Electronic Supplementary Material (ESI) for Green Chemistry.

Using Fluorogenic Probes for the Investigation of Selective Biomass Degradation by Fungi

Qian Zhang,[†] *Xinrui Peng,* [†]*Michelle Grilley,*[‡] *Jon Y. Takemoto,*[‡] *and Cheng-Wei Tom Chang*[†],*

[†] Department of Chemistry and Biochemistry, Utah State University, 0300 Old Main Hill, Logan, Utah 84322-0300, U.S.A.

[‡] Department of Biology, Utah State University, 5305 Old Main Hill, Logan, Utah 84322-5305, U.S.A.

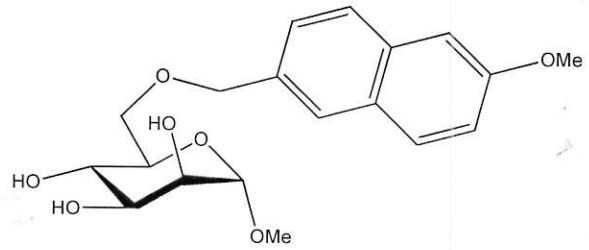
tom.chang@usu.edu

* To whom correspondence should be addressed. Ph: (435) 797-3545. Fax: 435-797-3390

Supporting Information

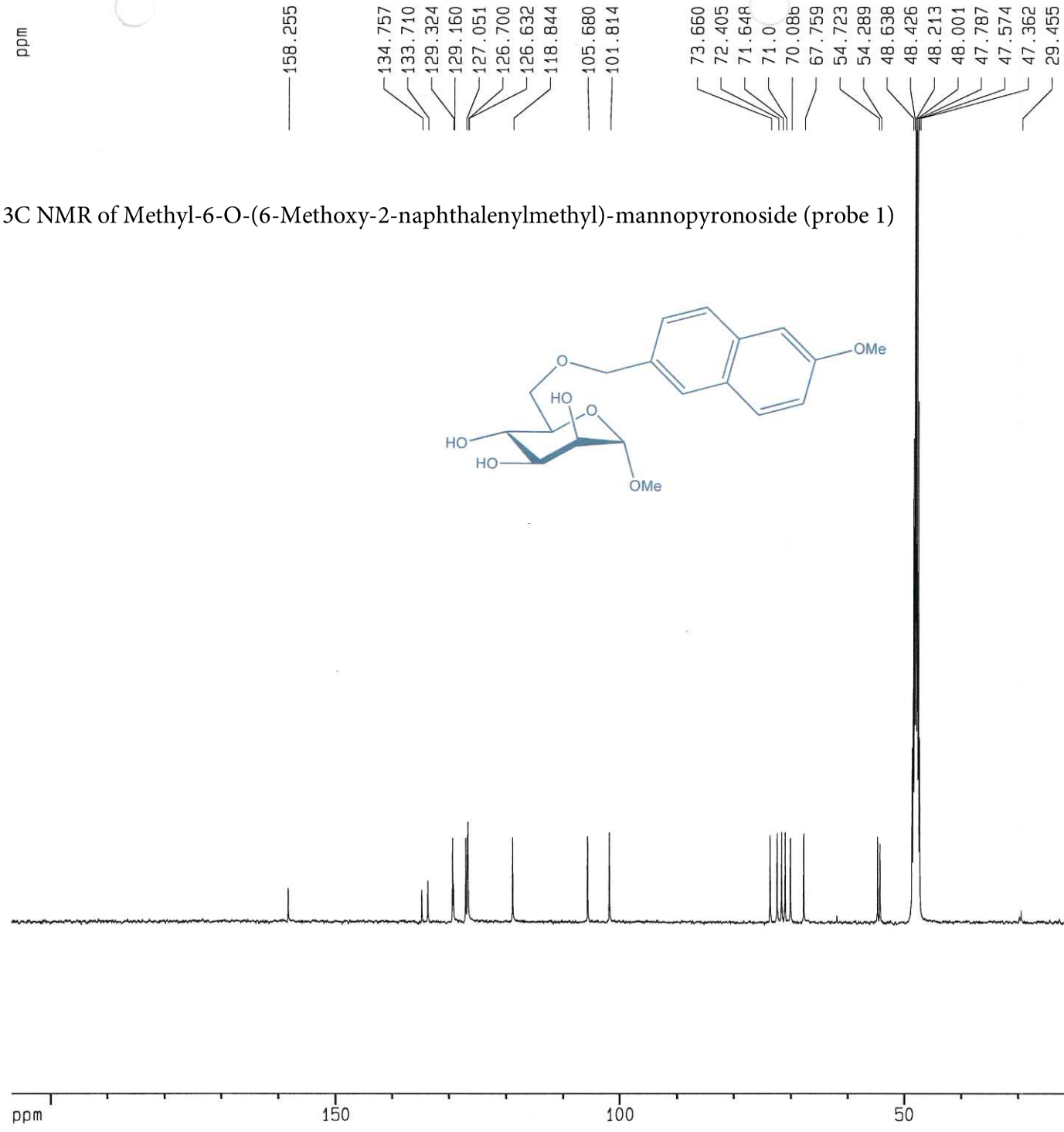
I. ^{1}H NMR, ^{13}C NMR and Related Spectra for the Synthesized Compounds

1H NMR of Methyl-6-O-(6-Methoxy-2-naphthalenylmethyl)-mannopyronoside (probe 1)



Filename	= 040312QZ-III-54single
Author	= qzhang
Experiment	= single_pulse.ex2
Sample_id	= 040312QZ-III-54single
Solvent	= METHANOL-D3
Creation_time	= 3-APR-2012 14:45:08
Revision_time	= 4-APR-2012 09:54:14
Current_time	= 4-APR-2012 09:54:23
Comment	= single_pulse
Data_format	= 1D COMPLEX
Dim_size	= 13107
Dim_title	= 1H
Dim_units	= [ppm]
Dimensions	= X
Site	= ECX 300
Spectrometer	= ECX-300
Field_strength	= 7.0586013[T] (300[MHz
X_acq_duration	= 2.90717696[s]
X_domain	= 1H
X_freq	= 300.52965592[MHz]
X_offset	= 5[ppm]
X_points	= 16384
X_prescans	= 1
X_resolution	= 0.34397631[Hz]
X_sweep	= 5.63570784[kHz]
Irr_domain	= 1H
Irr_freq	= 300.52965592[MHz]
Irr_offset	= 5[ppm]
Tri_domain	= 1H
Tri_freq	= 300.52965592[MHz]
Tri_offset	= 5[ppm]
Clipped	= FALSE
Mod_return	= 1
Scans	= 8
Total_scans	= 8
X_90_width	= 13.43[us]
X_acq_time	= 2.90717696[s]
X_angle	= 45[deg]
X_atn	= 3[dB]
X_pulse	= 6.715[us]
Irr_mode	= Off
Tri_mode	= Off
Dante_presat	= FALSE
Initial_wait	= 1[s]
Recvr_gain	= 44
Relaxation_delay	= 5[s]
Repetition_time	= 7.90717696[s]
Temp_get	= 23[dC]

13C NMR of Methyl-6-O-(6-Methoxy-2-naphthalenylmethyl)-mannopyronoside (probe 1)



Current Data Parameters

NAME	QZ-III-54
EXPNO	9
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	16.54
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	D2O
NS	9460
DS	32
SWH	20833.334 Hz
FIDRES	0.635783 Hz
AQ	0.7864820 sec
RG	32768
DW	24.000 usec
DE	34.29 usec
TE	298.0 K
D12	0.00002000 sec
DL5	21.40 dB
CPDPRG	waltz16
P31	90.00 usec
D1	0.50000000 sec
P1	6.75 usec
DE	34.29 usec
SFO1	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

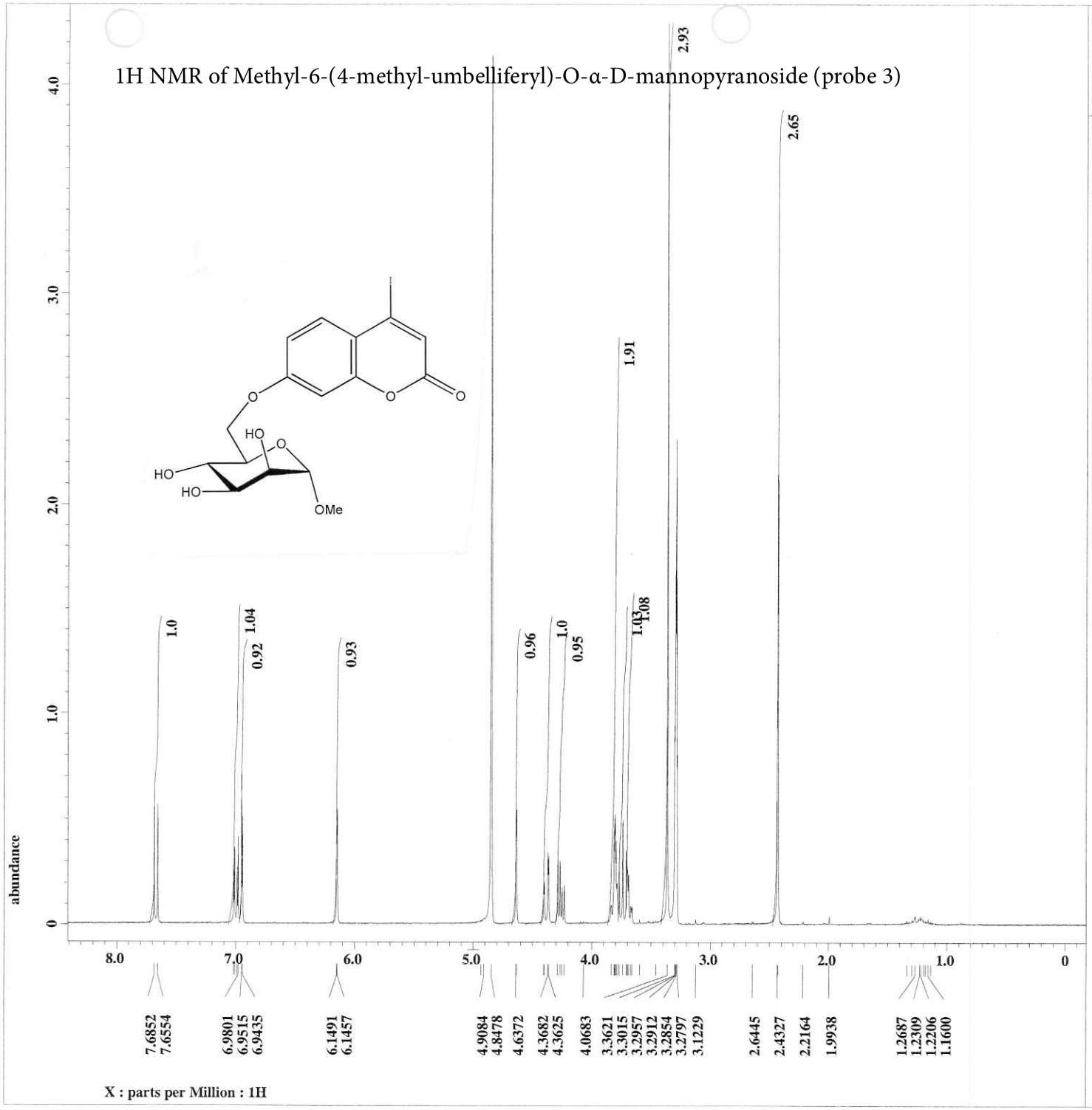
F2 - Processing parameters

SI	16384
SF	100.6127290 MHz
WDW	EM
SSB	0
LB	5.00 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
F1P	206.789 ppm
F1	20805.56 Hz
F2P	-0.276 ppm
F2	-27.78 Hz
PPMCM	10.35323 ppm/cm
HZCM	1041.66675 Hz/cm

1H NMR of Methyl-6-(4-methyl-umbelliferyl)-O-α-D-mannopyranoside (probe 3)

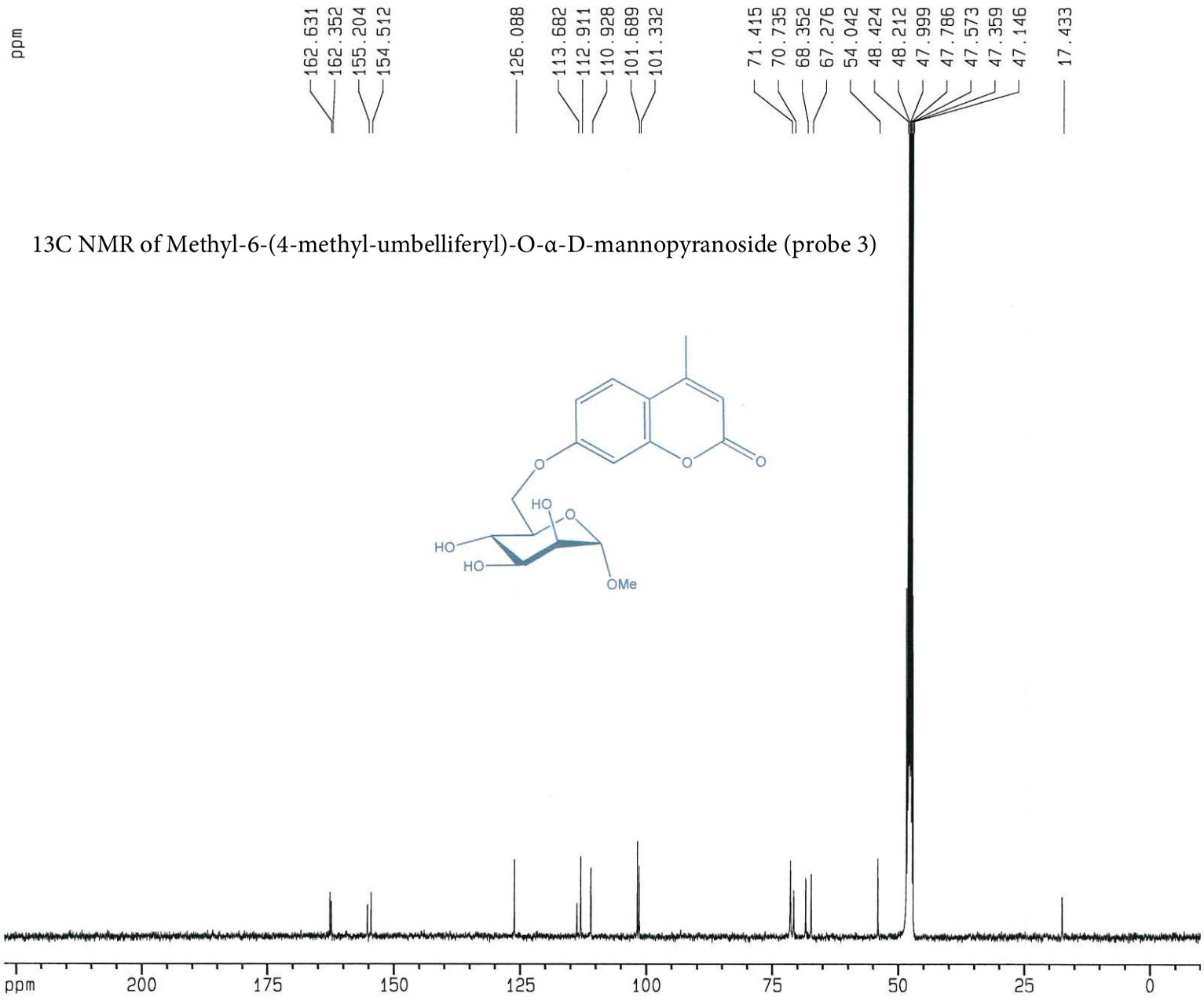


JEOL

```
Filename          = 040512QZ-II-231Csingl
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 040512QZ-II-231Csingl
Solvent           = METHANOL-D3
Creation_time     =  5-APR-2012 14:58:29
Revision_time     =  5-APR-2012 14:56:07
Current_time      =  5-APR-2012 14:56:21

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 46
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 23[dC]
```

