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**Electronic Supplementary Information**

# DABCO-catalyzed ring opening of activated cyclopropanes and recyclization leading to γ-lactams with an all-carbon quaternary center

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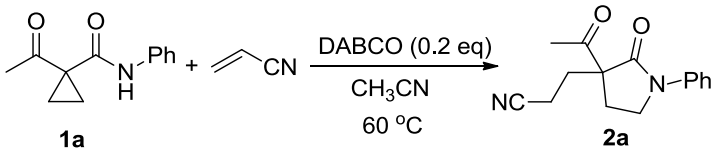
## Contents

**I. General information:**

All reagents were purchased from commercial sources and used without further treatment, unless otherwise indicated. The products were purified by column chromatography over silica gel. $^{1}H$ NMR and $^{13}C$ NMR spectra were recorded at 25 ℃ on a Varian 500 MHz and 125 MHz, respectively, with TMS as the internal standard. Melting points were obtained with a micro melting point XT4A Beijing Keyi electrooptic apparatus and are uncorrected. High resolution mass spectra were recorded on Bruck microtof. All reactions were monitored by TLC with Taizhou GF254 silica gel coated plates. Flash column chromatography was carried out using 200-300 mesh silica gel at increased pressure.

**II. General procedure for the construction of γ-lactams (2a as an example):**

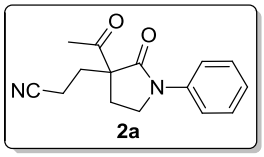



**1a** **2a**

To a solution of **1a** (203 mg, 1.0 mmol) and DABCO (44 mg, 0.2 mmol) in $CH_3CN$ (2.0 mL) was added acrylonitrile (0.08 mL, 1.1 mmol) in a 25 mL flask. The reaction mixture was stirred at 60 ℃ for 6 h, cooled down to room temperature, poured into brine and extracted with EtOAc. The combined organic phase was washed with water (3 × 10 mL), dried over anhydrous $MgSO_4$, filtered and concentrated under reduced pressure. The crude product was purified by column chromatography (petroleum ether/diethyl ether) to afford the desired product **2a** (238 mg, 93%).

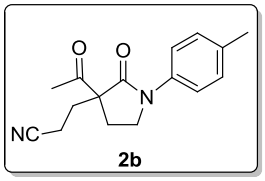
## III. Characterization of the products

### 3-(3-acetyl-2-oxo-1-phenylpyrrolidin-3-yl)propanenitrile (2a)



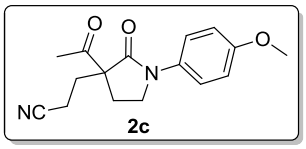

Colorless crystals. m.p. 86-88 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.00-2.06 (m, 1H), 2.34 (s, 3H), 2.35-2.46 (m, 4H), 2.77-2.82 (m, 1H), 3.81-3.89 (m, 2H), 7.20-7.23 (t, $J$ = 7.5 Hz, 1H), 7.39-7.42 (t, $J$ = 7.5 Hz, 2H), 7.60-7.61 (d, $J$ = 8.0 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 13.0, 26.1, 26.1, 29.6, 29.8, 45.8, 62.7, 118.8, 120.0, 125.4, 129.0, 138.5, 170.4, 203.5. HRMS (ESI-TOF): Calc for $C_{15}H_{16}N_2O_2$ [M+H]: 257.1290; found: 257.1290.

### 3-(3-acetyl-2-oxo-1-(*p*-tolyl)pyrrolidin-3-yl)propanenitrile (2b)



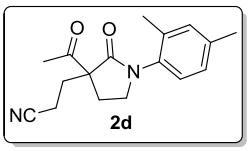

White solid. m.p. 91-93 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.98-2.04 (m, 1H), 2.14 (s, 3H), 2.30-2.46 (m, 10H), 2.74-2.79 (m, 1H), 3.77-3.87 (m, 2H), 7.18-7.20 (d, $J$ = 8.5 Hz, 2H), 7.46-7.47 (d, $J$ = 8.5 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 13.0, 20.9, 26.1, 26.2, 29.8, 30.9, 46.0, 62.6, 118.9, 120.0, 129.5, 135.3, 136.0, 170.2, 203.7. HRMS (ESI-TOF): Calc for $C_{16}H_{18}N_2O_2$ [M+H]: 271.1447; found: 271.1453.

### 3-(3-acetyl-1-(4-methoxyphenyl)-2-oxopyrrolidin-3-yl)propanenitrile (2c)




Colorless crystals. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.00-2.04 (m, 1H), 2.33 (s, 3H), 2.34-2.39 (m, 2H), 2.42-2.46 (m, 4H), 2.74-2.79 (m, 1H), 3.77-3.84 (m, 5H), 6.91-6.93 (m, 2H), 7.48-7.50 (m, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 13.0, 26.1, 26.2, 29.8, 46.2, 55.4, 62.4, 114.1, 118.9, 121.8, 131.6, 157.1, 170.0, 203.8. HRMS (ESI-TOF): Calc for $C_{16}H_{18}N_2O_3$ [M+H]: 287.1396; found: 287.1391.

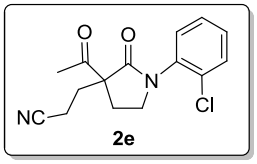
### 3-(3-acetyl-1-(2,4-dimethylphenyl)-2-oxopyrrolidin-3-yl)propanenitrile (2d)




White solid. m.p. 74-76 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.05-2.11 (m, 1H), 2.14 (s, 3H), 2.32 (s, 3H), 2.33-2.45 (m, 5H), 2.46-2.50 (m, 2H), 2.74-2.79 (m, 1H), 3.60-3.65 (m, 1H), 3.68-3.73 (m, 1H), 6.98-6.99 (d, $J$ = 8.0 Hz, 1H), 7.04-7.05 (d, $J$ = 8.5 Hz, 1H), 7.09 (s, 1H). $^{13}$C NMR (125

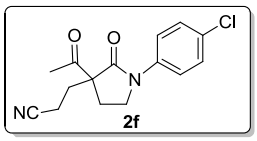
MHz, $CDCl_3$): $\delta$ = 12.9, 17.6, 20.9, 26.1, 27.1, 29.6, 47.7, 61.3, 118.9, 126.0, 127.6, 131.8, 133.7, 134.7, 138.2, 170.4, 204.0. HRMS (ESI-TOF): Calc for $C_{17}H_{20}N_2O_2$ [M+H]: 285.1603; found: 285.1607.

**3-(3-acetyl-1-(2-chlorophenyl)-2-oxopyrrolidin-3-yl)propanenitrile (2e)**



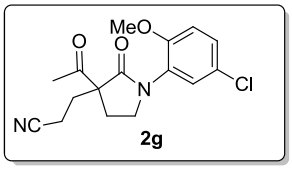

White solid. m.p. 77-79 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.09-2.14 (m, 1H), 2.33-2.42 (m, 5H), 2.45-2.50 (m, 2H), 2.78-2.83 (m, 1H), 3.68-3.72 (m, 1H), 3.75-3.80 (m, 1H), 7.25-7.27 (m, 1H), 7.30-7.35 (m, 2H), 7.47-7.49 (m, 1H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 12.9, 26.2, 27.3, 29.5, 47.0, 61.0, 119.0, 128.0, 129.1, 129.8, 130.5, 132.0, 135.1, 171.2, 203.7. HRMS (ESI-TOF): Calc for $C_{15}H_{15}ClN_2O_2$ [M+H]: 291.0900; found: 291.0984.

**3-(3-acetyl-1-(4-chlorophenyl)-2-oxopyrrolidin-3-yl)propanenitrile (2f)**



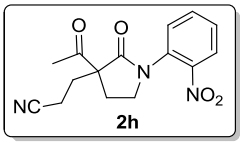

White solid. m.p. 119-121 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.00-2.06 (m, 1H), 2.33 (s, 3H), 2.34-2.45 (m, 4H), 2.79-2.83 (m, 1H), 3.77-3.85 (m, 2H), 7.35-7.37 (d, $J$ = 8.5 Hz, 2H), 7.56-7.58 (t, $J$ = 9.5 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 13.0, 25.9, 26.1, 29.8, 45.8, 62.7, 118.7, 121.0, 129.0, 130.6, 137.1, 170.4, 203.3. HRMS (ESI-TOF): Calc for $C_{15}H_{15}ClN_2O_2$ [M+H]: 291.0900; found: 291.0905.

**3-(3-acetyl-1-(5-chloro-2-methoxyphenyl)-2-oxopyrrolidin-3-yl)propanenitrile (2g)**



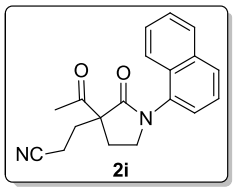

White solid. m.p. 55-57 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.05-2.11 (m, 1H), 2.26-2.38 (m, 5H), 2.43-2.56 (m, 2H), 2.70-2.75 (m, 1H), 3.66-3.74 (m, 2H), 3.82 (s, 3H), 6.90-6.92 (d, $J$ = 8.5 Hz, 1H), 7.22-7.22 (d, $J$ = 2.5 Hz, 2H), 7.27-7.30 (m, 1H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 12.8, 26.1, 27.4, 29.4, 46.9, 55.9, 60.8, 113.0, 119.1, 125.4, 127.0, 128.4, 129.1, 153.3, 171.6, 203.9. HRMS (ESI-TOF): Calc for $C_{16}H_{17}ClN_2O_3$ [M+H]: 321.1006; found: 321.1010.

**3-(3-acetyl-1-(2-nitrophenyl)-2-oxopyrrolidin-3-yl)propanenitrile (2h)**



Colorless oil. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.15-2.19 (m, 1H), 2.31-2.45 (m, 7H), 2.86-2.91 (m, 1H), 3.82-3.86 (m, 1H), 3.89-3.94 (m, 1H), 7.35-7.36 (m, 1H), 7.47-7.51 (m, 1H), 7.67-7.71 (m, 1H), 8.00-8.02 (m, 1H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 12.8, 26.1, 27.0, 29.2, 30.9, 47.2, 61.4, 118.8, 125.6, 127.0, 128.3, 131.1, 134.0, 145.3, 171.0, 203.0. HRMS (ESI-TOF): Calc for $C_{15}H_{15}N_3O_4$ [M+H]: 302.1141; found: 302.1147.

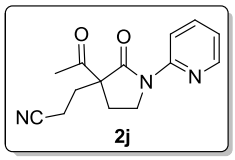
**3-(3-acetyl-1-(naphthalen-1-yl)-2-oxopyrrolidin-3-yl)propanenitrile (2i)**



**2i**

Colorless oil. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.19-2.25 (m, 1H), 2.41-2.60 (m, 7H), 2.87-2.92 (m, 1H), 3.75-3.78 (m, 1H), 3.79-3.91 (m, 1H), 7.33-7.35 (d, $J$ = 7.0 Hz, 1H), 7.49-7.60 (m, 4H), 7.86-7.92 (m, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 13.1, 26.3, 27.4, 29.8, 48.8, 61.7, 118.9, 121.8, 124.7, 125.6, 126.6, 127.1, 128.7, 129.0, 129.3, 134.3, 134.5, 171.5, 204.2. HRMS (ESI-TOF): Calc for $C_{19}H_{18}N_2O_2$ [M+H]: 307.1447; found: 307.1446.

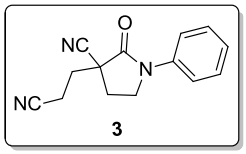
**3-(3-acetyl-2-oxo-1-(pyridin-2-yl)pyrrolidin-3-yl)propanenitrile (2j)**



**2j**

White solid. m.p. 83-85 ℃. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.97-2.02 (m, 1H), 2.32 (s, 3H), 2.33-2.39 (m, 2H), 2.43-2.47 (m, 2H), 2.69-2.74 (m, 1H), 3.99-4.05 (m, 1H), 4.15-4.19 (m, 1H), 7.09-7.12 (m, 1H), 7.72-7.75 (m, 1H), 8.35-8.39 (m, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 12.9, 25.8, 26.1, 29.6, 44.3, 63.3, 114.6, 118.8, 120.2, 137.7, 147.6, 150.9, 171.3, 203.2. HRMS (ESI-TOF): Calc for $C_{14}H_{15}N_3O_2$ [M+H]: 257.1164; found: 257.1171.

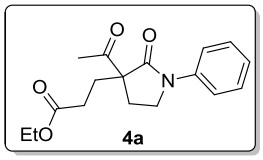
**3-(2-cyanoethyl)-2-oxo-1-phenylpyrrolidine-3-carbonitrile (3)**



**3**

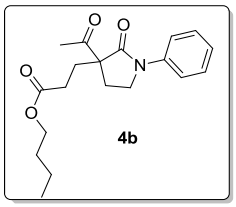
Colorless oil. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.10-2.27 (m, 1H), 2.28-2.32 (m, 1H), 2.37-2.43 (m, 1H), 2.61-2.73 (m, 2H), 2.81-2.88 (m, 1H), 3.84-3.89 (m, 1H), 3.95-4.00 (m, 1H), 7.22-7.25 (t, $J$ = 7.0 Hz, 1H), 7.38-7.42 (t, $J$ = 7.0 Hz, 2H), 7.55-7.57 (d, $J$ = 7.0 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ =13.3, 29.8, 30.6, 44.8, 45.3, 117.5, 118.1, 120.2, 125.9, 129.0, 137.7, 166.0. HRMS (ESI-TOF): Calc for $C_{14}H_{13}N_3O$ [M+H]: 239.1059; found: 239.1055.

**ethyl 3-(3-acetyl-2-oxo-1-phenylpyrrolidin-3-yl)propanoate (4a)**



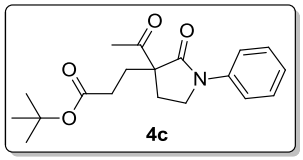

White solid. m.p. 56-58 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.24-1.27 (t, $J$ = 7.5Hz, 3H), 1.86-1.92 (m, 1H), 2.22-2.33 (m, 3H), 2.35 (s, 3H), 2.45-2.50 (m, 1H), 2.79-2.83 (m, 1H), 3.71-3.75 (m, 1H), 3.79-3.84 (m, 1H), 4.12-4.16 (m, 2H), 7.16-7.19 (t, $J$ = 7.5 Hz, 1H), 7.36-7.40 (t, $J$ = 8.5 Hz, 2H), 7.59-7.61 (d, $J$ = 8.0 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.1, 25.6, 26.1, 29.7, 45.9, 60.7, 63.4, 119.9, 125.1, 128.9, 138.9, 171.0, 172.4, 204.6. HRMS (ESI-TOF): Calc for $C_{17}H_{21}NO_4$ [M+H]: 303.1471; found: 303.1477.

**butyl 3-(3-acetyl-2-oxo-1-phenylpyrrolidin-3-yl)propanoate (4b)**



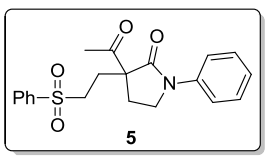

White solid. m.p. 36-38 ℃. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 0.92-0.94 (t, $J$ = 7.5Hz, 3H), 1.33-1.41 (m, 2H), 1.57-1.63 (m, 2H), 1.86-1.92 (m, 1H), 2.21-2.36 (m, 6H), 2.43-2.48 (m, 1H), 2.76-2.81 (m, 1H), 3.70-3.83 (m, 2H), 4.06-4.09 (t, $J$ = 6.5Hz, 2H), 7.15-7.18 (t, $J$ = 7.5 Hz, 1H), 7.35-7.38 (t, $J$ = 8.0 Hz, 2H), 7.60-7.61 (d, $J$ = 8.0 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 13.5, 18.8, 25.3, 25.8, 29.4, 30.3, 45.6, 63.1, 64.4, 119.6, 124.8, 128.6, 138.8, 170.8, 172.2, 204.3. HRMS (ESI-TOF): Calc for $C_{19}H_{25}NO_4$ [M+H]: 332.1862; found: 332.1867.

***tert*-butyl 3-(3-acetyl-2-oxo-1-phenylpyrrolidin-3-yl)propanoate (4c)**




White solid. m.p. 74-76 $^o$C. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.44 (s, 9H), 1.86-1.92 (m, 1H), 2.16-2.62 (m, 3H), 2.34 (s, 3H), 2.39-2.46 (m, 1H), 2.77-2.81 (m, 1H), 2.70-3.83 (m, 2H), 7.15-7.18 (t, $J$ = 7.5 Hz, 1H), 7.35-7.39 (t, $J$ = 7.5 Hz, 2H), 7.59-7.61 (d, $J$ = 8.5 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 25.4, 26.0, 27.9, 29.7, 30.7, 45.8, 63.3, 80.7, 119.8, 124.9, 128.8, 138.9, 171.0, 171.5, 204.6. HRMS (ESI-TOF): Calc for $C_{19}H_{25}NO_4$ [M+H]: 332.1862; found: 332.1867.

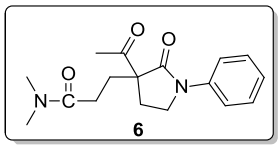
**3-acetyl-1-phenyl-3-(2-(phenylsulfonyl)ethyl)pyrrolidin-2-one (5)**




White solid. m.p. 121-123 $^o$C. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.86-1.88 (m, 1H), 2.19 (s, 3H), 2.26-2.30 (t, $J$ = 8.0 Hz, 1H), 2.36-2.40 (m, 1H), 2.63-2.66 (m, 1H), 3.10-3.13 (m, 2H), 3.74-3.80 (m, 2H), 7.14-7.17 (t, $J$ = 7.0 Hz, 1H), 7.33-7.36 (t, $J$ = 8.0Hz, 2H), 7.53-7.57 (t, $J$ = 8.5 Hz, 4H),

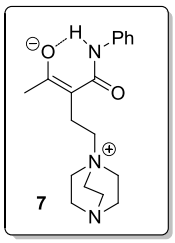
7.63-7.66 (t, *J* = 8.0 Hz, 1H), 7.88-7.90 (d, *J* = 8.5 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 25.8, 26.1, 26.9, 45.6, 51.5, 61.9, 119.8, 125.2, 127.8, 128.8, 129.3, 133.8, 138.3, 138.4, 170.3, 203.7. HRMS (ESI-TOF): Calc for $C_{20}H_{21}NO_4S$ [M+H]: 372.1270; found: 372.1267.

