



wwPDB EM Validation Summary Report ⓘ

Jul 8, 2025 – 04:24 pm BST

PDB ID : 8RD4 / pdb_00008rd4
EMDB ID : EMD-19065
Title : Telomeric RAP1:DNA-PK complex
Authors : Eickhoff, P.; Fisher, C.E.L.; Inian, O.; Guettler, S.; Douglas, M.E.
Deposited on : 2023-12-07
Resolution : 3.58 Å(reported)

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

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

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : 0.0.1.dev118
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

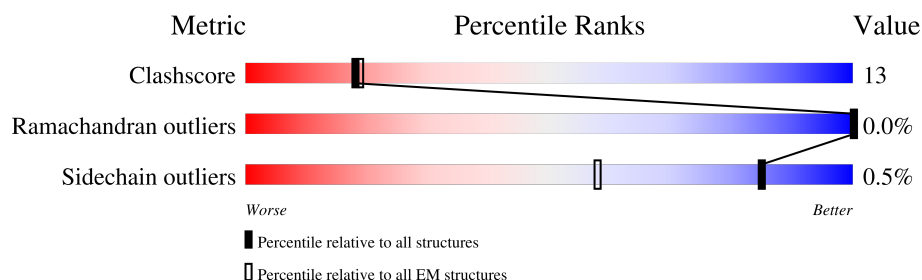
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

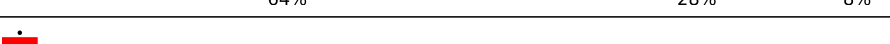
The reported resolution of this entry is 3.58 Å.

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	4128	
2	D	399	
3	E	609	
4	F	732	
5	X	100	
6	Y	100	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 40711 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 DNA-dependent protein kinase catalytic subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	3597	Total	C	N	O	S	0	0
			28855	18531	4885	5250	189		

- Molecule 2 is a protein called Telomeric repeat-binding factor 2-interacting protein 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	D	158	Total	C	N	O	S	0	0
			1232	770	223	235	4		

- Molecule 3 is a protein called X-ray repair cross-complementing protein 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	E	560	Total	C	N	O	S	0	0
			4522	2891	764	847	20		

- Molecule 4 is a protein called X-ray repair cross-complementing protein 5.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	F	553	Total	C	N	O	S	0	0
			4421	2820	747	831	23		

- Molecule 5 is a DNA chain called DNA (41-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
5	X	41	Total	C	N	O	P	0	0
			842	401	154	246	41		

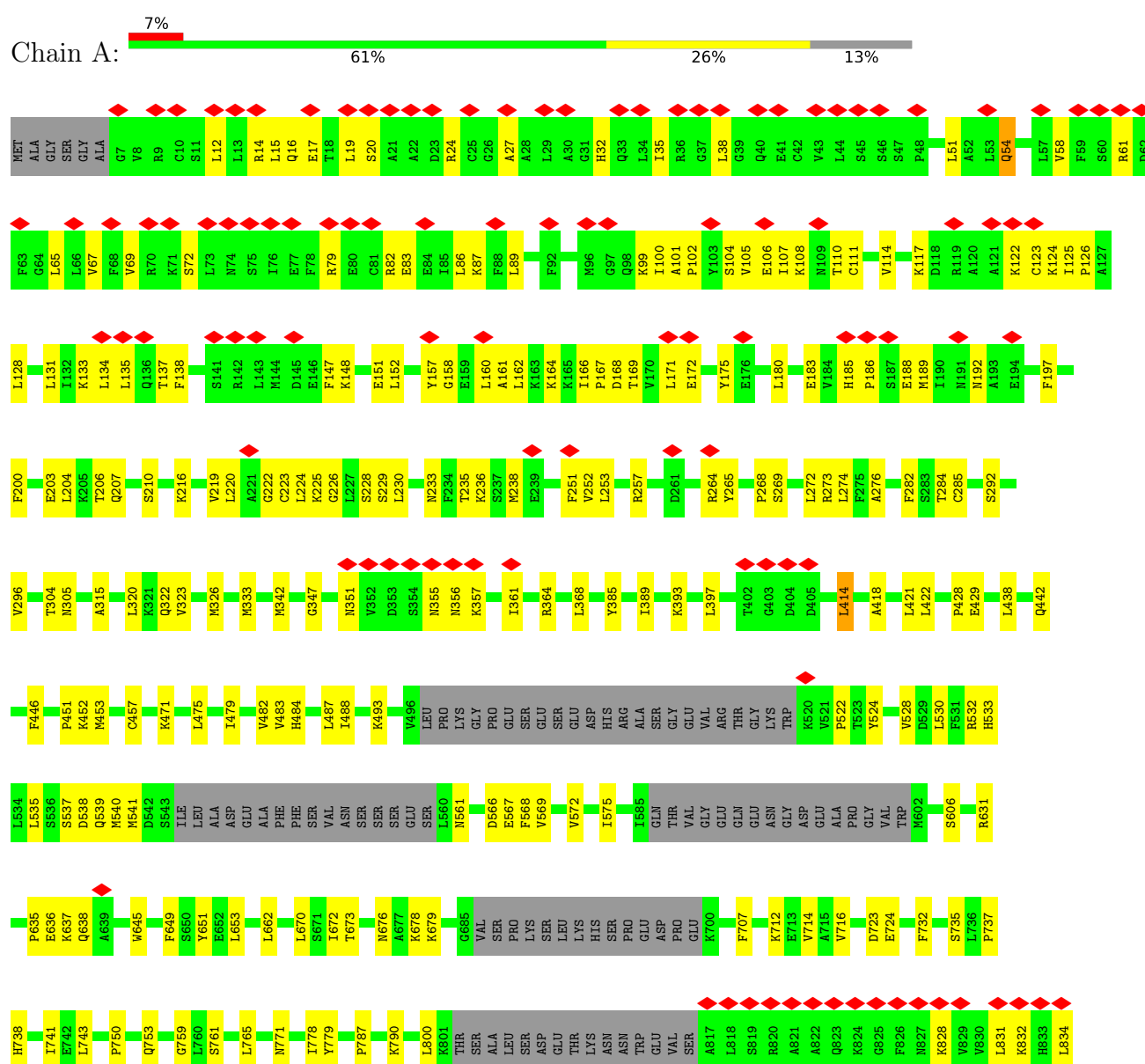
- Molecule 6 is a DNA chain called DNA (41-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
6	Y	41	Total	C	N	O	P	0	0
			839	400	152	246	41		

