



## wwPDB EM Validation Summary Report ⓘ

Mar 23, 2026 – 05:01 AM UTC

PDB ID : 4BGN / pdb\_00004bgn  
EMDB ID : EMD-2347  
Title : cryo-EM structure of the NavCt voltage-gated sodium channel  
Authors : Tsai, C.J.; Tani, K.; Irie, K.; Hiroaki, Y.; Shimomura, T.; Mcmillan, D.G.;  
Cook, G.M.; Schertler, G.; Fujiyoshi, Y.; Li, X.D.  
Deposited on : 2013-03-28  
Resolution : 9.00 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.dev132  
MolProbity : 4-5-2 with Phenix2.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

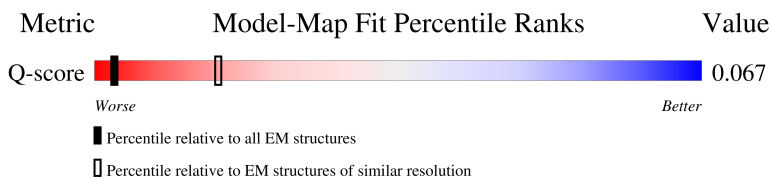
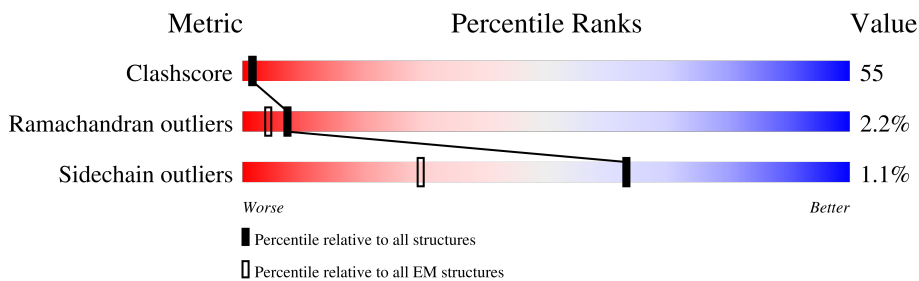
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON CRYSTALLOGRAPHY*

The reported resolution of this entry is 9.00 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	257 ( 8.50 - 9.50 )

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	298	<p>66% (Upper red bar)            21% (Green)            48% (Yellow)            28% (Grey)</p>
1	B	298	<p>24% (Green)            47% (Yellow)            29% (Grey)</p>

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 3464 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 VOLTAGE-GATED SODIUM CHANNEL.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	214	Total	C	N	O	S	0	1
			1742	1177	276	282	7		
1	B	212	Total	C	N	O	S	0	1
			1722	1162	269	284	7		



F188	Q189	V190	V191	T192	L193	E194	S195	W196	A197	S198	G199	I200	M201	R202	P203	I204	M205	A206	E207	V208	F209	W210	S211	W212	I213	Y214	F215	V216	A217	F218	I219	L220	V221	G222	T223	F224	V225	I226	F227	N228	L229	F230	V231	G232	V233	I234	V235	N236	N237	V238	E239	R240	A241	E242	T243	E244	D245	A246	E247
Q248	E249	E250	G251	Q252	ARG	GLU	GLU	ARG	GLN	GLY	LEU	PHE	GLU	GLY	ASP	GLY	SER	SER	VAL	SER	ALA	GLU	GLU	ILE	ALA	LYS	LEU	ARG	GLN	GLU	ILE	LYS	GLU	LEU	ARG	GLN	LEU	LEU	LYS	GLU	LEU	LYS	ASP	HIS	HIS	SER	SER	GLN	SER	SER	THR								

