



wwPDB EM Validation Summary Report ⓘ

Mar 9, 2026 – 03:58 AM UTC

PDB ID : 6R1T / pdb_00006r1t
EMDB ID : EMD-4704
Title : Structure of LSD2/NPAC-linker/nucleosome core particle complex: Class 1, free nucleosome
Authors : Marabelli, C.; Pilotto, S.; Chittori, S.; Subramaniam, S.; Mattevi, A.
Deposited on : 2019-03-15
Resolution : 4.02 Å(reported)
Based on initial model : 6ESF

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

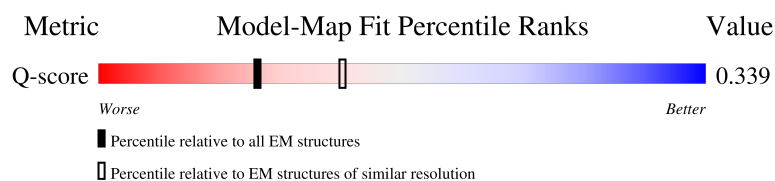
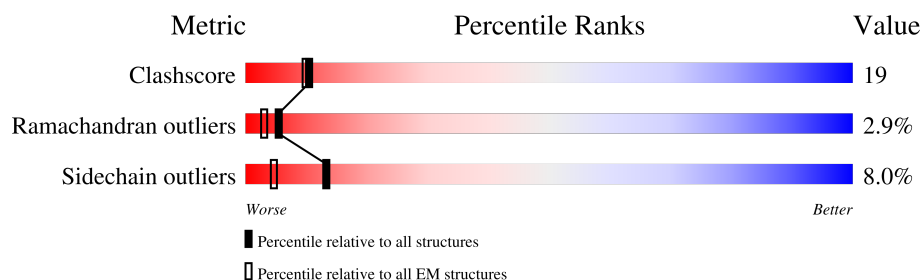
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.02 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	6727 (3.52 - 4.52)

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	99	
1	E	99	
2	B	87	
2	F	87	

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Mol	Chain	Length	Quality of chain
3	C	111	 73% 18% . . .
3	G	111	 76% 19% 5% .
4	D	96	 80% 14% . .
4	H	96	 79% 15% 5% .
5	I	147	 81% 19%
6	J	147	 82% 18% .

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 12230 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 Histone H3.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	99	Total	C	N	O	S	0	0
			816	515	158	140	3		
1	E	98	Total	C	N	O	S	0	0
			811	512	157	139	3		

- Molecule 2 is a protein called HISTONE H2A.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	86	Total	C	N	O	S	0	0
			698	440	141	116	1		
2	F	86	Total	C	N	O	S	0	0
			694	436	140	117	1		

- Molecule 3 is a protein called Histone H2A.

Mol	Chain	Residues	Atoms				AltConf	Trace
3	C	108	Total	C	N	O	0	0
			824	520	159	145		
3	G	111	Total	C	N	O	0	0
			857	539	169	149		

- Molecule 4 is a protein called Histone H2B.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	96	Total	C	N	O	S	0	0
			757	475	140	140	2		
4	H	95	Total	C	N	O	S	0	0
			746	469	136	139	2		

- Molecule 5 is a DNA chain called DNA (147-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
5	I	147	Total	C	N	O	P	0	0
			3031	1435	566	883	147		

- Molecule 6 is a DNA chain called DNA (147-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
6	J	147	Total	C	N	O	P	0	0
			2996	1423	545	881	147		

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: Histone H3

Chain A: 



• Molecule 1: Histone H3

Chain E: 



• Molecule 2: HISTONE H2A

Chain B: 



• Molecule 2: HISTONE H2A

Chain F: 



• Molecule 3: Histone H2A

Chain C: 



• Molecule 3: Histone H2A

Chain G:  76% 19% 5% .



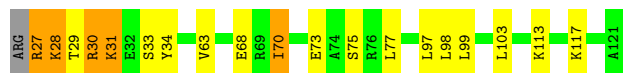
- Molecule 4: Histone H2B

Chain D:  80% 14% . .



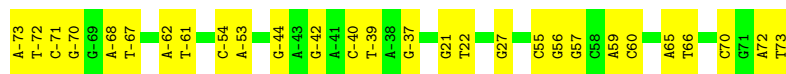
- Molecule 4: Histone H2B

Chain H:  79% 15% 5% .



