Full wwPDB EM Validation Report

Oct 27, 2025 – 04:51 PM EDT

PDB ID	:	9NVM / pdb_00009nvm
EMDB ID	:	EMD-49840
Title	:	ATPase Hybrid F1 with the ancestral core domains Catalytic Dwell
Authors	:	Stewart, A.G.; Noji, H.; Sobti, M.; Suzuki, A.K.
Deposited on	:	2025-03-20
Resolution	:	2.58 Å(reported)

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

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/EMValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

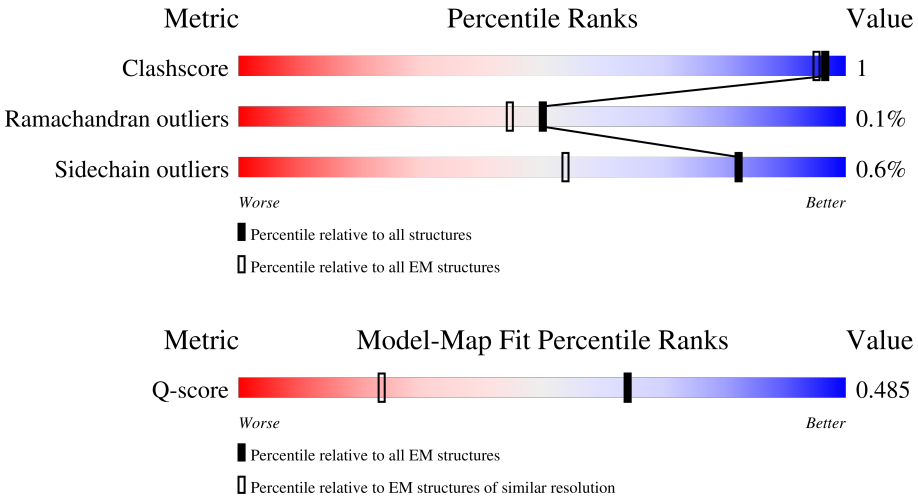
EMDB validation analysis	:	0.0.1.dev129
Mogul	:	2022.3.0, CSD as543be (2022)
MolProbity	:	4-5-2 with Phenix2.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics	:	202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.46

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 2.58 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	7675 (2.08 - 3.08)

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 <=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	509	14% 89% • 6%
1	B	509	17% 90% • 7%
1	C	509	13% 90% • 7%
2	D	482	15% 94% • •

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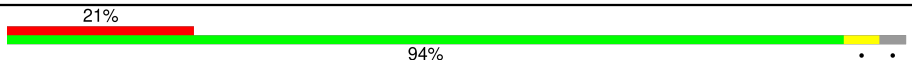
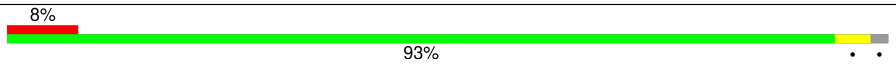
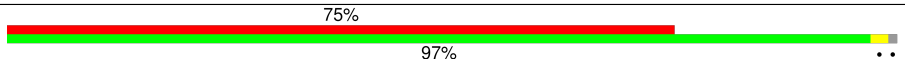
Mol	Chain	Length	Quality of chain
2	E	482	
2	F	482	
3	G	285	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 24284 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 ATPase hybrid F1 with the ancestral core domains alpha chains.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	476	Total	C	N	O	S	0	0
			3661	2314	633	702	12		
1	B	475	Total	C	N	O	S	0	0
			3655	2311	632	700	12		
1	C	475	Total	C	N	O	S	0	0
			3655	2311	632	700	12		

- Molecule 2 is a protein called ATPase hybrid F1 with the ancestral core domains beta chains.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	D	469	Total	C	N	O	S	0	0
			3660	2319	632	695	14		
2	E	468	Total	C	N	O	S	0	0
			3650	2312	629	694	15		
2	F	470	Total	C	N	O	S	0	0
			3668	2324	633	696	15		

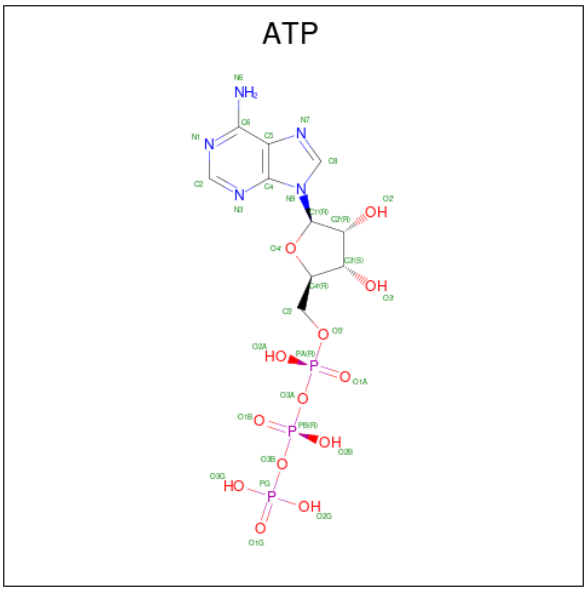
- Molecule 3 is a protein called ATP synthase gamma chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	G	282	Total	C	N	O	S	0	0
			2211	1393	388	420	10		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	112	CYS	SER	conflict	UNP Q5KUJ2
G	215	CYS	ILE	conflict	UNP Q5KUJ2

- Molecule 4 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).

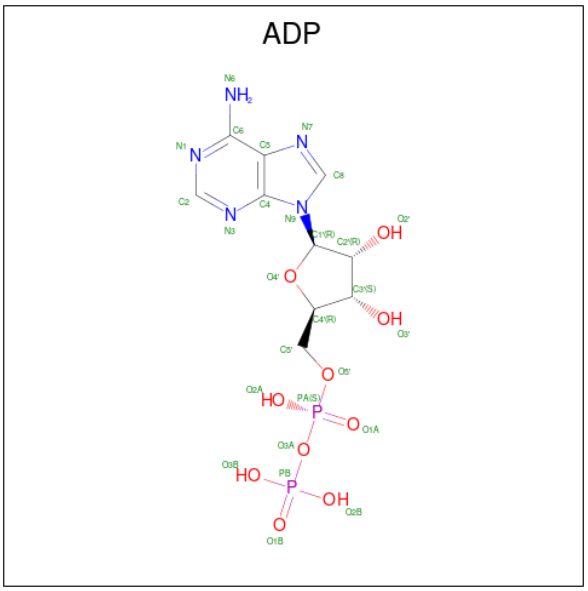


Mol	Chain	Residues	Atoms					AltConf
4	A	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	C	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	D	1	Total	C	N	O	P	0
			31	10	5	13	3	

- Molecule 5 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
5	A	1	Total	Mg	0
			1	1	
5	C	1	Total	Mg	0
			1	1	
5	D	1	Total	Mg	0
			1	1	
5	F	1	Total	Mg	0
			1	1	

- Molecule 6 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).



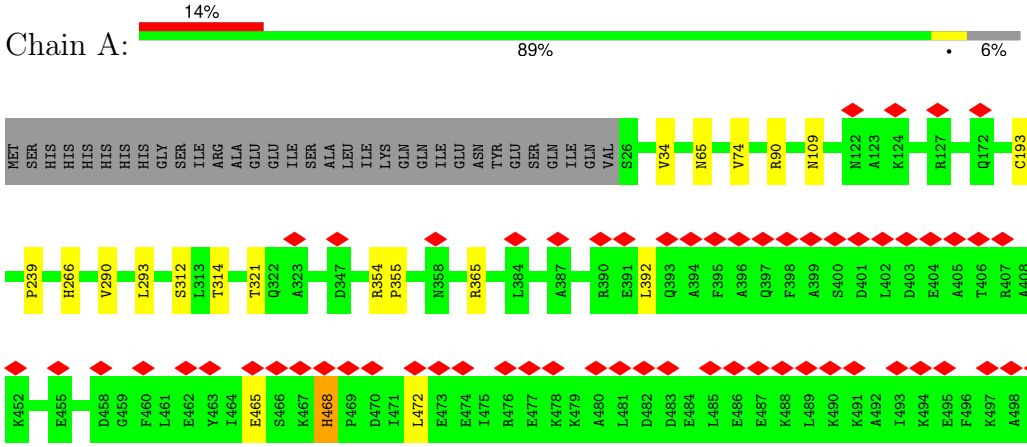
Mol	Chain	Residues	Atoms					AltConf
6	F	1	Total	C	N	O	P	0
			27	10	5	10	2	

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.

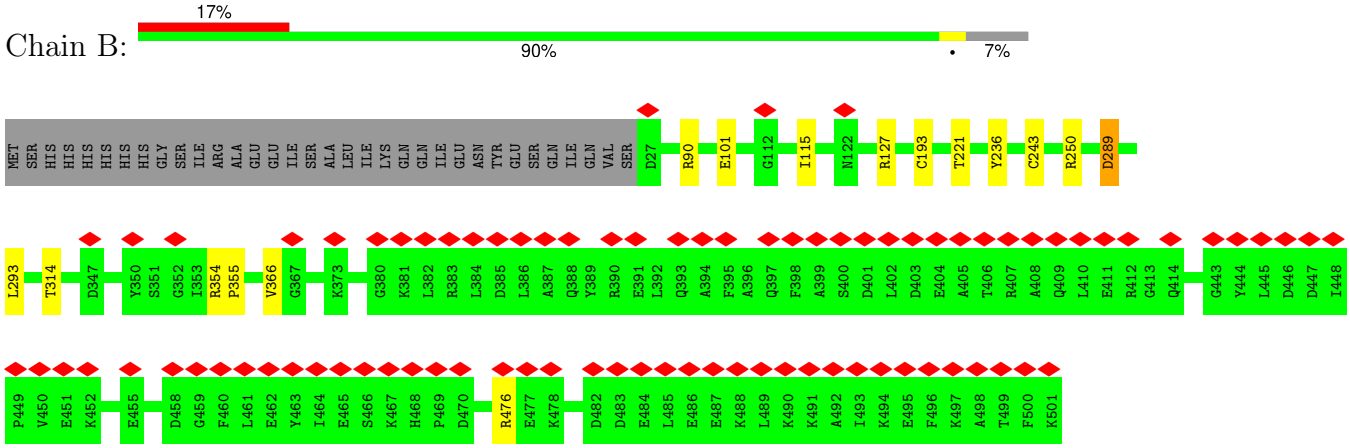
• Molecule 1: ATPase hybrid F1 with the ancestral core domains alpha chains

Chain A:



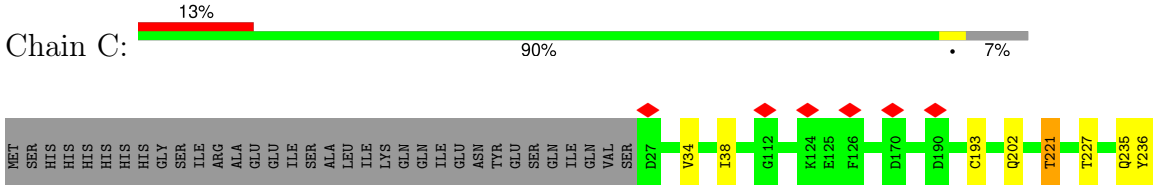
• Molecule 1: ATPase hybrid F1 with the ancestral core domains alpha chains

