



wwPDB EM Validation Summary Report ⓘ

May 24, 2025 – 04:15 pm BST

PDB ID : 9FGH / pdb_00009fgh
EMDB ID : EMD-50402
Title : Cryo-EM structure of the full-length alpha1beta3gamma2 GABA(A) receptor in large MSP2N2 nanodisc in complex with GABA in the long-lived symmetric desensitised state
Authors : Mihaylov, D.B.; Malinauskas, T.; Aricescu, A.R.
Deposited on : 2024-05-23
Resolution : 3.00 Å (reported)
Based on initial model : 6HUK

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.dev118
Mogul : 1.8.4, CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0rc1
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) : 2.43.1

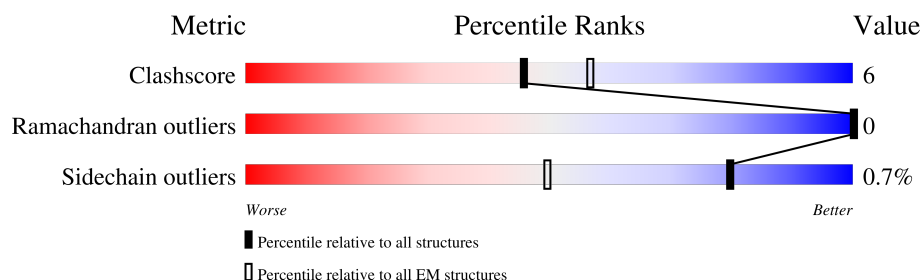
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.00 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 $\leq 5\%$. 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	464	
1	D	464	
2	B	473	
2	E	473	
3	C	495	
4	G	133	
5	F	9	
6	H	2	

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Mol	Chain	Length	Quality of chain
6	K	2	 100%
7	I	6	 83%17%
7	L	6	 100%
8	J	5	 100%

2 Entry composition

There are 12 unique types of molecules in this entry. The entry contains 15116 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 Gamma-aminobutyric acid receptor subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	340	Total	C	N	O	S	0	0
			2755	1786	460	493	16		
1	D	340	Total	C	N	O	S	0	0
			2755	1786	460	493	16		

There are 70 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-34	MET	-	initiating methionine	UNP P14867
A	-33	LYS	-	expression tag	UNP P14867
A	-32	LYS	-	expression tag	UNP P14867
A	-31	SER	-	expression tag	UNP P14867
A	-30	PRO	-	expression tag	UNP P14867
A	-29	GLY	-	expression tag	UNP P14867
A	-28	LEU	-	expression tag	UNP P14867
A	-27	SER	-	expression tag	UNP P14867
A	-26	ASP	-	expression tag	UNP P14867
A	-25	TYR	-	expression tag	UNP P14867
A	-24	LEU	-	expression tag	UNP P14867
A	-23	TRP	-	expression tag	UNP P14867
A	-22	ALA	-	expression tag	UNP P14867
A	-21	TRP	-	expression tag	UNP P14867
A	-20	THR	-	expression tag	UNP P14867
A	-19	LEU	-	expression tag	UNP P14867
A	-18	PHE	-	expression tag	UNP P14867
A	-17	LEU	-	expression tag	UNP P14867
A	-16	SER	-	expression tag	UNP P14867
A	-15	THR	-	expression tag	UNP P14867
A	-14	LEU	-	expression tag	UNP P14867
A	-13	THR	-	expression tag	UNP P14867
A	-12	GLY	-	expression tag	UNP P14867
A	-11	ARG	-	expression tag	UNP P14867
A	-10	SER	-	expression tag	UNP P14867
A	-9	TYR	-	expression tag	UNP P14867

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-8	GLY	-	expression tag	UNP P14867
A	-7	ASP	-	expression tag	UNP P14867
A	-6	TYR	-	expression tag	UNP P14867
A	-5	LYS	-	expression tag	UNP P14867
A	-4	ASP	-	expression tag	UNP P14867
A	-3	ASP	-	expression tag	UNP P14867
A	-2	ASP	-	expression tag	UNP P14867
A	-1	ASP	-	expression tag	UNP P14867
A	0	LYS	-	expression tag	UNP P14867
D	-34	MET	-	initiating methionine	UNP P14867
D	-33	LYS	-	expression tag	UNP P14867
D	-32	LYS	-	expression tag	UNP P14867
D	-31	SER	-	expression tag	UNP P14867
D	-30	PRO	-	expression tag	UNP P14867
D	-29	GLY	-	expression tag	UNP P14867
D	-28	LEU	-	expression tag	UNP P14867
D	-27	SER	-	expression tag	UNP P14867
D	-26	ASP	-	expression tag	UNP P14867
D	-25	TYR	-	expression tag	UNP P14867
D	-24	LEU	-	expression tag	UNP P14867
D	-23	TRP	-	expression tag	UNP P14867
D	-22	ALA	-	expression tag	UNP P14867
D	-21	TRP	-	expression tag	UNP P14867
D	-20	THR	-	expression tag	UNP P14867
D	-19	LEU	-	expression tag	UNP P14867
D	-18	PHE	-	expression tag	UNP P14867
D	-17	LEU	-	expression tag	UNP P14867
D	-16	SER	-	expression tag	UNP P14867
D	-15	THR	-	expression tag	UNP P14867
D	-14	LEU	-	expression tag	UNP P14867
D	-13	THR	-	expression tag	UNP P14867
D	-12	GLY	-	expression tag	UNP P14867
D	-11	ARG	-	expression tag	UNP P14867
D	-10	SER	-	expression tag	UNP P14867
D	-9	TYR	-	expression tag	UNP P14867
D	-8	GLY	-	expression tag	UNP P14867
D	-7	ASP	-	expression tag	UNP P14867
D	-6	TYR	-	expression tag	UNP P14867
D	-5	LYS	-	expression tag	UNP P14867
D	-4	ASP	-	expression tag	UNP P14867
D	-3	ASP	-	expression tag	UNP P14867
D	-2	ASP	-	expression tag	UNP P14867

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-1	ASP	-	expression tag	UNP P14867
D	0	LYS	-	expression tag	UNP P14867

- Molecule 2 is a protein called Gamma-aminobutyric acid receptor subunit beta-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	332	Total	C	N	O	S	1	0
			2732	1792	444	480	16		
2	E	332	Total	C	N	O	S	1	0
			2732	1792	444	480	16		

- Molecule 3 is a protein called Gamma-aminobutyric acid receptor subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	328	Total	C	N	O	S	0	0
			2701	1766	443	477	15		

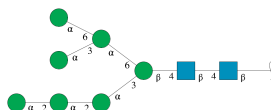
There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	437	GLY	-	expression tag	UNP P18507
C	438	GLY	-	expression tag	UNP P18507
C	439	SER	-	expression tag	UNP P18507
C	440	GLY	-	expression tag	UNP P18507
C	441	GLY	-	expression tag	UNP P18507
C	442	SER	-	expression tag	UNP P18507
C	443	GLY	-	expression tag	UNP P18507
C	444	GLY	-	expression tag	UNP P18507
C	445	SER	-	expression tag	UNP P18507
C	446	GLY	-	expression tag	UNP P18507
C	447	LYS	-	expression tag	UNP P18507
C	448	THR	-	expression tag	UNP P18507
C	449	GLU	-	expression tag	UNP P18507
C	450	THR	-	expression tag	UNP P18507
C	451	SER	-	expression tag	UNP P18507
C	452	GLN	-	expression tag	UNP P18507
C	453	VAL	-	expression tag	UNP P18507
C	454	ALA	-	expression tag	UNP P18507
C	455	PRO	-	expression tag	UNP P18507
C	456	ALA	-	expression tag	UNP P18507

- Molecule 4 is a protein called Megabody-38.

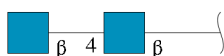
Mol	Chain	Residues	Atoms					AltConf	Trace
4	G	123	Total	C	N	O	S	0	0
			950	594	171	181	4		

- Molecule 5 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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.



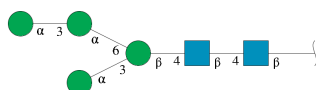
Mol	Chain	Residues	Atoms				AltConf	Trace
5	F	9	Total	C	N	O	0	0
			105	58	2	45		

- Molecule 6 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



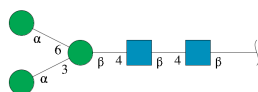
Mol	Chain	Residues	Atoms				AltConf	Trace
6	H	2	Total	C	N	O	0	0
			28	16	2	10		
6	K	2	Total	C	N	O	0	0
			28	16	2	10		

- Molecule 7 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



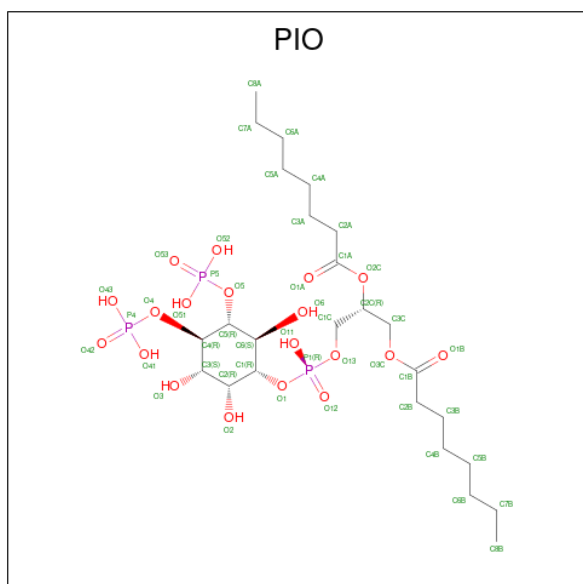
Mol	Chain	Residues	Atoms				AltConf	Trace
7	I	6	Total	C	N	O	0	0
			72	40	2	30		
7	L	6	Total	C	N	O	0	0
			72	40	2	30		

- Molecule 8 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
8	J	5	Total	C	N	O	0	0
			61	34	2	25		

- Molecule 9 is [(2R)-2-octanoyloxy-3-[oxidanyl-[(1R,2R,3S,4R,5R,6S)-2,3,6-tris(oxidanyl)-4,5-diphosphonooxy-cyclohexyl]oxy-phosphoryl]oxy-propyl] octanoate (CCD ID: PIO) (formula: C₂₅H₄₉O₁₉P₃).



Mol	Chain	Residues	Atoms				AltConf
9	A	1	Total	C	O	P	0
			47	25	19	3	
9	D	1	Total	C	O	P	0
			47	25	19	3	

- Molecule 10 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

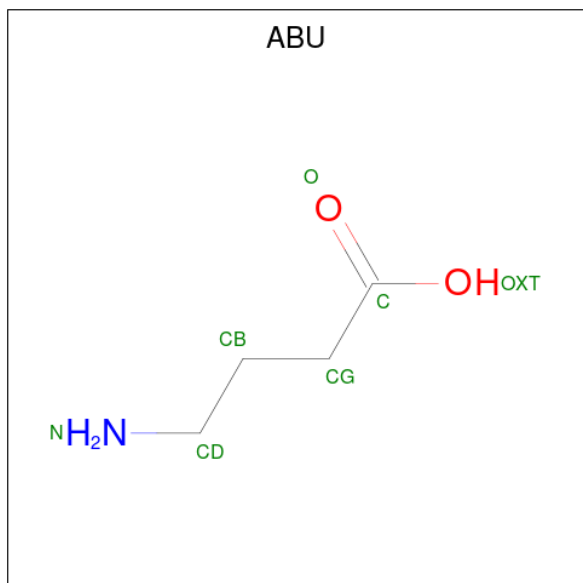
Mol	Chain	Residues	Atoms		AltConf
10	A	1	Total	Cl	0
			1	1	

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Mol	Chain	Residues	Atoms		AltConf
10	C	1	Total	Cl	0
			1	1	
10	D	1	Total	Cl	0
			1	1	

- Molecule 11 is GAMMA-AMINO-BUTANOIC ACID (CCD ID: ABU) (formula: $C_4H_9NO_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
11	B	1	Total	C	N	O	0
			7	4	1	2	
11	E	1	Total	C	N	O	0
			7	4	1	2	

- Molecule 12 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).

