W O R L D W I D E

wwPDB

PROTEIN DATA BANK

Full wwPDB EM Validation Report (i)

Nov 20, 2022 – 11:48 PM JST

PDB ID	:	7CUB
EMDB ID	:	EMD-30471
Title	:	2.55-Angstrom Cryo-EM structure of Cytochrome bo3 from Escherichia coli in Native Membrane
Authors	:	Li, J.; Han, L.; Gennis, R.B.; Zhu, J.P.; Zhang, K.
Deposited on	:	2020-08-22
Resolution	:	2.55 Å(reported)

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 (i) 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 (i)) were used in the production of this report:

|		
EMDB validation analysis	:	0.0.1.dev43
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ	:	1.9.9
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.31.3

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 2.55 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	Percentile Ranks	Value
Clashscore		4
Ramachandran outliers		0.3%
Sidechain outliers		3.8%

Worse   *Better*

▮ Percentile relative to all structures
▯ Percentile relative to all EM structures
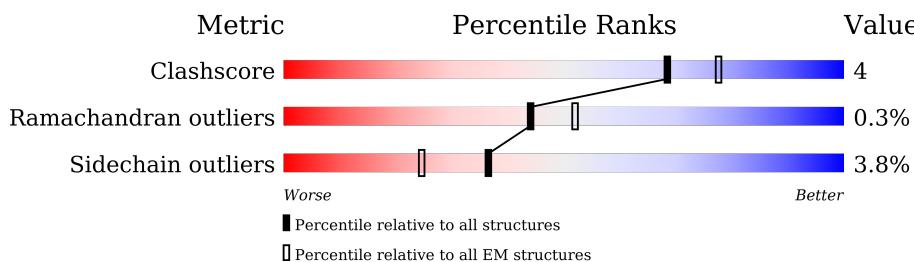
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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

Mol	Chain	Length	Quality of chain
1	A	663	85% 14%
2	B	291	78% 11% 11%
3	C	204	82% 8% 10%
4	D	109	6% 83% 6% 11%
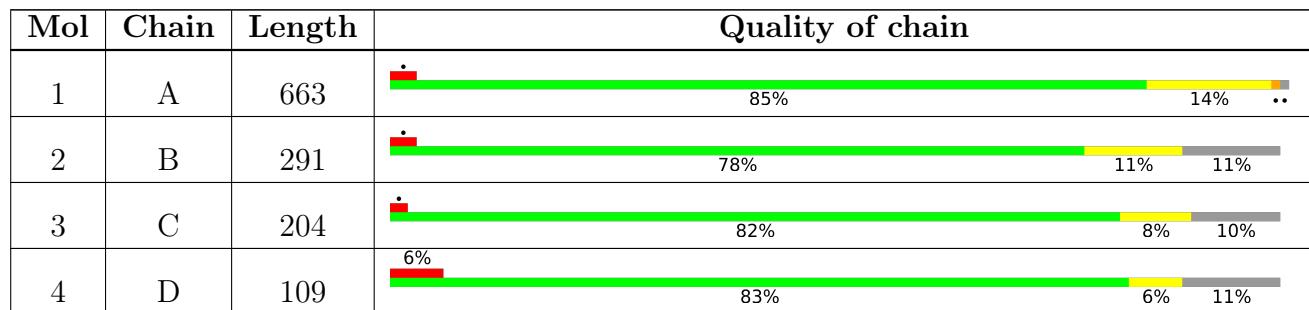
2　Entry composition ⓘ

There are 10 unique types of molecules in this entry. The entry contains 9842 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 Cytochrome bo(3) ubiquinol oxidase subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	659	Total 5230	C 3508	N 827	O 858	S 37	0	0

- Molecule 2 is a protein called Cytochrome bo(3) ubiquinol oxidase subunit 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	259	Total 2027	C 1325	N 327	O 364	S 11	0	0

- Molecule 3 is a protein called Cytochrome bo(3) ubiquinol oxidase subunit 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	184	Total 1440	C 965	N 226	O 236	S 13	0	0

- Molecule 4 is a protein called Cytochrome bo(3) ubiquinol oxidase subunit 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	97	Total 753	C 505	N 115	O 122	S 11	0	0

- Molecule 5 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).

HEM
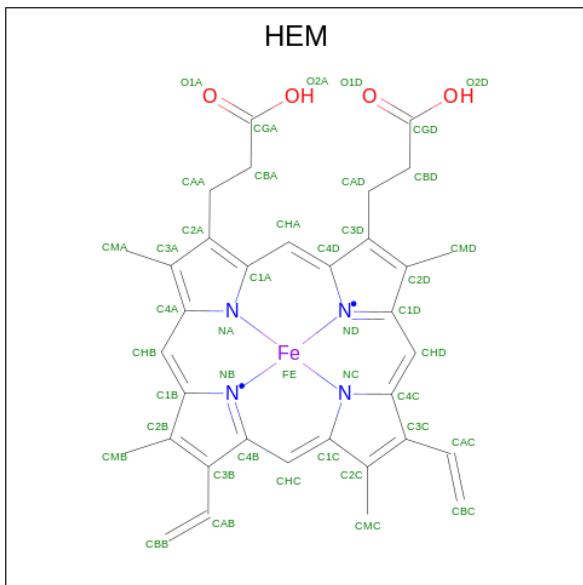
Mol	Chain	Residues	Atoms					AltConf
			Total	C	Fe	N	O	
5	A	1	43	34	1	4	4	0

- Molecule 6 is HEME O (three-letter code: HEO) (formula: $C_{49}H_{58}FeN_4O_5$).

HEO
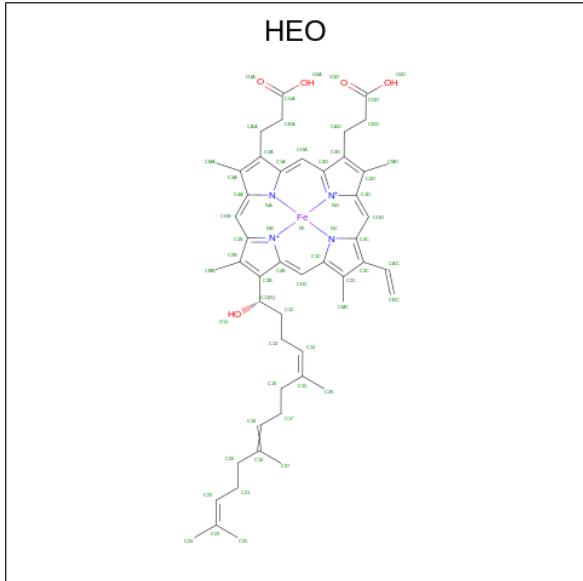
Mol	Chain	Residues	Atoms					AltConf
			Total	C	Fe	N	O	
6	A	1	59	49	1	4	5	0

- Molecule 7 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

Mol	Chain	Residues	Atoms		AltConf
7	A	1	Total	Cu	0
			1	1	

- Molecule 8 is 1,2-Distearoyl-sn-glycerophosphoethanolamine (three-letter code: 3PE) (formula: $C_{41}H_{82}NO_8P$).

3PE
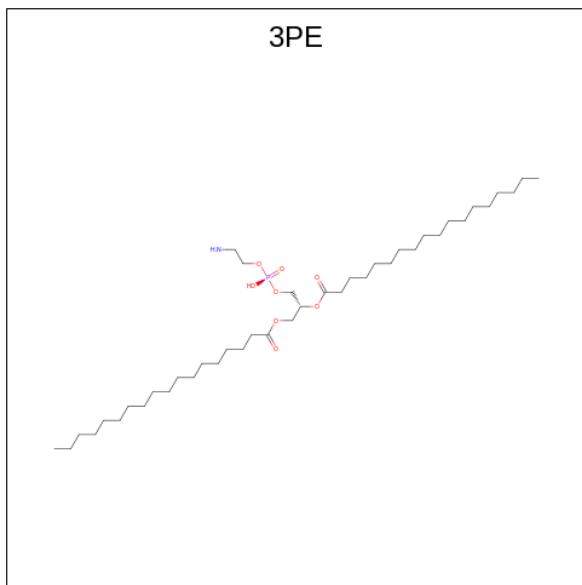
Mol	Chain	Residues	Atoms					AltConf
8	A	1	Total	C	N	O	P	0
			192	152	4	32	4	
8	A	1	Total	C	N	O	P	0
			192	152	4	32	4	
8	A	1	Total	C	N	O	P	0
			192	152	4	32	4	
8	A	1	Total	C	N	O	P	0
			192	152	4	32	4	
8	C	1	Total	C	N	O	P	0
			51	41	1	8	1	

- Molecule 9 is Ubiquinone-8 (three-letter code: UQ8) (formula: $C_{49}H_{74}O_4$).

