

## Electronic Supplementary Information

### Synthesis of Oseltamivir and Tamiphosphor from *N*-Acetyl-D-glucosamine

Chih-An Chen<sup>a</sup> and Jim-Min Fang<sup>\*ab</sup>

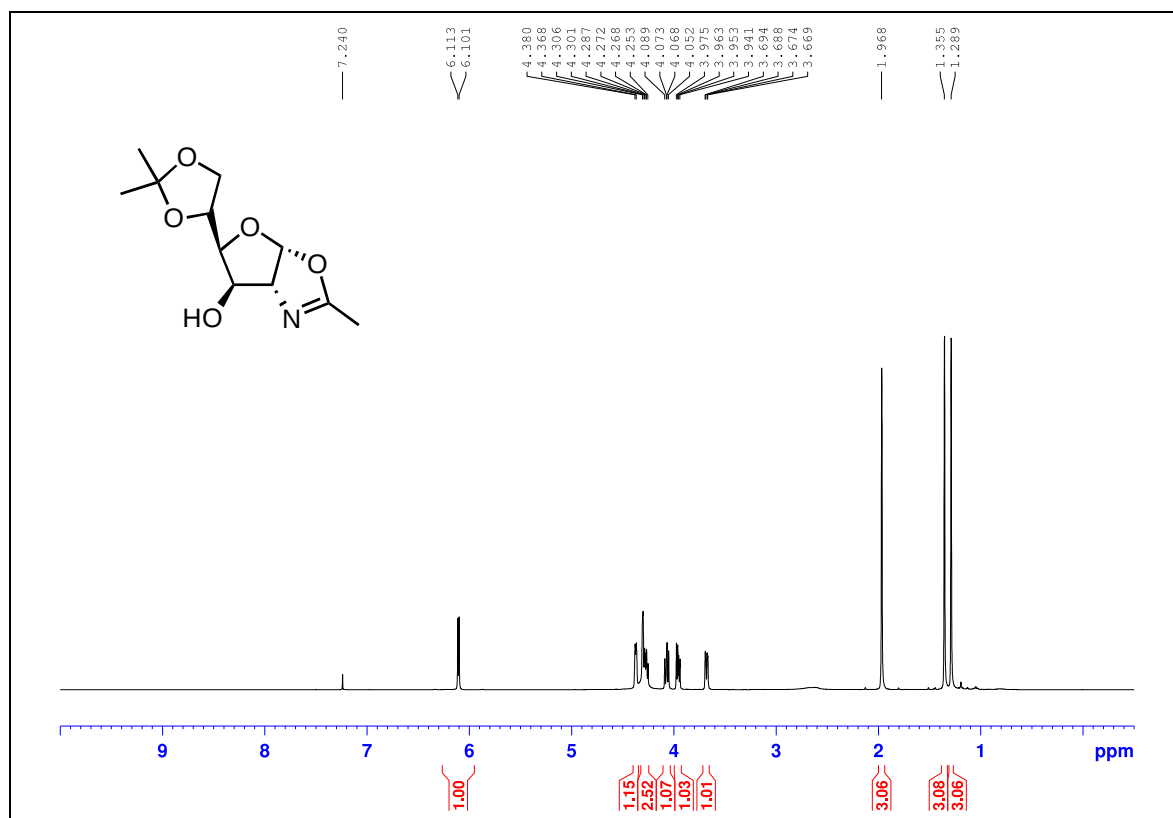
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[jmfang@ntu.edu.tw](mailto:jmfang@ntu.edu.tw); Fax: (8862) 23637812; Tel: (8862) 33661663

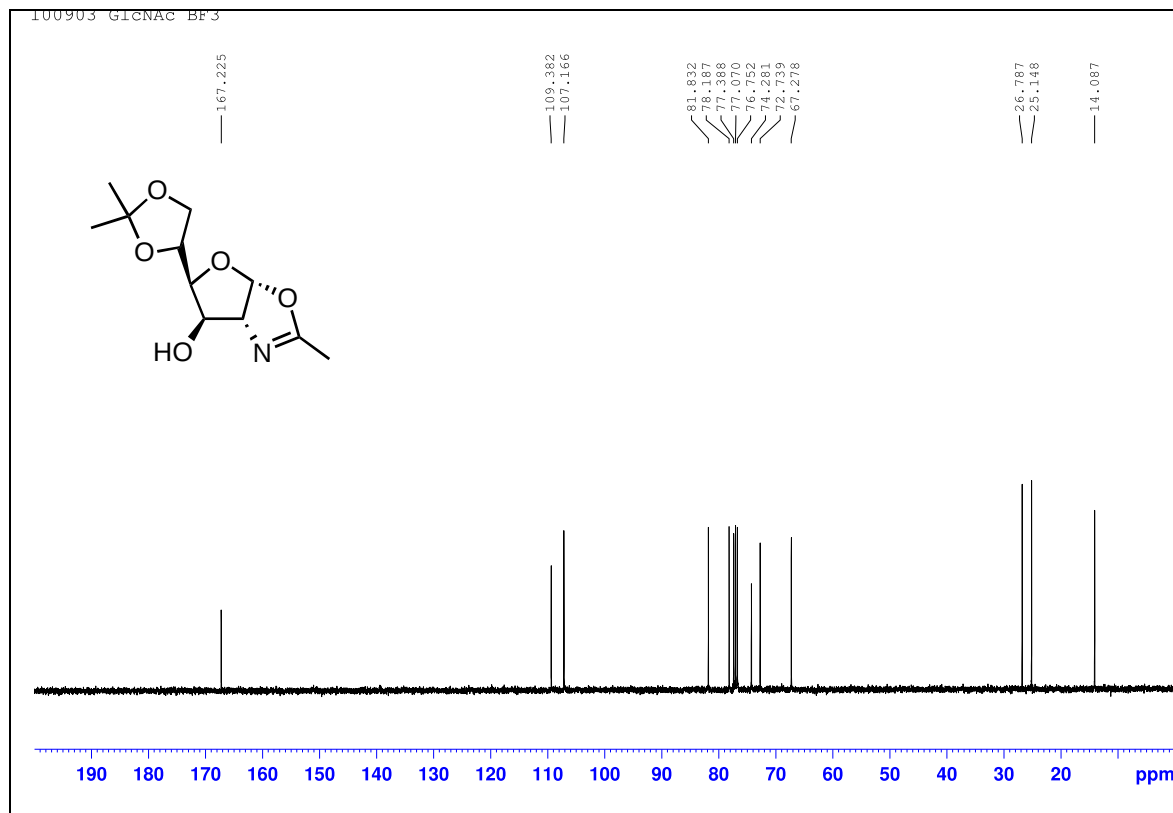
<sup>b</sup>*The Genomics Research Center, Academia Sinica, Taipei, 115, Taiwan.*

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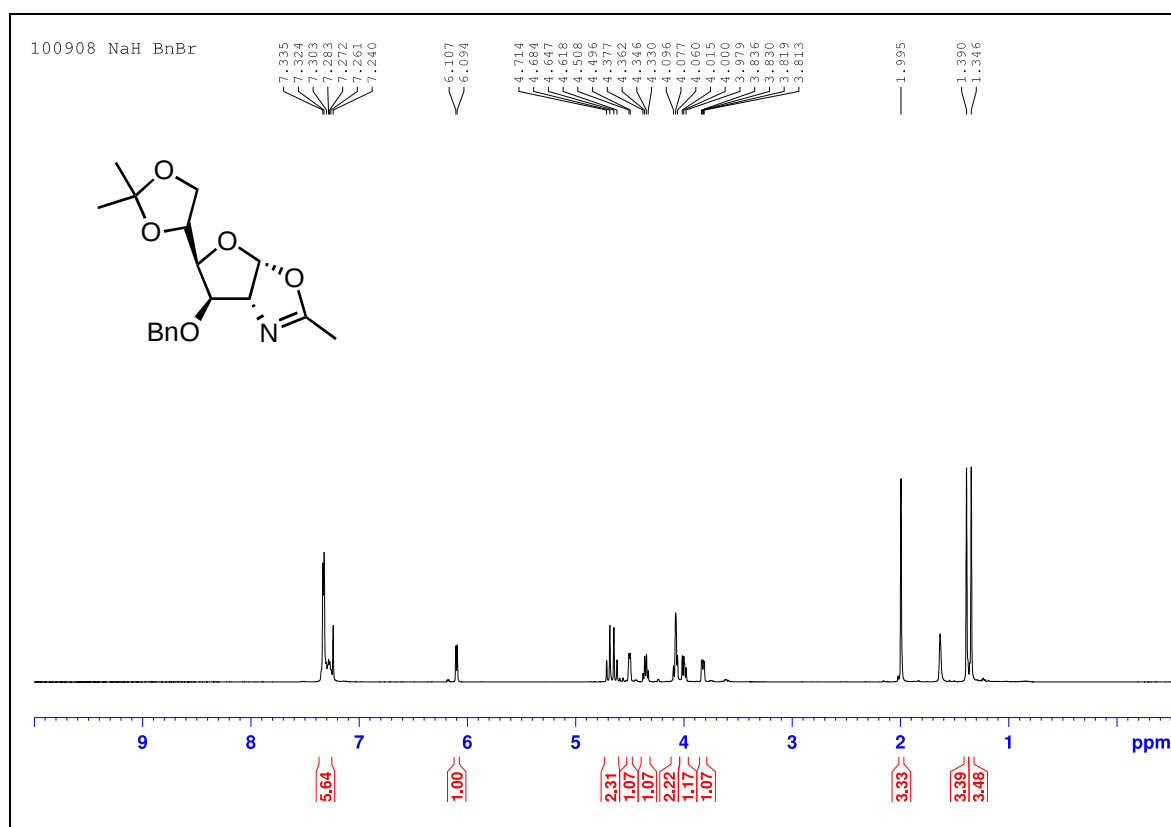
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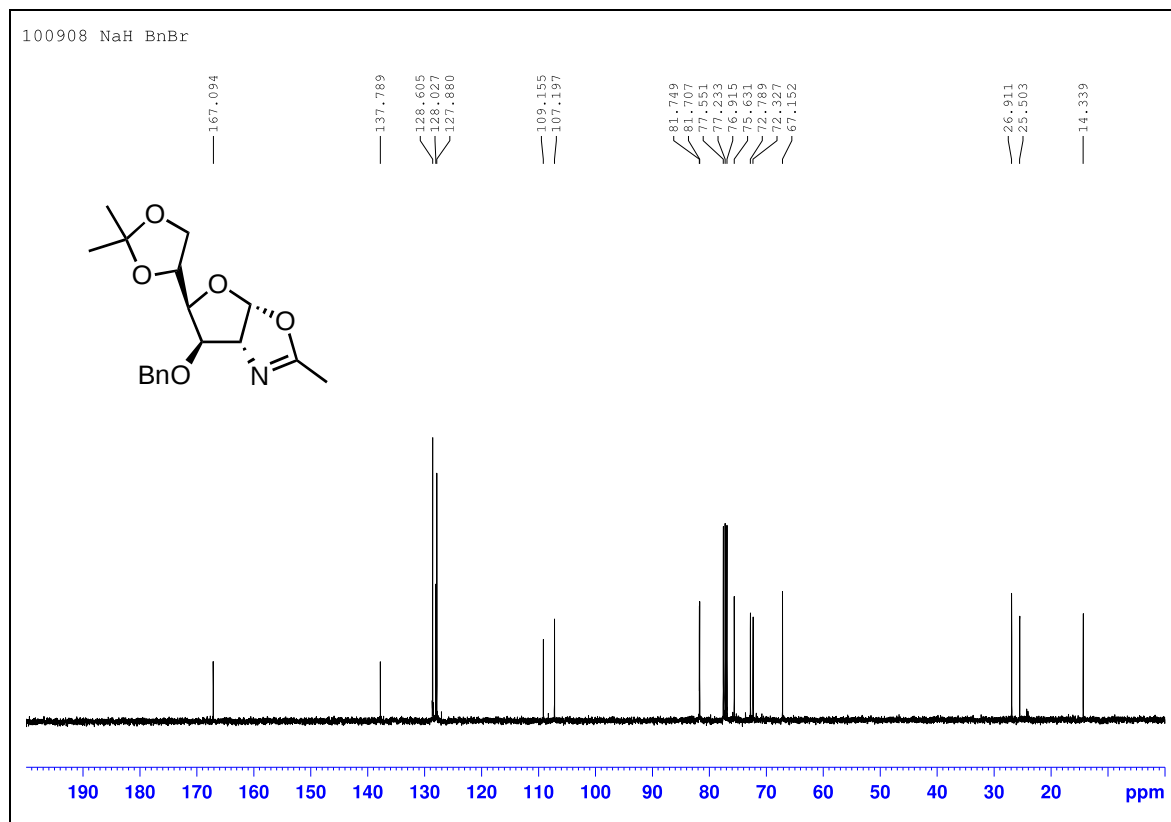
<sup>1</sup>H NMR spectrum of compound **4** (CDCl<sub>3</sub>, 400 MHz)



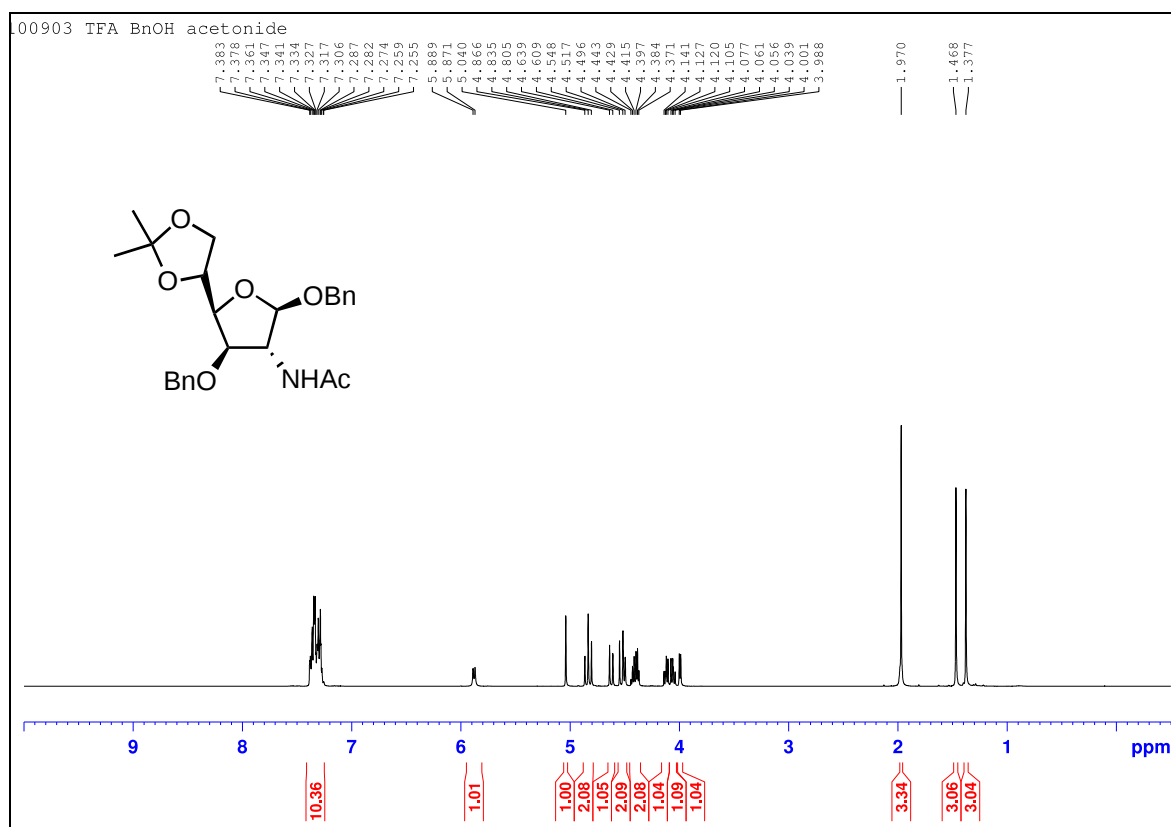
<sup>13</sup>C NMR spectrum of compound **4** (CDCl<sub>3</sub>, 100 MHz)



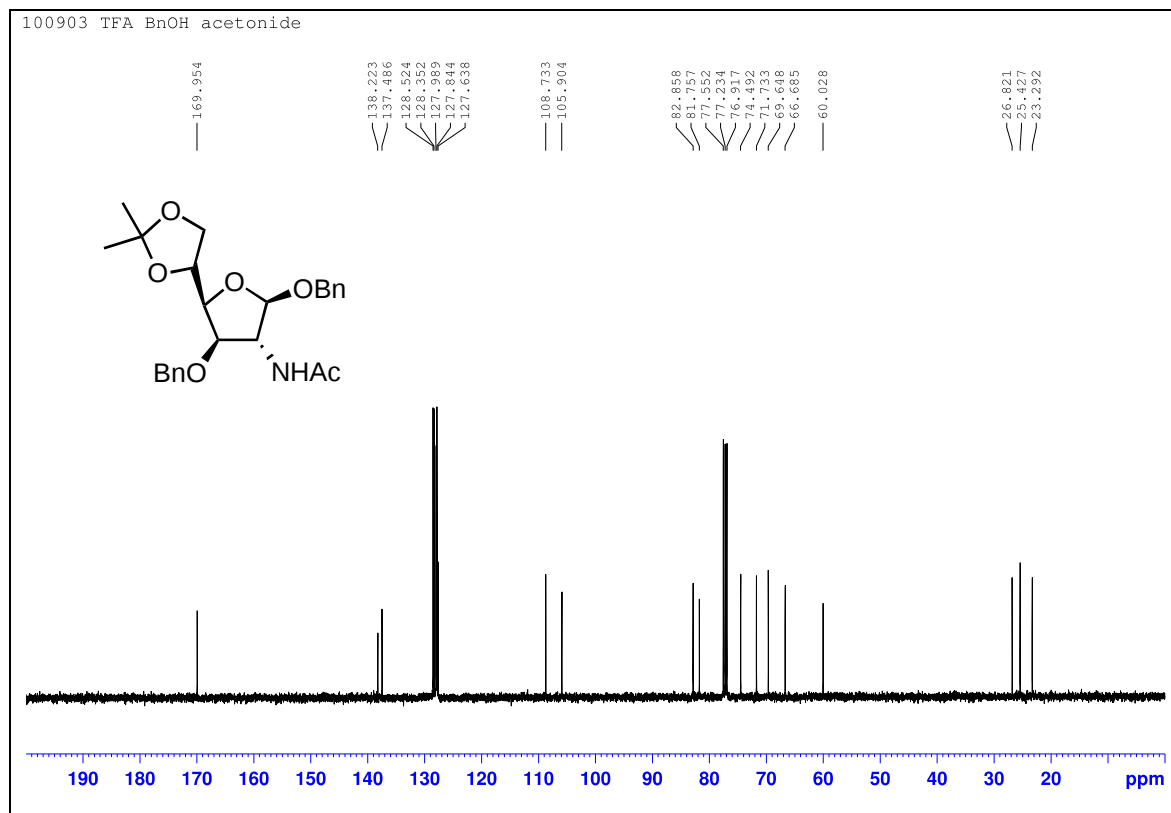
<sup>1</sup>H NMR spectrum of compound 5 (CDCl<sub>3</sub>, 400 MHz)



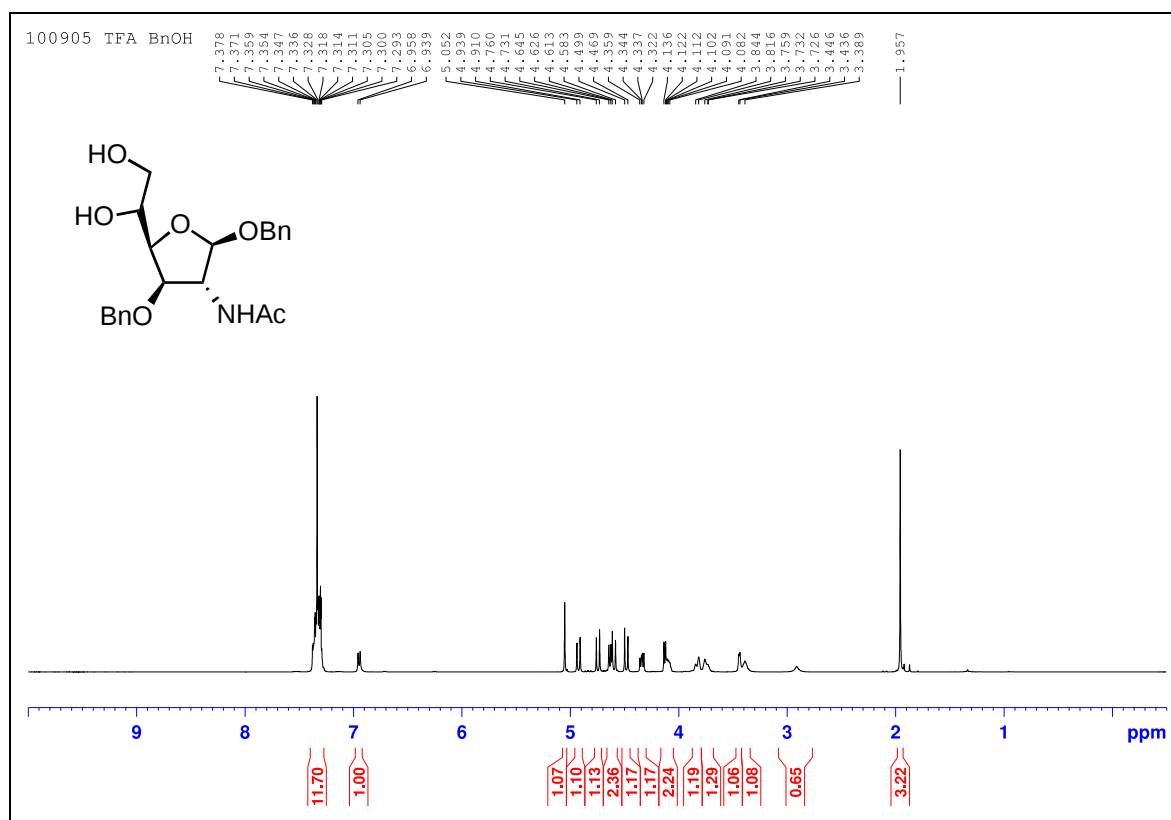
<sup>13</sup>C NMR spectrum of compound 5 (CDCl<sub>3</sub>, 100 MHz)



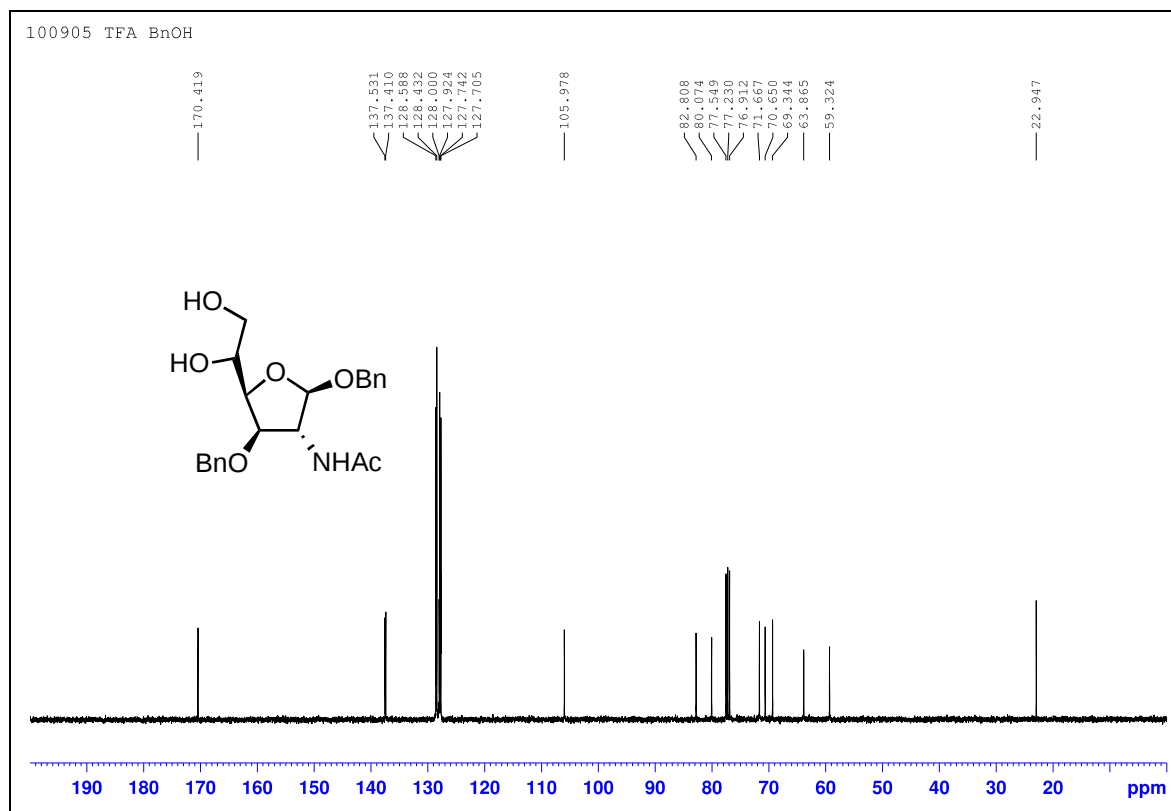
<sup>1</sup>H NMR spectrum of compound 6 (CDCl<sub>3</sub>, 400 MHz)



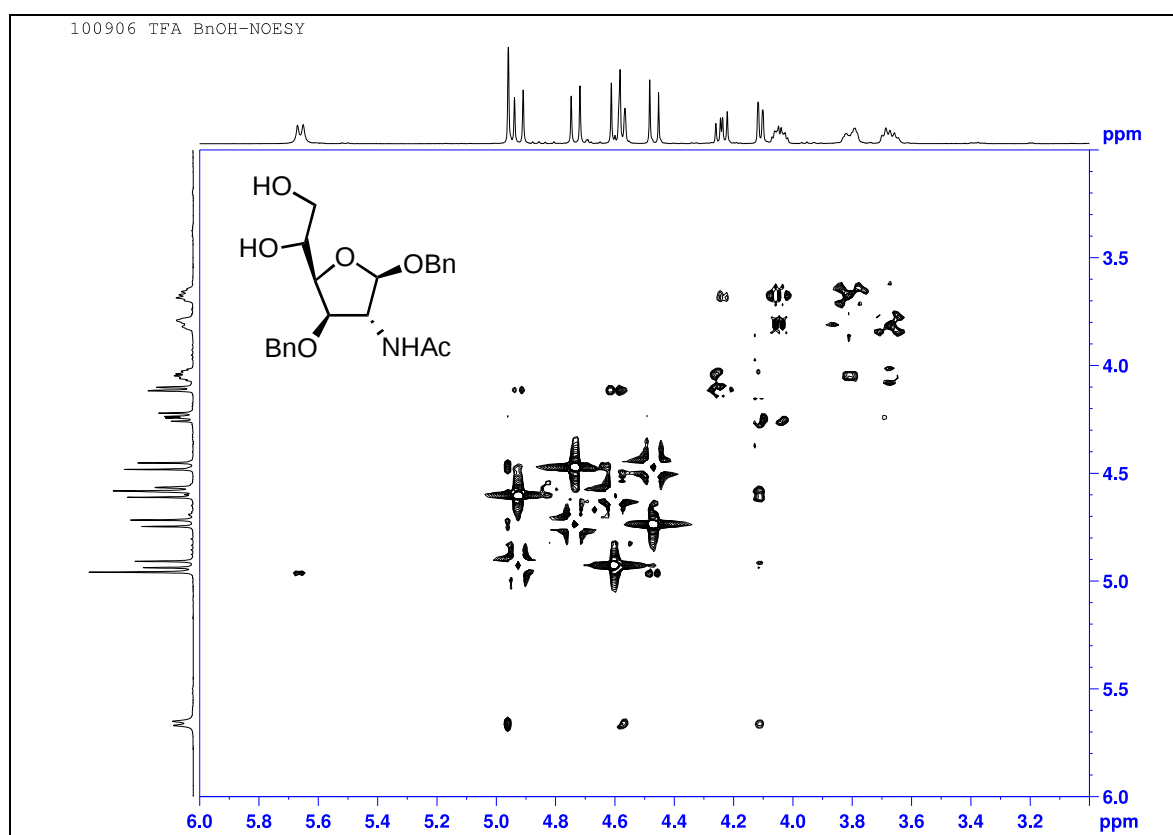
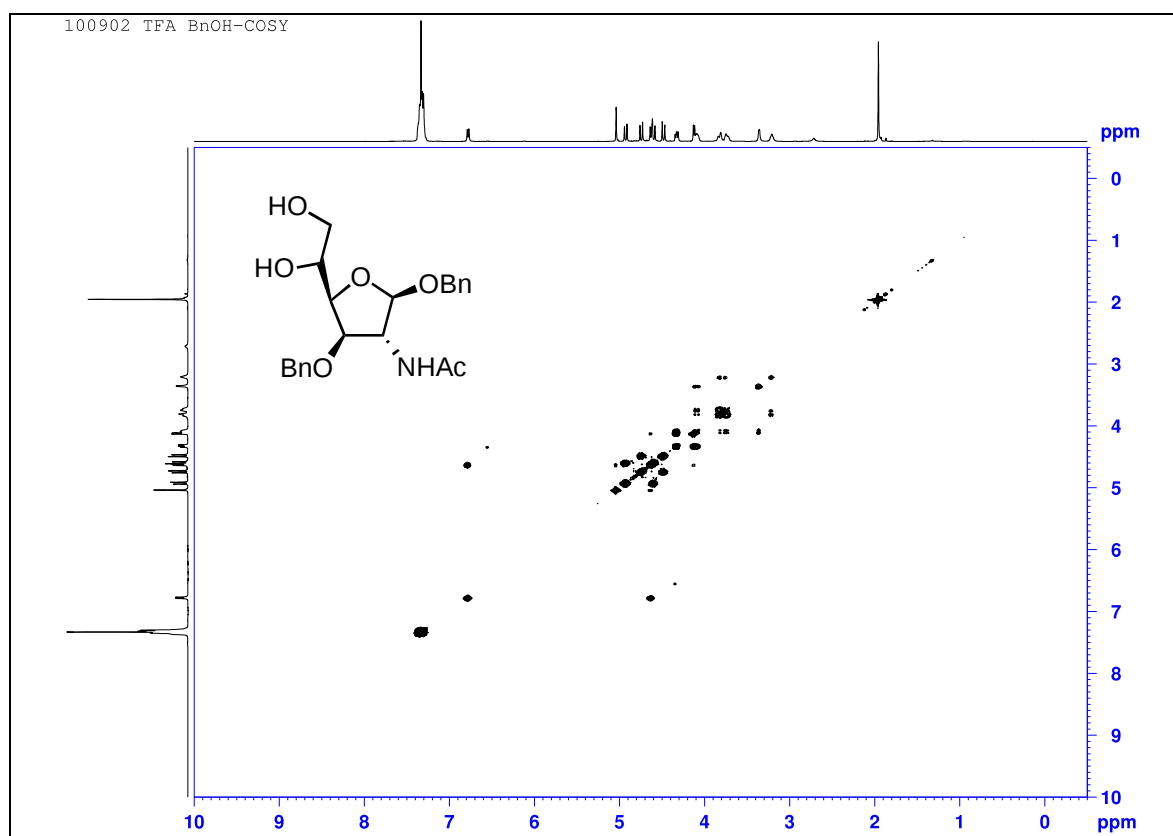
<sup>13</sup>C NMR spectrum of compound 6 (CDCl<sub>3</sub>, 100 MHz)

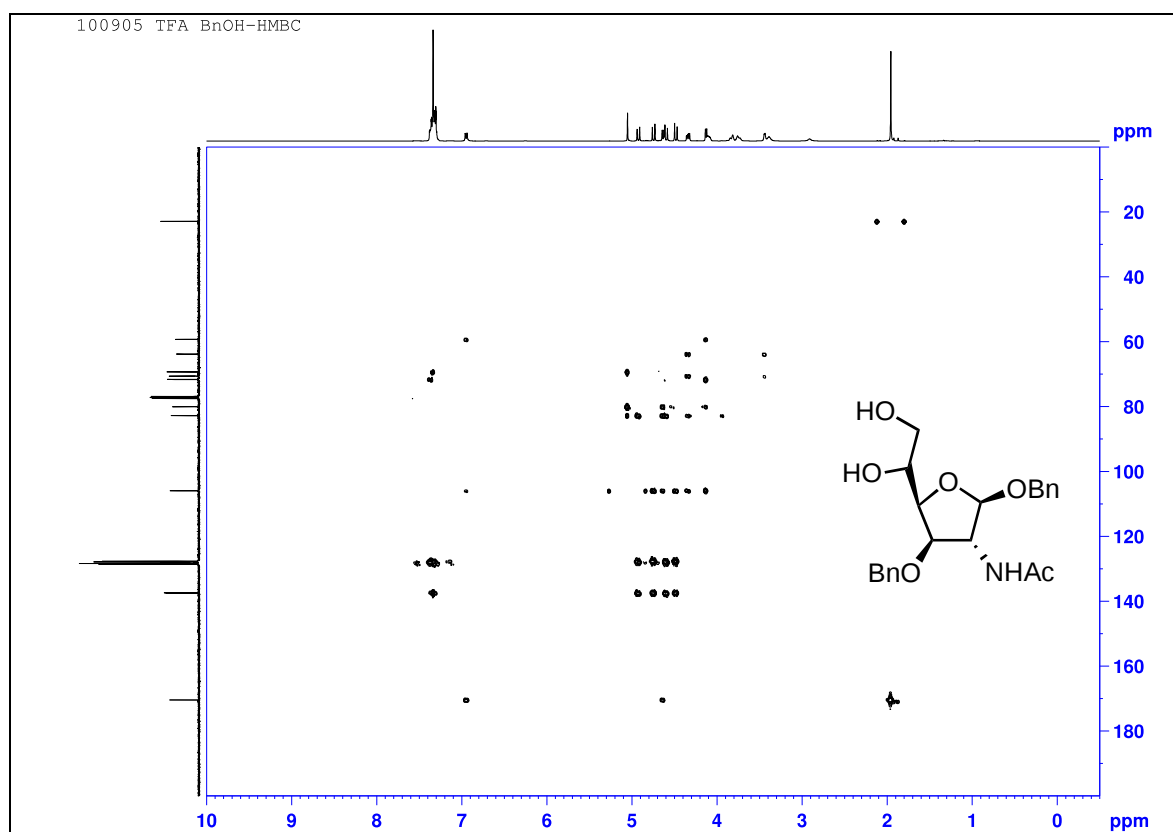
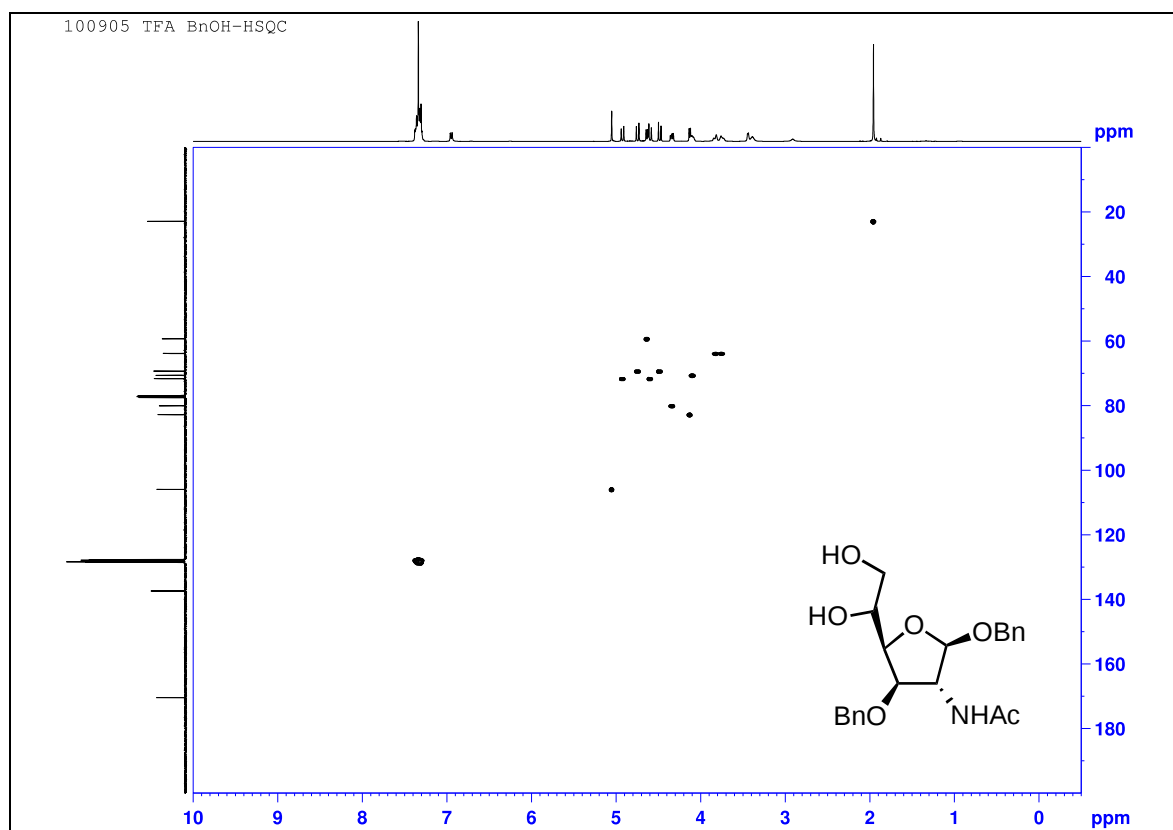


