Doty XC MAS Probe Series

Features:

1. **XC 4 mm, 5 mm, or 7 mm spinners**, (7 mm – WB only)
2. **High sensitivity**, ^{13}C S/N=250:1 on 70 μg glycine at 750 MHz (triple-resonance XC4, nt=4)
3. **Wide Temperature range**,
   -170 to +250°C WB XVT (extended temperature)
   -140°C to +170°C for standard WB VT
   -80°C to +120°C for standard NB VT
4. **High decoupling efficiency**, over 120 kHz for XC4 NB at 750 MHz with 250 W
5. **An order of magnitude lower decoupler heating** of biological solids compared to solenoid only
6. **Longest acquisition times with full decoupling**, 150-300 ms
7. **Lowest thermal gradients**, <1°C over sample with full ^{1}H decoupling, 13 kHz MAS, in XC5 with a Si_3N_4 stator
8. **Double-broadband X & Y channels**
9. **For conventional solids or liquids**
10. **Excellent B_0 line shape**, 0.005 ppm FWHM.
11. **Optical spin rate detection**
12. **Stable spinning slow-MAS, and fast-MAS**
13. **Leak-proof MAS sample cells**, simple, low-cost, are especially useful for liquids and tissues

WB XC4 H/X 400MHz

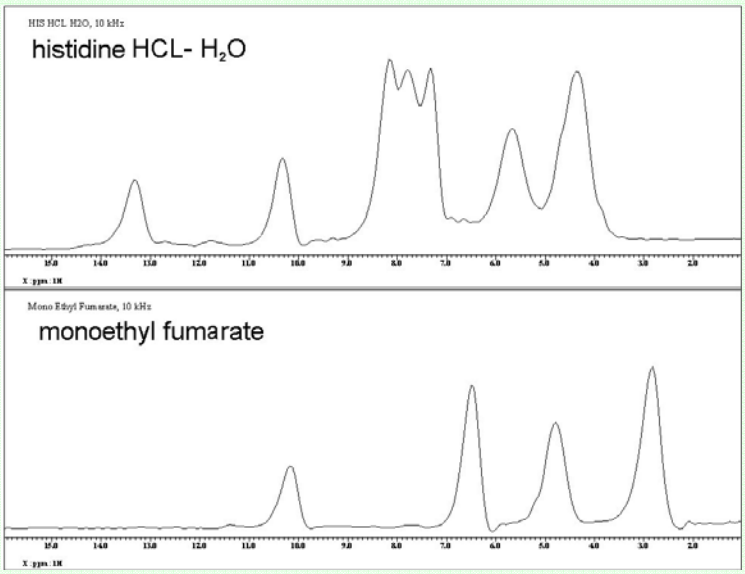
Wide bore or narrow bore
Fastest spinning 4 mm, 5 mm and 7 mm
Must remove probe to change samples
High sensitivity - no cold zone cooling

Doty XC4 MAS Probe Results

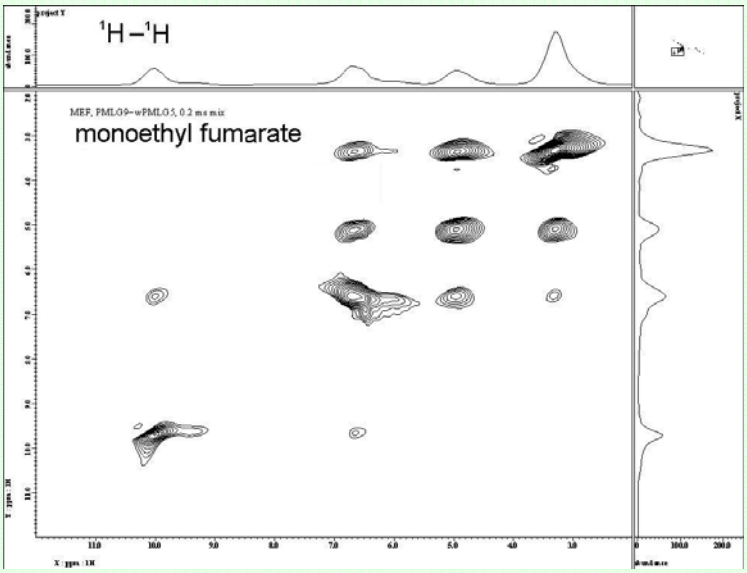
Doty HXY XC4 MAS Probe at 500 MHz on a JEOL ECA 500