UQ8
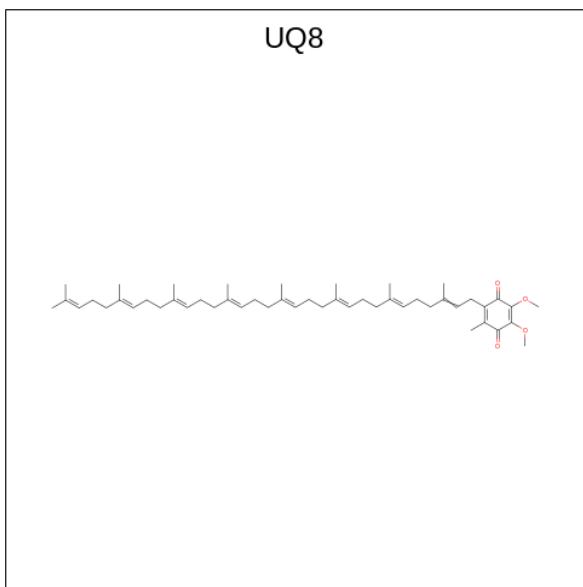
Mol	Chain	Residues	Atoms			AltConf
			Total	C	O	
9	A	1	33	29	4	0

- Molecule 10 is water.

| Mol	Chain	Residues	Atoms		AltConf
			Total	O	
10	A	13	13	13	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: Cytochrome bo(3) ubiquinol oxidase subunit 1

Chain A:
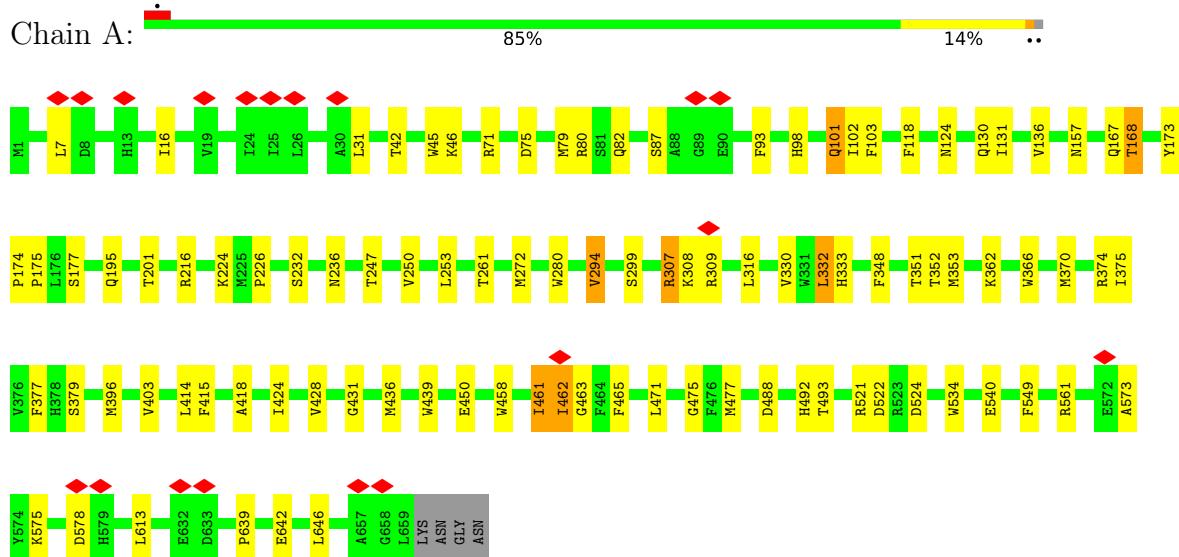
• Molecule 2: Cytochrome bo(3) ubiquinol oxidase subunit 2

Chain B:
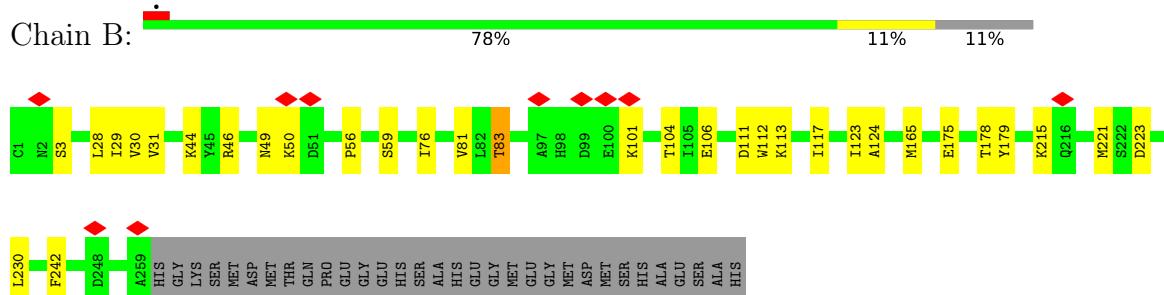
• Molecule 3: Cytochrome bo(3) ubiquinol oxidase subunit 3

Chain C:
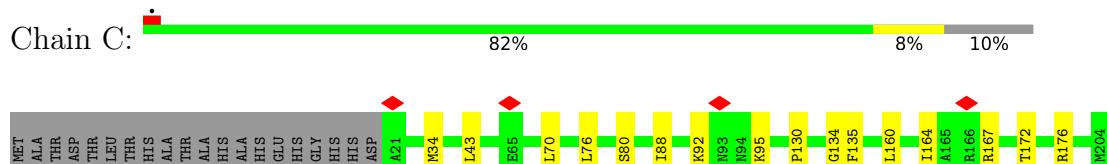
• Molecule 4: Cytochrome bo(3) ubiquinol oxidase subunit 4

Chain D:
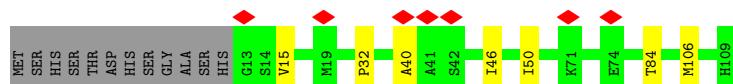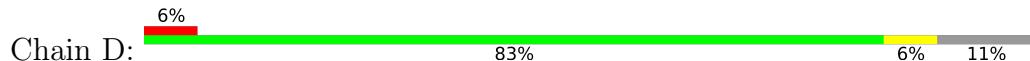
4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	193845	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	1.3	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	4.408	Depositor
Minimum map value	-2.289	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.097	Depositor
Recommended contour level	0.9	Depositor
Map size (Å)	299.52002, 299.52002, 299.52002	wwPDB
Map dimensions	360, 360, 360	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.8320001, 0.8320001, 0.8320001	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CU, 3PE, UQ8, HEM, HEO

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	0.29	0/5407	0.53	1/7372 (0.0%)
2	B	0.29	0/2086	0.50	0/2841
3	C	0.28	0/1482	0.47	0/2012
4	D	0.26	0/772	0.46	0/1054
All	All	0.29	0/9747	0.51	1/13279 (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
1	A	0	2
2	B	0	1
All	All	0	3

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	332	LEU	CA-CB-CG	8.02	133.74	115.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	174	PRO	Peptide
1	A	461	ILE	Peptide
2	B	81	VAL	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	5230	0	5229	55	0
2	B	2027	0	2023	16	0
3	C	1440	0	1454	6	0
4	D	753	0	788	5	0
5	A	43	0	30	2	0
6	A	59	0	56	3	0
7	A	1	0	0	0	0
8	A	192	0	298	4	0
8	C	51	0	82	2	0
9	A	33	0	39	2	0
10	A	13	0	0	0	0
All	All	9842	0	9999	76	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 4.

