



wwPDB EM Validation Summary Report ⓘ

Nov 22, 2022 – 09:44 PM JST

PDB ID : 7VUH
EMDB ID : EMD-32128
Title : Cryo-EM structure of a class A orphan GPCR
Authors : Liu, Z.J.; Hua, T.; Zhou, Y.L.; Wu, L.J.
Deposited on : 2021-11-02
Resolution : 3.22 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:

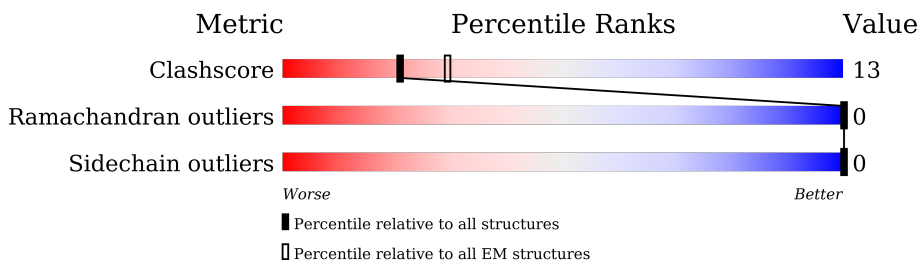
EMDB validation analysis : 0.0.1.dev43
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.9
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.3

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 3.22 Å.

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



Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. 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	261	
2	B	346	
3	G	71	
4	N	157	
5	R	533	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 8302 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 Isoform Gnas-2 of Guanine nucleotide-binding protein G(s) subunit alpha isoforms short.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	239	1970	1241	354	368	7	0	0

There are 57 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	HIS	-	expression tag	UNP P63092-2
A	-6	HIS	-	expression tag	UNP P63092-2
A	-5	HIS	-	expression tag	UNP P63092-2
A	-4	HIS	-	expression tag	UNP P63092-2
A	-3	HIS	-	expression tag	UNP P63092-2
A	-2	HIS	-	expression tag	UNP P63092-2
A	-1	GLU	-	expression tag	UNP P63092-2
A	0	ASN	-	expression tag	UNP P63092-2
A	1	LEU	-	expression tag	UNP P63092-2
A	2	TYR	-	expression tag	UNP P63092-2
A	3	PHE	-	expression tag	UNP P63092-2
A	4	GLN	-	expression tag	UNP P63092-2
A	49	ASP	GLY	engineered mutation	UNP P63092-2
A	50	ASN	GLU	engineered mutation	UNP P63092-2
A	196	GLY	-	linker	UNP P63092-2
A	197	GLY	-	linker	UNP P63092-2
A	198	SER	-	linker	UNP P63092-2
A	199	GLY	-	linker	UNP P63092-2
A	200	GLY	-	linker	UNP P63092-2
A	201	SER	-	linker	UNP P63092-2
A	202	GLY	-	linker	UNP P63092-2
A	203	GLY	-	linker	UNP P63092-2
A	249	ASP	ALA	engineered mutation	UNP P63092-2
A	252	ASP	SER	engineered mutation	UNP P63092-2
A	?	-	ASN	deletion	UNP P63092-2
A	?	-	MET	deletion	UNP P63092-2
A	?	-	VAL	deletion	UNP P63092-2

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Chain	Residue	Modelled	Actual	Comment	Reference
A	?	-	ILE	deletion	UNP P63092-2
A	?	-	ARG	deletion	UNP P63092-2
A	?	-	GLU	deletion	UNP P63092-2
A	?	-	ASP	deletion	UNP P63092-2
A	?	-	ASN	deletion	UNP P63092-2
A	?	-	GLN	deletion	UNP P63092-2
A	?	-	THR	deletion	UNP P63092-2
A	362	ALA	-	expression tag	UNP P63092-2
A	363	ARG	-	expression tag	UNP P63092-2
A	364	ARG	-	expression tag	UNP P63092-2
A	365	ILE	-	expression tag	UNP P63092-2
A	366	PHE	-	expression tag	UNP P63092-2
A	367	ASN	-	expression tag	UNP P63092-2
A	368	ASP	-	expression tag	UNP P63092-2
A	369	CYS	-	expression tag	UNP P63092-2
A	370	LYS	-	expression tag	UNP P63092-2
A	371	ASP	-	expression tag	UNP P63092-2
A	372	ILE	-	expression tag	UNP P63092-2
A	373	ILE	-	expression tag	UNP P63092-2
A	374	LEU	-	expression tag	UNP P63092-2
A	375	GLN	-	expression tag	UNP P63092-2
A	376	MET	-	expression tag	UNP P63092-2
A	377	ASN	-	expression tag	UNP P63092-2
A	378	LEU	-	expression tag	UNP P63092-2
A	379	ARG	-	expression tag	UNP P63092-2
A	380	GLU	-	expression tag	UNP P63092-2
A	381	TYR	-	expression tag	UNP P63092-2
A	382	ASN	-	expression tag	UNP P63092-2
A	383	LEU	-	expression tag	UNP P63092-2
A	384	VAL	-	expression tag	UNP P63092-2

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	338	2600	1604	467	508	21	0	0

There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-5	ILE	-	expression tag	UNP P62873

