

# Nuclear Magnetic Resonance Spectrometer CAN400

Nuclear Magnetic Resonance (NMR) Spectroscopy is a powerful analytical technique used primarily to determine the structure of organic compounds, study molecular dynamics, and analyze the composition of various substances. It leverages the magnetic properties of certain atomic nuclei to provide detailed information about the physical and chemical properties of the atoms or molecules in which they are contained.

## Product Introduction

CAN400 is an intelligent liquid-state NMR spectrometer. The spectrometer system consists of a superconducting magnet with ultra-high homogeneity and ultra-shielding, a multifunctional intelligent console, and a high-sensitivity fully automated tuning probe, along with other modules.

CAN400 includes multiple highly integrated RF transceivers. The improved design enhances the performance of tuning, shimming and auto sample changing, effectively reducing experimental time.

Accessories such as the intelligent control screen expand the management interface of the NMR system. Sample insertion and ejection can be controlled and monitored via a touchscreen, elevating the flexibility of various experiments.

CAN400 combines high-performance hardware and intelligent software, providing users with a more reliable and convenient NMR experimental platform.



## Product Highlights

### Expansibility

- > Distributed architecture design
- > Enables flexible instrument configuration and upgrade capabilities

### Performance

- > Timing resolution  $\leq 4$  ns, frequency resolution  $\leq 0.0005$  Hz
- > Supports fast automatic sample changing, with sample change time reduced to the second level

### Intelligence

- > Intelligent control screen
- > Remote access and control
- > Provides users with more options for managing the NMR spectrometer



## Product Features

- 01 Low consumption, highly homogeneous, ultra-shielded 400 MHz superconducting magnet
- 02 High-sensitivity auto tuning probe supporting detection of various atomic nuclei
- 03 Advanced distributed console which is expandable to 8 independent transceiver RF channels. timing resolution:  $\leq 4$  ns, frequency resolution:  $\leq 0.0005$  Hz
- 04 High throughput and efficient auto sample changer with 72 slots, installed at the waist of the magnet, supports fast sample changing
- 05 Intelligent control screen allows users to monitor instrument status and control sample entry and exit directly from the touchscreen
- 06 Intelligent software allows users to remote power on/off of the spectrometer and real-time monitoring of experiments and equipment status



# CAN400 Module Introduction

The sub-modules of the CAN400 NMR Spectrometer primarily consist of the magnet, console, probe, and preamplifier. Controlled by advanced software, the spectrometer system can accurately collect and analyze experimental data, providing users with more comprehensive and precise analytical results. The intelligent control screen and remote control capabilities optimize the user experience.

## Magnet

- > 9.39 Tesla magnetic field
- > 54 mm standard bore, compatible with various probes
- > Long liquid helium hold time
- > Liquid helium level gauge including alarm functions for low helium level
- > Intelligent control screen providing quick access to system status



## Preamplifier

- > Preamplifier separated from the console
- > Multi-channel preamplifier
- > Low noise minimizes impact on signal acquisition
- > Built-in dynamic transmit-receive switch on all channels
- > Expandable design

## Auto Sample Changer

- > High throughput : Optimized space utilization with up to 72 slots
- > Safe and user-friendly : Waist-mounted design with bidirectional free rotation
- > Effective: Additional storage tube for rapid sample changing in seconds



## Console

- > RF transceiver channels: default 2, expandable to 8
- > High-precision digital control with 4 ns timing resolution, 0.0005 Hz frequency resolution, and 0.001° phase resolution. Frequency, amplitude, and phase can be set simultaneously in 4 ns
- > High-speed data acquisition with 16-bit amplitude resolution and 250 Msps sampling rate
- > 12.5 MHz maximum receiver spectral width
- > Enable software-controlled console power-up and power-down