- Molecule 5: DNA (147-MER)

Chain I:  81% 19%



- Molecule 6: DNA (147-MER)

Chain J:  82% 18%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	124354	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 ($e^-/\text{\AA}^2$)	1.25	Depositor
Minimum defocus (nm)	0.7	Depositor
Maximum defocus (nm)	3.05	Depositor
Magnification	130000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.086	Depositor
Minimum map value	-0.031	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.003	Depositor
Recommended contour level	0.00636	Depositor
Map size (Å)	317.99997, 317.99997, 317.99997	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.06, 1.06, 1.06	Depositor

5 Model quality

5.1 Standard geometry

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	0.45	0/828	0.71	0/1111
1	E	0.37	0/823	0.63	0/1104
2	B	0.51	0/706	0.70	0/943
2	F	0.49	0/702	0.65	0/937
3	C	0.50	0/834	0.72	0/1127
3	G	0.41	0/867	0.65	0/1169
4	D	0.40	0/768	0.57	0/1032
4	H	0.42	0/757	0.60	0/1018
5	I	0.37	0/3403	0.58	0/5255
6	J	0.37	1/3357 (0.0%)	0.53	0/5174
All	All	0.41	1/13045 (0.0%)	0.60	0/18870

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	3
2	B	0	1
2	F	0	3
3	C	0	1
3	G	0	1
4	D	0	1
4	H	0	1
All	All	0	11

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	J	71	DG	C1'-N9	-5.41	1.35	1.46

There are no bond angle outliers.

There are no chirality outliers.

5 of 11 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	129	ARG	Sidechain
1	A	131	ARG	Sidechain
1	A	40	ARG	Sidechain
2	B	17	ARG	Sidechain
3	C	17	ARG	Sidechain

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	816	0	858	58	0
1	E	811	0	853	54	0
2	B	698	0	752	97	0
2	F	694	0	742	47	0
3	C	824	0	875	48	0
3	G	857	0	922	47	0
4	D	757	0	786	47	0
4	H	746	0	773	27	0
5	I	3031	0	1651	43	0
6	J	2996	0	1650	56	0
All	All	12230	0	9862	411	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 19.

The worst 5 of 411 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)
3:G:17:ARG:HD3	6:J:-43:DT:P	1.34	1.67
1:A:69:ARG:NE	2:B:22:LEU:HD21	1.26	1.47
1:A:69:ARG:HE	2:B:22:LEU:CD2	1.32	1.41
1:E:37:LYS:CD	1:E:38:PRO:HD2	1.52	1.38
3:G:17:ARG:CD	6:J:-43:DT:P	2.12	1.38

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	97/99 (98%)	90 (93%)	5 (5%)	2 (2%)	5	32
1	E	96/99 (97%)	91 (95%)	3 (3%)	2 (2%)	5	32
2	B	84/87 (97%)	71 (84%)	5 (6%)	8 (10%)	0	9
2	F	84/87 (97%)	78 (93%)	5 (6%)	1 (1%)	10	42
3	C	106/111 (96%)	94 (89%)	9 (8%)	3 (3%)	4	27
3	G	109/111 (98%)	100 (92%)	6 (6%)	3 (3%)	4	27
4	D	94/96 (98%)	87 (93%)	4 (4%)	3 (3%)	3	25
4	H	93/96 (97%)	87 (94%)	6 (6%)	0	100	100
All	All	763/786 (97%)	698 (92%)	43 (6%)	22 (3%)	5	26

5 of 22 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	21	VAL
2	B	24	ASP
2	B	25	ASN
2	B	28	GLY
2	B	29	ILE

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	86/86 (100%)	80 (93%)	6 (7%)	14	38
1	E	86/86 (100%)	84 (98%)	2 (2%)	44	64
2	B	72/72 (100%)	62 (86%)	10 (14%)	3	17
2	F	71/72 (99%)	62 (87%)	9 (13%)	4	20
3	C	84/88 (96%)	75 (89%)	9 (11%)	6	24
3	G	88/88 (100%)	81 (92%)	7 (8%)	11	34
4	D	82/82 (100%)	78 (95%)	4 (5%)	22	46
4	H	81/82 (99%)	76 (94%)	5 (6%)	16	41
All	All	650/656 (99%)	598 (92%)	52 (8%)	13	34

5 of 52 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	30	ARG
2	F	22	LEU
4	H	31	LYS
1	E	37	LYS
2	F	18	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

Mol	Chain	Res	Type
3	G	38	ASN
4	H	46	HIS
4	H	81	ASN
4	D	81	ASN
1	E	68	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.

