



Full wwPDB EM Validation Report ⓘ

Mar 10, 2026 – 03:24 AM UTC

PDB ID : 9O4F / pdb_00009o4f
EMDB ID : EMD-70098
Title : Pre-fusion Stabilized HERV-K Envelope Trimer Ectodomain
Authors : Shek, J.; Sun, C.; Hastie, K.; Saphire, E.O.
Deposited on : 2025-04-08
Resolution : 2.24 Å (reported)
Based on initial model : .

This is a Full wwPDB EM Validation 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:

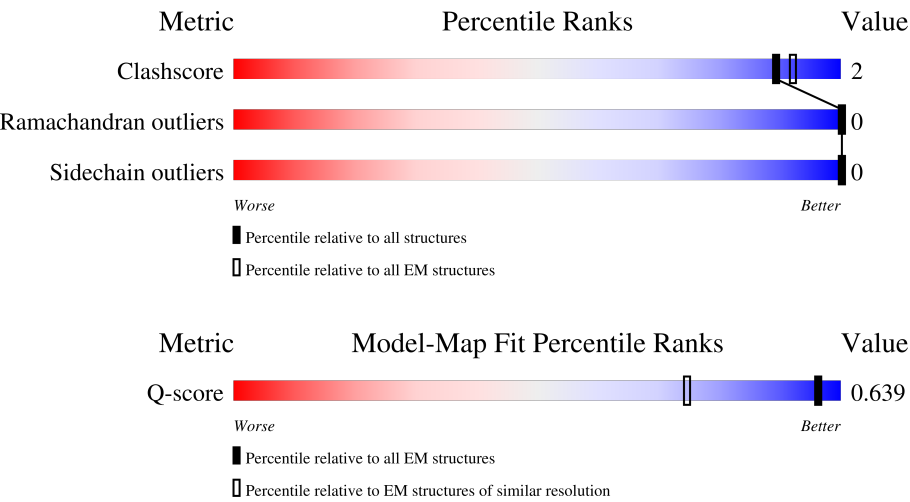
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDb archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

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 2.24 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.



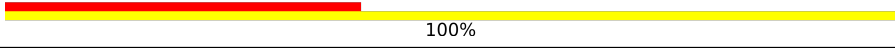
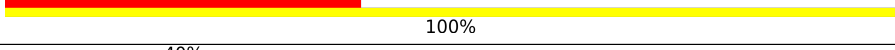
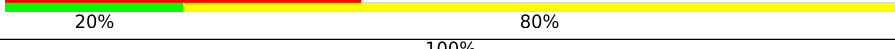
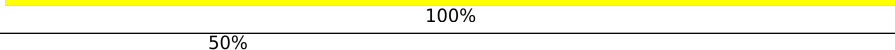
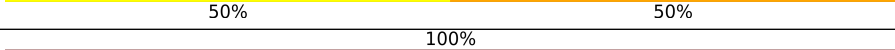
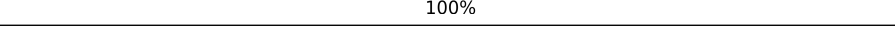
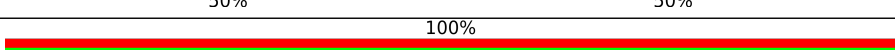
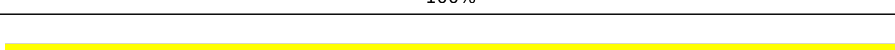
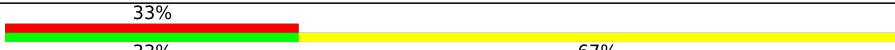
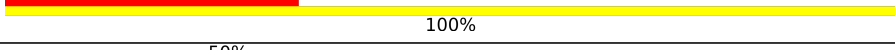
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	3381 (1.75 - 2.74)

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 $\leq 5\%$. 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	A	369	
1	B	369	
1	C	369	
2	D	253	

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Mol	Chain	Length	Quality of chain
2	E	253	
2	F	253	
3	G	5	
3	L	5	
3	Q	5	
4	H	2	
4	J	2	
4	K	2	
4	M	2	
4	O	2	
4	P	2	
4	R	2	
4	T	2	
4	U	2	
5	I	3	
5	N	3	
5	S	3	
5	V	3	
5	W	3	
5	Y	3	
5	Z	3	
5	b	3	
5	c	3	
6	X	4	
6	a	4	

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Mol	Chain	Length	Quality of chain
6	d	4	50% 50%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 13353 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 Surface protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	360	Total	C	N	O	S	0	0
			2882	1846	495	521	20		
1	B	360	Total	C	N	O	S	0	0
			2882	1846	495	521	20		
1	C	360	Total	C	N	O	S	0	0
			2882	1846	495	521	20		

There are 27 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	123	ILE	THR	conflict	UNP Q69384
A	159	ARG	HIS	conflict	UNP Q69384
A	190	SER	CYS	conflict	UNP Q69384
A	328	ILE	VAL	conflict	UNP Q69384
A	369	VAL	ILE	conflict	UNP Q69384
A	437	CYS	VAL	engineered mutation	UNP Q69384
A	449	ILE	VAL	conflict	UNP Q69384
A	463	ARG	SER	engineered mutation	UNP Q69384
A	464	ARG	LYS	engineered mutation	UNP Q69384
B	123	ILE	THR	conflict	UNP Q69384
B	159	ARG	HIS	conflict	UNP Q69384
B	190	SER	CYS	conflict	UNP Q69384
B	328	ILE	VAL	conflict	UNP Q69384
B	369	VAL	ILE	conflict	UNP Q69384
B	437	CYS	VAL	engineered mutation	UNP Q69384
B	449	ILE	VAL	conflict	UNP Q69384
B	463	ARG	SER	engineered mutation	UNP Q69384
B	464	ARG	LYS	engineered mutation	UNP Q69384
C	123	ILE	THR	conflict	UNP Q69384
C	159	ARG	HIS	conflict	UNP Q69384
C	190	SER	CYS	conflict	UNP Q69384
C	328	ILE	VAL	conflict	UNP Q69384
C	369	VAL	ILE	conflict	UNP Q69384
C	437	CYS	VAL	engineered mutation	UNP Q69384

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Chain	Residue	Modelled	Actual	Comment	Reference
C	449	ILE	VAL	conflict	UNP Q69384
C	463	ARG	SER	engineered mutation	UNP Q69384
C	464	ARG	LYS	engineered mutation	UNP Q69384

- Molecule 2 is a protein called Transmembrane protein,Fibritin.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	D	155	Total	C	N	O	S	0	0
			1230	772	219	232	7		
2	E	155	Total	C	N	O	S	0	0
			1230	772	219	232	7		
2	F	155	Total	C	N	O	S	0	0
			1230	772	219	232	7		

There are 186 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	498	CYS	VAL	engineered mutation	UNP Q69384
D	633	ASP	-	linker	UNP Q69384
D	634	ASP	-	linker	UNP Q69384
D	635	ASP	-	linker	UNP Q69384
D	636	ASP	-	linker	UNP Q69384
D	637	LYS	-	linker	UNP Q69384
D	638	ALA	-	linker	UNP Q69384
D	639	GLY	-	linker	UNP Q69384
D	640	GLY	-	linker	UNP Q69384
D	641	SER	-	linker	UNP Q69384
D	642	GLY	-	linker	UNP Q69384
D	643	GLY	-	linker	UNP Q69384
D	644	SER	-	linker	UNP Q69384
D	645	GLY	-	linker	UNP Q69384
D	646	GLY	-	linker	UNP Q69384
D	647	SER	-	linker	UNP Q69384
D	648	GLY	-	linker	UNP Q69384
D	649	GLY	-	linker	UNP Q69384
D	650	GLY	-	linker	UNP Q69384
D	671	LEU	PHE	conflict	UNP P10104
D	677	ALA	-	expression tag	UNP P10104
D	678	SER	-	expression tag	UNP P10104
D	679	GLY	-	expression tag	UNP P10104
D	680	LEU	-	expression tag	UNP P10104
D	681	GLU	-	expression tag	UNP P10104

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Chain	Residue	Modelled	Actual	Comment	Reference
D	682	VAL	-	expression tag	UNP P10104
D	683	LEU	-	expression tag	UNP P10104
D	684	PHE	-	expression tag	UNP P10104
D	685	GLN	-	expression tag	UNP P10104
D	686	GLY	-	expression tag	UNP P10104
D	687	PRO	-	expression tag	UNP P10104
D	688	GLY	-	expression tag	UNP P10104
D	689	ALA	-	expression tag	UNP P10104
D	690	GLY	-	expression tag	UNP P10104
D	691	TRP	-	expression tag	UNP P10104
D	692	SER	-	expression tag	UNP P10104
D	693	HIS	-	expression tag	UNP P10104
D	694	PRO	-	expression tag	UNP P10104
D	695	GLN	-	expression tag	UNP P10104
D	696	PHE	-	expression tag	UNP P10104
D	697	GLU	-	expression tag	UNP P10104
D	698	LYS	-	expression tag	UNP P10104
D	699	GLY	-	expression tag	UNP P10104
D	700	GLY	-	expression tag	UNP P10104
D	701	GLY	-	expression tag	UNP P10104
D	702	SER	-	expression tag	UNP P10104
D	703	GLY	-	expression tag	UNP P10104
D	704	GLY	-	expression tag	UNP P10104
D	705	GLY	-	expression tag	UNP P10104
D	706	SER	-	expression tag	UNP P10104
D	707	GLY	-	expression tag	UNP P10104
D	708	GLY	-	expression tag	UNP P10104
D	709	GLY	-	expression tag	UNP P10104
D	710	SER	-	expression tag	UNP P10104
D	711	TRP	-	expression tag	UNP P10104
D	712	SER	-	expression tag	UNP P10104
D	713	HIS	-	expression tag	UNP P10104
D	714	PRO	-	expression tag	UNP P10104
D	715	GLN	-	expression tag	UNP P10104
D	716	PHE	-	expression tag	UNP P10104
D	717	GLU	-	expression tag	UNP P10104
D	718	LYS	-	expression tag	UNP P10104
E	498	CYS	VAL	engineered mutation	UNP Q69384
E	633	ASP	-	linker	UNP Q69384
E	634	ASP	-	linker	UNP Q69384
E	635	ASP	-	linker	UNP Q69384
E	636	ASP	-	linker	UNP Q69384

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Chain	Residue	Modelled	Actual	Comment	Reference
E	637	LYS	-	linker	UNP Q69384
E	638	ALA	-	linker	UNP Q69384
E	639	GLY	-	linker	UNP Q69384
E	640	GLY	-	linker	UNP Q69384
E	641	SER	-	linker	UNP Q69384
E	642	GLY	-	linker	UNP Q69384
E	643	GLY	-	linker	UNP Q69384
E	644	SER	-	linker	UNP Q69384
E	645	GLY	-	linker	UNP Q69384
E	646	GLY	-	linker	UNP Q69384
E	647	SER	-	linker	UNP Q69384
E	648	GLY	-	linker	UNP Q69384
E	649	GLY	-	linker	UNP Q69384
E	650	GLY	-	linker	UNP Q69384
E	671	LEU	PHE	conflict	UNP P10104
E	677	ALA	-	expression tag	UNP P10104
E	678	SER	-	expression tag	UNP P10104
E	679	GLY	-	expression tag	UNP P10104
E	680	LEU	-	expression tag	UNP P10104
E	681	GLU	-	expression tag	UNP P10104
E	682	VAL	-	expression tag	UNP P10104
E	683	LEU	-	expression tag	UNP P10104
E	684	PHE	-	expression tag	UNP P10104
E	685	GLN	-	expression tag	UNP P10104
E	686	GLY	-	expression tag	UNP P10104
E	687	PRO	-	expression tag	UNP P10104
E	688	GLY	-	expression tag	UNP P10104
E	689	ALA	-	expression tag	UNP P10104
E	690	GLY	-	expression tag	UNP P10104
E	691	TRP	-	expression tag	UNP P10104
E	692	SER	-	expression tag	UNP P10104
E	693	HIS	-	expression tag	UNP P10104
E	694	PRO	-	expression tag	UNP P10104
E	695	GLN	-	expression tag	UNP P10104
E	696	PHE	-	expression tag	UNP P10104
E	697	GLU	-	expression tag	UNP P10104
E	698	LYS	-	expression tag	UNP P10104
E	699	GLY	-	expression tag	UNP P10104
E	700	GLY	-	expression tag	UNP P10104
E	701	GLY	-	expression tag	UNP P10104
E	702	SER	-	expression tag	UNP P10104
E	703	GLY	-	expression tag	UNP P10104

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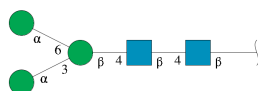
Chain	Residue	Modelled	Actual	Comment	Reference
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E	705	GLY	-	expression tag	UNP P10104
E	706	SER	-	expression tag	UNP P10104
E	707	GLY	-	expression tag	UNP P10104
E	708	GLY	-	expression tag	UNP P10104
E	709	GLY	-	expression tag	UNP P10104
E	710	SER	-	expression tag	UNP P10104
E	711	TRP	-	expression tag	UNP P10104
E	712	SER	-	expression tag	UNP P10104
E	713	HIS	-	expression tag	UNP P10104
E	714	PRO	-	expression tag	UNP P10104
E	715	GLN	-	expression tag	UNP P10104
E	716	PHE	-	expression tag	UNP P10104
E	717	GLU	-	expression tag	UNP P10104
E	718	LYS	-	expression tag	UNP P10104
F	498	CYS	VAL	engineered mutation	UNP Q69384
F	633	ASP	-	linker	UNP Q69384
F	634	ASP	-	linker	UNP Q69384
F	635	ASP	-	linker	UNP Q69384
F	636	ASP	-	linker	UNP Q69384
F	637	LYS	-	linker	UNP Q69384
F	638	ALA	-	linker	UNP Q69384
F	639	GLY	-	linker	UNP Q69384
F	640	GLY	-	linker	UNP Q69384
F	641	SER	-	linker	UNP Q69384
F	642	GLY	-	linker	UNP Q69384
F	643	GLY	-	linker	UNP Q69384
F	644	SER	-	linker	UNP Q69384
F	645	GLY	-	linker	UNP Q69384
F	646	GLY	-	linker	UNP Q69384
F	647	SER	-	linker	UNP Q69384
F	648	GLY	-	linker	UNP Q69384
F	649	GLY	-	linker	UNP Q69384
F	650	GLY	-	linker	UNP Q69384
F	671	LEU	PHE	conflict	UNP P10104
F	677	ALA	-	expression tag	UNP P10104
F	678	SER	-	expression tag	UNP P10104
F	679	GLY	-	expression tag	UNP P10104
F	680	LEU	-	expression tag	UNP P10104
F	681	GLU	-	expression tag	UNP P10104
F	682	VAL	-	expression tag	UNP P10104
F	683	LEU	-	expression tag	UNP P10104

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Chain	Residue	Modelled	Actual	Comment	Reference
F	684	PHE	-	expression tag	UNP P10104
F	685	GLN	-	expression tag	UNP P10104
F	686	GLY	-	expression tag	UNP P10104
F	687	PRO	-	expression tag	UNP P10104
F	688	GLY	-	expression tag	UNP P10104
F	689	ALA	-	expression tag	UNP P10104
F	690	GLY	-	expression tag	UNP P10104
F	691	TRP	-	expression tag	UNP P10104
F	692	SER	-	expression tag	UNP P10104
F	693	HIS	-	expression tag	UNP P10104
F	694	PRO	-	expression tag	UNP P10104
F	695	GLN	-	expression tag	UNP P10104
F	696	PHE	-	expression tag	UNP P10104
F	697	GLU	-	expression tag	UNP P10104
F	698	LYS	-	expression tag	UNP P10104
F	699	GLY	-	expression tag	UNP P10104
F	700	GLY	-	expression tag	UNP P10104
F	701	GLY	-	expression tag	UNP P10104
F	702	SER	-	expression tag	UNP P10104
F	703	GLY	-	expression tag	UNP P10104
F	704	GLY	-	expression tag	UNP P10104
F	705	GLY	-	expression tag	UNP P10104
F	706	SER	-	expression tag	UNP P10104
F	707	GLY	-	expression tag	UNP P10104
F	708	GLY	-	expression tag	UNP P10104
F	709	GLY	-	expression tag	UNP P10104
F	710	SER	-	expression tag	UNP P10104
F	711	TRP	-	expression tag	UNP P10104
F	712	SER	-	expression tag	UNP P10104
F	713	HIS	-	expression tag	UNP P10104
F	714	PRO	-	expression tag	UNP P10104
F	715	GLN	-	expression tag	UNP P10104
F	716	PHE	-	expression tag	UNP P10104
F	717	GLU	-	expression tag	UNP P10104
F	718	LYS	-	expression tag	UNP P10104

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



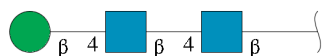
Mol	Chain	Residues	Atoms				AltConf	Trace
3	G	5	Total	C	N	O	0	0
			61	34	2	25		
3	L	5	Total	C	N	O	0	0
			61	34	2	25		
3	Q	5	Total	C	N	O	0	0
			61	34	2	25		

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



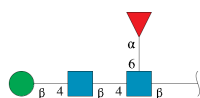
Mol	Chain	Residues	Atoms				AltConf	Trace
4	H	2	Total	C	N	O	0	0
			28	16	2	10		
4	J	2	Total	C	N	O	0	0
			28	16	2	10		
4	K	2	Total	C	N	O	0	0
			28	16	2	10		
4	M	2	Total	C	N	O	0	0
			28	16	2	10		
4	O	2	Total	C	N	O	0	0
			28	16	2	10		
4	P	2	Total	C	N	O	0	0
			28	16	2	10		
4	R	2	Total	C	N	O	0	0
			28	16	2	10		
4	T	2	Total	C	N	O	0	0
			28	16	2	10		
4	U	2	Total	C	N	O	0	0
			28	16	2	10		

- Molecule 5 is an oligosaccharide called beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



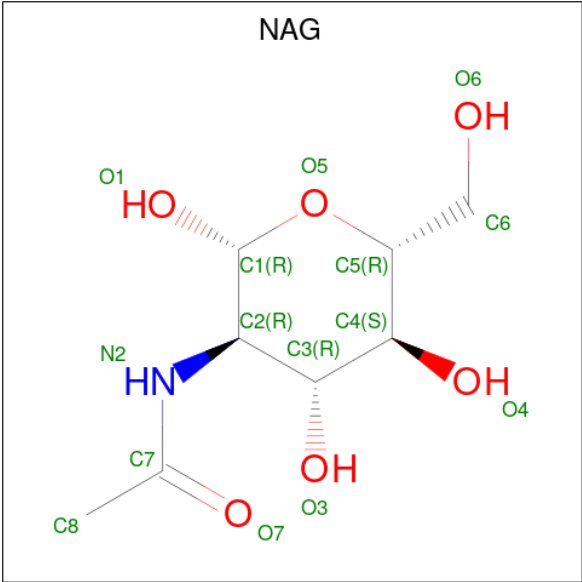
Mol	Chain	Residues	Atoms				AltConf	Trace
5	I	3	Total	C	N	O	0	0
			39	22	2	15		
5	N	3	Total	C	N	O	0	0
			39	22	2	15		
5	S	3	Total	C	N	O	0	0
			39	22	2	15		
5	V	3	Total	C	N	O	0	0
			39	22	2	15		
5	W	3	Total	C	N	O	0	0
			39	22	2	15		
5	Y	3	Total	C	N	O	0	0
			39	22	2	15		
5	Z	3	Total	C	N	O	0	0
			39	22	2	15		
5	b	3	Total	C	N	O	0	0
			39	22	2	15		
5	c	3	Total	C	N	O	0	0
			39	22	2	15		

- Molecule 6 is an oligosaccharide called beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				AltConf	Trace
6	X	4	Total	C	N	O	0	0
			49	28	2	19		
6	a	4	Total	C	N	O	0	0
			49	28	2	19		
6	d	4	Total	C	N	O	0	0
			49	28	2	19		

- Molecule 7 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).

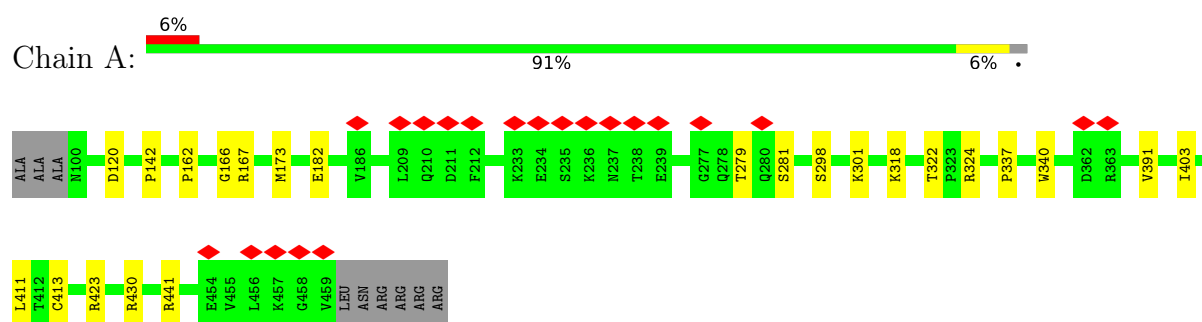


Mol	Chain	Residues	Atoms				AltConf
7	A	1	Total	C	N	O	0
			14	8	1	5	
7	B	1	Total	C	N	O	0
			14	8	1	5	
7	C	1	Total	C	N	O	0
			14	8	1	5	
7	D	1	Total	C	N	O	0
			14	8	1	5	
7	E	1	Total	C	N	O	0
			14	8	1	5	
7	F	1	Total	C	N	O	0
			14	8	1	5	

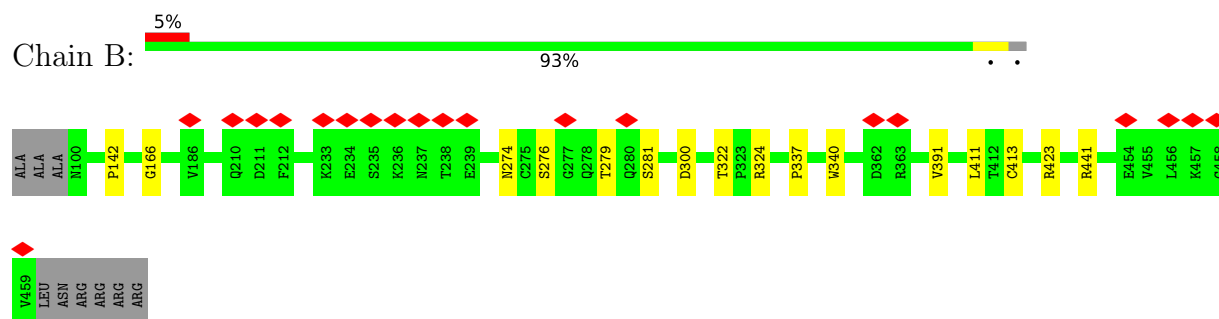
3 Residue-property plots [i](#)

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.