3 Residue-property plots

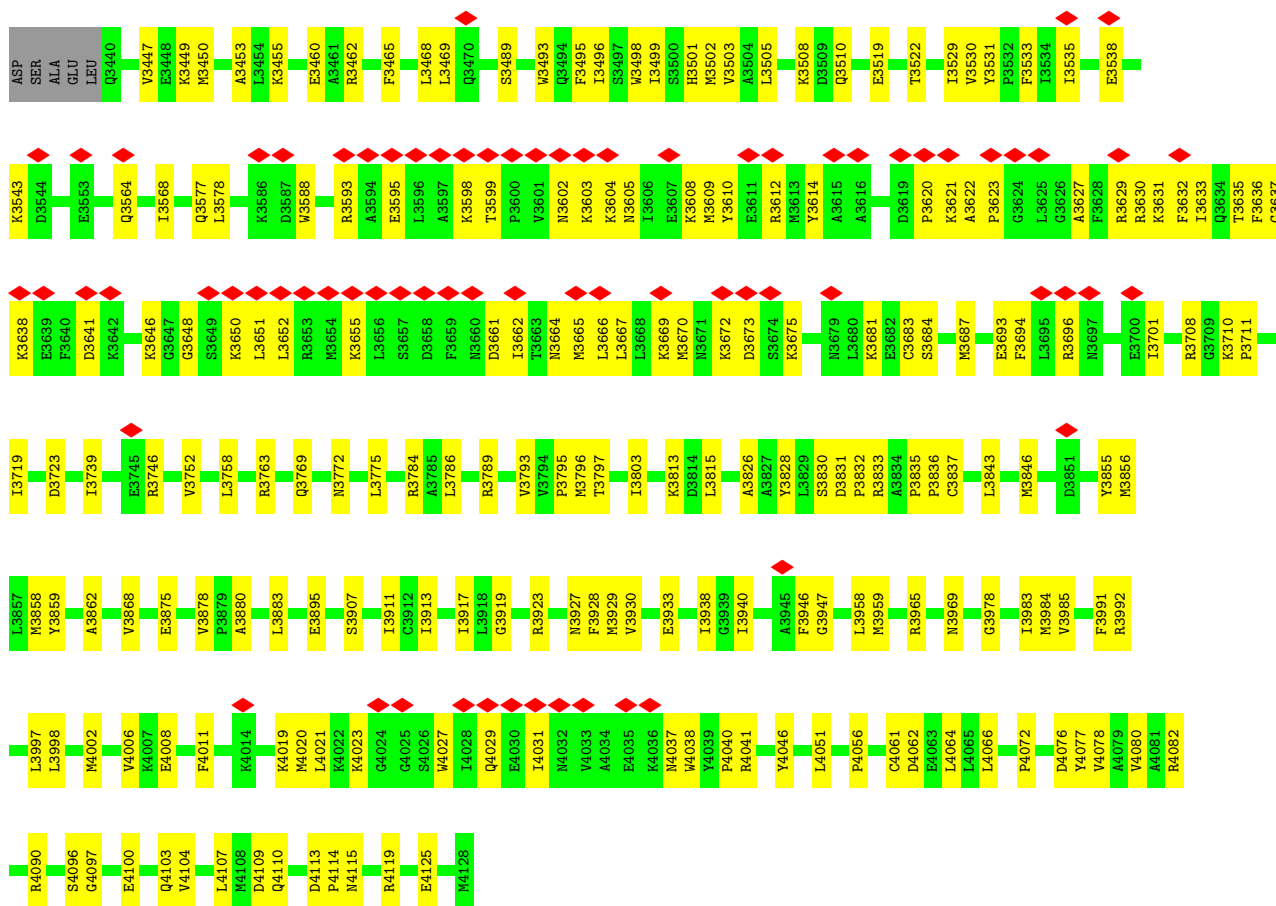
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion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

