



wwPDB EM Validation Summary Report ⓘ

Nov 19, 2022 – 10:48 PM EST

PDB ID : 3J26
EMDB ID : EMD-5495
Title : The 3.5 Å resolution structure of the Sputnik virophage by cryo-EM
Authors : Zhang, X.Z.
Deposited on : 2012-09-18
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.dev43
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

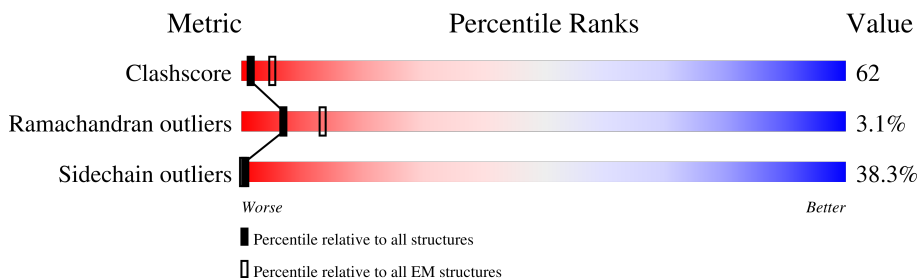
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.50 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.



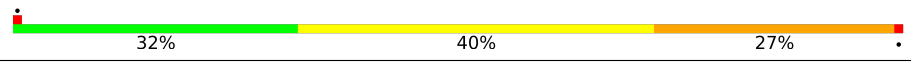
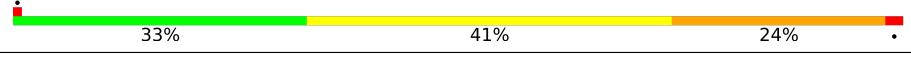
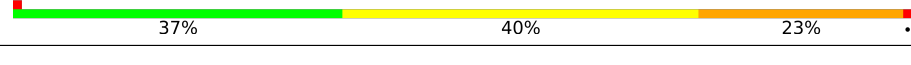
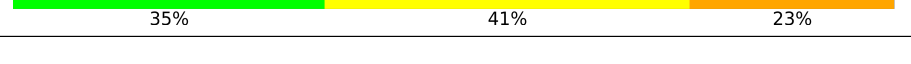
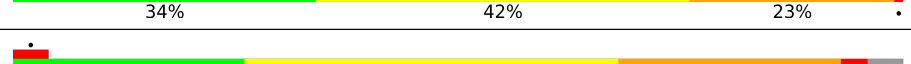
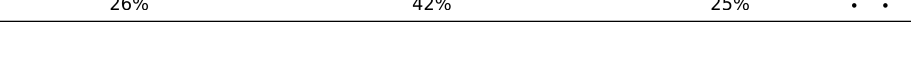
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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 ≥ 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	508	
1	B	508	
1	C	508	
1	D	508	
1	E	508	
1	F	508	
1	G	508	
1	H	508	

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Mol	Chain	Length	Quality of chain
1	I	508	
1	J	508	
1	K	508	
1	L	508	
1	M	508	
2	N	378	

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 54479 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 capsid protein V20.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	508	3968	2516	672	769	11	0	0
1	B	508	3968	2516	672	769	11	0	0
1	C	508	3968	2516	672	769	11	0	0
1	D	508	3968	2516	672	769	11	0	0
1	E	508	3968	2516	672	769	11	0	0
1	F	508	3968	2516	672	769	11	0	0
1	G	508	3968	2516	672	769	11	0	0
1	H	508	3968	2516	672	769	11	0	0
1	I	508	3968	2516	672	769	11	0	0
1	J	508	3968	2516	672	769	11	0	0
1	K	508	3968	2516	672	769	11	0	0
1	L	508	3968	2516	672	769	11	0	0
1	M	508	3968	2516	672	769	11	0	0

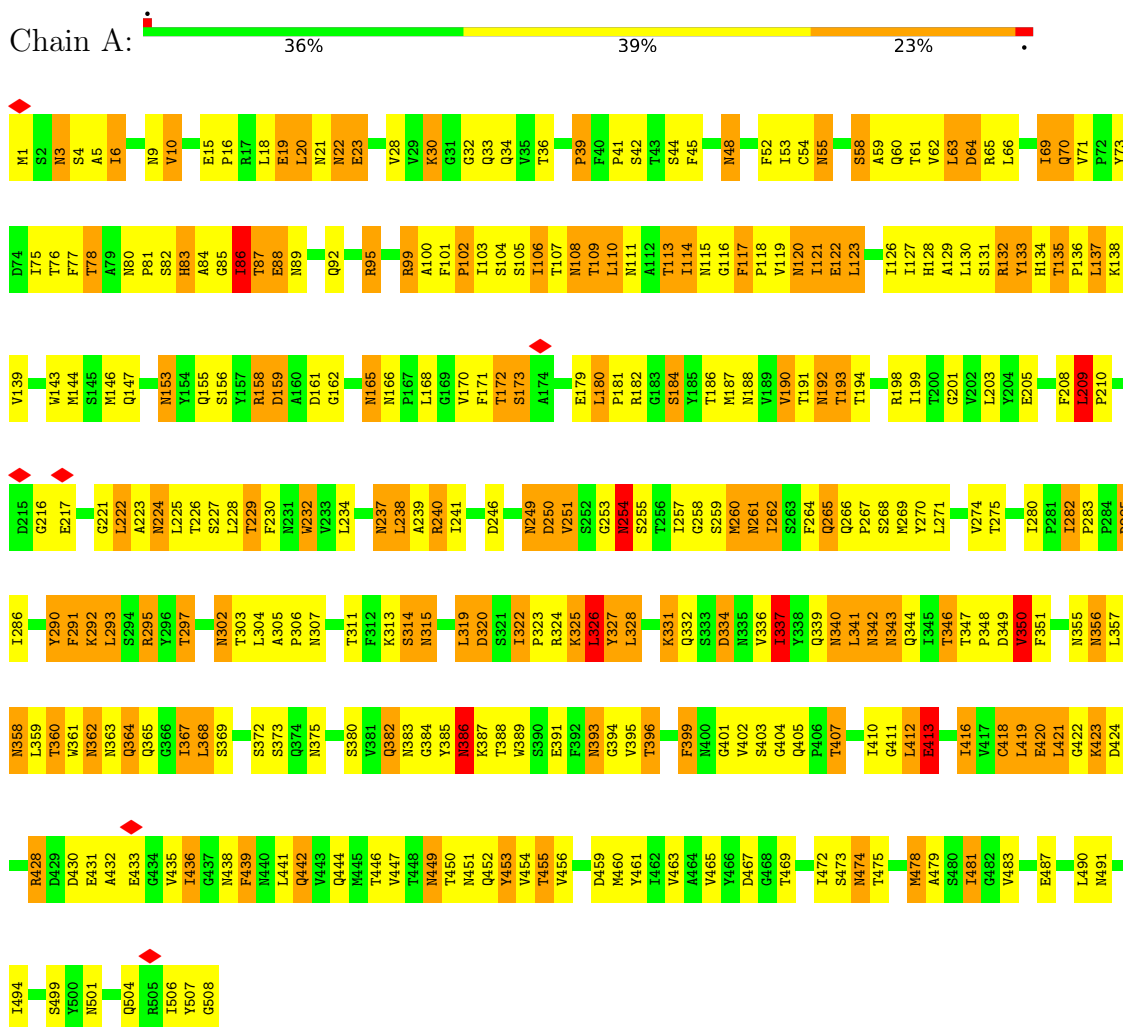
- Molecule 2 is a protein called Minor virion protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	N	362	2895	1889	451	549	6	0	0

