



Full wwPDB EM Validation Report ⓘ

Jul 20, 2024 – 07:51 am BST

PDB ID : 8QV3
EMDB ID : EMD-18666
Title : Structure of the γ -Tubulin Small Complex (γ TuSC) as part of the native γ -Tubulin Ring Complex (γ TuRC) capping microtubule minus ends at the spindle pole body
Authors : Dendooven, T.; Yatskevich, S.; Burt, A.; Bellini, D.; Kilmartin, J.; Barford, D.
Deposited on : 2023-10-17
Resolution : 8.20 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 ⓘ 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.dev92
Mogul : 1.8.4, 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 : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.37.1

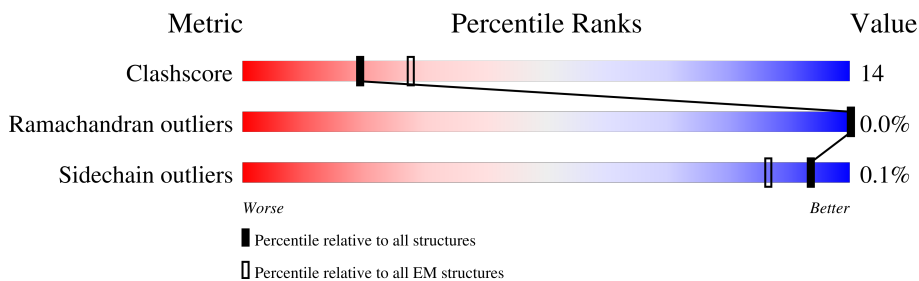
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 8.20 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



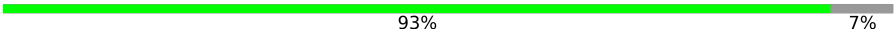
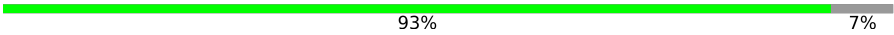


Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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 $\leq 5\%$. 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	c	473	
1	d	473	
2	E	823	
3	F	846	
4	Sc	944	
4	Sd	944	
5	Ac	447	
5	Ad	447	

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Mol	Chain	Length	Quality of chain
6	Bc	457	 93% 7%
6	Bd	457	 93% 7%
7	Uc	67	 100%
8	Ud	62	 100%

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 33813 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 Tubulin gamma chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	c	441	Total	C	N	O	S	0	0
			3448	2158	585	689	16		
1	d	453	Total	C	N	O	S	0	0
			3545	2217	599	712	17		

- Molecule 2 is a protein called Spindle pole body component.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	E	701	Total	C	N	O	S	0	0
			5847	3760	985	1073	29		

- Molecule 3 is a protein called Spindle pole body component.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	F	672	Total	C	N	O	S	0	0
			5557	3595	918	1028	16		

- Molecule 4 is a protein called Spindle pole body component 110.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	Sc	42	Total	C	N	O	S	0	0
			352	215	61	76			
4	Sd	95	Total	C	N	O	S	0	0
			792	488	142	160	2		

- Molecule 5 is a protein called Tubulin alpha-1 chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	Ad	440	Total	C	N	O	S	0	0
			3438	2167	585	667	19		
5	Ac	440	Total	C	N	O	S	0	0
			3438	2167	585	667	19		

- Molecule 6 is a protein called Tubulin beta chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	Bd	427	Total 3343	2098	571	653	21	0	0
6	Bc	427	Total 3343	2098	571	653	21	0	0

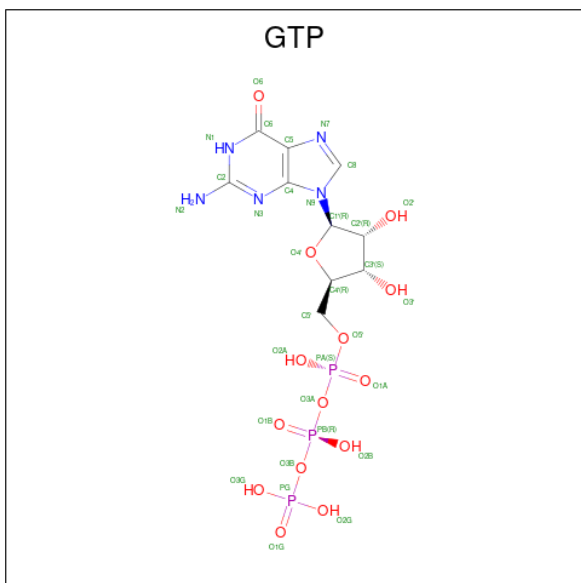
- Molecule 7 is a protein called Unknown protein.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
7	Uc	67	Total 335	201	67	67	0	0

- Molecule 8 is a protein called Unknown protein.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
8	Ud	62	Total 310	186	62	62	0	0

- Molecule 9 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula: $C_{10}H_{16}N_5O_{14}P_3$).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
9	c	1	Total 32	10	5	14	3	0
9	d	1	Total 32	10	5	14	3	0

- Molecule 10 is water.

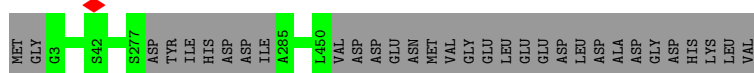
Mol	Chain	Residues	Atoms		AltConf
10	Uc	1	Total	O	0
			1	1	

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

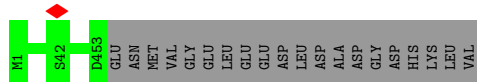
- Molecule 1: Tubulin gamma chain

Chain c:  93% 7%



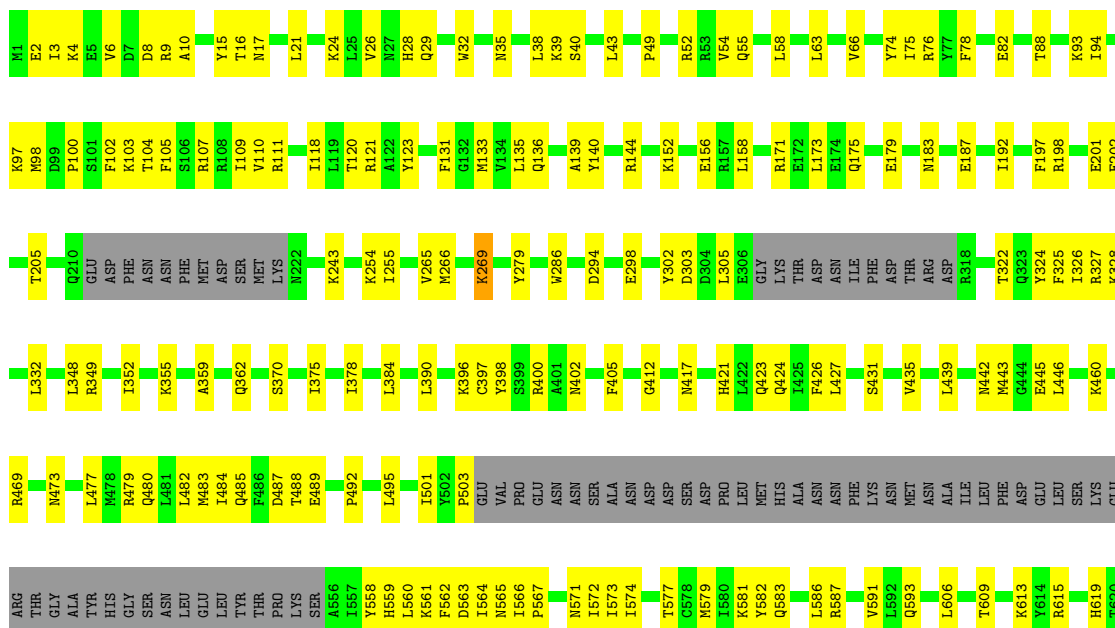
- Molecule 1: Tubulin gamma chain

Chain d:  96%



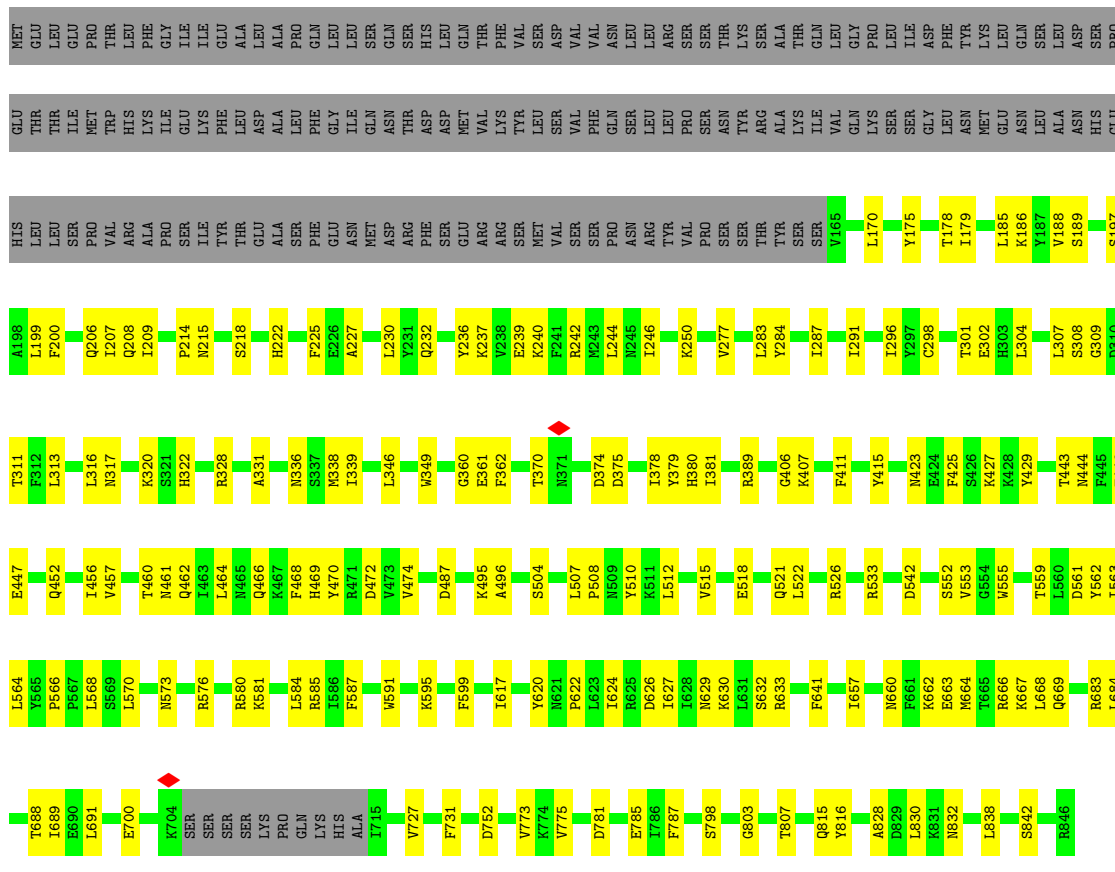
- Molecule 2: Spindle pole body component

Chain E:  59% 26% 15%

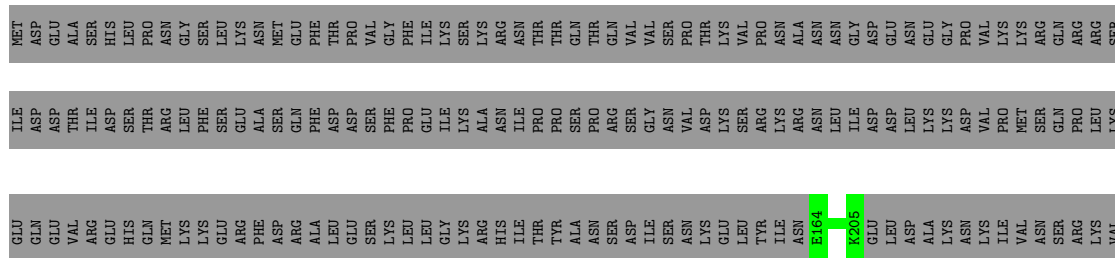


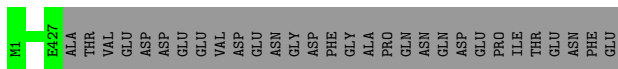


● Molecule 3: Spindle pole body component



● Molecule 4: Spindle pole body component 110





- Molecule 7: Unknown protein

Chain Uc:  100%

There are no outlier residues recorded for this chain.

