Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supplementary Information

for

Asymmetric Boron Conjugate Addition to α,β-Unsaturated Carbonyl Compounds Catalyzed by CuOTf/Josiphos under Non-Alkaline Condition

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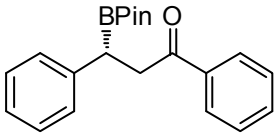
General Information

All commercially available chemicals including solvents, unless otherwise mentioned, were used without purification. DCM was distilled from CaH_2. Toluene and THF were distilled from Na/benzophenone. MeOH, EtOH, ^{i}PrOH and ^{t}BuOH were dried by 4Å Molecular Sieves. B_2Pin_2 was purchased from Frontier Scientific. $(CuOTf)_2$.Benzene was purchased from Alfa Asear. The Josiphos ligands were purchased from Strem Chemicals Inc. HPLC analyses were performed using a Waters Delta 600 instrument with a Waters 2996 PDA detector. All the glasswares used were dried overnight at 110 ^{o}C. The NMR spectra were recorded at 400, 100, and 162 MHz for ^{1}H, ^{13}C, and ^{31}P, respectively with a JEOL ECS 400 MHz Spectrometer. Optical rotations were determined using an Autopol® IV automatic polarimeter.

General procedure for asymmetric boron conjugate addition

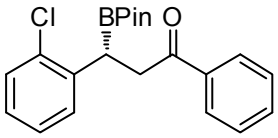
To a dry and clean 10 mL schlenk tube was added $(CuOTf)_2$.Benzene (1.2 mg, 2.4×10^{-3} mmol, 2.5 mol%) and chiral ligand (5.8×10^{-3} mmol, 6.0 mol%). Then replace the atmosphere by Argon for three times. Toluene (2.0 mL) was added and the mixture was stirred for 24 hrs. Then the α,β-unsaturated carbonyl compound and B_2Pin_2 in 0.5 mL toluene was added by syringe, followed by addition of MeOH (100 μL). The reaction was stirred vigorously for 48 hrs. The reaction mixture was concentrated in vacuum and analyzed with ^{1}H NMR. The crude product was purified by flash column chromatography eluted by ethyl acetate / hexanes (v/v = 1/10 to 1/15). The product obtained was checked by HPLC analysis.

(*R*)-1,3-Diphenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2a**)



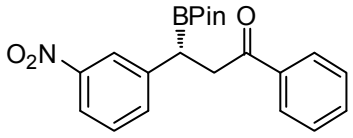
90% yield, 91% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.16 (CH_3, s, 6H), 1.24 (CH_3, s, 6H), 2.79 (CH, dd, *J* = 5.0 Hz, *J* = 10.6 Hz, 1H), 3.42 (CH_2, dd, *J* = 5.0 Hz, *J* = 18.3 Hz, 1H), 3.55 (CH_2, dd, *J* = 10.6 Hz, *J* = 18.3 Hz, 1H), 7.15–7.54 (Ar-H, m, 8H), 7.95 (Ar-H, d, *J* = 7.8 Hz, 2H). $[\alpha]_D^{25}$ –17.2 (*c* 0.50, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 15.5 min (minor); tR = 22.8 min (major).

(*R*)-3-(2-Chlorophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2b**)



24% yield, 93% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.22 (CH_3, s, 6H), 1.27 (CH_3, s, 6H), 3.27–3.32 (CH, m, 1H), 3.45–3.48 (CH_2, m, 2H), 7.06–7.55 (Ar-H, m, 7H), 7.94 (Ar-H, d, *J* = 7.3 Hz, 2H). $[\alpha]_D^{25}$ +17.5 (*c* 0.20, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 12.8 min (minor); tR = 14.6 min (major).

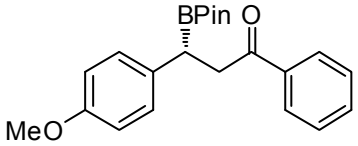
3-(3-Nitrophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2c**)



95% yield, 95% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.17 (CH_3, s, 6H), 1.23 (CH_3, s, 6H), 2.92 (CH, dd, *J* = 5.5 Hz,

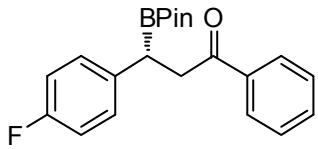
J = 9.6 Hz, 1H), 3.47 (CH_2, dd, *J* = 5.5 Hz, *J* = 12.4 Hz, 1H), 3.57 (CH_2, dd, *J* = 9.6 Hz, *J* = 12.4 Hz, 1H), 7.40–7.66 (Ar-H, m, 4H), 7.96–8.04 (Ar-H, m, 3H), 8.19 (Ar-H, t, *J* = 1.8 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.6, 42.6, 83.9, 120.9, 123.2, 128.2, 128.7, 129.3, 133.3, 135.1, 136.5, 144.4, 148.5, 199.0. HRMS (ESI) m/z calcd for $C_{21}H_{25}BNO_5$ ($[M + H]^+$): 382.1820; found: 382.1817. $[\alpha]_D^{25}$ +3.4 (*c* 0.90, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (90:10); flow rate = 1.0 mL/min; tR = 17.8 min (minor); tR = 23.1 min (major).

(*R*)-3-(4-Methoxyphenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2d**)



89% yield, 93% ee. ^1H NMR (400 MHz, $CDCl_3$) δ 1.16 (CH_3, s, 6H), 1.23 (CH_3, s, 6H), 2.73 (CH, dd, *J* = 5.0 Hz, *J* = 11.0 Hz, 1H), 3.37 (CH_2, dd, *J* = 5.0 Hz, *J* = 18.3 Hz, 1H), 3.49 (CH_2, dd, *J* = 11.0 Hz, *J* = 18.3 Hz, 1H), 3.77 (OMe, s, 3H), 6.80–7.95 (Ar-H, m, 9H). $[\alpha]_D^{25}$ –21.5 (*c* 1.00, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 24.8 min (minor); tR = 38.9 min (major).

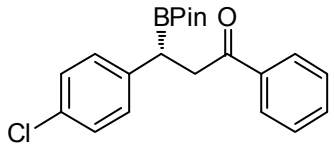
3-(4-Fluorophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2e**)



96% yield, 95% ee. ^1H NMR (400 MHz, $CDCl_3$) δ 1.15

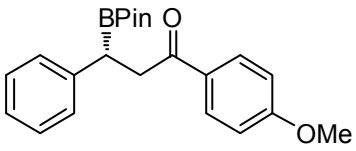
(CH_3, s, 6H), 1.22 (CH_3, s, 6H), 2.76 (CH, dd, J = 5.0 Hz, J = 10.5 Hz, 1H), 3.38 (CH_2, dd, J = 5.0 Hz, J = 17.9 Hz, 1H), 3.49 (CH_2, dd, J = 10.5 Hz, J = 17.9 Hz, 1H), 6.92–7.55 (Ar-H, m, 7H), 7.94 (ArH, d, J = 7.3 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.6, 24.6, 43.4, 83.5, 115.2, 115.4, 128.1, 128.6, 129.7, 129.8, 133.1, 136.8, 137.6, 137.6, 160.0, 162.5, 199.6. HRMS (ESI) m/z calcd for $C_{21}H_{25}BFO_3$ ($[M + H]^+$): 355.1875; found: 355.1872. $[\alpha]_D^{25}$ –15.1 (*c* 0.90, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 17.0 min (minor); tR = 24.6 min (major).

(*R*)-3-(4-Chlorophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2f**)



98% yield, 95% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.16 (CH_3, s, 6H), 1.23 (CH_3, s, 6H), 2.77 (CH, dd, J = 5.5 Hz, J = 10.6 Hz, 1H), 3.42 (CH_2, dd, J = 5.5 Hz, J = 18.4 Hz, 1H), 3.50 (CH_2, dd, J = 10.6 Hz, J = 18.4 Hz, 1H), 7.13–7.56 (Ar-H, m, 7H), 7.95 (ArH, d, J = 7.3 Hz, 1H). $[\alpha]_D^{25}$ –30.5 (*c* 1.00, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 18.4 min (minor); tR = 27.9 min (major).

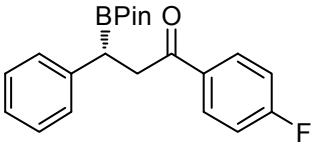
(*R*)-1-(4-Methoxyphenyl)-3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2g**)



98% yield, 90% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.15

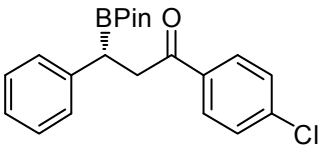
(CH_3, s, 6H), 1.24 (CH_3, s, 6H), 2.76 (CH, dd, J = 5.5 Hz, J = 11.0 Hz, 1H), 3.37 (CH_2, dd, J = 5.5 Hz, J = 18.3 Hz, 1H), 3.48 (CH_2, dd, J = 11.0 Hz, J = 18.3 Hz, 1H), 3.84 (OMe, s, 3H), 6.89 (Ar-H, d, J = 9.2 Hz, 2H), 7.12–7.30 (Ar-H, m, 5H), 7.93–7.56 (Ar-H, d, J = 9.2 Hz, 2H). $[\alpha]_D^{25}$ –12.5 (*c* 1.00, $CHCl_3$).The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 34.3 min (minor); tR = 50.8 min (major).

(*R*)-1-(4-Fluorophenyl)-3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2h**)



96% yield, 95% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.15 (CH_3, s, 6H), 1.23 (CH_3, s, 6H), 2.78 (CH, dd, J = 5.0 Hz, J = 11.0 Hz, 1H), 3.37 (CH_2, dd, J = 5.0 Hz, J = 18.3 Hz, 1H), 3.51 (CH_2, dd, J = 11.0 Hz, J = 18.3 Hz, 1H), 7.08–7.99 (Ar-H, m, 9H). $[\alpha]_D^{25}$ –23.4 (*c* 1.00, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 16.5 min (minor); tR = 22.6 min (major).

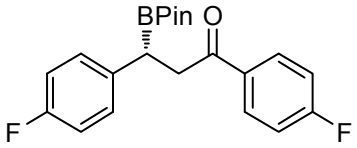
1-(4-Chlorophenyl)-3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2i**)



86% yield, 92% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.16 (CH_3, s, 6H), 1.25 (CH_3, s, 6H), 2.79 (CH, dd, J = 5.0 Hz, J = 10.7 Hz, 1H), 3.36 (CH_2, dd, J = 5.0 Hz, J = 18.3 Hz, 1H), 3.51 (CH_2, dd, J = 10.7

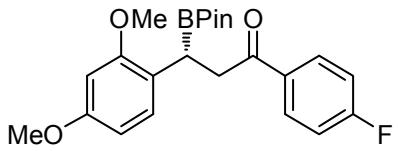
Hz, J = 18.3 Hz, 1H), 7.13–7.41 (Ar-H, m, 7H), 7.89 (Ar-H, d, J = 8.2 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.6, 24.6, 43.3, 83.5, 125.8, 128.4, 128.6, 128.9, 129.6, 135.2, 139.4, 141.8, 198.6. HRMS (ESI) m/z calcd for $C_{21}H_{25}BClO_3$ ($[M + H]^+$): 371.1580; found: 371.1577. $[\alpha]_D^{25}$ –15.0 (*c* 0.60, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 18.0 min (minor); tR = 27.5 min (major).

1,3-Bis(4-fluorophenyl)-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2j**)



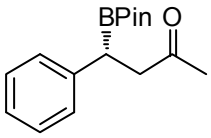
95% yield, 94% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.15 (CH_3, s, 6H), 1.22 (CH_3, s, 6H), 2.75 (CH, dd, J = 5.0 Hz, J = 10.5 Hz, 1H), 3.34 (CH_2, dd, J = 5.0 Hz, J = 17.9 Hz, 1H), 3.45 (CH_2, dd, J = 10.5 Hz, J = 17.9 Hz, 1H), 6.92–7.25 (Ar-H, m, 6H), 7.94–7.98 (Ar-H, m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.6, 24.6, 43.2, 83.6, 115.2, 115.5, 115.6, 115.8, 129.7, 129.8, 130.7, 130.8, 133.2, 133.2, 137.5, 137.5, 160.0, 162.5, 164.5, 167.1, 198.0. HRMS (ESI) m/z calcd for $C_{21}H_{24}BF_2O_3$ ($[M + H]^+$): 373.1781; found: 373.1777. $[\alpha]_D^{25}$ –16.3 (*c* 0.60, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 19.5 min (minor); tR = 22.3 min (major).

3-(2,4-Dimethoxyphenyl)-1-(4-fluorophenyl)-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2k**)



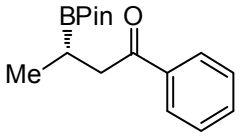
50% yield, 82% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.18 (CH_3, s, 6H), 1.24 (CH_3, s, 6H), 2.99 (CH, dd, *J* = 6.4 Hz, *J* = 8.2 Hz, 1H), 3.22 (CH_2, dd, *J* = 6.4 Hz, *J* = 17.9 Hz, 1H), 3.37 (CH_2, dd, *J* = 8.2 Hz, *J* = 17.9 Hz, 1H), 3.74 (OCH_3, s, 3H), 3.75 (OCH_3, s, 3H), 6.36–6.39 (Ar-H, m, 2H), 7.02–7.16 (Ar-H, m, 3H), 7.90–7.94 (Ar-H, m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.7, 24.9, 41.5, 55.2, 55.3, 83.3, 115.3, 115.5, 123.1, 130.6, 130.7, 130.8, 133.8, 158.0, 159.1, 164.3, 166.8, 198.7. HRMS (ESI) m/z calcd for $C_{23}H_{29}BFO_5$ ($[M + H]^+$): 415.2087; found: 415.2079. $[\alpha]_D^{25}$ –30.9 (*c* 0.75, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak OD-H column: eluent, hexanes/^{i}PrOH (90:10); flow rate = 1.0 mL/min; tR = 11.9 min (major); tR = 14.7 min (minor).

(*R*)-4-Phenyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)butan-2-one (**2l**)



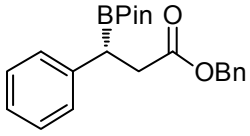
76% yield, 72% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.14 (CH_3, s, 6H), 1.21 (CH_3, s, 6H), 2.12 (CH_3, s, 3H), 2.62 (CH, dd, *J* = 5.5 Hz, *J* = 10.5 Hz, 1H), 2.82 (CH, dd, *J* = 5.5 Hz, *J* = 18.3 Hz, 1H), 3.02 (CH, dd, *J* = 10.5 Hz, *J* = 18.3 Hz, 1H), 7.10–7.25 (Ar-H, m, 5H). $[\alpha]_D^{25}$ –8.8 (*c* 0.50, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 0.5 mL/min; tR = 27.7 min (minor); tR = 28.9 min (major).

