W O R L D W I D E
wwPDB
P R O T E I N   D A T A   B A N K

wwPDB EM Validation Summary Report (i)

Dec 12, 2022 – 06:23 PM EST

PDB ID	:	3JBR
EMDB ID	:	EMD-6475
Title	:	Cryo-EM structure of the rabbit voltage-gated calcium channel Cav1.1 complex at 4.2 angstrom
Authors	:	Wu, J.P.; Yan, Z.; Yan, N.
Deposited on	:	2015-09-29
Resolution	:	4.20 Å(reported)
Based on initial model	:	1T0J

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 4.20 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	Percentile Ranks	Value
Clashscore		19
Ramachandran outliers		7.1%
Sidechain outliers		0.5%

Worse   *Better*

▮ Percentile relative to all structures
▯ Percentile relative to all EM structures
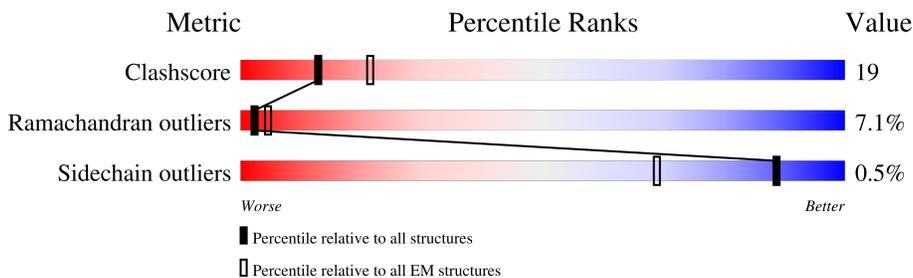
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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	1873	23% / 47% 17% • 35%
2	B	356	79% / 56% 23% 21%
3	E	222	8% / 58% 5% 38%
4	F	1106	• / 46% 29% • 21%

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 16467 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 Voltage-dependent L-type calcium channel subunit alpha-1S.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1224	Total	C	N	O	S	0	0
			7601	4843	1330	1400	28		

- Molecule 2 is a protein called Voltage-dependent L-type calcium channel subunit beta-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	281	Total	C	N	O	S	0	0
			2210	1405	385	411	9		

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	14	GLY	-	expression tag	UNP Q8VGC3
B	15	HIS	-	expression tag	UNP Q8VGC3
B	16	MET	-	expression tag	UNP Q8VGC3
B	201	MET	-	linker	UNP Q8VGC3

- Molecule 3 is a protein called Voltage-dependent calcium channel gamma-1 subunit.

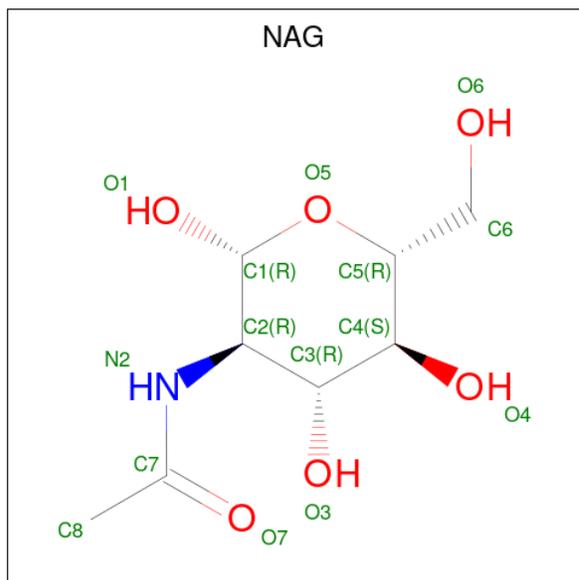| Mol	Chain	Residues	Atoms				AltConf	Trace
3	E	138	Total	C	N	O	0	0
			688	410	138	140		

- Molecule 4 is a protein called Voltage-dependent calcium channel subunit alpha-2/delta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	F	872	Total	C	N	O	S	0	0
			5735	3570	1042	1108	15		

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).

Mol	Chain	Residues	Atoms				AltConf
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	

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Mol	Chain	Residues	Atoms				AltConf
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	
6	F	1	Total	C	N	O	0
			210	120	15	75	

- Molecule 7 is beta-D-mannopyranose (three-letter code: BMA) (formula: $C_6H_{12}O_6$).
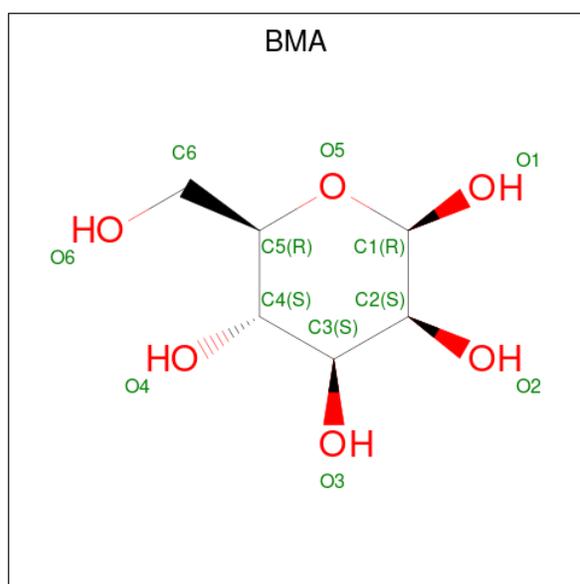
Mol	Chain	Residues	Atoms			AltConf
7	F	1	Total	C	O	0
			22	12	10	
7	F	1	Total	C	O	0
			22	12	10	