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	GLY	-	expression tag	UNP P62873
B	-3	ARG	-	expression tag	UNP P62873
B	-2	ALA	-	expression tag	UNP P62873
B	-1	ARG	-	expression tag	UNP P62873
B	0	GLY	-	expression tag	UNP P62873
B	1	PHE	-	expression tag	UNP P62873

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	G	57	436	273	77	83	3	0	0

- Molecule 4 is a protein called Nanobody 35.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	N	126	961	599	168	188	6	0	0

- Molecule 5 is a protein called chimera of Endo-1,4-beta-xylanase and Probable G-protein coupled receptor 139.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	R	282	2313	1558	368	374	13	0	0

There are 31 discrepancies between the modelled and reference sequences:

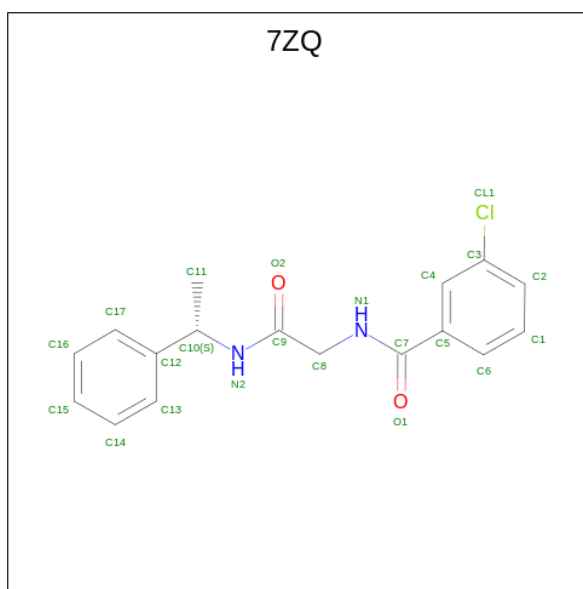
Chain	Residue	Modelled	Actual	Comment	Reference
R	-211	HIS	-	expression tag	UNP P09850
R	-210	HIS	-	expression tag	UNP P09850
R	-209	HIS	-	expression tag	UNP P09850
R	-208	HIS	-	expression tag	UNP P09850
R	-207	HIS	-	expression tag	UNP P09850
R	-206	HIS	-	expression tag	UNP P09850
R	-205	HIS	-	expression tag	UNP P09850
R	-204	HIS	-	expression tag	UNP P09850
R	-203	HIS	-	expression tag	UNP P09850
R	-202	HIS	-	expression tag	UNP P09850
R	-201	ASP	-	expression tag	UNP P09850
R	-200	TYR	-	expression tag	UNP P09850

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Chain	Residue	Modelled	Actual	Comment	Reference
R	-199	LYS	-	expression tag	UNP P09850
R	-198	ASP	-	expression tag	UNP P09850
R	-197	ASP	-	expression tag	UNP P09850
R	-196	ASP	-	expression tag	UNP P09850
R	-195	ASP	-	expression tag	UNP P09850
R	-194	LYS	-	expression tag	UNP P09850
R	-193	GLU	-	expression tag	UNP P09850
R	-192	ASN	-	expression tag	UNP P09850
R	-191	LEU	-	expression tag	UNP P09850
R	-190	TYR	-	expression tag	UNP P09850
R	-189	PHE	-	expression tag	UNP P09850
R	-188	GLN	-	expression tag	UNP P09850
R	-187	SER	-	expression tag	UNP P09850
R	-186	GLY	-	expression tag	UNP P09850
R	-185	ALA	-	expression tag	UNP P09850
R	-184	PRO	-	expression tag	UNP P09850
R	-173	PHE	ASP	engineered mutation	UNP P09850
R	-62	ASP	ARG	engineered mutation	UNP P09850
R	62	VAL	SER	engineered mutation	UNP Q6DWJ6

- Molecule 6 is 3-chloranyl-N-[2-oxidanylidene-2-[(1S)-1-phenylethyl]amino]ethyl]benzamide (three-letter code: 7ZQ) (formula: C₁₇H₁₇ClN₂O₂) (labeled as "Ligand of Interest" by depositor).

