



Full wwPDB EM Validation Report ⓘ

Mar 27, 2026 – 08:24 PM UTC

PDB ID : 9SHX / pdb_00009shx
EMDB ID : EMD-54919
Title : Type I-F_HNH variant Cascade bound to dsDNA, HNH domain in middle position
Authors : Fuglsang, A.; Montoya, G.
Deposited on : 2025-08-28
Resolution : 2.40 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:

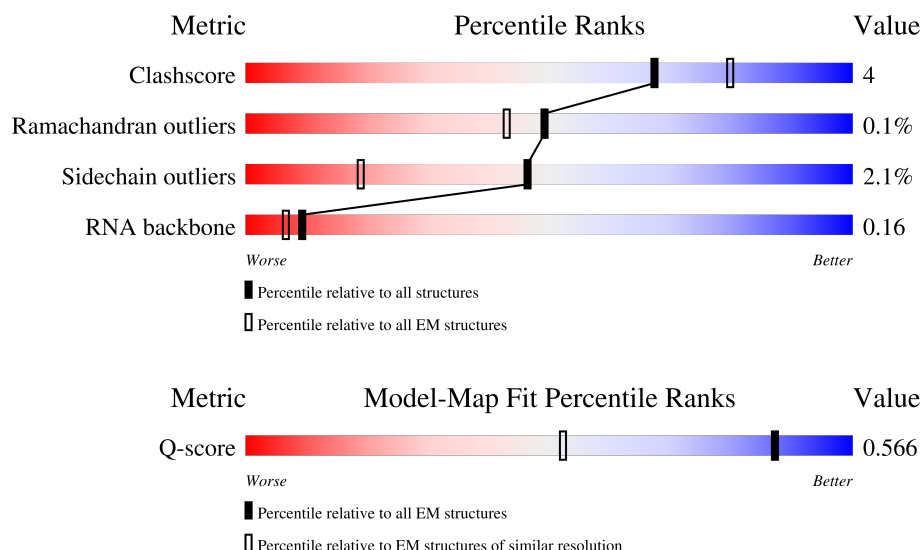
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
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 i

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

The reported resolution of this entry is 2.40 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.



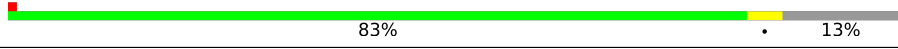
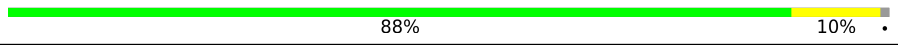
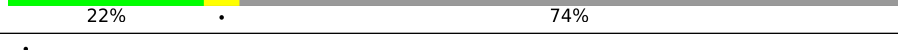
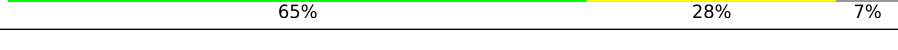
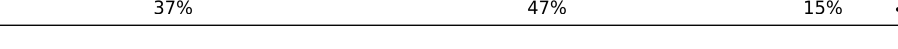
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
RNA backbone	8273	3508	-
Q-score	-	25397	5628 (1.90 - 2.90)

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

Mol	Chain	Length	Quality of chain
1	C	335	
1	D	335	
1	E	335	

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Mol	Chain	Length	Quality of chain
1	F	335	
1	G	335	
1	H	335	
2	B	255	
3	A	384	
4	I	181	
5	L	46	
6	K	46	
7	J	60	

2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 46741 atoms, of which 22726 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 Cas7f.

Mol	Chain	Residues	Atoms						AltConf	Trace
1	D	322	Total	C	H	N	O	S	0	0
			5218	1677	2597	433	496	15		
1	E	323	Total	C	H	N	O	S	0	0
			5225	1680	2599	434	497	15		
1	F	323	Total	C	H	N	O	S	0	0
			5202	1675	2587	433	492	15		
1	C	323	Total	C	H	N	O	S	0	0
			5232	1682	2602	434	499	15		
1	G	324	Total	C	H	N	O	S	0	0
			5244	1686	2607	435	501	15		
1	H	293	Total	C	H	N	O	S	0	0
			4743	1532	2357	393	448	13		

- Molecule 2 is a protein called Cas5f.

Mol	Chain	Residues	Atoms						AltConf	Trace
2	B	252	Total	C	H	N	O	S	0	0
			3984	1265	1998	335	374	12		

- Molecule 3 is a protein called Cas8f fusion with HNH.

Mol	Chain	Residues	Atoms						AltConf	Trace
3	A	339	Total	C	H	N	O	S	0	0
			5401	1717	2687	469	516	12		

There are 41 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-39	MET	-	initiating methionine	UNP A0AAX7FM29
A	-38	LEU	-	expression tag	UNP A0AAX7FM29
A	-37	ARG	-	expression tag	UNP A0AAX7FM29
A	-36	SER	-	expression tag	UNP A0AAX7FM29
A	-35	LYS	-	expression tag	UNP A0AAX7FM29

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-34	HIS	-	expression tag	UNP A0AAX7FM29
A	-33	HIS	-	expression tag	UNP A0AAX7FM29
A	-32	HIS	-	expression tag	UNP A0AAX7FM29
A	-31	HIS	-	expression tag	UNP A0AAX7FM29
A	-30	SER	-	expression tag	UNP A0AAX7FM29
A	-29	GLY	-	expression tag	UNP A0AAX7FM29
A	-28	HIS	-	expression tag	UNP A0AAX7FM29
A	-27	HIS	-	expression tag	UNP A0AAX7FM29
A	-26	HIS	-	expression tag	UNP A0AAX7FM29
A	-25	THR	-	expression tag	UNP A0AAX7FM29
A	-24	GLY	-	expression tag	UNP A0AAX7FM29
A	-23	HIS	-	expression tag	UNP A0AAX7FM29
A	-22	HIS	-	expression tag	UNP A0AAX7FM29
A	-21	HIS	-	expression tag	UNP A0AAX7FM29
A	-20	HIS	-	expression tag	UNP A0AAX7FM29
A	-19	SER	-	expression tag	UNP A0AAX7FM29
A	-18	GLY	-	expression tag	UNP A0AAX7FM29
A	-17	SER	-	expression tag	UNP A0AAX7FM29
A	-16	HIS	-	expression tag	UNP A0AAX7FM29
A	-15	HIS	-	expression tag	UNP A0AAX7FM29
A	-14	HIS	-	expression tag	UNP A0AAX7FM29
A	-13	THR	-	expression tag	UNP A0AAX7FM29
A	-12	GLY	-	expression tag	UNP A0AAX7FM29
A	-11	GLY	-	expression tag	UNP A0AAX7FM29
A	-10	SER	-	expression tag	UNP A0AAX7FM29
A	-9	GLY	-	expression tag	UNP A0AAX7FM29
A	-8	GLU	-	expression tag	UNP A0AAX7FM29
A	-7	ASN	-	expression tag	UNP A0AAX7FM29
A	-6	LEU	-	expression tag	UNP A0AAX7FM29
A	-5	TYR	-	expression tag	UNP A0AAX7FM29
A	-4	PHE	-	expression tag	UNP A0AAX7FM29
A	-3	GLN	-	expression tag	UNP A0AAX7FM29
A	-2	GLY	-	expression tag	UNP A0AAX7FM29
A	-1	SER	-	expression tag	UNP A0AAX7FM29
A	0	GLY	-	expression tag	UNP A0AAX7FM29
A	1	GLY	-	expression tag	UNP A0AAX7FM29

- Molecule 4 is a protein called Cas6f.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	I	177	Total	C	H	N	O	S	
			2864	917	1441	241	260	5	
								0	0

- Molecule 5 is a DNA chain called Non-target strand.

Mol	Chain	Residues	Atoms						AltConf	Trace
5	L	12	Total	C	H	N	O	P	0	0
			384	119	133	58	63	11		

- Molecule 6 is a DNA chain called Target strand.

Mol	Chain	Residues	Atoms						AltConf	Trace
6	K	43	Total	C	H	N	O	P	0	0
			1305	402	472	127	262	42		

- Molecule 7 is a RNA chain called crRNA.

Mol	Chain	Residues	Atoms						AltConf	Trace
7	J	60	Total	C	H	N	O	P	0	0
			1937	577	646	240	414	60		

- Molecule 8 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
8	A	1	Total	Mg	0
			1	1	

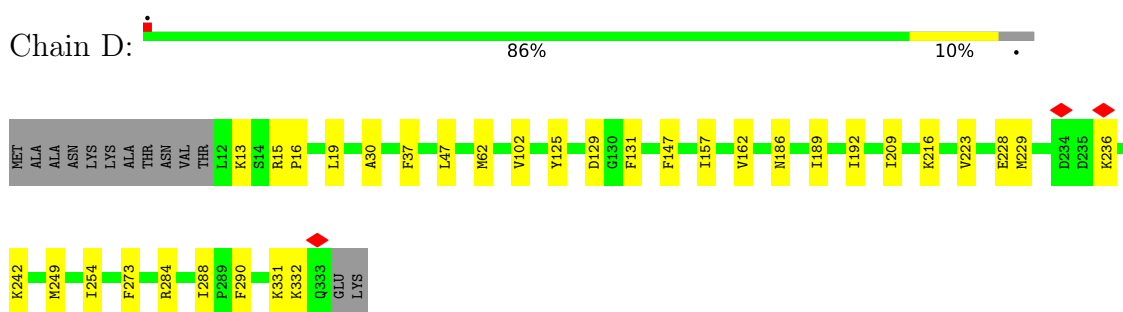
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		AltConf
9	K	1	Total	O	0
			1	1	

