wwPDB EM Validation Summary Report (i)

May 26, 2025 – 11:37 PM EDT

PDB ID	:	7RW6 / pdb_00007rw6
EMDB ID	:	EMD-24709
Title	:	BORF2-APOBEC3Bctd Complex
Authors	:	Shaban, N.M.; Yan, R.; Shi, K.; McLellan, J.S.; Yu, Z.; Harris, R.S.
Deposited on	:	2021-08-19
Resolution	:	2.55 Å(reported)

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 2.55 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		9
Ramachandran outliers		0
Sidechain outliers		0

Worse   *Better*

∎ Percentile relative to all structures

▯ Percentile relative to all EM structures
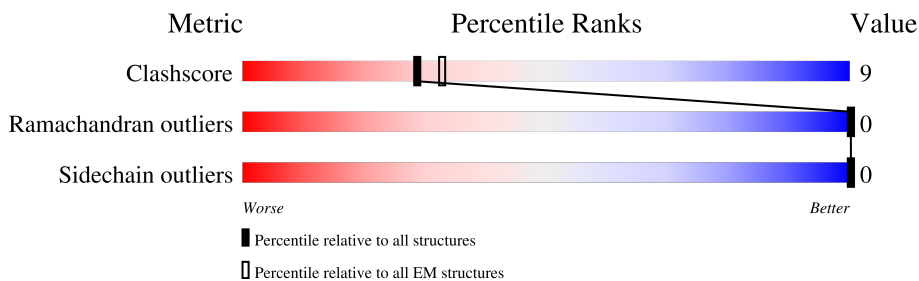
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=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	1197	· 42% 11% 46%
1	C	1197	· 42% 12% 46%
2	B	215	10% 56% 26% 19%
2	D	215	11% 60% 21% 19%

2   Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 13130 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 Maltose/maltodextrin-binding periplasmic protein,Ribonucleo side-diphosphate reductase large subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	642	Total 5100	C 3254	N 871	O 943	S 32	0	0
1	C	642	Total 5100	C 3254	N 871	O 943	S 32	0	0

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-370	MET	-	initiating methionine	UNP P0AEX9
A	-288	ALA	ASP	engineered mutation	UNP P0AEX9
A	-287	ALA	LYS	engineered mutation	UNP P0AEX9
A	-198	ALA	GLU	engineered mutation	UNP P0AEX9
A	-197	ALA	ASN	engineered mutation	UNP P0AEX9
A	-131	ALA	LYS	engineered mutation	UNP P0AEX9
A	-11	ALA	-	linker	UNP P0AEX9
A	-10	ALA	-	linker	UNP P0AEX9
A	-9	LEU	-	linker	UNP P0AEX9
A	-8	ALA	-	linker	UNP P0AEX9
A	-7	ALA	-	linker	UNP P0AEX9
A	-6	ALA	-	linker	UNP P0AEX9
A	-5	GLN	-	linker	UNP P0AEX9
A	-4	THR	-	linker	UNP P0AEX9
A	-3	ASN	-	linker	UNP P0AEX9
A	-2	ALA	-	linker	UNP P0AEX9
A	-1	ALA	-	linker	UNP P0AEX9
A	0	ALA	-	linker	UNP P0AEX9
C	-370	MET	-	initiating methionine	UNP P0AEX9
C	-288	ALA	ASP	engineered mutation	UNP P0AEX9
C	-287	ALA	LYS	engineered mutation	UNP P0AEX9
C	-198	ALA	GLU	engineered mutation	UNP P0AEX9
C	-197	ALA	ASN	engineered mutation	UNP P0AEX9
C	-131	ALA	LYS	engineered mutation	UNP P0AEX9
C	-11	ALA	-	linker	UNP P0AEX9

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-10	ALA	-	linker	UNP P0AEX9
C	-9	LEU	-	linker	UNP P0AEX9
C	-8	ALA	-	linker	UNP P0AEX9
C	-7	ALA	-	linker	UNP P0AEX9
C	-6	ALA	-	linker	UNP P0AEX9
C	-5	GLN	-	linker	UNP P0AEX9
C	-4	THR	-	linker	UNP P0AEX9
C	-3	ASN	-	linker	UNP P0AEX9
C	-2	ALA	-	linker	UNP P0AEX9
C	-1	ALA	-	linker	UNP P0AEX9
C	0	ALA	-	linker	UNP P0AEX9

- Molecule 2 is a protein called DNA dC->dU-editing enzyme APOBEC-3B.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	175	Total 1464	C 940	N 250	O 263	S 11	0	0
2	D	175	Total 1464	C 940	N 250	O 263	S 11	0	0

There are 50 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	383	LYS	-	expression tag	UNP Q9UH17
B	384	LEU	-	expression tag	UNP Q9UH17
B	385	GLY	-	expression tag	UNP Q9UH17
B	386	PRO	-	expression tag	UNP Q9UH17
B	387	GLU	-	expression tag	UNP Q9UH17
B	388	GLN	-	expression tag	UNP Q9UH17
B	389	LYS	-	expression tag	UNP Q9UH17
B	390	LEU	-	expression tag	UNP Q9UH17
B	391	ILE	-	expression tag	UNP Q9UH17
B	392	SER	-	expression tag	UNP Q9UH17
B	393	GLU	-	expression tag	UNP Q9UH17
B	394	GLU	-	expression tag	UNP Q9UH17
B	395	ASP	-	expression tag	UNP Q9UH17
B	396	LEU	-	expression tag	UNP Q9UH17
B	397	ASN	-	expression tag	UNP Q9UH17
B	398	SER	-	expression tag	UNP Q9UH17
B	399	ALA	-	expression tag	UNP Q9UH17
B	400	VAL	-	expression tag	UNP Q9UH17
B	401	ASP	-	expression tag	UNP Q9UH17

