wwPDB EM Validation Summary Report (i)

Dec 4, 2023 – 02:27 PM JST

PDB ID	:	8X2I
EMDB ID	:	EMD-38011
Title	:	Cryo-EM structure of the TcsL at pH 5.0 in its open conformation
Authors	:	Zhan, X.; Tao, L.
Deposited on	:	2023-11-09
Resolution	:	2.50 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 (i) 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 (i)) were used in the production of this report:

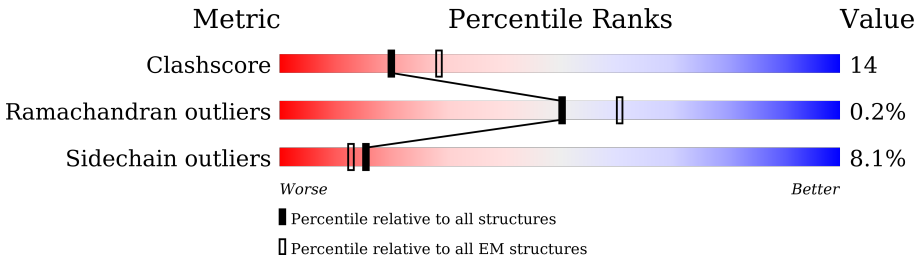
EMDB validation analysis	:	0.0.1.dev70
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ	:	1.9.9
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 2.50 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	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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 <=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	2372	25% 65% 29%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 18645 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 Cytotoxin-L.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	2303	18644	11942	2959	3697	46	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	2365	HIS	-	expression tag	UNP T0D3N5
A	2366	HIS	-	expression tag	UNP T0D3N5
A	2367	HIS	-	expression tag	UNP T0D3N5
A	2368	HIS	-	expression tag	UNP T0D3N5
A	2369	HIS	-	expression tag	UNP T0D3N5
A	2370	HIS	-	expression tag	UNP T0D3N5
A	2371	HIS	-	expression tag	UNP T0D3N5
A	2372	HIS	-	expression tag	UNP T0D3N5

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

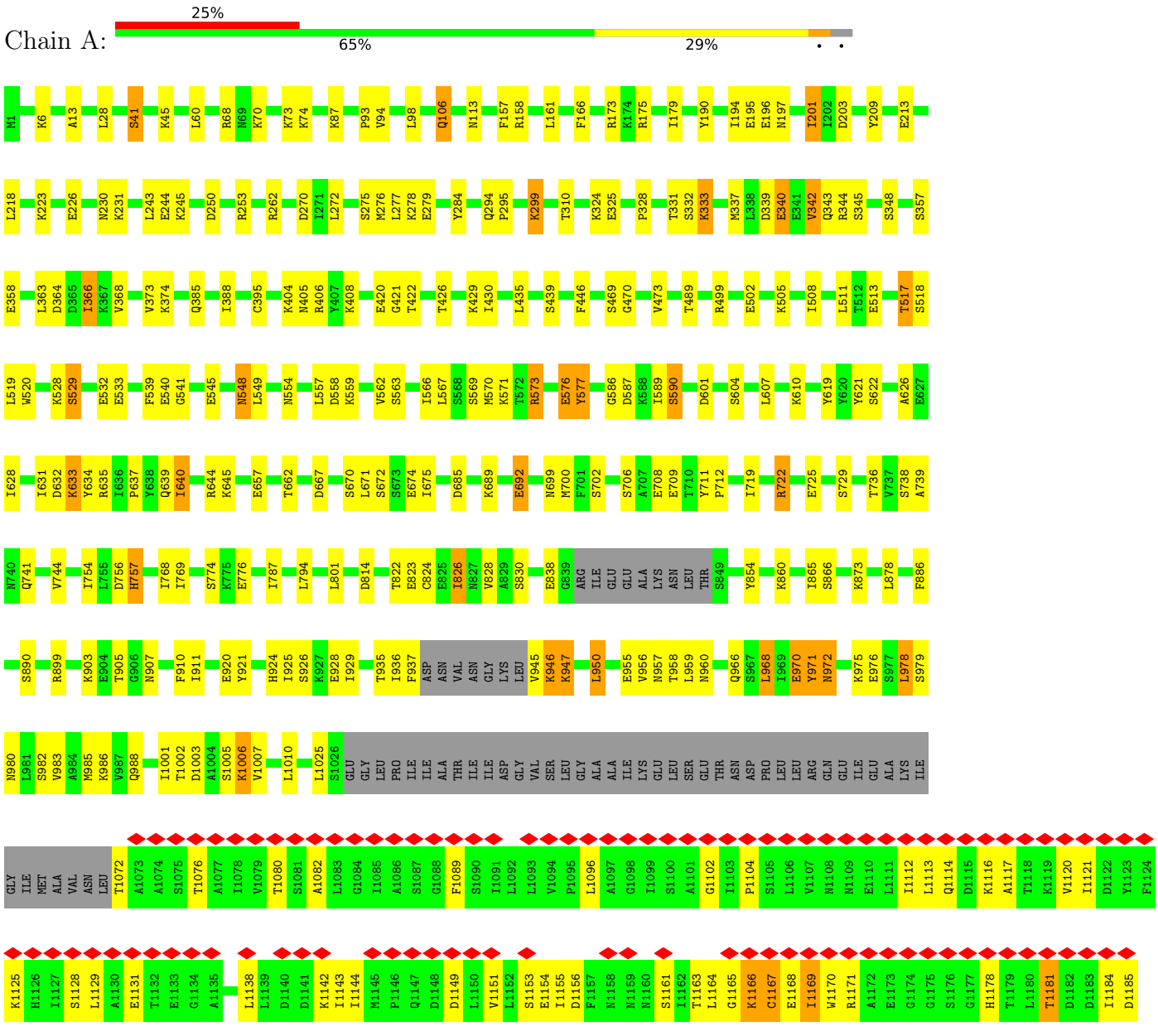
Mol	Chain	Residues	Atoms		AltConf
			Total	Zn	
2	A	1	1	1	0

