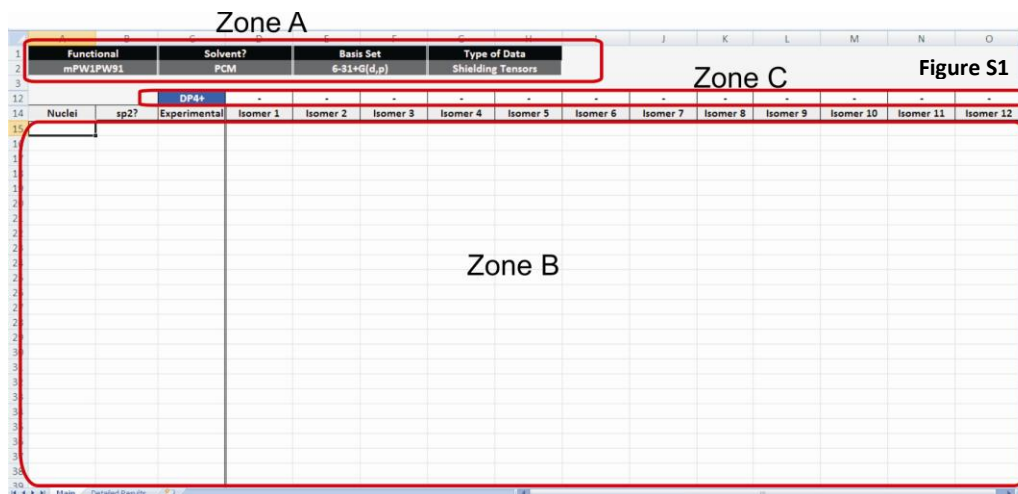


## Instructions for using the Excel file to compute the DP4+ probability

- Despite the DP4+ calculations can be made "by hand", an Excel file is provided from the authors as part of the Supporting Information of this paper that considerably simplifies the procedure.
- The file contains 2 sheets: "Main" and "Detailed Results" (Figure S1).
- The "Main" sheet is divided in 3 different zones: A, B and C.



### Zone A: user selection (drop down lists):

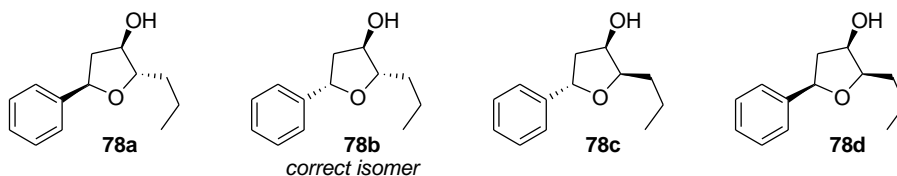
- *Functional*: functional used to perform the GIAO NMR calculations (B3LYP or mPW1PW91).
- *Solvent?*: inclusion of solvent effect in the GIAO NMR calculations (PCM or Gas Phase).
- *Basis Set*: basis set used in the GIAO NMR calculations (6-31G\*, 6-31G\*\*, 6-31+G\*\*, 6-311G\*, 6-311G\*\* or 6-311+G\*\*)
- *Type of Data*: indicates the type of data entered in Zone B (Shielding Tensors, Unscaled Shifts or Scaled Shifts).

### Zone B: enabled cells to enter the data:

- *Nuclei*: enter the letter "C" (without quotes) for  $^{13}\text{C}$  data or the letter "H" (without quotes) for  $^1\text{H}$  data.
- *sp2?*: enter the letter "x" (without quotes) if the carbon is sp-sp<sup>2</sup> hybridized (or if the proton is attached to an sp-sp<sup>2</sup> hybridized carbon).
- *Experimental*: enter the experimental  $^{13}\text{C}$  and/or  $^1\text{H}$  chemical shifts.
- *Isomer 1, Isomer 2, etc.*: enter the computed data for the candidate structures.

**Zone C:** displays the DP4+ probabilities once the data is entered in Zone B.

### Tutorial: compounds 78a-d (four candidates). NMR data from: 78b (correct isomer).



**Step 1:** perform a conformational search using a suitable package (Hyperchem, Spartan, MacroModel, etc).

**Step 2:** optimize the most significant conformations at the B3LYP/6-31G\* level (gas phase).

**Step 3:** perform the NMR GIAO calculations at the selected level of theory (in this case, at the PCM/mPW1PW91/6-31G\*\*) for all representative conformations.