All (76) 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)
3:C:34:MET:HB3	4:D:84:THR:HG21	1.76	0.68
1:A:82:GLN:NE2	1:A:93:PHE:O	2.30	0.63
2:B:123:ILE:HD11	2:B:215:LYS:HB3	1.80	0.63
1:A:294:VAL:HG21	1:A:428:VAL:HA	1.83	0.59
8:C:301:3PE:H2C2	8:C:301:3PE:H3F1	1.84	0.59
1:A:299:SER:HG	1:A:366:TRP:HE1	1.50	0.58
4:D:32:PRO:HB3	4:D:50:ILE:HG12	1.88	0.56
1:A:79:MET:HE1	1:A:103:PHE:HB3	1.86	0.56
1:A:414:LEU:HD13	1:A:471:LEU:HD22	1.88	0.56
1:A:232:SER:O	1:A:236:ASN:ND2	2.37	0.55
1:A:458:TRP:HA	1:A:461:ILE:HG22	1.89	0.55
1:A:436:MET:HA	8:A:1006:3PE:H3I2	1.89	0.55
1:A:461:ILE:O	1:A:463:GLY:N	2.41	0.54
1:A:377:PHE:HE2	2:B:46:ARG:HG2	1.72	0.54
3:C:95:LYS:NZ	3:C:164:ILE:O	2.40	0.53
1:A:71:ARG:NH1	1:A:157:ASN:OD1	2.42	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:124:ALA:HB3	2:B:242:PHE:HB2	1.90	0.53
1:A:168:THR:HG21	1:A:177:SER:HB3	1.92	0.52
5:A:1001:HEM:HBB2	5:A:1001:HEM:HHC	1.91	0.52
1:A:353:MET:HB3	2:B:76:ILE:HD12	1.93	0.51
1:A:98:HIS:NE2	9:A:1007:UQ8:O2	2.43	0.51
1:A:75:ASP:HB3	9:A:1007:UQ8:H8	1.92	0.51
1:A:307:ARG:NH1	1:A:374:ARG:O	2.43	0.51
1:A:330:VAL:HG12	1:A:351:THR:HG23	1.94	0.50
1:A:332:LEU:HD12	1:A:348:PHE:HB2	1.94	0.49
1:A:75:ASP:HB2	1:A:102:ILE:HG23	1.93	0.49
1:A:130:GLN:HB3	1:A:226:PRO:HG2	1.94	0.49
3:C:88:ILE:HD13	4:D:15:VAL:HG22	1.93	0.49
1:A:578:ASP:OD1	1:A:578:ASP:N	2.45	0.49
2:B:106:GLU:HB2	2:B:117:ILE:HB	1.93	0.49
1:A:403:VAL:HG13	2:B:83:THR:HG23	1.95	0.49
1:A:330:VAL:O	1:A:333:HIS:ND1	2.45	0.48
1:A:424:ILE:HG13	6:A:1002:HEO:HAC	1.95	0.48
1:A:308:LYS:HG3	2:B:56:PRO:HA	1.96	0.48
1:A:45:TRP:HD1	1:A:46:LYS:HG3	1.78	0.47
1:A:396:MET:HB2	2:B:31:VAL:HG21	1.96	0.47
2:B:44:LYS:O	2:B:49:ASN:ND2	2.37	0.47
1:A:31:LEU:HD11	8:A:1008:3PE:H2B2	1.95	0.47
1:A:224:LYS:HA	1:A:561:ARG:HG2	1.95	0.47
1:A:352:THR:HG22	6:A:1002:HEO:HMB2	1.96	0.47
1:A:247:THR:HG21	8:A:1004:3PE:H3G1	1.97	0.47
1:A:477:MET:HG2	2:B:3:SER:HB2	1.96	0.47
1:A:521:ARG:NH1	1:A:522:ASP:OD2	2.48	0.47
1:A:87:SER:HB2	1:A:492:HIS:HB2	1.98	0.46
1:A:131:ILE:HB	1:A:216:ARG:HG2	1.98	0.45
1:A:418:ALA:HB2	1:A:471:LEU:HB2	1.97	0.45
1:A:195:GLN:HE21	1:A:250:VAL:HB	1.81	0.45
1:A:370:MET:HB2	1:A:375:ILE:HD11	1.99	0.45
1:A:415:PHE:HB2	1:A:475:GLY:HA3	1.99	0.45
5:A:1001:HEM:HHD	5:A:1001:HEM:HBC2	1.98	0.45
1:A:173:TYR:HH	1:A:280:TRP:HE1	1.64	0.44
1:A:439:TRP:NE1	1:A:540:GLU:OE1	2.51	0.44
1:A:16:ILE:HB	1:A:98:HIS:HE1	1.82	0.44
1:A:294:VAL:HG22	1:A:431:GLY:HA3	1.99	0.44
2:B:165:MET:HB3	4:D:106:MET:HB3	2.00	0.43
8:A:1005:3PE:H352	8:A:1005:3PE:H242	2.00	0.43
1:A:45:TRP:CD1	1:A:46:LYS:HG3	2.52	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:A:1002:HEO:H212	6:A:1002:HEO:H18	1.76	0.43
2:B:101:LYS:HA	2:B:101:LYS:HD2	1.82	0.43
1:A:101:GLN:HG2	1:A:167:GLN:HG2	2.01	0.42
1:A:575:LYS:HD3	1:A:575:LYS:HA	1.83	0.42
1:A:639:PRO:HD2	1:A:642:GLU:HG3	2.01	0.42
1:A:316:LEU:HD23	1:A:362:LYS:HG2	2.01	0.42
1:A:332:LEU:HB3	1:A:348:PHE:CG	2.55	0.42
1:A:462:ILE:HA	1:A:465:PHE:HD1	1.85	0.42
3:C:176:ARG:HG2	8:C:301:3PE:H32	2.03	0.41
1:A:261:THR:HG22	3:C:130:PRO:HB2	2.03	0.41
2:B:223:ASP:OD1	2:B:223:ASP:N	2.54	0.41
1:A:379:SER:N	1:A:450:GLU:OE2	2.54	0.41
2:B:111:ASP:HA	2:B:112:TRP:HA	1.81	0.41
1:A:348:PHE:HA	1:A:351:THR:HG22	2.03	0.41
2:B:175:GLU:O	2:B:179:TYR:OH	2.36	0.40
4:D:40:ALA:HB3	4:D:46:ILE:HD11	2.02	0.40
1:A:461:ILE:HD12	1:A:461:ILE:HA	1.98	0.40
1:A:309:ARG:NH2	2:B:59:SER:OG	2.53	0.40
3:C:76:LEU:HD23	3:C:76:LEU:HA	1.93	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	657/663 (99%)	627 (95%)	27 (4%)	3 (0%)	29	40
2	B	257/291 (88%)	248 (96%)	9 (4%)	0	100	100
3	C	182/204 (89%)	177 (97%)	4 (2%)	1 (0%)	29	40
4	D	95/109 (87%)	90 (95%)	5 (5%)	0	100	100
All	All	1191/1267 (94%)	1142 (96%)	45 (4%)	4 (0%)	44	51

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	175	PRO
1	A	462	ILE
1	A	573	ALA
3	C	134	GLY

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	543/547 (99%)	523 (96%)	20 (4%)	34	46
2	B	216/242 (89%)	206 (95%)	10 (5%)	27	36
3	C	150/166 (90%)	142 (95%)	8 (5%)	22	30
4	D	84/94 (89%)	84 (100%)	0	100	100
All	All	993/1049 (95%)	955 (96%)	38 (4%)	36	45

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	LEU
1	A	42	THR
1	A	80	ARG
1	A	101	GLN
1	A	118	PHE
1	A	124	ASN
1	A	136	VAL
1	A	168	THR
1	A	201	THR
1	A	253	LEU
1	A	272	MET
1	A	294	VAL
1	A	307	ARG
1	A	488	ASP
1	A	493	THR
1	A	524	ASP

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Mol	Chain	Res	Type
1	A	534	TRP
1	A	549	PHE
1	A	613	LEU
1	A	646	LEU
2	B	28	LEU
2	B	29	ILE
2	B	30	VAL
2	B	50	LYS
2	B	83	THR
2	B	104	THR
2	B	113	LYS
2	B	178	THR
2	B	221	MET
2	B	230	LEU
3	C	43	LEU
3	C	70	LEU
3	C	80	SER
3	C	92	LYS
3	C	135	PHE
3	C	160	LEU
3	C	167	ARG
3	C	172	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	82	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 9 ligands modelled in this entry, 1 is monoatomic - leaving 8 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	#$|Z| > 2$
8	3PE	C	301	-	50,50,50	0.55	0	53,55,55	0.58	1 (1%)
8	3PE	A	1006	-	50,50,50	0.53	0	53,55,55	0.58	1 (1%)
9	UQ8	A	1007	-	33,33,53	3.73	12 (36%)	40,43,67	0.87	2 (5%)
6	HEO	A	1002	1	63,66,66	2.44	18 (28%)	71,102,102	4.41	35 (49%)
8	3PE	A	1004	-	50,50,50	0.55	0	53,55,55	0.51	1 (1%)
5	HEM	A	1001	1	41,50,50	1.55	3 (7%)	45,82,82	1.61	8 (17%)
8	3PE	A	1008	-	50,50,50	0.52	0	53,55,55	0.55	1 (1%)
8	3PE	A	1005	-	38,38,50	0.61	0	41,43,55	0.61	1 (2%)

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	3PE	C	301	-	-	26/54/54/54	-
8	3PE	A	1006	-	-	31/54/54/54	-
9	UQ8	A	1007	-	-	12/27/51/75	0/1/1/1
6	HEO	A	1002	1	-	7/32/114/114	-
8	3PE	A	1004	-	-	23/54/54/54	-
5	HEM	A	1001	1	-	3/12/54/54	-
8	3PE	A	1008	-	-	25/54/54/54	-
8	3PE	A	1005	-	-	16/42/42/54	-

