C-Metallated Nitriles: Electrophile-Dependent Alkylations.

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Compound	Procedure	¹ H NMR	¹³ C NMR	X-ray	CCDC
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13b	S5	S22	S23
9c	S6	S24	S25	S26	242090
9d	S6	S27	S28	S29	218679
9e	S6	S30	S31	S32	242092
13e	S6	S33	S34
9f	S7	S35	S36	S37	281459

13f	S7	S38	S39
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13g	S8	S43	S44
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9i	S9	S48	S49	S50	242091
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iiia	S10	S58	S59
iiib	S10	S60	S61
9o	S11	S62	S63
9l	S11	S64	S65

S11	S66	S67
S12	S68	S69	S70	242095
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S13	S74	S75
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General Grignard Addition-Alkylation procedure: A THF solution of the Grignard reagent (2 equiv) was added to a $-78\text{ }^{\circ}\text{C}$, THF solution (0.1M) of oxonitrile **14**. After 1 h at $-78\text{ }^{\circ}\text{C}$, a THF solution of the second Grignard reagent (1.5 equiv) was added, or for reactions with only one Grignard reagent, 3.5 eq was added initially. The mixture was stirred at $-78\text{ }^{\circ}\text{C}$ for 10 min, and then warmed to room temperature. After 1.5 h, the electrophile (3 equiv) was added neat, either at room temperature or with prior cooling to $-78\text{ }^{\circ}\text{C}$. Subsequent addition of saturated NH_4Cl and extraction with EtOAc afforded a crude product that was washed with brine and dried (MgSO_4), concentrated, and purified by radial chromatography to afford the pure nitrile.

(1*S,2*R**,3*S**)-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile (9a) and (1*R**, 2*R**,3*S**)-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile (13a):** The standard procedure was employed with oxonitrile **14** (470 mg, 3.88 mmol) and MeMgCl (3M, 13.0 mmol) with addition of saturated, aqueous NH₄Cl at room temperature, to afford, after radial chromatography (stepped gradient 3:17, 1:4 to 1:3 EtOAc/hexanes), 485 mg (82%) of **9a** and 44 mg (8%) of **13a** as light yellow oils. For **9a**: IR (film) 3507, 2240 cm⁻¹; ¹H NMR: d 1.05 (s, 1H), 1.17 (d, *J*= 7.4 Hz, 3H), 1.23 (s, 3 H), 1.30 – 1.69 (m, 6H), 2.10 (d, *J*=10.3 Hz, 1H), 2.59 (td, *J*=11.8, 2.9 Hz, 1H); ¹³C NMR: d 13.0, 20.1, 28.7, 30.1, 32.0, 39.2, 42.6, 69.7, 122.7; HRMS(EI) calcd for (M⁺), C₉H₁₅NO⁺ 153.1148, found 149.1158. For **13a**: IR (film) 3564, 2238 cm⁻¹; ¹H NMR: d 1.17 (d, *J* = 4.1 Hz, 3H), 1.20 (s, 3 H), 1.05 – 2.04 (m, 8H), 2.76 (q, *J* = 4.4 Hz, 1H); ¹³C NMR: d 13.1, 18.8, 28.4, 28.7, 32.0, 38.7, 40.5, 70.6, 121.7; HRMS(ESI) calcd for (M+Na⁺), C₉H₁₅NONa⁺ 176.1046, found 176.1048.

(1*R, 2*S**, 3*R**)-3-hydroxy-1,2,3-trimethylcyclohexanecarbonitrile (9b):** A THF solution of *i*-PrMgBr (0.90M, 0.66 mmol) was added to a rt, THF solution (3 mL) of **9a** (50 mg, 0.33 mmol) and after 2 h neat MeI (94 mg, 0.66 mmol) was added in one portion. After 30 min saturated, aqueous NH₄Cl (1 mL) was added and the crude product extracted with ether (3x). The combined organic phase was washed with brine, dried (MgSO₄) and then purified by radial chromatography (1:99 to 1:49 MeOH in CH₂Cl₂) to afford 30 mg (55%) of **9b** as a white crystalline solid (m.p. 100-103 °C) whose structure was confirmed by X-ray crystallography: IR (film) 3475, 2233 cm⁻¹; ¹H NMR: d 1.19 (d, *J* = 7.4 Hz, 3H), 1.22 (s, 3H), 1.44 (s, 3H) 1.01-1.98

(m, 8H); ^{13}C NMR: δ 10.7, 16.5, 18.1, 30.1, 37.1, 37.4, 39.7, 44.0, 70.8, 126.4; HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{10}\text{H}_{17}\text{NONa}^+$ 190.1202, found 190.1202.

(1*R, 2*R**, 3*S**)-3-hydroxy-1,2,3-trimethylcyclohexanecarbonitrile (13b):** A THF solution (3 mL) of **9a** (82 mg, 0.53 mmol) was added to a $-78\text{ }^{\circ}\text{C}$ THF solution (2 mL) of LDA prepared from *n*-BuLi (2.2 M, 1.08 mmol) and *i*-Pr₂NH (118 mg, 1.08 mmol). After 2 h *n*-BuLi (2.2 M, 1.08 mmol) was added, the cooling bath was removed, and after 10 min neat MeI (3.76 mmol, 535 mg) was added. After 30 min aqueous, saturated NH₄Cl was added, and the aqueous phase extracted with ether (3x). The combined extracts were dried (MgSO₄), concentrated and purified by radial chromatography (stepped gradient 1:4, 1:5 EtOAc/hexanes) to afford 61 mg (66%) of **13b** as a white solid (m.p. 53-54 $^{\circ}\text{C}$): IR (film) 3488, 2235 cm^{-1} ; ^1H NMR: δ 1.20 (br s, 6H), 1.40 (s, 3H), 1.13-2.06 (m, 8H); ^{13}C NMR: δ 9.9, 18.8, 27.3, 29.4, 36.6, 38.7, 39.9, 47.6, 70.8, 124.0; HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{10}\text{H}_{17}\text{NO}^+$ 190.1202, found 190.1204.

(1*R, 2*S**, 3*R**)-3-hydroxy-1,2,3-trimethylcyclohexanecarbonitrile (9b):** The standard procedure was employed with oxonitrile **14** (130 mg, 1.06 mmol) and MeMgCl (1.9M, 2.12 mmol) except that 1.5 h after warming the reaction to room temperature, methyl iodide (452 mg, 3.18 mmol) was added to afford, after radial chromatography (stepped gradient 1:4, 1:5 EtOAc/hexanes), **9b** 154 mg (86%) as a crystalline solid. For the alkylation with dimethylsulfate the standard procedure was employed with oxonitrile **14** (10 mg, 0.082 mmol), MeMgCl (1.9 M, 0.287 mmol) and dimethylsulfate (19 mg, 0.17 mmol) to afford 7.8 mg of **9b** (57%) as a crystalline solid.