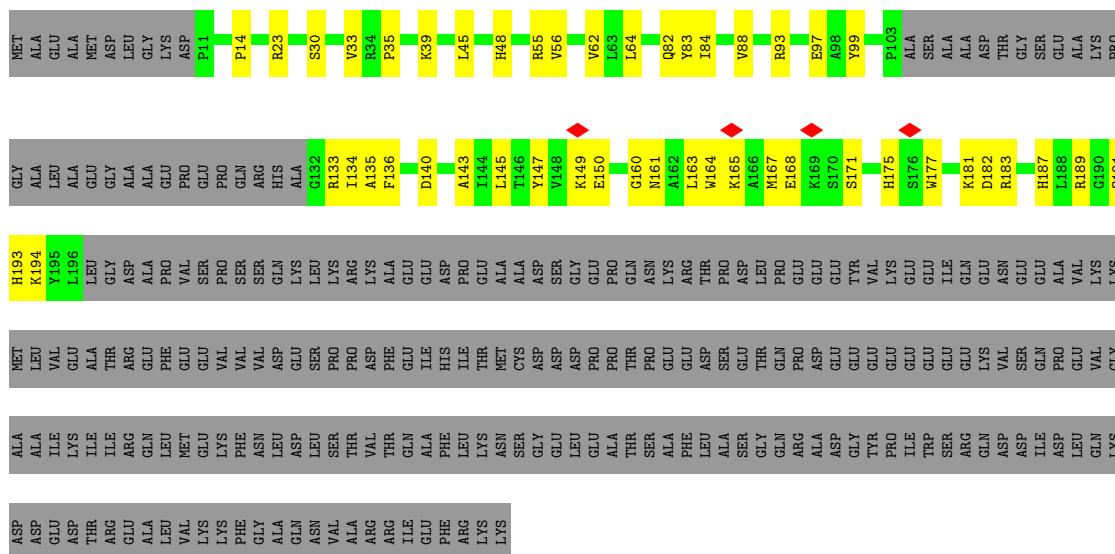


ASP	K1869	E1769	V1671	S1564	L1458	I1341	W1256	H1152	V1054	Y938	K835
GLY	K1870	Q1770	T1674	I1567	H1459	M1342	L1261	L1153	R1062	M939	LYS
PRO	M1871	Q1771	Y1675	N1568	R1460	T1347	E1265	P1154	F940	M941	THR
TYR	Y1873	M1773	S1677	L1464	L1463	T1351	E1273	R1155	L1068	Q947	LYS
MET	K1875	E1775	L1575	D1576	H1465	K1357	R1274	S1160	L1069	NET	ASN
SER	L1876	E1778	V1579	M1583	I1467	K1361	L1282	A1161	P1070	PRO	LEU
LEU	L1877	F1778	D1681	K1591	Q1471	K1364	GLY	S1162	N1071	GLY	SER
SER	D1878	F1782	K1683	M1592	D1474	C1366	THR	C1164	K1074	GLY	ASN
TYR	L1879	R1783	L1684	L1597	S1478	T1366	ALA	C1165	R1075	GLN	ASN
LEU	M1880	R1784	D1685	K1591	L1484	H1367	GLU	L1166	F1082	ALA	GLU
ALA	Y1881	I1785	H1686	M1592	Q1471	L1368	ALA	D1167	N1083	ALA	A845
ASP	L1884	T1786	H1687	K1591	D1474	H1369	GLN	L1168	N1084	ALA	E849
SER	P1885	R1787	H1687	M1592	S1478	L1369	SER	R1178	N1085	P956	R854
THR	K1886	R1788	L1688	L1597	L1484	L1368	GLN	C1183	Y1086	P957	L859
LEU	K1887	G1789	L1689	L1597	L1484	L1369	SER	R1184	R1087	N958	G860
SER	D1888	Q1790	Q1691	D1602	V1487	V1371	LEU	H1185	F1088	V968	L870
GLU	V1889	T1794	A1692	E1607	P1493	T1375	L1291	K1186	R1090	D977	L871
MET	H1890	L1797	L1695	Q1614	GLY	T1375	F1296	F1191	E1093	Q978	V873
SER	A1891	L1797	L1696	Q1614	ASP	E1378	F1297	F1191	S1094	T980	T874
GLN	K1892	L1797	L1696	Q1614	GLU	P1379	L1298	V1195	L1095	Q981	S875
PHE	E1893	Y1802	S1701	K1617	ARG	E1378	E1299	C1183	Y1086	Q982	S876
ASP	S1894	E1803	L1702	L1618	GLN	P1379	Y1299	R1202	R1087	Y983	D877
PHE	K1895	M1804	T1703	A1619	CYS	F1384	I1301	M1205	E1088	Y984	E878
SER	L1896	F1805	T1703	T1620	LEU	I1386	M1303	L1206	F1089	P986	M879
THR	N1897	R1806	T1711	T1621	PRO	G1387	HIS	K1213	I1105	L987	M880
GLY	Q1898	L1812	R1712	L1623	S1502	D1388	ASP	E1214	Y1107	N988	K881
GLN	V1899	S1813	V1713	W1626	L1515	V1398	ILE	F1219	M1108	Q990	D887
TYR	G1902	T1814	L1714	K1628	E1516	C1399	ALA	L1010	K1119	L1010	K890
SER	S1903	T1815	E1715	K1628	E1516	L1400	ALA	E1011	I1124	R891	L892
VAL	C1904	S1818	Q1716	K1628	E1516	M1401	GLY	L1014	Q1125	L1014	S893
SER	I1905	V1819	L1717	W1633	A1520	M1403	LYS	I1017	Q1126	V1018	F894
GLN	T1906	F1820	I1718	W1633	A1520	M1403	CYS	P1232	D1132	V1021	A895
ASP	L1918	D1821	H1721	L1639	G1523	L1402	PHE	G1234	H1133	D1022	V896
PRO	C1919	R1822	F1722	L1639	L1524	M1403	GLY	I1235	L1134	S1023	P897
ARG	Y1920	S1823	P1723	M1643	C1525	K1407	THR	A1237	C1135	D1027	E900
PRO	Y1920	L1824	H1724	M1643	E1526	M1408	GLY	Q1236	I1137	F1028	M901
ALA	D1921	L1825	Q1725	L1646	L1533	D1413	ALA	T1240	I1138	C1029	L907
THR	A1922	C1831	Q1725	A1647	L1533	D1413	ALA	L1241	K1141	L1037	V909
GLY	F1923	S1832	E1728	L1648	S1539	H1418	ASN	Y1243	H1142	T1045	F910
ARG	T1924	L1833	P1734	L1648	T1540	H1418	ARG	L1145	L1145	T1045	T915
PHE	E1925	D1834	M1737	A1650	A1541	L1419	THR	R1245	N1146	P1046	E916
ARG	A1835	L1836	L1652	K1651	SER	R1420	THR	G1246	Q1047	Q1047	L917
ARG	L1836	L1836	L1653	L1653	LEU	R1420	THR	P1247	A1148	E1050	C931
ARG	V1850	L1851	V1659	S1660	GLY	E1430	THR	S1249	K1149	K1051	E932
GLN	L1851	L1851	S1661	F1661	GLN	V1434	ALA	L1250	K1150	L933	L933
ASP	Y1852	Y1852	H1665	G1666	GLY	Y1437	C1335	L1250	L1151	M937	
PRO	C1942	S1853	H1665	G1666	ILE	D1440	T1336				
THR	A1943	R1854	S1667	S1667	VAL	D1444	V1337				
VAL	A1944	L1854	E1760	S1667	ILE	D1444	V1337				
ALA	Y1945	L1858	V1765	S1667	H1552	D1444	V1337				
HIS	Y1945	L1858	V1765	S1667	H1552	D1444	V1337				
ASN	N1946	L1766	C1767	S1667	H1552	D1444	V1337				
ASP	C1947	L1766	C1767	S1667	H1552	D1444	V1337				
ASP	A1948	L1766	C1767	S1667	H1552	D1444	V1337				
SER	I1949	L1766	C1767	S1667	H1552	D1444	V1337				





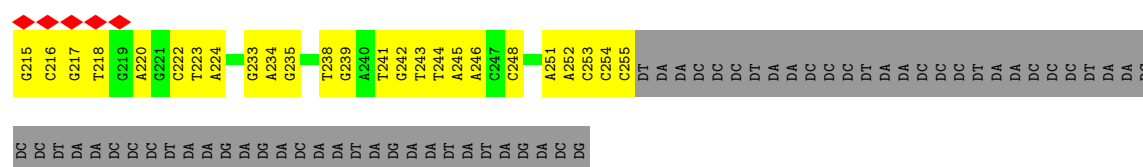
• Molecule 2: Telomeric repeat-binding factor 2-interacting protein 1



