



Full wwPDB EM Validation Report ⓘ

Mar 10, 2026 – 12:42 pm GMT

PDB ID : 9RM0 / pdb_00009rm0
EMDB ID : EMD-54047
Title : 13S+Beta5+Beta6 proteasome precursor complex
Authors : Mark, E.; Ramos, P.C.; Nunes, M.M.; Dohmen, R.J.; Wendler, P.
Deposited on : 2025-06-17
Resolution : 3.29 Å (reported)
Based on initial model : 8RVL

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

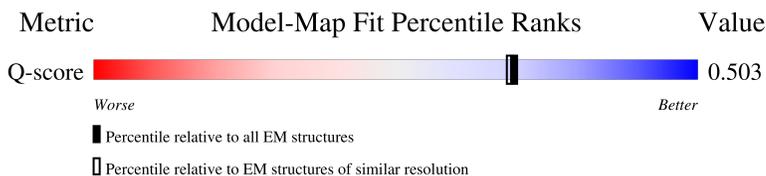
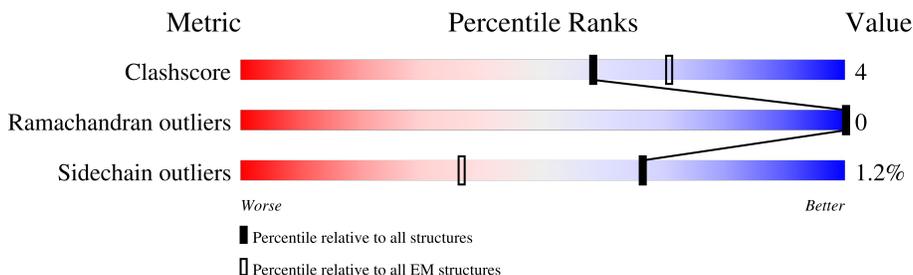
EMDB validation analysis : 0.0.1.dev132
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.48.1

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 3.29 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.



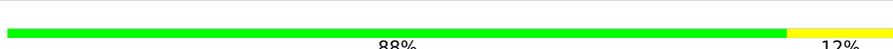
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	210492	15764	-
Ramachandran outliers	207382	16835	-
Sidechain outliers	206894	16415	-
Q-score	-	25397	14466 (2.79 - 3.79)

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	M	241	
2	A	252	
3	D	254	
4	E	260	

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Mol	Chain	Length	Quality of chain
5	F	234	 88% 10%
6	3	162	 12% 71% 13% 16%
7	4	276	 6% 84% 16%
8	5	267	 87% 12%
9	B	250	 88% 12%
10	C	258	 81% 10% 8%
11	G	288	 76% 10% 14%
12	I	261	 70% 13% 16%
13	J	205	 80% 13% 7%
14	K	198	 5% 90% 8%
15	L	287	 5% 61% 7% 32%

2 Entry composition [i](#)

There are 15 unique types of molecules in this entry. The entry contains 26081 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 beta type-6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	M	160	1185	752	206	223	4	0	0

- Molecule 2 is a protein called Proteasome subunit alpha type-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	A	250	1955	1241	329	377	8	0	0

- Molecule 3 is a protein called Proteasome subunit alpha type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	D	249	1949	1214	341	389	5	0	0

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

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	E	250	1929	1207	325	389	8	0	0

- Molecule 5 is a protein called Proteasome subunit alpha type-6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	F	234	1802	1134	313	350	5	0	0

- Molecule 6 is a protein called Proteasome maturation factor UMP1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	3	136	1078	661	196	215	6	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
3	-14	ASP	-	expression tag	UNP P38293
3	-13	TYR	-	expression tag	UNP P38293
3	-12	LYS	-	expression tag	UNP P38293
3	-11	ASP	-	expression tag	UNP P38293
3	-10	ASP	-	expression tag	UNP P38293
3	-9	ASP	-	expression tag	UNP P38293
3	-8	ASP	-	expression tag	UNP P38293
3	-7	LYS	-	expression tag	UNP P38293
3	-6	HIS	-	expression tag	UNP P38293
3	-5	HIS	-	expression tag	UNP P38293
3	-4	HIS	-	expression tag	UNP P38293
3	-3	HIS	-	expression tag	UNP P38293
3	-2	HIS	-	expression tag	UNP P38293
3	-1	HIS	-	expression tag	UNP P38293

- Molecule 7 is a protein called Proteasome chaperone 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
7	4	276	2147	1382	337	415	13	0	0

- Molecule 8 is a protein called Proteasome assembly chaperone 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
8	5	266	2161	1396	347	410	8	0	0

- Molecule 9 is a protein called Proteasome subunit alpha type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
9	B	248	1898	1208	313	374	3	0	0

- Molecule 10 is a protein called Proteasome subunit alpha type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	C	238	1868	1182	314	369	3	0	0

- Molecule 11 is a protein called Probable proteasome subunit alpha type-7.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
11	G	247	1917	1218	333	362	4	0	0

- Molecule 12 is a protein called Proteasome subunit beta type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
12	I	220	1672	1051	287	328	6	0	0

- Molecule 13 is a protein called Proteasome subunit beta type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
13	J	190	1477	950	240	279	8	0	0

- Molecule 14 is a protein called Proteasome subunit beta type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
14	K	196	1562	992	263	301	6	0	0

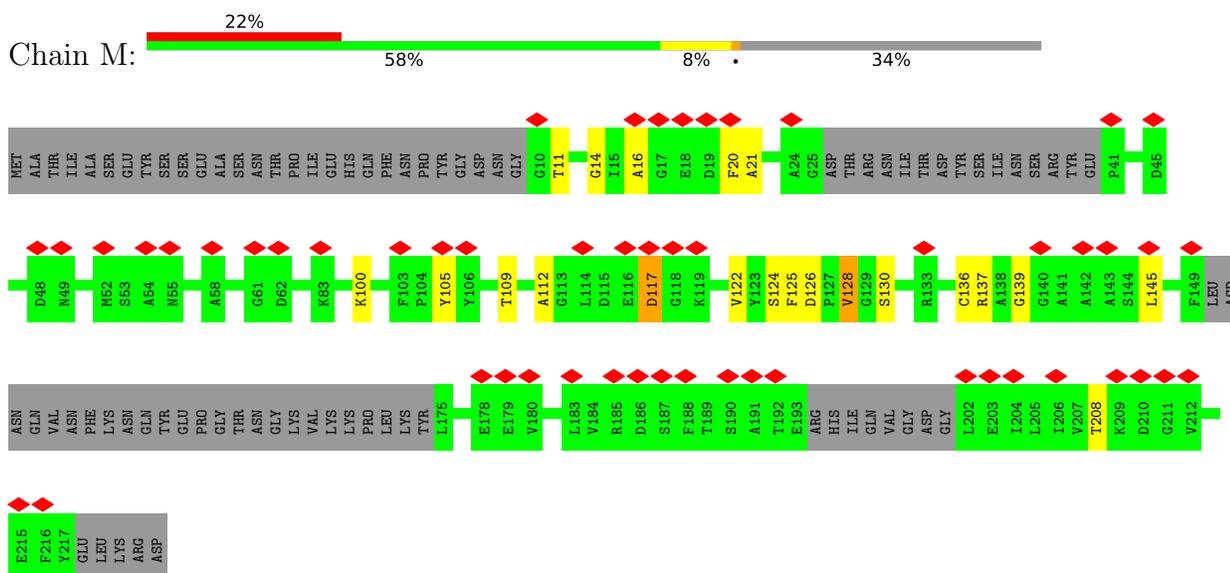
- Molecule 15 is a protein called Proteasome subunit beta type-5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
15	L	196	1481	942	251	280	8	0	0

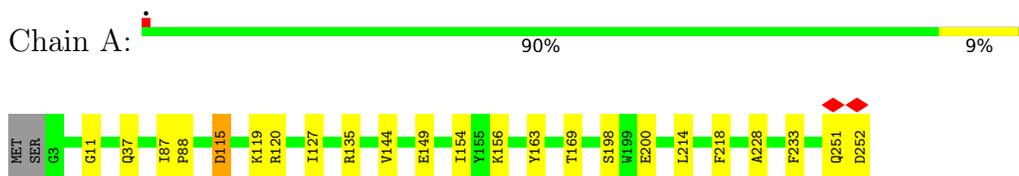
3 Residue-property plots [i](#)

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.

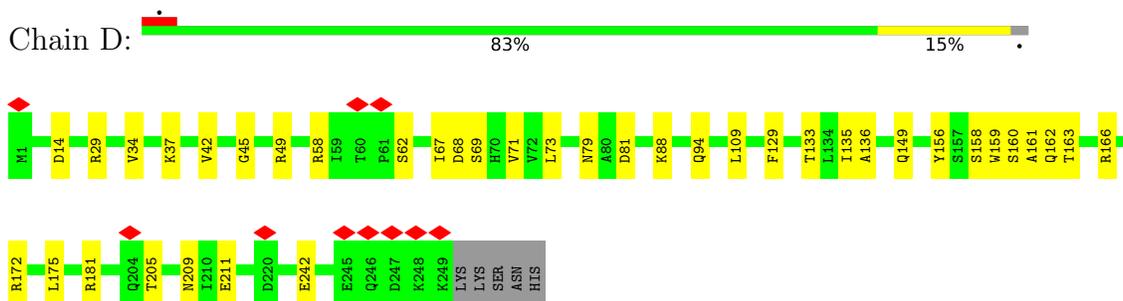
- Molecule 1: Proteasome subunit beta type-6



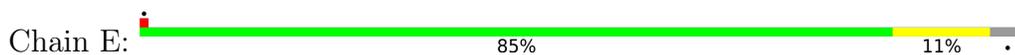
- Molecule 2: Proteasome subunit alpha type-1



- Molecule 3: Proteasome subunit alpha type-4



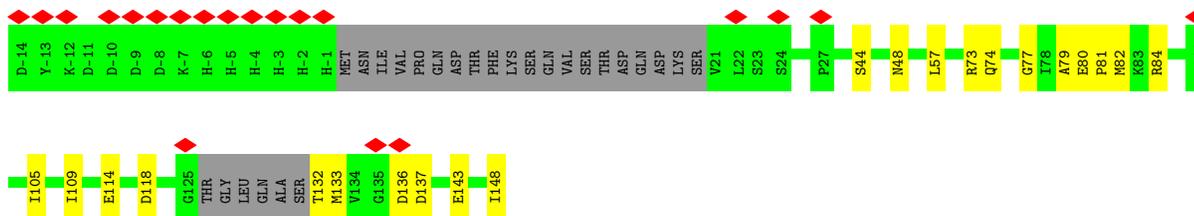
• Molecule 4: Proteasome subunit alpha type-5