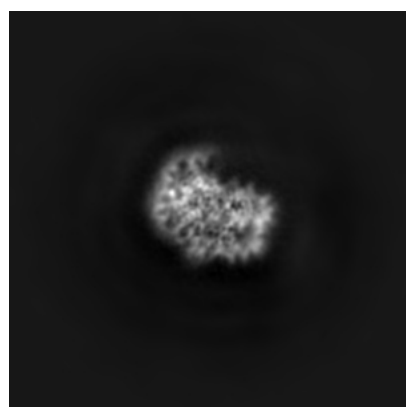
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-4704. These allow visual inspection of the internal detail of the map and identification of artifacts.

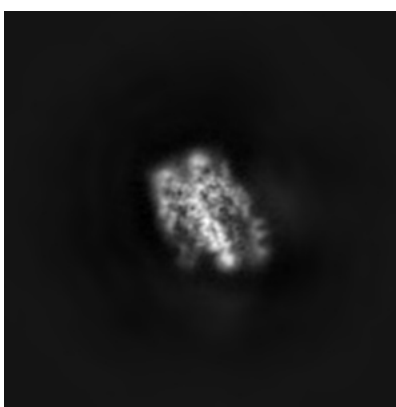
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

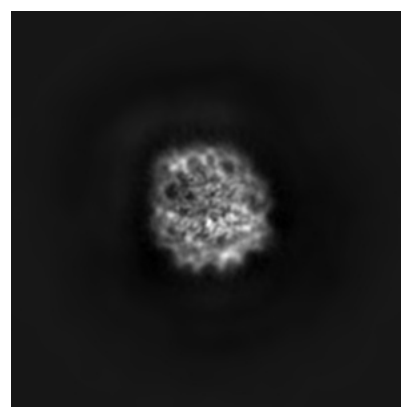
6.1.1 Primary map



X



Y

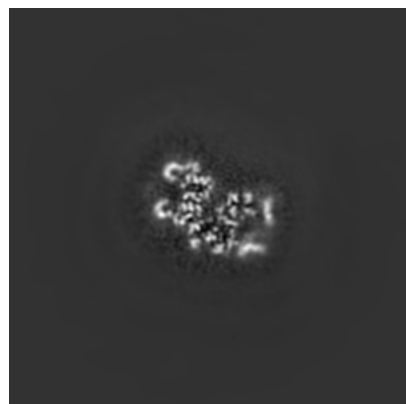


Z

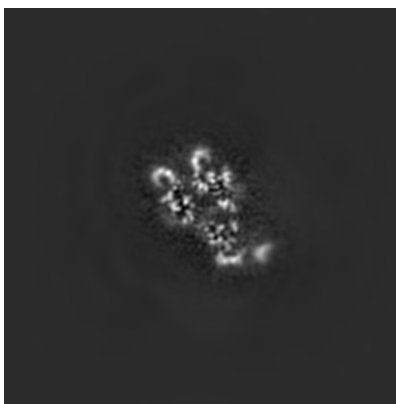
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

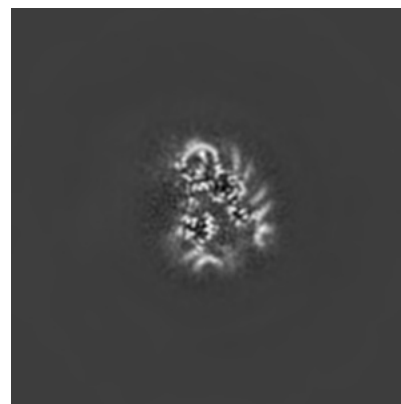
6.2.1 Primary map



X Index: 150



Y Index: 150

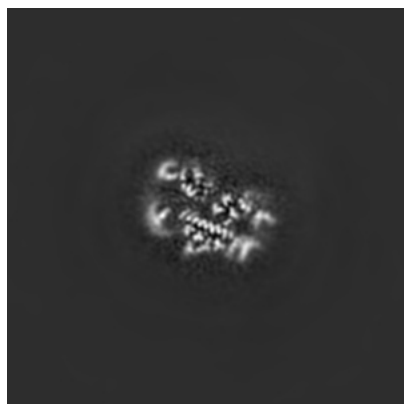


Z Index: 150

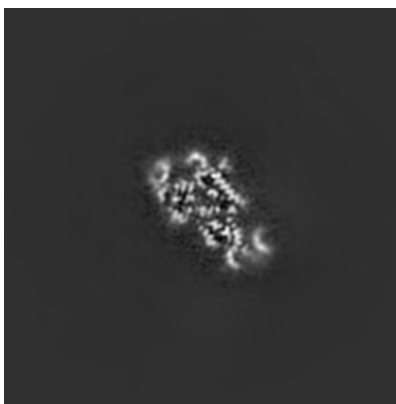
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

