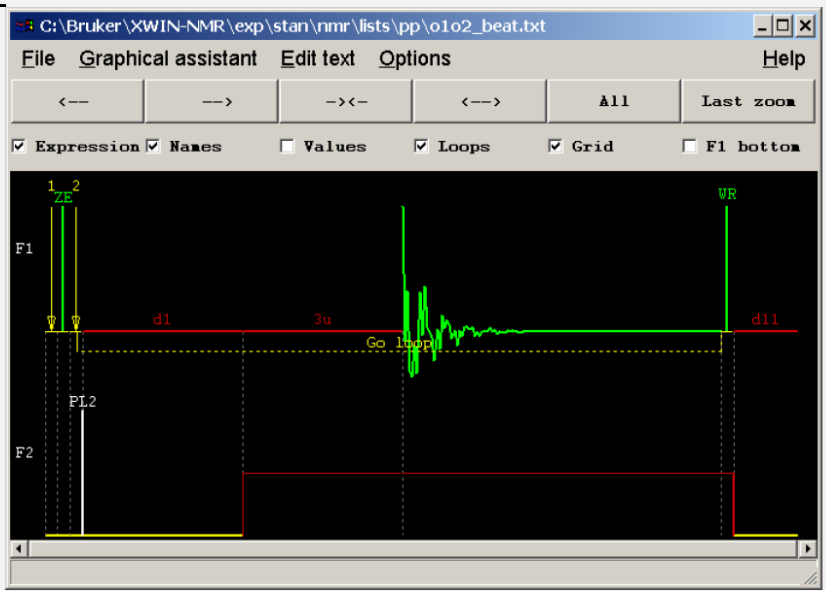
  1. ze
  2. d1 pl2:f2
     3u cw:f2
     go=2
     30m mc #0 to 2 F0 (zd)
     3u do:f2

  exit

- ased parameters:

PULPROG:	o1o2_beat
AQ:	1s
D1:	30us
Pl2:	90 dB (adjust for filling digitizer)
RG:	128
NS:	1
O1:	0 Hz
O2:	10 Hz

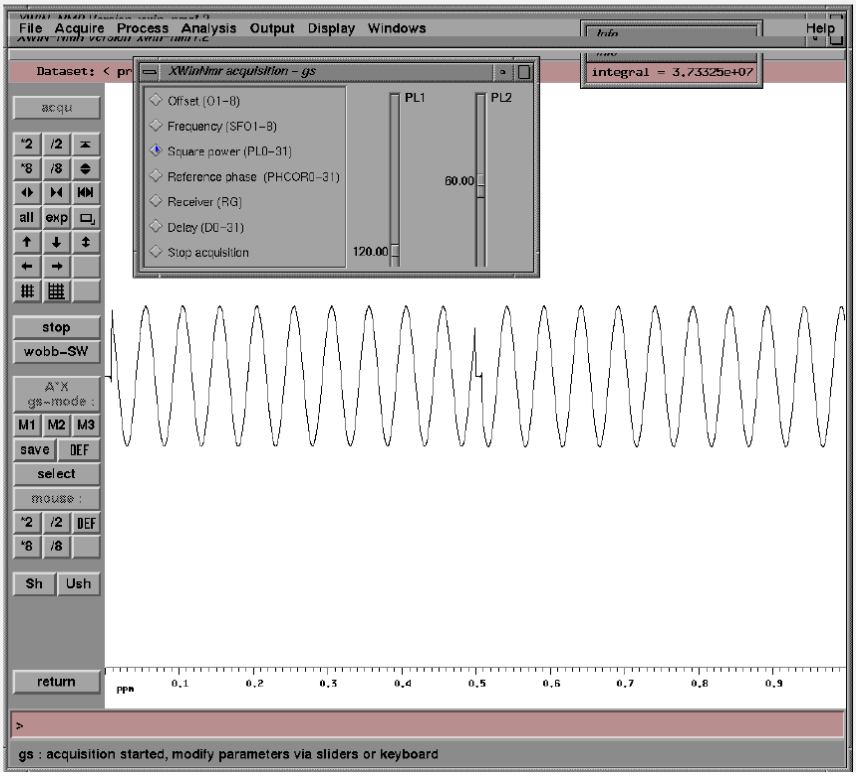
spdisp



Note: Start the sequence in GS mode and calibrate the power level PL2 to obtain a good signal.