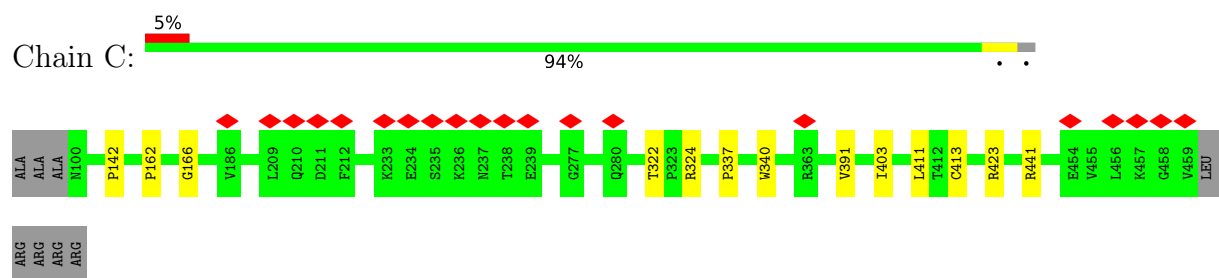
- Molecule 1: Surface protein



- Molecule 1: Surface protein

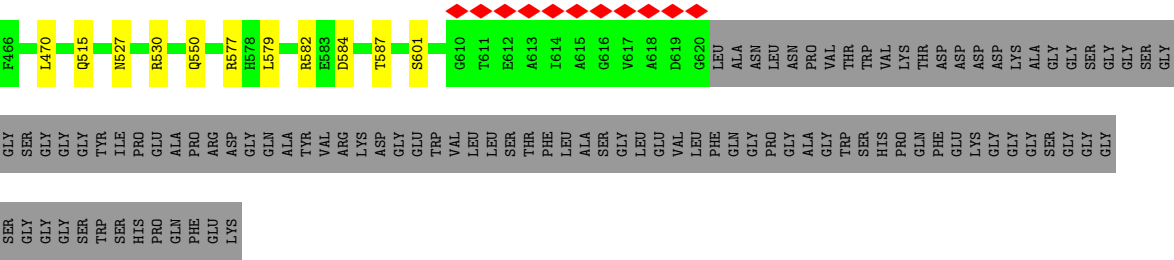


- Molecule 1: Surface protein

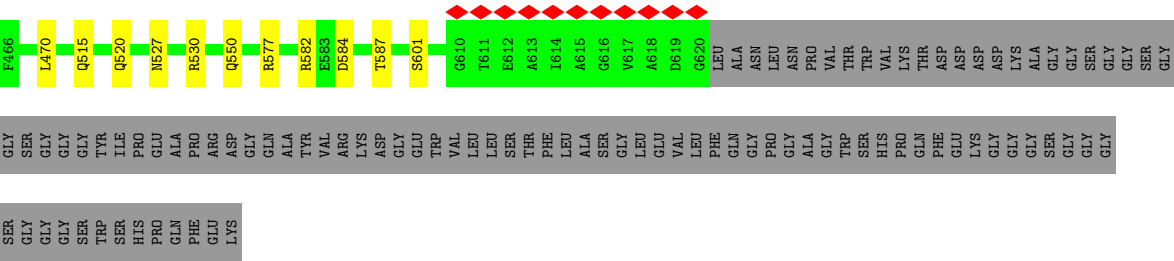


- Molecule 2: Transmembrane protein, Fibrin

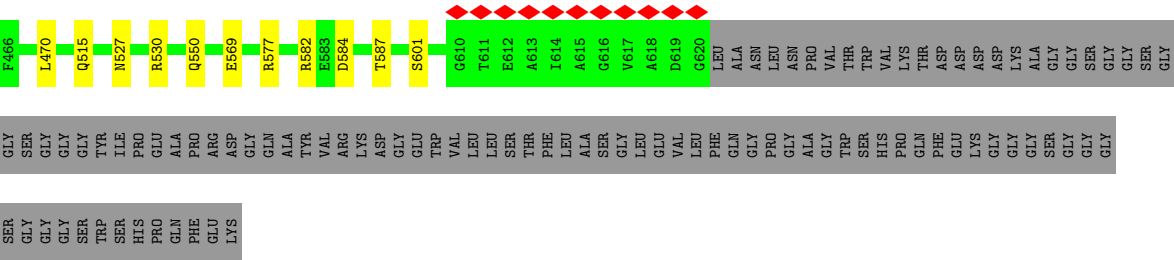




• Molecule 2: Transmembrane protein,Fibrin



• Molecule 2: Transmembrane protein,Fibrin



• Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

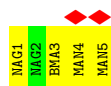


• Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose





- Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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



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



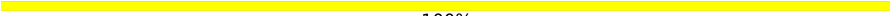
- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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



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

Chain O:  100%



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

Chain P:  50% 50% 50%



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

Chain R:  100% 100%



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

Chain T:  100%



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

Chain U:  50% 50% 50%



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain I:  33% 67% 33%



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



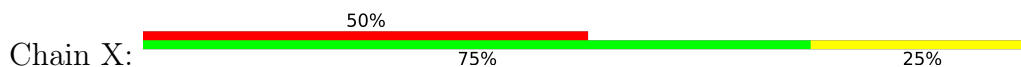
- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



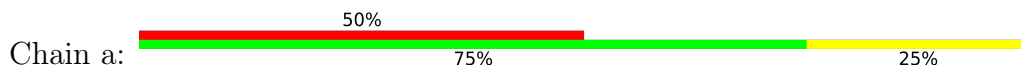
- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 6: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 6: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 6: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C3	Depositor
Number of particles used	81000	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.861	Depositor
Minimum map value	-0.338	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.018	Depositor
Recommended contour level	0.165	Depositor
Map size ($\text{\AA}$)	337.92, 337.92, 337.92	wwPDB
Map dimensions	360, 360, 360	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	0.9386667, 0.9386667, 0.9386667	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, MAN, BMA, FUC

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	A	0.13	0/2974	0.28	0/4070
1	B	0.12	0/2974	0.27	0/4070
1	C	0.12	0/2974	0.27	0/4070
2	D	0.10	0/1254	0.24	0/1702
2	E	0.10	0/1254	0.25	0/1702
2	F	0.09	0/1254	0.25	0/1702
All	All	0.11	0/12684	0.27	0/17316

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	A	2882	0	2817	13	0
1	B	2882	0	2817	9	0
1	C	2882	0	2817	7	0
2	D	1230	0	1194	7	0
2	E	1230	0	1194	7	0
2	F	1230	0	1194	7	0
3	G	61	0	52	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	L	61	0	52	0	0
3	Q	61	0	52	0	0
4	H	28	0	25	0	0
4	J	28	0	25	0	0
4	K	28	0	25	1	0
4	M	28	0	25	0	0
4	O	28	0	25	0	0
4	P	28	0	25	0	0
4	R	28	0	25	0	0
4	T	28	0	25	0	0
4	U	28	0	25	0	0
5	I	39	0	34	0	0
5	N	39	0	34	0	0
5	S	39	0	34	0	0
5	V	39	0	34	0	0
5	W	39	0	34	1	0
5	Y	39	0	34	0	0
5	Z	39	0	34	1	0
5	b	39	0	34	0	0
5	c	39	0	34	1	0
6	X	49	0	43	0	0
6	a	49	0	43	0	0
6	d	49	0	43	1	0
7	A	14	0	13	0	0
7	B	14	0	13	0	0
7	C	14	0	13	0	0
7	D	14	0	13	0	0
7	E	14	0	13	0	0
7	F	14	0	13	0	0
All	All	13353	0	12927	46	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 2.

All (46) 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)
1:B:441:ARG:HE	5:Z:1:NAG:H81	1.57	0.69
1:A:441:ARG:HE	5:W:1:NAG:H81	1.60	0.67
1:A:279:THR:HG23	1:A:281:SER:H	1.62	0.64
1:B:279:THR:HG23	1:B:281:SER:H	1.62	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:584:ASP:OD1	2:E:587:THR:OG1	2.16	0.63
1:A:298:SER:HB3	1:A:301:LYS:HD3	1.80	0.62
2:D:584:ASP:OD1	2:D:587:THR:OG1	2.18	0.61
2:F:584:ASP:OD1	2:F:587:THR:OG1	2.18	0.58
2:E:530:ARG:HH21	2:F:527:ASN:HA	1.69	0.57
2:D:530:ARG:HH21	2:E:527:ASN:HA	1.69	0.57
1:C:166:GLY:HA3	1:C:423:ARG:HG2	1.85	0.57
1:C:441:ARG:HE	5:c:1:NAG:H81	1.69	0.57
2:F:470:LEU:HD21	2:F:515:GLN:HA	1.88	0.55
1:B:166:GLY:HA3	1:B:423:ARG:HG2	1.90	0.54
1:A:166:GLY:HA3	1:A:423:ARG:HG2	1.90	0.54
1:B:274:ASN:OD1	1:B:276:SER:OG	2.25	0.52
2:E:470:LEU:HD21	2:E:515:GLN:HA	1.91	0.52
1:B:391:VAL:HG21	1:B:411:LEU:HD12	1.92	0.51
1:C:391:VAL:HG21	1:C:411:LEU:HD12	1.92	0.51
2:D:470:LEU:HD21	2:D:515:GLN:HA	1.91	0.51
2:D:527:ASN:HA	2:F:530:ARG:HH21	1.75	0.50
2:E:577:ARG:HG2	2:E:582:ARG:HD2	1.95	0.49
1:A:391:VAL:HG21	1:A:411:LEU:HD12	1.94	0.48
1:A:182:GLU:OE2	1:A:318:LYS:NZ	2.47	0.47
1:B:324:ARG:HG2	1:B:337:PRO:HB3	1.96	0.47
1:C:324:ARG:HG2	1:C:337:PRO:HB3	1.95	0.46
2:E:550:GLN:HG3	2:E:601:SER:O	2.15	0.46
2:F:577:ARG:HG2	2:F:582:ARG:HD2	1.98	0.46
1:A:167:ARG:HG2	1:A:173:MET:HG2	1.98	0.46
2:F:550:GLN:HG3	2:F:601:SER:O	2.16	0.46
1:B:322:THR:HG21	1:B:340:TRP:CZ2	2.52	0.45
2:D:550:GLN:HG3	2:D:601:SER:O	2.16	0.45
2:F:569:GLU:HA	6:d:4:FUC:H5	1.99	0.45
1:B:300:ASP:N	1:B:300:ASP:OD1	2.46	0.44
2:D:577:ARG:HG2	2:D:582:ARG:HD2	2.00	0.44
1:A:322:THR:HG21	1:A:340:TRP:CZ2	2.53	0.43
4:K:1:NAG:H61	4:K:2:NAG:H82	2.01	0.43
1:C:322:THR:HG21	1:C:340:TRP:CZ2	2.54	0.43
1:A:324:ARG:HG2	1:A:337:PRO:HB3	2.01	0.42
1:C:162:PRO:HG3	1:C:403:ILE:HD11	2.02	0.42
1:A:142:PRO:HG3	1:A:413:CYS:SG	2.59	0.42
1:A:430:ARG:NH1	2:D:579:LEU:O	2.53	0.41
1:B:142:PRO:HG3	1:B:413:CYS:SG	2.60	0.41
1:C:142:PRO:HG3	1:C:413:CYS:SG	2.61	0.41
1:A:120:ASP:OD1	2:E:520:GLN:NE2	2.54	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:162:PRO:HG3	1:A:403:ILE:HD11	2.03	0.40

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	A	46/369 (12%)	45 (98%)	1 (2%)	0	100	100
1	B	339/369 (92%)	333 (98%)	6 (2%)	0	100	100
1	C	358/369 (97%)	352 (98%)	6 (2%)	0	100	100
2	D	153/253 (60%)	149 (97%)	4 (3%)	0	100	100
2	E	153/253 (60%)	151 (99%)	2 (1%)	0	100	100
2	F	153/253 (60%)	151 (99%)	2 (1%)	0	100	100
All	All	1202/1866 (64%)	1181 (98%)	21 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	A	328/336 (98%)	328 (100%)	0	100	100
1	B	328/336 (98%)	328 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	328/336 (98%)	328 (100%)	0	100	100
2	D	135/203 (66%)	135 (100%)	0	100	100
2	E	135/203 (66%)	135 (100%)	0	100	100
2	F	135/203 (66%)	135 (100%)	0	100	100
All	All	1389/1617 (86%)	1389 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	195	HIS
1	A	255	GLN
1	A	270	GLN
1	A	356	GLN
1	A	422	HIS
1	B	177	GLN
1	B	255	GLN
1	B	422	HIS
1	C	177	GLN
1	C	195	HIS
1	C	255	GLN
1	C	278	GLN
1	C	422	HIS
2	D	563	GLN
2	D	570	HIS
2	E	563	GLN
2	E	570	HIS
2	F	563	GLN
2	F	570	HIS
2	F	596	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

72 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	G	1	1,3	14,14,15	0.79	0	17,19,21	0.99	2 (11%)
3	NAG	G	2	3	14,14,15	0.75	0	17,19,21	0.96	1 (5%)
3	BMA	G	3	3	11,11,12	0.84	0	15,15,17	1.95	2 (13%)
3	MAN	G	4	3	11,11,12	0.79	0	15,15,17	0.95	1 (6%)
3	MAN	G	5	3	11,11,12	0.68	0	15,15,17	1.18	1 (6%)
4	NAG	H	1	1,4	14,14,15	0.73	0	17,19,21	1.06	0
4	NAG	H	2	4	14,14,15	0.72	0	17,19,21	0.85	1 (5%)
5	NAG	I	1	1,5	14,14,15	0.75	0	17,19,21	0.96	0
5	NAG	I	2	5	14,14,15	0.71	0	17,19,21	0.88	0
5	BMA	I	3	5	11,11,12	0.83	0	15,15,17	2.14	3 (20%)
4	NAG	J	1	1,4	14,14,15	0.78	0	17,19,21	1.13	1 (5%)
4	NAG	J	2	4	14,14,15	0.72	0	17,19,21	1.12	1 (5%)
4	NAG	K	1	1,4	14,14,15	0.75	0	17,19,21	0.98	0
4	NAG	K	2	4	14,14,15	0.74	0	17,19,21	2.32	3 (17%)
3	NAG	L	1	1,3	14,14,15	0.80	0	17,19,21	1.03	2 (11%)
3	NAG	L	2	3	14,14,15	0.77	0	17,19,21	0.98	1 (5%)
3	BMA	L	3	3	11,11,12	0.85	0	15,15,17	2.03	3 (20%)
3	MAN	L	4	3	11,11,12	0.76	0	15,15,17	0.97	1 (6%)
3	MAN	L	5	3	11,11,12	0.71	0	15,15,17	1.11	1 (6%)
4	NAG	M	1	1,4	14,14,15	0.72	0	17,19,21	1.01	0
4	NAG	M	2	4	14,14,15	0.72	0	17,19,21	0.87	0
5	NAG	N	1	1,5	14,14,15	0.75	0	17,19,21	0.96	1 (5%)
5	NAG	N	2	5	14,14,15	0.71	0	17,19,21	0.89	0
5	BMA	N	3	5	11,11,12	0.84	0	15,15,17	2.18	3 (20%)
4	NAG	O	1	1,4	14,14,15	0.79	0	17,19,21	1.16	1 (5%)
4	NAG	O	2	4	14,14,15	0.72	0	17,19,21	1.12	1 (5%)
4	NAG	P	1	1,4	14,14,15	0.76	0	17,19,21	0.97	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	NAG	P	2	4	14,14,15	0.73	0	17,19,21	2.33	3 (17%)
3	NAG	Q	1	1,3	14,14,15	0.79	0	17,19,21	0.95	2 (11%)
3	NAG	Q	2	3	14,14,15	0.76	0	17,19,21	0.95	0
3	BMA	Q	3	3	11,11,12	0.85	0	15,15,17	2.04	3 (20%)
3	MAN	Q	4	3	11,11,12	0.76	0	15,15,17	0.96	1 (6%)
3	MAN	Q	5	3	11,11,12	0.67	0	15,15,17	1.20	1 (6%)
4	NAG	R	1	1,4	14,14,15	0.74	0	17,19,21	1.06	0
4	NAG	R	2	4	14,14,15	0.72	0	17,19,21	0.88	0
5	NAG	S	1	1,5	14,14,15	0.75	0	17,19,21	0.95	0
5	NAG	S	2	5	14,14,15	0.71	0	17,19,21	0.89	0
5	BMA	S	3	5	11,11,12	0.85	0	15,15,17	2.17	3 (20%)
4	NAG	T	1	1,4	14,14,15	0.79	0	17,19,21	1.16	1 (5%)
4	NAG	T	2	4	14,14,15	0.71	0	17,19,21	1.10	1 (5%)
4	NAG	U	1	1,4	14,14,15	0.76	0	17,19,21	1.00	0
4	NAG	U	2	4	14,14,15	0.73	0	17,19,21	2.33	3 (17%)
5	NAG	V	1	5,2	14,14,15	0.72	0	17,19,21	0.82	0
5	NAG	V	2	5	14,14,15	0.73	0	17,19,21	0.94	1 (5%)
5	BMA	V	3	5	11,11,12	0.87	0	15,15,17	2.09	3 (20%)
5	NAG	W	1	5,2	14,14,15	0.72	0	17,19,21	0.87	0
5	NAG	W	2	5	14,14,15	0.73	0	17,19,21	0.98	2 (11%)
5	BMA	W	3	5	11,11,12	0.81	0	15,15,17	1.97	3 (20%)
6	NAG	X	1	6,2	14,14,15	0.74	0	17,19,21	0.97	0
6	NAG	X	2	6	14,14,15	0.71	0	17,19,21	0.85	0
6	BMA	X	3	6	11,11,12	0.86	0	15,15,17	2.15	3 (20%)
6	FUC	X	4	6	10,10,11	0.77	0	14,14,16	0.97	0
5	NAG	Y	1	5,2	14,14,15	0.71	0	17,19,21	0.82	0
5	NAG	Y	2	5	14,14,15	0.73	0	17,19,21	0.92	1 (5%)
5	BMA	Y	3	5	11,11,12	0.84	0	15,15,17	2.08	3 (20%)
5	NAG	Z	1	5,2	14,14,15	0.72	0	17,19,21	0.89	0
5	NAG	Z	2	5	14,14,15	0.72	0	17,19,21	1.00	2 (11%)
5	BMA	Z	3	5	11,11,12	0.83	0	15,15,17	1.99	3 (20%)
6	NAG	a	1	6,2	14,14,15	0.73	0	17,19,21	0.97	0
6	NAG	a	2	6	14,14,15	0.73	0	17,19,21	0.84	0
6	BMA	a	3	6	11,11,12	0.85	0	15,15,17	2.13	4 (26%)
6	FUC	a	4	6	10,10,11	0.79	0	14,14,16	0.95	0
5	NAG	b	1	5,2	14,14,15	0.73	0	17,19,21	0.81	0
5	NAG	b	2	5	14,14,15	0.73	0	17,19,21	0.94	1 (5%)
5	BMA	b	3	5	11,11,12	0.86	0	15,15,17	2.08	3 (20%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	NAG	c	1	5,2	14,14,15	0.70	0	17,19,21	0.87	0
5	NAG	c	2	5	14,14,15	0.73	0	17,19,21	0.98	2 (11%)
5	BMA	c	3	5	11,11,12	0.82	0	15,15,17	1.99	3 (20%)
6	NAG	d	1	6,2	14,14,15	0.74	0	17,19,21	0.95	0
6	NAG	d	2	6	14,14,15	0.71	0	17,19,21	0.84	0
6	BMA	d	3	6	11,11,12	0.84	0	15,15,17	2.15	4 (26%)
6	FUC	d	4	6	10,10,11	0.77	0	14,14,16	0.95	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	G	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	G	2	3	-	2/6/23/26	0/1/1/1
3	BMA	G	3	3	-	0/2/19/22	0/1/1/1
3	MAN	G	4	3	-	0/2/19/22	0/1/1/1
3	MAN	G	5	3	-	0/2/19/22	0/1/1/1
4	NAG	H	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	H	2	4	-	1/6/23/26	0/1/1/1
5	NAG	I	1	1,5	-	2/6/23/26	0/1/1/1
5	NAG	I	2	5	-	2/6/23/26	0/1/1/1
5	BMA	I	3	5	-	1/2/19/22	0/1/1/1
4	NAG	J	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	J	2	4	-	2/6/23/26	0/1/1/1
4	NAG	K	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	K	2	4	-	4/6/23/26	0/1/1/1
3	NAG	L	1	1,3	-	1/6/23/26	0/1/1/1
3	NAG	L	2	3	-	2/6/23/26	0/1/1/1
3	BMA	L	3	3	-	0/2/19/22	0/1/1/1
3	MAN	L	4	3	-	2/2/19/22	0/1/1/1
3	MAN	L	5	3	-	0/2/19/22	0/1/1/1
4	NAG	M	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	M	2	4	-	1/6/23/26	0/1/1/1
5	NAG	N	1	1,5	-	2/6/23/26	0/1/1/1
5	NAG	N	2	5	-	2/6/23/26	0/1/1/1
5	BMA	N	3	5	-	2/2/19/22	0/1/1/1
4	NAG	O	1	1,4	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	O	2	4	-	2/6/23/26	0/1/1/1
4	NAG	P	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	P	2	4	-	4/6/23/26	0/1/1/1
3	NAG	Q	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	Q	2	3	-	2/6/23/26	0/1/1/1
3	BMA	Q	3	3	-	0/2/19/22	0/1/1/1
3	MAN	Q	4	3	-	2/2/19/22	0/1/1/1
3	MAN	Q	5	3	-	1/2/19/22	0/1/1/1
4	NAG	R	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	R	2	4	-	1/6/23/26	0/1/1/1
5	NAG	S	1	1,5	-	2/6/23/26	0/1/1/1
5	NAG	S	2	5	-	2/6/23/26	0/1/1/1
5	BMA	S	3	5	-	2/2/19/22	0/1/1/1
4	NAG	T	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	T	2	4	-	2/6/23/26	0/1/1/1
4	NAG	U	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	U	2	4	-	4/6/23/26	0/1/1/1
5	NAG	V	1	5,2	-	0/6/23/26	0/1/1/1
5	NAG	V	2	5	-	2/6/23/26	0/1/1/1
5	BMA	V	3	5	-	0/2/19/22	0/1/1/1
5	NAG	W	1	5,2	-	2/6/23/26	0/1/1/1
5	NAG	W	2	5	-	0/6/23/26	0/1/1/1
5	BMA	W	3	5	-	0/2/19/22	0/1/1/1
6	NAG	X	1	6,2	-	2/6/23/26	0/1/1/1
6	NAG	X	2	6	-	0/6/23/26	0/1/1/1
6	BMA	X	3	6	-	0/2/19/22	0/1/1/1
6	FUC	X	4	6	-	-	0/1/1/1
5	NAG	Y	1	5,2	-	0/6/23/26	0/1/1/1
5	NAG	Y	2	5	-	2/6/23/26	0/1/1/1
5	BMA	Y	3	5	-	0/2/19/22	0/1/1/1
5	NAG	Z	1	5,2	-	2/6/23/26	0/1/1/1
5	NAG	Z	2	5	-	0/6/23/26	0/1/1/1
5	BMA	Z	3	5	-	0/2/19/22	0/1/1/1
6	NAG	a	1	6,2	-	2/6/23/26	0/1/1/1
6	NAG	a	2	6	-	0/6/23/26	0/1/1/1
6	BMA	a	3	6	-	0/2/19/22	0/1/1/1
6	FUC	a	4	6	-	-	0/1/1/1
5	NAG	b	1	5,2	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	NAG	b	2	5	-	2/6/23/26	0/1/1/1
5	BMA	b	3	5	-	0/2/19/22	0/1/1/1
5	NAG	c	1	5,2	-	2/6/23/26	0/1/1/1
5	NAG	c	2	5	-	0/6/23/26	0/1/1/1
5	BMA	c	3	5	-	0/2/19/22	0/1/1/1
6	NAG	d	1	6,2	-	2/6/23/26	0/1/1/1
6	NAG	d	2	6	-	0/6/23/26	0/1/1/1
6	BMA	d	3	6	-	0/2/19/22	0/1/1/1
6	FUC	d	4	6	-	-	0/1/1/1

There are no bond length outliers.