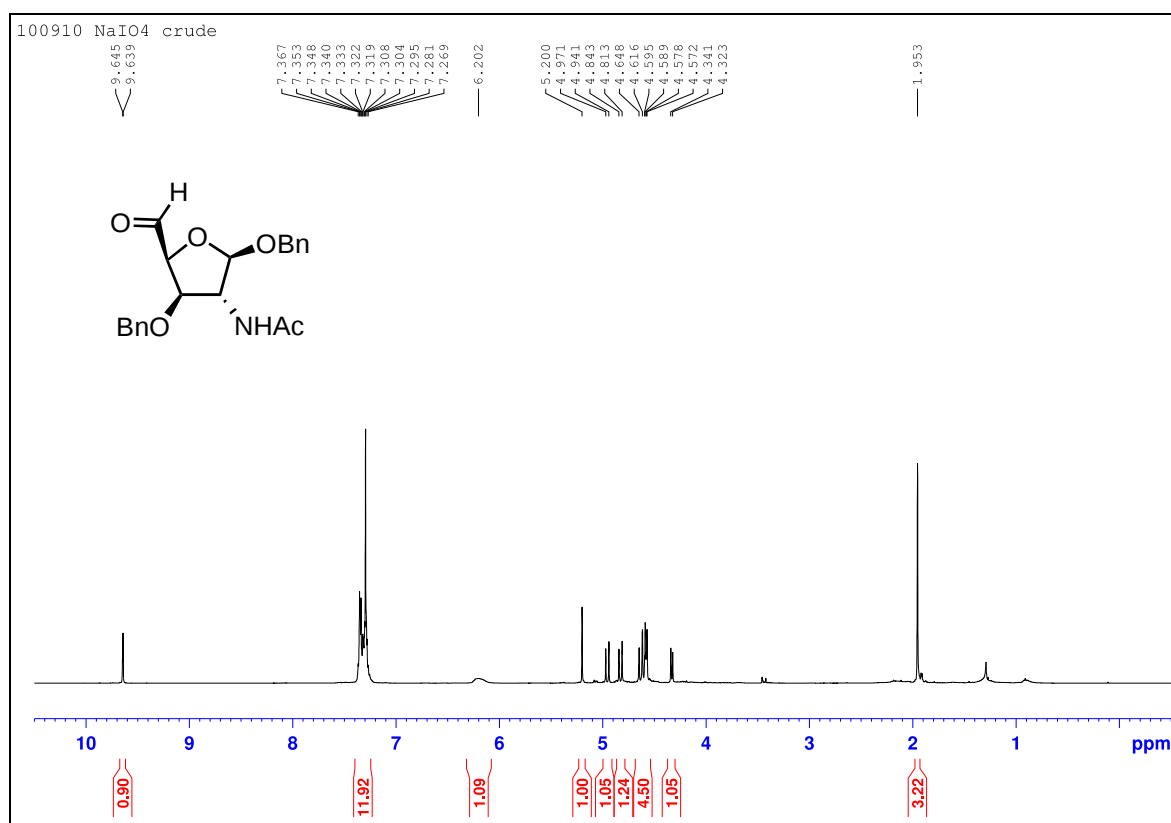
<sup>1</sup>H NMR spectrum of compound 7 (CDCl<sub>3</sub>, 400 MHz)



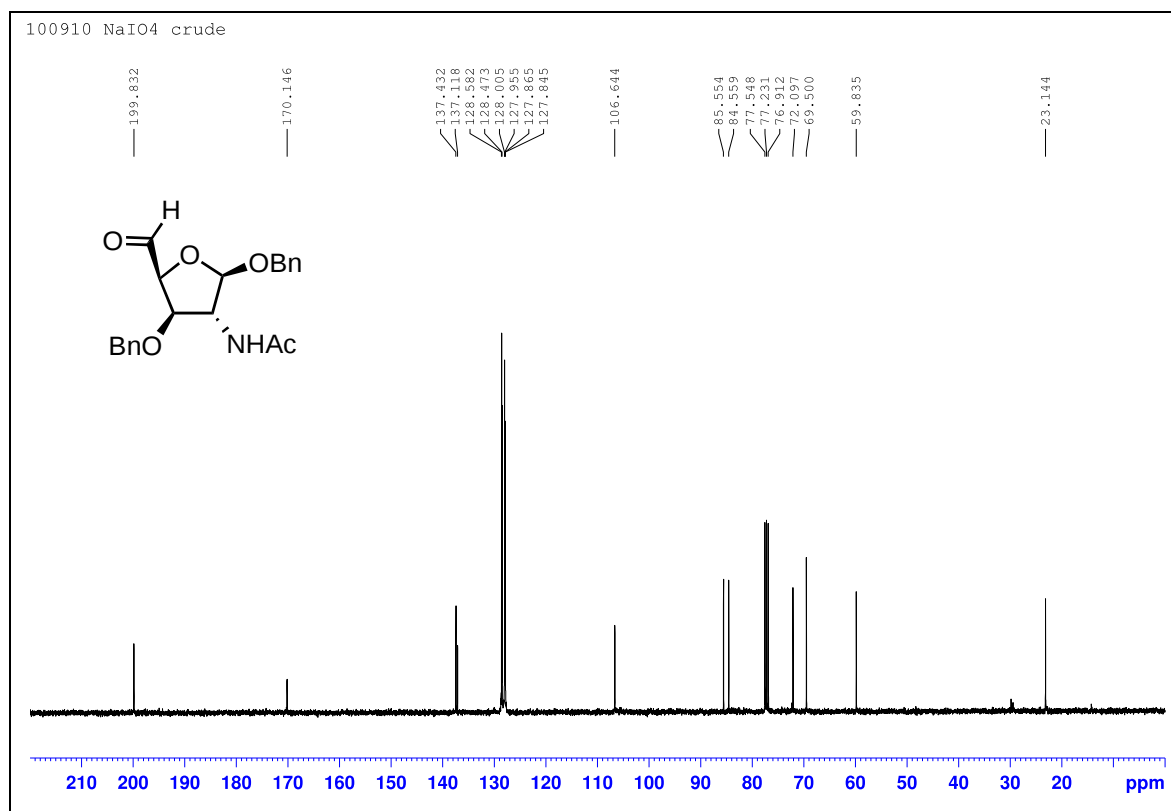
<sup>13</sup>C NMR spectrum of compound 7 (CDCl<sub>3</sub>, 100 MHz)



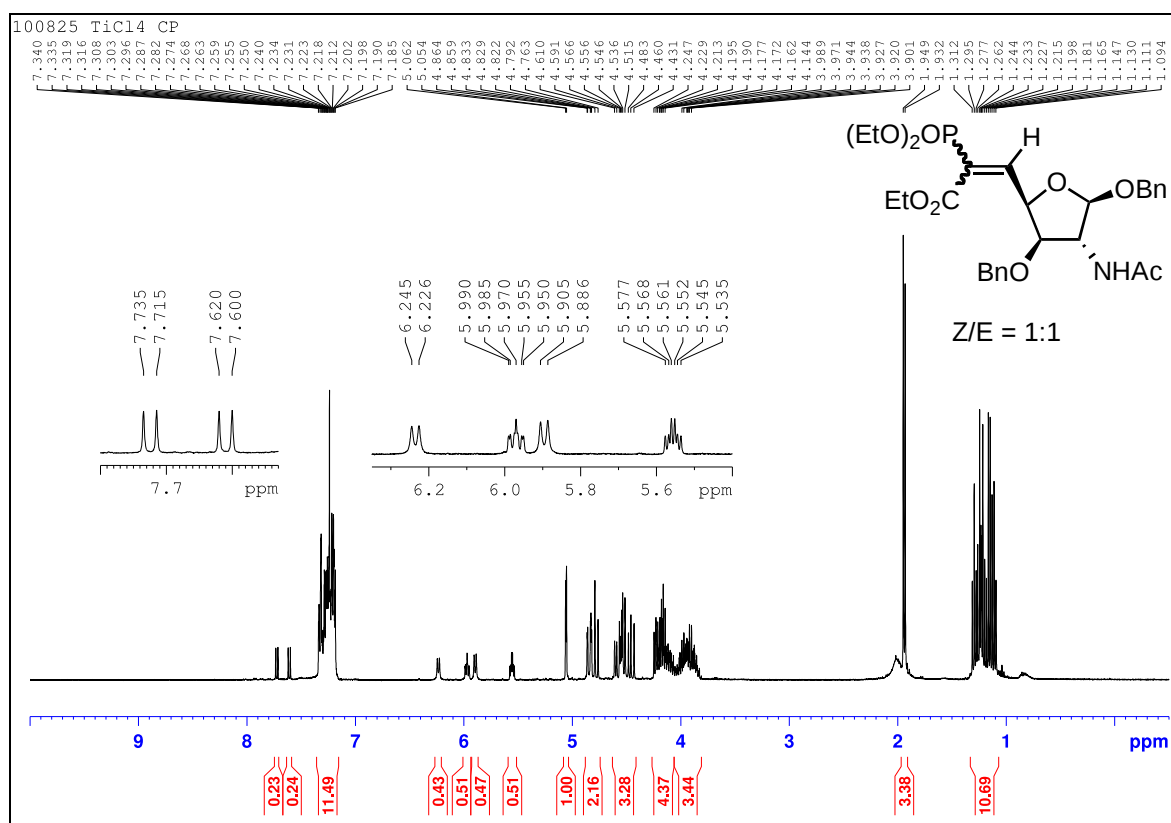




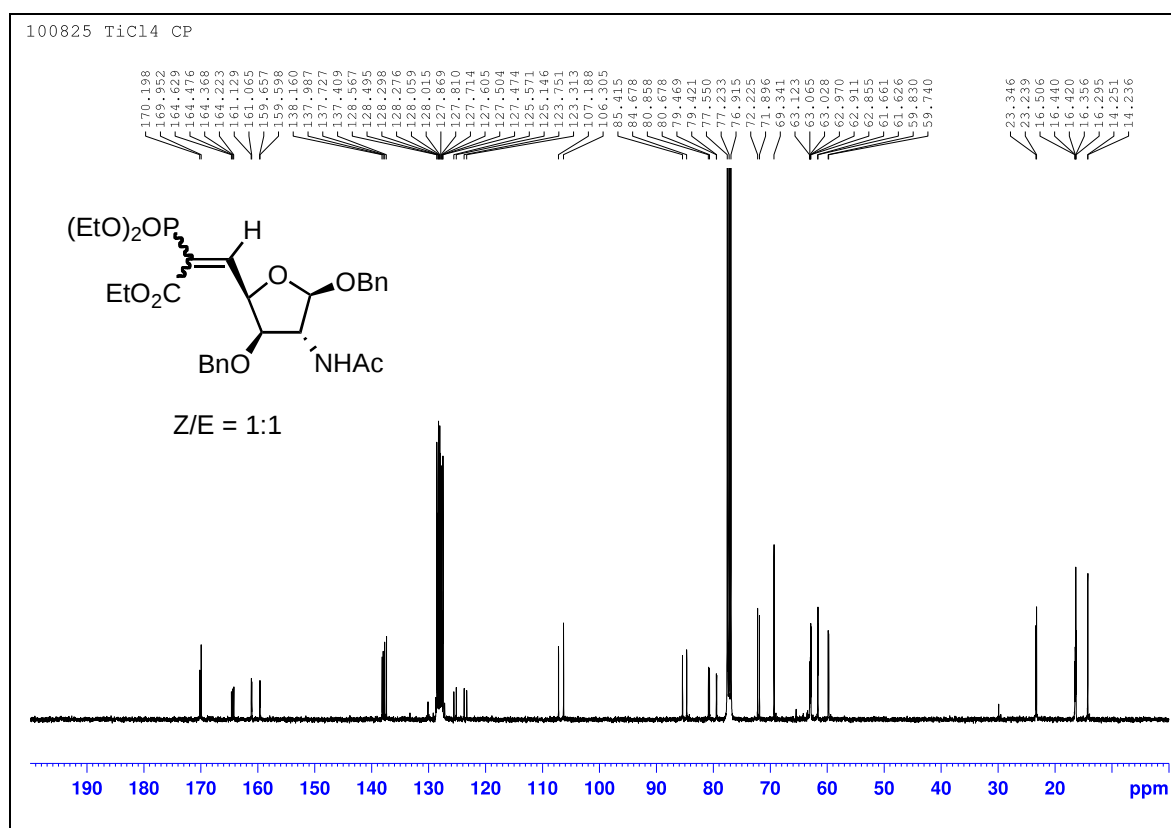
<sup>1</sup>H NMR spectrum of compound **8** (CDCl<sub>3</sub>, 400 MHz)



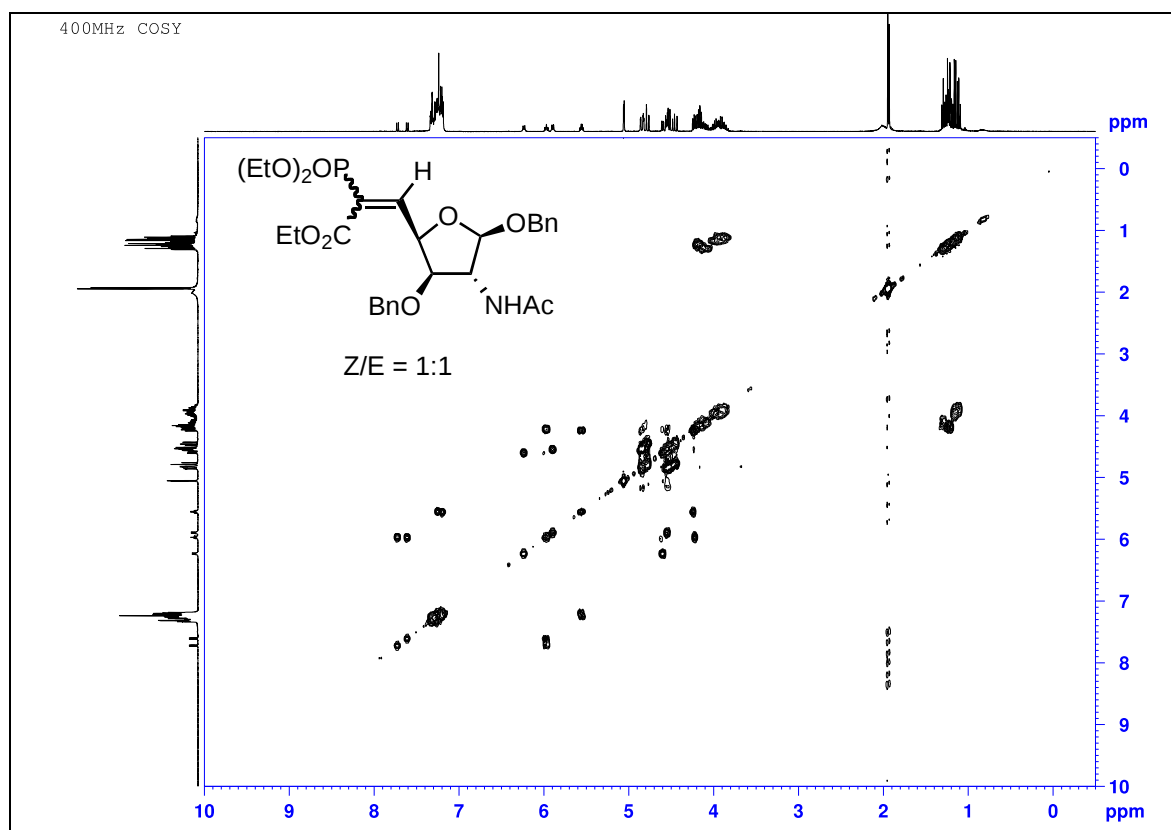
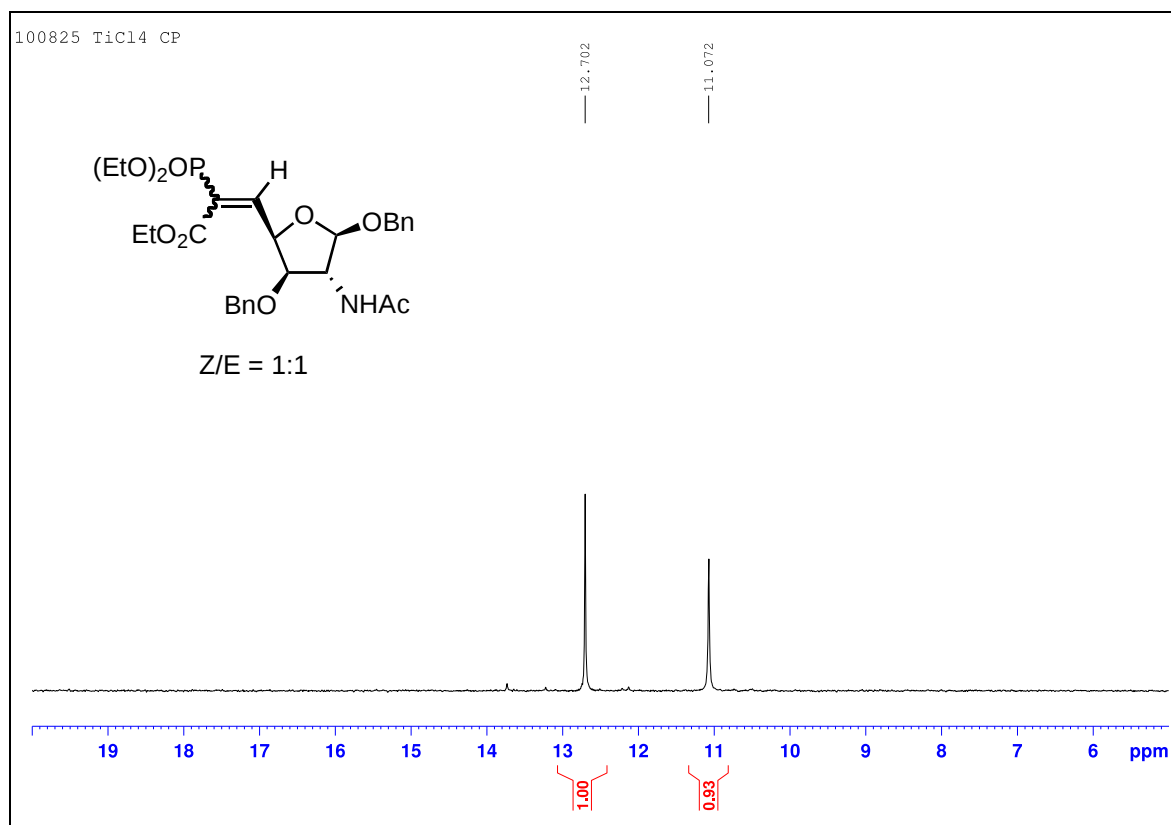
<sup>13</sup>C NMR spectrum of compound **8** (CDCl<sub>3</sub>, 100 MHz)

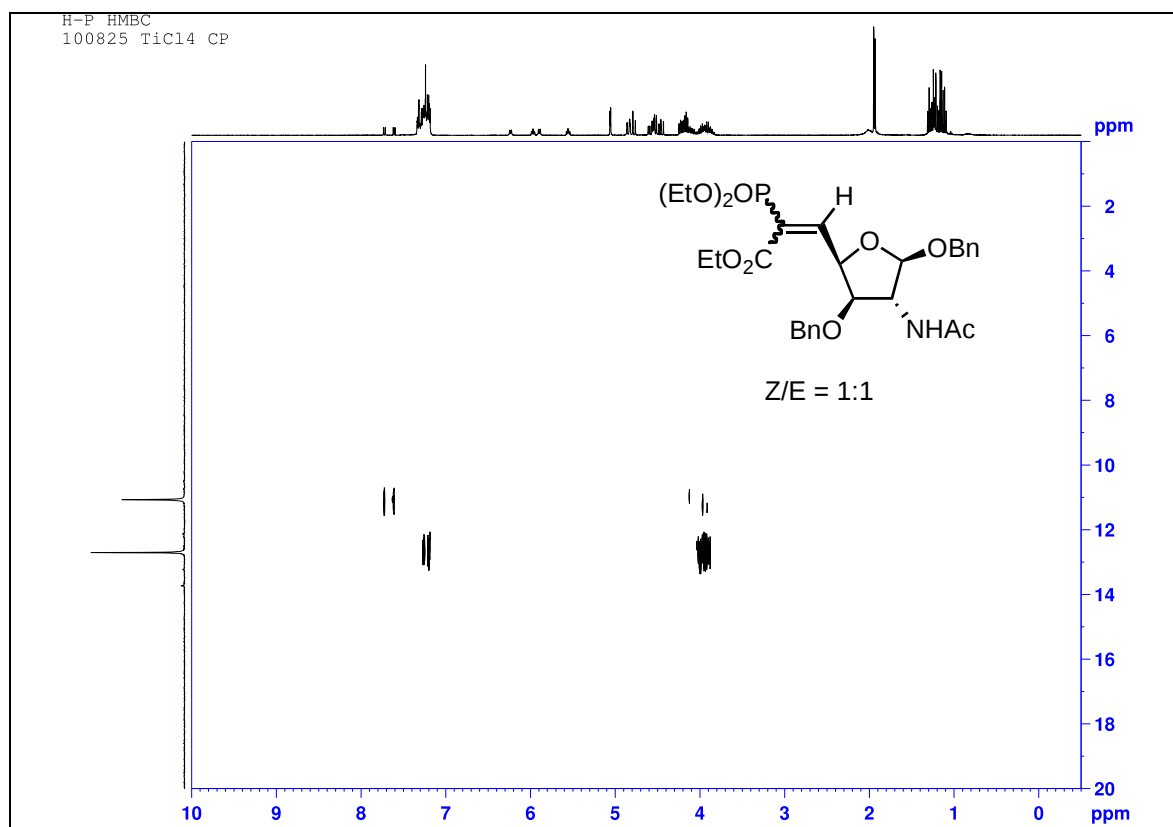


<sup>1</sup>H NMR spectrum of compound **9** (CDCl<sub>3</sub>, 400 MHz)

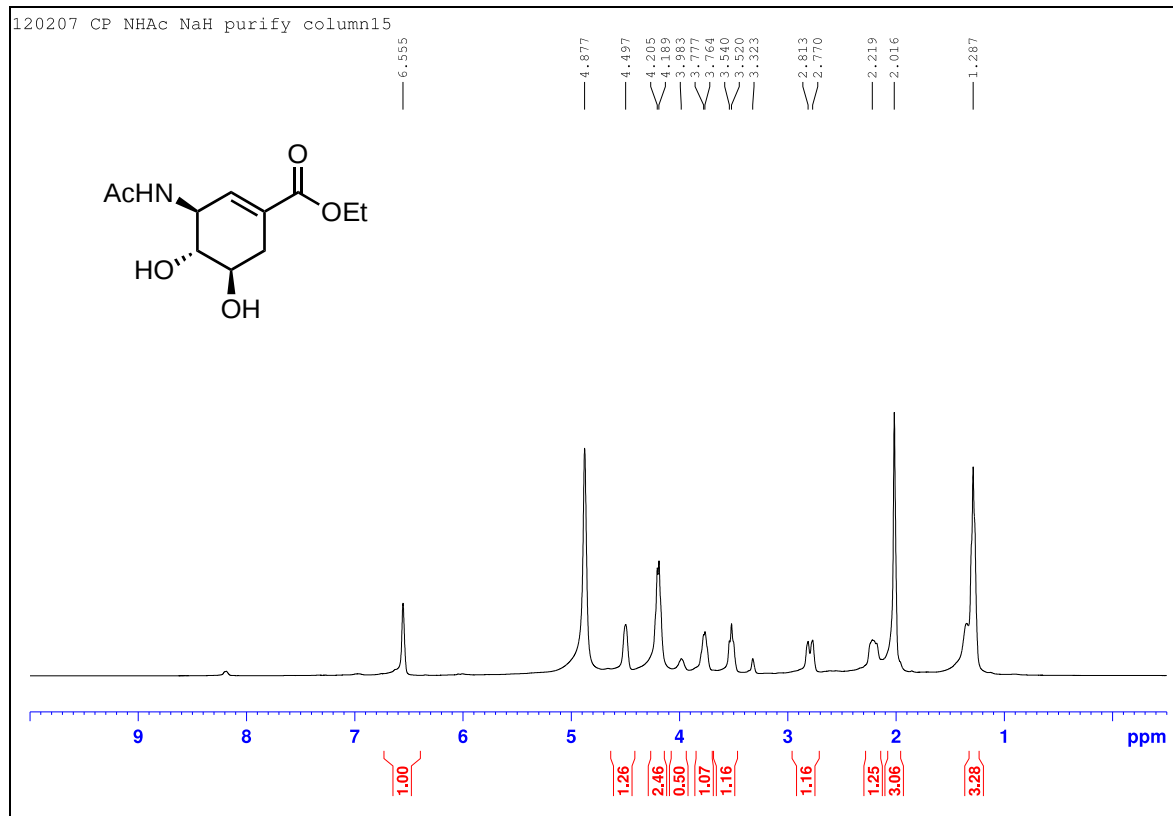


<sup>13</sup>C NMR spectrum of compound **9** (CDCl<sub>3</sub>, 100 MHz)

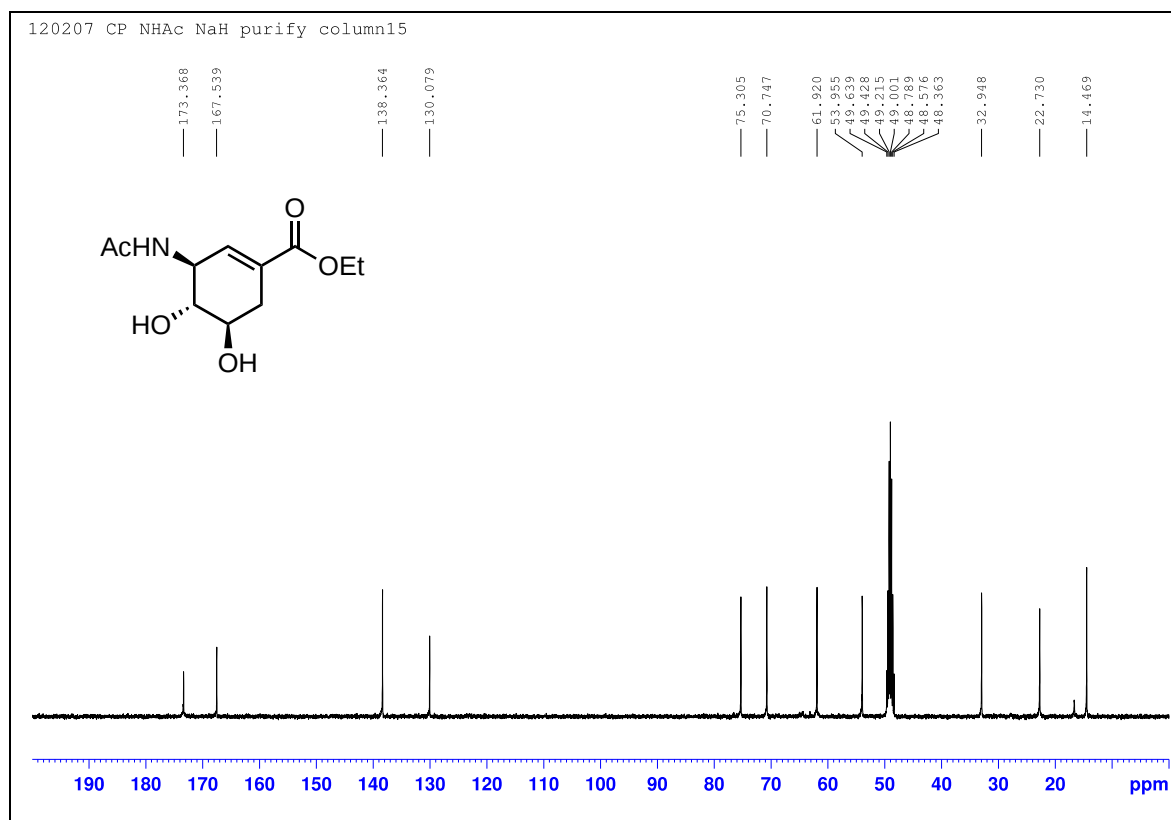




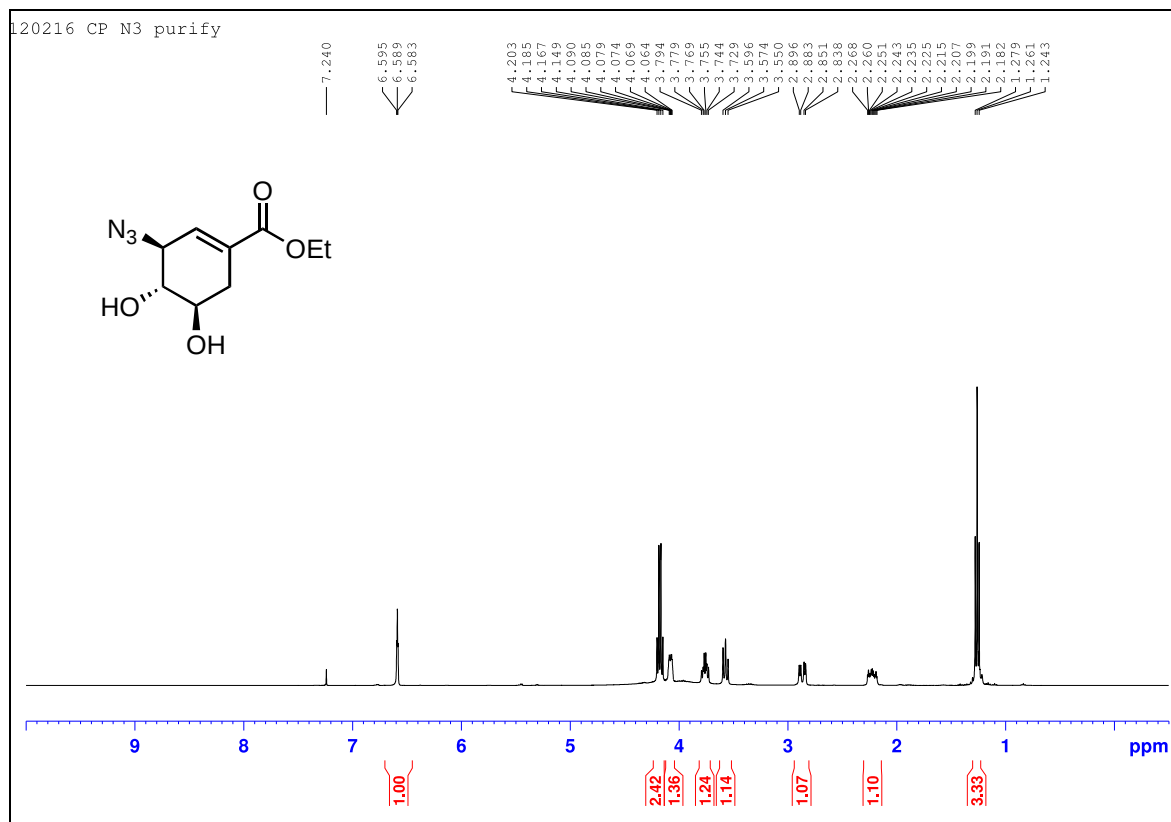
<sup>1</sup>H-<sup>31</sup>P HMBC NMR spectrum of compound **9** (CDCl<sub>3</sub>, 400 MHz)



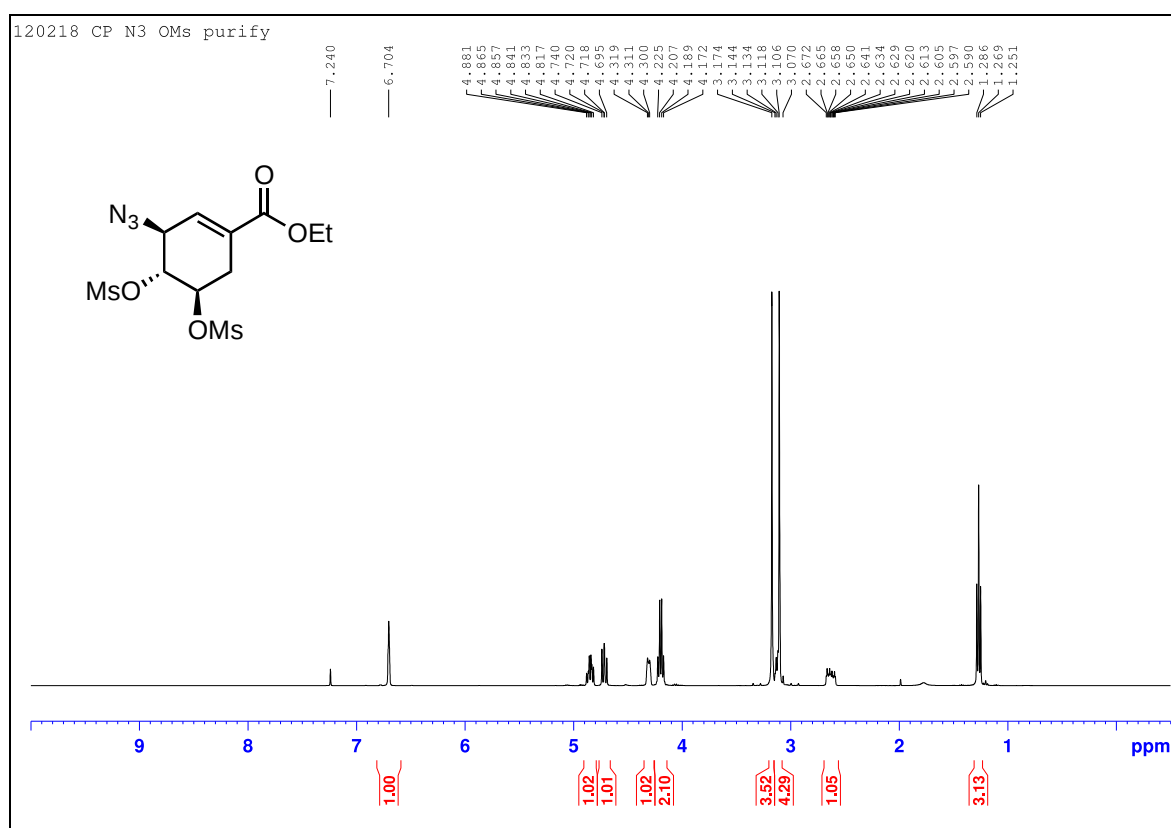
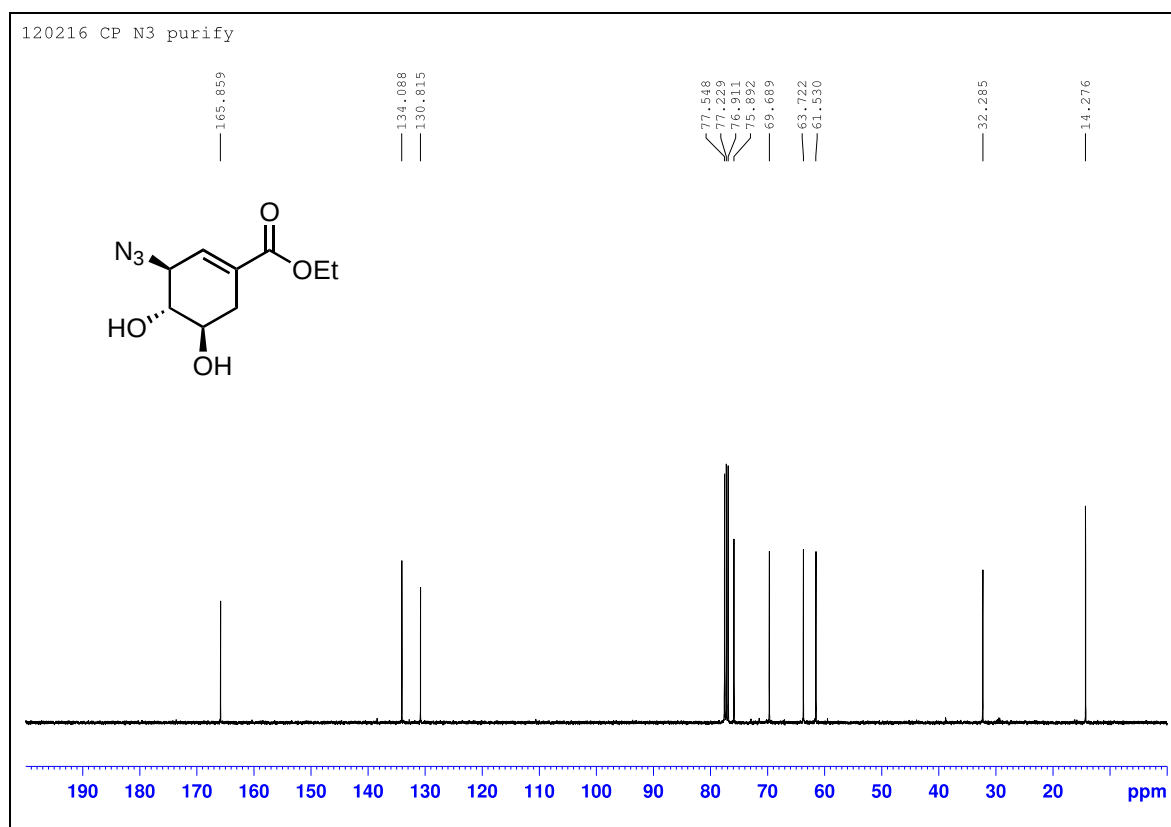
<sup>1</sup>H NMR spectrum of compound **10** (CD<sub>3</sub>OD, 400 MHz)