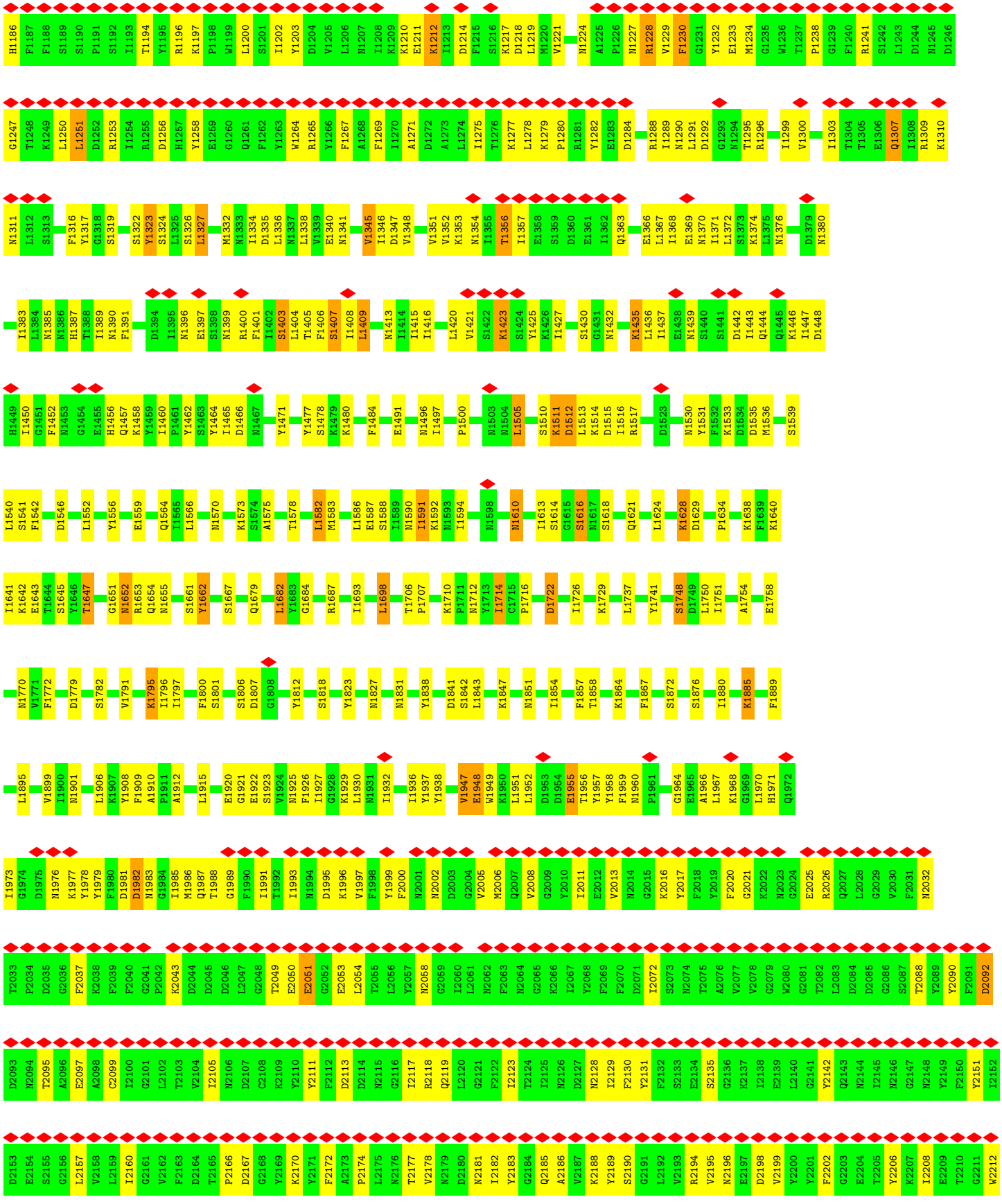
3 Residue-property plots (i)

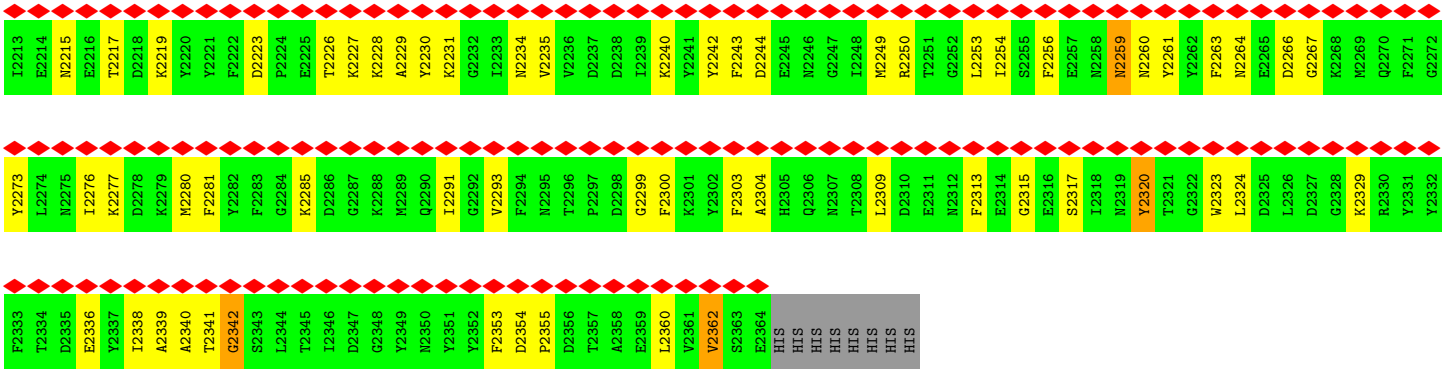
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion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

Chain A:




H1186 F1187 F1188 S1189 S1190 P1191 S1192 I1193 T1194 Y1195 R1196 K1197 P1198 W1199 L1200 S1201 I1202 Y1203 D1204 V1205 L1206 N1207 I1208 K1209 K1210 E1211 K1212 I1213 D1214 F1215 S1216 K1217 D1218 L1219 M1220 V1221 N1224 A1225 P1226 N1227 R1228 V1229 F1230 G1231 Y1232 E1233 M1234 G1235 W1236 T1237 P1238 G1239 F1240 R1241 S1242 L1243 D1244 N1245 D1246
G1247 T1248 K1249 L1250 L1251 D1252 R1253 I1254 R1255 D1256 H1257 Y1258 E1259 G1260 Q1261 F1262 Y1263 W1264 R1265 Y1266 F1267 A1268 F1269 I1270 A1271 D1272 A1273 L1274 I1275 T1276 K1277 L1278 K1279 P1280 R1281 Y1282 E1283 D1284 R1288 I1289 N1290 L1291 D1292 G1293 N1294 T1295 R1296 I1299 V1300 I1303 T1304 T1305 E1306 Q1307 I1308 R1309 K1310
N1311 L1312 S1313 F1316 Y1317 G1318 S1319 S1322 Y1323 S1324 L1325 S1326 L1327 M1332 N1333 I1334 D1335 L1336 N1337 L1338 Y1339 E1340 N1341 V1345 I1346 D1347 V1348 V1351 V1352 K1353 N1354 I1355 T1356 I1357 E1358 S1359 D1360 E1361 I1362 Q1363 E1366 L1367 I1368 E1369 N1370 I1371 L1372 S1373 K1374 L1375 N1376 D1379 N1380
I1383 L1384 N1385 N1386 H1387 T1388 I1389 N1390 F1391 D1394 I1395 N1396 E1397 S1398 N1399 R1400 F1401 I1402 S1403 L1404 T1405 F1406 S1407 I1408 L1409 N1413 I1414 I1415 I1416 L1420 V1421 S1422 K1423 S1424 Y1425 K1426 I1427 S1430 G1431 N1432 K1435 L1436 I1437 E1438 N1439 S1440 S1441 D1442 I1443 Q1444 Q1445 K1446 I1447 D1448
H1449 I1450 G1451 F1452 N1453 G1454 E1455 H1456 Q1457 K1458 Y1459 I1460 P1461 Y1462 S1463 Y1464 I1465 D1466 N1467 Y1471 Y1477 S1478 K1479 K1480 F1484 E1491 N1496 I1497 P1500 N1503 N1504 L1505 S1510 K1511 D1512 L1513 K1514 D1515 I1516 R1517 D1523 N1530 Y1531 F1532 K1533 D1534 D1535 M1536 S1539
L1540 S1541 F1542 D1546 L1552 Y1556 E1559 Q1564 I1565 L1566 N1570 K1573 S1574 A1575 T1578 L1582 M1583 L1586 E1587 S1588 I1589 N1590 I1591 K1592 N1593 I1594 N1598 M1610 I1613 S1614 G1615 S1616 N1617 S1618 Q1621 L1624 K1628 D1629 P1634 K1638 F1639 K1640
I1641 K1642 E1643 T1644 S1645 Y1646 T1647 G1651 N1652 R1653 Q1654 N1655 S1661 Y1662 S1667 Q1679 L1682 Y1683 G1684 R1687 I1693 L1698 T1706 P1707 K1710 P1711 N1712 Y1713 I1714 C1715 P1716 D1722 I1726 K1729 L1737 Y1741 S1748 D1749 L1750 I1751 A1754 E1758
N1770 V1771 F1772 D1779 S1782 V1791 K1795 I1796 I1797 F1800 S1801 S1806 D1807 G1808 Y1812 S1818 Y1823 N1827 N1831 Y1838 D1841 S1842 L1843 K1847 N1851 I1854 F1857 T1858 K1864 F1867 S1872 S1876 I1880 K1885 F1889
L1895 V1899 I1900 N1901 L1906 K1907 Y1908 F1909 A1910 P1911 A1912 L1915 E1920 G1921 E1922 S1923 V1924 N1925 F1926 I1927 G1928 K1929 L1930 N1931 I1932 I1936 Y1937 Y1938 V1947 E1948 W1949 K1950 L1951 L1952 D1953 D1954 E1955 T1956 Y1957 Y1958 F1959 N1960 P1961 G1964 E1965 A1966 L1967 K1968 G1969 L1970 H1971 Q1972
I1973 G1974 D1975 N1976 K1977 Y1978 Y1979 F1980 D1981 D1982 N1983 G1984 I1985 M1986 Q1987 T1988 G1989 F1990 I1991 T1992 I1993 N1994 D1995 K1996 V1997 F1998 Y1999 F2000 N2001 N2002 D2003 G2004 V2005 M2006 Q2007 V2008 G2009 Y2010 I2011 E2012 V2013 N2014 G2015 K2016 Y2017 F2018 Y2019 F2020 G2021 K2022 N2023 G2024 E2025 R2026 Q2027 L2028 G2029 V2030 F2031 N2032
T2033 P2034 D2035 G2036 F2037 K2038 F2039 F2040 G2041 P2042 K2043 D2044 D2045 D2046 L2047 G2048 T2049 E2050 E2051 G2052 E2053 L2054 T2055 L2056 Y2057 N2058 G2059 I2060 L2061 N2062 F2063 N2064 G2065 K2066 I2067 Y2068 F2069 F2070 D2071 I2072 S2073 N2074 T2075 A2076 V2077 Y2078 G2079 W2080 G2081 T2082 L2083 D2084 D2085 G2086 S2087 T2088 Y2089 Y2090 F2091 D2092
D2093 N2094 T2095 A2096 E2097 A2098 C2099 I2100 G2101 L2102 T2103 V2104 I2105 N2106 D2107 C2108 K2109 Y2110 Y2111 F2112 D2113 D2114 N2115 G2116 I2117 R2118 Q2119 L2120 G2121 F2122 I2123 I2124 I2125 N2126 D2127 N2128 I2129 F2130 Y2131 F2132 S2133 E2134 S2135 G2136 K2137 I2138 E2139 L2140 G2141 Y2142 Q2143 N2144 I2145 N2146 G2147 N2148 Y2149 F2150 Y2151 I2152
D2153 E2154 S2155 G2156 L2157 V2158 L2159 I2160 G2161 V2162 F2163 D2164 T2165 P2166 D2167 G2168 Y2169 K2170 Y2171 F2172 A2173 P2174 L2175 N2176 T2177 V2178 N2179 D2180 N2181 I2182 Y2183 G2184 Q2185 A2186 V2187 K2188 Y2189 S2190 G2191 L2192 V2193 R2194 V2195 N2196 E2197 D2198 V2199 Y2200 Y2201 F2202 G2203 E2204 T2205 Y2206 K2207 I2208 E2209 T2210 G2211 W2212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Y2273 L2274 N2275 I2276 K2277 D2278 K2279 M2280 F2281 Y2282 F2283 G2284 K2285 D2286 G2287 K2288 M2289 Q2290 I2291 G2292 V2293 F2294 N2295 T2296 P2297 D2298 G2299 F2300 K2301 Y2302 F2303 A2304 H2305 Q2306 N2307 T2308 L2309 D2310 E2311 N2312 F2313 E2314 G2315 E2316 S2317 I2318 N2319 Y2320 T2321 G2322 W2323 L2324 D2325 L2326 D2327 G2328 K2329 R2330 Y2331 Y2332
F2333 T2334 D2335 E2336 Y2337 I2338 A2339 A2340 T2341 G2342 S2343 L2344 T2345 I2346 D2347 G2348 Y2349 N2350 Y2351 Y2352 F2353 D2354 P2355 D2356 T2357 A2358 E2359 L2360 V2361 V2362 S2363 E2364 HIS HIS HIS HIS HIS HIS HIS HIS

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	1045888	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	50	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	12.371	Depositor
Minimum map value	-8.281	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.107	Depositor
Recommended contour level	0.25	Depositor
Map size (Å)	434.80002, 434.80002, 434.80002	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.087, 1.087, 1.087	Depositor

5 Model quality

5.1 Standard geometry

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

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	0.45	2/19023 (0.0%)	0.56	2/25734 (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
1	A	0	2

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	284	TYR	CD1-CE1	-5.46	1.31	1.39
1	A	284	TYR	CD2-CE2	-5.22	1.31	1.39

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	1505	LEU	CA-CB-CG	6.18	129.52	115.30
1	A	1982	ASP	CB-CG-OD2	5.10	122.89	118.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	1511	LYS	Peptide
1	A	364	ASP	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	18644	0	18175	508	0
2	A	1	0	0	0	0
All	All	18645	0	18175	508	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 14.

The worst 5 of 508 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:1956:THR:HG23	1:A:1986:MET:N	1.21	1.51
1:A:1956:THR:CG2	1:A:1986:MET:N	1.86	1.38
1:A:1956:THR:HG21	1:A:1986:MET:CA	1.71	1.19
1:A:1956:THR:HG21	1:A:1986:MET:CB	1.74	1.18
1:A:1956:THR:CG2	1:A:1986:MET:CB	2.34	1.05

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	2295/2372 (97%)	2163 (94%)	128 (6%)	4 (0%)	47 68

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1948	GLU
1	A	633	LYS
1	A	2342	GLY
1	A	422	THR

5.3.2 Protein sidechains (i)

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	2088/2146 (97%)	1919 (92%)	169 (8%)	11 23

5 of 169 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1465	ILE
1	A	1722	ASP
1	A	1517	ARG
1	A	1628	LYS
1	A	1841	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 31 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1290	ASN
1	A	2058	ASN
1	A	1449	HIS
1	A	2260	ASN
1	A	1724	ASN

5.3.3 RNA (i)

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

There are no monosaccharides in this entry.

5.6 Ligand geometry

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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.

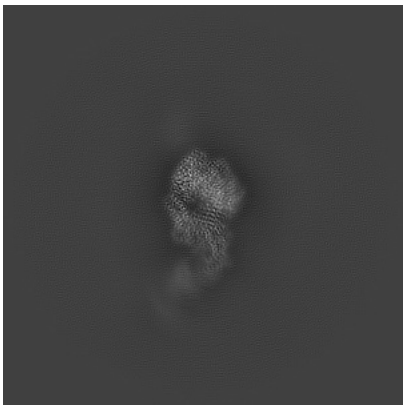
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-38011. These allow visual inspection of the internal detail of the map and identification of artifacts.