Standard 13C
Experiment

13C NMR of Methyl-6-(4-methyl-umbelliferyl)-O-α-D-mannopyranoside (probe 3)



Current Data Parameters

NAME	QZ-II-231
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	16.33
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	MeOH
NS	16547
DS	2
SWH	25000.000 Hz
FIDRES	0.762939 Hz
AQ	0.6554100 sec
RG	45500
DW	20.000 usec
DE	27.14 usec
TE	300.0 K
D12	0.00002000 sec
DL5	20.00 dB
CPDPRG	waltz16
P31	100.00 usec
D1	0.40000001 sec
P1	6.75 usec
DE	27.14 usec
SFO1	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

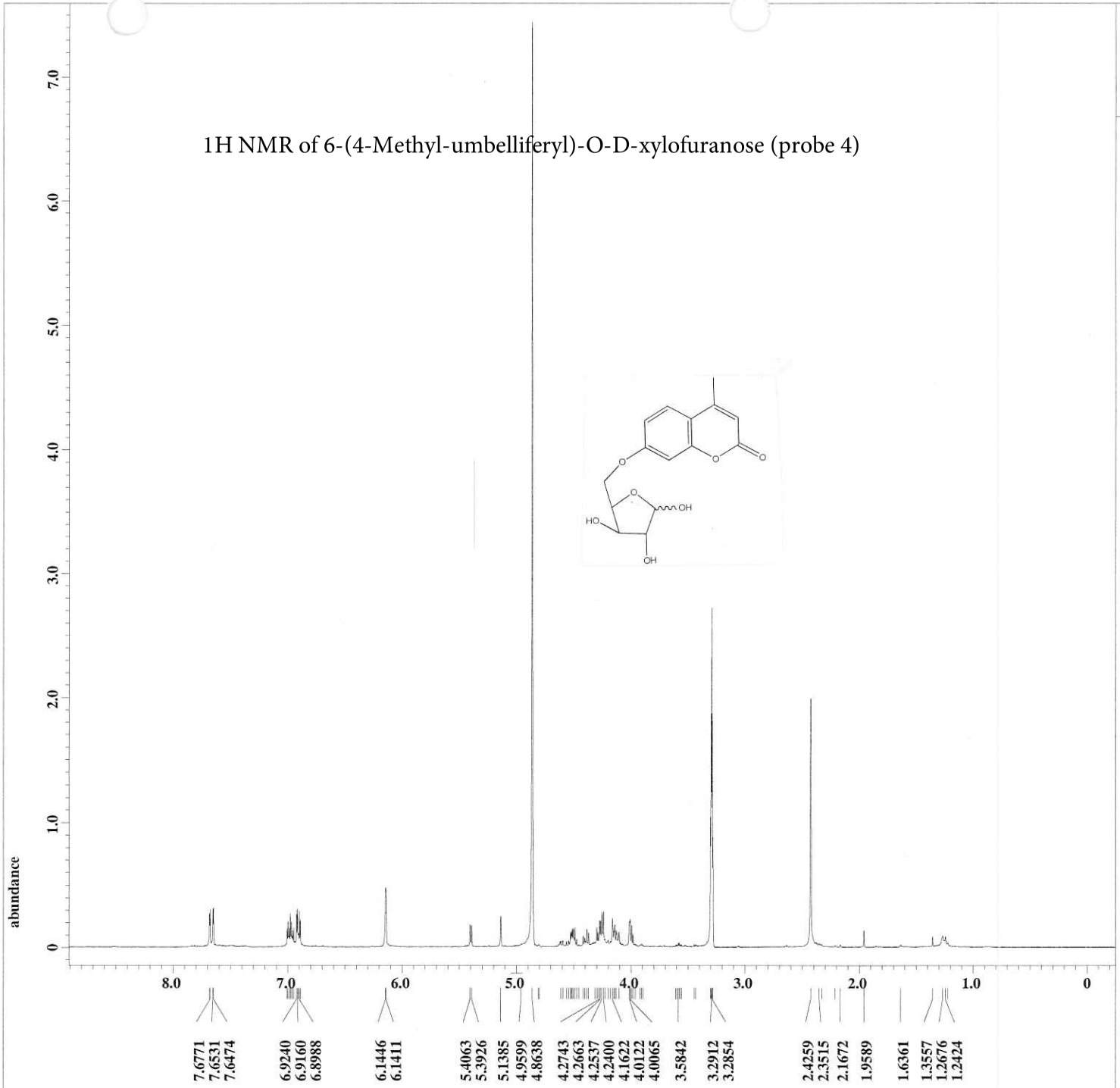
F2 - Processing parameters

SI	16384
SF	100.6127490 MHz
WDW	EM
SSB.	0
LB	2.00 Hz
GB	0
PC	1.40

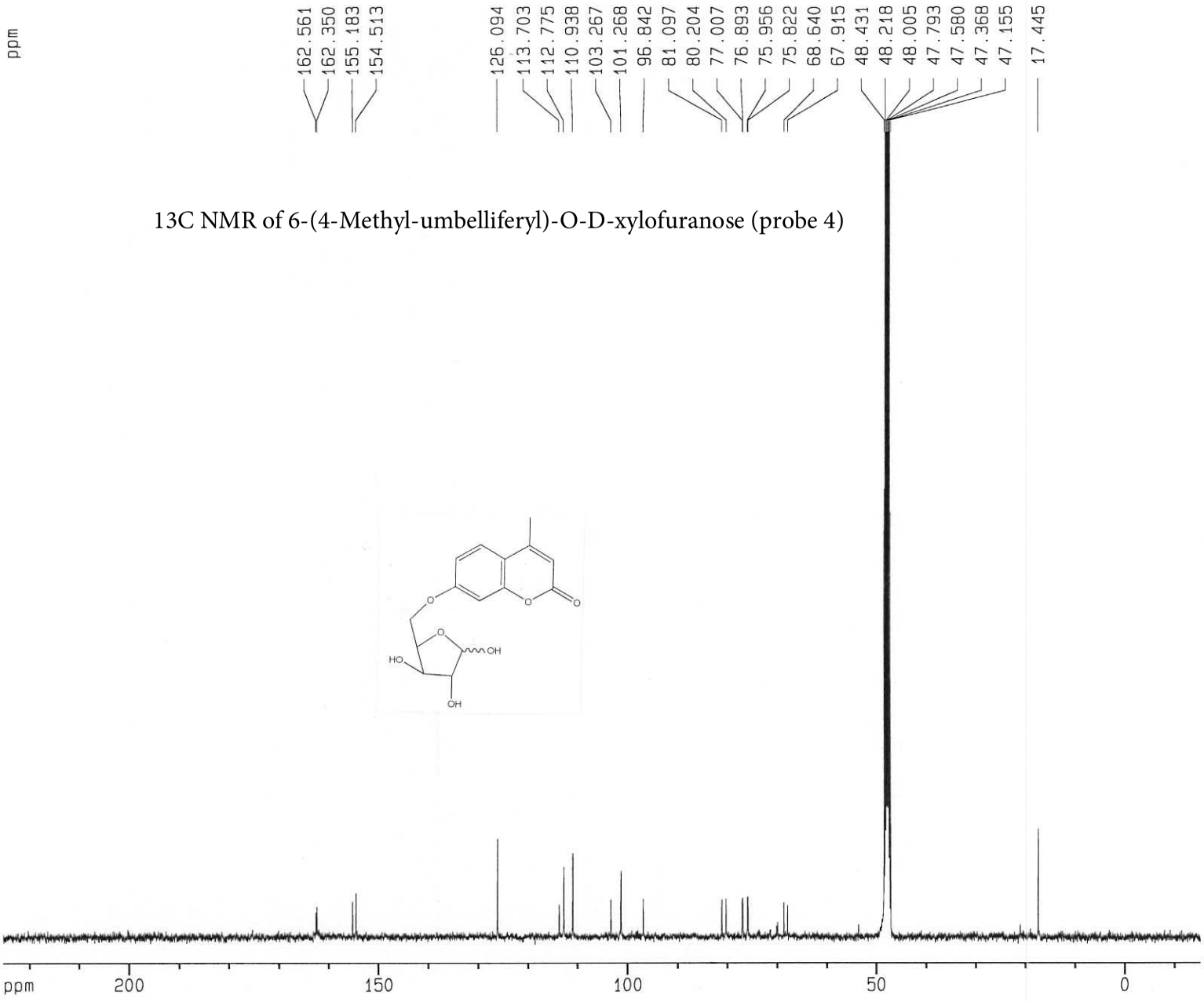
1D NMR plot parameters

CX	20.00 cm
F1P	227.296 ppm
F1	22868.89 Hz
F2P	-10.000 ppm
F2	-1006.13 Hz
PPMCM	11.86481 ppm/cm
HZCM	1193.75122 Hz/cm

1H NMR of 6-(4-Methyl-umbelliferyl)-O-D-xylofuranose (probe 4)



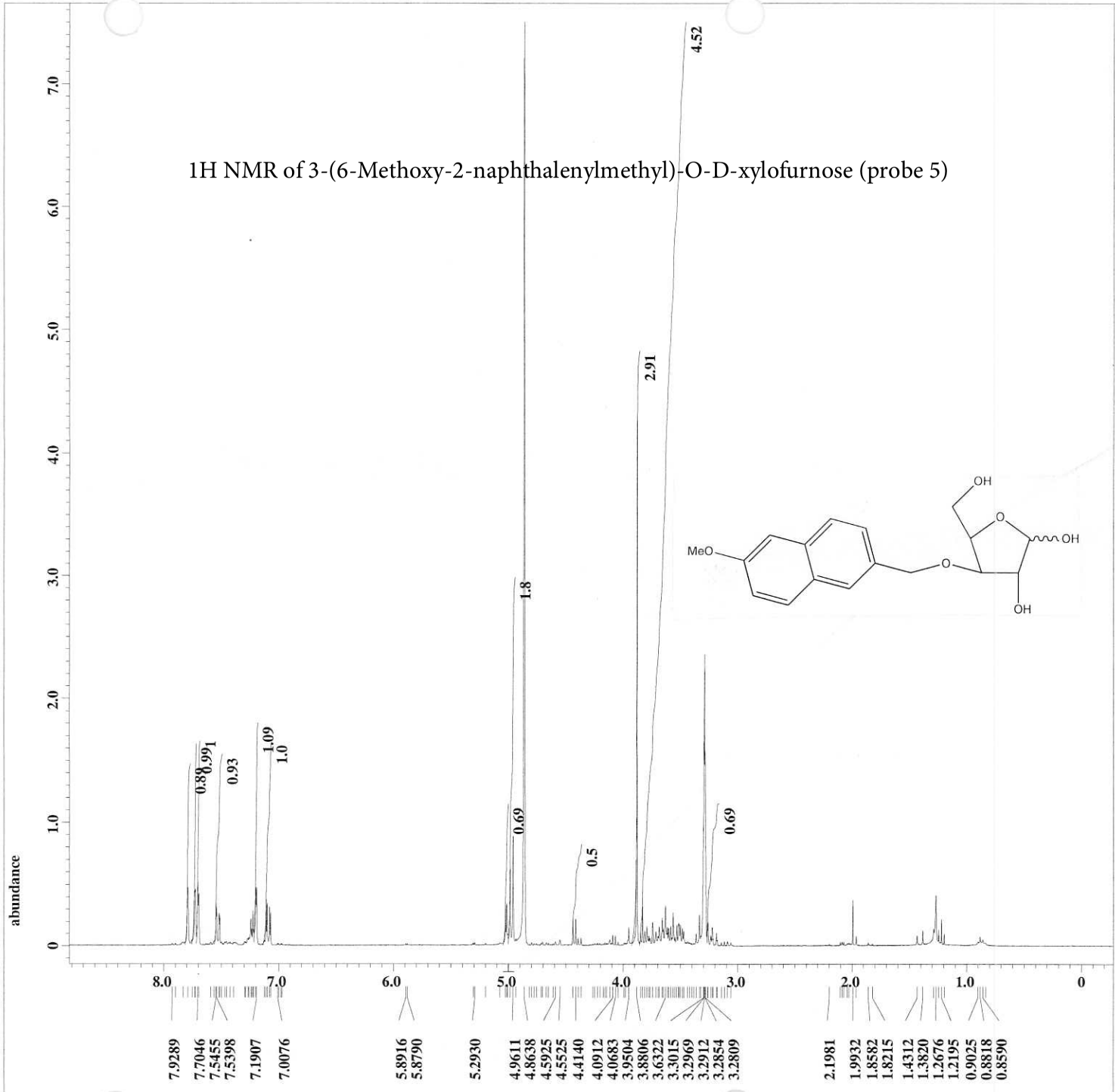

```
Filename          = 021413QZ-IV-24Fsingle
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 021413QZ-IV-24Fsingle
Solvent           = METHANOL-D3
Creation_time     = 14-FEB-2013 09:26:23
Revision_time     = 14-FEB-2013 09:48:17
Current_time      = 14-FEB-2013 09:48:22

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 46
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 21.6[dC]
```



