



wwPDB EM Validation Summary Report ⓘ

Mar 9, 2026 – 12:50 AM UTC

PDB ID : 8C8R / pdb_00008c8r
EMDB ID : EMD-16492
Title : In situ structure of the Nitrosopumilus maritimus S-layer - Composite map between C2 and C6
Authors : von Kuegelgen, A.; Bharat, T.
Deposited on : 2023-01-20
Resolution : 3.50 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
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

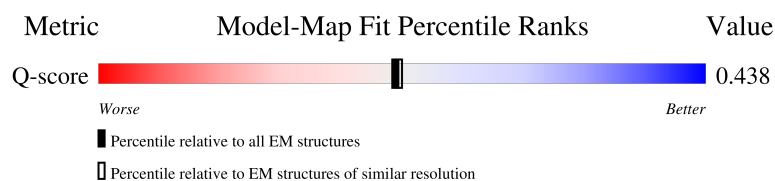
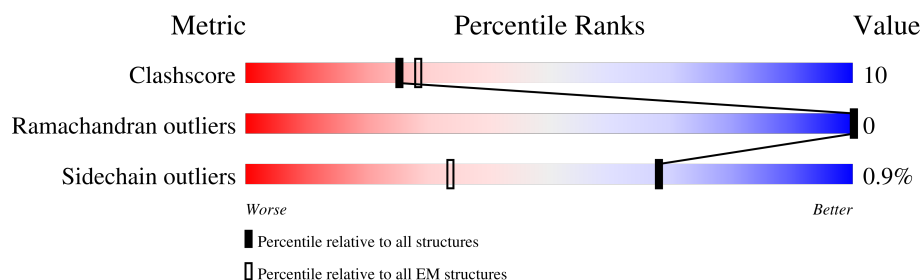
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.50 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	13950 (3.00 - 4.00)

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	A	1734	7% 66% 18% 16%
1	B	1734	7% 67% 17% 16%
1	C	1734	7% 66% 18% 16%
1	D	1734	7% 67% 17% 16%

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Mol	Chain	Length	Quality of chain
1	E	1734	 7% 67% 17% 16%
1	F	1734	 7% 66% 18% 16%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 65154 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.

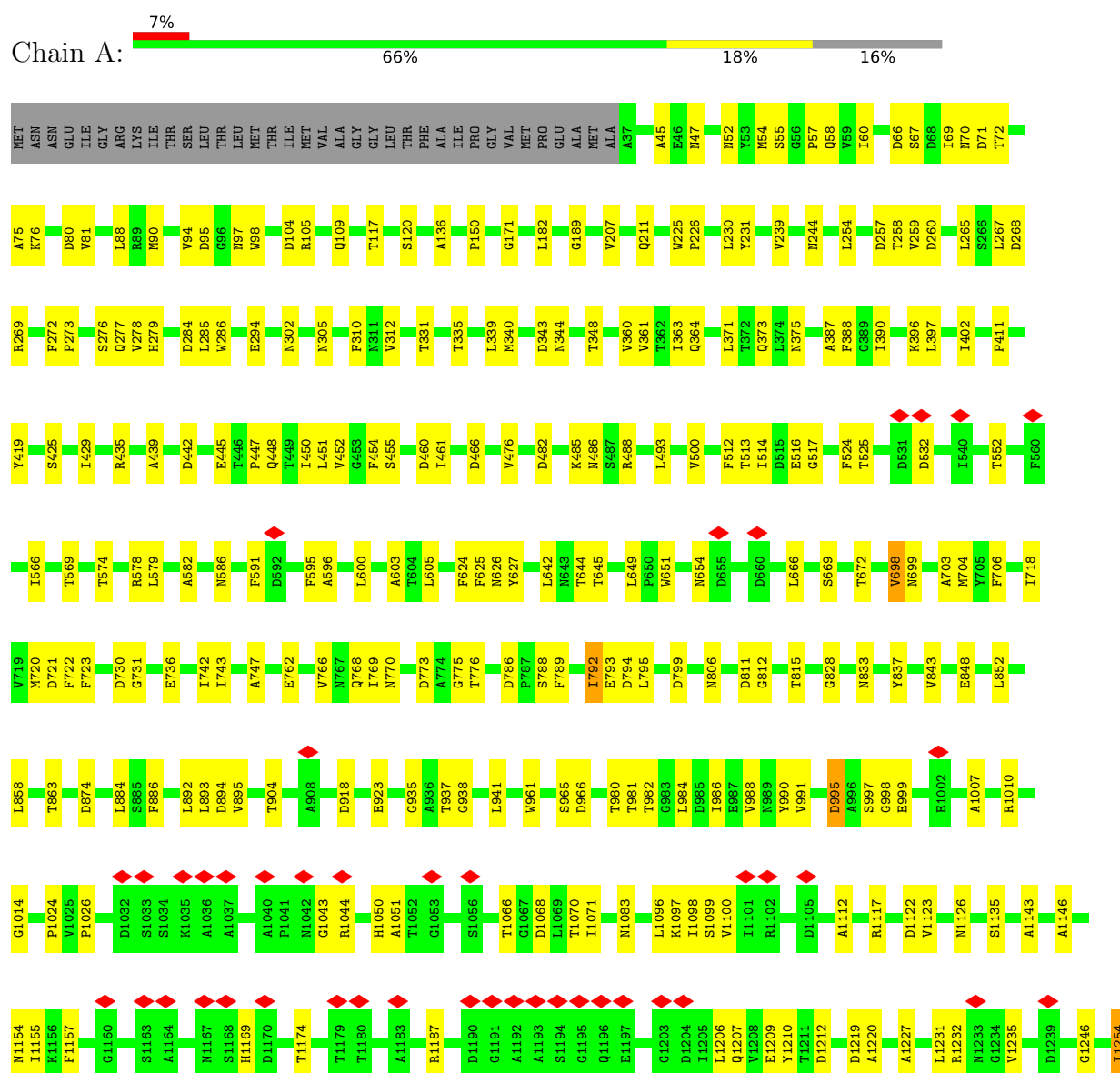
- Molecule 1 is a protein called Cell surface protein.