## 4 Experimental information

Property	Value	Source
EM reconstruction method	CRYSTALLOGRAPHY	Depositor
Imposed symmetry	2D CRYSTAL, $a$ =Not provided Å, $b$ =Not provided Å, $c$ =Not provided Å, $\gamma$ =Not provided°, space group=Not provided	Depositor
Number of images used	Not provided	
Resolution determination method	OTHER	Depositor
CTF correction method	Not provided	
Microscope	JEOL KYOTO-3000SFF	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{Å}^2$ )	20	Depositor
Minimum defocus (nm)	910	Depositor
Maximum defocus (nm)	3820	Depositor
Magnification	40000	Depositor
Image detector	KODAK SO-163 FILM	Depositor
Maximum map value	6.820	Depositor
Minimum map value	-5.027	Depositor
Average map value	0.003	Depositor
Map value standard deviation	0.993	Depositor
Recommended contour level	1.3	Depositor
Map size (Å)	115.0, 115.0, 180.0	wwPDB
Map dimensions	55, 55, 81	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	2.090909, 2.090909, 2.222223	Depositor

## 5 Model quality [i](#)

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

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	0.35	1/1790 (0.1%)	0.90	6/2439 (0.2%)
1	B	0.36	1/1770 (0.1%)	0.95	9/2412 (0.4%)
All	All	0.35	2/3560 (0.1%)	0.92	15/4851 (0.3%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	251	GLY	C-N	-5.71	1.25	1.33
1	A	247	GLU	C-N	-5.67	1.25	1.33

The worst 5 of 15 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	82	ARG	CA-C-N	-9.30	110.20	119.78
1	B	82	ARG	C-N-CA	-9.30	110.20	119.78
1	A	82	ARG	CA-C-N	-9.18	110.33	119.78
1	A	82	ARG	C-N-CA	-9.18	110.33	119.78
1	B	201	MET	N-CA-C	6.74	118.28	111.07

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1742	0	1793	195	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1722	0	1754	190	0
All	All	3464	0	3547	385	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 55.

The worst 5 of 385 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:B:52:TYR:O	1:B:56:GLN:HB3	1.60	0.99
1:A:147:LEU:HD22	1:A:229:LEU:HD11	1.41	0.97
1:A:52:TYR:O	1:A:56:GLN:HB3	1.62	0.96
1:A:78:LEU:HG	1:A:84:ARG:HG3	1.46	0.95
1:B:53:GLN:HB3	1:B:54:PRO:HD3	1.50	0.94

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	210/298 (70%)	195 (93%)	11 (5%)	4 (2%)	6	32
1	B	208/298 (70%)	195 (94%)	8 (4%)	5 (2%)	4	27
All	All	418/596 (70%)	390 (93%)	19 (4%)	9 (2%)	7	29

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	82	ARG
1	B	82	ARG
1	A	54	PRO

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	B	54	PRO
1	B	132	SER

### 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	188/265 (71%)	186 (99%)	2 (1%)	65	76
1	B	185/265 (70%)	183 (99%)	2 (1%)	65	76
All	All	373/530 (70%)	369 (99%)	4 (1%)	63	76

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

Mol	Chain	Res	Type
1	A	151	MET
1	A	193	LEU
1	B	151	MET
1	B	193	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	237	ASN
1	B	149	ASN
1	B	56	GLN
1	A	237	ASN
1	B	93	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](#)

There are no ligands in this entry.

## 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.

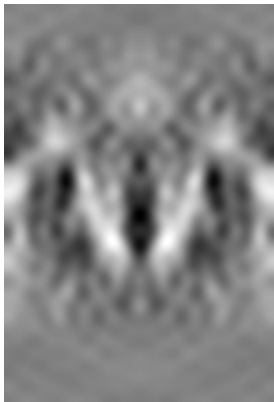
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-2347. These allow visual inspection of the internal detail of the map and identification of artifacts.

