



wwPDB EM Validation Summary Report ⓘ

Mar 8, 2026 – 06:27 AM UTC

PDB ID : 5W9P / pdb_00005w9p
EMDB ID : EMD-8791
Title : MERS S ectodomain trimer in complex with variable domain of neutralizing antibody G4
Authors : Pallesen, J.; Ward, A.B.
Deposited on : 2017-06-23
Resolution : 4.00 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

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

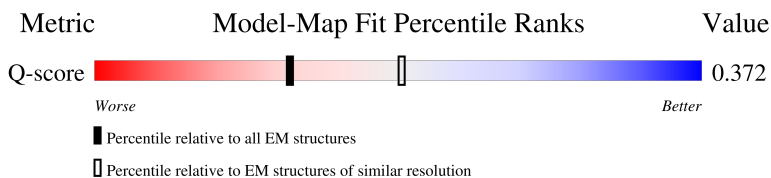
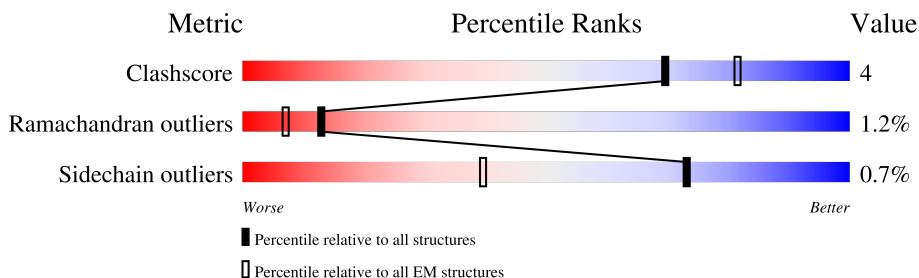
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.00 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	7587 (3.50 - 4.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 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	1329	
1	B	1329	
1	C	1329	
1	H	1329	

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Mol	Chain	Length	Quality of chain
1	I	1329	
1	J	1329	
2	D	233	
2	F	233	
2	K	233	
3	E	218	
3	G	218	
3	L	218	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 28014 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
1	J	463	Total	C	N	O	S	0	0
			3545	2243	600	685	17		
1	A	513	Total	C	N	O	S	0	0
			4010	2549	664	774	23		
1	B	463	Total	C	N	O	S	0	0
			3545	2243	600	685	17		
1	C	513	Total	C	N	O	S	0	0
			4010	2549	664	774	23		
1	H	463	Total	C	N	O	S	0	0
			3545	2243	600	685	17		
1	I	513	Total	C	N	O	S	0	0
			4010	2549	664	774	23		

There are 258 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
J	506	PHE	LEU	conflict	UNP W5ZZF5
J	748	ALA	ARG	conflict	UNP W5ZZF5
J	751	GLY	ARG	conflict	UNP W5ZZF5
J	1060	PRO	VAL	engineered mutation	UNP W5ZZF5
J	1061	PRO	LEU	engineered mutation	UNP W5ZZF5
J	1292	GLY	-	expression tag	UNP W5ZZF5
J	1293	SER	-	expression tag	UNP W5ZZF5
J	1294	GLY	-	expression tag	UNP W5ZZF5
J	1295	TYR	-	expression tag	UNP W5ZZF5
J	1296	ILE	-	expression tag	UNP W5ZZF5
J	1297	PRO	-	expression tag	UNP W5ZZF5
J	1298	GLU	-	expression tag	UNP W5ZZF5
J	1299	ALA	-	expression tag	UNP W5ZZF5
J	1300	PRO	-	expression tag	UNP W5ZZF5
J	1301	ARG	-	expression tag	UNP W5ZZF5
J	1302	ASP	-	expression tag	UNP W5ZZF5
J	1303	GLY	-	expression tag	UNP W5ZZF5
J	1304	GLN	-	expression tag	UNP W5ZZF5

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Chain	Residue	Modelled	Actual	Comment	Reference
J	1305	ALA	-	expression tag	UNP W5ZZF5
J	1306	TYR	-	expression tag	UNP W5ZZF5
J	1307	VAL	-	expression tag	UNP W5ZZF5
J	1308	ARG	-	expression tag	UNP W5ZZF5
J	1309	LYS	-	expression tag	UNP W5ZZF5
J	1310	ASP	-	expression tag	UNP W5ZZF5
J	1311	GLY	-	expression tag	UNP W5ZZF5
J	1312	GLU	-	expression tag	UNP W5ZZF5
J	1313	TRP	-	expression tag	UNP W5ZZF5
J	1314	VAL	-	expression tag	UNP W5ZZF5
J	1315	LEU	-	expression tag	UNP W5ZZF5
J	1316	LEU	-	expression tag	UNP W5ZZF5
J	1317	SER	-	expression tag	UNP W5ZZF5
J	1318	THR	-	expression tag	UNP W5ZZF5
J	1319	PHE	-	expression tag	UNP W5ZZF5
J	1320	LEU	-	expression tag	UNP W5ZZF5
J	1321	GLY	-	expression tag	UNP W5ZZF5
J	1322	ARG	-	expression tag	UNP W5ZZF5
J	1323	SER	-	expression tag	UNP W5ZZF5
J	1324	LEU	-	expression tag	UNP W5ZZF5
J	1325	GLU	-	expression tag	UNP W5ZZF5
J	1326	VAL	-	expression tag	UNP W5ZZF5
J	1327	LEU	-	expression tag	UNP W5ZZF5
J	1328	PHE	-	expression tag	UNP W5ZZF5
J	1329	GLN	-	expression tag	UNP W5ZZF5
A	506	PHE	LEU	conflict	UNP W5ZZF5
A	748	ALA	ARG	conflict	UNP W5ZZF5
A	751	GLY	ARG	conflict	UNP W5ZZF5
A	1060	PRO	VAL	engineered mutation	UNP W5ZZF5
A	1061	PRO	LEU	engineered mutation	UNP W5ZZF5
A	1292	GLY	-	expression tag	UNP W5ZZF5
A	1293	SER	-	expression tag	UNP W5ZZF5
A	1294	GLY	-	expression tag	UNP W5ZZF5
A	1295	TYR	-	expression tag	UNP W5ZZF5
A	1296	ILE	-	expression tag	UNP W5ZZF5
A	1297	PRO	-	expression tag	UNP W5ZZF5
A	1298	GLU	-	expression tag	UNP W5ZZF5
A	1299	ALA	-	expression tag	UNP W5ZZF5
A	1300	PRO	-	expression tag	UNP W5ZZF5
A	1301	ARG	-	expression tag	UNP W5ZZF5
A	1302	ASP	-	expression tag	UNP W5ZZF5
A	1303	GLY	-	expression tag	UNP W5ZZF5

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Chain	Residue	Modelled	Actual	Comment	Reference
A	1304	GLN	-	expression tag	UNP W5ZZF5
A	1305	ALA	-	expression tag	UNP W5ZZF5
A	1306	TYR	-	expression tag	UNP W5ZZF5
A	1307	VAL	-	expression tag	UNP W5ZZF5
A	1308	ARG	-	expression tag	UNP W5ZZF5
A	1309	LYS	-	expression tag	UNP W5ZZF5
A	1310	ASP	-	expression tag	UNP W5ZZF5
A	1311	GLY	-	expression tag	UNP W5ZZF5
A	1312	GLU	-	expression tag	UNP W5ZZF5
A	1313	TRP	-	expression tag	UNP W5ZZF5
A	1314	VAL	-	expression tag	UNP W5ZZF5
A	1315	LEU	-	expression tag	UNP W5ZZF5
A	1316	LEU	-	expression tag	UNP W5ZZF5
A	1317	SER	-	expression tag	UNP W5ZZF5
A	1318	THR	-	expression tag	UNP W5ZZF5
A	1319	PHE	-	expression tag	UNP W5ZZF5
A	1320	LEU	-	expression tag	UNP W5ZZF5
A	1321	GLY	-	expression tag	UNP W5ZZF5
A	1322	ARG	-	expression tag	UNP W5ZZF5
A	1323	SER	-	expression tag	UNP W5ZZF5
A	1324	LEU	-	expression tag	UNP W5ZZF5
A	1325	GLU	-	expression tag	UNP W5ZZF5
A	1326	VAL	-	expression tag	UNP W5ZZF5
A	1327	LEU	-	expression tag	UNP W5ZZF5
A	1328	PHE	-	expression tag	UNP W5ZZF5
A	1329	GLN	-	expression tag	UNP W5ZZF5
B	506	PHE	LEU	conflict	UNP W5ZZF5
B	748	ALA	ARG	conflict	UNP W5ZZF5
B	751	GLY	ARG	conflict	UNP W5ZZF5
B	1060	PRO	VAL	engineered mutation	UNP W5ZZF5
B	1061	PRO	LEU	engineered mutation	UNP W5ZZF5
B	1292	GLY	-	expression tag	UNP W5ZZF5
B	1293	SER	-	expression tag	UNP W5ZZF5
B	1294	GLY	-	expression tag	UNP W5ZZF5
B	1295	TYR	-	expression tag	UNP W5ZZF5
B	1296	ILE	-	expression tag	UNP W5ZZF5
B	1297	PRO	-	expression tag	UNP W5ZZF5
B	1298	GLU	-	expression tag	UNP W5ZZF5
B	1299	ALA	-	expression tag	UNP W5ZZF5
B	1300	PRO	-	expression tag	UNP W5ZZF5
B	1301	ARG	-	expression tag	UNP W5ZZF5
B	1302	ASP	-	expression tag	UNP W5ZZF5

