

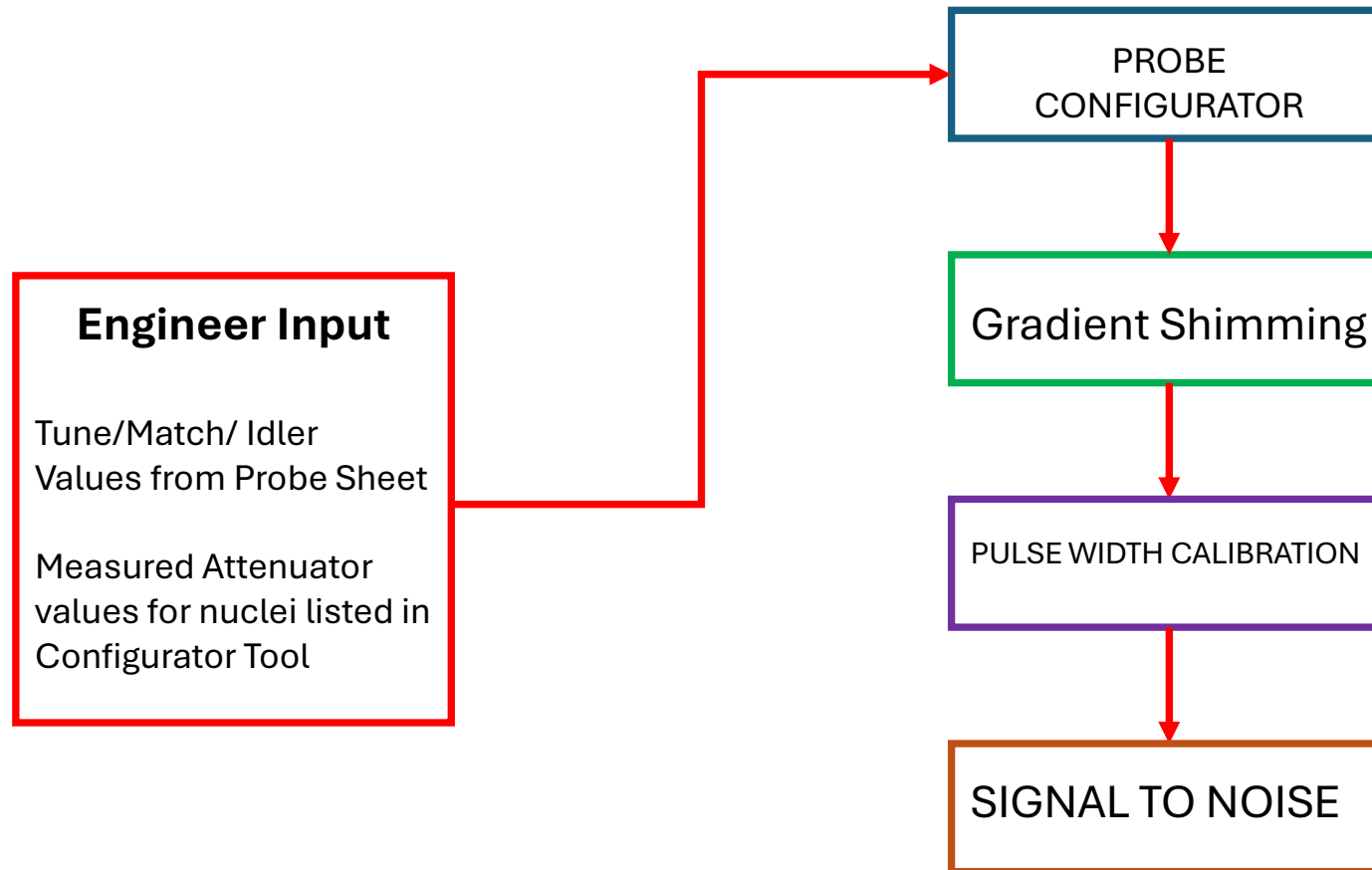
Automation Methods for Installation, Maintenance and Debugging

Consistency is the key

Automation methods created to normalize installs and routine maintenance tasks

- Shim routine to optimize all shims from zeros – eliminates any bias
- Single automation method to configure probe file parameters
 - ❑ Update of all probe related parameters (tune, match, idler, recommended pulse width durations, user measured attenuators based on max wattage, max wattage based on field strength, max duration based on field strength)
- Complete suite of pulse width calibrations based on measured **hard** attenuator values
 - ❑ ^1H , ^{19}F , ^{13}C , ^{31}P , ^{15}N , Lock
- Signal to noise routine
 - ❑ Database of signal to noise specifications for ^1H , ^{19}F , ^{13}C , ^{31}P , ^{15}N based on field strength, tube type, and RF window width
- Routine maintenance routines for pw calibration, shimming, troubleshooting
 - ❑ Update of pulse widths to probe file based on user defined allowed variance, update of system shims based on allowed standard deviation
- Automatic update of pulse widths and meta data to probe file
- Logging of information to custom log files

Flow Chart at New Installations



Optimized Gradient shim
routines to fit axial and radial
shims from all zeros

Fitting of Axial and low order Shims from raw field

Method Parameters: 1. Fitting of Low Order Shims from raw field		
▶	auto_discovered_probe_id	2800
▶	determine_lock_90	☒
▶	system_type	Homospoil ▾
▶	force_tune	☒
▶	sample_type	2H:Acetone-D6 ▾
▶	scans	1
▶	zero_shims	☐
▶	collect_lineshape_data	☐
▶	test_comment	

Logged to custom log file: "total_shim.log"

Generating Calibration Maps of Radial Shims

Method Parameters: 2. 3D Calibration of Radial Shims		
▶	auto_discovered_probe_id	2800
▶	system_type	Homospoil ▾
▶	sample_type	2H:Acetone-D6 ▾
▶	scans	1
▶	collect_lineshape_data	☐

Fitting of Axial and Radial Shims

Method Parameters: 3. Fitting of Axial and Radial Shims		
▶	auto_discovered_probe_id	2800
▶	system_type	Homospoil ▾
▶	sample_type	2H:Acetone-D6 ▾
▶	shim_set	Radial Full ▾
▶	scans	1
▶	iteration	3
▶	final_shim_fitting	☒
▶	save_system_shims	☒
▶	make_z_axis_homospoil_maps	☒
▶	cut_width_and_shim	☒
▶	collect_lineshape_data	☒

Centralized Location for Update of
Tune/Match/Idler/Attenuator/Recommended
90's and Wattages for Royal/Royal HFX probes

Tune/Match/Idler value input

Method Parameters: Pulse Width Configurator

▶	auto_discovered_probe_id	2800
▶	spectrometer_model	ECZL-S
▶	probe_serial_number	
▶	update_tune_match_values	☒
▶	nucleus	1H
▶	proton_tune	0
▶	proton_match	0
▶	fluorine_tune	0
▶	fluorine_match	0
▶	proton_fluorine_dual_tune	0
▶	proton_fluorine_dual_match	0
▶	idler_constant	0
▶	single_tune_idler	0
▶	dual_tune_idler	0
▶	carbon_tune	0
▶	carbon_match	0
▶	phosphorus_tune	0
▶	phosphorus_match	0
▶	nitrogen_tune	0
▶	nitrogen_match	0