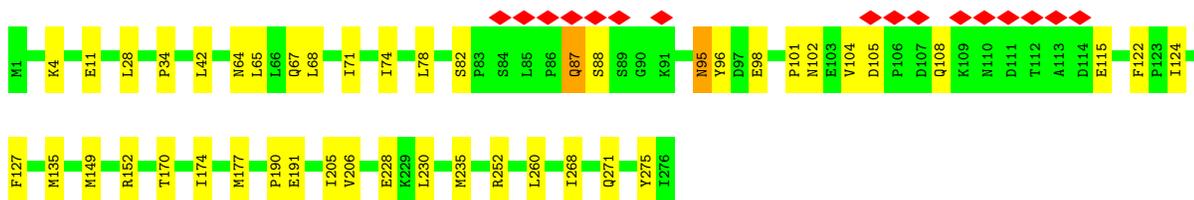
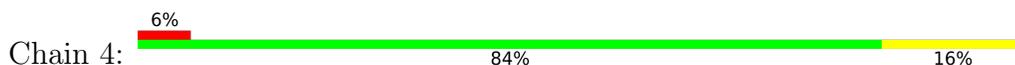
• Molecule 5: Proteasome subunit alpha type-6



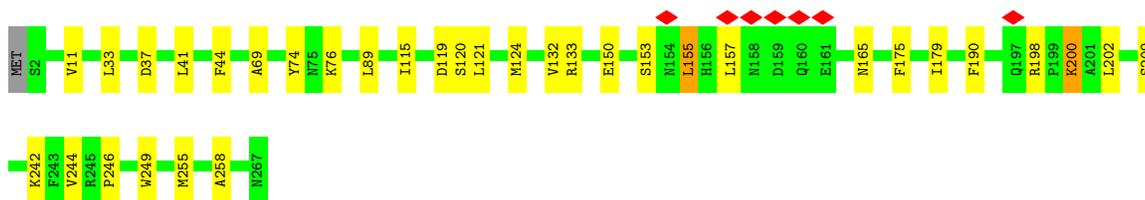
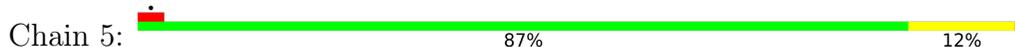
• Molecule 6: Proteasome maturation factor UMP1



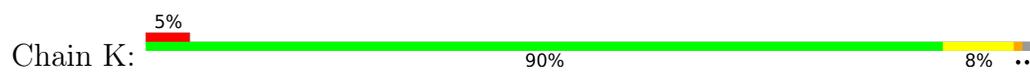
• Molecule 7: Proteasome chaperone 1



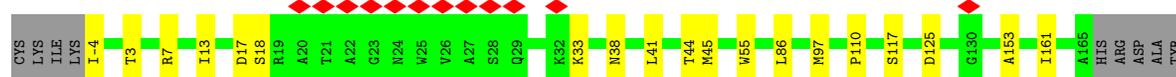
• Molecule 8: Proteasome assembly chaperone 2



• Molecule 9: Proteasome subunit alpha type-2



• Molecule 15: Proteasome subunit beta type-5



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	41532	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 ($e^-/\text{\AA}^2$)	64	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2800	Depositor
Magnification	105000	Depositor
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	0.815	Depositor
Minimum map value	-0.524	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.016	Depositor
Recommended contour level	0.0974	Depositor
Map size (Å)	498.0, 498.0, 498.0	wwPDB
Map dimensions	500, 500, 500	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.996, 0.996, 0.996	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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	M	0.08	0/1207	0.21	0/1627
2	A	0.10	0/1993	0.25	0/2700
3	D	0.10	0/1978	0.24	0/2677
4	E	0.09	0/1956	0.20	0/2635
5	F	0.09	0/1830	0.23	0/2473
6	3	0.08	0/1097	0.20	0/1484
7	4	0.09	0/2201	0.24	0/2993
8	5	0.09	0/2214	0.22	0/3010
9	B	0.10	0/1935	0.23	0/2621
10	C	0.10	0/1897	0.23	0/2566
11	G	0.10	0/1957	0.23	0/2643
12	I	0.09	0/1700	0.24	0/2306
13	J	0.10	0/1505	0.24	0/2031
14	K	0.08	0/1590	0.21	0/2144
15	L	0.08	0/1510	0.20	0/2046
All	All	0.09	0/26570	0.23	0/35956

