



Full wwPDB EM Validation Report ⓘ

Mar 22, 2026 – 10:30 AM UTC

PDB ID : 8AQU / pdb_00008aqu
EMDB ID : EMD-15590
Title : BA.1 SARS-CoV-2 Spike bound to mouse ACE2 (local)
Authors : Lau, K.; Ni, D.; Beckert, B.; Nazarov, S.; Myasnikov, A.; Pojer, F.; Stahlberg, H.; Uchikawa, E.
Deposited on : 2022-08-13
Resolution : 3.22 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.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

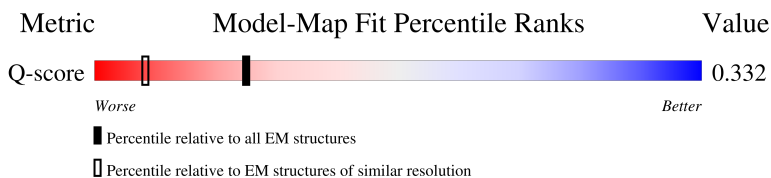
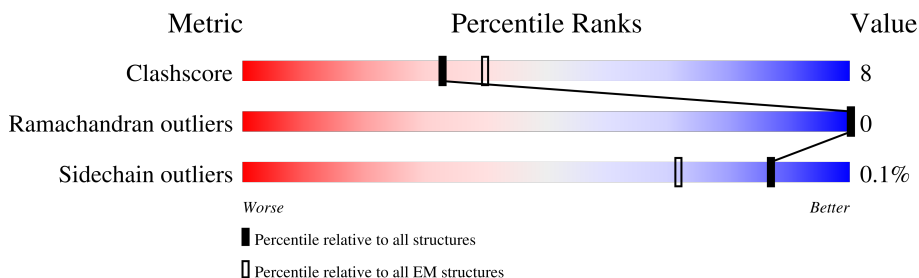
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.22 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	14612 (2.72 - 3.72)

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	886	23% 52% 14% 34%
2	B	1285	12% 85%
3	C	2	50% 50%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6340 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 Processed angiotensin-converting enzyme 2,Ig gamma-2A chain C region, membrane-bound form.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	584	4744	3023	797	895	29	0	0

There are 57 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-15	MET	-	initiating methionine	UNP Q8R0I0
A	-14	GLY	-	expression tag	UNP Q8R0I0
A	-13	THR	-	expression tag	UNP Q8R0I0
A	-12	LEU	-	expression tag	UNP Q8R0I0
A	-11	SER	-	expression tag	UNP Q8R0I0
A	-10	ALA	-	expression tag	UNP Q8R0I0
A	-9	PRO	-	expression tag	UNP Q8R0I0
A	-8	PRO	-	expression tag	UNP Q8R0I0
A	-7	CYS	-	expression tag	UNP Q8R0I0
A	-6	THR	-	expression tag	UNP Q8R0I0
A	-5	GLN	-	expression tag	UNP Q8R0I0
A	-4	ARG	-	expression tag	UNP Q8R0I0
A	-3	ILE	-	expression tag	UNP Q8R0I0
A	-2	LYS	-	expression tag	UNP Q8R0I0
A	-1	TRP	-	expression tag	UNP Q8R0I0
A	0	LYS	-	expression tag	UNP Q8R0I0
A	1	GLY	-	expression tag	UNP Q8R0I0
A	2	LEU	-	expression tag	UNP Q8R0I0
A	3	LEU	-	expression tag	UNP Q8R0I0
A	4	LEU	-	expression tag	UNP Q8R0I0
A	5	THR	-	expression tag	UNP Q8R0I0
A	6	ALA	-	expression tag	UNP Q8R0I0
A	7	SER	-	expression tag	UNP Q8R0I0
A	8	LEU	-	expression tag	UNP Q8R0I0
A	9	LEU	-	expression tag	UNP Q8R0I0
A	10	ASN	-	expression tag	UNP Q8R0I0
A	11	PHE	-	expression tag	UNP Q8R0I0

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Chain	Residue	Modelled	Actual	Comment	Reference
A	12	TRP	-	expression tag	UNP Q8R0I0
A	13	ASN	-	expression tag	UNP Q8R0I0
A	14	LEU	-	expression tag	UNP Q8R0I0
A	15	PRO	-	expression tag	UNP Q8R0I0
A	16	THR	-	expression tag	UNP Q8R0I0
A	17	THR	-	expression tag	UNP Q8R0I0
A	18	ALA	-	expression tag	UNP Q8R0I0
A	616	THR	-	linker	UNP Q8R0I0
A	617	GLY	-	linker	UNP Q8R0I0
A	618	LEU	-	linker	UNP Q8R0I0
A	619	GLU	-	linker	UNP Q8R0I0
A	620	VAL	-	linker	UNP Q8R0I0
A	621	LEU	-	linker	UNP Q8R0I0
A	622	PHE	-	linker	UNP Q8R0I0
A	623	GLN	-	linker	UNP Q8R0I0
A	624	GLY	-	linker	UNP Q8R0I0
A	625	PRO	-	linker	UNP Q8R0I0
A	626	MET	-	linker	UNP Q8R0I0
A	627	ASP	-	linker	UNP Q8R0I0
A	860	LYS	-	expression tag	UNP P01865
A	861	HIS	-	expression tag	UNP P01865
A	862	HIS	-	expression tag	UNP P01865
A	863	HIS	-	expression tag	UNP P01865
A	864	HIS	-	expression tag	UNP P01865
A	865	HIS	-	expression tag	UNP P01865
A	866	HIS	-	expression tag	UNP P01865
A	867	HIS	-	expression tag	UNP P01865
A	868	HIS	-	expression tag	UNP P01865
A	869	HIS	-	expression tag	UNP P01865
A	870	HIS	-	expression tag	UNP P01865

- Molecule 2 is a protein called Spike glycoprotein, Fibritin.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	193	Total	C	N	O	S	0	0
			1554	1002	262	282	8		

There are 99 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	70	VAL	ALA	variant	UNP P0DTC2
B	?	-	HIS	deletion	UNP P0DTC2

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Chain	Residue	Modelled	Actual	Comment	Reference
B	?	-	VAL	deletion	UNP P0DTC2
B	96	ILE	THR	variant	UNP P0DTC2
B	143	ASP	GLY	variant	UNP P0DTC2
B	?	-	VAL	deletion	UNP P0DTC2
B	?	-	TYR	deletion	UNP P0DTC2
B	?	-	TYR	deletion	UNP P0DTC2
B	209	ILE	ASN	variant	UNP P0DTC2
B	210	VAL	LEU	variant	UNP P0DTC2
B	211	ARG	VAL	variant	UNP P0DTC2
B	212	GLU	ARG	variant	UNP P0DTC2
B	213	PRO	-	insertion	UNP P0DTC2
B	214	GLU	-	insertion	UNP P0DTC2
B	339	ASP	GLY	variant	UNP P0DTC2
B	371	LEU	SER	variant	UNP P0DTC2
B	373	PRO	SER	variant	UNP P0DTC2
B	375	PHE	SER	variant	UNP P0DTC2
B	417	ASN	LYS	variant	UNP P0DTC2
B	440	LYS	ASN	variant	UNP P0DTC2
B	446	SER	GLY	variant	UNP P0DTC2
B	477	ASN	SER	variant	UNP P0DTC2
B	478	LYS	THR	variant	UNP P0DTC2
B	484	ALA	GLU	variant	UNP P0DTC2
B	493	ARG	GLN	variant	UNP P0DTC2
B	496	SER	GLY	variant	UNP P0DTC2
B	498	ARG	GLN	variant	UNP P0DTC2
B	501	TYR	ASN	variant	UNP P0DTC2
B	505	HIS	TYR	variant	UNP P0DTC2
B	547	LYS	THR	variant	UNP P0DTC2
B	614	GLY	ASP	variant	UNP P0DTC2
B	655	TYR	HIS	variant	UNP P0DTC2
B	679	LYS	ASN	variant	UNP P0DTC2
B	681	HIS	PRO	variant	UNP P0DTC2
B	682	GLY	ARG	engineered mutation	UNP P0DTC2
B	683	SER	ARG	engineered mutation	UNP P0DTC2
B	685	SER	ARG	engineered mutation	UNP P0DTC2
B	764	LYS	ASN	variant	UNP P0DTC2
B	796	TYR	ASP	variant	UNP P0DTC2
B	856	LYS	ASN	variant	UNP P0DTC2
B	954	HIS	GLN	variant	UNP P0DTC2
B	969	LYS	ASN	variant	UNP P0DTC2
B	981	PHE	LEU	variant	UNP P0DTC2
B	986	PRO	LYS	engineered mutation	UNP P0DTC2