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Chain	Residue	Modelled	Actual	Comment	Reference
B	402	HIS	-	expression tag	UNP Q9UH17
B	403	HIS	-	expression tag	UNP Q9UH17
B	404	HIS	-	expression tag	UNP Q9UH17
B	405	HIS	-	expression tag	UNP Q9UH17
B	406	HIS	-	expression tag	UNP Q9UH17
B	407	HIS	-	expression tag	UNP Q9UH17
D	383	LYS	-	expression tag	UNP Q9UH17
D	384	LEU	-	expression tag	UNP Q9UH17
D	385	GLY	-	expression tag	UNP Q9UH17
D	386	PRO	-	expression tag	UNP Q9UH17
D	387	GLU	-	expression tag	UNP Q9UH17
D	388	GLN	-	expression tag	UNP Q9UH17
D	389	LYS	-	expression tag	UNP Q9UH17
D	390	LEU	-	expression tag	UNP Q9UH17
D	391	ILE	-	expression tag	UNP Q9UH17
D	392	SER	-	expression tag	UNP Q9UH17
D	393	GLU	-	expression tag	UNP Q9UH17
D	394	GLU	-	expression tag	UNP Q9UH17
D	395	ASP	-	expression tag	UNP Q9UH17
D	396	LEU	-	expression tag	UNP Q9UH17
D	397	ASN	-	expression tag	UNP Q9UH17
D	398	SER	-	expression tag	UNP Q9UH17
D	399	ALA	-	expression tag	UNP Q9UH17
D	400	VAL	-	expression tag	UNP Q9UH17
D	401	ASP	-	expression tag	UNP Q9UH17
D	402	HIS	-	expression tag	UNP Q9UH17
D	403	HIS	-	expression tag	UNP Q9UH17
D	404	HIS	-	expression tag	UNP Q9UH17
D	405	HIS	-	expression tag	UNP Q9UH17
D	406	HIS	-	expression tag	UNP Q9UH17
D	407	HIS	-	expression tag	UNP Q9UH17

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

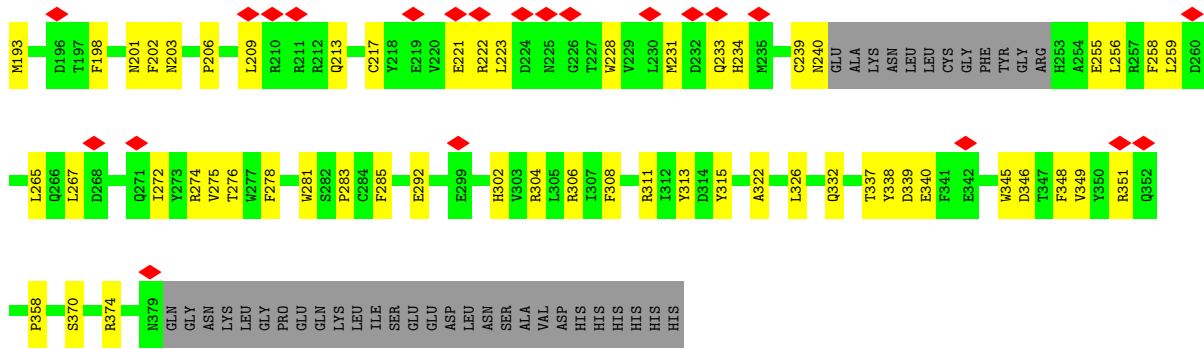| Mol	Chain	Residues	Atoms		AltConf
3	B	1	Total 1	Zn 1	0
3	D	1	Total 1	Zn 1	0

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: Maltose/maltodextrin-binding periplasmic protein,Ribonucleoside-diphosphate reductase large subunit

• Molecule 1: Maltose/maltodextrin-binding periplasmic protein,Ribonucleoside-diphosphate reductase large subunit

Chain C:

D682 R683 D688 Q689 S690 Q691 F696 E700 D701 L708 L712 V713 R714 S715 L718 G719 L720 K721 T722 I723 E730 LYS ALA ALA ASP LEU GLY VAL MET GLU CYS LYS ALA SER ALA ALA LEU SER VAL PRO ARG GLU GLU GLN ASN GLU ARG SER PRO ALA GLU GLN MET

PRO PRO ARG MET GLU PRO ALA GLN VAL ALA GLY PRO VAL ASP ILE MET SER LYS GLY PRO GLY GLU GLY PRO GLY GLY TRP CYS VAL PRO GLY GLY LEU GLU VAL CYS TYR LYS TYR ARG GLN LEU PHE SER GLU ASP ASP LEU LEU GLU THR ASP GLY PHE THR GLU ARG ALA CYS

GLU SER CYS GLN

• Molecule 2: DNA dC->dU-editing enzyme APOBEC-3B

Chain B:

10%

56%　　26%　　19%

M193 D196 T197 F198 N201 F202 N203 P206 L209 R210 R211 R212 Q213 C217 Y218 E219 V220 E221 R222 L223 D224 N225 G226 T227 W228 V229 L230 M231 D232 Q233 H234 M235 C239 N240 GLU ALA LYS ASN LEU LEU CYS GLY PHE TYR GLY ARG H253 A254 E255 L256 R257 F258 L259 D260

L265 Q266 L267 D268 Q271 I272 Y273 R274 V275 T276 W277 F278 W281 S282 P283 C284 F285 E292 E299 H302 V303 R304 L305 R306 I307 F308 R311 I312 Y313 D314 Y315 A322 L326 Q332 T337 Y338 D339 E340 F341 E342 W345 D346 T347 F348 V349 Y350 R351 Q352

P358 S370 R374 N379 GLN GLY ASN LYS LEU GLY PRO GLU GLU GLN LYS LEU ILE SER GLU GLU ASP LEU ASN SER ALA VAL ASP HIS HIS HIS HIS HIS HIS

• Molecule 2: DNA dC->dU-editing enzyme APOBEC-3B

Chain D:

11%

60%　　21%　　19%

M193 D194 P195 D196 T197 F198 F202 N203 P206 L209 R210 R211 C217 Y218 E219 V220 E221 R222 L223 D224 N225 G226 T227 W228 V229 L230 M231 D232 Q233 H234 M235 N240 GLU ALA LYS ASN LEU LEU CYS GLY PHE TYR GLY ARG H253 L256 R257 F258 L259 D260 P263 S264 L265

D268 I272 Y273 R274 V275 T276 W277 F278 W281 S282 P283 C284 F285 S286 E299 H302 R306 I307 F308 A309 A310 R311 I312 Y313 D314 Y315 D316 P317 L318 A322 L326 Q332 M336 T337 Y338 D339 E342 R351 Q352 P358 N379 GLN GLY ASN LYS LEU

GLY PRO GLU GLN LYS LEU ILE SER GLU GLU ASP LEU ASN SER ALA VAL ASP HIS HIS HIS HIS HIS HIS

4 Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	243192	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	1.2	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	72.193	Depositor
Minimum map value	-3.075	Depositor
Average map value	0.013	Depositor
Map value standard deviation	1.289	Depositor
Recommended contour level	10	Depositor
Map size (Å)	283.58398, 283.58398, 283.58398	wwPDB
Map dimensions	336, 336, 336	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.844, 0.844, 0.844	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	0.13	0/5222	0.30	0/7069
1	C	0.13	0/5222	0.30	0/7069
2	B	0.12	0/1507	0.33	0/2048
2	D	0.13	0/1507	0.34	0/2048
All	All	0.13	0/13458	0.31	0/18234

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	5100	0	4954	83	0
1	C	5100	0	4954	91	0
2	B	1464	0	1378	36	0
2	D	1464	0	1378	32	0
3	B	1	0	0	0	0
3	D	1	0	0	0	0
All	All	13130	0	12664	237	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 9.

The worst 5 of 237 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)
2:B:285:PHE:HB2	2:B:322:ALA:HB2	1.58	0.85
2:D:285:PHE:HB2	2:D:322:ALA:HB2	1.62	0.80
1:C:168:CYS:SG	1:C:494:GLN:NE2	2.56	0.79
2:B:306:ARG:HG2	2:B:332:GLN:HE21	1.48	0.78
1:A:681:ARG:HG3	1:A:718:LEU:HB3	1.67	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	632/1197 (53%)	590 (93%)	42 (7%)	0	100	100
1	C	632/1197 (53%)	592 (94%)	40 (6%)	0	100	100
2	B	171/215 (80%)	166 (97%)	5 (3%)	0	100	100
2	D	171/215 (80%)	163 (95%)	8 (5%)	0	100	100
All	All	1606/2824 (57%)	1511 (94%)	95 (6%)	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	541/985 (55%)	541 (100%)	0	100	100
1	C	541/985 (55%)	541 (100%)	0	100	100
2	B	156/190 (82%)	156 (100%)	0	100	100
2	D	156/190 (82%)	156 (100%)	0	100	100
All	All	1394/2350 (59%)	1394 (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 19 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	600	GLN
1	C	691	GLN
2	D	332	GLN
1	C	689	GLN
1	C	207	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 2 ligands modelled in this entry, 2 are 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-24709. 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
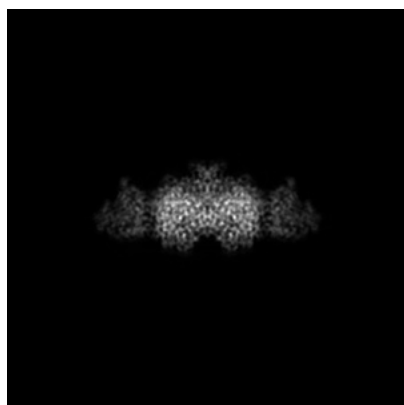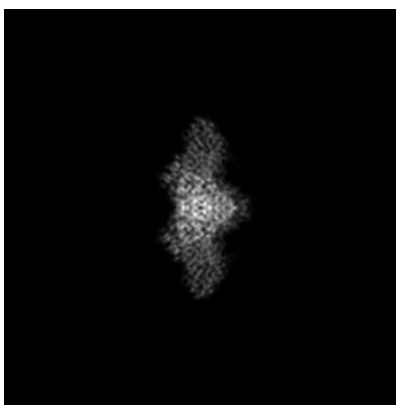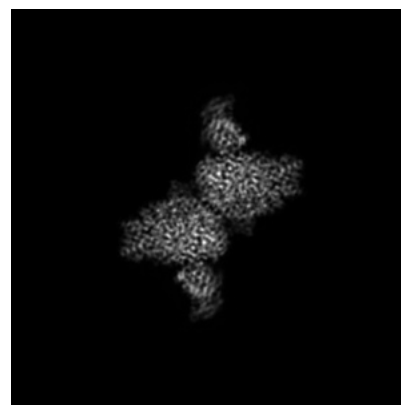
The images above show the map projected in three orthogonal directions.