Danger: This test is performed in Continuous Wave mode. PL2 must always be below 20dB (higher number)

Unshuffled data display



Power check & Cortab

In order to protect the probe from excessive RF power, and to linearize the power output of the RF amplifiers over their entire range, two features, called Power check and Cortab, are implemented.

- Power check requires that the output power of the amplifiers is measured for each nucleus that will be pulsed or decoupled.
- Power check also requires that a Cortab be performed on each routing that will be used.
- Cortab requires that the power is known, and also requires some attenuators to reduce the RF output of the amplifier to a level that can be measured by the receiver.

To measure the power output of the amplifiers, you will need:

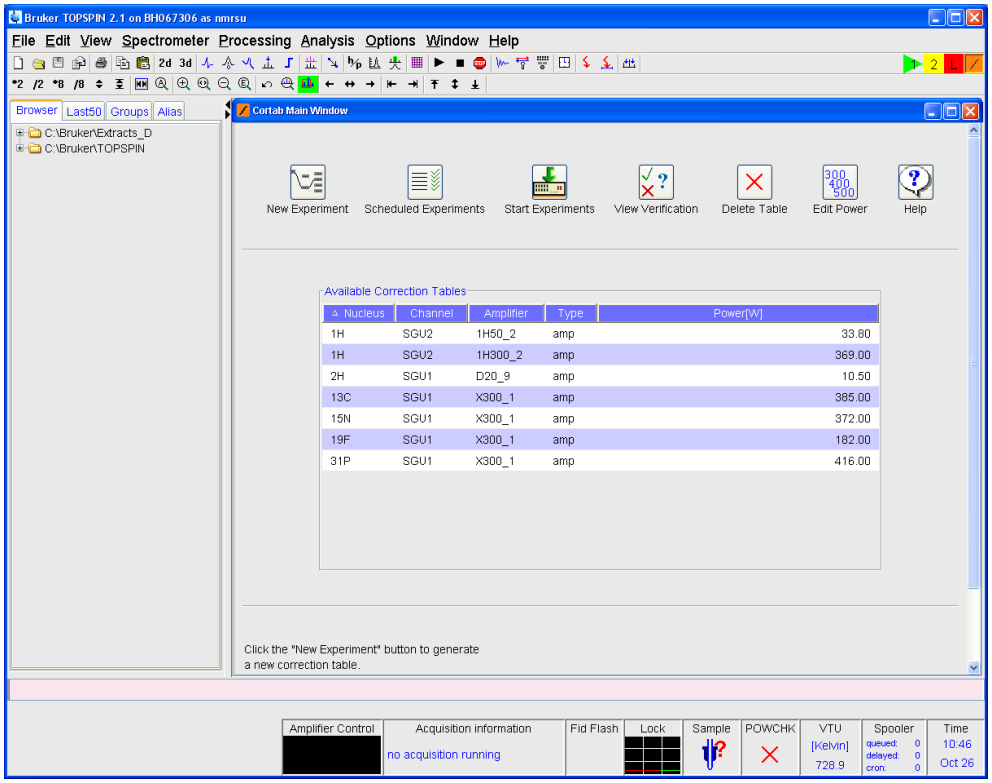
- Attenuators that will handle the pulse power of the amplifier.
- A power meter, scope, or detector to measure the power

- To measure the power of your amps, you can set up a test data set:
  - With the **edc** or **new** command, name a new dataset for testing
  - Run the **cf** routine, and uncheck the **power check** box
  - Read in a standard one pulse parameter set: **rpar PROTON all**