**Step 4:** compute all the Boltzmann-averaged shielding tensors values for each compound.

**Step 5:** open the Excel file.

**Step 6:** select the correct level of theory that was used to perform the NMR shift calculation (Figure S2). In this particular case, PCM/mPW1PW91/6-31G\*\*.

1	Functional	Solvent?	Basis Set	Type of Data	Figure S2													
2	mPW1PW91	PCM	6-31G(d,p)	Shielding Tensors														
3																		
12	DP4+				-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Nuclei	sp2?	Experimental	Isomer 1	Isomer 4	Isomer 5	Isomer 6	Isomer 7	Isomer 8	Isomer 9	Isomer 10	Isomer 11	Isomer 12					
15																		
16																		
17																		
18																		
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**Step 7:** Introduce the experimental data (Figure S3). **Important: mark the sp<sup>2</sup> nuclei.**

1	Functional	Solvent?	Basis Set	Type of Data	Figure S3													
2	mPW1PW91	PCM	6-31G(d,p)	Shielding Tensors														
3																		
12	DP4+				-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Nuclei	sp2?	Experimental	Isomer 1	Isomer 2	Isomer 3	Isomer 4	Isomer 5	Isomer 6	Isomer 7	Isomer 8	Isomer 9	Isomer 10	Isomer 11	Isomer 12	Isomer 1		
15	C		14.1															
16	C		19.1															
17	C		36.5															
18	C		87.1															
19	C		76.8															
20	C		44															
21	C		79.5															
22	C	x	142.1															
23	C	x	125.9															
24	C	x	128.3															
25	C	x	127.4															
26																		
27	H		0.99															
28	H		1.57															
29	H		1.57															
30	H		1.57															
31	H		1.57															
32	H		3.91															
33	H		4.17															
34	H		2.21															
35	H		1.97															
36	H		5.12															
37	H	x	7.31															
38	H	x	7.31															
39	H	x	7.31															
40																		

**Step 8:** Introduce the calculated shielding tensors for each possible candidate structure (4 in this case) (Figure S4). The DP4+ values are automatically calculated and displayed for each isomer above the number of isomer. **Important: the data must be assigned (know which shift corresponds to which nuclei).**

1	Functional	Solvent?	Basis Set	Type of Data	Figure S4												
2	mPW1PW91	PCM	6-31G(d,p)	Shielding Tensors													
3																	
12	DP4+				1.14%	98.86%	0.00%	0.00%									
14	Nuclei	sp2?	Experimental	Isomer 1	Isomer 2	Isomer 3	Isomer 4	Isomer 5	Isomer 6	Isomer 7	Isomer 8	Isomer 9	Isomer 10	Isomer 11	Isomer 12	Isomer 1	
15	C		14.1	179.9196	180.1373	179.9399	180.0162										
16	C		19.1	172.8964	173.3515	173.4542	173.5358										
17	C		36.5	157.9646	157.6417	163.0213	162.9474										
18	C		87.1	109.1556	108.5436	112.3933	111.7789										
19	C		76.8	118.0431	117.3266	120.4208	120.9119										
20	C		44	150.8993	147.839	149.3826	150.3874										
21	C		79.5	116.4113	114.7047	116.7205	116.6315										
22	C	x	142.1	53.8342	56.7221	54.4331	52.3925										
23	C	x	125.9	74.7449	73.624	74.6877	74.3109										
24	C	x	128.3	70.7683	71.3076	71.2565	70.6357										
25	C	x	127.4	72.5268	72.3561	72.9547	72.5315										
26																	
27	H		0.99	30.6875	30.6539	30.6474	30.644										
28	H		1.57	30.2644	30.2418	30.002	30.1779										
29	H		1.57	29.902	29.968	30.192	30.0426										
30	H		1.57	30.1591	30.1629	30.1614	30.0376										
31	H		1.57	30.2663	30.0551	29.9549	29.8596										
32	H		3.91	27.573	27.6859	27.609	27.7074										
33	H		4.17	27.581	27.4333	27.42	27.6226										
34	H		2.21	29.176	29.724	29.2871	29.0403										
35	H		1.97	29.7766	30.1193	29.8576	29.6836										
36	H		5.12	26.3421	26.422	26.184	26.4771										
37	H	x	7.31	23.9898	23.9798	24.0261	23.9303										
38	H	x	7.31	24.0226	24.0685	24.0707	24.0235										
39	H	x	7.31	24.1368	24.132	24.1664	24.1398										
40																	

