



wwPDB EM Validation Summary Report ⓘ

Aug 18, 2026 – 06:27 PM JST

PDB ID : 23FE / pdb_000023fe
EMDB ID : EMD-68921
Title : Cryo-EM structure of human ATR-ATRIP complex with ATPgammaS, Chk1 and ETAA1
Authors : Wang, M.; Wang, L.; Cheng, J.; Qiao, S.
Deposited on : 2026-02-04
Resolution : 2.90 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.dev133
Mogul : 1.8.5 (274361), CSD as541be (2020)
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) : 2.50

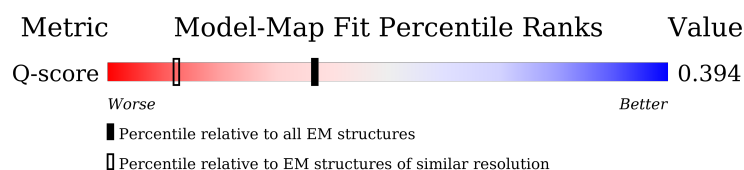
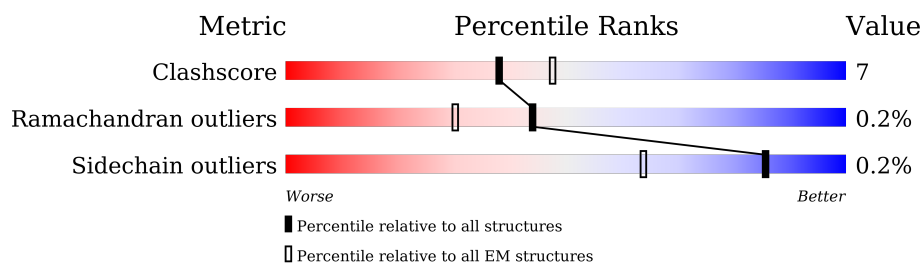
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.90 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	13054 (2.40 - 3.40)

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	2644	
1	B	2644	
2	E	14	
2	F	14	

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Mol	Chain	Length	Quality of chain
3	G	250	20% 6% 78%
3	H	250	6% 19% 80%
4	C	791	38% 7% 54%
4	D	791	39% 7% 54%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 46261 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 Serine/threonine-protein kinase ATR.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	2499	Total	C	N	O	S	0	0
			20025	12849	3397	3639	140		
1	B	2485	Total	C	N	O	S	0	0
			19926	12790	3380	3616	140		

- Molecule 2 is a protein called Serine/threonine-protein kinase Chk1.

Mol	Chain	Residues	Atoms				AltConf	Trace
2	E	8	Total	C	N	O	0	0
			56	34	9	13		
2	F	8	Total	C	N	O	0	0
			49	28	9	12		

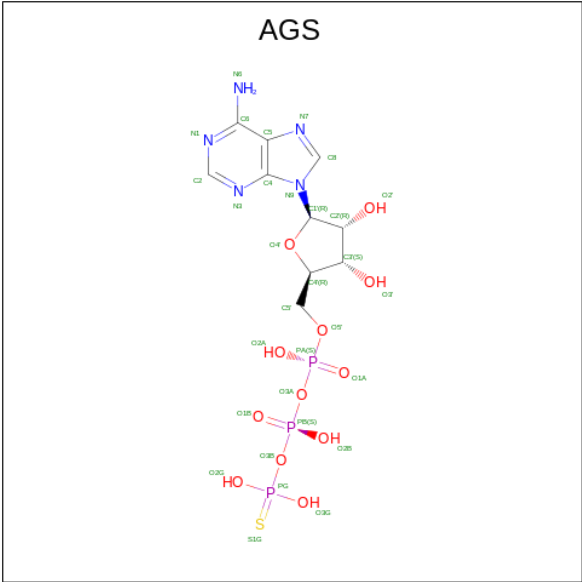
- Molecule 3 is a protein called Ewing's tumor-associated antigen 1.

Mol	Chain	Residues	Atoms				AltConf	Trace
3	G	55	Total	C	N	O	0	0
			315	190	60	65		
3	H	49	Total	C	N	O	0	0
			262	163	50	49		

- Molecule 4 is a protein called ATR-interacting protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	C	361	Total	C	N	O	S	0	0
			2779	1776	484	494	25		
4	D	361	Total	C	N	O	S	0	0
			2779	1776	484	494	25		

- Molecule 5 is PHOSPHOTHIOPHOSPHORIC ACID-ADENYLATE ESTER (CCD ID: AGS) (formula: C₁₀H₁₆N₅O₁₂P₃S).



Mol	Chain	Residues	Atoms						AltConf
5	A	1	Total	C	N	O	P	S	0
			31	10	5	12	3	1	
5	B	1	Total	C	N	O	P	S	0
			31	10	5	12	3	1	

- Molecule 6 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
6	A	2	Total	Mg	0
			2	2	
6	B	2	Total	Mg	0
			2	2	

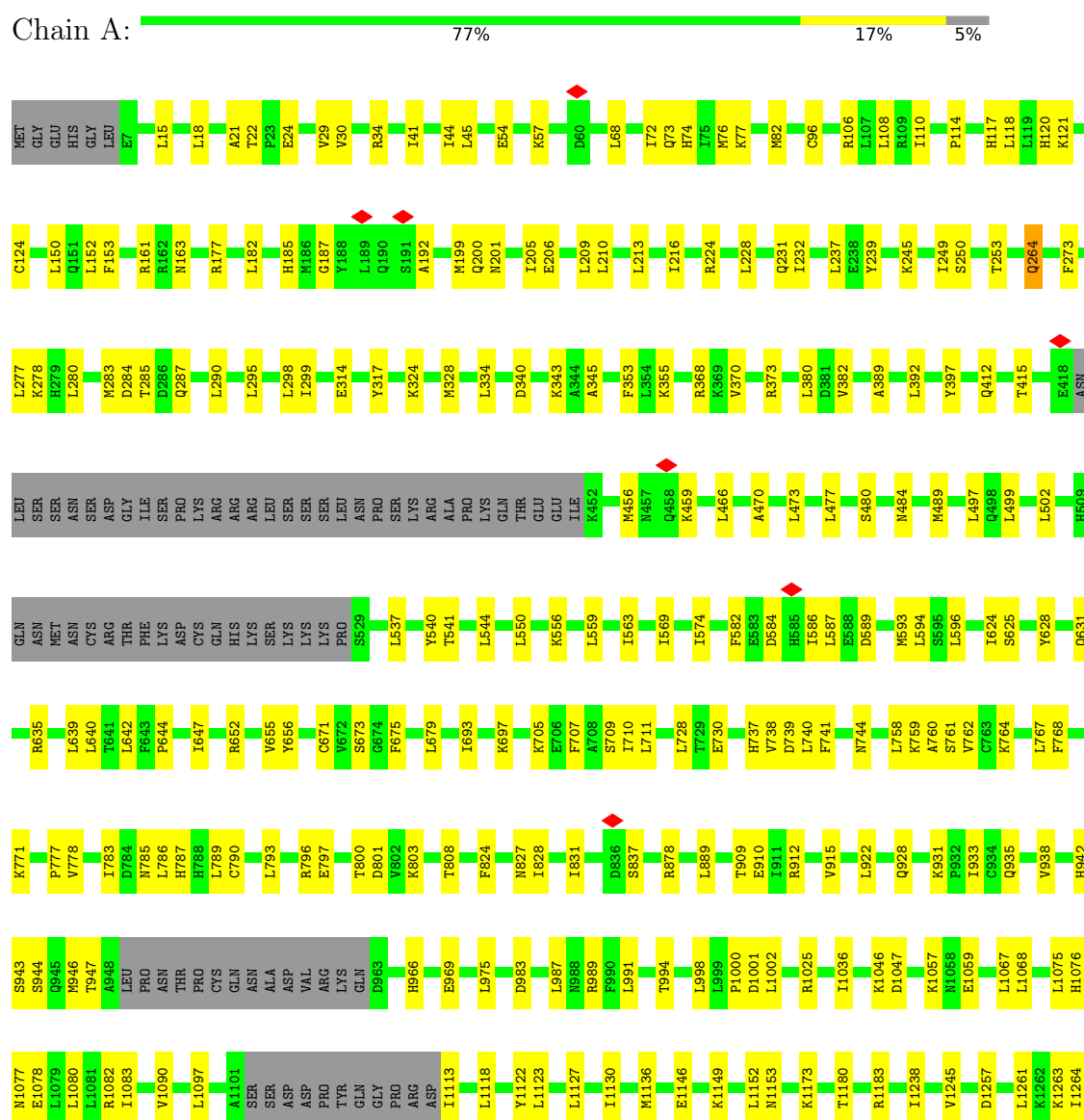
- Molecule 7 is ZINC ION (CCD ID: ZN) (formula: Zn).

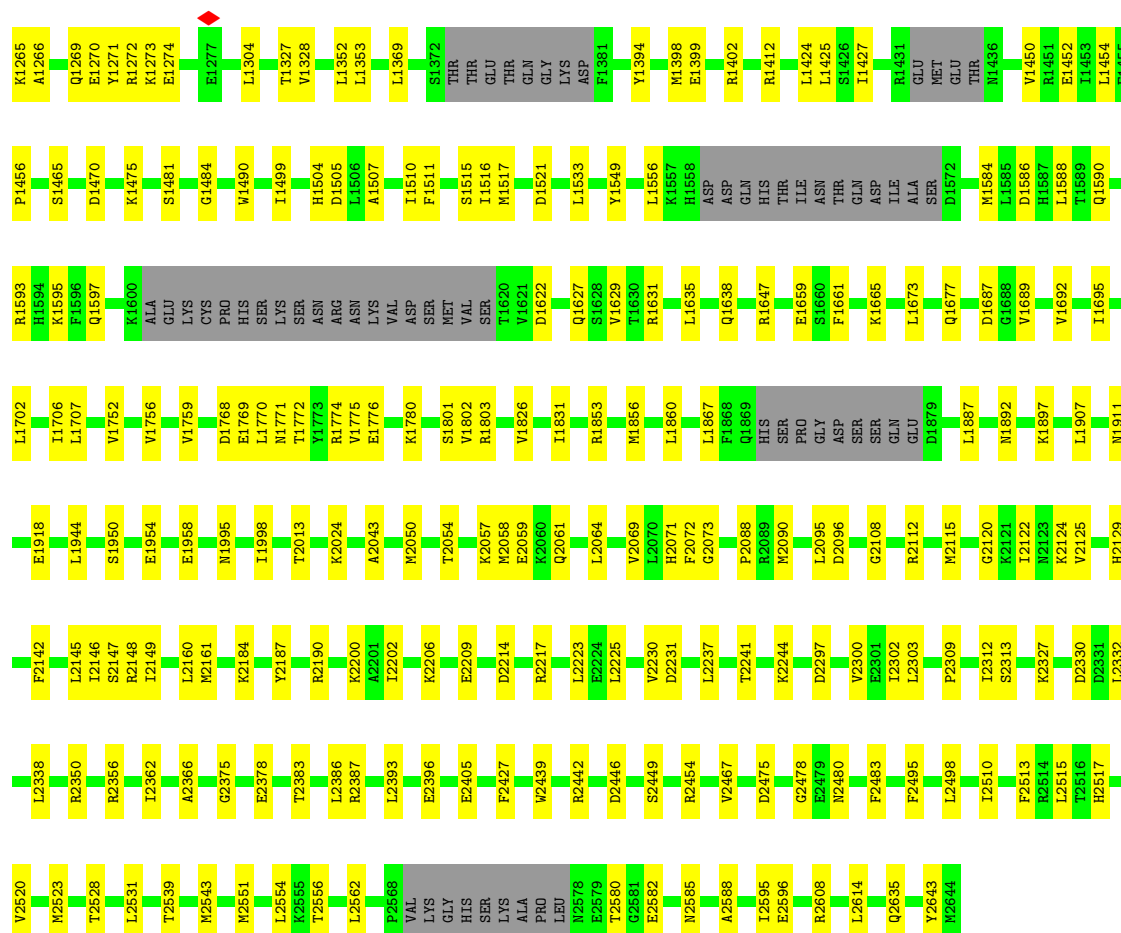
Mol	Chain	Residues	Atoms		AltConf
7	A	1	Total	Zn	0
			1	1	
7	B	1	Total	Zn	0
			1	1	
7	C	1	Total	Zn	0
			1	1	
7	D	1	Total	Zn	0
			1	1	

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.