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Chain	Residue	Modelled	Actual	Comment	Reference
B	987	PRO	VAL	engineered mutation	UNP P0DTC2
B	1209	GLY	-	linker	UNP P0DTC2
B	1210	SER	-	linker	UNP P0DTC2
B	1232	LEU	PHE	engineered mutation	UNP P10104
B	1238	GLY	-	expression tag	UNP P10104
B	1239	ARG	-	expression tag	UNP P10104
B	1240	SER	-	expression tag	UNP P10104
B	1241	LEU	-	expression tag	UNP P10104
B	1242	GLU	-	expression tag	UNP P10104
B	1243	VAL	-	expression tag	UNP P10104
B	1244	LEU	-	expression tag	UNP P10104
B	1245	PHE	-	expression tag	UNP P10104
B	1246	GLN	-	expression tag	UNP P10104
B	1247	GLY	-	expression tag	UNP P10104
B	1248	PRO	-	expression tag	UNP P10104
B	1249	GLY	-	expression tag	UNP P10104
B	1250	HIS	-	expression tag	UNP P10104
B	1251	HIS	-	expression tag	UNP P10104
B	1252	HIS	-	expression tag	UNP P10104
B	1253	HIS	-	expression tag	UNP P10104
B	1254	HIS	-	expression tag	UNP P10104
B	1255	HIS	-	expression tag	UNP P10104
B	1256	HIS	-	expression tag	UNP P10104
B	1257	HIS	-	expression tag	UNP P10104
B	1258	SER	-	expression tag	UNP P10104
B	1259	ALA	-	expression tag	UNP P10104
B	1260	TRP	-	expression tag	UNP P10104
B	1261	SER	-	expression tag	UNP P10104
B	1262	HIS	-	expression tag	UNP P10104
B	1263	PRO	-	expression tag	UNP P10104
B	1264	GLN	-	expression tag	UNP P10104
B	1265	PHE	-	expression tag	UNP P10104
B	1266	GLU	-	expression tag	UNP P10104
B	1267	LYS	-	expression tag	UNP P10104
B	1268	GLY	-	expression tag	UNP P10104
B	1269	GLY	-	expression tag	UNP P10104
B	1270	GLY	-	expression tag	UNP P10104
B	1271	SER	-	expression tag	UNP P10104
B	1272	GLY	-	expression tag	UNP P10104
B	1273	GLY	-	expression tag	UNP P10104
B	1274	GLY	-	expression tag	UNP P10104
B	1275	GLY	-	expression tag	UNP P10104

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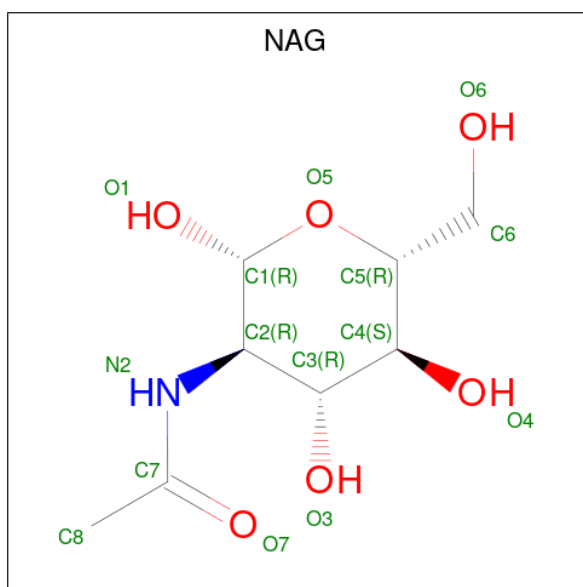
Chain	Residue	Modelled	Actual	Comment	Reference
B	1276	SER	-	expression tag	UNP P10104
B	1277	GLY	-	expression tag	UNP P10104
B	1278	GLY	-	expression tag	UNP P10104
B	1279	SER	-	expression tag	UNP P10104
B	1280	ALA	-	expression tag	UNP P10104
B	1281	TRP	-	expression tag	UNP P10104
B	1282	SER	-	expression tag	UNP P10104
B	1283	HIS	-	expression tag	UNP P10104
B	1284	PRO	-	expression tag	UNP P10104
B	1285	GLN	-	expression tag	UNP P10104
B	1286	PHE	-	expression tag	UNP P10104
B	1287	GLU	-	expression tag	UNP P10104
B	1288	LYS	-	expression tag	UNP P10104

- Molecule 3 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				AltConf	Trace
3	C	2	Total	C	N	O	0	0
			28	16	2	10		

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
4	B	1	14	8	1	5	0

[illegible]

- Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	87727	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	58	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2800	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	2.555	Depositor
Minimum map value	-2.109	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.027	Depositor
Recommended contour level	0.16	Depositor
Map size ($\text{\AA}$)	362.985, 362.985, 362.985	wwPDB
Map dimensions	350, 350, 350	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.0371, 1.0371, 1.0371	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NAG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.12	0/4873	0.33	0/6612
2	B	0.14	0/1600	0.39	0/2178
All	All	0.12	0/6473	0.35	0/8790

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	4744	0	4530	75	0
2	B	1554	0	1483	29	0
3	C	28	0	25	1	0
4	B	14	0	13	1	0
All	All	6340	0	6051	104	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 8.

