



Full wwPDB EM Validation Report ⓘ

Mar 8, 2026 – 03:59 AM UTC

PDB ID : 6QNO / pdb_00006qno
EMDB ID : EMD-4598
Title : Rhodopsin-Gi protein complex
Authors : Tsai, C.-J.; Marino, J.; Adaixo, R.J.; Pamula, F.; Muehle, J.; Maeda, S.;
Flock, T.; Taylor, N.M.I.; Mohammed, I.; Matile, H.; Dawson, R.J.P.; Deupi,
X.; Stahlberg, H.; Schertler, G.F.X.
Deposited on : 2019-02-11
Resolution : 4.38 Å (reported)
Based on initial models : 1GOT, 6FUF, 6QNK

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:

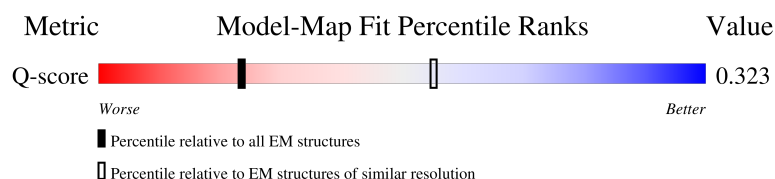
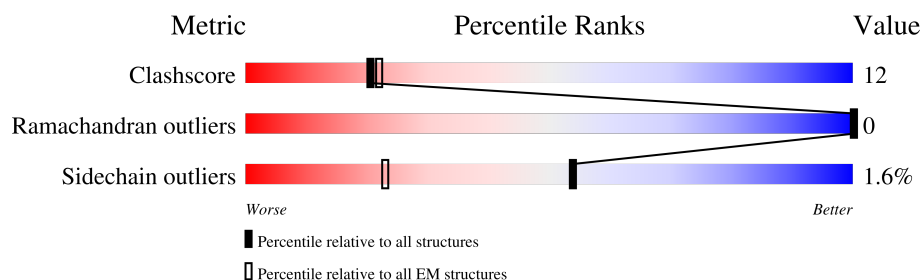
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data 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

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

The reported resolution of this entry is 4.38 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	3702 (3.88 - 4.88)

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	376	
2	B	340	
3	G	74	

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Mol	Chain	Length	Quality of chain
4	L	239	5% 62% 28% • 9%
5	H	249	8% 63% 25% 11%
6	R	348	17% 76% 20% • •
7	C	2	100% 100%

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 10429 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 Guanine nucleotide-binding protein G(i) subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	212	Total	C	N	O	S	0	0
			1711	1089	286	324	12		

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-21	MET	-	initiating methionine	UNP P63096
A	-20	LYS	-	expression tag	UNP P63096
A	-19	LYS	-	expression tag	UNP P63096
A	-18	HIS	-	expression tag	UNP P63096
A	-17	HIS	-	expression tag	UNP P63096
A	-16	HIS	-	expression tag	UNP P63096
A	-15	HIS	-	expression tag	UNP P63096
A	-14	HIS	-	expression tag	UNP P63096
A	-13	HIS	-	expression tag	UNP P63096
A	-12	HIS	-	expression tag	UNP P63096
A	-11	HIS	-	expression tag	UNP P63096
A	-10	HIS	-	expression tag	UNP P63096
A	-9	HIS	-	expression tag	UNP P63096
A	-8	GLU	-	expression tag	UNP P63096
A	-7	ASN	-	expression tag	UNP P63096
A	-6	LEU	-	expression tag	UNP P63096
A	-5	TYR	-	expression tag	UNP P63096
A	-4	PHE	-	expression tag	UNP P63096
A	-3	GLN	-	expression tag	UNP P63096
A	-2	GLY	-	expression tag	UNP P63096
A	-1	GLY	-	expression tag	UNP P63096
A	0	SER	-	expression tag	UNP P63096

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	312	Total	C	N	O	S	0	0
			2392	1481	425	466	20		

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(T) subunit gamma-T1.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	G	36	Total	C	N	O	S	0	0
			293	183	47	60	3		

- Molecule 4 is a protein called Fab antibody fragment light chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	L	217	Total	C	N	O	S	0	0
			1679	1049	284	338	8		

- Molecule 5 is a protein called Fab antibody fragment heavy chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	H	221	Total	C	N	O	S	2	0
			1660	1051	267	333	9		

- Molecule 6 is a protein called Rhodopsin.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	R	334	Total	C	N	O	S	0	0
			2646	1758	407	455	26		

There are 3 discrepancies between the modelled and reference sequences:

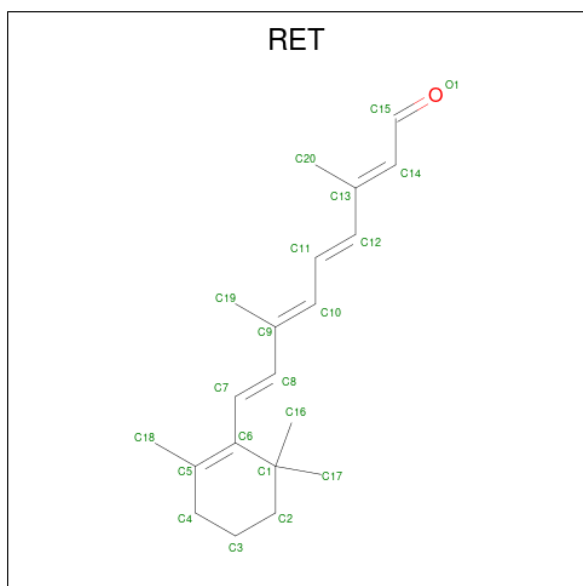
Chain	Residue	Modelled	Actual	Comment	Reference
R	2	CYS	ASN	engineered mutation	UNP P02699
R	257	TYR	MET	engineered mutation	UNP P02699
R	282	CYS	ASP	engineered mutation	UNP P02699

- Molecule 7 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.

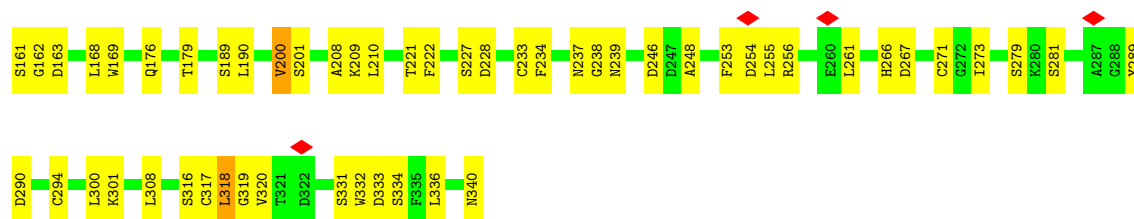


Mol	Chain	Residues	Atoms				AltConf	Trace
7	C	2	Total	C	N	O	0	0
			28	16	2	10		

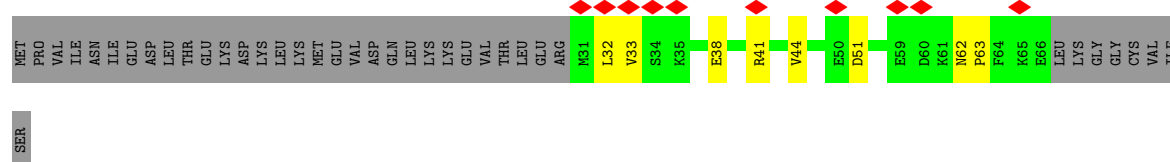
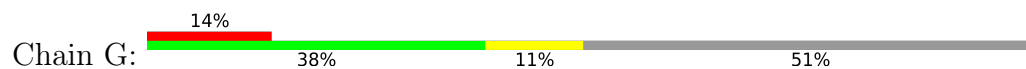
- Molecule 8 is RETINAL (CCD ID: RET) (formula: $C_{20}H_{28}O$) (labeled as "Ligand of Interest" by depositor).