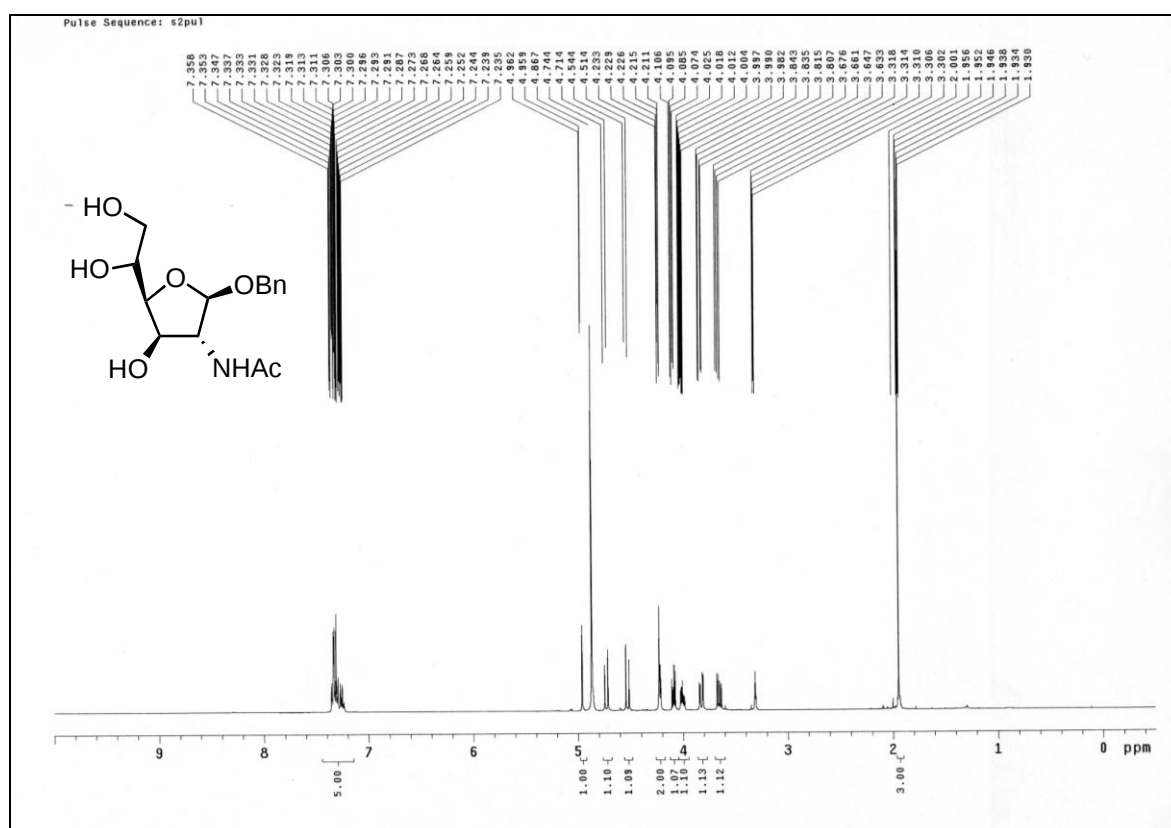
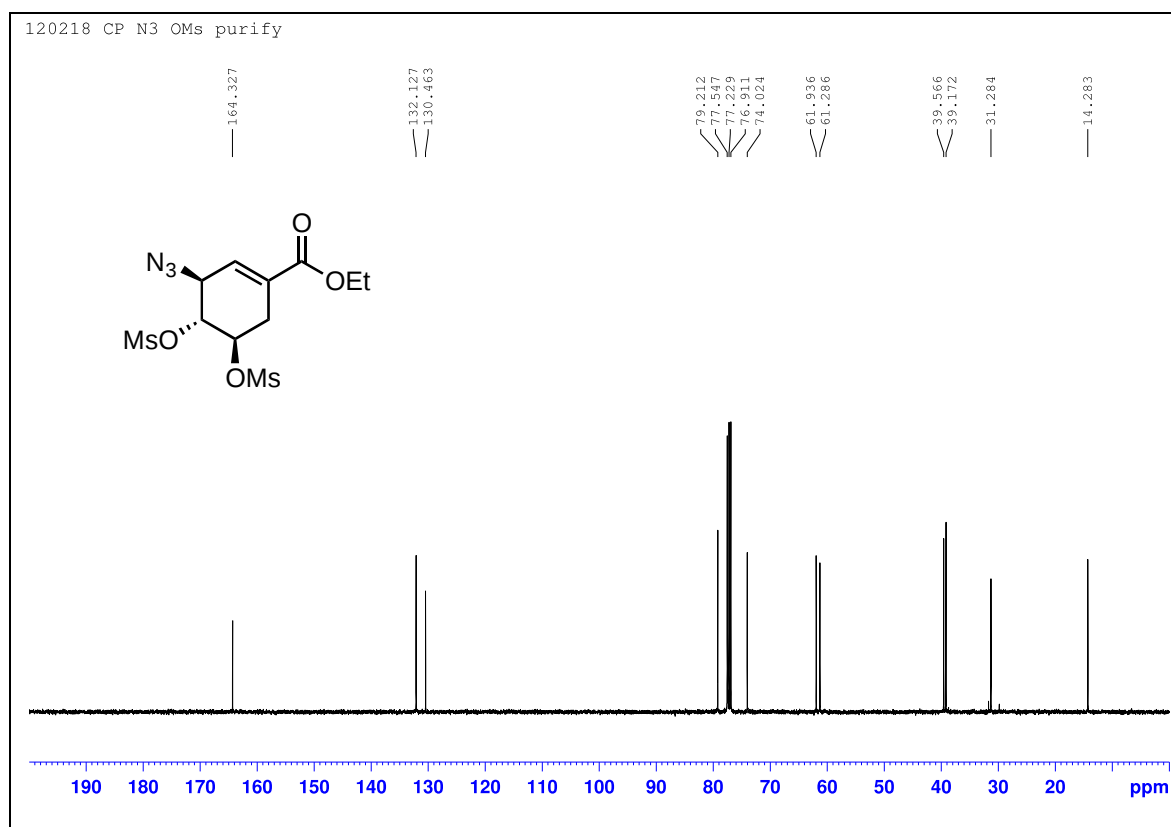


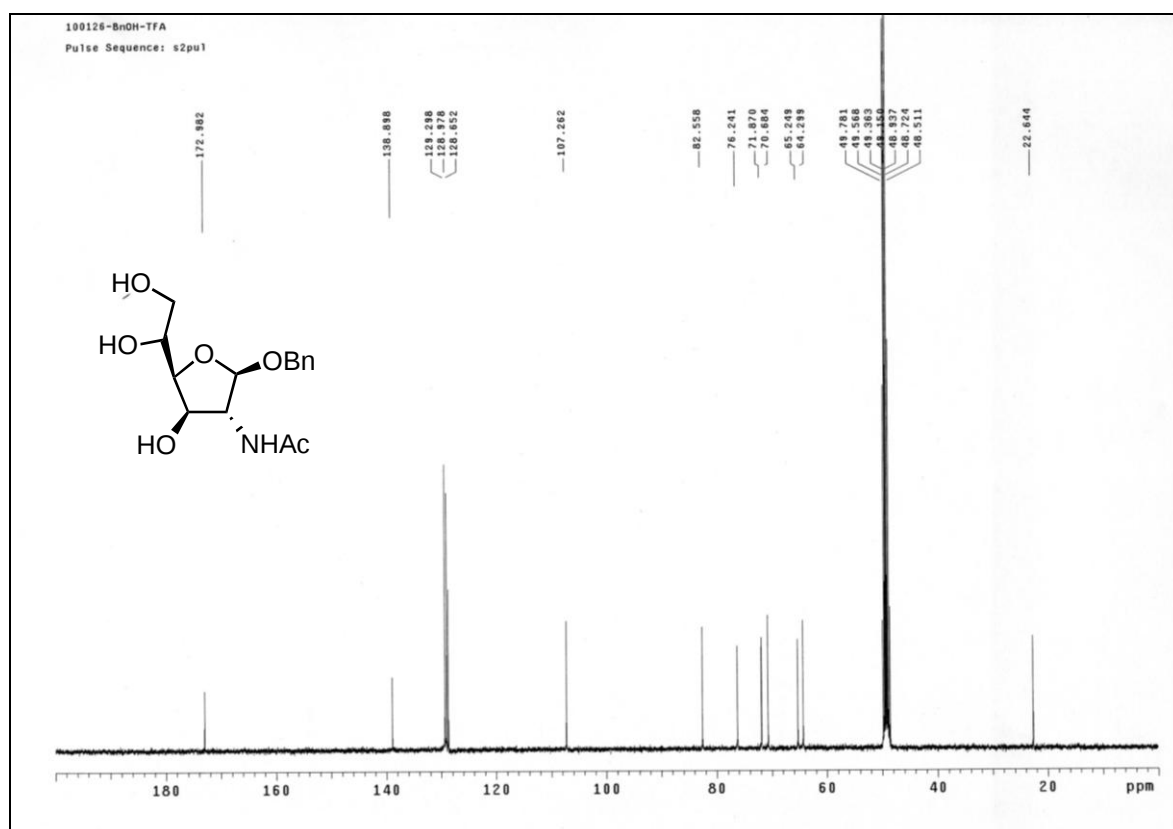
<sup>13</sup>C NMR spectrum of compound **10** (CD<sub>3</sub>OD, 100 MHz)



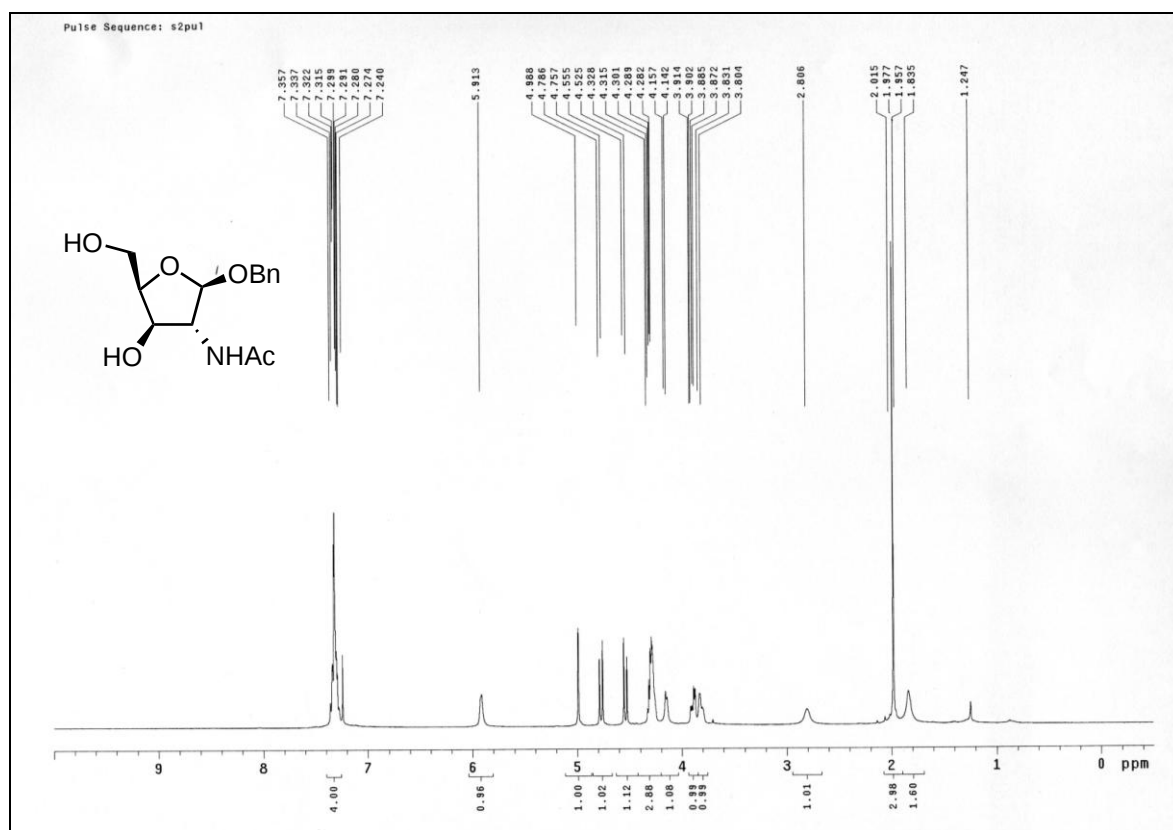
<sup>1</sup>H NMR spectrum of compound **11** (CDCl<sub>3</sub>, 400 MHz)



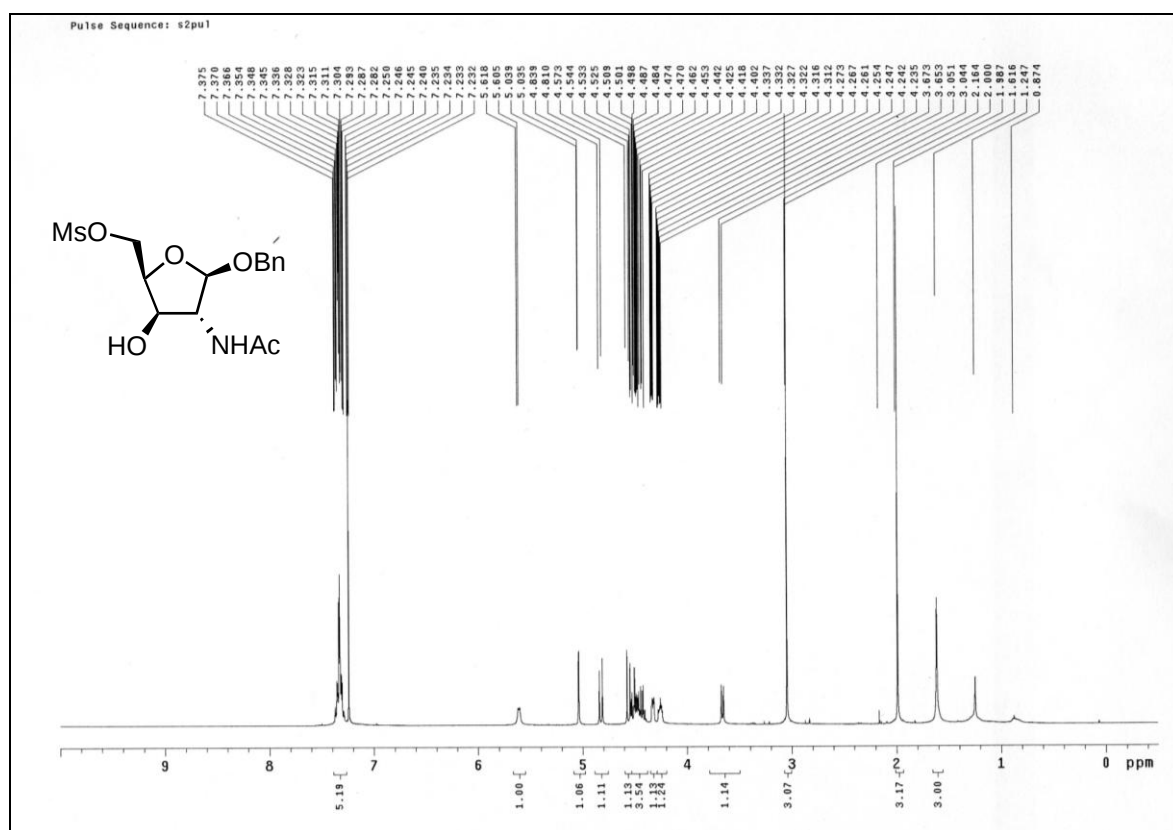
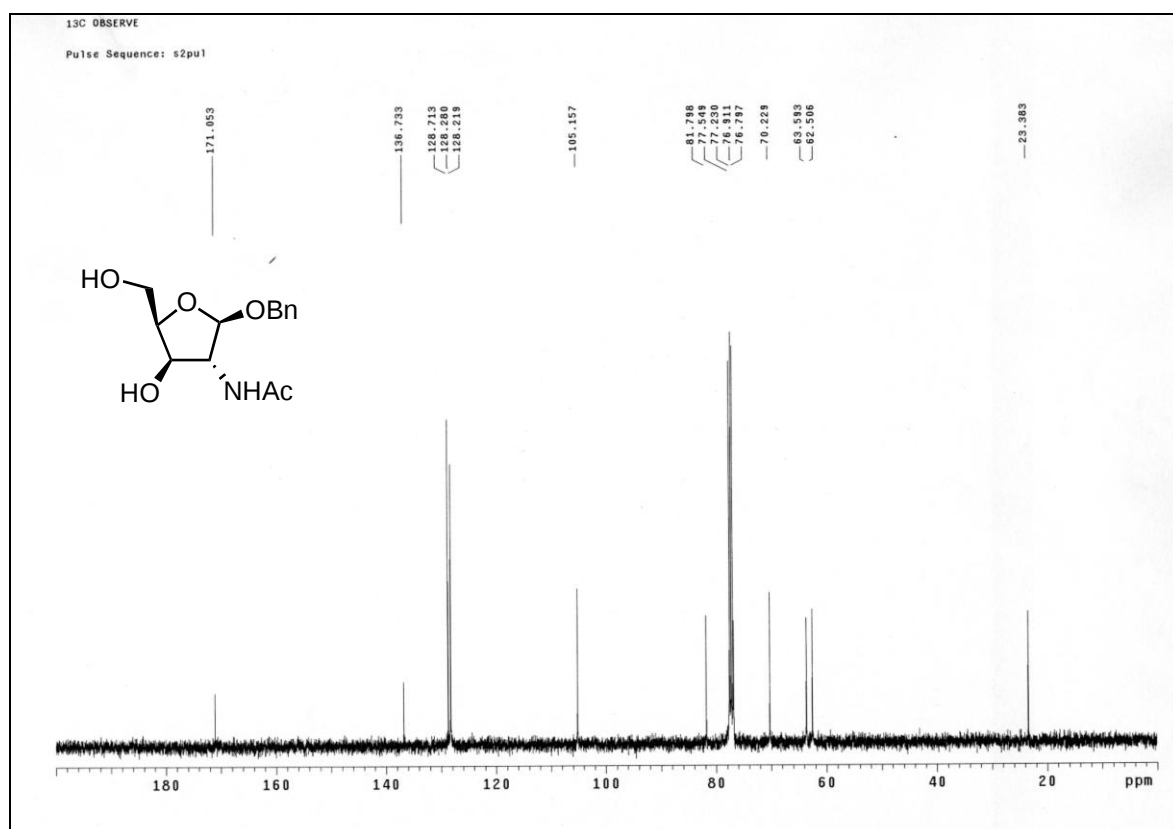


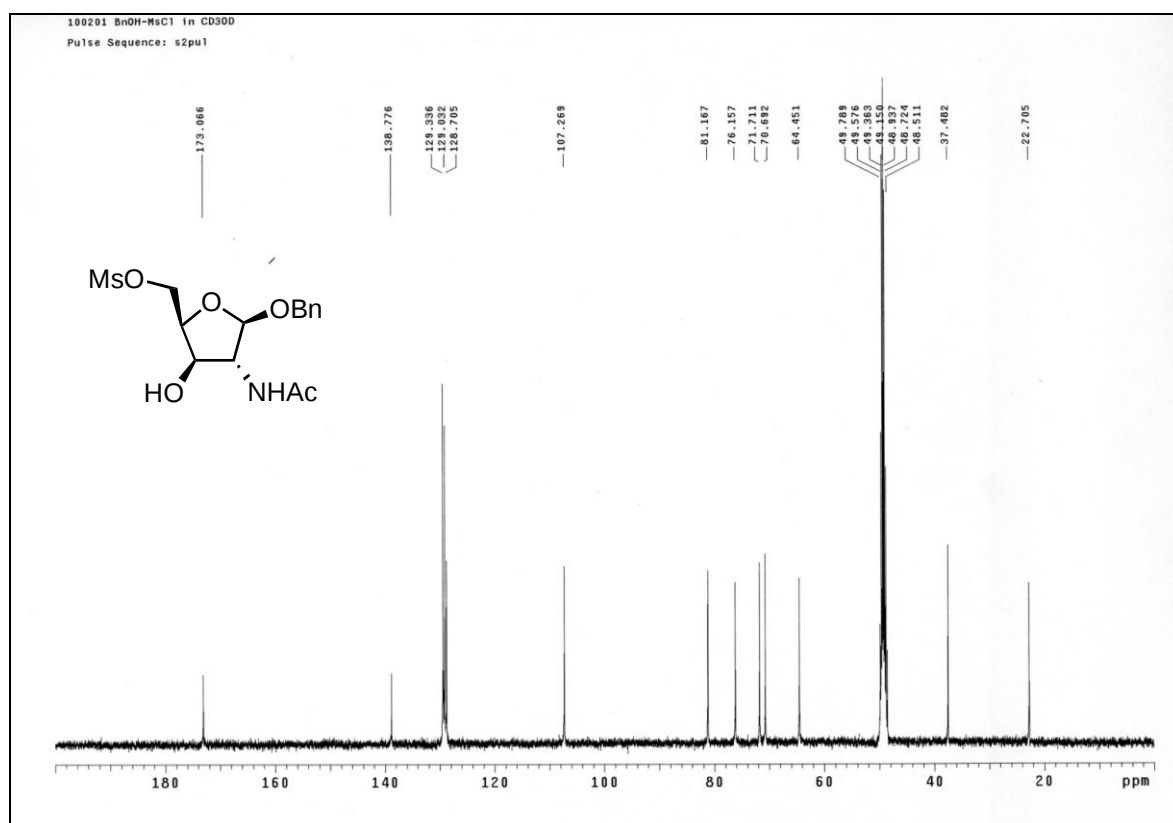


$^{13}\text{C}$  NMR spectrum of compound 13 ( $\text{CD}_3\text{OD}$ , 100 MHz)

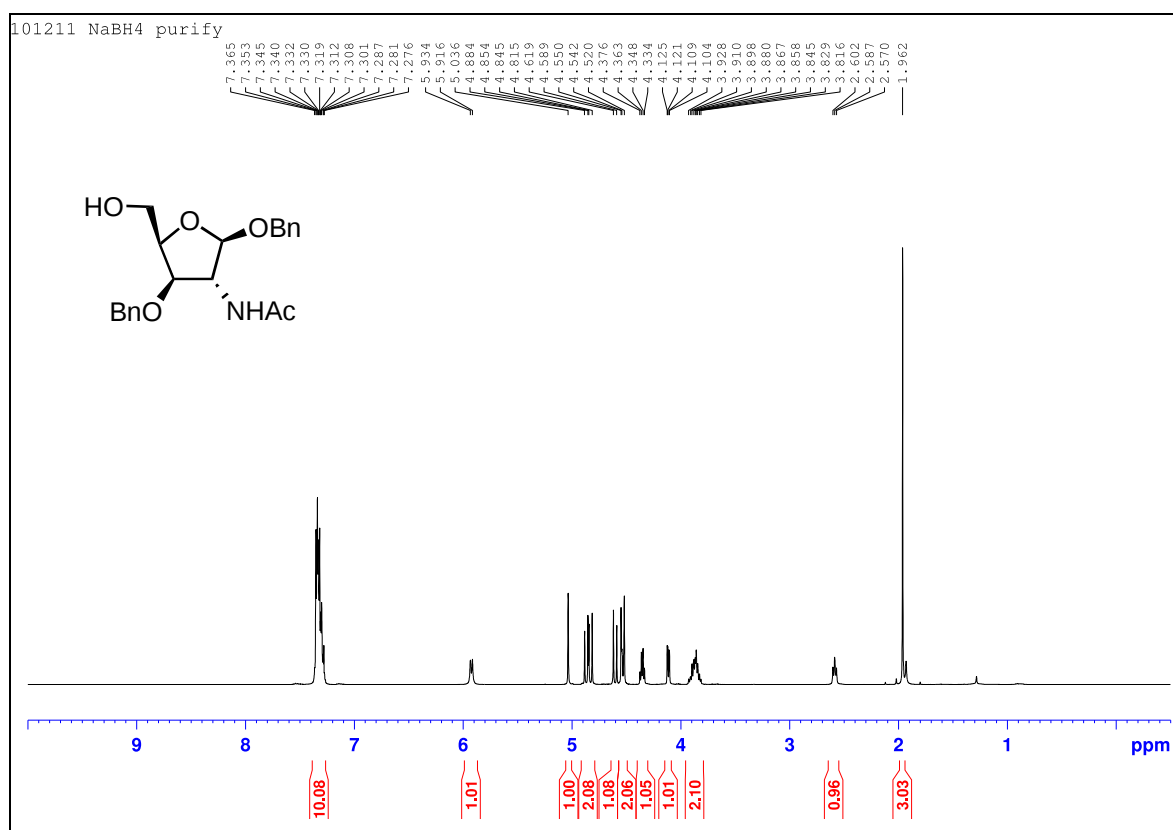


$^1\text{H}$  NMR spectrum of compound 14 ( $\text{CDCl}_3$ , 400 MHz)

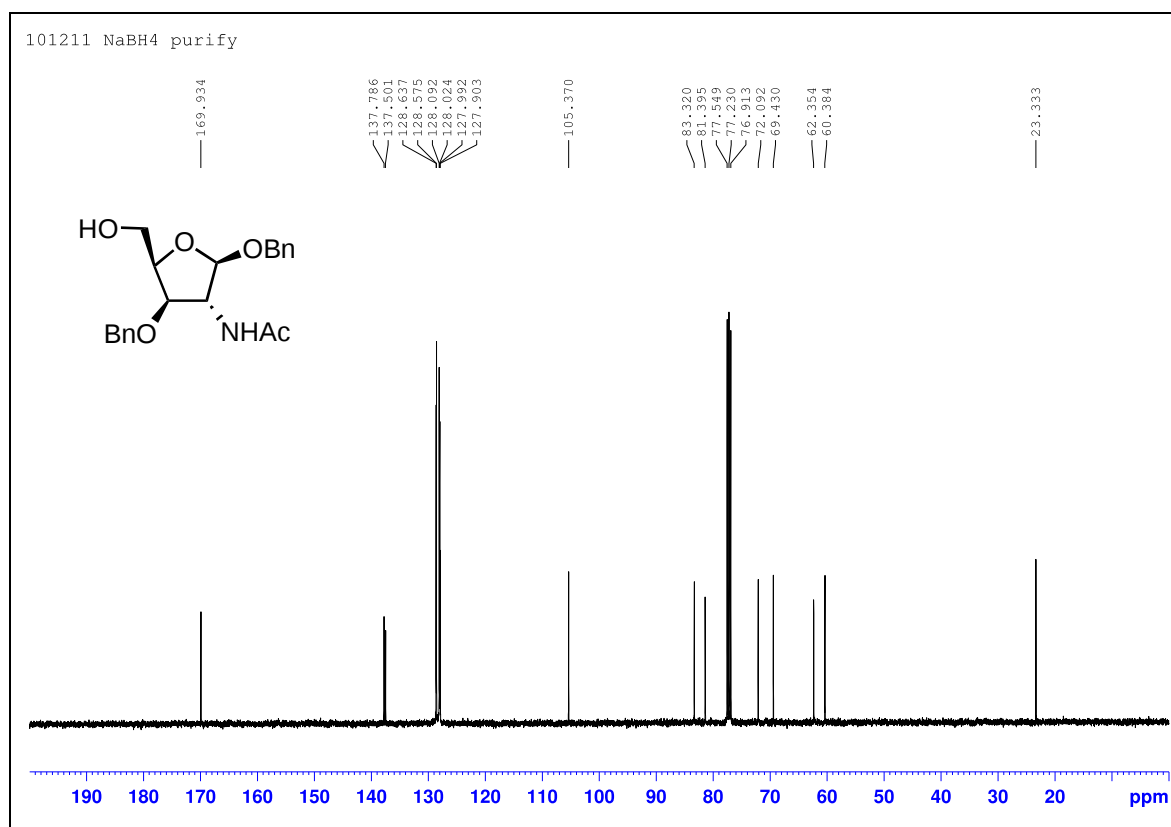




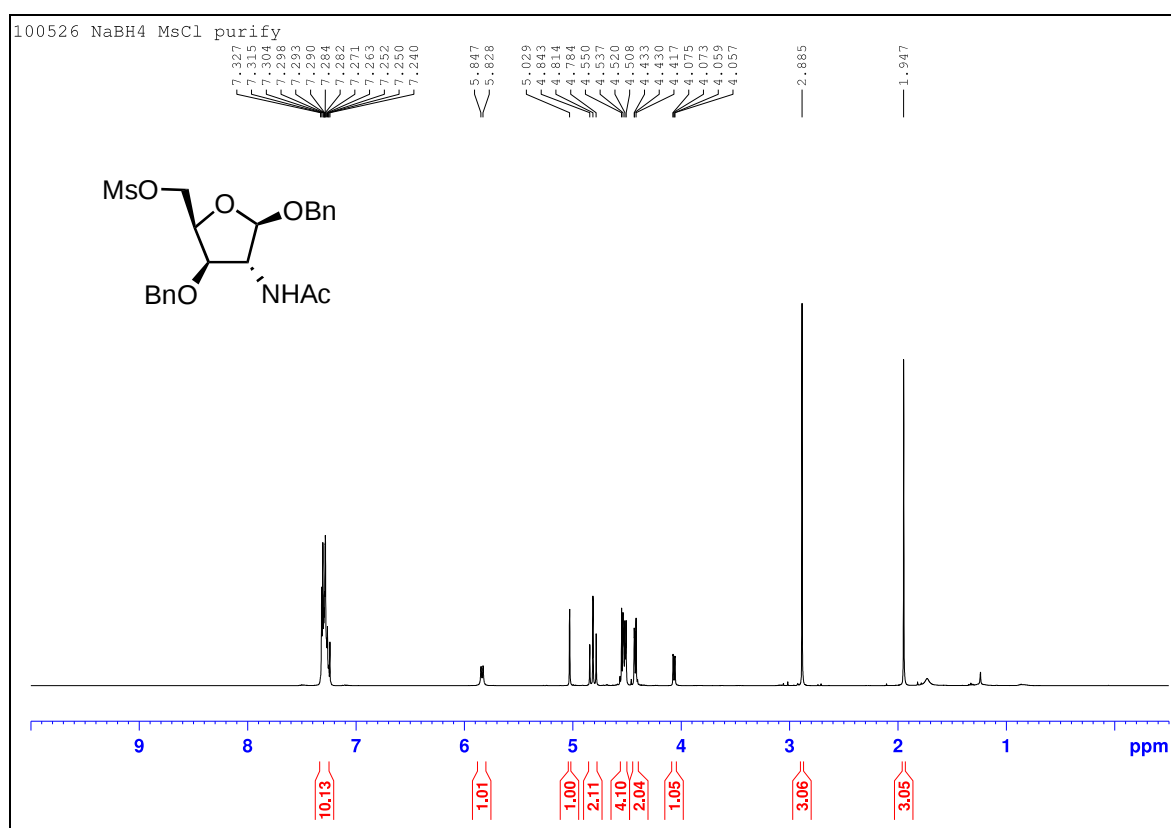
$^{13}\text{C}$  NMR spectrum of compound 15 ( $\text{CD}_3\text{OD}$ , 100 MHz)



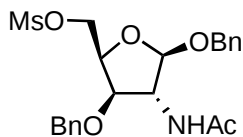
$^1\text{H}$  NMR spectrum of compound 16 ( $\text{CDCl}_3$ , 400 MHz)



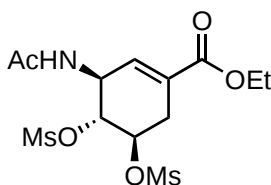
<sup>13</sup>C NMR spectrum of compound **16** (CDCl<sub>3</sub>, 100 MHz)



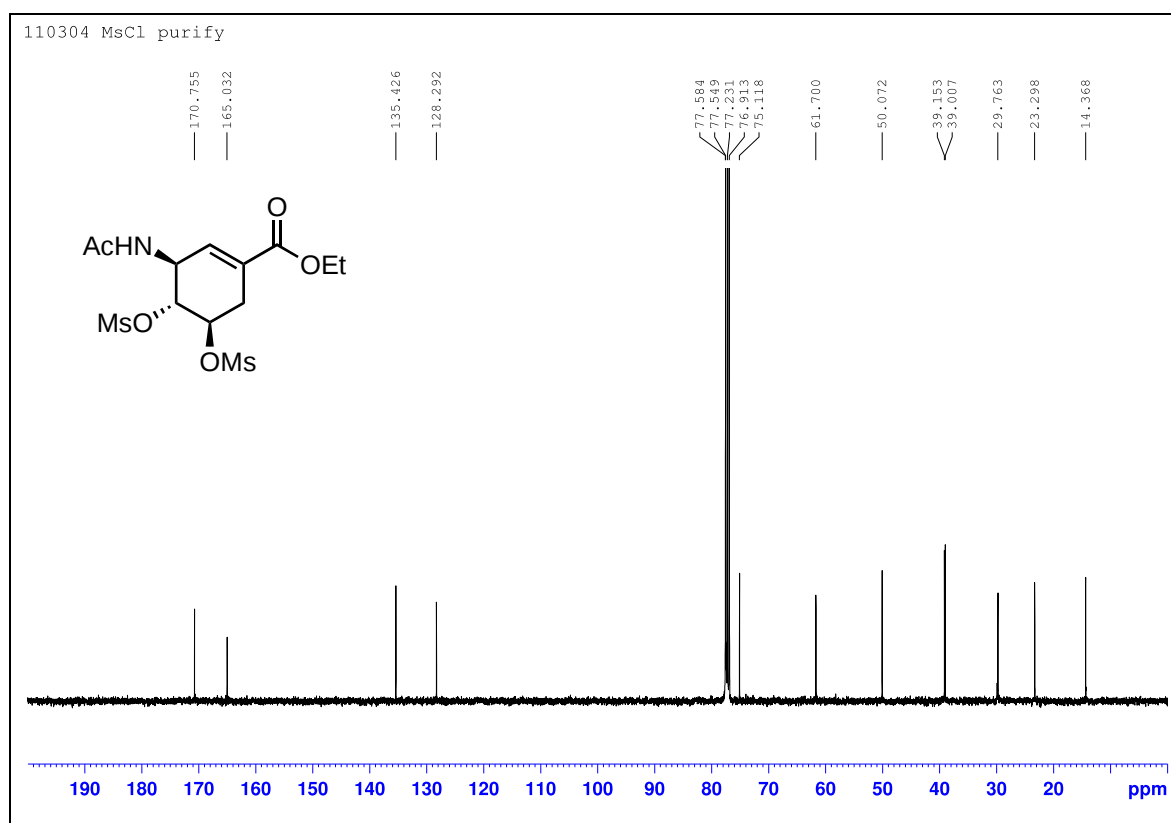
<sup>1</sup>H NMR spectrum of compound **17** (CDCl<sub>3</sub>, 400 MHz)



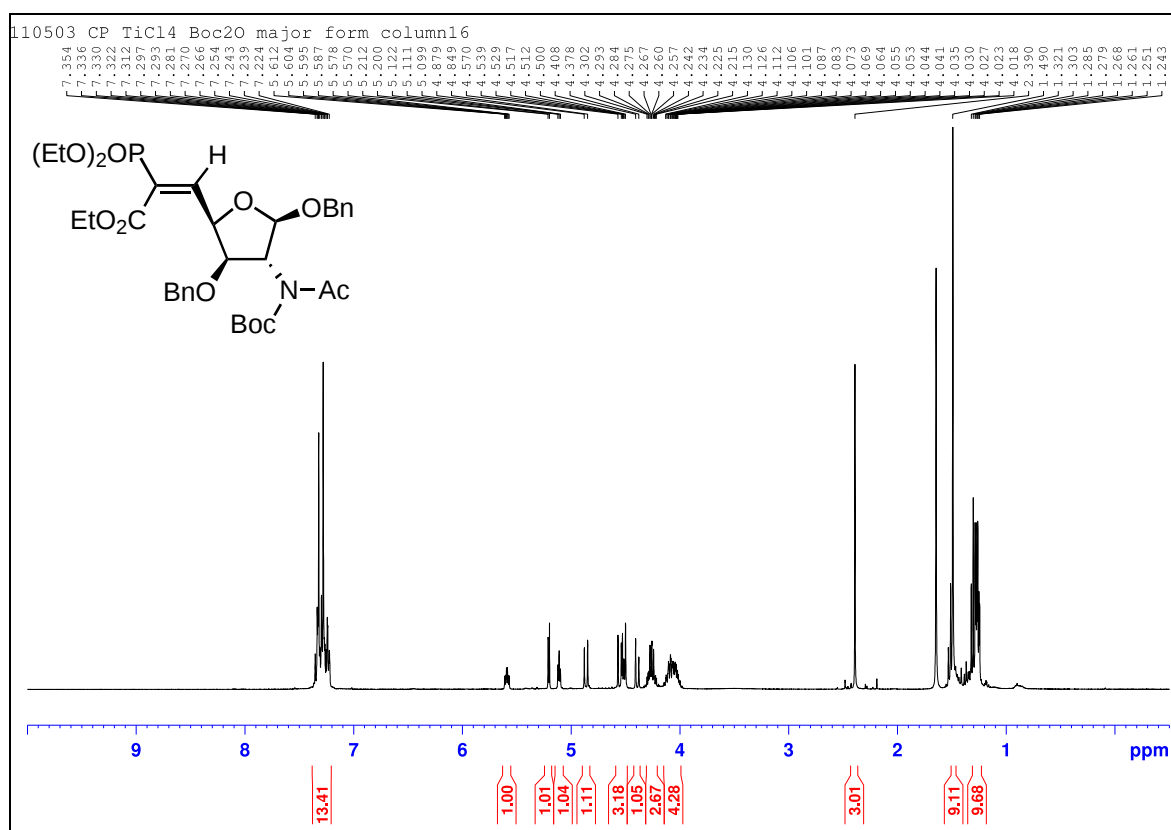
<sup>13</sup>C NMR spectrum of compound **17** (CDCl<sub>3</sub>, 100 MHz)



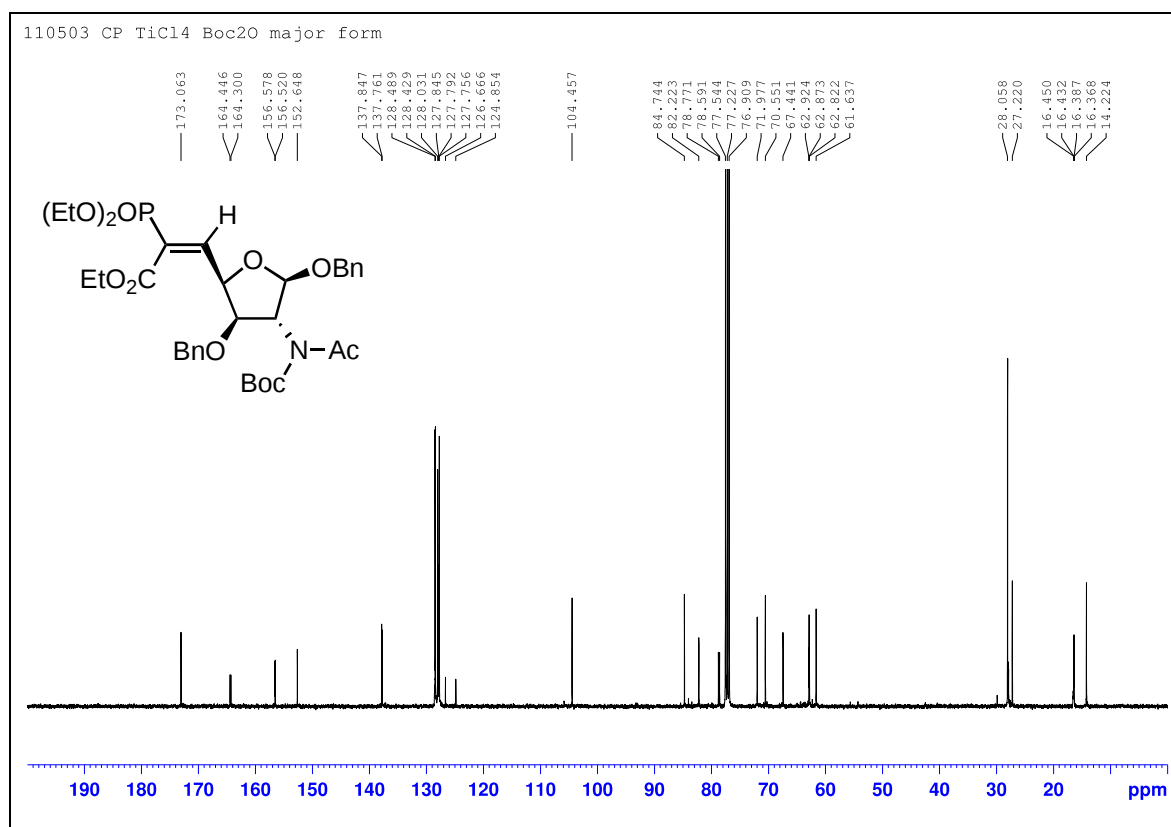
<sup>1</sup>H NMR spectrum of compound **18** (CDCl<sub>3</sub>, 400 MHz)



