



Full wwPDB EM Validation Report ⓘ

Mar 12, 2026 – 07:59 PM UTC

PDB ID : 7VPL / pdb_00007vpl
EMDB ID : EMD-32069
Title : Cryo-EM structure of the human ATP13A2 (SPM-bound E2Pi state)
Authors : Tomita, A.; Yamashita, K.; Nishizawa, T.; Nureki, O.
Deposited on : 2021-10-17
Resolution : 3.78 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
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
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

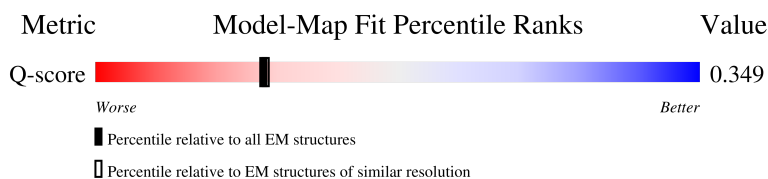
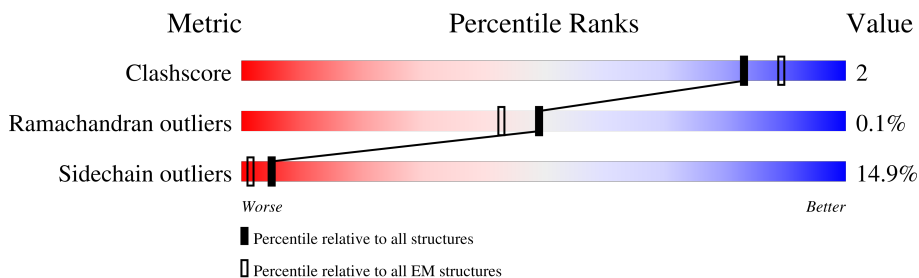
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.78 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	10074 (3.28 - 4.27)

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	1184	31% 70% 17% • 11%
2	B	2	100% 100%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 8198 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 Polyamine-transporting ATPase 13A2.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1055	Total	C	N	O	S	0	0
			8150	5269	1397	1430	54		

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP Q9NQ11
A	-2	PRO	-	expression tag	UNP Q9NQ11
A	-1	SER	-	expression tag	UNP Q9NQ11
A	0	ARG	-	expression tag	UNP Q9NQ11

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

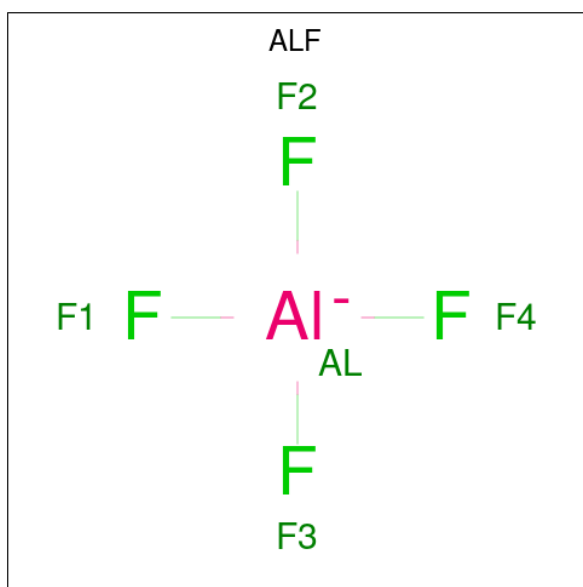


Mol	Chain	Residues	Atoms				AltConf	Trace
2	B	2	Total	C	N	O	0	0
			28	16	2	10		

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

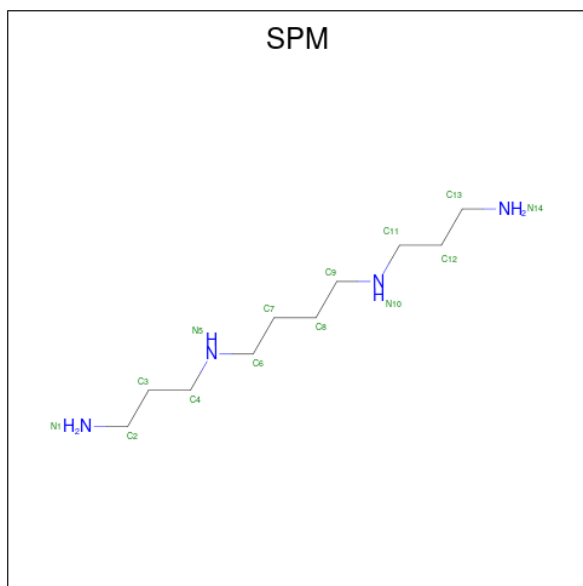
Mol	Chain	Residues	Atoms		AltConf
3	A	1	Total	Mg	0
			1	1	

- Molecule 4 is TETRAFLUOROALUMINATE ION (CCD ID: ALF) (formula: AlF₄) (labeled as "Ligand of Interest" by depositor).

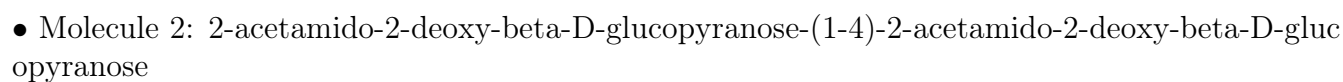


Mol	Chain	Residues	Atoms			AltConf
4	A	1	Total	Al	F	0
			5	1	4	

- Molecule 5 is SPERMINE (CCD ID: SPM) (formula: $C_{10}H_{26}N_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			AltConf
5	A	1	Total	C	N	0
			14	10	4	



100%

100%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	3834	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 ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	0.313	Depositor
Minimum map value	-0.246	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.007	Depositor
Recommended contour level	0.0396	Depositor
Map size (Å)	210.405, 210.405, 210.405	wwPDB
Map dimensions	156, 156, 156	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.34875, 1.34875, 1.34875	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: SPM, NAG, MG, ALF

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	1.33	4/8338 (0.0%)	1.91	62/11365 (0.5%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	540	VAL	N-CA	5.59	1.50	1.46
1	A	604	ARG	N-CA	5.37	1.50	1.45
1	A	469	VAL	N-CA	5.14	1.50	1.46
1	A	54	VAL	N-CA	5.12	1.51	1.46

All (62) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1172	PRO	N-CA-CB	-11.29	92.12	103.08
1	A	1172	PRO	CB-CA-C	9.58	122.61	110.92
1	A	65	PHE	CA-CB-CG	8.20	122.00	113.80
1	A	1078	ASN	CA-C-N	7.95	126.69	120.33
1	A	1078	ASN	C-N-CA	7.95	126.69	120.33
1	A	521	ASP	CA-CB-CG	7.55	120.15	112.60
1	A	1172	PRO	N-CA-C	7.45	119.79	110.70
1	A	915	CYS	CA-C-N	6.03	125.16	120.33
1	A	915	CYS	C-N-CA	6.03	125.16	120.33
1	A	713	GLU	CA-C-N	6.02	126.62	119.94
1	A	713	GLU	C-N-CA	6.02	126.62	119.94
1	A	566	ASP	CA-CB-CG	5.97	118.57	112.60
1	A	463	ASP	CA-CB-CG	5.83	118.43	112.60
1	A	1172	PRO	CA-N-CD	-5.71	104.01	112.00
1	A	48	ILE	CA-C-N	5.69	126.42	119.99
1	A	48	ILE	C-N-CA	5.69	126.42	119.99
1	A	202	HIS	CA-C-N	5.69	125.39	119.92