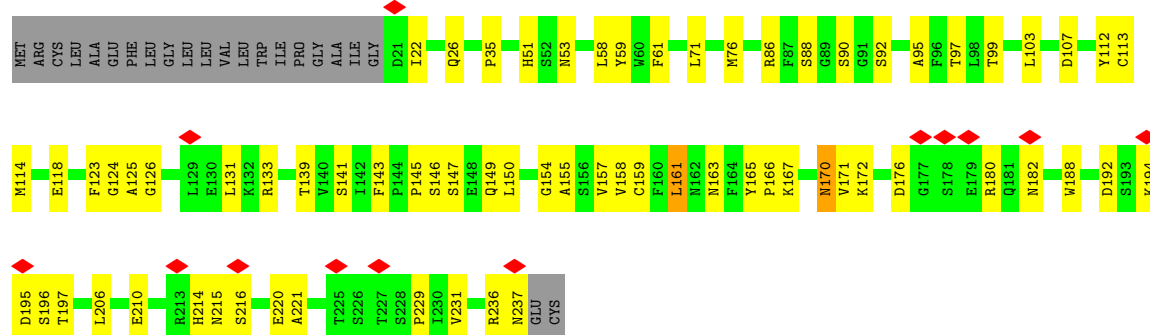
Mol	Chain	Residues	Atoms		AltConf
8	R	1	Total	C	0
			20	20	



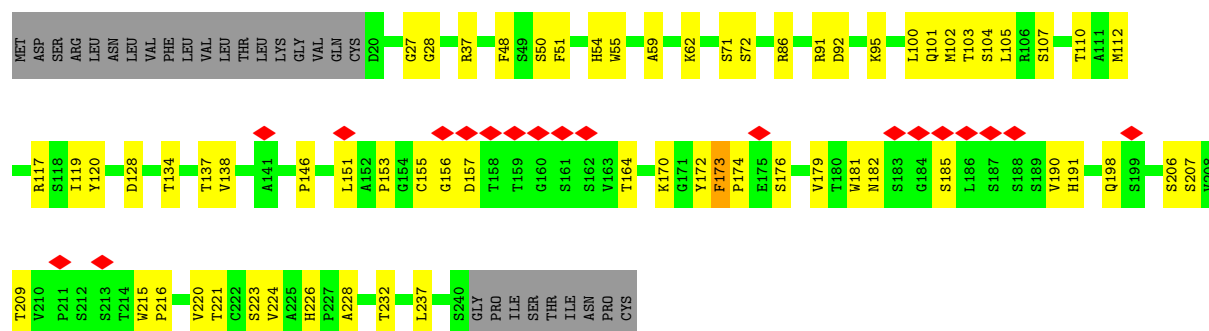
• Molecule 3: Guanine nucleotide-binding protein G(T) subunit gamma-T1



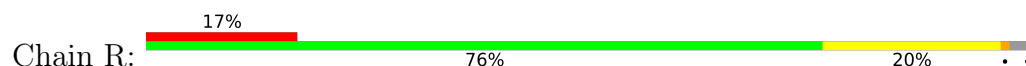
• Molecule 4: Fab antibody fragment light chain

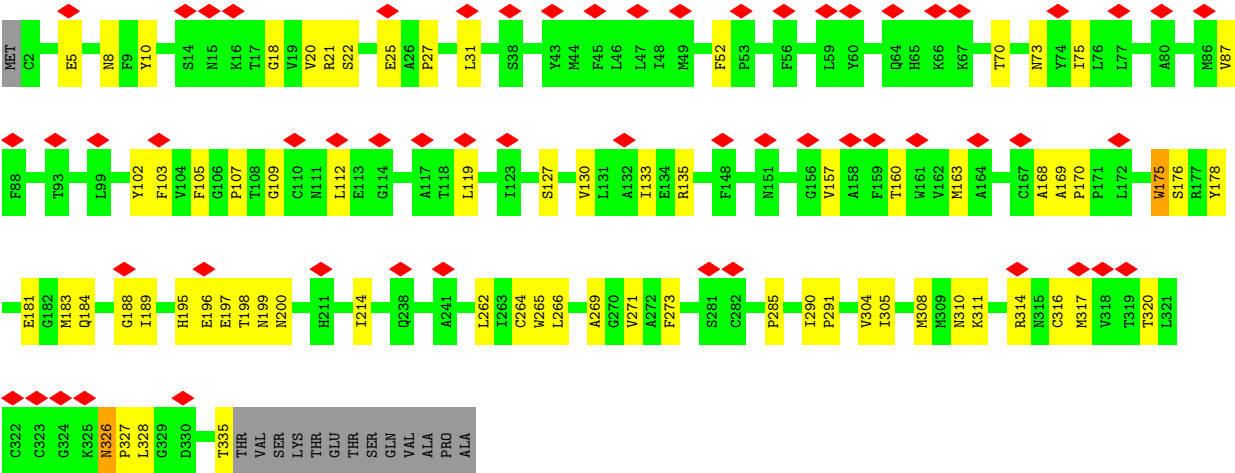


• Molecule 5: Fab antibody fragment heavy chain



• Molecule 6: Rhodopsin





● Molecule 7: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	115000	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	15000	Depositor
Maximum defocus (nm)	25000	Depositor
Magnification	165000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.120	Depositor
Minimum map value	-0.051	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.003	Depositor
Recommended contour level	0.03	Depositor
Map size ($\text{\AA}$)	280.54, 280.54, 280.54	wwPDB
Map dimensions	338, 338, 338	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	0.83000004, 0.83000004, 0.83000004	Depositor

5 Model quality

5.1 Standard geometry

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

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.36	0/1740	0.74	0/2331
2	B	0.55	0/2439	0.81	0/3310
3	G	0.39	0/298	0.72	0/398
4	L	0.44	0/1717	0.69	0/2333
5	H	0.46	0/1712	0.71	0/2337
6	R	0.38	0/2730	0.72	1/3722 (0.0%)
All	All	0.44	0/10636	0.74	1/14431 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
5	H	0	1
6	R	0	3
All	All	0	4

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	R	170	PRO	N-CA-C	5.44	117.34	110.70

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
5	H	173	PHE	Peptide

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Mol	Chain	Res	Type	Group
6	R	169	ALA	Peptide
6	R	175	TRP	Peptide
6	R	327	PRO	Peptide

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	1711	0	1700	44	0
2	B	2392	0	2298	79	0
3	G	293	0	280	9	0
4	L	1679	0	1620	43	0
5	H	1660	0	1600	41	0
6	R	2646	0	2605	47	0
7	C	28	0	25	1	0
8	R	20	0	27	1	0
All	All	10429	0	10155	248	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 12.

