
NMR Spectroscopy of Organic Compounds

Lesson 4: 2D experiments



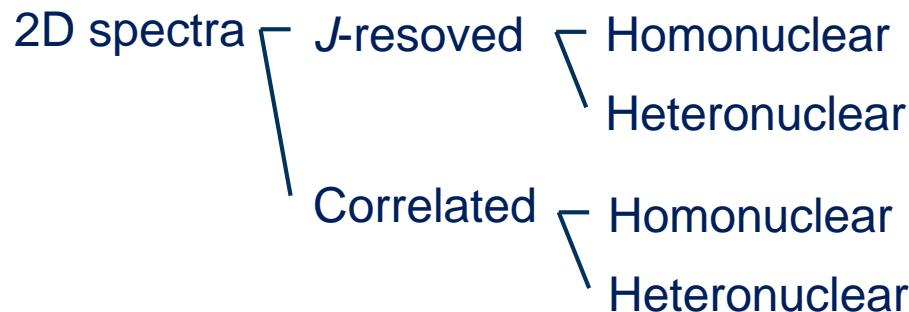
Martin Dračínský

Overview

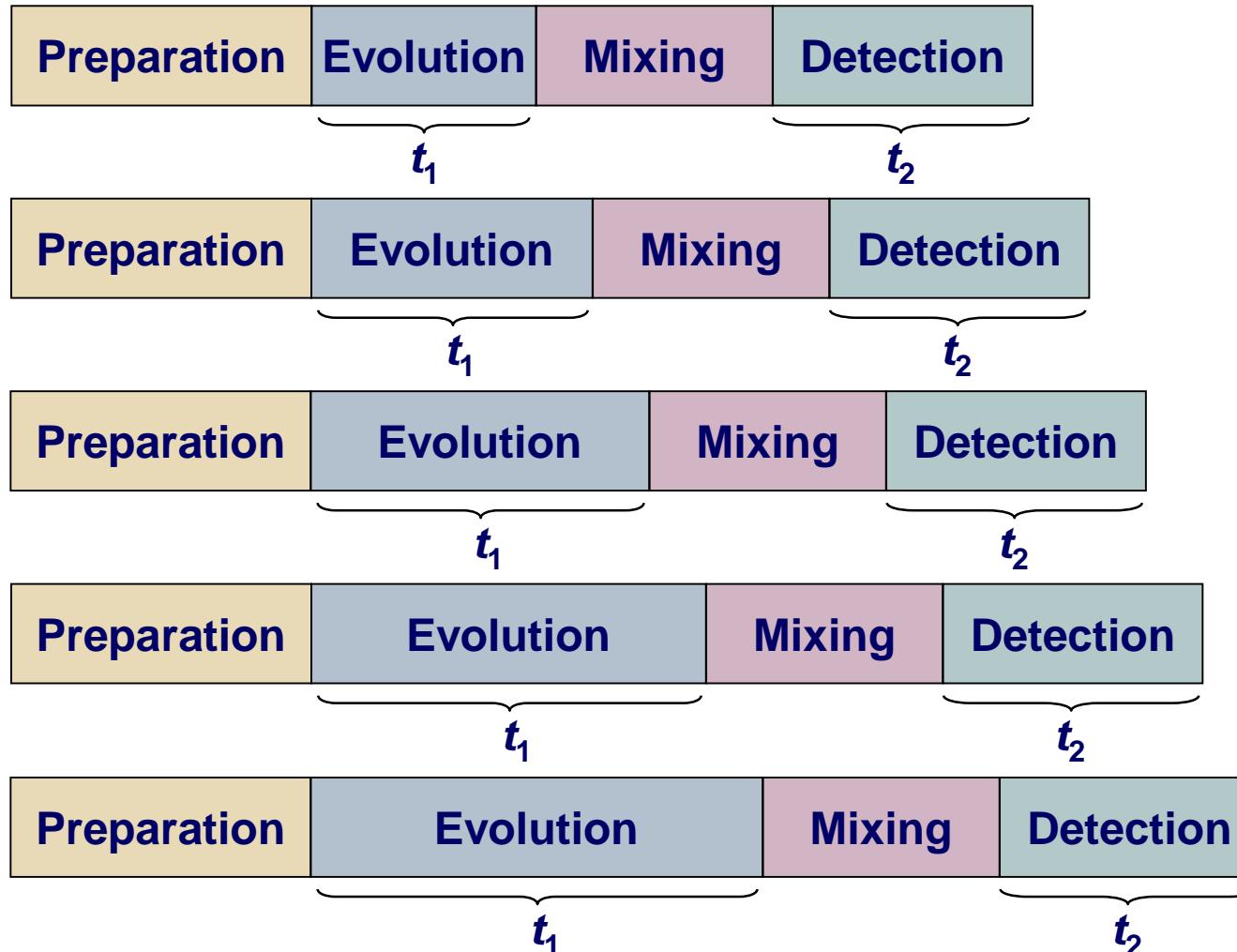
- Basic principle of 2D experiments
- Most common 2D experiments

2D NMR Experiments

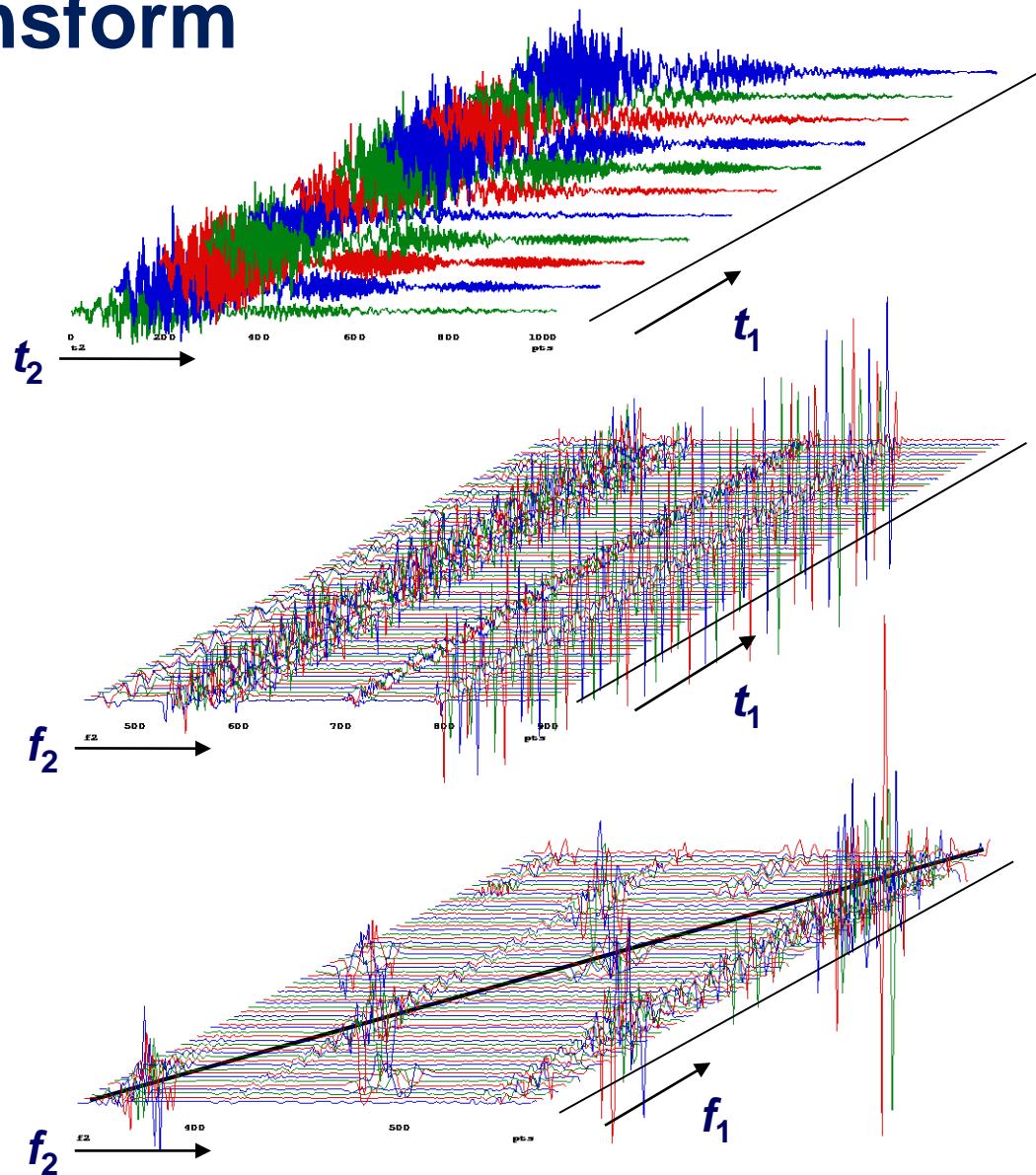
- Second time variable
- Measurement of a series of 1D experiments
- Two-dimensional Fourier transform