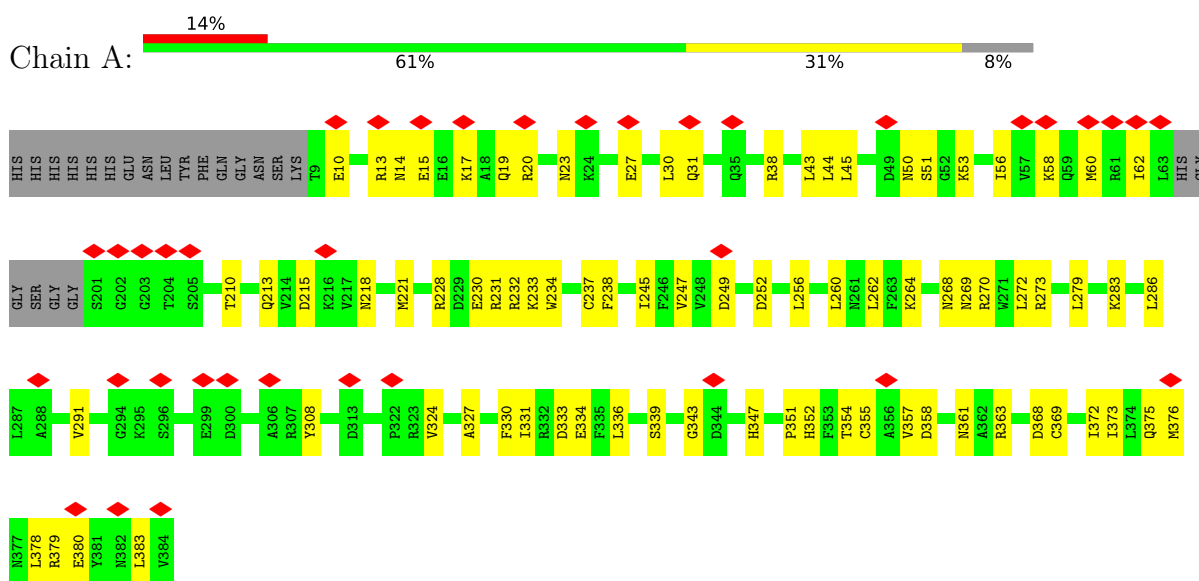


Mol	Chain	Residues	Atoms				AltConf	
			Total	C	Cl	N		O
6	R	1	22	17	1	2	2	0

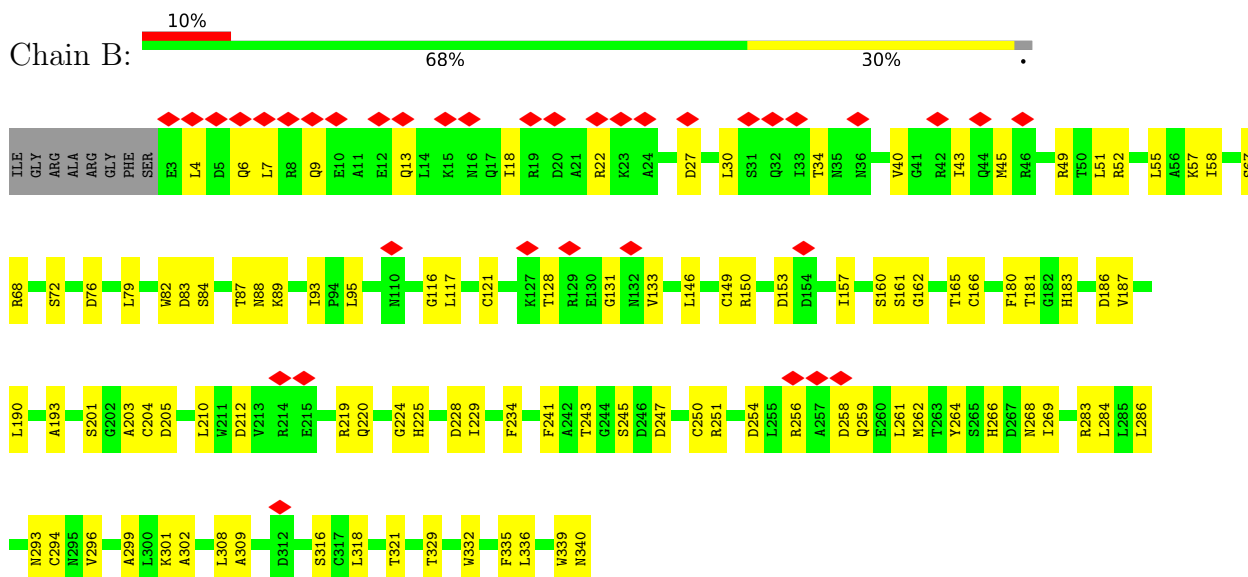
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Isoform Gnas-2 of Guanine nucleotide-binding protein G(s) subunit alpha isoforms short



- Molecule 2: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	110337	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION; Patch CTF refinement	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	8	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	130000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	1.862	Depositor
Minimum map value	-0.020	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.020	Depositor
Recommended contour level	0.16	Depositor
Map size (Å)	266.24, 266.24, 266.24	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.04, 1.04, 1.04	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 7ZQ

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	0.26	0/2006	0.54	0/2699
2	B	0.26	0/2647	0.55	0/3589
3	G	0.25	0/442	0.43	0/597
4	N	0.29	0/981	0.53	0/1329
5	R	0.26	0/2383	0.49	0/3258
All	All	0.26	0/8459	0.52	0/11472

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 [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1970	0	1949	60	0
2	B	2600	0	2505	81	0
3	G	436	0	448	12	0
4	N	961	0	928	37	0
5	R	2313	0	2400	54	0
6	R	22	0	0	0	0
All	All	8302	0	8230	219	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 13.