All (248) 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:208:ALA:O	2:B:222:PHE:HB2	1.88	0.73
2:B:45:MET:HA	2:B:340:ASN:O	1.90	0.70
5:H:224:VAL:O	5:H:232:THR:HA	1.94	0.68
2:B:51:LEU:HD22	2:B:336:LEU:HD12	1.76	0.68
1:A:227:LEU:HD13	1:A:274:PHE:HB2	1.76	0.67
5:H:182:ASN:HD21	5:H:220:VAL:HA	1.58	0.67
5:H:190:VAL:HA	5:H:207:SER:O	1.94	0.67
5:H:27:GLY:O	5:H:37:ARG:NH1	2.28	0.66
2:B:33:ILE:O	3:G:41:ARG:NH2	2.28	0.66
6:R:310:ASN:O	6:R:314:ARG:N	2.29	0.66
1:A:224:CYS:SG	1:A:269:ASN:ND2	2.69	0.65
1:A:15:ARG:NH2	5:H:50:SER:O	2.29	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:L:133:ARG:HH21	4:L:165:TYR:HB2	1.62	0.65
2:B:271:CYS:HB2	2:B:290:ASP:HB2	1.79	0.65
5:H:48:PHE:O	5:H:91:ARG:NH2	2.30	0.64
5:H:101:GLN:NE2	5:H:102:MET:O	2.30	0.64
2:B:121:CYS:HB3	2:B:139:LEU:HB2	1.80	0.64
4:L:172:LYS:HB2	4:L:220:GLU:HB2	1.80	0.63
6:R:27:PRO:HA	6:R:102:TYR:HB3	1.80	0.63
6:R:269:ALA:O	6:R:273:PHE:HB2	2.00	0.62
2:B:51:LEU:HB2	2:B:336:LEU:HB2	1.83	0.61
4:L:59:TYR:HB2	4:L:114:MET:O	2.01	0.61
2:B:69:LEU:HA	2:B:82:TRP:O	2.01	0.60
4:L:145:PRO:HG2	4:L:155:ALA:HB1	1.82	0.60
2:B:233:CYS:SG	2:B:234:PHE:N	2.74	0.60
2:B:159:THR:OG1	2:B:169:TRP:NE1	2.33	0.60
2:B:64:GLY:N	2:B:69:LEU:O	2.35	0.59
2:B:279:SER:HA	2:B:320:VAL:HG11	1.83	0.59
5:H:155:CYS:SG	5:H:156:GLY:N	2.74	0.59
5:H:172:TYR:HD2	5:H:174:PRO:HD2	1.68	0.59
6:R:262:LEU:HD12	6:R:266:LEU:HD22	1.85	0.59
1:A:257:LYS:HZ2	6:R:335:THR:H	1.50	0.58
2:B:32:GLN:O	2:B:35:ASN:ND2	2.36	0.58
2:B:79:LEU:HB3	2:B:93:ILE:HB	1.85	0.58
2:B:161:SER:OG	2:B:162:GLY:N	2.36	0.58
2:B:253:PHE:HA	2:B:261:LEU:HD13	1.86	0.58
2:B:281:SER:HB3	3:G:51:ASP:HB2	1.85	0.57
4:L:176:ASP:HA	4:L:216:SER:HB3	1.86	0.57
2:B:201:SER:O	2:B:208:ALA:HA	2.04	0.57
6:R:10:TYR:O	6:R:184:GLN:NE2	2.38	0.57
2:B:331:SER:OG	2:B:332:TRP:N	2.38	0.57
1:A:187:THR:HG22	1:A:198:MET:HB3	1.87	0.56
5:H:71:SER:OG	5:H:72:SER:N	2.38	0.56
2:B:73:ALA:HB1	2:B:100:VAL:HG11	1.87	0.56
1:A:250:PHE:HA	1:A:253:ILE:HG22	1.88	0.56
4:L:145:PRO:HD3	4:L:157:VAL:HG22	1.86	0.56
1:A:184:ILE:HD12	1:A:185:VAL:H	1.71	0.56
2:B:60:ALA:HB3	2:B:73:ALA:HB3	1.88	0.56
2:B:176:GLN:NE2	2:B:179:THR:OG1	2.39	0.56
4:L:220:GLU:HG2	4:L:231:VAL:HG12	1.87	0.56
4:L:86:ARG:NE	4:L:107:ASP:OD2	2.36	0.55
6:R:176:SER:HA	6:R:198:THR:HB	1.88	0.55
1:A:262:THR:O	1:A:317:LYS:NZ	2.39	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:L:214:HIS:O	4:L:236:ARG:NH1	2.36	0.55
5:H:51:PHE:HE1	5:H:119:ILE:HD12	1.72	0.54
6:R:195:HIS:O	6:R:200:ASN:ND2	2.41	0.54
6:R:20:VAL:HG12	7:C:1:NAG:H82	1.89	0.54
5:H:110:THR:HG23	5:H:137:THR:HA	1.90	0.54
2:B:267:ASP:N	2:B:267:ASP:OD1	2.39	0.54
1:A:190:THR:HG22	1:A:195:HIS:HA	1.90	0.54
4:L:192:ASP:OD1	4:L:194:LYS:NZ	2.40	0.54
2:B:142:HIS:ND1	2:B:163:ASP:OD2	2.36	0.53
5:H:220:VAL:H	5:H:237:LEU:HD22	1.72	0.53
4:L:133:ARG:NH1	4:L:196:SER:O	2.42	0.53
1:A:271:LYS:HE2	1:A:323:PHE:HB3	1.91	0.53
1:A:339:VAL:HA	1:A:342:VAL:HG22	1.91	0.53
5:H:59:ALA:HB3	5:H:62:LYS:HB2	1.91	0.53
5:H:137:THR:HG21	5:H:173:PHE:HZ	1.74	0.52
2:B:145:TYR:O	2:B:162:GLY:N	2.42	0.52
1:A:207:GLU:HA	1:A:210:LYS:HD3	1.90	0.52
4:L:143:PHE:HB2	4:L:158:VAL:HG12	1.92	0.52
5:H:37:ARG:H	5:H:101:GLN:HE22	1.57	0.52
2:B:29:THR:OG1	2:B:30:LEU:N	2.43	0.52
5:H:146:PRO:HB3	5:H:172:TYR:HB3	1.91	0.52
2:B:333:ASP:OD1	2:B:333:ASP:N	2.43	0.51
4:L:146:SER:OG	4:L:149:GLN:NE2	2.43	0.51
2:B:228:ASP:OD1	2:B:228:ASP:N	2.43	0.51
4:L:180:ARG:HH11	4:L:182:ASN:HB2	1.75	0.51
1:A:263:SER:HA	1:A:317:LYS:HD2	1.93	0.51
2:B:62:HIS:CD2	2:B:63:TRP:H	2.29	0.51
2:B:49:ARG:NH2	3:G:63:PRO:O	2.44	0.50
2:B:144:GLY:O	2:B:161:SER:OG	2.28	0.50
1:A:322:HIS:NE2	1:A:331:ASN:OD1	2.45	0.50
2:B:33:ILE:HG22	3:G:41:ARG:HH22	1.76	0.50
2:B:56:ALA:O	2:B:334:SER:OG	2.24	0.50
6:R:317:MET:HA	6:R:320:THR:HB	1.93	0.50
2:B:129:ARG:NH1	2:B:134:ARG:O	2.44	0.50
5:H:102:MET:HB3	5:H:105:LEU:HD21	1.94	0.50
4:L:92:SER:OG	4:L:95:ALA:N	2.42	0.50
5:H:28:GLY:O	5:H:37:ARG:NH1	2.44	0.49
2:B:31:SER:O	2:B:34:THR:OG1	2.26	0.49
6:R:5:GLU:HA	6:R:10:TYR:HD1	1.77	0.49
2:B:103:CYS:HA	2:B:113:ALA:O	2.12	0.49
1:A:332:VAL:O	1:A:336:PHE:HB2	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:H:164:THR:HA	5:H:209:THR:HA	1.95	0.49
6:R:178:TYR:HA	6:R:188:GLY:O	2.13	0.49
4:L:163:ASN:HA	4:L:197:THR:HB	1.94	0.49
2:B:37:ILE:O	2:B:301:LYS:NZ	2.37	0.49
2:B:294:CYS:HB3	2:B:308:LEU:HB2	1.95	0.49
5:H:170:LYS:NZ	5:H:198:GLN:OE1	2.46	0.49
6:R:183:MET:HG2	6:R:285:PRO:HB2	1.95	0.49
2:B:254:ASP:OD1	2:B:255:LEU:N	2.45	0.49
5:H:146:PRO:HD3	5:H:226:HIS:CD2	2.48	0.49
6:R:304:VAL:HA	6:R:308:MET:HB2	1.95	0.49
2:B:58:ILE:HG12	2:B:74:SER:HB3	1.95	0.48
2:B:237:ASN:OD1	2:B:238:GLY:N	2.47	0.48
4:L:154:GLY:CA	4:L:206:LEU:O	2.62	0.48
2:B:129:ARG:NH2	2:B:136:SER:OG	2.46	0.48
2:B:248:ALA:HA	2:B:273:ILE:HG13	1.95	0.48
4:L:88:SER:OG	4:L:99:THR:OG1	2.28	0.48
4:L:141:SER:O	4:L:159:CYS:HA	2.13	0.48
2:B:153:ASP:OD1	2:B:153:ASP:N	2.43	0.48
6:R:181:GLU:H	6:R:184:GLN:HA	1.79	0.48
6:R:326:ASN:O	6:R:328:LEU:N	2.47	0.48
6:R:316:CYS:O	6:R:320:THR:OG1	2.26	0.48
5:H:112:MET:HA	5:H:134:THR:O	2.14	0.48
6:R:18:GLY:O	6:R:21:ARG:NH1	2.45	0.48
1:A:26:ASP:OD2	2:B:78:LYS:HE2	2.13	0.47
4:L:155:ALA:HB3	4:L:206:LEU:HB2	1.96	0.47
6:R:196:GLU:O	6:R:199:ASN:ND2	2.47	0.47
1:A:12:ALA:O	2:B:88:ASN:ND2	2.48	0.47
2:B:60:ALA:O	2:B:73:ALA:N	2.41	0.47
3:G:41:ARG:O	3:G:44:VAL:N	2.48	0.47
