



Full wwPDB EM Validation Report ⓘ

Mar 24, 2026 – 03:07 AM UTC

PDB ID : 9F2B / pdb_00009f2b
EMDB ID : EMD-50146
Title : Focused refinement of SV2B luminal domain and BoNT/A1 complex
Authors : Khanppnavar, B.; Leka, O.; Korkhov, V.; Kammerer, R.
Deposited on : 2024-04-22
Resolution : 3.49 Å (reported)
Based on initial models : 9F1R, 6UL6

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

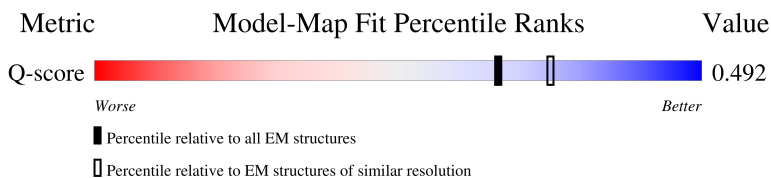
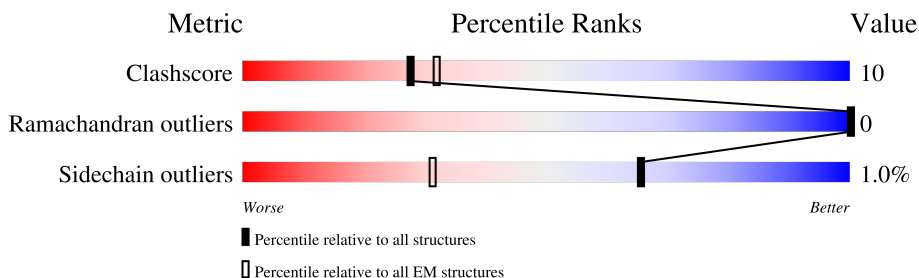
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.49 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	13600 (2.99 - 3.99)

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	683	 10% 6% 84%
2	B	1329	 6% 74% 20% 6%
3	C	2	 50% 50%
4	D	5	 20% 40% 40% 20%

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

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	FUC	C	2	X	-	-	-
4	BMA	D	3	X	-	-	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 11208 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 Synaptic vesicle glycoprotein 2B.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	106	Total	C	N	O	S	0	0
			906	587	143	168	8		

- Molecule 2 is a protein called Botulinum neurotoxin type A.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	1253	Total	C	N	O	S	0	0
			10204	6554	1681	1937	32		

There are 39 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-16	MET	-	initiating methionine	UNP P0DPI0
B	-15	ARG	-	expression tag	UNP P0DPI0
B	-14	GLY	-	expression tag	UNP P0DPI0
B	-13	SER	-	expression tag	UNP P0DPI0
B	-12	HIS	-	expression tag	UNP P0DPI0
B	-11	HIS	-	expression tag	UNP P0DPI0
B	-10	HIS	-	expression tag	UNP P0DPI0
B	-9	HIS	-	expression tag	UNP P0DPI0
B	-8	HIS	-	expression tag	UNP P0DPI0
B	-7	HIS	-	expression tag	UNP P0DPI0
B	-6	GLY	-	expression tag	UNP P0DPI0
B	-5	SER	-	expression tag	UNP P0DPI0
B	-4	LEU	-	expression tag	UNP P0DPI0
B	-3	VAL	-	expression tag	UNP P0DPI0
B	-2	PRO	-	expression tag	UNP P0DPI0
B	-1	ARG	-	expression tag	UNP P0DPI0
B	0	GLY	-	expression tag	UNP P0DPI0
B	1	SER	-	expression tag	UNP P0DPI0
B	27	ALA	VAL	variant	UNP P0DPI0
B	224	GLN	GLU	engineered mutation	UNP P0DPI0
B	363	ALA	ARG	engineered mutation	UNP P0DPI0

Continued on next page...

Continued from previous page...

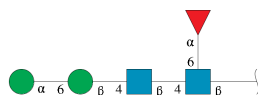
Chain	Residue	Modelled	Actual	Comment	Reference
B	366	PHE	TYR	engineered mutation	UNP P0DPI0
B	1158	ALA	THR	conflict	UNP P0DPI0
B	1297	VAL	-	expression tag	UNP P0DPI0
B	1298	PRO	-	expression tag	UNP P0DPI0
B	1299	PRO	-	expression tag	UNP P0DPI0
B	1300	THR	-	expression tag	UNP P0DPI0
B	1301	PRO	-	expression tag	UNP P0DPI0
B	1302	GLY	-	expression tag	UNP P0DPI0
B	1303	SER	-	expression tag	UNP P0DPI0
B	1304	ALA	-	expression tag	UNP P0DPI0
B	1305	TRP	-	expression tag	UNP P0DPI0
B	1306	SER	-	expression tag	UNP P0DPI0
B	1307	HIS	-	expression tag	UNP P0DPI0
B	1308	PRO	-	expression tag	UNP P0DPI0
B	1309	GLN	-	expression tag	UNP P0DPI0
B	1310	PHE	-	expression tag	UNP P0DPI0
B	1311	GLU	-	expression tag	UNP P0DPI0
B	1312	LYS	-	expression tag	UNP P0DPI0

- Molecule 3 is an oligosaccharide called alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				AltConf	Trace
3	C	2	Total	C	N	O	0	0
			24	14	1	9		

- Molecule 4 is an oligosaccharide called alpha-D-mannopyranose-(1-6)-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.



Mol	Chain	Residues	Atoms				AltConf	Trace
4	D	5	Total	C	N	O	0	0
			60	34	2	24		

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).