All (104) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:445:THR:HG23	1:A:446:ILE:HG23	1.71	0.73
1:A:77:SER:O	1:A:81:GLN:NE2	2.24	0.71
1:A:503:LEU:HB3	1:A:506:VAL:HG12	1.74	0.69
2:B:350:VAL:HG11	2:B:418:ILE:HD11	1.73	0.69
2:B:454:ARG:HD3	2:B:457:ARG:HD3	1.75	0.66
1:A:53:ASN:O	1:A:58:ASN:ND2	2.26	0.65
2:B:393:THR:HG22	2:B:394:ASN:H	1.62	0.65
2:B:454:ARG:NH1	2:B:467:ASP:O	2.31	0.64
1:A:306:ARG:NH1	1:A:309:GLN:OE1	2.32	0.62
1:A:404:VAL:HA	1:A:407:ILE:HD12	1.82	0.61
1:A:126:ILE:HD12	1:A:176:LEU:HD11	1.83	0.59
1:A:31:ASN:OD1	2:B:493:ARG:NH1	2.35	0.59
1:A:460:ARG:HH12	1:A:506:VAL:HG23	1.68	0.59
2:B:380:TYR:H	2:B:432:CYS:HB3	1.68	0.58
1:A:436:ILE:HD13	1:A:439:LEU:HD21	1.86	0.58
1:A:297:MET:HA	1:A:302:TRP:HD1	1.68	0.58
1:A:133:CYS:HB2	1:A:141:CYS:HA	1.85	0.57
1:A:58:ASN:HA	1:A:61:LYS:HG2	1.87	0.56
1:A:484:ILE:HG22	1:A:485:VAL:HG13	1.88	0.55
4:B:526:NAG:H3	4:B:526:NAG:H83	1.88	0.55
1:A:273:ARG:O	1:A:445:THR:OG1	2.24	0.55
1:A:414:THR:HG23	1:A:417:HIS:H	1.71	0.55
1:A:318:VAL:HG22	1:A:545:SER:HA	1.90	0.54
1:A:411:SER:OG	1:A:526:GLN:NE2	2.40	0.54
1:A:518:ARG:NH1	1:A:522:GLN:OE1	2.41	0.54
1:A:508:ASN:HB2	1:A:510:TYR:CE2	2.44	0.53
1:A:465:ARG:HB3	1:A:467:GLU:HG3	1.90	0.52
1:A:358:ILE:HB	1:A:379:ILE:HD11	1.92	0.52
1:A:539:LEU:H	1:A:539:LEU:HD23	1.75	0.51
2:B:401:VAL:HG22	2:B:509:ARG:HG2	1.92	0.51
2:B:355:ARG:HA	2:B:398:ASP:HB3	1.93	0.51
1:A:374:HIS:HB2	1:A:409:SER:HB2	1.92	0.51
1:A:180:TYR:HA	1:A:183:TYR:HB3	1.91	0.50
1:A:457:GLU:HG2	1:A:513:ILE:HD11	1.93	0.50
1:A:560:LEU:HD21	1:A:564:GLU:HB3	1.93	0.50
2:B:406:GLU:HA	2:B:409:GLN:HB2	1.94	0.49
1:A:534:LYS:NZ	1:A:549:GLU:OE2	2.45	0.49
2:B:497:PHE:CD2	2:B:507:PRO:HB3	2.47	0.49
1:A:52:THR:HA	1:A:342:VAL:HG12	1.95	0.49
2:B:379:CYS:HA	2:B:432:CYS:HB2	1.94	0.49
1:A:382:ASP:OD1	1:A:385:TYR:OH	2.31	0.48
1:A:455:MET:O	1:A:458:LYS:HG3	2.13	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:495:TYR:HB3	2:B:497:PHE:CE1	2.48	0.48
1:A:368:ASN:HA	1:A:371:THR:HG22	1.95	0.48
2:B:383:SER:OG	2:B:385:THR:O	2.32	0.48
1:A:396:ALA:HB3	1:A:400:PHE:HD2	1.79	0.48
1:A:209:ALA:HB1	1:A:565:PRO:HB3	1.97	0.47
1:A:519:THR:O	1:A:522:GLN:HG2	2.15	0.47
1:A:165:TRP:O	1:A:169:ARG:HG2	2.15	0.47
1:A:347:THR:OG1	1:A:349:TRP:NE1	2.43	0.47
1:A:436:ILE:O	1:A:440:LEU:HG	2.15	0.47
1:A:494:ASP:OD1	1:A:494:ASP:N	2.47	0.46
1:A:376:MET:HE2	1:A:376:MET:HB2	1.86	0.46
2:B:457:ARG:NH1	2:B:459:SER:OG	2.49	0.46
1:A:349:TRP:HB3	1:A:351:LEU:HD23	1.98	0.45
2:B:498:ARG:HG2	2:B:501:TYR:CZ	2.51	0.45
1:A:21:THR:OG1	1:A:22:GLU:N	2.48	0.45
1:A:356:PHE:CE2	1:A:383:MET:HG2	2.51	0.45
2:B:353:TRP:HZ3	2:B:355:ARG:HB2	1.81	0.45
1:A:252:TYR:HB2	1:A:255:TYR:CZ	2.52	0.45
2:B:406:GLU:O	2:B:410:ILE:HG12	2.17	0.45
2:B:336:CYS:HA	2:B:361:CYS:HB2	1.98	0.45
2:B:406:GLU:HB3	2:B:418:ILE:HG21	1.98	0.44
2:B:376:THR:OG1	2:B:435:ALA:O	2.33	0.44
2:B:458:LYS:HE2	2:B:458:LYS:HB3	1.82	0.44
2:B:412:PRO:HB3	2:B:429:PHE:HB3	1.99	0.43
1:A:381:TYR:CD2	1:A:558:LEU:HD22	2.54	0.43
1:A:389:PRO:O	1:A:393:ARG:HG3	2.18	0.43
1:A:554:LEU:O	1:A:558:LEU:HG	2.17	0.43
1:A:269:ASP:N	1:A:269:ASP:OD1	2.52	0.43
1:A:443:ALA:O	1:A:447:VAL:HB	2.19	0.43
1:A:308:PHE:CE2	1:A:333:LEU:HD22	2.54	0.43
2:B:444:LYS:HB3	2:B:448:ASN:HB3	1.99	0.43
1:A:365:THR:OG1	1:A:368:ASN:OD1	2.35	0.43
2:B:438:SER:O	2:B:507:PRO:HG2	2.19	0.43
1:A:395:GLY:O	1:A:562:ASN:ND2	2.47	0.42
2:B:338:PHE:HA	2:B:341:VAL:HG12	2.00	0.42
1:A:85:LEU:HD23	1:A:85:LEU:O	2.18	0.42
1:A:207:TYR:HE2	1:A:397:ASN:HD21	1.67	0.42
1:A:539:LEU:HD13	1:A:590:PRO:HG2	2.01	0.42
2:B:454:ARG:NH2	2:B:469:SER:O	2.53	0.42
1:A:56:GLU:HA	1:A:59:ALA:HB3	2.02	0.42
1:A:115:GLN:O	1:A:118:THR:OG1	2.38	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:452:PHE:O	1:A:455:MET:HG3	2.20	0.42
1:A:349:TRP:HB3	1:A:351:LEU:CD2	2.50	0.42
1:A:418:LEU:O	1:A:424:LEU:HB2	2.19	0.42
2:B:350:VAL:HG12	2:B:422:ASN:HB3	2.01	0.42
1:A:34:GLN:NE2	2:B:493:ARG:HB3	2.34	0.42
1:A:315:PHE:CE1	1:A:408:MET:HG2	2.53	0.42
3:C:1:NAG:H62	3:C:2:NAG:H61	2.01	0.42
1:A:327:PHE:O	1:A:331:SER:HB3	2.20	0.41
1:A:134:ASN:HB3	1:A:137:ASN:HB2	2.02	0.41
1:A:201:ASP:HA	1:A:204:ARG:HG2	2.02	0.41
1:A:316:VAL:HG11	1:A:322:HIS:CE1	2.55	0.41
2:B:439:ASN:O	2:B:443:SER:HB2	2.20	0.41
1:A:525:PHE:HE1	1:A:570:LEU:HD13	1.86	0.41
1:A:177:ARG:HH22	1:A:495:GLU:HB3	1.84	0.41
1:A:112:LYS:HA	1:A:112:LYS:HD2	1.96	0.41
1:A:491:LEU:HD23	1:A:491:LEU:HA	1.94	0.41
1:A:568:LYS:HA	1:A:568:LYS:HD3	1.95	0.41
1:A:20:LEU:HB3	1:A:24:ASN:HB2	2.02	0.41
1:A:419:LYS:NZ	1:A:428:PHE:O	2.44	0.40
1:A:303:ASP:N	1:A:303:ASP:OD1	2.53	0.40
1:A:369:PHE:CZ	1:A:373:HIS:HE1	2.40	0.40

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	582/886 (66%)	539 (93%)	43 (7%)	0	100	100
2	B	191/1285 (15%)	171 (90%)	20 (10%)	0	100	100
All	All	773/2171 (36%)	710 (92%)	63 (8%)	0	100	100

There are no Ramachandran outliers to report.

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	507/789 (64%)	506 (100%)	1 (0%)	87	88
2	B	169/1113 (15%)	169 (100%)	0	100	100
All	All	676/1902 (36%)	675 (100%)	1 (0%)	87	89

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	51	ASN
1	A	265	HIS
1	A	388	GLN
1	A	599	ASN

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 ⓘ

2 monosaccharides are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z > 2$	Counts	RMSZ	# $ Z > 2$
3	NAG	C	1	1,3	14,14,15	0.23	0	17,19,21	0.49	0
3	NAG	C	2	3	14,14,15	0.61	1 (7%)	17,19,21	1.30	1 (5%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	C	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	C	2	3	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	2	NAG	O5-C1	2.12	1.47	1.43

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	2	NAG	C1-O5-C5	4.96	118.83	112.19

There are no chirality outliers.

All (4) torsion outliers are listed below:

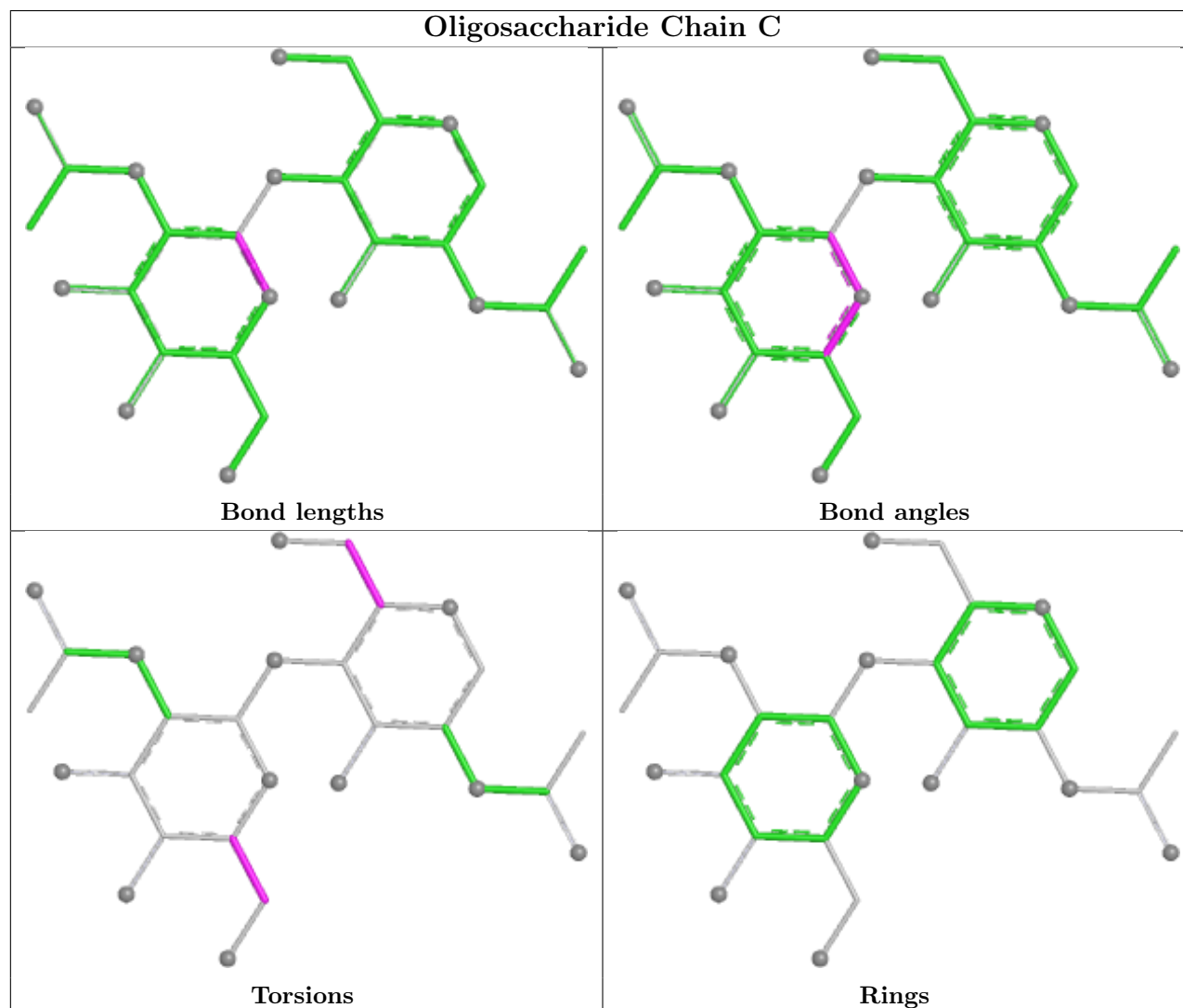
Mol	Chain	Res	Type	Atoms
3	C	1	NAG	O5-C5-C6-O6
3	C	2	NAG	O5-C5-C6-O6
3	C	1	NAG	C4-C5-C6-O6
3	C	2	NAG	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	2	NAG	1	0
3	C	1	NAG	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	NAG	B	526	2	14,14,15	0.46	0	17,19,21	1.36	2 (11%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	B	526	2	-	6/6/23/26	0/1/1/1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
4	B	526	NAG	C2-N2-C7	4.61	129.08	122.90
4	B	526	NAG	C1-C2-N2	2.22	113.93	110.43

