



## wwPDB EM Validation Summary Report ⓘ

Nov 23, 2022 – 05:59 AM JST

PDB ID : 7FIG  
EMDB ID : EMD-31596  
Title : luteinizing hormone/choriogonadotropin receptor(S277I)-chorionic gonadotropin-Gs complex  
Authors : Duan, J.; Xu, P.; Cheng, X.; Mao, C.; Croll, T.; He, X.; Shi, J.; Luan, X.; Yin, W.; You, E.; Liu, Q.; Zhang, S.; Jiang, H.; Zhang, Y.; Jiang, Y.; Xu, H.E.  
Deposited on : 2021-07-31  
Resolution : 3.90 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](mailto: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:

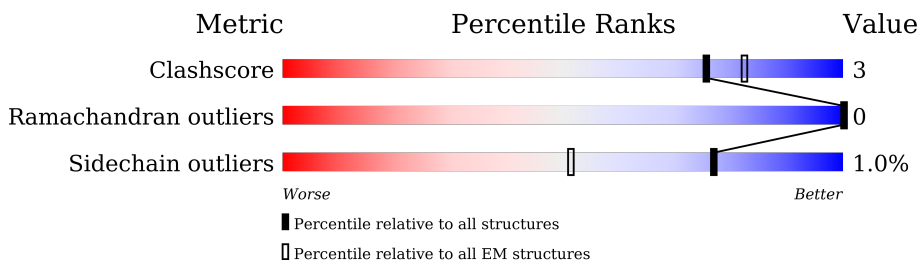
EMDB validation analysis : 0.0.1.dev43  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
MolProbity : 4.02b-467  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.9  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.31.3

# 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 3.90 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	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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  $\geq 3$ , 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	A	361	
2	B	350	
3	G	71	
4	N	134	
5	R	697	
6	X	116	
7	Y	165	

## 2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 12839 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 Engineered guanine nucleotide-binding protein G(s) subunit alpha.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	359	2932	1845	525	549	13	0	0

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	338	2600	1604	467	508	21	0	0

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-9	HIS	-	expression tag	UNP P54311
B	-8	HIS	-	expression tag	UNP P54311
B	-7	HIS	-	expression tag	UNP P54311
B	-6	HIS	-	expression tag	UNP P54311
B	-5	HIS	-	expression tag	UNP P54311
B	-4	HIS	-	expression tag	UNP P54311
B	-3	GLY	-	expression tag	UNP P54311
B	-2	SER	-	expression tag	UNP P54311
B	-1	LEU	-	expression tag	UNP P54311
B	0	LEU	-	expression tag	UNP P54311
B	1	GLN	-	expression tag	UNP P54311

- 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
			Total	C	N	O	S		
3	G	57	436	273	77	83	3	0	0

- Molecule 4 is a protein called Camelid antibody VHH fragment Nb35.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	N	128	973	605	170	192	6	0	0

- Molecule 5 is a protein called Lutropin-choriogonadotropic hormone receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	R	552	4334	2830	701	773	30	0	0

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	11	ASP	-	expression tag	UNP P22888
R	12	TYR	-	expression tag	UNP P22888
R	13	LYS	-	expression tag	UNP P22888
R	14	ASP	-	expression tag	UNP P22888
R	15	ASP	-	expression tag	UNP P22888
R	16	ASP	-	expression tag	UNP P22888
R	17	ASP	-	expression tag	UNP P22888
R	18	VAL	-	expression tag	UNP P22888
R	19	GLU	-	expression tag	UNP P22888
R	20	ASN	-	expression tag	UNP P22888
R	21	LEU	-	expression tag	UNP P22888
R	22	TYR	-	expression tag	UNP P22888
R	23	PHE	-	expression tag	UNP P22888
R	24	GLN	-	expression tag	UNP P22888
R	25	GLY	-	expression tag	UNP P22888
R	26	ALA	-	expression tag	UNP P22888
R	27	SER	-	expression tag	UNP P22888
R	277	ILE	SER	engineered mutation	UNP P22888
R	700	HIS	-	expression tag	UNP P22888
R	701	HIS	-	expression tag	UNP P22888
R	702	HIS	-	expression tag	UNP P22888
R	703	HIS	-	expression tag	UNP P22888
R	704	HIS	-	expression tag	UNP P22888
R	705	HIS	-	expression tag	UNP P22888
R	706	HIS	-	expression tag	UNP P22888
R	707	HIS	-	expression tag	UNP P22888

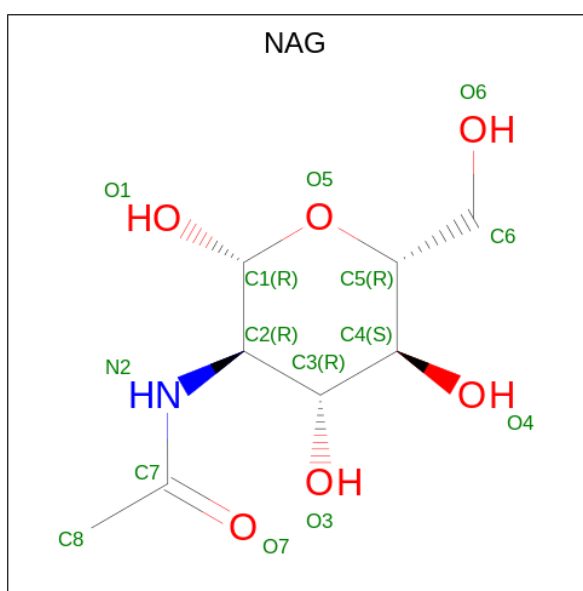
- Molecule 6 is a protein called Glycoprotein hormones alpha chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	X	88	678	420	118	127	13	0	0

- Molecule 7 is a protein called Choriogonadotropin subunit beta 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
7	Y	110	816	505	151	147	13	0	0

- Molecule 8 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula:  $C_8H_{15}NO_6$ ).