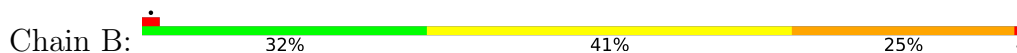
3 Residue-property plots

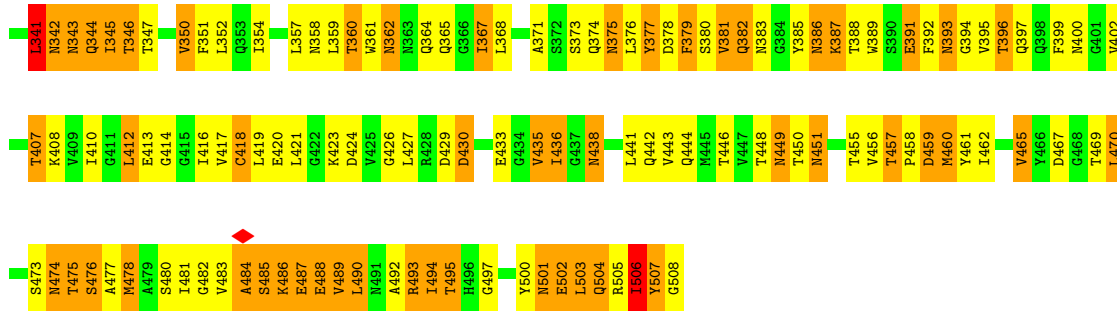
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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: capsid protein V20