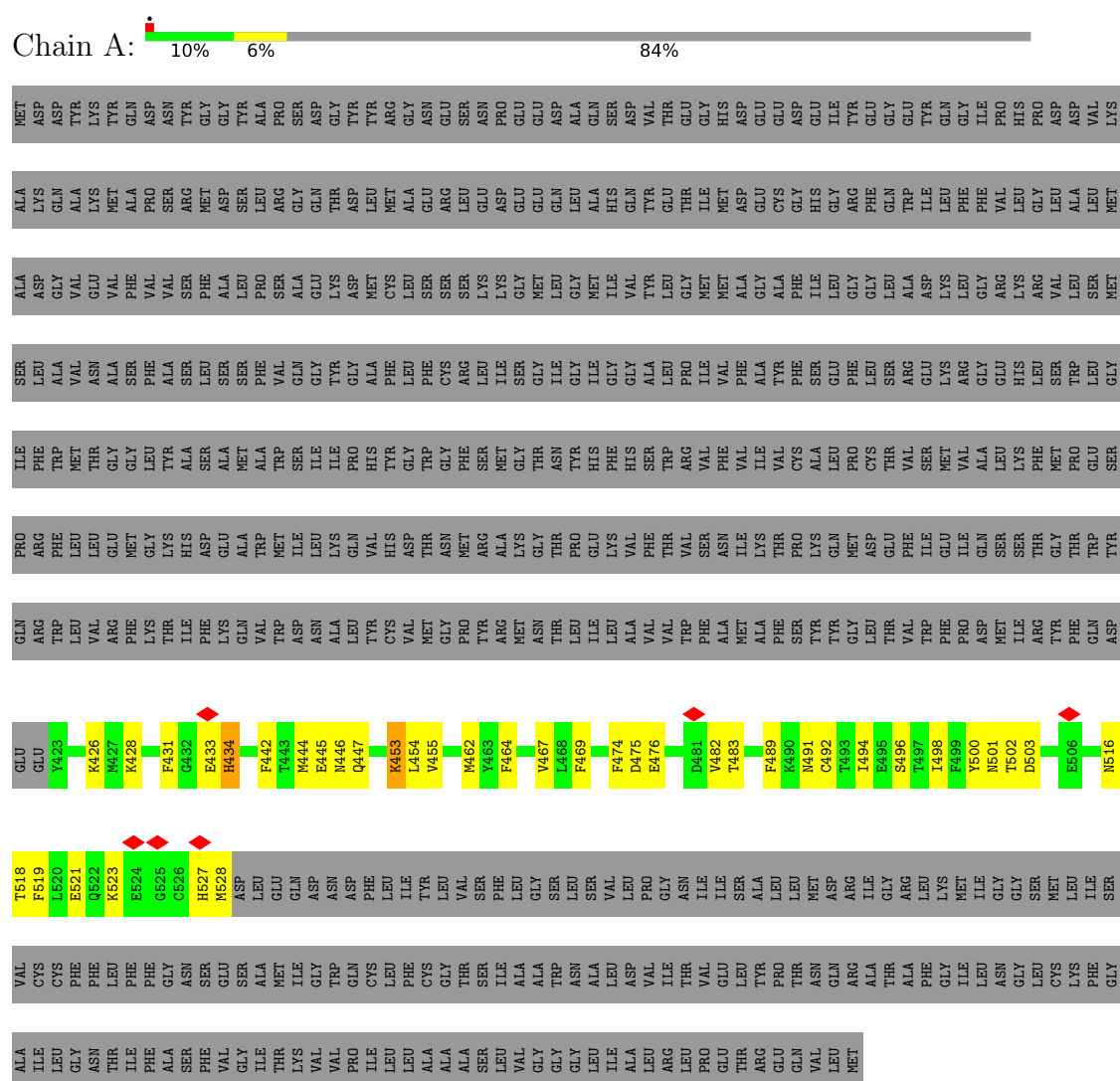


Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
5	A	1	14	8	1	5	0

3 Residue-property plots

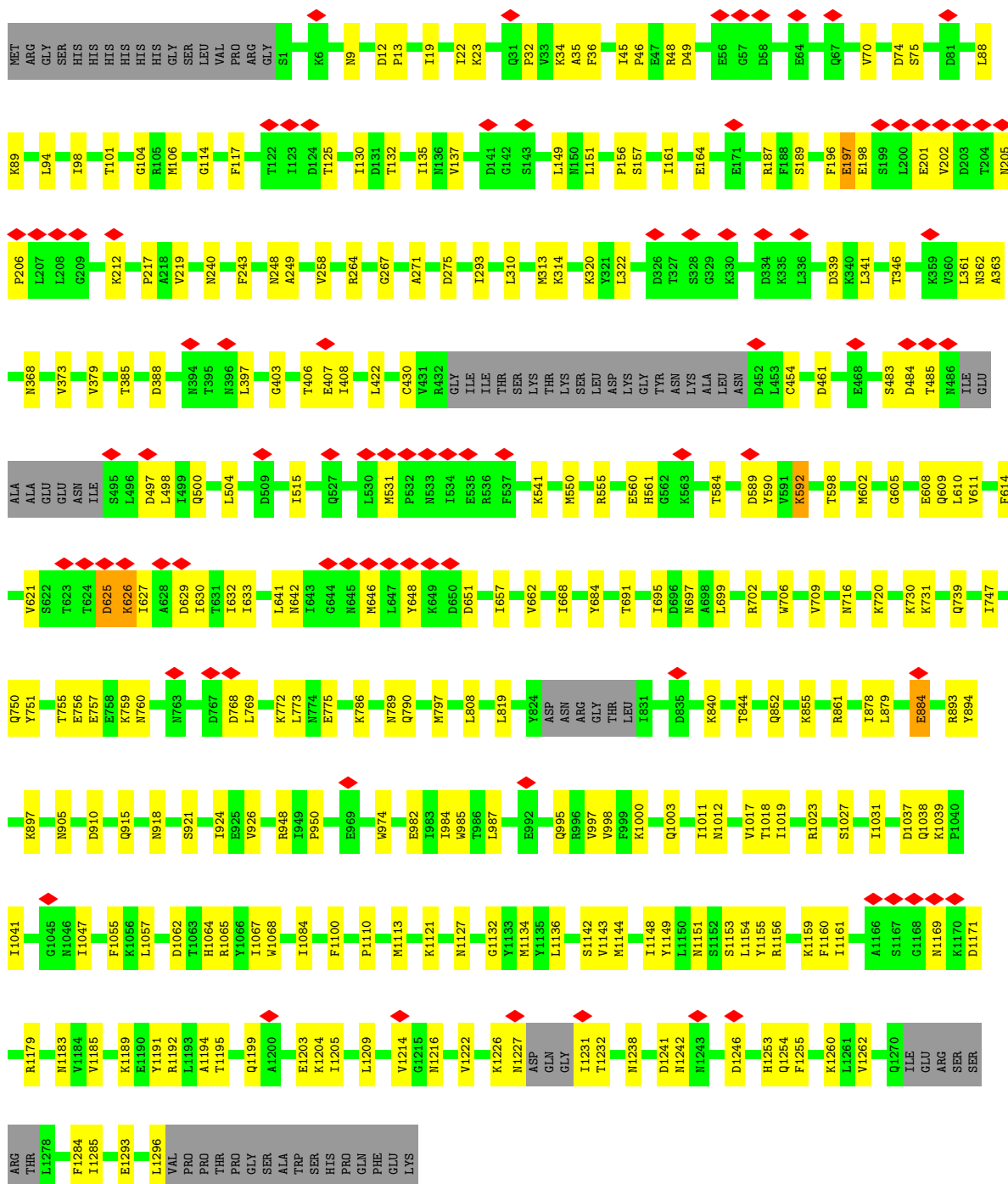
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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: Synaptic vesicle glycoprotein 2B



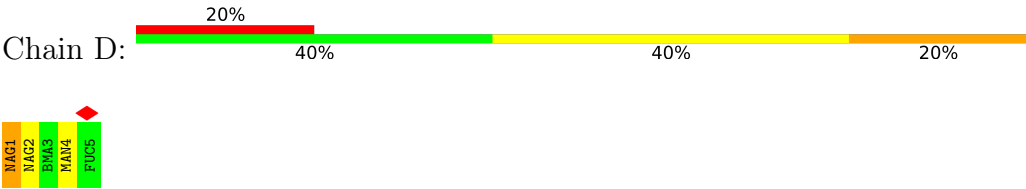
• Molecule 2: Botulinum neurotoxin type A





e

Chain D:



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	129039	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 ($e^-/\text{\AA}^2$)	54	Depositor
Minimum defocus (nm)	600	Depositor
Maximum defocus (nm)	2400	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	1.881	Depositor
Minimum map value	-1.162	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.032	Depositor
Recommended contour level	0.325	Depositor
Map size (Å)	390.0, 390.0, 390.0	wwPDB
Map dimensions	600, 600, 600	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.65, 0.65, 0.65	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: NAG, FUC, BMA, MAN

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	0.30	0/932	0.48	0/1252
2	B	0.21	0/10421	0.37	0/14106
All	All	0.22	0/11353	0.38	0/15358

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
2	B	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	1179	ARG	Sidechain

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	906	0	841	37	0
2	B	10204	0	10076	181	0
3	C	24	0	22	3	0
4	D	60	0	52	8	0
5	A	14	0	13	0	0
All	All	11208	0	11004	215	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 10.

All (215) 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:A:516:ASN:HD21	4:D:1:NAG:C1	1.05	1.58
1:A:491:ASN:HD21	3:C:1:NAG:C1	1.10	1.55
1:A:491:ASN:ND2	3:C:1:NAG:C1	1.87	1.34
1:A:516:ASN:ND2	4:D:1:NAG:C1	1.85	1.34
2:B:1064:HIS:HB2	4:D:2:NAG:H82	1.50	0.94
2:B:1064:HIS:CB	4:D:2:NAG:H82	1.97	0.93
1:A:434:HIS:HE1	1:A:453:LYS:HE2	1.34	0.92
2:B:430:CYS:HB3	2:B:454:CYS:HA	1.57	0.87
2:B:1064:HIS:HB2	4:D:2:NAG:C8	2.06	0.85
1:A:491:ASN:HD21	3:C:1:NAG:C2	1.94	0.80
2:B:461:ASP:OD1	2:B:731:LYS:NZ	2.17	0.76
2:B:197:GLU:HG2	2:B:212:LYS:H	1.50	0.76
2:B:1064:HIS:CG	4:D:2:NAG:H82	2.23	0.74
2:B:34:LYS:HG2	2:B:36:PHE:HE1	1.52	0.73
1:A:434:HIS:CE1	1:A:453:LYS:HE2	2.23	0.70
2:B:1159:LYS:HE2	2:B:1185:VAL:HG21	1.74	0.69
2:B:135:ILE:HD13	2:B:149:LEU:HD13	1.74	0.69
1:A:444:MET:HG2	1:A:462:MET:HE1	1.75	0.68
2:B:1003:GLN:O	2:B:1151:ASN:ND2	2.27	0.67
2:B:201:GLU:OE1	2:B:205:ASN:ND2	2.28	0.67
1:A:428:LYS:HB3	1:A:447:GLN:HE21	1.59	0.67
2:B:610:LEU:HD12	2:B:747:ILE:HD11	1.77	0.66
2:B:22:ILE:HG22	2:B:137:VAL:HG12	1.79	0.63
2:B:1161:ILE:HG12	2:B:1183:ASN:HB2	1.80	0.63
1:A:462:MET:HG2	1:A:482:VAL:HG23	1.81	0.63
2:B:756:GLU:OE2	2:B:759:LYS:NZ	2.30	0.62
2:B:1023:ARG:HH21	2:B:1047:ILE:HG12	1.65	0.62
2:B:982:GLU:OE2	2:B:1000:LYS:NZ	2.32	0.61
2:B:1121:LYS:HD3	2:B:1136:LEU:HB3	1.82	0.61

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:614:PHE:HD2	2:B:773:LEU:HD22	1.64	0.61
1:A:426:LYS:O	1:A:446:ASN:ND2	2.33	0.61
2:B:756:GLU:O	2:B:760:ASN:ND2	2.34	0.60
2:B:310:LEU:HD21	2:B:314:LYS:HE3	1.85	0.59
2:B:156:PRO:HD3	2:B:189:SER:HB2	1.85	0.58
2:B:1227:ASN:HB2	2:B:1231:ILE:HG23	1.85	0.58
1:A:489:PHE:HB3	1:A:492:CYS:SG	2.43	0.58
2:B:584:THR:OG1	2:B:739:GLN:NE2	2.36	0.58
2:B:48:ARG:NH2	2:B:157:SER:O	2.37	0.58
2:B:657:ILE:HG21	2:B:884:GLU:HG2	1.86	0.58
2:B:1194:ALA:HB3	2:B:1209:LEU:HD12	1.88	0.56
2:B:589:ASP:OD1	2:B:590:TYR:N	2.39	0.56
2:B:1113:MET:HE3	2:B:1113:MET:HA	1.86	0.55
2:B:1222:VAL:HG13	2:B:1238:ASN:HB3	1.87	0.55
1:A:433:GLU:N	1:A:433:GLU:OE2	2.40	0.55
2:B:46:PRO:HG3	2:B:88:LEU:HD13	1.88	0.55
2:B:699:LEU:HD13	2:B:844:THR:HG21	1.89	0.55
2:B:385:THR:HG23	2:B:388:ASP:H	1.72	0.55
2:B:1003:GLN:HA	2:B:1011:ILE:HD11	1.87	0.55
2:B:1214:VAL:HG12	2:B:1216:ASN:H	1.71	0.55
2:B:313:MET:HE1	2:B:515:ILE:HD12	1.88	0.55
2:B:974:TRP:HB3	2:B:987:LEU:HD12	1.89	0.55
1:A:517:SER:OG	1:A:518:THR:N	2.37	0.55
2:B:101:THR:HG22	2:B:104:GLY:H	1.72	0.55
2:B:598:THR:O	2:B:750:GLN:NE2	2.39	0.55
2:B:49:ASP:OD2	2:B:187:ARG:NE	2.28	0.54
2:B:407:GLU:HG3	2:B:408:ILE:HD12	1.89	0.54
2:B:422:LEU:HD23	2:B:422:LEU:H	1.71	0.54
2:B:161:ILE:HG12	2:B:161:ILE:O	2.07	0.54
2:B:74:ASP:OD1	2:B:75:SER:N	2.41	0.54
2:B:89:LYS:HB2	2:B:379:VAL:HG22	1.89	0.53
2:B:1064:HIS:HB2	4:D:2:NAG:H81	1.89	0.53
1:A:476:GLU:HG3	1:A:476:GLU:O	2.08	0.53
2:B:23:LYS:HD3	2:B:32:PRO:HG3	1.90	0.52
1:A:454:LEU:HD22	1:A:474:PHE:HE1	1.75	0.52
2:B:948:ARG:HB3	2:B:1068:TRP:HB2	1.91	0.52
2:B:12:ASP:HB2	2:B:19:ILE:HD12	1.91	0.51
2:B:1255:PHE:HB3	2:B:1260:LYS:HD2	1.92	0.51
2:B:995:GLN:NE2	2:B:1039:LYS:HB3	2.25	0.51
1:A:498:ILE:HG21	2:B:1296:LEU:HD22	1.93	0.51
2:B:1199:GLN:HE21	2:B:1204:LYS:HA	1.76	0.51