- Molecule 8: Unknown protein

Chain Ud:  100%

There are no outlier residues recorded for this chain.

4 Experimental information

Property	Value	Source
EM reconstruction method	SUBTOMOGRAM AVERAGING	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of subtomograms used	31720	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 ($e^-/\text{\AA}^2$)	123	Depositor
Minimum defocus (nm)	2000	Depositor
Maximum defocus (nm)	4500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.075	Depositor
Minimum map value	-0.307	Depositor
Average map value	0.003	Depositor
Map value standard deviation	0.038	Depositor
Recommended contour level	0.163	Depositor
Map size (Å)	554.39996, 554.39996, 554.39996	wwPDB
Map dimensions	168, 168, 168	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	3.2999997, 3.2999997, 3.2999997	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: GTP

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	c	0.24	0/3520	0.40	0/4779
1	d	0.24	0/3620	0.40	0/4917
2	E	0.24	0/5961	0.37	0/8045
3	F	0.24	0/5676	0.37	0/7672
4	Sc	0.22	0/353	0.37	0/471
4	Sd	0.23	0/800	0.38	0/1069
5	Ac	0.25	0/3514	0.41	0/4766
5	Ad	0.25	0/3514	0.41	0/4766
6	Bc	0.25	0/3416	0.41	0/4627
6	Bd	0.25	0/3416	0.41	0/4627
All	All	0.24	0/33790	0.39	0/45739

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	Ac	0	4
5	Ad	0	1
All	All	0	5

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
5	Ac	348	CYS	Peptide

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Mol	Chain	Res	Type	Group
5	Ac	35	HIS	Peptide
5	Ac	36	LEU	Peptide
5	Ac	37	GLU	Peptide
5	Ad	348	CYS	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	c	3448	0	3313	0	0
1	d	3545	0	3396	0	0
2	E	5847	0	5908	134	0
3	F	5557	0	5578	115	0
4	Sc	352	0	347	0	0
4	Sd	792	0	788	0	0
5	Ac	3438	0	3339	0	0
5	Ad	3438	0	3339	0	0
6	Bc	3343	0	3208	0	0
6	Bd	3343	0	3208	0	0
7	Uc	335	0	69	0	0
8	Ud	310	0	64	0	0
9	c	32	0	12	0	0
9	d	32	0	12	0	0
10	Uc	1	0	0	0	0
All	All	33813	0	32581	238	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 14.

