



Full wwPDB EM Validation Report ⓘ

Apr 3, 2023 – 12:31 PM EDT

PDB ID : 8FEZ
EMDB ID : EMD-29035
Title : Prefusion-stabilized SARS-CoV-2 spike protein
Authors : Gonzalez, K.J.; Mousa, J.J.; Strauch, E.M.
Deposited on : 2022-12-07
Resolution : 3.72 Å (reported)

This is a Full wwPDB EM Validation 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.dev50
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) : 2.32.2

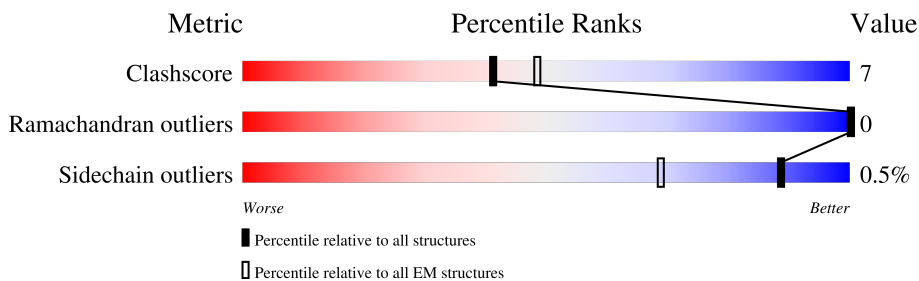
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.72 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	1243	 67% 9% 23%
1	B	1243	 68% 6% 26%
1	C	1243	 70% 8% 22%

2 Entry composition i

There is only 1 type of molecule in this entry. The entry contains 17515 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 Spike glycoprotein.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	955	5931	3732	1057	1116	26	0	0
1	B	916	5621	3562	1002	1030	27	0	0
1	C	972	5963	3762	1068	1109	24	0	0

There are 147 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	682	GLY	ARG	conflict	UNP P0DTC2
A	683	SER	ARG	conflict	UNP P0DTC2
A	685	SER	ARG	conflict	UNP P0DTC2
A	856	LEU	ASN	engineered mutation	UNP P0DTC2
A	899	GLN	ALA	engineered mutation	UNP P0DTC2
A	916	PHE	LEU	engineered mutation	UNP P0DTC2
A	917	TRP	TYR	engineered mutation	UNP P0DTC2
A	941	ASP	THR	engineered mutation	UNP P0DTC2
A	956	LEU	ALA	engineered mutation	UNP P0DTC2
A	964	GLU	LYS	engineered mutation	UNP P0DTC2
A	985	ASN	ASP	engineered mutation	UNP P0DTC2
A	986	PRO	LYS	conflict	UNP P0DTC2
A	987	PRO	VAL	conflict	UNP P0DTC2
A	1143	GLN	PRO	engineered mutation	UNP P0DTC2
A	1209	GLY	-	expression tag	UNP P0DTC2
A	1210	SER	-	expression tag	UNP P0DTC2
A	1211	GLY	-	expression tag	UNP P0DTC2
A	1212	TYR	-	expression tag	UNP P0DTC2
A	1213	ILE	-	expression tag	UNP P0DTC2
A	1214	PRO	-	expression tag	UNP P0DTC2
A	1215	GLU	-	expression tag	UNP P0DTC2
A	1216	ALA	-	expression tag	UNP P0DTC2
A	1217	PRO	-	expression tag	UNP P0DTC2
A	1218	ARG	-	expression tag	UNP P0DTC2

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
A	1219	ASP	-	expression tag	UNP P0DTC2
A	1220	GLY	-	expression tag	UNP P0DTC2
A	1221	GLN	-	expression tag	UNP P0DTC2
A	1222	ALA	-	expression tag	UNP P0DTC2
A	1223	TYR	-	expression tag	UNP P0DTC2
A	1224	VAL	-	expression tag	UNP P0DTC2
A	1225	ARG	-	expression tag	UNP P0DTC2
A	1226	LYS	-	expression tag	UNP P0DTC2
A	1227	ASP	-	expression tag	UNP P0DTC2
A	1228	GLY	-	expression tag	UNP P0DTC2
A	1229	GLU	-	expression tag	UNP P0DTC2
A	1230	TRP	-	expression tag	UNP P0DTC2
A	1231	VAL	-	expression tag	UNP P0DTC2
A	1232	LEU	-	expression tag	UNP P0DTC2
A	1233	LEU	-	expression tag	UNP P0DTC2
A	1234	SER	-	expression tag	UNP P0DTC2
A	1235	THR	-	expression tag	UNP P0DTC2
A	1236	PHE	-	expression tag	UNP P0DTC2
A	1237	LEU	-	expression tag	UNP P0DTC2
A	1238	HIS	-	expression tag	UNP P0DTC2
A	1239	HIS	-	expression tag	UNP P0DTC2
A	1240	HIS	-	expression tag	UNP P0DTC2
A	1241	HIS	-	expression tag	UNP P0DTC2
A	1242	HIS	-	expression tag	UNP P0DTC2
A	1243	HIS	-	expression tag	UNP P0DTC2
B	682	GLY	ARG	conflict	UNP P0DTC2
B	683	SER	ARG	conflict	UNP P0DTC2
B	685	SER	ARG	conflict	UNP P0DTC2
B	856	LEU	ASN	engineered mutation	UNP P0DTC2
B	899	GLN	ALA	engineered mutation	UNP P0DTC2
B	916	PHE	LEU	engineered mutation	UNP P0DTC2
B	917	TRP	TYR	engineered mutation	UNP P0DTC2
B	941	ASP	THR	engineered mutation	UNP P0DTC2
B	956	LEU	ALA	engineered mutation	UNP P0DTC2
B	964	GLU	LYS	engineered mutation	UNP P0DTC2
B	985	ASN	ASP	engineered mutation	UNP P0DTC2
B	986	PRO	LYS	conflict	UNP P0DTC2
B	987	PRO	VAL	conflict	UNP P0DTC2
B	1143	GLN	PRO	engineered mutation	UNP P0DTC2
B	1209	GLY	-	expression tag	UNP P0DTC2
B	1210	SER	-	expression tag	UNP P0DTC2
B	1211	GLY	-	expression tag	UNP P0DTC2

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	1212	TYR	-	expression tag	UNP P0DTC2
B	1213	ILE	-	expression tag	UNP P0DTC2
B	1214	PRO	-	expression tag	UNP P0DTC2
B	1215	GLU	-	expression tag	UNP P0DTC2
B	1216	ALA	-	expression tag	UNP P0DTC2
B	1217	PRO	-	expression tag	UNP P0DTC2
B	1218	ARG	-	expression tag	UNP P0DTC2
B	1219	ASP	-	expression tag	UNP P0DTC2
B	1220	GLY	-	expression tag	UNP P0DTC2
B	1221	GLN	-	expression tag	UNP P0DTC2
B	1222	ALA	-	expression tag	UNP P0DTC2
B	1223	TYR	-	expression tag	UNP P0DTC2
B	1224	VAL	-	expression tag	UNP P0DTC2
B	1225	ARG	-	expression tag	UNP P0DTC2
B	1226	LYS	-	expression tag	UNP P0DTC2
B	1227	ASP	-	expression tag	UNP P0DTC2
B	1228	GLY	-	expression tag	UNP P0DTC2
B	1229	GLU	-	expression tag	UNP P0DTC2
B	1230	TRP	-	expression tag	UNP P0DTC2
B	1231	VAL	-	expression tag	UNP P0DTC2
B	1232	LEU	-	expression tag	UNP P0DTC2
B	1233	LEU	-	expression tag	UNP P0DTC2
B	1234	SER	-	expression tag	UNP P0DTC2
B	1235	THR	-	expression tag	UNP P0DTC2
B	1236	PHE	-	expression tag	UNP P0DTC2
B	1237	LEU	-	expression tag	UNP P0DTC2
B	1238	HIS	-	expression tag	UNP P0DTC2
B	1239	HIS	-	expression tag	UNP P0DTC2
B	1240	HIS	-	expression tag	UNP P0DTC2
B	1241	HIS	-	expression tag	UNP P0DTC2
B	1242	HIS	-	expression tag	UNP P0DTC2
B	1243	HIS	-	expression tag	UNP P0DTC2
C	682	GLY	ARG	conflict	UNP P0DTC2
C	683	SER	ARG	conflict	UNP P0DTC2
C	685	SER	ARG	conflict	UNP P0DTC2
C	856	LEU	ASN	engineered mutation	UNP P0DTC2
C	899	GLN	ALA	engineered mutation	UNP P0DTC2
C	916	PHE	LEU	engineered mutation	UNP P0DTC2
C	917	TRP	TYR	engineered mutation	UNP P0DTC2
C	941	ASP	THR	engineered mutation	UNP P0DTC2
C	956	LEU	ALA	engineered mutation	UNP P0DTC2
C	964	GLU	LYS	engineered mutation	UNP P0DTC2

Continued on next page...