13C NMR of 6-(4-Methyl-umbelliferyl)-O-D-xylofuranose (probe 4)

```
Current Data Parameters
NAME      QZ-IV-24FIIC13
EXPNO                  9
PROCNO                 1

F2 - Acquisition Parameters
Date_             500000
Time               18.35
INSTRUM          arx400
PROBHD   5 mm Multinucl
PULPROG          zgdc30
TD                32768
SOLVENT            MeOH
NS                15487
DS                    2
SWH           25000.000 Hz
FIDRES        0.762939 Hz
AQ            0.6554100 sec
RG                45500
DW               20.000 usec
DE               27.14 usec
TE               300.0 K
D12           0.00002000 sec
DL5              20.00 dB
CPDPRG          waltz16
P31              100.00 usec
D1            0.40000001 sec
P1                6.75 usec
DE               27.14 usec
SFO1        100.6231179 MHz
NUCLEUS             13C
D11           0.03000000 sec

F2 - Processing parameters
SI                16384
SF          100.6127490 MHz
WDW                  EM
SSB                   0
LB                 2.00 Hz
GB                    0
PC                 1.40

1D NMR plot parameters
CX                20.00 cm
F1P              225.290 ppm
F1              22667.08 Hz
F2P              -15.164 ppm
F2              -1525.65 Hz
PPMCM           12.02270 ppm/cm
HZCM          1209.63672 Hz/cm
```

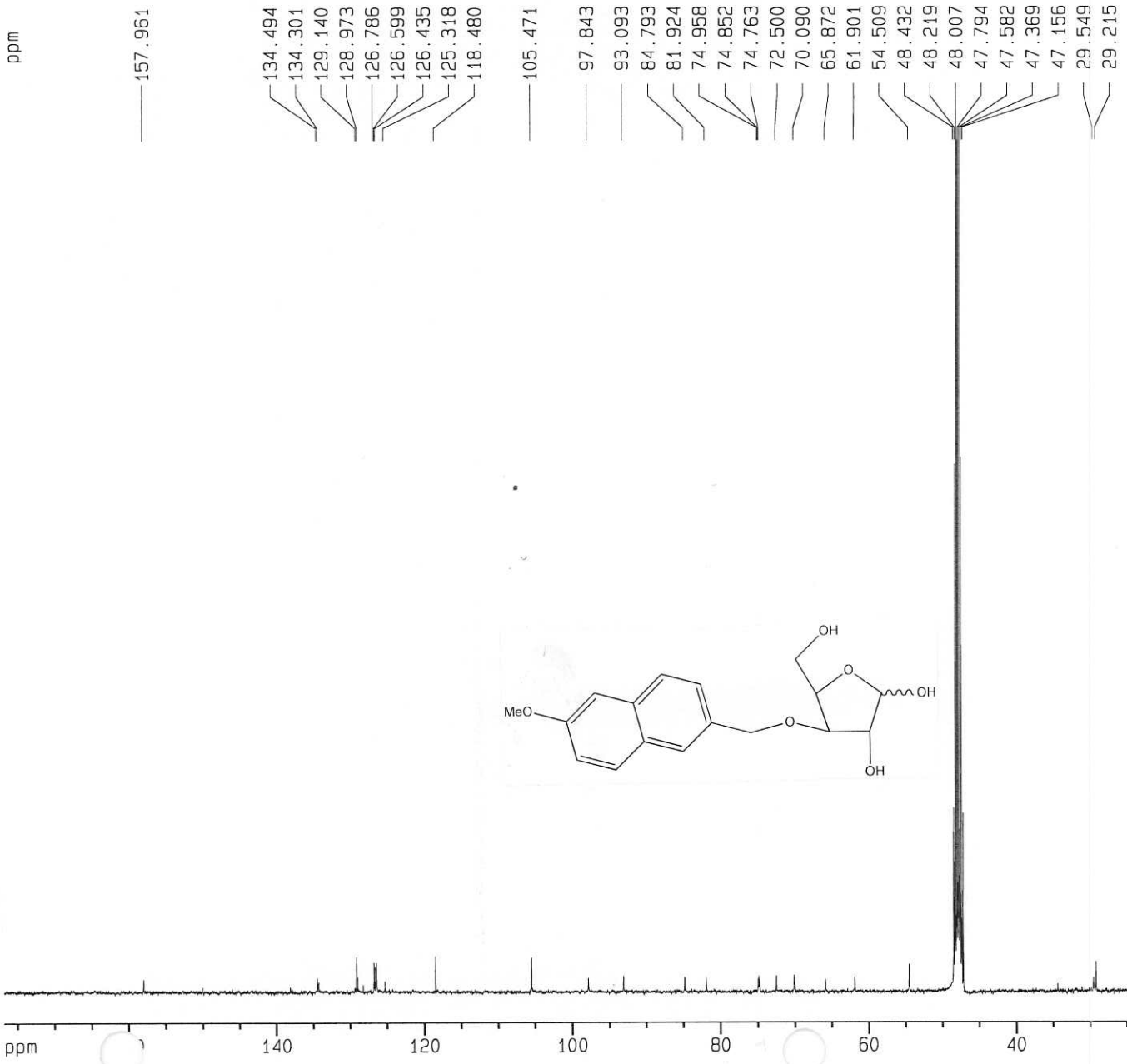
1H NMR of 3-(6-Methoxy-2-naphthalenylmethyl)-O-D-xylofurnose (probe 5)



```
Filename          = 021413QZ-IV-32single_
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 021413QZ-IV-32single_
Solvent           = METHANOL-D3
Creation_time     = 14-FEB-2013 09:19:18
Revision_time     = 14-FEB-2013 09:45:31
Current_time      = 14-FEB-2013 09:45:45

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 46
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 21.6[dC]
```

Standard 13C
Experiment

13C NMR of 3-(6-Methoxy-2-naphthalenylmethyl)-O-D-xylofurnose (probe 5)



Current Data Parameters

NAME	QZ-IV-39
EXPNO	9
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	12.28
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	MeOH
NS	5422
DS	2
SWH	25000.000 Hz
FIDRES	0.762939 Hz
AQ	0.6554100 sec
RG	45500
DW	20.000 usec
DE	27.14 usec
TE	300.0 K
D12	0.00002000 sec
DL5	20.00 dB
CPDPRG	waltz16
P31	100.00 usec
D1	0.40000001 sec
P1	6.75 usec
DE	27.14 usec
SF01	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

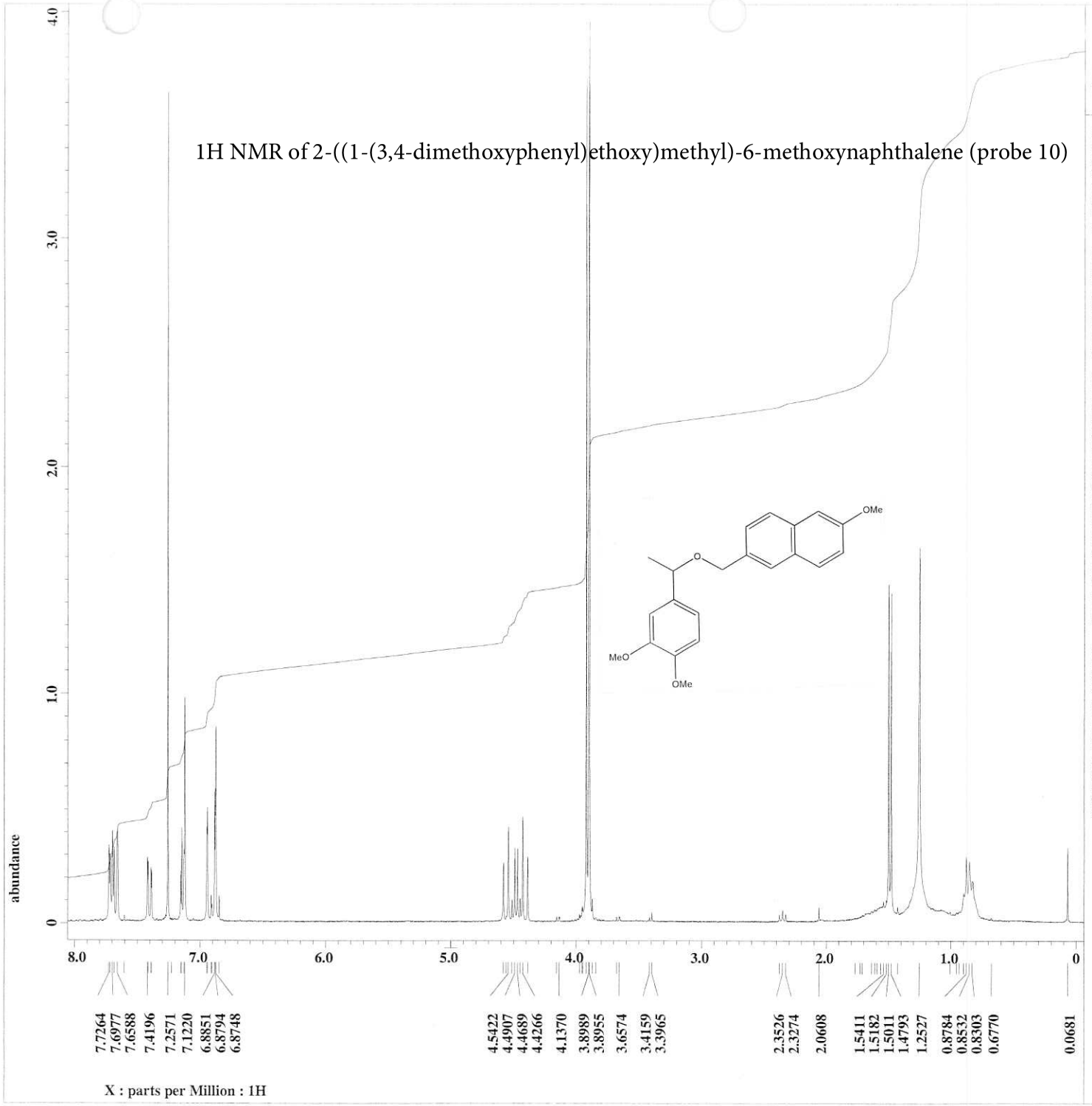
F2 - Processing parameters

SI	16384
SF	100.6127490 MHz
WDW	EM
SSB	0
LB	2.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	176.793 ppm
F1	17787.59 Hz
F2P	5.081 ppm
F2	511.17 Hz
PPMCM	8.58560 ppm/cm
HZCM	863.82104 Hz/cm

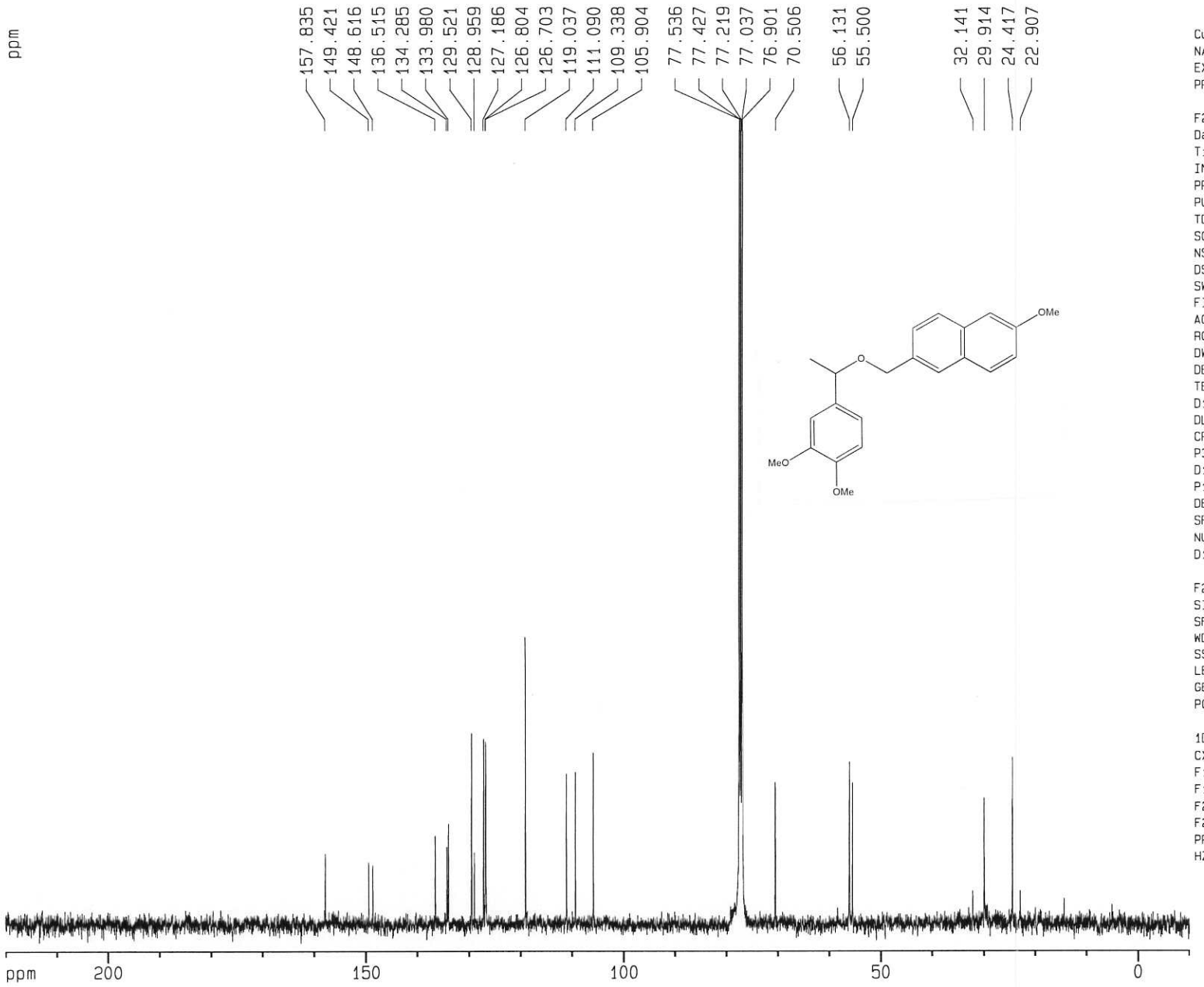
1H NMR of 2-((1-(3,4-dimethoxyphenyl)ethoxy)methyl)-6-methoxynaphthalene (probe 10)




```
Filename          = 061312QZ-III-113Bsing
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 061312QZ-III-113Bsing
Solvent           = CHLOROFORM-D
Creation_time     = 13-JUN-2012 11:21:28
Revision_time     = 13-JUN-2012 11:19:07
Current_time      = 13-JUN-2012 11:19:10

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 48
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 23.2[dC]
```