All (238) 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:F:663:GLU:HG2	3:F:667:LYS:HD2	1.71	0.72
2:E:131:PHE:HB3	2:E:135:LEU:HD23	1.69	0.72
2:E:384:LEU:HG	2:E:390:LEU:HB2	1.71	0.70
2:E:566:ILE:HG21	2:E:574:ILE:HB	1.73	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:462:GLN:NE2	3:F:466:GLN:OE1	2.26	0.68
2:E:24:LYS:NZ	2:E:26:VAL:O	2.30	0.65
2:E:558:TYR:O	2:E:587:ARG:NH2	2.28	0.65
3:F:667:LYS:HD3	3:F:727:VAL:HG13	1.77	0.65
3:F:664:MET:HG3	3:F:668:LEU:HD12	1.78	0.65
2:E:567:PRO:HG3	3:F:691:LEU:HD13	1.79	0.65
2:E:412:GLY:HA2	3:F:700:GLU:HB3	1.80	0.64
2:E:9:ARG:HG2	3:F:208:GLN:HA	1.80	0.63
2:E:66:VAL:HG11	2:E:110:VAL:HG23	1.80	0.63
2:E:485:GLN:HG2	2:E:561:LYS:HG3	1.80	0.63
2:E:63:LEU:HB3	2:E:109:ILE:HG21	1.81	0.62
2:E:359:ALA:O	2:E:362:GLN:NE2	2.33	0.61
2:E:120:THR:HA	2:E:123:TYR:CE1	2.36	0.61
2:E:78:PHE:HA	2:E:93:LYS:HG3	1.83	0.60
2:E:9:ARG:NH1	3:F:206:GLN:OE1	2.34	0.60
2:E:43:LEU:HD22	2:E:55:GLN:HG3	1.83	0.60
2:E:98:MET:O	2:E:103:LYS:NZ	2.33	0.60
2:E:294:ASP:OD2	2:E:327:ARG:NH1	2.35	0.60
3:F:301:THR:HA	3:F:304:LEU:HB2	1.82	0.60
3:F:580:ARG:O	3:F:585:ARG:NH2	2.34	0.60
2:E:152:LYS:NZ	2:E:156:GLU:OE1	2.35	0.59
2:E:40:SER:OG	2:E:76:ARG:NH2	2.35	0.59
3:F:239:GLU:OE1	3:F:242:ARG:NH2	2.35	0.59
3:F:775:VAL:HG11	3:F:815:GLN:HE22	1.67	0.59
3:F:313:LEU:HD21	3:F:338:MET:HB2	1.85	0.59
2:E:484:ILE:HD11	2:E:560:LEU:HD21	1.85	0.58
2:E:63:LEU:HD22	2:E:109:ILE:HB	1.85	0.58
2:E:102:PHE:HE1	2:E:171:ARG:HH12	1.50	0.58
3:F:232:GLN:NE2	3:F:236:TYR:OH	2.37	0.57
2:E:286:TRP:HZ2	2:E:348:LEU:HA	1.67	0.57
2:E:442:ASN:O	2:E:446:LEU:HG	2.05	0.57
2:E:561:LYS:HB3	2:E:587:ARG:HD2	1.85	0.57
3:F:322:HIS:O	3:F:328:ARG:NH2	2.37	0.57
3:F:456:ILE:O	3:F:460:THR:HG23	2.05	0.57
2:E:445:GLU:OE2	2:E:460:LYS:NZ	2.37	0.57
3:F:464:LEU:HA	3:F:468:PHE:HD2	1.69	0.57
3:F:581:LYS:HB3	3:F:584:LEU:HB3	1.86	0.57
2:E:702:ILE:HA	2:E:705:LYS:HE2	1.88	0.56
3:F:599:PHE:HB3	3:F:773:VAL:HG11	1.87	0.56
3:F:411:PHE:HE1	3:F:570:LEU:HD13	1.70	0.56
2:E:673:GLN:NE2	2:E:677:GLU:OE2	2.39	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:381:ILE:HG21	3:F:407:LYS:HE3	1.88	0.55
2:E:111:ARG:NH2	2:E:187:GLU:OE1	2.39	0.55
2:E:495:LEU:HB3	2:E:501:ILE:HD11	1.87	0.55
3:F:360:GLY:O	3:F:389:ARG:NH1	2.40	0.55
3:F:469:HIS:CE1	3:F:533:ARG:HB2	2.42	0.55
2:E:660:GLU:OE2	2:E:664:ARG:NH2	2.40	0.54
3:F:374:ASP:OD2	3:F:380:HIS:N	2.41	0.54
3:F:361:GLU:HA	3:F:389:ARG:HH22	1.72	0.54
2:E:577:THR:HG22	2:E:581:LYS:HE3	1.89	0.54
3:F:803:GLY:O	3:F:807:THR:HG23	2.08	0.54
2:E:648:ASN:HA	2:E:652:ILE:HB	1.89	0.54
3:F:317:ASN:HA	3:F:320:LYS:HD3	1.90	0.54
3:F:379:TYR:HA	3:F:570:LEU:HG	1.90	0.54
2:E:370:SER:OG	2:E:400:ARG:NH2	2.41	0.53
2:E:762:GLN:HA	2:E:765:ILE:HG22	1.89	0.53
2:E:658:SER:HA	2:E:661:LYS:HG2	1.90	0.53
3:F:641:PHE:HE1	3:F:816:TYR:HD1	1.55	0.53
2:E:243:LYS:HG2	2:E:298:GLU:HG2	1.90	0.53
3:F:185:LEU:HA	3:F:188:VAL:HG12	1.89	0.53
3:F:632:SER:OG	3:F:633:ARG:NH1	2.41	0.53
2:E:4:LYS:HE2	2:E:39:LYS:HA	1.91	0.53
2:E:398:TYR:O	2:E:402:ASN:ND2	2.31	0.52
3:F:207:ILE:HG21	3:F:225:PHE:CD2	2.45	0.52
3:F:423:ASN:HD21	3:F:427:LYS:HE3	1.72	0.52
2:E:21:LEU:HD21	3:F:296:ILE:HG12	1.92	0.52
2:E:801:ALA:HA	2:E:804:ILE:HD13	1.90	0.52
2:E:16:THR:OG1	3:F:302:GLU:OE2	2.25	0.51
2:E:417:ASN:OD1	2:E:421:HIS:NE2	2.43	0.51
3:F:179:ILE:HG21	3:F:199:LEU:HD21	1.92	0.51
3:F:284:TYR:HA	3:F:287:ILE:HG12	1.92	0.51
2:E:6:VAL:HG11	2:E:35:ASN:HB3	1.93	0.51
2:E:326:ILE:O	2:E:328:LYS:NZ	2.36	0.51
2:E:405:PHE:HE2	2:E:573:ILE:HD11	1.76	0.51
2:E:705:LYS:HA	2:E:708:LYS:HE2	1.92	0.51
2:E:754:GLU:HG2	2:E:756:ALA:H	1.76	0.51
2:E:435:VAL:HG23	2:E:593:GLN:HE22	1.76	0.51
3:F:378:ILE:HG23	3:F:566:PRO:HD3	1.93	0.51
2:E:104:THR:HG22	2:E:107:ARG:HH21	1.75	0.51
2:E:424:GLN:O	2:E:431:SER:OG	2.24	0.51
3:F:555:TRP:O	3:F:591:TRP:NE1	2.42	0.51
3:F:573:ASN:HA	3:F:576:ARG:HH12	1.75	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:375:ILE:HD11	2:E:396:LYS:HB3	1.92	0.50
3:F:660:ASN:HD22	3:F:731:PHE:HZ	1.58	0.50
2:E:375:ILE:HG13	2:E:397:CYS:HB3	1.93	0.50
3:F:175:TYR:HD1	3:F:178:THR:HG21	1.76	0.50
3:F:518:GLU:O	3:F:522:LEU:HG	2.11	0.50
3:F:346:LEU:HD23	3:F:362:PHE:HE1	1.75	0.49
2:E:639:PHE:HE2	2:E:699:ILE:HG21	1.77	0.49
2:E:469:ARG:NH1	2:E:480:GLN:O	2.45	0.49
3:F:308:SER:OG	3:F:309:GLY:N	2.45	0.49
3:F:542:ASP:HB2	3:F:563:ILE:HG12	1.95	0.49
2:E:609:THR:O	2:E:613:LYS:NZ	2.45	0.49
2:E:623:ARG:HA	2:E:627:ARG:HG3	1.94	0.49
3:F:662:LYS:HB3	3:F:666:ARG:CZ	2.43	0.49
2:E:52:ARG:HH21	2:E:171:ARG:HH22	1.61	0.49
3:F:470:TYR:O	3:F:474:VAL:HG23	2.12	0.49
2:E:613:LYS:O	2:E:615:ARG:NH1	2.46	0.49
2:E:808:LEU:O	2:E:812:VAL:HG23	2.12	0.49
3:F:381:ILE:HD13	3:F:407:LYS:HE3	1.95	0.49
2:E:201:GLU:O	2:E:205:THR:HG23	2.13	0.48
3:F:320:LYS:O	3:F:328:ARG:NE	2.45	0.48
3:F:487:ASP:OD1	3:F:487:ASP:N	2.45	0.48
2:E:123:TYR:HB2	2:E:139:ALA:HB1	1.95	0.48
2:E:279:TYR:HE2	2:E:332:LEU:HD11	1.77	0.48
2:E:473:ASN:O	2:E:480:GLN:NE2	2.47	0.48
2:E:492:PRO:HB2	2:E:503:PRO:HB3	1.95	0.48
2:E:426:PHE:HA	2:E:586:LEU:HD13	1.94	0.48
3:F:237:LYS:HA	3:F:240:LYS:HE2	1.95	0.48
3:F:684:LEU:HD12	3:F:688:THR:HB	1.96	0.48
2:E:324:TYR:CZ	2:E:352:ILE:HG12	2.49	0.47
2:E:567:PRO:O	2:E:571:ASN:N	2.46	0.47
2:E:8:ASP:O	3:F:209:ILE:N	2.47	0.47
2:E:28:HIS:ND1	2:E:29:GLN:O	2.47	0.47
2:E:100:PRO:O	2:E:104:THR:HG23	2.14	0.47
2:E:621:VAL:HG13	2:E:625:ILE:HD12	1.96	0.47
3:F:664:MET:O	3:F:669:GLN:NE2	2.48	0.47
3:F:830:LEU:HB2	3:F:842:SER:HB3	1.96	0.47
2:E:619:HIS:C	2:E:621:VAL:H	2.17	0.47
2:E:692:LEU:O	2:E:696:GLN:N	2.39	0.47
3:F:444:ASN:O	3:F:447:GLU:HG3	2.15	0.47
3:F:277:VAL:HG11	3:F:283:LEU:HB2	1.97	0.47
3:F:443:THR:HA	3:F:446:PHE:CD2	2.50	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:381:ILE:HG12	3:F:570:LEU:HD23	1.96	0.46
2:E:378:ILE:HG21	2:E:384:LEU:HD22	1.97	0.46
3:F:240:LYS:O	3:F:244:LEU:HG	2.15	0.46
2:E:303:ASP:OD2	2:E:355:LYS:NZ	2.46	0.46
2:E:158:LEU:HD22	2:E:173:LEU:HG	1.97	0.46
2:E:255:ILE:HG23	2:E:265:VAL:HG13	1.96	0.46
3:F:186:LYS:O	3:F:189:SER:OG	2.32	0.46
2:E:563:ASP:OD1	2:E:564:ILE:N	2.49	0.46
3:F:798:SER:O	3:F:798:SER:OG	2.33	0.46
2:E:75:ILE:HG12	2:E:94:ILE:HG23	1.98	0.46
3:F:830:LEU:HD22	3:F:838:LEU:HD22	1.98	0.46
3:F:555:TRP:HB3	3:F:595:LYS:HD2	1.98	0.45
3:F:349:TRP:CZ2	3:F:406:GLY:HA3	2.51	0.45
2:E:140:TYR:HE1	2:E:144:ARG:HH21	1.64	0.45
2:E:565:ASN:ND2	3:F:689:ILE:O	2.50	0.45
3:F:561:ASP:OD1	3:F:562:TYR:N	2.46	0.45
2:E:439:LEU:O	2:E:443:MET:HG3	2.16	0.45
2:E:773:SER:O	2:E:777:LYS:HG2	2.16	0.45
3:F:581:LYS:HB2	3:F:585:ARG:HH21	1.82	0.45
2:E:302:TYR:CE2	2:E:325:PHE:HB2	2.51	0.45
3:F:214:PRO:O	3:F:218:SER:N	2.48	0.45
2:E:58:LEU:HB3	2:E:74:TYR:HE2	1.81	0.45
2:E:423:GLN:HG2	2:E:427:LEU:HD12	1.98	0.45
2:E:606:LEU:HD11	2:E:710:ILE:HD12	1.98	0.45
3:F:429:TYR:CE1	3:F:452:GLN:HB2	2.52	0.45
3:F:469:HIS:HB3	3:F:472:ASP:HB2	1.98	0.45
2:E:405:PHE:HZ	2:E:572:ILE:HD11	1.82	0.44
3:F:464:LEU:HG	3:F:470:TYR:HB2	1.99	0.44
3:F:617:ILE:HD11	3:F:787:PHE:CE1	2.52	0.44
2:E:15:TYR:CE2	2:E:17:ASN:HB2	2.53	0.44
2:E:175:GLN:NE2	2:E:179:GLU:OE2	2.50	0.44
3:F:246:ILE:HB	3:F:250:LYS:HB2	1.99	0.44
3:F:370:THR:HG21	3:F:375:ASP:HA	2.00	0.44
2:E:621:VAL:O	2:E:625:ILE:N	2.33	0.44
3:F:504:SER:HB3	3:F:507:LEU:HD21	2.00	0.44
3:F:496:ALA:HB2	3:F:515:VAL:HG11	2.00	0.44
2:E:349:ARG:HH11	2:E:670:VAL:HG11	1.82	0.44
2:E:631:VAL:O	2:E:635:LYS:HG2	2.18	0.44
3:F:316:LEU:HD22	3:F:331:ALA:HA	1.99	0.44
3:F:411:PHE:HA	3:F:415:TYR:HD2	1.83	0.44
3:F:495:LYS:HB3	3:F:515:VAL:HG13	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:828:ALA:O	3:F:832:ASN:ND2	2.32	0.44
2:E:111:ARG:NE	2:E:187:GLU:OE2	2.50	0.43
2:E:10:ALA:HB2	3:F:222:HIS:CD2	2.52	0.43
2:E:424:GLN:HB3	2:E:479:ARG:HH21	1.83	0.43
3:F:507:LEU:HD13	3:F:512:LEU:HD11	1.99	0.43
2:E:3:ILE:HD13	2:E:38:LEU:HG	2.00	0.43
2:E:266:MET:O	2:E:269:LYS:HG3	2.19	0.43
3:F:573:ASN:OD1	3:F:576:ARG:NH1	2.51	0.43
3:F:188:VAL:HG23	3:F:225:PHE:CE1	2.52	0.43
2:E:303:ASP:HB3	2:E:324:TYR:CD2	2.54	0.43
2:E:579:MET:O	2:E:583:GLN:HG3	2.19	0.43
2:E:82:GLU:H	2:E:88:THR:HG21	1.83	0.43
3:F:313:LEU:HD23	3:F:316:LEU:HD12	2.00	0.43
2:E:426:PHE:CG	2:E:582:TYR:HB3	2.53	0.42
2:E:669:ALA:HA	2:E:672:ILE:HD12	2.00	0.42
3:F:559:THR:HA	3:F:587:PHE:HE2	1.84	0.42
3:F:624:ILE:HD12	3:F:627:ILE:HD12	2.01	0.42
2:E:32:TRP:CE2	3:F:215:ASN:HB2	2.54	0.42
3:F:552:SER:OG	3:F:553:VAL:N	2.52	0.42
2:E:15:TYR:CZ	2:E:17:ASN:HB2	2.55	0.42
2:E:687:ARG:HB2	2:E:791:PHE:CE1	2.54	0.42
2:E:183:ASN:N	2:E:183:ASN:OD1	2.53	0.42
2:E:133:MET:O	2:E:136:GLN:HB2	2.20	0.42
2:E:118:ILE:HG12	2:E:121:ARG:NH2	2.35	0.42
2:E:198:ARG:O	2:E:202:GLU:HG2	2.19	0.42
3:F:781:ASP:O	3:F:785:GLU:HG2	2.19	0.42
2:E:477:LEU:HA	2:E:480:GLN:HB2	2.02	0.42
3:F:522:LEU:O	3:F:526:ARG:NH1	2.53	0.42
2:E:54:VAL:HG22	3:F:170:LEU:HD13	2.01	0.41
2:E:483:MET:HG2	2:E:563:ASP:O	2.19	0.41
3:F:626:ASP:O	3:F:630:LYS:HG2	2.20	0.41
2:E:305:LEU:HD12	2:E:322:THR:HB	2.02	0.41
3:F:752:ASP:OD1	3:F:752:ASP:N	2.53	0.41
2:E:43:LEU:HB2	2:E:97:LYS:HB2	2.02	0.41
3:F:374:ASP:HB2	3:F:379:TYR:CZ	2.56	0.41
2:E:587:ARG:O	2:E:591:VAL:HG23	2.21	0.41
3:F:307:LEU:HD22	3:F:311:THR:HG21	2.03	0.41
3:F:197:SER:HB3	3:F:200:PHE:O	2.21	0.41
3:F:657:ILE:HD12	3:F:657:ILE:HA	1.92	0.41
2:E:760:LEU:HD23	2:E:763:LYS:HD3	2.02	0.41
3:F:629:ASN:O	3:F:633:ARG:HD2	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:660:ASN:ND2	3:F:731:PHE:HZ	2.18	0.41
2:E:482:LEU:HD11	2:E:562:PHE:HB3	2.03	0.41
2:E:639:PHE:CE2	2:E:699:ILE:HG21	2.55	0.41
3:F:188:VAL:HG23	3:F:225:PHE:HE1	1.86	0.41
3:F:425:PHE:CZ	3:F:452:GLN:HG3	2.55	0.41
3:F:457:VAL:O	3:F:461:ASN:ND2	2.54	0.41
3:F:495:LYS:HE3	3:F:515:VAL:HG13	2.03	0.41
2:E:192:ILE:HG12	2:E:254:LYS:HE3	2.02	0.41
2:E:197:PHE:O	2:E:201:GLU:HG2	2.21	0.41
3:F:227:ALA:HB2	3:F:291:ILE:HG12	2.03	0.41
3:F:620:TYR:HE1	3:F:622:PRO:HB3	1.85	0.41
3:F:683:ARG:HD2	3:F:689:ILE:HG12	2.03	0.41
2:E:649:GLN:O	2:E:653:ASP:HB3	2.21	0.41
2:E:758:LEU:O	2:E:762:GLN:HG2	2.21	0.41
3:F:230:LEU:HD22	3:F:298:CYS:SG	2.61	0.41
3:F:468:PHE:HB3	3:F:568:LEU:HD21	2.03	0.41
3:F:564:LEU:HD23	3:F:564:LEU:HA	1.93	0.41
2:E:32:TRP:HH2	2:E:38:LEU:HD13	1.85	0.40
2:E:488:THR:HG23	2:E:489:GLU:HG3	2.03	0.40
2:E:615:ARG:HE	2:E:622:LYS:HE2	1.85	0.40
3:F:521:GLN:HA	3:F:526:ARG:HB3	2.02	0.40
2:E:2:GLU:O	2:E:39:LYS:N	2.45	0.40
3:F:508:PRO:HB2	3:F:510:TYR:HD1	1.86	0.40
2:E:105:PHE:O	2:E:109:ILE:HG12	2.20	0.40
2:E:487:ASP:HB2	2:E:561:LYS:HE2	2.04	0.40
3:F:336:ASN:HA	3:F:339:ILE:HG22	2.02	0.40
2:E:49:PRO:HA	2:E:52:ARG:HB2	2.04	0.40
2:E:487:ASP:O	2:E:559:HIS:HB3	2.20	0.40
2:E:763:LYS:O	2:E:766:GLU:HG3	2.21	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	c	437/473 (92%)	426 (98%)	11 (2%)	0	100	100
1	d	451/473 (95%)	441 (98%)	10 (2%)	0	100	100
2	E	689/823 (84%)	672 (98%)	17 (2%)	0	100	100
3	F	668/846 (79%)	652 (98%)	16 (2%)	0	100	100
4	Sc	40/944 (4%)	40 (100%)	0	0	100	100
4	Sd	93/944 (10%)	89 (96%)	4 (4%)	0	100	100
5	Ac	438/447 (98%)	410 (94%)	27 (6%)	1 (0%)	47	81
5	Ad	438/447 (98%)	426 (97%)	12 (3%)	0	100	100
6	Bc	425/457 (93%)	416 (98%)	9 (2%)	0	100	100
6	Bd	425/457 (93%)	418 (98%)	7 (2%)	0	100	100
All	All	4104/6311 (65%)	3990 (97%)	113 (3%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
5	Ac	404	ALA