All (33) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	A	1007	UQ8	C18-C19	8.37	1.53	1.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	A	1007	UQ8	C8-C9	8.37	1.53	1.33
9	A	1007	UQ8	C13-C14	8.37	1.53	1.33
9	A	1007	UQ8	O5-C5	7.73	1.40	1.23
9	A	1007	UQ8	O2-C2	7.66	1.40	1.23
9	A	1007	UQ8	C23-C24	7.23	1.53	1.32
6	A	1002	HEO	C1C-NC	6.24	1.49	1.36
6	A	1002	HEO	C4C-NC	5.88	1.48	1.36
6	A	1002	HEO	C4B-NB	5.29	1.49	1.40
5	A	1001	HEM	C3C-C2C	-5.23	1.33	1.40
6	A	1002	HEO	C3D-C2D	5.11	1.47	1.36
6	A	1002	HEO	C4D-ND	4.91	1.48	1.38
6	A	1002	HEO	C3B-C2B	4.77	1.45	1.34
6	A	1002	HEO	C1D-ND	4.76	1.48	1.40
6	A	1002	HEO	C1B-NB	4.68	1.48	1.38
6	A	1002	HEO	C1A-NA	4.68	1.48	1.39
6	A	1002	HEO	C2A-C3A	4.58	1.46	1.36
6	A	1002	HEO	C4A-NA	4.44	1.48	1.39
9	A	1007	UQ8	C3-C2	-3.61	1.38	1.48
6	A	1002	HEO	C3C-C2C	3.57	1.45	1.40
5	A	1001	HEM	C3C-CAC	3.54	1.55	1.47
9	A	1007	UQ8	C4-C5	-3.33	1.39	1.48
6	A	1002	HEO	CHC-C4B	3.15	1.43	1.35
5	A	1001	HEM	CAB-C3B	2.99	1.55	1.47
6	A	1002	HEO	C4B-C3B	2.96	1.49	1.44
6	A	1002	HEO	CHD-C1D	2.92	1.42	1.35
9	A	1007	UQ8	O3-C3M	-2.68	1.39	1.45
9	A	1007	UQ8	C6-C5	-2.64	1.39	1.46
9	A	1007	UQ8	C6-C1	2.60	1.39	1.35
6	A	1002	HEO	CHA-C1A	2.49	1.43	1.38
9	A	1007	UQ8	C1-C2	-2.45	1.38	1.47
6	A	1002	HEO	C4D-C3D	2.28	1.49	1.45
6	A	1002	HEO	CHB-C4A	2.16	1.42	1.38

All (50) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	1002	HEO	C1D-ND-C4D	-13.03	91.62	105.07
6	A	1002	HEO	C4A-NA-C1A	-12.76	92.85	105.35
6	A	1002	HEO	C4B-NB-C1B	-12.35	92.32	105.07
6	A	1002	HEO	C3D-C4D-ND	10.88	120.90	110.36
6	A	1002	HEO	C2D-C1D-ND	9.90	121.57	109.84
6	A	1002	HEO	C2A-C1A-NA	9.71	119.78	110.32

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	A	1002	HEO	C2B-C1B-NB	8.69	120.29	109.88
6	A	1002	HEO	C3B-C4B-NB	8.68	120.12	109.84
6	A	1002	HEO	C3C-C4C-NC	7.36	118.72	109.21
6	A	1002	HEO	CHA-C4D-C3D	-5.62	116.58	124.84
6	A	1002	HEO	CHB-C1B-C2B	-5.61	116.21	124.98
6	A	1002	HEO	C3A-C4A-NA	5.53	119.90	109.69
6	A	1002	HEO	CHA-C1A-C2A	-4.77	117.21	124.94
6	A	1002	HEO	CHB-C4A-C3A	-4.65	115.73	125.48
6	A	1002	HEO	C4A-CHB-C1B	-4.62	116.08	126.06
6	A	1002	HEO	C1A-CHA-C4D	-4.59	116.15	126.06
6	A	1002	HEO	C13-C12-C11	-4.55	107.52	114.35
6	A	1002	HEO	C1D-C2D-C3D	-4.12	102.62	106.96
5	A	1001	HEM	C4B-CHC-C1C	4.10	127.97	122.56
6	A	1002	HEO	CHD-C1D-C2D	-3.89	115.96	126.72
6	A	1002	HEO	CAA-CBA-CGA	-3.15	106.83	113.60
5	A	1001	HEM	C4C-CHD-C1D	3.09	126.64	122.56
6	A	1002	HEO	C1A-C2A-C3A	-3.09	103.11	107.13
5	A	1001	HEM	C3B-C2B-C1B	3.05	108.75	106.49
6	A	1002	HEO	CMC-C2C-C3C	2.94	130.18	124.68
9	A	1007	UQ8	C7-C8-C9	-2.90	121.97	126.79
6	A	1002	HEO	CHC-C4B-C3B	-2.88	118.38	125.80
5	A	1001	HEM	C4D-ND-C1D	2.86	108.03	105.07
5	A	1001	HEM	C1B-NB-C4B	2.82	107.98	105.07
5	A	1001	HEM	CMA-C3A-C4A	-2.80	124.16	128.46
8	A	1006	3PE	O13-C11-C12	2.77	119.47	109.10
8	A	1005	3PE	O13-C11-C12	2.75	119.40	109.10
6	A	1002	HEO	C4D-C3D-C2D	-2.74	102.90	106.90
8	C	301	3PE	O13-C11-C12	2.70	119.21	109.10
6	A	1002	HEO	C4B-C3B-C2B	-2.69	102.81	107.41
8	A	1008	3PE	O13-C11-C12	2.67	119.08	109.10
6	A	1002	HEO	CAD-C3D-C2D	2.64	132.80	127.88
8	A	1004	3PE	O13-C11-C12	2.62	118.91	109.10
9	A	1007	UQ8	C8-C7-C6	2.59	119.04	112.05
5	A	1001	HEM	CHC-C4B-C3B	2.49	128.38	124.57
6	A	1002	HEO	CHC-C4B-NB	-2.45	121.36	124.38
6	A	1002	HEO	CMD-C2D-C3D	2.44	132.75	126.12
6	A	1002	HEO	CMB-C2B-C1B	2.33	128.58	125.04
6	A	1002	HEO	C1B-C2B-C3B	-2.22	104.15	106.80
6	A	1002	HEO	C25-C23-C24	2.21	119.47	114.60
6	A	1002	HEO	C4A-C3A-C2A	-2.18	103.76	106.94
6	A	1002	HEO	C26-C15-C16	2.16	118.91	115.27
6	A	1002	HEO	C13-C14-C15	-2.10	122.60	127.66

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	A	1001	HEM	CAB-C3B-C2B	-2.02	121.94	128.60
6	A	1002	HEO	CHA-C4D-ND	-2.01	122.23	124.42

There are no chirality outliers.

All (143) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	1002	HEO	C2D-C3D-CAD-CBD
6	A	1002	HEO	C4D-C3D-CAD-CBD
8	A	1004	3PE	C11-O13-P-O12
8	A	1005	3PE	C11-O13-P-O14
8	A	1005	3PE	O13-C11-C12-N
8	A	1006	3PE	O22-C21-O21-C2
8	A	1008	3PE	C1-O11-P-O12
8	A	1008	3PE	C1-O11-P-O14
8	A	1008	3PE	C11-O13-P-O14
8	A	1008	3PE	C22-C21-O21-C2
8	C	301	3PE	C1-O11-P-O12
8	C	301	3PE	C1-O11-P-O14
8	C	301	3PE	O13-C11-C12-N
8	C	301	3PE	O22-C21-O21-C2
9	A	1007	UQ8	C22-C23-C24-C26
9	A	1007	UQ8	C12-C13-C14-C16
9	A	1007	UQ8	C12-C13-C14-C15
9	A	1007	UQ8	C11-C12-C13-C14
9	A	1007	UQ8	C7-C8-C9-C11
9	A	1007	UQ8	C7-C8-C9-C10
9	A	1007	UQ8	C22-C23-C24-C25
8	A	1008	3PE	O32-C31-O31-C3
8	A	1008	3PE	O22-C21-O21-C2
8	A	1008	3PE	C32-C31-O31-C3
8	A	1006	3PE	C22-C21-O21-C2
8	C	301	3PE	C22-C21-O21-C2
8	A	1006	3PE	C32-C31-O31-C3
8	A	1006	3PE	O32-C31-O31-C3
9	A	1007	UQ8	C9-C11-C12-C13
8	A	1006	3PE	C31-C32-C33-C34
8	C	301	3PE	C31-C32-C33-C34
9	A	1007	UQ8	C19-C21-C22-C23
8	A	1006	3PE	C2D-C2E-C2F-C2G
8	A	1004	3PE	C22-C21-O21-C2
8	A	1004	3PE	C1-O11-P-O13