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Chain	Residue	Modelled	Actual	Comment	Reference
B	1303	GLY	-	expression tag	UNP W5ZZF5
B	1304	GLN	-	expression tag	UNP W5ZZF5
B	1305	ALA	-	expression tag	UNP W5ZZF5
B	1306	TYR	-	expression tag	UNP W5ZZF5
B	1307	VAL	-	expression tag	UNP W5ZZF5
B	1308	ARG	-	expression tag	UNP W5ZZF5
B	1309	LYS	-	expression tag	UNP W5ZZF5
B	1310	ASP	-	expression tag	UNP W5ZZF5
B	1311	GLY	-	expression tag	UNP W5ZZF5
B	1312	GLU	-	expression tag	UNP W5ZZF5
B	1313	TRP	-	expression tag	UNP W5ZZF5
B	1314	VAL	-	expression tag	UNP W5ZZF5
B	1315	LEU	-	expression tag	UNP W5ZZF5
B	1316	LEU	-	expression tag	UNP W5ZZF5
B	1317	SER	-	expression tag	UNP W5ZZF5
B	1318	THR	-	expression tag	UNP W5ZZF5
B	1319	PHE	-	expression tag	UNP W5ZZF5
B	1320	LEU	-	expression tag	UNP W5ZZF5
B	1321	GLY	-	expression tag	UNP W5ZZF5
B	1322	ARG	-	expression tag	UNP W5ZZF5
B	1323	SER	-	expression tag	UNP W5ZZF5
B	1324	LEU	-	expression tag	UNP W5ZZF5
B	1325	GLU	-	expression tag	UNP W5ZZF5
B	1326	VAL	-	expression tag	UNP W5ZZF5
B	1327	LEU	-	expression tag	UNP W5ZZF5
B	1328	PHE	-	expression tag	UNP W5ZZF5
B	1329	GLN	-	expression tag	UNP W5ZZF5
C	506	PHE	LEU	conflict	UNP W5ZZF5
C	748	ALA	ARG	conflict	UNP W5ZZF5
C	751	GLY	ARG	conflict	UNP W5ZZF5
C	1060	PRO	VAL	engineered mutation	UNP W5ZZF5
C	1061	PRO	LEU	engineered mutation	UNP W5ZZF5
C	1292	GLY	-	expression tag	UNP W5ZZF5
C	1293	SER	-	expression tag	UNP W5ZZF5
C	1294	GLY	-	expression tag	UNP W5ZZF5
C	1295	TYR	-	expression tag	UNP W5ZZF5
C	1296	ILE	-	expression tag	UNP W5ZZF5
C	1297	PRO	-	expression tag	UNP W5ZZF5
C	1298	GLU	-	expression tag	UNP W5ZZF5
C	1299	ALA	-	expression tag	UNP W5ZZF5
C	1300	PRO	-	expression tag	UNP W5ZZF5
C	1301	ARG	-	expression tag	UNP W5ZZF5

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Chain	Residue	Modelled	Actual	Comment	Reference
C	1302	ASP	-	expression tag	UNP W5ZZF5
C	1303	GLY	-	expression tag	UNP W5ZZF5
C	1304	GLN	-	expression tag	UNP W5ZZF5
C	1305	ALA	-	expression tag	UNP W5ZZF5
C	1306	TYR	-	expression tag	UNP W5ZZF5
C	1307	VAL	-	expression tag	UNP W5ZZF5
C	1308	ARG	-	expression tag	UNP W5ZZF5
C	1309	LYS	-	expression tag	UNP W5ZZF5
C	1310	ASP	-	expression tag	UNP W5ZZF5
C	1311	GLY	-	expression tag	UNP W5ZZF5
C	1312	GLU	-	expression tag	UNP W5ZZF5
C	1313	TRP	-	expression tag	UNP W5ZZF5
C	1314	VAL	-	expression tag	UNP W5ZZF5
C	1315	LEU	-	expression tag	UNP W5ZZF5
C	1316	LEU	-	expression tag	UNP W5ZZF5
C	1317	SER	-	expression tag	UNP W5ZZF5
C	1318	THR	-	expression tag	UNP W5ZZF5
C	1319	PHE	-	expression tag	UNP W5ZZF5
C	1320	LEU	-	expression tag	UNP W5ZZF5
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C	1322	ARG	-	expression tag	UNP W5ZZF5
C	1323	SER	-	expression tag	UNP W5ZZF5
C	1324	LEU	-	expression tag	UNP W5ZZF5
C	1325	GLU	-	expression tag	UNP W5ZZF5
C	1326	VAL	-	expression tag	UNP W5ZZF5
C	1327	LEU	-	expression tag	UNP W5ZZF5
C	1328	PHE	-	expression tag	UNP W5ZZF5
C	1329	GLN	-	expression tag	UNP W5ZZF5
H	506	PHE	LEU	conflict	UNP W5ZZF5
H	748	ALA	ARG	conflict	UNP W5ZZF5
H	751	GLY	ARG	conflict	UNP W5ZZF5
H	1060	PRO	VAL	engineered mutation	UNP W5ZZF5
H	1061	PRO	LEU	engineered mutation	UNP W5ZZF5
H	1292	GLY	-	expression tag	UNP W5ZZF5
H	1293	SER	-	expression tag	UNP W5ZZF5
H	1294	GLY	-	expression tag	UNP W5ZZF5
H	1295	TYR	-	expression tag	UNP W5ZZF5
H	1296	ILE	-	expression tag	UNP W5ZZF5
H	1297	PRO	-	expression tag	UNP W5ZZF5
H	1298	GLU	-	expression tag	UNP W5ZZF5
H	1299	ALA	-	expression tag	UNP W5ZZF5
H	1300	PRO	-	expression tag	UNP W5ZZF5

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Chain	Residue	Modelled	Actual	Comment	Reference
H	1301	ARG	-	expression tag	UNP W5ZZF5
H	1302	ASP	-	expression tag	UNP W5ZZF5
H	1303	GLY	-	expression tag	UNP W5ZZF5
H	1304	GLN	-	expression tag	UNP W5ZZF5
H	1305	ALA	-	expression tag	UNP W5ZZF5
H	1306	TYR	-	expression tag	UNP W5ZZF5
H	1307	VAL	-	expression tag	UNP W5ZZF5
H	1308	ARG	-	expression tag	UNP W5ZZF5
H	1309	LYS	-	expression tag	UNP W5ZZF5
H	1310	ASP	-	expression tag	UNP W5ZZF5
H	1311	GLY	-	expression tag	UNP W5ZZF5
H	1312	GLU	-	expression tag	UNP W5ZZF5
H	1313	TRP	-	expression tag	UNP W5ZZF5
H	1314	VAL	-	expression tag	UNP W5ZZF5
H	1315	LEU	-	expression tag	UNP W5ZZF5
H	1316	LEU	-	expression tag	UNP W5ZZF5
H	1317	SER	-	expression tag	UNP W5ZZF5
H	1318	THR	-	expression tag	UNP W5ZZF5
H	1319	PHE	-	expression tag	UNP W5ZZF5
H	1320	LEU	-	expression tag	UNP W5ZZF5
H	1321	GLY	-	expression tag	UNP W5ZZF5
H	1322	ARG	-	expression tag	UNP W5ZZF5
H	1323	SER	-	expression tag	UNP W5ZZF5
H	1324	LEU	-	expression tag	UNP W5ZZF5
H	1325	GLU	-	expression tag	UNP W5ZZF5
H	1326	VAL	-	expression tag	UNP W5ZZF5
H	1327	LEU	-	expression tag	UNP W5ZZF5
H	1328	PHE	-	expression tag	UNP W5ZZF5
H	1329	GLN	-	expression tag	UNP W5ZZF5
I	506	PHE	LEU	conflict	UNP W5ZZF5
I	748	ALA	ARG	conflict	UNP W5ZZF5
I	751	GLY	ARG	conflict	UNP W5ZZF5
I	1060	PRO	VAL	engineered mutation	UNP W5ZZF5
I	1061	PRO	LEU	engineered mutation	UNP W5ZZF5
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I	1293	SER	-	expression tag	UNP W5ZZF5
I	1294	GLY	-	expression tag	UNP W5ZZF5
I	1295	TYR	-	expression tag	UNP W5ZZF5
I	1296	ILE	-	expression tag	UNP W5ZZF5
I	1297	PRO	-	expression tag	UNP W5ZZF5
I	1298	GLU	-	expression tag	UNP W5ZZF5
I	1299	ALA	-	expression tag	UNP W5ZZF5