• Molecule 3: X-ray repair cross-complementing protein 6



Chain X: 6% 20% 21% 59%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	526885	Depositor
Resolution determination method	OTHER	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS GLACIOS	Depositor
Voltage (kV)	200	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	TFS FALCON 4i (4k x 4k)	Depositor
Maximum map value	57.506	Depositor
Minimum map value	-30.445	Depositor
Average map value	-0.003	Depositor
Map value standard deviation	1.084	Depositor
Recommended contour level	5.2	Depositor
Map size ($\text{\AA}$)	360.96, 360.96, 360.96	wwPDB
Map dimensions	384, 384, 384	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	0.94, 0.94, 0.94	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.14	0/29447	0.37	2/39776 (0.0%)
2	D	0.17	0/1257	0.52	0/1699
3	E	0.20	0/4609	0.34	0/6202
4	F	0.18	0/4511	0.36	0/6084
5	X	0.22	0/944	0.38	0/1455
6	Y	0.24	0/940	0.40	0/1448
All	All	0.16	0/41708	0.37	2/56664 (0.0%)

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.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	1734	PRO	CA-N-CD	-8.61	99.95	112.00
1	A	1991	PRO	CA-N-CD	-6.06	103.52	112.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	D	183	ARG	Peptide

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	28855	0	29332	749	0
2	D	1232	0	1217	40	0
3	E	4522	0	4607	134	0
4	F	4421	0	4445	130	0
5	X	842	0	463	21	0
6	Y	839	0	463	22	0
All	All	40711	0	40527	1056	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 13.

The worst 5 of 1056 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:1437:TYR:HH	1:A:1502:SER:N	1.47	1.12
1:A:2374:LEU:HD12	1:A:2375:ALA:H	1.37	0.88
1:A:1976:LEU:HD12	1:A:1979:GLU:HB3	1.57	0.86
3:E:411:VAL:HG11	3:E:434:LEU:HG	1.56	0.85
4:F:387:LEU:HD12	4:F:388:ASP:H	1.44	0.82

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	3557/4128 (86%)	3192 (90%)	365 (10%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	D	154/399 (39%)	132 (86%)	21 (14%)	1 (1%)	22	55
3	E	556/609 (91%)	513 (92%)	43 (8%)	0	100	100
4	F	551/732 (75%)	493 (90%)	58 (10%)	0	100	100
All	All	4818/5868 (82%)	4330 (90%)	487 (10%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	192	GLU

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	3218/3671 (88%)	3202 (100%)	16 (0%)	86	93
2	D	133/336 (40%)	133 (100%)	0	100	100
3	E	507/548 (92%)	504 (99%)	3 (1%)	84	92
4	F	496/649 (76%)	494 (100%)	2 (0%)	89	95
All	All	4354/5204 (84%)	4333 (100%)	21 (0%)	85	93

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

Mol	Chain	Res	Type
1	A	3450	MET
3	E	205	LEU
4	F	353	ARG
3	E	281	LEU
3	E	85	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 45 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3339	ASN
1	A	3903	HIS
1	A	3379	GLN
1	A	3423	GLN
2	D	48	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

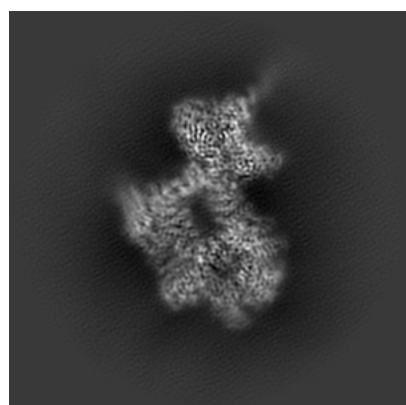
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-19065. These allow visual inspection of the internal detail of the map and identification of artifacts.

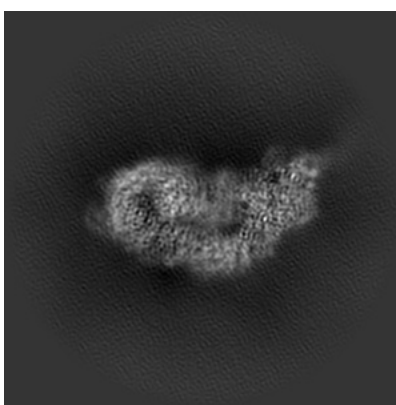
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

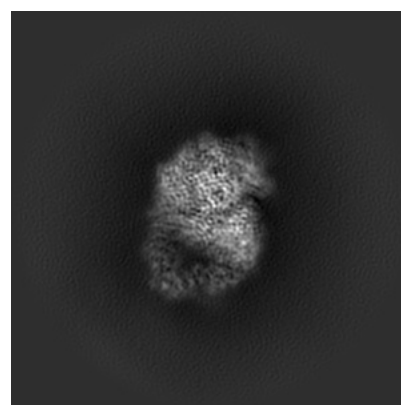
6.1.1 Primary map



X



Y

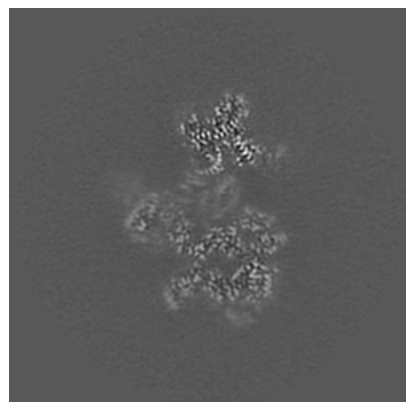


Z

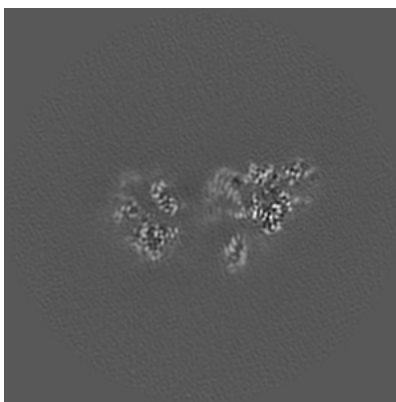
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