The worst 5 of 219 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:231:ARG:NH2	1:A:262:LEU:HD22	1.72	1.02
1:A:375:GLN:HB3	1:A:379:ARG:HH12	1.39	0.88
1:A:231:ARG:HH21	1:A:262:LEU:HD22	1.44	0.83
2:B:30:LEU:HD13	3:G:34:ALA:HB1	1.68	0.74
2:B:22:ARG:HB3	2:B:259:GLN:NE2	2.03	0.74

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	235/261 (90%)	223 (95%)	12 (5%)	0	100	100
2	B	336/346 (97%)	323 (96%)	13 (4%)	0	100	100
3	G	55/71 (78%)	54 (98%)	1 (2%)	0	100	100
4	N	124/157 (79%)	111 (90%)	13 (10%)	0	100	100
5	R	280/533 (52%)	255 (91%)	25 (9%)	0	100	100
All	All	1030/1368 (75%)	966 (94%)	64 (6%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

The Analysed column shows the number of residues for which the sidechain conformation was

analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	214/231 (93%)	214 (100%)	0	100	100
2	B	281/286 (98%)	281 (100%)	0	100	100
3	G	46/58 (79%)	46 (100%)	0	100	100
4	N	104/127 (82%)	104 (100%)	0	100	100
5	R	257/467 (55%)	257 (100%)	0	100	100
All	All	902/1169 (77%)	902 (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. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	340	ASN
3	G	59	ASN
5	R	277	ASN

5.3.3 RNA [i](#)

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

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	7ZQ	R	401	-	23,23,23	1.77	4 (17%)	30,30,30	1.25	4 (13%)

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	7ZQ	R	401	-	-	2/17/17/17	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	R	401	7ZQ	C7-N1	5.23	1.45	1.33
6	R	401	7ZQ	C9-N2	5.19	1.45	1.34
6	R	401	7ZQ	O2-C9	-2.36	1.18	1.23
6	R	401	7ZQ	O1-C7	-2.27	1.18	1.23

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	R	401	7ZQ	C10-N2-C9	-3.17	118.38	122.90
6	R	401	7ZQ	C9-C8-N1	-2.86	105.14	113.17
6	R	401	7ZQ	C8-C9-N2	2.68	122.50	116.10
6	R	401	7ZQ	O2-C9-N2	-2.56	118.64	122.95

There are no chirality outliers.

All (2) torsion outliers are listed below:

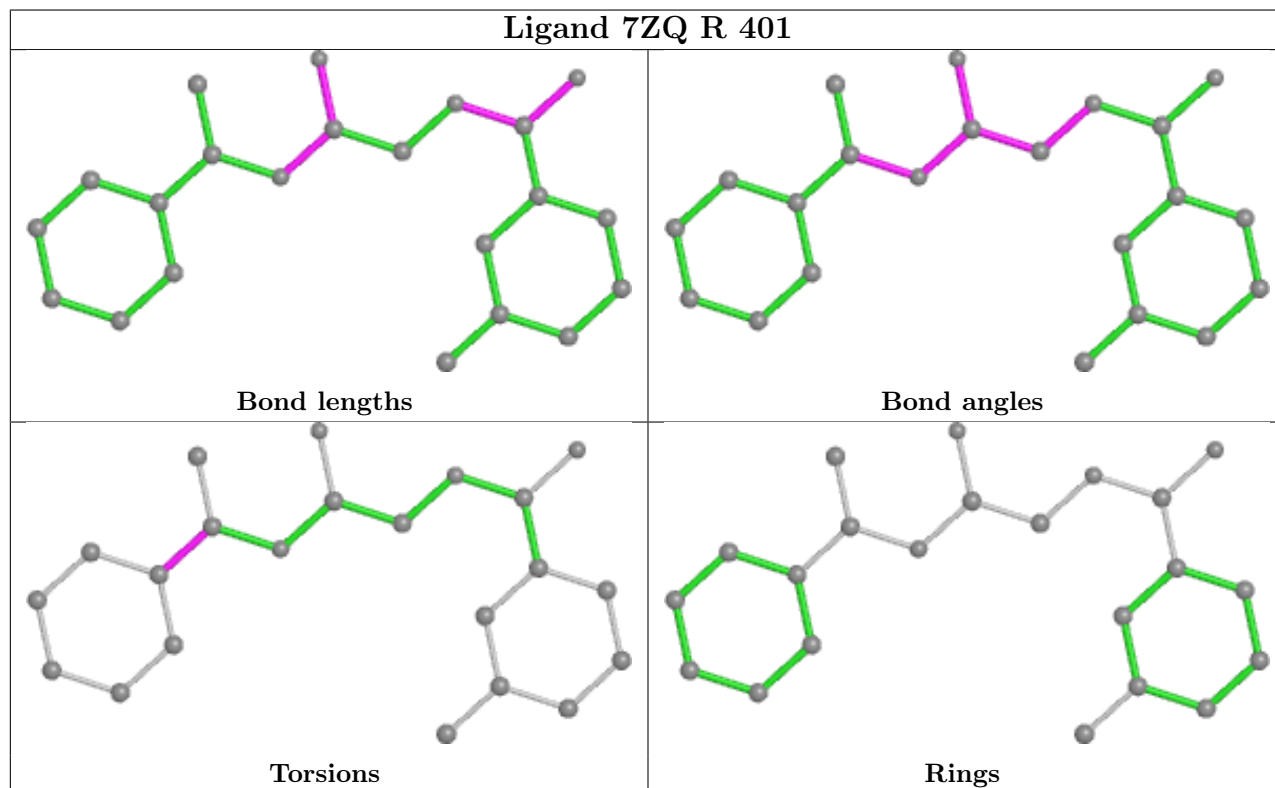
Mol	Chain	Res	Type	Atoms
6	R	401	7ZQ	N2-C10-C12-C13
6	R	401	7ZQ	N2-C10-C12-C17

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 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.

