wwPDB EM Validation Summary Report

Oct 20, 2024 – 09:00 PM EDT

PDB ID	:	8EYH
EMDB ID	:	EMD-28688
Title	:	SARS-CoV-2 spike protein bound with a nanobody
Authors	:	Laughlin, Z.T.; Patel, A.; Ortlund, E.A.
Deposited on	:	2022-10-27
Resolution	:	3.75 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/EMValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references ⓘ) were used in the production of this report:

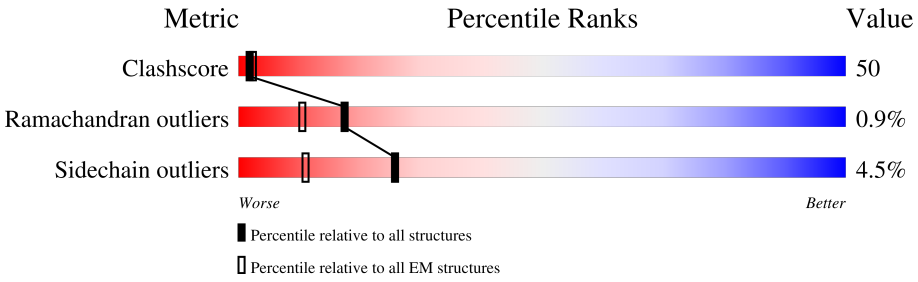
EMDB validation analysis	:	0.0.1.dev113
Mogul	:	2022.3.0, CSD as543be (2022)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 3.75 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion < 40%). The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	D	118	59% 81% 18%
2	A	1136	37% 37% 54% 6%
2	B	1136	36% 35% 57%
2	C	1136	42% 36% 54% 6%
3	E	2	50% 100%
3	F	2	100% 50% 50%
3	G	2	50% 50% 50%
3	H	2	50% 50% 50%

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Mol	Chain	Length	Quality of chain
3	I	2	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	NAG	I	1	-	-	X	-
4	NAG	C	1201	-	-	X	-

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 26575 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Nanobody.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	D	118	Total	C	N	O	S	0	0
			868	543	147	174	4		

- Molecule 2 is a protein called Spike glycoprotein.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	1088	Total	C	N	O	S	0	0
			8515	5436	1421	1620	38		
2	C	1067	Total	C	N	O	S	0	0
			8350	5327	1395	1589	39		
2	A	1069	Total	C	N	O	S	0	0
			8366	5339	1397	1591	39		

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	817	PRO	PHE	conflict	UNP P0DTC2
B	892	PRO	ALA	conflict	UNP P0DTC2
B	899	PRO	ALA	conflict	UNP P0DTC2
B	942	PRO	ALA	conflict	UNP P0DTC2
B	986	PRO	LYS	conflict	UNP P0DTC2
B	987	PRO	VAL	conflict	UNP P0DTC2
C	817	PRO	PHE	conflict	UNP P0DTC2
C	892	PRO	ALA	conflict	UNP P0DTC2
C	899	PRO	ALA	conflict	UNP P0DTC2
C	942	PRO	ALA	conflict	UNP P0DTC2
C	986	PRO	LYS	conflict	UNP P0DTC2
C	987	PRO	VAL	conflict	UNP P0DTC2
A	817	PRO	PHE	conflict	UNP P0DTC2
A	892	PRO	ALA	conflict	UNP P0DTC2
A	899	PRO	ALA	conflict	UNP P0DTC2
A	942	PRO	ALA	conflict	UNP P0DTC2
A	986	PRO	LYS	conflict	UNP P0DTC2

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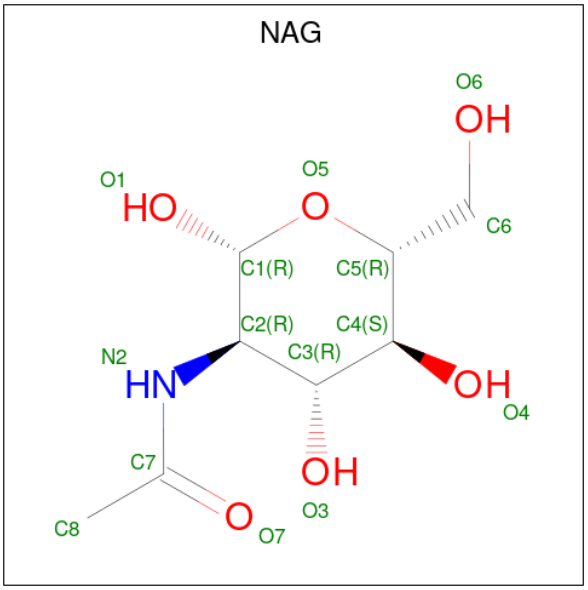
Chain	Residue	Modelled	Actual	Comment	Reference
A	987	PRO	VAL	conflict	UNP P0DTC2

- Molecule 3 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.

Mol	Chain	Residues	Atoms				AltConf	Trace
3	E	2	Total	C	N	O	0	0
			28	16	2	10		
3	F	2	Total	C	N	O	0	0
			28	16	2	10		
3	G	2	Total	C	N	O	0	0
			28	16	2	10		
3	H	2	Total	C	N	O	0	0
			28	16	2	10		
3	I	2	Total	C	N	O	0	0
			28	16	2	10		

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
4	B	1	Total 14	C 8	N 1	O 5	0
4	B	1	Total 14	C 8	N 1	O 5	0
4	B	1	Total 14	C 8	N 1	O 5	0
4	B	1	Total 14	C 8	N 1	O 5	0
4	B	1	Total 14	C 8	N 1	O 5	0
4	B	1	Total 14	C 8	N 1	O 5	0
4	B	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	C	1	Total 14	C 8	N 1	O 5	0
4	A	1	Total 14	C 8	N 1	O 5	0
4	A	1	Total 14	C 8	N 1	O 5	0
4	A	1	Total 14	C 8	N 1	O 5	0
4	A	1	Total 14	C 8	N 1	O 5	0
4	A	1	Total 14	C 8	N 1	O 5	0
4	A	1	Total 14	C 8	N 1	O 5	0
4	A	1	Total 14	C 8	N 1	O 5	0

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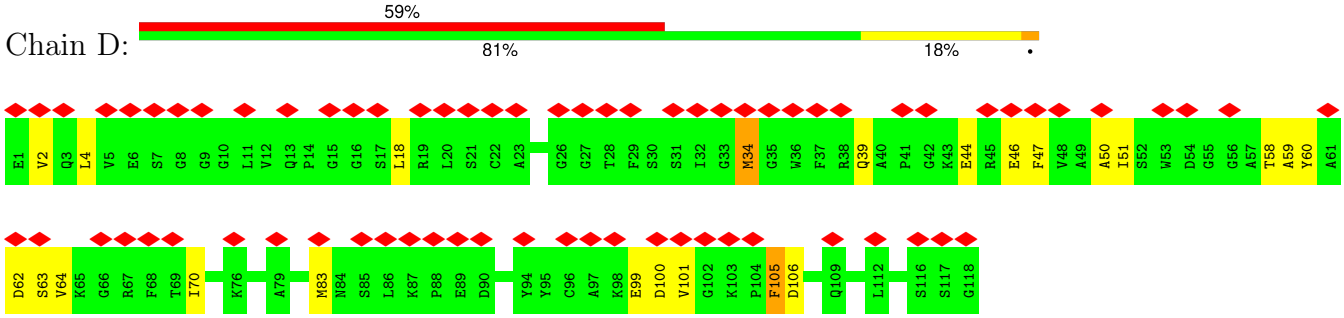
Mol	Chain	Residues	Atoms				AltConf
4	A	1	Total	C	N	O	0
			14	8	1	5	
4	A	1	Total	C	N	O	0
			14	8	1	5	

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

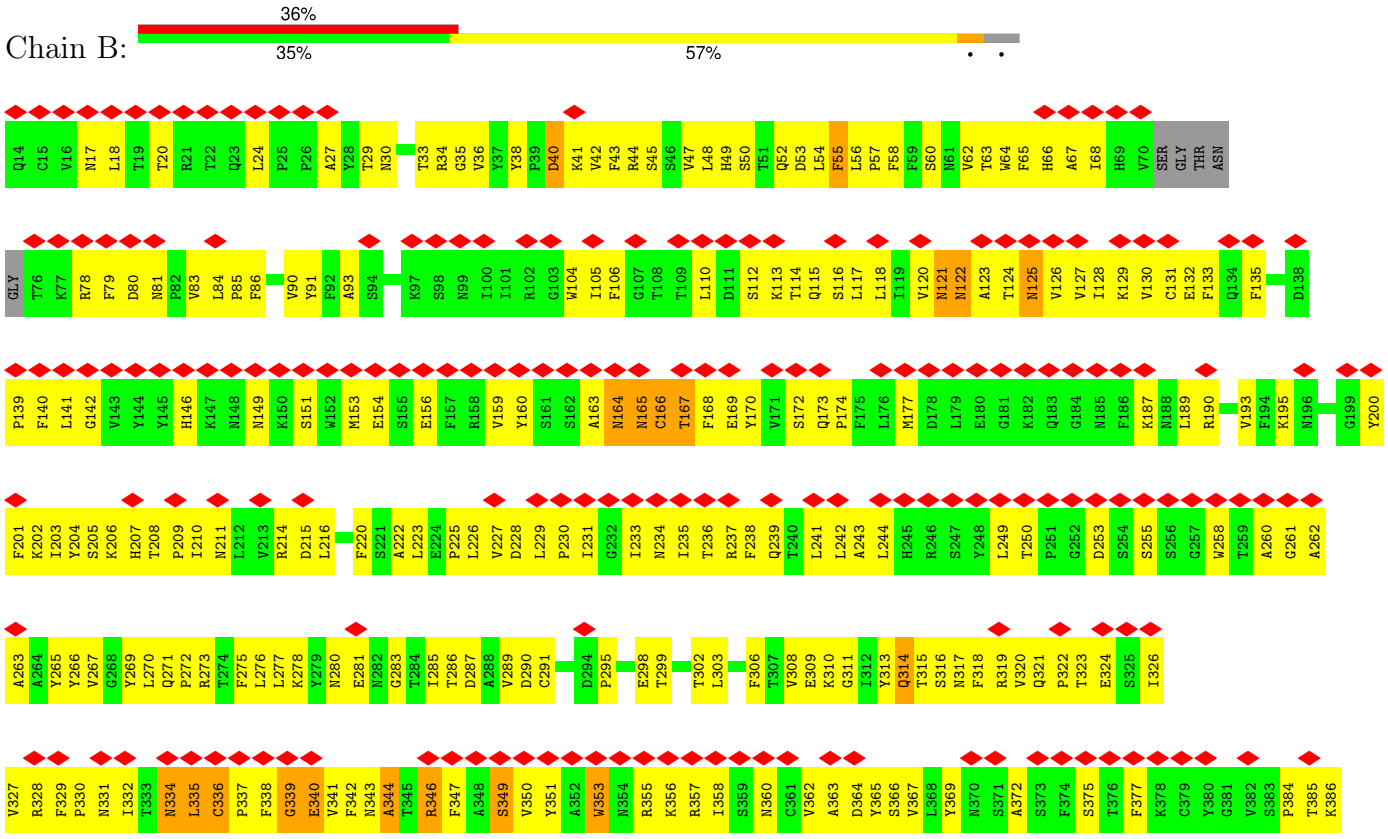
- Molecule 1: Nanobody

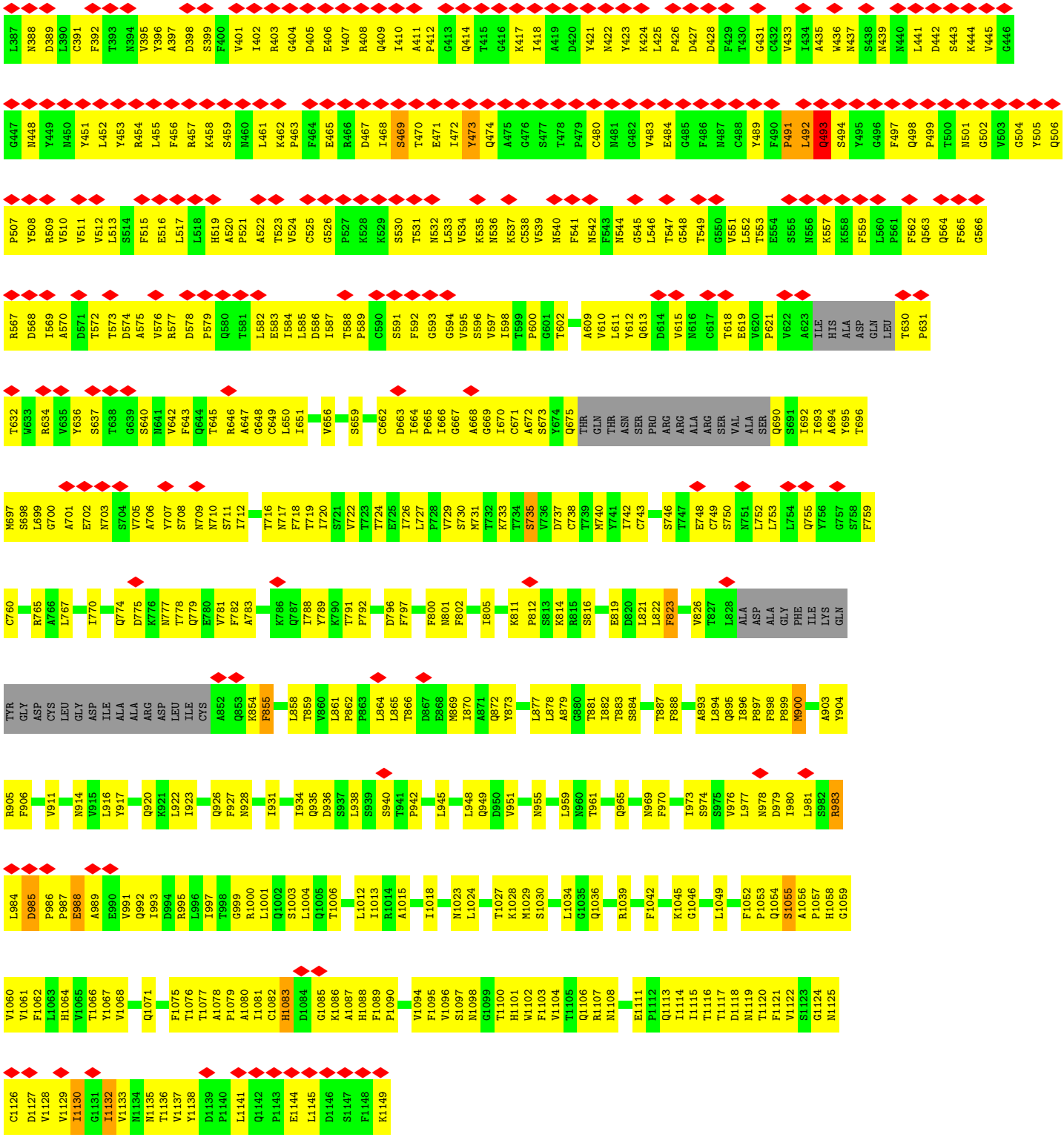
Chain D:



- Molecule 2: Spike glycoprotein

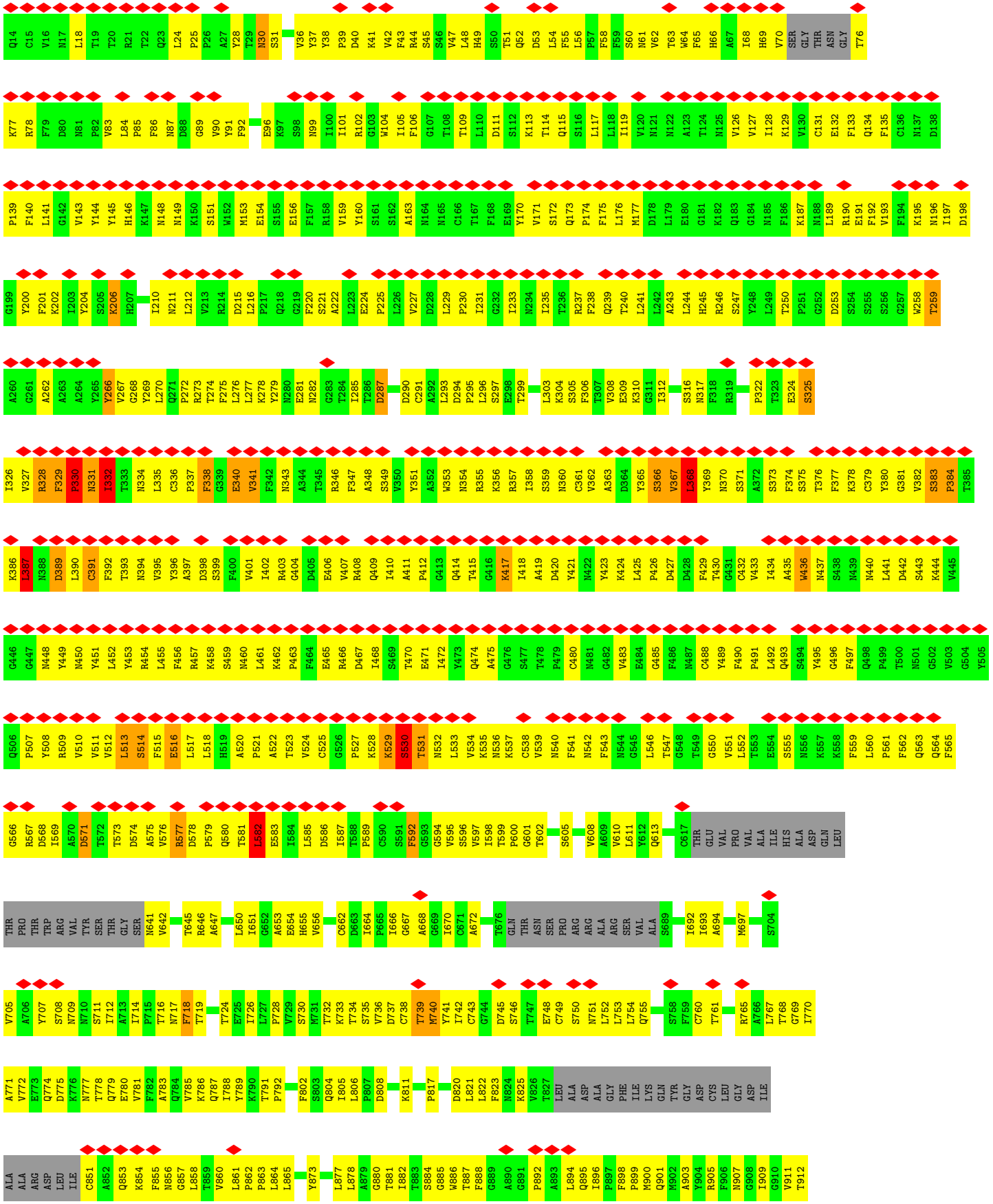
Chain B:

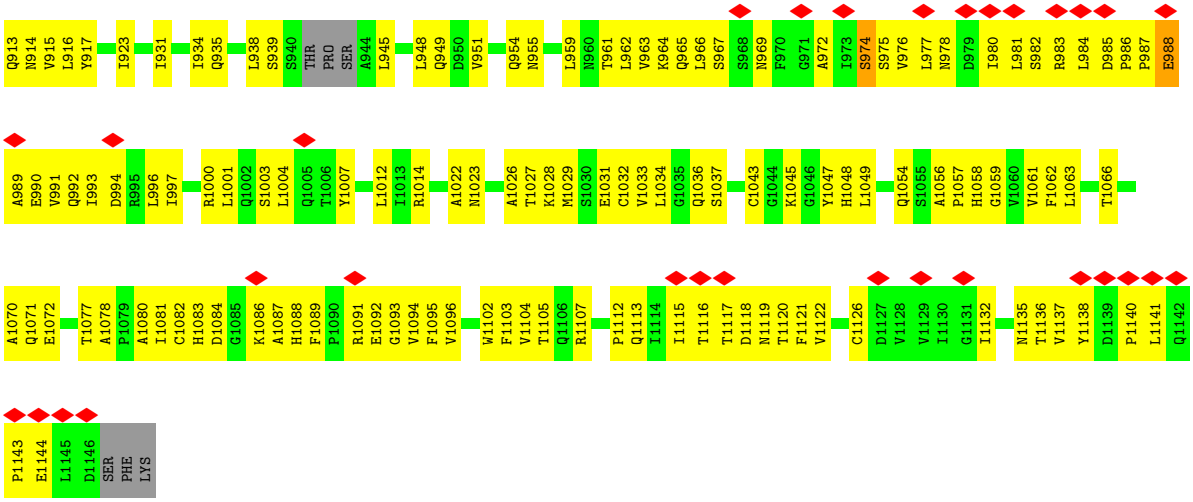




- Molecule 2: Spike glycoprotein

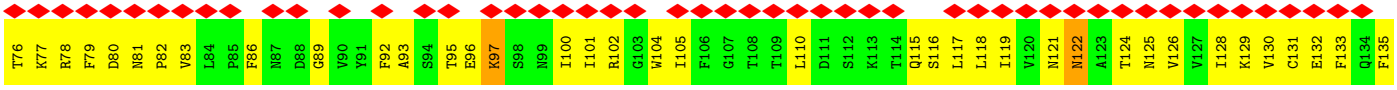
Chain C:

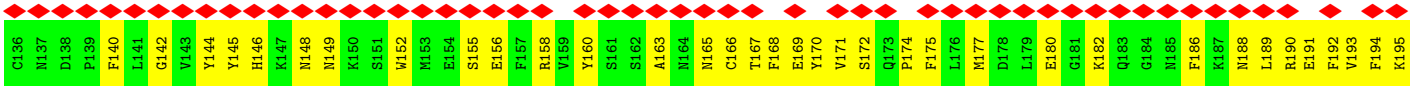

Q14 C15 V16 N17 L18 T19 T20 R21 T22 Q23 L24 P25 P26 A27 Y28 T29 N30 S31 V36 Y37 Y38 P39 D40 K41 V42 F43 R44 S45 S46 V47 L48 H49 S50 T51 Q52 D53 L54 F55 L56 P57 F58 F59 S60 N61 V62 T63 W64 F65 H66 A67 I68 H69 V70 SER GLY THR ASN GLY T76
K77 R78 F79 D80 N81 P82 V83 L84 P85 F86 N87 D88 G89 Y90 Y91 F92 E96 K97 S98 N99 I100 I101 R102 G103 W104 I105 F106 G107 T108 T109 L110 D111 S112 K113 T114 Q115 S116 L117 L118 I119 V120 N121 N122 A123 T124 N125 V126 V127 I128 K129 V130 C131 E132 F133 Q134 F135 C136 N137 D138
P139 F140 L141 G142 V143 Y144 Y145 H146 K147 N148 N149 K150 S151 W152 M153 E154 S155 E156 F157 R158 V159 Y160 S161 S162 A163 N164 N165 C166 T167 F168 E169 Y170 V171 S172 Q173 P174 F175 L176 M177 D178 L179 E180 G181 K182 Q183 G184 N185 F186 K187 N188 L189 R190 E191 F192 V193 F194 K195 N196 I197 D198
G199 Y200 F201 K202 I203 Y204 S205 K206 H207 I210 N211 L212 V213 R214 D215 L216 P217 Q218 G219 F220 S221 A222 L223 E224 P225 L226 V227 D228 L229 P230 I231 G232 I233 N234 I235 T236 R237 F238 Q239 T240 L241 L242 A243 L244 H245 R246 S247 Y248 L249 T250 P251 G252 D253 S254 S255 S256 C257 W258 T259
A260 G261 A262 A263 A264 Y265 Y266 V267 G268 Y269 L270 Q271 P272 R273 T274 F275 L276 L277 K278 Y279 N280 E281 N282 G283 T284 I285 T286 D287 D290 C291 A292 L293 D294 P295 L296 S297 E298 T299 L303 K304 S305 F306 T307 V308 E309 K310 G311 I312 S316 N317 F318 R319 P322 T323 E324 S325
I326 V327 R328 F329 P330 N331 I332 T333 N334 L335 C336 P337 F338 G339 E340 V341 F342 N343 A344 T345 R346 F347 A348 S349 V350 Y351 A352 W353 N354 R355 K356 R357 I358 S359 N360 C361 V362 A363 D364 Y365 S366 V367 L368 Y369 N370 S371 A372 S373 F374 S375 T376 F377 K378 C379 Y380 G381 V382 S383 P384 T385
K386 L387 N388 D389 L390 C391 F392 T393 N394 V395 Y396 A397 D398 S399 F400 V401 I402 R403 G404 D405 E406 V407 R408 Q409 I410 A411 P412 G413 Q414 T415 G416 K417 I418 A419 D420 Y421 N422 Y423 K424 L425 P426 D427 D428 F429 T430 G431 C432 V433 I434 A435 W436 N437 S438 N439 N440 L441 D442 S443 K444 V445
G446 G447 N448 Y449 N450 Y451 L452 Y453 R454 L455 F456 R457 K458 S459 N460 L461 K462 P463 F464 E465 R466 D467 I468 S469 T470 E471 I472 Y473 Q474 A475 G476 S477 T478 P479 C480 N481 G482 V483 E484 G485 F486 N487 C488 Y489 F490 P491 L492 Q493 S494 Y495 G496 F497 Q498 P499 T500 N501 G502 V503 Q504 Y505
Q506 P507 Y508 R509 V510 V511 V512 L513 S514 F515 E516 L517 L518 H519 A520 P521 A522 T523 V524 C525 G526 P527 K528 K529 S530 T531 N532 L533 V534 K535 N536 K537 C538 V539 N540 F541 N542 F543 N544 G545 L546 T547 G548 T549 G550 V551 L552 T553 E554 S555 N556 K557 K558 F559 L560 P561 F562 Q563 Q564 F565
G566 R567 D568 I569 A570 D571 T572 T573 D574 A575 V576 R577 D578 P579 Q580 T581 L582 E583 I584 L585 D586 I587 T588 P589 C590 S591 F592 G593 G594 V595 S596 V597 I598 T599 P600 G601 T602 S605 V608 A609 V610 L611 Y612 Q613 C617 THR GLU VAL PRO VAL ALA ILE HIS ALA ASP GLN LEU
THR PRO THR TRP ARG VAL TYR SER THR GLY SER N641 V642 T645 R646 A647 L650 I651 G652 A653 E654 H655 V656 C662 D663 I664 P665 I666 G667 A668 G669 I670 C671 A672 T676 GLN THR ASN SER PRO ARG ARG ALA ARG SER VAL ALA S689 I692 I693 A694 M697 S704
V705 A706 Y707 S708 N709 N710 S711 I712 A713 I714 P715 T716 N717 F718 T719 T724 E725 I726 L727 P728 F729 S730 M731 T732 K733 T734 S735 V736 D737 C738 T739 M740 Y741 I742 C743 G744 D745 S746 T747 E748 C749 S750 N751 L752 L753 L754 Q755 S758 F759 C760 T761 R765 A766 L767 T768 G769 I770
A771 V772 E773 Q774 D775 K776 N777 T778 Q779 E780 V781 F782 A783 Q784 V785 K786 Q787 I788 Y789 K790 T791 P792 F802 S803 Q804 I805 L806 P807 D808 K811 P817 D820 L821 L822 F823 N824 K825 V826 T827 LEU ALA ASP ALA GLY PHE ILE LYS GLN TYR GLY ASP CYS LEU GLY ASP ILE
ALA ALA ARG ASP LEU ILE C851 A852 Q853 K854 F855 N856 G857 L858 T859 V860 L861 P862 P863 L864 L865 Y873 L877 L878 A879 G880 T881 I882 T883 S884 G885 W886 T887 F888 G889 A890 G891 P892 A893 L894 Q895 I896 P897 F898 P899 M900 Q901 M902 A903 Y904 R905 F906 N907 G908 I909 G910 V911 T912

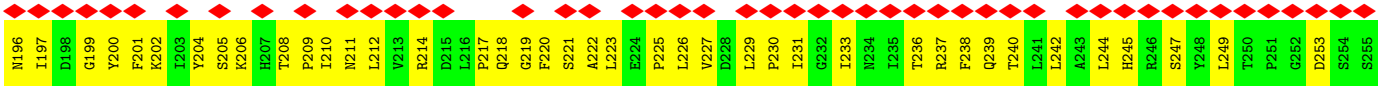


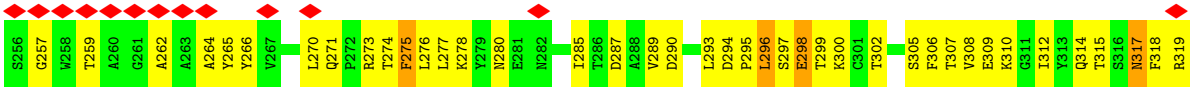
- Molecule 2: Spike glycoprotein

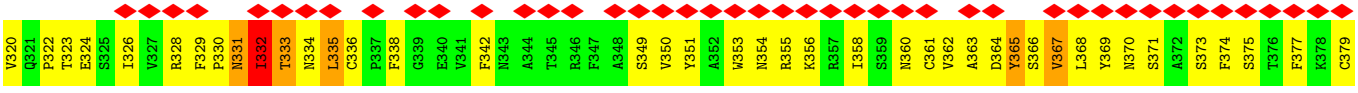
Chain A:

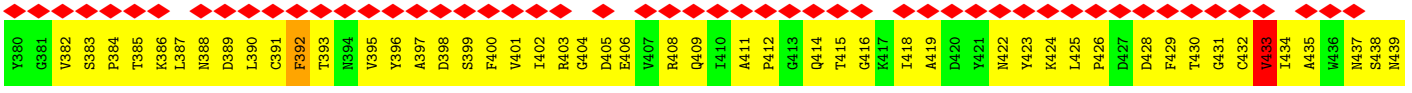


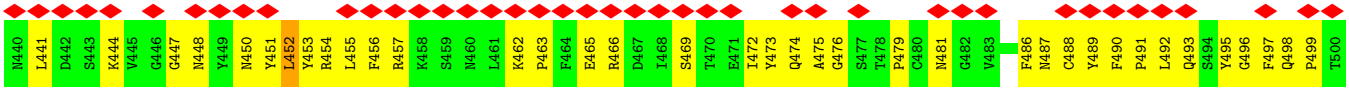


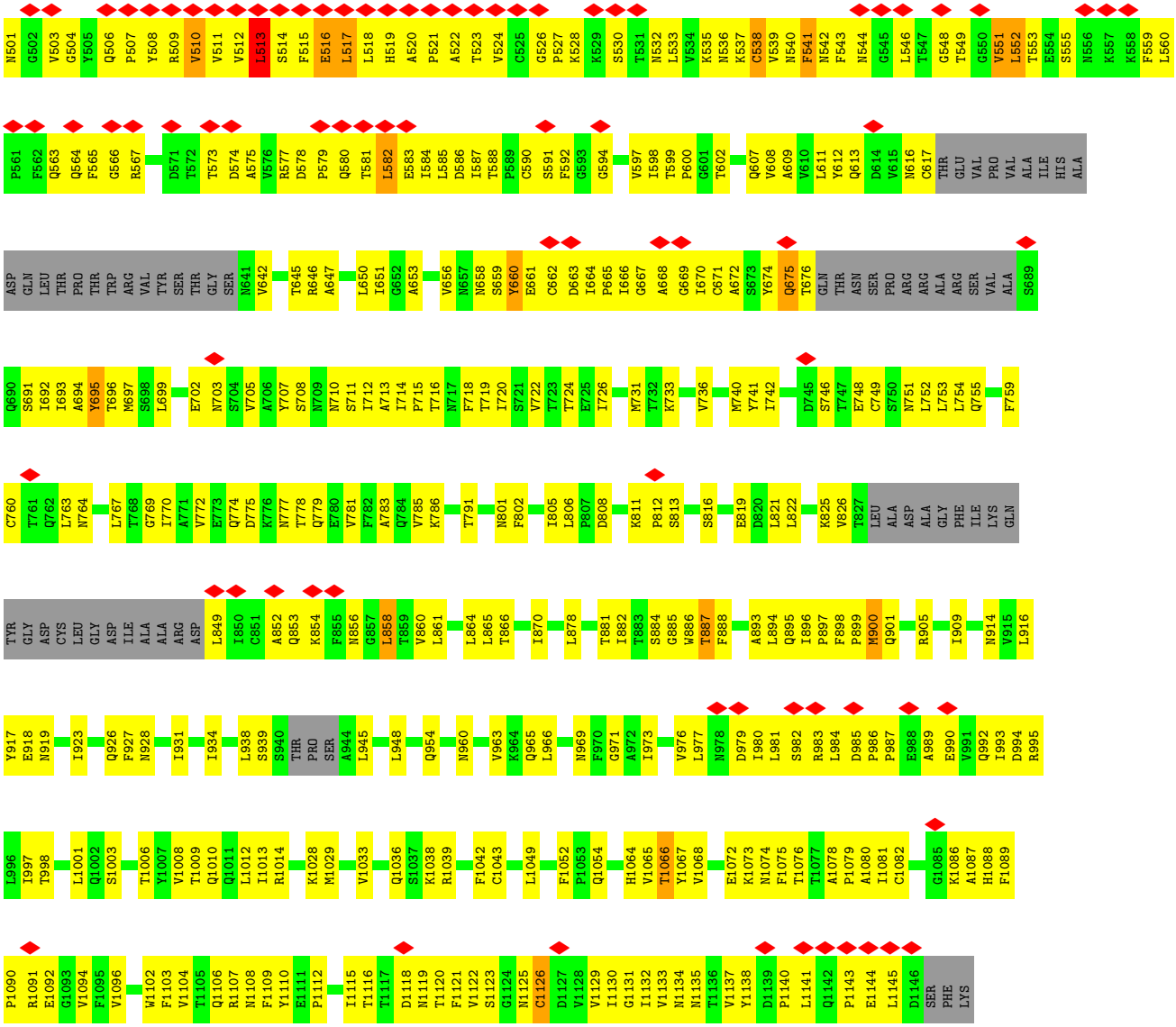






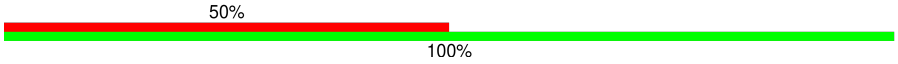






• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain E:



• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain F:

• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain G:

• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain H:

• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain I:

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	615492	Depositor
Resolution determination method	FSC 0.5 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	63.81	Depositor
Minimum defocus (nm)	600	Depositor
Maximum defocus (nm)	2600	Depositor
Magnification	81000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	66.367	Depositor
Minimum map value	-45.933	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.755	Depositor
Recommended contour level	5	Depositor
Map size (Å)	444.7456, 444.7456, 444.7456	wwPDB
Map dimensions	416, 416, 416	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.0691, 1.0691, 1.0691	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NAG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| > 5$	RMSZ	$\#\|Z\| > 5$
1	D	0.25	0/886	0.47	0/1198
2	A	0.29	0/8562	0.48	0/11654
2	B	0.29	0/8719	0.47	0/11874
2	C	0.30	0/8546	0.48	0/11632
All	All	0.29	0/26713	0.47	0/36358

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	868	0	831	18	0
2	A	8366	0	8167	880	0
2	B	8515	0	8324	1084	0
2	C	8350	0	8147	964	0
3	E	28	0	25	0	0
3	F	28	0	25	6	0
3	G	28	0	25	4	0
3	H	28	0	25	4	0
3	I	28	0	25	9	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	126	0	116	9	0
4	B	98	0	91	6	0
4	C	112	0	104	19	0
All	All	26575	0	25905	2628	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 50.

The worst 5 of 2628 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:343:ASN:HD21	3:I:1:NAG:C1	1.07	1.63
2:C:331:ASN:ND2	4:C:1201:NAG:C1	1.77	1.47
2:C:331:ASN:HD21	4:C:1201:NAG:C1	1.31	1.41
2:B:343:ASN:ND2	3:I:1:NAG:C1	1.93	1.30
2:A:334:ASN:HA	2:A:362:VAL:HG13	1.18	1.16

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	D	116/118 (98%)	110 (95%)	6 (5%)	0	100 100
2	A	1057/1136 (93%)	957 (90%)	90 (8%)	10 (1%)	14 47
2	B	1078/1136 (95%)	963 (89%)	110 (10%)	5 (0%)	25 58
2	C	1055/1136 (93%)	933 (88%)	107 (10%)	15 (1%)	9 39
All	All	3306/3526 (94%)	2963 (90%)	313 (10%)	30 (1%)	17 47

5 of 30 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	C	329	PHE
2	C	330	PRO
2	C	450	ASN
2	A	332	ILE
2	A	367	VAL

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	89/89 (100%)	85 (96%)	4 (4%)	23	49
2	A	937/990 (95%)	897 (96%)	40 (4%)	25	50
2	B	954/990 (96%)	912 (96%)	42 (4%)	24	50
2	C	935/990 (94%)	889 (95%)	46 (5%)	21	47
All	All	2915/3059 (95%)	2783 (96%)	132 (4%)	26	49

5 of 132 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	551	VAL
2	A	582	LEU
2	A	1126	CYS
2	C	64	TRP
2	C	58	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 33 such sidechains are listed below:

Mol	Chain	Res	Type
2	A	804	GLN
2	A	926	GLN
2	A	1119	ASN
2	C	149	ASN
2	C	66	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

10 monosaccharides are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	NAG	E	1	3,2	14,14,15	0.25	0	17,19,21	0.45	0
3	NAG	E	2	3	14,14,15	0.25	0	17,19,21	0.44	0
3	NAG	F	1	3,2	14,14,15	0.67	1 (7%)	17,19,21	0.98	1 (5%)
3	NAG	F	2	3	14,14,15	0.24	0	17,19,21	0.45	0
3	NAG	G	1	3,2	14,14,15	0.39	0	17,19,21	0.49	0
3	NAG	G	2	3	14,14,15	0.26	0	17,19,21	0.41	0
3	NAG	H	1	3,2	14,14,15	0.64	1 (7%)	17,19,21	0.64	0
3	NAG	H	2	3	14,14,15	0.27	0	17,19,21	0.44	0
3	NAG	I	1	3	14,14,15	0.48	0	17,19,21	0.37	0
3	NAG	I	2	3	14,14,15	0.36	0	17,19,21	0.41	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	E	1	3,2	-	1/6/23/26	0/1/1/1
3	NAG	E	2	3	-	2/6/23/26	0/1/1/1
3	NAG	F	1	3,2	-	3/6/23/26	0/1/1/1
3	NAG	F	2	3	-	3/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	G	1	3,2	-	3/6/23/26	0/1/1/1
3	NAG	G	2	3	-	2/6/23/26	0/1/1/1
3	NAG	H	1	3,2	-	2/6/23/26	0/1/1/1
3	NAG	H	2	3	-	3/6/23/26	0/1/1/1
3	NAG	I	1	3	-	4/6/23/26	0/1/1/1
3	NAG	I	2	3	-	3/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	H	1	NAG	O5-C1	-2.22	1.40	1.43
3	F	1	NAG	O5-C1	2.14	1.47	1.43

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	F	1	NAG	C1-O5-C5	3.73	117.18	112.19

There are no chirality outliers.

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	H	1	NAG	C1-C2-N2-C7
3	F	2	NAG	C4-C5-C6-O6
3	I	1	NAG	O5-C5-C6-O6
3	F	2	NAG	O5-C5-C6-O6
3	G	2	NAG	O5-C5-C6-O6

There are no ring outliers.

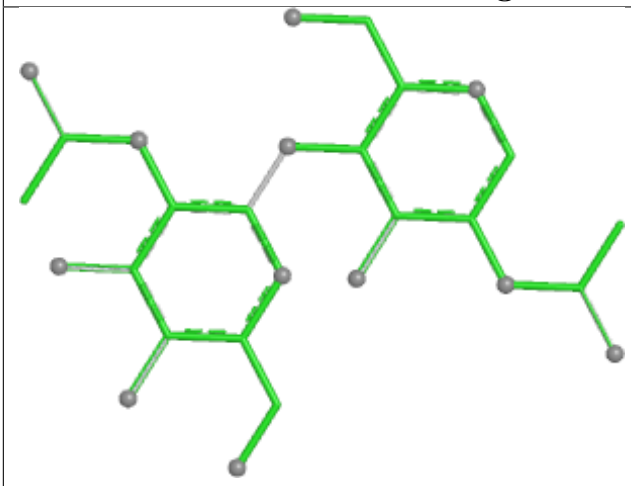
6 monomers are involved in 23 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	H	2	NAG	1	0
3	G	1	NAG	4	0
3	I	1	NAG	9	0
3	I	2	NAG	1	0
3	H	1	NAG	3	0
3	F	1	NAG	6	0

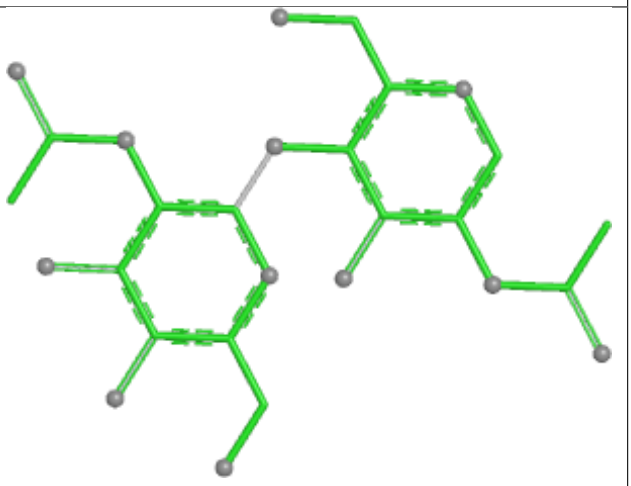
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,

bond angles, torsion angles, and ring geometry for oligosaccharide.