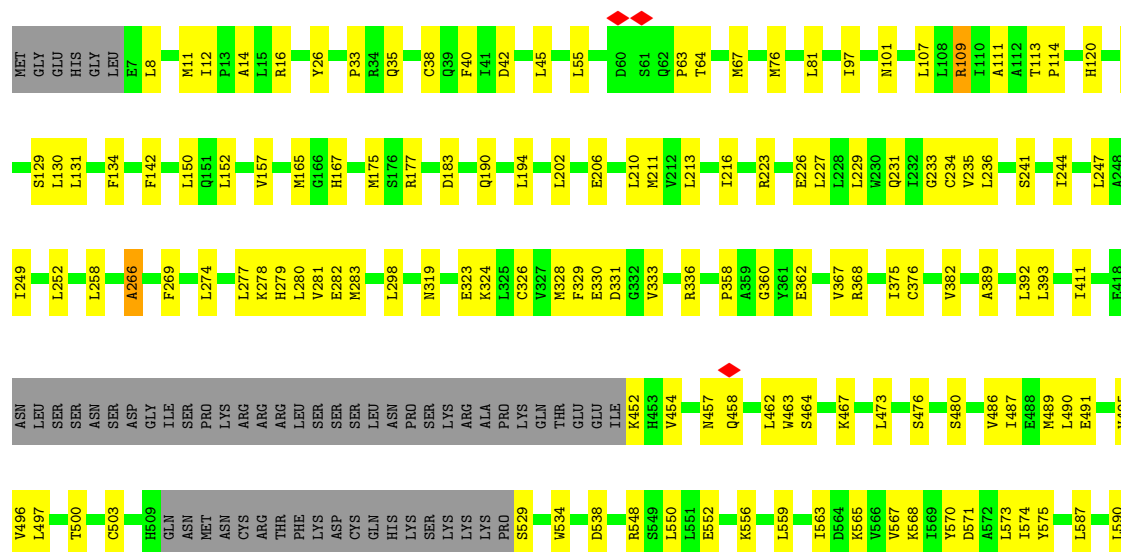
- Molecule 1: Serine/threonine-protein kinase ATR



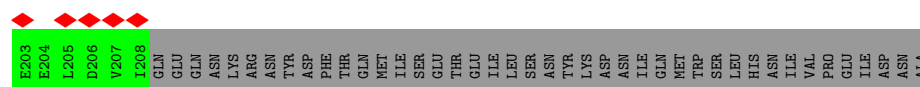
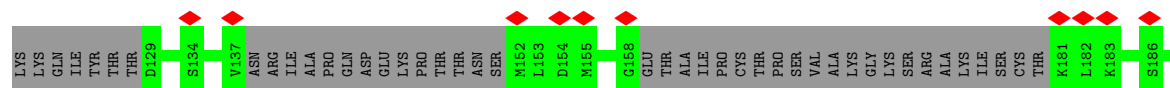
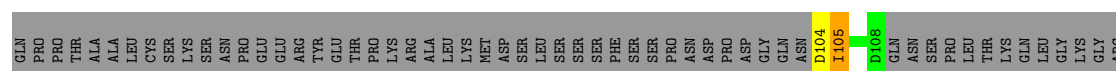
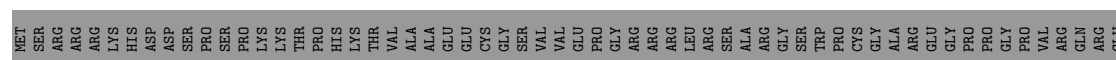
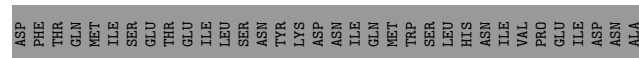
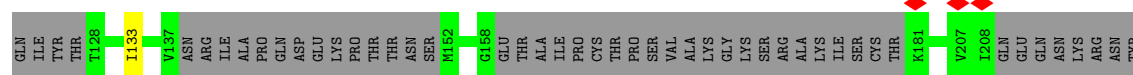
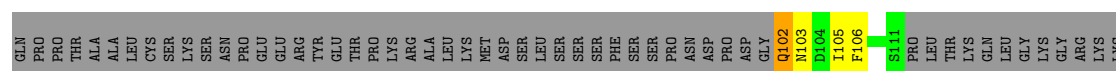
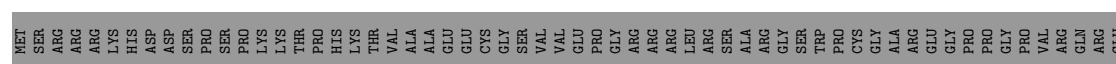
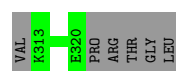
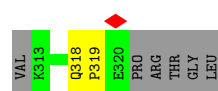


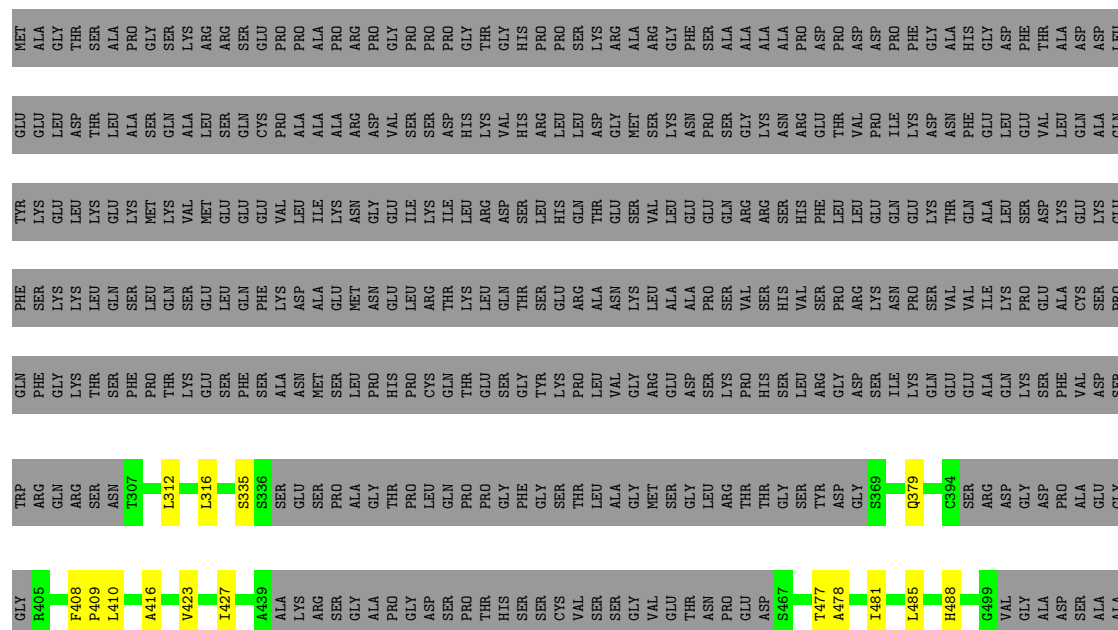
• Molecule 1: Serine/threonine-protein kinase ATR