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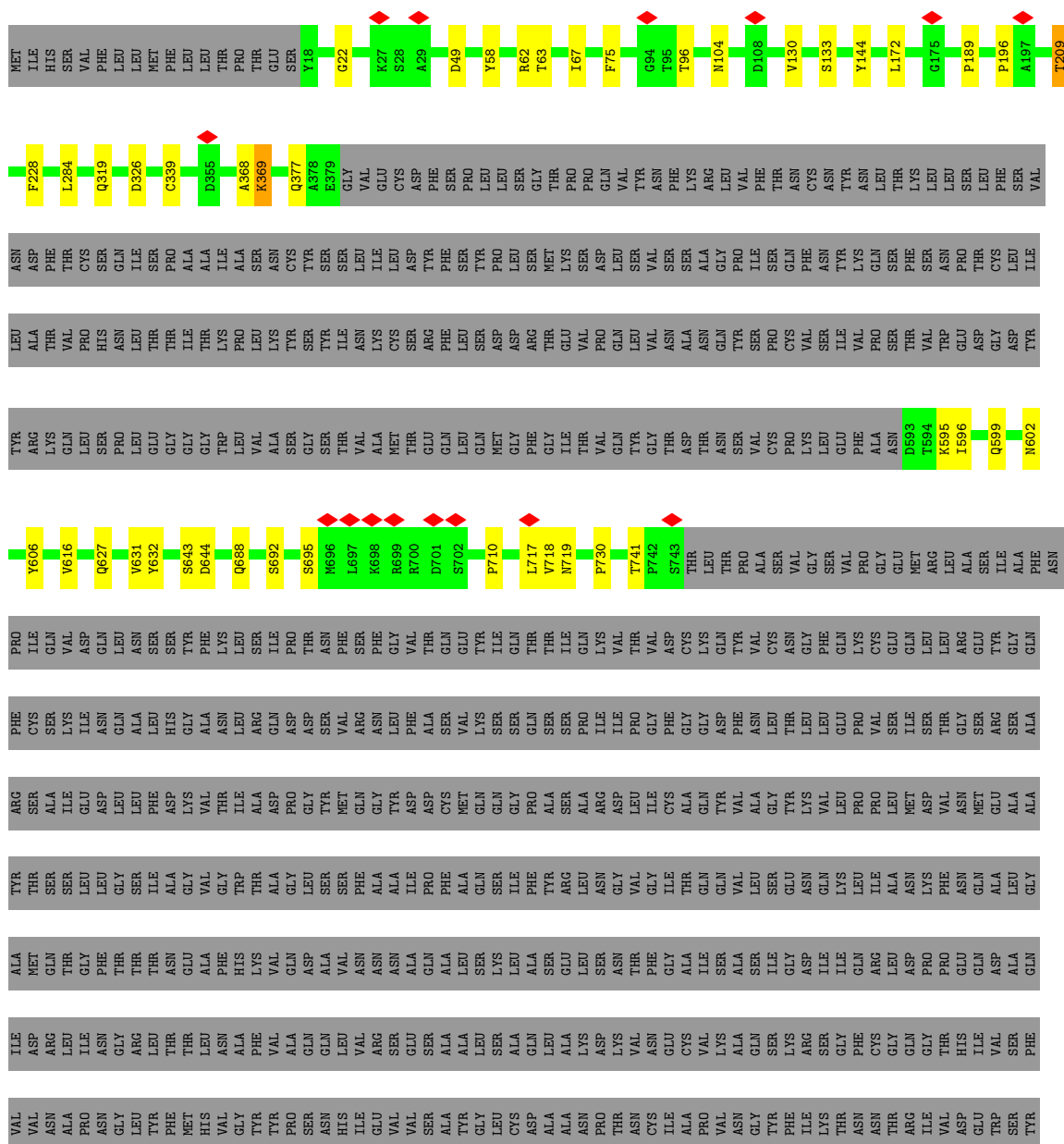
Chain	Residue	Modelled	Actual	Comment	Reference
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I	1301	ARG	-	expression tag	UNP W5ZZF5
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I	1303	GLY	-	expression tag	UNP W5ZZF5
I	1304	GLN	-	expression tag	UNP W5ZZF5
I	1305	ALA	-	expression tag	UNP W5ZZF5
I	1306	TYR	-	expression tag	UNP W5ZZF5
I	1307	VAL	-	expression tag	UNP W5ZZF5
I	1308	ARG	-	expression tag	UNP W5ZZF5
I	1309	LYS	-	expression tag	UNP W5ZZF5
I	1310	ASP	-	expression tag	UNP W5ZZF5
I	1311	GLY	-	expression tag	UNP W5ZZF5
I	1312	GLU	-	expression tag	UNP W5ZZF5
I	1313	TRP	-	expression tag	UNP W5ZZF5
I	1314	VAL	-	expression tag	UNP W5ZZF5
I	1315	LEU	-	expression tag	UNP W5ZZF5
I	1316	LEU	-	expression tag	UNP W5ZZF5
I	1317	SER	-	expression tag	UNP W5ZZF5
I	1318	THR	-	expression tag	UNP W5ZZF5
I	1319	PHE	-	expression tag	UNP W5ZZF5
I	1320	LEU	-	expression tag	UNP W5ZZF5
I	1321	GLY	-	expression tag	UNP W5ZZF5
I	1322	ARG	-	expression tag	UNP W5ZZF5
I	1323	SER	-	expression tag	UNP W5ZZF5
I	1324	LEU	-	expression tag	UNP W5ZZF5
I	1325	GLU	-	expression tag	UNP W5ZZF5
I	1326	VAL	-	expression tag	UNP W5ZZF5
I	1327	LEU	-	expression tag	UNP W5ZZF5
I	1328	PHE	-	expression tag	UNP W5ZZF5
I	1329	GLN	-	expression tag	UNP W5ZZF5

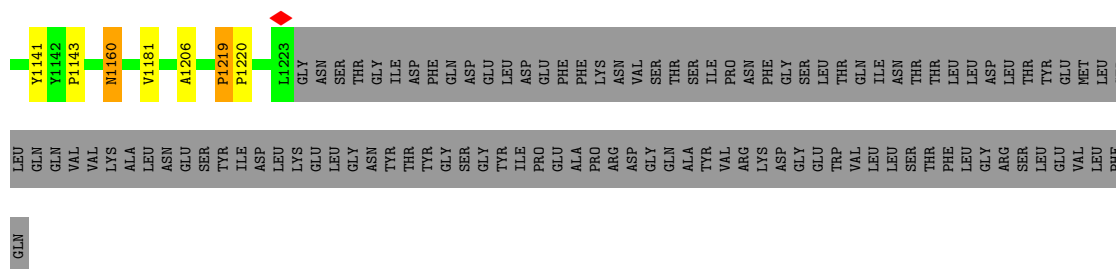
- Molecule 2 is a protein called G4 VH.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	F	119	Total	C	N	O	S	0	0
			948	602	156	185	5		
2	D	119	Total	C	N	O	S	0	0
			948	602	156	185	5		
2	K	119	Total	C	N	O	S	0	0
			948	602	156	185	5		

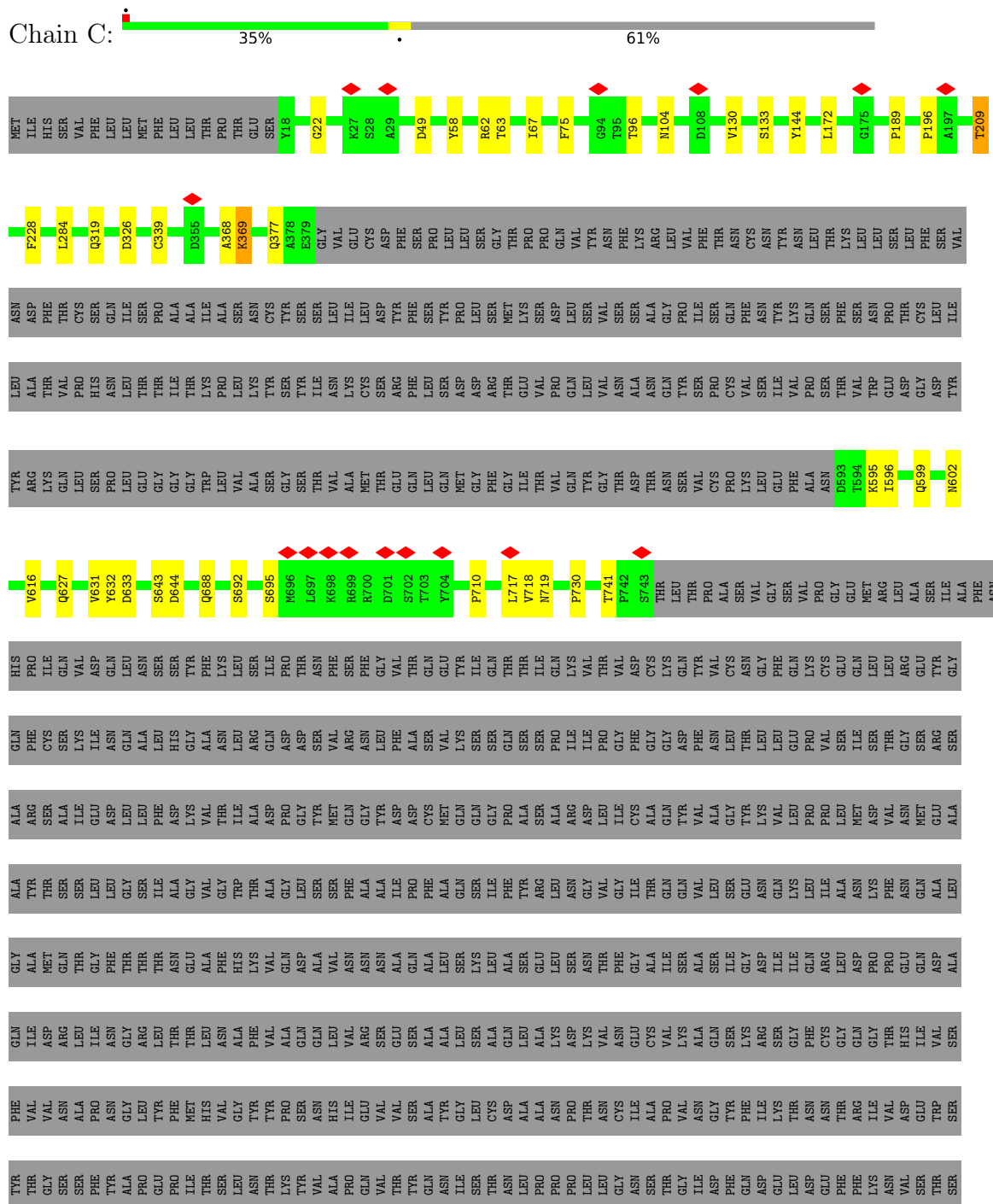
- Molecule 3 is a protein called G4 VL.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	G	111	Total 835	C 522	N 143	O 166	S 4	0	0
3	E	111	Total 835	C 522	N 143	O 166	S 4	0	0
3	L	111	Total 835	C 522	N 143	O 166	S 4	0	0





• Molecule 1: Spike glycoprotein



[illegible]