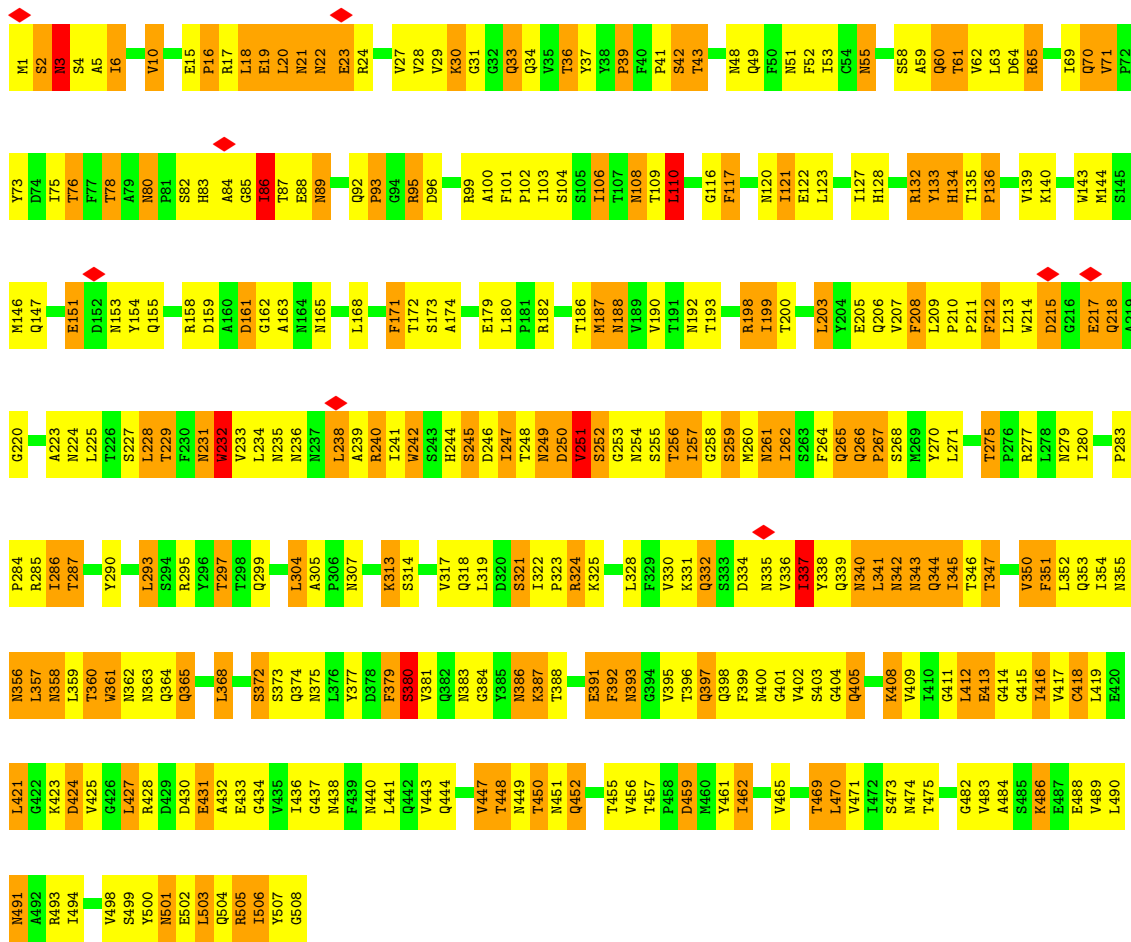


- Molecule 1: capsid protein V20

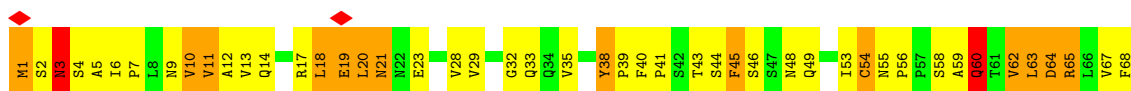


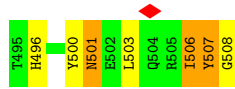


• Molecule 1: capsid protein V20

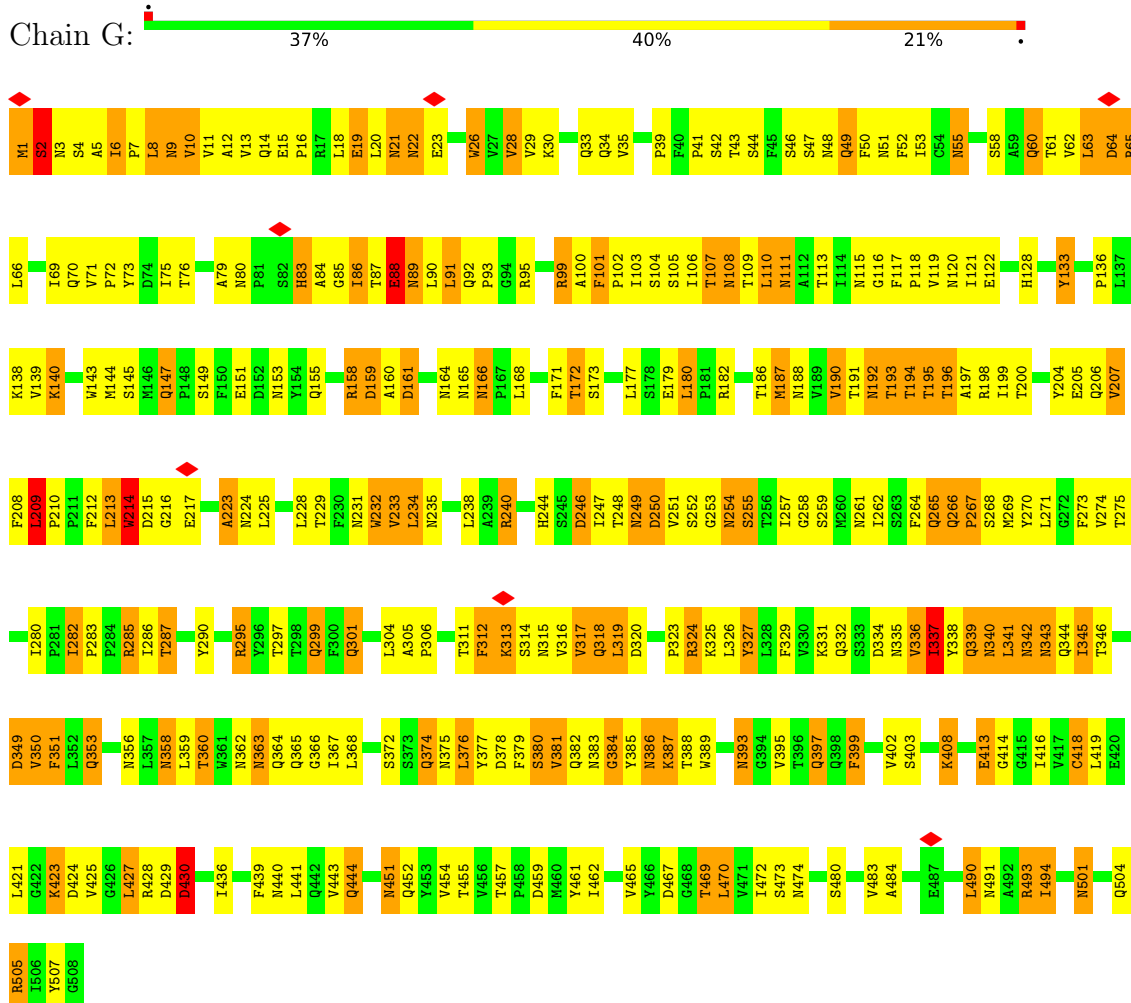


• Molecule 1: capsid protein V20

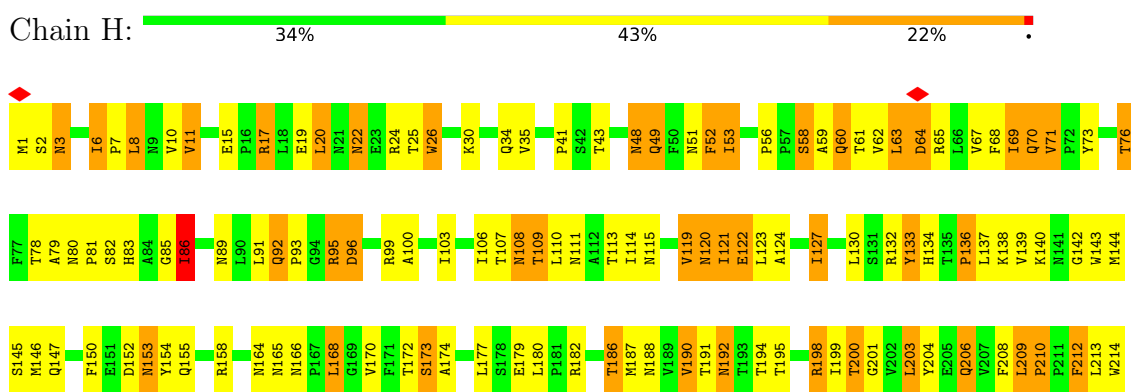


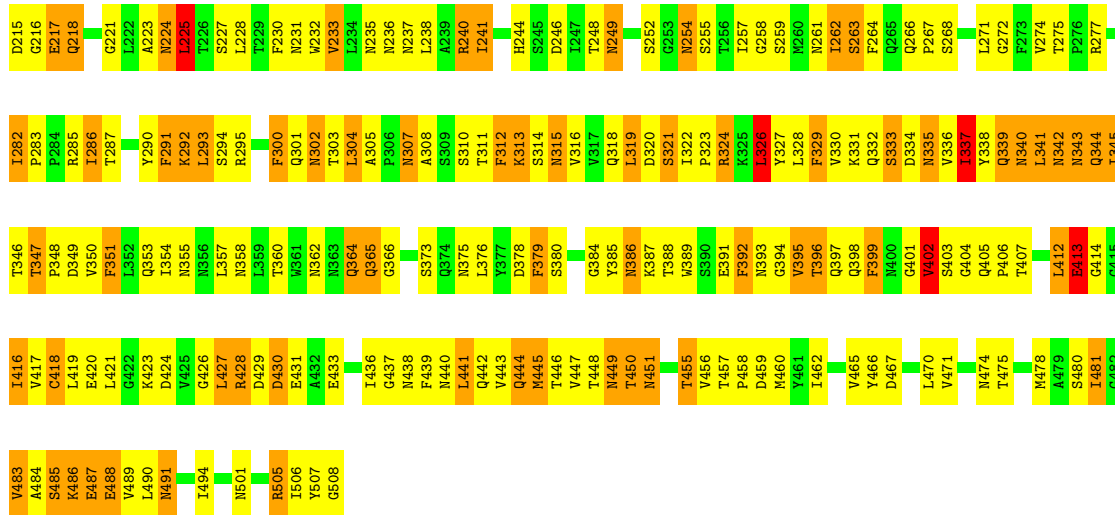


• Molecule 1: capsid protein V20

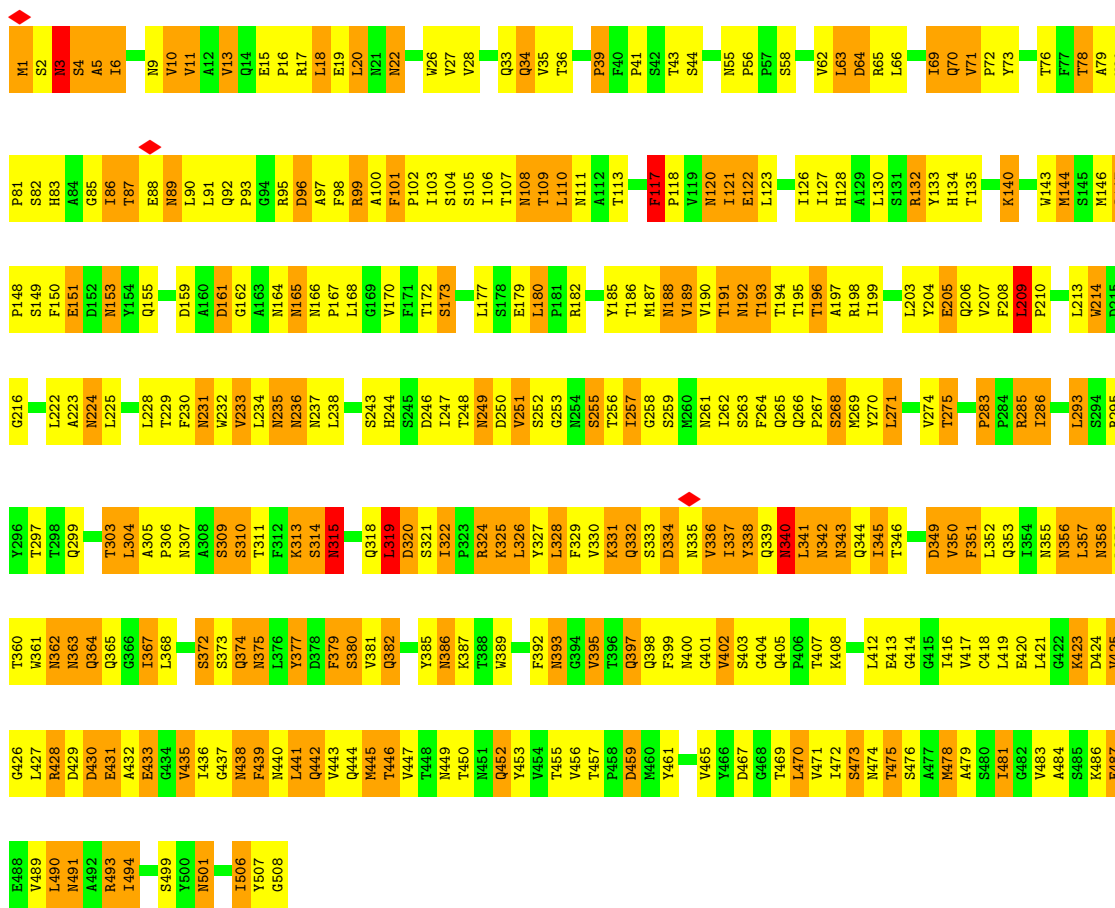


• Molecule 1: capsid protein V20



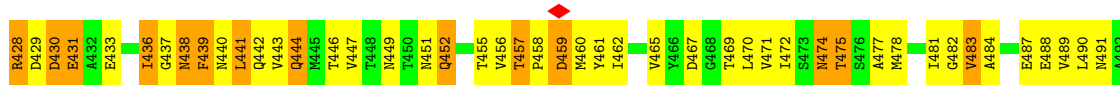


● Molecule 1: capsid protein V20

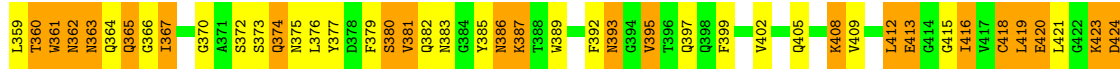
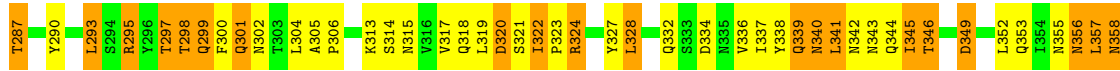
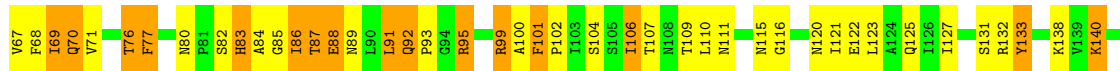
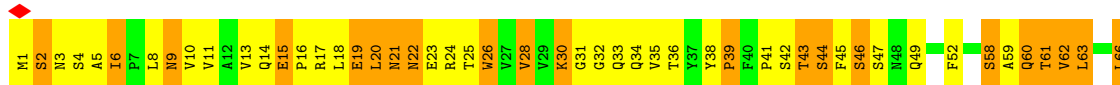