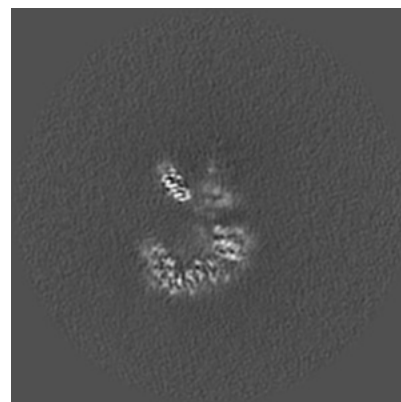
6.2.1 Primary map



X Index: 192



Y Index: 192

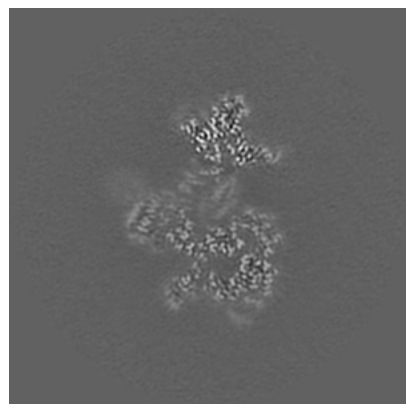


Z Index: 192

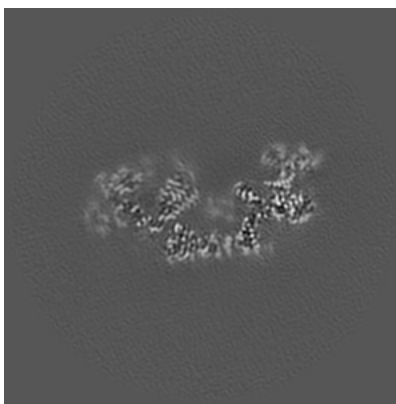
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

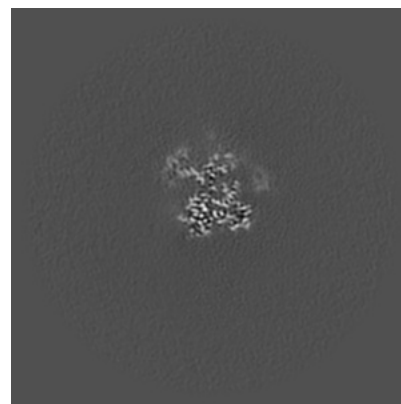
6.3.1 Primary map



X Index: 194



Y Index: 217



Z Index: 251

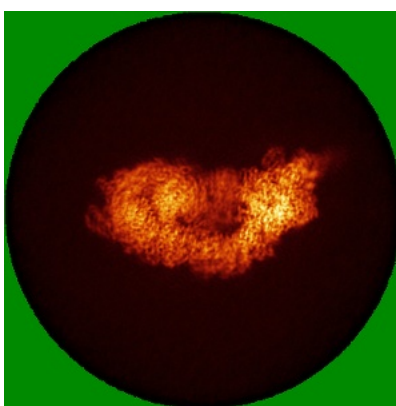
The images above show the largest variance slices of the map in three orthogonal directions.

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

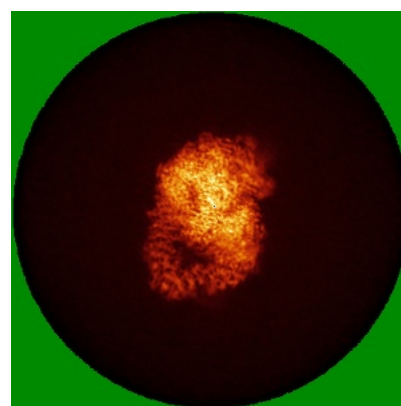
6.4.1 Primary map



X



Y

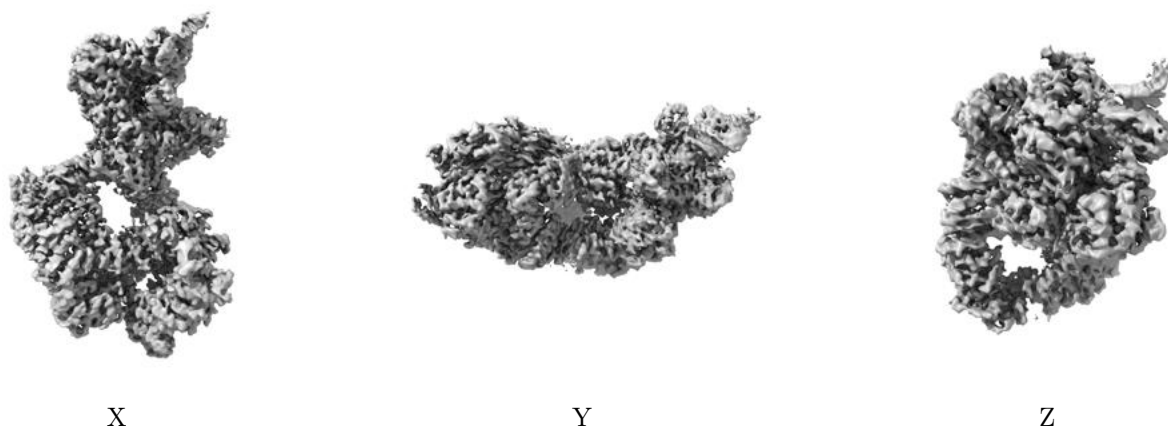


Z

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 5.2. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