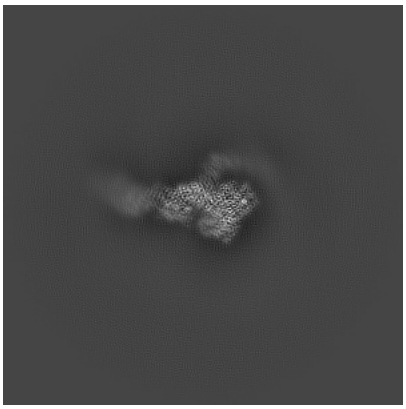
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections

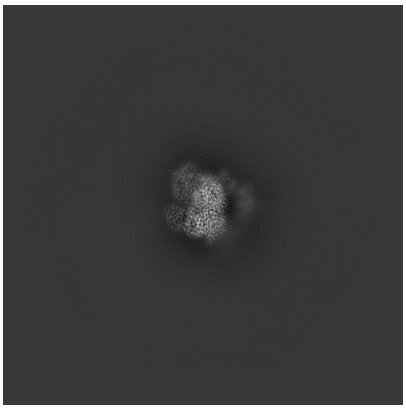
6.1.1 Primary map



X

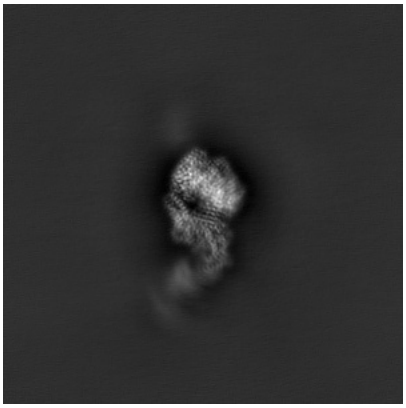


Y

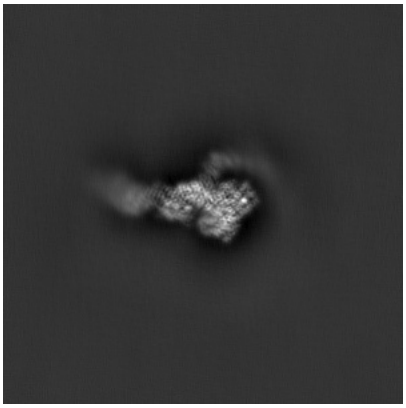


Z

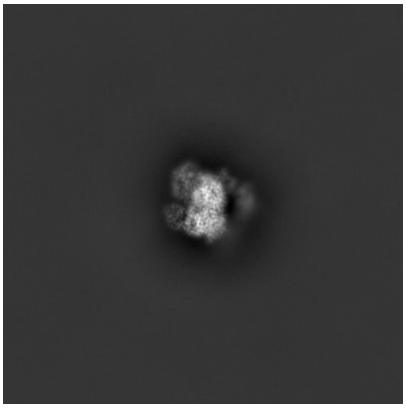
6.1.2 Raw map



X



Y

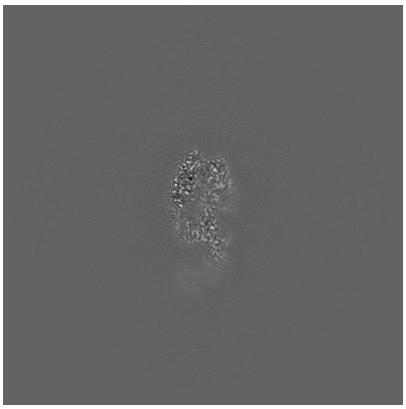


Z

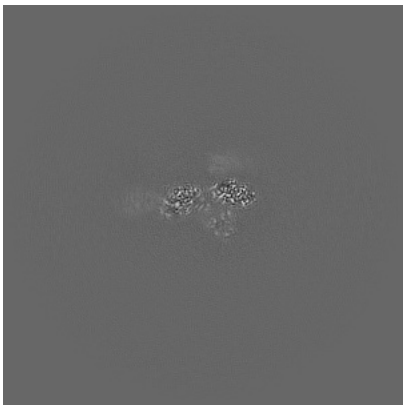
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

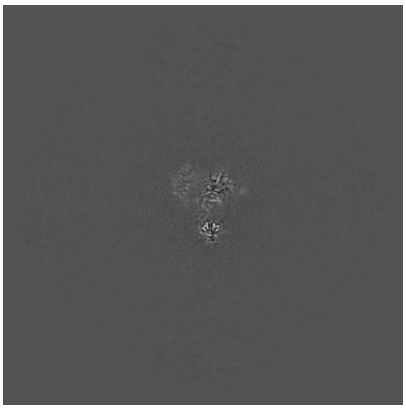
6.2.1 Primary map



X Index: 200

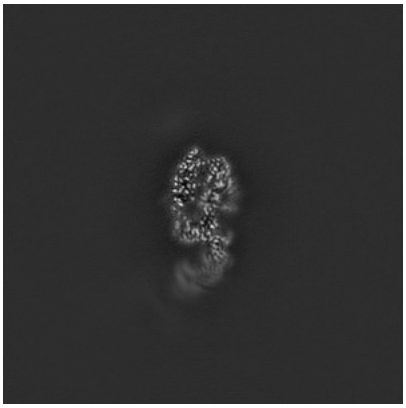


Y Index: 200

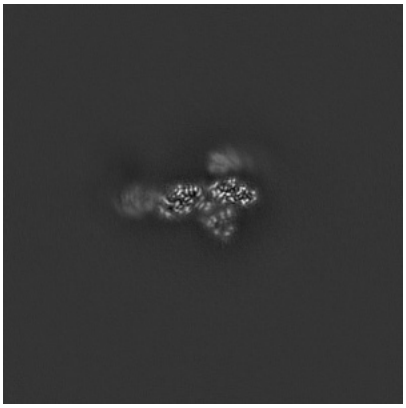


Z Index: 200

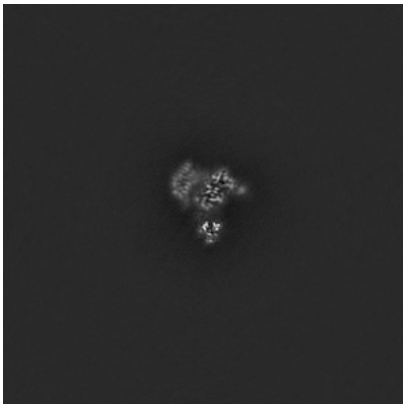
6.2.2 Raw map



X Index: 200



Y Index: 200



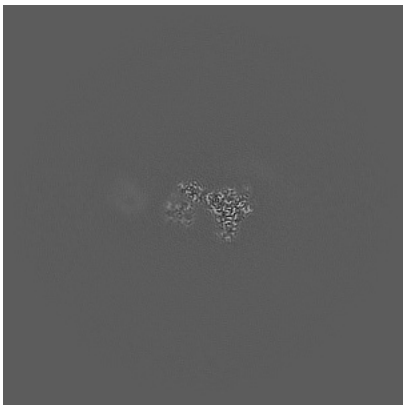
Z Index: 200

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

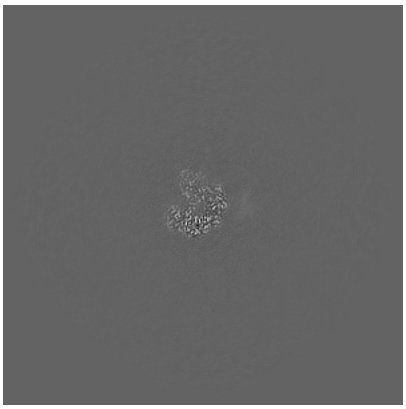
6.3 Largest variance slices (i)