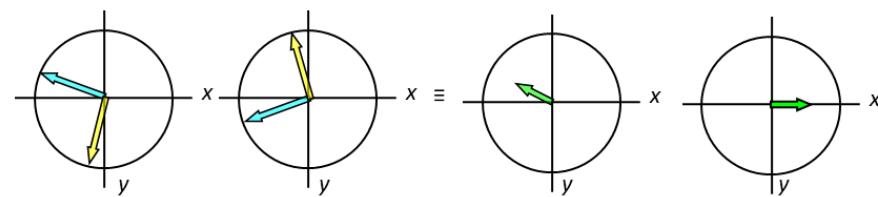
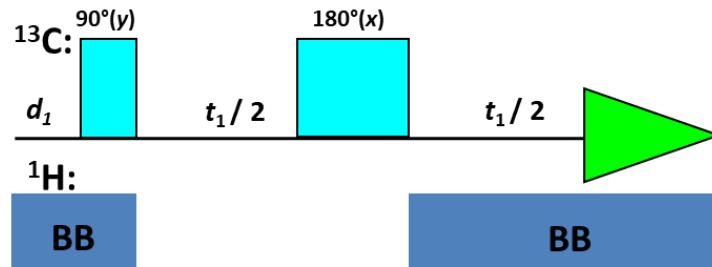
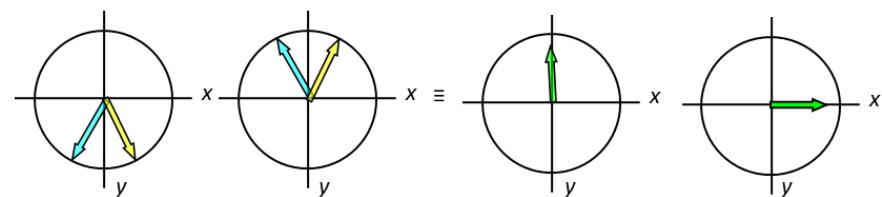
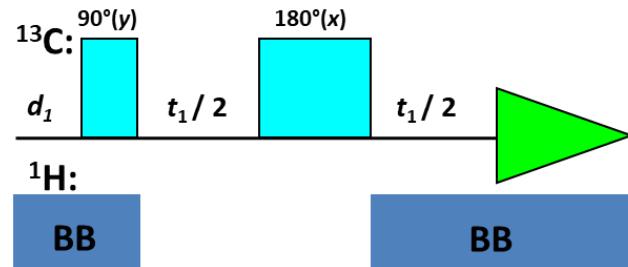
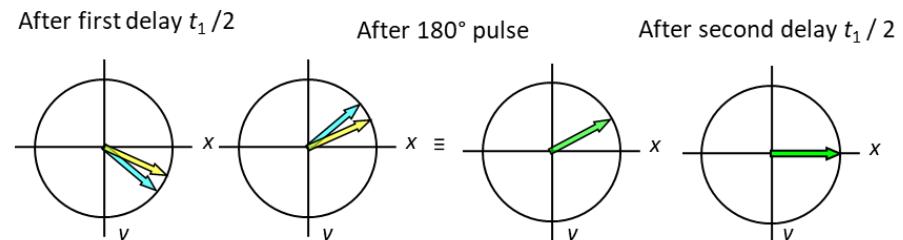
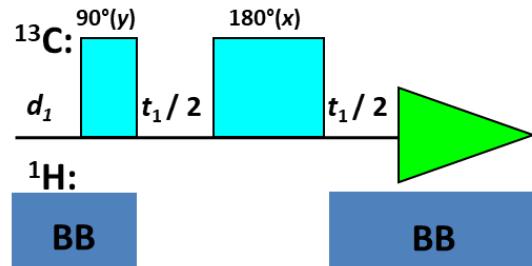
Basic principle of 2D experiments



