



Full wwPDB EM Validation Report ⓘ

Jul 24, 2025 – 12:51 PM EDT

PDB ID : 9MV0 / pdb_00009mv0
EMDB ID : EMD-48650
Title : Structure of HKU5 spike C-terminal domain in complex with ACE2 from *Pipistrellus abramus*
Authors : Li, N.; Tsybovsky, Y.; Teng, I.; Zhou, T.
Deposited on : 2025-01-15
Resolution : 4.20 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.dev118
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

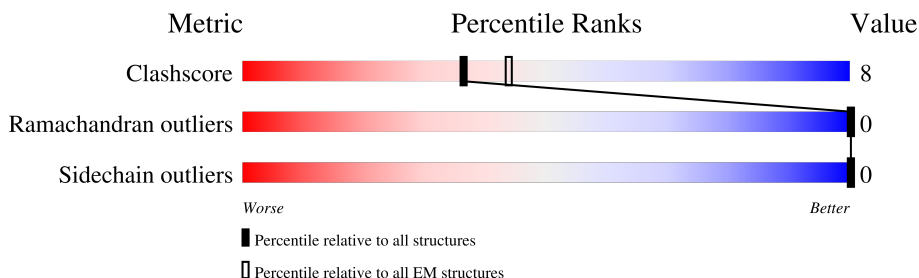
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.20 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	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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	803	69% 17% 14%
1	C	803	72% 14% 14%
2	B	1352	12% 86%
2	D	1352	12% 86%
3	E	2	100%
3	F	2	100%
3	G	2	100%
3	H	2	100%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 14631 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 Angiotensin-converting enzyme.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	692	Total	C	N	O	S	0	0
			5686	3623	958	1071	34		
1	C	692	Total	C	N	O	S	0	0
			5686	3623	958	1071	34		

- Molecule 2 is a protein called Spike glycoprotein.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	196	Total	C	N	O	S	0	0
			1521	970	238	301	12		
2	D	195	Total	C	N	O	S	0	0
			1514	965	237	300	12		

- 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	E	2	Total	C	N	O	0	0
			28	16	2	10		
3	F	2	Total	C	N	O	0	0
			28	16	2	10		
3	G	2	Total	C	N	O	0	0
			28	16	2	10		
3	H	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).

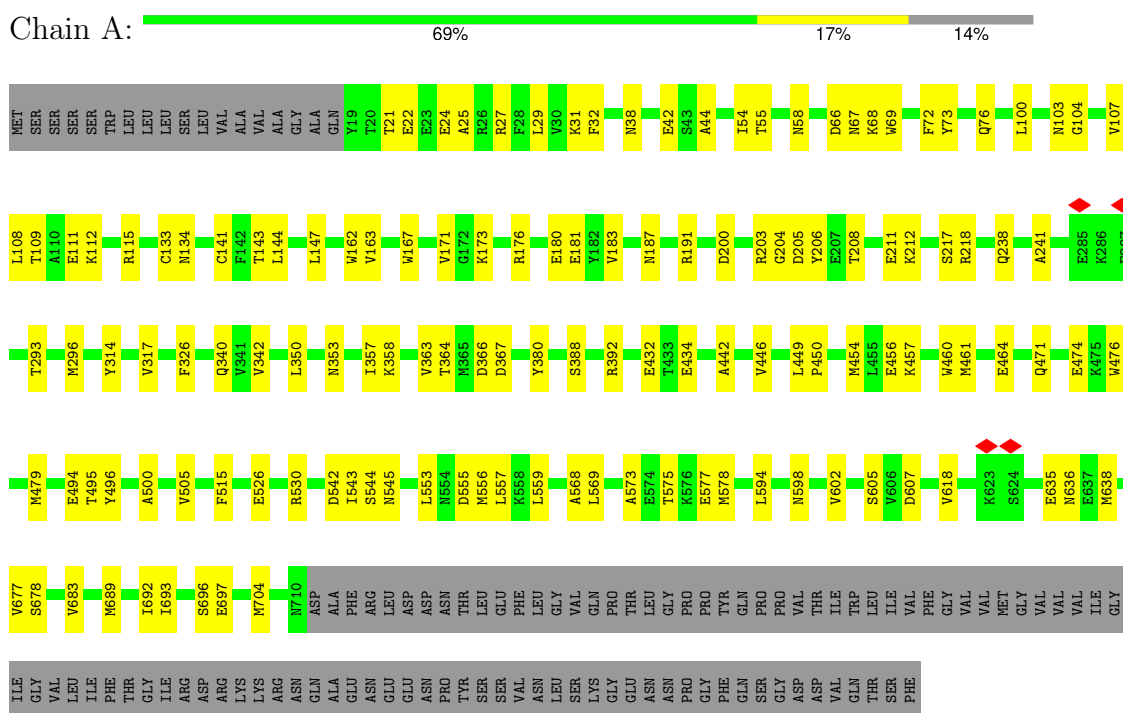


Mol	Chain	Residues	Atoms				AltConf
4	A	1	Total	C	N	O	0
			14	8	1	5	
4	A	1	Total	C	N	O	0
			14	8	1	5	
4	A	1	Total	C	N	O	0
			14	8	1	5	
4	A	1	Total	C	N	O	0
			14	8	1	5	
4	C	1	Total	C	N	O	0
			14	8	1	5	
4	C	1	Total	C	N	O	0
			14	8	1	5	
4	C	1	Total	C	N	O	0
			14	8	1	5	

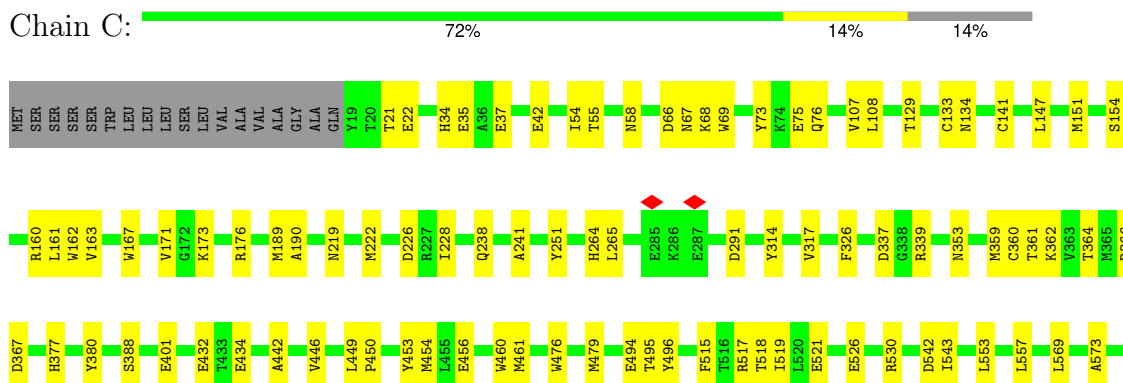
3 Residue-property plots

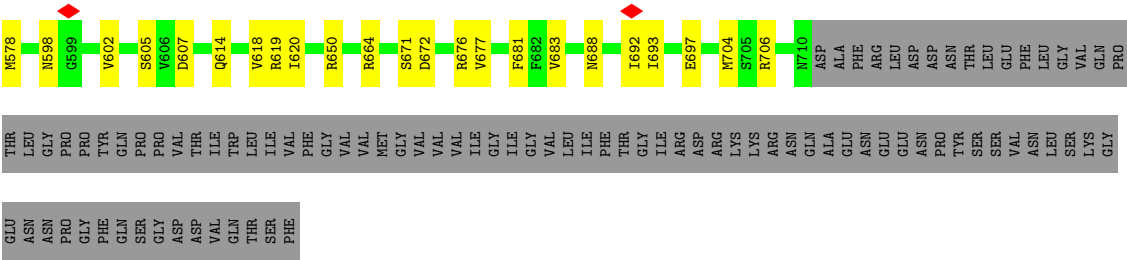
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion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