All (86) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	P	2	NAG	C2-N2-C7	8.30	134.02	122.90
4	U	2	NAG	C2-N2-C7	8.29	134.01	122.90
4	K	2	NAG	C2-N2-C7	8.25	133.96	122.90
5	N	3	BMA	C1-O5-C5	6.77	121.26	112.19
5	S	3	BMA	C1-O5-C5	6.74	121.22	112.19
5	I	3	BMA	C1-O5-C5	6.66	121.11	112.19
6	d	3	BMA	C1-O5-C5	6.50	120.90	112.19
6	X	3	BMA	C1-O5-C5	6.49	120.88	112.19
6	a	3	BMA	C1-O5-C5	6.41	120.78	112.19
5	V	3	BMA	C1-O5-C5	6.38	120.73	112.19
5	b	3	BMA	C1-O5-C5	6.35	120.69	112.19
5	Y	3	BMA	C1-O5-C5	6.34	120.69	112.19
3	L	3	BMA	C1-O5-C5	6.25	120.56	112.19
3	Q	3	BMA	C1-O5-C5	6.24	120.56	112.19
3	G	3	BMA	C1-O5-C5	6.00	120.23	112.19
5	c	3	BMA	C1-O5-C5	5.96	120.17	112.19
5	Z	3	BMA	C1-O5-C5	5.95	120.16	112.19
5	W	3	BMA	C1-O5-C5	5.81	119.97	112.19
3	Q	5	MAN	C1-O5-C5	3.66	117.10	112.19
3	G	5	MAN	C1-O5-C5	3.59	116.99	112.19
3	L	5	MAN	C1-O5-C5	3.28	116.58	112.19
4	O	2	NAG	C2-N2-C7	3.05	126.98	122.90
4	J	2	NAG	C2-N2-C7	3.03	126.95	122.90
4	T	2	NAG	C2-N2-C7	2.94	126.84	122.90
6	a	3	BMA	C3-C4-C5	2.58	114.90	110.23
4	K	2	NAG	C8-C7-N2	2.57	120.37	116.12
4	U	2	NAG	C8-C7-N2	2.55	120.35	116.12

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	P	2	NAG	C8-C7-N2	2.54	120.33	116.12
6	X	3	BMA	C3-C4-C5	2.53	114.83	110.23
6	d	3	BMA	C3-C4-C5	2.53	114.81	110.23
3	L	1	NAG	C1-O5-C5	2.46	115.49	112.19
3	L	1	NAG	O5-C1-C2	-2.44	107.51	111.29
5	W	2	NAG	O5-C1-C2	-2.37	107.63	111.29
5	Y	3	BMA	C2-C3-C4	2.35	114.99	110.86
5	Z	2	NAG	O5-C1-C2	-2.34	107.67	111.29
5	b	3	BMA	C2-C3-C4	2.34	114.97	110.86
5	S	3	BMA	C3-C4-C5	2.32	114.44	110.23
5	V	3	BMA	C2-C3-C4	2.31	114.92	110.86
5	N	3	BMA	C3-C4-C5	2.30	114.41	110.23
6	X	3	BMA	C2-C3-C4	2.30	114.91	110.86
3	G	1	NAG	O5-C1-C2	-2.30	107.73	111.29
5	S	3	BMA	C2-C3-C4	2.29	114.89	110.86
3	Q	1	NAG	O5-C1-C2	-2.29	107.75	111.29
3	Q	1	NAG	C1-O5-C5	2.29	115.25	112.19
5	N	3	BMA	C2-C3-C4	2.28	114.87	110.86
5	I	3	BMA	C3-C4-C5	2.28	114.36	110.23
5	b	3	BMA	C3-C4-C5	2.28	114.36	110.23
5	V	3	BMA	C3-C4-C5	2.26	114.34	110.23
6	d	3	BMA	C2-C3-C4	2.26	114.84	110.86
4	O	1	NAG	C2-N2-C7	2.26	125.92	122.90
5	c	2	NAG	O5-C1-C2	-2.26	107.80	111.29
3	Q	4	MAN	C1-O5-C5	2.25	115.21	112.19
6	a	3	BMA	C2-C3-C4	2.24	114.81	110.86
3	G	4	MAN	C1-O5-C5	2.24	115.18	112.19
5	Y	2	NAG	C2-N2-C7	2.23	125.89	122.90
3	G	1	NAG	C1-O5-C5	2.23	115.18	112.19
5	Y	3	BMA	C3-C4-C5	2.22	114.25	110.23
3	L	4	MAN	C1-O5-C5	2.22	115.16	112.19
5	I	3	BMA	C2-C3-C4	2.21	114.75	110.86
3	Q	3	BMA	C3-C4-C5	2.20	114.22	110.23
5	W	3	BMA	C3-C4-C5	2.19	114.20	110.23
5	c	3	BMA	C3-C4-C5	2.17	114.17	110.23
5	Z	3	BMA	C3-C4-C5	2.16	114.14	110.23
4	T	1	NAG	C2-N2-C7	2.14	125.77	122.90
4	K	2	NAG	C1-C2-N2	2.14	113.80	110.43
4	U	2	NAG	C1-C2-N2	2.12	113.78	110.43
3	L	3	BMA	C2-C3-C4	2.12	114.58	110.86
3	Q	3	BMA	C2-C3-C4	2.11	114.56	110.86
5	c	3	BMA	C2-C3-C4	2.10	114.56	110.86

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	H	2	NAG	O5-C1-C2	-2.10	108.04	111.29
5	Z	3	BMA	C2-C3-C4	2.10	114.55	110.86
5	W	3	BMA	C2-C3-C4	2.08	114.52	110.86
4	J	1	NAG	C2-N2-C7	2.08	125.68	122.90
4	P	2	NAG	C1-C2-N2	2.07	113.70	110.43
3	G	3	BMA	C2-C3-C4	2.07	114.50	110.86
3	L	3	BMA	C3-C4-C5	2.06	113.96	110.23
5	N	1	NAG	C2-N2-C7	2.05	125.65	122.90
5	V	2	NAG	C2-N2-C7	2.04	125.63	122.90
5	Z	2	NAG	O4-C4-C3	-2.04	105.58	110.38
6	a	3	BMA	O4-C4-C3	-2.03	105.60	110.38
6	d	3	BMA	O4-C4-C3	-2.02	105.61	110.38
5	W	2	NAG	O4-C4-C3	-2.01	105.64	110.38
3	L	2	NAG	C1-O5-C5	2.01	114.88	112.19
5	c	2	NAG	O4-C4-C3	-2.00	105.65	110.38
3	G	2	NAG	C1-O5-C5	2.00	114.87	112.19
5	b	2	NAG	C2-N2-C7	2.00	125.58	122.90

There are no chirality outliers.

All (72) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	N	3	BMA	O5-C5-C6-O6
5	I	3	BMA	O5-C5-C6-O6
5	S	3	BMA	O5-C5-C6-O6
3	G	1	NAG	O5-C5-C6-O6
3	G	2	NAG	C8-C7-N2-C2
3	G	2	NAG	O7-C7-N2-C2
3	L	2	NAG	C8-C7-N2-C2
3	L	2	NAG	O7-C7-N2-C2
3	Q	2	NAG	C8-C7-N2-C2
3	Q	2	NAG	O7-C7-N2-C2
4	K	2	NAG	C8-C7-N2-C2
4	K	2	NAG	O7-C7-N2-C2
4	P	2	NAG	C8-C7-N2-C2
4	P	2	NAG	O7-C7-N2-C2
4	U	2	NAG	C8-C7-N2-C2
4	U	2	NAG	O7-C7-N2-C2
5	I	1	NAG	C8-C7-N2-C2
5	I	1	NAG	O7-C7-N2-C2
5	I	2	NAG	C8-C7-N2-C2
5	I	2	NAG	O7-C7-N2-C2

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Mol	Chain	Res	Type	Atoms
5	N	1	NAG	C8-C7-N2-C2
5	N	1	NAG	O7-C7-N2-C2
5	N	2	NAG	C8-C7-N2-C2
5	N	2	NAG	O7-C7-N2-C2
5	S	1	NAG	C8-C7-N2-C2
5	S	1	NAG	O7-C7-N2-C2
5	S	2	NAG	C8-C7-N2-C2
5	S	2	NAG	O7-C7-N2-C2
5	V	2	NAG	C8-C7-N2-C2
5	V	2	NAG	O7-C7-N2-C2
5	W	1	NAG	C8-C7-N2-C2
5	W	1	NAG	O7-C7-N2-C2
5	Y	2	NAG	C8-C7-N2-C2
5	Y	2	NAG	O7-C7-N2-C2
5	Z	1	NAG	C8-C7-N2-C2
5	Z	1	NAG	O7-C7-N2-C2
5	b	2	NAG	C8-C7-N2-C2
5	b	2	NAG	O7-C7-N2-C2
5	c	1	NAG	C8-C7-N2-C2
5	c	1	NAG	O7-C7-N2-C2
6	X	1	NAG	C8-C7-N2-C2
6	X	1	NAG	O7-C7-N2-C2
6	a	1	NAG	C8-C7-N2-C2
6	a	1	NAG	O7-C7-N2-C2
6	d	1	NAG	C8-C7-N2-C2
6	d	1	NAG	O7-C7-N2-C2
3	Q	1	NAG	O5-C5-C6-O6
3	L	1	NAG	O5-C5-C6-O6
3	Q	4	MAN	C4-C5-C6-O6
3	Q	4	MAN	O5-C5-C6-O6
3	Q	5	MAN	O5-C5-C6-O6
4	R	2	NAG	O5-C5-C6-O6
4	M	2	NAG	O5-C5-C6-O6
4	H	2	NAG	O5-C5-C6-O6
3	G	1	NAG	C4-C5-C6-O6
4	J	2	NAG	C1-C2-N2-C7
4	O	2	NAG	C1-C2-N2-C7
4	T	2	NAG	C1-C2-N2-C7
5	N	3	BMA	C4-C5-C6-O6
4	J	2	NAG	C3-C2-N2-C7
4	O	2	NAG	C3-C2-N2-C7
4	T	2	NAG	C3-C2-N2-C7

Continued on next page...

Continued from previous page...

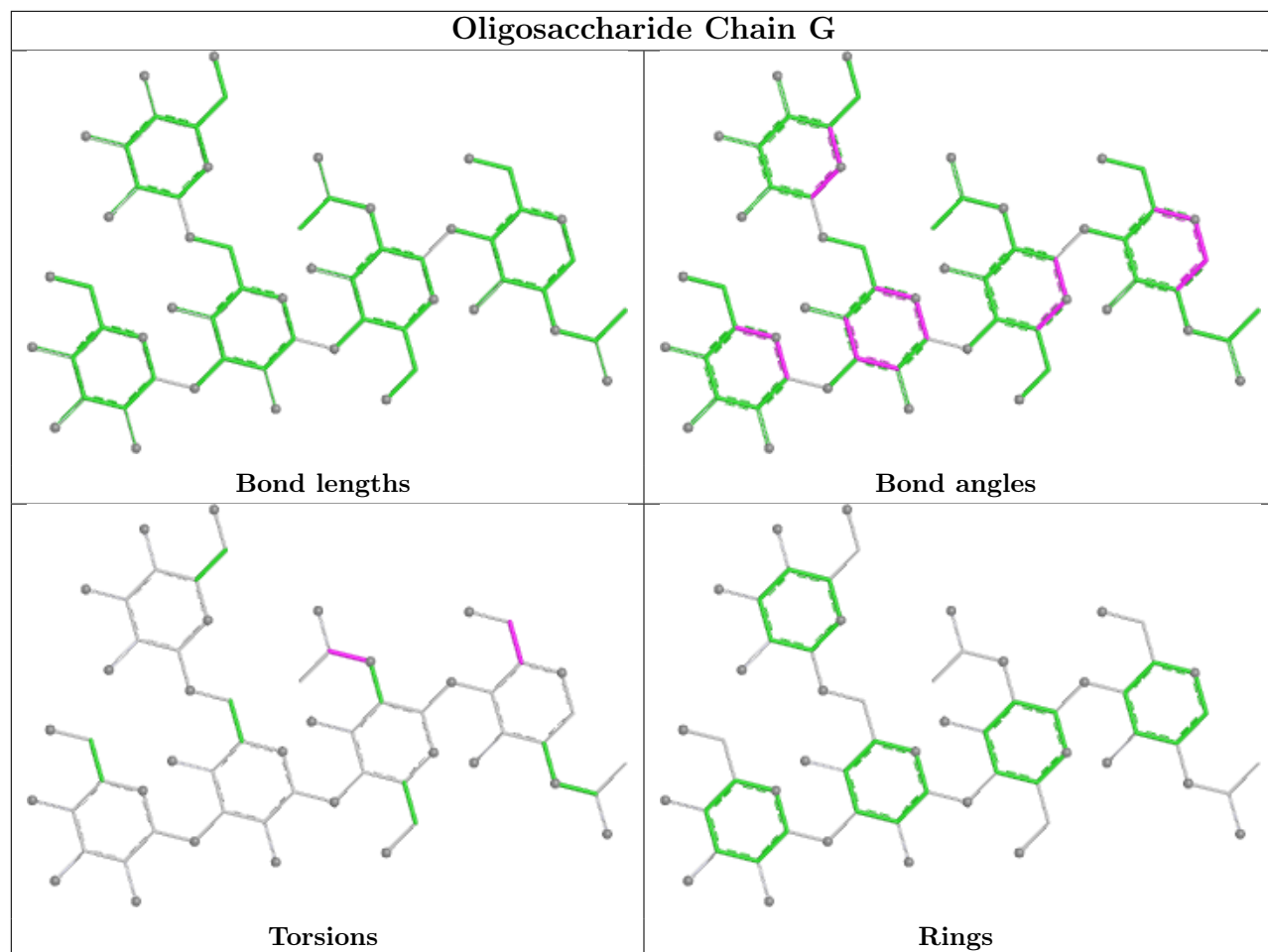
Mol	Chain	Res	Type	Atoms
5	S	3	BMA	C4-C5-C6-O6
4	K	2	NAG	C1-C2-N2-C7
4	P	2	NAG	C1-C2-N2-C7
4	U	2	NAG	C1-C2-N2-C7
3	L	4	MAN	C4-C5-C6-O6
4	K	2	NAG	C3-C2-N2-C7
4	P	2	NAG	C3-C2-N2-C7
4	U	2	NAG	C3-C2-N2-C7
3	L	4	MAN	O5-C5-C6-O6
3	Q	1	NAG	C4-C5-C6-O6

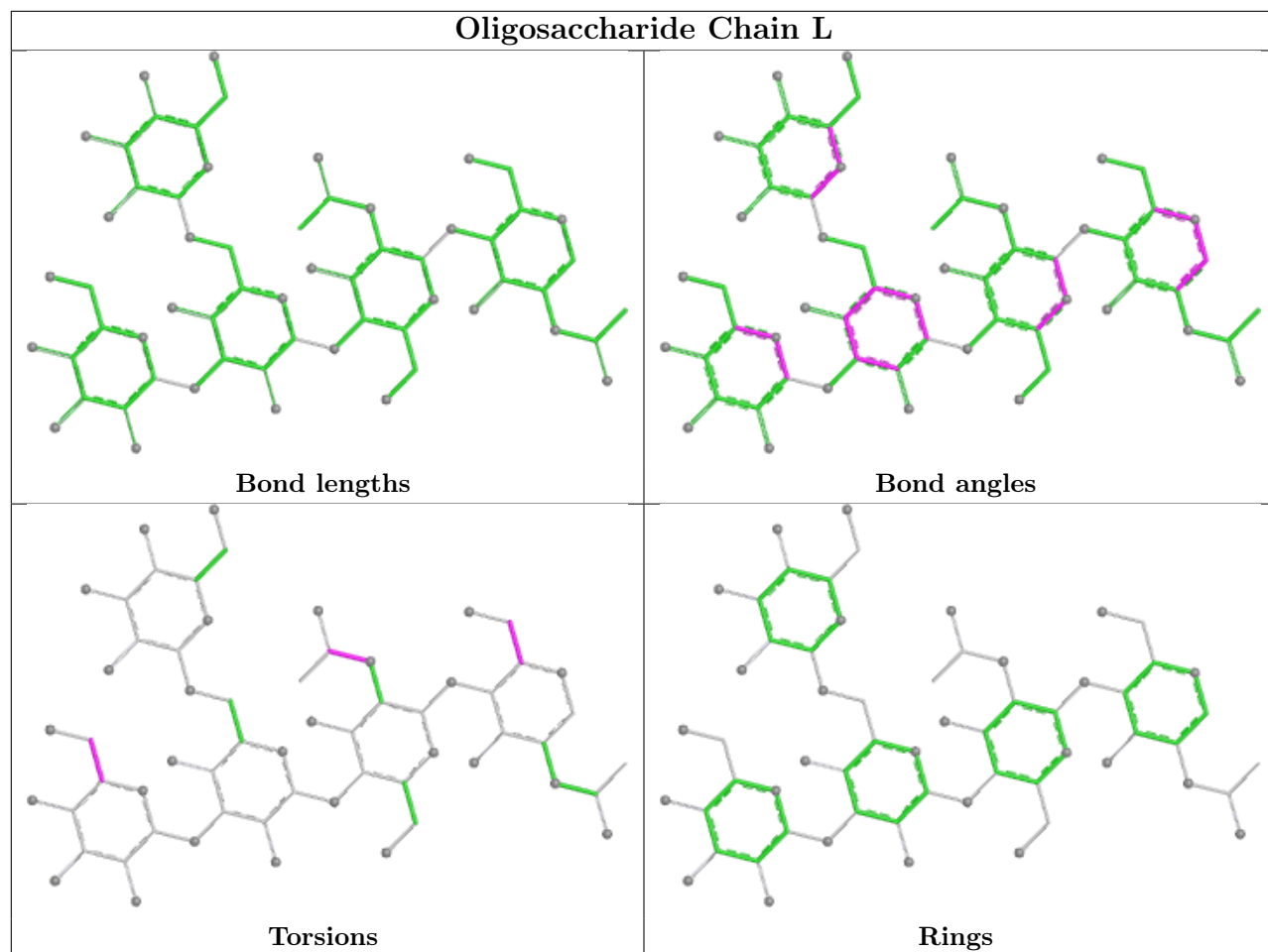
There are no ring outliers.

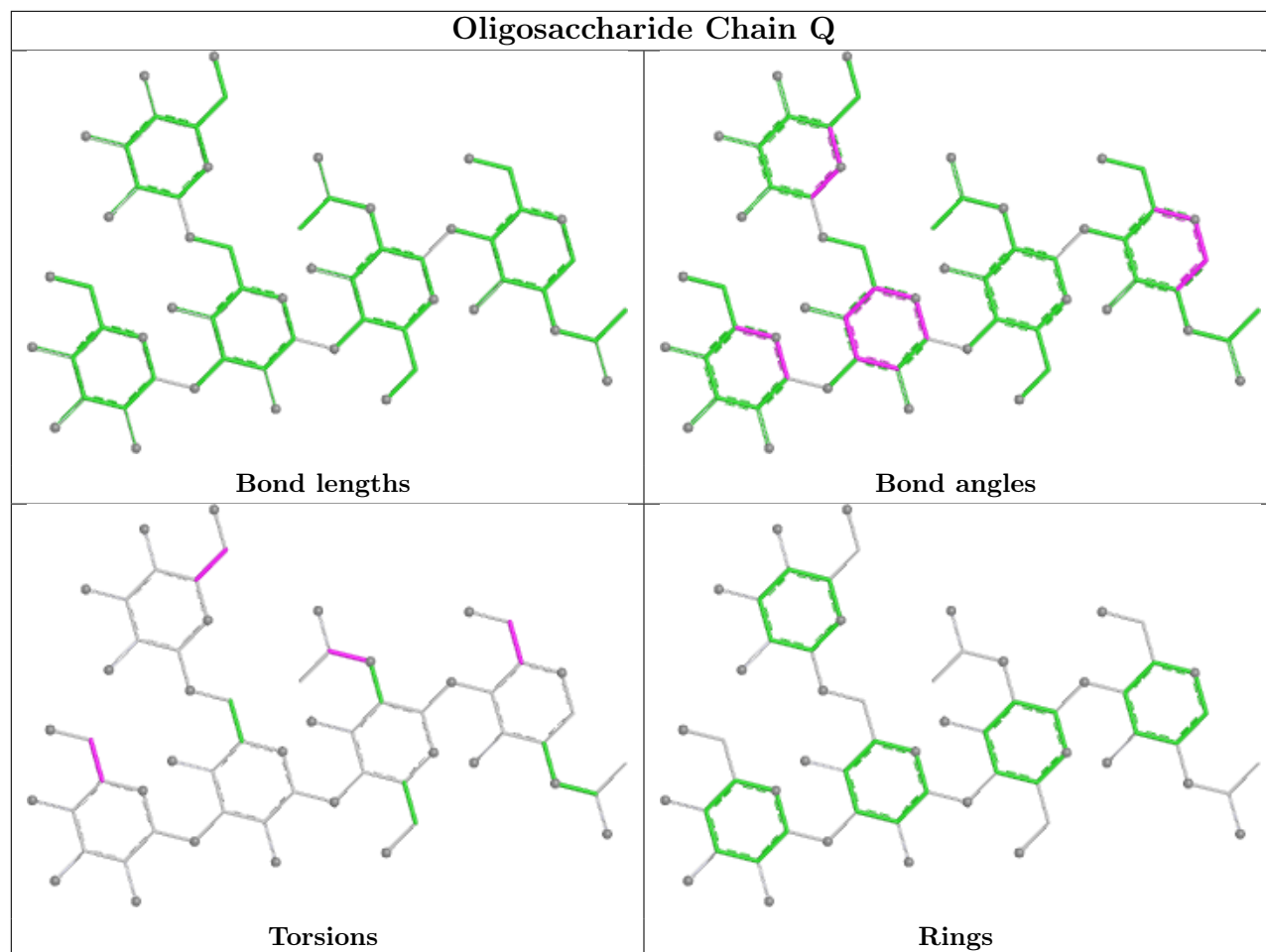
6 monomers are involved in 5 short contacts:

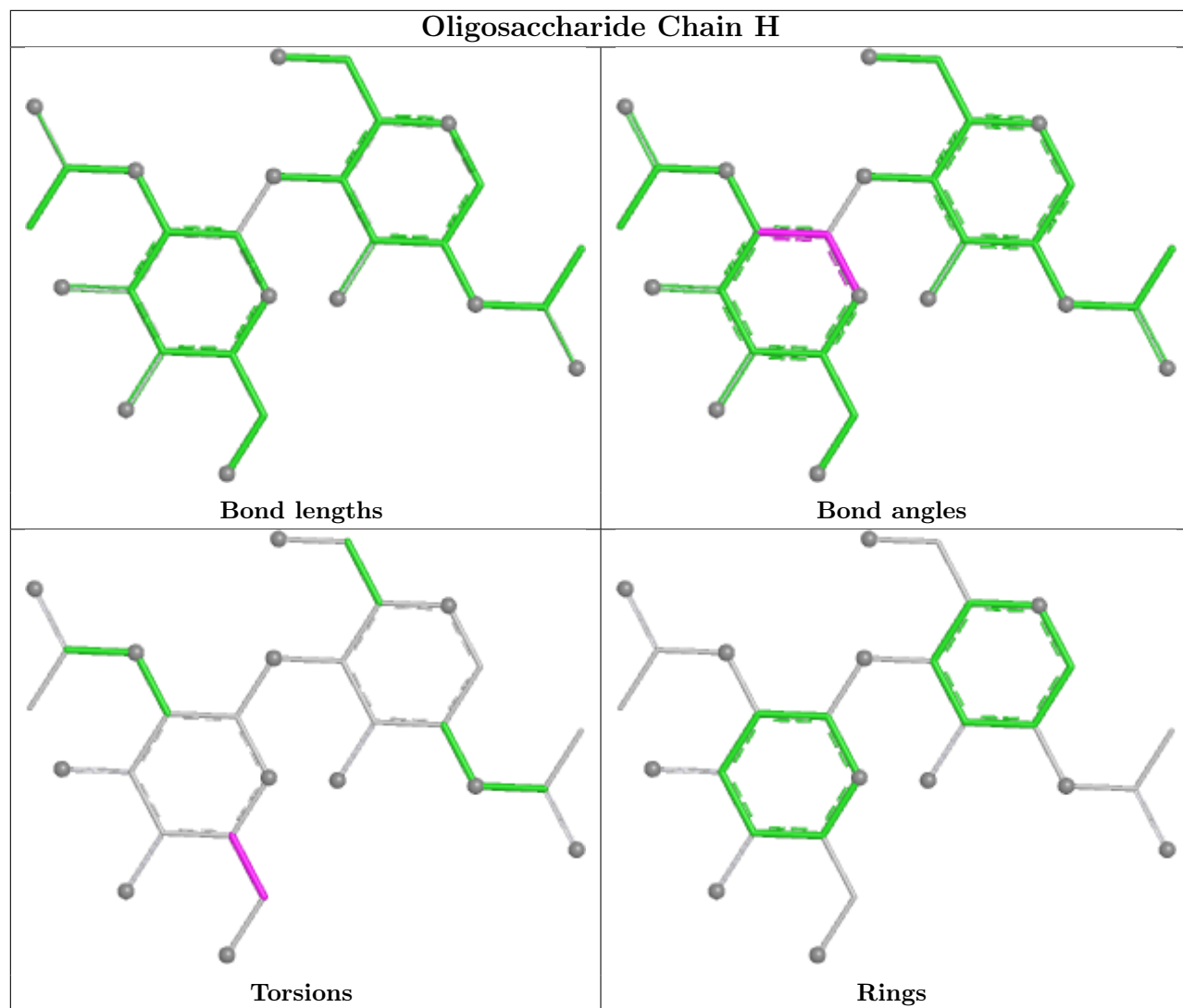
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	Z	1	NAG	1	0
4	K	2	NAG	1	0
5	c	1	NAG	1	0
5	W	1	NAG	1	0
4	K	1	NAG	1	0
6	d	4	FUC	1	0

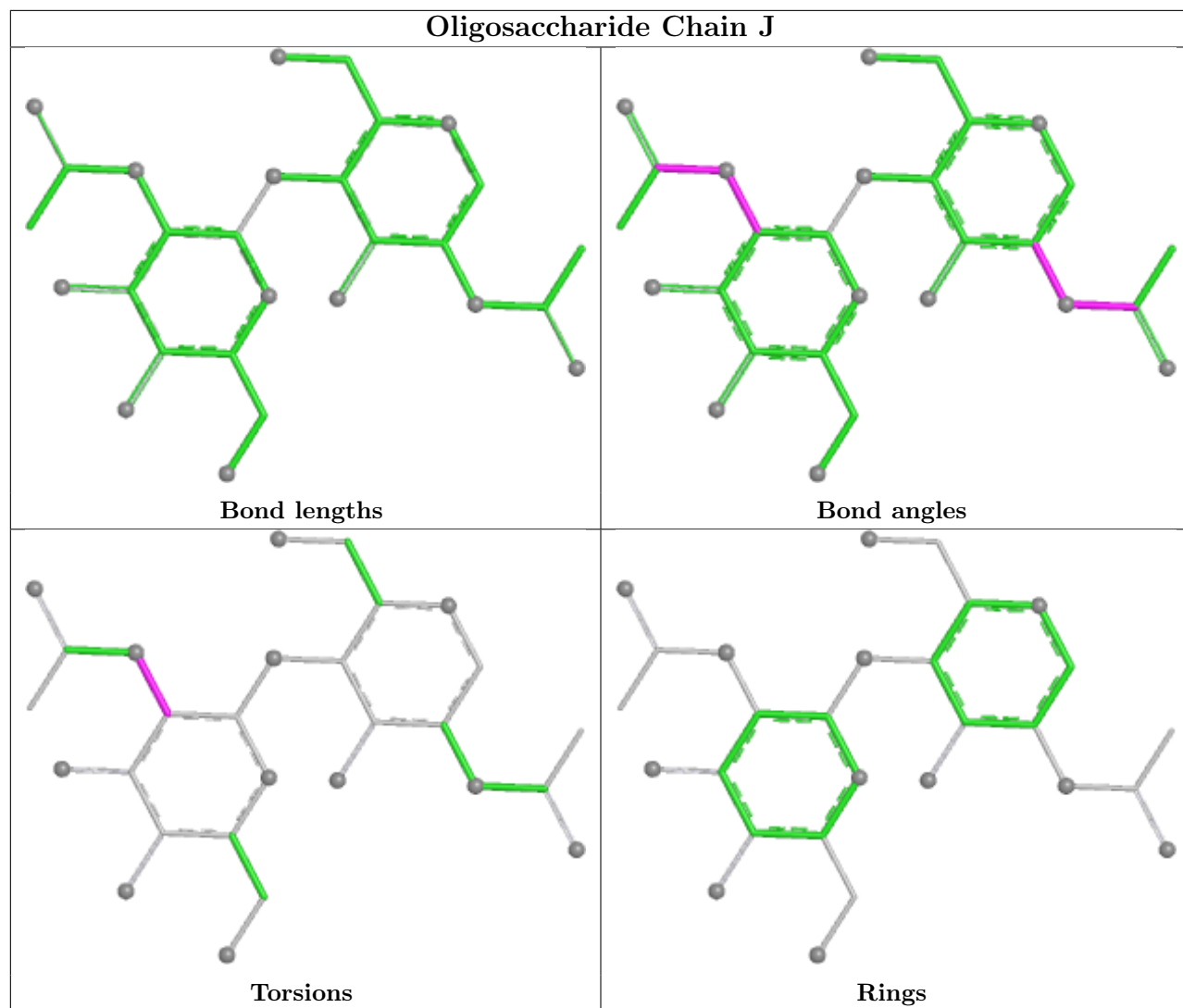
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