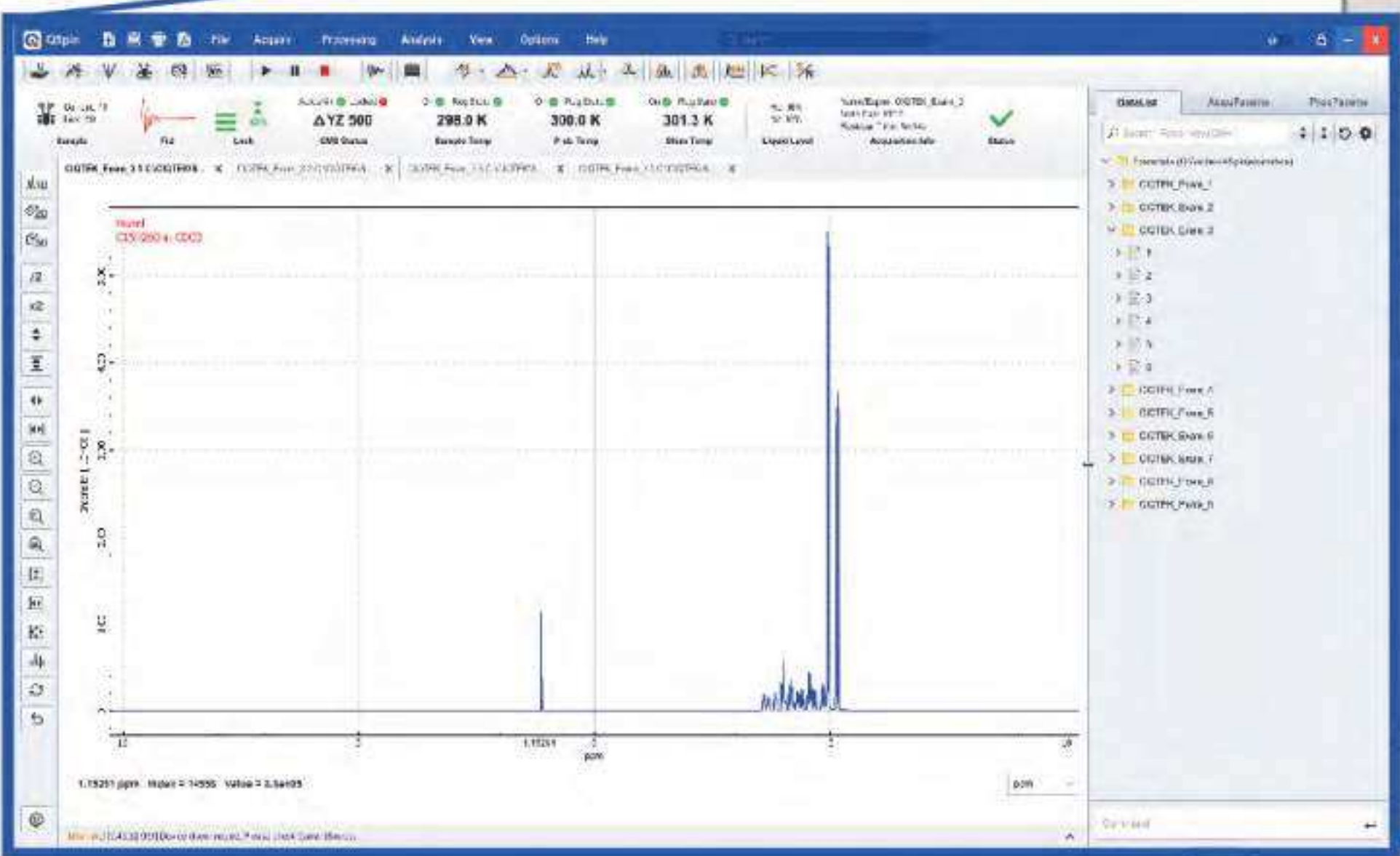


## Probe

- > Suitable for 5 mm diameter sample tubes
- >  $^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{15}\text{N}$ ,  $^{31}\text{P}$ ,  $^{19}\text{F}$ ,  $^{109}\text{Ag}$ , and other nuclei
- > Equipped with deuterium lock channel
- > Supports manual and automatic tuning
- > Z Gradient strength: 50G/cm maximum
- > High sensitivity and resolution
- > Wide temperature range
- > Capable of  $^{19}\text{F}$  NMR experiment with  $^1\text{H}$  decoupling and  $^1\text{H}$  NMR experiment with  $^{19}\text{F}$  decoupling.