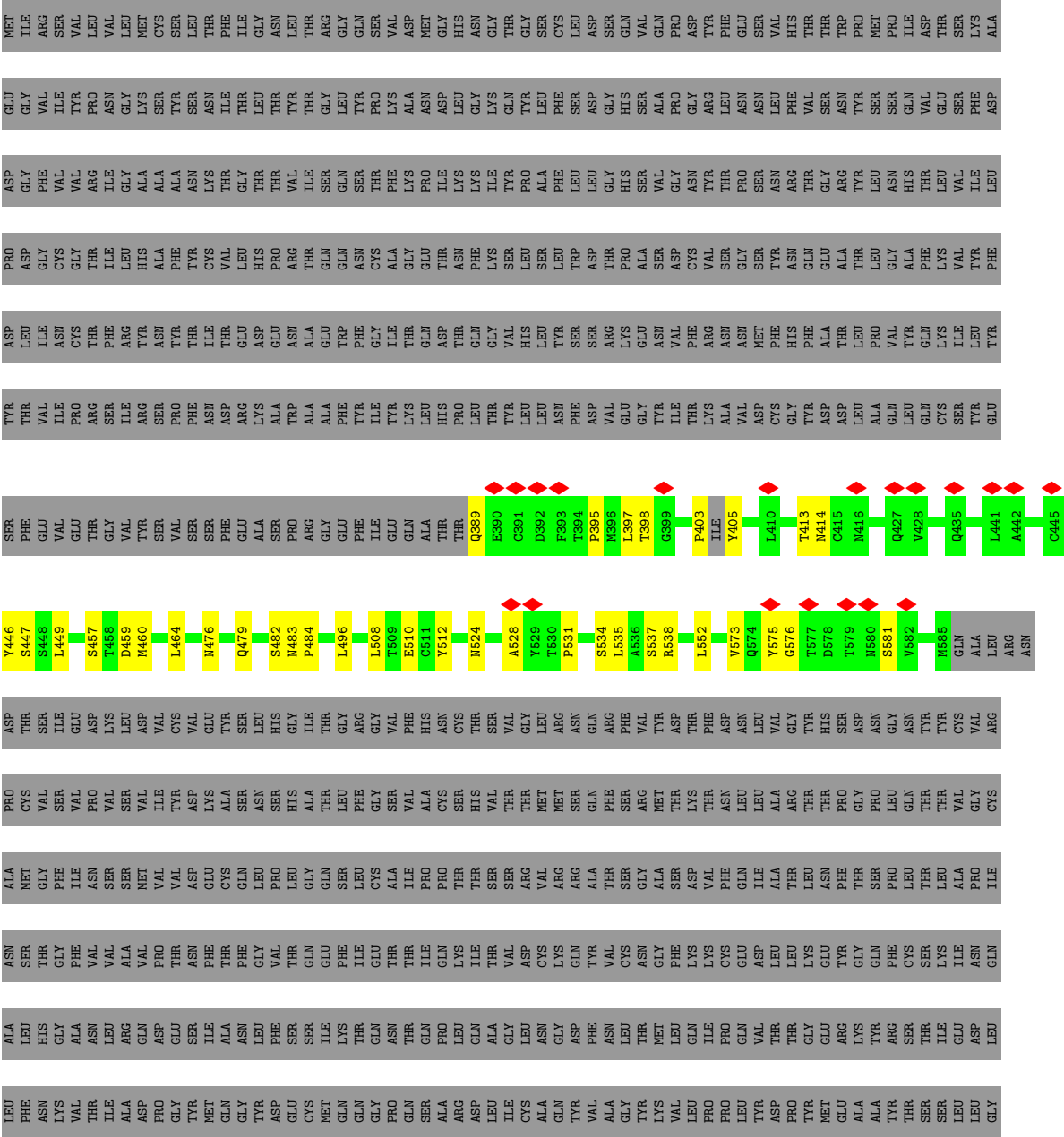


• Molecule 1: Angiotensin-converting enzyme





● Molecule 2: Spike glycoprotein



LEU	GLN	SER	LEU	ARG	THR	SER
ALA	GLU	PHE	TYR	LEU	THR	ILE
LEU	ILE	PHE	THR	THR	ASN	THR
CYS	SER	HIS	HIS	SER	GLY	ALA
VAL	LYS	PRO	PHE	LEU	ALA	ALA
PHE	ILE	GLU	VAL	ASN	PHE	SER
ASN	ASN	PRO	GLY	ALA	ASN	THR
THR	THR	ILE	THR	THR	ASN	THR
LEU	THR	THR	GLN	VAL	VAL	ALA
CYS	LEU	GLU	PRO	ALA	GLY	LEU
THR	LEU	ALA	THR	GLN	ASP	LEU
ASN	ASN	ASN	SER	GLN	GLN	SER
GLY	LEU	SER	HIS	LEU	VAL	SER
CYS	ASN	LYS	VAL	VAL	ASN	PHE
GLY	THR	TYR	ASN	ARG	ALA	ALA
THR	GLU	VAL	ALA	THR	ASN	ALA
SER	LEU	SER	THR	GLU	ALA	ILE
CYS	MET	MET	ALA	ALA	MET	PRO
LEU	VAL	ASP	ALA	ALA	ALA	PHE
GLY	LEU	VAL	TYR	ALA	LEU	PHE
LYS	SER	LYS	GLY	ARG	SER	GLN
LEU	GLU	PHE	LEU	SER	LYS	SER
CYS	VAL	GLU	CYS	ALA	ILE	ILE
LYS	VAL	ASN	ASN	GLN	ALA	PHE
ASN	LYS	LEU	THR	LEU	ALA	THR
ARG	GLN	THR	GLU	ALA	GLU	ARG
CYS	LEU	ASN	ASN	GLN	LEU	LEU
ASN	ASN	ARG	PRO	ASP	SER	ASN
ASP	GLU	LEU	GLN	LYS	ASN	GLY
SER	SER	PRO	LYS	VAL	THR	VAL
TYR	ASP	PRO	CYS	ASN	PHE	GLY
ASP	ILE	PRO	ILE	GLU	GLY	ILE
GLU	ASP	LEU	ALA	CYS	ILE	THR
TYR	LEU	LEU	PRO	VAL	ILE	GLN
GLU	LYS	SER	ILE	LYS	SER	GLN
VAL	GLU	ASN	ASP	SER	SER	VAL
GLU	GLU	SER	GLY	GLN	SER	LEU
LYS	GLY	THR	PHE	LYS	ILE	GLU
ILE	ASN	ASP	THR	LYS	SER	GLU
HIS	THR	LEU	LEU	ARG	ASP	ASN
VAL	PHE	PHE	ASN	GLY	ILE	GLN
HIS	THR	LYS	GLN	THR	ALA	LYS
	THR	GLU	THR	THR	THR	LYS
	TYR	PHE	ALA	HIS	GLU	PHE
	ILE	PHE	ASP	ILE	GLN	ASN
	TRP	TRP	SER	VAL	GLY	ALA
	LEU	ASN	GLN	PHE	GLN	GLY
	PHE	SER	GLN	ALA	ILE	ALA
	ILE	SER	TRP	ILE	ASP	MET
	ALA	GLN	TYR	GLN	ARG	THR
	GLY	GLY	THR	ALA	ILE	GLY
	LEU	PRO	THR	PRO	THR	THR
	VAL	ASN	GLY	ASN	ASN	PHE
	ALA	THR	SER	CYS	GLN	THR

- Molecule 2: Spike glycoprotein

Chain D: 12% 86%

[illegible]

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

Chain E: 100%

NAG1
NAG2

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

Chain F: 100%

NAG1
NAG2

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

Chain G: 100%

NAG1
NAG2

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

Chain H:  100%

HA01
HA02

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	242675	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 ($e^-/\text{\AA}^2$)	40	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	1900	Depositor
Magnification	47000	Depositor
Image detector	DIRECT ELECTRON APOLLO (4k x 4k)	Depositor
Maximum map value	1.881	Depositor
Minimum map value	-1.155	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.036	Depositor
Recommended contour level	0.23	Depositor
Map size (Å)	360.0, 360.0, 360.0	wwPDB
Map dimensions	360, 360, 360	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.0, 1.0, 1.0	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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	0.13	0/5834	0.33	0/7888
1	C	0.13	0/5834	0.30	0/7888
2	B	0.13	0/1562	0.35	0/2133
2	D	0.13	0/1554	0.34	0/2120
All	All	0.13	0/14784	0.32	0/20029

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
2	D	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	D	446	TYR	Peptide