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	202	HIS	C-N-CA	5.69	125.39	119.92
1	A	182	PHE	CA-CB-CG	5.64	119.44	113.80
1	A	404	LYS	CA-C-N	5.54	126.12	119.98
1	A	404	LYS	C-N-CA	5.54	126.12	119.98
1	A	848	GLY	CA-C-O	-5.52	116.06	120.81
1	A	628	PHE	CA-CB-CG	5.46	119.26	113.80
1	A	1114	THR	CA-C-N	5.45	126.15	119.99
1	A	1114	THR	C-N-CA	5.45	126.15	119.99
1	A	1170	PRO	CA-C-N	5.43	128.38	120.51
1	A	1170	PRO	C-N-CA	5.43	128.38	120.51
1	A	504	GLY	CA-C-N	5.41	126.09	120.03
1	A	504	GLY	C-N-CA	5.41	126.09	120.03
1	A	530	PRO	N-CA-C	5.41	120.65	113.40
1	A	316	ASP	CA-CB-CG	5.31	117.91	112.60
1	A	1018	GLY	CA-C-N	5.31	125.83	119.94
1	A	1018	GLY	C-N-CA	5.31	125.83	119.94
1	A	958	LEU	CA-C-N	5.29	125.12	120.10
1	A	958	LEU	C-N-CA	5.29	125.12	120.10
1	A	1037	ALA	CA-C-N	5.27	128.77	120.97
1	A	1037	ALA	C-N-CA	5.27	128.77	120.97
1	A	417	ILE	N-CA-CB	5.24	116.24	110.53
1	A	438	LEU	CA-C-N	5.23	125.90	119.99
1	A	438	LEU	C-N-CA	5.23	125.90	119.99
1	A	661	ALA	CA-C-N	5.20	125.71	119.94
1	A	661	ALA	C-N-CA	5.20	125.71	119.94
1	A	1110	ASN	CA-CB-CG	5.18	117.78	112.60
1	A	1068	GLY	CA-C-N	5.18	128.63	120.97
1	A	1068	GLY	C-N-CA	5.18	128.63	120.97
1	A	71	TRP	CA-C-N	5.16	125.67	119.94
1	A	71	TRP	C-N-CA	5.16	125.67	119.94
1	A	1121	LEU	CA-C-N	5.16	125.81	119.99
1	A	1121	LEU	C-N-CA	5.16	125.81	119.99
1	A	72	GLY	CA-C-N	5.15	127.24	120.60
1	A	72	GLY	C-N-CA	5.15	127.24	120.60
1	A	205	SER	CA-C-N	5.12	127.86	120.38
1	A	205	SER	C-N-CA	5.12	127.86	120.38
1	A	402	THR	CA-C-N	5.10	127.07	120.44
1	A	402	THR	C-N-CA	5.10	127.07	120.44
1	A	54	VAL	CA-C-O	-5.09	115.71	120.34
1	A	883	CYS	CA-C-N	5.05	125.70	119.99
1	A	883	CYS	C-N-CA	5.05	125.70	119.99
1	A	1101	LEU	CA-C-N	5.05	127.75	120.38

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1101	LEU	C-N-CA	5.05	127.75	120.38
1	A	1099	PRO	CA-C-N	5.01	125.89	121.58
1	A	1099	PRO	C-N-CA	5.01	125.89	121.58

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	8150	0	8433	40	0
2	B	28	0	25	0	0
3	A	1	0	0	0	0
4	A	5	0	0	0	0
5	A	14	0	26	0	0
All	All	8198	0	8484	40	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 2.

All (40) 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:383:ALA:HB1	1:A:391:VAL:HG21	1.79	0.64
1:A:1015:VAL:HG21	1:A:1127:ASN:HB3	1.90	0.53
1:A:546:LEU:HD13	1:A:552:LEU:HD12	1.91	0.52
1:A:821:ARG:NH1	1:A:1172:PRO:O	2.42	0.52
1:A:943:THR:HG23	1:A:1058:TYR:CE1	2.45	0.51
1:A:514:LYS:HD2	1:A:760:VAL:HG11	1.93	0.50
1:A:1164:ARG:CZ	1:A:1164:ARG:HA	2.41	0.50
1:A:163:LEU:HD22	1:A:165:TYR:CE1	2.47	0.49
1:A:1147:ARG:HA	1:A:1147:ARG:CZ	2.42	0.49
1:A:561:LEU:HD22	1:A:575:LEU:HD12	1.95	0.48
1:A:1171:TRP:CG	1:A:1172:PRO:HD2	2.49	0.48
1:A:977:LEU:HD13	1:A:980:ARG:HD2	1.97	0.47

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1171:TRP:CD1	1:A:1172:PRO:HD2	2.49	0.47
1:A:40:TYR:HA	1:A:79:PRO:HA	1.97	0.47
1:A:1059:LEU:HD21	1:A:1088:LEU:HB3	1.97	0.46
1:A:833:ILE:HD13	1:A:844:VAL:HG21	1.98	0.46
1:A:299:ARG:O	1:A:303:GLU:N	2.49	0.45
1:A:879:GLY:HA3	1:A:900:ALA:HB2	1.99	0.45
1:A:82:LEU:H	1:A:82:LEU:HD13	1.82	0.44
1:A:939:LEU:HB3	1:A:1061:LEU:HD13	2.00	0.44
1:A:531:LEU:HD22	1:A:536:PHE:CE1	2.53	0.44
1:A:1076:TYR:HA	1:A:1082:LEU:HD11	1.98	0.44
1:A:357:LEU:HD22	1:A:372:HIS:HB2	1.99	0.43
1:A:707:LEU:HB3	1:A:712:VAL:HG23	2.00	0.43
1:A:87:THR:HG22	1:A:106:GLN:HA	2.00	0.43
1:A:419:PHE:CE1	1:A:506:LYS:HD3	2.54	0.42
1:A:531:LEU:HD23	1:A:718:LEU:HB3	2.00	0.42
1:A:1008:GLN:HE21	1:A:1135:GLU:HG2	1.84	0.42
1:A:668:THR:HG21	1:A:717:SER:HA	2.01	0.42
1:A:173:TYR:HA	1:A:184:GLN:HA	2.01	0.42
1:A:1164:ARG:HA	1:A:1164:ARG:NE	2.35	0.41
1:A:285:LEU:HD11	1:A:411:ILE:HD12	2.02	0.41
1:A:332:ALA:HB1	1:A:357:LEU:HD23	2.03	0.41
1:A:80:CYS:SG	1:A:81:ASN:N	2.94	0.41
1:A:735:VAL:HG11	1:A:913:ILE:HG12	2.01	0.41
1:A:944:GLN:O	1:A:948:VAL:HG23	2.20	0.41
1:A:518:LEU:HD11	1:A:913:ILE:HD12	2.02	0.40
1:A:477:MET:HE1	1:A:934:PHE:HD2	1.85	0.40
1:A:297:VAL:O	1:A:303:GLU:HA	2.21	0.40
1:A:529:VAL:HB	1:A:721:LEU:HG	2.04	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	1045/1184 (88%)	1013 (97%)	31 (3%)	1 (0%)	48 79

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1172	PRO

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	904/1005 (90%)	769 (85%)	135 (15%)	3 16

All (135) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	36	ARG
1	A	37	LEU
1	A	41	CYS
1	A	46	ARG
1	A	56	MET
1	A	63	LEU
1	A	66	ARG
1	A	67	TRP
1	A	68	LYS
1	A	82	LEU
1	A	88	LEU
1	A	90	ILE
1	A	102	LEU
1	A	168	PHE
1	A	173	TYR
1	A	178	THR
1	A	187	LEU
1	A	197	VAL
1	A	221	ILE
1	A	240	TYR

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	248	ILE
1	A	251	TRP
1	A	279	ARG
1	A	280	LYS
1	A	296	CYS
1	A	298	CYS
1	A	307	VAL
1	A	313	VAL
1	A	323	GLU
1	A	327	MET
1	A	333	LEU
1	A	337	GLU
1	A	345	LEU
1	A	352	VAL
1	A	357	LEU
1	A	371	ARG
1	A	373	THR
1	A	374	LEU
1	A	382	GLN
1	A	390	HIS
1	A	391	VAL
1	A	398	THR
1	A	407	LEU
1	A	415	ARG
1	A	417	ILE
1	A	418	ASN
1	A	441	ILE
1	A	449	ARG
1	A	451	ARG
1	A	454	LEU
1	A	457	ILE
1	A	480	CYS
1	A	503	LEU
1	A	506	LYS
1	A	519	THR
1	A	521	ASP
1	A	525	VAL
1	A	529	VAL
1	A	544	ARG
1	A	546	LEU
1	A	551	LEU
1	A	552	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	563	ARG
1	A	564	LEU
1	A	571	ASP
1	A	575	LEU
1	A	576	LYS
1	A	602	VAL
1	A	618	PRO
1	A	622	VAL
1	A	625	LEU
1	A	641	VAL
1	A	644	PRO
1	A	676	MET
1	A	687	VAL
1	A	688	VAL
1	A	690	LEU
1	A	702	GLU
1	A	708	THR
1	A	712	VAL
1	A	716	LEU
1	A	719	LEU
1	A	723	VAL
1	A	728	LEU
1	A	740	ARG
1	A	743	ARG
1	A	749	VAL
1	A	753	ASN
1	A	764	CYS
1	A	767	VAL
1	A	779	THR
1	A	781	PRO
1	A	782	GLU
1	A	783	ARG
1	A	791	PHE
1	A	794	MET
1	A	822	HIS
1	A	829	THR
1	A	839	LYS
1	A	843	LYS
1	A	850	VAL
1	A	866	LEU
1	A	868	LYS
1	A	902	VAL

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	914	GLU
1	A	940	TYR
1	A	942	LEU
1	A	954	ILE
1	A	956	THR
1	A	958	LEU
1	A	961	LEU
1	A	967	ASP
1	A	969	VAL
1	A	981	THR
1	A	997	LEU
1	A	999	VAL
1	A	1001	VAL
1	A	1023	THR
1	A	1032	LEU
1	A	1034	ARG
1	A	1042	LEU
1	A	1093	VAL
1	A	1102	LEU
1	A	1109	ARG
1	A	1110	ASN
1	A	1121	LEU
1	A	1127	ASN
1	A	1138	LEU
1	A	1142	LEU
1	A	1147	ARG
1	A	1156	LYS
1	A	1158	ARG
1	A	1160	LYS
1	A	1164	ARG
1	A	1172	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	84	HIS
1	A	169	GLN
1	A	171	GLN
1	A	180	GLN
1	A	283	GLN
1	A	322	GLN
1	A	390	HIS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	491	GLN
1	A	565	GLN
1	A	726	ASN
1	A	737	GLN
1	A	772	HIS
1	A	780	HIS
1	A	785	GLN
1	A	962	GLN
1	A	1044	ASN
1	A	1047	ASN
1	A	1110	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	$\# Z > 2$
2	NAG	B	1	1,2	14,14,15	0.69	1 (7%)	17,19,21	1.62	3 (17%)
2	NAG	B	2	2	14,14,15	0.53	0	17,19,21	1.45	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
2	NAG	B	1	1,2	-	1/6/23/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1	NAG	C1-C2	-2.17	1.49	1.52

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	NAG	C1-O5-C5	4.63	118.39	112.19
2	B	2	NAG	C1-O5-C5	3.47	116.84	112.19
2	B	2	NAG	C1-C2-N2	2.93	115.05	110.43
2	B	1	NAG	C3-C4-C5	2.22	114.26	110.23
2	B	1	NAG	O5-C1-C2	2.07	114.49	111.29

There are no chirality outliers.