- Molecule 1: Spike glycoprotein



H1122	V877	SER	VAL	GLY	TTR	LEU	ASN	TTR	ASN	TTR	ARG	TTR	ARG	GLY	MET
I1123	SER	LEU	ILE	ASN	ARG	ALA	ASP	VAL	ASP	SER	SER	ALA	ARG	THR	ILE
V1124	THR	PHE	TTR	ILE	LYS	THR	PHE	GLN	THR	THR	LYS	THR	THR	ALA	THR
Y1141	THR	VAL	ASP	VAL	GLN	VAL	GLY	LEU	CYS	SER	GLN	ILE	CYS	SER	VAL
Y1142	GLY	GLU	GLY	TTR	SER	HIS	TTR	SER	SER	PHE	GLU	THR	ILE	ASN	PHE
P1143	SER	ASP	THR	SER	PRO	ASN	ASN	PRO	GLN	GLU	ARG	GLU	LEU	THR	LEU
N1160	ARG	CYS	LYS	LYS	LEU	LEU	LEU	LEU	ILE	ALA	ALA	ALA	SER	THR	LEU
V1181	SER	LEU	ALA	VAL	GLY	GLY	GLY	GLY	ALA	GLY	SER	LEU	THR	THR	LEU
A1206	THR	GLN	LEU	GLY	TRP	LYS	ILE	TRP	ILE	PHE	ALA	GLU	ASN	GLY	THR
P1219	THR	LEU	PHE	ARG	LEU	PRO	ALA	LEU	ALA	VAL	HIS	PRO	HIS	PRO	THR
P1220	SER	LEU	GLY	GLY	VAL	LEU	SER	VAL	ASN	VAL	CYS	GLY	CYS	GLY	THR
L1223	GLY	CYS	VAL	ASN	ALA	LYS	ASN	GLY	CYS	LYS	LYS	THR	ALA	THR	THR
ASN	THR	PRO	CYS	GLN	GLY	SER	TTR	SER	TTR	LEU	GLN	GLN	GLY	GLY	ASN
SER	M913	PRO	ILE	THR	VAL	THR	THR	GLN	CYS	GLY	THR	THR	GLY	THR	THR
THR	Q914	SER	SER	VAL	MET	THR	GLY	GLU	CYS	ASP	PHE	VAL	SER	ASP	PRO
GLY	Q915	THR	THR	GLY	THR	VAL	VAL	THR	LEU	THR	LEU	HIS	ASP	MET	ASP
ILE	Q916	LEU	THR	THR	ARG	THR	VAL	GLN	ASP	ARG	LEU	ALA	VAL	TTR	SER
ASP	G916	THR	MET	ASN	GLN	SER	GLN	GLN	GLN	SER	ASP	THR	VAL	TTR	SER
PHE	Y909	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
GLN	M913	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
ASN	Q914	SER	SER	VAL	MET	THR	GLY	GLU	CYS	ASP	PHE	VAL	SER	ASP	PRO
SER	Q915	THR	THR	GLY	THR	VAL	VAL	THR	LEU	THR	LEU	HIS	ASP	MET	ASP
THR	Q916	LEU	THR	THR	ARG	THR	VAL	GLN	ASP	ARG	LEU	ALA	VAL	TTR	SER
THR	G916	THR	MET	ASN	GLN	SER	GLN	GLN	GLN	SER	ASP	THR	VAL	TTR	SER
THR	Y909	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
THR	M913	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
THR	Q914	SER	SER	VAL	MET	THR	GLY	GLU	CYS	ASP	PHE	VAL	SER	ASP	PRO
THR	Q915	THR	THR	GLY	THR	VAL	VAL	THR	LEU	THR	LEU	HIS	ASP	MET	ASP
THR	Q916	LEU	THR	THR	ARG	THR	VAL	GLN	ASP	ARG	LEU	ALA	VAL	TTR	SER
THR	G916	THR	MET	ASN	GLN	SER	GLN	GLN	GLN	SER	ASP	THR	VAL	TTR	SER
THR	Y909	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
THR	M913	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
THR	Q914	SER	SER	VAL	MET	THR	GLY	GLU	CYS	ASP	PHE	VAL	SER	ASP	PRO
THR	Q915	THR	THR	GLY	THR	VAL	VAL	THR	LEU	THR	LEU	HIS	ASP	MET	ASP
THR	Q916	LEU	THR	THR	ARG	THR	VAL	GLN	ASP	ARG	LEU	ALA	VAL	TTR	SER
THR	G916	THR	MET	ASN	GLN	SER	GLN	GLN	GLN	SER	ASP	THR	VAL	TTR	SER
THR	Y909	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
THR	M913	PRO	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR
THR	Q914	SER	SER	VAL	MET	THR	GLY	GLU	CYS	ASP</					

- Molecule 1: Spike glycoprotein

[illegible]

ASN	PHE	TYR	PRO	LYS	ASP	ILE	ASN	VAL	TRP	LYS	ILE	ASN	GLY	GLU	ARG	GLN	ASN	SER	THR	THR	ASP	GLN	ASP	ASP	SER	SER	ASP	THR	TYR	SER	MET	SER	SER	SER	THR	LEU	LEU	THR	LYS	ASP	GLU	TYR	GLU	ARG	HIS	ASN	SER	TYR	THR	CYS	GLU	ALA	THR
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• Molecule 3: G4 VL



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GI173
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GI182
PI193
EI196
DI197
DI198
K1208
F1214
K1223
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• Molecule 3: G4 VL



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VI174
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GI182
PI193
EI196
DI197
DI198
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4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C3	Depositor
Number of particles used	11218	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 ($e^-/\text{\AA}^2$)	1.89	Depositor
Minimum defocus (nm)	700	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	29000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.089	Depositor
Minimum map value	-0.042	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.004	Depositor
Recommended contour level	0.015	Depositor
Map size (Å)	310.08, 310.08, 310.08	wwPDB
Map dimensions	304, 304, 304	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.02, 1.02, 1.02	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	0.77	0/4112	1.15	25/5590 (0.4%)
1	B	0.87	0/3618	1.18	34/4921 (0.7%)
1	C	0.77	0/4112	1.15	25/5590 (0.4%)
1	H	0.87	0/3618	1.18	34/4921 (0.7%)
1	I	0.77	0/4112	1.15	25/5590 (0.4%)
1	J	0.87	0/3618	1.18	34/4921 (0.7%)
2	D	0.78	0/972	1.05	4/1317 (0.3%)
2	F	0.77	0/972	1.05	4/1317 (0.3%)
2	K	0.78	0/972	1.05	4/1317 (0.3%)
3	E	0.84	0/852	1.22	10/1153 (0.9%)
3	G	0.84	0/852	1.22	10/1153 (0.9%)
3	L	0.85	0/852	1.22	10/1153 (0.9%)
All	All	0.82	0/28662	1.16	219/38943 (0.6%)

There are no bond length outliers.

The worst 5 of 219 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	284	LEU	CA-C-N	9.00	129.23	119.87
1	A	284	LEU	C-N-CA	9.00	129.23	119.87
1	C	284	LEU	CA-C-N	8.92	129.15	119.87
1	C	284	LEU	C-N-CA	8.92	129.15	119.87
1	I	284	LEU	CA-C-N	8.92	129.15	119.87

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	4010	0	3820	28	0
1	B	3545	0	3472	37	0
1	C	4010	0	3820	28	0
1	H	3545	0	3472	40	0
1	I	4010	0	3820	29	0
1	J	3545	0	3472	39	0
2	D	948	0	904	3	0
2	F	948	0	904	3	0
2	K	948	0	904	3	0
3	E	835	0	813	0	0
3	G	835	0	813	0	0
3	L	835	0	813	0	0
All	All	28014	0	27027	198	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 4.

The worst 5 of 198 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:905:TYR:CZ	1:B:936:PRO:HA	1.67	1.25
1:J:905:TYR:CZ	1:J:936:PRO:HA	1.67	1.25
1:H:905:TYR:CZ	1:H:936:PRO:HA	1.67	1.25
1:H:905:TYR:CE1	1:H:936:PRO:HD3	1.75	1.22
1:H:905:TYR:CZ	1:H:936:PRO:CA	2.20	1.21

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	509/1329 (38%)	474 (93%)	28 (6%)	7 (1%)	9	39
1	B	459/1329 (34%)	435 (95%)	18 (4%)	6 (1%)	9	41
1	C	509/1329 (38%)	474 (93%)	28 (6%)	7 (1%)	9	39
1	H	459/1329 (34%)	435 (95%)	18 (4%)	6 (1%)	9	41
1	I	509/1329 (38%)	474 (93%)	28 (6%)	7 (1%)	9	39
1	J	459/1329 (34%)	435 (95%)	18 (4%)	6 (1%)	9	41
2	D	117/233 (50%)	114 (97%)	3 (3%)	0	100	100
2	F	117/233 (50%)	114 (97%)	3 (3%)	0	100	100
2	K	117/233 (50%)	114 (97%)	3 (3%)	0	100	100
3	E	109/218 (50%)	105 (96%)	3 (3%)	1 (1%)	14	48
3	G	109/218 (50%)	105 (96%)	3 (3%)	1 (1%)	14	48
3	L	109/218 (50%)	105 (96%)	3 (3%)	1 (1%)	14	48
All	All	3582/9327 (38%)	3384 (94%)	156 (4%)	42 (1%)	13	42

5 of 42 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	G	1193	PRO
3	E	1193	PRO
3	L	1193	PRO
1	A	368	ALA
1	A	627	GLN

5.3.2 Protein sidechains ⓘ

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	442/1148 (38%)	438 (99%)	4 (1%)	70	76
1	B	388/1148 (34%)	385 (99%)	3 (1%)	73	77
1	C	442/1148 (38%)	438 (99%)	4 (1%)	70	76
1	H	388/1148 (34%)	385 (99%)	3 (1%)	73	77

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	I	442/1148 (38%)	438 (99%)	4 (1%)	70	76
1	J	388/1148 (34%)	385 (99%)	3 (1%)	73	77
2	D	102/202 (50%)	102 (100%)	0	100	100
2	F	102/202 (50%)	102 (100%)	0	100	100
2	K	102/202 (50%)	102 (100%)	0	100	100
3	E	93/192 (48%)	93 (100%)	0	100	100
3	G	93/192 (48%)	93 (100%)	0	100	100
3	L	93/192 (48%)	93 (100%)	0	100	100
All	All	3075/8070 (38%)	3054 (99%)	21 (1%)	73	79

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	971	PRO
1	I	189	PRO
1	I	730	PRO
1	I	196	PRO
1	H	1143	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
3	E	1192	HIS
1	H	772	GLN
3	L	1206	GLN
3	E	1206	GLN
1	H	836	HIS

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.

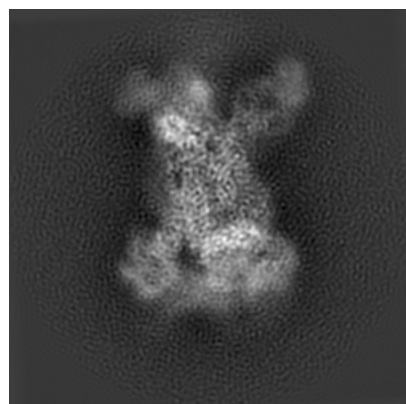
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-8791. These allow visual inspection of the internal detail of the map and identification of artifacts.

