



wwPDB EM Validation Summary Report ⓘ

Mar 8, 2026 – 08:07 AM UTC

PDB ID : 7TD4 / pdb_00007td4
EMDB ID : EMD-25823
Title : Sphingosine-1-phosphate receptor 1-Gi complex bound to Siponimod
Authors : Liu, S.; Paknejad, N.; Zhu, L.; Kihara, Y.; Ray, D.; Chun, J.; Liu, W.; Hite, R.K.; Huang, X.Y.
Deposited on : 2021-12-30
Resolution : 2.60 Å(reported)

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

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

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

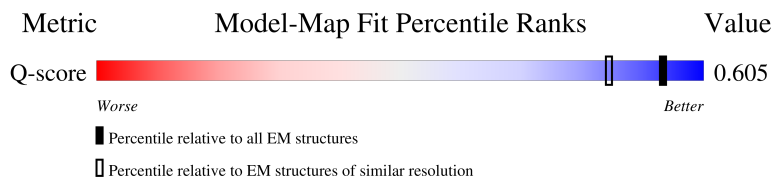
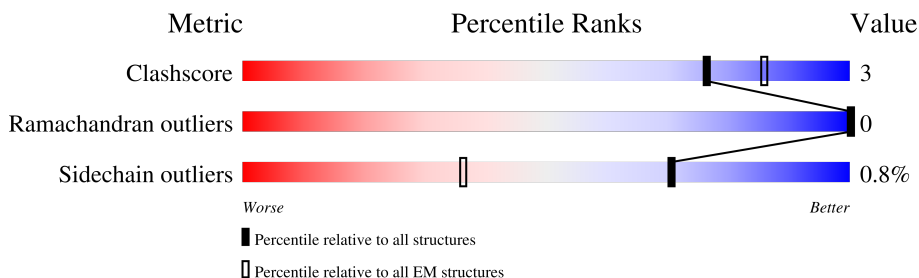
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data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

1 Overall quality at a glance

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

The reported resolution of this entry is 2.60 Å.

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



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

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

Mol	Chain	Length	Quality of chain
1	B	340	 90% 6% . .
2	A	379	 56% . 41%
3	G	71	 69% . 28%
4	R	392	 65% 8% . 26%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6893 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 Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	B	331	Total	C	N	O	S	0	0
			2497	1545	446	485	21		

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(i) subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	A	222	Total	C	N	O	S	0	0
			1757	1123	293	329	12		

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-24	MET	-	initiating methionine	UNP B2RSH2
A	-23	GLY	-	expression tag	UNP B2RSH2
A	-22	SER	-	expression tag	UNP B2RSH2
A	-21	SER	-	expression tag	UNP B2RSH2
A	-20	HIS	-	expression tag	UNP B2RSH2
A	-19	HIS	-	expression tag	UNP B2RSH2
A	-18	HIS	-	expression tag	UNP B2RSH2
A	-17	HIS	-	expression tag	UNP B2RSH2
A	-16	HIS	-	expression tag	UNP B2RSH2
A	-15	HIS	-	expression tag	UNP B2RSH2
A	-14	SER	-	expression tag	UNP B2RSH2
A	-13	SER	-	expression tag	UNP B2RSH2
A	-12	GLY	-	expression tag	UNP B2RSH2
A	-11	LEU	-	expression tag	UNP B2RSH2
A	-10	GLU	-	expression tag	UNP B2RSH2
A	-9	VAL	-	expression tag	UNP B2RSH2
A	-8	LEU	-	expression tag	UNP B2RSH2
A	-7	PHE	-	expression tag	UNP B2RSH2
A	-6	GLN	-	expression tag	UNP B2RSH2
A	-5	GLY	-	expression tag	UNP B2RSH2

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	PRO	-	expression tag	UNP B2RSH2
A	-3	HIS	-	expression tag	UNP B2RSH2
A	-2	MET	-	expression tag	UNP B2RSH2
A	-1	ALA	-	expression tag	UNP B2RSH2
A	0	SER	-	expression tag	UNP B2RSH2
A	203	ALA	GLY	engineered mutation	UNP B2RSH2

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	G	51	Total	C	N	O	S	0	0
			368	234	64	67	3		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	68	SER	CYS	engineered mutation	UNP P63212

- Molecule 4 is a protein called Sphingosine 1-phosphate receptor 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	R	290	Total	C	N	O	S	0	0
			2220	1478	353	374	15		

There are 11 discrepancies between the modelled and reference sequences:

