



wwPDB EM Validation Summary Report ⓘ

Apr 25, 2026 – 10:49 PM EDT

PDB ID : 9YUZ / pdb_00009yuz
EMDB ID : EMD-73510
Title : Structure of the human 20S proteasome in complex with a beta5-selective covalent syringolin analogue inhibitor.
Authors : Yan, N.L.; Gu, X.; Fajtova, P.; Tse, E.; Melo, A.; Southworth, D.R.; O'Donoghue, A.; Sello, J.K.; Gestwicki, J.E.
Deposited on : 2025-10-23
Resolution : 2.60 Å (reported)
Based on initial model : 7NAN

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

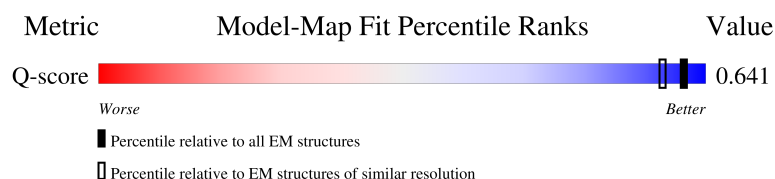
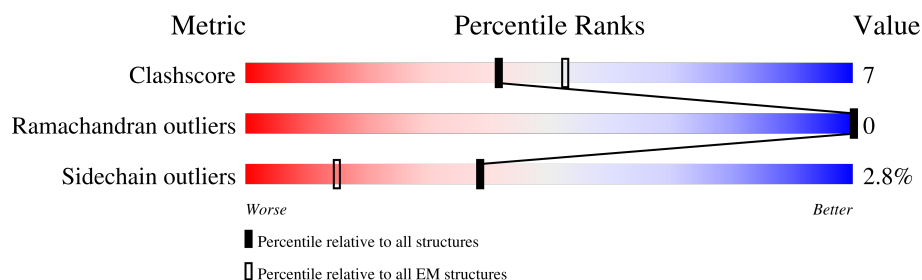
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

1 Overall quality at a glance

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

The reported resolution of this entry is 2.60 Å.

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



Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	8728 (2.10 - 3.10)

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	234	
1	O	234	
2	B	261	

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
2	P	261	
3	C	248	
3	Q	248	
4	D	241	
4	R	241	
5	E	263	
5	S	263	
6	F	255	
6	T	255	
7	G	246	
7	U	246	
8	H	277	
8	V	277	
9	I	205	
9	W	205	
10	J	201	
10	X	201	
11	K	263	
11	Y	263	
12	L	241	
12	Z	241	
13	M	264	
13	a	264	
14	N	239	
14	b	239	

2 Entry composition

There are 15 unique types of molecules in this entry. The entry contains 46426 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 Proteasome subunit alpha type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	229	Total	C	N	O	S	0	0
			1665	1083	288	288	6		
1	O	229	Total	C	N	O	S	0	0
			1665	1083	288	288	6		

- Molecule 2 is a protein called Proteasome subunit alpha type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	250	Total	C	N	O	S	0	0
			1795	1146	322	317	10		
2	P	250	Total	C	N	O	S	0	0
			1795	1146	322	317	10		

- Molecule 3 is a protein called Proteasome subunit alpha type-7.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	235	Total	C	N	O	S	0	0
			1694	1077	317	295	5		
3	Q	235	Total	C	N	O	S	0	0
			1694	1077	317	295	5		

- Molecule 4 is a protein called Proteasome subunit alpha type-5.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	235	Total	C	N	O	S	0	0
			1699	1079	292	317	11		
4	R	235	Total	C	N	O	S	0	0
			1699	1079	292	317	11		

- Molecule 5 is a protein called Proteasome subunit alpha type-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	E	238	Total	C	N	O	S	0	0
			1794	1134	330	319	11		
5	S	238	Total	C	N	O	S	0	0
			1794	1134	330	319	11		

- Molecule 6 is a protein called Proteasome subunit alpha type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	F	240	Total	C	N	O	S	0	0
			1783	1145	315	313	10		
6	T	240	Total	C	N	O	S	0	0
			1783	1145	315	313	10		

- Molecule 7 is a protein called Proteasome subunit alpha type-6.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	G	243	Total	C	N	O	S	0	0
			1781	1138	308	323	12		
7	U	243	Total	C	N	O	S	0	0
			1781	1138	308	323	12		

- Molecule 8 is a protein called Proteasome subunit beta type-7.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	H	222	Total	C	N	O	S	0	0
			1604	1020	276	297	11		
8	V	222	Total	C	N	O	S	0	0
			1604	1020	276	297	11		

- Molecule 9 is a protein called Proteasome subunit beta type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	I	204	Total	C	N	O	S	0	0
			1563	1001	264	279	19		
9	W	204	Total	C	N	O	S	0	0
			1563	1001	264	279	19		

- Molecule 10 is a protein called Proteasome subunit beta type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	J	197	Total	C	N	O	S	0	0
			1541	996	265	271	9		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms					AltConf	Trace
10	X	197	Total	C	N	O	S	0	0
			1541	996	265	271	9		

- Molecule 11 is a protein called Proteasome subunit beta type-5.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	K	200	Total	C	N	O	S	0	0
			1525	968	273	275	9		
11	Y	200	Total	C	N	O	S	0	0
			1525	968	273	275	9		

- Molecule 12 is a protein called Proteasome subunit beta type-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	L	213	Total	C	N	O	S	0	0
			1604	1025	280	289	10		
12	Z	213	Total	C	N	O	S	0	0
			1604	1025	280	289	10		

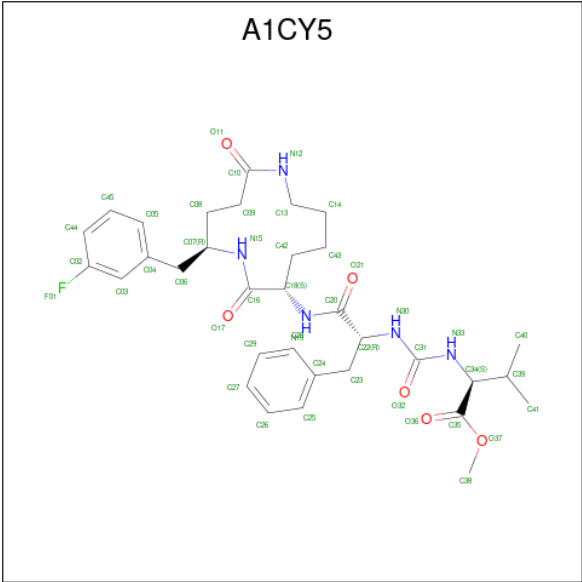
- Molecule 13 is a protein called Proteasome subunit beta type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	M	215	Total	C	N	O	S	0	0
			1635	1038	288	297	12		
13	a	215	Total	C	N	O	S	0	0
			1635	1038	288	297	12		

- Molecule 14 is a protein called Proteasome subunit beta type-6.

Mol	Chain	Residues	Atoms					AltConf	Trace
14	N	202	Total	C	N	O	S	0	0
			1485	935	258	281	11		
14	b	202	Total	C	N	O	S	0	0
			1485	935	258	281	11		

- Molecule 15 is methyl N-{[(2R)-1-({(5R,8S)-5-[(3-fluorophenyl)methyl]-2,7-dioxo-1,6-diazacyclododecan-8-yl}amino)-1-oxo-3-phenylpropan-2-yl]carbonyl}-L-valinate (CCD ID: A1CY5) (formula: C₃₃H₄₄FN₅O₆) (labeled as "Ligand of Interest" by depositor).

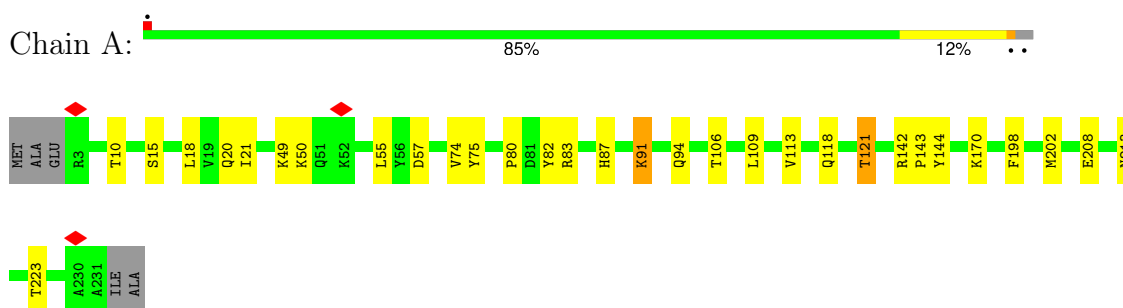


Mol	Chain	Residues	Atoms					AltConf
15	K	1	Total	C	F	N	O	0
			45	33	1	5	6	
15	Y	1	Total	C	F	N	O	0
			45	33	1	5	6	

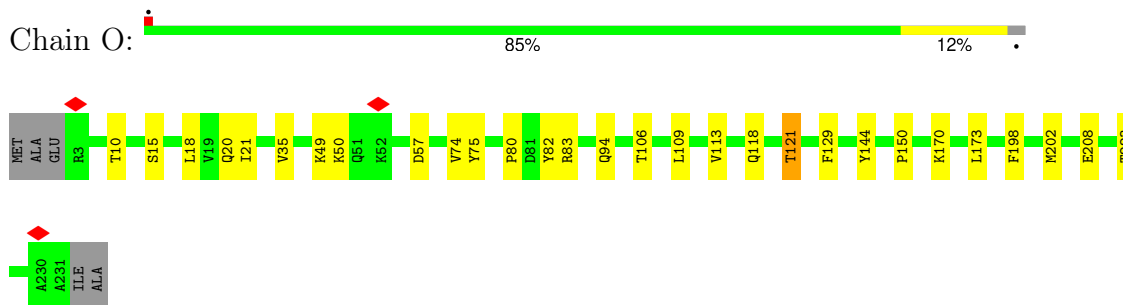
3 Residue-property plots [i](#)

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.