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:19:ILE:HG23	2:B:36:PHE:CD1	2.46	0.51
2:B:164:GLU:OE2	2:B:187:ARG:NH1	2.44	0.50
2:B:212:LYS:O	2:B:406:THR:HG22	2.11	0.50
2:B:362:ASN:OD1	2:B:363:ALA:N	2.43	0.50
2:B:878:ILE:HG13	2:B:894:TYR:CD2	2.46	0.50
2:B:1183:ASN:OD1	2:B:1192:ARG:NH1	2.45	0.50
2:B:219:VAL:HG11	2:B:362:ASN:HD22	1.77	0.50
2:B:70:VAL:HG22	2:B:373:VAL:HG23	1.94	0.50
1:A:464:PHE:HE2	1:A:469:PHE:HE2	1.60	0.49
2:B:789:ASN:HD21	2:B:861:ARG:HD2	1.76	0.49
1:A:483:THR:CG2	1:A:527:HIS:HB2	2.43	0.49
1:A:483:THR:HG23	1:A:527:HIS:HB2	1.94	0.49
2:B:550:MET:HB2	2:B:641:LEU:HB3	1.94	0.49
2:B:267:GLY:HA2	2:B:271:ALA:HB2	1.95	0.48
1:A:498:ILE:HD13	2:B:1296:LEU:HD22	1.94	0.48
2:B:94:LEU:HD11	2:B:217:PRO:HB2	1.96	0.48
2:B:397:LEU:HD23	2:B:403:GLY:HA2	1.95	0.48
2:B:924:ILE:HB	2:B:1055:PHE:HB2	1.94	0.48
2:B:1203:GLU:OE1	2:B:1203:GLU:HA	2.13	0.48
2:B:19:ILE:HG23	2:B:36:PHE:CE1	2.49	0.48
1:A:442:PHE:O	1:A:462:MET:HB2	2.14	0.47
2:B:483:SER:N	2:B:684:TYR:OH	2.47	0.47
2:B:702:ARG:HH21	2:B:844:THR:HG22	1.78	0.47
2:B:485:THR:H	2:B:697:ASN:ND2	2.12	0.47
2:B:1189:LYS:NZ	2:B:1191:TYR:OH	2.47	0.47
2:B:751:TYR:CE1	2:B:759:LYS:HG2	2.49	0.47
2:B:1195:THR:OG1	2:B:1205:ILE:O	2.28	0.47
2:B:948:ARG:NH1	2:B:1012:ASN:OD1	2.48	0.47
2:B:629:ASP:OD1	2:B:790:GLN:NE2	2.48	0.46
1:A:428:LYS:HB2	1:A:447:GLN:HG2	1.97	0.46
2:B:125:THR:O	2:B:125:THR:OG1	2.30	0.46
2:B:852:GLN:HG3	2:B:855:LYS:HD3	1.97	0.46
2:B:555:ARG:O	2:B:555:ARG:NH1	2.49	0.46
2:B:662:VAL:HG13	2:B:668:ILE:HD11	1.98	0.46
2:B:819:LEU:HD23	2:B:819:LEU:HA	1.77	0.46
1:A:502:THR:O	1:A:523:LYS:N	2.49	0.46
2:B:243:PHE:HB3	2:B:258:VAL:HG13	1.98	0.46
2:B:840:LYS:O	2:B:844:THR:OG1	2.21	0.46
2:B:950:PRO:HG2	2:B:1065:ARG:HH11	1.80	0.46
2:B:1017:VAL:HG22	2:B:1031:ILE:HD12	1.98	0.46
1:A:431:PHE:N	1:A:433:GLU:OE1	2.49	0.46

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:453:LYS:HB3	1:A:453:LYS:HE3	1.45	0.46
1:A:516:ASN:ND2	4:D:1:NAG:C2	2.73	0.46
2:B:531:MET:SD	2:B:531:MET:N	2.88	0.46
2:B:1110:PRO:HB2	2:B:1159:LYS:HE3	1.98	0.46
2:B:560:GLU:OE1	2:B:560:GLU:N	2.42	0.46
2:B:879:LEU:HD21	2:B:926:VAL:HG11	1.98	0.46
1:A:476:GLU:OE1	1:A:496:SER:O	2.34	0.46
1:A:483:THR:HA	1:A:503:ASP:OD2	2.15	0.46
2:B:114:GLY:HA2	2:B:320:LYS:HG3	1.97	0.46
2:B:196:PHE:HZ	2:B:361:LEU:HB3	1.80	0.46
2:B:36:PHE:HD2	2:B:88:LEU:HD21	1.81	0.45
2:B:275:ASP:N	2:B:275:ASP:OD1	2.45	0.45
2:B:1018:THR:HG21	2:B:1084:ILE:HD12	1.97	0.45
2:B:88:LEU:HA	2:B:88:LEU:HD12	1.77	0.45
2:B:646:MET:SD	2:B:646:MET:N	2.90	0.45
2:B:1226:LYS:HG2	2:B:1232:THR:HG22	1.98	0.45
2:B:363:ALA:HB1	2:B:368:ASN:HB3	1.99	0.44
2:B:1134:MET:HE1	2:B:1160:PHE:CZ	2.52	0.44
2:B:1238:ASN:HD21	2:B:1246:ASP:CG	2.25	0.44
2:B:1199:GLN:O	2:B:1204:LYS:NZ	2.48	0.44
2:B:12:ASP:OD1	2:B:12:ASP:N	2.50	0.44
2:B:264:ARG:HD2	2:B:346:THR:HG23	1.98	0.44
2:B:500:GLN:O	2:B:504:LEU:HD22	2.17	0.44
2:B:611:VAL:HG21	2:B:772:LYS:NZ	2.33	0.44
2:B:730:LYS:HB3	2:B:730:LYS:HE2	1.86	0.44
2:B:1205:ILE:HA	2:B:1262:VAL:HG12	1.99	0.44
2:B:36:PHE:CD1	2:B:36:PHE:N	2.86	0.44
2:B:130:ILE:HG22	2:B:132:THR:H	1.83	0.44
2:B:768:ASP:OD1	2:B:769:LEU:N	2.51	0.44
2:B:1241:ASP:OD1	2:B:1242:ASN:N	2.48	0.44
2:B:950:PRO:HG2	2:B:1065:ARG:NH1	2.33	0.44
2:B:35:ALA:C	2:B:36:PHE:HD1	2.25	0.43
2:B:605:GLY:O	2:B:609:GLN:HG3	2.17	0.43
2:B:648:TYR:HB2	2:B:651:ASP:HB2	2.00	0.43
2:B:657:ILE:O	2:B:893:ARG:NH2	2.51	0.43
2:B:755:THR:O	2:B:759:LYS:HE3	2.17	0.43
2:B:772:LYS:O	2:B:775:GLU:HG2	2.18	0.43
2:B:1057:LEU:HD11	2:B:1067:ILE:HG12	2.00	0.43
2:B:1121:LYS:HD3	2:B:1136:LEU:CB	2.46	0.43
2:B:1155:TYR:O	2:B:1156:ARG:HD2	2.18	0.43
1:A:455:VAL:HA	1:A:475:ASP:HB3	2.01	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:36:PHE:CD2	2:B:88:LEU:HD21	2.53	0.43
2:B:98:ILE:O	2:B:104:GLY:HA3	2.19	0.43
2:B:541:LYS:HD2	2:B:541:LYS:HA	1.92	0.43
2:B:918:ASN:ND2	2:B:1062:ASP:O	2.52	0.43
1:A:519:PHE:N	2:B:1142:SER:O	2.46	0.43
2:B:602:MET:HE2	2:B:602:MET:HB3	1.86	0.43
1:A:447:GLN:O	1:A:467:VAL:HA	2.19	0.43
2:B:1027:SER:HB3	2:B:1041:ILE:HD13	2.01	0.43
2:B:1037:ASP:OD1	2:B:1038:GLN:N	2.52	0.43
2:B:497:ASP:OD1	2:B:498:LEU:N	2.51	0.42
1:A:474:PHE:HD2	1:A:494:ILE:HG12	1.84	0.42
2:B:797:MET:HE3	2:B:797:MET:HB3	1.81	0.42
2:B:985:TRP:CD2	2:B:1019:ILE:HG21	2.54	0.42
2:B:117:PHE:CD1	2:B:293:ILE:HD11	2.54	0.42
2:B:985:TRP:HB3	2:B:997:VAL:HG22	2.02	0.42
2:B:1143:VAL:HG12	2:B:1149:TYR:HE1	1.84	0.42
2:B:35:ALA:HB2	2:B:45:ILE:HG12	2.02	0.42
2:B:625:ASP:C	2:B:627:ILE:N	2.77	0.42
2:B:691:THR:O	2:B:695:ILE:HG12	2.20	0.42
2:B:709:VAL:HB	2:B:808:LEU:HD21	2.02	0.42
2:B:921:SER:O	2:B:921:SER:OG	2.38	0.42
2:B:202:VAL:HG23	2:B:206:PRO:HA	2.01	0.42
2:B:716:ASN:OD1	2:B:720:LYS:HD2	2.20	0.42
2:B:630:ILE:O	2:B:633:ILE:HG13	2.20	0.42
2:B:755:THR:C	2:B:759:LYS:HE3	2.44	0.41
1:A:501:ASN:OD1	1:A:523:LYS:HG2	2.20	0.41
2:B:219:VAL:HG11	2:B:362:ASN:ND2	2.33	0.41
2:B:786:LYS:O	2:B:790:GLN:HG3	2.20	0.41
2:B:1153:SER:HB2	2:B:1293:GLU:OE2	2.19	0.41
2:B:626:LYS:H	2:B:626:LYS:HG2	1.41	0.41
2:B:1100:PHE:N	2:B:1284:PHE:O	2.47	0.41
2:B:151:LEU:HD23	2:B:151:LEU:HA	1.93	0.41
2:B:1169:ASN:HB3	2:B:1171:ASP:OD1	2.20	0.41
2:B:1253:HIS:HB2	2:B:1262:VAL:HG21	2.01	0.41
1:A:445:GLU:N	1:A:445:GLU:OE1	2.54	0.41
1:A:476:GLU:HA	1:A:496:SER:O	2.21	0.41
2:B:240:ASN:OD1	2:B:240:ASN:N	2.43	0.41
2:B:757:GLU:HA	2:B:760:ASN:HD21	1.85	0.41
2:B:9:ASN:O	2:B:88:LEU:HD23	2.20	0.41
2:B:1142:SER:HB3	2:B:1144:MET:HE3	2.03	0.41
2:B:1154:LEU:HB3	2:B:1285:ILE:HD13	2.03	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:339:ASP:OD1	2:B:339:ASP:C	2.64	0.41
2:B:608:GLU:O	2:B:611:VAL:HG22	2.21	0.41
2:B:642:ASN:OD1	2:B:642:ASN:O	2.39	0.41
2:B:897:LYS:HE3	2:B:897:LYS:HB3	1.81	0.41
2:B:984:ILE:HG12	2:B:998:VAL:HG12	2.03	0.41
2:B:995:GLN:OE1	2:B:995:GLN:HA	2.20	0.41
2:B:1127:ASN:O	2:B:1132:GLY:HA3	2.21	0.41
2:B:1134:MET:HE1	2:B:1160:PHE:HZ	1.86	0.41
1:A:500:TYR:CE1	1:A:521:GLU:HB2	2.56	0.41
2:B:1110:PRO:HA	2:B:1161:ILE:HG22	2.03	0.41
2:B:1254:GLN:H	2:B:1254:GLN:HG3	1.69	0.41
2:B:106:MET:HE3	2:B:106:MET:HB2	1.88	0.40
2:B:706:TRP:HA	2:B:808:LEU:HD22	2.02	0.40
2:B:910:ASP:OD1	2:B:910:ASP:C	2.64	0.40
2:B:629:ASP:O	2:B:630:ILE:HD13	2.20	0.40
2:B:12:ASP:HB3	2:B:13:PRO:HD2	2.02	0.40
2:B:248:ASN:OD1	2:B:249:ALA:N	2.54	0.40
2:B:484:ASP:OD1	2:B:484:ASP:N	2.53	0.40
2:B:1148:ILE:HG22	2:B:1149:TYR:HD2	1.85	0.40
2:B:322:LEU:HD12	2:B:341:LEU:HB2	2.04	0.40
2:B:592:LYS:HD3	2:B:592:LYS:HA	1.92	0.40
2:B:905:ASN:HB3	2:B:915:GLN:HB3	2.04	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	104/683 (15%)	95 (91%)	9 (9%)	0	100	100
2	B	1241/1329 (93%)	1193 (96%)	48 (4%)	0	100	100
All	All	1345/2012 (67%)	1288 (96%)	57 (4%)	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	101/580 (17%)	98 (97%)	3 (3%)	36	60
2	B	1138/1204 (94%)	1129 (99%)	9 (1%)	73	77
All	All	1239/1784 (70%)	1227 (99%)	12 (1%)	65	75

