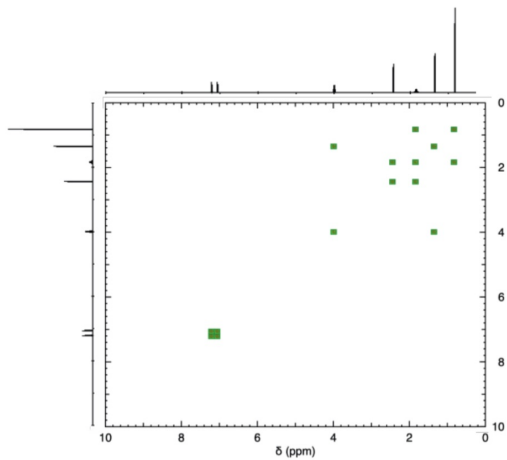


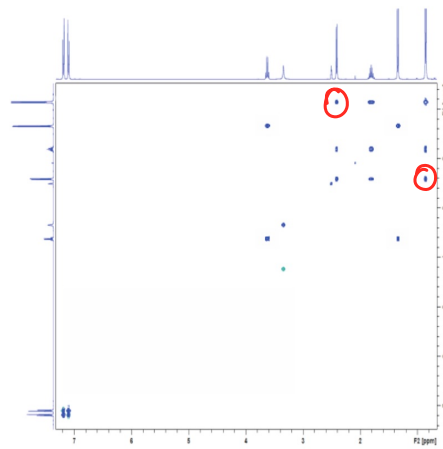
Jigsaw 4:

1) TOCSY correlates all spins within a coupled spin network through multiple relays of magnetization transfer. COSY only shows correlations between directly coupled spins.

2)



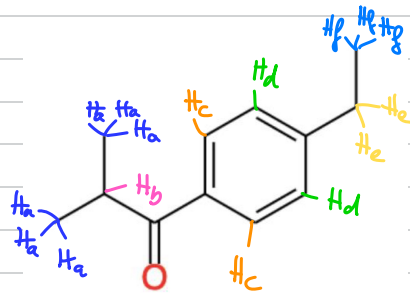
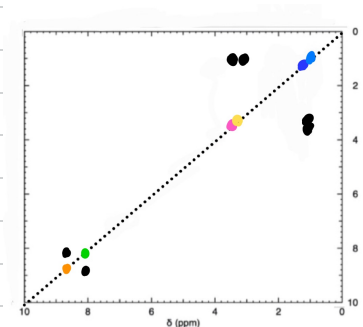
COSY



TOCSY

It is a TOCSY spectrum because we see a larger number of signals. We can say that because this is a whole spin system. The red circle shows that there is more signal on the TOCSY spectrum.

3) COSY & TOCSY spectra:



The spectra is the same for COSY and TOCSY because there is only $^2J_{H-H}$ and not $^3J_{H-H}$ coupling, so there is no difference between the two spectra.