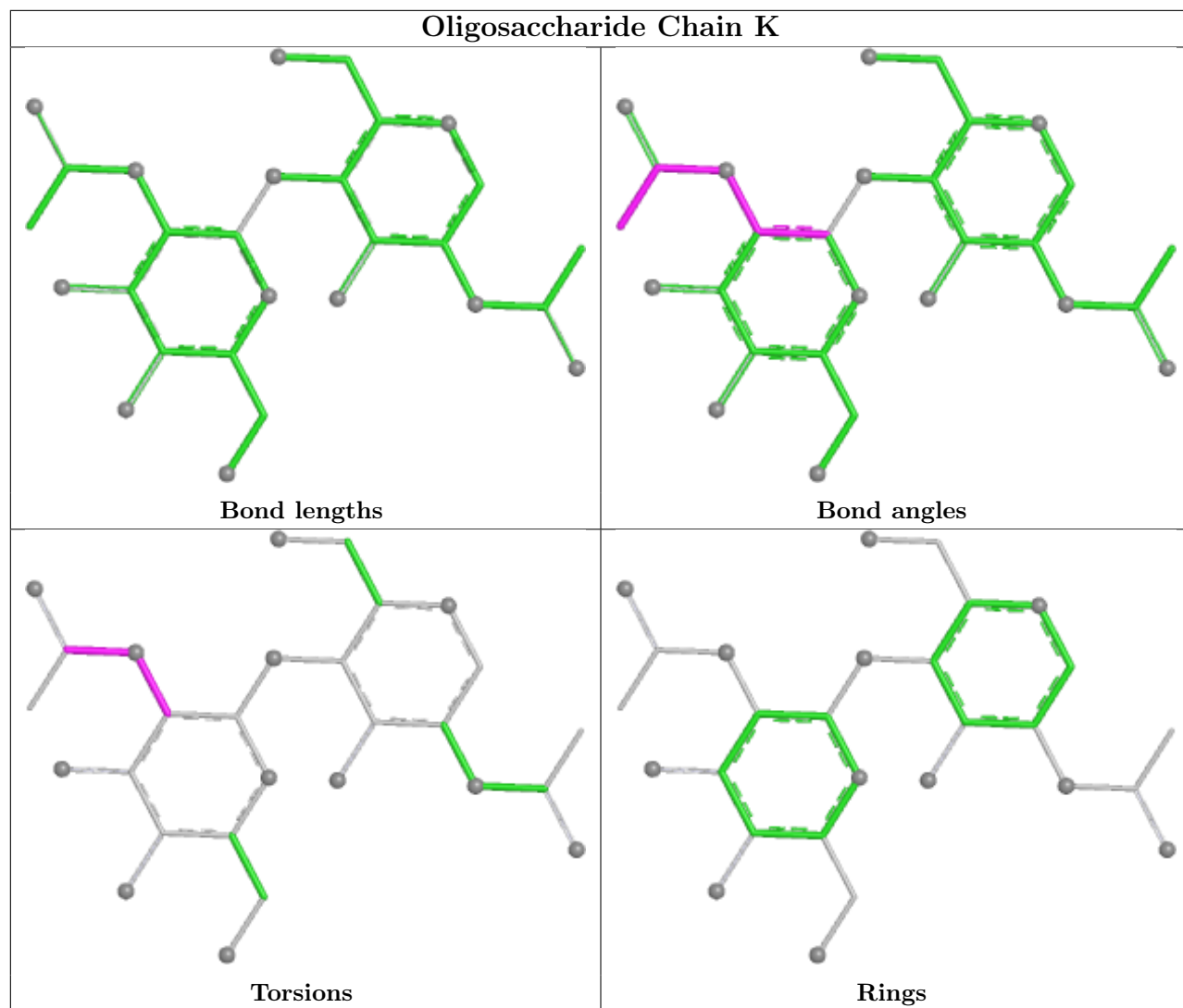


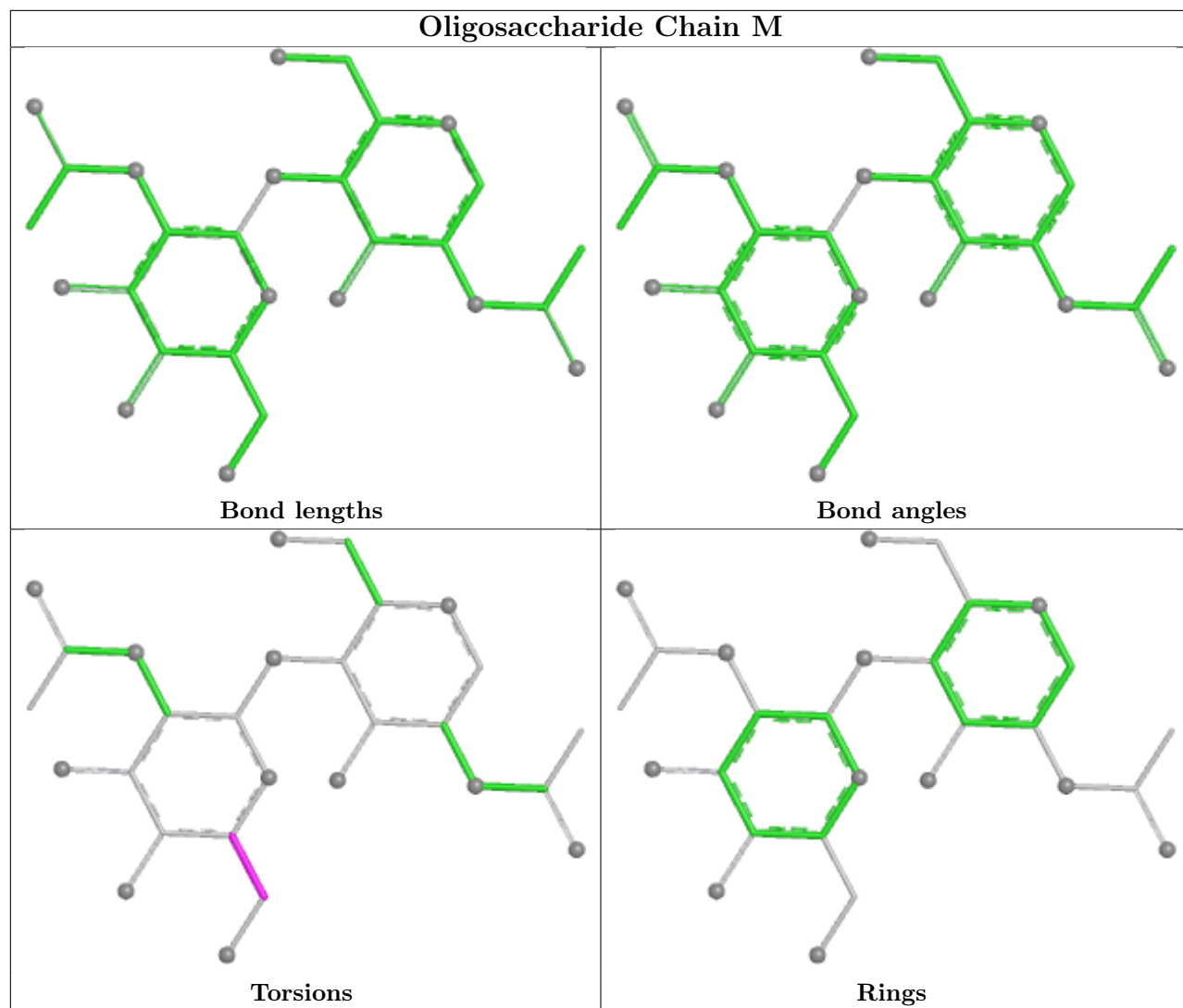


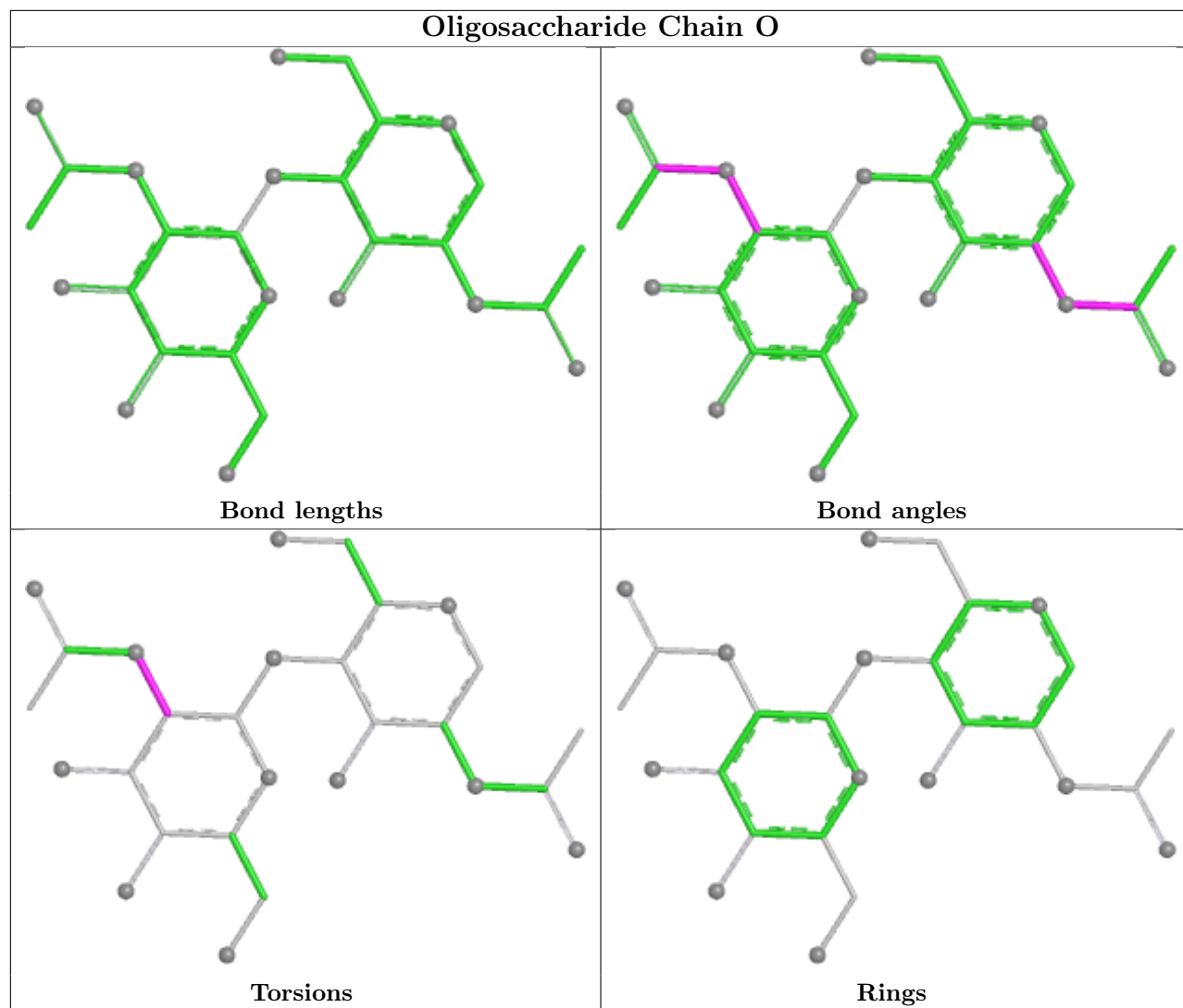


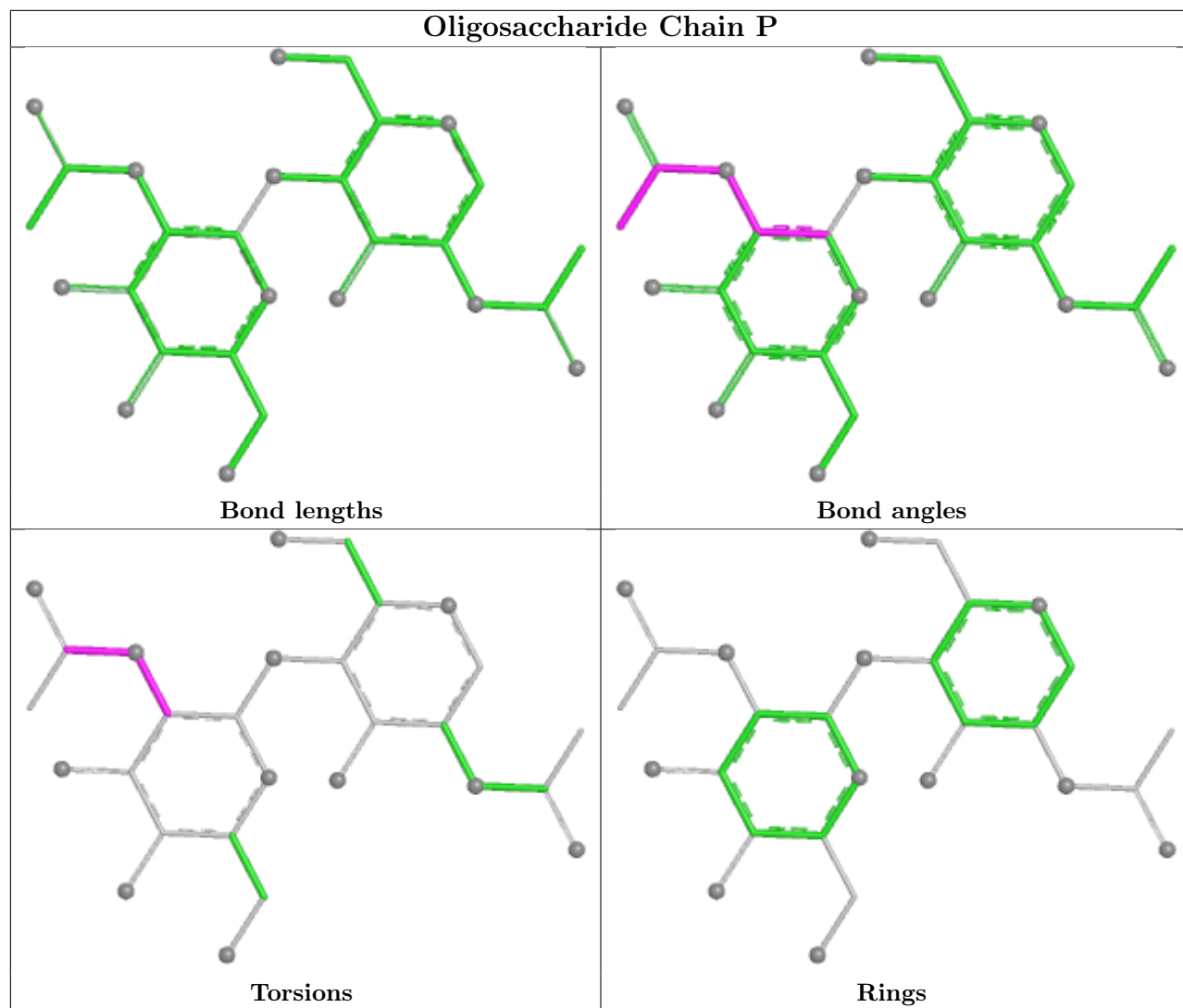


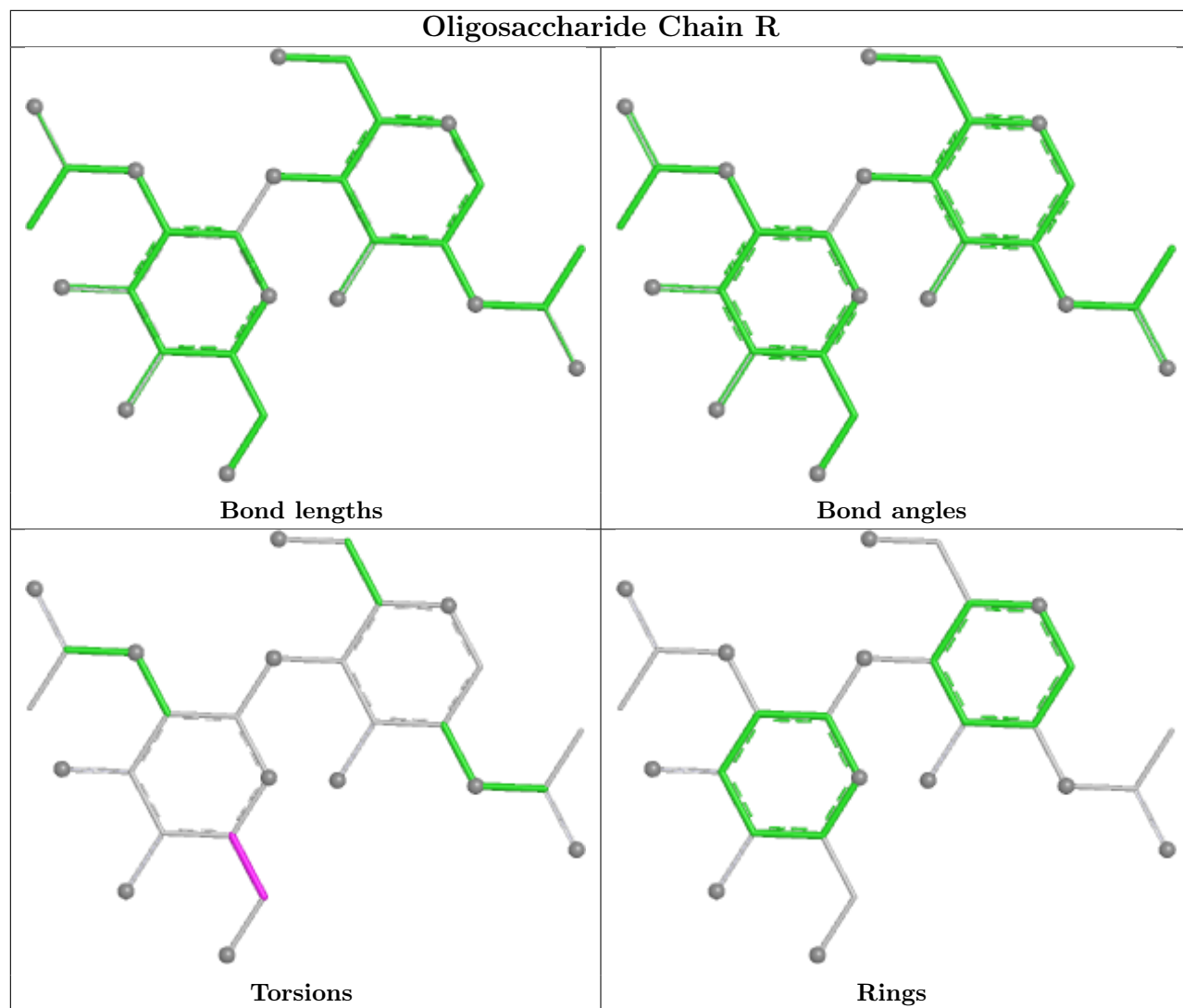


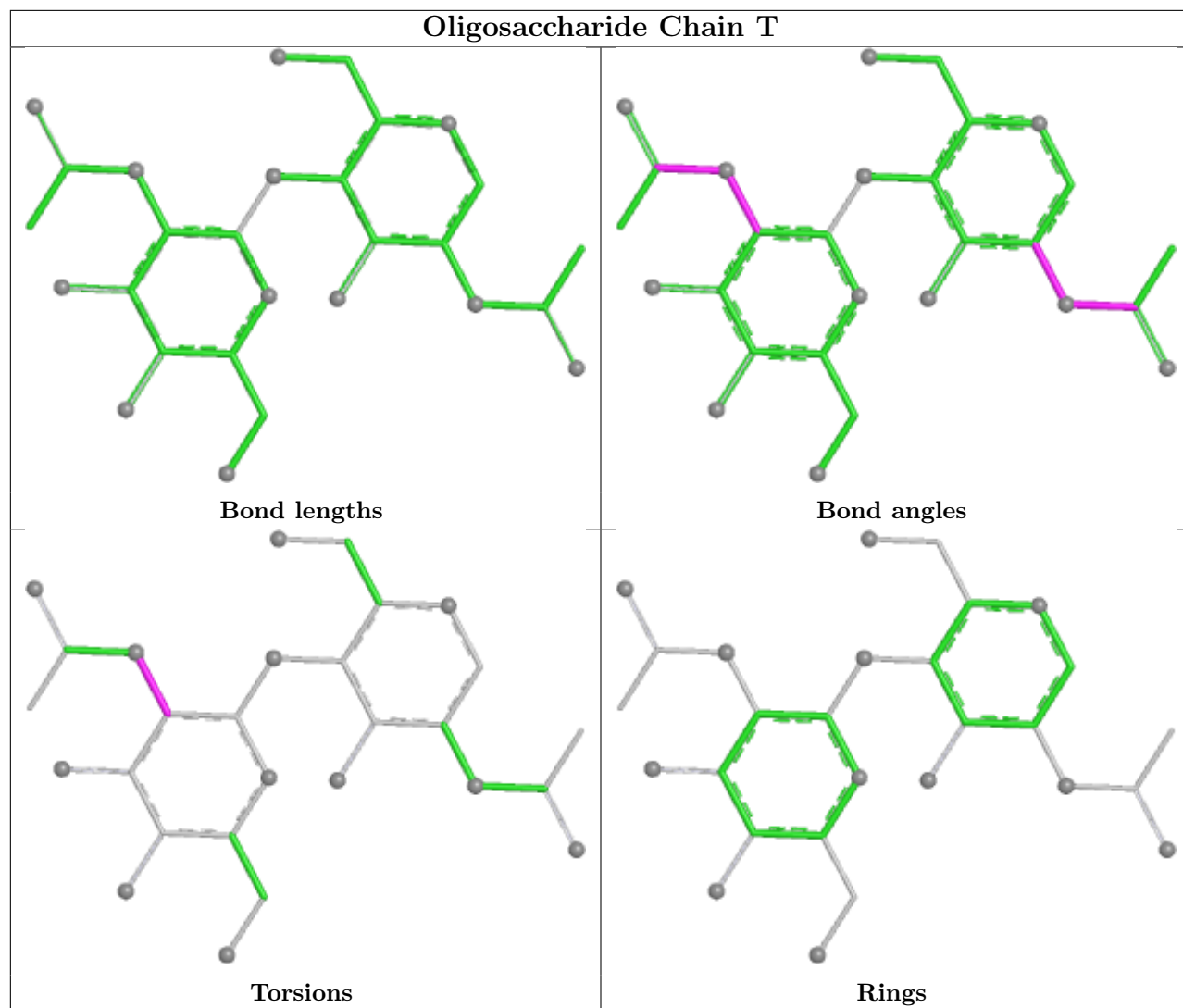


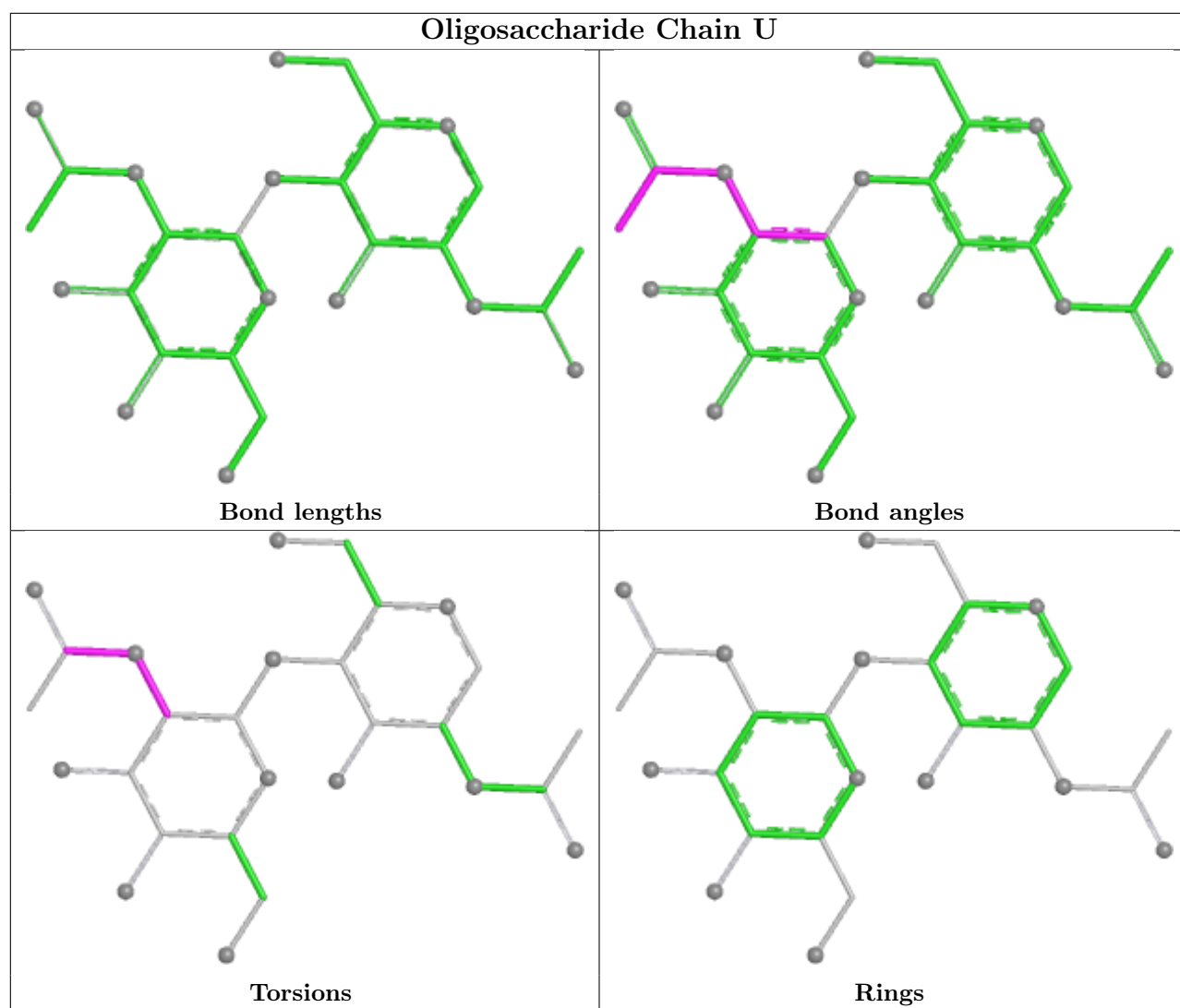


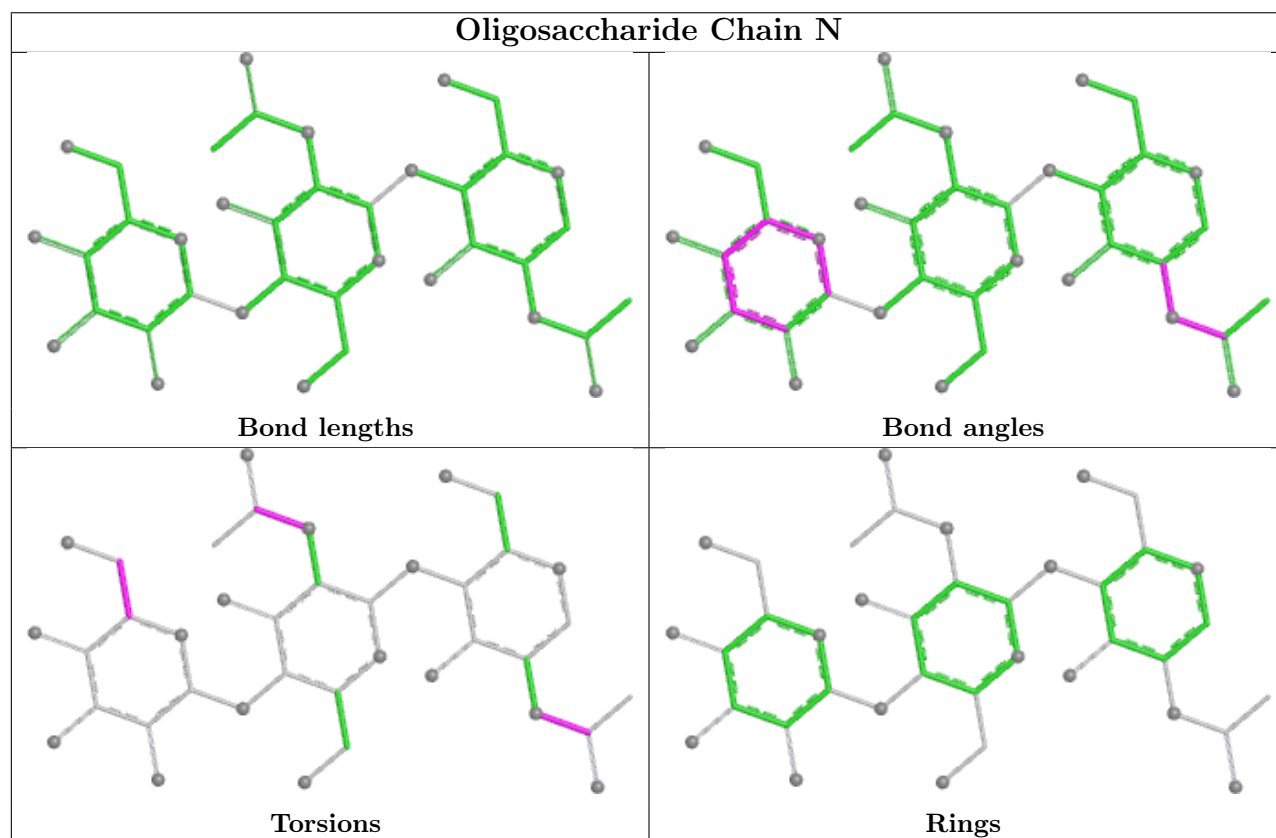
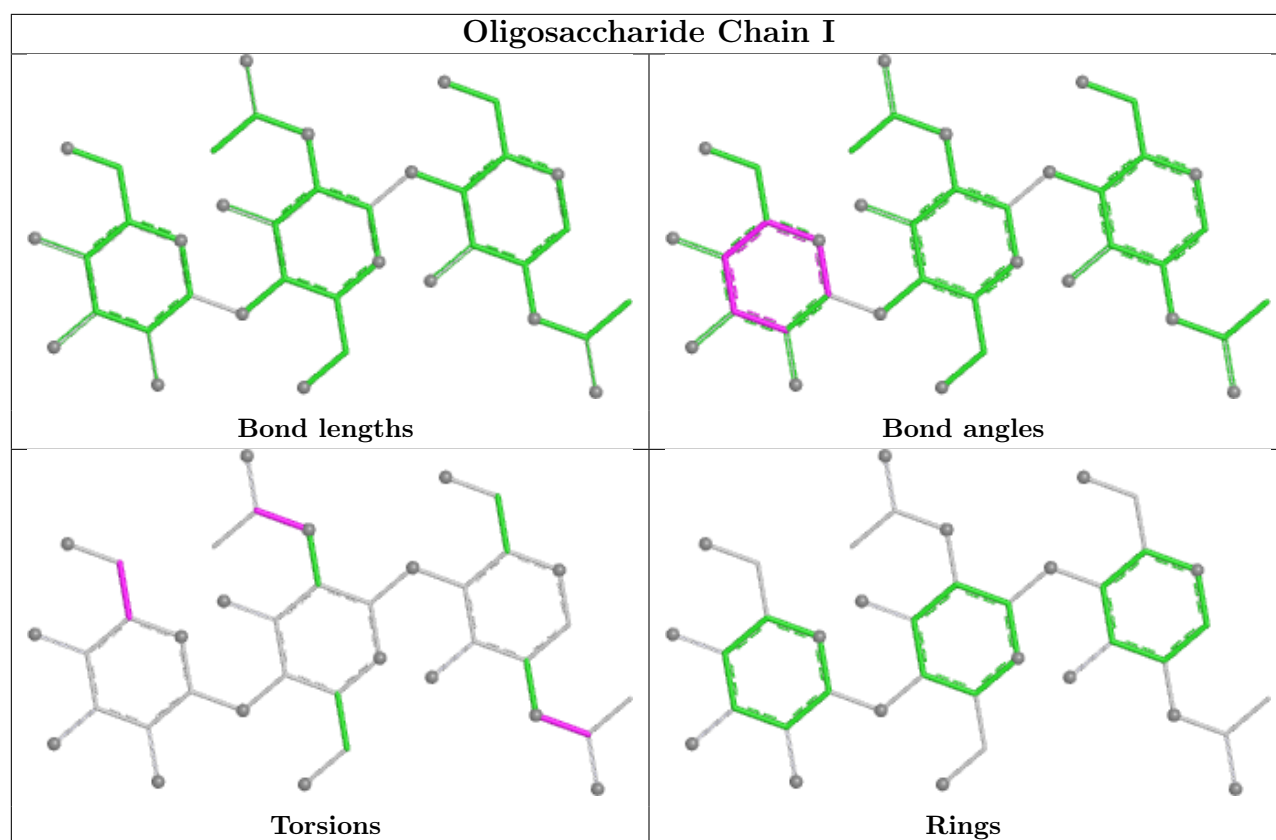


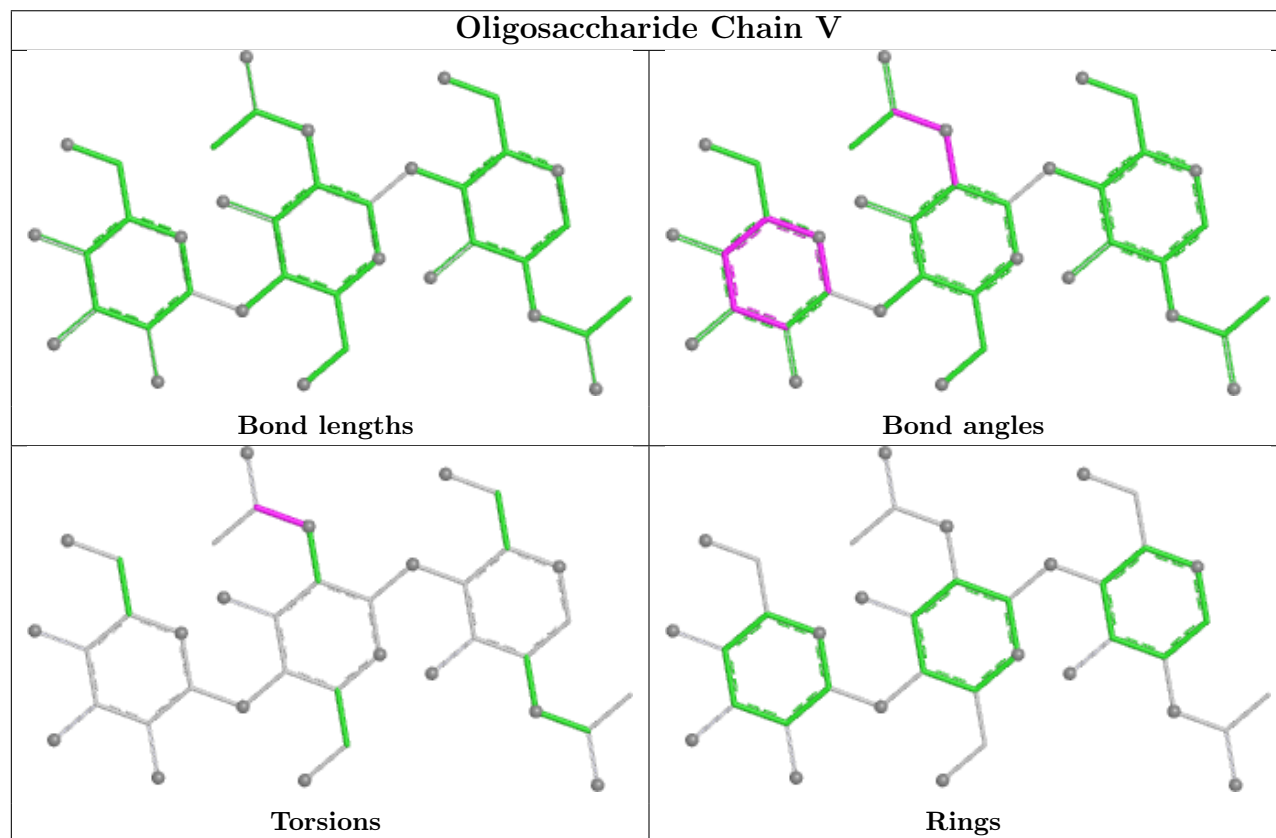
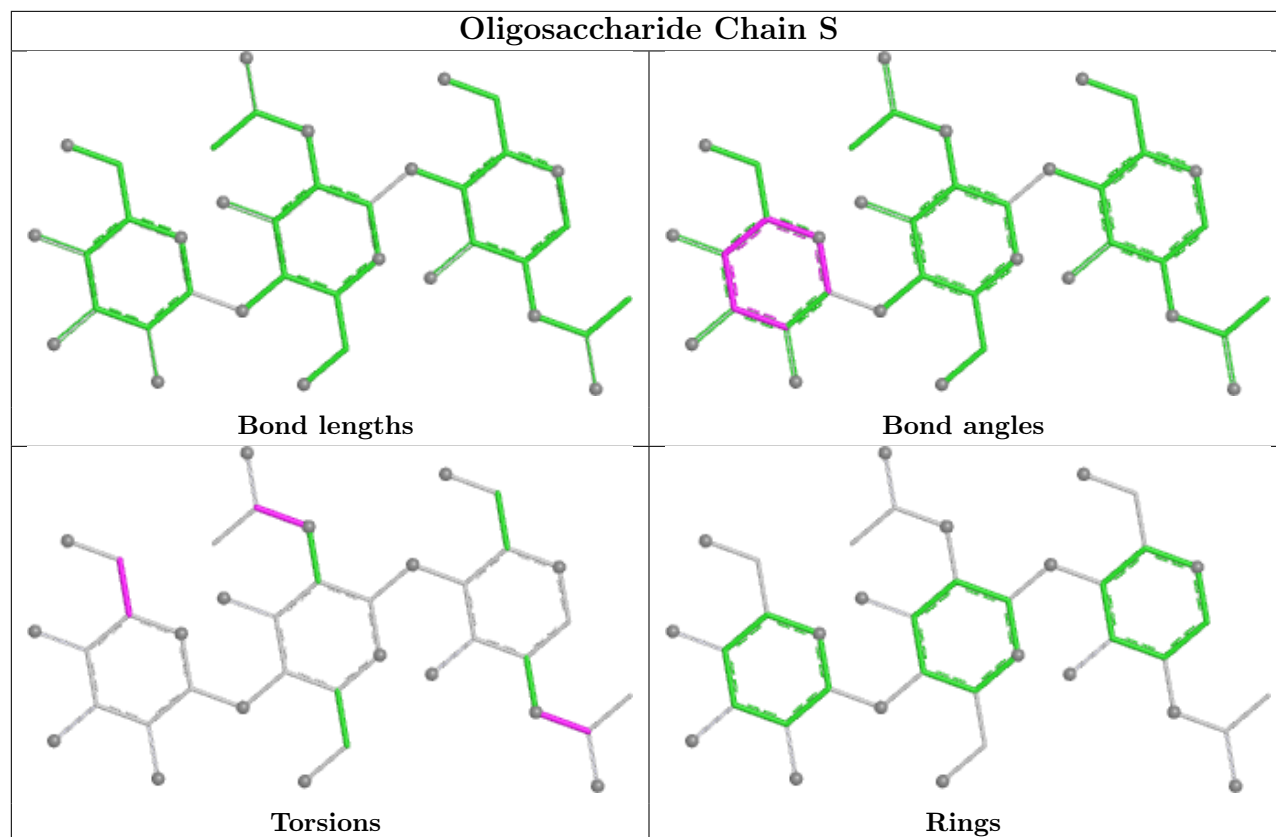