6.3.1 Primary map

X Index: 204

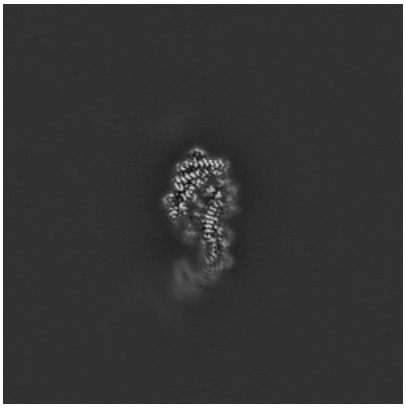


Y Index: 182

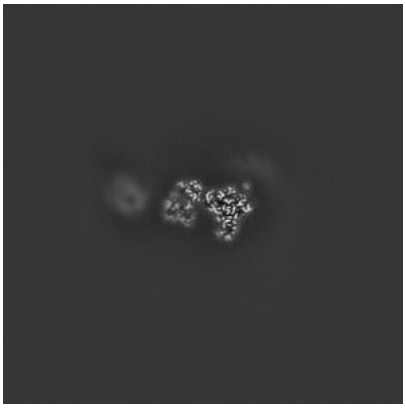


Z Index: 226

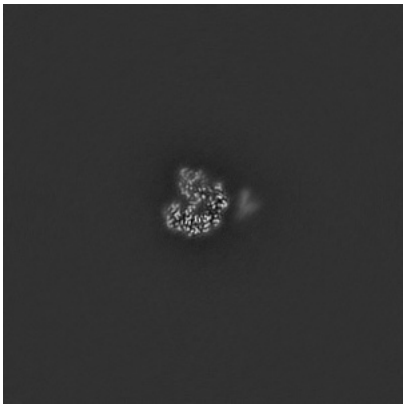
6.3.2 Raw map



X Index: 204



Y Index: 182

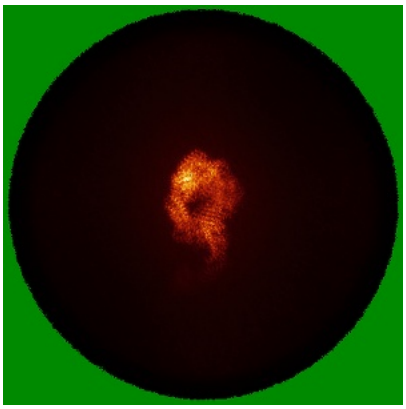


Z Index: 226

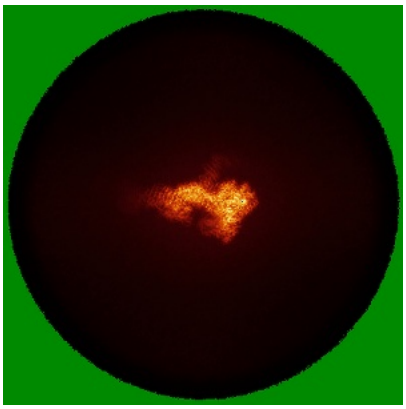
The images above show the largest variance slices of the map in three orthogonal directions.

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

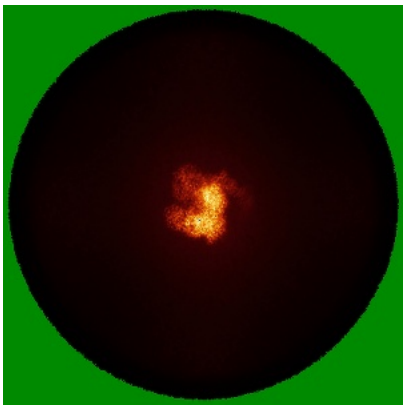
6.4.1 Primary map



X

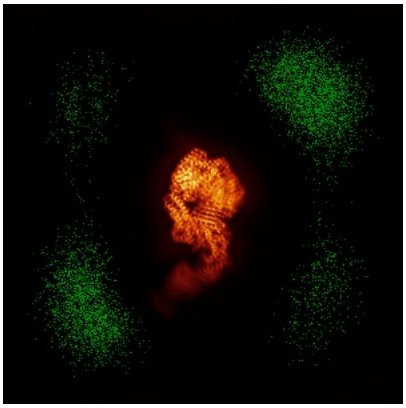


Y

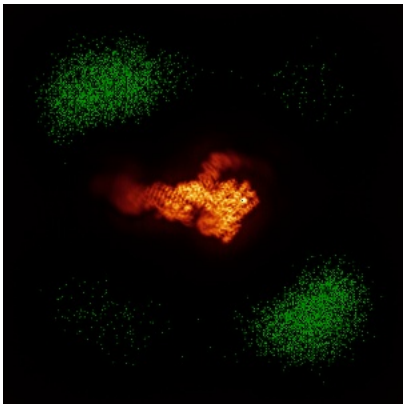


Z

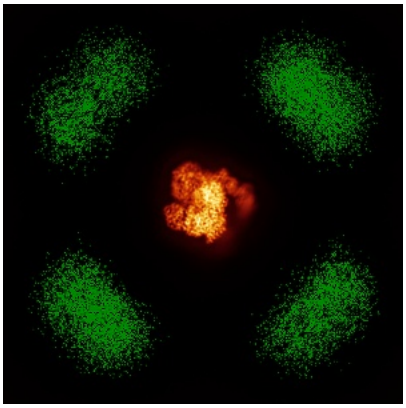
6.4.2 Raw map



X



Y

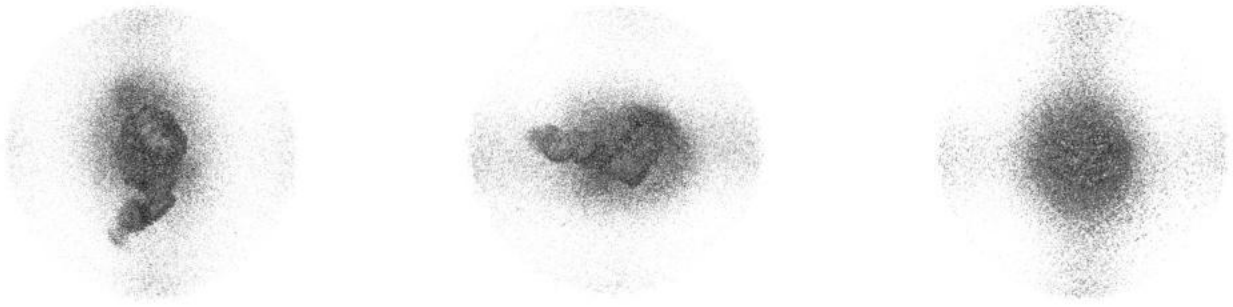


Z

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



X Y Z

The images above show the 3D surface view of the map at the recommended contour level 0.25. 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