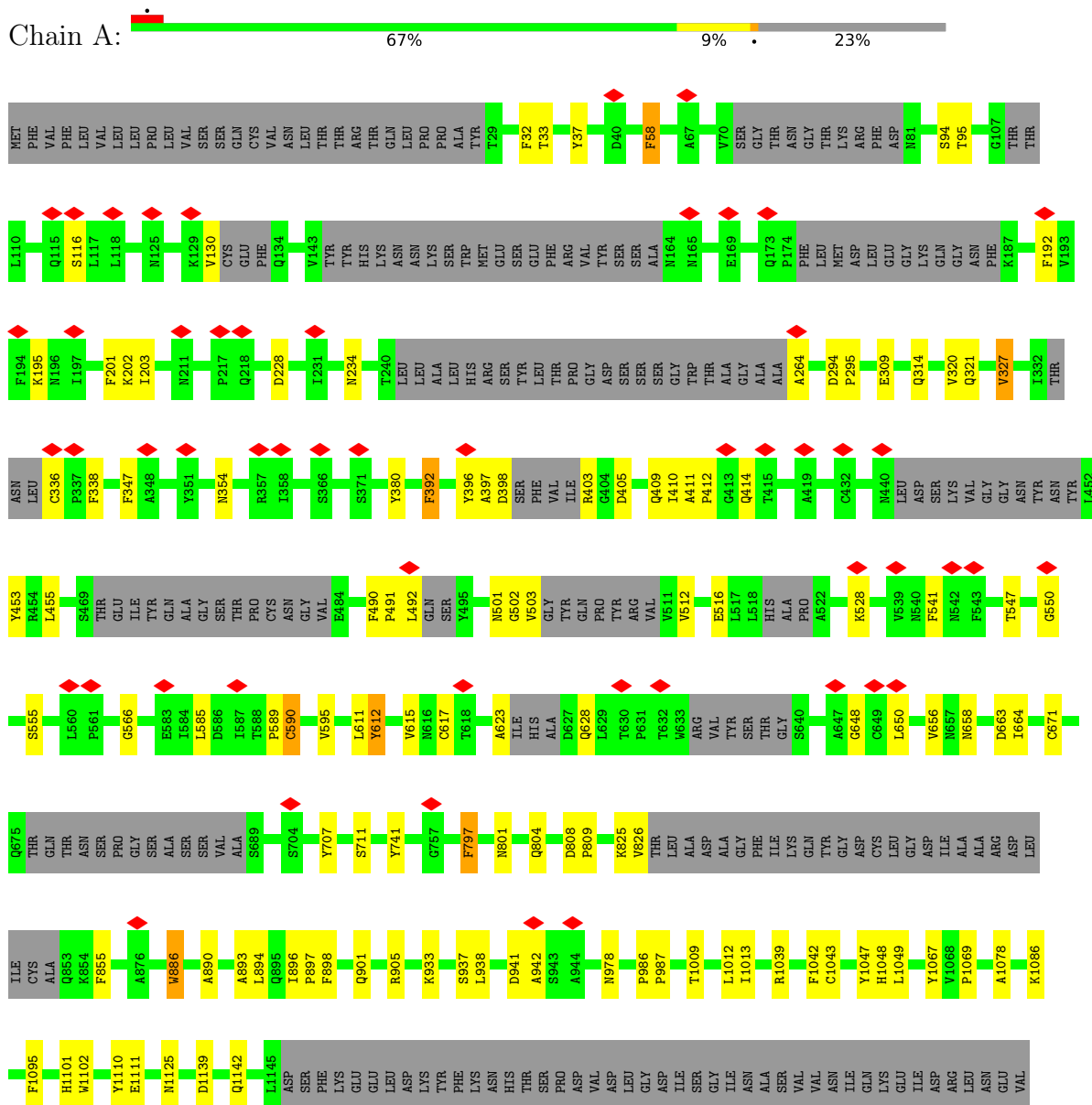
Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
C	985	ASN	ASP	engineered mutation	UNP P0DTC2
C	986	PRO	LYS	conflict	UNP P0DTC2
C	987	PRO	VAL	conflict	UNP P0DTC2
C	1143	GLN	PRO	engineered mutation	UNP P0DTC2
C	1209	GLY	-	expression tag	UNP P0DTC2
C	1210	SER	-	expression tag	UNP P0DTC2
C	1211	GLY	-	expression tag	UNP P0DTC2
C	1212	TYR	-	expression tag	UNP P0DTC2
C	1213	ILE	-	expression tag	UNP P0DTC2
C	1214	PRO	-	expression tag	UNP P0DTC2
C	1215	GLU	-	expression tag	UNP P0DTC2
C	1216	ALA	-	expression tag	UNP P0DTC2
C	1217	PRO	-	expression tag	UNP P0DTC2
C	1218	ARG	-	expression tag	UNP P0DTC2
C	1219	ASP	-	expression tag	UNP P0DTC2
C	1220	GLY	-	expression tag	UNP P0DTC2
C	1221	GLN	-	expression tag	UNP P0DTC2
C	1222	ALA	-	expression tag	UNP P0DTC2
C	1223	TYR	-	expression tag	UNP P0DTC2
C	1224	VAL	-	expression tag	UNP P0DTC2
C	1225	ARG	-	expression tag	UNP P0DTC2
C	1226	LYS	-	expression tag	UNP P0DTC2
C	1227	ASP	-	expression tag	UNP P0DTC2
C	1228	GLY	-	expression tag	UNP P0DTC2
C	1229	GLU	-	expression tag	UNP P0DTC2
C	1230	TRP	-	expression tag	UNP P0DTC2
C	1231	VAL	-	expression tag	UNP P0DTC2
C	1232	LEU	-	expression tag	UNP P0DTC2
C	1233	LEU	-	expression tag	UNP P0DTC2
C	1234	SER	-	expression tag	UNP P0DTC2
C	1235	THR	-	expression tag	UNP P0DTC2
C	1236	PHE	-	expression tag	UNP P0DTC2
C	1237	LEU	-	expression tag	UNP P0DTC2
C	1238	HIS	-	expression tag	UNP P0DTC2
C	1239	HIS	-	expression tag	UNP P0DTC2
C	1240	HIS	-	expression tag	UNP P0DTC2
C	1241	HIS	-	expression tag	UNP P0DTC2
C	1242	HIS	-	expression tag	UNP P0DTC2
C	1243	HIS	-	expression tag	UNP P0DTC2

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.

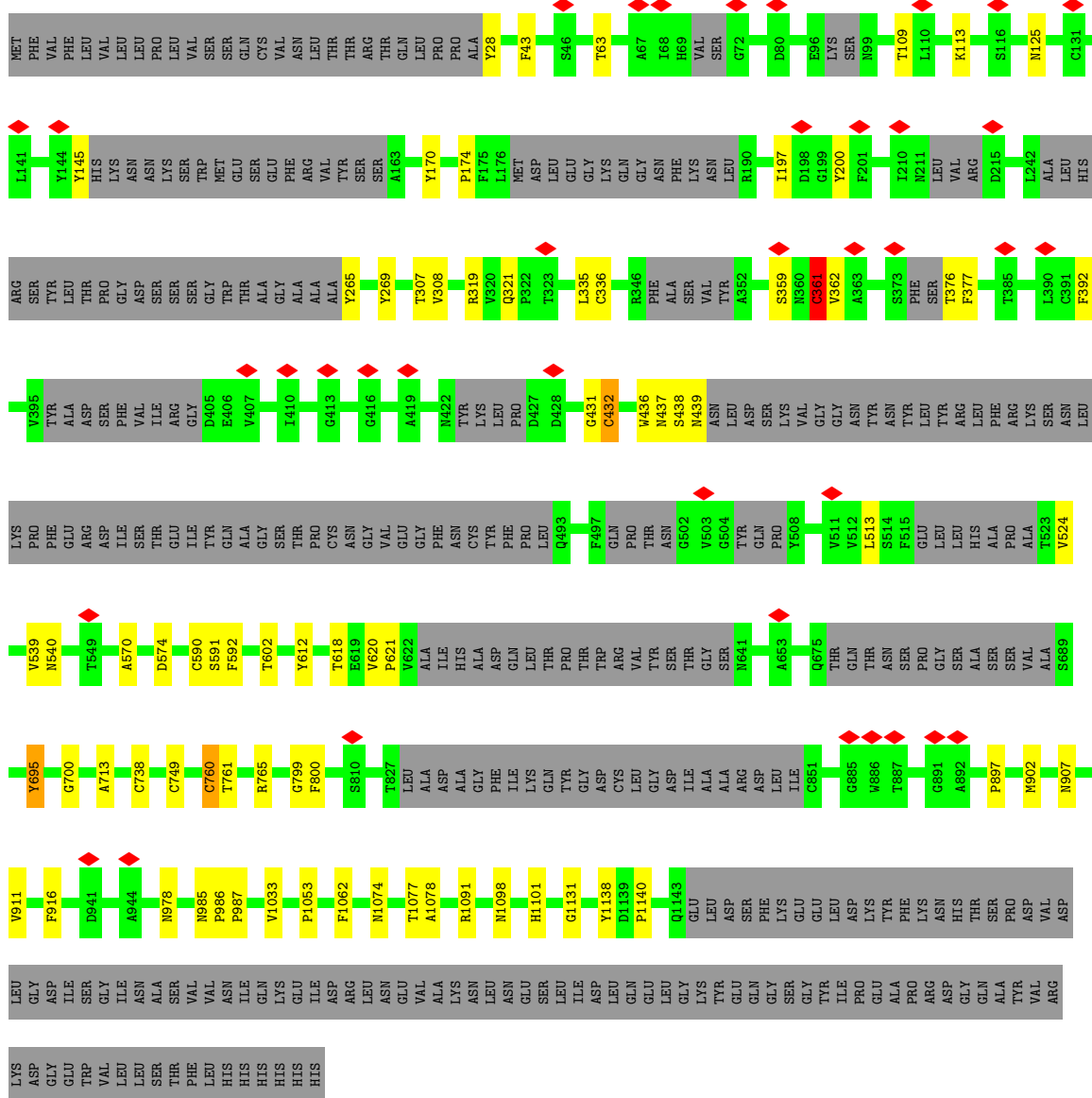
- Molecule 1: Spike glycoprotein



ALA LYS ASN ASN ASN ASN SER LEU ILE LEU ASP ASP LEU LEU LEU LYS LYS TYR ASN TYR LEU LEU GLN GLY LYS TYR TYR TYR TYR PRO PRO GLU ALA PRO PRO ARG ARG ASP ASP ASP GYL GYL GLN ALA TYR VAL ARG ARG LYS ASP ASP ASP GYL VAL VAL LEU LEU LEU THR THR SER SER HIS HIS HIS HIS HIS HIS

