Brucine (2,3-Dimethoxystrychnidin-10-one) is an alkaloid, structurally related to strychnine, but less toxic. Figure 1 shows the $^1$H NMR spectrum of a 250 mM Brucine sample in CDCl$_3$ measured in a single scan taking 10 seconds to acquire.

**1D Proton spectrum**

![1H NMR spectrum of a 250 mM Brucine sample in CDCl$_3$ measured on a Spinsolve 90 MHz system in a single scan.](image)

Figure 1: $^1$H NMR spectrum of a 250 mM Brucine sample in CDCl$_3$ measured on a Spinsolve 90 MHz system in a single scan.

**1D Carbon spectrum**

Figure 2 shows the $^{13}$C NMR spectrum of 250 mM Brucine in CDCl$_3$ acquired using NOE polarization transfer from $^1$H to $^{13}$C and $^1$H decoupling. The 1D Carbon experiment using NOE is sensitive to all $^{13}$C nuclei in the sample. It clearly resolves all the expected resonances.

![13C NMR spectrum of a 250 mM Brucine sample in CDCl$_3$ measured on a Spinsolve 90 MHz system in 120 minutes.](image)

Figure 2: $^{13}$C NMR spectrum of a 250 mM Brucine sample in CDCl$_3$ measured on a Spinsolve 90 MHz system in 120 minutes.
The 2D COSY experiment allows one to identify coupled $^1$H nuclei as they generate cross peaks out of the diagonal of the 2D data set. In Figure 2 a large number of cross peaks can be nicely observed. For example, the protons at position 6 and 11 (light green) couple with each other. Furthermore, proton 19 couples with proton 10 (light blue), 12 (orange) and 20 (pink). In addition, the couplings between protons 8 and 9 (dark blue) as well as the couplings of protons 8 and 9 with protons 14 and 15 (dark green) can be nicely observed.

Figure 3: $^1$H 2D COSY experiment of a 250 mM Brucine sample in CDCl$_3$ acquired in 13 minutes on a Spinsolve 90 MHz system (top); zoom into the aliphatic region (0.5-5.0 ppm) of the $^1$H 2D COSY spectrum which underlines the superb resolution.
**2D JRES spectrum**

This experiment is useful to identify the chemical groups generating a single line for each group by collapsing the J-coupling along the direct direction. The multiplets are generated along the vertical direction.

![2D JRES spectrum](image)

**2D HSQC-ME**

The HSQC is a powerful sequence widely used to correlate the $^1$H with the one-bond coupled $^{13}$C nuclei. The Spinsolve is equipped with a multiplicity edited version (HSQC-ME) of this method. It provides the editing power of the DEPT-135 sequence, which is useful to differentiate between the signals of the CH$_2$ groups (blue) from the CH and CH$_3$ groups (red). Figure 5 shows the HSQC-ME spectrum of a 250 mM Brucine sample in CDCl$_3$ acquired in 2 minutes. The measurement time was optimized applying NUS (non uniform sampling).

![2D HSQC-ME spectrum](image)
2D HMBC
To obtain long-range $^1\text{H}$-$^{13}\text{C}$ correlations through two or three bond couplings, the Heteronuclear Multiple Bond Correlation (HMBC) experiment can be used. Figure 6 shows the long-range correlation of proton 8 with carbons 2, 3, 5, 7, 9 and 17 (the sequence shows the correlation with quaternary carbons, too).

Figure 6: HMBC spectrum of a 250 mM Bruccine sample in CDCl$_3$ showing the long-range couplings between $^1\text{H}$ and $^{13}\text{C}$ nuclei.