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5686	0	5510	94	0
1	C	5686	0	5510	77	0
2	B	1521	0	1444	23	0
2	D	1514	0	1434	25	0
3	E	28	0	25	0	0
3	F	28	0	25	0	0
3	G	28	0	25	0	0
3	H	28	0	25	2	0
4	A	56	0	52	0	0
4	C	56	0	52	0	0
All	All	14631	0	14102	216	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 (216) 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:25:ALA:O	1:A:29:LEU:HD23	1.79	0.81
1:C:226:ASP:OD1	1:C:453:TYR:OH	2.03	0.76
1:A:55:THR:OG1	1:A:58:ASN:OD1	2.05	0.75
1:C:683:VAL:CG2	1:C:693:ILE:HG21	2.17	0.75
1:C:21:THR:HG22	1:C:22:GLU:OE1	1.87	0.74
2:D:459:ASP:OD2	2:D:460:MET:N	2.20	0.74
1:A:176:ARG:NH1	1:A:496:TYR:O	2.21	0.73
1:C:176:ARG:NH1	1:C:496:TYR:O	2.21	0.73
2:D:395:PRO:O	2:D:398:THR:OG1	2.05	0.73
1:A:456:GLU:OE2	1:A:460:TRP:NE1	2.22	0.72
1:A:569:LEU:O	1:A:573:ALA:N	2.22	0.72
2:D:447:SER:N	2:D:576:GLY:O	2.23	0.72
1:A:173:LYS:NZ	1:A:495:THR:OG1	2.24	0.71
1:A:314:TYR:O	1:A:317:VAL:HG22	1.90	0.70
2:D:447:SER:OG	2:D:575:TYR:O	2.05	0.70
1:C:154:SER:O	1:C:160:ARG:NH1	2.23	0.70
2:B:447:SER:OG	2:B:575:TYR:O	2.08	0.70
1:C:388:SER:OG	2:D:517:TYR:O	2.10	0.69
1:A:29:LEU:HD13	1:A:32:PHE:CE1	2.29	0.68
2:B:397:LEU:HD23	2:B:496:LEU:HD12	1.76	0.68
1:C:456:GLU:OE2	1:C:460:TRP:NE1	2.28	0.67
2:B:395:PRO:O	2:B:398:THR:OG1	2.10	0.67
1:C:442:ALA:O	1:C:446:VAL:HG12	1.93	0.67
1:A:293:THR:HA	1:A:296:MET:HE2	1.77	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:526:GLU:OE2	1:C:530:ARG:NH2	2.28	0.67
1:A:143:THR:HG22	1:A:144:LEU:H	1.61	0.66
1:C:55:THR:OG1	1:C:58:ASN:OD1	2.12	0.66
1:A:21:THR:HG22	1:A:22:GLU:OE1	1.95	0.66
1:C:683:VAL:HG23	1:C:693:ILE:HG21	1.79	0.65
1:A:442:ALA:O	1:A:446:VAL:HG12	1.96	0.65
1:A:29:LEU:HD13	1:A:32:PHE:HE1	1.61	0.64
2:B:447:SER:N	2:B:576:GLY:O	2.30	0.64
1:A:103:ASN:OD1	1:A:104:GLY:N	2.28	0.64
1:A:29:LEU:HA	1:A:32:PHE:CE1	2.33	0.64
1:C:569:LEU:O	1:C:573:ALA:N	2.30	0.64
1:C:380:TYR:CD1	1:C:557:LEU:HD22	2.34	0.63
1:A:434:GLU:N	1:A:434:GLU:OE1	2.31	0.63
2:D:476:ASN:OD1	2:D:508:LEU:N	2.31	0.62
1:A:67:ASN:OD1	1:A:68:LYS:N	2.32	0.61
1:C:434:GLU:N	1:C:434:GLU:OE1	2.33	0.61
1:A:238:GLN:OE1	1:A:598:ASN:ND2	2.33	0.61
1:A:205:ASP:OD1	1:A:206:TYR:N	2.31	0.61
1:A:38:ASN:O	1:A:42:GLU:OE1	2.19	0.60
1:C:34:HIS:ND1	1:C:35:GLU:OE2	2.30	0.60
2:B:537:SER:OG	2:B:538:ARG:NH2	2.35	0.60
2:B:534:SER:OG	2:B:535:LEU:N	2.34	0.60
1:C:614:GLN:N	1:C:614:GLN:OE1	2.36	0.59
1:A:109:THR:HG22	1:A:111:GLU:OE1	2.03	0.58
1:C:67:ASN:OD1	1:C:68:LYS:N	2.36	0.58
2:B:389:GLN:NE2	2:B:413:THR:OG1	2.37	0.58
2:D:449:LEU:HD22	2:D:582:VAL:HG21	1.85	0.58
1:C:618:VAL:HG21	1:C:681:PHE:CE2	2.38	0.58
1:C:359:MET:SD	1:C:361:THR:OG1	2.60	0.58
1:A:638:MET:SD	1:A:638:MET:N	2.77	0.57
1:C:683:VAL:HG23	1:C:693:ILE:HD13	1.86	0.57
1:A:577:GLU:OE1	1:A:577:GLU:N	2.37	0.57
1:A:147:LEU:HD11	1:A:163:VAL:CG2	2.34	0.57
3:H:2:NAG:H3	3:H:2:NAG:H83	1.87	0.57
1:A:366:ASP:OD1	1:A:367:ASP:N	2.37	0.57
1:A:677:VAL:O	1:A:678:SER:OG	2.17	0.57
1:A:380:TYR:CD1	1:A:557:LEU:HD22	2.39	0.56
1:C:360:CYS:SG	1:C:362:LYS:NZ	2.78	0.56
1:C:542:ASP:OD1	1:C:543:ILE:N	2.38	0.56
2:B:476:ASN:O	2:B:524:ASN:ND2	2.38	0.56
1:A:636:ASN:OD1	1:C:650:ARG:NH1	2.38	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:526:GLU:OE2	1:A:530:ARG:NH2	2.39	0.55
1:A:542:ASP:OD1	1:A:543:ILE:N	2.38	0.55
1:A:457:LYS:HG2	1:A:461:MET:HE2	1.88	0.55
2:D:457:SER:HB3	2:D:460:MET:HE2	1.89	0.54
1:C:364:THR:OG1	1:C:366:ASP:OD1	2.10	0.54
1:A:217:SER:OG	1:A:218:ARG:N	2.41	0.54
1:A:238:GLN:HG3	1:A:594:LEU:HD23	1.89	0.54
1:C:366:ASP:OD1	1:C:367:ASP:N	2.41	0.54
2:B:457:SER:HB3	2:B:460:MET:HE2	1.90	0.53
1:C:133:CYS:HB3	1:C:141:CYS:HA	1.90	0.53
2:B:403:PRO:O	2:B:405:TYR:N	2.41	0.53
1:C:518:THR:HA	1:C:521:GLU:OE1	2.08	0.53
2:D:403:PRO:O	2:D:405:TYR:N	2.42	0.53
2:B:476:ASN:OD1	2:B:508:LEU:N	2.42	0.52
1:A:241:ALA:HB2	1:A:602:VAL:HG23	1.91	0.52
1:C:688:ASN:OD1	3:H:1:NAG:N2	2.42	0.52
1:A:692:ILE:HG22	1:A:693:ILE:N	2.24	0.52
1:A:635:GLU:HA	1:A:638:MET:HE1	1.92	0.52
2:B:464:LEU:O	2:B:479:GLN:NE2	2.39	0.52
1:A:143:THR:HG22	1:A:144:LEU:N	2.24	0.52
1:C:66:ASP:OD1	1:C:67:ASN:N	2.43	0.52
1:C:377:HIS:NE2	1:C:401:GLU:OE2	2.38	0.52
1:A:689:MET:O	1:A:689:MET:HG2	2.09	0.51
2:D:464:LEU:O	2:D:479:GLN:NE2	2.40	0.51
2:D:483:ASN:OD1	2:D:484:PRO:HD2	2.11	0.51
1:A:342:VAL:O	1:A:358:LYS:NZ	2.42	0.51
1:A:556:MET:HE1	1:A:568:ALA:HB1	1.93	0.51
1:A:27:ARG:O	1:A:31:LYS:HG2	2.10	0.51
1:C:151:MET:O	1:C:160:ARG:NH1	2.42	0.50
1:C:189:MET:SD	1:C:190:ALA:N	2.84	0.50
1:A:704:MET:SD	1:A:704:MET:C	2.95	0.50
1:A:635:GLU:HG3	1:A:636:ASN:H	1.76	0.50
1:A:187:ASN:OD1	1:A:191:ARG:NH1	2.44	0.49
1:C:314:TYR:O	1:C:317:VAL:HG22	2.12	0.49
1:A:200:ASP:O	1:A:204:GLY:N	2.45	0.49
1:A:432:GLU:N	1:A:432:GLU:OE1	2.46	0.49
2:B:476:ASN:ND2	2:B:508:LEU:O	2.40	0.49
1:A:54:ILE:HD11	1:A:340:GLN:H	1.78	0.49
1:C:692:ILE:O	1:C:693:ILE:C	2.56	0.49
1:C:107:VAL:HG23	1:C:108:LEU:HD22	1.94	0.49
1:C:697:GLU:OE1	1:C:697:GLU:N	2.44	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:176:ARG:NH1	1:A:494:GLU:O	2.41	0.49
1:A:697:GLU:N	1:A:697:GLU:OE1	2.46	0.49
1:C:167:TRP:CZ2	1:C:171:VAL:HG21	2.47	0.49
1:A:605:SER:OG	1:A:607:ASP:OD1	2.25	0.48
1:C:176:ARG:NH1	1:C:494:GLU:O	2.42	0.48
1:C:432:GLU:N	1:C:432:GLU:OE1	2.46	0.48
1:C:173:LYS:NZ	1:C:495:THR:OG1	2.46	0.48
1:C:449:LEU:HD22	1:C:515:PHE:CD1	2.48	0.48
1:C:337:ASP:OD2	1:C:339:ARG:NH1	2.42	0.48
1:C:704:MET:SD	1:C:706:ARG:NH1	2.87	0.48
1:A:66:ASP:OD1	1:A:67:ASN:N	2.46	0.48
1:A:108:LEU:HD12	1:A:112:LYS:HD2	1.95	0.47
1:C:35:GLU:N	1:C:35:GLU:OE1	2.48	0.47
1:A:449:LEU:HD22	1:A:515:PHE:CD1	2.49	0.47
1:A:500:ALA:HA	1:A:505:VAL:HG11	1.96	0.47
1:C:69:TRP:NE1	1:C:73:TYR:OH	2.47	0.47
1:C:129:THR:HG22	1:C:129:THR:O	2.15	0.47
1:A:211:GLU:O	1:A:212:LYS:HG2	2.14	0.47
1:A:461:MET:CE	1:A:479:MET:HE1	2.44	0.47
2:B:459:ASP:OD1	2:B:460:MET:N	2.48	0.47
1:C:461:MET:CE	1:C:479:MET:HE1	2.44	0.47
1:A:683:VAL:HG23	1:A:693:ILE:HG21	1.97	0.47
1:A:115:ARG:NH2	1:A:181:GLU:OE2	2.45	0.47
1:A:555:ASP:O	1:A:559:LEU:HD23	2.16	0.46
1:C:454:MET:SD	1:C:454:MET:C	2.99	0.46
1:C:37:GLU:OE1	1:C:37:GLU:N	2.34	0.46
1:C:704:MET:SD	1:C:704:MET:C	2.98	0.46
2:D:459:ASP:OD2	2:D:460:MET:SD	2.74	0.46
1:C:238:GLN:OE1	1:C:598:ASN:ND2	2.45	0.45
1:A:104:GLY:O	1:A:107:VAL:HG22	2.16	0.45
1:C:147:LEU:HD11	1:C:163:VAL:CG2	2.46	0.45
1:C:578:MET:SD	1:C:578:MET:N	2.90	0.45
1:A:578:MET:SD	1:A:578:MET:N	2.90	0.45
1:C:134:ASN:HA	1:C:162:TRP:CZ2	2.52	0.45
1:A:44:ALA:HB1	1:A:350:LEU:CD2	2.47	0.45
1:C:380:TYR:CE1	1:C:557:LEU:HD22	2.51	0.45
1:A:180:GLU:O	1:A:183:VAL:HG12	2.17	0.44
1:A:208:THR:HG22	1:A:208:THR:O	2.16	0.44
1:A:72:PHE:O	1:A:76:GLN:HG3	2.17	0.44
2:B:483:ASN:O	2:B:484:PRO:C	2.60	0.44
1:C:461:MET:HE1	1:C:479:MET:HE1	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:484:PRO:O	2:B:573:VAL:HG12	2.17	0.44
1:A:200:ASP:OD1	1:A:203:ARG:NH2	2.51	0.44
1:A:326:PHE:HZ	1:A:357:ILE:HD12	1.82	0.44
1:A:133:CYS:HA	1:A:141:CYS:HB3	1.98	0.44
1:C:251:TYR:CE2	1:C:265:LEU:HD22	2.53	0.44
2:D:469:ALA:O	2:D:474:GLN:NE2	2.41	0.44
1:A:454:MET:SD	1:A:454:MET:C	3.01	0.43
1:A:544:SER:O	1:A:545:ASN:C	2.61	0.43
1:A:76:GLN:OE1	1:A:100:LEU:HD11	2.18	0.43
1:C:219:ASN:HA	1:C:222:MET:HE1	2.00	0.43
1:C:676:ARG:O	1:C:677:VAL:HG12	2.18	0.43
2:D:449:LEU:H	2:D:449:LEU:HD23	1.83	0.43
1:A:618:VAL:HG13	1:A:618:VAL:O	2.19	0.43
1:C:241:ALA:HB2	1:C:602:VAL:HG23	2.00	0.43
2:D:473:VAL:HG13	2:D:474:GLN:N	2.34	0.43
1:A:454:MET:HE1	1:A:476:TRP:CH2	2.53	0.43
1:C:605:SER:OG	1:C:607:ASP:OD1	2.27	0.43
2:D:476:ASN:ND2	2:D:508:LEU:O	2.40	0.43
1:A:553:LEU:O	1:A:557:LEU:HG	2.19	0.43
1:C:454:MET:HE1	1:C:476:TRP:CH2	2.53	0.43
2:D:390:GLU:O	2:D:392:ASP:N	2.52	0.43
2:D:422:LEU:HA	2:D:425:LEU:HD12	2.01	0.42
2:B:528:ALA:HB1	2:B:531:PRO:HG3	2.01	0.42
2:D:534:SER:OG	2:D:535:LEU:N	2.51	0.42
2:D:446:TYR:HD2	2:D:574:GLN:O	2.02	0.42
1:A:353:ASN:ND2	2:B:510:GLU:OE2	2.51	0.42
2:B:446:TYR:O	2:B:581:SER:HA	2.19	0.42
1:C:517:ARG:O	1:C:521:GLU:CD	2.62	0.42
1:C:619:ARG:O	1:C:620:ILE:C	2.63	0.42
1:C:54:ILE:O	1:C:54:ILE:HG13	2.19	0.42
1:A:134:ASN:HA	1:A:162:TRP:CZ2	2.55	0.42
2:B:449:LEU:HD12	2:B:449:LEU:C	2.44	0.42
1:C:75:GLU:OE2	1:C:76:GLN:NE2	2.45	0.42
1:A:388:SER:O	1:A:392:ARG:HG3	2.20	0.42
1:C:161:LEU:HD12	1:C:264:HIS:CE1	2.55	0.42
1:A:449:LEU:HB2	1:A:450:PRO:HD3	2.01	0.42
2:B:512:TYR:O	2:B:552:LEU:HD12	2.20	0.42
2:D:567:MET:SD	2:D:568:ALA:N	2.93	0.42
1:C:664:ARG:HE	1:C:664:ARG:HB3	1.75	0.41
1:C:671:SER:O	1:C:672:ASP:C	2.63	0.41
1:A:24:GLU:HG2	1:A:25:ALA:N	2.35	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:107:VAL:HG23	1:A:108:LEU:HD22	2.03	0.41
1:A:635:GLU:HG3	1:A:636:ASN:N	2.35	0.41
1:C:42:GLU:OE1	1:C:42:GLU:N	2.46	0.41
1:C:291:ASP:O	1:C:291:ASP:OD1	2.38	0.41
1:C:326:PHE:CD1	1:C:326:PHE:C	2.99	0.41
1:A:24:GLU:OE1	1:A:24:GLU:N	2.44	0.41
1:A:456:GLU:OE2	1:A:460:TRP:CD1	2.74	0.41
1:A:575:THR:HG22	1:A:577:GLU:H	1.86	0.41
1:A:457:LYS:CG	1:A:461:MET:HE2	2.51	0.41
1:C:553:LEU:O	1:C:557:LEU:HG	2.21	0.41
2:D:393:PHE:HZ	2:D:425:LEU:HD11	1.85	0.41
1:A:167:TRP:CZ2	1:A:171:VAL:HG21	2.56	0.41
1:A:363:VAL:O	1:A:364:THR:HG23	2.21	0.41
1:A:461:MET:HA	1:A:464:GLU:CD	2.46	0.41
2:B:389:GLN:NE2	2:B:414:ASN:O	2.54	0.41
2:D:513:LYS:HE3	2:D:513:LYS:HA	2.03	0.41
1:A:69:TRP:NE1	1:A:73:TYR:OH	2.54	0.41
1:C:449:LEU:HB2	1:C:450:PRO:HD3	2.03	0.41
1:A:471:GLN:O	1:A:474:GLU:HG3	2.21	0.40
1:A:607:ASP:OD1	1:A:607:ASP:N	2.47	0.40
1:A:696:SER:OG	1:A:697:GLU:OE1	2.39	0.40
1:A:689:MET:O	1:A:689:MET:CG	2.69	0.40
2:B:482:SER:O	2:B:483:ASN:C	2.63	0.40
1:C:34:HIS:HD1	1:C:35:GLU:CD	2.23	0.40
1:C:228:ILE:HG21	1:C:519:ILE:HD11	2.02	0.40
1:A:460:TRP:O	1:A:464:GLU:OE1	2.40	0.40
2:D:485:THR:OG1	2:D:571:ILE:O	2.38	0.40
1:C:353:ASN:ND2	2:D:510:GLU:OE2	2.48	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	690/803 (86%)	633 (92%)	57 (8%)	0	100	100
1	C	690/803 (86%)	645 (94%)	45 (6%)	0	100	100
2	B	192/1352 (14%)	175 (91%)	17 (9%)	0	100	100
2	D	189/1352 (14%)	171 (90%)	18 (10%)	0	100	100
All	All	1761/4310 (41%)	1624 (92%)	137 (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	621/716 (87%)	621 (100%)	0	100	100
1	C	621/716 (87%)	621 (100%)	0	100	100
2	B	174/1174 (15%)	174 (100%)	0	100	100
2	D	173/1174 (15%)	173 (100%)	0	100	100
All	All	1589/3780 (42%)	1589 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	101	GLN
1	A	299	GLN
1	A	353	ASN
1	A	539	HIS
1	A	614	GLN
2	B	389	GLN
1	C	33	ASN
1	C	51	ASN
1	C	400	HIS
1	C	504	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 ⓘ

8 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	E	1	3,1	14,14,15	0.70	0	17,19,21	1.01	1 (5%)
3	NAG	E	2	3	14,14,15	0.69	0	17,19,21	1.14	1 (5%)
3	NAG	F	1	3,1	14,14,15	0.74	0	17,19,21	0.80	0
3	NAG	F	2	3	14,14,15	0.70	0	17,19,21	0.85	0
3	NAG	G	1	3,1	14,14,15	0.72	0	17,19,21	1.01	0
3	NAG	G	2	3	14,14,15	0.70	0	17,19,21	0.83	0
3	NAG	H	1	3,1	14,14,15	0.74	0	17,19,21	0.93	1 (5%)
3	NAG	H	2	3	14,14,15	0.73	0	17,19,21	1.68	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
3	NAG	E	1	3,1	-	1/6/23/26	0/1/1/1
3	NAG	E	2	3	-	2/6/23/26	0/1/1/1
3	NAG	F	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	F	2	3	-	1/6/23/26	0/1/1/1
3	NAG	G	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	G	2	3	-	1/6/23/26	0/1/1/1

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

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	H	2	NAG	C2-N2-C7	5.48	130.24	122.90
3	E	2	NAG	C2-N2-C7	3.40	127.46	122.90
3	H	1	NAG	O5-C1-C2	-2.33	107.68	111.29
3	H	2	NAG	C8-C7-N2	2.15	119.69	116.12
3	E	1	NAG	C1-O5-C5	2.08	114.97	112.19

There are no chirality outliers.

