wwPDB EM Validation Summary Report ⓘ

Jun 1, 2026 – 10:31 AM EDT

PDB ID	:	12JP / pdb_000012jp
EMDB ID	:	EMD-76487
Title	:	Structural determination of lipid-bound Factor VIII
Authors	:	Mohammed, B.M.
Deposited on	:	2026-04-08
Resolution	:	3.46 Å(reported)
Based on initial models	:	., 3CDZ

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

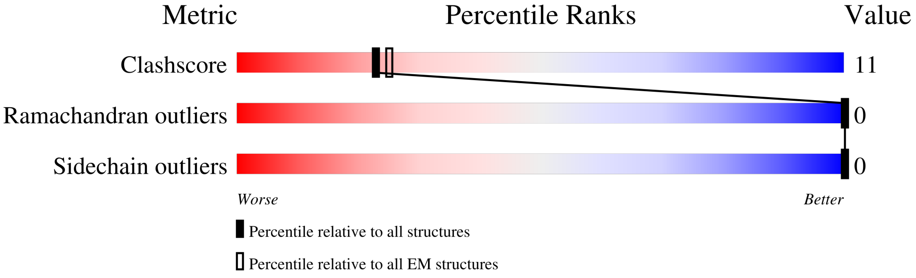
EMDB validation analysis	:	0.0.1.dev132
Mogul	:	2022.3.0, CSD as543be (2022)
MolProbity	:	4-5-2 with Phenix2.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics	:	202505.v01 (Using data 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

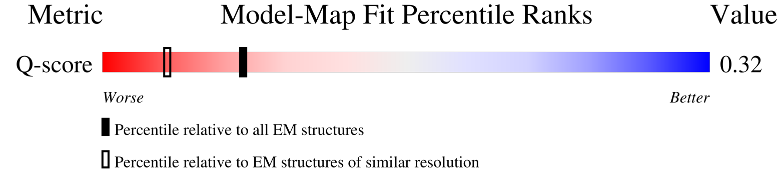
1 Overall quality at a glance ⓘ

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

The reported resolution of this entry is 3.46 Å.

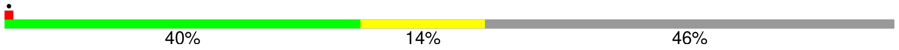
Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.





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	13788 (2.96 - 3.96)

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	2332	

2 Entry composition ⓘ

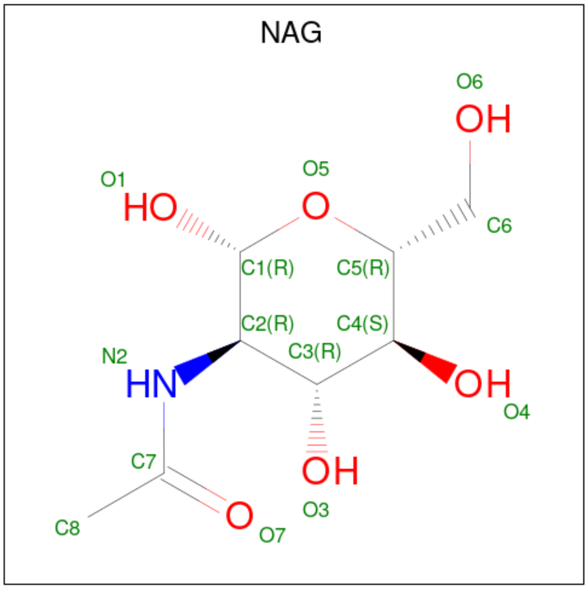
There are 4 unique types of molecules in this entry. The entry contains 10272 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Coagulation factor VIII.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	1263	10227	6572	1744	1854	57	0	0

- Molecule 2 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

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

- Molecule 4 is COPPER (II) ION (CCD ID: CU) (formula: Cu) (labeled as "Ligand of Interest" by depositor).

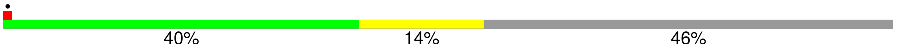
Mol	Chain	Residues	Atoms		AltConf
			Total	Cu	
4	A	2	2	2	0