● Molecule 1: capsid protein V20

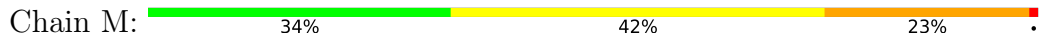


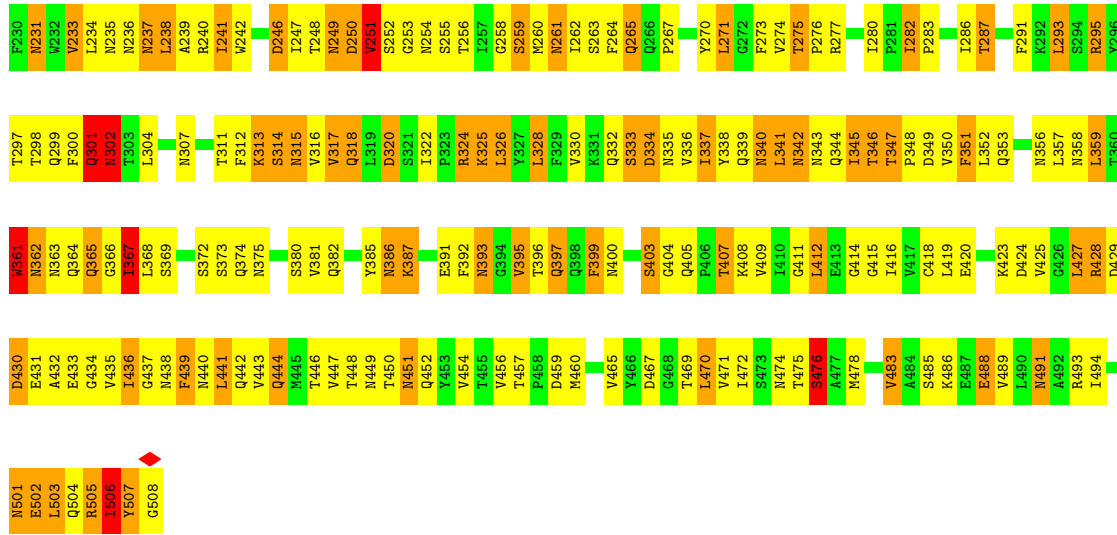


• Molecule 1: capsid protein V20

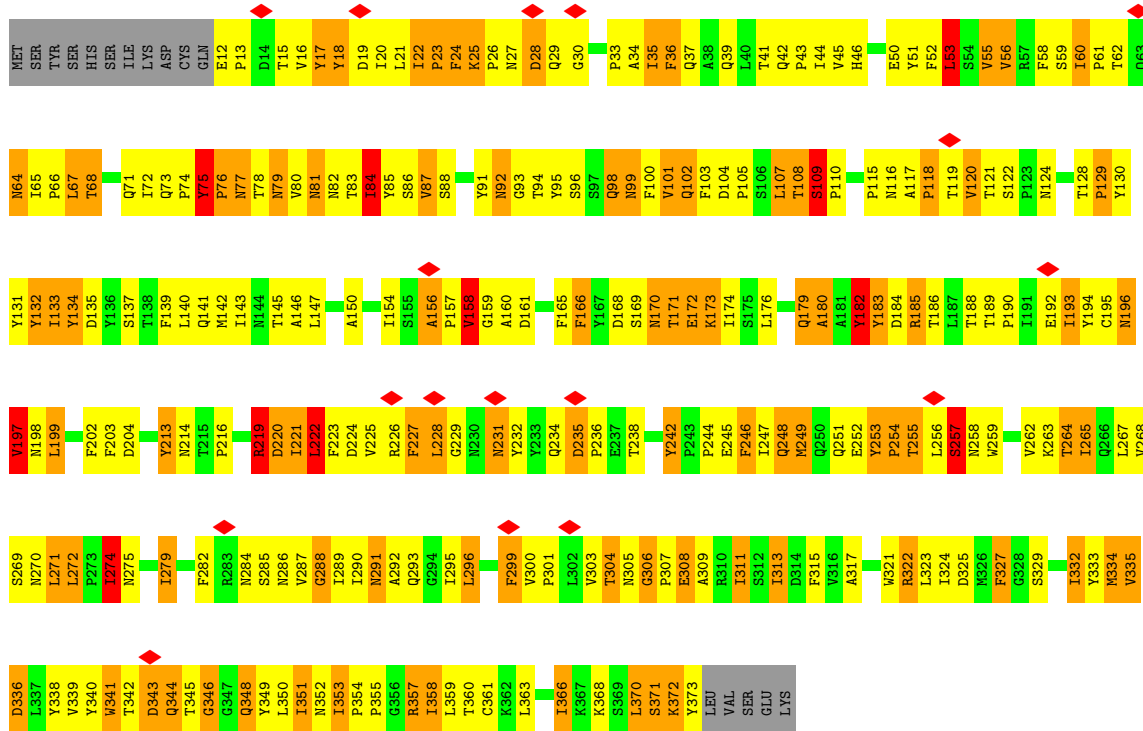


• Molecule 1: capsid protein V20





• Molecule 2: Minor virion protein



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, I	Depositor
Number of particles used	12000	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	each particle	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	22	Depositor
Minimum defocus (nm)	1100	Depositor
Maximum defocus (nm)	2400	Depositor
Magnification	59000	Depositor
Image detector	KODAK SO-163 FILM	Depositor
Maximum map value	21.700	Depositor
Minimum map value	-2.144	Depositor
Average map value	0.109	Depositor
Map value standard deviation	1.242	Depositor
Recommended contour level	2.0	Depositor
Map size (\AA)	844.80005, 844.80005, 422.40002	wwPDB
Map dimensions	768, 768, 384	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (\AA)	1.1, 1.1, 1.1	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	0.57	2/4060 (0.0%)	0.77	3/5551 (0.1%)
1	B	0.57	2/4060 (0.0%)	0.75	5/5551 (0.1%)
1	C	0.57	1/4060 (0.0%)	0.78	2/5551 (0.0%)
1	D	0.56	1/4060 (0.0%)	0.73	1/5551 (0.0%)
1	E	0.58	2/4060 (0.0%)	0.76	3/5551 (0.1%)
1	F	0.57	1/4060 (0.0%)	0.73	3/5551 (0.1%)
1	G	0.57	2/4060 (0.0%)	0.74	3/5551 (0.1%)
1	H	0.59	1/4060 (0.0%)	0.76	5/5551 (0.1%)
1	I	0.61	3/4060 (0.1%)	0.77	5/5551 (0.1%)
1	J	0.60	1/4060 (0.0%)	0.78	5/5551 (0.1%)
1	K	0.56	1/4060 (0.0%)	0.73	1/5551 (0.0%)
1	L	0.57	1/4060 (0.0%)	0.74	3/5551 (0.1%)
1	M	0.56	2/4060 (0.0%)	0.80	7/5551 (0.1%)
2	N	0.58	1/2986 (0.0%)	0.77	3/4103 (0.1%)
All	All	0.57	21/55766 (0.0%)	0.76	49/76266 (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
1	B	0	3
1	C	0	1
1	D	0	1
1	E	0	1
1	F	0	1
1	L	0	1
1	M	0	1
All	All	0	10

The worst 5 of 21 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	I	117	PHE	CG-CD2	8.70	1.51	1.38
1	E	473	SER	CB-OG	8.12	1.52	1.42
1	I	117	PHE	CE1-CZ	8.06	1.52	1.37
2	N	341	TRP	CD2-CE2	5.93	1.48	1.41
1	M	361	TRP	CD2-CE2	5.72	1.48	1.41

The worst 5 of 49 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	M	302	ASN	N-CA-CB	14.64	136.95	110.60
1	C	506	ILE	N-CA-CB	-9.54	88.85	110.80
1	M	301	GLN	N-CA-C	-8.64	87.68	111.00
1	A	326	LEU	CA-CB-CG	7.07	131.57	115.30
1	L	209	LEU	CA-CB-CG	7.03	131.47	115.30

There are no chirality outliers.