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	526	NAG	C4-C5-C6-O6
4	B	526	NAG	O5-C5-C6-O6
4	B	526	NAG	C8-C7-N2-C2
4	B	526	NAG	O7-C7-N2-C2
4	B	526	NAG	C1-C2-N2-C7
4	B	526	NAG	C3-C2-N2-C7

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	526	NAG	1	0

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

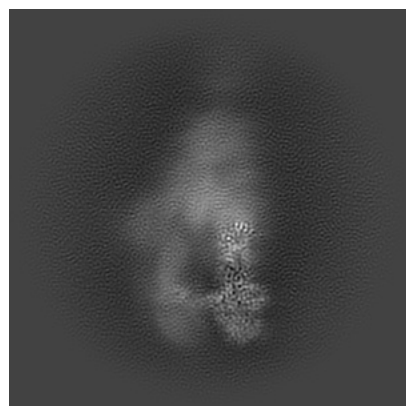
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-15590. These allow visual inspection of the internal detail of the map and identification of artifacts.

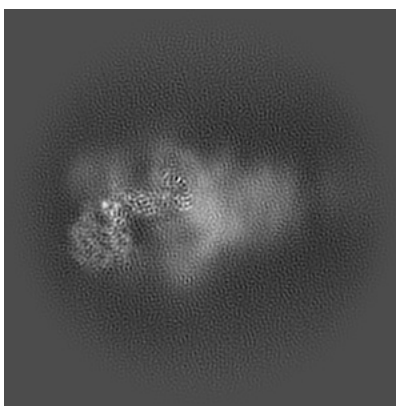
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

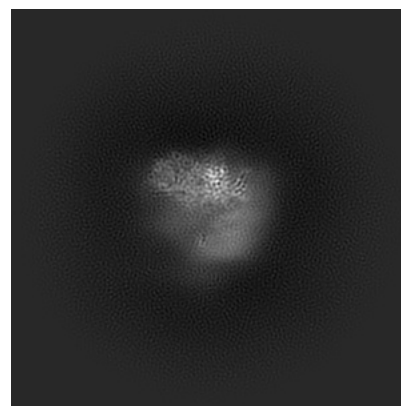
6.1.1 Primary map



X

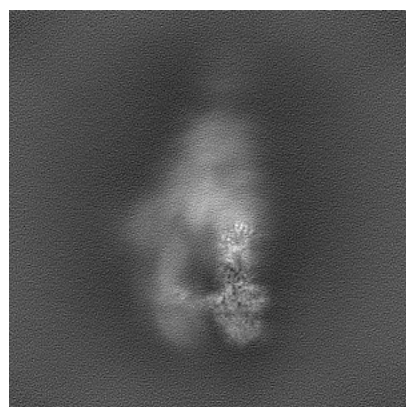


Y

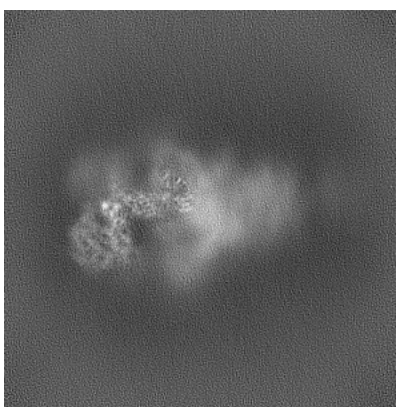


Z

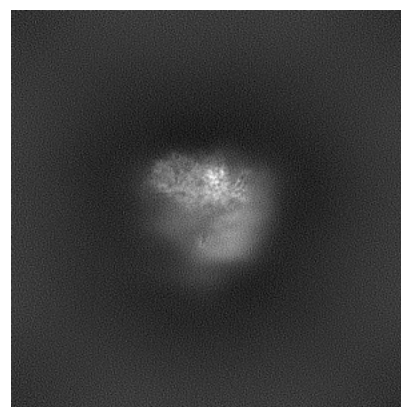
6.1.2 Raw map



X



Y

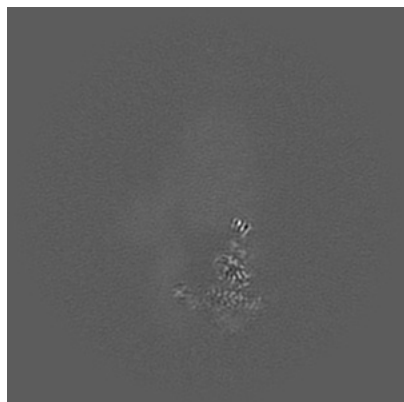


Z

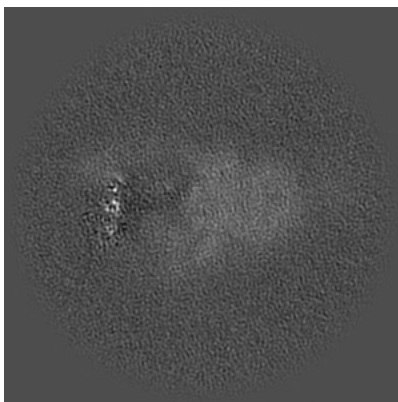
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

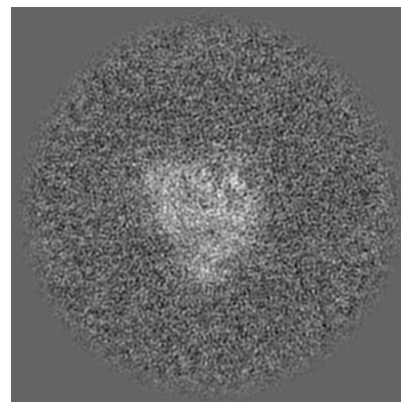
6.2.1 Primary map



X Index: 175



Y Index: 175

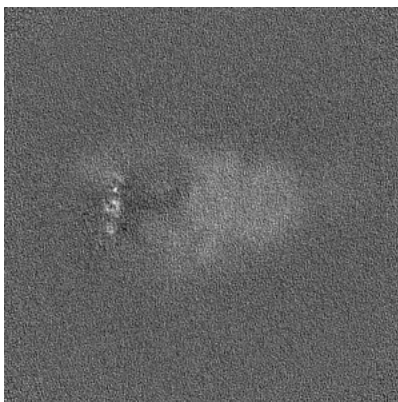


Z Index: 175

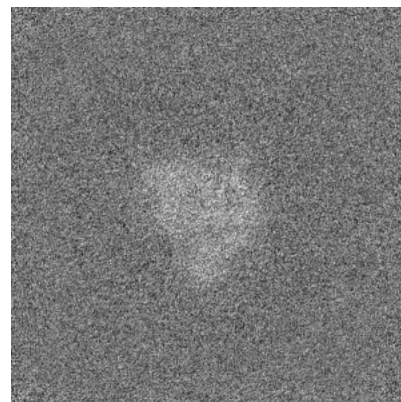
6.2.2 Raw map



X Index: 175



Y Index: 175



Z Index: 175

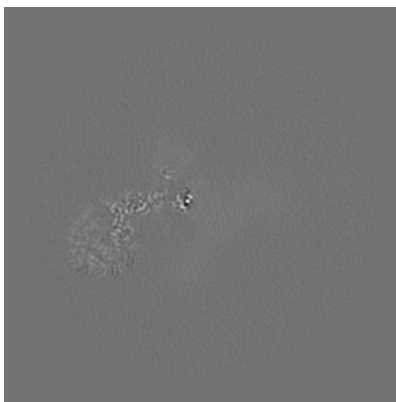
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