Jigsaw 4A

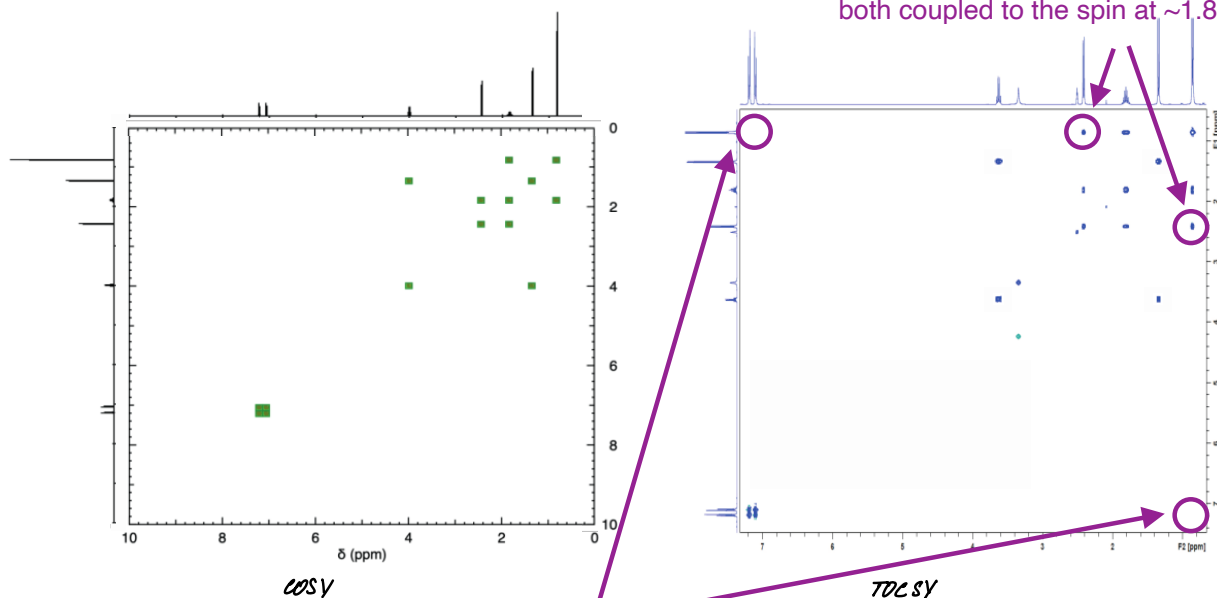
2D NMR: COSY and TOCSY

1. Explain the difference between the TOCSY and COSY experiments.

COSY	TOCSY
- scalar coupling between directly coupled protons	- correlations between ALL protons through spin system
- identifies neighbouring protons	- identifies full spin systems

Not QUITE... shows correlations between all COUPLED protons through the spin system. See the TOCSY spectrum below; the cross peaks aren't present for all combinations of peaks.

2. Of the two spectra below, which spectrum corresponds to which experiment? How do you know?

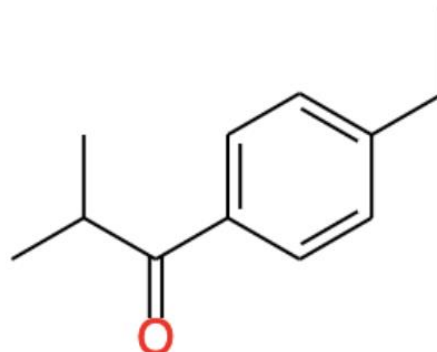


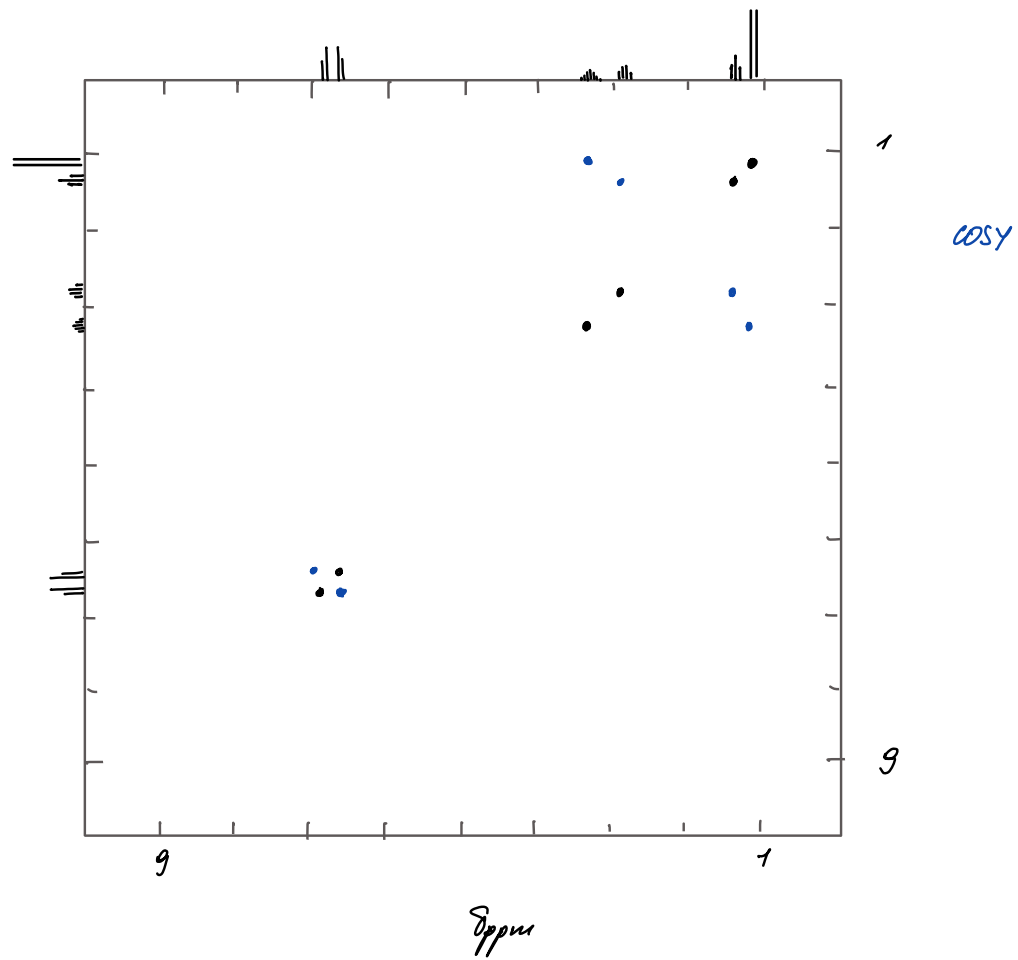
For example, these crosspeaks are not present in the COSY, but are present in the TOCSY, because they are both coupled to the spin at ~1.8ppm