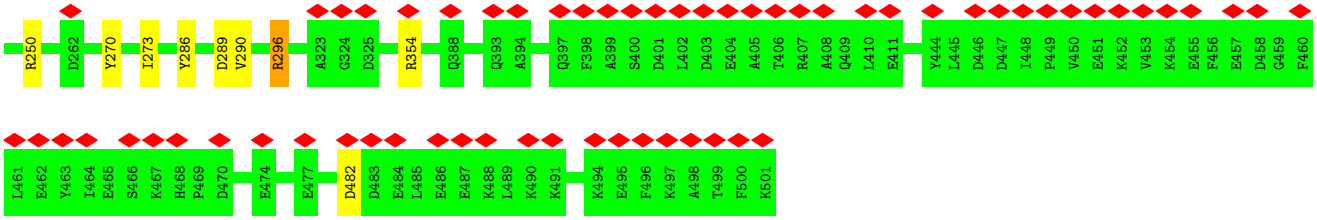
Chain B:



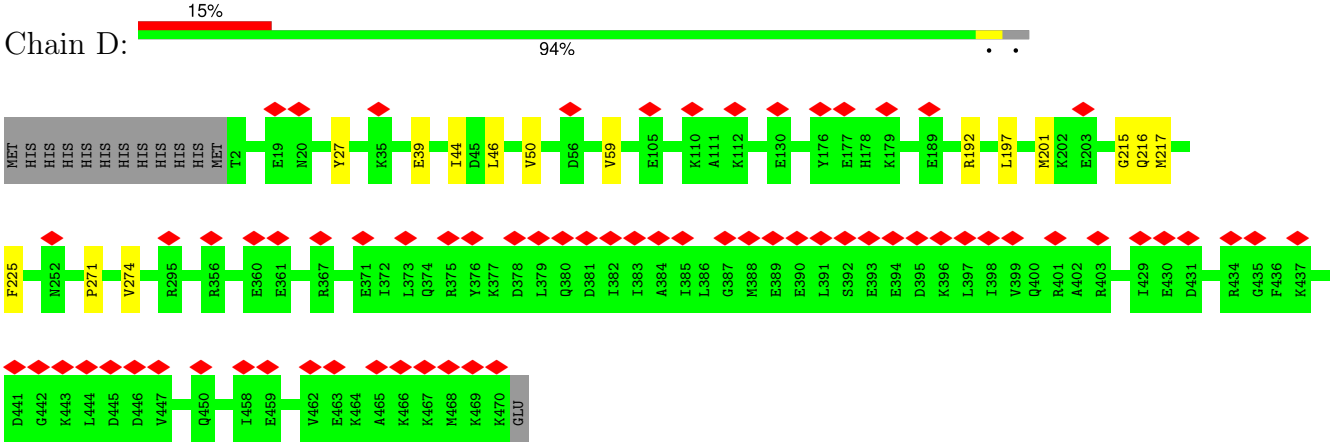
• Molecule 1: ATPase hybrid F1 with the ancestral core domains alpha chains

Chain C:

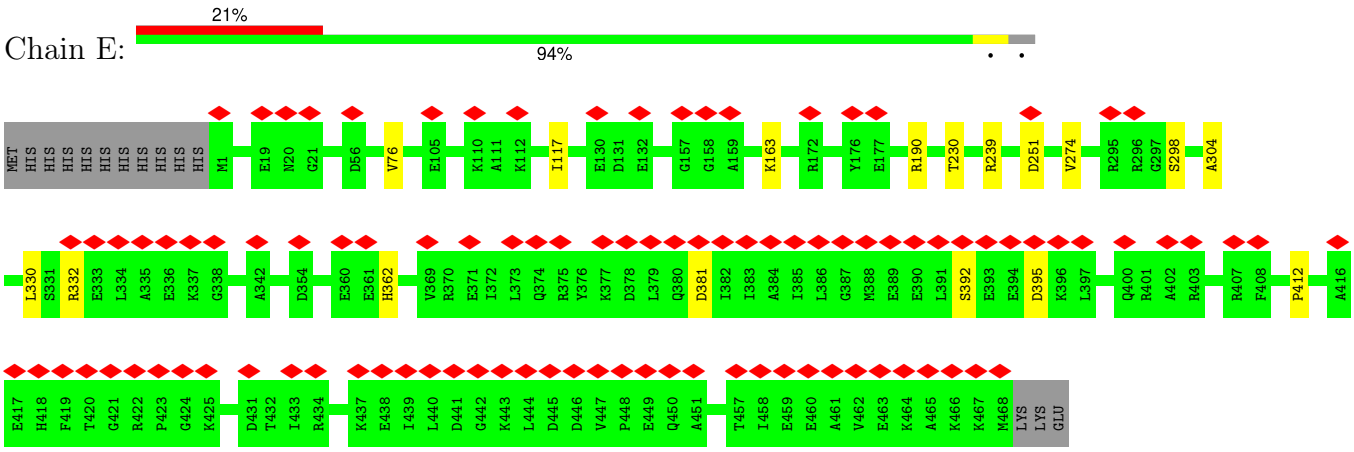




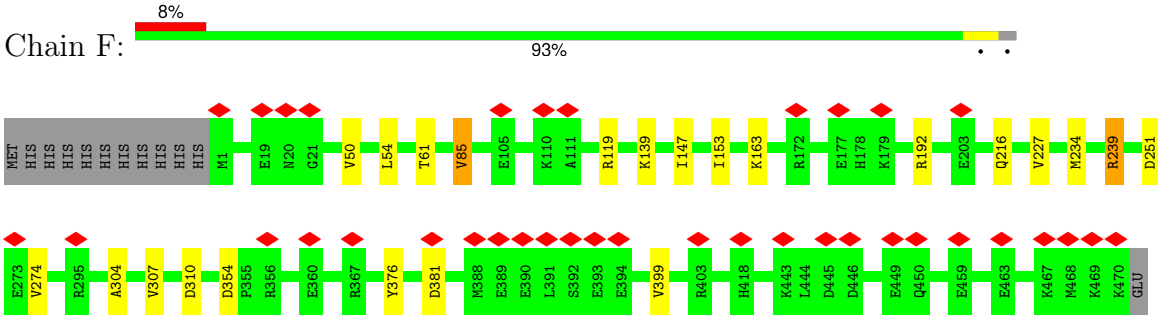
• Molecule 2: ATPase hybrid F1 with the ancestral core domains beta chains



• Molecule 2: ATPase hybrid F1 with the ancestral core domains beta chains

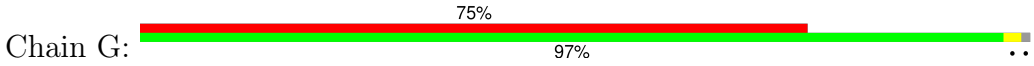


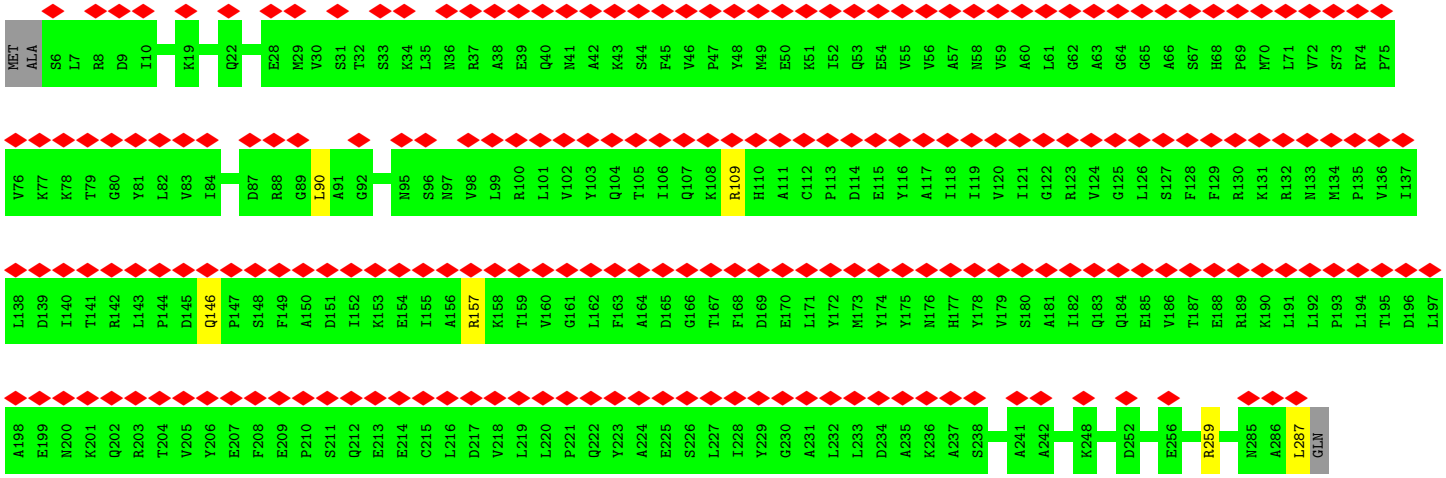
• Molecule 2: ATPase hybrid F1 with the ancestral core domains beta chains



• Molecule 3: ATP synthase gamma chain

Chain G:


75%
97%


MET ALA S6 L7 R8 D9 I10 K19 Q22 E28 M29 V30 S31 T32 S33 K34 L35 N36 R37 A38 E39 Q40 N41 A42 K43 S44 F45 V46 P47 Y48 M49 E50 K51 I52 Q53 E54 V55 V56 A57 N58 V59 A60 L61 G62 A63 G64 G65 A66 S67 H68 P69 M70 L71 V72 S73 R74 P75
V76 K77 K78 T79 G80 Y81 L82 V83 I84 D87 R88 G89 L90 A91 G92 N95 S96 N97 V98 L99 R100 L101 V102 Y103 Q104 T105 I106 Q107 K108 R109 H110 A111 C112 P113 D114 E115 Y116 A117 I118 I119 V120 I121 G122 R123 V124 G125 L126 S127 F128 F129 R130 K131 R132 N133 M134 P135 V136 I137
L138 D139 I140 T141 R142 L143 P144 D145 Q146 P147 S148 F149 A150 D151 I152 K153 E154 I155 A156 R157 K158 T159 V160 G161 L162 F163 A164 D165 G166 T167 F168 D169 E170 L171 Y172 M173 Y174 Y175 N176 H177 Y178 V179 S180 A181 I182 Q183 Q184 E185 V186 T187 E188 R189 K190 L191 L192 P193 L194 T195 D196 L197
A198 E199 N200 K201 Q202 R203 T204 V205 Y206 E207 F208 E209 P210 S211 Q212 E213 E214 C215 L216 D217 V218 L219 L220 P221 Q222 Y223 A224 E225 S226 L227 I228 Y229 G230 A231 L232 L233 D234 A235 K236 A237 S238 A241 A242 K248 D252 E256 R259 N285 A286 L287 GLN