5 of 10 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	340	ASN	Peptide
1	B	132	ARG	Peptide
1	B	332	GLN	Peptide
1	B	380	SER	Peptide
1	C	341	LEU	Peptide

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	3968	0	3871	408	0
1	B	3968	0	3871	627	0
1	C	3968	0	3871	631	0
1	D	3968	0	3871	619	0
1	E	3968	0	3871	509	0
1	F	3968	0	3871	429	0
1	G	3968	0	3871	497	0
1	H	3968	0	3871	523	0
1	I	3968	0	3871	521	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	J	3968	0	3871	525	0
1	K	3968	0	3871	401	0
1	L	3968	0	3871	492	0
1	M	3968	0	3871	524	0
2	N	2895	0	2810	508	0
All	All	54479	0	53133	6718	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 62.

The worst 5 of 6718 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:396:THR:CA	1:B:410:ILE:HD11	1.25	1.67
2:N:173:LYS:HD3	2:N:254:PRO:CG	1.22	1.62
1:C:376:LEU:HA	1:C:379:PHE:CE2	1.34	1.61
2:N:173:LYS:CD	2:N:254:PRO:HG3	1.24	1.60
2:N:186:THR:CG2	2:N:226:ARG:HD3	1.27	1.59

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	506/508 (100%)	430 (85%)	61 (12%)	15 (3%)	4	30
1	B	506/508 (100%)	456 (90%)	41 (8%)	9 (2%)	8	41
1	C	506/508 (100%)	433 (86%)	65 (13%)	8 (2%)	9	43
1	D	506/508 (100%)	442 (87%)	48 (10%)	16 (3%)	4	29
1	E	506/508 (100%)	443 (88%)	49 (10%)	14 (3%)	5	32

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	F	506/508 (100%)	431 (85%)	59 (12%)	16 (3%)	4	29
1	G	506/508 (100%)	447 (88%)	45 (9%)	14 (3%)	5	32
1	H	506/508 (100%)	436 (86%)	58 (12%)	12 (2%)	6	35
1	I	506/508 (100%)	424 (84%)	64 (13%)	18 (4%)	3	26
1	J	506/508 (100%)	434 (86%)	54 (11%)	18 (4%)	3	26
1	K	506/508 (100%)	436 (86%)	55 (11%)	15 (3%)	4	30
1	L	506/508 (100%)	449 (89%)	47 (9%)	10 (2%)	7	39
1	M	506/508 (100%)	439 (87%)	49 (10%)	18 (4%)	3	26
2	N	360/378 (95%)	280 (78%)	49 (14%)	31 (9%)	1	9
All	All	6938/6982 (99%)	5980 (86%)	744 (11%)	214 (3%)	7	30

5 of 214 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	86	ILE
1	A	173	SER
1	A	251	VAL
1	B	209	LEU
1	D	39	PRO

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	447/447 (100%)	274 (61%)	173 (39%)	0	1
1	B	447/447 (100%)	263 (59%)	184 (41%)	0	0
1	C	447/447 (100%)	266 (60%)	181 (40%)	0	1
1	D	447/447 (100%)	278 (62%)	169 (38%)	0	1
1	E	447/447 (100%)	284 (64%)	163 (36%)	0	1
1	F	447/447 (100%)	271 (61%)	176 (39%)	0	1
1	G	447/447 (100%)	280 (63%)	167 (37%)	0	1

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	H	447/447 (100%)	284 (64%)	163 (36%)	0	1
1	I	447/447 (100%)	266 (60%)	181 (40%)	0	1
1	J	447/447 (100%)	277 (62%)	170 (38%)	0	1
1	K	447/447 (100%)	276 (62%)	171 (38%)	0	1
1	L	447/447 (100%)	283 (63%)	164 (37%)	0	1
1	M	447/447 (100%)	274 (61%)	173 (39%)	0	1
2	N	328/344 (95%)	212 (65%)	116 (35%)	0	1
All	All	6139/6155 (100%)	3788 (62%)	2351 (38%)	0	1

5 of 2351 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	K	393	ASN
2	N	185	ARG
1	L	21	ASN
1	K	388	THR
1	M	87	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 410 such sidechains are listed below:

Mol	Chain	Res	Type
1	I	9	ASN
1	J	339	GLN
2	N	98	GLN
1	I	153	ASN
1	I	374	GLN

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 [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.

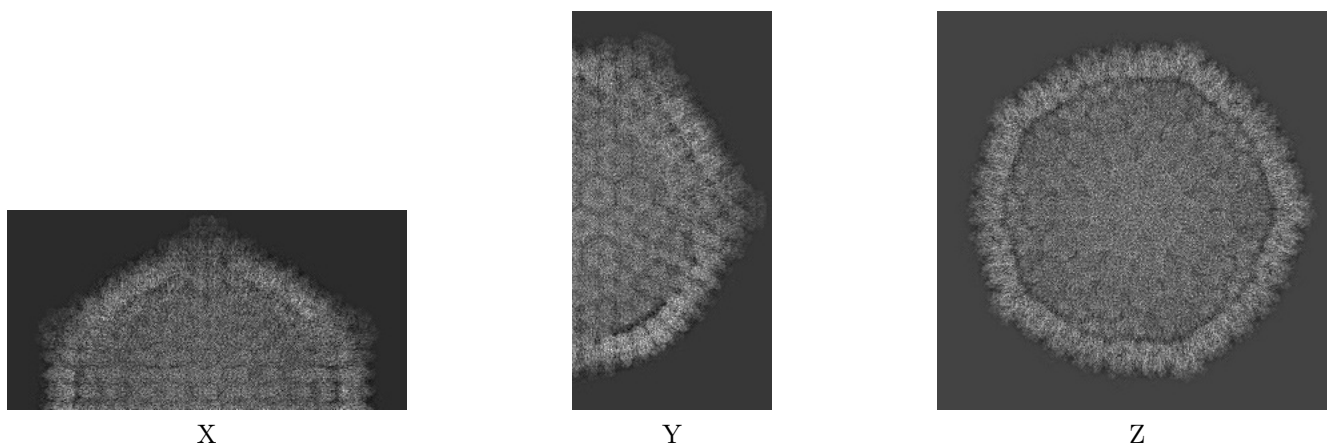
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-5495. 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](#)