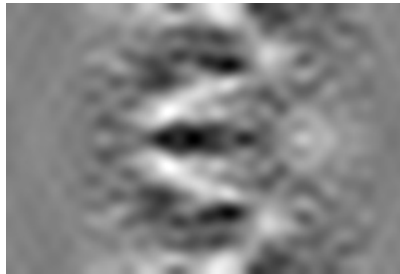
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

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

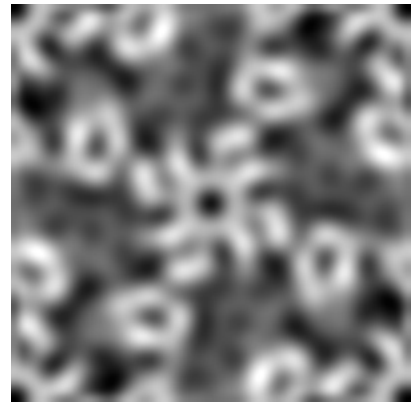
#### 6.1.1 Primary map



X



Y



Z

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

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

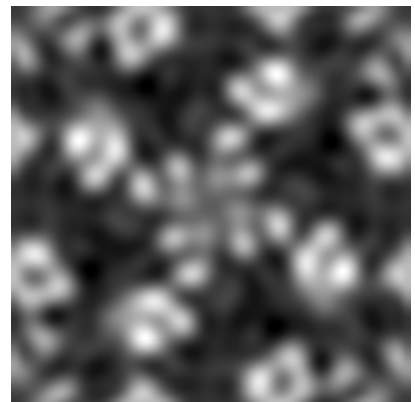
#### 6.2.1 Primary map



X Index: 27



Y Index: 27

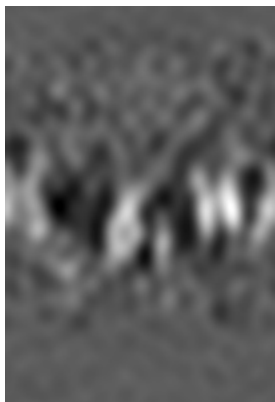


Z Index: 40

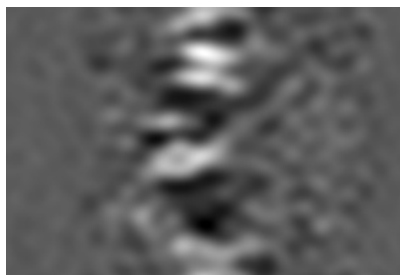
The images above show central slices of the map in three orthogonal directions.

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

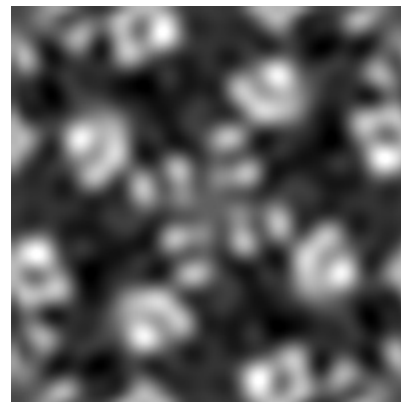
### 6.3.1 Primary map



X Index: 36



Y Index: 18

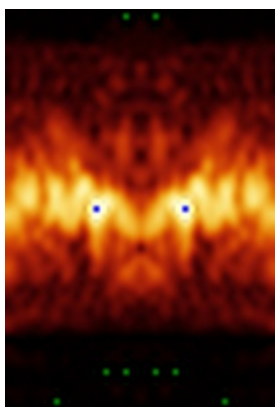


Z Index: 41

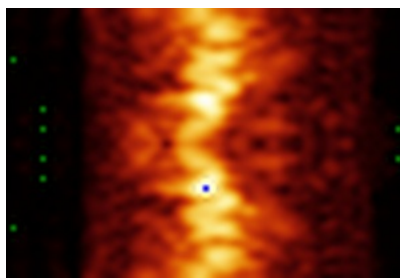
The images above show the largest variance slices of the map in three orthogonal directions.