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: Voltage-dependent L-type calcium channel subunit alpha-1S

• Molecule 2: Voltage-dependent L-type calcium channel subunit beta-2

Chain B:

79%

56% 23% 21%

• Molecule 3: Voltage-dependent calcium channel gamma-1 subunit

Chain E:

8%

58% 5% 38%

• Molecule 4: Voltage-dependent calcium channel subunit alpha-2/delta-1
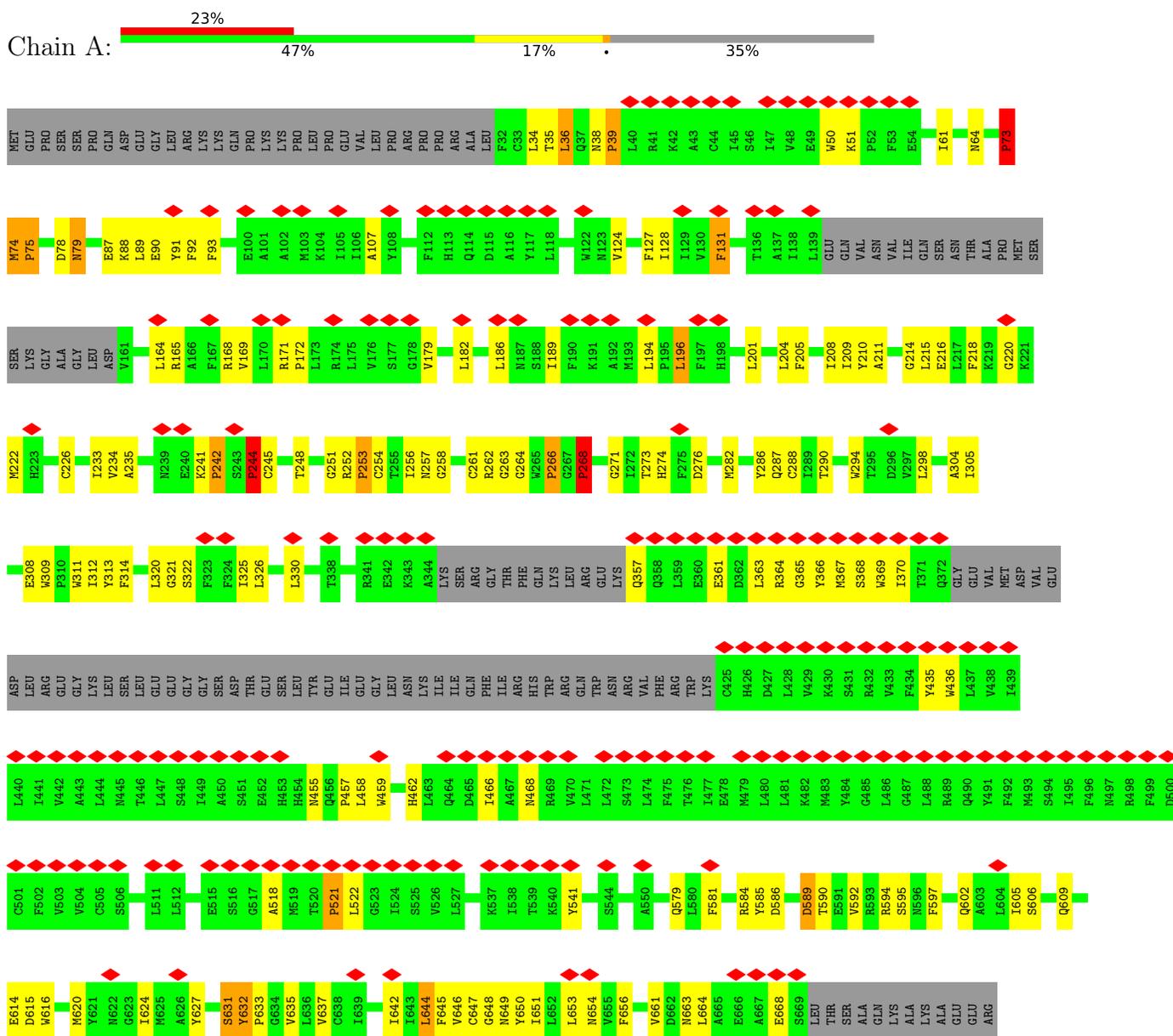
4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	353372	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	each micrograph	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	50	Depositor
Minimum defocus (nm)	2.0	Depositor
Maximum defocus (nm)	3.3	Depositor
Magnification	Not provided	
Image detector	GATAN K2 (4k x 4k)	Depositor
Maximum map value	0.159	Depositor
Minimum map value	-0.079	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.005	Depositor
Recommended contour level	0.035	Depositor
Map size (Å)	337.92, 337.92, 337.92	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.32, 1.32, 1.32	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, BMA, 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	0.45	0/7080	0.57	19/9723 (0.2%)
2	B	0.22	0/2252	0.40	0/3051
3	E	0.31	0/685	0.45	0/950
4	F	0.48	1/4603 (0.0%)	0.67	14/6265 (0.2%)
All	All	0.43	1/14620 (0.0%)	0.58	33/19989 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	627	PRO	N-CD	5.04	1.54	1.47

The worst 5 of 33 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	987	PRO	N-CA-CB	6.39	110.96	103.30
1	A	1346	PRO	N-CA-CB	6.35	110.92	103.30
1	A	457	PRO	N-CA-CB	6.34	110.91	103.30
1	A	73	PRO	N-CA-CB	6.10	110.62	103.30
1	A	253	PRO	N-CA-CB	6.10	110.62	103.30

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.