**3-(3-acetyl-2-oxo-1-phenylpyrrolidin-3-yl)-*N*,*N*-dimethylpropanamide (6)**



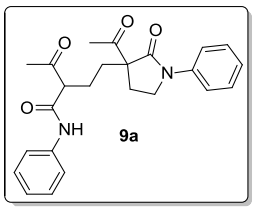

White solid. m.p. 61-63 °C. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.93-1.98 (m, 1H), 2.22-2.45 (m, 7H), 2.73-2.78 (m, 1H), 2.94 (s, 3H), 3.00 (s, 3H), 3.75-3.82 (m, 2H), 7.16-7.19 (d, *J* = 7.0 Hz, 1H), 7.36-7.39 (t, *J* = 7.5 Hz, 2H), 7.60-7.61 (t, *J* = 7.5 Hz, 2H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 25.9, 26.2, 28.4, 29.5, 35.5, 37.2, 45.9, 63.4, 119.9, 125.0, 128.9, 139.0, 171.4, 171.5, 205.2. HRMS (ESI-TOF): Calc for $C_{17}H_{22}N_2O_3$ [M+H]: 303.1709; found: 303.1712.

**1,3-zwitterion (7)**



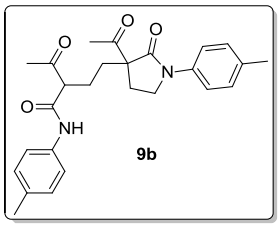

White solid. m.p. 173-175 ℃. $^1$H NMR (500 MHz, $D_2O$): $\delta$ = 1.75-1.76 (d, *J* = 7.5 Hz, 3H), 2.32-2.35 (t, *J* = 8.0 Hz, 2H), 2.72-2.75 (t, *J* = 8.5 Hz, 2H), 2.79-2.80 (d, *J* = 6.5 Hz, 6H), 3.01-3.02 (d, *J* = 6.5 Hz, 6H), 6.83-6.86 (t, *J* = 7.0 Hz, 1H), 7.11-7.14 (t, *J* = 8.0 Hz, 2H), 7.25-7.26 (d, *J* = 8.0 Hz, 2H). $^{13}$C NMR (125 MHz, $D_2O$): $\delta$ = 20.4, 24.1, 44.2, 51.8, 63.7, 93.2, 119.9, 123.1, 129.5, 139.6, 170.0, 181.4. HRMS (ESI-TOF): Calc for $C_{18}H_{25}N_3O_2$ [M+H]: 316.2025; found: 316.2021.

**2-acetyl-4-(3-acetyl-2-oxo-1-phenylpyrrolidin-3-yl)-*N*-phenylbutanamide (9a)**



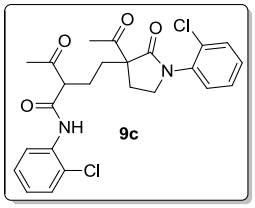

Colorless oil. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.88-2.00 (m, 4H), 2.14-2.19 (m, 1H), 2.29 (s, 3H), 2.32-2.33 (d, *J* = 4.0 Hz, 3H), 2.79-2.82 (m, 1H), 3.46-3.54 (m, 1H), 3.73-3.85 (m, 2H), 7.11-7.20 (m, 2H), 7.30-7.39 (m, 4H), 7.52-7.58 (m, 4H), 8.30-8.35 (d, *J* = 25.0 Hz, 1H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 24.5, 24.6, 25.4, 25.6, 26.0, 28.8, 29.2, 32.0, 32.3, 46.2, 46.3, 61.5, 61.6, 63.9, 63.9, 120.0, 120.0, 120.2, 120.0, 124.7, 125.3, 125.3, 128.9, 137.4, 137.4, 138.7, 166.3, 166.3, 171.3, 171.4, 204.6, 204.6, 205.5, 205.6. HRMS (ESI-TOF): Calc for $C_{24}H_{26}N_2O_4$ [M+H]: 407.1971; found: 407.1976.

**2-acetyl-4-(3-acetyl-2-oxo-1-(*p*-tolyl)pyrrolidin-3-yl)-*N*-(*p*-tolyl)butanamide (9b)**



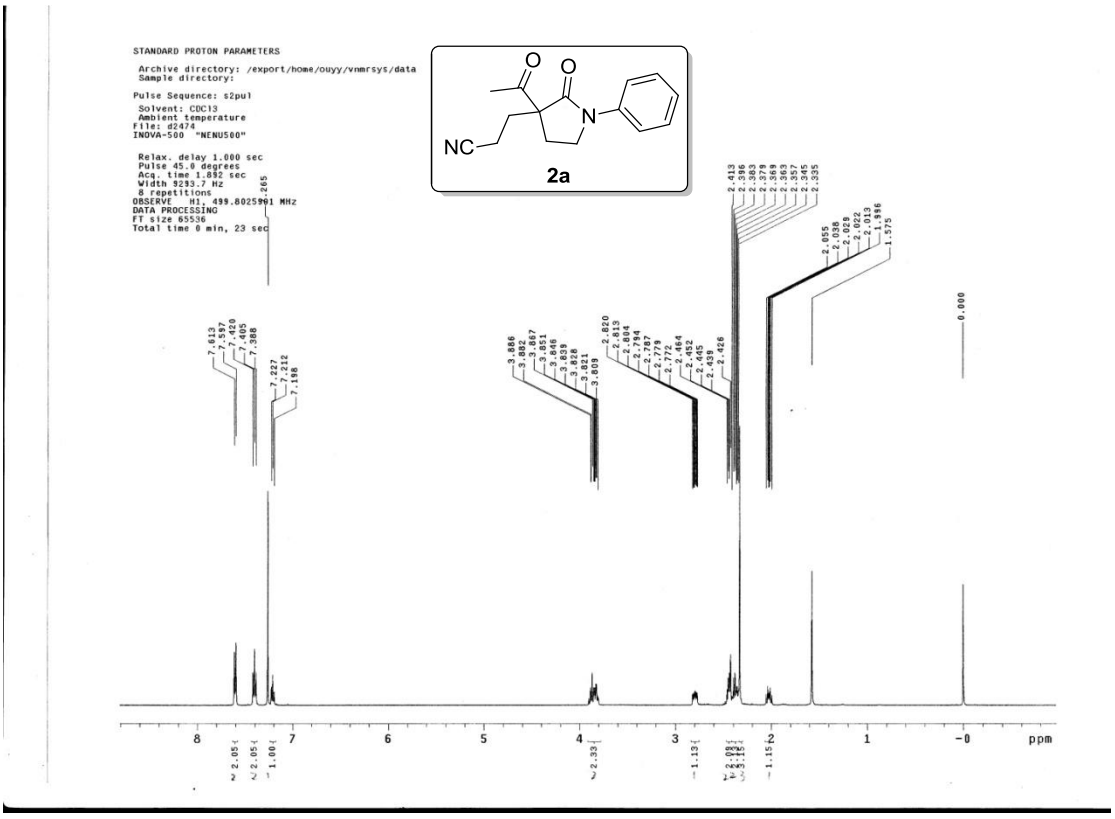

Colorless oil. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.85-2.00 (m, 4H), 2.13-2.17 (m, 1H), 2.25-2.38(m, 12H), 2.76-2.83 (m, 1H), 3.43-3.51 (m, 1H), 3.68-3.83 (m, 2H), 7.07-7.17 (m, 4H), 7.38-7.44 (m, 4H), 8.21-8.26 (d, $J$ = 27.5 Hz, 1H). $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.8, 24.5, 24.7, 25.4, 25.7, 26.0, 26.0, 28.8, 29.2, 32.0, 32.3, 46.3, 46.4, 61.5, 61.6, 63.8, 63.8, 120.0, 120.0, 120.3, 120.3, 129.4, 129.4, 129.4, 134.3, 134.3, 134.8, 134.9, 135.1, 135.2, 136.2, 166.1, 166.2, 171.1, 171.2, 204.7, 204.8, 205.6, 205.7. HRMS (ESI-TOF): Calc for $C_{26}H_{30}N_2O_4$ [M+H]: 435.2284; found: 435.2288.

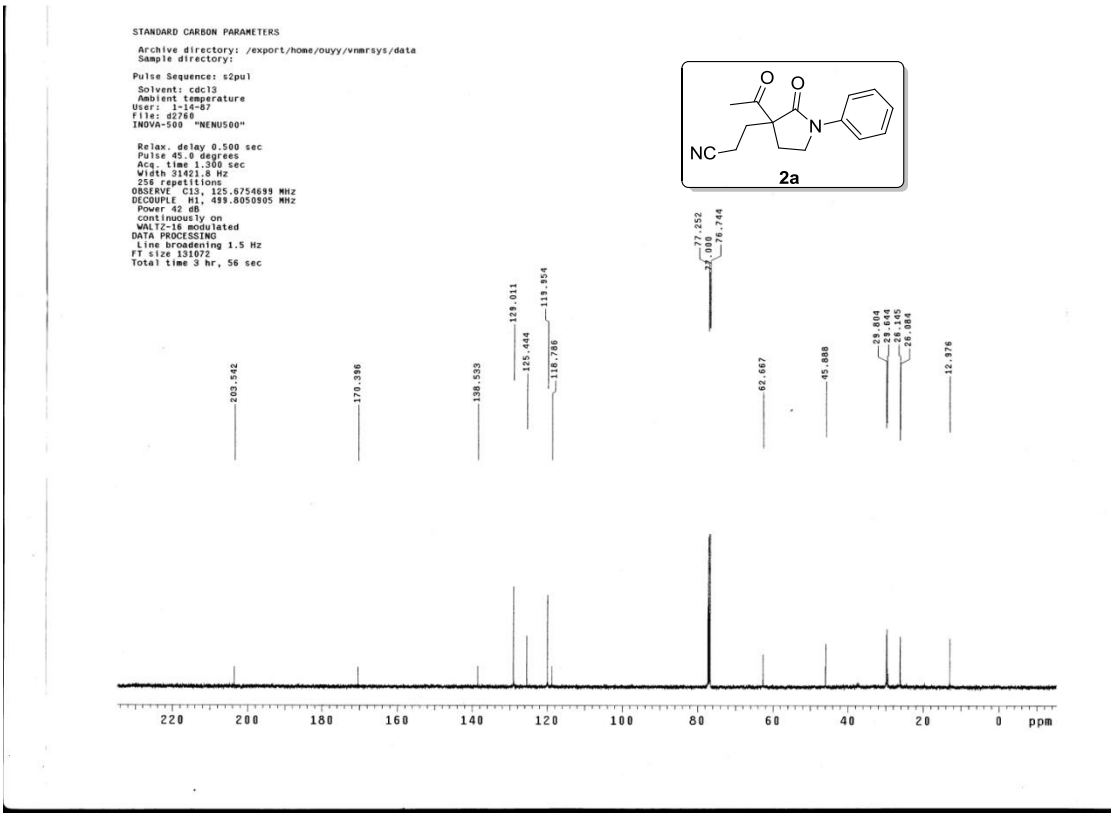
**2-acetyl-4-(3-acetyl-1-(2-chlorophenyl)-2-oxopyrrolidin-3-yl)-*N*-(2-chlorophenyl)butanamide (9c)**

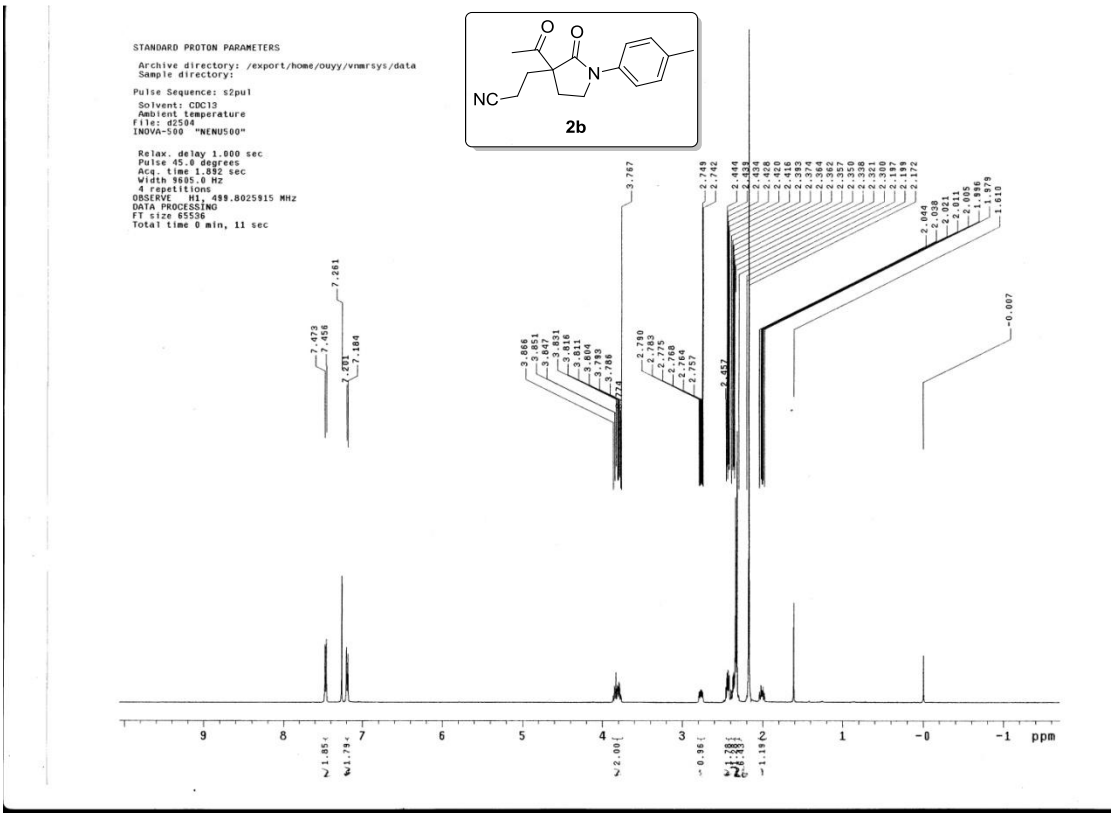


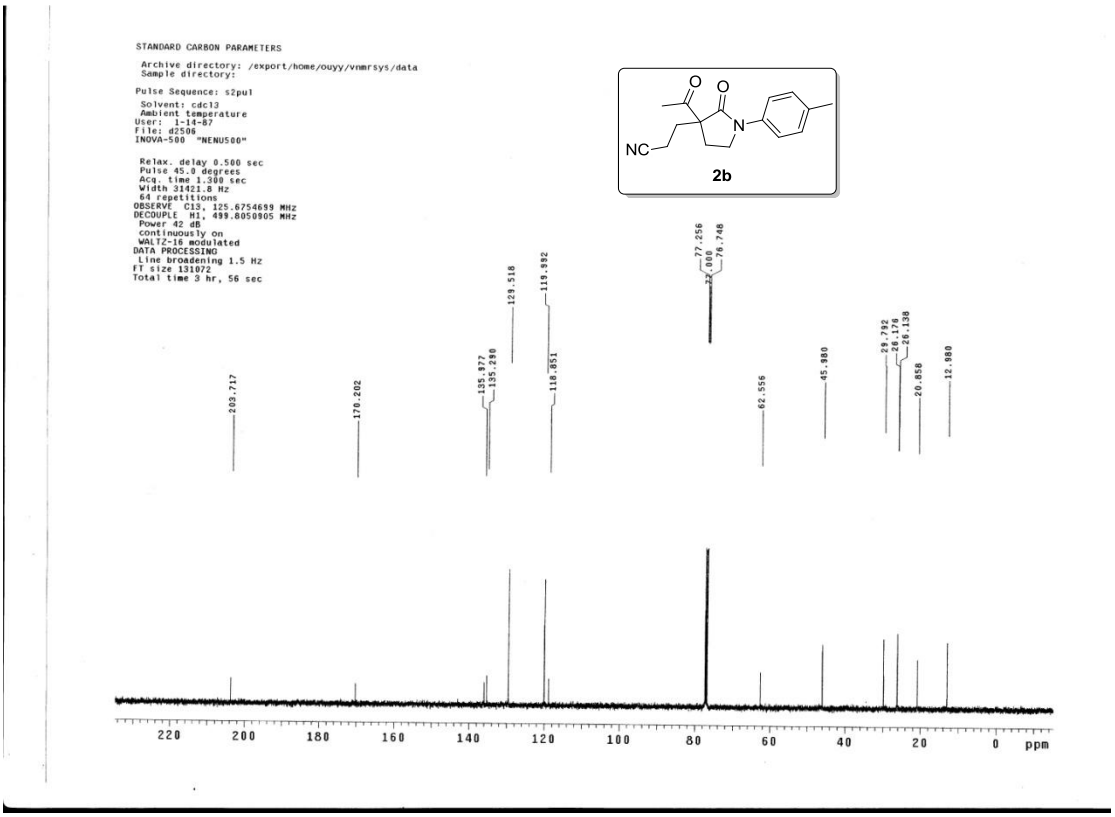

Colorless oil. $^{1}$H NMR (500 MHz, $CDCl_3$)： $\delta$ = 1.94-2.18 (m, 5H), 2.33-2.40 (m, 6H), 2.85-2.88 (m, 1H), 3.56-3.74 (m, 3H), 7.07-7.10 (t, $J$ = 7.0 Hz, 1H), 7.22-7.47 (m, 6H), 8.23-8.25 (m, 1H), 8.54-8.63 (d, $J$ = 41.5 Hz, 1H). $^{13}$C NMR (125 MHz, $CDCl_3$)： $\delta$ = 25.2, 25.4, 26.0, 26.0, 26.5, 26.8, 29.3, 29.4, 29.8, 31.8, 31.9, 47.2, 47.3, 61.2, 61.6, 62.3, 62.4, 122.3, 122.3, 123.8, 123.9, 125.4, 127.5, 127.5, 127.9, 129.1, 129.1, 129.5, 129.5, 130.4, 132.0, 132.0, 134.0, 135.5, 135.6, 166.2, 166.2, 171.8, 171.8, 204.5, 204.6, 205.7, 206.0. HRMS (ESI-TOF): Calc for $C_{24}H_{24}Cl_2N_2O_4$ [M+H]: 475.1191; found: 475.1187.