➔

1H

19F

13C

31P

15N

Logged to custom log file: "installation_probe_configurator.log"

Attenuator input

▶	update_attenuator_values	
▶	determined_1h_atn	79.00
▶	determined_19f_atn	79.00
▶	determined_13c_atn	79.00
▶	determined_31p_atn	79.00
▶	determined_15n_atn	79.00
▶	determined_lock_atn	79.00
▶	determined_11b_atn	79.00
▶	determined_29si_atn	79.00
▶	determined_2h_atn	79.00
▶	determined_17o_atn	79.00
▶	determined_39k_atn	79.00



Nucleus	Attenuator updated automatically for nuclei in close proximity
³¹ P	7Li, 117Sn, 119Sn
¹¹ B	81Br, 63Cu, 65Cu, 71Ga, 141Pr, 87Rb, 23Na, 125Te, 51V, 129Xe
¹³ C	27Al, 79Br, 151Eu, 69Ga, 55Mn, 95Nb, 45Sc, 123Te, 159Tb
²⁹ Si	121Sb, 111Cd, 113Cd, 59Co, 65Ho, 113In, 115In, 127I, 207Pb, 195Pt, 185Rh, 187Rh, 99Tc
² H	75As, 209Bi, 6Li, 199Hg, 77Se, 171Y
¹⁷ O	123Sb, 7Be, 133Cs, 128La, 139La, 175Lu, 181Ta
¹⁵ N	10B, 137Ba, 153Eu
³⁹ K	107Ag

Logged to custom log file: "update_probe_parameters.log"

Maximum wattage/Recommended Maximum 90 values

▶	update_max_wattage_values	
▶	update_max_90_value	

Logged to custom log file: "update_probe_parameters.log"



Nucleus	Attenuator updated automatically for nuclei in close proximity
³¹ P	7Li, 117Sn, 119Sn
¹¹ B	81Br, 63Cu, 65Cu, 71Ga, 141Pr, 87Rb, 23Na, 125Te, 51V, 129Xe
¹³ C	27Al, 79Br, 151Eu, 69Ga, 55Mn, 95Nb, 45Sc, 123Te, 159Tb
²⁹ Si	121Sb, 111Cd, 113Cd, 59Co, 65Ho, 113In, 115In, 127I, 207Pb, 195Pt, 185Rh, 187Rh, 99Tc
² H	75As, 209Bi, 6Li, 199Hg, 77Se, 171Y
¹⁷ O	123Sb, 7Be, 133Cs, 128La, 139La, 175Lu, 181Ta
¹⁵ N	10B, 137Ba, 153Eu
³⁹ K	107Ag

Updated meta data in probe file using configurator

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler Single

Coil HF1 Domain Fluorine19

	Square	Hi	Lo
90 Pulse (μs)	1.0	1.0	1.0
Power Level (dB)	5.0	79.0	79.0
Wattage (W)	30.0	1.0	1.0
Max 90 Pulse (μs)	10.0	80.0	80.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler Dual

Coil HF1 Domain Fluorine19

	Square	Hi	Lo
90 Pulse (μs)	1.0	1.0	1.0
Power Level (dB)	5.0	79.0	79.0
Wattage (W)	30.0	1.0	1.0
Max 90 Pulse (μs)	14.0	80.0	80.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Carbon13

	Square	Hi	Lo
90 Pulse (μs)	1.0	1.0	1.0
Power Level (dB)	6.0	79.0	79.0
Wattage (W)	80.0	1.0	1.0
Max 90 Pulse (μs)	12.0	147.0	147.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Aluminum27

	Square
90 Pulse (μs)	1.0
Power Level (dB)	6.0
Wattage (W)	80.0
Max 90 Pulse (μs)	1.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler Single

Coil HF1 Domain Proton

	Square	Hi	Lo	Soft	Spin
90 Pulse (μs)	1.0	1.0	1.0	1.0	1.0
Power Level (dB)	4.0	79.0	79.0	79.0	79.0
Wattage (W)	30.0	1.0	1.0	1.0	1.0
Max 90 Pulse (μs)	7.0	115.0	115.0	20000.0	75.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler Dual

Coil HF1 Domain Proton

	Square	Hi	Lo	Soft	Spin
90 Pulse (μs)	1.0	1.0	1.0	1.0	1.0
Power Level (dB)	4.0	79.0	79.0	79.0	79.0
Wattage (W)	30.0	1.0	1.0	1.0	1.0
Max 90 Pulse (μs)	14.0	115.0	115.0	20000.0	75.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Phosphorus31

	Square	Hi	Lo
90 Pulse (μs)	1.0	1.0	1.0
Power Level (dB)	7.0	79.0	79.0
Wattage (W)	50.0	1.0	1.0
Max 90 Pulse (μs)	18.0	108.0	108.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Cobalt59

	Square
90 Pulse (μs)	1.0
Power Level (dB)	11.0
Wattage (W)	80.0
Max 90 Pulse (μs)	1.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LOCK Domain Deuterium

	Square	Soft
90 Pulse (μs)	1.0	1.0
Power Level (dB)	79.0	79.0
Wattage (W)	15.0	1.0
Max 90 Pulse (μs)	150.0	20000.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Nitrogen15

	Square	Hi
90 Pulse (μs)	1.0	1.0
Power Level (dB)	8.0	79.0
Wattage (W)	120.0	1.0
Max 90 Pulse (μs)	24.0	296.0

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Oxygen17

	Square
90 Pulse (μs)	1.0
Power Level (dB)	12.0
Wattage (W)	120.0
Max 90 Pulse (μs)	1.0

Pulse Calculator Shape Viewer

Royal/Royal HFX
Pulse width updates to probe file for
 $^1\text{H}/^{19}\text{F}/^{13}\text{C}/^{31}\text{P}/^{15}\text{N}/\text{Lock}$

Pulse width updates to probe file for $^1\text{H}/^{13}\text{C}/^{15}\text{N}/\text{Lock}$

Method Parameters: 1H, 13C, 15N, Lock Pulse Width Calibration		
▶	auto_discovered_probe_id	2800
▶	spectrometer_model	ECZL-S
▶	pulsewidth_test	Proton Hard
▶	save_as	pulsewidth calibration
▶	force_tune	☒
▶	dual_tuned	☐
▶	update_probe_file	☒
▶	allowed_variance	10[%]
▶	temperature_set	25[dC]
▶	temperature_state	Current
▶	temperature_delay	120[s]



Proton Hard
Proton Spin Lock
Proton Gauss
Proton Decoupler High/Low
Carbon Direct Hard
Carbon Direct Decoupler High/Low
Nitrogen15 Inverse Hard/High
Lock Hard
Lock Gauss

Logged to custom log file: "installation_pulse_width_calibration.log"

Sample: CIL CDNLM-7001. 1% H_2O , 1% ^{13}C enriched CH_3OH , 1% ^{15}N enriched CH_3CN , GdCl_3 in D_2O

Due to dependencies, HARD PULSE WIDTHS for each nucleus MUST be determined prior to other pulses for the same nucleus