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PROTEIN DATA BANK

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	7601	0	5495	201	0
2	B	2210	0	2208	65	0
3	E	688	0	336	4	0
4	F	5735	0	4413	281	0
5	A	1	0	0	0	0
6	F	210	0	195	11	0
7	F	22	0	20	2	0
All	All	16467	0	12667	542	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 19.

The worst 5 of 542 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)
4:F:607:ARG:HA	4:F:627:PRO:HD3	1.21	1.14
4:F:607:ARG:HA	4:F:627:PRO:CD	1.84	1.07
4:F:626:LEU:O	4:F:628:THR:N	2.02	0.92
4:F:248:GLN:HE21	4:F:447:GLN:HG2	1.37	0.89
4:F:606:ASN:O	4:F:627:PRO:HD2	1.73	0.88

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	1084/1873 (58%)	936 (86%)	75 (7%)	73 (7%)	1	18
2	B	272/356 (76%)	261 (96%)	11 (4%)	0	100	100
3	E	132/222 (60%)	127 (96%)	2 (2%)	3 (2%)	6	37
4	F	617/1106 (56%)	461 (75%)	83 (14%)	73 (12%)	0	6
All	All	2105/3557 (59%)	1785 (85%)	171 (8%)	149 (7%)	2	17

5 of 149 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	38	ASN
1	A	39	PRO
1	A	74	MET
1	A	75	PRO
1	A	242	PRO

5.3.2   Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	430/1519 (28%)	428 (100%)	2 (0%)	88	93
2	B	240/315 (76%)	240 (100%)	0	100	100
3	E	3/192 (2%)	3 (100%)	0	100	100
4	F	417/706 (59%)	414 (99%)	3 (1%)	84	90
All	All	1090/2732 (40%)	1085 (100%)	5 (0%)	89	93

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	364	ARG
1	A	1070	GLU
4	F	359	ILE
4	F	626	LEU
4	F	628	THR

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

Mol	Chain	Res	Type
2	B	324	ASN
2	B	363	HIS
4	F	1013	ASN
4	F	615	ASN
4	F	1007	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 monosaccharides in this entry.

5.6   Ligand geometry ⓘ

Of 18 ligands modelled in this entry, 1 is monoatomic - leaving 17 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	$\#\|Z\| > 2$
6	NAG	F	1203	-	14,14,15	0.31	0	17,19,21	0.36	0
6	NAG	F	1212	-	14,14,15	0.25	0	17,19,21	0.44	0
6	NAG	F	1206	-	14,14,15	0.28	0	17,19,21	0.40	0
6	NAG	F	1214	-	14,14,15	0.31	0	17,19,21	0.42	0
6	NAG	F	1213	-	14,14,15	0.30	0	17,19,21	0.37	0
6	NAG	F	1215	-	14,14,15	0.29	0	17,19,21	0.48	0
6	NAG	F	1210	-	14,14,15	0.27	0	17,19,21	0.39	0
6	NAG	F	1207	-	14,14,15	0.25	0	17,19,21	0.44	0
6	NAG	F	1211	-	14,14,15	0.26	0	17,19,21	0.37	0
6	NAG	F	1208	-	14,14,15	0.29	0	17,19,21	0.44	0
6	NAG	F	1202	-	14,14,15	0.22	0	17,19,21	0.42	0
7	BMA	F	1217	-	11,11,12	0.63	0	15,15,17	0.70	0
6	NAG	F	1205	-	14,14,15	0.23	0	17,19,21	0.40	0
6	NAG	F	1209	-	14,14,15	0.27	0	17,19,21	0.39	0
7	BMA	F	1216	-	11,11,12	0.56	0	15,15,17	0.76	0
6	NAG	F	1204	-	14,14,15	0.22	0	17,19,21	0.51	0
6	NAG	F	1201	-	14,14,15	0.24	0	17,19,21	0.55	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
6	NAG	F	1203	-	-	2/6/23/26	0/1/1/1
6	NAG	F	1212	-	-	1/6/23/26	0/1/1/1
6	NAG	F	1206	-	-	0/6/23/26	0/1/1/1
6	NAG	F	1214	-	-	2/6/23/26	0/1/1/1
6	NAG	F	1213	-	-	0/6/23/26	0/1/1/1
6	NAG	F	1215	-	-	3/6/23/26	0/1/1/1
6	NAG	F	1210	-	-	0/6/23/26	0/1/1/1
6	NAG	F	1207	-	-	2/6/23/26	0/1/1/1
6	NAG	F	1211	-	-	2/6/23/26	0/1/1/1
6	NAG	F	1208	-	-	0/6/23/26	0/1/1/1
6	NAG	F	1202	-	-	2/6/23/26	0/1/1/1
7	BMA	F	1217	-	-	0/2/19/22	0/1/1/1
6	NAG	F	1205	-	-	2/6/23/26	0/1/1/1
6	NAG	F	1209	-	-	3/6/23/26	0/1/1/1
7	BMA	F	1216	-	-	0/2/19/22	0/1/1/1
6	NAG	F	1204	-	-	0/6/23/26	0/1/1/1
6	NAG	F	1201	-	-	3/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 22 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	F	1201	NAG	O5-C5-C6-O6
6	F	1205	NAG	O5-C5-C6-O6
6	F	1203	NAG	C4-C5-C6-O6
6	F	1202	NAG	O5-C5-C6-O6
6	F	1207	NAG	O5-C5-C6-O6

There are no ring outliers.