## Software



Intelligent software simplifies user operations

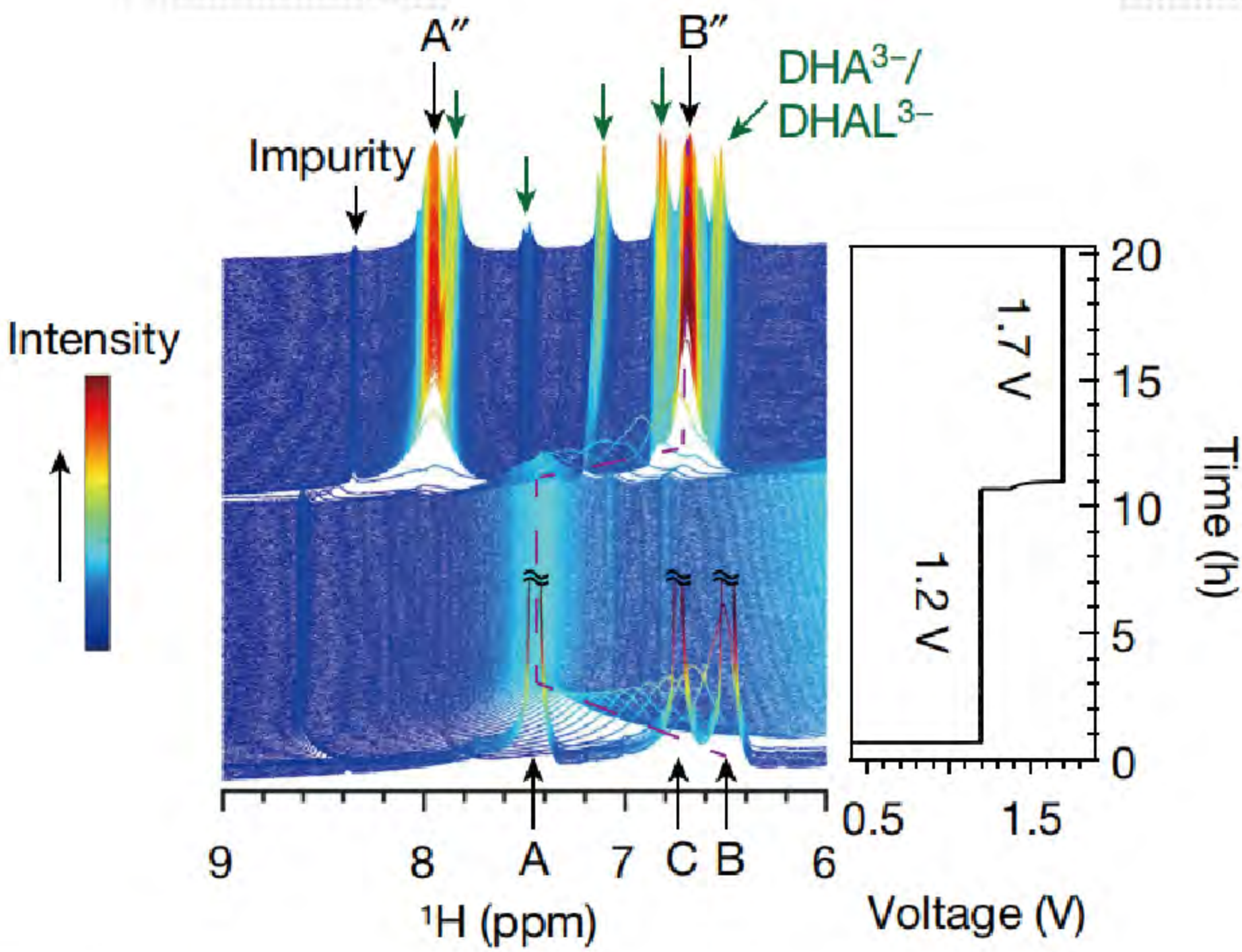
Streamlined software with one-click data processing improves experimental efficiency

Experimental data can be saved in universal formats



CAN400 Application Areas

Application Examples



<sup>1</sup>H NMR spectra of 100 mM DHAQ during a potential hold at 1.2 V and 1.7 V, following charging at 100 mA.