24-JUL-2025 21:54:59 Started Proton Hard 90 degree Pulse Width Calibration
 24-JUL-2025 21:56:54 Updated Attenuator values with 3.93489[dB] for hf1 for 1hs
 24-JUL-2025 21:57:04 Updated Attenuator values with 3.93489[dB] for hf1 for 1hd
 24-JUL-2025 21:59:03 Updated Pulse width values with 6.705[us] for hf1 for 1hs
24-JUL-2025 21:59:13 Pulse width updated in probe file. Proton Hard set to 6.705[us] at 3.93489[dB]
 24-JUL-2025 21:59:23 Completed Proton Hard 90 degree Pulse Width Calibration
 24-JUL-2025 22:00:24 Started Proton Spin Lock 90 degree Pulse Width Calibration
 24-JUL-2025 22:00:46 Updated Attenuator values with 24.90814[dB] for hf1 for 1hs
 24-JUL-2025 22:04:53 Updated Attenuator values with 24.69578[dB] for hf1 for 1hs
 24-JUL-2025 22:08:52 Updated Pulse width values with 71.68828[us] for hf1 for 1hs
24-JUL-2025 22:09:03 Pulse width updated in probe file. Proton Spin Lock set to 71.68828[us] at 24.69578[dB]
 24-JUL-2025 22:09:13 Completed Proton Spin Lock 90 degree Pulse Width Calibration
 24-JUL-2025 22:10:10 Started Proton Gauss 90 degree Pulse Width Calibration
 24-JUL-2025 22:10:20 Updated Attenuator values with 65.72752[dB] for hf1 for 1hs
 24-JUL-2025 22:12:35 Updated Attenuator values with 64.60604[dB] for hf1 for 1hs
 24-JUL-2025 22:14:22 Updated Pulse width values with 19610.47835[us] for hf1 for 1hs
24-JUL-2025 22:14:32 Pulse width updated in probe file. Proton Gauss set to 19610.47835[us] at 64.60604[dB]

Pulse width updates to probe file for ^{19}F

Method Parameters: 19F Pulse Width Calibrations		
▶	auto_discovered_probe_id	2800
▶	spectrometer_model	ECZL-S ⚡
▶	pulsewidth_test	Fluorine Hard ⚡
▶	save_as	pulsewidth calibration
▶	force_tune	
▶	dual_tuned	
▶	update_probe_file	
▶	allowed_variance	10[%]
▶	temperature_set	25[dC]
▶	temperature_state	Current ⚡
▶	temperature_delay	120[s]



Fluorine Hard
Fluorine Decoupler High/Low

Logged to custom log file: "installation_pulse_width_calibration.log"

Sample: CIL DLM-78 (0.05% Trifluoro toluene) **Standard Wall**

Sample: ALDRICH 551406-8IN (0.05% Trifluoro toluene) **Standard Wall**

**Due to dependencies, HARD PULSE WIDTHS for each nucleus
MUST be determined prior to other pulses for the same nucleus**

Pulse width updates to probe file for ^{31}P

Method Parameters: 31P Pulse Width Calibrations		
▶	auto_discovered_probe_id	2800
▶	spectrometer_model	ECZL-S ⚡
▶	pulsewidth_test	Phosphorus Direct Hard/High/Low ⚡
▶	save_as	pulsewidth calibration
▶	force_tune	☒
▶	dual_tuned	☐
▶	update_probe_file	☒
▶	allowed_variance	10[%]
▶	temperature_set	25[dC]
▶	temperature_state	Current ⚡
▶	temperature_delay	120[s]



Phosphorus Direct Hard/High/Low ⚡

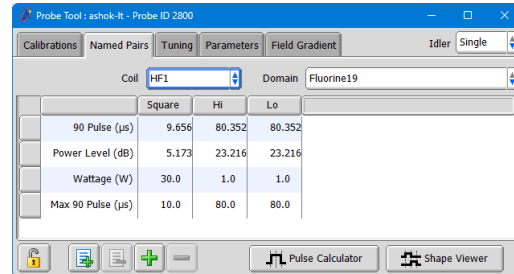
Logged to custom log file: "installation_pulse_width_calibration.log"

Sample: CIL DLM-77 (0.0485 Triphenyl phosphate in CDCl_3) **Standard Wall**

Sample: ALDRICH 708968-8IN (0.0485 Triphenyl phosphate in Acetone- D_6) **Standard Wall**

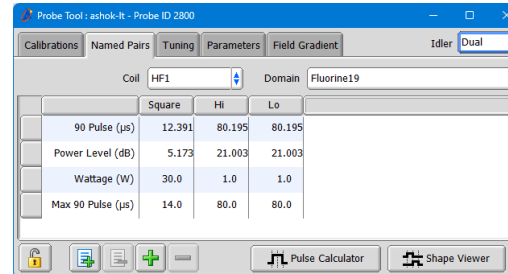
Updated pulse width values

Fluorine19 Single Tune



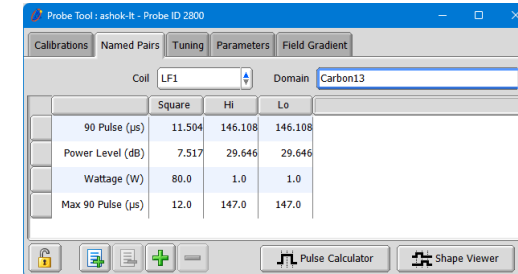
	Square	Hi	Lo
90 Pulse (µs)	9.656	80.352	80.352
Power Level (dB)	5.173	23.216	23.216
Wattage (W)	30.0	1.0	1.0
Max 90 Pulse (µs)	10.0	80.0	80.0

Fluorine19 Dual Tune



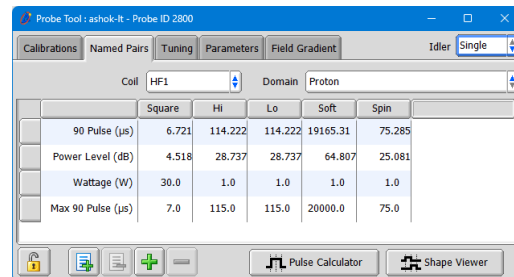
	Square	Hi	Lo
90 Pulse (µs)	12.391	80.195	80.195
Power Level (dB)	5.173	21.003	21.003
Wattage (W)	30.0	1.0	1.0
Max 90 Pulse (µs)	14.0	80.0	80.0

Carbon13



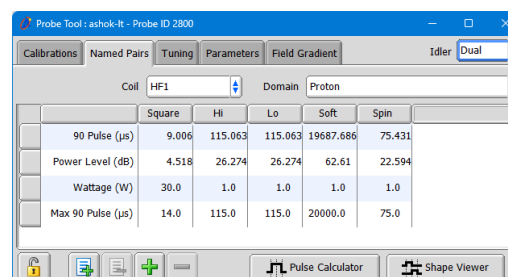
	Square	Hi	Lo
90 Pulse (µs)	11.504	146.108	146.108
Power Level (dB)	7.517	29.646	29.646
Wattage (W)	80.0	1.0	1.0
Max 90 Pulse (µs)	12.0	147.0	147.0

