



Full wwPDB EM Validation Report ⓘ

Feb 3, 2026 – 06:17 pm GMT

PDB ID : 9QO1 / pdb_00009qo1
EMDB ID : EMD-53253
Title : Activated 9-subunit COP9 signalosome and neddylated SCF (SKP1-SKP2-CKS1) complex structure
Authors : Ding, S.; Clapperton, J.A.; Maeots, M.E.; Shaaban, M.; Enchev, R.I.
Deposited on : 2025-03-25
Resolution : 3.23 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:

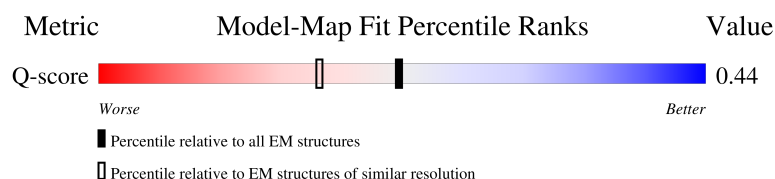
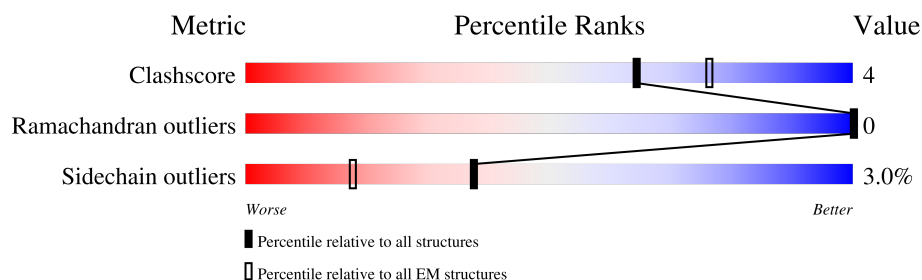
EMDB validation analysis : 0.0.1.dev129
Mogul : 1.8.4, CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up 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) : 2.47

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 3.23 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.



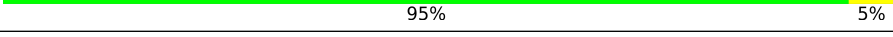
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	210492	15764	-
Ramachandran outliers	207382	16835	-
Sidechain outliers	206894	16415	-
Q-score	-	25397	14612 (2.73 - 3.73)

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	491	
2	B	443	
3	C	423	
4	D	406	

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Mol	Chain	Length	Quality of chain
5	E	334	 77%7%16%
6	F	327	 77%6%17%
7	G	264	 72%8%19%
8	H	209	 74%8%18%
9	I	776	 56%9%34%
10	J	108	 67%6%27%
11	P	57	 30%5%63%
12	K	76	 95%5%

2 Entry composition [i](#)

There are 14 unique types of molecules in this entry. The entry contains 25382 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 COP9 signalosome complex subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	406	Total	C	N	O	S	0	0
			3213	2033	555	603	22		

- Molecule 2 is a protein called COP9 signalosome complex subunit 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	404	Total	C	N	O	S	0	0
			3305	2101	567	622	15		

- Molecule 3 is a protein called COP9 signalosome complex subunit 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	350	Total	C	N	O	S	0	0
			2809	1793	471	522	23		

- Molecule 4 is a protein called COP9 signalosome complex subunit 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	381	Total	C	N	O	S	0	0
			3067	1938	531	585	13		

- Molecule 5 is a protein called COP9 signalosome complex subunit 5.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	E	281	Total	C	N	O	S	0	0
			2228	1425	371	419	13		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	138	ALA	HIS	conflict	UNP Q92905

- Molecule 6 is a protein called COP9 signalosome complex subunit 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	F	272	Total	C	N	O	S	0	0
			2156	1382	354	405	15		

- Molecule 7 is a protein called COP9 signalosome complex subunit 7b.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	G	214	Total	C	N	O	S	0	0
			1694	1074	288	326	6		

- Molecule 8 is a protein called COP9 signalosome complex subunit 8.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	H	171	Total	C	N	O	S	0	0
			1359	868	235	252	4		

- Molecule 9 is a protein called Cullin-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	I	509	Total	C	N	O	S	0	0
			4073	2590	684	781	18		

- Molecule 10 is a protein called E3 ubiquitin-protein ligase RBX1.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	J	79	Total	C	N	O	S	0	0
			661	423	120	109	9		

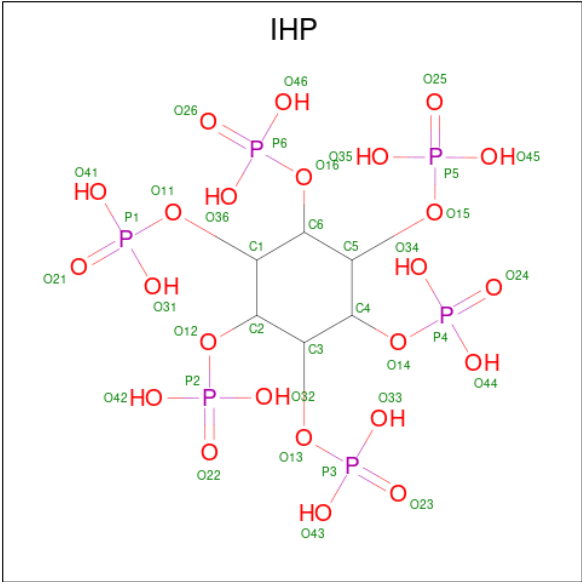
- Molecule 11 is a protein called COP9 signalosome complex subunit 9.

Mol	Chain	Residues	Atoms				AltConf	Trace
11	P	21	Total	C	N	O	0	0
			179	113	26	40		

- Molecule 12 is a protein called NEDD8.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	K	76	Total	C	N	O	S	0	0
			599	378	104	115	2		

- Molecule 13 is INOSITOL HEXAKISPHOSPHATE (CCD ID: IHP) (formula: C₆H₁₈O₂₄P₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
13	B	1	Total	C	O	P	0
			36	6	24	6	

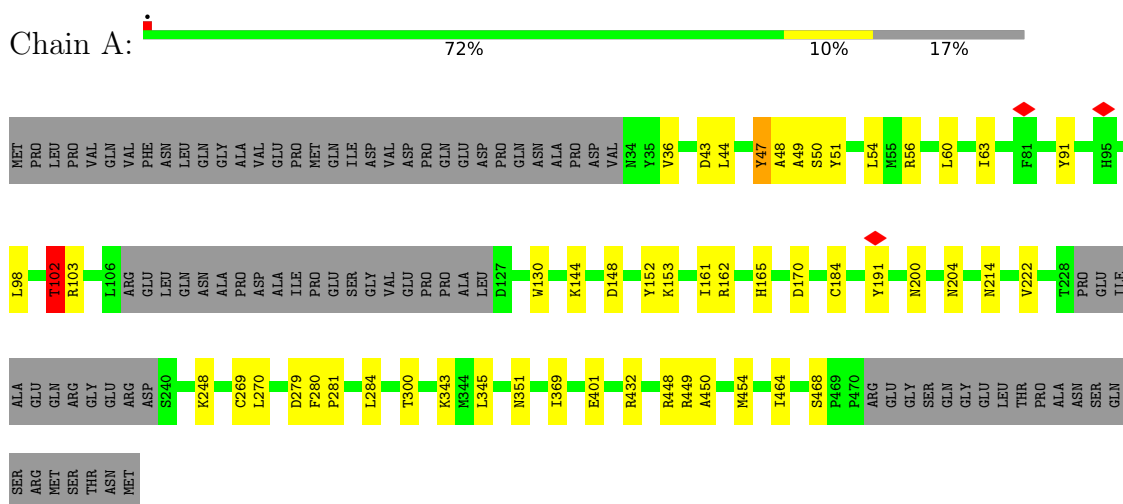
- Molecule 14 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
14	J	3	Total	Zn	0
			3	3	

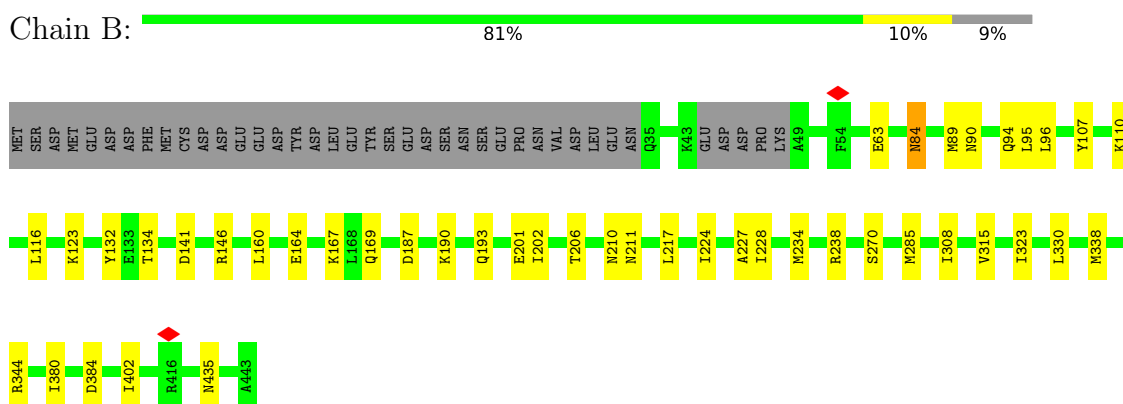
3 Residue-property plots [i](#)

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.