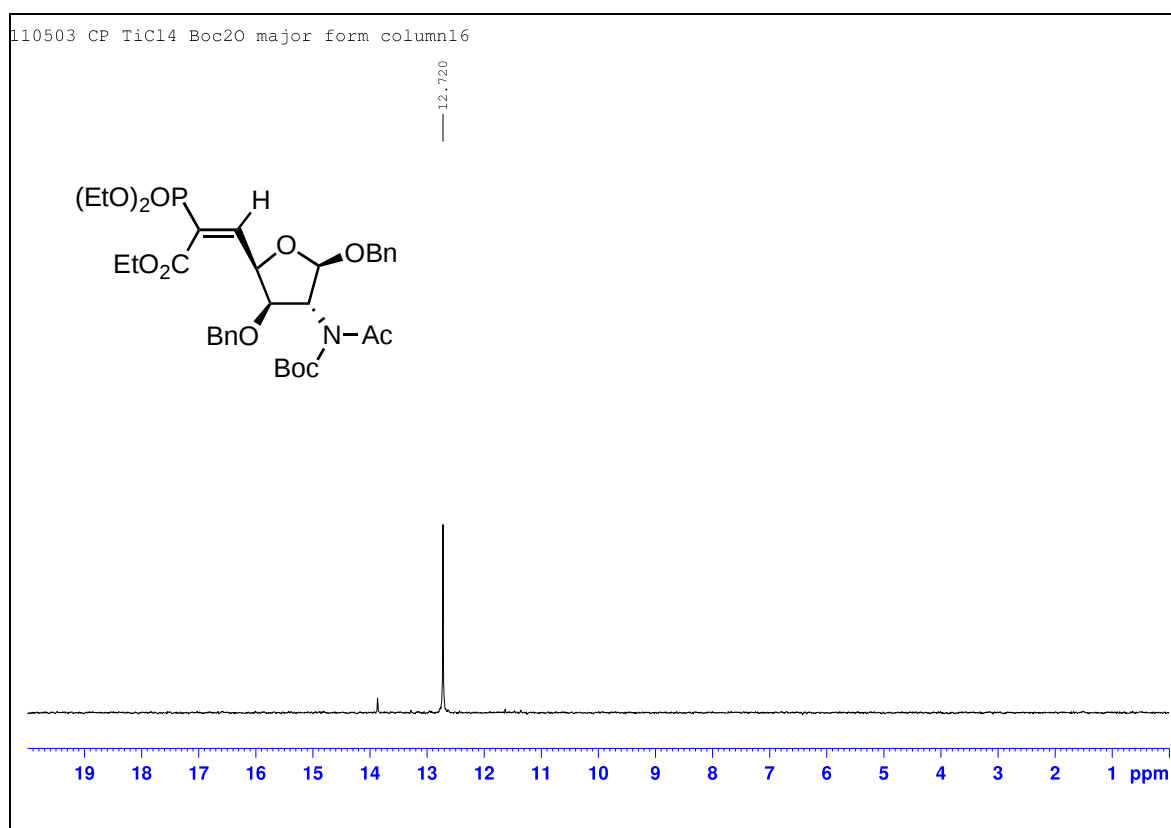
$^{13}\text{C}$  NMR spectrum of compound **18** ( $\text{CDCl}_3$ , 100 MHz)



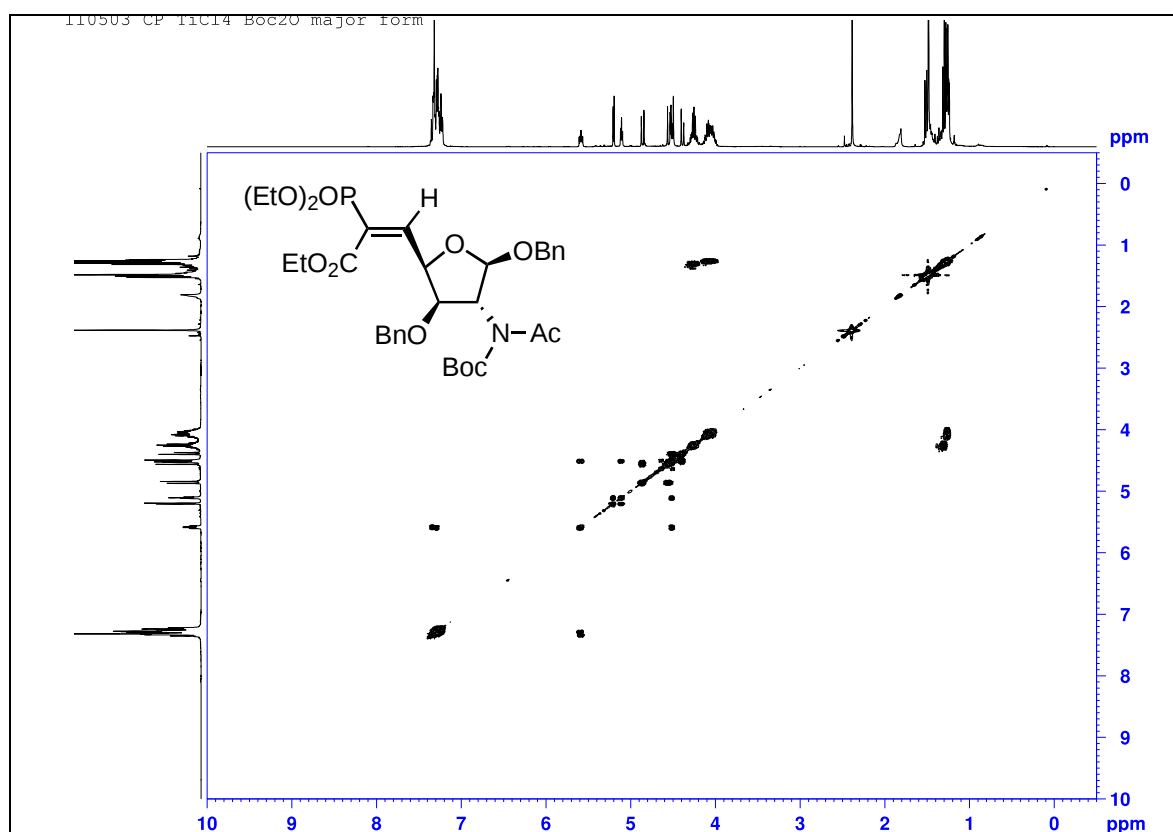
$^1\text{H}$  NMR spectrum of compound **(E)-20** ( $\text{CDCl}_3$ , 400 MHz)



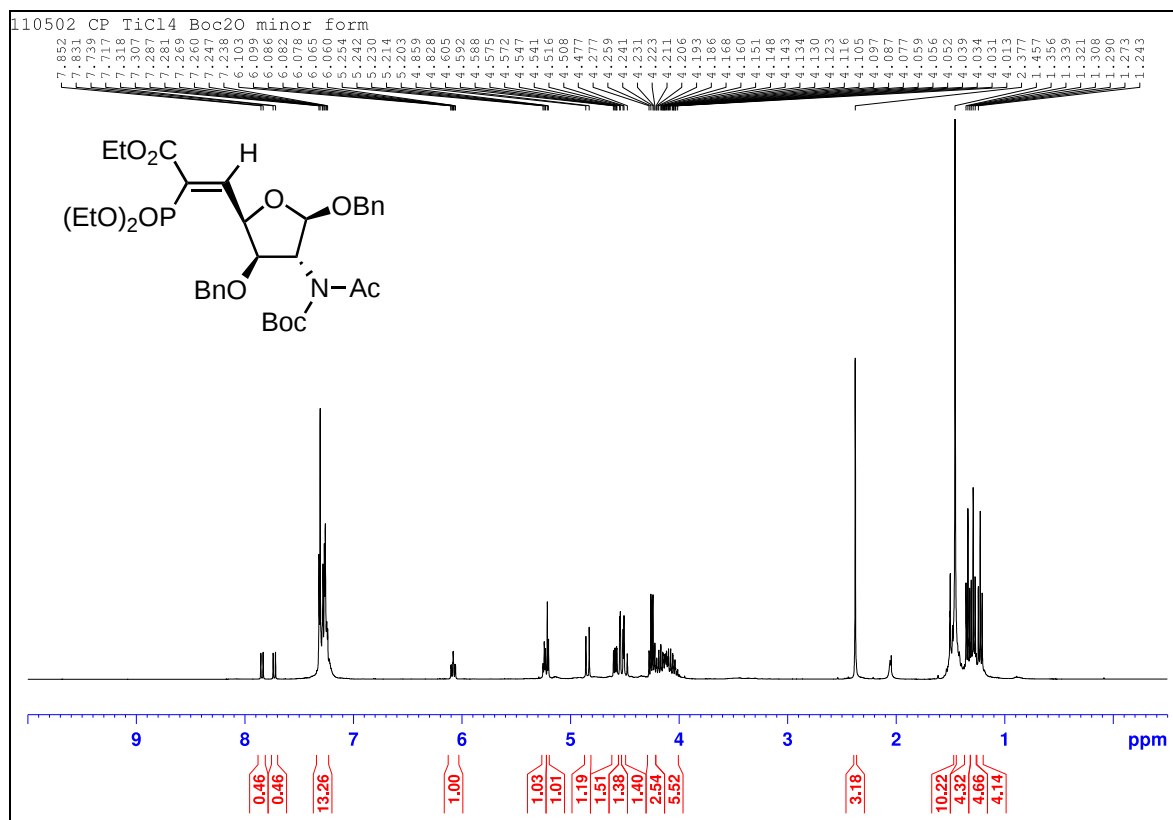
<sup>13</sup>C NMR spectrum of compound (E)-20 (CDCl<sub>3</sub>, 100 MHz)



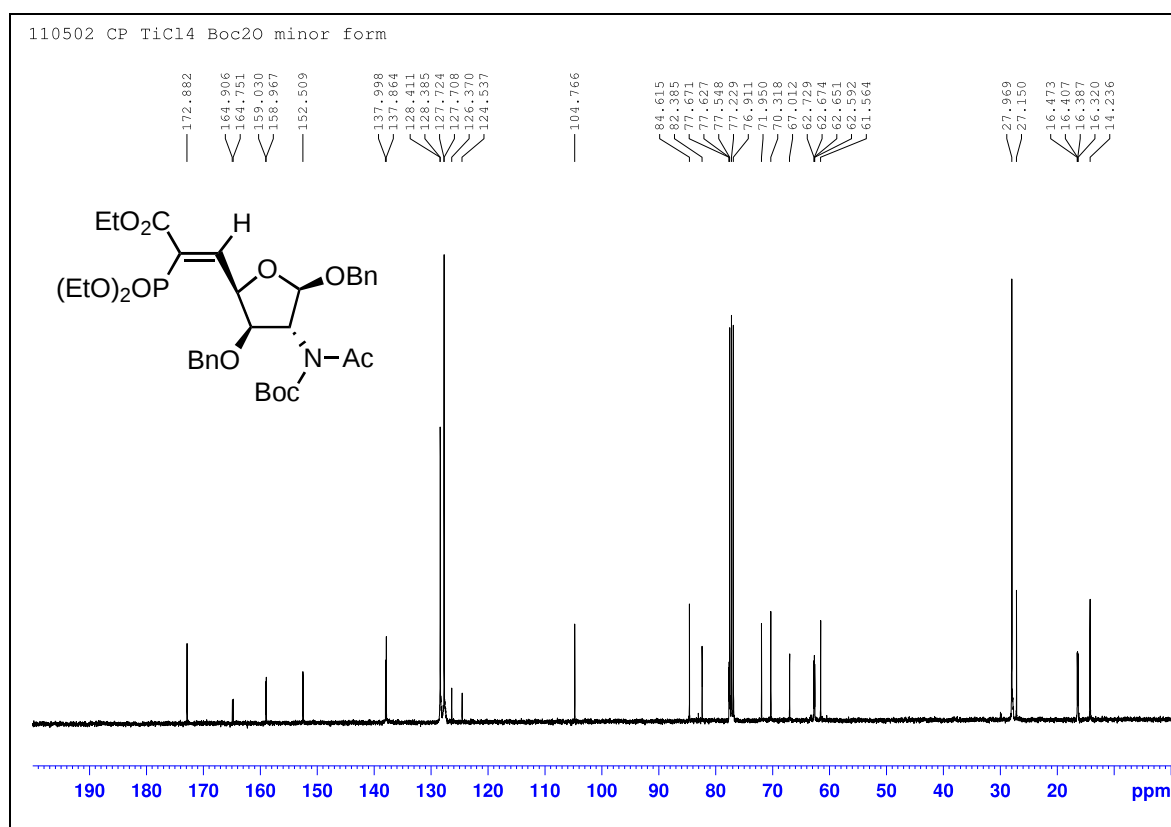
<sup>31</sup>P NMR spectrum of compound (E)-20 (CDCl<sub>3</sub>, 162 MHz)



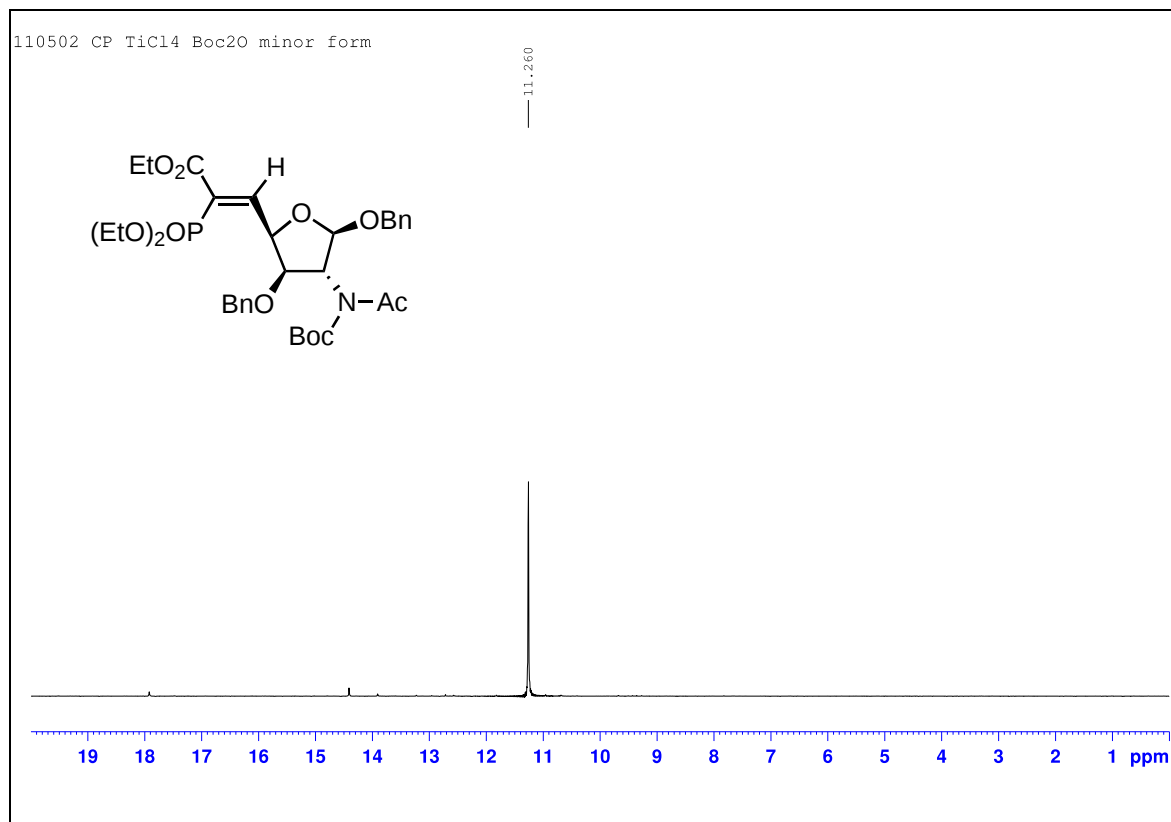
$^1\text{H}$ - $^1\text{H}$  COSY NMR spectrum of compound (E)-20 ( $\text{CDCl}_3$ , 400 MHz)



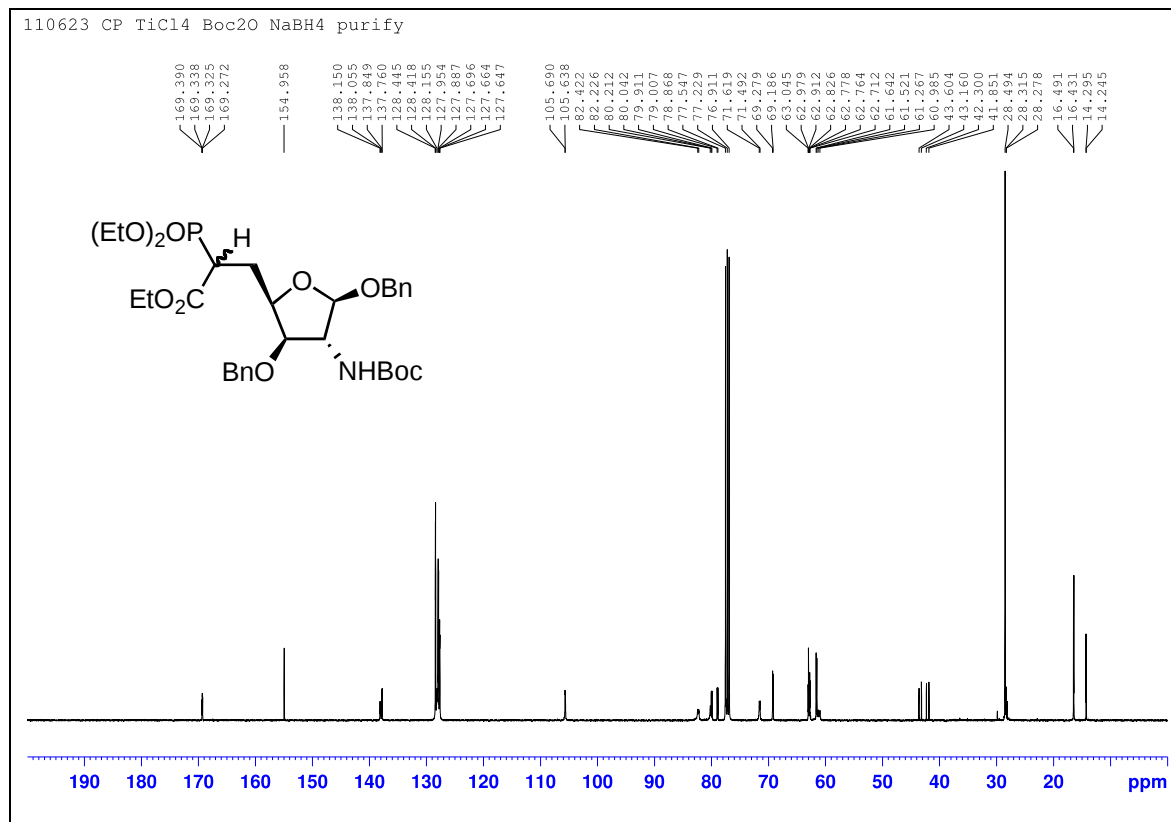
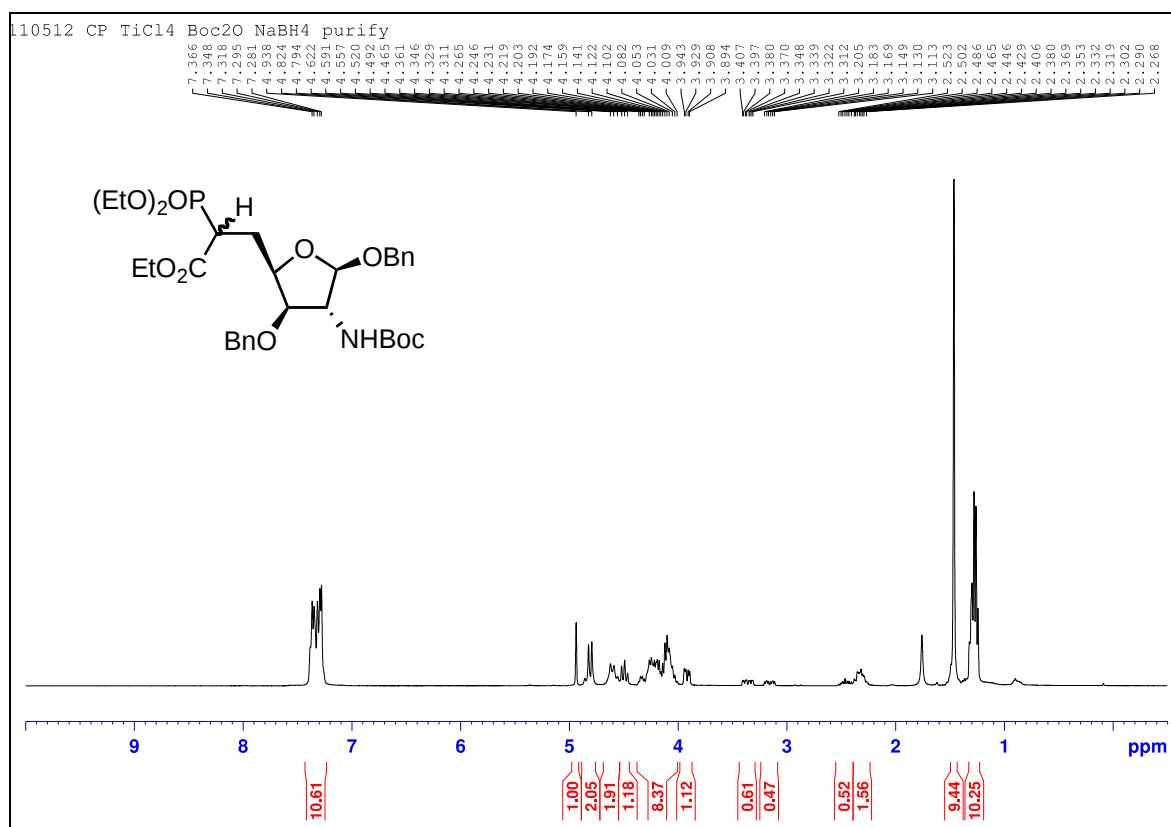
$^1\text{H}$  NMR spectrum of compound (Z)-20 ( $\text{CDCl}_3$ , 400 MHz)

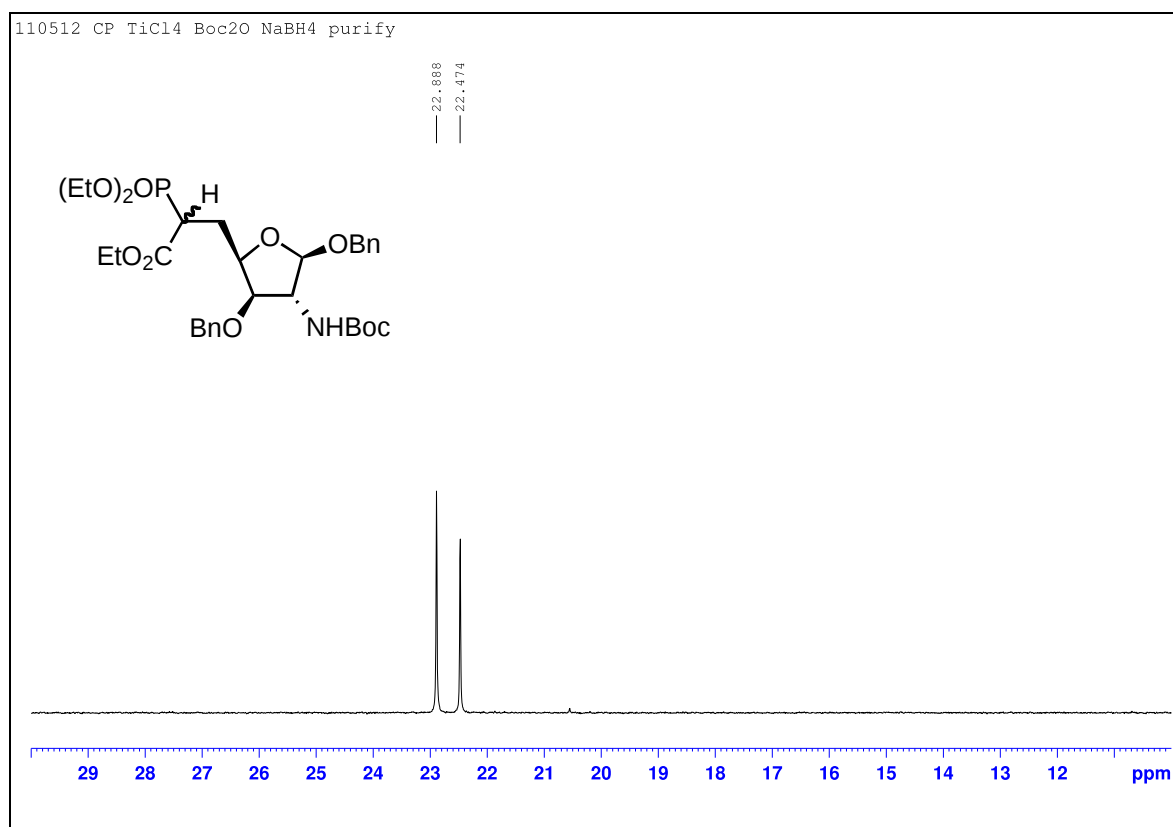


<sup>13</sup>C NMR spectrum of compound (Z)-20 (CDCl<sub>3</sub>, 100 MHz)

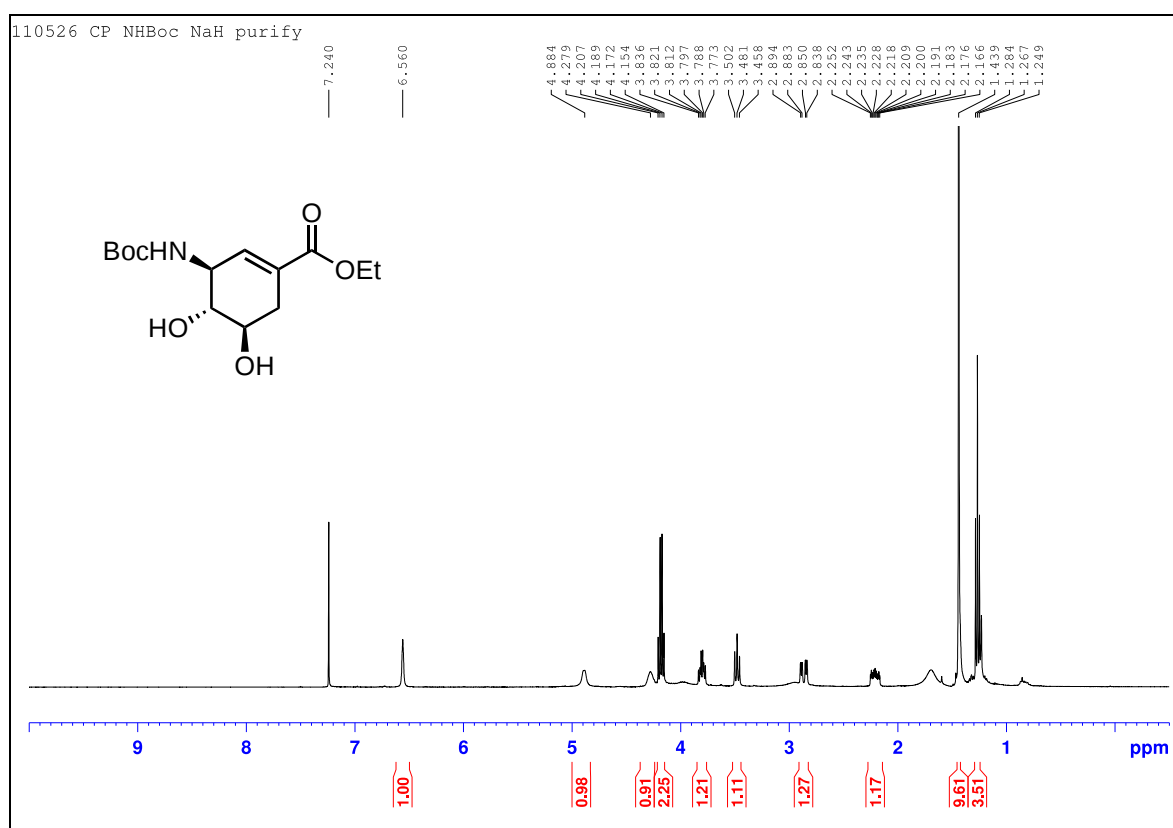


<sup>31</sup>P NMR spectrum of compound (Z)-20 (CDCl<sub>3</sub>, 162 MHz)

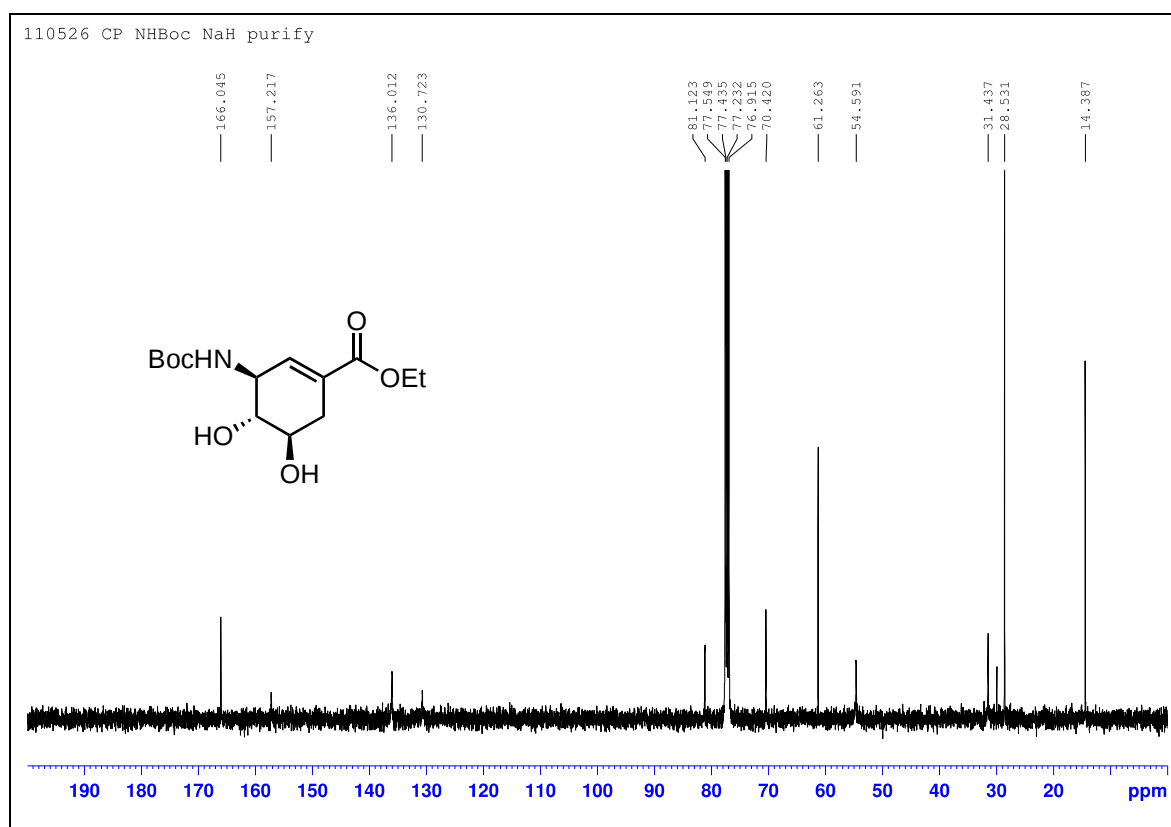




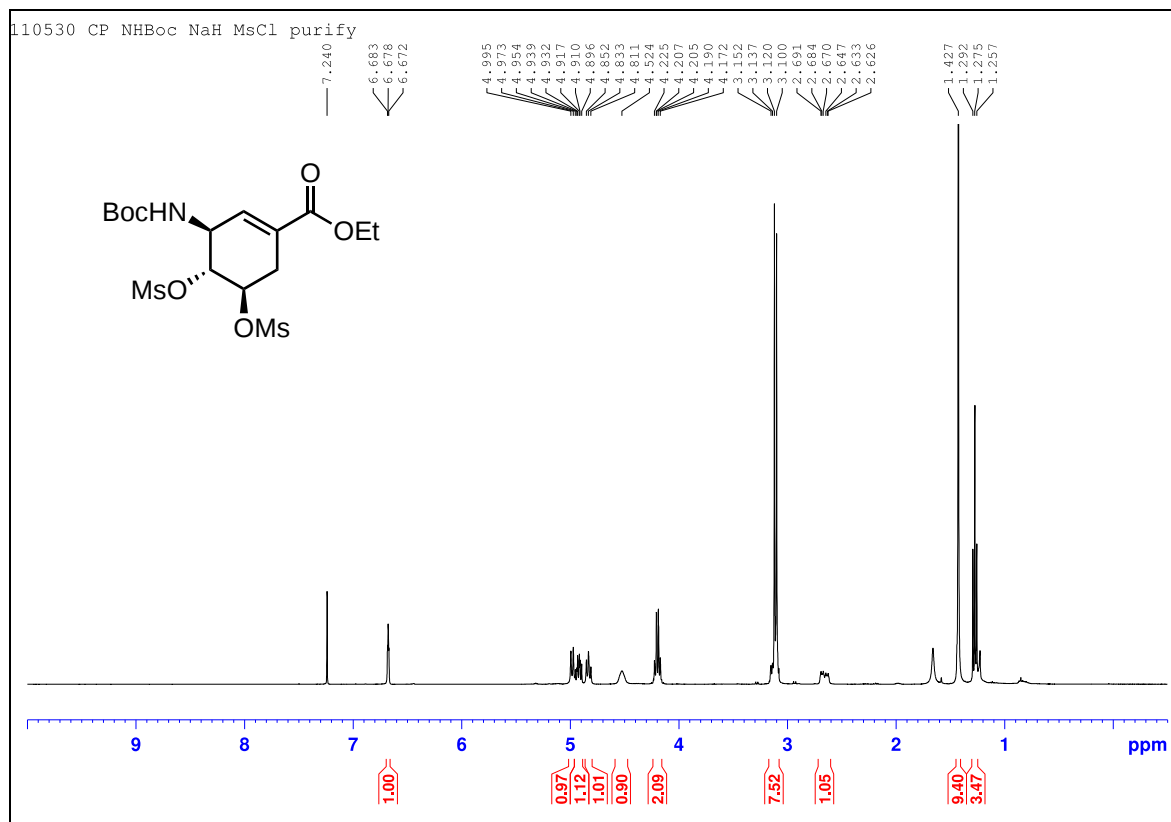
$^{31}\text{P}$  NMR spectrum of compound **21** ( $\text{CDCl}_3$ , 162 MHz)



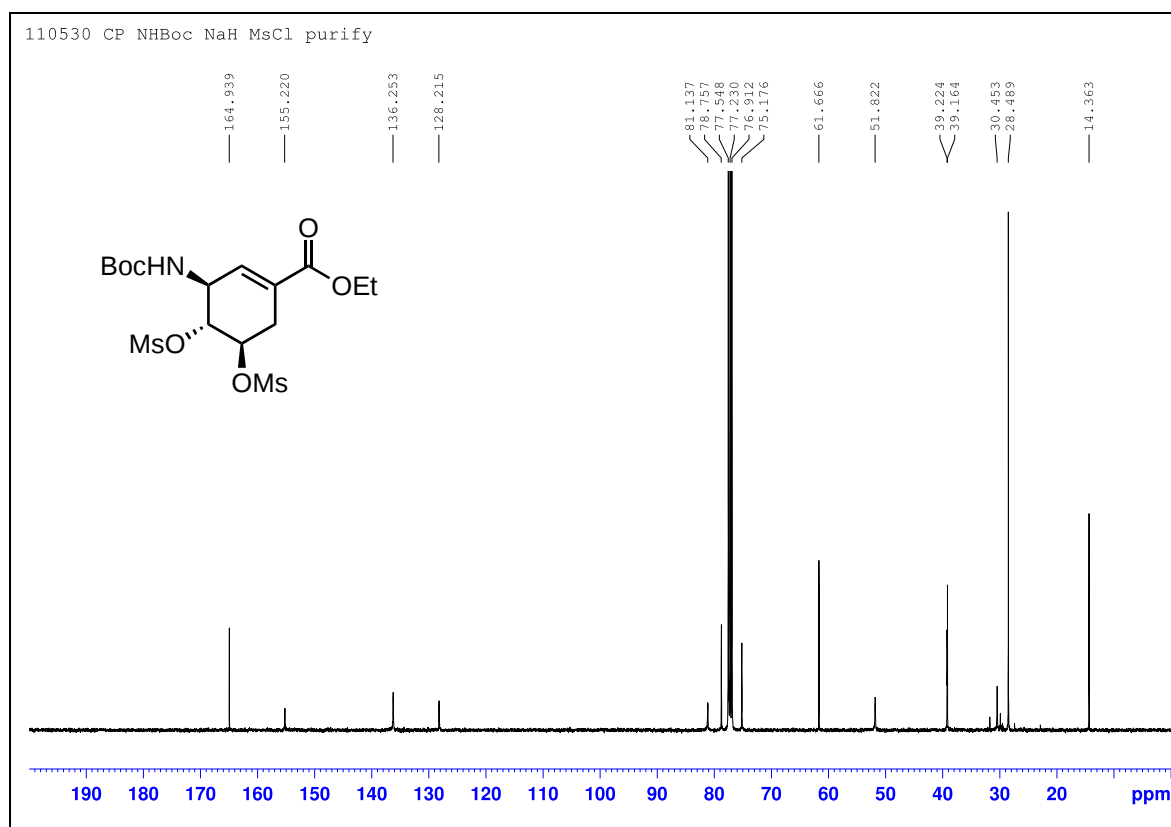
$^1\text{H}$  NMR spectrum of compound **22** ( $\text{CDCl}_3$ , 400 MHz)



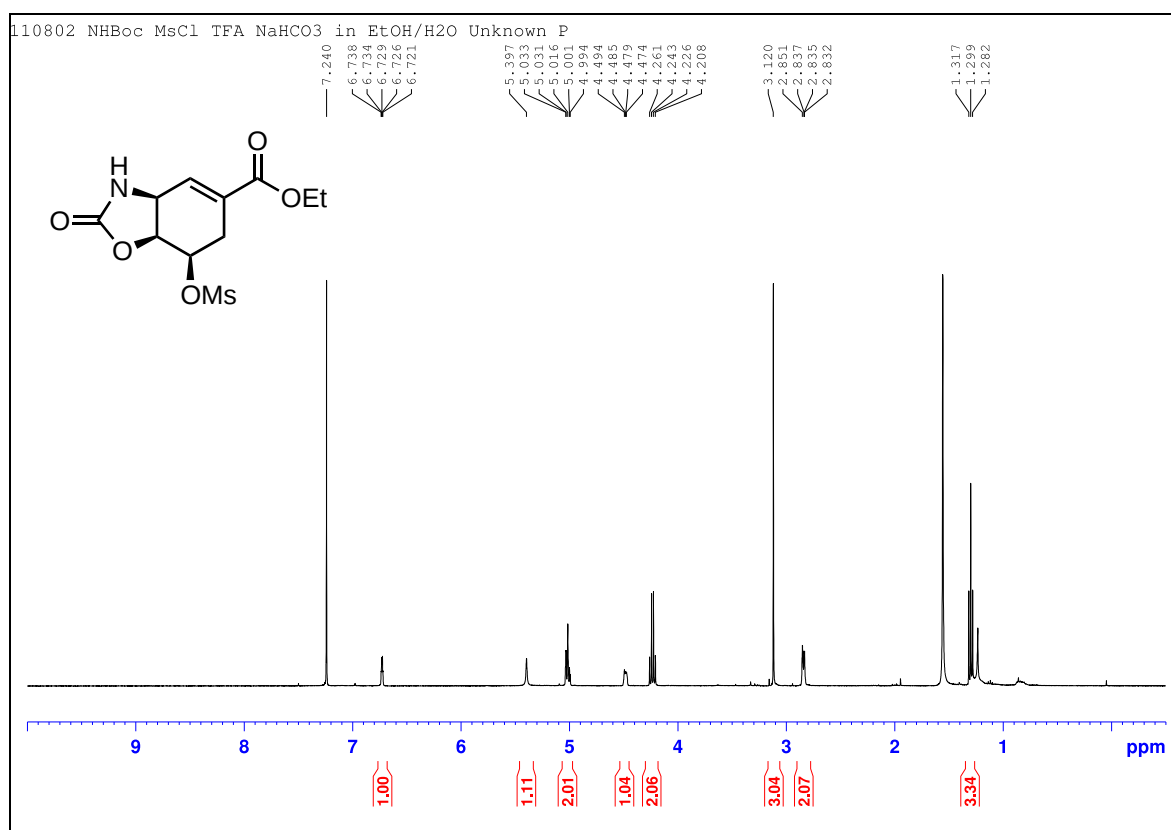
<sup>13</sup>C NMR spectrum of compound 22 (CDCl<sub>3</sub>, 100 MHz)