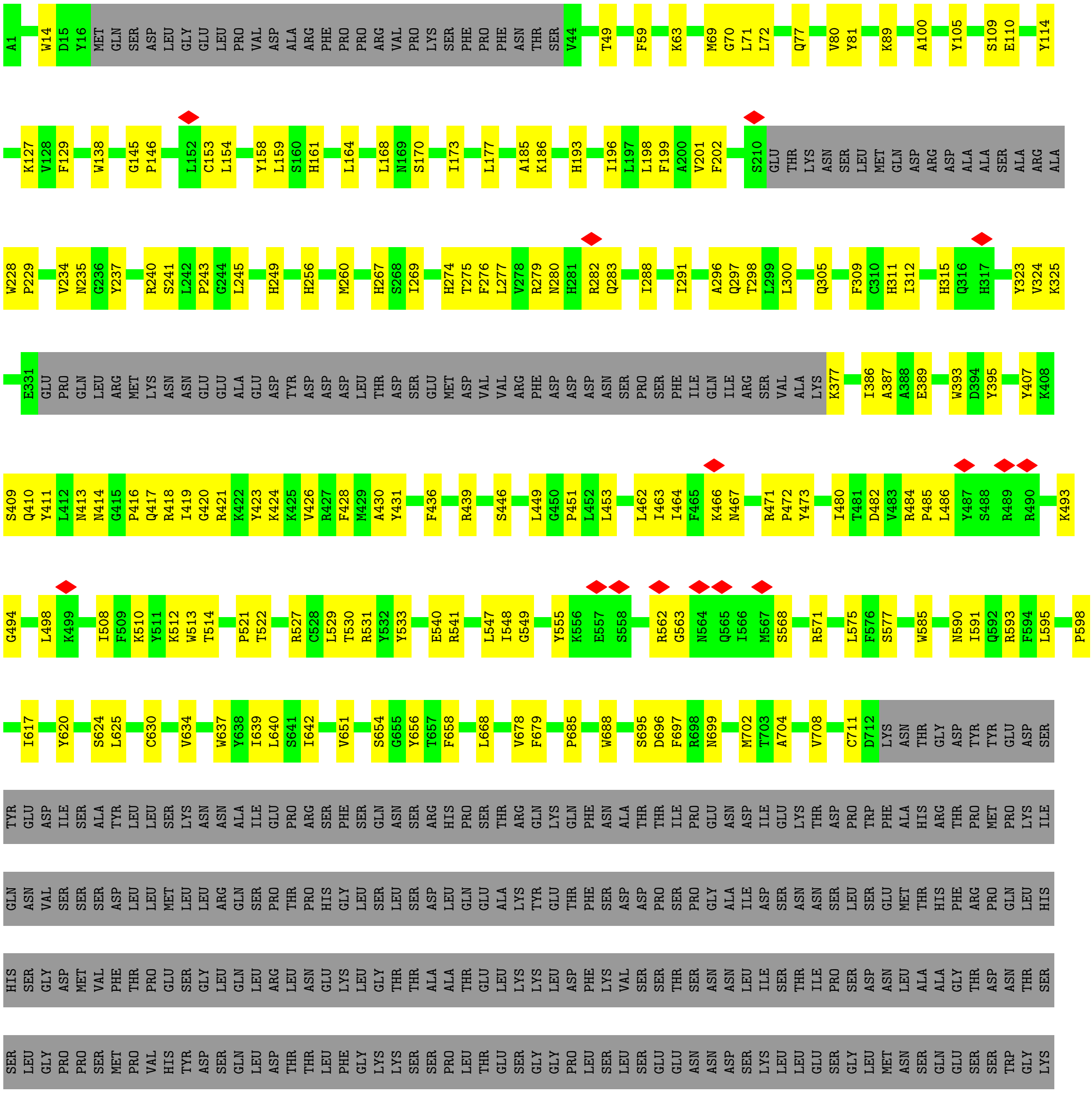
3 Residue-property plots ⓘ

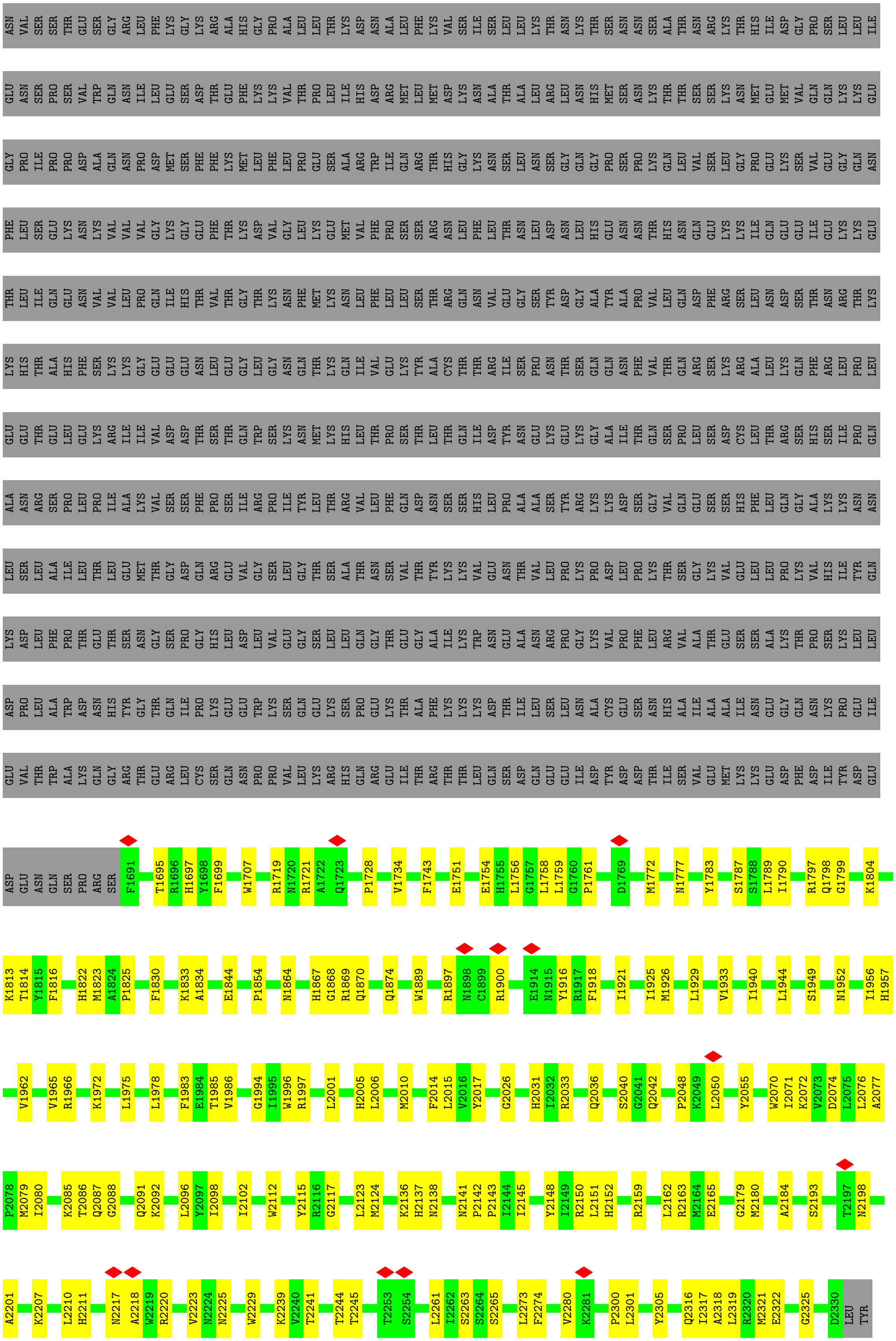
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion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

Chain A:






ASN VAL SER SER THR GLU SER GLY ARG LEU PHE LYS GLY LYS ARG ALA HIS GLY PRO ALA LEU LEU THR LYS ASP ASN ALA LEU PHE LYS VAL SER ILE SER LEU LEU LYS THR ASN LYS THR SER ASN ASN SER ALA THR ASN ARG LYS THR HIS ILE ASP GLY PRO SER LEU LEU ILE
GLU ASN SER PRO SER VAL TRP GLN ASN ILE LEU GLU SER ASP THR GLU PHE LYS LYS VAL THR PRO LEU ILE HIS ASP ARG MET LEU MET ASP LYS ASN ALA THR ALA LEU ARG LEU ASN HIS MET SER ASN LYS THR THR SER SER LYS ASN MET GLU MET VAL GLN GLN LYS LYS GLU
GLY PRO ILE PRO PRO ASP ALA GLN ASN PRO ASP MET SER PHE PHE LYS MET LEU PHE LEU PRO GLU SER ALA ARG TRP ILE GLN ARG THR HIS GLY LYS ASN SER LEU ASN SER GLY GLN GLY PRO SER PRO LYS GLN LEU VAL SER LEU GLY PRO GLU LYS SER VAL GLU GLY GLN ASN
PHE LEU SER GLU LYS ASN LYS VAL VAL VAL GLY LYS GLY GLU PHE THR LYS ASP VAL GLY LEU LYS GLU MET VAL PHE PRO SER SER ARG ASN LEU PHE LEU THR ASN LEU ASP ASN LEU HIS GLU ASN ASN THR HIS ASN GLN GLU LYS LYS ILE GLN GLU GLU ILE GLU LYS LYS GLU
THR LEU ILE GLN GLU ASN VAL VAL LEU PRO GLN ILE HIS THR VAL THR GLY THR LYS ASN PHE MET LYS ASN LEU PHE LEU LEU SER THR ARG GLN ASN VAL GLU GLY SER TYR ASP GLY ALA TYR ALA PRO VAL LEU GLN ASP PHE ARG SER LEU ASN ASP SER THR ASN ARG THR LYS
LYS HIS THR ALA HIS PHE SER LYS LYS GLY GLY GLU GLU ASN LEU GLU GLY LEU GLY ASN GLN THR LYS GLN ILE VAL GLU LYS TYR ALA CYS THR THR ARG ILE SER PRO ASN THR SER GLN GLN ASN PHE VAL THR GLN ARG SER LYS ARG ALA LEU LYS GLN PHE ARG LEU PRO LEU
GLU GLU THR GLU LEU GLU LYS ARG ILE ILE VAL ASP ASP THR SER THR GLN TRP SER LYS ASN MET LYS HIS LEU THR PRO SER THR LEU THR GLN ILE ASP TYR ASN GLU LYS GLU LYS GLY ALA ILE THR GLN SER PRO LEU SER ASP CYS LEU THR ARG SER HIS SER ILE PRO GLN
ALA ASN ARG SER PRO LEU PRO ILE ALA LYS VAL SER SER PHE PRO SER ILE ARG PRO ILE TYR LEU THR ARG VAL LEU PHE GLN ASP ASN SER SER HIS LEU PRO ALA ALA SER TYR ARG LYS LYS ASP SER GLY VAL GLN GLU SER SER HIS PHE LEU GLN GLY ALA LYS LYS ASN ASN
LEU SER LEU ALA ILE LEU THR LEU GLU MET THR GLY ASP GLN ARG GLU VAL GLY SER LEU GLY THR SER ALA THR ASN SER VAL THR TYR LYS LYS VAL GLU ASN THR VAL LEU PRO LYS PRO ASP LEU PRO LYS THR SER GLY LYS VAL GLU LEU LEU PRO LYS VAL HIS ILE TYR GLN
LYS ASP LEU PHE PRO THR GLU THR SER ASN GLY SER PRO GLY HIS LEU ASP LEU VAL GLU GLY SER LEU LEU GLN GLY THR GLU GLY ALA ILE LYS TRP ASN GLU ALA ASN ARG PRO GLY LYS VAL PRO PHE LEU ARG VAL ALA THR GLU SER SER ALA LYS THR PRO SER LYS LEU LEU
ASP PRO LEU ALA TRP ASP ASN HIS TYR GLY THR GLN ILE PRO LYS GLU GLU TRP LYS SER GLN GLU LYS SER PRO GLU LYS THR ALA PHE LYS LYS LYS ASP THR ILE LEU SER LEU ASN ALA CYS GLU SER ASN HIS ALA ILE ALA ALA ILE ASN GLU GLY GLN ASN LYS PRO GLU ILE
GLU VAL THR TRP ALA LYS GLN GLY ARG THR GLU ARG LEU CYS SER GLN ASN PRO PRO VAL LEU LYS ARG HIS GLN ARG GLU ILE THR ARG THR THR LEU GLN SER SER ASP GLN GLU GLU ILE ASP TYR ASP ASP THR ILE SER VAL GLU MET LYS LYS GLU ASP PHE ASP ILE TYR ASP GLU
ASP GLU ASN GLN SER PRO ARG SER F1691 T1695 R1696 H1697 Y1698 F1699 W1707 R1719 N1720 R1721 A1722 Q1723 P1728 V1734 F1743 E1751 E1754 H1755 L1756 G1757 L1758 L1759 G1760 P1761 D1769 M1772 N1777 Y1783 S1787 S1788 L1789 I1790 R1797 Q1798 G1799 K1804
K1813 T1814 Y1815 F1816 H1822 M1823 A1824 P1825 F1830 K1833 A1834 E1844 P1854 N1864 H1867 G1868 R1869 Q1870 Q1874 W1889 R1897 N1898 C1899 R1900 E1914 N1915 Y1916 R1917 F1918 I1921 I1925 M1926 L1929 V1933 I1940 L1944 S1949 N1952 I1956 H1957
V1962 V1965 R1966 K1972 L1975 L1978 F1983 E1984 T1985 V1986 G1994 I1995 W1996 R1997 L2001 H2005 L2006 M2010 F2014 L2015 V2016 Y2017 G2026 H2031 I2032 R2033 Q2036 S2040 G2041 Q2042 P2048 K2049 L2050 Y2055 W2070 I2071 K2072 V2073 D2074 L2075 L2076 A2077
P2078 M2079 I2080 K2085 T2086 Q2087 G2088 Q2091 K2092 L2096 Y2097 I2098 I2102 W2112 Y2115 R2116 G2117 L2123 M2124 K2136 H2137 N2138 N2141 P2142 P2143 I2144 I2145 Y2148 I2149 R2150 L2151 H2152 R2159 L2162 R2163 M2164 E2165 G2179 M2180 A2184 S2193 T2197 N2198
A2201 K2207 L2210 H2211 N2217 A2218 W2219 R2220 V2223 N2224 N2225 W2229 K2239 V2240 T2241 T2244 T2245 T2253 S2254 L2261 I2262 S2263 S2264 S2265 L2273 F2274 V2280 K2281 P2300 L2301 Y2305 Q2316 I2317 A2318 L2319 R2320 M2321 E2322 G2325 D2330 LEU TYR

4 Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	58291	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS GLACIOS	Depositor
Voltage (kV)	200	Depositor
Electron dose $(e^-/\text{Å}^2)$	55	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	150000	Depositor
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	2.681	Depositor
Minimum map value	-0.001	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.030	Depositor
Recommended contour level	0.149	Depositor
Map size (Å)	386.04797, 386.04797, 386.04797	wwPDB
Map dimensions	416, 416, 416	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.9279999, 0.9279999, 0.9279999	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: NAG, CU, CA

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	0/10517	0.37	0/14259

There are no bond length outliers.

There are no bond angle outliers.

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	10227	0	9975	228	0
2	A	42	0	39	0	0
3	A	1	0	0	0	0
4	A	2	0	0	0	0
All	All	10272	0	10014	228	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 11.

The worst 5 of 228 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:484:ARG:O	1:A:512:LYS:HB3	1.62	0.99
1:A:1797:ARG:HG3	1:A:1798:GLN:H	1.37	0.87
1:A:277:LEU:HD12	1:A:282:ARG:HE	1.40	0.84
1:A:2070:TRP:HA	1:A:2151:LEU:O	1.80	0.80
1:A:1864:ASN:H	1:A:1869:ARG:H	1.29	0.80

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	1253/2332 (54%)	1167 (93%)	86 (7%)	0	100 100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	1122/2093 (54%)	1122 (100%)	0	100 100

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

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	618	ASN
1	A	1770	ASN
1	A	2031	HIS
1	A	1820	GLN
1	A	1954	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 6 ligands modelled in this entry, 3 are monoatomic - leaving 3 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	$\#\|Z\| > 2$
2	NAG	A	2402	1	14,14,15	0.74	0	17,19,21	0.96	0
2	NAG	A	2401	1	14,14,15	0.72	0	17,19,21	0.87	1 (5%)
2	NAG	A	2403	1	14,14,15	0.75	0	17,19,21	0.84	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
2	NAG	A	2402	1	-	2/6/23/26	0/1/1/1
2	NAG	A	2401	1	-	0/6/23/26	0/1/1/1
2	NAG	A	2403	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	2401	NAG	C1-O5-C5	2.08	114.98	112.19

There are no chirality outliers.