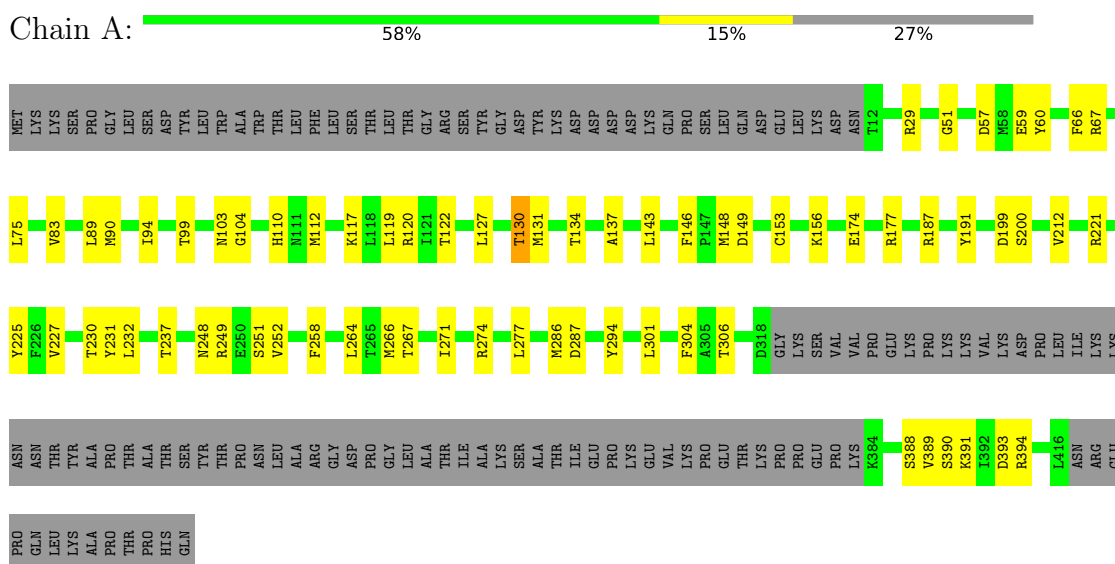


Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
12	C	1	14	8	1	5	0

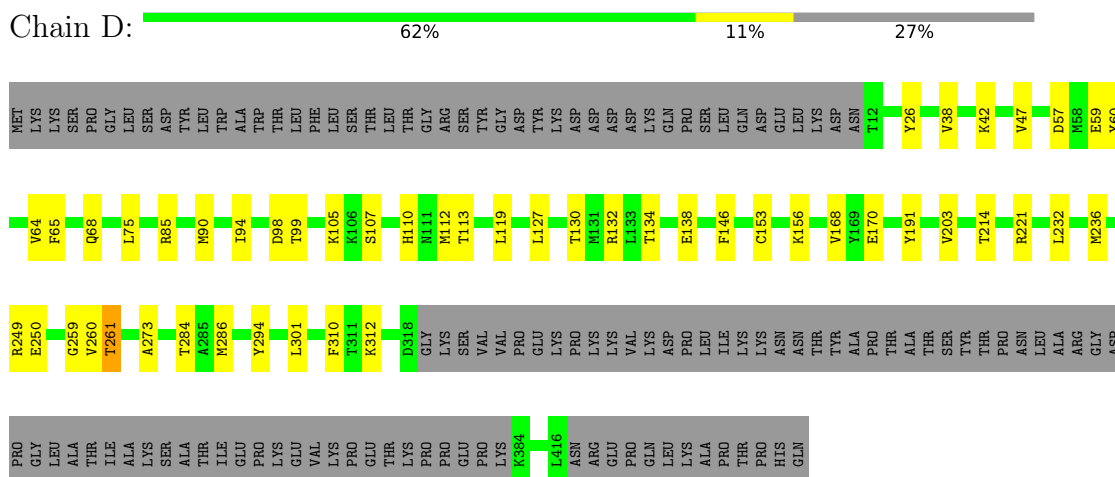
3 Residue-property plots [i](#)

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: Gamma-aminobutyric acid receptor subunit alpha-1



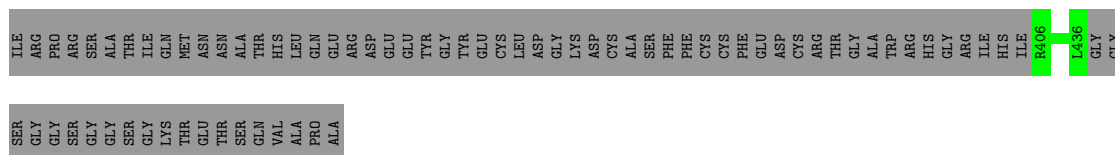
- Molecule 1: Gamma-aminobutyric acid receptor subunit alpha-1



- Molecule 2: Gamma-aminobutyric acid receptor subunit beta-3

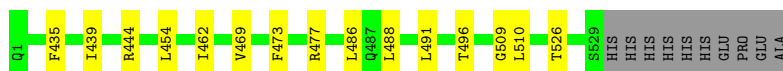
[illegible][illegible]

Y226	R231	R232	M233	G234	Y235	F236	T237	T238	Y241	L246	S254	R265	T271	L274	T281	K285	L287	A295	M296	M323	A330	PRO	GLY	SER	ASN	ILE	TRP	THR	GLY	SER	VAL	TYR	THR	PRO	VAL	PHE	GLN	LYS	MET	THR	VAL	TRP	ILE	LEU	LEU	LEU	LEU	TYR	PRO	GLY	PHE	THR	SER	GLN	LYS	LYS	ASP	F157	P159	M160	D161	E162	H163	ASN	PRO	LEU	LEU	ASP	TYR	ALA	MET	PHE	SER	LYS	THR	TRP	VAL	LEU	PRO	THR	THR	PRO	YS
VAL	PRO	GLU	GLY	ASP	Y27	L31	R43	P44	D45	G47	V48	K49	G63	T73	R85	K88	S100	M101	M102	T111	I124	R129	L133	Q134	L155	H156	L157	F158	P159	M160	D161	E162	H163	P166	Y181	Q182	V183	S187	V188	Y199	L206	PRO	GLY	SER	ASN	ILE	TRP	THR	GLY	PHE	THR	SER	GLN	LYS	LYS	ASP	F157	P159	M160	D161	E162	H163	ASN	PRO	LEU	LEU	ASP	TYR	ALA	MET	PHE	SER	LYS	THR	TRP	VAL	LEU	PRO	THR	THR	PRO	YS	



• Molecule 4: Megabody-38

Chain G: 81% 11% 8%



• Molecule 5: alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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

Chain F: 89% 11%



• Molecule 6: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain H: 100%



• Molecule 6: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain K: 100%



• Molecule 7: alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain I: 83% 17%



• Molecule 7: alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain L:  100%

MAN1
MAN2
MAN3
MAN4
MAN5
MAN6

- Molecule 8: α -D-mannopyranose-(1-3)-[α -D-mannopyranose-(1-6)] β -D-mannopyranose-(1-4)-2-acetamido-2-deoxy- β -D-glucopyranose-(1-4)-2-acetamido-2-deoxy- β -D-glucopyranose

Chain J:  100%

MAN1
MAN2
MAN3
MAN4
MAN5

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	153000	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	46.84	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	1700	Depositor
Magnification	130000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.122	Depositor
Minimum map value	-0.034	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.004	Depositor
Recommended contour level	0.01	Depositor
Map size (Å)	271.232, 271.232, 271.232	wwPDB
Map dimensions	208, 208, 208	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.304, 1.304, 1.304	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: PIO, BMA, NAG, CL, MAN, ABU

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	0.19	0/2826	0.26	0/3840
1	D	0.18	0/2826	0.25	0/3840
2	B	0.19	0/2809	0.26	0/3822
2	E	0.19	0/2809	0.26	0/3822
3	C	0.17	0/2775	0.27	0/3779
4	G	0.18	0/971	0.29	0/1312
All	All	0.18	0/15016	0.26	0/20415

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 [i](#)

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	2755	0	2744	46	0
1	D	2755	0	2744	32	0
2	B	2732	0	2724	41	0
2	E	2732	0	2724	43	0
3	C	2701	0	2693	31	0
4	G	950	0	898	10	0
5	F	105	0	88	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	H	28	0	25	0	0
6	K	28	0	25	0	0
7	I	72	0	61	1	0
7	L	72	0	61	0	0
8	J	61	0	52	0	0
9	A	47	0	44	2	0
9	D	47	0	44	2	0
10	A	1	0	0	0	0
10	C	1	0	0	0	0
10	D	1	0	0	0	0
11	B	7	0	0	0	0
11	E	7	0	0	0	0
12	C	14	0	13	0	0
All	All	15116	0	14940	181	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 6.

The worst 5 of 181 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:9:MET:HG2	3:C:46:ILE:HG22	1.70	0.73
1:D:259:GLY:HA3	1:D:301:LEU:HD13	1.73	0.70
3:C:45:ASP:OD1	3:C:85:ARG:NH2	2.26	0.69
2:E:85:ASN:HB2	2:E:114:ARG:HB2	1.73	0.68
1:D:312:LYS:NZ	9:D:501:PIO:O43	2.30	0.65

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	336/464 (72%)	327 (97%)	9 (3%)	0	100	100
1	D	336/464 (72%)	327 (97%)	9 (3%)	0	100	100
2	B	329/473 (70%)	325 (99%)	4 (1%)	0	100	100
2	E	329/473 (70%)	321 (98%)	8 (2%)	0	100	100
3	C	324/495 (66%)	313 (97%)	11 (3%)	0	100	100
4	G	121/133 (91%)	117 (97%)	4 (3%)	0	100	100
All	All	1775/2502 (71%)	1730 (98%)	45 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	303/413 (73%)	300 (99%)	3 (1%)	73	88
1	D	303/413 (73%)	300 (99%)	3 (1%)	73	88
2	B	299/422 (71%)	298 (100%)	1 (0%)	91	96
2	E	299/422 (71%)	296 (99%)	3 (1%)	73	88
3	C	303/448 (68%)	302 (100%)	1 (0%)	91	96
4	G	94/105 (90%)	94 (100%)	0	100	100
All	All	1601/2223 (72%)	1590 (99%)	11 (1%)	80	91

5 of 11 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	261	THR
2	E	36	VAL
2	E	145	LEU
2	E	101	ASP
3	C	157	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
2	E	224	GLN
2	E	119	HIS
1	D	68	GLN
2	E	90	GLN
3	C	323	ASN

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 ⓘ

30 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	$\# Z > 2$
5	NAG	F	1	5,1	14,14,15	0.24	0	17,19,21	0.49	0
5	NAG	F	2	5	14,14,15	0.23	0	17,19,21	0.41	0
5	BMA	F	3	5	11,11,12	0.18	0	15,15,17	0.57	0
5	MAN	F	4	5	11,11,12	0.30	0	15,15,17	0.61	1 (6%)
5	MAN	F	5	5	11,11,12	0.20	0	15,15,17	0.28	0
5	MAN	F	6	5	11,11,12	0.22	0	15,15,17	0.26	0
5	MAN	F	7	5	11,11,12	0.25	0	15,15,17	0.52	0
5	MAN	F	8	5	11,11,12	0.24	0	15,15,17	0.31	0
5	MAN	F	9	5	11,11,12	0.19	0	15,15,17	0.33	0
6	NAG	H	1	2,6	14,14,15	0.25	0	17,19,21	0.44	0
6	NAG	H	2	6	14,14,15	0.22	0	17,19,21	0.44	0
7	NAG	I	1	2,7	14,14,15	0.26	0	17,19,21	0.41	0
7	NAG	I	2	7	14,14,15	0.24	0	17,19,21	0.44	0
7	BMA	I	3	7	11,11,12	0.19	0	15,15,17	0.34	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
7	MAN	I	4	7	11,11,12	0.19	0	15,15,17	0.30	0
7	MAN	I	5	7	11,11,12	0.20	0	15,15,17	0.29	0
7	MAN	I	6	7	11,11,12	0.20	0	15,15,17	0.32	0
8	NAG	J	1	1,8	14,14,15	0.23	0	17,19,21	0.39	0
8	NAG	J	2	8	14,14,15	0.22	0	17,19,21	0.68	0
8	BMA	J	3	8	11,11,12	0.20	0	15,15,17	0.39	0
8	MAN	J	4	8	11,11,12	0.21	0	15,15,17	0.28	0
8	MAN	J	5	8	11,11,12	0.21	0	15,15,17	0.30	0
6	NAG	K	1	2,6	14,14,15	0.24	0	17,19,21	0.58	0
6	NAG	K	2	6	14,14,15	0.22	0	17,19,21	0.41	0
7	NAG	L	1	2,7	14,14,15	0.26	0	17,19,21	0.38	0
7	NAG	L	2	7	14,14,15	0.24	0	17,19,21	0.48	0
7	BMA	L	3	7	11,11,12	0.19	0	15,15,17	0.34	0
7	MAN	L	4	7	11,11,12	0.22	0	15,15,17	0.32	0
7	MAN	L	5	7	11,11,12	0.22	0	15,15,17	0.29	0
7	MAN	L	6	7	11,11,12	0.21	0	15,15,17	0.29	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
5	NAG	F	1	5,1	-	0/6/23/26	0/1/1/1
5	NAG	F	2	5	-	0/6/23/26	0/1/1/1
5	BMA	F	3	5	-	0/2/19/22	0/1/1/1
5	MAN	F	4	5	-	0/2/19/22	0/1/1/1
5	MAN	F	5	5	-	0/2/19/22	0/1/1/1
5	MAN	F	6	5	-	0/2/19/22	0/1/1/1
5	MAN	F	7	5	-	1/2/19/22	0/1/1/1
5	MAN	F	8	5	-	0/2/19/22	0/1/1/1
5	MAN	F	9	5	-	0/2/19/22	0/1/1/1
6	NAG	H	1	2,6	-	0/6/23/26	0/1/1/1
6	NAG	H	2	6	-	0/6/23/26	0/1/1/1
7	NAG	I	1	2,7	-	0/6/23/26	0/1/1/1
7	NAG	I	2	7	-	0/6/23/26	0/1/1/1
7	BMA	I	3	7	-	0/2/19/22	0/1/1/1
7	MAN	I	4	7	-	1/2/19/22	0/1/1/1
7	MAN	I	5	7	-	0/2/19/22	0/1/1/1
7	MAN	I	6	7	-	1/2/19/22	0/1/1/1
8	NAG	J	1	1,8	-	0/6/23/26	0/1/1/1
8	NAG	J	2	8	-	0/6/23/26	0/1/1/1
8	BMA	J	3	8	-	0/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
8	MAN	J	4	8	-	0/2/19/22	0/1/1/1
8	MAN	J	5	8	-	0/2/19/22	0/1/1/1
6	NAG	K	1	2,6	-	0/6/23/26	0/1/1/1
6	NAG	K	2	6	-	0/6/23/26	0/1/1/1
7	NAG	L	1	2,7	-	0/6/23/26	0/1/1/1
7	NAG	L	2	7	-	0/6/23/26	0/1/1/1
7	BMA	L	3	7	-	0/2/19/22	0/1/1/1
7	MAN	L	4	7	-	0/2/19/22	0/1/1/1
7	MAN	L	5	7	-	1/2/19/22	0/1/1/1
7	MAN	L	6	7	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	F	4	MAN	C1-O5-C5	2.04	114.95	112.19

There are no chirality outliers.