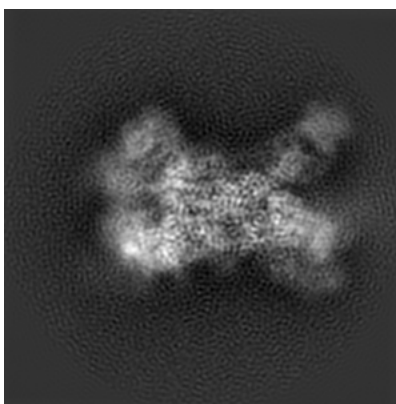
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

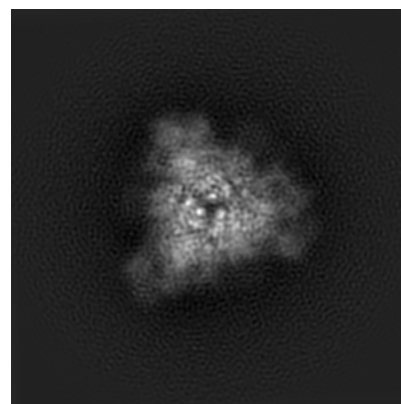
6.1.1 Primary map



X

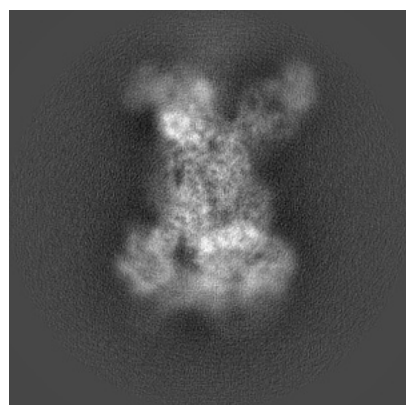


Y

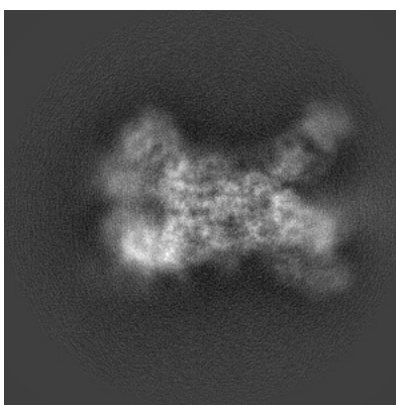


Z

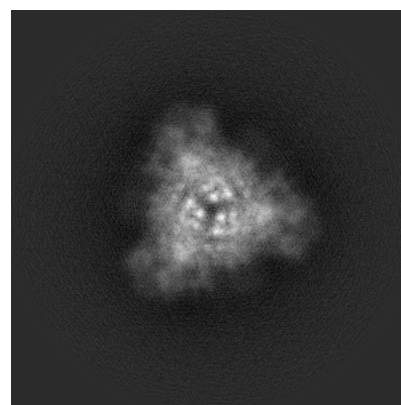
6.1.2 Raw map



X



Y

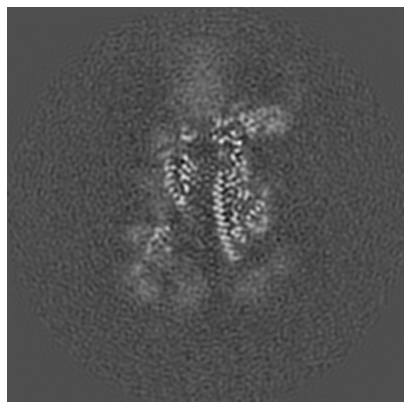


Z

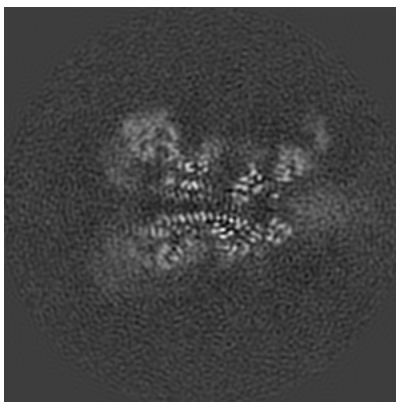
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

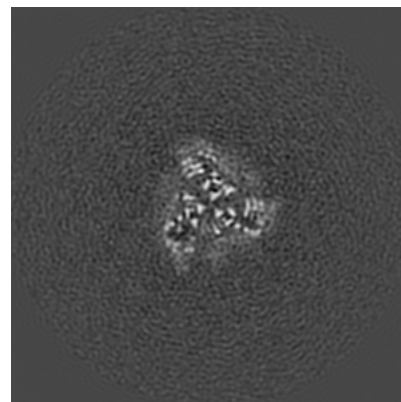
6.2.1 Primary map



X Index: 152

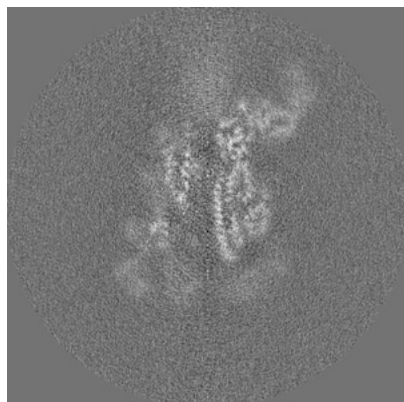


Y Index: 152

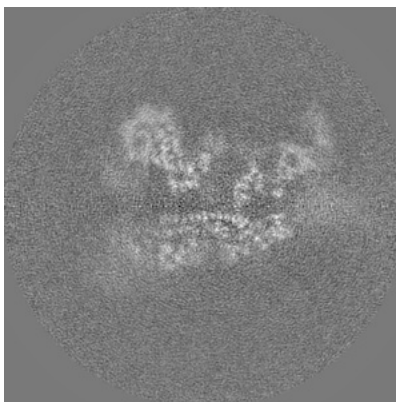


Z Index: 152

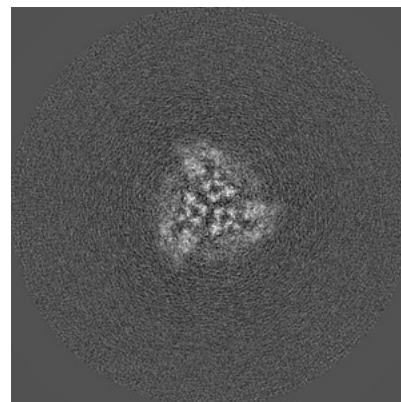
6.2.2 Raw map



X Index: 152



Y Index: 152

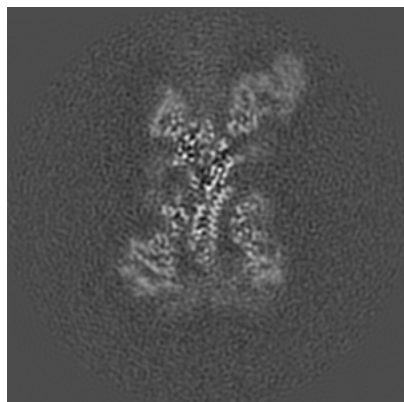


Z Index: 152

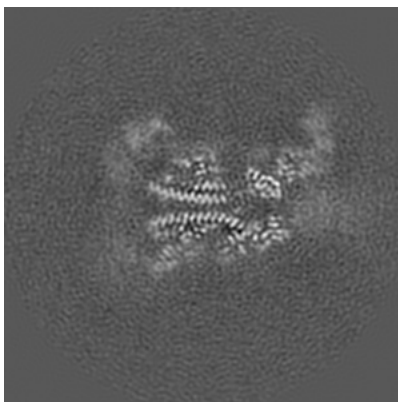
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

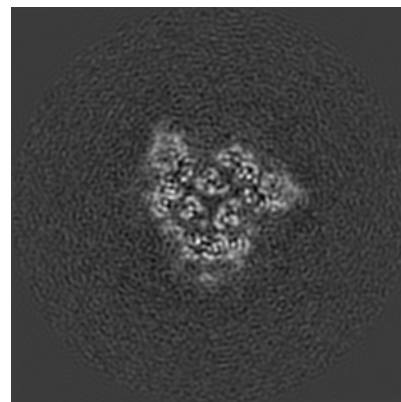
6.3.1 Primary map



X Index: 134

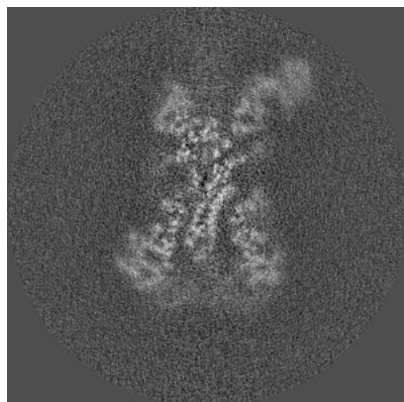


Y Index: 148

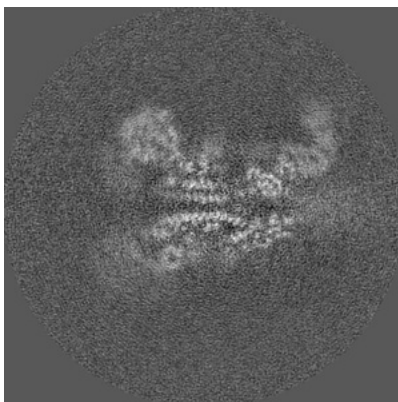


Z Index: 129

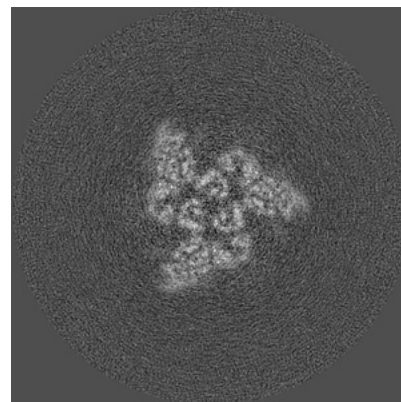
6.3.2 Raw map



X Index: 135



Y Index: 149

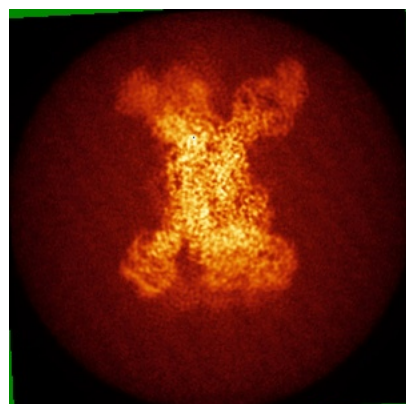


Z Index: 126

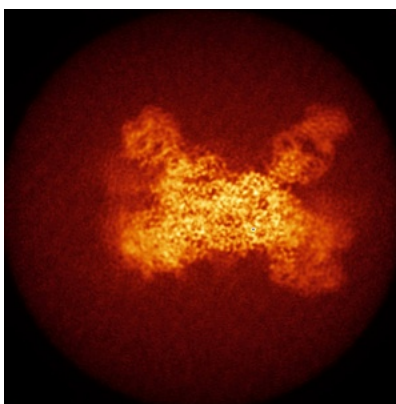
The images above show the largest variance slices of the map in three orthogonal directions.