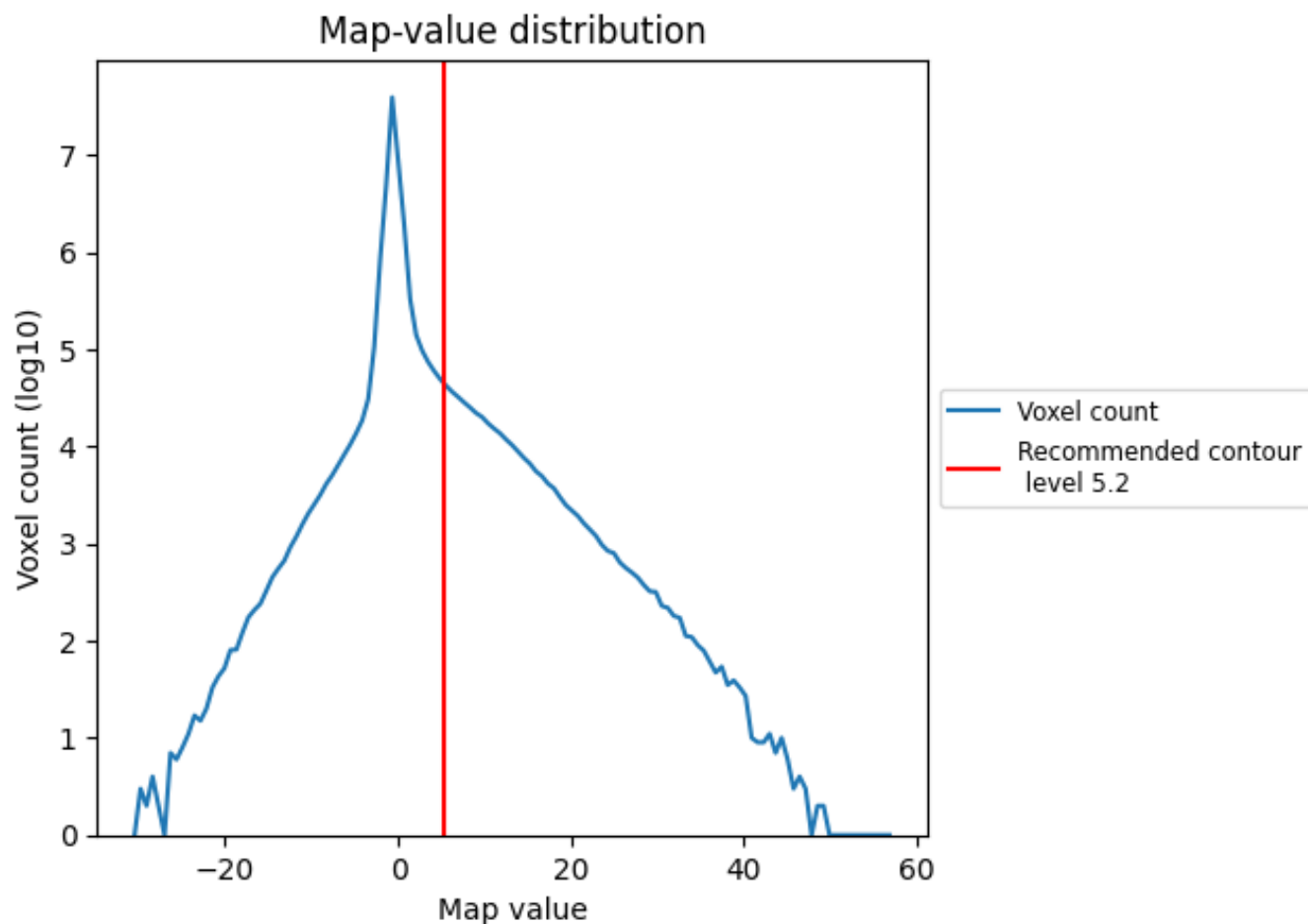
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

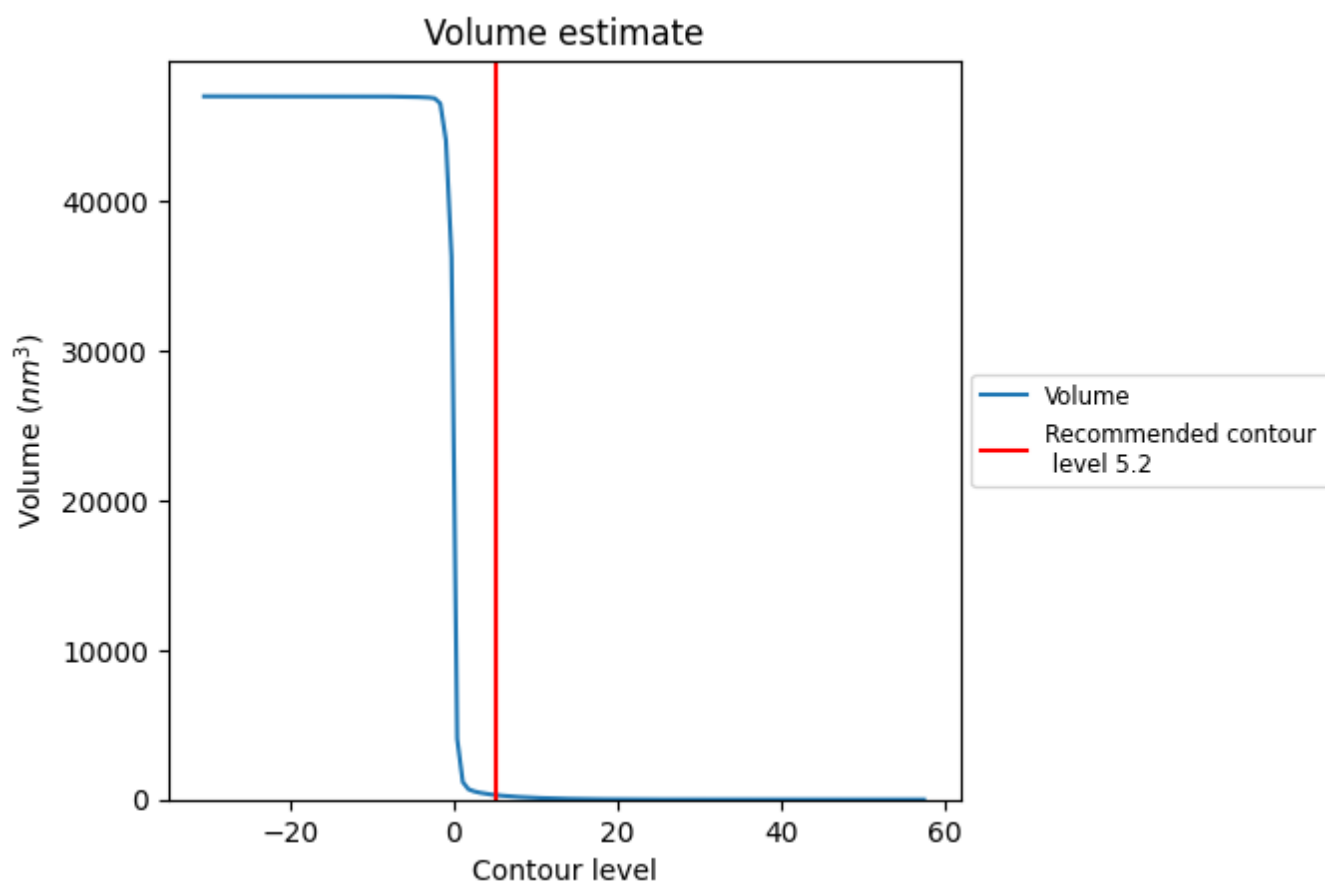
This section contains the results of statistical analysis of the map.

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.