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 [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	M	1185	0	1092	11	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	1955	0	1943	15	0
3	D	1949	0	1947	27	0
4	E	1929	0	1904	22	0
5	F	1802	0	1809	17	0
6	3	1078	0	1017	17	0
7	4	2147	0	2117	31	0
8	5	2161	0	2115	19	0
9	B	1898	0	1906	17	0
10	C	1868	0	1872	16	0
11	G	1917	0	1909	14	0
12	I	1672	0	1637	20	0
13	J	1477	0	1467	17	0
14	K	1562	0	1559	11	0
15	L	1481	0	1435	13	0
All	All	26081	0	25729	231	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 (231) 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:E:85:ALA:HB2	4:E:140:VAL:HG21	1.69	0.74
5:F:74:LEU:HD22	5:F:81:ALA:HB1	1.69	0.74
7:4:235:MET:HE1	7:4:268:ILE:HB	1.70	0.73
9:B:94:HIS:HA	9:B:98:LYS:HB3	1.74	0.68
3:D:73:LEU:HD11	3:D:133:THR:HB	1.77	0.67
4:E:52:LYS:HE3	4:E:218:GLN:HB2	1.74	0.67
7:4:74:ILE:HB	7:4:122:PHE:HB3	1.76	0.66
8:5:255:MET:HB2	8:5:258:ALA:HB2	1.78	0.65
6:3:133:MET:SD	10:C:102:TYR:OH	2.55	0.65
1:M:14:GLY:O	1:M:136:CYS:HA	1.96	0.64
6:3:118:ASP:OD2	12:I:89:LYS:NZ	2.32	0.63
3:D:58:ARG:NH2	10:C:146:TYR:O	2.32	0.63
12:I:35:HIS:HB3	12:I:56:THR:HG21	1.79	0.63
2:A:87:ILE:HG23	2:A:88:PRO:HD3	1.82	0.62
6:3:133:MET:HE1	14:K:67:TYR:HB2	1.82	0.62
12:I:188:ARG:NH1	12:I:189:ASN:OD1	2.33	0.61
15:L:7:ARG:NH2	15:L:125:ASP:OD1	2.33	0.61
2:A:120:ARG:NH1	6:3:114:GLU:OE2	2.32	0.61
2:A:144:VAL:HG12	2:A:154:ILE:HG12	1.82	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
10:C:216:ILE:HG12	10:C:227:GLN:HG2	1.82	0.60
7:4:152:ARG:NH2	8:5:37:ASP:OD1	2.34	0.60
5:F:177:ASP:O	5:F:181:LYS:NZ	2.35	0.59
10:C:136:ILE:HG12	10:C:150:THR:HG22	1.84	0.58
3:D:67:ILE:HG21	3:D:109:LEU:HD21	1.85	0.58
14:K:15:LEU:HD12	14:K:43:LEU:HD23	1.85	0.58
2:A:198:SER:OG	2:A:200:GLU:OE1	2.19	0.58
12:I:-2:THR:HB	12:I:33:LYS:HE2	1.85	0.57
4:E:205:LYS:HB2	4:E:212:LEU:HD22	1.85	0.57
2:A:228:ALA:HB2	2:A:233:PHE:HD1	1.70	0.57
2:A:156:LYS:O	2:A:163:TYR:HA	2.05	0.57
4:E:5:ARG:O	5:F:4:ASN:ND2	2.37	0.57
3:D:81:ASP:HB3	3:D:129:PHE:HD1	1.69	0.56
11:G:200:ILE:HG21	11:G:214:LEU:HD13	1.87	0.56
5:F:63:ILE:HG21	5:F:214:ALA:HB2	1.88	0.56
7:4:105:ASP:HB3	7:4:108:GLN:HB2	1.87	0.56
8:5:33:LEU:HD22	8:5:74:TYR:HB2	1.87	0.56
11:G:51:GLU:OE2	11:G:204:HIS:ND1	2.32	0.56
3:D:181:ARG:NH2	4:E:57:PRO:O	2.31	0.56
4:E:70:ILE:HG21	4:E:112:LEU:HD21	1.87	0.56
12:I:174:ASP:OD1	12:I:188:ARG:NH1	2.38	0.56
15:L:33:LYS:HA	15:L:45:MET:HE2	1.86	0.56
8:5:200:LYS:H	8:5:200:LYS:HD3	1.72	0.55
12:I:124:TYR:HB2	12:I:138:LEU:HD13	1.88	0.55
1:M:16:ALA:HB2	1:M:122:VAL:HG23	1.89	0.55
3:D:73:LEU:HD13	3:D:135:ILE:HG12	1.89	0.55
4:E:31:ILE:HD13	4:E:141:ALA:HB2	1.89	0.54
4:E:5:ARG:NH2	4:E:7:GLU:OE2	2.40	0.54
3:D:88:LYS:NZ	6:3:143:GLU:OE2	2.38	0.54
9:B:42:GLY:HA3	9:B:185:LEU:HD13	1.89	0.54
7:4:82:SER:N	7:4:115:GLU:OE1	2.41	0.53
3:D:158:SER:HB3	4:E:63:SER:HB3	1.90	0.53
3:D:161:ALA:HB1	3:D:175:LEU:HD13	1.90	0.53
2:A:127:ILE:HD11	6:3:109:ILE:HB	1.90	0.53
3:D:161:ALA:HB3	4:E:58:LEU:HD13	1.89	0.53
7:4:170:THR:OG1	7:4:228:GLU:OE1	2.22	0.53
7:4:205:ILE:HG22	7:4:206:VAL:HG13	1.91	0.53
5:F:52:ASN:ND2	5:F:54:ASP:O	2.41	0.53
10:C:7:ASP:O	10:C:21:GLN:NE2	2.39	0.53
2:A:119:LYS:HE3	9:B:83:ARG:HD2	1.89	0.52
5:F:117:GLN:HG2	11:G:83:PRO:HB3	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
8:5:132:VAL:HG23	8:5:133:ARG:HG3	1.91	0.52
13:J:9:GLY:O	13:J:42:LYS:NZ	2.43	0.52
2:A:149:GLU:OE2	12:I:75:ARG:NH2	2.40	0.52
1:M:21:ALA:HB1	1:M:112:ALA:HB1	1.90	0.52
15:L:13:ILE:HG13	15:L:153:ALA:HB1	1.91	0.52
11:G:193:VAL:HG13	11:G:216:ILE:HG21	1.92	0.52
15:L:18:SER:HA	15:L:33:LYS:HZ1	1.74	0.52
11:G:9:ASP:O	11:G:23:GLN:NE2	2.43	0.51
13:J:15:MET:HE3	13:J:154:TYR:HD1	1.75	0.51
3:D:94:GLN:HG3	14:K:66:LEU:HB2	1.92	0.51
14:K:11:ASP:OD1	14:K:11:ASP:N	2.43	0.51
5:F:72:LEU:HD23	5:F:88:LEU:HD23	1.93	0.51
10:C:150:THR:HG21	10:C:163:ILE:HG12	1.91	0.51
4:E:52:LYS:HB2	4:E:216:ASN:HA	1.93	0.51
15:L:7:ARG:HD3	15:L:110:PRO:HB2	1.92	0.51
2:A:214:LEU:HD12	2:A:218:PHE:HZ	1.76	0.51
4:E:5:ARG:HH22	7:4:11:GLU:HB2	1.76	0.51
12:I:112:SER:HB3	12:I:125:LEU:HD13	1.91	0.51
9:B:45:ILE:HG13	9:B:212:ALA:HB3	1.93	0.51
10:C:50:ARG:NH2	10:C:62:SER:OG	2.43	0.51
3:D:205:THR:OG1	3:D:209:ASN:OD1	2.19	0.51
2:A:115:ASP:OD1	2:A:115:ASP:N	2.33	0.51
6:3:44:SER:O	6:3:48:ASN:ND2	2.38	0.50
8:5:115:ILE:HG22	8:5:202:LEU:HD11	1.93	0.50
12:I:45:GLY:HA3	12:I:52:THR:HG21	1.92	0.50
13:J:173:ASN:ND2	13:J:176:ASP:OD2	2.43	0.50
8:5:165:ASN:HB3	8:5:179:ILE:HG13	1.93	0.50
1:M:126:ASP:OD1	1:M:130:SER:N	2.45	0.50
3:D:71:VAL:HG11	3:D:109:LEU:HD23	1.94	0.50
3:D:29:ARG:NH1	7:4:96:TYR:OH	2.45	0.50
11:G:87:HIS:O	11:G:91:ARG:HG2	2.11	0.50
6:3:132:THR:N	6:3:136:ASP:OD2	2.45	0.49
4:E:84:ASP:N	4:E:84:ASP:OD1	2.45	0.49
6:3:73:ARG:HA	6:3:77:GLY:O	2.12	0.49
10:C:44:ILE:HD11	10:C:146:TYR:HB3	1.95	0.49
5:F:135:ILE:HD11	5:F:222:PHE:HE1	1.77	0.49
1:M:124:SER:HB2	1:M:137:ARG:HG3	1.95	0.49
4:E:50:VAL:HG21	4:E:66:LYS:HB2	1.94	0.49
5:F:34:VAL:HA	5:F:161:ILE:O	2.13	0.49
7:4:65:LEU:HD13	7:4:252:ARG:HE	1.78	0.49
10:C:107:PRO:HD2	10:C:110:ILE:HD12	1.95	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
12:I:14:ILE:HG23	12:I:176:CYS:HB3	1.94	0.48
8:5:242:LYS:HG3	8:5:244:VAL:HG23	1.96	0.48
3:D:49:ARG:HH21	7:4:102:ASN:H	1.62	0.48
6:3:80:GLU:HB3	6:3:81:PRO:HD3	1.94	0.48
12:I:51:ASP:OD2	13:J:99:ARG:NH2	2.37	0.48
13:J:146:LEU:HD13	13:J:174:ALA:HB2	1.95	0.48
1:M:100:LYS:HG3	1:M:105:TYR:CZ	2.48	0.47
10:C:66:LEU:HD13	10:C:214:ALA:HB2	1.95	0.47
13:J:180:LEU:HB3	13:J:202:MET:HG2	1.96	0.47
12:I:148:LYS:HE3	12:I:177:VAL:HG11	1.97	0.47
14:K:3:ILE:HD12	14:K:135:TYR:HB3	1.97	0.47
7:4:64:ASN:O	7:4:67:GLN:NE2	2.48	0.47
15:L:3:THR:HG21	15:L:44:THR:HG21	1.94	0.47
13:J:149:MET:HE1	13:J:174:ALA:HA	1.96	0.47
1:M:11:THR:HA	1:M:139:GLY:O	2.14	0.47
3:D:79:ASN:ND2	7:4:101:PRO:O	2.46	0.47
6:3:79:ALA:HA	6:3:82:MET:HE2	1.97	0.47
7:4:95:ASN:ND2	7:4:98:GLU:OE1	2.45	0.47
9:B:186:GLU:OE1	9:B:246:ARG:NH1	2.45	0.47
9:B:193:LEU:HD21	9:B:211:LEU:HD11	1.97	0.47
12:I:51:ASP:HB3	12:I:94:ILE:HG23	1.97	0.47
13:J:23:ILE:HG23	13:J:188:TYR:HB2	1.95	0.47
13:J:21:VAL:HG23	13:J:190:ILE:HB	1.97	0.47
11:G:211:ASP:OD1	11:G:212:PHE:N	2.48	0.47
8:5:155:LEU:O	8:5:157:LEU:N	2.48	0.47
7:4:122:PHE:HE1	7:4:135:MET:HB2	1.81	0.46
8:5:74:TYR:CE2	8:5:76:LYS:HG2	2.50	0.46
7:4:230:LEU:HB2	7:4:235:MET:HE3	1.96	0.46
9:B:140:ASP:OD1	9:B:140:ASP:N	2.48	0.46
3:D:42:VAL:HG11	3:D:136:ALA:HB1	1.98	0.46
9:B:75:TYR:HB3	9:B:82:TYR:CD1	2.50	0.46
5:F:71:GLY:HA3	5:F:222:PHE:CE1	2.51	0.46
13:J:193:ASP:OD1	13:J:193:ASP:N	2.46	0.46
15:L:18:SER:O	15:L:174:SER:OG	2.29	0.46
4:E:1:MET:HE2	7:4:190:PRO:HA	1.98	0.46
13:J:190:ILE:HG23	13:J:195:VAL:HG22	1.97	0.46
15:L:55:TRP:CE3	15:L:86:LEU:HD21	2.51	0.46
9:B:149:GLN:O	9:B:156:TYR:HA	2.15	0.46
13:J:176:ASP:HA	13:J:180:LEU:HD21	1.97	0.45
5:F:180:ILE:HG23	5:F:181:LYS:HG3	1.98	0.45
7:4:87:GLN:OE1	7:4:88:SER:N	2.36	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
13:J:88:THR:HG23	13:J:124:PHE:CZ	2.51	0.45
9:B:62:SER:OG	9:B:237:LYS:NZ	2.45	0.45
9:B:64:VAL:HG11	9:B:212:ALA:HB2	1.99	0.45
10:C:158:THR:HB	10:C:160:TRP:HE1	1.81	0.45
12:I:13:VAL:HG22	12:I:177:VAL:HG22	1.99	0.45
8:5:119:ASP:O	8:5:209:SER:HA	2.16	0.45
11:G:24:VAL:HG11	11:G:154:SER:HB3	1.98	0.45
13:J:16:THR:HG22	13:J:21:VAL:HG12	1.99	0.45
9:B:74:VAL:HG12	9:B:135:LEU:HB2	1.98	0.45
8:5:44:PHE:HB3	8:5:69:ALA:HB2	1.98	0.45
10:C:198:SER:O	10:C:201:THR:OG1	2.34	0.45
7:4:68:LEU:HD23	7:4:127:PHE:HB3	2.00	0.44
15:L:17:ASP:HB2	15:L:161:ILE:HG23	1.99	0.44
1:M:128:VAL:HG13	15:L:-4:ILE:HD13	1.99	0.44
2:A:37:GLN:NE2	11:G:19:GLY:O	2.48	0.44
4:E:84:ASP:HB3	4:E:138:PHE:CD1	2.53	0.44
4:E:121:LEU:HD22	5:F:79:PRO:HB3	1.98	0.44
10:C:215:THR:HG21	10:C:217:ARG:HH21	1.82	0.44
7:4:177:MET:HE2	7:4:177:MET:HB3	1.83	0.44
5:F:38:LEU:HD21	5:F:193:GLY:HA2	2.00	0.44
6:3:80:GLU:O	6:3:84:ARG:HG2	2.17	0.44
11:G:220:SER:HB3	11:G:223:GLU:HB2	1.99	0.44
3:D:149:GLN:O	3:D:156:TYR:HA	2.18	0.44
3:D:162:GLN:OE1	3:D:172:ARG:NH2	2.47	0.44
4:E:197:GLU:OE2	4:E:231:TYR:OH	2.29	0.44
12:I:17:ASP:HB2	12:I:163:ILE:HD11	1.99	0.44
14:K:111:LYS:HD3	14:K:113:LYS:HE2	2.00	0.44
3:D:166:ARG:NE	7:4:104:VAL:HG21	2.33	0.44
6:3:57:LEU:HD12	12:I:-24:PHE:HZ	1.81	0.44
7:4:34:PRO:HG2	7:4:149:MET:HG3	2.00	0.44
5:F:156:LEU:HB3	11:G:59:LEU:HD23	2.00	0.43
6:3:73:ARG:HH21	6:3:74:GLN:HG2	1.82	0.43
11:G:68:GLN:HG3	11:G:89:VAL:HG21	2.00	0.43
13:J:146:LEU:HA	13:J:149:MET:HE3	1.99	0.43
15:L:38:ASN:OD1	15:L:41:LEU:N	2.51	0.43
12:I:80:LEU:HD12	12:I:113:ILE:HD11	2.00	0.43
3:D:159:TRP:HZ3	4:E:56:SER:HB3	1.83	0.43
6:3:143:GLU:HG2	6:3:148:ILE:HD11	1.99	0.43
8:5:119:ASP:OD1	8:5:120:SER:N	2.52	0.43
14:K:167:GLU:HA	14:K:170:LYS:HZ2	1.84	0.43
1:M:20:PHE:HB3	1:M:208:THR:HG22	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:D:34:VAL:HG13	3:D:163:THR:HG22	2.00	0.43
4:E:71:ASP:OD1	4:E:72:ARG:N	2.45	0.43
12:I:12:VAL:HG13	12:I:178:MET:HE3	1.99	0.43
14:K:149:ARG:HB2	14:K:152:MET:HG3	2.00	0.43
8:5:121:LEU:HD23	8:5:175:PHE:HE2	1.83	0.43
12:I:1:THR:OG1	12:I:33:LYS:NZ	2.52	0.43
13:J:63:LEU:HD11	13:J:105:VAL:HG21	2.01	0.43
5:F:186:PRO:HB3	5:F:215:ILE:HD11	2.01	0.43
1:M:117:ASP:OD1	1:M:117:ASP:N	2.38	0.43
8:5:41:LEU:HD23	8:5:89:LEU:HD23	2.00	0.43
6:3:137:ASP:N	6:3:137:ASP:OD1	2.52	0.42
3:D:14:ASP:N	3:D:14:ASP:OD1	2.47	0.42
7:4:34:PRO:HB3	7:4:78:LEU:HB2	2.00	0.42
10:C:10:THR:HG22	10:C:21:GLN:HG3	2.01	0.42
2:A:135:ARG:HD3	11:G:13:SER:HB2	2.01	0.42
9:B:71:ILE:HG21	9:B:110:LEU:HD23	2.00	0.42
7:4:74:ILE:HG13	7:4:124:ILE:HD11	2.02	0.42
7:4:42:LEU:HD13	7:4:71:ILE:HG21	2.01	0.42
14:K:167:GLU:OE2	14:K:171:ARG:NE	2.52	0.42
1:M:109:THR:HB	1:M:125:PHE:HB2	2.01	0.42
7:4:260:LEU:HD23	7:4:260:LEU:HA	1.92	0.42
6:3:105:ILE:HG21	9:B:84:VAL:HG13	2.02	0.42
3:D:68:ASP:OD1	3:D:69:SER:N	2.51	0.42
8:5:246:PRO:HG2	8:5:249:TRP:CD1	2.54	0.42
10:C:207:THR:OG1	10:C:209:ASP:OD1	2.27	0.42
12:I:3:ILE:HG22	12:I:99:ILE:HD12	2.02	0.42
9:B:101:TYR:HB3	13:J:86:THR:HG23	2.02	0.41
5:F:26:LEU:HD23	5:F:149:PRO:HG2	2.03	0.41
11:G:150:MET:HB3	11:G:160:TYR:CE1	2.55	0.41
14:K:16:ALA:HB1	14:K:179:VAL:HG11	2.02	0.41
3:D:37:LYS:HE2	3:D:160:SER:HA	2.03	0.41
15:L:97:MET:H	15:L:117:SER:HB3	1.85	0.41
3:D:45:GLY:HA2	3:D:211:GLU:O	2.21	0.41
8:5:150:GLU:O	8:5:153:SER:OG	2.34	0.41
4:E:232:ASP:OD1	4:E:232:ASP:N	2.49	0.41
7:4:174:ILE:HG22	7:4:191:GLU:HB3	2.03	0.41
7:4:268:ILE:HD12	7:4:271:GLN:HB2	2.03	0.41
9:B:181:ASP:OD1	9:B:181:ASP:N	2.53	0.41
10:C:83:ASP:HB3	10:C:131:PHE:CD1	2.56	0.41
15:L:17:ASP:HB2	15:L:161:ILE:HD12	2.03	0.41
3:D:62:SER:OG	3:D:211:GLU:OE2	2.26	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:F:123:TYR:CE2	7:4:4:LYS:HG2	2.56	0.40
2:A:251:GLN:HB3	2:A:252:ASP:H	1.59	0.40
4:E:19:GLY:O	7:4:275:TYR:OH	2.33	0.40
9:B:18:LEU:HD12	9:B:21:ILE:HD12	2.01	0.40
2:A:11:GLY:HA3	8:5:124:MET:HE2	2.03	0.40
14:K:22:THR:HG23	14:K:25:ILE:HB	2.02	0.40
7:4:28:LEU:HD13	8:5:190:PHE:CE2	2.56	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	M	152/241 (63%)	146 (96%)	6 (4%)	0	100	100
2	A	248/252 (98%)	242 (98%)	6 (2%)	0	100	100
3	D	247/254 (97%)	241 (98%)	6 (2%)	0	100	100
4	E	248/260 (95%)	246 (99%)	2 (1%)	0	100	100
5	F	232/234 (99%)	226 (97%)	6 (3%)	0	100	100
6	3	130/162 (80%)	127 (98%)	3 (2%)	0	100	100
7	4	274/276 (99%)	269 (98%)	5 (2%)	0	100	100
8	5	264/267 (99%)	259 (98%)	5 (2%)	0	100	100
9	B	246/250 (98%)	246 (100%)	0	0	100	100
10	C	234/258 (91%)	230 (98%)	4 (2%)	0	100	100
11	G	245/288 (85%)	238 (97%)	7 (3%)	0	100	100
12	I	212/261 (81%)	207 (98%)	5 (2%)	0	100	100
13	J	186/205 (91%)	181 (97%)	5 (3%)	0	100	100
14	K	194/198 (98%)	188 (97%)	6 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
15	L	190/287 (66%)	188 (99%)	2 (1%)	0	100	100
All	All	3302/3693 (89%)	3234 (98%)	68 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	M	111/201 (55%)	108 (97%)	3 (3%)	40	65
2	A	208/210 (99%)	206 (99%)	2 (1%)	73	84
3	D	219/226 (97%)	218 (100%)	1 (0%)	86	91
4	E	205/215 (95%)	203 (99%)	2 (1%)	73	84
5	F	193/193 (100%)	189 (98%)	4 (2%)	48	70
6	3	120/150 (80%)	120 (100%)	0	100	100
7	4	247/251 (98%)	245 (99%)	2 (1%)	79	87
8	5	243/244 (100%)	239 (98%)	4 (2%)	58	76
9	B	207/209 (99%)	206 (100%)	1 (0%)	86	91
10	C	200/216 (93%)	198 (99%)	2 (1%)	73	84
11	G	204/239 (85%)	200 (98%)	4 (2%)	50	71
12	I	179/214 (84%)	174 (97%)	5 (3%)	38	64
13	J	158/173 (91%)	156 (99%)	2 (1%)	65	79
14	K	172/175 (98%)	170 (99%)	2 (1%)	67	80
15	L	149/235 (63%)	149 (100%)	0	100	100
All	All	2815/3151 (89%)	2781 (99%)	34 (1%)	66	80