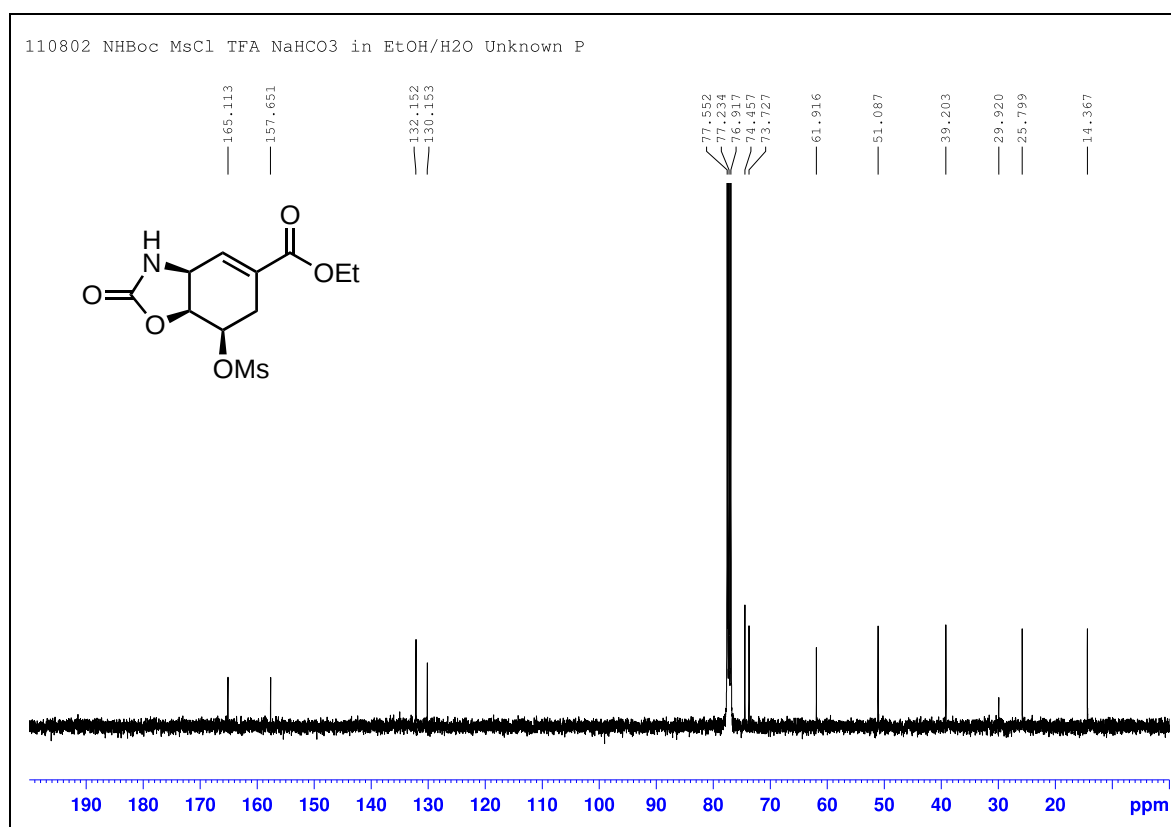
<sup>1</sup>H NMR spectrum of compound 23 (CDCl<sub>3</sub>, 400 MHz)



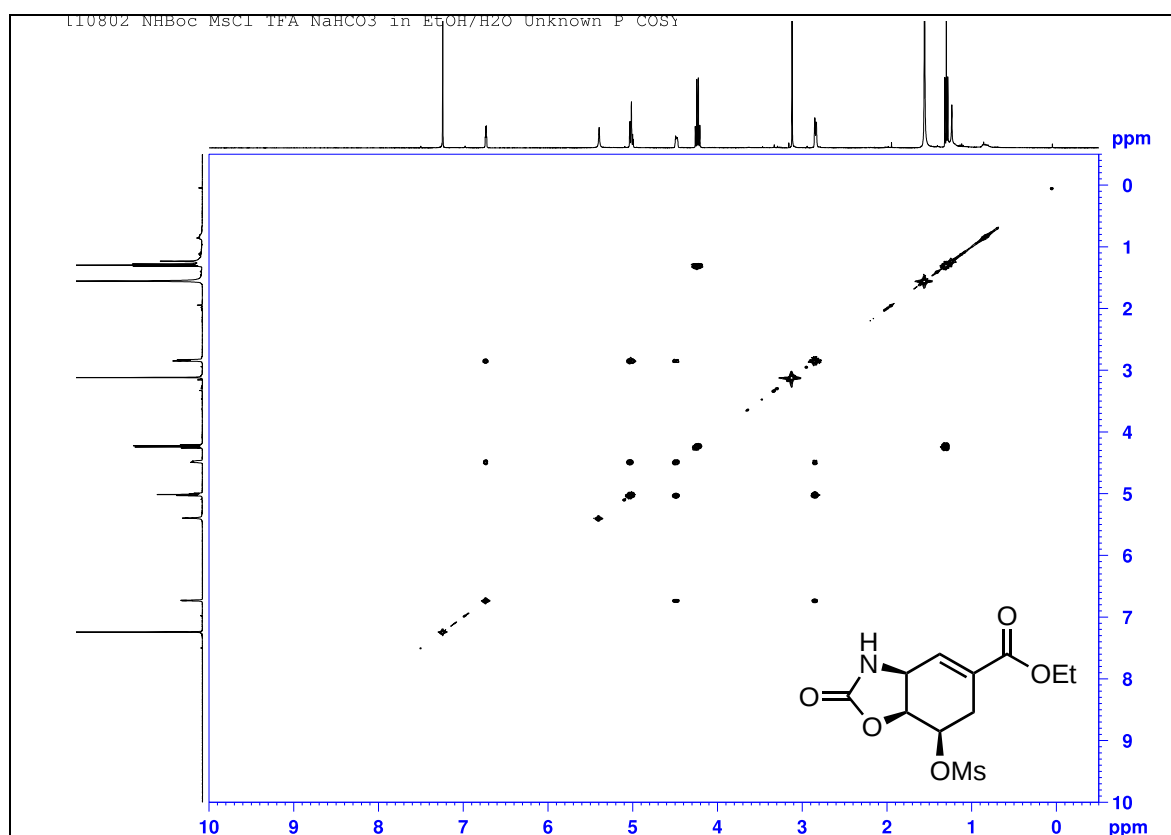
$^{13}\text{C}$  NMR spectrum of compound 23 ( $\text{CDCl}_3$ , 100 MHz)



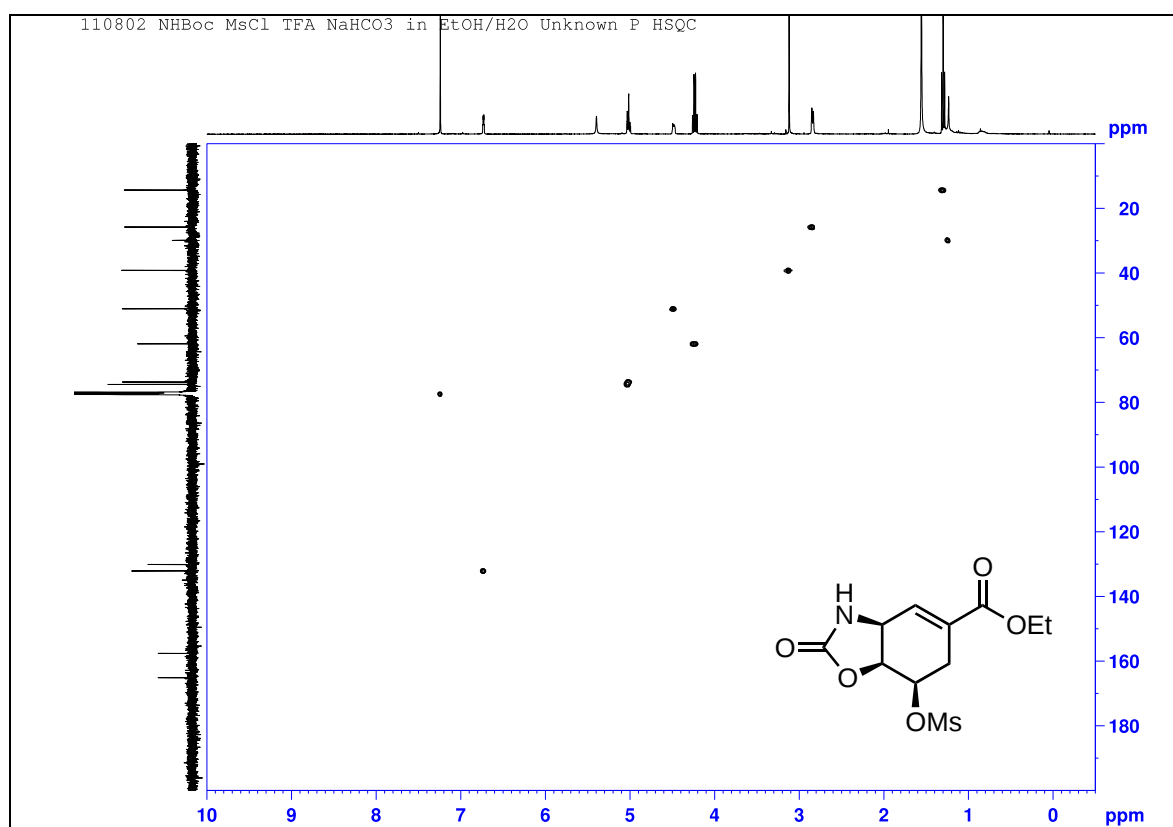
$^1\text{H}$  NMR spectrum of compound 24 ( $\text{CDCl}_3$ , 400 MHz)



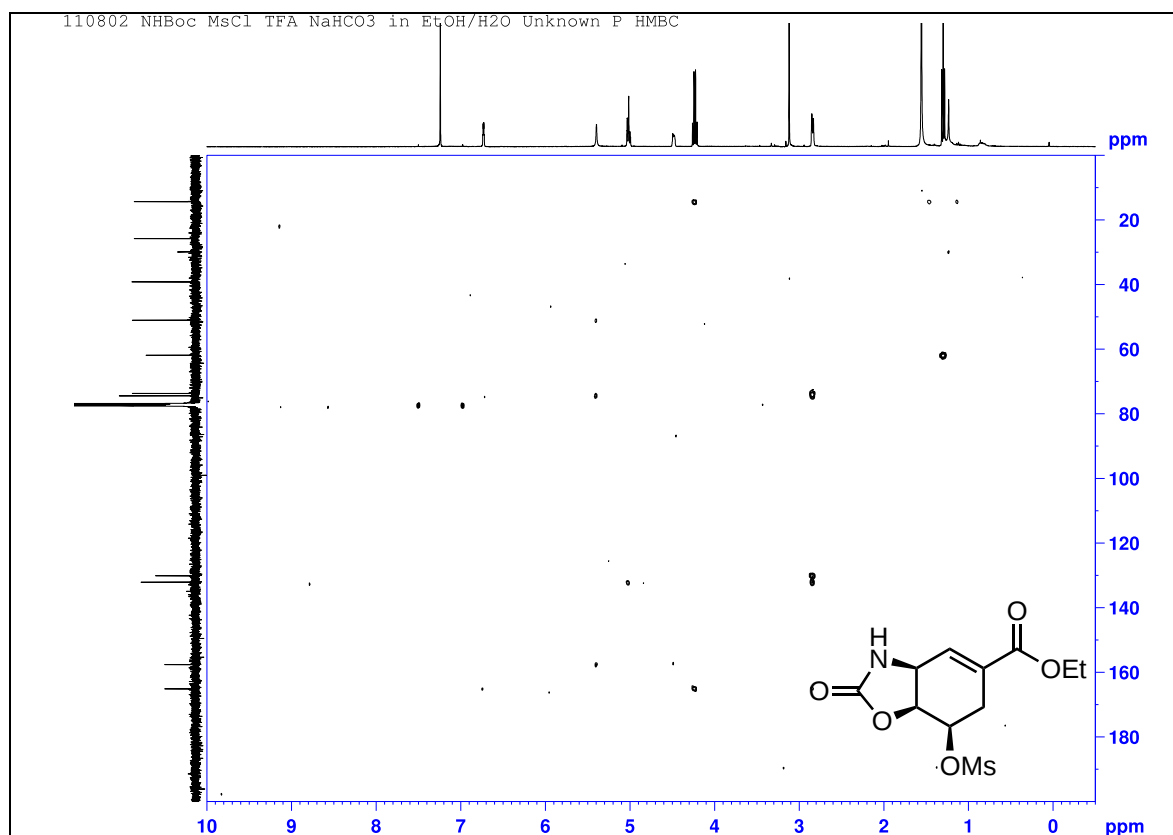
<sup>13</sup>C NMR spectrum of compound **24** (CDCl<sub>3</sub>, 100 MHz)



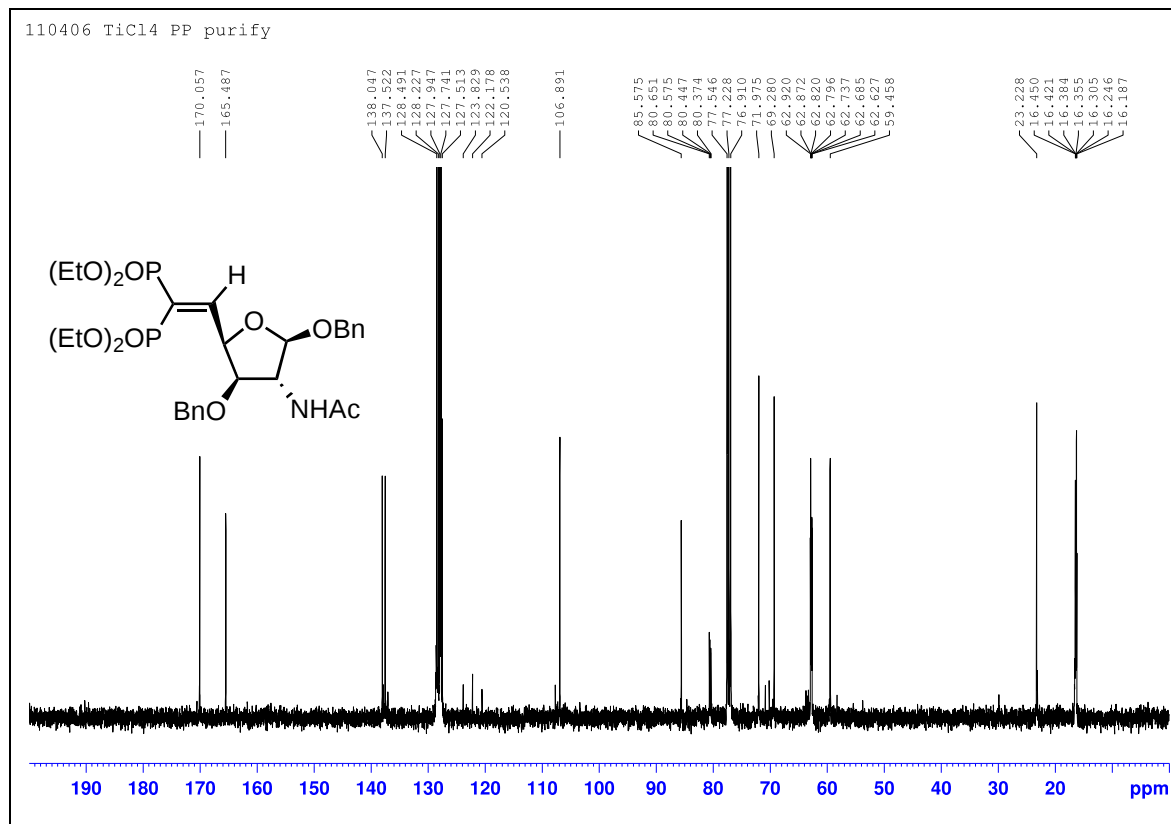
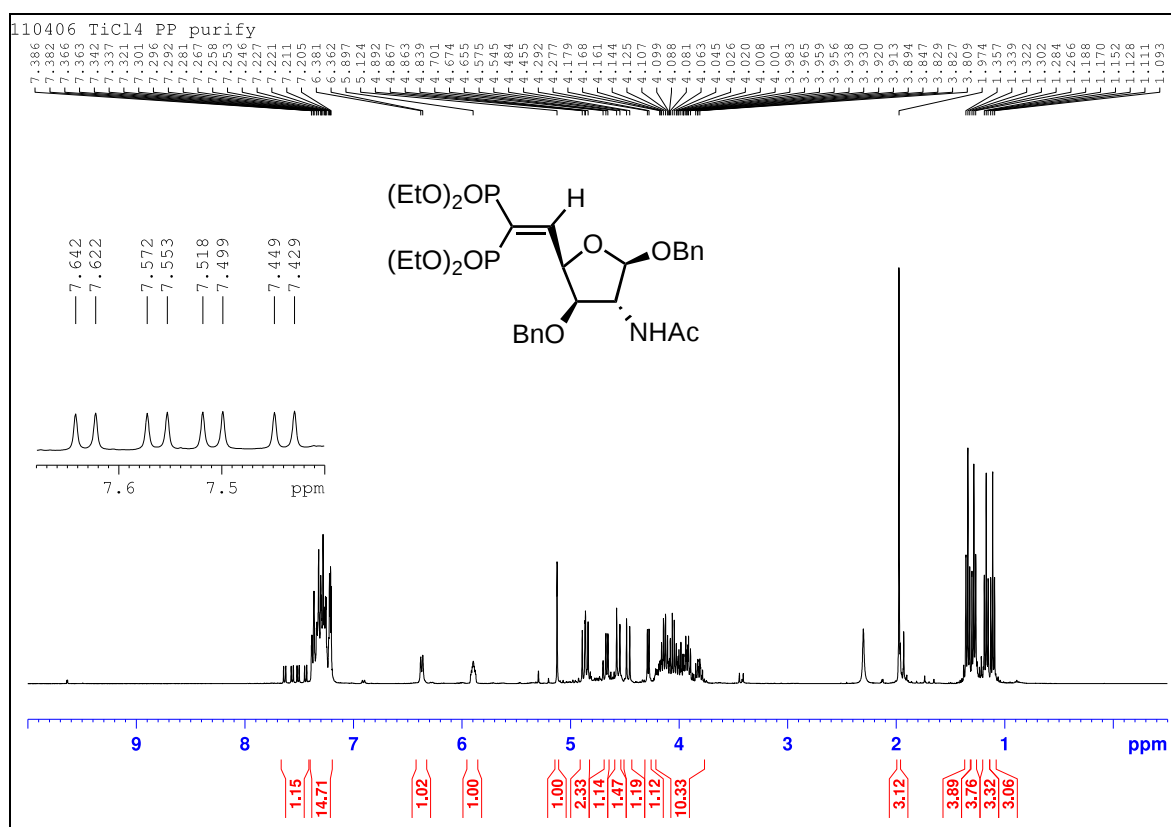
<sup>1</sup>H-<sup>1</sup>H COSY NMR spectrum of compound **24** (CDCl<sub>3</sub>, 400 MHz)

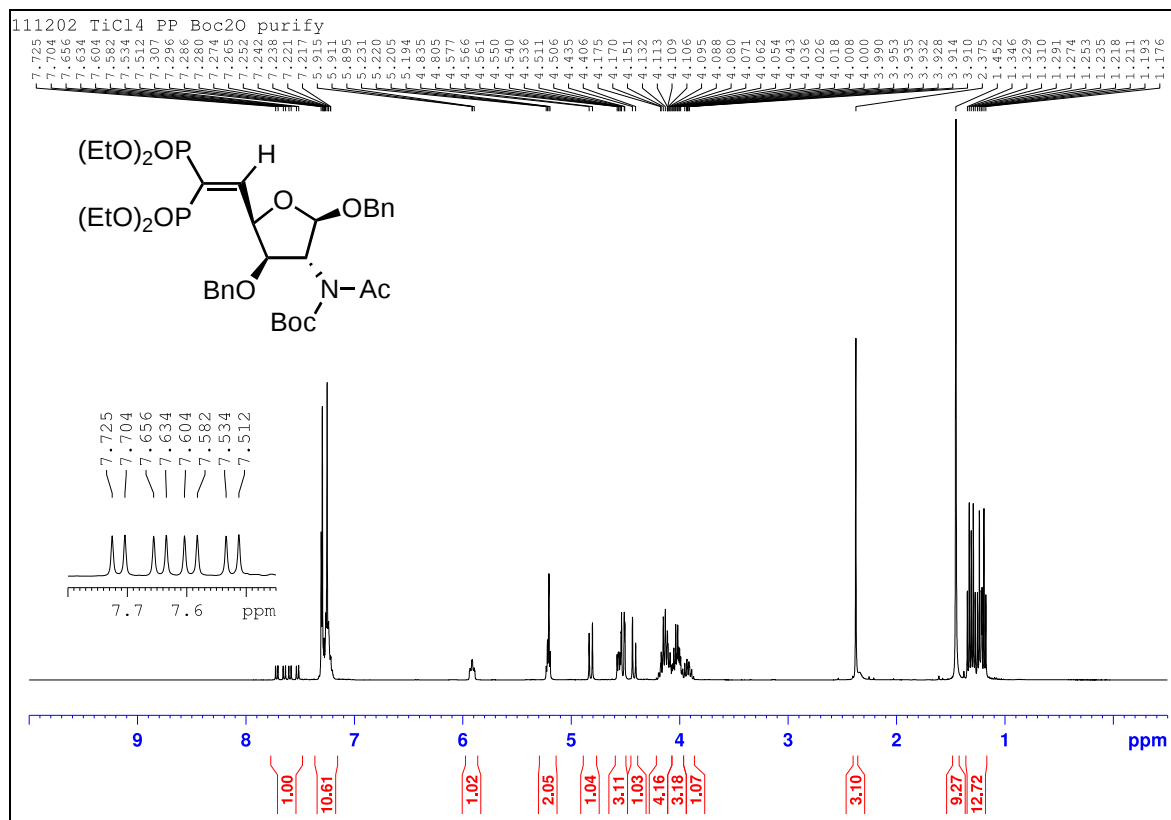
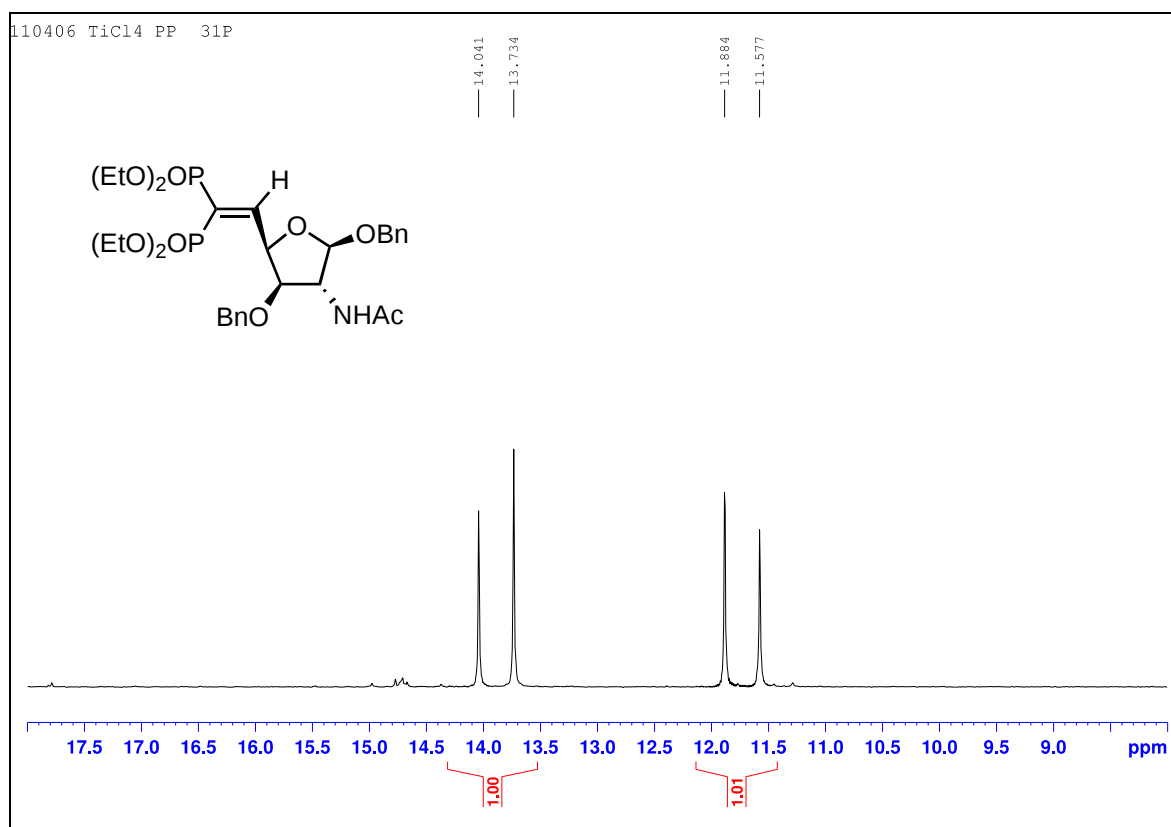


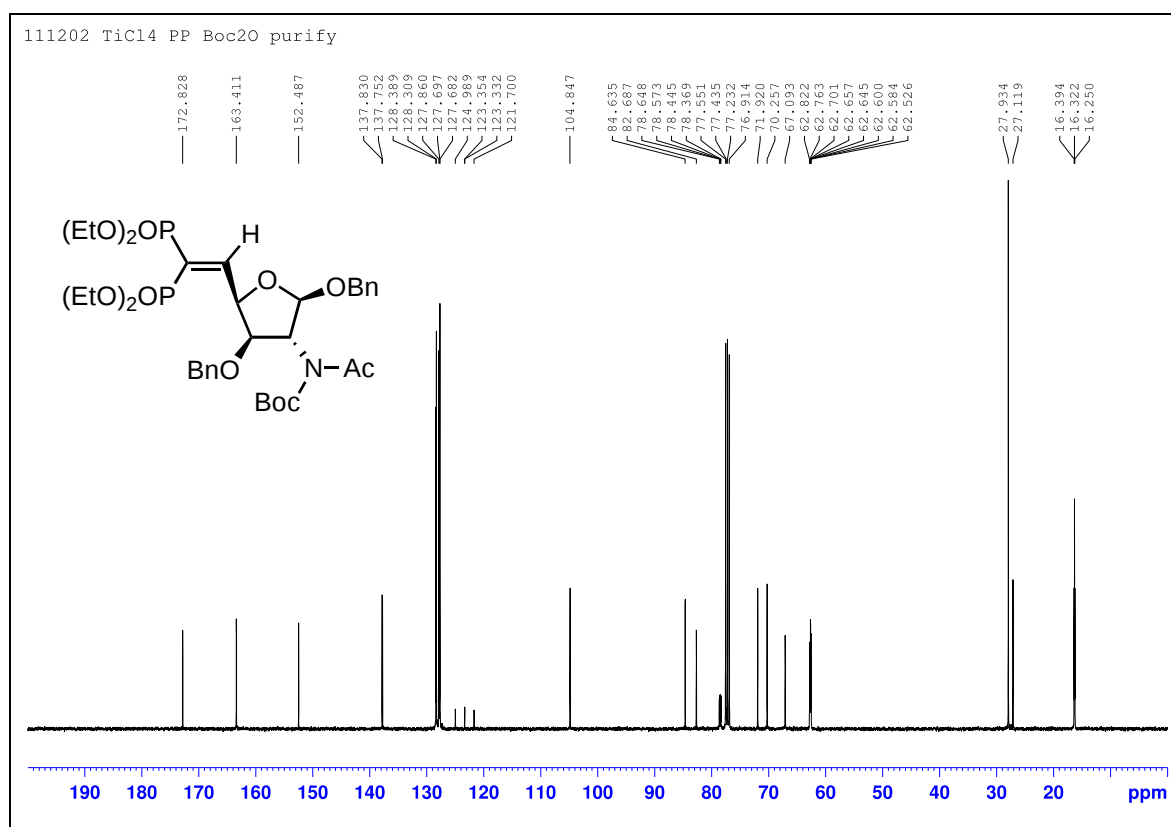
$^1\text{H}$ - $^{13}\text{C}$  HSQC NMR spectrum of compound **24** ( $\text{CDCl}_3$ , 400 MHz)



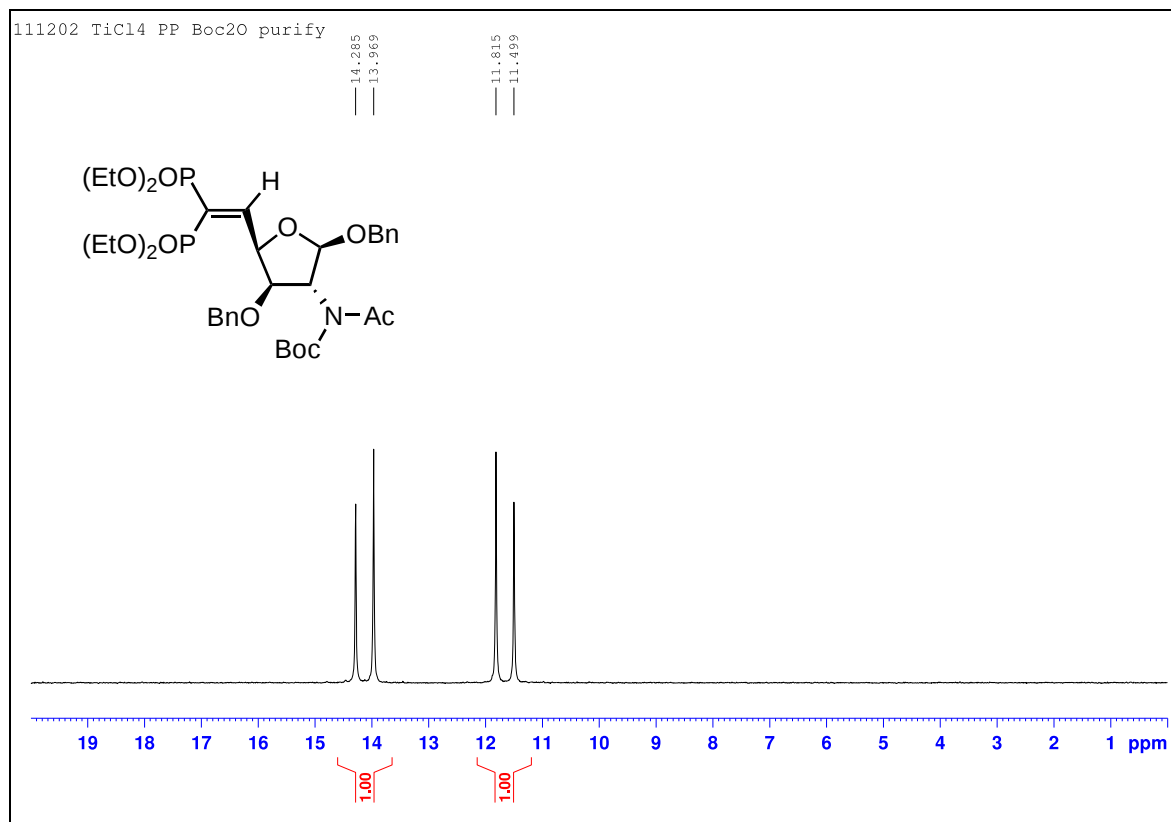
$^1\text{H}$ - $^{13}\text{C}$  HMBC NMR spectrum of compound **24** ( $\text{CDCl}_3$ , 400 MHz)



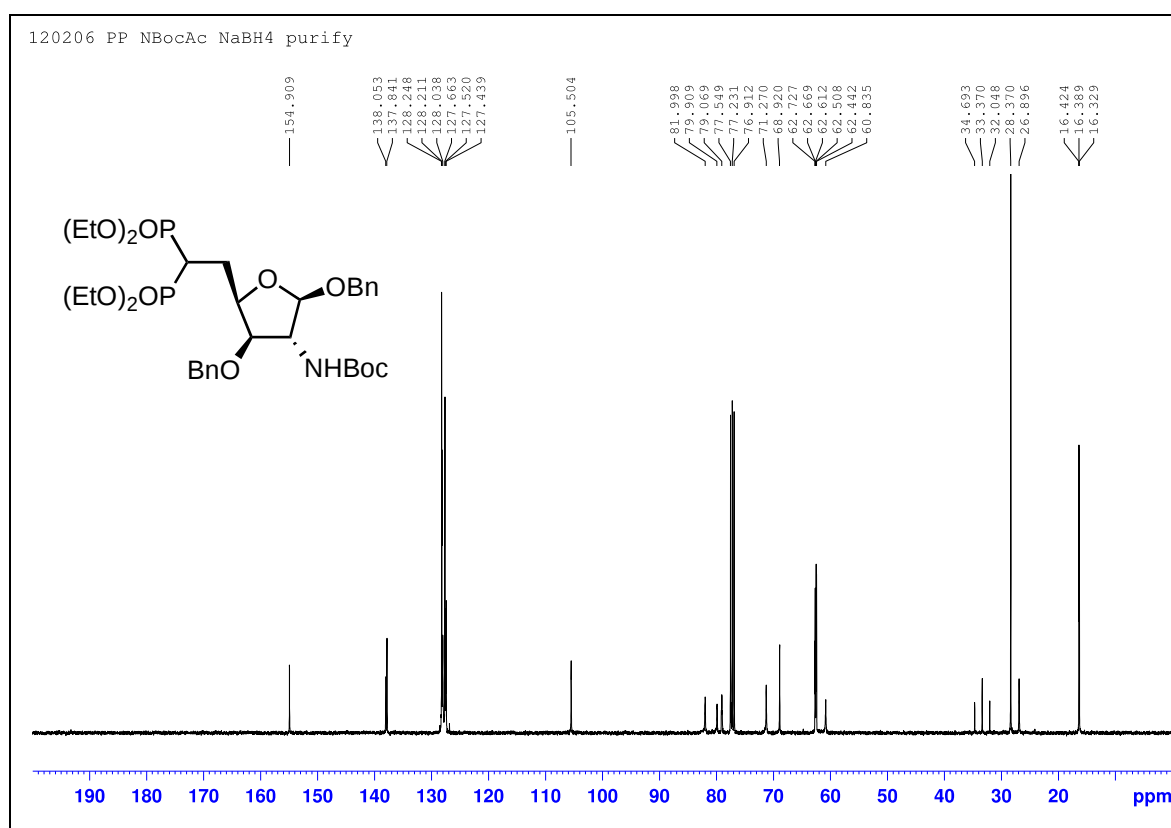
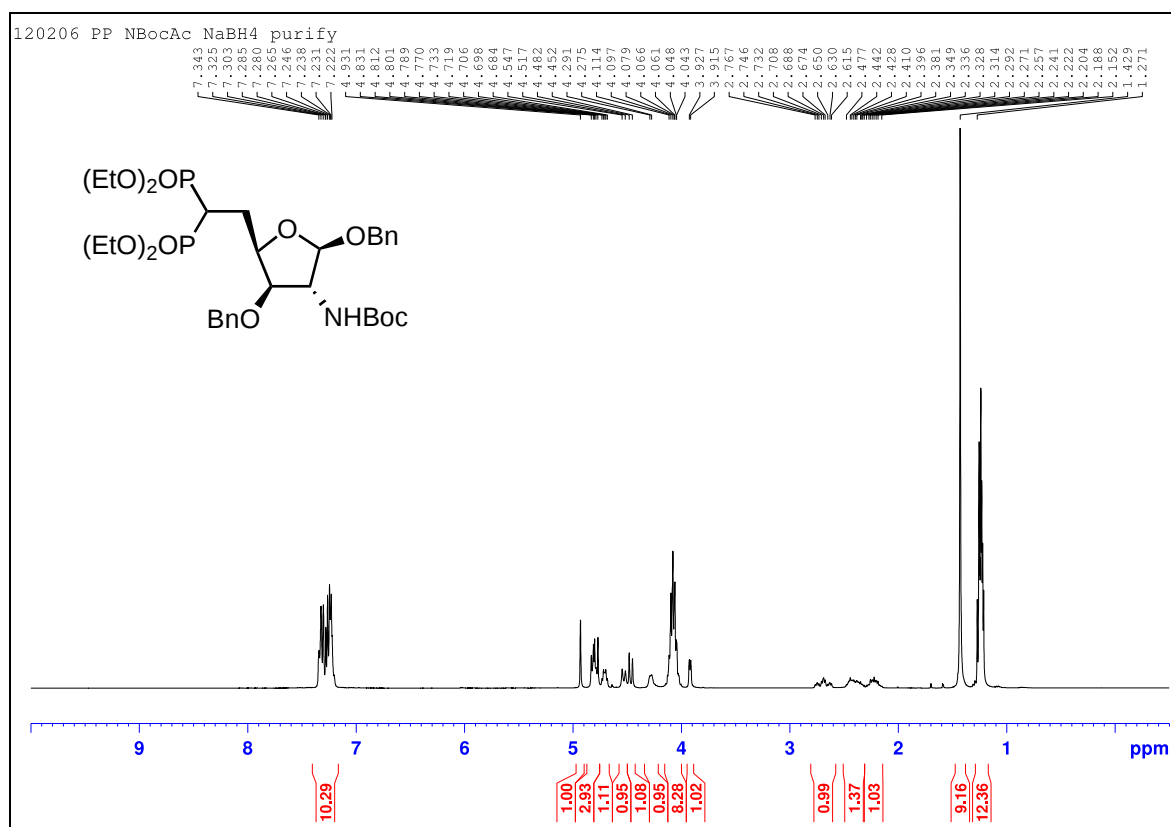