All (4) torsion outliers are listed below:

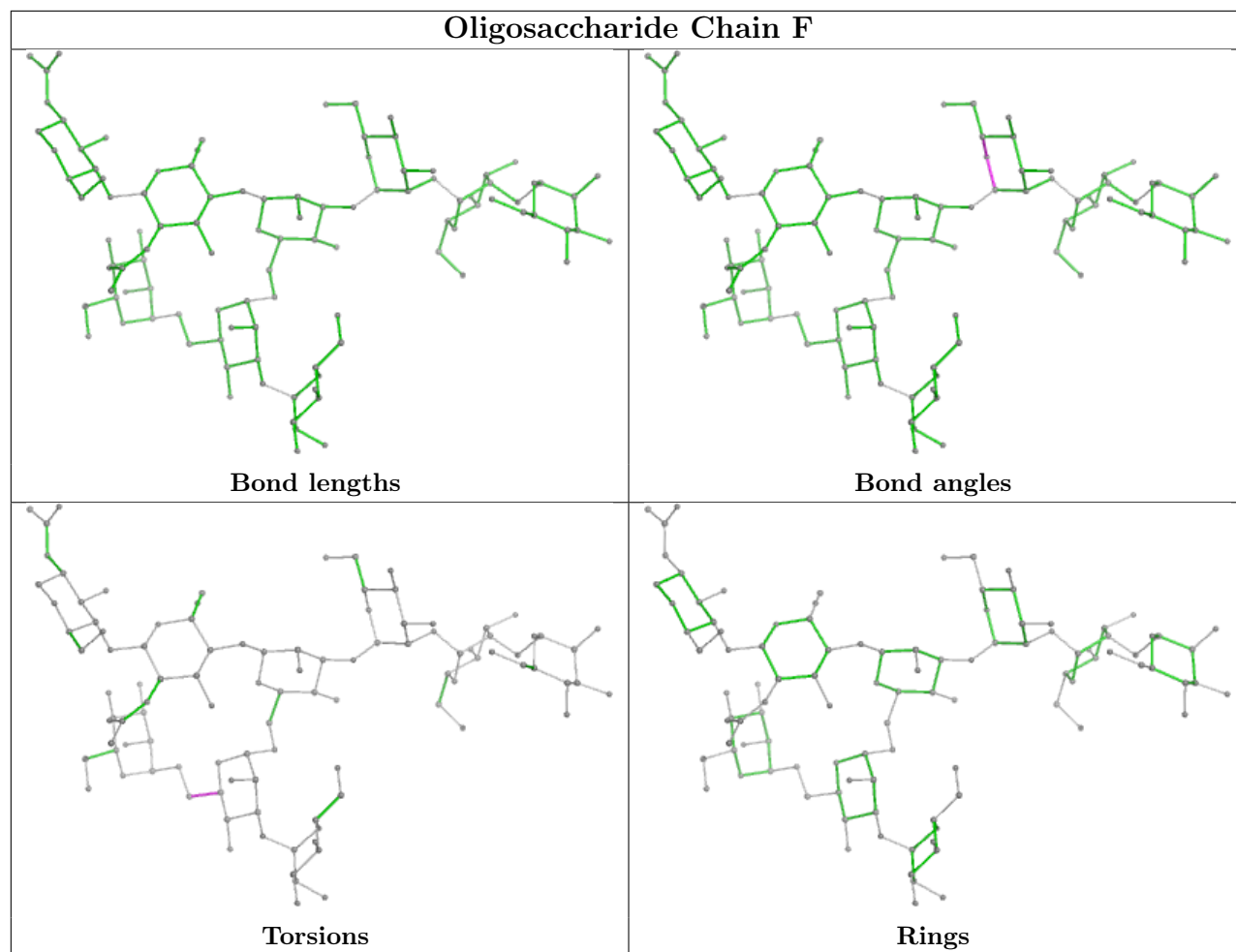
Mol	Chain	Res	Type	Atoms
7	I	6	MAN	O5-C5-C6-O6
7	I	4	MAN	O5-C5-C6-O6
7	L	5	MAN	O5-C5-C6-O6
5	F	7	MAN	O5-C5-C6-O6

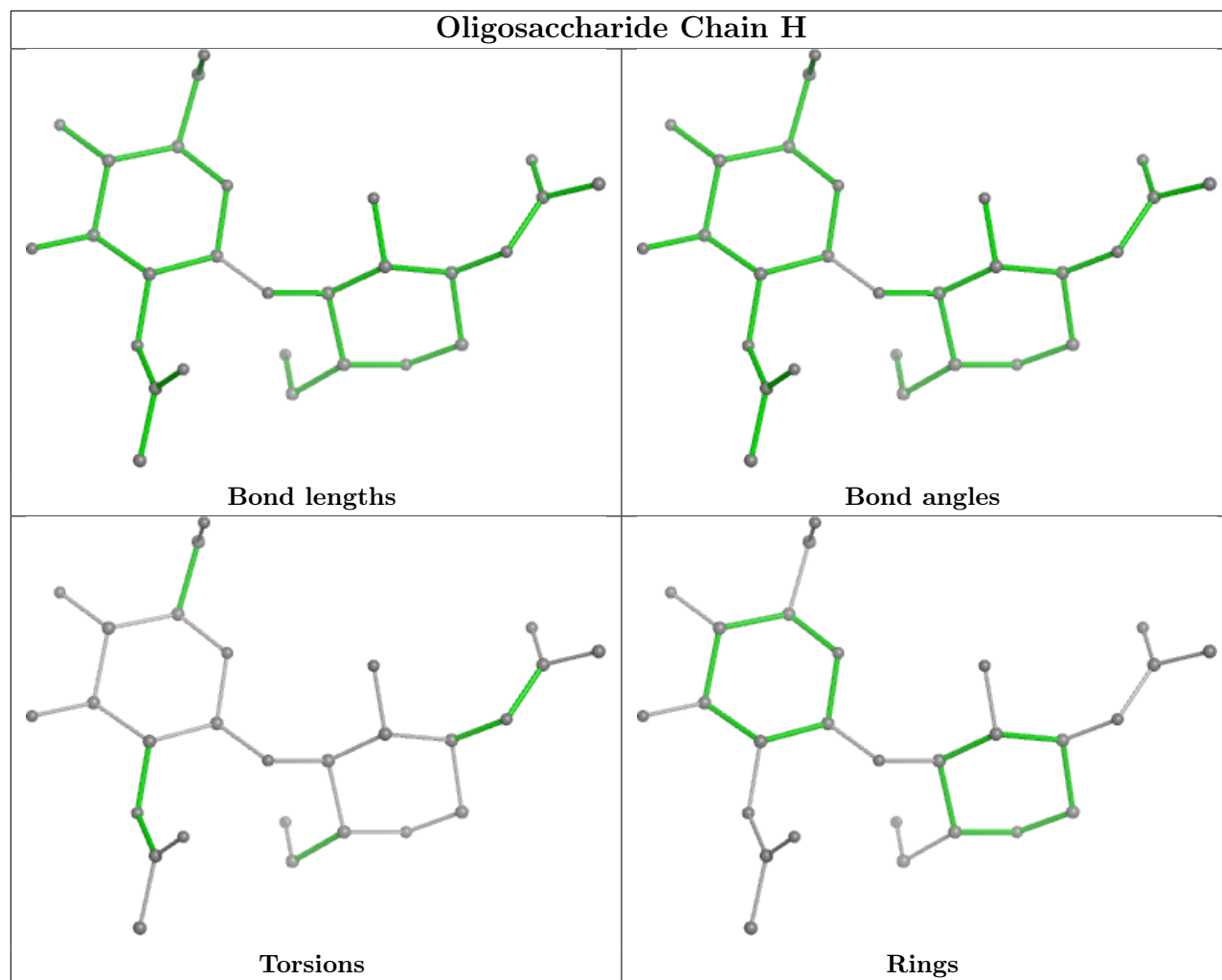
There are no ring outliers.

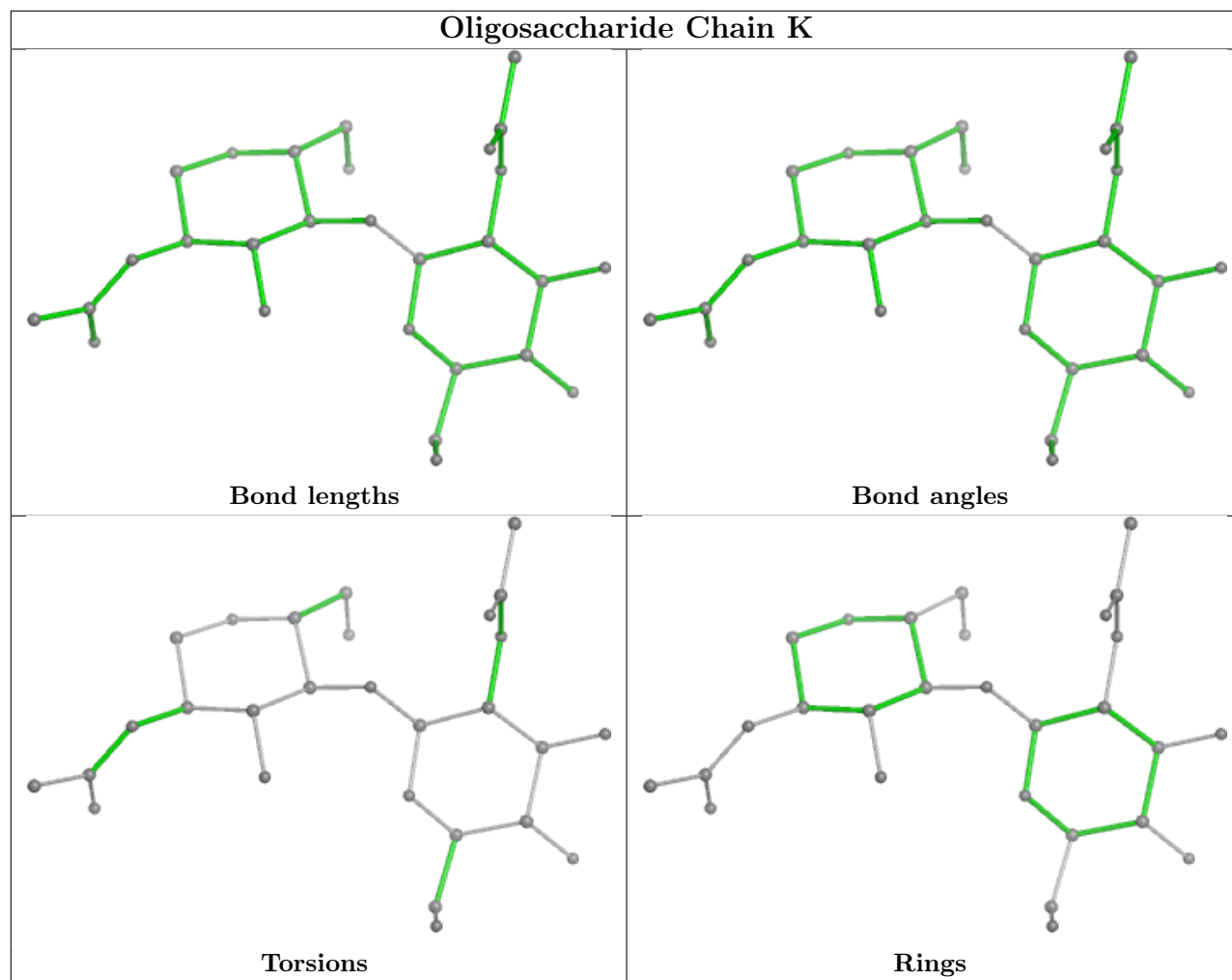
1 monomer is involved in 1 short contact:

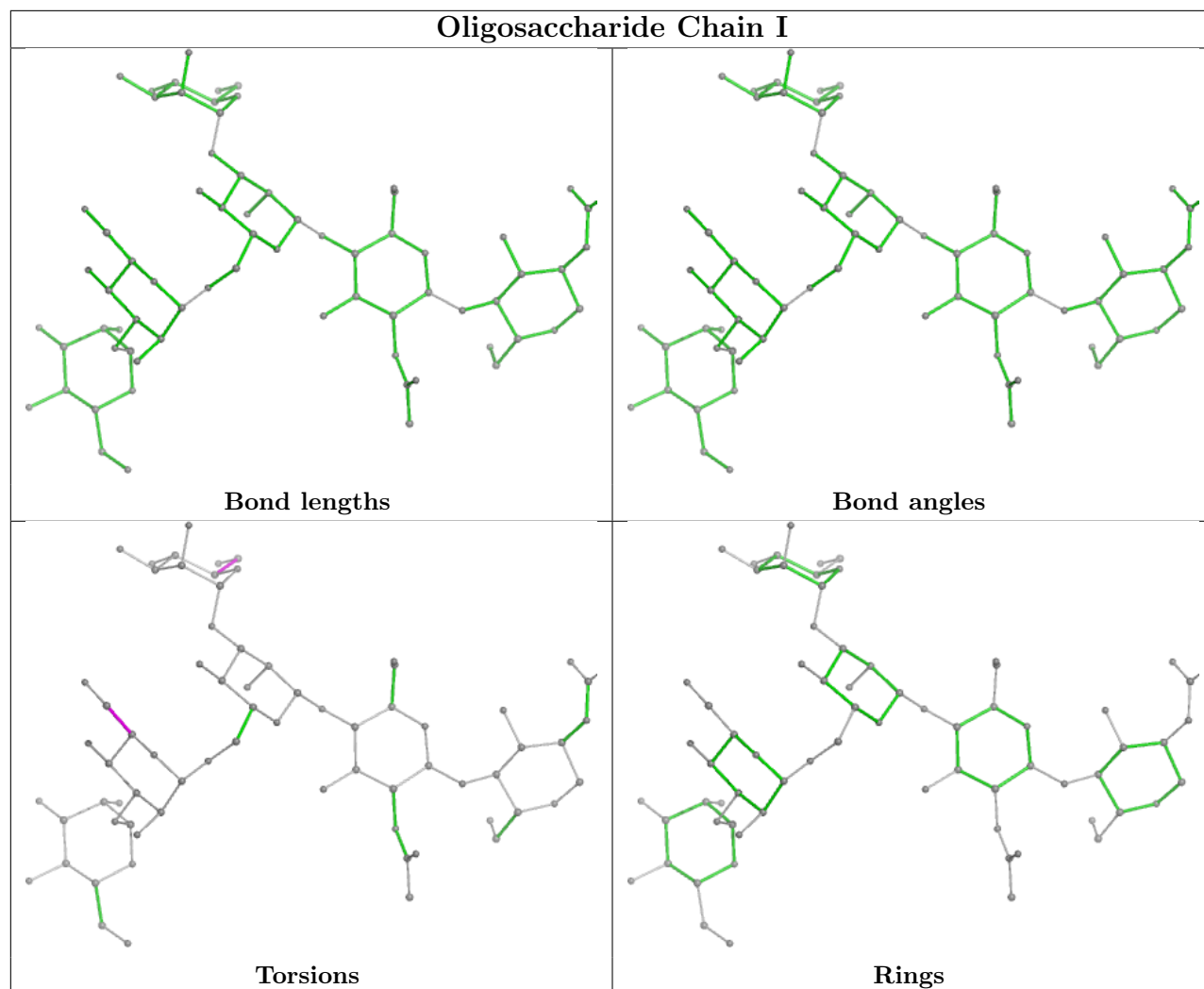
Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	I	2	NAG	1	0

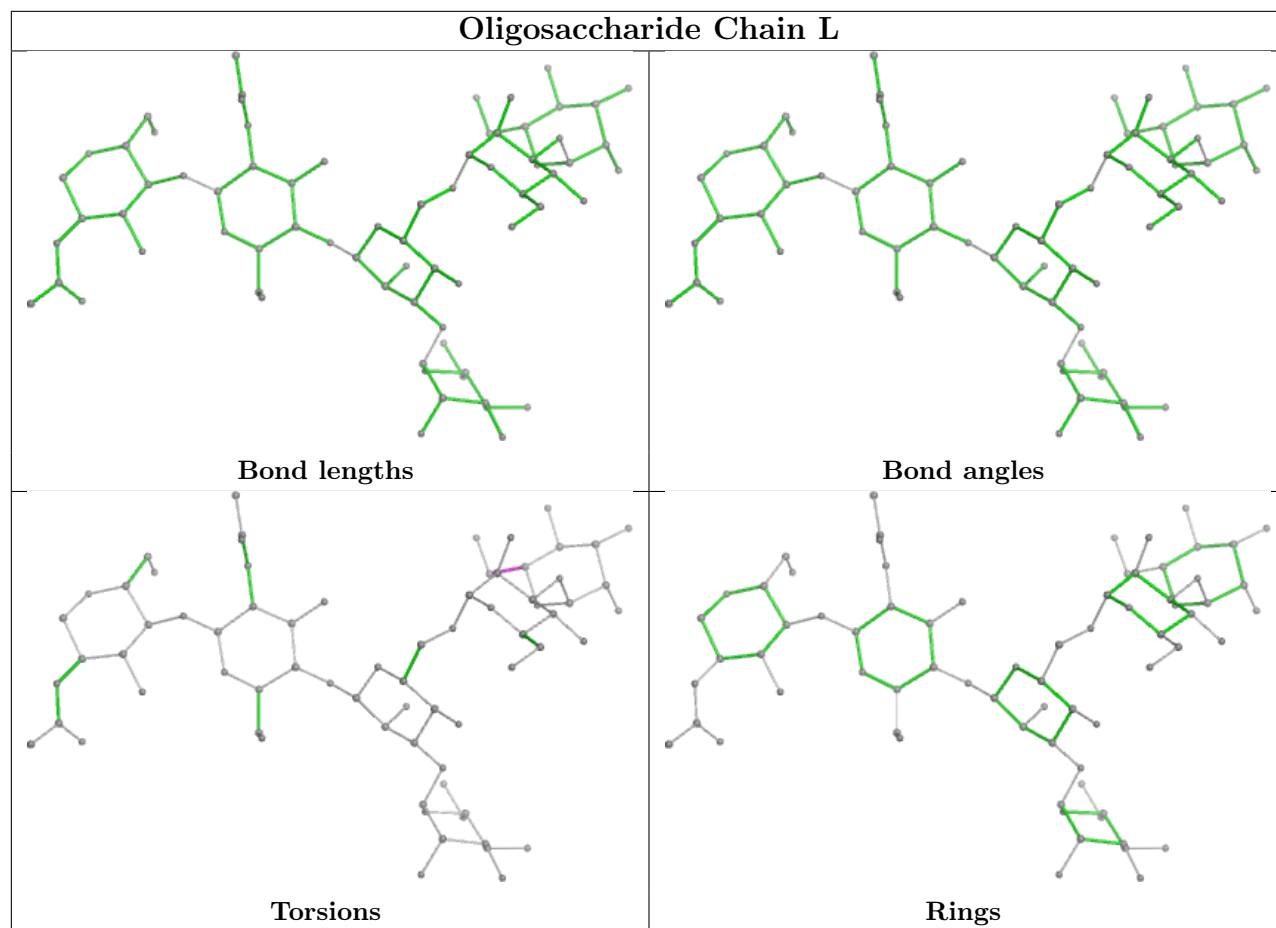
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

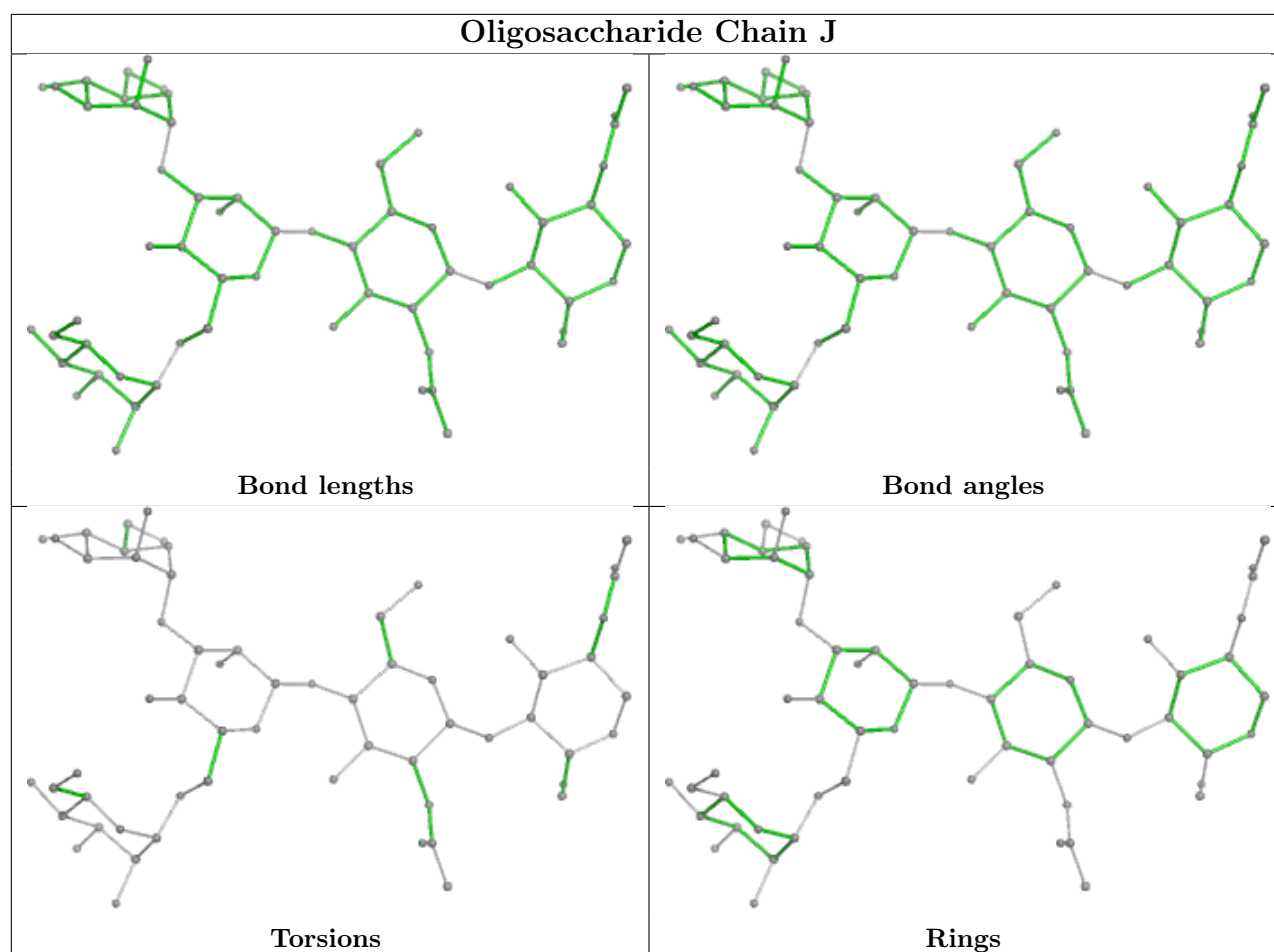












5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 3 are monoatomic - leaving 5 for Mogul analysis.

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	$\# Z > 2$
12	NAG	C	501	3	14,14,15	0.23	0	17,19,21	0.57	0
9	PIO	A	601	-	47,47,47	0.32	0	61,65,65	0.27	0
11	ABU	E	1601	-	6,6,6	0.75	0	6,6,6	1.73	2 (33%)
9	PIO	D	501	-	47,47,47	0.31	0	61,65,65	0.27	0
11	ABU	B	1601	-	6,6,6	0.76	0	6,6,6	1.70	2 (33%)

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
12	NAG	C	501	3	-	1/6/23/26	0/1/1/1
9	PIO	A	601	-	-	5/44/68/68	0/1/1/1
11	ABU	E	1601	-	-	2/4/4/4	-
9	PIO	D	501	-	-	8/44/68/68	0/1/1/1
11	ABU	B	1601	-	-	2/4/4/4	-

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
11	E	1601	ABU	O-C-CG	-3.07	113.21	123.08
11	B	1601	ABU	O-C-CG	-3.04	113.30	123.08
11	E	1601	ABU	OXT-C-CG	2.92	123.42	114.03
11	B	1601	ABU	OXT-C-CG	2.85	123.17	114.03

There are no chirality outliers.