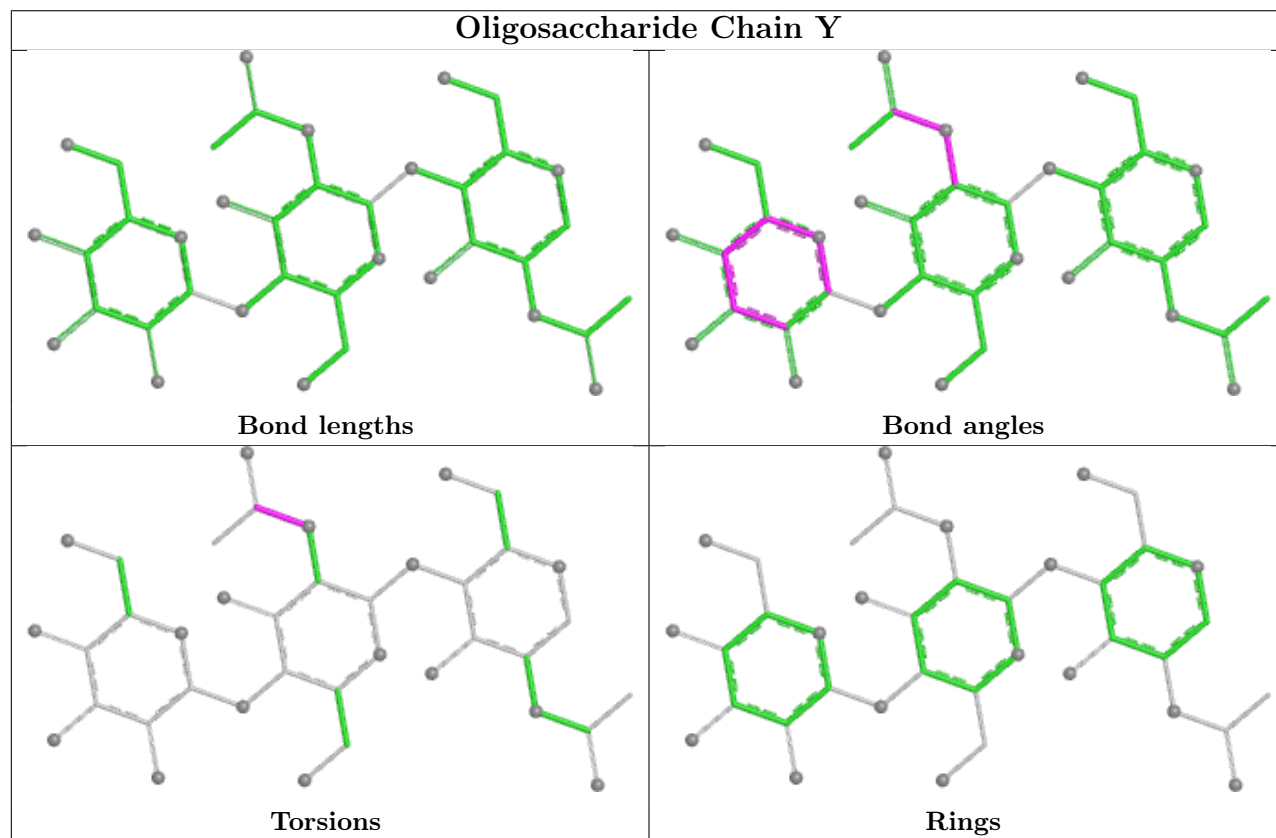
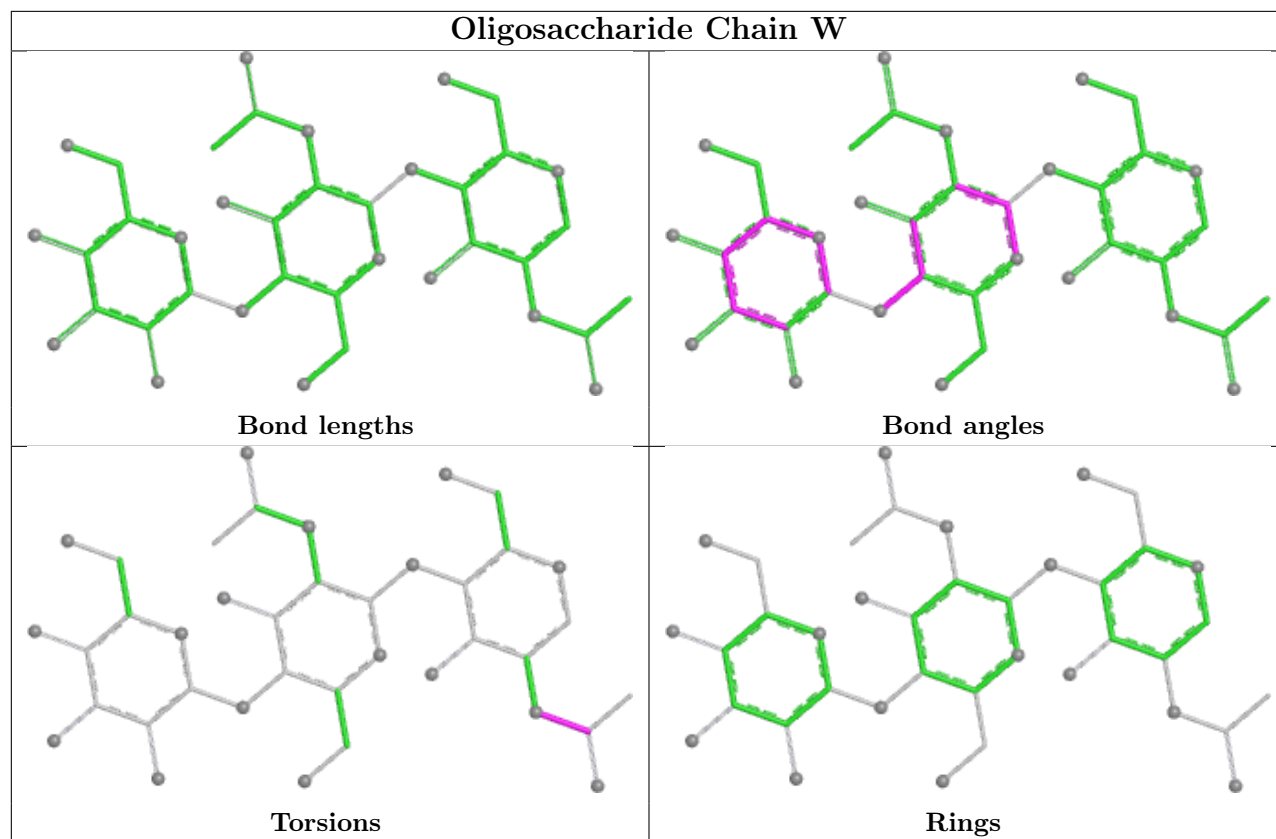


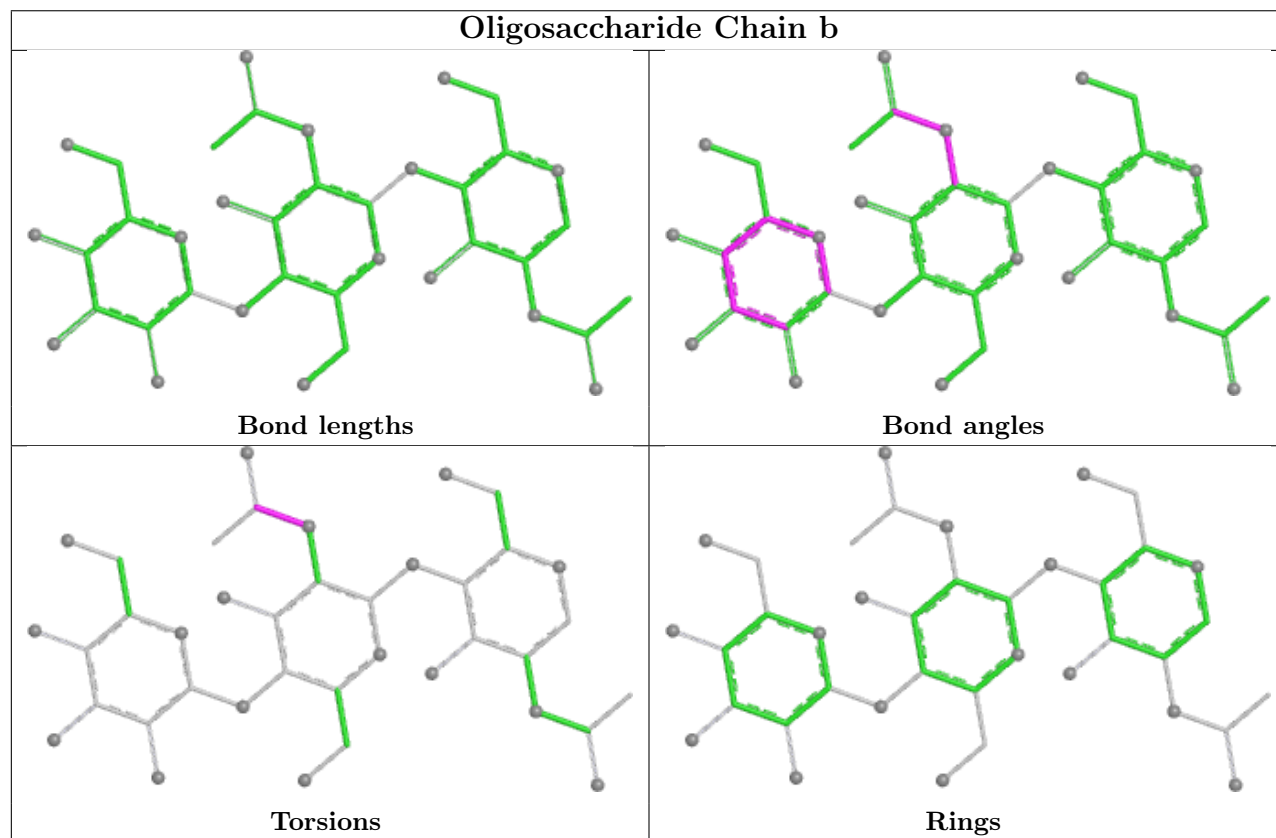
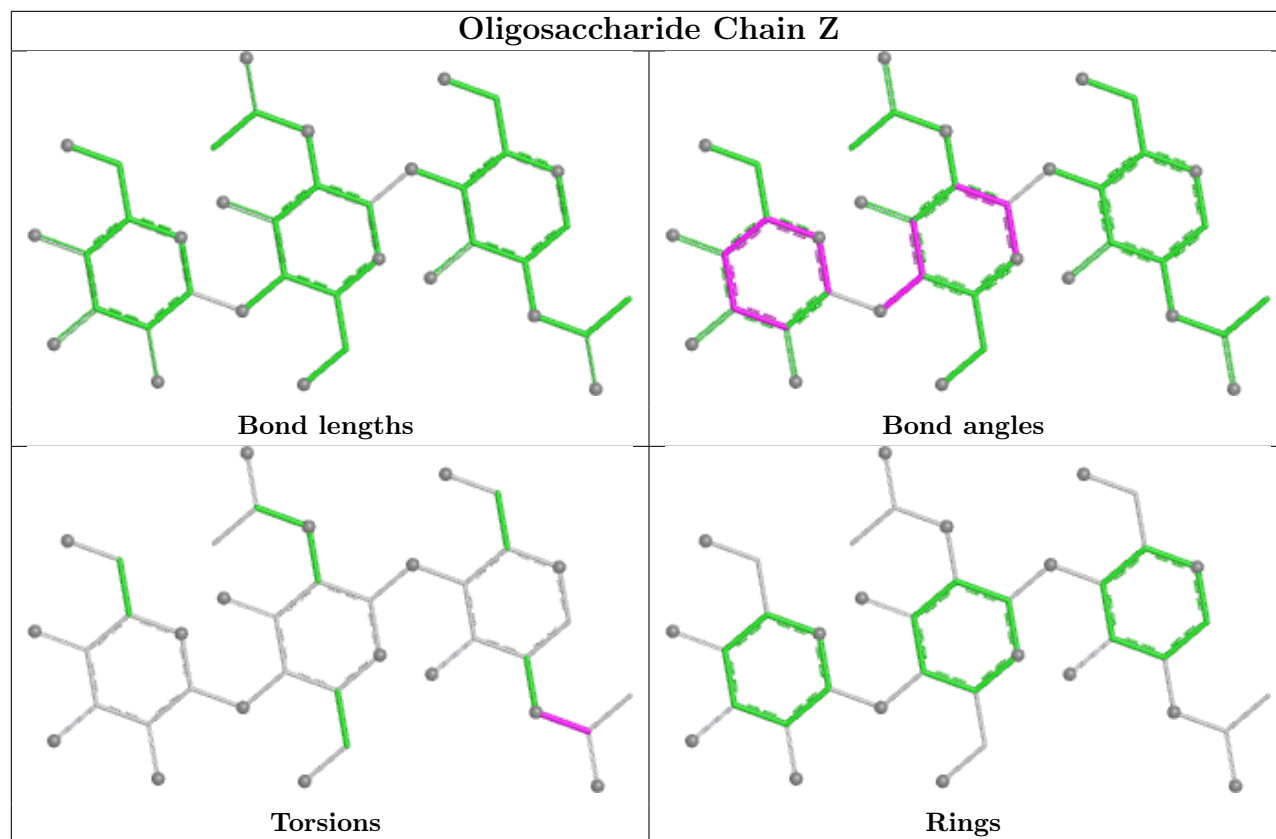


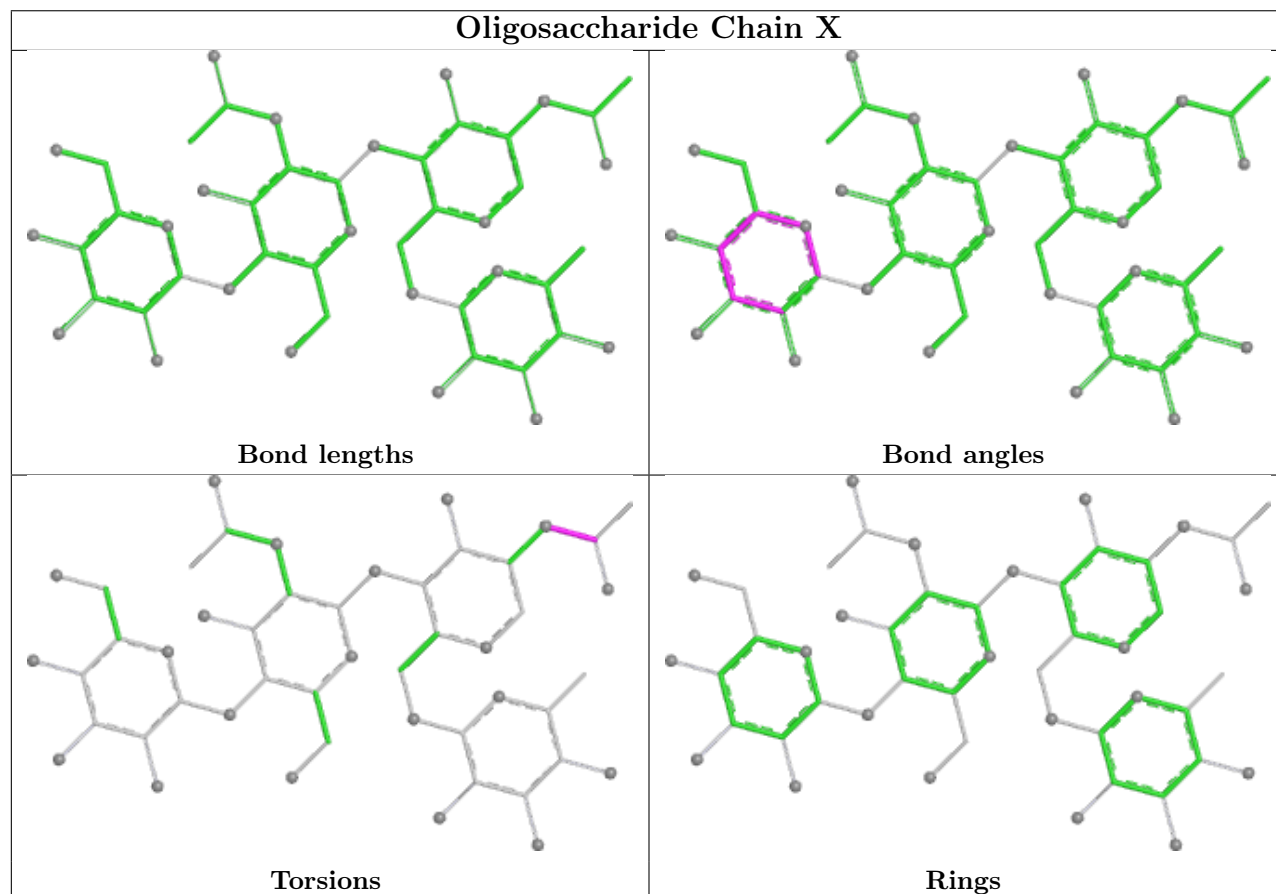
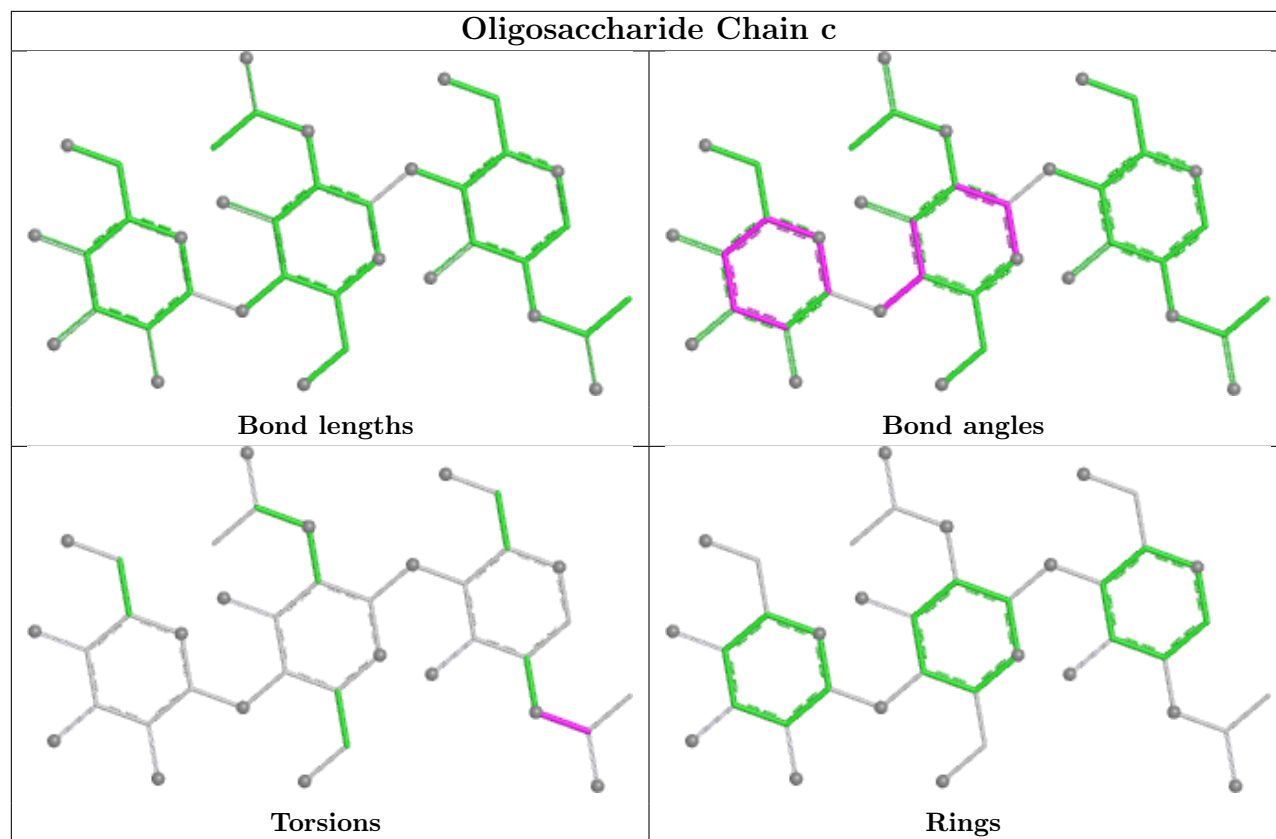