8 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	F	1203	NAG	3	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	F	1212	NAG	1	0
6	F	1207	NAG	2	0
6	F	1211	NAG	1	0
7	F	1217	BMA	2	0
6	F	1205	NAG	2	0
6	F	1209	NAG	2	0
6	F	1204	NAG	2	0

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-6475. 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 |
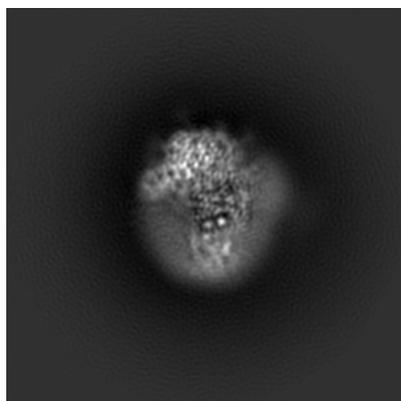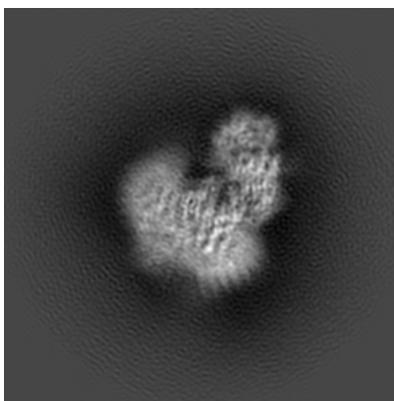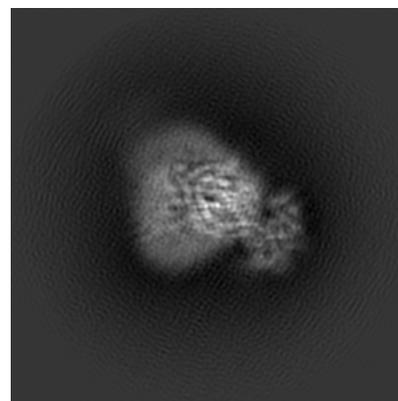
The images above show the map projected in three orthogonal directions.

6.2 Central slices ⓘ
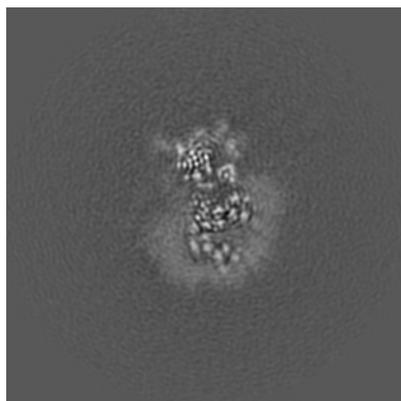
6.2.1 Primary map
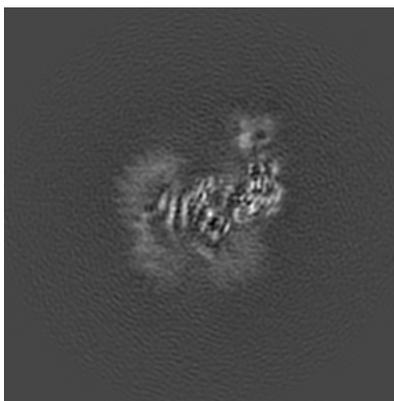
| X Index: 128 | Y Index: 128 | Z Index: 128 |
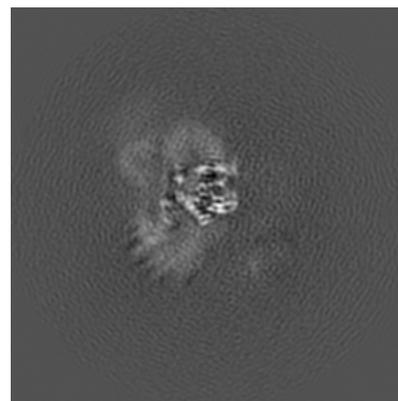
The images above show central slices of the map in three orthogonal directions.