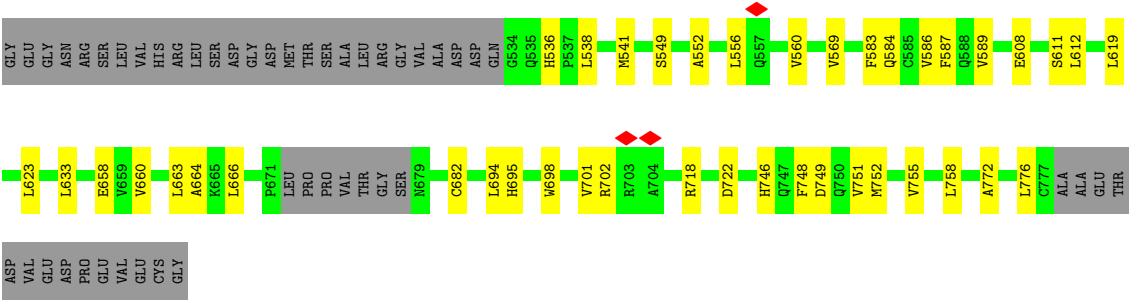
Chain B: 74% 20% 6%



M693	M694	M695	M696	M697	M698	M699	M700	M701	M702	M703	M704	M705	M706	M707	M708	M709	M710	M711	M712	M713	M714	M715	M716	M717	M718	M719	M720	M721	M722	M723	M724	M725	M726	M727	M728	M729	M730	M731	M732	M733	M734	M735	M736	M737	M738	M739	M740	M741	M742	M743	M744	M745	M746	M747	M748	M749	M750	M751	M752	M753	M754	M755	M756	M757	M758	M759	M760	M761	M762	M763	M764	M765	M766	M767	M768	M769	M770	M771	M772	M773	M774	M775	M776	M777	M778	M779	M780	M781	M782	M783	M784	M785	M786	M787	M788	M789	M790	M791	M792	M793	M794	M795	M796	M797	M798	M799	M800	M801	M802	M803	M804	M805	M806	M807	M808	M809	M810	M811	M812	M813	M814	M815	M816	M817	M818	M819	M820	M821	M822	M823	M824	M825	M826	M827	M828	M829	M830	M831	M832	M833	M834	M835	M836	M837	M838	M839	M840	M841	M842	M843	M844	M845	M846	M847	M848	M849	M850	M851	M852	M853	M854	M855	M856	M857	M858	M859	M860	M861	M862	M863	M864	M865	M866	M867	M868	M869	M870	M871	M872	M873	M874	M875	M876	M877	M878	M879	M880	M881	M882	M883	M884	M885	M886	M887	M888	M889	M890	M891	M892	M893	M894	M895	M896	M897	M898	M899	M900	M901	M902	M903	M904	M905	M906	M907	M908	M909	M910	M911	M912	M913	M914	M915	M916	M917	M918	M919	M920	M921	M922	M923	M924	M925	M926	M927	M928	M929	M930	M931	M932	M933	M934	M935	M936	M937	M938	M939	M940	M941	M942	M943	M944	M945	M946	M947	M948	M949	M950	M951	M952	M953	M954	M955	M956	M957	M958	M959	M960	M961	M962	M963	M964	M965	M966	M967	M968	M969	M970	M971	M972	M973	M974	M975	M976	M977	M978	M979	M980	M981	M982	M983	M984	M985	M986	M987	M988	M989	M990	M991	M992	M993	M994	M995	M996	M997	M998	M999	M1000	M1001	M1002	M1003	M1004	M1005	M1006	M1007	M1008	M1009	M1010	M1011	M1012	M1013	M1014	M1015	M1016	M1017	M1018	M1019	M1020	M1021	M1022	M1023	M1024	M1025	M1026	M1027	M1028	M1029	M1030	M1031	M1032	M1033	M1034	M1035	M1036	M1037	M1038	M1039	M1040	M1041	M1042	M1043	M1044	M1045	M1046	M1047	M1048	M1049	M1050	M1051	M1052	M1053	M1054	M1055	M1056	M1057	M1058	M1059	M1060	M1061	M1062	M1063	M1064	M1065	M1066	M1067	M1068	M1069	M1070	M1071	M1072	M1073	M1074	M1075	M1076	M1077	M1078	M1079	M1080	M1081	M1082	M1083	M1084	M1085	M1086	M1087	M1088	M1089	M1090	M1091	M1092	M1093	M1094	M1095	M1096	M1097	M1098	M1099	M1100	M1101	M1102	M1103	M1104	M1105	M1106	M1107	M1108	M1109	M1110	M1111	M1112	M1113	M1114	M1115	M1116	M1117	M1118	M1119	M1120	M1121	M1122	M1123	M1124	M1125	M1126	M1127	M1128	M1129	M1130	M1131	M1132	M1133	M1134	M1135	M1136	M1137	M1138	M1139	M1140	M1141	M1142	M1143	M1144	M1145	M1146	M1147	M1148	M1149	M1150	M1151	M1152	M1153	M1154	M1155	M1156	M1157	M1158	M1159	M1160	M1161	M1162	M1163	M1164	M1165	M1166	M1167	M1168	M1169	M1170	M1171	M1172	M1173	M1174	M1175	M1176	M1177	M1178	M1179	M1180	M1181	M1182	M1183	M1184	M1185	M1186	M1187	M1188	M1189	M1190	M1191	M1192	M1193	M1194	M1195	M1196	M1197	M1198	M1199	M1200	M1201	M1202	M1203	M1204	M1205	M1206	M1207	M1208	M1209	M1210	M1211	M1212	M1213	M1214	M1215	M1216	M1217	M1218	M1219	M1220	M1221	M1222	M1223	M1224	M1225	M1226	M1227	M1228	M1229	M1230	M1231	M1232	M1233	M1234	M1235	M1236	M1237	M1238	M1239	M1240	M1241	M1242	M1243	M1244	M1245	M1246	M1247	M1248	M1249	M1250	M1251	M1252	M1253	M1254	M1255	M1256	M1257	M1258	M1259	M1260	M1261	M1262	M1263	M1264	M1265	M1266	M1267	M1268	M1269	M1270	M1271	M1272	M1273	M1274	M1275	M1276	M1277	M1278	M1279	M1280	M1281	M1282	M1283	M1284	M1285	M1286	M1287	M1288	M1289	M1290	M1291	M1292	M1293	M1294	M1295	M1296	M1297	M1298	M1299	M1300	M1301	M1302	M1303	M1304	M1305	M1306	M1307	M1308	M1309	M1310	M1311	M1312	M1313	M1314	M1315	M1316	M1317	M1318	M1319	M1320	M1321	M1322	M1323	M1324	M1325	M1326	M1327	M1328	M1329	M1330	M1331	M1332	M1333	M1334	M1335	M1336	M1337	M1338	M1339	M1340	M1341	M1342	M1343	M1344	M1345	M1346	M1347	M1348	M1349	M1350	M1351	M1352	M1353	M1354	M1355	M1356	M1357	M1358	M1359	M1360	M1361	M1362	M1363	M1364	M1365	M1366	M1367	M1368	M1369	M1370	M1371	M1372	M1373	M1374	M1375	M1376	M1377	M1378	M1379	M1380	M1381	M1382	M1383	M1384	M1385	M1386	M1387	M1388	M1389	M1390	M1391	M1392	M1393	M1394	M1395	M1396	M1397	M1398	M1399	M1400	M1401	M1402	M1403	M1404	M1405	M1406	M1407	M1408	M1409	M1410	M1411	M1412	M1413	M1414	M1415	M1416	M1417	M1418	M1419	M1420	M1421	M1422	M1423	M1424	M1425	M1426	M1427	M1428	M1429	M1430	M1431	M1432	M1433	M1434	M1435	M1436	M1437	M1438	M1439	M1440	M1441	M1442	M1443	M1444	M1445	M1446	M1447	M1448	M1449	M1450	M1451	M1452	M1453	M1454	M1455	M1456	M1457	M1458	M1459	M1460	M1461	M1462	M1463	M1464	M1465	M1466	M1467	M1468	M1469	M1470	M1471	M1472	M1473	M1474	M1475	M1476	M1477	M1478	M1479	M1480	M1481	M1482	M1483	M1484	M1485	M1486	M1487	M1488	M1489	M1490	M1491	M1492	M1493	M1494	M1495	M1496	M1497	M1498	M1499	M1500	M1501	M1502	M1503	M1504	M1505	M1506	M1507	M1508	M1509	M1510	M1511	M1512	M1513	M1514	M1515	M1516	M1517	M1518	M1519	M1520	M1521	M1522	M1523	M1524	M1525	M1526	M1527	M1528	M1529	M1530	M1531	M1532	M1533	M1534	M1535	M1536	M1537	M1538	M1539	M1540	M1541	M1542	M1543	M1544	M1545	M1546	M1547	M1548	M1549	M1550	M1551	M1552	M1553	M1554	M1555	M1556	M1557	M1558	M1559	M1560	M1561	M1562	M1563	M1564	M1565	M1566	M1567	M1568	M1569	M1570	M1571	M1572	M1573	M1574	M1575	M1576	M1577	M1578	M1579	M1580	M1581	M1582	M1583	M1584	M1585	M1586	M1587	M1588	M1589	M1590	M1591	M1592	M1593	M1594	M1595	M1596	M1597	M1598	M1599	M1600	M1601	M1602	M1603	M1604	M1605	M1606	M1607	M1608	M1609	M1610	M1611	M1612	M1613	M1614	M1615	M1616	M1617	M1618	M1619	M1620	M1621	M1622	M1623	M1624	M1625	M1626	M1627	M1628	M1629	M1630	M1631	M1632	M1633	M1634	M1635	M1636	M1637	M1638	M1639	M1640	M1641	M1642	M1643	M1644	M1645	M1646	M1647	M1648	M1649	M1650	M1651	M1652	M1653	M1654	M1655	M1656	M1657	M1658	M1659	M1660	M1661	M1662	M1663	M1664	M1665	M1666	M1667	M1668	M1669	M1670	M1671	M1672	M1673	M1674	M1675	M1676	M1677	M1678	M1679	M1680	M1681	M1682	M1683	M1684	M1685	M1686	M1687	M1688	M1689	M1690	M1691	M1692	M1693	M1694	M1695	M1696	M1697	M1698	M1699	M1700	M1701	M1702	M1703	M1704	M1705	M1706	M1707	M1708	M1709	M1710	M1711	M1712	M1713	M1714	M1715	M1716	M1717	M1718	M1719	M1720	M1721	M1722	M1723	M1724	M1725	M1726	M1727	M1728	M1729	M1730	M1731	M1732	M1733	M1734	M1735	M1736	M1737	M1738	M1739	M1740	M1741	M1742	M1743	M1744	M1745	M1746	M1747	M1748	M1749	M1750	M1751	M1752	M1753	M1754	M1755	M1756	M1757	M1758	M1759	M1760	M1761	M1762	M1763	M1764	M1765	M1766	M1767	M1768	M1769	M1770	M1771	M1772	M1773	M1774	M1775	M1776	M1777	M1778	M1779	M1780	M1781	M1782	M1783	M1784	M1785	M1786	M1787	M1788	M1789	M1790	M1791	M1792	M1793	M1794	M1795	M1796	M1797	M1798	M1799	M1800	M1801	M1802	M1803	M1804	M1805	M1806	M1807	M1808	M1809	M1810	M1811	M1812	M1813	M1814	M1815	M1816	M1817	M1818	M1819	M1820	M1821	M1822	M1823	M1824	M1825	M1826	M1827	M1828	M1829	M1830	M1831	M1832	M1833	M1834	M1835	M1836	M1837	M1838	M1839	M1840	M1841	M1842	M1843	M1844	M1845	M1846	M1847	M1848	M1849	M1850	M1851	M1852	M1853	M1854	M1855	M1856	M1857	M1858	M1859	M1860	M1861	M1862	M1863	M1864	M1865	M1866	M1867	M1868	M1869	M1870	M1871	M1872	M1873	M1874	M1875	M1876	M1877	M1878	M1879	M1880	M1881	M1882	M1883	M1884	M1885	M1886	M1887	M1888	M1889	M1890	M1891	M1892	M1893	M1894	M1895	M1896	M1897	M1898	M1899	M1900	M1901	M1902	M1903	M1904	M1905	M1906	M1907	M1908	M1909	M1910	M1911	M1912	M1913	M1914	M1915	M1916	M1917	M1918	M1919	M1920	M1921	M1922	M1923	M1924	M1925	M1926	M1927	M1928	M1929	M1930	M1931	M1932	M1933	M1934	M1935	M1936	M1937	M1938	M1939	M1940	M1941	M1942	M1943	M1944	M1945	M1946	M1947	M1948	M1949	M1950	M1951	M1952	M1953	M1954	M1955	M1956	M1957	M1958	M1959	M1960	M1961	M1962	M1963	M1964	M1965	M1966	M1967	M1968	M1969	M1970	M1971	M1972	M1973	M1974	M1975	M1976	M1977	M1978	M1979	M1980	M1981	M1982	M1983	M1984	M1985	M1986	M1987	M1988	M1989	M1990	M1991	M1992	M1993	M1994	M1995	M1996	M1997	M1998	M1999	M2000	M2001	M2002	M2003	M2004	M2005	M2006	M2007	M2008	M2009	M2010	M2011	M2012	M2013	M2014	M2015	M2016	M2017	M2018	M2019	M2020	M2021	M2022	M2023	M2024	M2025	M2026	M2027	M2028	M2029	M2030	M2031	M2032	M2033	M2034	M2035	M2036	M2037	M2038	M2039	M2040	M2041	M2042	M2043	M2044	M2045	M2046	M2047	M2048	M2049	M2050	M2051	M2052	M2053	M2054	M2055	M2056	M2057	M2058	M2059	M2060	M2061	M2062	M2063	M2064	M2065	M2066	M2067	M2068	M2069	M2070	M2071	M2072	M2073	M2074	M2075	M2076	M2077	M2078	M2079	M2080	M2081	M2082	M2083	M2084	M2085	M2086	M2
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4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	254757	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 ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	1.765	Depositor
Minimum map value	-1.081	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.024	Depositor
Recommended contour level	0.05	Depositor
Map size (Å)	401.76, 401.76, 401.76	wwPDB
Map dimensions	432, 432, 432	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.93, 0.93, 0.93	Depositor

5 Model quality

5.1 Standard geometry

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

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	0.23	0/20441	0.56	3/27628 (0.0%)
1	B	0.25	0/20336	0.62	8/27479 (0.0%)
2	E	0.16	0/57	0.61	0/77
2	F	0.23	0/49	0.63	0/66
3	G	0.14	0/314	0.55	0/430
3	H	0.36	0/261	0.58	0/358
4	C	0.24	0/2826	0.61	1/3837 (0.0%)
4	D	0.29	0/2826	0.66	0/3837
All	All	0.25	0/47110	0.59	12/63712 (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	1
1	B	0	3
All	All	0	4

There are no bond length outliers.

