

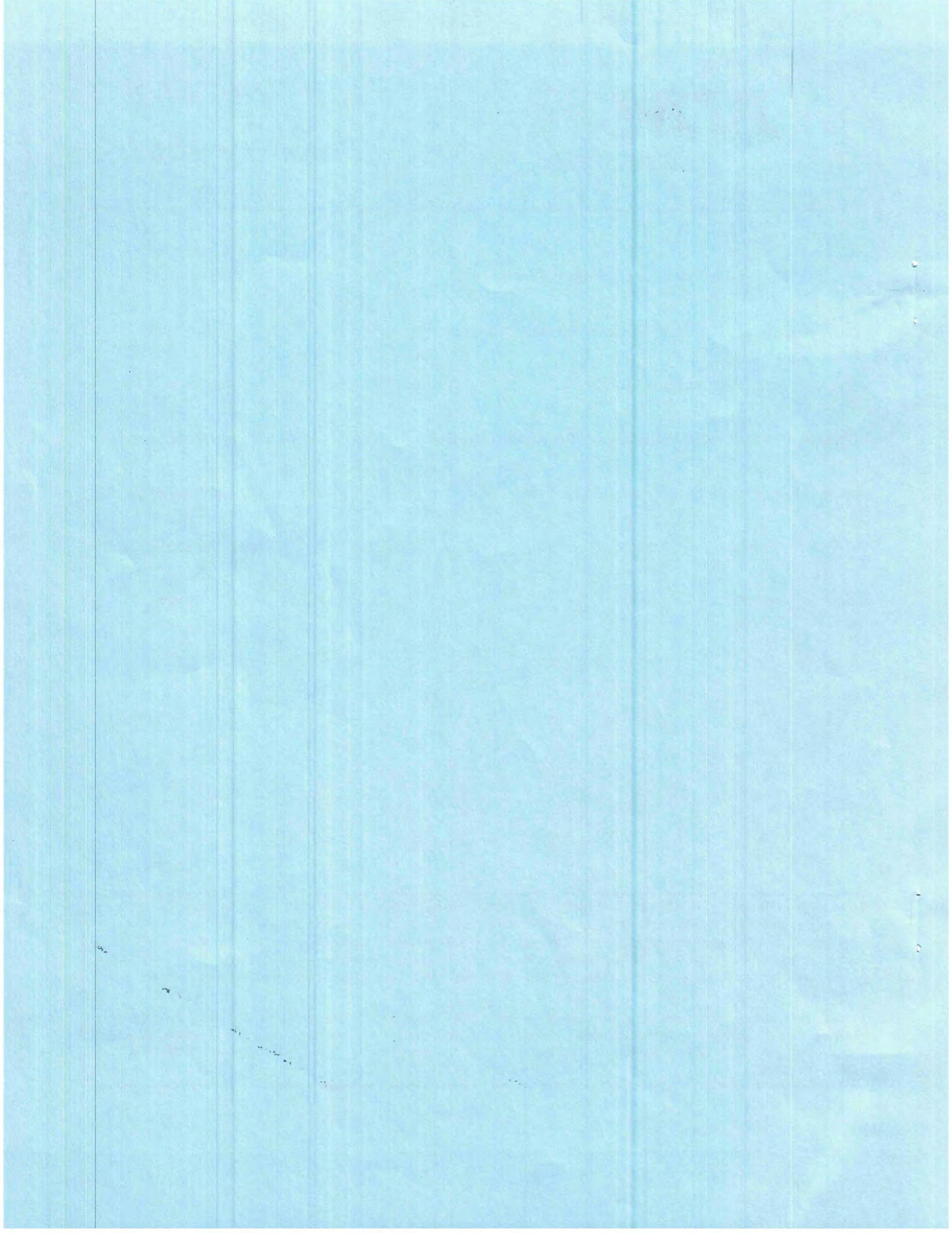
THE
NMR
NEWSLETTER

No. 508
January 2001

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FORTHCOMING NMR MEETINGS

Frontiers of NMR in Molecular Biology VII, Big Sky, Montana, **January 20-26, 2001**. Contact: Keystone Symposia, Drawer 1630, 221 Summit Place, Suite 272, Silverthorne, CO 80498. Tel: 800-253-0685 or 970-262-1230; Fax: 970-262-1525; E-mail: keystone@symposia.com. <http://www.symposia.com>.

PITTCON 2001, New Orleans, LA, **March 4-9, 2001**. Contact: The Pittsburgh Conference, Dept. CFP, 300 Penn Center Blvd., Suite 332, Pittsburgh, PA 15235-5503. Tel: 412-825-3220; Fax: 412-825-3224; E-mail: pittconinfo@pittcon.org.

42nd ENC (Experimental NMR Conference), Rosen Plaza Hotel, Orlando, Florida, **March 11-16, 2001**; Arthur G. Palmer, Chair: Agp6@columbia.edu; Contact: ENC, 1201 Don Diego Avenue, Santa Fe, NM 87505; (505) 989-4573; Fax: (505) 989-1073; E-mail: enc@enc-conference.org; Web: www.enc-conference.org.

ACS National Meeting, "Symposium on High Resolution NMR Spectroscopy of Polymers", San Diego, CA, **April 1-5, 2001**; Contact: H. N. Cheng (hcheng@herc.com) or A. D. English (alan.d.English@usa.dupont.com); See Newsletter 505, 29.

Magnetic Resonance in Chemistry and Biology, XIth International Conference, Zvenigorod, Russia, **April 20-27, 2001**. Contact: <http://www.nmr.de/html/conf/zelino.shtml>.

ISMRM 9th Scientific Meeting and Exhibition; ESMRMB 18th Annual Meeting and Exhibition, Joint Annual Meeting. Glasgow, Scotland, **April 21-27, 2001**. Contact: ISMRM Central Office, 2118 Melvia Street, Suite 201, Berkeley, CA 94704. Tel: 510-841-1899; Fax: 510-841-2340; E-mail: info@ismrm.org.

Computational Aspects of Biomolecular NMR, Gordon Conference, "Il Ciocco", Barga (Pisa) Italy, **May 6-11, 2001**. Contact: Michael Nilges nilges@embl-heidelberg.de, or Dave Cast case@scripps.edu.