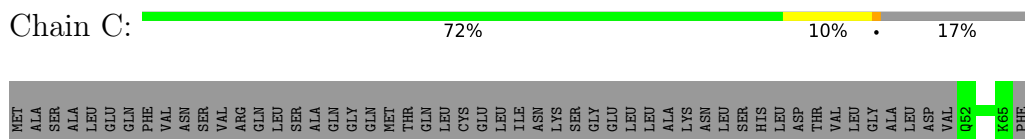
- Molecule 1: COP9 signalosome complex subunit 1

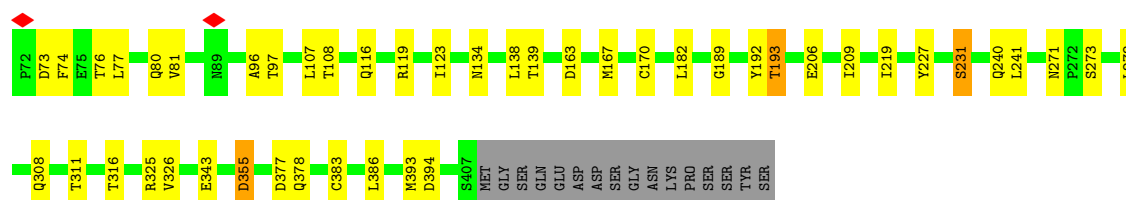


- Molecule 2: COP9 signalosome complex subunit 2

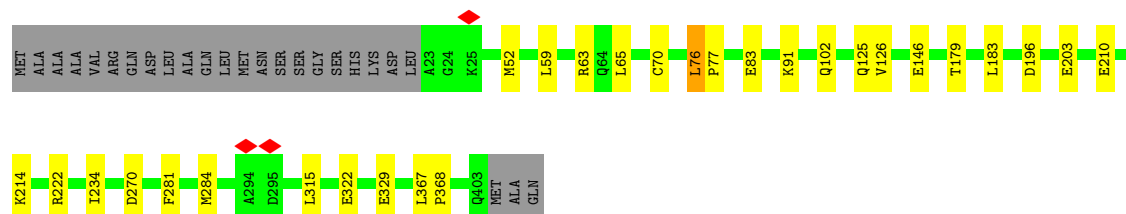
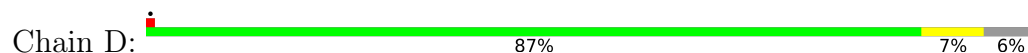


- Molecule 3: COP9 signalosome complex subunit 3

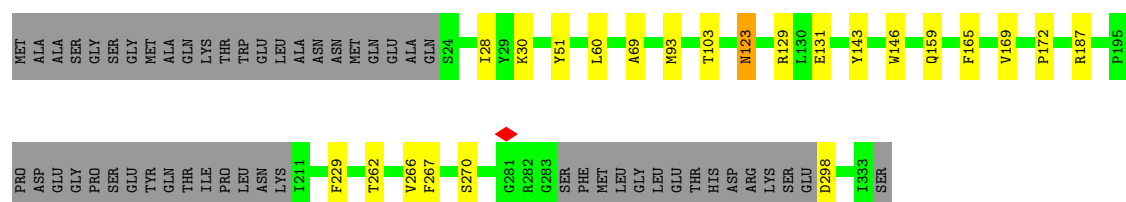




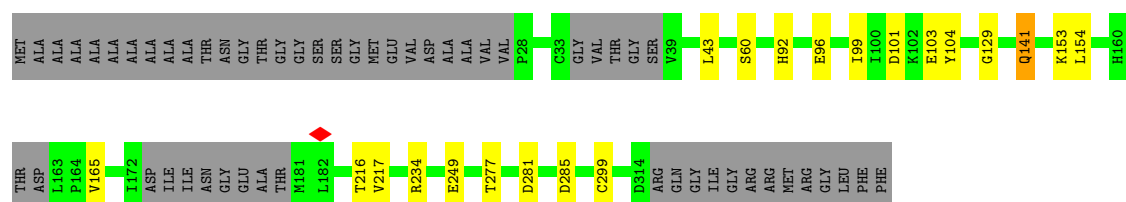
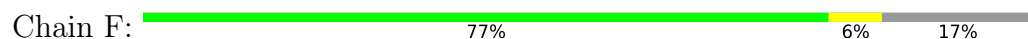
• Molecule 4: COP9 signalosome complex subunit 4



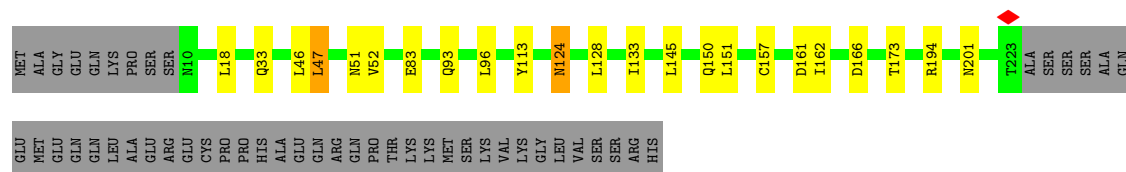
• Molecule 5: COP9 signalosome complex subunit 5



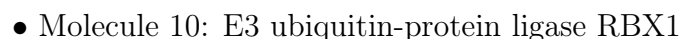
• Molecule 6: COP9 signalosome complex subunit 6



• Molecule 7: COP9 signalosome complex subunit 7b



• Molecule 8: COP9 signalosome complex subunit 8





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	556830	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 ($e^-/\text{\AA}^2$)	47	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	5000	Depositor
Magnification	Not provided	
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	2.062	Depositor
Minimum map value	-0.002	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.026	Depositor
Recommended contour level	0.0174	Depositor
Map size ($\text{\AA}$)	345.6, 345.6, 345.6	wwPDB
Map dimensions	320, 320, 320	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.08, 1.08, 1.08	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: IHP, ZN

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	0.26	2/3266 (0.1%)	0.58	7/4406 (0.2%)
2	B	0.17	0/3361	0.39	0/4519
3	C	0.12	0/2863	0.30	0/3863
4	D	0.12	0/3118	0.30	0/4214
5	E	0.15	0/2273	0.31	0/3067
6	F	0.13	0/2201	0.31	0/2981
7	G	0.22	0/1714	0.48	2/2319 (0.1%)
8	H	0.11	0/1390	0.29	0/1889
9	I	0.16	0/4133	0.34	0/5564
10	J	0.12	0/682	0.33	0/925
11	P	0.11	0/183	0.36	0/245
12	K	0.13	0/604	0.33	0/808
All	All	0.17	2/25788 (0.0%)	0.38	9/34800 (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	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	343	LYS	C-N	8.23	1.45	1.33
1	A	102	THR	C-N	-5.49	1.26	1.33

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	102	THR	O-C-N	16.32	139.00	122.03
1	A	102	THR	CA-C-N	-15.74	98.82	120.38
1	A	102	THR	C-N-CA	-15.74	98.82	120.38
7	G	93	GLN	N-CA-C	-6.36	104.45	111.82
1	A	47	TYR	N-CA-CB	-5.41	102.14	110.20
1	A	343	LYS	CA-C-N	5.24	127.73	120.29
1	A	343	LYS	C-N-CA	5.24	127.73	120.29
1	A	343	LYS	O-C-N	-5.19	116.62	122.12
7	G	96	LEU	N-CA-C	-5.12	105.78	111.36