Research on redox flow batteries requires fundamental insight at the molecular level to improve performance. By applying in situ nuclear magnetic resonance (NMR) methods to the electrolyte, electrolyte decomposition and battery self-discharge can be explored in real time.

Reference: Nature, 2020, 579(7798): 224-228.

Application Fields



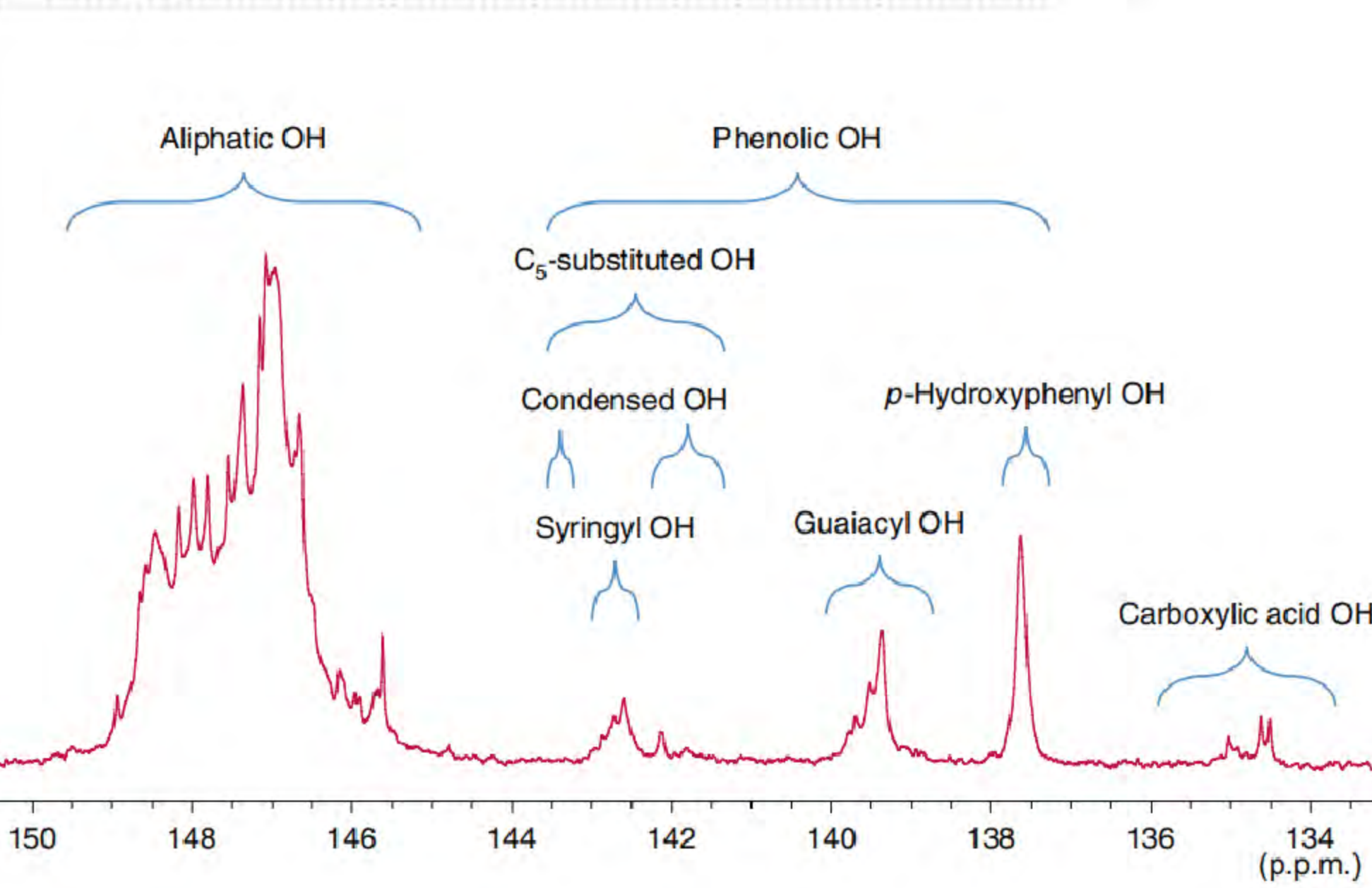
- Chemistry Field**
- Study of chemical reaction kinetics
  - Determination of catalyst structures
  - Analysis of intermediate
  - Screening and combinatorial synthesis of compound libraries
  - Identification of unknown products