ISMRM 9th Scientific Meeting and Exhibition, and ESMRMB 18th Annual Meeting and Exhibition, Joint Annual Meeting, April 21-27, 2001, 10th Annual Meeting of the Section for Magnetic Resonance Technologists, and 17th Annual Meeting of the British Association of MR Radiographers, April 20-22, 2001 Glasgow, Scotland, UK; Contact: ISMRM, P.O. Box 45690, San Francisco, CA 94145-0690; <http://www.ismrm.org>

continued on page 22



Dr. B. L. Shapiro
 The NMR Newsletter
 966 Elsinore Court
 Palo Alto, California
 USA 94303

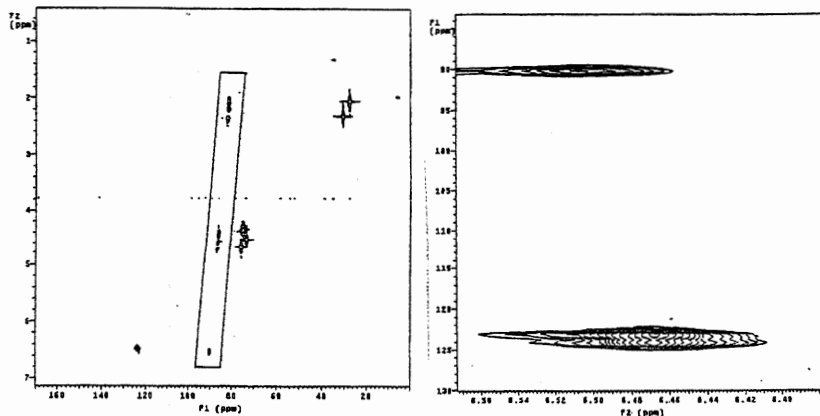
Nov. 29, 2000
 (received 12/06/2000)

Re: Shielded Magnets Revisited and ghmqc Artifacts

Dear Barry:

Recently I reported on the observation that the magnetic field homogeneity of shielded magnets changes over the course of time and some of your readers may be interested in the drift rate of the homogeneity after five months. I repeated the magnetic field drift test again and the resolution of the line shape sample changed from 0.56, 6.3, 13 Hz non-spinning to 1.4, 8.9, 16.3 Hz over a time period of 16 hours. This is considerably better than previously reported but still unacceptable. I guess we will have to wait longer for the homogeneity to stop drifting (another specification for new systems delivered with shielded magnets).

On another note, I would like to ask the Newsletter readers if they have encountered artifacts that appear to be ^1H - ^1H autocorrelation responses in ghmqc experiments as shown in the left Figure. They appear as diagonals at a two dimensional frequency of $f_1/2=f_2$. Another curious thing about these artifacts is that they do not have the same f_2 proton frequency as the true H-C correlation as is shown in the expansion on the right. Product operator analysis tells us several things about these artifacts. They cannot be due to proton magnetization created by the first pulse because in order to detect these signals, H_1 must be formed by the 180° proton pulse. If H_{-1} were present after the carbon 90° pulse, then converted to H_1 by the ^1H 180° , ^1H chemical shift information would be refocussed. If H_1 is present before the ^1H 180° pulse, then the artifact would be at a frequency $f_1=f_2$. The artifacts must arise from H_0 left by an imperfect 90° ^1H pulse which are converted to H_1 by the 180° proton pulse. If this magnetization were coupled to ^{13}C then the next ^{13}C 90° pulse should send this signal to two quantum land which is undetectable. Thus the artifact signal must pass through the ^{13}C pulse and be detected during t_2 acquisition. (I have run ghmqc experiments on a neat D_2O sample and observed these artifacts from the residual proton signals). In the ghmqc experiment three gradients are applied to the sample for coherence selection and in this experiment the gradient levels were in a ratio of 2:2:-1. The only way for these artifact signals to come through is for these molecules to be in a position in the sample tube such that they experience the same amplitude from the second and third gradient. This can happen only if the amplitudes are zero and can occur (I suppose) for molecules outside the receiver coil which also explains the different f_2 frequencies, suggesting that the artifact signals arise from molecules experiencing a slightly different B_0 . One might wonder if these signals outside the receiver coil should show up in normal spectra but examination of the contour map shows them to be much smaller than the ^{13}C satellite intensities. Anyway that was my best guess as to the origin of these signals and I would be interested to hear other explanations.



Sincerely,
 Tom Nakashima

Tom

e-mail:
 tom.nakashima@ualberta.ca

A New Revolutionary Milestone: Shielded 800 magnet from Bruker

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Shown in operation as part of a complete AVANCE 800 NMR System used for customer demonstrations at our application laboratory in Karlsruhe, Germany.

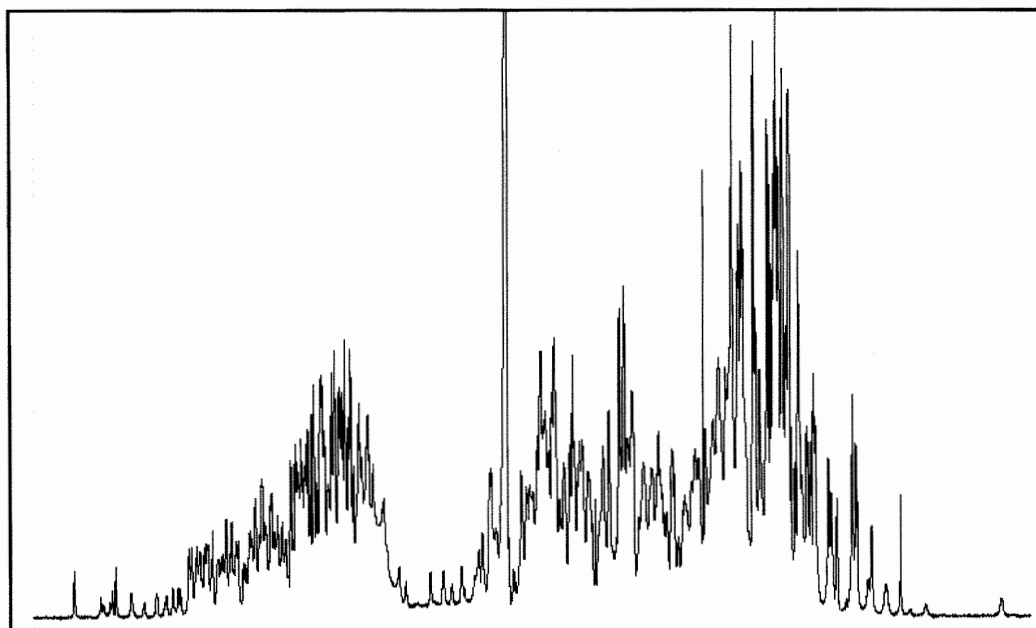
Bruker is proud to introduce the 800US²[™], the world's first shielded 800MHz high resolution NMR magnet. This superb system is a result of merging our latest and innovative magnet technologies: UltraShield[™] - Bruker's advanced self-shielding technology, and UltraStabilized[™] - Bruker's advanced sub-cooled technology for Ultra-High Field NMR. What was once thought almost impossible has now become a reality: siting an 800 MHz NMR magnet in a smaller footprint than a non-shielded 500!