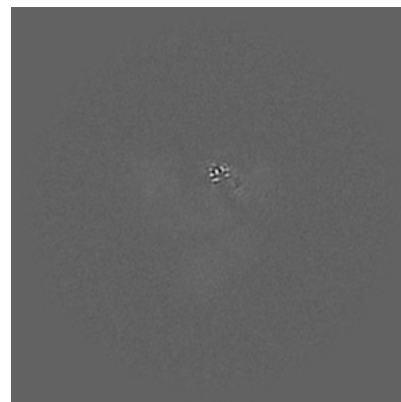
6.3.1 Primary map



X Index: 179

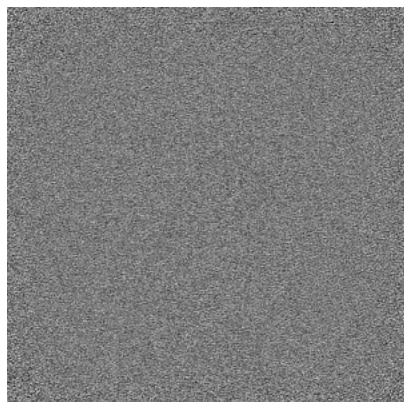


Y Index: 205

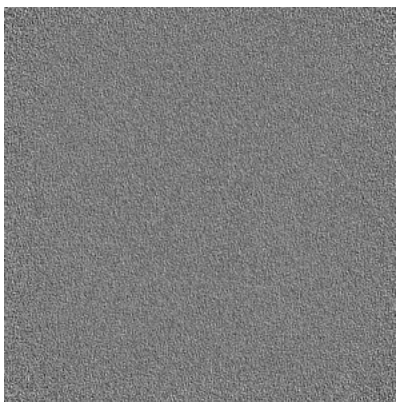


Z Index: 160

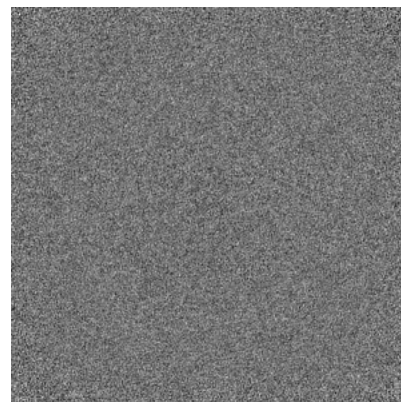
6.3.2 Raw map



X Index: 0



Y Index: 0

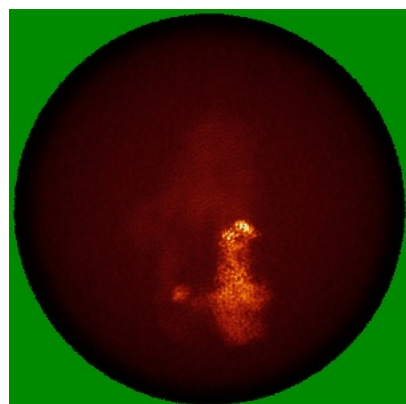


Z Index: 349

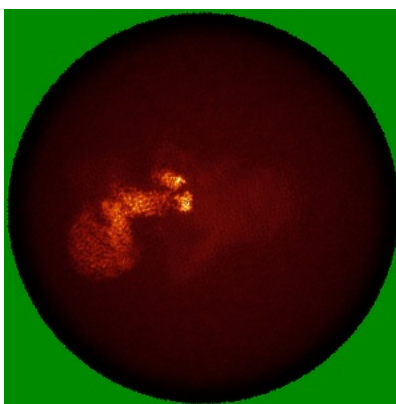
The images above show the largest variance slices of the map in three orthogonal directions.

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

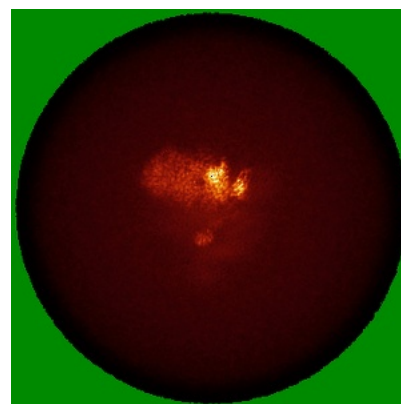
6.4.1 Primary map



X

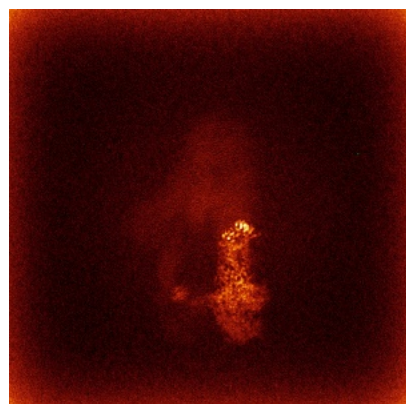


Y

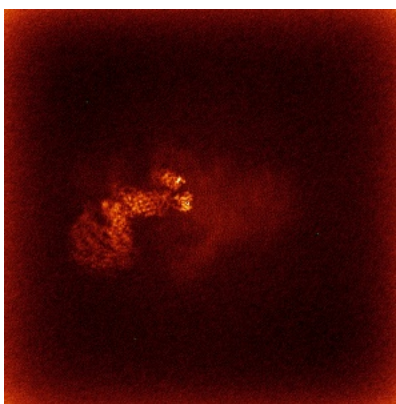


Z

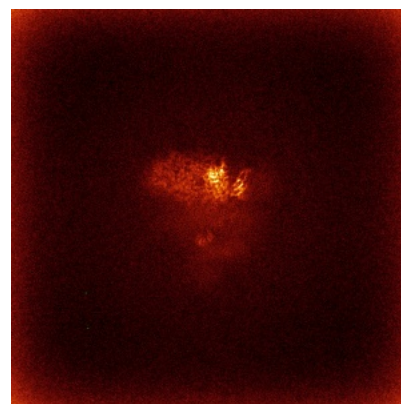
6.4.2 Raw map



X



Y

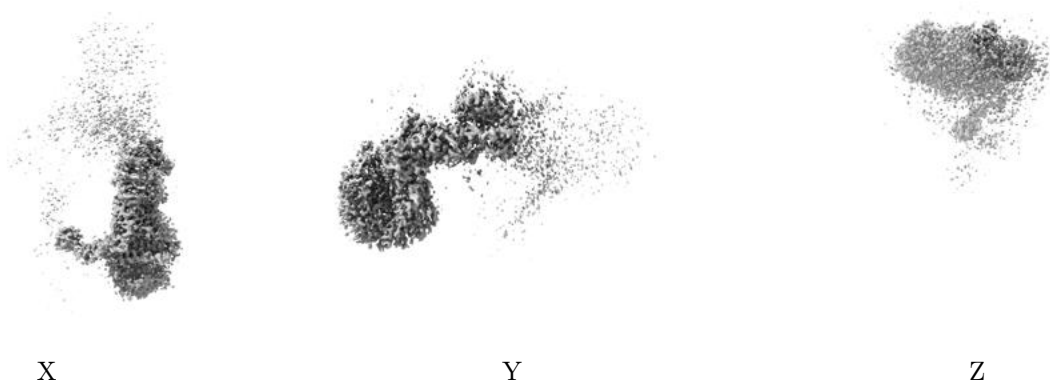


Z

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.