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	102	THR	Mainchain

5.2 Too-close contacts

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	3213	0	3227	33	0
2	B	3305	0	3353	29	0
3	C	2809	0	2821	27	0
4	D	3067	0	3067	18	0
5	E	2228	0	2216	10	0
6	F	2156	0	2134	14	0
7	G	1694	0	1737	10	0
8	H	1359	0	1339	11	0
9	I	4073	0	4037	48	0
10	J	661	0	613	3	0
11	P	179	0	144	2	0
12	K	599	0	638	2	0
13	B	36	0	6	4	0
14	J	3	0	0	0	0
All	All	25382	0	25332	196	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 (196) 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)
9:I:621:THR:CG2	9:I:624:GLN:NE2	1.70	1.52
9:I:621:THR:HG23	9:I:624:GLN:NE2	1.35	1.21
9:I:621:THR:HG22	9:I:624:GLN:NE2	1.44	1.09
9:I:621:THR:HG23	9:I:624:GLN:HE21	1.39	0.87
9:I:624:GLN:HE21	9:I:624:GLN:H	1.22	0.83
9:I:621:THR:HG22	9:I:624:GLN:CD	2.06	0.79
9:I:268:LEU:HD21	9:I:325:LEU:HD11	1.68	0.75
3:C:77:LEU:O	3:C:81:VAL:HG23	1.87	0.74
4:D:102:GLN:N	4:D:102:GLN:OE1	2.21	0.73
2:B:164:GLU:OE2	2:B:167:LYS:N	2.21	0.72
6:F:249:GLU:N	6:F:249:GLU:OE1	2.25	0.70
9:I:317:GLU:N	9:I:317:GLU:OE1	2.24	0.70
3:C:240:GLN:OE1	3:C:240:GLN:N	2.24	0.69
1:A:448:ARG:NH2	3:C:206:GLU:OE1	2.26	0.69
1:A:161:ILE:O	1:A:165:HIS:ND1	2.26	0.68
9:I:300:LEU:O	9:I:304:HIS:ND1	2.27	0.68
9:I:284:GLN:N	9:I:284:GLN:OE1	2.27	0.68
1:A:162:ARG:NH2	1:A:191:TYR:O	2.28	0.67
5:E:129:ARG:NH2	5:E:131:GLU:OE2	2.28	0.67
5:E:159:GLN:OE1	5:E:187:ARG:NH2	2.28	0.66
9:I:680:LEU:HD12	9:I:681:ARG:H	1.61	0.66
9:I:370:VAL:HG22	9:I:374:HIS:CE1	2.31	0.65
1:A:44:LEU:O	1:A:47:TYR:HB3	1.97	0.64
2:B:169:GLN:O	2:B:169:GLN:NE2	2.30	0.64
13:B:501:IHP:O46	13:B:501:IHP:O35	2.15	0.64
9:I:275:VAL:O	9:I:279:LEU:N	2.31	0.63
3:C:393:MET:HA	3:C:393:MET:HE2	1.80	0.63
6:F:141:GLN:N	6:F:141:GLN:OE1	2.31	0.63
9:I:633:MET:SD	9:I:633:MET:N	2.72	0.63
2:B:201:GLU:OE1	2:B:217:LEU:HD13	1.98	0.63
4:D:322:GLU:OE2	4:D:322:GLU:N	2.28	0.62
8:H:13:PHE:HE1	8:H:105:ILE:HG22	1.64	0.62
9:I:370:VAL:O	9:I:374:HIS:ND1	2.33	0.61
1:A:48:ALA:C	1:A:50:SER:N	2.54	0.61
5:E:262:THR:O	5:E:266:VAL:HG23	1.99	0.61
13:B:501:IHP:O12	13:B:501:IHP:O31	2.19	0.60
6:F:99:ILE:HG21	6:F:141:GLN:HE21	1.65	0.60
9:I:388:ASP:OD1	9:I:390:GLY:N	2.34	0.60
4:D:59:LEU:O	4:D:63:ARG:NH1	2.34	0.60
9:I:280:HIS:ND1	9:I:281:GLU:OE1	2.35	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
9:I:680:LEU:HD12	9:I:681:ARG:N	2.16	0.59
9:I:559:LEU:HD21	10:J:27:TRP:CH2	2.38	0.59
12:K:32:GLU:N	12:K:32:GLU:OE1	2.37	0.58
4:D:203:GLU:N	4:D:203:GLU:OE2	2.37	0.57
3:C:138:LEU:HD23	3:C:139:THR:N	2.19	0.57
9:I:281:GLU:OE1	9:I:281:GLU:N	2.39	0.56
12:K:3:ILE:HG21	12:K:61:ILE:HD11	1.87	0.56
2:B:380:ILE:HD11	2:B:384:ASP:HB3	1.87	0.56
9:I:386:ASN:O	9:I:386:ASN:ND2	2.39	0.56
9:I:624:GLN:NE2	9:I:624:GLN:H	2.00	0.56
1:A:102:THR:O	1:A:103:ARG:C	2.43	0.55
6:F:99:ILE:HG21	6:F:141:GLN:NE2	2.21	0.55
9:I:625:LEU:O	9:I:626:THR:C	2.49	0.55
7:G:124:ASN:N	7:G:124:ASN:OD1	2.40	0.54
9:I:416:SER:O	9:I:416:SER:OG	2.25	0.54
7:G:18:LEU:HD23	7:G:18:LEU:O	2.07	0.54
1:A:56:ARG:O	1:A:60:LEU:HD22	2.07	0.54
2:B:190:LYS:NZ	2:B:193:GLN:OE1	2.40	0.54
8:H:143:GLU:O	8:H:147:GLY:N	2.42	0.52
2:B:228:ILE:O	2:B:228:ILE:HG13	2.10	0.52
9:I:498:PHE:O	9:I:502:SER:OG	2.23	0.52
1:A:48:ALA:O	1:A:49:ALA:C	2.53	0.51
9:I:626:THR:HG23	9:I:633:MET:SD	2.50	0.51
5:E:143:TYR:O	5:E:146:TRP:NE1	2.41	0.51
5:E:30:LYS:NZ	6:F:60:SER:O	2.35	0.51
9:I:532:ASP:OD1	9:I:532:ASP:N	2.36	0.51
11:P:45:ASN:O	11:P:45:ASN:ND2	2.44	0.51
5:E:28:ILE:HD11	5:E:229:PHE:CE2	2.45	0.50
11:P:54:ASP:OD1	11:P:54:ASP:N	2.44	0.50
2:B:107:TYR:OH	13:B:501:IHP:O41	2.28	0.50
9:I:285:ASP:N	9:I:285:ASP:OD1	2.45	0.50
9:I:314:ASP:O	9:I:318:ASP:N	2.41	0.50
1:A:449:ARG:NH1	2:B:435:ASN:OD1	2.45	0.50
9:I:590:LEU:N	9:I:601:LEU:O	2.42	0.50
1:A:47:TYR:CE2	1:A:63:ILE:HD11	2.47	0.50
2:B:116:LEU:HD21	2:B:132:TYR:CE2	2.47	0.49
2:B:338:MET:HE3	2:B:344:ARG:HG2	1.94	0.49
7:G:83:GLU:N	7:G:83:GLU:OE2	2.45	0.49
6:F:96:GLU:N	6:F:96:GLU:OE1	2.46	0.49
8:H:13:PHE:CE1	8:H:105:ILE:HG22	2.45	0.49
7:G:51:ASN:OD1	7:G:51:ASN:N	2.44	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
9:I:237:LEU:C	9:I:237:LEU:HD23	2.38	0.49
1:A:144:LYS:NZ	1:A:148:ASP:OD2	2.38	0.49
2:B:146:ARG:NE	9:I:483:ASP:OD2	2.40	0.49
3:C:209:ILE:HD12	3:C:241:LEU:HD21	1.95	0.49
10:J:74:VAL:HG13	10:J:102:GLU:CB	2.43	0.49
3:C:116:GLN:OE1	3:C:119:ARG:NH1	2.39	0.48
2:B:234:MET:O	2:B:238:ARG:HG2	2.13	0.48
5:E:28:ILE:HD12	5:E:93:MET:HE2	1.95	0.48
9:I:306:GLU:O	9:I:311:LEU:N	2.45	0.48
1:A:36:VAL:HG23	1:A:36:VAL:O	2.14	0.48
1:A:47:TYR:C	1:A:49:ALA:N	2.69	0.48
2:B:160:LEU:O	2:B:160:LEU:HD23	2.13	0.48
6:F:154:LEU:HD12	6:F:165:VAL:HG12	1.95	0.48
8:H:16:LEU:HD12	8:H:16:LEU:O	2.13	0.48
9:I:596:LYS:HA	9:I:596:LYS:HE3	1.96	0.48
3:C:163:ASP:OD1	3:C:192:TYR:OH	2.31	0.48
3:C:182:LEU:HB3	3:C:219:ILE:HG21	1.96	0.48
6:F:129:GLY:O	6:F:153:LYS:NZ	2.40	0.48
1:A:91:TYR:OH	1:A:130:TRP:NE1	2.46	0.48
1:A:200:ASN:OD1	1:A:204:ASN:ND2	2.40	0.48
3:C:227:TYR:O	3:C:231:SER:OG	2.22	0.47
3:C:326:VAL:HG12	3:C:326:VAL:O	2.15	0.47
7:G:150:GLN:O	7:G:151:LEU:HD12	2.14	0.47
1:A:43:ASP:O	1:A:44:LEU:C	2.58	0.47
1:A:47:TYR:C	1:A:49:ALA:H	2.23	0.47
1:A:464:ILE:O	1:A:464:ILE:HG13	2.15	0.47
3:C:271:ASN:OD1	3:C:273:SER:OG	2.26	0.47
6:F:277:THR:O	6:F:281:ASP:OD2	2.32	0.47
9:I:570:TYR:O	9:I:574:HIS:N	2.45	0.47
1:A:454:MET:SD	3:C:167:MET:HE2	2.55	0.47
2:B:187:ASP:N	2:B:187:ASP:OD1	2.48	0.47
4:D:270:ASP:N	4:D:270:ASP:OD1	2.48	0.46
9:I:433:SER:OG	9:I:434:SER:N	2.49	0.46
3:C:96:ALA:O	3:C:97:THR:HG22	2.15	0.46
3:C:278:LEU:HD23	3:C:278:LEU:O	2.16	0.46
7:G:162:ILE:HD11	7:G:166:ASP:HB2	1.98	0.46
8:H:33:THR:O	8:H:36:VAL:HG12	2.15	0.46
9:I:311:LEU:O	9:I:315:LYS:N	2.49	0.46
8:H:141:VAL:O	8:H:145:VAL:HG23	2.15	0.46
9:I:636:LEU:HG	9:I:640:LEU:HD23	1.98	0.46
3:C:76:THR:O	3:C:80:GLN:HG3	2.15	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
8:H:34:PRO:N	8:H:35:PRO:HD2	2.31	0.45
3:C:189:GLY:O	3:C:193:THR:OG1	2.30	0.45
9:I:444:ASP:OD1	9:I:445:THR:N	2.50	0.45
3:C:394:ASP:OD1	3:C:394:ASP:C	2.60	0.45
3:C:343:GLU:HG2	8:H:120:LEU:HD13	1.99	0.44
9:I:609:ALA:O	9:I:613:GLN:NE2	2.47	0.44
4:D:125:GLN:HA	4:D:125:GLN:OE1	2.18	0.44
2:B:380:ILE:HD11	2:B:384:ASP:CB	2.48	0.44
4:D:146:GLU:OE2	4:D:183:LEU:HD11	2.17	0.44
1:A:54:LEU:HD12	1:A:54:LEU:O	2.17	0.44
9:I:411:MET:N	9:I:411:MET:HE2	2.33	0.44
1:A:170:ASP:OD1	1:A:170:ASP:C	2.60	0.44
4:D:146:GLU:OE2	4:D:183:LEU:HD21	2.17	0.44
4:D:329:GLU:HA	4:D:329:GLU:OE2	2.18	0.44
1:A:280:PHE:N	1:A:281:PRO:HD2	2.33	0.44
4:D:91:LYS:HA	4:D:91:LYS:HE2	1.98	0.44
6:F:217:VAL:HG13	8:H:204:VAL:HG11	2.00	0.44
9:I:265:GLU:CB	9:I:325:LEU:HD13	2.47	0.44
2:B:224:ILE:HD13	2:B:224:ILE:N	2.33	0.44
4:D:315:LEU:HD13	7:G:133:ILE:HD12	1.99	0.44
5:E:267:PHE:O	5:E:270:SER:OG	2.31	0.44
2:B:84:ASN:OD1	2:B:84:ASN:N	2.51	0.44
2:B:110:LYS:NZ	13:B:501:IHP:O32	2.51	0.44
5:E:123:ASN:HD22	5:E:123:ASN:C	2.25	0.43
1:A:248:LYS:NZ	1:A:279:ASP:OD1	2.48	0.43
1:A:102:THR:OG1	1:A:103:ARG:N	2.50	0.43
2:B:338:MET:HE3	2:B:338:MET:HA	2.00	0.43
4:D:234:ILE:HG21	4:D:281:PHE:CE2	2.52	0.43
1:A:401:GLU:OE1	3:C:325:ARG:NH2	2.51	0.43
1:A:48:ALA:C	1:A:50:SER:H	2.25	0.43
2:B:210:ASN:OD1	2:B:211:ASN:N	2.51	0.43
4:D:367:LEU:HB2	4:D:368:PRO:HD3	2.01	0.43
6:F:99:ILE:HD13	6:F:141:GLN:HG3	2.01	0.43
9:I:453:PHE:O	9:I:456:ILE:HG22	2.19	0.43
6:F:103:GLU:OE1	6:F:104:TYR:N	2.52	0.42
4:D:196:ASP:OD1	4:D:196:ASP:C	2.62	0.42
3:C:138:LEU:HD23	3:C:139:THR:H	1.81	0.42
1:A:269:CYS:SG	1:A:270:LEU:N	2.92	0.42
1:A:351:ASN:OD1	1:A:351:ASN:C	2.62	0.42
5:E:69:ALA:HB1	5:E:172:PRO:HG3	2.01	0.42
9:I:290:LYS:O	9:I:294:VAL:HG22	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:450:ALA:HB1	3:C:386:LEU:HD21	2.00	0.42
7:G:47:LEU:HA	7:G:52:VAL:HG11	2.01	0.42
1:A:279:ASP:OD1	1:A:279:ASP:N	2.53	0.42
7:G:113:TYR:CD1	7:G:128:LEU:HD23	2.55	0.42
1:A:148:ASP:O	1:A:152:TYR:CD1	2.73	0.42
2:B:116:LEU:HD11	2:B:132:TYR:CZ	2.54	0.42
2:B:202:ILE:O	2:B:206:THR:HG22	2.19	0.42
4:D:76:LEU:HD12	4:D:77:PRO:O	2.20	0.42
4:D:214:LYS:O	4:D:222:ARG:NH1	2.52	0.42
2:B:308:ILE:O	2:B:308:ILE:HG22	2.20	0.42
3:C:355:ASP:OD1	3:C:355:ASP:N	2.52	0.42
4:D:52:MET:HE1	4:D:65:LEU:HD13	2.02	0.42
9:I:621:THR:HG22	9:I:624:GLN:OE1	2.18	0.42
3:C:73:ASP:OD1	3:C:74:PHE:N	2.52	0.41
3:C:107:LEU:HD21	3:C:123:ILE:HD11	2.01	0.41
3:C:308:GLN:O	3:C:311:THR:OG1	2.35	0.41
2:B:90:ASN:O	2:B:94:GLN:HG3	2.20	0.41
2:B:190:LYS:HE2	2:B:227:ALA:HB1	2.03	0.41
1:A:345:LEU:HD21	1:A:369:ILE:HD13	2.03	0.41
6:F:101:ASP:OD1	6:F:101:ASP:N	2.51	0.41
7:G:113:TYR:HD1	7:G:128:LEU:HD23	1.85	0.41
2:B:96:LEU:HD12	2:B:96:LEU:O	2.21	0.41
9:I:280:HIS:O	9:I:283:THR:OG1	2.37	0.41
2:B:89:MET:SD	2:B:90:ASN:N	2.94	0.41
8:H:128:ILE:HG23	8:H:162:VAL:HG13	2.03	0.41
9:I:614:TYR:CE1	9:I:620:TYR:HB2	2.56	0.41
3:C:377:ASP:OD1	8:H:203:TYR:OH	2.36	0.41
2:B:141:ASP:OD1	2:B:141:ASP:N	2.53	0.40
9:I:626:THR:HG23	9:I:633:MET:CE	2.51	0.40
1:A:432:ARG:NH1	6:F:285:ASP:OD1	2.55	0.40
2:B:63:GLU:OE2	2:B:63:GLU:N	2.55	0.40
4:D:83:GLU:OE1	4:D:83:GLU:N	2.50	0.40
10:J:75:CYS:O	10:J:77:HIS:N	2.53	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	400/491 (82%)	377 (94%)	23 (6%)	0	100	100
2	B	400/443 (90%)	377 (94%)	23 (6%)	0	100	100
3	C	346/423 (82%)	338 (98%)	8 (2%)	0	100	100
4	D	379/406 (93%)	368 (97%)	11 (3%)	0	100	100
5	E	275/334 (82%)	260 (94%)	15 (6%)	0	100	100
6	F	264/327 (81%)	248 (94%)	16 (6%)	0	100	100
7	G	212/264 (80%)	206 (97%)	6 (3%)	0	100	100
8	H	167/209 (80%)	161 (96%)	6 (4%)	0	100	100
9	I	497/776 (64%)	477 (96%)	20 (4%)	0	100	100
10	J	75/108 (69%)	62 (83%)	13 (17%)	0	100	100
11	P	19/57 (33%)	18 (95%)	1 (5%)	0	100	100
12	K	74/76 (97%)	73 (99%)	1 (1%)	0	100	100
All	All	3108/3914 (79%)	2965 (95%)	143 (5%)	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	350/429 (82%)	341 (97%)	9 (3%)	41	67
2	B	366/405 (90%)	356 (97%)	10 (3%)	40	66