But these crosspeaks are not present in either the COSY or the TOCSY, indicating that there is no coupling network of spins that connects them together

- shows many more cross-peaks due correlations between all protons \Rightarrow more possibilities

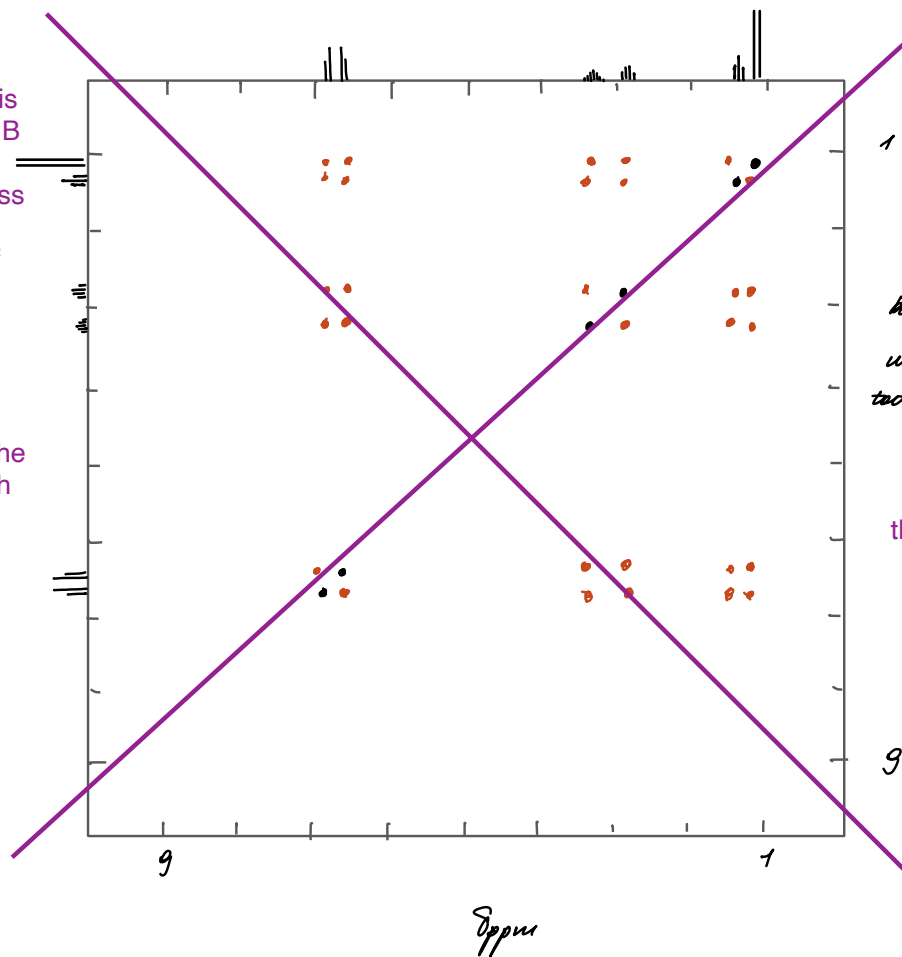
3. [From past exam] Draw the schematic ^1H - ^1H COSY and TOCSY spectra of the following molecule, using qualitative estimates for the expected chemical shifts. You do not need to draw the splittings due to $^3\text{J}_{\text{HH}}$ couplings.





Think of TOCSY as an extension of COSY; if spin A is correlated to spin B and spin B is correlated to spin C (in COSY), then there will be cross peaks between A and C in TOCSY (but not in COSY, if they're not directly coupled)

In the case of this molecule, the TOCSY actually would match the COSY!



but in reality not all would be seen, some are too far

It's not necessarily about distance; far away peaks that are coupled can still be seen with longer mixing times