(*S*)-1-Phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)butan-1-one (**2m**)



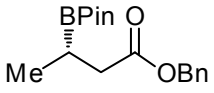
95% yield, 96% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.04 (CH_3, d, J = 7.8 Hz, 3H), 1.23 (CH_3, s, 6H), 1.24 (CH_3, s, 6H), 1.39–1.48 (CH, m, 1H), 3.10 (CH_2, d, J = 6.8 Hz, 2H), 7.42 (Ar-H, t, J = 7.8 Hz, 2H), 7.52 (Ar-H, t, J = 6.9 Hz, 1H), 7.94 (Ar-H, d, J = 7.4 Hz, 2H). $[\alpha]_D^{25}$ +25.1 (c 0.75, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 11.2 min (minor); tR = 14.8 min (major).

(*R*)-Benzyl 3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propanoate (**2n**)



62% yield, 84% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.04 (CH_3, s, 6H), 1.10 (CH_3, s, 6H), 2.60–2.70 (CH, CH_2, m, 2H), 2.86 (CH_2, dd, J = 9.2 Hz, J = 15.6 Hz, 1H), 5.00 (CH_2, d, d, J = 12.4 Hz, 2H), 7.02–7.25 (Ar-H, m, 10H). $[\alpha]_D^{25}$ –19.6 (c 0.50, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 16.8 min (minor); tR = 18.0 min (major).

(*S*)-Benzyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)butanoate (**2o**)

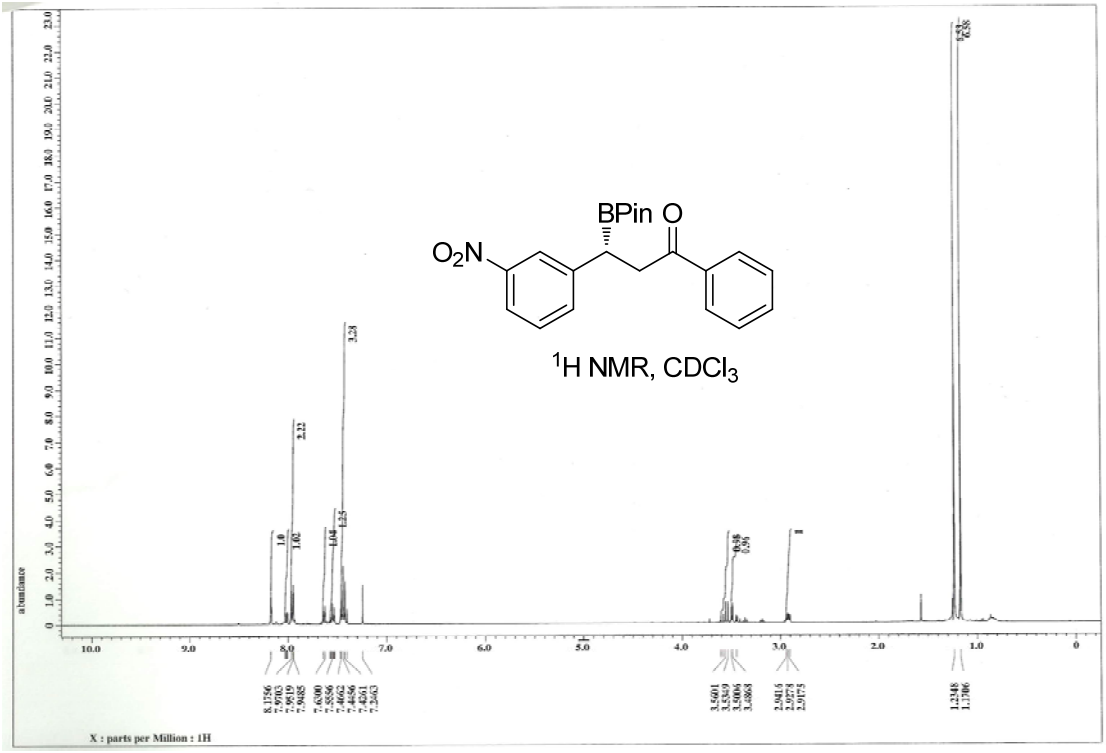


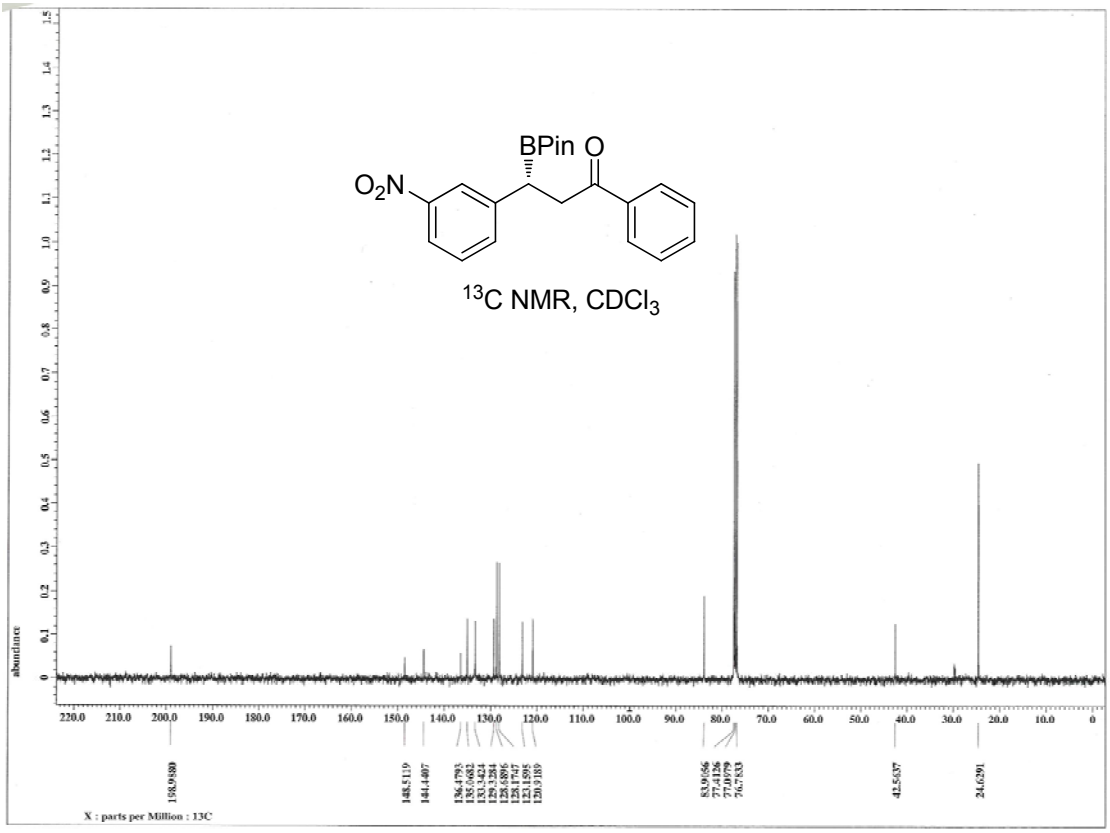
96% yield, 88% ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.99 (CH_3, d, J = 7.3 Hz, 3H), 1.19 (CH_3, s, 6H), 1.20 (CH_3, s, 6H), 1.35–1.44 (CH, m, 1H), 2.41 (CH_2, dd, J = 6.9 Hz, J = 16.5 Hz, 1H), 2.49 (CH_2, dd, J = 7.8 Hz, J = 16.5 Hz, 1H), 5.09 (CH_2, d, d, J = 12.5 Hz, 2H), 7.28–7.36 (Ar-H, m, 5H). $[\alpha]_D^{25}$ +7.6 (c 1.00, $CHCl_3$). The enantiomeric excess was determined by HPLC with a Chiralpak

AD column: eluent, hexanes/^{i}PrOH (98:2); flow rate = 1.0 mL/min; tR = 10.4 min (minor); tR = 11.0 min (major).

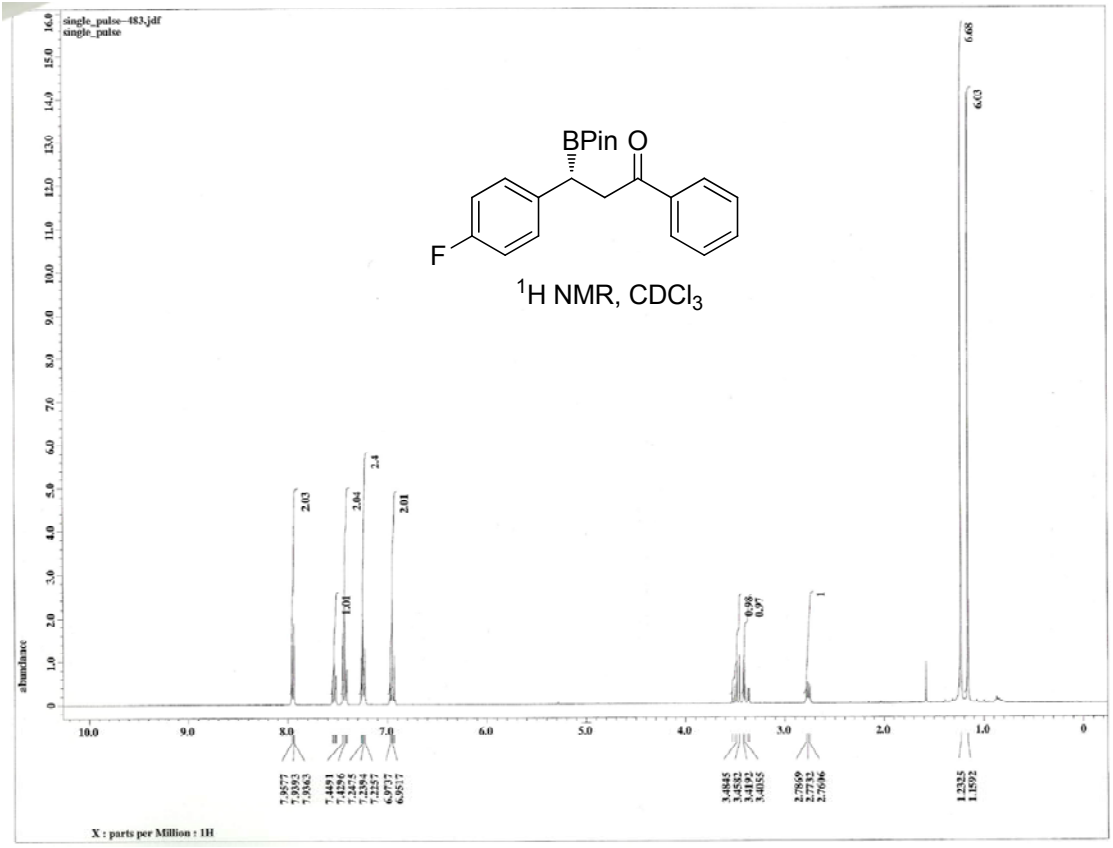
NMR spectra of new compounds

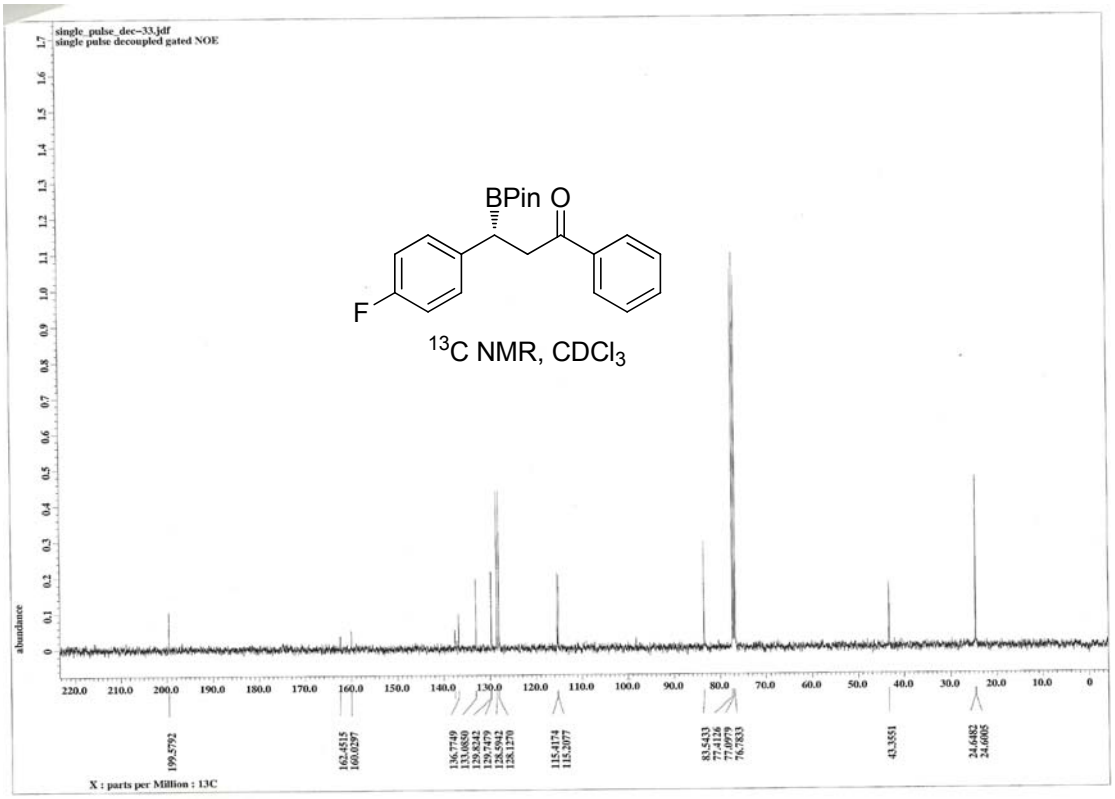
3-(3-Nitrophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2c**)