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	285	THR	N-CA-C	7.97	119.88	111.03
1	A	187	GLY	N-CA-C	6.19	119.64	110.60
1	B	1421	ILE	N-CA-C	-5.52	104.99	110.62
4	C	554	GLY	N-CA-C	5.47	116.89	111.21
1	A	489	MET	CA-CB-CG	5.38	124.86	114.10

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	284	ASP	Peptide
1	B	109	ARG	Sidechain
1	B	1203	LEU	Peptide
1	B	16	ARG	Sidechain

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	20025	0	20298	283	0
1	B	19926	0	20225	336	0
2	E	56	0	42	1	0
2	F	49	0	35	0	0
3	G	315	0	166	7	0
3	H	262	0	122	5	0
4	C	2779	0	2873	40	0
4	D	2779	0	2872	44	0
5	A	31	0	12	1	0
5	B	31	0	12	0	0
6	A	2	0	0	0	0
6	B	2	0	0	0	0
7	A	1	0	0	0	0
7	B	1	0	0	0	0
7	C	1	0	0	0	0
7	D	1	0	0	0	0
All	All	46261	0	46657	688	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 7.

The worst 5 of 688 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:B:1208:LEU:O	1:B:1212:LEU:HB2	1.56	1.04

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1046:LYS:O	1:B:1049:LEU:HB3	1.67	0.93
1:A:117:HIS:O	1:A:120:HIS:HB2	1.74	0.86
1:A:707:PHE:O	1:A:711:LEU:HB2	1.79	0.81
3:G:102:GLN:N	3:G:102:GLN:HE21	1.83	0.76

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	2477/2644 (94%)	2393 (97%)	82 (3%)	2 (0%)	48	77
1	B	2459/2644 (93%)	2349 (96%)	99 (4%)	11 (0%)	30	59
2	E	6/14 (43%)	6 (100%)	0	0	100	100
2	F	6/14 (43%)	6 (100%)	0	0	100	100
3	G	47/250 (19%)	46 (98%)	1 (2%)	0	100	100
3	H	41/250 (16%)	41 (100%)	0	0	100	100
4	C	349/791 (44%)	328 (94%)	20 (6%)	1 (0%)	36	65
4	D	349/791 (44%)	337 (97%)	12 (3%)	0	100	100
All	All	5734/7398 (78%)	5506 (96%)	214 (4%)	14 (0%)	44	72

5 of 14 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	266	ALA
1	B	1046	LYS
1	B	1259	PRO
1	B	1260	GLU
1	B	625	SER

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	2227/2363 (94%)	2226 (100%)	1 (0%)	100	100
1	B	2216/2363 (94%)	2209 (100%)	7 (0%)	86	96
2	E	6/13 (46%)	6 (100%)	0	100	100
2	F	5/13 (38%)	5 (100%)	0	100	100
3	G	11/226 (5%)	10 (91%)	1 (9%)	9	28
3	H	3/226 (1%)	2 (67%)	1 (33%)	0	0
4	C	319/678 (47%)	319 (100%)	0	100	100
4	D	319/678 (47%)	319 (100%)	0	100	100
All	All	5106/6560 (78%)	5096 (100%)	10 (0%)	85	96

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	1466	GLN
3	G	102	GLN
3	H	105	ILE
1	B	1458	LEU
1	B	1460	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 49 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	1241	ASN
1	B	1970	HIS
1	B	1296	ASN
1	B	1587	HIS
1	B	1999	HIS

5.3.3 RNA ⓘ

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](#)

Of 10 ligands modelled in this entry, 8 are 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	$\# Z > 2$
5	AGS	A	5001	6	29,33,33	0.46	1 (3%)	39,52,52	0.73	1 (2%)
5	AGS	B	5001	6	29,33,33	0.50	1 (3%)	39,52,52	0.73	1 (2%)

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	AGS	A	5001	6	-	0/21/38/38	0/3/3/3
5	AGS	B	5001	6	-	7/21/38/38	0/3/3/3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	5001	AGS	PG-S1G	2.04	1.95	1.90
5	A	5001	AGS	PG-S1G	2.00	1.95	1.90

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
5	A	5001	AGS	PA-O3A-PB	-3.68	120.19	132.83
5	B	5001	AGS	PA-O3A-PB	-3.49	120.83	132.83

There are no chirality outliers.

5 of 7 torsion outliers are listed below:

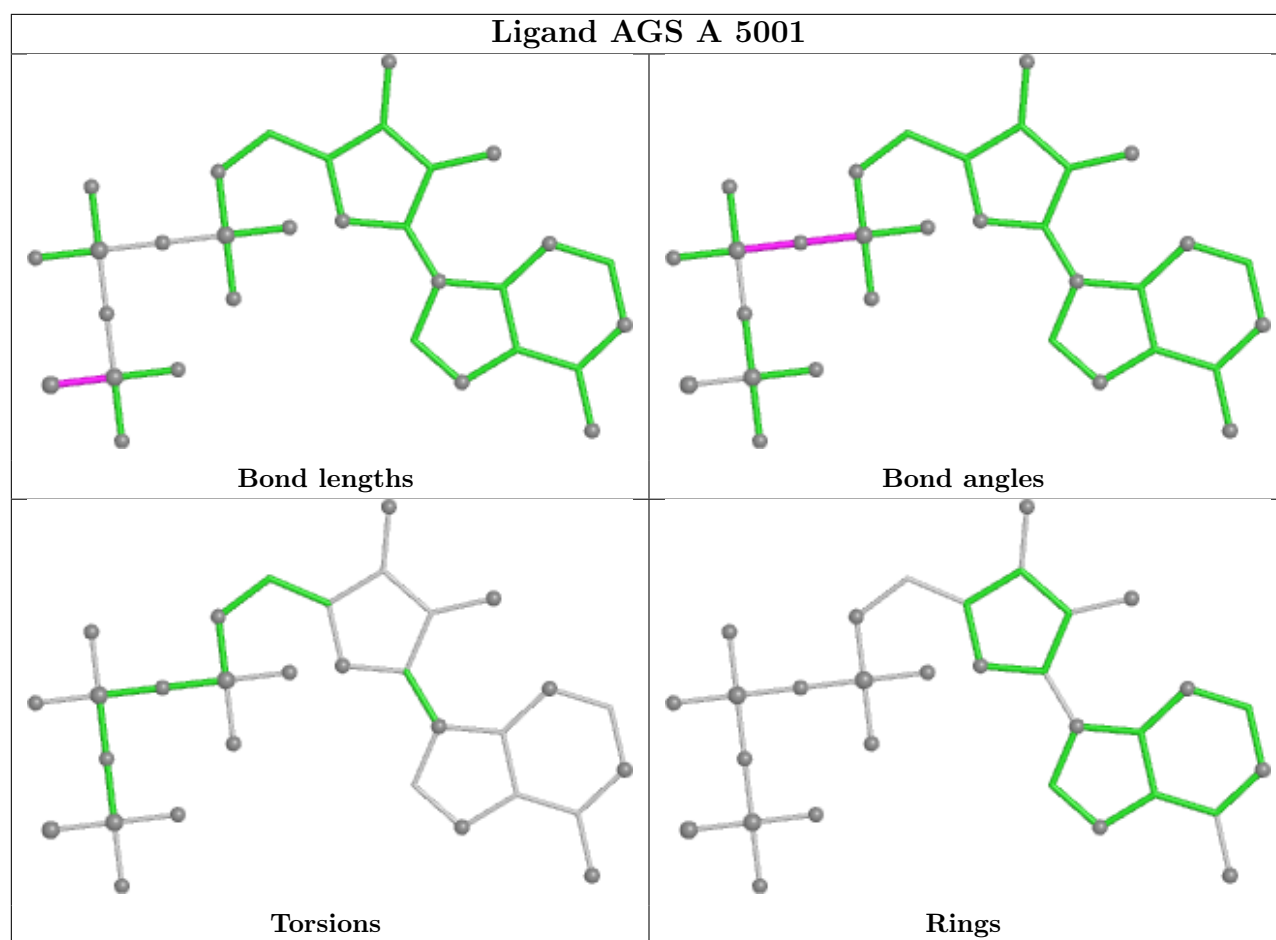
Mol	Chain	Res	Type	Atoms
5	B	5001	AGS	PB-O3B-PG-O2G
5	B	5001	AGS	C5'-O5'-PA-O1A
5	B	5001	AGS	C5'-O5'-PA-O2A
5	B	5001	AGS	O4'-C4'-C5'-O5'
5	B	5001	AGS	C3'-C4'-C5'-O5'