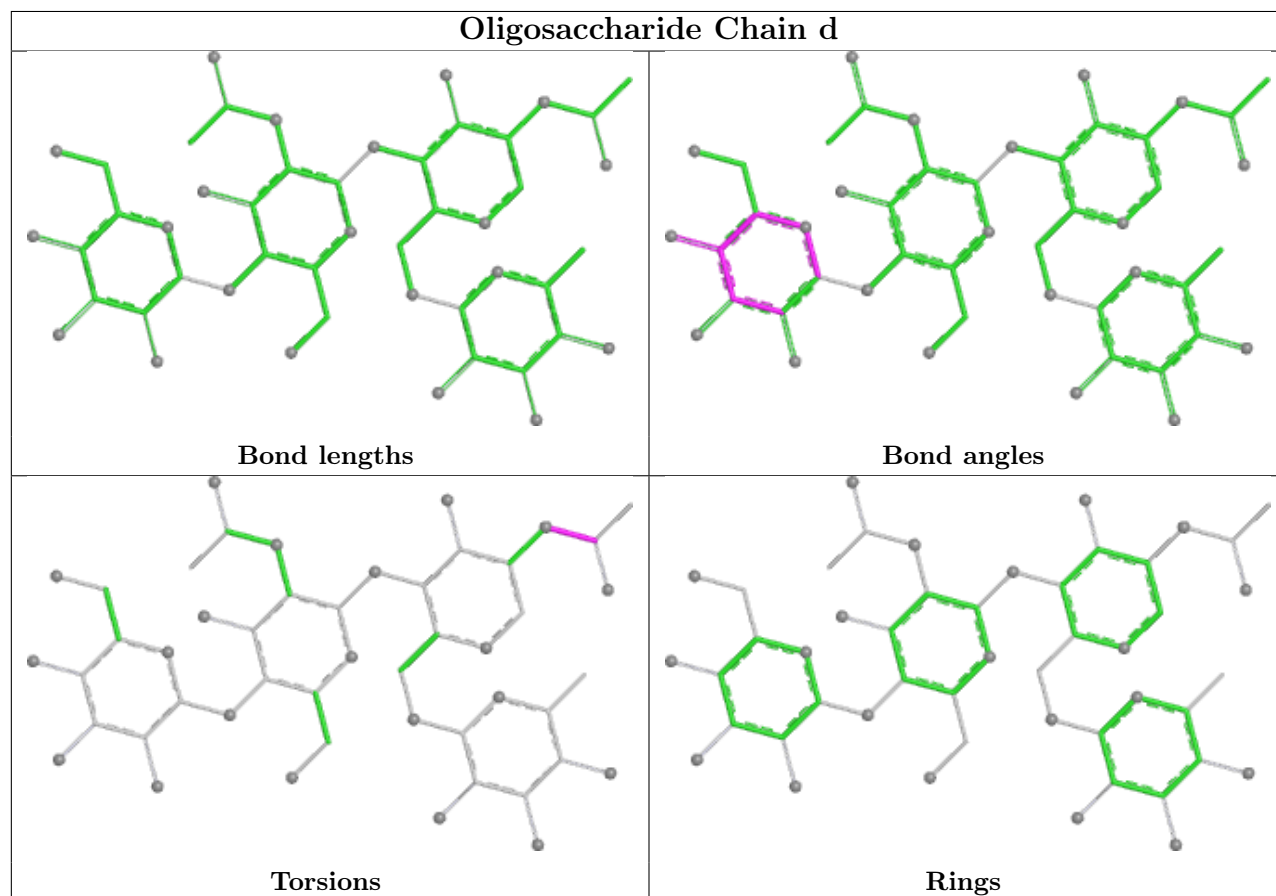
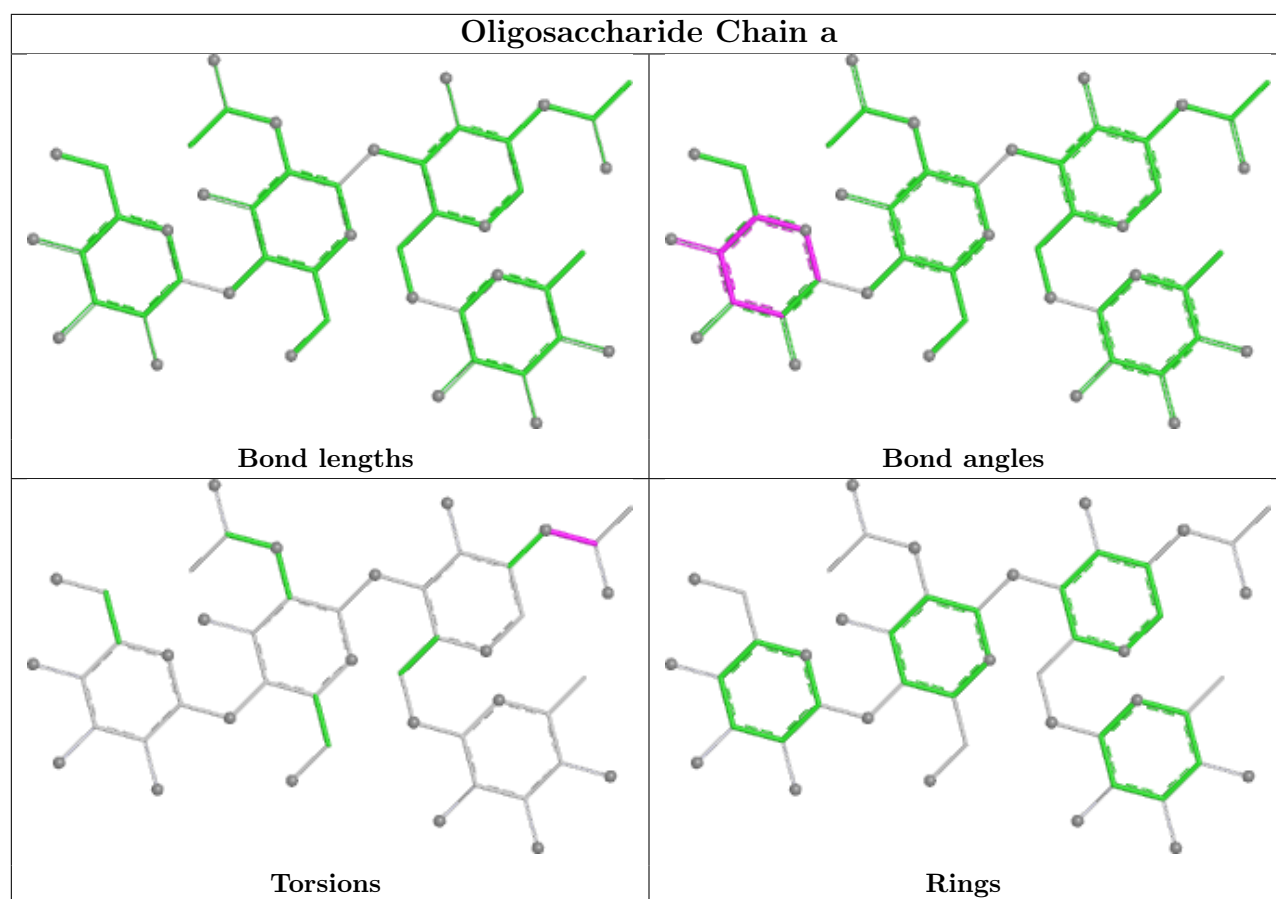












5.6 Ligand geometry

6 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$
7	NAG	C	501	1	14,14,15	0.71	0	17,19,21	0.85	0
7	NAG	E	801	2	14,14,15	0.73	0	17,19,21	0.89	1 (5%)
7	NAG	A	501	1	14,14,15	0.72	0	17,19,21	0.85	0
7	NAG	F	801	2	14,14,15	0.74	0	17,19,21	0.90	1 (5%)
7	NAG	D	801	2	14,14,15	0.75	0	17,19,21	0.91	1 (5%)
7	NAG	B	501	1	14,14,15	0.71	0	17,19,21	0.85	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
7	NAG	C	501	1	-	2/6/23/26	0/1/1/1
7	NAG	E	801	2	-	3/6/23/26	0/1/1/1
7	NAG	A	501	1	-	2/6/23/26	0/1/1/1
7	NAG	F	801	2	-	3/6/23/26	0/1/1/1
7	NAG	D	801	2	-	3/6/23/26	0/1/1/1
7	NAG	B	501	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	D	801	NAG	C2-N2-C7	2.24	125.90	122.90
7	E	801	NAG	C2-N2-C7	2.20	125.84	122.90
7	F	801	NAG	C2-N2-C7	2.14	125.77	122.90

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	A	501	NAG	C8-C7-N2-C2
7	A	501	NAG	O7-C7-N2-C2
7	B	501	NAG	C8-C7-N2-C2
7	B	501	NAG	O7-C7-N2-C2
7	C	501	NAG	C8-C7-N2-C2
7	C	501	NAG	O7-C7-N2-C2
7	D	801	NAG	C8-C7-N2-C2
7	D	801	NAG	O7-C7-N2-C2
7	E	801	NAG	C8-C7-N2-C2
7	E	801	NAG	O7-C7-N2-C2
7	F	801	NAG	C8-C7-N2-C2
7	F	801	NAG	O7-C7-N2-C2
7	F	801	NAG	O5-C5-C6-O6
7	D	801	NAG	O5-C5-C6-O6
7	E	801	NAG	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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.

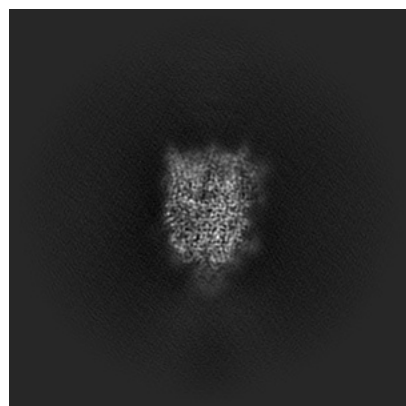
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-70098. These allow visual inspection of the internal detail of the map and identification of artifacts.

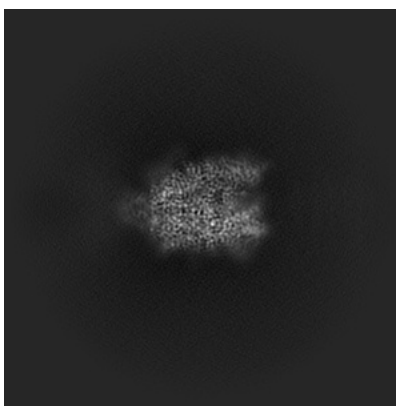
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

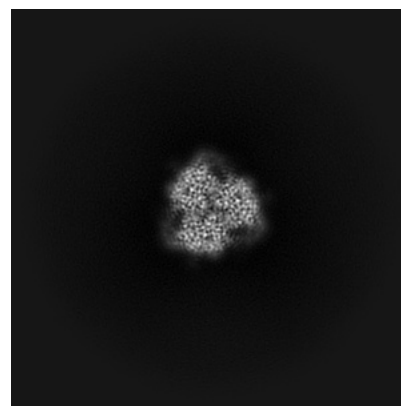
6.1.1 Primary map



X

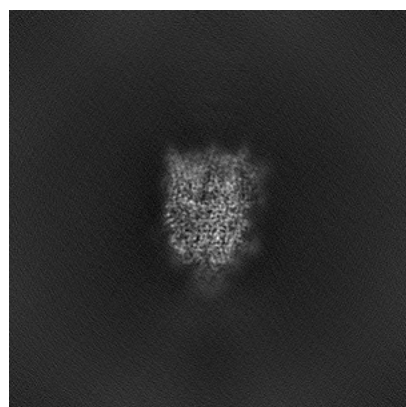


Y

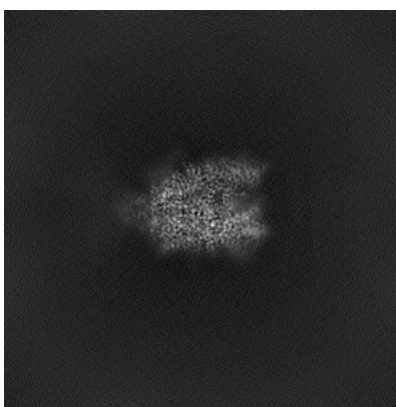


Z

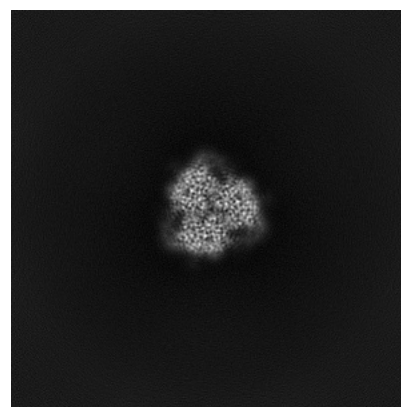
6.1.2 Raw map



X



Y

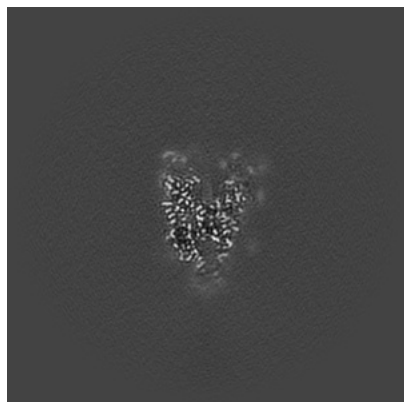


Z

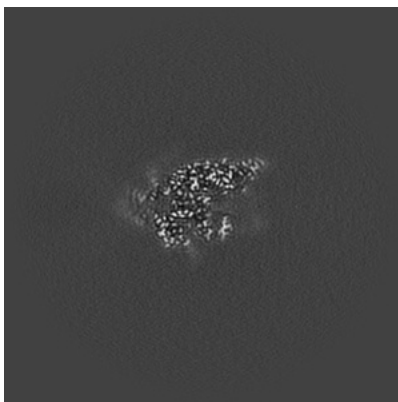
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

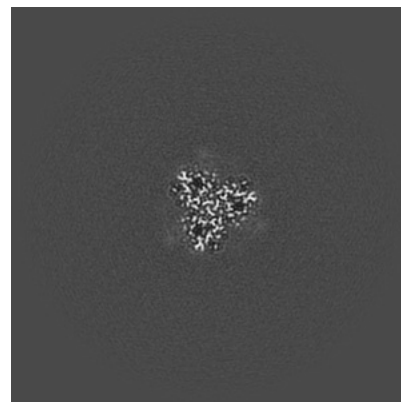
6.2.1 Primary map



X Index: 180

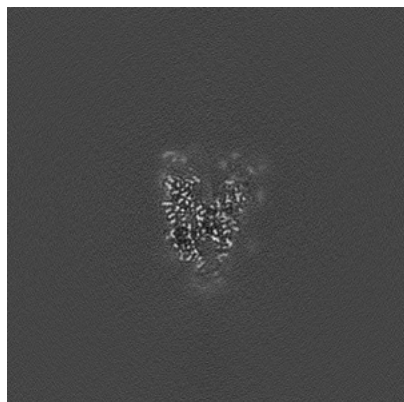


Y Index: 180

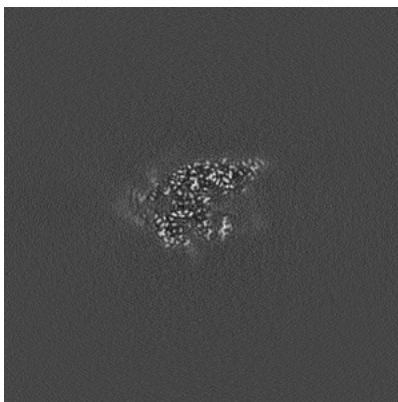


Z Index: 180

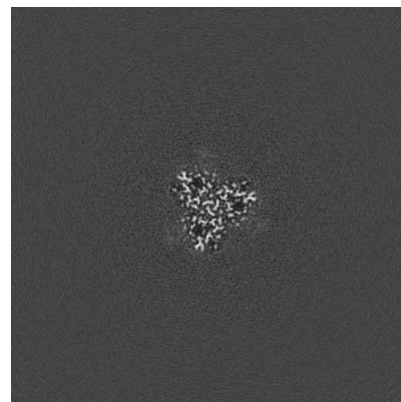
6.2.2 Raw map



X Index: 180



Y Index: 180

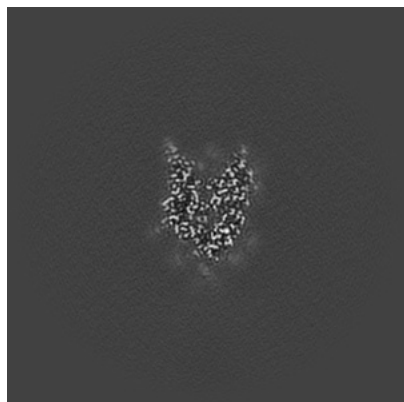


Z Index: 180

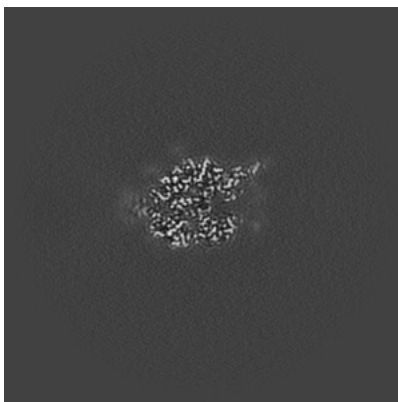
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

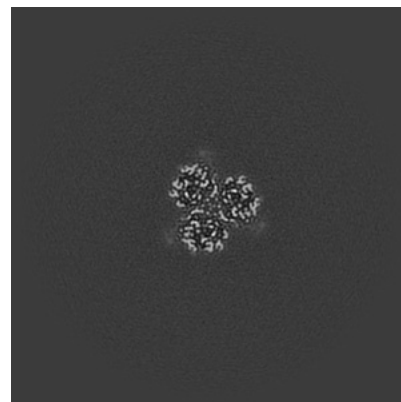
6.3.1 Primary map



X Index: 165

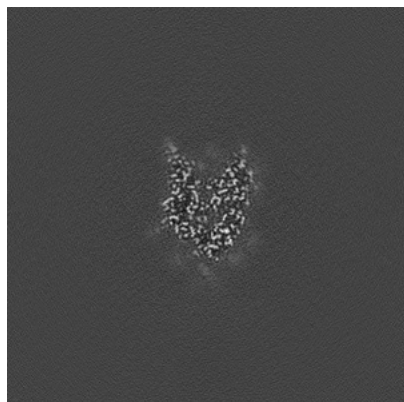


Y Index: 187

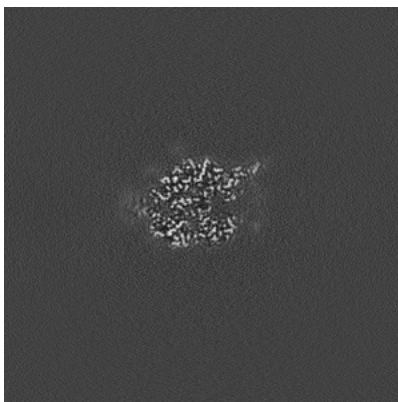


Z Index: 183

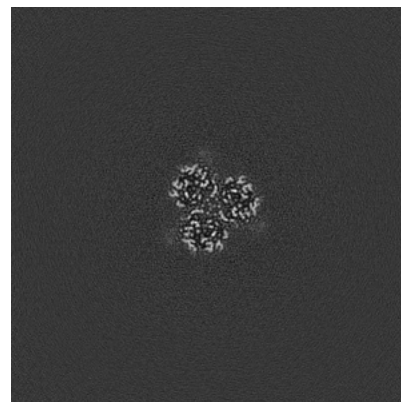
6.3.2 Raw map



X Index: 165



Y Index: 187

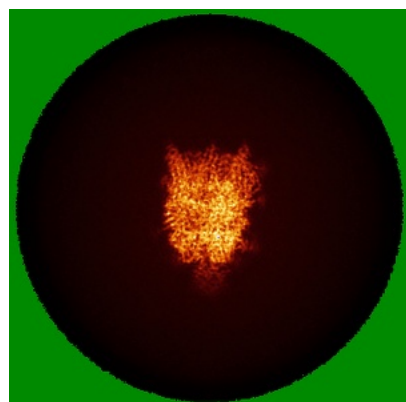


Z Index: 183

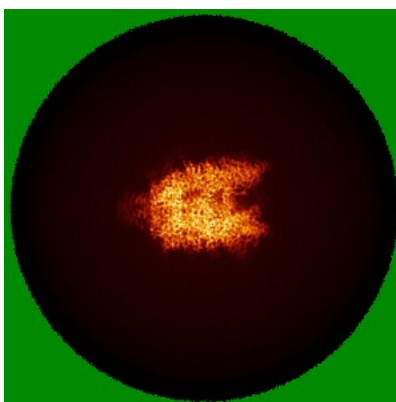
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) [i](#)

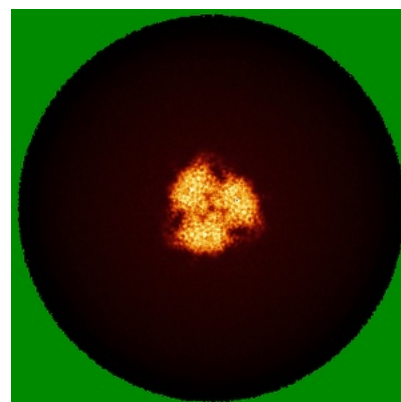
6.4.1 Primary map



X

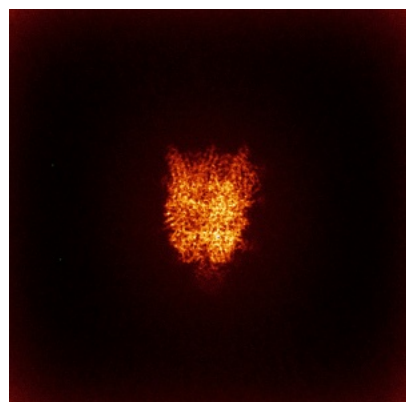


Y

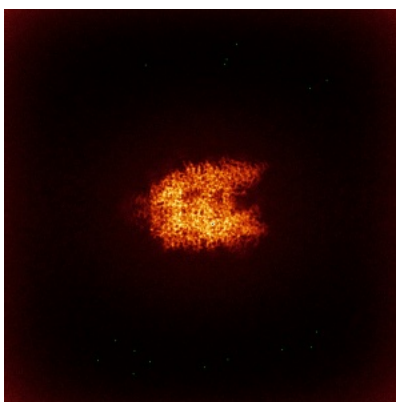


Z

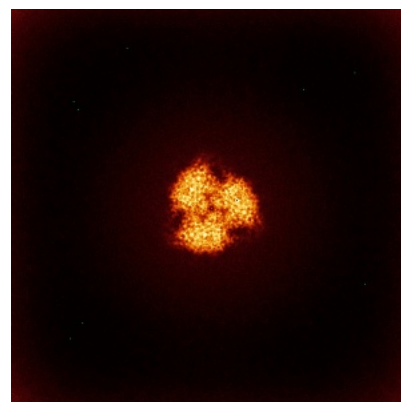
6.4.2 Raw map



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](#)

This section was not generated.