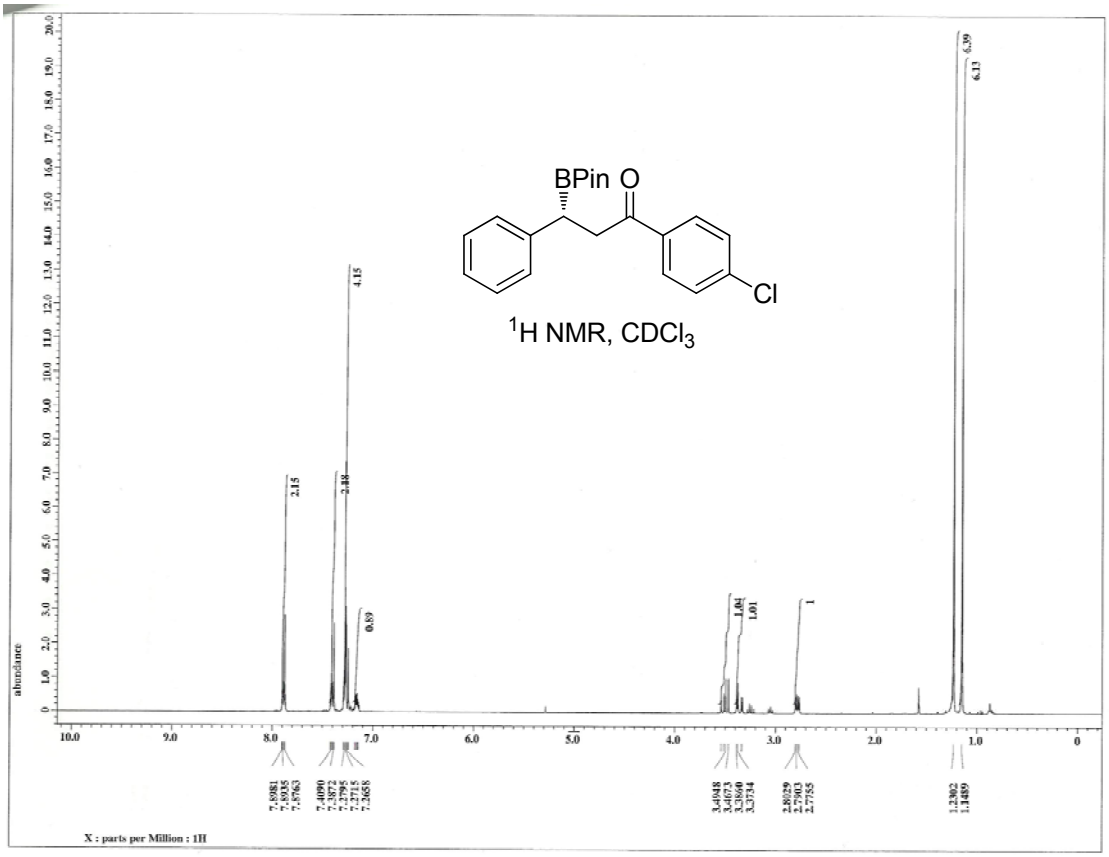


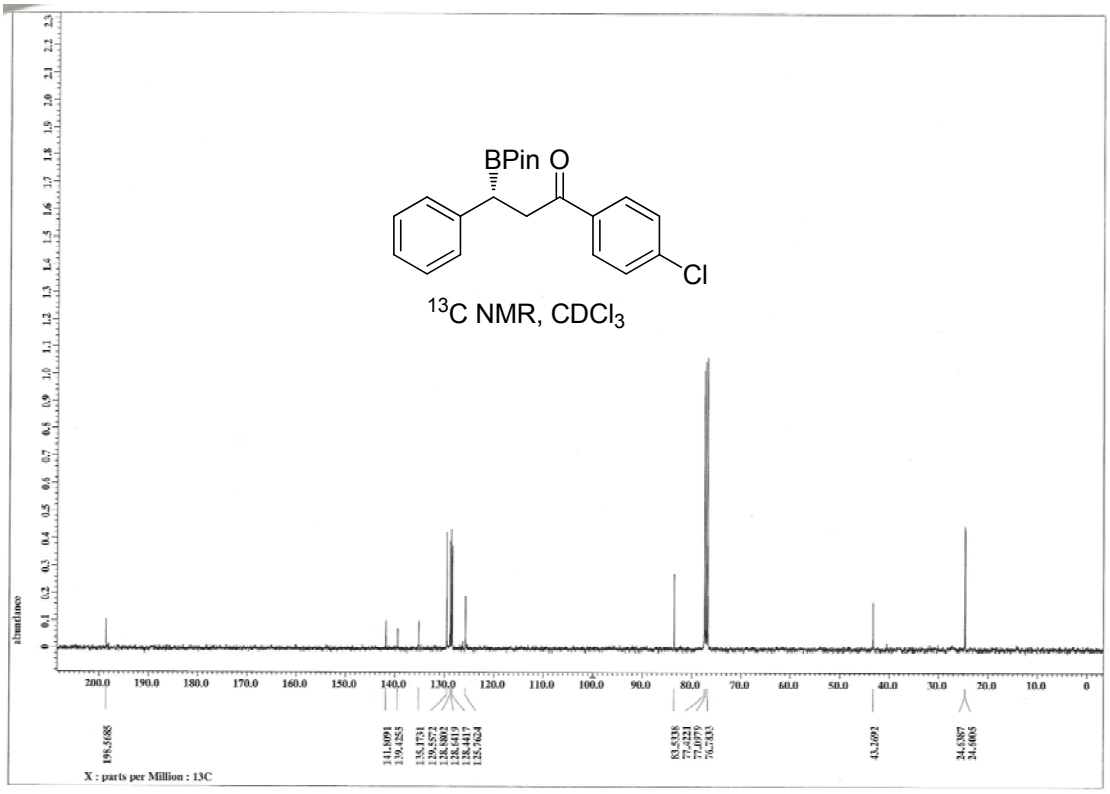
3-(4-Fluorophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2e**)



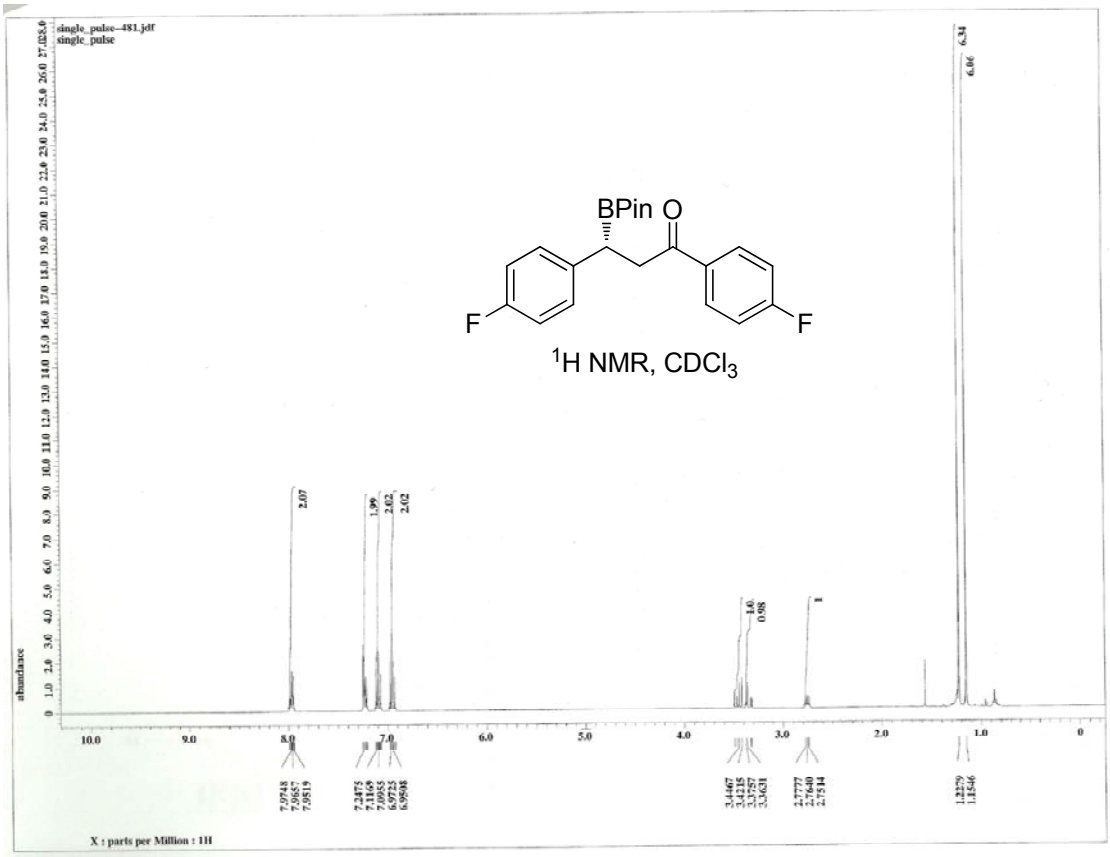


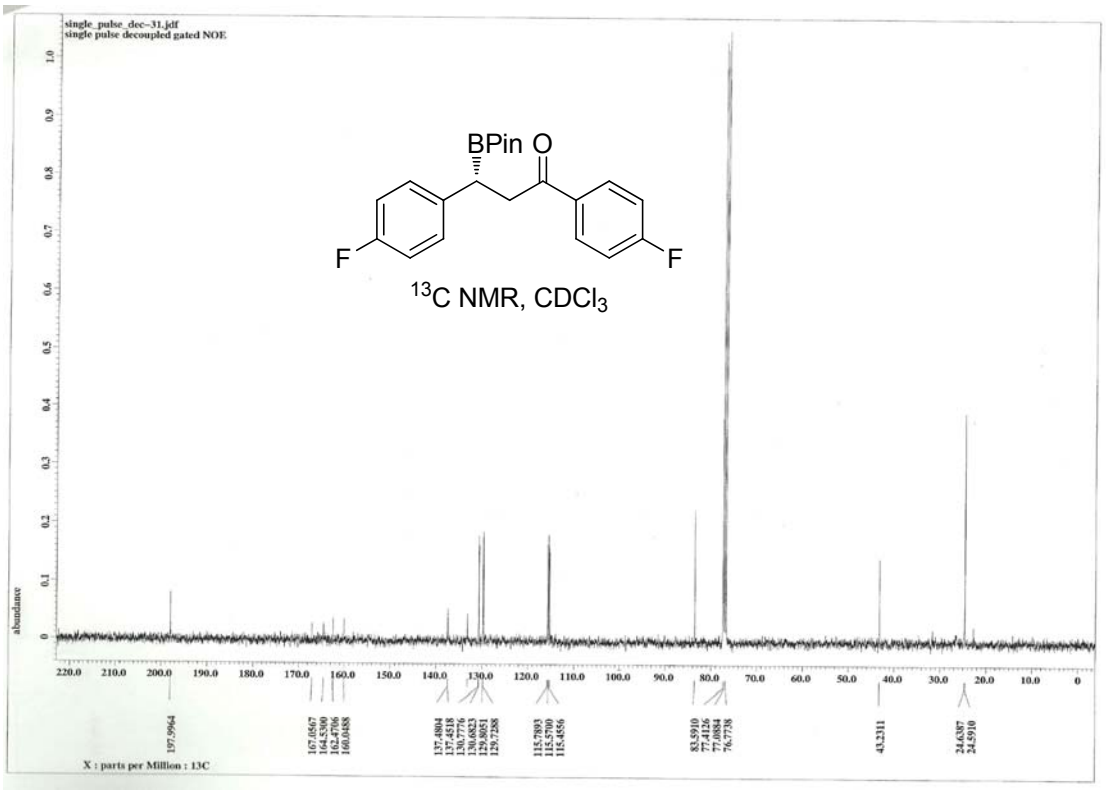
1-(4-Chlorophenyl)-3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2i**)



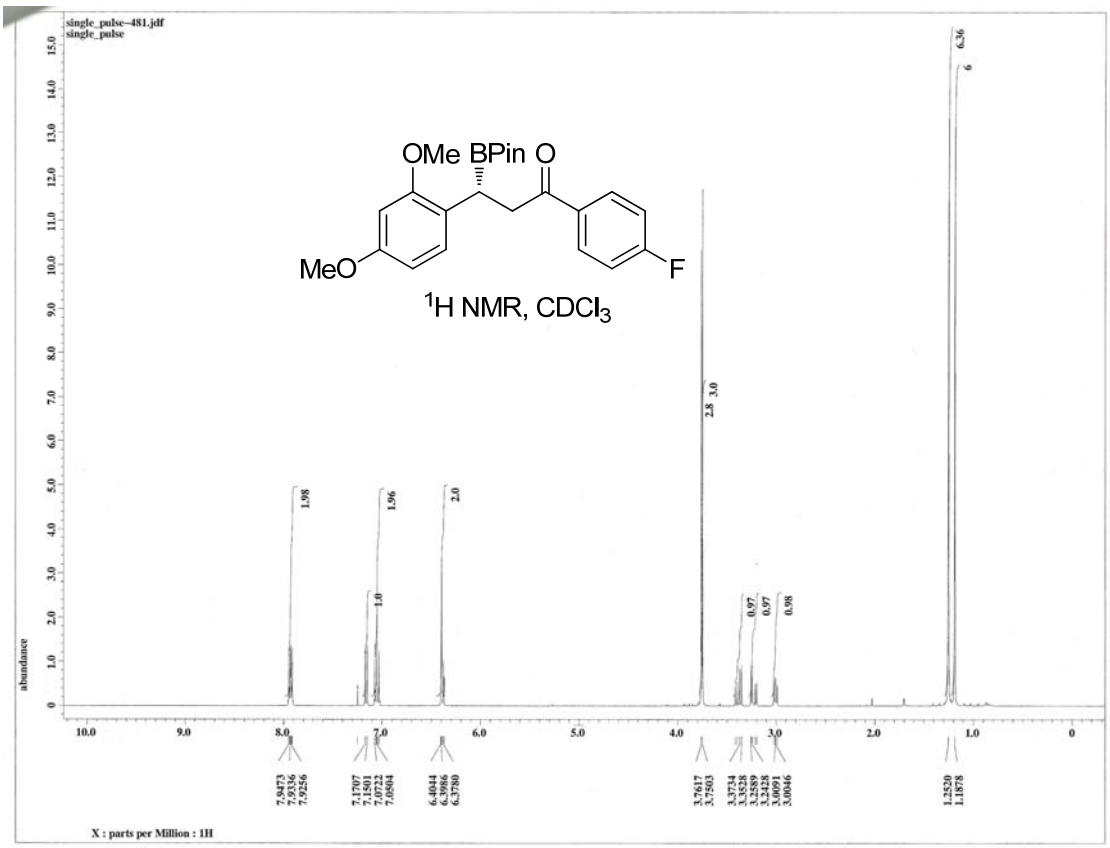


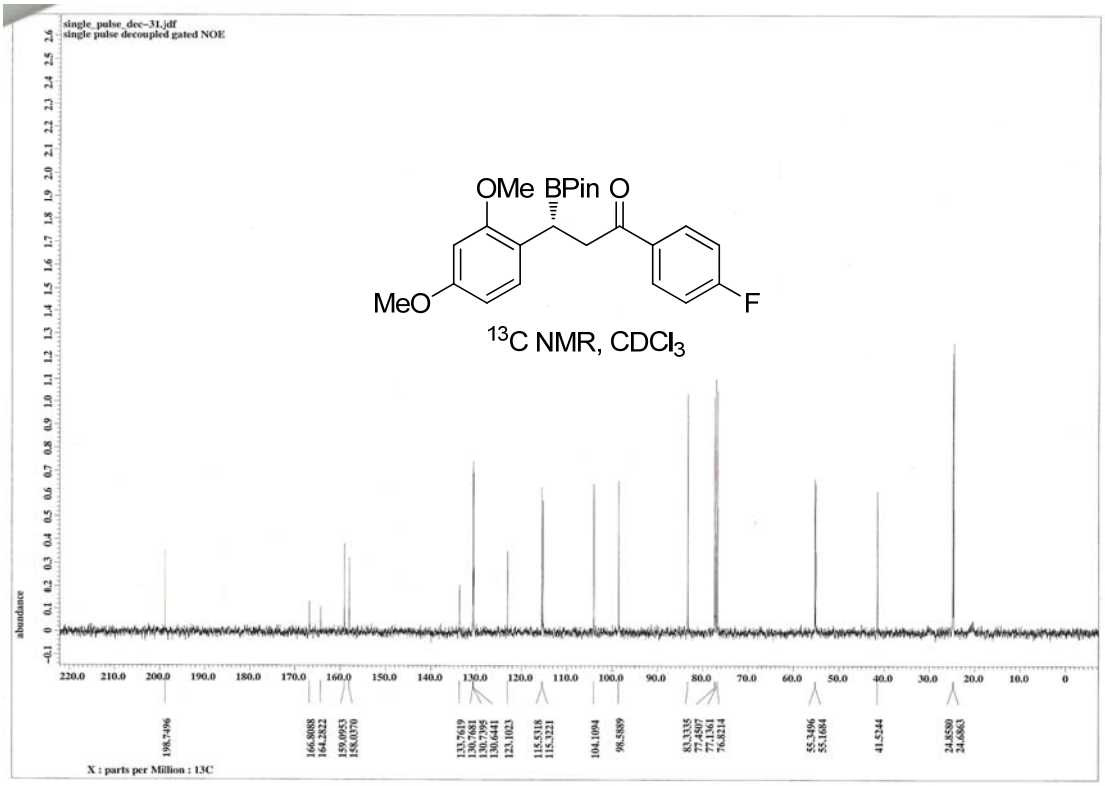
1,3-Bis(4-fluorophenyl)-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2j**)