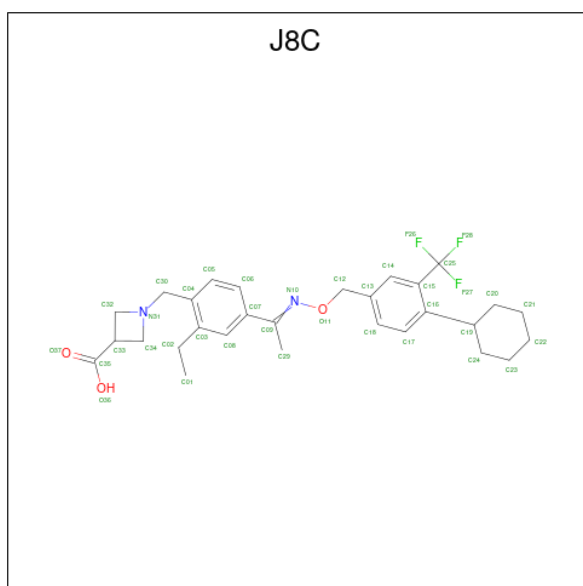
Chain	Residue	Modelled	Actual	Comment	Reference
R	-9	ASP	-	expression tag	UNP P21453
R	-8	TYR	-	expression tag	UNP P21453
R	-7	LYS	-	expression tag	UNP P21453
R	-6	ASP	-	expression tag	UNP P21453
R	-5	ASP	-	expression tag	UNP P21453
R	-4	ASP	-	expression tag	UNP P21453
R	-3	ASP	-	expression tag	UNP P21453
R	-2	LYS	-	expression tag	UNP P21453
R	-1	ALA	-	expression tag	UNP P21453
R	0	ALA	-	expression tag	UNP P21453
R	1	ALA	-	expression tag	UNP P21453

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms				AltConf
5	R	1	Total	C	N	O	0
			14	8	1	5	

- Molecule 6 is 1-[[4-[({E})- {N}]-[[4-cyclohexyl-3-(trifluoromethyl)phenyl]methoxy]- {C}-methyl-carbonimidoyl]-2-ethyl-phenyl]methyl]azetidine-3-carboxylic acid (CCD ID: J8C) (formula: $C_{29}H_{35}F_3N_2O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
6	R	1	Total	C	F	N	O	0
			37	29	3	2	3	

F133		ILE
E141		MET
M149		SER
K150		CYS
L151		LYS
H152		CYS
L163		PRO
I164		SER
C167		GLY
L177		SER
G181		ALA
L188		GLY
S192		LYS
T193		LYS
V194		PHE
R231		LYS
K239		ARG
ASN		PRO
ILE		ILE
SER		ILE
LYS		ALA
ALA		SER
SER		ASP
ARG		ASN
SER		SER
S248		SER
V261		HIS
V264		PRO
D279		GLN
Y285		LYS
F296		ASP
L297		GLU
V298		GLY
P308		ASP
I309		ASN
I310		PRO
N315		GLU
M318		THR
A321		ILE
F322		MET
I323		SER
ARG		SER
		GLY
		ASN
		VAL
		ASN
		SER
		SER

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	1789970	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	23.4	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	68.952	Depositor
Minimum map value	-38.750	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.981	Depositor
Recommended contour level	2	Depositor
Map size (Å)	272.384, 272.384, 272.384	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.064, 1.064, 1.064	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NAG, J8C

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	B	0.28	0/2544	0.35	0/3456
2	A	0.29	0/1787	0.32	0/2401
3	G	0.17	0/374	0.27	0/509
4	R	0.57	3/2269 (0.1%)	0.75	7/3100 (0.2%)
All	All	0.40	3/6974 (0.0%)	0.51	7/9466 (0.1%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	R	193	THR	C-O	-6.42	1.16	1.24
4	R	192	SER	C-O	-5.91	1.16	1.23
4	R	163	LEU	C-O	-5.75	1.17	1.24

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	R	141	GLU	CB-CA-C	-6.28	101.03	110.88
4	R	152	HIS	CA-C-N	-5.82	115.03	122.77
4	R	152	HIS	C-N-CA	-5.82	115.03	122.77
4	R	193	THR	CA-CB-OG1	-5.51	101.33	109.60
4	R	194	VAL	CA-C-O	-5.50	115.41	121.29

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	B	2497	0	2378	14	0
2	A	1757	0	1727	6	0
3	G	368	0	357	2	0
4	R	2220	0	2226	24	0
5	R	14	0	13	0	0
6	R	37	0	0	0	0
All	All	6893	0	6701	41	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 3.

The worst 5 of 41 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)
2:A:347:ASN:HD21	4:R:149:MET:HA	1.59	0.67
1:B:333:ASP:O	1:B:334:SER:OG	2.15	0.62
1:B:30:LEU:HD23	1:B:262:MET:HB2	1.83	0.59
1:B:196:THR:HG22	1:B:196:THR:O	2.04	0.57
2:A:347:ASN:ND2	4:R:149:MET:HA	2.18	0.57

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	B	329/340 (97%)	310 (94%)	19 (6%)	0	100	100
2	A	218/379 (58%)	211 (97%)	7 (3%)	0	100	100
3	G	49/71 (69%)	48 (98%)	1 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
4	R	284/392 (72%)	272 (96%)	12 (4%)	0	100	100
All	All	880/1182 (74%)	841 (96%)	39 (4%)	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	B	264/283 (93%)	260 (98%)	4 (2%)	57	80
2	A	186/326 (57%)	186 (100%)	0	100	100
3	G	35/58 (60%)	35 (100%)	0	100	100
4	R	231/349 (66%)	229 (99%)	2 (1%)	70	87
All	All	716/1016 (70%)	710 (99%)	6 (1%)	70	88

5 of 6 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	340	ASN
4	R	149	MET
4	R	164	ILE
1	B	228	ASP
1	B	186	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	239	ASN
1	B	259	GLN
4	R	77	HIS
4	R	199	HIS

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 ⓘ

2 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
5	NAG	R	401	4	14,14,15	0.26	0	17,19,21	0.67	1 (5%)
6	J8C	R	402	-	38,40,40	0.17	0	49,57,57	0.47	0

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
5	NAG	R	401	4	-	2/6/23/26	0/1/1/1
6	J8C	R	402	-	-	3/30/46/46	0/4/4/4

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	R	401	NAG	C1-O5-C5	2.07	114.96	112.19

There are no chirality outliers.