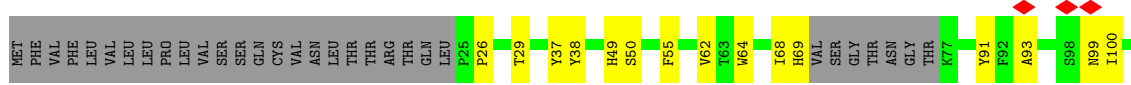
• Molecule 1: Spike glycoprotein

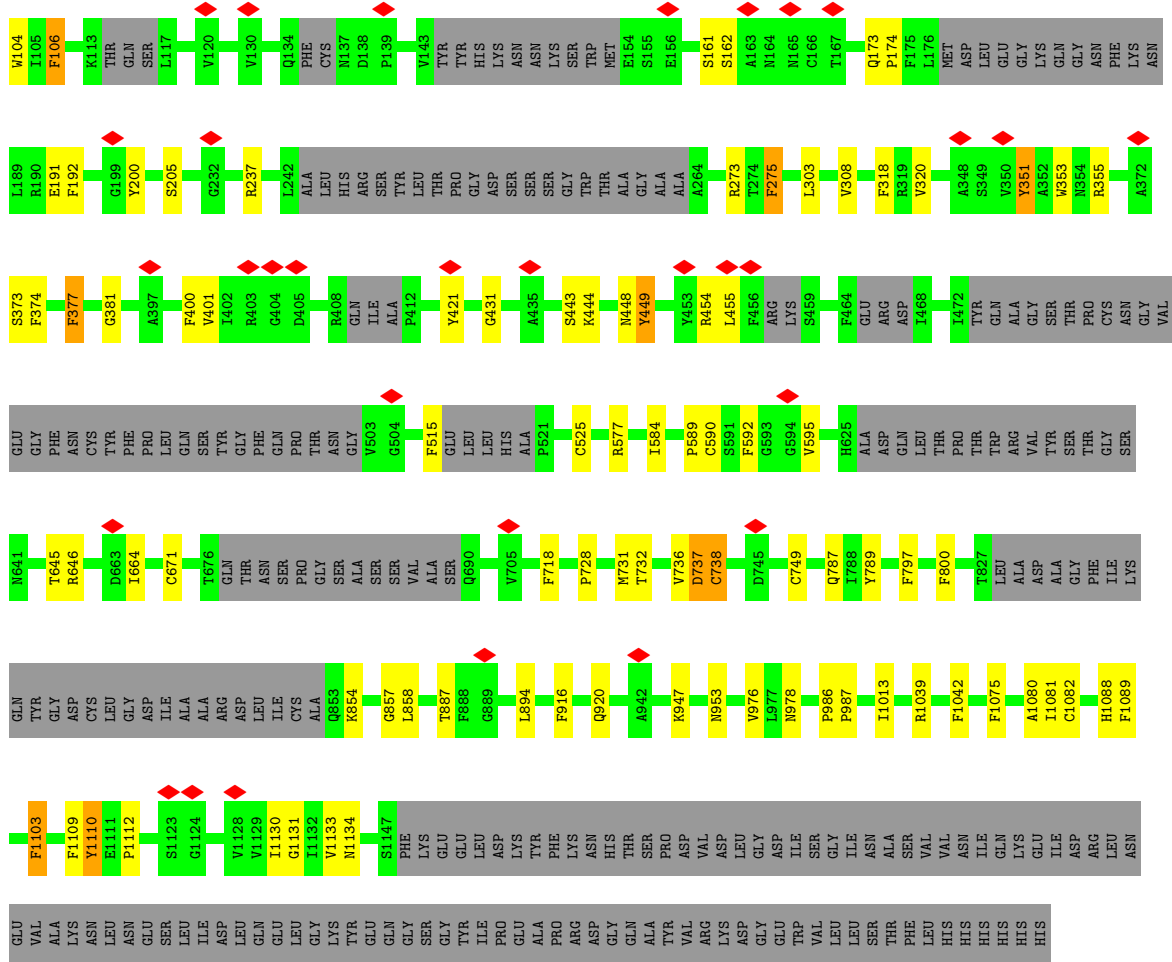
Chain B:  68% 6% 26%



• Molecule 1: Spike glycoprotein

Chain C:  70% 8% 22%





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	87514	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	58.24	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2600	Depositor
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	1.797	Depositor
Minimum map value	-0.025	Depositor
Average map value	0.003	Depositor
Map value standard deviation	0.034	Depositor
Recommended contour level	0.06	Depositor
Map size (\AA)	262.144, 262.144, 262.144	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (\AA)	1.024, 1.024, 1.024	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	0.90	8/6029 (0.1%)	0.89	6/8284 (0.1%)
1	B	0.90	10/5727 (0.2%)	0.85	6/7866 (0.1%)
1	C	0.92	7/6083 (0.1%)	0.88	12/8359 (0.1%)
All	All	0.91	25/17839 (0.1%)	0.87	24/24509 (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

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	361	CYS	CB-SG	7.49	1.95	1.82
1	C	449	TYR	CE1-CZ	-7.47	1.28	1.38
1	B	432	CYS	CB-SG	-7.22	1.70	1.82
1	B	760	CYS	CB-SG	-6.86	1.70	1.82
1	C	749	CYS	CB-SG	-6.81	1.70	1.82
1	C	525	CYS	CB-SG	-6.59	1.71	1.82
1	B	145	TYR	CG-CD2	6.54	1.47	1.39
1	B	1033	VAL	CB-CG1	-6.37	1.39	1.52
1	B	145	TYR	CG-CD1	6.37	1.47	1.39
1	A	327	VAL	CB-CG2	-6.11	1.40	1.52
1	A	590	CYS	CB-SG	-6.09	1.72	1.82
1	A	396	TYR	CG-CD2	-6.06	1.31	1.39
1	B	749	CYS	CB-SG	-5.93	1.72	1.81
1	B	145	TYR	CE1-CZ	5.89	1.46	1.38
1	B	738	CYS	CB-SG	-5.83	1.72	1.81
1	B	265	TYR	CG-CD2	5.73	1.46	1.39
1	A	37	TYR	CG-CD2	-5.59	1.31	1.39

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	37	TYR	CE1-CZ	-5.51	1.31	1.38
1	C	377	PHE	CG-CD1	-5.34	1.30	1.38
1	C	308	VAL	CB-CG1	-5.34	1.41	1.52
1	C	275	PHE	CD1-CE1	-5.33	1.28	1.39
1	A	392	PHE	CG-CD1	-5.21	1.30	1.38
1	C	106	PHE	CG-CD2	-5.21	1.30	1.38
1	A	741	TYR	CE2-CZ	-5.20	1.31	1.38
1	A	886	TRP	CB-CG	-5.18	1.41	1.50

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	789	TYR	CB-CG-CD2	-8.92	115.65	121.00
1	A	797	PHE	CB-CG-CD1	8.88	127.01	120.80
1	A	797	PHE	CB-CG-CD2	-8.69	114.72	120.80
1	B	170	TYR	CB-CG-CD2	-7.74	116.36	121.00
1	C	38	TYR	CB-CG-CD1	-7.22	116.67	121.00
1	C	200	TYR	CB-CG-CD1	-6.94	116.84	121.00
1	C	237	ARG	NE-CZ-NH2	-6.61	117.00	120.30
1	C	789	TYR	CB-CG-CD1	6.39	124.83	121.00
1	B	269	TYR	CB-CG-CD2	-6.07	117.36	121.00
1	C	91	TYR	CB-CG-CD2	-5.90	117.46	121.00
1	C	737	ASP	N-CA-C	-5.79	95.35	111.00
1	B	695	TYR	CB-CG-CD1	-5.51	117.69	121.00
1	C	1103	PHE	CB-CG-CD1	5.50	124.65	120.80
1	C	351	TYR	CB-CG-CD2	-5.49	117.71	121.00
1	B	170	TYR	CB-CG-CD1	5.37	124.22	121.00
1	B	612	TYR	CB-CG-CD2	-5.35	117.79	121.00
1	C	1110	TYR	CB-CG-CD1	-5.33	117.80	121.00
1	B	765	ARG	NE-CZ-NH2	-5.32	117.64	120.30
1	A	58	PHE	CB-CG-CD1	5.30	124.51	120.80
1	A	347	PHE	CB-CG-CD2	-5.30	117.09	120.80
1	C	38	TYR	CB-CG-CD2	5.24	124.14	121.00
1	A	453	TYR	CB-CG-CD1	-5.22	117.86	121.00
1	C	592	PHE	CB-CG-CD1	5.15	124.41	120.80
1	A	192	PHE	N-CA-C	-5.07	97.32	111.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	612	TYR	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	5931	0	4279	96	0
1	B	5621	0	3892	53	0
1	C	5963	0	4077	78	0
All	All	17515	0	12248	219	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 7.

All (219) 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:C:1103:PHE:CD1	1:C:1112:PRO:HB3	1.39	1.57
1:A:195:LYS:NZ	1:A:203:ILE:CB	1.69	1.55
1:A:455:LEU:CD1	1:A:492:LEU:HA	1.60	1.28
1:A:825:LYS:O	1:A:826:VAL:HG12	1.34	1.22
1:B:392:PHE:O	1:B:524:VAL:HG22	1.42	1.16
1:C:1103:PHE:CD1	1:C:1112:PRO:CB	2.35	1.08
1:A:455:LEU:HD11	1:A:492:LEU:HA	1.15	1.08
1:A:501:ASN:HB3	1:A:503:VAL:HG22	1.38	1.05
1:C:29:THR:HG22	1:C:64:TRP:HD1	1.18	1.04
1:B:359:SER:HA	1:B:524:VAL:HG12	1.42	1.00
1:C:29:THR:HG22	1:C:64:TRP:CD1	1.98	0.97
1:A:455:LEU:HD12	1:A:492:LEU:HA	1.47	0.95
1:A:550:GLY:HA2	1:A:589:PRO:HA	1.48	0.95
1:B:307:THR:HA	1:B:602:THR:HG21	1.49	0.94
1:C:1103:PHE:CE1	1:C:1112:PRO:HB3	2.04	0.92
1:A:195:LYS:HZ1	1:A:203:ILE:CB	1.81	0.92
1:B:524:VAL:HG23	1:B:524:VAL:O	1.69	0.89
1:C:797:PHE:CB	1:C:800:PHE:HB2	2.02	0.89
1:C:1103:PHE:HD1	1:C:1112:PRO:HB3	1.24	0.89
1:A:455:LEU:HD11	1:A:492:LEU:CA	2.04	0.86
1:A:825:LYS:O	1:A:826:VAL:CG1	2.22	0.84
1:A:455:LEU:CD1	1:A:492:LEU:CA	2.53	0.83
1:C:29:THR:CG2	1:C:64:TRP:HD1	1.94	0.81
1:A:612:TYR:CE2	1:A:650:LEU:CB	2.66	0.79

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:728:PRO:HD3	1:C:947:LYS:HG3	1.62	0.79
1:A:612:TYR:HE2	1:A:650:LEU:CB	1.96	0.79
1:A:501:ASN:CB	1:A:503:VAL:HG22	2.13	0.78
1:B:392:PHE:C	1:B:524:VAL:HG22	2.04	0.77
1:C:26:PRO:HG2	1:C:64:TRP:CZ2	2.22	0.74
1:A:896:ILE:HG22	1:A:898:PHE:H	1.50	0.74
1:C:1103:PHE:CZ	1:C:1110:TYR:OH	2.42	0.72
1:A:1047:TYR:HD2	1:A:1067:TYR:HD2	1.36	0.71
1:A:501:ASN:OD1	1:A:502:GLY:N	2.24	0.70
1:C:1103:PHE:HZ	1:C:1110:TYR:HH	1.34	0.69
1:A:455:LEU:HD12	1:A:492:LEU:CA	2.22	0.69
1:B:985:ASN:OD1	1:B:987:PRO:HG2	1.93	0.69
1:B:574:ASP:OD1	1:B:574:ASP:O	2.11	0.68
1:A:550:GLY:CA	1:A:589:PRO:HA	2.21	0.66
1:A:195:LYS:HD3	1:A:203:ILE:HA	1.78	0.66
1:B:524:VAL:O	1:B:524:VAL:CG2	2.42	0.66
1:B:1053:PRO:HB3	1:B:1062:PHE:CE1	2.31	0.66
1:B:335:LEU:HA	1:B:362:VAL:HB	1.79	0.65
1:A:905:ARG:HB3	1:A:1049:LEU:HB2	1.78	0.64
1:C:55:PHE:HB2	1:C:275:PHE:CE1	2.33	0.63
1:A:978:ASN:OD1	1:A:978:ASN:N	2.31	0.63
1:C:448:ASN:OD1	1:C:449:TYR:N	2.32	0.63
1:A:501:ASN:HB3	1:A:503:VAL:CG2	2.24	0.62
1:C:1103:PHE:CE1	1:C:1110:TYR:OH	2.49	0.62
1:A:195:LYS:HD3	1:A:202:LYS:O	1.99	0.62
1:B:1098:ASN:H	1:B:1101:HIS:H	1.48	0.62
1:B:902:MET:HB3	1:B:916:PHE:CE2	2.34	0.61
1:C:1080:ALA:O	1:C:1133:VAL:N	2.33	0.61
1:C:320:VAL:HB	1:C:590:CYS:SG	2.40	0.61
1:A:116:SER:N	1:A:130:VAL:O	2.33	0.61
1:A:314:GLN:HE22	1:A:595:VAL:H	1.48	0.61
1:B:307:THR:HA	1:B:602:THR:CG2	2.29	0.60
1:B:392:PHE:HB2	1:B:524:VAL:CG2	2.31	0.60
1:A:550:GLY:HA2	1:A:589:PRO:CA	2.29	0.60
1:C:1039:ARG:HG2	1:C:1042:PHE:HB2	1.84	0.60
1:A:195:LYS:CD	1:A:202:LYS:O	2.50	0.60
1:A:896:ILE:HG21	1:A:901:GLN:HB2	1.84	0.59
1:A:541:PHE:HA	1:A:547:THR:HA	1.85	0.59
1:B:392:PHE:HB2	1:B:524:VAL:HG21	1.86	0.58
1:B:431:GLY:HA3	1:B:513:LEU:O	2.03	0.57
1:A:94:SER:OG	1:A:264:ALA:O	2.21	0.57