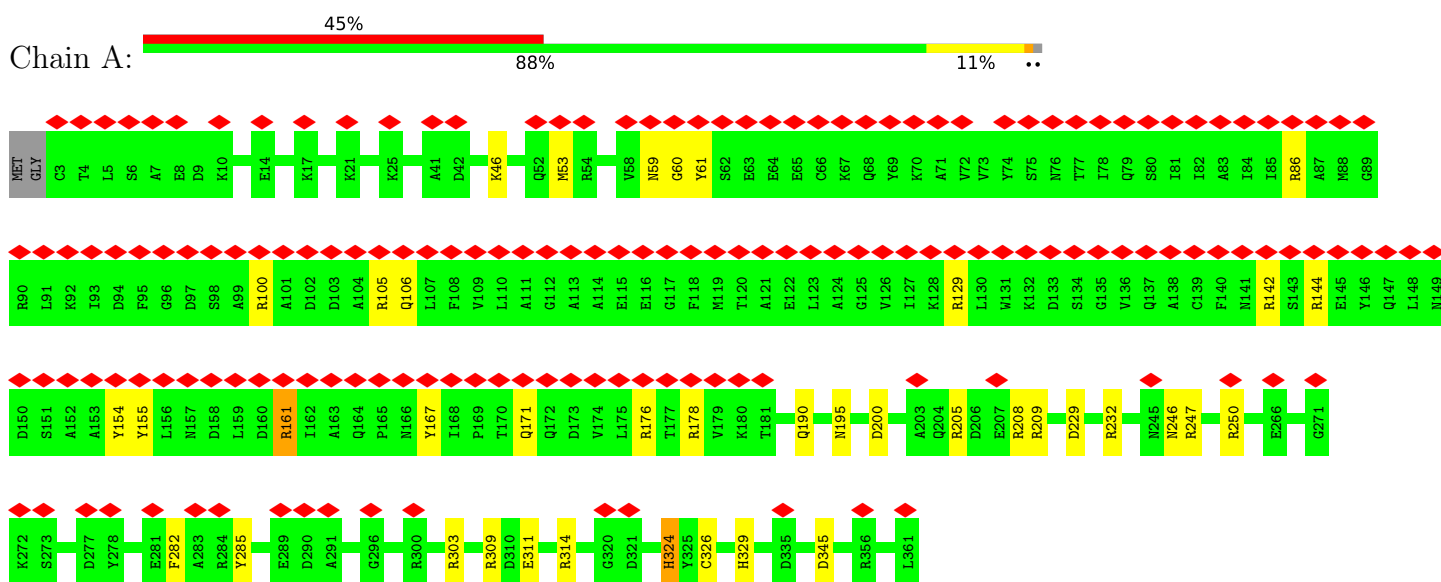


Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
8	R	1	28	16	2	10	0
8	R	1	28	16	2	10	0
8	X	1	28	16	2	10	0
8	X	1	28	16	2	10	0
8	Y	1	14	8	1	5	0

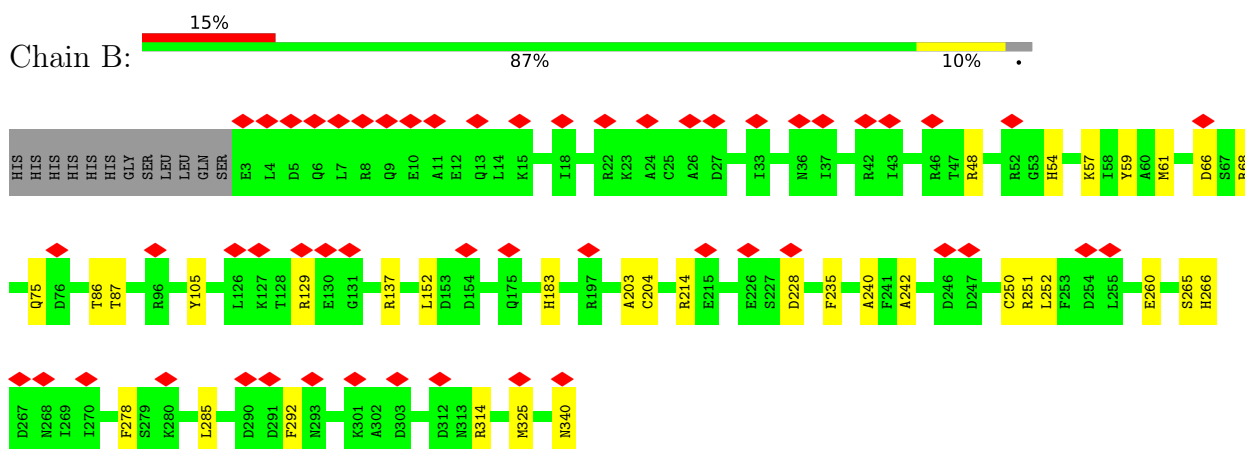
### 3 Residue-property plots

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

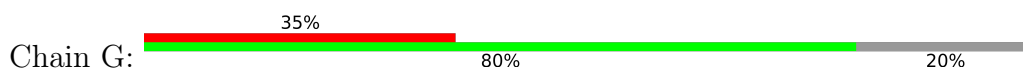
- Molecule 1: Engineered guanine nucleotide-binding protein G(s) subunit alpha

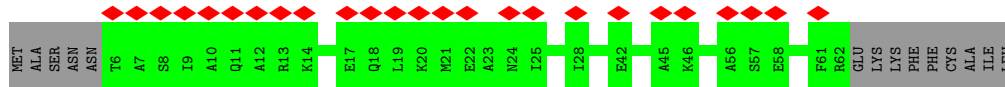


- Molecule 2: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1

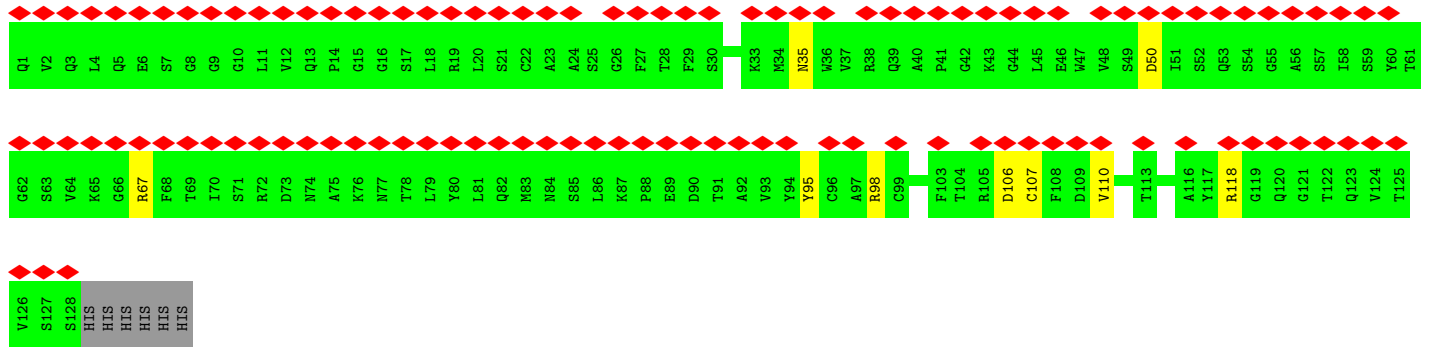
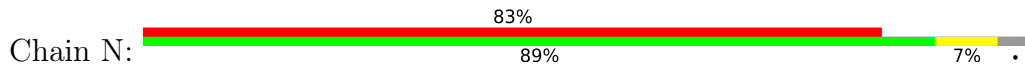