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	C	314/377 (83%)	305 (97%)	9 (3%)	37	64
4	D	328/347 (94%)	322 (98%)	6 (2%)	54	75
5	E	238/282 (84%)	231 (97%)	7 (3%)	37	64
6	F	241/276 (87%)	235 (98%)	6 (2%)	42	68
7	G	186/229 (81%)	176 (95%)	10 (5%)	18	49
8	H	141/173 (82%)	139 (99%)	2 (1%)	62	80
9	I	443/698 (64%)	425 (96%)	18 (4%)	26	56
10	J	70/90 (78%)	68 (97%)	2 (3%)	37	64
11	P	19/45 (42%)	16 (84%)	3 (16%)	2	9
12	K	66/66 (100%)	65 (98%)	1 (2%)	60	78
All	All	2762/3417 (81%)	2679 (97%)	83 (3%)	37	63

All (83) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	51	TYR
1	A	98	LEU
1	A	153	LYS
1	A	184	CYS
1	A	214	ASN
1	A	222	VAL
1	A	284	LEU
1	A	300	THR
1	A	468	SER
2	B	84	ASN
2	B	95	LEU
2	B	123	LYS
2	B	134	THR
2	B	270	SER
2	B	285	MET
2	B	315	VAL
2	B	323	ILE
2	B	330	LEU
2	B	402	ILE
3	C	108	THR
3	C	134	ASN
3	C	170	CYS
3	C	193	THR

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Mol	Chain	Res	Type
3	C	231	SER
3	C	316	THR
3	C	355	ASP
3	C	378	GLN
3	C	383	CYS
4	D	70	CYS
4	D	76	LEU
4	D	126	VAL
4	D	179	THR
4	D	210	GLU
4	D	284	MET
5	E	51	TYR
5	E	60	LEU
5	E	103	THR
5	E	123	ASN
5	E	165	PHE
5	E	169	VAL
5	E	298	ASP
6	F	43	LEU
6	F	92	HIS
6	F	141	GLN
6	F	216	THR
6	F	234	ARG
6	F	299	CYS
7	G	33	GLN
7	G	46	LEU
7	G	47	LEU
7	G	124	ASN
7	G	145	LEU
7	G	157	CYS
7	G	161	ASP
7	G	173	THR
7	G	194	ARG
7	G	201	ASN
8	H	101	THR
8	H	162	VAL
9	I	251	PHE
9	I	349	LEU
9	I	385	PHE
9	I	395	LEU
9	I	481	SER
9	I	494	GLN

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Mol	Chain	Res	Type
9	I	522	LYS
9	I	527	ASN
9	I	531	LEU
9	I	569	PHE
9	I	591	VAL
9	I	592	THR
9	I	602	GLN
9	I	620	TYR
9	I	624	GLN
9	I	633	MET
9	I	648	LEU
9	I	738	LEU
10	J	38	VAL
10	J	92	GLN
11	P	53	ASP
11	P	54	ASP
11	P	56	ILE
12	K	36	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	83	GLN
1	A	217	HIS
2	B	297	GLN
2	B	334	HIS
2	B	370	HIS
2	B	429	ASN
3	C	374	HIS
3	C	378	GLN
4	D	64	GLN
4	D	354	GLN
4	D	373	GLN
5	E	35	GLN
5	E	258	ASN
6	F	232	HIS
6	F	284	ASN
6	F	300	ASN
6	F	304	GLN
9	I	574	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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 3 are monoatomic - leaving 1 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
13	IHP	B	501	-	36,36,36	0.71	2 (5%)	54,60,60	0.43	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
13	IHP	B	501	-	-	6/30/54/54	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	B	501	IHP	P3-O13	2.84	1.64	1.59
13	B	501	IHP	P1-O11	2.04	1.63	1.59

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

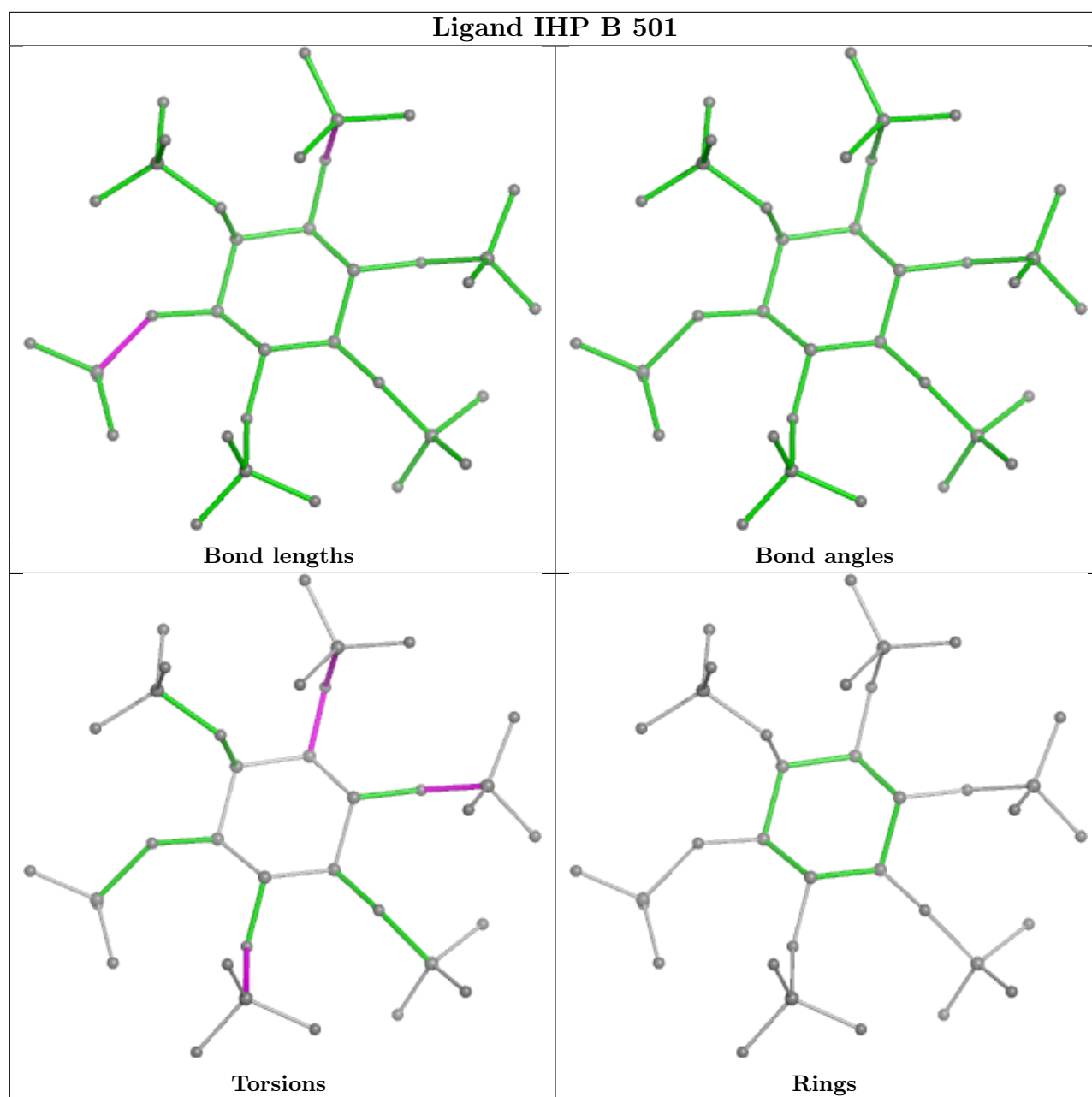
Mol	Chain	Res	Type	Atoms
13	B	501	IHP	C6-C1-O11-P1
13	B	501	IHP	C1-O11-P1-O21
13	B	501	IHP	C6-O16-P6-O26
13	B	501	IHP	C4-O14-P4-O44
13	B	501	IHP	C2-C1-O11-P1
13	B	501	IHP	C1-O11-P1-O31

There are no ring outliers.