6.2 Central slices ⓘ
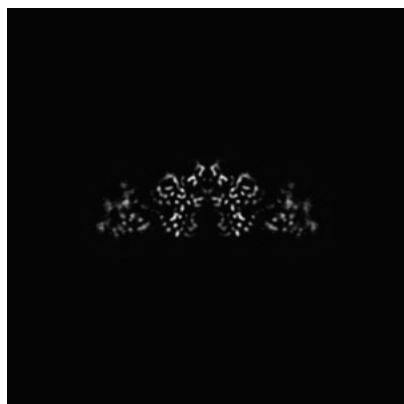
6.2.1 Primary map
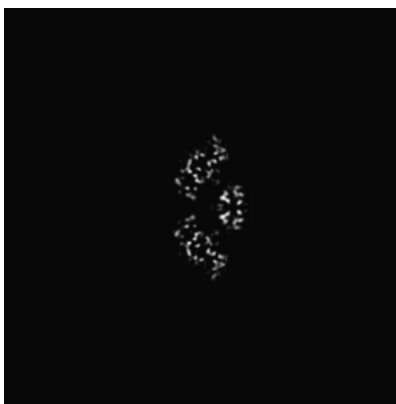
X Index: 168 Y Index: 168 Z Index: 168

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: 168 | Y Index: 139 | Z Index: 160 |

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 |
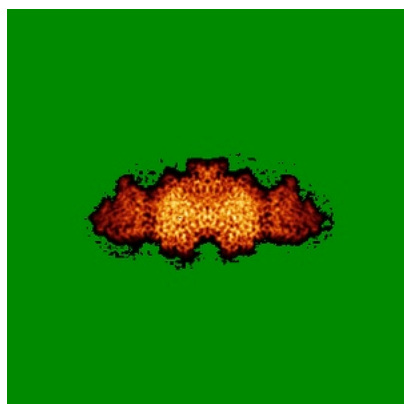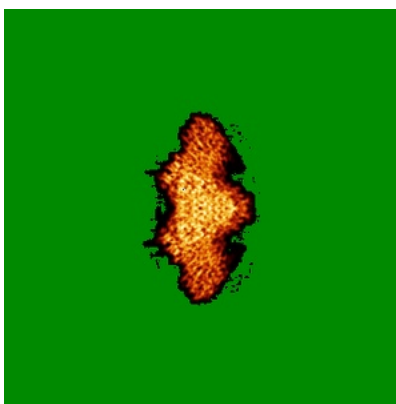
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5   Orthogonal surface views ⓘ

6.5.1   Primary map

X   Y   Z
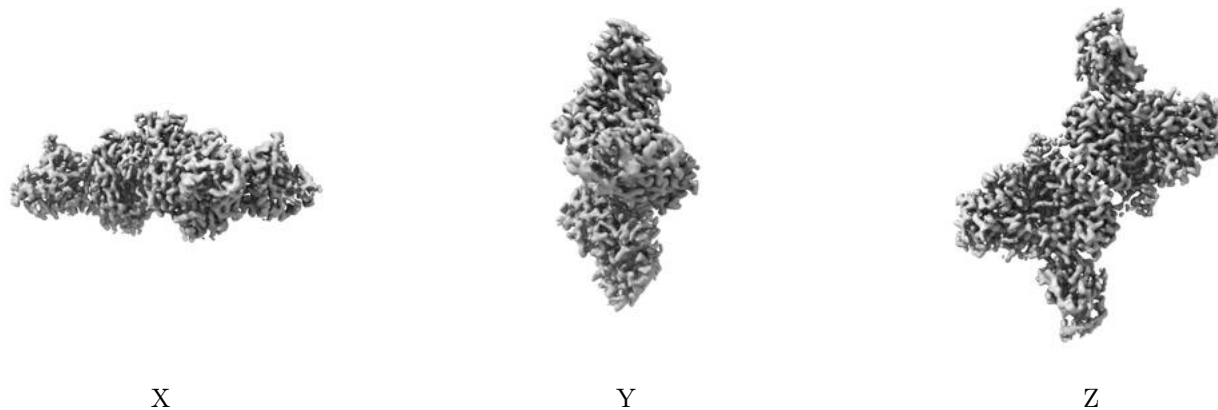
The images above show the 3D surface view of the map at the recommended contour level 10.0. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