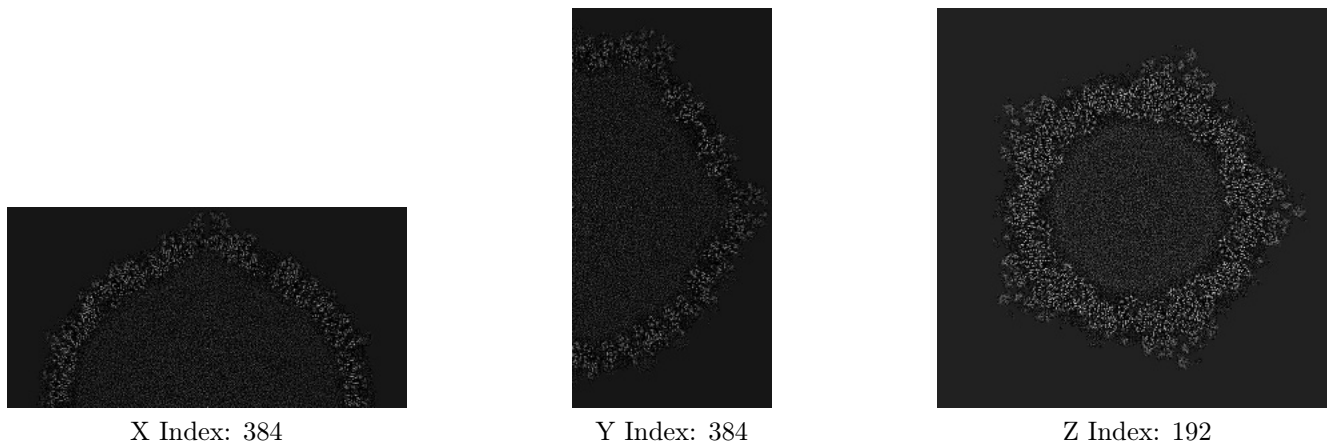
6.1.1 Primary map



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

6.2 Central slices [i](#)

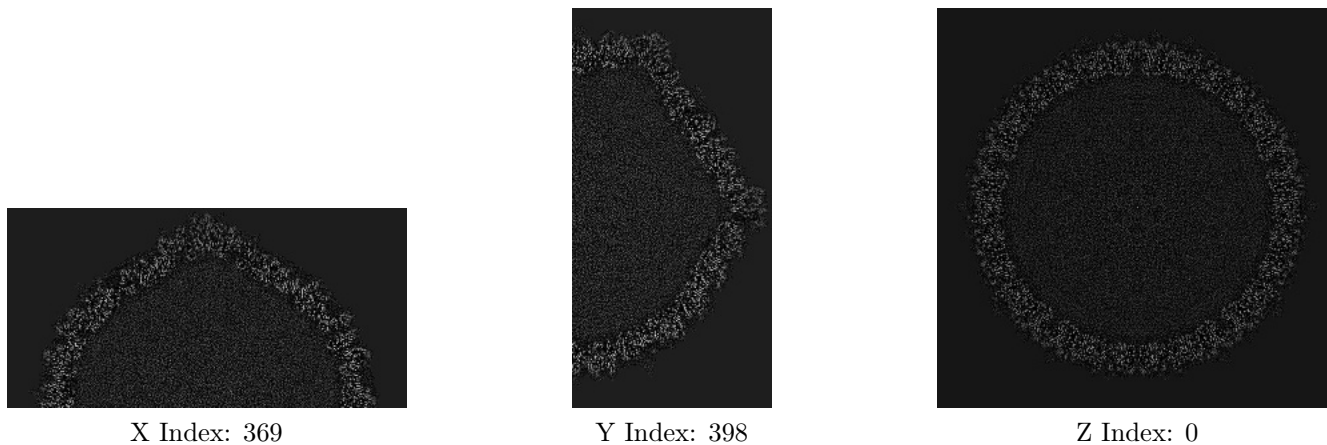
6.2.1 Primary map



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

6.3 Largest variance slices [i](#)

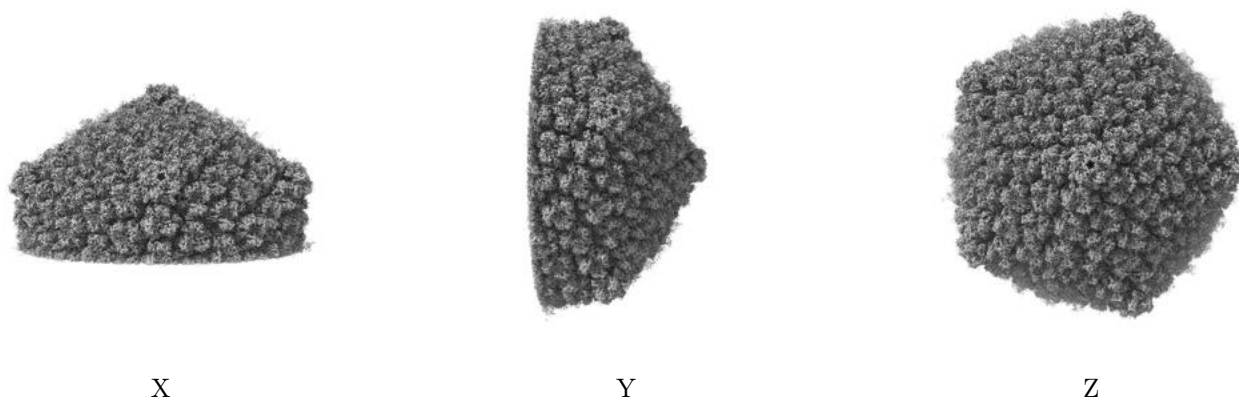
6.3.1 Primary map



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



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.