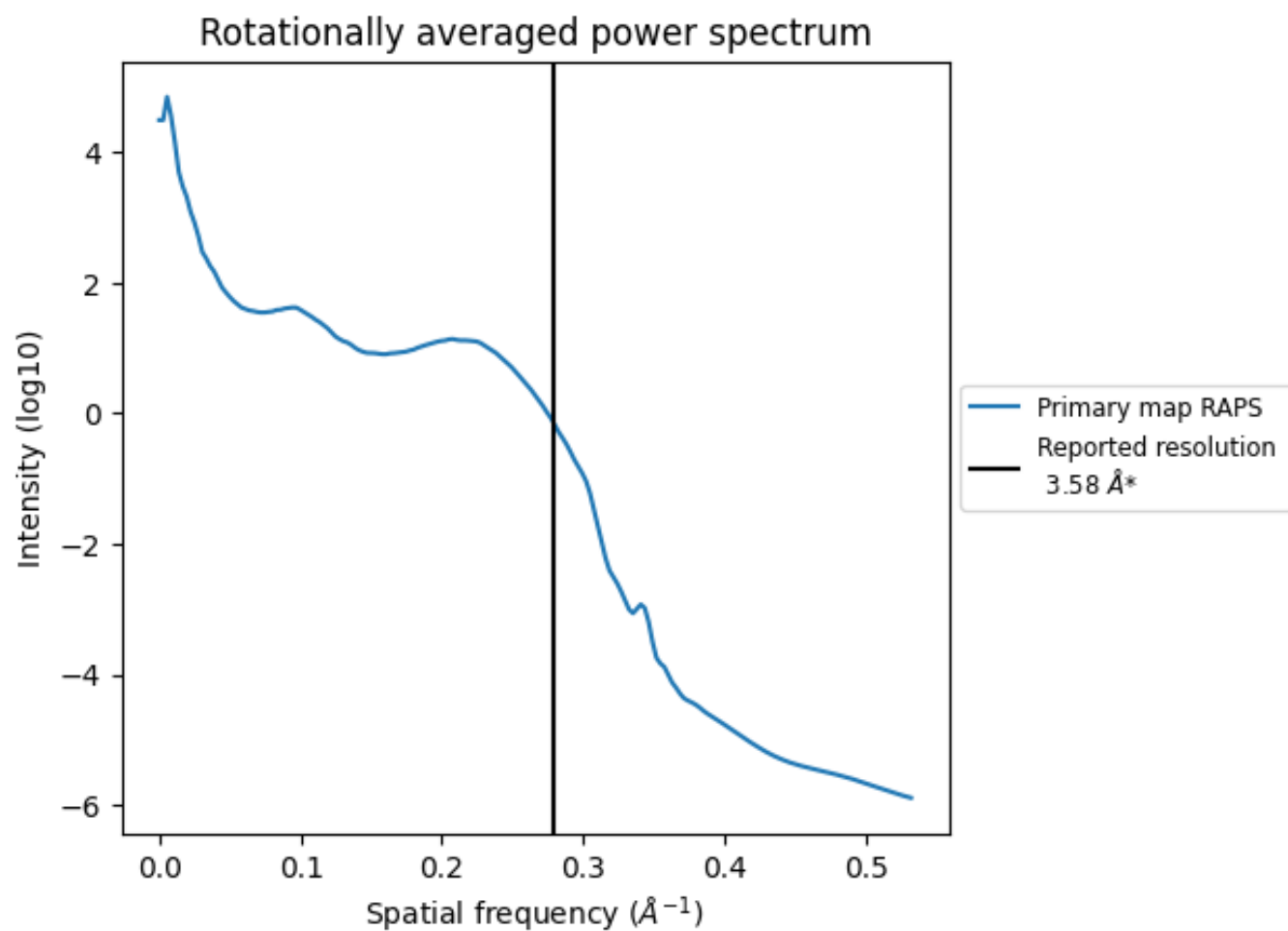
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 301 nm^3 ; this corresponds to an approximate mass of 272 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 0.279 Å⁻¹

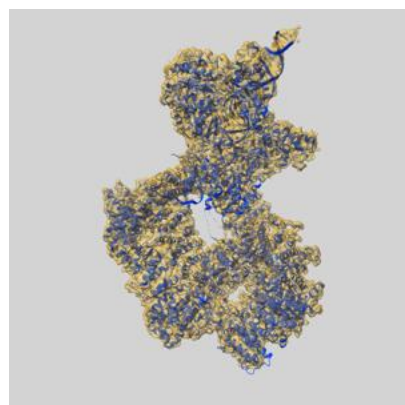
8 Fourier-Shell correlation

This section was not generated. No FSC curve or half-maps provided.

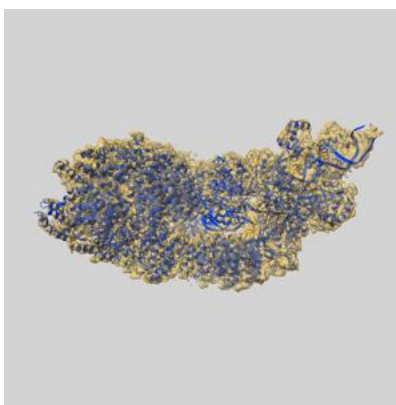
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-19065 and PDB model 8RD4. Per-residue inclusion information can be found in [section 3](#) on [page 4](#).

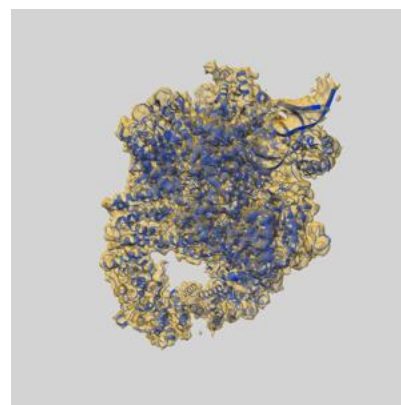
9.1 Map-model overlay [i](#)