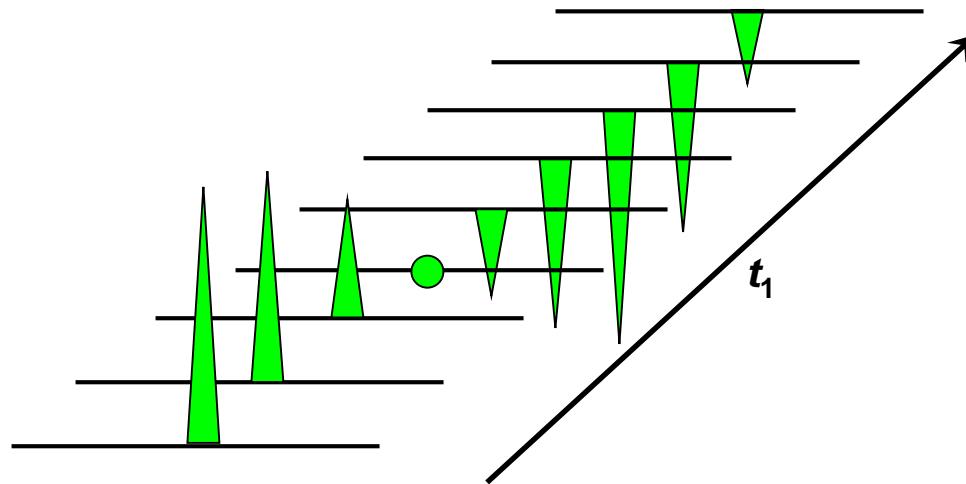
2D Fourier transform



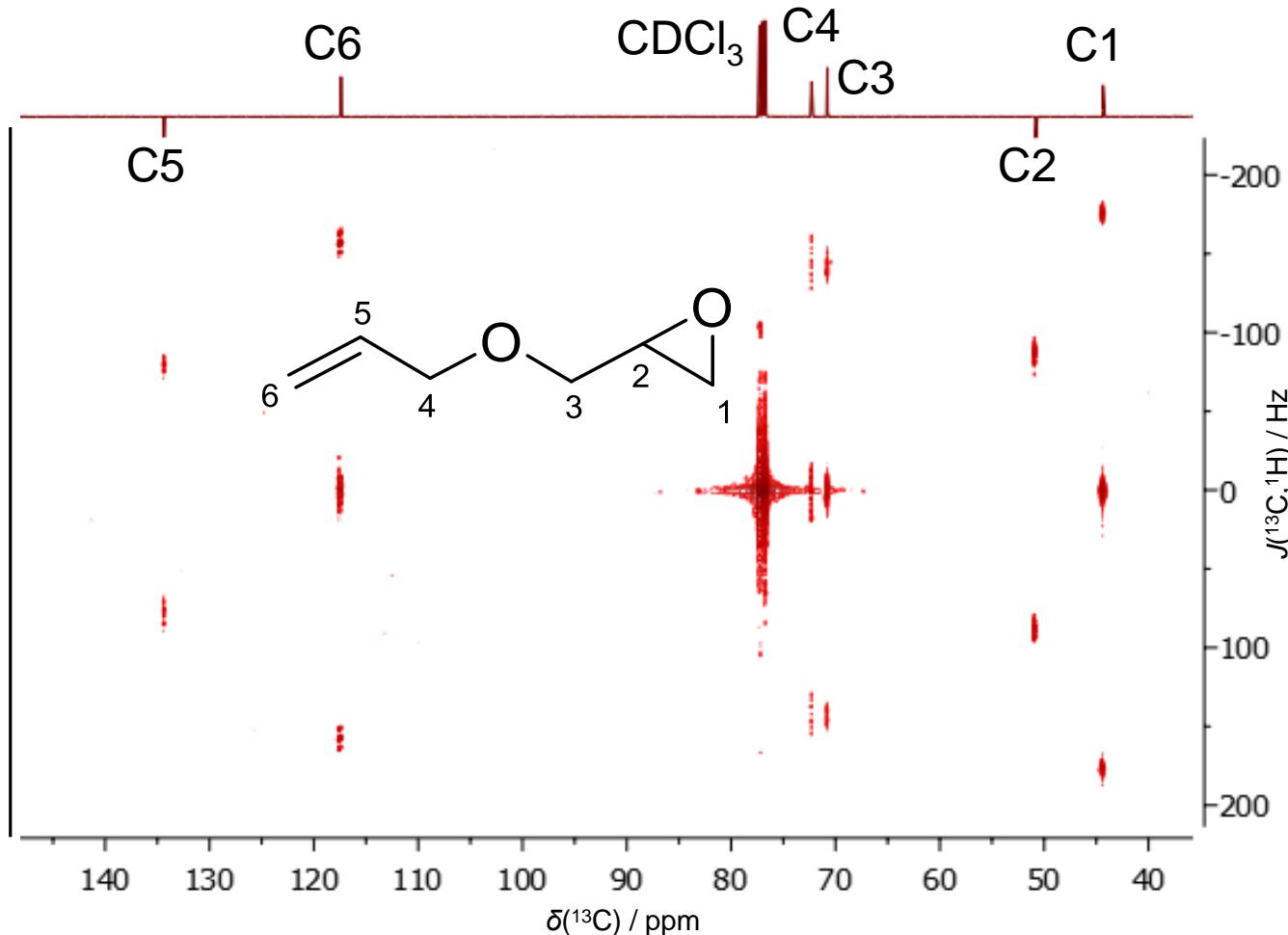
Heteronuclear J -resolved experiment



Heteronuclear J -resolved experiment

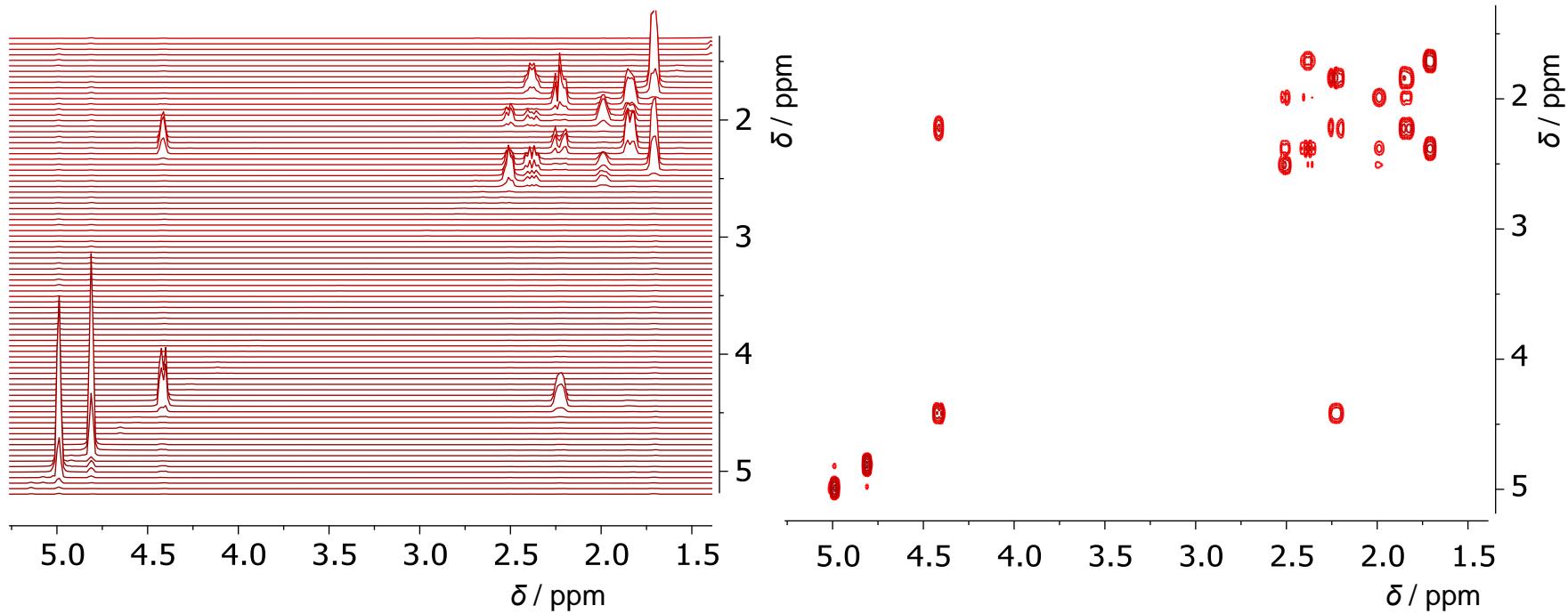


Heteronuclear J -resolved experiment



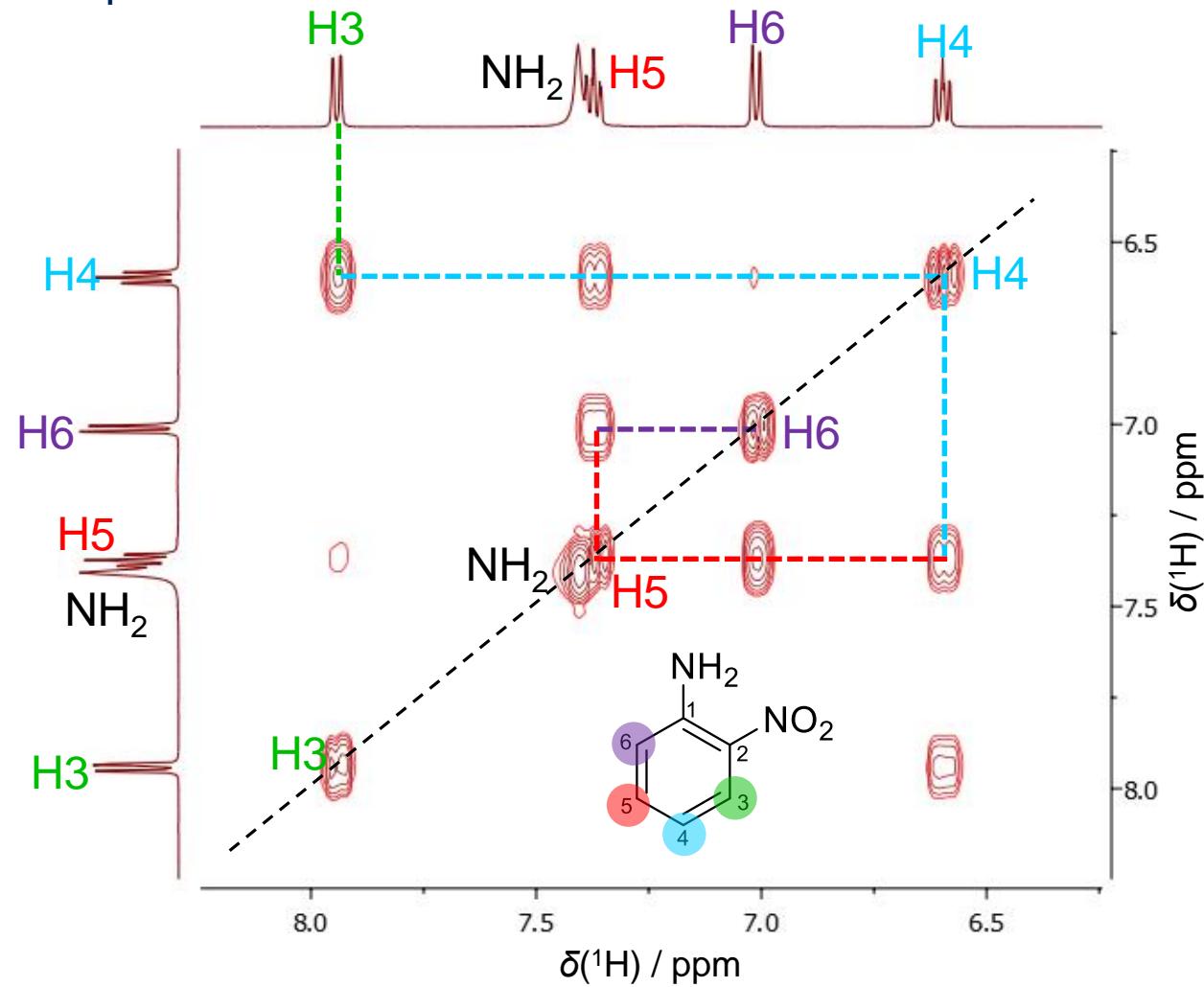
Displaying 2D spectra