6.3   Largest variance slices ⓘ
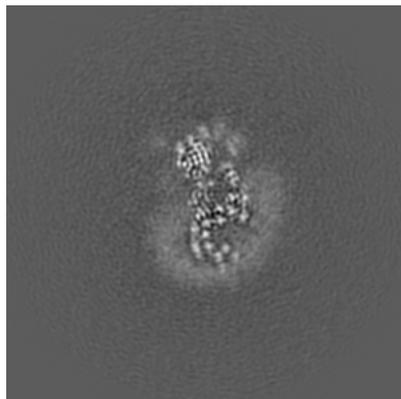
6.3.1   Primary map
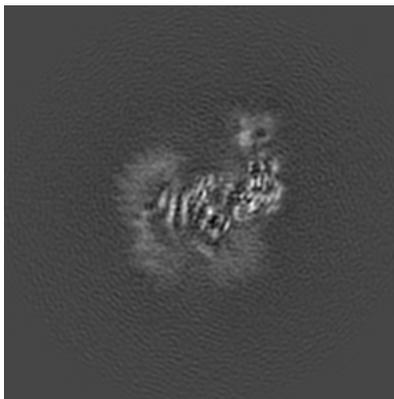
| X Index: 126 | Y Index: 128 | Z Index: 153 |
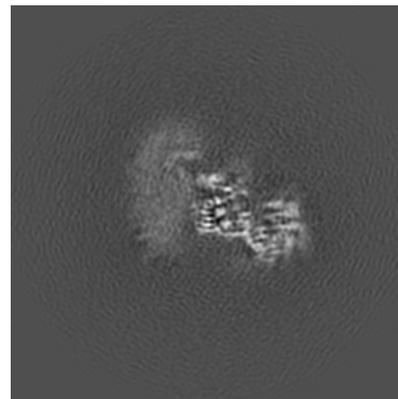
The images above show the largest variance slices of the map in three orthogonal directions.

6.4   Orthogonal surface views ⓘ

6.4.1   Primary map

| X | Y | Z |

The images above show the 3D surface view of the map at the recommended contour level 0.035. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

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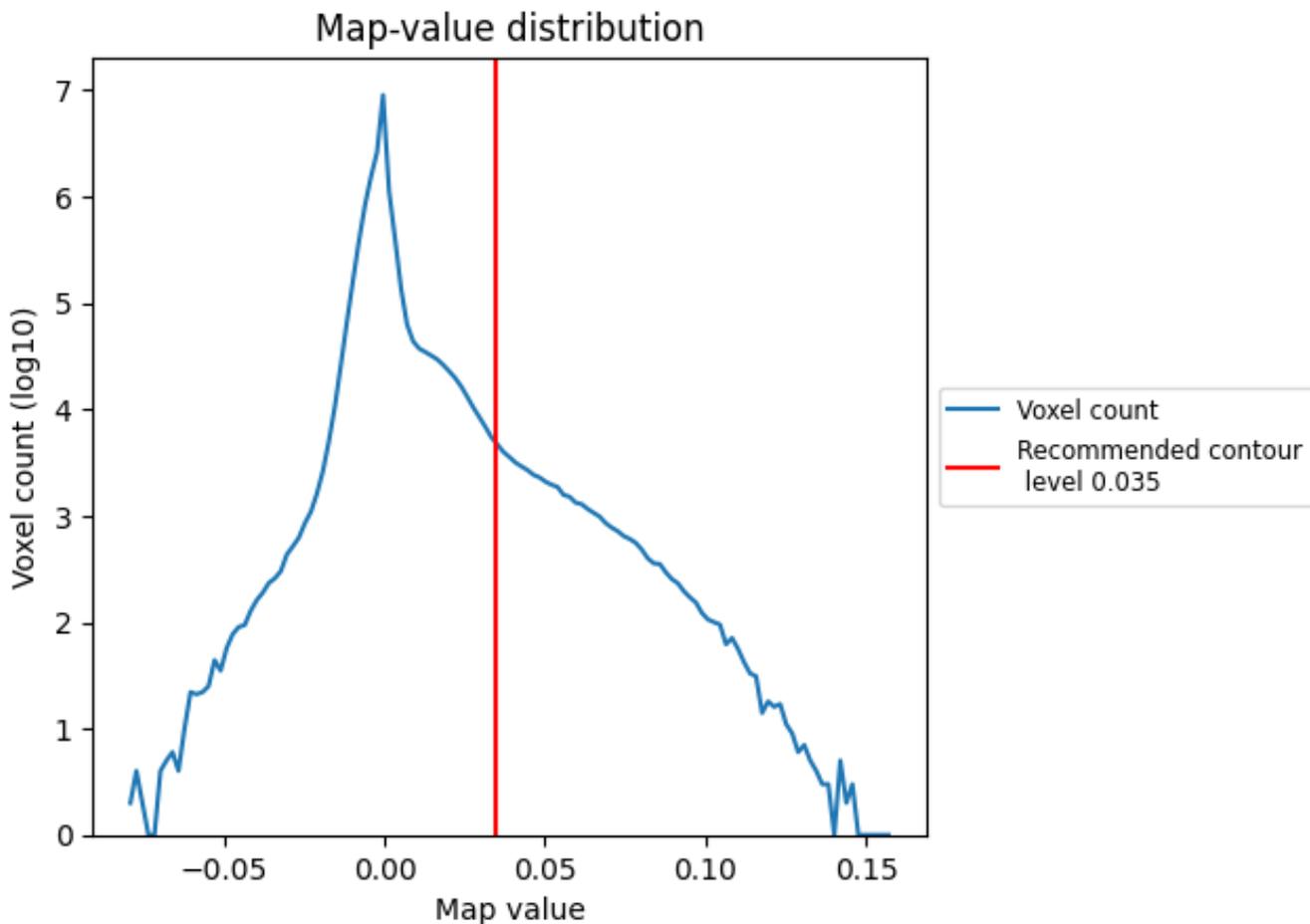
The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