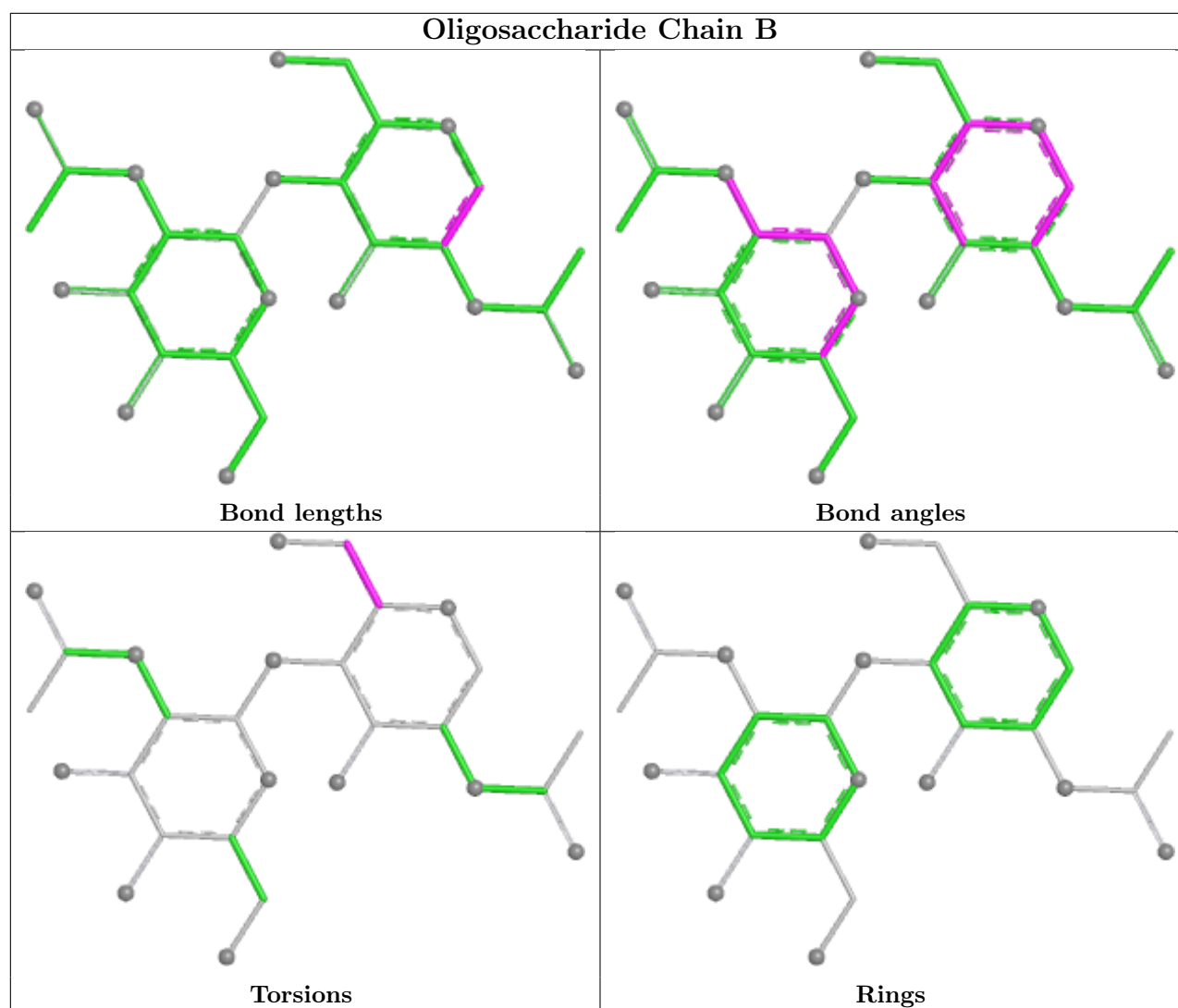
All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1	NAG	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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](#)

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 for Mogul analysis.

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	ALF	A	1202	-	4,4,4	1.39	0	-		
5	SPM	A	1203	-	13,13,13	0.19	0	12,12,12	0.60	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
5	SPM	A	1203	-	-	3/11/11/11	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

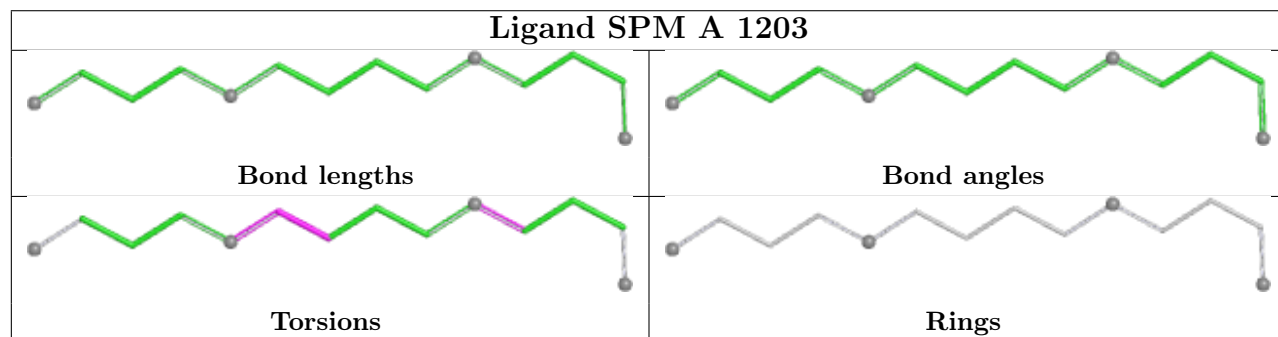
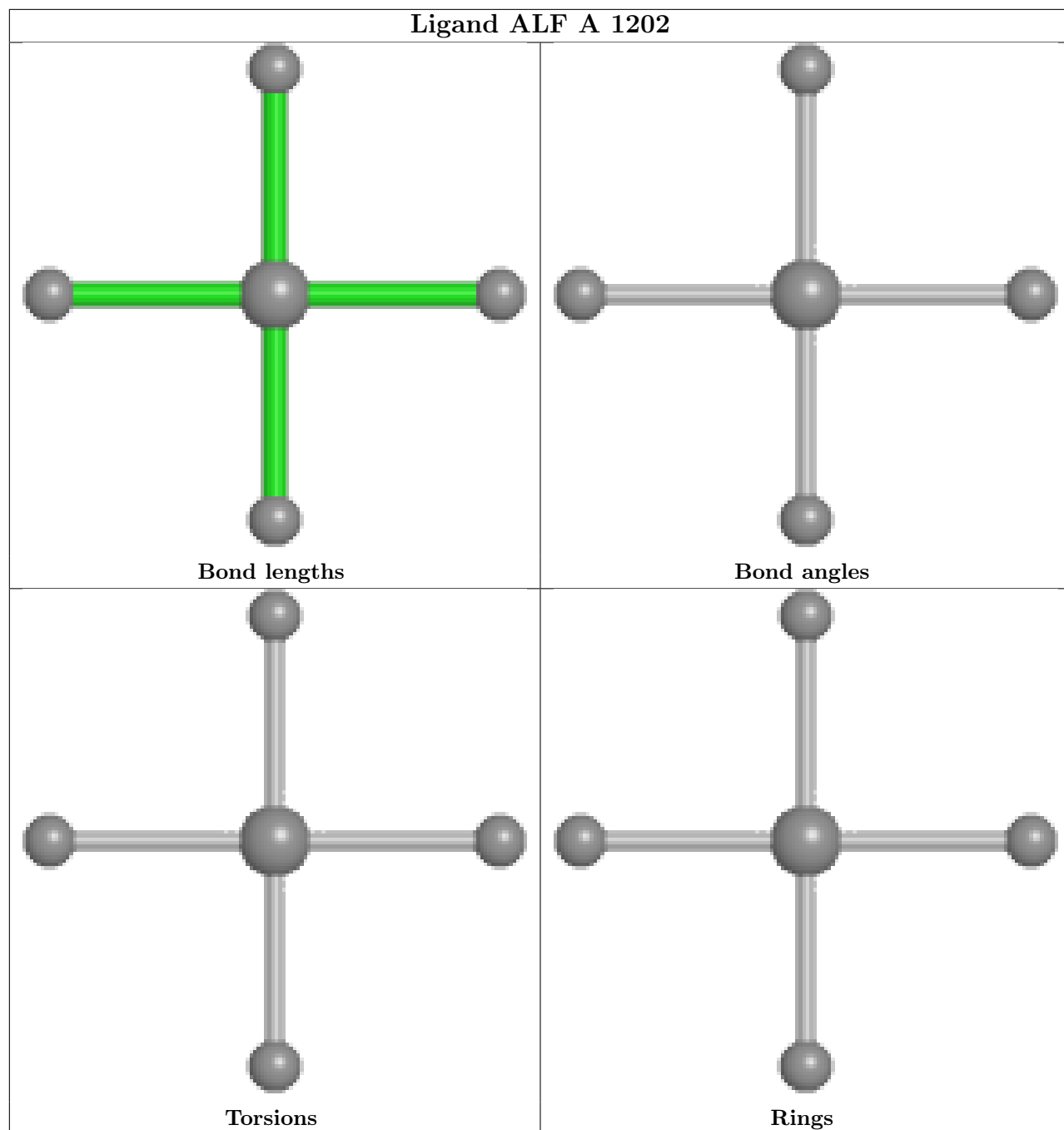
All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	1203	SPM	C7-C8-C9-N10
5	A	1203	SPM	C3-C4-N5-C6
5	A	1203	SPM	C8-C9-N10-C11