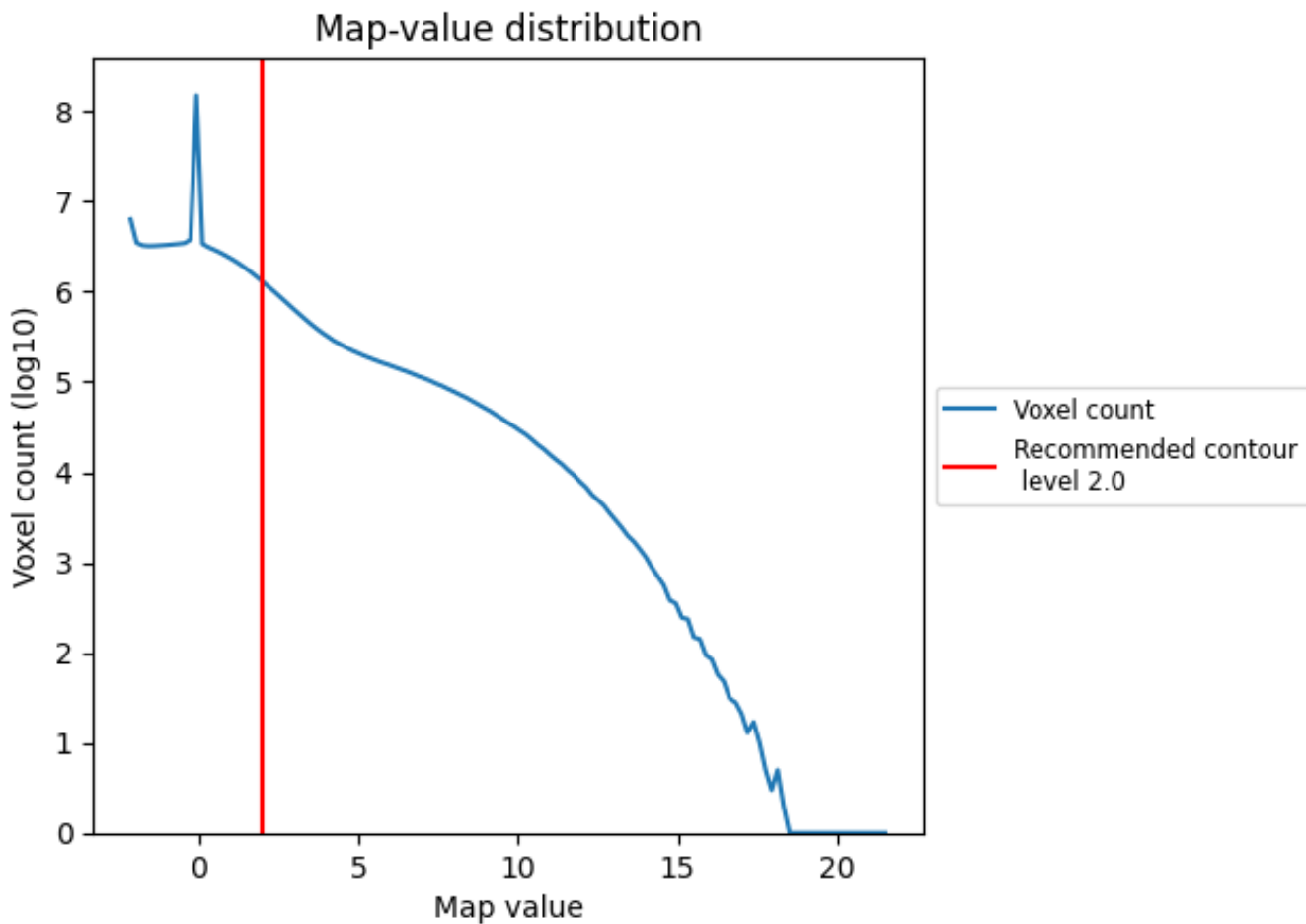
6.5 Mask visualisation

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

7 Map analysis [i](#)

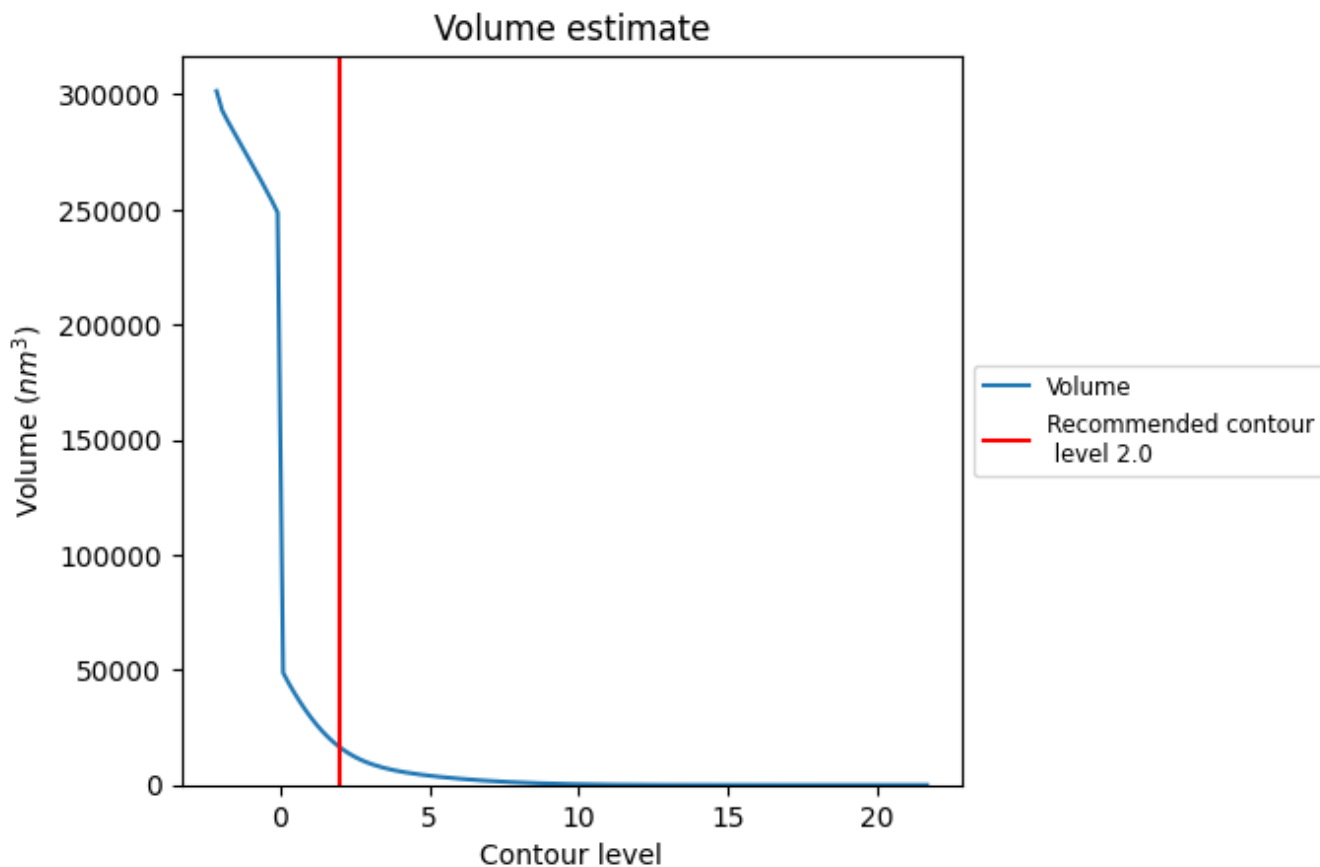
This section contains the results of statistical analysis of the map.

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 16322 nm³; this corresponds to an approximate mass of 14744 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

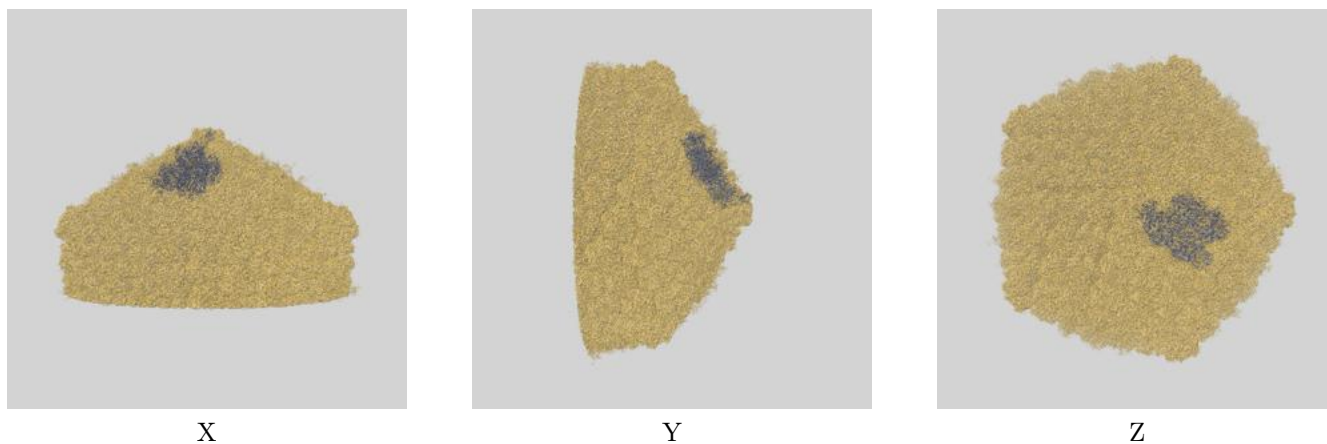
This section was not generated. No FSC curve or half-maps provided.

9 Map-model fit [i](#)

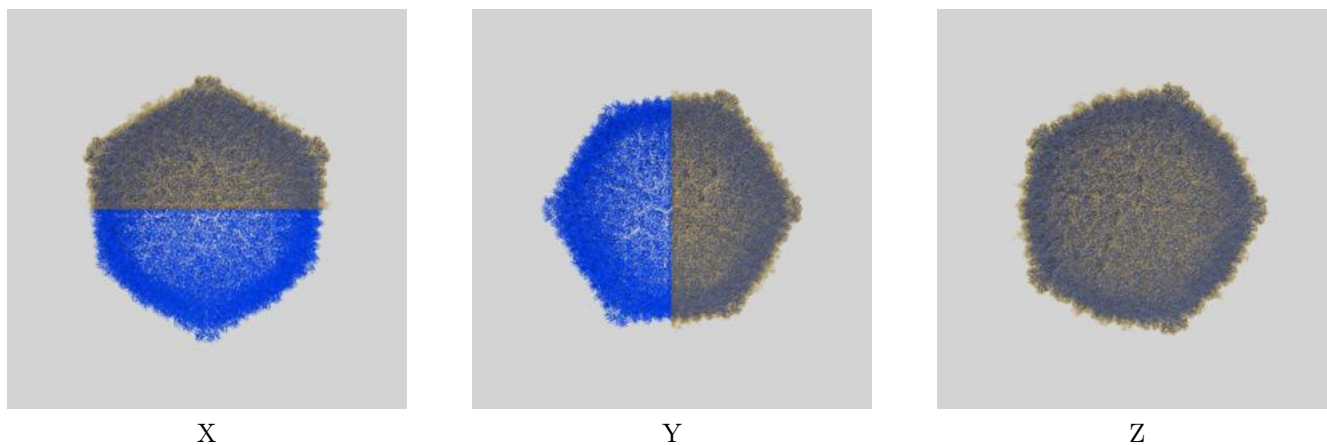
This section contains information regarding the fit between EMDB map EMD-5495 and PDB model 3J26. Per-residue inclusion information can be found in section 3 on page 5.