- Perspective plot
- Contour plot



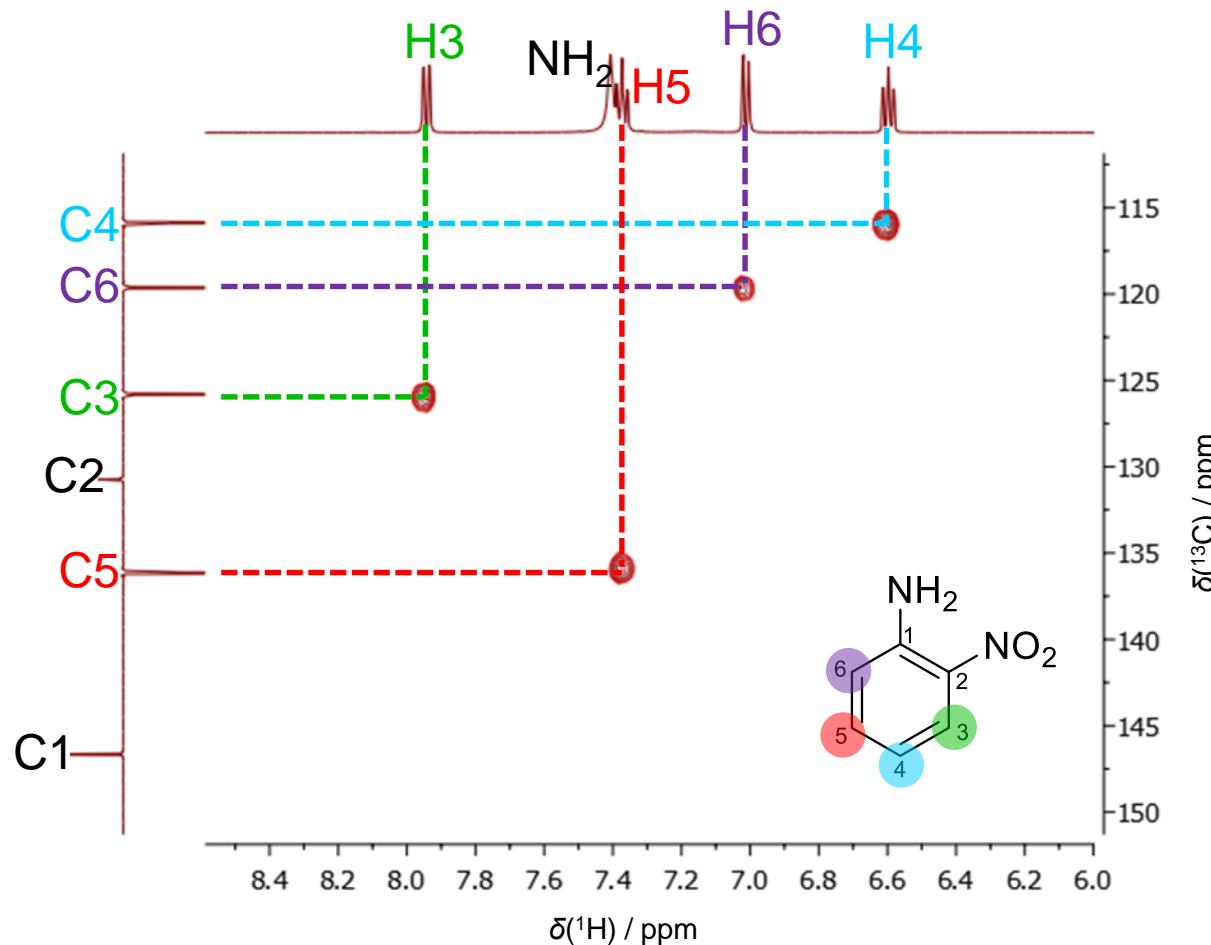
Most common 2D experiments – COSY

- COrrelation SpectroscopY



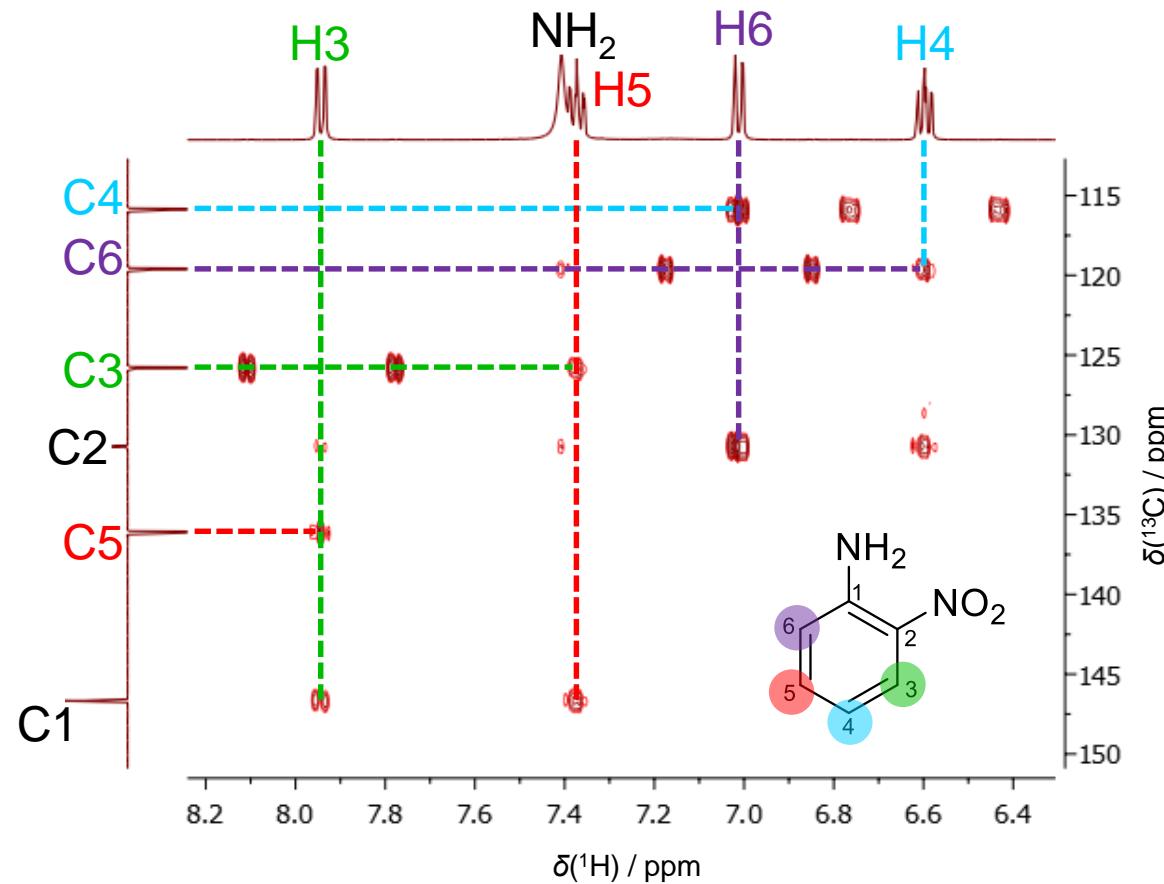
Most common 2D experiments – HSQC

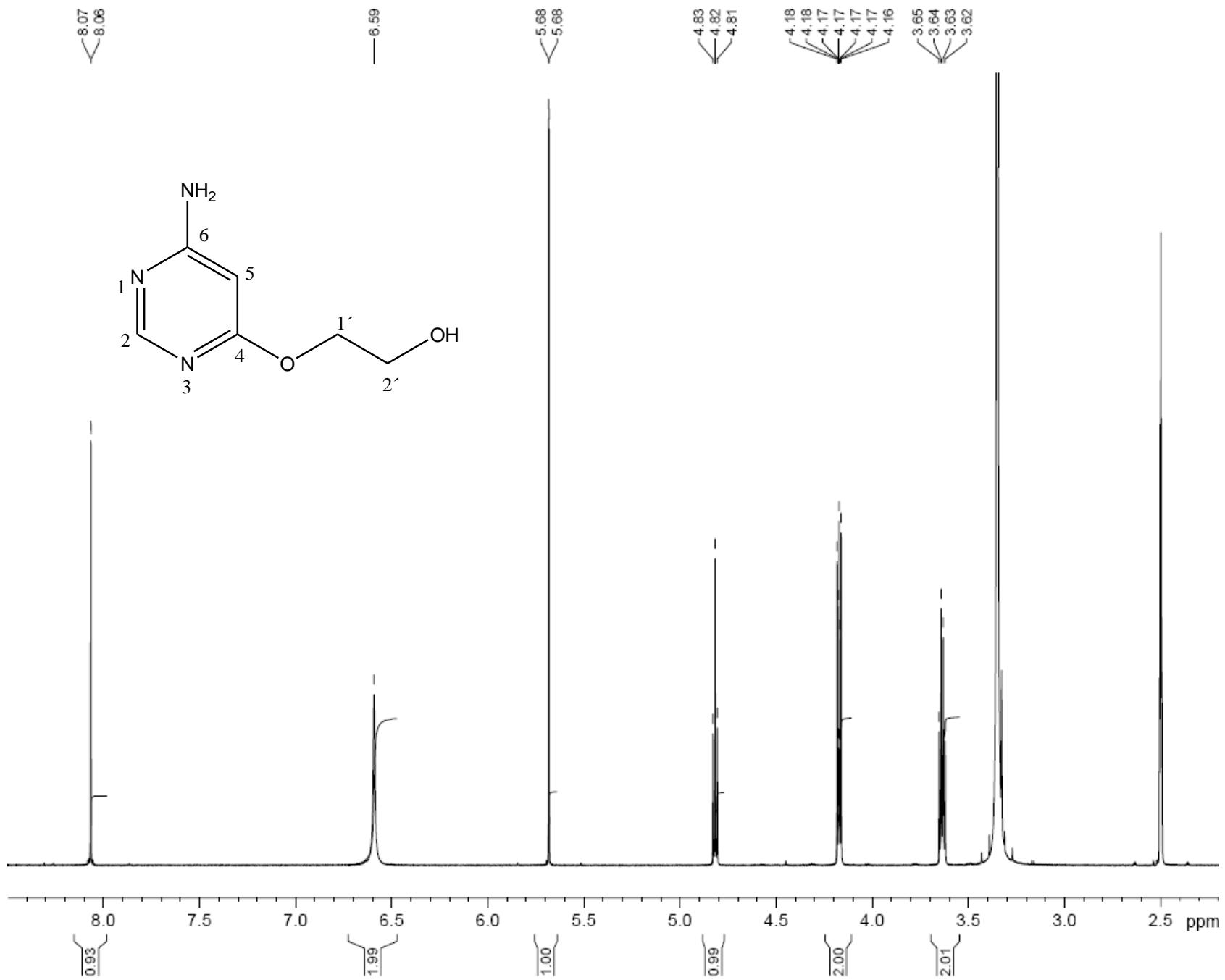
- Heteronuclear Single-Quantum Correlation, HMQC – the same result