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	c	392/420 (93%)	392 (100%)	0	100	100
1	d	403/420 (96%)	403 (100%)	0	100	100
2	E	658/766 (86%)	657 (100%)	1 (0%)	93	96
3	F	626/787 (80%)	626 (100%)	0	100	100
4	Sc	40/901 (4%)	40 (100%)	0	100	100
4	Sd	89/901 (10%)	88 (99%)	1 (1%)	73	84
5	Ac	375/381 (98%)	374 (100%)	1 (0%)	92	95
5	Ad	375/381 (98%)	375 (100%)	0	100	100
6	Bc	366/392 (93%)	366 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
6	Bd	366/392 (93%)	366 (100%)	0	100	100
All	All	3690/5741 (64%)	3687 (100%)	3 (0%)	93	97

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	E	269	LYS
4	Sd	146	ARG
5	Ac	403	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (58) such sidechains are listed below:

Mol	Chain	Res	Type
1	c	9	GLN
1	c	107	ASN
1	c	229	GLN
1	c	385	ASN
1	c	389	ASN
1	c	417	GLN
1	d	9	GLN
1	d	81	ASN
1	d	107	ASN
1	d	303	ASN
1	d	317	ASN
1	d	330	GLN
1	d	417	GLN
2	E	55	GLN
2	E	362	GLN
2	E	411	GLN
2	E	423	GLN
2	E	433	HIS
2	E	565	ASN
2	E	673	GLN
2	E	753	GLN
3	F	169	GLN
3	F	232	GLN
3	F	303	HIS
3	F	430	HIS
3	F	469	HIS
3	F	642	GLN
3	F	720	ASN

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Mol	Chain	Res	Type
4	Sd	117	GLN
4	Sd	122	GLN
4	Sd	152	ASN
4	Sd	157	ASN
4	Sd	198	ASN
5	Ad	8	ASN
5	Ad	18	ASN
5	Ad	134	GLN
5	Ad	198	HIS
5	Ad	234	GLN
5	Ad	254	ASN
5	Ad	301	ASN
5	Ad	330	GLN
5	Ac	74	ASN
5	Ac	92	GLN
5	Ac	102	ASN
5	Ac	177	GLN
5	Ac	259	ASN
5	Ac	284	HIS
5	Ac	335	GLN
5	Ac	366	ASN
6	Bd	28	HIS
6	Bd	137	HIS
6	Bd	191	GLN
6	Bd	219	GLN
6	Bc	134	GLN
6	Bc	191	GLN
6	Bc	291	GLN
6	Bc	334	GLN
6	Bc	350	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z > 2$	Counts	RMSZ	# $ Z > 2$
9	GTP	d	501	-	26,34,34	1.14	2 (7%)	32,54,54	1.64	7 (21%)
9	GTP	c	501	-	26,34,34	1.12	2 (7%)	32,54,54	1.60	7 (21%)

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
9	GTP	d	501	-	-	2/18/38/38	0/3/3/3
9	GTP	c	501	-	-	2/18/38/38	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	d	501	GTP	C5-C6	-4.14	1.39	1.47
9	c	501	GTP	C5-C6	-4.02	1.39	1.47
9	c	501	GTP	C2-N3	2.23	1.38	1.33
9	d	501	GTP	C2-N3	2.20	1.38	1.33

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	d	501	GTP	PA-O3A-PB	-3.92	119.37	132.83
9	c	501	GTP	PA-O3A-PB	-3.70	120.13	132.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	d	501	GTP	PB-O3B-PG	-3.63	120.38	132.83
9	c	501	GTP	PB-O3B-PG	-3.48	120.90	132.83
9	d	501	GTP	C5-C6-N1	3.32	119.81	113.95
9	c	501	GTP	C5-C6-N1	3.21	119.62	113.95
9	d	501	GTP	C3'-C2'-C1'	3.09	105.63	100.98
9	c	501	GTP	C3'-C2'-C1'	3.04	105.56	100.98
9	c	501	GTP	C8-N7-C5	2.94	108.59	102.99
9	d	501	GTP	C8-N7-C5	2.94	108.59	102.99
9	c	501	GTP	C2-N1-C6	-2.86	119.82	125.10
9	d	501	GTP	C2-N1-C6	-2.86	119.83	125.10
9	d	501	GTP	O6-C6-C5	-2.25	119.99	124.37
9	c	501	GTP	O6-C6-C5	-2.17	120.13	124.37

There are no chirality outliers.

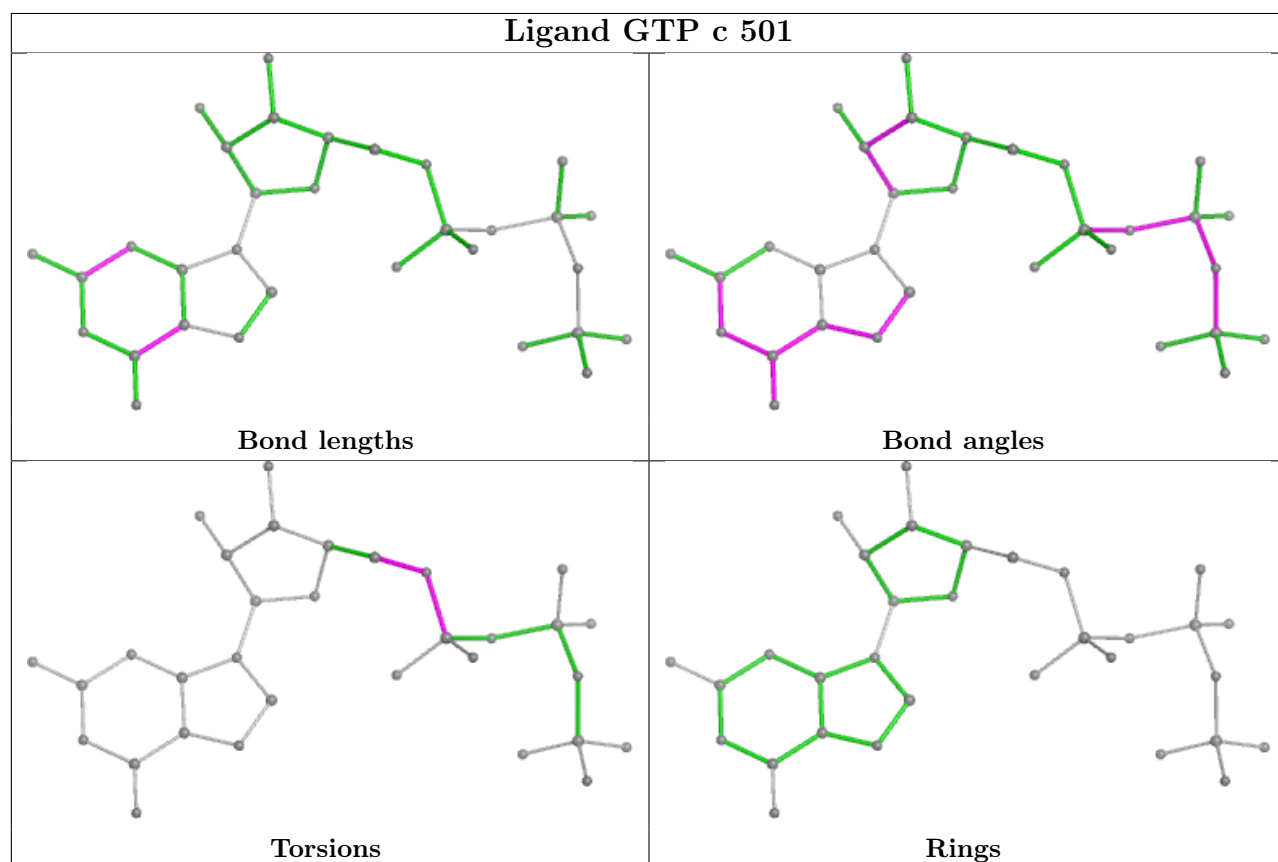
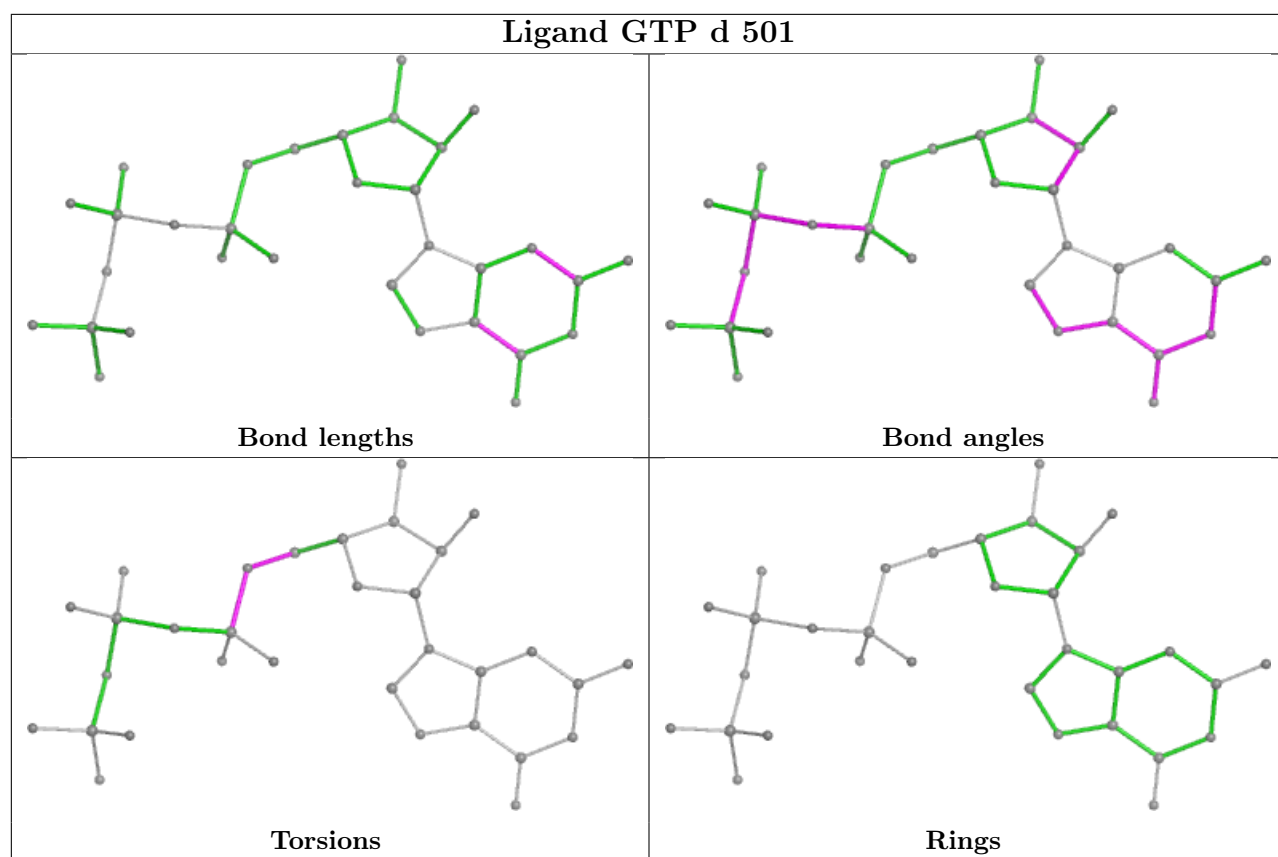
All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	c	501	GTP	C4'-C5'-O5'-PA
9	c	501	GTP	C5'-O5'-PA-O3A
9	d	501	GTP	C4'-C5'-O5'-PA
9	d	501	GTP	C5'-O5'-PA-O1A