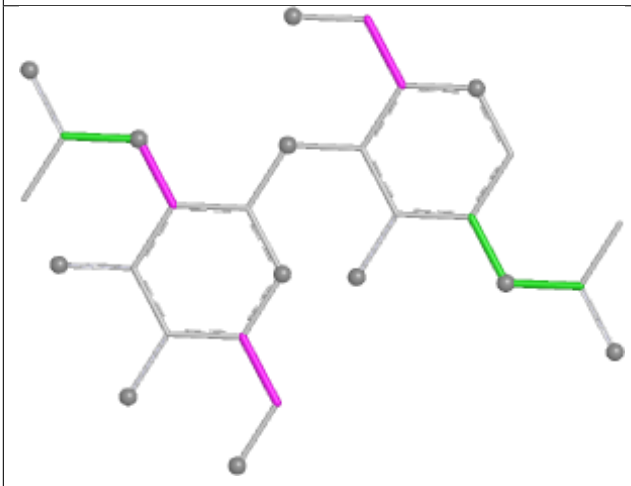
Oligosaccharide Chain E



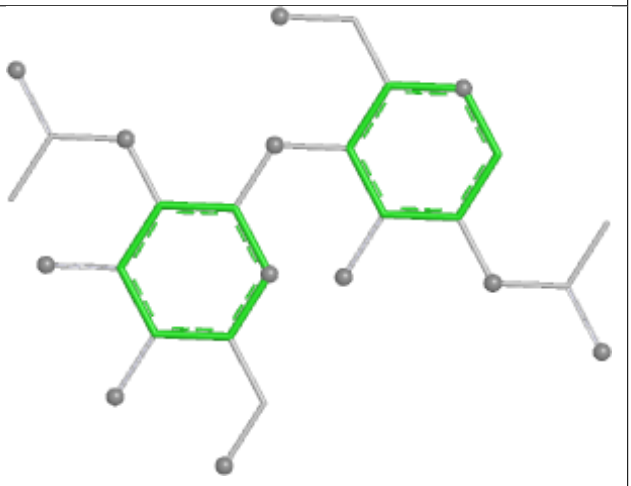
Bond lengths



Bond angles

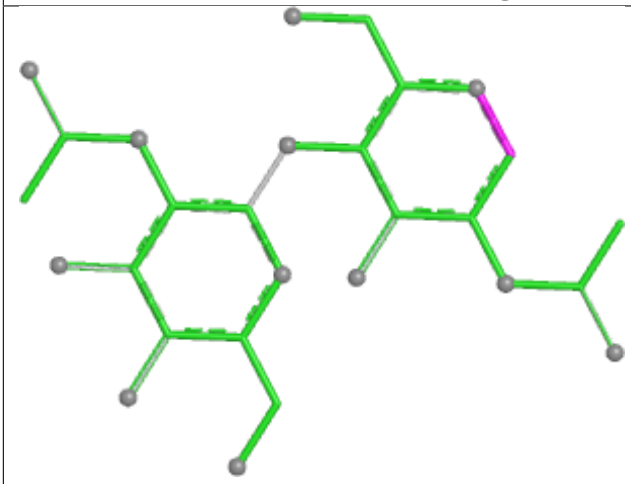


Torsions

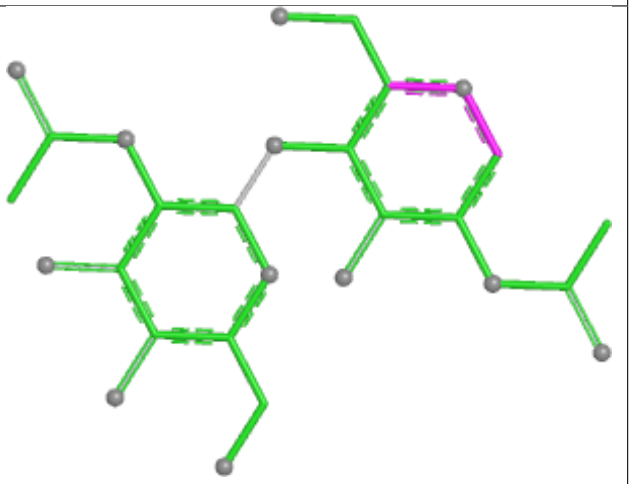


Rings

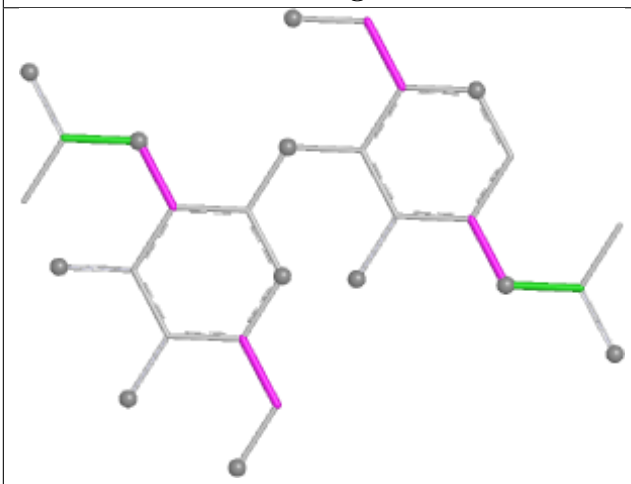
Oligosaccharide Chain F



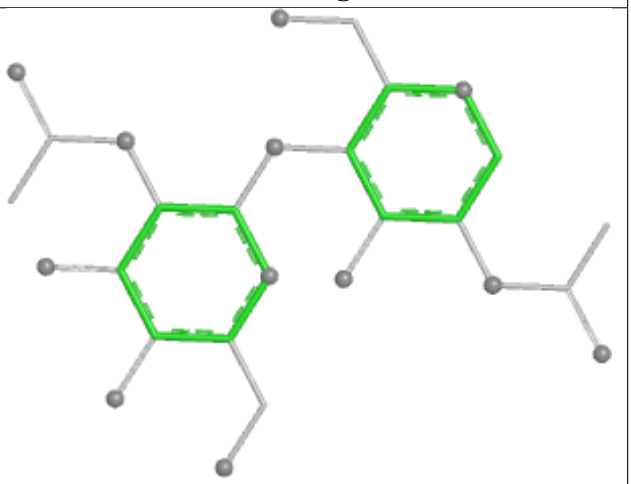
Bond lengths



Bond angles

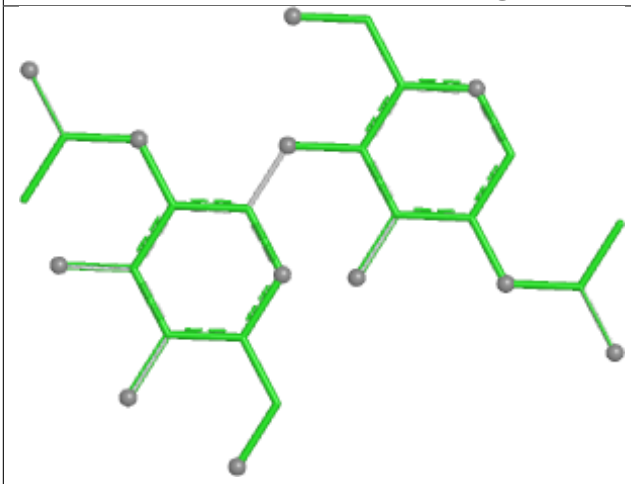


Torsions

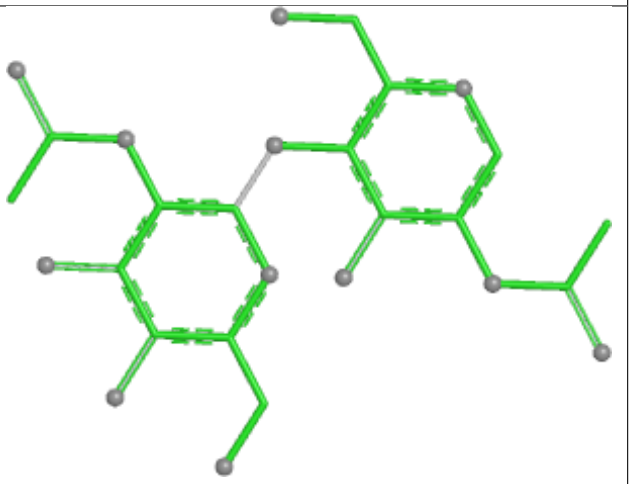


Rings

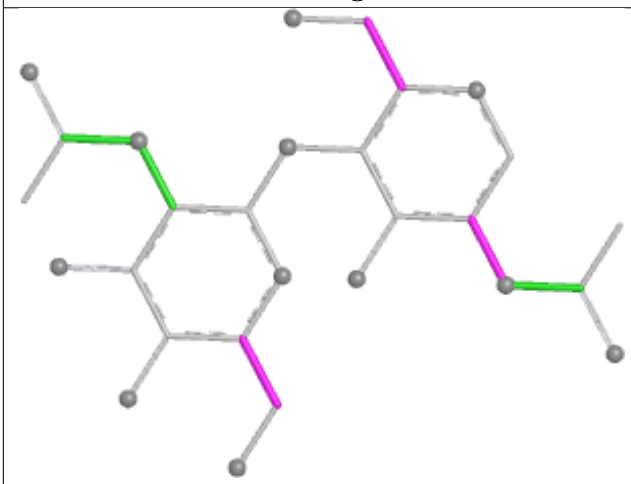
Oligosaccharide Chain G



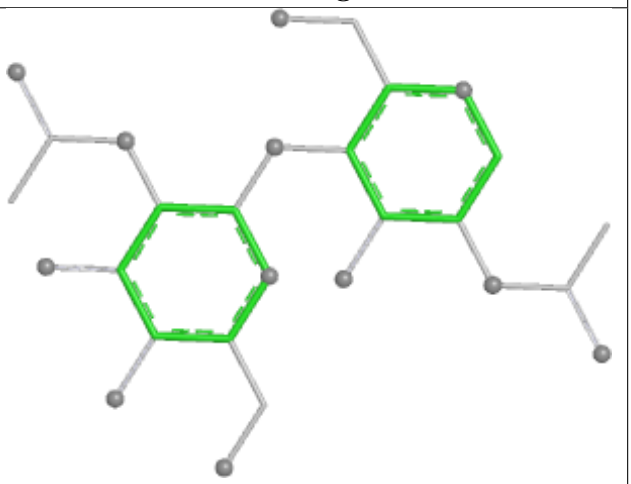
Bond lengths



Bond angles

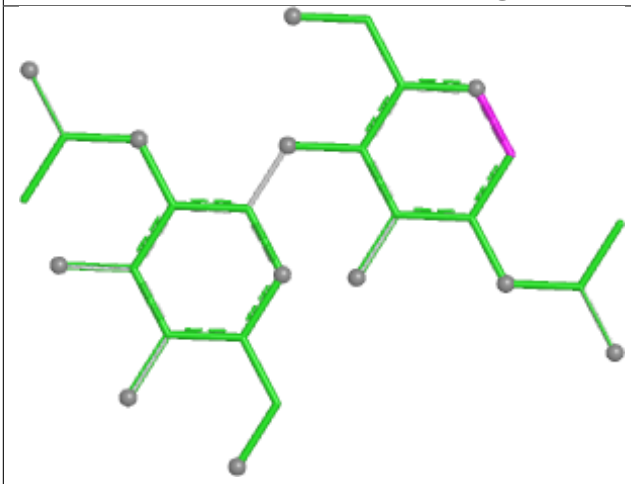


Torsions

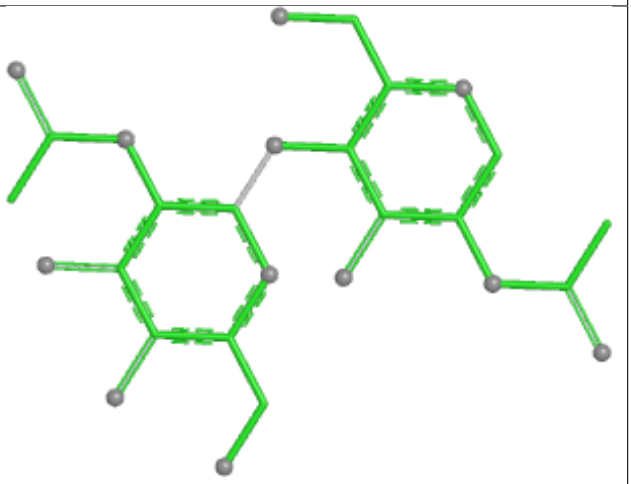


Rings

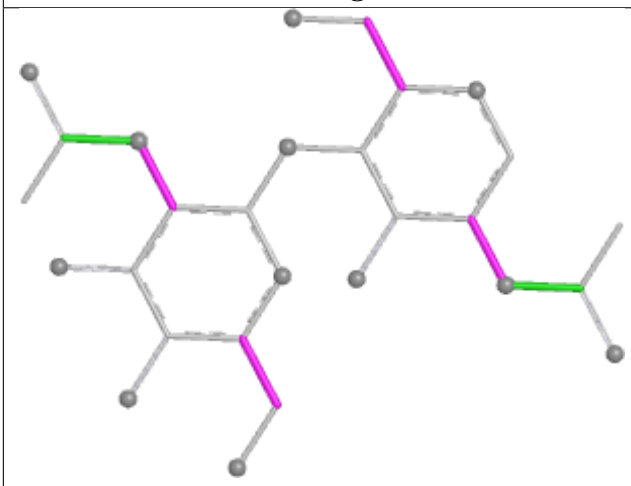
Oligosaccharide Chain H



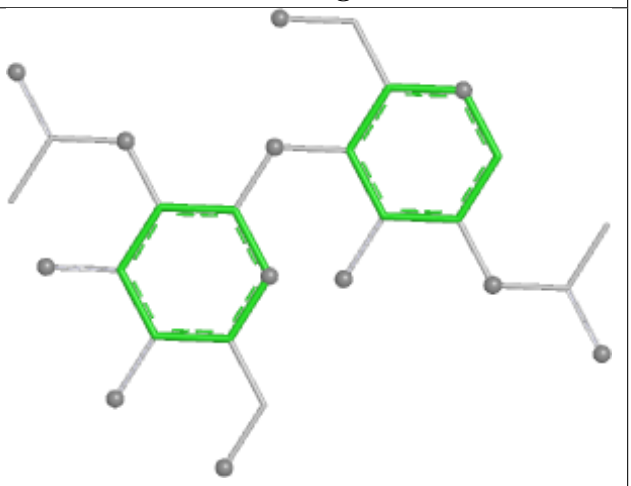
Bond lengths



Bond angles

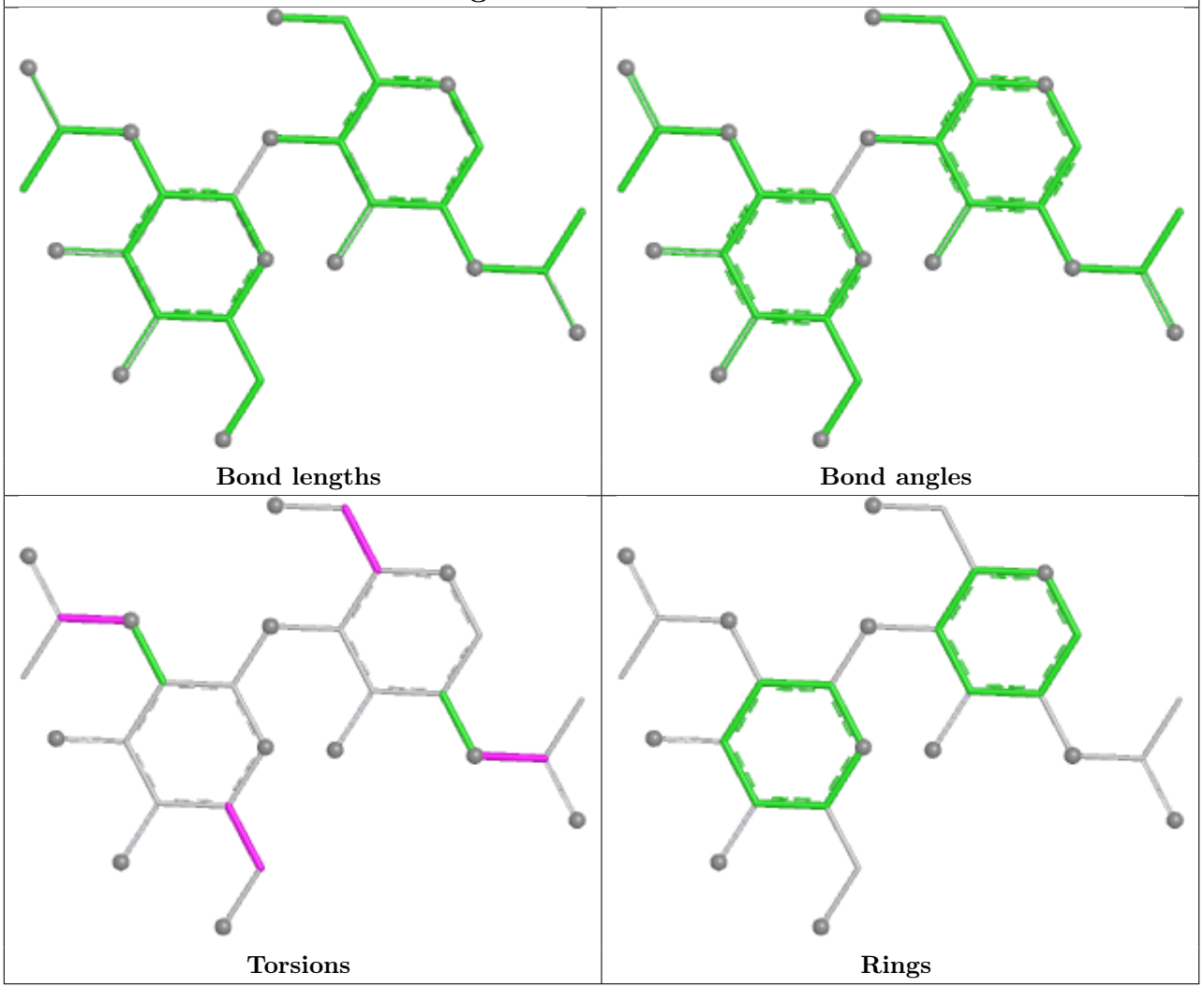


Torsions



Rings

Oligosaccharide Chain I



5.6 Ligand geometry (i)

24 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
4	NAG	C	1208	-	14,14,15	0.99	0	17,19,21	0.94	1 (5%)
4	NAG	B	1302	2	14,14,15	0.22	0	17,19,21	0.44	0
4	NAG	A	1205	2	14,14,15	0.25	0	17,19,21	0.43	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
4	NAG	A	1202	-	14,14,15	2.70	7 (50%)	17,19,21	1.23	2 (11%)
4	NAG	C	1206	2	14,14,15	0.31	0	17,19,21	0.34	0
4	NAG	A	1208	2	14,14,15	0.23	0	17,19,21	0.46	0
4	NAG	A	1206	2	14,14,15	0.22	0	17,19,21	0.44	0
4	NAG	C	1205	2	14,14,15	0.21	0	17,19,21	0.40	0
4	NAG	B	1303	2	14,14,15	0.28	0	17,19,21	0.43	0
4	NAG	A	1203	2	14,14,15	0.23	0	17,19,21	0.44	0
4	NAG	B	1306	2	14,14,15	0.23	0	17,19,21	0.42	0
4	NAG	A	1201	2	14,14,15	0.50	0	17,19,21	0.76	1 (5%)
4	NAG	C	1207	2	14,14,15	0.24	0	17,19,21	0.50	0
4	NAG	C	1202	2	14,14,15	0.53	0	17,19,21	0.79	1 (5%)
4	NAG	C	1204	2	14,14,15	0.25	0	17,19,21	0.42	0
4	NAG	A	1209	2	14,14,15	0.43	0	17,19,21	0.35	0
4	NAG	C	1203	2	14,14,15	0.24	0	17,19,21	0.43	0
4	NAG	B	1304	2	14,14,15	0.28	0	17,19,21	0.40	0
4	NAG	C	1201	-	14,14,15	0.61	0	17,19,21	0.58	0
4	NAG	A	1204	2	14,14,15	0.23	0	17,19,21	0.44	0
4	NAG	B	1301	2	14,14,15	0.58	0	17,19,21	0.82	1 (5%)
4	NAG	B	1307	2	14,14,15	0.26	0	17,19,21	0.45	0
4	NAG	B	1305	-	14,14,15	1.65	2 (14%)	17,19,21	1.23	3 (17%)
4	NAG	A	1207	2	14,14,15	0.27	0	17,19,21	0.42	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	C	1208	-	-	4/6/23/26	0/1/1/1
4	NAG	B	1302	2	-	4/6/23/26	0/1/1/1
4	NAG	A	1205	2	-	2/6/23/26	0/1/1/1
4	NAG	A	1202	-	-	0/6/23/26	0/1/1/1
4	NAG	C	1206	2	-	2/6/23/26	0/1/1/1
4	NAG	A	1208	2	-	2/6/23/26	0/1/1/1
4	NAG	A	1206	2	-	1/6/23/26	0/1/1/1
4	NAG	C	1205	2	-	1/6/23/26	0/1/1/1
4	NAG	B	1303	2	-	4/6/23/26	0/1/1/1
4	NAG	A	1203	2	-	4/6/23/26	0/1/1/1
4	NAG	B	1306	2	-	2/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	A	1201	2	-	4/6/23/26	0/1/1/1
4	NAG	C	1207	2	-	2/6/23/26	0/1/1/1
4	NAG	C	1202	2	-	1/6/23/26	0/1/1/1
4	NAG	C	1204	2	-	2/6/23/26	0/1/1/1
4	NAG	A	1209	2	-	3/6/23/26	0/1/1/1
4	NAG	C	1203	2	-	3/6/23/26	0/1/1/1
4	NAG	B	1304	2	-	4/6/23/26	0/1/1/1
4	NAG	C	1201	-	-	4/6/23/26	0/1/1/1
4	NAG	A	1204	2	-	2/6/23/26	0/1/1/1
4	NAG	B	1301	2	-	4/6/23/26	0/1/1/1
4	NAG	B	1307	2	-	2/6/23/26	0/1/1/1
4	NAG	B	1305	-	-	2/6/23/26	0/1/1/1
4	NAG	A	1207	2	-	3/6/23/26	0/1/1/1

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1305	NAG	C1-C2	5.23	1.59	1.52
4	A	1202	NAG	O5-C5	4.45	1.52	1.43
4	A	1202	NAG	C3-C2	4.25	1.61	1.52
4	A	1202	NAG	C8-C7	-3.49	1.43	1.50
4	A	1202	NAG	C2-N2	-3.48	1.40	1.46

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	B	1301	NAG	C1-O5-C5	3.04	116.27	112.19
4	A	1202	NAG	O7-C7-C8	-2.95	116.80	122.05
4	C	1202	NAG	C1-O5-C5	2.88	116.05	112.19
4	A	1201	NAG	C1-O5-C5	2.75	115.87	112.19
4	B	1305	NAG	O5-C5-C4	-2.72	104.20	110.83

There are no chirality outliers.