**Step 9:** The probabilities computed using unscaled ( $uDP4+$ ) and scaled ( $sDP4+$ ), as well as using carbon and/or proton data, is shown in the sheet "Detailed Results" (Figure S5)

Functional	Solvent?	Basis Set				Type of Data									
mpW1PW91	PCM	6-31G(d,p)				Shielding Tensors									
		Isomer 1	Isomer 2	Isomer 3	Isomer 4	Isomer 5	Isomer 6	Isomer 7	Isomer 8	Isomer 9	Isomer 10	Isomer 11	Isomer 12	Isomer 13	Isomer 14
$sDP4+$ (H data)		5.31%	10.32%	82.53%	1.85%	-	-	-	-	-	-	-	-	-	-
$sDP4+$ (C data)		58.32%	41.47%	0.14%	0.07%	-	-	-	-	-	-	-	-	-	-
$sDP4+$ (all data)		41.31%	57.12%	1.55%	0.02%	-	-	-	-	-	-	-	-	-	-
$uDP4+$ (H data)		6.13%	19.43%	21.41%	53.03%	-	-	-	-	-	-	-	-	-	-
$uDP4+$ (C data)		4.82%	95.18%	0.00%	0.00%	-	-	-	-	-	-	-	-	-	-
$uDP4+$ (all data)		1.57%	98.43%	0.00%	0.00%	-	-	-	-	-	-	-	-	-	-
$DP4+$ (H data)		1.55%	9.55%	84.22%	4.68%	-	-	-	-	-	-	-	-	-	-
$DP4+$ (C data)		6.65%	93.35%	0.00%	0.00%	-	-	-	-	-	-	-	-	-	-
$DP4+$ (all data)		1.14%	98.86%	0.00%	0.00%	-	-	-	-	-	-	-	-	-	-

**Note 1:** the same results are obtained using unscaled shifts (Figure S6).

Functional	Solvent?	Basis Set				Type of Data									
mpW1PW91	PCM	6-31G(d,p)				Unscaled Shifts									
		DP4+	Isomer 1	Isomer 2	Isomer 3	Isomer 4	Isomer 5	Isomer 6	Isomer 7	Isomer 8	Isomer 9	Isomer 10	Isomer 11	Isomer 12	Isomer 13
Nuclei	sp2?	Experimental	1.14%	98.86%	0.00%	0.00%	-	-	-	-	-	-	-	-	-
C		14.1	16.0	15.8	16.0	15.9	-	-	-	-	-	-	-	-	-
C		19.1	23.0	22.6	22.5	22.4	-	-	-	-	-	-	-	-	-
C		36.5	38.4	38.3	32.9	33.0	-	-	-	-	-	-	-	-	-
C		87.1	86.8	87.4	82.9	84.1	-	-	-	-	-	-	-	-	-
C		76.8	77.9	78.6	75.5	75.0	-	-	-	-	-	-	-	-	-
C		44	45.0	48.1	46.5	45.5	-	-	-	-	-	-	-	-	-
C		79.5	79.5	81.2	79.2	79.3	-	-	-	-	-	-	-	-	-
C	x	142.1	142.1	139.2	141.5	143.5	-	-	-	-	-	-	-	-	-
C	x	125.9	121.2	122.3	121.2	121.6	-	-	-	-	-	-	-	-	-
C	x	128.3	125.2	124.6	124.7	125.3	-	-	-	-	-	-	-	-	-
C	x	127.4	123.4	123.6	123.0	123.4	-	-	-	-	-	-	-	-	-
H		0.99	0.95	0.98	0.99	0.99	-	-	-	-	-	-	-	-	-
H		1.57	1.37	1.39	1.63	1.46	-	-	-	-	-	-	-	-	-
H		1.57	1.73	1.67	1.44	1.59	-	-	-	-	-	-	-	-	-
H		1.57	1.48	1.47	1.47	1.60	-	-	-	-	-	-	-	-	-
H		1.57	1.37	1.58	1.68	1.77	-	-	-	-	-	-	-	-	-
H		3.91	4.06	3.95	4.03	3.93	-	-	-	-	-	-	-	-	-
H		4.17	4.05	4.20	4.21	4.01	-	-	-	-	-	-	-	-	-
H		2.21	2.46	1.91	2.35	2.59	-	-	-	-	-	-	-	-	-
H		1.97	1.86	1.51	1.78	1.95	-	-	-	-	-	-	-	-	-
H		5.12	5.29	5.21	5.45	5.16	-	-	-	-	-	-	-	-	-
H	x	7.31	7.64	7.65	7.61	7.70	-	-	-	-	-	-	-	-	-
H	x	7.31	7.61	7.57	7.56	7.61	-	-	-	-	-	-	-	-	-
H	x	7.31	7.50	7.50	7.47	7.49	-	-	-	-	-	-	-	-	-

**Note 2:** if scaled shifts are introduced, the Excel file cannot compute the  $DP4+$  probability (Figure S7), but instead the  $sDP4+$  values can be seen in the "Detailed Results" sheet (Figure S8).