- Molecule 3: Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2

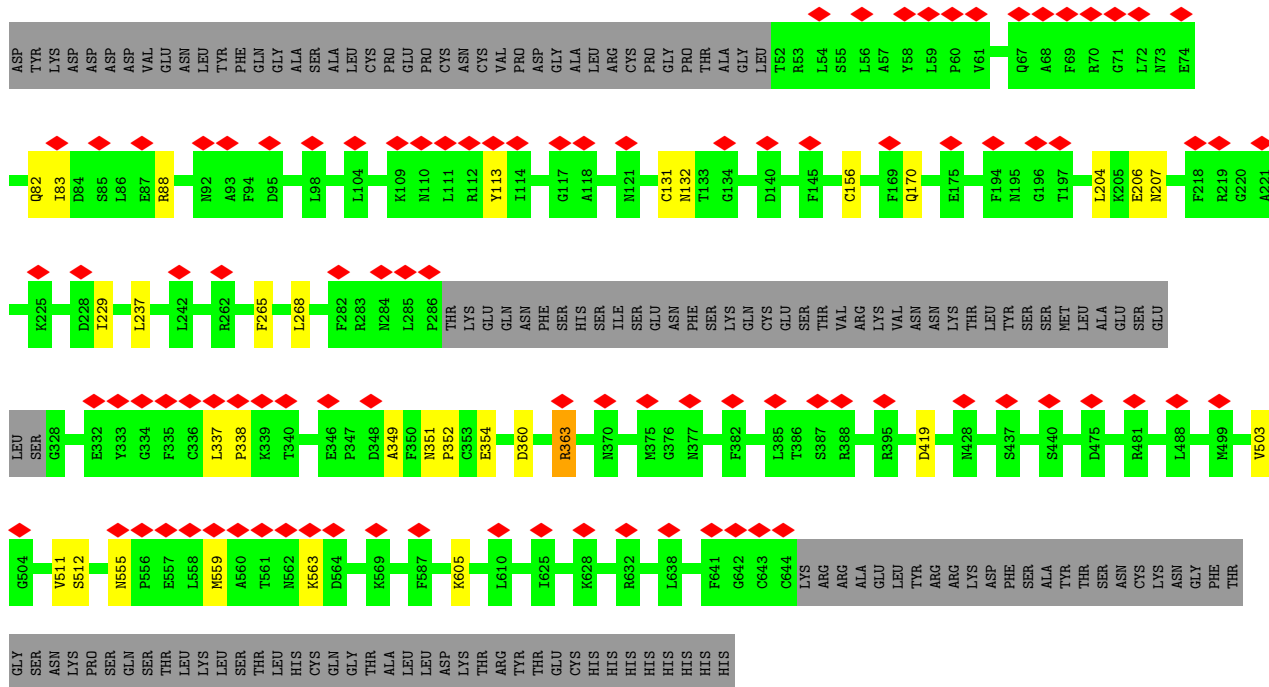
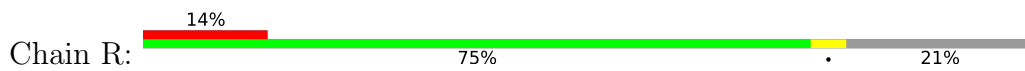




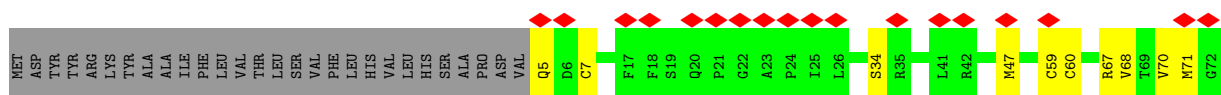
• Molecule 4: Camelid antibody VHH fragment Nb35

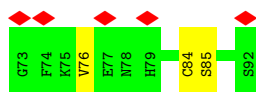


• Molecule 5: Lutropin-choriogonadotropic hormone receptor

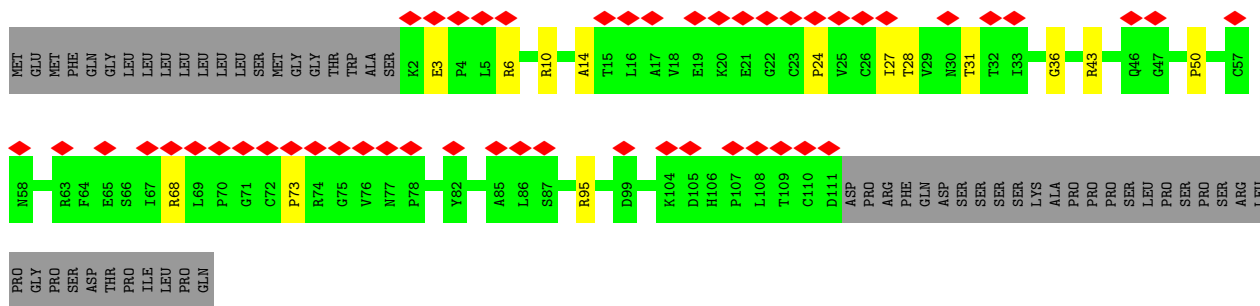


• Molecule 6: Glycoprotein hormones alpha chain





• Molecule 7: Choriogonadotropin subunit beta 3





## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	355345	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	70	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.094	Depositor
Minimum map value	-0.057	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.003	Depositor
Recommended contour level	0.022	Depositor
Map size ( $\text{\AA}$ )	267.52, 267.52, 267.52	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles ( $^\circ$ )	90.0, 90.0, 90.0	wwPDB
Pixel spacing ( $\text{\AA}$ )	1.045, 1.045, 1.045	Depositor

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

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

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	0.56	0/2987	0.91	15/4026 (0.4%)
2	B	0.41	0/2647	0.76	4/3589 (0.1%)
3	G	0.25	0/442	0.47	0/597
4	N	0.64	0/993	1.05	3/1345 (0.2%)
5	R	0.28	0/4431	0.50	0/6021
6	X	0.28	0/694	0.53	0/938
7	Y	0.25	0/832	0.58	0/1138
All	All	0.42	0/13026	0.72	22/17654 (0.1%)

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	A	0	1
2	B	0	1
4	N	0	1
5	R	0	1
6	X	0	1
All	All	0	5

There are no bond length outliers.