There are no ring outliers.

No monomer is involved in short contacts.

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.

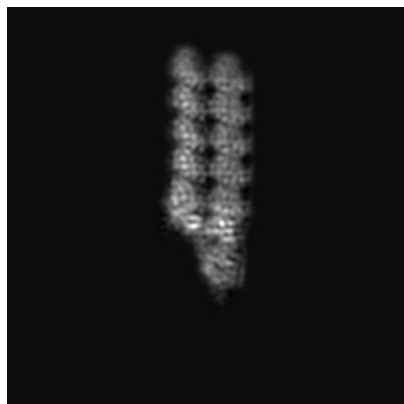
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-18666. 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](#)

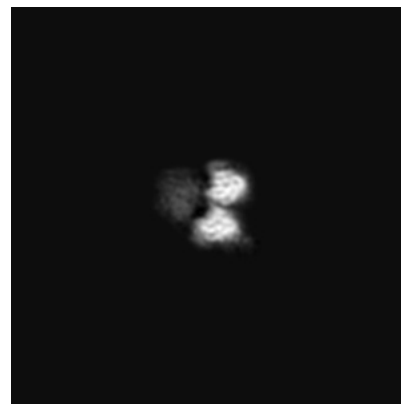
6.1.1 Primary map



X

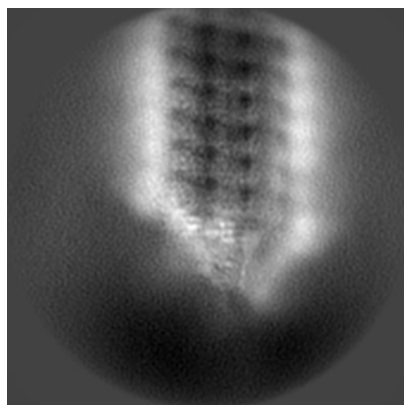


Y

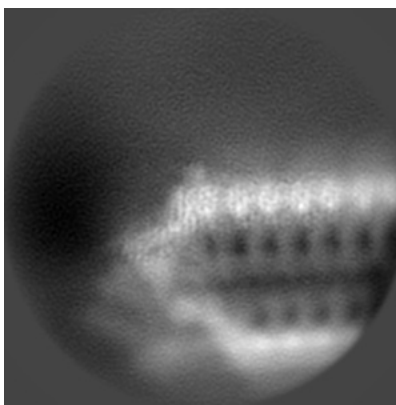


Z

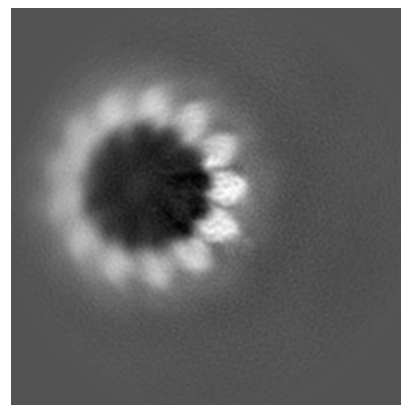
6.1.2 Raw map



X



Y

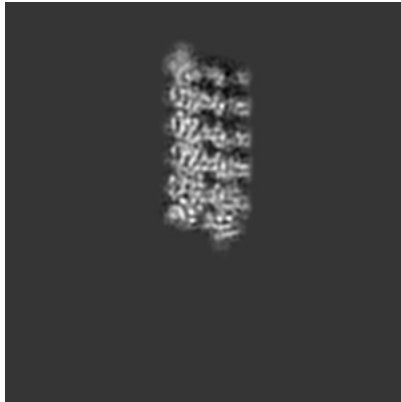


Z

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

6.2 Central slices [i](#)

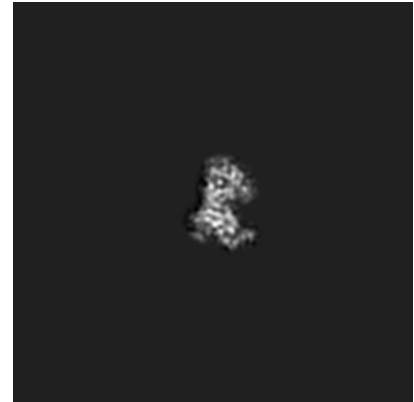
6.2.1 Primary map



X Index: 84

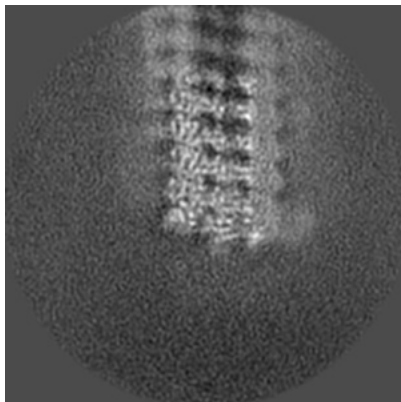


Y Index: 84

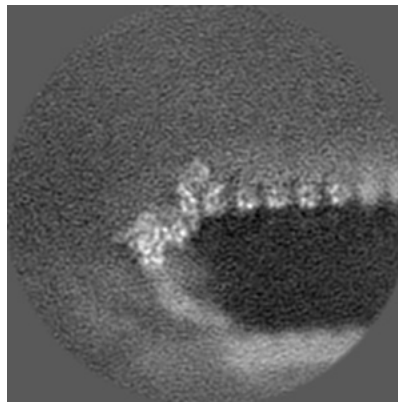


Z Index: 84

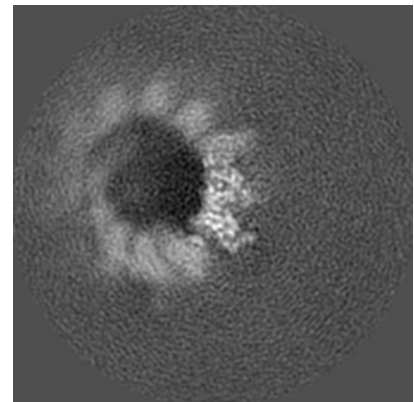
6.2.2 Raw map



X Index: 84



Y Index: 84

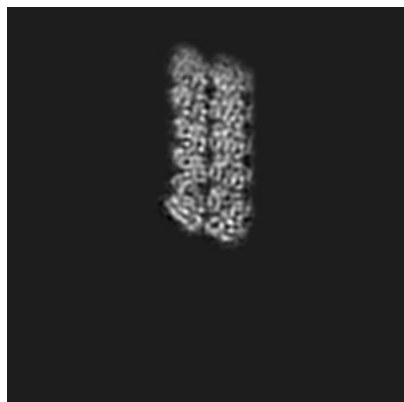


Z Index: 84

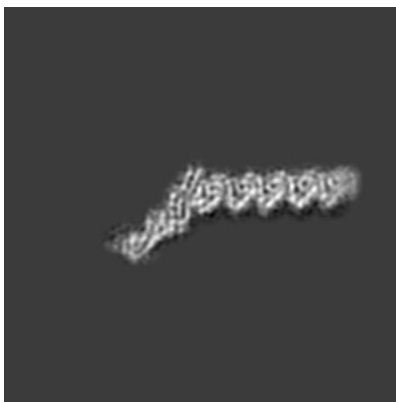
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