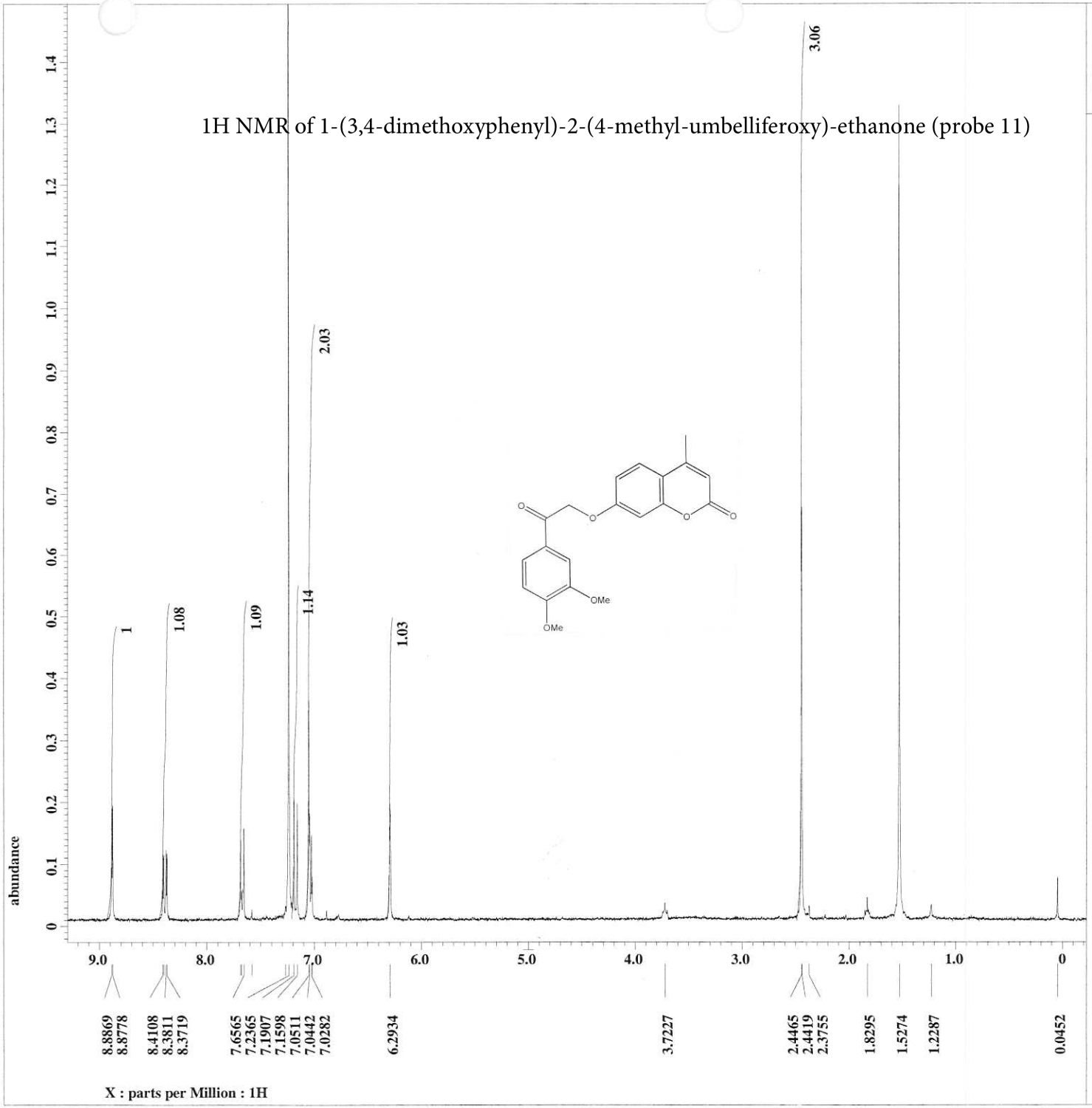
Standard ¹³C Experiment

13C NMR of 2-((1-(3,4-dimethoxyphenyl)ethoxy)methyl)-6-methoxynaphthalene (probe 10)




```
Current Data Parameters
NAME          QZ-III-113B
EXPNO                   9
PROCNO                  1

F2 - Acquisition Parameters
Date_              500000
Time                17.22
INSTRUM           arx400
PROBHD   5 mm Multinucl
PULPROG           zgdc30
TD                 32768
SOLVENT             CDCl3
NS                  15007
DS                      2
SWH             25000.000 Hz
FIDRES          0.762939 Hz
AQ              0.6554100 sec
RG                  45500
DW                 20.000 usec
DE                 27.14 usec
TE                 300.0 K
D12             0.00002000 sec
DL5                20.00 dB
CPDPRG            waltz16
P31               100.00 usec
D1              0.40000001 sec
P1                  6.75 usec
DE                 27.14 usec
SFO1          100.6231179 MHz
NUCLEUS              13C
D11             0.03000000 sec

F2 - Processing parameters
SI                  16384
SF            100.6127490 MHz
WDW                    EM
SSB                     0
LB                 2.00 Hz
GB                      0
PC                 1.40

1D NMR plot parameters
CX                 20.00 cm
F1P              220.000 ppm
F1              22134.80 Hz
F2P              -10.000 ppm
F2              -1006.13 Hz
PPMCM            11.50000 ppm/cm
HZCM           1157.04663 Hz/cm
```

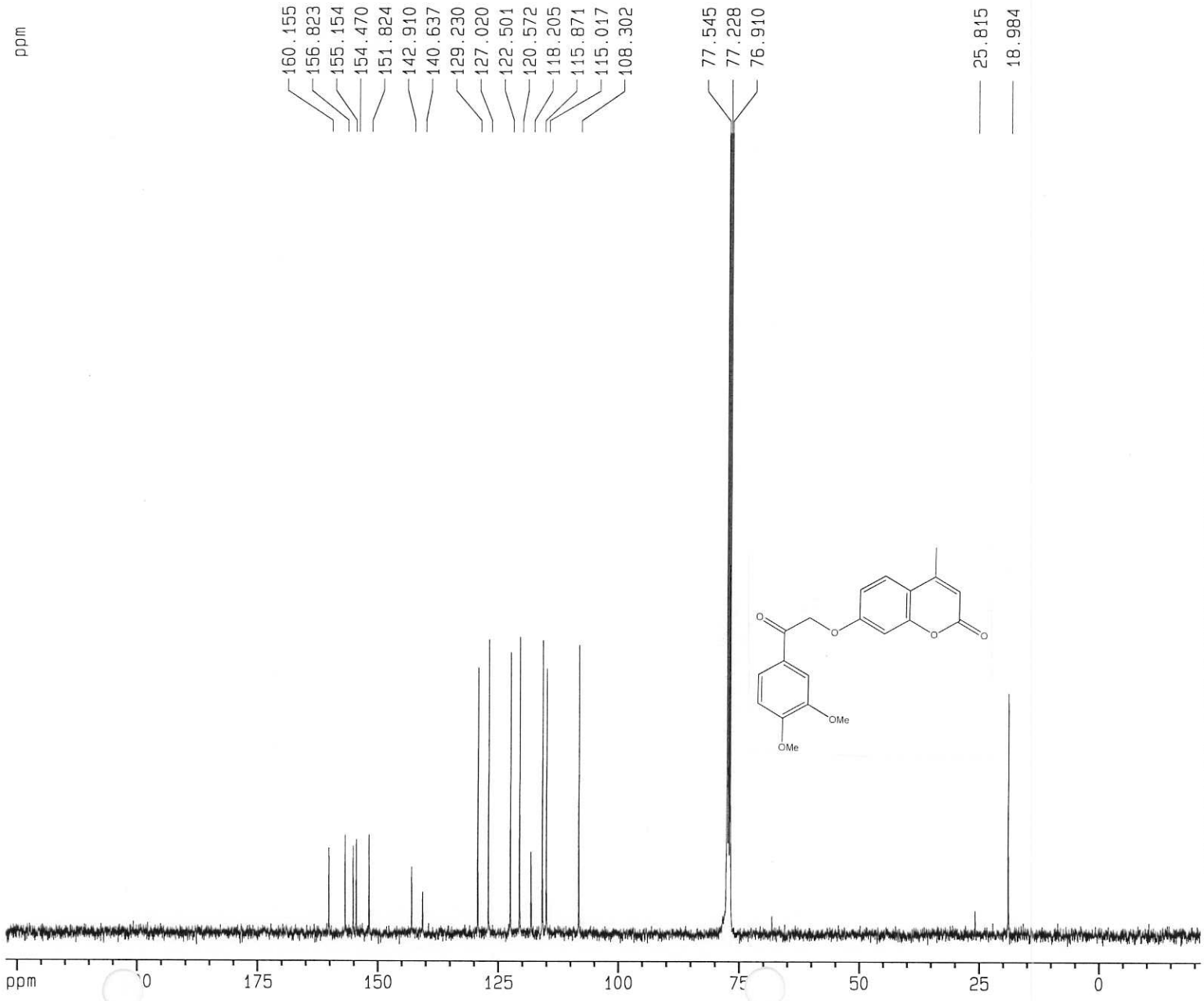
1H NMR of 1-(3,4-dimethoxyphenyl)-2-(4-methyl-umbelliferoxy)-ethanone (probe 11)



Filename	= 102512QZ-III-206singl
Author	= qzhang
Experiment	= single_pulse.ex2
Sample_id	= 102512QZ-III-206singl
Solvent	= CHLOROFORM-D
Creation_time	= 26-OCT-2012 15:05:24
Revision_time	= 26-OCT-2012 14:59:48
Current_time	= 26-OCT-2012 15:00:02
Comment	= single_pulse
Data_format	= 1D COMPLEX
Dim_size	= 13107
Dim_title	= 1H
Dim_units	= [ppm]
Dimensions	= X
Site	= ECX 300
Spectrometer	= ECX-300
Field_strength	= 7.0586013[T] (300[MHz
X_acq_duration	= 2.90717696[s]
X_domain	= 1H
X_freq	= 300.52965592[MHz]
X_offset	= 5[ppm]
X_points	= 16384
X_prescans	= 1
X_resolution	= 0.34397631[Hz]
X_sweep	= 5.63570784[kHz]
Irr_domain	= 1H
Irr_freq	= 300.52965592[MHz]
Irr_offset	= 5[ppm]
Tri_domain	= 1H
Tri_freq	= 300.52965592[MHz]
Tri_offset	= 5[ppm]
Clipped	= FALSE
Mod_return	= 1
Scans	= 8
Total_scans	= 8
X_90_width	= 13.43[us]
X_acq_time	= 2.90717696[s]
X_angle	= 45[deg]
X_atn	= 3[dB]
X_pulse	= 6.715[us]
Irr_mode	= Off
Tri_mode	= Off
Dante_presat	= FALSE
Initial_wait	= 1[s]
Recvr_gain	= 50
Relaxation_delay	= 5[s]
Repetition_time	= 7.90717696[s]
Temp_get	= 22.7[dC]

Standard 13C
Experiment

13C NMR of 1-(3,4-dimethoxyphenyl)-2-(4-methyl-umbelliferoxy)-ethanone (probe 11)



Current Data Parameters

NAME	QZ-III-206II
EXPNO	9
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	11.12
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	CDCl3
NS	15239
DS	2
SWH	25000.000 Hz
FIDRES	0.762939 Hz
AQ	0.6554100 sec
RG	45500
DW	20.000 usec
DE	27.14 usec
TE	300.0 K
D12	0.00002000 sec
DL5	20.00 dB
CPDPRG	waltz16
P31	100.00 usec
D1	0.40000001 sec
P1	6.75 usec
DE	27.14 usec
SFO1	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

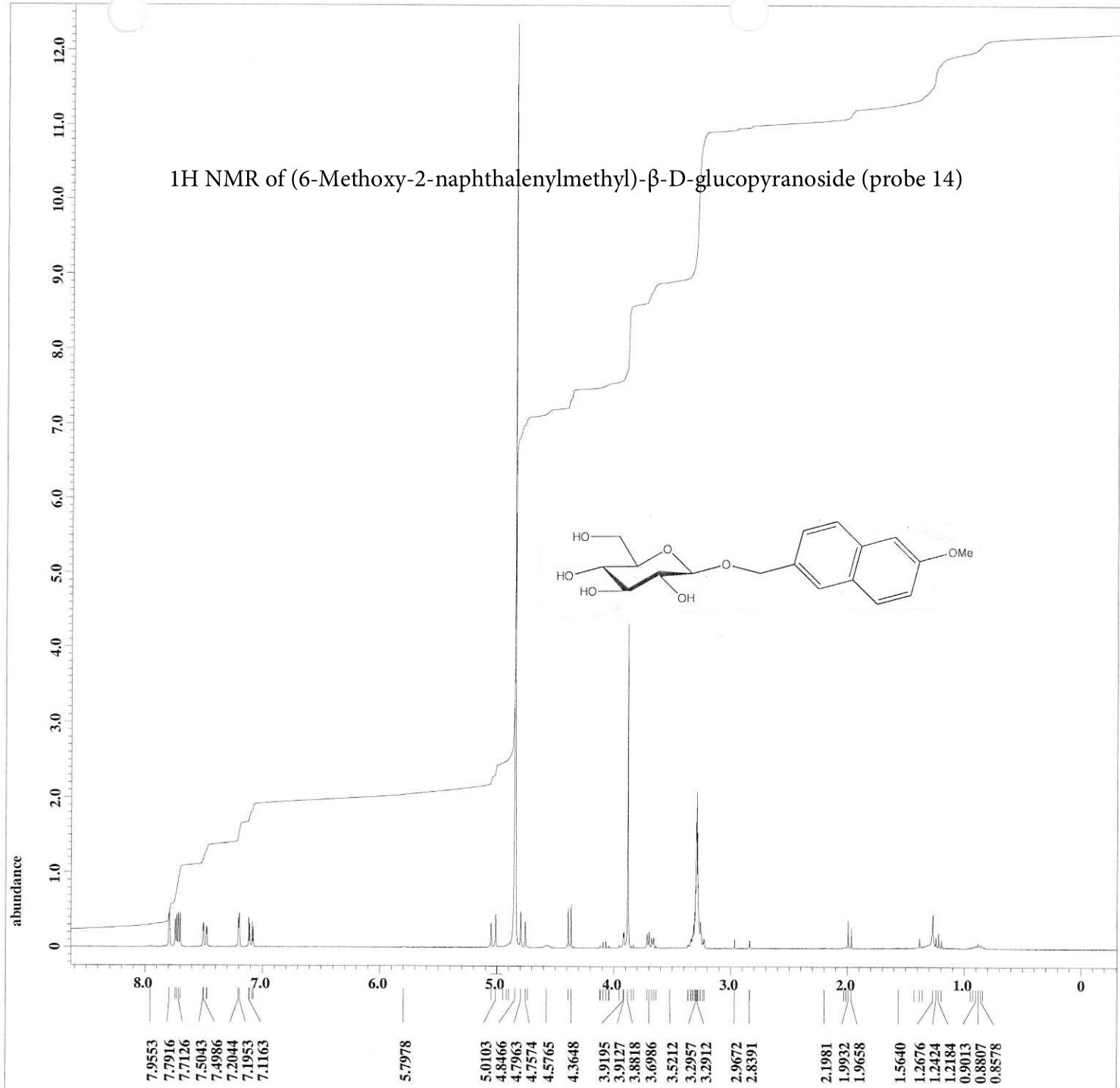
F2 - Processing parameters

SI	16384
SF	100.6127490 MHz
WDW	EM
SSB	0
LB	2.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	227.296 ppm
F1	22868.89 Hz
F2P	-21.181 ppm
F2	-2131.11 Hz
PPMCM	12.42387 ppm/cm
HZCM	1250.00012 Hz/cm