All (4) torsion outliers are listed below:

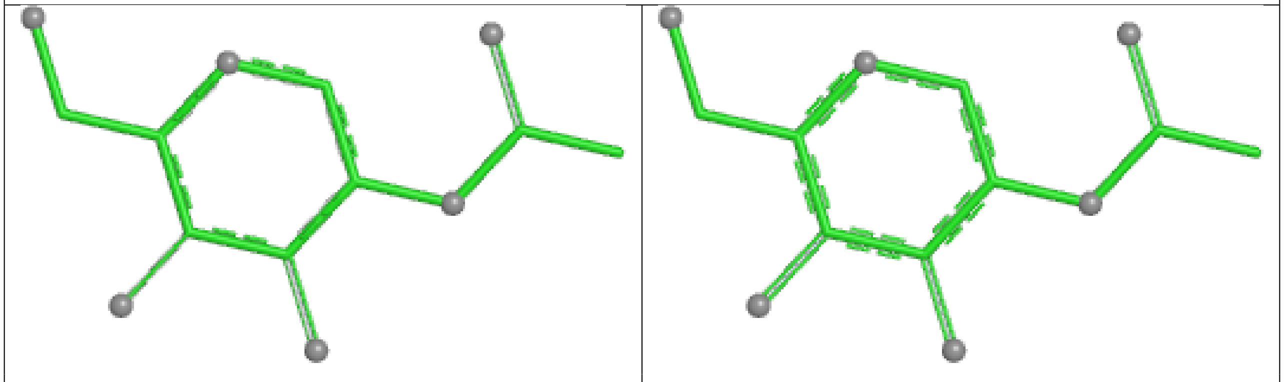
Mol	Chain	Res	Type	Atoms
2	A	2402	NAG	C8-C7-N2-C2
2	A	2402	NAG	O7-C7-N2-C2
2	A	2403	NAG	O5-C5-C6-O6
2	A	2403	NAG	C4-C5-C6-O6

There are no ring outliers.

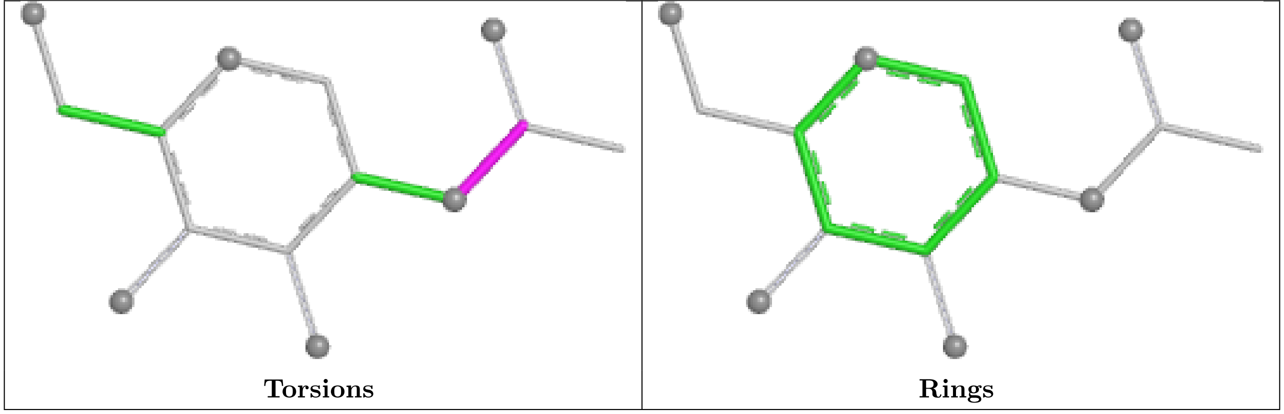
No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for 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 then 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.