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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.

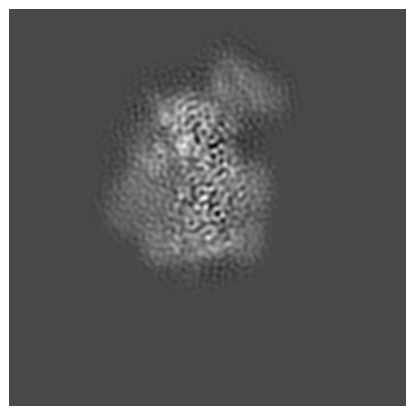
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-32069. These allow visual inspection of the internal detail of the map and identification of artifacts.

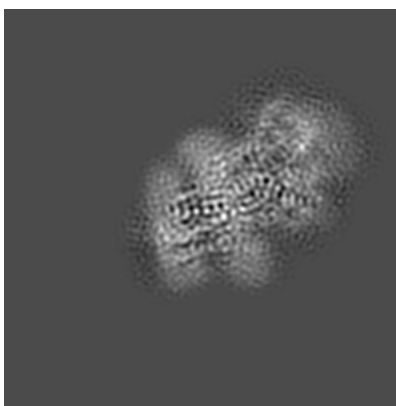
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

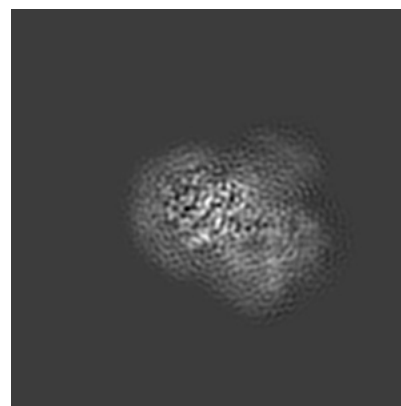
6.1.1 Primary map



X

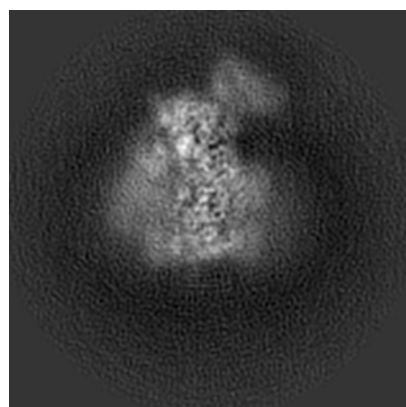


Y

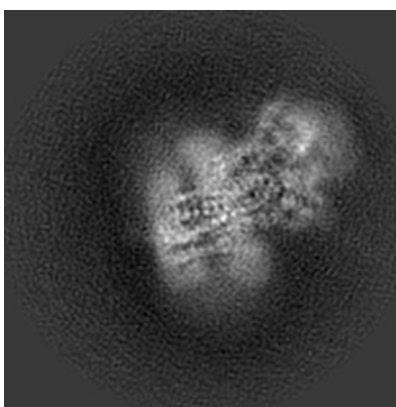


Z

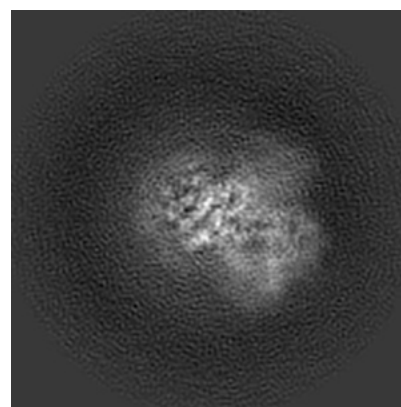
6.1.2 Raw map



X



Y

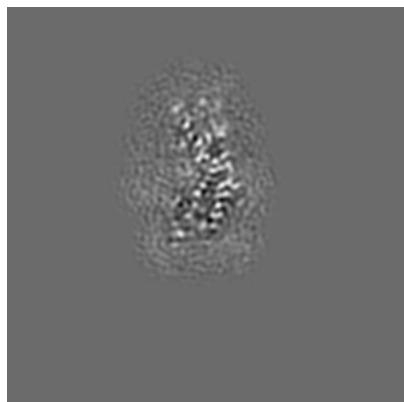


Z

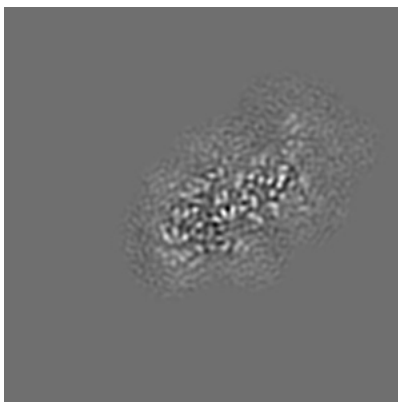
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

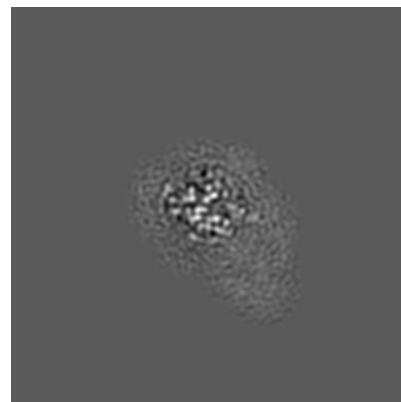
6.2.1 Primary map



X Index: 78

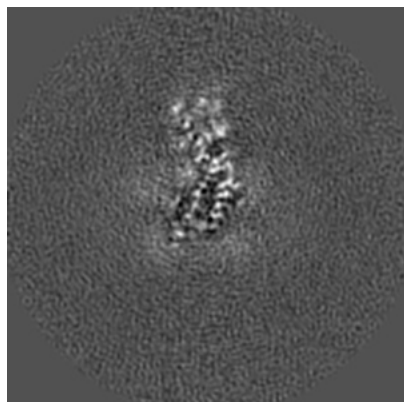


Y Index: 78

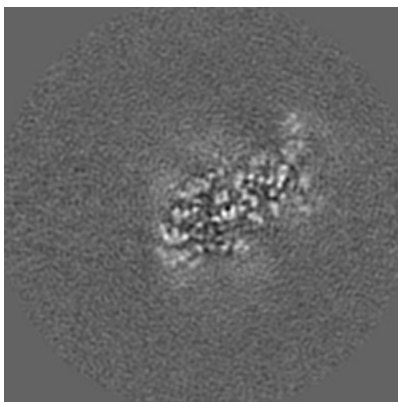


Z Index: 78

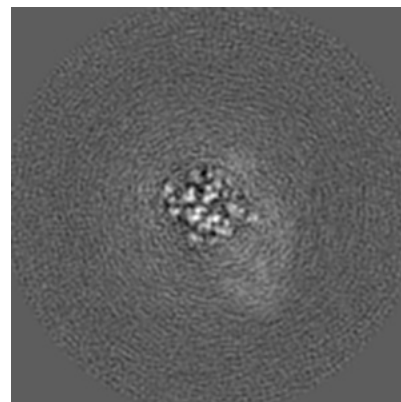
6.2.2 Raw map



X Index: 78



Y Index: 78

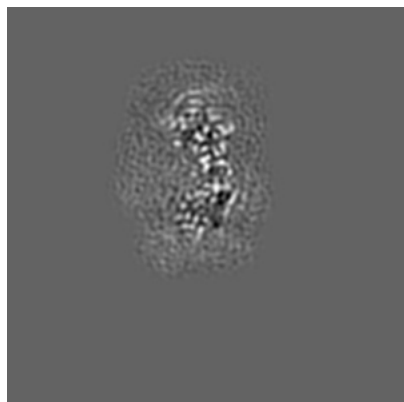


Z Index: 78

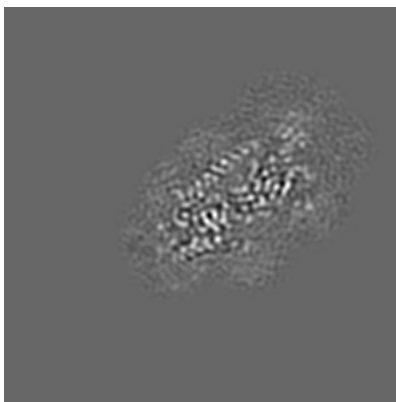
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