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

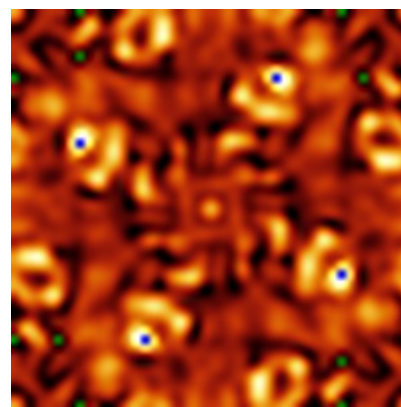
### 6.4.1 Primary map



X



Y

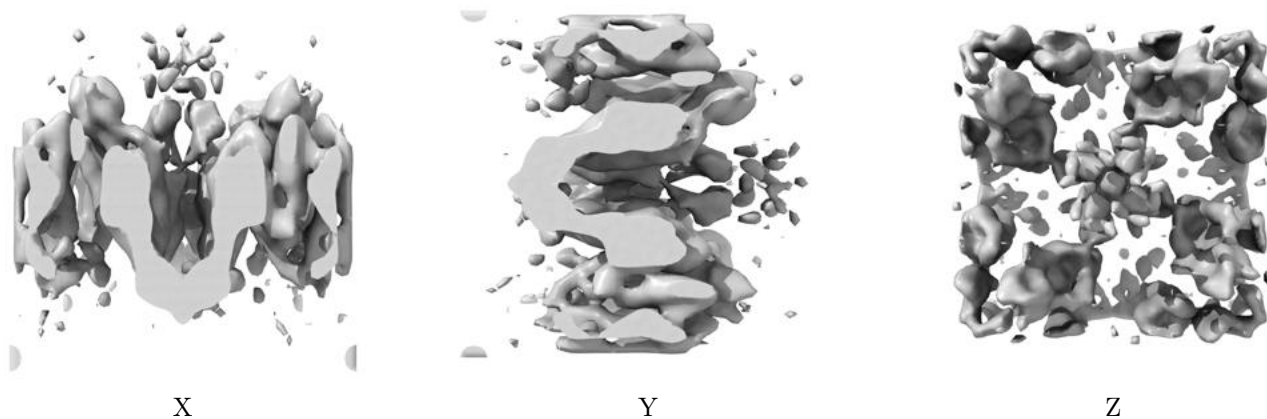


Z