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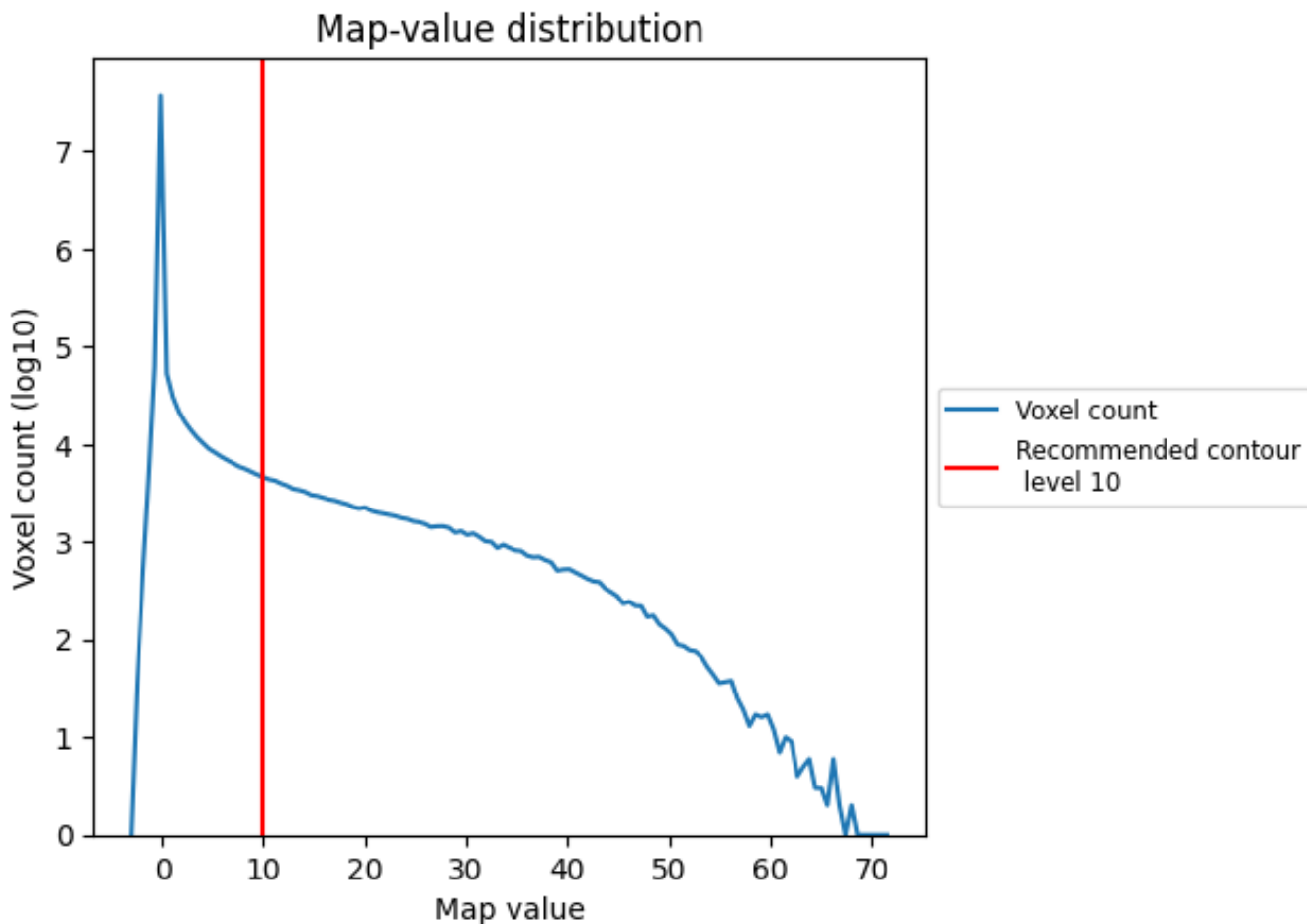
The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