The worst 5 of 22 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	N	67	ARG	NE-CZ-NH1	8.56	124.58	120.30
1	A	205	ARG	NE-CZ-NH1	8.48	124.54	120.30
2	B	137	ARG	NE-CZ-NH1	8.35	124.47	120.30
1	A	176	ARG	NE-CZ-NH1	8.14	124.37	120.30

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	129	ARG	NE-CZ-NH1	7.83	124.22	120.30

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	154	TYR	Sidechain
2	B	314	ARG	Sidechain
4	N	95	TYR	Sidechain
5	R	363	ARG	Sidechain
6	X	67	ARG	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	2932	0	2895	23	0
2	B	2600	0	2505	17	0
3	G	436	0	448	0	0
4	N	973	0	938	8	0
5	R	4334	0	4406	20	0
6	X	678	0	645	10	0
7	Y	816	0	816	8	0
8	R	28	0	26	1	0
8	X	28	0	26	0	0
8	Y	14	0	13	2	0
All	All	12839	0	12718	80	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 80 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:A:190:GLN:HG2	1:A:195:ASN:OD1	1.40	1.18

*Continued on next page...*

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:60:GLY:HA2	1:A:171:GLN:NE2	1.61	1.15
1:A:60:GLY:HA2	1:A:171:GLN:HE21	0.90	1.06
1:A:190:GLN:HG3	1:A:195:ASN:HA	1.45	0.97
1:A:60:GLY:CA	1:A:171:GLN:HE21	1.79	0.96

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	357/361 (99%)	343 (96%)	14 (4%)	0	100	100
2	B	336/350 (96%)	317 (94%)	19 (6%)	0	100	100
3	G	55/71 (78%)	55 (100%)	0	0	100	100
4	N	126/134 (94%)	117 (93%)	9 (7%)	0	100	100
5	R	548/697 (79%)	514 (94%)	34 (6%)	0	100	100
6	X	86/116 (74%)	80 (93%)	6 (7%)	0	100	100
7	Y	108/165 (66%)	105 (97%)	3 (3%)	0	100	100
All	All	1616/1894 (85%)	1531 (95%)	85 (5%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	314/315 (100%)	306 (98%)	8 (2%)	47	69
2	B	281/292 (96%)	278 (99%)	3 (1%)	73	84
3	G	46/58 (79%)	46 (100%)	0	100	100
4	N	106/112 (95%)	106 (100%)	0	100	100
5	R	482/621 (78%)	481 (100%)	1 (0%)	93	96
6	X	80/105 (76%)	80 (100%)	0	100	100
7	Y	94/145 (65%)	92 (98%)	2 (2%)	53	73
All	All	1403/1648 (85%)	1389 (99%)	14 (1%)	77	86

5 of 14 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	326	CYS
2	B	54	HIS
7	Y	68	ARG
5	R	563	LYS
7	Y	10	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	171	GLN
5	R	170	GLN
5	R	555	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 monosaccharides in this entry.

## 5.6 Ligand geometry

5 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
8	NAG	Y	1000	7	14,14,15	0.27	0	17,19,21	0.56	0
8	NAG	R	2001	5	14,14,15	0.23	0	17,19,21	0.45	0
8	NAG	R	2000	5	14,14,15	0.20	0	17,19,21	0.59	0
8	NAG	X	101	6	14,14,15	0.41	0	17,19,21	1.00	1 (5%)
8	NAG	X	102	6	14,14,15	0.16	0	17,19,21	0.64	1 (5%)

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
8	NAG	Y	1000	7	-	4/6/23/26	0/1/1/1
8	NAG	R	2001	5	-	1/6/23/26	0/1/1/1
8	NAG	R	2000	5	-	1/6/23/26	0/1/1/1
8	NAG	X	101	6	-	2/6/23/26	0/1/1/1
8	NAG	X	102	6	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	X	101	NAG	C1-O5-C5	3.96	117.56	112.19
8	X	102	NAG	C1-O5-C5	2.16	115.11	112.19

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	Y	1000	NAG	C1-C2-N2-C7
8	Y	1000	NAG	O5-C5-C6-O6
8	Y	1000	NAG	C4-C5-C6-O6
8	X	102	NAG	O5-C5-C6-O6
8	X	102	NAG	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	Y	1000	NAG	2	0
8	R	2001	NAG	1	0

## 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.

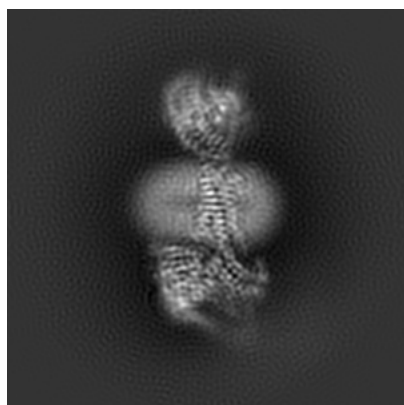
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-31596. These allow visual inspection of the internal detail of the map and identification of artifacts.