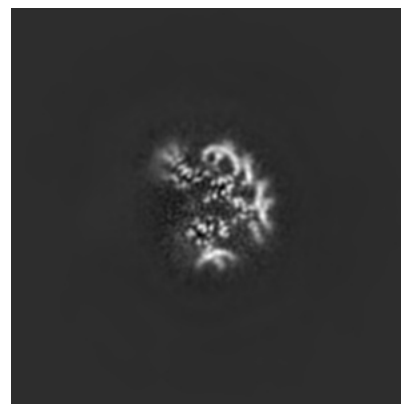
6.3.1 Primary map



X Index: 156



Y Index: 143



Z Index: 144

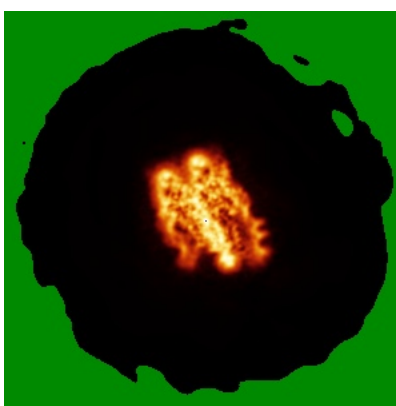
The images above show the largest variance slices of the map in three orthogonal directions.

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

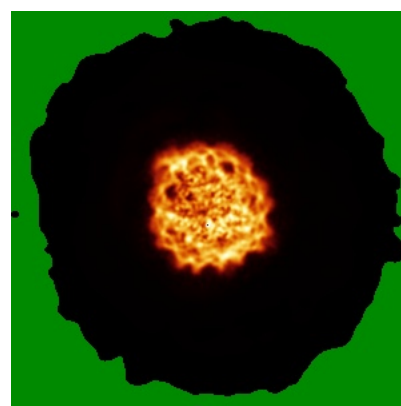
6.4.1 Primary map



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.