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 1.3. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

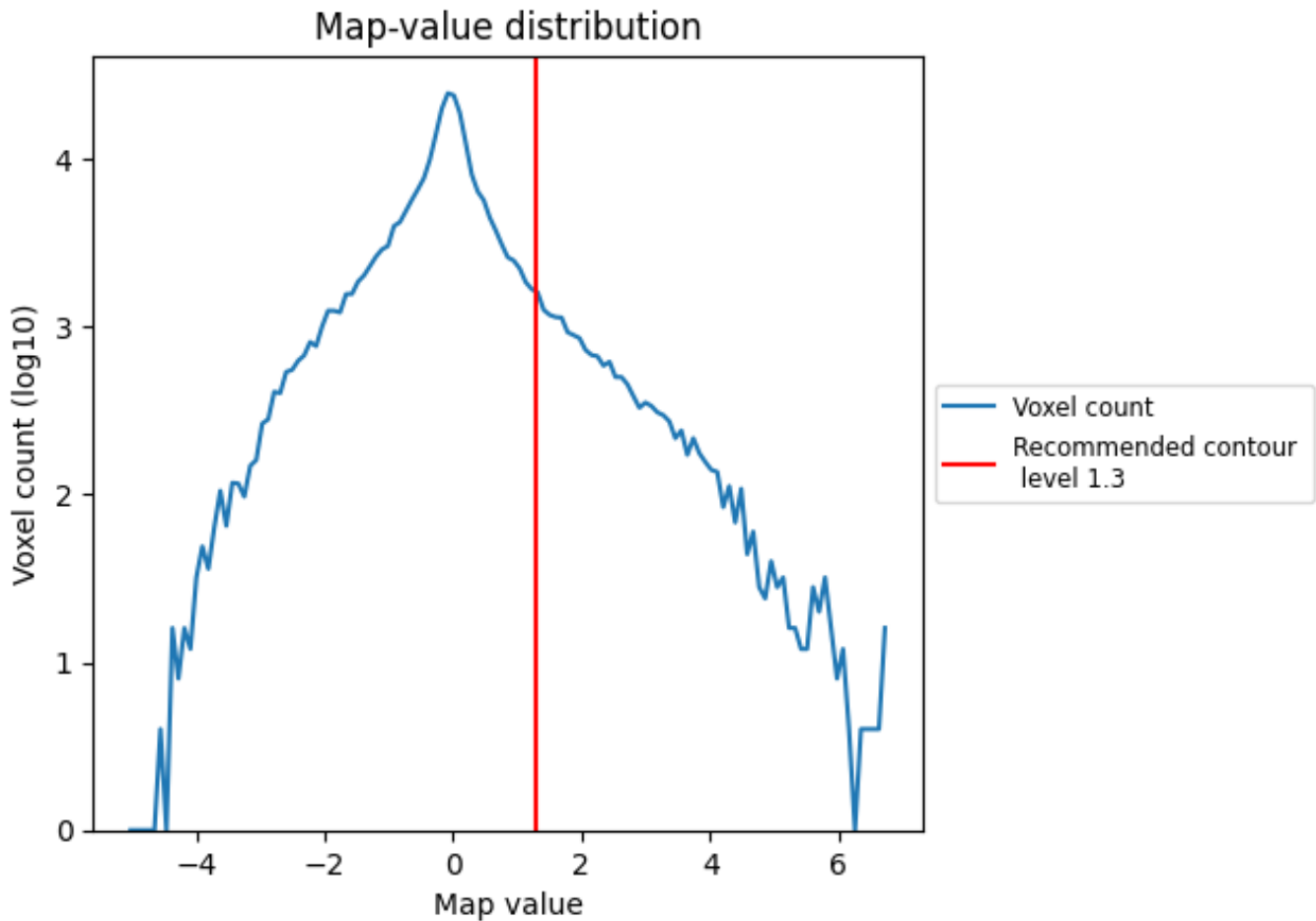
## 6.6 Mask visualisation [i](#)