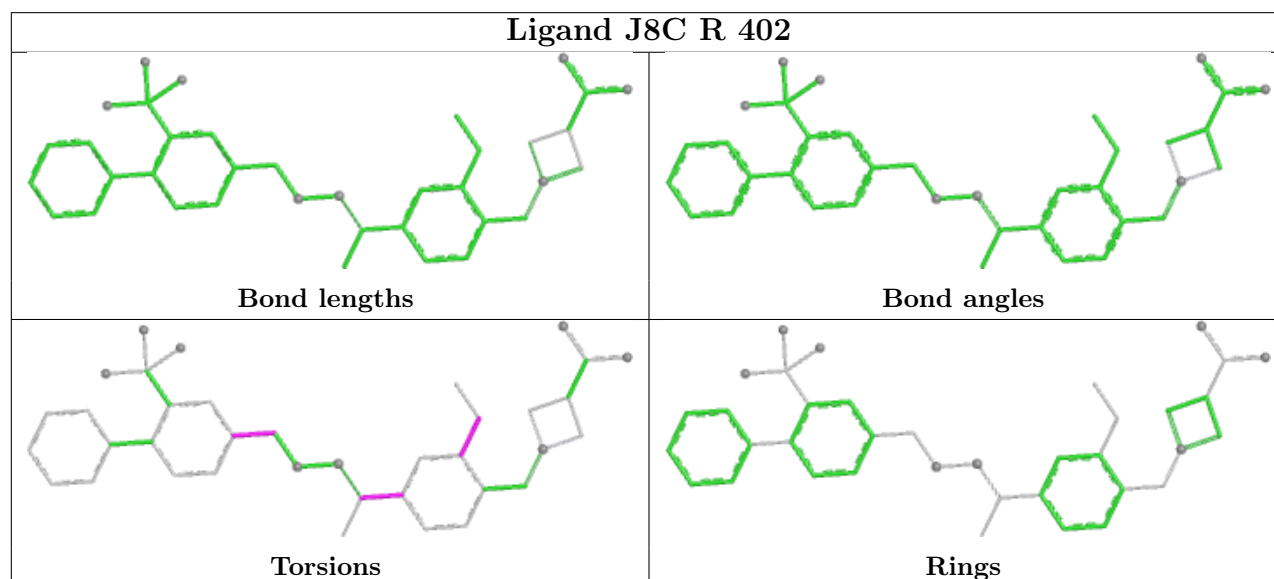
All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	R	401	NAG	O5-C5-C6-O6
5	R	401	NAG	C4-C5-C6-O6
6	R	402	J8C	C01-C02-C03-C08
6	R	402	J8C	O11-C12-C13-C18
6	R	402	J8C	C08-C07-C09-C29

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

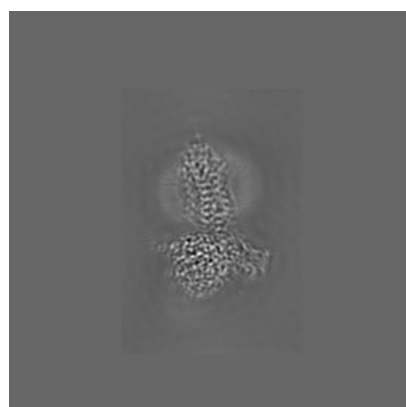
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-25823. These allow visual inspection of the internal detail of the map and identification of artifacts.

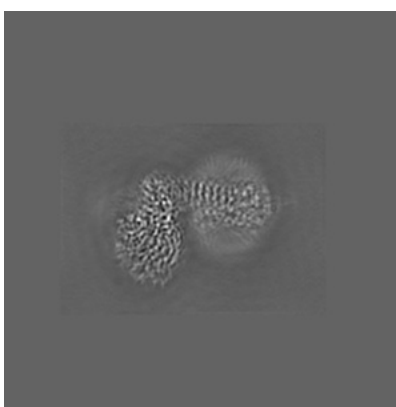
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

6.1.1 Primary map



X



Y



Z

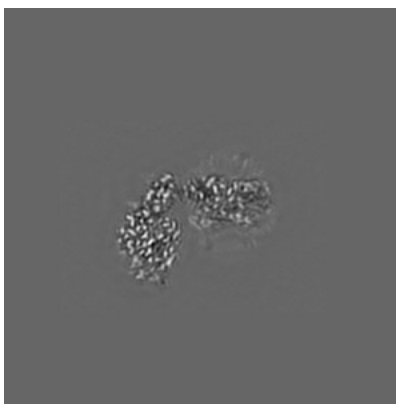
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