5 of 62 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	C	1204	NAG	C4-C5-C6-O6
4	A	1209	NAG	C4-C5-C6-O6
4	B	1301	NAG	C4-C5-C6-O6

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Mol	Chain	Res	Type	Atoms
4	A	1203	NAG	C4-C5-C6-O6
4	A	1205	NAG	O5-C5-C6-O6

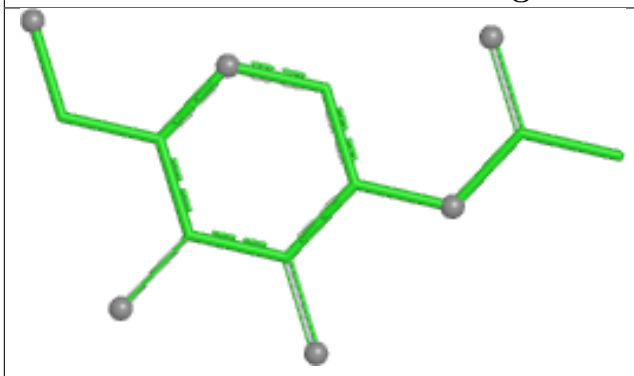
There are no ring outliers.

11 monomers are involved in 34 short contacts:

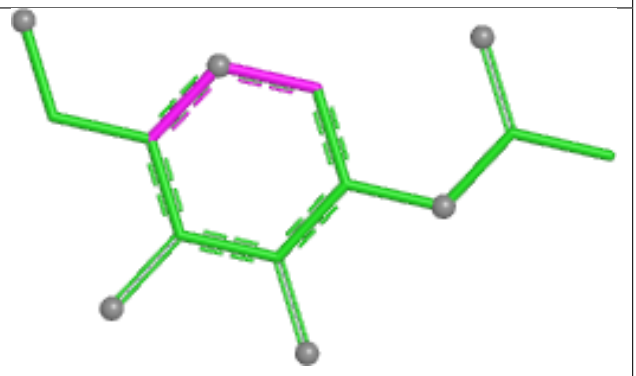
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	C	1208	NAG	3	0
4	A	1202	NAG	5	0
4	C	1206	NAG	6	0
4	C	1205	NAG	1	0
4	B	1303	NAG	1	0
4	B	1304	NAG	1	0
4	C	1201	NAG	9	0
4	A	1204	NAG	3	0
4	B	1301	NAG	1	0
4	B	1307	NAG	3	0
4	A	1207	NAG	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

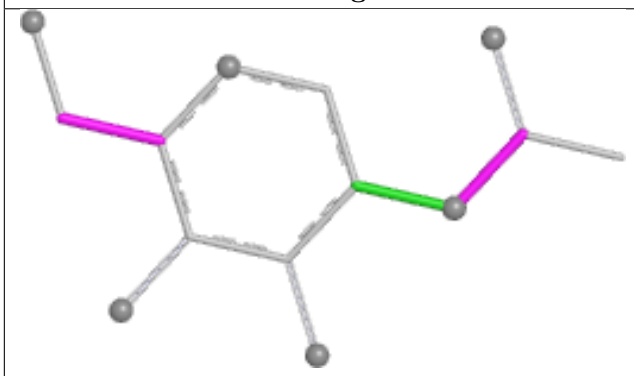
Ligand NAG C 1208



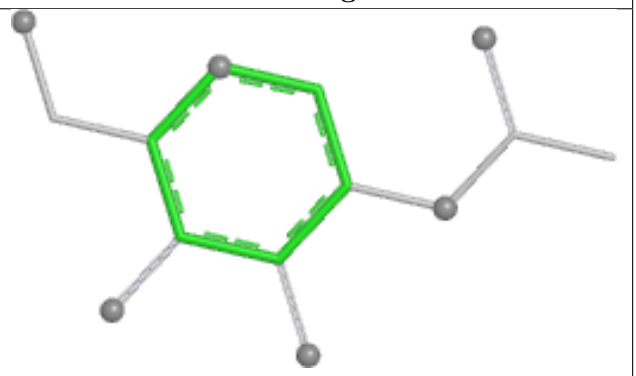
Bond lengths



Bond angles

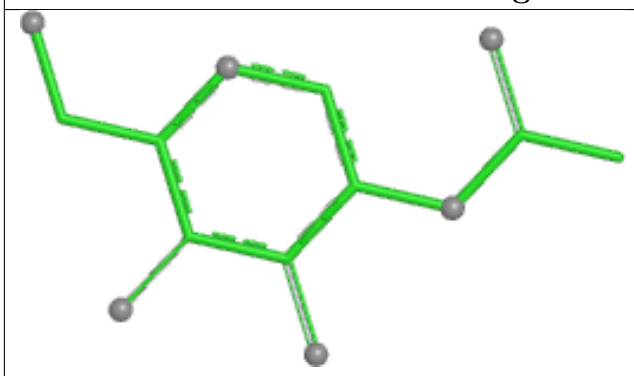


Torsions

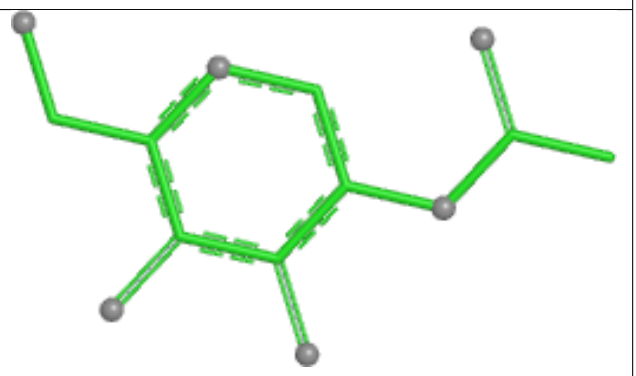


Rings

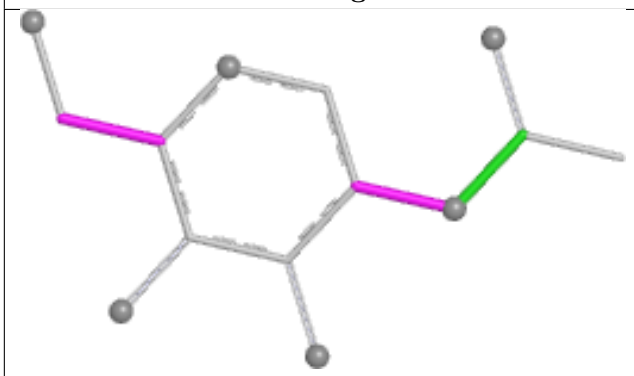
Ligand NAG B 1302



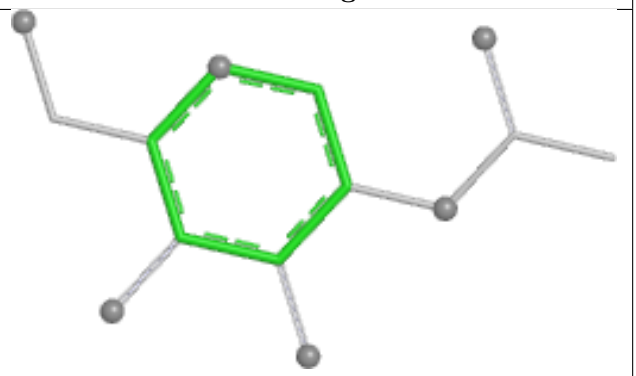
Bond lengths



Bond angles

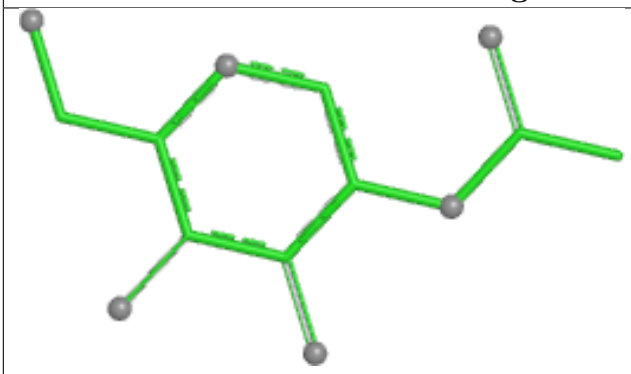


Torsions



Rings

Ligand NAG A 1205



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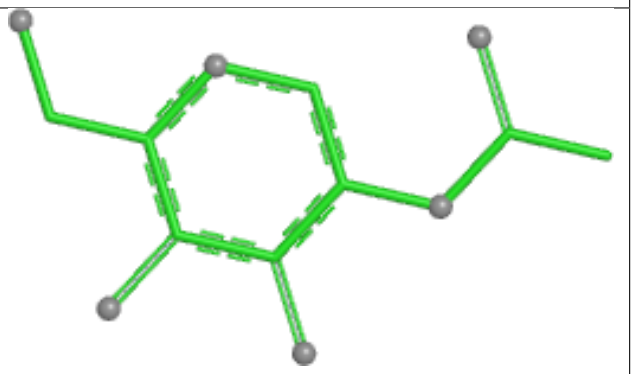
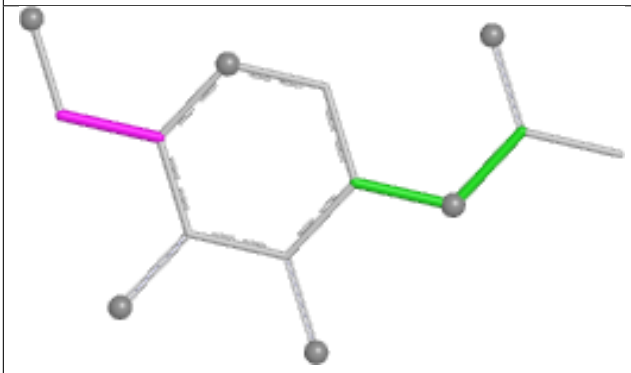
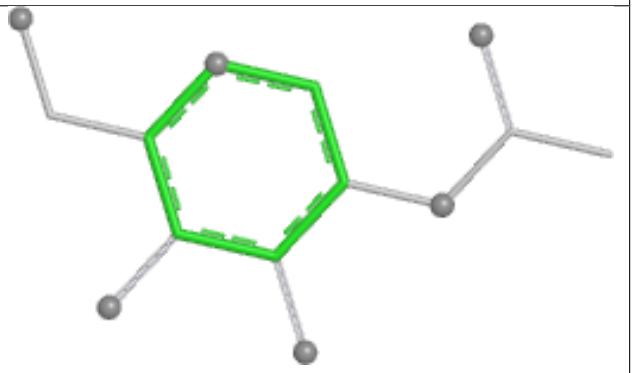


Bond angles

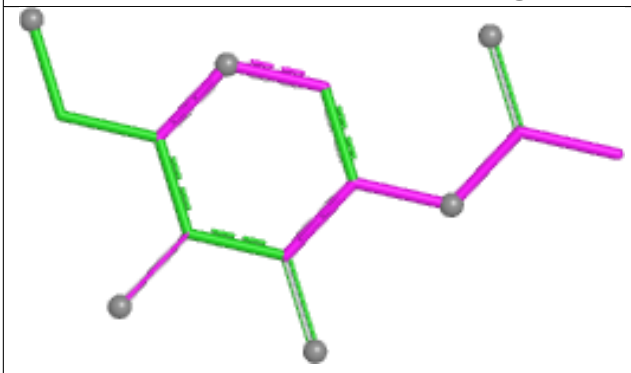


Torsions



Rings

Ligand NAG A 1202



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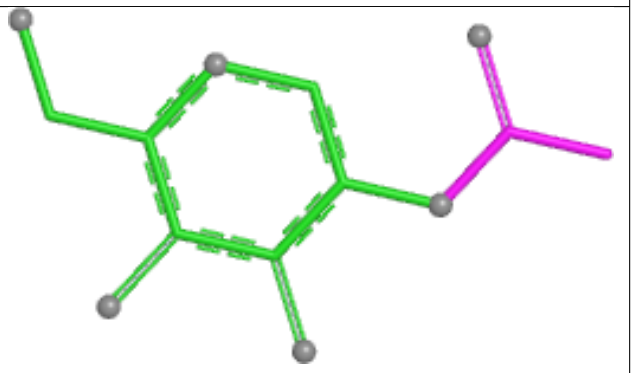
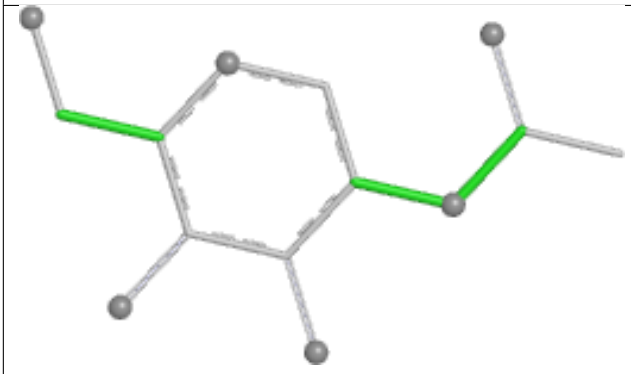
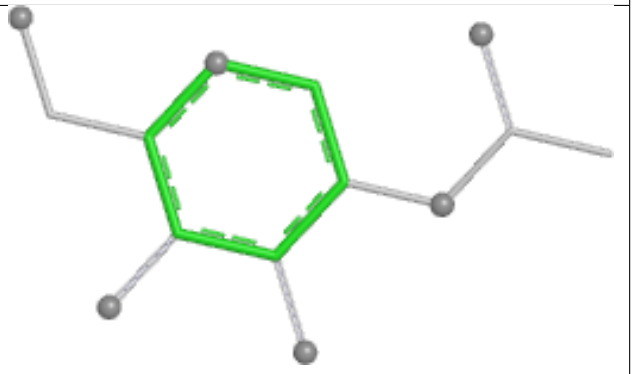


Bond angles

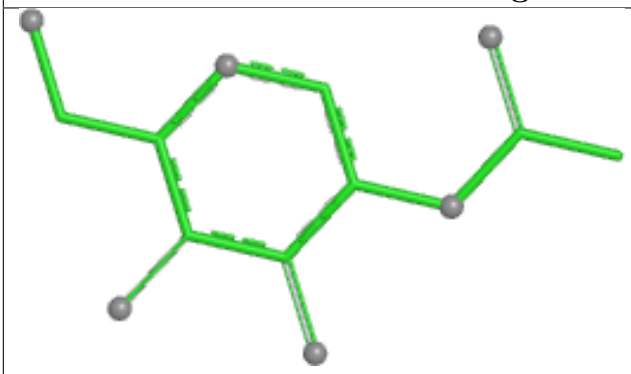


Torsions

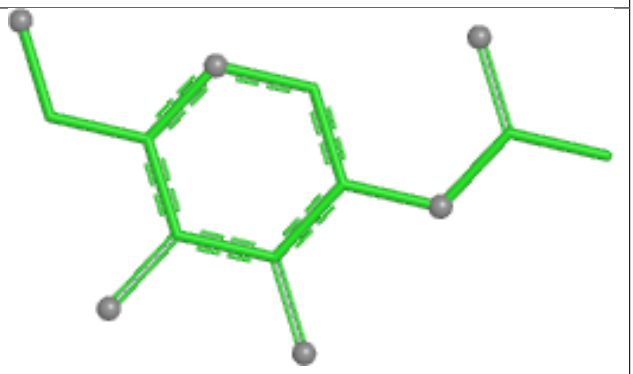


Rings

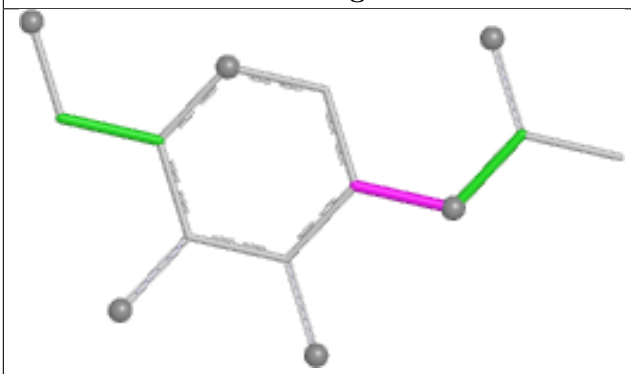
Ligand NAG C 1206



Bond lengths



Bond angles



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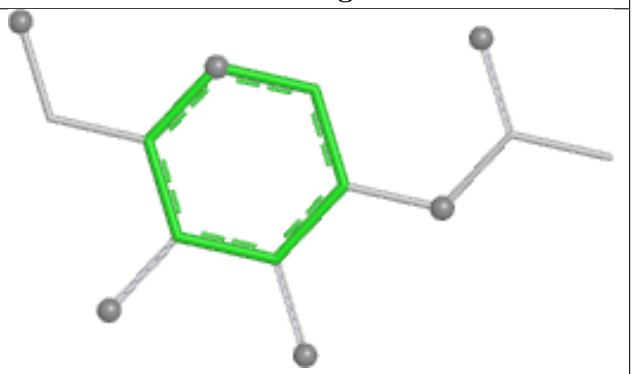
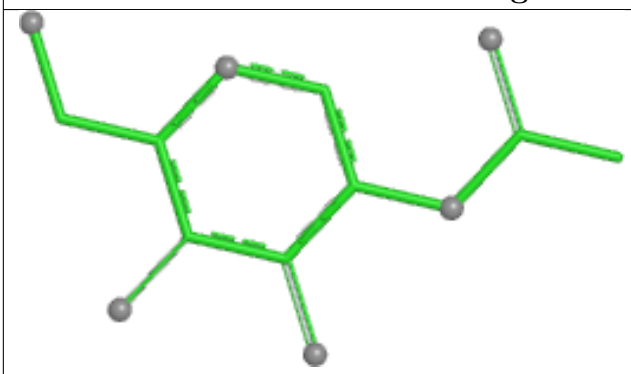


Rings

Ligand NAG A 1208



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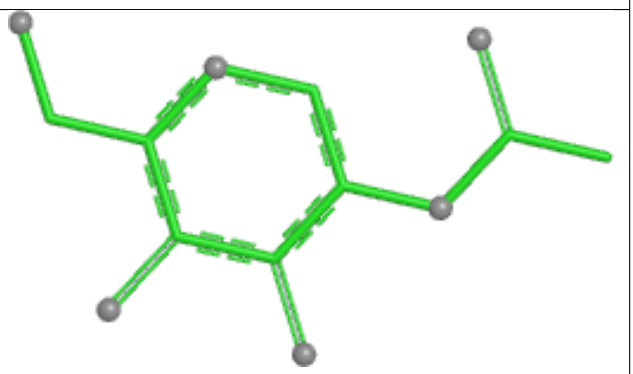
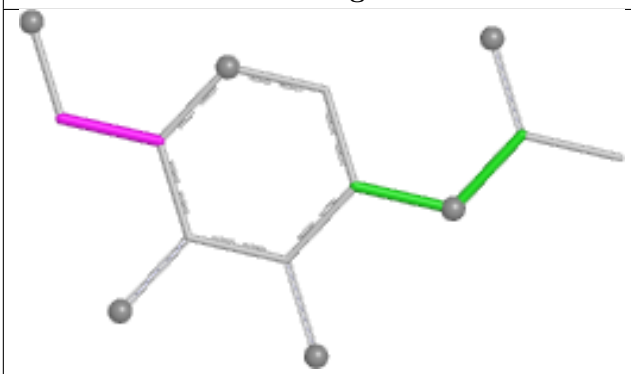


Bond angles



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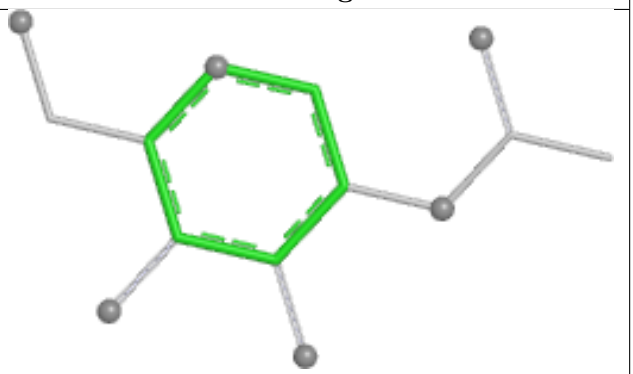
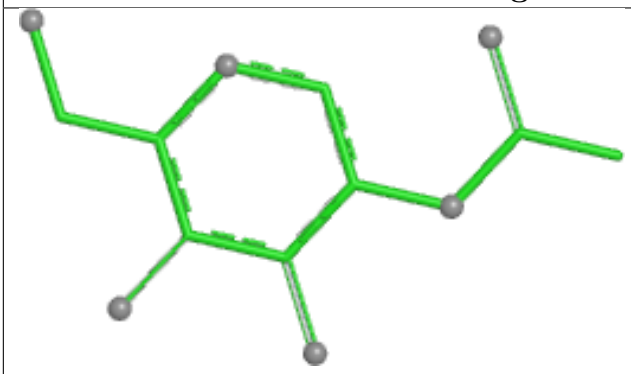


Rings

Ligand NAG A 1206



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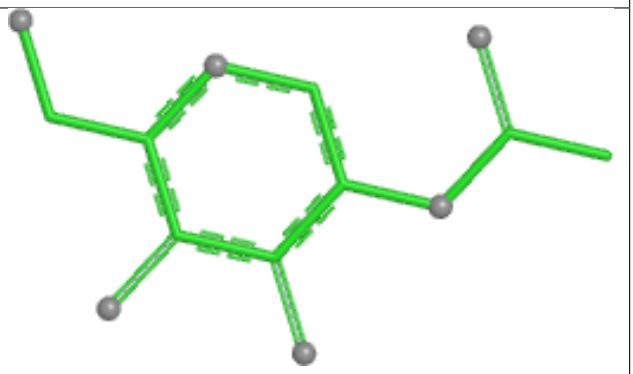
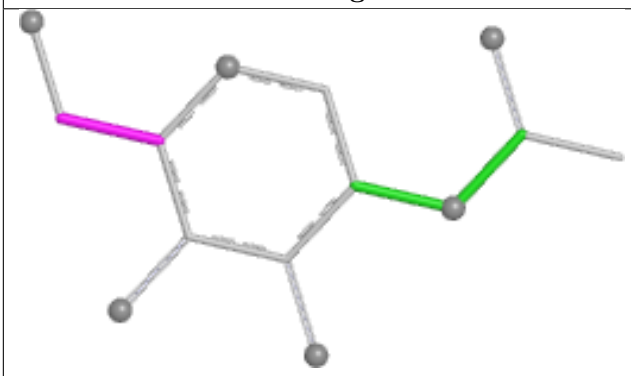