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

## 7 Map analysis [i](#)

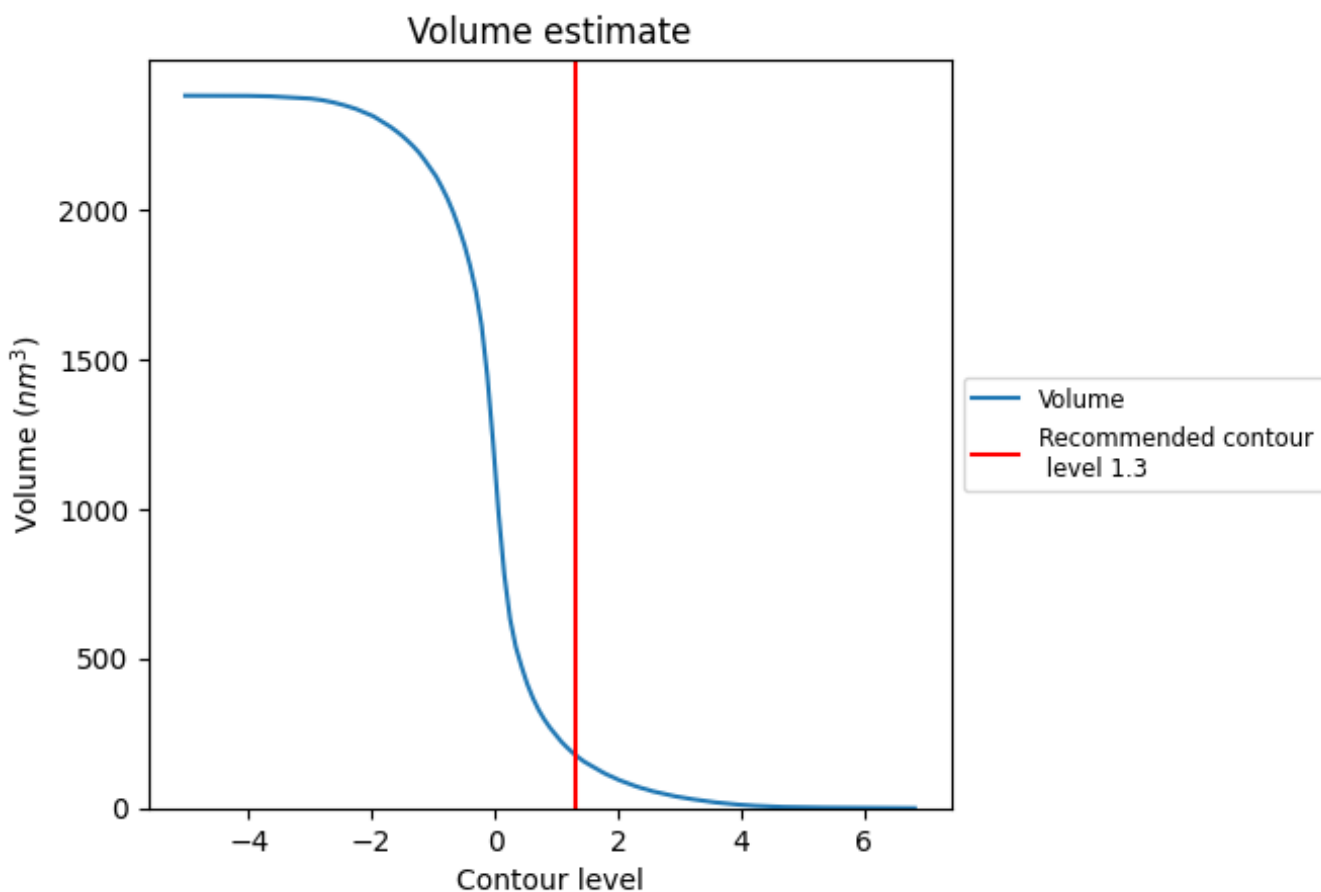
This section contains the results of statistical analysis of the map.