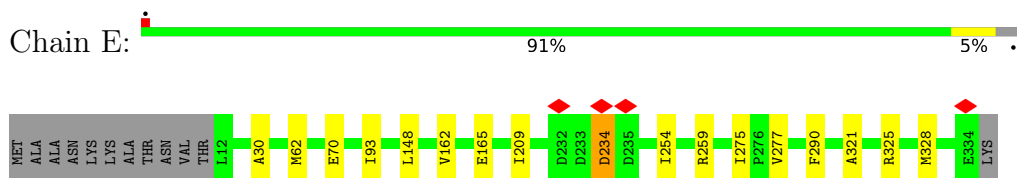
3 Residue-property plots

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

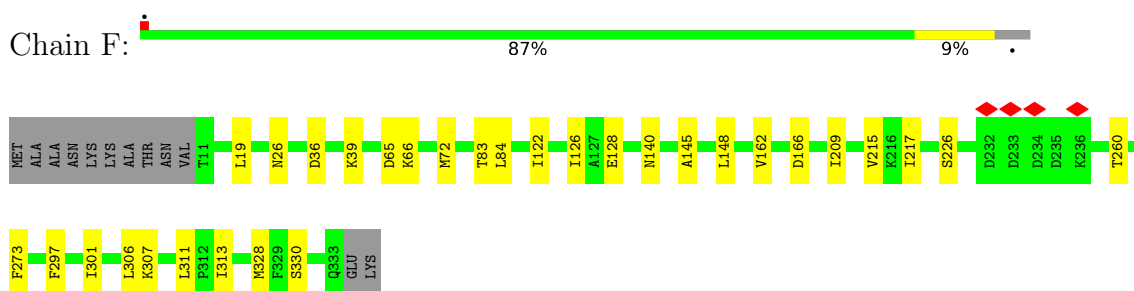
- Molecule 1: Cas7f



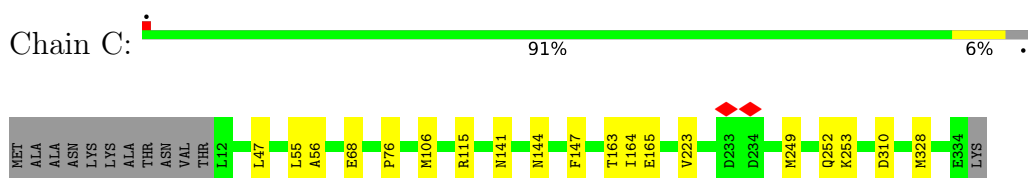
- Molecule 1: Cas7f



- Molecule 1: Cas7f

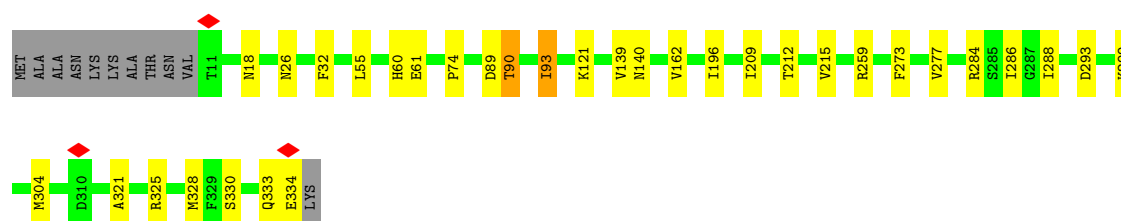


- Molecule 1: Cas7f



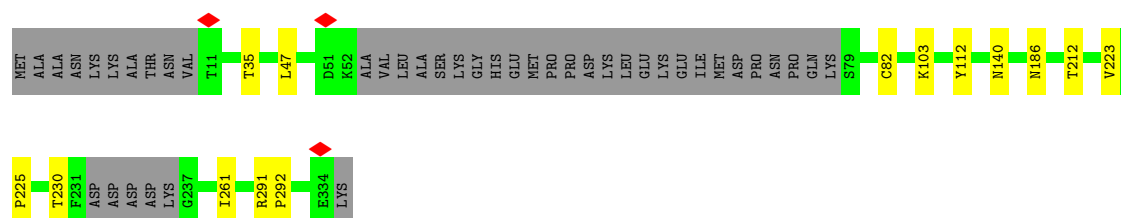
- Molecule 1: Cas7f

Chain G:  87% 9% ..



• Molecule 1: Cas7f

Chain H:  83% 13%



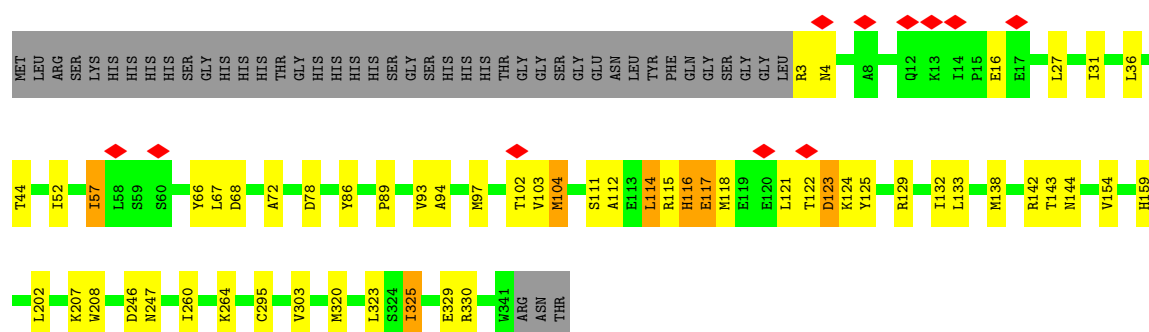
• Molecule 2: Cas5f

Chain B:  88% 10%



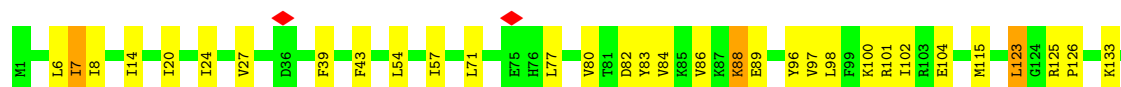
• Molecule 3: Cas8f fusion with HNH

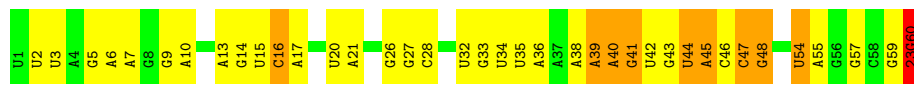
Chain A:  73% 13% 12%



• Molecule 4: Cas6f

Chain I:  76% 20%





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	174646	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 ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	600	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	1.983	Depositor
Minimum map value	-0.028	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.029	Depositor
Recommended contour level	0.06	Depositor
Map size (Å)	304.5, 304.5, 304.5	wwPDB
Map dimensions	420, 420, 420	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.725, 0.725, 0.725	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: 23G, MG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	C	0.12	0/2689	0.27	0/3630
1	D	0.12	0/2680	0.29	0/3618
1	E	0.13	0/2685	0.28	0/3625
1	F	0.12	0/2674	0.30	0/3612
1	G	0.12	0/2696	0.29	0/3640
1	H	0.12	0/2438	0.27	0/3290
2	B	0.14	0/2021	0.31	0/2725
3	A	0.14	0/2772	0.39	0/3745
4	I	0.14	0/1454	0.37	0/1955
5	L	0.18	0/285	0.36	0/439
6	K	0.20	0/926	0.54	0/1424
7	J	0.13	0/1418	0.33	0/2210
All	All	0.13	0/24738	0.32	0/33913