7.2 Volume estimate ⓘ
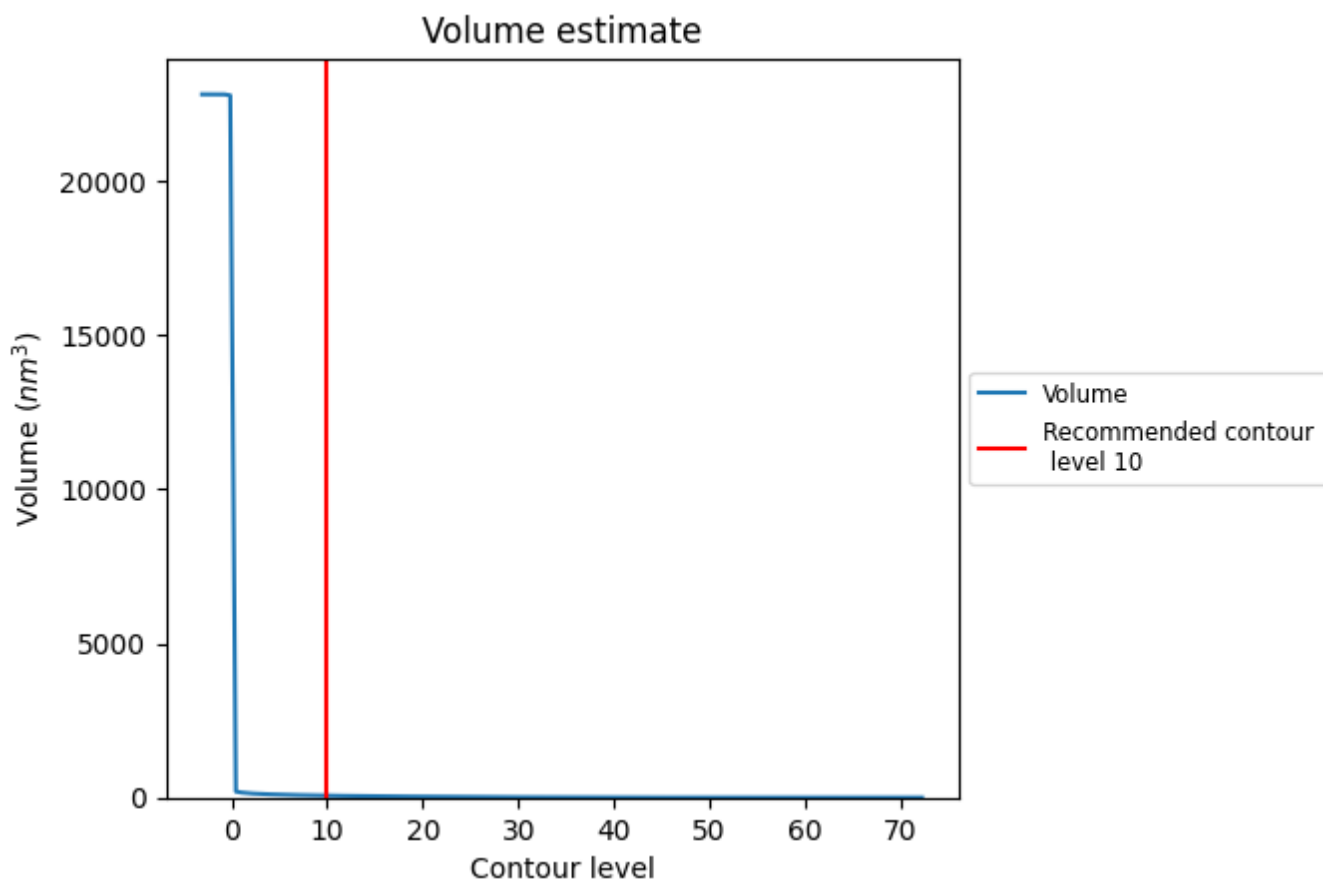
The volume at the recommended contour level is 62 nm^3; this corresponds to an approximate mass of 56 kDa.

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 ⓘ
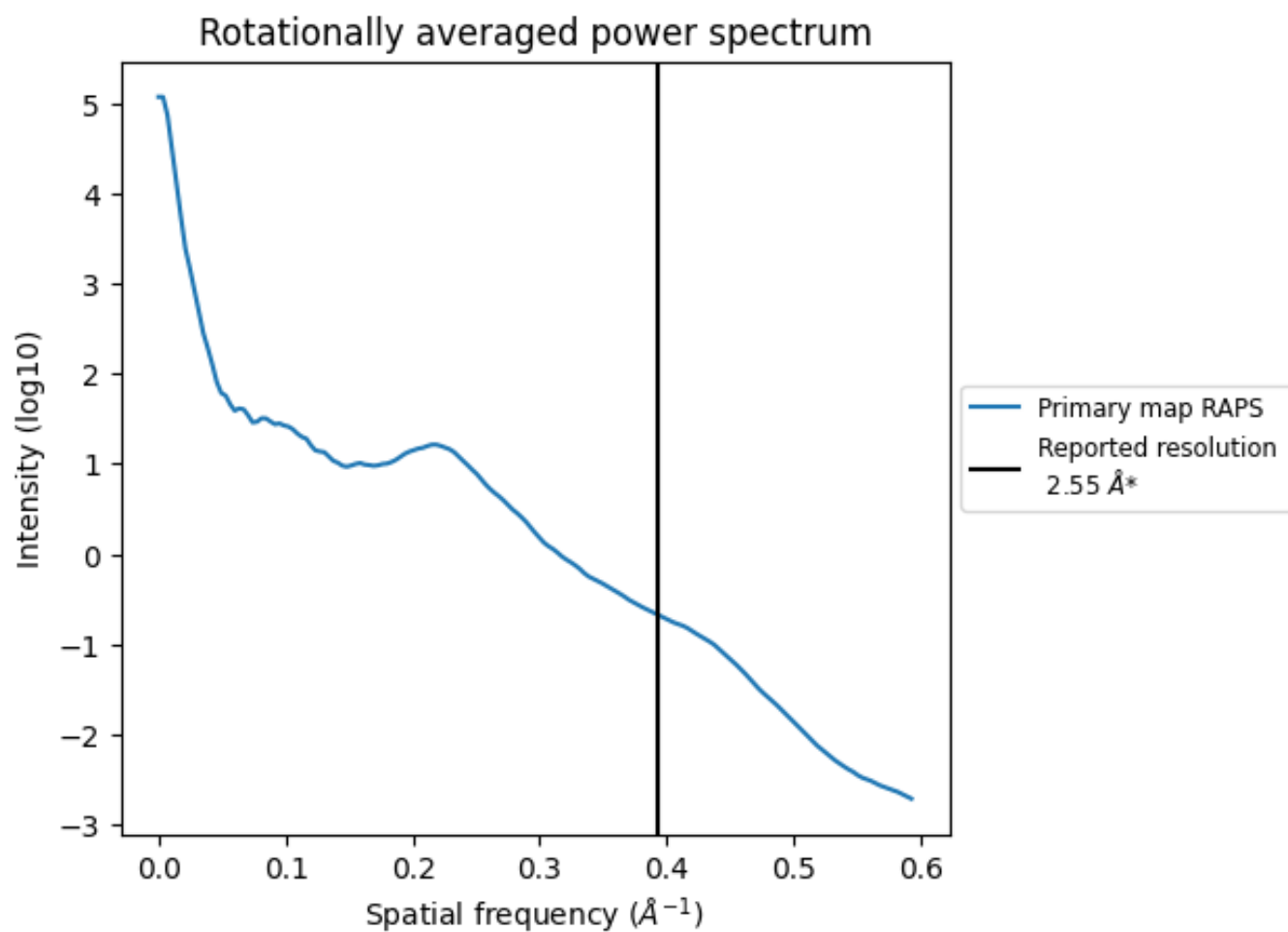
*Reported resolution corresponds to spatial frequency of 0.392 Å^{-1}

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-24709 and PDB model 7RW6. Per-residue inclusion information can be found in section 3 on page 6.