### 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 179 nm<sup>3</sup>; this corresponds to an approximate mass of 162 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](#)

This section was not generated. The rotationally averaged power spectrum is only generated for cubic maps.

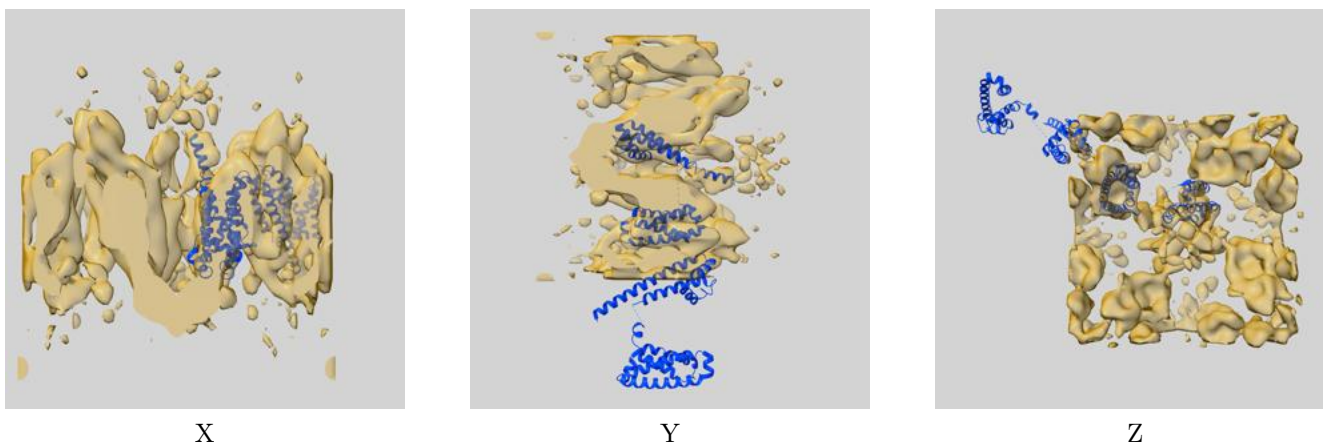
## 8 Fourier-Shell correlation

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

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

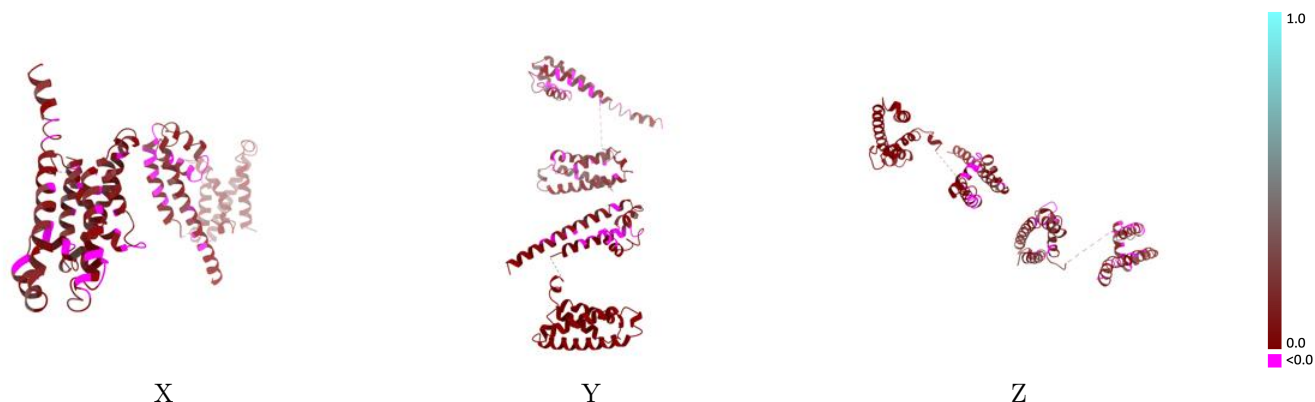
This section contains information regarding the fit between EMDB map EMD-2347 and PDB model 4BGN. Per-residue inclusion information can be found in section [3](#) on page [4](#).

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



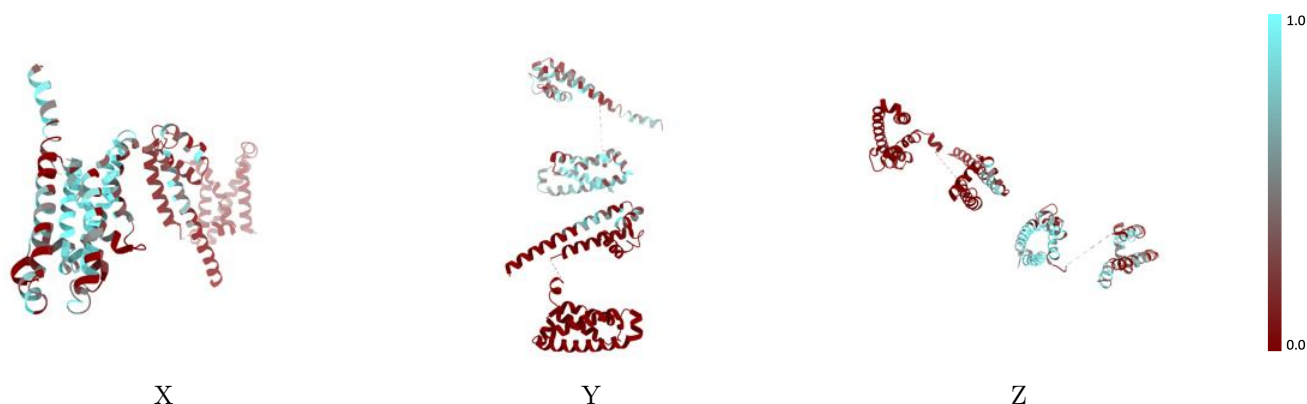
The images above show the 3D surface view of the map at the recommended contour level 1.3 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