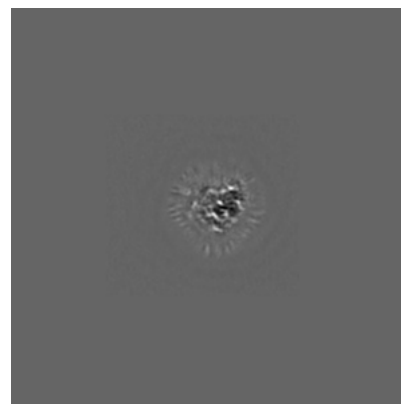
6.2.1 Primary map



X Index: 128



Y Index: 128

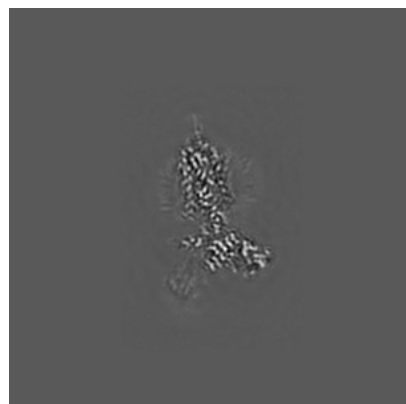


Z Index: 128

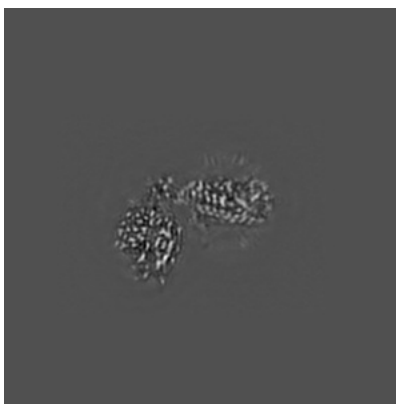
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

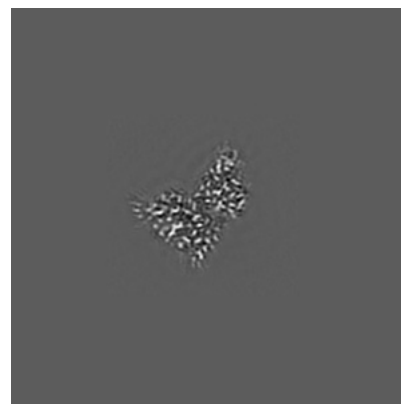
6.3.1 Primary map



X Index: 133



Y Index: 125

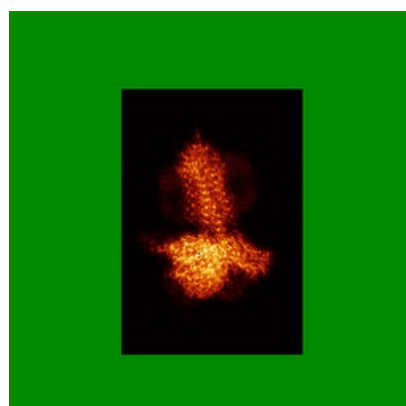


Z Index: 102

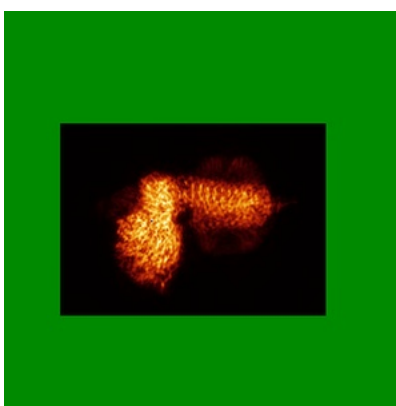
The images above show the largest variance slices of the map in three orthogonal directions.

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

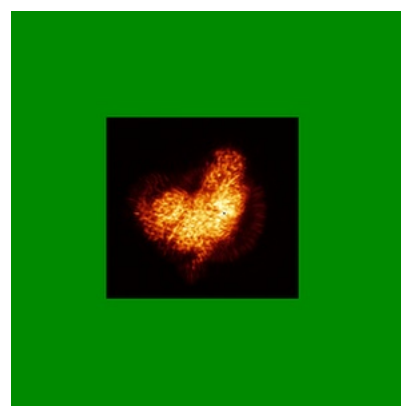
6.4.1 Primary map



X



Y



Z

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

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 2.0. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