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

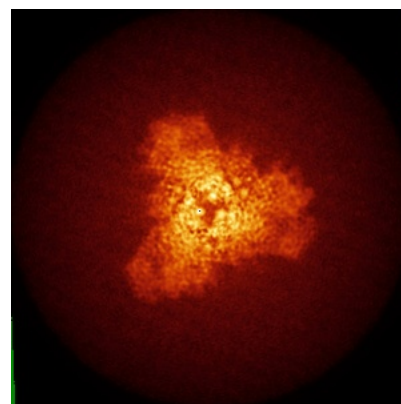
6.4.1 Primary map



X

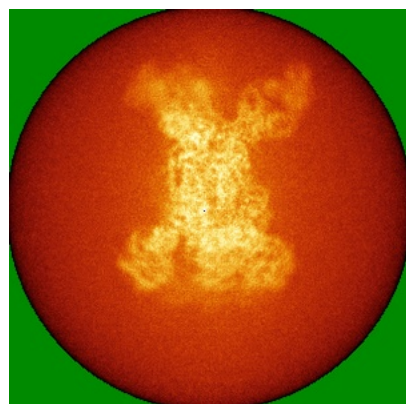


Y

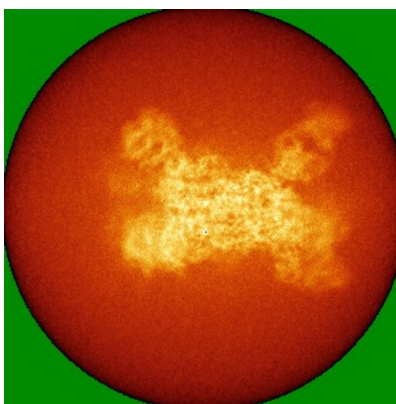


Z

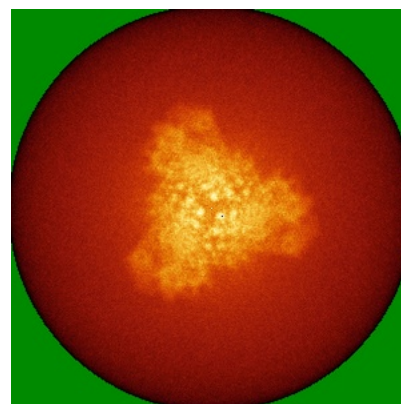
6.4.2 Raw map



X



Y

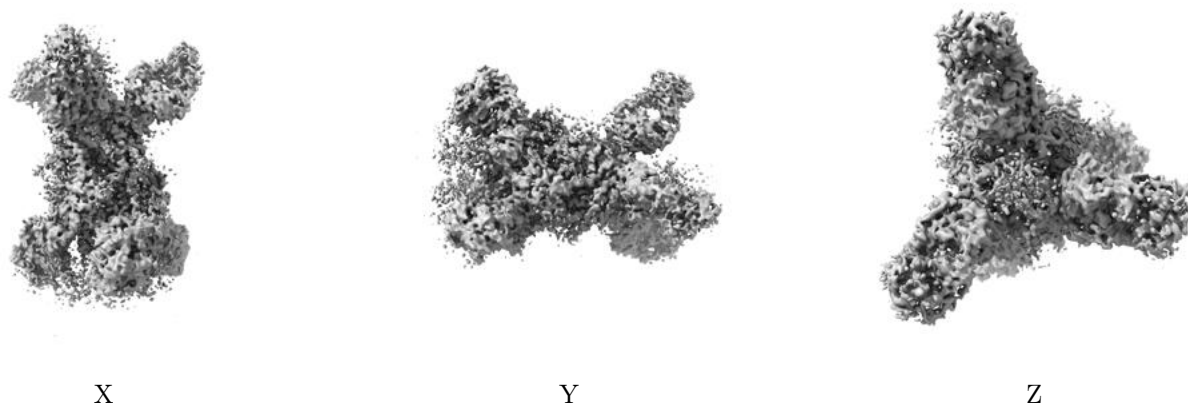


Z

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.

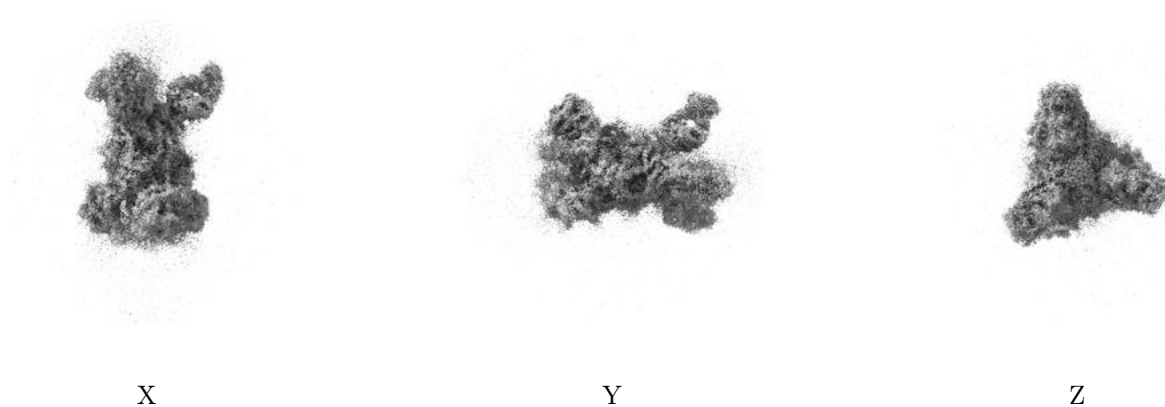
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.015. 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.

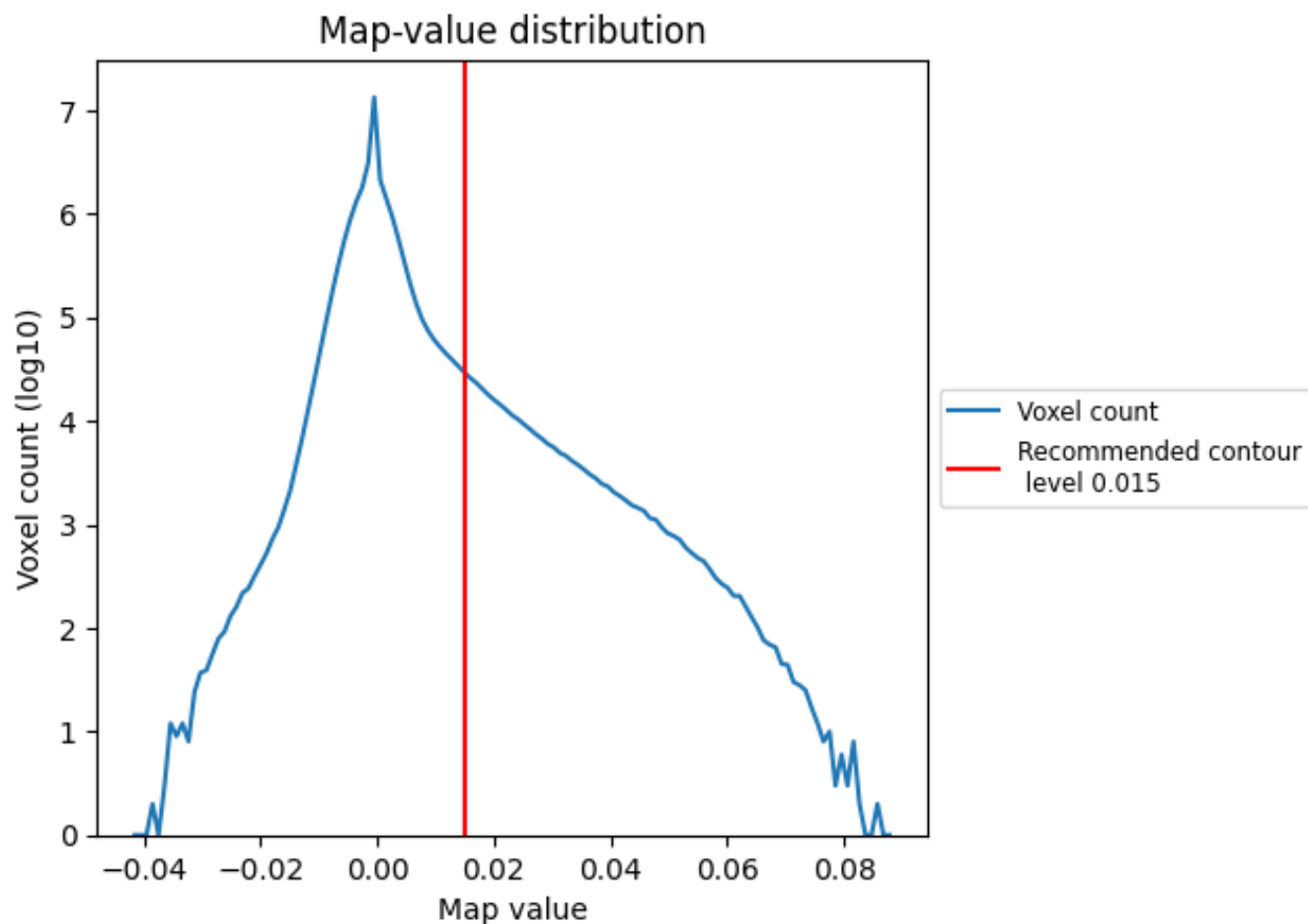
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