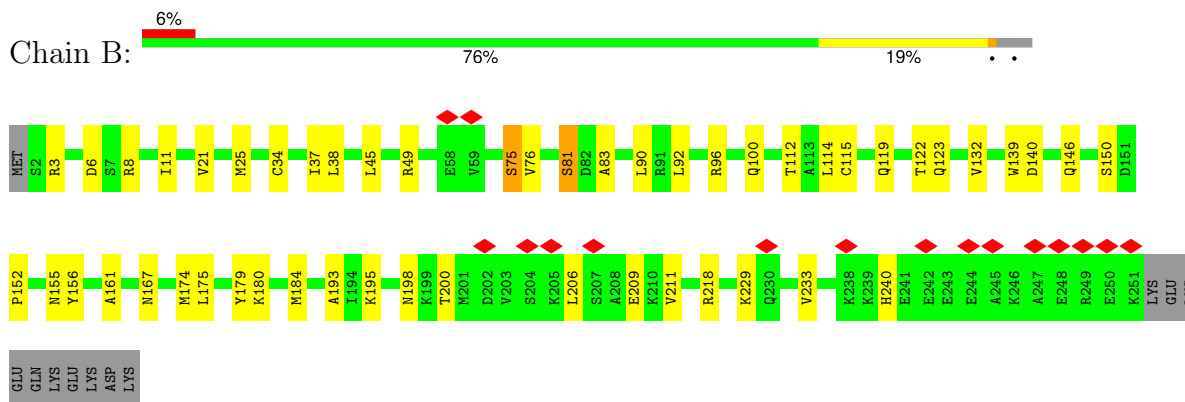
- Molecule 1: Proteasome subunit alpha type-2



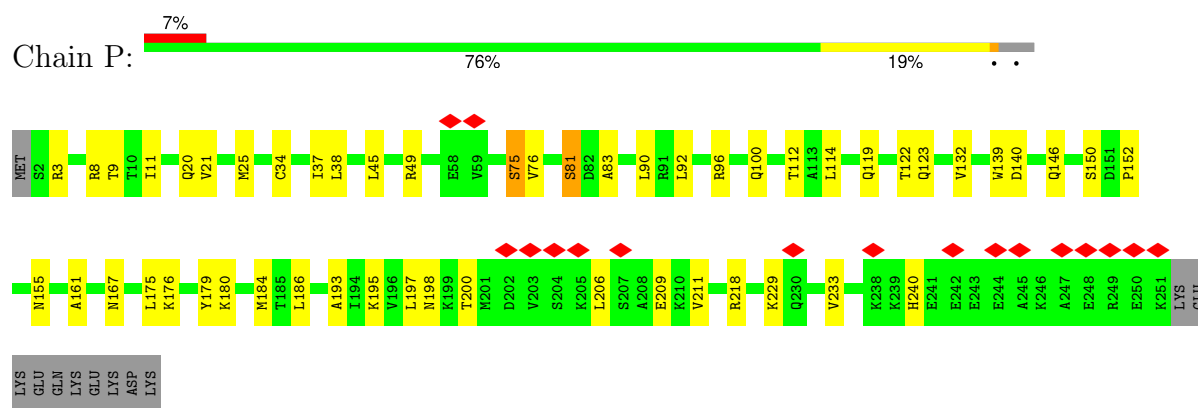
- Molecule 1: Proteasome subunit alpha type-2



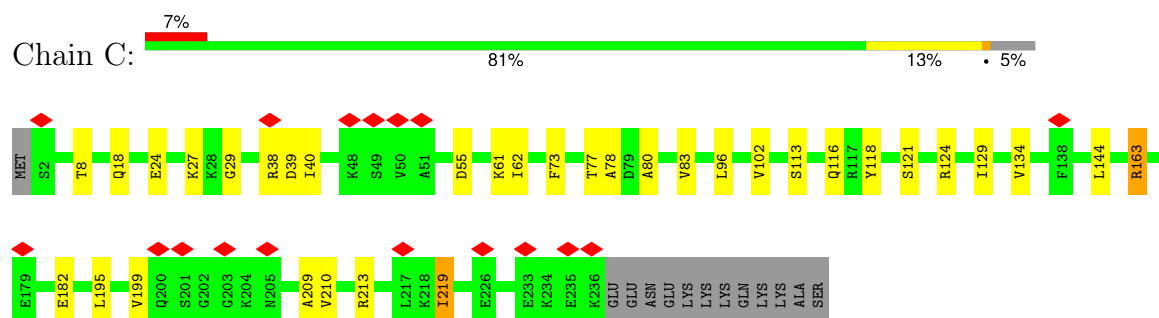
- Molecule 2: Proteasome subunit alpha type-4



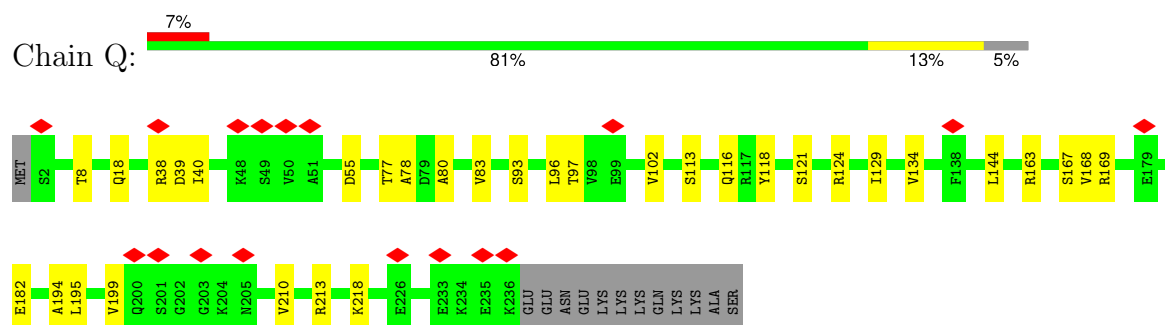
- Molecule 2: Proteasome subunit alpha type-4



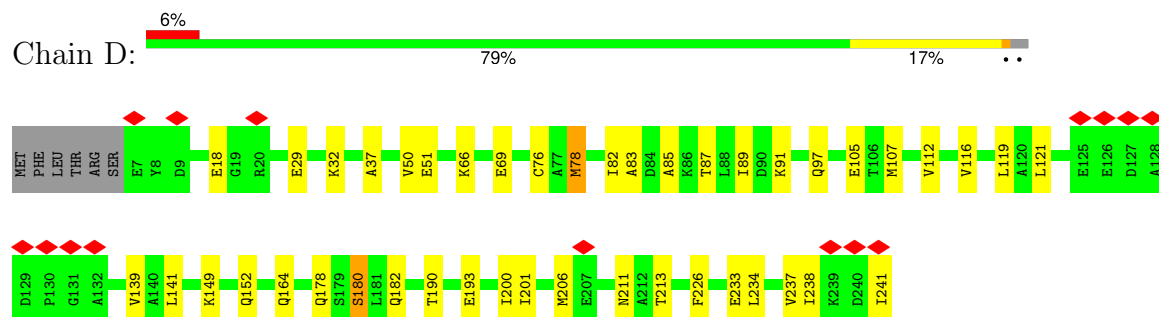
- Molecule 3: Proteasome subunit alpha type-7



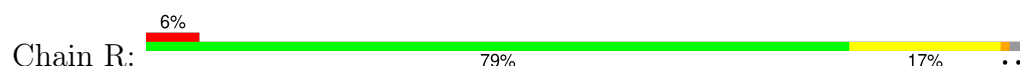
- Molecule 3: Proteasome subunit alpha type-7

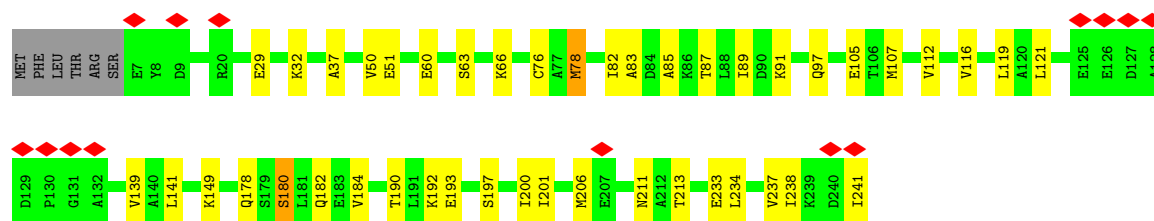


- Molecule 4: Proteasome subunit alpha type-5

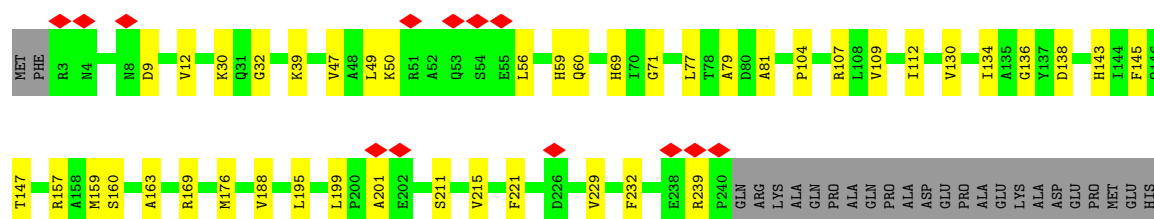
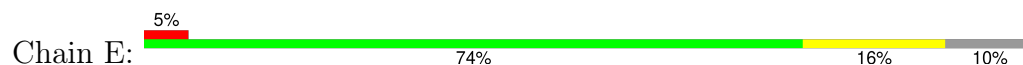


- Molecule 4: Proteasome subunit alpha type-5

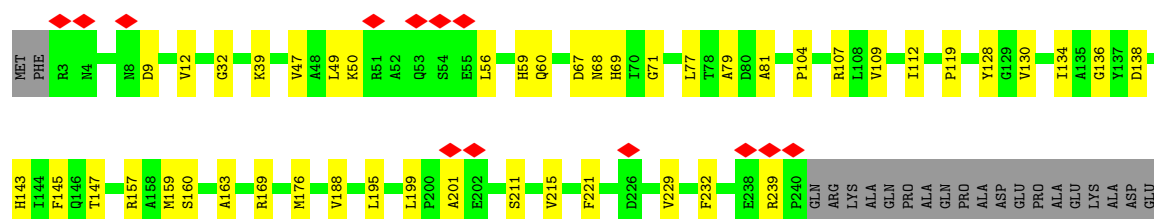




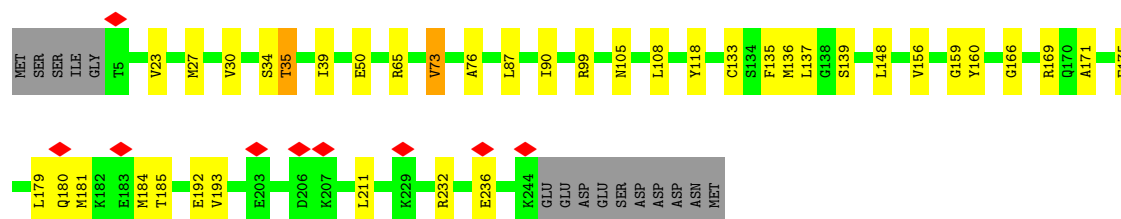
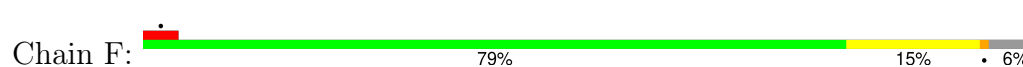
- Molecule 5: Proteasome subunit alpha type-1