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	206455	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 ($e^-/Å^2$)	62	Depositor
Minimum defocus (nm)	200	Depositor
Maximum defocus (nm)	1000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.326	Depositor
Minimum map value	-0.834	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.047	Depositor
Recommended contour level	0.15	Depositor
Map size (Å)	215.04, 215.04, 215.04	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.84, 0.84, 0.84	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG, ATP, ADP

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	0.81	0/3717	1.44	7/5020 (0.1%)
1	B	0.82	1/3711 (0.0%)	1.43	8/5012 (0.2%)
1	C	0.81	0/3711	1.43	6/5012 (0.1%)
2	D	0.82	0/3726	1.41	7/5039 (0.1%)
2	E	0.82	0/3716	1.41	8/5027 (0.2%)
2	F	0.81	0/3734	1.44	16/5049 (0.3%)
3	G	0.82	0/2244	1.41	4/3036 (0.1%)
All	All	0.82	1/24559 (0.0%)	1.43	56/33195 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	C	0	2
2	D	0	1
All	All	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	90	ARG	CZ-NH2	-8.81	1.22	1.33

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	216	GLN	N-CA-C	6.86	118.70	110.19
2	E	239	ARG	NE-CZ-NH2	6.64	125.17	119.20
1	C	289	ASP	CA-CB-CG	6.59	119.19	112.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	65	ASN	CA-CB-CG	6.56	119.16	112.60
1	B	366	VAL	CA-C-N	6.53	126.31	120.10
1	B	366	VAL	C-N-CA	6.53	126.31	120.10
2	E	412	PRO	N-CA-CB	6.51	106.57	102.92
2	E	190	ARG	NE-CZ-NH2	6.35	124.92	119.20
2	F	54	LEU	N-CA-CB	-6.26	101.21	110.53
1	B	289	ASP	CA-CB-CG	6.25	118.85	112.60
2	D	192	ARG	NE-CZ-NH2	6.13	124.72	119.20
3	G	146	GLN	CB-CA-C	6.04	116.50	110.33
2	F	239	ARG	NE-CZ-NH2	6.00	124.60	119.20
1	C	250	ARG	NE-CZ-NH2	5.76	124.38	119.20
1	A	365	ARG	NE-CZ-NH2	5.71	124.34	119.20
1	C	482	ASP	CA-CB-CG	5.67	118.27	112.60
2	E	381	ASP	CA-CB-CG	5.65	118.25	112.60
1	A	392	LEU	N-CA-C	5.65	117.24	111.14
2	E	395	ASP	CA-CB-CG	5.62	118.22	112.60
1	B	250	ARG	NE-CZ-NH2	5.59	124.23	119.20
2	F	119	ARG	NE-CZ-NH2	5.58	124.22	119.20
2	F	119	ARG	CA-C-N	5.57	123.67	119.66
2	F	119	ARG	C-N-CA	5.57	123.67	119.66
2	F	381	ASP	CA-CB-CG	5.53	118.13	112.60
3	G	259	ARG	NE-CZ-NH2	5.53	124.17	119.20
2	D	217	MET	N-CA-C	5.52	118.01	111.33
1	B	127	ARG	NE-CZ-NH2	5.51	124.16	119.20
1	B	101	GLU	CA-C-N	5.47	128.16	120.28
1	B	101	GLU	C-N-CA	5.47	128.16	120.28
1	A	312	SER	N-CA-C	5.47	117.53	108.13
2	D	215	GLY	CA-C-N	5.46	130.78	121.29
2	D	215	GLY	C-N-CA	5.46	130.78	121.29
2	F	227	VAL	N-CA-C	5.45	116.18	110.62
2	E	332	ARG	NE-CZ-NH2	5.40	124.06	119.20
3	G	109	ARG	NE-CZ-NH2	5.34	124.00	119.20
1	C	296	ARG	NE-CZ-NH2	5.33	123.99	119.20
1	B	476	ARG	NE-CZ-NH2	5.32	123.99	119.20
1	C	235	GLN	OE1-CD-NE2	-5.28	117.32	122.60
2	F	216	GLN	OE1-CD-NE2	-5.24	117.36	122.60
2	D	216	GLN	OE1-CD-NE2	-5.23	117.37	122.60
2	F	85	VAL	N-CA-C	5.23	113.59	107.89
2	F	307	VAL	CA-C-N	5.22	125.52	119.47
2	F	307	VAL	C-N-CA	5.22	125.52	119.47
2	D	225	PHE	CA-CB-CG	5.21	119.01	113.80
2	F	354	ASP	CA-CB-CG	5.18	117.78	112.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	468	HIS	CB-CG-CD2	-5.15	124.51	131.20
1	A	90	ARG	NE-CZ-NH2	5.13	123.82	119.20
2	E	362	HIS	CB-CG-CD2	-5.12	124.54	131.20
2	F	139	LYS	N-CA-C	5.10	117.23	111.11
1	A	109	ASN	CA-CB-CG	5.09	117.69	112.60
2	F	192	ARG	NE-CZ-NH2	5.07	123.76	119.20
1	C	221	THR	CA-CB-CG2	5.05	119.08	110.50
2	F	310	ASP	CA-C-N	5.03	130.20	122.95
2	F	310	ASP	C-N-CA	5.03	130.20	122.95
3	G	157	ARG	NE-CZ-NH2	5.02	123.72	119.20
2	E	298	SER	N-CA-C	5.01	117.42	109.50

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	296	ARG	Sidechain
1	C	354	ARG	Sidechain
2	D	27	TYR	Sidechain

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	A	3661	0	3727	6	0
1	B	3655	0	3723	4	0
1	C	3655	0	3722	8	0
2	D	3660	0	3710	4	0
2	E	3650	0	3697	4	0
2	F	3668	0	3722	6	0
3	G	2211	0	2257	1	0
4	A	31	0	12	0	0
4	C	31	0	12	0	0
4	D	31	0	12	0	0
5	A	1	0	0	0	0
5	C	1	0	0	0	0
5	D	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	F	1	0	0	0	0
6	F	27	0	12	0	0
All	All	24284	0	24606	32	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 1.

All (32) 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)
1:C:193:CYS:HB2	1:C:221:THR:HG22	1.65	0.77
1:A:193:CYS:HB2	1:A:221:THR:HG22	1.74	0.69
1:C:236:TYR:CZ	1:C:273:ILE:HD12	2.33	0.63
1:C:202:GLN:HG2	1:C:227:THR:HG21	1.80	0.62
2:D:197:LEU:HD11	2:D:201:MET:HE2	1.81	0.61
2:E:251:ASP:O	2:E:304:ALA:HB3	2.01	0.61
1:A:239:PRO:HD3	1:A:266:HIS:CE1	2.38	0.59
1:B:193:CYS:HB2	1:B:221:THR:HG22	1.84	0.57
1:C:236:TYR:CE2	1:C:273:ILE:HD12	2.41	0.56
1:C:236:TYR:CZ	1:C:270:TYR:HA	2.43	0.53
1:C:286:TYR:HB3	1:C:290:VAL:HG21	1.91	0.53
1:B:236:TYR:CE1	1:B:293:LEU:HD11	2.45	0.52
2:D:50:VAL:HG13	2:D:59:VAL:CG1	2.41	0.51
1:C:38:ILE:HD11	1:C:273:ILE:HG23	1.93	0.50
2:F:147:ILE:HG23	2:F:153:ILE:HD11	1.93	0.49
2:E:163:LYS:HG2	2:E:330:LEU:HD12	1.95	0.48
1:B:236:TYR:HE1	1:B:293:LEU:HD11	1.78	0.48
2:F:376:TYR:CE1	2:F:399:VAL:HG23	2.50	0.47
2:F:251:ASP:O	2:F:304:ALA:HB3	2.16	0.46
2:E:117:ILE:HD12	2:E:230:THR:HA	1.98	0.46
2:F:85:VAL:CG1	2:F:234:MET:HE3	2.46	0.45
2:F:50:VAL:HA	2:F:61:THR:HG22	1.97	0.45
2:D:271:PRO:HD3	3:G:287:LEU:HD12	1.98	0.45
1:A:74:VAL:HG12	1:A:233:ALA:HB2	1.98	0.44
1:C:202:GLN:CG	1:C:227:THR:HG21	2.45	0.44
2:E:163:LYS:HG2	2:E:330:LEU:CD1	2.48	0.44
1:B:354:ARG:HA	1:B:355:PRO:C	2.45	0.42
1:A:465:GLU:HA	1:A:468:HIS:CD2	2.56	0.41
1:A:354:ARG:HA	1:A:355:PRO:C	2.45	0.41
2:F:163:LYS:HB2	2:F:163:LYS:HE3	1.87	0.40
1:A:472:LEU:HD13	1:A:472:LEU:C	2.47	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:39:GLU:CD	2:D:39:GLU:H	2.30	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	A	474/509 (93%)	465 (98%)	9 (2%)	0	100	100
1	B	473/509 (93%)	461 (98%)	12 (2%)	0	100	100
1	C	473/509 (93%)	462 (98%)	11 (2%)	0	100	100
2	D	467/482 (97%)	451 (97%)	15 (3%)	1 (0%)	44	64
2	E	466/482 (97%)	452 (97%)	13 (3%)	1 (0%)	44	64
2	F	468/482 (97%)	453 (97%)	14 (3%)	1 (0%)	44	64
3	G	280/285 (98%)	275 (98%)	5 (2%)	0	100	100
All	All	3101/3258 (95%)	3019 (97%)	79 (2%)	3 (0%)	50	69

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	F	274	VAL
2	E	274	VAL
2	D	274	VAL

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	A	385/415 (93%)	380 (99%)	5 (1%)	65	83
1	B	384/415 (92%)	380 (99%)	4 (1%)	73	87
1	C	384/415 (92%)	383 (100%)	1 (0%)	91	97
2	D	395/408 (97%)	393 (100%)	2 (0%)	86	95
2	E	394/408 (97%)	392 (100%)	2 (0%)	86	95
2	F	396/408 (97%)	395 (100%)	1 (0%)	91	97
3	G	238/240 (99%)	237 (100%)	1 (0%)	89	96
All	All	2576/2709 (95%)	2560 (99%)	16 (1%)	82	93

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	VAL
1	A	290	VAL
1	A	293	LEU
1	A	314	THR
1	A	321	THR
1	B	115	ILE
1	B	243	CYS
1	B	289	ASP
1	B	314	THR
1	C	34	VAL
2	D	44	ILE
2	D	46	LEU
2	E	76	VAL
2	E	392	SER
2	F	239	ARG
3	G	90	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (28) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	140	GLN
1	A	442	ASN
1	B	140	GLN
1	B	172	GLN
1	B	186	GLN

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Mol	Chain	Res	Type
1	B	202	GLN
1	B	272	GLN
1	B	397	GLN
1	C	202	GLN
1	C	235	GLN
1	C	272	GLN
1	C	409	GLN
2	D	118	HIS
2	D	195	ASN
2	D	288	GLN
2	D	303	GLN
2	D	347	GLN
2	D	380	GLN
2	D	414	HIS
2	E	33	GLN
2	E	195	ASN
2	E	288	GLN
2	E	303	GLN
2	E	362	HIS
2	E	414	HIS
2	F	178	HIS
2	F	374	GLN
2	F	380	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 8 ligands modelled in this entry, 4 are monoatomic - leaving 4 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
6	ADP	F	500	-	24,29,29	1.22	2 (8%)	29,45,45	1.34	4 (13%)
4	ATP	D	501	5	28,33,33	1.45	4 (14%)	34,52,52	1.37	5 (14%)
4	ATP	C	601	5	28,33,33	1.28	1 (3%)	34,52,52	1.23	1 (2%)
4	ATP	A	601	5	28,33,33	1.37	4 (14%)	34,52,52	1.27	3 (8%)