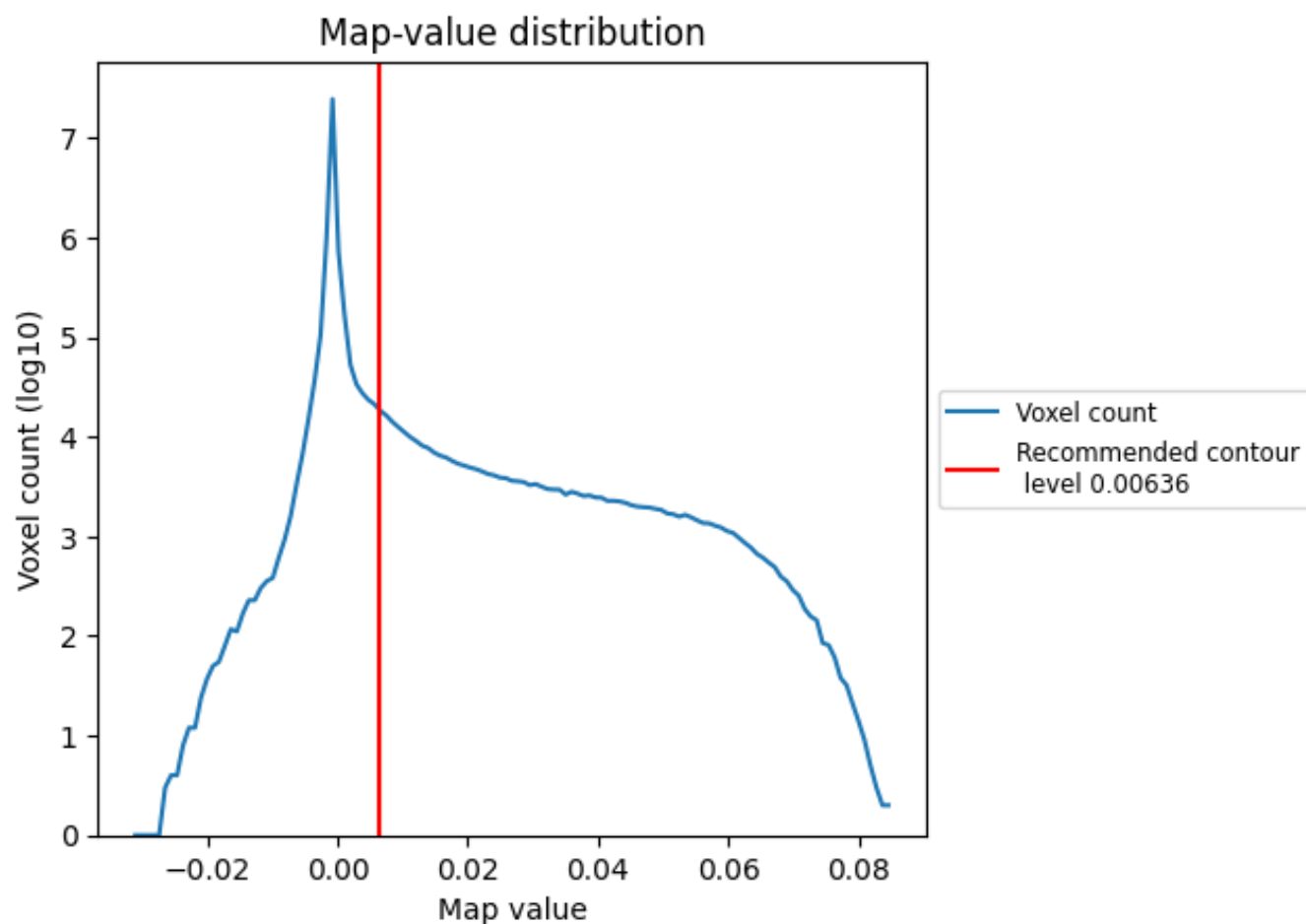
6.6 Mask visualisation

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

7 Map analysis [i](#)

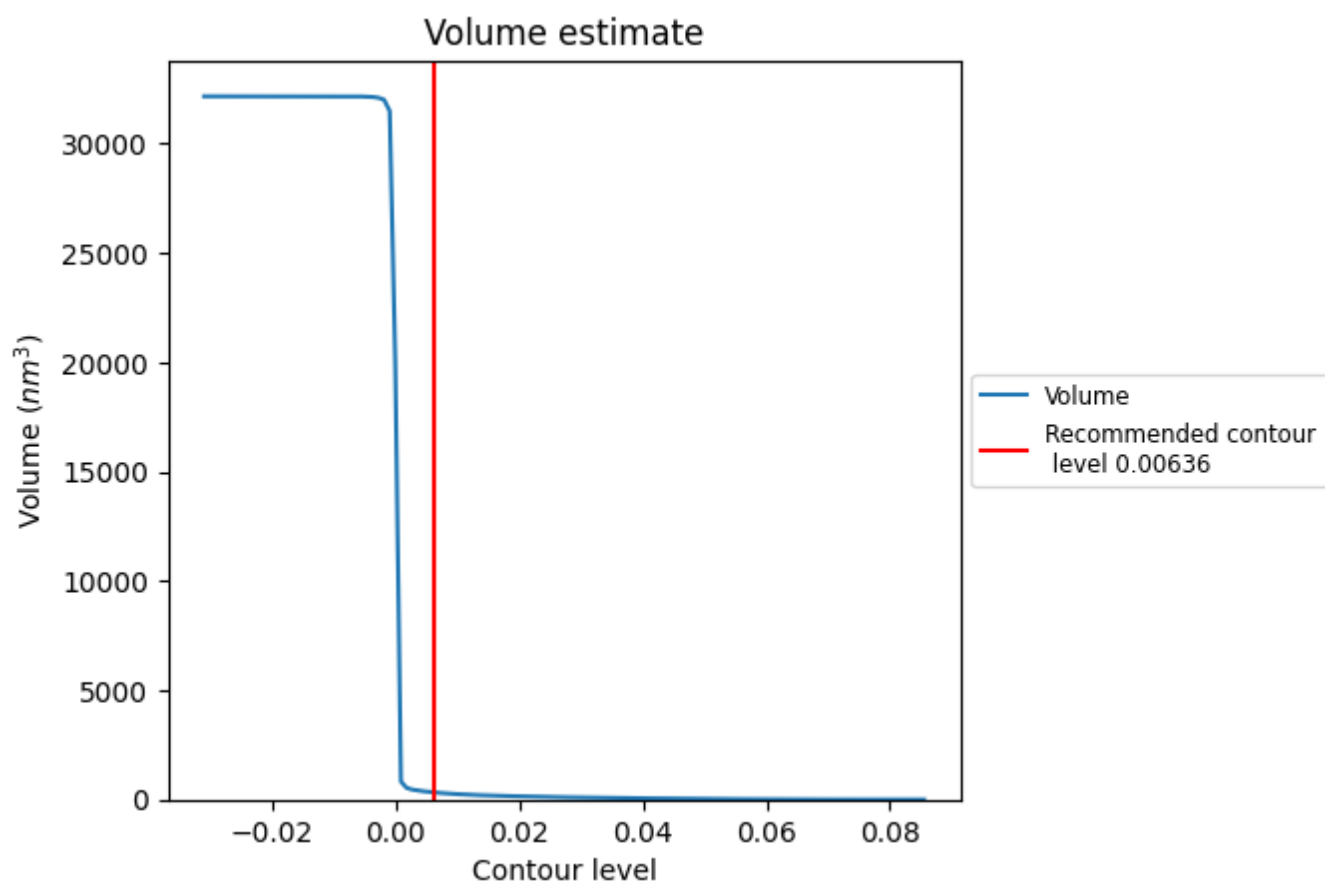
This section contains the results of statistical analysis of the map.