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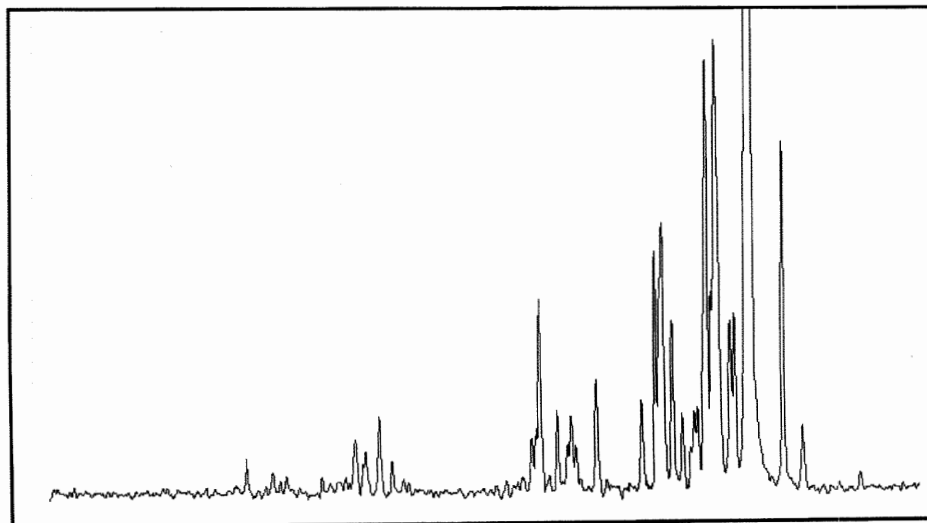
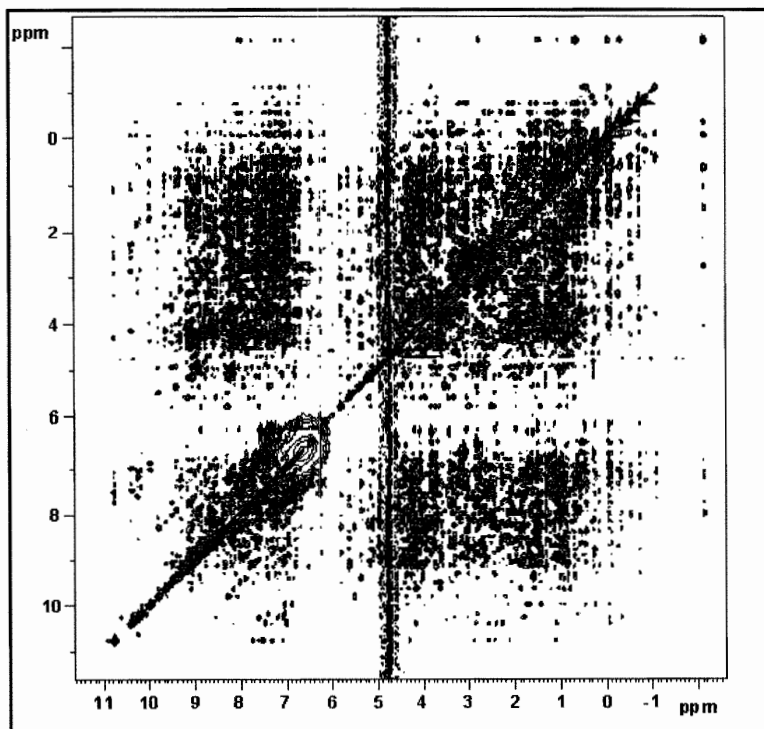
In addition to its remarkably small stray fields, the 800US² incorporates UltraShield's optimized system design for compensating (screening) against external field perturbations. As already demonstrated by UltraShield magnets at numerous sites located near sources of large external field perturbations (e.g. subways, trains), the 800US² will respond similarly and perform better than a non-shielded magnet under the same site conditions.

The 800US² magnet has been energized at full field in its final cryostat (customer system cryostat) on October 2, 2000. It is currently in operation as part of a complete AVANCE 800 spectrometer used for customer demonstrations at our application laboratory in Karlsruhe, Germany.



*1D ¹H spectrum
w/presat 2mM
Lysozyme*

2D NOESY w/presat 2mM Lysozyme



*2D NOESY w/presat 2mM
Lysozyme*

*Column through methyl
diagonal peak - showing
almost no T1 noise!*

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December 8, 2000 (received 12/22/2000)

Prof. B. L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto, CA 94303

Dear Barry,

SCHOOL OF SCIENCE



Method to Obtain Higher Resolution MRI Heart Mapping

Higher resolution MRI mapping of hearts might serve to reduce the need to do catheterizations. It would also allow for a non-invasive follow-up after bypass surgery. For planer imaging one records the signal

$$M(t) = \int F(t, x', y') \rho(x', y') dx' dy'$$

and obtains the mapping density $\rho^*(x, y)$ as

$$\rho^*(x, y) = \sum_t E(t, x, y) M(t)$$

which can be expressed as

$$\rho^*(x, y) = \int A(x, y, x', y') \rho(x', y') dx' dy'$$

where

$$A(x, y, x', y') = \sum_t E(t, x, y) F(t, x', y')$$

Discretizing space one has

$$\rho^*(x, y) = \sum_{x', y'} B(x, y, x', y') \rho(x', y')$$

which can be inverted to obtain the higher resolution density mapping as

$$\rho^{**}(x, y) = \sum_{x', y'} B^{-1}(x, y, x', y') \rho^*(x', y')$$

Patent Pending

Plot showing increase in resolution is a computer simulation.

Sincerely,

Jerome I. Kaplan

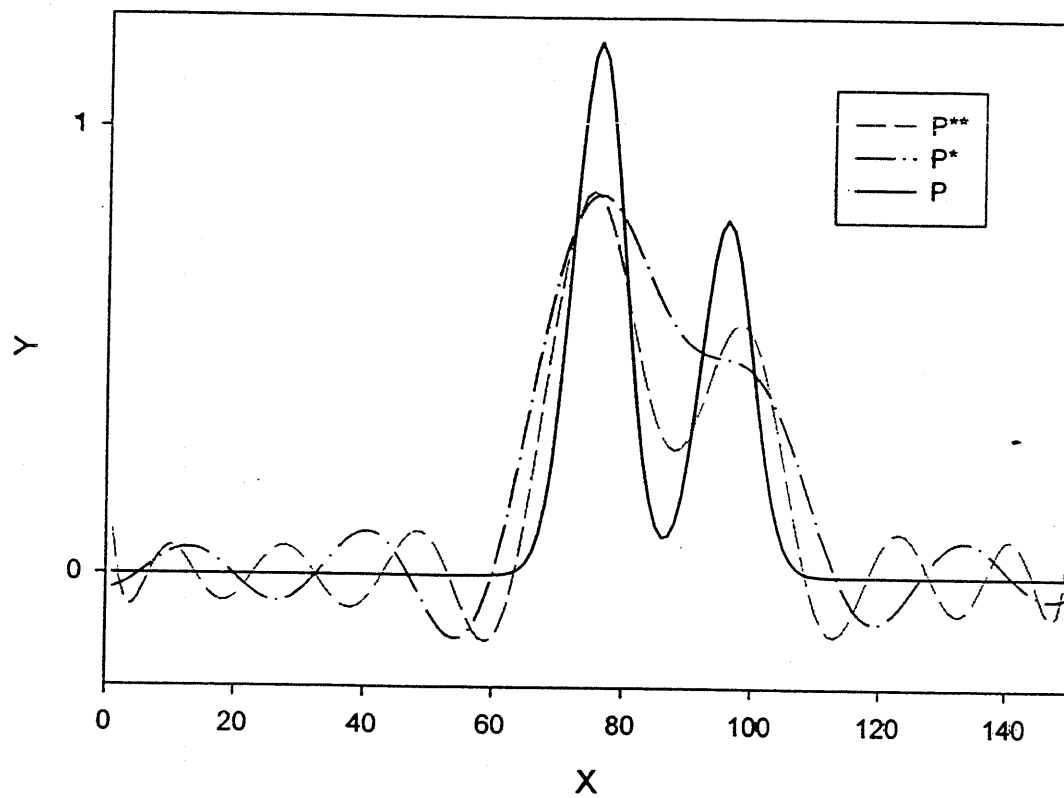
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Please credit this contribution to the account of B. D. Nageswara Rao.