Ligand NAG A 2402

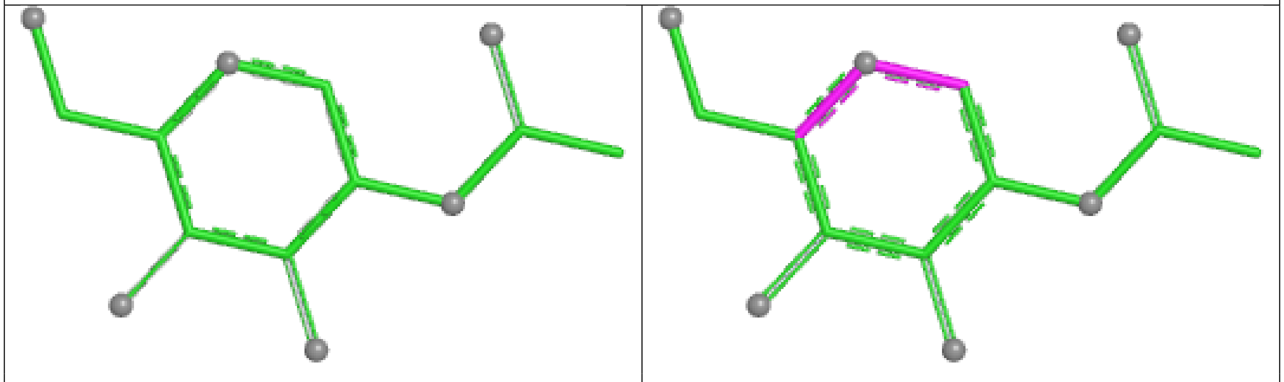


Bond lengths Bond angles

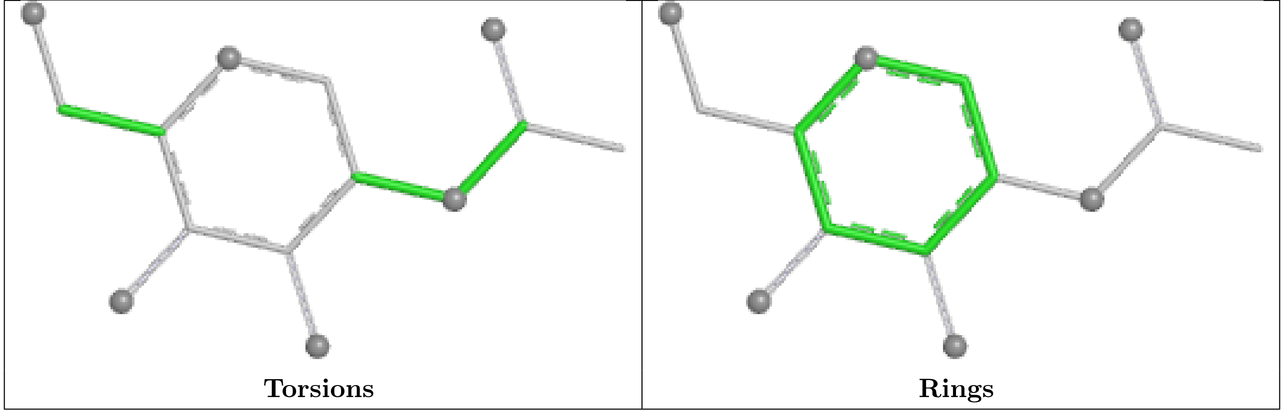


Torsions Rings

Ligand NAG A 2401

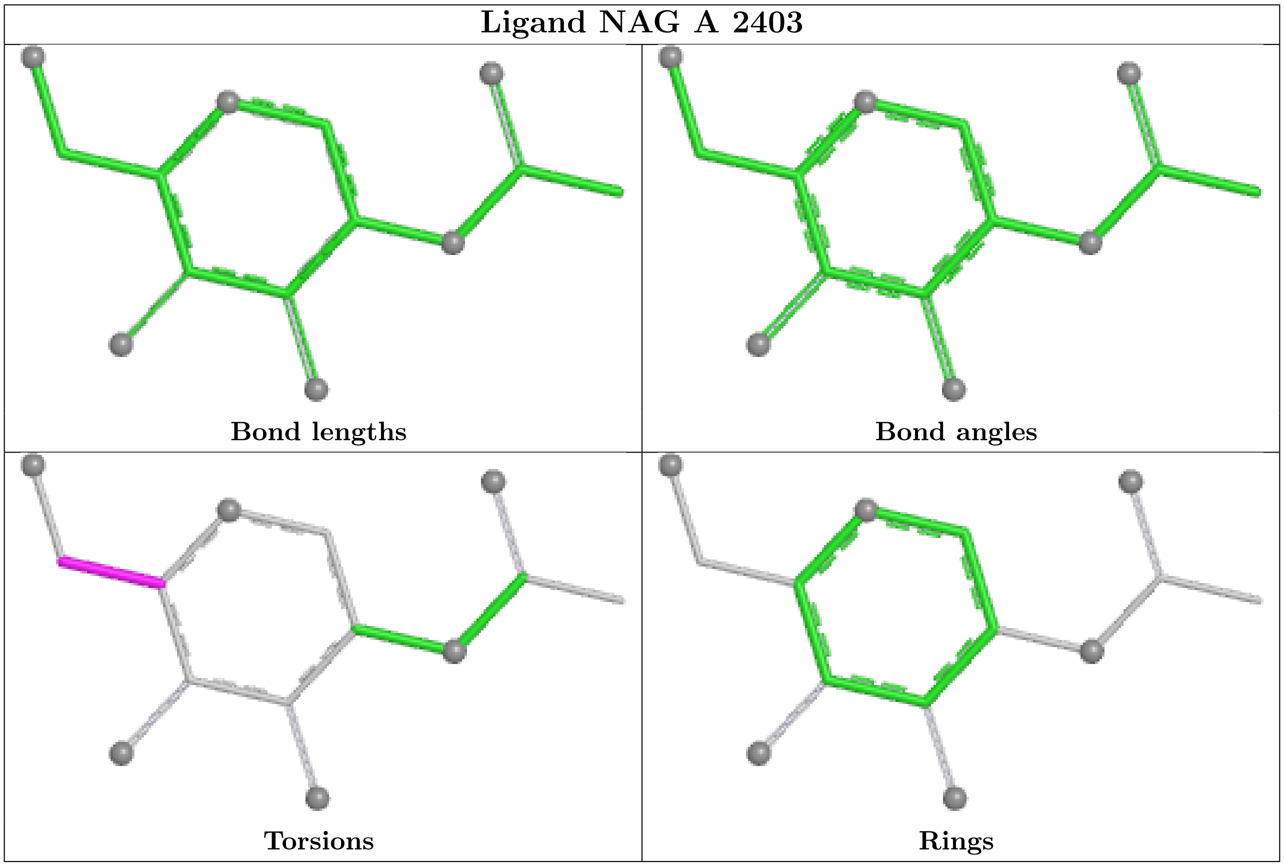


Bond lengths Bond angles



Torsions Rings

Ligand NAG A 2403



Bond lengths

Bond angles

Torsions

Rings

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.

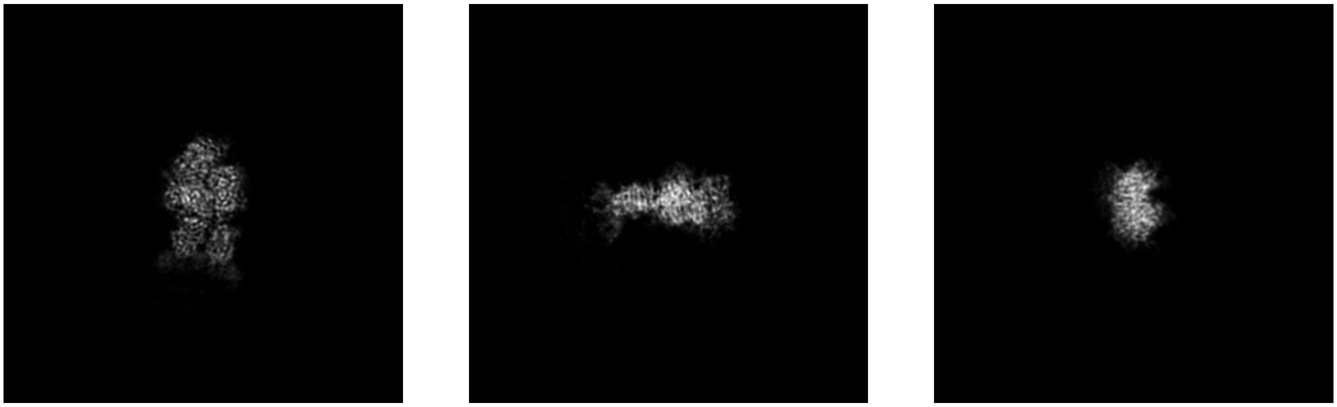
6 Map visualisation ⓘ

This section contains visualisations of the EMDB entry EMD-76487. 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 ⓘ

6.1.1 Primary map



X Y Z

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

6.2 Central slices ⓘ

6.2.1 Primary map

X Index: 208 Y Index: 208 Z Index: 208

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

6.3 Largest variance slices ⓘ

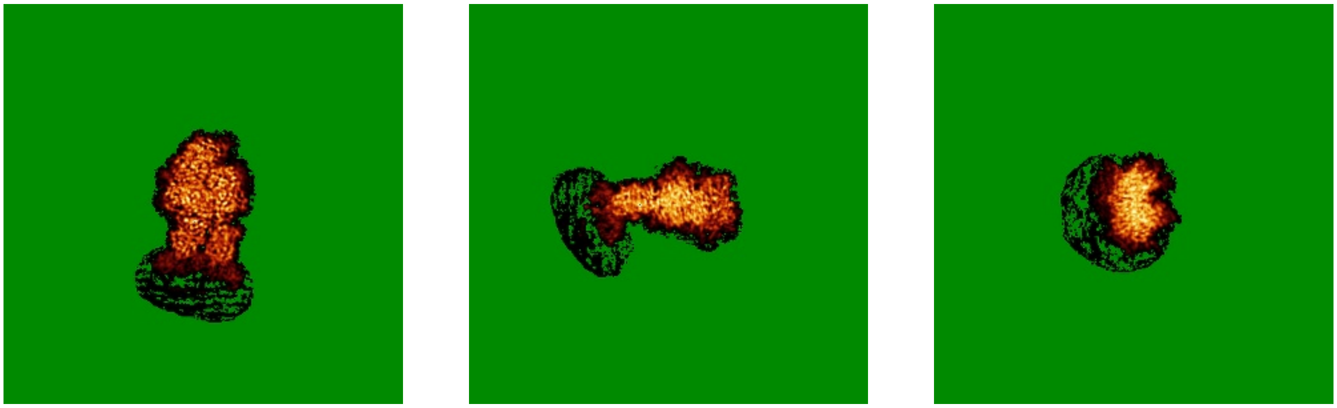
6.3.1 Primary map

X Index: 209 Y Index: 192 Z Index: 218

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

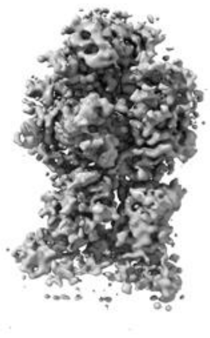


X Y Z

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.