1 monomer is involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
13	B	501	IHP	4	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

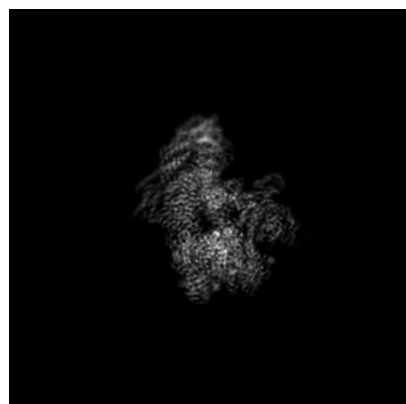
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-53253. These allow visual inspection of the internal detail of the map and identification of artifacts.

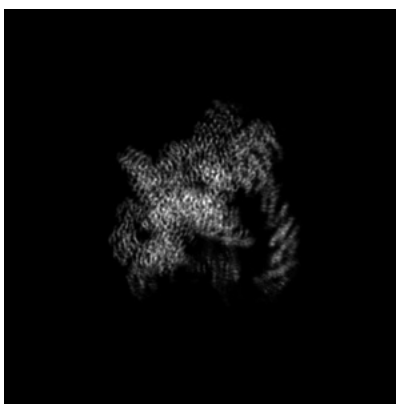
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

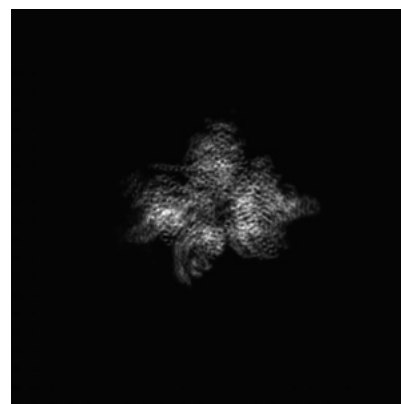
6.1.1 Primary map



X

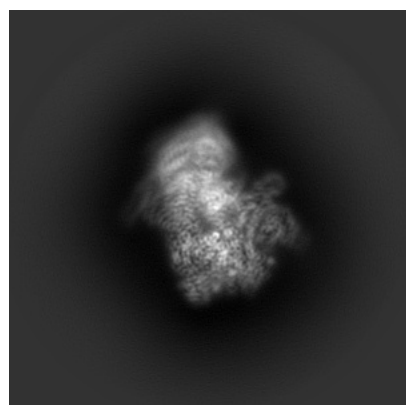


Y

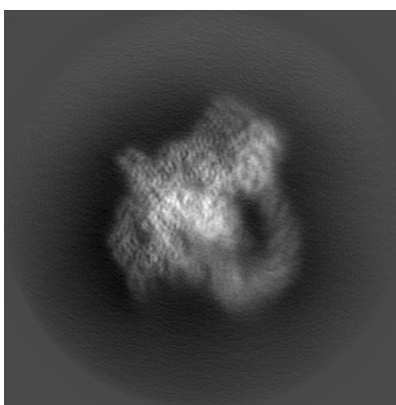


Z

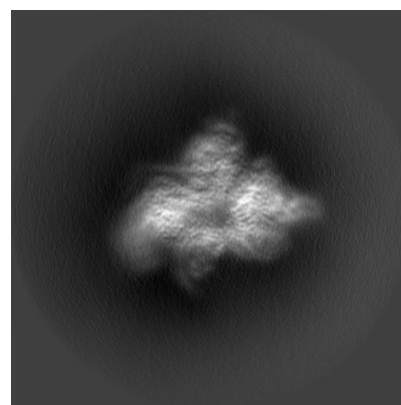
6.1.2 Raw map



X



Y



Z

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

6.2 Central slices [i](#)

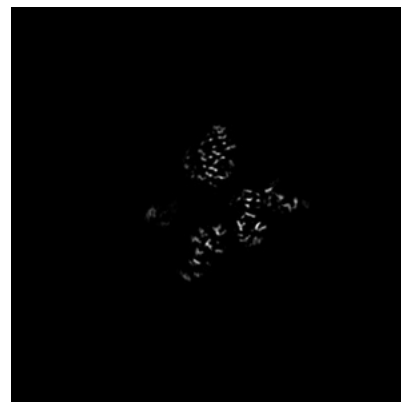
6.2.1 Primary map



X Index: 160

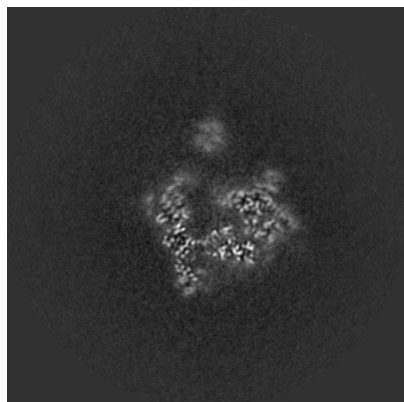


Y Index: 160

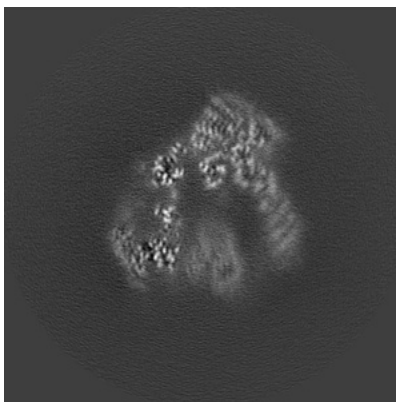


Z Index: 160

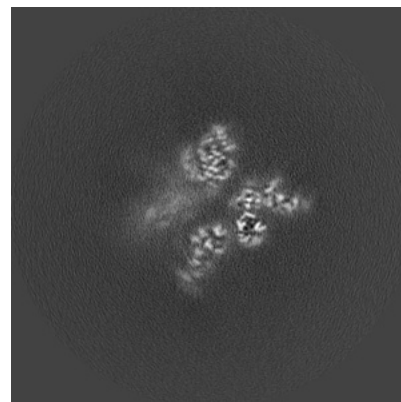
6.2.2 Raw map



X Index: 160



Y Index: 160



Z Index: 160

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: 157

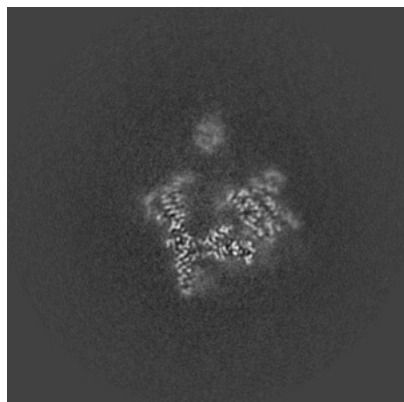


Y Index: 158

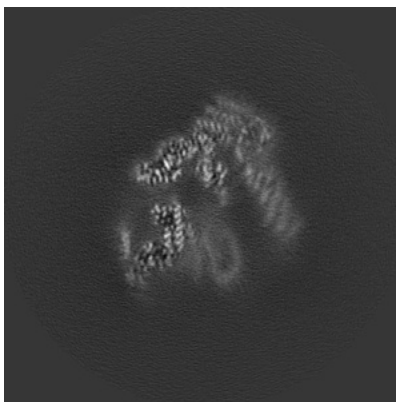


Z Index: 124

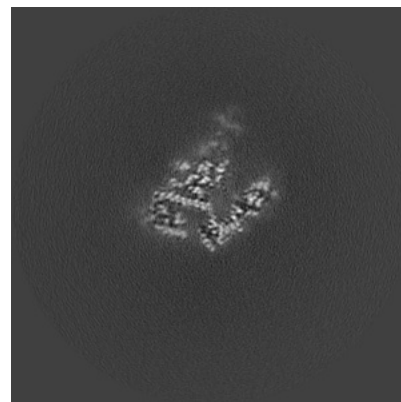
6.3.2 Raw map



X Index: 158



Y Index: 166

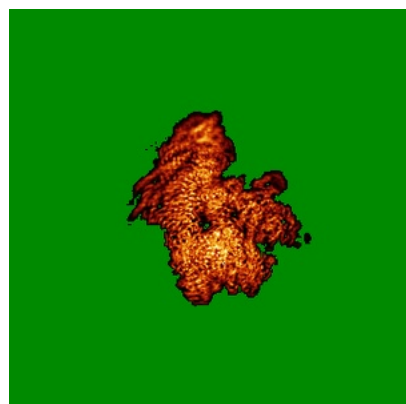


Z Index: 131

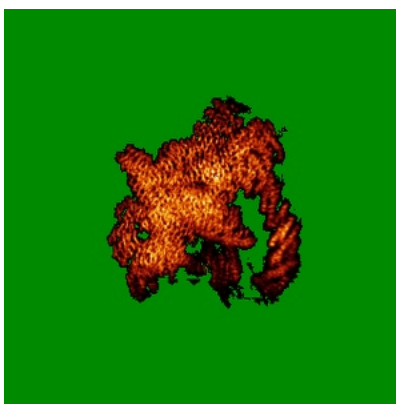
The images above show the largest variance slices of the map in three orthogonal directions.