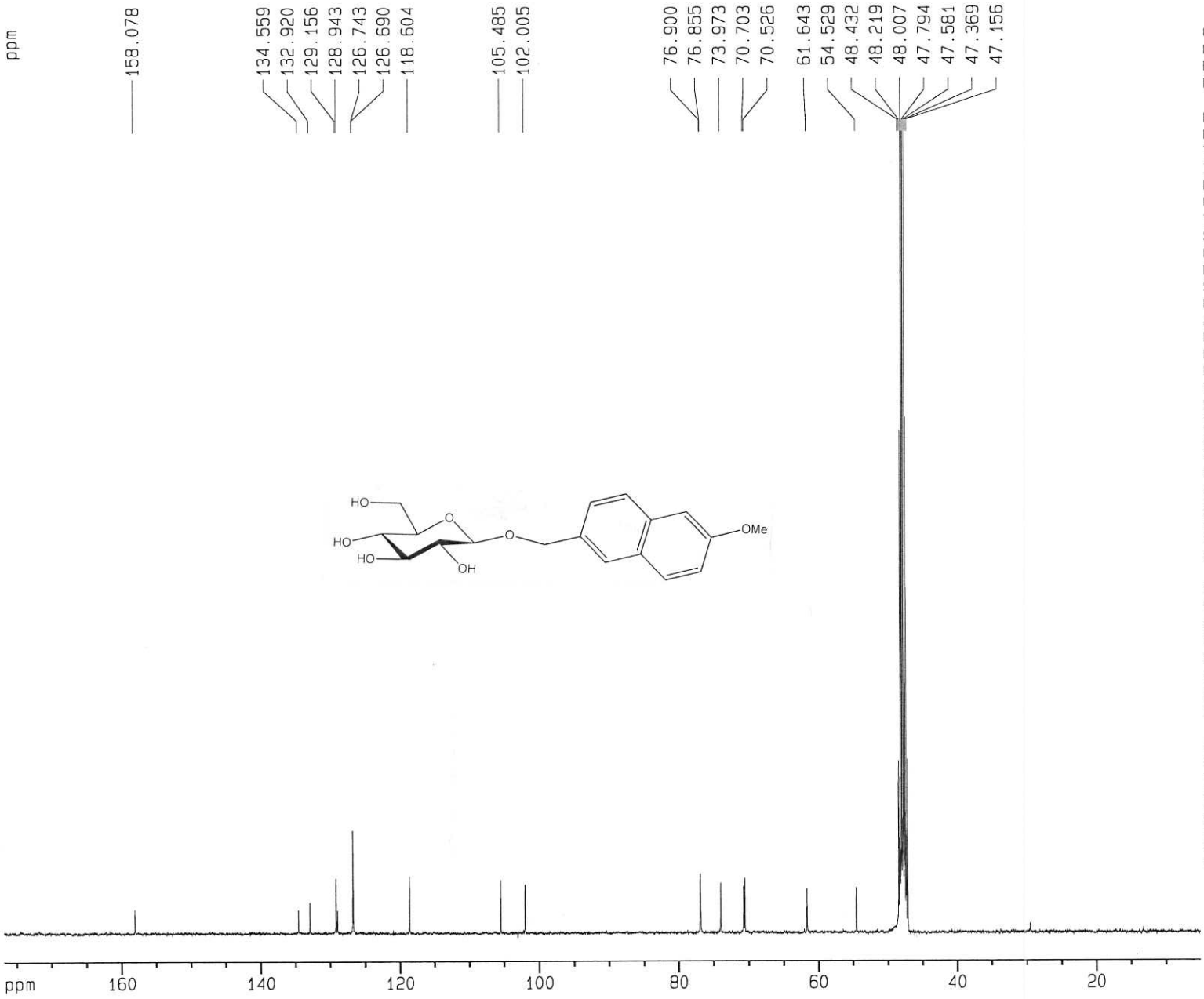
1H NMR of (6-Methoxy-2-naphthalenylmethyl)-β-D-glucopyranoside (probe 14)




```
Filename          = 051413QZ-IV-112single
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 051413QZ-IV-112single
Solvent           = METHANOL-D3
Creation_time     = 14-MAY-2013 09:36:26
Revision_time     = 14-MAY-2013 10:12:02
Current_time      = 14-MAY-2013 10:12:06

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 44
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 23.8[dC]
```

Standard 13C Experiment

13C NMR of (6-Methoxy-2-naphthalenylmethyl)-β-D-glucopyranoside (probe 14)



Current Data Parameters

NAME	QZ-IV-112
EXPNO	9
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	10.58
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	MeOH
NS	10487
DS	2
SWH	25000.000 Hz
FIDRES	0.762939 Hz
AQ	0.6554100 sec
RG	45500
DW	20.000 usec
DE	27.14 usec
TE	300.0 K
D12	0.00002000 sec
DL5	20.00 dB
CPDPRG	waltz16
P31	100.00 usec
D1	0.40000001 sec
P1	6.75 usec
DE	27.14 usec
SFO1	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

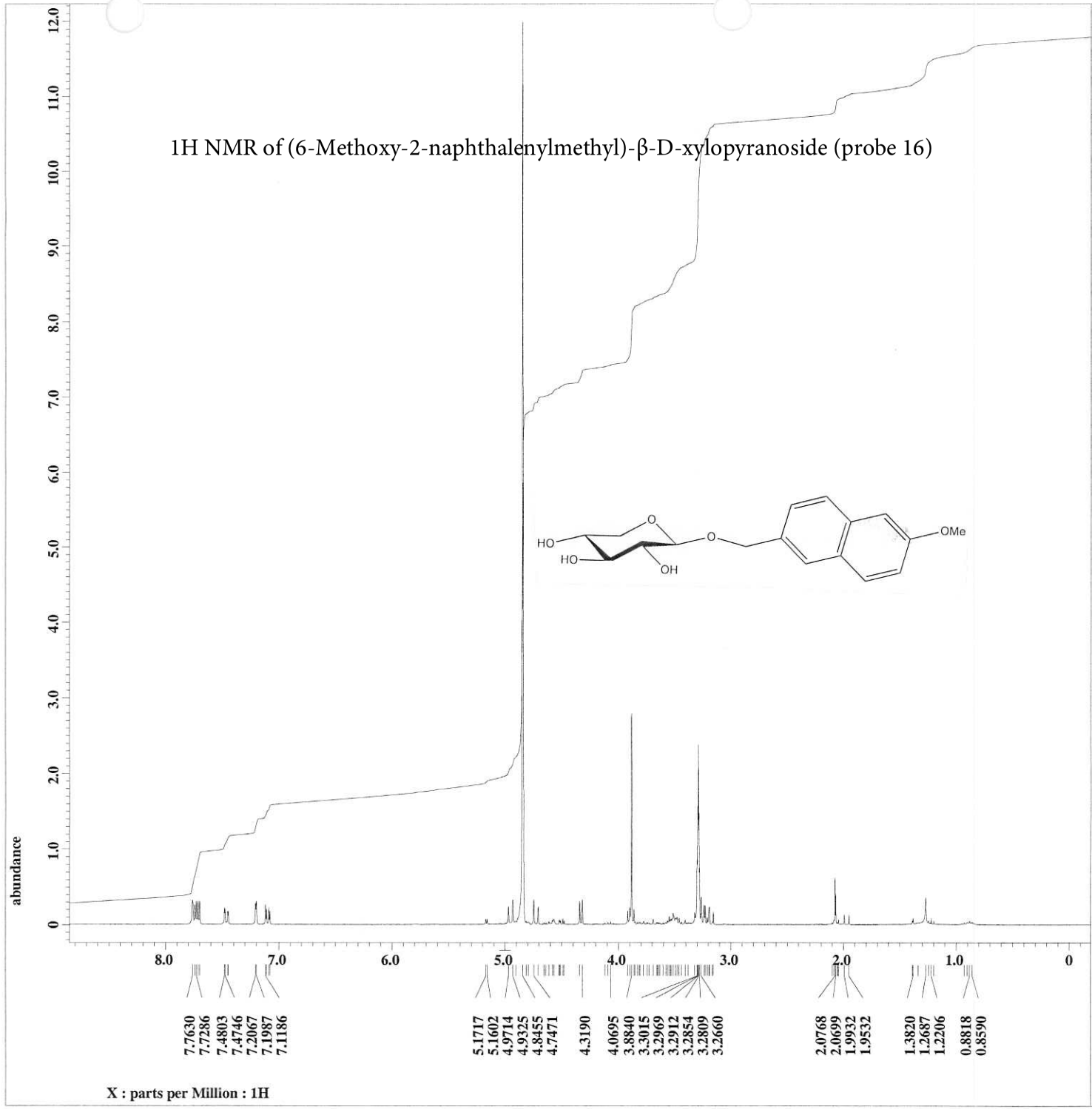
F2 - Processing parameters

SI	16384
SF	100.6127490 MHz
WDW	EM
SSB	0
LB	2.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	176.793 ppm
F1	17787.59 Hz
F2P	5.081 ppm
F2	511.17 Hz
PPMCM	8.58560 ppm/cm
HZCM	863.82104 Hz/cm

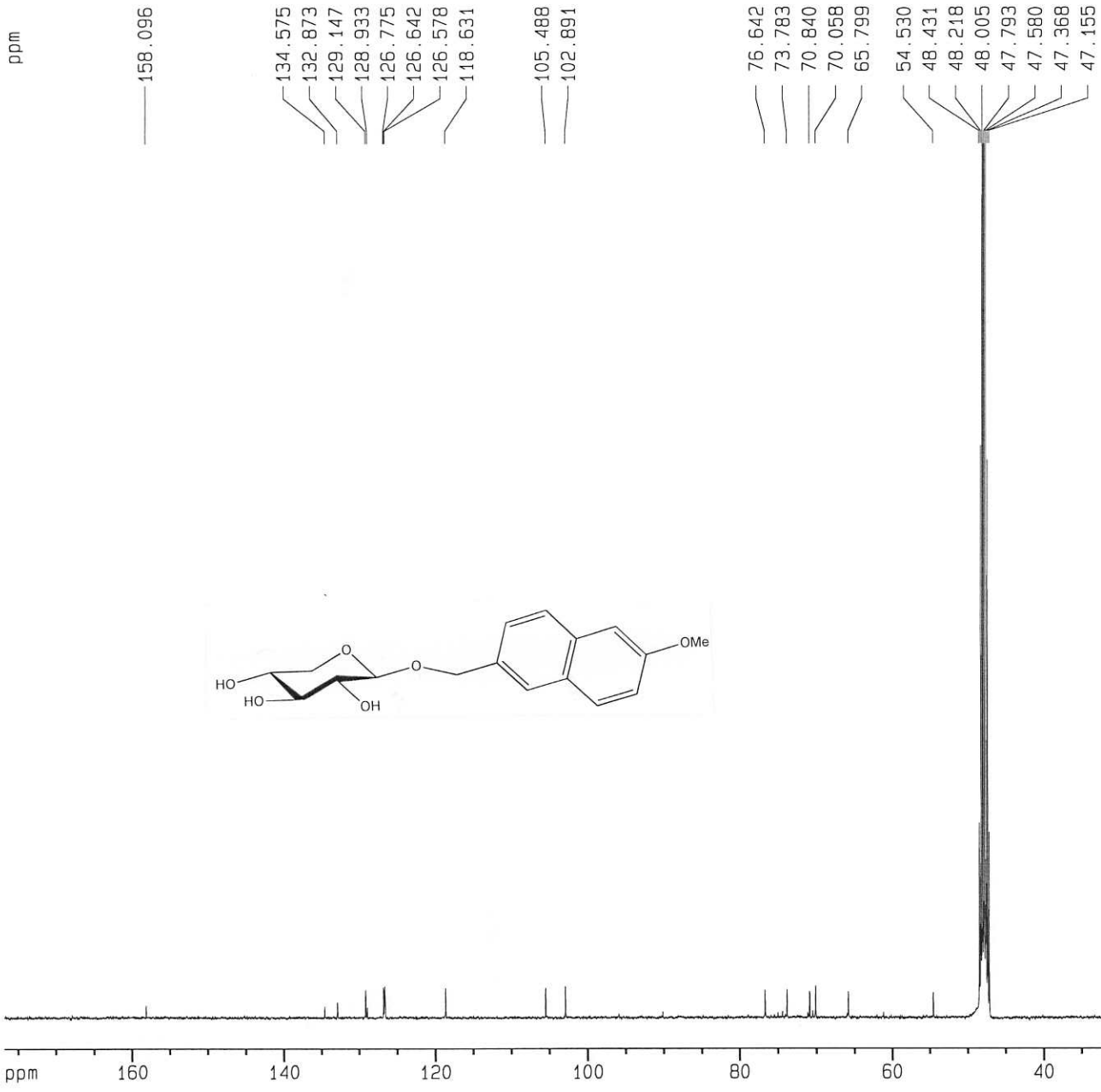
1H NMR of (6-Methoxy-2-naphthalenylmethyl)-β-D-xylopyranoside (probe 16)



JEOL

```
Filename          = 050813QZ-IV-105IVsing
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 050813QZ-IV-105IVsing
Solvent           = METHANOL-D3
Creation_time     =  8-MAY-2013 14:08:33
Revision_time     =  8-MAY-2013 14:44:12
Current_time      =  8-MAY-2013 14:44:16

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 46
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 23.8[dC]
```

13C NMR of (6-Methoxy-2-naphthalenylmethyl)-β-D-xylopyranoside (probe 16)



Current Data Parameters

NAME	QZ-IV-105IV
EXPNO	9
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	10.29
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	MeOH
NS	12330
DS	2
SWH	25000.000 Hz
FIDRES	0.762939 Hz
AQ	0.6554100 sec
RG	45500
DW	20.000 usec
DE	27.14 usec
TE	300.0 K
D12	0.00002000 sec
DL5	20.00 dB
CPDPRG	waltz16
P31	100.00 usec
D1	0.40000001 sec
P1	6.75 usec
DE	27.14 usec
SFO1	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