5 of 18 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	D	501	PIO	C5-O5-P5-O51
9	D	501	PIO	C5-O5-P5-O53
9	D	501	PIO	C1C-O13-P1-O1
9	D	501	PIO	C1-O1-P1-O13
9	A	601	PIO	O13-C1C-C2C-C3C

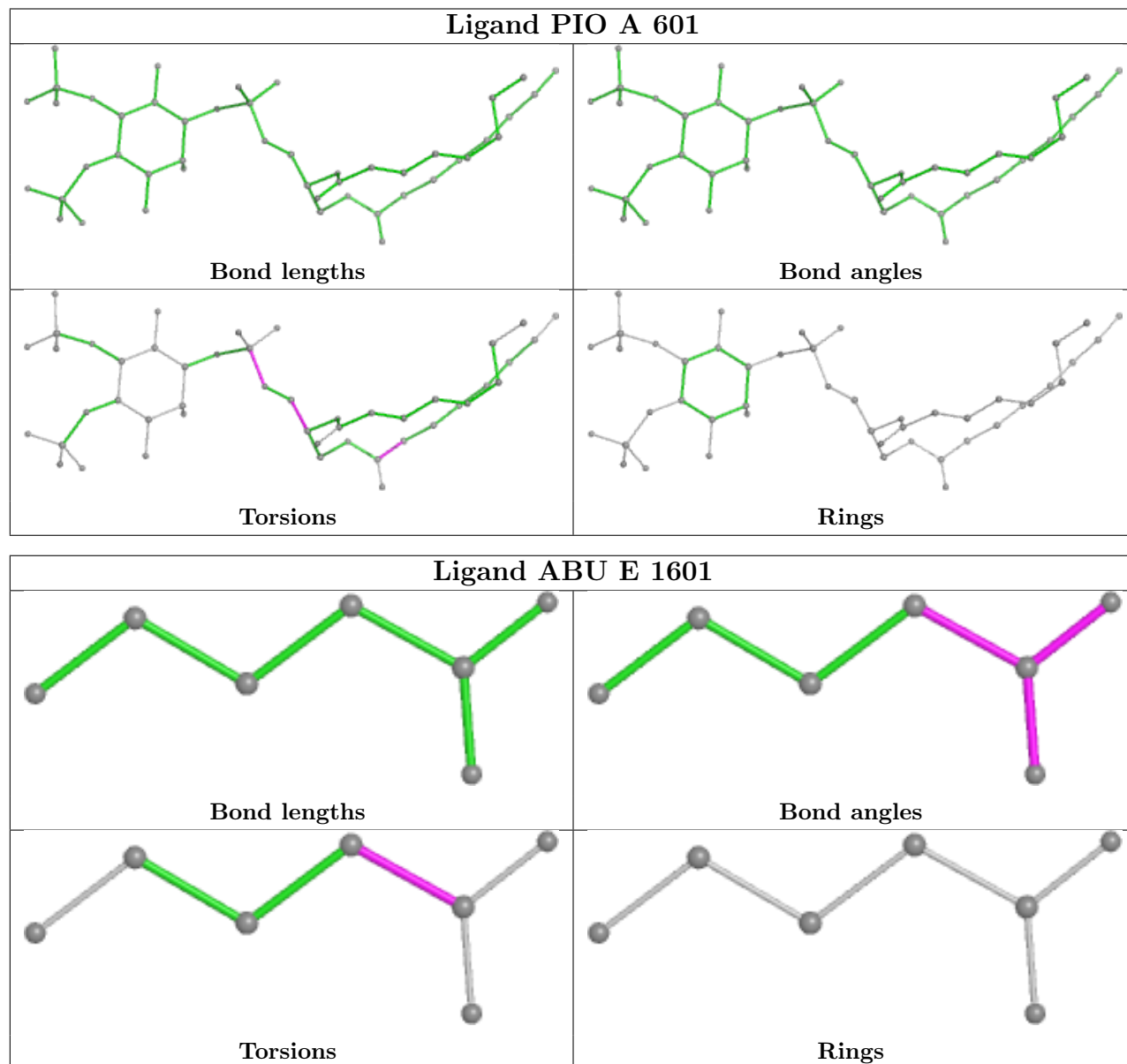
There are no ring outliers.

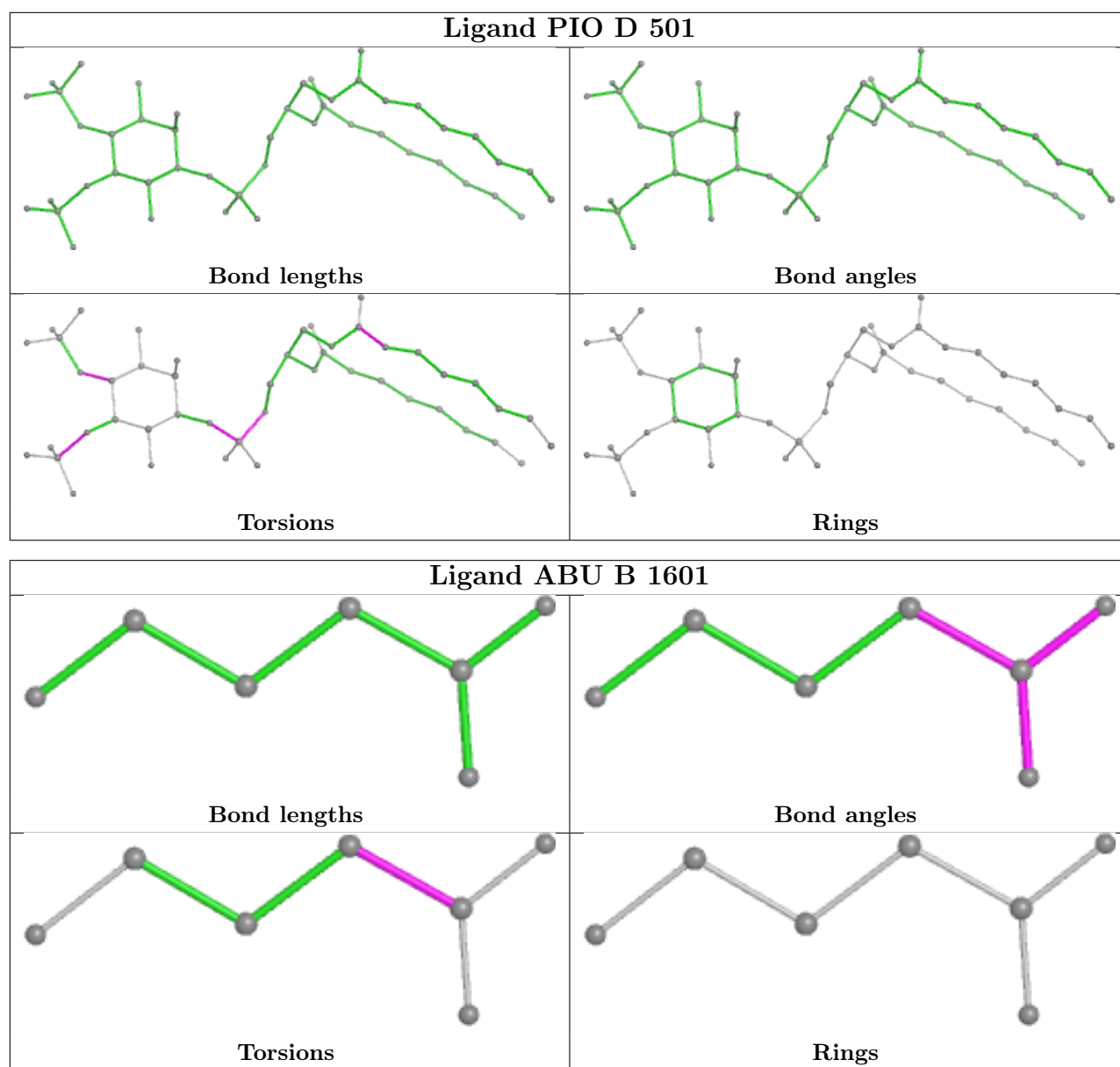
2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	A	601	PIO	2	0
9	D	501	PIO	2	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 than 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.





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.

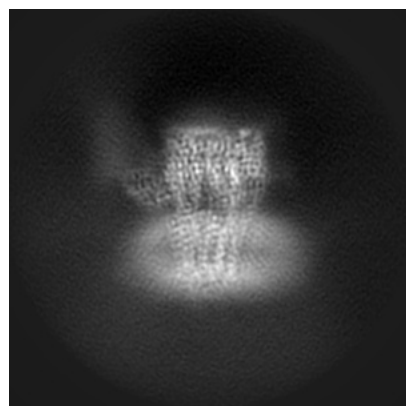
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-50402. These allow visual inspection of the internal detail of the map and identification of artifacts.

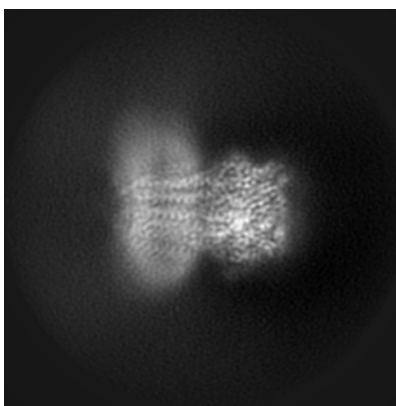
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

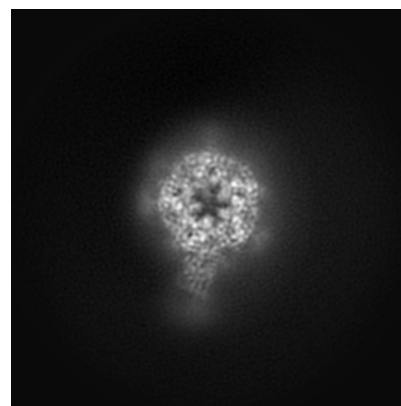
6.1.1 Primary map



X

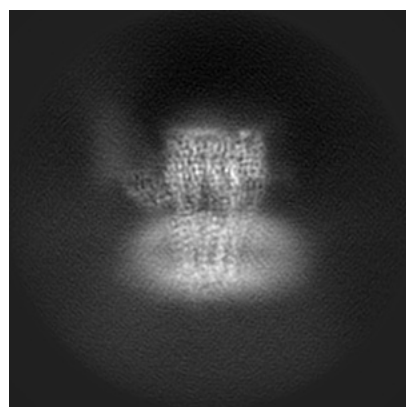


Y

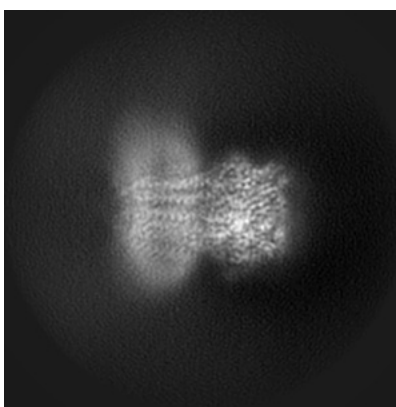


Z

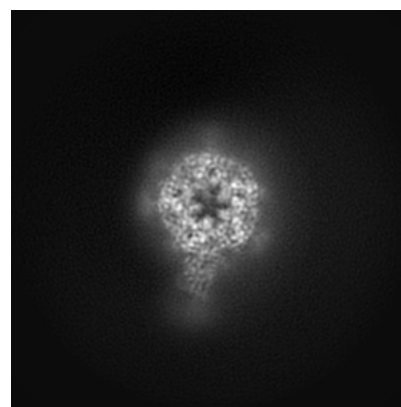
6.1.2 Raw map



X



Y

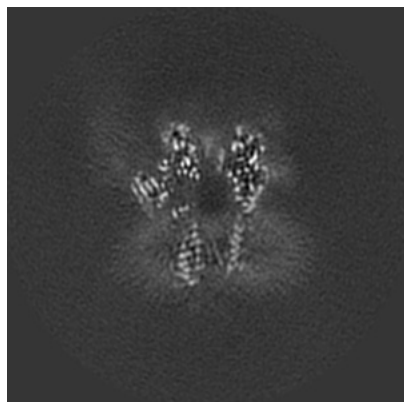


Z

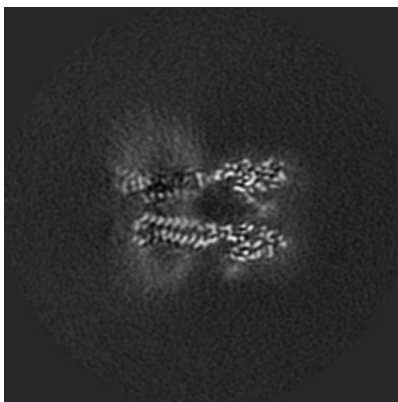
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