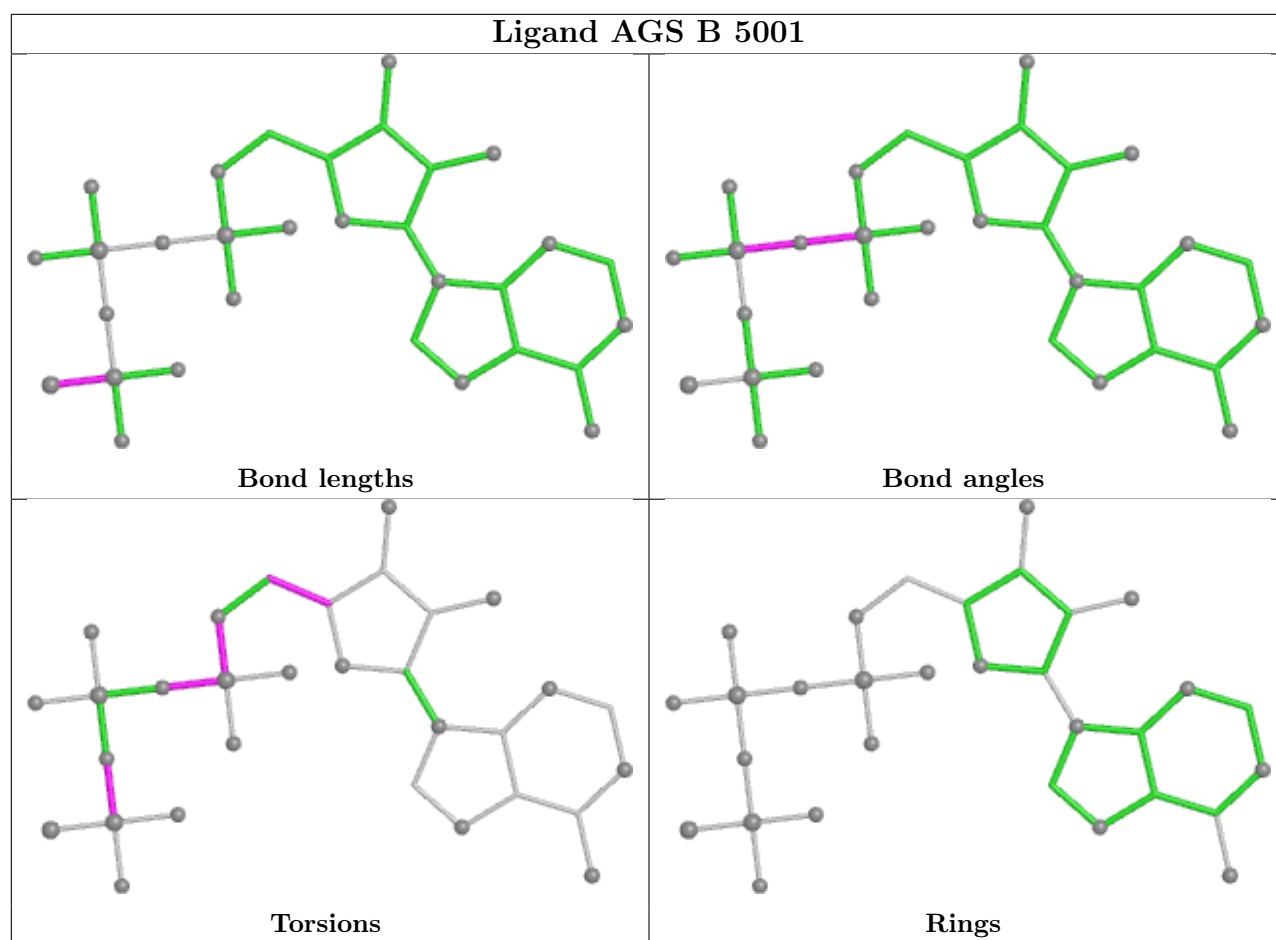
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	5001	AGS	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 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.

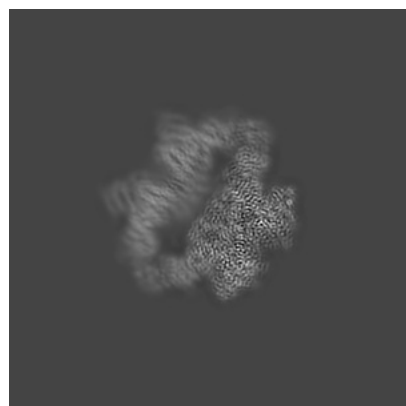
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-68921. These allow visual inspection of the internal detail of the map and identification of artifacts.

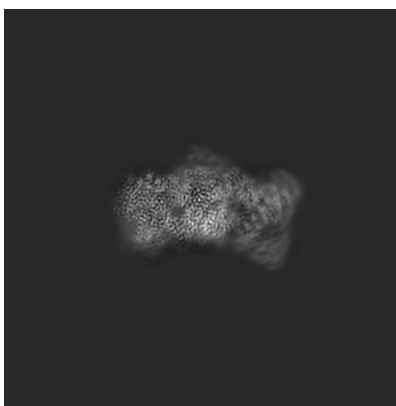
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

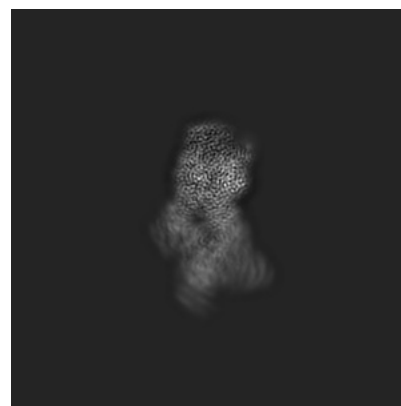
6.1.1 Primary map



X

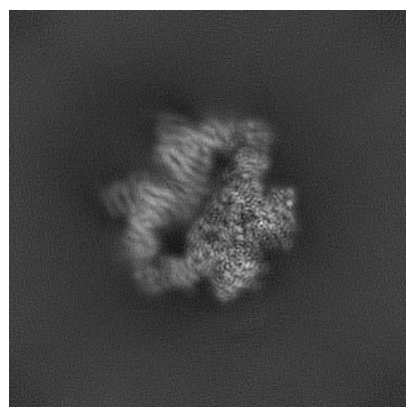


Y

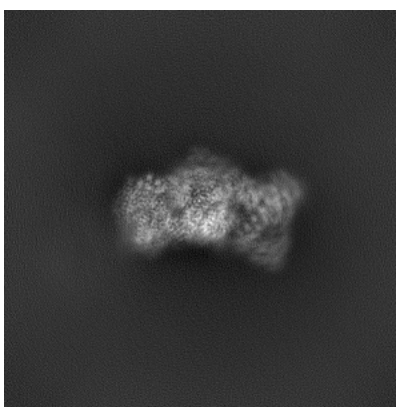


Z

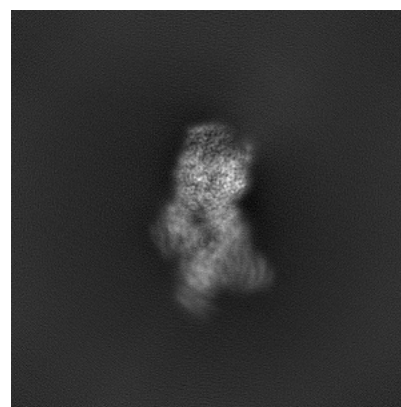
6.1.2 Raw map



X



Y

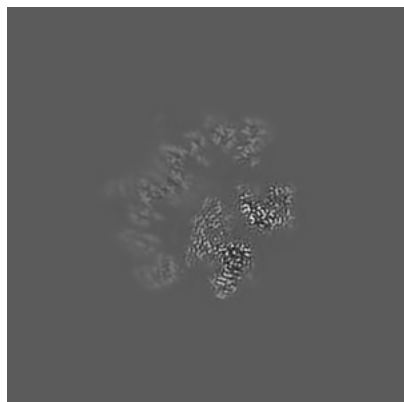


Z

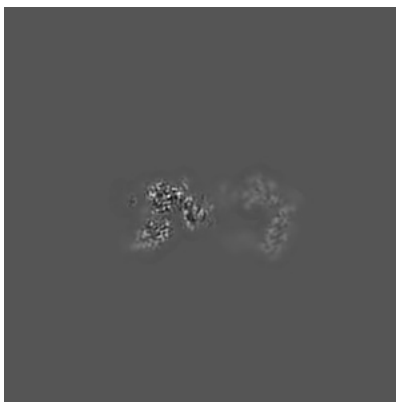
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

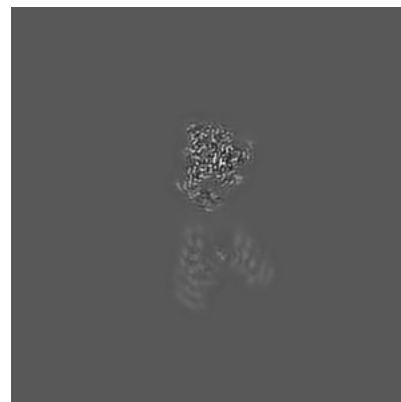
6.2.1 Primary map



X Index: 216

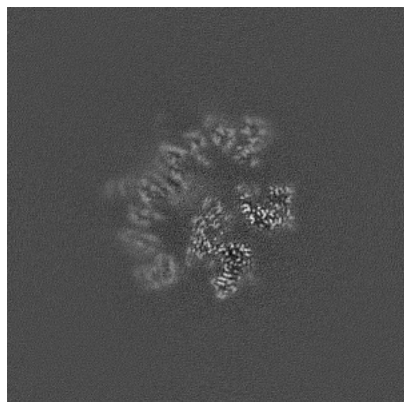


Y Index: 216

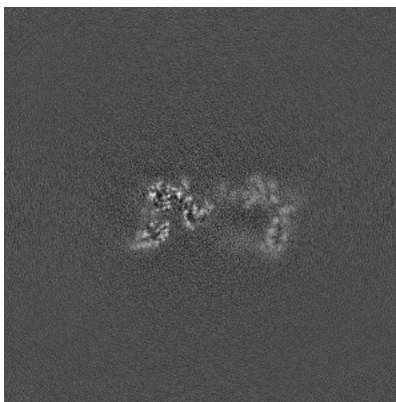


Z Index: 216

6.2.2 Raw map



X Index: 216



Y Index: 216

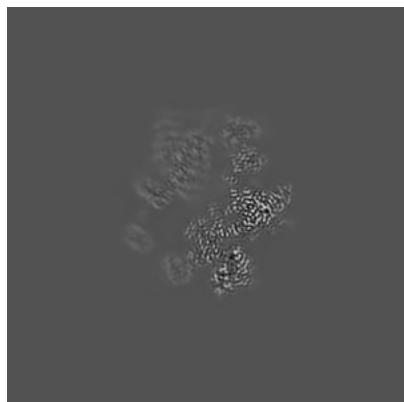


Z Index: 216

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: 228

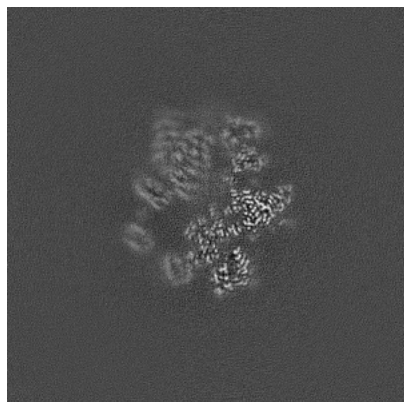


Y Index: 248

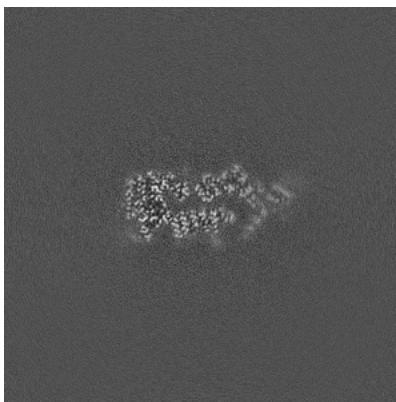


Z Index: 217

6.3.2 Raw map



X Index: 228



Y Index: 248

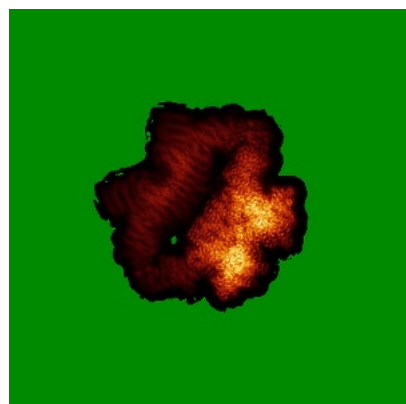


Z Index: 217

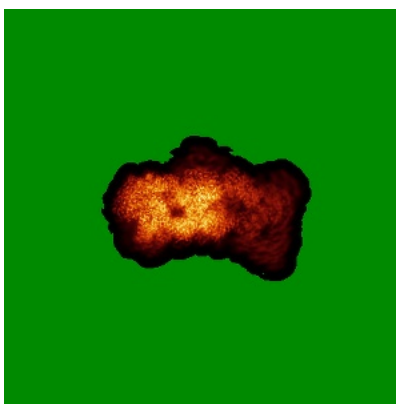
The images above show the largest variance slices of the map in three orthogonal directions.