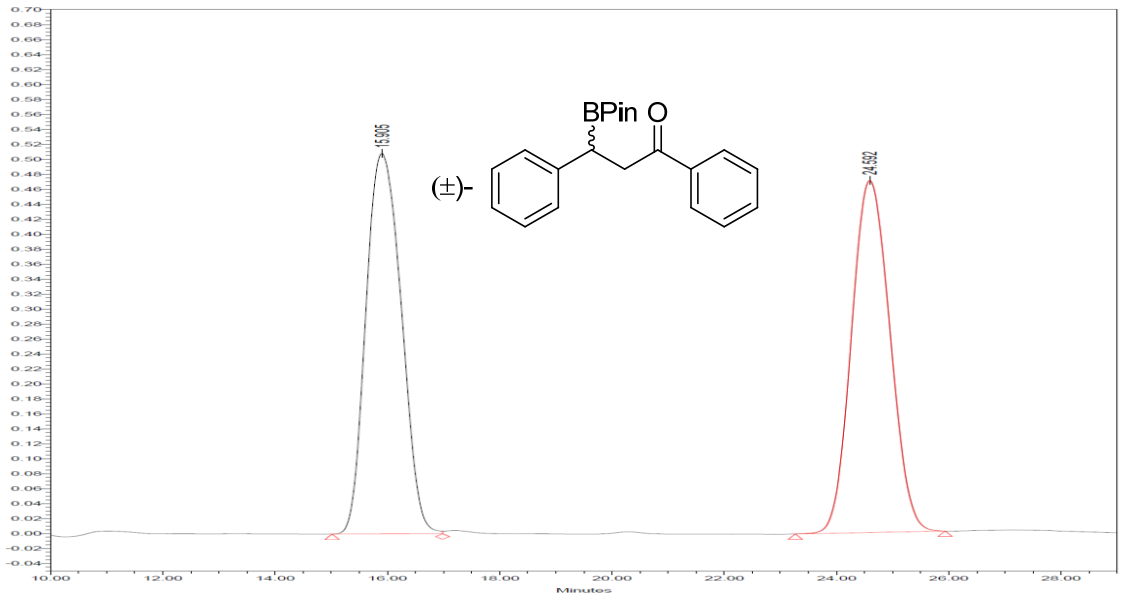
3-(2,4-Dimethoxyphenyl)-1-(4-fluorophenyl)-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2k**)



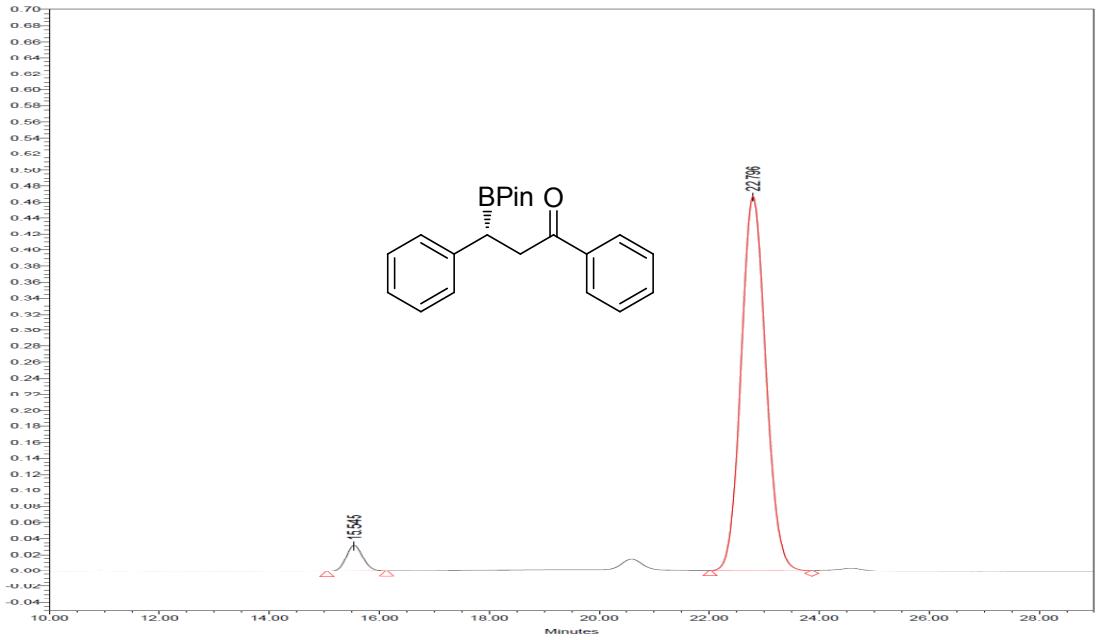


HPLC charts for products

(*R*)-1,3-Diphenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2a**)

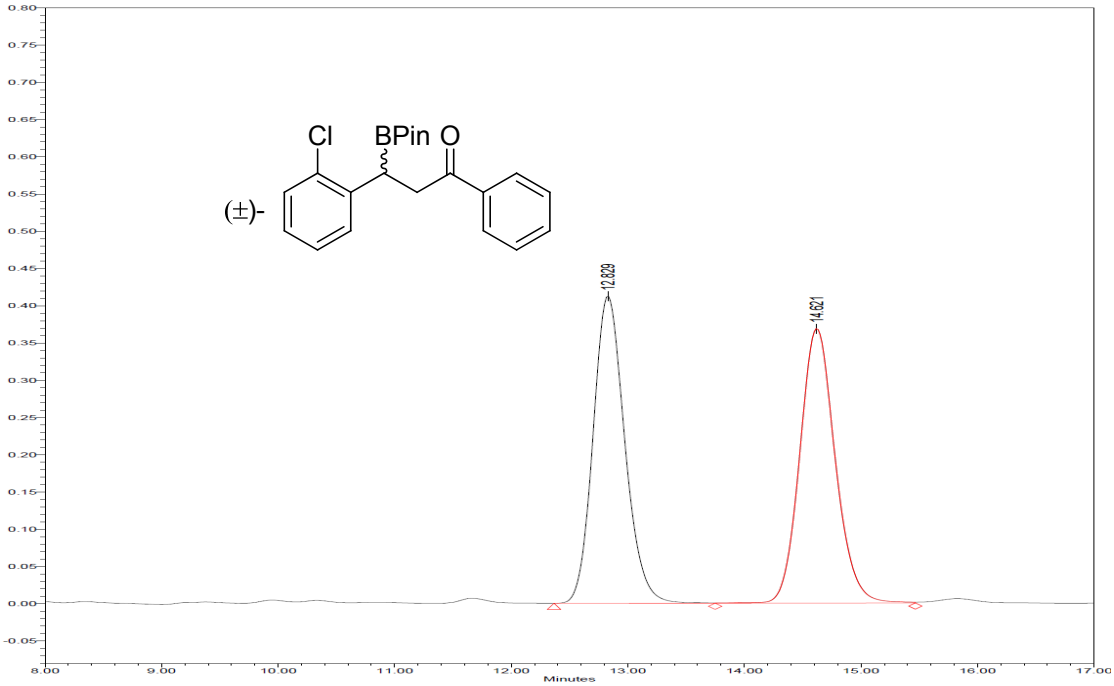


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		15.905	22259391	49.88	508688	BV
2		24.592	22370077	50.12	470366	BB

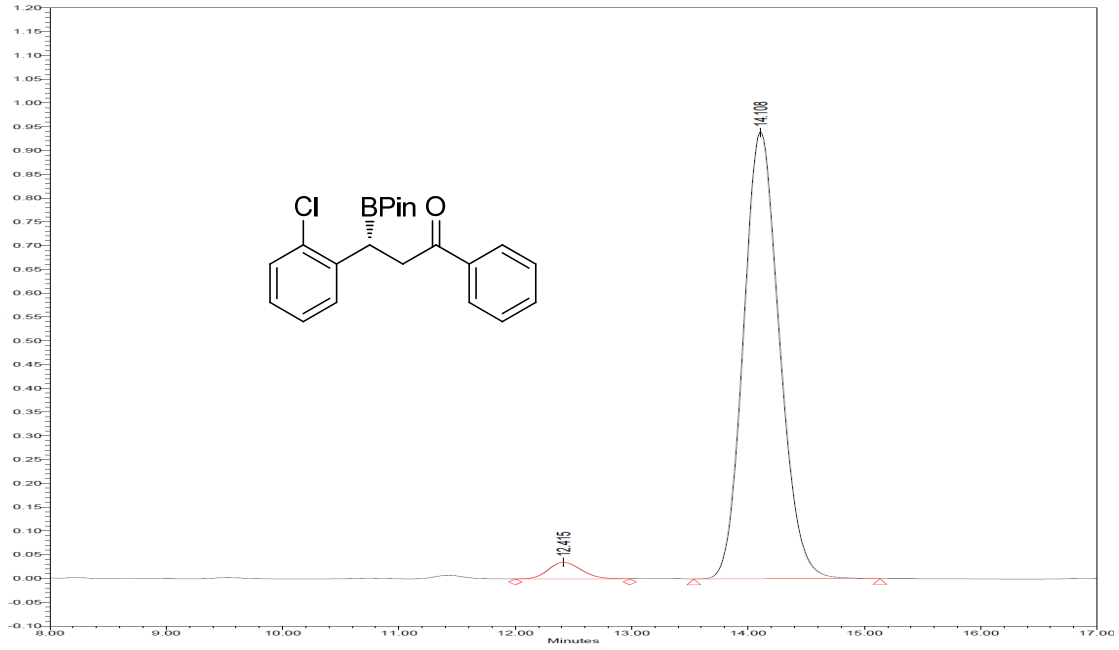


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		15.545	667939	4.38	31281	BB
2		22.796	14585768	95.62	466899	BV

(*R*)-3-(2-Chlorophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2b**)

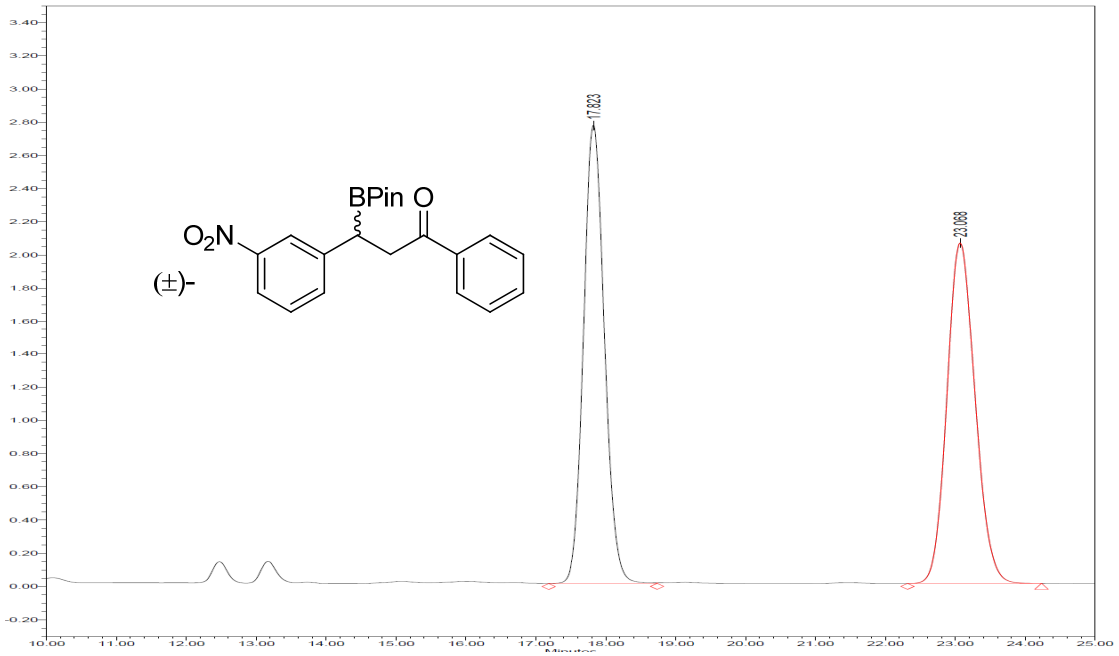


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		12.829	7789530	50.06	412742	BV
2		14.621	7770905	49.94	368748	VV