(1S*, 2R*, 3S*)-3-hydroxy-2,3-dimethyl-1-propylcyclohexanecarbonitrile (9c): The standard procedure was employed with oxonitrile **14** (95 mg, 0.79 mmol) and MeMgCl (3M, 2.75 mmol), alkylating with iodopropane (400 mg, 2.36 mmol) at room temperature overnight and terminating the reaction with D₂O rather than NHCl₄, to afford, after radial chromatography (stepped gradient 3:17, 1:4, 1:3 EtOAc/hexanes), 107 mg (70%) of **9c** as a crystalline solid (m.p. 125-126 °C) whose structure was confirmed by X-ray crystallography: IR (film) 3469, 2235 cm⁻¹; ¹H NMR: d 0.91-0.95 (m, 3H), 1.15 (d, *J* = 5.9 Hz, 3 H), 1.19 (s, 3 H), 1.36-1.78 (m, 9H), 2.02-2.10 (m, 3H); ¹³C NMR: d 10.4, 14.3, 16.6, 18.8, 30.4, 30.5, 33.0, 39.7, 42.0, 45.3, 71.1, 125.3. HRMS(ESI) calcd for (M⁺), C₁₂H₂₁NONa⁺ 218.1515, found 218.1509.

(1R*, 2S*, 3R*)-3-hydroxy-1,3-dimethyl-2-phenylcyclohexanecarbonitrile (9d) : The standard procedure was employed with oxonitrile **14** (20.8 mg, 0.17 mmol), MeMgCl (1.95M, 0.34 mmol) and PhMgCl (1.6M, 0.26 mmol) except that 1.5 h after warming the reaction to room temperature, methyl iodide (72 mg, 0.51 mmol) was added to afford, after radial chromatography (1:4 EtOAc/hexanes), **9d** 28 mg (71%) as a crystalline solid (m.p. 146-148 °C) whose structure was confirmed by X-ray crystallography: IR (film) 3460, 3049, 2226 cm⁻¹; ¹H NMR: d 1.02 (s, 3 H), 1.28 (br s, 1H), 1.60 (s, 3 H), 1.37-1.75 (m, 3H), 1.97-2.11 (m, 3H), 2.71 (s, 1H), 7.26-7.54 (m, 5H); ¹³C NMR: d 17.0, 19.7, 31.2, 38.4, 38.4, 41.2, 56.9, 72.4, 125.4, 127.5, 128.0, 137.7; HRMS(ESI) calcd for (M+Na⁺), C₁₅H₁₉NONa⁺ 252.1359, found 252.1352.

(1R*, 2R*, 3S*)-1-allyl-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile (9e) and (1S*, 2R*, 3S*)-1-allyl-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile (13e): The standard procedure was employed with oxonitrile **14** (19 mg, 0.16 mmol) and MeMgCl (1.9M, 0.55 mmol)

alkylating with allyl bromide (56 mg, 0.04 mmol) at room temperature for 1 h to afford, after radial chromatography (1:9 EtOAc/hexanes), 7.9 mg (26%) of **13e** as an oil and 13.5 mg (45%) of **9e** as a crystalline solid (m.p. 73-74°C) whose structure was confirmed by X-ray crystallography: IR (film) 3490, 3077, 2230, 1641 cm^{-1} ; ^1H NMR: d 1.02 (s, 1H), 1.22 (d, $J = 9.1$ Hz, 3H), 1.24 (s, 3 H), 1.40 - 1.72 (m, 5H), 1.83 (q, $J = 7.1$ Hz, 1H), 2.13 (br d, $J = 11.4$ Hz, 1H), 2.36 (dd, $J = 14.5, 5.6$ Hz, 1H), 2.87 (dd, $J = 14.5, 9.0$ Hz, 1H), 5.16 (d, $J = 5.5$ Hz, 1H), 5.20 (s, 1H), 5.82-5.93 (m, 1H); ^{13}C NMR: d 10.6, 16.3, 30.6, 33.0, 33.2, 39.9, 41.6, 45.0, 71.2, 119.1, 124.8, 133.8; HRMS(ESI) calcd for ($\text{M}+\text{Na}^+$), $\text{C}_{12}\text{H}_{19}\text{NONa}^+$ 216.1359, found 216.1354. For **13e**: IR (film) 3492, 3075, 2231, 1635 cm^{-1} ; ^1H NMR: d 1.20 (d, $J = 4.3$ Hz, 3H), 1.20 (s, 3 H), 1.14 – 2.03 (m, 8H), 2.19 (dd, $J = 13.8, 8.3$ Hz, 1H), 2.60 (dd, $J = 13.8, 6.3$ Hz, 1H), 5.14-5.22 (m, 2H), 5.73-5.87 (m, 1H); ^{13}C NMR: d 9.8, 18.6, 29.6, 35.0, 39.9, 40.7, 43.1, 45.3, 71.1, 120.1, 123.2, 131.4; HRMS(ESI) calcd for ($\text{M}+\text{Na}^+$), $\text{C}_{12}\text{H}_{19}\text{NONa}^+$ 216.1359, found 216.1377.

(1R*, 2R*, 3S*)-1-benzyl-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile (9f) and **(1S*, 2R*, 3S*)-1-benzyl-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile (13f)**: The standard procedure was employed with oxonitrile **14** (20 mg, 0.16 mmol) and MeMgCl (1.9M, 0.57 mmol) alkylating with BnBr (34 mg, 0.3 mmol) at room temperature for 0.5 h to afford, after radial chromatography (1:3 EtOAc/hexanes), 13 mg (33%) of **13f** as a white solid (m.p. 137-139°C) and 15 mg (38%) of **9f** as a crystalline solid (m.p. 115-116 °C) whose structure was confirmed by X-ray crystallography: IR (film) 3498, 2229 cm^{-1} ; ^1H NMR: d 1.28 (s, 3H), 1.35 (d, $J = 6.7$ Hz, 3 H), 1.15 – 2.02 (m, 8H), 2.85 (d, $J = 13.9$ Hz, 1H), 3.49 (d, $J = 14.5$ Hz, 1H), 7.26-7.33 (m, 5H); ^{13}C NMR: d 10.8, 16.6, 30.7, 32.5, 34.0, 40.2, 43.2, 45.8, 71.4, 125.0, 126.9, 128.2, 130.5, 137.0; HRMS(ESI) calcd for ($\text{M}+\text{Na}^+$), $\text{C}_{16}\text{H}_{21}\text{NONa}^+$ 266.1515, found 266.1521.