7.2   Volume estimate ⓘ
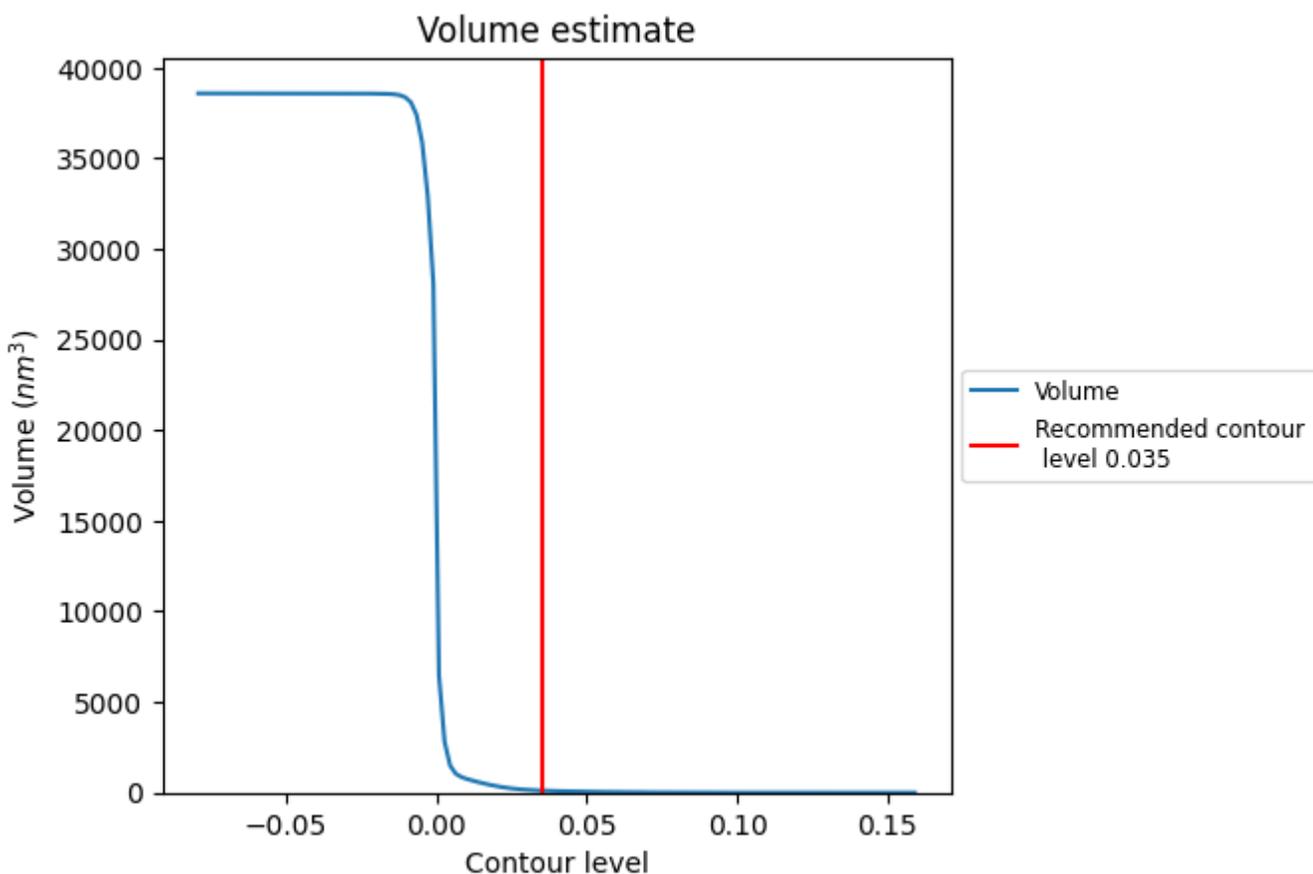
The volume at the recommended contour level is 113 nm^3; this corresponds to an approximate mass of 102 kDa.