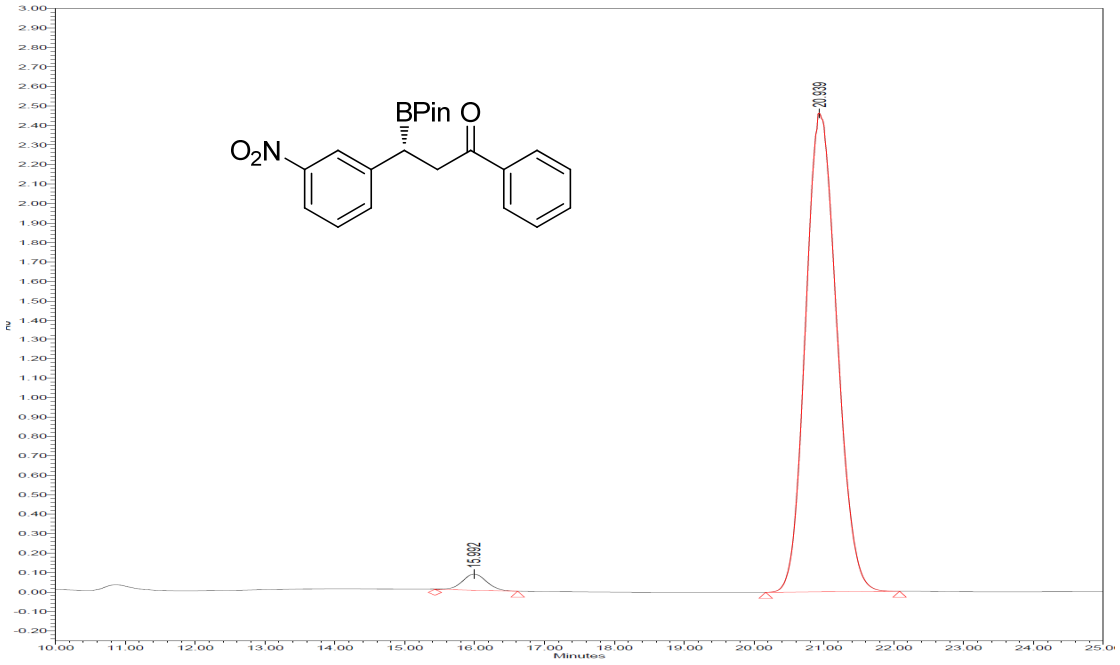


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		12.415	690002	3.31	34881	VV
2		14.108	20184812	96.69	940200	BB

3-(3-Nitrophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2c**)

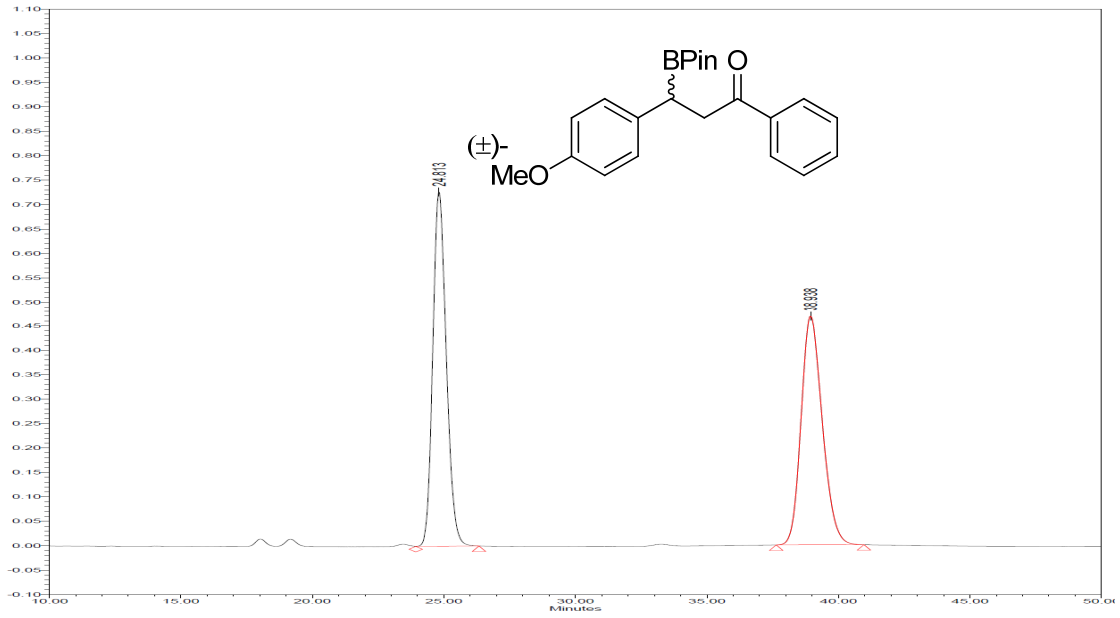


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		17.823	57450206	50.00	2765404	VV
2		23.068	57459979	50.00	2053697	VB

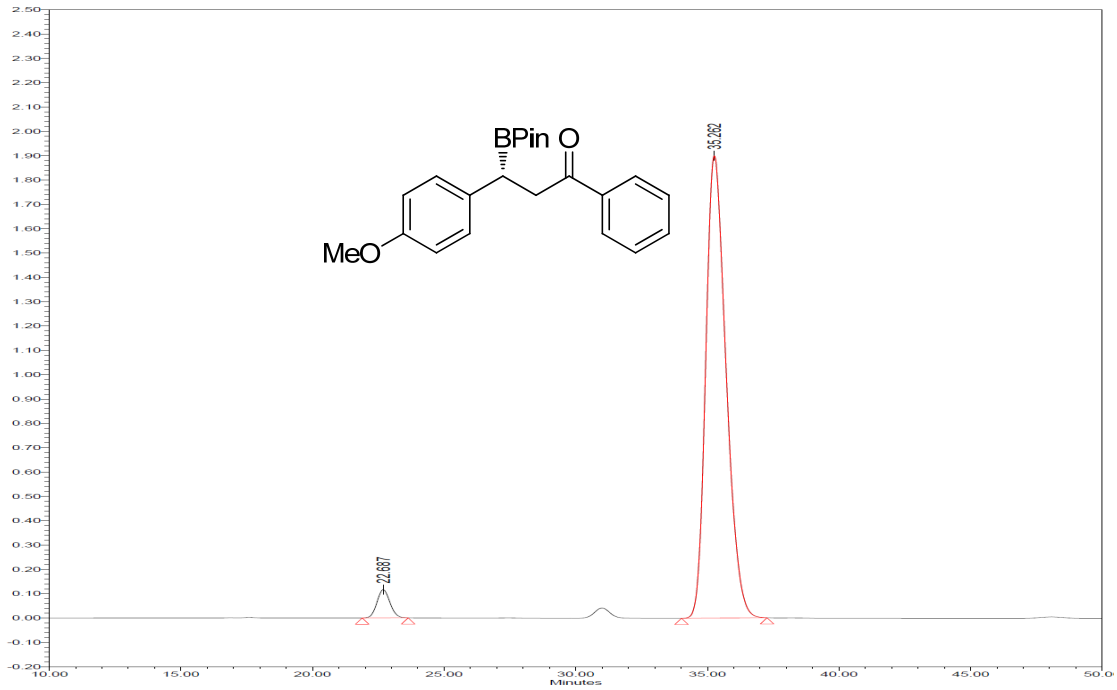


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		15.992	2012401	2.55	82781	VB
2		20.939	76924745	97.45	2469924	BB

(*R*)-3-(4-Methoxyphenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2d**)

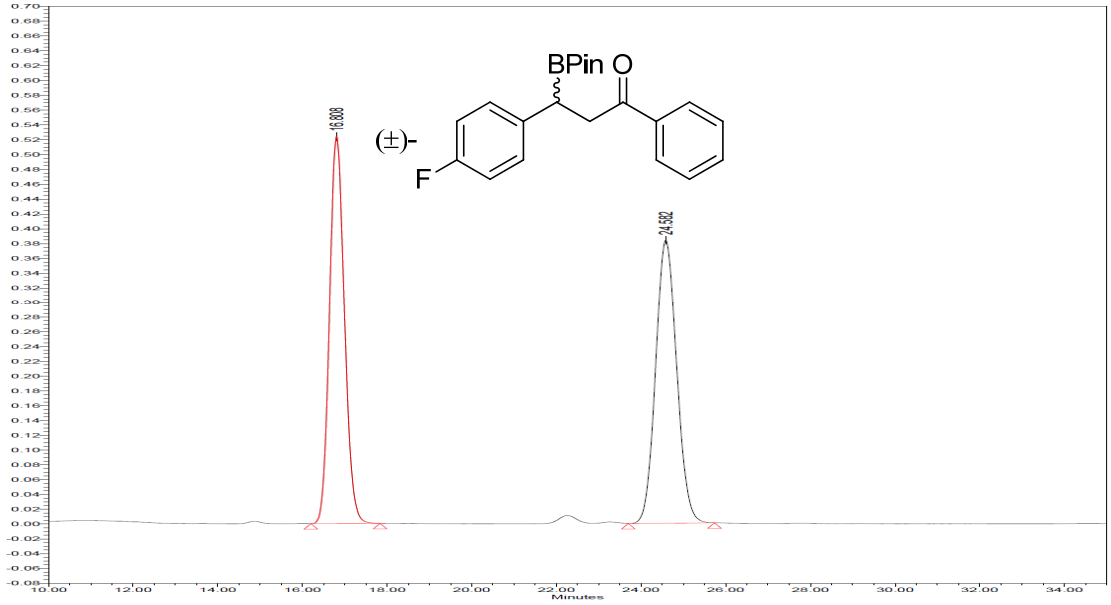


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		24.813	25972993	49.79	727216	VB
2		38.938	26187004	50.21	468055	BB

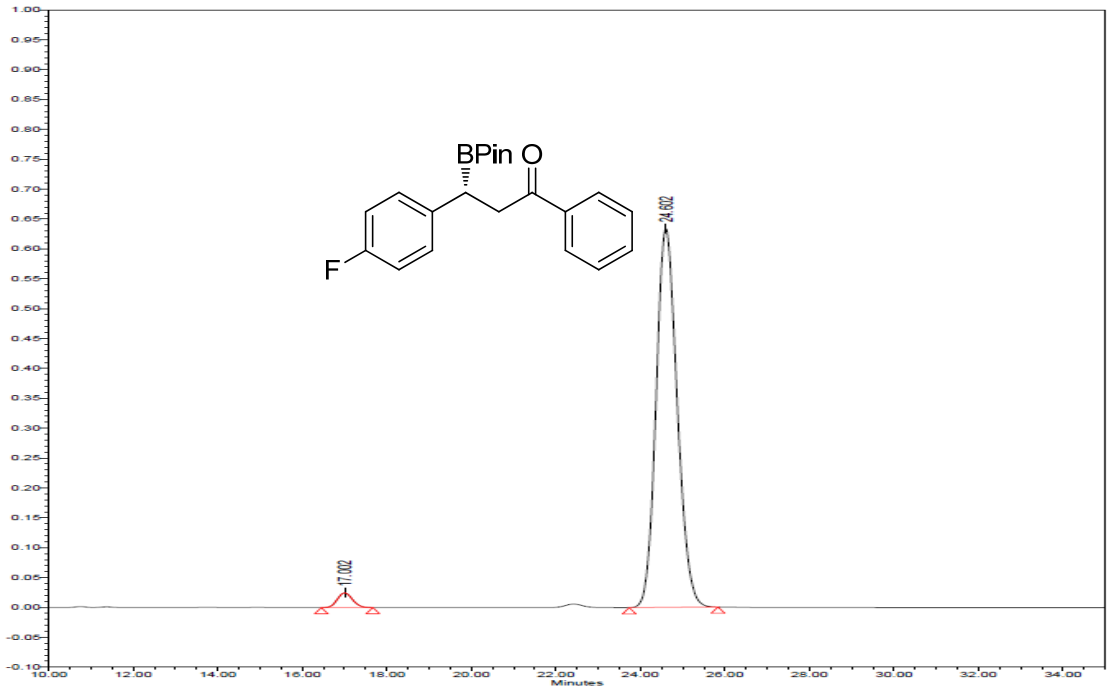


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		22.687	3969531	3.75	116070	BB
2		35.262	101810025	96.25	1900574	BB

3-(4-Fluorophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2e**)

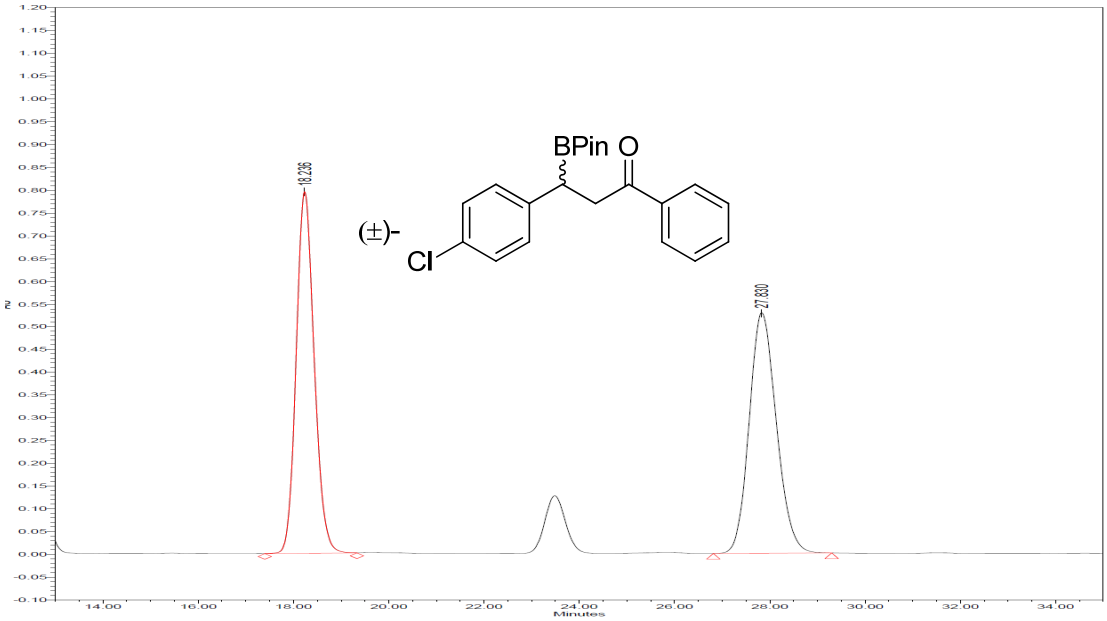


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		16.808	12855211	49.21	524323	BB
2		24.582	13269630	50.79	383703	BB