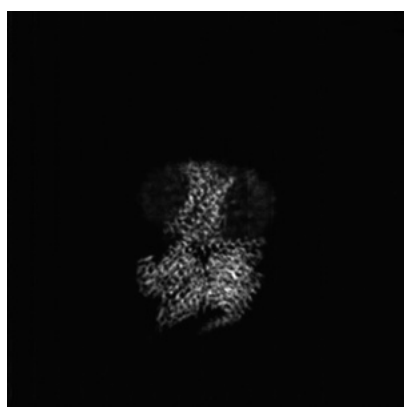
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-32128. These allow visual inspection of the internal detail of the map and identification of artifacts.

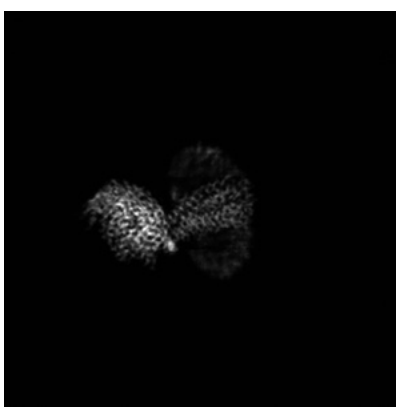
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

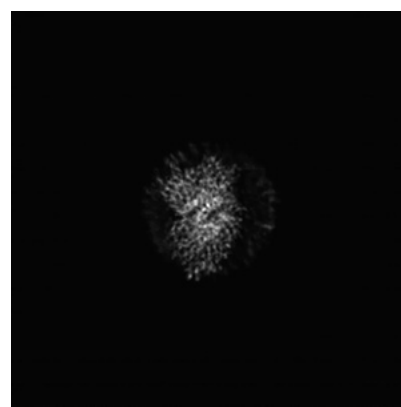
6.1.1 Primary map



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: 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 [i](#)

6.3.1 Primary map



X Index: 123



Y Index: 117

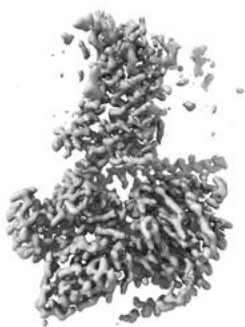


Z Index: 89

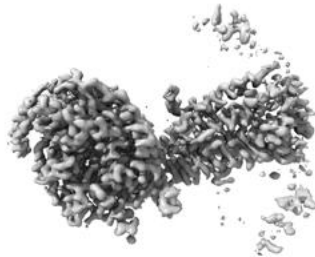
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal surface views [i](#)

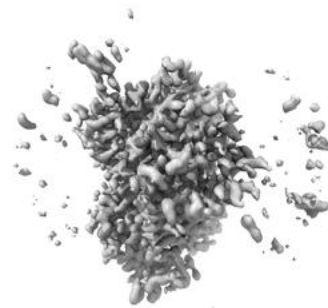
6.4.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.16. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