X Y Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

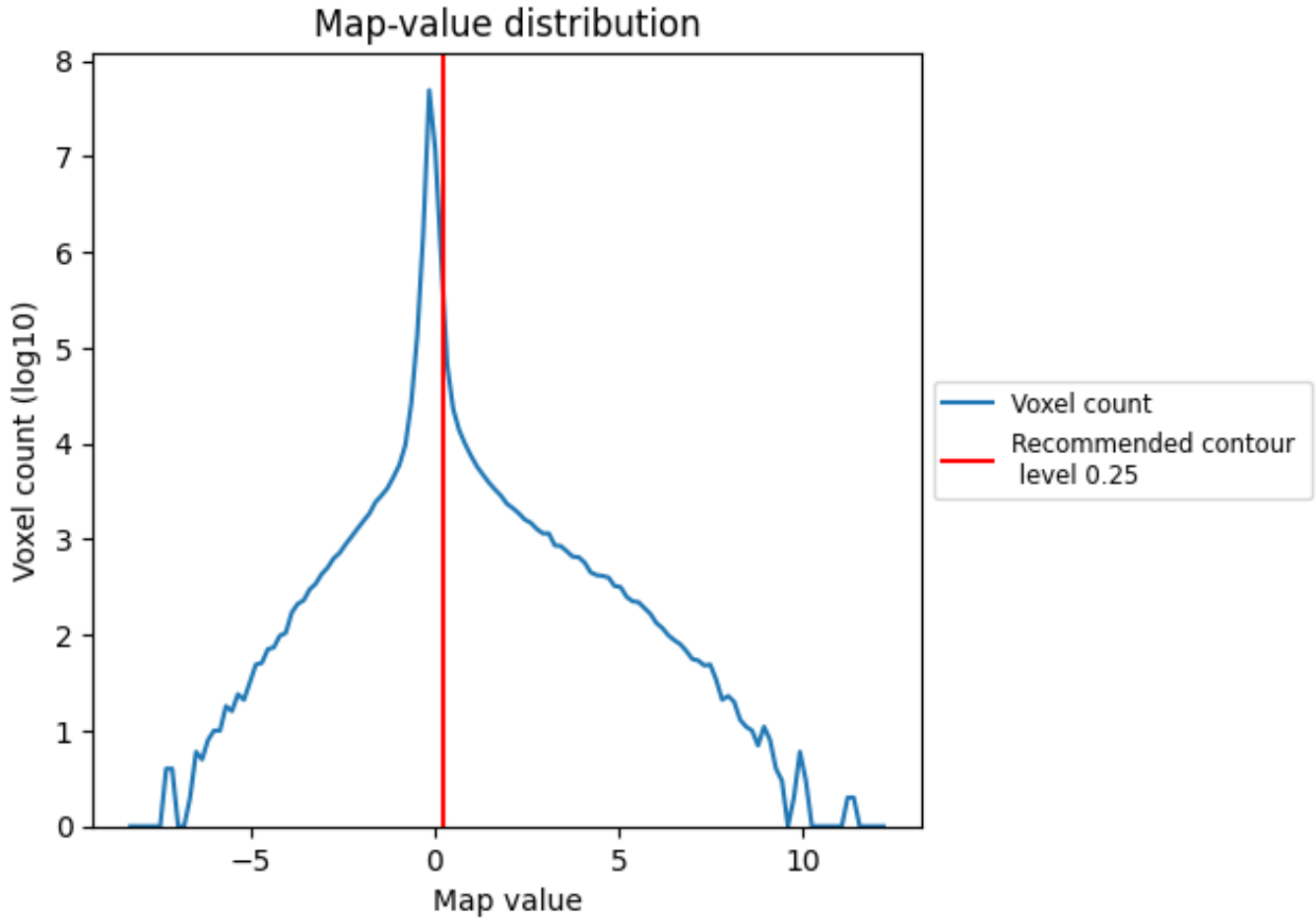
6.6 Mask visualisation (i)

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

7 Map analysis

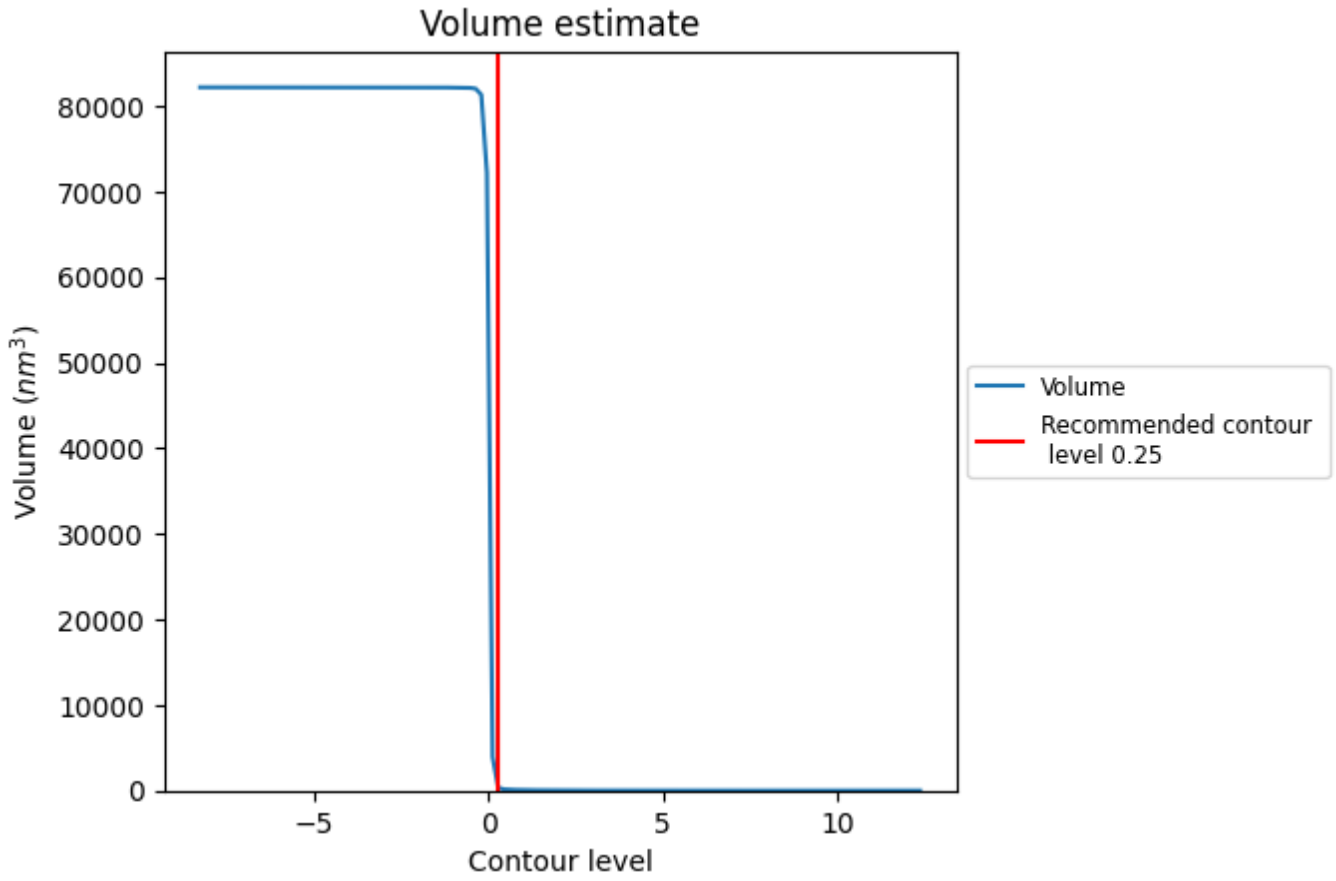
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution



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.