For **13f**: IR (film) 3496, 3061, 2230 cm^{-1} ; ^1H NMR: d 1.22 (s, 3H), 1.37 (s, 3 H), 1.15 – 1.87 (m, 8H), 2.58 (d, $J = 13.3$ Hz, 1H), 3.25 (d, $J = 13.3$ Hz, 1H), 7.23-7.31 (m, 5H); ^{13}C NMR: d 10.2, 18.4, 29.7, 34.9, 39.9, 41.8, 44.8, 46.3, 71.2, 123.0, 127.3, 128.3, 130.5, 135.1; HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{16}\text{H}_{21}\text{NONa}^+$ 266.1515, found 266.1521.

(1R*, 2R*, 3S*)-1-benzyl-3-hydroxy-3-methyl-2-phenylcyclohexanecarbonitrile (9g) and **(1S*, 2R*, 3S*)-1-benzyl-3-hydroxy-3-methyl-2-phenylcyclohexanecarbonitrile (13g)**: The standard procedure was employed with oxonitrile **14** (20 mg, 0.16 mmol) and PhMgCl (1.6M, 0.56 mmol), alkylating with BnBr (82 mg, 0.48 mmol) at room temperature overnight, to afford, after radial chromatography (stepped gradient 1:9, 1:4, 1:3 EtOAc/hexanes), 6.5 mg (14%) of **13g** as a white solid (m.p. 134-135 $^{\circ}\text{C}$) and 23 mg (47%) of **9g** as a crystalline solid (m.p. 158-159 $^{\circ}\text{C}$) whose structure was confirmed by X-ray crystallography: IR (film) 3498, 3088, 2230 cm^{-1} ; ^1H NMR: d 1.09 (s, 3H), 1.30 (s, 1H), 1.50-1.85 (m, 4H), 2.00-2.23 (m, 2H), 2.90 (s, 1H), 2.96 (d, $J = 14.7$ Hz, 1H), 3.84 (d, $J = 13.2$ Hz, 1H), 7.21-7.41 (m, 10H); ^{13}C NMR: d 16.9, 31.5, 32.9, 35.2, 41.6, 43.9, 58.2, 72.7, 123.9, 126.9, 127.6, 128.2, 130.5, 136.9, 137.2; HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{21}\text{H}_{23}\text{NONa}^+$ 328.1672, found 328.1685. For **13g**: IR (film) 3484, 3086, 2230 cm^{-1} ; ^1H NMR: d 0.95 (s, 3H), 0.85-2.17 (m, 7H), 2.38 (d, $J = 4.5$ Hz, 1H), 2.40 (s, 1H), 2.70 (d, $J = 3.8$ Hz, 1H), 7.05-7.53 (m, 9H), 8.27 (d, $J = 7.7$ Hz, 1H); ^{13}C NMR: d 18.7, 30.4, 36.4, 40.1, 41.3, 45.6, 60.4, 71.5, 123.5, 127.1, 127.5, 127.6, 127.9, 128.0, 129.1, 130.5, 132.8, 134.9, 137.4; HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{21}\text{H}_{23}\text{NONa}^+$ 328.1672, found 328.1672.

(1R*, 2R*, 3S*)-1-cyano-3-hydroxy-2,3-dimethyl-N-phenylcyclohexanecarboxamide (9h): The standard procedure was employed with oxonitrile **14** (120 mg, 1 mmol) and MeMgCl (3M,

3.5mmol) alkylating with phenylisocyanate (357 mg, 3 mmol) at -78°C for 1 h, and then room temperature for 1 h to afford, after radial chromatography (stepped gradient 3:7, 1:2.5, 1:1 EtOAc/hexanes), 158 mg (58%) of **9h** as a crystalline solid (m.p. $164\text{--}165^{\circ}\text{C}$) whose structure was confirmed by X-ray crystallography: IR (film) 3390, 2243, 1660 cm^{-1} ; ^1H NMR: δ 1.30 (s, 3 H), 1.35 (d, $J = 4.4\text{ Hz}$, 3 H), 1.46–1.66 (m, 2H), 1.88–2.11 (m, 4H), 2.45 (br d, $J = 10.9\text{ Hz}$, 1H), 5.23 (s, 1H), 7.19–7.55 (m, 5H), 9.02 (s, 1 H); ^{13}C NMR: δ 11.3, 17.2, 29.1, 35.9, 39.9, 45.1, 51.4, 69.3, 121.0, 122.5, 125.8, 129.1, 136.4, 166.9; HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{16}\text{H}_{20}\text{N}_2\text{O}_2\text{Na}^+$ 295.1417, found 295.1417.

(1R*, 2R*, 3S*)-1',3-dihydroxy-2,3-dimethyl-1,1'-bi(cyclohexyl)-1-carbonitrile (9i): The standard procedure was employed with oxonitrile **14** (100 mg, 0.82 mmol) and MeMgCl (3M, 2.87mmol) alkylating with cyclohexanone (242 mg, 2.46 mmol) at -78°C for 1 h, to afford, after radial chromatography (stepped gradient 3:17, 1:4, 1:3 EtOAc/hexanes), 138 mg (68%) of **9i** as a crystalline solid (m.p. $149\text{--}150^{\circ}\text{C}$) whose structure was confirmed by X-ray crystallography: IR (film) 3436, 2230 cm^{-1} ; ^1H NMR: δ 1.20 (s, 1H), 1.34 (s, 3H), 1.35 (d, $J = 5.9\text{ Hz}$, 3H), 1.13–2.15 (m, 17H), 2.39 (br d, $J = 14.7\text{ Hz}$, 1H); ^{13}C NMR: δ 13.8, 19.3, 21.7, 22.1, 25.0, 30.0, 31.3, 34.8, 35.6, 39.1, 48.5, 50.1, 71.5, 76.2, 125.5. HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{15}\text{H}_{25}\text{NO}_2\text{Na}^+$ 274.1777, found 274.1787.