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1078:ALA:O	1:A:1095:PHE:HB2	2.04	0.56
1:A:321:GLN:HG2	1:A:623:ALA:HB1	1.87	0.56
1:A:1047:TYR:HE2	1:A:1069:PRO:HD3	1.70	0.56
1:A:1047:TYR:CE2	1:A:1069:PRO:HD3	2.41	0.55
1:A:1009:THR:O	1:A:1013:ILE:HG23	2.06	0.55
1:B:359:SER:CA	1:B:524:VAL:HG12	2.28	0.55
1:A:663:ASP:O	1:A:664:ILE:C	2.45	0.54
1:B:618:THR:O	1:B:621:PRO:HD2	2.06	0.54
1:A:411:ALA:HA	1:A:414:GLN:HB2	1.89	0.54
1:B:392:PHE:H	1:B:524:VAL:HG23	1.72	0.54
1:C:1103:PHE:HE1	1:C:1110:TYR:HH	1.50	0.54
1:C:68:ILE:HG22	1:C:69:HIS:N	2.23	0.54
1:C:1075:PHE:CE2	1:C:1110:TYR:CZ	2.96	0.54
1:C:37:TYR:CE2	1:C:55:PHE:CD1	2.96	0.54
1:C:1103:PHE:CE1	1:C:1112:PRO:CB	2.82	0.54
1:C:1103:PHE:HZ	1:C:1110:TYR:OH	1.85	0.54
1:C:1109:PHE:CG	1:C:1110:TYR:N	2.76	0.54
1:A:547:THR:HG23	1:B:978:ASN:CG	2.28	0.54
1:C:26:PRO:HG2	1:C:64:TRP:CH2	2.42	0.54
1:A:403:ARG:NH1	1:A:503:VAL:HA	2.22	0.54
1:B:570:ALA:HB2	1:C:854:LYS:HB2	1.90	0.54
1:A:1047:TYR:HD2	1:A:1067:TYR:CD2	2.21	0.53
1:C:1039:ARG:CG	1:C:1042:PHE:HB2	2.38	0.53
1:A:1086:LYS:HA	1:A:1125:ASN:HA	1.89	0.53
1:C:29:THR:CG2	1:C:64:TRP:CD1	2.79	0.53
1:C:577:ARG:HA	1:C:584:ILE:HA	1.91	0.53
1:B:1138:TYR:OH	1:B:1140:PRO:HB3	2.09	0.52
1:B:700:GLY:HA3	1:C:787:GLN:HA	1.92	0.52
1:A:327:VAL:CG2	1:A:528:LYS:HG3	2.40	0.52
1:C:26:PRO:CG	1:C:64:TRP:CZ2	2.91	0.51
1:A:711:SER:O	1:B:897:PRO:HG3	2.10	0.51
1:B:539:VAL:HG12	1:B:540:ASN:N	2.26	0.51
1:B:1078:ALA:CB	1:B:1131:GLY:O	2.59	0.50
1:A:380:TYR:CE2	1:A:412:PRO:HG2	2.46	0.50
1:B:125:ASN:HA	1:B:174:PRO:HD3	1.92	0.50
1:B:376:THR:HG23	1:B:436:TRP:HA	1.93	0.50
1:C:192:PHE:CE2	1:C:205:SER:HB2	2.46	0.50
1:C:645:THR:OG1	1:C:646:ARG:N	2.45	0.50
1:B:1053:PRO:HB3	1:B:1062:PHE:CD1	2.46	0.50
1:C:1088:HIS:CG	1:C:1089:PHE:N	2.79	0.50
1:C:318:PHE:HB2	1:C:595:VAL:CG2	2.42	0.49

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:93:ALA:HA	1:C:191:GLU:HA	1.95	0.49
1:B:319:ARG:HB2	1:B:321:GLN:HE22	1.78	0.49
1:C:49:HIS:CG	1:C:50:SER:N	2.80	0.49
1:A:663:ASP:H	1:A:671:CYS:HB3	1.78	0.49
1:C:916:PHE:O	1:C:920:GLN:N	2.45	0.49
1:A:1139:ASP:OD2	1:A:1142:GLN:N	2.46	0.49
1:A:320:VAL:O	1:A:590:CYS:SG	2.70	0.48
1:A:1012:LEU:HG	1:C:1013:ILE:HG21	1.95	0.48
1:A:195:LYS:NZ	1:A:203:ILE:CA	2.67	0.48
1:C:986:PRO:HB2	1:C:987:PRO:HD3	1.96	0.48
1:A:392:PHE:CD1	1:A:516:GLU:O	2.65	0.48
1:A:411:ALA:CA	1:A:414:GLN:HB2	2.44	0.48
1:C:373:SER:O	1:C:374:PHE:C	2.50	0.48
1:C:448:ASN:OD1	1:C:448:ASN:C	2.51	0.48
1:A:555:SER:HA	1:A:585:LEU:HB3	1.94	0.48
1:C:431:GLY:HA2	1:C:515:PHE:CD2	2.49	0.47
1:C:1081:ILE:O	1:C:1088:HIS:HB3	2.13	0.47
1:C:431:GLY:HA2	1:C:515:PHE:CE2	2.49	0.47
1:C:736:VAL:HG12	1:C:858:LEU:HA	1.97	0.47
1:C:976:VAL:HG12	1:C:978:ASN:H	1.80	0.47
1:A:611:LEU:HB3	1:A:648:GLY:HA3	1.97	0.46
1:B:1077:THR:OG1	1:B:1078:ALA:N	2.48	0.46
1:C:1103:PHE:CE1	1:C:1112:PRO:CG	2.99	0.46
1:A:656:VAL:HG12	1:A:658:ASN:H	1.79	0.46
1:A:455:LEU:CD1	1:A:491:PRO:O	2.63	0.46
1:B:28:TYR:CD1	1:B:63:THR:HA	2.50	0.46
1:C:161:SER:O	1:C:162:SER:C	2.53	0.46
1:B:109:THR:HG21	1:B:113:LYS:HB2	1.98	0.46
1:C:318:PHE:HB2	1:C:595:VAL:HG22	1.98	0.46
1:C:887:THR:HG21	1:C:894:LEU:HB2	1.98	0.46
1:A:501:ASN:CG	1:A:503:VAL:HG22	2.37	0.45
1:B:336:CYS:HB3	1:B:361:CYS:HB2	1.57	0.45
1:C:99:ASN:O	1:C:100:ILE:HG13	2.16	0.45
1:A:886:TRP:C	1:A:893:ALA:HB2	2.36	0.45
1:B:437:ASN:O	1:B:438:SER:C	2.55	0.45
1:C:1130:ILE:CG2	1:C:1131:GLY:N	2.79	0.45
1:A:234:ASN:OD1	1:A:234:ASN:N	2.50	0.45
1:A:615:VAL:HG22	1:A:617:CYS:H	1.81	0.45
1:A:801:ASN:ND2	1:A:804:GLN:OE1	2.49	0.45
1:C:68:ILE:CG2	1:C:69:HIS:N	2.80	0.45
1:A:455:LEU:HD12	1:A:492:LEU:CB	2.46	0.45