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

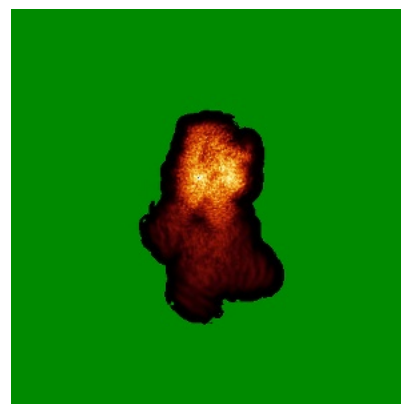
6.4.1 Primary map



X

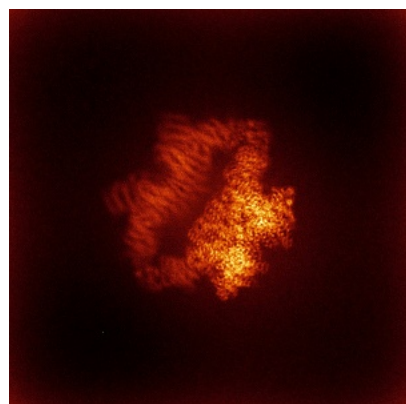


Y

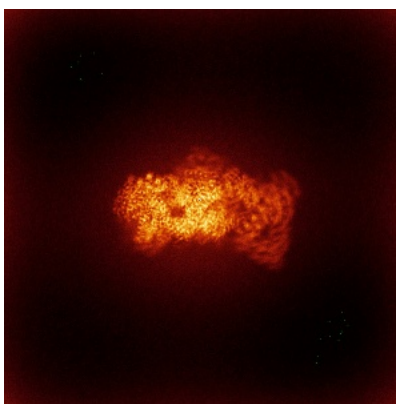


Z

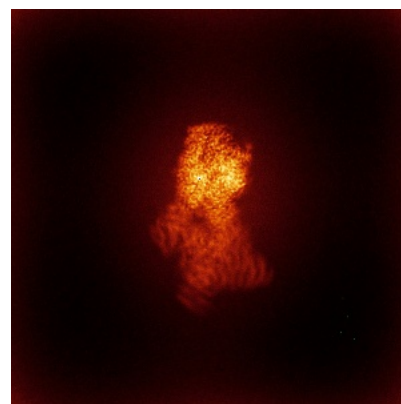
6.4.2 Raw map



X



Y

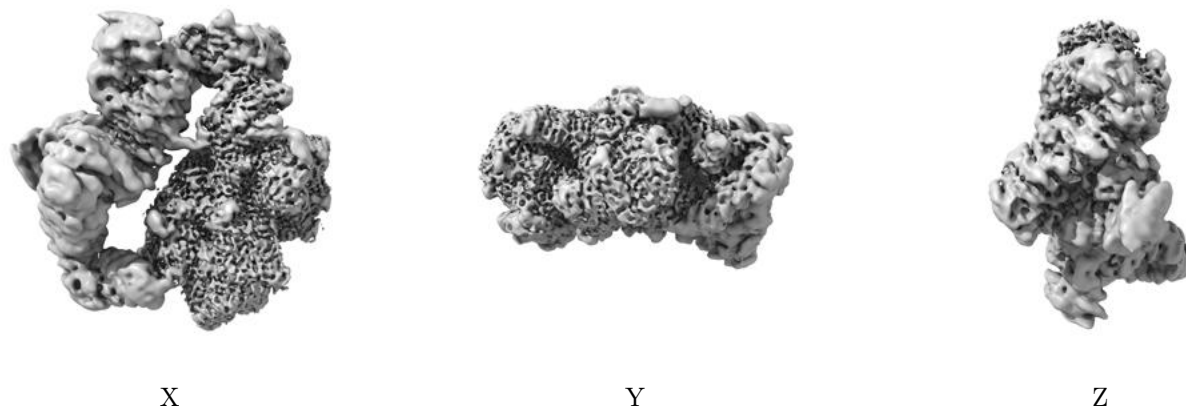


Z

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.

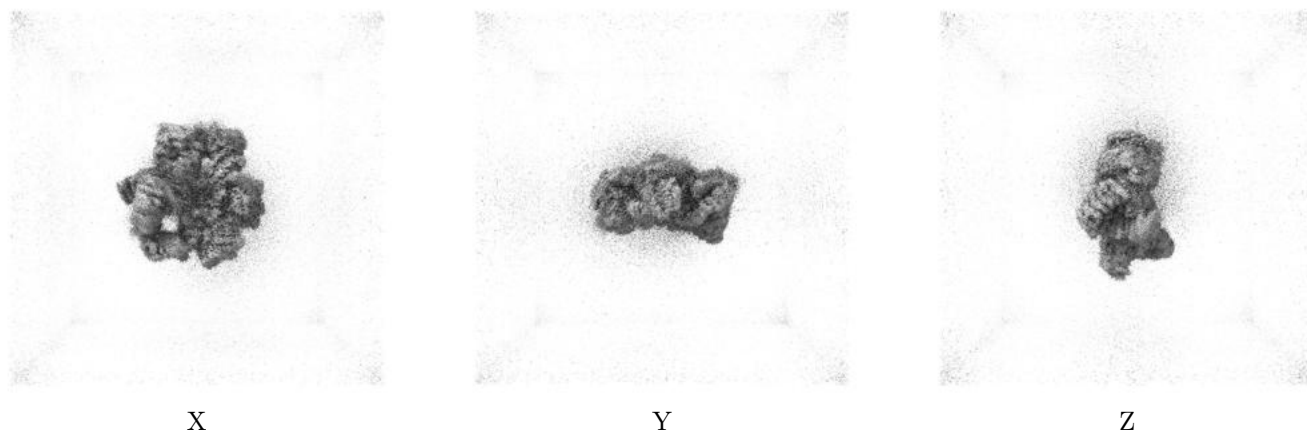
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.05. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map



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

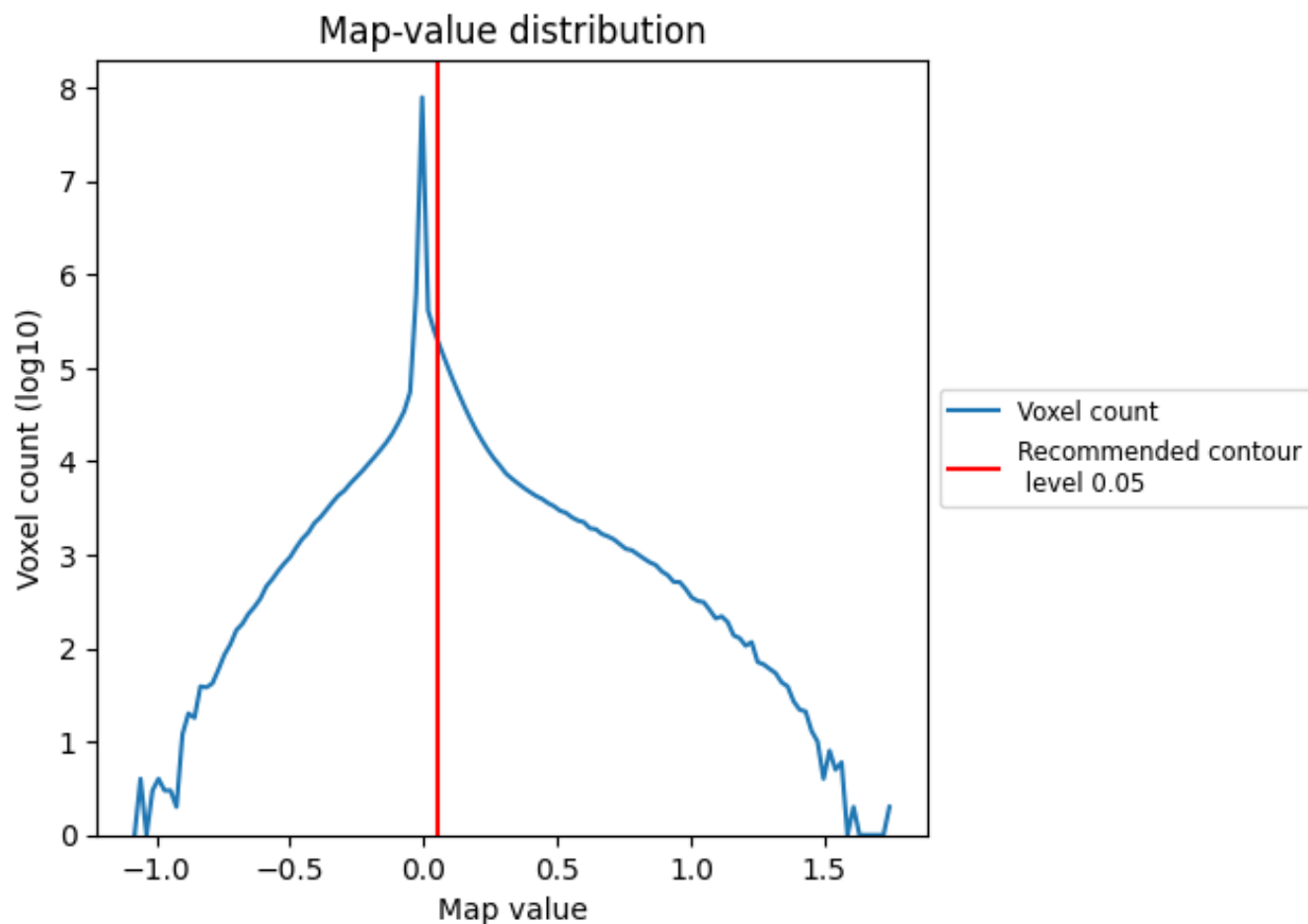
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