All (34) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	M	117	ASP

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Mol	Chain	Res	Type
1	M	128	VAL
1	M	145	LEU
2	A	115	ASP
2	A	169	THR
3	D	242	GLU
4	E	84	ASP
4	E	222	ILE
5	F	34	VAL
5	F	38	LEU
5	F	74	LEU
5	F	156	LEU
7	4	87	GLN
7	4	95	ASN
8	5	11	VAL
8	5	155	LEU
8	5	198	ARG
8	5	200	LYS
9	B	128	ARG
10	C	5	ARG
10	C	201	THR
11	G	55	THR
11	G	76	CYS
11	G	208	LYS
11	G	235	LEU
12	I	-9	THR
12	I	-8	GLN
12	I	-6	LYS
12	I	14	ILE
12	I	121	VAL
13	J	27	LEU
13	J	58	THR
14	K	3	ILE
14	K	179	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	41	ASN
2	A	56	GLN
2	A	84	ASN
4	E	147	HIS
4	E	218	GLN

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Mol	Chain	Res	Type
6	3	46	GLN
8	5	158	ASN
8	5	217	ASN
10	C	103	ASN
11	G	33	ASN
11	G	225	ASN
12	I	81	GLN
14	K	78	GLN
15	L	-74	GLN
15	L	133	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](#)

There are no ligands in this entry.

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.

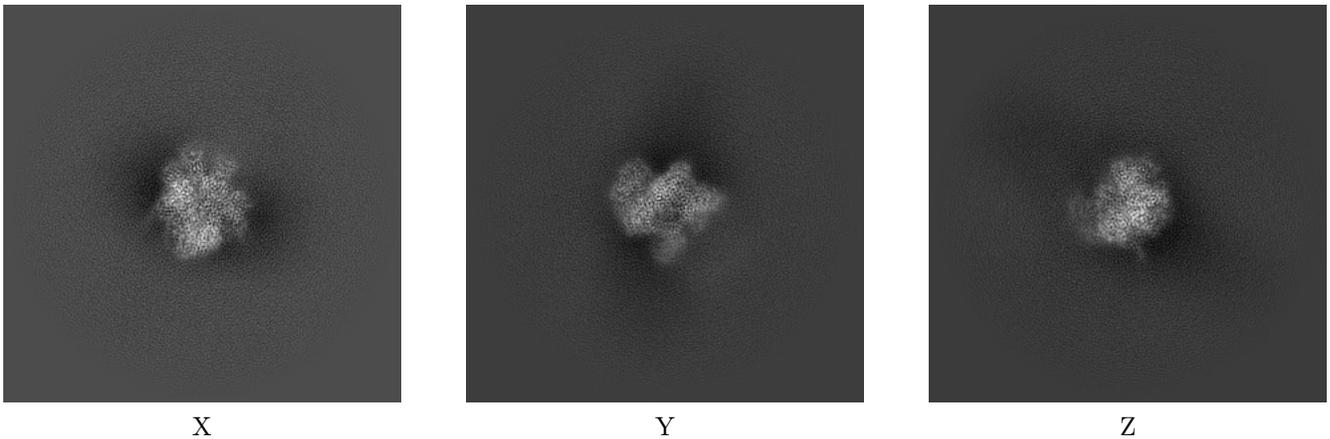
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-54047. These allow visual inspection of the internal detail of the map and identification of artifacts.