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
6	ADP	F	500	-	-	3/12/32/32	0/3/3/3
4	ATP	D	501	5	-	3/18/38/38	0/3/3/3
4	ATP	C	601	5	-	0/18/38/38	0/3/3/3
4	ATP	A	601	5	-	1/18/38/38	0/3/3/3

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	C	601	ATP	O4'-C1'	3.94	1.46	1.40
4	A	601	ATP	O4'-C1'	3.84	1.45	1.40
4	D	501	ATP	O4'-C1'	3.26	1.45	1.40
6	F	500	ADP	O4'-C1'	2.99	1.44	1.40
4	D	501	ATP	PB-O3A	-2.94	1.56	1.59
4	D	501	ATP	PB-O3B	-2.88	1.56	1.59
4	D	501	ATP	PA-O3A	-2.77	1.56	1.59
6	F	500	ADP	PA-O3A	-2.60	1.56	1.59
4	A	601	ATP	PB-O3A	-2.52	1.56	1.59
4	A	601	ATP	PA-O3A	-2.48	1.56	1.59
4	A	601	ATP	PG-O3G	-2.05	1.47	1.54

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	D	501	ATP	C4-C5-N7	4.50	114.10	109.34
6	F	500	ADP	C4-C5-N7	4.30	113.88	109.34
4	A	601	ATP	C4-C5-N7	4.27	113.85	109.34
4	C	601	ATP	C4-C5-N7	4.09	113.66	109.34
4	D	501	ATP	O2A-PA-O3A	2.98	115.31	107.27
4	D	501	ATP	O3G-PG-O3B	2.65	113.52	104.64
6	F	500	ADP	O2B-PB-O3A	2.56	113.23	104.64
4	A	601	ATP	O2A-PA-O3A	2.27	113.41	107.27
4	D	501	ATP	O3G-PG-O1G	-2.24	102.09	110.83
6	F	500	ADP	N6-C6-N1	-2.04	113.97	118.33
4	D	501	ATP	O2B-PB-O3A	2.04	112.78	107.27
4	A	601	ATP	O3G-PG-O3B	2.03	111.43	104.64
6	F	500	ADP	O2A-PA-O3A	2.01	112.70	107.27

There are no chirality outliers.

All (7) torsion outliers are listed below:

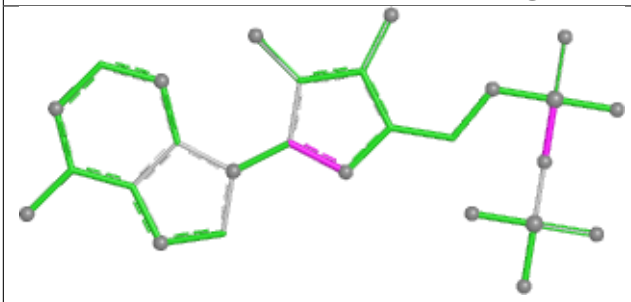
Mol	Chain	Res	Type	Atoms
6	F	500	ADP	PA-O3A-PB-O2B
6	F	500	ADP	PA-O3A-PB-O3B
4	D	501	ATP	O4'-C4'-C5'-O5'
4	D	501	ATP	PG-O3B-PB-O2B
4	A	601	ATP	O4'-C4'-C5'-O5'
6	F	500	ADP	PA-O3A-PB-O1B
4	D	501	ATP	PG-O3B-PB-O1B

There are no ring outliers.

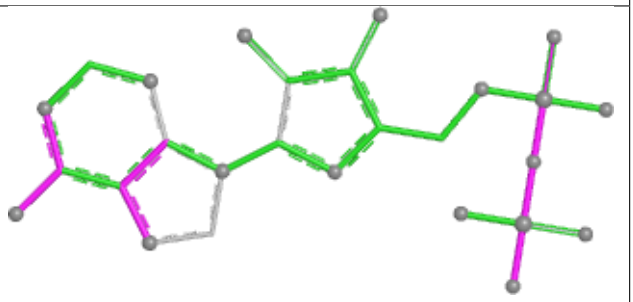
No monomer is involved in short contacts.

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 then 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.