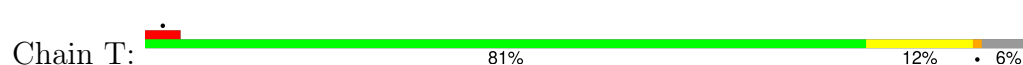
- Molecule 5: Proteasome subunit alpha type-1

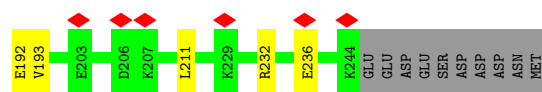


- Molecule 6: Proteasome subunit alpha type-3

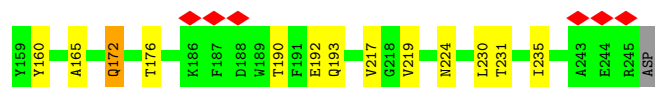
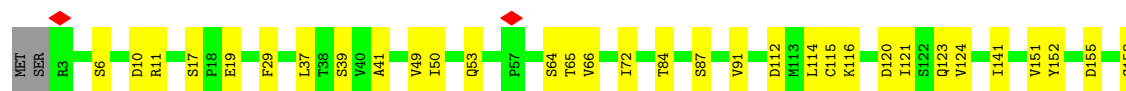
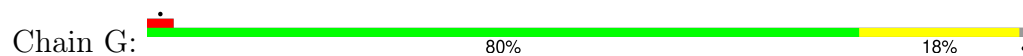


- Molecule 6: Proteasome subunit alpha type-3

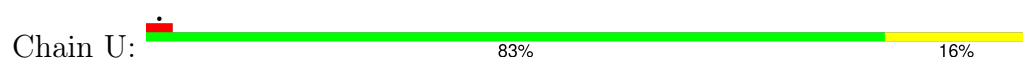




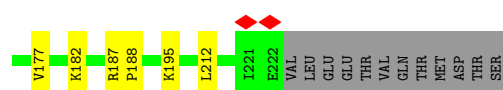
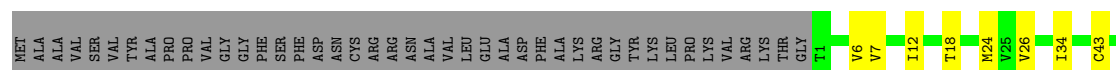
- Molecule 7: Proteasome subunit alpha type-6



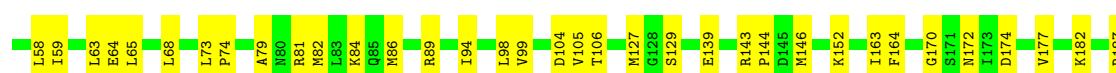
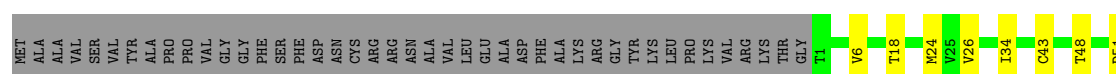
- Molecule 7: Proteasome subunit alpha type-6

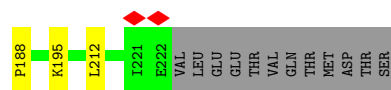


- Molecule 8: Proteasome subunit beta type-7



- Molecule 8: Proteasome subunit beta type-7





- Molecule 9: Proteasome subunit beta type-3

Chain I: 85% 14%



- Molecule 9: Proteasome subunit beta type-3

Chain W: 84% 16%



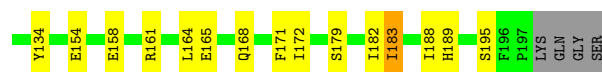
- Molecule 10: Proteasome subunit beta type-2

Chain J: 78% 19% ..



- Molecule 10: Proteasome subunit beta type-2

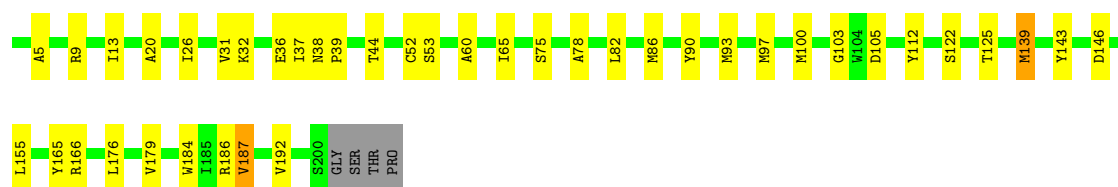
Chain X: 75% 22% ..



- Molecule 11: Proteasome subunit beta type-5

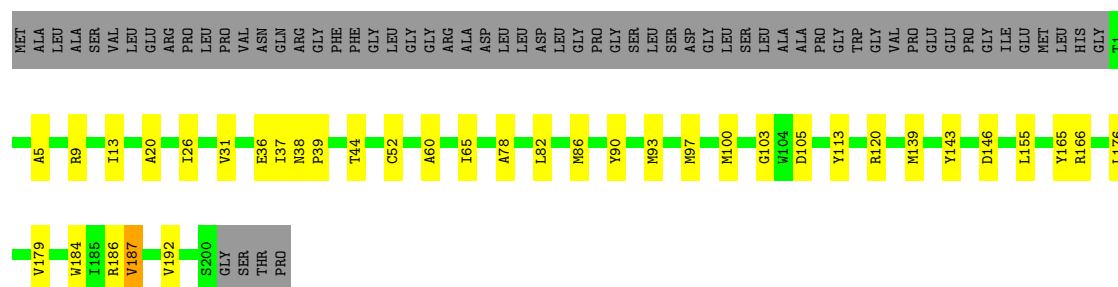
Chain K: 60% 15% 24%





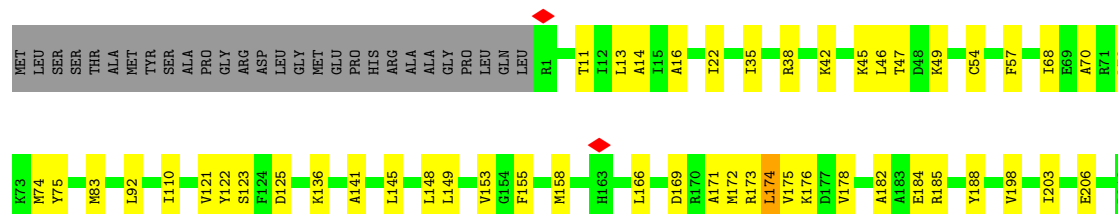
• Molecule 11: Proteasome subunit beta type-5

Chain Y: 62% 14% 24%



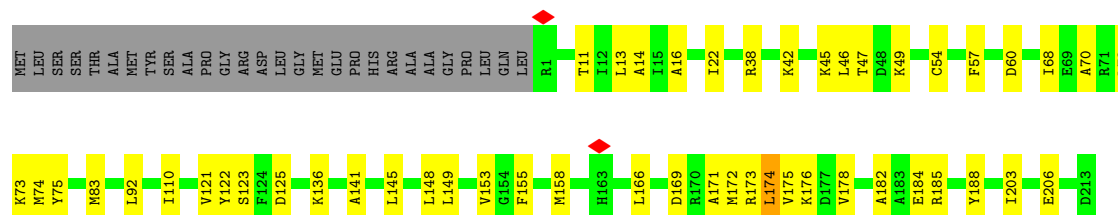
• Molecule 12: Proteasome subunit beta type-1

Chain L: 68% 20% 12%



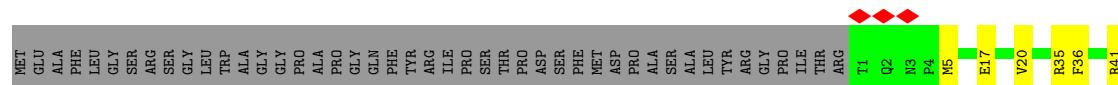
• Molecule 12: Proteasome subunit beta type-1

Chain Z: 68% 20% 12%



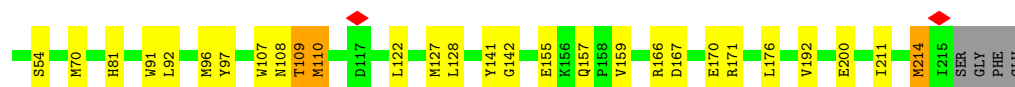
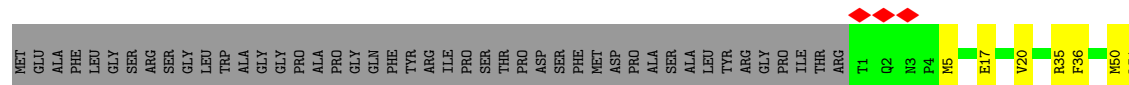
• Molecule 13: Proteasome subunit beta type-4

Chain M: 67% 14% 19%

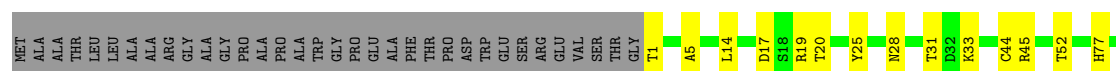




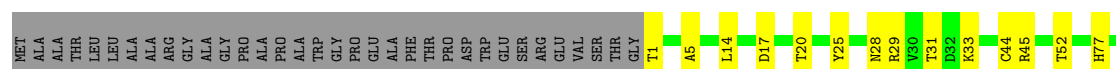
• Molecule 13: Proteasome subunit beta type-4



• Molecule 14: Proteasome subunit beta type-6



• Molecule 14: Proteasome subunit beta type-6



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	50210	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 ($e^-/\text{\AA}^2$)	45	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	1.652	Depositor
Minimum map value	-0.960	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.061	Depositor
Recommended contour level	0.28	Depositor
Map size (Å)	372.0, 372.0, 372.0	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.93, 0.93, 0.93	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: A1CY5