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	C	2630	2602	2602	12	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	2621	2597	2596	19	0
1	E	2626	2599	2598	10	0
1	F	2615	2587	2586	17	0
1	G	2637	2607	2609	19	0
1	H	2386	2357	2355	5	0
2	B	1986	1998	1998	19	0
3	A	2714	2687	2686	40	0
4	I	1423	1441	1441	25	0
5	L	251	133	134	1	0
6	K	833	472	473	10	0
7	J	1291	646	646	13	0
8	A	1	0	0	0	0
9	K	1	0	0	0	0
All	All	24015	22726	22724	176	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 (176) 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)
7:J:60:23G:O4'	7:J:60:23G:C1'	1.70	1.10
1:D:147:PHE:O	1:D:249:MET:HE1	1.91	0.70
4:I:101:ARG:O	4:I:101:ARG:HG2	1.94	0.68
3:A:103:VAL:HG13	3:A:104:MET:H	1.59	0.68
3:A:154:VAL:HG12	3:A:154:VAL:O	1.94	0.66
1:G:286:ILE:HG22	1:G:288:ILE:HD12	1.78	0.65
3:A:114:LEU:HD13	3:A:118:MET:CE	2.26	0.64
6:K:35:DT:H71	6:K:36:DC:H41	1.65	0.62
1:E:30:ALA:HB2	1:E:254:ILE:HD11	1.82	0.61
4:I:8:ILE:HG22	4:I:84:VAL:HG12	1.82	0.61
2:B:119:MET:HE2	2:B:119:MET:HA	1.82	0.60
2:B:179:MET:HE2	2:B:224:LEU:CD1	2.32	0.60
1:E:259:ARG:HD2	1:E:325:ARG:HG3	1.84	0.60
4:I:115:MET:SD	4:I:123:LEU:HD22	2.42	0.59
4:I:148:SER:OG	4:I:151:THR:HG22	2.01	0.59
2:B:6:ILE:HD11	2:B:110:LEU:HD12	1.84	0.59
2:B:123:LYS:HD2	2:B:123:LYS:C	2.28	0.58
3:A:114:LEU:HD13	3:A:118:MET:HE1	1.84	0.58
4:I:159:LEU:HD22	4:I:174:LEU:HD21	1.86	0.58
1:F:145:ALA:HB1	1:F:148:LEU:HD12	1.87	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:189:LEU:HD23	2:B:224:LEU:HD23	1.85	0.57
4:I:7:ILE:HG23	4:I:57:ILE:HG23	1.88	0.56
1:H:47:LEU:HD21	1:H:82:CYS:SG	2.45	0.56
1:D:162:VAL:HG11	1:D:192:ILE:HD13	1.88	0.55
4:I:102:ILE:HD12	4:I:138:ILE:CD1	2.37	0.55
1:F:162:VAL:HG13	1:F:209:ILE:HG23	1.87	0.55
3:A:102:THR:HG22	3:A:103:VAL:H	1.72	0.54
1:E:277:VAL:HG21	1:E:321:ALA:HB1	1.90	0.53
1:E:93:ILE:HD12	1:E:148:LEU:CD2	2.38	0.53
3:A:142:ARG:CG	3:A:143:THR:H	2.22	0.53
4:I:151:THR:HG21	7:J:60:23G:HN2A	1.73	0.53
4:I:7:ILE:HD12	4:I:7:ILE:O	2.09	0.53
1:D:16:PRO:HG2	1:D:19:LEU:HB2	1.90	0.53
2:B:249:LEU:HD21	2:B:251:LEU:HD11	1.90	0.53
2:B:145:ILE:HD12	2:B:145:ILE:N	2.24	0.52
4:I:6:LEU:HD22	4:I:86:VAL:HG22	1.90	0.52
1:F:72:MET:HE1	1:G:284:ARG:HA	1.92	0.51
2:B:179:MET:HE2	2:B:224:LEU:HD13	1.92	0.51
4:I:39:PHE:CZ	4:I:71:LEU:HD21	2.45	0.51
1:F:307:LYS:N	1:F:307:LYS:HE2	2.25	0.51
2:B:138:ILE:HD12	2:B:138:ILE:N	2.25	0.51
1:C:328:MET:HE1	7:J:6:A:C2	2.45	0.51
3:A:115:ARG:O	3:A:116:HIS:HB3	2.11	0.50
1:E:162:VAL:HG13	1:E:209:ILE:HG23	1.94	0.50
4:I:123:LEU:N	4:I:123:LEU:HD23	2.27	0.50
2:B:249:LEU:CD2	2:B:251:LEU:HD11	2.42	0.50
1:D:228:GLU:OE2	1:D:228:GLU:HA	2.11	0.50
3:A:111:SER:O	3:A:112:ALA:HB3	2.12	0.50
4:I:14:ILE:HD13	4:I:83:TYR:CE1	2.47	0.50
1:G:32:PHE:CE1	1:G:93:ILE:HD13	2.47	0.49
5:L:7:DC:H2"	5:L:8:DG:C8	2.47	0.49
3:A:114:LEU:HD12	3:A:125:TYR:CZ	2.48	0.49
3:A:303:VAL:HG11	3:A:320:MET:HE2	1.95	0.49
1:D:102:VAL:HG11	1:D:131:PHE:CZ	2.48	0.48
1:F:128:GLU:OE1	1:F:313:ILE:HD13	2.13	0.48
1:E:165:GLU:HA	1:E:165:GLU:OE1	2.14	0.48
4:I:20:ILE:HA	4:I:24:ILE:HB	1.96	0.48
1:D:288:ILE:HD11	1:D:290:PHE:CE1	2.49	0.47
1:E:275:ILE:HD13	1:E:290:PHE:CD2	2.49	0.47
1:C:328:MET:HE1	7:J:6:A:N1	2.30	0.47
1:G:288:ILE:HD11	1:H:112:TYR:HB2	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:251:LEU:HD21	3:A:66:TYR:CZ	2.50	0.47
1:E:62:MET:HE1	1:E:70:GLU:HB2	1.96	0.47
6:K:35:DT:H71	6:K:36:DC:N4	2.30	0.47
3:A:89:PRO:O	3:A:93:VAL:HG22	2.13	0.47
6:K:41:DC:H2'	6:K:42:DT:H72	1.95	0.47
2:B:249:LEU:HD23	2:B:249:LEU:O	2.15	0.47
4:I:43:PHE:HE2	4:I:54:LEU:HD12	1.79	0.47
1:D:162:VAL:HG13	1:D:209:ILE:HG23	1.98	0.46
7:J:59:G:H4'	7:J:60:23G:OP1	2.15	0.46
2:B:175:MET:HA	2:B:178:LYS:HG3	1.97	0.46
7:J:47:C:H2'	7:J:48:G:O4'	2.16	0.46
7:J:16:C:H2'	7:J:17:A:C4	2.50	0.46
3:A:246:ASP:O	3:A:247:ASN:C	2.59	0.46
4:I:125:ARG:N	4:I:126:PRO:HD2	2.31	0.46
3:A:154:VAL:HG21	3:A:159:HIS:CG	2.51	0.46
1:G:277:VAL:HG21	1:G:321:ALA:HB1	1.98	0.46
3:A:125:TYR:CD1	3:A:125:TYR:O	2.69	0.46
3:A:86:TYR:O	3:A:89:PRO:HD2	2.16	0.45
1:C:106:MET:HE1	1:C:115:ARG:HA	1.98	0.45
1:C:147:PHE:O	1:C:249:MET:HE1	2.17	0.45
1:G:139:VAL:CG2	1:G:196:ILE:HD12	2.46	0.45
1:F:83:THR:HG22	1:F:84:LEU:O	2.17	0.45
1:D:13:LYS:HB3	1:D:13:LYS:NZ	2.32	0.45
1:D:284:ARG:HH12	1:C:55:LEU:HD23	1.82	0.44
1:F:122:ILE:O	1:F:126:ILE:HG13	2.17	0.44
3:A:67:LEU:HD23	3:A:68:ASP:N	2.32	0.44
4:I:100:LYS:HD3	4:I:175:LEU:HB3	2.00	0.44
3:A:129:ARG:O	3:A:133:LEU:HD23	2.18	0.44
1:F:297:PHE:O	1:F:301:ILE:HG22	2.18	0.44
1:G:55:LEU:HD11	1:G:74:PRO:HB2	2.00	0.44
1:D:47:LEU:HD21	1:D:223:VAL:HG21	1.99	0.44
1:F:65:ASP:C	1:F:65:ASP:OD1	2.60	0.44
2:B:138:ILE:N	2:B:138:ILE:CD1	2.81	0.44
2:B:162:LEU:H	2:B:254:ILE:HD12	1.83	0.44
2:B:179:MET:SD	3:A:67:LEU:HD12	2.57	0.44
1:G:18:ASN:HD21	6:K:19:DG:H21	1.66	0.44
2:B:37:ARG:O	2:B:41:ARG:HG3	2.18	0.44
4:I:88:LYS:O	4:I:89:GLU:C	2.60	0.43
7:J:44:U:O2'	7:J:45:A:H2'	2.18	0.43
1:G:259:ARG:HD2	1:G:325:ARG:HG3	2.00	0.43
3:A:143:THR:O	3:A:144:ASN:HB2	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:325:ILE:O	3:A:329:GLU:OE1	2.37	0.43
1:E:328:MET:O	1:E:328:MET:HG3	2.17	0.43
1:G:89:ASP:OD1	1:G:90:THR:HG23	2.18	0.43
1:F:215:VAL:HG12	1:F:217:ILE:HG23	1.99	0.43
1:F:273:PHE:CD2	1:F:273:PHE:C	2.97	0.43
1:G:293:ASP:O	1:G:299:LYS:HD2	2.19	0.43
1:H:230:THR:O	1:H:230:THR:HG23	2.18	0.43
3:A:68:ASP:N	3:A:68:ASP:OD1	2.52	0.43
3:A:117:GLU:HG3	3:A:118:MET:HE2	2.00	0.43
1:G:162:VAL:HG13	1:G:209:ILE:HG23	2.01	0.43
3:A:57:ILE:HD12	3:A:57:ILE:O	2.19	0.43
4:I:115:MET:HE1	7:J:54:U:C6	2.54	0.43
1:C:141:ASN:HA	1:C:144:ASN:OD1	2.18	0.42
1:D:37:PHE:CE2	1:D:157:ILE:HD13	2.54	0.42
1:C:328:MET:HE2	7:J:5:G:C4	2.55	0.42
3:A:330:ARG:HH11	3:A:330:ARG:HG3	1.83	0.42
7:J:40:A:O2'	7:J:41:G:P	2.78	0.42
3:A:154:VAL:O	3:A:154:VAL:CG1	2.65	0.42
3:A:207:LYS:HG3	3:A:208:TRP:CD1	2.55	0.42
3:A:27:LEU:C	3:A:27:LEU:HD23	2.44	0.42
6:K:13:DA:H2'	6:K:14:DC:C1'	2.49	0.42
1:D:157:ILE:HD12	1:D:216:LYS:HD2	2.02	0.42
1:F:306:LEU:HB2	1:F:307:LYS:HE2	2.01	0.42
6:K:16:DG:H2''	6:K:17:DT:O4'	2.20	0.42
1:G:333:GLN:O	1:G:334:GLU:C	2.62	0.42
3:A:67:LEU:HD21	3:A:72:ALA:HB2	2.02	0.42
3:A:123:ASP:O	3:A:124:LYS:HG2	2.20	0.42
3:A:138:MET:HE3	3:A:138:MET:HA	2.02	0.42
1:H:291:ARG:N	1:H:292:PRO:HD3	2.34	0.41
1:D:229:MET:SD	1:C:76:PRO:HB3	2.61	0.41
1:C:249:MET:HE3	1:C:253:LYS:HG2	2.01	0.41
3:A:52:ILE:HD13	3:A:143:THR:OG1	2.20	0.41
1:D:249:MET:HE2	1:D:254:ILE:HG12	2.02	0.41
1:F:19:LEU:H	1:F:330:SER:HB3	1.85	0.41
1:F:65:ASP:OD1	1:F:66:LYS:N	2.53	0.41
3:A:121:LEU:O	3:A:122:THR:C	2.64	0.41
1:C:164:ILE:C	1:C:165:GLU:HG3	2.45	0.41
2:B:33:LEU:HD23	2:B:55:VAL:CG2	2.50	0.41
4:I:80:VAL:HG22	4:I:80:VAL:O	2.21	0.41
4:I:97:VAL:O	4:I:98:LEU:C	2.64	0.41
6:K:42:DT:H2''	6:K:43:DT:C6	2.55	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:9:GLU:HG2	2:B:10:LYS:HG2	2.02	0.41
6:K:18:DG:H2'	6:K:19:DG:C8	2.56	0.41
1:D:186:ASN:HB3	1:D:189:ILE:HB	2.02	0.41
1:C:47:LEU:HD21	1:C:223:VAL:HG21	2.02	0.41
1:G:93:ILE:O	1:G:212:THR:HA	2.21	0.41
4:I:104:GLU:HB3	4:I:138:ILE:HG21	2.02	0.41
1:G:60:HIS:O	1:G:61:GLU:C	2.63	0.41
3:A:31:ILE:HD12	3:A:132:ILE:HG13	2.02	0.41
4:I:8:ILE:HD12	4:I:8:ILE:O	2.20	0.41
1:F:328:MET:HE3	1:F:330:SER:OG	2.21	0.41
1:G:273:PHE:CD1	1:G:273:PHE:C	2.99	0.41
3:A:94:ALA:HA	3:A:103:VAL:CG2	2.51	0.41
3:A:260:ILE:O	3:A:264:LYS:HG3	2.21	0.41
4:I:27:VAL:HG11	4:I:77:LEU:HD21	2.01	0.41
1:F:36:ASP:HB3	1:F:39:LYS:HZ2	1.86	0.41
1:G:55:LEU:HD13	7:J:39:A:C2	2.56	0.41
1:G:121:LYS:HB3	1:G:304:MET:HE2	2.03	0.41
3:A:3:ARG:HG2	3:A:4:ASN:H	1.86	0.40
1:D:15:ARG:H	1:D:331:LYS:HE3	1.86	0.40
1:D:125:TYR:O	1:D:129:ASP:O	2.39	0.40
1:E:30:ALA:CB	1:E:254:ILE:HD11	2.50	0.40
1:F:311:LEU:HD12	1:F:311:LEU:N	2.36	0.40
4:I:101:ARG:HA	4:I:158:PHE:O	2.21	0.40
1:D:30:ALA:HB2	1:D:254:ILE:HD11	2.03	0.40
1:G:328:MET:HE3	1:G:330:SER:HB2	2.03	0.40
3:A:78:ASP:OD2	3:A:202:LEU:HG	2.21	0.40
1:D:273:PHE:CD2	1:D:273:PHE:C	2.99	0.40
1:C:56:ALA:HB2	7:J:13:A:H1'	2.03	0.40
1:H:223:VAL:O	1:H:225:PRO:HD3	2.21	0.40
3:A:323:LEU:N	3:A:323:LEU:HD23	2.37	0.40
6:K:44:DT:H2''	6:K:45:DT:C6	2.56	0.40
3:A:3:ARG:HD3	3:A:3:ARG:N	2.37	0.40
6:K:41:DC:C2'	6:K:42:DT:H72	2.52	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	C	321/335 (96%)	315 (98%)	6 (2%)	0	100	100
1	D	320/335 (96%)	310 (97%)	9 (3%)	1 (0%)	36	50
1	E	321/335 (96%)	314 (98%)	6 (2%)	1 (0%)	36	50
1	F	321/335 (96%)	314 (98%)	7 (2%)	0	100	100
1	G	322/335 (96%)	309 (96%)	13 (4%)	0	100	100
1	H	287/335 (86%)	280 (98%)	7 (2%)	0	100	100
2	B	250/255 (98%)	236 (94%)	14 (6%)	0	100	100
3	A	337/384 (88%)	304 (90%)	32 (10%)	1 (0%)	36	50
4	I	175/181 (97%)	160 (91%)	15 (9%)	0	100	100
All	All	2654/2830 (94%)	2542 (96%)	109 (4%)	3 (0%)	49	64