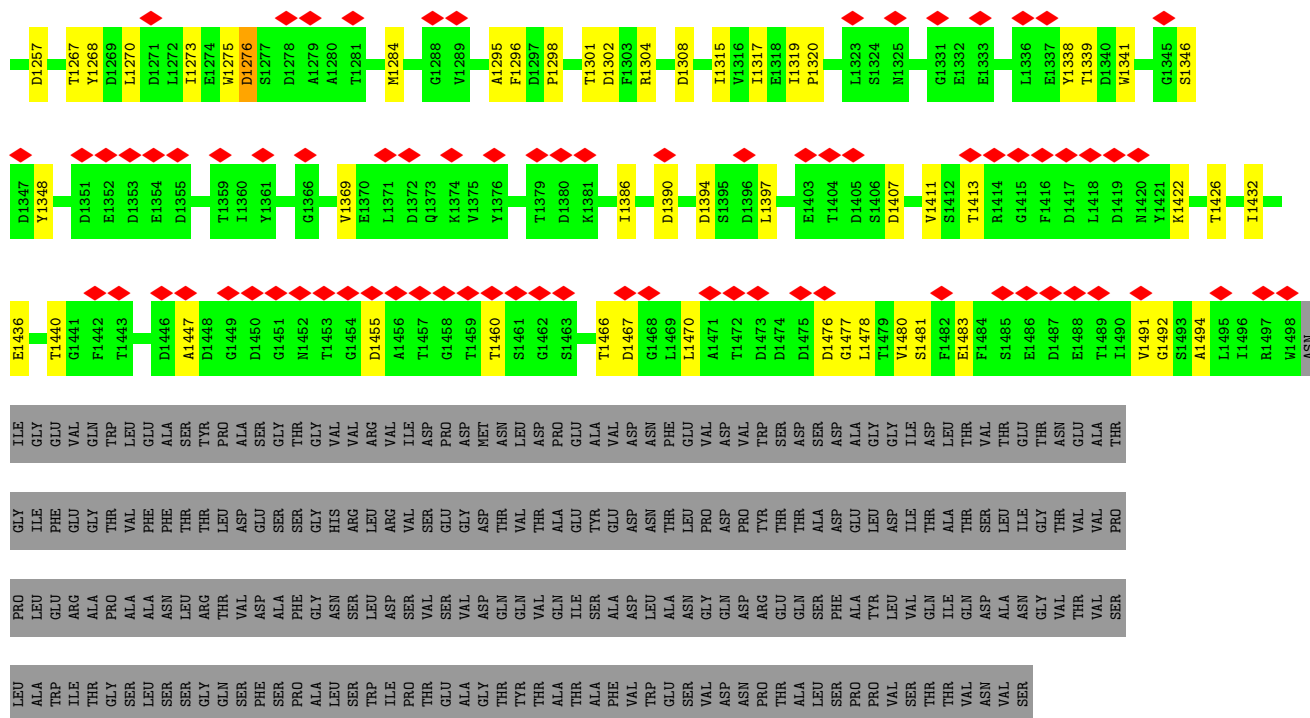
Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1462	Total 10859	C 6683	N 1751	O 2407	S 18	0	0
1	B	1462	Total 10859	C 6683	N 1751	O 2407	S 18	0	0
1	C	1462	Total 10859	C 6683	N 1751	O 2407	S 18	0	0
1	D	1462	Total 10859	C 6683	N 1751	O 2407	S 18	0	0
1	E	1462	Total 10859	C 6683	N 1751	O 2407	S 18	0	0
1	F	1462	Total 10859	C 6683	N 1751	O 2407	S 18	0	0

3 Residue-property plots

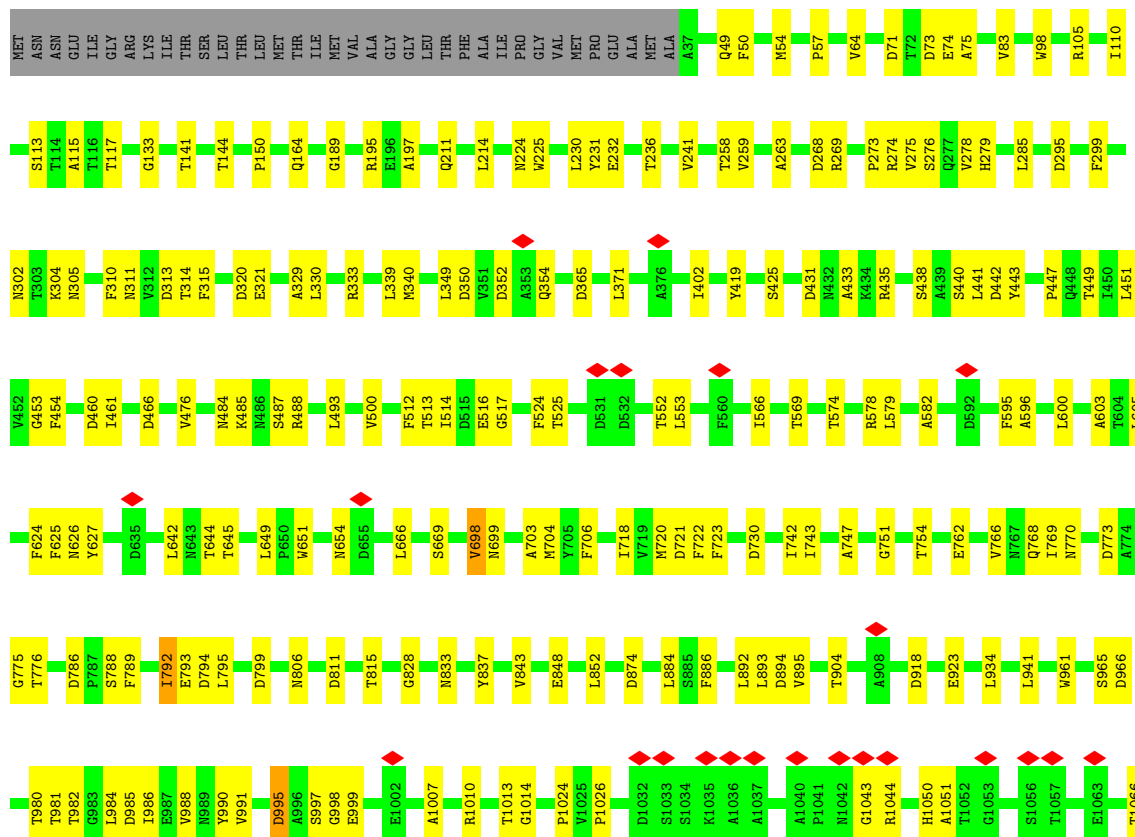
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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: Cell surface protein





