Full wwPDB EM Validation Report

May 13, 2025 – 04:36 PM EDT

PDB ID	:	8FC9 / pdb_00008fc9
EMDB ID	:	EMD-28977
Title	:	Cryo-EM structure of the human TRPV4 - RhoA, apo condition
Authors	:	Kwon, D.H.; Lee, S.-Y.; Zhang, F.
Deposited on	:	2022-12-01
Resolution	:	3.75 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 (i) 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 (1)) were used in the production of this report:

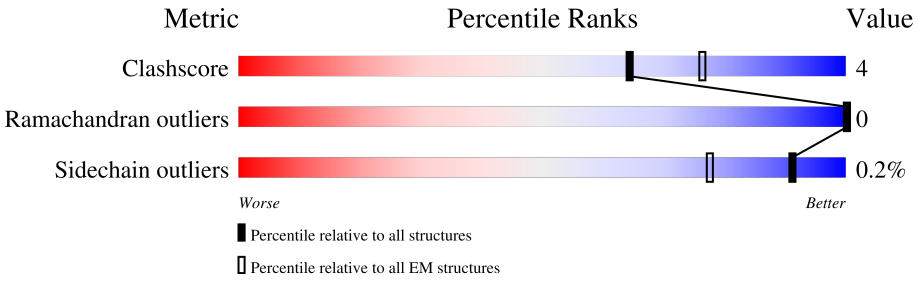
EMDB validation analysis	:	0.0.1.dev118
Mogul	:	2022.3.0, CSD as543be (2022)
MolProbity	:	4-5-2 with Phenix2.0rc1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

1 Overall quality at a glance

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

The reported resolution of this entry is 3.75 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)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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	901	5% 59% 6% 35%
1	B	901	5% 59% 6% 35%
1	C	901	5% 59% 6% 35%
1	D	901	5% 59% 6% 35%
2	E	193	80% 93% 6% ·
2	F	193	80% 93% 6% ·
2	G	193	82% 92% 7% ·
2	H	193	78% 91% 7% ·

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 41172 atoms, of which 19360 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 Transient receptor potential cation channel subfamily V member 4.

Mol	Chain	Residues	Atoms						AltConf	Trace
1	A	583	Total	C	H	N	O	S	0	0
			7676	2608	3595	720	736	17		
1	B	583	Total	C	H	N	O	S	0	0
			7676	2608	3595	720	736	17		
1	C	583	Total	C	H	N	O	S	0	0
			7676	2608	3595	720	736	17		
1	D	583	Total	C	H	N	O	S	0	0
			7676	2608	3595	720	736	17		

There are 120 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	872	GLU	-	expression tag	UNP Q9HBA0
A	873	ASN	-	expression tag	UNP Q9HBA0
A	874	SER	-	expression tag	UNP Q9HBA0
A	875	LEU	-	expression tag	UNP Q9HBA0
A	876	GLU	-	expression tag	UNP Q9HBA0
A	877	VAL	-	expression tag	UNP Q9HBA0
A	878	LEU	-	expression tag	UNP Q9HBA0
A	879	PHE	-	expression tag	UNP Q9HBA0
A	880	GLN	-	expression tag	UNP Q9HBA0
A	881	GLY	-	expression tag	UNP Q9HBA0
A	882	PRO	-	expression tag	UNP Q9HBA0
A	883	ASP	-	expression tag	UNP Q9HBA0
A	884	TYR	-	expression tag	UNP Q9HBA0
A	885	LYS	-	expression tag	UNP Q9HBA0
A	886	ASP	-	expression tag	UNP Q9HBA0
A	887	ASP	-	expression tag	UNP Q9HBA0
A	888	ASP	-	expression tag	UNP Q9HBA0
A	889	ASP	-	expression tag	UNP Q9HBA0
A	890	LYS	-	expression tag	UNP Q9HBA0
A	891	ALA	-	expression tag	UNP Q9HBA0
A	892	HIS	-	expression tag	UNP Q9HBA0

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Chain	Residue	Modelled	Actual	Comment	Reference
A	893	HIS	-	expression tag	UNP Q9HBA0
A	894	HIS	-	expression tag	UNP Q9HBA0
A	895	HIS	-	expression tag	UNP Q9HBA0
A	896	HIS	-	expression tag	UNP Q9HBA0
A	897	HIS	-	expression tag	UNP Q9HBA0
A	898	HIS	-	expression tag	UNP Q9HBA0
A	899	HIS	-	expression tag	UNP Q9HBA0
A	900	HIS	-	expression tag	UNP Q9HBA0
A	901	HIS	-	expression tag	UNP Q9HBA0
B	872	GLU	-	expression tag	UNP Q9HBA0
B	873	ASN	-	expression tag	UNP Q9HBA0
B	874	SER	-	expression tag	UNP Q9HBA0
B	875	LEU	-	expression tag	UNP Q9HBA0
B	876	GLU	-	expression tag	UNP Q9HBA0
B	877	VAL	-	expression tag	UNP Q9HBA0
B	878	LEU	-	expression tag	UNP Q9HBA0
B	879	PHE	-	expression tag	UNP Q9HBA0
B	880	GLN	-	expression tag	UNP Q9HBA0
B	881	GLY	-	expression tag	UNP Q9HBA0
B	882	PRO	-	expression tag	UNP Q9HBA0
B	883	ASP	-	expression tag	UNP Q9HBA0
B	884	TYR	-	expression tag	UNP Q9HBA0
B	885	LYS	-	expression tag	UNP Q9HBA0
B	886	ASP	-	expression tag	UNP Q9HBA0
B	887	ASP	-	expression tag	UNP Q9HBA0
B	888	ASP	-	expression tag	UNP Q9HBA0
B	889	ASP	-	expression tag	UNP Q9HBA0
B	890	LYS	-	expression tag	UNP Q9HBA0
B	891	ALA	-	expression tag	UNP Q9HBA0
B	892	HIS	-	expression tag	UNP Q9HBA0
B	893	HIS	-	expression tag	UNP Q9HBA0
B	894	HIS	-	expression tag	UNP Q9HBA0
B	895	HIS	-	expression tag	UNP Q9HBA0
B	896	HIS	-	expression tag	UNP Q9HBA0
B	897	HIS	-	expression tag	UNP Q9HBA0
B	898	HIS	-	expression tag	UNP Q9HBA0
B	899	HIS	-	expression tag	UNP Q9HBA0
B	900	HIS	-	expression tag	UNP Q9HBA0
B	901	HIS	-	expression tag	UNP Q9HBA0
C	872	GLU	-	expression tag	UNP Q9HBA0
C	873	ASN	-	expression tag	UNP Q9HBA0
C	874	SER	-	expression tag	UNP Q9HBA0

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Chain	Residue	Modelled	Actual	Comment	Reference
C	875	LEU	-	expression tag	UNP Q9HBA0
C	876	GLU	-	expression tag	UNP Q9HBA0
C	877	VAL	-	expression tag	UNP Q9HBA0
C	878	LEU	-	expression tag	UNP Q9HBA0
C	879	PHE	-	expression tag	UNP Q9HBA0
C	880	GLN	-	expression tag	UNP Q9HBA0
C	881	GLY	-	expression tag	UNP Q9HBA0
C	882	PRO	-	expression tag	UNP Q9HBA0
C	883	ASP	-	expression tag	UNP Q9HBA0
C	884	TYR	-	expression tag	UNP Q9HBA0
C	885	LYS	-	expression tag	UNP Q9HBA0
C	886	ASP	-	expression tag	UNP Q9HBA0
C	887	ASP	-	expression tag	UNP Q9HBA0
C	888	ASP	-	expression tag	UNP Q9HBA0
C	889	ASP	-	expression tag	UNP Q9HBA0
C	890	LYS	-	expression tag	UNP Q9HBA0
C	891	ALA	-	expression tag	UNP Q9HBA0
C	892	HIS	-	expression tag	UNP Q9HBA0
C	893	HIS	-	expression tag	UNP Q9HBA0
C	894	HIS	-	expression tag	UNP Q9HBA0
C	895	HIS	-	expression tag	UNP Q9HBA0
C	896	HIS	-	expression tag	UNP Q9HBA0
C	897	HIS	-	expression tag	UNP Q9HBA0
C	898	HIS	-	expression tag	UNP Q9HBA0
C	899	HIS	-	expression tag	UNP Q9HBA0
C	900	HIS	-	expression tag	UNP Q9HBA0
C	901	HIS	-	expression tag	UNP Q9HBA0
D	872	GLU	-	expression tag	UNP Q9HBA0
D	873	ASN	-	expression tag	UNP Q9HBA0
D	874	SER	-	expression tag	UNP Q9HBA0
D	875	LEU	-	expression tag	UNP Q9HBA0
D	876	GLU	-	expression tag	UNP Q9HBA0
D	877	VAL	-	expression tag	UNP Q9HBA0
D	878	LEU	-	expression tag	UNP Q9HBA0
D	879	PHE	-	expression tag	UNP Q9HBA0
D	880	GLN	-	expression tag	UNP Q9HBA0
D	881	GLY	-	expression tag	UNP Q9HBA0
D	882	PRO	-	expression tag	UNP Q9HBA0
D	883	ASP	-	expression tag	UNP Q9HBA0
D	884	TYR	-	expression tag	UNP Q9HBA0
D	885	LYS	-	expression tag	UNP Q9HBA0
D	886	ASP	-	expression tag	UNP Q9HBA0

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Chain	Residue	Modelled	Actual	Comment	Reference
D	887	ASP	-	expression tag	UNP Q9HBA0
D	888	ASP	-	expression tag	UNP Q9HBA0
D	889	ASP	-	expression tag	UNP Q9HBA0
D	890	LYS	-	expression tag	UNP Q9HBA0
D	891	ALA	-	expression tag	UNP Q9HBA0
D	892	HIS	-	expression tag	UNP Q9HBA0
D	893	HIS	-	expression tag	UNP Q9HBA0
D	894	HIS	-	expression tag	UNP Q9HBA0
D	895	HIS	-	expression tag	UNP Q9HBA0
D	896	HIS	-	expression tag	UNP Q9HBA0
D	897	HIS	-	expression tag	UNP Q9HBA0
D	898	HIS	-	expression tag	UNP Q9HBA0
D	899	HIS	-	expression tag	UNP Q9HBA0
D	900	HIS	-	expression tag	UNP Q9HBA0
D	901	HIS	-	expression tag	UNP Q9HBA0

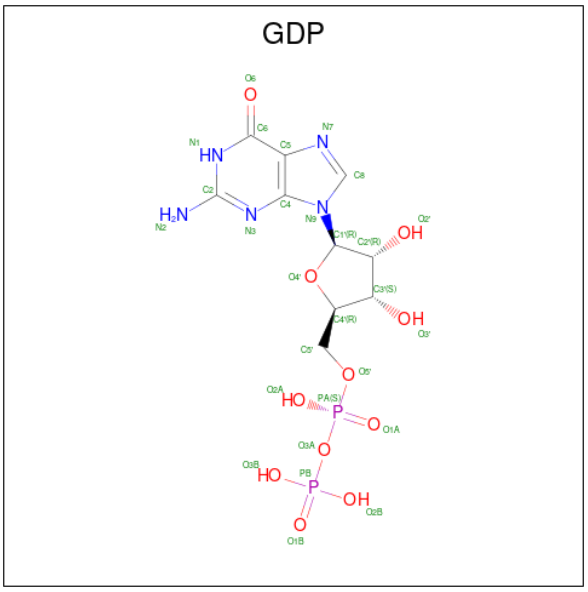
- Molecule 2 is a protein called Transforming protein RhoA.

Mol	Chain	Residues	Atoms						AltConf	Trace
2	E	190	Total	C	H	N	O	S	0	0
			2576	855	1233	234	245	9		
2	F	190	Total	C	H	N	O	S	0	0
			2576	855	1233	234	245	9		
2	G	190	Total	C	H	N	O	S	0	0
			2576	855	1233	234	245	9		
2	H	190	Total	C	H	N	O	S	0	0
			2576	855	1233	234	245	9		

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
3	E	1	Total	Mg	0
			1	1	
3	F	1	Total	Mg	0
			1	1	
3	G	1	Total	Mg	0
			1	1	
3	H	1	Total	Mg	0
			1	1	

- Molecule 4 is GUANOSINE-5'-DIPHOSPHATE (CCD ID: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$).