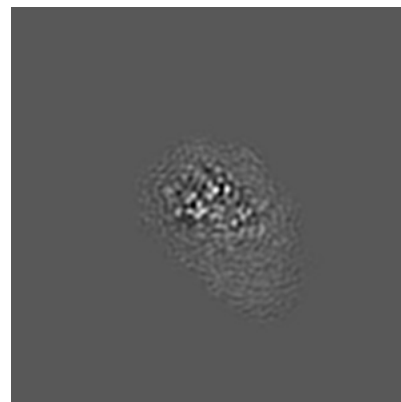
6.3.1 Primary map



X Index: 81

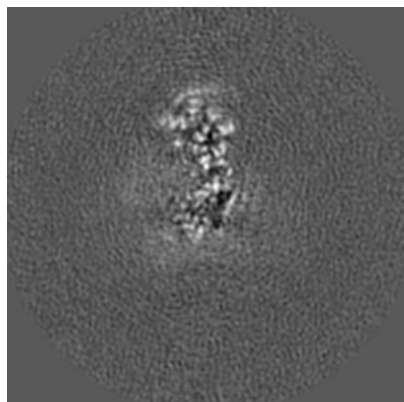


Y Index: 76

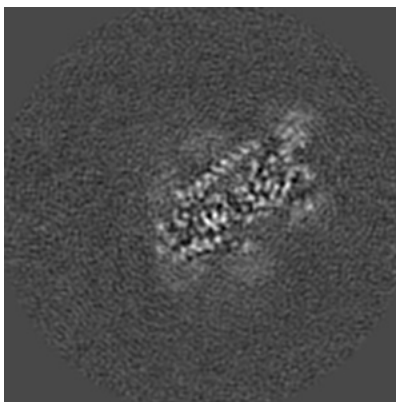


Z Index: 82

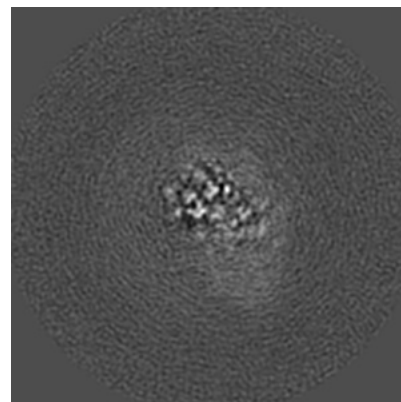
6.3.2 Raw map



X Index: 81



Y Index: 76

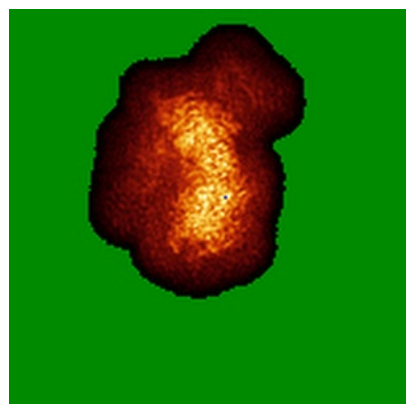


Z Index: 82

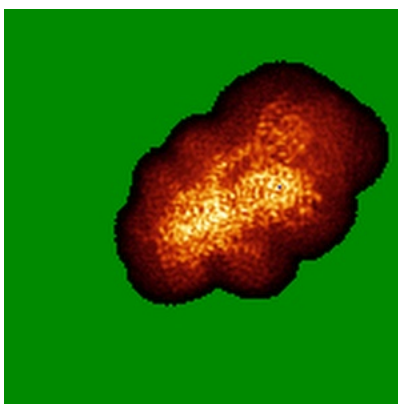
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) ⓘ

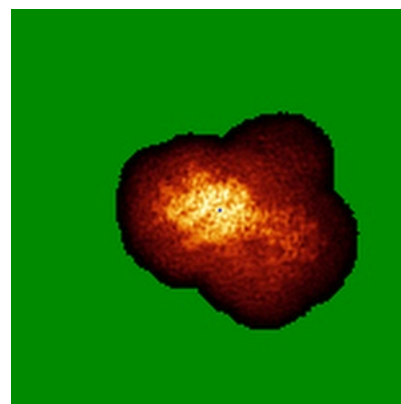
6.4.1 Primary map



X

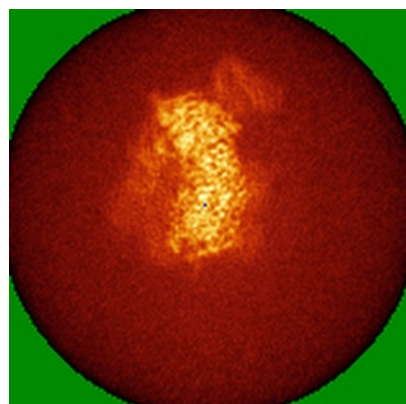


Y

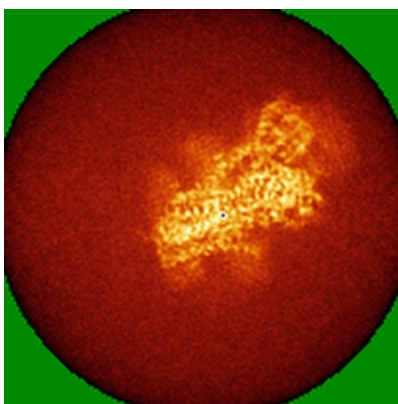


Z

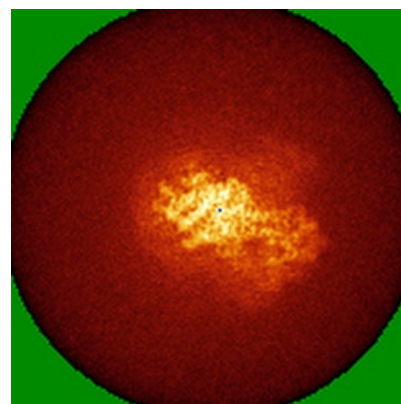
6.4.2 Raw map



X



Y

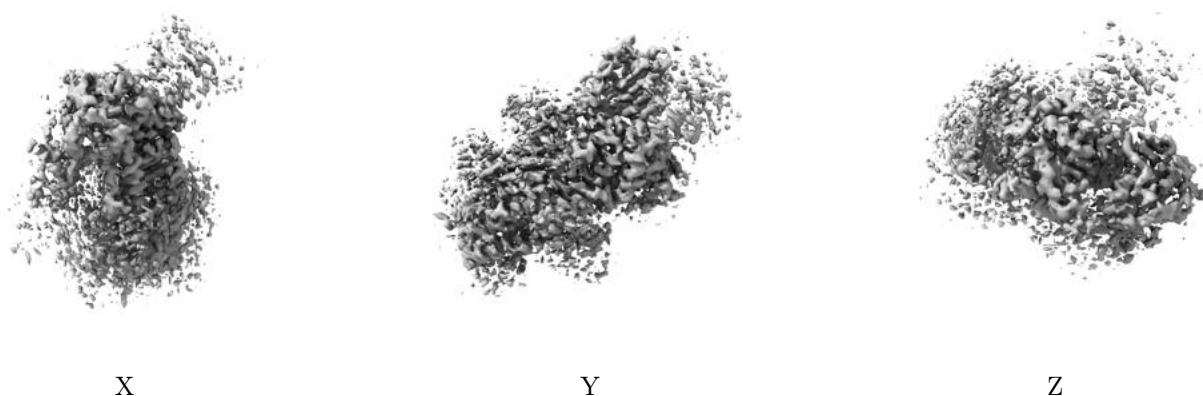


Z

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.