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

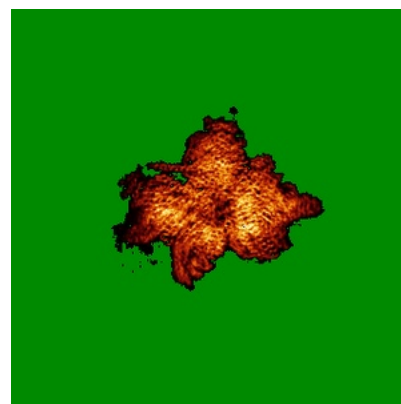
6.4.1 Primary map



X

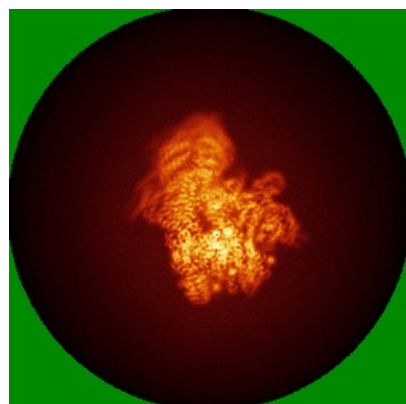


Y

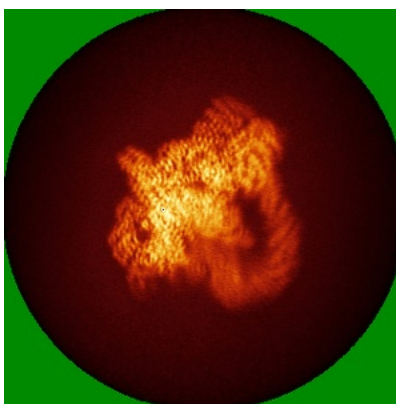


Z

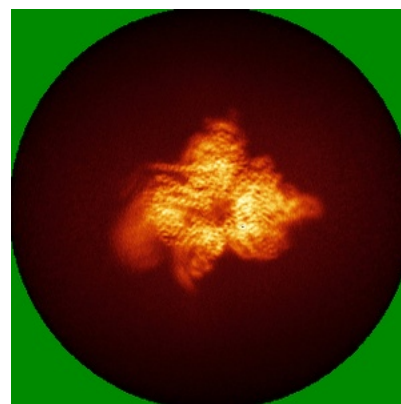
6.4.2 Raw map



X



Y

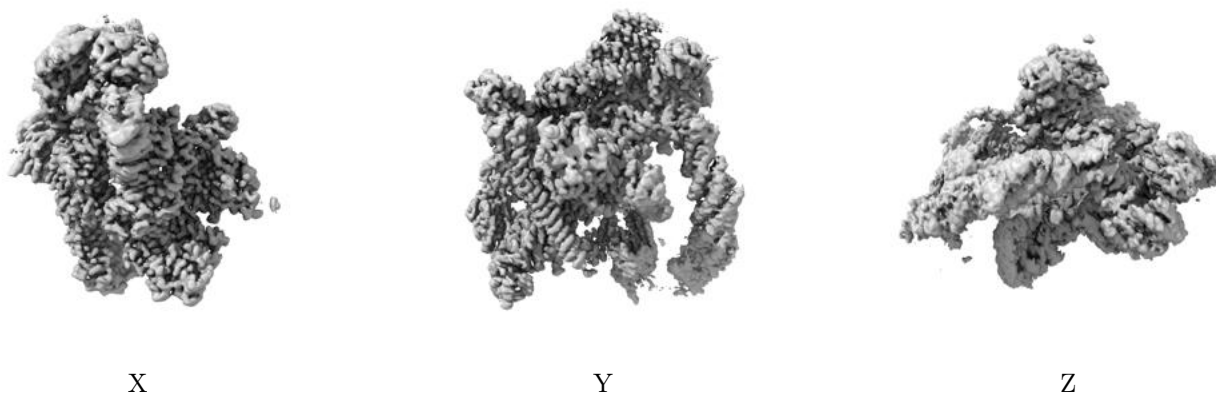


Z

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.

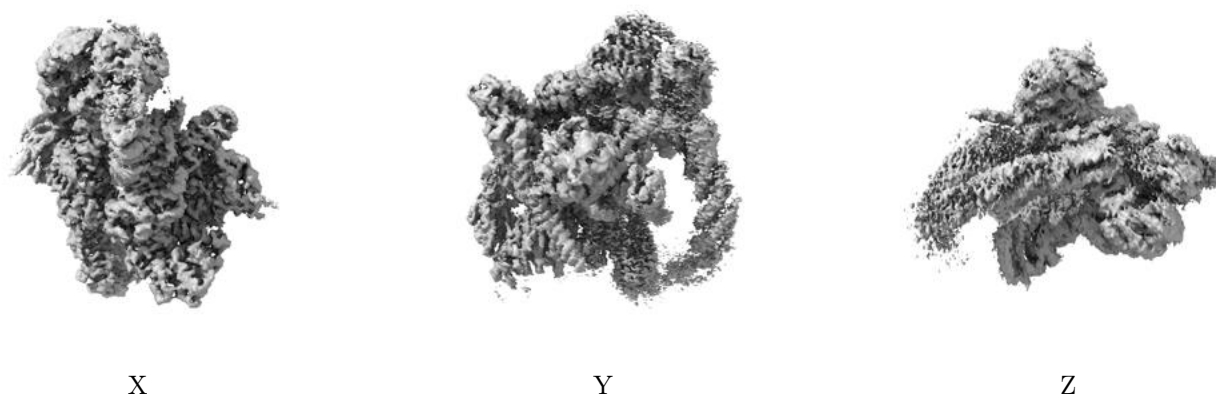
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.0174. 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.

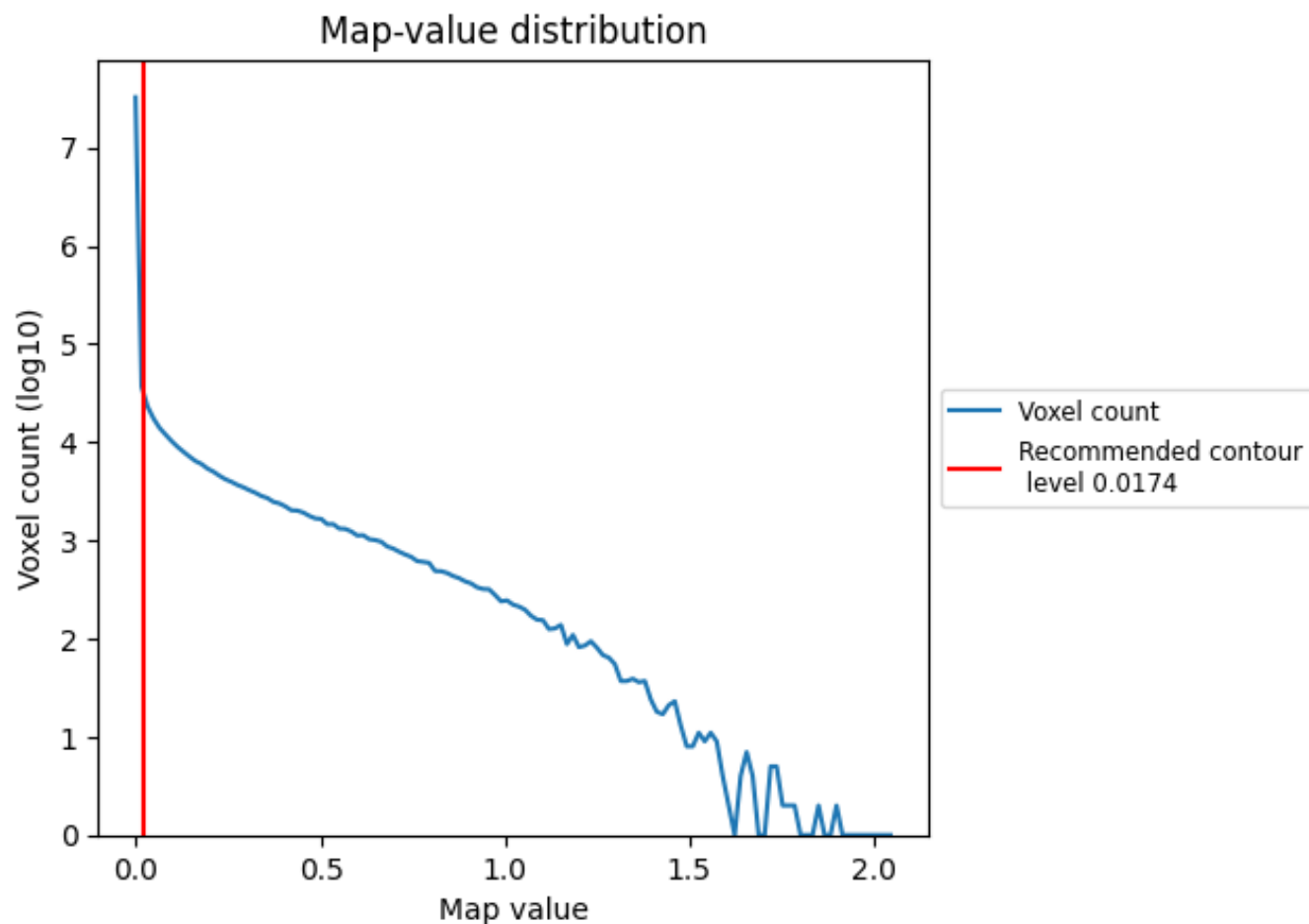
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