Proton Single Tune



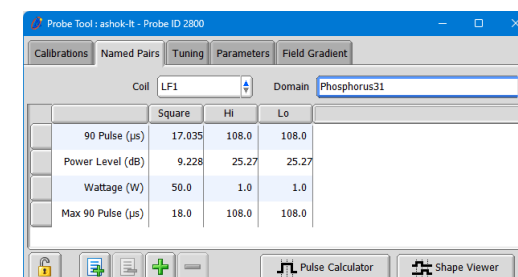
	Square	Hi	Lo	Soft	Spin
90 Pulse (µs)	6.721	114.222	114.222	19165.31	75.285
Power Level (dB)	4.518	28.737	28.737	64.807	25.081
Wattage (W)	30.0	1.0	1.0	1.0	1.0
Max 90 Pulse (µs)	7.0	115.0	115.0	20000.0	75.0

Proton Dual Tune



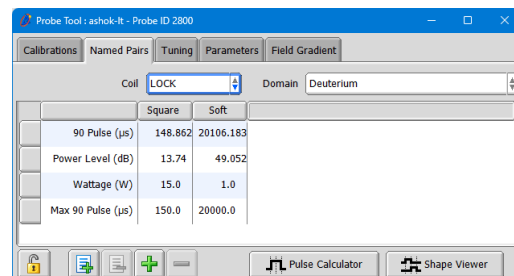
	Square	Hi	Lo	Soft	Spin
90 Pulse (µs)	9.006	115.063	115.063	19687.686	75.431
Power Level (dB)	4.518	26.274	26.274	62.61	22.594
Wattage (W)	30.0	1.0	1.0	1.0	1.0
Max 90 Pulse (µs)	14.0	115.0	115.0	20000.0	75.0

Phosphorus31



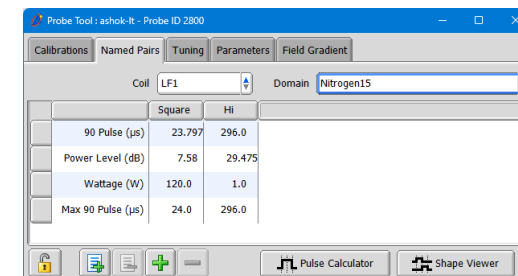
	Square	Hi	Lo
90 Pulse (µs)	17.035	108.0	108.0
Power Level (dB)	9.228	25.27	25.27
Wattage (W)	50.0	1.0	1.0
Max 90 Pulse (µs)	18.0	108.0	108.0

Lock



	Square	Soft
90 Pulse (µs)	148.862	20106.183
Power Level (dB)	13.74	49.052
Wattage (W)	15.0	1.0
Max 90 Pulse (µs)	150.0	20000.0

Nitrogen15



	Square	Hi
90 Pulse (µs)	23.797	296.0
Power Level (dB)	7.58	29.475
Wattage (W)	120.0	1.0
Max 90 Pulse (µs)	24.0	296.0

Signal to noise routines with database of values for ROYAL/ROYAL HFX with consideration for Thin Wall/Standard Wall tubes and 20mm/22mm RF Windows

^1H Signal to Noise (0.1% Ethyl Benzene)

Method Parameters: ^1H Signal to Noise (0.1% Ethyl Benzene)

▶	auto_discovered_probe_id	2800
▶	save_as	\$(SAMPLE)_1h_eb_sn
▶	std_manufacturer	CIL ⚙
▶	force_tune	☒
▶	dual_tuned	☐
▶	receiver_gain	50
▶	relaxation_delay	180[s]
▶	x_offset	3.79676[ppm]
▶	x_sweep	10[ppm]
▶	x_points	16384
▶	scans	1
▶	override_sn_ratio	
▶	custom_sn_ratio	0
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5
▶	gs_iterations	4



CIL
ALDRICH

04-JUL-2025 20:35:23 Started 1H Signal to Noise (0.1% Ethyl Benzene) Signal to Noise Cleave
 04-JUL-2025 20:38:35 1H Signal to Noise (0.1% Ethyl Benzene) Signal to Noise - 683.23432 : 1
 04-JUL-2025 20:38:35 1H Signal to Noise (0.1% Ethyl Benzene) Signal to Noise passed
04-JUL-2025 20:38:35 Determined = 683.23432 : Specification : 600
 04-JUL-2025 20:38:38 Completed 1H Signal to Noise (0.1% Ethyl Benzene) 90 degree Signal to Noise Test
 04-JUL-2025 20:44:21 Started 1H Signal to Noise (0.1% Ethyl Benzene)_DUAL_TUNED Signal to Noise Cleave
 04-JUL-2025 20:47:32 1H Signal to Noise (0.1% Ethyl Benzene)_DUAL_TUNED Signal to Noise - 503.75257 : 1
 04-JUL-2025 20:47:32 1H Signal to Noise (0.1% Ethyl Benzene)_DUAL_TUNED Signal to Noise passed
04-JUL-2025 20:47:32 Determined = 503.75257 : Specification : 400
 04-JUL-2025 20:47:35 Completed 1H Signal to Noise (0.1% Ethyl Benzene)_DUAL_TUNED 90 degree Signal to Noise Test

Logged to custom log file: "installation_specification_tests.log"

Sample: CIL DLM-5008 (0.1% Ethyl benzene in CDCl_3) **Thin Wall**

Sample: ALDRICH 487104-8IN (0.1% Ethyl benzene in CDCl_3) **Standard Wall**

Time/Date Logging of Signal to Noise Value to Probe File (Proton)

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler **Single**

Coil HF1 Domain Proton

Name	Value
actual_eb_signal_to_noise_single_tuned_09_13_2025	703
actual_eb_signal_to_noise_single_tuned_09_14_2025	729
eb_spec_signal_to_noise_single_tuned	500
ls_actual_width_at_0_11_percent	5.97878023[Hz]
ls_actual_width_at_0_55_percent	3.69096568[Hz]
ls_actual_width_at_50_percent	0.32685935[Hz]
probe_recovery	5[us]

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler **Dual**

Coil HF1 Domain Proton

Name	Value
actual_eb_signal_to_noise_dual_tuned_09_13_2025	531
actual_eb_signal_to_noise_dual_tuned_09_14_2025	519
eb_spec_signal_to_noise_dual_tuned	250
probe_recovery	5[us]

Pulse Calculator Shape Viewer

^{19}F Signal to Noise (0.05% Trifluoro toluene)

Method Parameters: ^{19}F Signal to Noise (0.05% Trifluorotoluene)		
	save_as	\$(SAMPLE)_19f_tft_sn
▶	std_manufacturer	CIL 
	force_tune	
	dual_tuned	
	receiver_gain	50
	relaxation_delay	180[s]
	x_offset	-62.37[ppm]
	x_sweep	2[kHz]
	x_points	16384
	scans	1
▶	pid_readback_from_probe	2800
▶	custom_sn_ratio	0
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 
	gs_iterations	4



CIL
ALDRICH

25-JUL-2025 13:04:10 Started ^{19}F Signal to Noise (0.05% Trifluorotoluene) Signal to Noise Test
 25-JUL-2025 13:17:45 Started ^{19}F Signal to Noise (0.05% Trifluorotoluene) Signal to Noise Test
 25-JUL-2025 13:21:01 ^{19}F Signal to Noise (0.05% Trifluorotoluene) Signal to Noise passed
25-JUL-2025 13:21:01 Determined = 655.97442 : Specification : 600
 25-JUL-2025 13:21:04 Completed ^{19}F Signal to Noise (0.05% Trifluorotoluene) Signal to Noise Test
 25-JUL-2025 13:28:57 Started ^{19}F Signal to Noise (0.05% Trifluorotoluene)_DUAL_TUNED Signal to Noise Test
 25-JUL-2025 13:32:10 ^{19}F Signal to Noise (0.05% Trifluorotoluene)_DUAL_TUNED Signal to Noise passed
25-JUL-2025 13:32:10 Determined = 545.29753 : Specification : 350
 25-JUL-2025 13:32:13 Completed ^{19}F Signal to Noise (0.05% Trifluorotoluene)_DUAL_TUNED Signal to Noise Test