9.1 Map-model overlays

9.1.1 Map-model overlay [i](#)

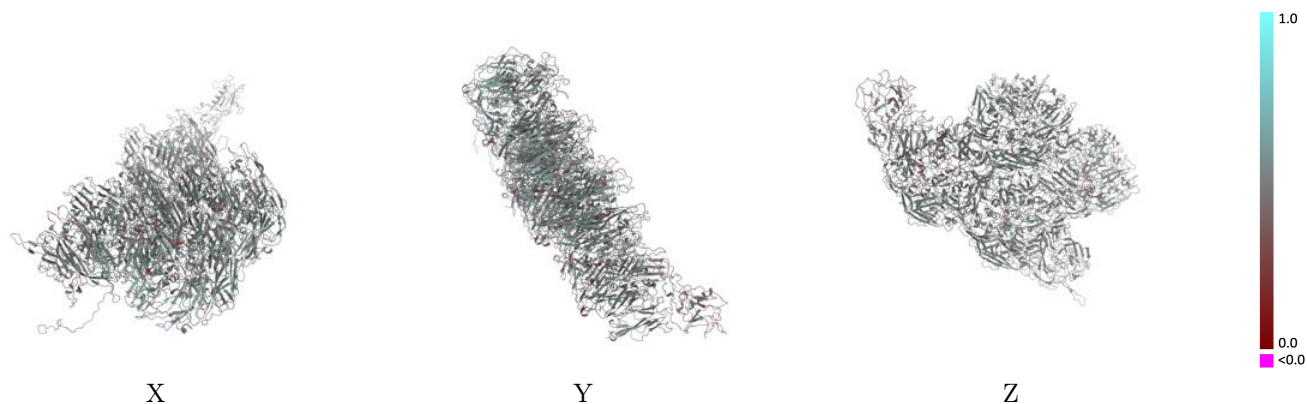


9.1.2 Map-model assembly overlay [i](#)



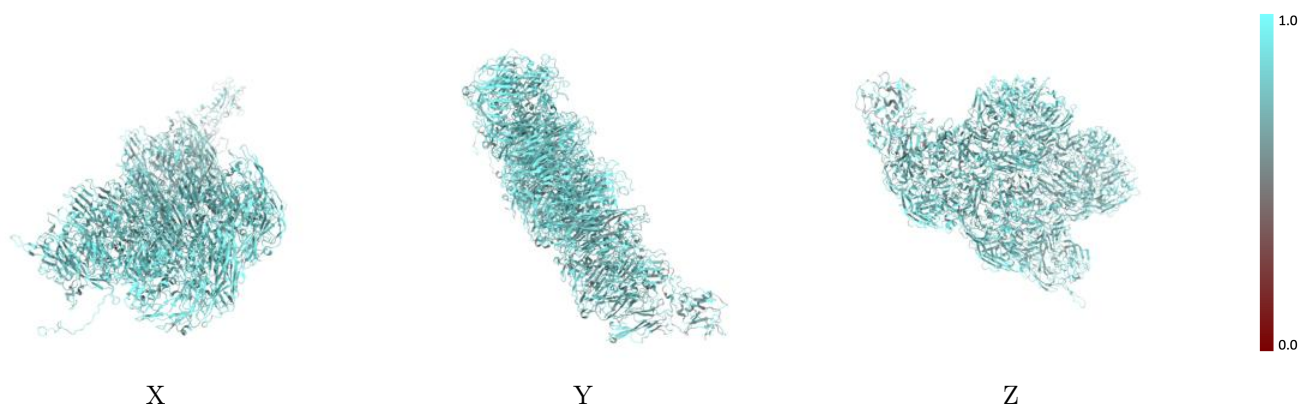
The images above show the 3D surface view of the map at the recommended contour level 2.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



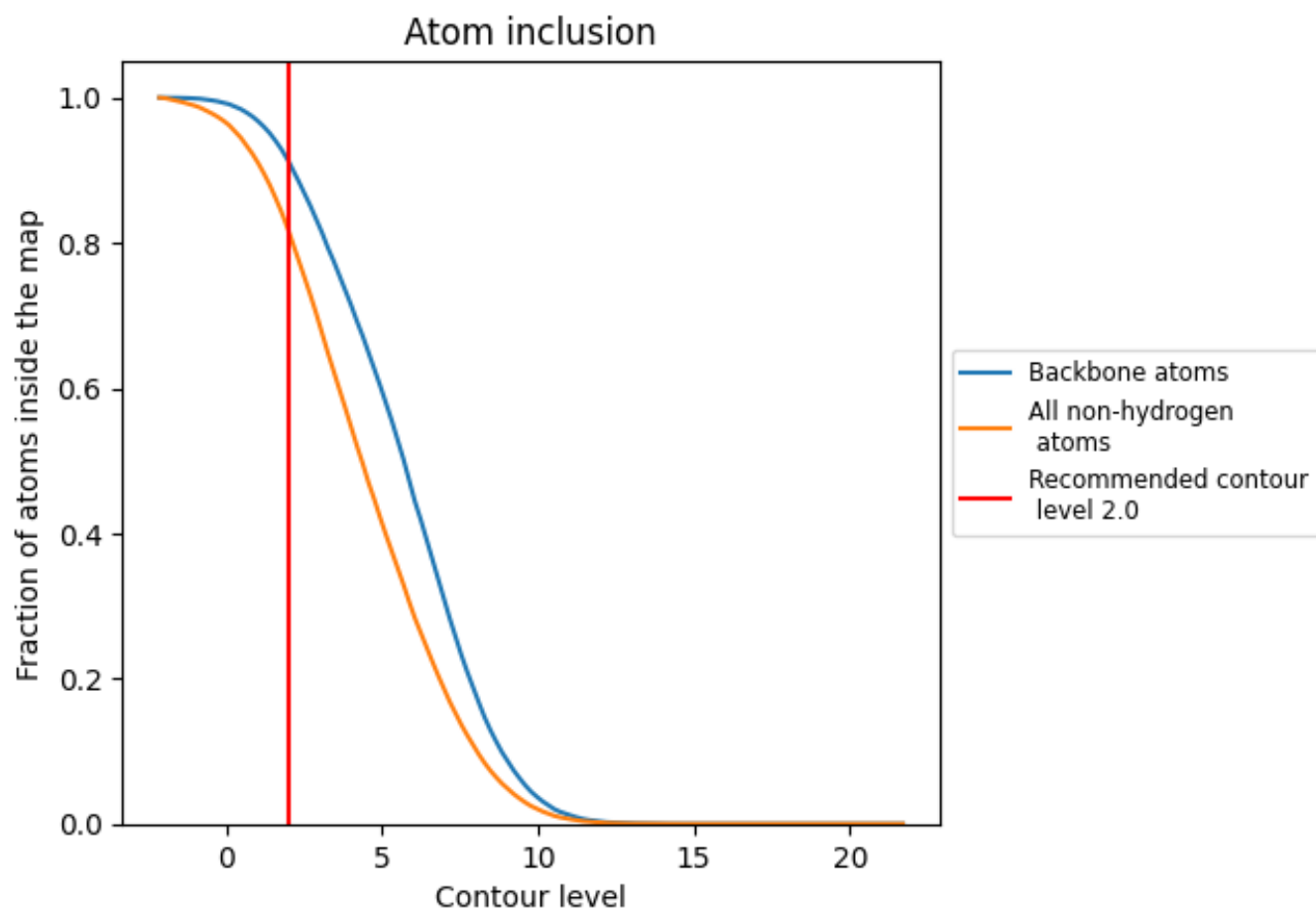
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (2.0).































9.4 Atom inclusion [i](#)



At the recommended contour level, 91% of all backbone atoms, 82% 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 (2.0) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8162	 0.4880
A	 0.8187	 0.4840
B	 0.8100	 0.4850
C	 0.8008	 0.4860
D	 0.7716	 0.4720
E	 0.8210	 0.4900
F	 0.8313	 0.4900
G	 0.8177	 0.4940
H	 0.8392	 0.4980
I	 0.8331	 0.4930
J	 0.8341	 0.4960
K	 0.8415	 0.4980
L	 0.8397	 0.5000
M	 0.8259	 0.4920
N	 0.7144	 0.4460