9.1 Map-model overlay ⓘ

X	Y	Z
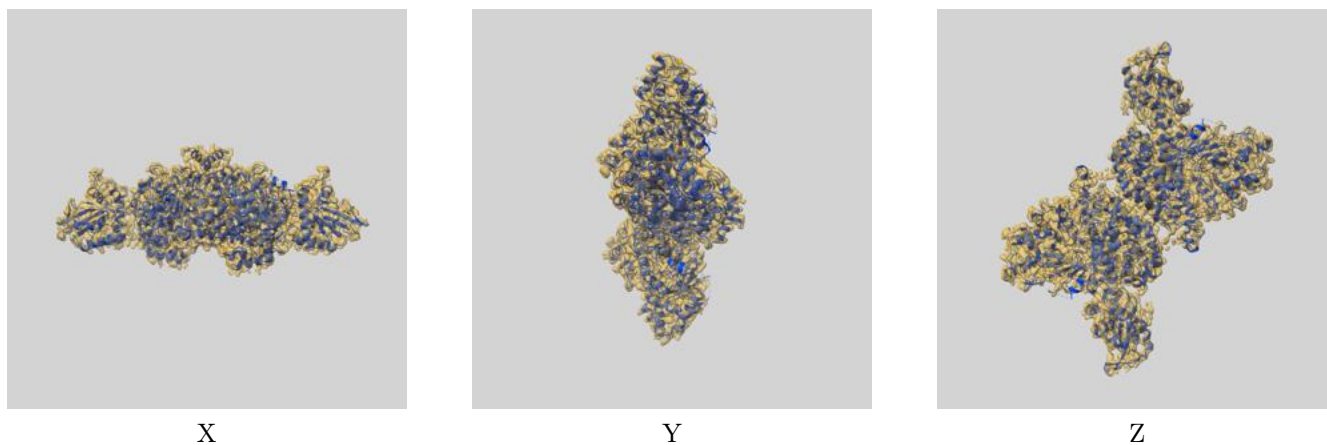
The images above show the 3D surface view of the map at the recommended contour level 10.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2   Q-score mapped to coordinate model (i)

X   Y   Z
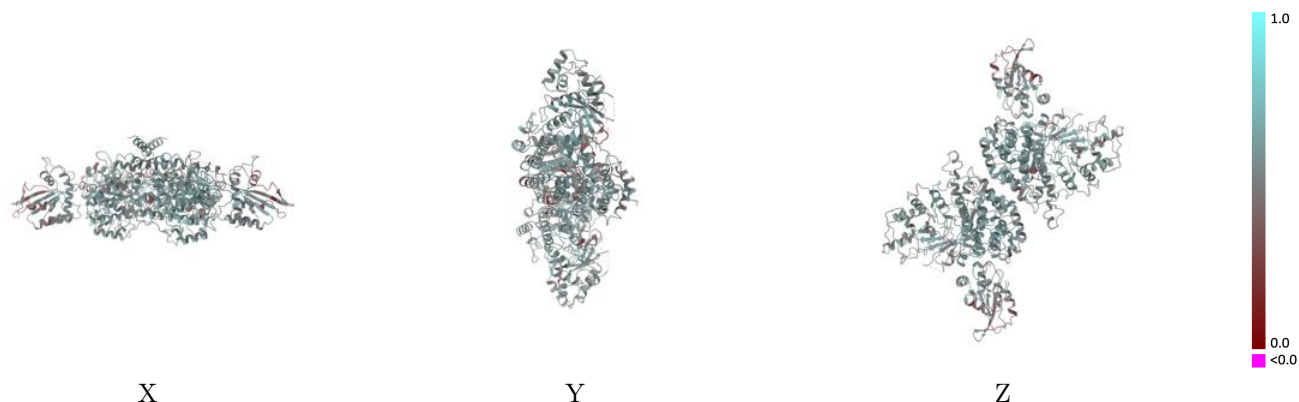
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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
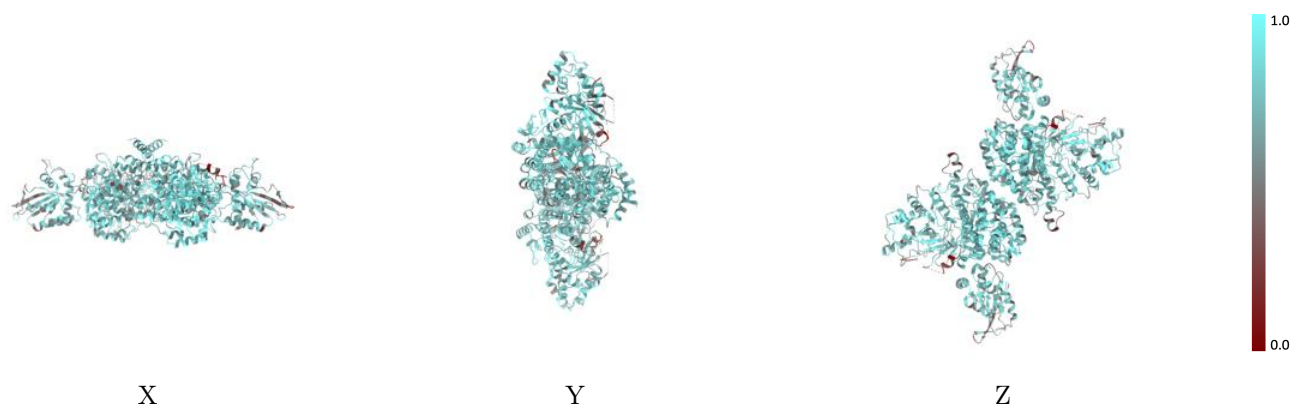
The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (10).