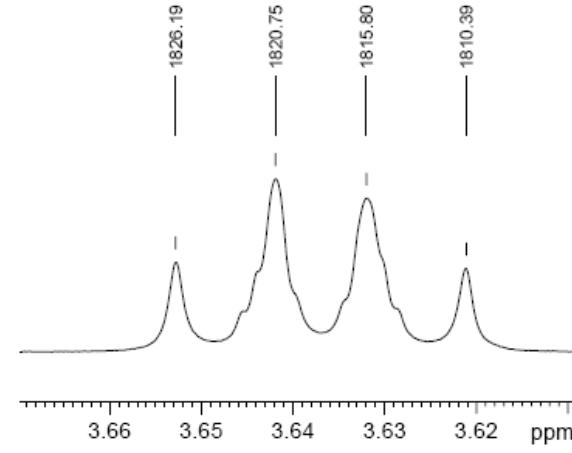
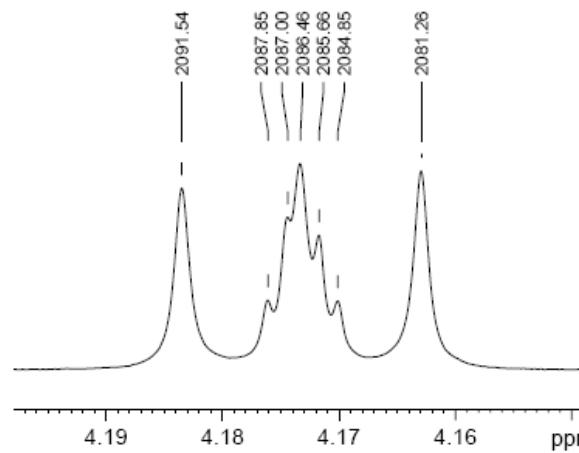
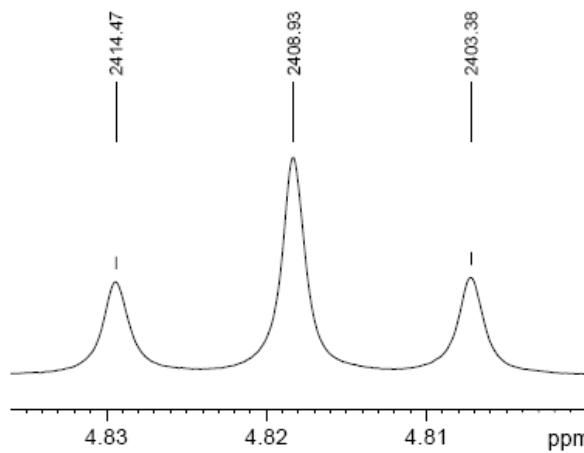
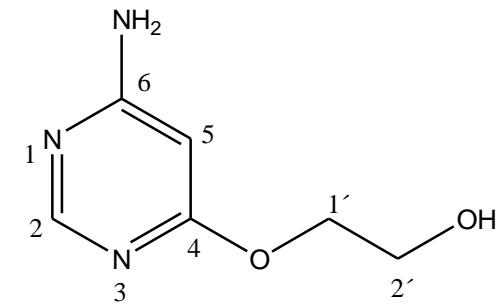
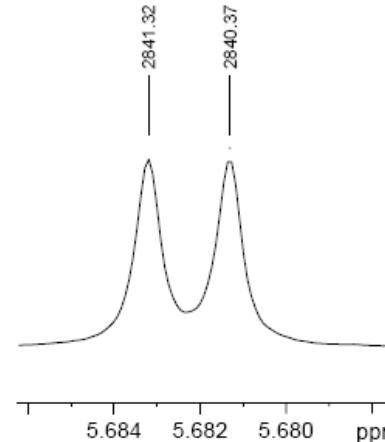
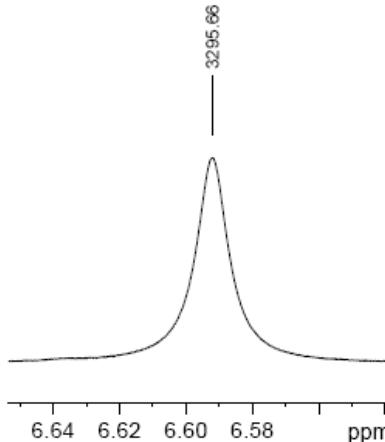
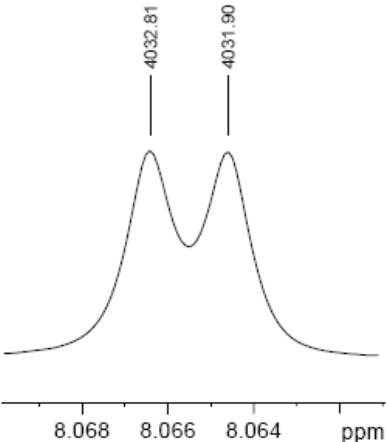