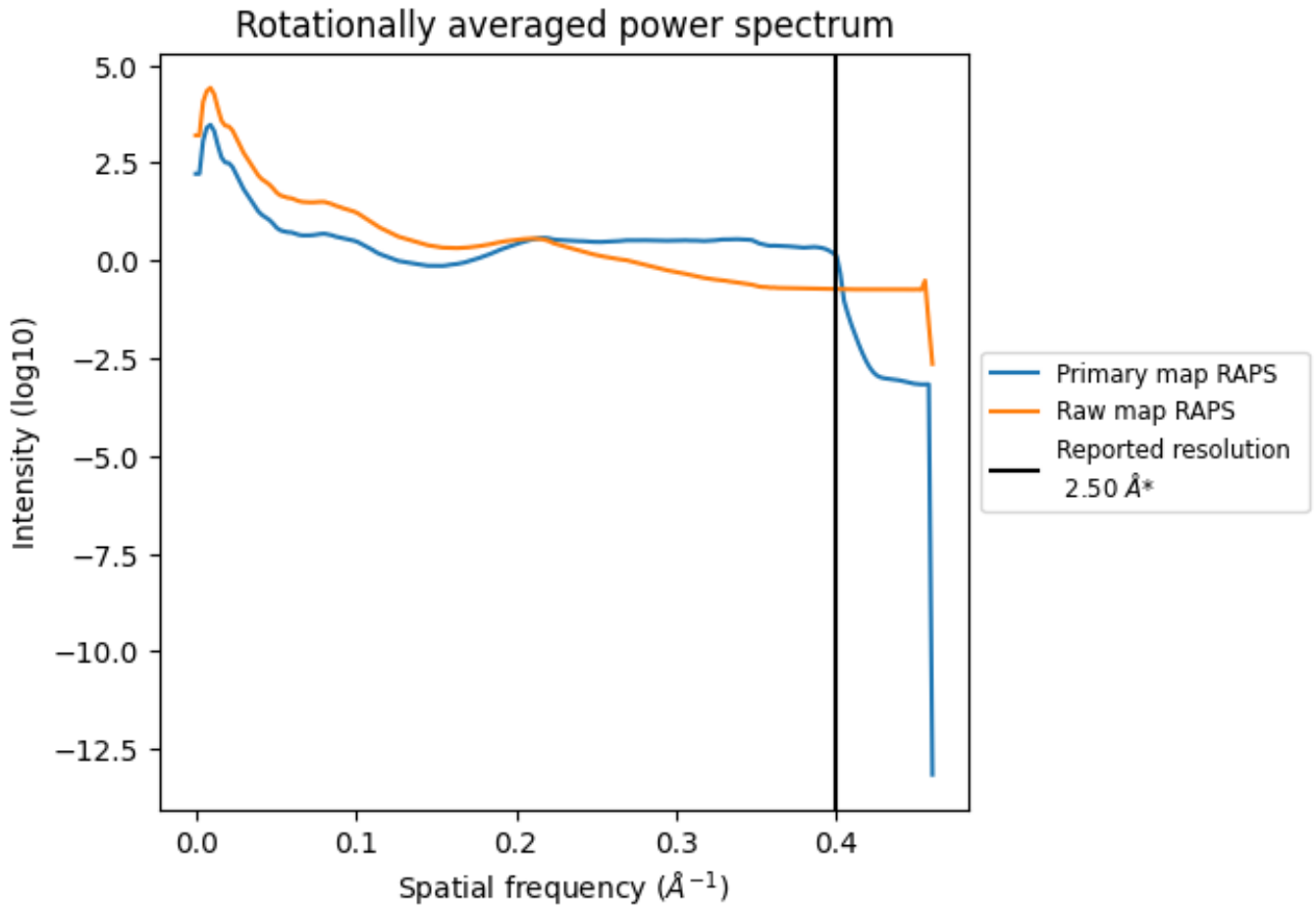
7.2 Volume estimate (i)



The volume at the recommended contour level is 802 nm^3; this corresponds to an approximate mass of 724 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 (i)

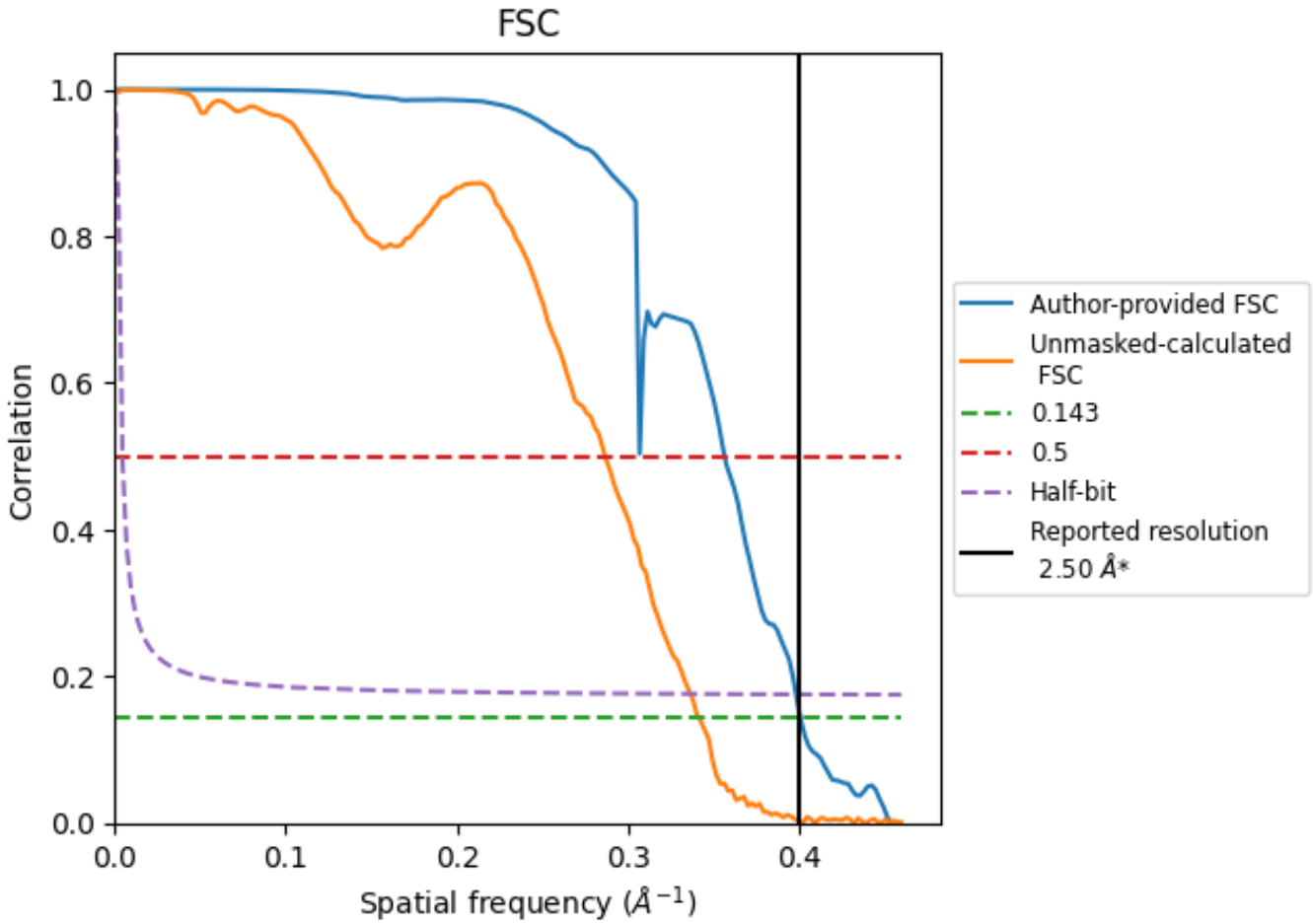


*Reported resolution corresponds to spatial frequency of 0.400 $Å^{-1}$

8 Fourier-Shell correlation

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



*Reported resolution corresponds to spatial frequency of 0.400 Å^{-1}

8.2 Resolution estimates (i)

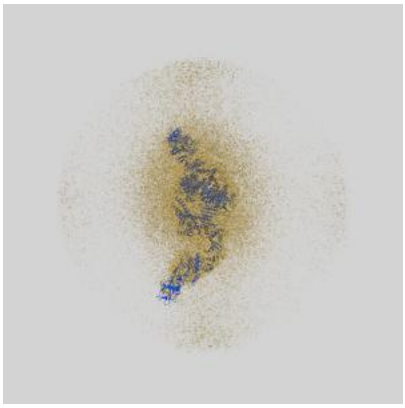
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.50	-	-
Author-provided FSC curve	2.49	2.80	2.51
Unmasked-calculated*	2.93	3.49	2.97

*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 2.93 differs from the reported value 2.5 by more than 10 %

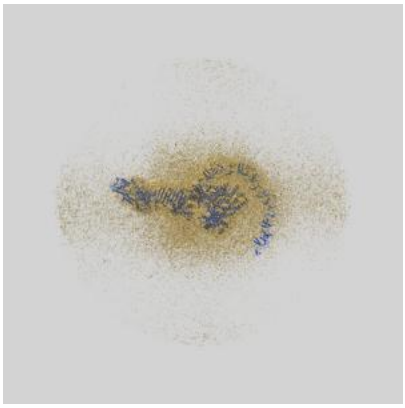
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-38011 and PDB model 8X2I. Per-residue inclusion information can be found in section 3 on page 4.