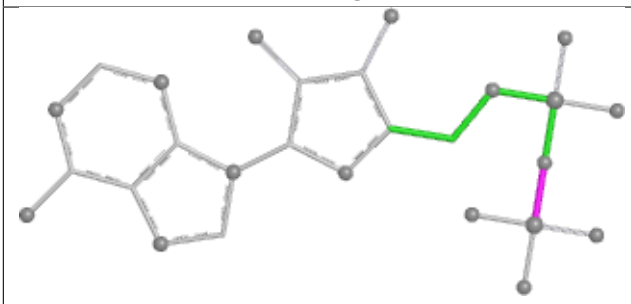
Ligand ADP F 500



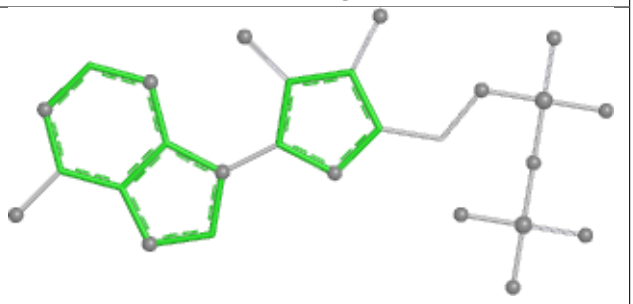
Bond lengths



Bond angles

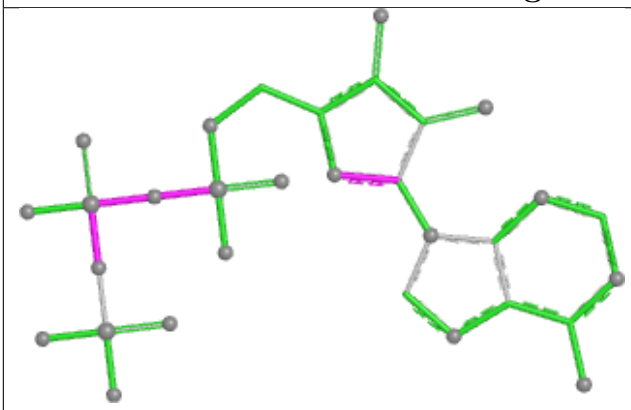


Torsions

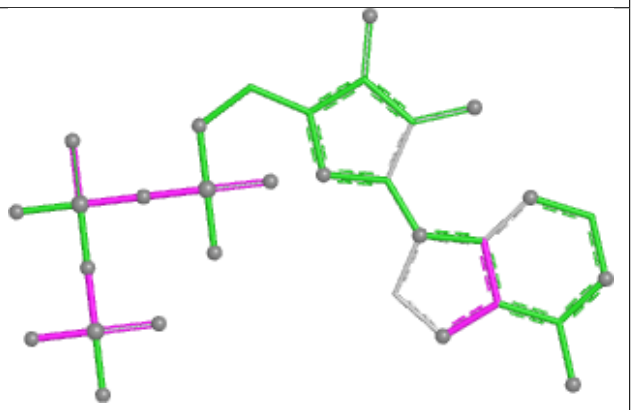


Rings

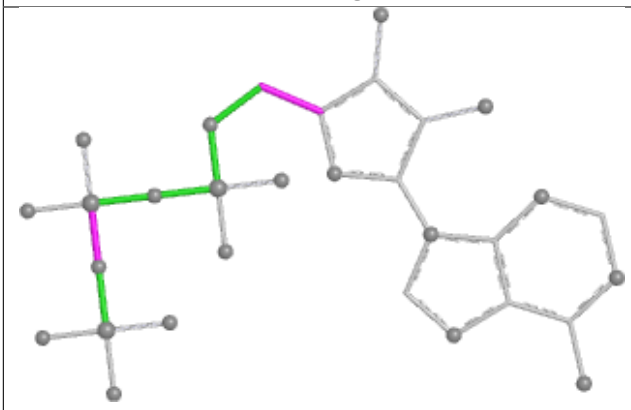
Ligand ATP D 501



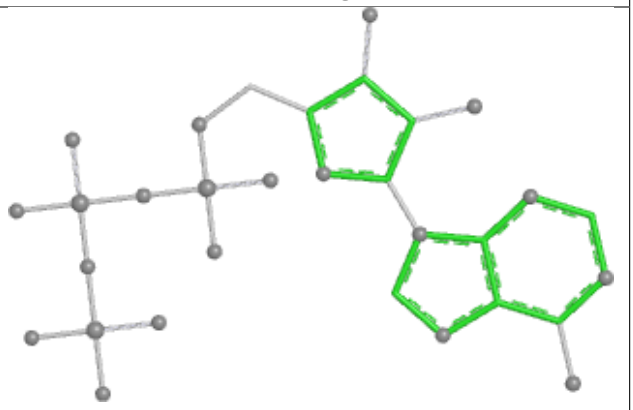
Bond lengths



Bond angles

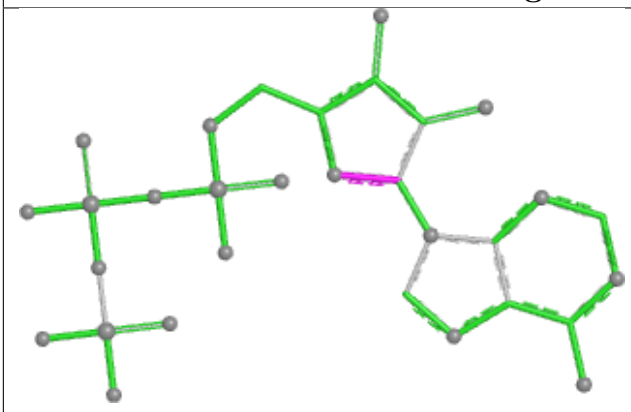


Torsions

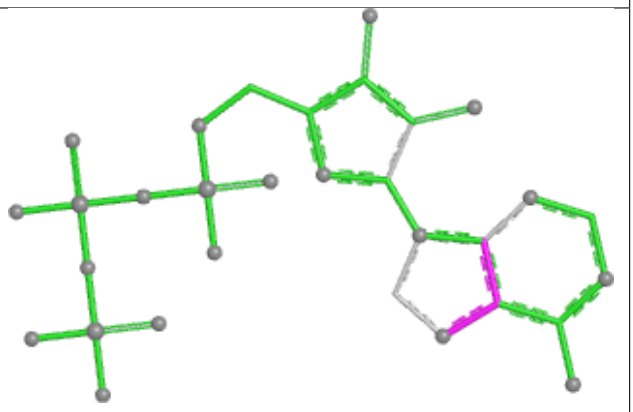


Rings

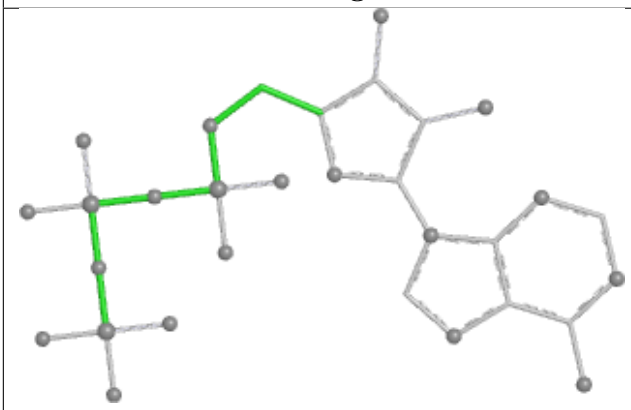
Ligand ATP C 601



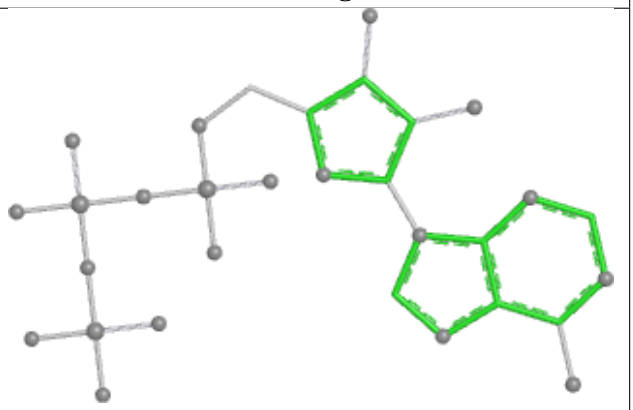
Bond lengths



Bond angles

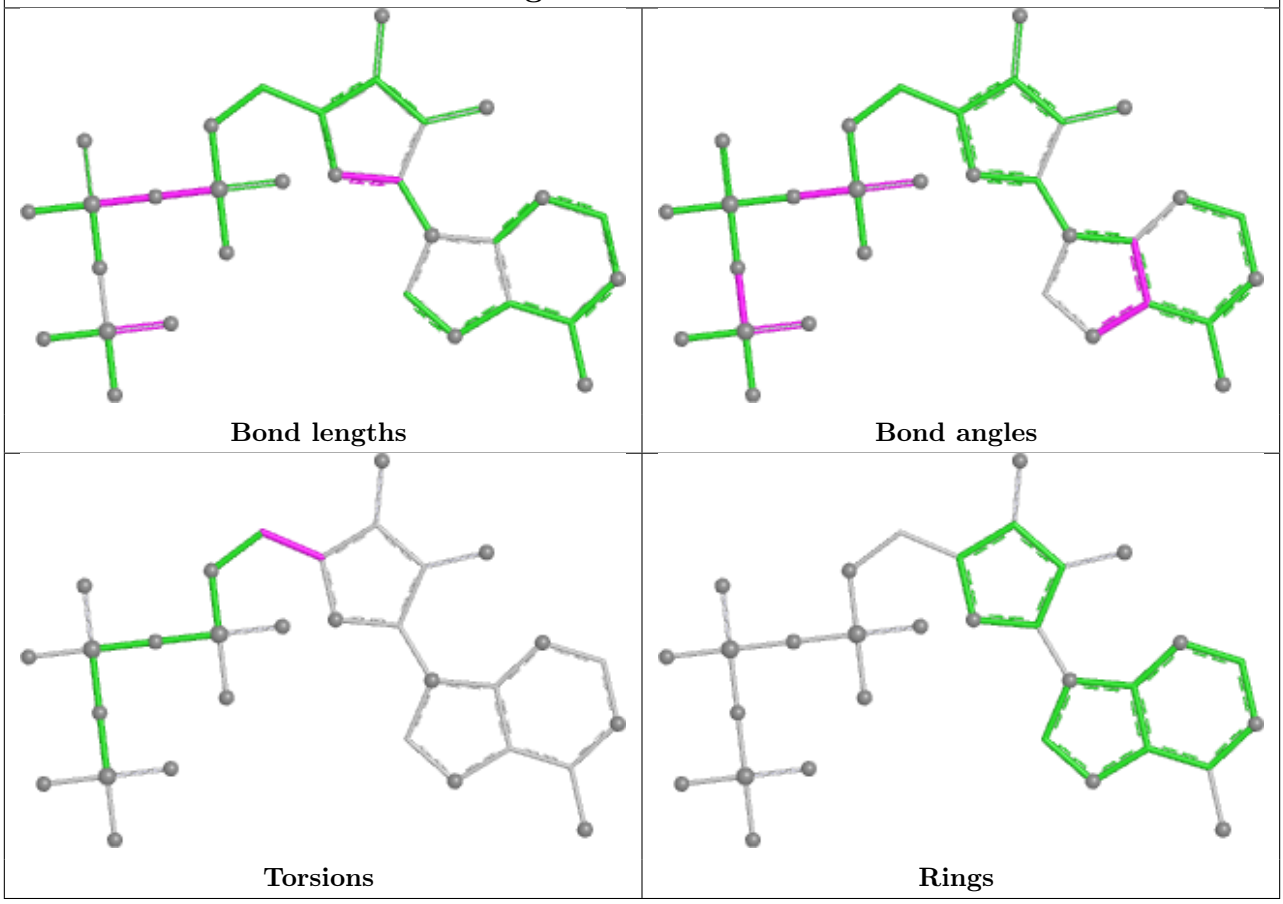


Torsions



Rings

Ligand ATP A 601



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.

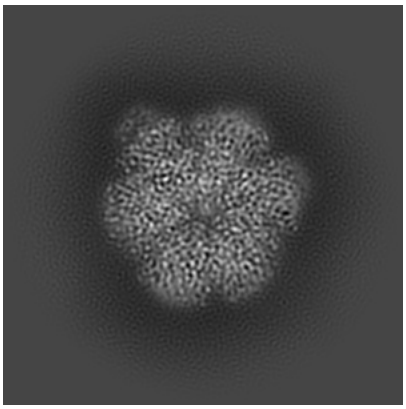
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-49840. These allow visual inspection of the internal detail of the map and identification of artifacts.

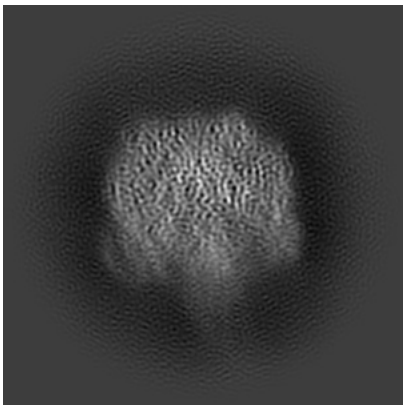
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections

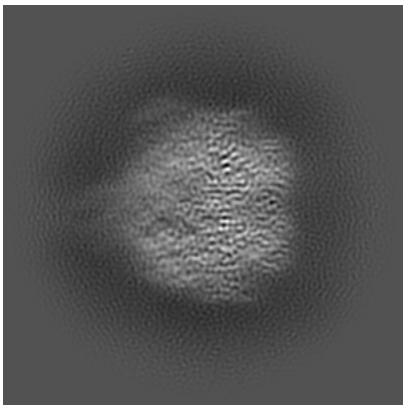
6.1.1 Primary map



X

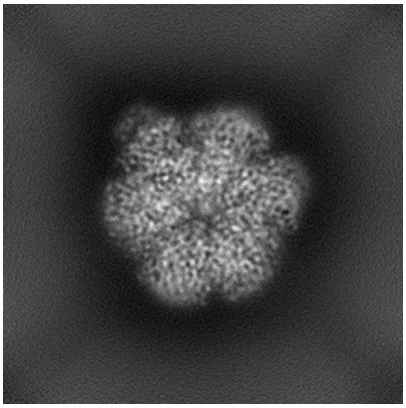


Y

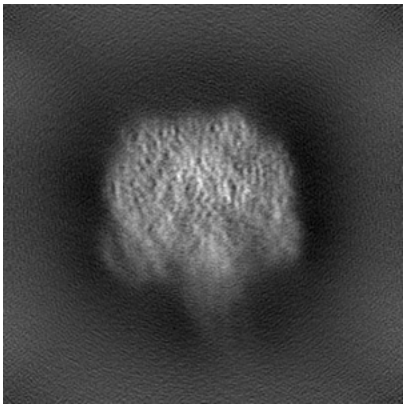


Z

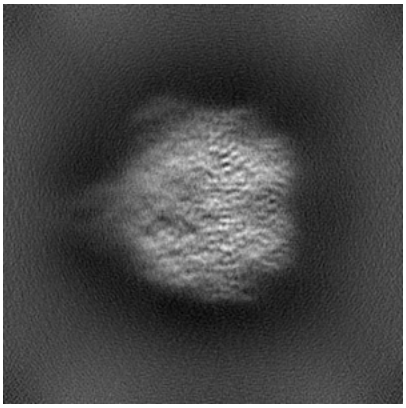
6.1.2 Raw map



X



Y

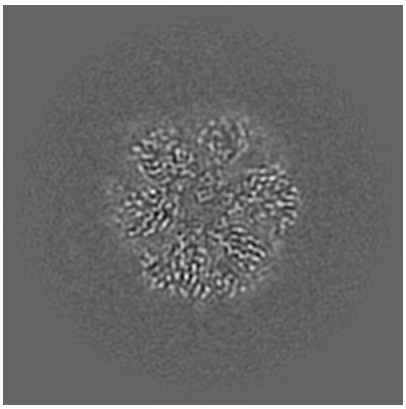


Z

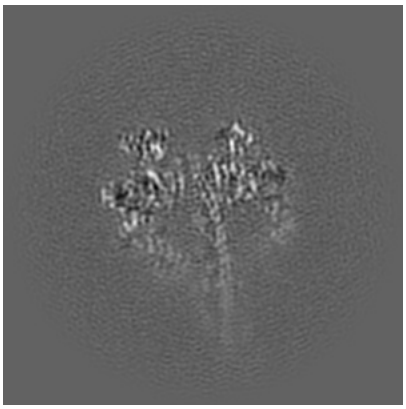
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