● Molecule 1: Cell surface protein

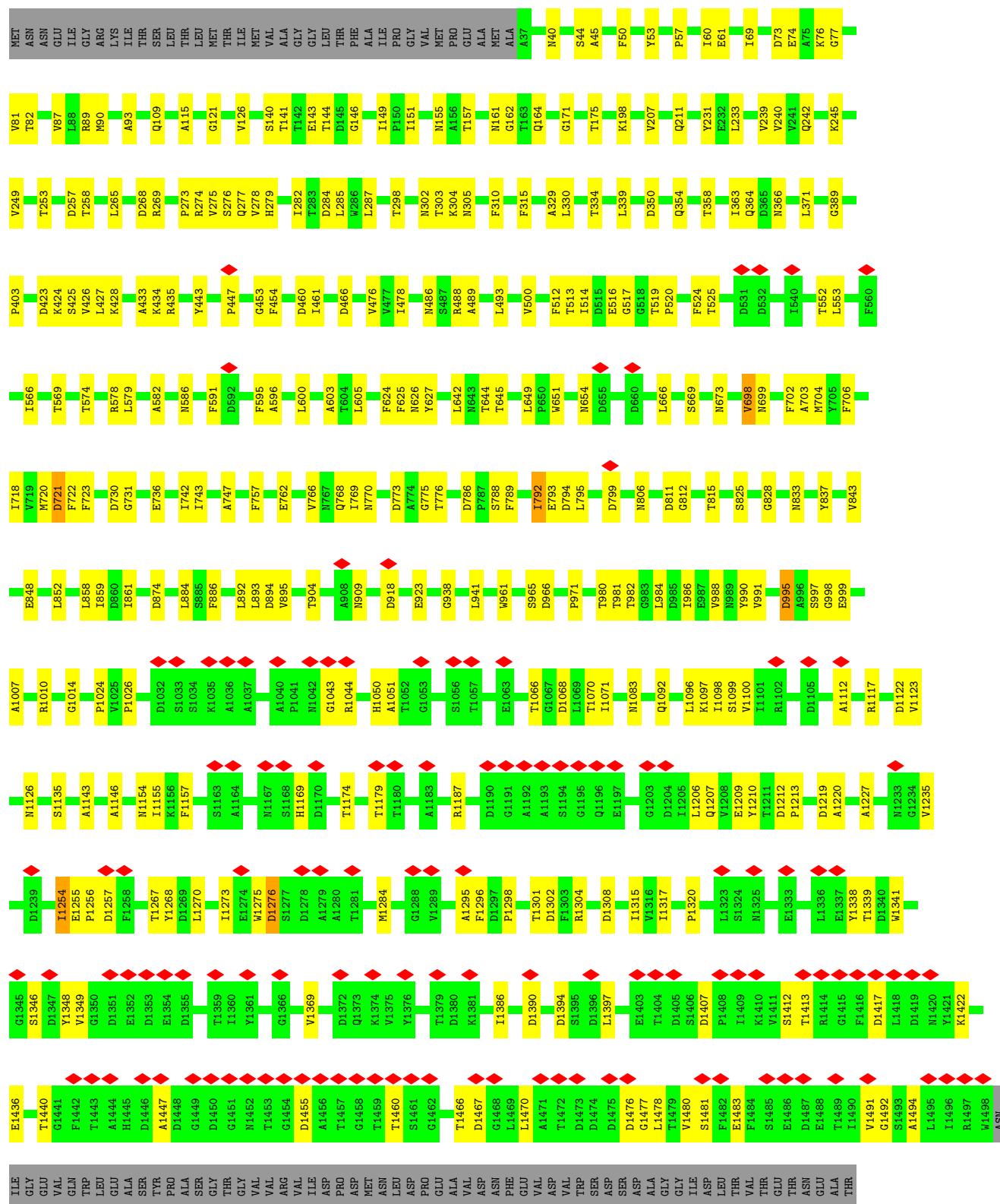




V278	V94	Met
H279	D95	Asn
E284	G96	Glu
N302	N97	Gly
I303	W98	Arg
K304	D104	Lys
N305	R105	Ile
F310	Q109	Ser
K311	T117	Leu
V312	S120	Thr
T335	A136	Met
L339	E143	Ile
D343	P150	Val
N344	Q164	Ala
T348	G171	Gly
L349	L182	Leu
D350	G189	Thr
V360	V207	Phe
V361	Q211	Ala
T362	N216	Ile
I363	P223	Pro
Q364	W225	Gly
L371	P226	Val
F386	L230	Met
G389	Y231	Pro
I390	N244	Glu
L397	D257	Ala
I402	T258	Met
E408	V259	Ala
P411	D260	Met
Y419	L265	Ala
D420	D268	Met
E421	R269	Met
S422	P273	Met
S425	S276	Met
I429	O277	Met
R435		
A439		
D442		



• Molecule 1: Cell surface protein



[illegible]