4:L:51:HIS:ND1	4:L:53:ASN:OD1	2.47	0.47
5:H:86:ARG:HD2	5:H:104:SER:HB2	1.95	0.47
5:H:215:TRP:CD1	5:H:216:PRO:HA	2.49	0.47
1:A:264:ILE:H	1:A:317:LYS:HD2	1.80	0.47
5:H:92:ASP:OD2	5:H:95:LYS:HD2	2.15	0.47
6:R:8:ASN:HD22	6:R:107:PRO:HG3	1.79	0.47
4:L:114:MET:HE2	4:L:114:MET:HB3	1.78	0.47
1:A:47:SER:HA	1:A:50:VAL:HG12	1.96	0.47
5:H:54:HIS:NE2	5:H:120:TYR:OH	2.38	0.47
1:A:250:PHE:HE1	1:A:264:ILE:HG13	1.79	0.46
4:L:26:GLN:OE1	4:L:126:GLY:N	2.47	0.46
2:B:147:SER:OG	2:B:160:SER:OG	2.28	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:38:LEU:HG	1:A:46:LYS:HD2	1.96	0.46
2:B:63:TRP:HE1	2:B:319:GLY:C	2.22	0.46
2:B:200:VAL:HG12	2:B:210:LEU:HA	1.96	0.46
4:L:90:SER:OG	4:L:97:THR:O	2.24	0.46
2:B:81:ILE:HD12	2:B:90:VAL:HB	1.98	0.46
6:R:326:ASN:HD22	6:R:326:ASN:HA	1.54	0.46
1:A:25:GLU:HG2	1:A:28:GLU:OE2	2.16	0.46
4:L:221:ALA:O	4:L:229:PRO:HA	2.15	0.46
2:B:119:ASN:ND2	2:B:143:THR:O	2.45	0.46
1:A:311:ASN:O	1:A:313:ARG:NH1	2.49	0.46
2:B:227:SER:OG	2:B:228:ASP:OD1	2.33	0.46
4:L:215:ASN:OD1	4:L:237:ASN:N	2.48	0.46
1:A:257:LYS:NZ	6:R:335:THR:H	2.14	0.45
6:R:163:MET:SD	6:R:163:MET:N	2.89	0.45
6:R:271:VAL:HG21	6:R:291:PRO:HG3	1.98	0.45
5:H:181:TRP:O	5:H:185:SER:N	2.47	0.45
6:R:311:LYS:HA	6:R:314:ARG:HG3	1.98	0.45
1:A:218:VAL:HG12	1:A:220:ALA:H	1.80	0.45
6:R:175:TRP:CD1	6:R:199:ASN:HB2	2.51	0.45
2:B:300:LEU:HD11	3:G:44:VAL:HG11	1.98	0.45
6:R:70:THR:OG1	6:R:73:ASN:ND2	2.50	0.45
5:H:51:PHE:CE2	5:H:117:ARG:HD2	2.51	0.45
1:A:18:MET:HA	1:A:21:ARG:HH21	1.82	0.45
2:B:80:ILE:HA	2:B:91:HIS:O	2.17	0.45
4:L:58:LEU:HB3	4:L:76:MET:HB2	1.99	0.45
4:L:71:LEU:HD22	5:H:128:ASP:HA	1.99	0.45
4:L:195:ASP:N	4:L:195:ASP:OD1	2.49	0.45
6:R:269:ALA:O	6:R:273:PHE:CB	2.65	0.45
4:L:170:ASN:HD22	4:L:171:VAL:H	1.64	0.44
6:R:157:VAL:O	6:R:160:THR:OG1	2.25	0.44
2:B:189:SER:OG	2:B:190:LEU:N	2.49	0.44
4:L:133:ARG:HH12	4:L:197:THR:HG22	1.83	0.44
5:H:191:HIS:O	5:H:206:SER:OG	2.27	0.44
4:L:22:ILE:HD12	4:L:118:GLU:OE2	2.16	0.44
1:A:11:ALA:HA	1:A:14:GLU:HB3	1.99	0.44
1:A:209:LYS:HG2	1:A:213:HIS:ND1	2.32	0.44
1:A:351:CYS:O	6:R:135:ARG:NE	2.50	0.44
2:B:168:LEU:HD22	2:B:169:TRP:H	1.83	0.44
4:L:180:ARG:NH2	4:L:210:GLU:OE2	2.50	0.44
6:R:52:PHE:HD1	6:R:87:VAL:HG11	1.83	0.44
2:B:209:LYS:HG2	2:B:221:THR:HA	2.00	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:L:143:PHE:HB3	5:H:151:LEU:HD12	1.99	0.44
5:H:174:PRO:HB3	5:H:228:ALA:HB2	1.99	0.44
6:R:181:GLU:N	6:R:184:GLN:HA	2.33	0.44
1:A:205:ARG:HE	1:A:245:GLU:HA	1.83	0.43
1:A:257:LYS:HG3	6:R:335:THR:HG22	2.00	0.43
2:B:70:LEU:O	2:B:81:ILE:HA	2.18	0.43
2:B:316:SER:OG	2:B:317:CYS:N	2.51	0.43
2:B:119:ASN:ND2	2:B:142:HIS:O	2.51	0.43
4:L:35:PRO:HG3	4:L:131:LEU:HD22	2.00	0.43
4:L:139:THR:O	4:L:161:LEU:HA	2.19	0.43
1:A:194:LEU:HD22	1:A:194:LEU:HA	1.92	0.43
5:H:182:ASN:OD1	5:H:221:THR:N	2.52	0.43
6:R:22:SER:HB3	6:R:25:GLU:HG2	2.00	0.43
2:B:79:LEU:O	2:B:92:ALA:HA	2.18	0.43
2:B:237:ASN:OD1	2:B:239:ASN:N	2.50	0.43
6:R:195:HIS:NE2	6:R:197:GLU:HB2	2.33	0.43
1:A:305:CYS:O	1:A:309:ASP:N	2.51	0.43
1:A:322:HIS:HB2	1:A:334:PHE:CE2	2.54	0.43
2:B:81:ILE:HD11	2:B:91:HIS:CD2	2.54	0.43
6:R:75:ILE:HD11	6:R:127:SER:HA	2.00	0.43
6:R:109:GLY:HA2	6:R:112:LEU:HD12	1.98	0.43
2:B:340:ASN:OD1	3:G:62:ASN:ND2	2.52	0.43
3:G:32:LEU:HD23	3:G:33:VAL:H	1.84	0.43
4:L:61:PHE:HB2	4:L:112:TYR:HB2	2.00	0.42
6:R:130:VAL:HG12	6:R:133:ILE:HD12	2.00	0.42
2:B:66:ASP:OD1	2:B:66:ASP:N	2.38	0.42
1:A:29:LYS:HD3	1:A:32:ARG:HD3	2.00	0.42
2:B:135:VAL:HG22	2:B:137:ARG:H	1.84	0.42
2:B:143:THR:OG1	2:B:144:GLY:N	2.51	0.42
2:B:318:LEU:H	2:B:318:LEU:HG	1.77	0.42
5:H:220:VAL:HB	5:H:237:LEU:HD13	2.01	0.42
5:H:55:TRP:CD2	5:H:100:LEU:HD22	2.55	0.42
1:A:48:THR:HG21	1:A:327:THR:HG23	2.02	0.42
1:A:230:TYR:HD2	1:A:277:LYS:HE3	1.85	0.42
5:H:153:PRO:HB3	5:H:157:ASP:OD2	2.19	0.42
6:R:189:ILE:HD11	8:R:401:RET:H183	2.01	0.42
6:R:290:ILE:H	6:R:290:ILE:HG13	1.64	0.42
1:A:314:LYS:HG2	1:A:315:ASP:H	1.84	0.42
2:B:108:SER:OG	2:B:109:GLY:N	2.52	0.42
2:B:255:LEU:HB3	2:B:256:ARG:HD3	2.02	0.42
1:A:306:GLN:NE2	1:A:309:ASP:OD2	2.52	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:106:ALA:HB2	2:B:111:TYR:HB2	2.01	0.42
1:A:198:MET:HE3	1:A:198:MET:HB2	1.94	0.42
2:B:142:HIS:HD1	2:B:163:ASP:CG	2.26	0.42
6:R:264:CYS:SG	6:R:265:TRP:NE1	2.92	0.42
1:A:46:LYS:HA	1:A:49:ILE:HD12	2.02	0.41
6:R:195:HIS:CD2	6:R:198:THR:H	2.38	0.41
6:R:195:HIS:HB3	6:R:200:ASN:HD21	1.85	0.41
2:B:246:ASP:HA	2:B:273:ILE:H	1.86	0.41
6:R:317:MET:HE2	6:R:317:MET:HB2	1.84	0.41
2:B:239:ASN:HA	2:B:255:LEU:HD22	2.02	0.41
6:R:119:LEU:HD13	6:R:168:ALA:HB2	2.02	0.41
2:B:160:SER:OG	2:B:160:SER:O	2.37	0.41
4:L:113:CYS:O	4:L:124:GLY:N	2.53	0.41
4:L:165:TYR:HA	4:L:166:PRO:HA	1.91	0.41
5:H:86:ARG:O	5:H:103:THR:OG1	2.33	0.41
5:H:174:PRO:HD3	5:H:226:HIS:NE2	2.36	0.41
1:A:320:TYR:OH	1:A:341:ASP:OD1	2.38	0.41
5:H:107:SER:HA	5:H:138:VAL:HB	2.01	0.41
6:R:262:LEU:HD13	6:R:262:LEU:HA	1.93	0.41
6:R:103:PHE:CZ	6:R:105:PHE:HB2	2.56	0.41
2:B:62:HIS:O	2:B:71:VAL:N	2.53	0.40
4:L:103:LEU:HD12	4:L:103:LEU:HA	1.91	0.40
4:L:147:SER:HA	4:L:150:LEU:HD12	2.03	0.40
2:B:273:ILE:HG12	2:B:289:TYR:CD1	2.56	0.40
3:G:38:GLU:HA	3:G:41:ARG:HH11	1.86	0.40
4:L:26:GLN:CD	4:L:125:ALA:H	2.28	0.40
1:A:208:ARG:O	1:A:212:ILE:HG22	2.22	0.40
1:A:16:SER:HA	1:A:19:ILE:HG22	2.03	0.40
2:B:190:LEU:HA	2:B:190:LEU:HD13	1.94	0.40
4:L:167:LYS:HB2	4:L:188:TRP:HD1	1.86	0.40