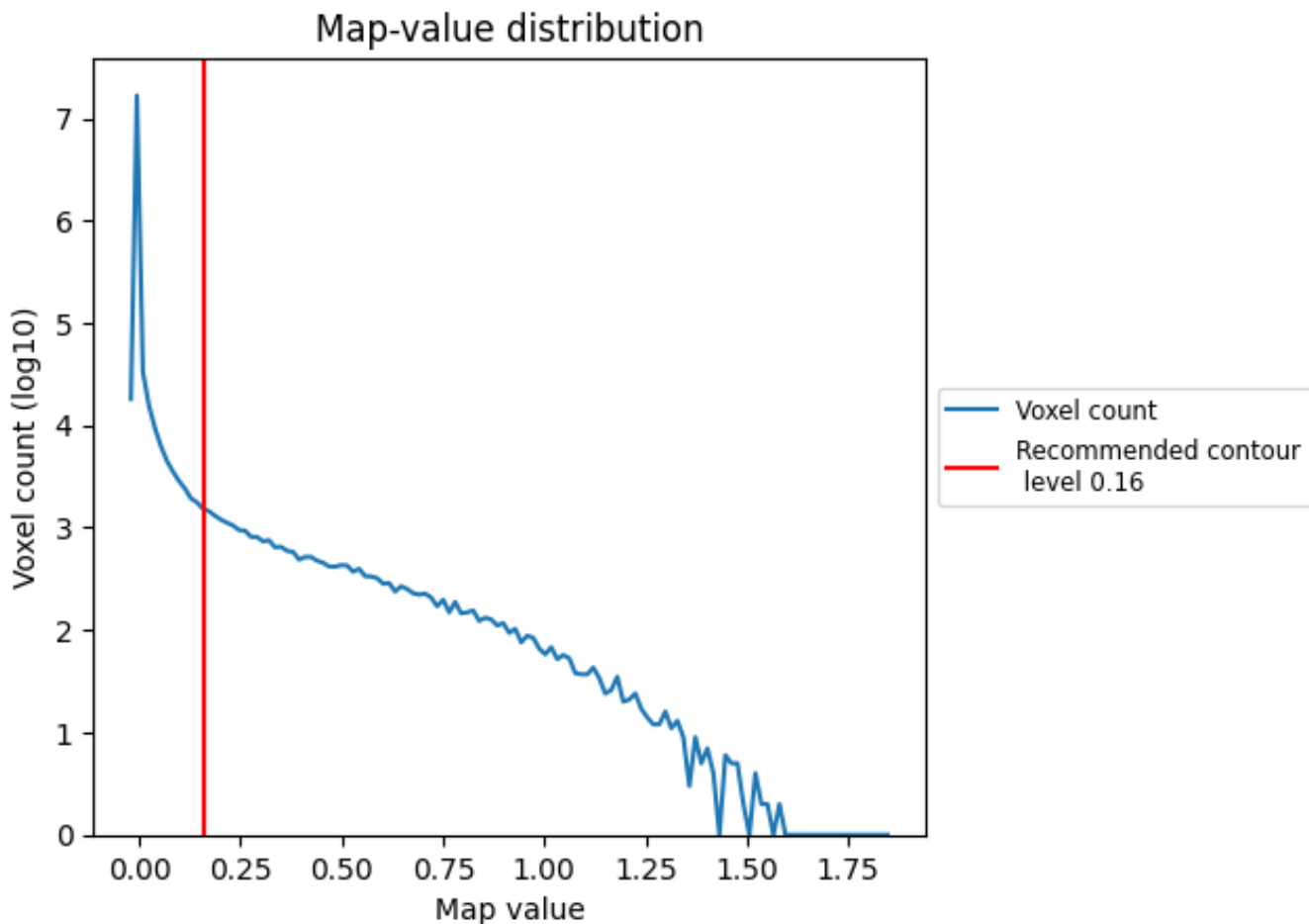
6.5 Mask visualisation

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

7 Map analysis [i](#)

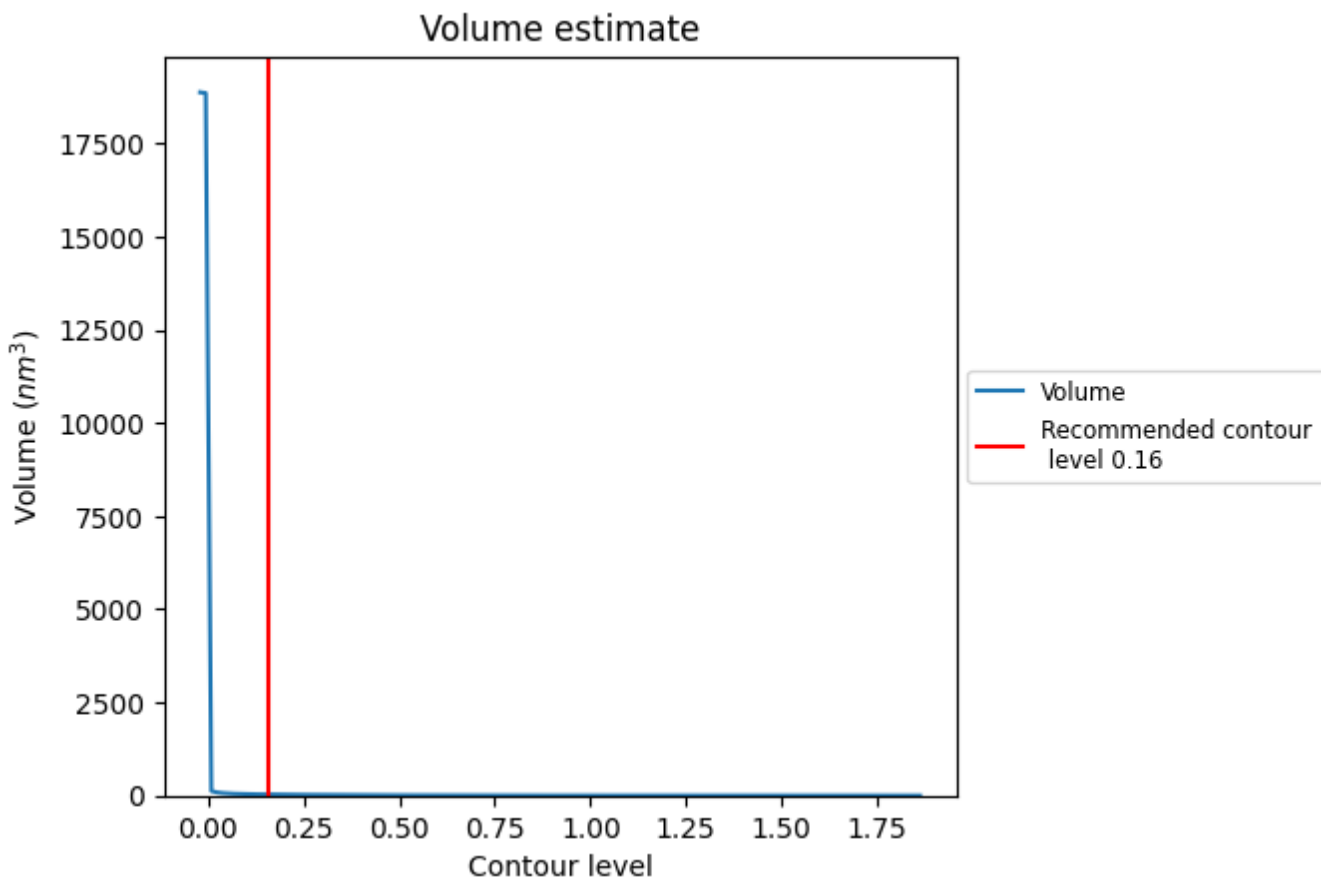
This section contains the results of statistical analysis of the map.