(1R*, 2R*, 3S*)-3-hydroxy-1-(1-hydroxy-1-methylethyl)-2,3-dimethylcyclohexanecarbonitrile (9j): The standard procedure was employed with oxonitrile **14** (95 mg, 0.78 mmol) and MeMgCl (3M, 2.75) alkylating with acetone (136 mg, 2.34 mmol) at -78°C for 1 h, to afford, after radial chromatography (stepped gradient 3:17, 1:4, 1:3 EtOAc/hexanes), 105 mg (64%) of

9j as a crystalline solid (m.p. 109-111 °C) whose structure was confirmed by X-ray crystallography: IR (film) 3289, 2232 cm⁻¹; ¹H NMR: d 1.46 (s, 3H), 1.51 (d, *J* = 7.4 Hz, 3H), 1.61 (s, 3H), 1.65 (s, 3H), 1.69 - 1.91 (m, 4H), 2.21 - 2.37 (m, 2H), 2.56 (br d, *J* = 13.2 Hz, 1H), 3.90 (br s, 1H), 5.15 (br s, 1H); ¹³C NMR: d 13.8, 19.0, 29.8, 30.4, 33.0, 39.4, 48.6, 48.9, 71.3, 75.2, 125.2. HRMS(ESI) calcd for (M+Na⁺), C₁₂H₂₁NO₂Na⁺ 234.1464, found 234.1464.

(1R*, 2R*, 3S*)-1-[cyclopropyl(hydroxy)methyl]-5,8-dimethyl-6-oxabicyclo[3.2.1]octan-7-one (9k and 18j). The standard procedure was employed with oxonitrile **14** (121 mg, 0.83 mmol) and MeMgCl (3.0M, 2.9 mmol) alkylating with cyclopropane carboxaldehyde (203 mg, 2.9 mmol) at -78 °C for 1 h to afford, after radial chromatography (1:9 EtOAc/hexanes), 105 mg (55%) of **9k** and **13k** as a 1:4 mixture from which pure **13k** was isolated as a crystalline solid (m.p. 124-125°C) whose structure was confirmed by X-ray crystallography: IR (film) 3390, 2233 cm⁻¹; ¹H NMR: d 0.34 (d, *J* = 11.1 Hz, 1H), 0.57 - 0.77 (m, 4H), 1.15 (d, *J* = 14.7 Hz, 3 H), 1.30 (s, 3H), 1.10 - 2.13 (m, 9H), 3.20 (d, *J* = 7.4 Hz, 1H); ¹³C NMR: d 2.25, 4.27, 9.30, 13.4, 18.1, 28.0, 29.7, 39.5, 41.2, 45.7, 71.5, 75.6, 122.5. For **9k**: IR (film) 3390, 2233 cm⁻¹; ¹³C NMR: d 2.88, 4.99, 10.4, 14.4, 18.8, 29.6, 31.3, 40.0, 46.1, 46.8, 70.1, 73.9, 124.4. Allowing the reaction to warm to room temperature affords varying amounts of two diastereomeric lactones (**iii**). For diastereomer **iiia**: IR (film) 3506, 3088, 1746 cm⁻¹; ¹H NMR: d 0.39 - 0.58 (m, 3H), 0.78 - 0.99 (m, 2H), 1.01 (d, *J* = 7.9 Hz, 3H), 1.36 (s, 3H), 0.99 - 2.30 (m, 7H), 3.79 (d, *J* = 4.6 Hz, 1H), 3.88 (s, 1H); ¹³C NMR: d 1.1, 1.2, 10.6, 11.0, 19.6, 21.5, 26.2, 36.0, 49.0, 56.1, 69.7, 85.8, 181.2. HRMS(ESI) calcd for (M+Na⁺), C₁₃H₂₀NO₃Na⁺ 247.1305, found 247.1290. For diastereomer (**iiib**) IR (film) 3484, 3078, 1755 cm⁻¹; ¹H NMR: d 0.28 - 0.75 (m, 5H), 1.17 (d, *J* = 6.5 Hz, 3H), 1.43 (s, 3H), 0.94 - 2.20 (m, 7H), 3.11 - 3.29 (m, 1H); ¹³C NMR: d 1.7, 4.7, 11.9, 12.3, 19.7,

21.5, 30.7, 35.9, 48.9, 58.0, 77.3, 85.6, 178.5. HRMS(ESI) calcd for (M+Na⁺), C₁₃H₂₀NO₃Na⁺ 247.1305, found 247.1314.

(1*R, 2*R**, 3*S**)-7-Cyclopropyl-5,8-dimethyl-6-oxabicyclo[3,2,1]octane-1-carbonitrile (9o).**

Neat DMSO (98 mg, 1.25 mmol) was added to a CH₂Cl₂ solution of (COCl)₂ (79 mg, 0.63 mmol) at -78 °C, and after 10 min a CH₂Cl₂ solution (2 mL) of **9k** (70 mg) was added. After 30 min. the cooling bath was removed and the solution allowed to warm to rt. After 2 h the solution was cooled to -78 °C and Et₃N (317 mg, 3.13mmol) was added. After 30 min. saturated, aqueous NH₄Cl was added and the crude product extracted with EtOAc, dried (MgSO₄), and purified by radial chromatography (1:9, 1:4, 3:7 EtOAc/hexanes) to afford **9o** as an oil: IR (film) 3082, 2236 cm⁻¹; ¹H NMR: d 0.31 – 0.39 (m, 2H), 0.66 – 0.71 (m, 3H), 1.25 (s, 3H), 1.30 (d, *J* = 7.3 Hz, 3H), 1.12 – 1.97 (m, 7H), 3.13 (d, *J* = 10.3 Hz, 1H); ¹³C NMR: d 3.2, 4.2, 13.5, 15.5, 18.7, 22.1, 36.8, 38.6, 48.6, 49.9, 84.0, 88.7, 120.5.