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Mol	Chain	Res	Type	Atoms
8	A	1004	3PE	C11-O13-P-O11
8	A	1005	3PE	C1-O11-P-O13
8	A	1006	3PE	C1-O11-P-O13
8	A	1008	3PE	C1-O11-P-O13
8	C	301	3PE	C1-O11-P-O13
8	C	301	3PE	C3C-C3D-C3E-C3F
8	A	1004	3PE	O22-C21-O21-C2
8	C	301	3PE	C2B-C2C-C2D-C2E
8	A	1006	3PE	C36-C37-C38-C39
8	C	301	3PE	C25-C26-C27-C28
8	A	1005	3PE	C24-C25-C26-C27
8	A	1008	3PE	C22-C23-C24-C25
8	A	1006	3PE	C22-C23-C24-C25
8	A	1006	3PE	C3D-C3E-C3F-C3G
8	A	1008	3PE	C28-C29-C2A-C2B
8	A	1005	3PE	C26-C27-C28-C29
8	A	1008	3PE	C23-C24-C25-C26
8	A	1005	3PE	C33-C34-C35-C36
8	A	1006	3PE	C25-C26-C27-C28
8	C	301	3PE	C37-C38-C39-C3A
8	A	1004	3PE	C25-C26-C27-C28
8	A	1006	3PE	C34-C35-C36-C37
8	A	1006	3PE	C24-C25-C26-C27
8	A	1008	3PE	C35-C36-C37-C38
8	A	1006	3PE	C33-C34-C35-C36
8	A	1006	3PE	C38-C39-C3A-C3B
8	C	301	3PE	C3A-C3B-C3C-C3D
8	A	1004	3PE	C24-C25-C26-C27
8	C	301	3PE	C29-C2A-C2B-C2C
8	A	1008	3PE	C3B-C3C-C3D-C3E
8	A	1006	3PE	C37-C38-C39-C3A
8	A	1004	3PE	C3C-C3D-C3E-C3F
8	A	1004	3PE	C22-C23-C24-C25
8	A	1008	3PE	C25-C26-C27-C28
8	A	1005	3PE	C11-O13-P-O11
8	C	301	3PE	O11-C1-C2-C3
8	A	1005	3PE	C37-C38-C39-C3A
8	C	301	3PE	C26-C27-C28-C29
8	A	1008	3PE	C21-C22-C23-C24
8	A	1006	3PE	C3F-C3G-C3H-C3I
6	A	1002	HEO	C27-C19-C20-C21
8	A	1008	3PE	C27-C28-C29-C2A

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Mol	Chain	Res	Type	Atoms
8	A	1004	3PE	C23-C24-C25-C26
8	A	1006	3PE	C39-C3A-C3B-C3C
8	A	1005	3PE	C36-C37-C38-C39
8	A	1008	3PE	C38-C39-C3A-C3B
8	A	1008	3PE	C33-C34-C35-C36
8	A	1004	3PE	O11-C1-C2-C3
6	A	1002	HEO	C18-C19-C20-C21
8	A	1005	3PE	C25-C26-C27-C28
8	A	1008	3PE	C3C-C3D-C3E-C3F
8	A	1008	3PE	C26-C27-C28-C29
8	A	1006	3PE	C29-C2A-C2B-C2C
8	A	1008	3PE	C11-O13-P-O11
8	A	1006	3PE	C2A-C2B-C2C-C2D
8	A	1006	3PE	C26-C27-C28-C29
8	A	1008	3PE	C37-C38-C39-C3A
8	A	1004	3PE	C2B-C2C-C2D-C2E
5	A	1001	HEM	C4B-C3B-CAB-CBB
8	C	301	3PE	C2E-C2F-C2G-C2H
8	A	1004	3PE	C26-C27-C28-C29
8	A	1004	3PE	C1-O11-P-O14
8	A	1004	3PE	C11-O13-P-O14
8	A	1005	3PE	C1-O11-P-O14
8	A	1005	3PE	C11-O13-P-O12
8	A	1006	3PE	C1-O11-P-O12
8	A	1006	3PE	O11-C1-C2-C3
8	A	1004	3PE	O11-C1-C2-O21
8	C	301	3PE	O11-C1-C2-O21
8	C	301	3PE	C22-C23-C24-C25
8	A	1006	3PE	O21-C2-C3-O31
6	A	1002	HEO	C1A-C2A-CAA-CBA
8	C	301	3PE	C33-C34-C35-C36
8	A	1006	3PE	C2C-C2D-C2E-C2F
8	C	301	3PE	C24-C25-C26-C27
8	A	1006	3PE	O11-C1-C2-O21
6	A	1002	HEO	C3A-C2A-CAA-CBA
8	A	1006	3PE	C2-C1-O11-P
8	A	1004	3PE	C35-C36-C37-C38
8	A	1004	3PE	C3E-C3F-C3G-C3H
8	A	1004	3PE	C2E-C2F-C2G-C2H
8	A	1008	3PE	C24-C25-C26-C27
8	A	1004	3PE	C27-C28-C29-C2A
8	A	1008	3PE	C34-C35-C36-C37

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Mol	Chain	Res	Type	Atoms
8	A	1006	3PE	C3B-C3C-C3D-C3E
8	A	1006	3PE	C32-C33-C34-C35
8	C	301	3PE	C39-C3A-C3B-C3C
8	A	1006	3PE	C3A-C3B-C3C-C3D
8	A	1005	3PE	O22-C21-O21-C2
6	A	1002	HEO	C26-C15-C16-C17
8	A	1006	3PE	C3E-C3F-C3G-C3H
9	A	1007	UQ8	C2-C3-O3-C3M
5	A	1001	HEM	CAA-CBA-CGA-O1A
8	C	301	3PE	C32-C33-C34-C35
5	A	1001	HEM	CAA-CBA-CGA-O2A
8	C	301	3PE	O31-C31-C32-C33
8	C	301	3PE	C3B-C3C-C3D-C3E
8	A	1004	3PE	C38-C39-C3A-C3B
8	A	1005	3PE	C38-C39-C3A-C3B
9	A	1007	UQ8	C5-C4-O4-C4M
8	A	1005	3PE	C22-C21-O21-C2
8	A	1004	3PE	C32-C31-O31-C3
8	A	1008	3PE	C29-C2A-C2B-C2C
8	C	301	3PE	C11-O13-P-O14
8	A	1004	3PE	O32-C31-O31-C3
9	A	1007	UQ8	C12-C11-C9-C10
8	C	301	3PE	O32-C31-C32-C33
8	A	1005	3PE	O31-C31-C32-C33

There are no ring outliers.

8 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	C	301	3PE	2	0
8	A	1006	3PE	1	0
9	A	1007	UQ8	2	0
6	A	1002	HEO	3	0
8	A	1004	3PE	1	0
5	A	1001	HEM	2	0
8	A	1008	3PE	1	0
8	A	1005	3PE	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is

within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand 3PE C 301

Bond lengths

Bond angles

Torsions

Rings

Ligand 3PE A 1006

Bond lengths

Bond angles

Torsions

Rings

Ligand UQ8 A 1007

Bond lengths

Bond angles

Torsions

Rings

Ligand HEO A 1002

Bond lengths

Bond angles

Torsions

Rings

Ligand 3PE A 1004

Bond lengths

Bond angles

Torsions

Rings

Ligand HEM A 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand 3PE A 1008

Bond lengths

Bond angles

Torsions

Rings

Ligand 3PE A 1005

Bond lengths

Bond angles

Torsions

Rings

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6   Map visualisation ⓘ

This section contains visualisations of the EMDB entry EMD-30471. These allow visual inspection of the internal detail of the map and identification of artifacts.

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

6.1   Orthogonal projections ⓘ

6.1.1   Primary map

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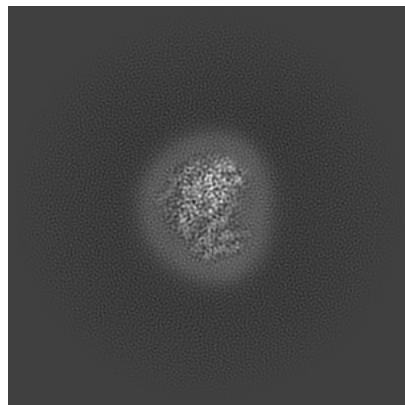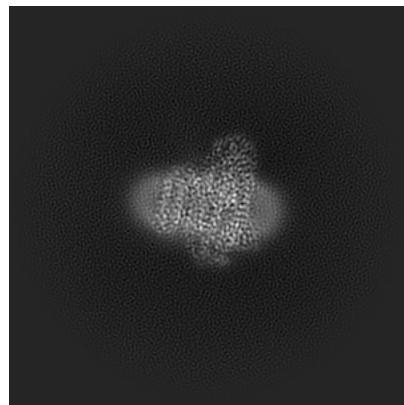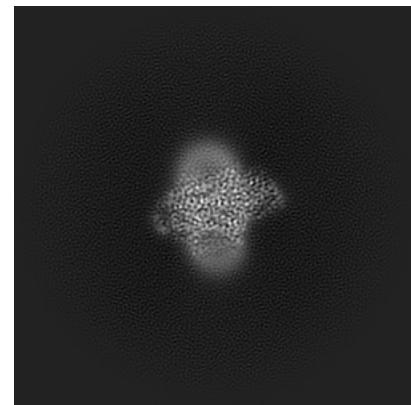
The images above show the map projected in three orthogonal directions.