All (9) torsion outliers are listed below:

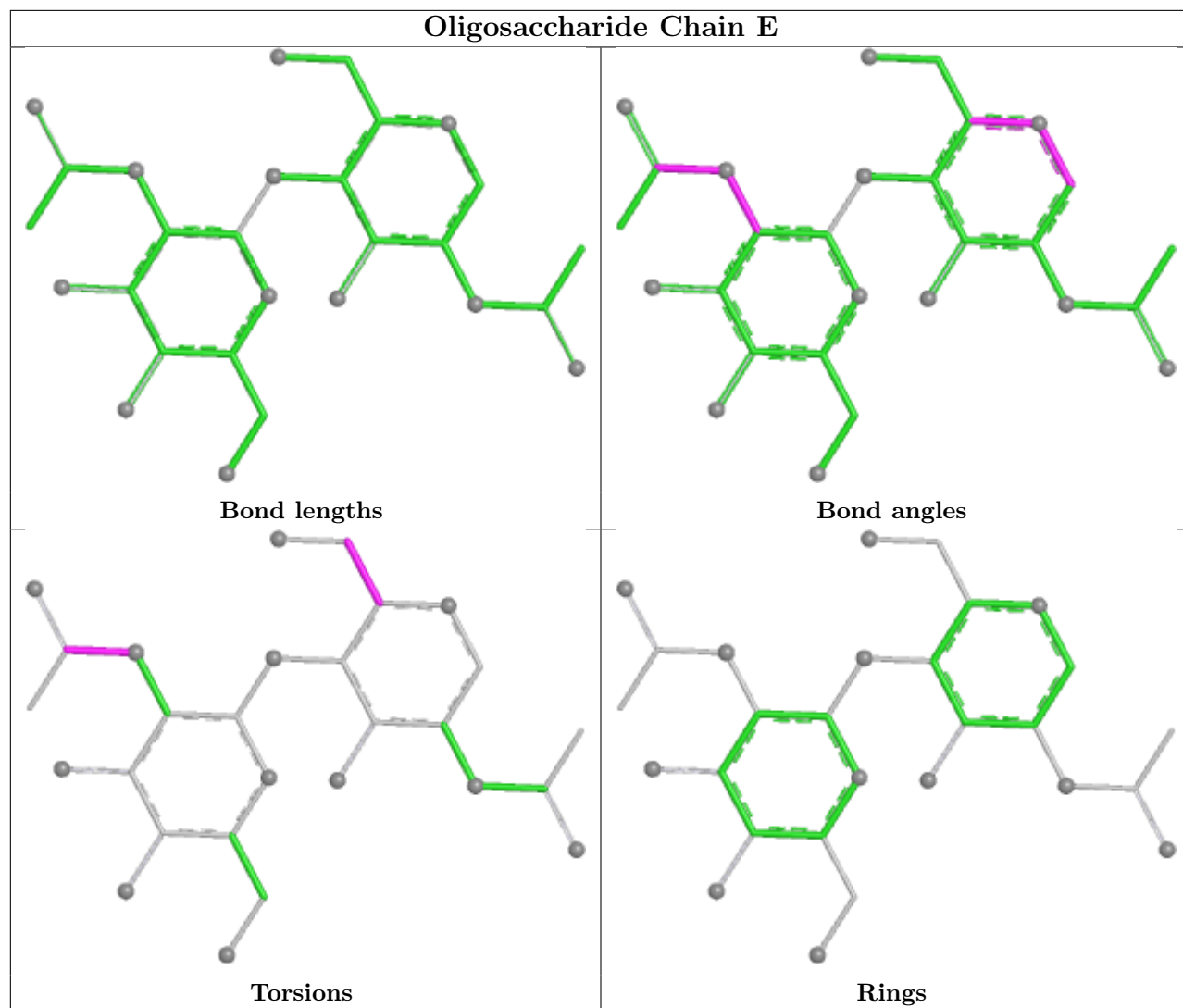
Mol	Chain	Res	Type	Atoms
3	E	2	NAG	C8-C7-N2-C2
3	E	2	NAG	O7-C7-N2-C2
3	H	2	NAG	C8-C7-N2-C2
3	H	2	NAG	O7-C7-N2-C2
3	E	1	NAG	O5-C5-C6-O6
3	G	2	NAG	O5-C5-C6-O6
3	F	2	NAG	O5-C5-C6-O6
3	H	1	NAG	O5-C5-C6-O6
3	H	2	NAG	C3-C2-N2-C7

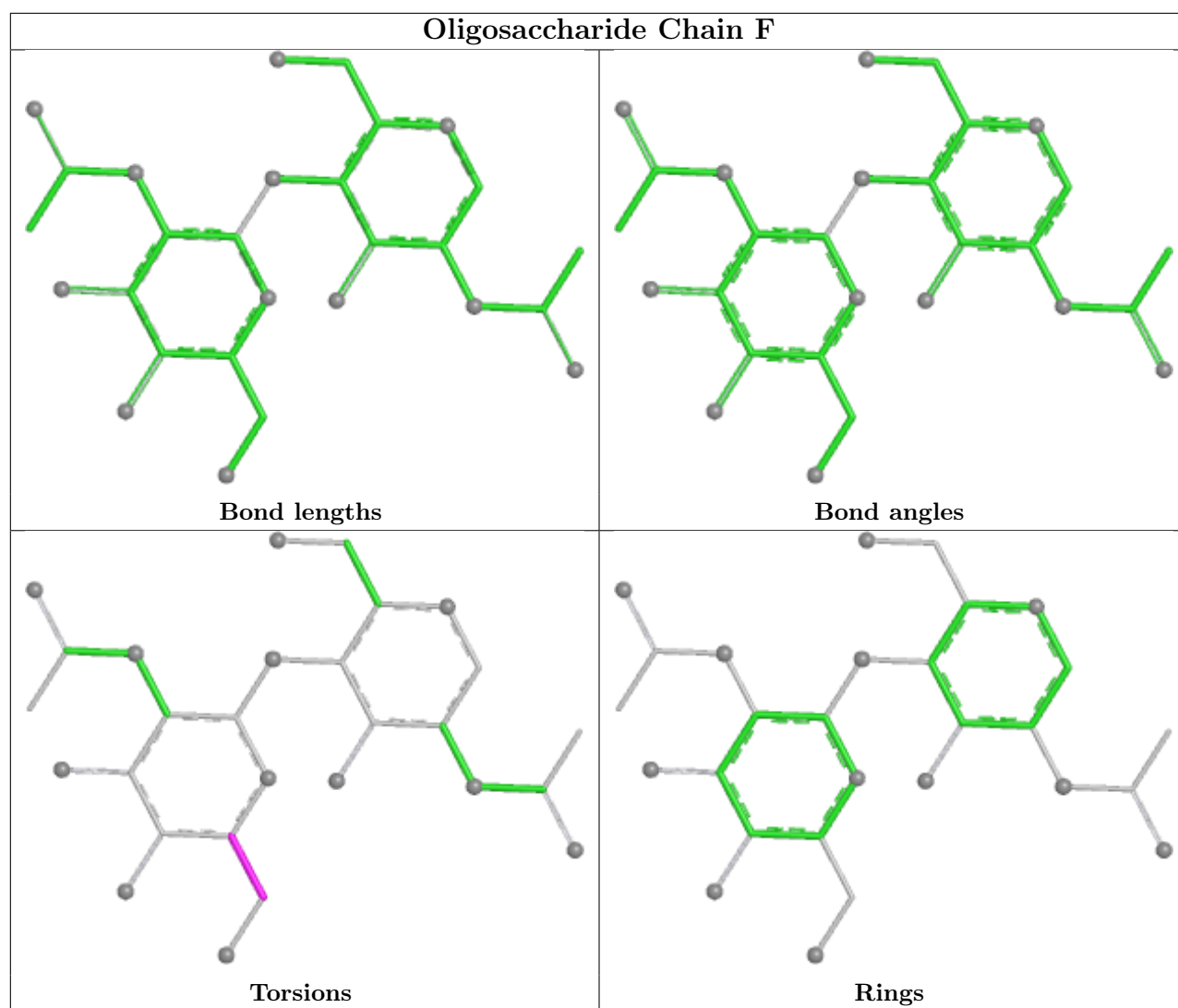
There are no ring outliers.

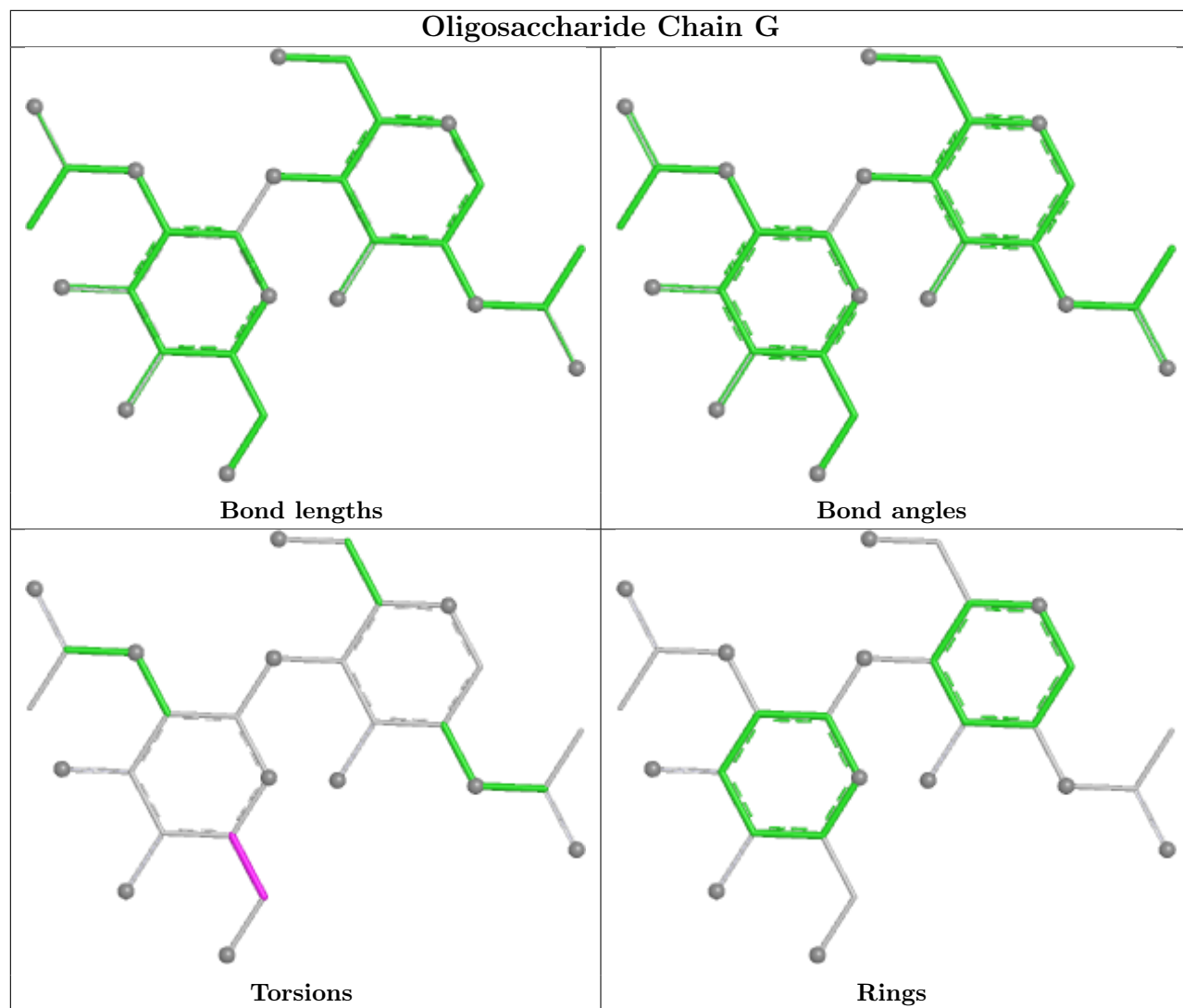
2 monomers are involved in 2 short contacts:

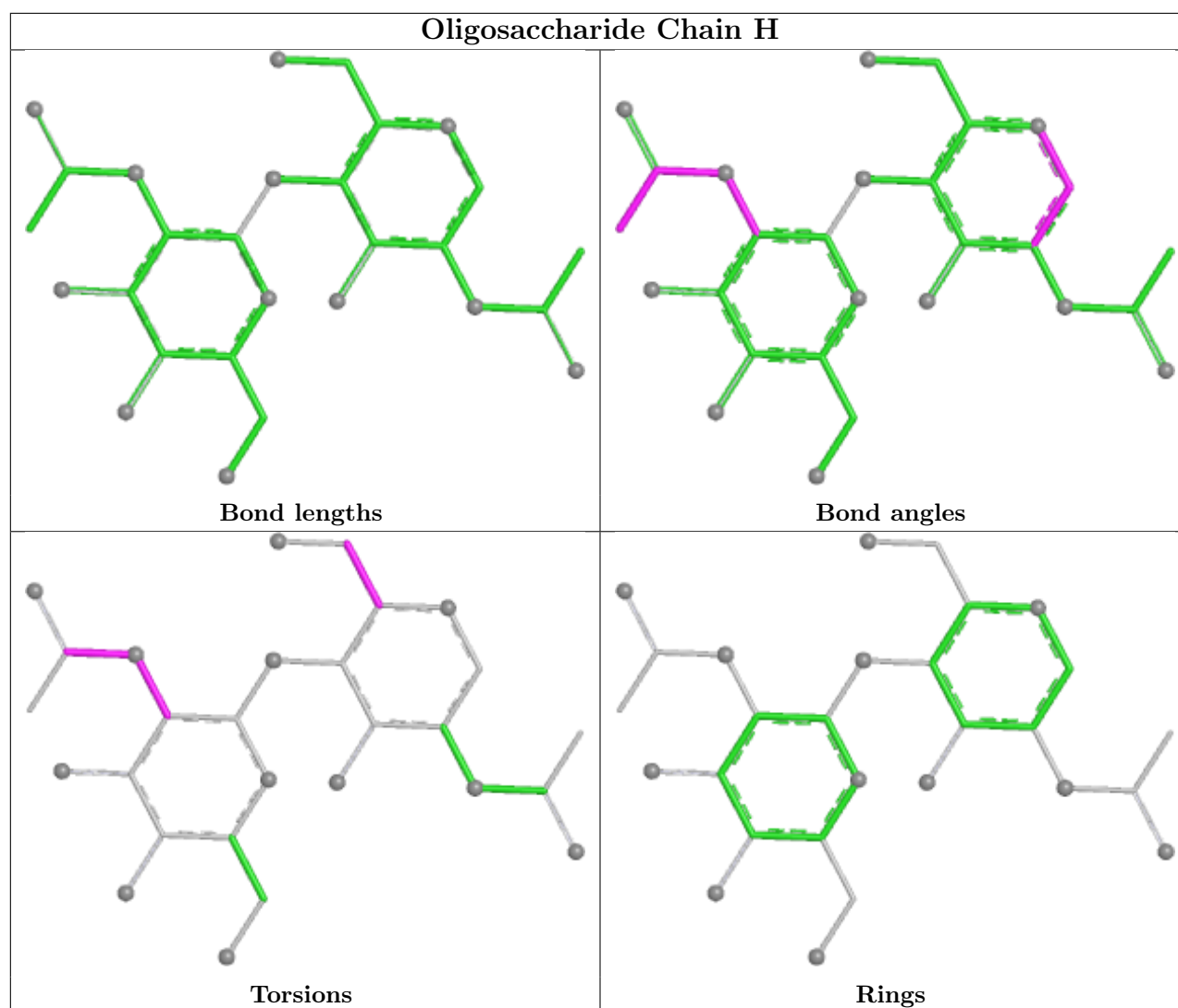
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	H	2	NAG	1	0
3	H	1	NAG	1	0

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](#)

8 ligands 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	$\# Z > 2$
4	NAG	A	904	1	14,14,15	0.70	0	17,19,21	0.70	0
4	NAG	A	903	1	14,14,15	0.69	0	17,19,21	1.11	2 (11%)
4	NAG	A	901	1	14,14,15	0.72	0	17,19,21	0.83	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	NAG	C	903	1	14,14,15	0.71	0	17,19,21	1.10	1 (5%)
4	NAG	C	902	1	14,14,15	0.74	0	17,19,21	0.99	1 (5%)
4	NAG	A	902	1	14,14,15	0.73	0	17,19,21	1.02	1 (5%)
4	NAG	C	904	1	14,14,15	0.72	0	17,19,21	0.77	0
4	NAG	C	901	1	14,14,15	0.72	0	17,19,21	0.93	0

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	A	904	1	-	0/6/23/26	0/1/1/1
4	NAG	A	903	1	-	1/6/23/26	0/1/1/1
4	NAG	A	901	1	-	1/6/23/26	0/1/1/1
4	NAG	C	903	1	-	1/6/23/26	0/1/1/1
4	NAG	C	902	1	-	1/6/23/26	0/1/1/1
4	NAG	A	902	1	-	1/6/23/26	0/1/1/1
4	NAG	C	904	1	-	0/6/23/26	0/1/1/1
4	NAG	C	901	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	903	NAG	C2-N2-C7	2.57	126.35	122.90
4	A	903	NAG	C2-N2-C7	2.50	126.25	122.90
4	A	902	NAG	C2-N2-C7	2.28	125.95	122.90
4	C	902	NAG	C2-N2-C7	2.10	125.72	122.90
4	A	903	NAG	O5-C1-C2	-2.03	108.15	111.29

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	902	NAG	C1-C2-N2-C7
4	A	903	NAG	C1-C2-N2-C7
4	C	902	NAG	C1-C2-N2-C7
4	C	903	NAG	C1-C2-N2-C7
4	A	901	NAG	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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.

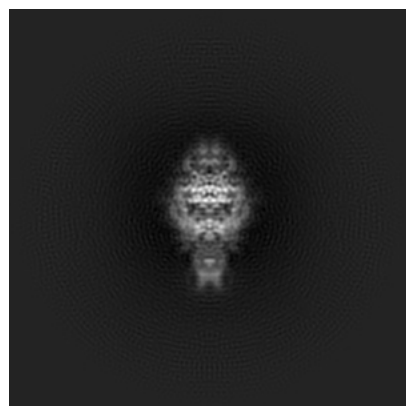
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-48650. These allow visual inspection of the internal detail of the map and identification of artifacts.

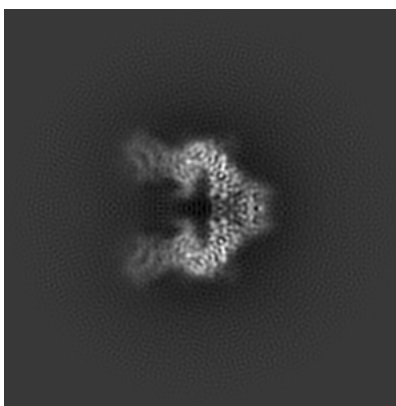
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

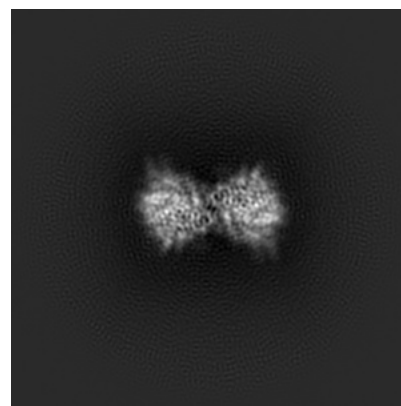
6.1.1 Primary map



X

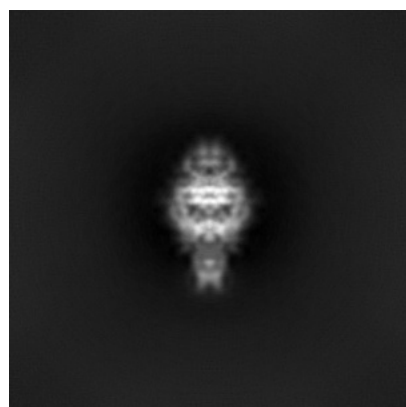


Y

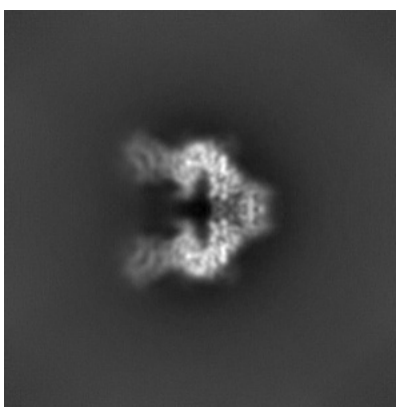


Z

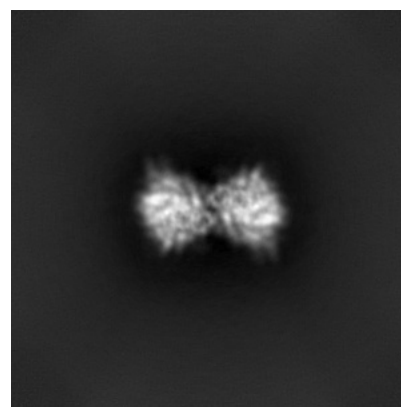
6.1.2 Raw map



X



Y

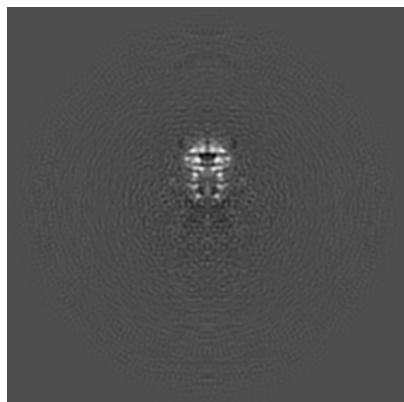


Z

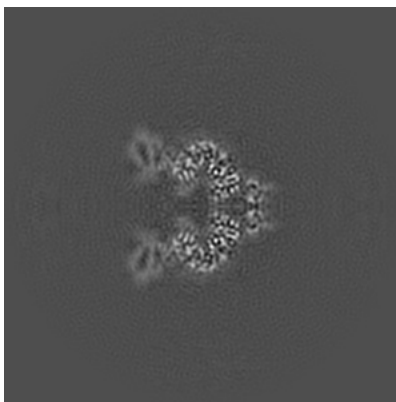
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