(1*R, 2*R**, 3*S**)-3-hydroxy-1-(1-hydroxycyclobutyl)-2,3-dimethylcyclohexanecarbonitrile (9l and 13l):**

The standard procedure was employed with oxonitrile **14** (132 mg, 1.1 mmol) and MeMgCl (3.0 M, 3.85 mmol) alkylating with cyclobutanone (231 mg, 3.3 mmol) at -78°C for 4.5 h to afford, after radial chromatography (0:1, 1:99, 1:49, 3:97, 1:19 MeOH/CH₂Cl₂), 130 mg (53%) of **13l** as an oil and 15 mg (6%) of **9l** as a white solid. For **13l** IR (film) 3400, 2228 cm⁻¹; ¹H NMR: d 0.80 – 0.85 (m, 1H), 1.07 (d, *J* = 7.3 Hz, 3H), 1.18 (s, 3 H), 1.23 – 2.23 (m, 12H), 2.44 – 2.54 (m, 1H), 2.73 – 2.83 (m, 1H); ¹³C NMR: d 10.6, 15.2, 18.5, 29.0, 29.4, 33.2, 36.4, 40.0, 41.6, 49.0, 71.7, 80.0, 122.9; HRMS(ESI) calcd for (M+Na⁺), C₁₃H₂₁NO₂Na⁺ 246.1464, found 246.1465. For **9l**: IR (film) 3446, 2232 cm⁻¹; ¹H NMR: d 1.33 (d, *J* = 7.4 Hz, 3H), 1.38 (s,

3 H), 1.42 – 2.30 (m, 13H), 2.55 – 2.65 (m, 1H), 2.79 – 2.89 (m, 1H); ^{13}C NMR: d 11.5, 15.5, 18.6, 29.8, 31.4, 35.0, 37.8, 39.9, 47.5, 48.6, 70.5, 80.2, 125.4; HRMS(ESI) calcd for $(\text{M}+\text{Na}^+)$, $\text{C}_{13}\text{H}_{21}\text{NO}_2\text{Na}^+$ 246.1464, found 246.1462.

(1R*, 2R*, 3S*)-3-benzoyl-3-cyano-1,2-dimethylcyclohexyl benzoate (13m): The standard procedure was employed with oxonitrile **14** (26 mg, 0.22 mmol) and MeMgCl (1.8M, 0.75 mmol), alkylating with benzoyl cyanide (85 mg, 0.65 mmol) at room temperature for 1 h to afford, after radial chromatography (stepped gradient 1:19, 1:9 EtOAc/hexanes), 42 mg (55%) of **13m** as a crystalline solid (m.p. 131-133 °C) whose structure was confirmed by X-ray crystallography: IR (film) 3060, 2235, 1710, 1686 cm^{-1} ; ^1H NMR: d 1.32 (d, $J = 7.0$ Hz, 3H), 1.46 (td, $J = 14$ Hz, 3 Hz, 2H), 1.76 (s, 3H), 1.56-1.91 (m, 1H), 1.95-1.99 (m, 1H), 2.48 (q, $J = 3.3$ Hz, 1H), 2.56 (br d, $J = 2.58$ Hz, 1H), 3.26 (dd, $J = 14.5$ Hz, 1.5 Hz, 1H), 7.41-7.61 (m, 6H), 8.06 (d, $J = 7.5$ Hz, 2H), 8.25 (d, $J = 7.5$ Hz, 2H); ^{13}C NMR (C_6D_6): d 12.5, 18.5, 24.9, 34.0, 36.4, 45.5, 53.1, 82.4, 121.4, 128.5, 129.3, 130.6, 131.9, 132.9, 133.2, 135.8, 165.8, 196.0; HRMS(EI) calcd for (M^+) , $\text{C}_{23}\text{H}_{23}\text{NO}_3^+$ 361.1672, found 361.1656.

(1R*, 2R*, 3S*)-3-acetyl-3-cyano-1,2-dimethylcyclohexyl acetate (13n): The standard procedure was employed with oxonitrile **14** (40 mg, 0.33 mmol) and MeMgCl (1.9M, 1.16mmol), alkylating with methyl cyanoformate (1.0 mmol, 85 mg) at -78 °C for 0.5 h, followed by warming to room temperature for 1 h, to afford, after radial chromatography (stepped gradient 1:19, 1:9 EtOAc/hexanes), 54 mg (61%) of **13n** as a crystalline solid (m.p. 89-90 °C) whose structure was confirmed by X-ray crystallography: IR (film) 2243, 1742 cm^{-1} ; ^1H NMR: d 1.18 (d, $J = 6.7$ Hz, 3H), 1.57 (s, 3H), 1.25-1.90 (m, 4H), 2.02 (q, $J = 7.0$ Hz, 1H), 2.25

(br d, $J = 10.4$ Hz, 1H), 2.93 (br d, $J = 5.5$ Hz, 1H), 3.75 (s, 3H), 3.85 (s, 3H); ^{13}C NMR: d 11.7, 18.0, 24.1, 33.6, 35.0, 45.0, 49.8, 53.7, 54.4, 81.8, 117.8, 153.7, 170.3; HRMS(ESI) calcd for ($\text{M}+\text{Na}^+$), $\text{C}_{13}\text{H}_{19}\text{NO}_5\text{Na}^+$ 292.1155, found 292.1157.

(1R*, 2R*, 3S*)-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile- d_1 (9p): The standard procedure was employed with oxonitrile **14** (95 mg, 0.79 mmol) and MeMgCl (3M, 4.27 mmol), alkylating with bromopropane (450 mg, 3.66 mmol) at room temperature for 16 h and terminating the reaction with D_2O rather than NH_4Cl , to afford, after radial chromatography (stepped gradient 3:17, 1:4, 1:3 EtOAc/hexanes), 30 mg (13%) of **9c** and 120 mg (64%) of **9p** as a yellow oil: IR (film) 3502, 2240 cm^{-1} ; ^1H NMR: d 1.12 (d, $J=5.9$ Hz, 3H), 1.19 (s, 3 H), 1.15 – 1.66 (m, 7H), 2.04 (d, $J=13.3$ Hz, 1H); ^{13}C NMR: d 12.9, 20.0, 28.5, 30.0, 39.1, 42.4, 69.6, 122.7. HRMS(EI) calcd for (M^+), $\text{C}_9\text{H}_{15}\text{DNO}$ 154.1204, found 154.1175.

(1R*, 2R*, 3S*)-1-(Cyclopropylmethyl)-3-hydroxy-2, 3-dimethylcyclohexanecarbonitrile (9q), **(1S*, 2R*, 3S*)-1-(Cyclopropylmethyl)-3-hydroxy-2, 3-dimethylcyclohexanecarbonitrile (13q)**, **(1R*, 2R*, 3S*)-1-(but-3-enyl)-3-hydroxy-2,3-dimethylcyclohexanecarbonitrile (9r)** **(1S*, 2R*, 3S*)-1-(But-3-enyl)-3-hydroxy-2, 3-dimethylcyclohexanecarbonitrile (13r)**. The standard procedure was employed with oxonitrile **14** (30.3 mg, 0.25 mmol) and MeMgCl (3M, 0.75 mmol), alkylating with cyclopropylmethyl iodide (137 mg, 0.75 mmol) at $-78\text{ }^\circ\text{C}$ and allowing to warm to rt overnight, to afford, after radial chromatography (stepped gradient 1:9, 1:4 EtOAc/hexanes), 12.5 mg (24%) of **9r**, 5.7 mg (11%) of **13r**, 11.4 mg (22%) of **9q** and 5.8 mg (10%) of **13q** as oils, except for **9r**. For **9q** IR (film): 3503, 3079, 2230 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): d 0.12-0.25 (m, 2H), 0.52-0.56 (m, 2H), 0.75-0.85 (m, 1H),