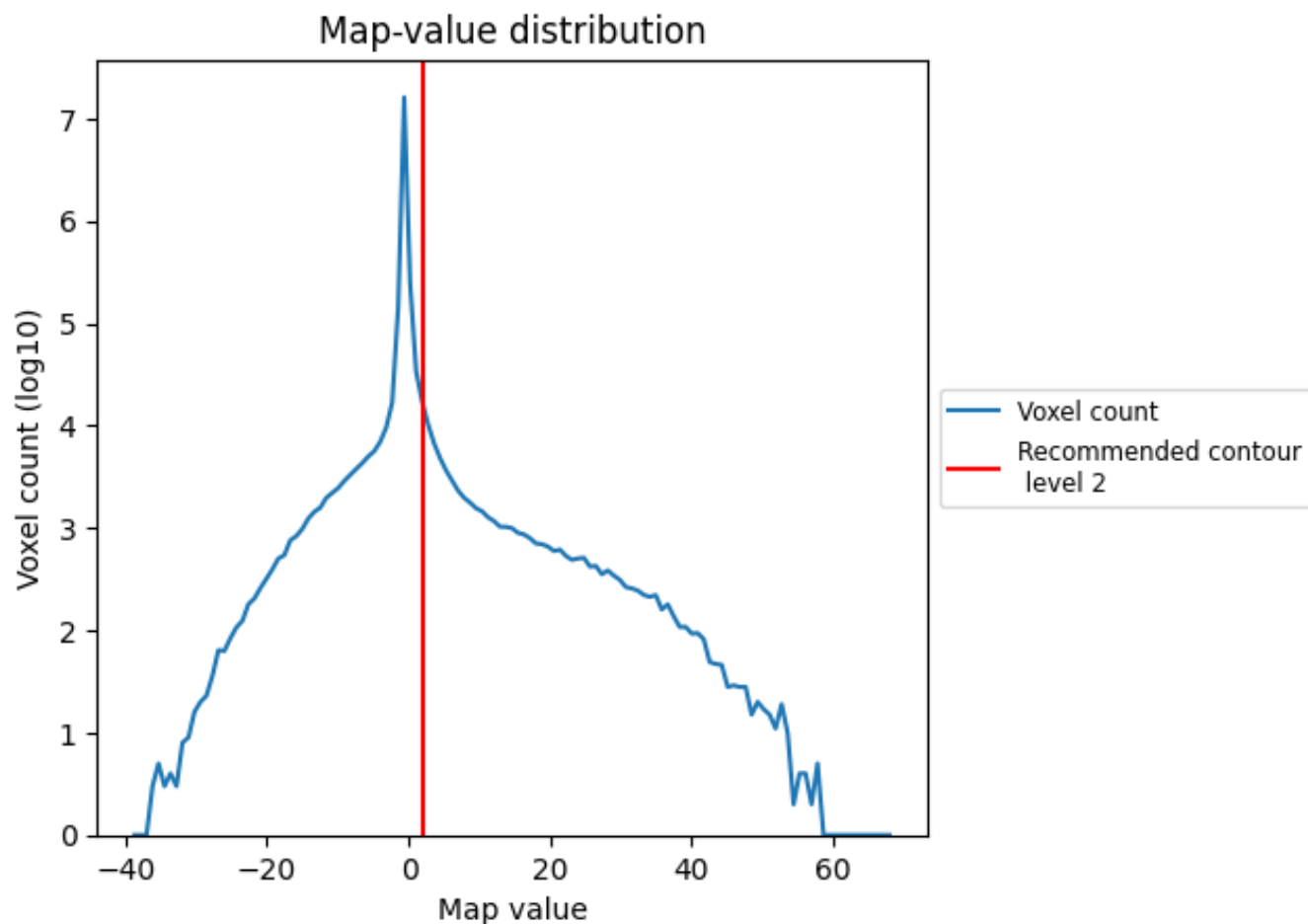
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

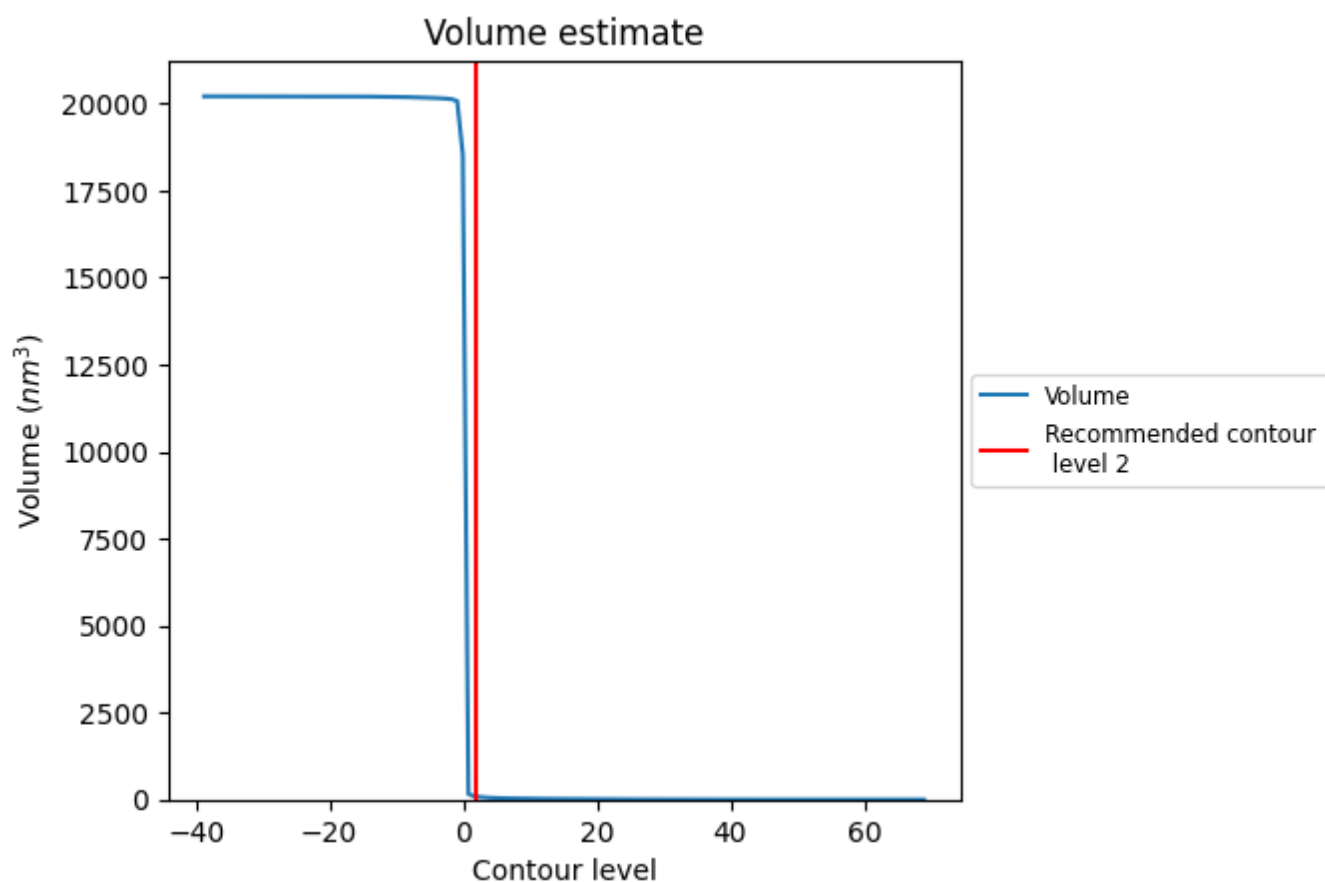
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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