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	A	116	HIS
1	E	234	ASP
1	D	332	LYS

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	C	290/299 (97%)	286 (99%)	4 (1%)	59	79

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	289/299 (97%)	286 (99%)	3 (1%)	68	84
1	E	289/299 (97%)	288 (100%)	1 (0%)	86	93
1	F	286/299 (96%)	281 (98%)	5 (2%)	53	74
1	G	291/299 (97%)	286 (98%)	5 (2%)	53	74
1	H	261/299 (87%)	255 (98%)	6 (2%)	44	66
2	B	216/219 (99%)	209 (97%)	7 (3%)	34	56
3	A	297/335 (89%)	286 (96%)	11 (4%)	30	51
4	I	156/160 (98%)	148 (95%)	8 (5%)	21	37
All	All	2375/2508 (95%)	2325 (98%)	50 (2%)	46	69

All (50) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	62	MET
1	D	236	LYS
1	D	242	LYS
1	E	234	ASP
1	F	26	ASN
1	F	140	ASN
1	F	166	ASP
1	F	226	SER
1	F	260	THR
1	C	68	GLU
1	C	163	THR
1	C	252	GLN
1	C	310	ASP
1	G	26	ASN
1	G	90	THR
1	G	93	ILE
1	G	140	ASN
1	G	215	VAL
2	B	6	ILE
2	B	50	ILE
2	B	127	SER
2	B	165	ASP
2	B	200	SER
2	B	220	SER
2	B	242	ARG
1	H	35	THR

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Mol	Chain	Res	Type
1	H	103	LYS
1	H	140	ASN
1	H	186	ASN
1	H	212	THR
1	H	261	ILE
3	A	16	GLU
3	A	36	LEU
3	A	44	THR
3	A	57	ILE
3	A	97	MET
3	A	104	MET
3	A	114	LEU
3	A	117	GLU
3	A	123	ASP
3	A	295	CYS
3	A	325	ILE
4	I	7	ILE
4	I	82	ASP
4	I	88	LYS
4	I	96	TYR
4	I	123	LEU
4	I	133	LYS
4	I	147	LYS
4	I	175	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	D	308	ASN
1	E	26	ASN
1	E	195	GLN
1	E	308	ASN
1	F	308	ASN
1	G	26	ASN
1	H	194	GLN
3	A	82	ASN
3	A	106	HIS

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
7	J	59/60 (98%)	33 (55%)	0

All (33) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
7	J	2	U
7	J	3	U
7	J	7	A
7	J	9	G
7	J	10	A
7	J	14	G
7	J	15	U
7	J	16	C
7	J	20	U
7	J	21	A
7	J	26	G
7	J	27	G
7	J	28	C
7	J	32	U
7	J	33	G
7	J	34	U
7	J	35	U
7	J	36	A
7	J	38	A
7	J	39	A
7	J	40	A
7	J	41	G
7	J	42	U
7	J	43	G
7	J	44	U
7	J	45	A
7	J	46	C
7	J	47	C
7	J	48	G
7	J	54	U
7	J	55	A
7	J	57	G
7	J	60	23G

There are no RNA pucker outliers to report.

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

1 non-standard protein/DNA/RNA residue is 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
7	23G	J	60	7	24,29,30	4.35	15 (62%)	34,45,48	1.88	8 (23%)

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
7	23G	J	60	7	-	1/7/35/36	0/4/4/4

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	J	60	23G	O4'-C1'	12.42	1.70	1.42
7	J	60	23G	C2'-C1'	-9.40	1.29	1.53
7	J	60	23G	C4-N3	7.08	1.50	1.34
7	J	60	23G	C2-N3	5.19	1.45	1.33
7	J	60	23G	C3'-C2'	5.10	1.64	1.53
7	J	60	23G	O4'-C4'	-5.03	1.33	1.45
7	J	60	23G	O6-C6	-3.98	1.16	1.23
7	J	60	23G	C2-N2	3.57	1.42	1.34
7	J	60	23G	C2-N1	2.83	1.44	1.37
7	J	60	23G	PC-OC1	2.76	1.68	1.55
7	J	60	23G	O3'-C3'	-2.66	1.26	1.46
7	J	60	23G	C5-N7	-2.64	1.33	1.39
7	J	60	23G	C5-C6	2.54	1.53	1.44
7	J	60	23G	C1'-N9	-2.31	1.41	1.47
7	J	60	23G	C6-N1	2.02	1.42	1.38

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	J	60	23G	C5-C4-N3	-5.44	119.73	128.39
7	J	60	23G	C2-N3-C4	4.54	120.12	112.30
7	J	60	23G	N9-C4-N3	3.26	132.47	125.95
7	J	60	23G	C2-N1-C6	-2.98	119.71	125.11
7	J	60	23G	N9-C8-N7	-2.80	108.21	113.40
7	J	60	23G	C5-C6-N1	2.64	119.97	113.25
7	J	60	23G	O6-C6-C5	-2.40	120.21	126.53
7	J	60	23G	C8-N7-C5	2.09	107.98	104.26

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	J	60	23G	C4'-C5'-O5'-P

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	J	60	23G	3	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

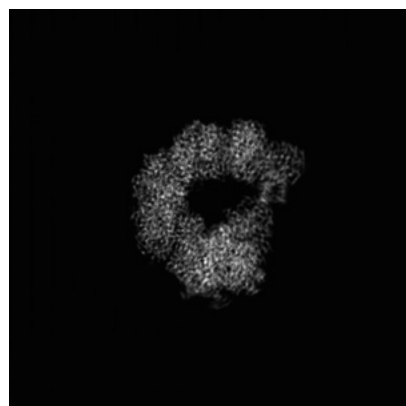
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-54919. These allow visual inspection of the internal detail of the map and identification of artifacts.