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	0.18	0/1704	0.33	0/2322
1	O	0.18	0/1704	0.33	0/2322
2	B	0.17	0/1824	0.37	0/2482
2	P	0.17	0/1824	0.38	0/2482
3	C	0.17	0/1719	0.39	0/2341
3	Q	0.17	0/1719	0.40	0/2341
4	D	0.16	0/1725	0.34	0/2342
4	R	0.16	0/1725	0.34	0/2342
5	E	0.18	0/1829	0.35	0/2484
5	S	0.17	0/1829	0.35	0/2484
6	F	0.17	0/1818	0.33	0/2461
6	T	0.17	0/1818	0.33	0/2461
7	G	0.16	0/1813	0.36	0/2464
7	U	0.16	0/1813	0.35	0/2464
8	H	0.18	0/1631	0.39	0/2217
8	V	0.18	0/1631	0.38	0/2217
9	I	0.19	0/1592	0.34	0/2149
9	W	0.19	0/1592	0.34	0/2149
10	J	0.18	0/1574	0.34	0/2134
10	X	0.18	0/1574	0.34	0/2134
11	K	0.18	0/1556	0.35	0/2104
11	Y	0.18	0/1556	0.35	0/2104
12	L	0.18	0/1634	0.36	0/2206
12	Z	0.18	0/1634	0.36	0/2206
13	M	0.19	0/1668	0.37	0/2263
13	a	0.19	0/1668	0.37	0/2263
14	N	0.17	0/1511	0.31	0/2049
14	b	0.18	0/1511	0.32	0/2049
All	All	0.17	0/47196	0.35	0/64036

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	1665	0	1599	22	0
1	O	1665	0	1599	19	0
2	B	1795	0	1703	32	0
2	P	1795	0	1703	35	0
3	C	1694	0	1612	18	0
3	Q	1694	0	1612	15	0
4	D	1699	0	1645	27	0
4	R	1699	0	1645	27	0
5	E	1794	0	1743	22	0
5	S	1794	0	1743	27	0
6	F	1783	0	1721	23	0
6	T	1783	0	1721	19	0
7	G	1781	0	1726	28	0
7	U	1781	0	1726	24	0
8	H	1604	0	1603	29	0
8	V	1604	0	1603	29	0
9	I	1563	0	1580	17	0
9	W	1563	0	1580	18	0
10	J	1541	0	1536	27	0
10	X	1541	0	1536	30	0
11	K	1525	0	1489	24	0
11	Y	1525	0	1489	23	0
12	L	1604	0	1596	35	0
12	Z	1604	0	1596	34	0
13	M	1635	0	1596	29	0
13	a	1635	0	1596	26	0
14	N	1485	0	1450	20	0
14	b	1485	0	1450	21	0
15	K	45	0	0	0	0
15	Y	45	0	0	0	0
All	All	46426	0	45198	622	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 7.

The worst 5 of 622 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)
4:D:91:LYS:HG2	4:D:119:LEU:HD11	1.55	0.88
4:R:91:LYS:HG2	4:R:119:LEU:HD11	1.57	0.86
10:X:68:LYS:HG3	10:X:74:GLU:HG3	1.64	0.80
10:J:68:LYS:HG3	10:J:74:GLU:HG3	1.64	0.79
12:L:47:THR:HG22	12:L:49:LYS:H	1.51	0.76

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	227/234 (97%)	223 (98%)	4 (2%)	0	100	100
1	O	227/234 (97%)	223 (98%)	4 (2%)	0	100	100
2	B	248/261 (95%)	246 (99%)	2 (1%)	0	100	100
2	P	248/261 (95%)	246 (99%)	2 (1%)	0	100	100
3	C	233/248 (94%)	229 (98%)	4 (2%)	0	100	100
3	Q	233/248 (94%)	228 (98%)	5 (2%)	0	100	100
4	D	233/241 (97%)	225 (97%)	8 (3%)	0	100	100
4	R	233/241 (97%)	225 (97%)	8 (3%)	0	100	100
5	E	236/263 (90%)	232 (98%)	4 (2%)	0	100	100
5	S	236/263 (90%)	232 (98%)	4 (2%)	0	100	100
6	F	238/255 (93%)	237 (100%)	1 (0%)	0	100	100
6	T	238/255 (93%)	237 (100%)	1 (0%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
7	G	241/246 (98%)	236 (98%)	5 (2%)	0	100	100
7	U	241/246 (98%)	237 (98%)	4 (2%)	0	100	100
8	H	220/277 (79%)	214 (97%)	6 (3%)	0	100	100
8	V	220/277 (79%)	214 (97%)	6 (3%)	0	100	100
9	I	202/205 (98%)	193 (96%)	9 (4%)	0	100	100
9	W	202/205 (98%)	194 (96%)	8 (4%)	0	100	100
10	J	195/201 (97%)	192 (98%)	3 (2%)	0	100	100
10	X	195/201 (97%)	191 (98%)	4 (2%)	0	100	100
11	K	198/263 (75%)	195 (98%)	3 (2%)	0	100	100
11	Y	198/263 (75%)	195 (98%)	3 (2%)	0	100	100
12	L	211/241 (88%)	208 (99%)	3 (1%)	0	100	100
12	Z	211/241 (88%)	208 (99%)	3 (1%)	0	100	100
13	M	213/264 (81%)	205 (96%)	8 (4%)	0	100	100
13	a	213/264 (81%)	207 (97%)	6 (3%)	0	100	100
14	N	200/239 (84%)	198 (99%)	2 (1%)	0	100	100
14	b	200/239 (84%)	198 (99%)	2 (1%)	0	100	100
All	All	6190/6876 (90%)	6068 (98%)	122 (2%)	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	151/191 (79%)	144 (95%)	7 (5%)	24	49
1	O	151/191 (79%)	145 (96%)	6 (4%)	28	55
2	B	159/221 (72%)	152 (96%)	7 (4%)	25	50
2	P	159/221 (72%)	152 (96%)	7 (4%)	25	50
3	C	149/211 (71%)	142 (95%)	7 (5%)	23	48

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	Q	149/211 (71%)	141 (95%)	8 (5%)	20	42
4	D	167/203 (82%)	164 (98%)	3 (2%)	51	76
4	R	167/203 (82%)	164 (98%)	3 (2%)	51	76
5	E	179/224 (80%)	173 (97%)	6 (3%)	32	60
5	S	179/224 (80%)	174 (97%)	5 (3%)	38	66
6	F	166/212 (78%)	162 (98%)	4 (2%)	43	70
6	T	166/212 (78%)	161 (97%)	5 (3%)	36	64
7	G	174/210 (83%)	170 (98%)	4 (2%)	44	71
7	U	174/210 (83%)	170 (98%)	4 (2%)	44	71
8	H	164/228 (72%)	161 (98%)	3 (2%)	51	76
8	V	164/228 (72%)	160 (98%)	4 (2%)	43	70
9	I	164/174 (94%)	160 (98%)	4 (2%)	43	70
9	W	164/174 (94%)	160 (98%)	4 (2%)	43	70
10	J	156/171 (91%)	151 (97%)	5 (3%)	34	62
10	X	156/171 (91%)	150 (96%)	6 (4%)	29	56
11	K	146/202 (72%)	141 (97%)	5 (3%)	32	60
11	Y	146/202 (72%)	145 (99%)	1 (1%)	76	89
12	L	163/199 (82%)	159 (98%)	4 (2%)	42	69
12	Z	163/199 (82%)	160 (98%)	3 (2%)	51	76
13	M	164/215 (76%)	164 (100%)	0	100	100
13	a	164/215 (76%)	160 (98%)	4 (2%)	43	70
14	N	148/181 (82%)	144 (97%)	4 (3%)	39	67
14	b	148/181 (82%)	143 (97%)	5 (3%)	32	60
All	All	4500/5684 (79%)	4372 (97%)	128 (3%)	38	66

5 of 128 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
11	Y	187	VAL
13	a	109	THR
10	J	183	ILE
10	J	179	SER
13	a	155	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 35 such sidechains are listed below:

Mol	Chain	Res	Type
7	U	53	GLN
7	U	100	ASN
12	Z	58	HIS
7	G	100	ASN
7	G	53	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 oligosaccharides 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	$\# Z > 2$
15	A1CY5	Y	301	11	47,47,47	0.21	0	62,62,62	0.65	1 (1%)
15	A1CY5	K	301	11	47,47,47	0.22	0	62,62,62	0.65	1 (1%)

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
15	A1CY5	Y	301	11	-	8/55/55/55	0/2/3/3
15	A1CY5	K	301	11	-	8/55/55/55	0/2/3/3

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
15	K	301	A1CY5	C08-C07-C06	-2.70	106.84	111.17
15	Y	301	A1CY5	C08-C07-C06	-2.67	106.89	111.17

There are no chirality outliers.

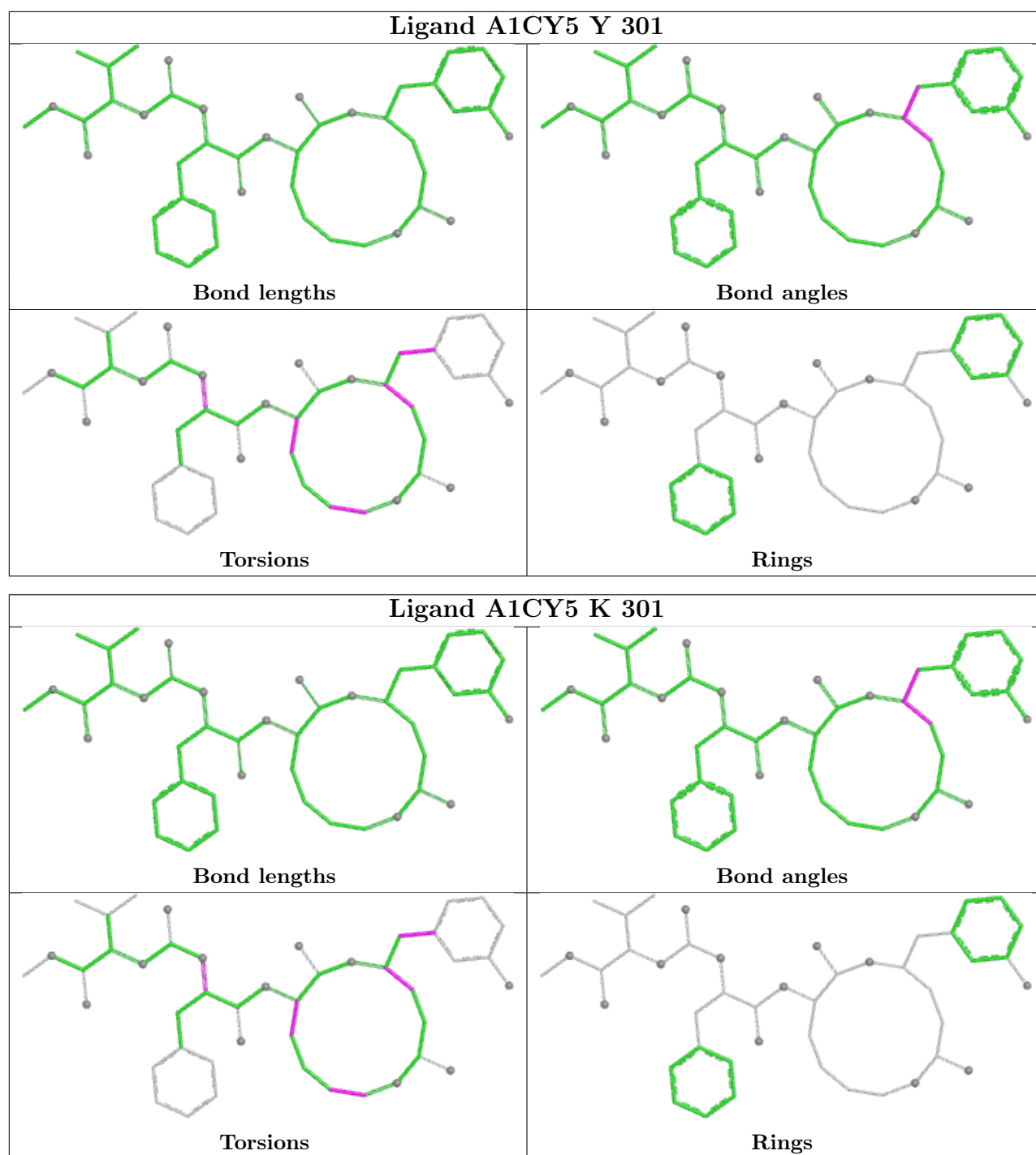
5 of 16 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
15	K	301	A1CY5	C06-C07-C08-C09
15	K	301	A1CY5	N15-C07-C08-C09
15	K	301	A1CY5	C16-C18-C42-C43
15	K	301	A1CY5	N19-C18-C42-C43
15	Y	301	A1CY5	C06-C07-C08-C09