Bond angles



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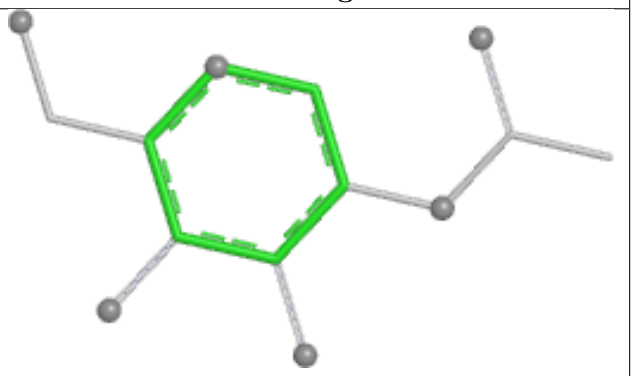
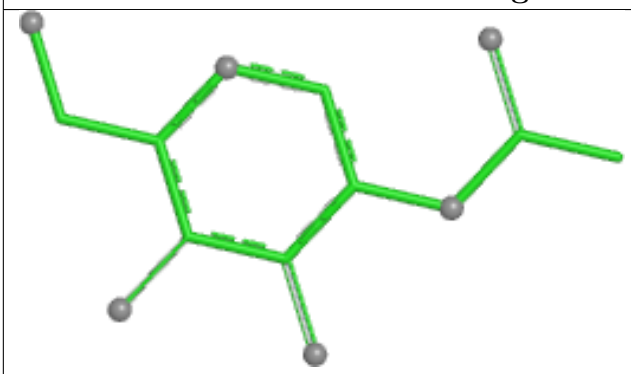


Rings

Ligand NAG C 1205



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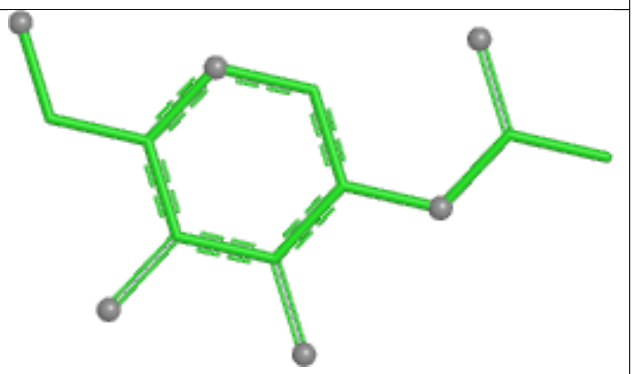
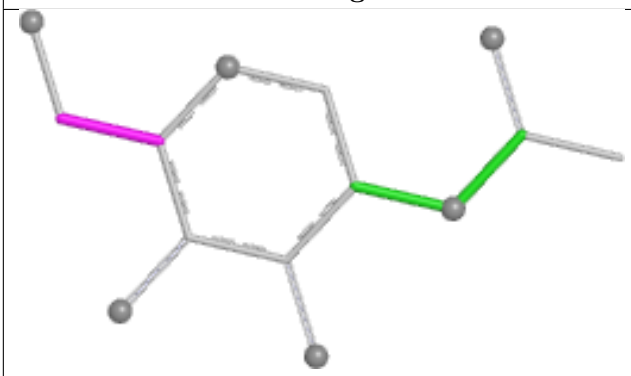
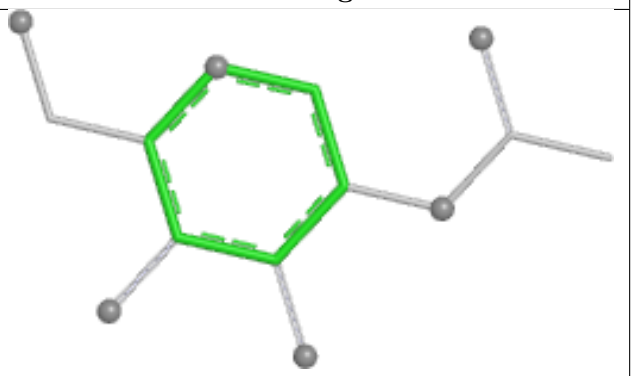


Bond angles

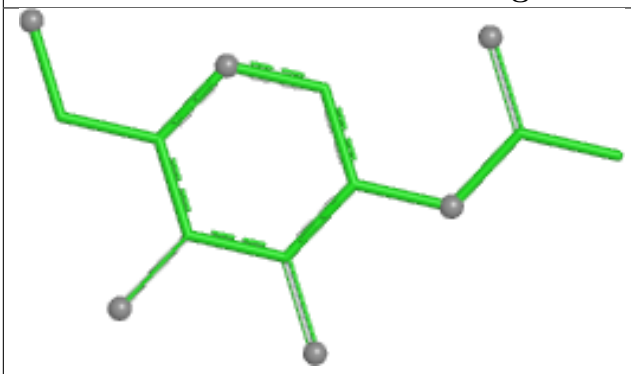


Torsions



Rings

Ligand NAG B 1303



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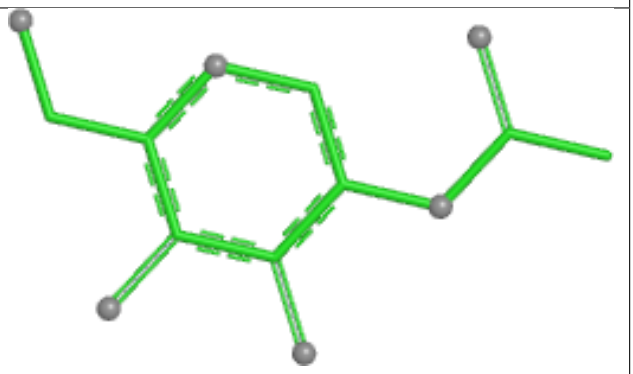
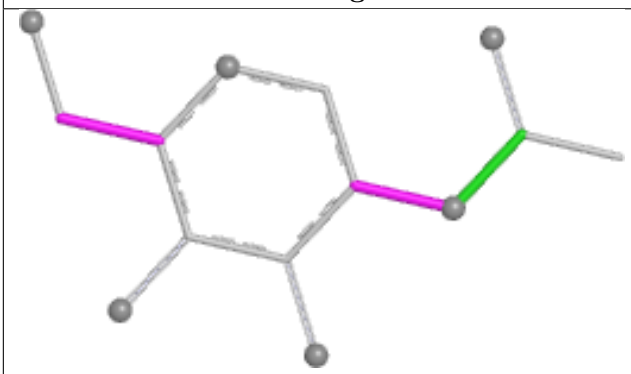


Bond angles



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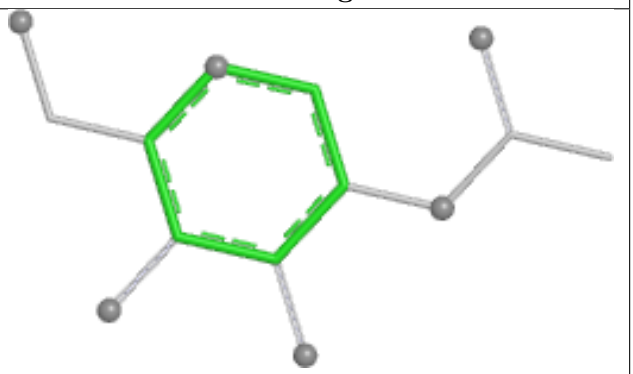
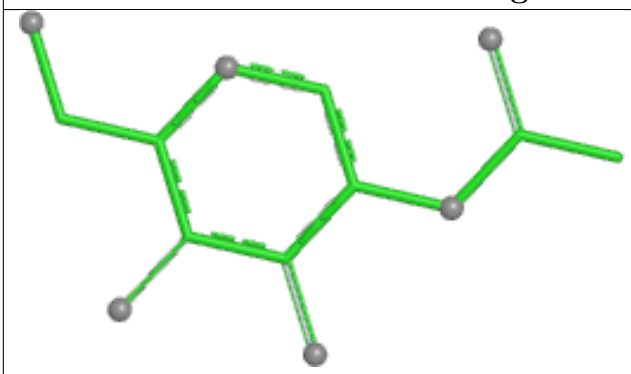
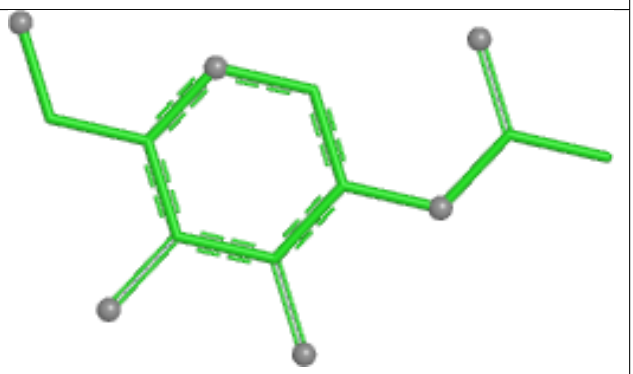


Rings

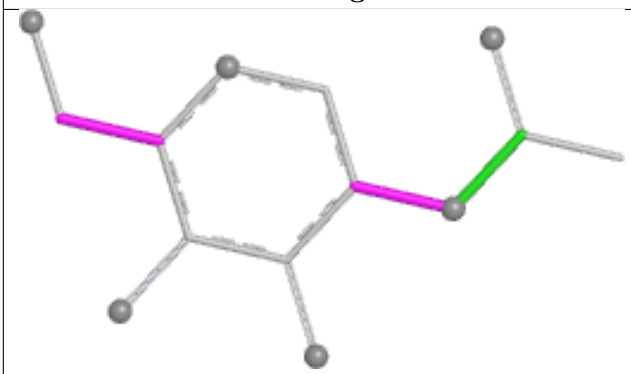
Ligand NAG A 1203



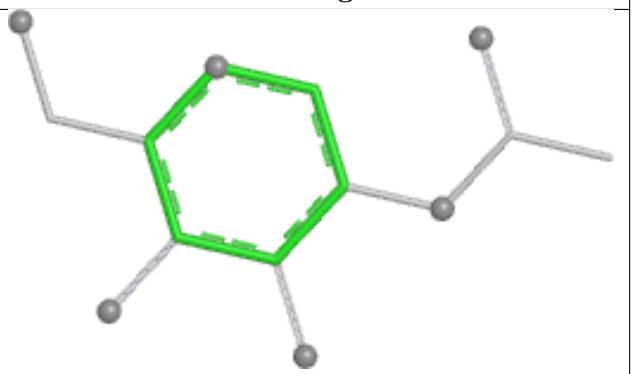
Bond lengths



Bond angles

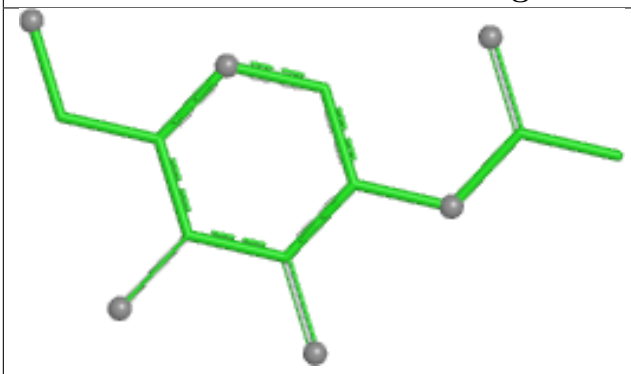


Torsions



Rings

Ligand NAG B 1306



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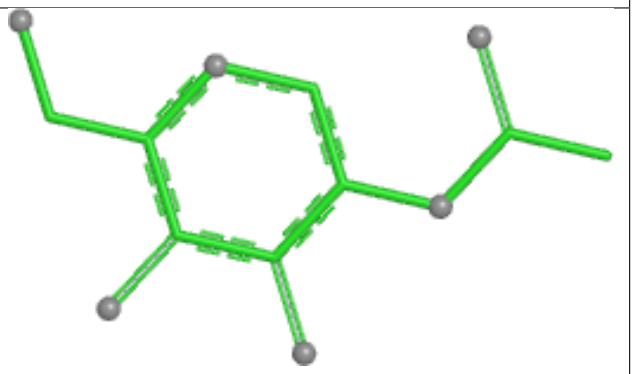
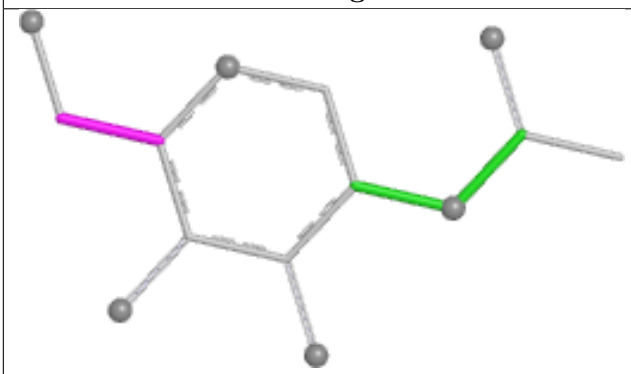
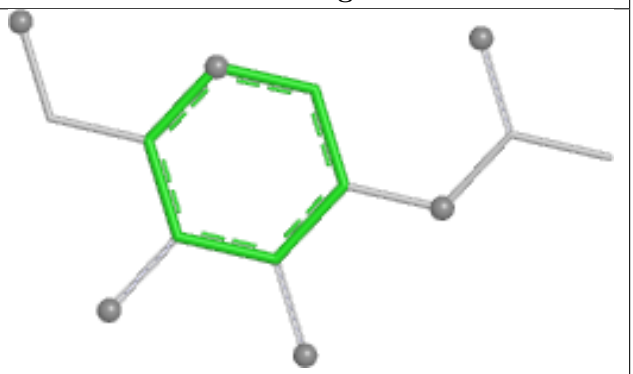


Bond angles

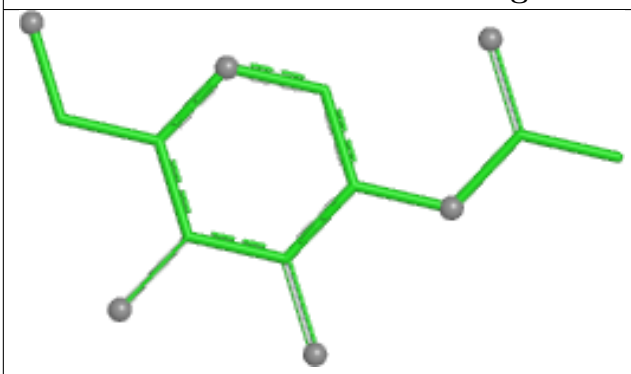


Torsions



Rings

Ligand NAG A 1201



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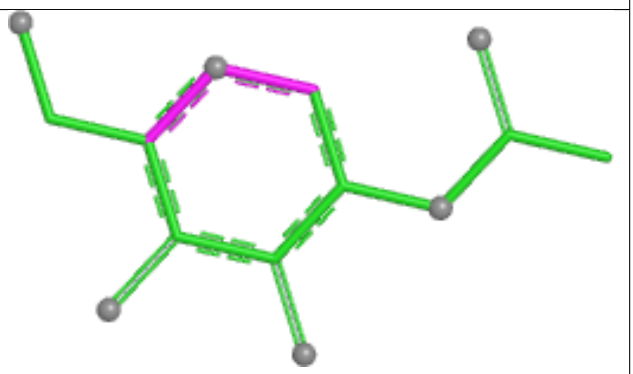
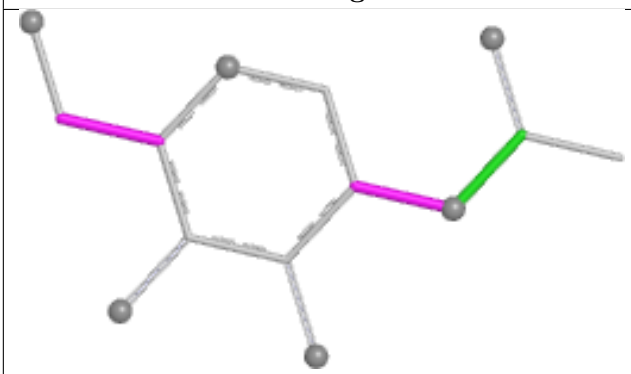
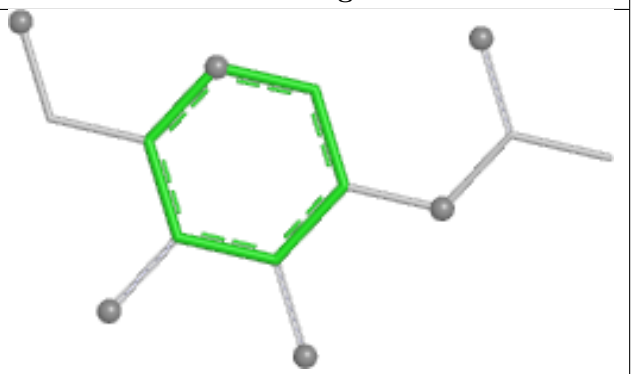


Bond angles

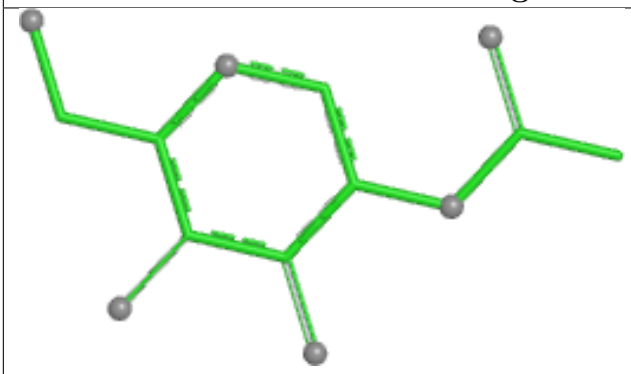


Torsions



Rings

Ligand NAG C 1207



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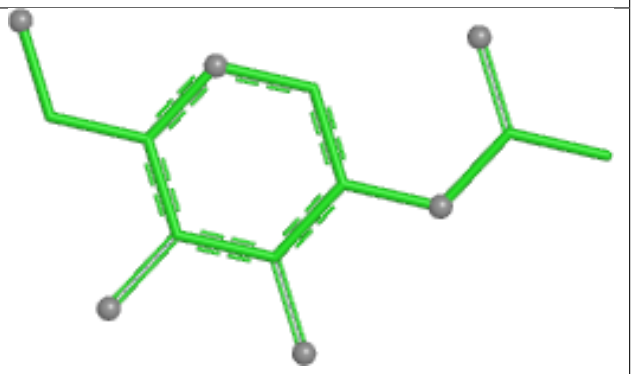
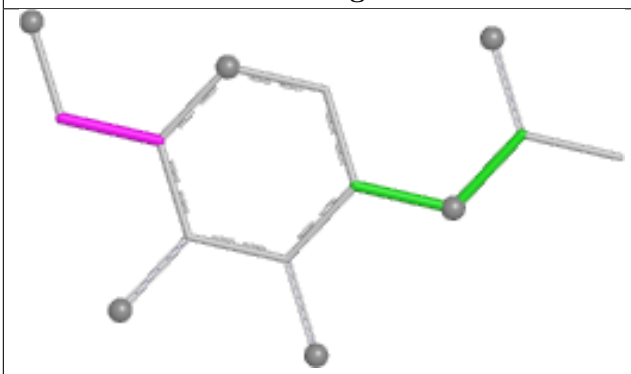
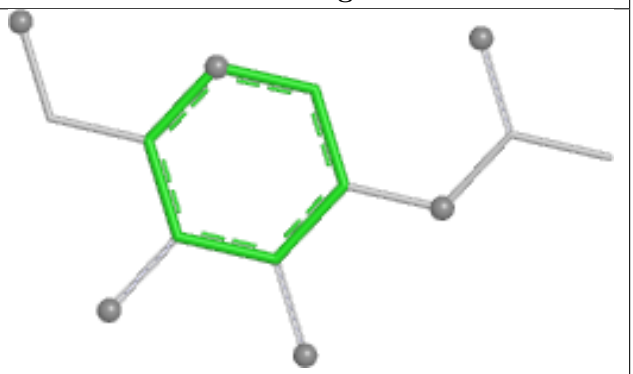