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	434	HIS
1	A	453	LYS
1	A	528	MET
2	B	197	GLU
2	B	198	GLU
2	B	561	HIS
2	B	592	LYS
2	B	621	VAL
2	B	625	ASP
2	B	626	LYS
2	B	632	ILE
2	B	884	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (30) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	434	HIS
1	A	447	GLN
1	A	491	ASN
1	A	516	ASN
2	B	31	GLN
2	B	39	HIS
2	B	205	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	B	224	GLN
2	B	404	GLN
2	B	470	ASN
2	B	514	ASN
2	B	533	ASN
2	B	570	ASN
2	B	573	ASN
2	B	642	ASN
2	B	697	ASN
2	B	739	GLN
2	B	752	ASN
2	B	765	ASN
2	B	778	ASN
2	B	790	GLN
2	B	842	ASN
2	B	875	ASN
2	B	886	ASN
2	B	913	GLN
2	B	1147	ASN
2	B	1199	GLN
2	B	1216	ASN
2	B	1233	ASN
2	B	1253	HIS

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 ⓘ

7 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	C	1	3	14,14,15	0.39	0	17,19,21	0.64	0
3	FUC	C	2	3	10,10,11	0.42	0	14,14,16	0.36	0
4	NAG	D	1	4	14,14,15	1.72	2 (14%)	17,19,21	1.04	2 (11%)
4	NAG	D	2	4	14,14,15	0.36	0	17,19,21	0.76	0
4	BMA	D	3	4	11,11,12	0.42	0	15,15,17	0.96	0
4	MAN	D	4	4	11,11,12	0.33	0	15,15,17	0.89	1 (6%)
4	FUC	D	5	4	10,10,11	0.83	0	14,14,16	0.82	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	C	1	3	-	4/6/23/26	0/1/1/1
3	FUC	C	2	3	1/1/4/5	-	0/1/1/1
4	NAG	D	1	4	-	4/6/23/26	0/1/1/1
4	NAG	D	2	4	-	2/6/23/26	0/1/1/1
4	BMA	D	3	4	1/1/4/5	2/2/19/22	0/1/1/1
4	MAN	D	4	4	-	0/2/19/22	0/1/1/1
4	FUC	D	5	4	-	-	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	1	NAG	C1-C2	5.16	1.59	1.52
4	D	1	NAG	O5-C1	-3.58	1.37	1.43

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	D	4	MAN	C1-O5-C5	2.53	115.58	112.19
4	D	1	NAG	C1-C2-N2	2.38	114.18	110.43
4	D	1	NAG	O3-C3-C2	2.07	113.70	109.40

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	C	2	FUC	C1
4	D	3	BMA	C1

All (12) torsion outliers are listed below:

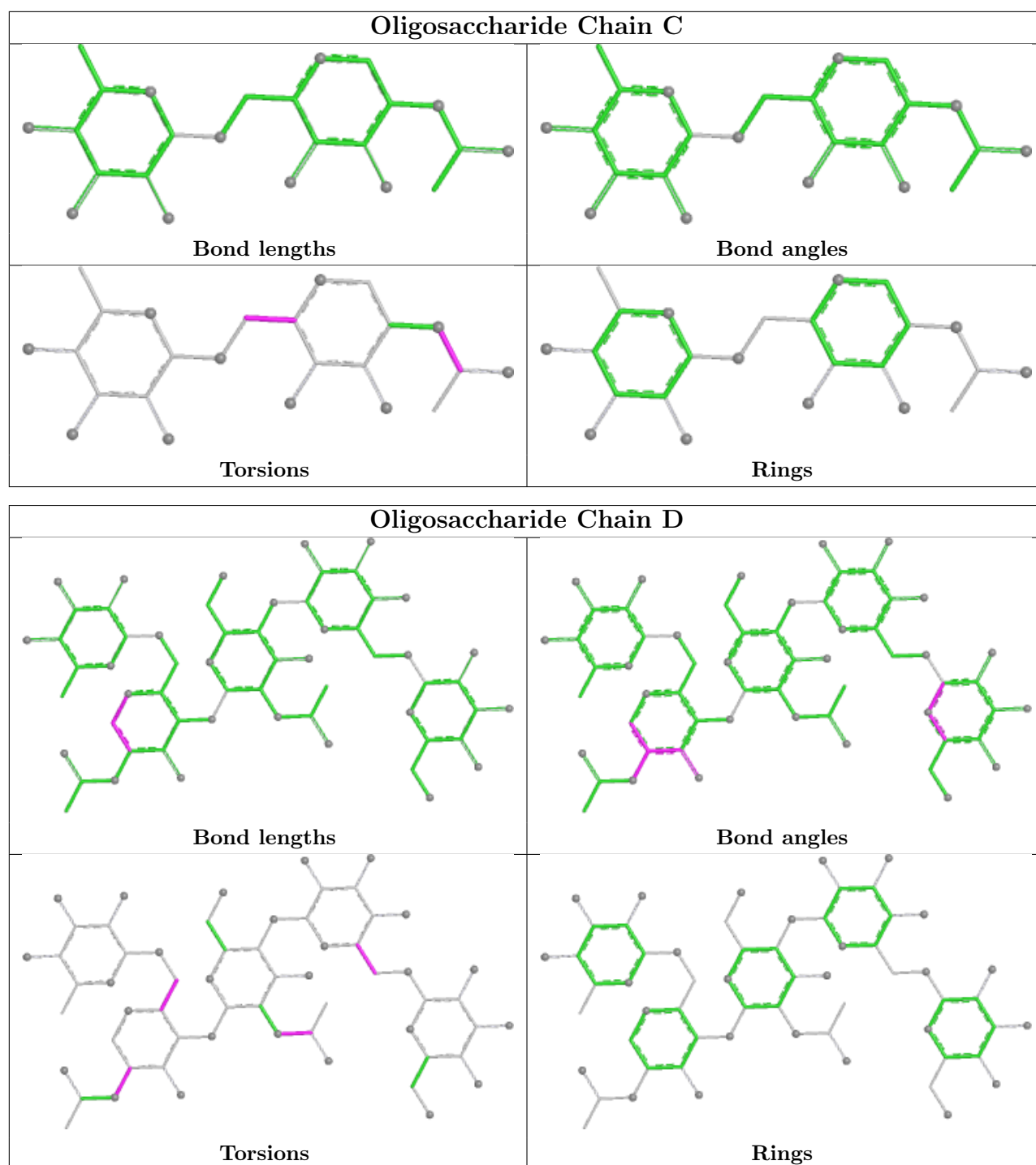
Mol	Chain	Res	Type	Atoms
4	D	1	NAG	O5-C5-C6-O6
3	C	1	NAG	O5-C5-C6-O6
4	D	1	NAG	C4-C5-C6-O6
3	C	1	NAG	C4-C5-C6-O6
3	C	1	NAG	C8-C7-N2-C2
4	D	2	NAG	C8-C7-N2-C2
4	D	2	NAG	O7-C7-N2-C2
3	C	1	NAG	O7-C7-N2-C2
4	D	3	BMA	C4-C5-C6-O6
4	D	3	BMA	O5-C5-C6-O6
4	D	1	NAG	C3-C2-N2-C7
4	D	1	NAG	C1-C2-N2-C7

There are no ring outliers.

3 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	D	2	NAG	5	0
3	C	1	NAG	3	0
4	D	1	NAG	3	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	$\# Z > 2$
5	NAG	A	701	1	14,14,15	0.26	0	17,19,21	0.38	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	A	701	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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.

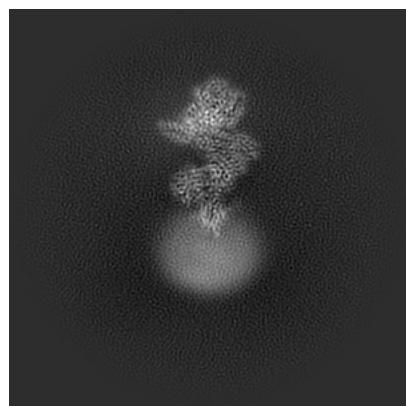
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-50146. These allow visual inspection of the internal detail of the map and identification of artifacts.