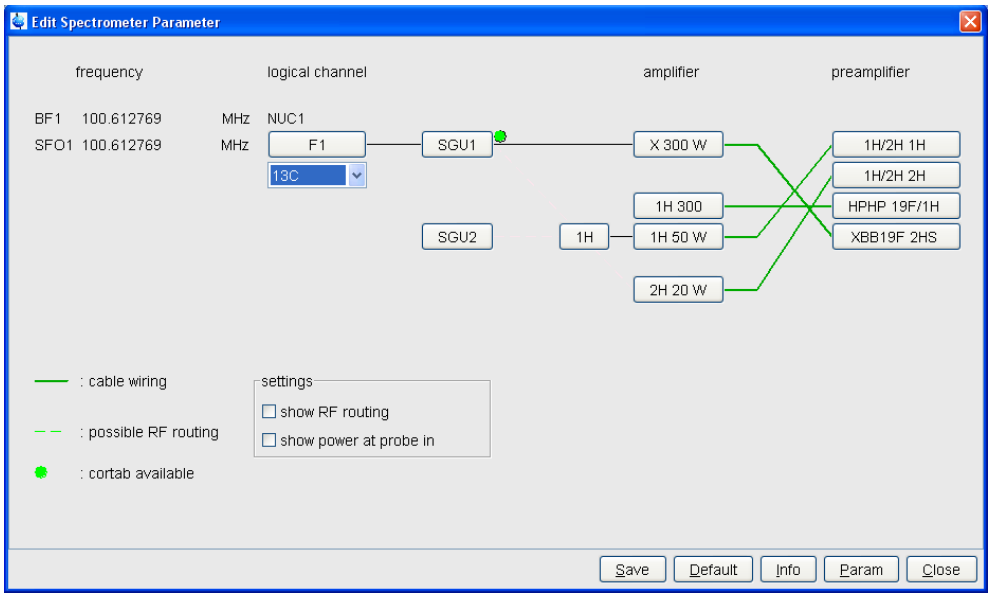
- Setup the F1 (observe) nucleus in **edasp**
  - For F1, choose the nucleus that you want to measure
  - Use the zg pulse program
  - Set AQ to 1 second (less for analog scopes)
  - Set D1 to .1 seconds
  - Set PL1 to max for amplifier (power check must be off for this)
  - Set P1 to 10 usec
  - Connect the preamp output to the measuring device via a suitable attenuator
- Measure the power for all nuclei and paths that will use this preamp output then go on to the other preamp outputs.
- If measuring with a scope, power is Vpp Squared /400. Be sure that the frequency that you are measuring is well within the frequency response of the scope. It should not be in the upper 30% for accurate readings.
- When done, connect the cables back, and run **cf** again to recheck the **power check** box (unless you are going to do cortab immediately

Check or create Cortab tables

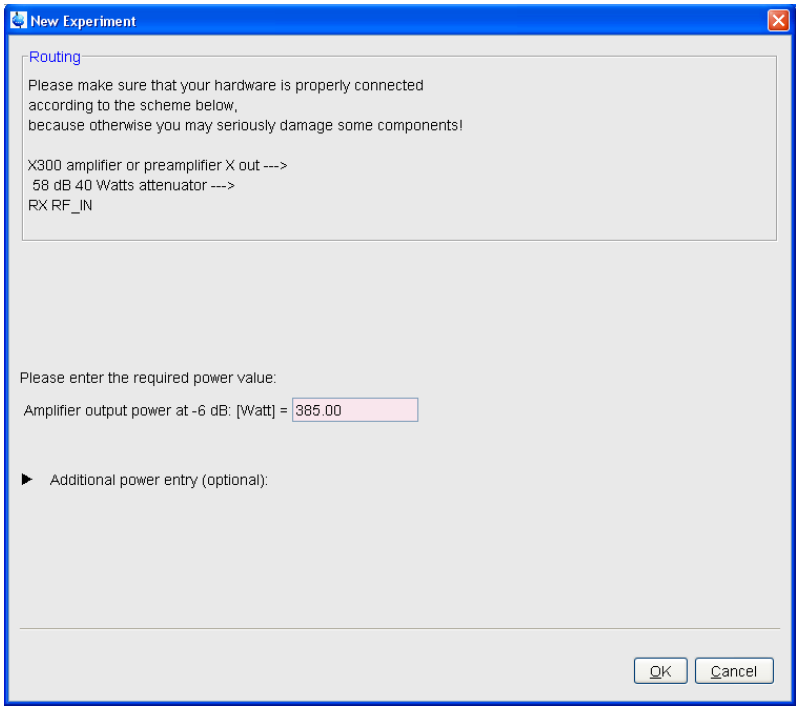
- In the TopSpin command area, type **cortab**
  - To create a new cortab table, select **BLA Liarization + Verificatioin**
    - You will get a window showing the current cortab tables
    - Tables for the entire cortab (SGU, Router, & amplifier) are type amp