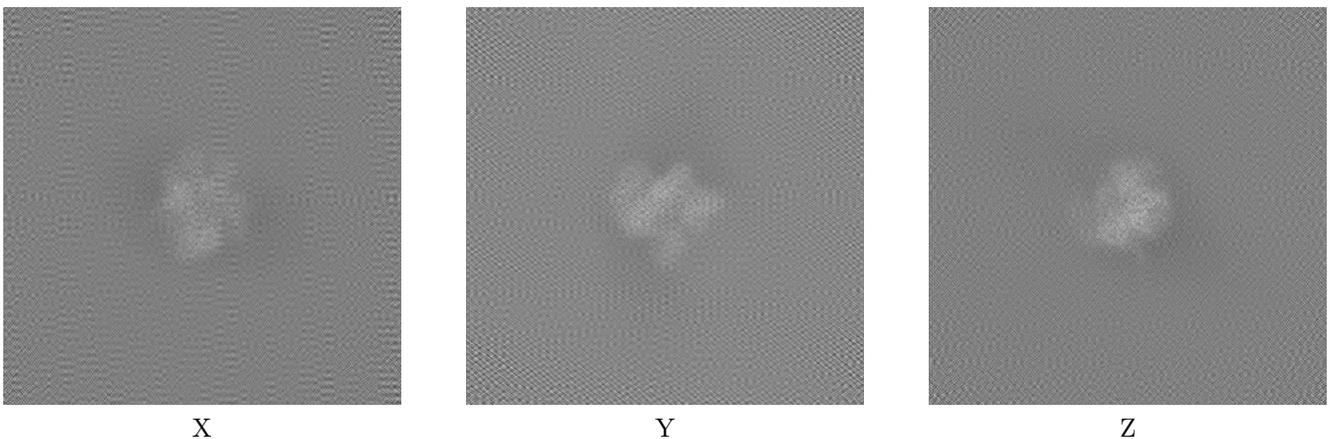
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

6.1.1 Primary map



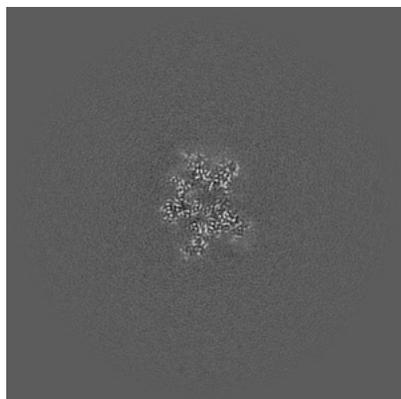
6.1.2 Raw map



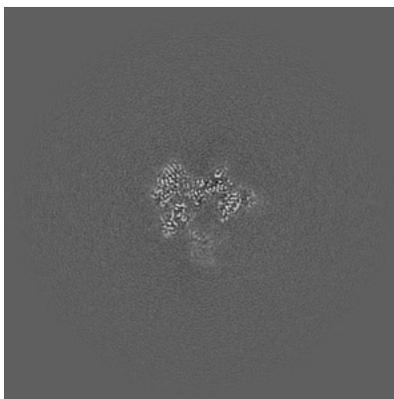
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

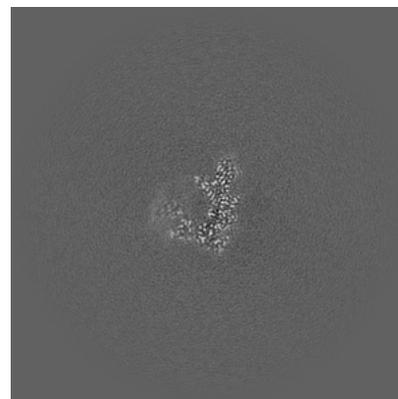
6.2.1 Primary map



X Index: 250

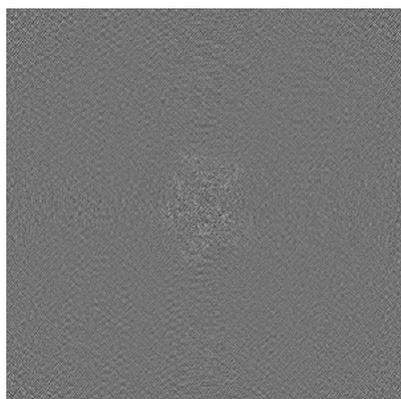


Y Index: 250

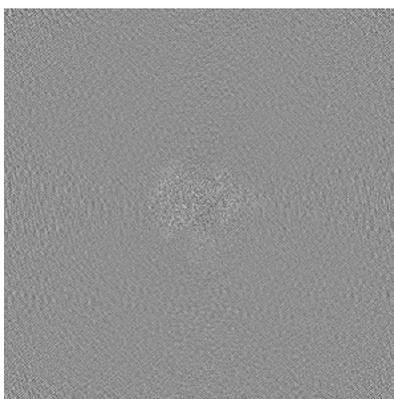


Z Index: 250

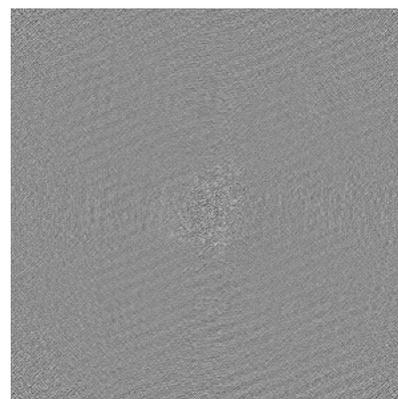
6.2.2 Raw map



X Index: 250



Y Index: 250

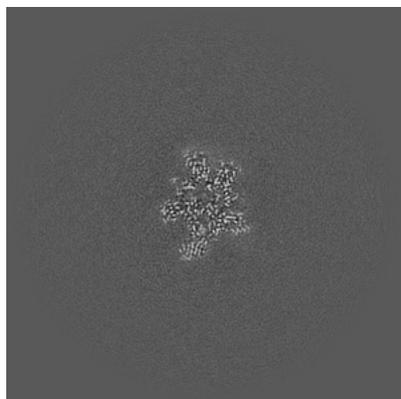


Z Index: 250

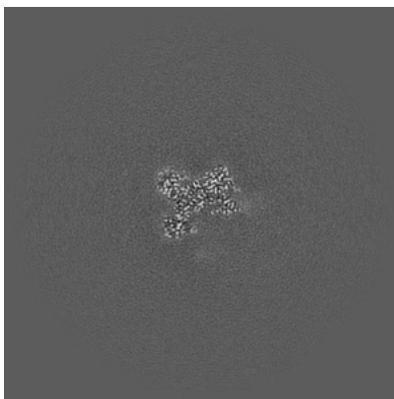
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