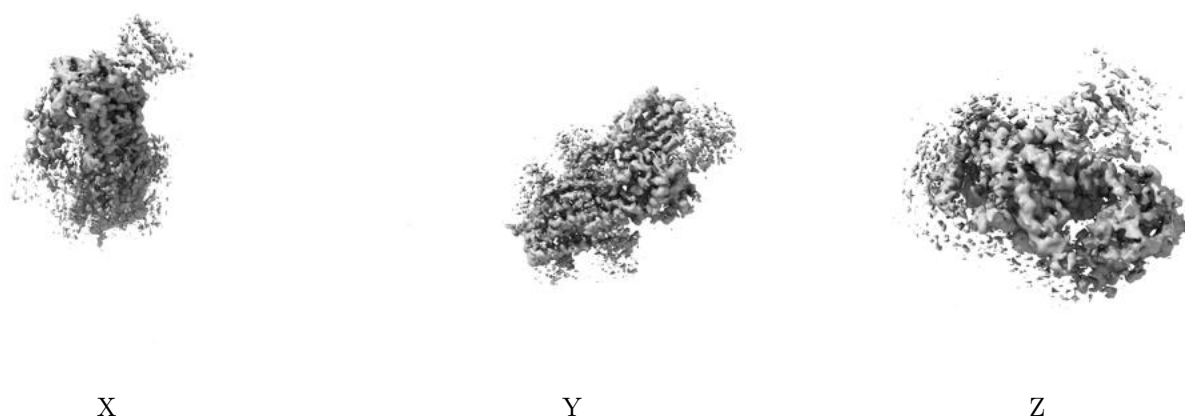
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.0396. 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.

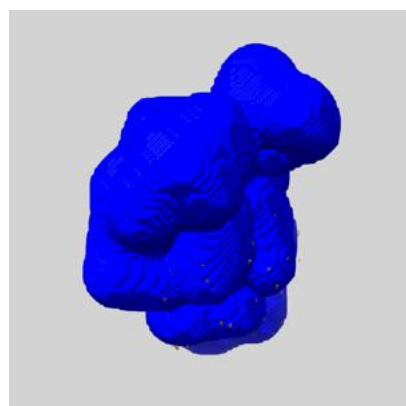
6.6 Mask visualisation [i](#)

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

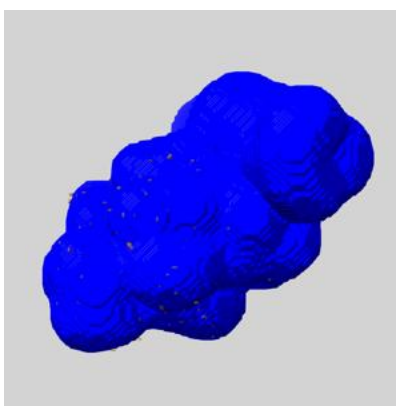
A mask typically either:

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

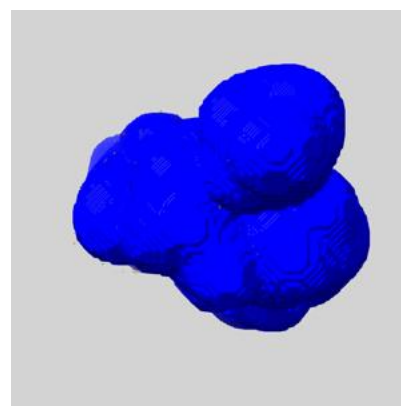
6.6.1 emd_32069_msk_1.map [i](#)