  - To create a new cotrab table, click **New Experiment**



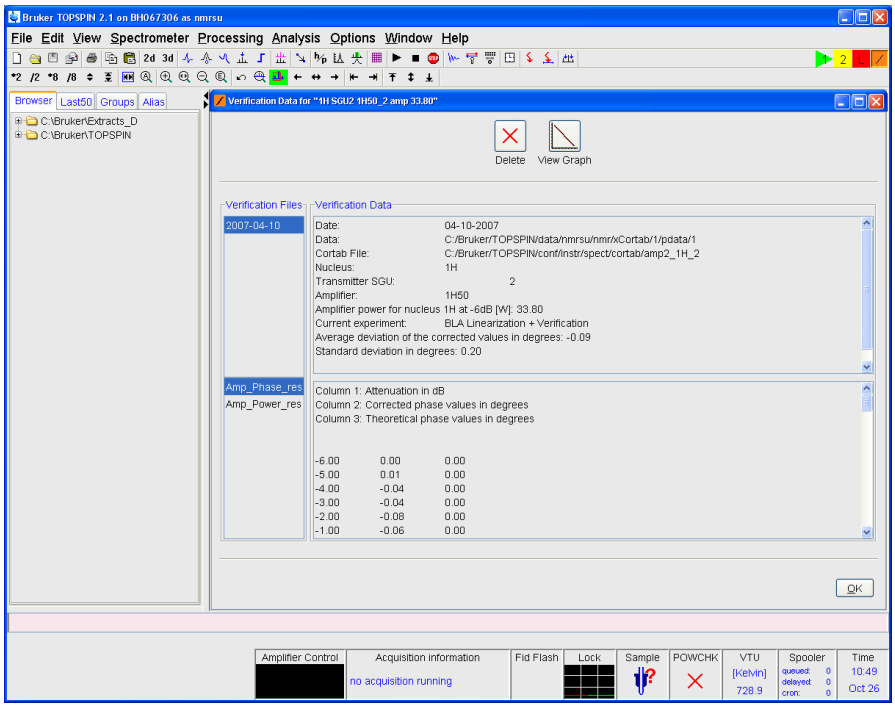
- Select the nucleus, SGU, and amplifier that you want to cortab in the **edsp** window
- Click **Save** when selection is complete



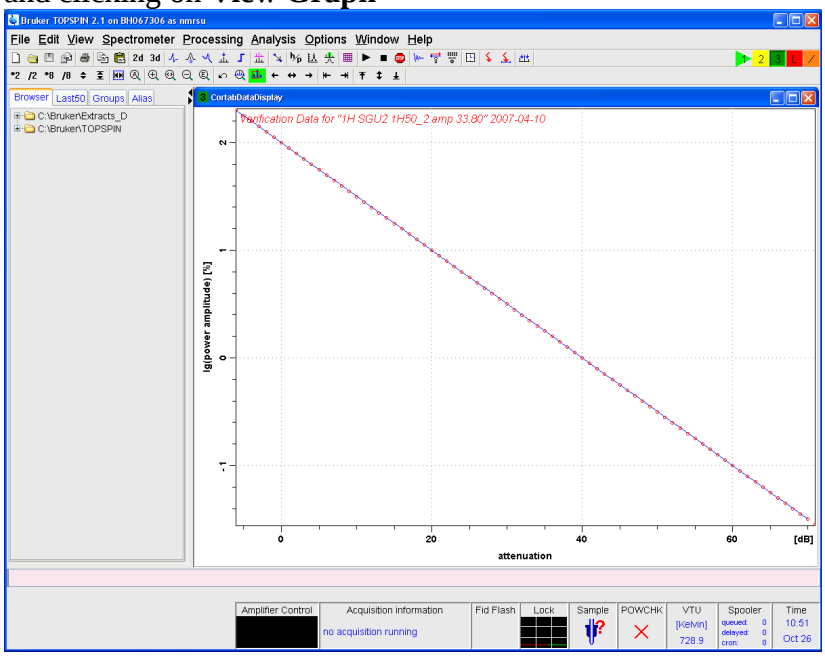
- You will see the screen with instructions on how to connect the cortab attenuator
- Enter the power at -6 dB in the box
- If there is more than one output of this amp (1H 300 + 50W) click the **Additional power entry** and enter the other power level
- When the attenuator is connected, click **OK**