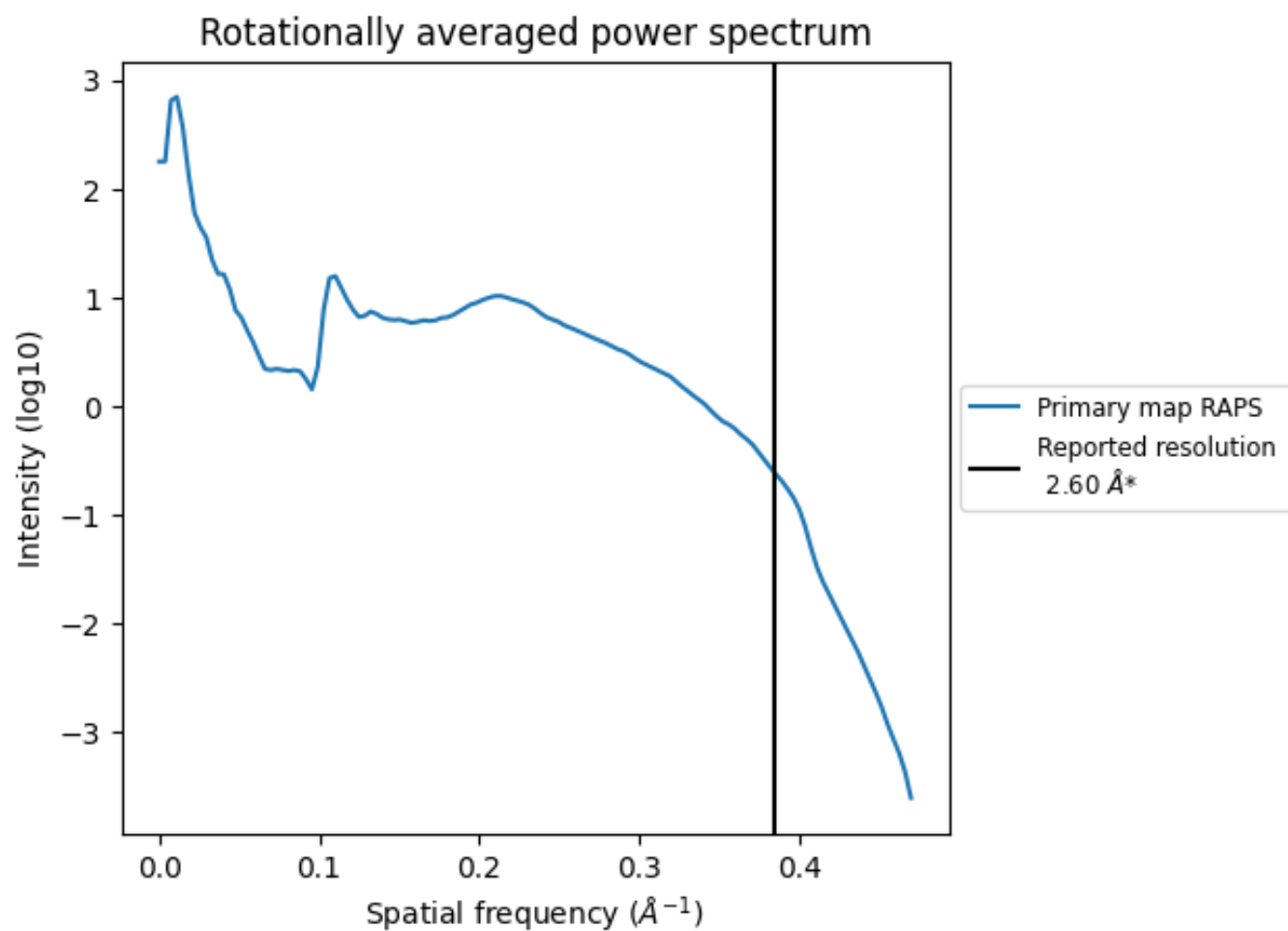
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 89 nm^3 ; this corresponds to an approximate mass of 80 kDa.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.