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	206/376 (55%)	169 (82%)	37 (18%)	0	100	100
2	B	310/340 (91%)	271 (87%)	39 (13%)	0	100	100
3	G	34/74 (46%)	29 (85%)	5 (15%)	0	100	100
4	L	215/239 (90%)	196 (91%)	19 (9%)	0	100	100
5	H	221/249 (89%)	201 (91%)	20 (9%)	0	100	100
6	R	332/348 (95%)	299 (90%)	33 (10%)	0	100	100
All	All	1318/1626 (81%)	1165 (88%)	153 (12%)	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	188/325 (58%)	185 (98%)	3 (2%)	55	69
2	B	260/283 (92%)	254 (98%)	6 (2%)	44	63
3	G	34/70 (49%)	34 (100%)	0	100	100
4	L	193/210 (92%)	190 (98%)	3 (2%)	55	69
5	H	191/215 (89%)	187 (98%)	4 (2%)	47	65
6	R	284/296 (96%)	280 (99%)	4 (1%)	59	71
All	All	1150/1399 (82%)	1130 (98%)	20 (2%)	54	67

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	184	ILE
1	A	185	VAL
1	A	194	LEU
2	B	47	THR

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Mol	Chain	Res	Type
2	B	82	TRP
2	B	133	VAL
2	B	200	VAL
2	B	266	HIS
2	B	318	LEU
4	L	123	PHE
4	L	161	LEU
4	L	170	ASN
5	H	176[A]	SER
5	H	176[B]	SER
5	H	223[A]	SER
5	H	223[B]	SER
6	R	31	LEU
6	R	214	ILE
6	R	305	ILE
6	R	326	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (25) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	269	ASN
1	A	346	ASN
2	B	62	HIS
2	B	75	GLN
2	B	88	ASN
2	B	91	HIS
2	B	176	GLN
2	B	183	HIS
2	B	230	ASN
2	B	239	ASN
2	B	295	ASN
2	B	311	HIS
4	L	67	GLN
4	L	116	HIS
4	L	149	GLN
4	L	170	ASN
5	H	101	GLN
6	R	64	GLN
6	R	73	ASN
6	R	78	ASN
6	R	195	HIS
6	R	199	ASN

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Mol	Chain	Res	Type
6	R	244	GLN
6	R	302	ASN
6	R	326	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 ⓘ

2 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	$\# Z > 2$
7	NAG	C	1	6,7	14,14,15	0.31	0	17,19,21	0.51	0
7	NAG	C	2	7	14,14,15	0.51	0	17,19,21	0.65	1 (5%)

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	1	6,7	-	0/6/23/26	0/1/1/1
7	NAG	C	2	7	-	2/6/23/26	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($^{\circ}$)	Ideal($^{\circ}$)
7	C	2	NAG	C1-O5-C5	2.17	115.10	112.19

There are no chirality outliers.

All (2) torsion outliers are listed below:

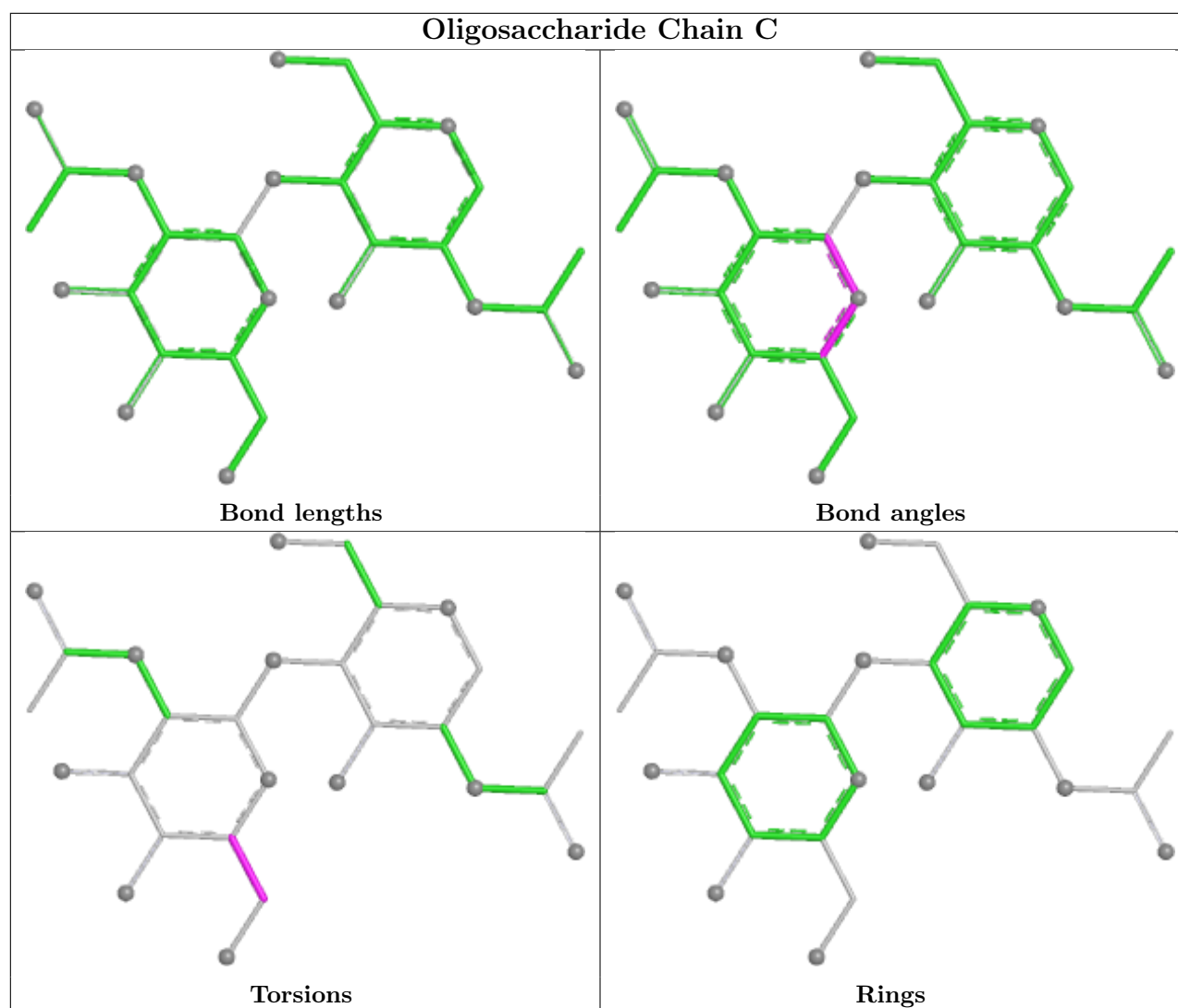
Mol	Chain	Res	Type	Atoms
7	C	2	NAG	O5-C5-C6-O6
7	C	2	NAG	C4-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	C	1	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](#)

1 ligand is 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	$\# Z > 2$
8	RET	R	401	6	20,20,21	3.43	10 (50%)	27,27,28	1.58	7 (25%)

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
8	RET	R	401	6	-	5/13/30/31	0/1/1/1

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	R	401	RET	C8-C9	6.43	1.59	1.46
8	R	401	RET	C7-C6	6.17	1.66	1.45
8	R	401	RET	C1-C6	6.16	1.61	1.53
8	R	401	RET	C14-C13	4.87	1.37	1.33
8	R	401	RET	C4-C5	4.43	1.59	1.51
8	R	401	RET	C18-C5	4.42	1.58	1.50
8	R	401	RET	C11-C10	3.88	1.55	1.43
8	R	401	RET	C12-C13	3.70	1.53	1.46
8	R	401	RET	C2-C1	2.27	1.59	1.54
8	R	401	RET	C16-C1	2.19	1.57	1.53

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	R	401	RET	C8-C9-C10	3.30	124.20	119.01
8	R	401	RET	C19-C9-C10	-3.01	117.95	122.82
8	R	401	RET	C16-C1-C6	-2.94	105.64	110.24
8	R	401	RET	C17-C1-C6	2.88	114.76	110.24
8	R	401	RET	C7-C8-C9	2.51	129.95	126.23
8	R	401	RET	C18-C5-C4	-2.27	108.76	113.60
8	R	401	RET	C7-C6-C5	2.18	126.58	121.56

There are no chirality outliers.