Courtesy of Michael Frey, JEOL USA

^{1}H spectra of histidine HCL·H_2O (top) and **monoethyl fumarate** (bottom) using wPMLG5 with ^{1}H rf field of 105 kHz, MAS =10 kHz



^{1}H spectrum of monoethyl fumarate obtained with PMLG9-wPMLG5 Proton Spin Exchange in a 2D experiment with 0.2 ms mixing time and 89 kHz ^{1}H rf field, MAS =10 kHz



Doty XC MAS Probe Series

Doty 4 mm XC4 Probe Spinning Specifications*			
Speeds	**Thick Wall Si_3N_4 Rotors**	**Thin Wall ZrO_2 Rotors**	**Slow MAS**
MAS (kHz)	4 to 24	4 to 11	.1 to 12

Caps	*Thick Long*	*Thick Short*	*Thin Long*	*Thin Short*
Volume (µl)	46	96	59	124
Active Volume (µl)	45	45	60	60

XC4 Series ^{1}H/X *RF* Performance			
^{1}H Frequency (MHz)	**^{1}H power (W)**	**^{1}H γ B_1 (kHz)**	**Multi-X pw90, (µs)**
400 WB	240	130	2.2
500 WB	300	130	2.9
600 WB	270	120	3.0
800 NB	200	110	4.2

Doty 5 mm XC5 Probe Spinning Specifications*			
Speeds	**Thick Wall Si_3N_4 Rotors**	**Thin Wall ZrO_2 Rotors**	**Slow MAS**
MAS (kHz)	3 to 18	3 to 9	.02 to 11

Caps	*Thick Long*	*Thick Short*	*Thin Long*	*Thin Short*
Volume (µl)	115	158	150	205
Active Volume (µl)	80	80	105	105

XC5 Series ^{1}H/X *RF* Performance			
^{1}H Frequency (MHz)	**^{1}H power (W)**	**^{1}H γ B_1 (kHz)**	**Multi-X pw90, (µs)**
300 WB	300	120	2.2
400 WB	300	120	2.5
500 WB	280	120	2.6
600 WB	260	110	2.8
750 NB	250	110	4.6

Doty 7 mm XC7 Probes Spinning Specifications*			
Rotor & Caps	**Thick Wall Si_3N_4 Rotors**	**Thin Wall ZrO_2 Rotors**	**Slow MAS**
MAS (kHz)	2 to 12	2 to 7	.1 to 6

Caps	*Thick Long*	*Thick Short*	*Thin Long*	*Thin Short*
Volume (µl)	241	455	299	564
Active Volume (µl)	211	211	262	262

XC7 WB Series ^{1}H/X *RF* Performance			
^{1}H Frequency (MHz)	**^{1}H power (W)**	**^{1}H γ B_1 (kHz)**	**Multi-X pw90, (µs)**
300 WB	350	120	2.5
400 WB	300	110	3.4
500 WB	250	90	4.2
600 WB	210	80	5.0
750 WB	170	70	6.2

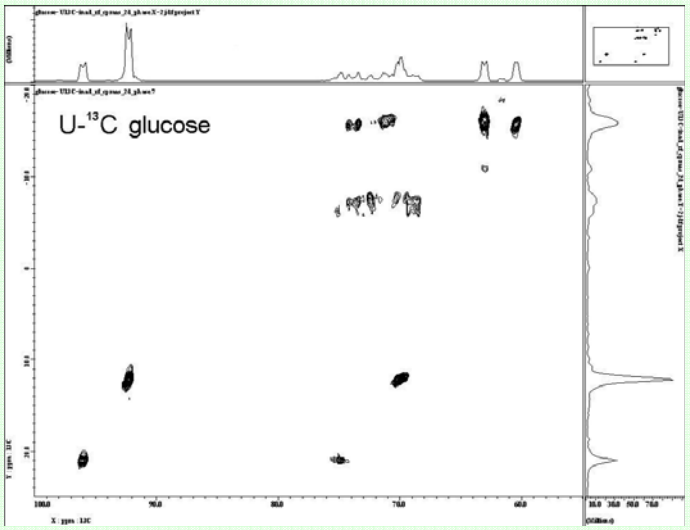
Note that γB_1 is proportional to $P^{1/2}$, so 70% of the indicated fields would be achieved at half power.