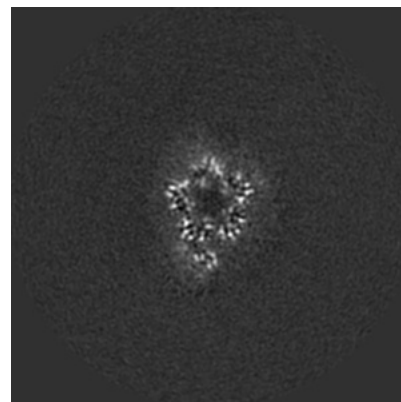
6.2.1 Primary map



X Index: 104

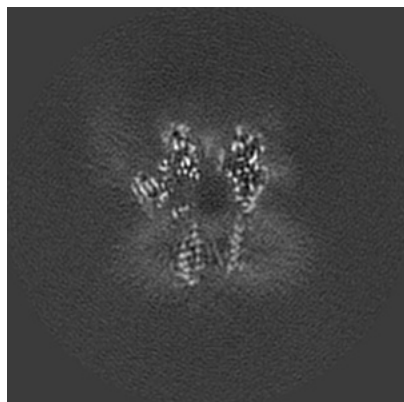


Y Index: 104

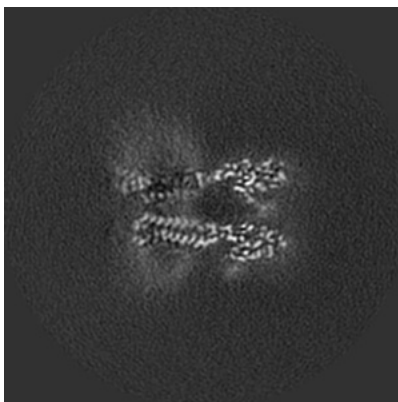


Z Index: 104

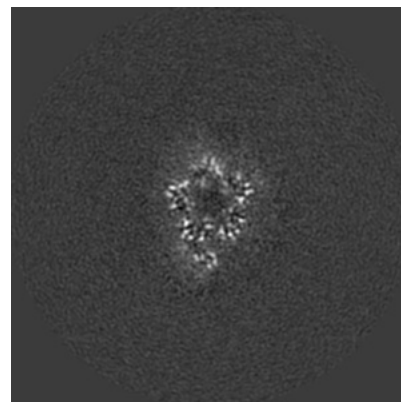
6.2.2 Raw map



X Index: 104



Y Index: 104

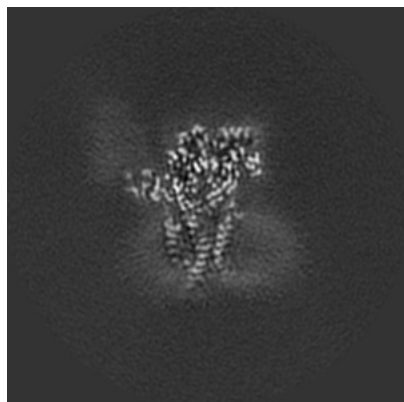


Z Index: 104

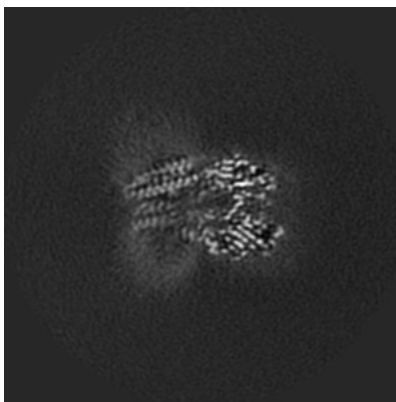
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

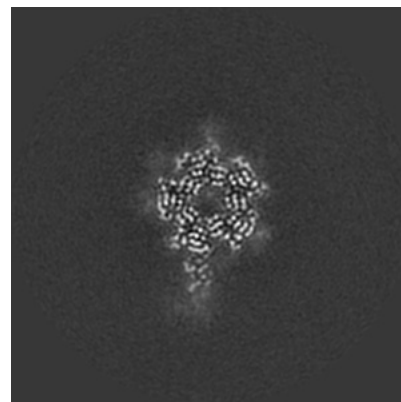
6.3.1 Primary map



X Index: 91

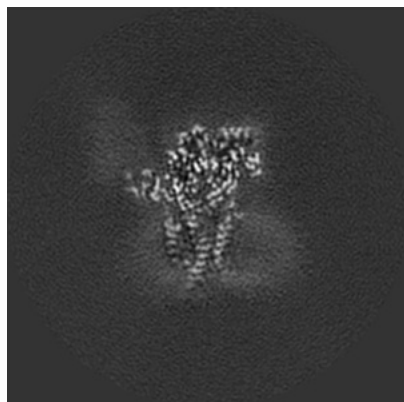


Y Index: 116

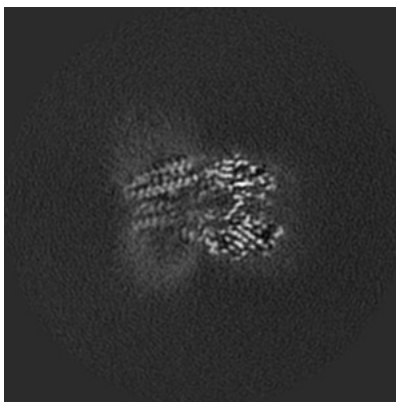


Z Index: 122

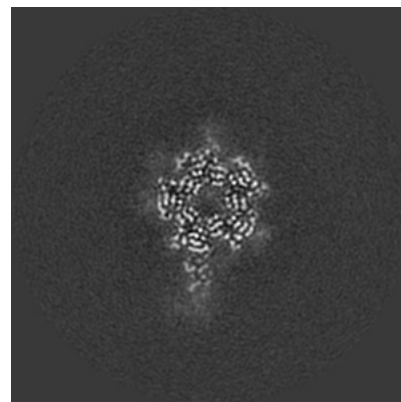
6.3.2 Raw map



X Index: 91



Y Index: 116

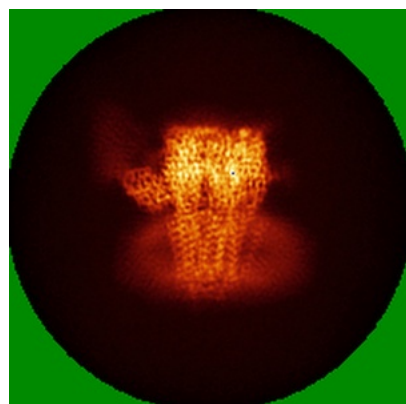


Z Index: 122

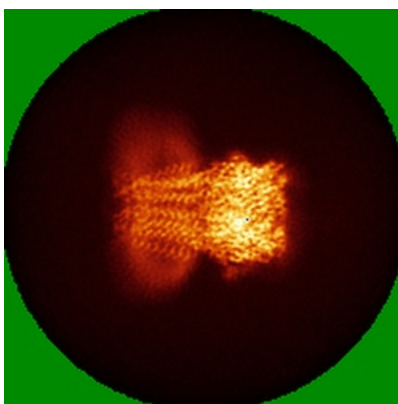
The images above show the largest variance slices of the map in three orthogonal directions.

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

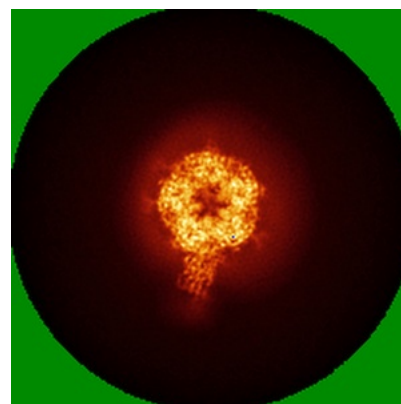
6.4.1 Primary map



X

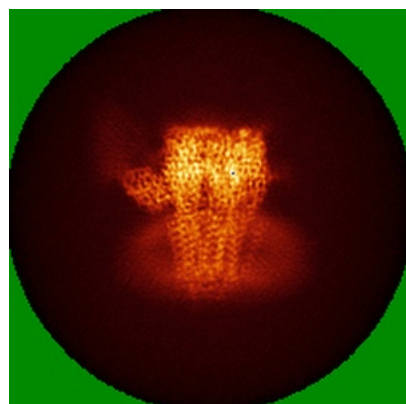


Y

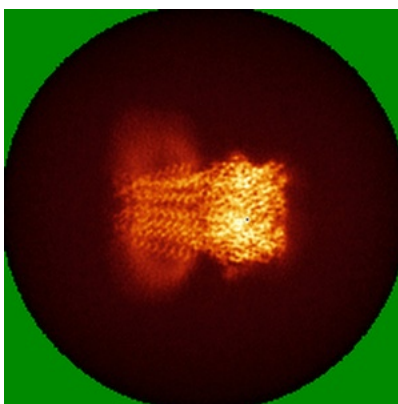


Z

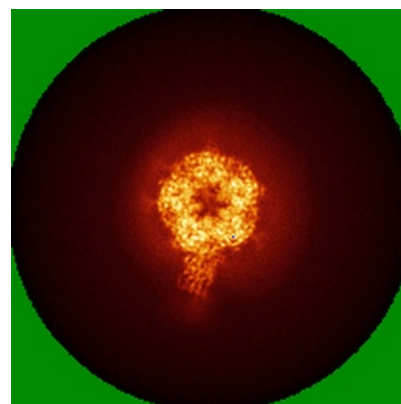
6.4.2 Raw map



X



Y

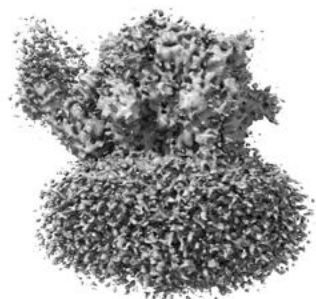


Z

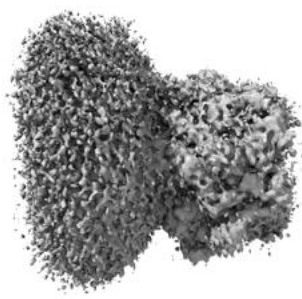
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



X



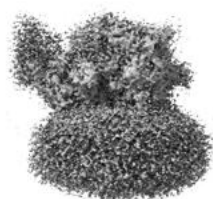
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.01. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

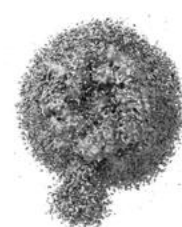
6.5.2 Raw map



X



Y



Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

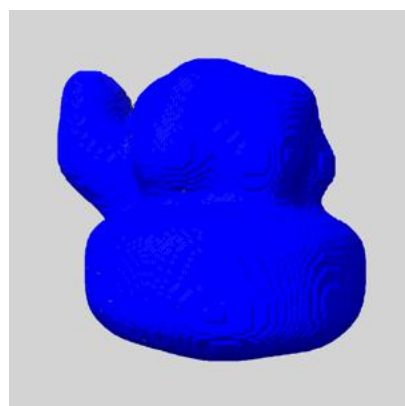
6.6 Mask visualisation [i](#)

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

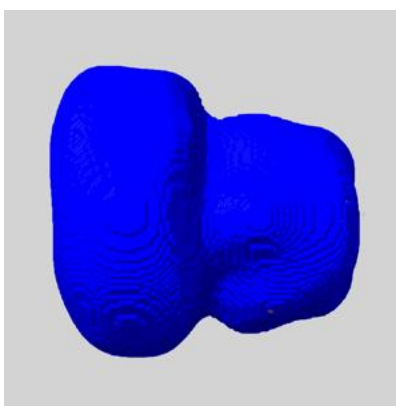
A mask typically either:

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

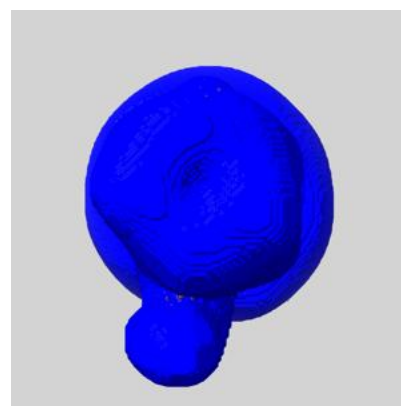
6.6.1 emd_50402_msk_1.map [i](#)