Logged to custom log file: "installation_specification_tests.log"

Sample: CIL DLM-78 (0.05% Trifluoro toluene) **Standard Wall**

Sample: ALDRICH 551406-8IN (0.05% Trifluoro toluene) **Standard Wall**

Time/Date Logging of Signal to Noise Value to Probe File (Fluorine19)

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler Single

Coil HF1 Domain Fluorine19

Name	Value
actual_tft_signal_to_noise_single_tuned_09_13_2025	850
actual_tft_signal_to_noise_single_tuned_09_14_2025	727
probe_recovery	5[us]
tft_spec_signal_to_noise_single_tuned	550

Pulse Calculator Shape Viewer

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient Idler Dual

Coil HF1 Domain Fluorine19

Name	Value
actual_tft_signal_to_noise_dual_tuned_09_13_2025	751
actual_tft_signal_to_noise_dual_tuned_09_14_2025	526
probe_recovery	5[us]
tft_spec_signal_to_noise_dual_tuned	380

Pulse Calculator Shape Viewer

^{13}C Signal to Noise (10% Ethyl Benzene)

Method Parameters: ^{13}C Signal to Noise (10% Ethyl Benzene)		
	save_as	\$(SAMPLE)_13c_eb_sn
▶	std_manufacturer	CIL ⚡
	force_tune	✓
	dual_tuned	⬜
	receiver_gain	50
	relaxation_delay	300[s]
	x_offset	79.9999[ppm]
	x_sweep	160[ppm]
	x_points	131072
	scans	1
	irr_noise	WALTZ16 ⚡
▶	pid_readback_from_probe	2800
▶	custom_sn_ratio	0
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 ⚡
	gs_iterations	4



CIL
ALDRICH

25-JUL-2025 12:36:50 Started ^{13}C Signal to Noise (10% Ethyl Benzene) Signal to Noise Test
25-JUL-2025 12:42:23 FATAL : ^{13}C Signal to Noise (10% Ethyl Benzene) Signal to Noise FAILED, rerun test!
25-JUL-2025 12:42:26 Completed ^{13}C Signal to Noise (10% Ethyl Benzene) Signal to Noise Test

10-AUG-2025 17:56:42 Started ^{13}C Signal to Noise (10% Ethyl Benzene) Signal to Noise Test
10-AUG-2025 18:02:14 ^{13}C Signal to Noise (10% Ethyl Benzene) Signal to Noise passed
10-AUG-2025 18:02:14 Determined = 286.07321 : Specification : 200
10-AUG-2025 18:02:17 Completed ^{13}C Signal to Noise (10% Ethyl Benzene) Signal to Noise Test

Logged to custom log file: "installation_specification_tests.log"

Sample: CIL DLM-78 (10% Ethyl benzene in CDCl_3) **Thin Wall**

Sample: ALDRICH 708046-8IN (10% Ethyl benzene in CDCl_3) **Standard Wall**

Time/Date Logging of Signal to Noise Value to Probe File (Carbon13 Ethyl Benzene)

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Carbon13

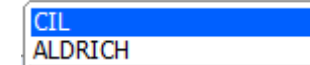
Name	Value
actual_astm_signal_to_noise_09_13_2025	232
actual_astm_signal_to_noise_09_14_2025	236
actual_eb_signal_to_noise_09_13_2025	298
actual_eb_signal_to_noise_09_14_2025	322
astm_spec_signal_to_noise	180
eb_spec_signal_to_noise	200
probe_recovery	20[us]

Icons: [Add] [Print] [Zoom In] [Zoom Out]

Pulse Calculator Shape Viewer

^{13}C Signal to Noise (ASTM)

Method Parameters: ^{13}C Signal to Noise (40% Dioxane)		
	save_as	\$(SAMPLE)_13c_astm_sn
▶	std_manufacturer	CIL ⚙
	force_tune	☒
	dual_tuned	☐
	receiver_gain	50
	relaxation_delay	180[s]
	x_offset	100[ppm]
	x_sweep	40[kHz]
	x_points	16384
	scans	1
▶	pid_readback_from_probe	2800
▶	custom_sn_ratio	0
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 ⚙
	gs_iterations	4



10-AUG-2025 17:24:00 Started ^{13}C Signal to Noise (40% Dioxane) Signal to Noise Test
10-AUG-2025 17:29:07 ^{13}C Signal to Noise (40% Dioxane) Signal to Noise passed
10-AUG-2025 17:29:07 Determined = 195.1197 : Specification : 180
10-AUG-2025 17:29:10 Completed ^{13}C Signal to Noise (40% Dioxane) Signal to Noise Test

Logged to custom log file: "installation_specification_tests.log"

Sample: CIL DLM-72 (40% Dioxane in Benzene D_6) **Thin Wall**

Sample: ALDRICH 551368-8IN (40% Dioxane in Benzene- D_6) **Standard Wall**

Time/Date Logging of Signal to Noise Value to Probe File (Carbon13 ASTM)

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Carbon13

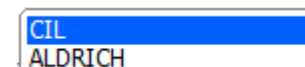
Name	Value
actual_astm_signal_to_noise_09_13_2025	232
actual_astm_signal_to_noise_09_14_2025	236
actual_eb_signal_to_noise_09_13_2025	298
actual_eb_signal_to_noise_09_14_2025	322
astm_spec_signal_to_noise	180
eb_spec_signal_to_noise	200
probe_recovery	20[us]

Icons: [Add] [Print] [Zoom In] [Zoom Out]

Pulse Calculator Shape Viewer

^{31}P Signal to Noise (0.0485M Triphenyl phosphate)

Method Parameters: 31P Signal to Noise (0.0485M Triphenylphosphate)		
	save_as	\$(SAMPLE)_31p_tpp_sn
▶	std_manufacturer	CIL ⚙
	force_tune	☒
	dual_tuned	☐
	receiver_gain	50
	relaxation_delay	180[s]
	x_offset	-17.0612[ppm]
	x_sweep	50[ppm]
	x_points	16384
	scans	1
▶	pid_readback_from_probe	2800
▶	custom_sn_ratio	0
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 ⚙
	gs_iterations	4



25-JUL-2025 12:57:22 Started 31P Signal to Noise (0.0485M Triphenylphosphate) Signal to Noise Test
 25-JUL-2025 13:00:32 31P Signal to Noise (0.0485M Triphenylphosphate) Signal to Noise passed
25-JUL-2025 13:00:32 Determined = 122.48266 : Specification : 110
 25-JUL-2025 13:00:35 Completed 31P Signal to Noise (0.0485M Triphenylphosphate) Signal to Noise Test

Logged to custom log file: "installation_specification_tests.log"