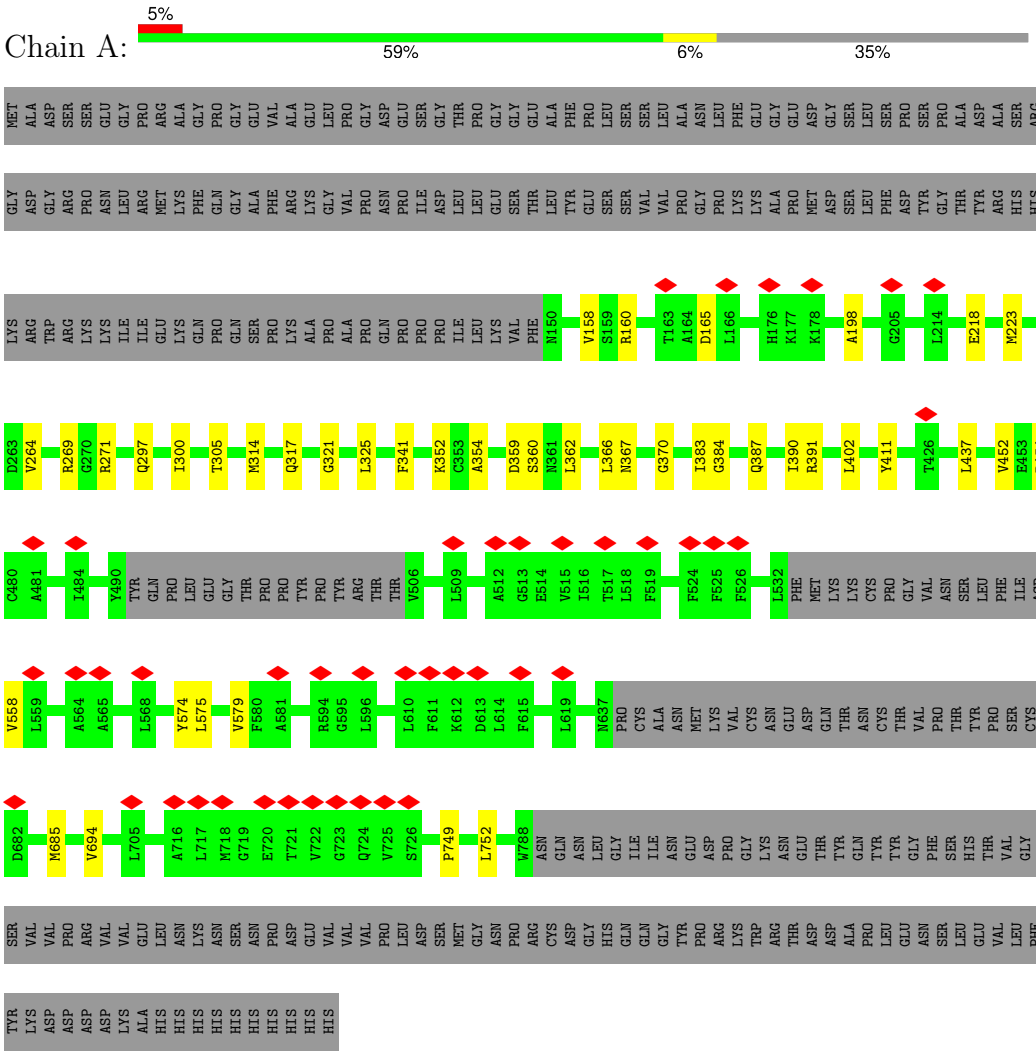
Mol	Chain	Residues	Atoms						AltConf
4	E	1	Total	C	H	N	O	P	0
			40	10	12	5	11	2	
4	F	1	Total	C	H	N	O	P	0
			40	10	12	5	11	2	
4	G	1	Total	C	H	N	O	P	0
			40	10	12	5	11	2	
4	H	1	Total	C	H	N	O	P	0
			40	10	12	5	11	2	

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.

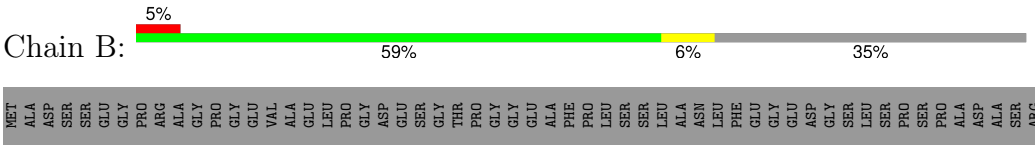
• Molecule 1: Transient receptor potential cation channel subfamily V member 4

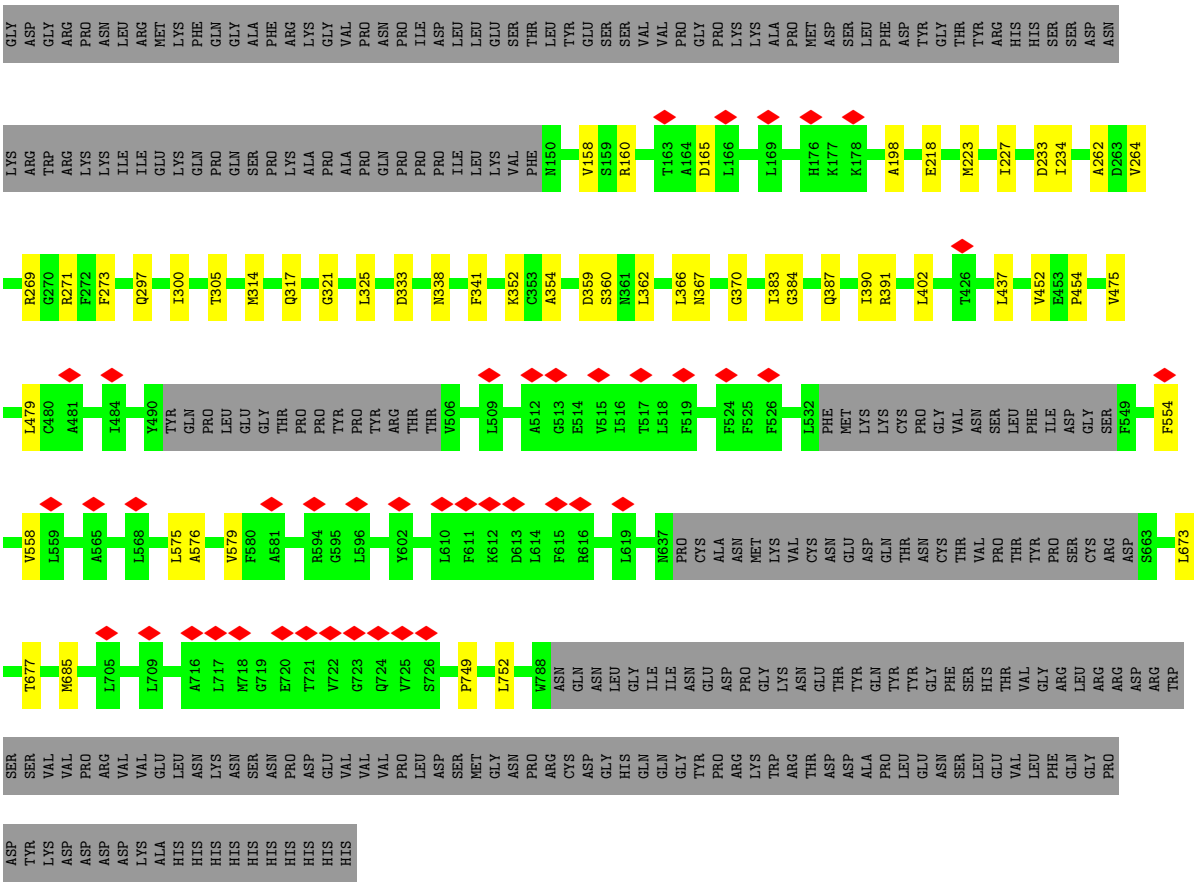
Chain A:



• Molecule 1: Transient receptor potential cation channel subfamily V member 4

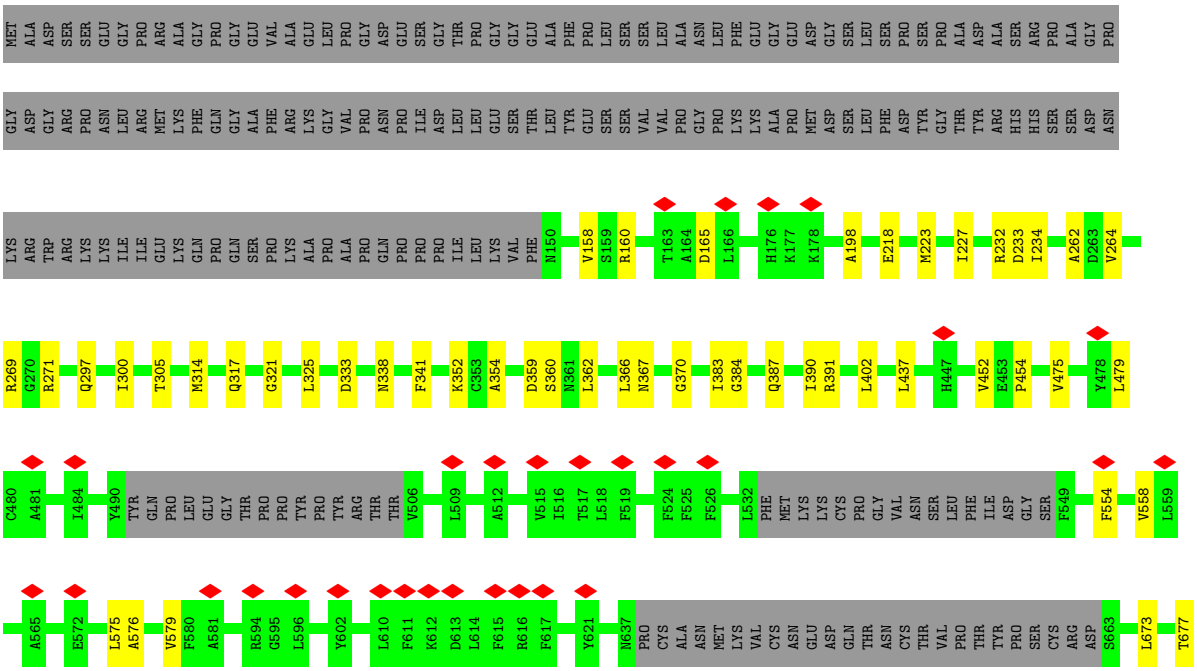
Chain B:

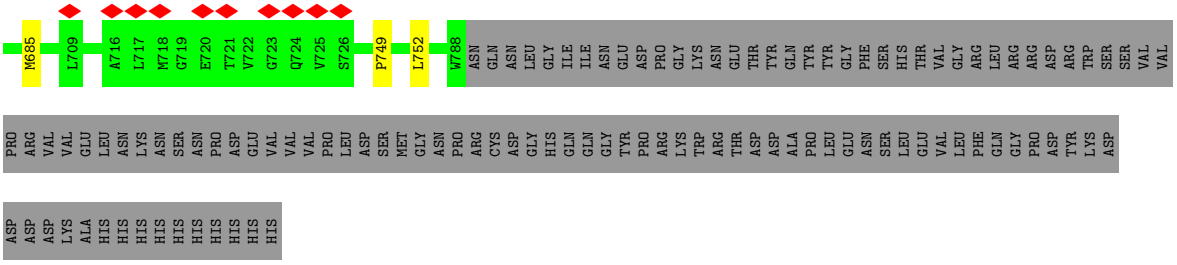




• Molecule 1: Transient receptor potential cation channel subfamily V member 4

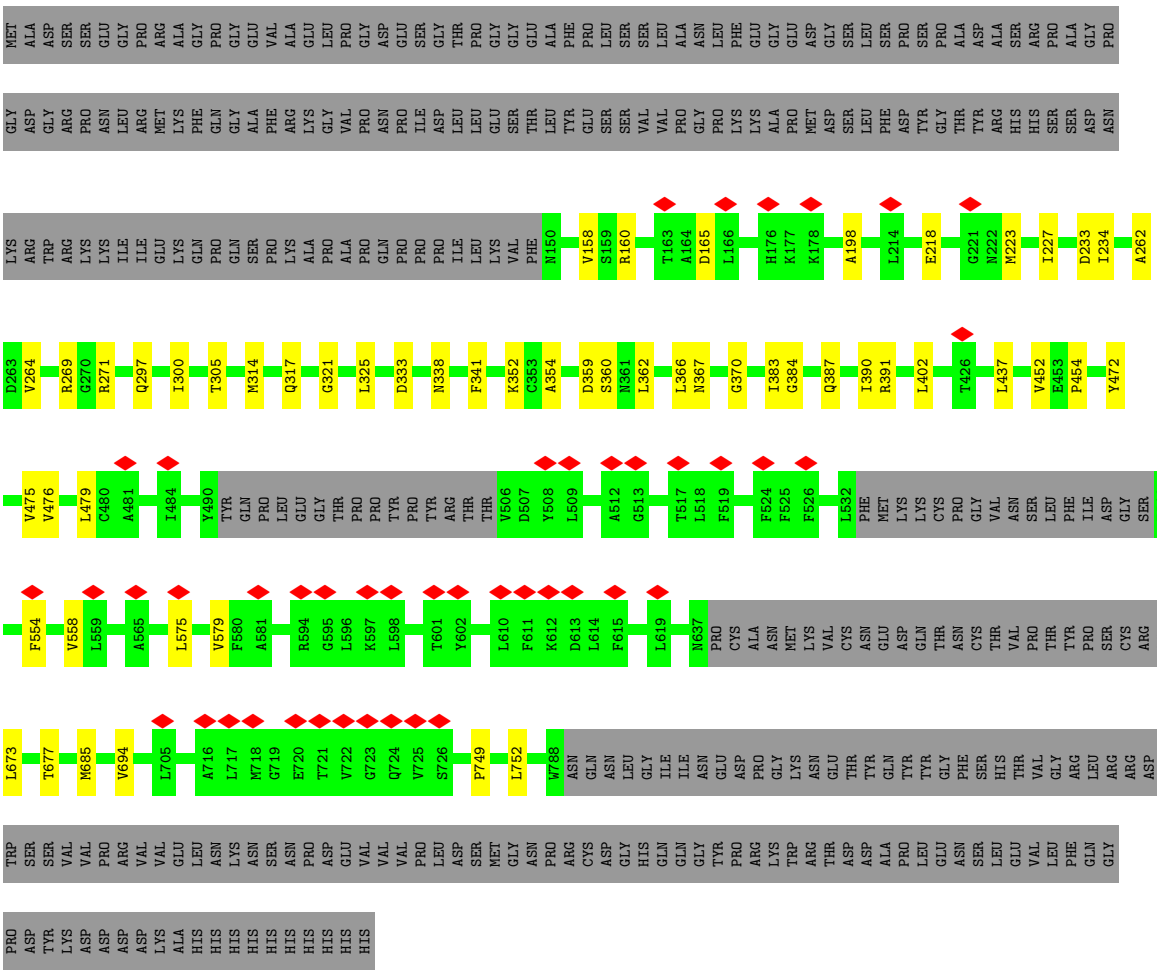
Chain C:





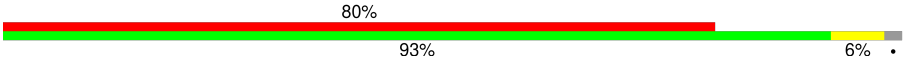
• Molecule 1: Transient receptor potential cation channel subfamily V member 4

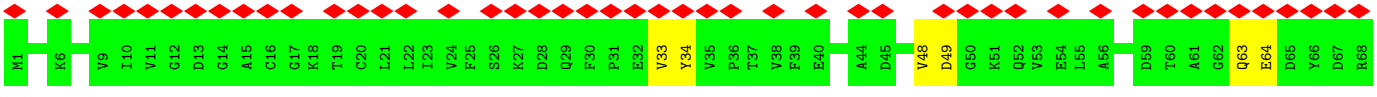
Chain D:

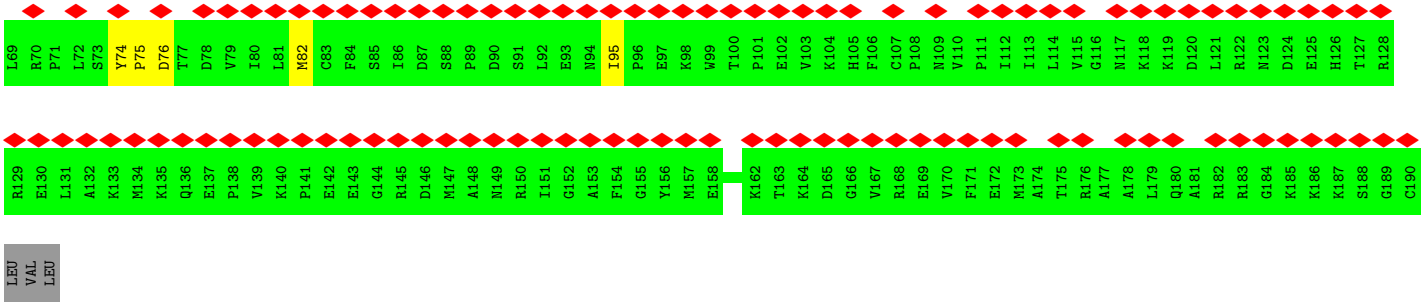


• Molecule 2: Transforming protein RhoA

Chain E:

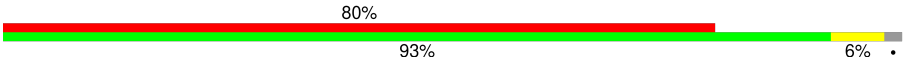


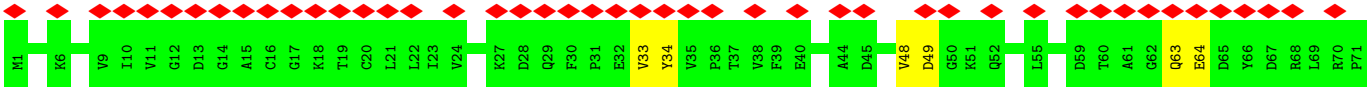


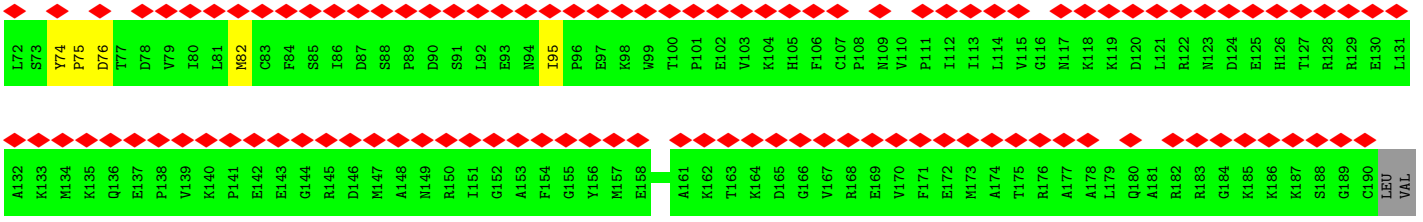


• Molecule 2: Transforming protein RhoA

Chain F:

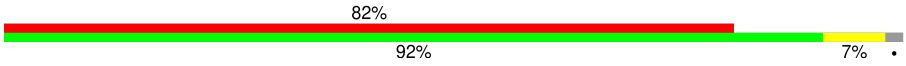


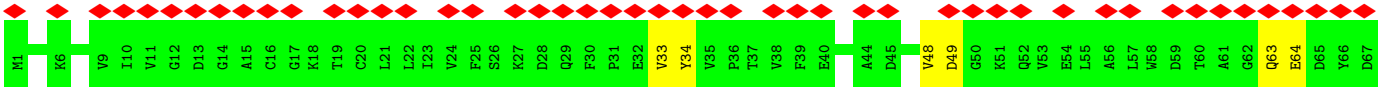


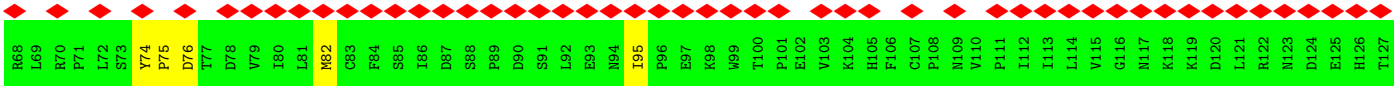


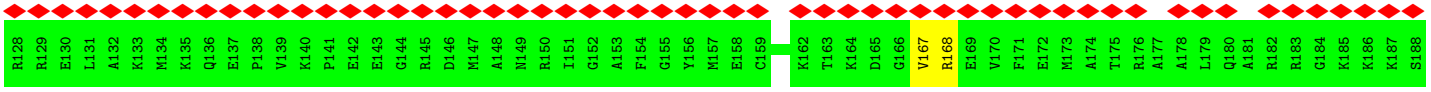
• Molecule 2: Transforming protein RhoA

Chain G:



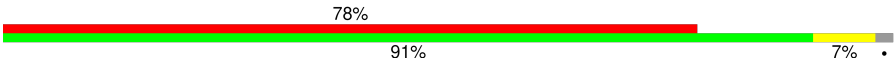


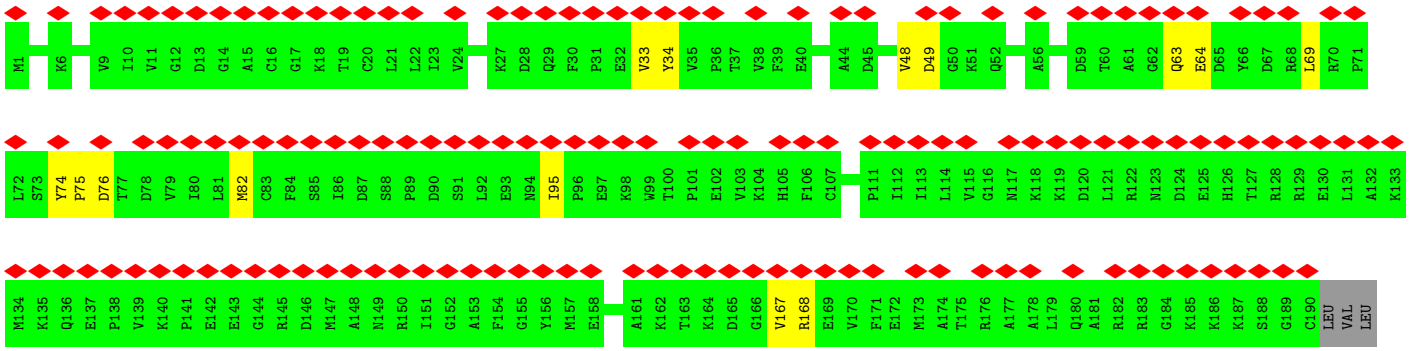




• Molecule 2: Transforming protein RhoA

Chain H:




M1 K6 V9 I10 V11 G12 D13 G14 A15 C16 G17 K18 T19 C20 L21 L22 I23 V24 K27 D28 Q29 F30 P31 E32 V33 Y34 V35 P36 T37 V38 F39 E40 A44 D45 V48 D49 G50 K51 Q52 A56 D59 T60 A61 G62 Q63 E64 D65 Y66 D67 R68 L69 R70 P71
L72 S73 Y74 P75 D76 T77 D78 V79 I80 L81 M82 C83 F84 S85 I86 D87 S88 P89 D90 S91 L92 E93 N94 T95 P96 E97 K98 W99 T100 P101 E102 V103 K104 H105 F106 C107 P111 I112 I113 L114 V115 G116 N117 K118 K119 D120 L121 R122 N123 D124 E125 H126 T127 R128 R129 E130 L131 A132 K133
M134 K135 Q136 E137 P138 V139 K140 P141 E142 E143 G144 R145 D146 M147 A148 N149 R150 I151 G152 A153 F154 G155 Y156 M157 E158 A161 K162 T163 K164 D165 G166 V167 R168 E169 V170 F171 E172 M173 A174 T175 R176 A177 A178 L179 Q180 A181 R182 R183 G184 K185 K186 K187 S188 G189 C190 LEU VAL LEU

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C4	Depositor
Number of particles used	172225	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	60	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	3000	Depositor
Magnification	81000	Depositor
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	3.356	Depositor
Minimum map value	-2.290	Depositor
Average map value	0.008	Depositor
Map value standard deviation	0.072	Depositor
Recommended contour level	0.209	Depositor
Map size (Å)	276.48, 276.48, 276.48	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.08, 1.08, 1.08	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, GDP

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	0.15	0/4158	0.32	0/5683
1	B	0.16	0/4158	0.32	0/5683
1	C	0.16	0/4158	0.32	0/5683
1	D	0.16	0/4158	0.32	0/5683
2	E	0.13	0/1370	0.31	0/1872
2	F	0.13	0/1370	0.31	0/1872
2	G	0.13	0/1370	0.31	0/1872
2	H	0.13	0/1370	0.31	0/1872
All	All	0.15	0/22112	0.32	0/30220