$N=150$, $dx=0.0125$, $dp=0.25$ (+lobe 28, bells 40 wide)



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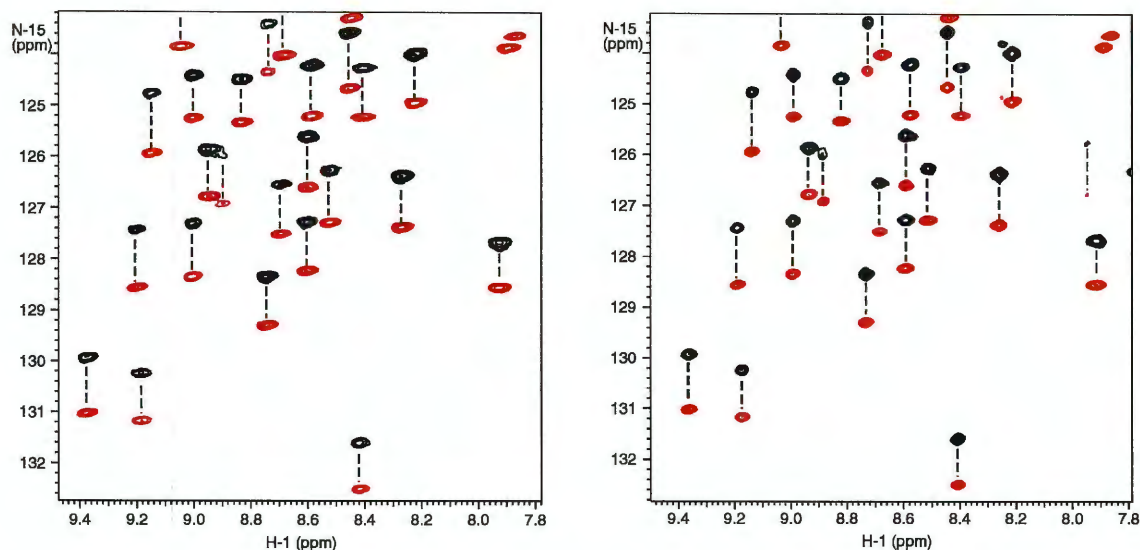
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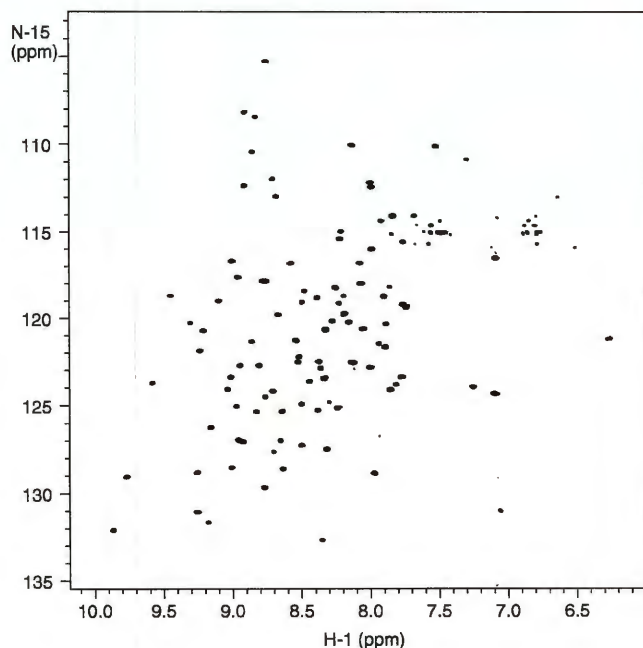
Varian NMR systems and Oxford Instruments are pleased to announce the acquisition of high resolution NMR data at 900 MHz! The Oxford 900 MHz magnet is now at field and providing stable operation with a low drift rate, and the homogeneity necessary for high quality NMR operation. The proof of this remarkable achievement is, of course, the NMR spectra included below and on our web-site at www.varianinc.com/900.

Partially Orientated Molecules



Measurement of residual dipolar N-H couplings at 900 MHz in partially oriented proteins with (right) and without the use of band-selective homonuclear decoupling.

TROSY at 900 MHz



The ^{15}N - ^1H TROSY correlation spectrum of 6F1 1F2 module pair from the gelatin-binding domain of fibronectin. Sample courtesy of Prof. J.D. Campbell of Oxford University.



VARIAN

Carlsberg Laboratory

Danish Instrument Center for NMR Spectroscopy of
Biological Macromolecules



Prof. B.L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto CA 94303, USA

(received 12/26/2000)

The Carlsberg Pulse Program Library

Dear Barry:

Pulse programs and related software developed at Carlsberg Research Center are now available via the WebPage <http://www.crc.dk/nmr/>. There are pulse programs both in Varian and Bruker format and we will keep adding new software as it is developed. Most programs are for protein applications but there is also a program package, MBOB, for 2D heteronuclear long-range correlation in small molecules.

Several authors have addressed the problem that it is impossible to achieve uniform excitation over a range of J coupling constants by a single delay in the HMBC pulse sequence. This comes about because the peak intensities are proportional to $\sin(\pi J \Delta)$ where J is the heteronuclear long-range J coupling constant and Δ is the excitation delay. A much used compromise is to set Δ slightly shorter than $1/J(\max)$ where J(max) is the largest expected J coupling constant in the molecule under investigation, which typically corresponds to $\Delta = 65$ ms. This value is often too small for the cross peaks associated with the smallest J values whilst choosing a larger value runs the risk that $\sin(\pi J \Delta)$ vanishes for some of the larger Js. It is also not possible to coadd spectra recorded with different Δ delays because the sine factor might change sign.

MBOB (Multiple-Bond and One-Bond correlation) combines HMBC spectra recorded with different Δ delays in absolute-value mode and includes a novel non-destructive low-pass J filter making it possible to extract a one-bond correlation spectrum from the same data set. In other words, MBOB yields a broadband HMBC spectrum and a one-bond correlation spectrum in the time it would typically take to record a single- Δ HMBC spectrum. Hence the time to record a separate HSQC or HMQC spectrum is saved.

On the next page is shown 500 MHz HMBC and edited MBOB spectra of ethyl *trans* cinnamate run with equal numbers of scans and the same instrument time. The long-range MBOB spectrum contains correlations that are absent in the $\Delta = 65$ ms HMBC spectrum and the sensitivity is adequate for detection of one-bond correlations in the coupled mode.

Our MBOB software package runs in full automation performing the experiments, making the appropriate linear combinations and plotting the spectra.