- In the **Additional Nuclei** window, other nuclei that use the same SGU, and amplifier can be added.
  - Use a comma to separate individual nuclei
  - Use a dash to set up a range of nuclei (31P-29Si will cortab all nuclei with frequencies between 31P and 29Si inclusive)
- When done, you can start the cortab process by clicking **Start Experiments** in the main window
- You might be prompted to change the attenuator value based on the strength of the signal getting to the digitizer.

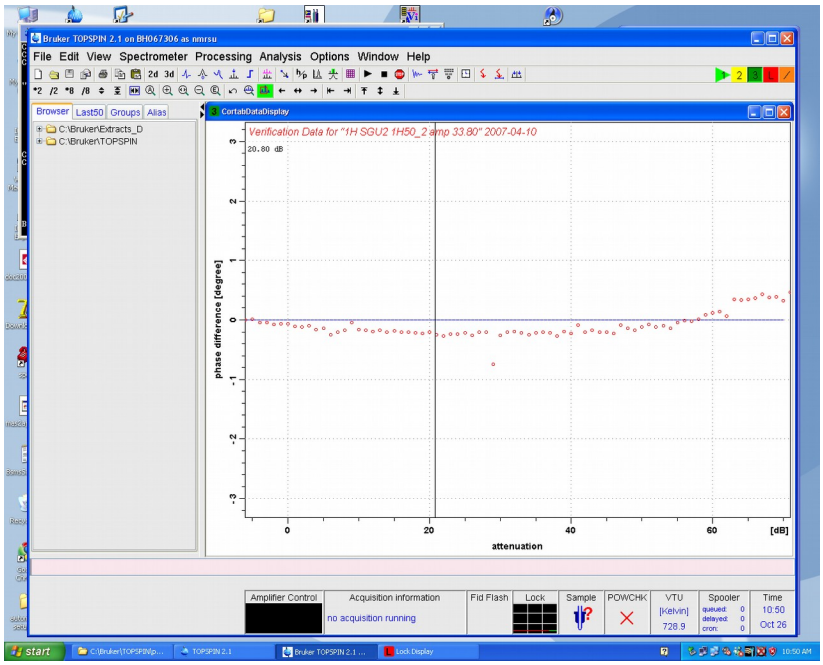
When cortab is done, you can check the results by selecting the nucleus + SGU + amplifier, and clicking **View Verification** in the main menu



- You can view the amplitude or phase results by selecting which one you want and clicking on **View Graph**