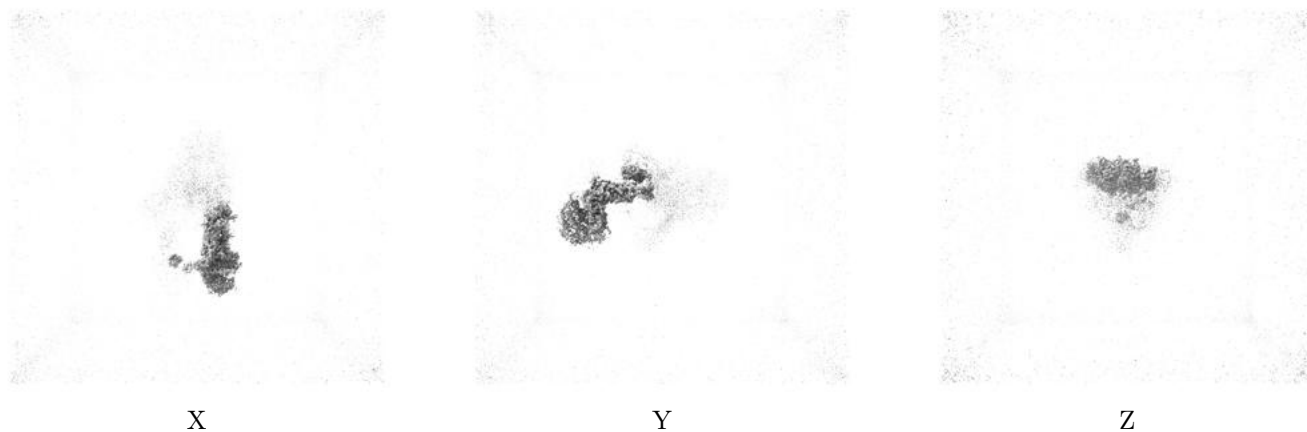
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.16. 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.

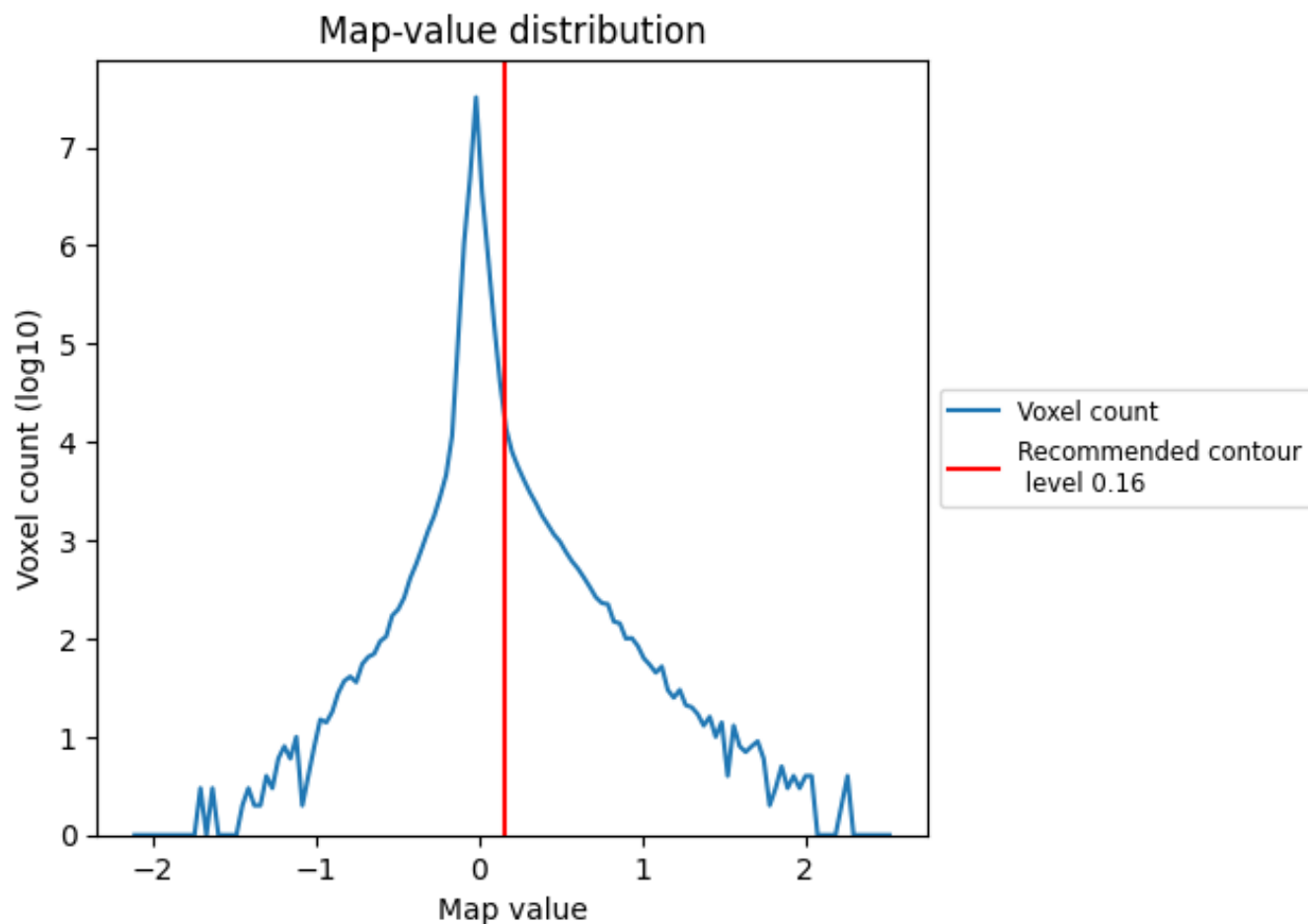
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

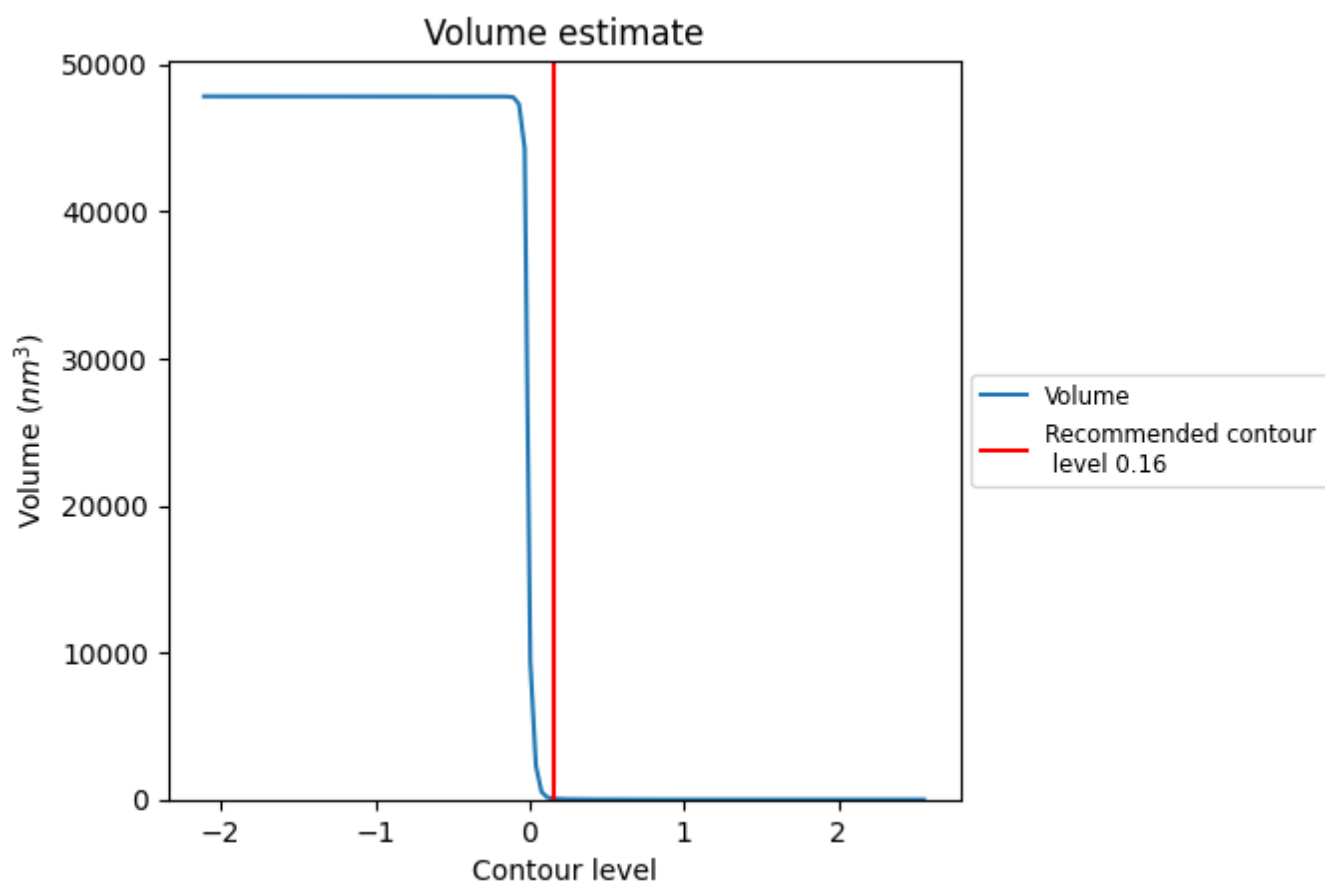
This section contains the results of statistical analysis of the map.

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.