Sincerely yours,

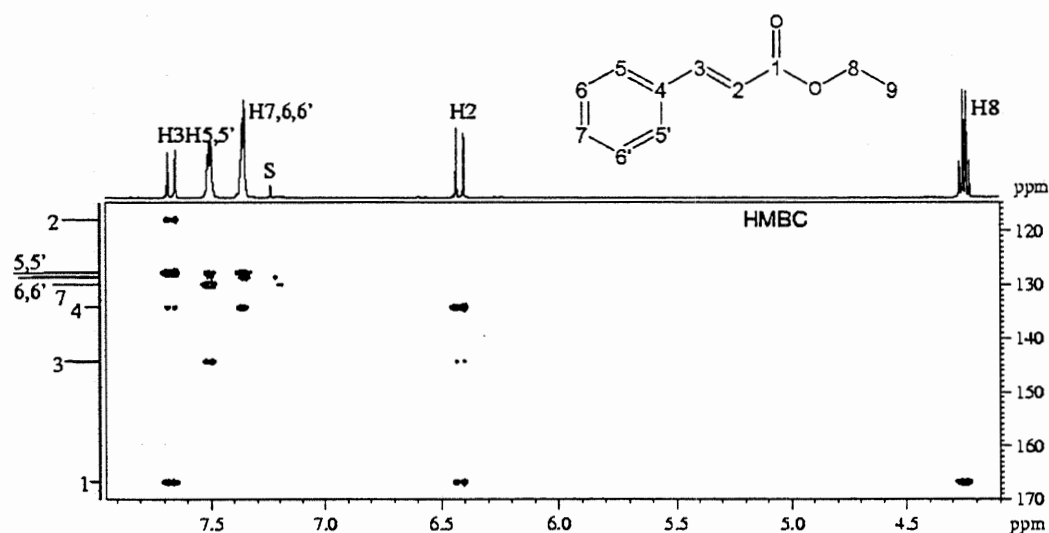
Ole W. Sørensen

MBOB reference: A. Meissner and O.W. Sørensen, *Magn. Reson. Chem.* **38**, 981-984 (2000).

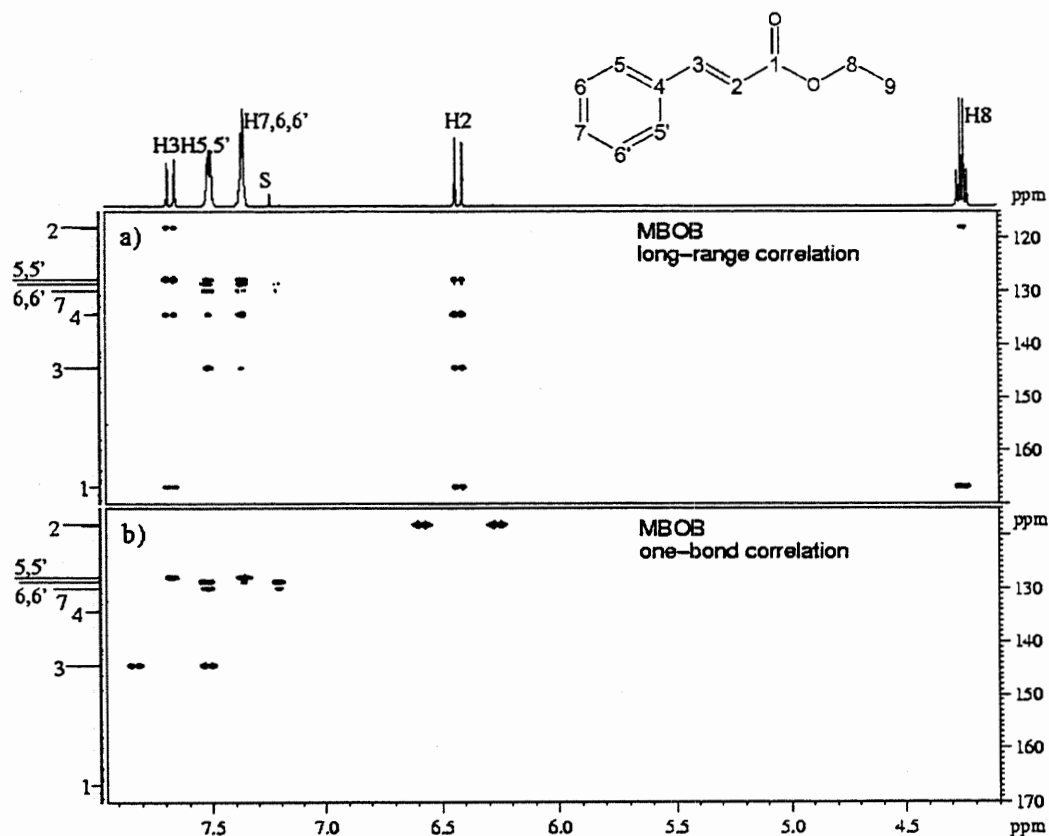
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Expansion of a conventional $\Delta = 65$ ms 2nd order LPJF HMBC spectra of 15 μ l of ethyl *trans* cinnamate in 600 μ l CDCl₃ at 25 °C.



Expansion of edited MBOB spectra of 15 μ l of ethyl *trans* cinnamate in 600 μ l CDCl₃ at 25 °C.

(a) MBOB multiple-bond correlation spectrum. (b) MBOB one-bond correlation spectrum.

A 2nd order J filter and four Δ values (440.7, 343.4, 290.3, and 242.2 ms) was employed.

The total number of scans leading to these spectra was the same as for the HMBC spectrum above.

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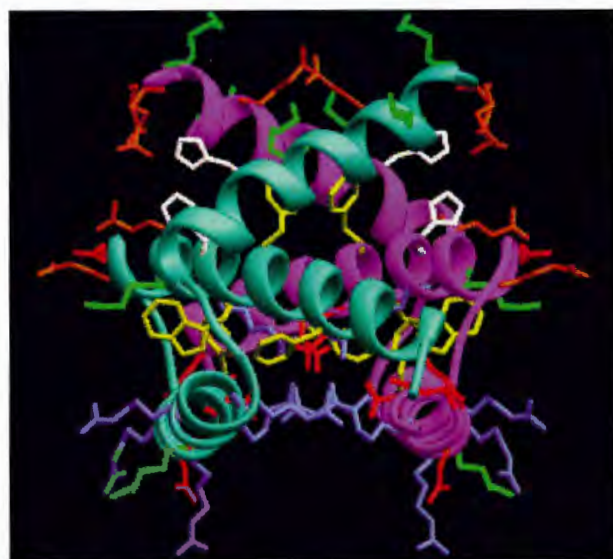
Frontiers of NMR in Molecular Biology VII

Saturday, January 20

through

Wednesday, January 24

Big Sky, Montana



Solution NMR structure of the RNA-binding domain of NS1 from influenza virus. (Provided by A. Chien and G. Montelione, Rutgers University)

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Ribonucleotides

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Villeurbanne, december 14, 2000

RF solenoidal microcoils performances

(received 12/23/2000)