Bond angles

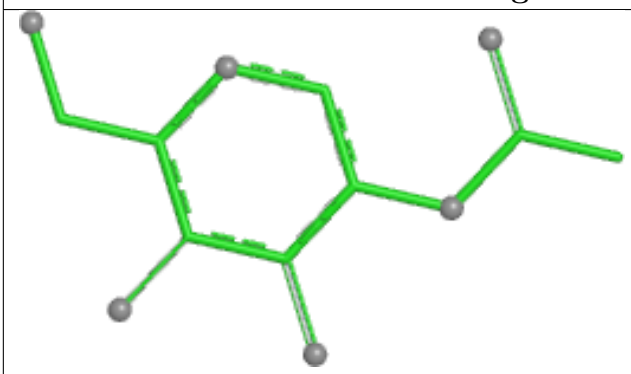


Torsions

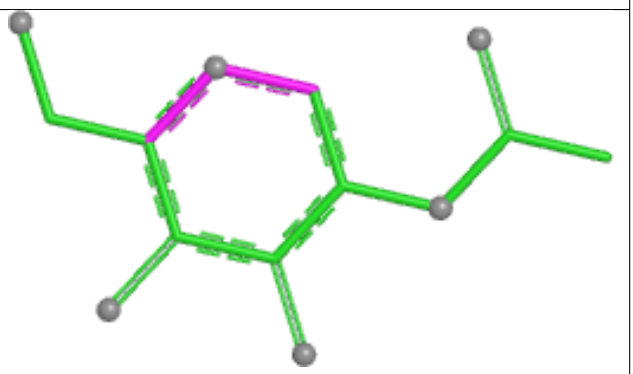


Rings

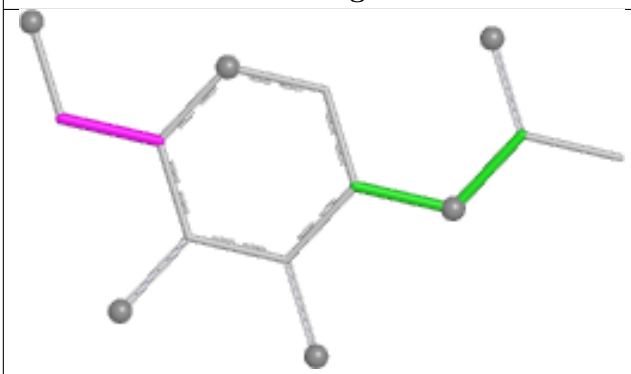
Ligand NAG C 1202



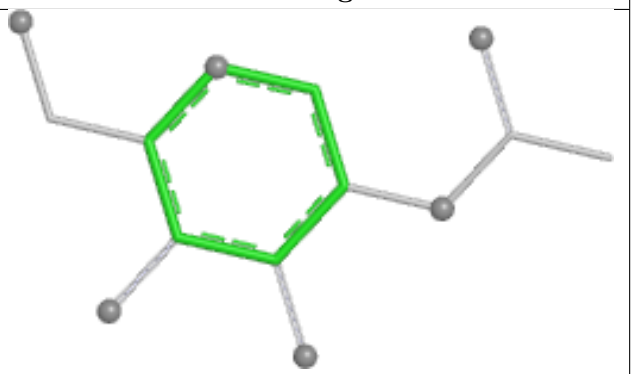
Bond lengths



Bond angles

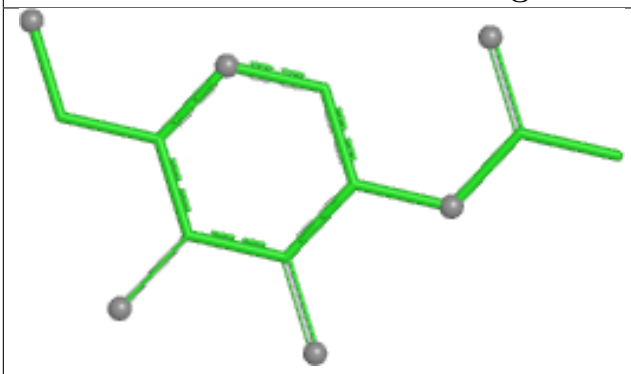


Torsions

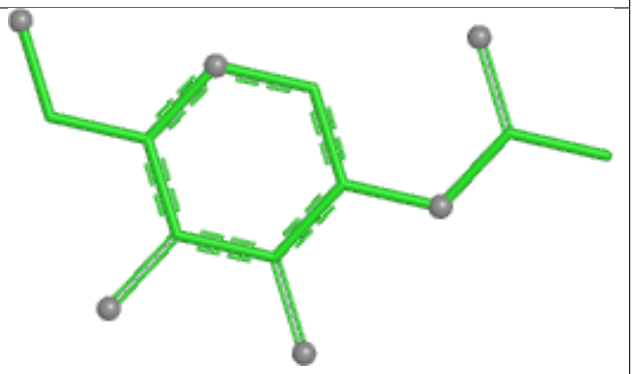


Rings

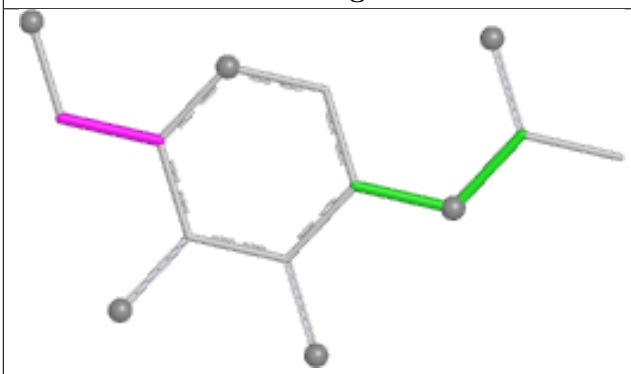
Ligand NAG C 1204



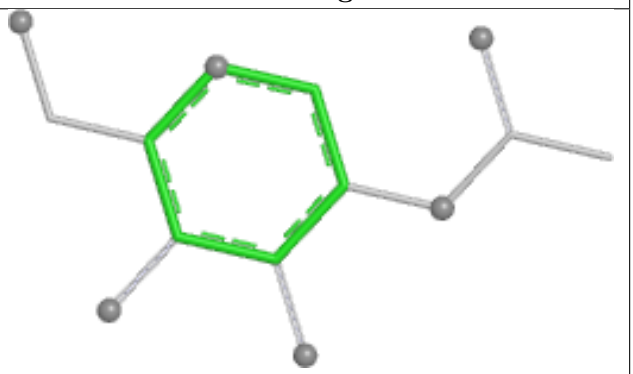
Bond lengths



Bond angles

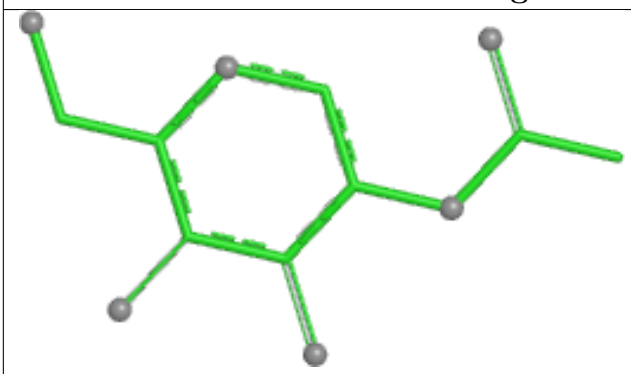


Torsions

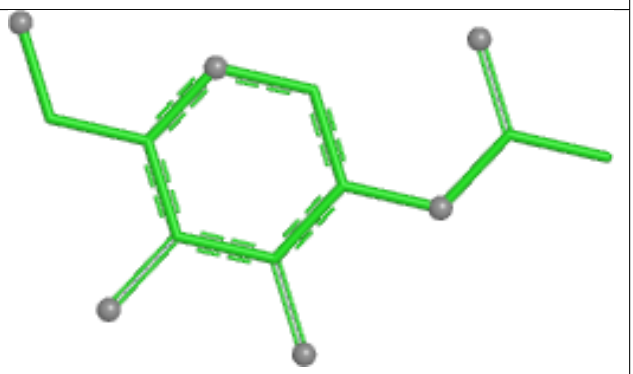


Rings

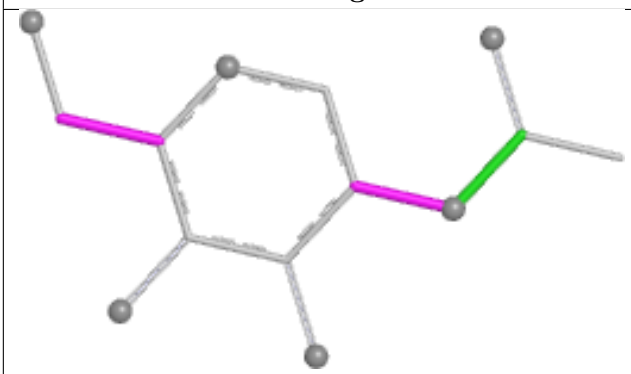
Ligand NAG A 1209



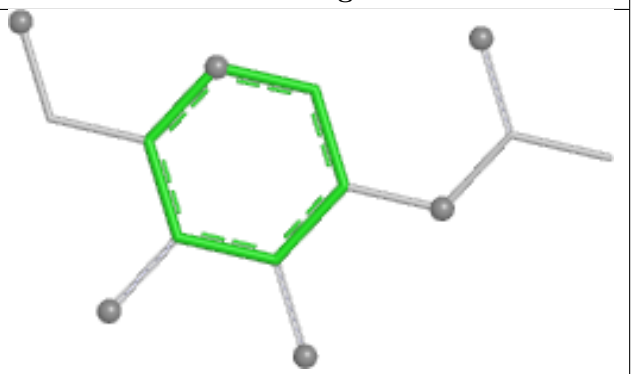
Bond lengths



Bond angles

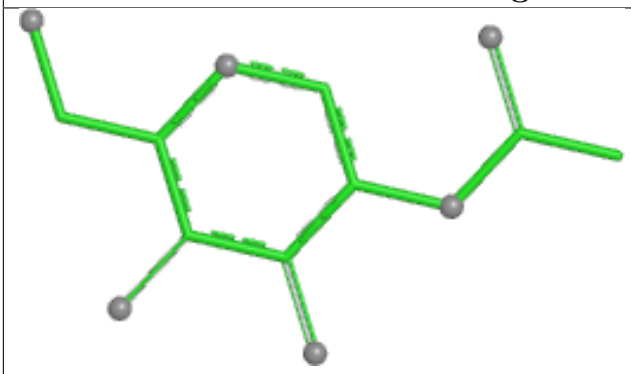


Torsions

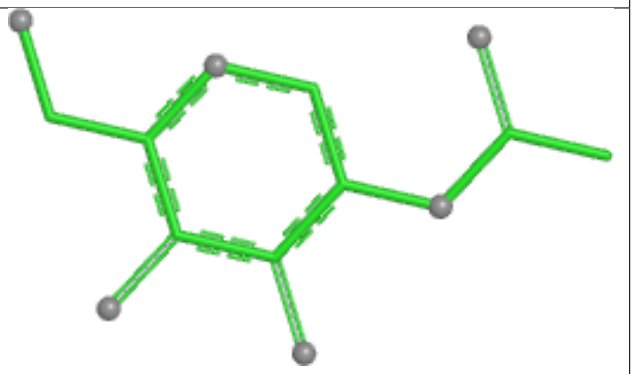


Rings

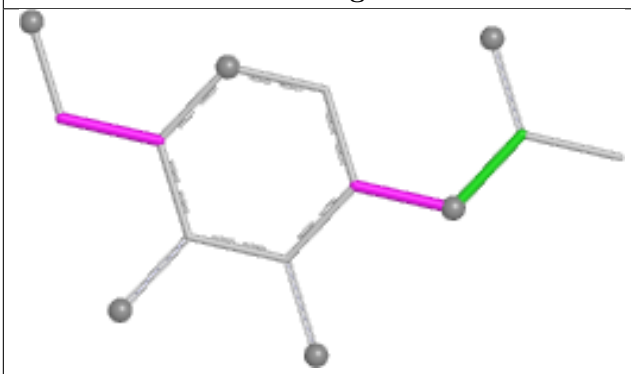
Ligand NAG C 1203



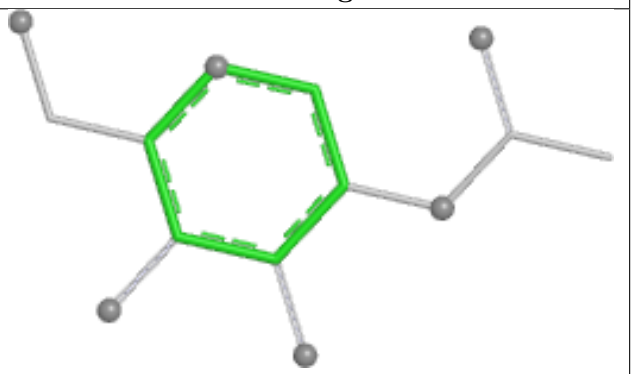
Bond lengths



Bond angles

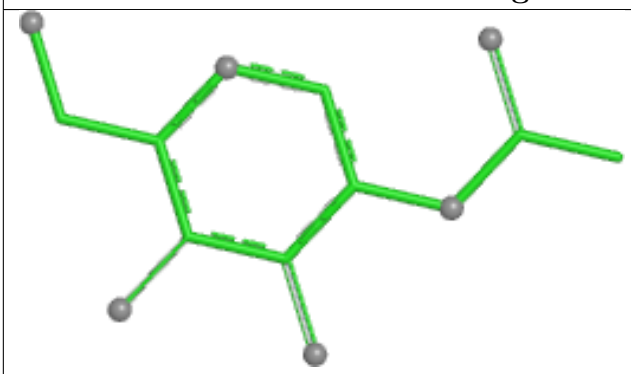


Torsions

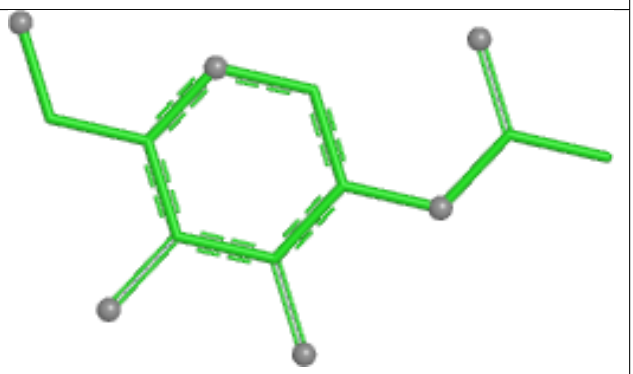


Rings

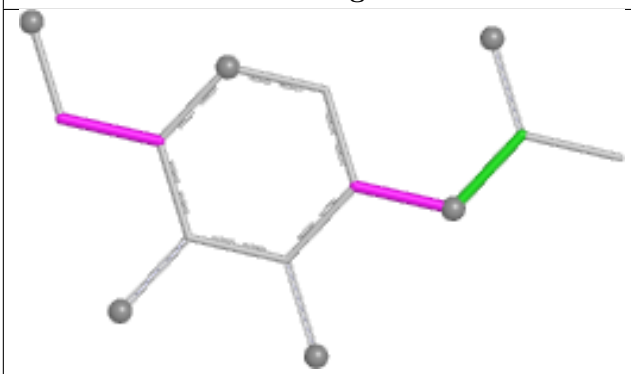
Ligand NAG B 1304



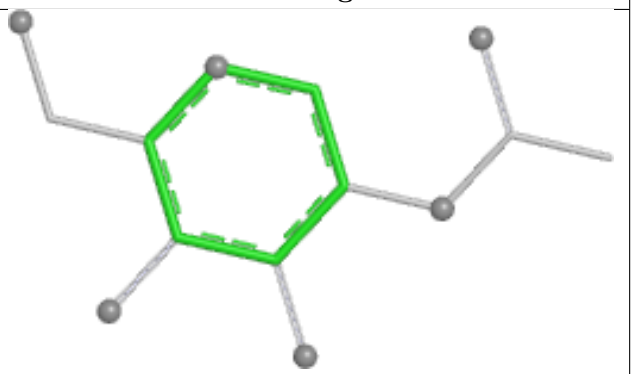
Bond lengths



Bond angles

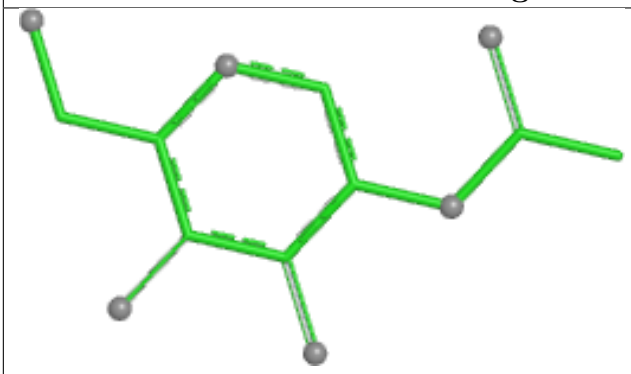


Torsions

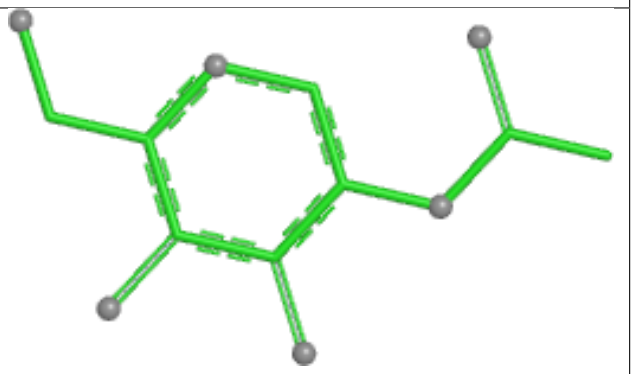


Rings

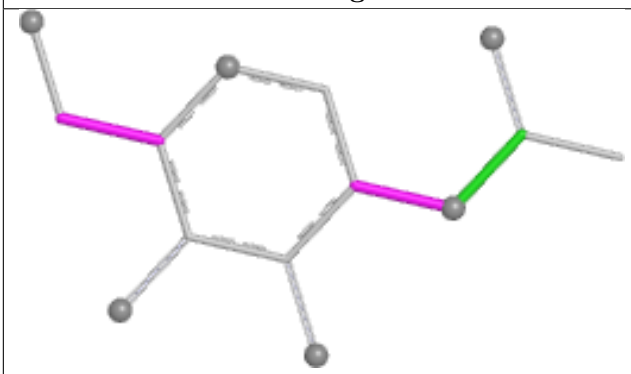
Ligand NAG C 1201



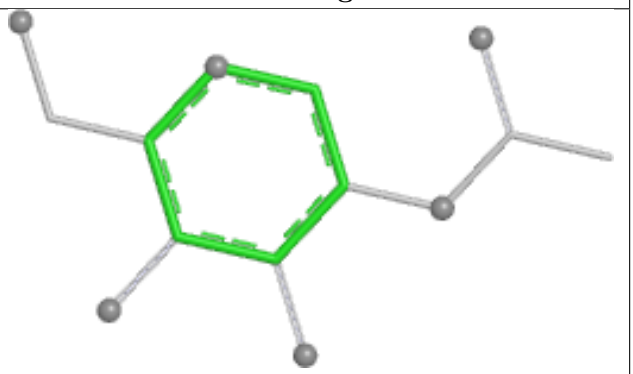
Bond lengths



Bond angles

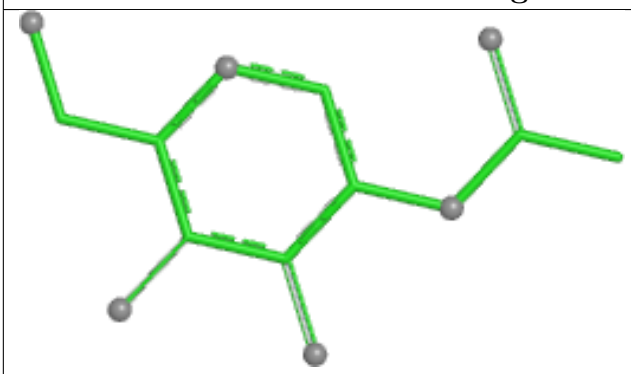


Torsions

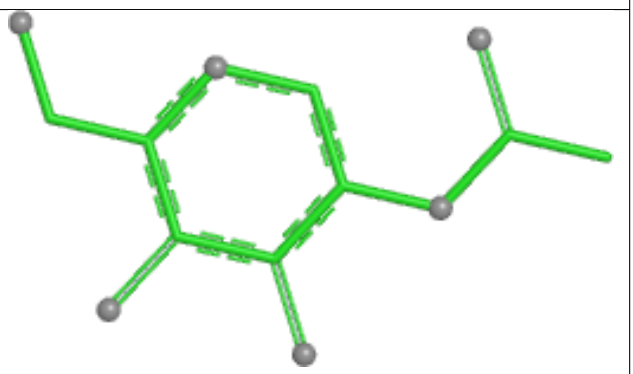


Rings

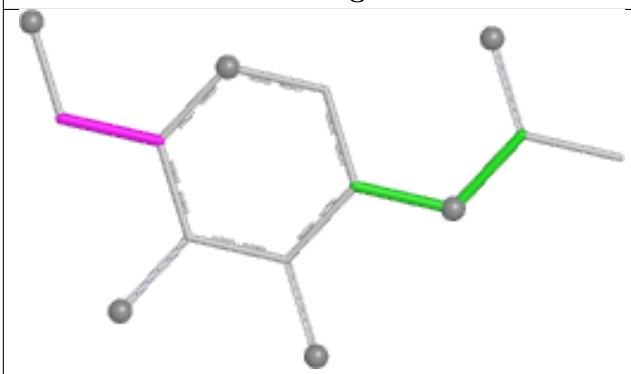
Ligand NAG A 1204



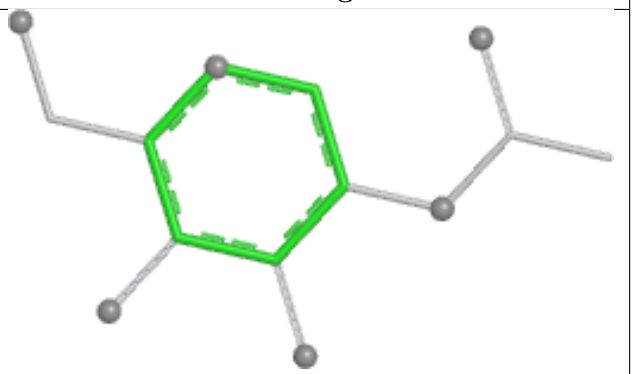
Bond lengths



Bond angles

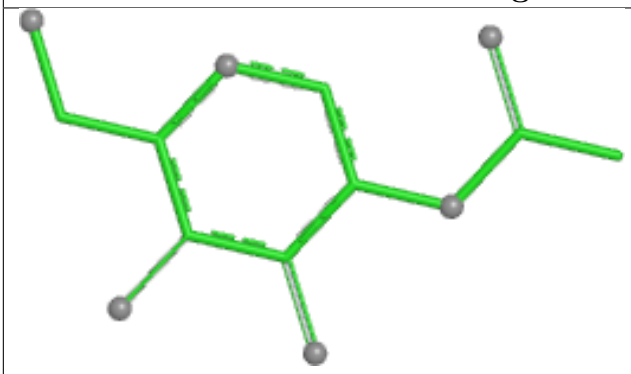


Torsions

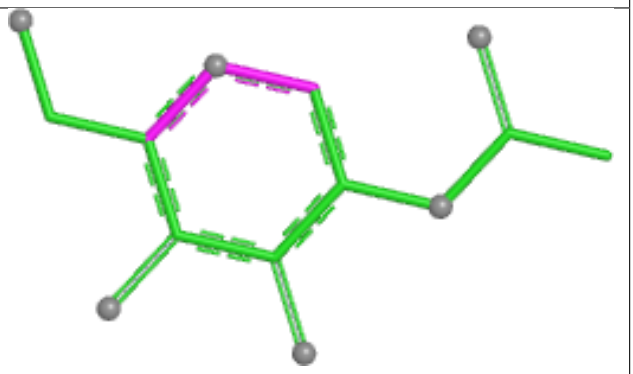


Rings

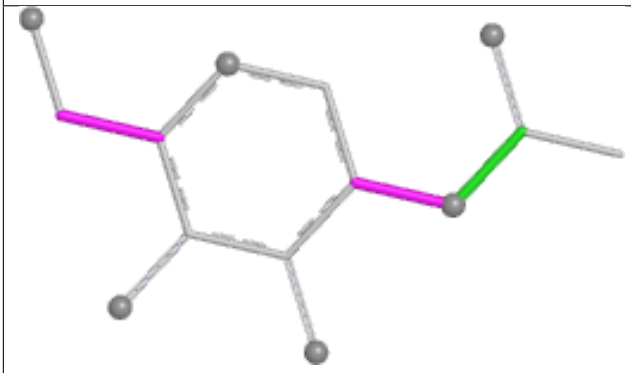
Ligand NAG B 1301



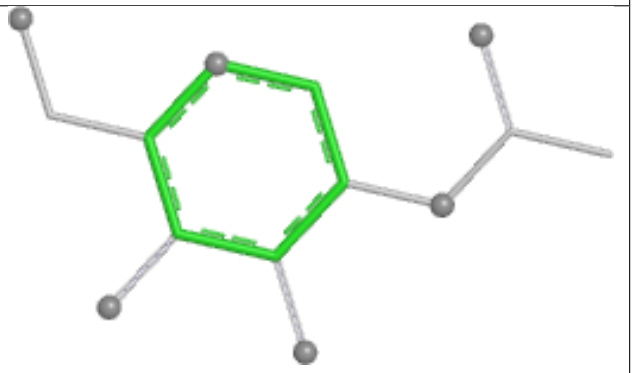
Bond lengths



Bond angles

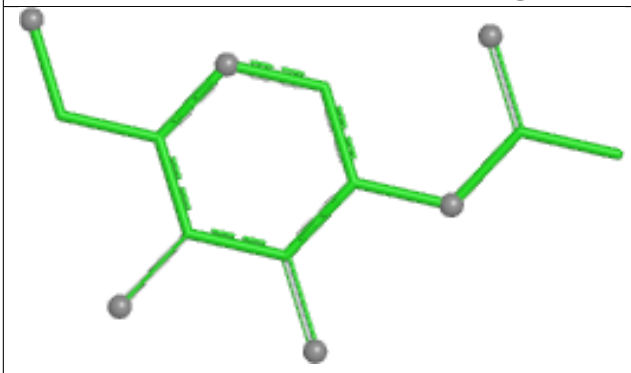


Torsions

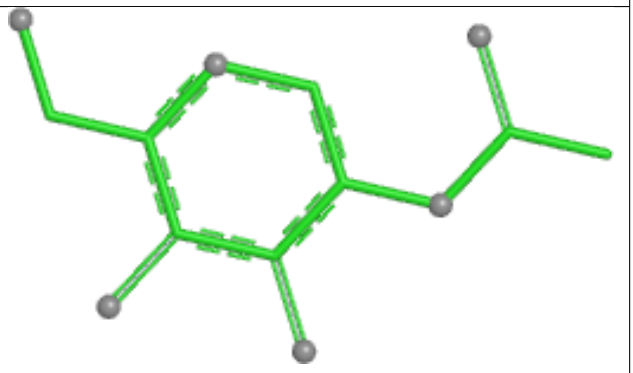


Rings

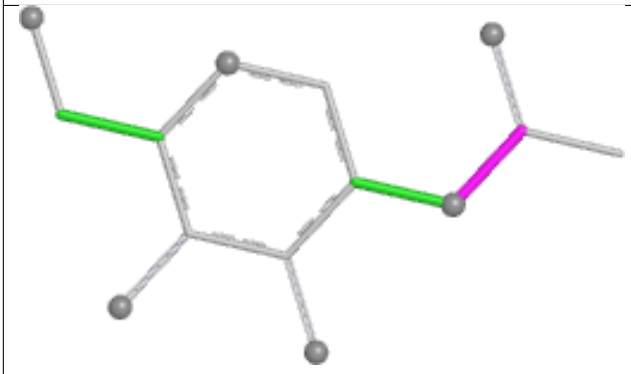
Ligand NAG B 1307



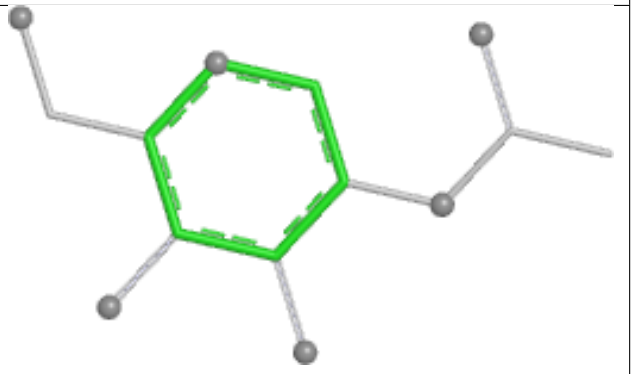