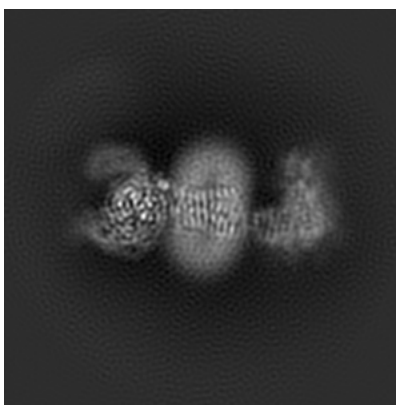
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

### 6.1 Orthogonal projections [i](#)

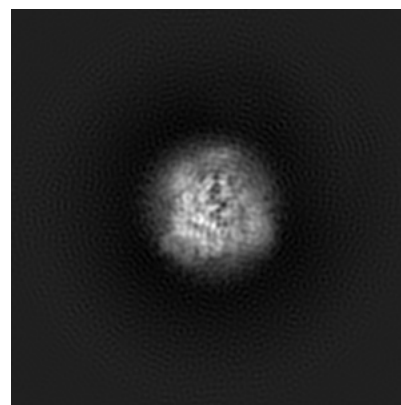
#### 6.1.1 Primary map



X



Y

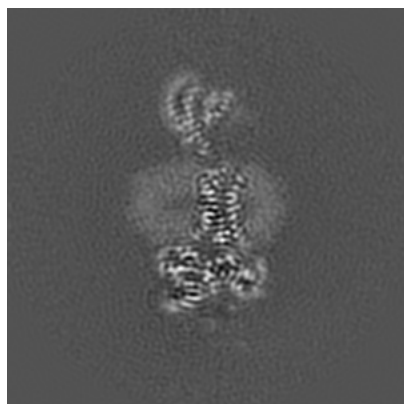


Z

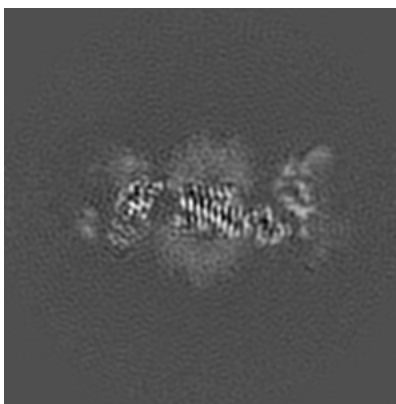
The images above show the map projected in three orthogonal directions.

### 6.2 Central slices [i](#)

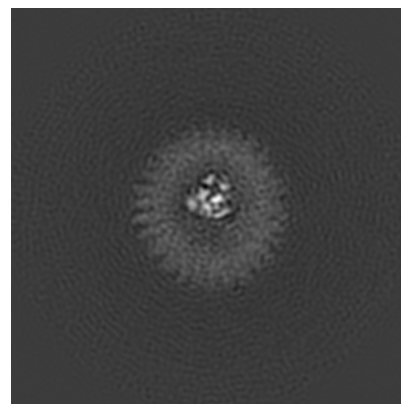
#### 6.2.1 Primary map



X Index: 128



Y Index: 128



Z Index: 128



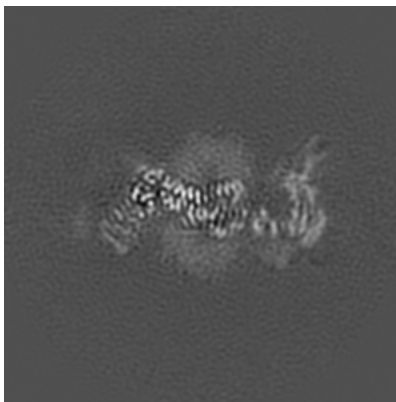
The images above show central slices of the map in three orthogonal directions.