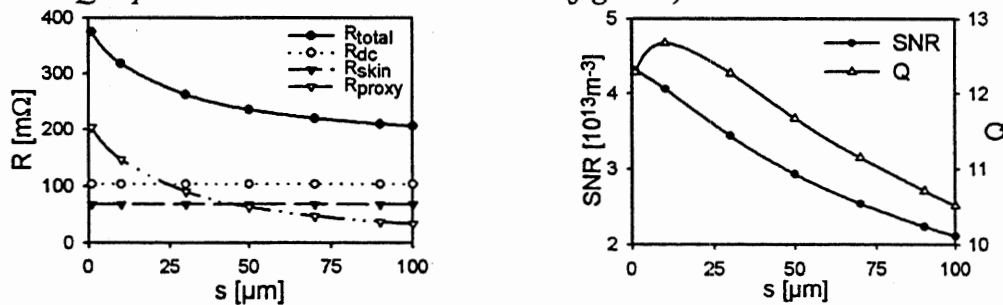
Dear Dr Shapiro,

Solenoidal microcoils represent interesting tools for NMR spectroscopy and their optimization for an efficient use is unavoidable. The magnetic coupling between a RF coil and the studied sample must be improved since it corresponds directly to an optimal sensitivity for the signal reception. For sensitivity optimization, not only the quality factor (Q) but also the signal-to-noise ratio (SNR) and the electromagnetic parameters (R, L, B) of given coils have to be estimated. The SNR of an NMR experiment is defined as the peak signal divided by the root mean square (rms) noise [1]:

$$\text{SNR} = \frac{\frac{B_1}{i} V_s N \gamma \frac{h^2}{4\pi^2} I(I+1) \frac{\omega_0^2}{3\sqrt{2}kT}}{V_{\text{noise}}} \quad \text{with} \quad V_{\text{noise}} = \sqrt{4k T R_{\text{noise}} \Delta f}$$

where B_1/i is the magnetic field per unit current (*coil sensitivity*), V_s the sample volume, N the spin density, γ the gyromagnetic ratio, I the spin quantum number, ω_0 the nuclear precession frequency, T the sample temperature, k the Boltzmann's constant, h the Planck's constant and Δf is the spectral bandwidth. The microcoil itself is the dominant source of noise ($R_{\text{noise}} \approx R_{\text{coil}}$) [2]. In the present simulations, based on the **ANSOFT Maxwell 2D/3D software**, we have varied the turn number ($n=1, 3, 5, 7, 10$ and 20 turns), the internal diameter of solenoidal microcoil ($D_{\text{int}}=100$ to $300\mu\text{m}$), the copper wire diameter ($d=8$ to $100\mu\text{m}$) and the interturn spacing ($s=1$ to $100\mu\text{m}$). The SNR per unit sample volume computation was done for proton in water at 2 teslas (85.13 MHz), $T=37^\circ\text{C}$ and $\Delta f/f=6\text{ppm}$.

Figures 1 (left) and 2 (right) : Contributions of different effects (dc, skin, proximity) at the total resistance of microcoil for $D_{int}=200\mu\text{m}$, $d=40\mu\text{m}$, $n=10$ turns (figure 1). SNR per unit sample volume and Q dependencies in the same conditions (figure 2)



A decrease in the diameter of a solenoidal microcoil produces, as already mentioned [2], an increase in SNR per unit sample volume but simultaneously Q quickly decreases. For a solenoidal microcoil with $n=10$ turns and $D_{int}=200\mu\text{m}$ if the interturn spacing s decreases from $100\mu\text{m}$ to $1\mu\text{m}$ the SNR per unit sample volume increases. It was also observed that the proximity effect on R_{noise} was compensated by a significant increase in sensitivity. For adjacent turns, Q reach then its maximum value if $d=20\mu\text{m}$ or for few microns interturn spacing if $d=40$ to $100\mu\text{m}$. Keeping the same D_{int} and $s=1\mu\text{m}$ with d decreasing from 100 to $8\mu\text{m}$, the SNR per unit sample volume increases to a maximum for $d \approx 16\mu\text{m}$, then it quickly decreases. If the wire radius of the coil is comparable to the skin depth, standard design rules [2] are no longer relevant, and the help of an electromagnetic simulation software is mandatory.

References : [1] Webb A. G. [1997], Progress in NMR Spectroscopy 31: 4
[2] Peck T. L., Magin R. L., Lauterbur P. C. [1995], J. Magn. Reson. SeriesB 108: 115.

Sincerely yours,

M. Armenean

H. Saint-Jalmes

B. Favre

A. Briguet

Handwritten signature of H. Saint-Jalmes

Handwritten signature of A. Briguet

MAPPING NEW FRONTIERS

FRONTIERS OF NMR IN MOLECULAR BIOLOGY VII

Participants of the Keystone Symposium
on Molecular and Cellular Biology

Big Sky Resort in Big Sky, Montana
January 20-26, 2001

In April of 1805, the Lewis & Clark Expedition mapped the frontiers of Montana. Their expedition created the foundation for the western development of America.

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CNLM-4349	L-Tyrosine-N-FMOC, O- <i>t</i> -Butyl Ether	(U- ¹³ C ₉ , 98%+; ¹⁵ N, 96-99%)
CNLM-4354	L-Asparagine-N-FMOC	(U- ¹³ C ₄ , 98%; U- ¹⁵ N ₂ , 96-99%)
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CNLM-4356	L-Glutamine-N-FMOC	(U- ¹³ C ₅ , 98%; U- ¹⁵ N ₂ , 96-99%)
CNLM-4357	Glycine-N-FMOC	(U- ¹³ C ₂ , 98%; ¹⁵ N, 96-99%)
CNLM-4358	L-Methionine-N-FMOC	(U- ¹³ C ₅ , 98%; ¹⁵ N, 96-99%)
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CNLM-4752	L-Aspartic Acid-N-FMOC, β-O- <i>t</i> -Butyl Ether	(U- ¹³ C ₄ , 98%+; ¹⁵ N, 96-99%)
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CNLM-4754	L-Lysine-α-N-FMOC, ε-N- <i>t</i> -BOC	(U- ¹³ C ₆ , 98%+; ¹⁵ N ₂ , 96-99%)
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CNLM-4788	L-Aspartic Acid-N-FMOC	(U- ¹³ C ₄ , 98%+; ¹⁵ N, 96-99%)
CNLM-4789	L-Aspartic Acid-N-FMOC, α-O- <i>t</i> -Butyl Ether	(U- ¹³ C ₄ , 98%+; ¹⁵ N, 96-99%)

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CNLM-2394	L-Alanine-N- <i>t</i> -BOC	(U- ¹³ C ₃ , 98%+; ¹⁵ N, 96-99%)
CNLM-2395	L-Valine-N- <i>t</i> -BOC	(U- ¹³ C ₅ , 98%+; ¹⁵ N, 96-99%)
CNLM-2396	L-Leucine-N- <i>t</i> -BOC:H ₂ O	(U- ¹³ C ₆ , 98%+; ¹⁵ N, 96-99%)
CNLM-2412	Glycine-N- <i>t</i> -BOC	(U- ¹³ C ₂ , 98%+; ¹⁵ N, 96-99%)

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Cambridge Isotope Laboratories, Inc.