6.2   Central slices ⓘ
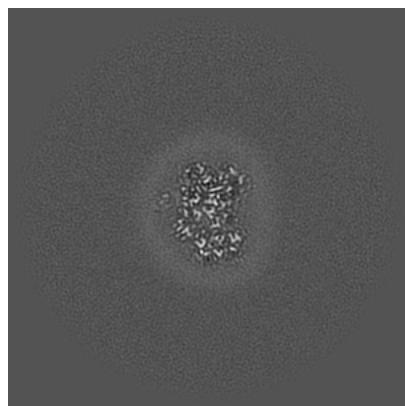
6.2.1   Primary map
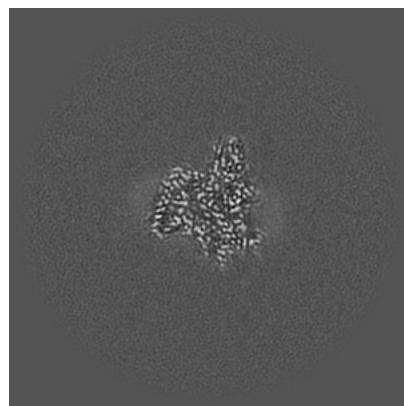
X Index: 180   Y Index: 180   Z Index: 180
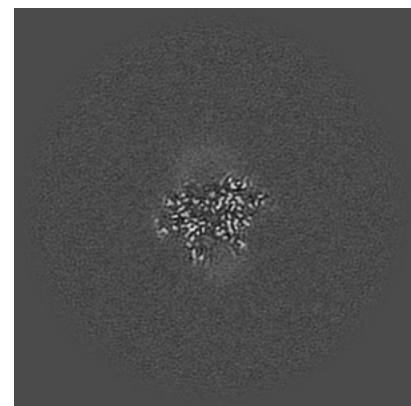
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

6.3.1 Primary map
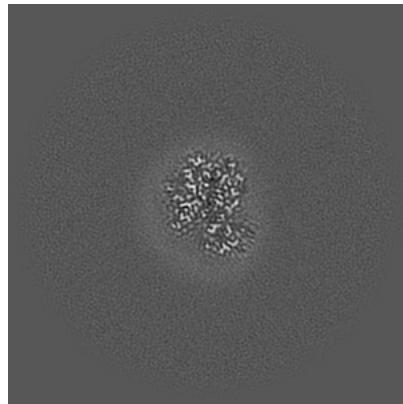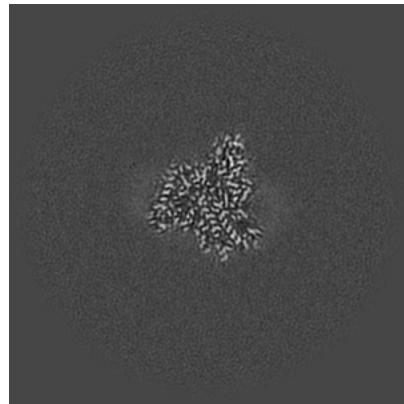
| X Index: 194 | Y Index: 182 | Z Index: 200 |
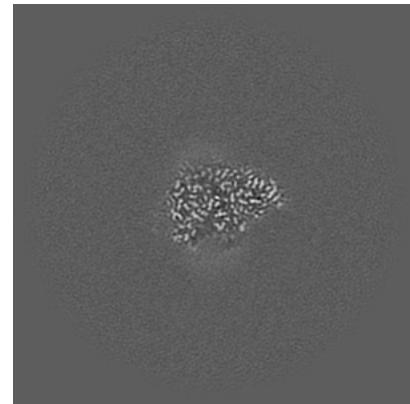
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal surface views (i)

6.4.1 Primary map

| X | Y | Z |
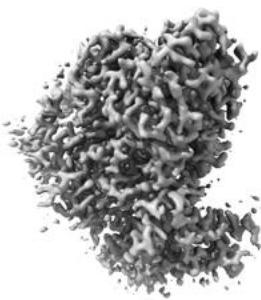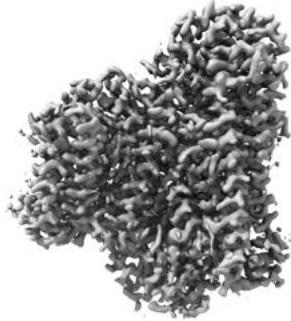
The images above show the 3D surface view of the map at the recommended contour level 0.9. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5 Mask visualisation (i)

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

7 Map analysis ⓘ

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

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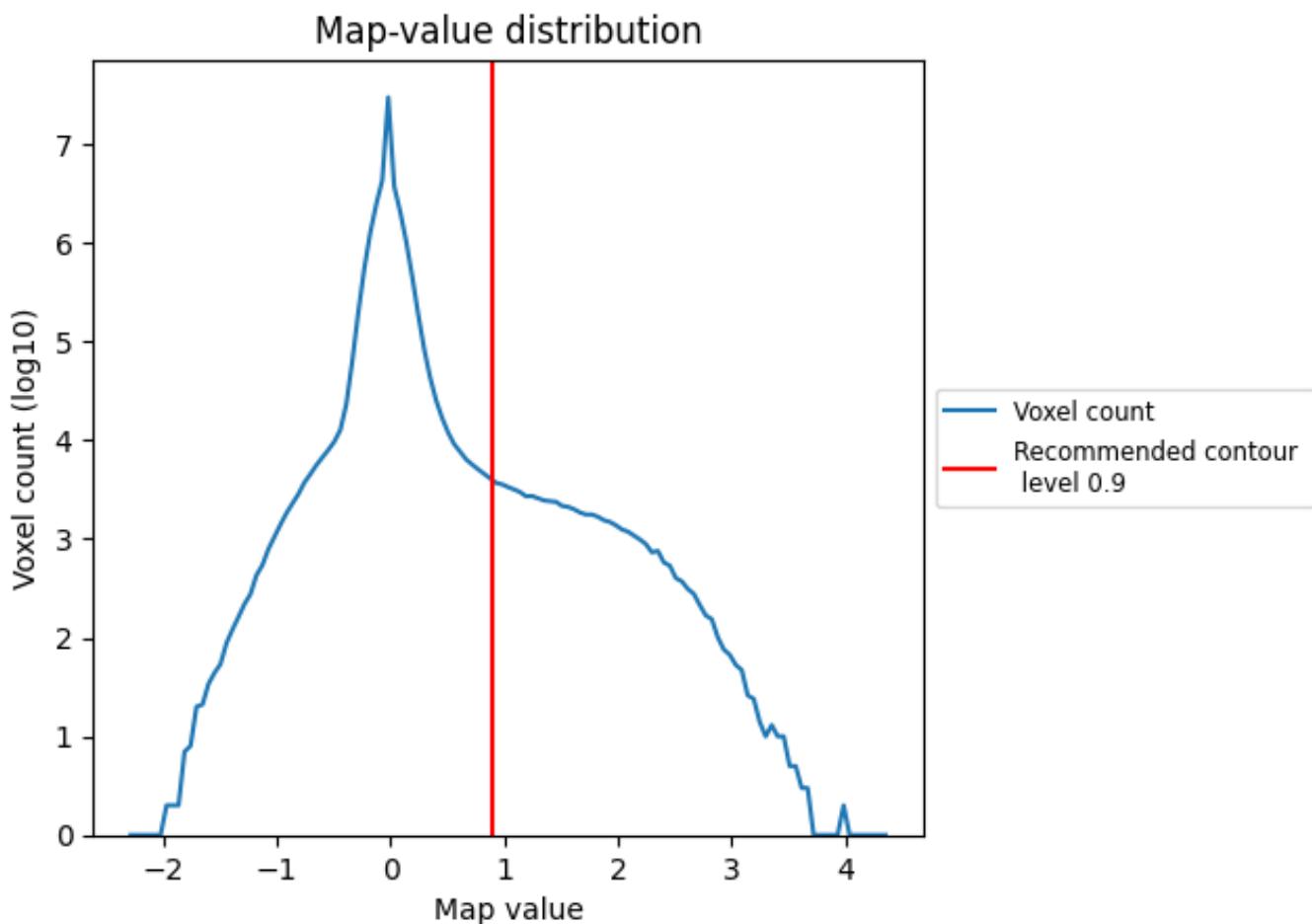
The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