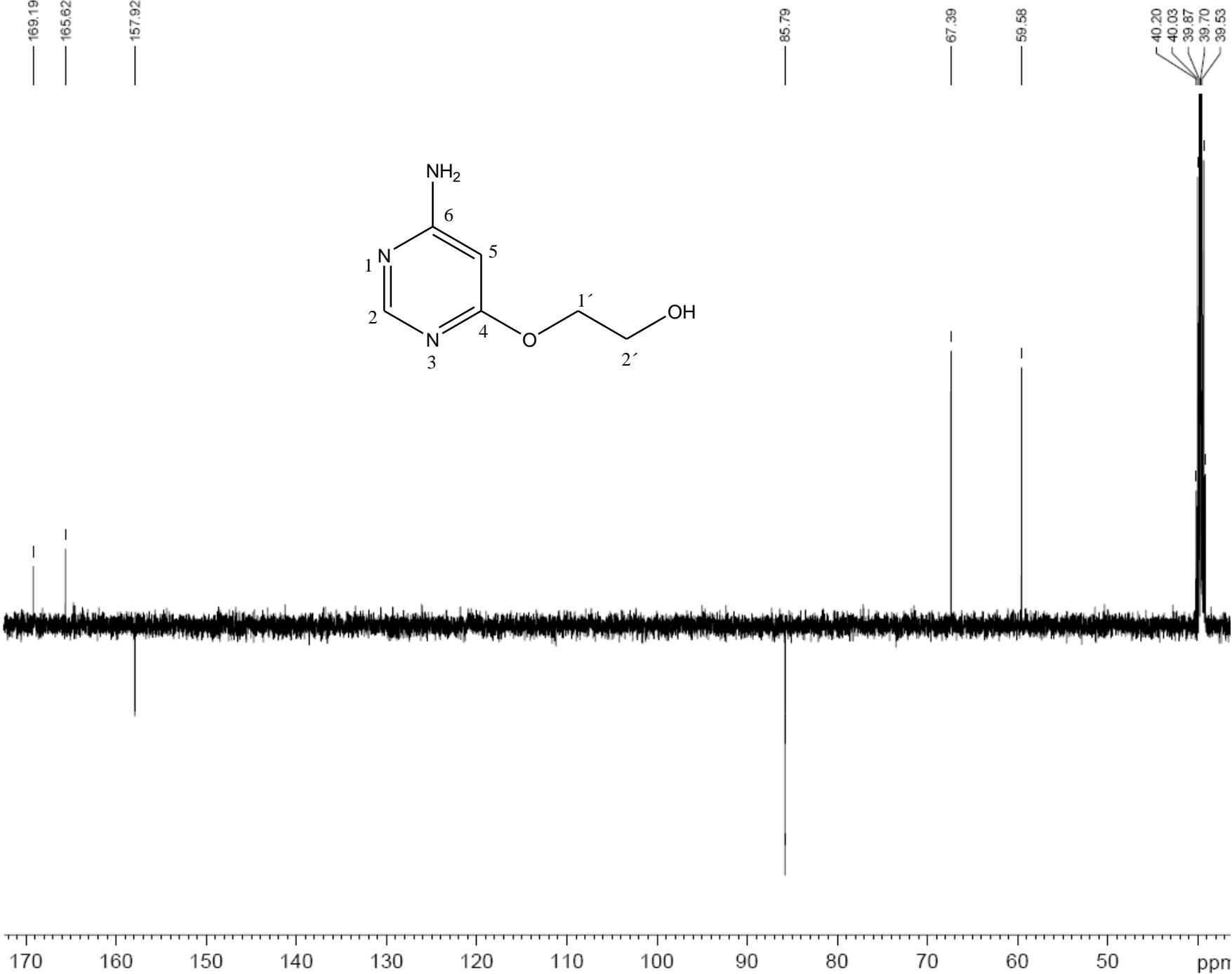
Most common 2D experiments – HMBC

- Heteronuclear Multiple-Bond Correlation

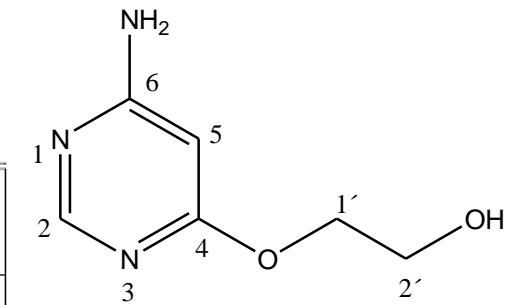
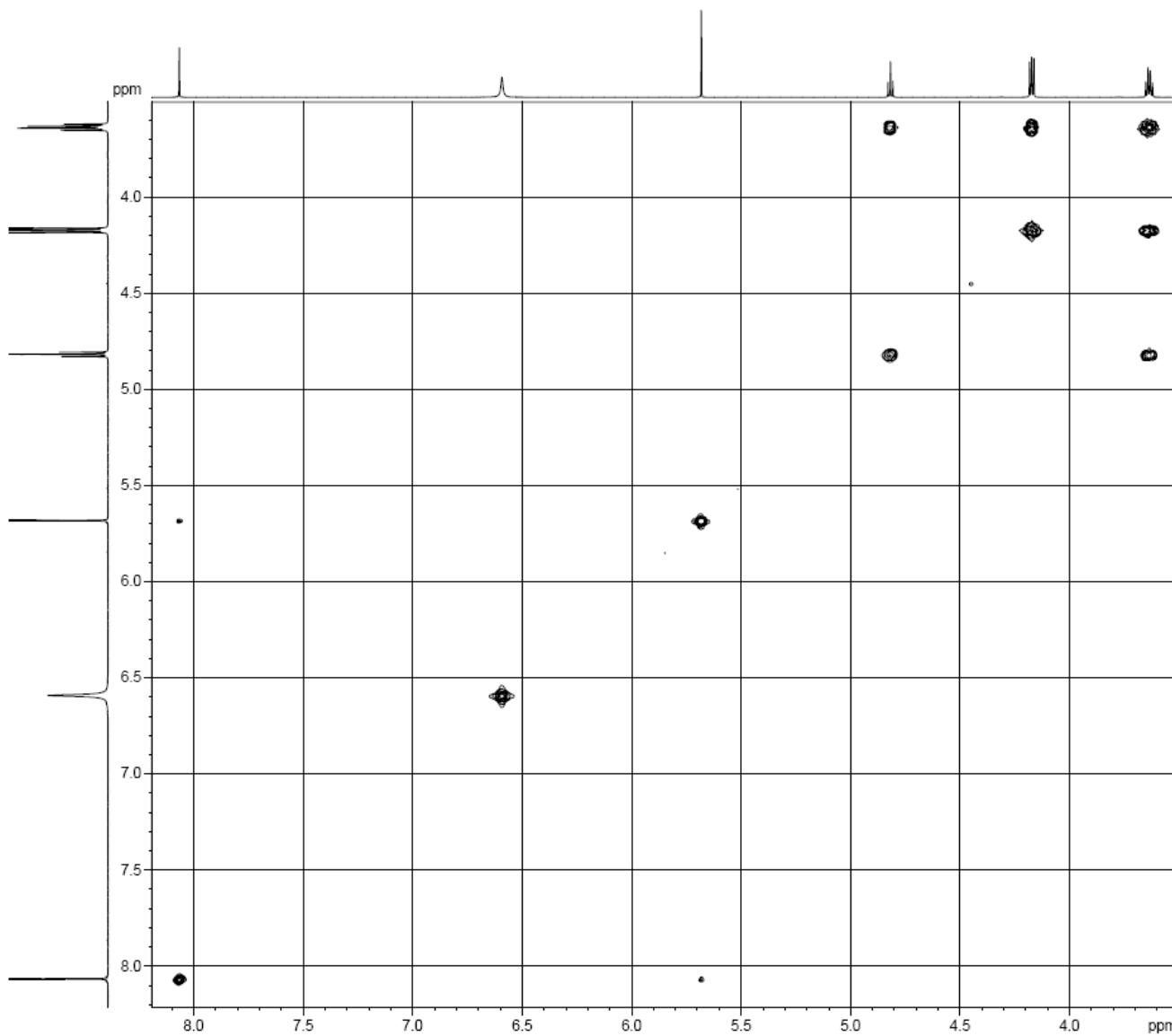




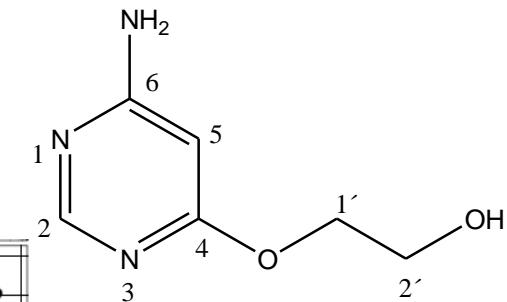
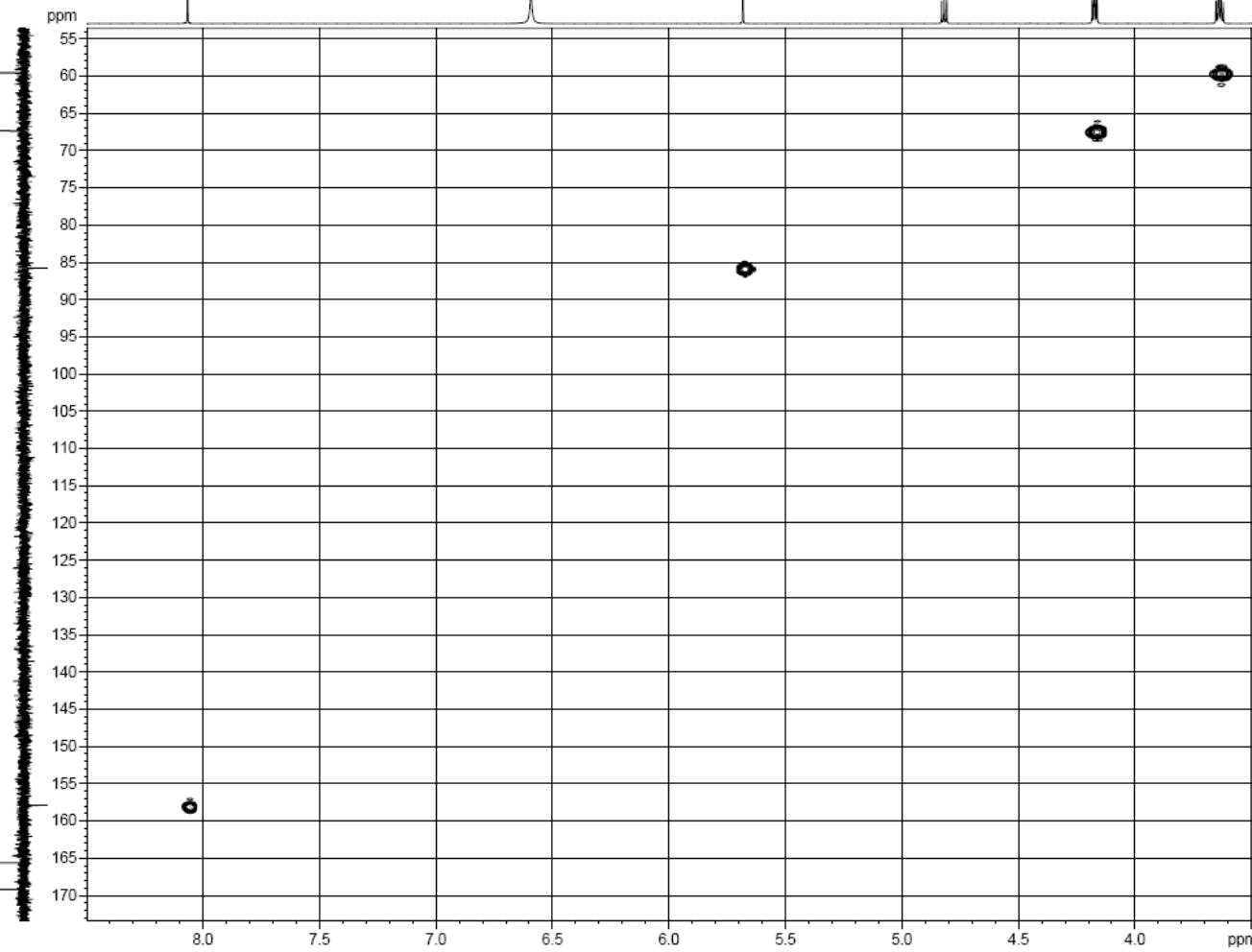




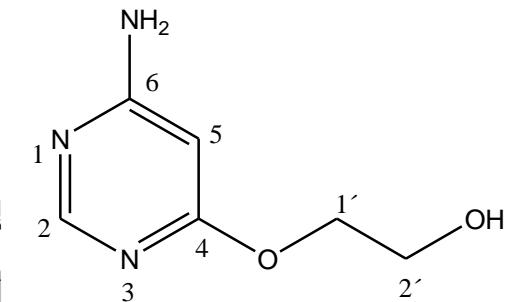
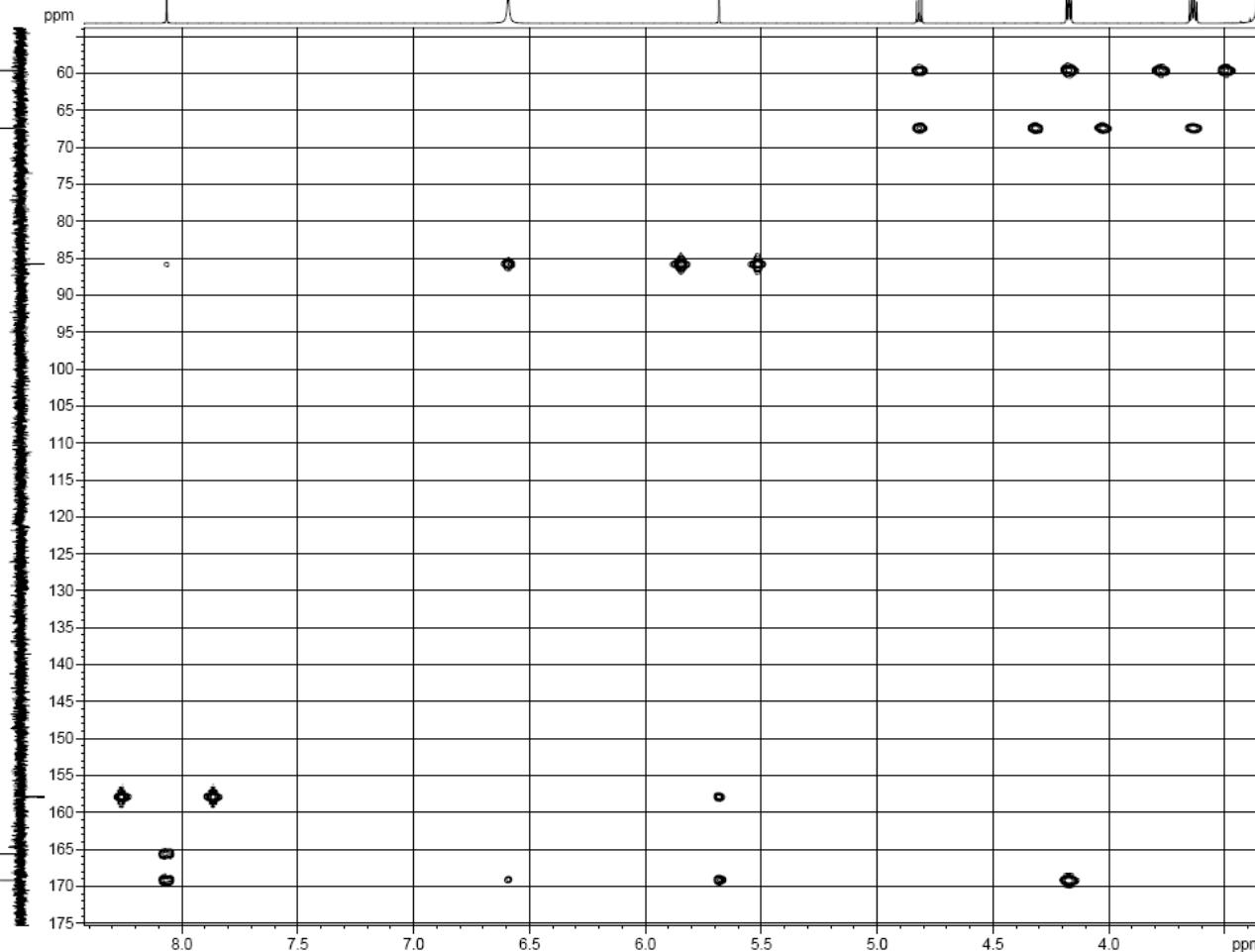
COSY