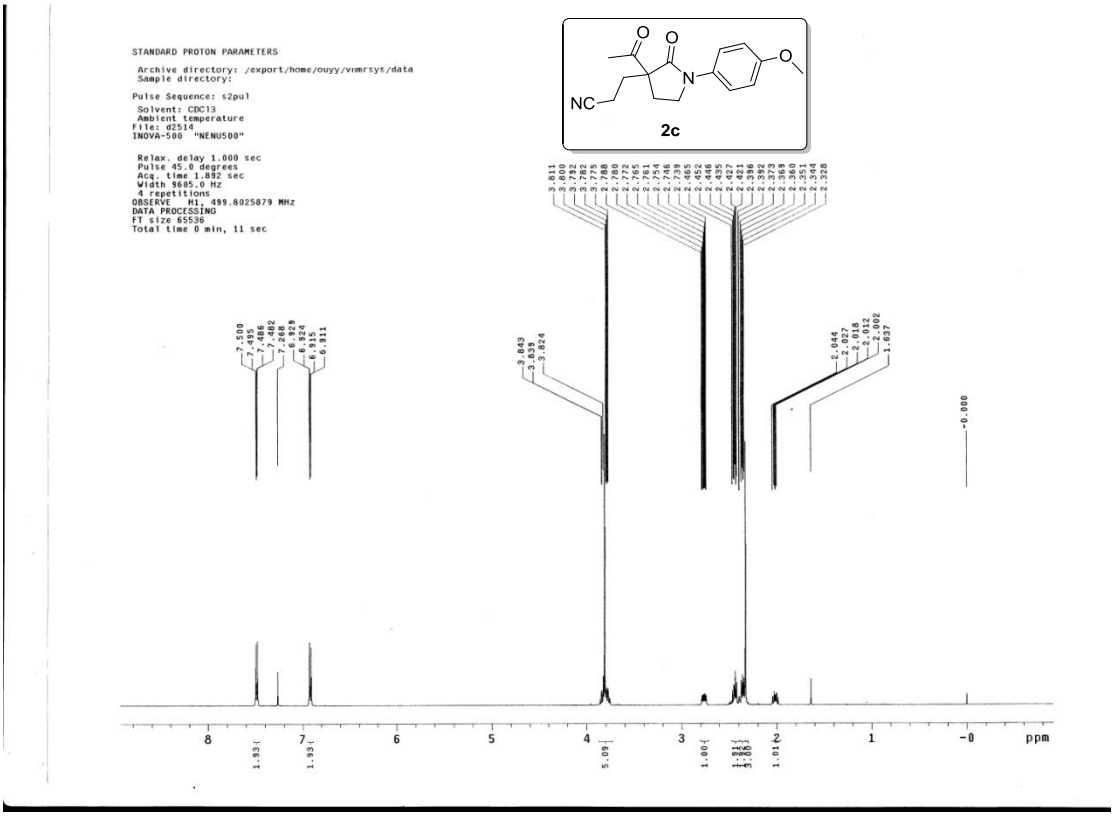
**IV. $^{1}$H and $^{13}$C NMR spectra of compounds 2-7.**



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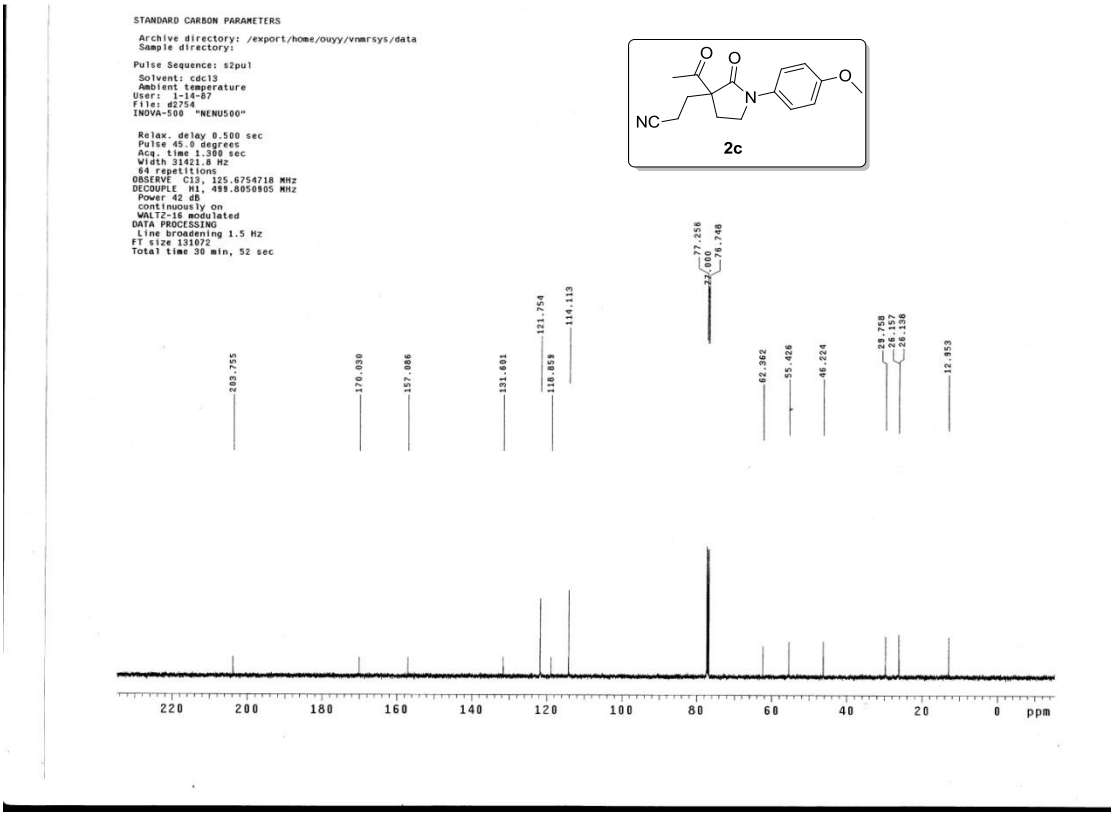
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2514
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.882 sec
Width 8605.0 Hz
4 repetitions
OBSERVE H1, 499.8025879 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
2c
ppm


STANDARD CARBON PARAMETERS
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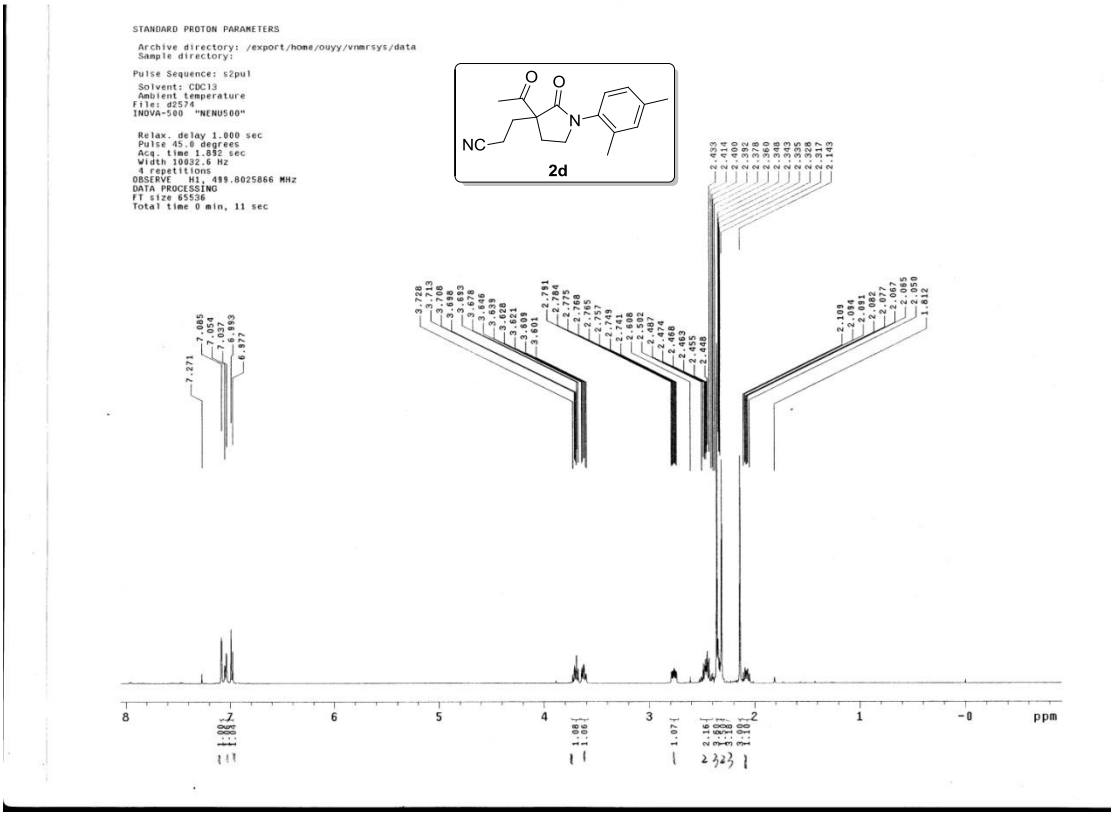
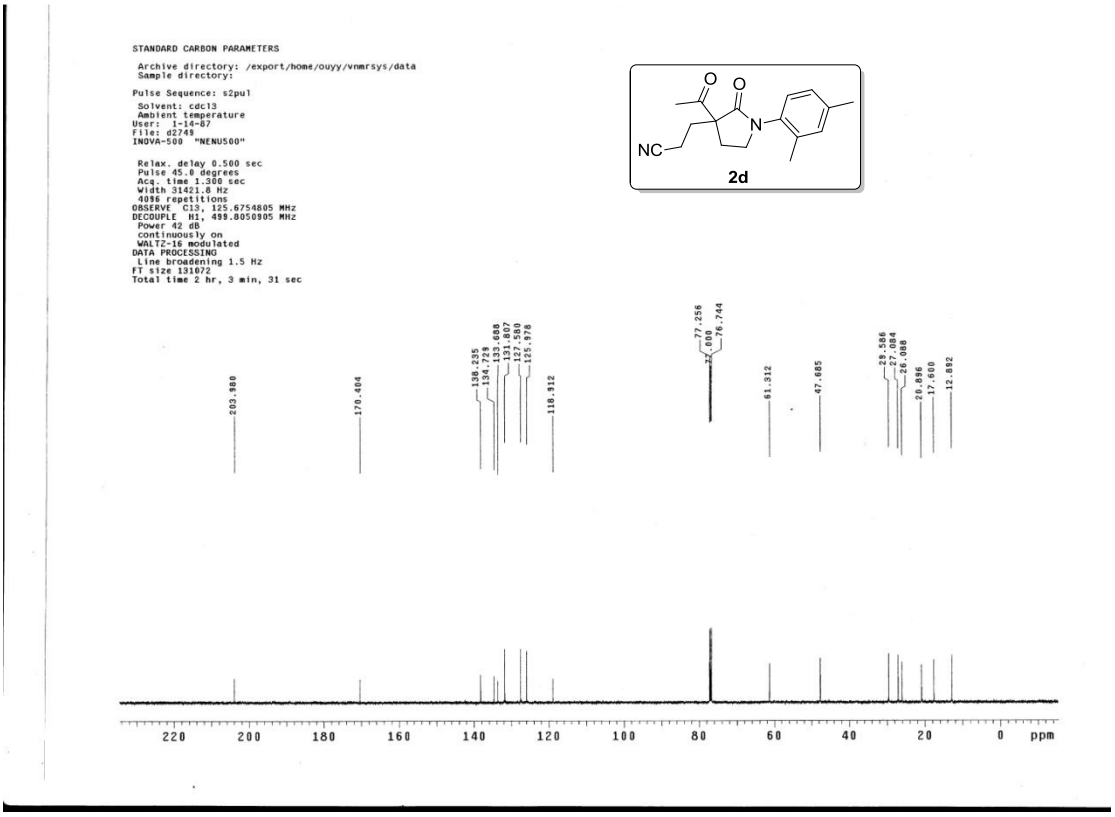
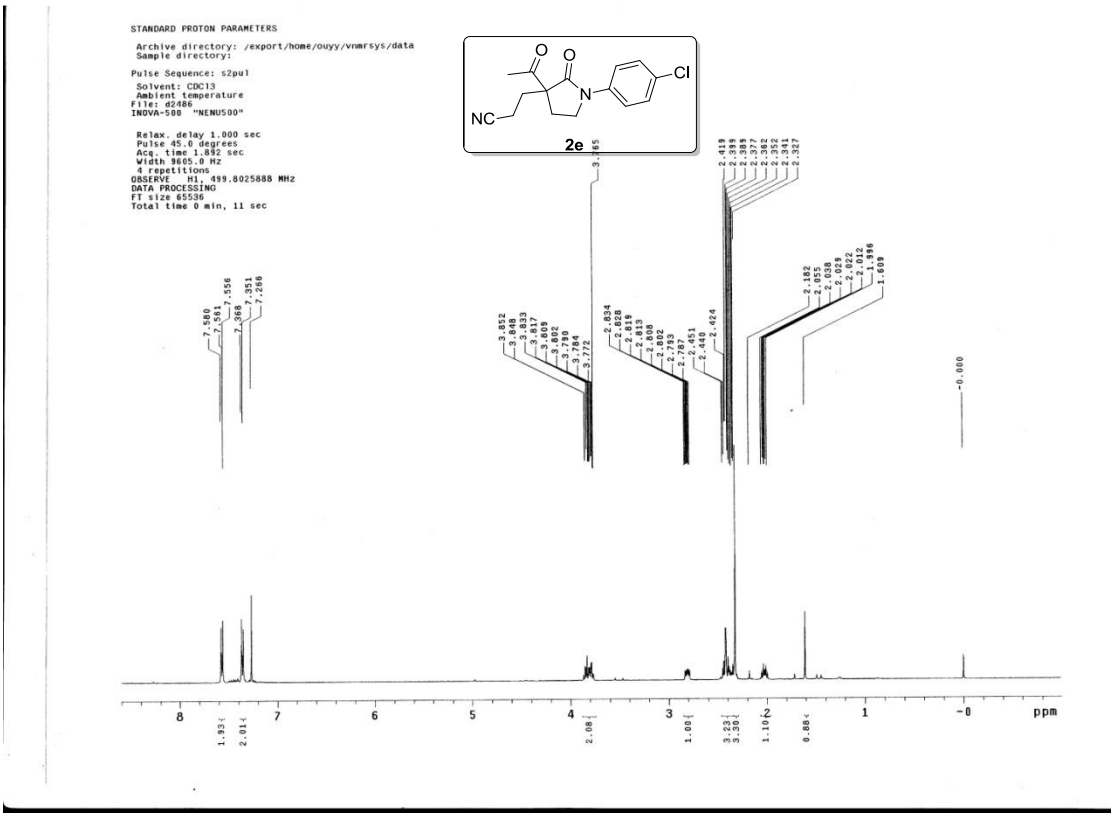
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2754
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
64 repetitions
OBSERVE C13, 125.6754718 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 30 min, 52 sec
2c
ppm