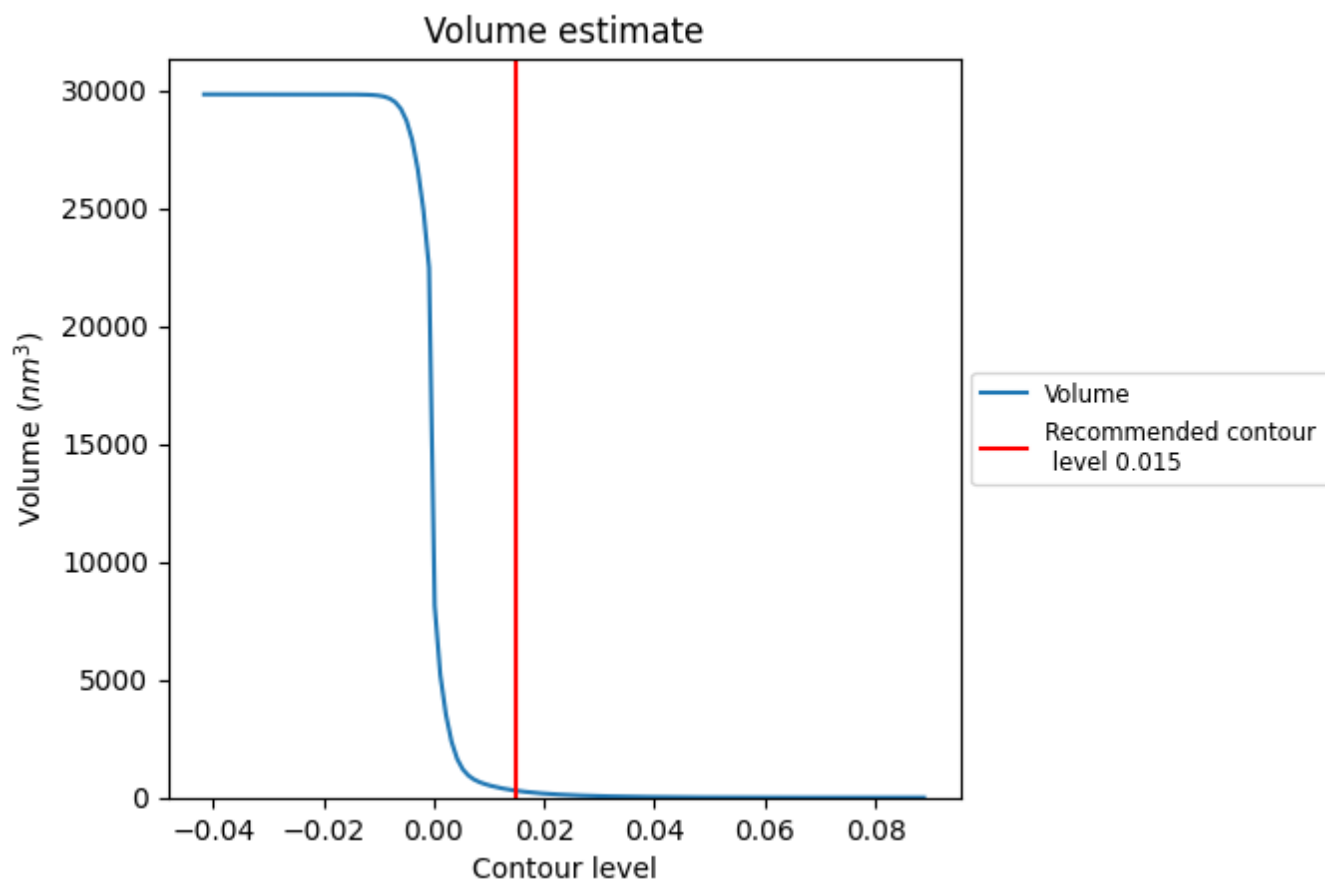
This section contains the results of statistical analysis of the map.

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.

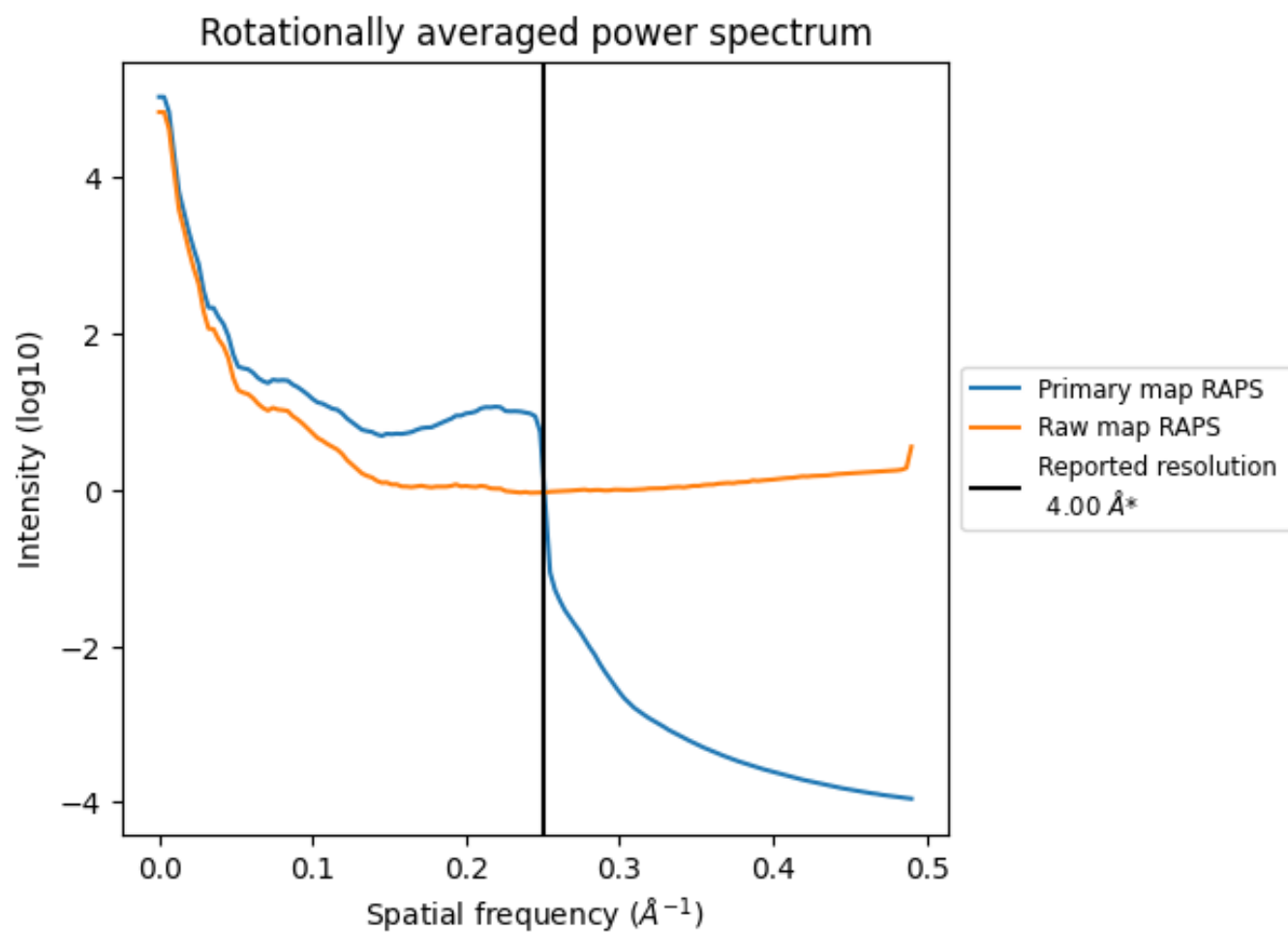
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 291 nm³; this corresponds to an approximate mass of 263 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 ⓘ