X



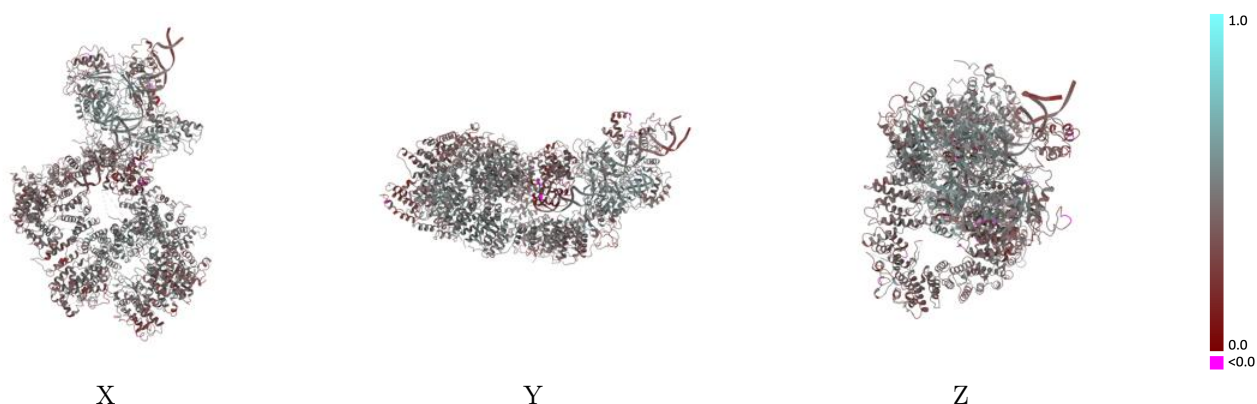
Y



Z

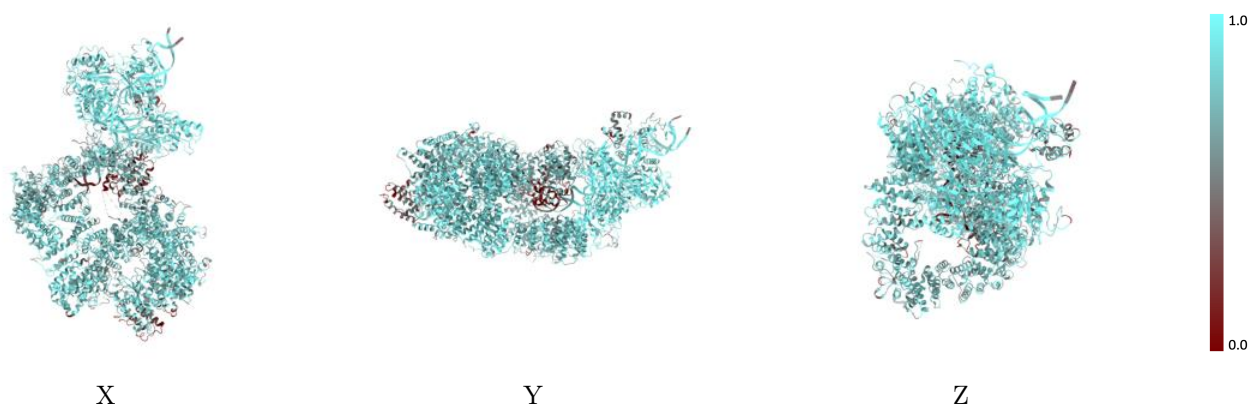
The images above show the 3D surface view of the map at the recommended contour level 5.2 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



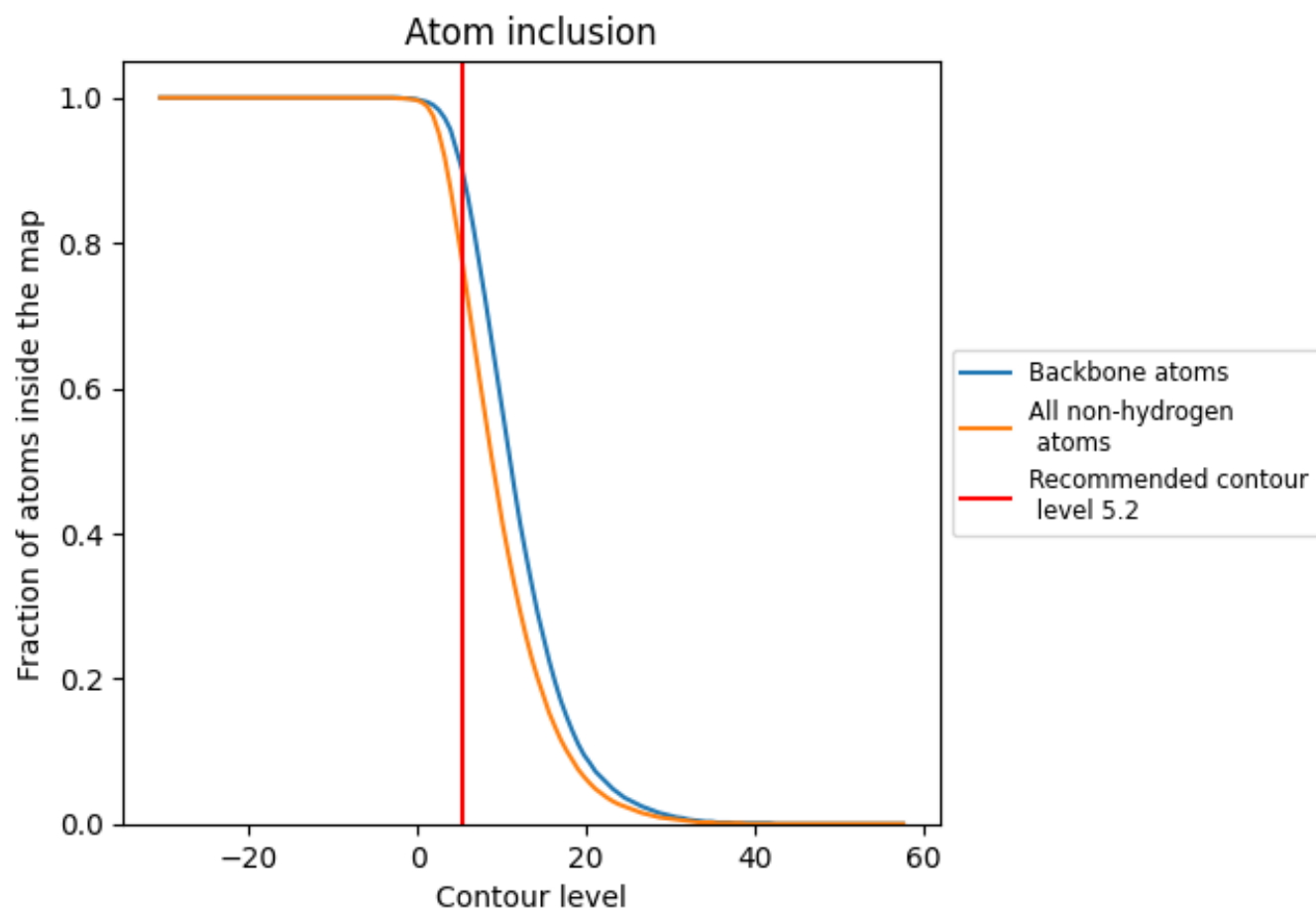
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (5.2).

9.4 Atom inclusion [i](#)



At the recommended contour level, 90% of all backbone atoms, 78% 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 (5.2) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7820	0.4280
A	0.7570	0.4190
D	0.8340	0.4110
E	0.8580	0.4590
F	0.8440	0.4610
X	0.8110	0.4230
Y	0.8090	0.4170

1.0

0.0

<0.0