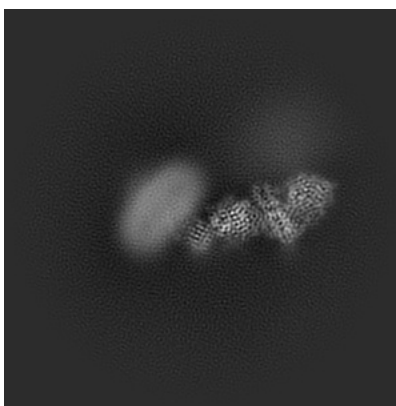
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

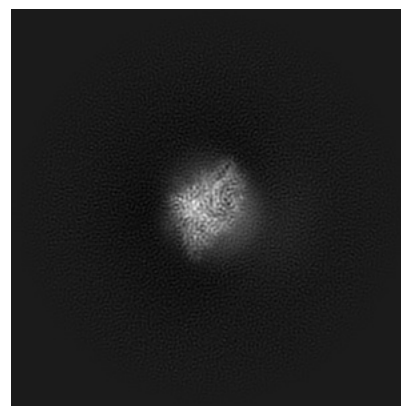
6.1.1 Primary map



X

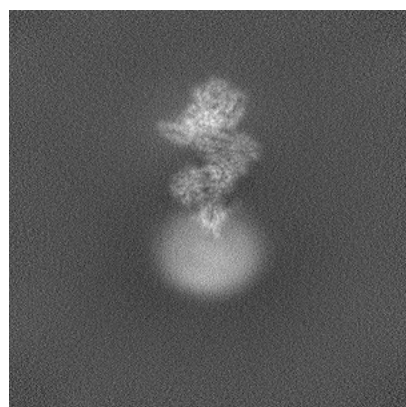


Y

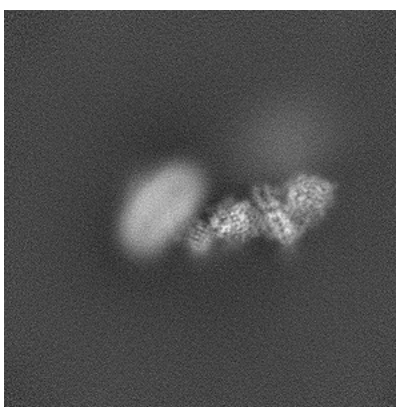


Z

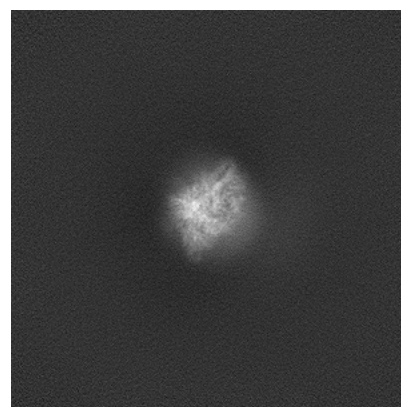
6.1.2 Raw map



X



Y

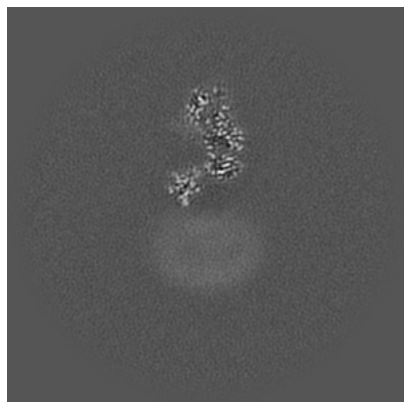


Z

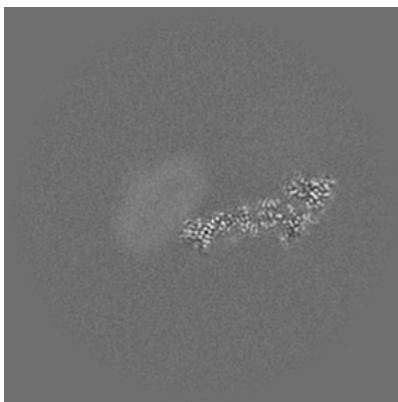
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

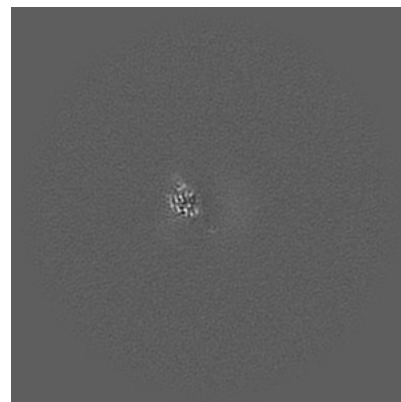
6.2.1 Primary map



X Index: 300

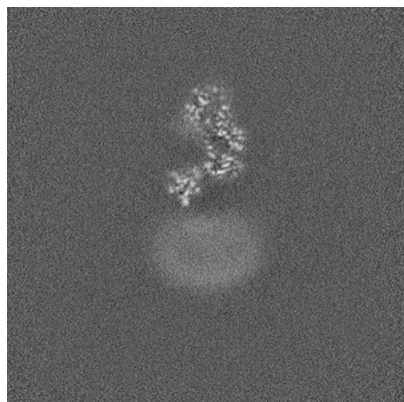


Y Index: 300

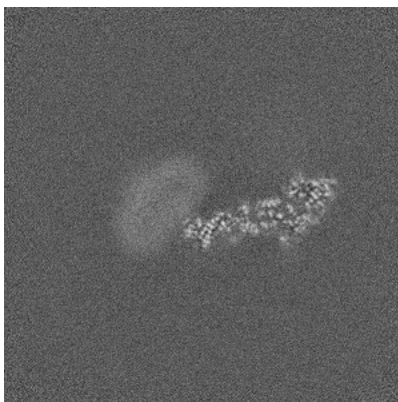


Z Index: 300

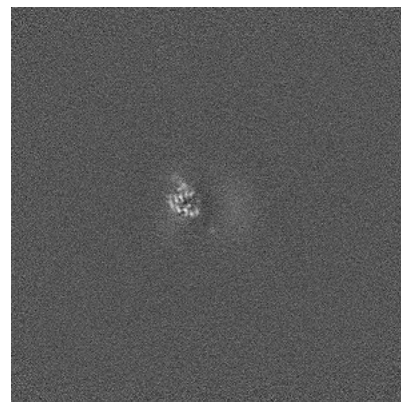
6.2.2 Raw map



X Index: 300



Y Index: 300

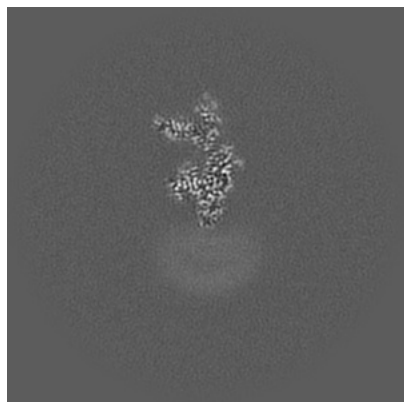


Z Index: 300

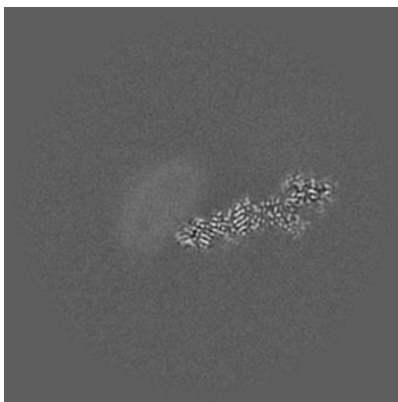
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

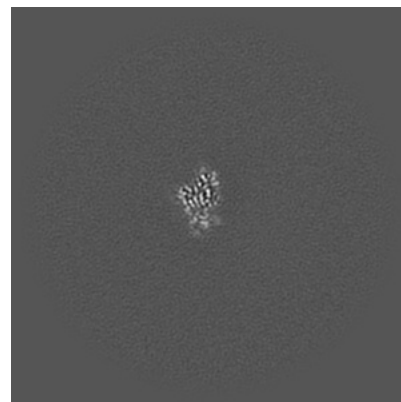
6.3.1 Primary map



X Index: 275

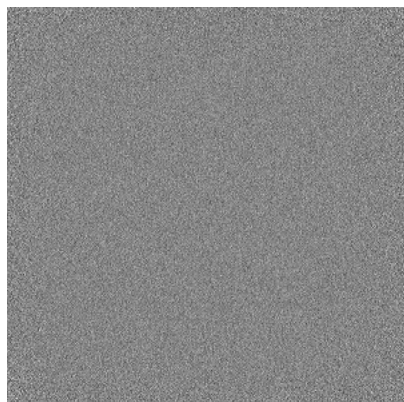


Y Index: 309

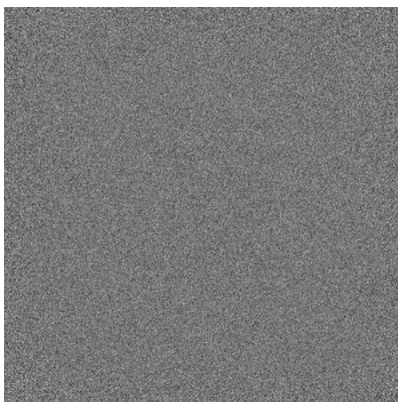


Z Index: 358

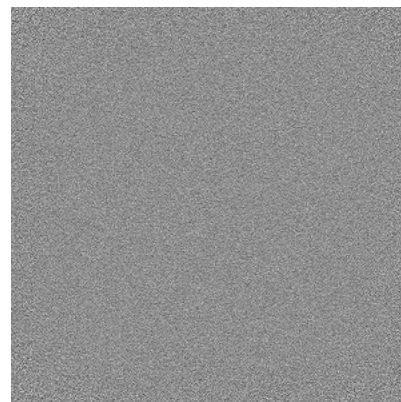
6.3.2 Raw map



X Index: 0



Y Index: 0

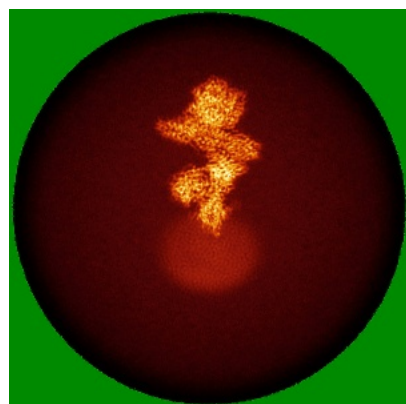


Z Index: 0

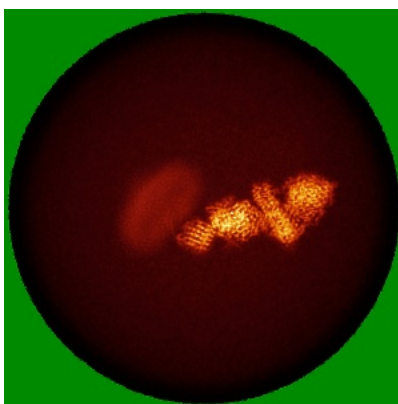
The images above show the largest variance slices of the map in three orthogonal directions.