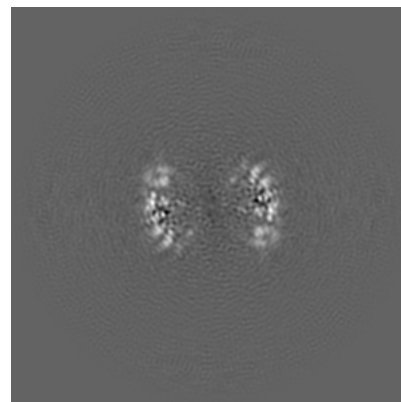
6.2.1 Primary map



X Index: 180

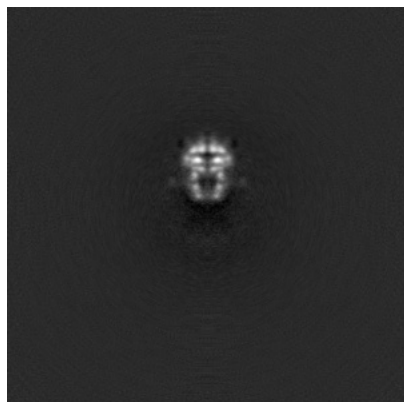


Y Index: 180

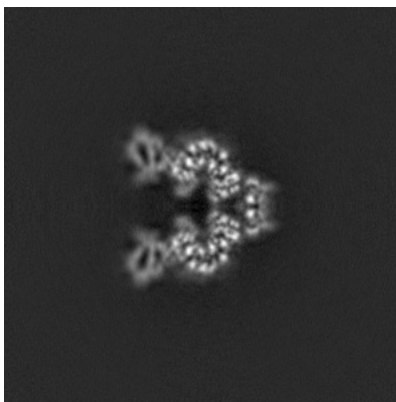


Z Index: 180

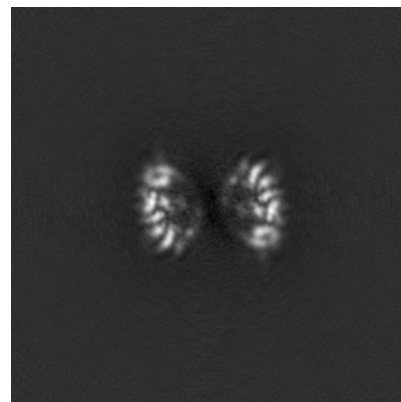
6.2.2 Raw map



X Index: 180



Y Index: 180

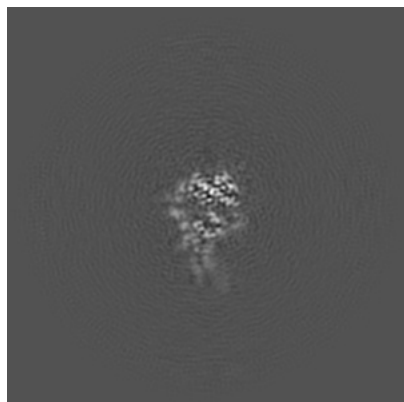


Z Index: 180

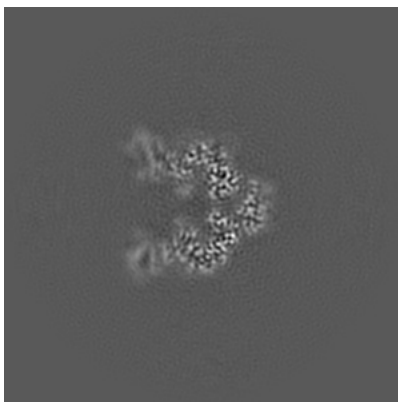
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

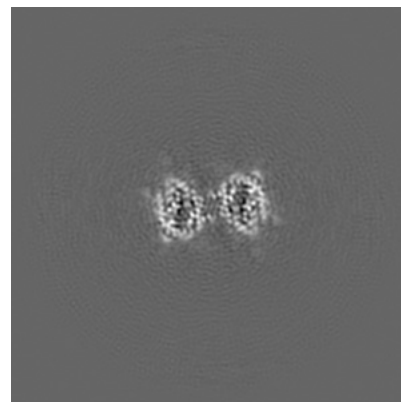
6.3.1 Primary map



X Index: 214

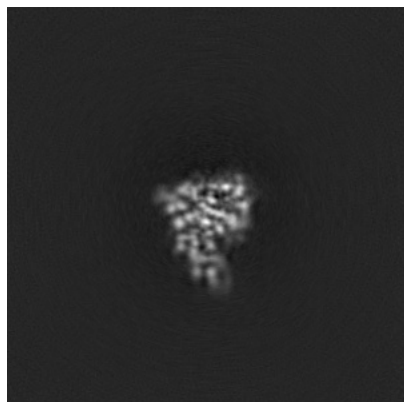


Y Index: 177

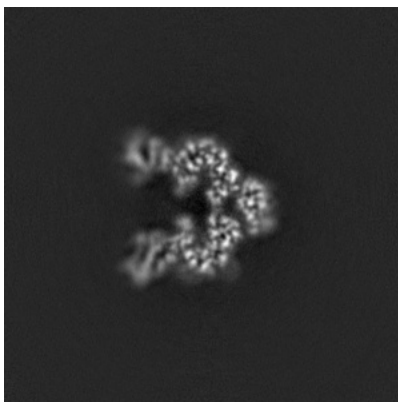


Z Index: 197

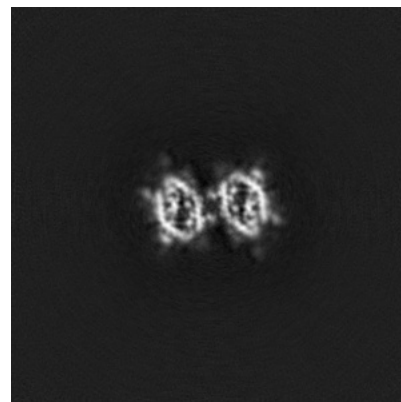
6.3.2 Raw map



X Index: 221



Y Index: 184

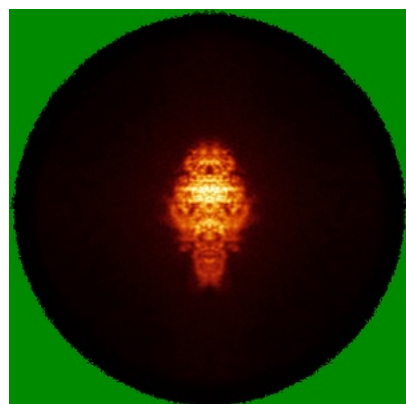


Z Index: 197

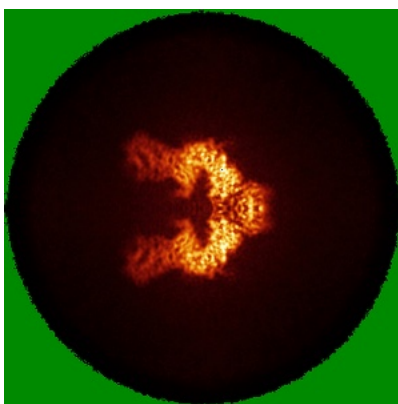
The images above show the largest variance slices of the map in three orthogonal directions.

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

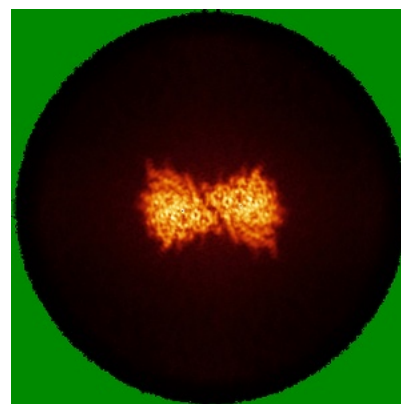
6.4.1 Primary map



X

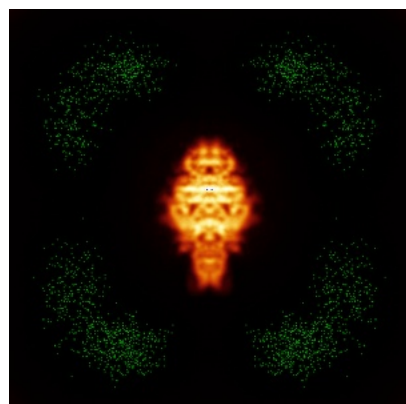


Y

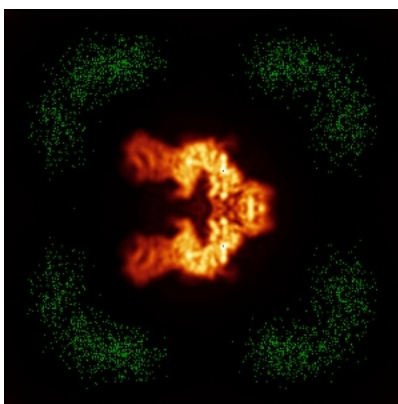


Z

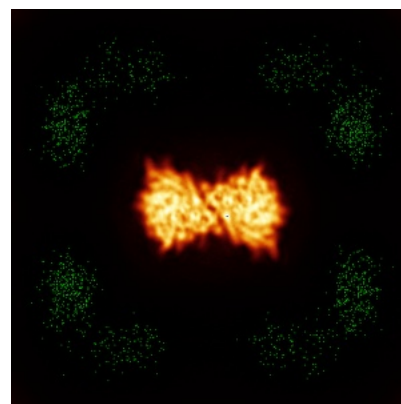
6.4.2 Raw map



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.

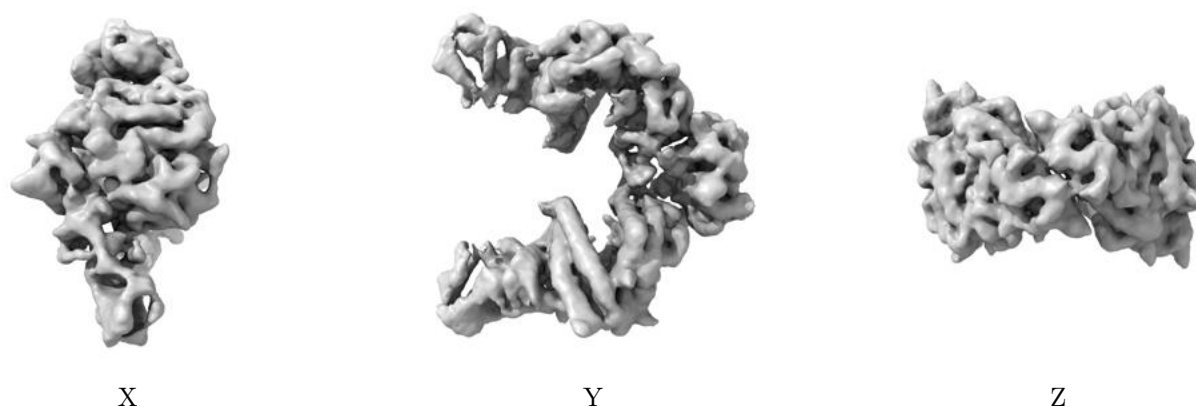
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.23. 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.

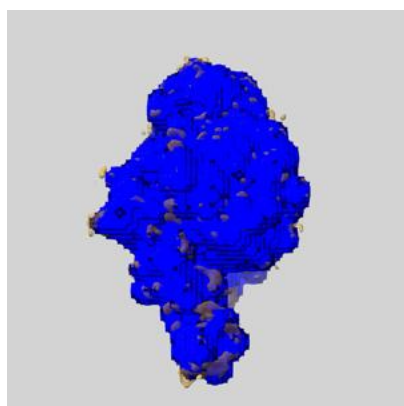
6.6 Mask visualisation [i](#)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

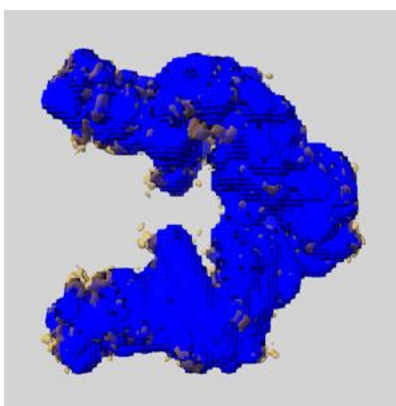
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

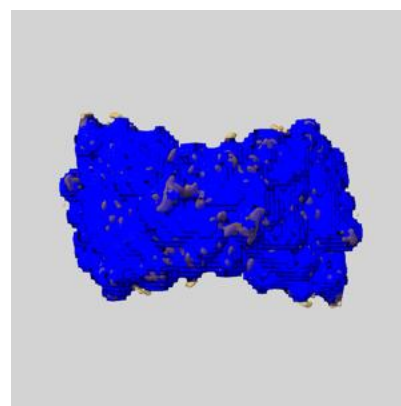
6.6.1 emd_48650_msk_1.map [i](#)