Sample: CIL DLM-77 (0.0485 Triphenyl phosphate in CDCl_3) **Standard Wall**

Sample: ALDRICH 708968-8IN (0.0485 Triphenyl phosphate in Acetone- D_6) **Standard Wall**

Time/Date Logging of Signal to Noise Value to Probe File (Phosphorus 31)

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Phosphorus31

Name	Value
actual_tpp_signal_to_noise_09_13_2025	113
actual_tpp_signal_to_noise_09_14_2025	126
probe_recovery	20[us]
tpp_spec_signal_to_noise	100

+ - Pulse Calculator Shape Viewer

^{15}N Signal to Noise (90% Formamide)

Method Parameters: ^{15}N Signal to Noise (90% Formamide)

	save_as	\$(SAMPLE)_15n_formamide_sn
▶	std_manufacturer	CIL ⚡
	force_tune	☒
	dual_tuned	☐
	receiver_gain	50
	relaxation_delay	180[s]
	x_offset	108.1[ppm]
	x_sweep	2[kHz]
	x_points	16384
	scans	1
	irr_noise	WALTZ16 ⚡
▶	pid_readback_from_probe	2800
▶	custom_sn_ratio	0
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 ⚡
	gs_iterations	4



CIL
ALDRICH

03-AUG-2025 13:17:15 Started ^{15}N Signal to Noise (90% Formamide) Signal to Noise Test
03-AUG-2025 13:17:41 ^{15}N Signal to Noise (90% Formamide) Signal to Noise passed
03-AUG-2025 13:17:41 Determined = 35 : Specification : 30
03-AUG-2025 13:17:44 Completed ^{15}N Signal to Noise (90% Formamide) Signal to Noise Test

Logged to custom log file: "installation_specification_tests.log"

Sample: CIL DLM-68 (90% Formamide in DMSO- d_6) **Standard Wall**

Sample: ALDRICH 551384-8IN (90% Formamide in DMSO- d_6) **Standard Wall**

Time/Date Logging of Signal to Noise Value to Probe File (Nitrogen15)

Probe Tool : ashok-It - Probe ID 2800

Calibrations Named Pairs Tuning Parameters Field Gradient

Coil LF1 Domain Nitrogen15

Name	Value
actual_formamide_signal_to_noise_09_14_2025	34
formamide_spec_signal_to_noise	30
probe_recovery	20[us]

+ - Pulse Calculator Shape Viewer

^1H Lineshape

Method Parameters: ^1H Lineshape		
	save_as	\$(SAMPLE)_1h_lineshape
	force_tune	
	dual_tuned	
	receiver_gain	50
	relaxation_delay	180[s]
	x_offset	7.5[ppm]
	x_sweep	1[kHz]
	x_points	16384
	scans	1
	spinner_state	SPIN OFF 
	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 
	gs_iterations	4

09-SEP-2025 14:39:00 Started ^1H Lineshape Resolution Test
09-SEP-2025 14:39:33 ^1H Lineshape Linewidth at 50%/0.55%/0.11% - 0.34635[Hz]/5.06433[Hz]/8.20432[Hz]
09-SEP-2025 14:39:35 Completed ^1H Lineshape Resolution Test

Logged to custom log file: "installation_specification_tests.log"

Sample: CIL DLM-76 (1% Lineshape in Acetone- D_6) **Standard Wall**

Sample: ALDRICH 487163-8IN (1% Lineshape- D_6) **Standard Wall**

Time/Date Logging of Lineshape Linewidth Values to Probe File

Probe Tool : ashok-It - Probe ID 2806

Calibrations Named Pairs Tuning Parameters Field Gradient Idler Single

Coil HF1 Domain Proton

Name	Value
actual_eb_signal_to_noise_single_tuned_07_31_2025	688
actual_ls_width_at_0_11_percent_spin_off_09_15_2025	9.08108931[Hz]
actual_ls_width_at_0_55_percent_spin_off_09_15_2025	5.89174859[Hz]
actual_ls_width_at_50_percent_spin_off_09_15_2025	0.63732852[Hz]
eb_spec_signal_to_noise_single_tuned	600
ls_spec_width_at_0_11_percent_spin_off	16[Hz]
ls_spec_width_at_0_55_percent_spin_off	8[Hz]
ls_spec_width_at_50_percent_spin_off	0.8[Hz]
probe_recovery	5[us]

Pulse Calculator Shape Viewer

Routine Maintenance (PM) Tests/Troubleshooting

Pulse width maintenance for $^1\text{H}/^{13}\text{C}/^{15}\text{N}/\text{Lock}$

Method Parameters: 1H,13C,15N,Lock Pulse Width Calibrations		
▶	auto_discovered_probe_id	2800
▶	pulwidth_test	Proton Hard ▴
▶	save_as	pulwidth calibration
▶	force_tune	☒
▶	dual_tuned	☐
▶	update_probe_file	☒
▶	allowed_variance	5[%]
▶	temperature_set	25[dC]
▶	temperature_state	Current ▴
▶	temperature_delay	120[s]



Proton Hard
 Proton Spin Lock
 Proton Gauss
 Proton Decoupler High
 Proton Decoupler Low
 Carbon Direct Hard
 Carbon Direct Decoupler High/Low
 Nitrogen15 Inverse Hard/High
 Lock Hard
 Lock Gauss

09-SEP-2025 07:51:15 Started Proton Hard 90 degree Pulse Width Calibration
 09-SEP-2025 07:52:58 Pulse width for Proton Hard calculated as 6.65898[us]
 09-SEP-2025 07:53:01 Pulse width within 5[%] of value in probe file, pw value changed from 6.70158[us] to 6.65898[us]
 09-SEP-2025 07:53:01 Completed Proton Hard 90 degree Pulse Width Calibration
 09-SEP-2025 07:53:52 Started Proton Spin Lock 90 degree Pulse Width Calibration
 09-SEP-2025 07:57:36 Pulse width for Proton Spin Lock calculated as 73.50596[us]
09-SEP-2025 07:57:39 Pulse width within 5[%] of value in probe file, pw value changed from 75.35278[us] to 73.50596[us]
 09-SEP-2025 07:57:39 Completed Proton Spin Lock 90 degree Pulse Width Calibration
 09-SEP-2025 08:08:14 Started Carbon Direct Hard 90 degree Pulse Width Calibration
 09-SEP-2025 08:13:13 Pulse width for Carbon Direct Hard calculated as 11.34668[us]
 09-SEP-2025 08:13:15 Pulse width within 5[%] of value in probe file, pw value changed from 11.58576[us] to 11.34668[us]
 09-SEP-2025 08:13:15 Completed Carbon Direct Hard 90 degree Pulse Width Calibration
 09-SEP-2025 08:14:04 Started Carbon Direct Decoupler High/Low 90 degree Pulse Width Calibration
 09-SEP-2025 08:19:19 Pulse width for Carbon Direct Decoupler High/Low calculated as 135.35567[us]
 09-SEP-2025 08:19:24 Pulse width within 5[%] of value in probe file, pw value changed from 139.34537[us] to 135.35567[us]
 09-SEP-2025 08:19:24 Completed Carbon Direct Decoupler High/Low 90 degree Pulse Width Calibration
 09-SEP-2025 08:21:00 Started Nitrogen15 Inverse Hard 90 degree Pulse Width Calibration
09-SEP-2025 08:26:09 FATAL : Pulse width less/greater than 5[%] of value in probe file, pw value will not be updated
 09-SEP-2025 08:26:09 Completed Nitrogen15 Inverse Hard 90 degree Pulse Width Calibration