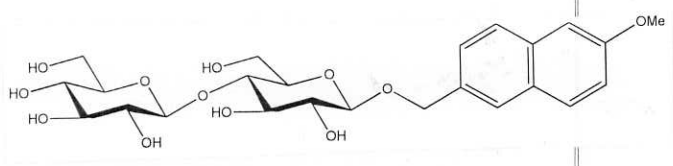
F2 - Processing parameters

SI	16384
SF	100.6127490 MHz
WDW	EM
SSB	0
LB	2.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	176.793 ppm
F1	17787.59 Hz
F2P	5.081 ppm
F2	511.17 Hz
PPMCM	8.58560 ppm/cm
HZCM	863.82104 Hz/cm

1H NMR of (6-Methoxy-2-naphthalenylmethyl)-β-D-cellubioside (probe 17)

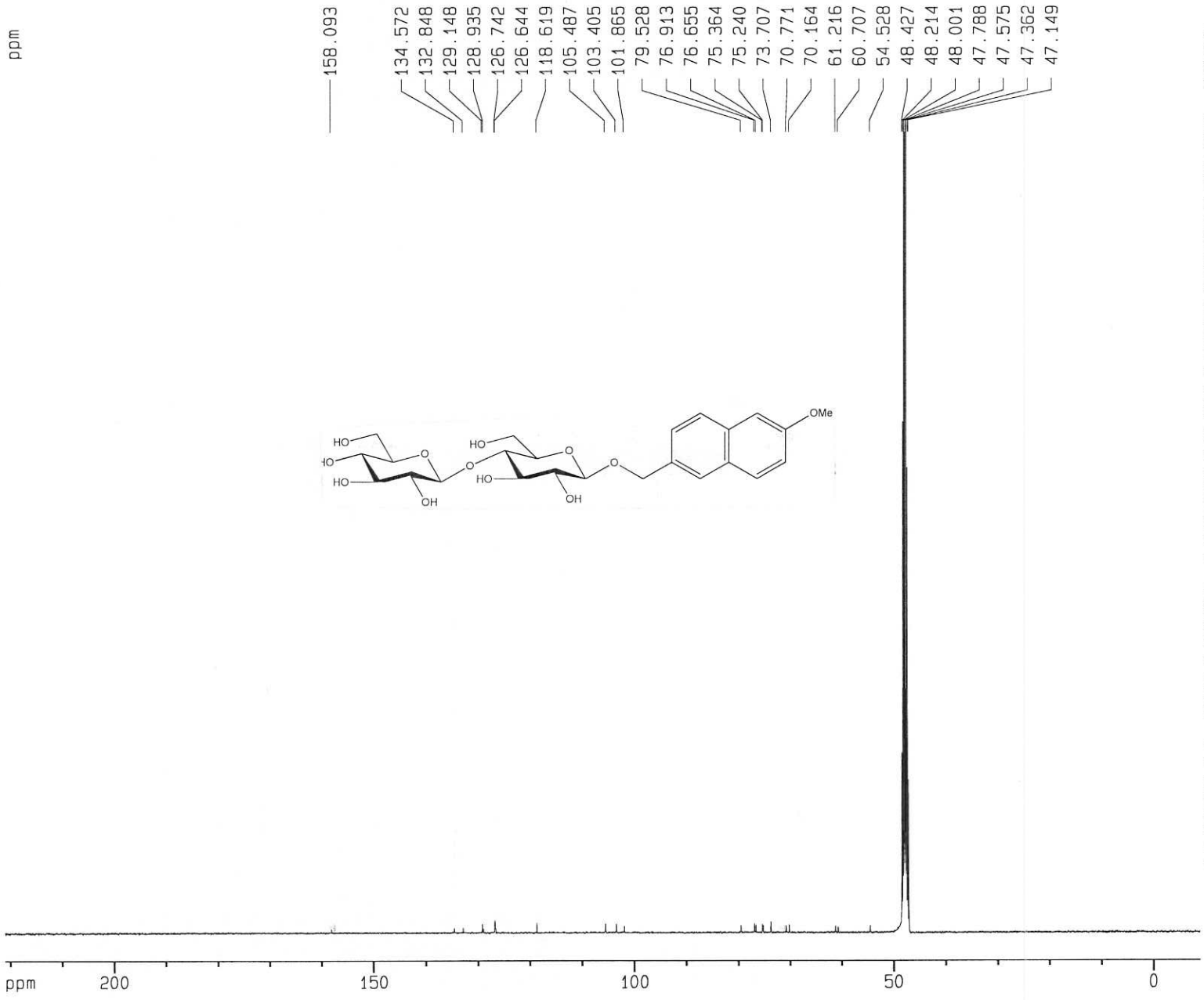


JEOL

Filename	= 052413QZ-IV-119single
Author	= qzhang
Experiment	= single_pulse.ex2
Sample_id	= 052413QZ-IV-119single
Solvent	= METHANOL-D3
Creation_time	= 24-MAY-2013 10:37:34
Revision_time	= 24-MAY-2013 11:11:13
Current_time	= 24-MAY-2013 11:11:28
Comment	= single_pulse
Data_format	= 1D COMPLEX
Dim_size	= 13107
Dim_title	= 1H
Dim_units	= [ppm]
Dimensions	= X
Site	= ECX 300
Spectrometer	= ECX-300
Field_strength	= 7.0586013[T] (300[MHz
X_acq_duration	= 2.90717696[s]
X_domain	= 1H
X_freq	= 300.52965592[MHz]
X_offset	= 5[ppm]
X_points	= 16384
X_prescans	= 1
X_resolution	= 0.34397631[Hz]
X_sweep	= 5.63570784[kHz]
Irr_domain	= 1H
Irr_freq	= 300.52965592[MHz]
Irr_offset	= 5[ppm]
Tri_domain	= 1H
Tri_freq	= 300.52965592[MHz]
Tri_offset	= 5[ppm]
Clipped	= FALSE
Mod_return	= 1
Scans	= 8
Total_scans	= 8
X_90_width	= 13.43[us]
X_acq_time	= 2.90717696[s]
X_angle	= 45[deg]
X_atn	= 3[dB]
X_pulse	= 6.715[us]
Irr_mode	= Off
Tri_mode	= Off
Dante_presat	= FALSE
Initial_wait	= 1[s]
Recvr_gain	= 46
Relaxation_delay	= 5[s]
Repetition_time	= 7.90717696[s]
Temp_get	= 23.3[dC]

13C NMR of (6-Methoxy-2-naphthalenylmethyl)-β-D-cellubioside (probe 17)

Standard 13C Experiment



Current Data Parameters

NAME	QZ-IV-119
EXPNO	9
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	11.37
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	MeOH
NS	39540
DS	2
SWH	25000.000 Hz
FIDRES	0.762939 Hz
AQ	0.6554100 sec
RG	45500
DW	20.000 usec
DE	27.14 usec
TE	300.0 K
D12	0.00002000 sec
DL5	20.00 dB
CPDPRG	waltz16
P31	100.00 usec
D1	0.40000001 sec
P1	6.75 usec
DE	27.14 usec
SFO1	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

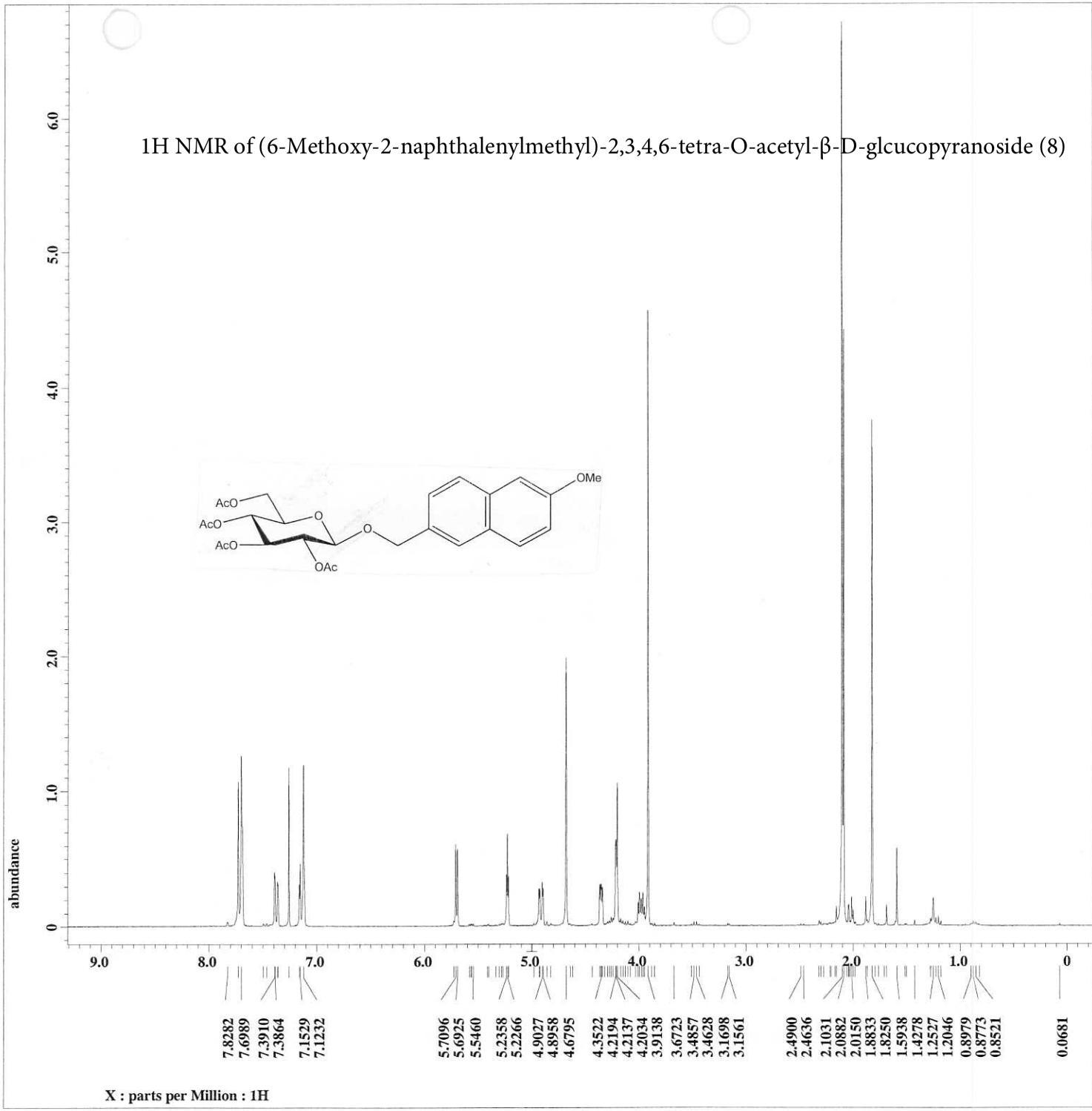
F2 - Processing parameters

SI	16384
SF	100.6127490 MHz
WDW	EM
SSB	0
LB	2.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

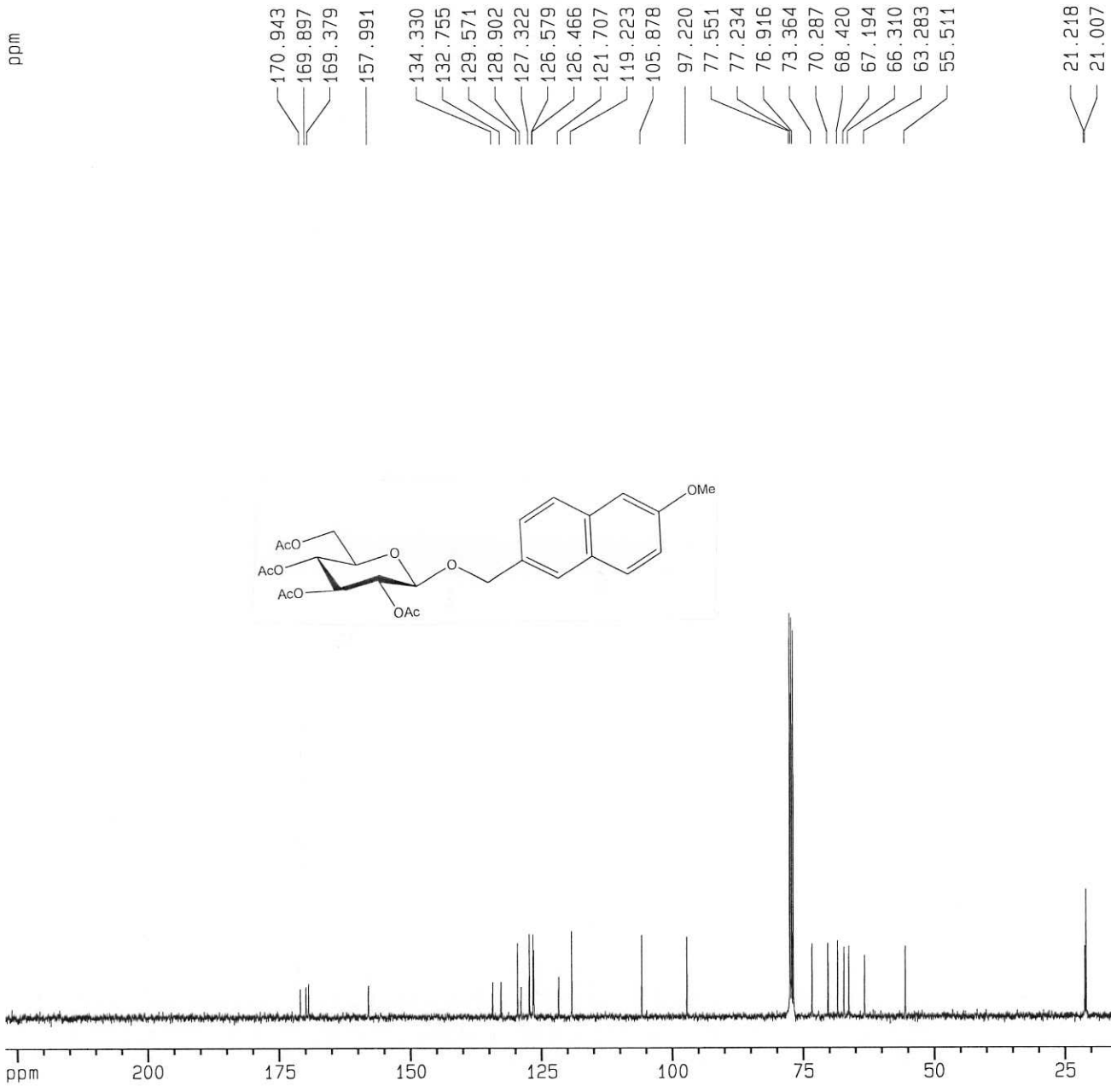
CX	20.00 cm
F1P	221.028 ppm
F1	22238.22 Hz
F2P	-8.895 ppm
F2	-894.98 Hz
PPMCM	11.49616 ppm/cm
HZCM	1156.65991 Hz/cm