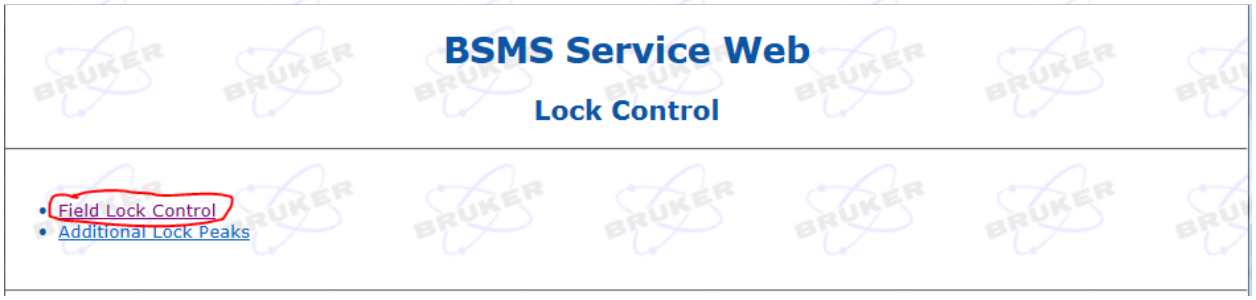
All points should be in a straight line



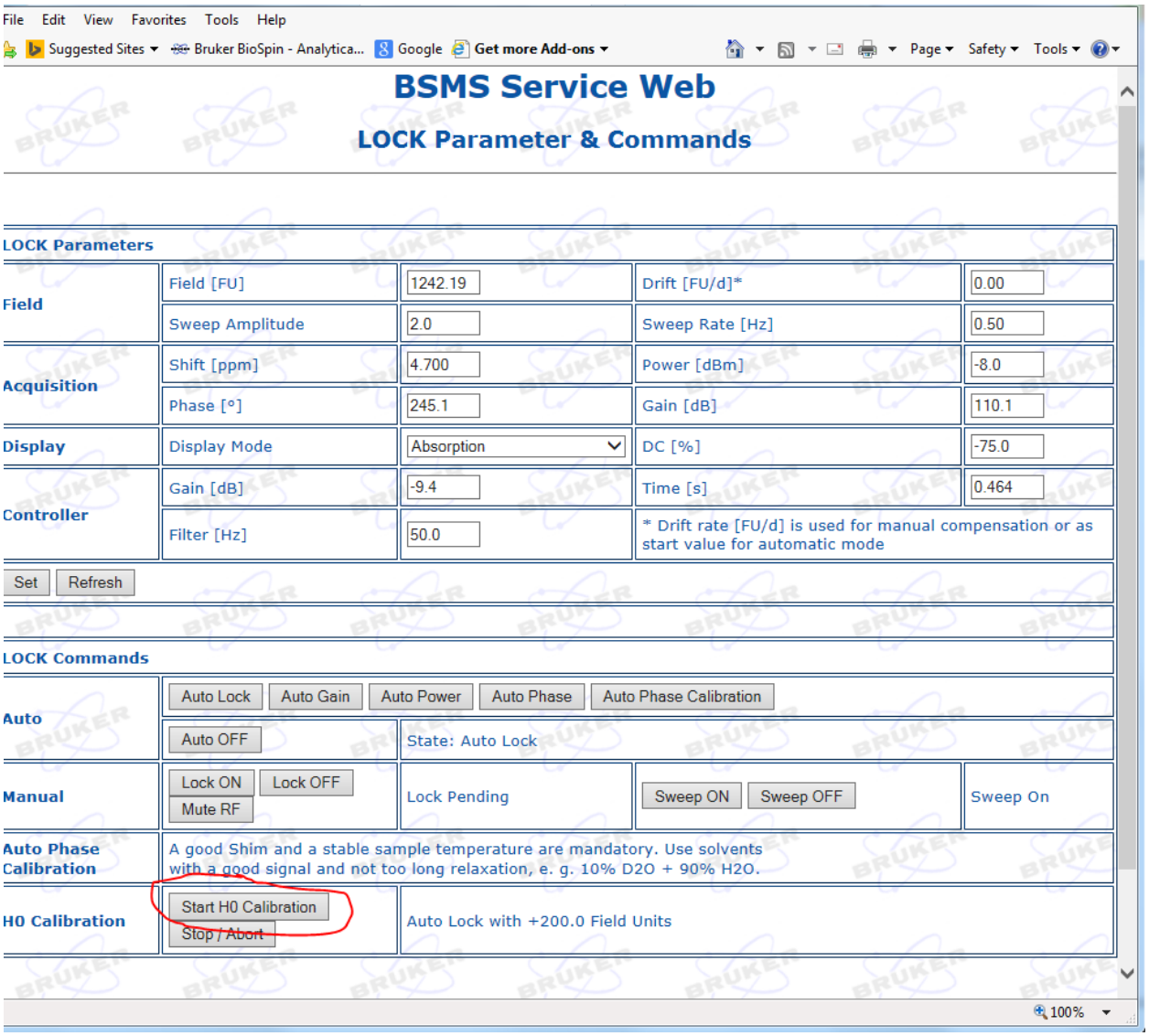
All points should be within a degree

H0 Calibration in BSMS

10% D2O = 90% H2O recommended for this procedure.



Turn lock sweep on before starting the H0 Calibration routine.



This calibration takes appx 10 minutes.