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.

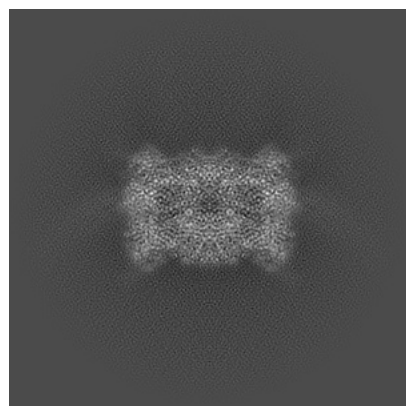
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-73510. These allow visual inspection of the internal detail of the map and identification of artifacts.

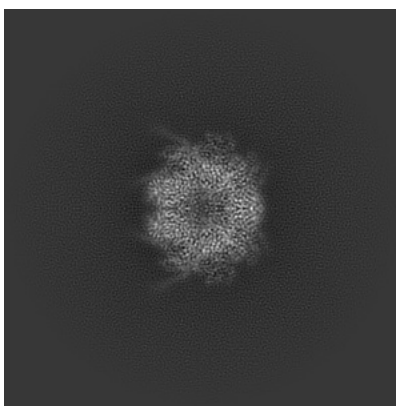
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

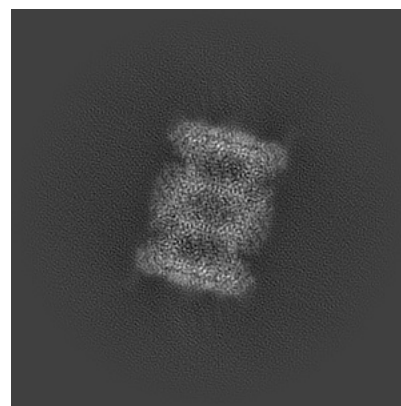
6.1.1 Primary map



X

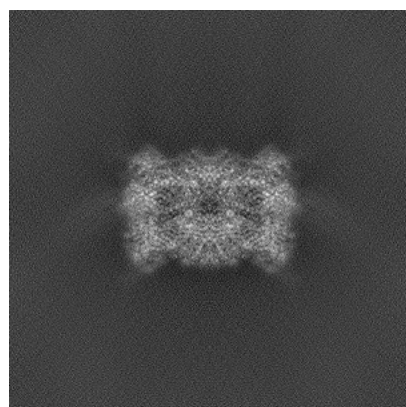


Y

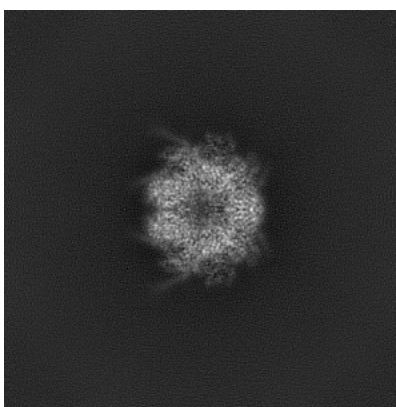


Z

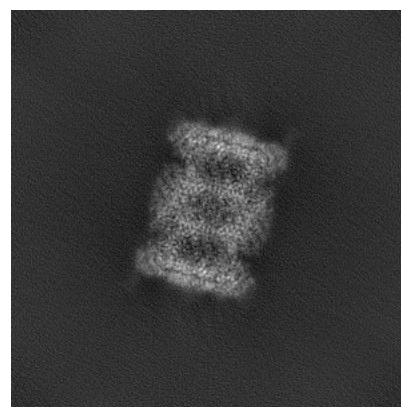
6.1.2 Raw map



X



Y

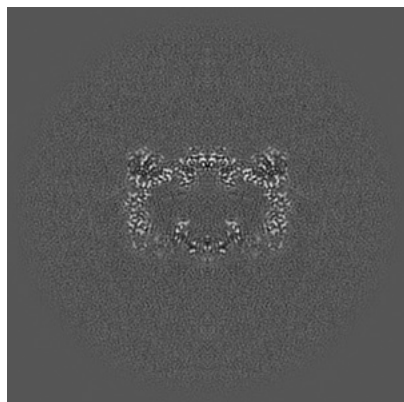


Z

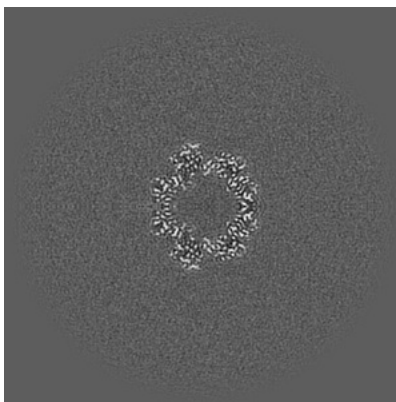
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

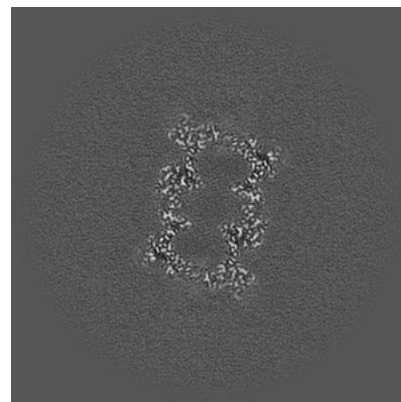
6.2.1 Primary map



X Index: 200

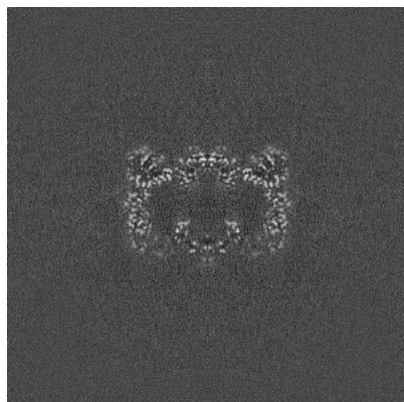


Y Index: 200

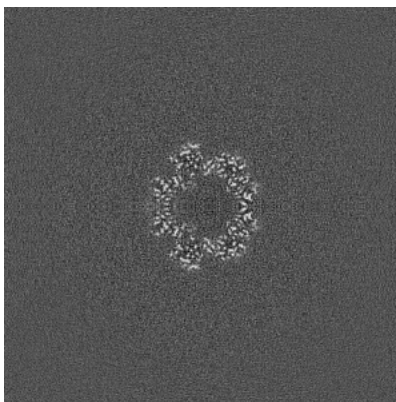


Z Index: 200

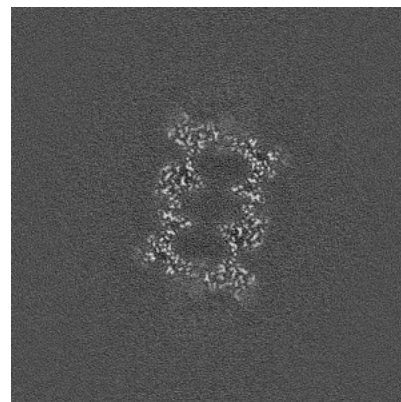
6.2.2 Raw map



X Index: 200



Y Index: 200

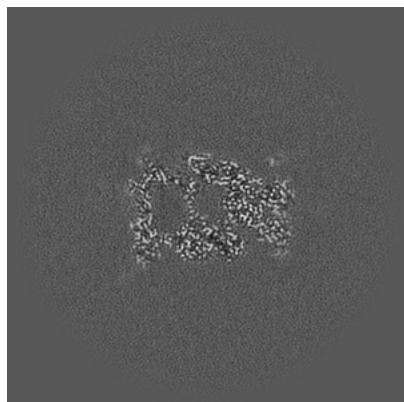


Z Index: 200

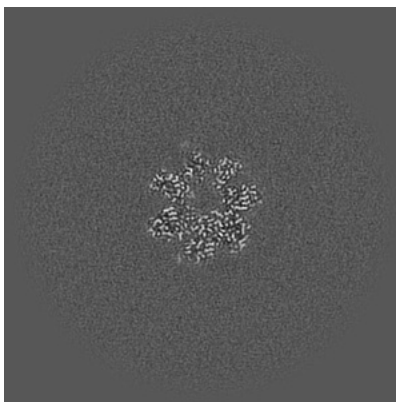
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