X



Y

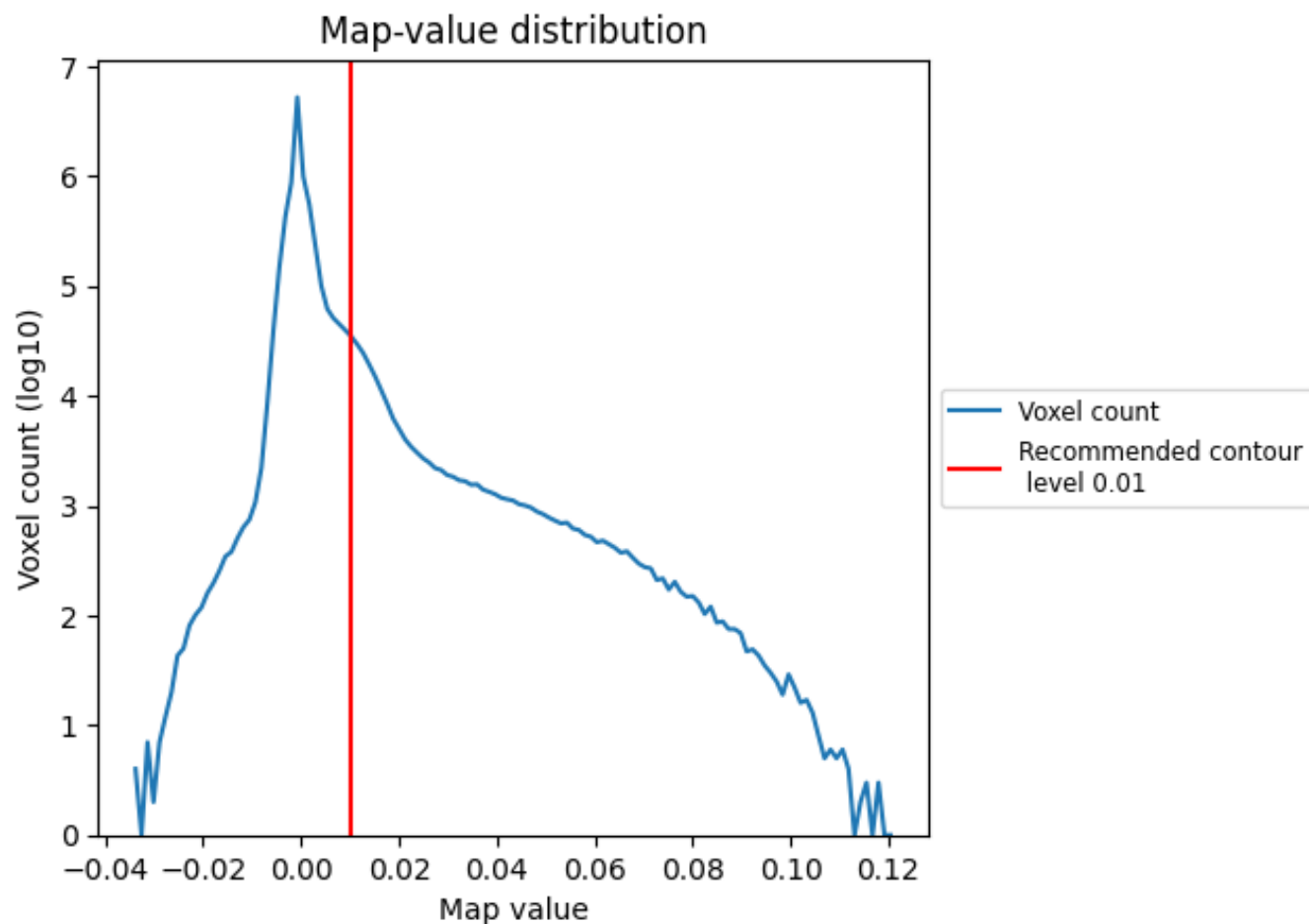


Z

7 Map analysis [i](#)

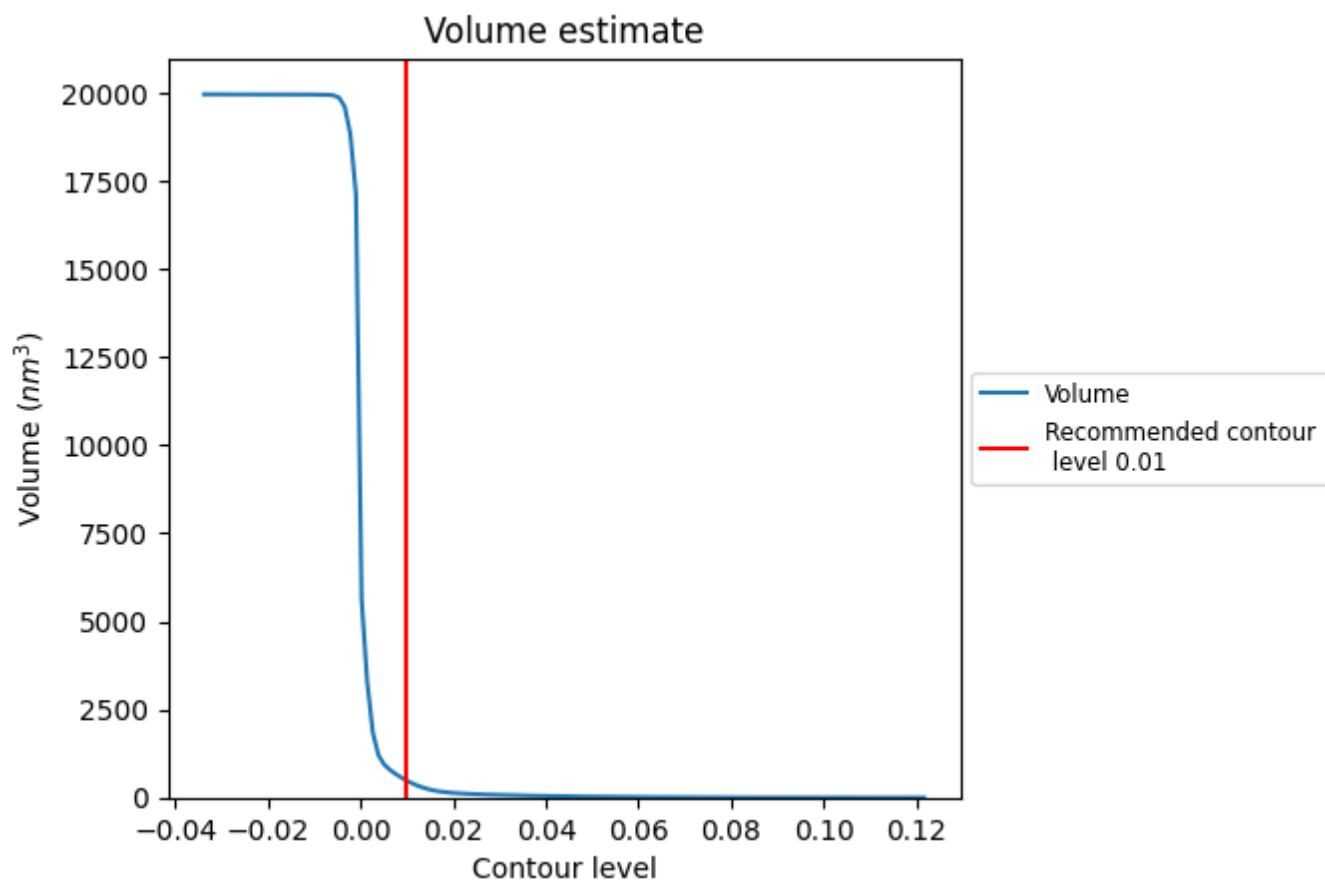
This section contains the results of statistical analysis of the map.

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.

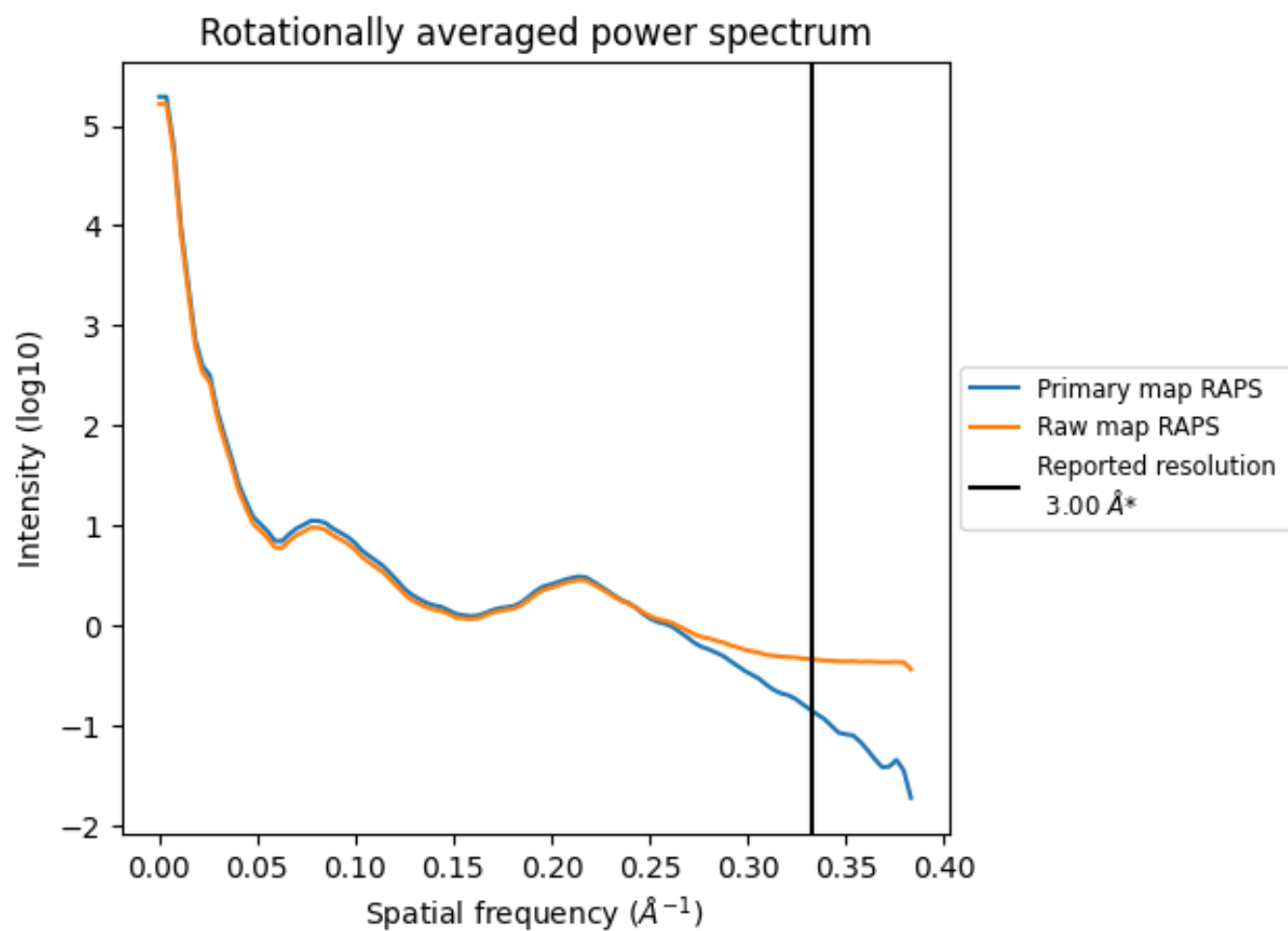
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 478 nm³; this corresponds to an approximate mass of 432 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 ⓘ