Bond lengths



Bond angles

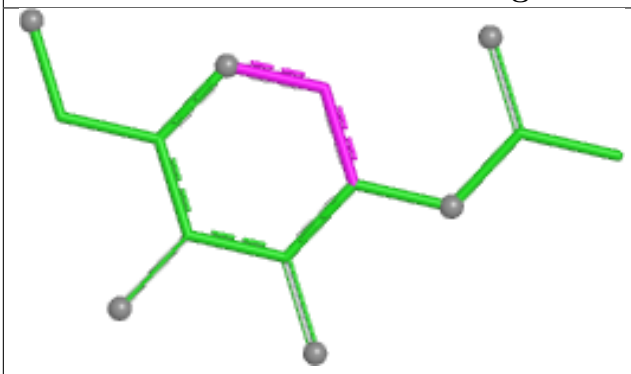


Torsions

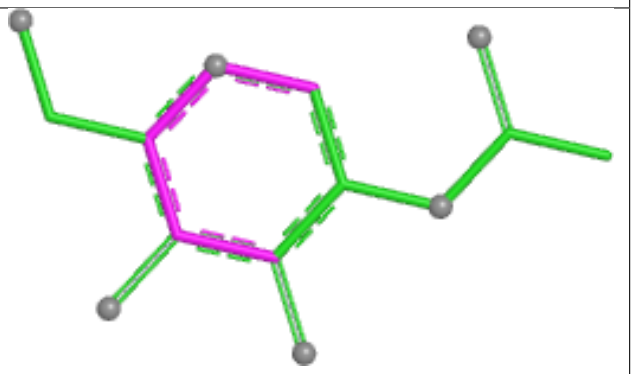


Rings

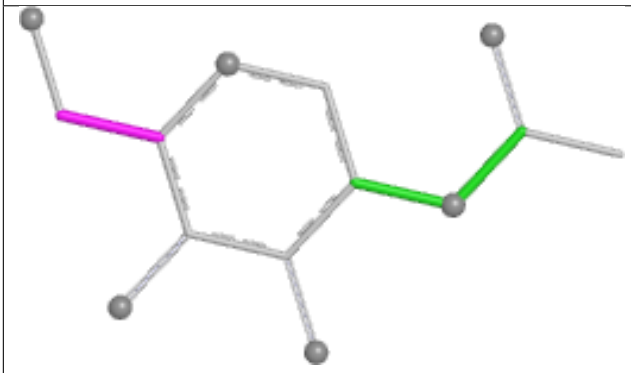
Ligand NAG B 1305



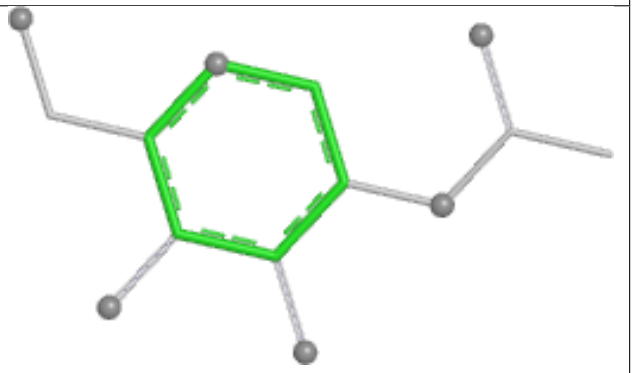
Bond lengths



Bond angles

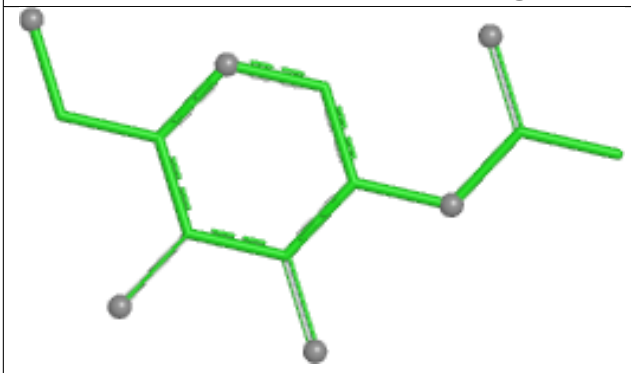


Torsions

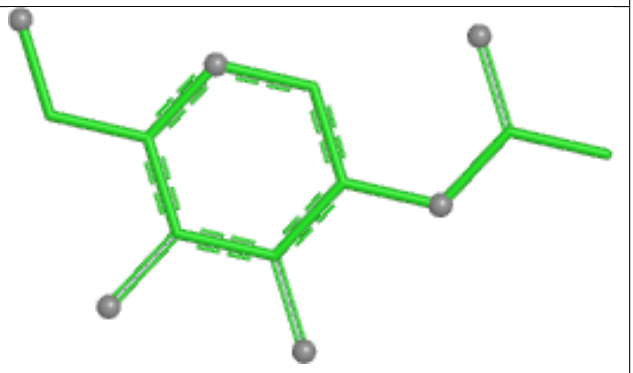


Rings

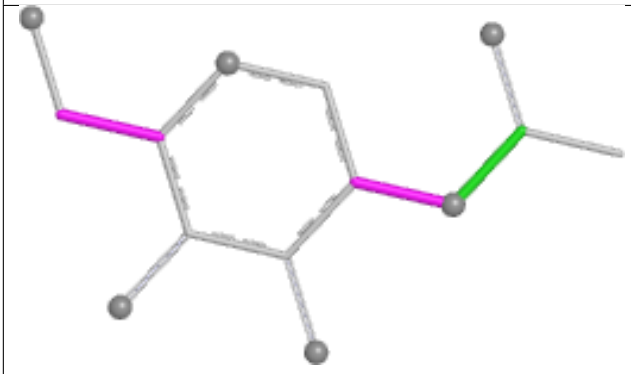
Ligand NAG A 1207



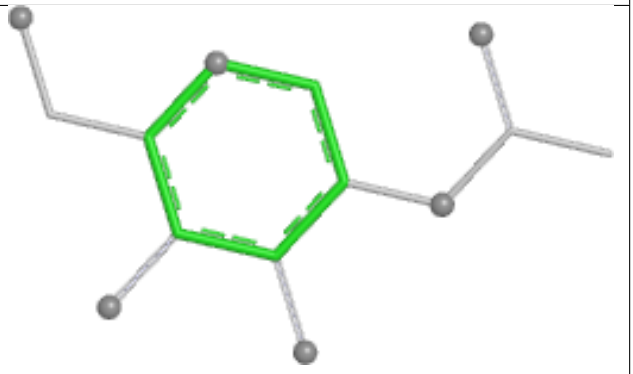
Bond lengths



Bond angles



Torsions



Rings

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

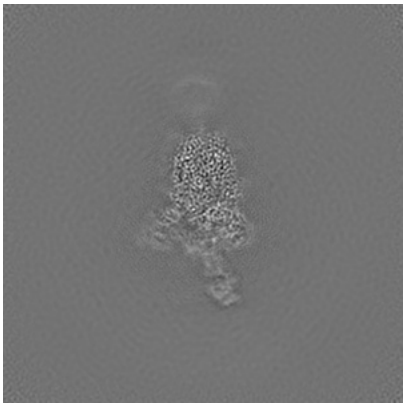
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-28688. These allow visual inspection of the internal detail of the map and identification of artifacts.

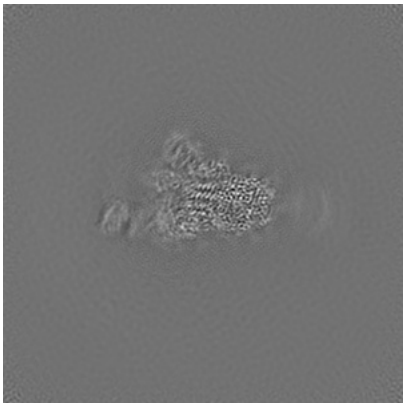
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections

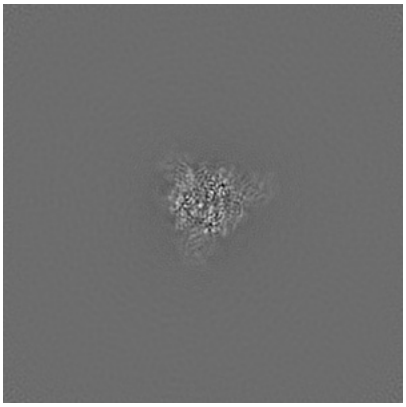
6.1.1 Primary map



X



Y

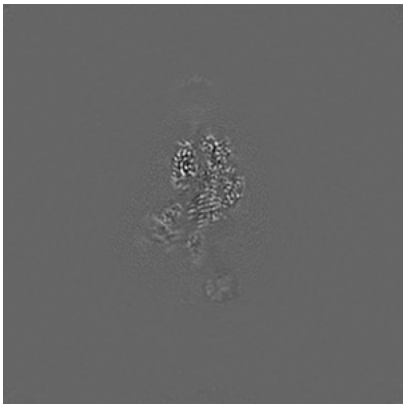


Z

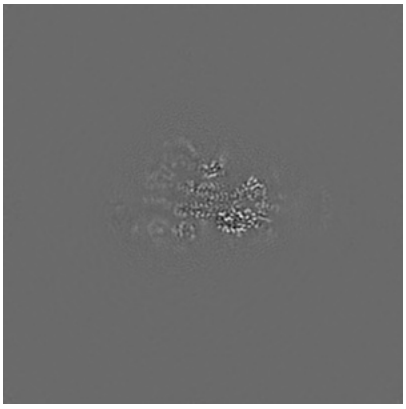
The images above show the map projected in three orthogonal directions.

6.2 Central slices

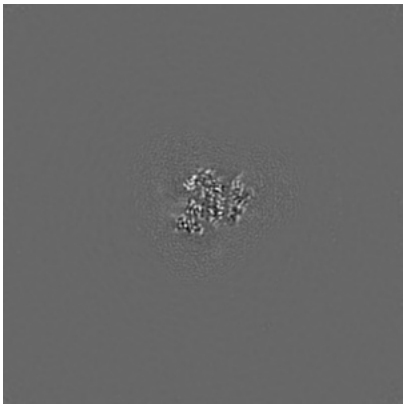
6.2.1 Primary map



X Index: 208



Y Index: 208



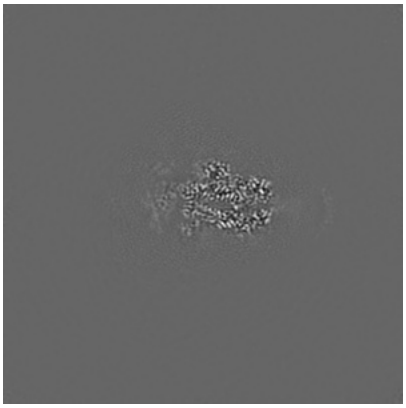
Z Index: 208

The images above show central slices of the map in three orthogonal directions.

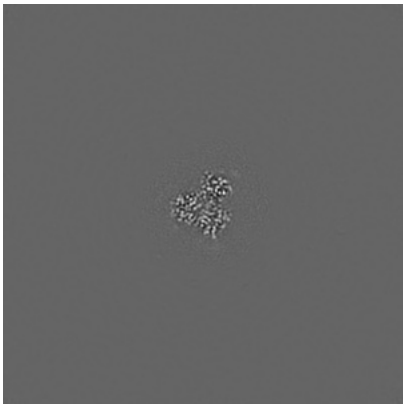
6.3 Largest variance slices (i)

6.3.1 Primary map

X Index: 219



Y Index: 198

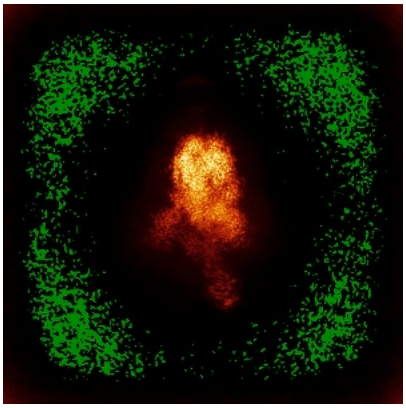


Z Index: 246

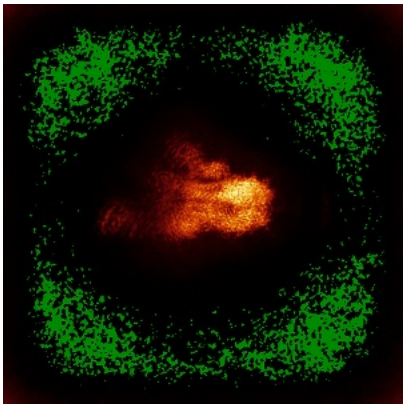
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) (i)

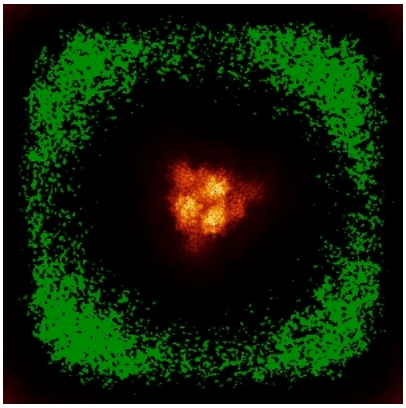
6.4.1 Primary map



X



Y



Z

The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views (i)

6.5.1 Primary map

X Y Z

The images above show the 3D surface view of the map at the recommended contour level 5.0. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

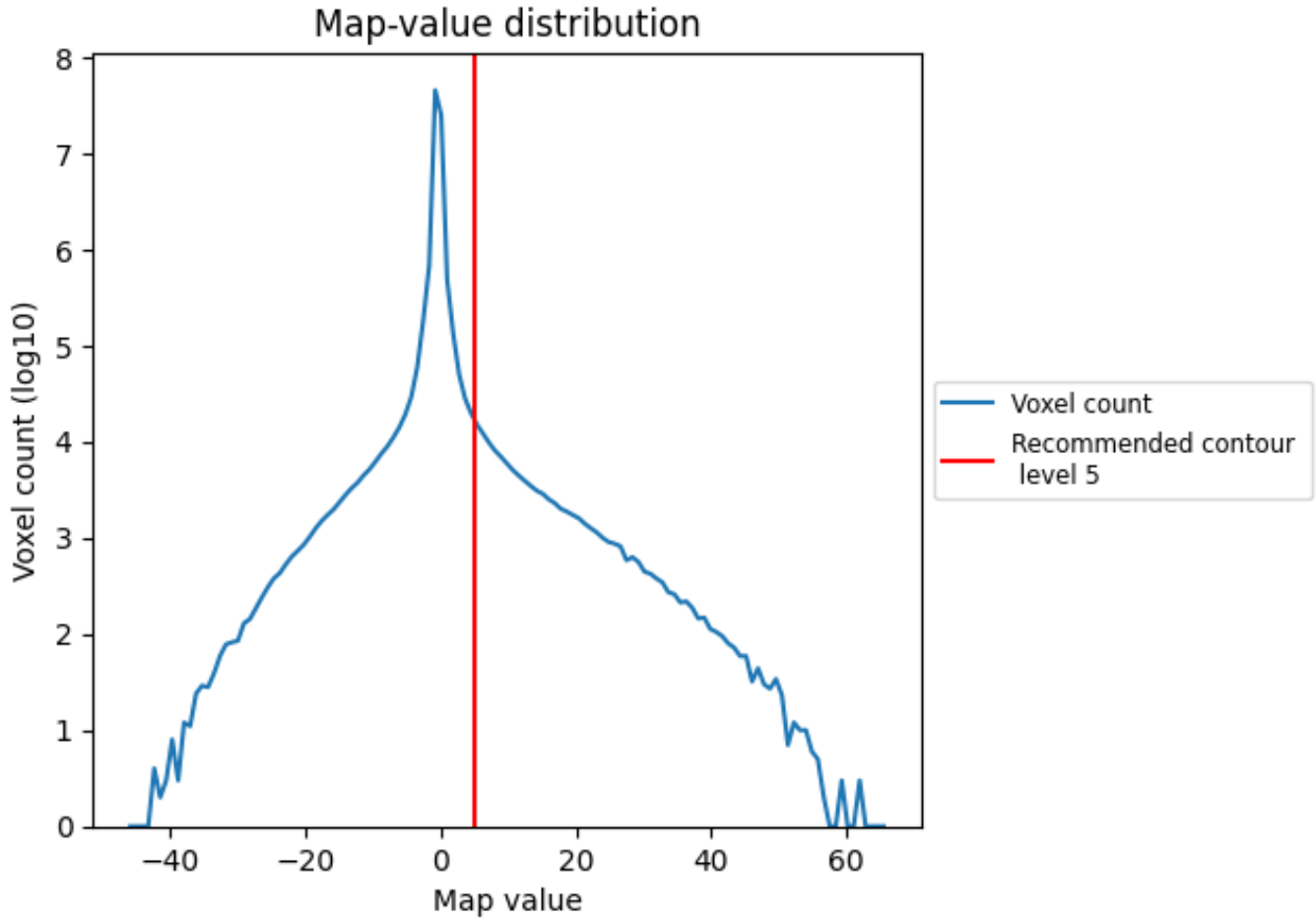
6.6 Mask visualisation (i)

This section was not generated. No masks/segmentation were deposited.