X



Y

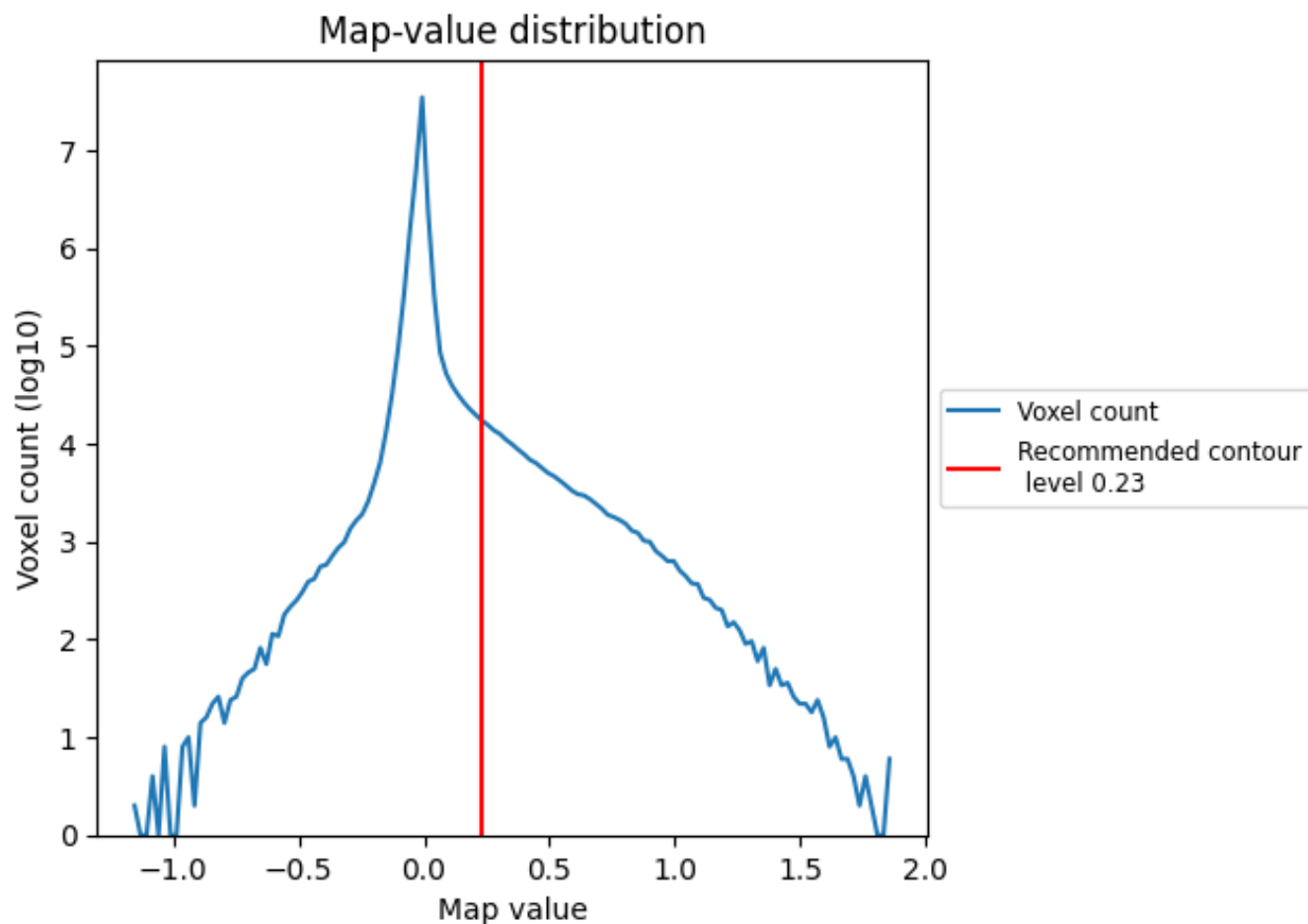


Z

7 Map analysis [i](#)

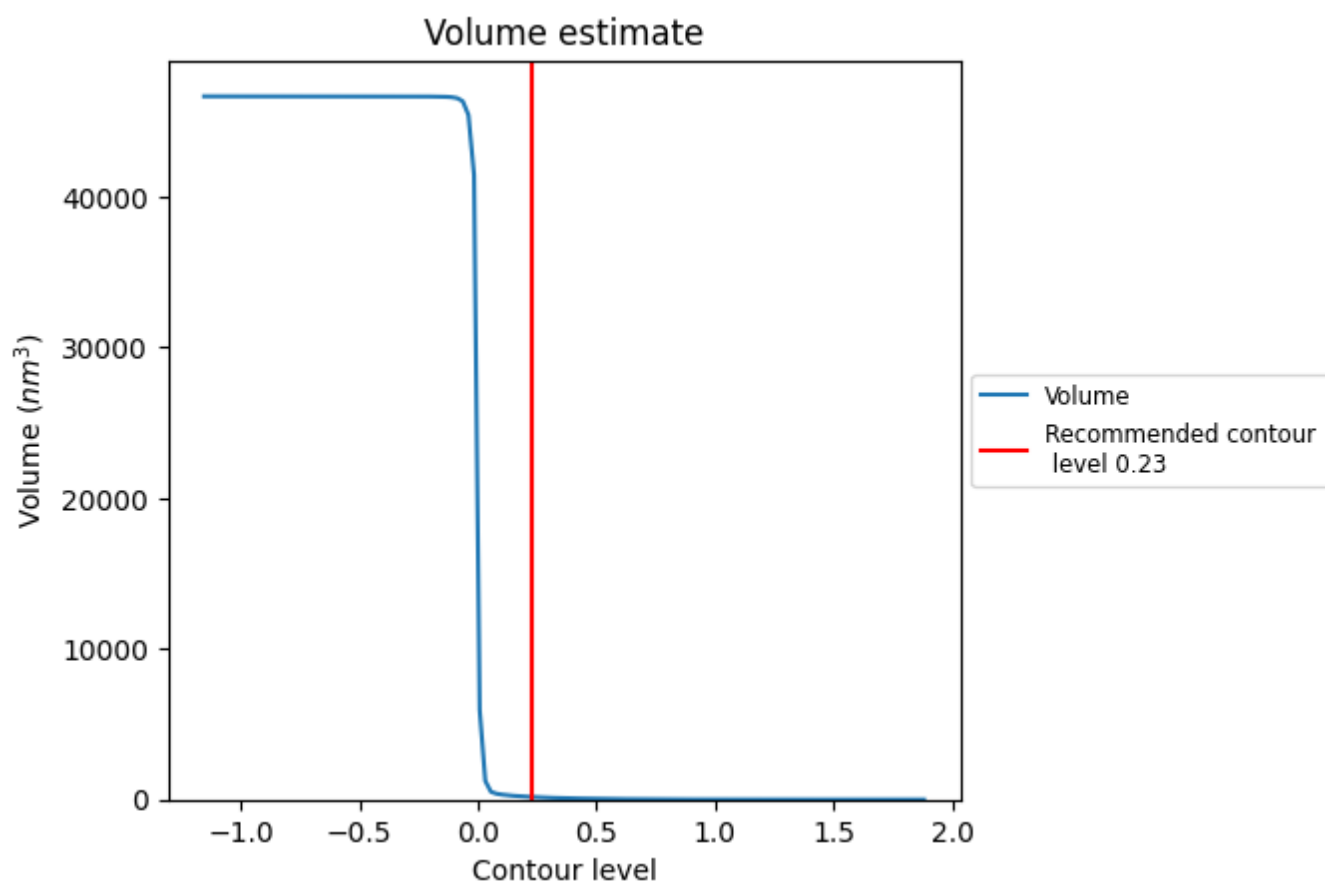
This section contains the results of statistical analysis of the map.

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.

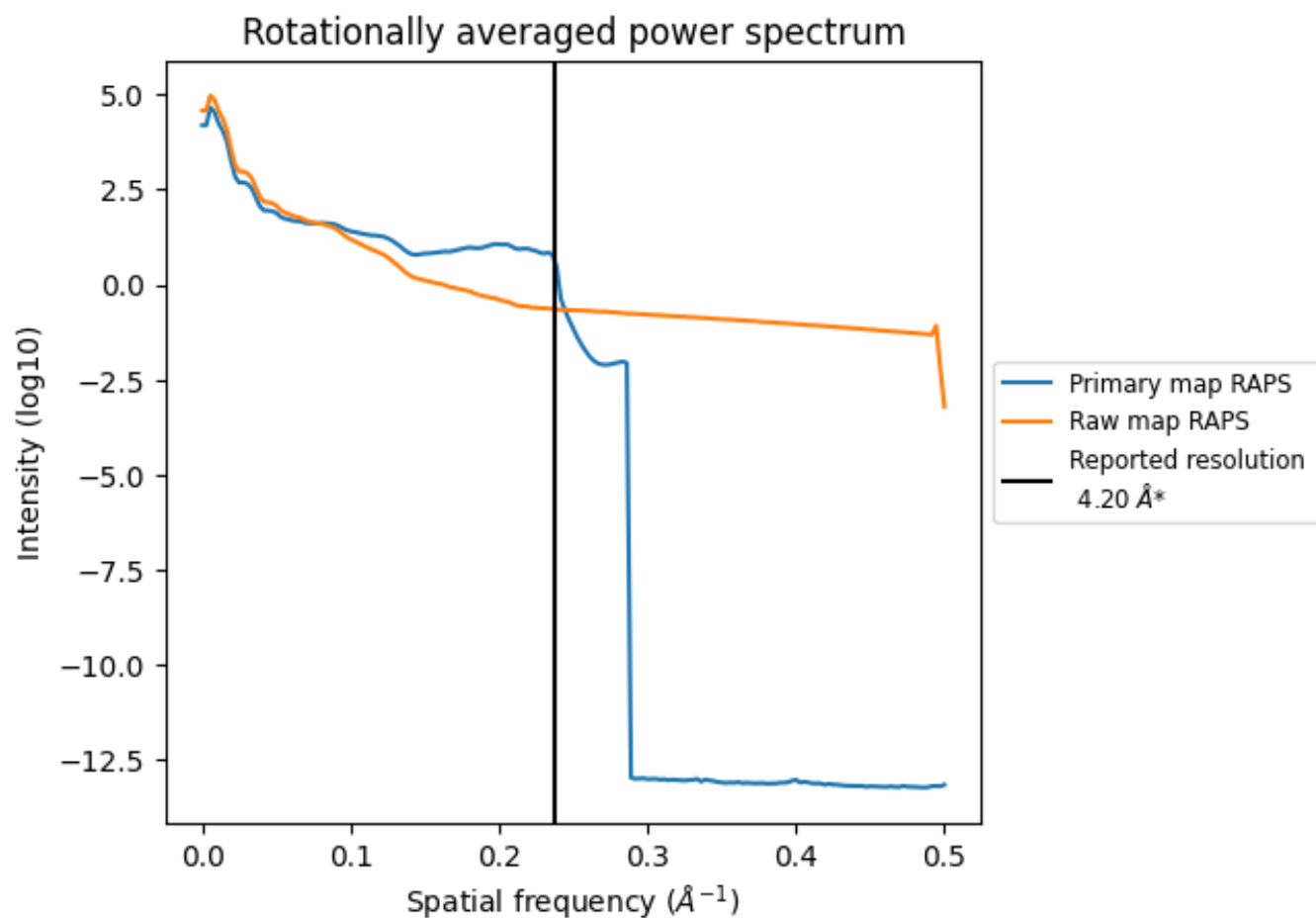
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 169 nm³; this corresponds to an approximate mass of 153 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 ⓘ