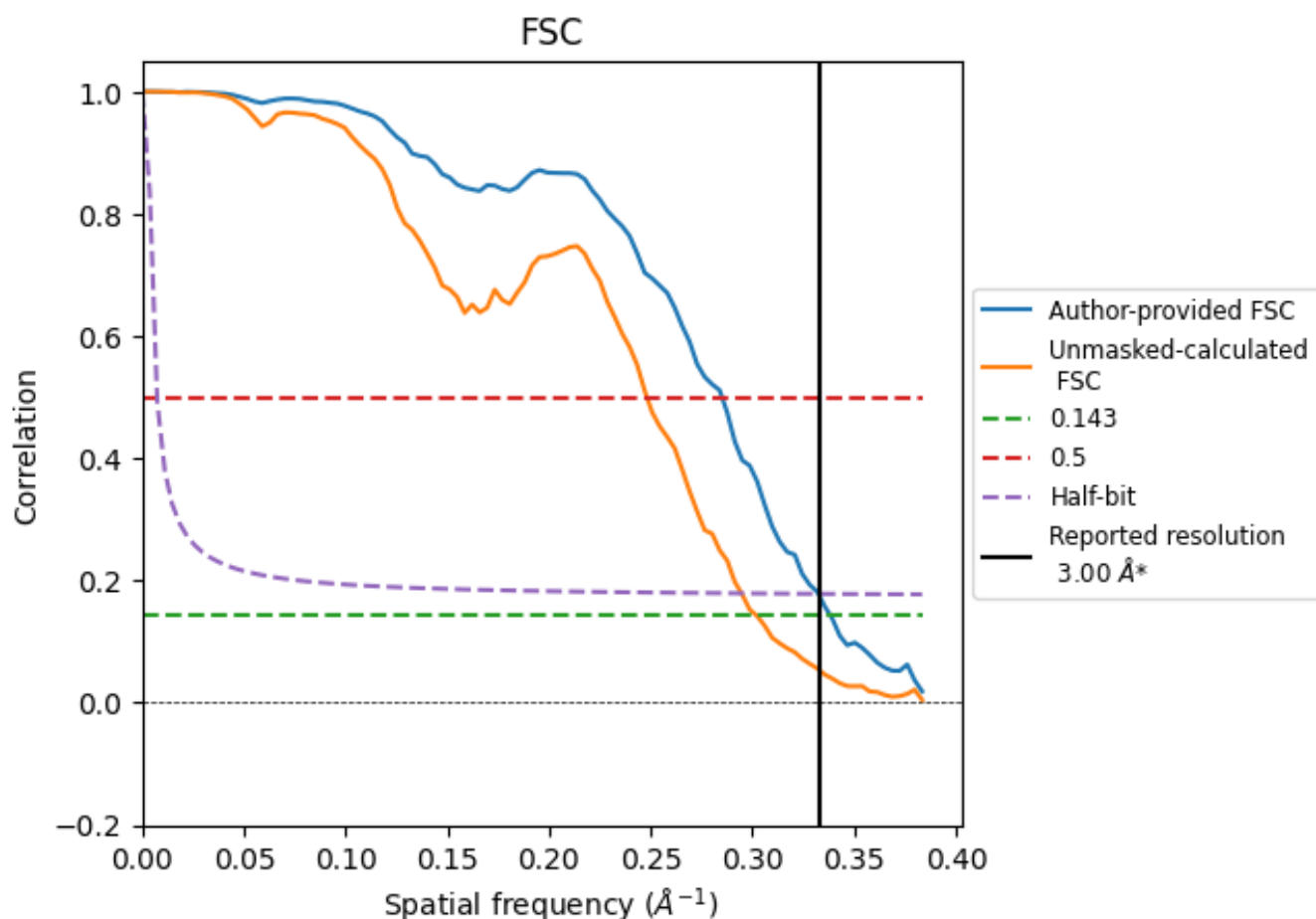


*Reported resolution corresponds to spatial frequency of 0.333 Å⁻¹

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 0.333 Å⁻¹

8.2 Resolution estimates [i](#)

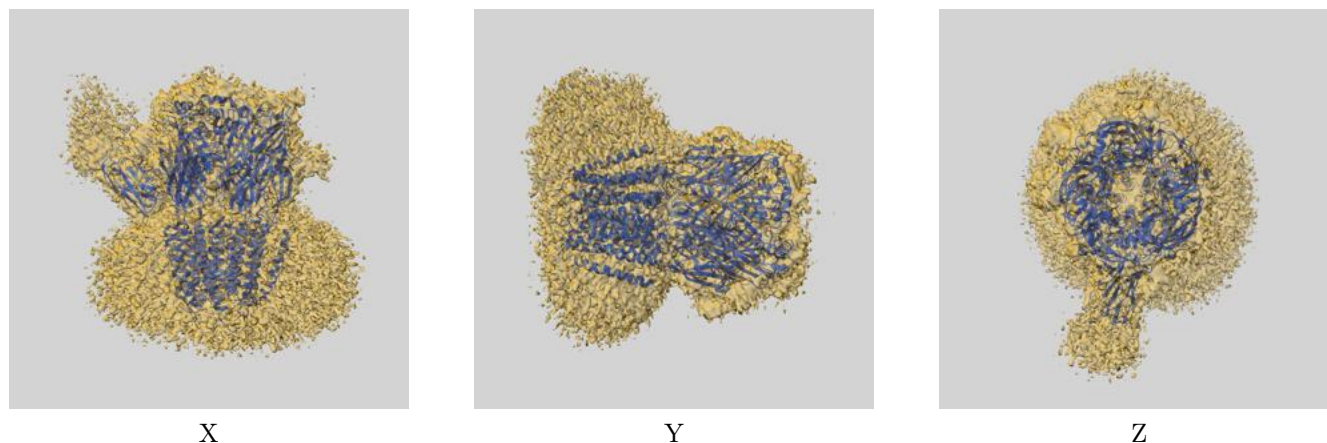
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.00	-	-
Author-provided FSC curve	2.96	3.51	3.01
Unmasked-calculated*	3.31	4.03	3.40

*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 3.31 differs from the reported value 3.0 by more than 10 %

9 Map-model fit [i](#)

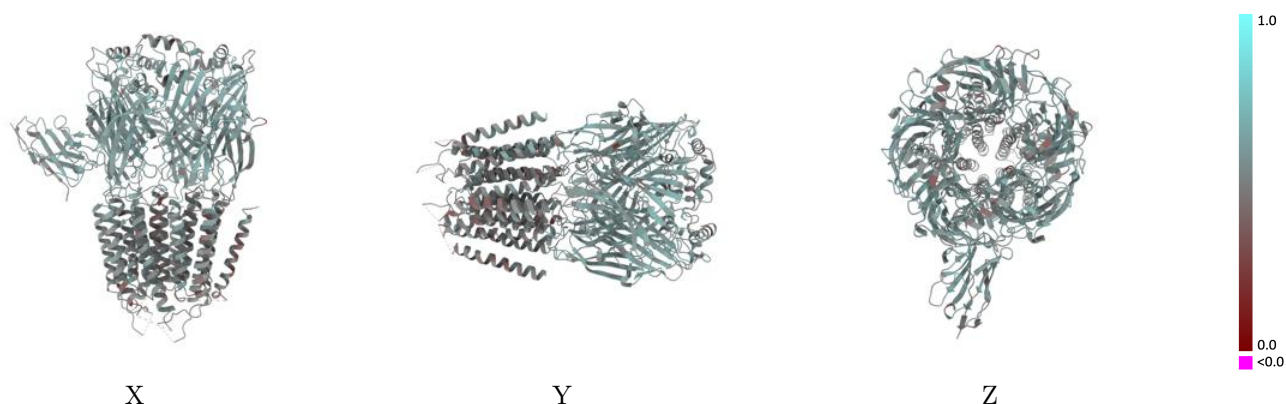
This section contains information regarding the fit between EMDB map EMD-50402 and PDB model 9FGH. Per-residue inclusion information can be found in section 3 on page 11.

9.1 Map-model overlay [i](#)



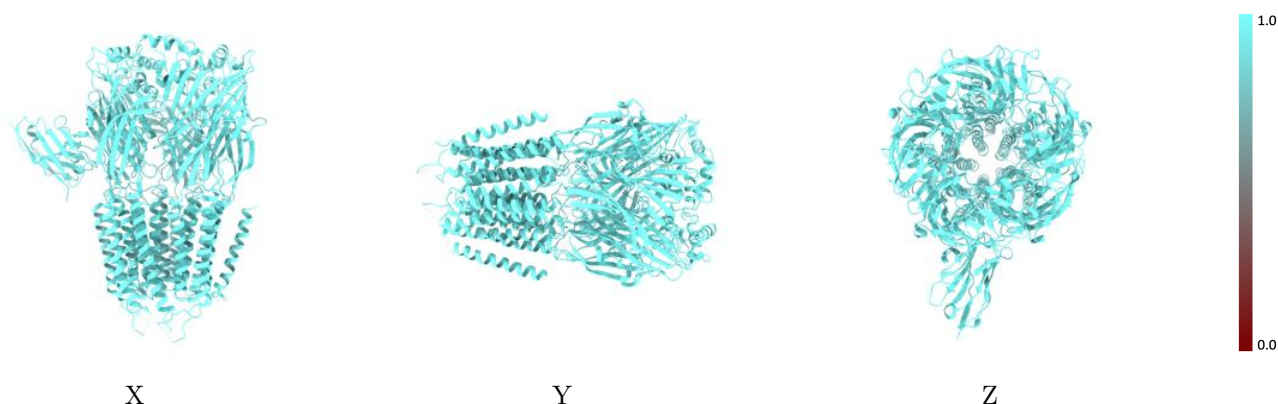
The images above show the 3D surface view of the map at the recommended contour level 0.01 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



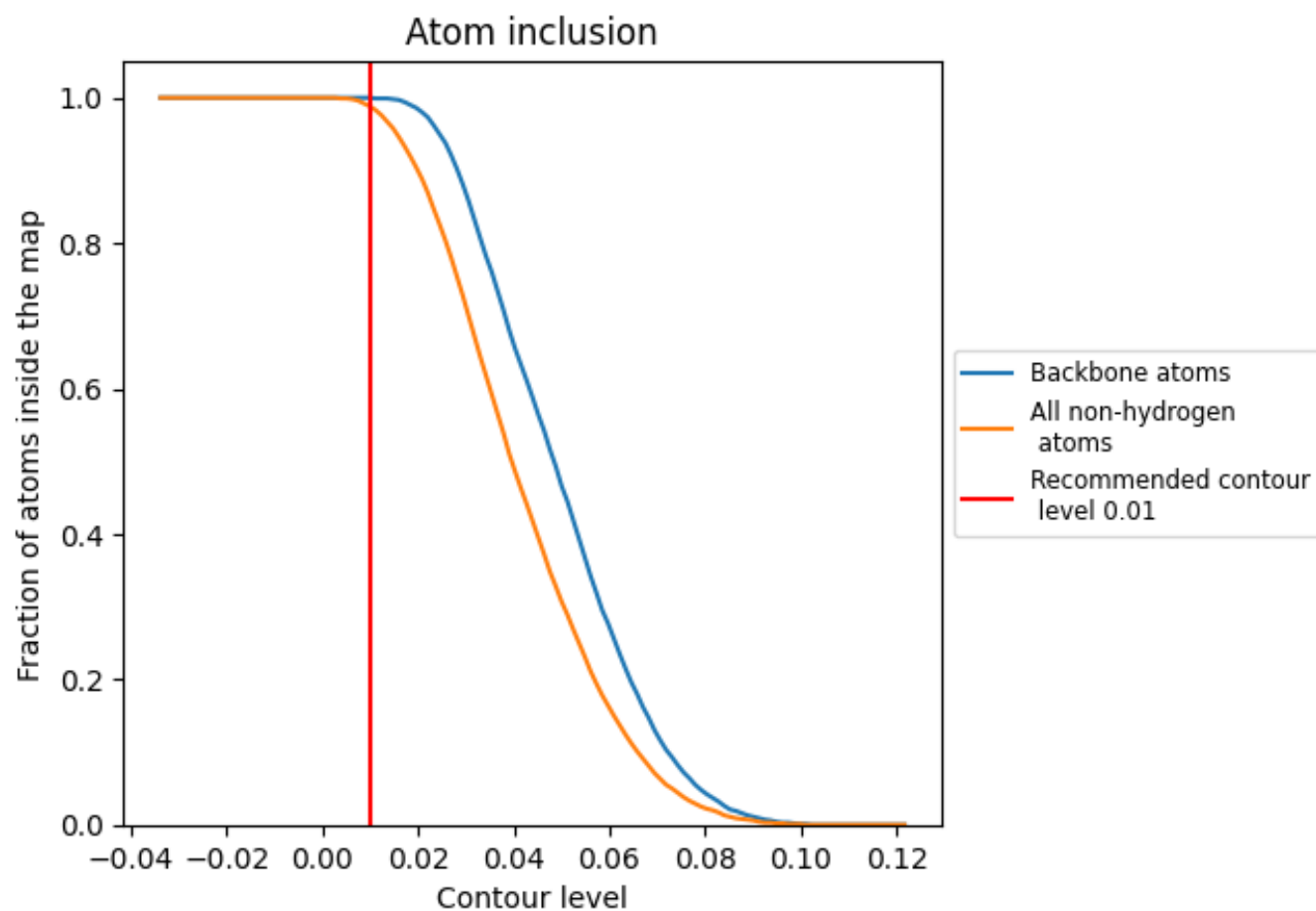
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.01).

9.4 Atom inclusion [i](#)



At the recommended contour level, 100% of all backbone atoms, 99% 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 (0.01) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div><div></div>0.9880</div>	<div><div></div>0.5360</div>
A	<div><div></div>0.9880</div>	<div><div></div>0.5470</div>
B	<div><div></div>0.9930</div>	<div><div></div>0.5350</div>
C	<div><div></div>0.9860</div>	<div><div></div>0.5220</div>
D	<div><div></div>0.9880</div>	<div><div></div>0.5360</div>
E	<div><div></div>0.9890</div>	<div><div></div>0.5380</div>
F	<div><div></div>0.9810</div>	<div><div></div>0.4630</div>
G	<div><div></div>0.9850</div>	<div><div></div>0.5520</div>
H	<div><div></div>1.0000</div>	<div><div></div>0.5120</div>
I	<div><div></div>0.9860</div>	<div><div></div>0.5070</div>
J	<div><div></div>1.0000</div>	<div><div></div>0.4900</div>
K	<div><div></div>1.0000</div>	<div><div></div>0.4710</div>
L	<div><div></div>1.0000</div>	<div><div></div>0.5000</div>

1.0

0.0

<0.0