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

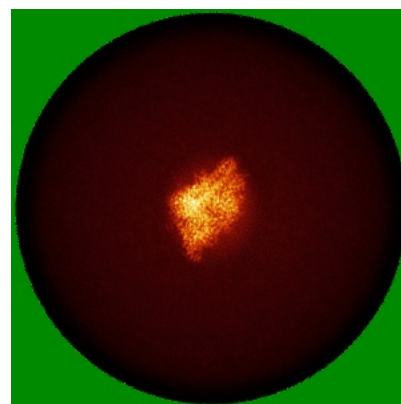
6.4.1 Primary map



X

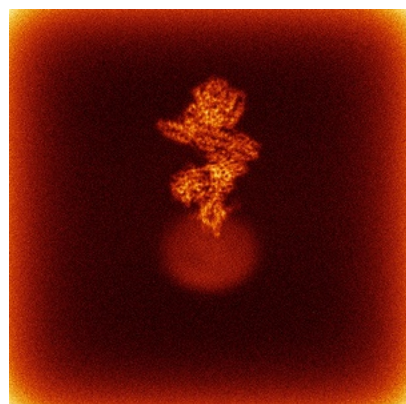


Y

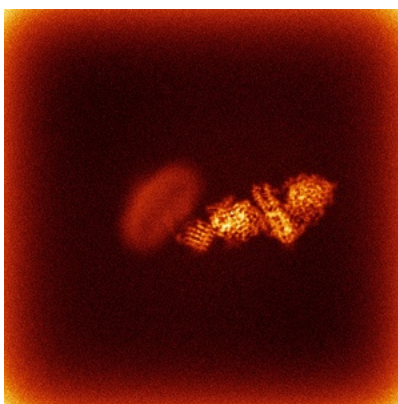


Z

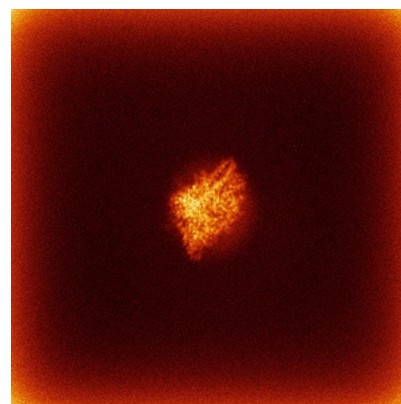
6.4.2 Raw map



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



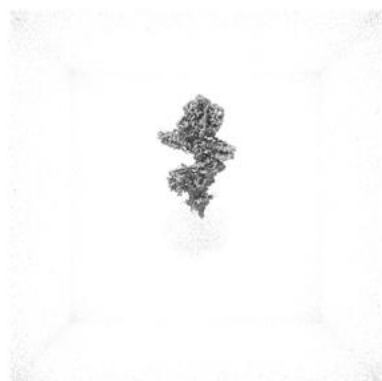
Y



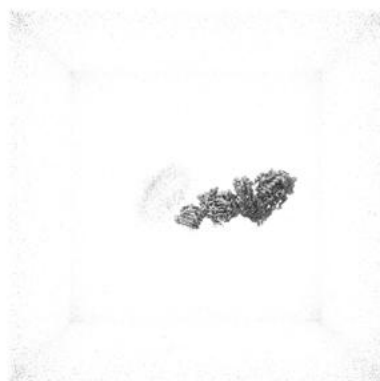
Z

The images above show the 3D surface view of the map at the recommended contour level 0.325. 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.

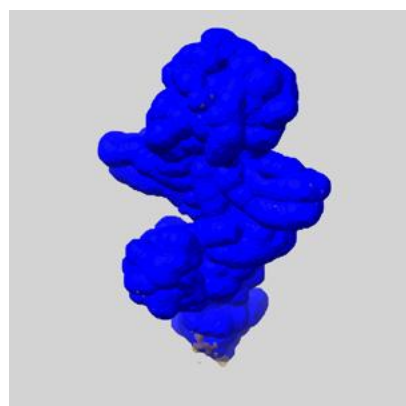
6.6 Mask visualisation [i](#)

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

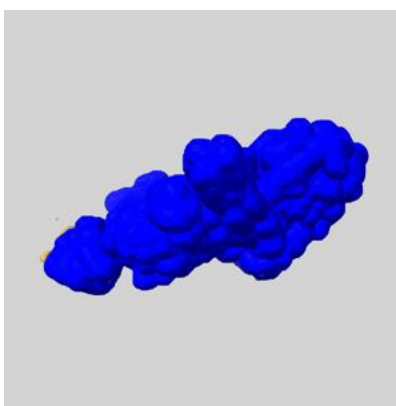
A mask typically either:

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

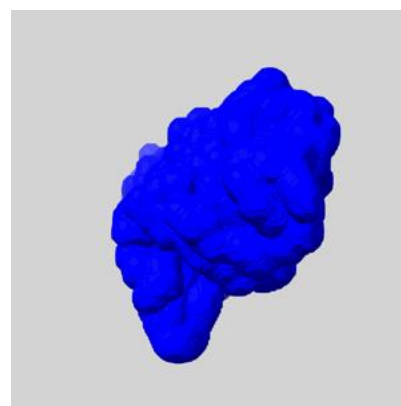
6.6.1 emd_50146_msk_1.map [i](#)