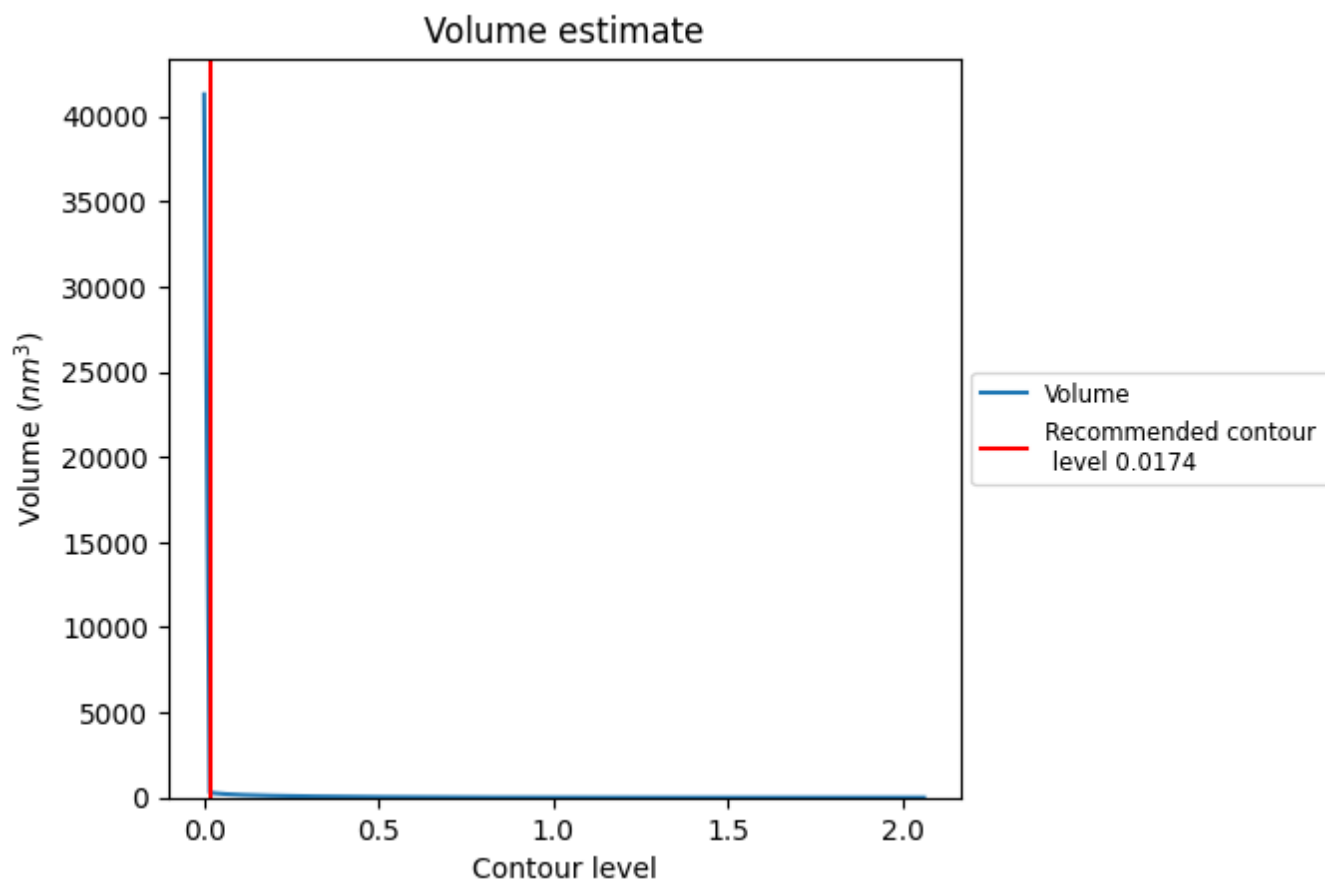
This section contains the results of statistical analysis of the map.

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.

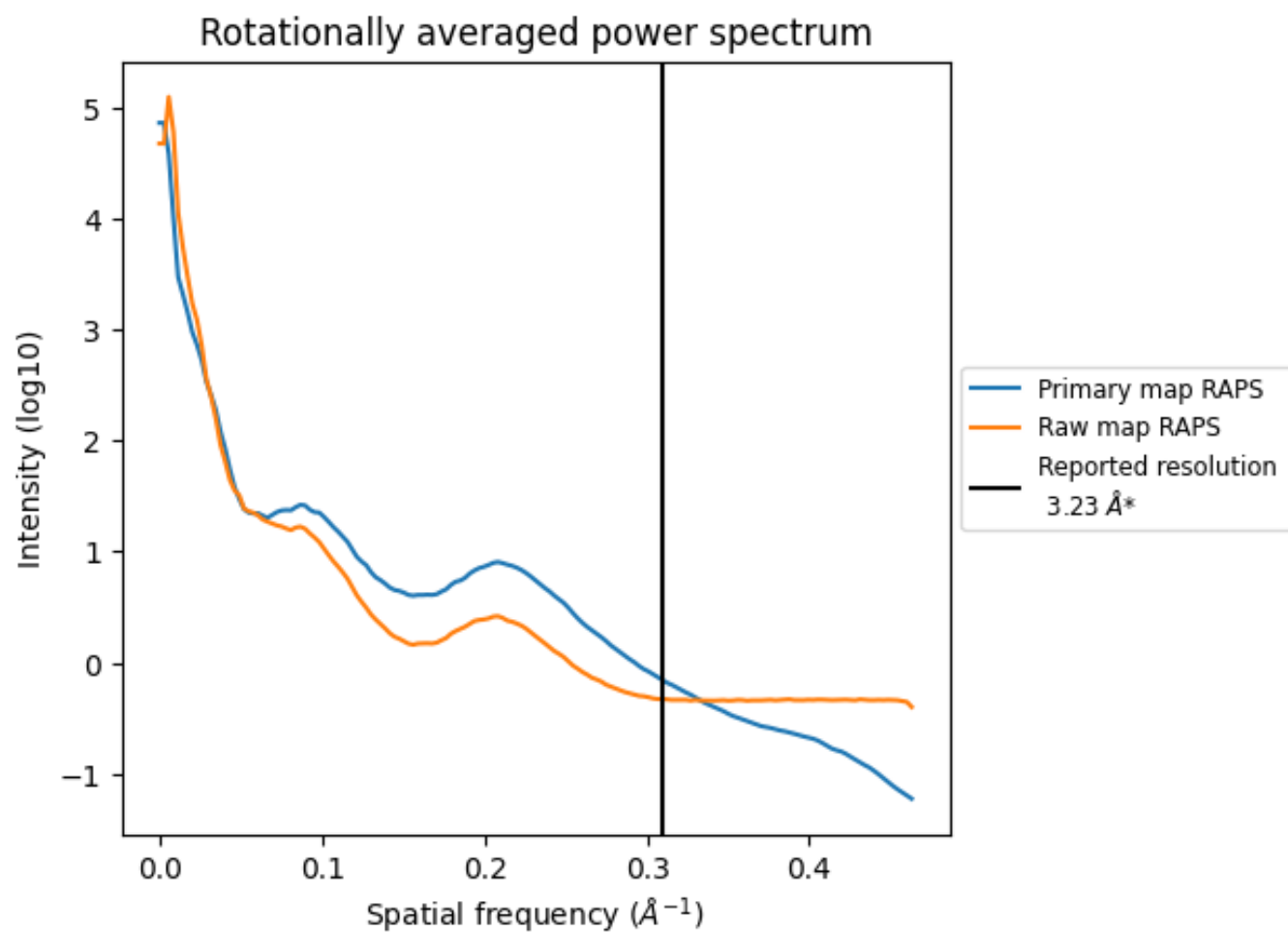
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 289 nm³; this corresponds to an approximate mass of 261 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 ⓘ

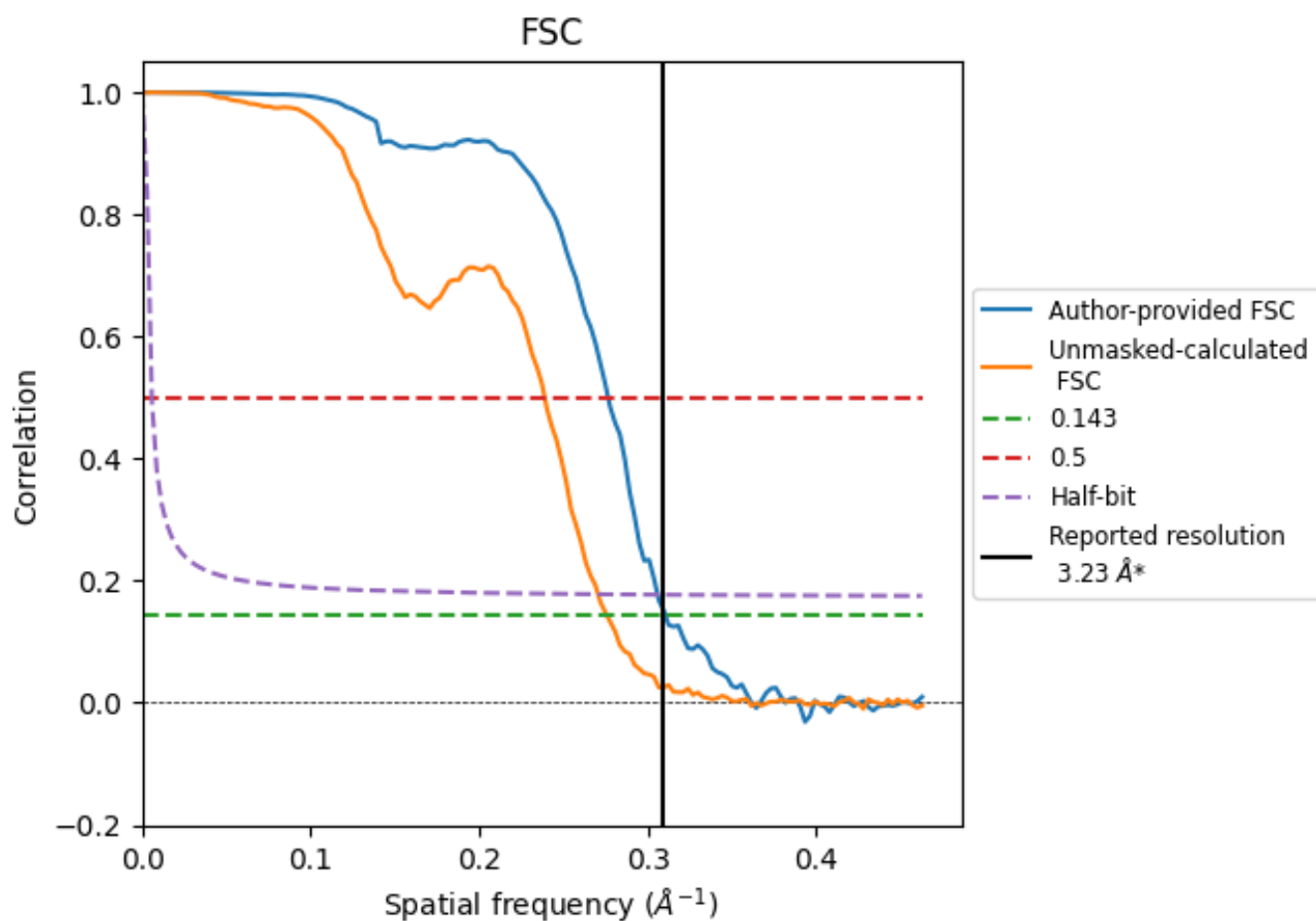


*Reported resolution corresponds to spatial frequency of 0.310 Å⁻¹

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 $0.310 \text{ \AA}^{-1}$

8.2 Resolution estimates [i](#)

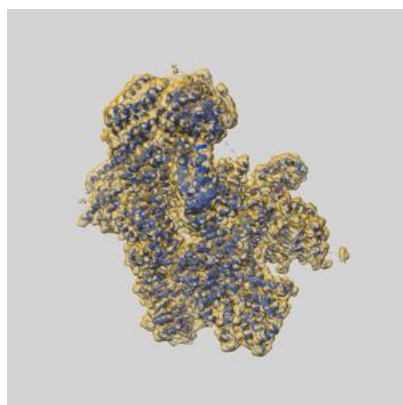
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.23	-	-
Author-provided FSC curve	3.22	3.62	3.27
Unmasked-calculated*	3.62	4.19	3.70