## 6.3 Largest variance slices [i](#)

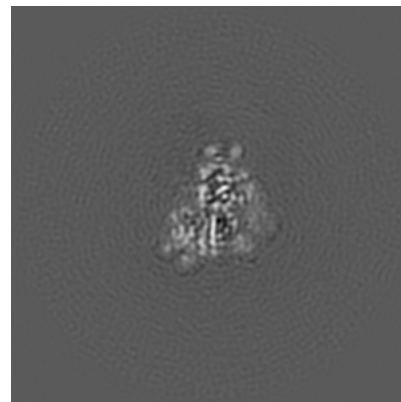
### 6.3.1 Primary map



X Index: 124



Y Index: 136



Z Index: 88

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

## 6.4 Orthogonal surface views [i](#)

### 6.4.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.022. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

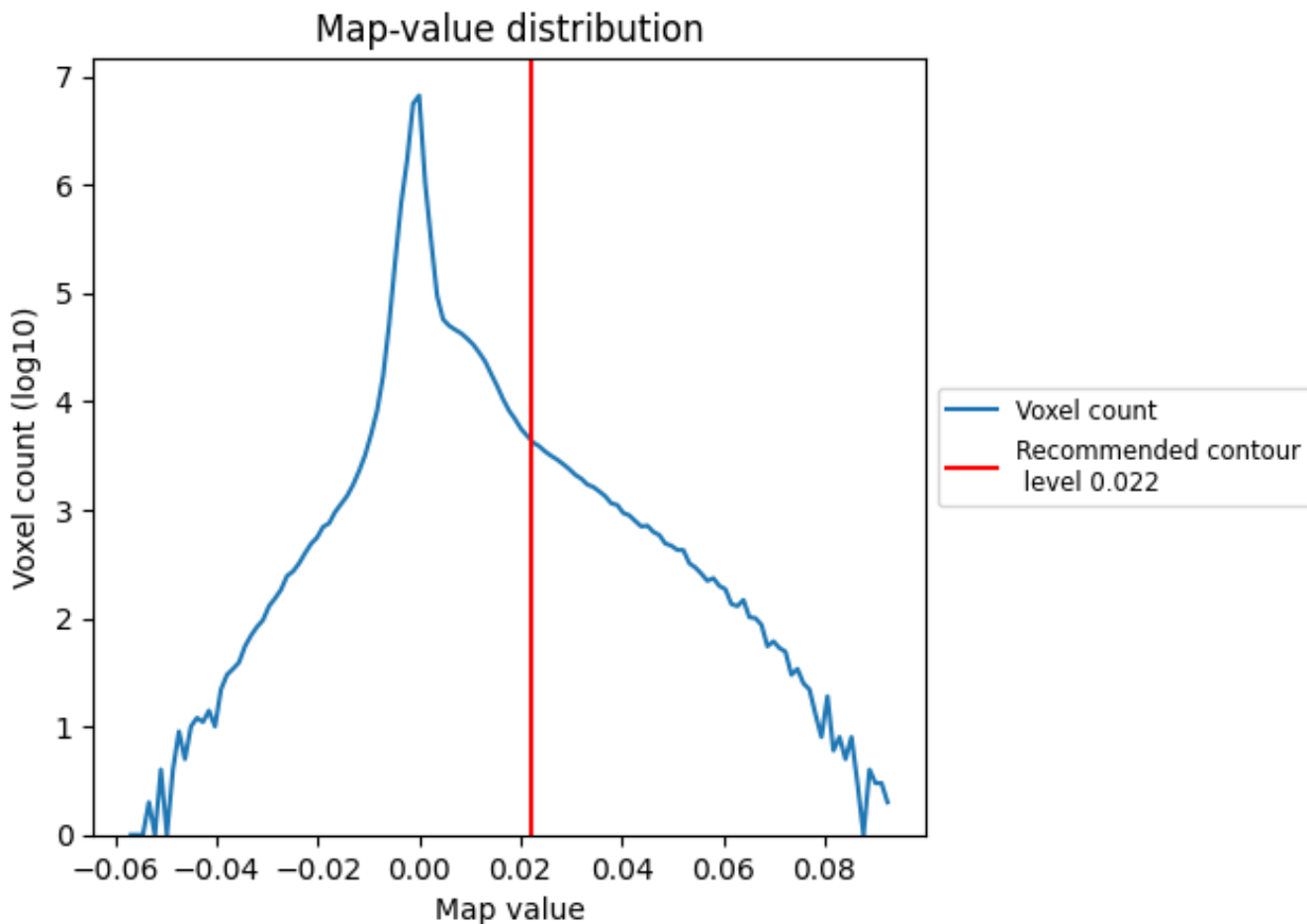
## 6.5 Mask visualisation

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

## 7 Map analysis [i](#)

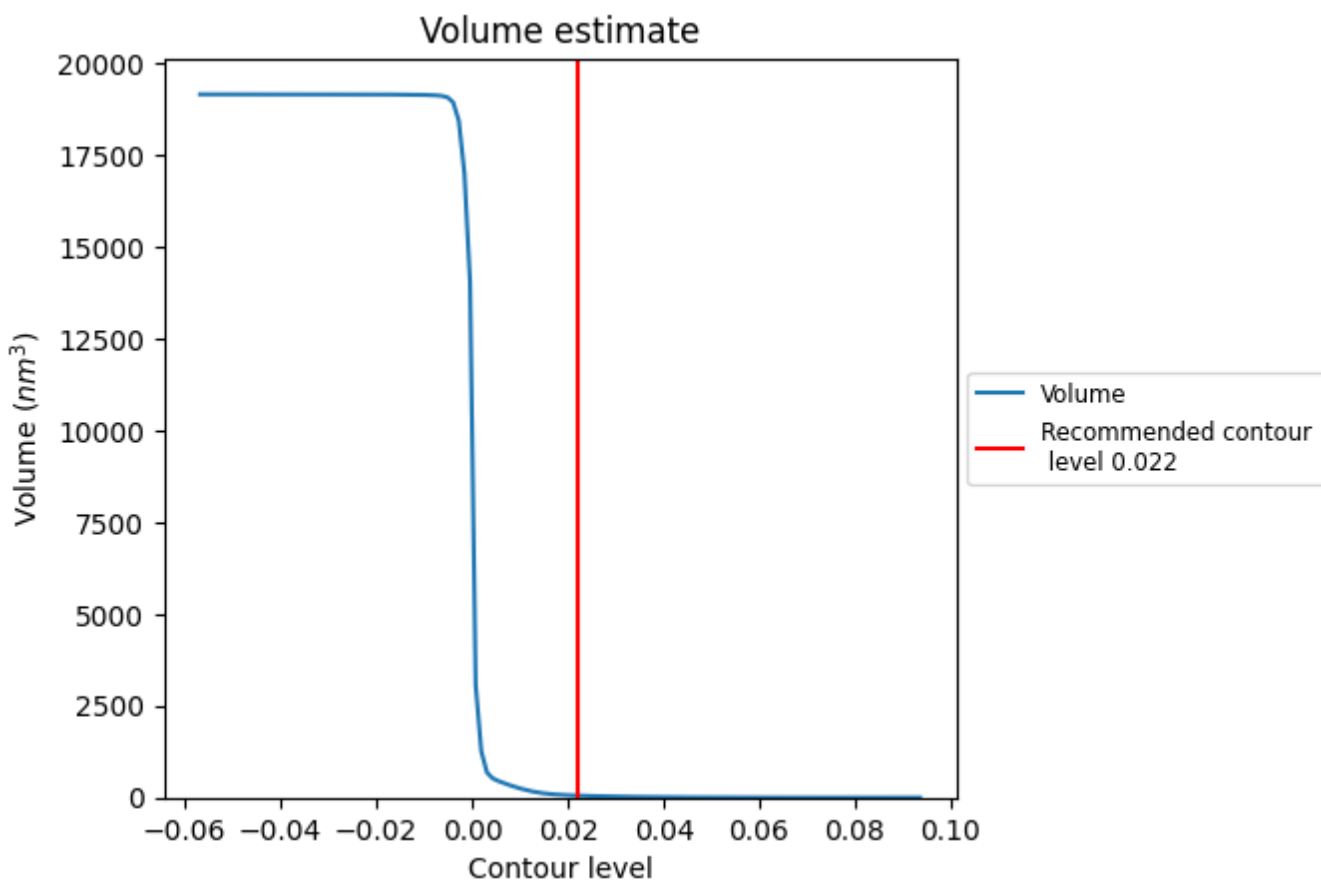
This section contains the results of statistical analysis of the map.