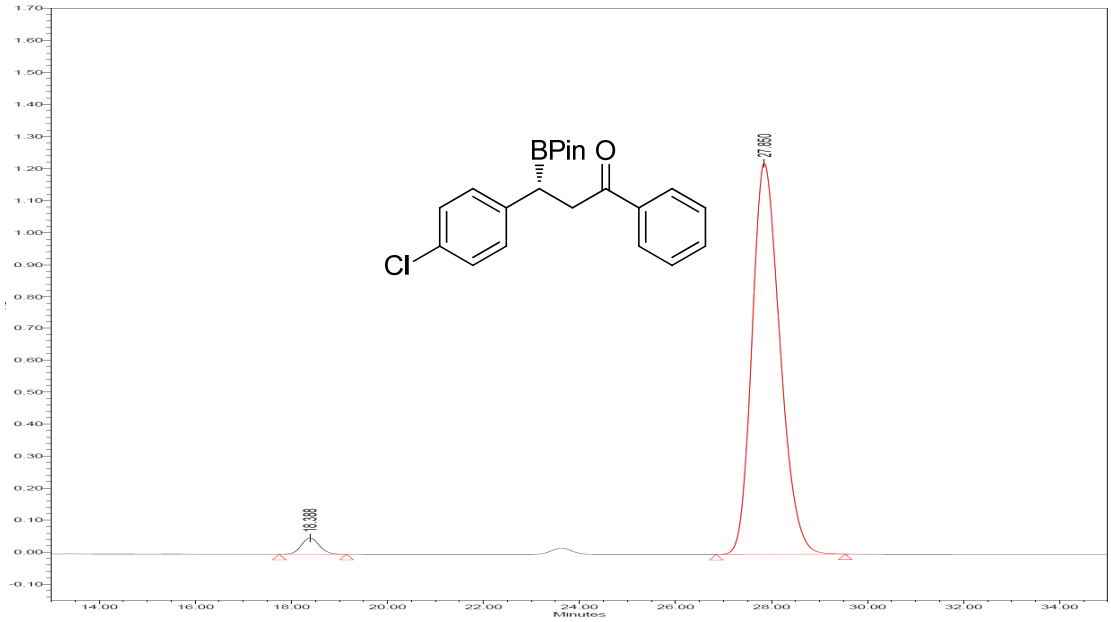


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		17.002	613486	2.71	24742	BB
2		24.602	21984423	97.29	633928	BB

(*R*)-3-(4-Chlorophenyl)-1-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2f**)

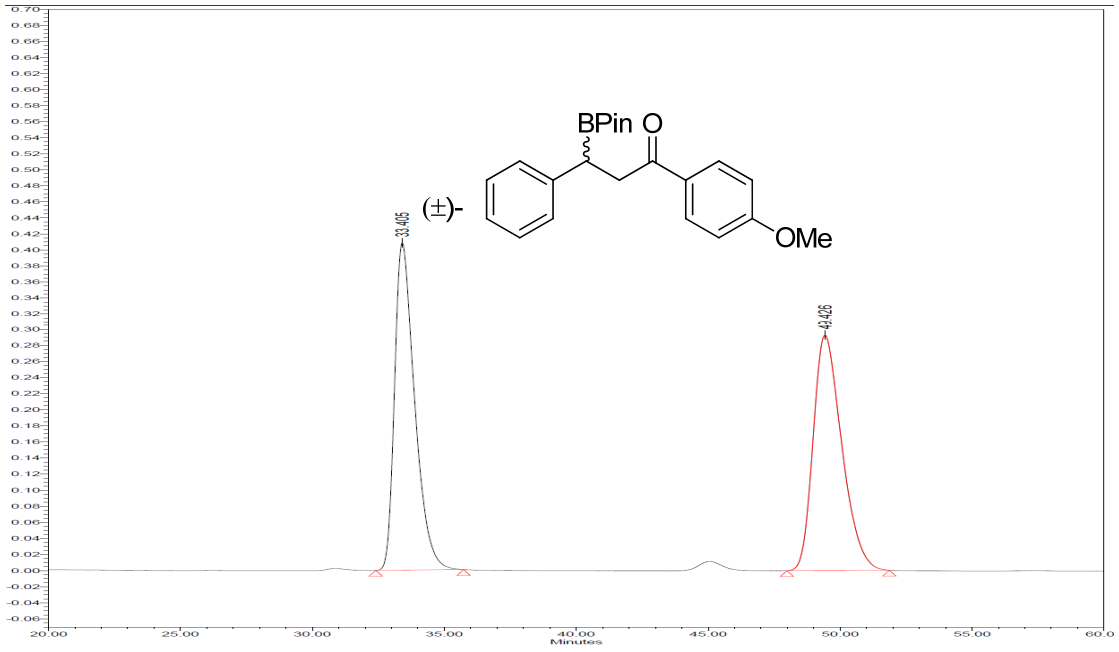


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		18.236	20909745	49.98	795211	VV
2		27.830	20925973	50.02	527997	BB

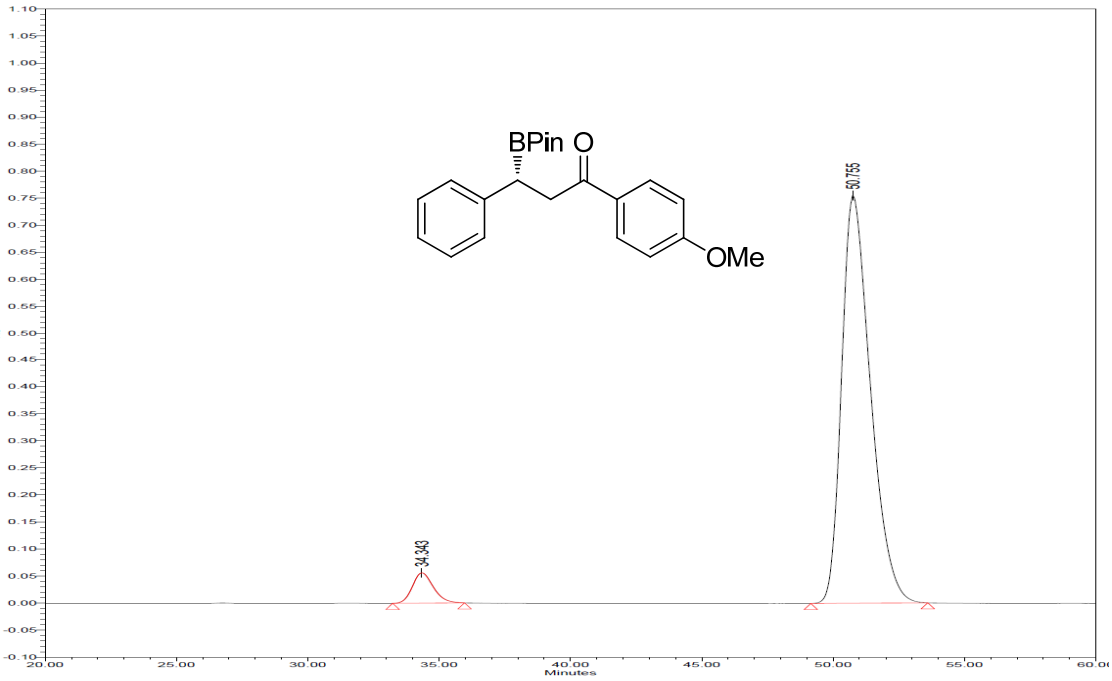


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		18.388	1339576	2.64	51101	BB
2		27.850	49456962	97.36	1223764	BB

(*R*)-1-(4-Methoxyphenyl)-3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2g**)

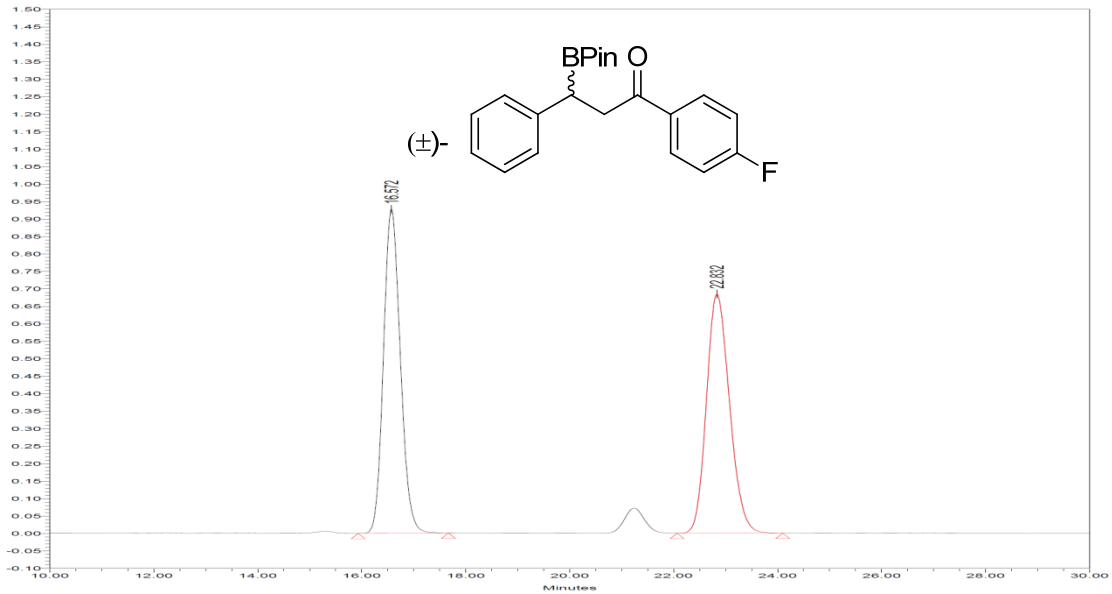


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		33.405	21561664	49.46	408242	BB
2		49.426	22029386	50.54	292548	BB

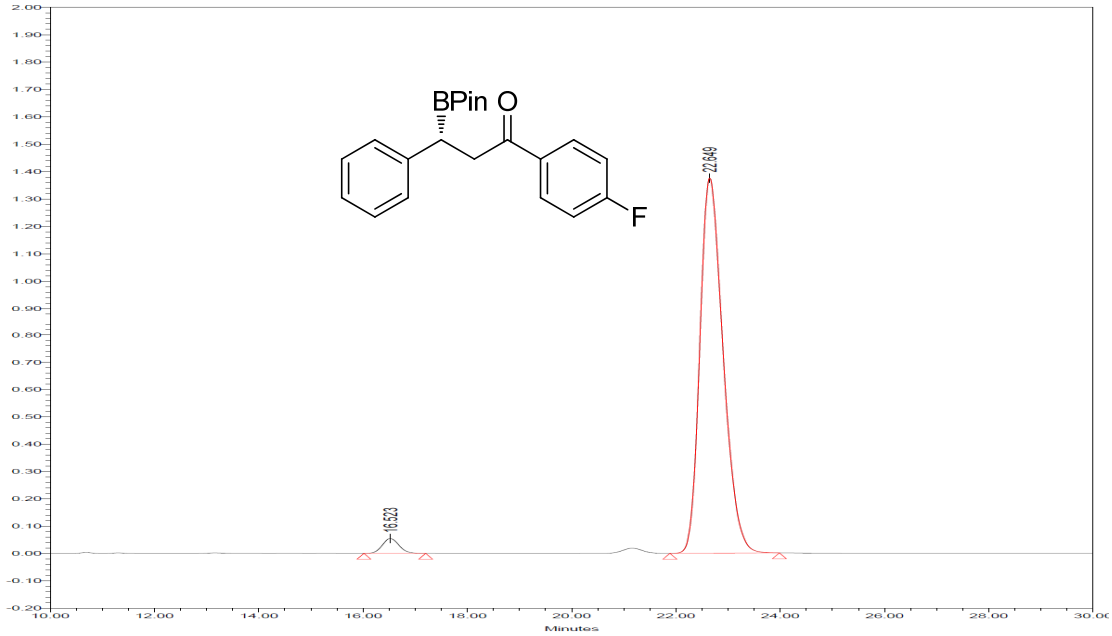


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		34.343	3101980	5.11	56038	BB
2		50.755	57579841	94.89	755469	BB

(*R*)-1-(4-Fluorophenyl)-3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2h**)

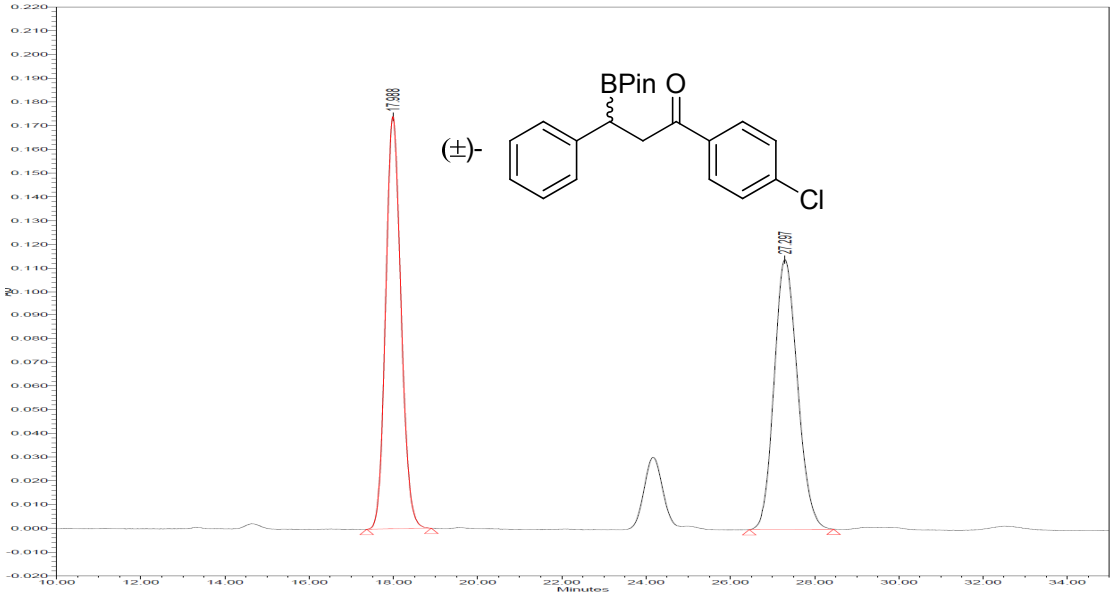


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		16.572	20952556	49.76	928663	BB
2		22.832	21157672	50.24	684455	BB

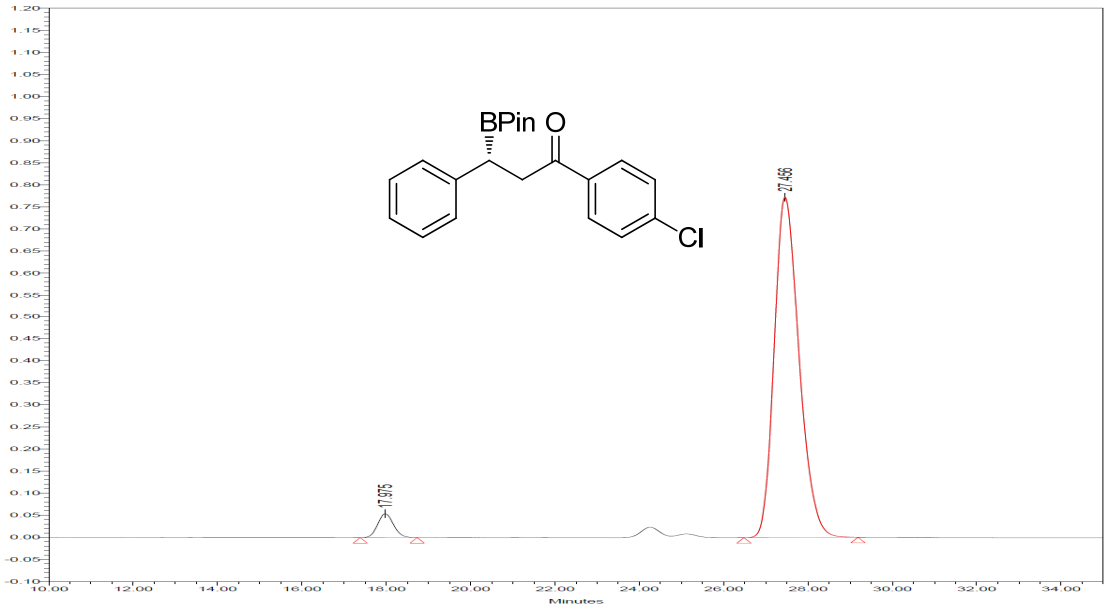


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		16.523	1203248	2.75	54506	BB
2		22.649	42512837	97.25	1376385	BB