7.3 Rotationally averaged power spectrum ⓘ



*Reported resolution corresponds to spatial frequency of 0.385 Å⁻¹

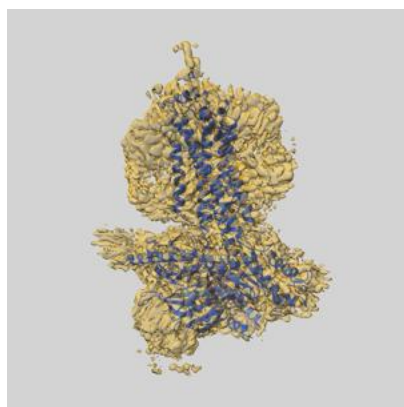
8 Fourier-Shell correlation

This section was not generated. No FSC curve or half-maps provided.

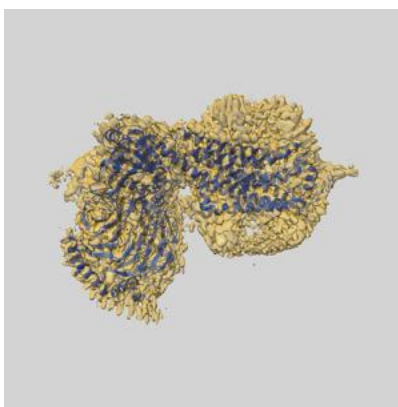
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-25823 and PDB model 7TD4. Per-residue inclusion information can be found in section [3](#) on page [6](#).

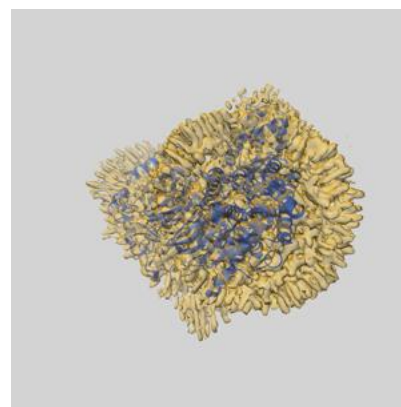
9.1 Map-model overlay [i](#)