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1110:TYR:O	1:A:1111:GLU:C	2.56	0.45
1:B:438:SER:O	1:B:439:ASN:C	2.55	0.45
1:A:1043:CYS:HB2	1:A:1048:HIS:CG	2.52	0.45
1:A:398:ASP:OD2	1:A:512:VAL:N	2.50	0.44
1:A:405:ASP:OD1	1:A:405:ASP:O	2.34	0.44
1:A:938:LEU:O	1:A:942:ALA:N	2.45	0.44
1:C:104:TRP:HB2	1:C:106:PHE:CZ	2.52	0.44
1:A:195:LYS:HD2	1:A:202:LYS:O	2.17	0.44
1:B:713:ALA:HB2	1:B:1074:ASN:HB3	1.98	0.44
1:C:351:TYR:CE2	1:C:421:TYR:O	2.70	0.44
1:C:1103:PHE:HE1	1:C:1110:TYR:CZ	2.36	0.44
1:C:381:GLY:H	1:C:431:GLY:H	1.65	0.44
1:B:590:CYS:O	1:B:591:SER:C	2.57	0.43
1:A:405:ASP:HB2	1:A:503:VAL:HB	2.00	0.43
1:A:897:PRO:O	1:A:898:PHE:HB3	2.18	0.43
1:C:737:ASP:N	1:C:857:GLY:O	2.51	0.43
1:C:353:TRP:CD1	1:C:355:ARG:HB2	2.54	0.43
1:B:197:ILE:HG22	1:B:200:TYR:O	2.19	0.42
1:A:986:PRO:N	1:A:987:PRO:HD2	2.34	0.42
1:B:319:ARG:HG2	1:B:592:PHE:CD1	2.54	0.42
1:C:273:ARG:HB2	1:C:275:PHE:HE1	1.83	0.42
1:A:295:PRO:HD3	1:A:628:GLN:HG2	2.01	0.42
1:A:933:LYS:O	1:A:937:SER:OG	2.31	0.42
1:C:736:VAL:O	1:C:738:CYS:N	2.52	0.42
1:A:94:SER:OG	1:A:95:THR:N	2.50	0.42
1:A:409:GLN:O	1:A:410:ILE:C	2.54	0.42
1:B:308:VAL:H	1:B:602:THR:CG2	2.32	0.42
1:A:941:ASP:O	1:A:942:ALA:HB3	2.20	0.42
1:C:1082:CYS:H	1:C:1134:ASN:HA	1.84	0.42
1:B:377:PHE:O	1:B:432:CYS:SG	2.78	0.42
1:C:55:PHE:HB2	1:C:275:PHE:CZ	2.55	0.42
1:A:309:GLU:OE2	1:A:309:GLU:N	2.52	0.42
1:A:411:ALA:CB	1:A:414:GLN:CB	2.97	0.42
1:C:454:ARG:O	1:C:455:LEU:C	2.57	0.42
1:C:953:ASN:C	1:C:953:ASN:OD1	2.57	0.42
1:C:173:GLN:N	1:C:174:PRO:CD	2.83	0.42
1:A:490:PHE:N	1:A:491:PRO:CD	2.83	0.41
1:A:886:TRP:HB2	1:A:890:ALA:HB3	2.01	0.41
1:A:1039:ARG:HB2	1:A:1042:PHE:HB3	2.01	0.41
1:C:443:SER:O	1:C:444:LYS:C	2.54	0.41
1:C:664:ILE:O	1:C:671:CYS:HB2	2.20	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:29:THR:N	1:C:62:VAL:O	2.54	0.41
1:A:58:PHE:N	1:A:58:PHE:CD1	2.84	0.41
1:B:907:ASN:HA	1:B:911:VAL:O	2.20	0.41
1:C:374:PHE:O	1:C:377:PHE:CE1	2.73	0.41
1:C:731:MET:O	1:C:732:THR:C	2.58	0.41
1:A:893:ALA:O	1:A:894:LEU:C	2.57	0.41
1:B:695:TYR:CD1	1:B:695:TYR:N	2.88	0.41
1:C:400:PHE:CG	1:C:401:VAL:N	2.89	0.41
1:A:32:PHE:O	1:A:33:THR:C	2.60	0.41
1:A:327:VAL:HG21	1:A:528:LYS:HG3	2.02	0.41
1:A:808:ASP:N	1:A:809:PRO:CD	2.84	0.41
1:B:308:VAL:H	1:B:602:THR:HG22	1.86	0.41
1:B:539:VAL:CG1	1:B:540:ASN:N	2.84	0.41
1:B:799:GLY:O	1:B:800:PHE:C	2.58	0.41
1:C:303:LEU:CG	1:C:303:LEU:O	2.69	0.41
1:A:566:GLY:HA2	1:B:43:PHE:H	1.85	0.41
1:A:855:PHE:HB3	1:C:589:PRO:HG2	2.03	0.41
1:C:718:PHE:CD1	1:C:718:PHE:C	2.94	0.41
1:A:711:SER:O	1:B:897:PRO:HD3	2.20	0.40
1:B:620:VAL:N	1:B:621:PRO:CD	2.84	0.40
1:A:354:ASN:O	1:A:397:ALA:HA	2.22	0.40
1:B:986:PRO:N	1:B:987:PRO:HD2	2.36	0.40
1:B:436:TRP:O	1:B:437:ASN:C	2.59	0.40
1:B:760:CYS:O	1:B:761:THR:C	2.58	0.40
1:A:201:PHE:O	1:A:228:ASP:HA	2.21	0.40
1:A:490:PHE:N	1:A:491:PRO:HD2	2.36	0.40
1:A:294:ASP:HA	1:A:628:GLN:HG2	2.04	0.40
1:A:336:CYS:SG	1:A:338:PHE:HB3	2.61	0.40
1:A:405:ASP:CG	1:A:503:VAL:HG11	2.42	0.40
1:A:1101:HIS:O	1:A:1102:TRP:C	2.58	0.40
1:C:1103:PHE:HE1	1:C:1110:TYR:OH	2.01	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	919/1243 (74%)	851 (93%)	68 (7%)	0	100	100
1	B	880/1243 (71%)	861 (98%)	19 (2%)	0	100	100
1	C	942/1243 (76%)	903 (96%)	39 (4%)	0	100	100
All	All	2741/3729 (74%)	2615 (95%)	126 (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	336/1084 (31%)	334 (99%)	2 (1%)	86	92
1	B	281/1084 (26%)	279 (99%)	2 (1%)	84	91
1	C	301/1084 (28%)	300 (100%)	1 (0%)	92	96
All	All	918/3252 (28%)	913 (100%)	5 (0%)	89	94

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	707	TYR
1	A	797	PHE
1	B	361	CYS
1	B	1091	ARG
1	C	738	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	314	GLN
1	A	321	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	801	ASN
1	B	49	HIS
1	B	422	ASN
1	B	1048	HIS

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.

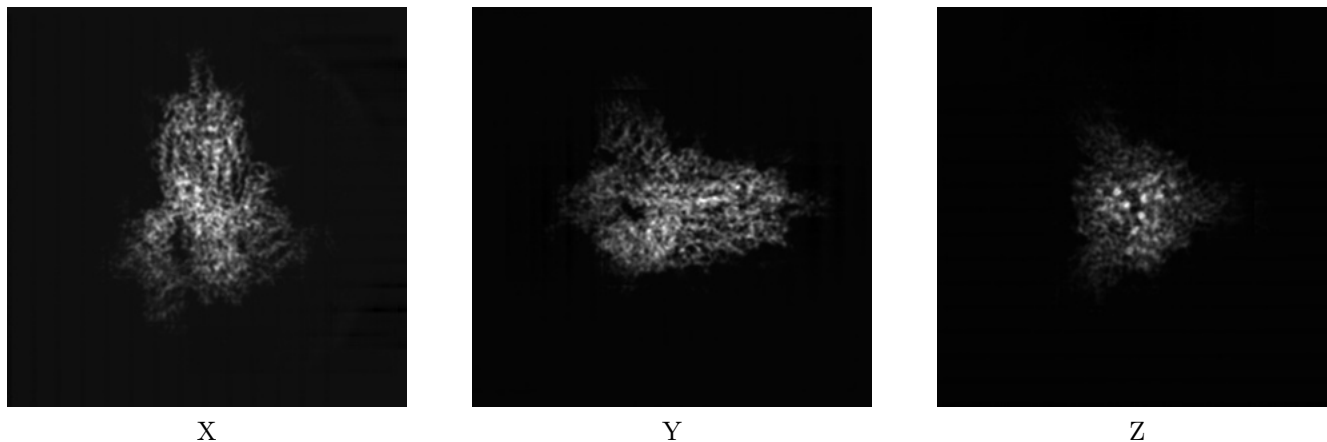
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-29035. These allow visual inspection of the internal detail of the map and identification of artifacts.

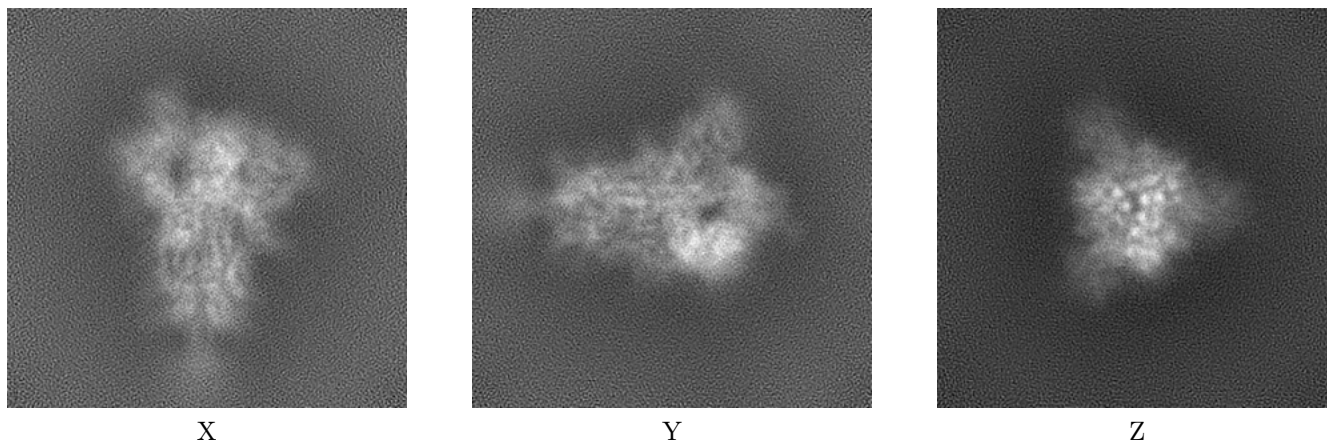
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