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 ⓘ
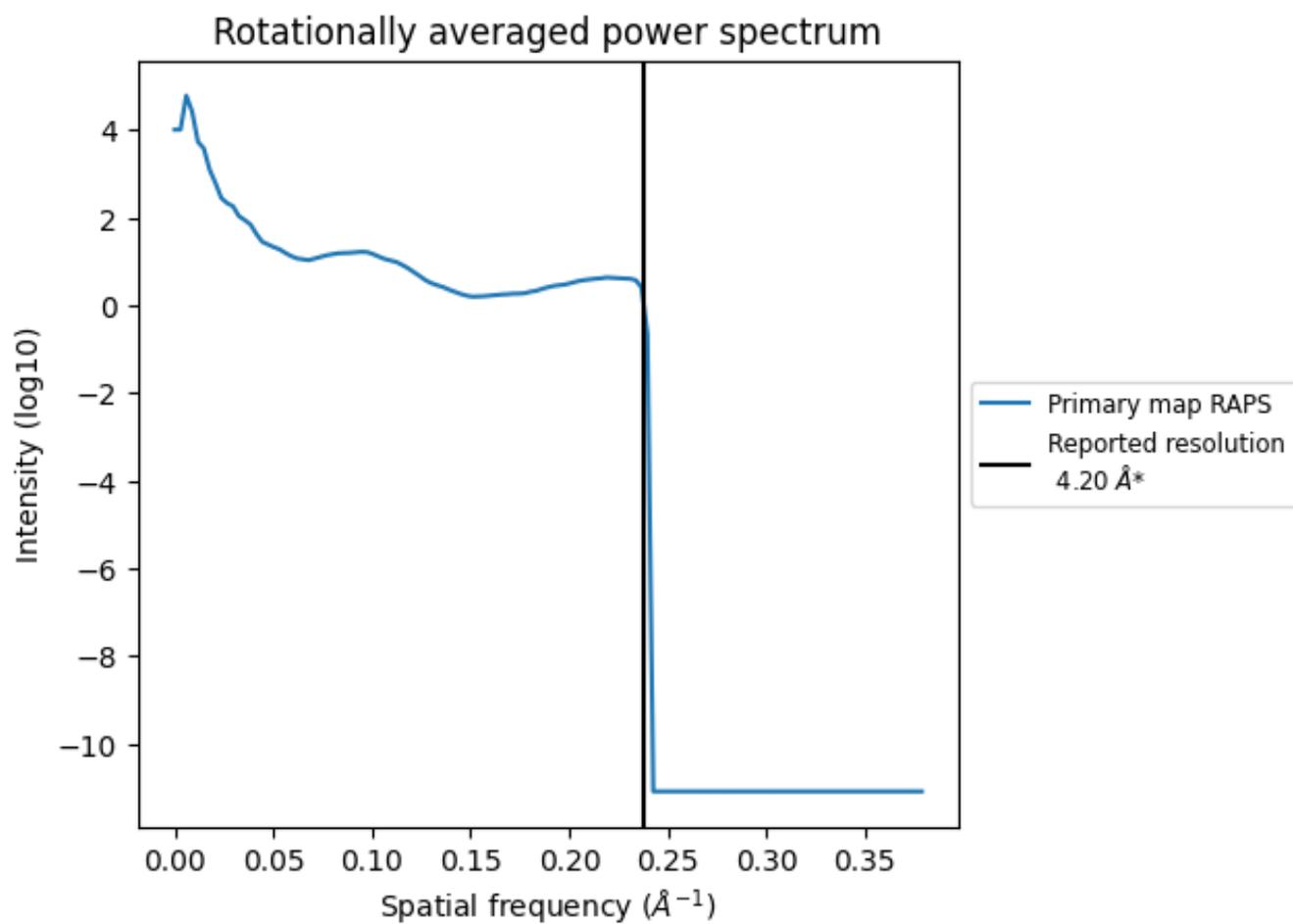
*Reported resolution corresponds to spatial frequency of 0.238 Å^{-1}

8　Fourier-Shell correlation (i)

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-6475 and PDB model 3JBR. Per-residue inclusion information can be found in section 3 on page 6.

9.1 Map-model overlay ⓘ

| X | Y | Z |
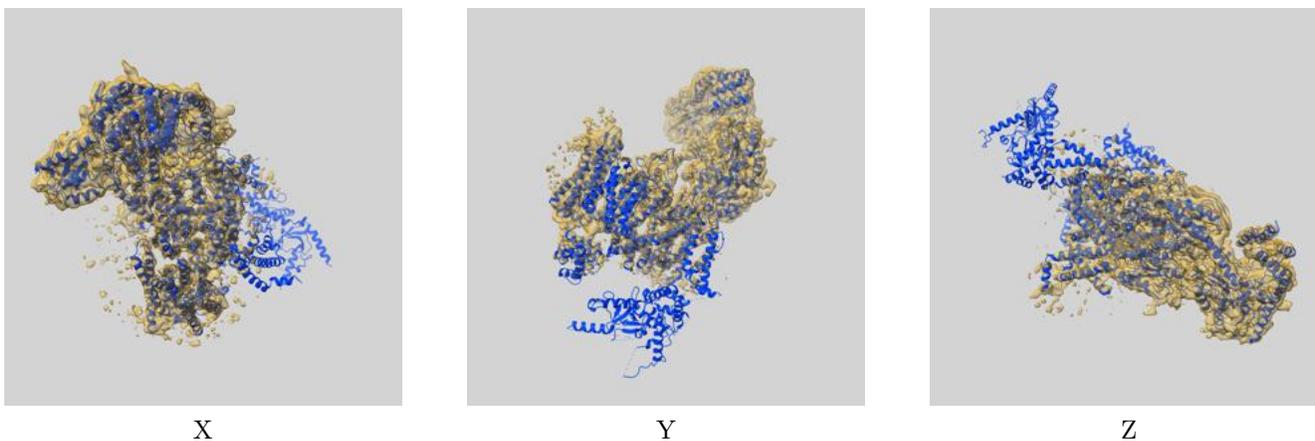
The images above show the 3D surface view of the map at the recommended contour level 0.035 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