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4081	3595	3592	33	0
1	B	4081	3595	3592	33	0
1	C	4081	3595	3592	33	0
1	D	4081	3595	3592	33	0
2	E	1343	1233	1233	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	F	1343	1233	1233	8	0
2	G	1343	1233	1233	9	0
2	H	1343	1233	1233	10	0
3	E	1	0	0	0	0
3	F	1	0	0	0	0
3	G	1	0	0	0	0
3	H	1	0	0	0	0
4	E	28	12	12	0	0
4	F	28	12	12	0	0
4	G	28	12	12	0	0
4	H	28	12	12	0	0
All	All	21812	19360	19348	159	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 (159) 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:390:ILE:HG23	1:C:391:ARG:HG3	1.74	0.69
1:A:390:ILE:HG23	1:A:391:ARG:HG3	1.74	0.69
1:D:390:ILE:HG23	1:D:391:ARG:HG3	1.74	0.68
1:B:314:MET:HE1	1:B:352:LYS:HB3	1.76	0.68
1:D:314:MET:HE1	1:D:352:LYS:HB3	1.76	0.68
1:B:390:ILE:HG23	1:B:391:ARG:HG3	1.74	0.67
1:C:314:MET:HE1	1:C:352:LYS:HB3	1.76	0.66
1:A:314:MET:HE1	1:A:352:LYS:HB3	1.76	0.65
1:C:305:THR:HG21	1:C:314:MET:HE2	1.78	0.65
1:A:305:THR:HG21	1:A:314:MET:HE2	1.78	0.65
1:B:305:THR:HG21	1:B:314:MET:HE2	1.78	0.65
2:G:76:ASP:OD2	1:D:269:ARG:NE	2.29	0.64
1:D:305:THR:HG21	1:D:314:MET:HE2	1.78	0.64
2:H:76:ASP:OD2	1:C:269:ARG:NE	2.29	0.62
1:D:387:GLN:O	1:D:390:ILE:HG22	2.00	0.62
1:C:387:GLN:O	1:C:390:ILE:HG22	2.00	0.62
1:A:387:GLN:O	1:A:390:ILE:HG22	2.00	0.62
1:B:387:GLN:O	1:B:390:ILE:HG22	2.00	0.60
1:A:269:ARG:NE	2:E:76:ASP:OD2	2.29	0.58
2:F:76:ASP:OD2	1:B:269:ARG:NE	2.29	0.56
1:D:227:ILE:HG21	1:D:262:ALA:HB2	1.90	0.54
1:A:354:ALA:HB2	1:A:402:LEU:HD11	1.90	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:554:PHE:O	1:A:558:VAL:HG23	2.08	0.54
1:C:354:ALA:HB2	1:C:402:LEU:HD11	1.90	0.53
1:C:554:PHE:O	1:C:558:VAL:HG23	2.08	0.53
1:B:227:ILE:HG21	1:B:262:ALA:HB2	1.90	0.53
1:B:452:VAL:HG12	1:B:454:PRO:HD2	1.91	0.53
1:C:452:VAL:HG12	1:C:454:PRO:HD2	1.91	0.53
1:D:554:PHE:O	1:D:558:VAL:HG23	2.08	0.53
1:D:354:ALA:HB2	1:D:402:LEU:HD11	1.90	0.53
1:D:452:VAL:HG12	1:D:454:PRO:HD2	1.91	0.53
1:A:452:VAL:HG12	1:A:454:PRO:HD2	1.91	0.53
1:A:227:ILE:HG21	1:A:262:ALA:HB2	1.90	0.53
1:B:325:LEU:HD11	1:B:362:LEU:HD23	1.91	0.53
1:C:227:ILE:HG21	1:C:262:ALA:HB2	1.90	0.53
1:B:554:PHE:O	1:B:558:VAL:HG23	2.08	0.53
1:D:325:LEU:HD11	1:D:362:LEU:HD23	1.91	0.53
1:A:694:VAL:HG21	1:C:576:ALA:HB2	1.90	0.52
1:B:354:ALA:HB2	1:B:402:LEU:HD11	1.90	0.52
1:C:367:ASN:OD1	1:C:370:GLY:N	2.43	0.52
1:A:367:ASN:OD1	1:A:370:GLY:N	2.43	0.52
1:A:575:LEU:O	1:A:579:VAL:HG23	2.11	0.51
1:B:367:ASN:OD1	1:B:370:GLY:N	2.43	0.51
1:C:575:LEU:O	1:C:579:VAL:HG23	2.11	0.51
1:D:575:LEU:O	1:D:579:VAL:HG23	2.11	0.51
2:F:74:TYR:N	2:F:75:PRO:HD2	2.26	0.51
1:C:325:LEU:HD11	1:C:362:LEU:HD23	1.91	0.51
1:D:317:GLN:NE2	1:D:366:LEU:O	2.43	0.51
1:D:367:ASN:OD1	1:D:370:GLY:N	2.43	0.51
1:A:325:LEU:HD11	1:A:362:LEU:HD23	1.91	0.51
1:B:575:LEU:O	1:B:579:VAL:HG23	2.11	0.51
1:D:160:ARG:NH2	1:D:165:ASP:OD2	2.44	0.51
2:E:74:TYR:N	2:E:75:PRO:HD2	2.26	0.50
1:B:297:GLN:HB3	1:B:300:ILE:HD13	1.94	0.50
1:A:317:GLN:NE2	1:A:366:LEU:O	2.43	0.50
2:G:74:TYR:N	2:G:75:PRO:HD2	2.26	0.50
1:B:160:ARG:NH2	1:B:165:ASP:OD2	2.44	0.50
1:D:297:GLN:HB3	1:D:300:ILE:HD13	1.94	0.50
1:B:317:GLN:NE2	1:B:366:LEU:O	2.43	0.50
1:C:160:ARG:NH2	1:C:165:ASP:OD2	2.44	0.50
1:A:160:ARG:NH2	1:A:165:ASP:OD2	2.44	0.50
2:F:48:VAL:HG23	2:F:49:ASP:N	2.27	0.50
2:G:48:VAL:HG23	2:G:49:ASP:N	2.27	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:317:GLN:NE2	1:C:366:LEU:O	2.43	0.50
2:E:48:VAL:HG23	2:E:49:ASP:N	2.27	0.49
1:D:233:ASP:OD1	1:D:234:ILE:N	2.45	0.49
2:H:48:VAL:HG23	2:H:49:ASP:N	2.27	0.49
1:A:233:ASP:OD1	1:A:234:ILE:N	2.45	0.49
2:H:74:TYR:N	2:H:75:PRO:HD2	2.26	0.49
1:B:233:ASP:OD1	1:B:234:ILE:N	2.45	0.49
1:C:233:ASP:OD1	1:C:234:ILE:N	2.45	0.49
1:C:685:MET:SD	1:C:685:MET:N	2.86	0.49
1:D:685:MET:SD	1:D:685:MET:N	2.86	0.49
1:A:685:MET:SD	1:A:685:MET:N	2.86	0.49
1:A:297:GLN:HB3	1:A:300:ILE:HD13	1.94	0.49
1:C:297:GLN:HB3	1:C:300:ILE:HD13	1.94	0.49
1:B:685:MET:SD	1:B:685:MET:N	2.86	0.48
1:B:576:ALA:HB2	1:D:694:VAL:HG21	1.96	0.48
2:E:48:VAL:HG23	2:E:49:ASP:H	1.79	0.48
2:F:48:VAL:HG23	2:F:49:ASP:H	1.79	0.48
2:H:48:VAL:HG23	2:H:49:ASP:H	1.79	0.48
2:G:48:VAL:HG23	2:G:49:ASP:H	1.79	0.47
1:D:475:VAL:O	1:D:479:LEU:HG	2.15	0.47
1:A:475:VAL:O	1:A:479:LEU:HG	2.15	0.46
1:C:475:VAL:O	1:C:479:LEU:HG	2.15	0.46
2:G:63:GLN:HG3	2:G:64:GLU:N	2.31	0.46
2:E:63:GLN:HG3	2:E:64:GLU:N	2.31	0.46
2:F:63:GLN:HG3	2:F:64:GLU:N	2.31	0.46
1:B:475:VAL:O	1:B:479:LEU:HG	2.15	0.46
1:B:158:VAL:HG13	1:B:198:ALA:HB2	1.98	0.46
1:C:158:VAL:HG13	1:C:198:ALA:HB2	1.98	0.45
1:A:158:VAL:HG13	1:A:198:ALA:HB2	1.98	0.45
2:H:63:GLN:HG3	2:H:64:GLU:N	2.31	0.45
1:C:218:GLU:CB	1:C:223:MET:HE3	2.47	0.45
1:D:218:GLU:CB	1:D:223:MET:HE3	2.47	0.45
1:B:218:GLU:CB	1:B:223:MET:HE3	2.47	0.45
1:A:218:GLU:CB	1:A:223:MET:HE3	2.47	0.45
1:D:158:VAL:HG13	1:D:198:ALA:HB2	1.98	0.45
1:A:749:PRO:HG2	1:A:752:LEU:HD23	1.99	0.45
1:C:749:PRO:HG2	1:C:752:LEU:HD23	1.99	0.44
1:C:264:VAL:HG12	1:C:264:VAL:O	2.17	0.44
1:D:333:ASP:N	1:D:338:ASN:OD1	2.46	0.44
1:C:234:ILE:HG22	1:C:271:ARG:HG2	1.99	0.44
1:D:264:VAL:O	1:D:264:VAL:HG12	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:234:ILE:HG22	1:A:271:ARG:HG2	1.99	0.44
1:B:390:ILE:HG21	1:B:452:VAL:HG11	2.00	0.44
1:A:264:VAL:HG12	1:A:264:VAL:O	2.17	0.44
1:A:411:TYR:HH	1:B:273:PHE:HE2	1.64	0.43
1:B:749:PRO:HG2	1:B:752:LEU:HD23	1.99	0.43
1:C:390:ILE:HG21	1:C:452:VAL:HG11	2.00	0.43
1:A:317:GLN:NE2	1:A:321:GLY:O	2.52	0.43
1:D:234:ILE:HG22	1:D:271:ARG:HG2	1.99	0.43
1:D:390:ILE:HG21	1:D:452:VAL:HG11	2.00	0.43
1:B:264:VAL:HG12	1:B:264:VAL:O	2.18	0.43
1:D:749:PRO:HG2	1:D:752:LEU:HD23	1.99	0.43
1:D:437:LEU:HD23	1:D:437:LEU:O	2.19	0.43
1:B:234:ILE:HG22	1:B:271:ARG:HG2	1.99	0.43
1:B:317:GLN:NE2	1:B:321:GLY:O	2.52	0.43
2:E:82:MET:SD	2:E:95:ILE:HG23	2.59	0.43
2:F:33:VAL:HG23	2:F:34:TYR:N	2.34	0.43
1:C:437:LEU:HD23	1:C:437:LEU:O	2.19	0.43
1:A:390:ILE:HG21	1:A:452:VAL:HG11	2.00	0.42
2:E:33:VAL:HG23	2:E:34:TYR:N	2.34	0.42
2:H:82:MET:SD	2:H:95:ILE:HG23	2.59	0.42
1:A:437:LEU:HD23	1:A:437:LEU:O	2.19	0.42
2:G:82:MET:SD	2:G:95:ILE:HG23	2.59	0.42
1:C:317:GLN:NE2	1:C:321:GLY:O	2.52	0.42
1:D:317:GLN:NE2	1:D:321:GLY:O	2.52	0.42
2:F:82:MET:SD	2:F:95:ILE:HG23	2.59	0.42
1:B:333:ASP:N	1:B:338:ASN:OD1	2.46	0.42
2:G:33:VAL:HG23	2:G:34:TYR:N	2.34	0.42
2:H:33:VAL:HG23	2:H:34:TYR:N	2.34	0.42
1:B:437:LEU:O	1:B:437:LEU:HD23	2.19	0.42
1:D:673:LEU:O	1:D:677:THR:HG23	2.20	0.42
1:B:359:ASP:OD1	1:B:360:SER:N	2.53	0.41
1:C:359:ASP:OD1	1:C:360:SER:N	2.53	0.41
1:C:391:ARG:NH1	1:C:391:ARG:HB3	2.36	0.41
2:E:74:TYR:N	2:E:75:PRO:CD	2.84	0.41
2:G:74:TYR:N	2:G:75:PRO:CD	2.84	0.41
1:A:391:ARG:HB3	1:A:391:ARG:NH1	2.36	0.41
1:B:673:LEU:O	1:B:677:THR:HG23	2.20	0.41
1:D:391:ARG:HB3	1:D:391:ARG:NH1	2.36	0.41
2:F:74:TYR:N	2:F:75:PRO:CD	2.84	0.41
1:A:359:ASP:OD1	1:A:360:SER:N	2.53	0.41
2:H:74:TYR:N	2:H:75:PRO:CD	2.84	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:359:ASP:OD1	1:D:360:SER:N	2.53	0.41
1:C:673:LEU:O	1:C:677:THR:HG23	2.20	0.41
1:B:391:ARG:HB3	1:B:391:ARG:NH1	2.36	0.41
1:C:333:ASP:N	1:C:338:ASN:OD1	2.46	0.41
1:D:383:ILE:HG23	1:D:384:GLY:N	2.36	0.41
1:C:383:ILE:HG23	1:C:384:GLY:N	2.36	0.41
1:A:673:LEU:O	1:A:677:THR:HG23	2.20	0.41
1:B:383:ILE:HG23	1:B:384:GLY:N	2.36	0.41
1:A:574:TYR:CE2	1:A:575:LEU:CD1	3.05	0.40
2:G:167:VAL:HG23	2:G:168:ARG:N	2.37	0.40
2:H:69:LEU:HD22	1:C:232:ARG:HE	1.87	0.40
1:A:383:ILE:HG23	1:A:384:GLY:N	2.36	0.40
2:H:167:VAL:HG23	2:H:168:ARG:N	2.37	0.40
1:D:472:TYR:O	1:D:476:VAL:HG23	2.22	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	575/901 (64%)	567 (99%)	8 (1%)	0	100	100
1	B	575/901 (64%)	567 (99%)	8 (1%)	0	100	100
1	C	575/901 (64%)	567 (99%)	8 (1%)	0	100	100
1	D	575/901 (64%)	567 (99%)	8 (1%)	0	100	100
2	E	188/193 (97%)	184 (98%)	4 (2%)	0	100	100
2	F	188/193 (97%)	184 (98%)	4 (2%)	0	100	100
2	G	188/193 (97%)	184 (98%)	4 (2%)	0	100	100
2	H	188/193 (97%)	184 (98%)	4 (2%)	0	100	100
All	All	3052/4376 (70%)	3004 (98%)	48 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	342/789 (43%)	341 (100%)	1 (0%)	91 94
1	B	342/789 (43%)	341 (100%)	1 (0%)	91 94
1	C	342/789 (43%)	341 (100%)	1 (0%)	91 94
1	D	342/789 (43%)	341 (100%)	1 (0%)	91 94
2	E	122/167 (73%)	122 (100%)	0	100 100
2	F	122/167 (73%)	122 (100%)	0	100 100
2	G	122/167 (73%)	122 (100%)	0	100 100
2	H	122/167 (73%)	122 (100%)	0	100 100
All	All	1856/3824 (48%)	1852 (100%)	4 (0%)	91 95

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	341	PHE
1	B	341	PHE
1	C	341	PHE
1	D	341	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	322	ASN
2	E	63	GLN
2	F	63	GLN
2	G	63	GLN
2	H	63	GLN
1	B	322	ASN
1	D	322	ASN

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)

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	$\#\|Z\| > 2$
4	GDP	H	302	3	25,30,30	1.00	2 (8%)	30,47,47	1.30	3 (10%)
4	GDP	E	302	3	25,30,30	1.01	2 (8%)	30,47,47	1.30	3 (10%)
4	GDP	F	302	3	25,30,30	1.01	2 (8%)	30,47,47	1.30	3 (10%)
4	GDP	G	302	3	25,30,30	1.01	2 (8%)	30,47,47	1.30	3 (10%)

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
4	GDP	H	302	3	-	5/12/32/32	0/3/3/3
4	GDP	E	302	3	-	5/12/32/32	0/3/3/3
4	GDP	F	302	3	-	5/12/32/32	0/3/3/3
4	GDP	G	302	3	-	5/12/32/32	0/3/3/3

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	302	GDP	O4'-C1'	2.27	1.43	1.40
4	G	302	GDP	O4'-C1'	2.26	1.43	1.40
4	E	302	GDP	O4'-C1'	2.25	1.43	1.40
4	H	302	GDP	O4'-C1'	2.20	1.43	1.40
4	G	302	GDP	C6-N1	-2.18	1.34	1.37
4	F	302	GDP	C6-N1	-2.15	1.34	1.37
4	E	302	GDP	C6-N1	-2.15	1.34	1.37
4	H	302	GDP	C6-N1	-2.13	1.34	1.37

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	H	302	GDP	O4'-C1'-N9	3.36	113.20	108.75
4	F	302	GDP	O4'-C1'-N9	3.36	113.20	108.75
4	G	302	GDP	O4'-C1'-N9	3.34	113.17	108.75
4	E	302	GDP	O4'-C1'-N9	3.33	113.17	108.75
4	E	302	GDP	C8-N7-C5	3.12	107.86	102.55
4	G	302	GDP	C8-N7-C5	3.11	107.85	102.55
4	F	302	GDP	C8-N7-C5	3.11	107.84	102.55
4	H	302	GDP	C8-N7-C5	3.10	107.83	102.55
4	E	302	GDP	C5-C6-N1	2.25	118.35	114.07
4	H	302	GDP	C5-C6-N1	2.24	118.34	114.07
4	G	302	GDP	C5-C6-N1	2.24	118.33	114.07
4	F	302	GDP	C5-C6-N1	2.23	118.33	114.07

There are no chirality outliers.