Dr. Bernard L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto, CA 94303

(received 12/06/2000)

Magic-Angle Setting in Satellite Transition MAS

Dear Barry,

Since the introduction of the MQMAS sequence by Frydman *et al.*¹ in 1995, the acquisition of isotropic spectra of half-integer quadrupolar nuclei is straightforward and allows for a good structural characterisation of elements e.g. ²⁷Al, ²³Na, ¹¹B, and ¹⁷O in a variety of materials, such as catalysts, glasses or minerals. It is well known that the efficiency of the multiple-quantum excitation and conversion is rather poor and this problem has been widely discussed in the scientific community. Developments by Madhu *et al.*² and Kentgens and Verhagen³ grandly improved the overall efficiency of the sequence by the use of amplitude-modulated pulses. More recently, Gan⁴ presented a new approach based on the same principles than MQMAS, but correlating satellite and central transitions for the complete averaging of anisotropic second-order quadrupolar terms. The gain in sensitivity compared to MQMAS seems to be very important but the sequence requires that (1) the spinning axis be precisely aligned with the magic-angle, and that (2) the dwell time in the t_1 evolution be set to the rotor period.

In the process of testing this latter sequence in our application laboratory, we opted for the two-pulse sequence, selecting the $p \rightarrow -1 \rightarrow -1$ coherence transfer pathway using the adequate phase cycle (see ref.⁴ for more experimental details). We set the magic-angle maximizing ⁷⁹Br rotational echo in KBr powder. But, as expected, the accuracy of this setting was far below that was required to run Gan's experiment successfully. Nevertheless, we found that this setting was sufficient to optimize experimentally the pulse lengths in the sequence (figure 1). It can be noted that the conditions of excitation and conversion of the satellite transitions are broad compared to those obtained in MQMAS.

In a second phase, we decided to set the angle of rotation precisely on the magic-angle by running a series of 2D spectra, just *slightly* changing the orientation of the spinning axis between each experiment. Thanks to the high efficiency of the satellite transition excitation, each 2D ²³Na spectrum shown in figure 2 were acquired in less than 15 minutes. It turns out that in the case of a highly-crystallized sample, the splitting of the resonances in figures 2-a, b and c, is a very good indicator of the orientation of the spinning axis.

Of course, acquiring 2D satellite transition MAS NMR of unknown samples is rather difficult if the previous setting is not reliable over several automatic rotor insertions and ejections. Therefore, we also tested the stability of the rotor orientation by ejecting and inserting the same rotor 5 times

between each experiment, as well as by manipulating the probes (2.5mm and 4mm) outside the magnet. Results revealed no splitting of the resonances that would have been a sign of a slight change of stator angle. The second critical parameter is the spinning speed, which must be very stable as the t_1 evolution time must be set to equal the rotor period. Indeed, a variation of a few hertz can lead to a drastic loss of the satellite signal. In our experiments, it in fact happened once that the echo signal disappeared in the 2D dataset, due to a variation of the spinning speed of more than 5 Hz. However, after repacking the rotor, the variation of the spinning speed remained within 1 Hz.

We believe that this simple 2D acquisition is an elegant and fast method to align the rotor axis exactly on the magic angle. However, there are still many problems to be solved in the acquisition of high-resolution MAS spectra of quadrupolar nuclei, using satellite transitions. Gan mentioned the presence of central transition signals that could be minimized using a presaturation pulse. In our case, we did not observe additional signals from the central transition and thus, we did not use a presaturation pulse. But, our 2D spectra were recorded by a selection of the echo pathway only, and the processing was made in absolute value mode. The main challenge in the near future will be to acquire pure absorption 2D spectra in a hypercomplex mode without introducing too much of the unwanted central transition signal.

Sincerely,

L. Delevoye



C. Brevard



1. FRYDMAN L. AND HARWOOD J. S. *J. Am. Chem. Soc.* 117 (1995), pp. 5367–5368.
2. MADHU P., GOLDBOURT A., FRYDMAN L. AND VEGA S. *Chem. Phys. Lett.* 307 (1999), pp. 41–47.
3. KENTGENS A. AND VERHAGEN R. *Chem. Phys. Lett.* 300 (1999), pp. 435–443.
4. GAN Z. *J. Am. Chem. Soc.* 122 (2000), pp. 3242–3243.

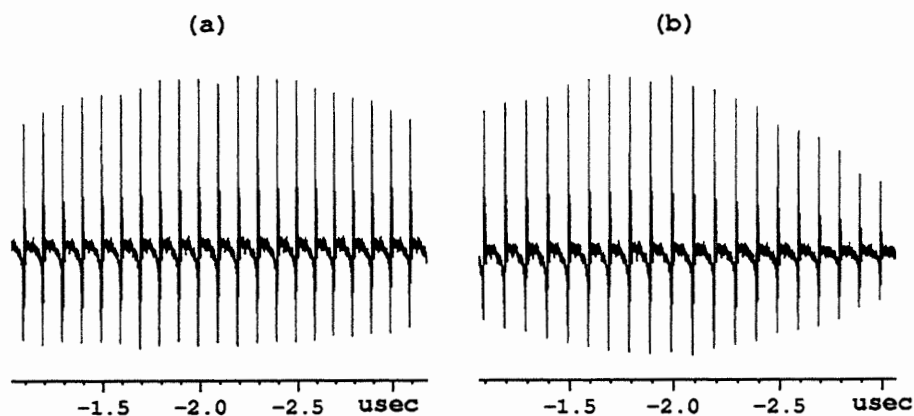


Figure 1 – Experimental optimisation of pulse lengths p_1 (a) and p_2 (b) of a ^{23}Na 2D satellite transition MAS sequence. The echo signal was acquired after an evolution period equal to several rotor periods in order to separate the satellite transition signal from any other undesired signal (possibly central transition). No phasing was applied during processing.

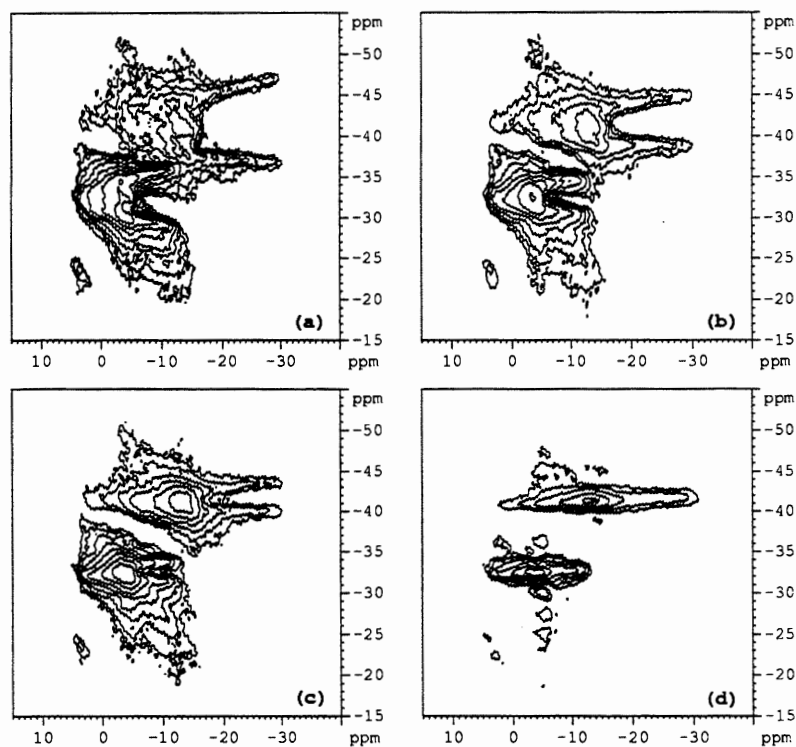


Figure 2 – ^{23}Na 2D satellite transition MAS spectra of Na_2HPO_4 . Spectrum 1-a corresponds to the first spectrum obtained after setting the spinning angle with the KBr sample. Each following spectrum was obtained after slightly changing the spinning angle until the splitting of the resonances disappeared.