1-(4-Chlorophenyl)-3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2i**)

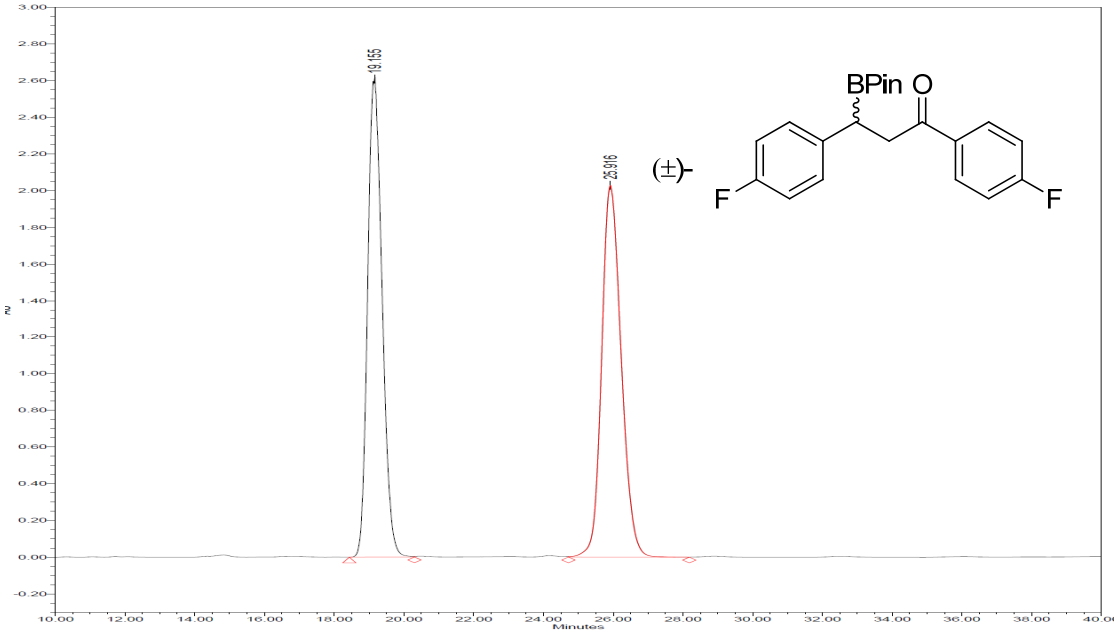


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		17.988	4418405	50.10	174171	BB
2		27.297	4400048	49.90	114134	BB

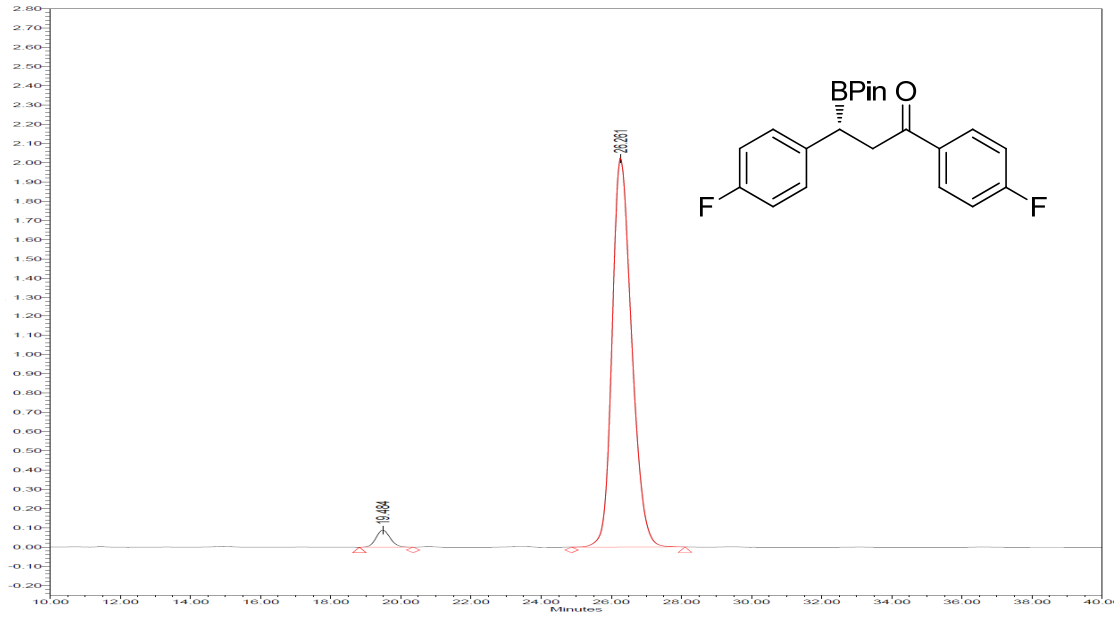


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		17.975	1396024	4.24	53899	BB
2		27.456	31555445	95.76	772644	BB

1,3-Bis(4-fluorophenyl)-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2j**)

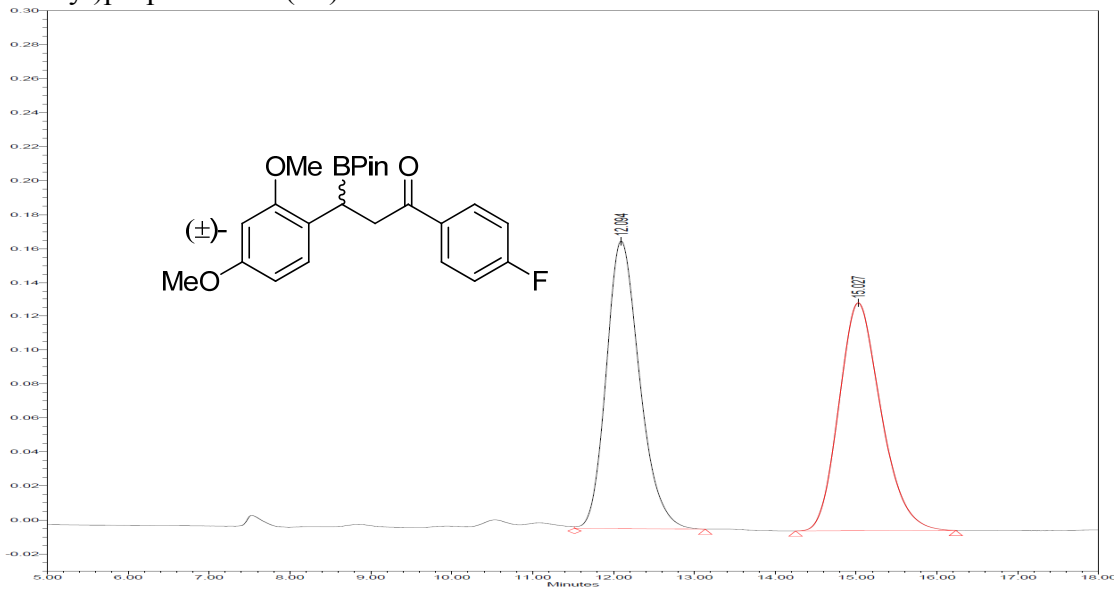


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		19.155	75453770	48.88	2606753	BV
2		25.916	78904442	51.12	2029850	VV

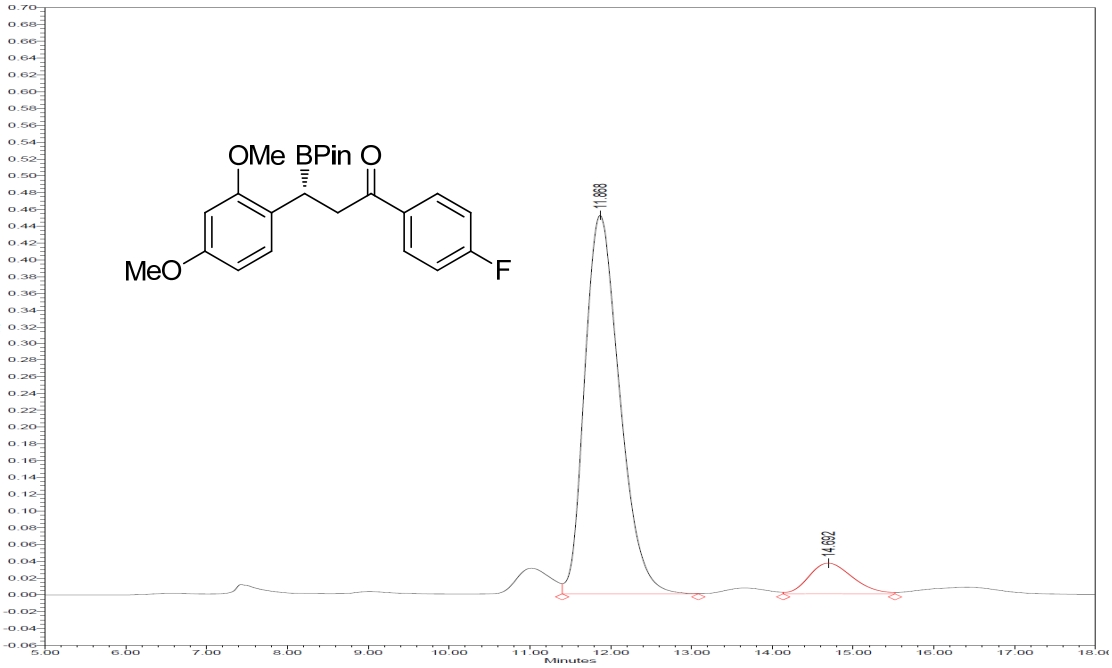


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		19.484	2472245	3.05	88235	BV
2		26.261	78511721	96.95	2024095	VB

3-(2,4-Dimethoxyphenyl)-1-(4-fluorophenyl)-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propan-1-one (**2k**)

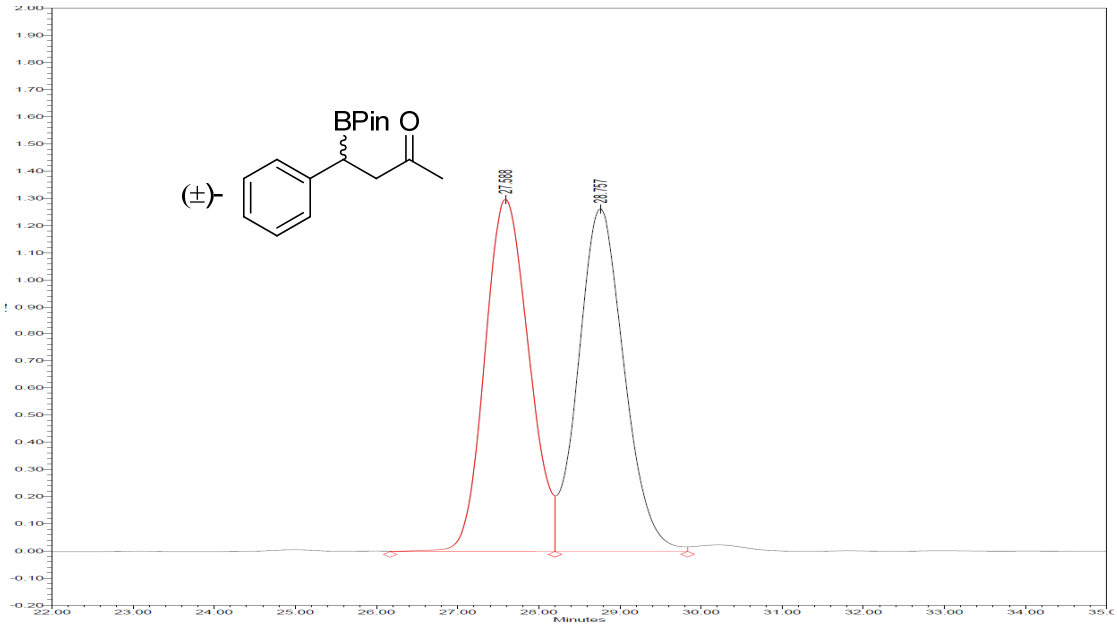


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		12.094	4859689	50.16	169687	VB
2		15.027	4829034	49.84	134083	BB

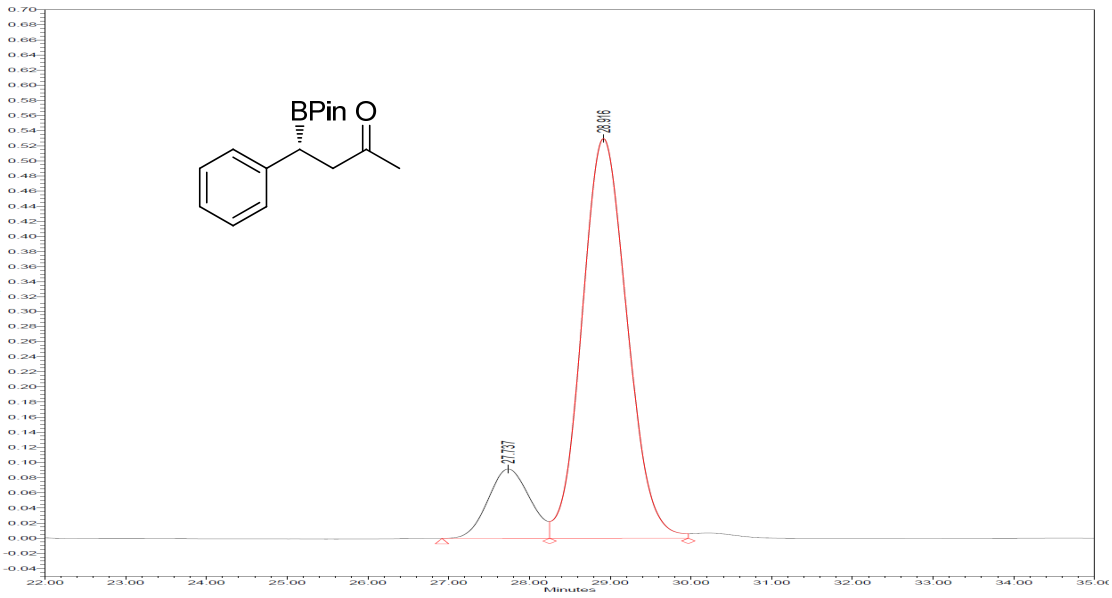


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		11.868	13567813	90.79	451963	VV
2		14.692	1376654	9.21	36618	VV