All (20) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	E	302	GDP	C5'-O5'-PA-O3A
4	E	302	GDP	C5'-O5'-PA-O1A
4	E	302	GDP	C5'-O5'-PA-O2A
4	F	302	GDP	C5'-O5'-PA-O3A
4	F	302	GDP	C5'-O5'-PA-O1A
4	F	302	GDP	C5'-O5'-PA-O2A
4	G	302	GDP	C5'-O5'-PA-O3A
4	G	302	GDP	C5'-O5'-PA-O1A
4	G	302	GDP	C5'-O5'-PA-O2A
4	H	302	GDP	C5'-O5'-PA-O3A
4	H	302	GDP	C5'-O5'-PA-O1A
4	H	302	GDP	C5'-O5'-PA-O2A

Continued on next page...

Continued from previous page...

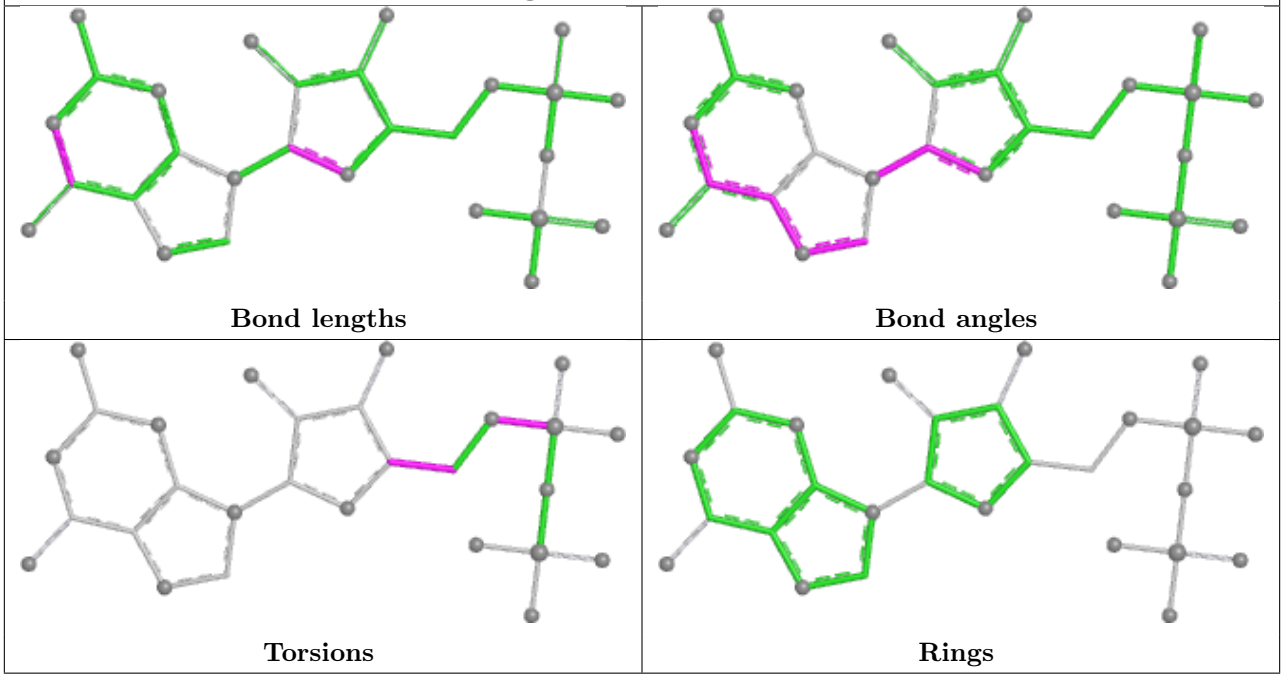
Mol	Chain	Res	Type	Atoms
4	E	302	GDP	O4'-C4'-C5'-O5'
4	F	302	GDP	O4'-C4'-C5'-O5'
4	G	302	GDP	O4'-C4'-C5'-O5'
4	H	302	GDP	O4'-C4'-C5'-O5'
4	E	302	GDP	C3'-C4'-C5'-O5'
4	F	302	GDP	C3'-C4'-C5'-O5'
4	G	302	GDP	C3'-C4'-C5'-O5'
4	H	302	GDP	C3'-C4'-C5'-O5'

There are no ring outliers.

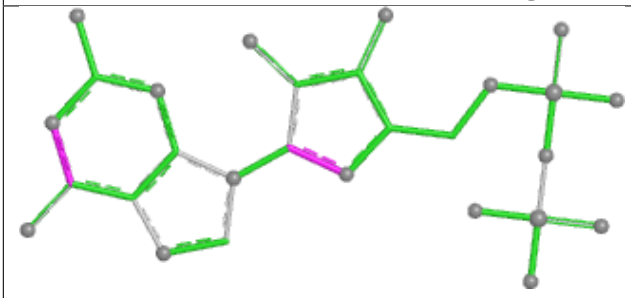
No monomer is involved in short contacts.

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.

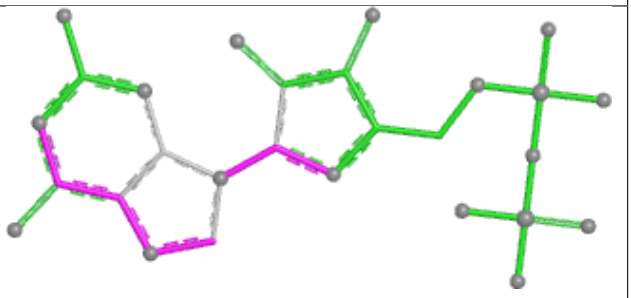
Ligand GDP H 302



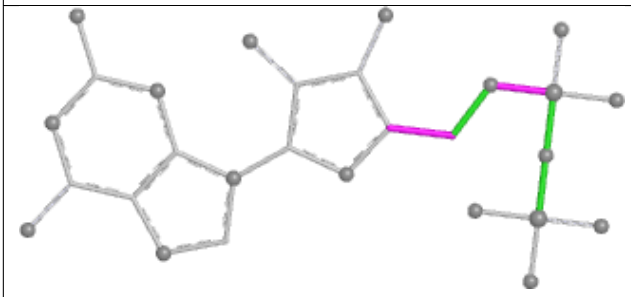
Ligand GDP E 302



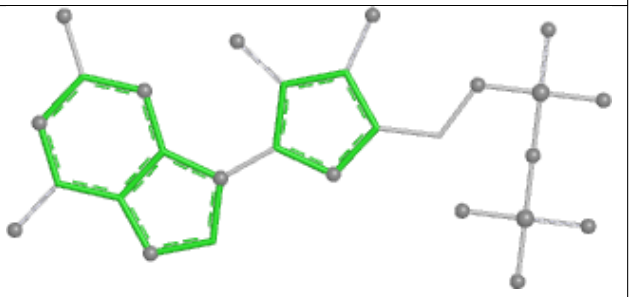
Bond lengths



Bond angles

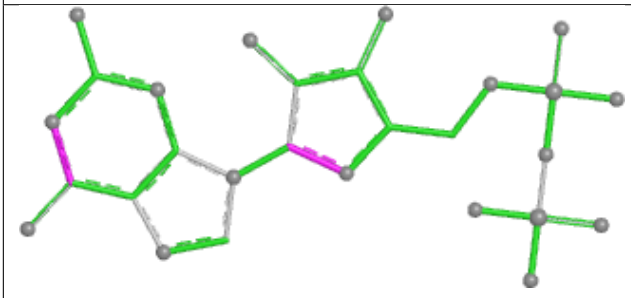


Torsions

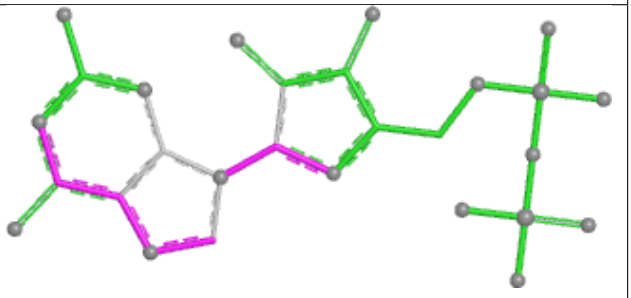


Rings

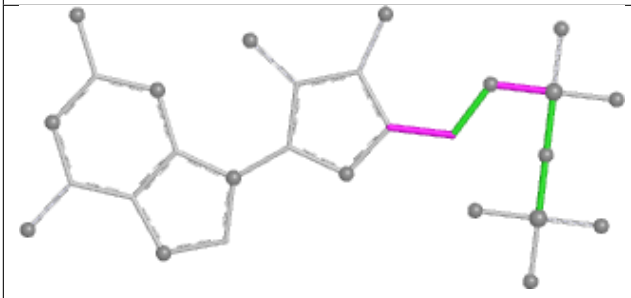
Ligand GDP F 302



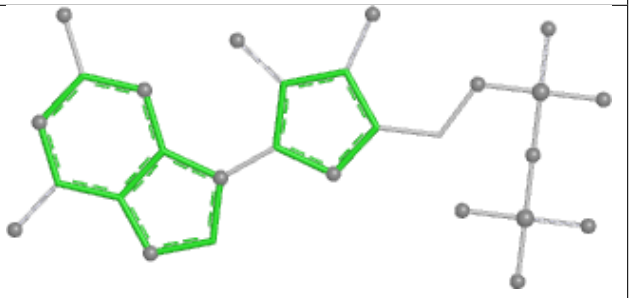
Bond lengths



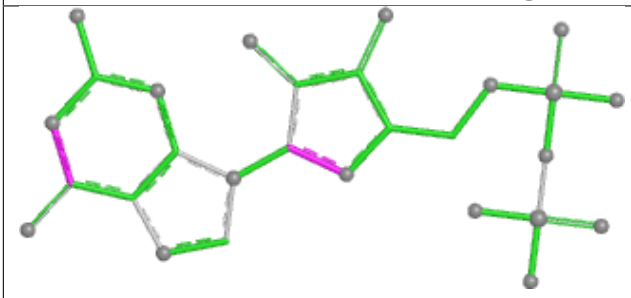
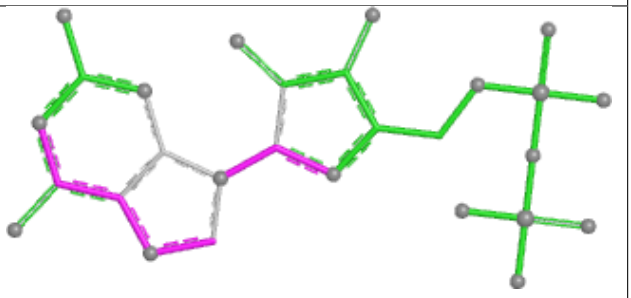
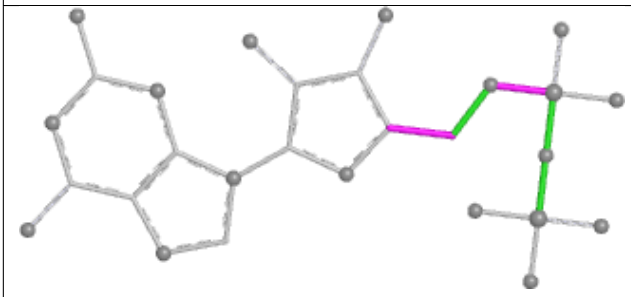
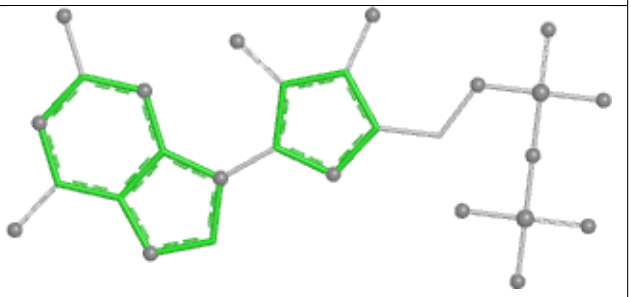
Bond angles



Torsions



Rings

Ligand GDP G 302	
 Bond lengths	 Bond angles
 Torsions	 Rings

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.