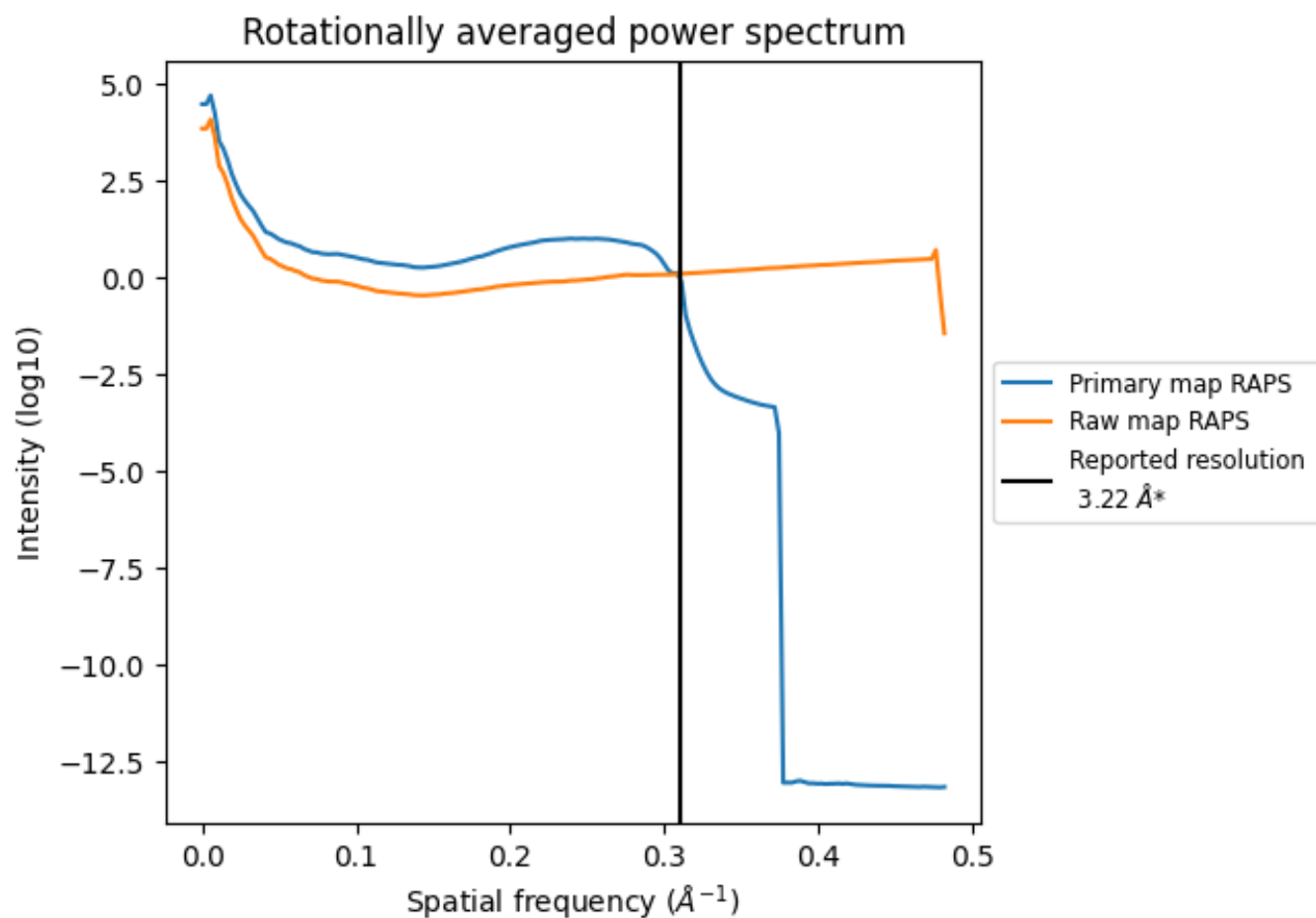
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 60 nm³; this corresponds to an approximate mass of 55 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 ⓘ

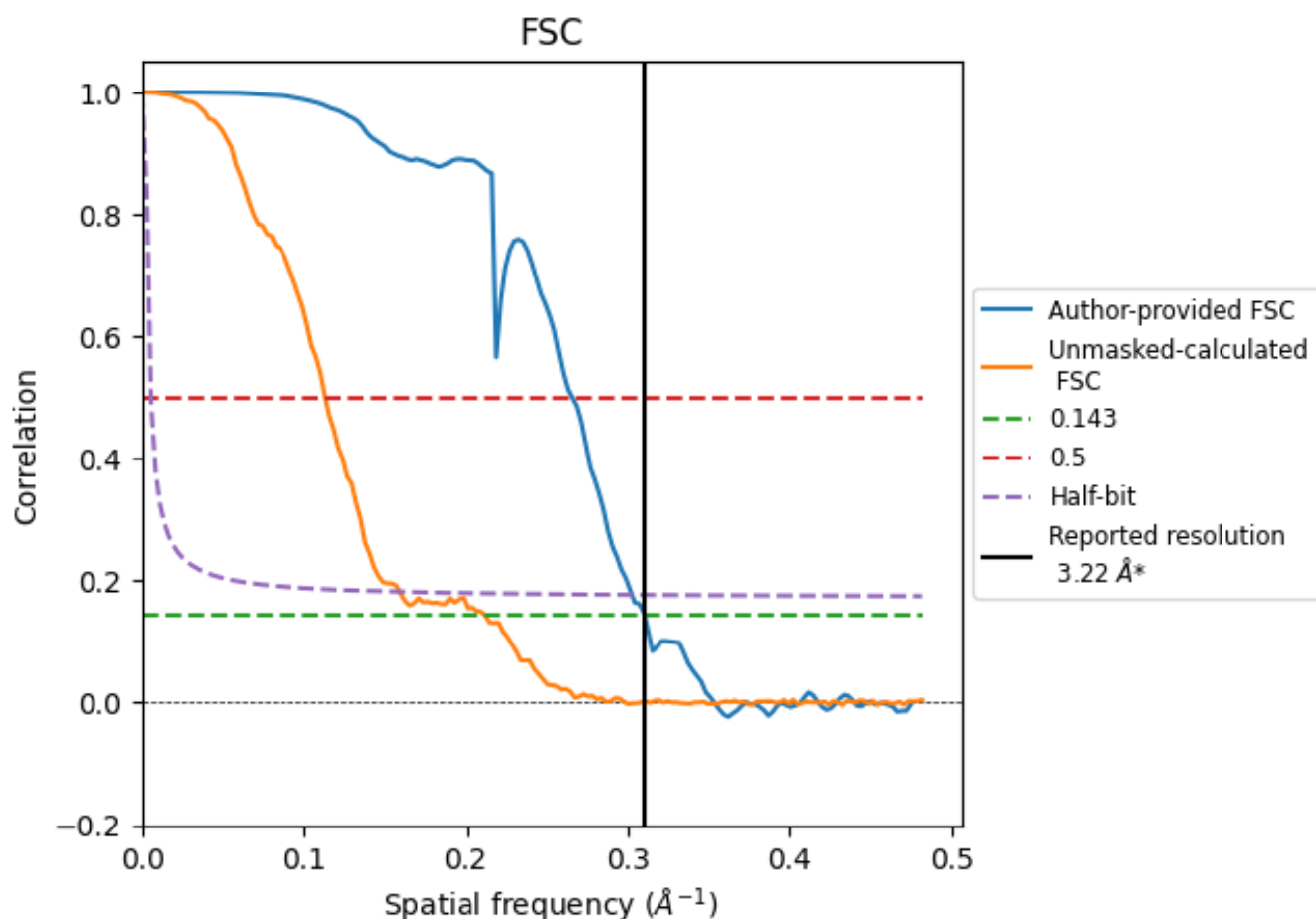


*Reported resolution corresponds to spatial frequency of 0.311 $\text{\AA}^{-1}$

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 0.311 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

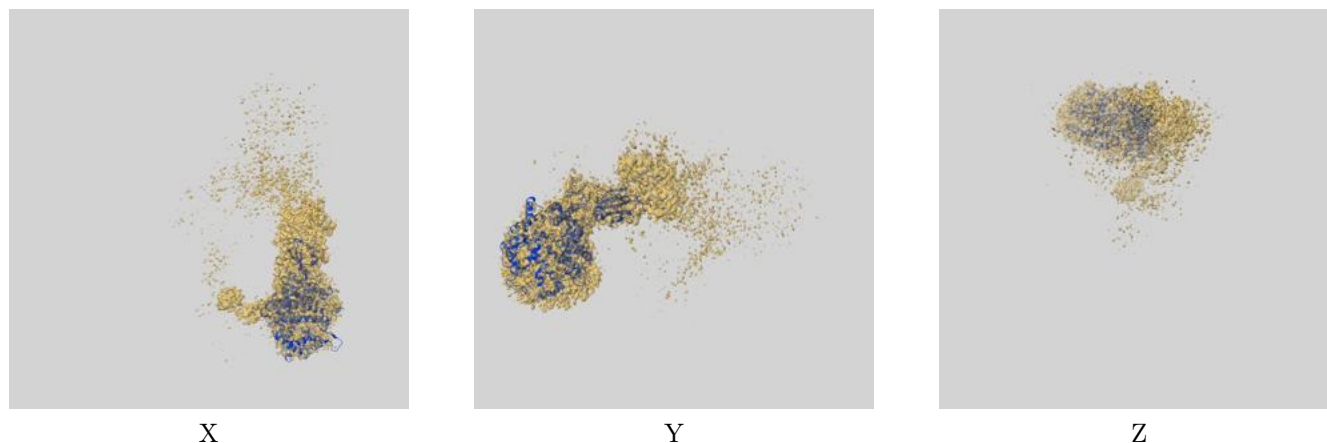
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.22	-	-
Author-provided FSC curve	3.22	3.76	3.30
Unmasked-calculated*	4.71	8.84	6.29