6.3.1 Primary map



X Index: 88

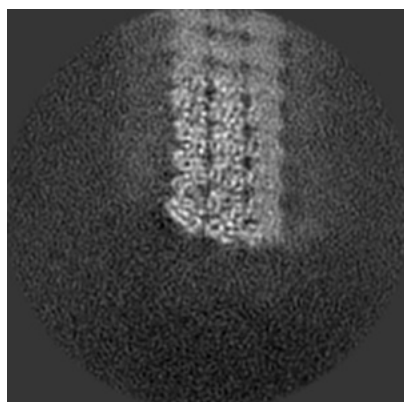


Y Index: 91

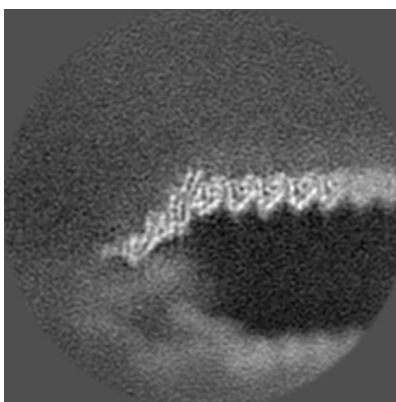


Z Index: 76

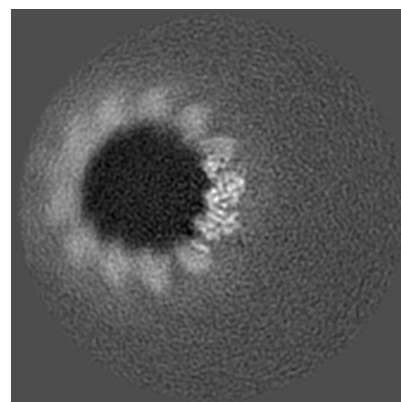
6.3.2 Raw map



X Index: 88



Y Index: 91

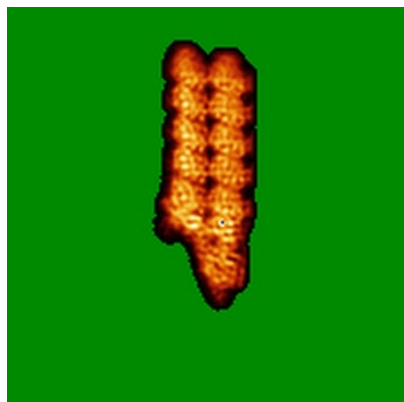


Z Index: 111

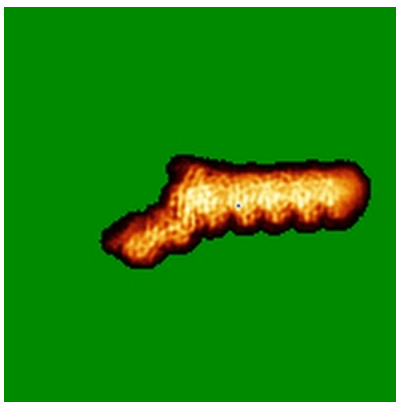
The images above show the largest variance slices of the map in three orthogonal directions.

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

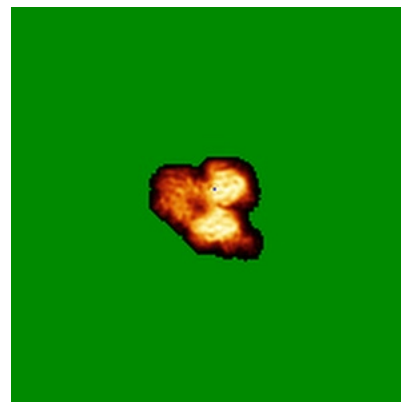
6.4.1 Primary map



X

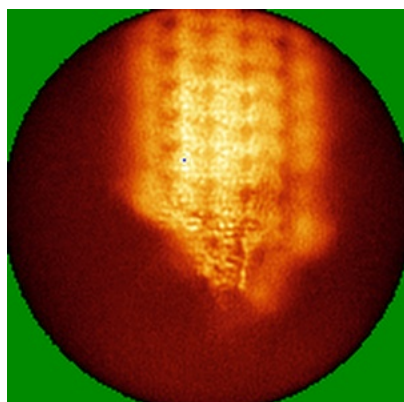


Y

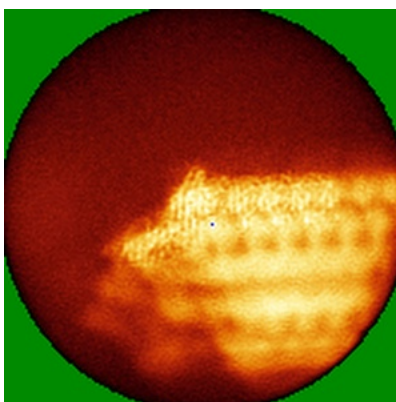


Z

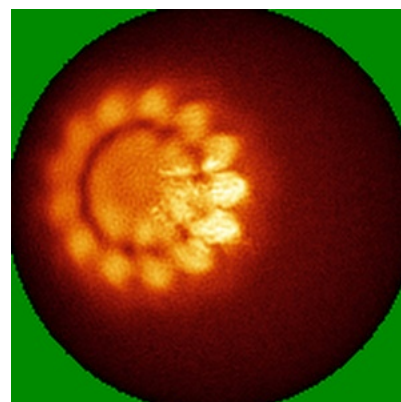
6.4.2 Raw map



X



Y

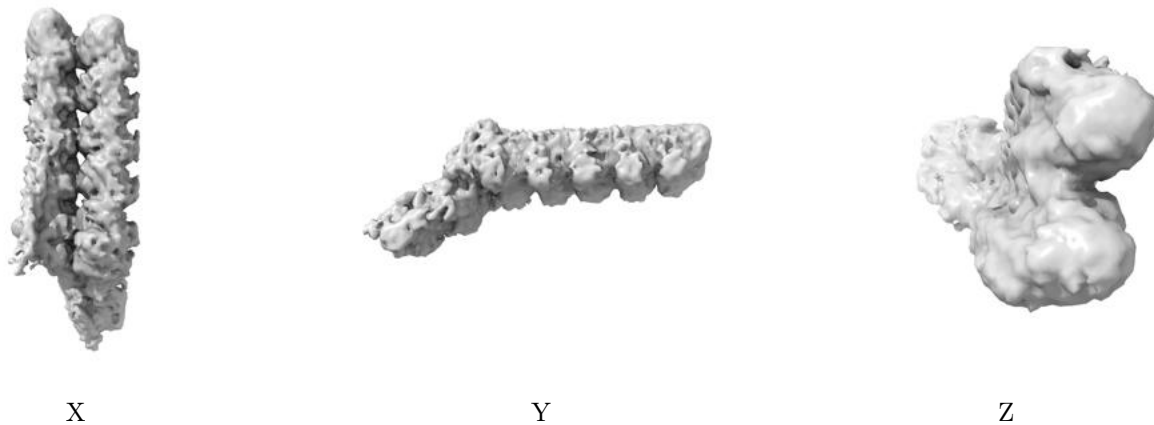


Z

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.

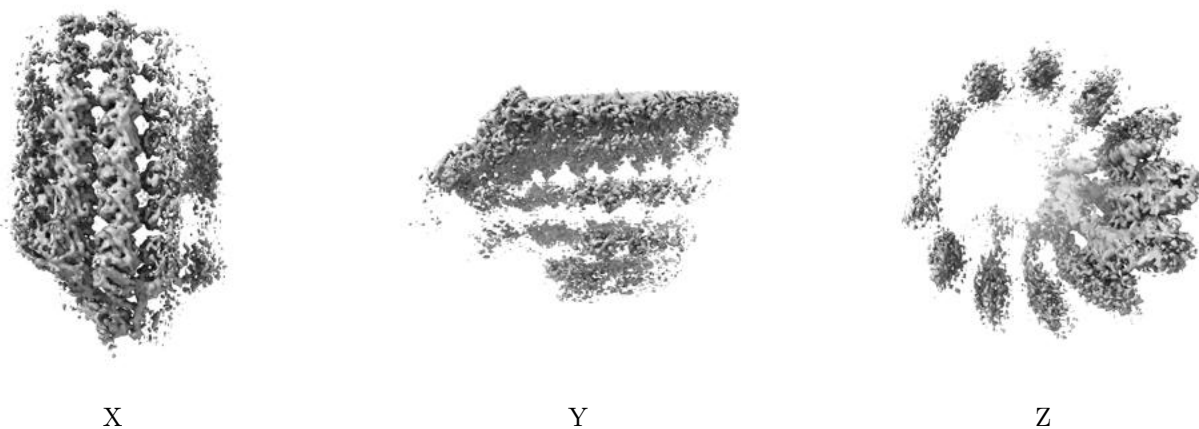
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.163. 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



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.

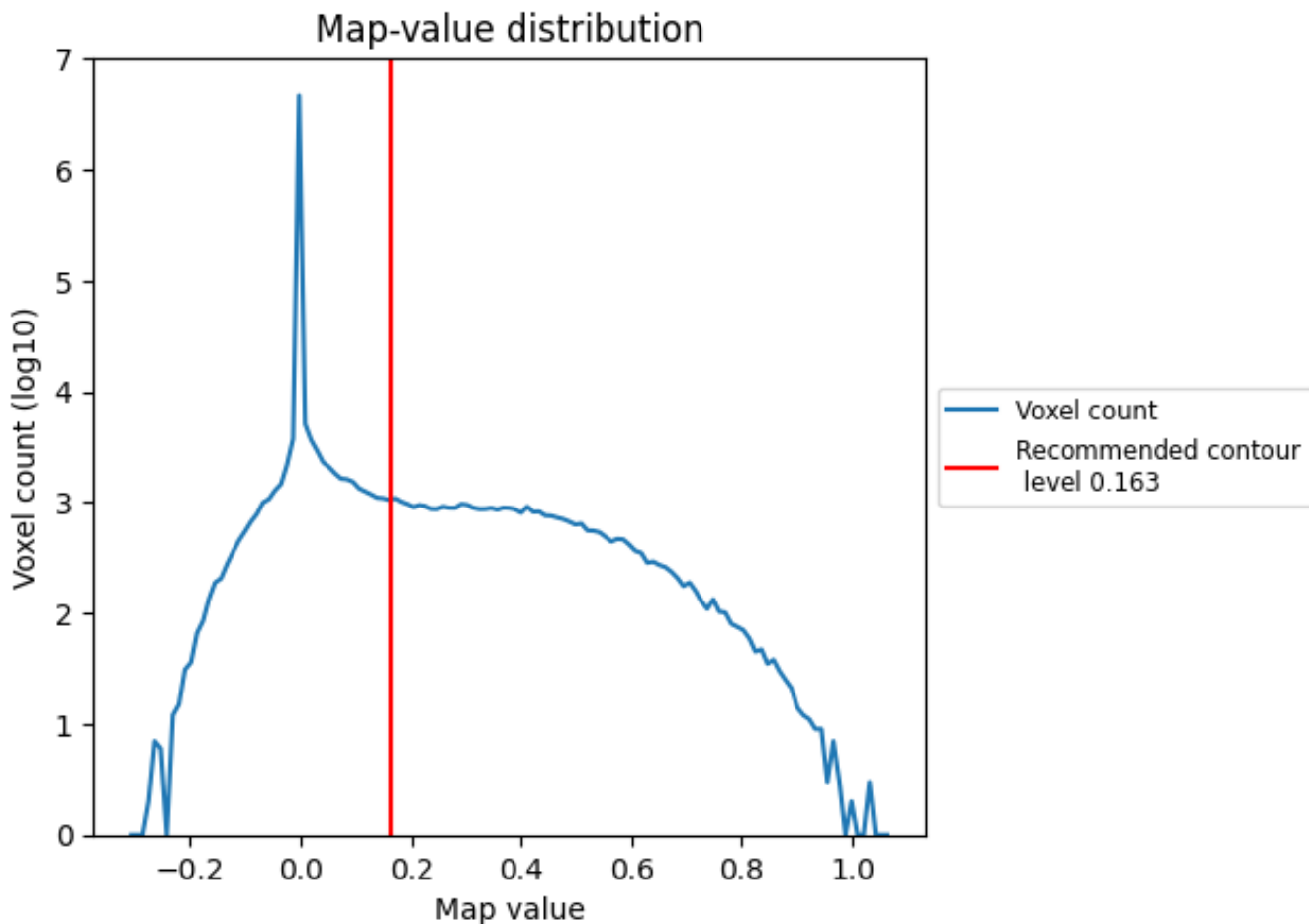
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