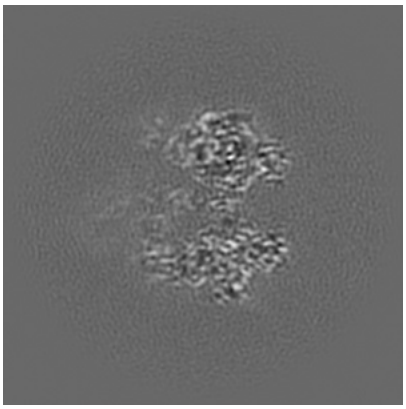
6.2.1 Primary map



X Index: 128

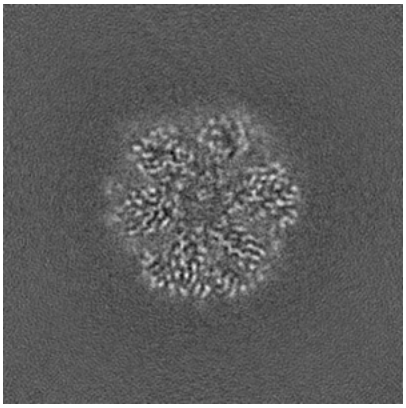


Y Index: 128

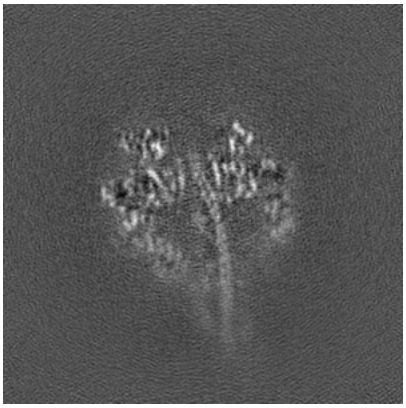


Z Index: 128

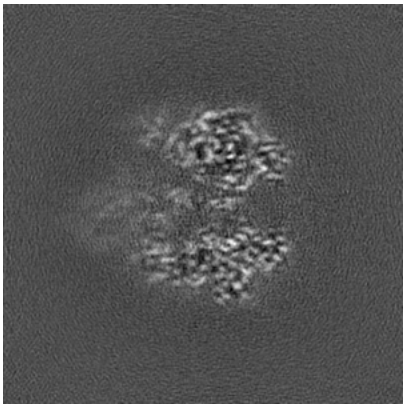
6.2.2 Raw map



X Index: 128



Y Index: 128

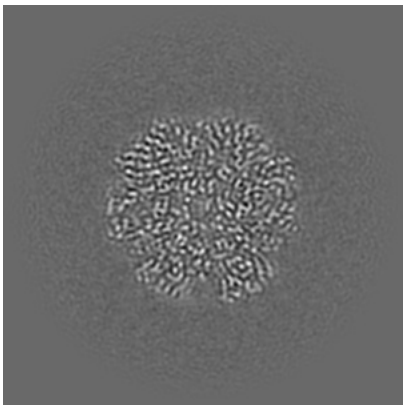


Z Index: 128

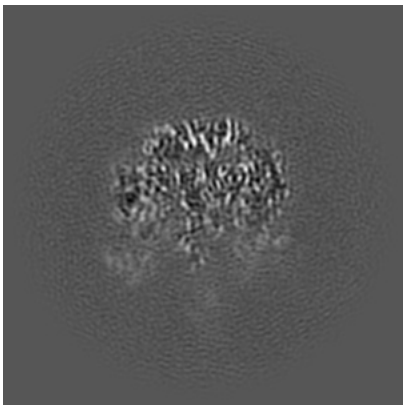
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

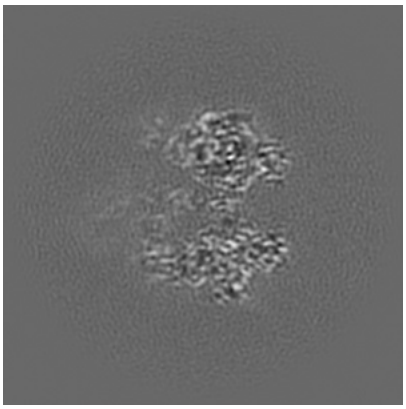
6.3.1 Primary map



X Index: 143

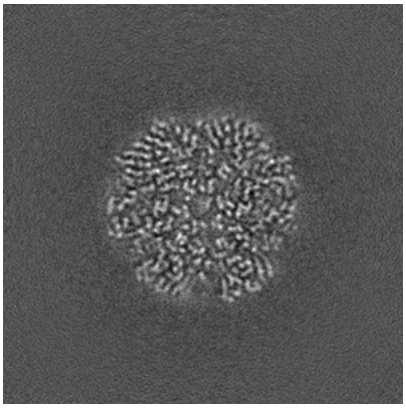


Y Index: 103

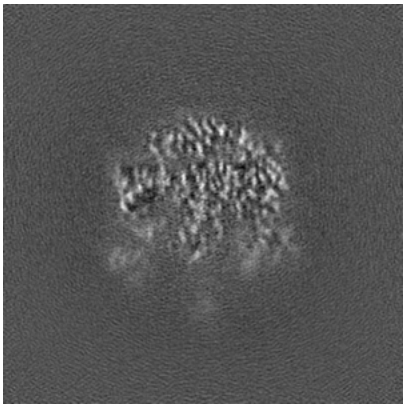


Z Index: 128

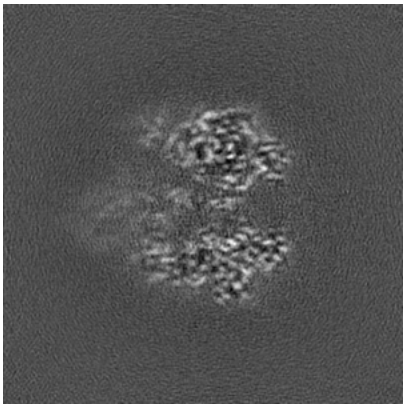
6.3.2 Raw map



X Index: 143



Y Index: 100

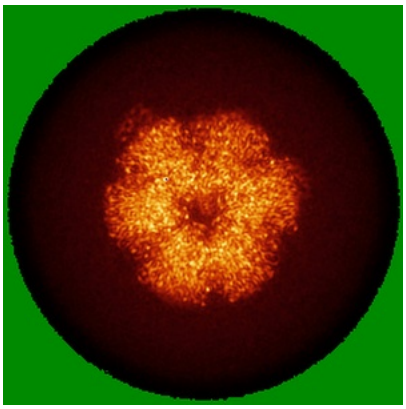


Z Index: 128

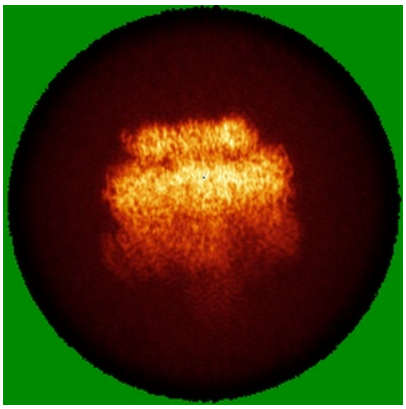
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) (i)

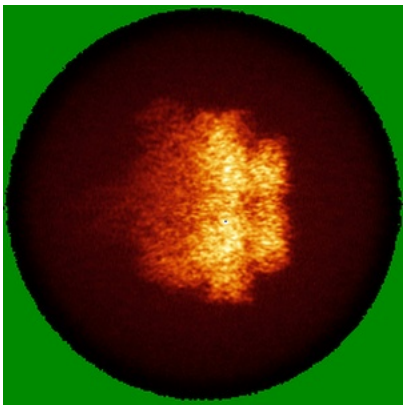
6.4.1 Primary map



X

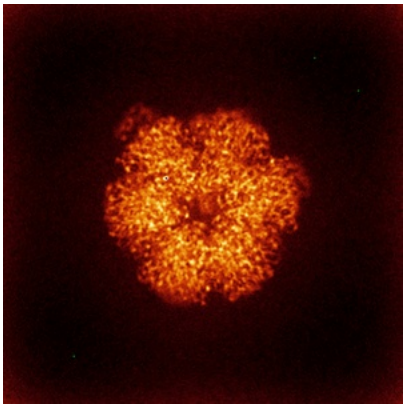


Y

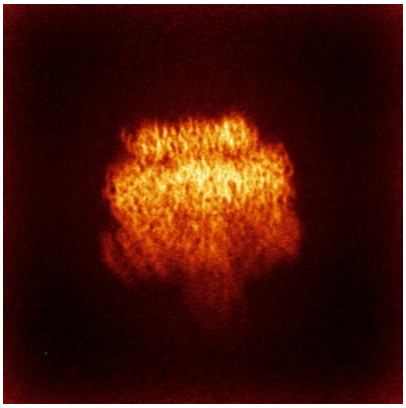


Z

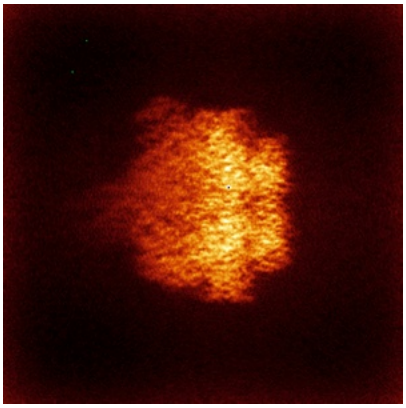
6.4.2 Raw map



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 0.15. 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.

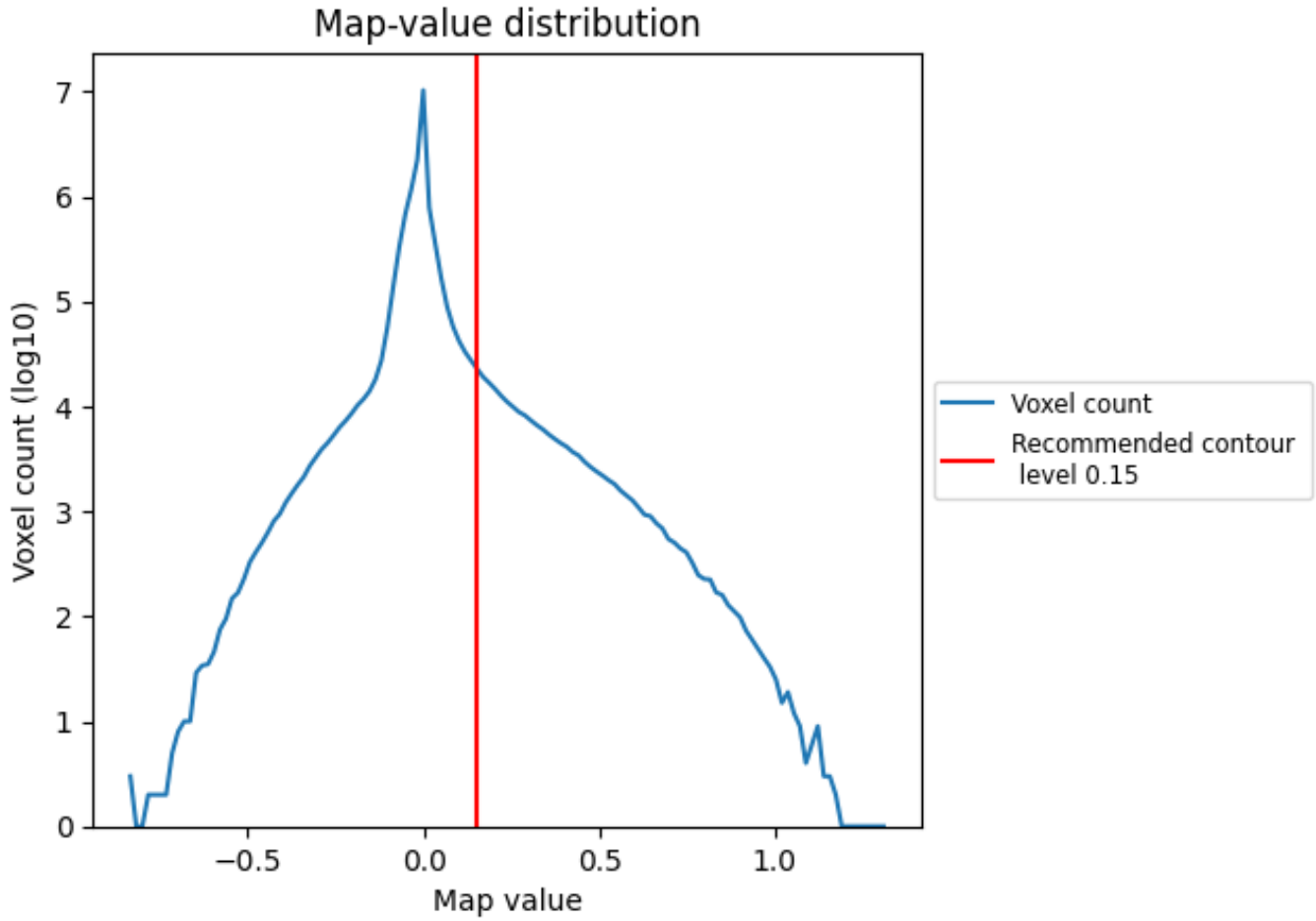
6.6 Mask visualisation (i)