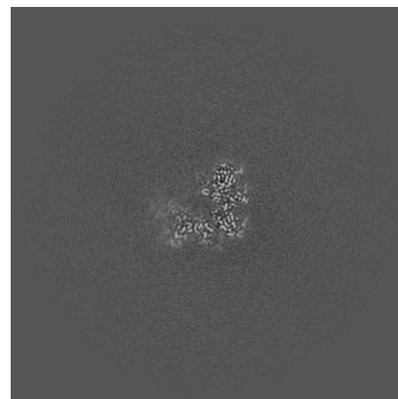
6.3.1 Primary map



X Index: 255

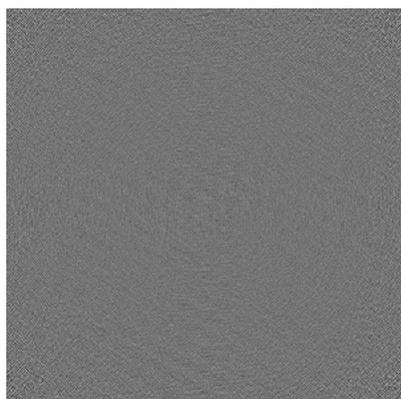


Y Index: 262

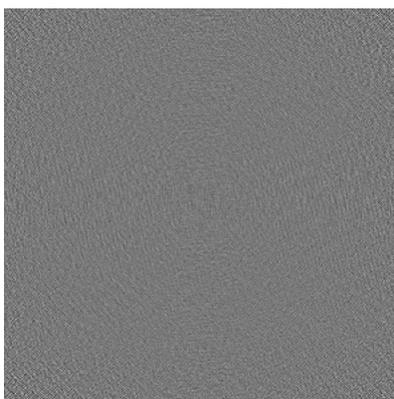


Z Index: 258

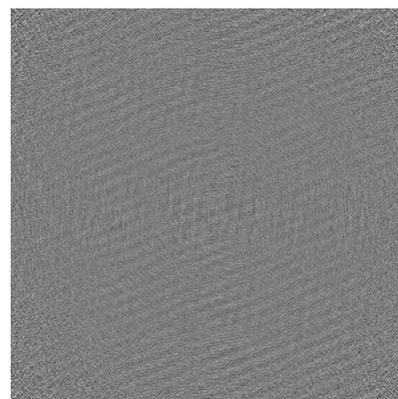
6.3.2 Raw map



X Index: 0



Y Index: 0

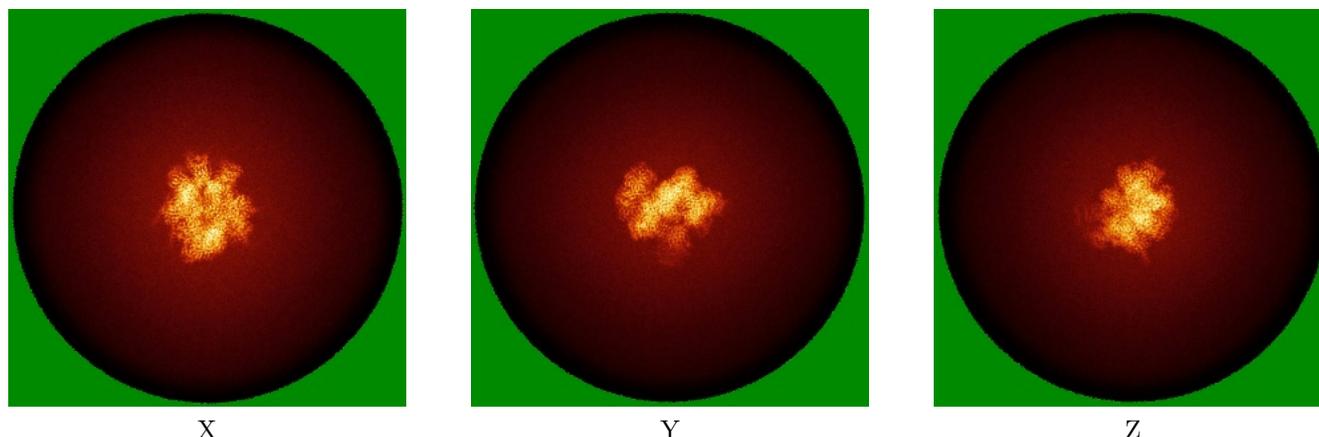


Z Index: 499

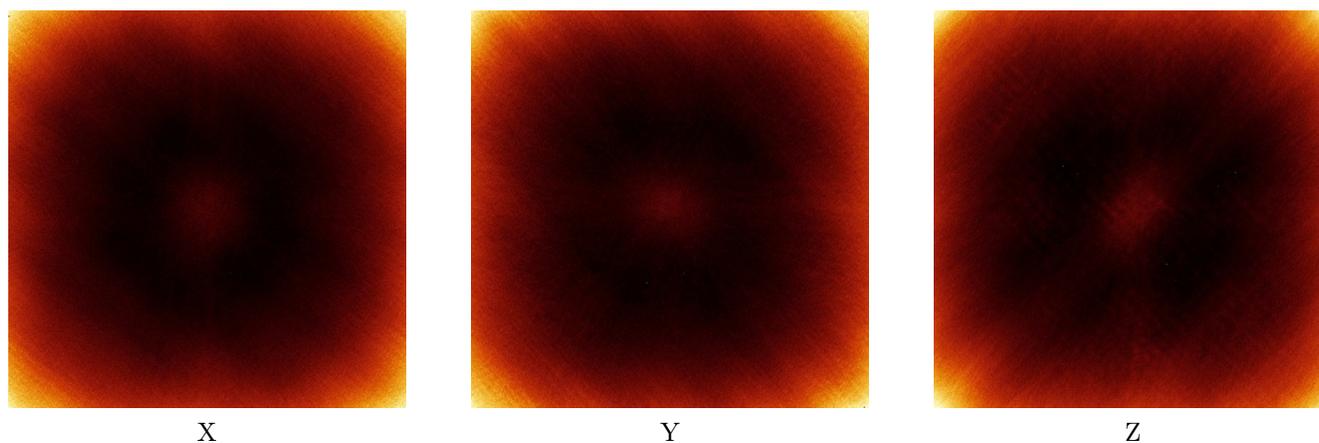
The images above show the largest variance slices of the map in three orthogonal directions.

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

6.4.1 Primary map



6.4.2 Raw map



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



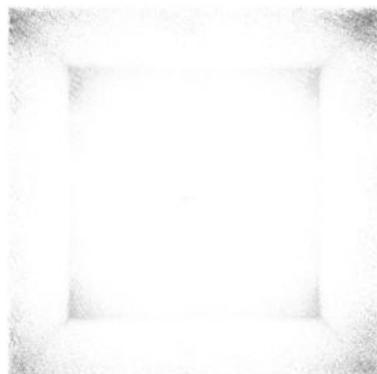
Y



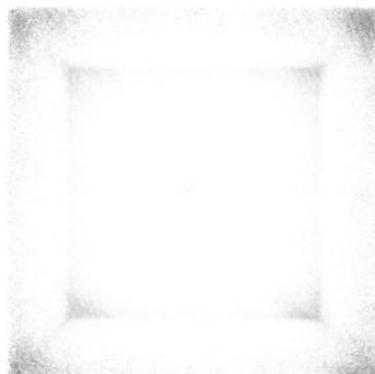
Z

The images above show the 3D surface view of the map at the recommended contour level 0.0974. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

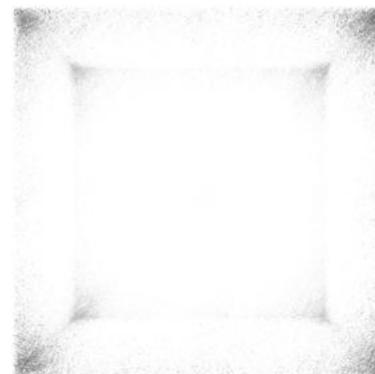
6.5.2 Raw map



X



Y



Z

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

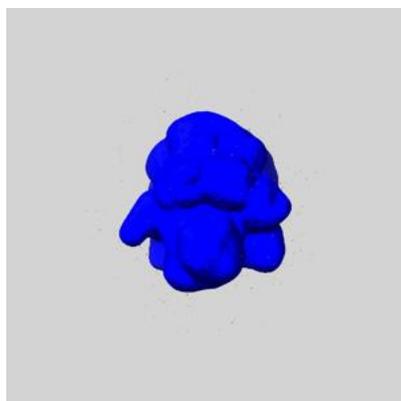
6.6 Mask visualisation [i](#)

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

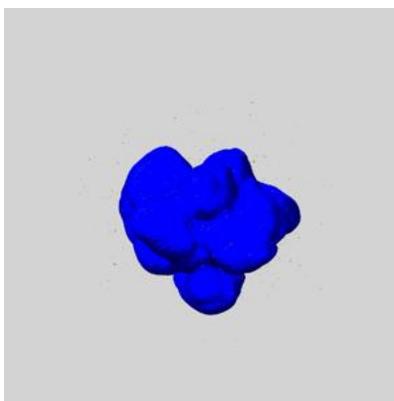
A mask typically either:

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

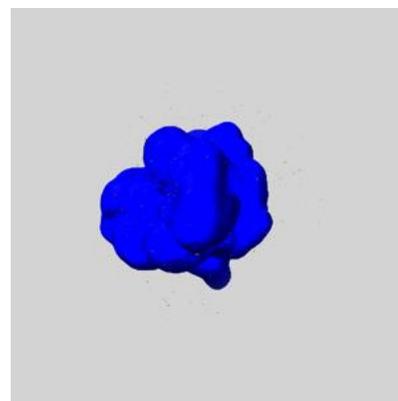
6.6.1 emd_54047_msk_1.map [i](#)