Functional	Solvent?	Basis Set				Type of Data									
mpW1PW91	PCM	6-31G(d,p)				Scaled Shifts									
		DP4+	Isomer 1	Isomer 2	Isomer 3	Isomer 4	Isomer 5	Isomer 6	Isomer 7	Isomer 8	Isomer 9	Isomer 10	Isomer 11	Isomer 12	Isomer 13
Nuclei	sp2?	Experimental	11.0	11.8	14.6	14.9	-	-	-	-	-	-	-	-	-
C		19.1	20.4	19.0	21.3	21.6	-	-	-	-	-	-	-	-	-
C		36.5	36.5	35.7	32.2	32.6	-	-	-	-	-	-	-	-	-
C		87.1	87.4	87.7	84.5	85.4	-	-	-	-	-	-	-	-	-
C		76.8	78.0	78.4	76.7	75.9	-	-	-	-	-	-	-	-	-
C		44	43.5	46.1	46.5	45.5	-	-	-	-	-	-	-	-	-
C		79.5	79.7	81.2	80.6	80.4	-	-	-	-	-	-	-	-	-
C	x	142.1	145.4	142.7	145.6	146.7	-	-	-	-	-	-	-	-	-
C	x	125.9	123.5	124.8	124.5	124.0	-	-	-	-	-	-	-	-	-
C	x	128.3	127.7	127.3	128.1	127.8	-	-	-	-	-	-	-	-	-
C	x	127.4	125.8	126.1	126.3	125.9	-	-	-	-	-	-	-	-	-
H		0.99	1.03	1.14	1.03	0.98	-	-	-	-	-	-	-	-	-
H		1.57	1.43	1.52	1.64	1.43	-	-	-	-	-	-	-	-	-
H		1.57	1.77	1.78	1.46	1.56	-	-	-	-	-	-	-	-	-
H		1.57	1.53	1.60	1.49	1.57	-	-	-	-	-	-	-	-	-
H		1.57	1.43	1.70	1.69	1.74	-	-	-	-	-	-	-	-	-
H		3.91	3.98	3.92	3.93	3.82	-	-	-	-	-	-	-	-	-
H		4.17	3.97	4.16	4.11	3.90	-	-	-	-	-	-	-	-	-
H		2.21	2.46	2.01	2.32	2.53	-	-	-	-	-	-	-	-	-
H		1.97	1.89	1.64	1.78	1.91	-	-	-	-	-	-	-	-	-
H		5.12	5.15	5.11	5.28	5.01	-	-	-	-	-	-	-	-	-
H	x	7.31	7.38	7.41	7.34	7.47	-	-	-	-	-	-	-	-	-
H	x	7.31	7.34	7.32	7.30	7.38	-	-	-	-	-	-	-	-	-
H	x	7.31	7.24	7.26	7.21	7.27	-	-	-	-	-	-	-	-	-

**Figure S8**

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
2	Functional	Solvent?	Basis Set	Type of Data													
3	mPW1PW91	PCM	6-31G(d,p)	Scaled Shifts													
4		Isomer 1	Isomer 2	Isomer 3	Isomer 4	Isomer 5	Isomer 6	Isomer 7	Isomer 8	Isomer 9	Isomer 10	Isomer 11	Isomer 12	Isomer 13	Isomer 14		
5	sDP4+ (H data)	5.31%	10.32%	82.53%	1.85%	-	-	-	-	-	-	-	-	-	-		
6	sDP4+ (C data)	58.32%	41.47%	0.14%	0.07%	-	-	-	-	-	-	-	-	-	-		
7	sDP4+ (all data)	41.31%	57.12%	1.55%	0.02%	-	-	-	-	-	-	-	-	-	-		
8	uDP4+ (H data)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
9	uDP4+ (C data)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
10	uDP4+ (all data)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11	DP4+ (H data)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
12	DP4+ (C data)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
13	DP4+ (all data)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Detailed Results