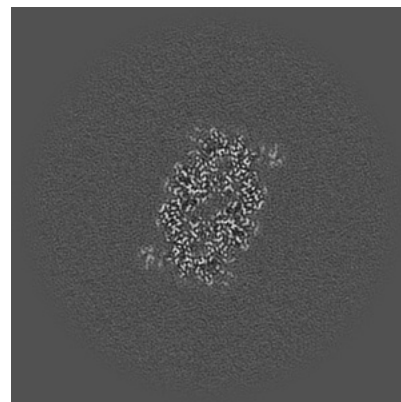
6.3.1 Primary map



X Index: 178

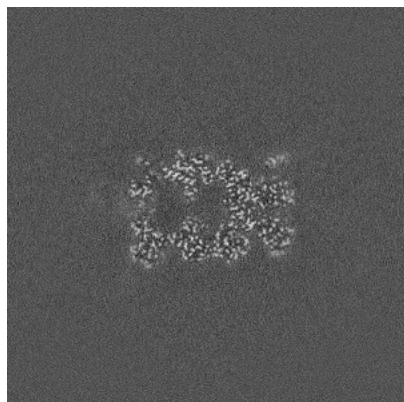


Y Index: 223

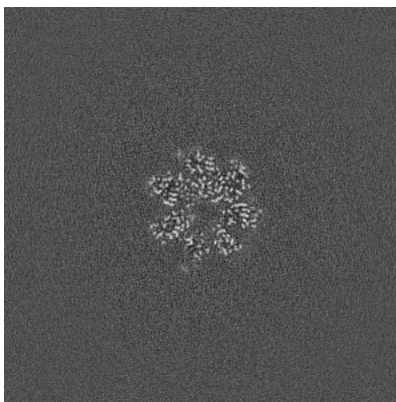


Z Index: 228

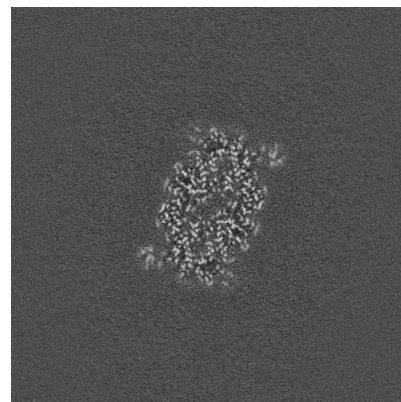
6.3.2 Raw map



X Index: 182



Y Index: 177

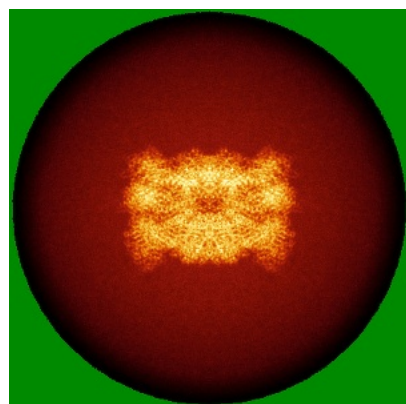


Z Index: 228

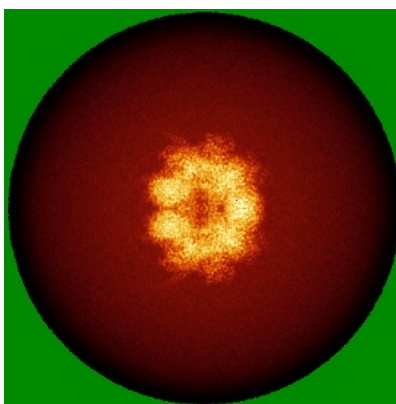
The images above show the largest variance slices of the map in three orthogonal directions.

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

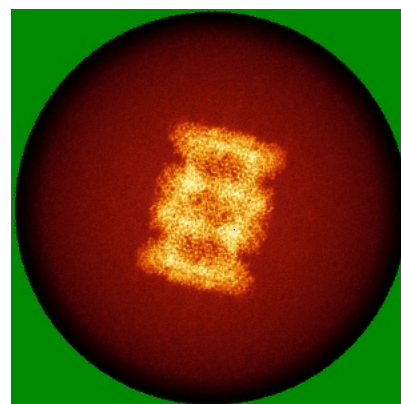
6.4.1 Primary map



X

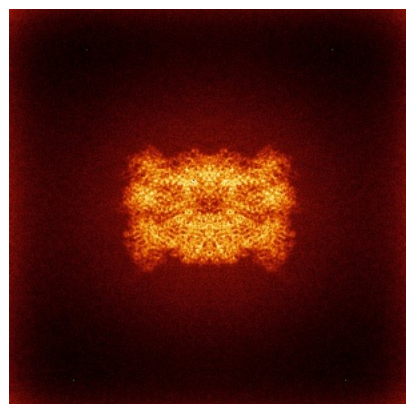


Y

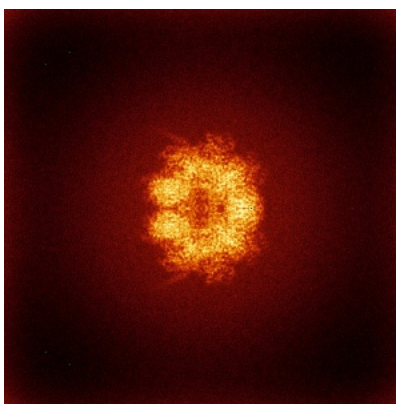


Z

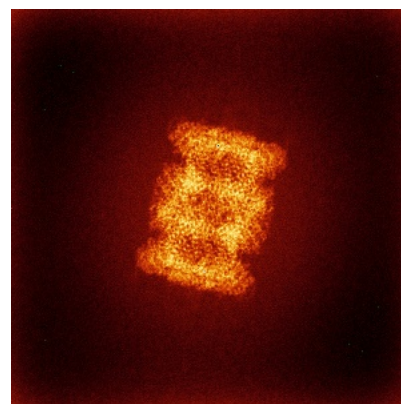
6.4.2 Raw map



X



Y

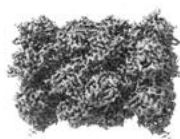


Z

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

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.28. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map



X



Y



Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

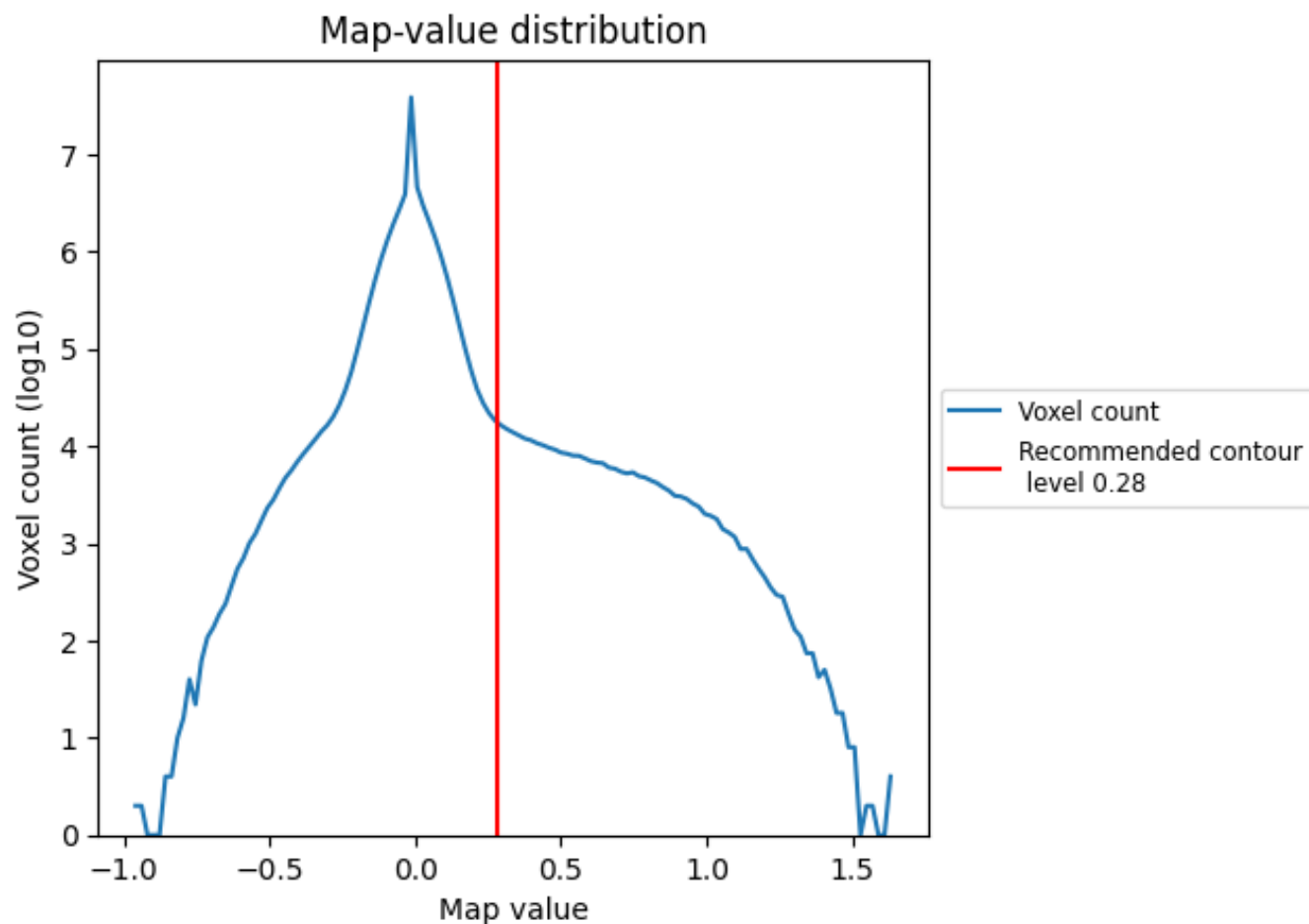
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