## 9.2   Q-score mapped to coordinate model ⓘ

X   Y   Z
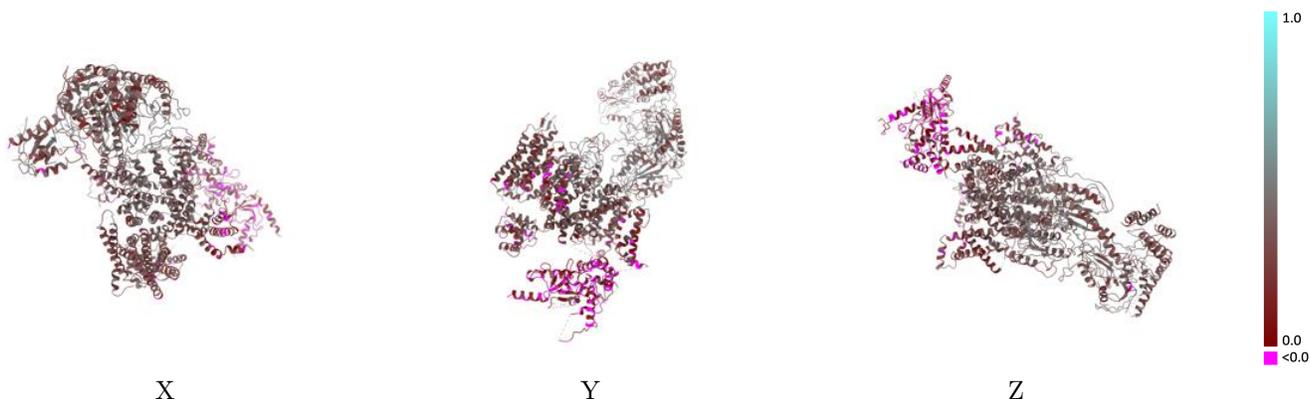
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.035).

9.4 Atom inclusion ⓘ
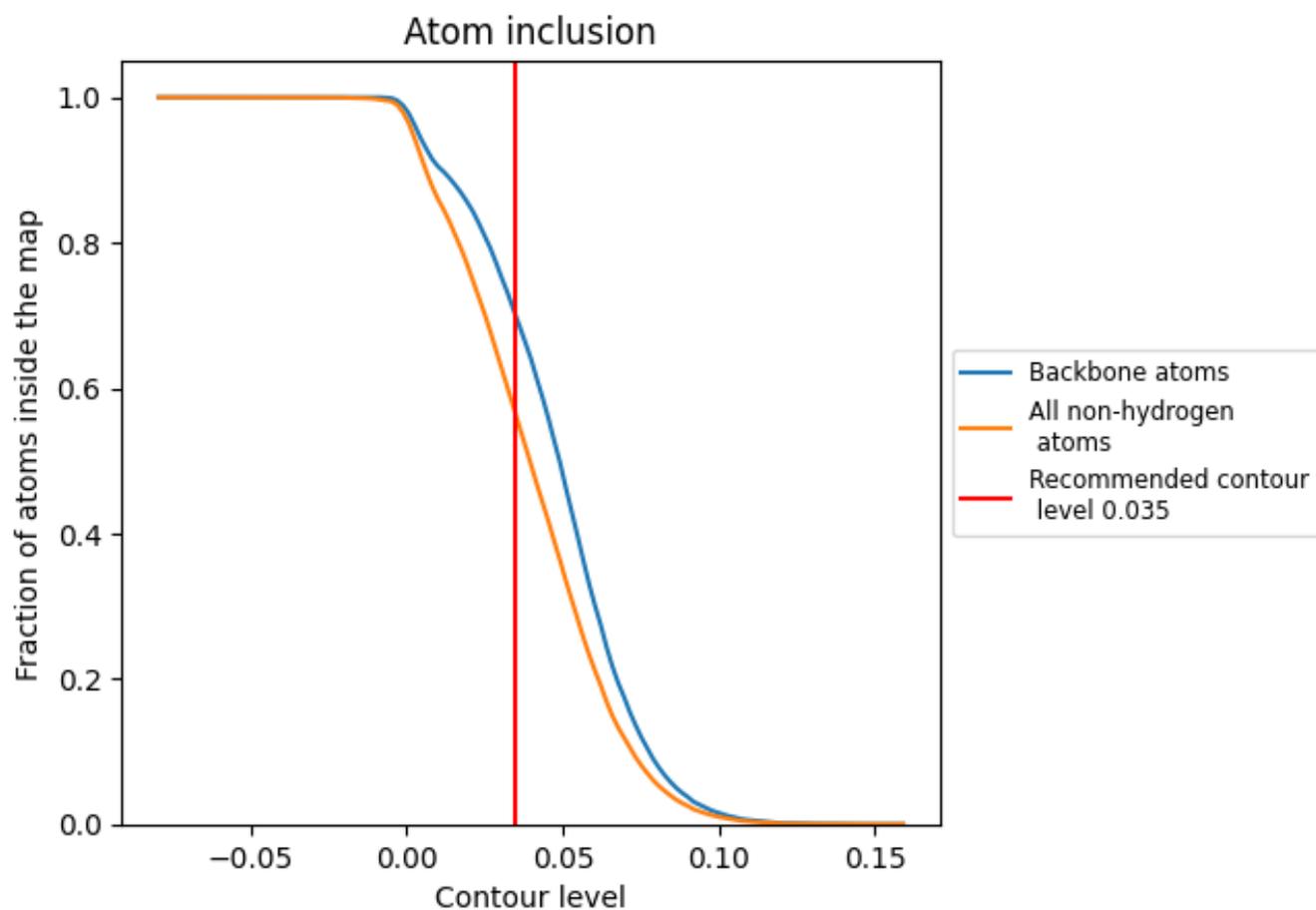
At the recommended contour level, 70% of all backbone atoms, 56% of all non-hydrogen atoms, are inside the map.

9.5   Map-model fit summary ⓘ

The table lists the average atom inclusion at the recommended contour level (0.035) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.5632	0.2980
A	0.5292	0.3090
B	0.0000	0.0640
E	0.7573	0.2800
F	0.7912	0.3730

1.0

0.0
<0.0