0.88 (s, 1H), 1.23 (s, 3H), 1.18 (d, $J = 5.9$ Hz, 3H), 1.45-1.69 (m, 6H), 1.80 (q, $J = 7.4$ Hz, 1H), 1.96 (dd, $J = 14.7, 8.8$ Hz, 1H), 2.47-2.50 (m, 1H); ^{13}C NMR (300 MHz, CDCl_3): d 3.7, 7.5, 10.6, 16.8, 30.6, 32.8, 33.4, 40.1, 42.7, 45.5, 71.3, 125.7; MS (EI) m/z 208 ($M+1$)⁺; HRMS (EI) m/z calculated for $\text{C}_{13}\text{H}_{21}\text{NO}$: 207.1617, found 207.1610. For **13q** IR (film): 3506, 2230 cm^{-1} ; ^1H NMR (500 MHz, CDCl_3): d 0.07-0.14 (m, 1H), 0.20-0.27 (m, 1H), 0.51-0.61 (m, 2H), 0.76-0.85 (m, 1H), 1.18 (d, $J = 6.8$ Hz, 3H), 1.21 (s, 3H), 1.32-1.43 (m, 4H), 1.63-1.68 (m, 2H), 1.78-1.86 (m, 2H), 1.98 (qt, $J = 3.4$ Hz, 1H), 2.30-2.34 (m, 1H); ^{13}C NMR (300 MHz, CDCl_3): d 4.2, 5.0, 6.1, 9.9, 18.7, 29.7, 35.4, 40, 41.5, 43.8, 46.0, 71.1, 123.7; MS (EI), m/z 208 ($M+1$)⁺. For **9r** as a crystalline solid (m.p. 78-80 °C) whose structure was confirmed by X-ray crystallography: IR (film) 3472, 3083, 2233, 1645 cm^{-1} ; ^1H NMR: d 1.19 (d, $J = 7.3$ Hz, 3H), 1.22 (s, 3H), 1.14 – 1.84 (m, 8H), 2.12 – 2.30 (m, 4H), 4.93 – 5.16 (m, 2H), 5.77 – 5.93 (m, 1H); ^{13}C NMR: d 10.5, 16.6, 27.8, 29.9, 30.6, 33.0, 39.9, 41.9, 45.4, 71.2, 115.1, 125.1, 137.7. For **13r** IR (film): 3489, 3078, 2230 cm^{-1} ; ^1H NMR (500 MHz, CDCl_3): d 1.21 (d, $J = 7.3$ Hz), 1.22 (s, 3H), 1.23-1.47 (m, 4H), 1.61-1.67 (m, 1H), 1.79-1.83 (m, 1H), 1.92-2.02 (m, 2H), 2.11-2.22 (m, 3H), 5.00-5.09 (m, 2H), 5.76-5.85 (m, 1H), 1.56 (s, 1H); ^{13}C NMR (300 MHz, CDCl_3): d 9.8, 18.6, 28.2, 29.7, 34.9, 38.3, 39.9, 40.6, 46.1, 71.0, 115.4, 123.2, 137.1.

PPM

FFZY137 101
DATE 18-12-3

SF 75.469
SY 75.0
Q1 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180
PW 4.0
RD 3.000
AQ .459
RG 200
NS 369
TE 297
FW 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 5.00
F1 220.033P
F2 .024P
HZ/CM 664.150
PPM/CM 8.800
SR -1394.66

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PPM

FFZY136.102
DATE 1-12-3

SF 75.475
SY 75.0
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SI 16384
TD 16384
SM 17857.143
HZ/PT 2.180
PM 4.0
RD 3.000
AQ .459
RG 200
NS 14411
TE 297
FW 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 12.00
F1 220.014P
F2 .024P
HZ/CM 664.150
PPM/CM 8.800
SR -1403.38

FFZY064.001
DATE 17-2-2

SF 300.133
SY 210.0
O1 4800.000
SI 8192
TD 8192
SW 4504.505
HZ/PT 1.100

PW 5.0
RD 2.500
AG .909
RG 4
NS 8
TE 297

FW 5700
O2 5684.205
DP 4L P0

LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 9.999P
F2 -198P
HZ/CM 122.422
PPM/CM .408
SR 3367.05

PPM

F: 001
DATE: 15-1-2

SF 75.469
SY 75.0
O1 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180

PM 4.0
RD 3.000
AG 459
RG 200
NS 80
TE 297

FW 22400
O2 4004.452
DP 20H 88

LB 0.0
GB 0.0
CX 25.00
CY 5.00
F1 220.004P
F2 -004P
HZ/CM 664.150
PPM/CM 8.800
SR -1388.12

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37.109

30.088

18.049

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10.655

FFZY101.001
DATE 24-11-2

SF 300.134
SY 210.0
O1 4900.000
SI 8192
TD 8192
SW 6024.096
HZ/Pt 1.471
PW 5.0
RD 2.500
AG .680
RG 4
NS 8
TE 297
FW 7600
O2 5684.205
DP 4L P0
LB 0.0
GB 0.0
CX 25.00
CY 12.00
F1 9.999P
F2 -198P
HZ/CM 122.423
PPM/CM .408
SR 3368.15

PPM

FFZY101.101
DATE 25-11-2

SF 75.469
SY 75.0
O1 6147.202
SI 16384
TD 16384
SM 17857.143
HZ/PT 2.180

PM 4.0
RD 3.000
AQ .459
RG 200
NS 14818
TE 297

FM 22400
O2 4004.452
DP 20H BB

LB 0.0
GB 0.0
CX 25.00
CY 7.50
F1 220.033P
F2 .024P
HZ/CM 664.150
PPM/CM 8.800
SR -1401.20

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39.728
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9.904

PPM

FFZY130.101
DATE 16-11-3

SF 75.475
SY 75.0
01 6147.202
SI 16384
TD 16384
SM 17857.143
HZ/PT 2.180
PM 4.0
RD 3.000
AQ .459
RG 200
NS 296
TE 297
FW 22400
02 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 3.00
F1 220.014P
F2 .024P
HZ/CM 664.150
PPM/CM 8.800
SR -1396.84