All (5) torsion outliers are listed below:

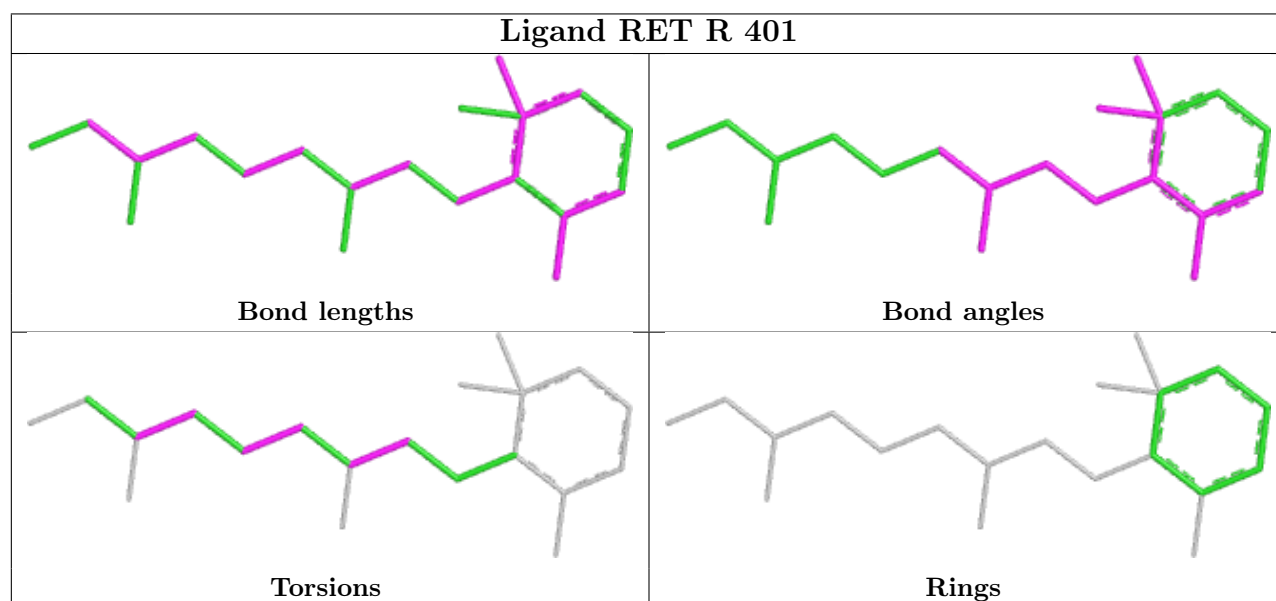
Mol	Chain	Res	Type	Atoms
8	R	401	RET	C7-C8-C9-C10
8	R	401	RET	C7-C8-C9-C19
8	R	401	RET	C11-C12-C13-C14
8	R	401	RET	C11-C12-C13-C20
8	R	401	RET	C9-C10-C11-C12

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	R	401	RET	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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.

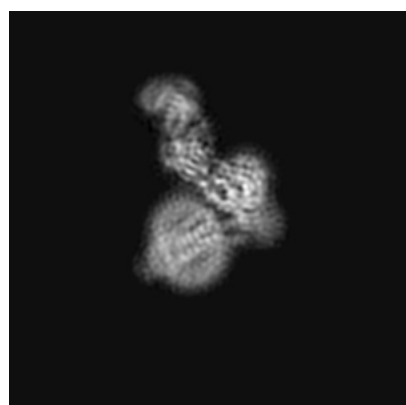
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-4598. These allow visual inspection of the internal detail of the map and identification of artifacts.

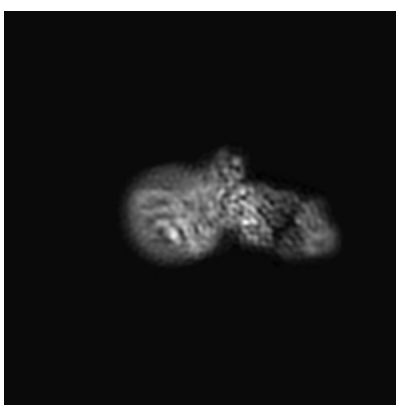
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

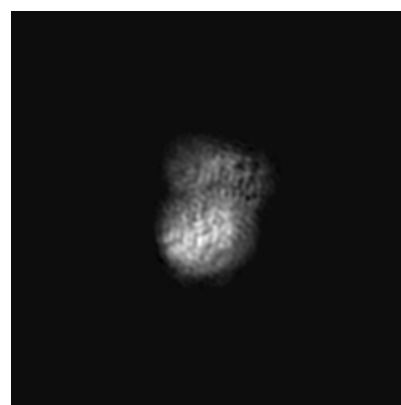
6.1.1 Primary map



X



Y

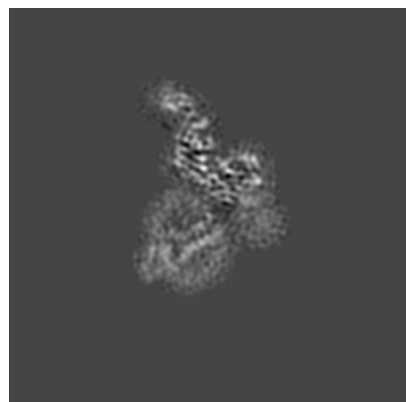


Z

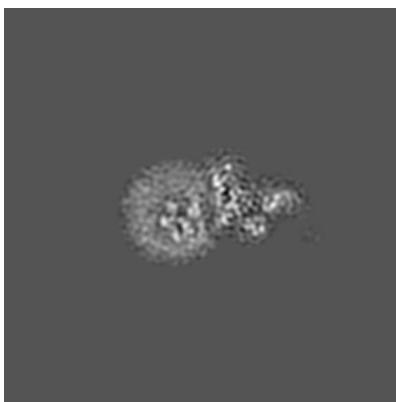
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

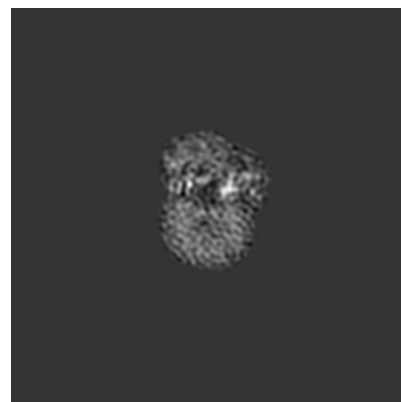
6.2.1 Primary map



X Index: 169



Y Index: 169

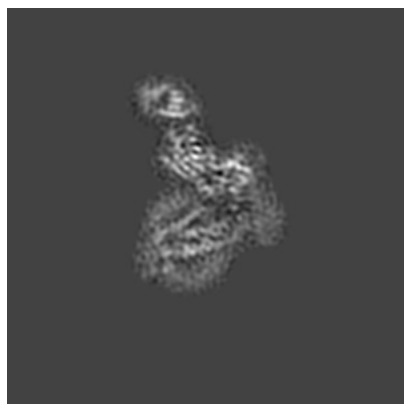


Z Index: 169

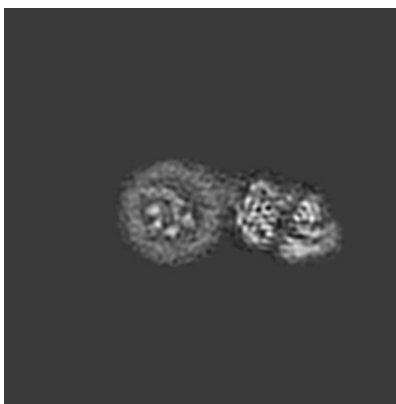
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

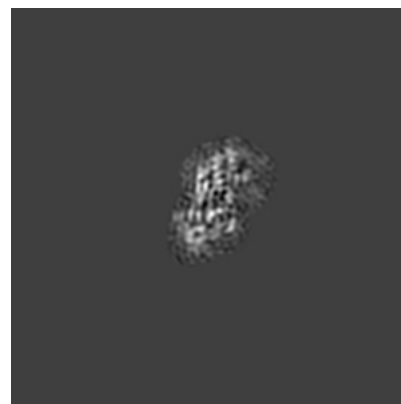
6.3.1 Primary map



X Index: 159



Y Index: 146

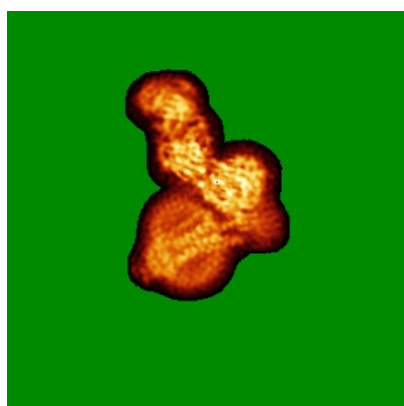


Z Index: 203

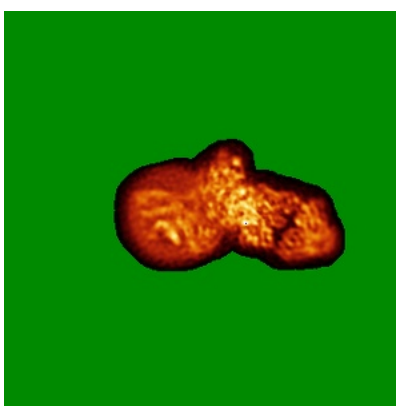
The images above show the largest variance slices of the map in three orthogonal directions.