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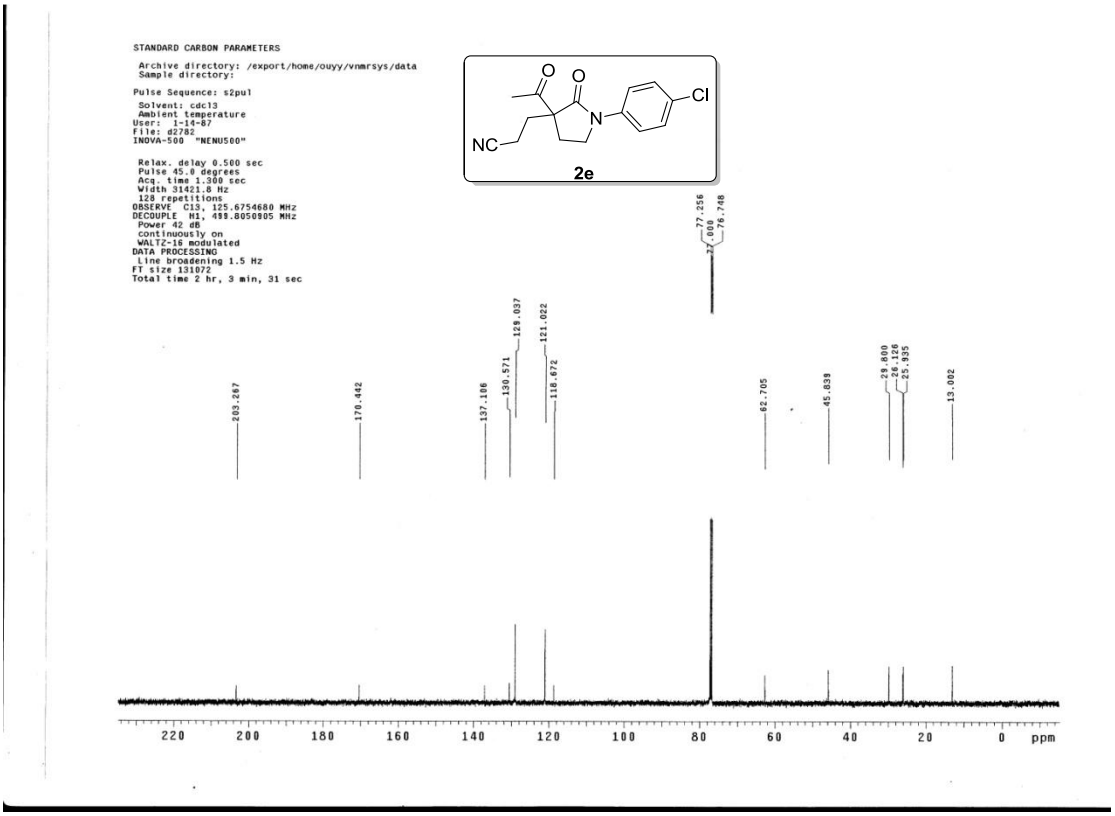
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2486
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.882 sec
Width 9605.0 Hz
4 repetitions
OBSERVE H1, 499.8025888 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
2e
ppm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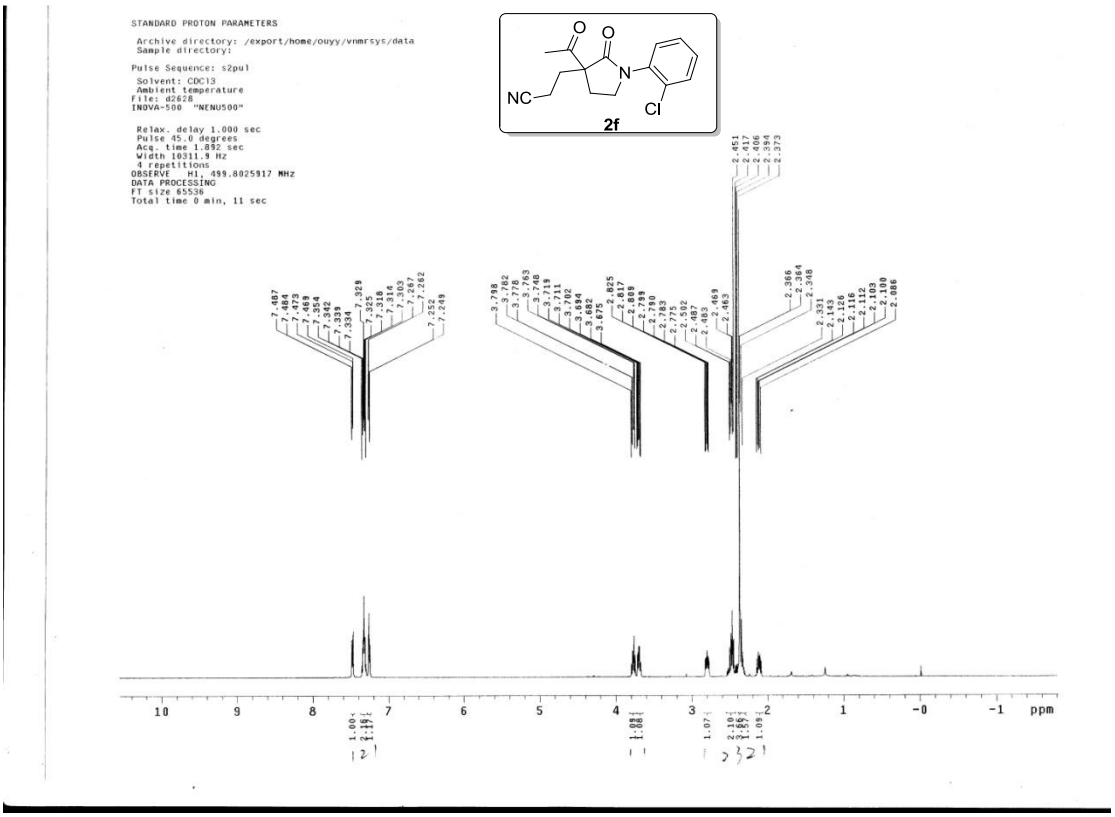
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2782
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
128 repetitions
OBSERVE C13, 125.6754680 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 2 hr, 3 min, 31 sec
2e
ppm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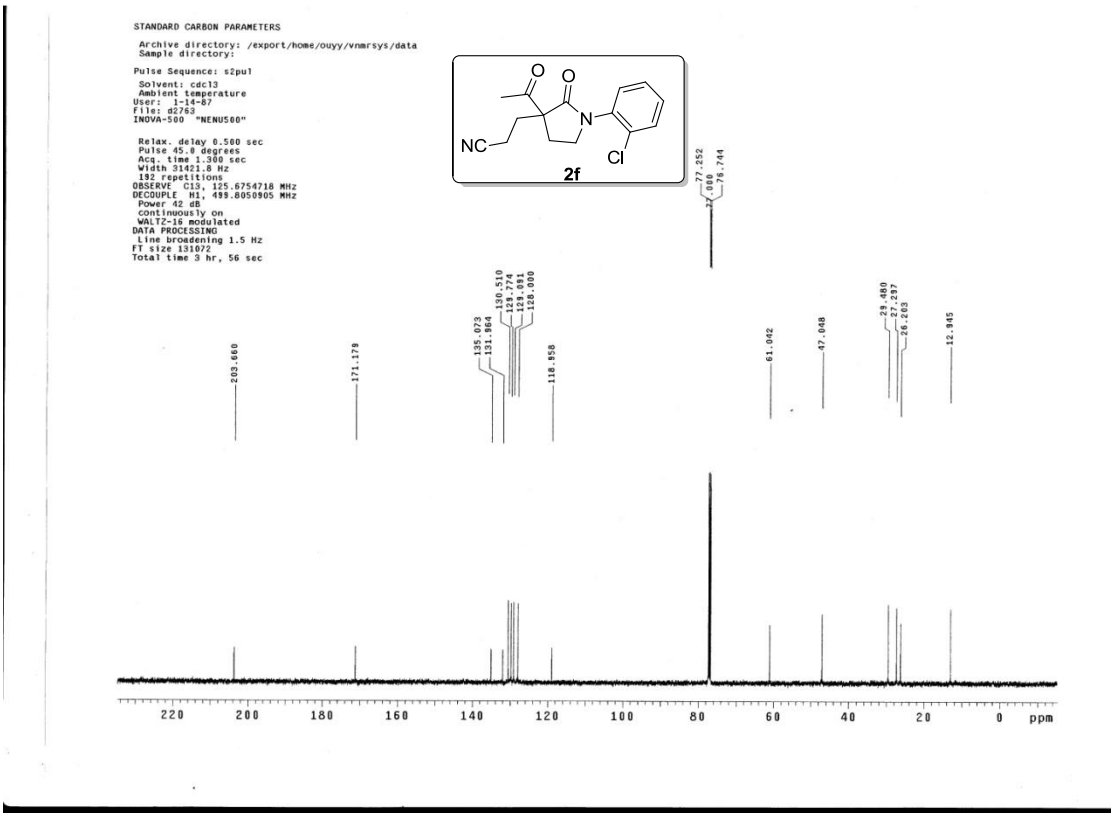
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2628
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 10311.9 Hz
4 repetitions
OBSERVE H1, 499.8025917 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
2f
ppm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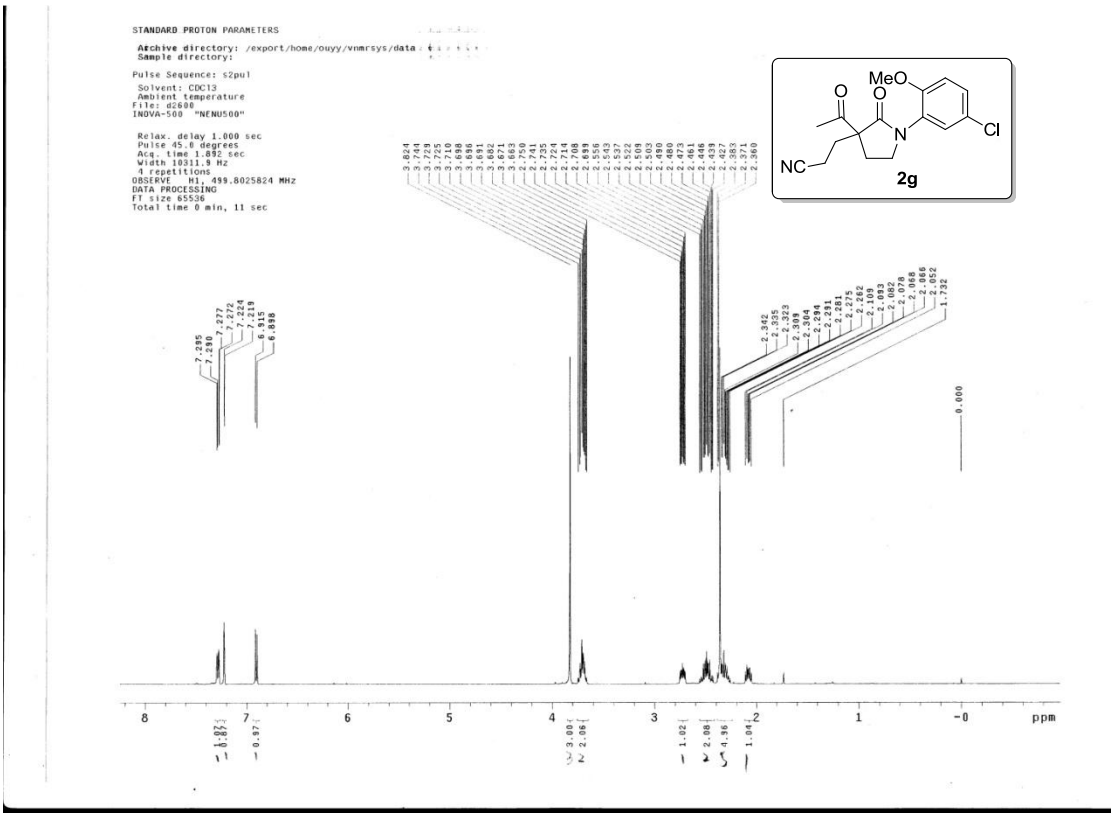
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2763
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
192 repetitions
OBSERVE C13, 125.6754718 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
2f
ppm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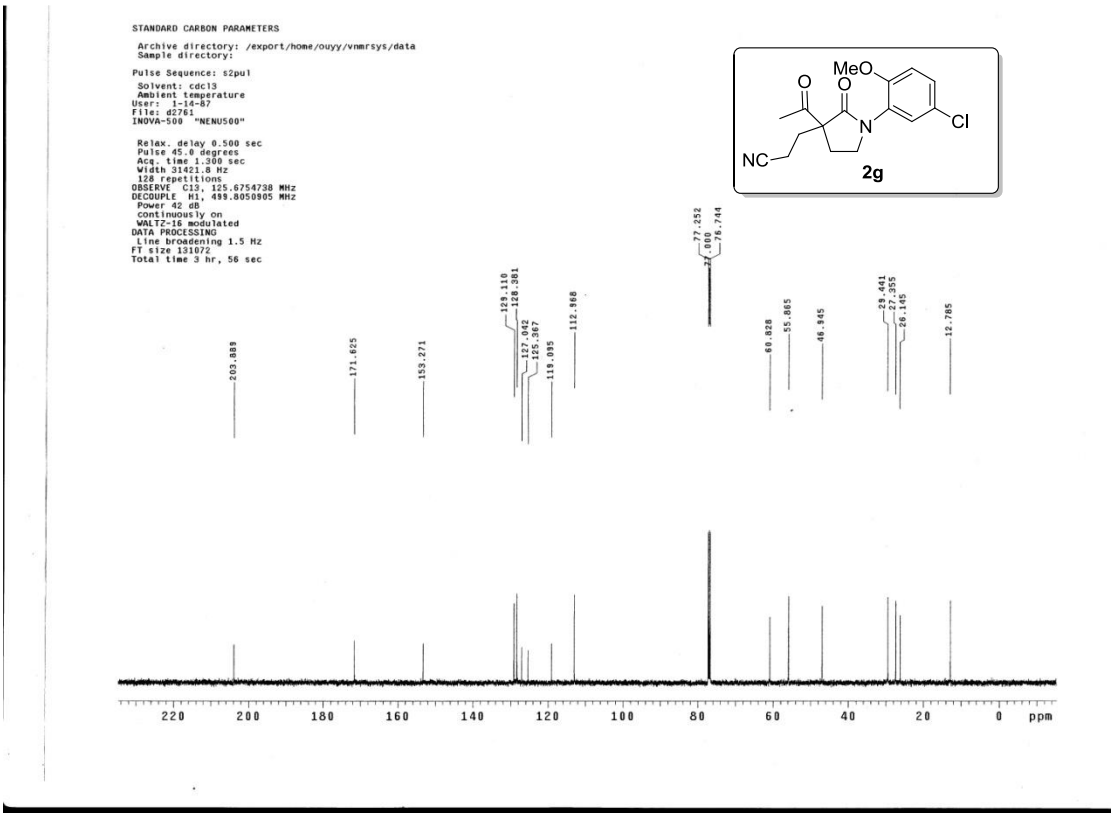
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2600
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 10311.9 Hz
4 repetitions
OBSERVE H1, 499.8025824 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
MeO
O
O
N
Cl
NC
2g
ppm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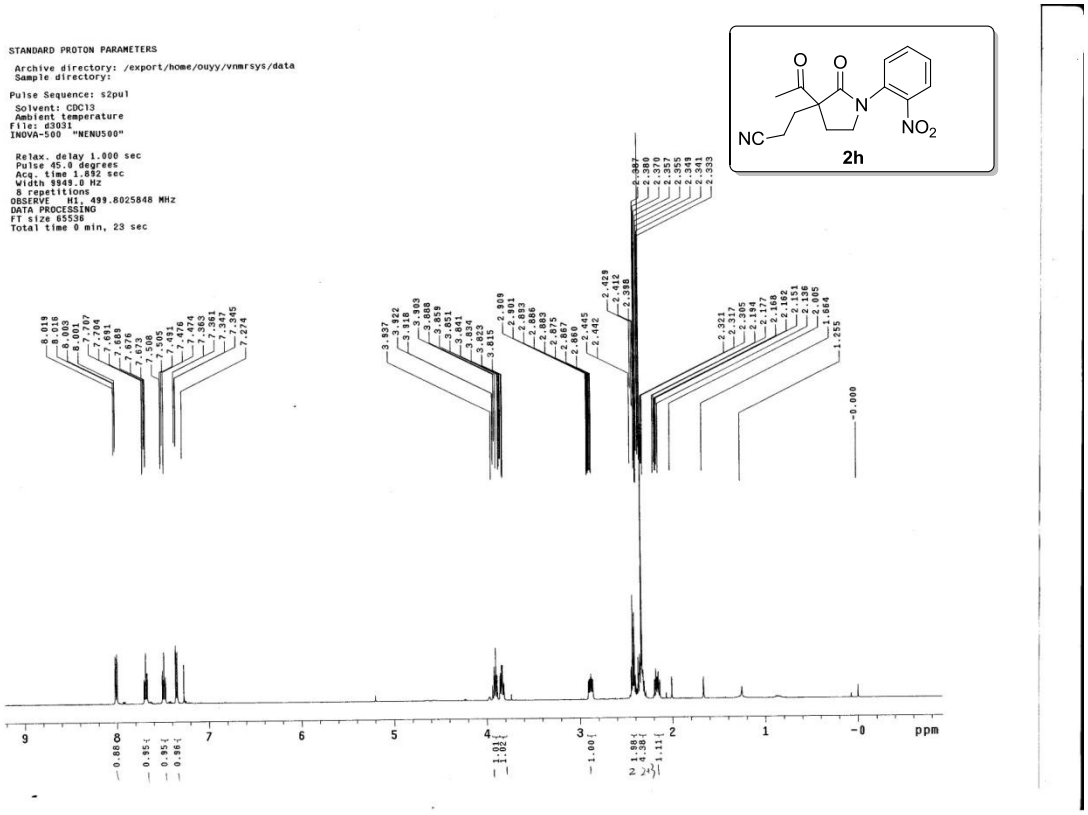
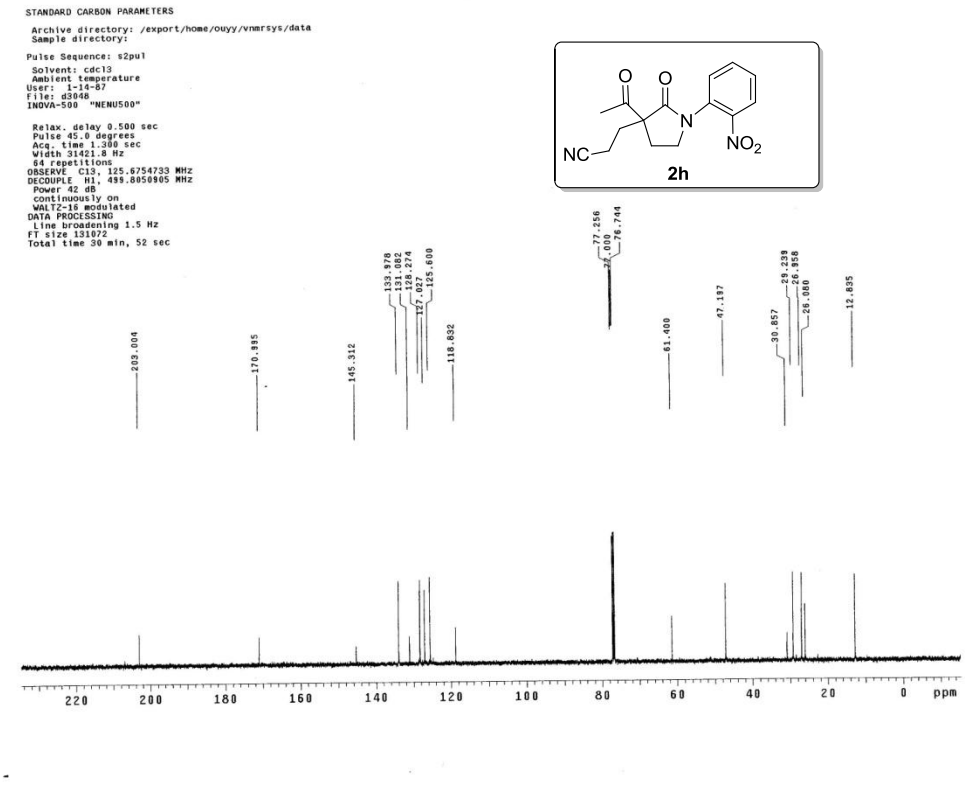
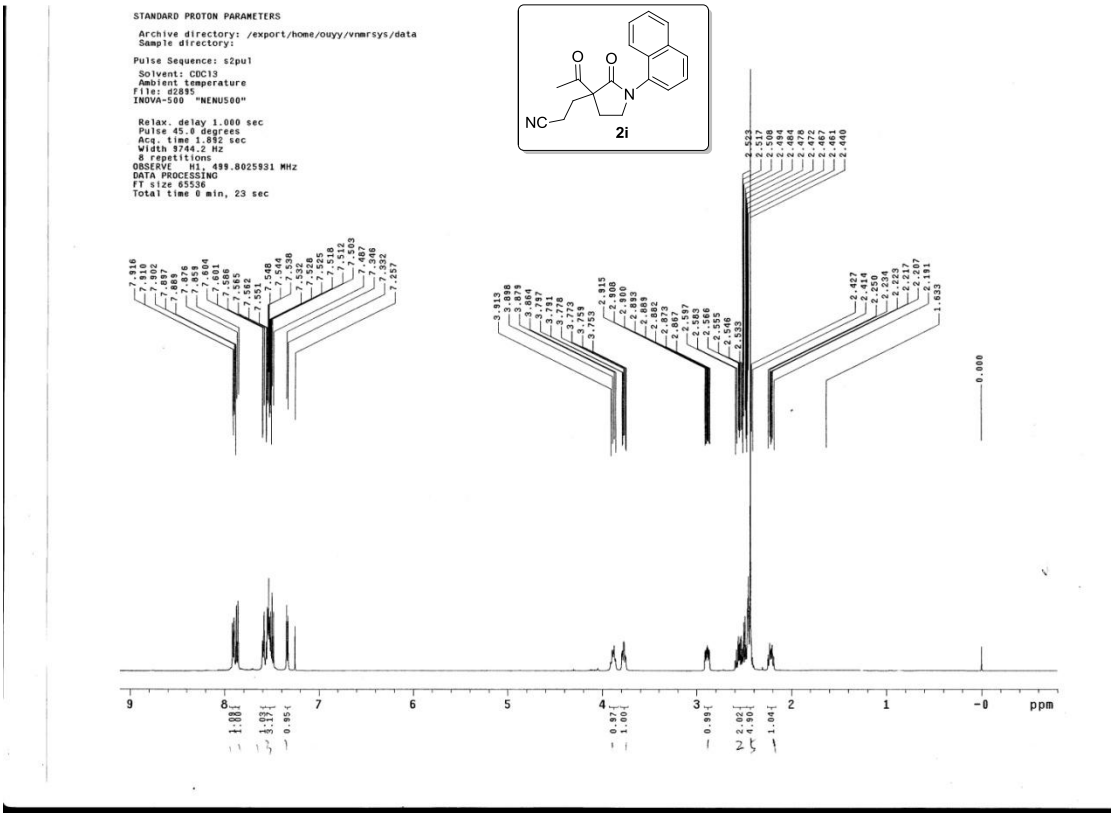
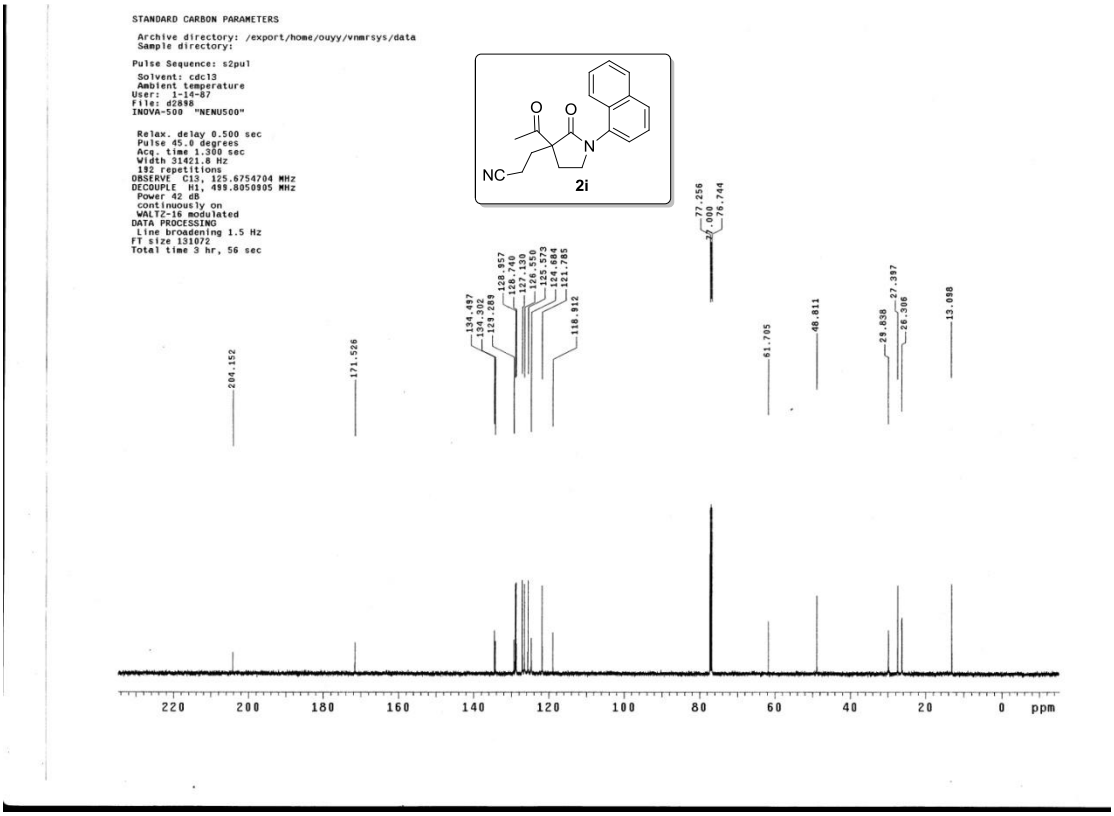
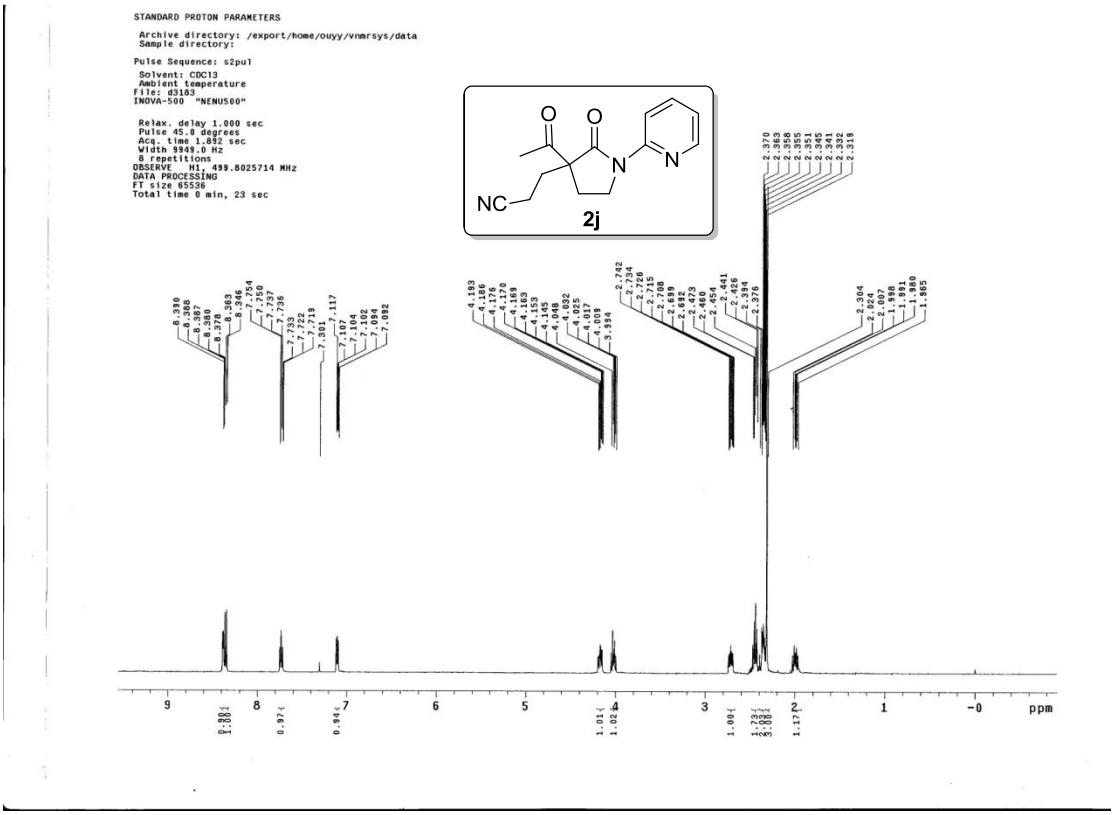
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2761
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
128 repetitions
OBSERVE C13, 125.6754738 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
MeO
O
O
N
Cl
NC
2g
ppm


STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d3031
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 9949.0 HZ
8 repetitions
OBSERVE H1, 499.8025848 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 23 sec
2h
ppm


STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d3048
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
64 repetitions
OBSERVE C13, 125.6754733 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 30 min, 52 sec
2h
ppm


STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2895
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.882 sec
Width 9744.2 Hz
8 repetitions
OBSERVE H1, 499.8025931 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 23 sec
NC
2i
ppm


STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2898
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
192 repetitions
OBSERVE C13, 125.6754704 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
NC
2i
ppm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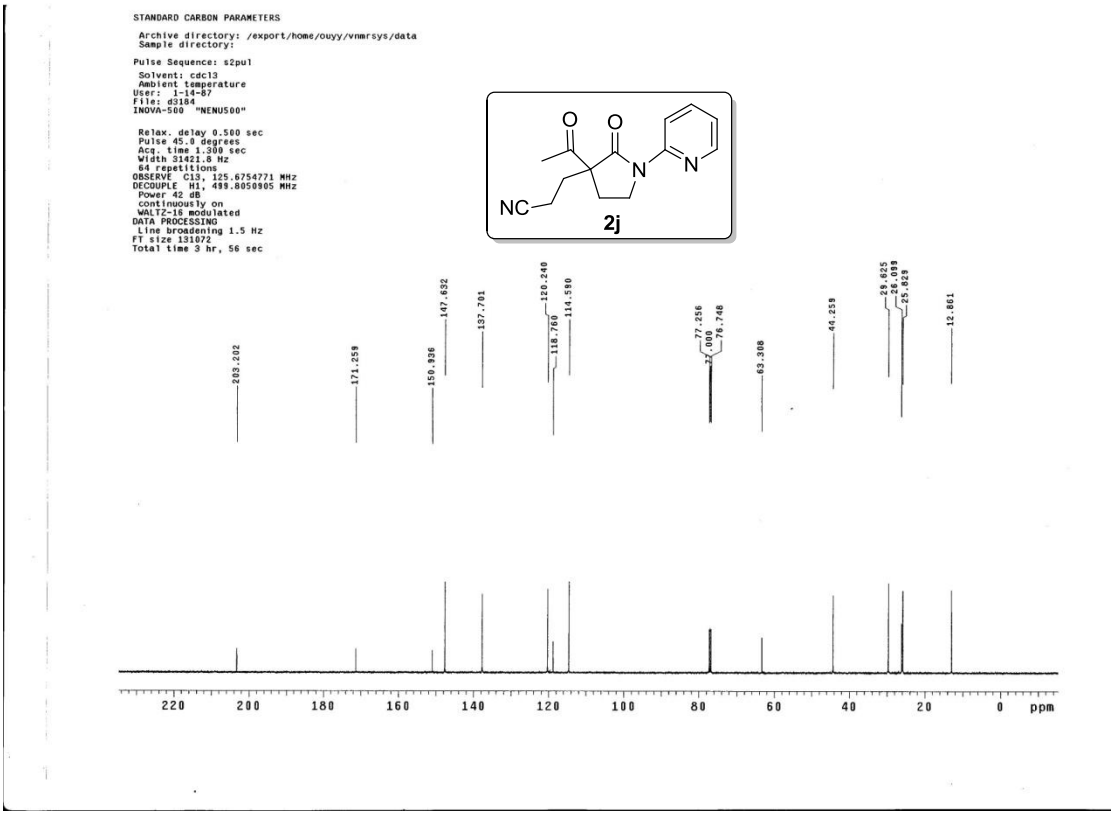
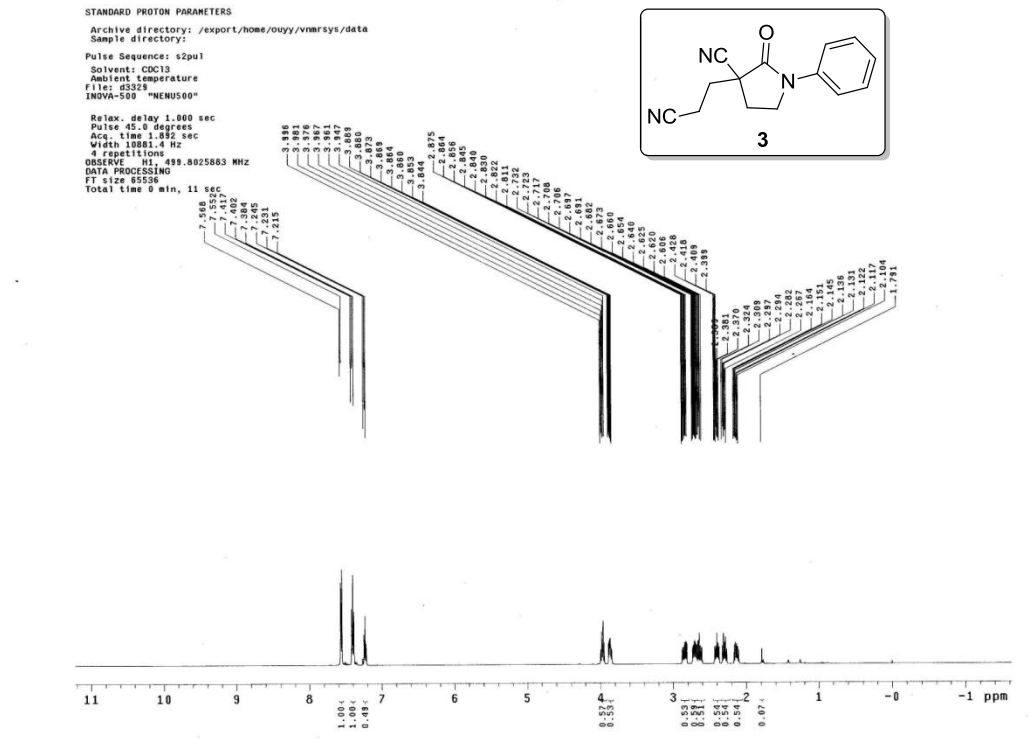
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d3183
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 9949.0 Hz
8 repetitions
OBSERVE H1, 499.8025714 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 23 sec
NC
2j
ppm


STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d3184
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
64 repetitions
OBSERVE C13, 125.6754771 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
NC
2j
ppm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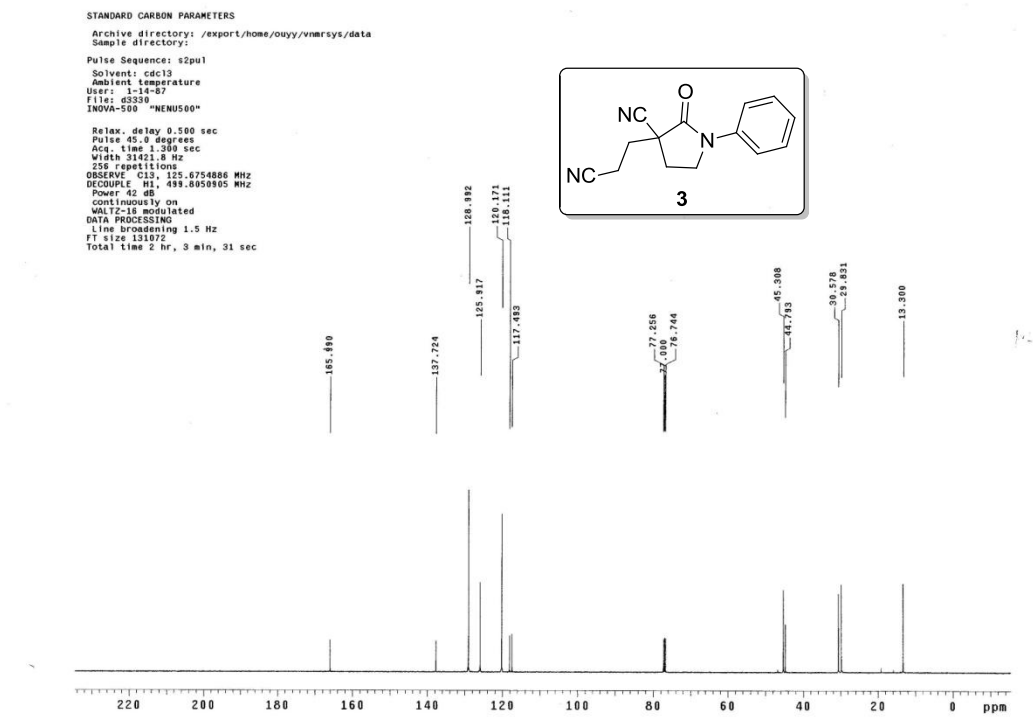
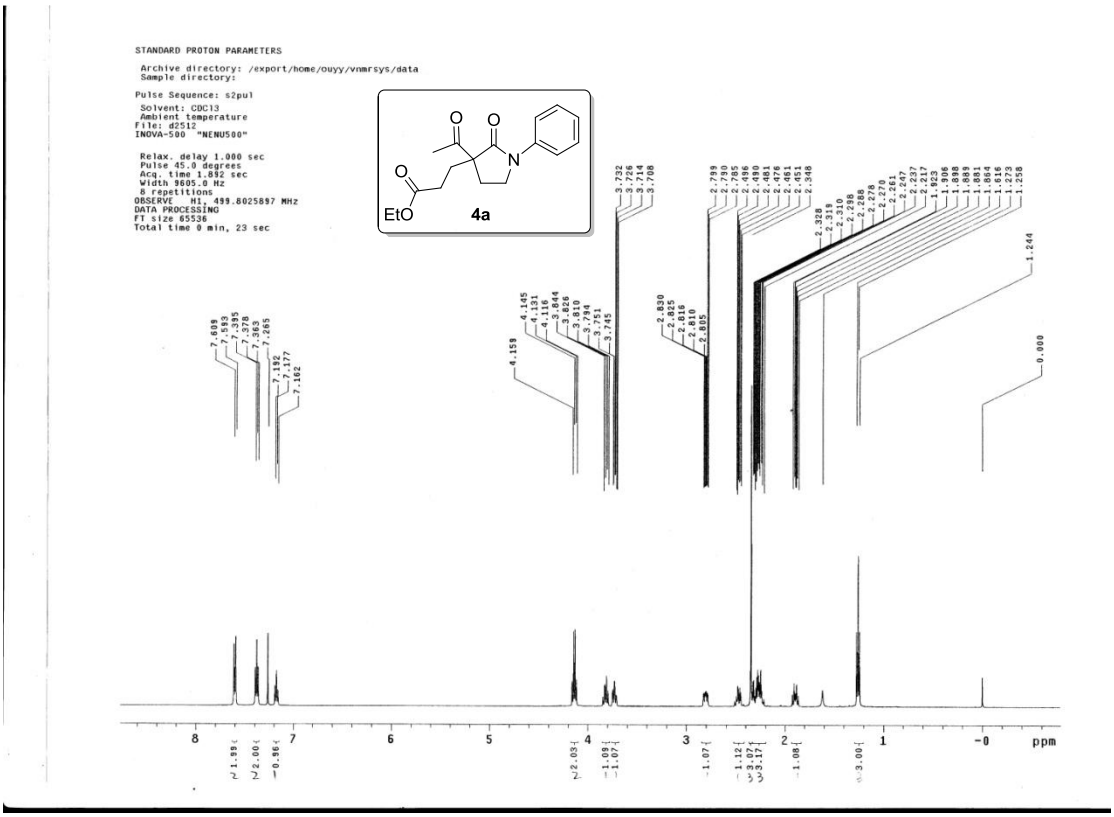
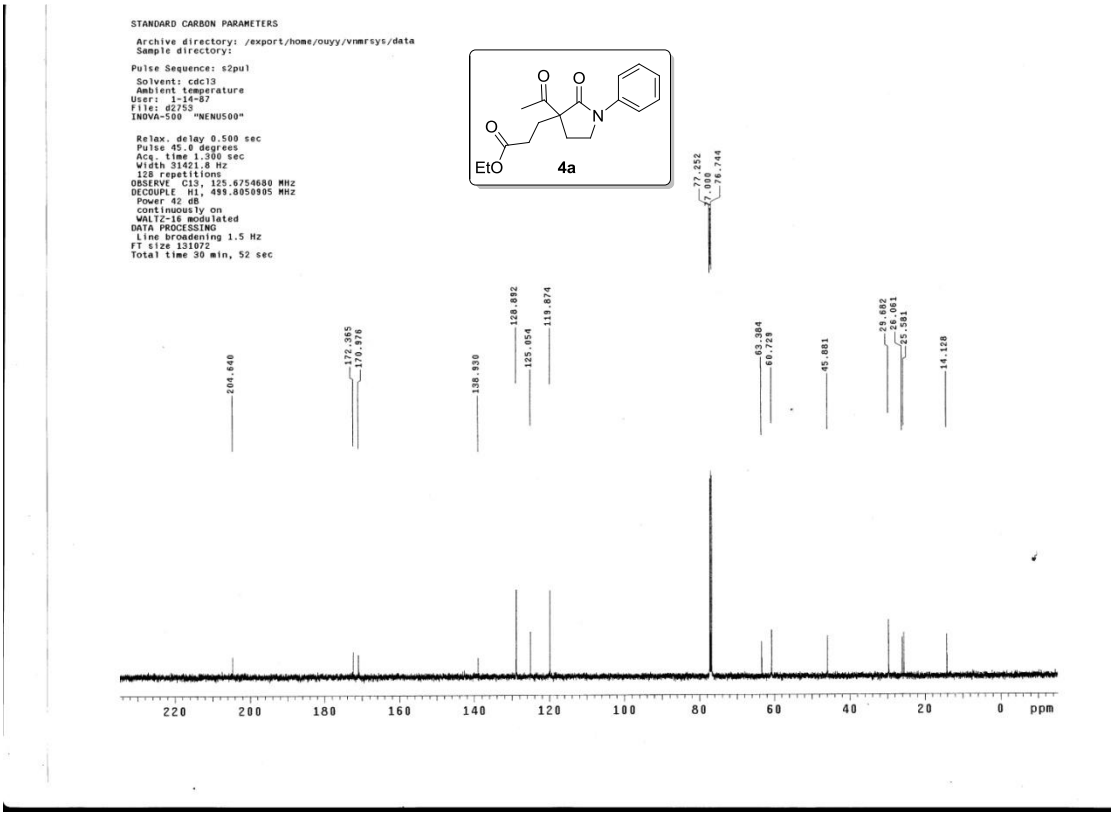
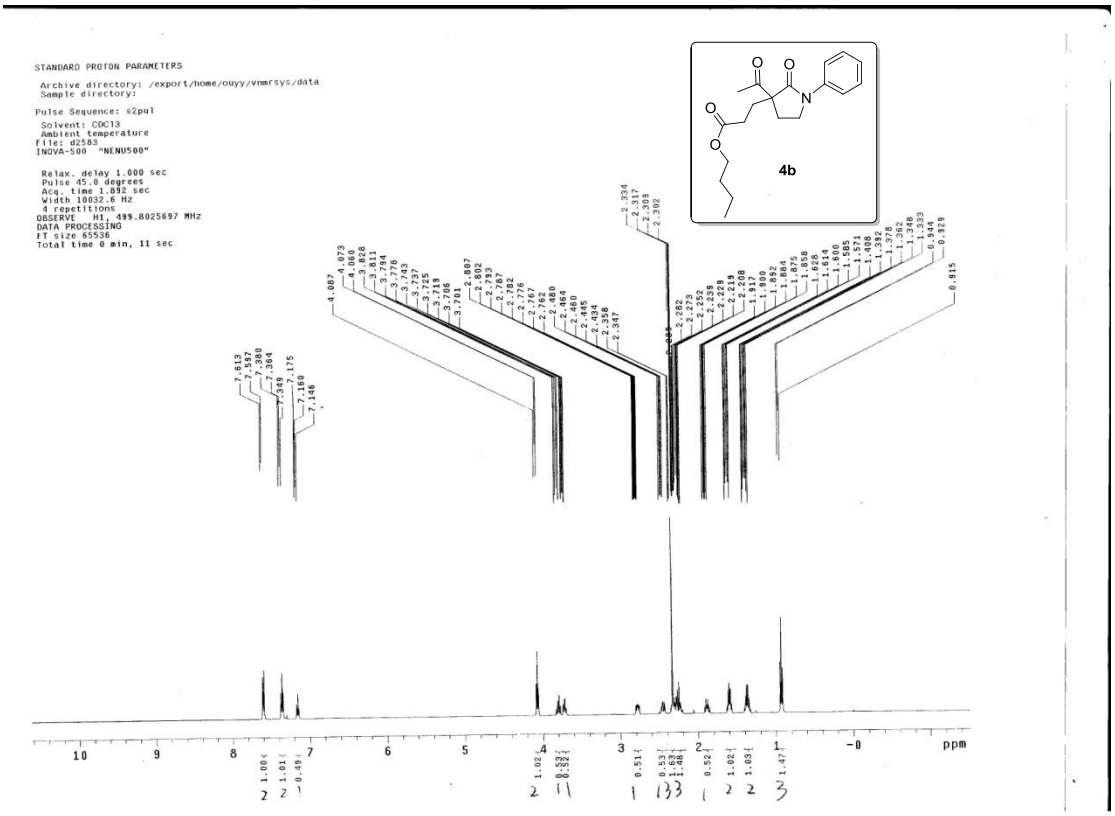
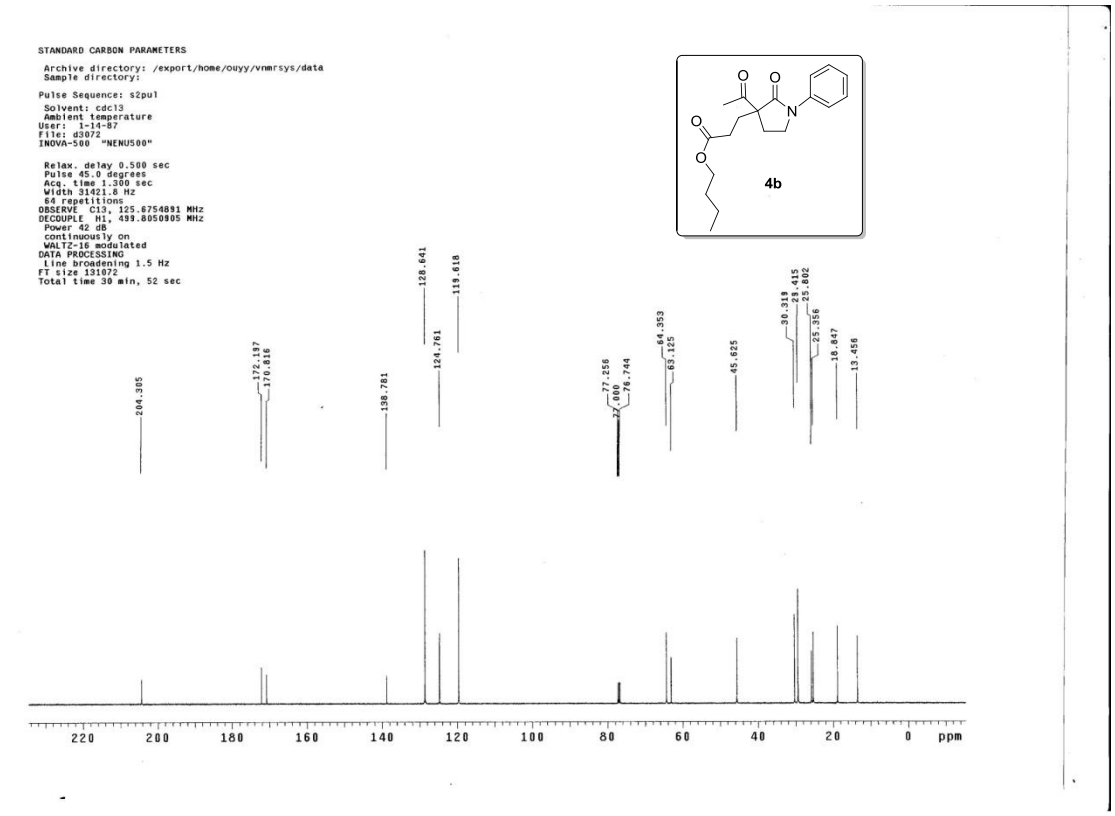
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d3329
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.882 sec
Width 10881.4 Hz
4 repetitions
OBSERVE H1, 499.8025883 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
NC
O
N
NC
3
11
10
9
8
7
6
5
4
3
2
1
-0
-1 ppm

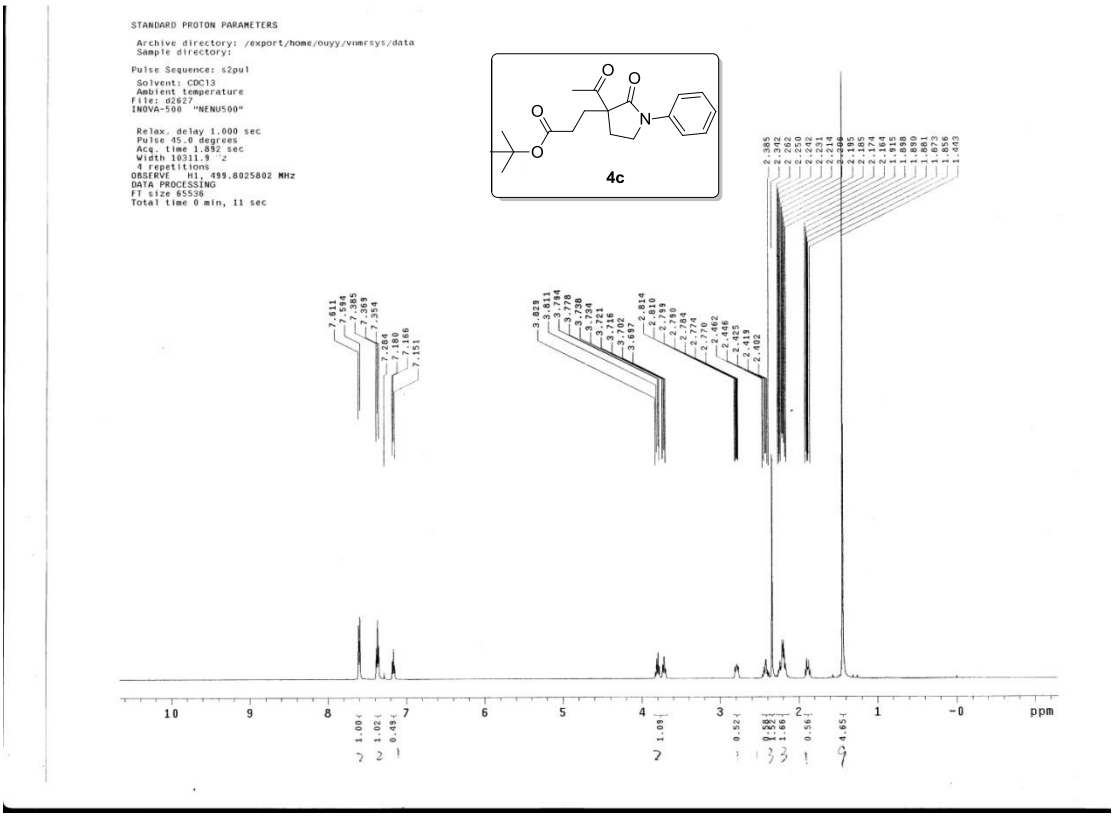

STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d3330
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
256 repetitions
OBSERVE C13, 125.6754886 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 2 hr, 3 min, 31 sec
NC
O
N
NC
3
220
200
180
160
140
120
100
80
60
40
20
0
ppm

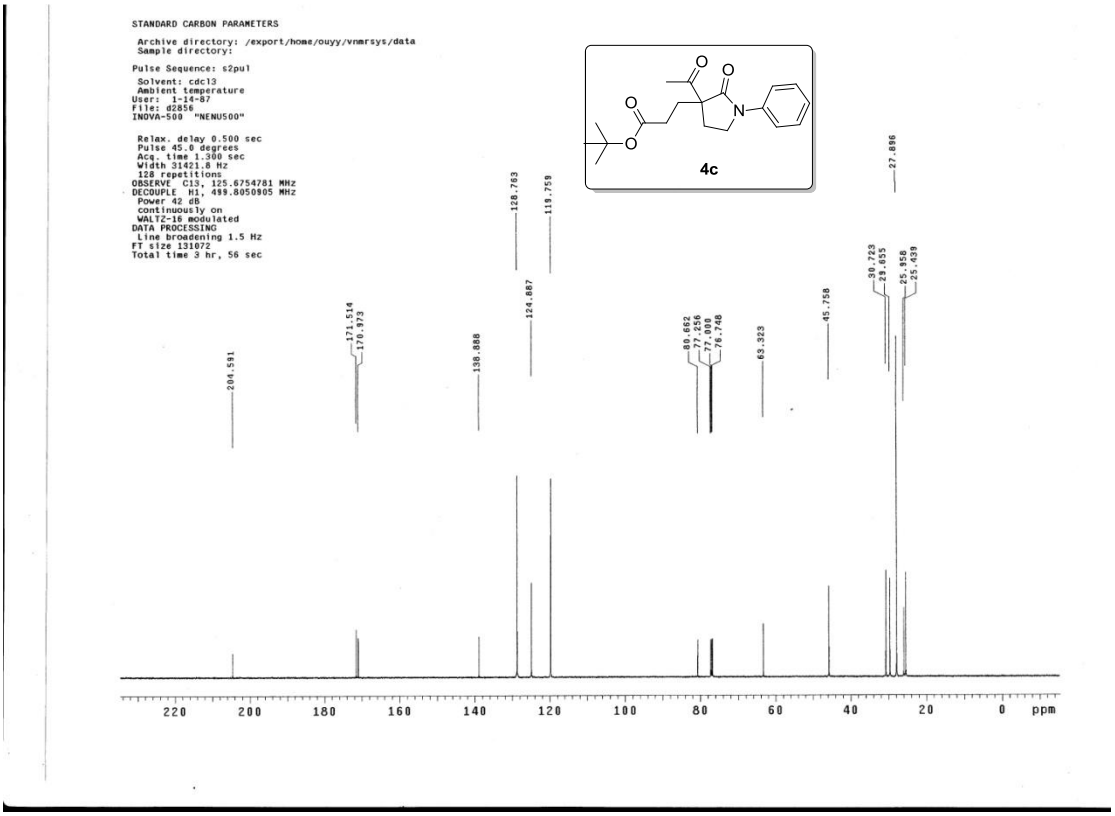

STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2512
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 9605.0 Hz
8 repetitions
OBSERVE H1, 499.8025897 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 23 sec
EtO
4a
ppm

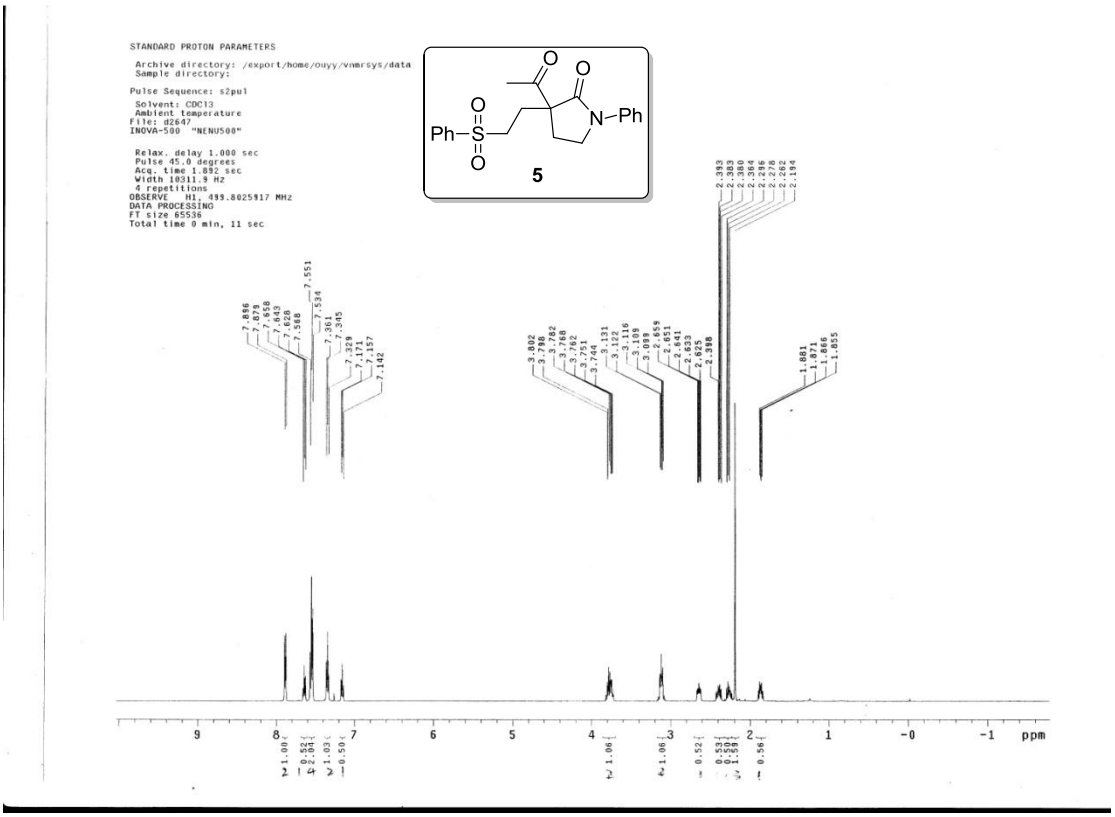

STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2753
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
128 repetitions
OBSERVE C13, 125.6754680 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 30 min, 52 sec
EtO
4a
ppm