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10.372

FFZY036.001
DATE 15-4-1

SF	300.133
SY	210.0
O1	4800.000
S1	8192
T0	8192
SM	4504.505
HZ/PT	1.100
PM	5.0
RD	2.500
AG	.909
RG	2
NS	8
TE	297
FW	5700
O2	5684.205
DP	4L P0
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GB	0.0
CX	25.00
CY	5.00
F1	10.001P
F2	-501P
HZ/CM	126.073
PPM/CM	.420
SR	3368.85

FFZY094.001
DATE 28-8-2

SF 300.133
SY 210.0
O1 4800.000
S1 8192
TD 8192
SW 4504.505
HZ/PT 1.100
PW 5.0
RD 2.500
AG 1.909
RG 4
NS 9
TE 297
FW 5700
O2 5684.205
DP 4L P0
LB 0.0
GB 0.0
CY 25.00
F1 9.00
F2 10.001P
HZ/CM 122.466
PPM/CM 408
SR 3367.75

~~BIOK-1~~

FFZY092.001
DATE 29-8-2

SF	300.133
SY	210.0
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TD	8192
SW	4504.505
HZ/PT	1.100
PW	5.0
RD	2.500
AG	.909
RG	4
NS	11
TE	297
FW	5700
O2	5684.205
DP	4L P0
LB	0 0
GB	0 0
CX	25.00
CY	12.00
F1	10.001P
F2	-197P
HZ/CM	122.422
PPM/CM	.408
SR	3367.75

PPM

FFZY092.101
DATE 30-8-2

SF 75.469
SY 75.0
O1 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180
PW 4.0
RD 3.000
AQ 459
RG 200
NS 14081
TE 297
FW 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY .50
F1 220.004P
F2 220.004P
HZ/CM 664.150
PPM/CM 8.800
SR -1405.56

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77.217

77.573

77.434

77.006

76.895

71.165

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43.062

40.864

38.328

35.024

29.603

18.570

9.789

FFZY071.001
DATE 25-3-2

SF 300.133
SY 210.0
O1 4900.000
S1 8192
TD 8192
SM 6024.096
HZ/PT 1.471
PM 5.0
RD 2.500
AQ .680
RG 4
NS 15
TE 297
FW 7600
O2 5684.205
DP 4L P0
LB 0.0
GB 0.0
CX 25.00
CY 8.00
F1 10.001P
F2 -.196P
HZ/CM 122.423
PPM/CM 408
SR 3368.97

ppm

FFZY071.101
DATE 27-3-2

SF 75.469
SY 75.0
01 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180
PM 4.0
RD 3.000
AQ .459
RG 200
NS 13683
TE 297
FW 22400
02 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 8.00
F1 220.004P
F2 .004P
HZ/CM 664.150
PPM/CM 8.800
SR -1403.38

137.023

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128.243

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125.003

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77.004

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71.365

45.751

43.211

40.189

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32.522

30.730

16.639

10.804

FFZY072.001
DATE 25-3-2

SF 300.133
SY 210.0
O1 4900.000
SI 8192
TD 8192
SW 6024.096
HZ/PT 1.471

PW 5.0
RD 2.500
AQ .680
RG 10
NS 16
TE 297

FW 7600
O2 5684.205
DP 4L P0

LB 0.0
GB 0.0
CX 25.00
CY 8.00
F1 10.003P
F2 -.194P
HZ/CM 122.423
PPM/CM .408
SR 3367.05

PPM

FFZY072-101
DATE 30-3-2

SF 75.469
SY 75.0
O1 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180
PW 4.0
RD 3.000
AQ .459
RG 200
NS 22919
TE 297
FW 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 7.00
F1 220.033P
F2 .053P
HZ/CM 664.062
PPM/CM 8.799
SR -1403.38

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FFZY074.001
DATE 1-4-2

SF 300.135
SY 210.0
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S1 8192
TD 8192
SW 10416.667
HZ/PT 2.543

PW 5.0
RD 2.500
AQ .393
RG 10
NS 8
TE 297

FW 13100
O2 5684.205
DP 4L P0

LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 10.004P
F2 .190P
HZ/CM 122.375
BPM/CM .408
SH 3370.44

FFZY094.001
DATE: 16-12-2

SF 300.133
SY 210.0
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SI 8192
TD 8192
SW 6024.096
HZ/Pt 1.471
PW 5.0
RD 2.500
AQ .680
RG 20
NS 100
TE 297
FW 7600
O2 5684.205
DP 4L PQ
LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 10.001P
F2 -.196P
HZ/CM 122.423
PPM/CM .408
SR 3364.56

PPM

FFZY094.101
DATE 27-9-2

SF 75.469
SY 75.0
Q1 6147.202
S1 16384
TD 16384
SM 17857.143
HZ/PT 2.180
PM 4.0
RD 3.000
AQ .459
RG 200
NS 13394
TE 297
FW 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 7.50
F1 220.004P
F2 -.004P
HZ/CM 664.150
PPM/CM 8.800
SR -1396.84

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77.000
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PPM

FFZY133.102
DATE 25-11-3

SF 75.475
SI 6147.202
SI 16384
TD 16384
SM 17857.143
HZ/PT 2.180

PM 4.0
RD 3.000
AG 459
RG 200
NS 14561
TE 297

FM 22400
O2 4004.452
DP 20H BB

LB 0.0
GB 0.0
CX 25.00
CY 7.50
F1 220.014P
F2 024P
HZ/CM 664.150
PPM/CM 8.800
SR -1403.38

125.459

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22.062
21.658
19.261
13.794

PPM

PPM

CARBON.000
DATE 6-1-0

SF 75.469
SY 75.0
O1 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180
PW 4.0
RD 3.000
AQ .459
RG 200
NS 13514
TE 297
FW 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 12.00
F1 220.004P
F2 .004P
HZ/CM 664.150
PPM/CM 8.800
SR -1403.38

125.235

FROM ACETON

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FFZY098.001
DATE 2-11-2

SF 300.133
SY 210.0
O1 4900.000
SI 8192
TD 8192
SW 8928.571
HZ/PT 2.180

PM 5.0
RD 2.500
AQ .459
RG 4
NS 8
TE 297

FW 11200
O2 5684.205
DP 4L P0

LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 9.999P
F2 .198P
HZ/CM 122.419
PPM/CM .408
SR 3368.15