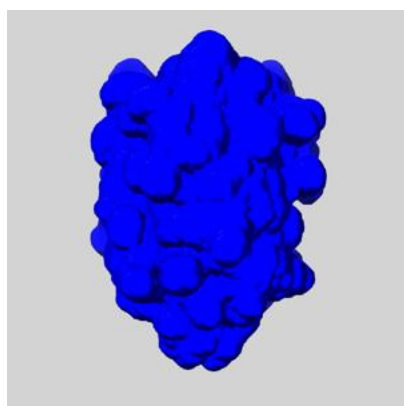
6.6 Mask visualisation [i](#)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

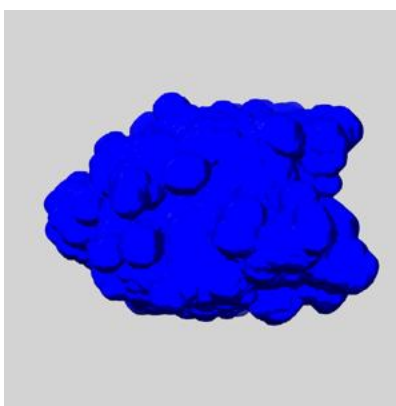
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

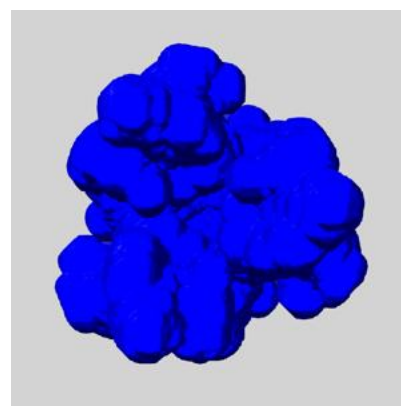
6.6.1 emd_70098_msk_1.map [i](#)



X



Y

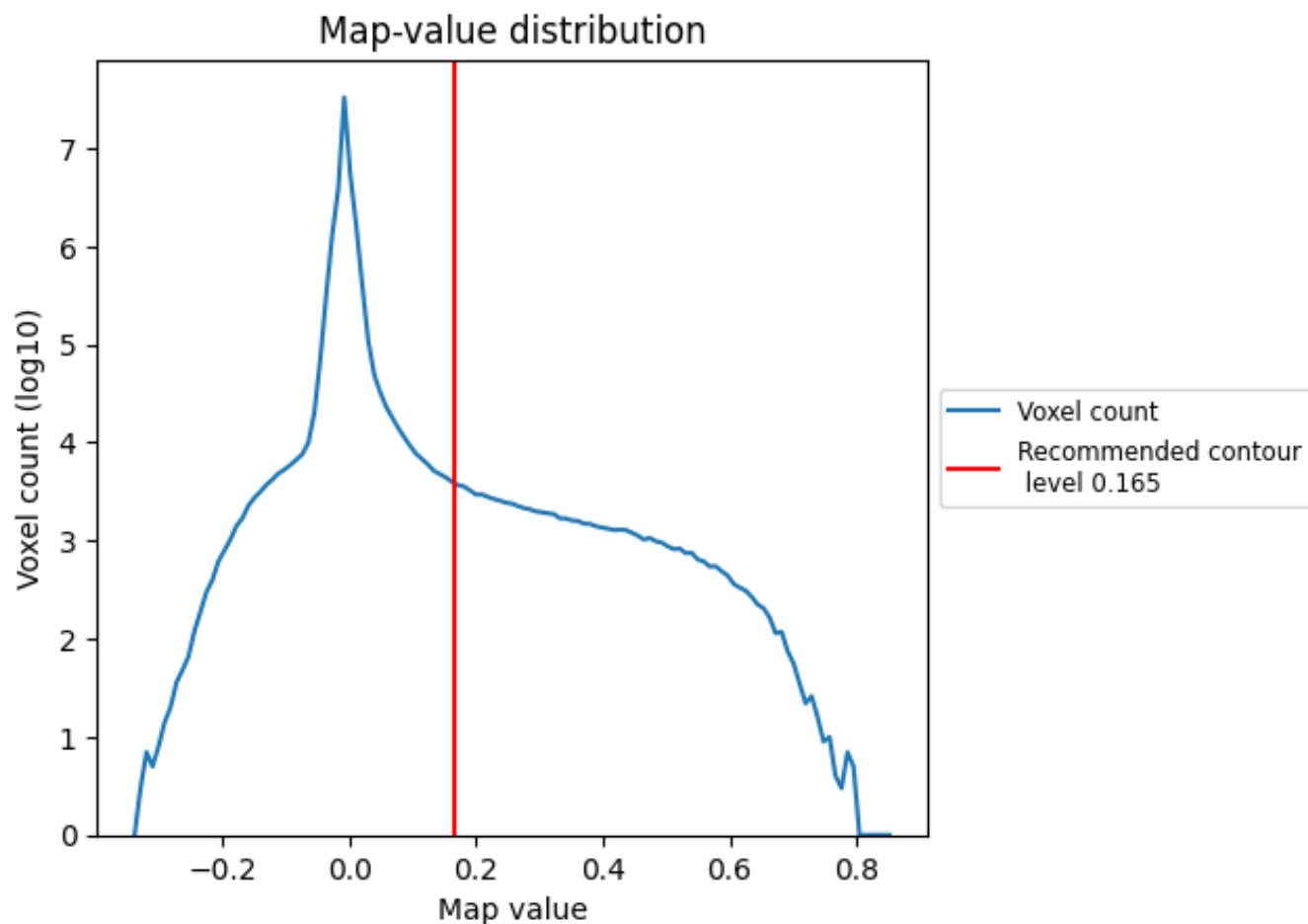


Z

7 Map analysis [i](#)

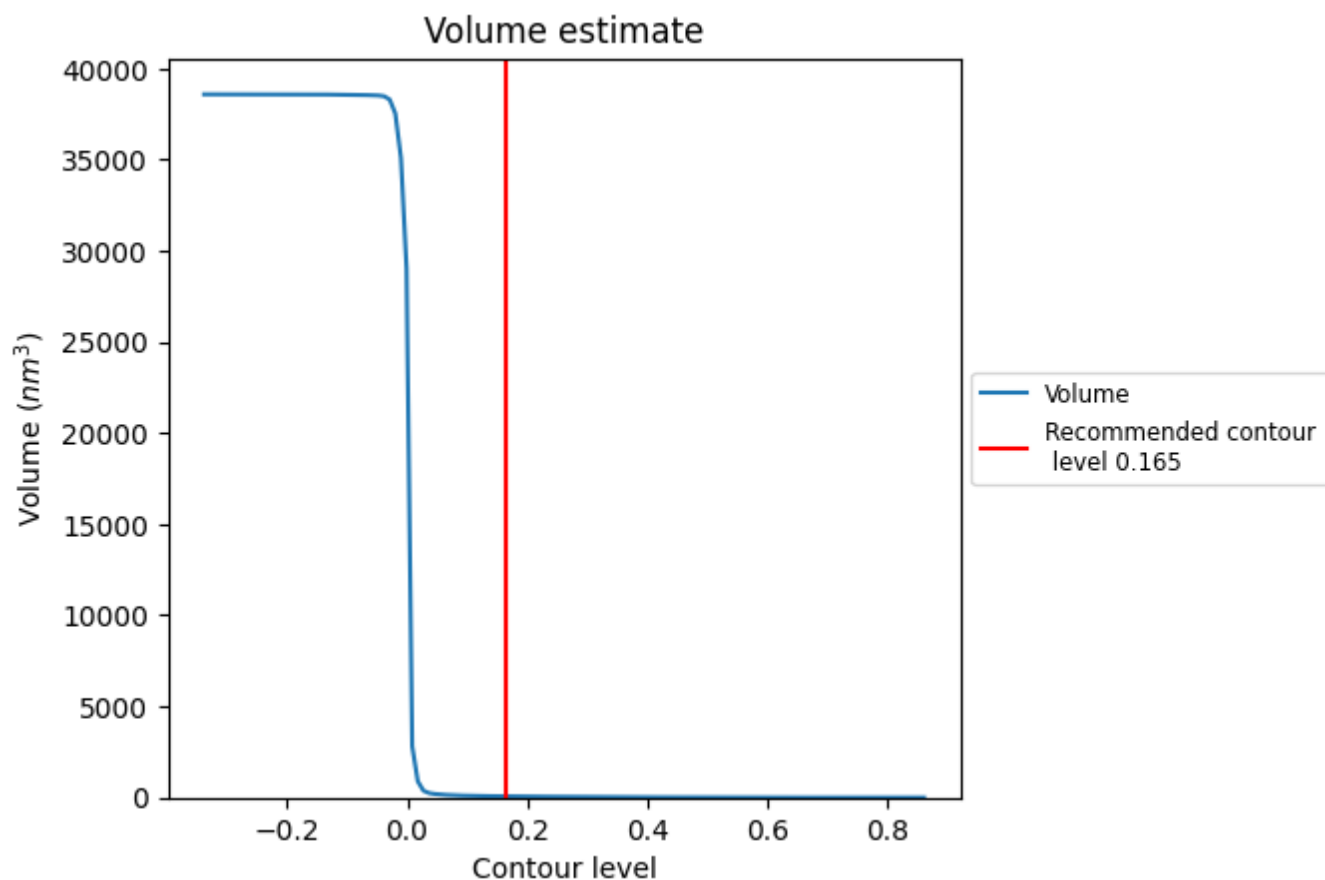
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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.

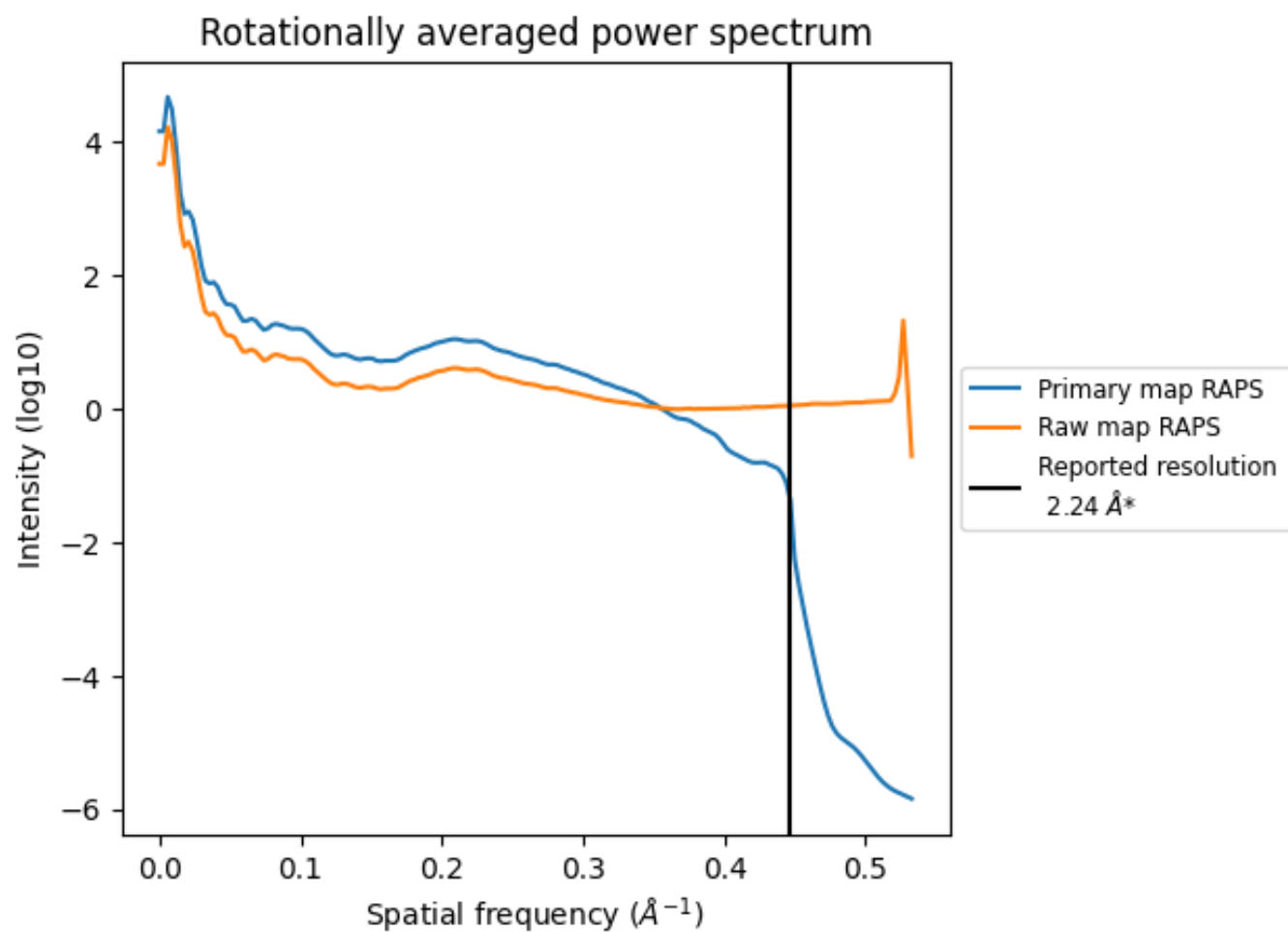
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 66 nm³; this corresponds to an approximate mass of 60 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 ⓘ

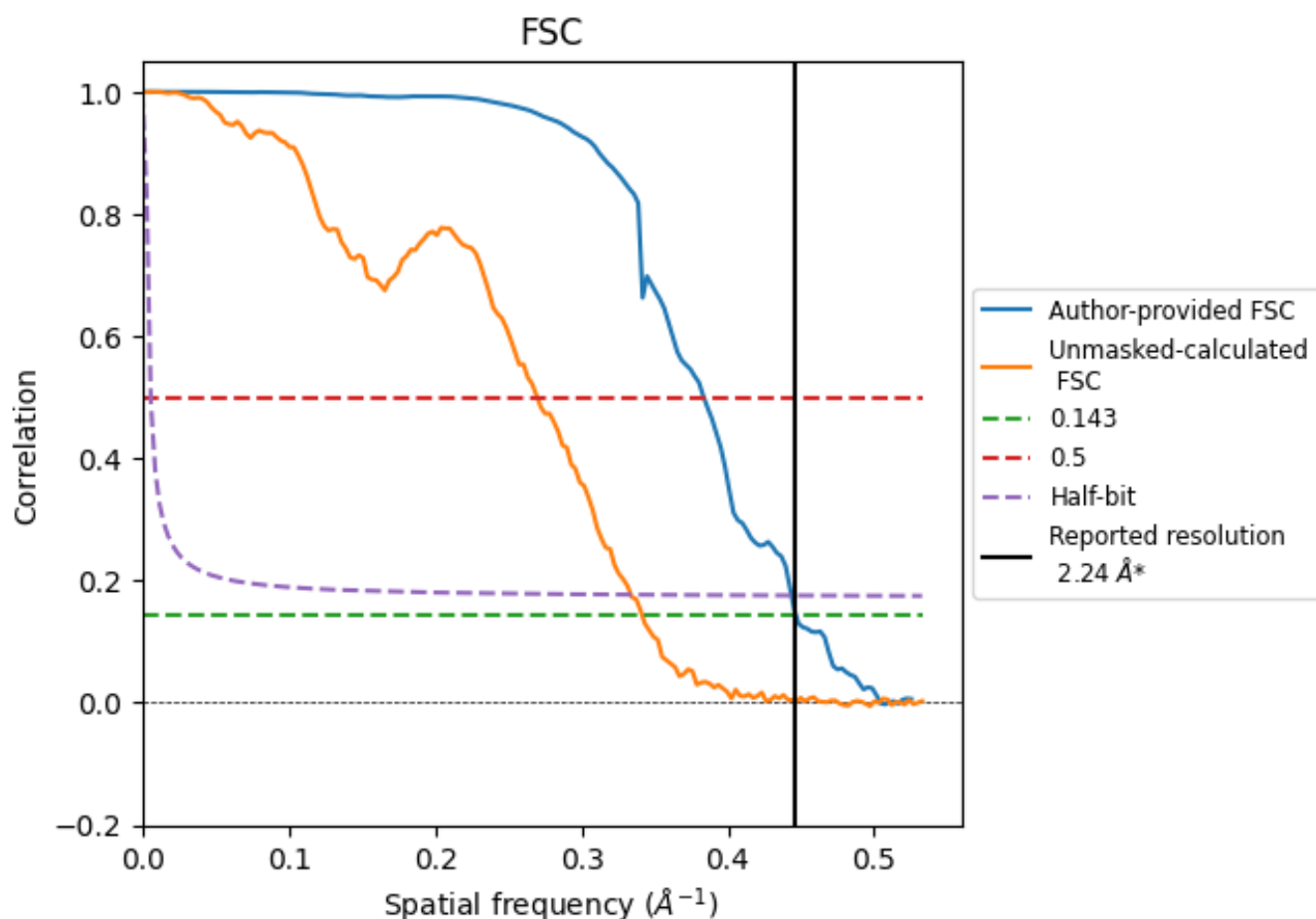


*Reported resolution corresponds to spatial frequency of 0.446 Å⁻¹

8 Fourier-Shell correlation [i](#)

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 [i](#)



*Reported resolution corresponds to spatial frequency of $0.446 \text{ \AA}^{-1}$

8.2 Resolution estimates [i](#)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.24	-	-
Author-provided FSC curve	2.24	2.61	2.25
Unmasked-calculated*	2.93	3.71	3.00

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 2.93 differs from the reported value 2.24 by more than 10 %

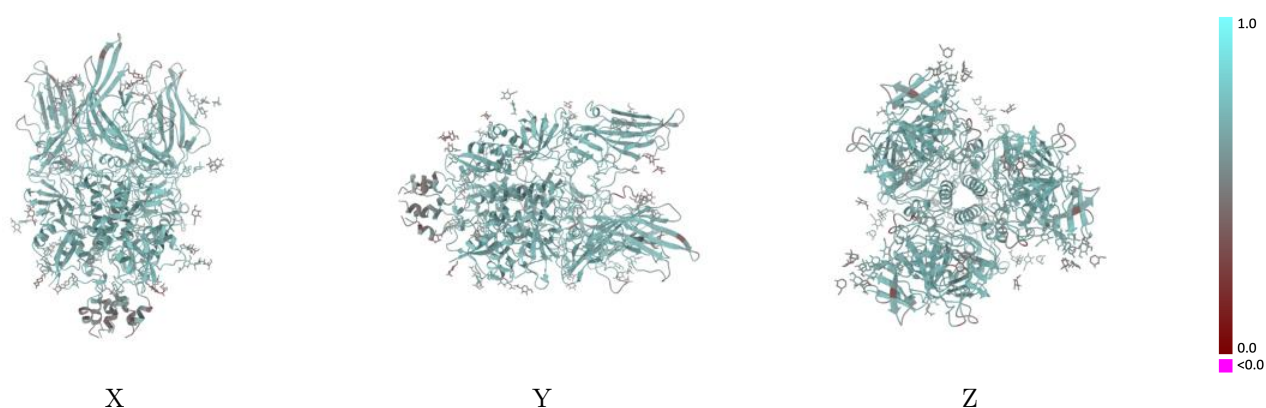
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-70098 and PDB model 9O4F. Per-residue inclusion information can be found in section 3 on page 14.

9.1 Map-model overlay [i](#)

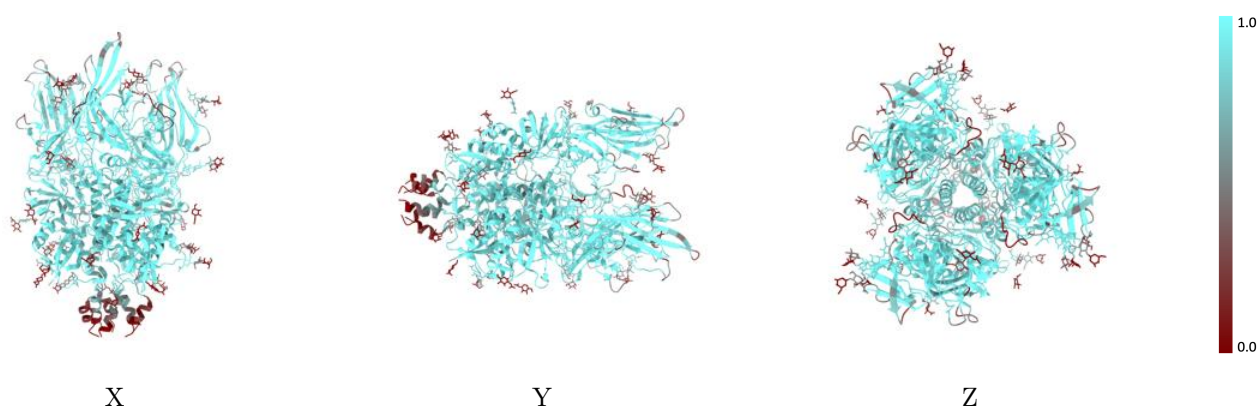
This section was not generated.

9.2 Q-score mapped to coordinate model [i](#)



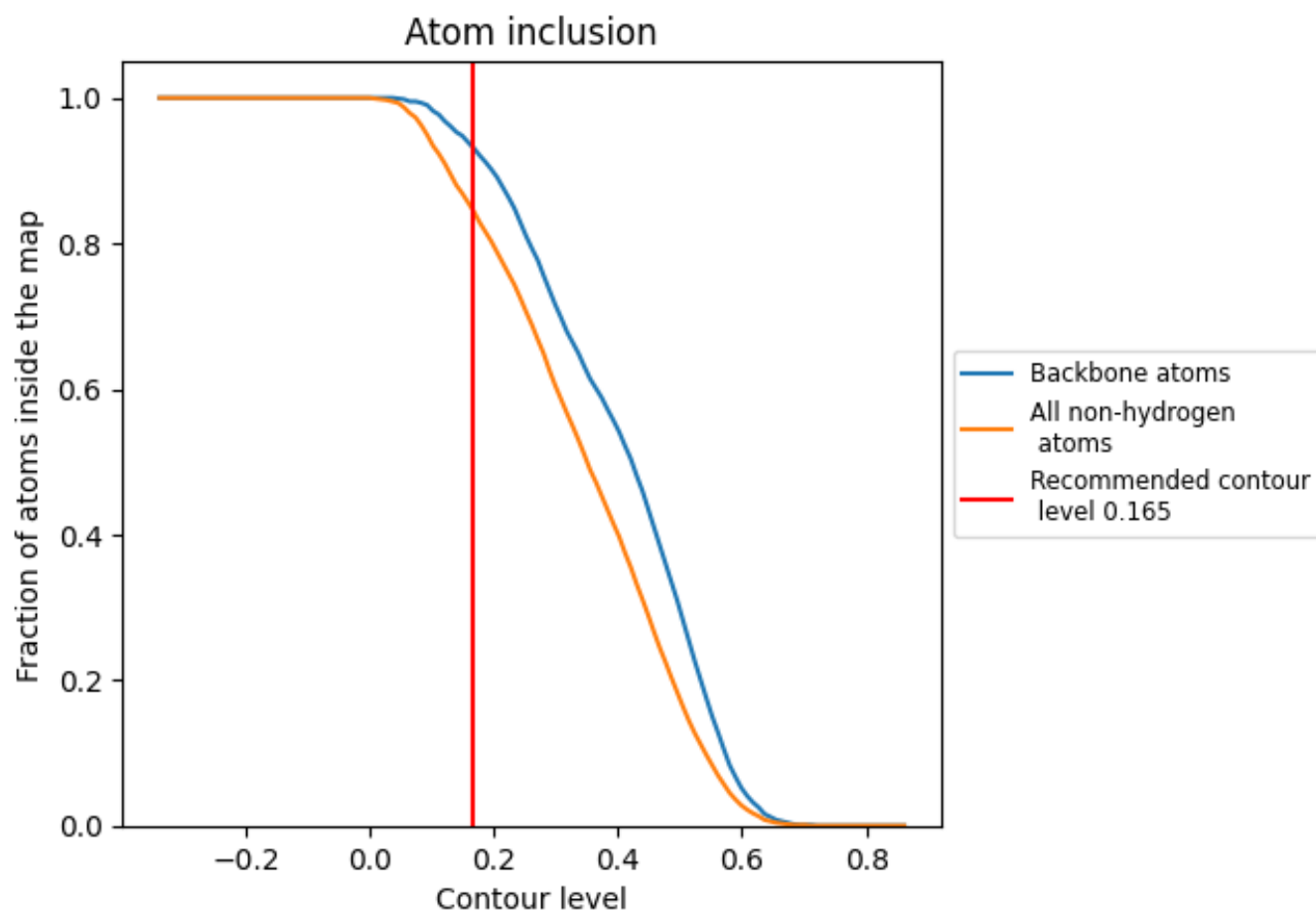
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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](#)



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 (0.165).

9.4 Atom inclusion [i](#)



At the recommended contour level, 93% of all backbone atoms, 85% 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 (0.165) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8480	 0.6390
A	 0.8770	 0.6450
B	 0.8750	 0.6440
C	 0.8770	 0.6450
D	 0.8760	 0.6560
E	 0.8800	 0.6550
F	 0.8770	 0.6530
G	 0.5740	 0.5470
H	 0.0710	 0.3560
I	 0.4620	 0.5570
J	 0.6790	 0.5490
K	 0.3570	 0.5630
L	 0.5740	 0.5450
M	 0.1430	 0.4270
N	 0.4620	 0.5570
O	 0.7140	 0.5660
P	 0.3570	 0.5620
Q	 0.5570	 0.5500
R	 0.1430	 0.3740
S	 0.4620	 0.5550
T	 0.7140	 0.5580
U	 0.3570	 0.5630
V	 0.4870	 0.5510
W	 0.4360	 0.4990
X	 0.4490	 0.5530
Y	 0.5130	 0.5330
Z	 0.4360	 0.5050
a	 0.5100	 0.5620
b	 0.4870	 0.5320
c	 0.4620	 0.5180
d	 0.5100	 0.5620