4 Experimental information

Property	Value	Source
EM reconstruction method	SUBTOMOGRAM AVERAGING	Depositor
Imposed symmetry	POINT, Not provided	
Number of subtomograms used	108621	Depositor
Resolution determination method	OTHER	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION; PseudoSubtomograms as described in Zivanov 2022 (https://elifesciences.org/articles/83724)	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	121	Depositor
Minimum defocus (nm)	2000	Depositor
Maximum defocus (nm)	5000	Depositor
Magnification	105000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	12.055	Depositor
Minimum map value	-6.789	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.582	Depositor
Recommended contour level	1.45621	Depositor
Map size ($\text{\AA}$)	265.4, 265.4, 265.4	wwPDB
Map dimensions	200, 200, 200	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.327, 1.327, 1.327	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	0.12	0/11032	0.29	0/15089
1	B	0.12	0/11032	0.29	0/15089
1	C	0.13	0/11032	0.29	0/15089
1	D	0.12	0/11032	0.29	0/15089
1	E	0.13	0/11032	0.29	0/15089
1	F	0.13	0/11032	0.29	0/15089
All	All	0.13	0/66192	0.29	0/90534

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 [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	10859	0	10131	266	0
1	B	10859	0	10136	209	0
1	C	10859	0	10136	242	0
1	D	10859	0	10130	255	0
1	E	10859	0	10135	220	0
1	F	10859	0	10136	241	0
All	All	65154	0	60804	1314	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 10.

The worst 5 of 1314 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:269:ARG:HH12	1:A:485:LYS:C	0.98	1.52
1:C:435:ARG:NH1	1:C:812:GLY:HA3	1.24	1.44
1:A:269:ARG:NH1	1:A:485:LYS:C	1.76	1.39
1:A:269:ARG:HH12	1:A:486:ASN:N	1.17	1.38
1:B:354:GLN:NE2	1:C:861:ILE:HD11	1.37	1.36

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	1460/1734 (84%)	1418 (97%)	42 (3%)	0	100	100
1	B	1460/1734 (84%)	1415 (97%)	45 (3%)	0	100	100
1	C	1460/1734 (84%)	1414 (97%)	46 (3%)	0	100	100
1	D	1460/1734 (84%)	1421 (97%)	39 (3%)	0	100	100
1	E	1460/1734 (84%)	1414 (97%)	46 (3%)	0	100	100
1	F	1460/1734 (84%)	1412 (97%)	48 (3%)	0	100	100
All	All	8760/10404 (84%)	8494 (97%)	266 (3%)	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	1212/1438 (84%)	1203 (99%)	9 (1%)	76	78
1	B	1212/1438 (84%)	1200 (99%)	12 (1%)	68	75
1	C	1212/1438 (84%)	1201 (99%)	11 (1%)	70	76
1	D	1212/1438 (84%)	1202 (99%)	10 (1%)	73	77
1	E	1212/1438 (84%)	1199 (99%)	13 (1%)	65	74
1	F	1212/1438 (84%)	1200 (99%)	12 (1%)	68	75
All	All	7272/8628 (84%)	7205 (99%)	67 (1%)	68	76

5 of 67 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	721	ASP
1	F	995	ASP
1	F	1390	ASP
1	C	792	ILE
1	C	698	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 61 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	853	ASN
1	F	409	GLN
1	D	311	ASN
1	F	322	ASN
1	F	956	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [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.

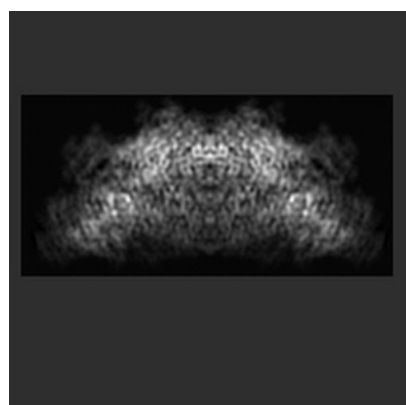
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-16492. These allow visual inspection of the internal detail of the map and identification of artifacts.

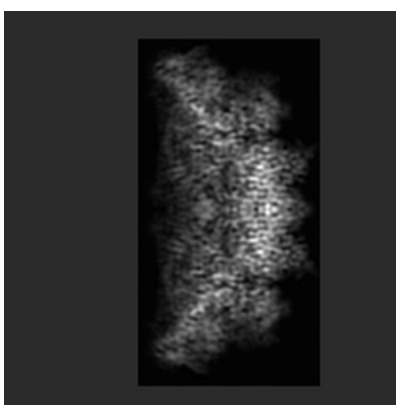
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

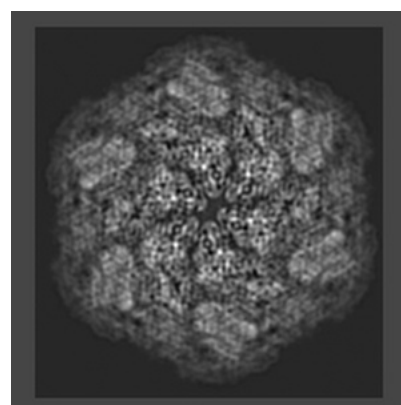
6.1.1 Primary map



X



Y



Z

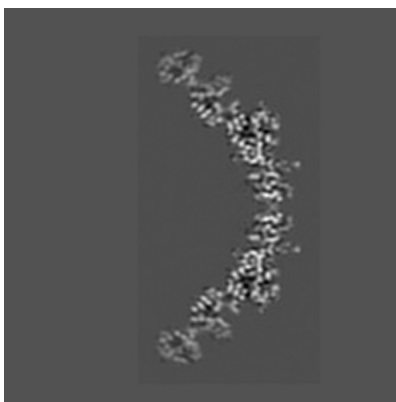
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