Logged to custom log file: "auto_test.log"

Sample: CIL CDNLM-7001. 1% H_2O , 1% ^{13}C enriched CH_3OH , 1% ^{15}N enriched CH_3CN , GdCl_3 in D_2O

Pulse width maintenance for ^{19}F

Method Parameters: ^{19}F Pulse Width Calibrations		
▶	auto_discovered_probe_id	2800
▶	pulsewidth_test	Fluorine Hard 🔽
▶	save_as	pulsewidth calibration
▶	force_tune	☒
▶	dual_tuned	☐
▶	update_probe_file	☒
▶	allowed_variance	5[%]
▶	temperature_set	25[dC]
▶	temperature_state	Current 🔽
▶	temperature_delay	120[s]



Fluorine Hard
Fluorine Decoupler High/Low

09-SEP-2025 09:35:11 Started Fluorine Hard 90 degree Pulse Width Calibration
09-SEP-2025 09:37:41 Pulse width for Fluorine Hard calculated as 9.38935[us]
09-SEP-2025 09:37:44 Pulse width within 5[%] of value in probe file, pw value changed from 9.75501[us] to 9.38935[us]
09-SEP-2025 09:37:44 Completed Fluorine Hard 90 degree Pulse Width Calibration
09-SEP-2025 09:38:43 Started Fluorine Decoupler High/Low 90 degree Pulse Width Calibration
09-SEP-2025 09:41:46 Pulse width for Fluorine Decoupler High/Low calculated as 75.80876[us]
09-SEP-2025 09:41:49 Pulse width within 5[%] of value in probe file, pw value changed from 78.29138[us] to 75.80876[us]
09-SEP-2025 09:41:49 Pulse width within 5[%] of value in probe file, pw value changed from 78.29138[us] to 75.80876[us]
09-SEP-2025 09:41:49 Completed Fluorine Decoupler High/Low 90 degree Pulse Width Calibration

Logged to custom log file: "auto_test.log"

Sample: CIL DLM-78 (0.05% Trifluoro toluene) **Standard Wall**

Sample: ALDRICH 551406-8IN (0.05% Trifluoro toluene) **Standard Wall**

Pulse width maintenance for ³¹P

Method Parameters: 31P Pulse Width Calibrations		
▶	auto_discovered_probe_id	2800
▶	pulsewidth_test	Phosphorus Direct Hard/High/Low ⚡
▶	save_as	pulsewidth calibration
▶	force_tune	☒
▶	dual_tuned	☐
▶	update_probe_file	☒
▶	allowed_variance	5[%]
▶	temperature_set	25[dC]
▶	temperature_state	Current ⚡
▶	temperature_delay	120[s]



Phosphorus Direct Hard/High/Low ⚡

09-SEP-2025 18:10:43 Started Phosphorus Direct Hard 90 degree Pulse Width Calibration
09-SEP-2025 18:14:36 Pulse width for Phosphorus Direct Hard calculated as 16.73575[us]
09-SEP-2025 18:14:38 FATAL : Determined Pulse width of 16.73575[us] less than 5[%] or greater than 5[%] of the current value of 17.66033[us] in probe file, pw value will not be updated
09-SEP-2025 18:14:38 Completed Phosphorus Direct Hard 90 degree Pulse Width Calibration

Logged to custom log file: "auto_test.log"

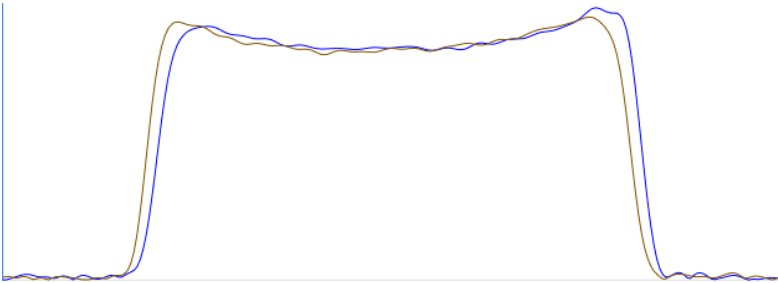
Sample: CIL DLM-77 (0.0485 Triphenyl phosphate in CDCl₃) **Standard Wall**
Sample: ALDRICH 708968-8IN (0.0485 Triphenyl phosphate in Acetone-D₆) **Standard Wall**

Field Gradient power check

Method Parameters: Gradient Power Test		
	save_as	fg_power
	force_tune	☒
	dual_tuned	☐
	auto_gain	☒
	relaxation_delay	5[s]
	pid_readback_from_probe	2800
▶	custom_coil_width	0[mm]
▶	temperature_set	25[dC]
▶	temperature_state	Current ▾
▶	temperature_delay	120[s]

Sample: CIL CDNLM-7001. 1% H₂O, 1% ¹³C enriched CH₃OH, 1% ¹⁵N enriched CH₃CN, GdCl₃ in D₂O

09-SEP-2025 16:16:17 Started Gradient Power Test
09-SEP-2025 16:17:30 Gradient Power Test on 1h with 20[mm] has a Positive Gradient strength: 0.29004[T/m] at 10[A]
09-SEP-2025 16:17:30 Gradient Power Test on 1h with 20[mm] has a Negative Gradient strength: -0.28977[T/m] at 10[A]
09-SEP-2025 16:17:32 Gradient Power Test completed



Bobbin/Insert Impurity Check

Method Parameters: Probe Insert Impurity Check		
▶	return_data_to_screen	☒
	save_as	divot_check_\$(DATE)
▶	tau_delay	200[ms]
	scans	16

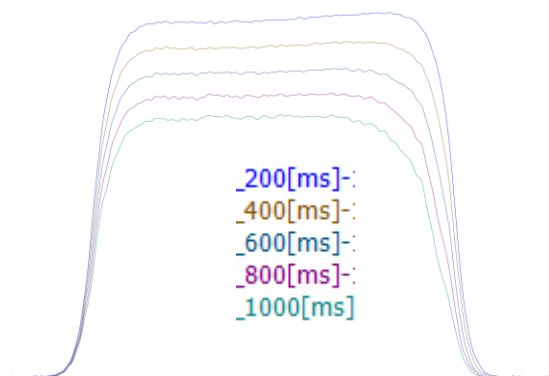


- 200[ms]
- 400[ms]
- 600[ms]
- 800[ms]
- 1000[ms]

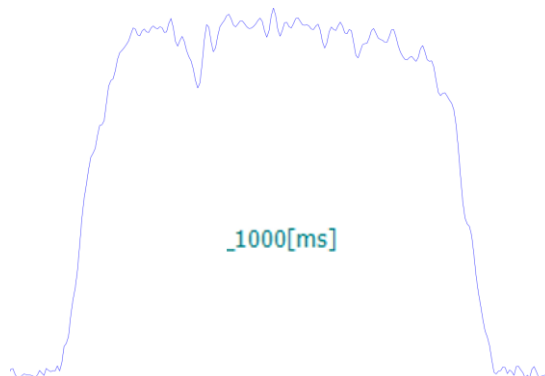
Sample: CIL DLM-76 (1% Lineshape in Acetone-D₆) **Standard Wall**

Sample: ALDRICH 487163-8IN (1% Lineshape-D₆) **Standard Wall**

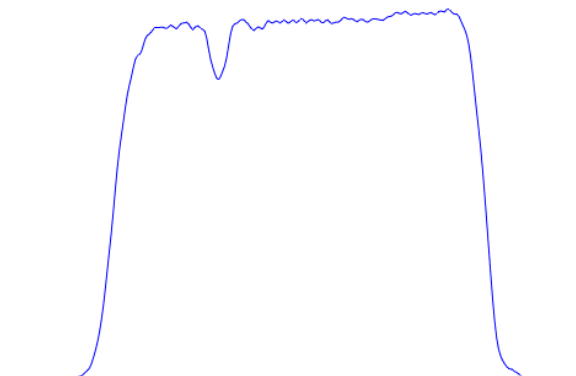
Good



Bad Tube/Impurities



Defect in coil?