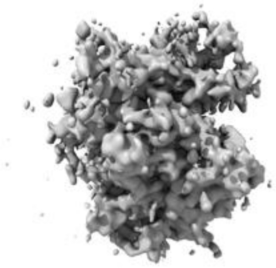
6.5 Orthogonal surface views ⓘ

6.5.1 Primary map



X

Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.149. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

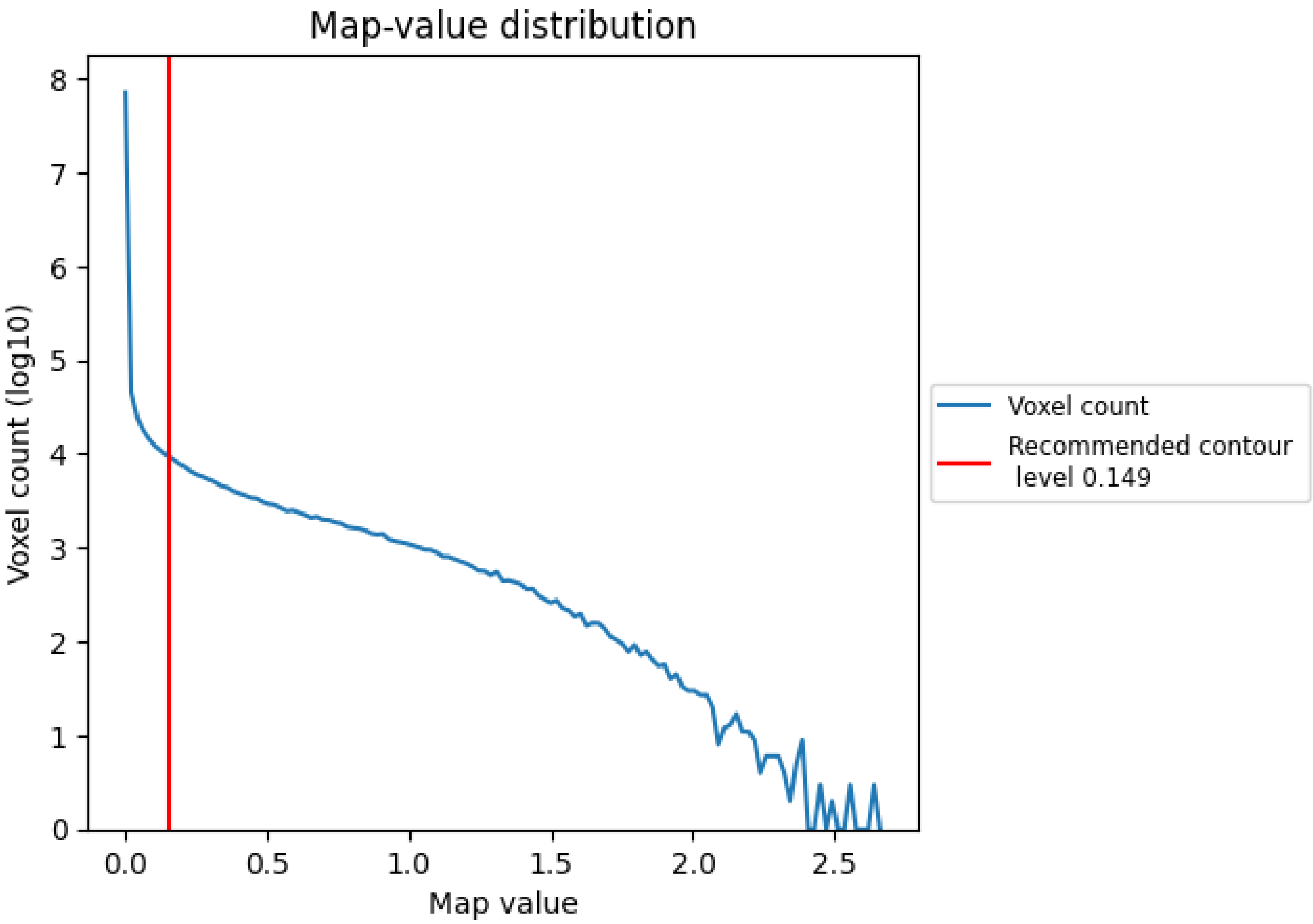
6.6 Mask visualisation ⓘ

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

7 Map analysis ⓘ

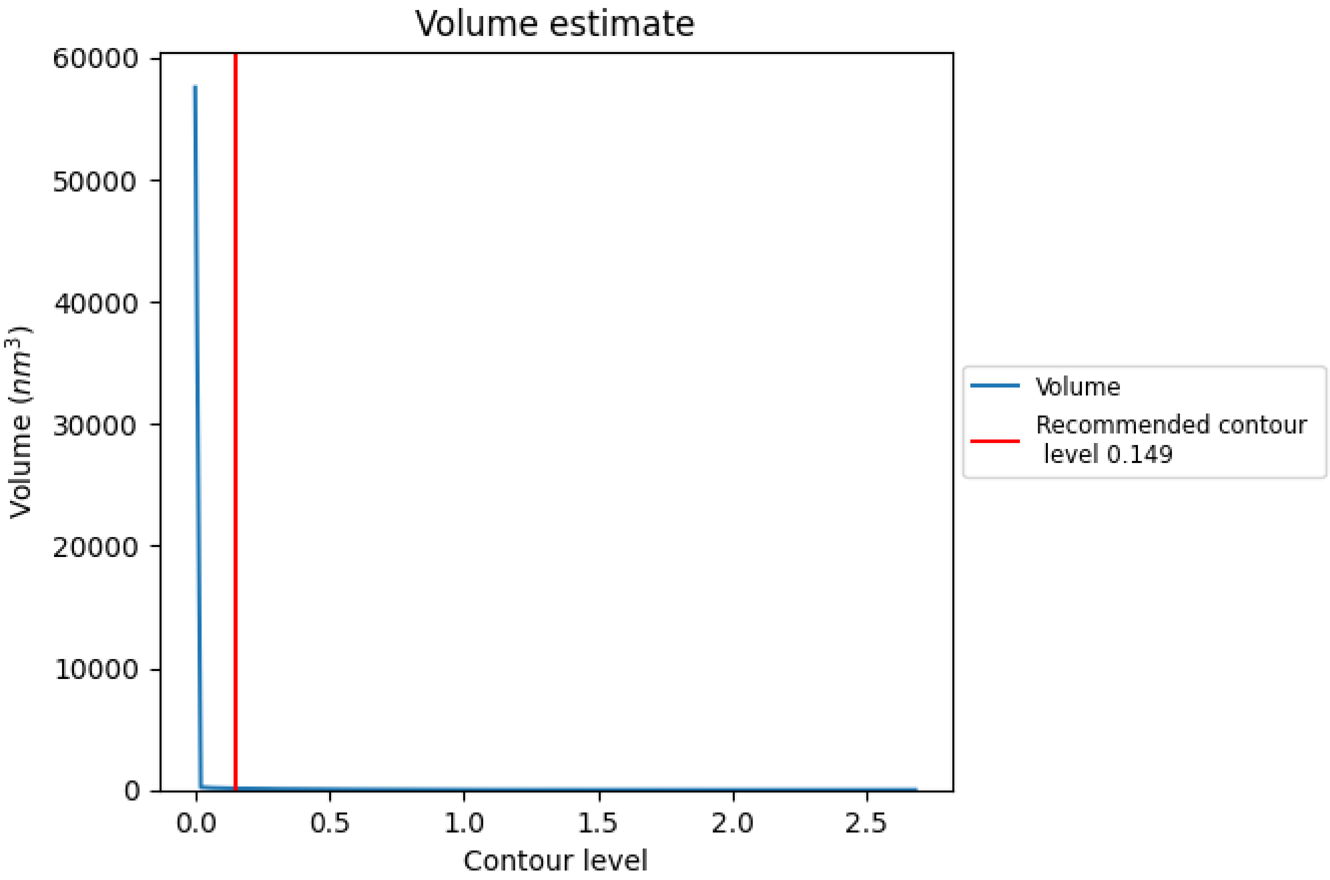
This section contains the results of statistical analysis of the map.