X



Y

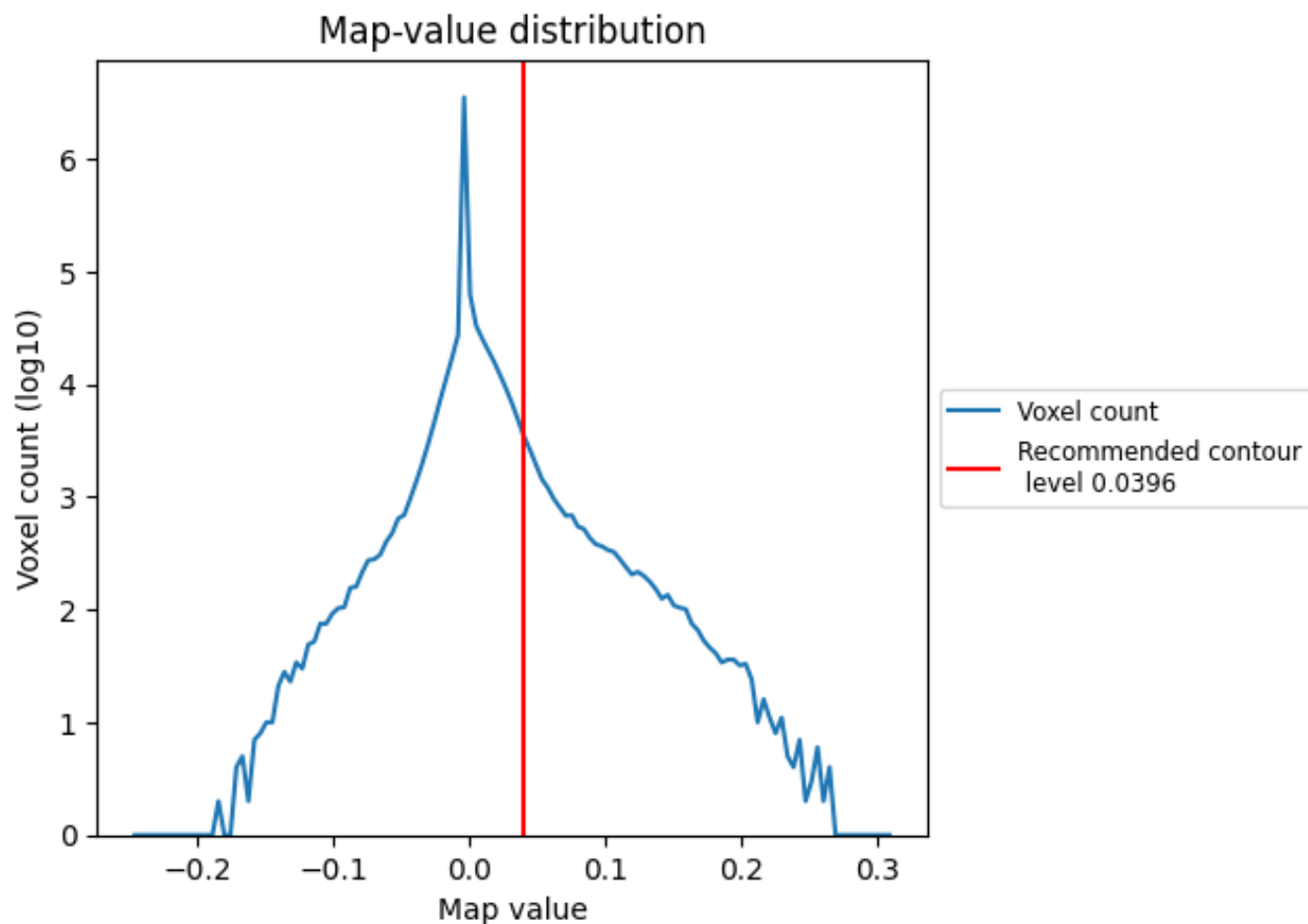


Z

7 Map analysis [i](#)

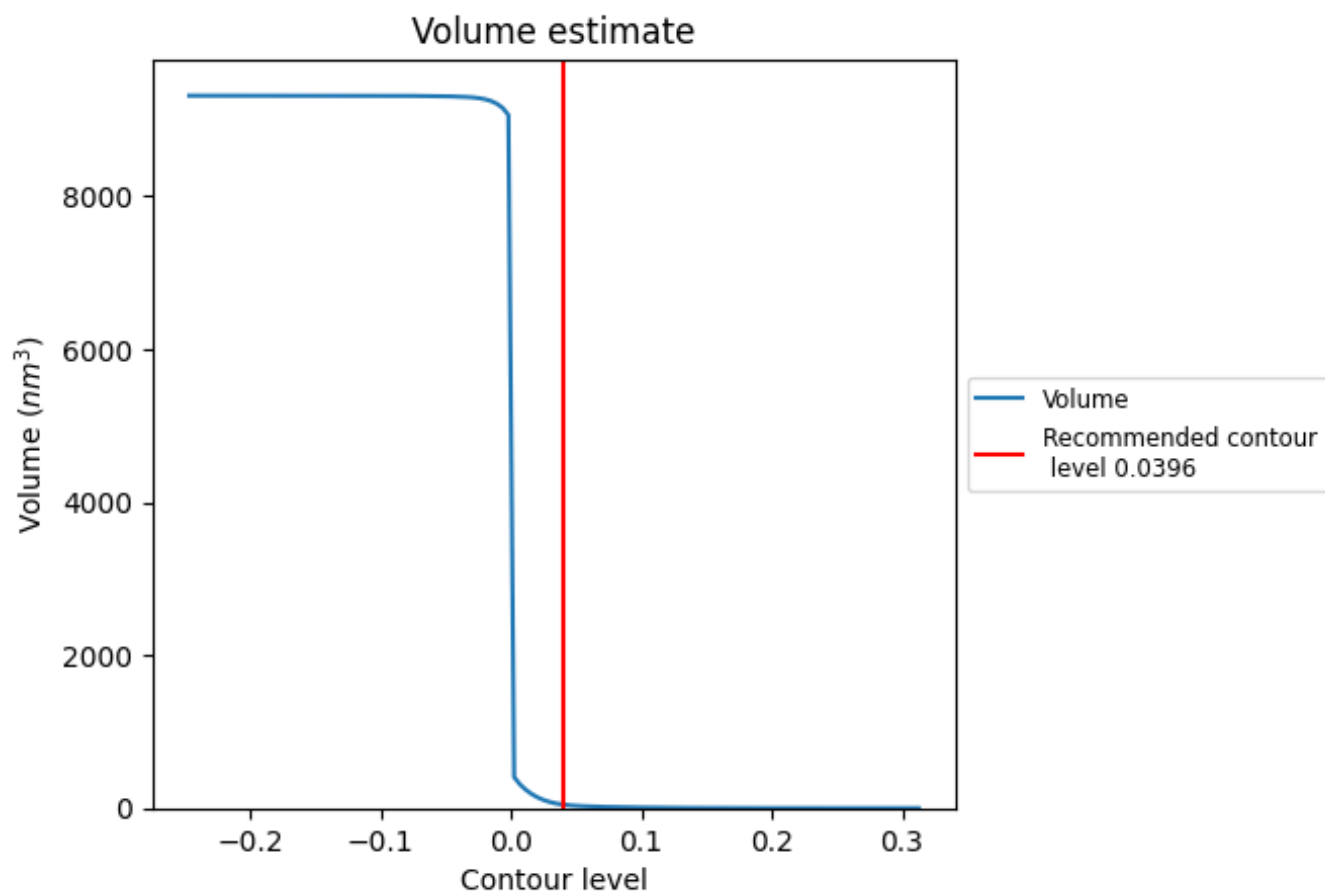
This section contains the results of statistical analysis of the map.

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.

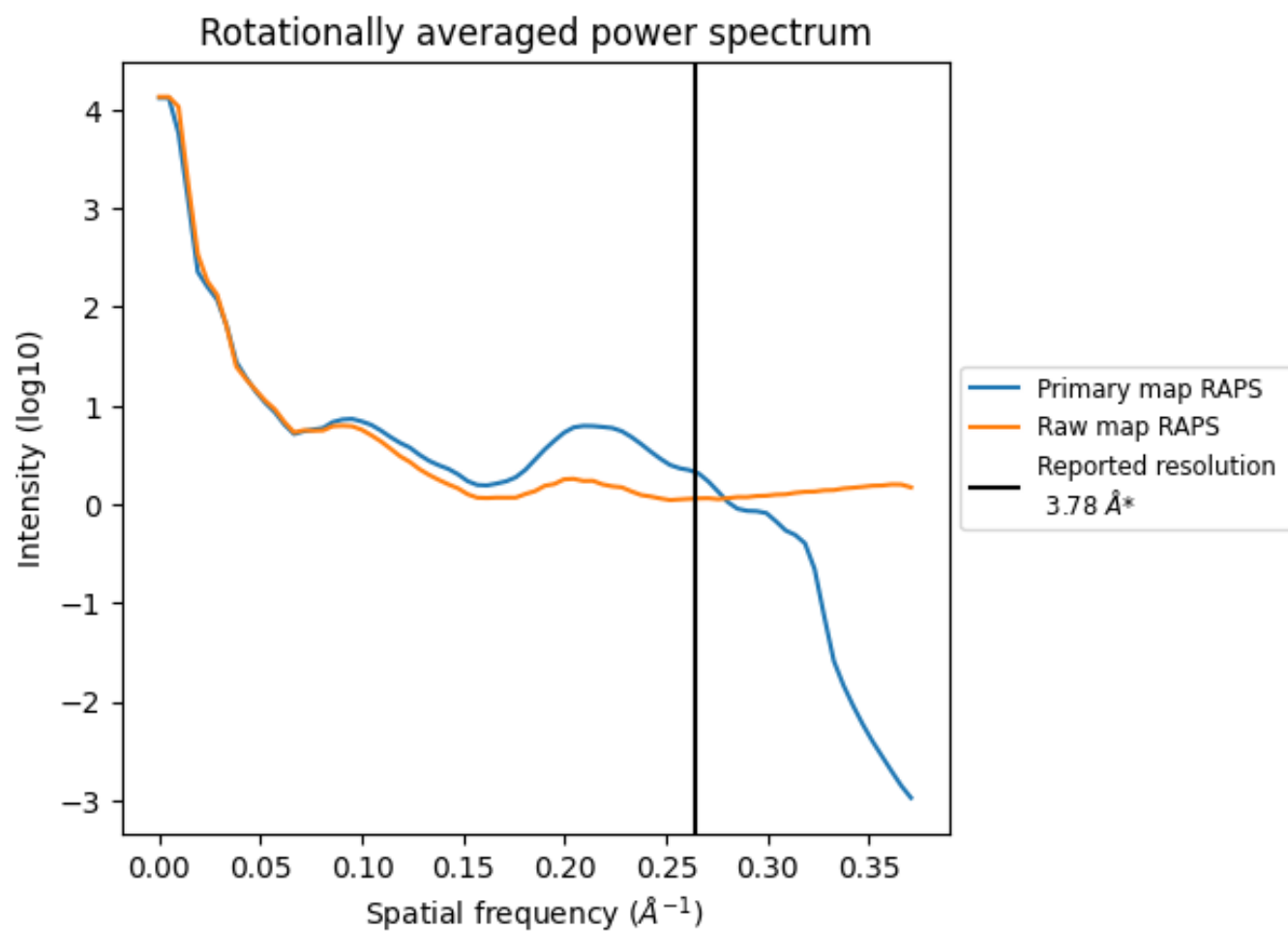
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 48 nm^3 ; this corresponds to an approximate mass of 43 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 ⓘ

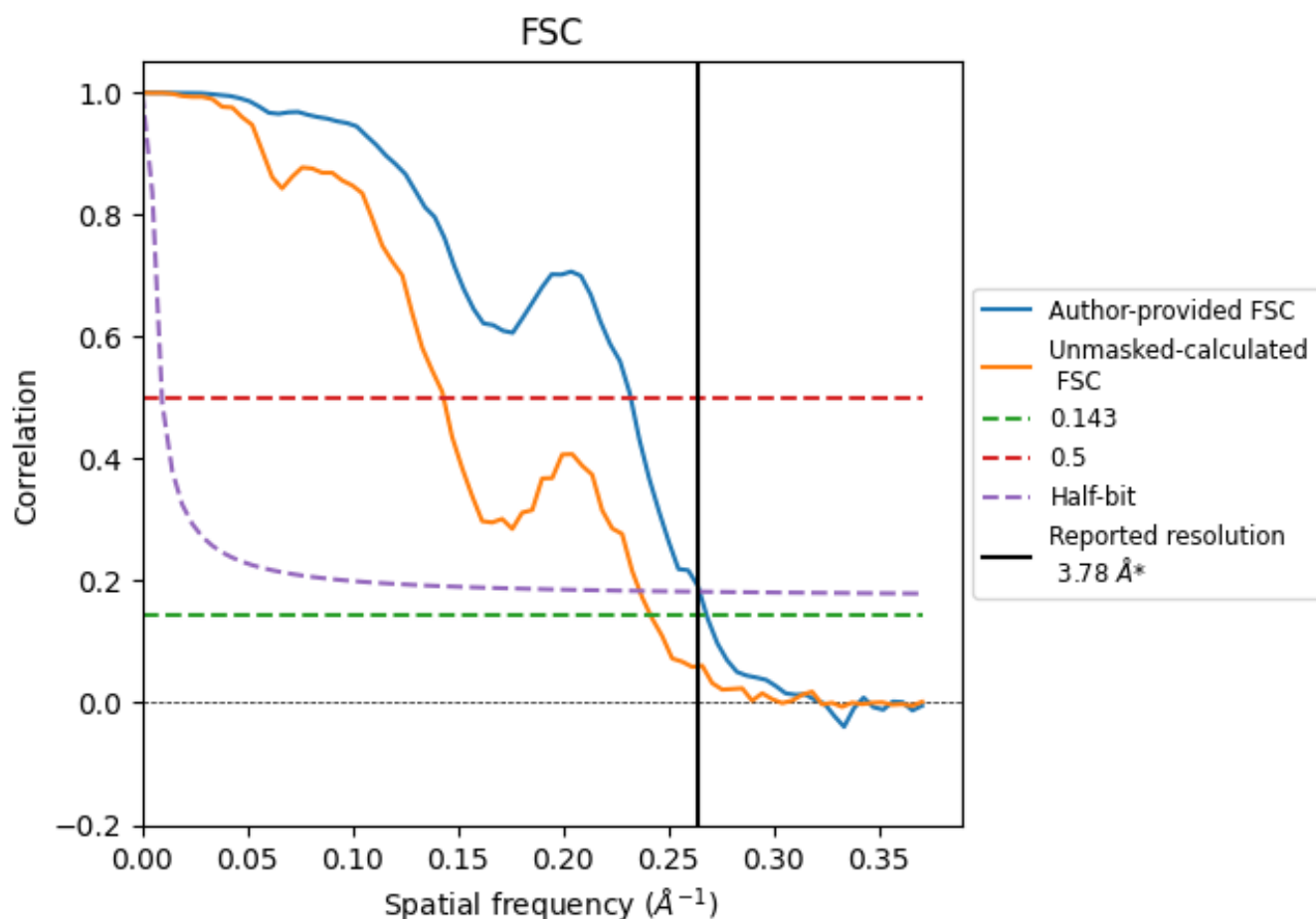


*Reported resolution corresponds to spatial frequency of $0.265 \text{ \AA}^{-1}$