*** Thick wall specifications are for silicon nitride rotors while thin wall specifications are for zirconia rotors.**

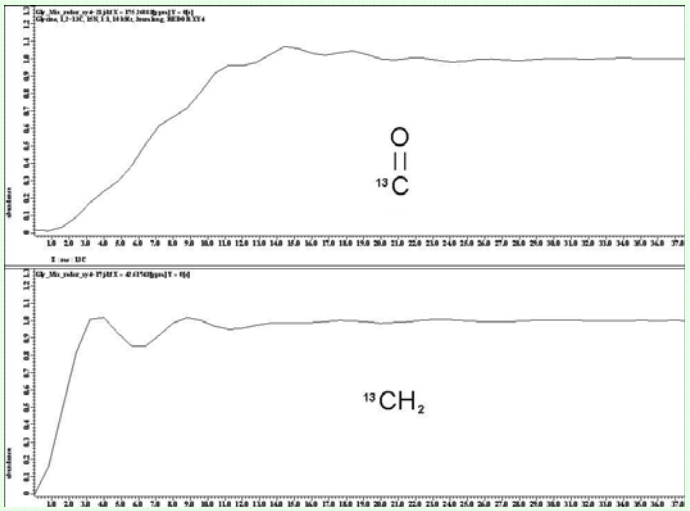
Results from Doty XC MAS probes

Spectra Courtesy of Michael Frey, JEOL USA

U-^{13}C Glucose
Refocused Inadequate, 114 kHz TPPM ^{1}H Decoupling with a **Doty XC5 probe** on a **JEOL ECX 400,** MAS =20 kHz



1:1 Mixture glycine -1-^{13}C,^{15}N and glycine -2 -^{13}C,^{15}N, **REDOR-xy4**, ^{13}C 90 4.68 µs, ^{15}N 90 6.18 µs, 132 kHz ^{1}H TPPM Decoupling, with a **Doty XC4 HXY probe** on **JEOL ECA 500**; Sample length restricted to 3 mm, MAS =10 kHz



Notes on Spinning:

XC thick wall rotors and caps are provided for fastest spinning and ease in packing. **XC thin wall** rotors and caps are available for maximum signal to noise. Long caps are provided for highest homogeneity and rf field strength. Short caps are used with XC sealing cells.