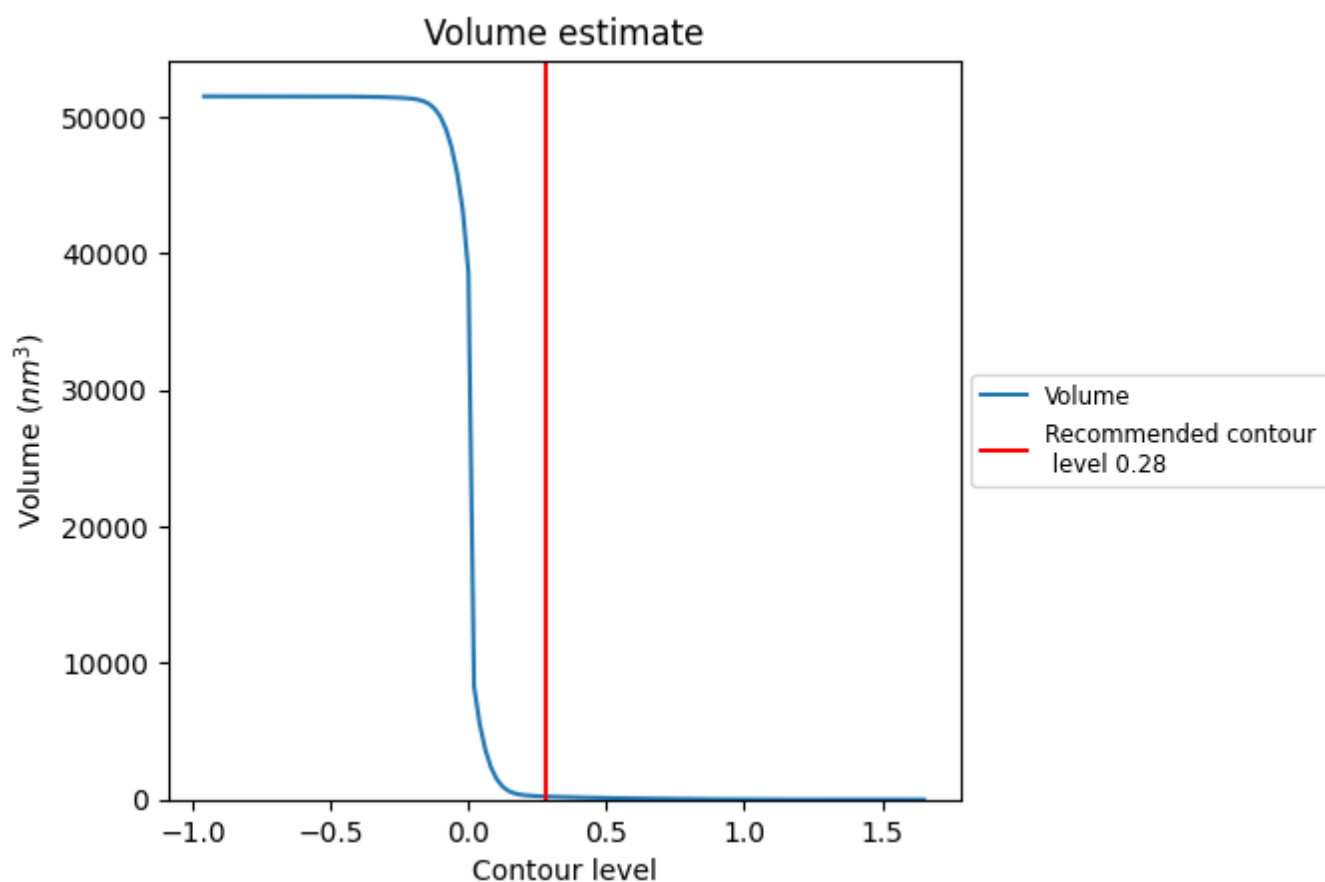
This section contains the results of statistical analysis of the map.

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.

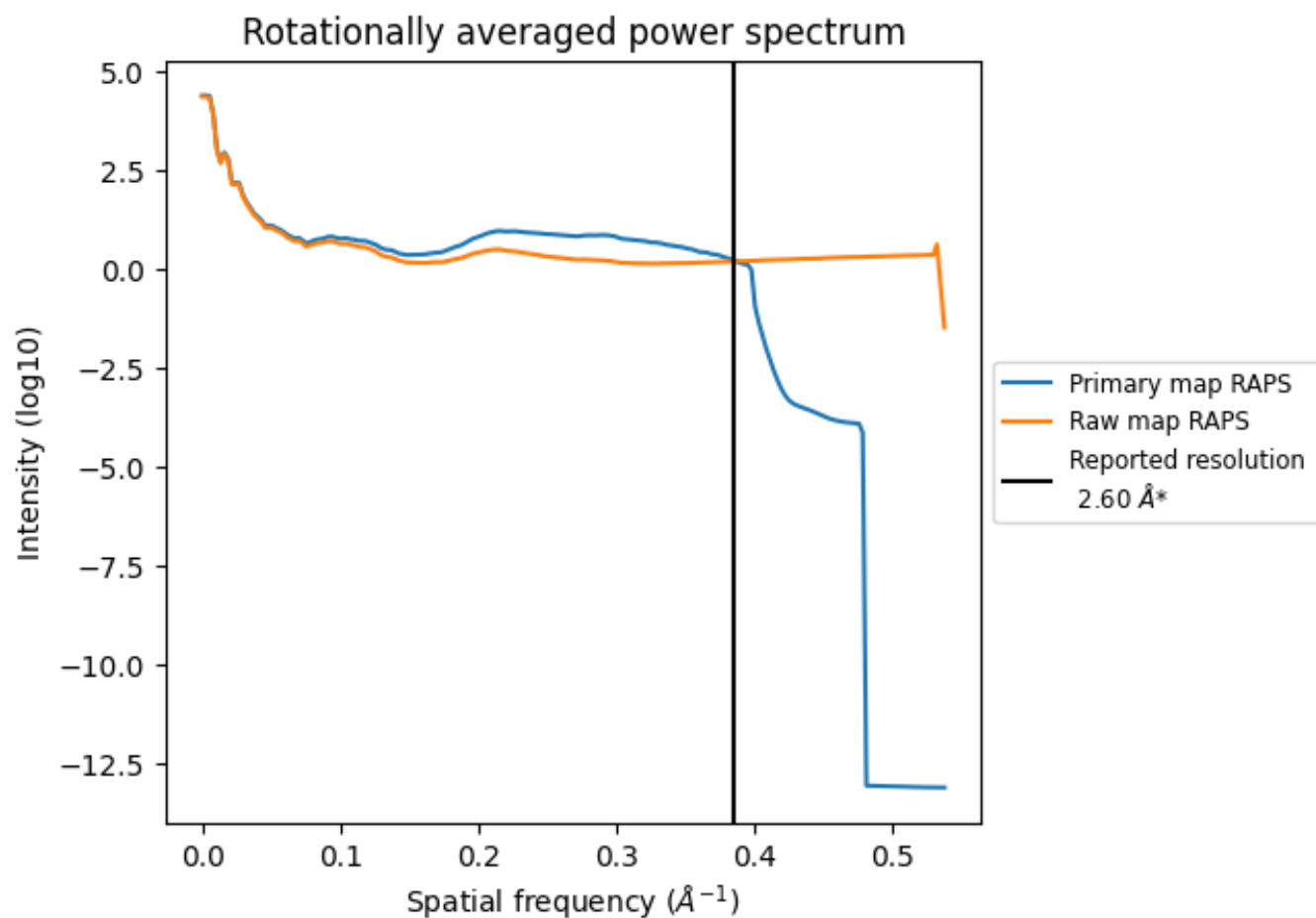
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 223 nm³; this corresponds to an approximate mass of 201 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 ⓘ