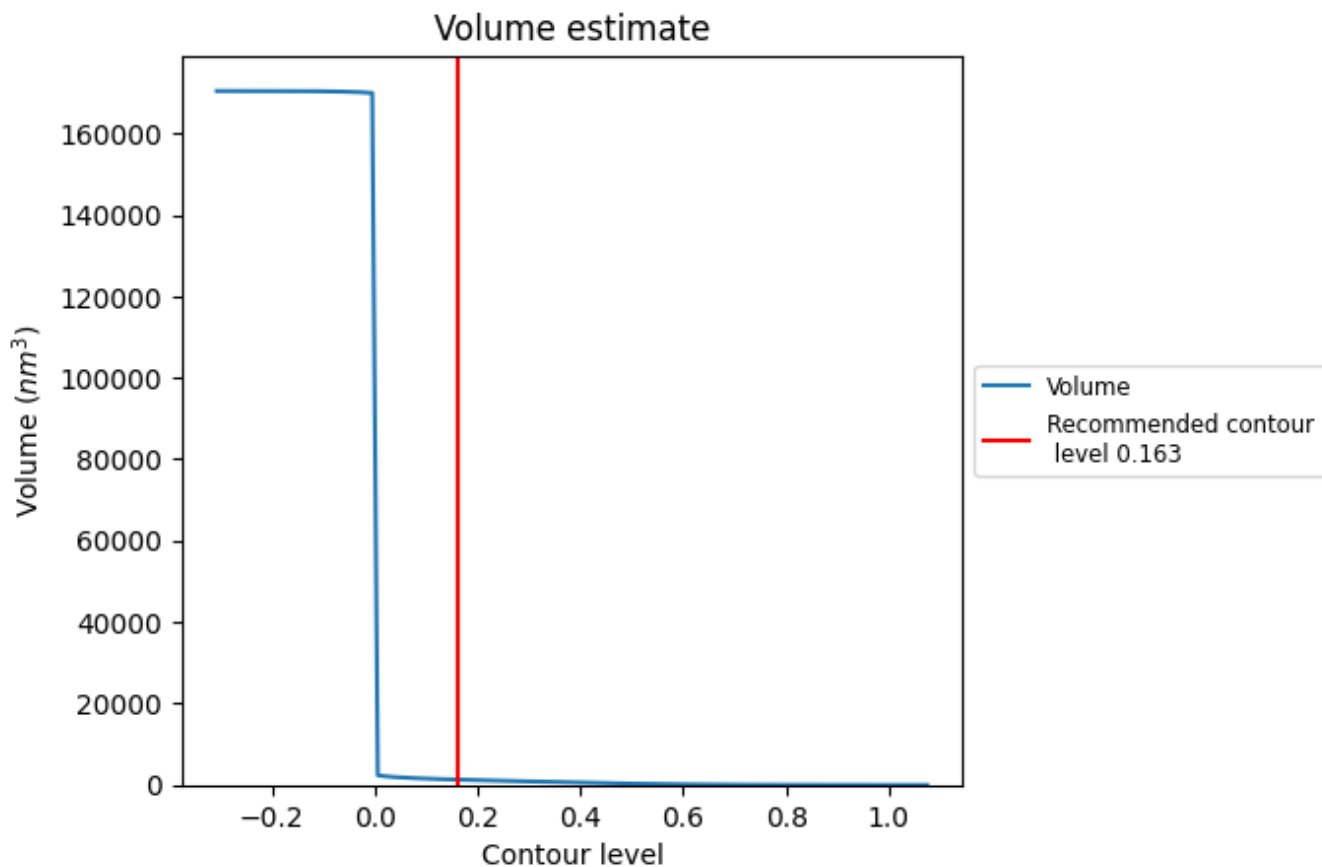
This section contains the results of statistical analysis of the map.

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.

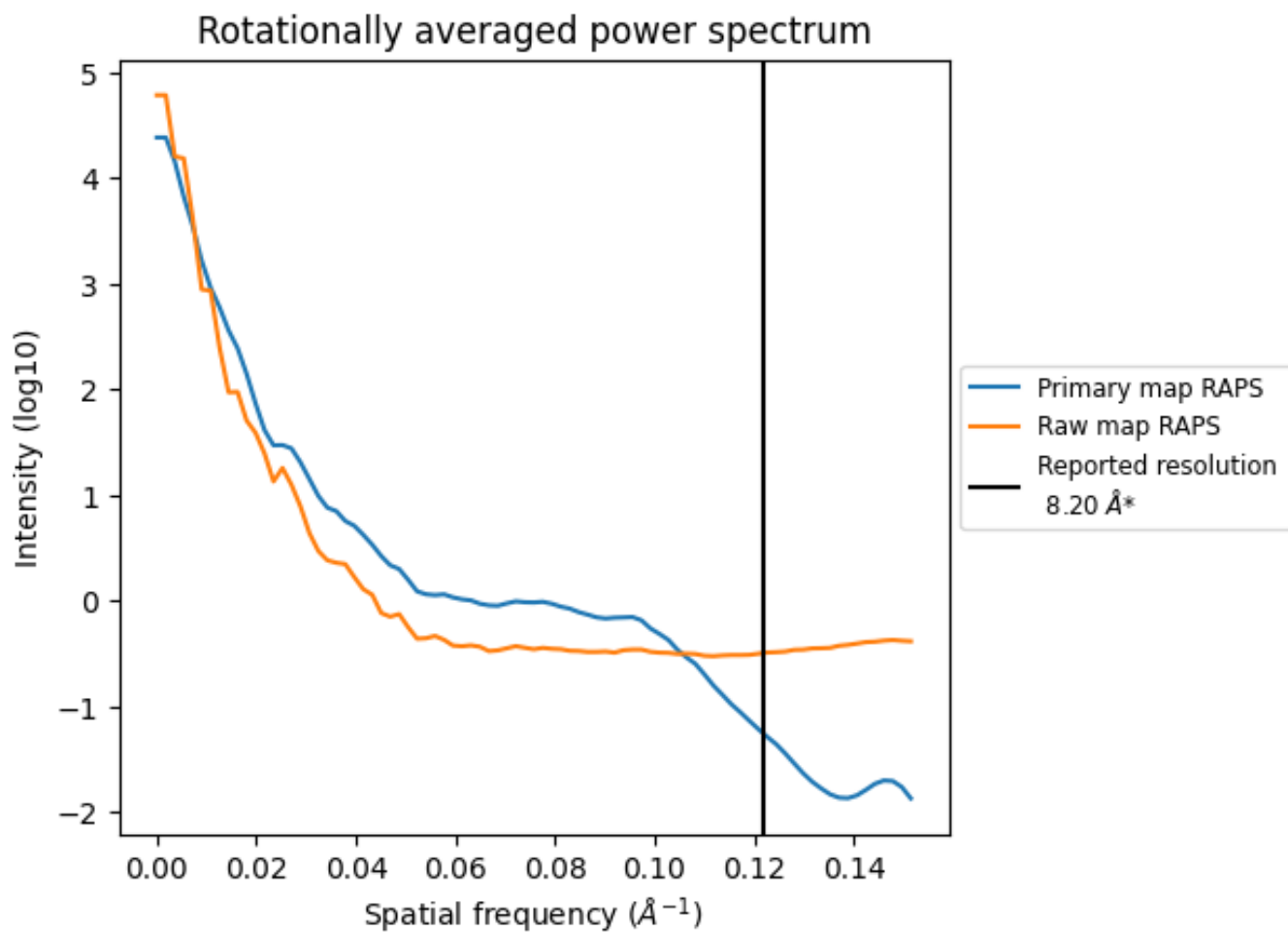
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 1298 nm^3 ; this corresponds to an approximate mass of 1173 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 i