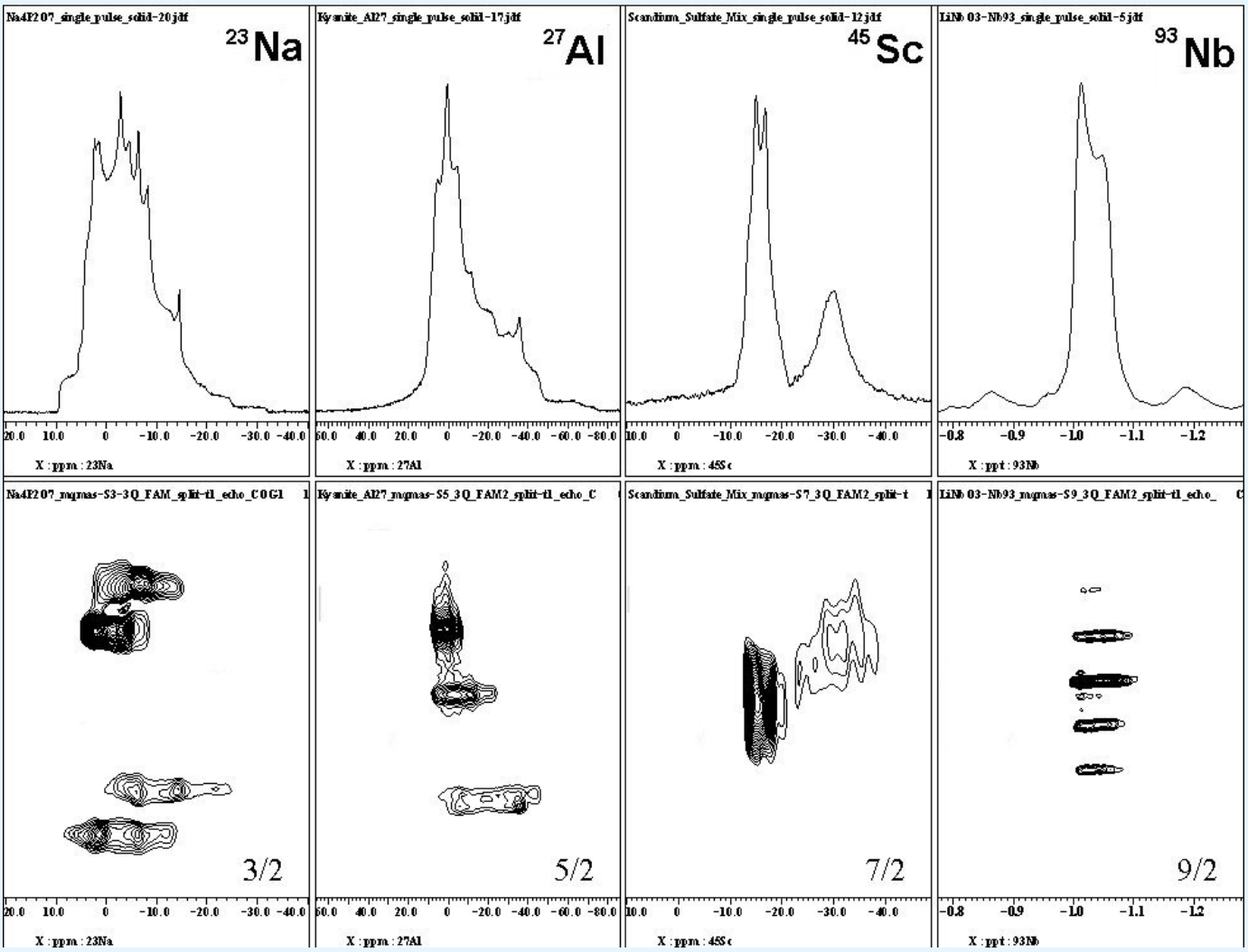
XC "Slow MAS" is designed for stable spinning with tissues, liquids, and semi-solids. The XC sample spinner easily reconfigures for slow spinning by changing the front and rear nozzle caps. All XC rotors and caps may be used with slow spin nozzle caps, but a 50% reduction in maximum spinning speeds should be expected.

Doty MAS Means Performance

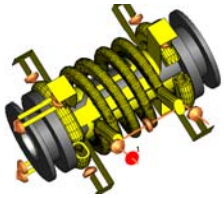
High Performance Multiple Quantum MAS On Quadrupolar Nuclei

3Q-MQMAS w/ FAM conversion, split-t1, whole echo acquisition and Cogwheel phase cycling

Collected with a **Doty XC4 HXY probe, MAS** = 20 kHz, on **JEOL ECA 500.** Courtesy of Michael Frey, JEOL USA



Doty MAS *Two-coil* Method: ^{1}H Cross Coil & X/Y Solenoid



What is a cross coil?

The cross coil is a "saddle-type" coil that has an inner one-turn loop in parallel with a segmented turn on each side.

Why use two coils?

Using two orthogonal coils simplifies tuning and permits higher RF fields in larger samples and very high B_0.

How does this help ?

The low inductance cross coil contributes much less to sample heating during decoupling. Compared to a solenoid, it's a factor of 6-25 times less!!

Lowest Decoupler Heating

110 kHz decoupling fields at 750 MHz with 6-25 times lower sample heating compared to solenoid-only probes. Stable tuning, low heating, high sensitivity, and excellent B_1 matching on both coils, even for lossy samples. Unlike many other sample coil designs, the B_1 homogeneity of the XC coil is not significantly affected by the sample because of its inherent electrical balance, symmetry, and very low inductance.

Reference: F. D. Doty, J. Kulkarni, C. Turner, G. Entzminger, A. Bielecki, J. Magn. Reson., 2006, 182, 239-253.

Triple-resonance, Double-broadband Tuning

- **H-F/X/Y in wide or narrow bore magnets.**
- **H/X/Y/lock in wide bore, H/X/lock in narrow bore.**
- **H/F/X in wide bore or narrow bore.**

Maximize versatility with multinuclear, X and Y channels even in probes with ^{1}H resolution optimized – to 0.003 ppm FWHM.