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

7 Map analysis

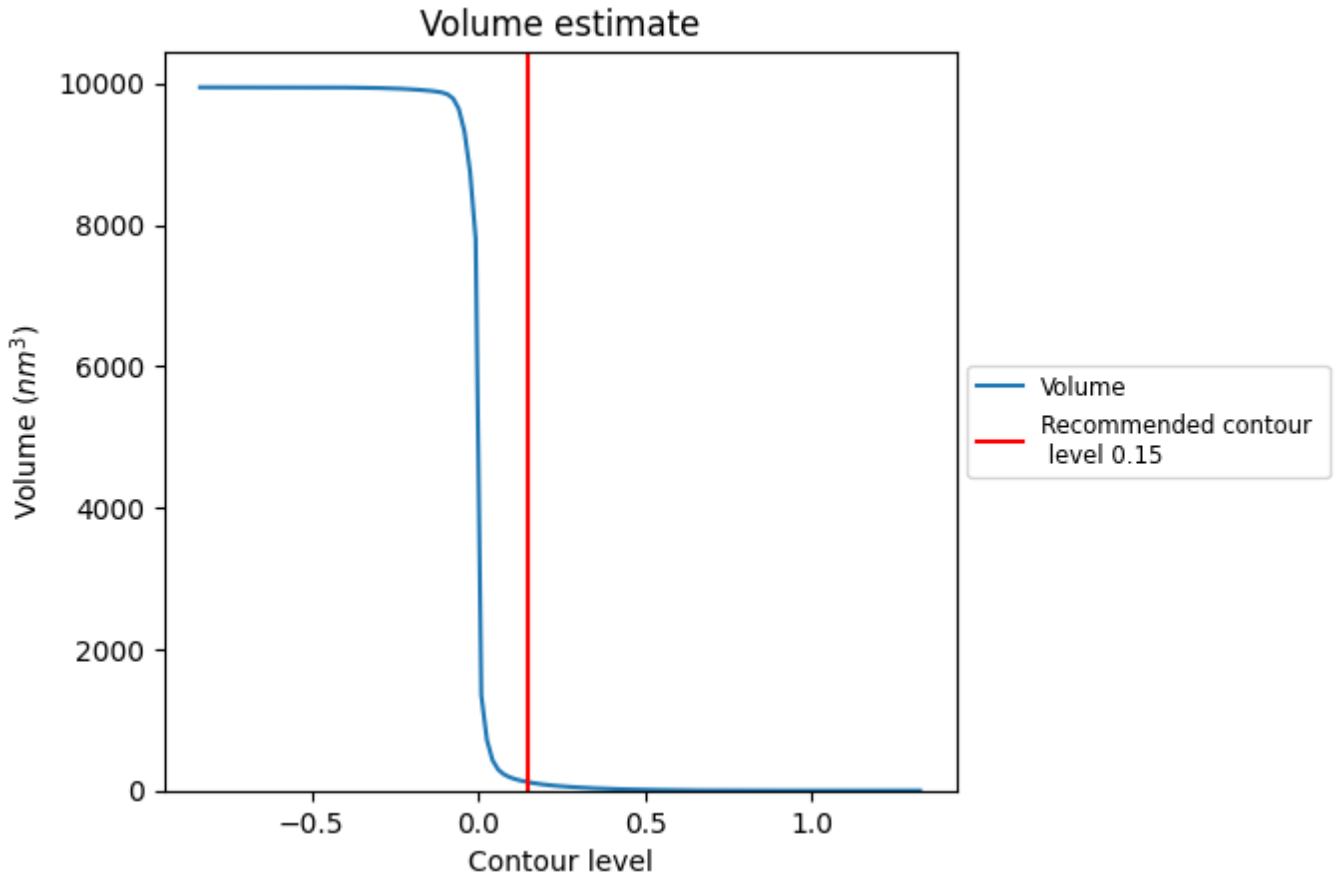
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution



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.

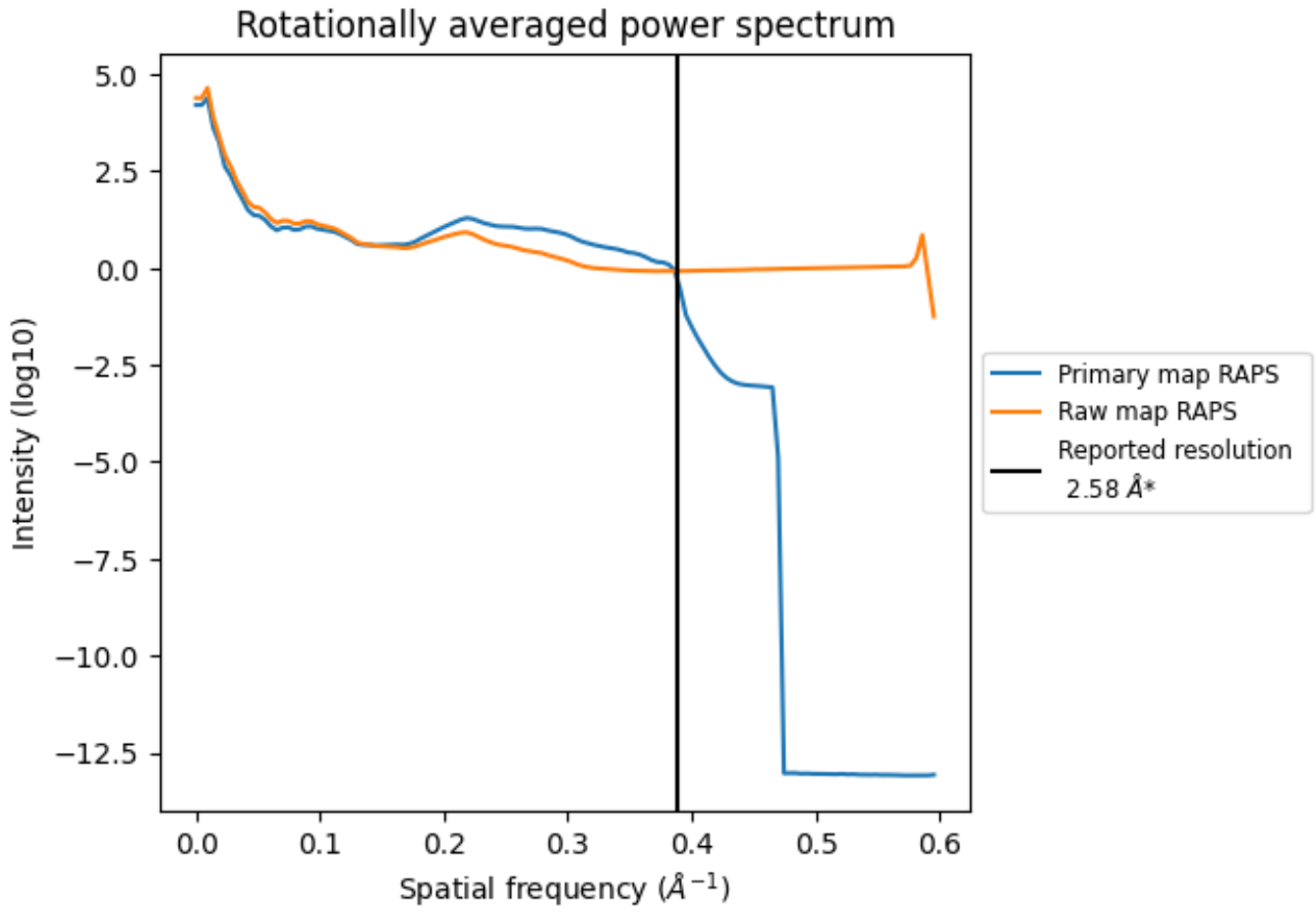
7.2 Volume estimate



The volume at the recommended contour level is 119 nm^3; this corresponds to an approximate mass of 107 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)