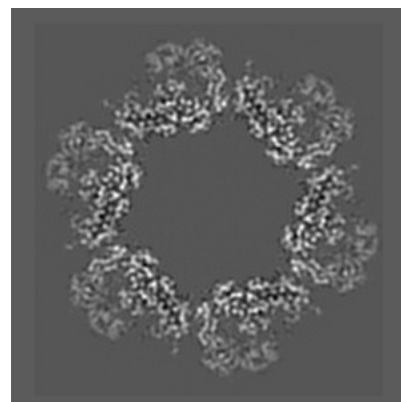
6.2.1 Primary map



X Index: 100



Y Index: 100

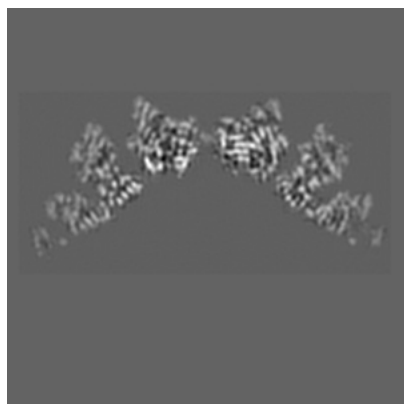


Z Index: 100

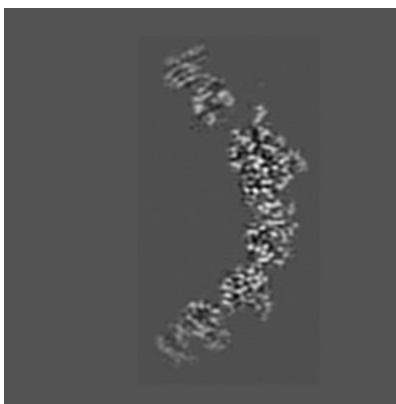
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

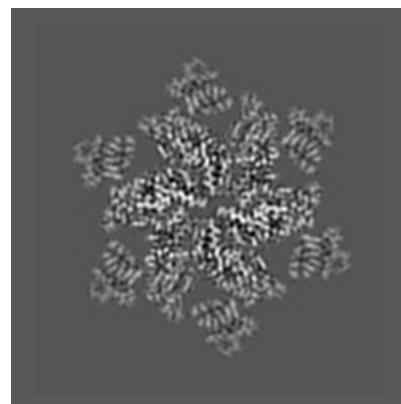
6.3.1 Primary map



X Index: 99



Y Index: 92

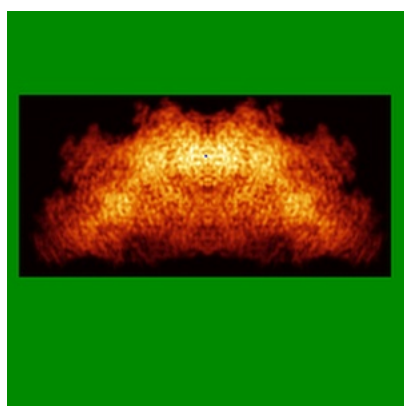


Z Index: 127

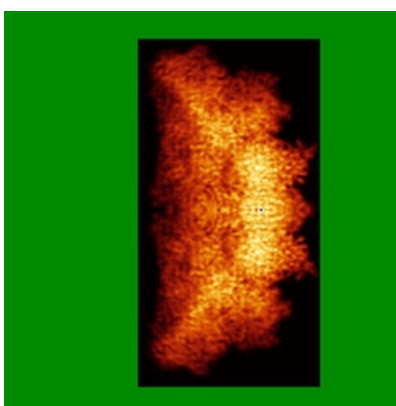
The images above show the largest variance slices of the map in three orthogonal directions.

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

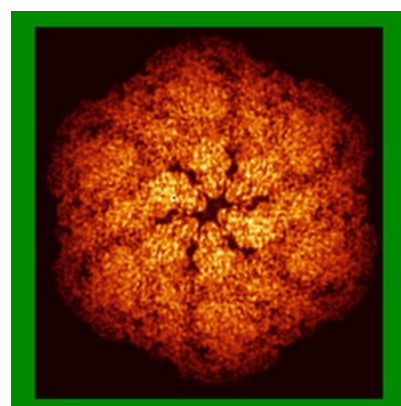
6.4.1 Primary map



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

This section was not generated.