6.1.1 Primary map



6.1.2 Raw map



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

6.2 Central slices [i](#)

6.2.1 Primary map



X Index: 128

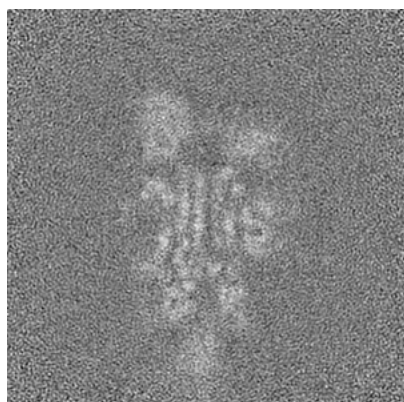


Y Index: 128

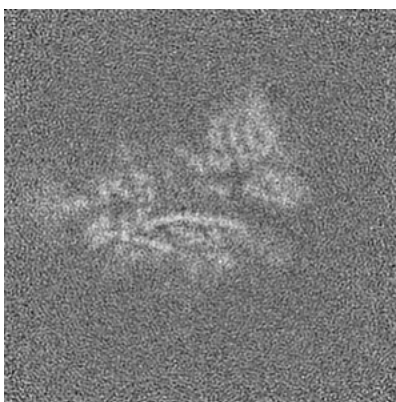


Z Index: 128

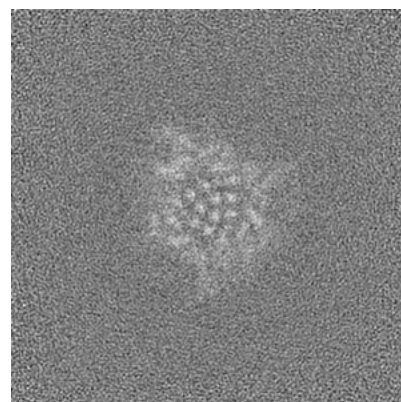
6.2.2 Raw map



X Index: 128



Y Index: 128

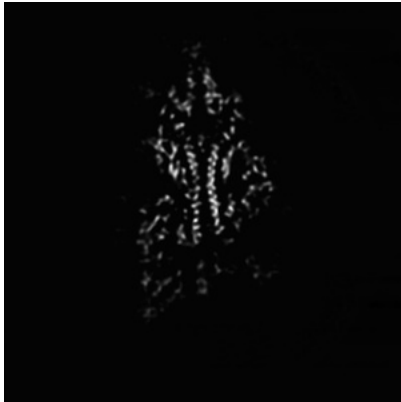


Z Index: 128

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

6.3 Largest variance slices [i](#)

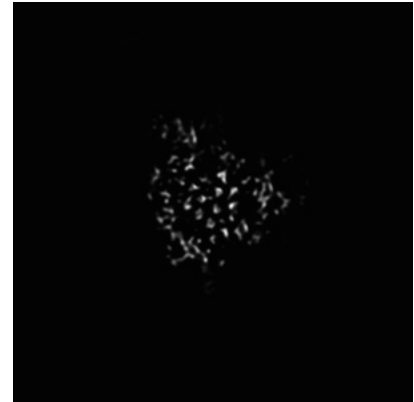
6.3.1 Primary map



X Index: 132

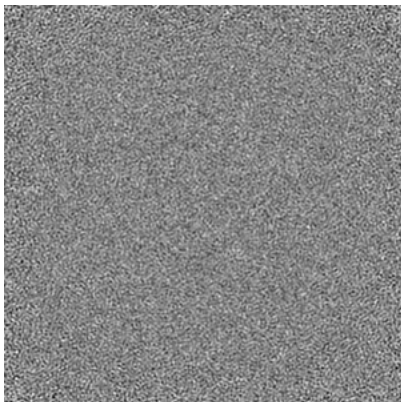


Y Index: 133

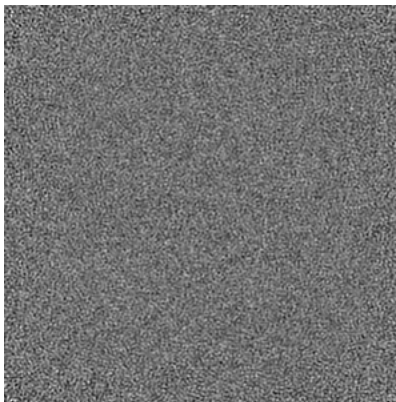


Z Index: 123

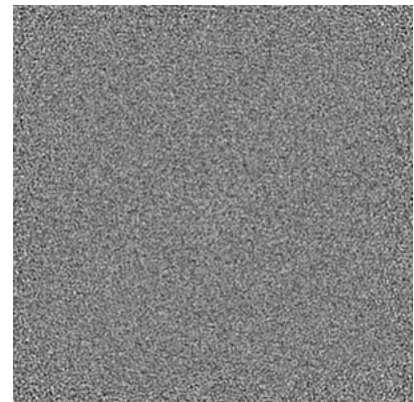
6.3.2 Raw map



X Index: 0



Y Index: 0

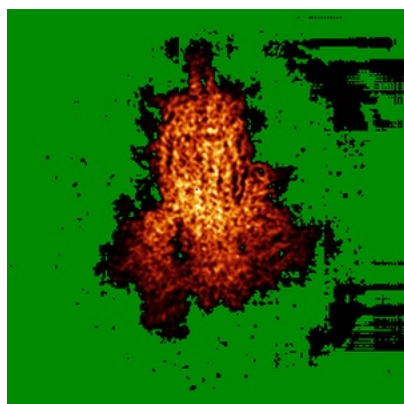


Z Index: 0

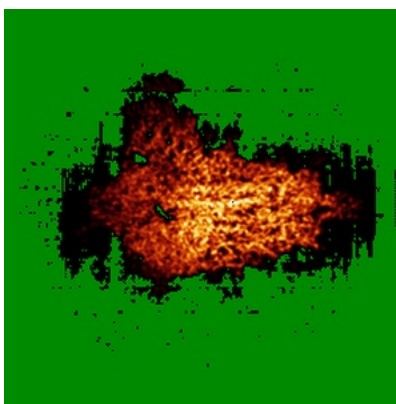
The images above show the largest variance slices of the map in three orthogonal directions.

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

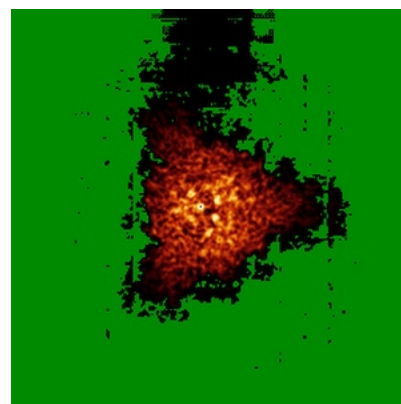
6.4.1 Primary map



X

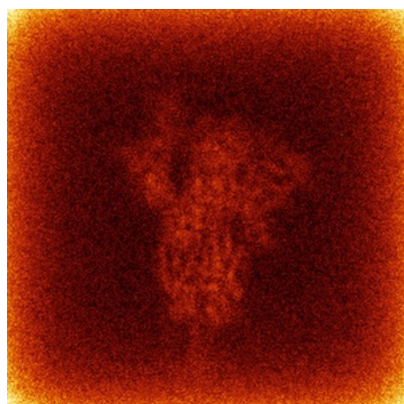


Y

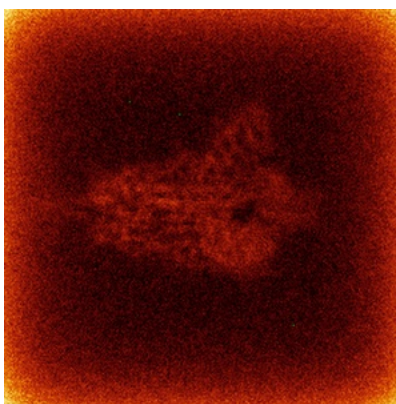


Z

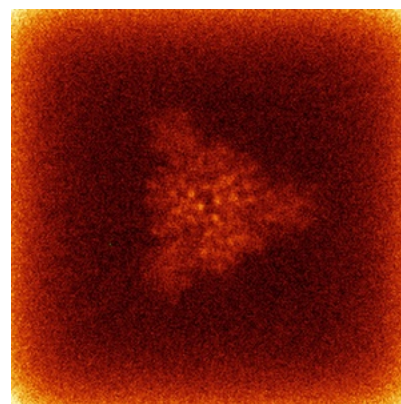
6.4.2 Raw map



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.

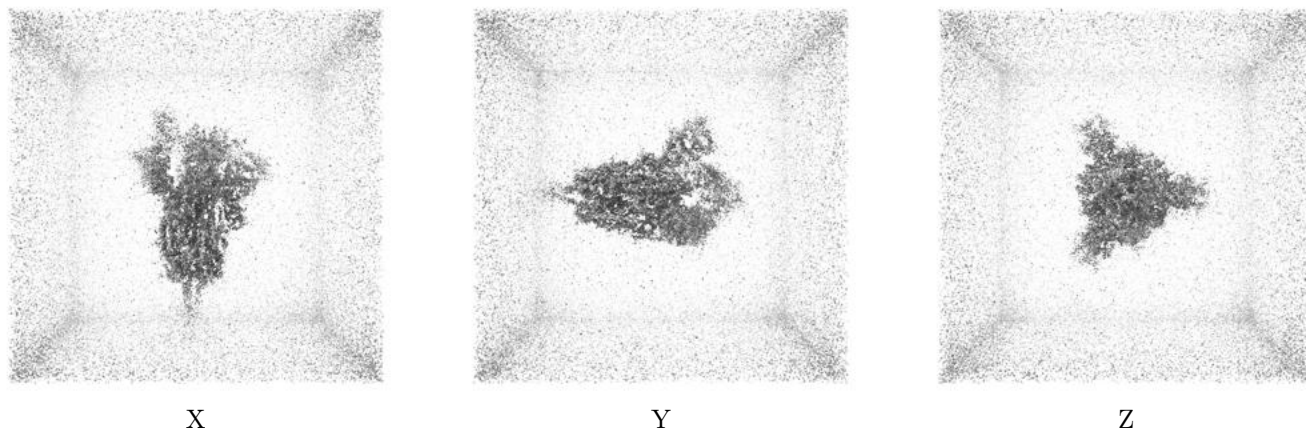
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.06. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map



These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

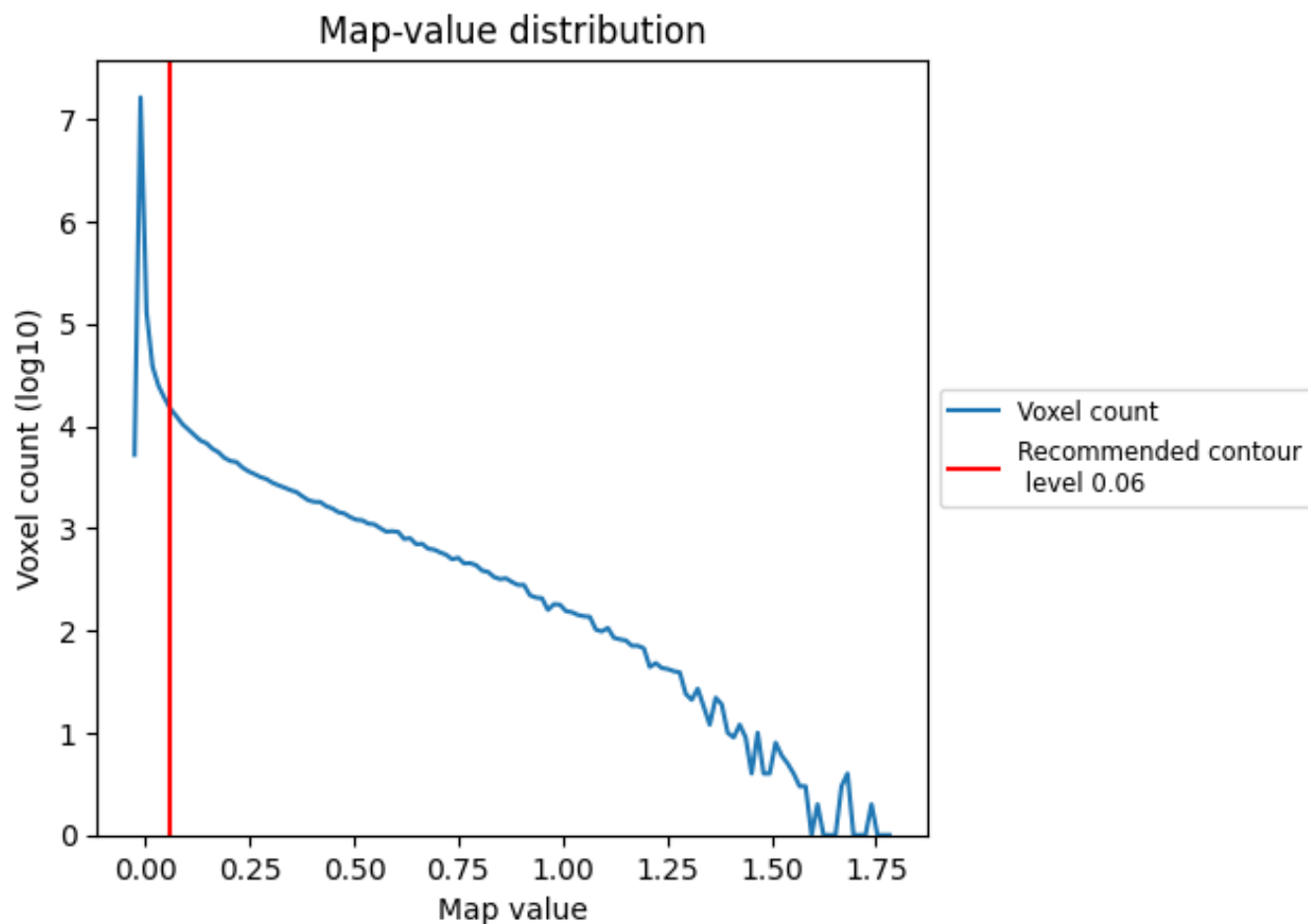
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