7.2 Volume estimate (i)
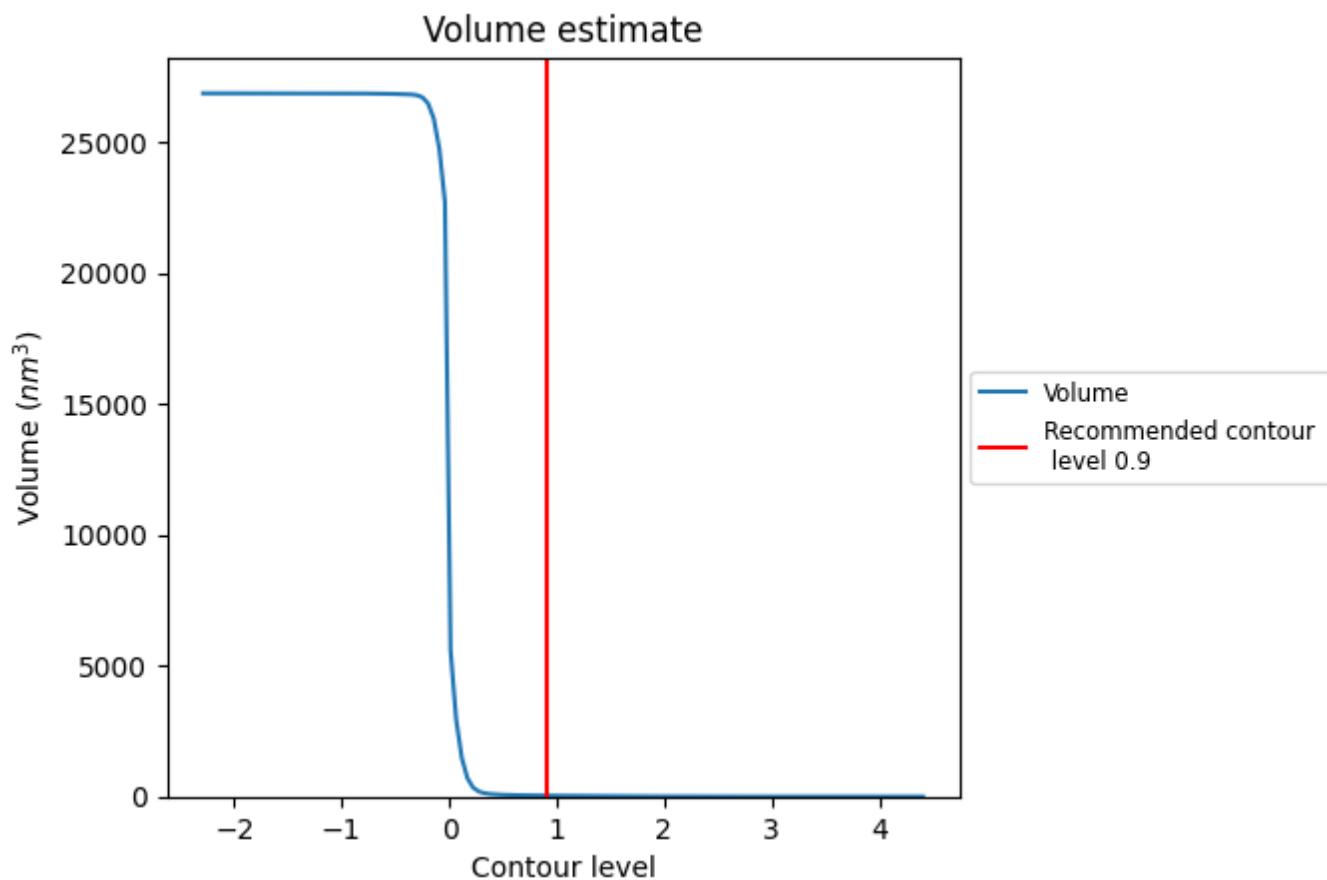
The volume at the recommended contour level is 36 nm^3; this corresponds to an approximate mass of 32 kDa.

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 ⓘ
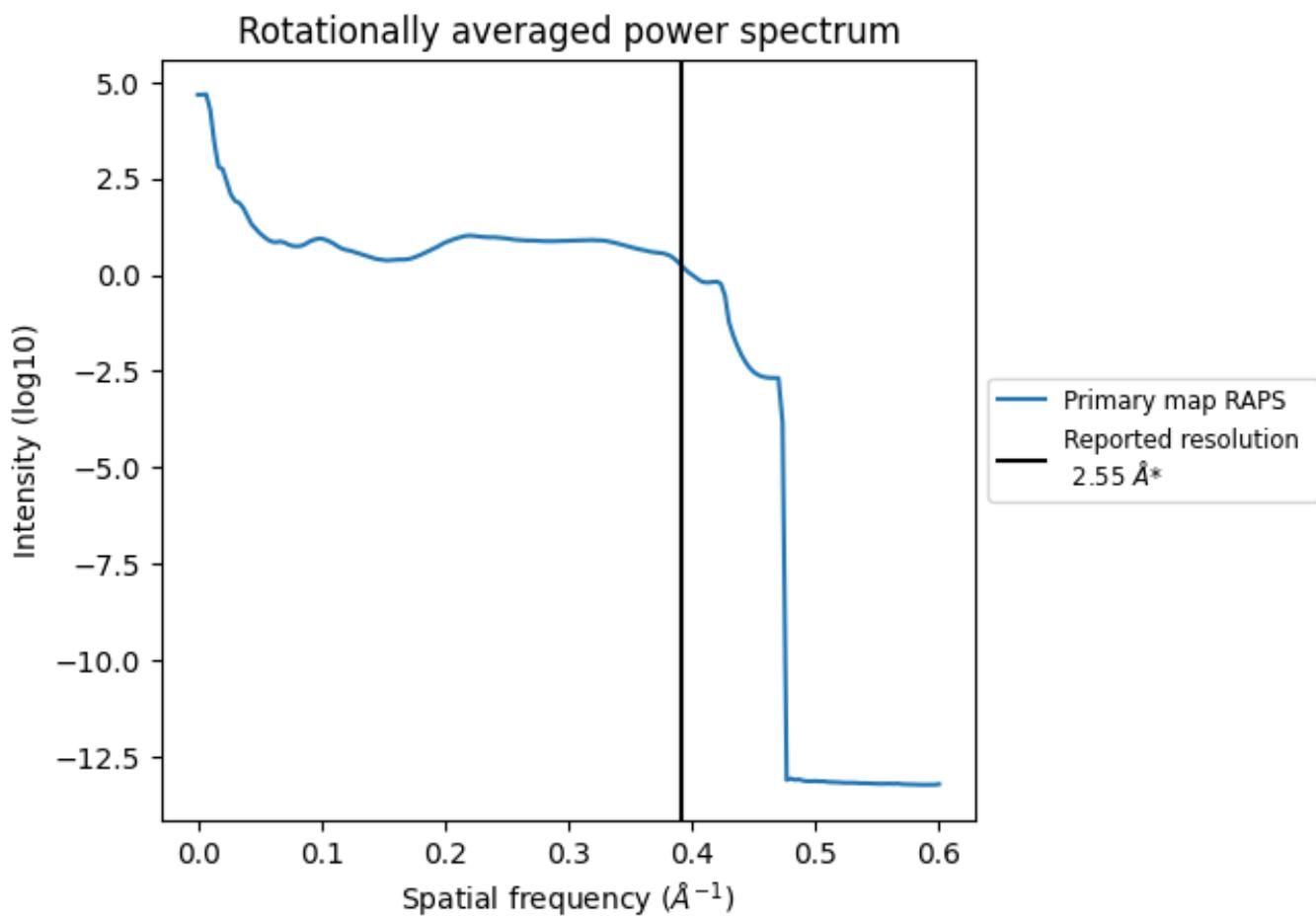
*Reported resolution corresponds to spatial frequency of 0.392 $Å^{-1}$

8　Fourier-Shell correlation ⓘ

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

9 Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-30471 and PDB model 7CUB. Per-residue inclusion information can be found in section 3 on page 7.