X



Y

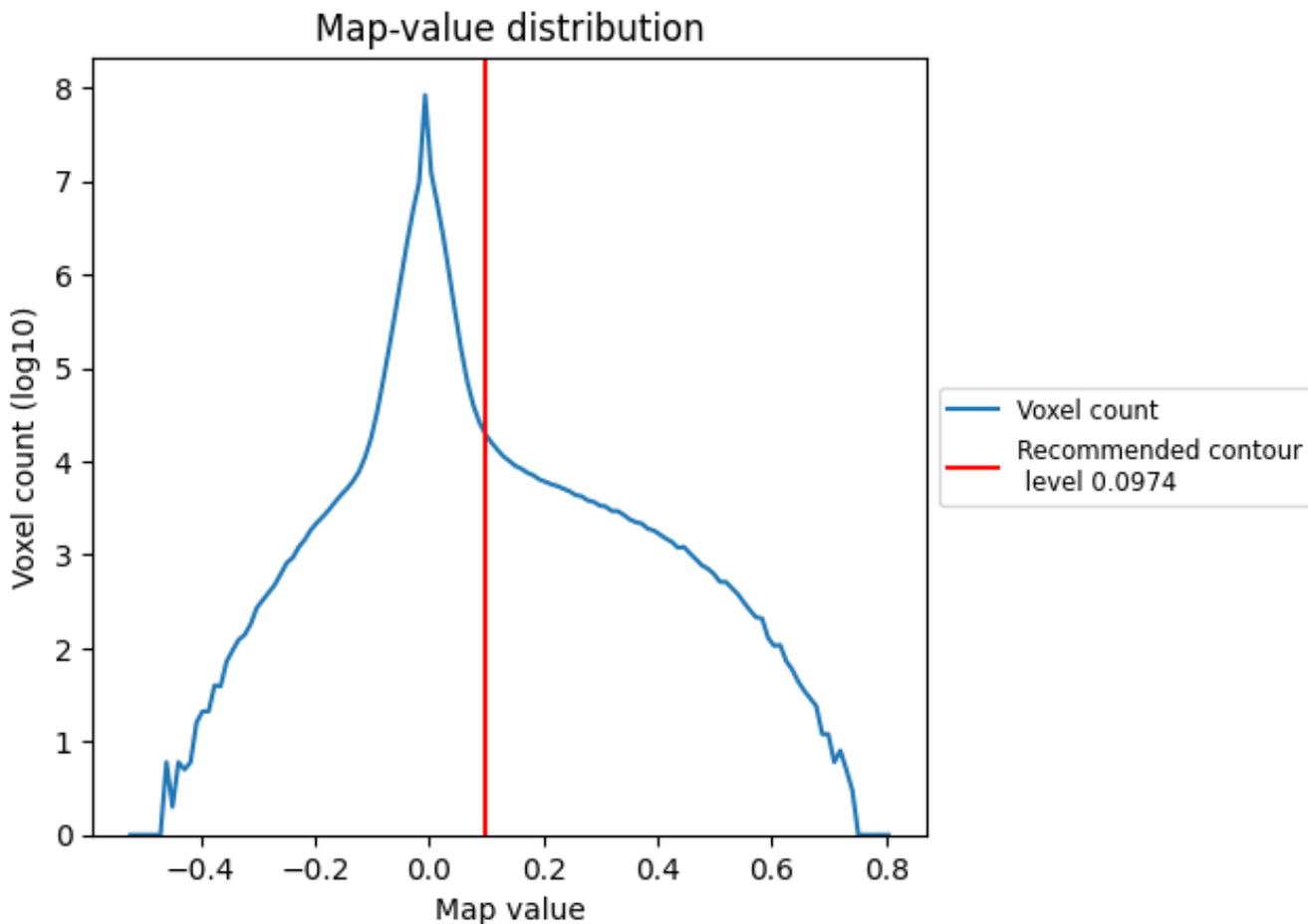


Z

7 Map analysis [i](#)

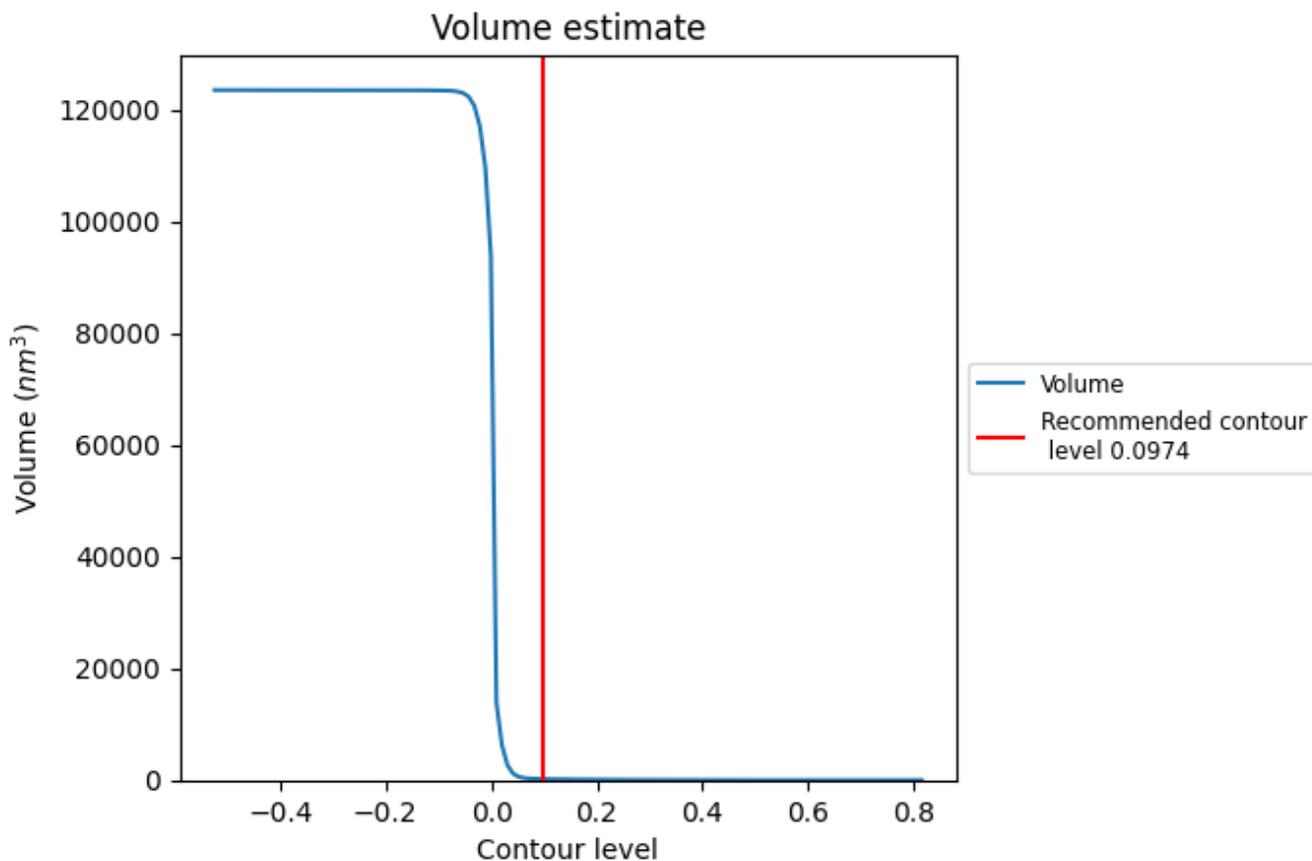
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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

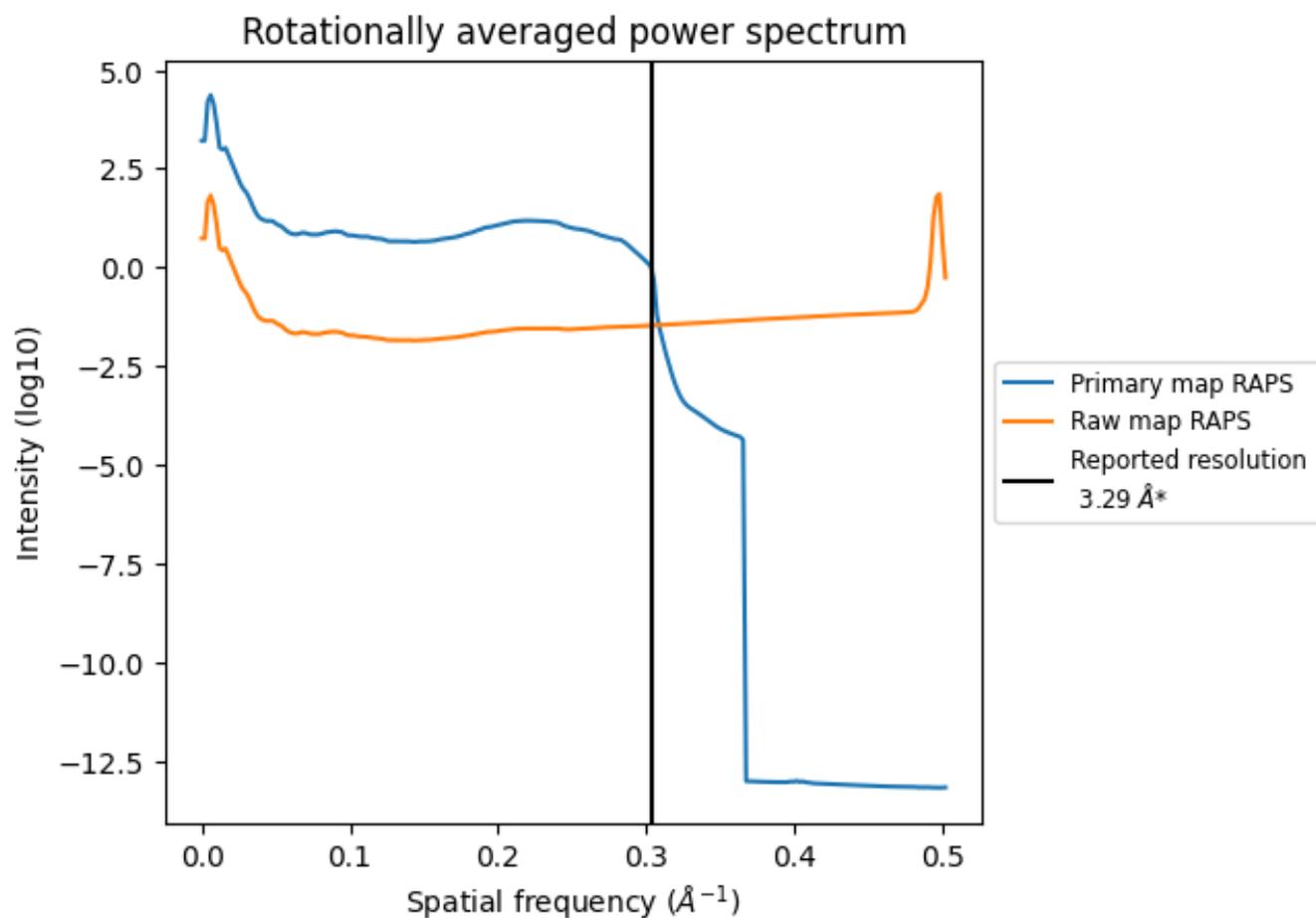
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 192 nm³; this corresponds to an approximate mass of 174 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](#)