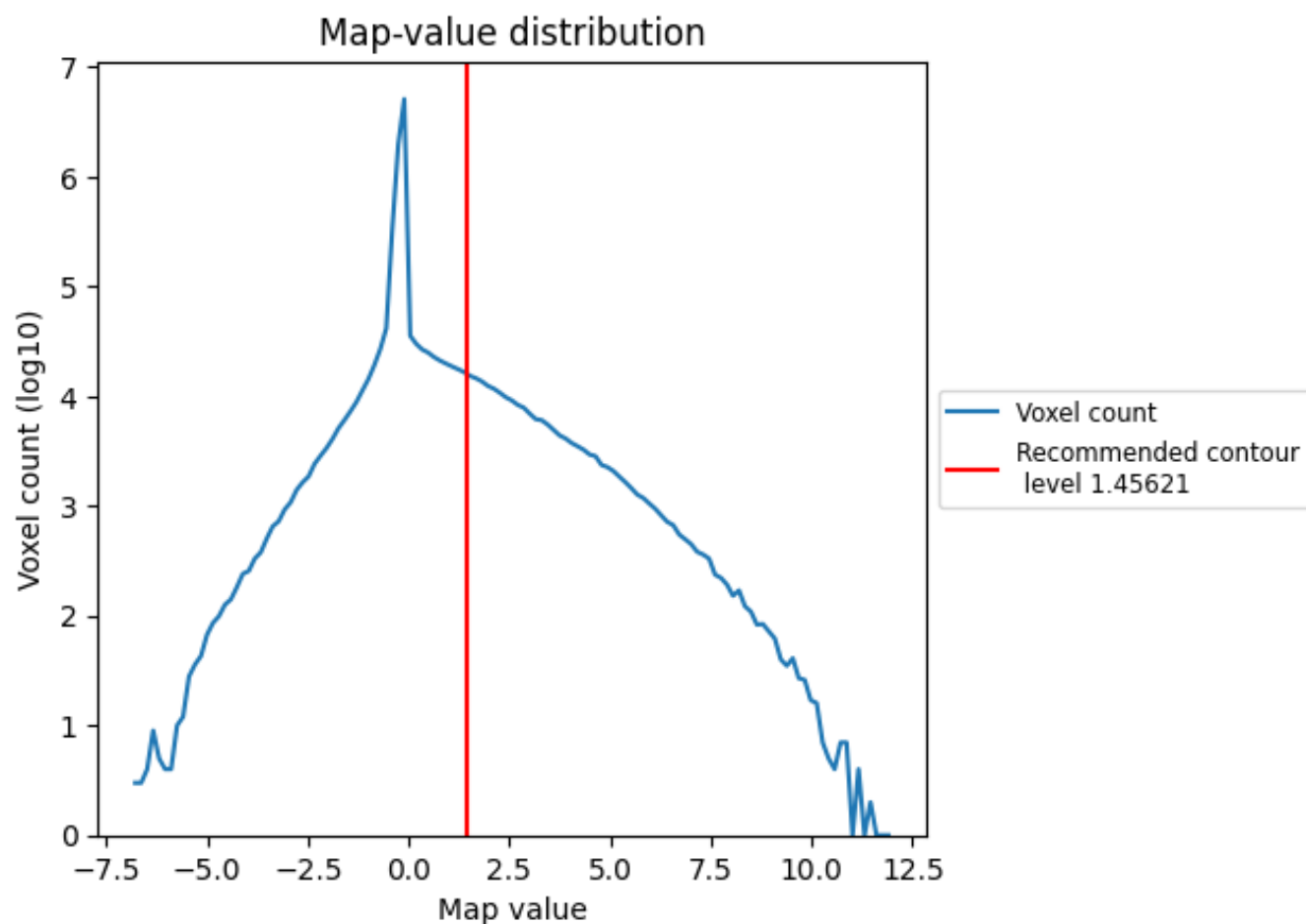
6.6 Mask visualisation

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

7 Map analysis [i](#)

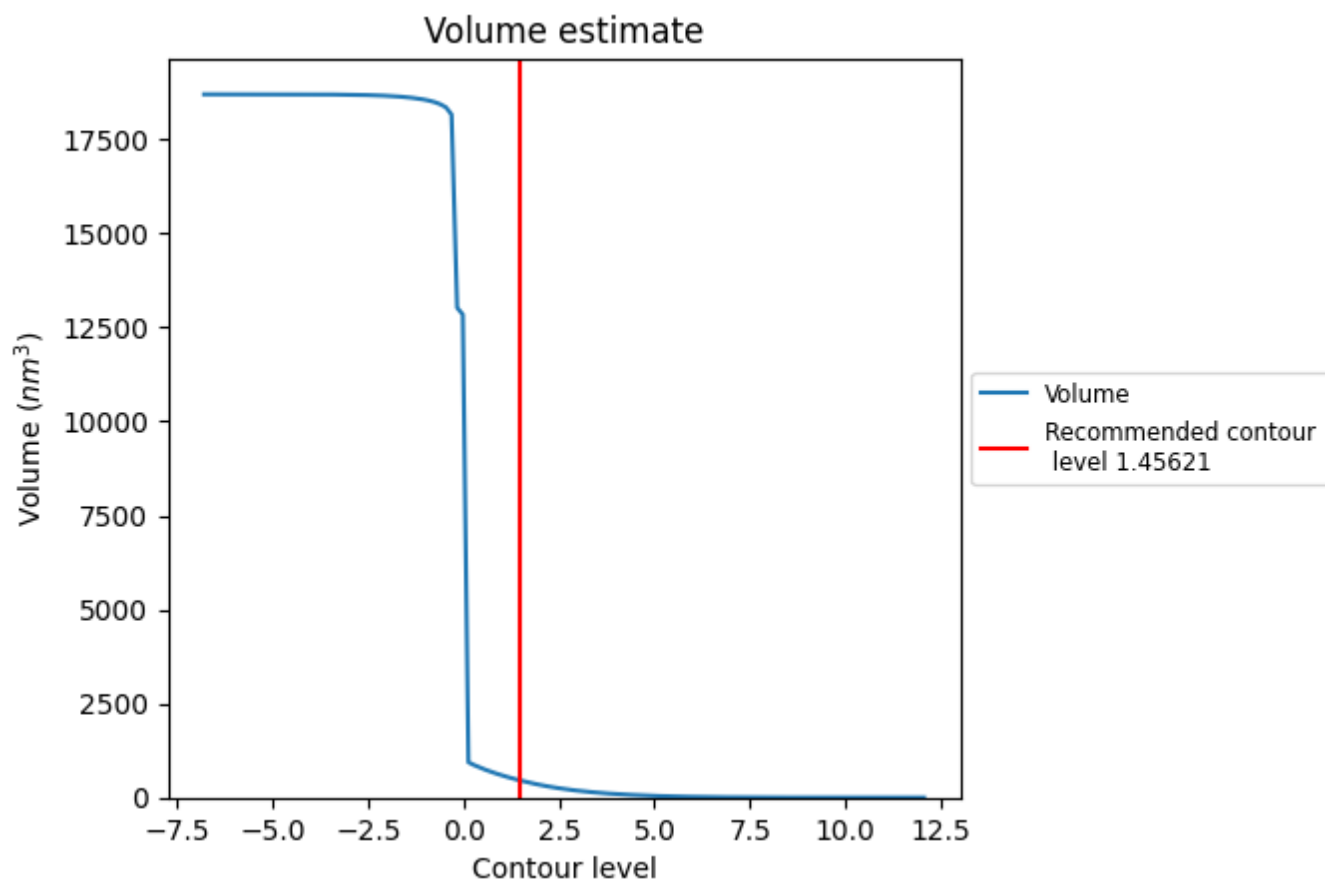
This section contains the results of statistical analysis of the map.

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.