X



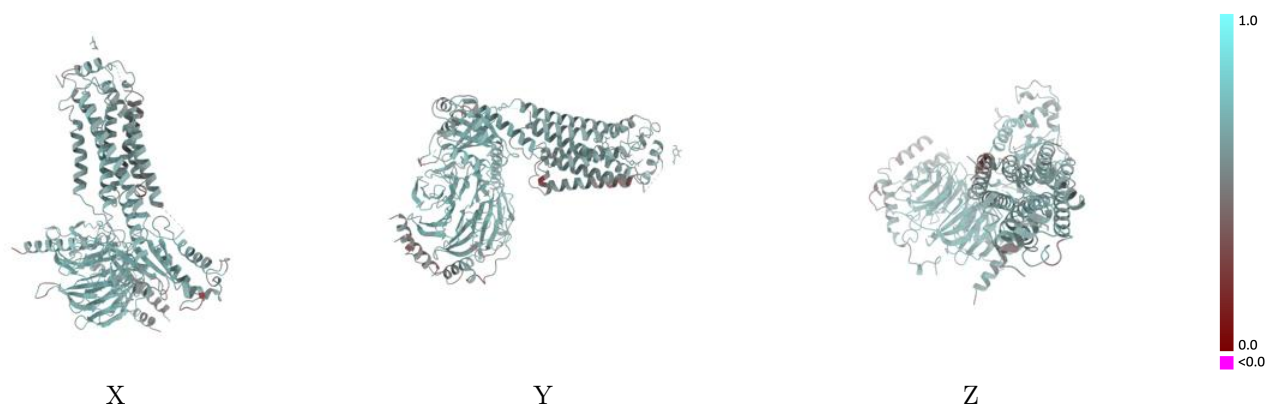
Y



Z

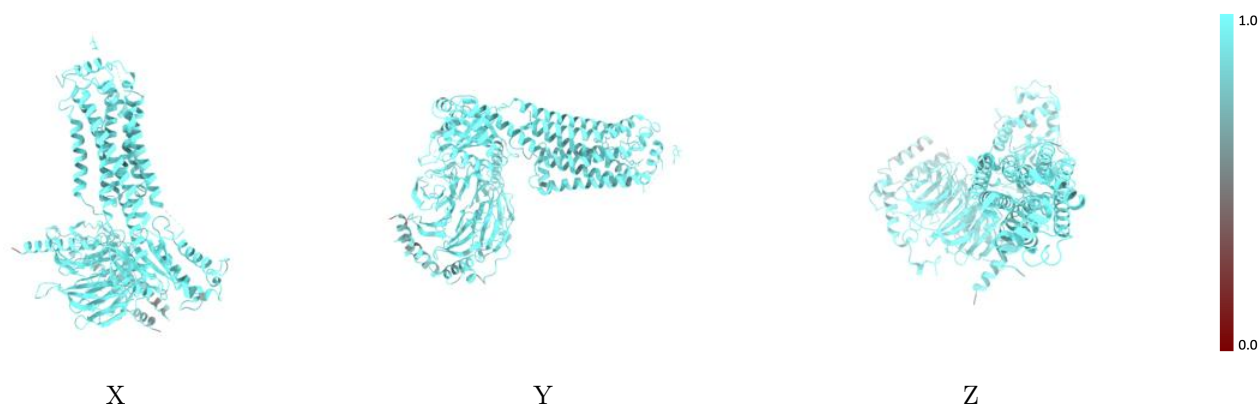
The images above show the 3D surface view of the map at the recommended contour level 2.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



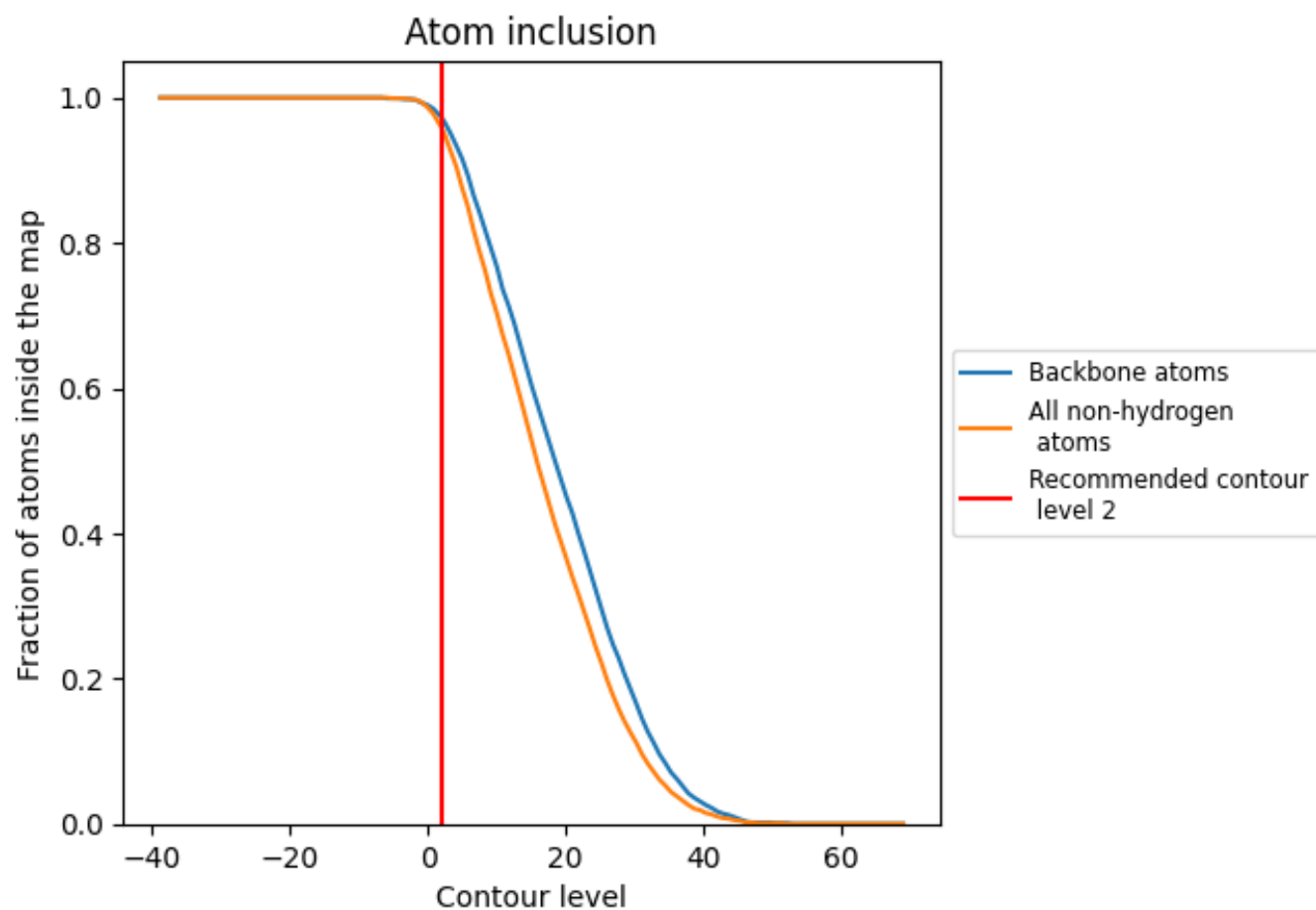
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

9.3 Atom inclusion mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (2).

9.4 Atom inclusion [i](#)



At the recommended contour level, 97% of all backbone atoms, 96% 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 (2) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9590	0.6050
A	0.9640	0.6060
B	0.9690	0.6360
G	0.8810	0.5600
R	0.9570	0.5770