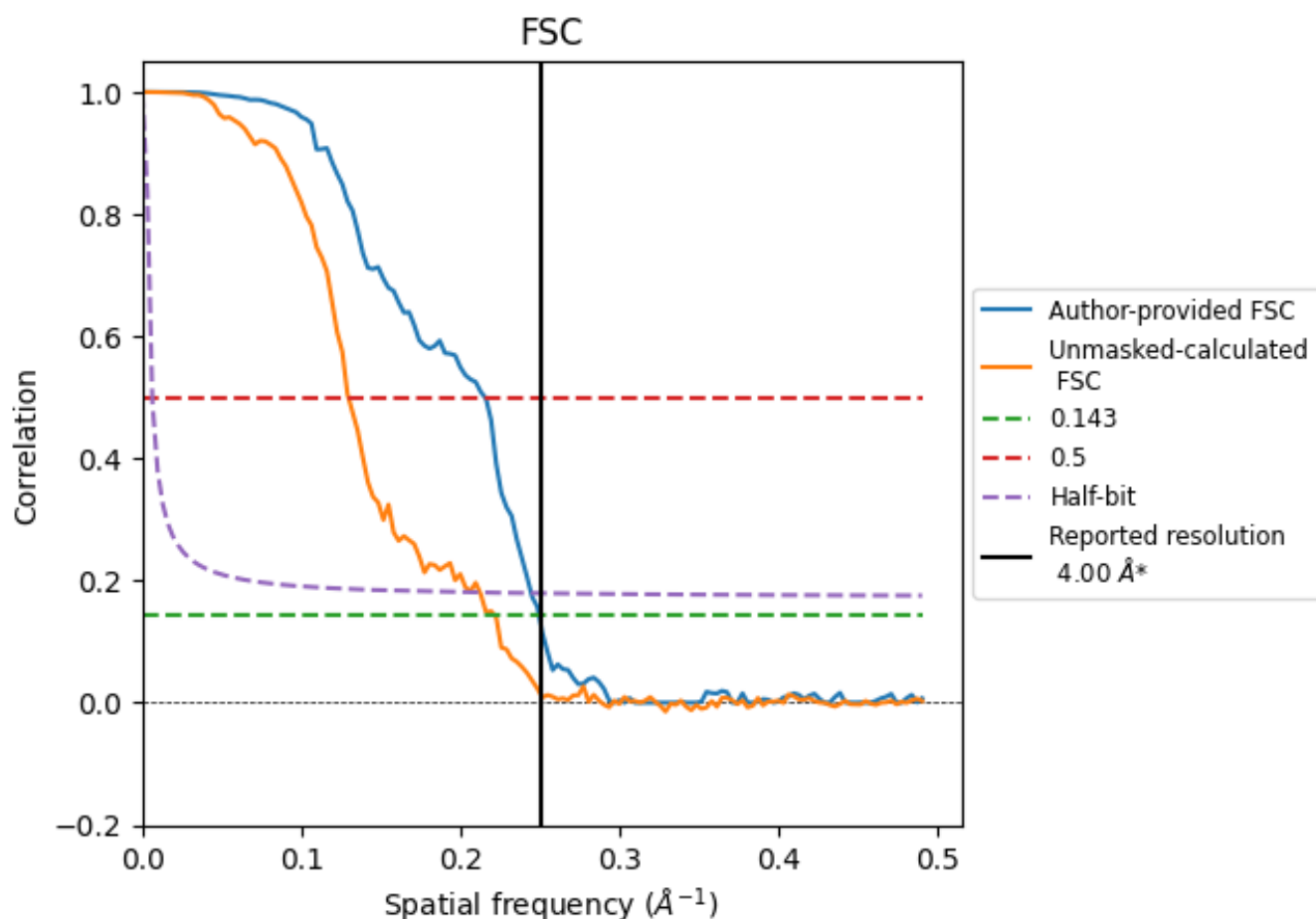


*Reported resolution corresponds to spatial frequency of 0.250 $\text{\AA}^{-1}$

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 0.250 Å⁻¹

8.2 Resolution estimates [i](#)

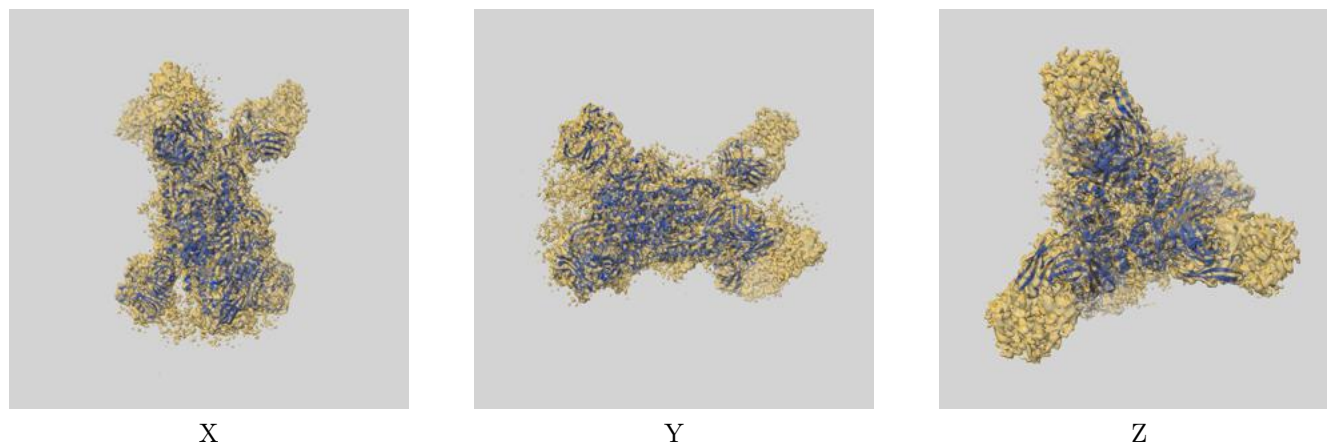
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.00	-	-
Author-provided FSC curve	4.01	4.64	4.09
Unmasked-calculated*	4.51	7.72	4.71

*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 4.51 differs from the reported value 4.0 by more than 10 %

9 Map-model fit [i](#)

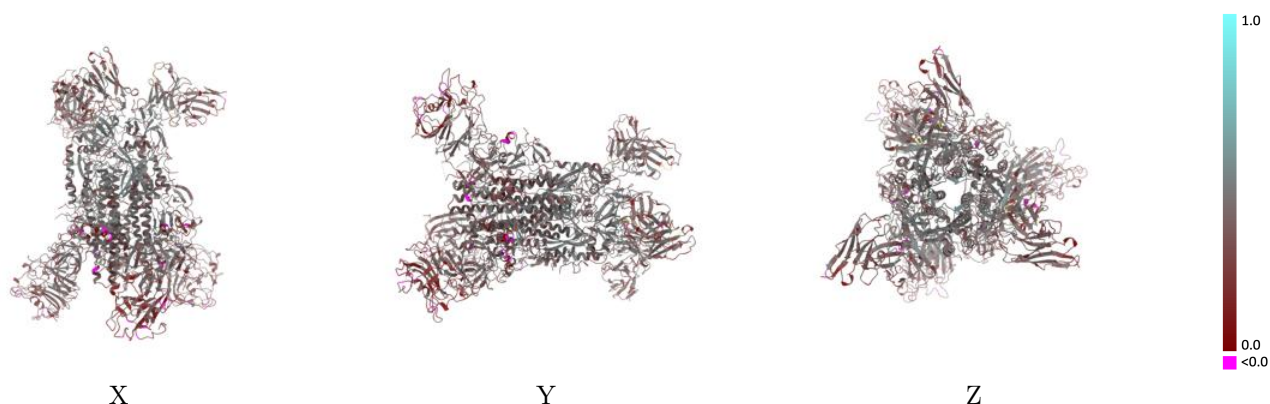
This section contains information regarding the fit between EMDB map EMD-8791 and PDB model 5W9P. Per-residue inclusion information can be found in [section 3](#) on [page 12](#).

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.015 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](#)

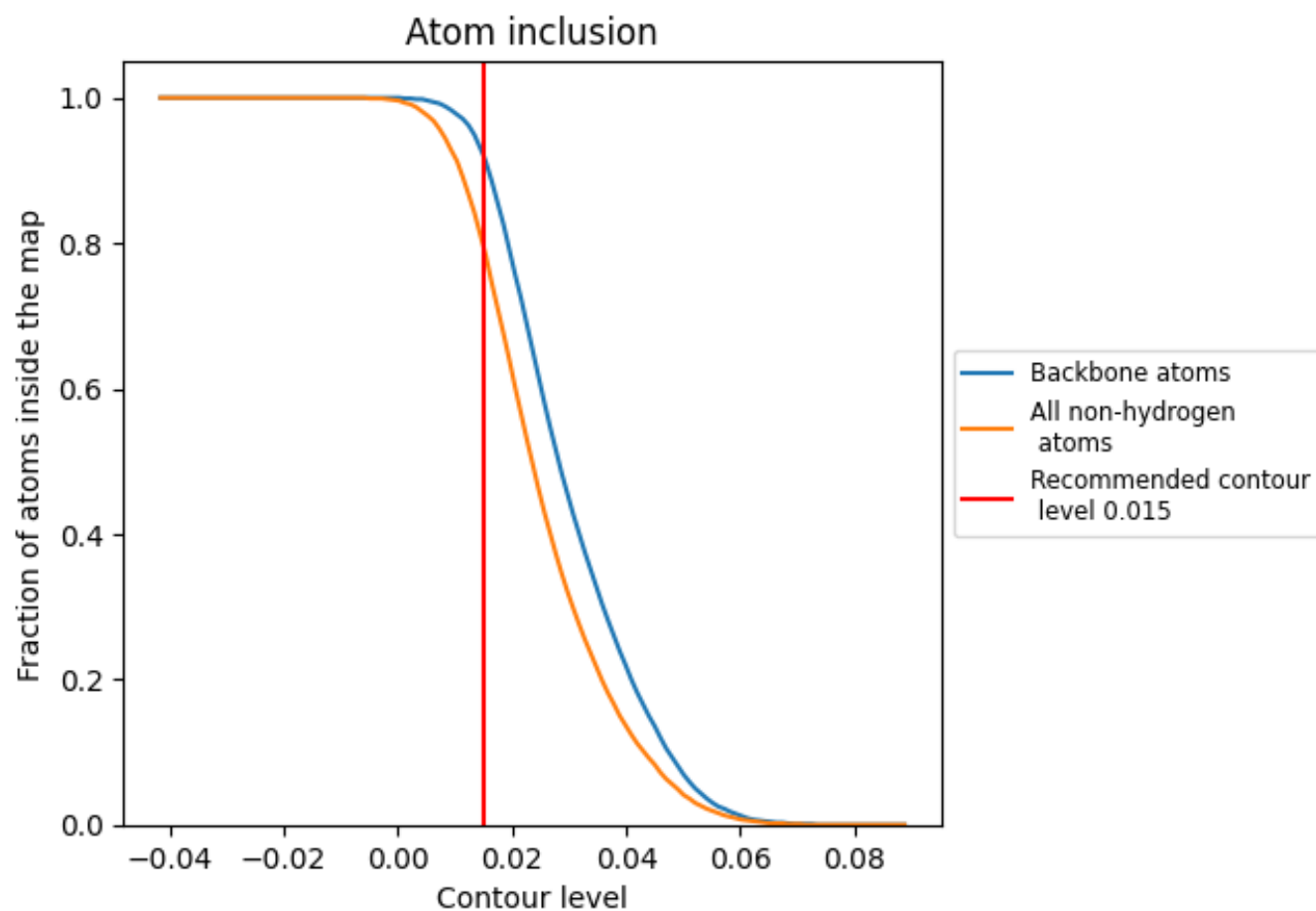


The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

This section was not generated.

9.4 Atom inclusion [i](#)



At the recommended contour level, 92% of all backbone atoms, 80% 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 (0.015) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7960	0.3720
A	0.7930	0.3420
B	0.8210	0.4150
C	0.7920	0.3420
D	0.7930	0.3780
E	0.7000	0.3230
F	0.7990	0.3800
G	0.7000	0.3240
H	0.8200	0.4160
I	0.7960	0.3430
J	0.8230	0.4160
K	0.7920	0.3800
L	0.7000	0.3200

1.0

0.0

<0.0