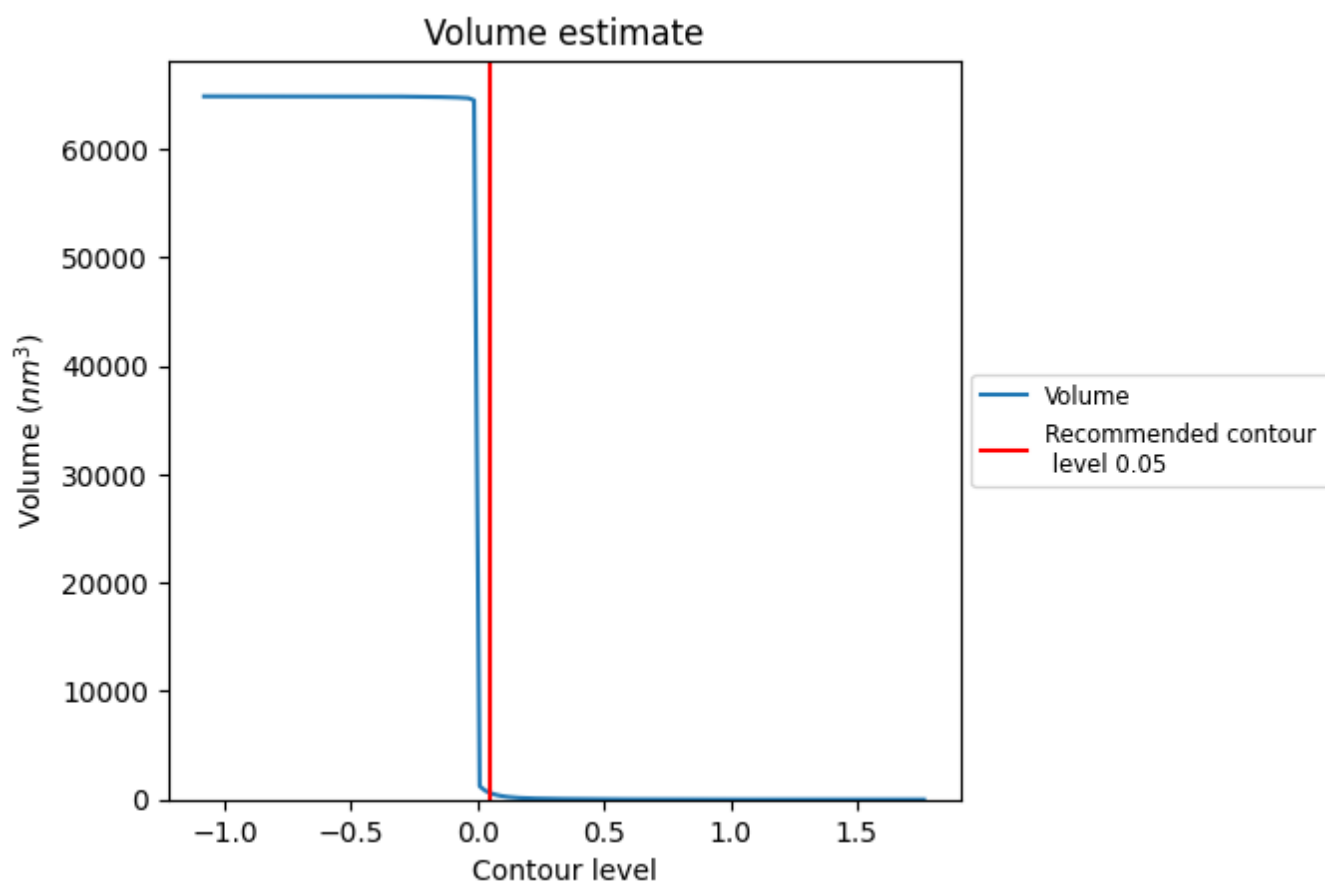
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

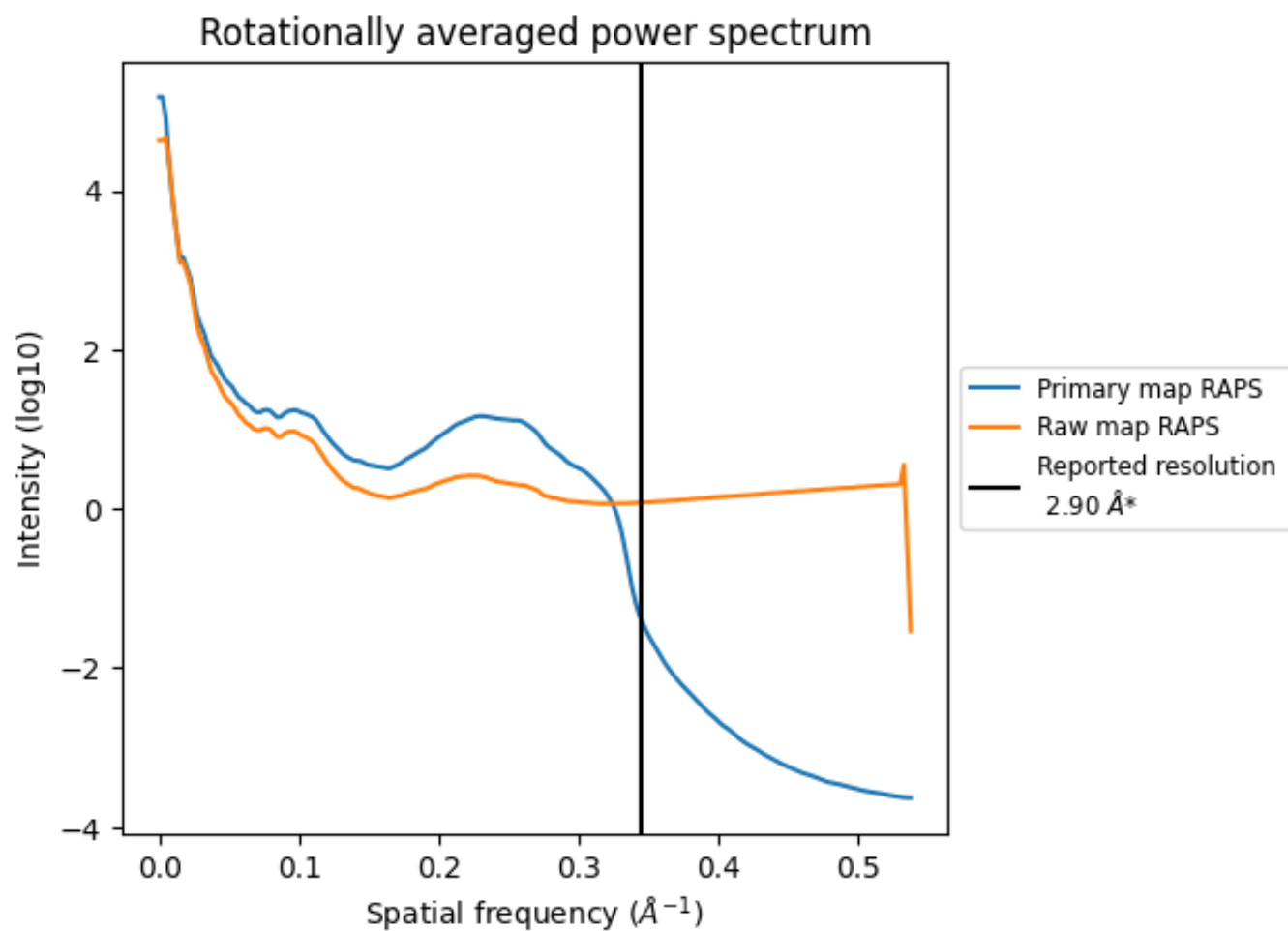
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 610 nm³; this corresponds to an approximate mass of 551 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 ⓘ