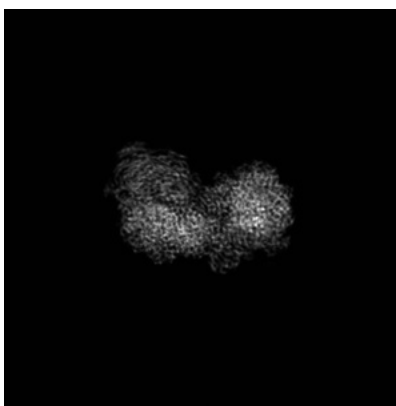
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

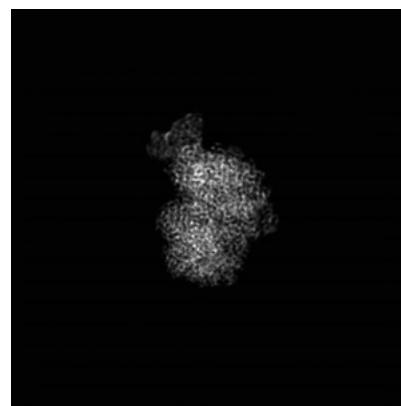
6.1.1 Primary map



X

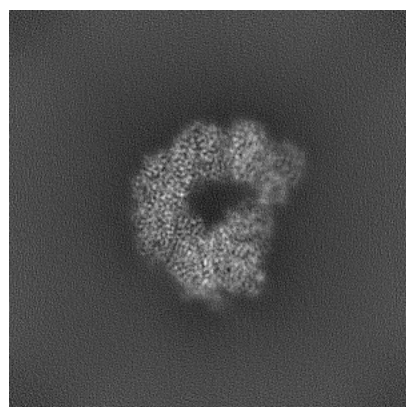


Y

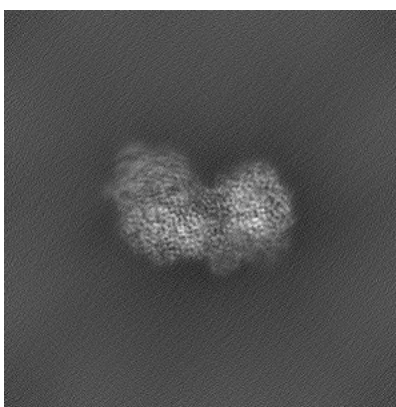


Z

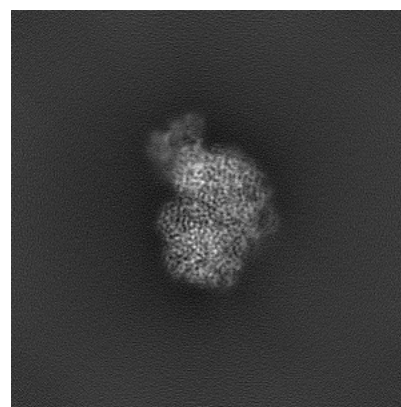
6.1.2 Raw map



X



Y



Z

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

6.2 Central slices [i](#)

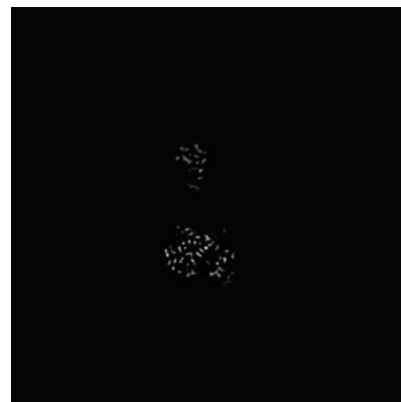
6.2.1 Primary map



X Index: 210

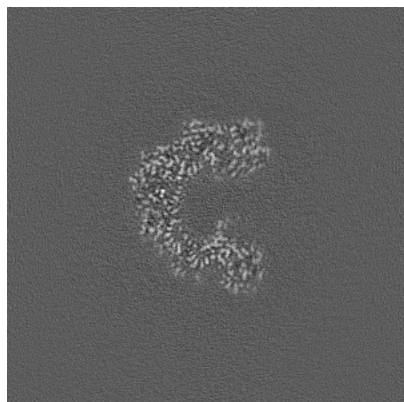


Y Index: 210

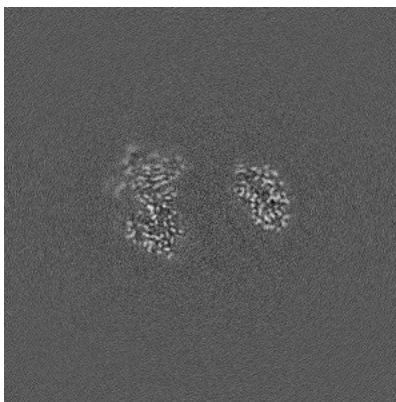


Z Index: 210

6.2.2 Raw map



X Index: 210



Y Index: 210



Z Index: 210

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: 193

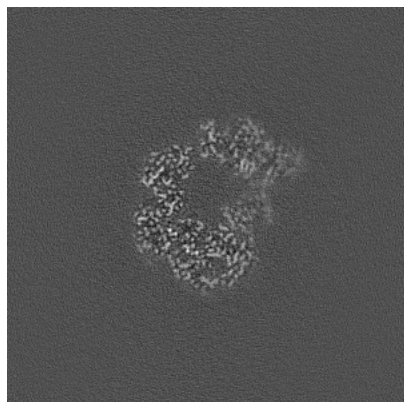


Y Index: 211

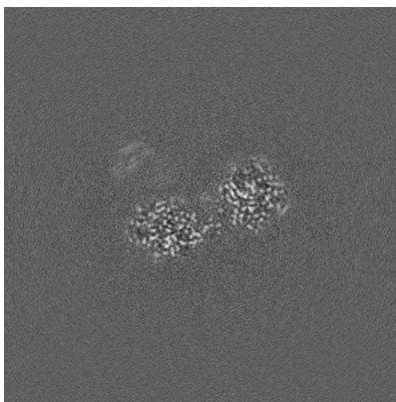


Z Index: 265

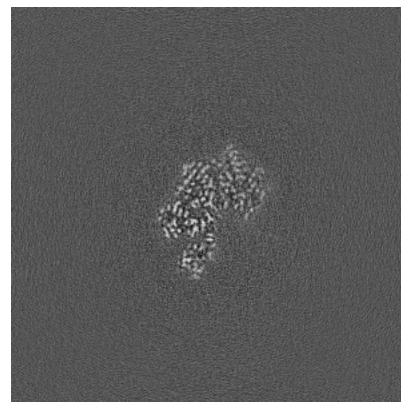
6.3.2 Raw map



X Index: 193



Y Index: 186

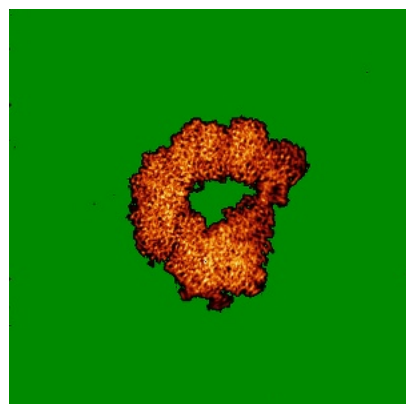


Z Index: 169

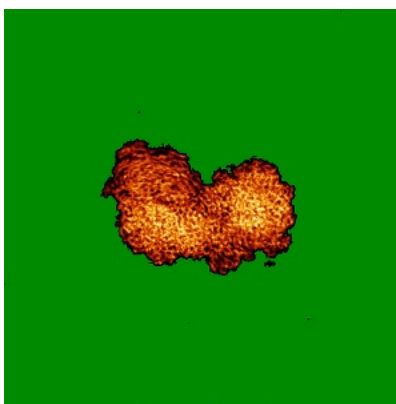
The images above show the largest variance slices of the map in three orthogonal directions.