- Energy Field**
- Research on electrolyte for sodium and lithium batteries
  - Analysis of battery electrode
  - Analysis of liquid fuel and lubricant components
  - Study of photochemical catalytic in hydrogen energy



- Food Field**
- Analysis of fatty acid components
  - Detection of adulteration and quality control
  - Identification of agricultural produce origins
  - Detection of food additives



The quantitative <sup>31</sup>P NMR partial spectrum of a hardwood poplar lignin derived with TMDP using NHND as an internal standard

In lignin, groups with unstable protons can react with phosphorus-containing reagents to form phosphorus-containing derivatives. By using the technique of quantitative <sup>31</sup>P NMR spectroscopy, the quantity and structure of functional groups such as carboxyl and hydroxyl groups can be studied.

Reference: Nature Protocols, 2019, 14(9): 2627-2647.



- Environmental Science Field**
- Detection of heavy metals and radionuclides(HMR)
  - Analysis of phosphorus forms and environment
  - Study of soil organic matter(SOM) and stability
  - Analysis of atmospheric aerosols



- Biological Science Field**
- Determination of structures of bacterial RNA
  - Identification mechanisms of protein complex interaction
  - Biological structure analysis of membrane proteins and fibrils
  - Analysis of cellular biomolecular complexes
  - Analysis of biological metabolites



- Pharmaceutical Field**
- Analysis of disease-causing proteins
  - Study and inhibition of virus life cycles
  - Analysis of cancer cell development and inhibition processes
  - Mechanism of drug action and antibody research
  - High-throughput drug screening

CAN400 Specifications

Magnet	Magnetic Field Strength	9.39 Tesla
	Bore Diameter	54 mm
	The radial 5 Gauss line	0.6 m
	The vertical 5 Gauss line	1.0 m
Console	Transceiver RF Channels	default 2, expandable to 8
	Frequency Resolution	0.0005 Hz
	Timing Resolution	4 ns
	Phase Resolution	0.001°
	RF Frequency Range	5-1300 MHz
	Digital Resolution	16 bit
Probe	Maximum Receiver Spectral Width	12.5 MHz
	Detected Nuclei	<sup>1</sup> H, <sup>13</sup> C, <sup>15</sup> N, <sup>31</sup> P, <sup>19</sup> F, <sup>109</sup> Ag, and other nuclei
	Deuterium Lock	Supported
	Z Gradient Strength	50 G/cm maximum
	Tuning and Matching	Supports rapid automatic tuning and matching
Software	Operating System	Windows
	Language	English
	Supported Experiments	Data acquisition and processing capability for 1D, 2D, and other NMR experiments
	Experimental Data	Includes common NMR experimental methods Experimental data can be saved in universal formats
	Pulse	Supports pulse sequence editing and graphical interface
	Remote Control	Enable software-controlled console power-up and power-down
Auto Sample changer	Slots	72
	Installation Position	At the waist of the magnet
	Rotation Direction	Bidirectional rotation
	Fast Sample Changing	Equipped with the automatic storage tube, allowing the next sample to be prepared in advance