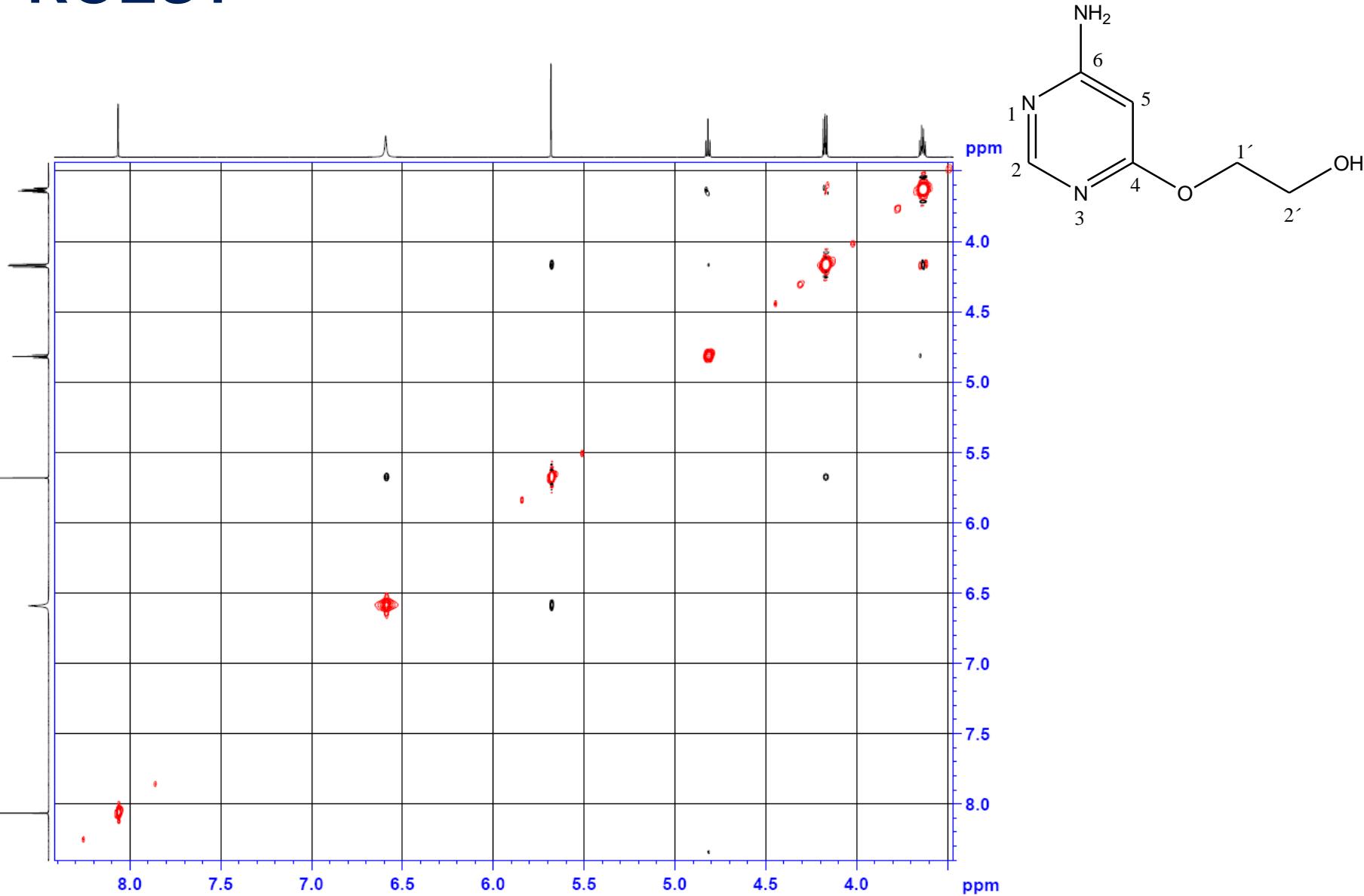
HSQC



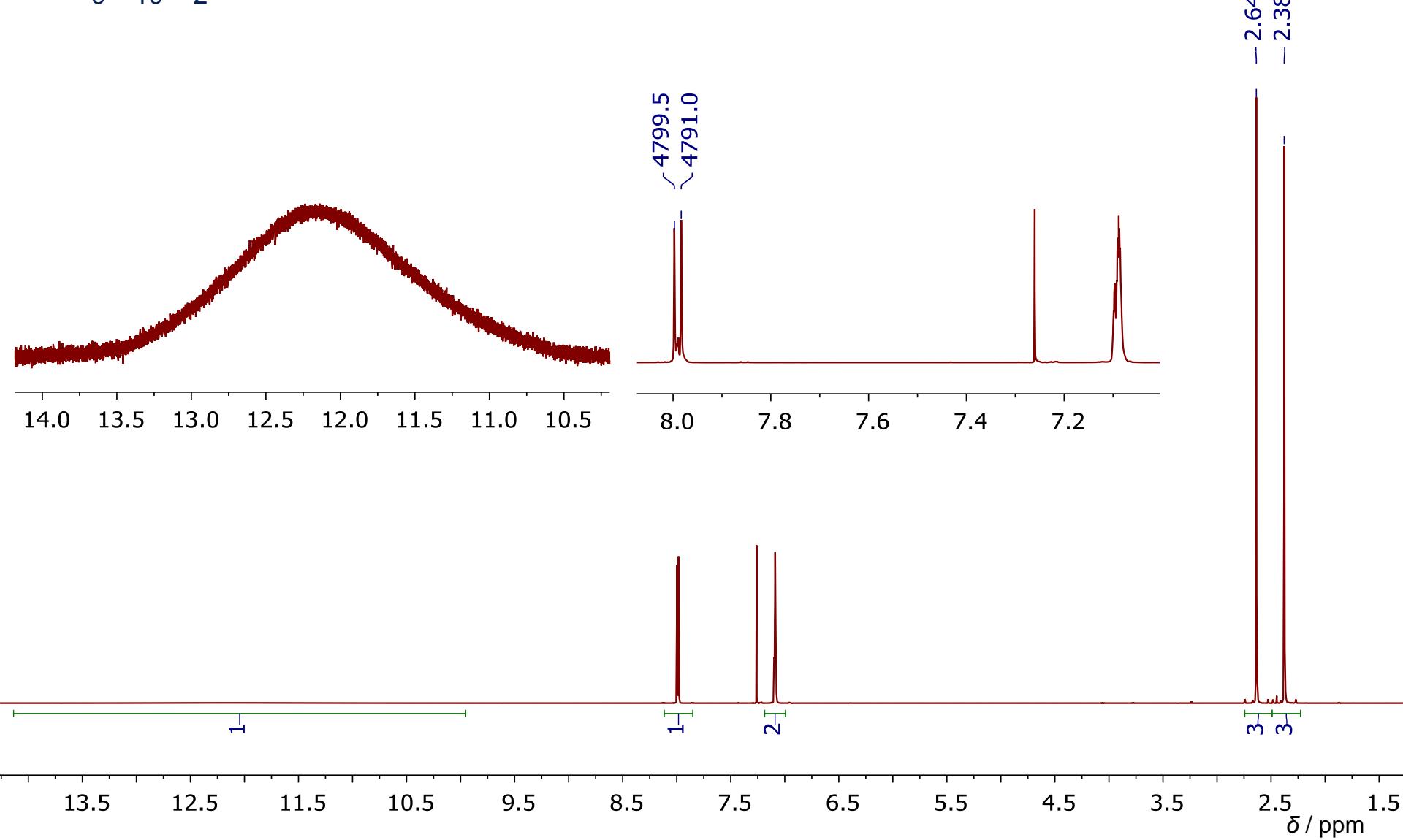
HMBC

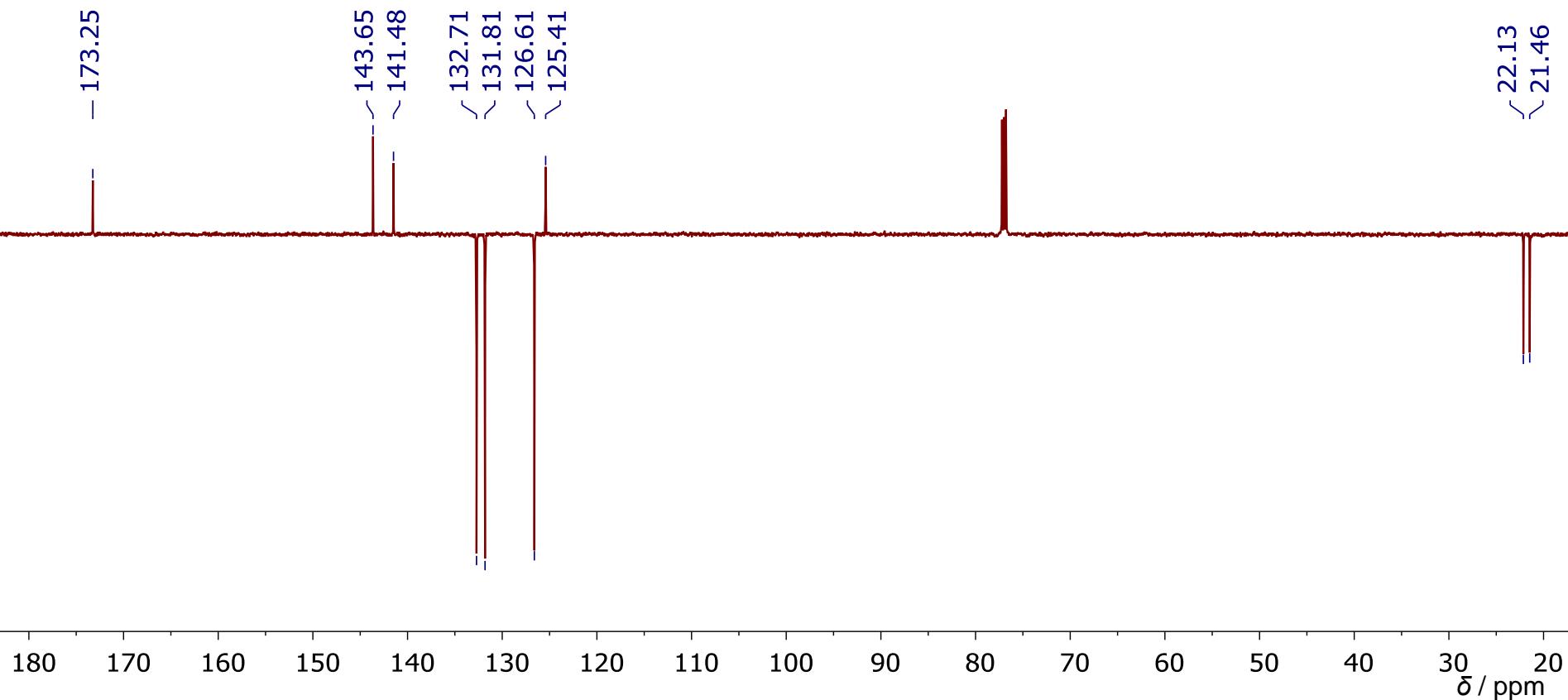


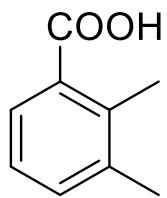
ROESY



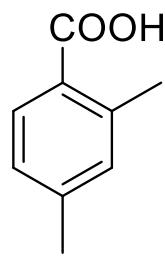
$\text{C}_9\text{H}_{10}\text{O}_2$



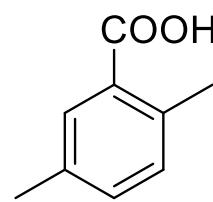




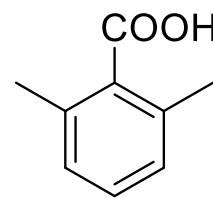
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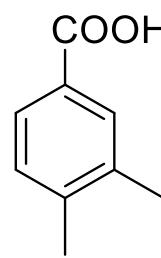
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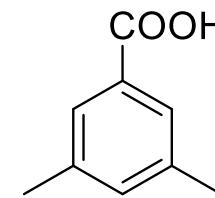
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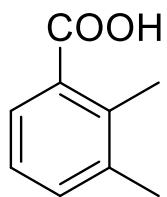