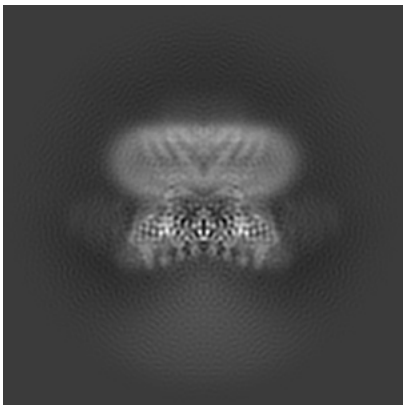
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-28977. These allow visual inspection of the internal detail of the map and identification of artifacts.

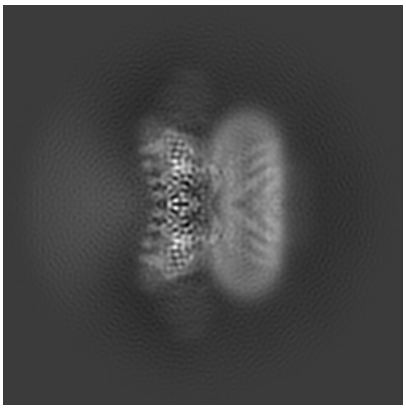
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections

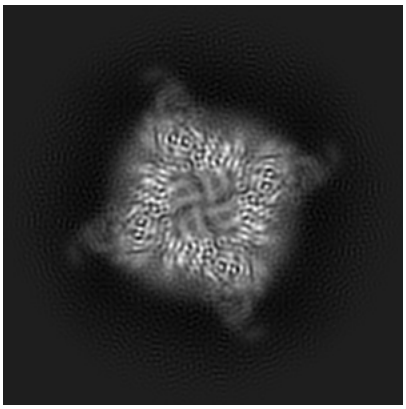
6.1.1 Primary map



X

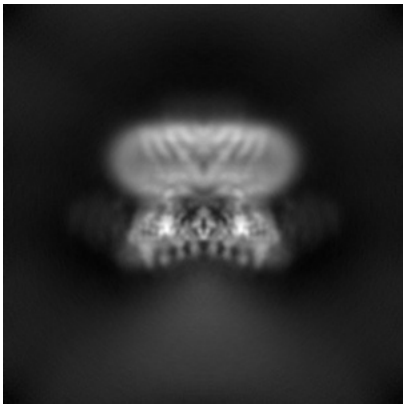


Y

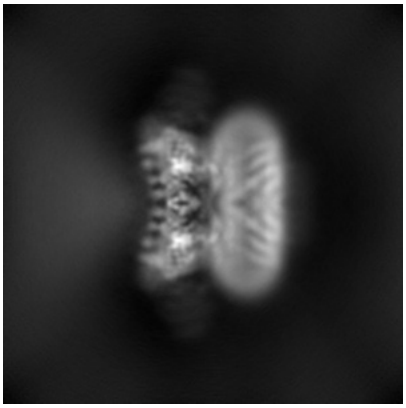


Z

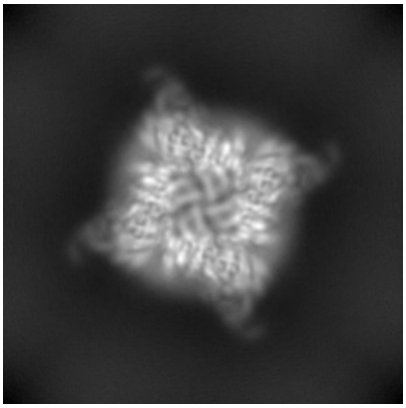
6.1.2 Raw map



X



Y

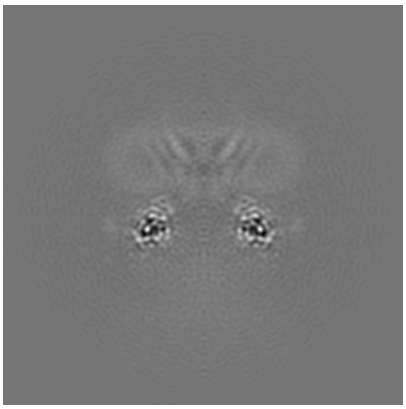


Z

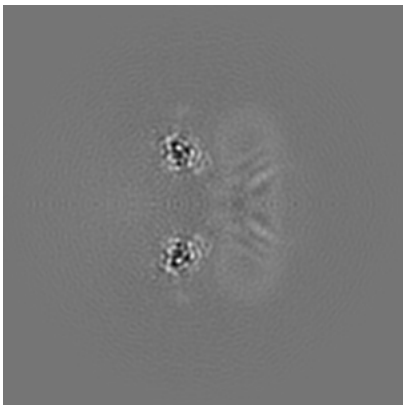
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

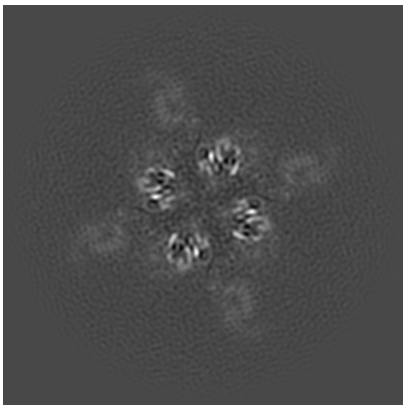
6.2.1 Primary map



X Index: 128

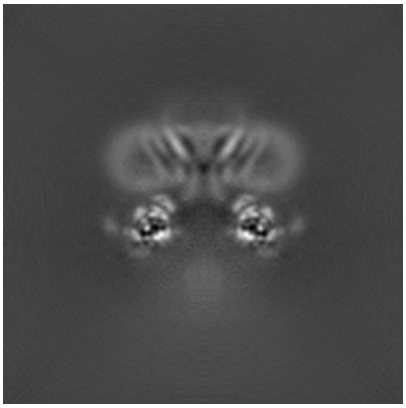


Y Index: 128

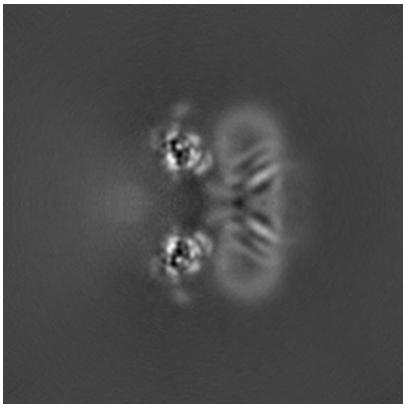


Z Index: 128

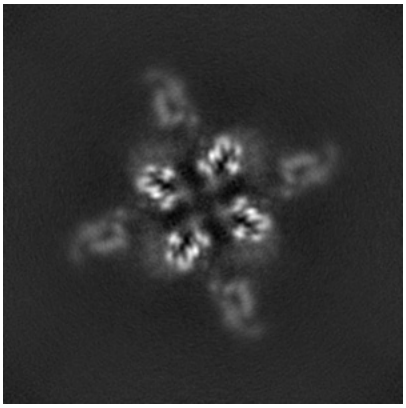
6.2.2 Raw map



X Index: 128



Y Index: 128

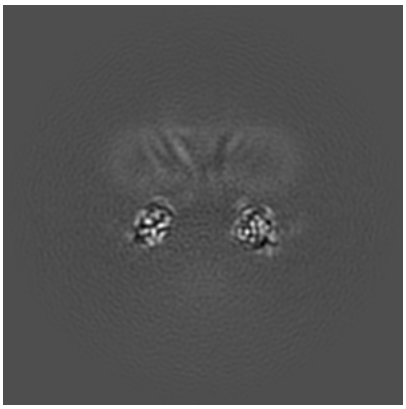


Z Index: 128

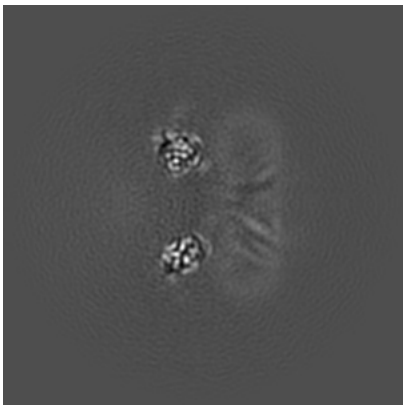
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

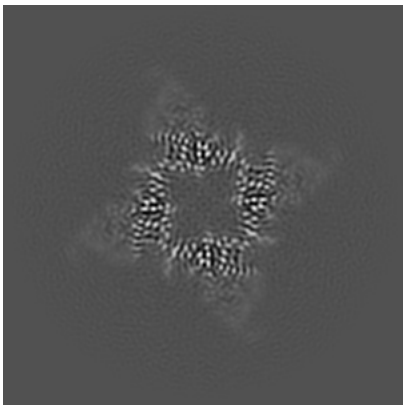
6.3.1 Primary map



X Index: 126

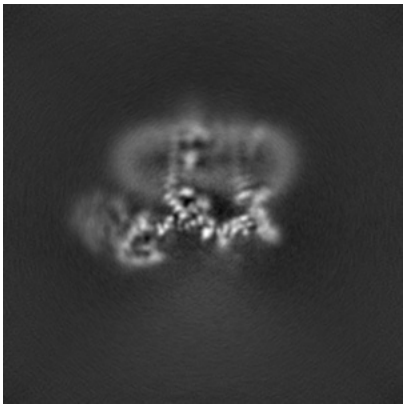


Y Index: 130

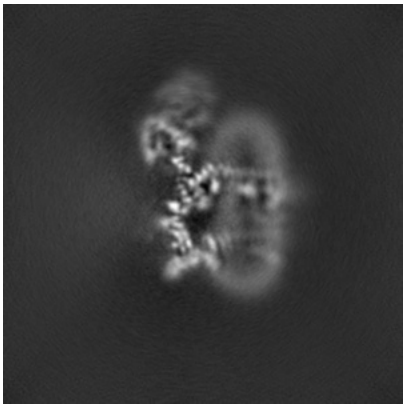


Z Index: 111

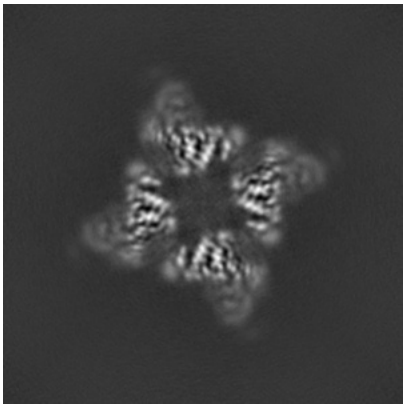
6.3.2 Raw map



X Index: 151



Y Index: 151

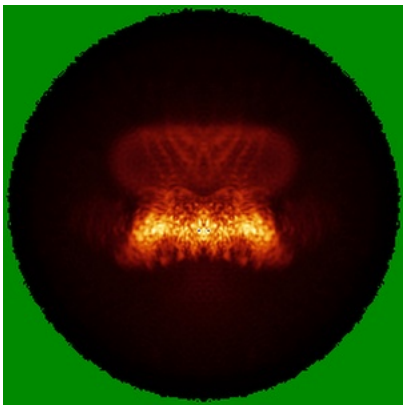


Z Index: 106

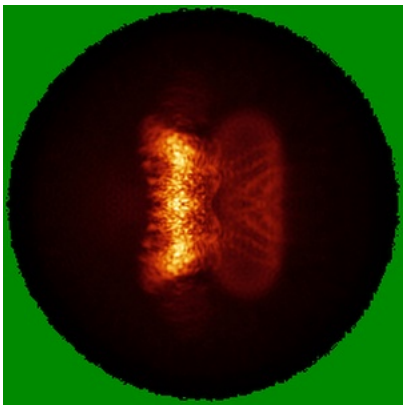
The images above show the largest variance slices of the map in three orthogonal directions.

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

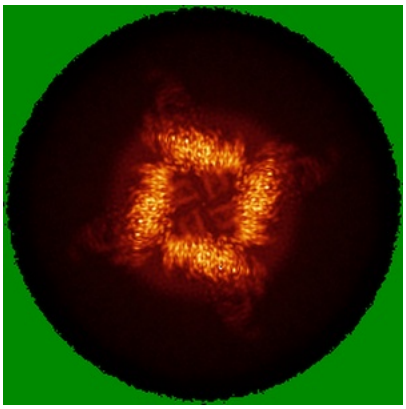
6.4.1 Primary map



X

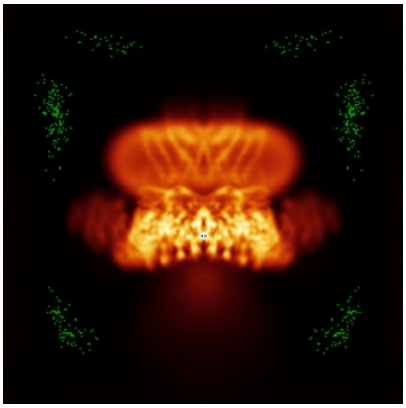


Y

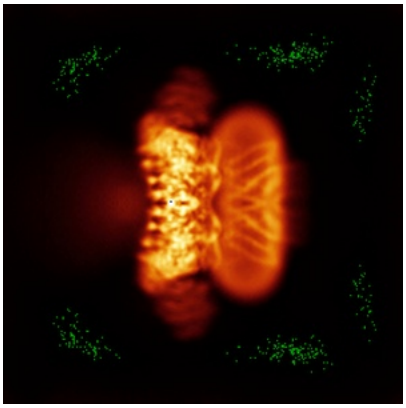


Z

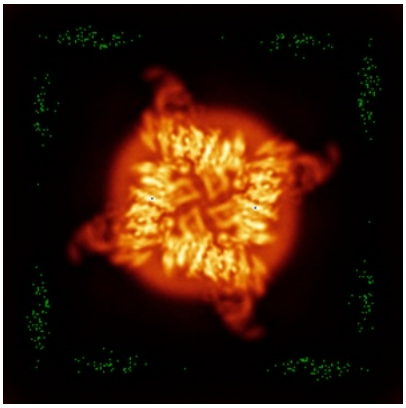
6.4.2 Raw map



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.