### 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.

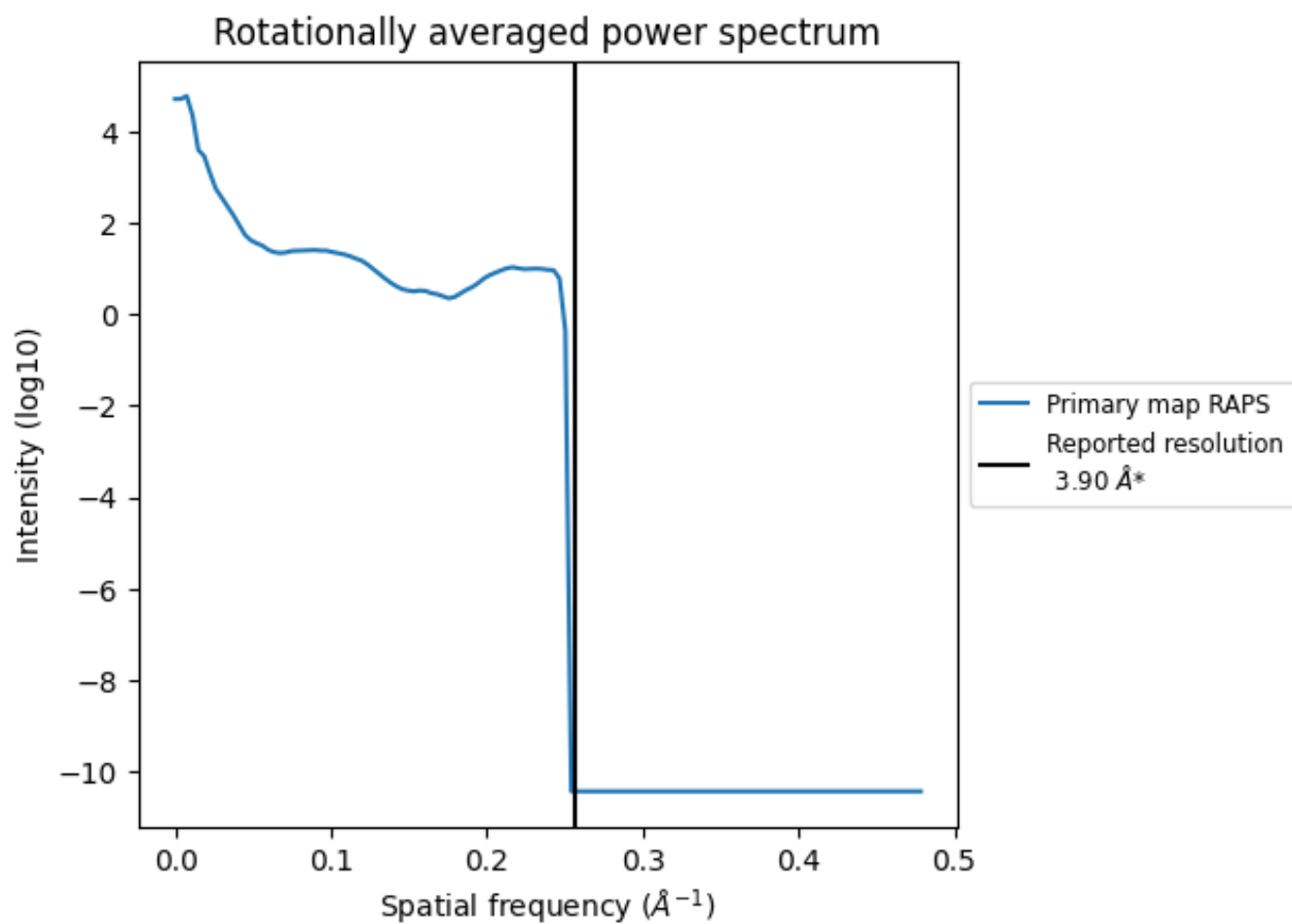
## 7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is  $54 \text{ nm}^3$ ; this corresponds to an approximate mass of 48 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 0.256 Å<sup>-1</sup>

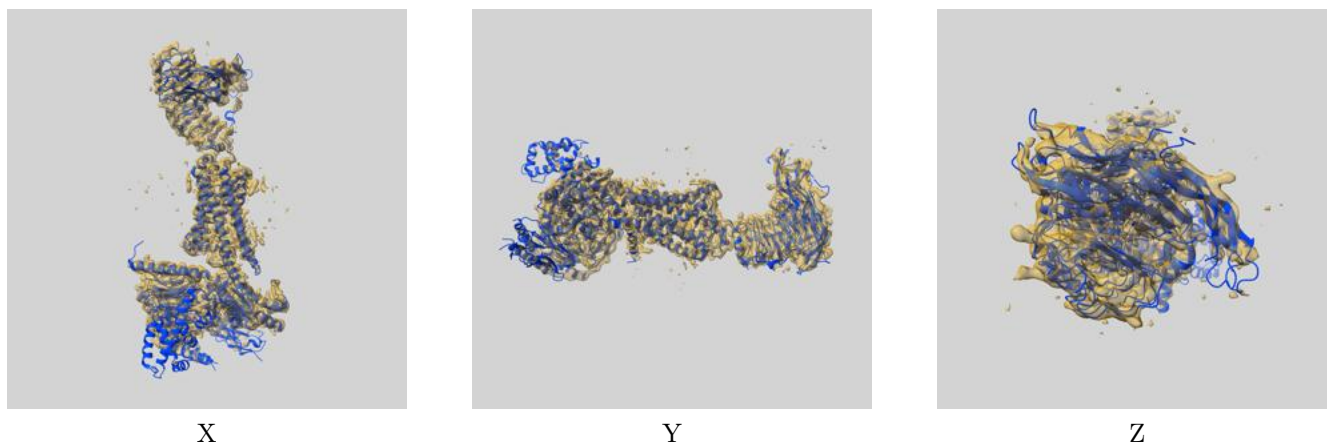
## 8 Fourier-Shell correlation

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

## 9 Map-model fit [i](#)

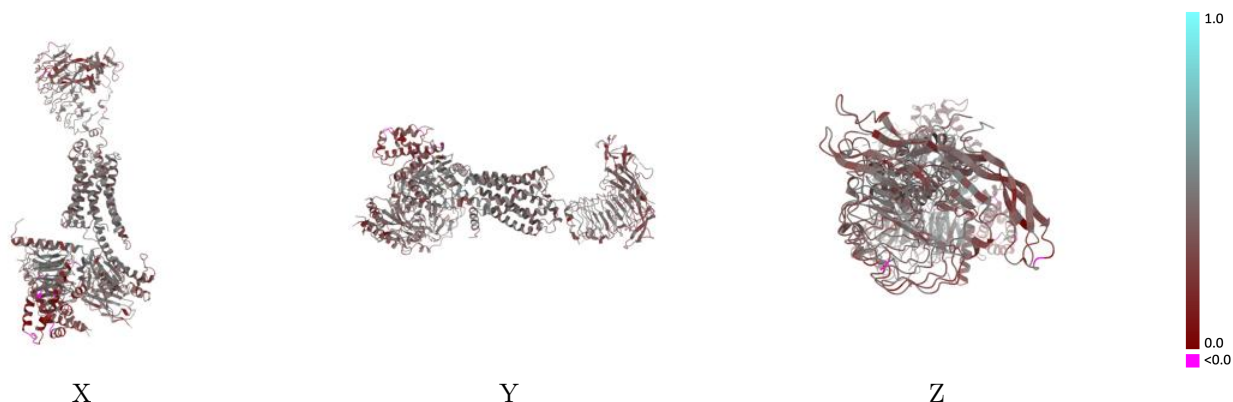
This section contains information regarding the fit between EMDB map EMD-31596 and PDB model 7FIG. Per-residue inclusion information can be found in section 3 on page 6.