7 Map analysis

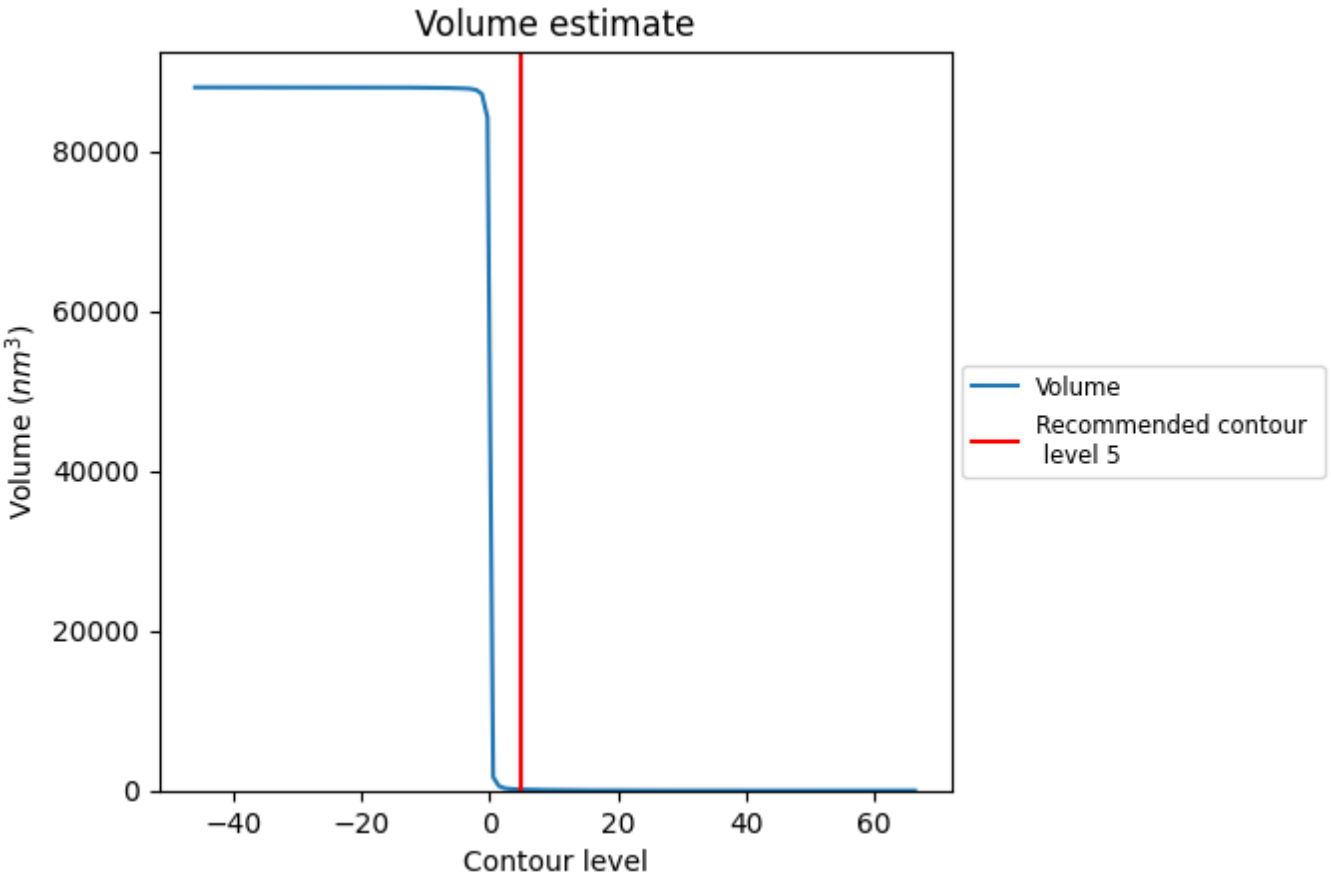
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution



The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

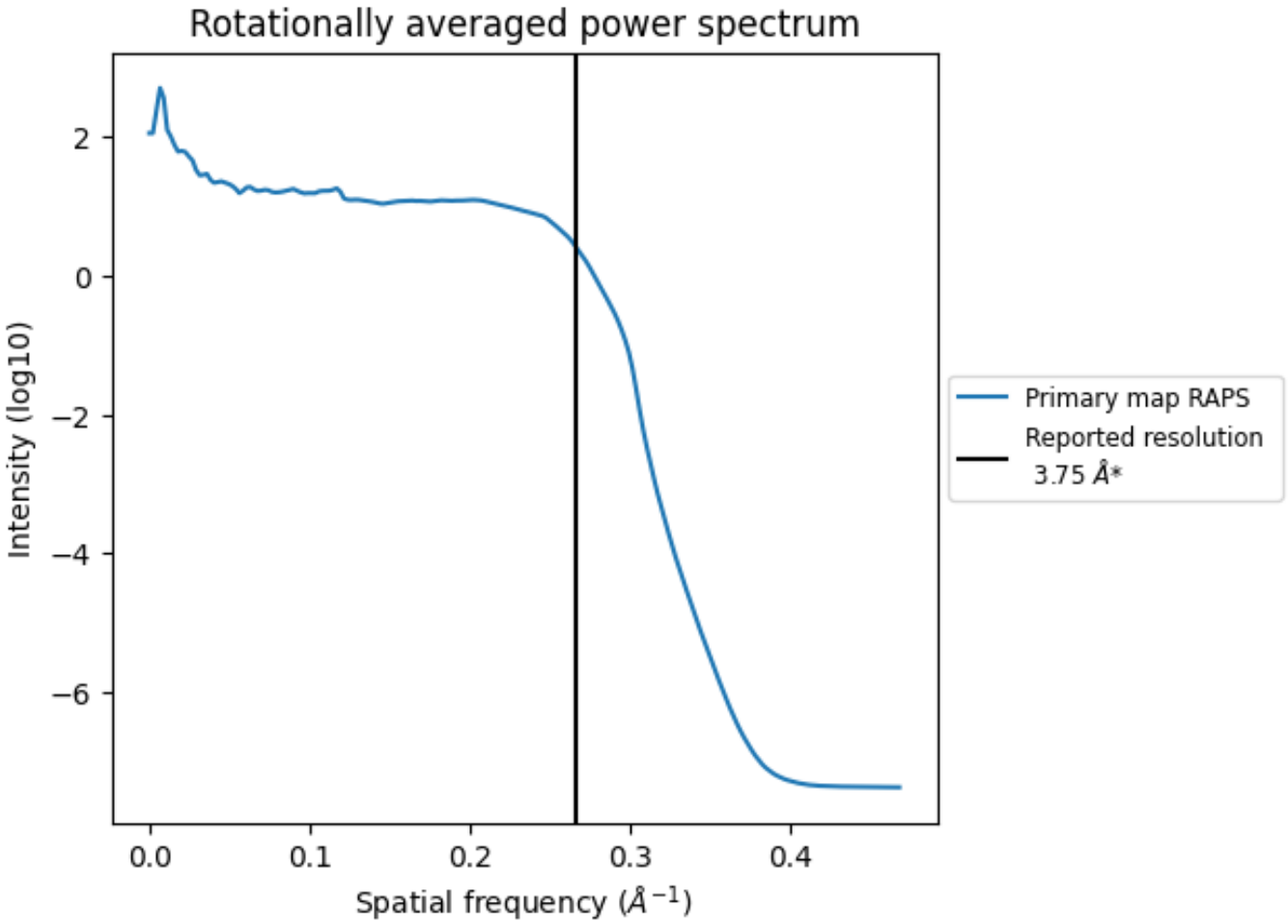
7.2 Volume estimate (i)



The volume at the recommended contour level is 138 nm^3; this corresponds to an approximate mass of 125 kDa.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.

7.3 Rotationally averaged power spectrum (i)

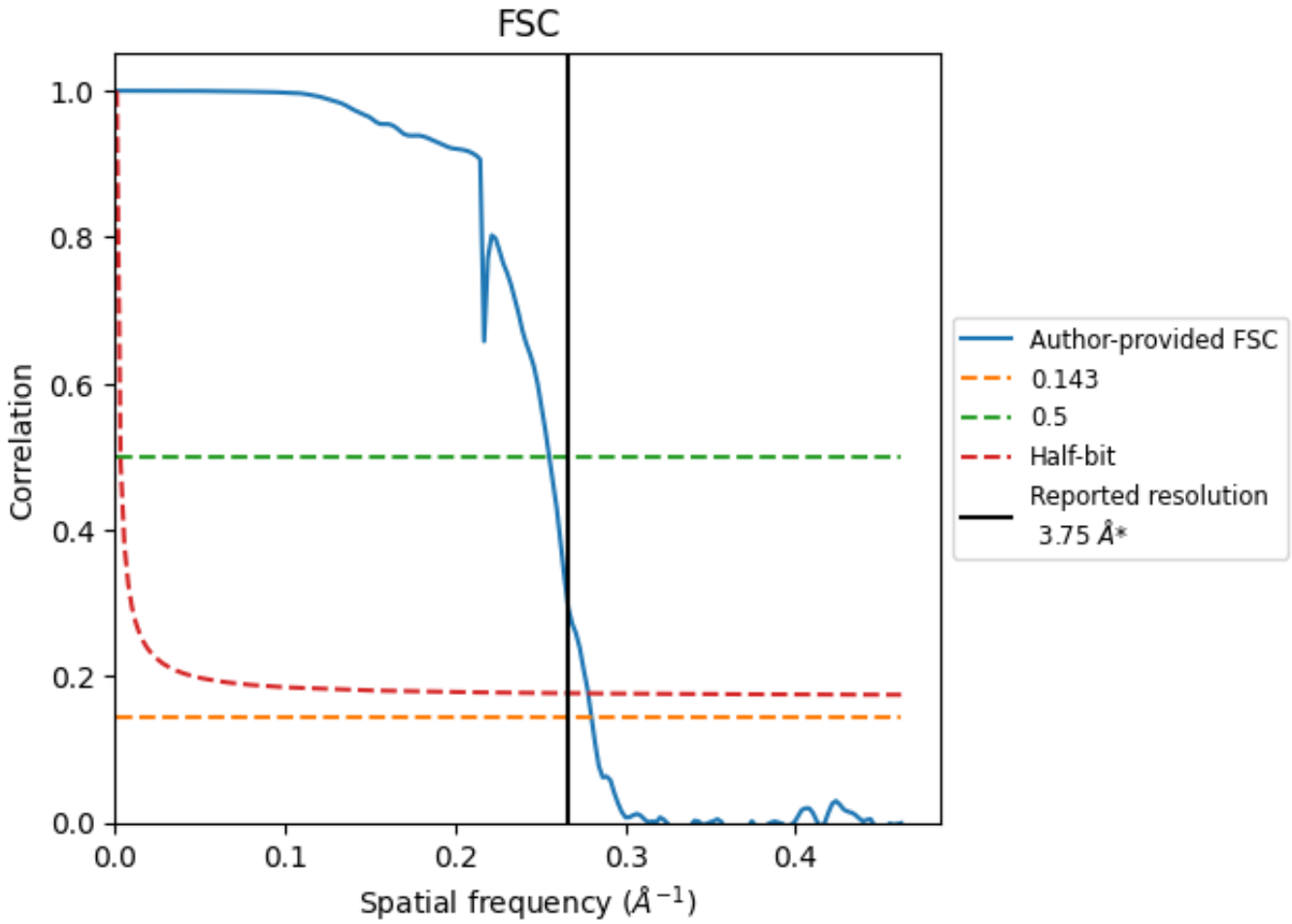


*Reported resolution corresponds to spatial frequency of 0.267 Å^{-1}

8 Fourier-Shell correlation

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

8.1 FSC



*Reported resolution corresponds to spatial frequency of 0.267 Å^{-1}

8.2 Resolution estimates (i)

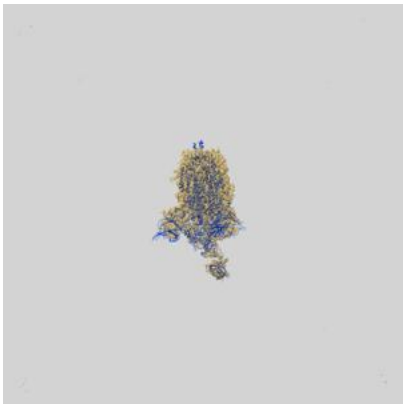
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	-	3.75	-
Author-provided FSC curve	3.57	3.92	3.60
Unmasked-calculated*	-	-	-

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

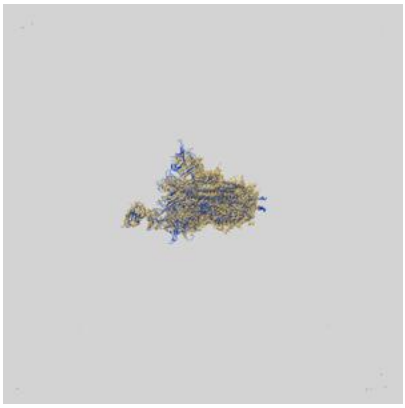
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-28688 and PDB model 8EYH. Per-residue inclusion information can be found in section 3 on page 8.

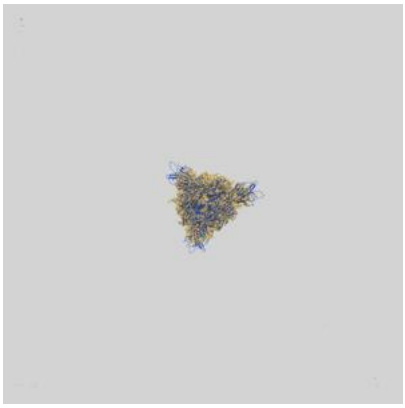
9.1 Map-model overlay



X



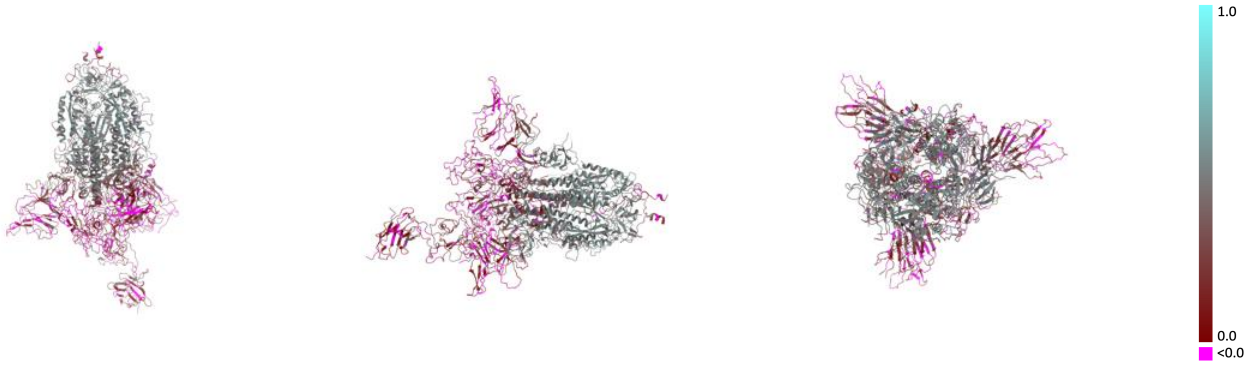
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 5.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

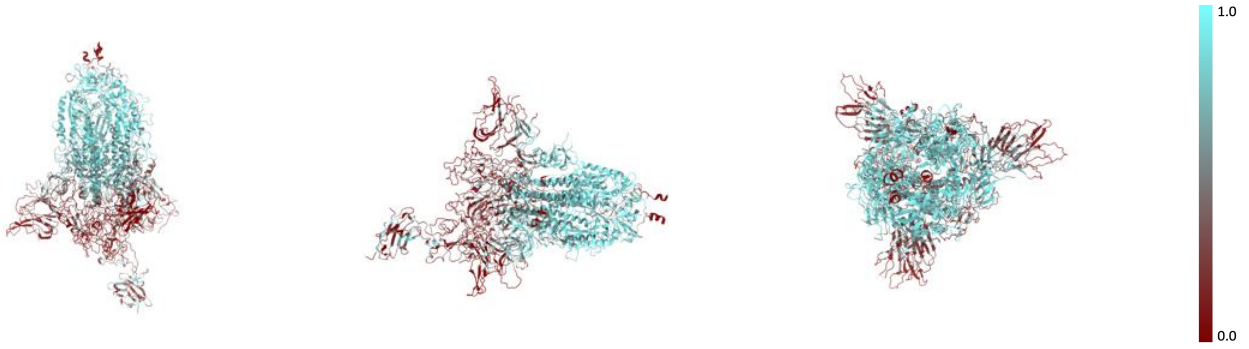
9.2 Q-score mapped to coordinate model (i)



X Y Z

The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

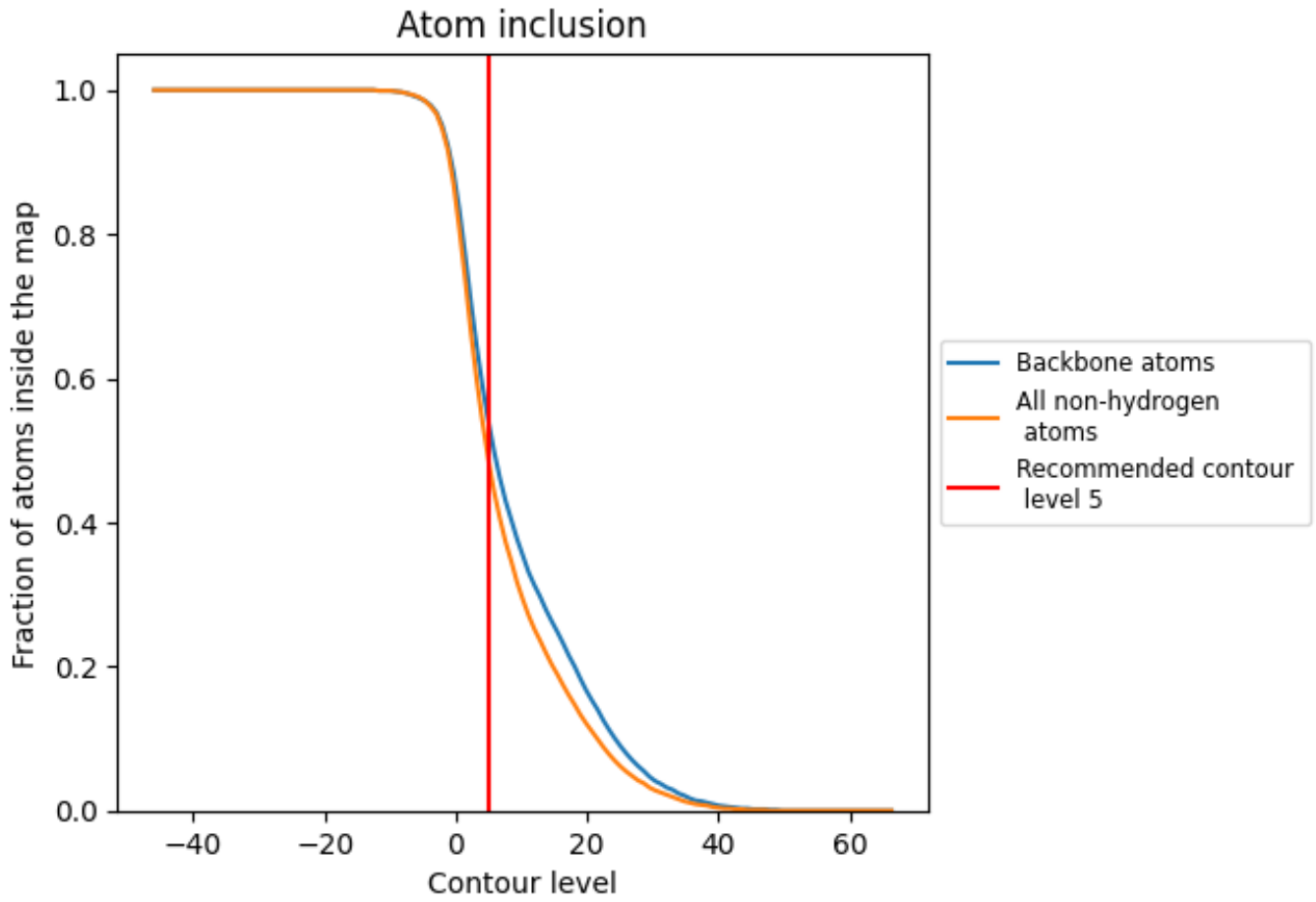
9.3 Atom inclusion mapped to coordinate model (i)



X Y Z

The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (5).

9.4 Atom inclusion (i)



At the recommended contour level, 54% of all backbone atoms, 48% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary

The table lists the average atom inclusion at the recommended contour level (5) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.4850	0.2870
A	0.4980	0.3080
B	0.5100	0.3000
C	0.4630	0.2720
D	0.3500	0.1460
E	0.3210	0.1470
F	0.1790	0.0860
G	0.3570	0.1290
H	0.2140	0.0730
I	0.0710	-0.0470