9.4   Atom inclusion ⓘ
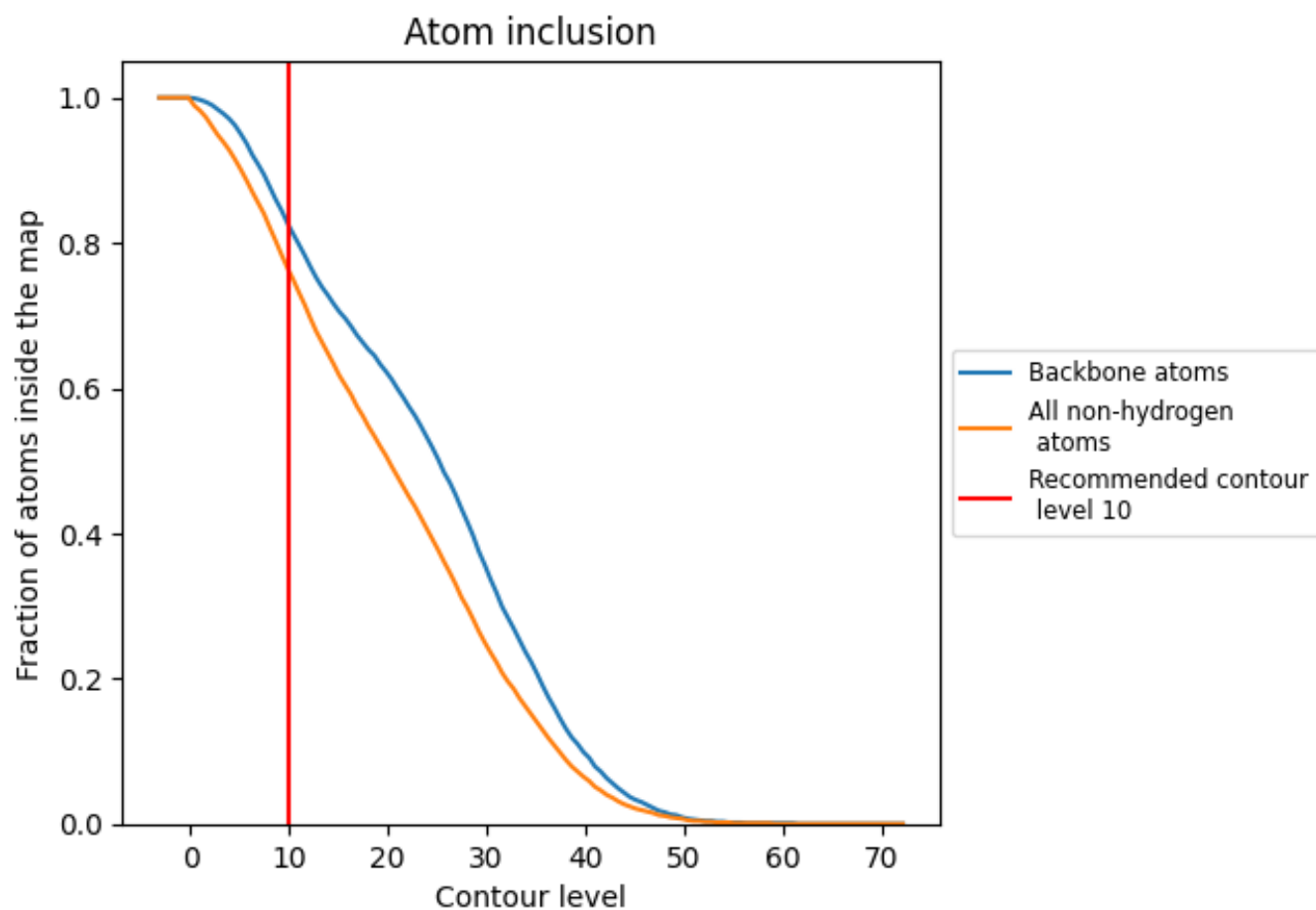
At the recommended contour level, 82% of all backbone atoms, 76% of all non-hydrogen atoms, are inside the map.

9.5   Map-model fit summary ⓘ

The table lists the average atom inclusion at the recommended contour level (10) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7620	0.5330
A	0.7790	0.5480
B	0.7000	0.4890
C	0.7820	0.5440
D	0.6980	0.4870

1.0

0.0

<0.0