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.

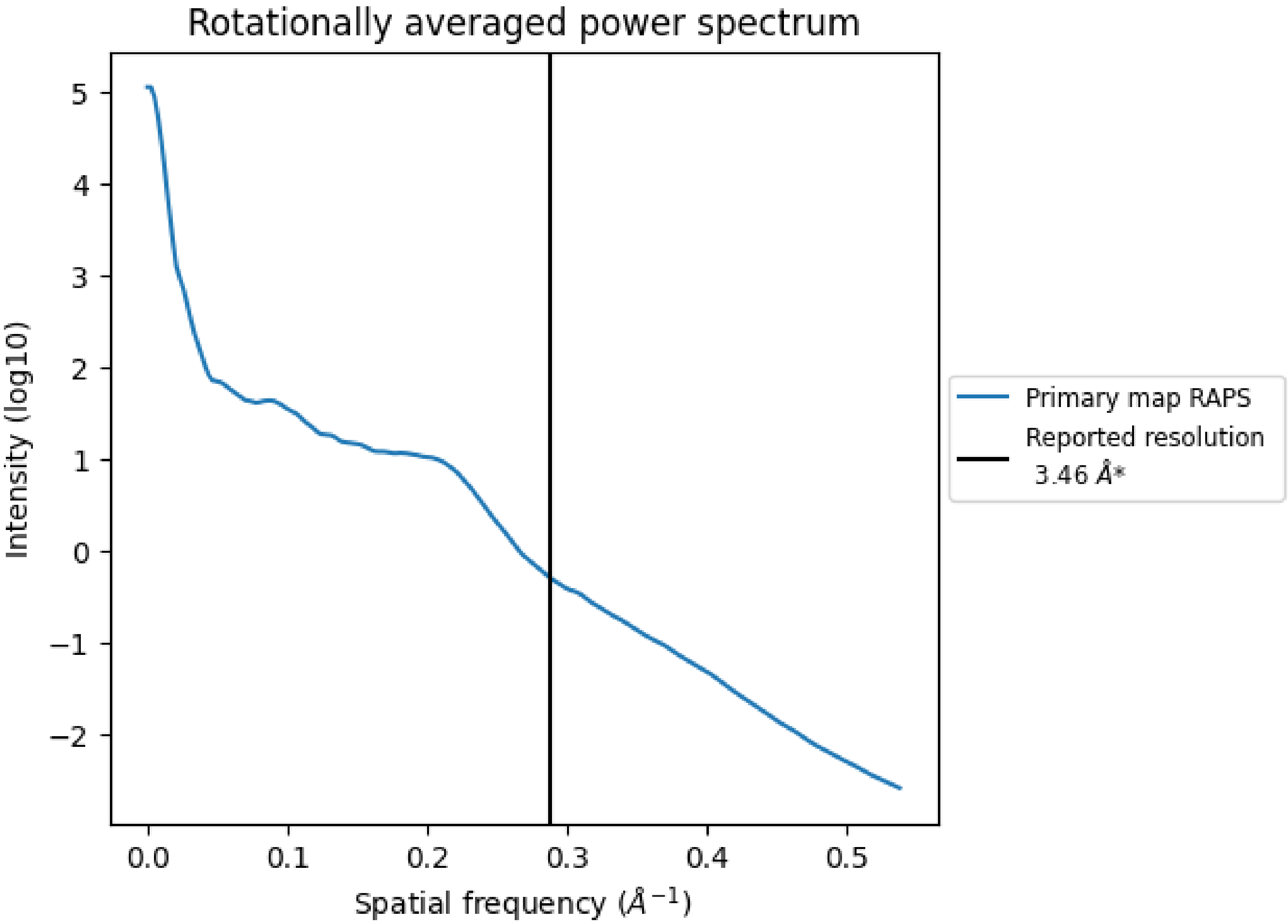
7.2 Volume estimate ⓘ



The volume at the recommended contour level is 123 nm^3; this corresponds to an approximate mass of 111 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 0.289 Å^{-1}

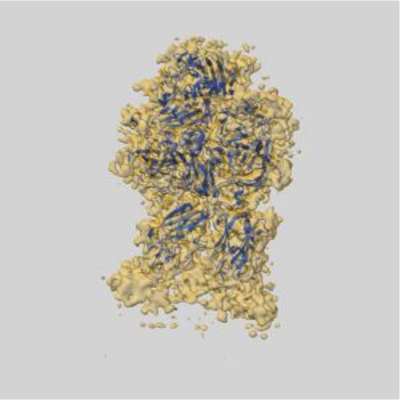
8 Fourier-Shell correlation

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

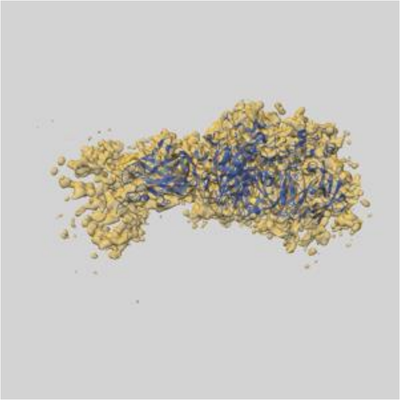
9 Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-76487 and PDB model 12JP. Per-residue inclusion information can be found in section 3 on page 5.