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.

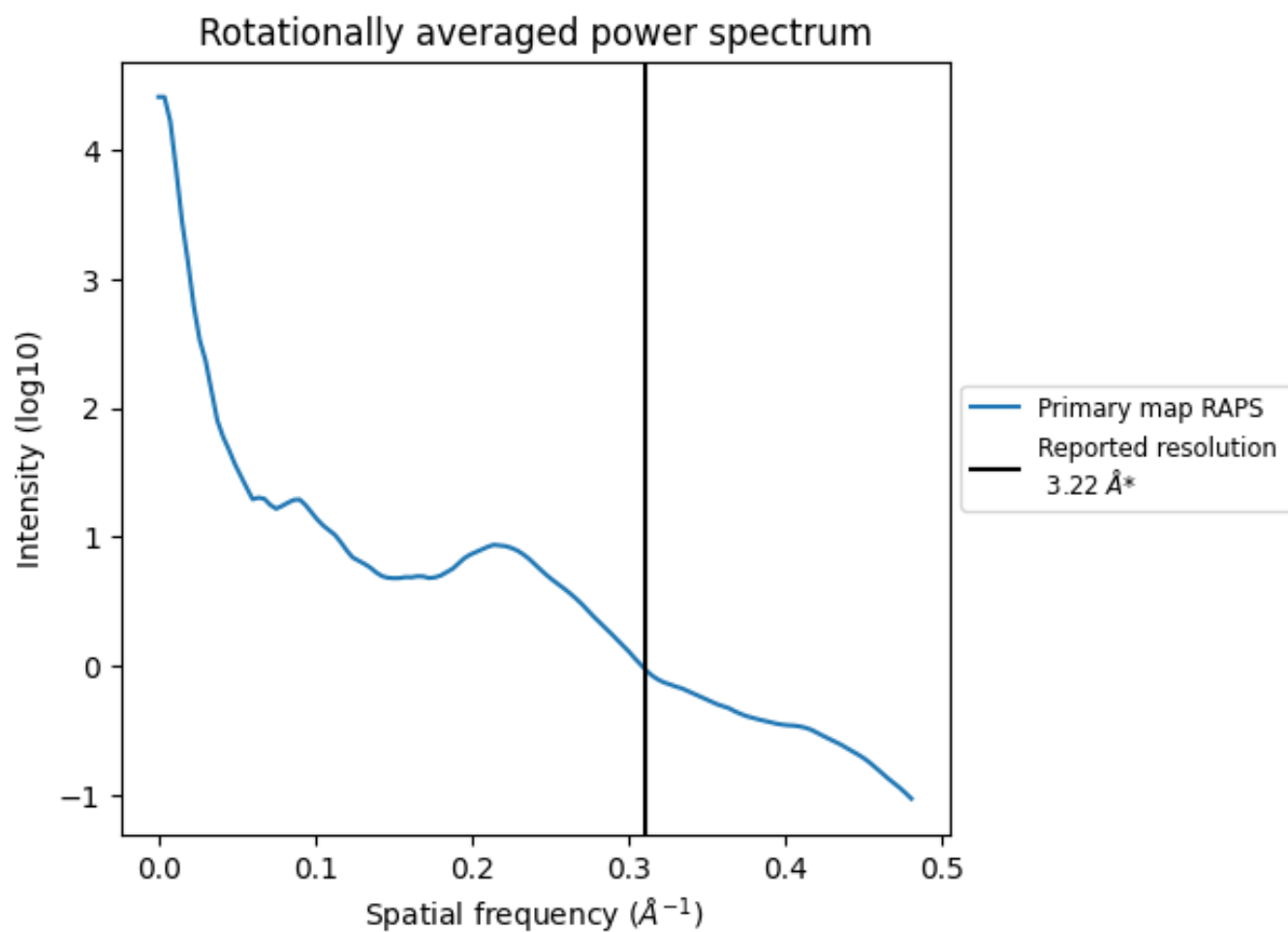
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 29 nm^3 ; this corresponds to an approximate mass of 26 kDa.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.