FFZY098.101
DATE 4-11-2

PPM
178.510

iiiia

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58.020

40.922

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PW 4.0
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AQ 459
RG 200
NS 15901
TE 297
FW 22400
O2 4004.452
DP 20H 88
LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 220.014P
F2 -4.972P
HZ/CM 679.234
PPM/CM 8.999
SR -1405.56

FFZY090.001	
DATE 27-10-2	
SE	300.134
SY	210.0
O1	4900.000
S1	8192
TD	8192
SW	6024.096
HZ/PT	1.4/1
PW	5.0
RD	2.500
AG	6.880
RG	2
NS	297
TE	9
FW	7600
O2	5684.205
DP	4L P0
LB	0.0
BB	0.0
CX	25.00
CY	10.00
F1	9.999P
F2	-198P
HZ/CM	122.423
PW/CM	408
SR	3368.15

FFZY090.101
DATE 27-10-2

PPM
181.224

SF 75.475
SY 75.0
O1 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180
PM 4.0
RD 3.000
AQ .459
RG 200
NS 16765
TE 297
FM 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 220.014P
F2 -5.001P
HZ/CM 679.321
PPM/CM 9.001
SR -1405.56

iiib

85.929

77.425

78.993

78.565

59.717

56.055

46.979

36.012

26.183

21.518

19.806

11.030

10.595

1.240

4.085

PPM

FFZY144.101
DATE 2-4-4

SF 75.475
SY 75.0
01 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180

PW 4.0
RD 3.000
AQ .459
RG 200
NS 14603
TE 297

FW 22400
02 4004.452
DP 20H BB

LB 0.0
GB 0.0
CX 25.00
CY 7.00
F1 220.014P
F2 .024P
HZ/CM 664.150
BPM/CM 8.800
SR -1405.56

125.399

80.198
77.627
77.426
77.227
77.161
76.994
76.758
76.568
76.566
76.283
76.508

48.671
47.466

39.927
37.803
35.091
31.447
29.749

18.550
15.475
11.462

PPM

FFZY143.102
DATE 24-3-4

SF	75.469
SY	75.0
O1	6147.202
S1	16384
T0	16384
SW	17857.143
HZ/PT	2.180
PM	4.0
RD	3.000
AG	.459
RG	200
NS	14096
TE	297
FW	22400
O2	4004.452
DP	20H BB
LB	0.0
GB	0.0
CX	25.00
CY	4.00
F1	220.033P
F2	.024P
HZ/CM	664.150
PPM/CM	8.800
SR	-1403.38

122.866

80.033
77.432
77.003
76.593
71.715

49.012

41.618
39.913
36.447
33.210
29.399
28.995

18.481
15.247
10.653

FFZY066.001
DATE 8-3-2

SF 300.133
SY 210.0
O1 4800.000
SI 8192
TD 8192
SW 4504.505
HZ/PT 1.100

PW 5.0
RD 2.500
AG 2.509
RG 20
NS 8
TE 297

FW 5700
O2 5684.205
DP 4L PD

LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 9.999P
F2 1.98P
HZ/CM 122.422
PPM/CM 7.408
SR 3367.05

FFZY086.001
DATE 16-6-2

SF 300.133
SY 210.0
Q1 4800.000
SI 8192
TD 8192
SN 4504.505
HZ/PT 1.100
PW 5.0
RD 2.500
AQ 2.509
RG 20
NS 8
TE 297
FM 5700
O2 5684.205
DP 4L P0
LB 0.0
GB 0.0
CX 25.00
CY 10.00
F1 9.999P
F2 -198P
HZ/CM 122.422
PPM/CM .408
SR 3363.75

PPM

FFZY138.101
DATE 4-2-4

SF 75.475
SY 75.0
O1 6147.202
SI 16384
TD 16384
SW 17857.143
HZ/PT 2.180
PM 4.0
RD 3.000
AG .459
RG 200
NS 233
TE 297
FW 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 4.00
F1 220.014P
F2 .024P
HZ/CM 664.150
PPM/CM 8.800
SR -1390.30

122.656

77.420
76.882
76.581
69.571

42.413
39.106

29.817
28.530

20.040

12.977

PPM

FFGW0128.125
DATE 6-1-0

B-1
1-0

Sf	75.469
Sy	75.0
O1	6147.202
S1	16384
T0	16384
SW	17857.143
HZ/PT	2.180

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69	02	43	00
59	59	59	59

461	207	141	0	451
207	141	0	451	451

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5.4
7.7
4.4
7.7
2.2
4.0
3.0
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3.3
0.0
4.4

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75	0	147	384	384	357	2	4	3	200	569	297	100	100	0	0	0
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F	Z/H
Y	W
Y	D
I	I
1	1
1	1
G	G
S	S
E	E
W	W
D	D
D	D
B	B
X	X
Y	Y
1	1
1	1
Z/C	Z/C
M//	M//
q	q

SF
 SSY
 D1
 SI
 TD
 SW
 HZ/
 MW
 RD
 AG
 RG
 NS
 TE
 -W
 D2
 DP
 B
 SB
 X
 Y
 1
 2
 HZ/
 PM
 SR

77.432
77.001
76.592
71.138

77.001

$$\begin{array}{r} 76.592 \\ 71.138 \end{array}$$

45.980

$$\begin{array}{r} 43.785 \\ 41.531 \end{array}$$

40.001

35.358

29.651

19.60%

18.691

0.006

6.061

$$\begin{array}{r} 5.022 \\ - 4.185 \\ \hline \end{array}$$

PPM

FFZY134.101
DATE 27-11-3

SF	75.475
SY	75.0
O1	6147.202
S1	16384
TD	16384
SM	17857.143
HZ/PT	2.180
PM	4.0
RD	3.000
AG	.459
RG	200
NS	15768
TE	297
FW	22400
O2	4004.452
DP	20H BB
LB	0.0
GB	0.0
CX	25.00
CY	7.50
F1	220.014P
F2	.024P
HZ/CM	664.150
PPM/CM	8.800
SR	-1401.20

137.691

125.083

115.059

77.399
76.990
76.560
71.18745.436
41.904
39.88133.006
30.554
29.911
27.758

16.637

10.484

9r

FFGWD129.115
DATE 25-2-0

SF 75.469
SY 75.0
O1 6147.202
SI 16384
TO 16384
SM 17857.143
H2/P1 2.180
PW 4.0
RO 3.000
AQ 459
RG 200
NS 23196
TE 297
FM 22400
O2 4004.452
DP 20H BB
LB 0.0
GB 0.0
CX 25.00
CY 0.0
F1 220.033P
F2 0224P
HZ/CW 664.150
PPM/CW 8.800
SR -1403.38