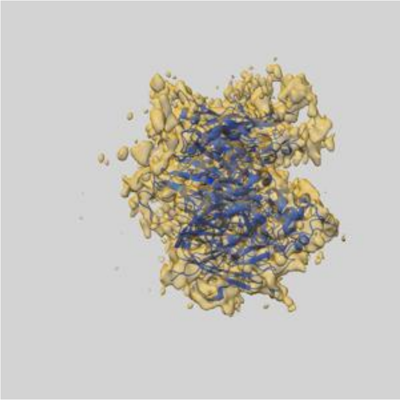
9.1 Map-model overlay ⓘ



X



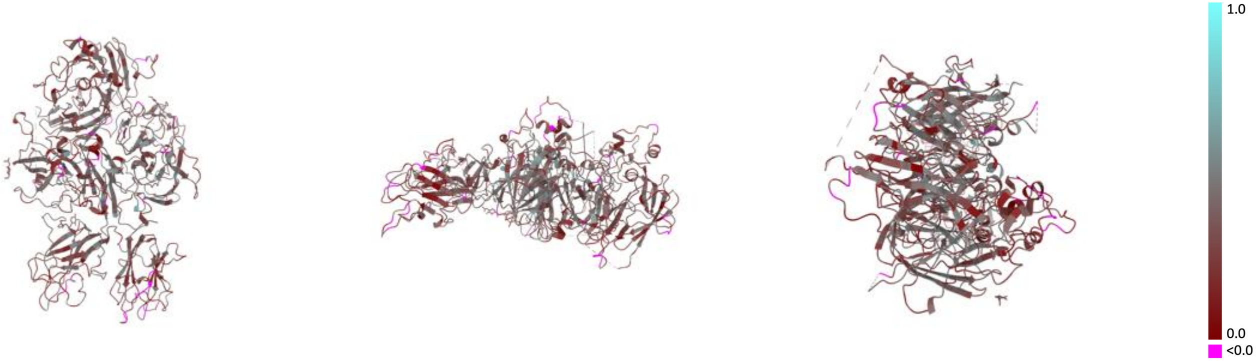
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.149 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.

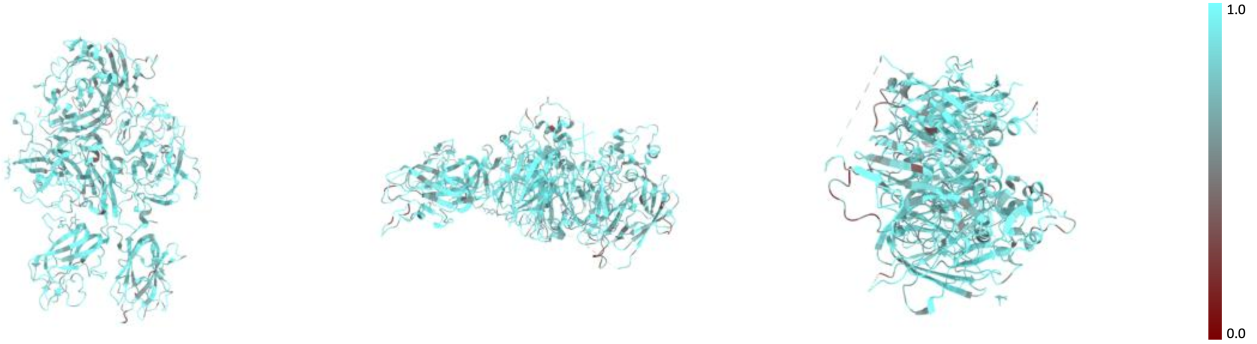
9.2 Q-score mapped to coordinate model (i)



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.

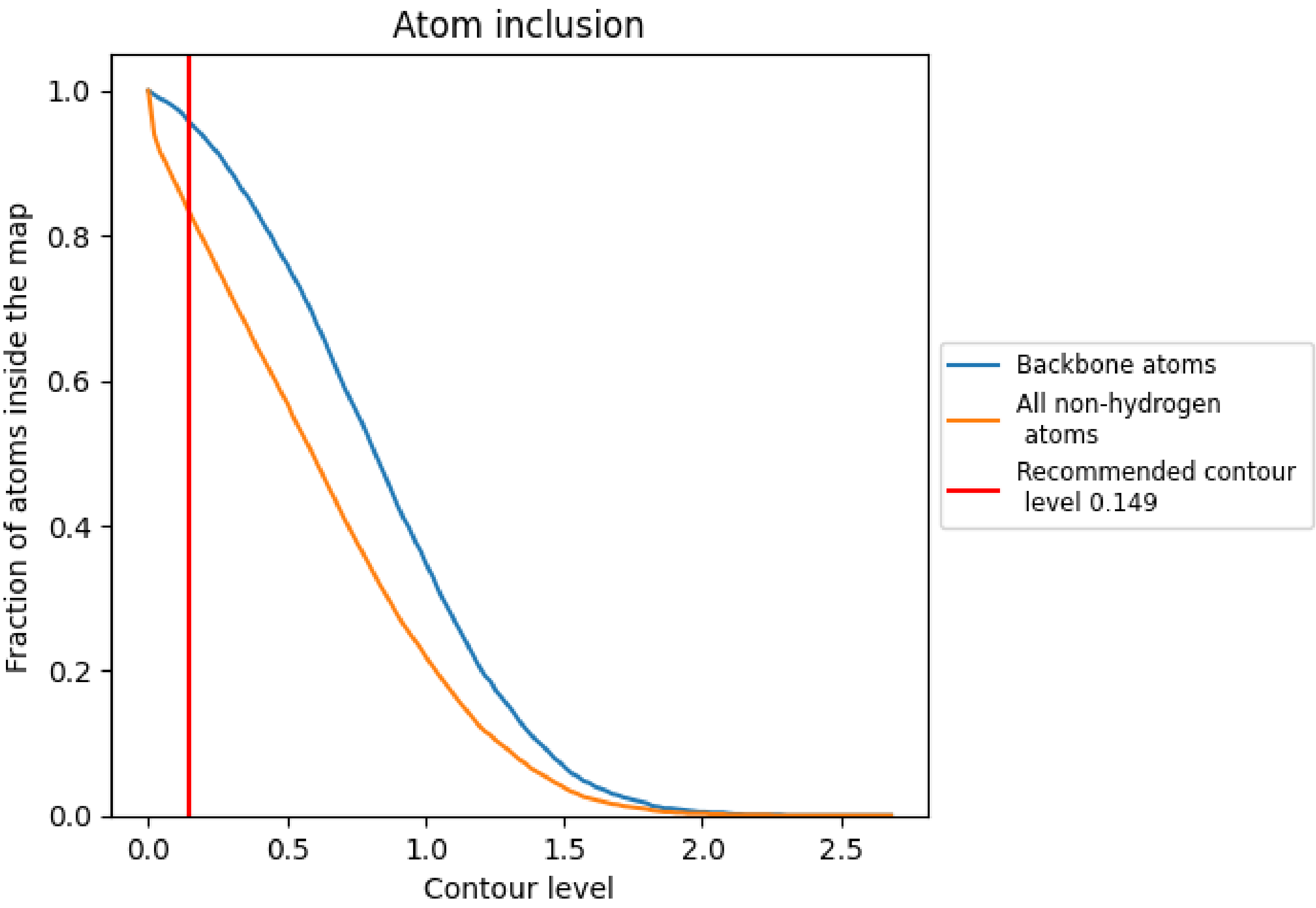
9.3 Atom inclusion mapped to coordinate model (i)



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 (0.149).

9.4 Atom inclusion ⓘ



At the recommended contour level, 96% of all backbone atoms, 83% 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 (0.149) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	🟦 0.8300	🟫 0.3200
A	🟦 0.8300	🟫 0.3200