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.

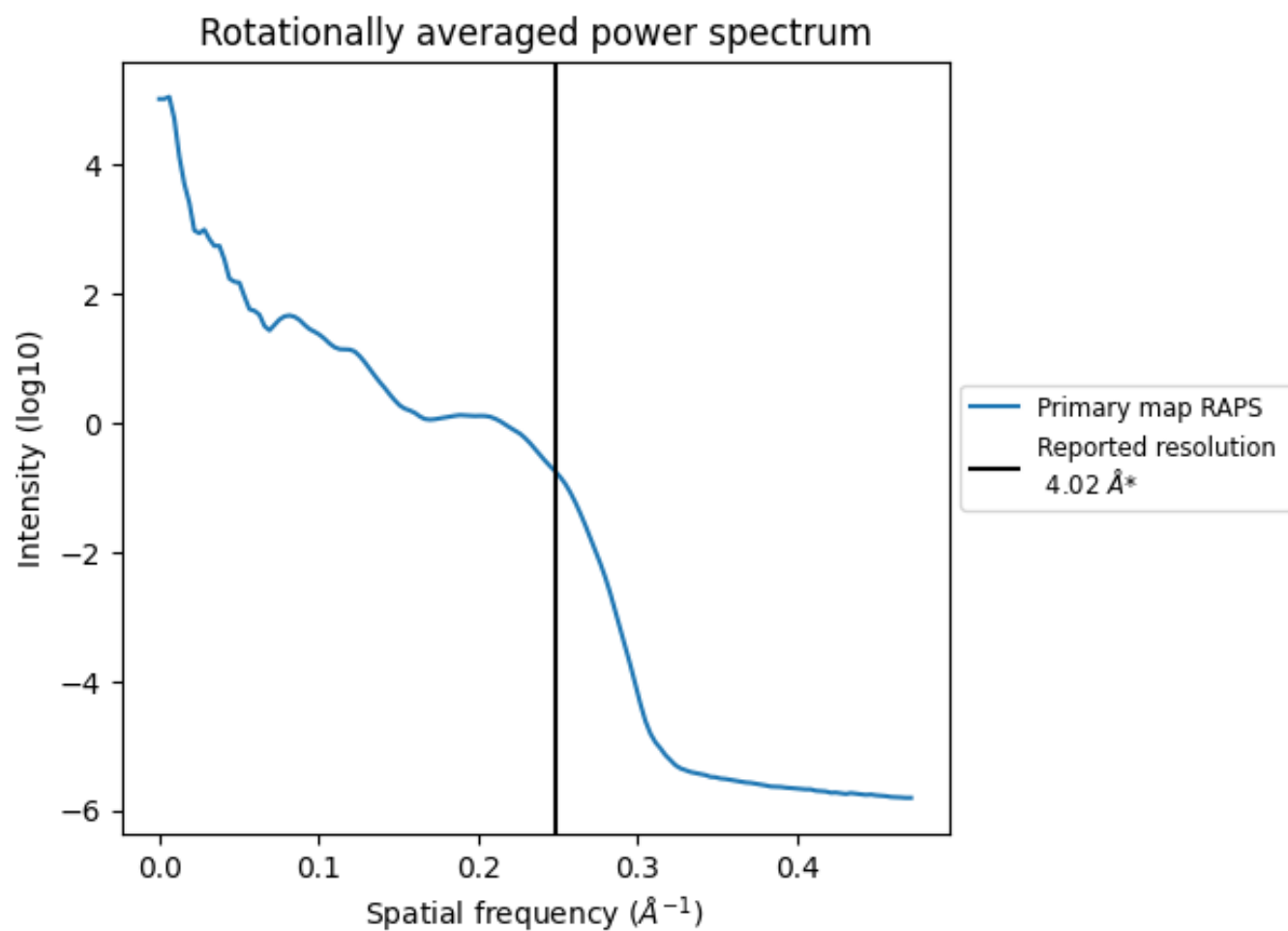
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 322 nm^3 ; this corresponds to an approximate mass of 291 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 0.249 Å⁻¹