(*R*)-4-Phenyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)butan-2-one (**2l**)

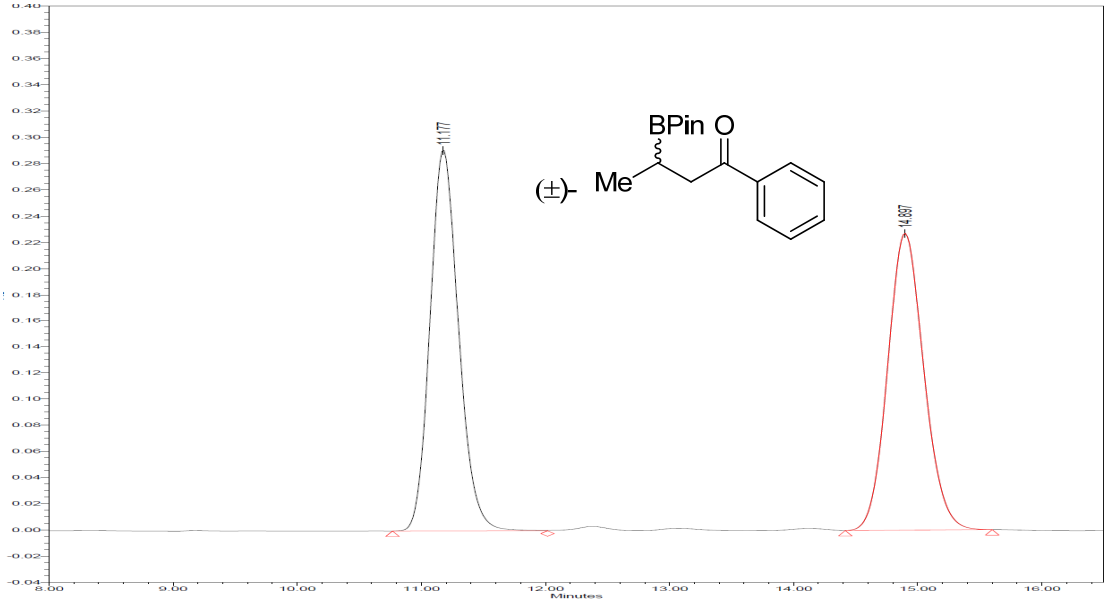


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		27.588	49059649	49.70	1298916	VV
2		28.757	49652632	50.30	1264155	VV

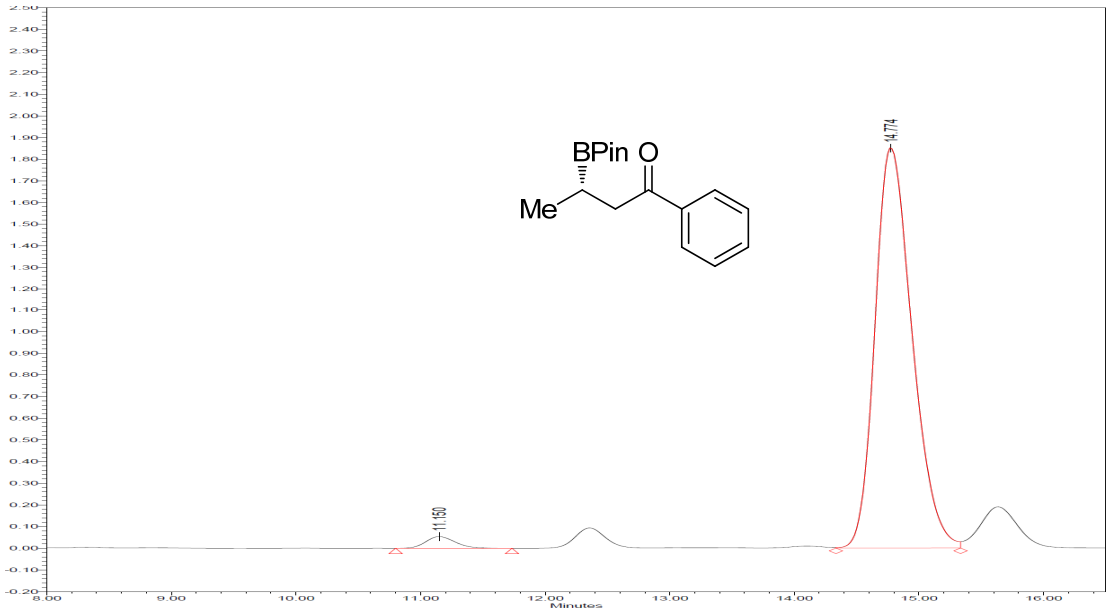


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		27.737	3309242	13.90	91657	BV
2		28.916	20498869	86.10	529699	VV

(*S*)-1-Phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)butan-1-one (**2m**)

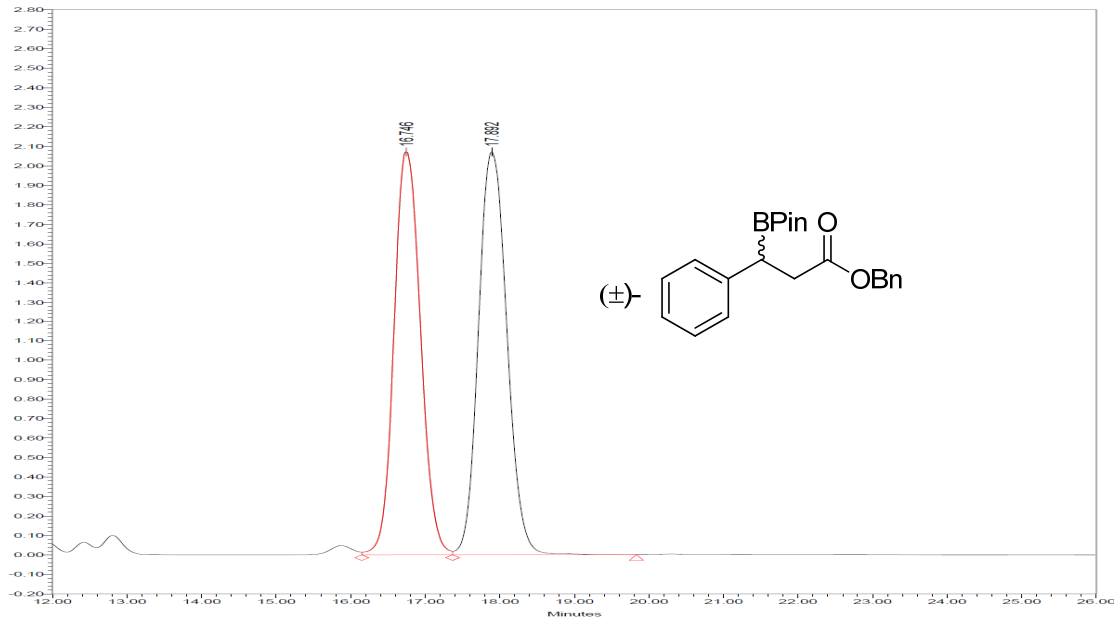


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		11.177	4667514	50.33	291475	BV
2		14.897	4607023	49.67	227222	BB

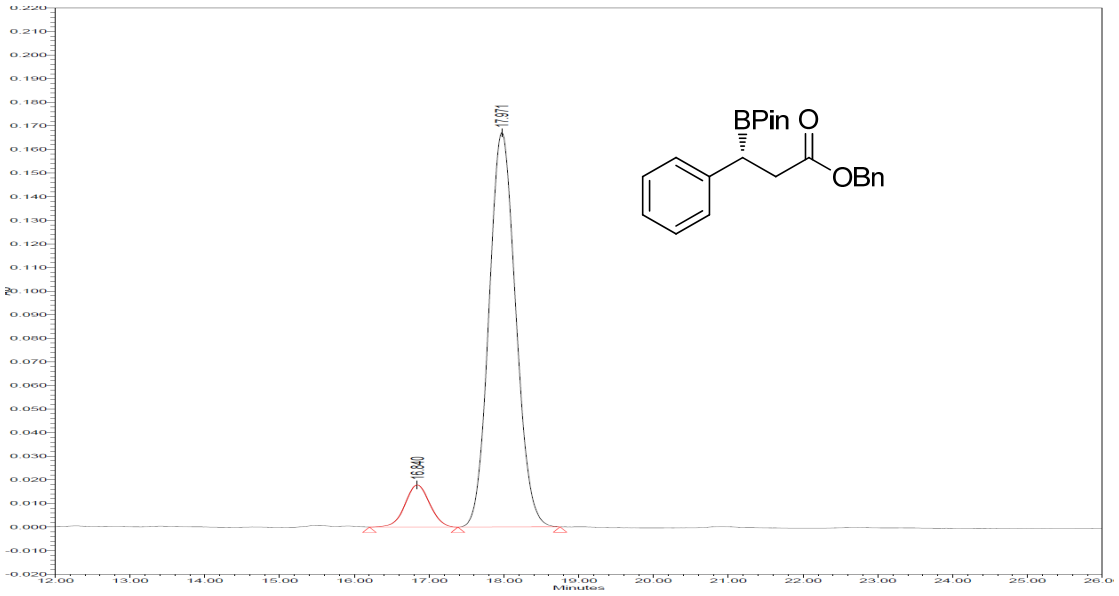


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		11.150	881765	2.25	54147	BB
2		14.774	38339979	97.75	1853989	VV

(*R*)-Benzyl 3-phenyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propanoate (**2n**)

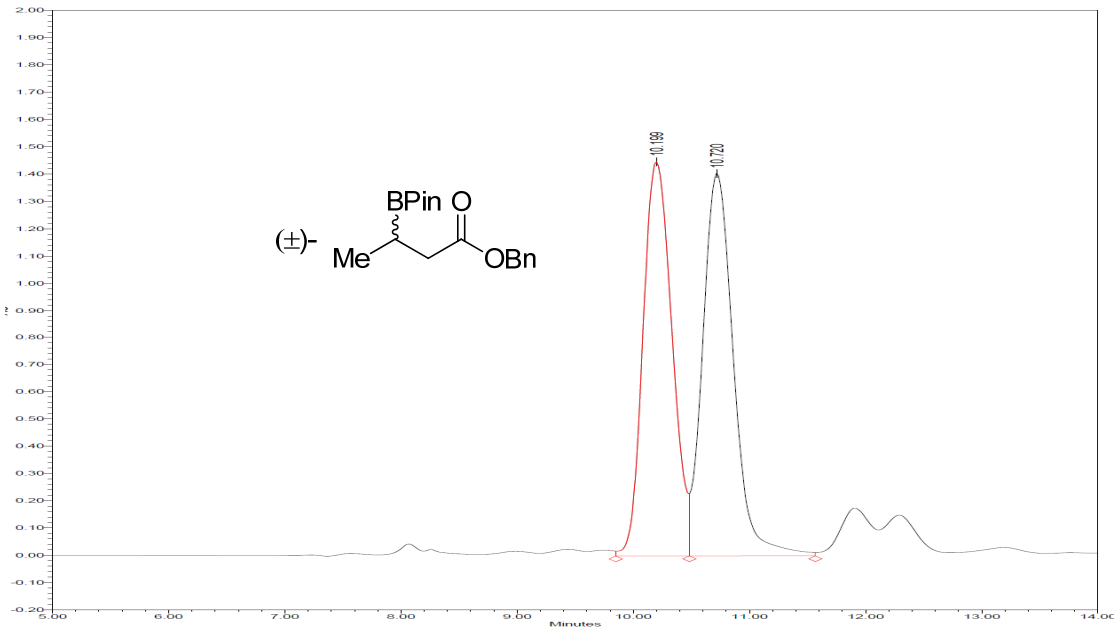


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		16.746	51300782	48.26	2076744	VV
2		17.892	54990007	51.74	2070962	VB

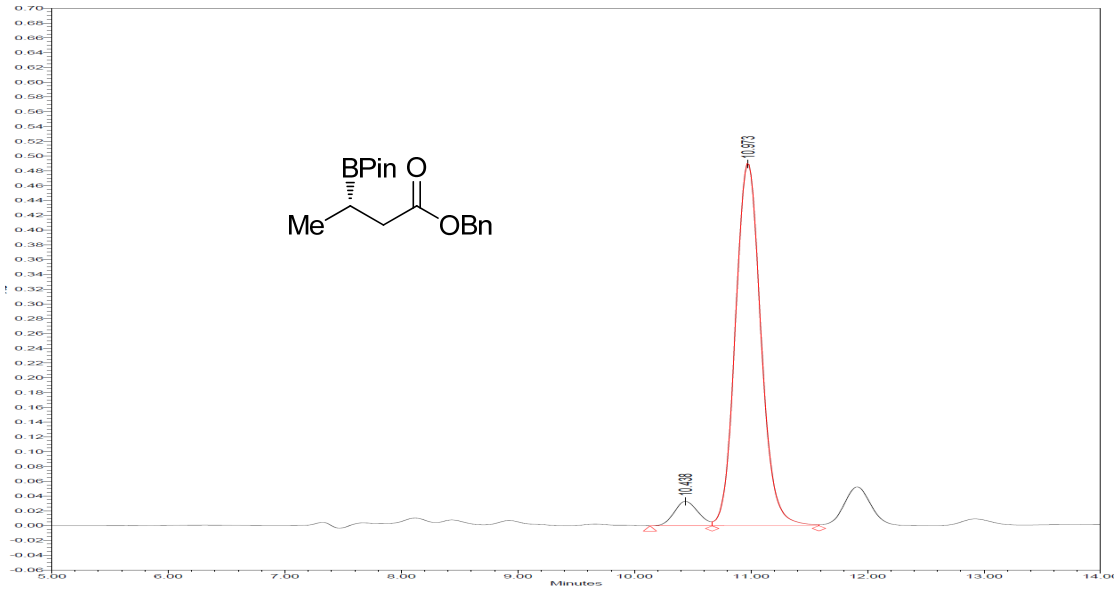


	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		16.840	411276	9.01	17904	BB
2		17.971	4151176	90.99	167224	BB

(*S*)-Benzyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)butanoate (**2o**)



	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		10.199	25108998	49.30	1448781	VV
2		10.720	25826409	50.70	1405695	VV



	Name	Retention Time (min)	Area (μV*sec)	% Area	Height (μV)	Int Type
1		10.438	472557	5.95	33180	BV
2		10.973	7466722	94.05	491107	VV