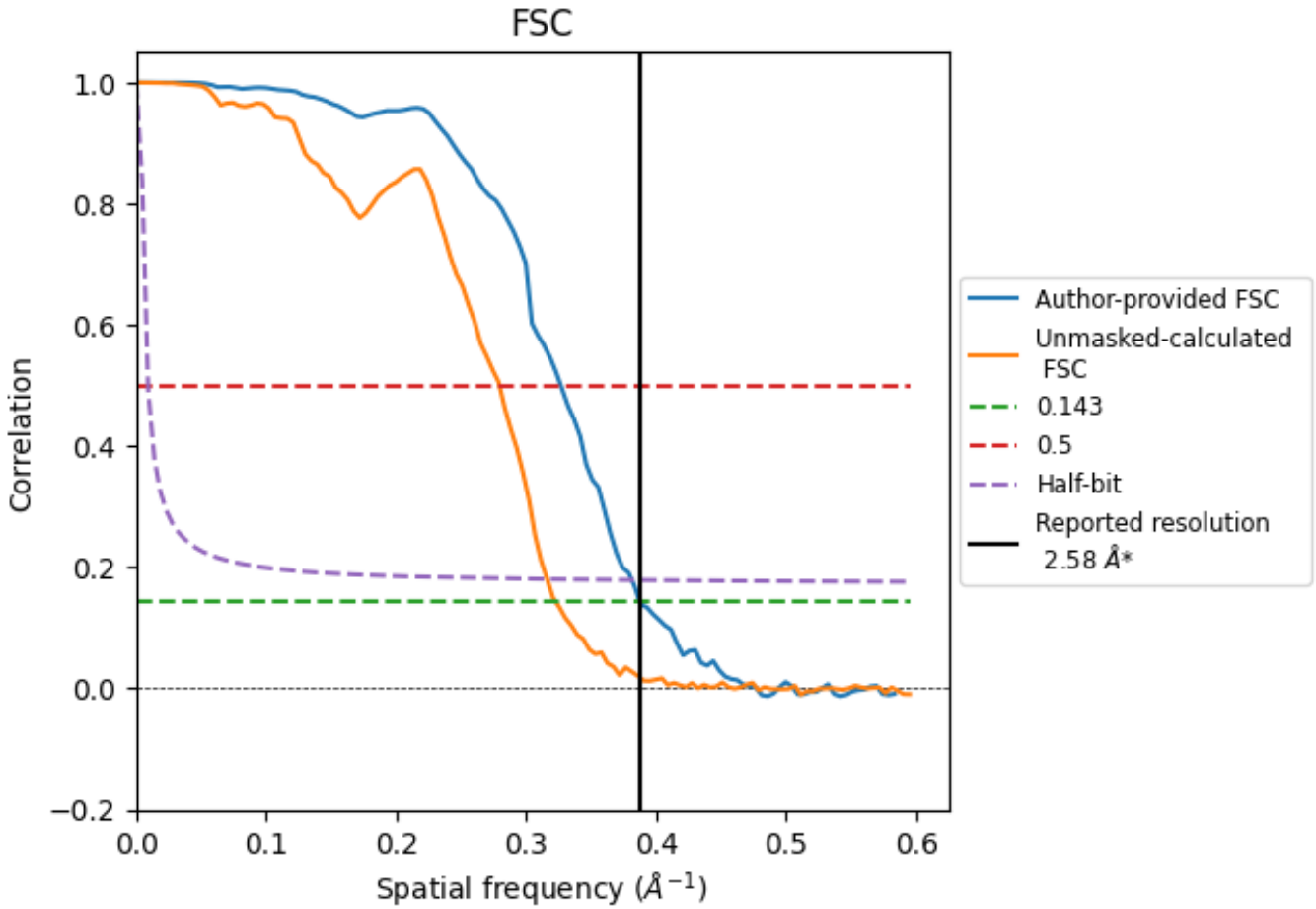


*Reported resolution corresponds to spatial frequency of 0.388 $Å^{-1}$

8 Fourier-Shell correlation

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



*Reported resolution corresponds to spatial frequency of 0.388 Å^{-1}

8.2 Resolution estimates (i)

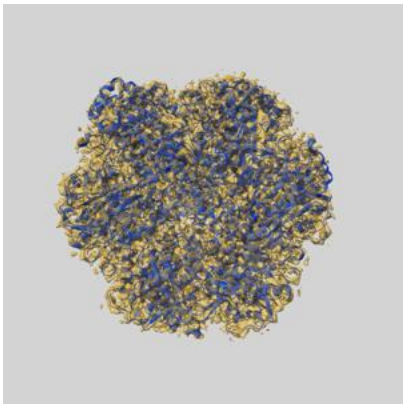
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.58	-	-
Author-provided FSC curve	2.58	3.06	2.62
Unmasked-calculated*	3.10	3.58	3.16

*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 3.10 differs from the reported value 2.58 by more than 10 %

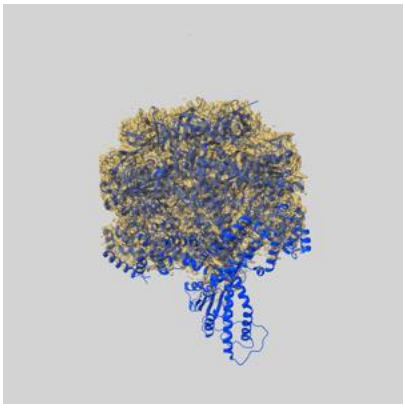
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-49840 and PDB model 9NVM. Per-residue inclusion information can be found in section 3 on page 7.

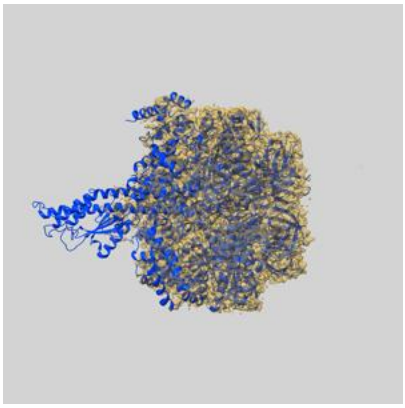
9.1 Map-model overlay



X



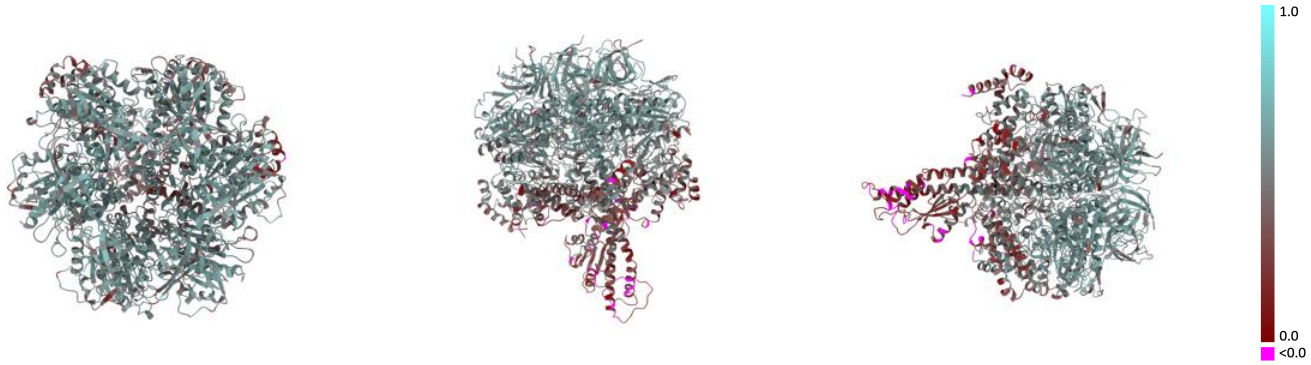
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.15 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.

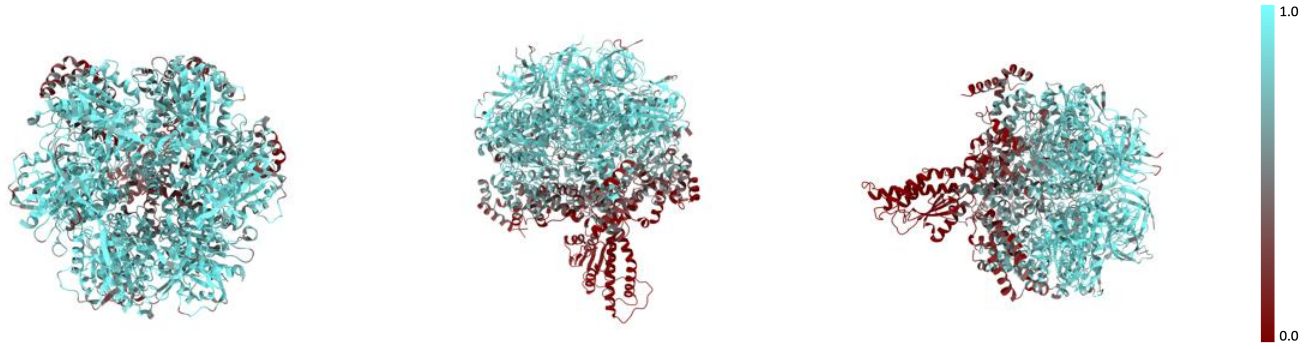
9.2 Q-score mapped to coordinate model



X Y Z

The images above show the model with each residue coloured according 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.

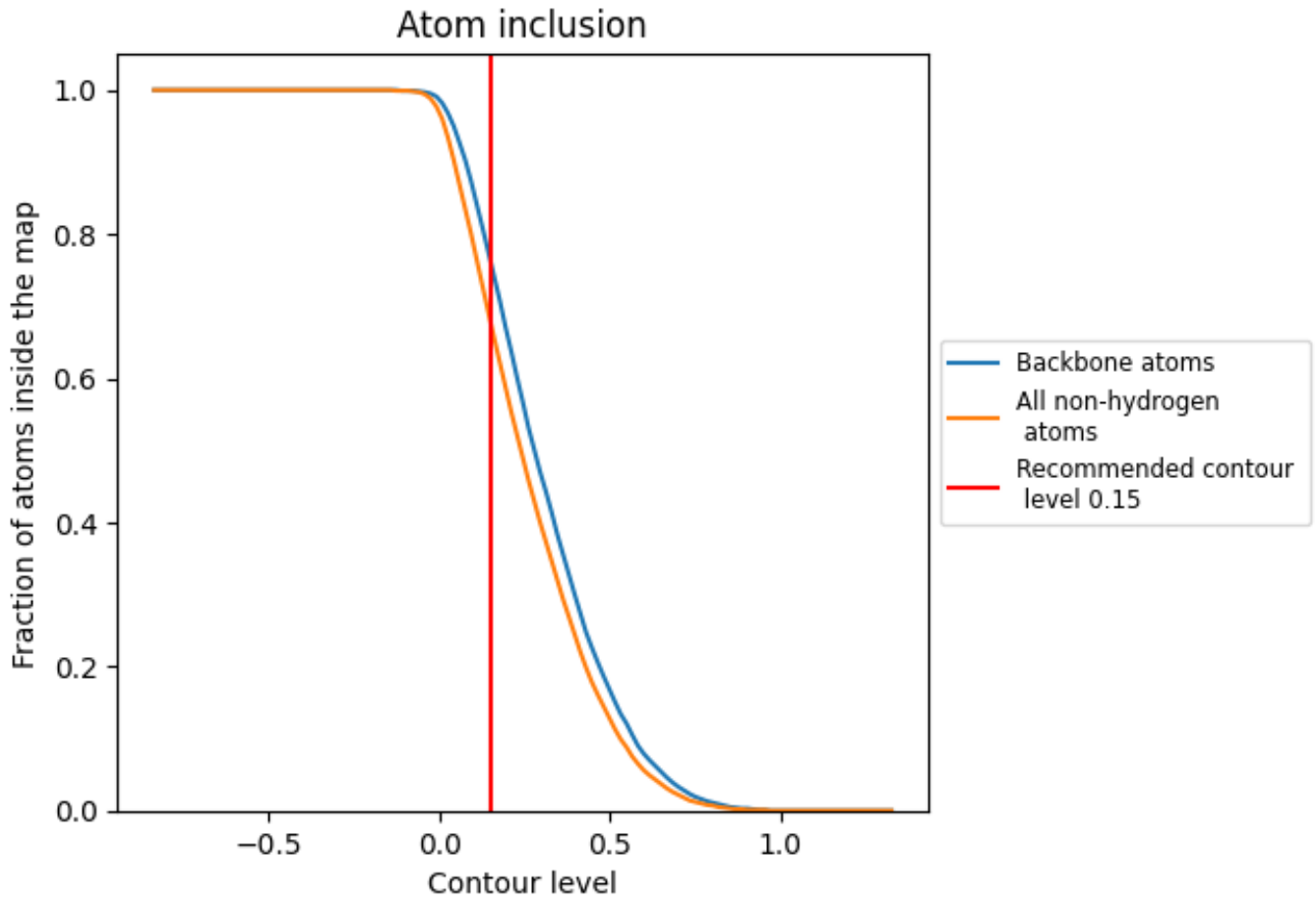
9.3 Atom inclusion mapped to coordinate model



X Y Z

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 (0.15).

9.4 Atom inclusion (i)



At the recommended contour level, 76% of all backbone atoms, 68% 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 (0.15) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6800	0.4850
A	0.7230	0.5030
B	0.7140	0.5020
C	0.7320	0.5110
D	0.7280	0.4920
E	0.6820	0.4940
F	0.7910	0.5330
G	0.1940	0.2730