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

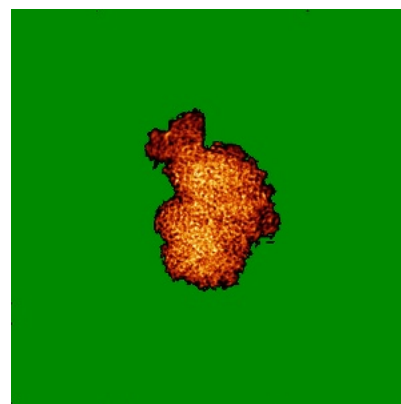
6.4.1 Primary map



X

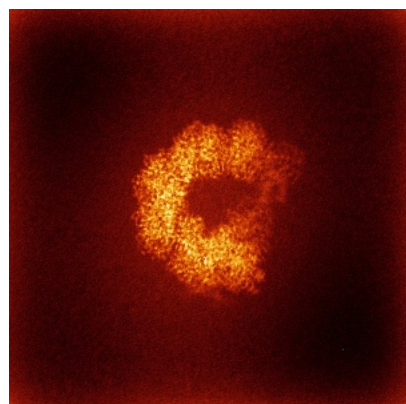


Y

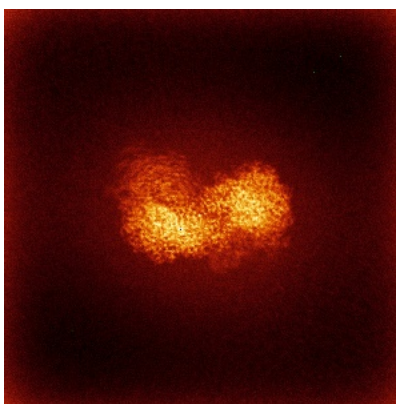


Z

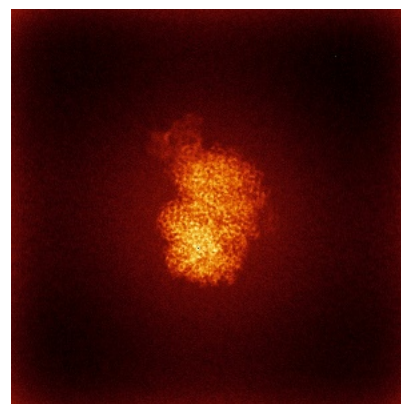
6.4.2 Raw map



X



Y

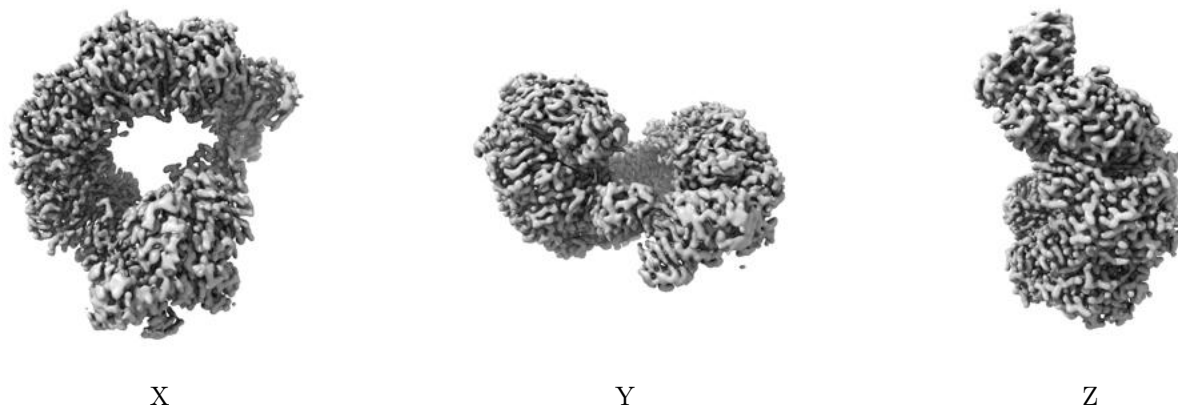


Z

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.

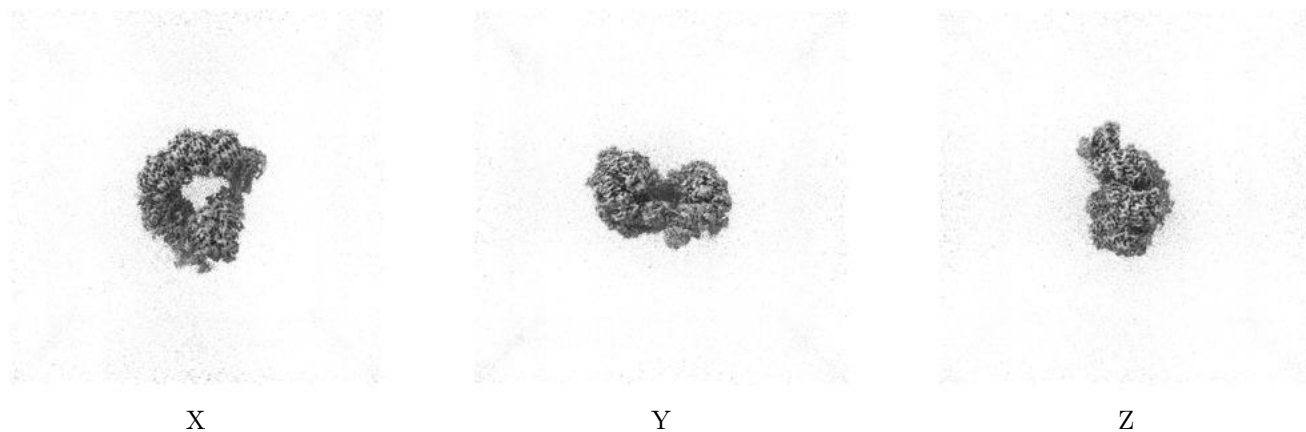
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.06. 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.

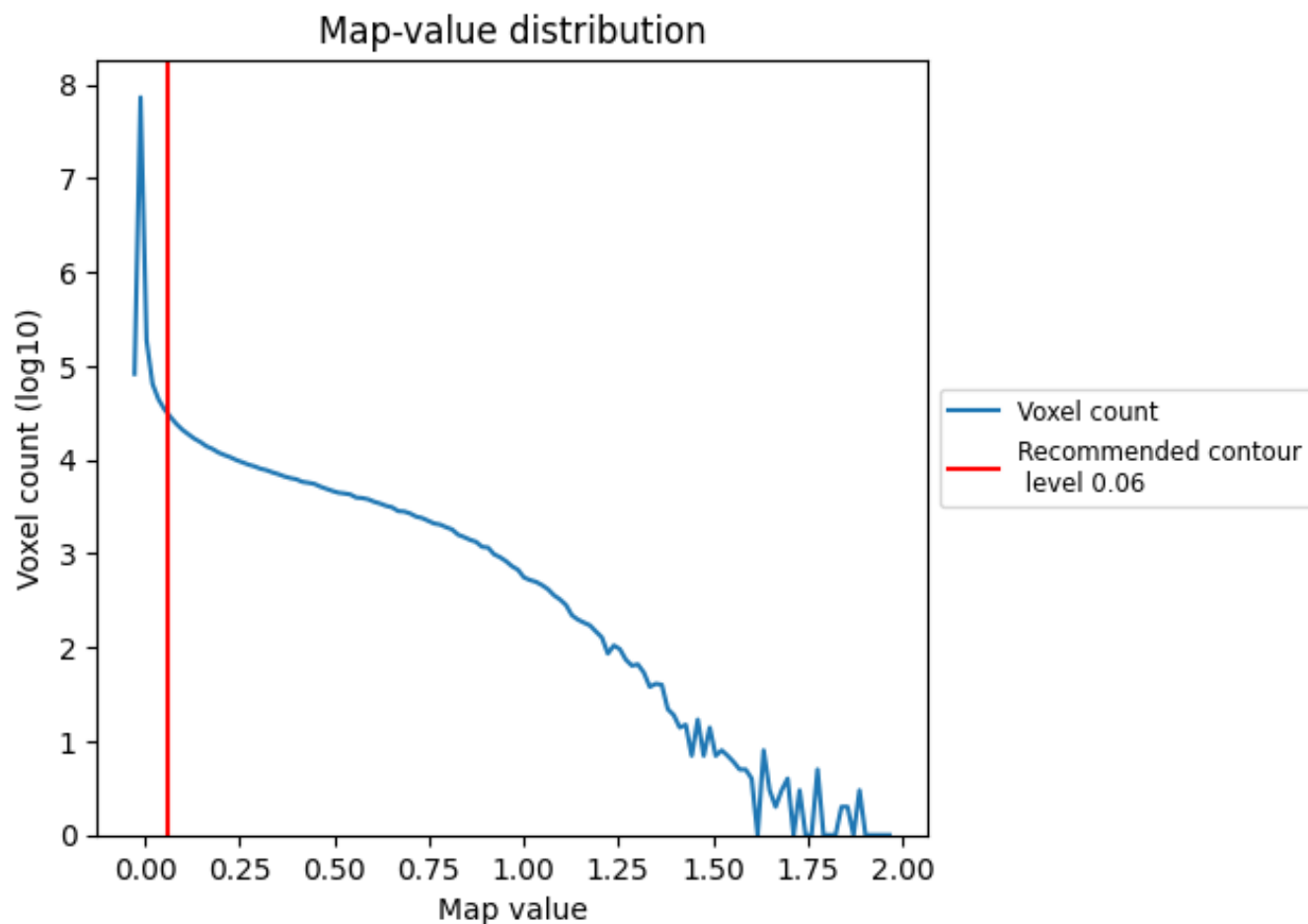
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

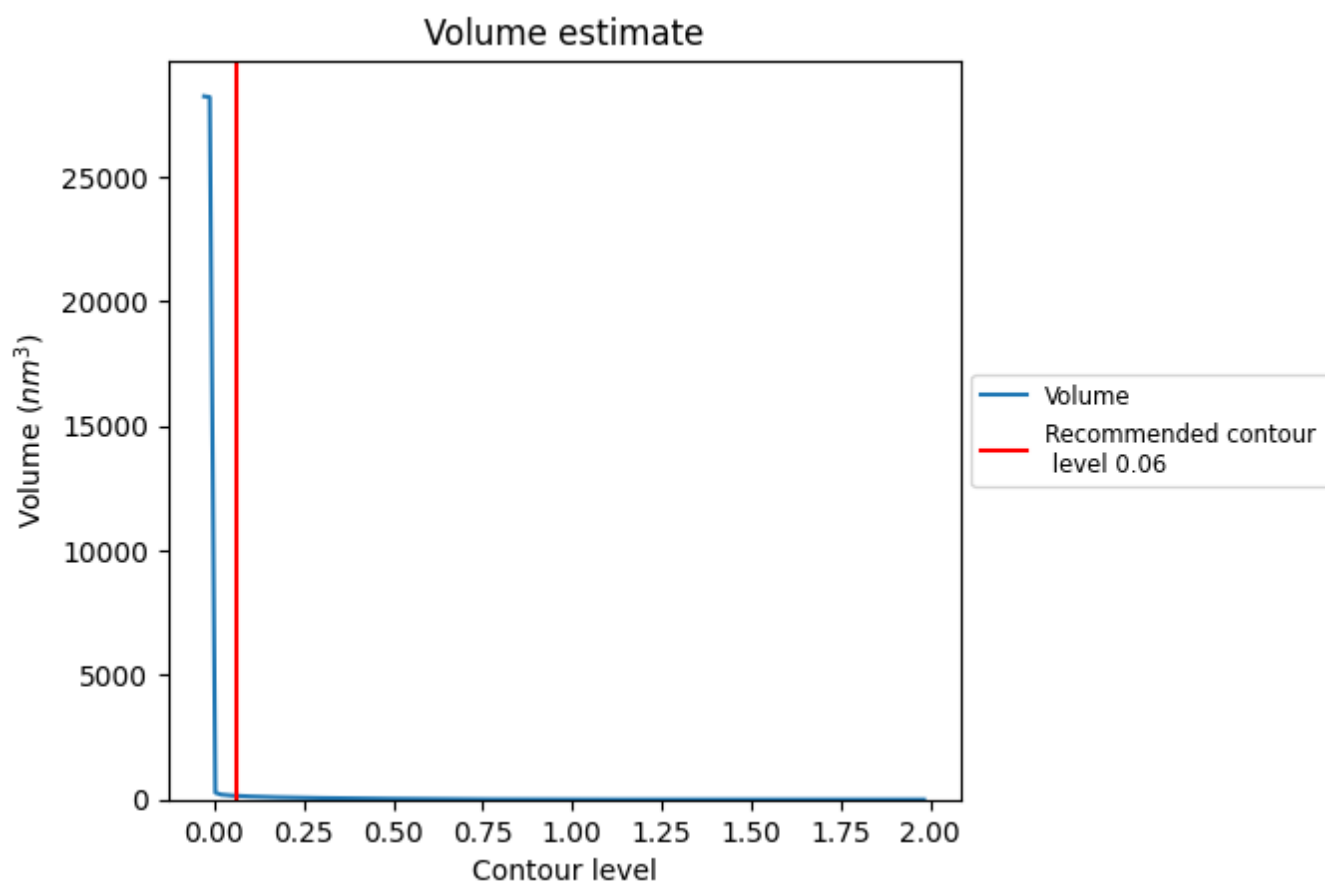
This section contains the results of statistical analysis of the map.