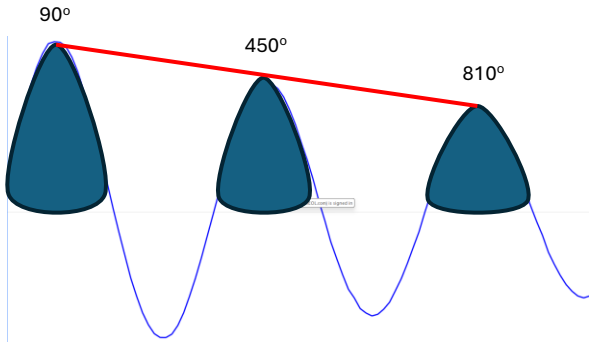


RF Homogeneity Check

Method Parameters: 1H RF Homogeneity		
	save_as	1h_rf_homogeneity
	force_tune	☒
	dual_tuned	☐
	auto_gain	☒
	scans	1
	relaxation_delay	10[s]
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 ⚙
	gs_iterations	4
▶	temperature_set	25[dC]
▶	temperature_state	Current ⚙
▶	temperature_delay	120[s]

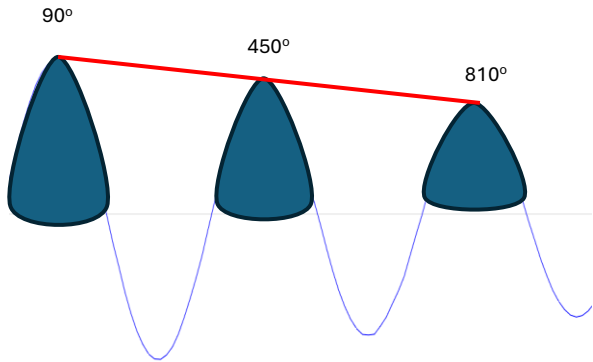
Sample: CIL CDNLM-7001. 1% H₂O, 1% ¹³C enriched CH₃OH, 1% ¹⁵N enriched CH₃CN, GdCl₃ in D₂O

Good



09-SEP-2025 17:01:30 Started 1H RF Homogeneity Test
09-SEP-2025 17:24:04 1H RF Homogeneity RF Homogeneity at 90[deg]/450[deg]/810[deg] - 100[%]/77[%]/62[%]
09-SEP-2025 17:24:06 1H RF Homogeneity Test completed

Bad



09-SEP-2025 17:01:30 Started 1H RF Homogeneity Test
09-SEP-2025 17:24:04 1H RF Homogeneity RF Homogeneity at 90[deg]/450[deg]/810[deg] - 100[%]/64[%]/44[%]
09-SEP-2025 17:24:06 1H RF Homogeneity Test completed

Routine shim maintenance to update shims
based on standard deviation criterion

Method 1: Begin Gradient Shim Axial

Method Parameters: 1. Begin Gradient Shim Axial		
	axial_system_mode	Homospoil
	force_tune	☒
	spinner_frequency	15[Hz]
	spinner_state	SPIN OFF
▶	auto_converge	☐
▶	gs_iterations	2
▶	auto_cut_range	☐
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6
	load_system_shims	☒



Homospoil
Fast_Homospoil
Fast_Gradient



SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6
SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5
SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4
SHIM_Z1, SHIM_Z2, SHIM_Z3
SHIM_Z1, SHIM_Z2
SHIM_Z1

Logged to custom log file: "routine_shim_maintenance.log"

Sample: CIL DLM-76 (1% Lineshape in Acetone-D₆) **Standard Wall**

Sample: ALDRICH 487163-8IN (1% Lineshape-D₆) **Standard Wall**

Method 2: Fitting of Radial Shims

Method Parameters: 2. Gradient Shim Radial			
▶	system_type	Homospoil	Homospoil
▶	sample_type	2H:Acetone-D6	Fast_Homospoil
▶	shimXY_array_pnts	4x4	Fast_Gradient
▶	shim_set	Radial Full Finish	Z1,Z2,X,Y,XZ,YZ
▶	scans	1	X,Y,XZ,YZ,X2,Y2
▶	iteration	3	Radial Higher Order
			Radial Full
			Radial 26
			Radial 28
			Radial Full Finish
			Radial Full Auto

Logged to custom log file: "routine_shim_maintenance.log"

Sample: CIL DLM-76 (1% Lineshape in Acetone-D₆) **Standard Wall**

Sample: ALDRICH 487163-8IN (1% Lineshape-D₆) **Standard Wall**

Method 3: End Gradient Shim Axial

Method Parameters: 3. End Gradient Shim Axial

	axial_system_mode	Homospoil ▾
	force_tune	☐
	spinner_frequency	15[Hz]
	spinner_state	SPIN OFF ▴
▶	auto_converge	☐
▶	gs_iterations	2
▶	auto_cut_range	☐
▶	shims_to_fit	SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6 ▴
	save_system_shims	☐
▶	allowed_deviation	0.28
	collect_lineshape_data	☒



Homospoil
Fast_Homospoil
Fast_Gradient



SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5, SHIM_Z6
SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4, SHIM_Z5
SHIM_Z1, SHIM_Z2, SHIM_Z3, SHIM_Z4
SHIM_Z1, SHIM_Z2, SHIM_Z3
SHIM_Z1, SHIM_Z2
SHIM_Z1

Logged to custom log file: "routine_shim_maintenance.log"

Sample: CIL DLM-76 (1% Lineshape in Acetone-D₆) **Standard Wall**

Sample: ALDRICH 487163-8IN (1% Lineshape-D₆) **Standard Wall**

Method 4: Save shim file to console for review



14-SEP-2025 14:09:35 Shim file saved to console for review. File saved to C:\Program Files (x86)\Common Files\JEOL\Control 6.5\users\console as 14-SEP-2025.shim

Logged to custom log file: "routine_shim_maintenance.log"

Sample: CIL DLM-76 (1% Lineshape in Acetone-D₆) **Standard Wall**

Sample: ALDRICH 487163-8IN (1% Lineshape-D₆) **Standard Wall**

Thanks to Matt for all the help with programming syntax and debugging.

Yuya spent countless weeks perfecting the 3D shim routine to make it extremely robust.

Without their assistance, this project would have failed miserably.

Thanks guys!!!!