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

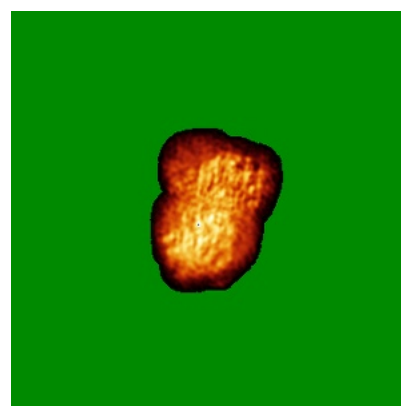
6.4.1 Primary map



X



Y

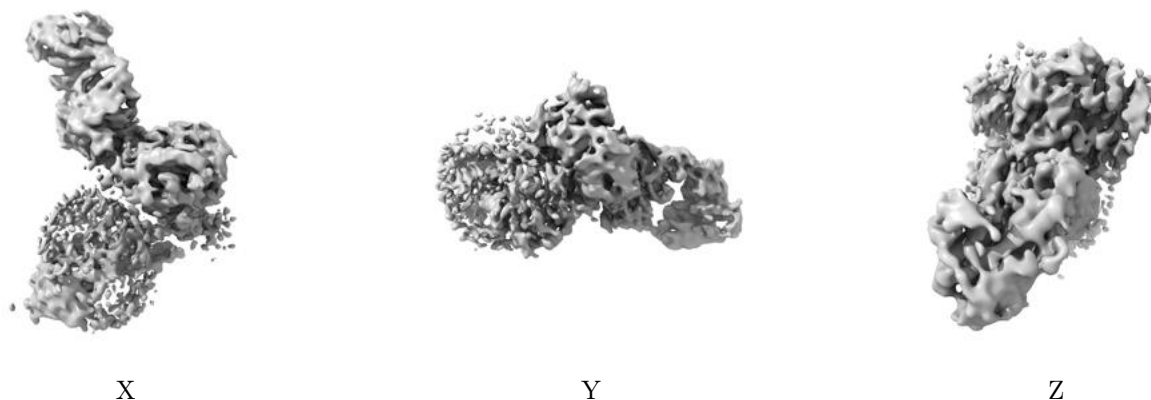


Z

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

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.03. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

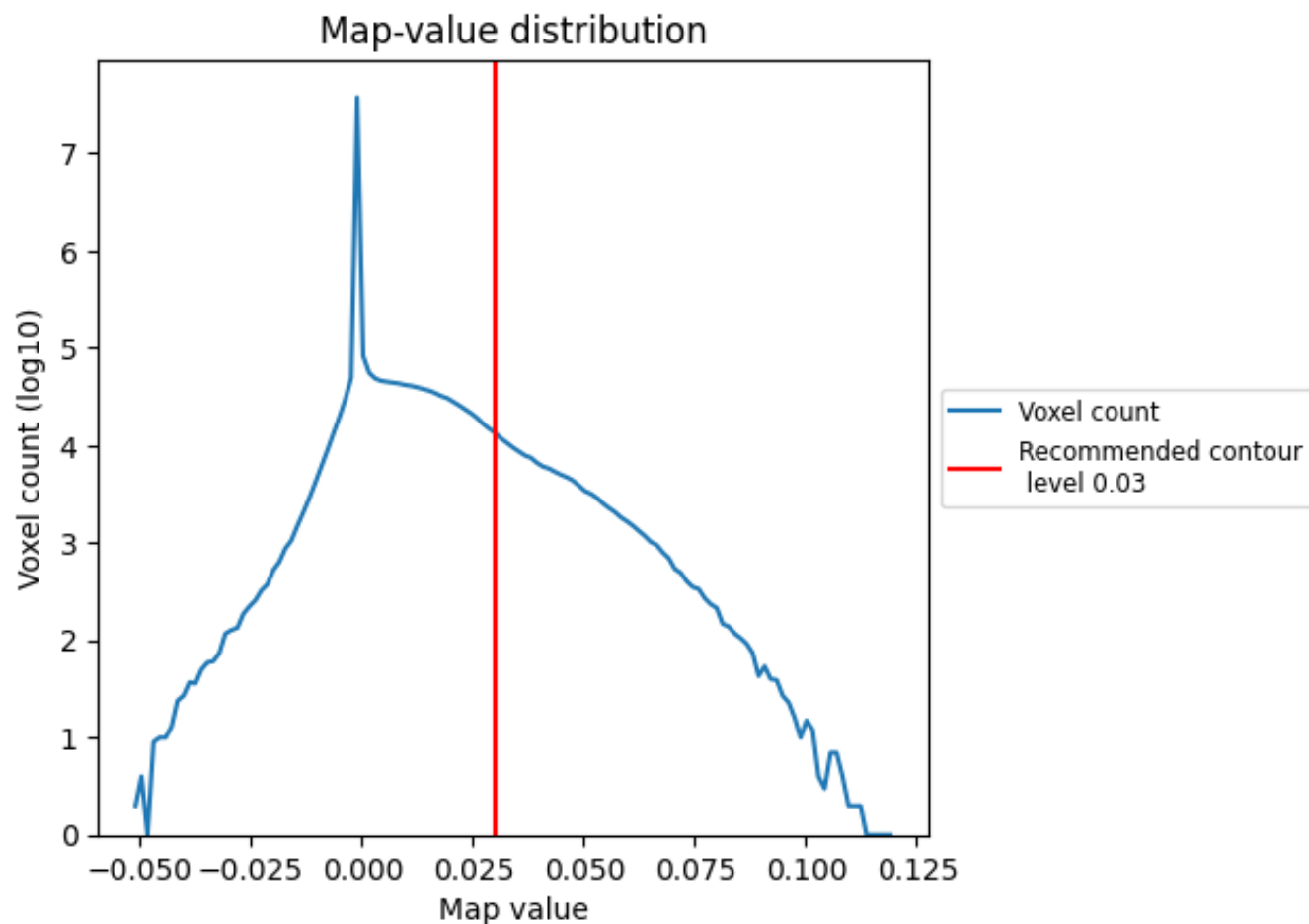
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

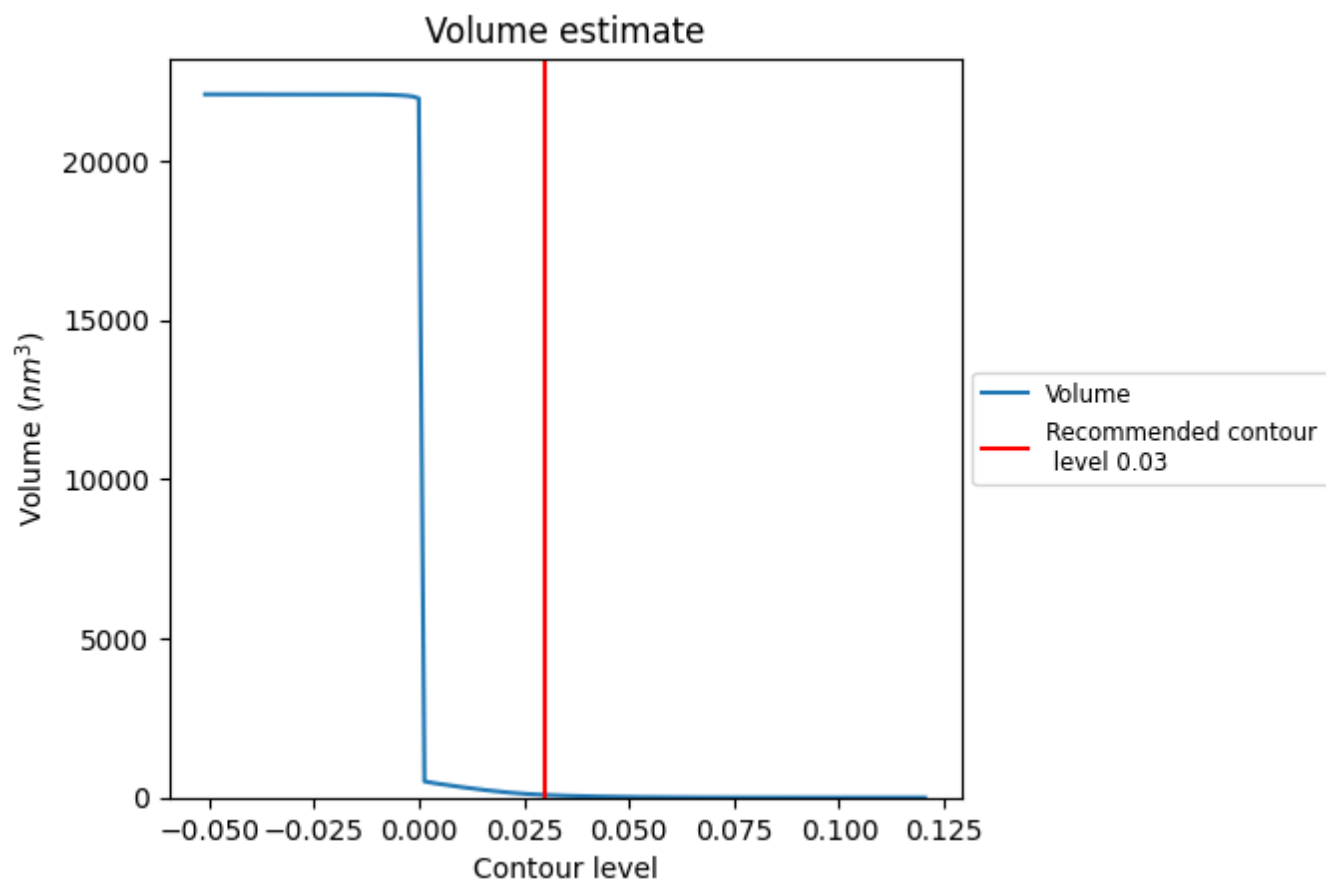
This section contains the results of statistical analysis of the map.