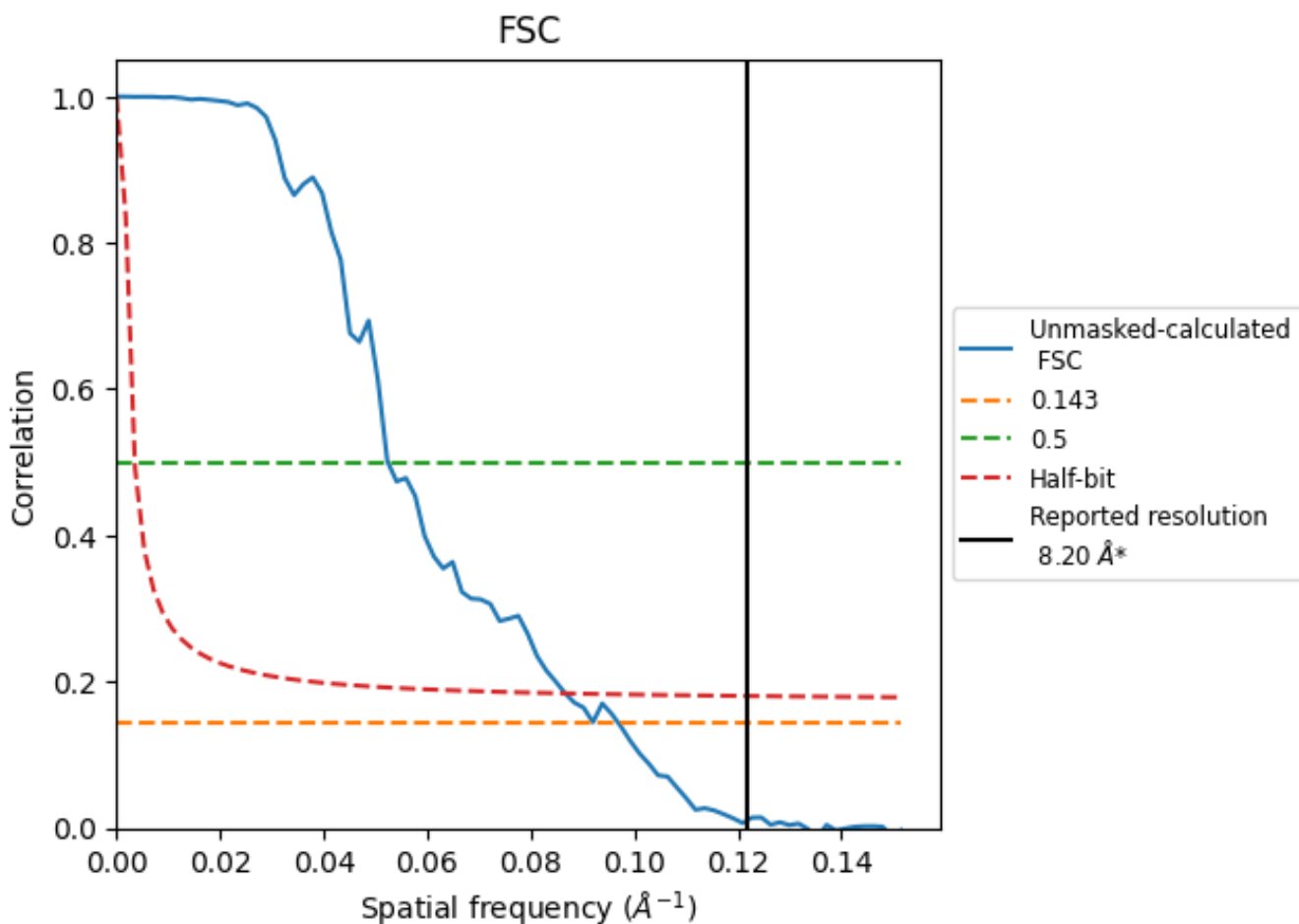


*Reported resolution corresponds to spatial frequency of 0.122 Å⁻¹

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 0.122 Å⁻¹

8.2 Resolution estimates [i](#)

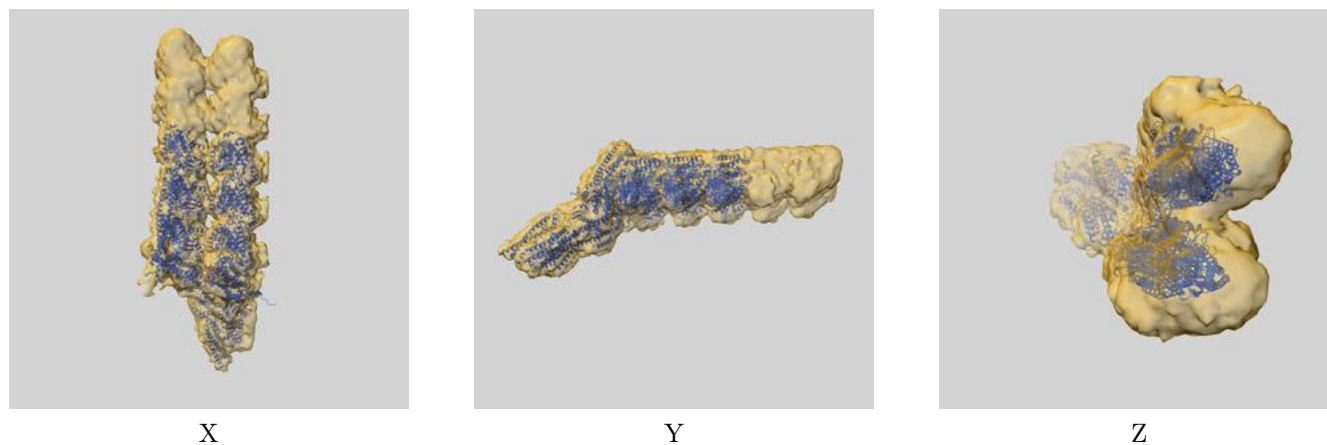
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	8.20	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	10.32	19.08	11.55

*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 10.32 differs from the reported value 8.2 by more than 10 %

9 Map-model fit [i](#)

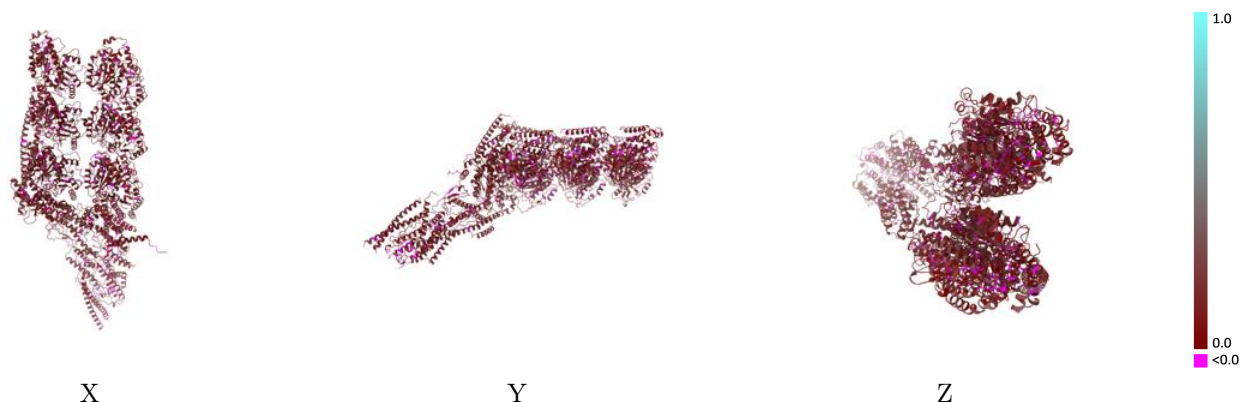
This section contains information regarding the fit between EMDB map EMD-18666 and PDB model 8QV3. Per-residue inclusion information can be found in section 3 on page 7.

9.1 Map-model overlay [i](#)



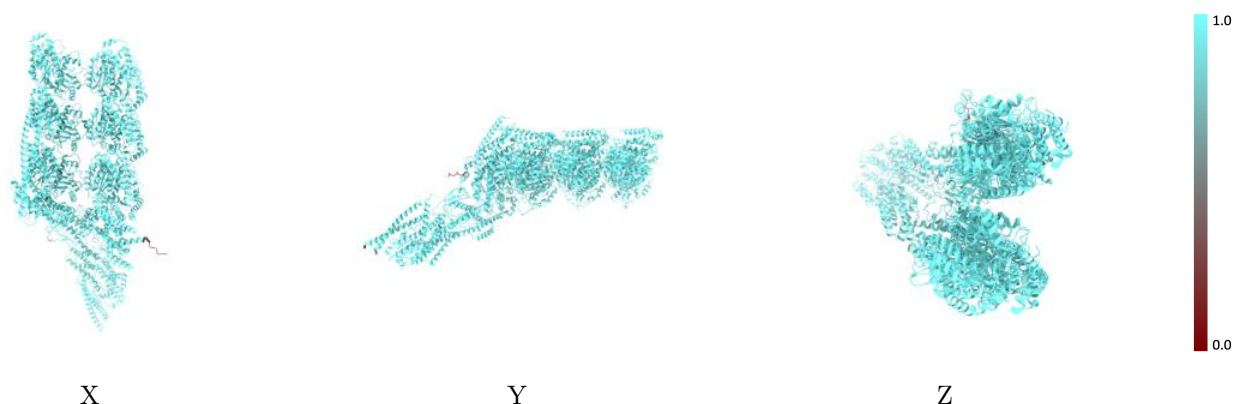
The images above show the 3D surface view of the map at the recommended contour level 0.163 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



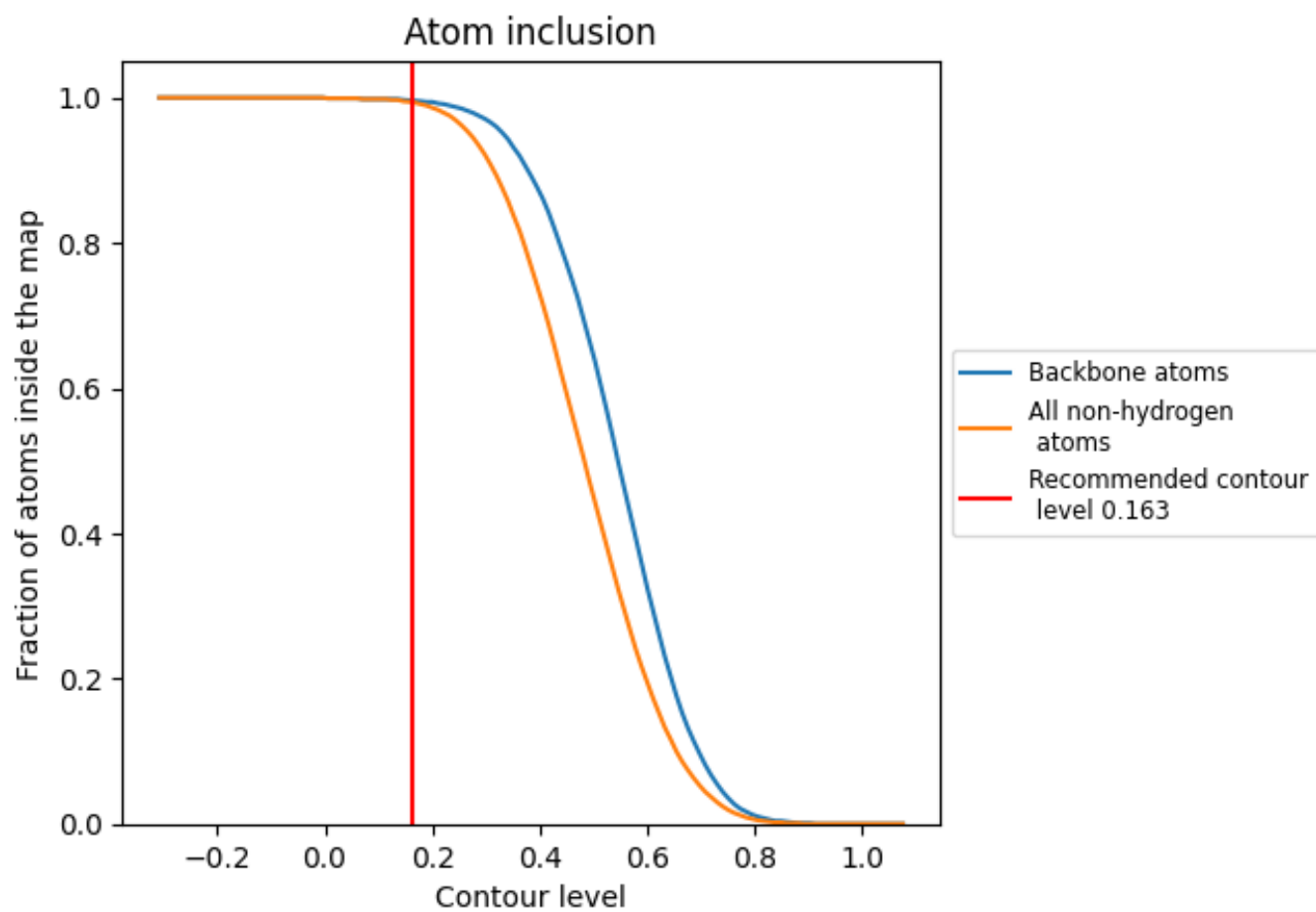
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.163).



























9.4 Atom inclusion [i](#)



At the recommended contour level, 100% of all backbone atoms, 99% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary

The table lists the average atom inclusion at the recommended contour level (0.163) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.9940	 0.1440
Ac	 0.9980	 0.1360
Ad	 0.9990	 0.1430
Bc	 0.9980	 0.1450
Bd	 0.9990	 0.1510
E	 0.9960	 0.1390
F	 0.9930	 0.1530
Sc	 0.9770	 0.1360
Sd	 0.9020	 0.1170
Uc	 0.9940	 0.2200
Ud	 0.9970	 0.2180
c	 0.9970	 0.1370
d	 0.9960	 0.1360