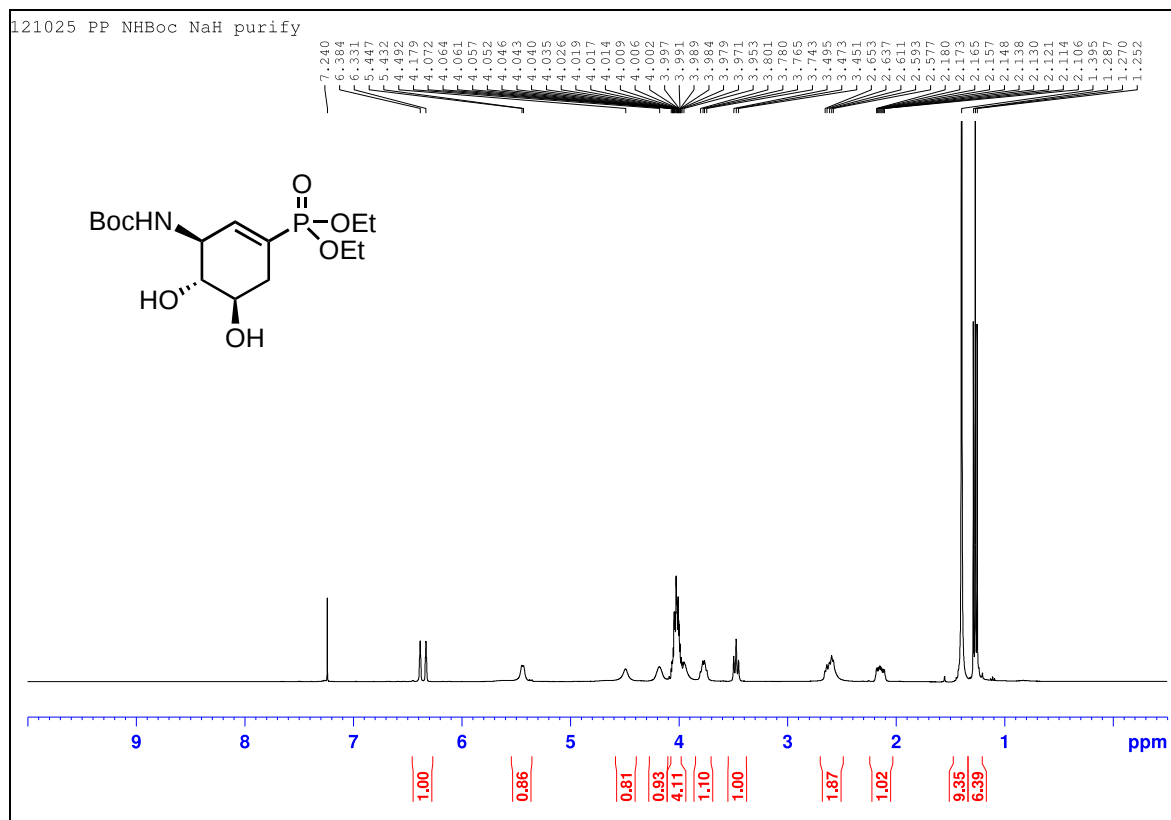
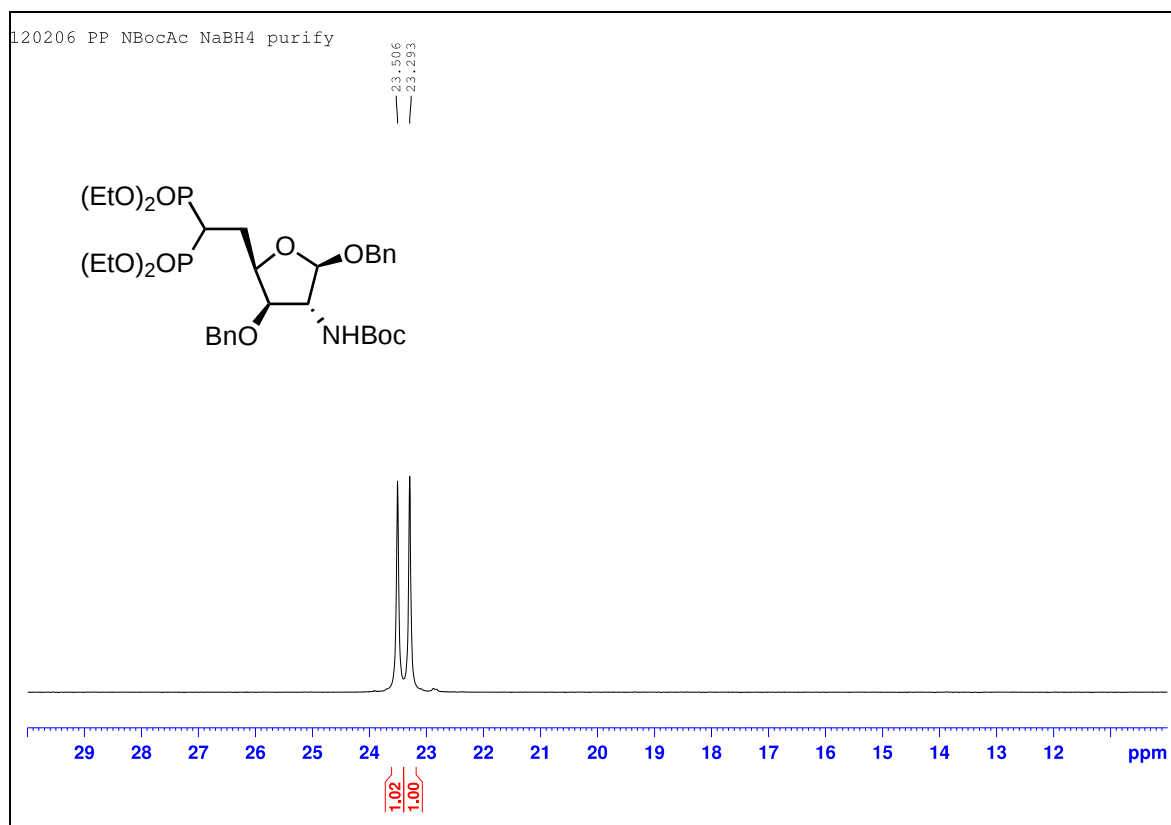


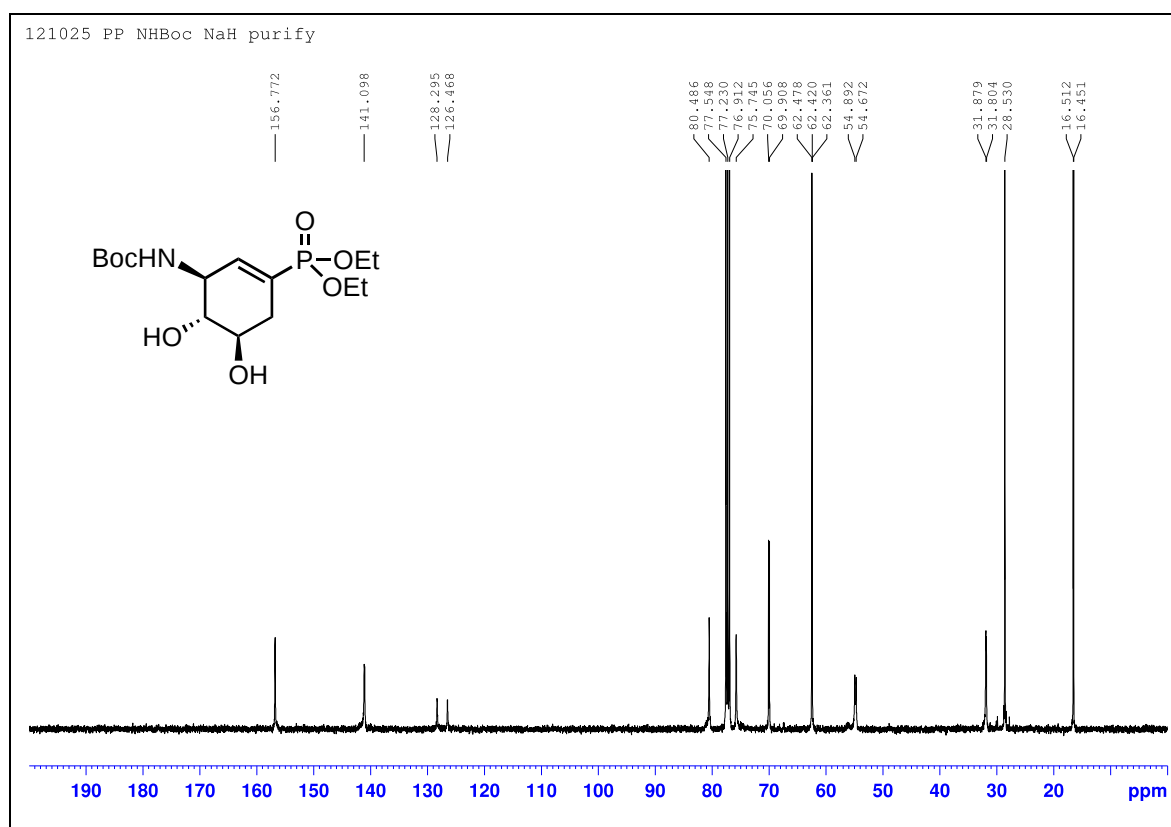
<sup>13</sup>C NMR spectrum of compound **26** (CDCl<sub>3</sub>, 100 MHz)



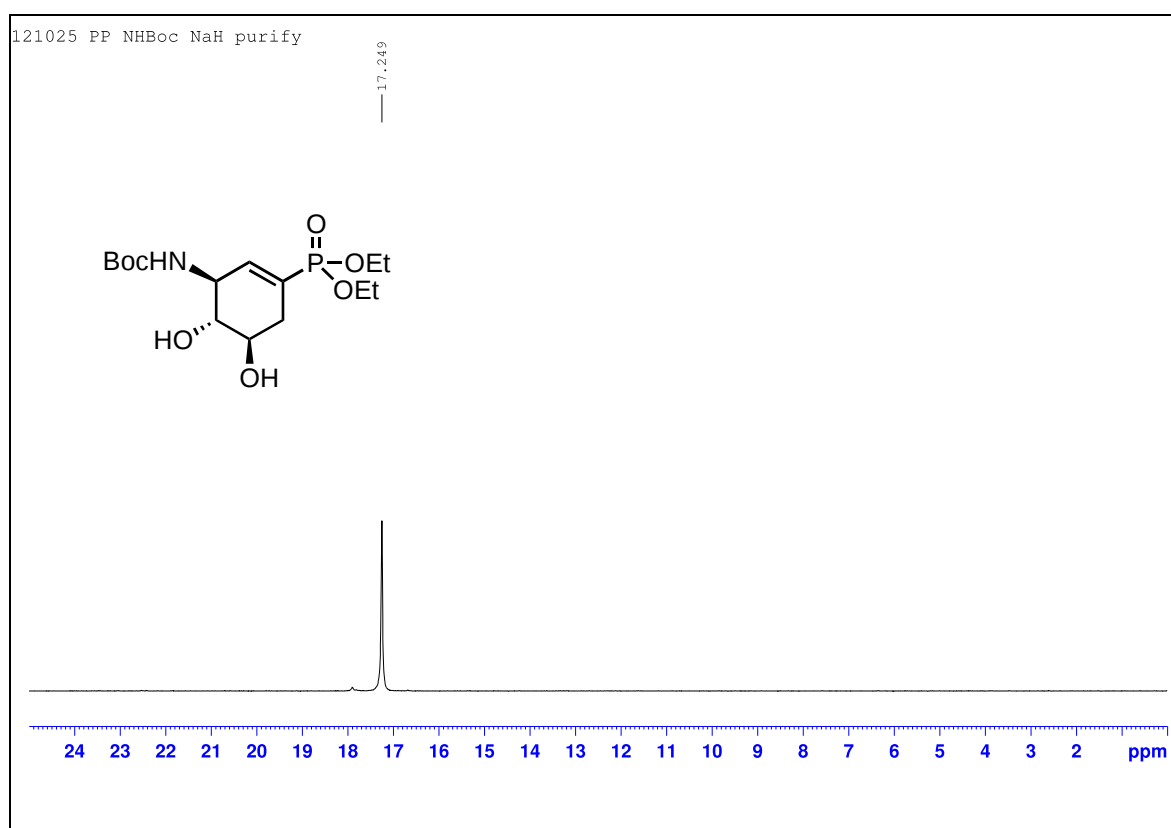
<sup>31</sup>P NMR spectrum of compound **26** (CDCl<sub>3</sub>, 162 MHz)



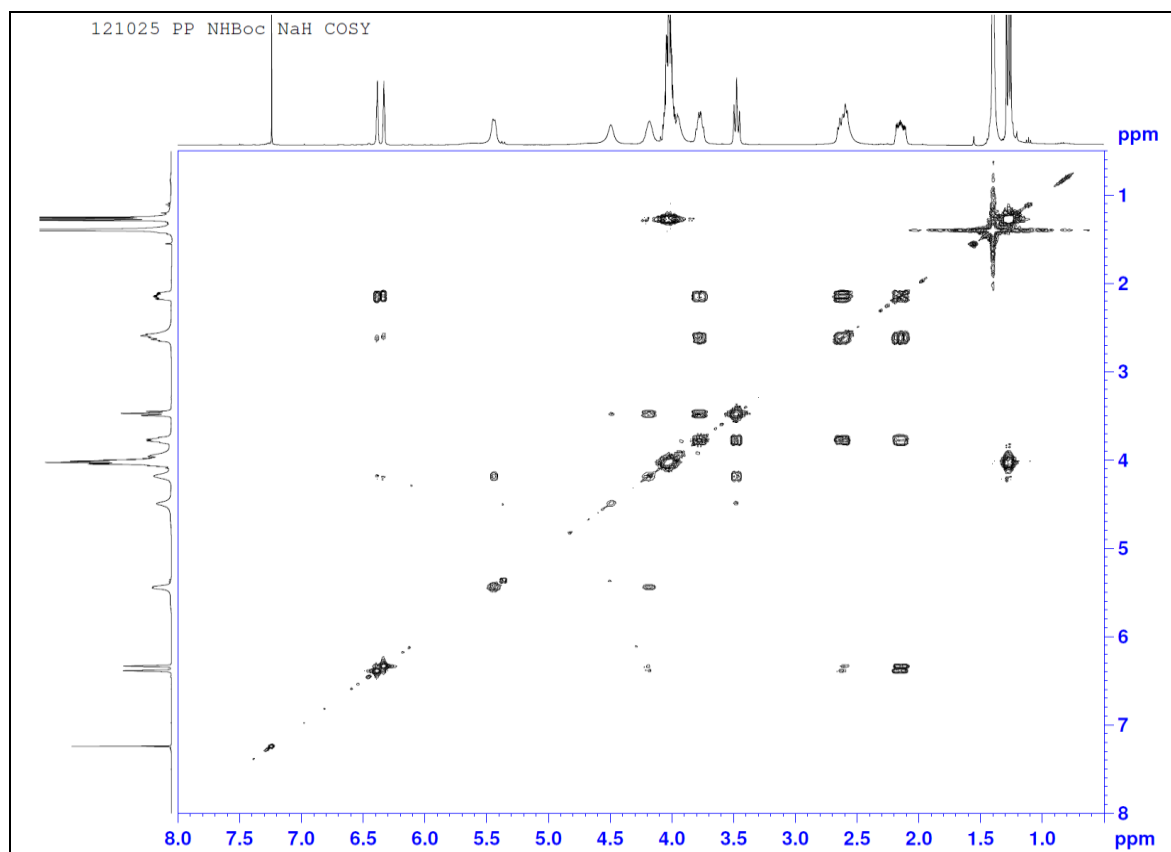




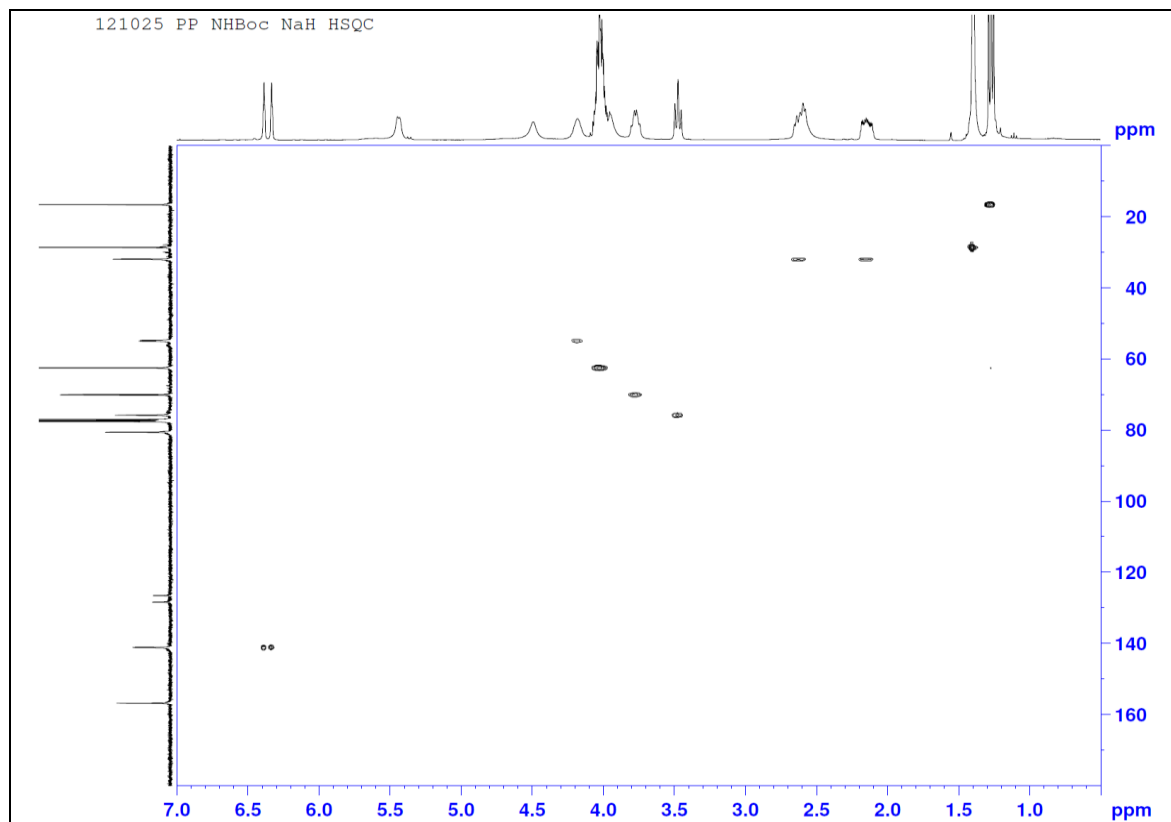
$^{13}\text{C}$  NMR spectrum of compound **28b** ( $\text{CDCl}_3$ , 100 MHz)



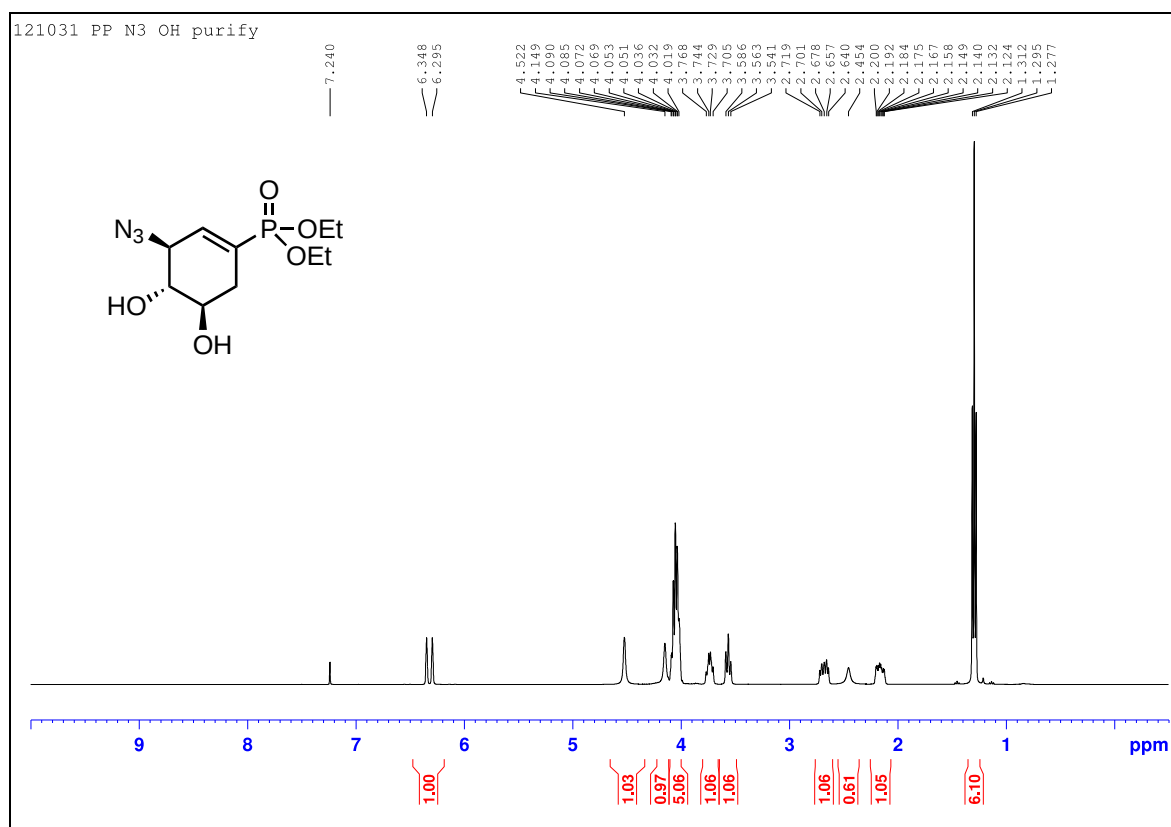
$^{31}\text{P}$  NMR spectrum of compound **28b** ( $\text{CDCl}_3$ , 162 MHz)



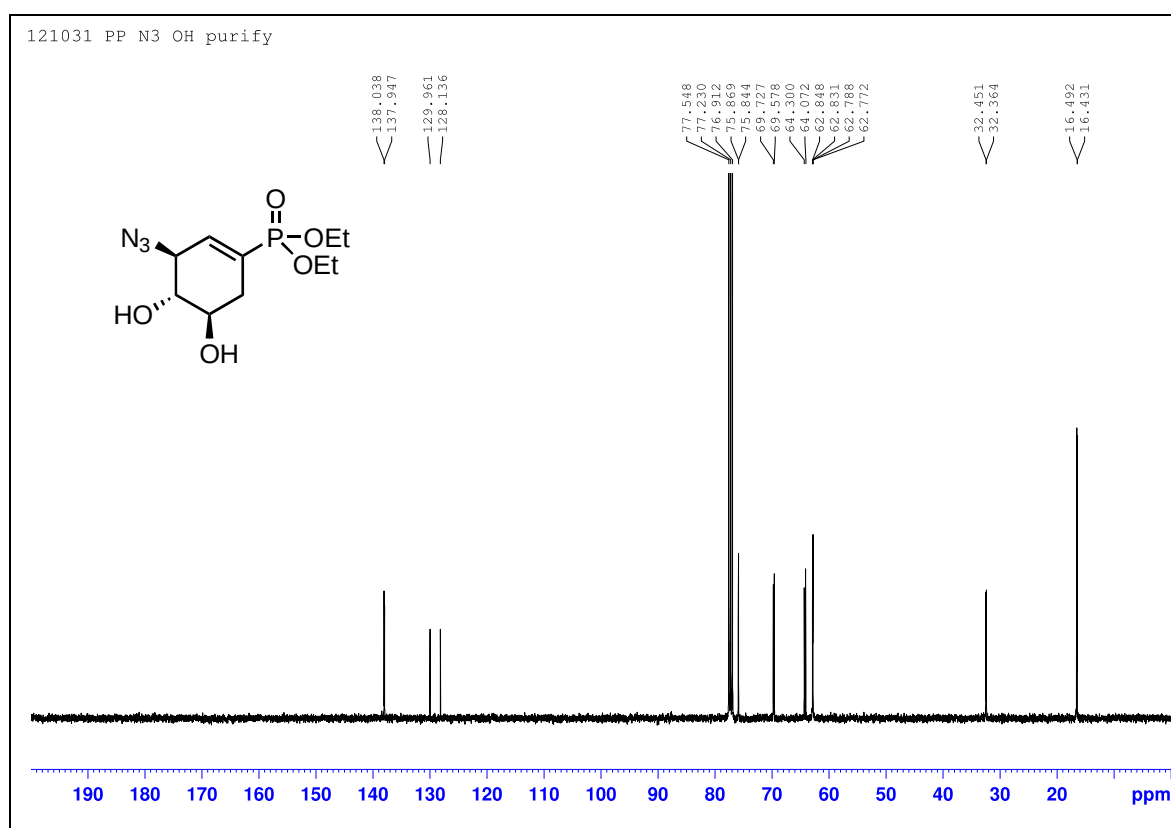
$^1\text{H}$ - $^1\text{H}$  COSY NMR spectrum of compound **28b** ( $\text{CDCl}_3$ , 400 MHz)



$^1\text{H}$ - $^{13}\text{C}$  HSQC NMR spectrum of compound **28b** ( $\text{CDCl}_3$ , 400 MHz)

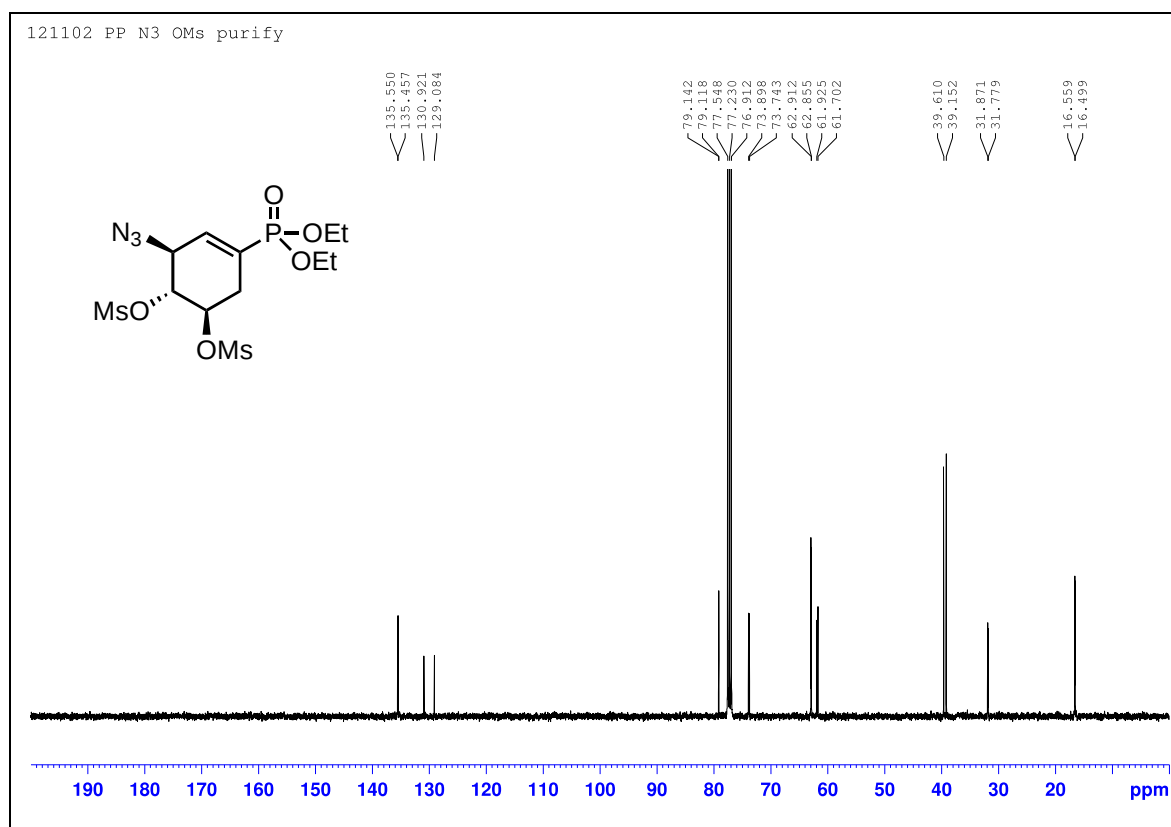


<sup>1</sup>H NMR spectrum of compound **29** (CDCl<sub>3</sub>, 400 MHz)

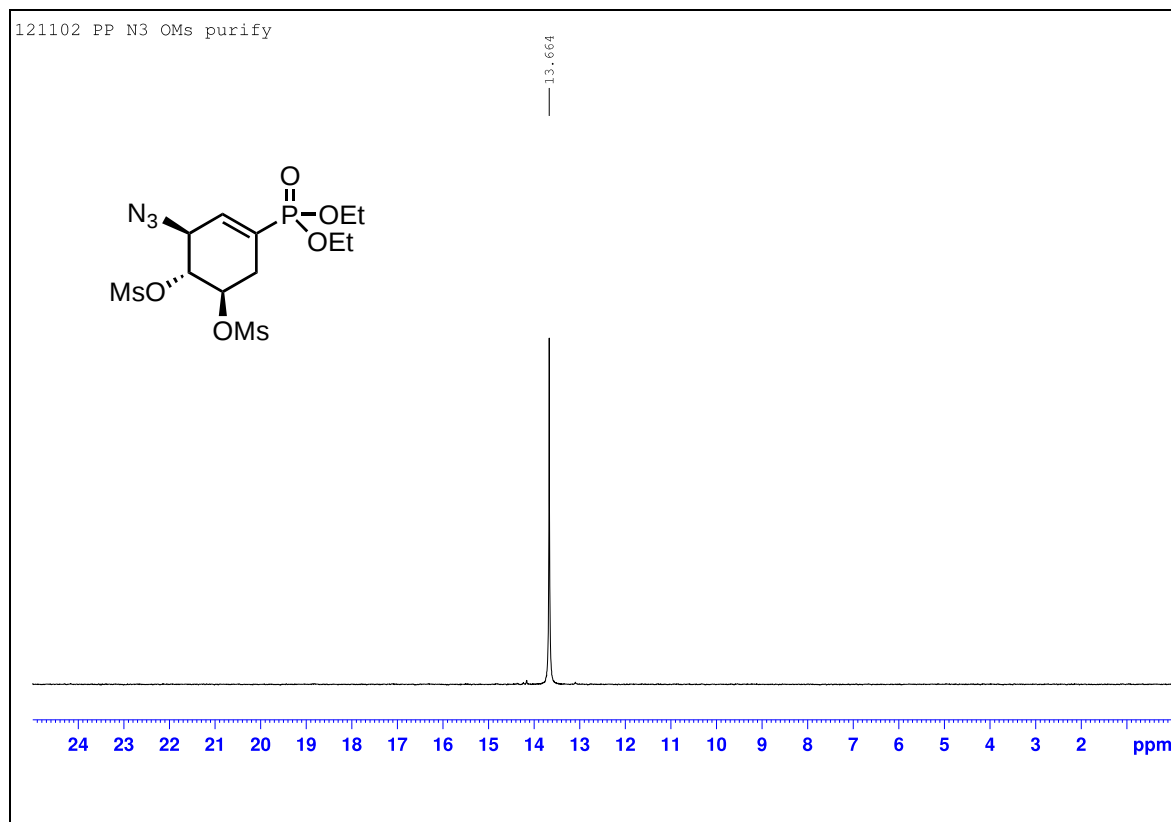


<sup>13</sup>C NMR spectrum of compound **29** (CDCl<sub>3</sub>, 100 MHz)

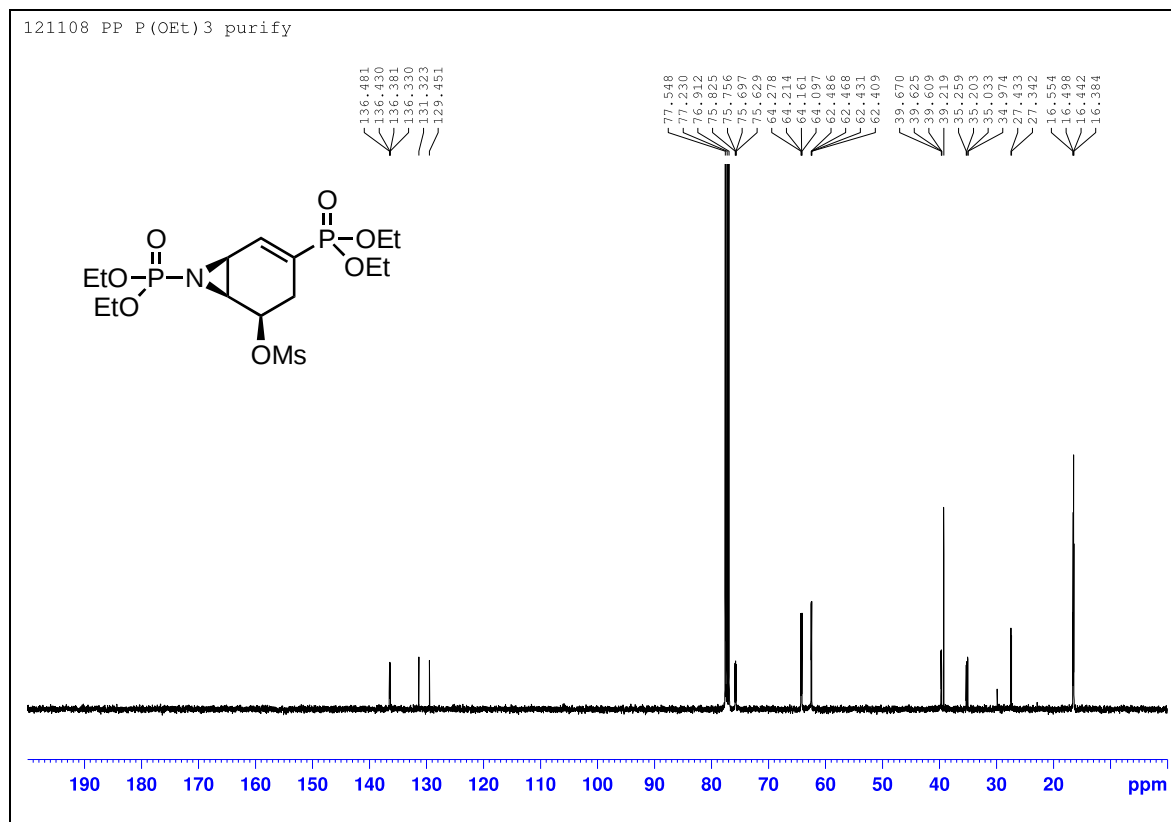
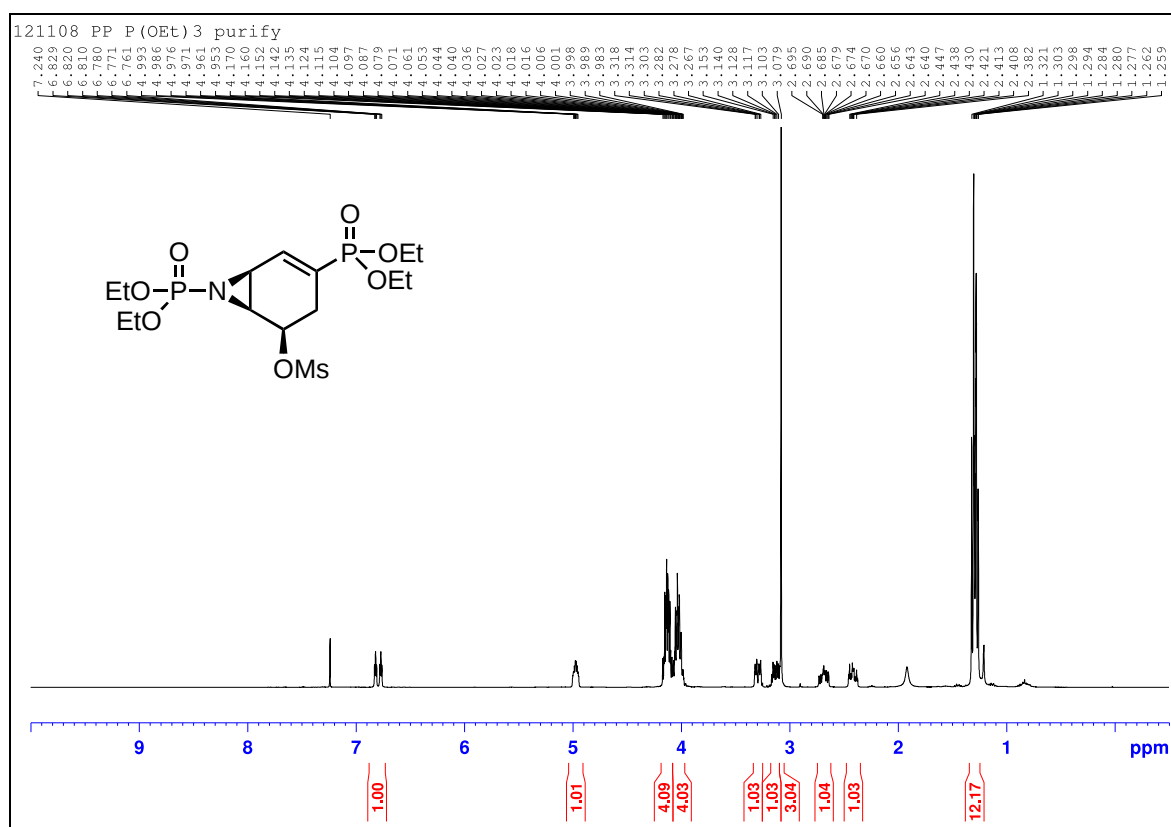