### 9.1 Map-model overlay [i](#)



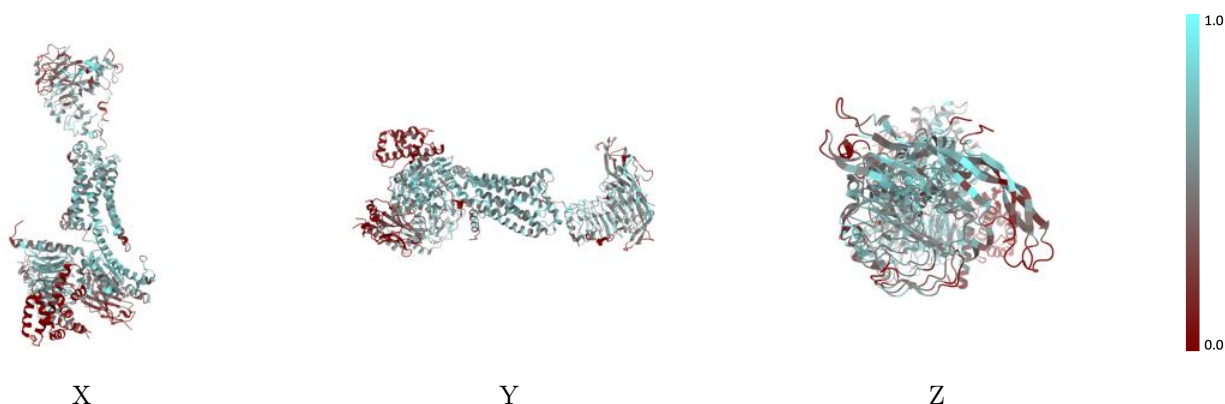
The images above show the 3D surface view of the map at the recommended contour level 0.022 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



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

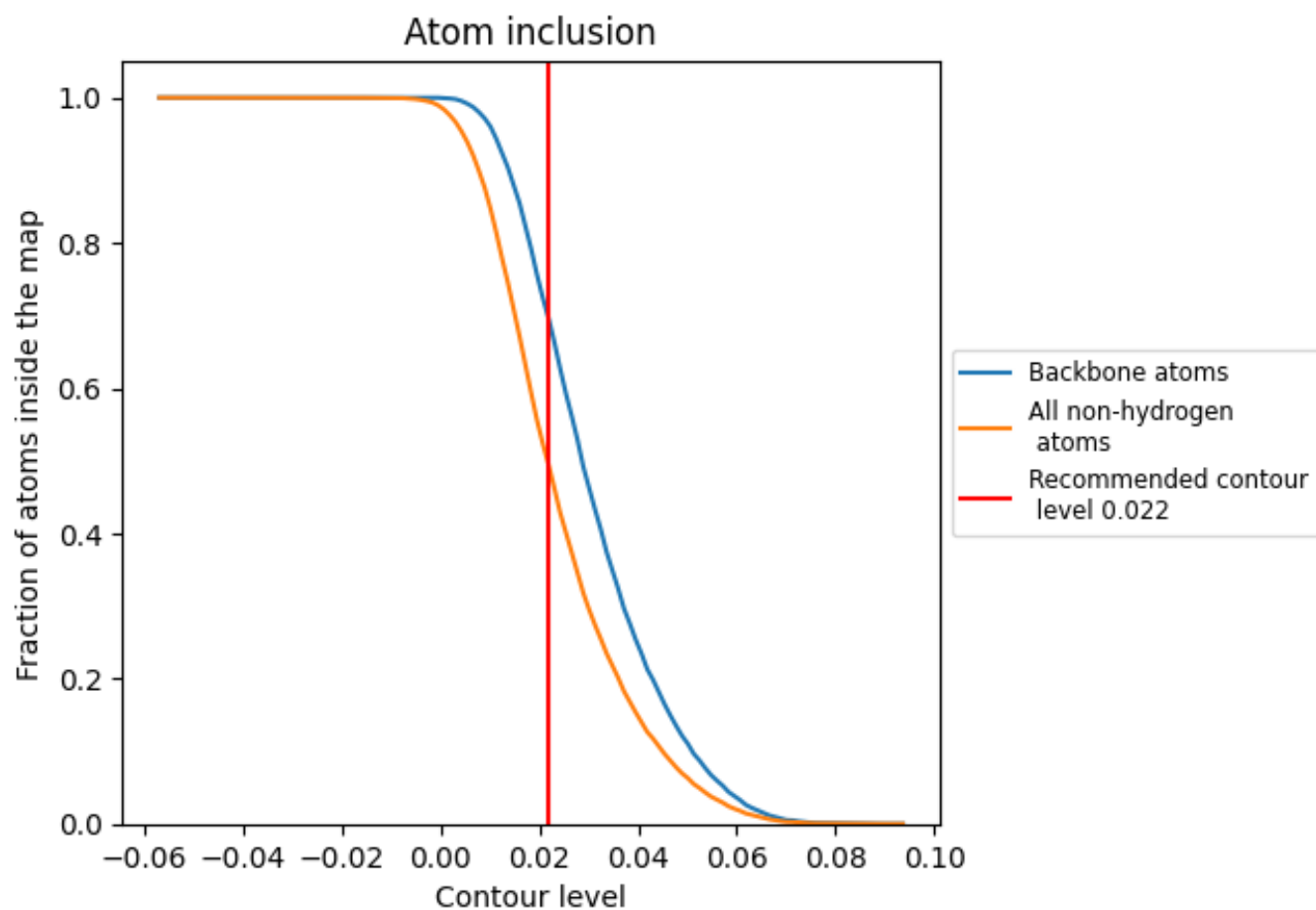
## 9.3 Atom inclusion mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.022).



















## 9.4 Atom inclusion [i](#)



At the recommended contour level, 69% of all backbone atoms, 49% 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 (0.022) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.4924	 0.3770
A	 0.4182	 0.3320
B	 0.6024	 0.4140
G	 0.4149	 0.3320
N	 0.1821	 0.3630
R	 0.5649	 0.4050
X	 0.4986	 0.3530
Y	 0.4226	 0.3440