X



Y

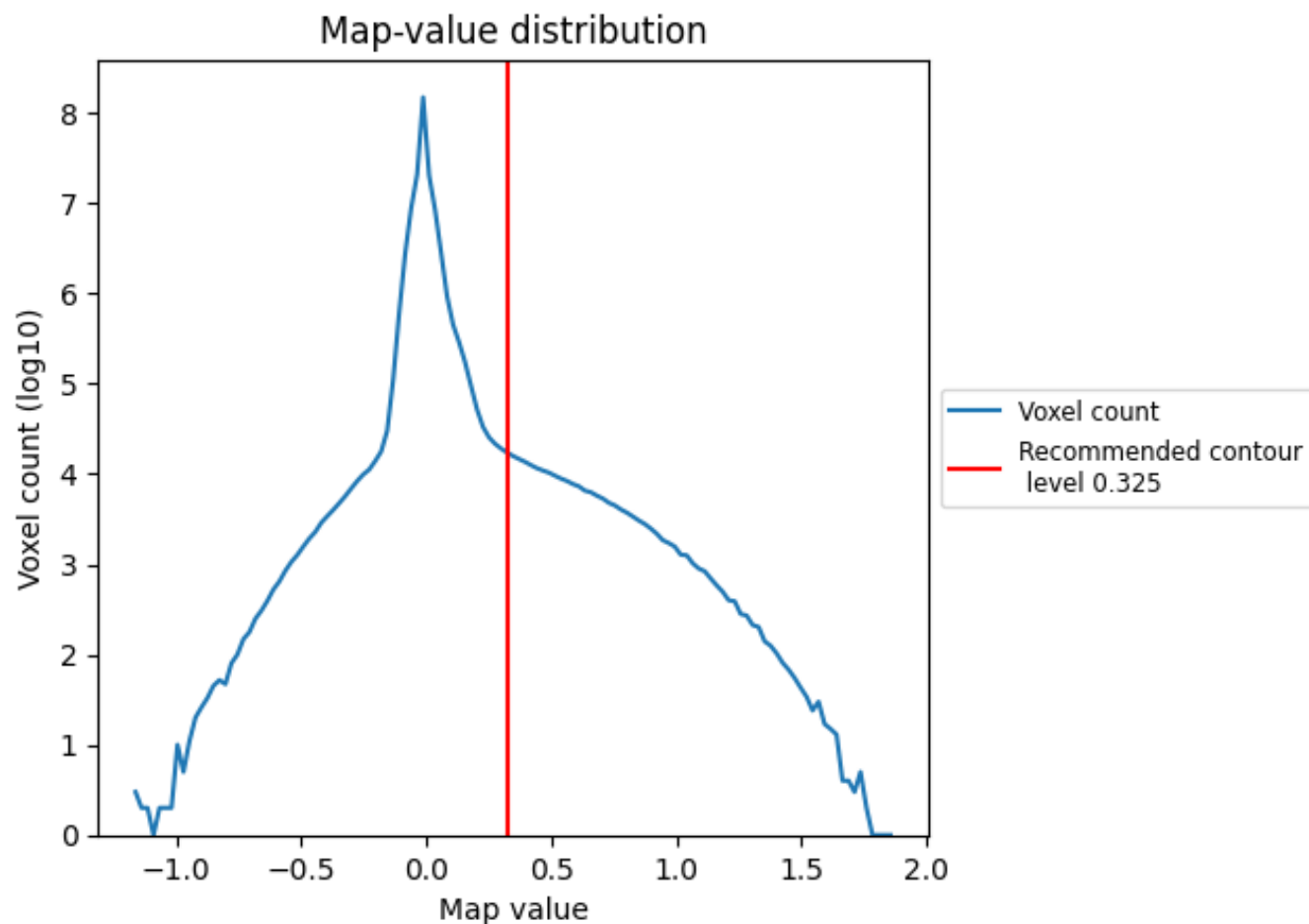


Z

7 Map analysis [i](#)

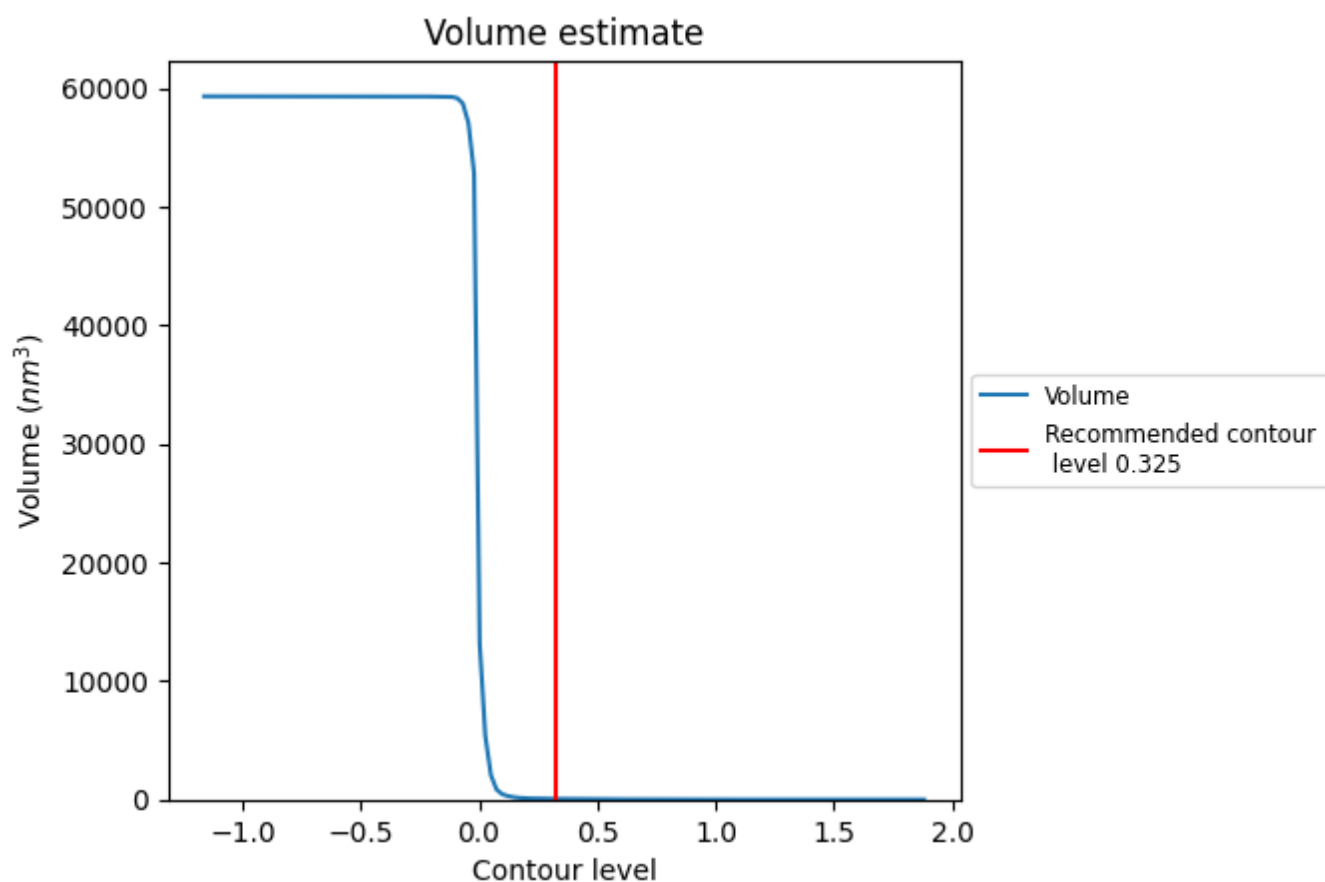
This section contains the results of statistical analysis of the map.

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.

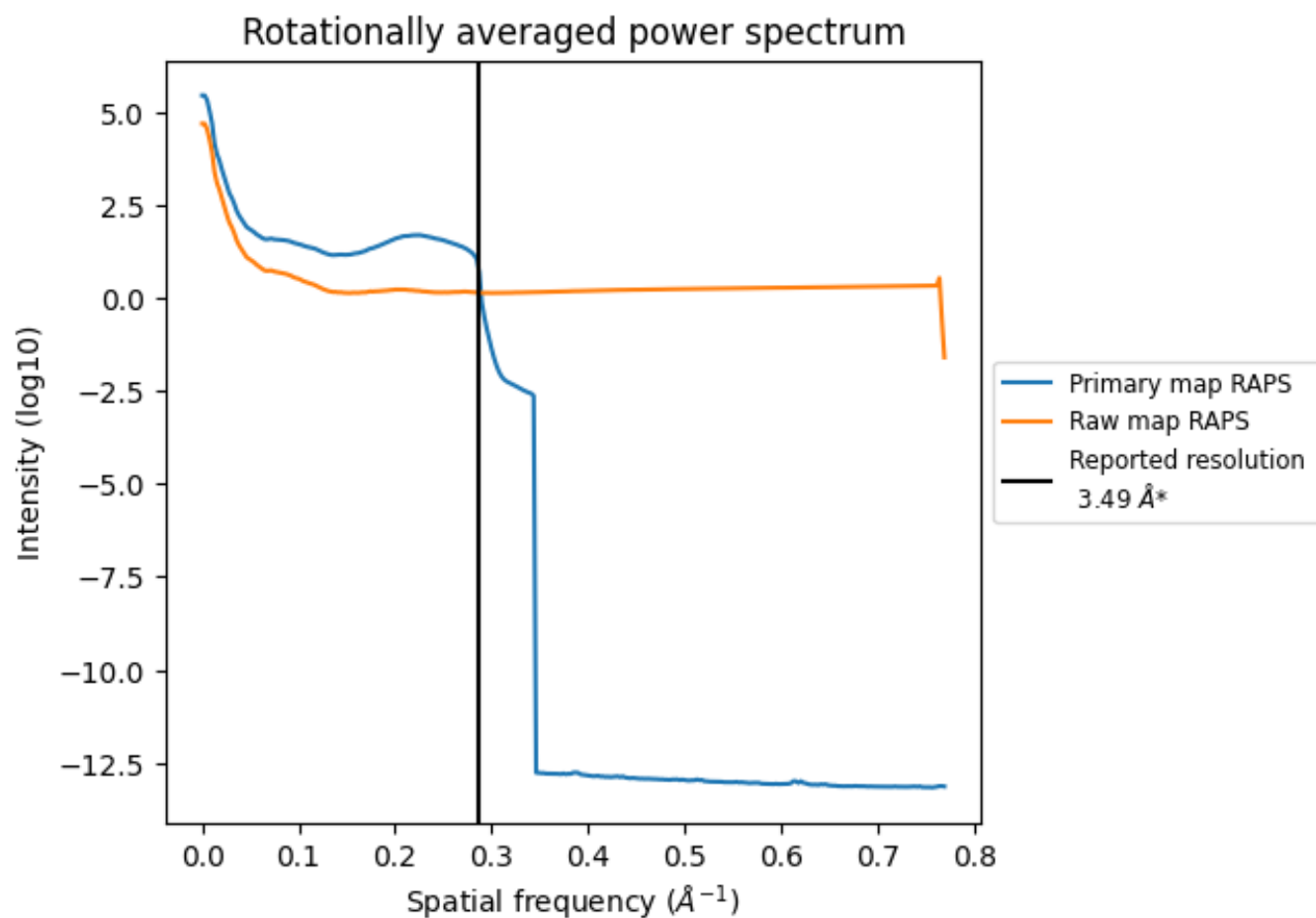
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 60 nm³; this corresponds to an approximate mass of 54 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 ⓘ

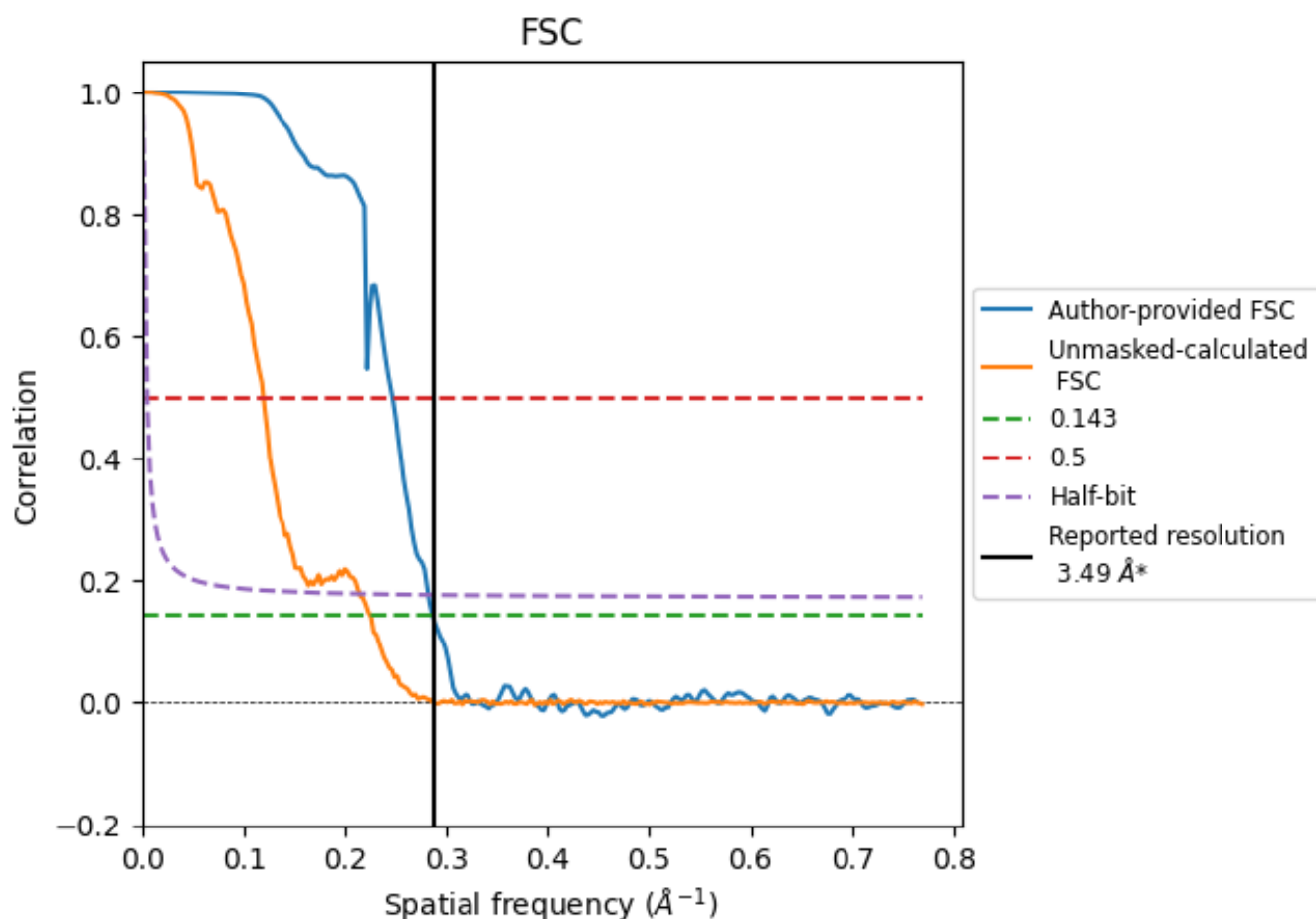


*Reported resolution corresponds to spatial frequency of 0.287 Å⁻¹

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 0.287 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