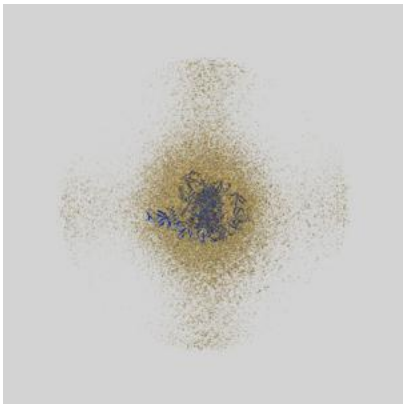
9.1 Map-model overlay



X



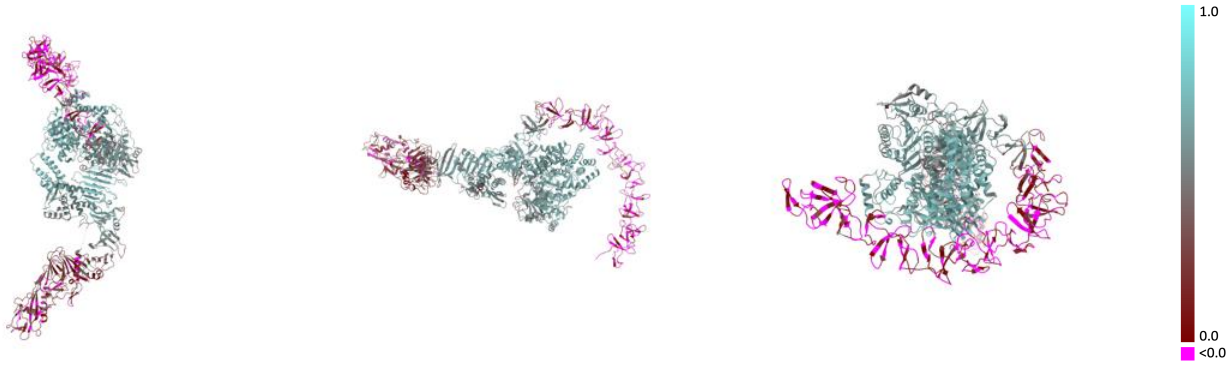
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.25 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.

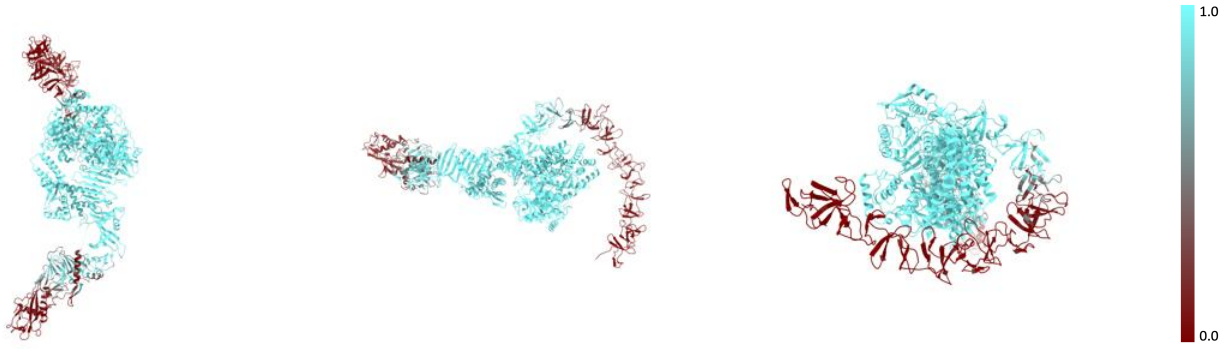
9.2 Q-score mapped to coordinate model



X Y Z

The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

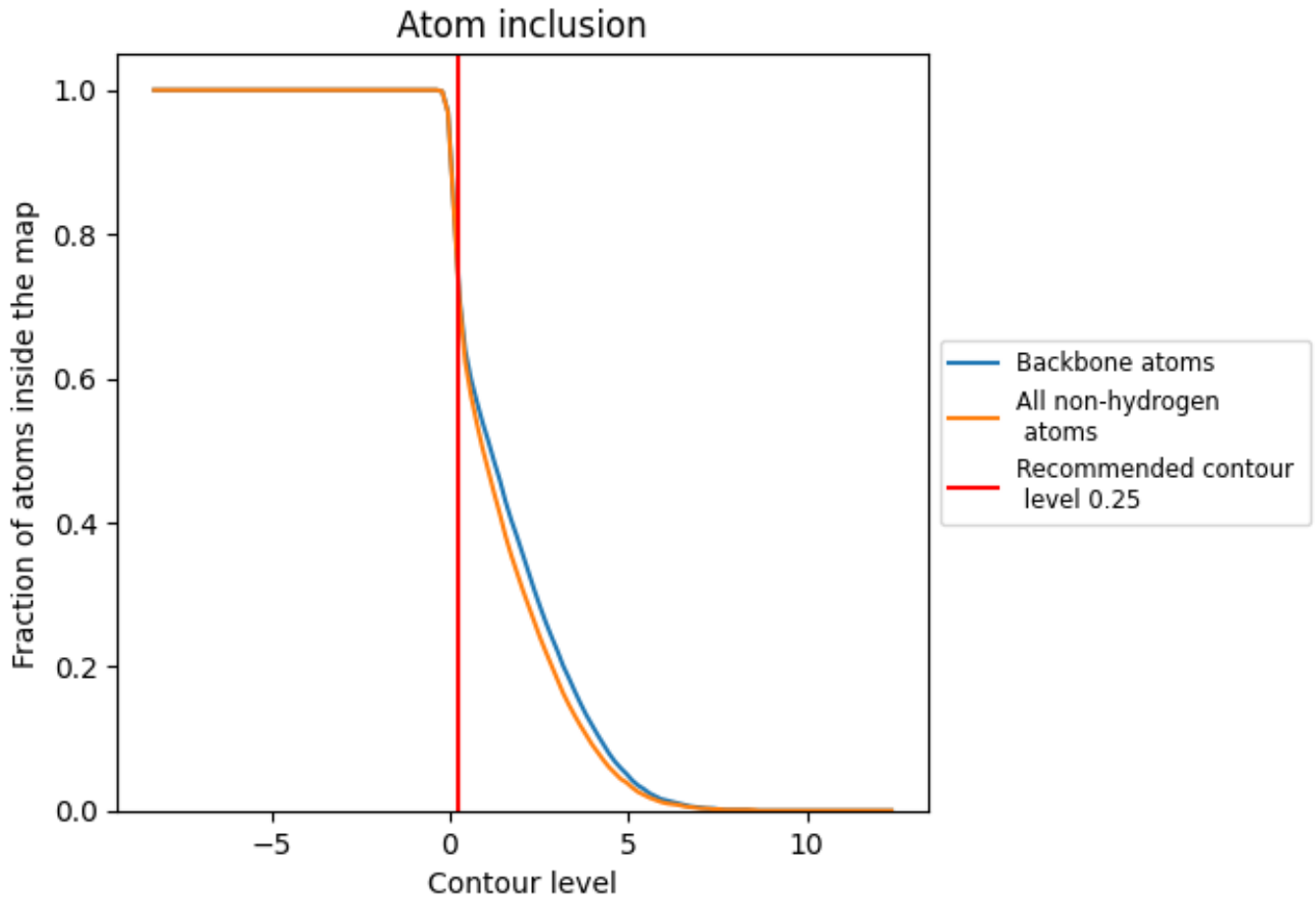
9.3 Atom inclusion mapped to coordinate model



X Y Z

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 (0.25).

9.4 Atom inclusion (i)



At the recommended contour level, 72% of all backbone atoms, 72% 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 (0.25) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7210	0.4140
A	0.7210	0.4140