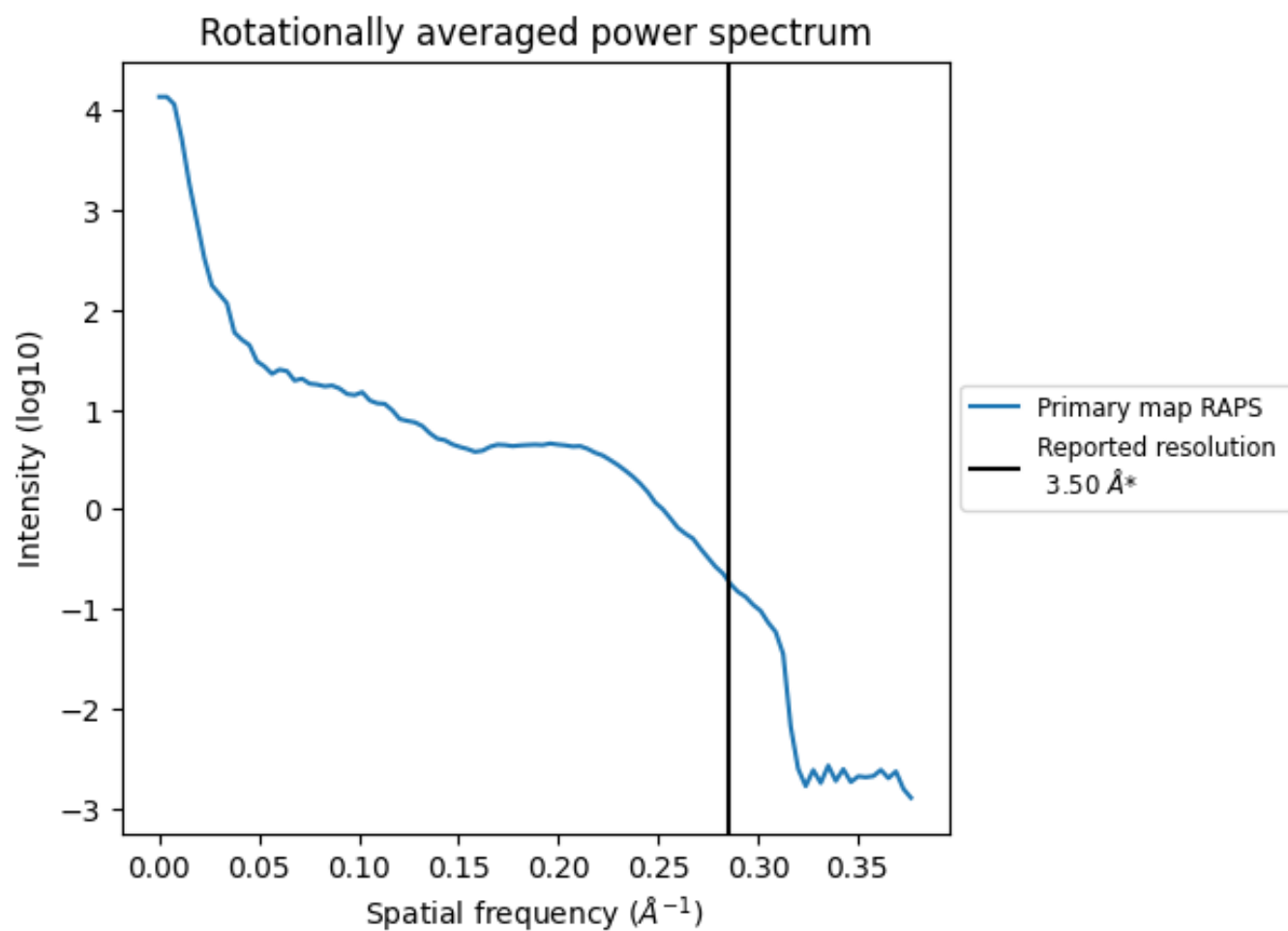
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 462 nm³; this corresponds to an approximate mass of 417 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 0.286 Å⁻¹

8 Fourier-Shell correlation

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

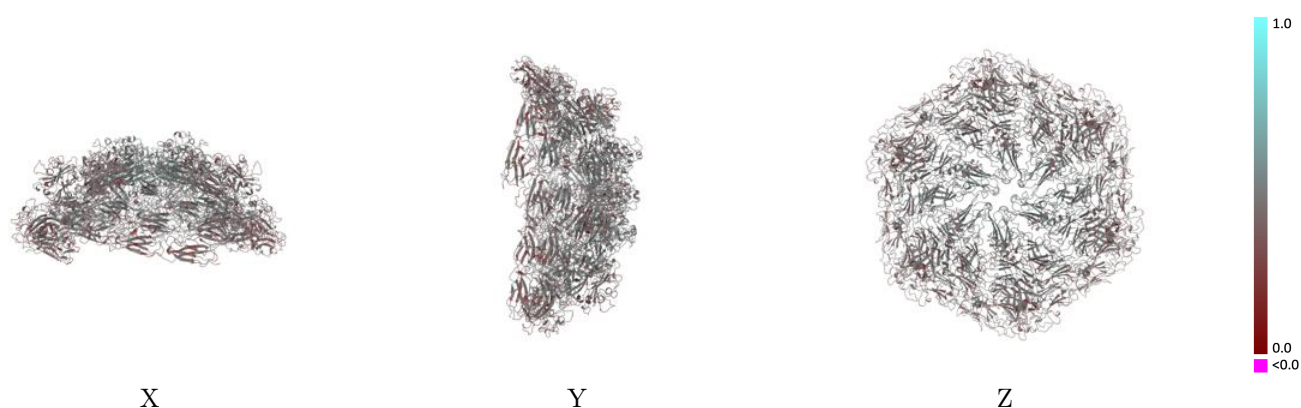
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-16492 and PDB model 8C8R. Per-residue inclusion information can be found in section 3 on page 5.