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Inquiries and applications to:

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fax.: 0043-1-58801-15399
email: uschuber@mail.zserv.tuwien.ac.at

Forthcoming NMR Meetings, continued from page 1:

Gordon Research Conference on Magnetic Resonance, **June 17-22, 2001**, Roger Williams University, Bristol, Rhode Island (note the new, improved location !!!). Contacts: Rob Tycko, Chair, 301-402-8272, tycko@helix.nih.gov, and Kurt Zilm, Vice-Chair, kurt.zilm@yale.edu. Site description and application information available at <http://www.grc.uri.edu>.

IXth International Symposium on Magnetic Resonance in Colloid and Interface Science, St. Petersburg, Russia, **June 26-30, 2001**. Contact: Mrs. L. Ya. Startseva, Secretariat of ISMRCIS, Boreskov Institute of Catalysis, 5, Prosp. Akad. Lavrentieva, Novosibirsk, 630090, Russia. Tel: +7 (3832) 34-12-97; Fax: +7 (3832) 34-30-56; E-mail: star@catalysis.nsk.su.

Royal Society of Chemistry: 15th International Meeting on NMR Spectroscopy, Durham, England, **July 8-12, 2001**; Contact: Mrs. Paula Whelan, The Royal Society of Chemistry, Burlington House, London W1J 0BA, England; tel: +44 (0) 207-437-8656; fax: +44 (0) 207-734-1227; Email: conferences@rsc.org; Use the subject header '01NMR15'

ESR and Solid State NMR in High Magnetic Fields, Stuttgart, Germany, **July 22-26, 2001**. Contact: Prof. Hans Paus, 2 Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, D-70550 Stuttgart, Germany. Tel: ++49-711-685-5223 or -5217; Fax: ++40-711-685-5285; E-mail: ampere2001@physik.uni-stuttgart.de.

ISMAR 2001, Jerusalem, Israel, **August 19-24, 2001**; See <http://www.tau.ac.il/chemistry/ISMAR.html>.

14th European Symposium on Polymer Spectroscopy, Dresden, Germany, **September 2-5, 2001**. Contact: Institut für Polymerforschung Dresden e. V., ESOPS 14, Postfach 12 04 11, 01005 Dresden, Germany. Tel: +49 351 4658-282; Fax: +49 351-4658-214; E-mail: espos@ipfdd.de.

Fourth International Conference on Molecular Structural Biology, Vienna, Austria, **September 5-9, 2001**. Contact: Andreas Kungl, Austrian Chemical Society (GÖCH), Biochemistry Subgroup, c/o Institute of Pharmaceutical Chemistry, University of Graz, Universitätsplatz 1, A-8010 Graz, Austria. Tel: +43 316 380 5373; Fax: +43 316 382541; E-mail: andreas.kungl@kfunigraz.ac.at.

2nd Alpine Conference on Solid-State NMR, Chamonix-Mont Blanc, France, **September 9-13, 2001**; Contact: Alpine Conference Secretariat, Laboratoire STIM, Ecole Normale Supérieure de Lyon, 46 allée d'Italie, 69364 Lyon Cedex 7, France; alpine.SSNMR@ens-lyon.fr; Tel. +33-(0)4 72-72-84-86 / 83 84; Fax. +33 (0)4 72 72 84 83; <http://ens-lyon.fr/STIM/alpineweb.html>

XXth International Conference on Magnetic Resonance in Biological Systems, Toronto, Ont., **August 25-30, 2002**. For further information check www.uwo.ca/chem/icmrbs/, or contact: mgordon@julian.uwo.ca

Additional listings of meetings, etc., are invited.

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Deadline Dates

No. 509 (Feb.)	26 Jan. 2001
No. 510 (Mar.)	23 Feb. 2001
No. 511 (Apr.)	23 Mar. 2001
No. 512 (May)	27 Apr. 2001
No. 513 (June)	25 May 2001

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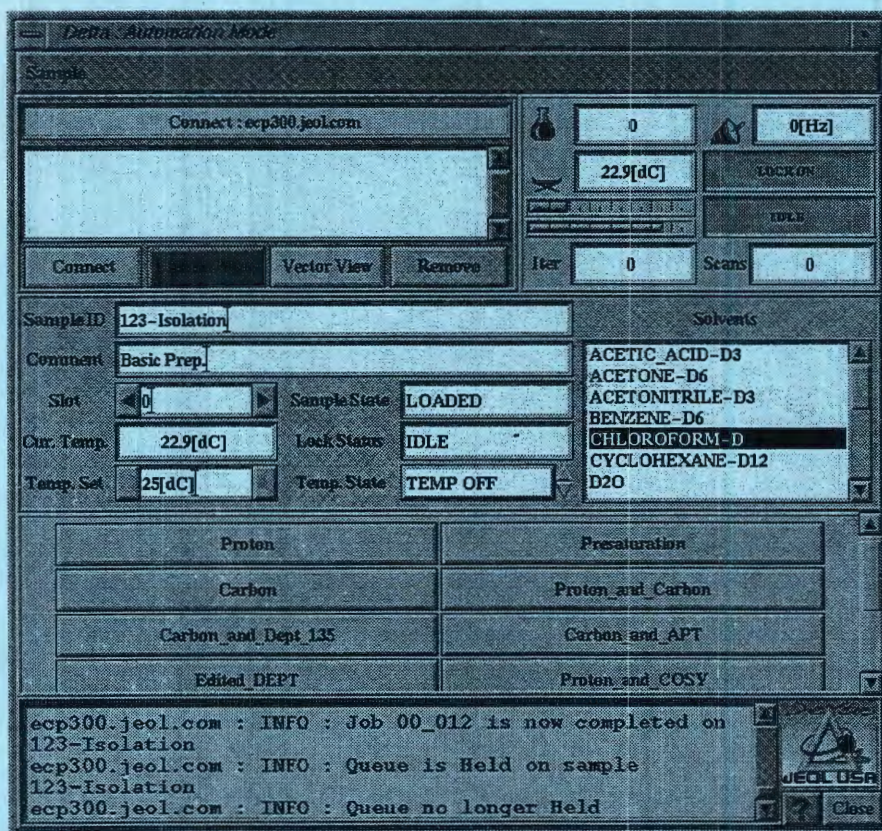


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