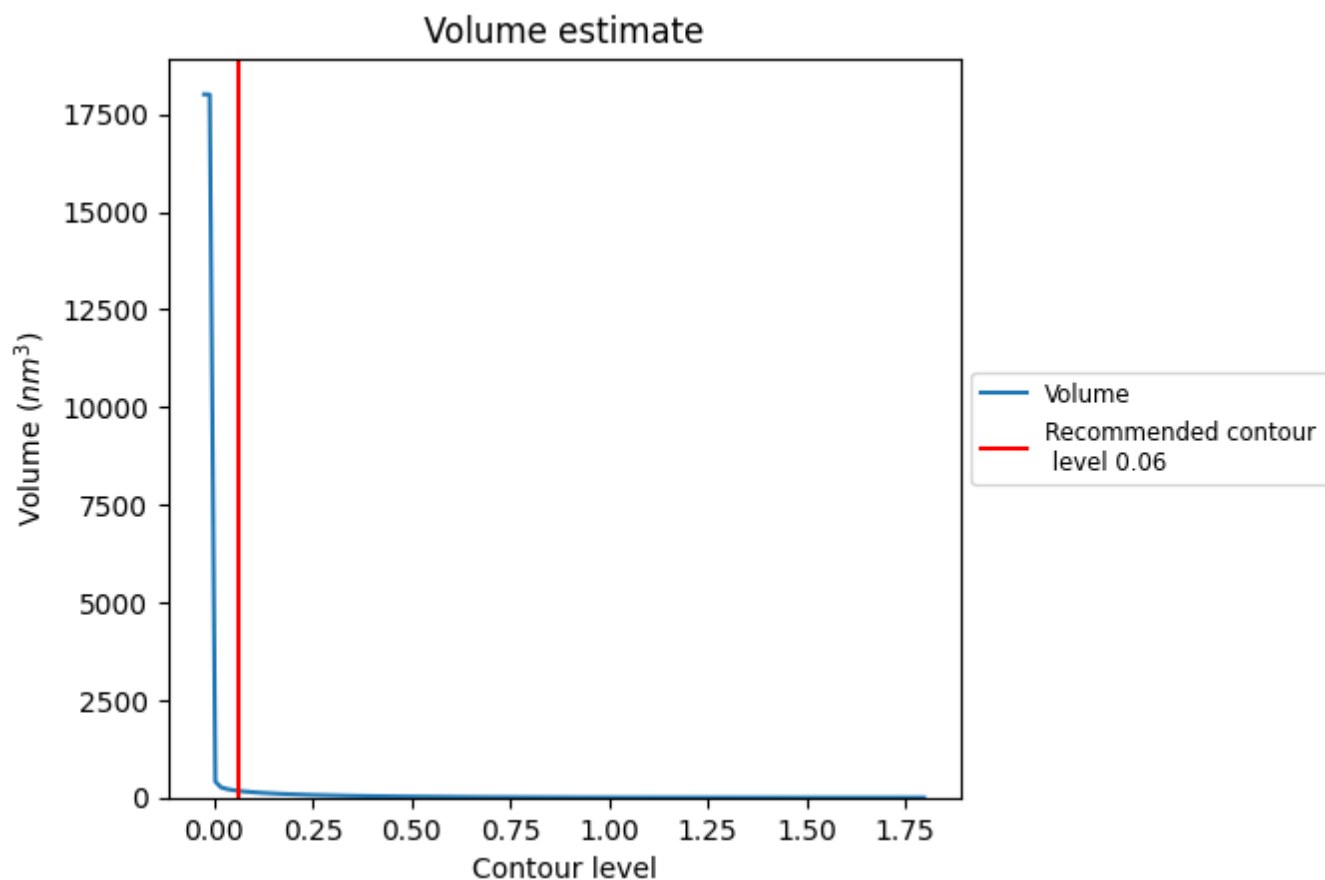
This section contains the results of statistical analysis of the map.

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.

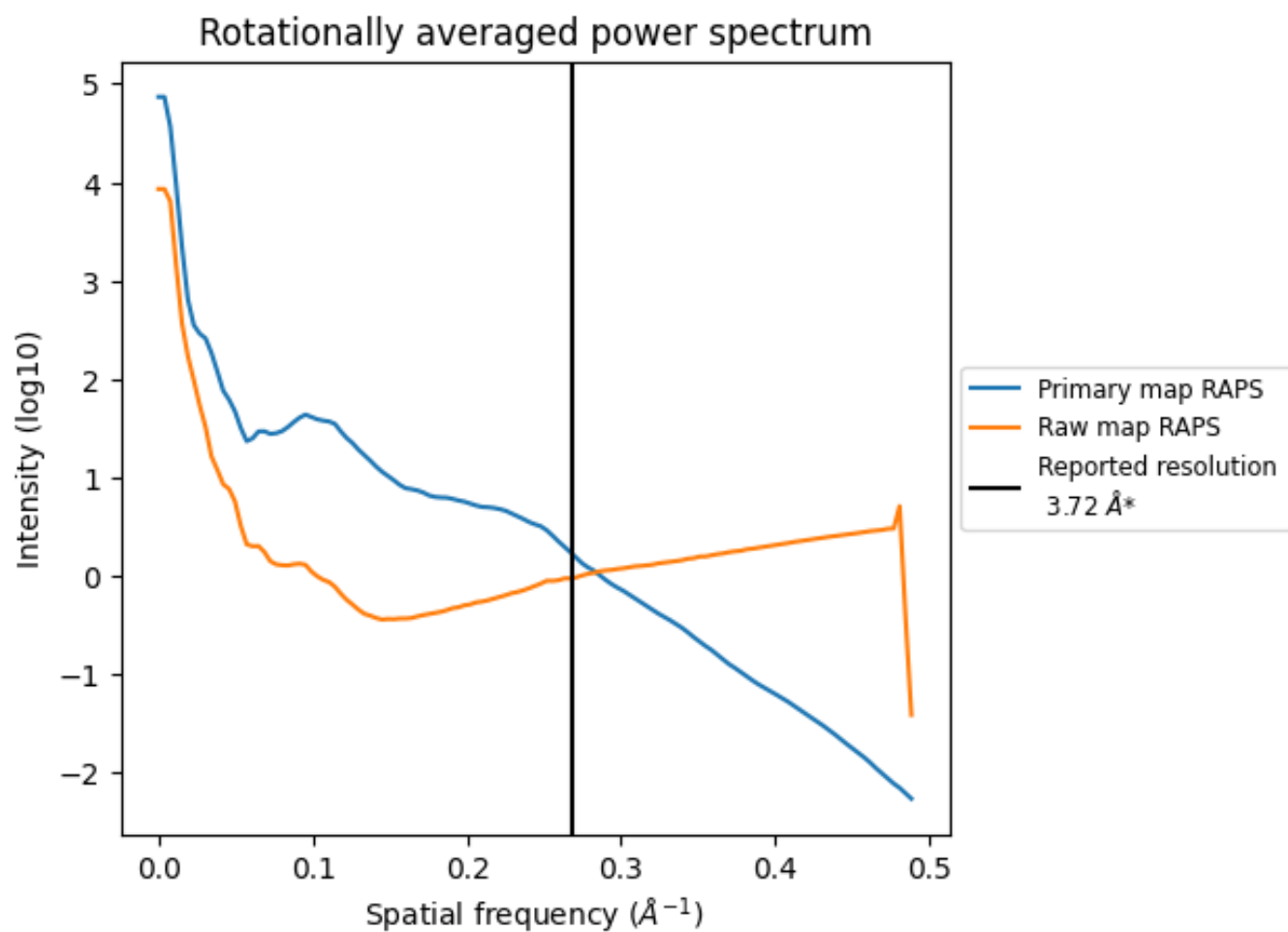
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 174 nm³; this corresponds to an approximate mass of 157 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](#)