1H NMR of (6-Methoxy-2-naphthalenylmethyl)-2,3,4,6-tetra-O-acetyl-β-D-glcucopyranoside (8)



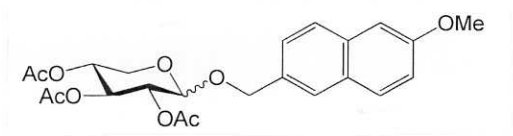

```
Filename          = 030713QZ-IV-50single_
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 030713QZ-IV-50single_
Solvent           = CHLOROFORM-D
Creation_time     =  7-MAR-2013 09:47:48
Revision_time     =  7-MAR-2013 10:12:07
Current_time      =  7-MAR-2013 10:12:47

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 44
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 22.2[dC]
```

13C NMR of (6-Methoxy-2-naphthalenylmethyl)-2,3,4,6-tetra-O-acetyl-β-D-glcucopyranoside (8)




```
Current Data Parameters
NAME                  QZ-IV-50
EXPNO                        9
PROCNO                       1

F2 - Acquisition Parameters
Date_                   500000
Time                     11.17
INSTRUM                  arx400
PROBHD   5 mm Multinucl
PULPROG                  zgdc30
TD                        32768
SOLVENT                   CDCl3
NS                         2118
DS                            2
SWH                  25000.000 Hz
FIDRES                0.762939 Hz
AQ                    0.6554100 sec
RG                        45500
DW                       20.000 usec
DE                       27.14 usec
TE                       300.0 K
D12                  0.00002000 sec
DL5                      20.00 dB
CPDPRG                  waltz16
P31                     100.00 usec
D1                   0.40000001 sec
P1                        6.75 usec
DE                       27.14 usec
SFO1               100.6231179 MHz
NUCLEUS                    13C
D11                  0.03000000 sec

F2 - Processing parameters
SI                        16384
SF                 100.6127490 MHz
WDW                          EM
SSB                           0
LB                         2.00 Hz
GB                            0
PC                         1.40

1D NMR plot parameters
CX                        20.00 cm
F1P                      227.296 ppm
F1                     22868.89 Hz
F2P                      -21.181 ppm
F2                     -2131.11 Hz
PPMCM                  12.42387 ppm/cm
HZCM                1250.00012 Hz/cm
```

1H NMR of (6-Methoxy-2-naphthalenylmethyl)-2,3,4,-tri-O-acetyl-D-xylopyranoside (10)

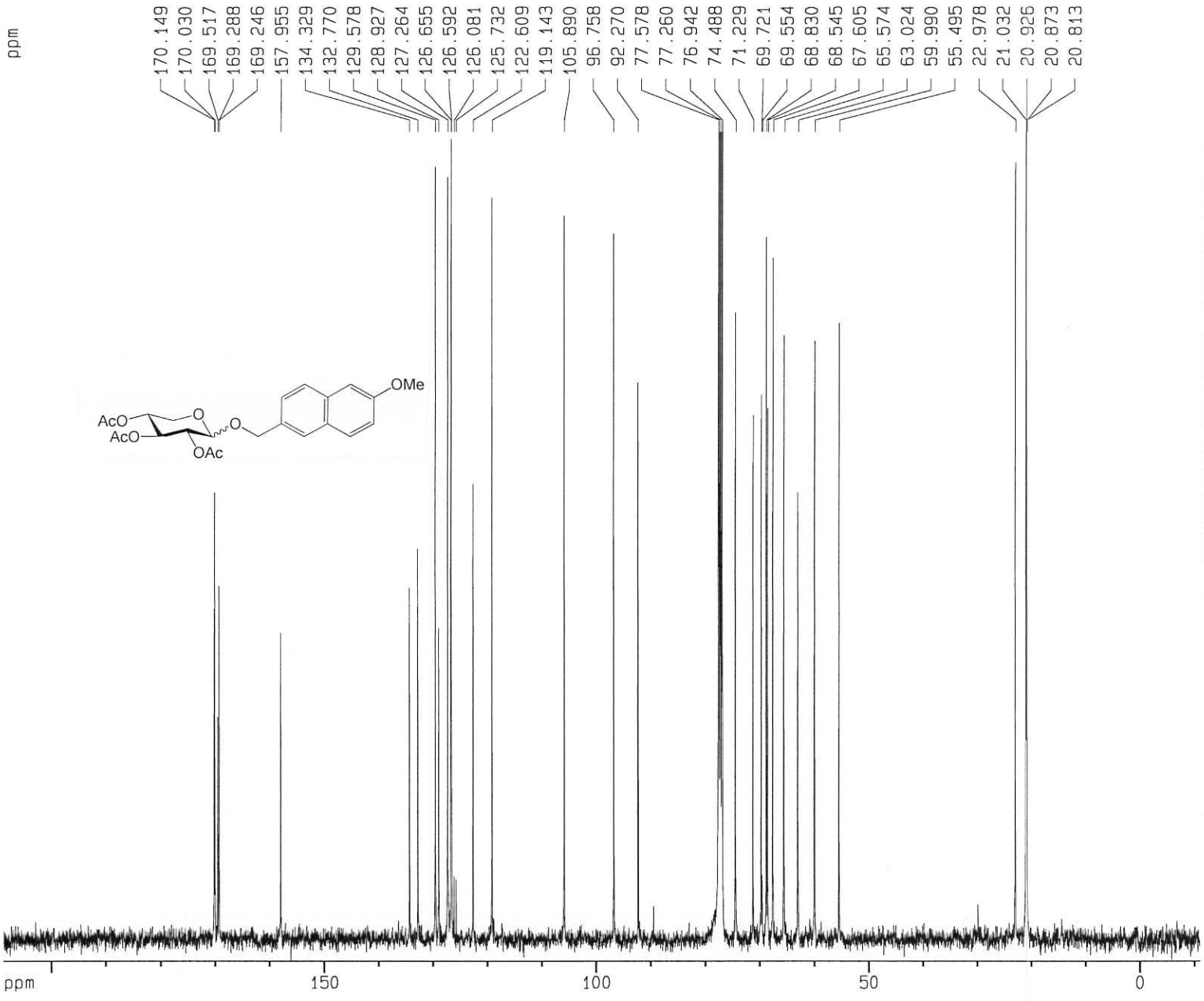


JEOL

```
Filename          = 053013QZ-IV-116single
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 053013QZ-IV-116single
Solvent           = CHLOROFORM-D
Creation_time     = 30-MAY-2013 14:36:47
Revision_time     = 30-MAY-2013 20:35:50
Current_time      = 30-MAY-2013 20:35:58

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 40
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 23.5[dC]
```

Standard 13C Experiment

13C NMR of (6-Methoxy-2-naphthalenylmethyl)-2,3,4,-tri-O-acetyl-D-xylopyranoside (10)



Current Data Parameters

NAME	QZ-IV-116
EXPNO	9
PROCNO	1

F2 - Acquisition Parameters

Date_	500000
Time	15.33
INSTRUM	arx400
PROBHD	5 mm Multinucl
PULPROG	zgdc30
TD	32768
SOLVENT	CDCl3
NS	11415
DS	2
SWH	25000.000 Hz
FIDRES	0.762939 Hz
AQ	0.6554100 sec
RG	45500
DW	20.000 usec
DE	27.14 usec
TE	300.0 K
D12	0.00002000 sec
DL5	20.00 dB
CPDPRG	waltz16
P31	100.00 usec
D1	0.40000001 sec
P1	6.75 usec
DE	27.14 usec
SFO1	100.6231179 MHz
NUCLEUS	13C
D11	0.03000000 sec

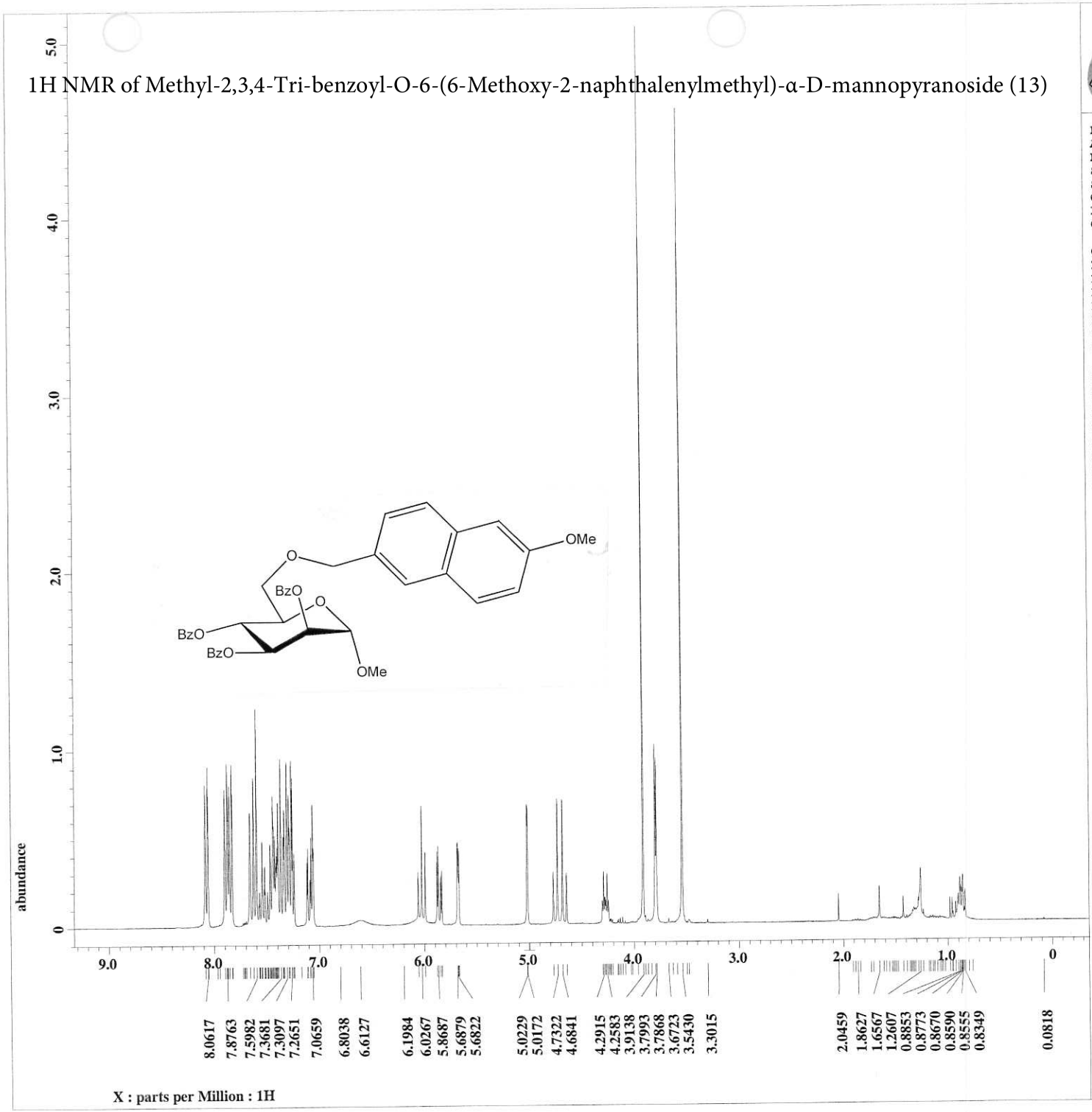
F2 - Processing parameters

SI	16384
SF	100.6127490 MHz
WDW	EM
SSB	0
LB	2.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
F1P	208.747 ppm
F1	21002.59 Hz
F2P	-10.992 ppm
F2	-1105.93 Hz
PPMCM	10.98694 ppm/cm
HZCM	1105.42627 Hz/cm

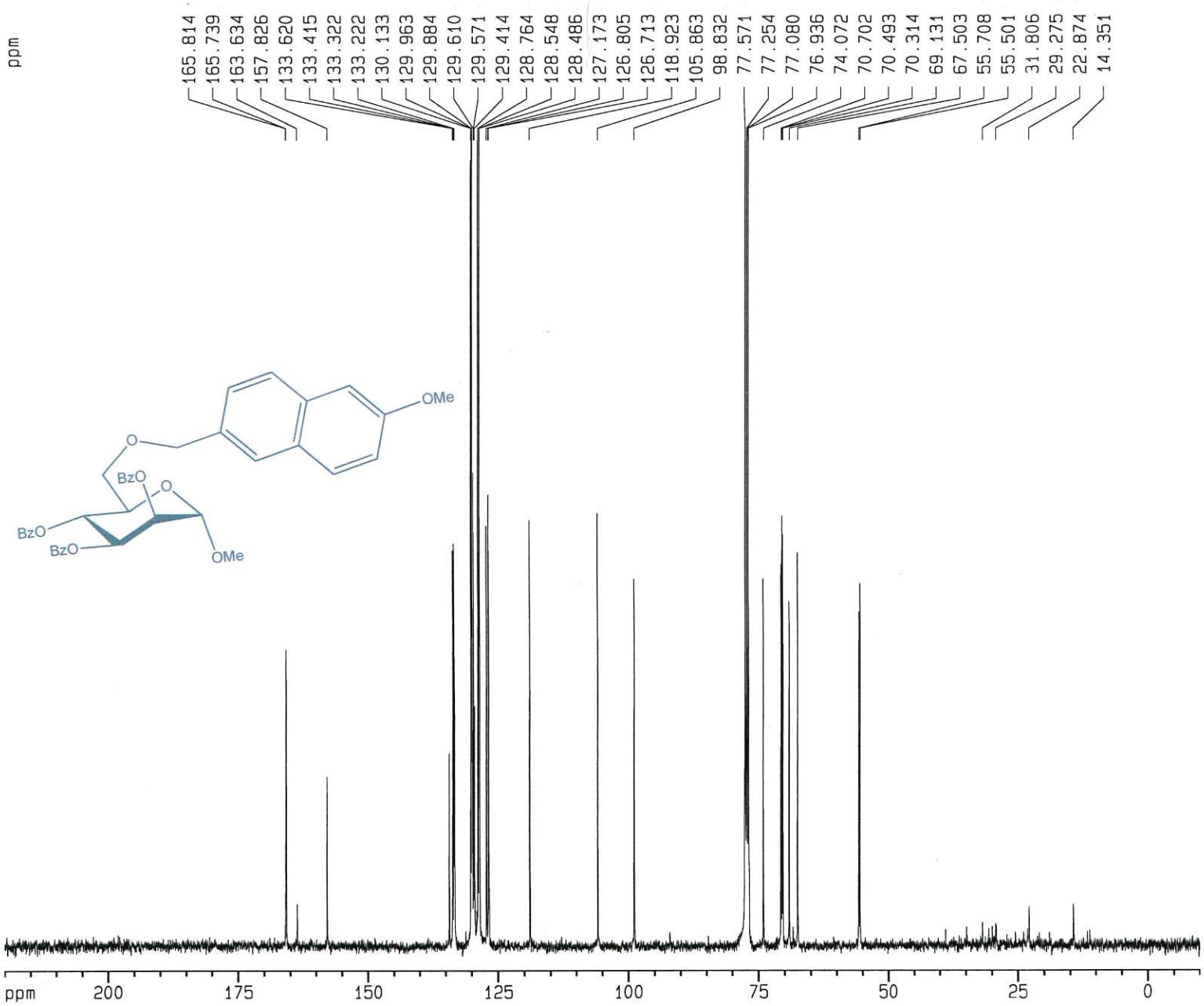
1H NMR of Methyl-2,3,4-Tri-benzoyl-O-6-(6-Methoxy-2-naphthalenylmethyl)-α-D-mannopyranoside (13)




```
Filename          = 040612QZ-III-57single
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 040612QZ-III-57single
Solvent           = CHLOROFORM-D
Creation_time     =  6-APR-2012 10:46:27
Revision_time     =  6-APR-2012 10:40:27
Current_time      =  6-APR-2012 10:40:37

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 40
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 22.6[dC]
```