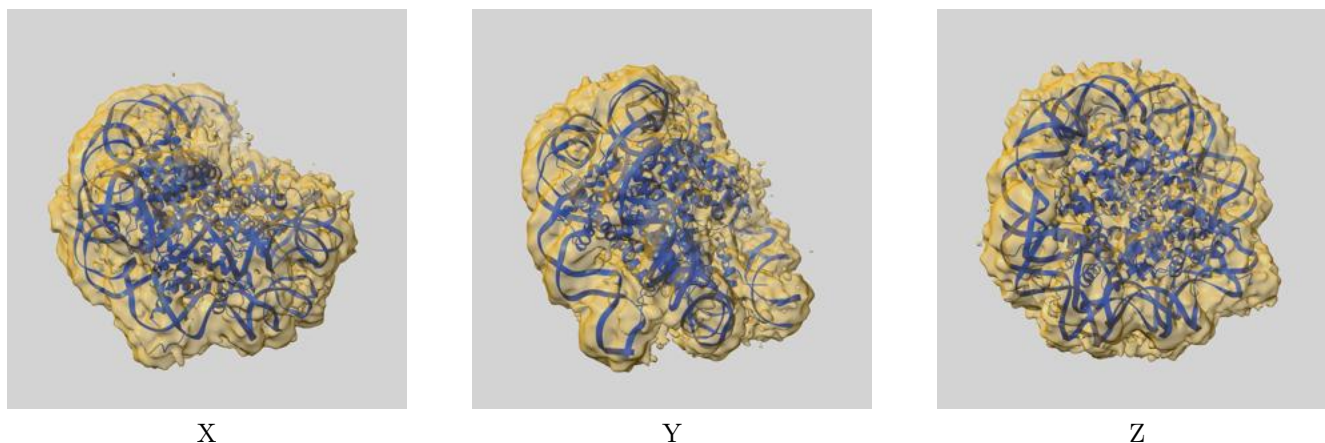
8 Fourier-Shell correlation

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

9 Map-model fit [i](#)

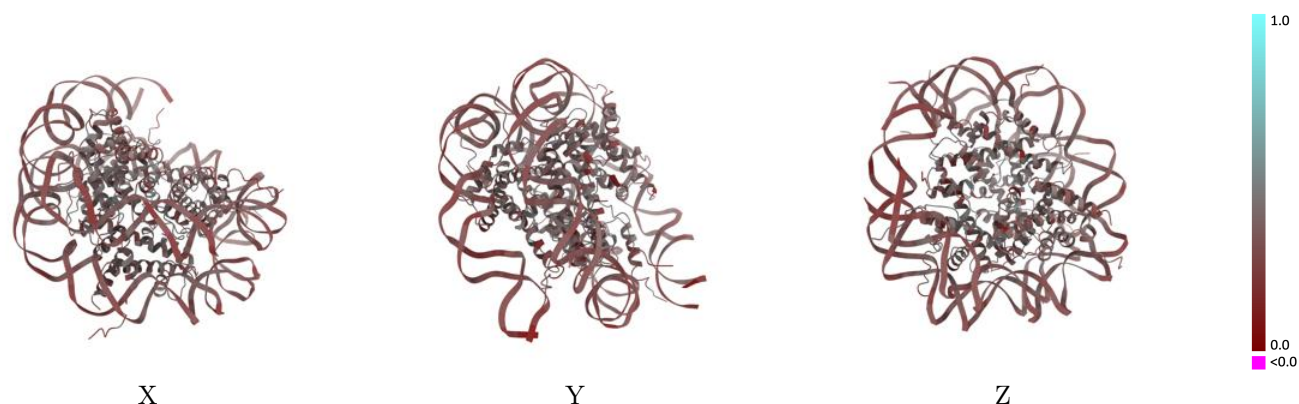
This section contains information regarding the fit between EMDB map EMD-4704 and PDB model 6R1T. Per-residue inclusion information can be found in section [3](#) on page [6](#).