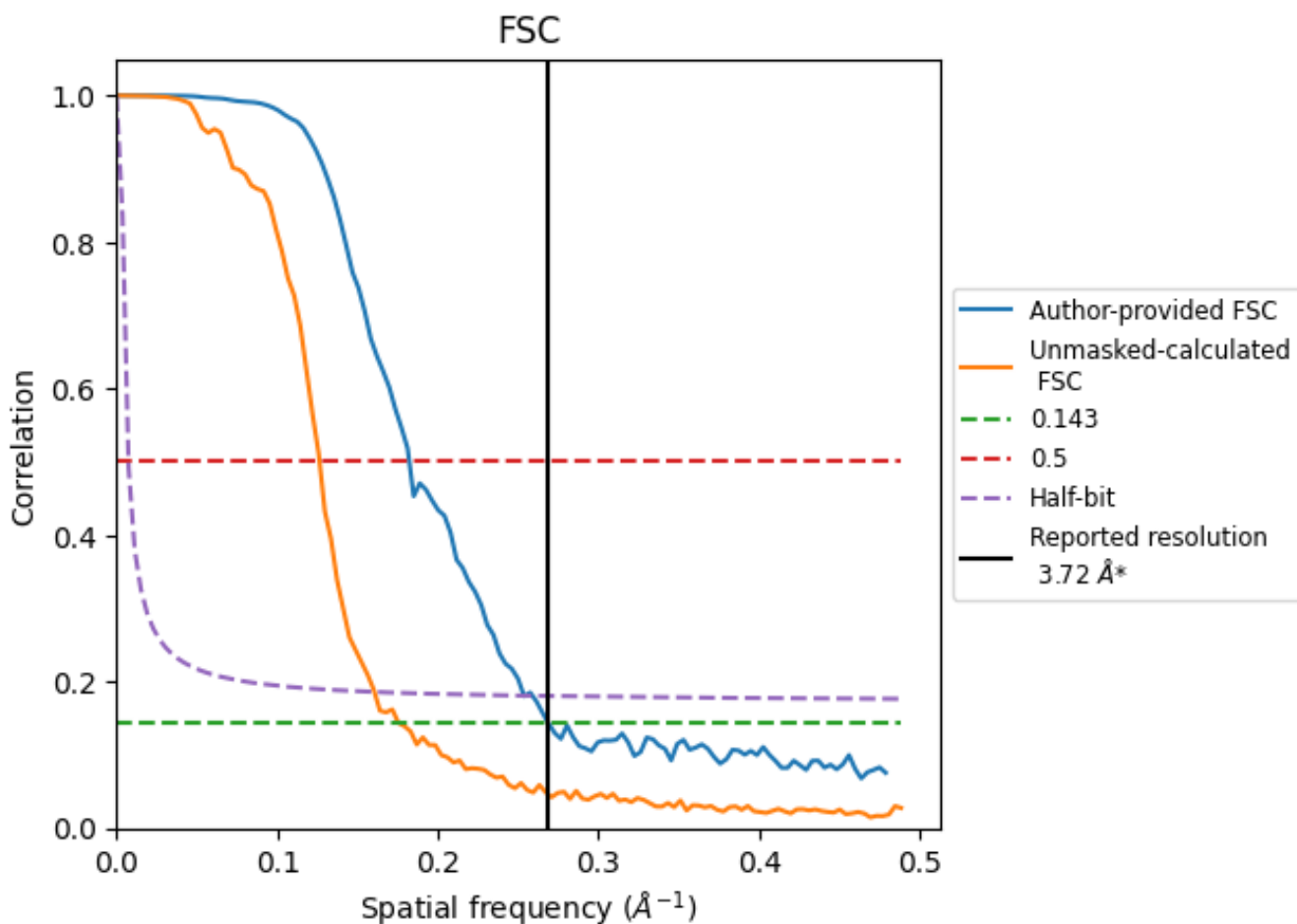


*Reported resolution corresponds to spatial frequency of 0.269 Å⁻¹

8 Fourier-Shell correlation [i](#)

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

8.1 FSC [i](#)



*Reported resolution corresponds to spatial frequency of 0.269 Å⁻¹

8.2 Resolution estimates [i](#)

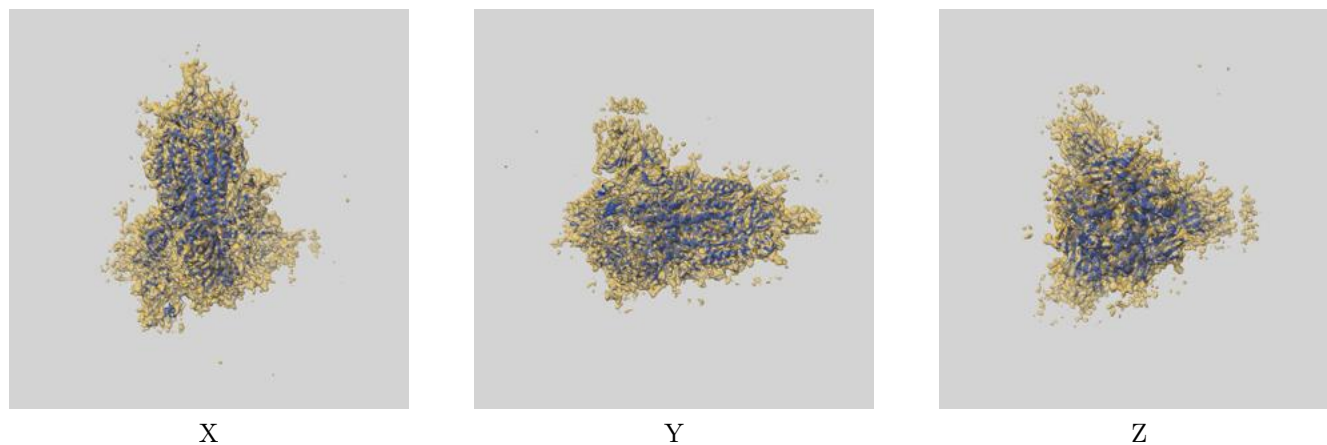
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.72	-	-
Author-provided FSC curve	3.72	5.49	3.94
Unmasked-calculated*	5.70	7.91	6.23

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 5.70 differs from the reported value 3.72 by more than 10 %

9 Map-model fit [i](#)

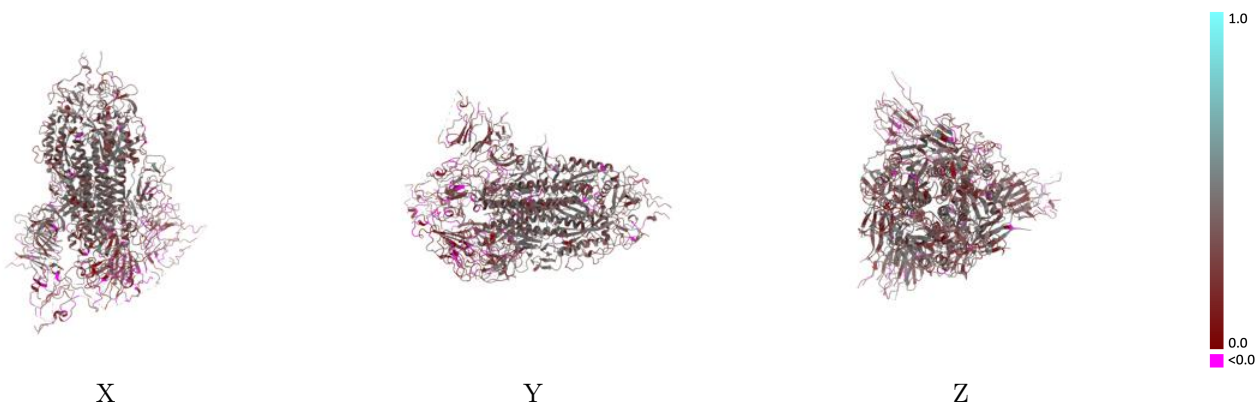
This section contains information regarding the fit between EMDB map EMD-29035 and PDB model 8FEZ. Per-residue inclusion information can be found in section 3 on page 7.

9.1 Map-model overlay [i](#)



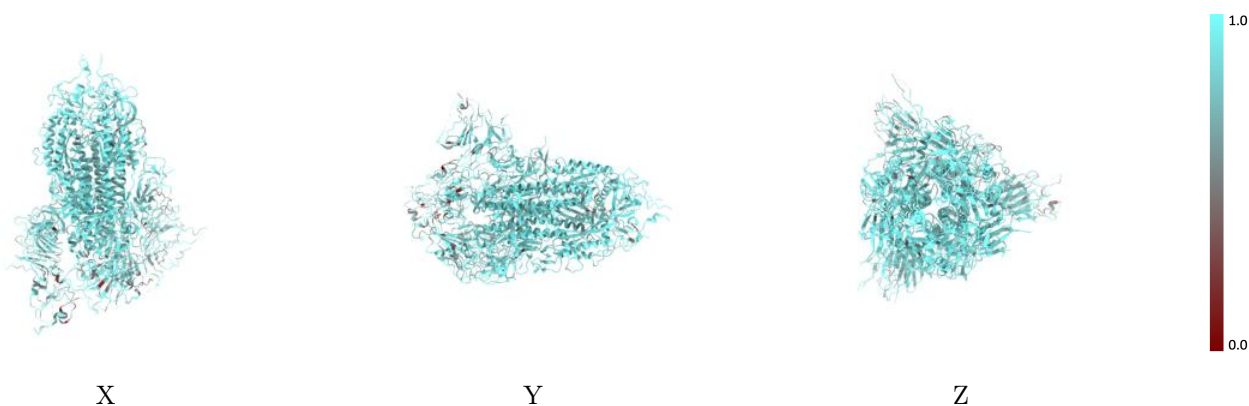
The images above show the 3D surface view of the map at the recommended contour level 0.06 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



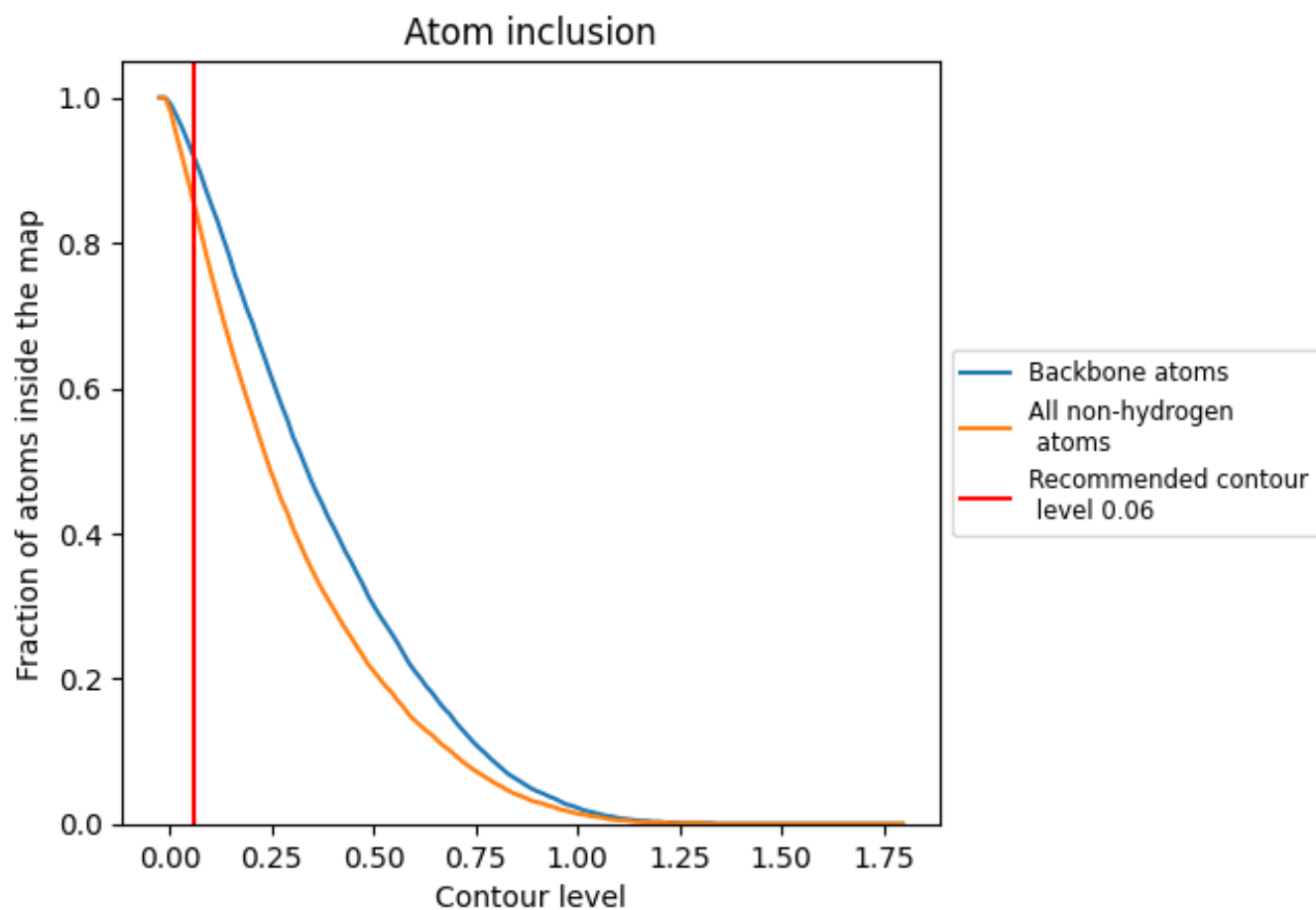
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.06).








9.4 Atom inclusion [i](#)



At the recommended contour level, 92% of all backbone atoms, 85% 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 (0.06) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8530	 0.3120
A	 0.8330	 0.2990
B	 0.8570	 0.3200
C	 0.8690	 0.3170