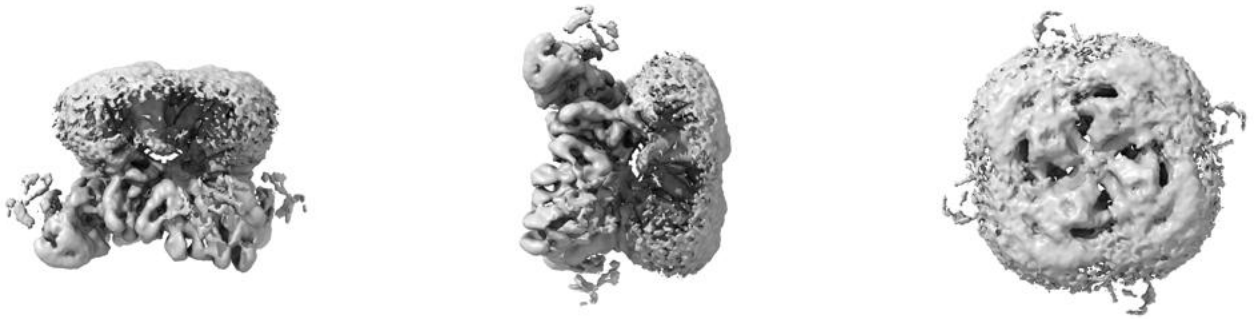
6.5 Orthogonal surface views (i)

6.5.1 Primary map

X Y Z

The images above show the 3D surface view of the map at the recommended contour level 0.209. 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.

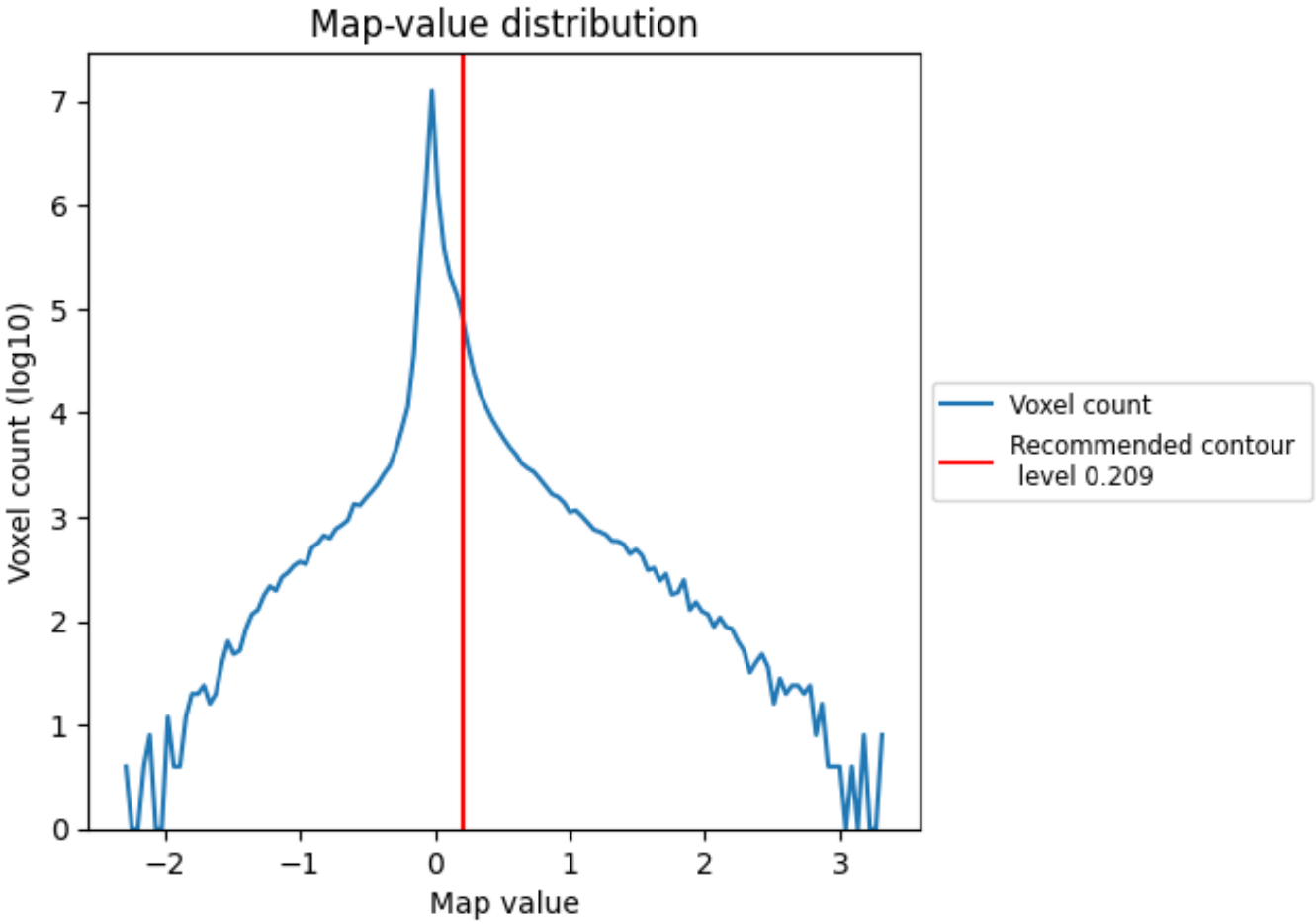
6.6 Mask visualisation (i)

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

7 Map analysis

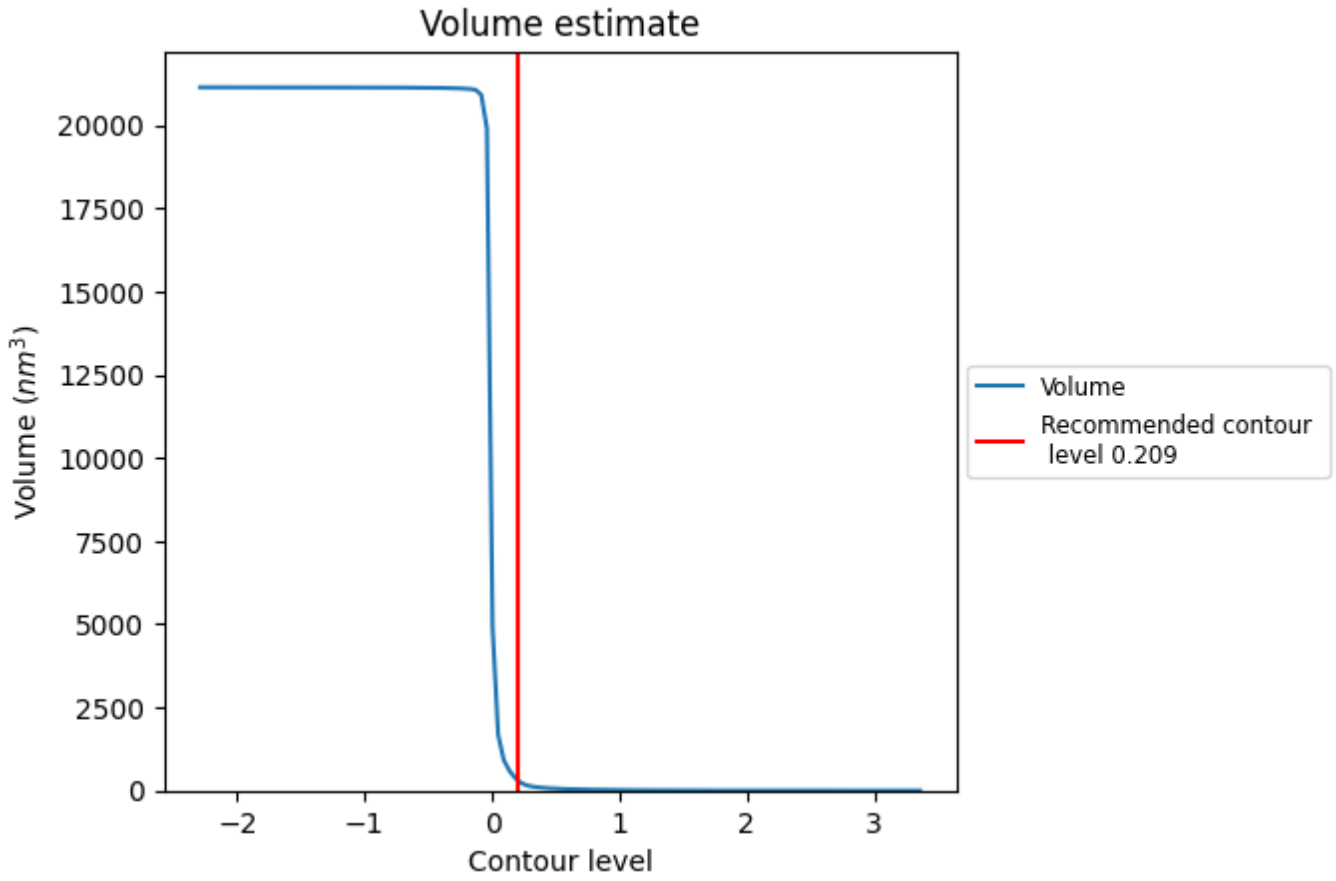
This section contains the results of statistical analysis of the map.

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.

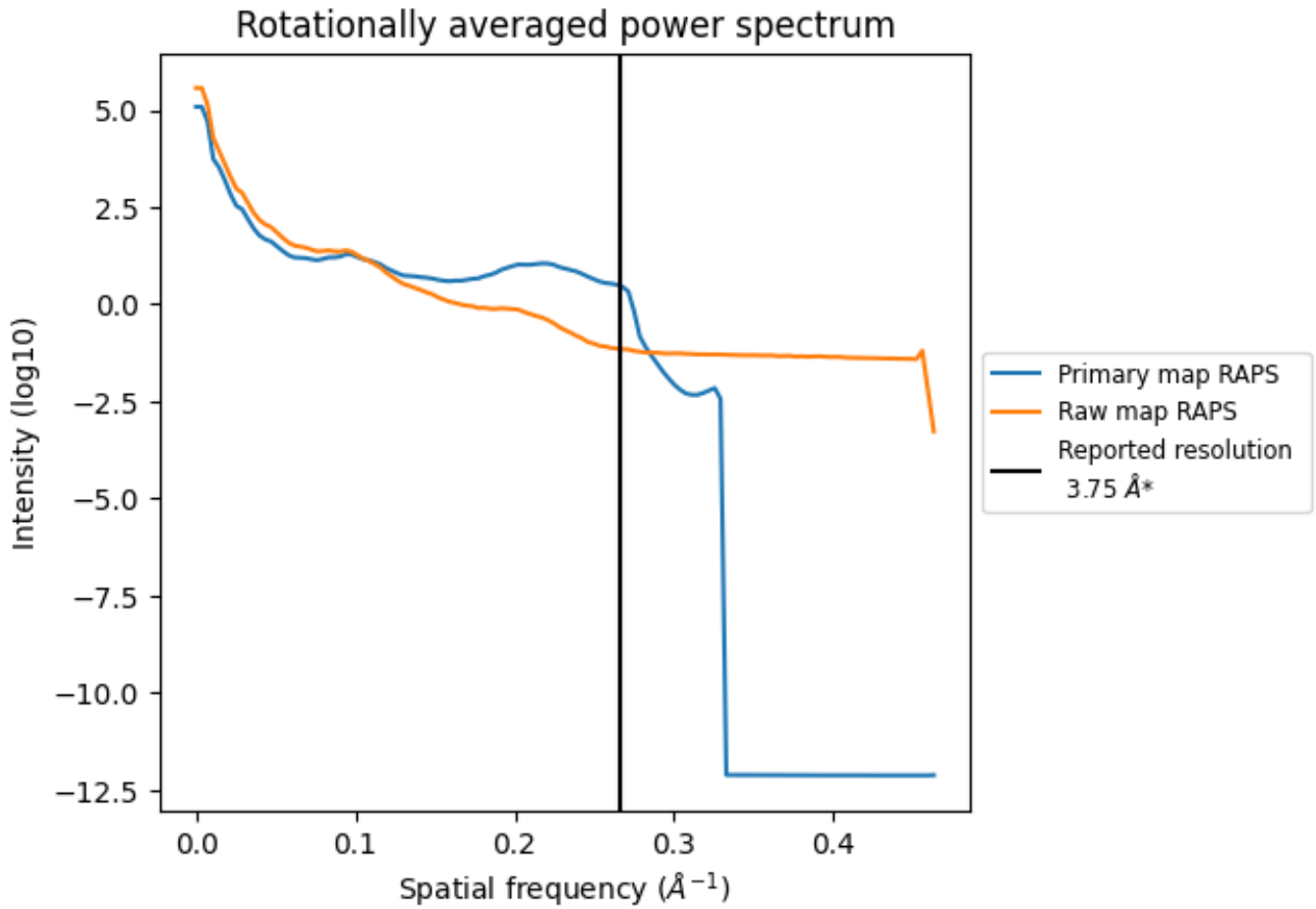
7.2 Volume estimate



The volume at the recommended contour level is 287 nm^3; this corresponds to an approximate mass of 259 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)