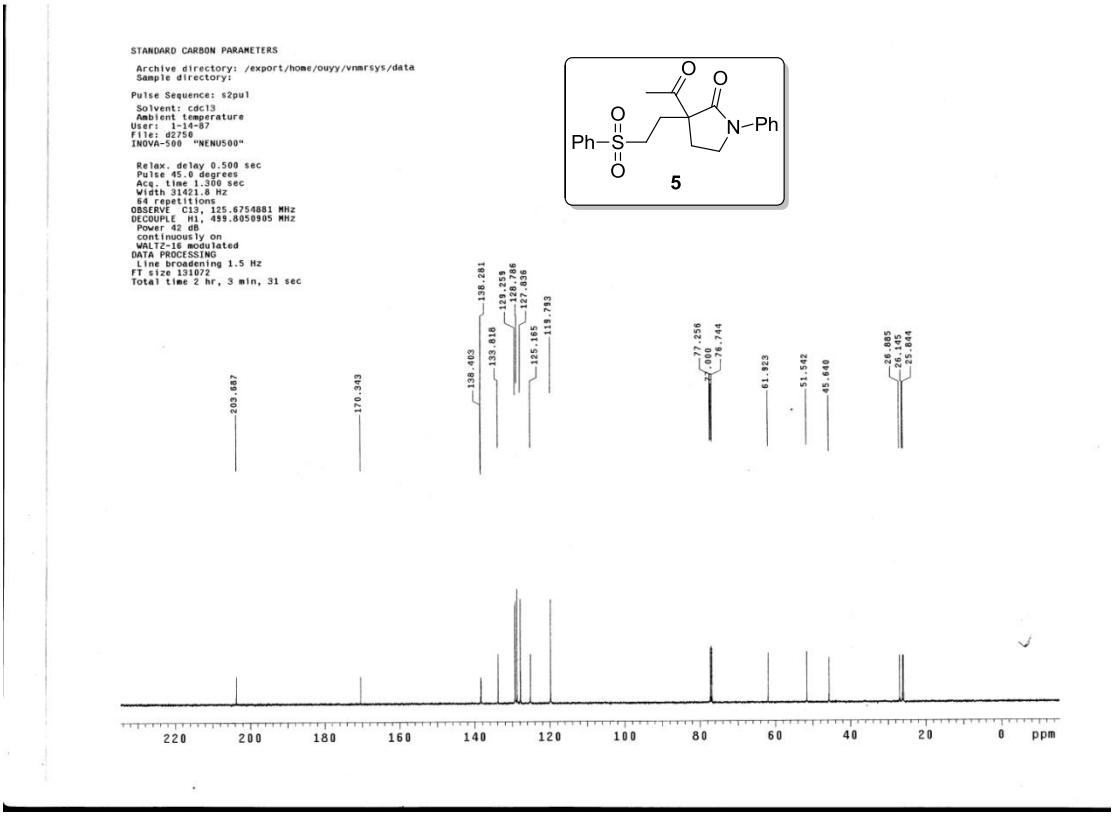

STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2583
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 10032.6 Hz
4 repetitions
OBSERVE H1, 499.8025697 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
4b
ppm

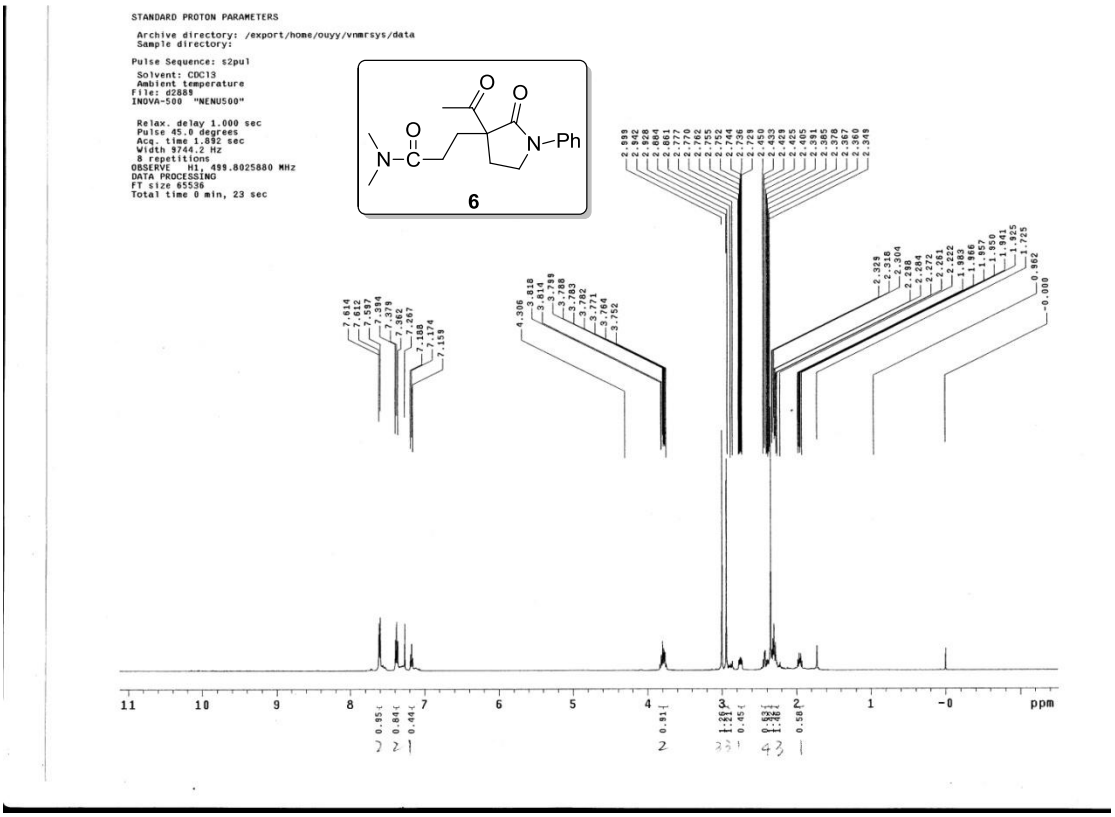

STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-07
File: d3072
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
64 repetitions
OBSERVE C13, 125.6754891 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 30 min, 52 sec
4b
ppm

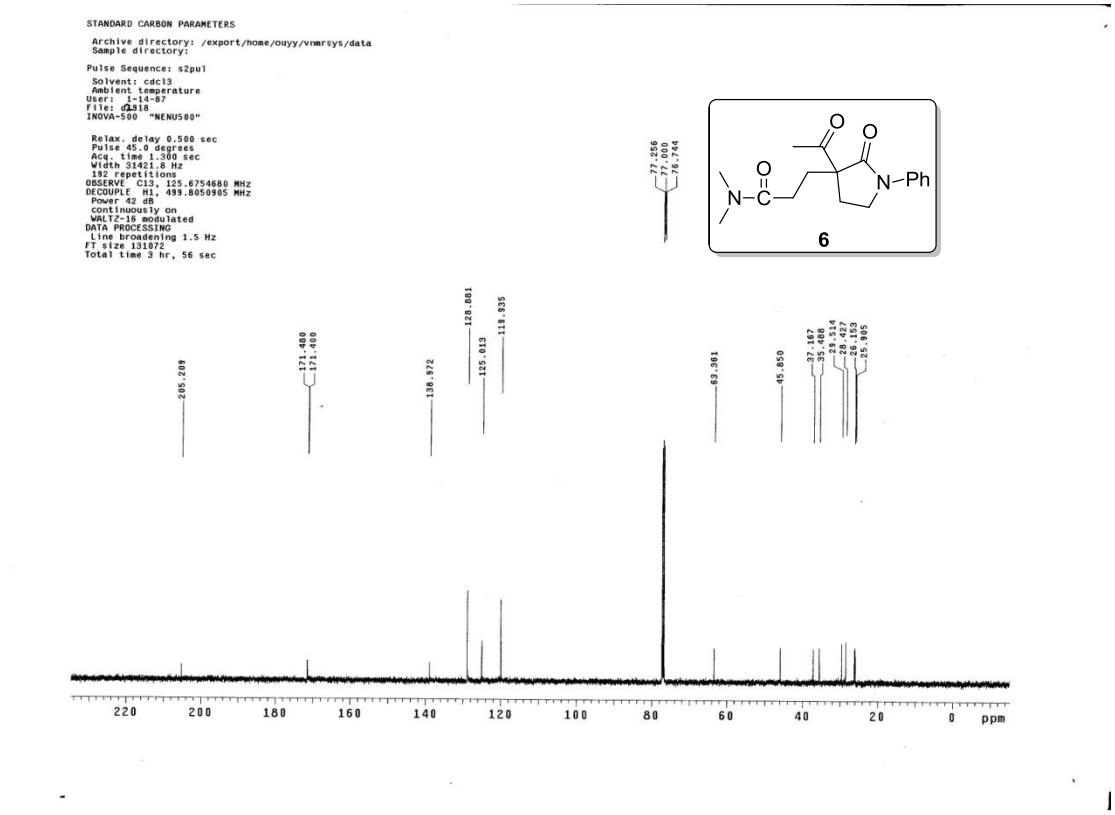

STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2827
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.852 sec
Width 10311.9 Hz
4 repetitions
OBSERVE H1, 499.8025802 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
4c
ppm

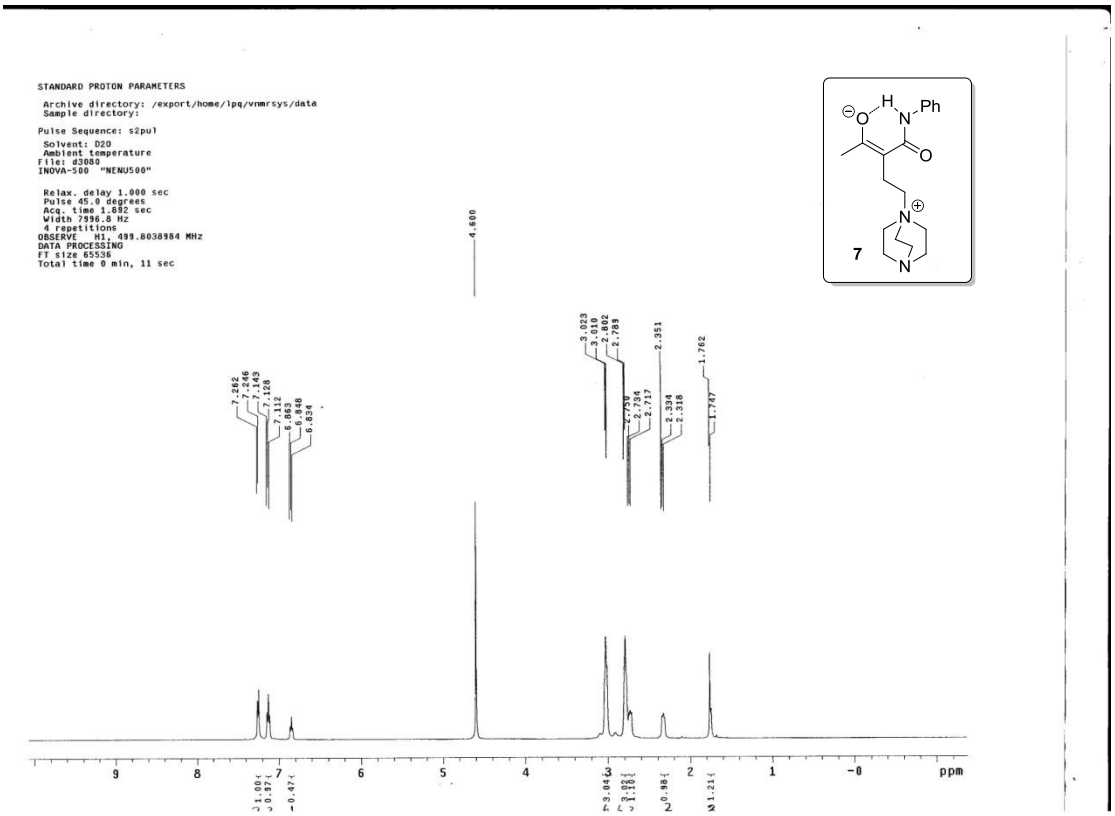

STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2856
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
128 repetitions
OBSERVE C13, 125.6754781 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
4c
ppm