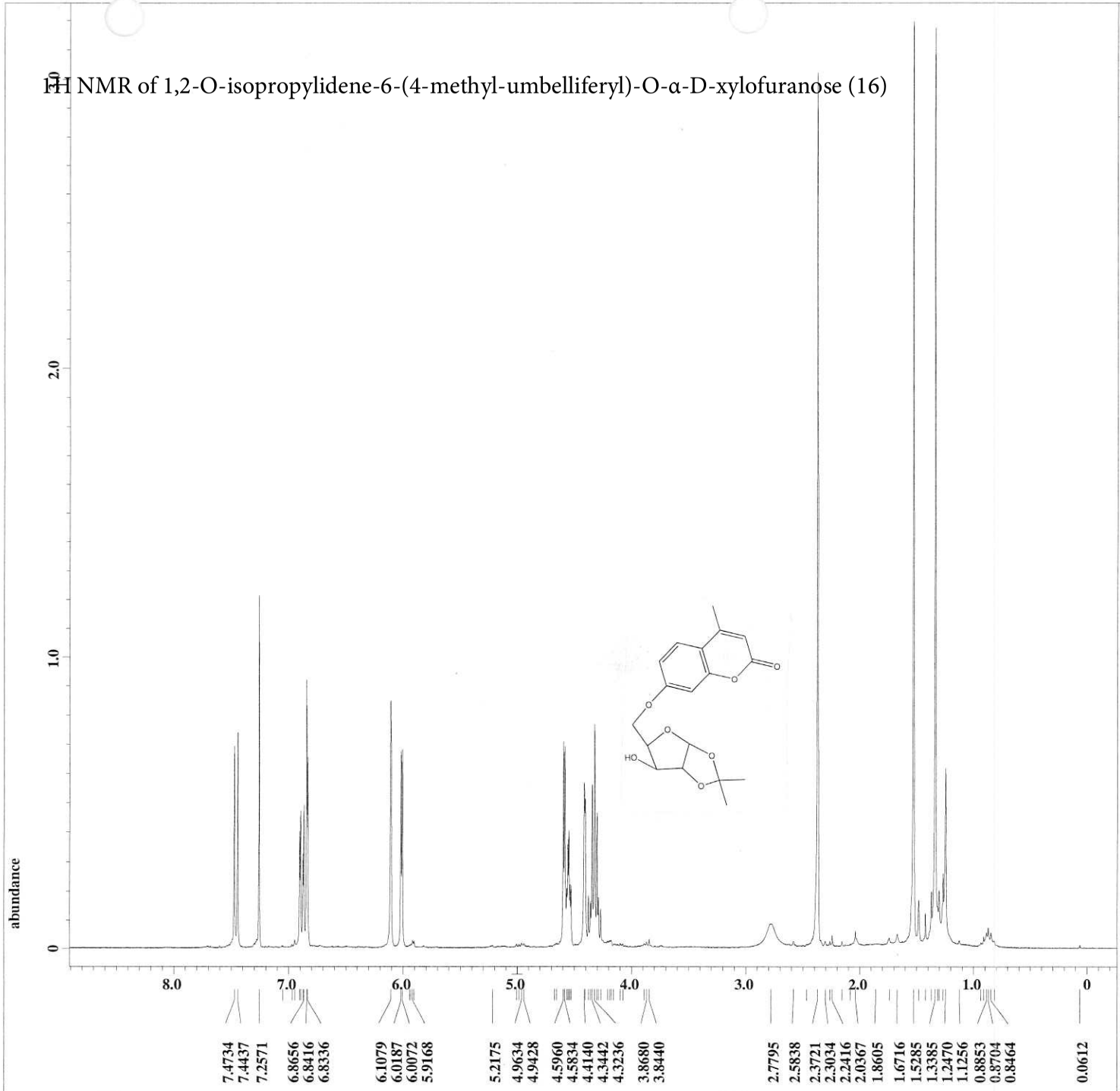
Standard 13C
Experiment

13C NMR of Methyl-2,3,4-Tri-benzoyl-O-6-(6-Methoxy-2-naphthalenylmethyl)-α-D-mannopyranoside (13)




```
Current Data Parameters
NAME        QZ-III-57C13
EXPNO                  9
PROCNO                 1

F2 - Acquisition Parameters
Date_             500000
Time               12.11
INSTRUM           arx400
PROBHD   5 mm Multinucl
PULPROG           zgdc30
TD                 32768
SOLVENT             CDCl3
NS                 16004
DS                     2
SWH           25000.000 Hz
FIDRES         0.762939 Hz
AQ            0.6554100 sec
RG                 45500
DW              20.000 usec
DE              27.14 usec
TE                300.0 K
D12           0.00002000 sec
DL5                20.00 dB
CPDPRG           waltz16
P31             100.00 usec
D1            0.40000001 sec
P1               6.75 usec
DE              27.14 usec
SFO1        100.6231179 MHz
NUCLEUS             13C
D11           0.03000000 sec

F2 - Processing parameters
SI                 16384
SF          100.6127490 MHz
WDW                   EM
SSB                    0
LB                  2.00 Hz
GB                     0
PC                  1.40

1D NMR plot parameters
CX                 20.00 cm
F1P              220.000 ppm
F1              22134.80 Hz
F2P              -10.000 ppm
F2              -1006.13 Hz
PPMCM           11.50000 ppm/cm
HZCM          1157.04663 Hz/cm
```

^{1}H NMR of 1,2-O-isopropylidene-6-(4-methyl-umbelliferyl)-O-α-D-xylofuranose (16)

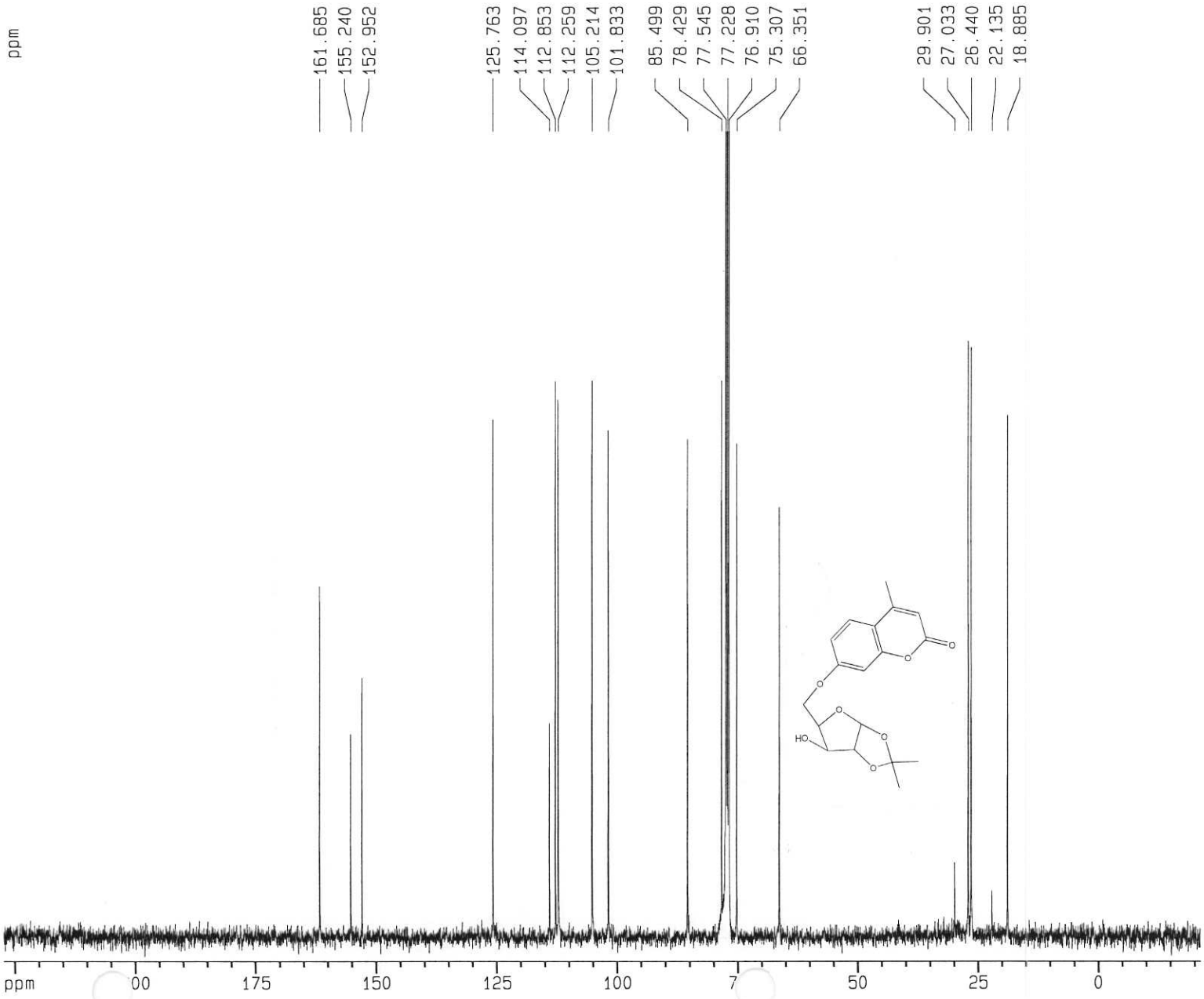


JEOL

```
Filename          = 121512QZ-III-236IIIsi
Author            = qzhang
Experiment        = single_pulse.ex2
Sample_id         = 121512QZ-III-236IIIsi
Solvent           = CHLOROFORM-D
Creation_time     = 15-DEC-2012 10:25:43
Revision_time     = 15-DEC-2012 10:21:03
Current_time      = 15-DEC-2012 10:21:11

Comment           = single_pulse
Data_format       = 1D COMPLEX
Dim_size          = 13107
Dim_title         = 1H
Dim_units         = [ppm]
Dimensions        = X
Site              = ECX 300
Spectrometer      = ECX-300

Field_strength    = 7.0586013[T] (300[MHz
X_acq_duration    = 2.90717696[s]
X_domain          = 1H
X_freq            = 300.52965592[MHz]
X_offset          = 5[ppm]
X_points          = 16384
X_prescans        = 1
X_resolution      = 0.34397631[Hz]
X_sweep           = 5.63570784[kHz]
Irr_domain        = 1H
Irr_freq          = 300.52965592[MHz]
Irr_offset        = 5[ppm]
Tri_domain        = 1H
Tri_freq          = 300.52965592[MHz]
Tri_offset        = 5[ppm]
Clipped           = FALSE
Mod_return        = 1
Scans             = 8
Total_scans       = 8

X_90_width        = 13.43[us]
X_acq_time        = 2.90717696[s]
X_angle           = 45[deg]
X_atn             = 3[dB]
X_pulse           = 6.715[us]
Irr_mode          = Off
Tri_mode          = Off
Dante_presat      = FALSE
Initial_wait      = 1[s]
Recvr_gain        = 44
Relaxation_delay  = 5[s]
Repetition_time   = 7.90717696[s]
Temp_get          = 23.3[dC]
```

Standard 13C
Experiment

13C NMR of 1,2-O-isopropylidene-6-(4-methyl-umbelliferyl)-O-α-D-xylofuranose (16)



Current Data Parameters
NAME GZ-III-236III
EXPNO 9
PROCNO 1

F2 - Acquisition Parameters
Date_ 500000
Time 13.16
INSTRUM arx400
PROBHD 5 mm Multinucl
PULPROG zgdc30
TD 32768
SOLVENT CDCl3
NS 13877
DS 2
SWH 25000.000 Hz
FIDRES 0.762939 Hz
AQ 0.6554100 sec
RG 45500
DW 20.000 usec
DE 27.14 usec
TE 300.0 K
D12 0.00002000 sec
DL5 20.00 dB
CPDPRG waltz16
P31 100.00 usec
D1 0.40000001 sec
P1 6.75 usec
DE 27.14 usec
SFO1 100.6231179 MHz
NUCLEUS 13C
D11 0.03000000 sec

F2 - Processing parameters
SI 16384
SF 100.6127490 MHz
WDW EM
SSB 0
LB 2.00 Hz
GB 0
PC 1.40

1D NMR plot parameters
CX 20.00 cm
F1P 227.296 ppm
F1 22868.89 Hz
F2P -21.181 ppm
F2 -2131.11 Hz
PPMCM 12.42387 ppm/cm
HZCM 1250.00012 Hz/cm

II. Incubation of 4MU with Aromatic Compounds

Three aromatic adducts from the possible degradation of class III probes were used for this investigation: 3,4-dimethoxyacetophenone (**A**), 3,4-dimethoxybenzyl alcohol (**B**) and 1-(3,4-dimethoxylphenyl)ethanol (**C**). The fluorescence measure showed no quenching of 4MU from these aromatic compounds. There was only a slight decrease in fluorescence when 4MU was mixed with 3,4-dimethoxyacetopheone and no changes on the other two combinations. The results confirm that no fluorescence quenching if the degradation of class III probes occurs .