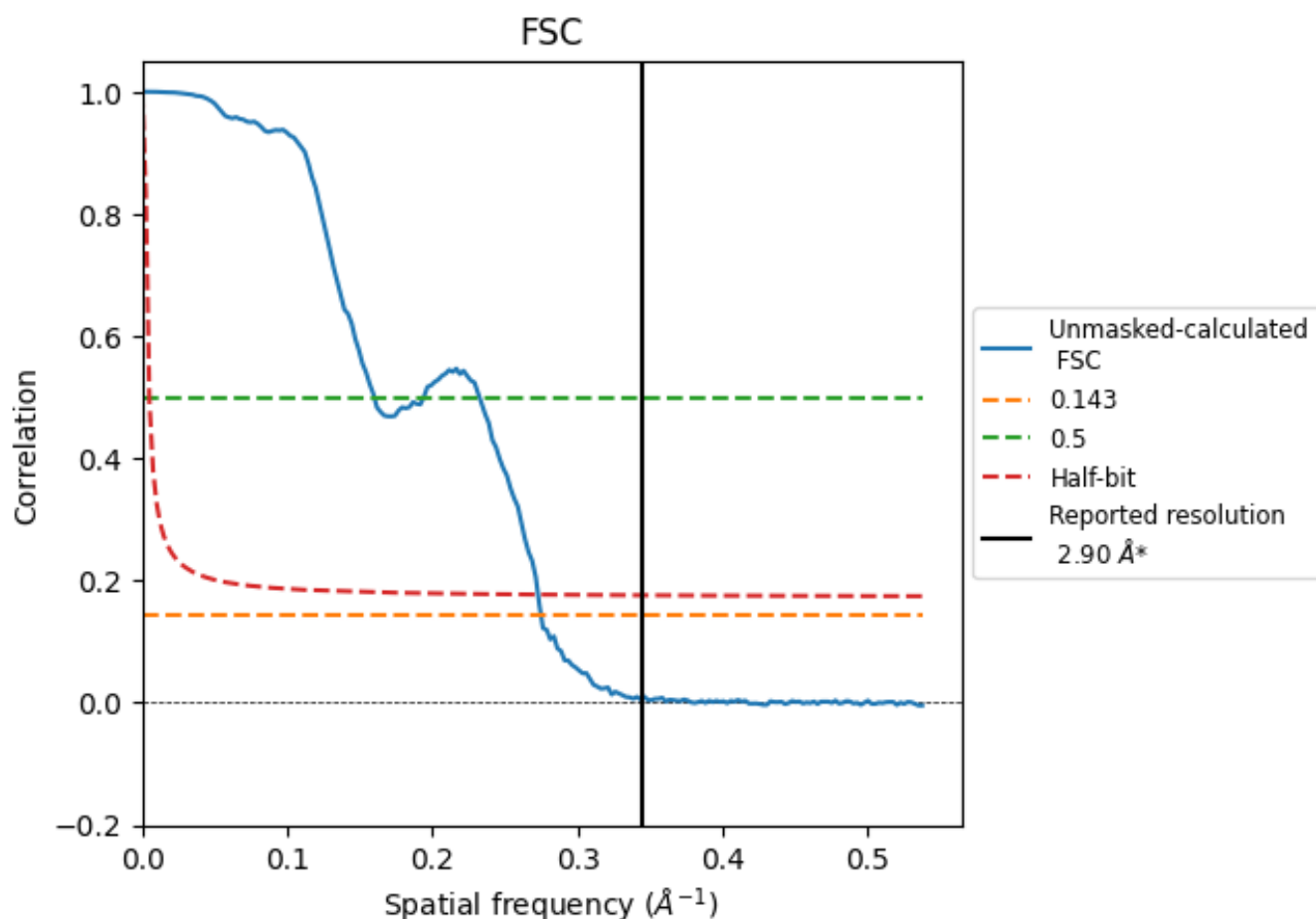


*Reported resolution corresponds to spatial frequency of 0.345 Å⁻¹

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 0.345 Å⁻¹

8.2 Resolution estimates [i](#)

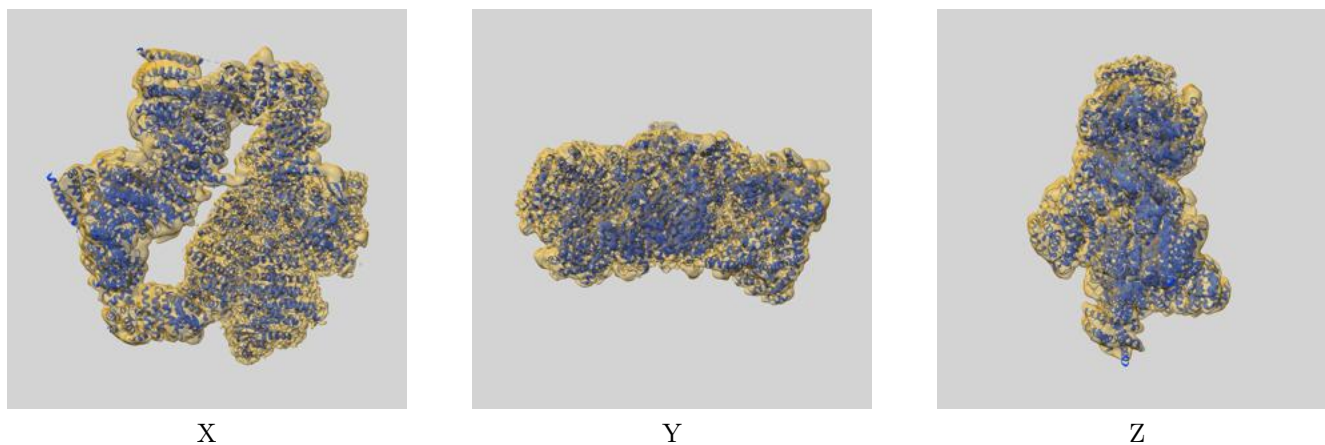
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.90	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.64	6.25	3.66

*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 3.64 differs from the reported value 2.9 by more than 10 %

9 Map-model fit [i](#)

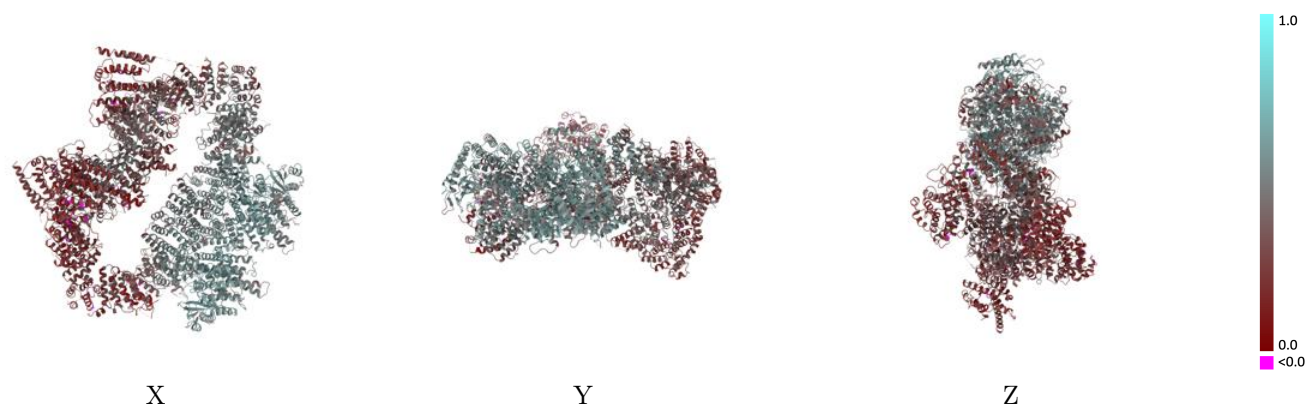
This section contains information regarding the fit between EMDB map EMD-68921 and PDB model 23FE. Per-residue inclusion information can be found in section [3](#) on page [6](#).

9.1 Map-model overlay [i](#)



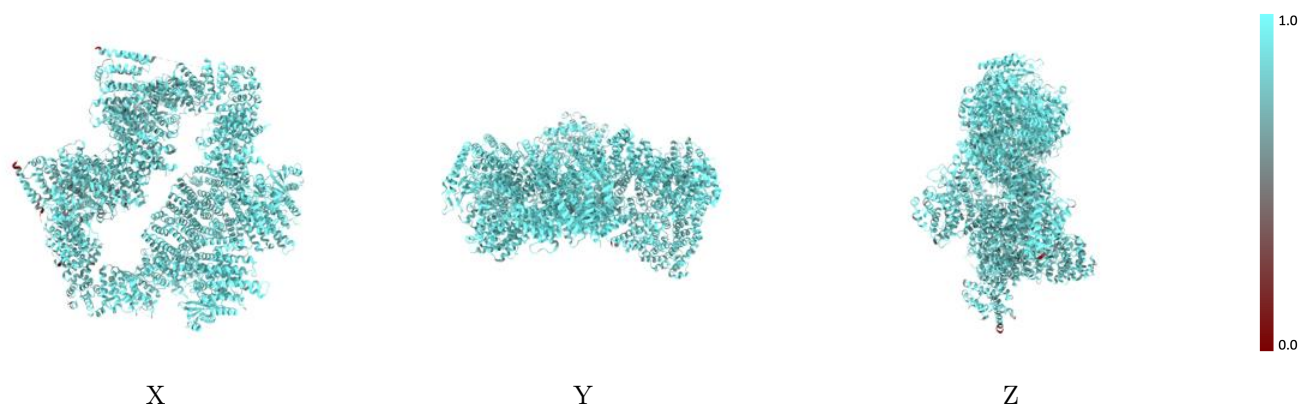
The images above show the 3D surface view of the map at the recommended contour level 0.05 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



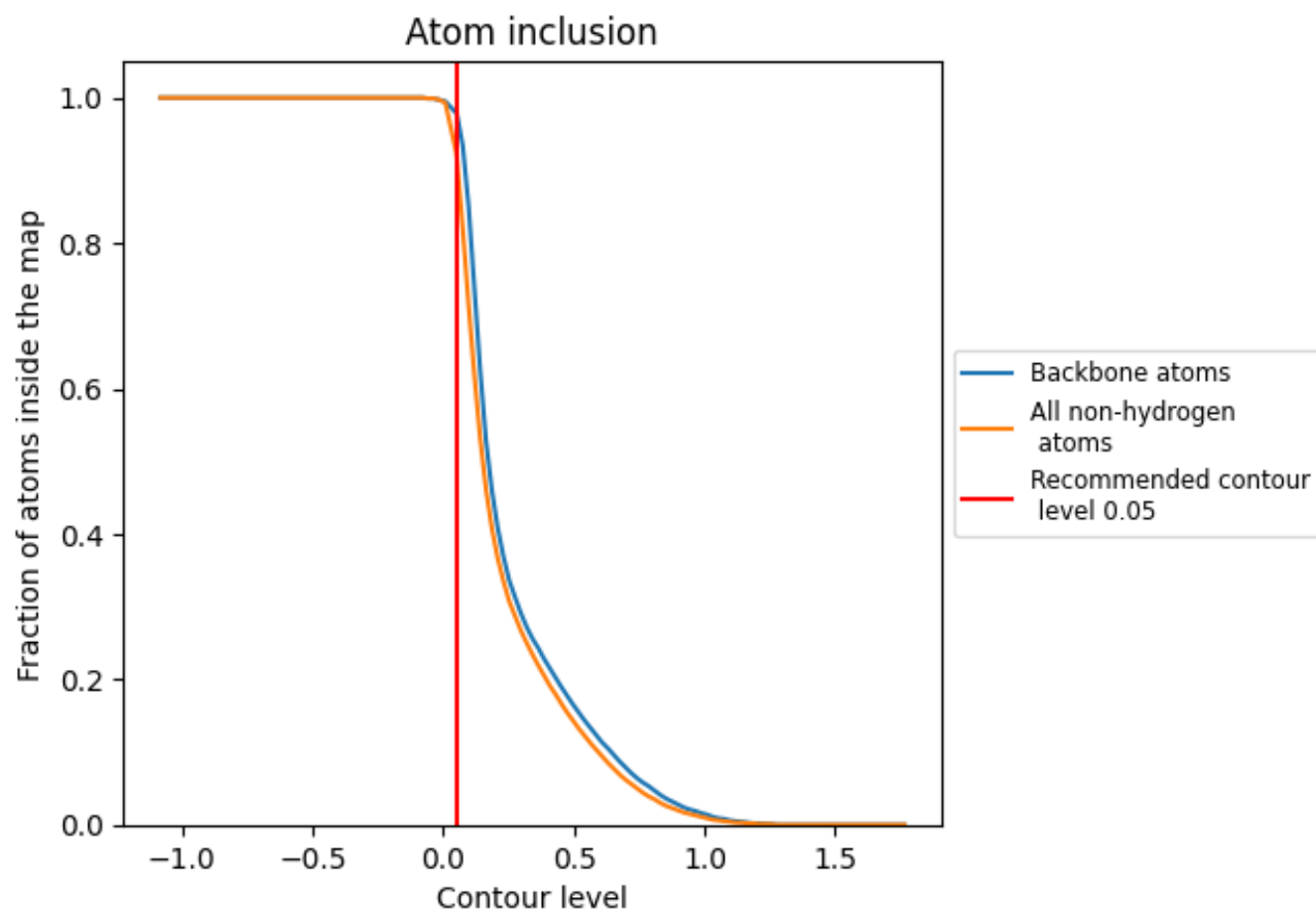
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.05).

9.4 Atom inclusion [i](#)



At the recommended contour level, 98% of all backbone atoms, 92% 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 (0.05) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9250	0.3940
A	0.9370	0.4350
B	0.9220	0.3780
C	0.9200	0.3410
D	0.8990	0.3010
E	0.6730	0.3340
F	0.7750	0.3770
G	0.9200	0.3190
H	0.6510	0.1850

1.0

0.0

<0.0