9.1 Map-model overlay [i](#)

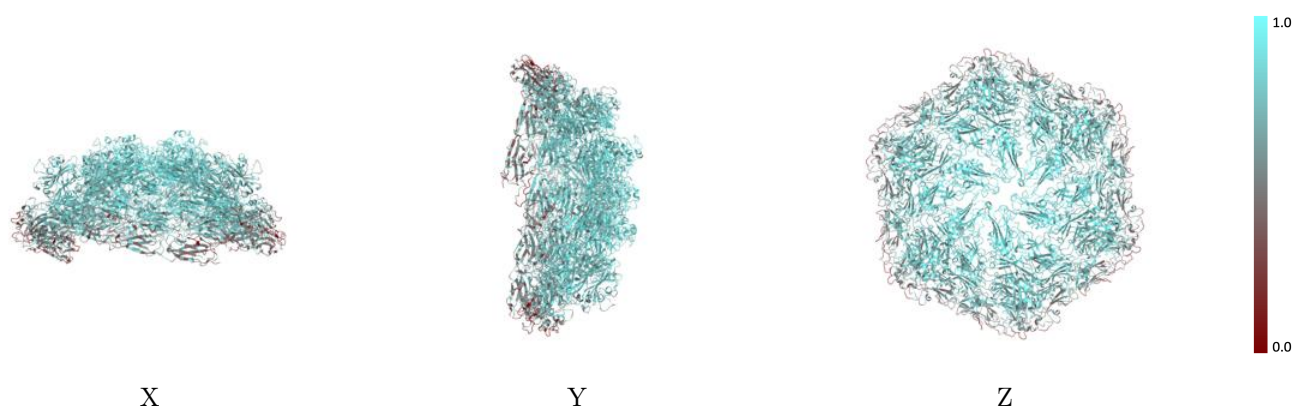
This section was not generated.

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



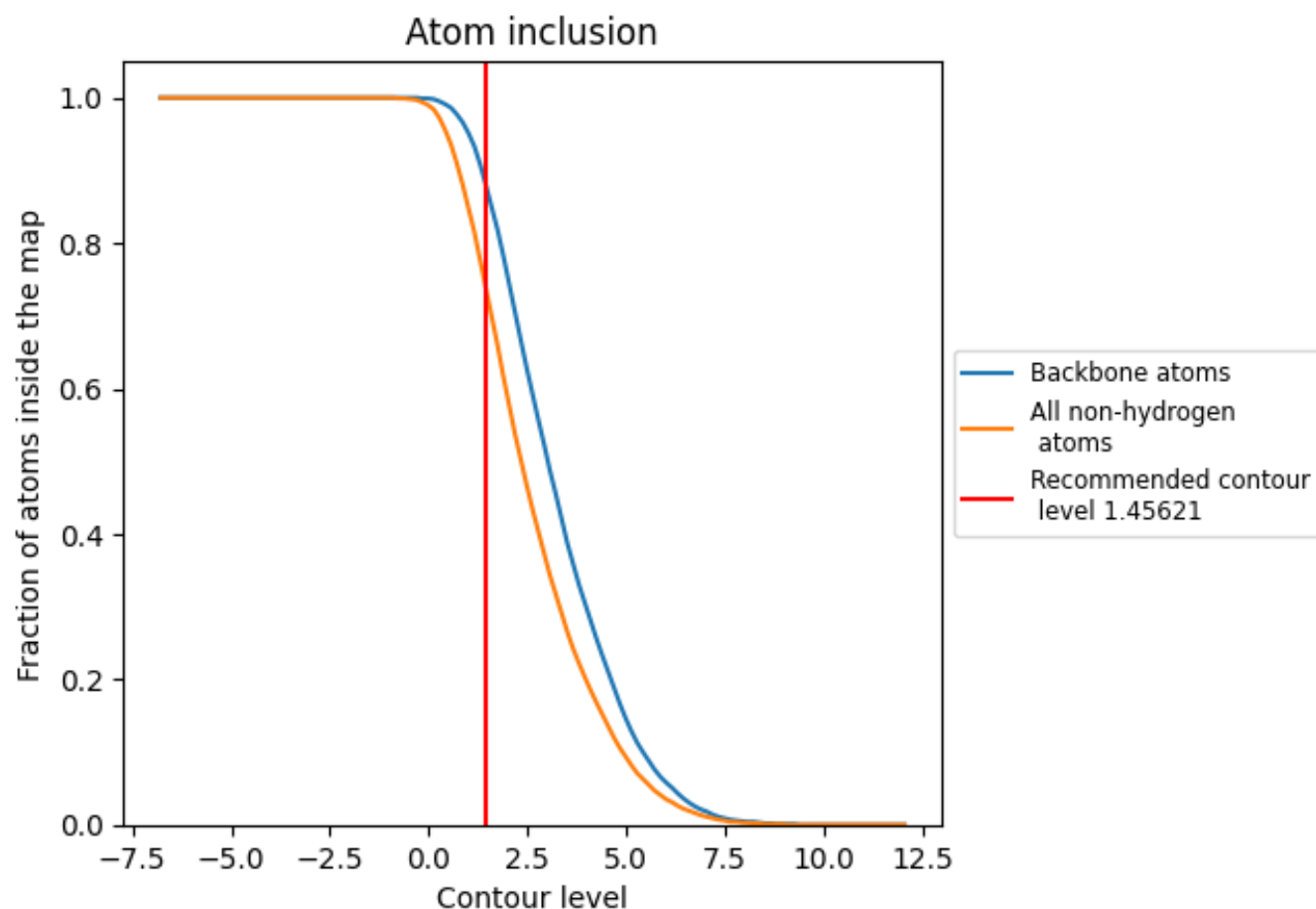
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (1.45621).

9.4 Atom inclusion [i](#)



At the recommended contour level, 88% of all backbone atoms, 74% 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 (1.45621) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7360	0.4380
A	0.7430	0.4440
B	0.7370	0.4350
C	0.7300	0.4350
D	0.7430	0.4440
E	0.7340	0.4360
F	0.7290	0.4350

1.0

0.0

<0.0