9.1 Map-model overlay ⓘ

X   Y   Z
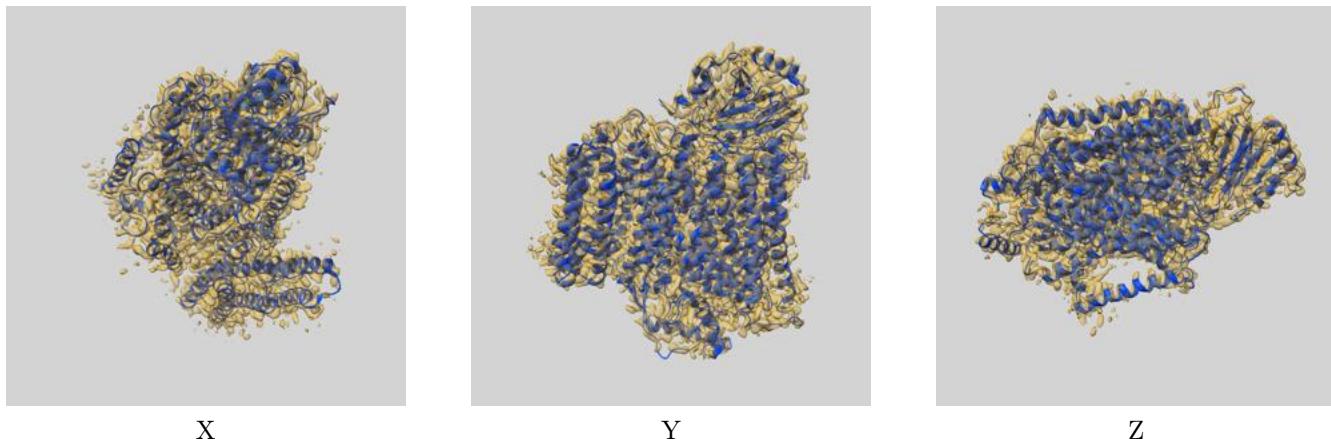
The images above show the 3D surface view of the map at the recommended contour level 0.9 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2 Q-score mapped to coordinate model ⓘ

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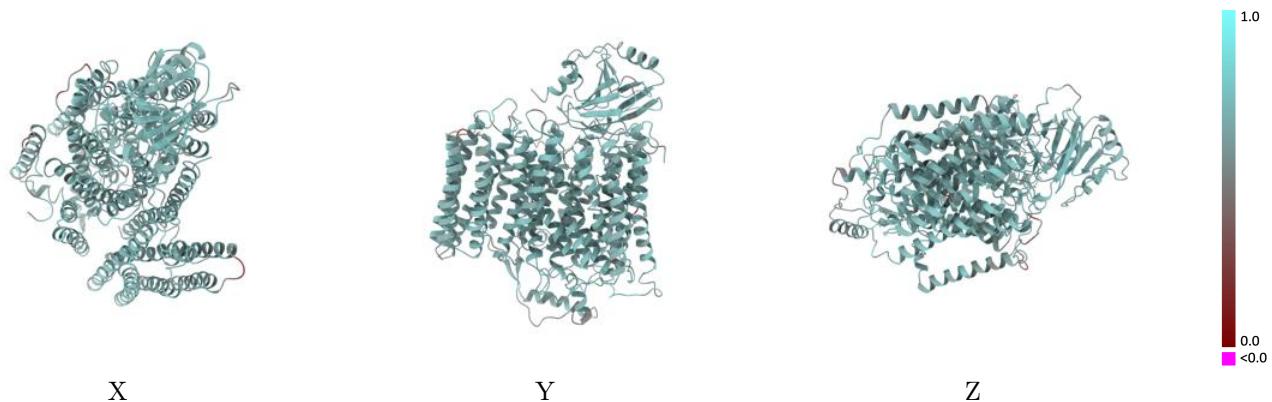
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

9.3 Atom inclusion mapped to coordinate model ⓘ

X   Y   Z
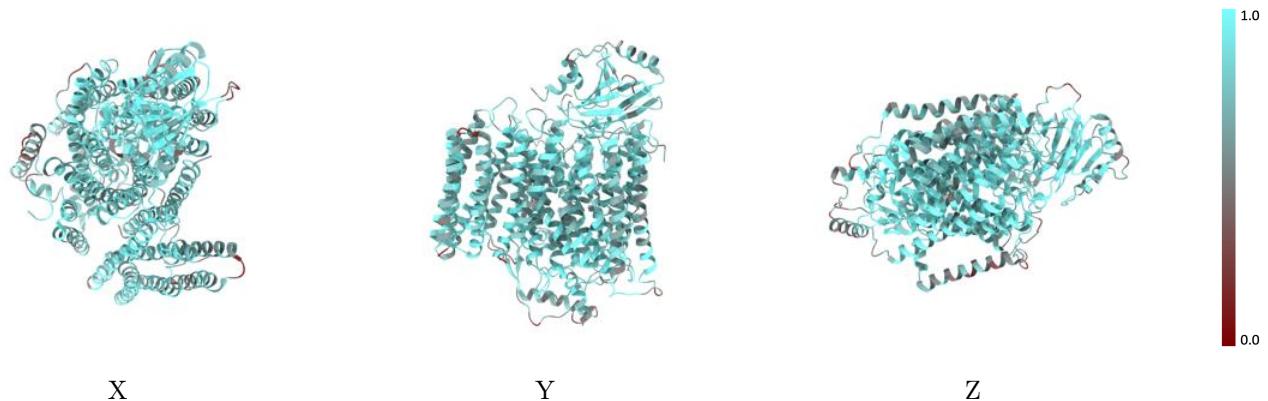
The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.9).

9.4 Atom inclusion ⓘ
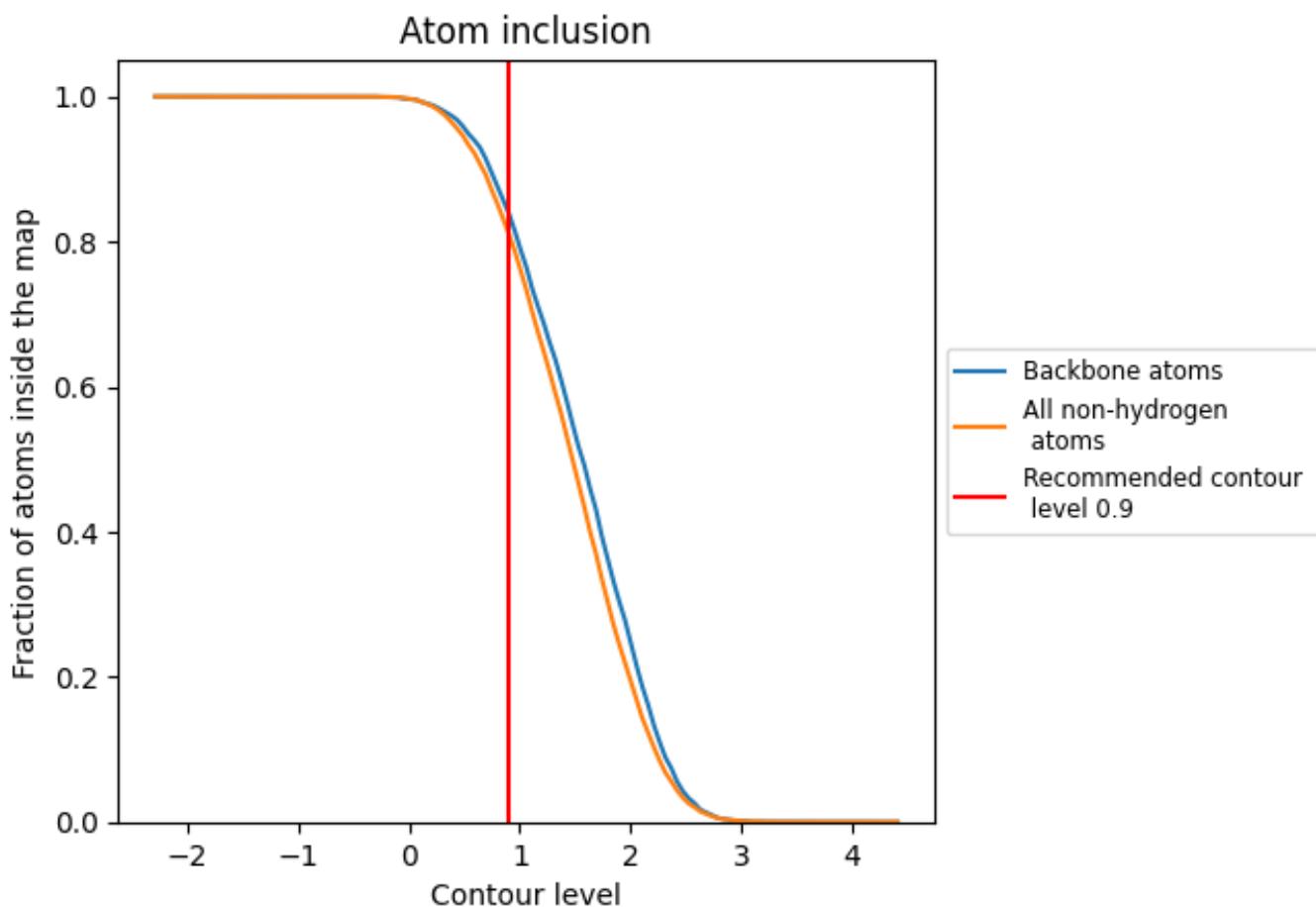
At the recommended contour level, 84% of all backbone atoms, 81% of all non-hydrogen atoms, are inside the map.

9.5   Map-model fit summary (i)

The table lists the average atom inclusion at the recommended contour level (0.9) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8116	0.6450
A	0.8236	0.6490
B	0.7961	0.6390
C	0.8487	0.6550
D	0.7229	0.6100

1.0

0.0

<0.0