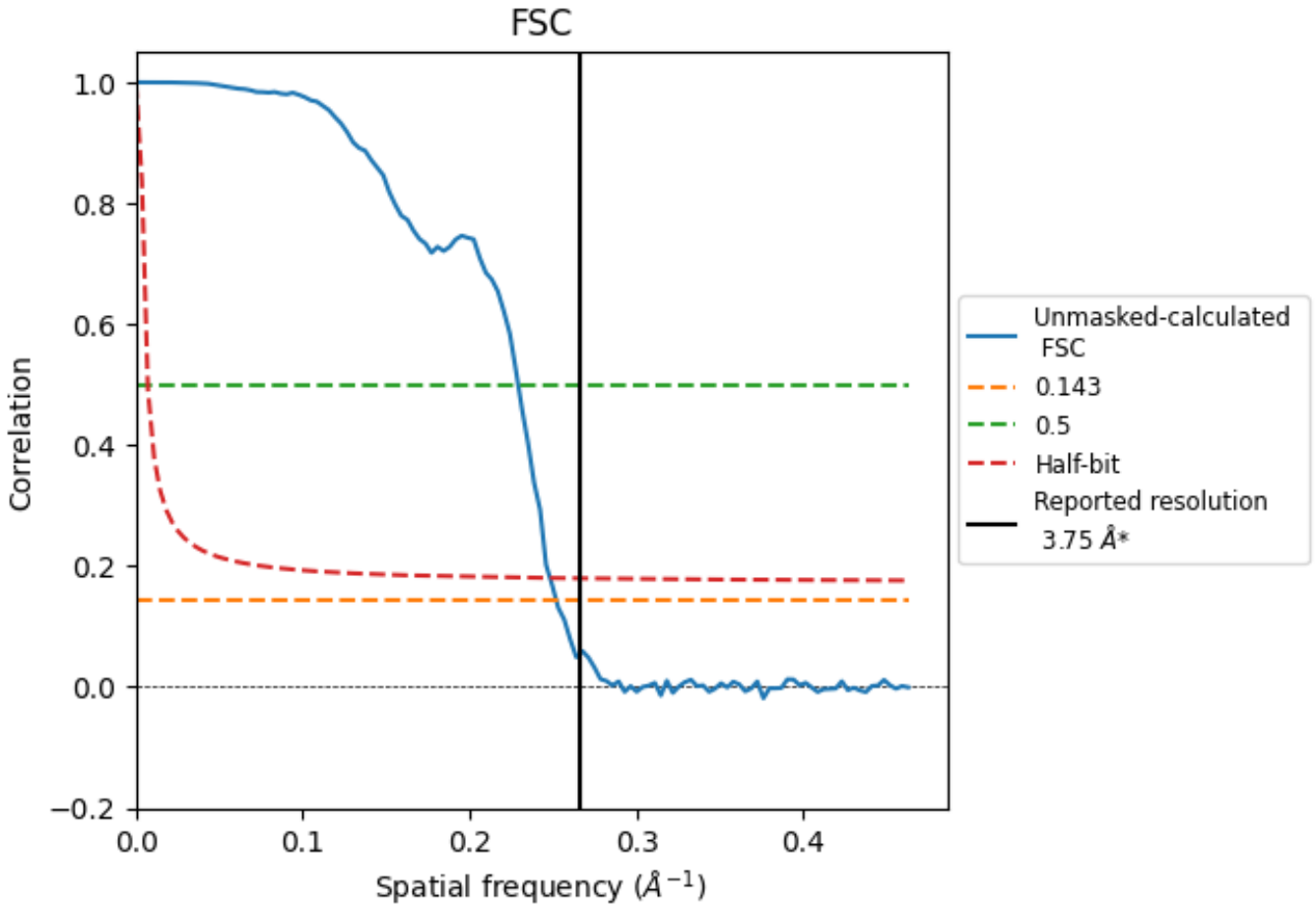


*Reported resolution corresponds to spatial frequency of 0.267 $Å^{-1}$

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 0.267 Å^{-1}

8.2 Resolution estimates (i)

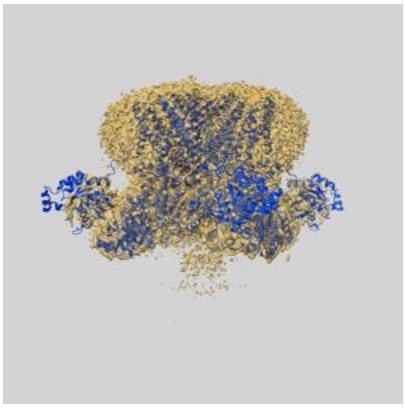
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.75	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.97	4.36	4.03

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

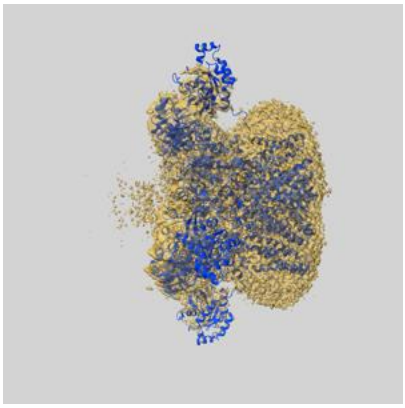
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-28977 and PDB model 8FC9. Per-residue inclusion information can be found in section 3 on page 8.

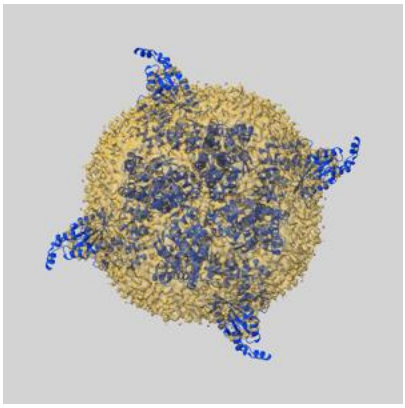
9.1 Map-model overlay



X



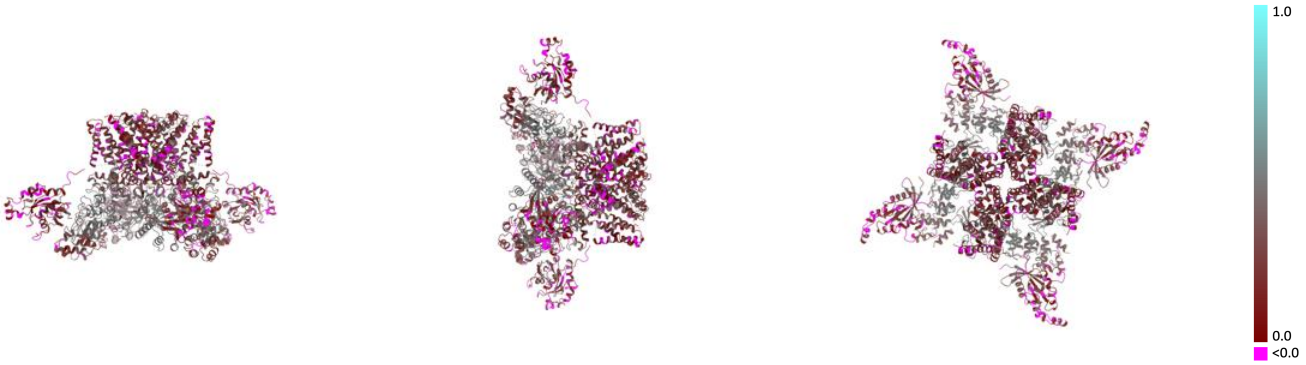
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.209 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.

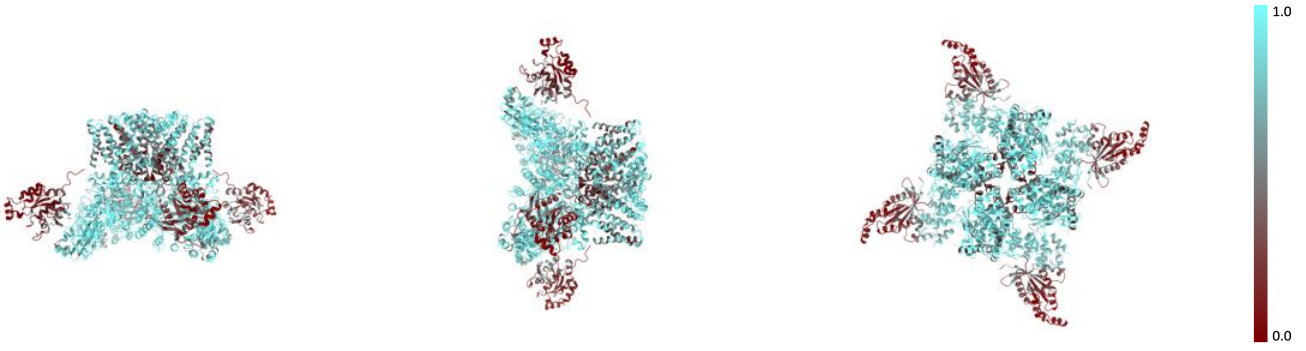
9.2 Q-score mapped to coordinate model (i)



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.

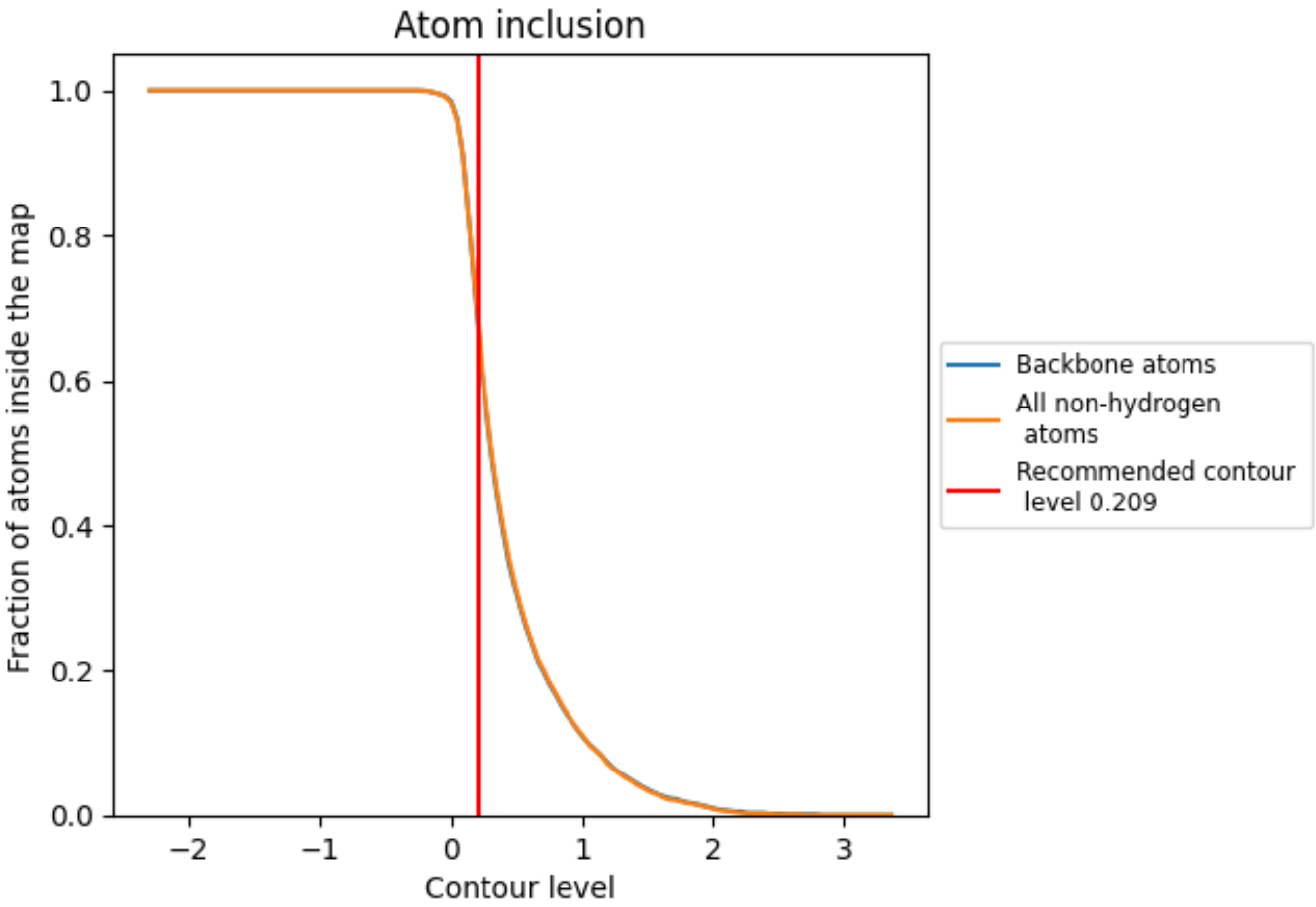
9.3 Atom inclusion mapped to coordinate model (i)



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 (0.209).

9.4 Atom inclusion (i)



At the recommended contour level, 67% 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 (0.209) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6770	0.2820
A	0.8370	0.3290
B	0.8420	0.3320
C	0.8380	0.3270
D	0.8360	0.3280
E	0.2260	0.1420
F	0.2310	0.1490
G	0.2220	0.1390
H	0.2310	0.1450