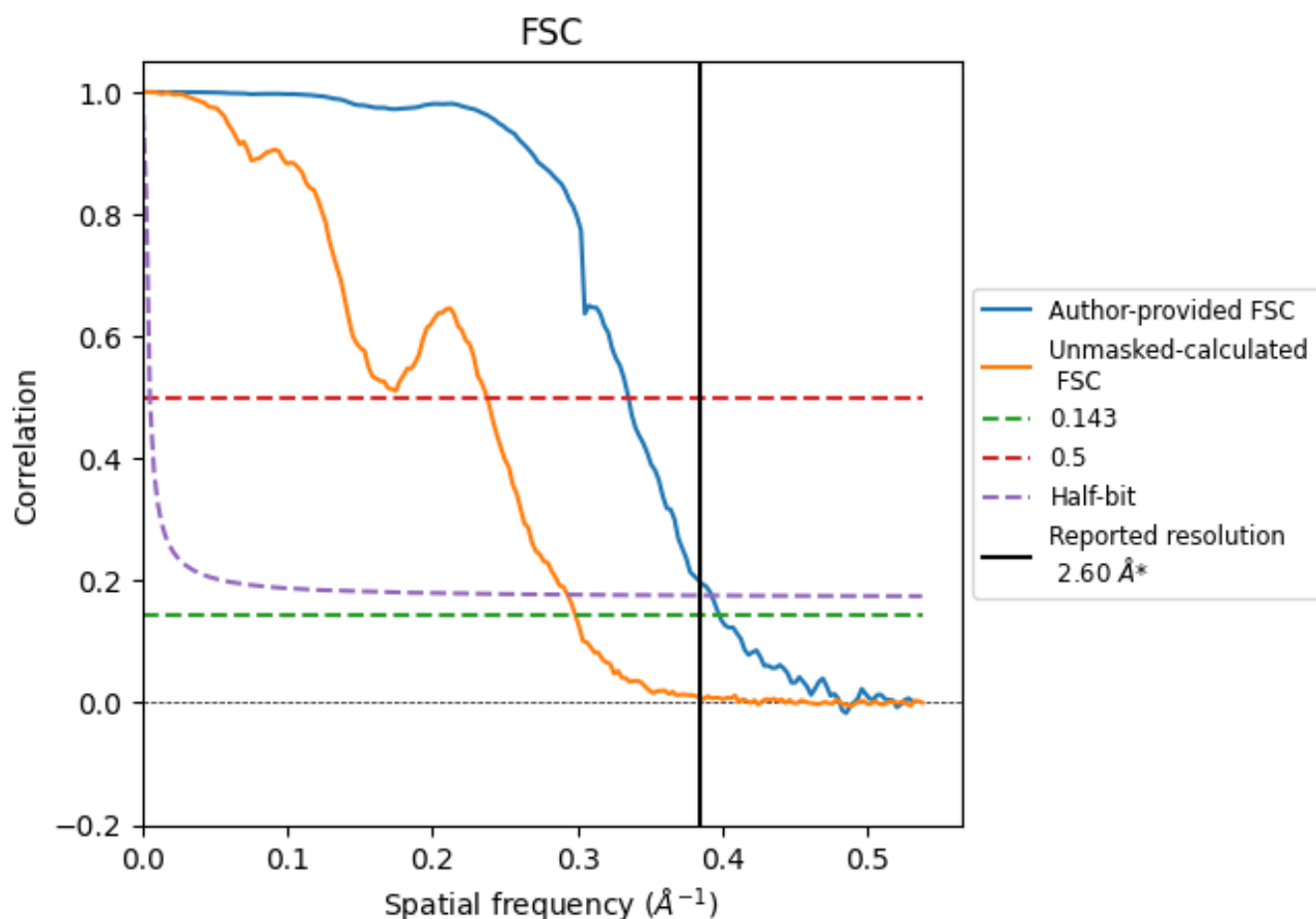


*Reported resolution corresponds to spatial frequency of 0.385 \AA^{-1}

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 0.385 \AA^{-1}

8.2 Resolution estimates [i](#)

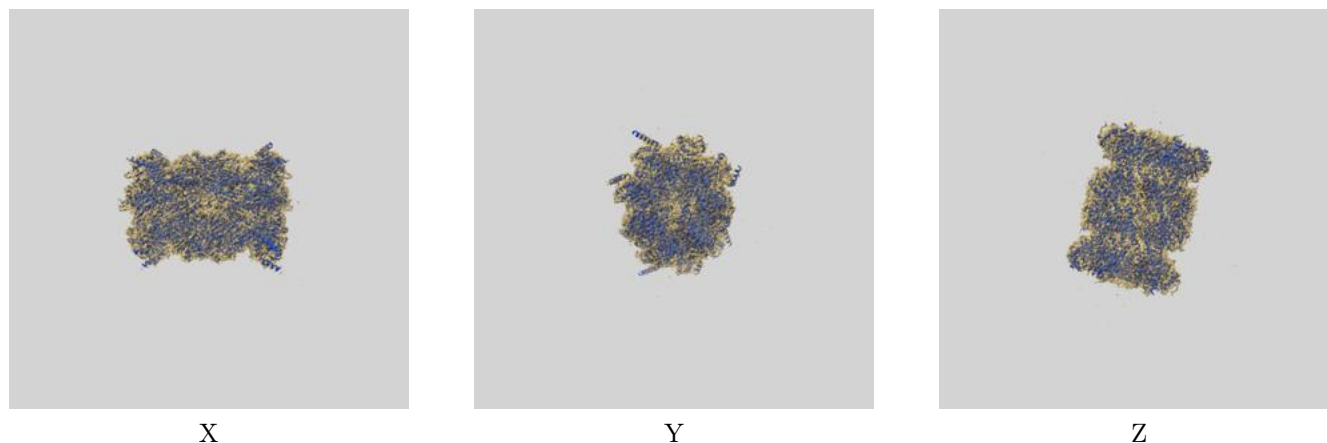
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.60	-	-
Author-provided FSC curve	2.51	2.98	2.55
Unmasked-calculated*	3.35	4.21	3.41

*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 3.35 differs from the reported value 2.6 by more than 10 %

9 Map-model fit [i](#)

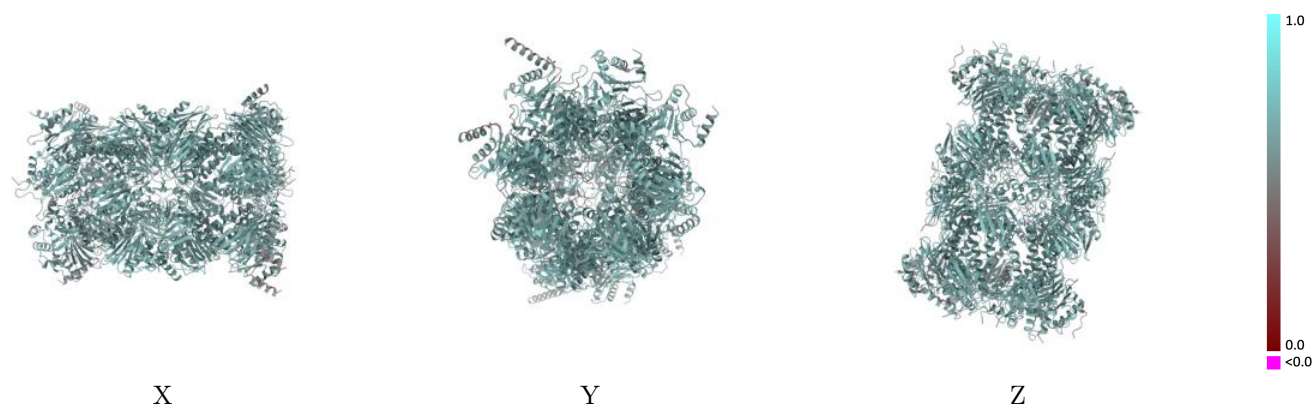
This section contains information regarding the fit between EMDB map EMD-73510 and PDB model 9YUZ. Per-residue inclusion information can be found in section [3](#) on page [8](#).

9.1 Map-model overlay [i](#)



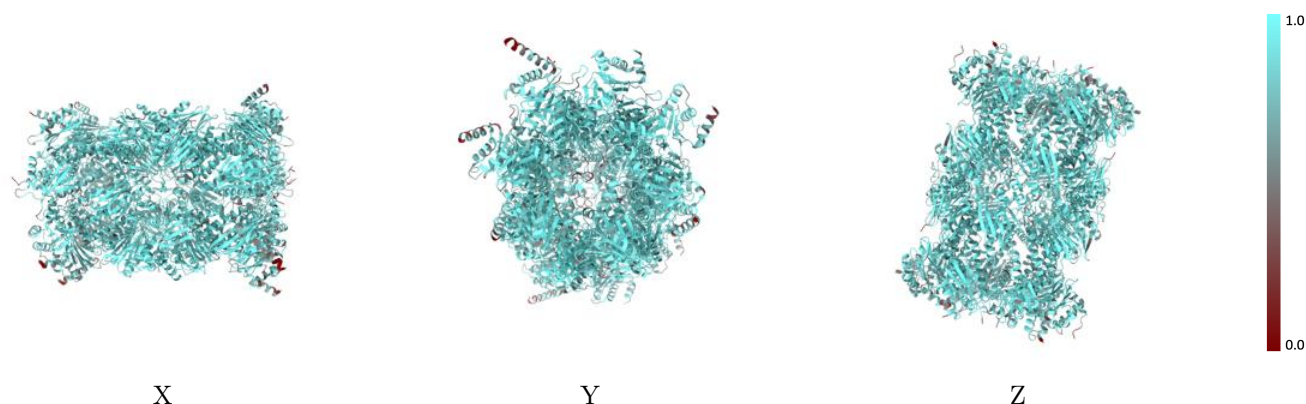
The images above show the 3D surface view of the map at the recommended contour level 0.28 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



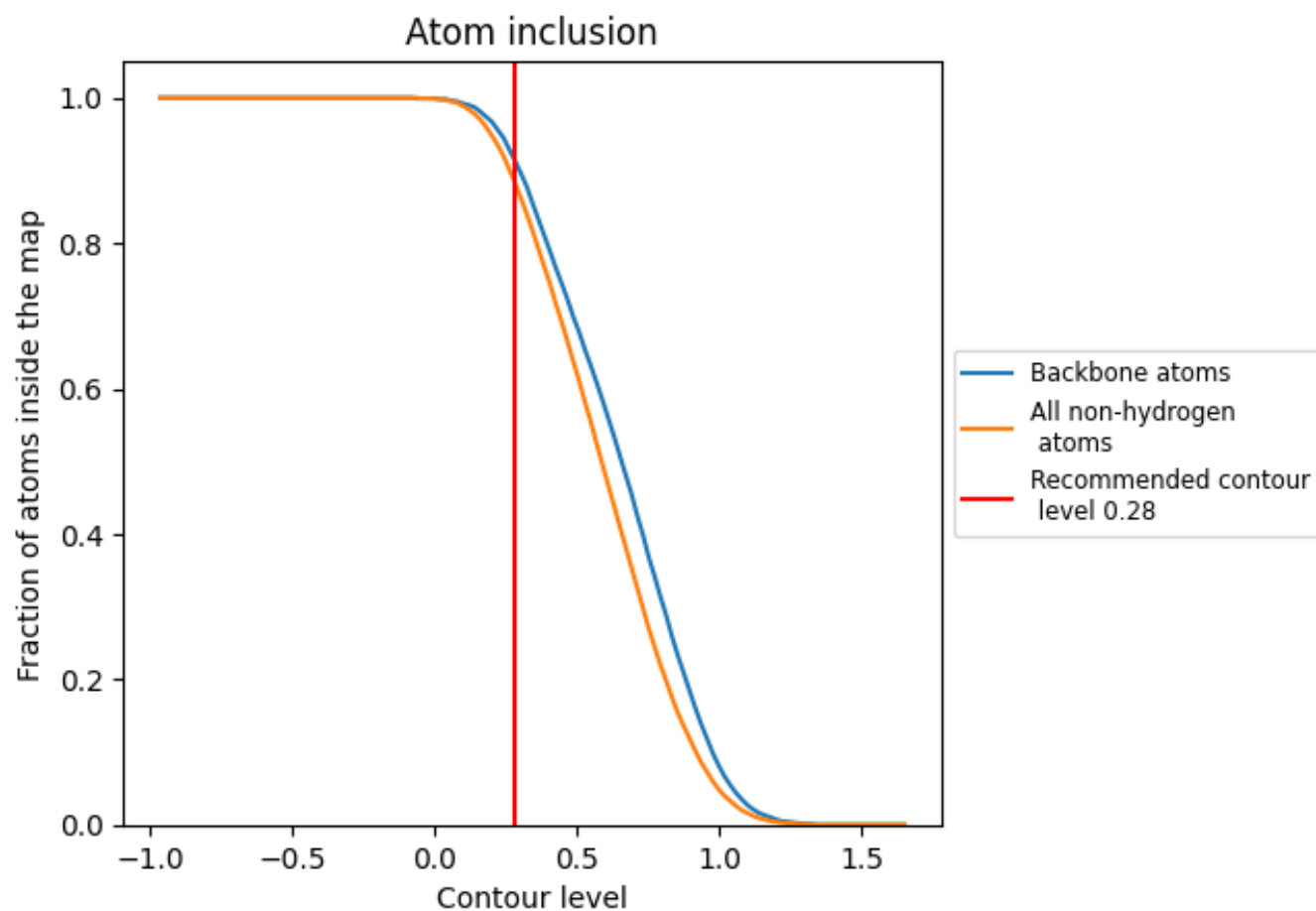
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.28).



























































9.4 Atom inclusion [i](#)



At the recommended contour level, 92% of all backbone atoms, 89% 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 (0.28) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8870	 0.6410
A	 0.9080	 0.6450
B	 0.8510	 0.6240
C	 0.8090	 0.6100
D	 0.8130	 0.6160
E	 0.8540	 0.6280
F	 0.8780	 0.6400
G	 0.8600	 0.6310
H	 0.9210	 0.6520
I	 0.9310	 0.6590
J	 0.9200	 0.6530
K	 0.9310	 0.6550
L	 0.9170	 0.6550
M	 0.9250	 0.6540
N	 0.9200	 0.6570
O	 0.9090	 0.6450
P	 0.8480	 0.6240
Q	 0.8090	 0.6090
R	 0.8150	 0.6170
S	 0.8580	 0.6270
T	 0.8780	 0.6400
U	 0.8590	 0.6300
V	 0.9210	 0.6540
W	 0.9290	 0.6580
X	 0.9200	 0.6550
Y	 0.9300	 0.6570
Z	 0.9160	 0.6560
a	 0.9260	 0.6540
b	 0.9200	 0.6570