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.00636 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](#)



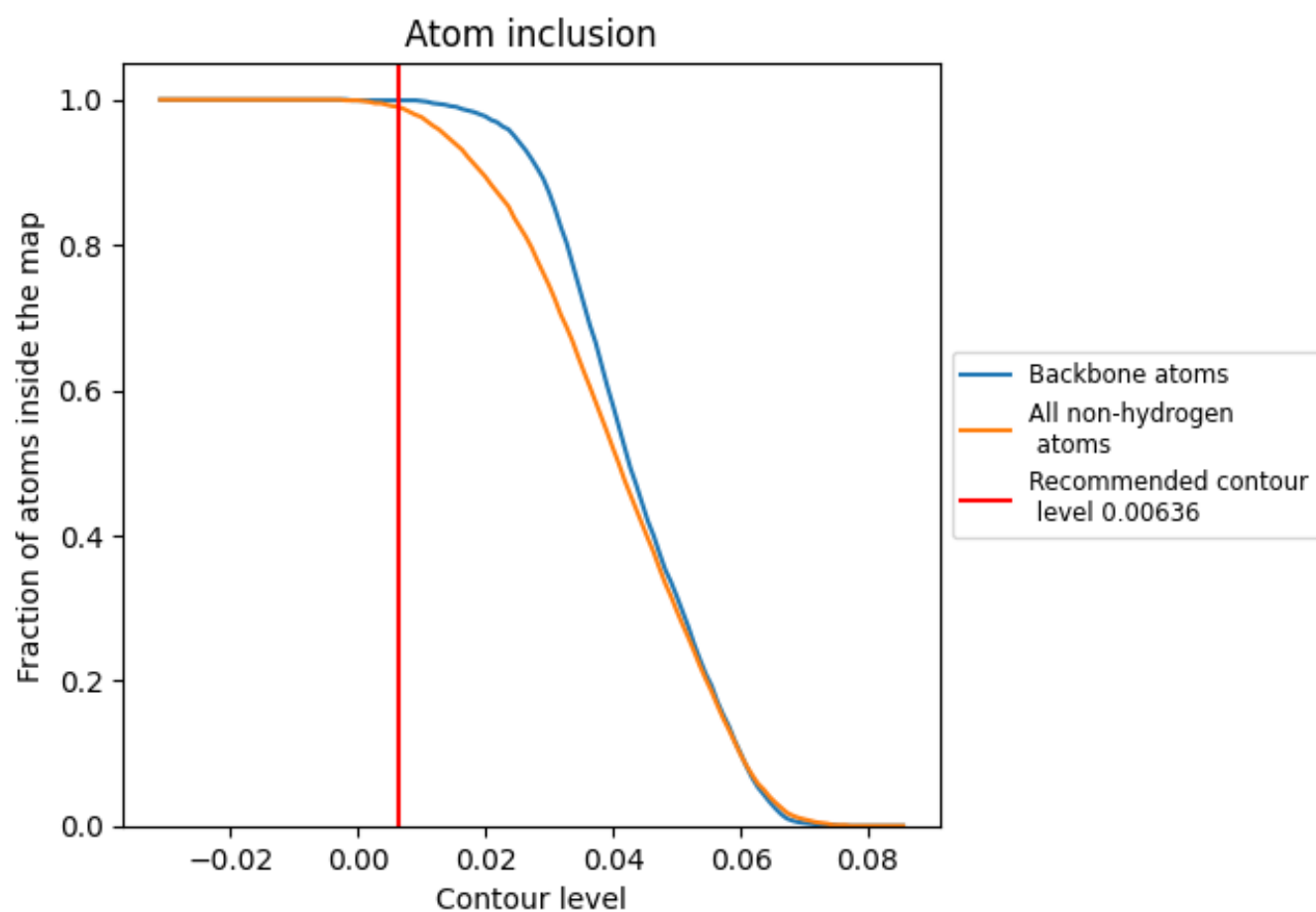
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.00636).

9.4 Atom inclusion ⓘ



At the recommended contour level, 100% of all backbone atoms, 99% 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 (0.00636) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9900	0.3390
A	0.9810	0.3790
B	0.9810	0.3860
C	0.9850	0.3740
D	0.9840	0.3730
E	0.9670	0.3520
F	0.9770	0.3800
G	0.9760	0.3690
H	0.9860	0.3750
I	1.0000	0.3030
J	1.0000	0.3060

1.0

0.0

<0.0