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.

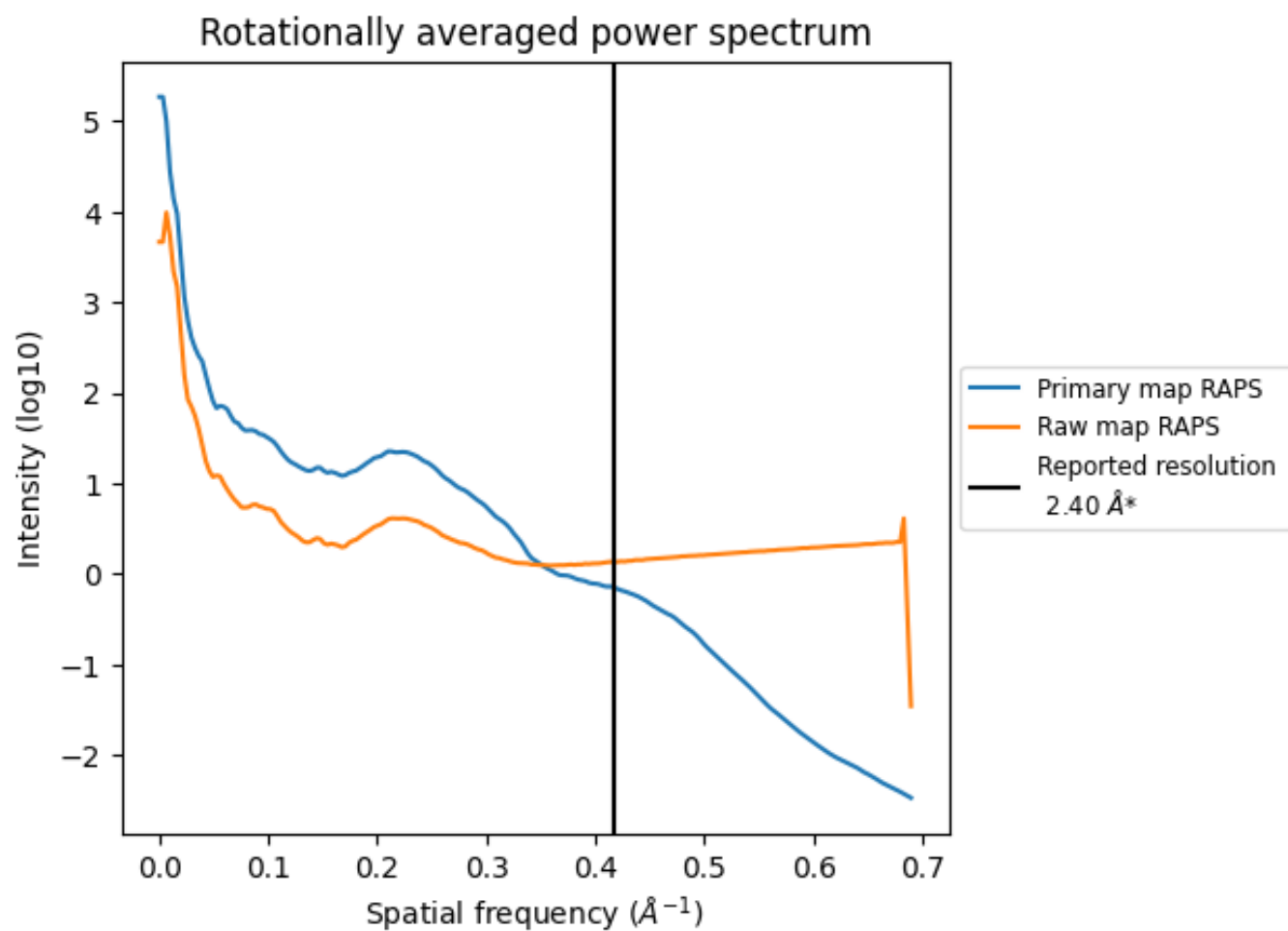
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 152 nm^3 ; this corresponds to an approximate mass of 137 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 ⓘ

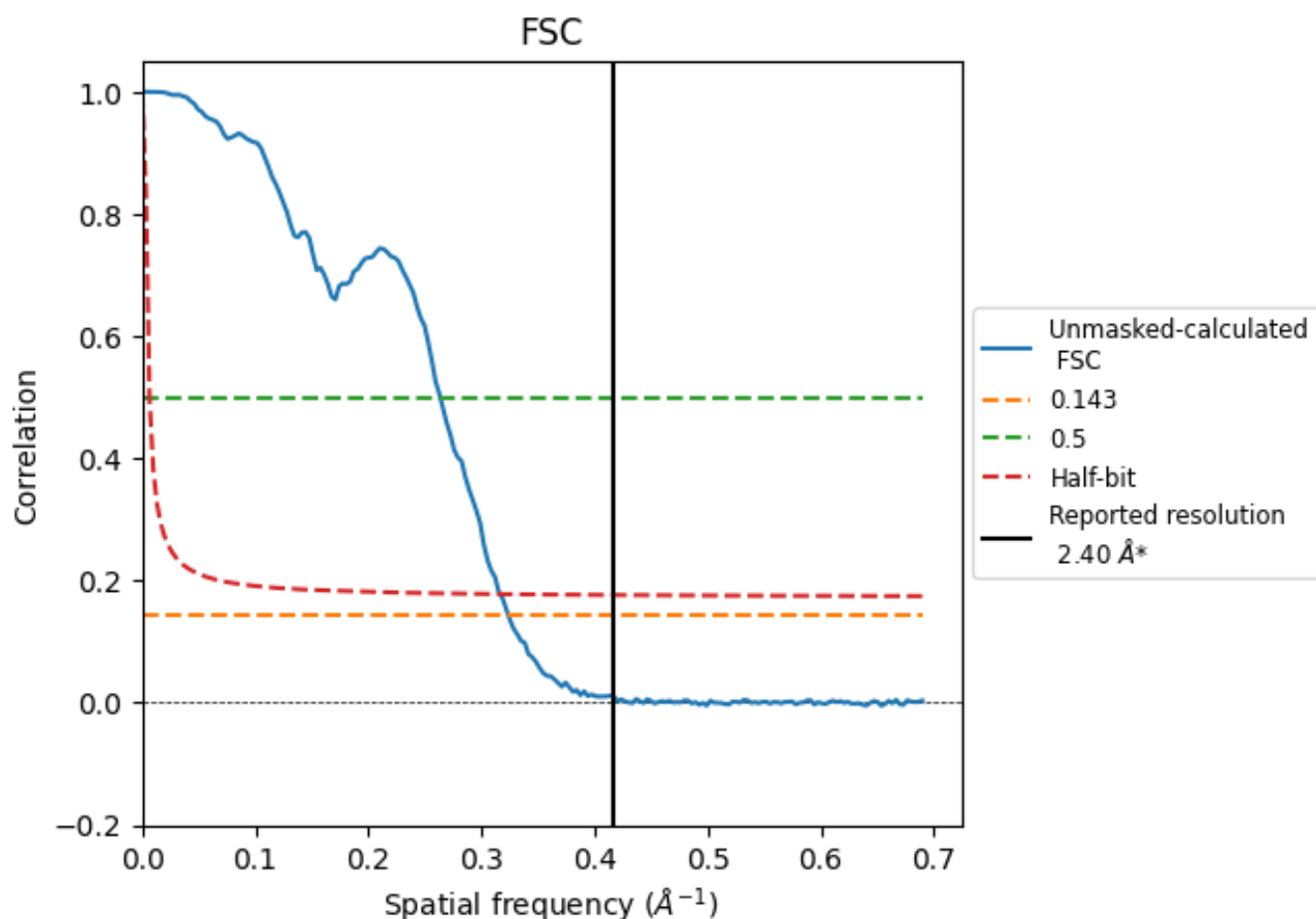


*Reported resolution corresponds to spatial frequency of $0.417 \text{ \AA}^{-1}$