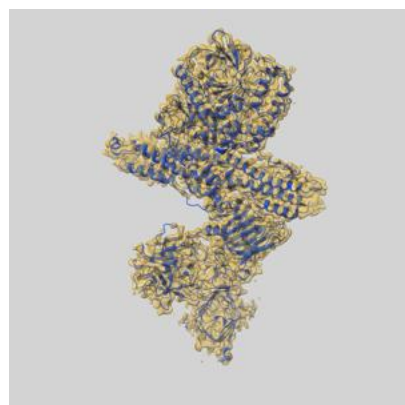
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.49	-	-
Author-provided FSC curve	3.50	4.05	3.54
Unmasked-calculated*	4.45	8.37	4.66

*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 4.45 differs from the reported value 3.49 by more than 10 %

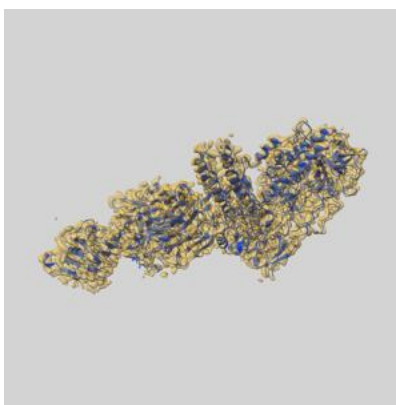
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-50146 and PDB model 9F2B. Per-residue inclusion information can be found in section [3](#) on page [7](#).

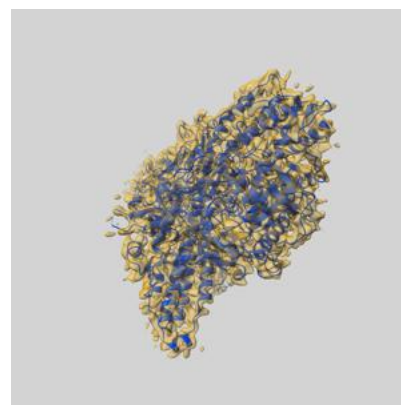
9.1 Map-model overlay [i](#)



X



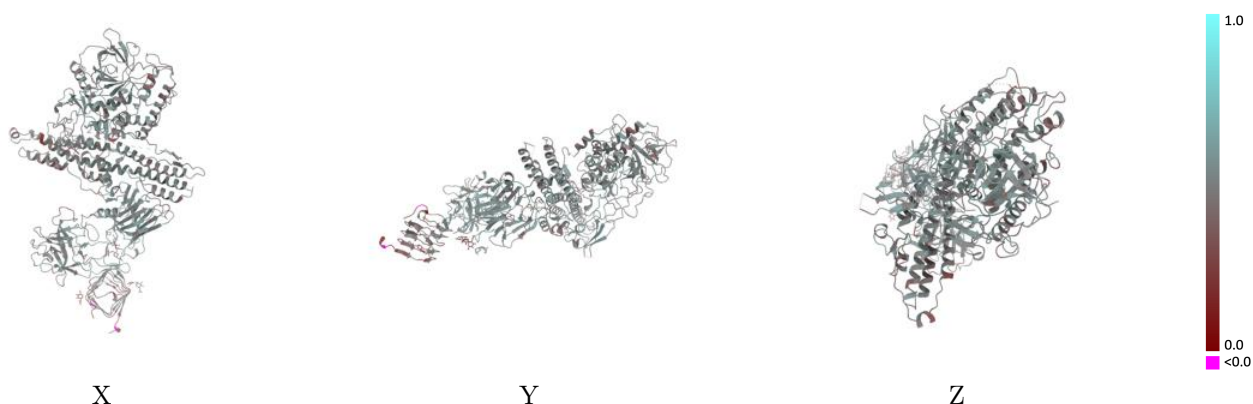
Y



Z

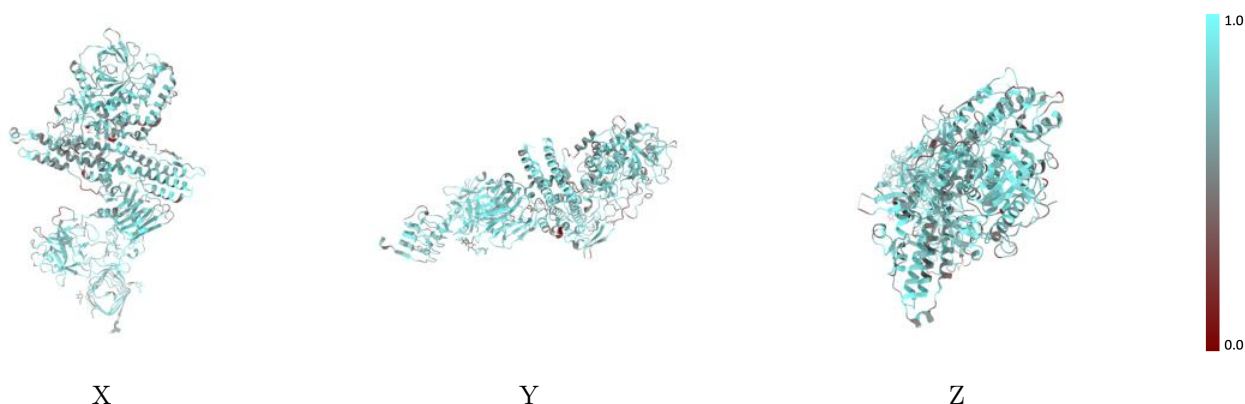
The images above show the 3D surface view of the map at the recommended contour level 0.325 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



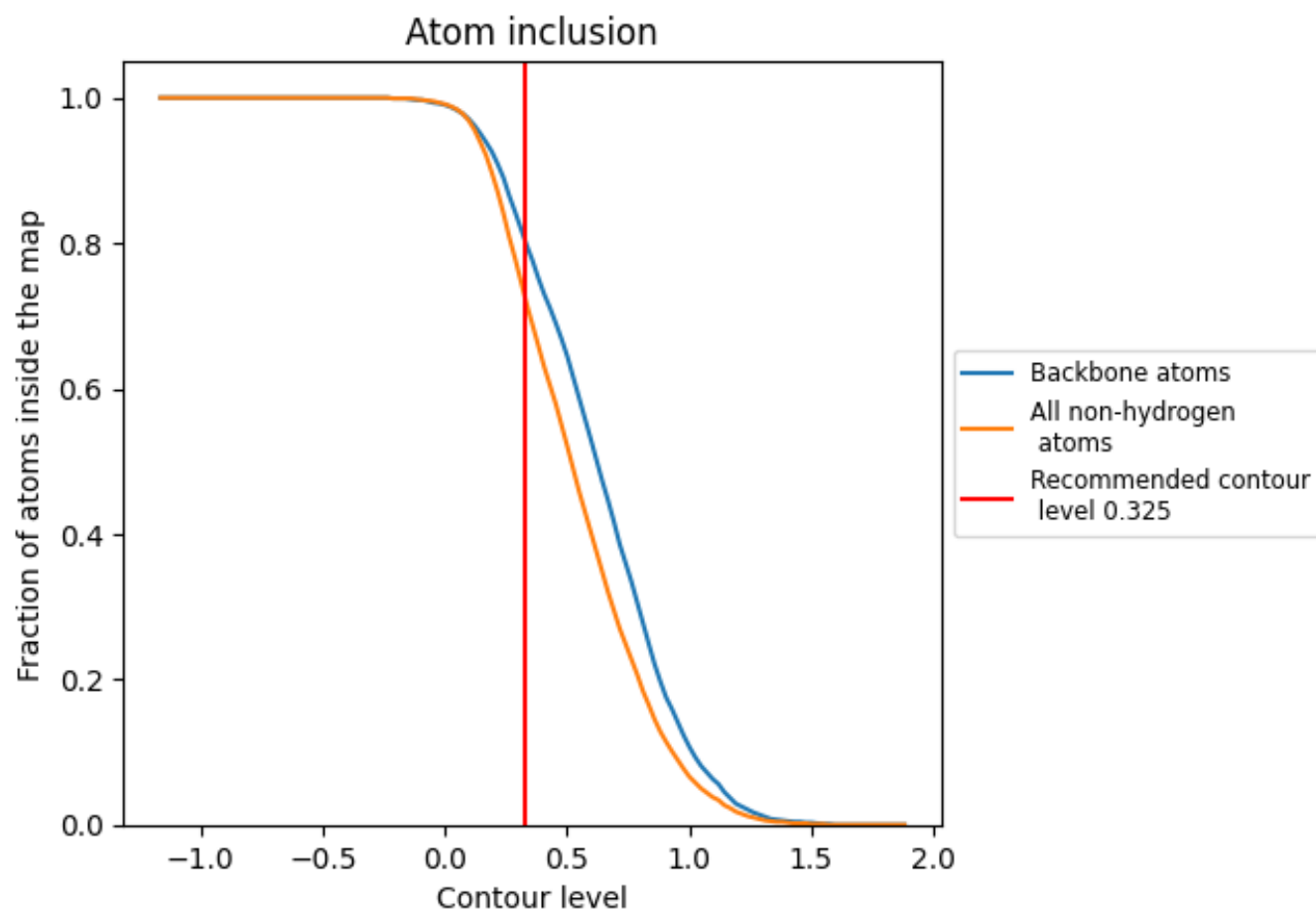
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.325).

9.4 Atom inclusion [i](#)



At the recommended contour level, 81% of all backbone atoms, 73% 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 (0.325) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7300	0.4920
A	0.7000	0.3940
B	0.7330	0.5020
C	0.6250	0.4030
D	0.6170	0.3790