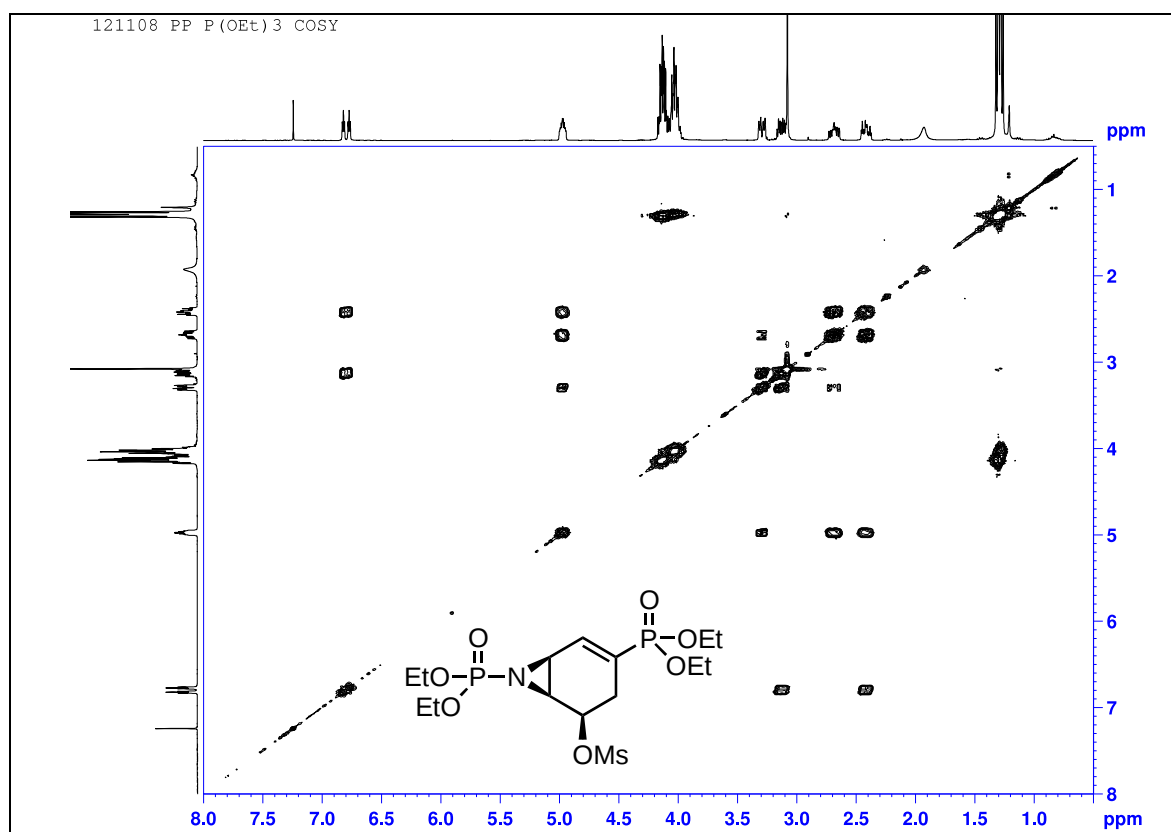
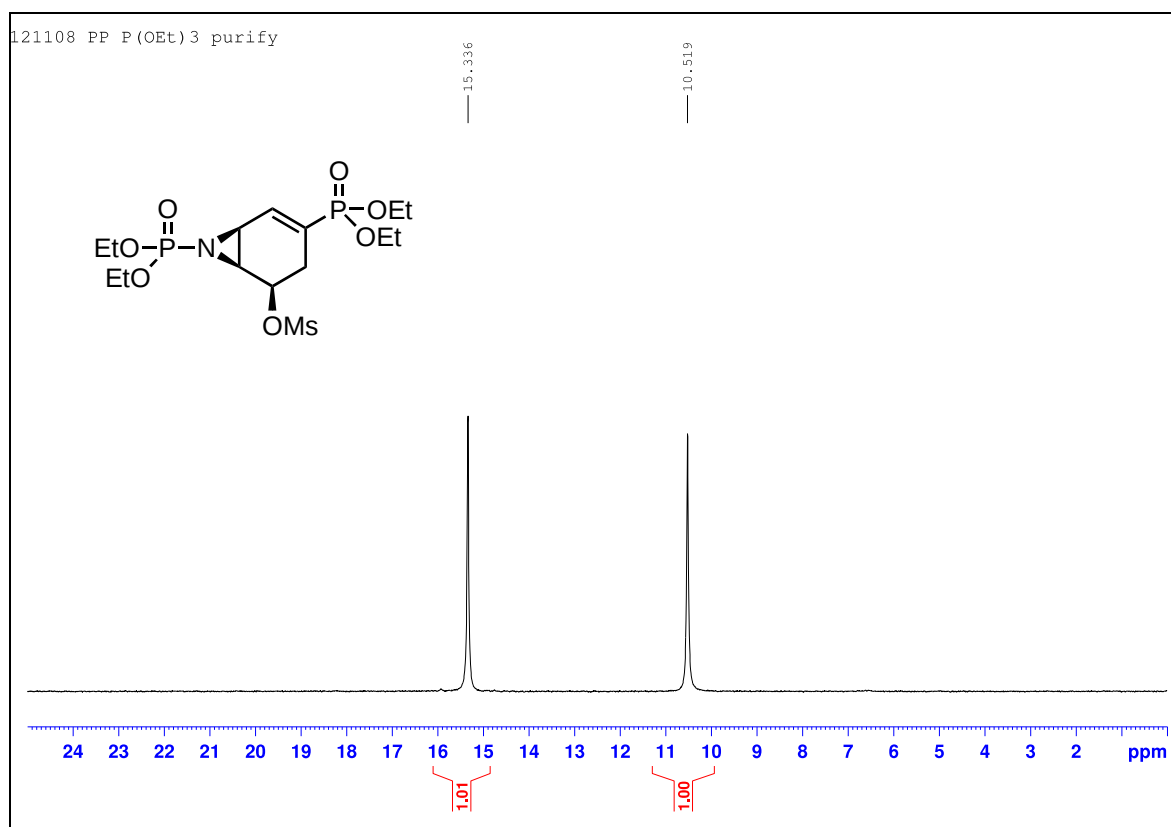


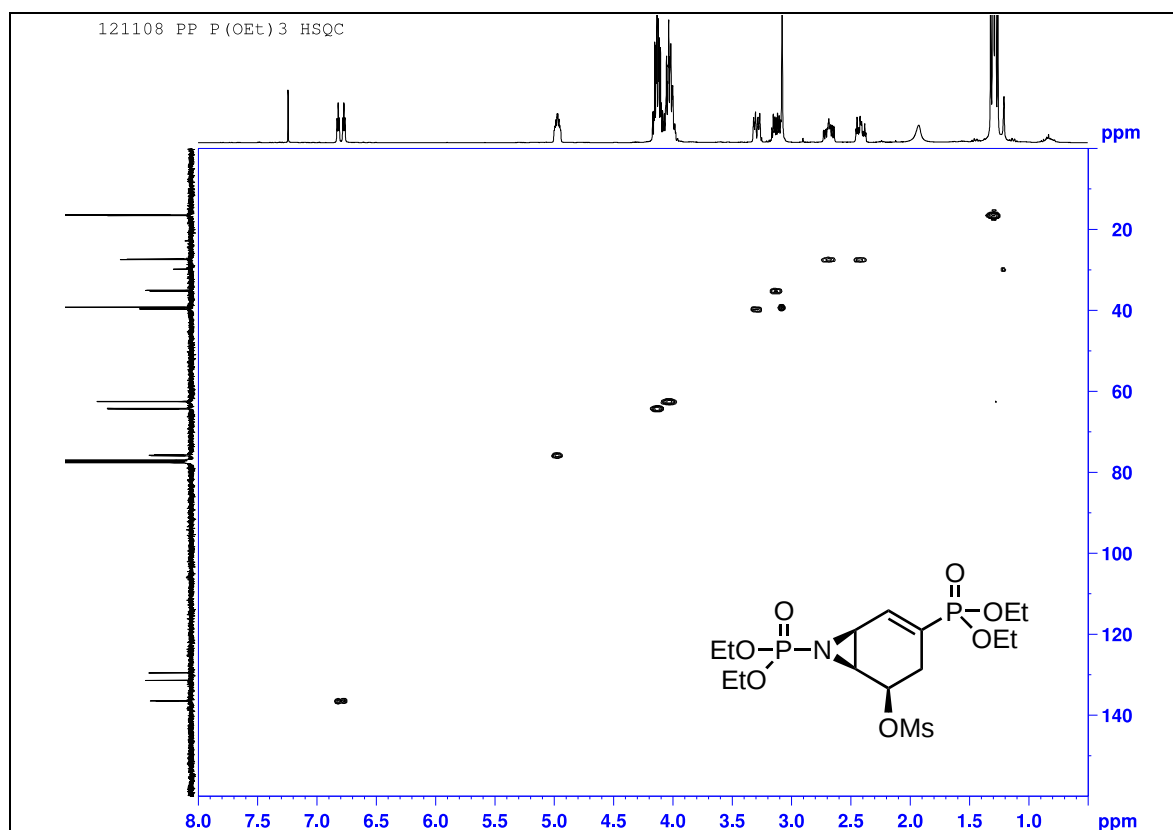
$^{13}\text{C}$  NMR spectrum of compound **30** ( $\text{CDCl}_3$ , 100 MHz)



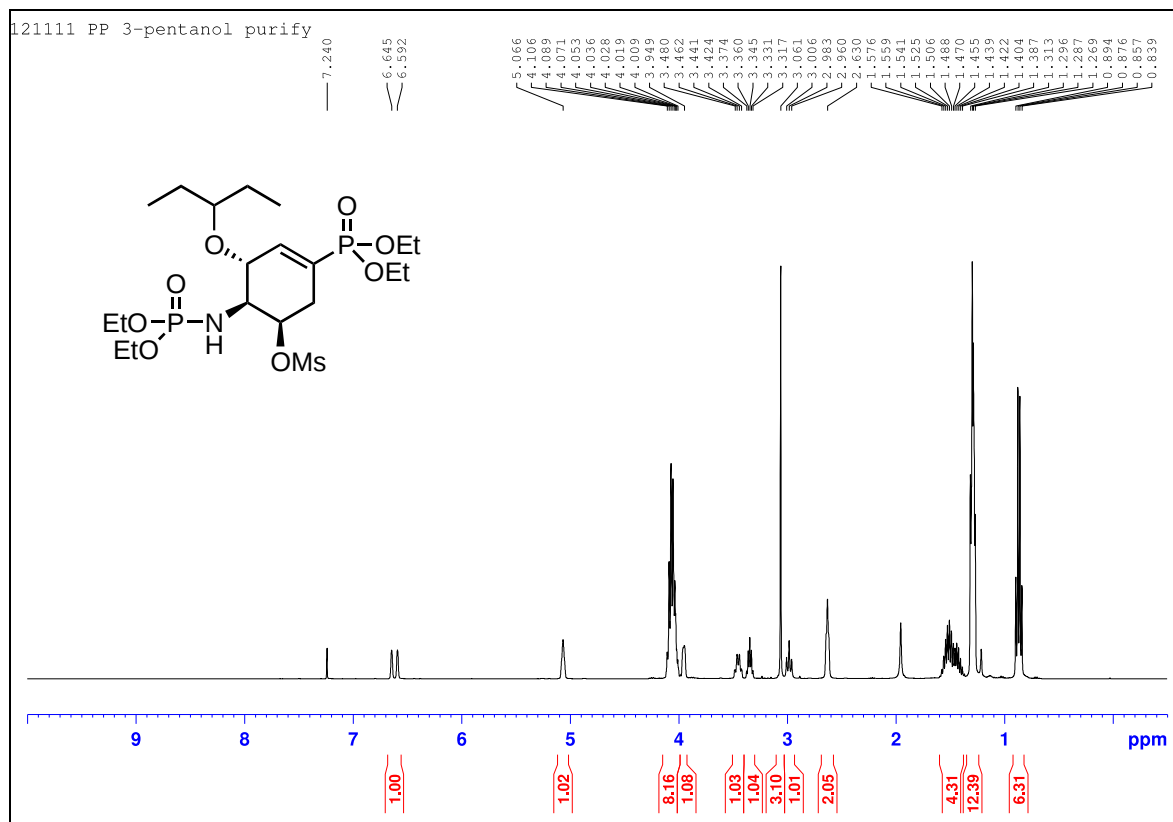
$^{31}\text{P}$  NMR spectrum of compound **30** ( $\text{CDCl}_3$ , 162 MHz)



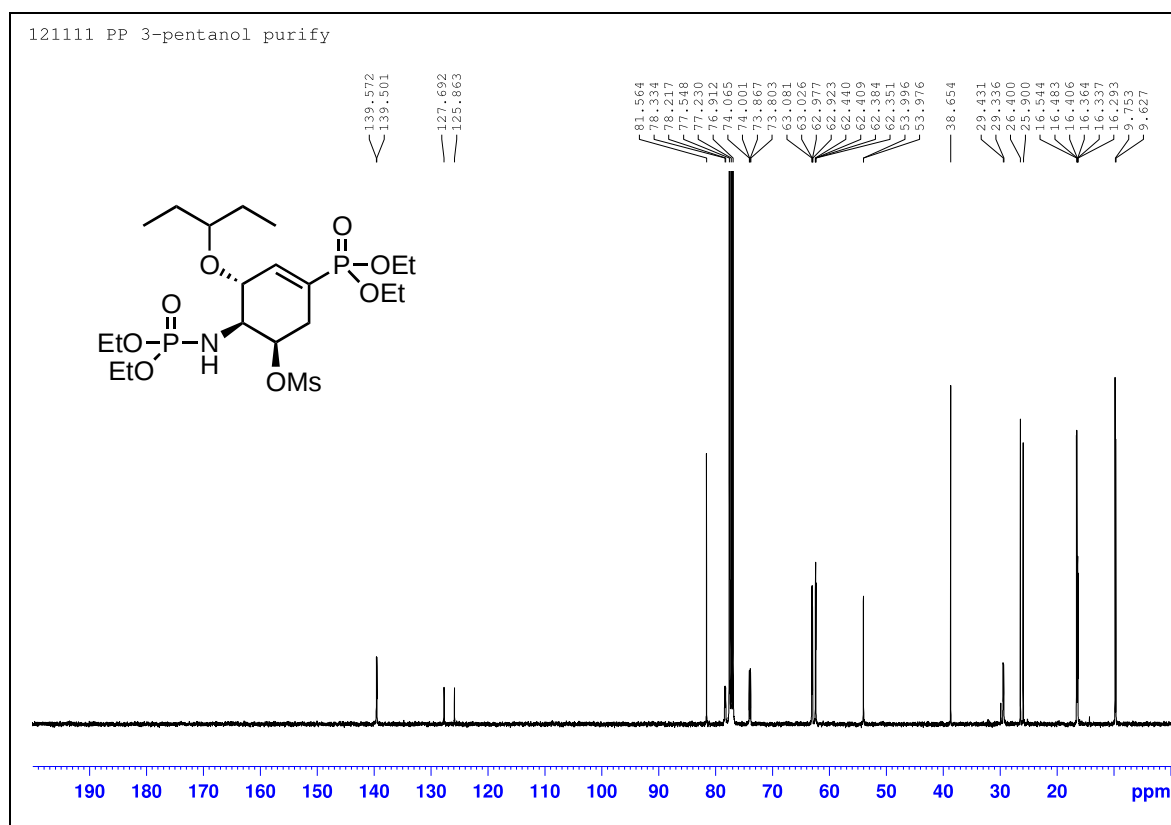




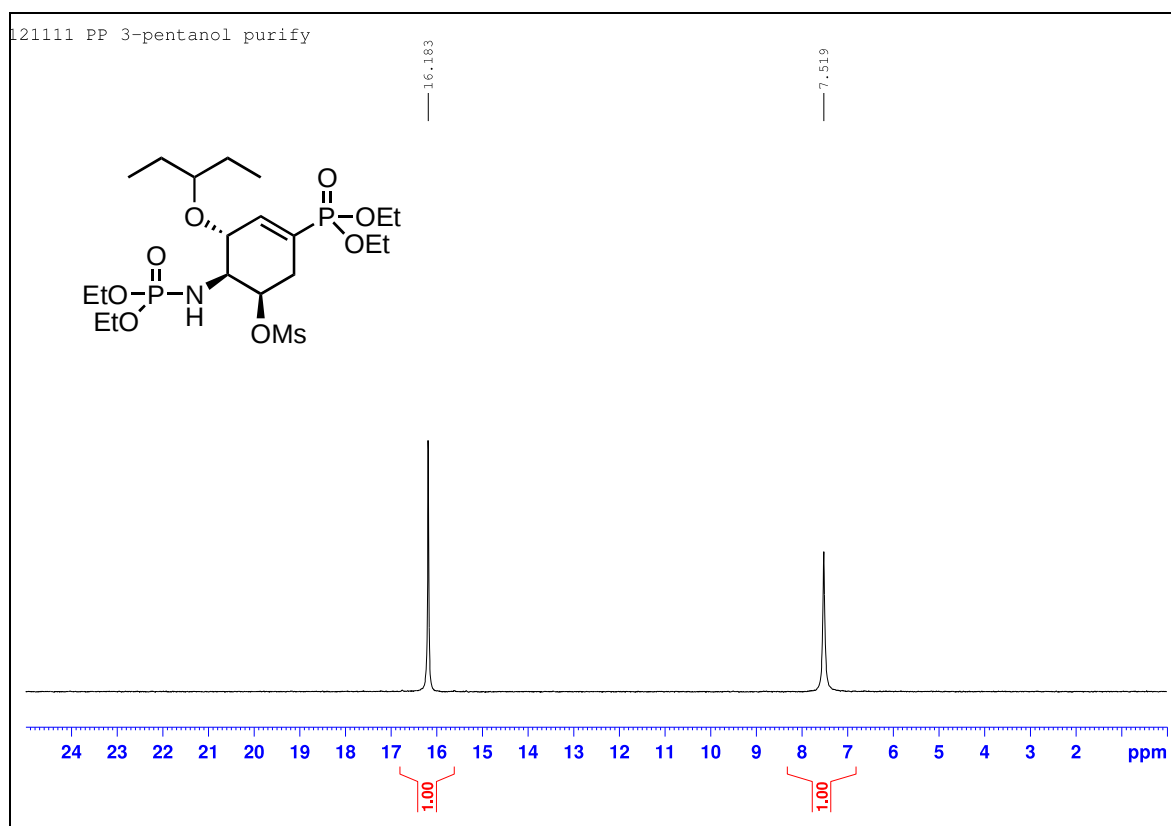
$^1\text{H}$ - $^{13}\text{C}$  HSQC NMR spectrum of compound **31** ( $\text{CDCl}_3$ , 400 MHz)



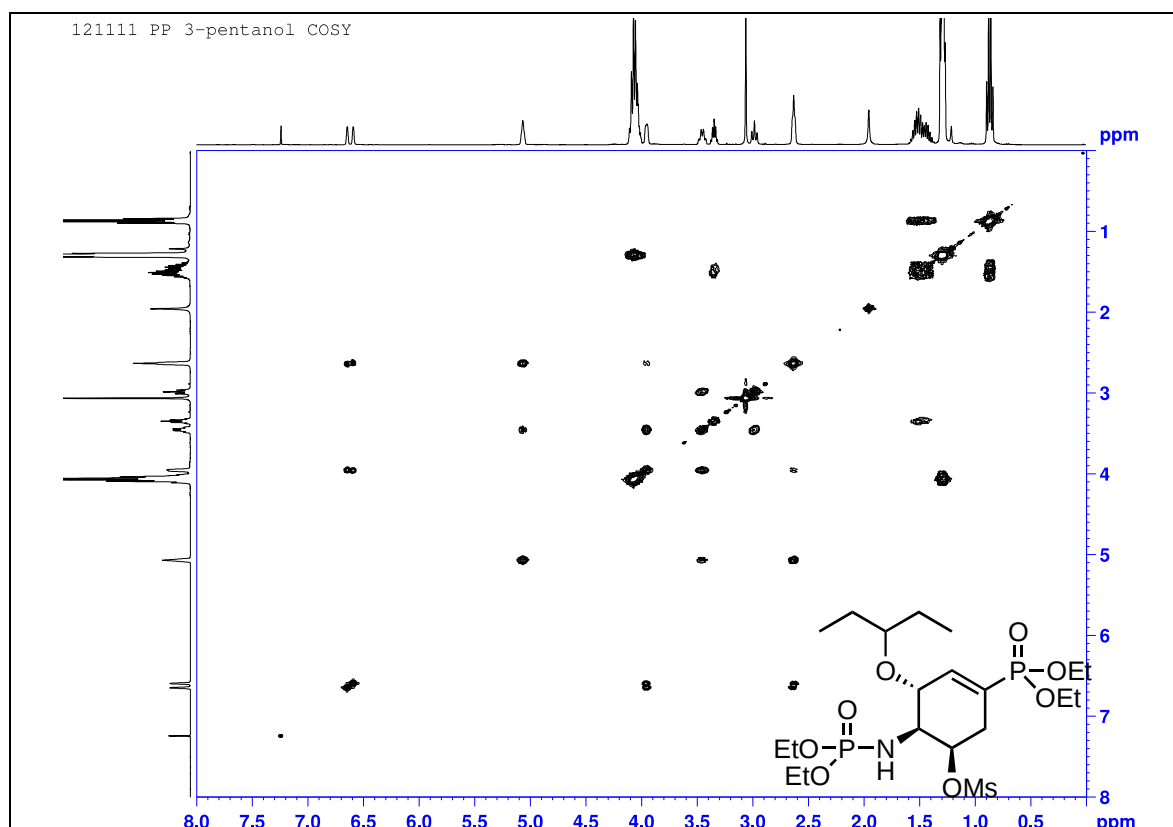
$^1\text{H}$  NMR spectrum of compound **32** ( $\text{CDCl}_3$ , 400 MHz)



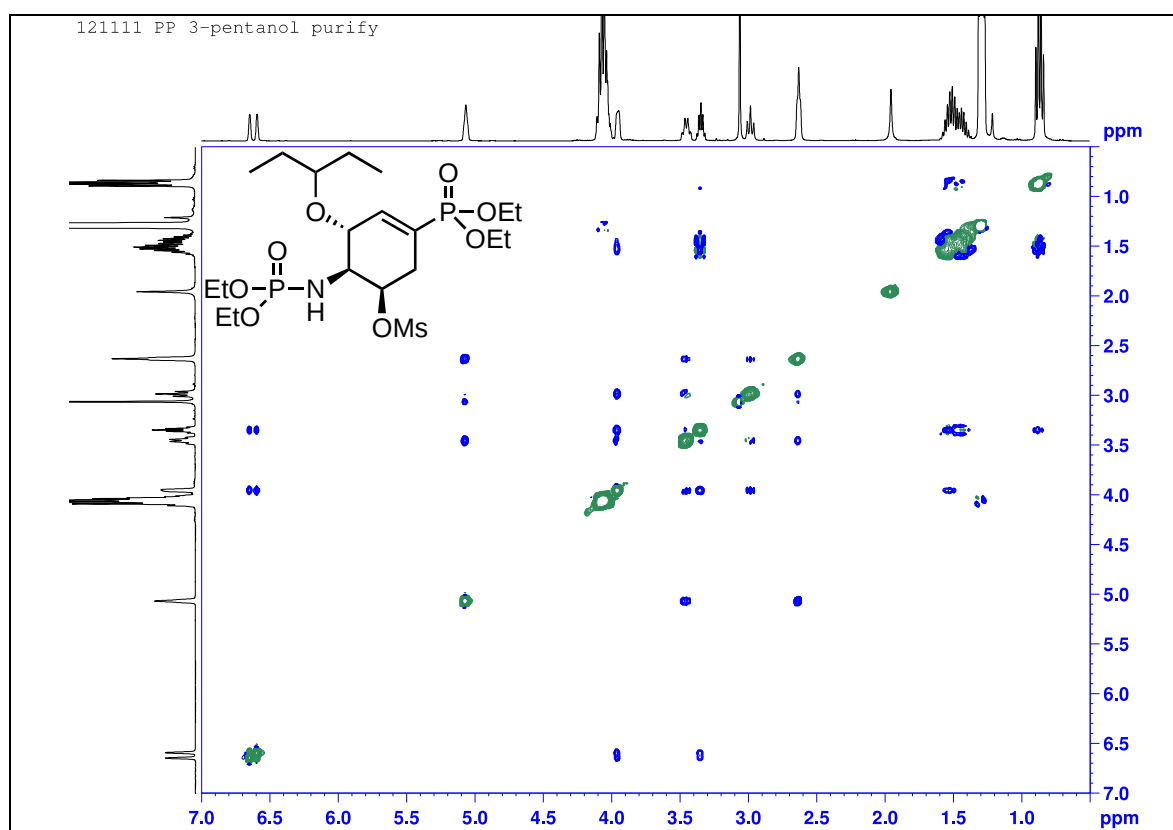
$^{13}\text{C}$  NMR spectrum of compound **32** ( $\text{CDCl}_3$ , 100 MHz)



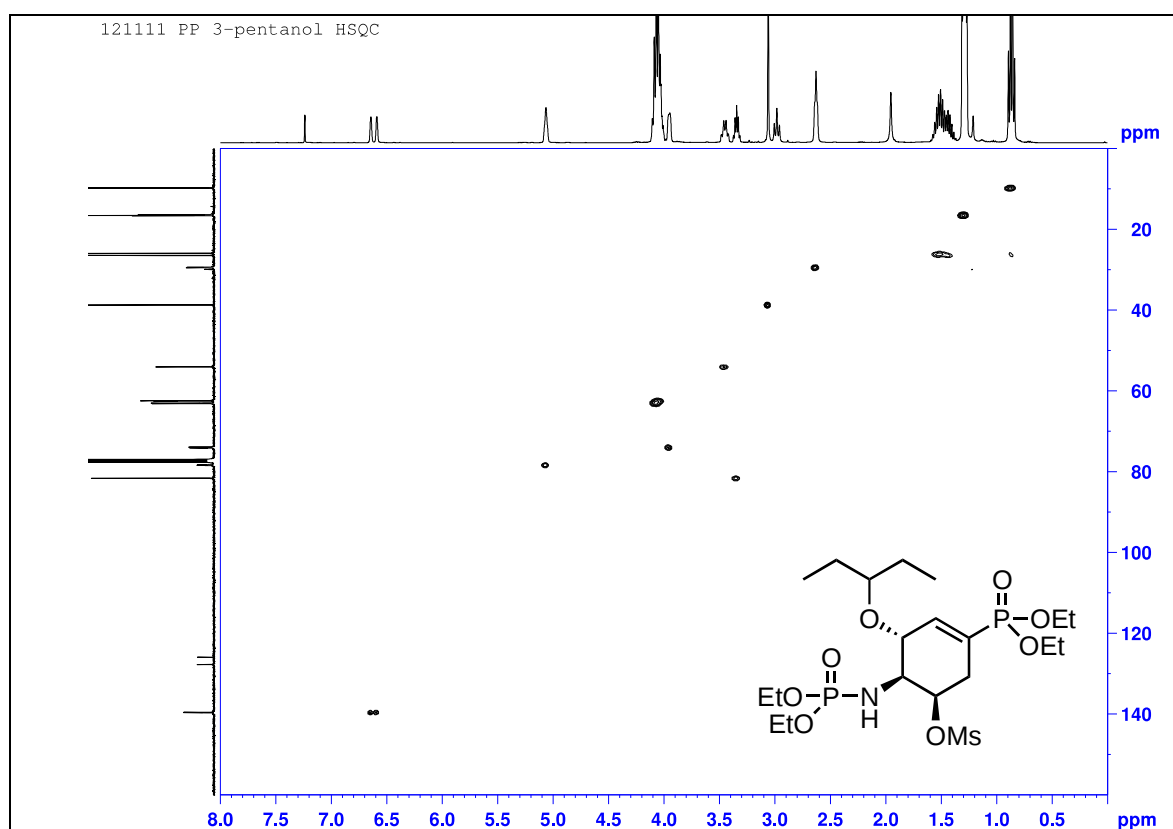
$^{31}\text{P}$  NMR spectrum of compound **32** ( $\text{CDCl}_3$ , 162 MHz)



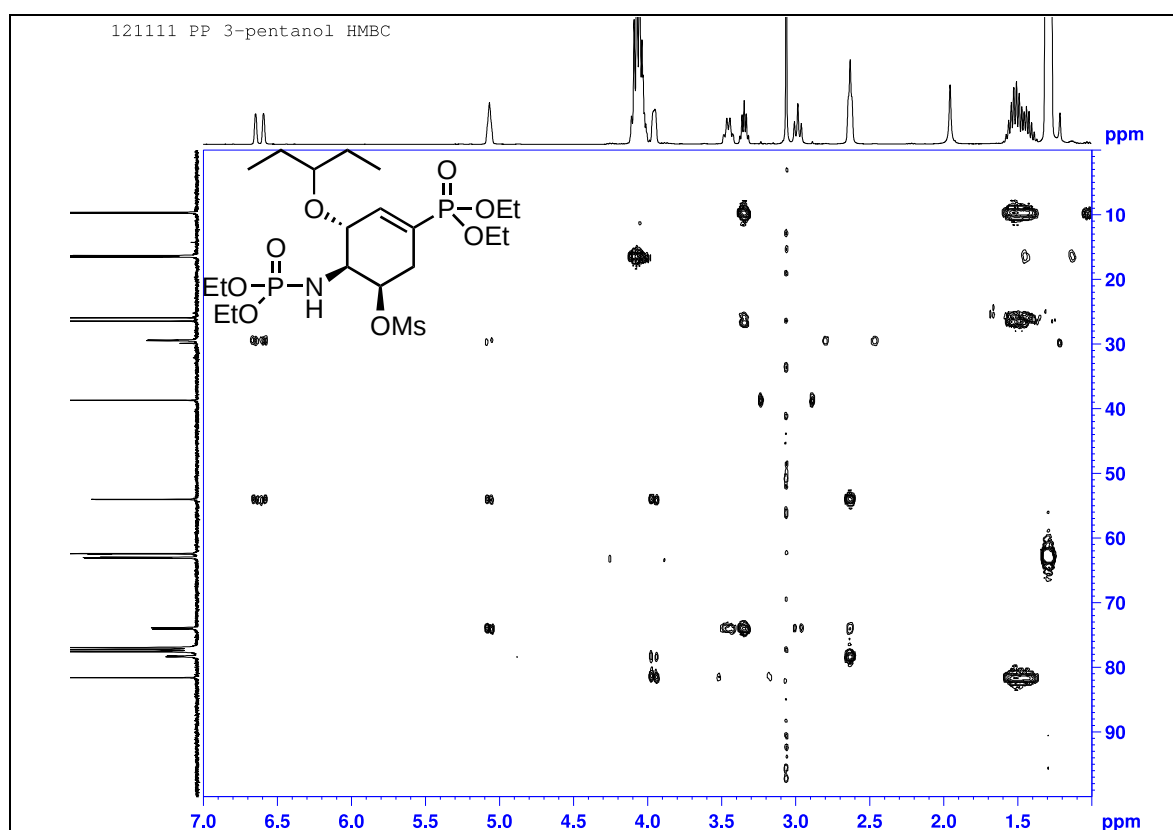
$^1\text{H}$ - $^1\text{H}$  COSY NMR spectrum of compound **32** ( $\text{CDCl}_3$ , 400 MHz)



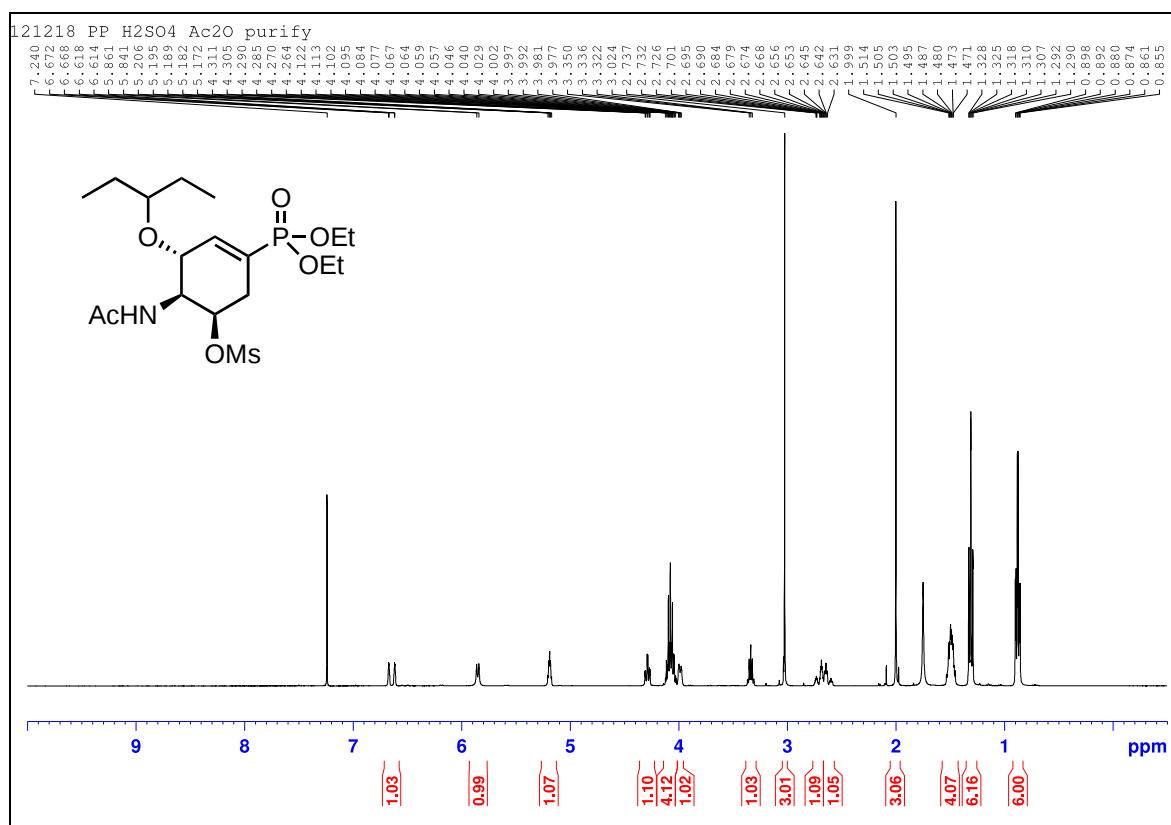
NOESY NMR spectrum of compound **32** ( $\text{CDCl}_3$ , 400 MHz)

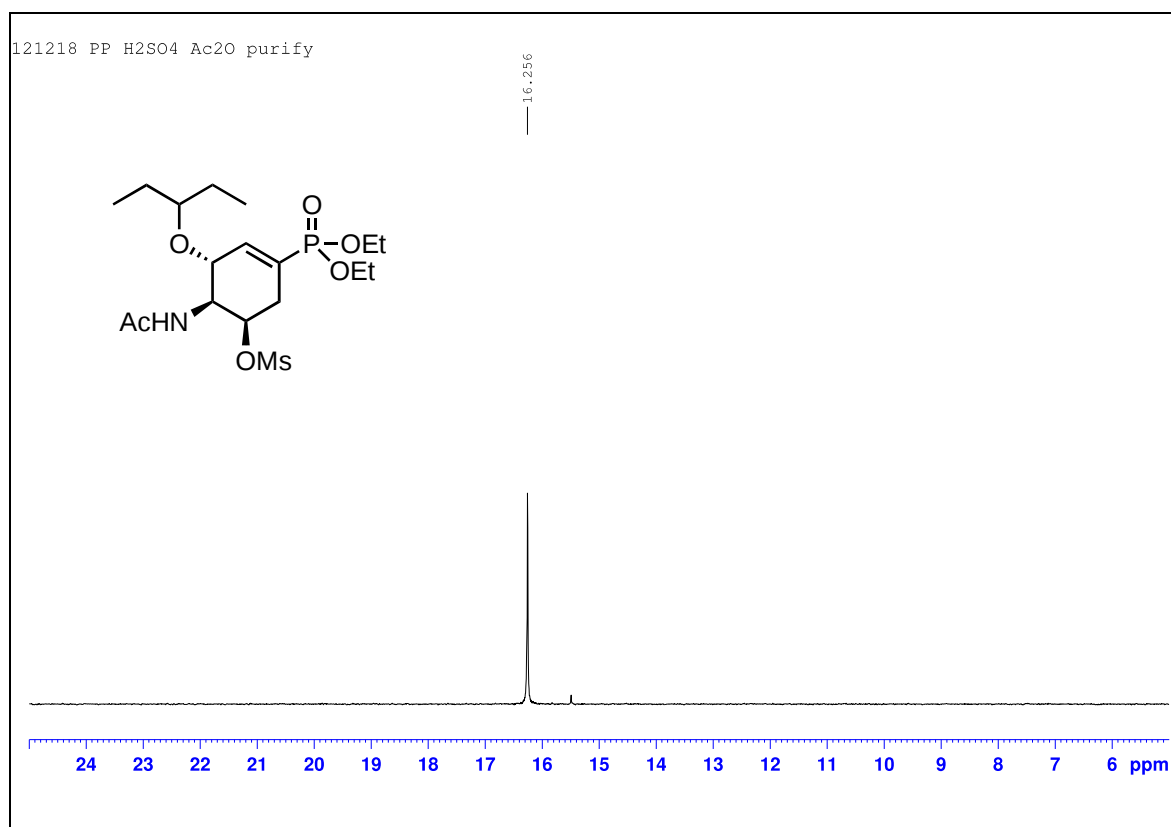


$^1\text{H}$ - $^{13}\text{C}$  HSQC NMR spectrum of compound **32** ( $\text{CDCl}_3$ , 400 MHz)

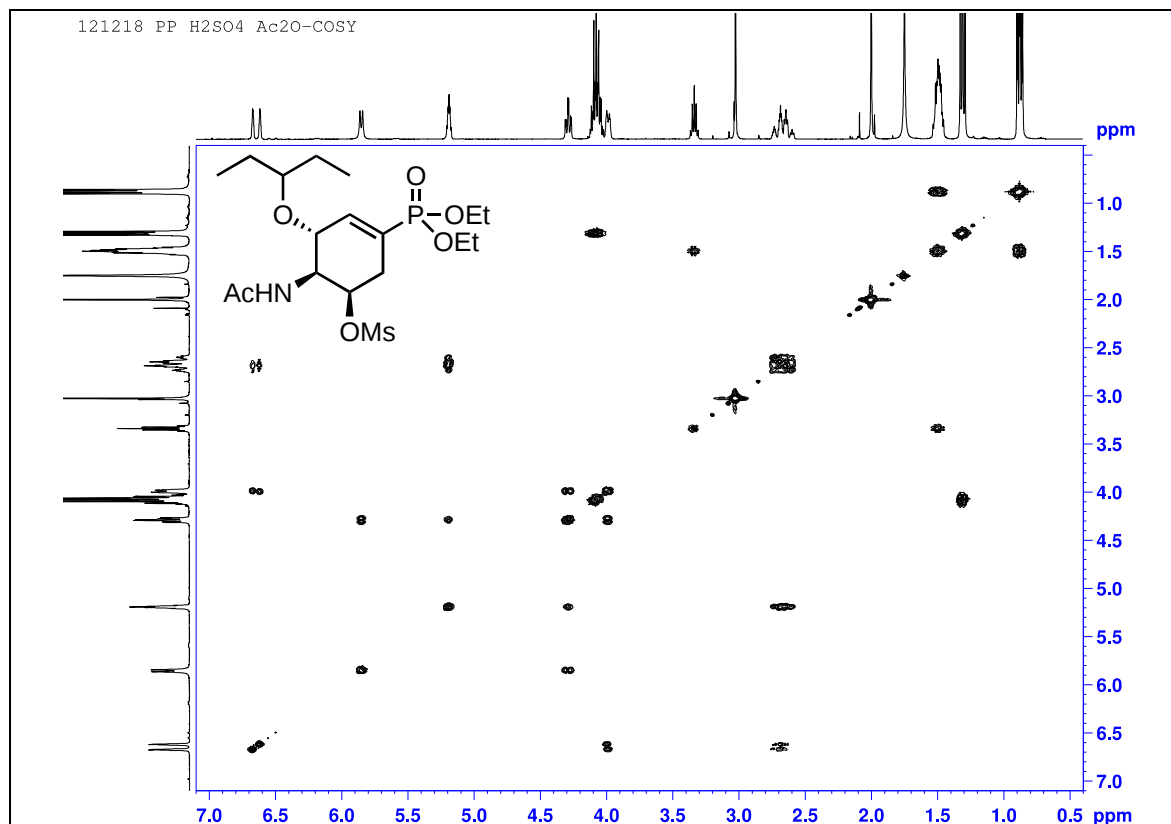


$^1\text{H}$ - $^{13}\text{C}$  HMBC NMR spectrum of compound **32** ( $\text{CDCl}_3$ , 400 MHz)