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 3.62 differs from the reported value 3.23 by more than 10 %

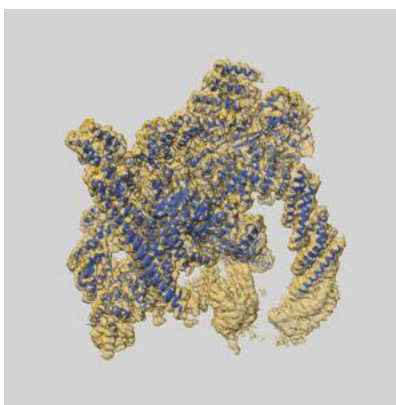
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-53253 and PDB model 9QO1. Per-residue inclusion information can be found in section 3 on page 7.

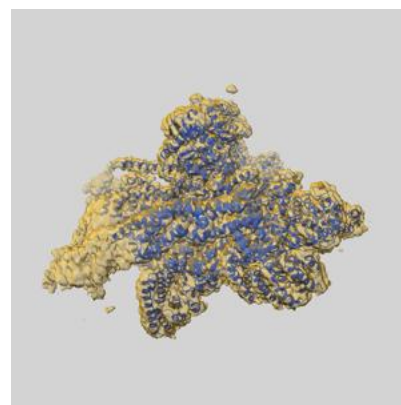
9.1 Map-model overlay [i](#)



X



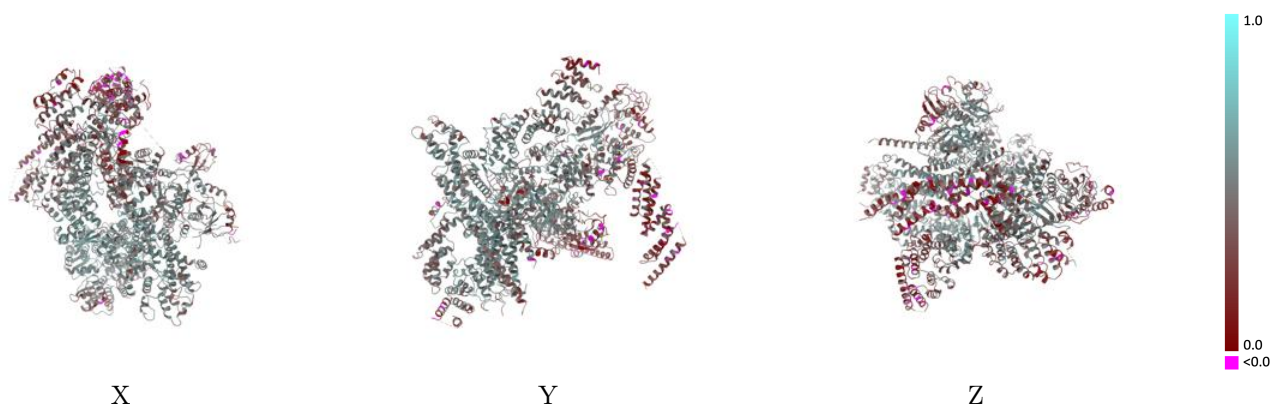
Y



Z

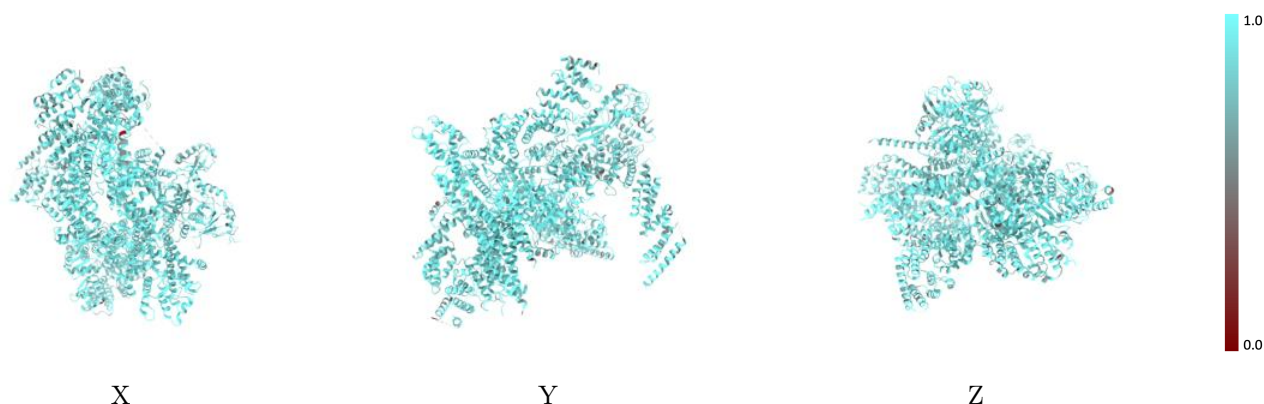
The images above show the 3D surface view of the map at the recommended contour level 0.0174 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



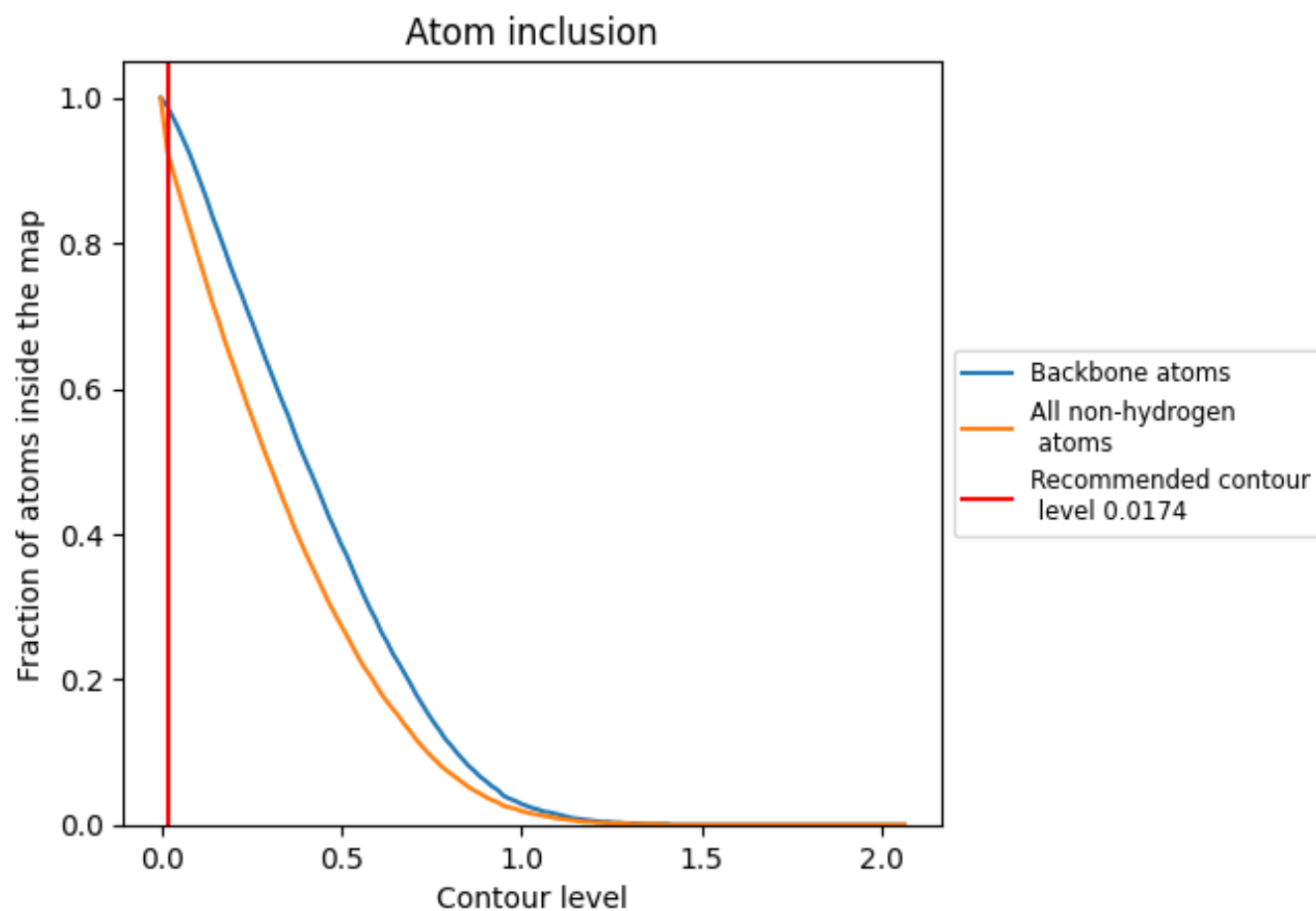
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.0174).

9.4 Atom inclusion ⓘ



At the recommended contour level, 99% of all backbone atoms, 93% 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 (0.0174) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9260	0.4400
A	0.9240	0.4190
B	0.9210	0.4430
C	0.9500	0.5060
D	0.9330	0.4590
E	0.9360	0.4860
F	0.9400	0.4770
G	0.9400	0.4950
H	0.9340	0.4530
I	0.8950	0.3350
J	0.9280	0.4680
K	0.8560	0.3100
P	0.9330	0.4800

1.0

0.0

<0.0