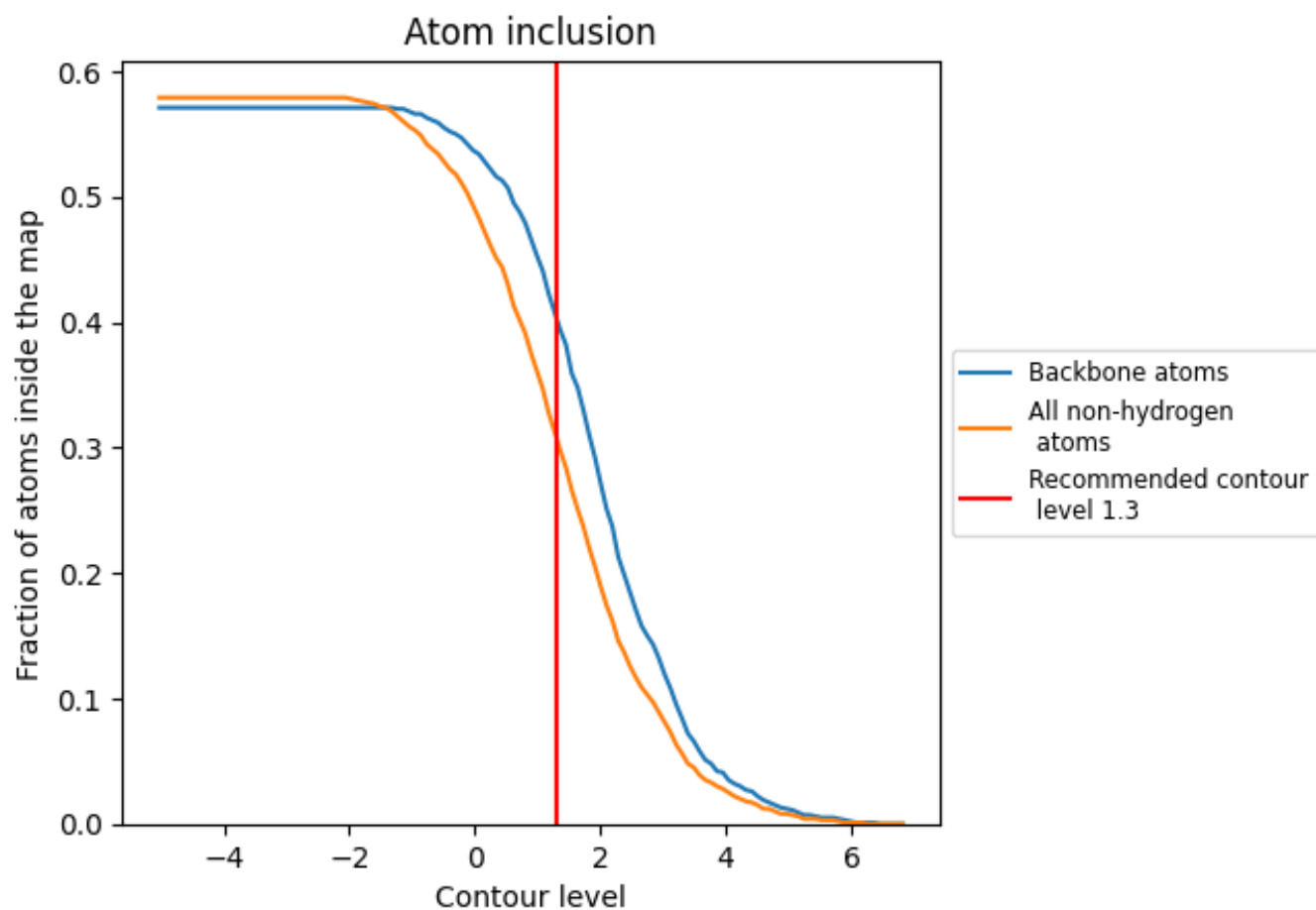
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (1.3).







## 9.4 Atom inclusion [i](#)



At the recommended contour level, 40% of all backbone atoms, 31% of all non-hydrogen atoms, are inside the map.

## 9.5 Map-model fit summary [i](#)

The table lists the average atom inclusion at the recommended contour level (1.3) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.3080	 0.0670
A	 0.0680	 0.0180
B	 0.5500	 0.1160