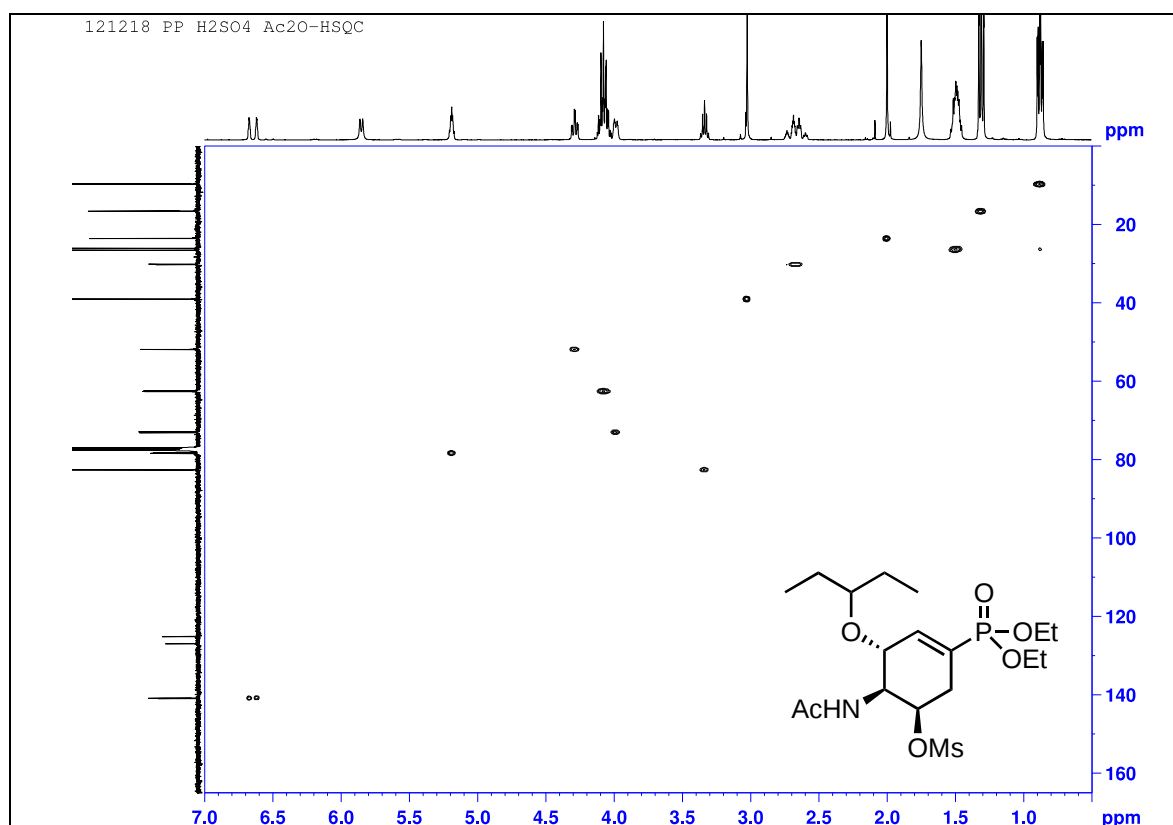




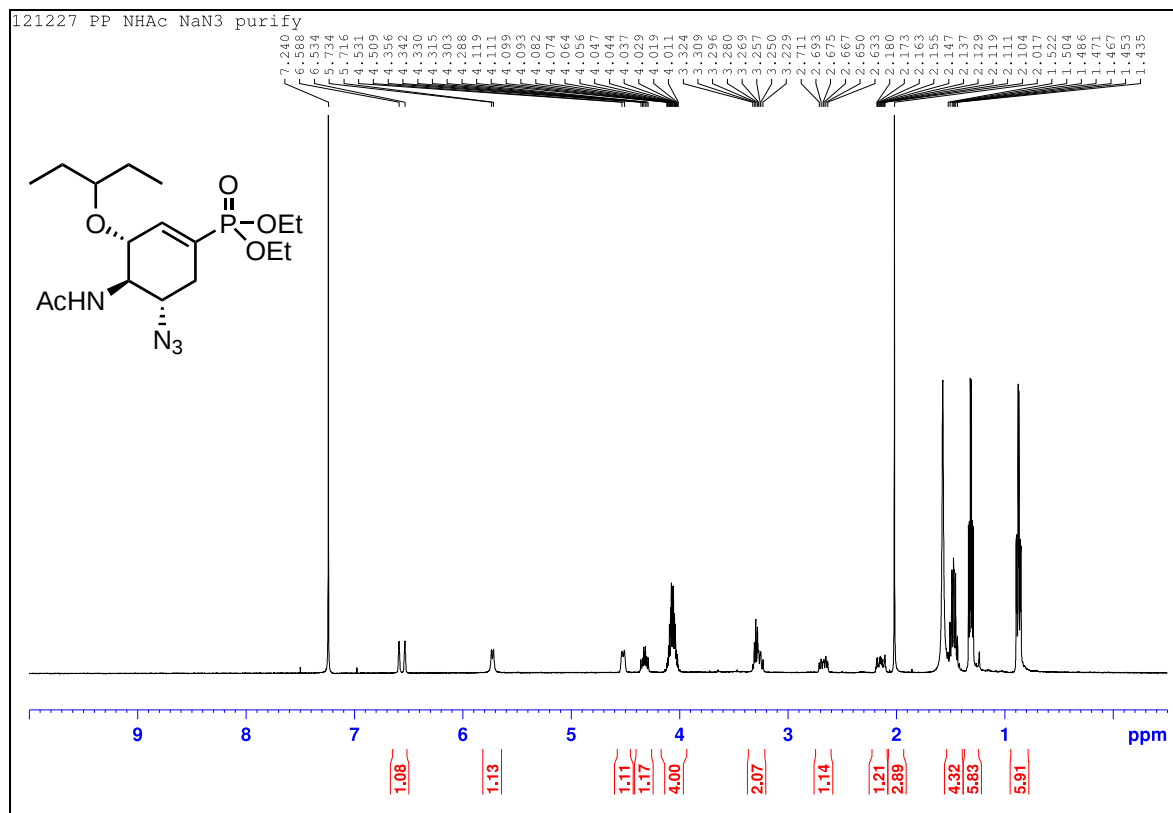
$^{31}\text{P}$  NMR spectrum of compound **33** ( $\text{CDCl}_3$ , 162 MHz)



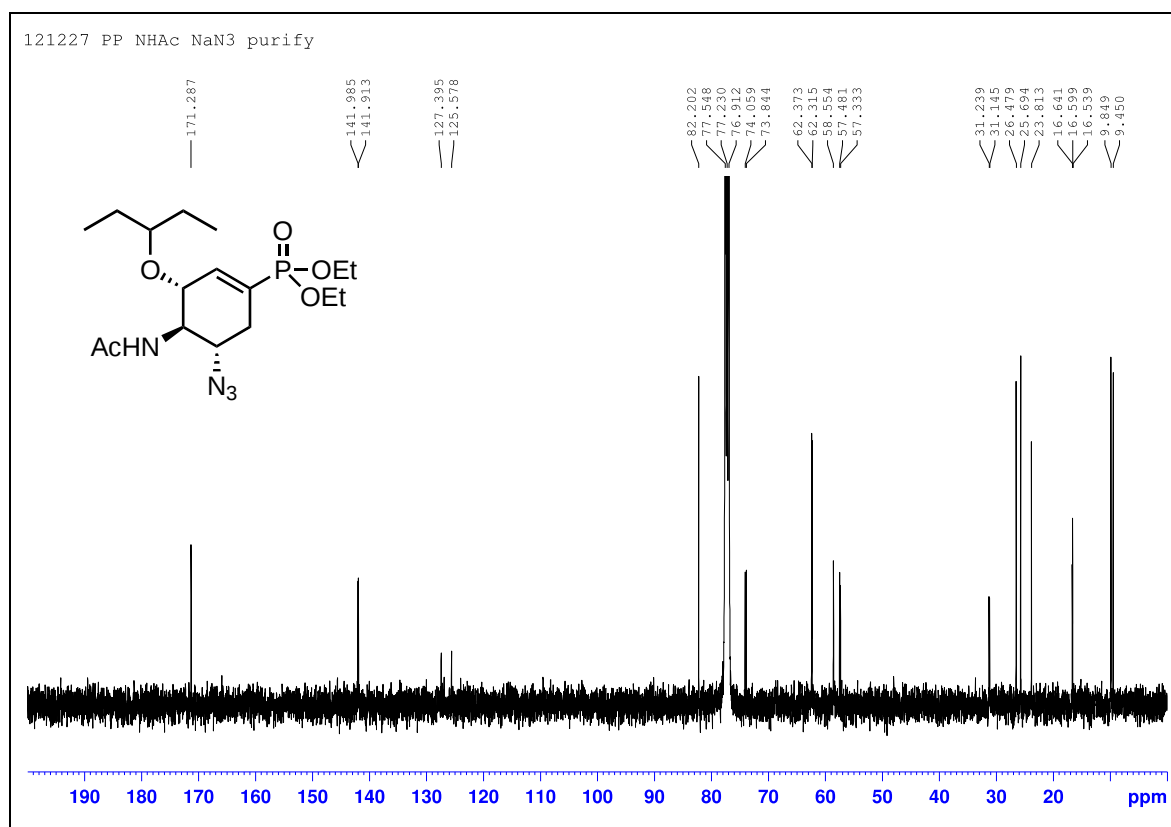
$^1\text{H}$ - $^1\text{H}$  COSY NMR spectrum of compound **33** ( $\text{CDCl}_3$ , 400 MHz)



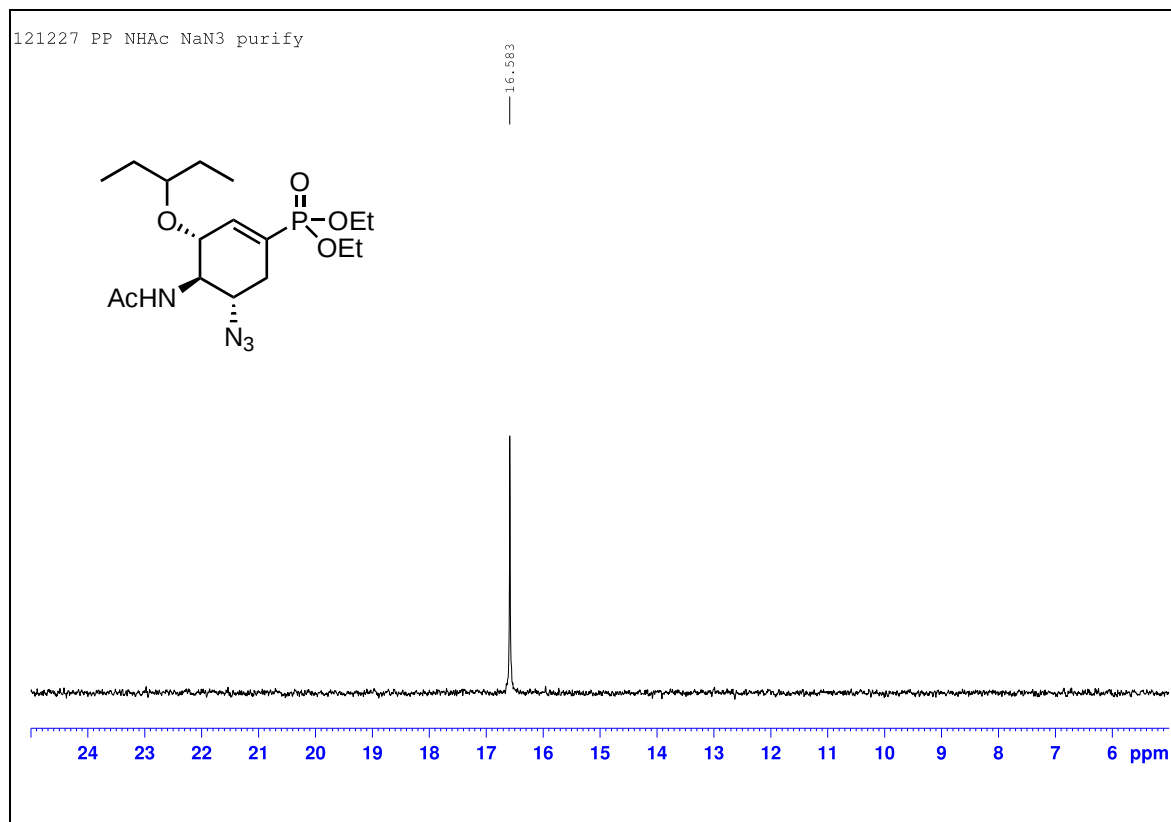
$^1\text{H}$ - $^{13}\text{C}$  HSQC NMR spectrum of compound 33 ( $\text{CDCl}_3$ , 400 MHz)



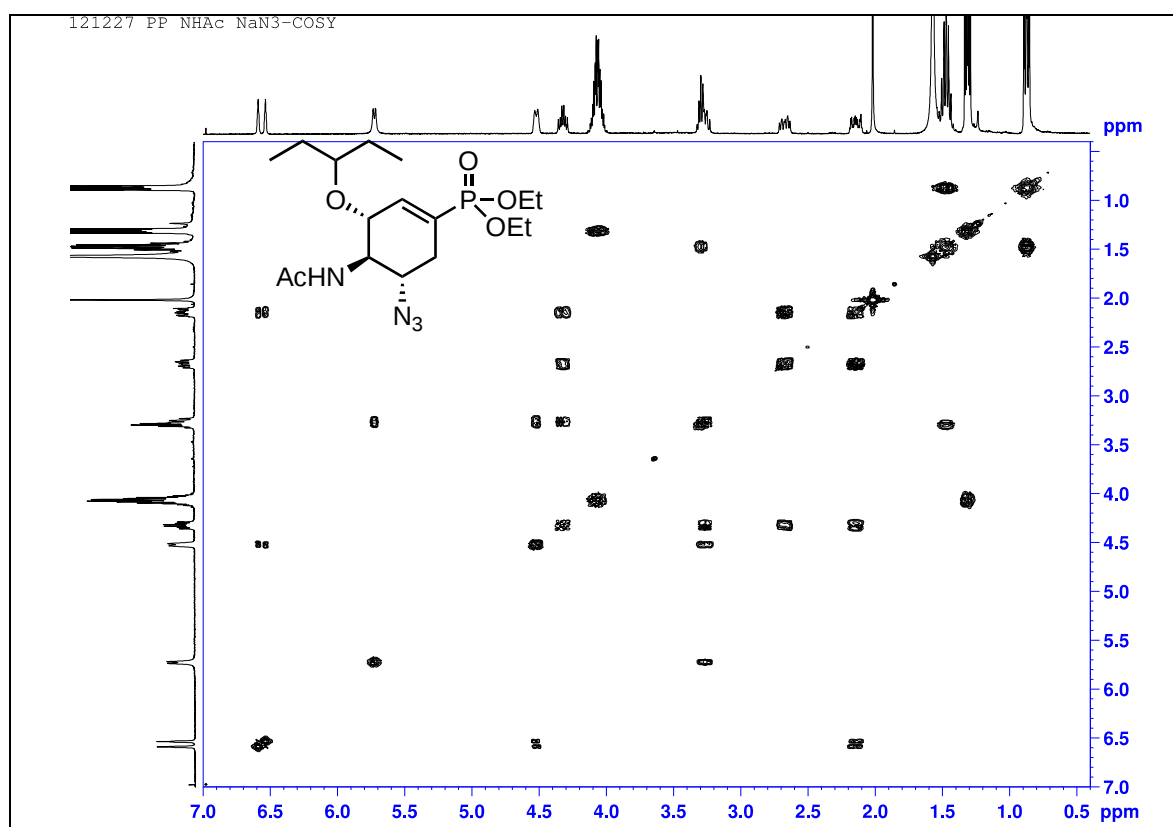
$^1\text{H}$  NMR spectrum of compound 34 ( $\text{CDCl}_3$ , 400 MHz)



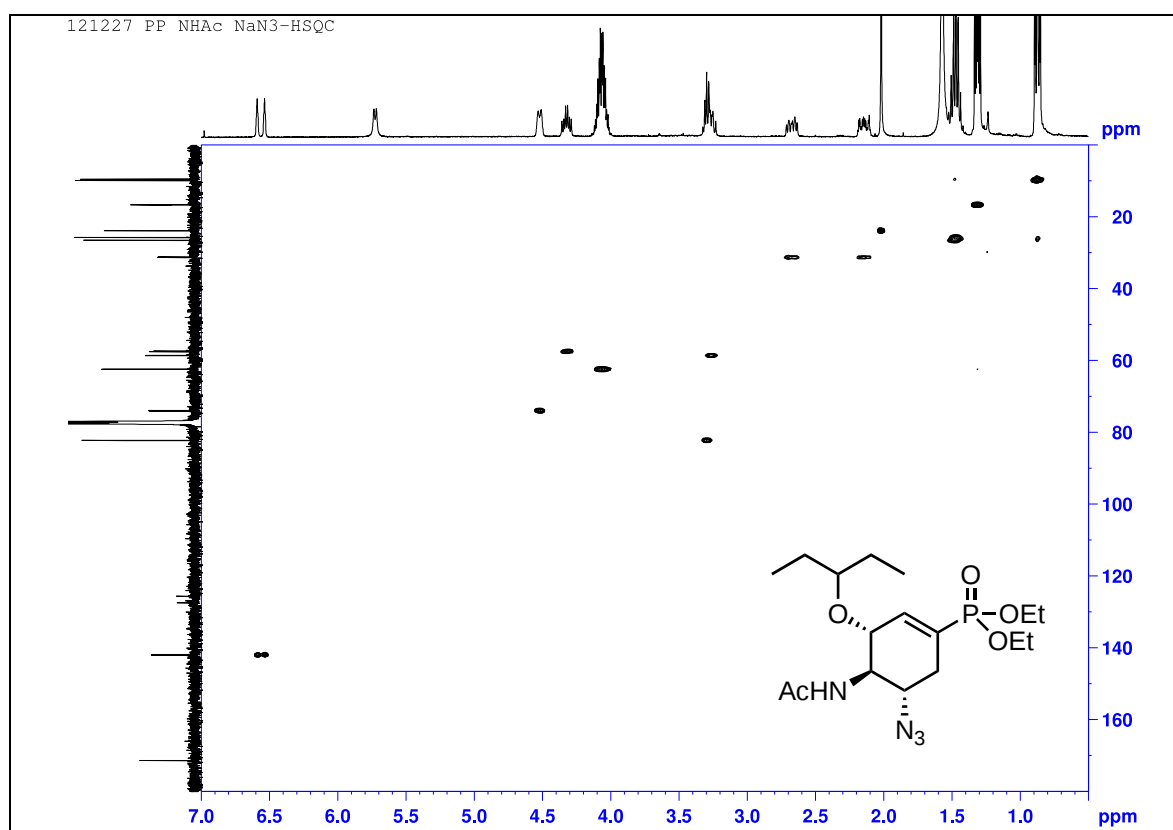
<sup>13</sup>C NMR spectrum of compound **34** (CDCl<sub>3</sub>, 100 MHz)



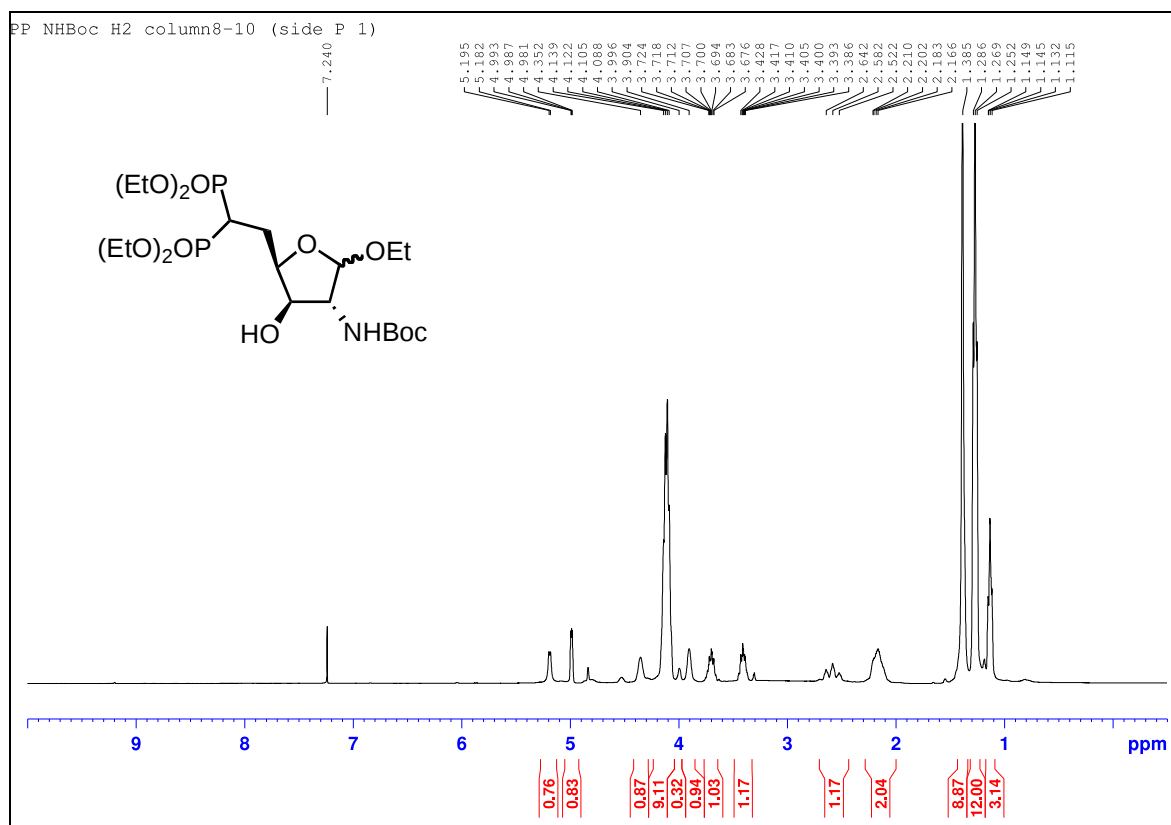
<sup>31</sup>P NMR spectrum of compound **34** (CDCl<sub>3</sub>, 162 MHz)



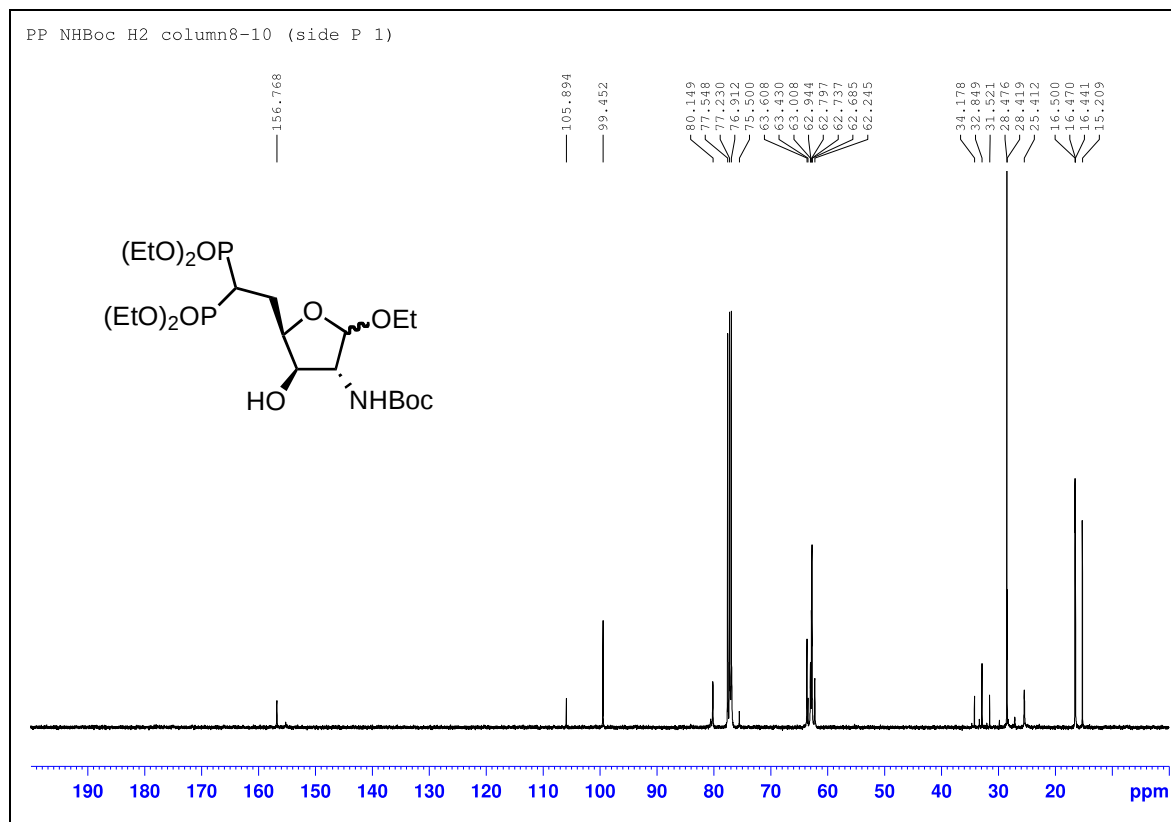
$^1\text{H}$ - $^1\text{H}$  COSY NMR spectrum of compound **34** ( $\text{CDCl}_3$ , 400 MHz)



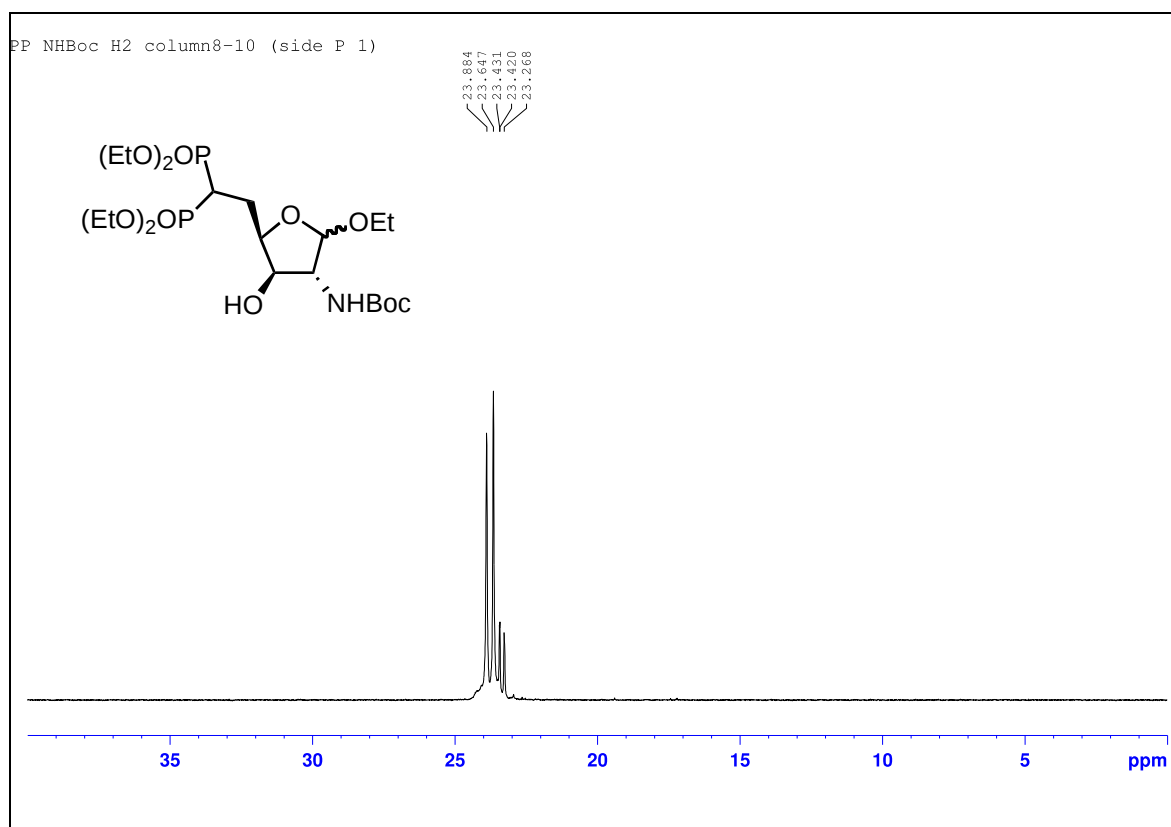
$^1\text{H}$ - $^{13}\text{C}$  HSQC NMR spectrum of compound **34** ( $\text{CDCl}_3$ , 400 MHz)



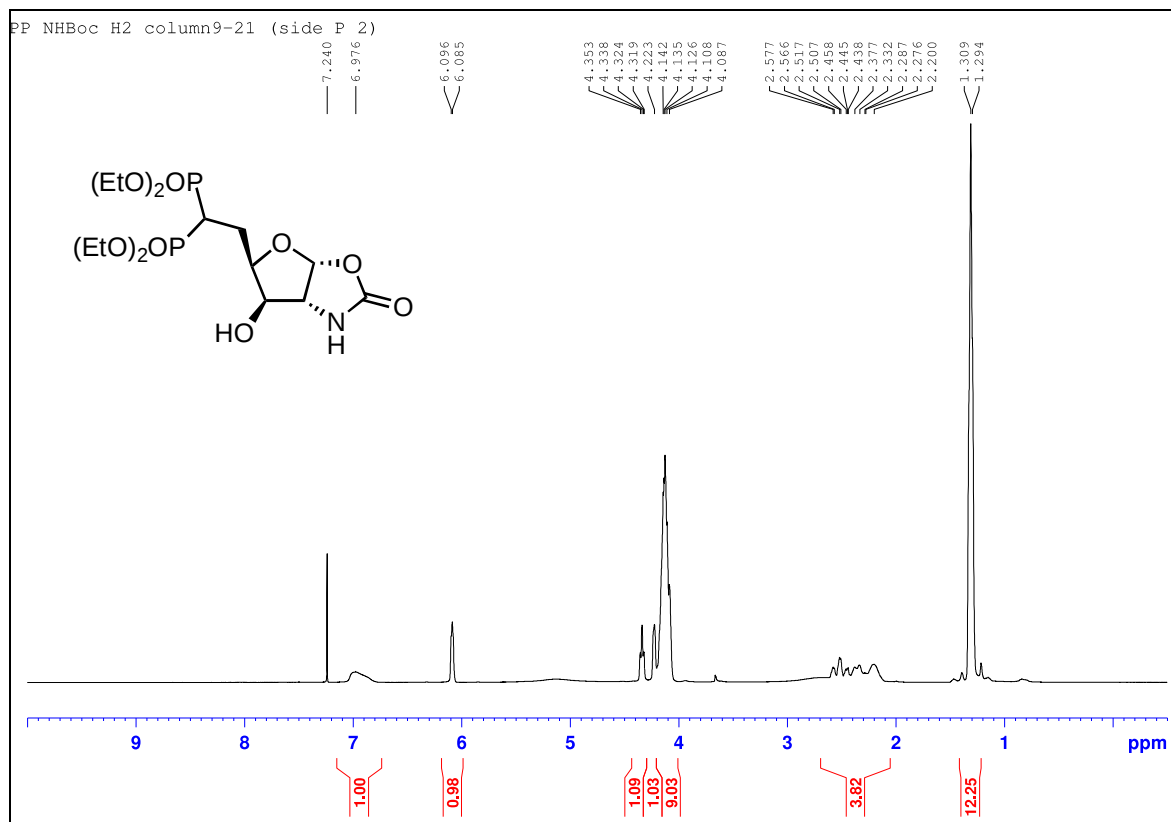
<sup>1</sup>H NMR spectrum of compound **35** (CDCl<sub>3</sub>, 400 MHz)



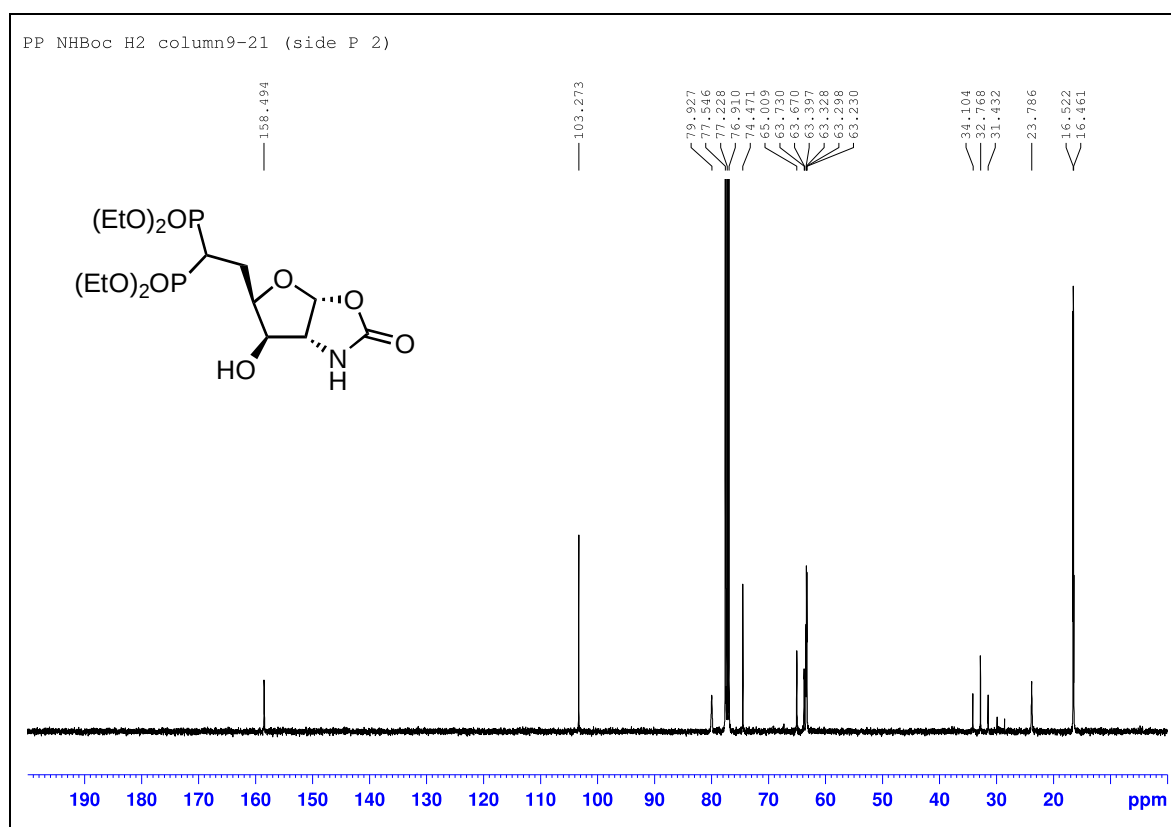
<sup>13</sup>C NMR spectrum of compound **35** (CDCl<sub>3</sub>, 100 MHz)



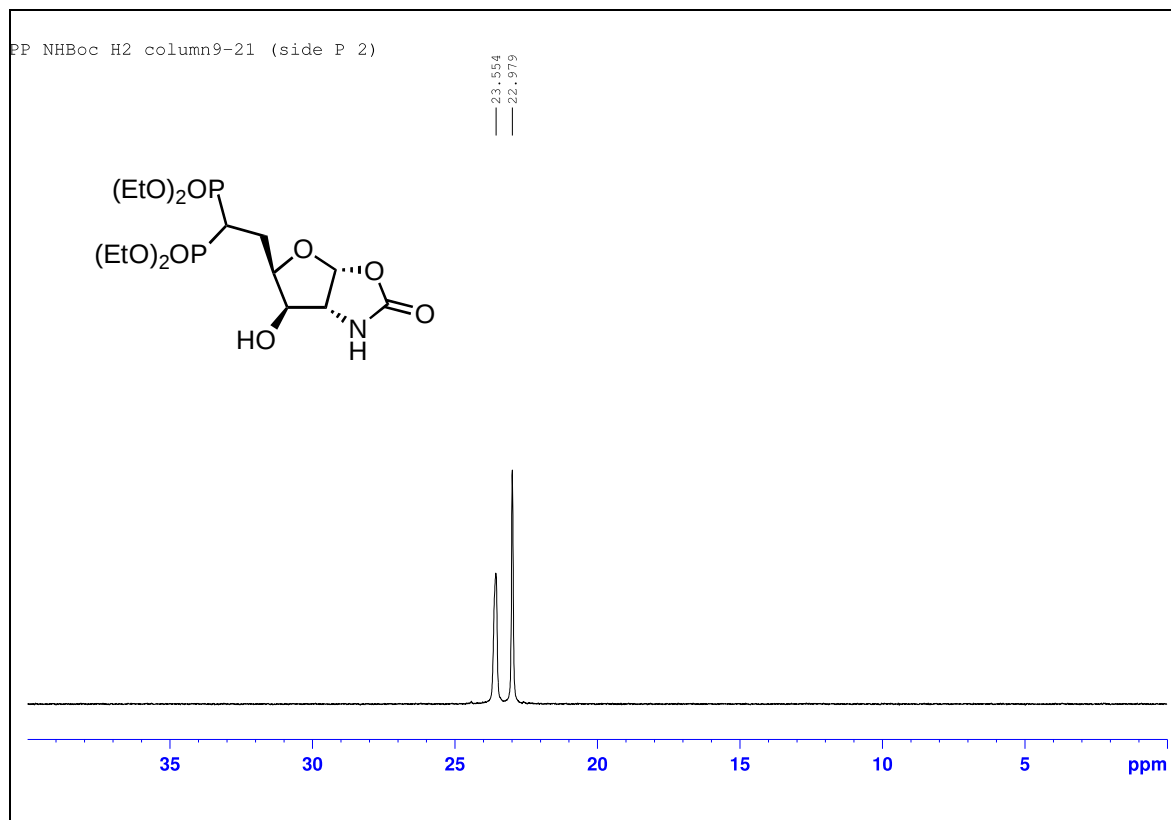
$^{31}\text{P}$  NMR spectrum of compound **35** ( $\text{CDCl}_3$ , 162 MHz)



$^1\text{H}$  NMR spectrum of compound **36** ( $\text{CDCl}_3$ , 400 MHz)



$^{13}\text{C}$  NMR spectrum of compound **36** ( $\text{CDCl}_3$ , 100 MHz)



$^{31}\text{P}$  NMR spectrum of compound **36** ( $\text{CDCl}_3$ , 162 MHz)