*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 4.71 differs from the reported value 3.22 by more than 10 %

9 Map-model fit [i](#)

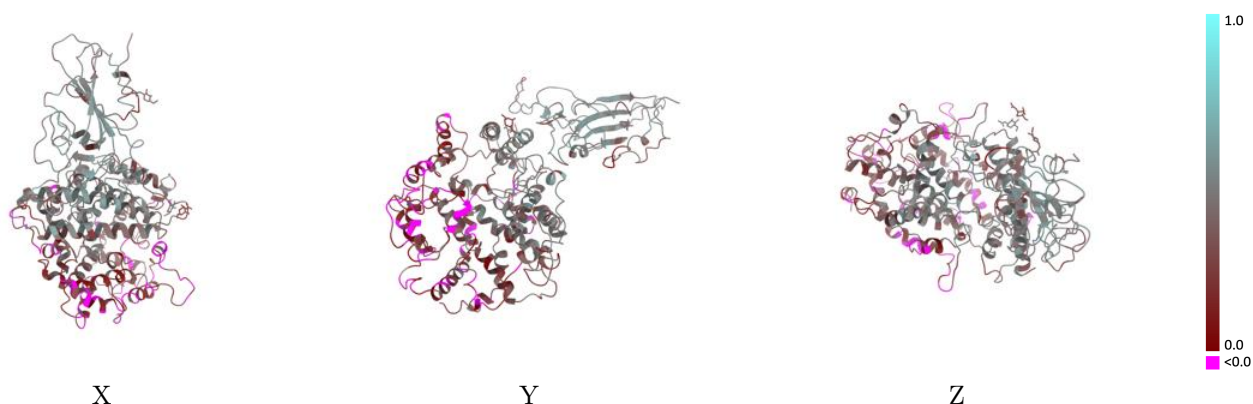
This section contains information regarding the fit between EMDB map EMD-15590 and PDB model 8AQU. Per-residue inclusion information can be found in [section 3](#) on [page 9](#).

9.1 Map-model overlay [i](#)



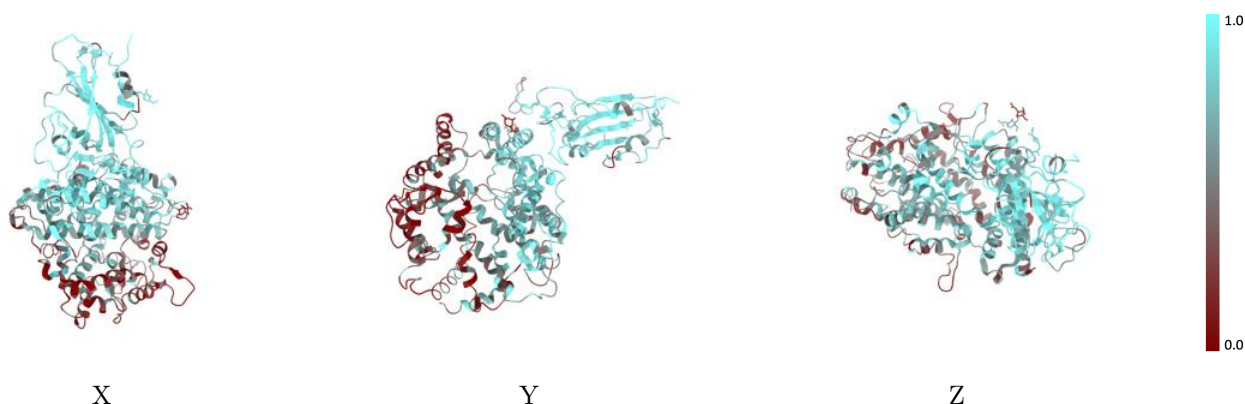
The images above show the 3D surface view of the map at the recommended contour level 0.16 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



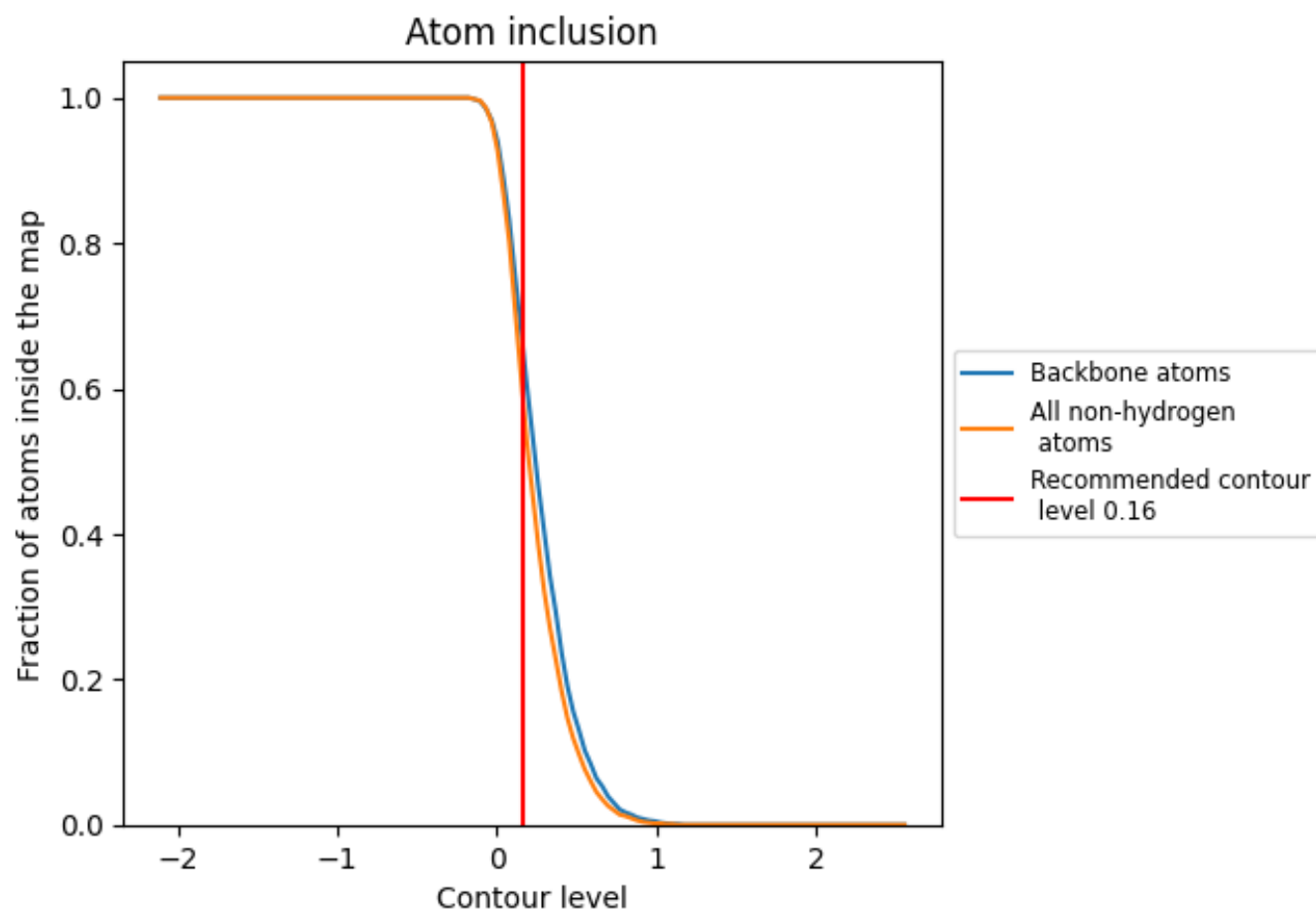
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.16).

9.4 Atom inclusion [i](#)



At the recommended contour level, 66% of all backbone atoms, 60% 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 (0.16) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.5960	0.3320
A	0.5300	0.2900
B	0.8030	0.4620
C	0.3930	0.3470