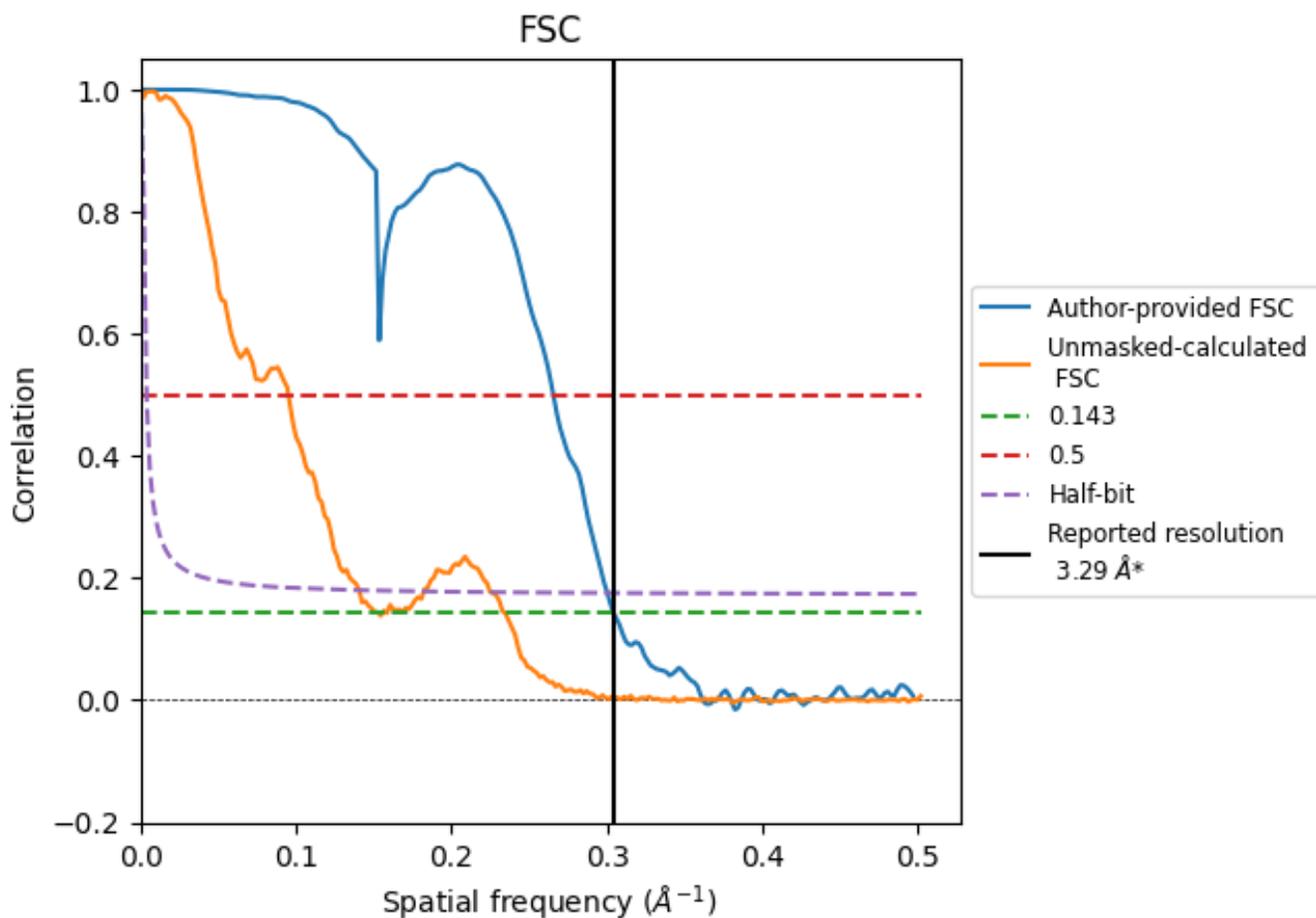


*Reported resolution corresponds to spatial frequency of 0.304 Å⁻¹

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 0.304\AA^{-1}

8.2 Resolution estimates [i](#)

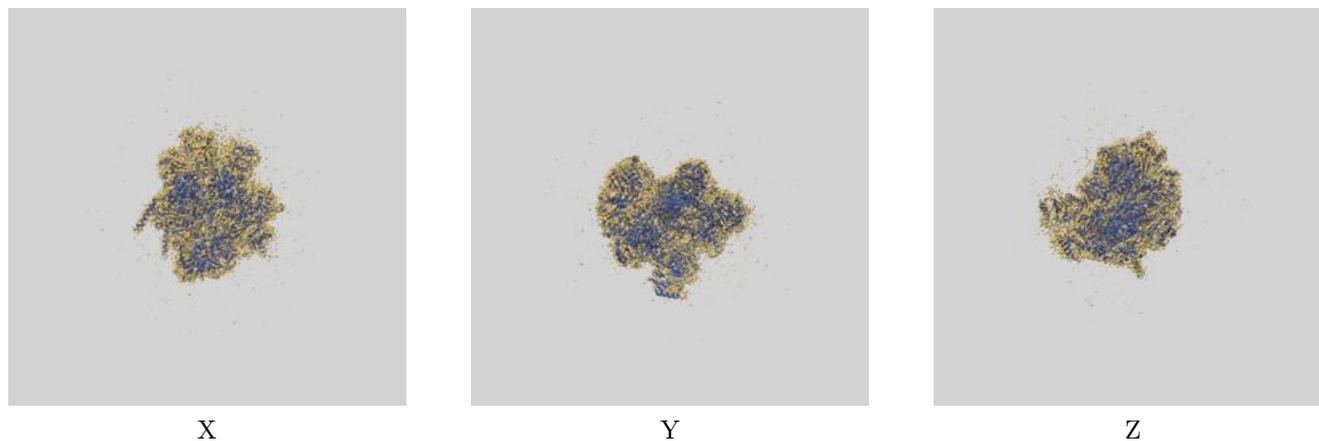
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.29	-	-
Author-provided FSC curve	3.29	3.77	3.33
Unmasked-calculated*	6.54	10.52	7.11

*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 6.54 differs from the reported value 3.29 by more than 10 %

9 Map-model fit [i](#)

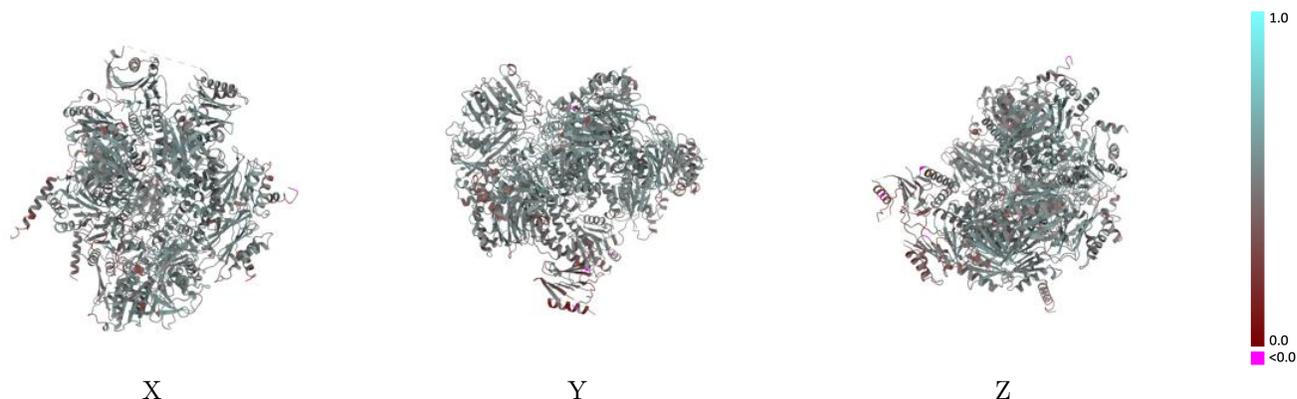
This section contains information regarding the fit between EMDB map EMD-54047 and PDB model 9RM0. Per-residue inclusion information can be found in section 3 on page 7.

9.1 Map-model overlay [i](#)



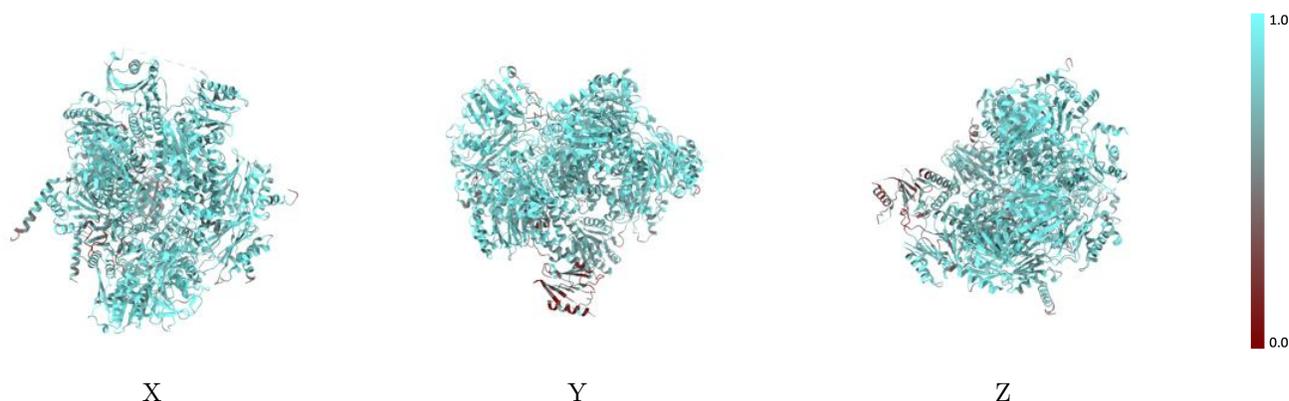
The images above show the 3D surface view of the map at the recommended contour level 0.0974 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



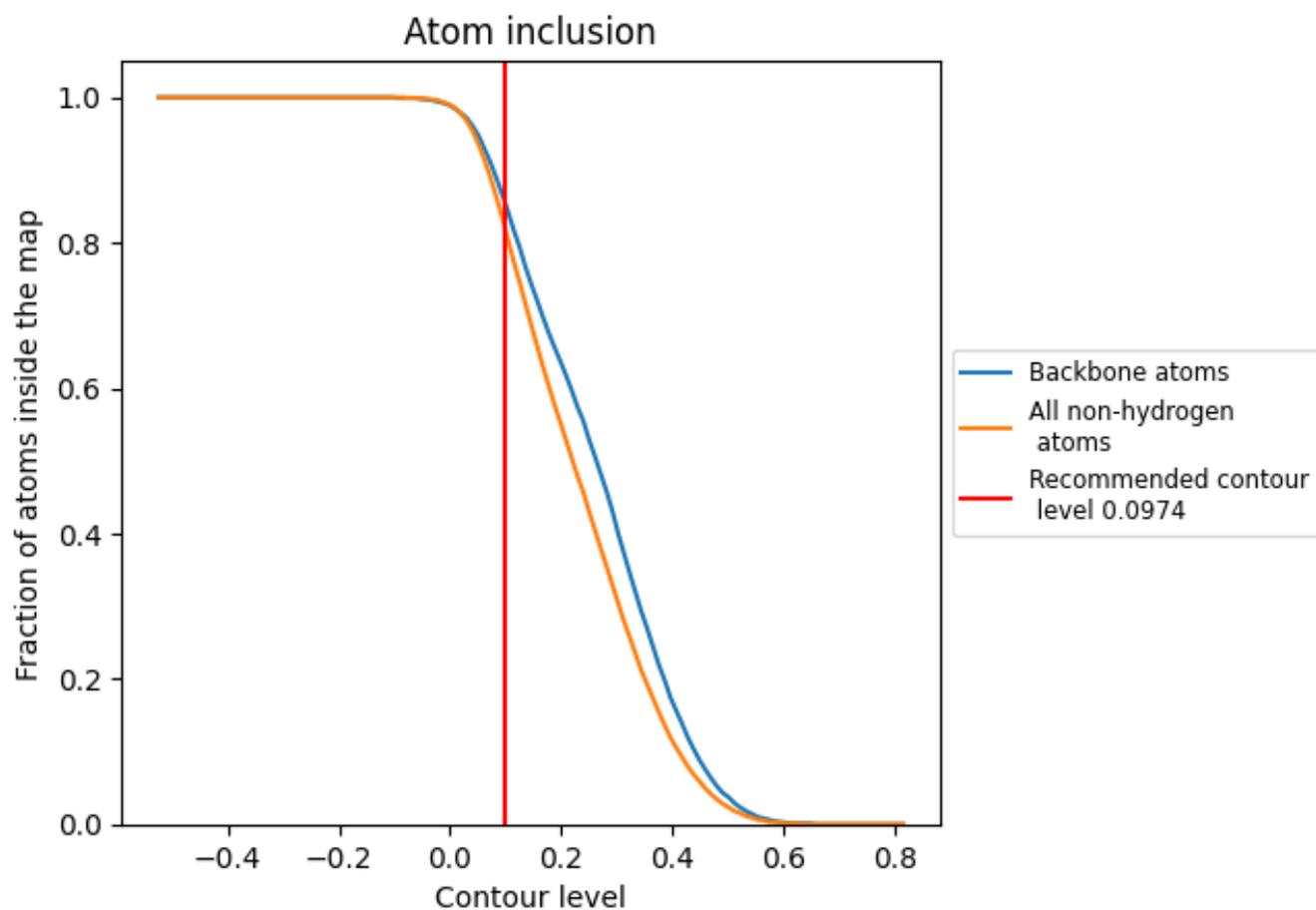
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.0974).

9.4 Atom inclusion [i](#)



At the recommended contour level, 86% of all backbone atoms, 82% 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 (0.0974) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8250	 0.5030
3	 0.7580	 0.5010
4	 0.8140	 0.4890
5	 0.8560	 0.5010
A	 0.8700	 0.5260
B	 0.8680	 0.5340
C	 0.8450	 0.5190
D	 0.8340	 0.5120
E	 0.8300	 0.5110
F	 0.8620	 0.5210
G	 0.8540	 0.5070
I	 0.8510	 0.5100
J	 0.8550	 0.5070
K	 0.8140	 0.4930
L	 0.7760	 0.4580
M	 0.5390	 0.4050