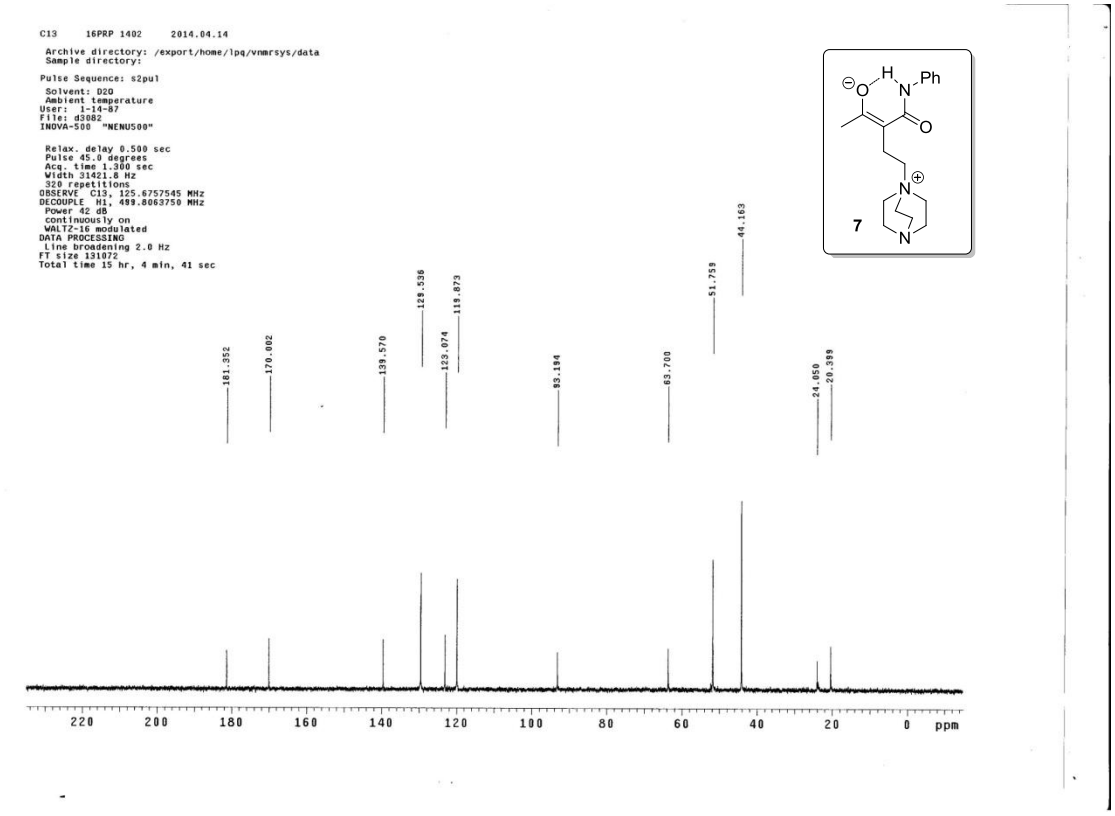


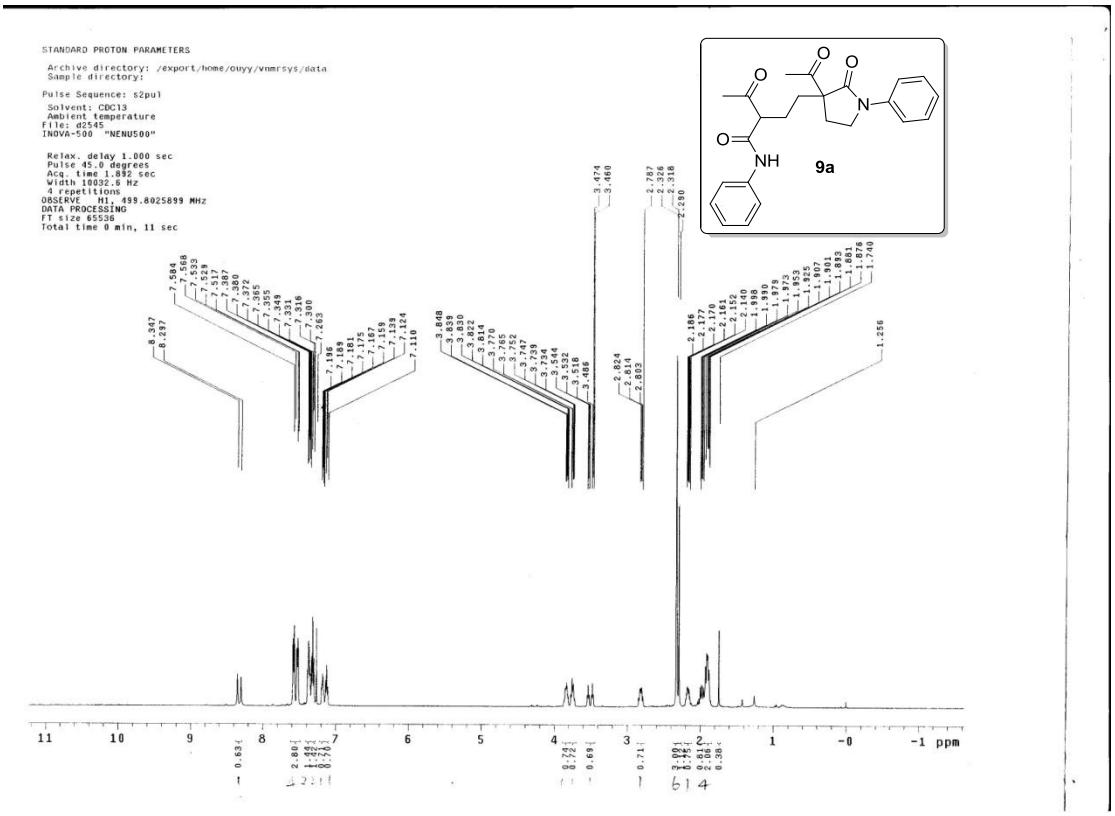



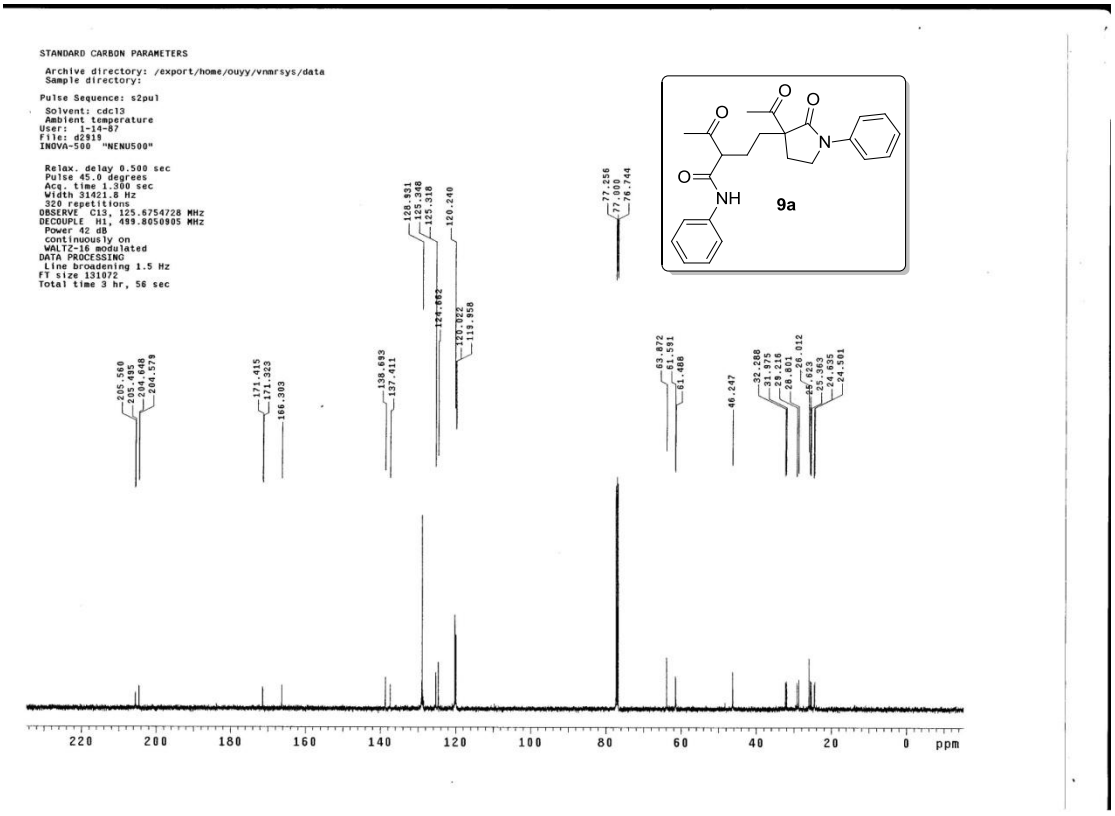

STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2885
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 9744.2 Hz
8 repetitions
OBSERVE H1, 499.8025880 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 23 sec
6
ppm

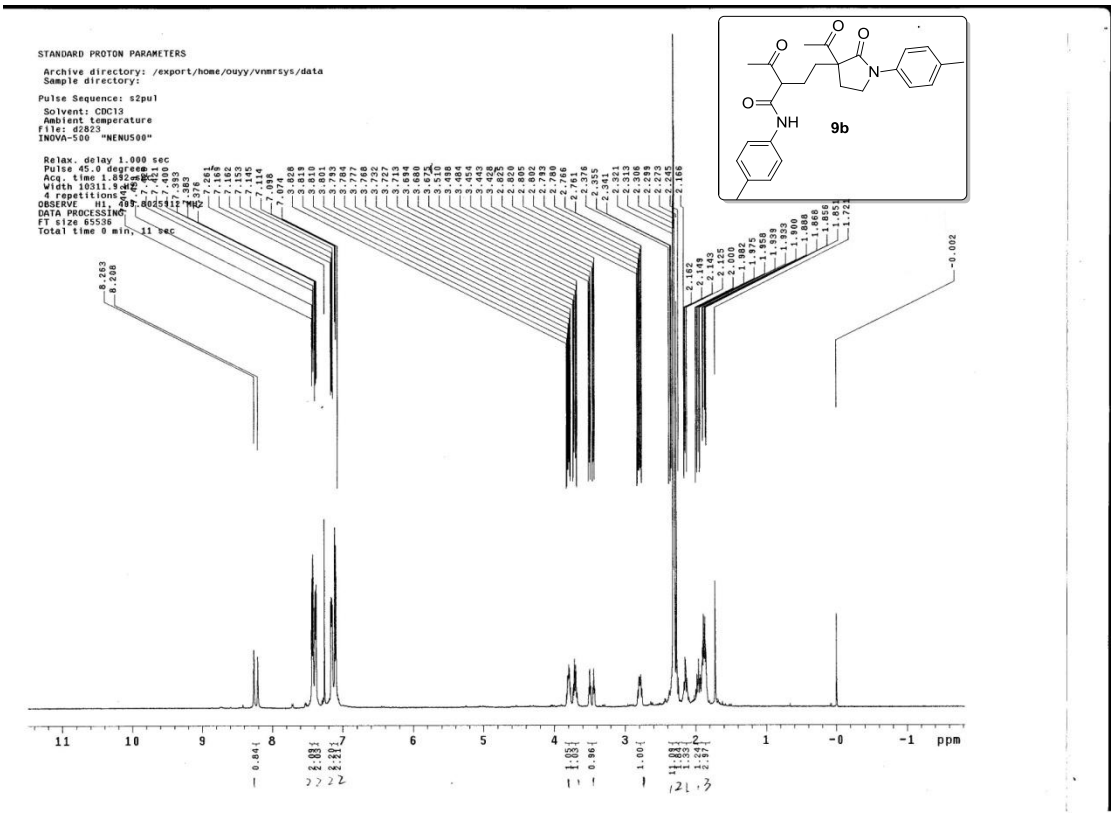

STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2818
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
192 repetitions
OBSERVE C13, 125.6754680 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
6
ppm

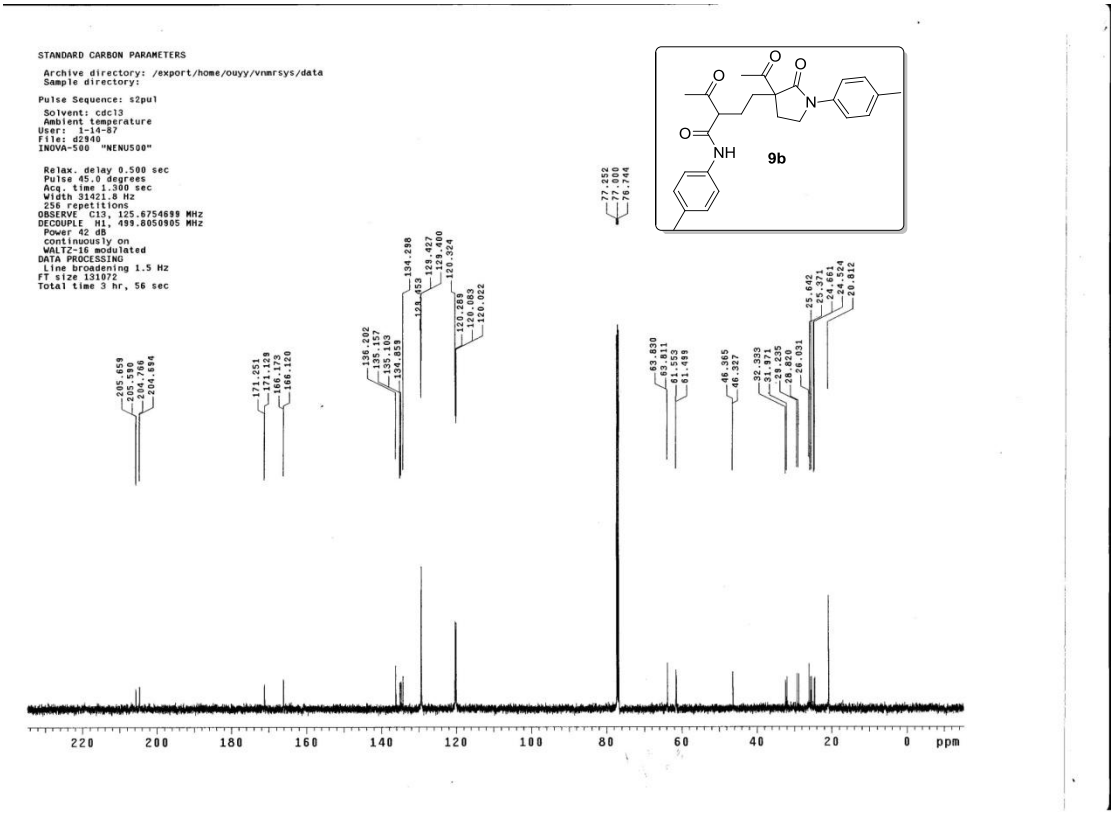

STANDARD PROTON PARAMETERS
Archive directory: /export/home/lpq/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: D2O
Ambient temperature
File: d3080
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 7998.8 Hz
4 repetitions
OBSERVE H1, 499.8038984 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
7
ppm

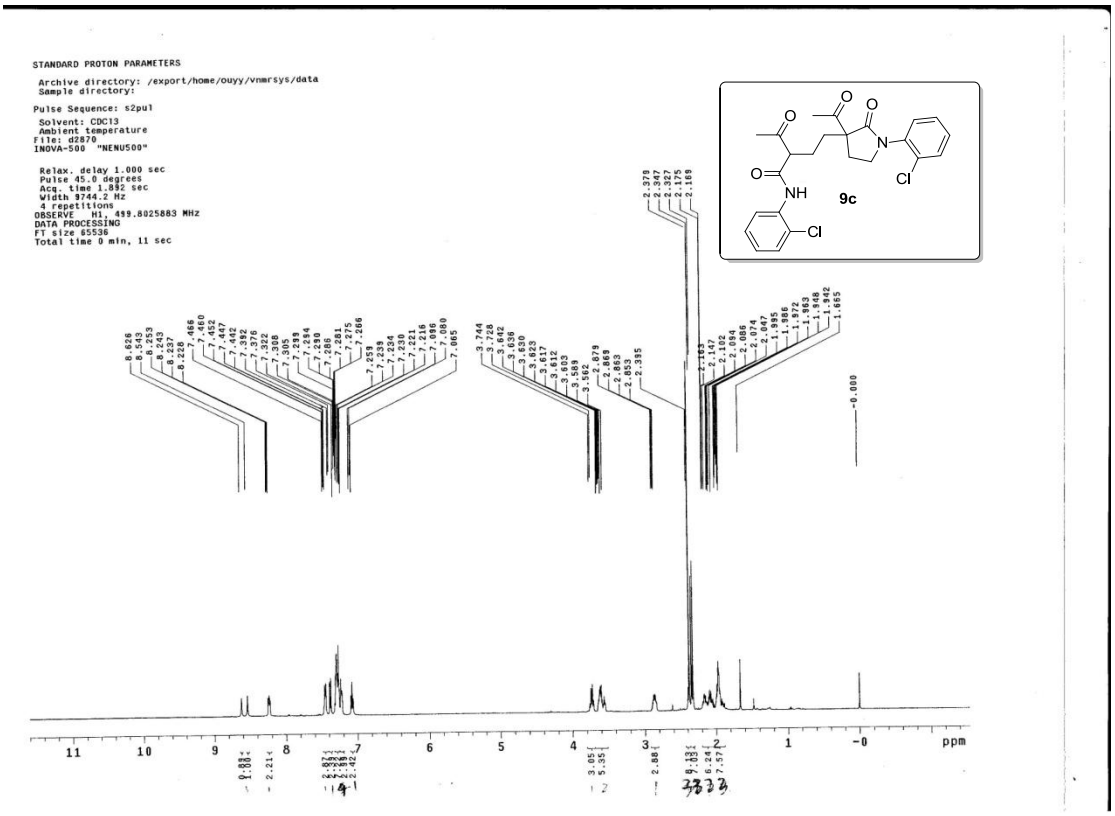

C13 16PRP 1402 2014.04.14
Archive directory: /export/home/lpq/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: D2O
Ambient temperature
User: 1-14-87
File: d3082
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
320 repetitions
OBSERVE C13, 125.6757545 MHz
DECOUPLE H1, 499.8063750 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 2.0 Hz
FT size 131072
Total time 15 hr, 4 min, 41 sec
7
ppm

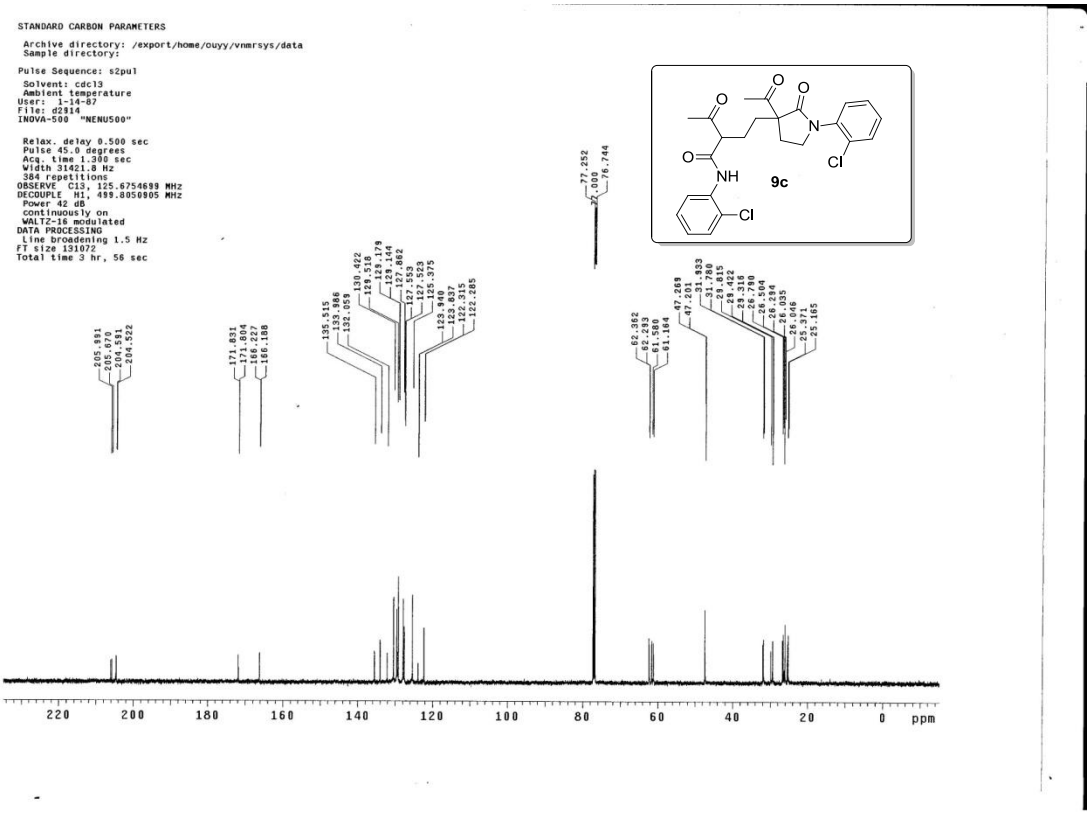

STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2545
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 10032.6 Hz
4 repetitions
OBSERVE H1, 499.8025899 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
9a
11 10 9 8 7 6 5 4 3 2 1 -0 -1 ppm


STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2919
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
320 repetitions
OBSERVE C13, 125.6754728 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
9a
220 200 180 160 140 120 100 80 60 40 20 0 ppm


STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2823
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.852 sec
Width 10311.9 Hz
4 repetitions
OBSERVE H1, 499.8025811 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
9b
ppm


STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2940
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
256 repetitions
OBSERVE C13, 125.6754699 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
9b
ppm


STANDARD PROTON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: d2870
INOVA-500 "NENU500"
Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 1.892 sec
Width 9744.2 Hz
4 repetitions
OBSERVE H1, 499.8025883 MHz
DATA PROCESSING
FT size 65536
Total time 0 min, 11 sec
9c
ppm


STANDARD CARBON PARAMETERS
Archive directory: /export/home/ouyy/vnmrsys/data
Sample directory:
Pulse Sequence: s2pul
Solvent: cdcl3
Ambient temperature
User: 1-14-87
File: d2914
INOVA-500 "NENU500"
Relax. delay 0.500 sec
Pulse 45.0 degrees
Acq. time 1.300 sec
Width 31421.8 Hz
384 repetitions
OBSERVE C13, 125.6756899 MHz
DECOUPLE H1, 499.8050905 MHz
Power 42 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.5 Hz
FT size 131072
Total time 3 hr, 56 sec
9c
ppm