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 0.265 Å⁻¹

8.2 Resolution estimates [i](#)

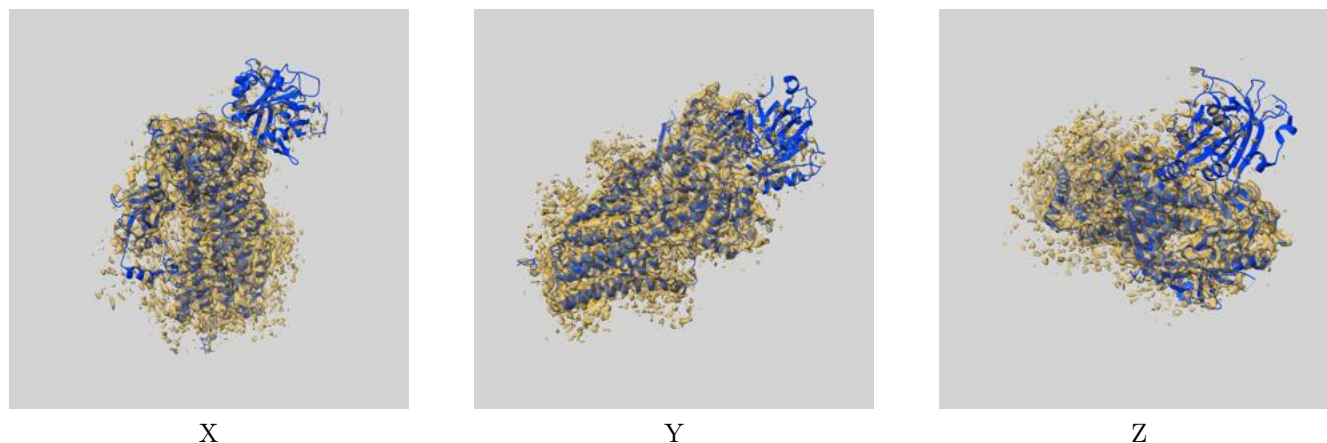
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.78	-	-
Author-provided FSC curve	3.73	4.31	3.77
Unmasked-calculated*	4.14	6.98	4.23

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-32069 and PDB model 7VPL. Per-residue inclusion information can be found in section [3](#) on page [5](#).

9.1 Map-model overlay [i](#)



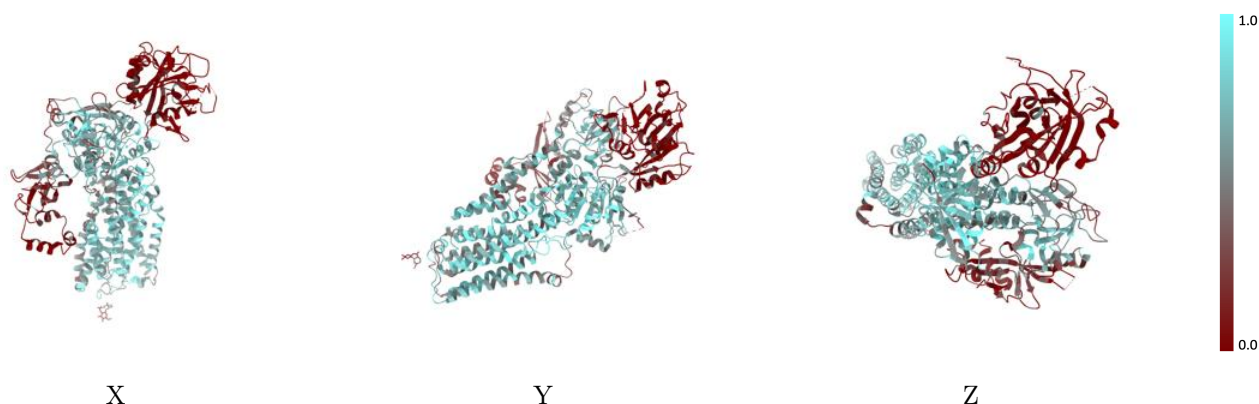
The images above show the 3D surface view of the map at the recommended contour level 0.0396 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



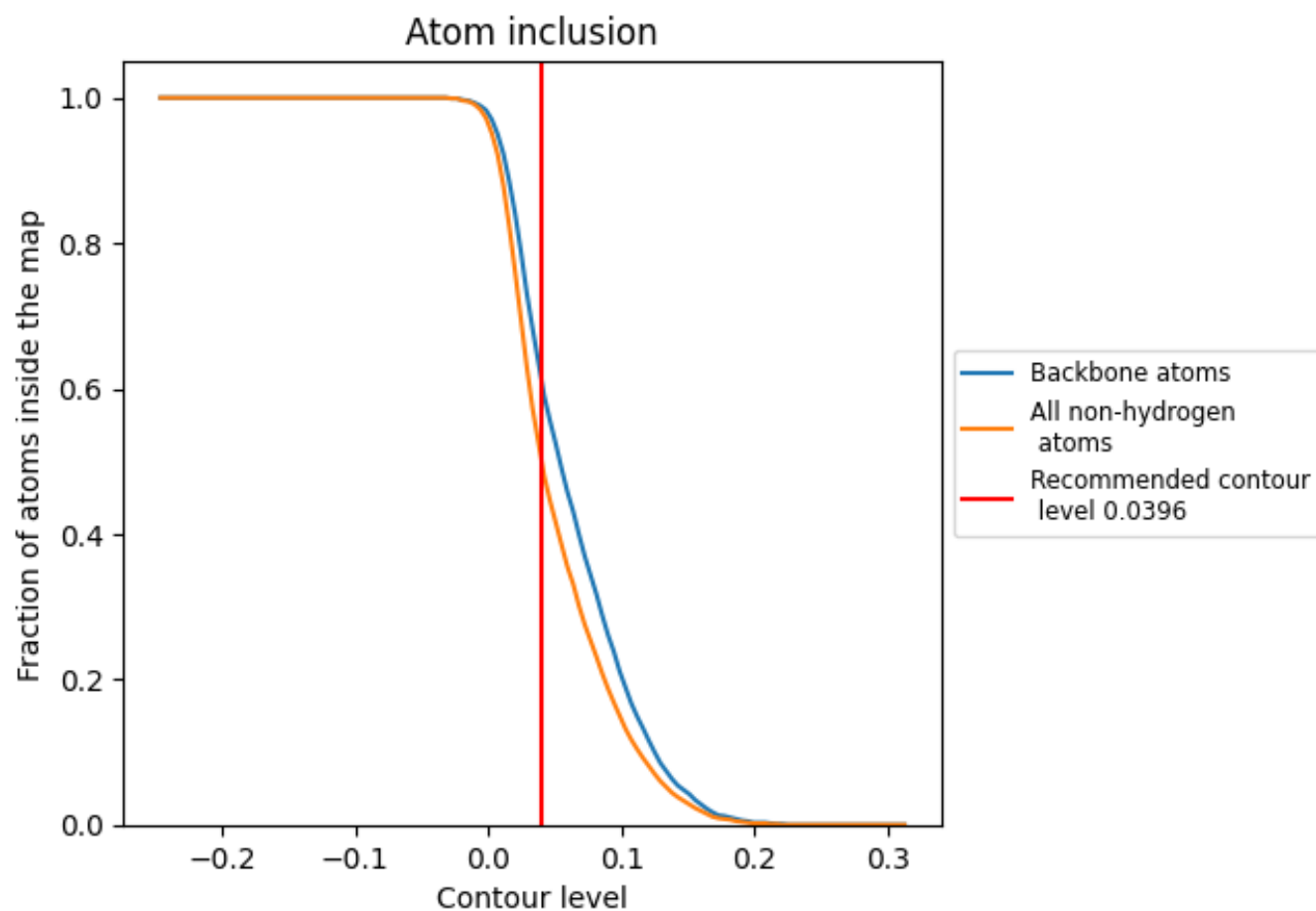
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.0396).

9.4 Atom inclusion [i](#)



At the recommended contour level, 62% of all backbone atoms, 50% 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 (0.0396) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.5040	0.3490
A	0.5050	0.3490
B	0.2140	0.2460