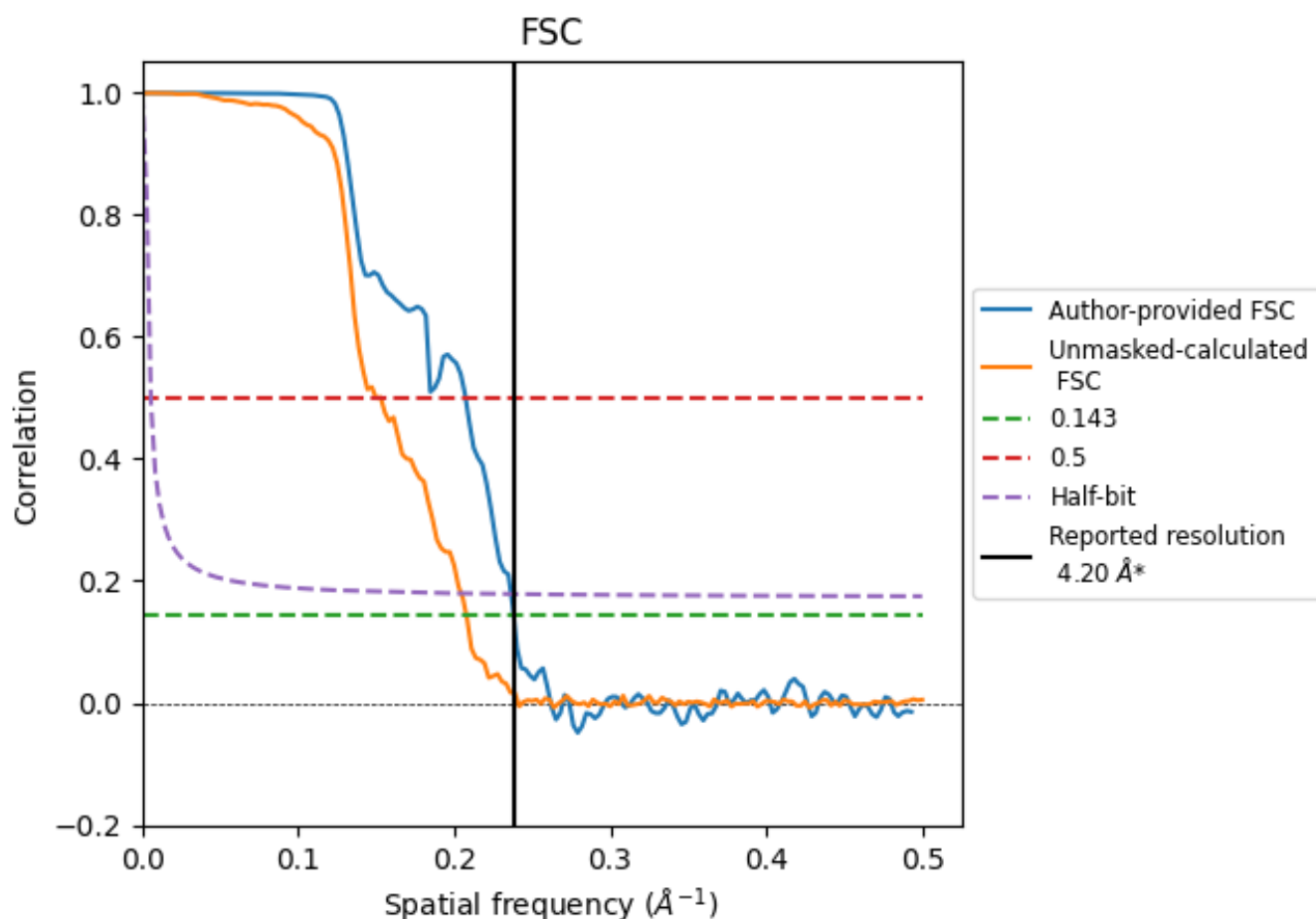


*Reported resolution corresponds to spatial frequency of 0.238 Å⁻¹

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 $0.238 \text{ \AA}^{-1}$

8.2 Resolution estimates [i](#)

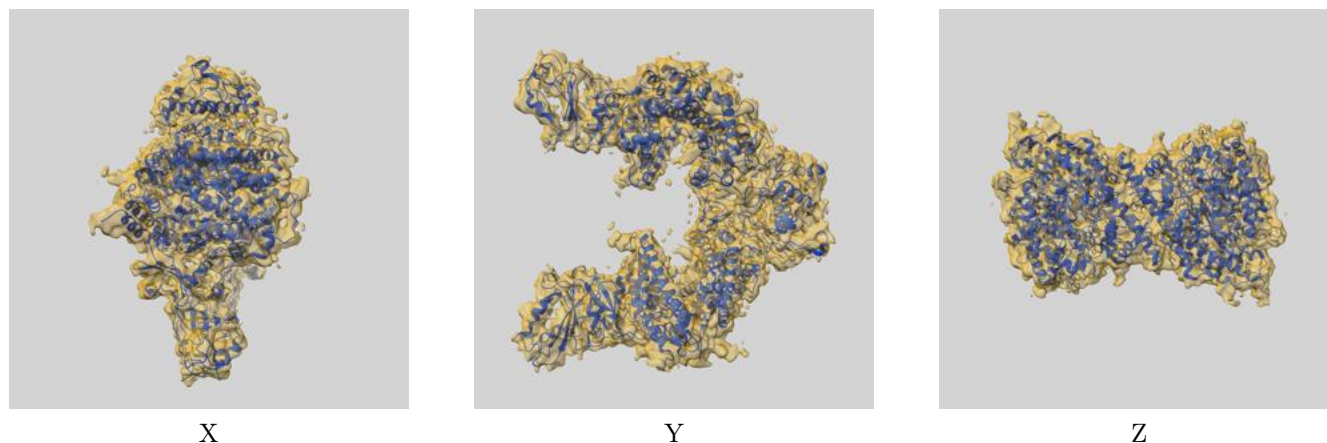
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.20	-	-
Author-provided FSC curve	4.20	4.82	4.23
Unmasked-calculated*	4.81	6.67	4.89

*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 4.81 differs from the reported value 4.2 by more than 10 %

9 Map-model fit [i](#)

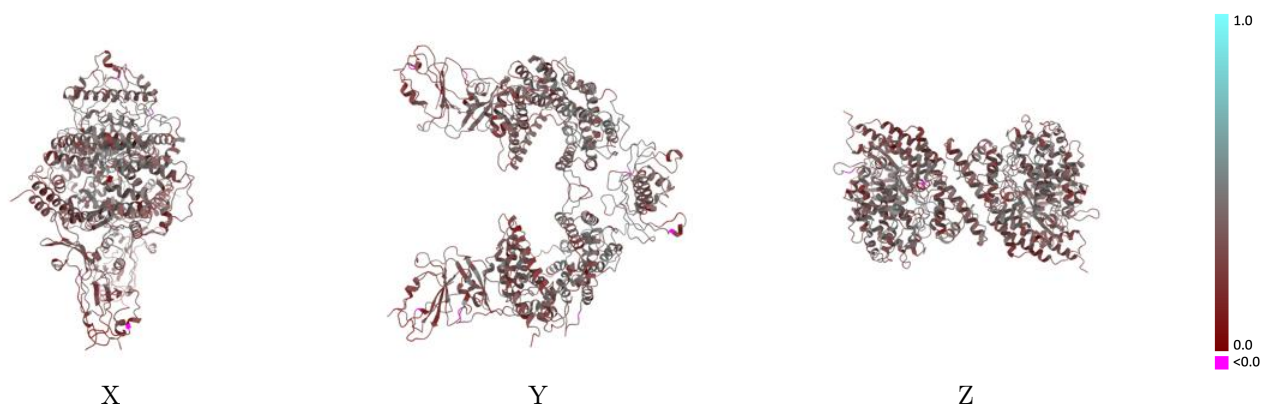
This section contains information regarding the fit between EMDB map EMD-48650 and PDB model 9MV0. Per-residue inclusion information can be found in section [3](#) on page [5](#).

9.1 Map-model overlay [i](#)



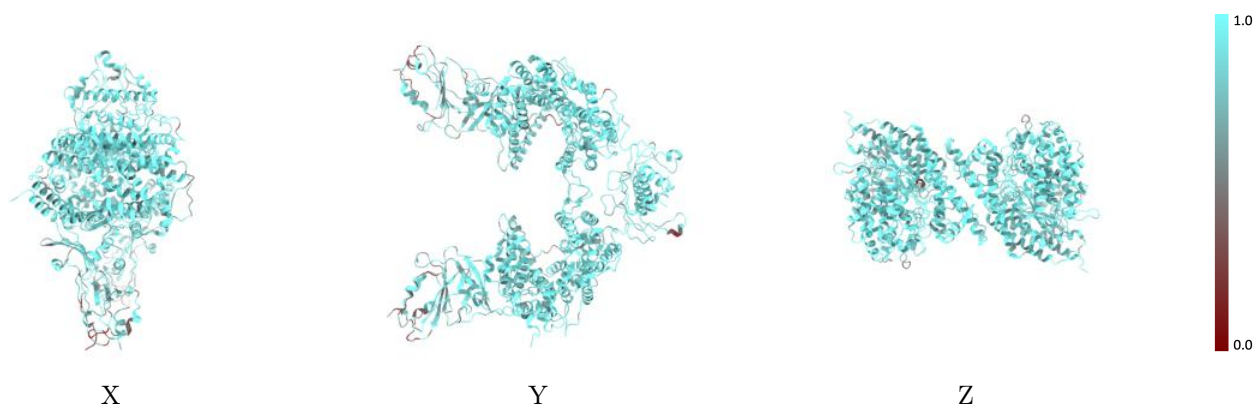
The images above show the 3D surface view of the map at the recommended contour level 0.23 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



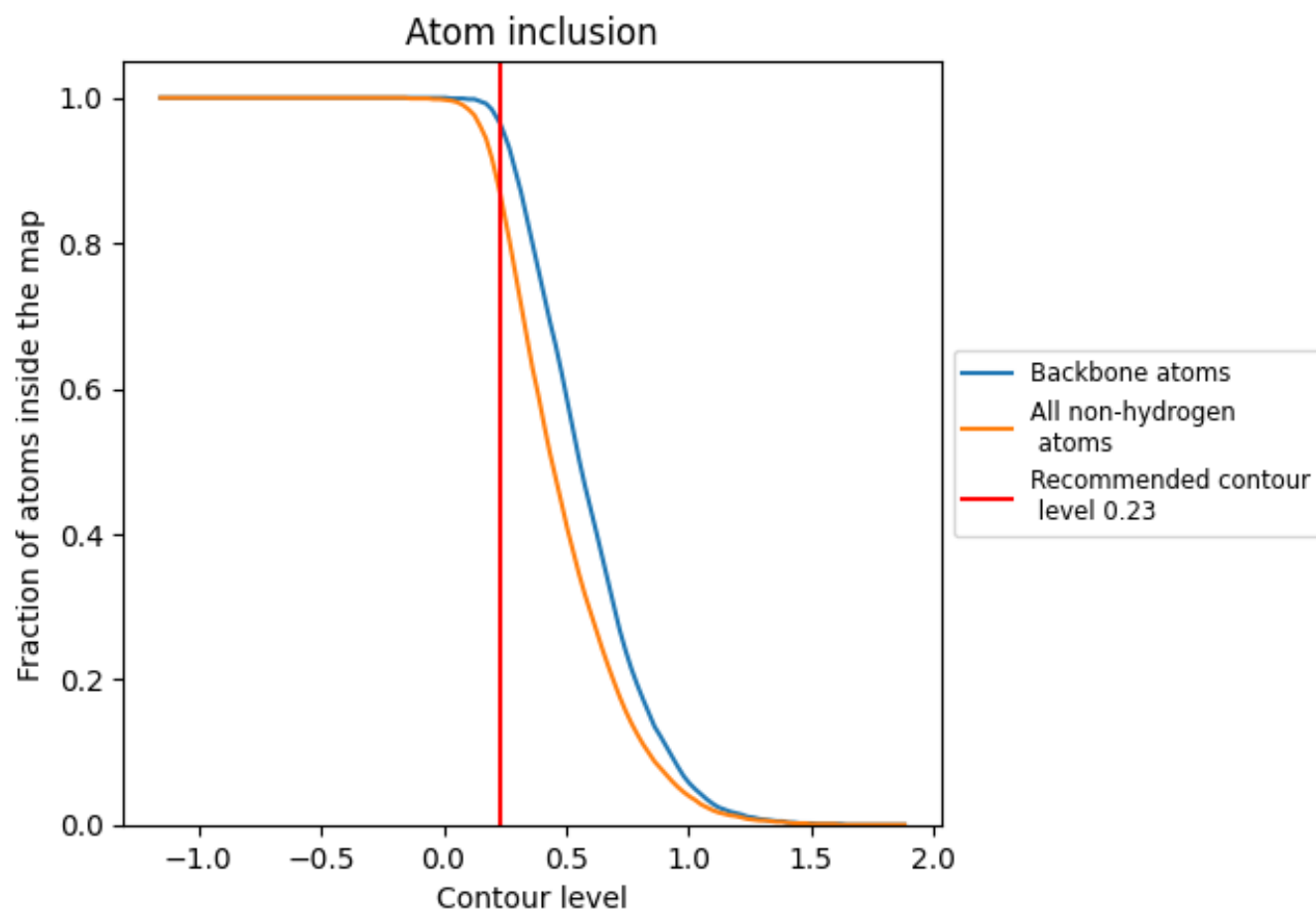
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.23).

9.4 Atom inclusion [i](#)



At the recommended contour level, 96% of all backbone atoms, 87% 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 (0.23) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8700	0.3560
A	0.9040	0.3720
B	0.7410	0.2940
C	0.9050	0.3740
D	0.7390	0.2910
E	0.8570	0.3710
F	0.8210	0.4200
G	0.7140	0.2900
H	0.8210	0.3940

1.0

0.0

<0.0