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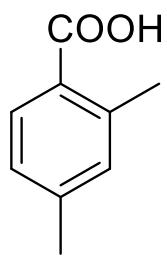
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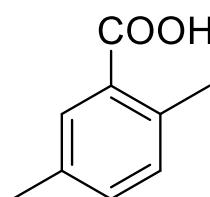
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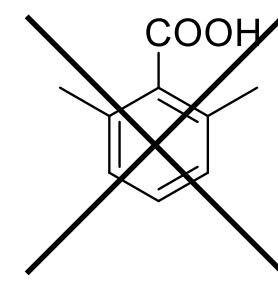
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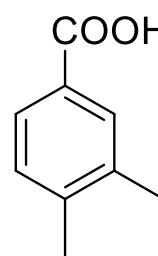
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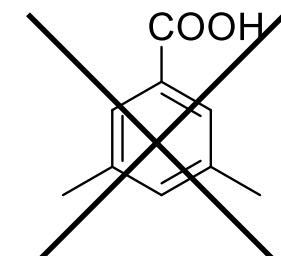
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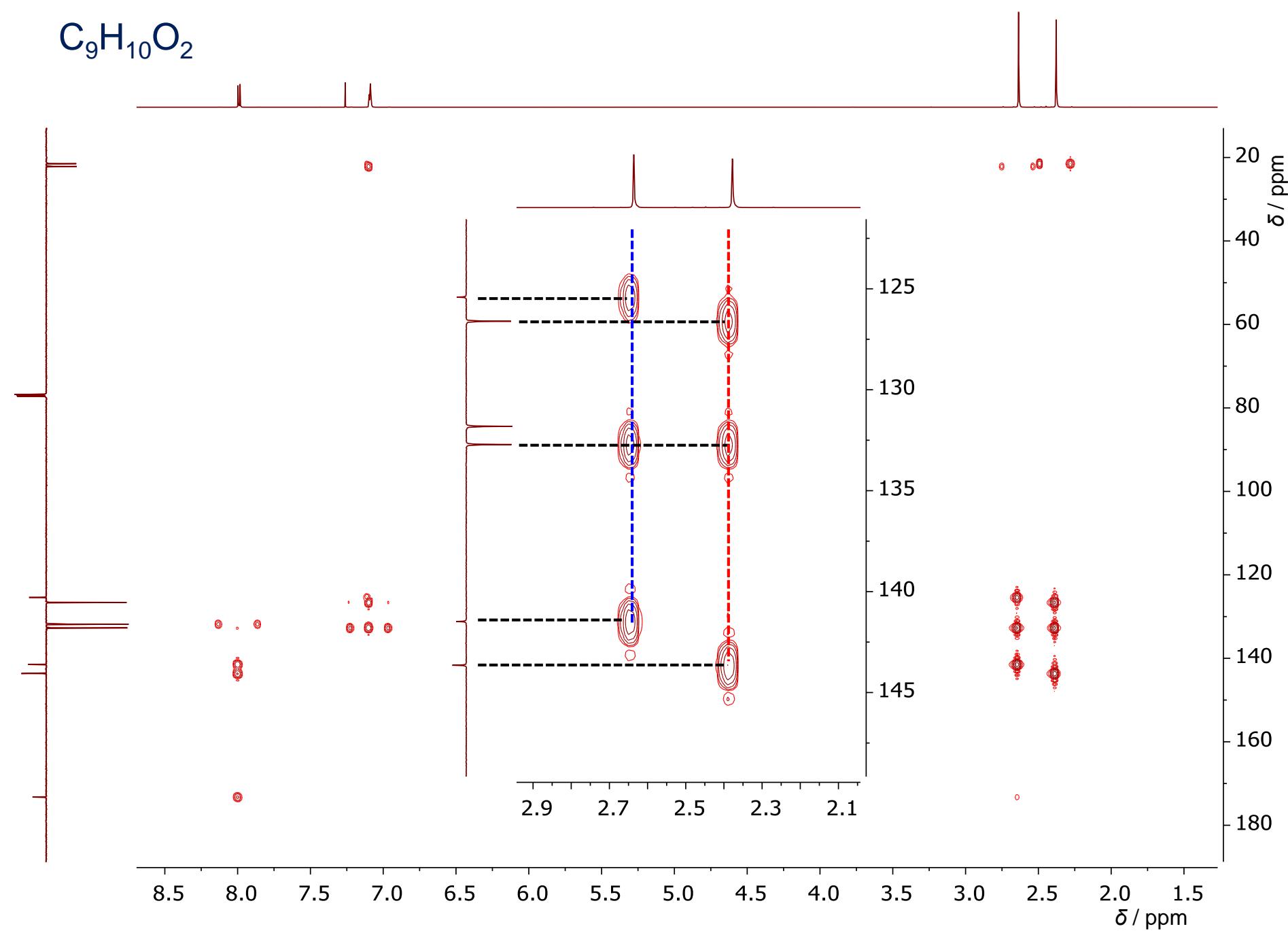
D



E



F



C₉H₁₀O₂