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.

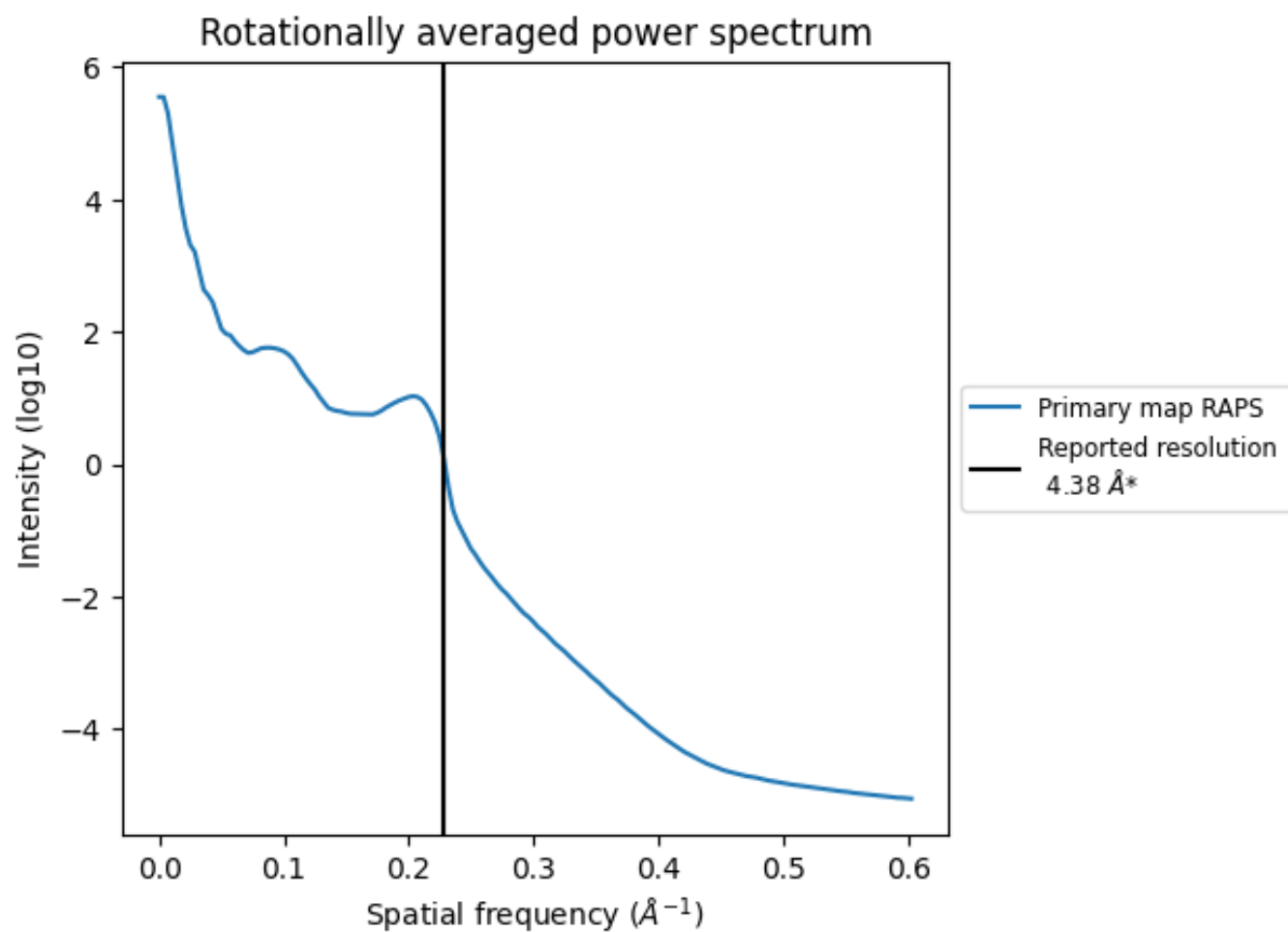
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 82 nm³; this corresponds to an approximate mass of 74 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 0.228 $\text{\AA}^{-1}$

8 Fourier-Shell correlation

This section was not generated. No FSC curve or half-maps provided.

9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-4598 and PDB model 6QNO. Per-residue inclusion information can be found in section [3](#) on page [7](#).

9.1 Map-model overlay [i](#)

This section was not generated.

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

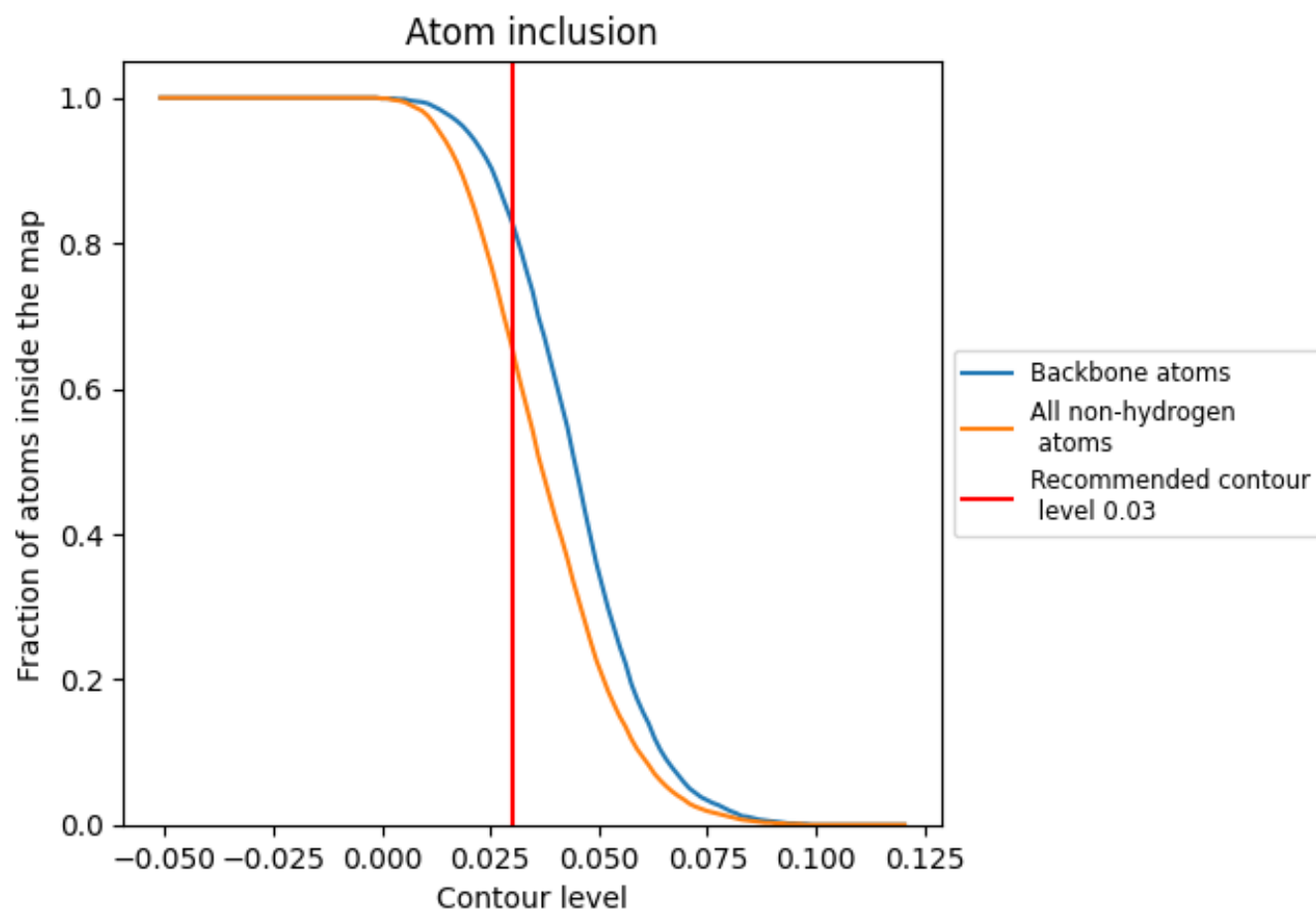


The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

This section was not generated.

9.4 Atom inclusion [i](#)



At the recommended contour level, 83% of all backbone atoms, 66% 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 (0.03) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6570	0.3230
A	0.3810	0.2640
B	0.7840	0.3680
C	0.2500	0.3450
G	0.5210	0.2870
H	0.7510	0.3560
L	0.7590	0.3620
R	0.6180	0.2800

1.0

0.0

<0.0