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 0.417 Å⁻¹

8.2 Resolution estimates [i](#)

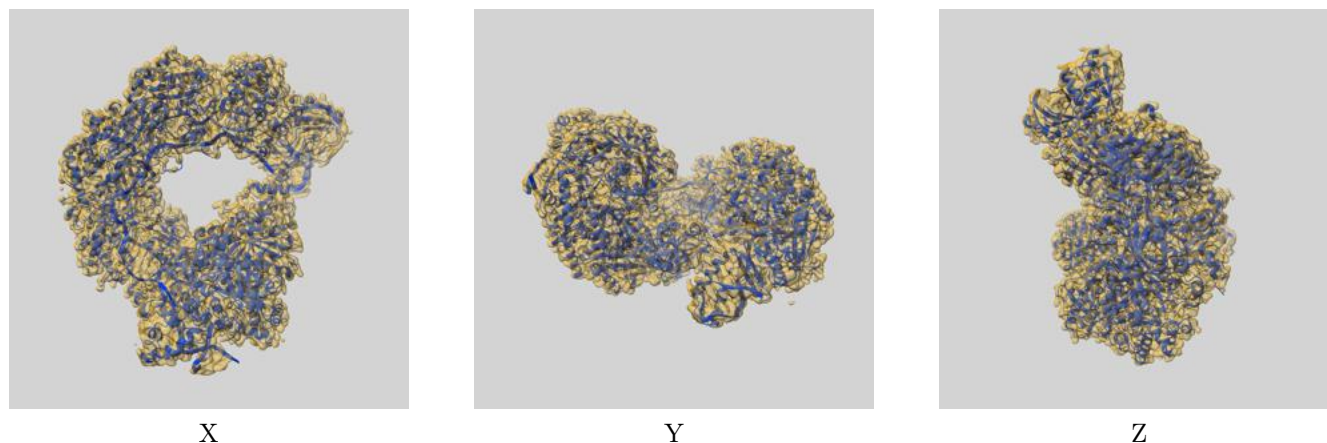
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.40	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.09	3.80	3.16

*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 3.09 differs from the reported value 2.4 by more than 10 %

9 Map-model fit [i](#)

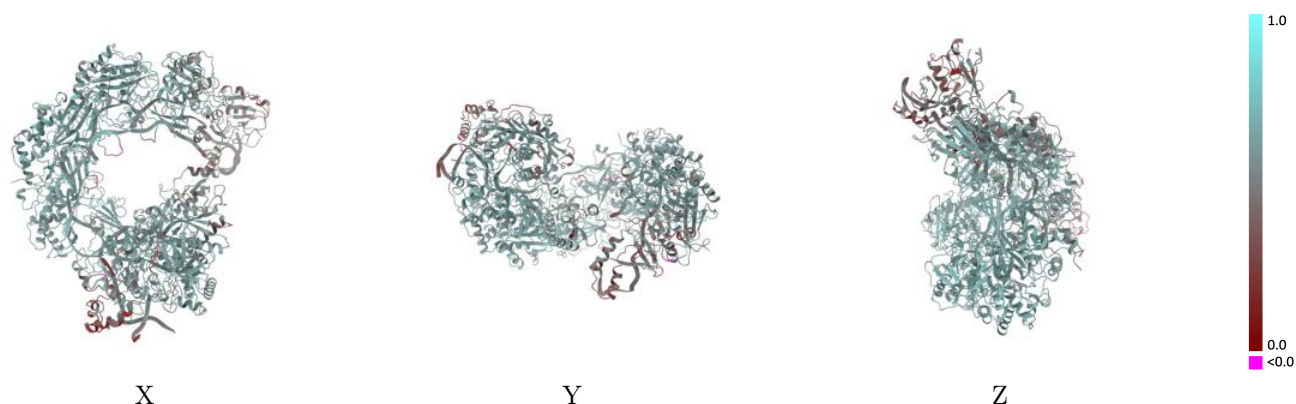
This section contains information regarding the fit between EMDB map EMD-54919 and PDB model 9SHX. Per-residue inclusion information can be found in section 3 on page 7.

9.1 Map-model overlay [i](#)



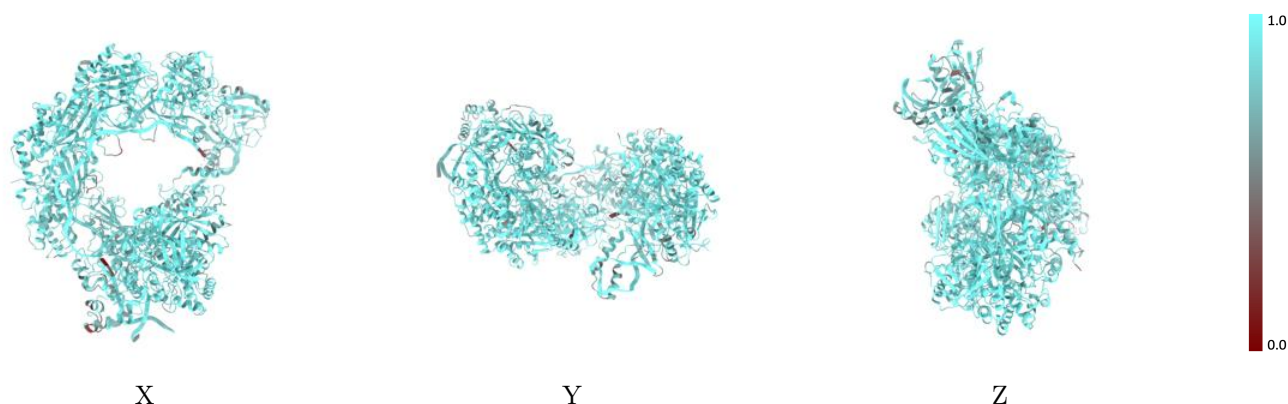
The images above show the 3D surface view of the map at the recommended contour level 0.06 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



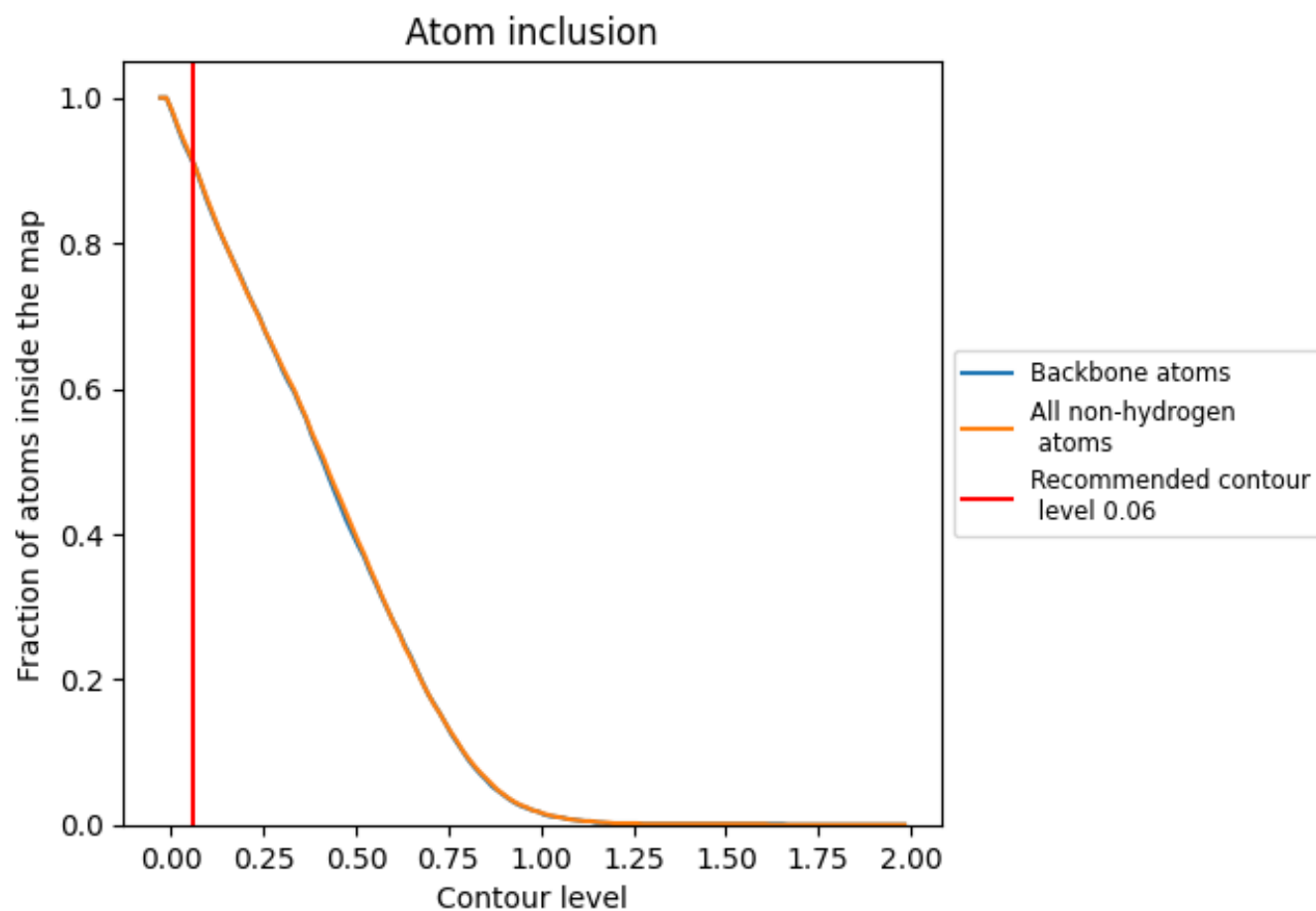
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.06).

9.4 Atom inclusion [i](#)



At the recommended contour level, 91% of all backbone atoms, 91% 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 (0.06) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9120	0.5660
A	0.8510	0.4820
B	0.8980	0.5640
C	0.9360	0.6030
D	0.9330	0.6130
E	0.9340	0.6170
F	0.9340	0.6110
G	0.9250	0.5920
H	0.9160	0.5620
I	0.7990	0.4230
J	0.9450	0.5330
K	0.9270	0.5430
L	0.7690	0.4470

1.0

0.0

<0.0