7.3 Rotationally averaged power spectrum [i](#)



*Reported resolution corresponds to spatial frequency of 0.311 Å⁻¹

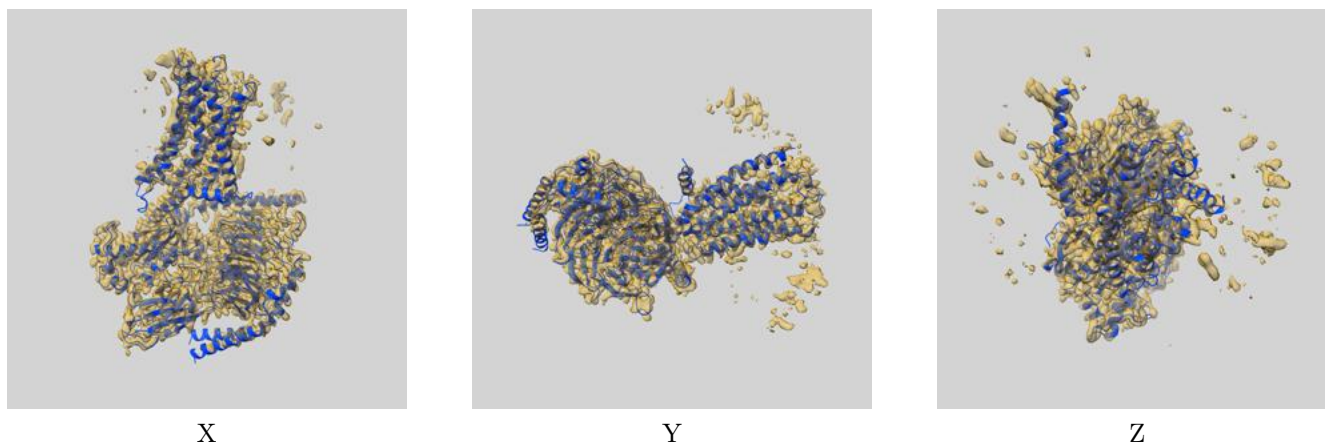
8 Fourier-Shell correlation

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

9 Map-model fit [i](#)

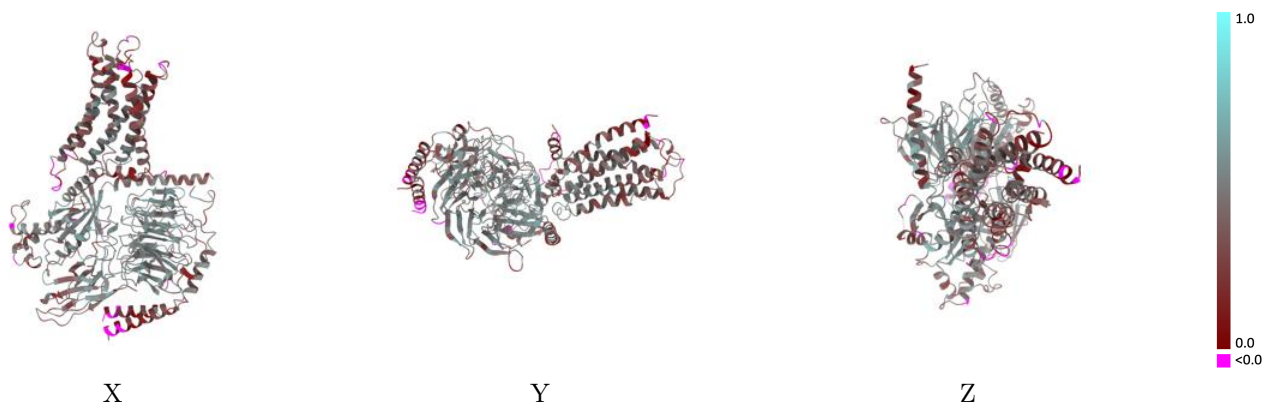
This section contains information regarding the fit between EMDB map EMD-32128 and PDB model 7VUH. Per-residue inclusion information can be found in section [3](#) on page [7](#).

9.1 Map-model overlay [i](#)



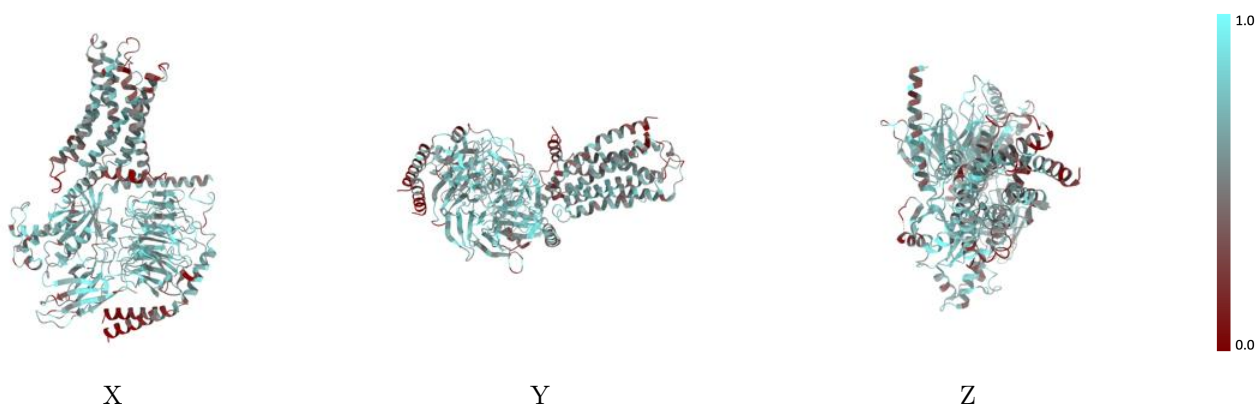
The images above show the 3D surface view of the map at the recommended contour level 0.16 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



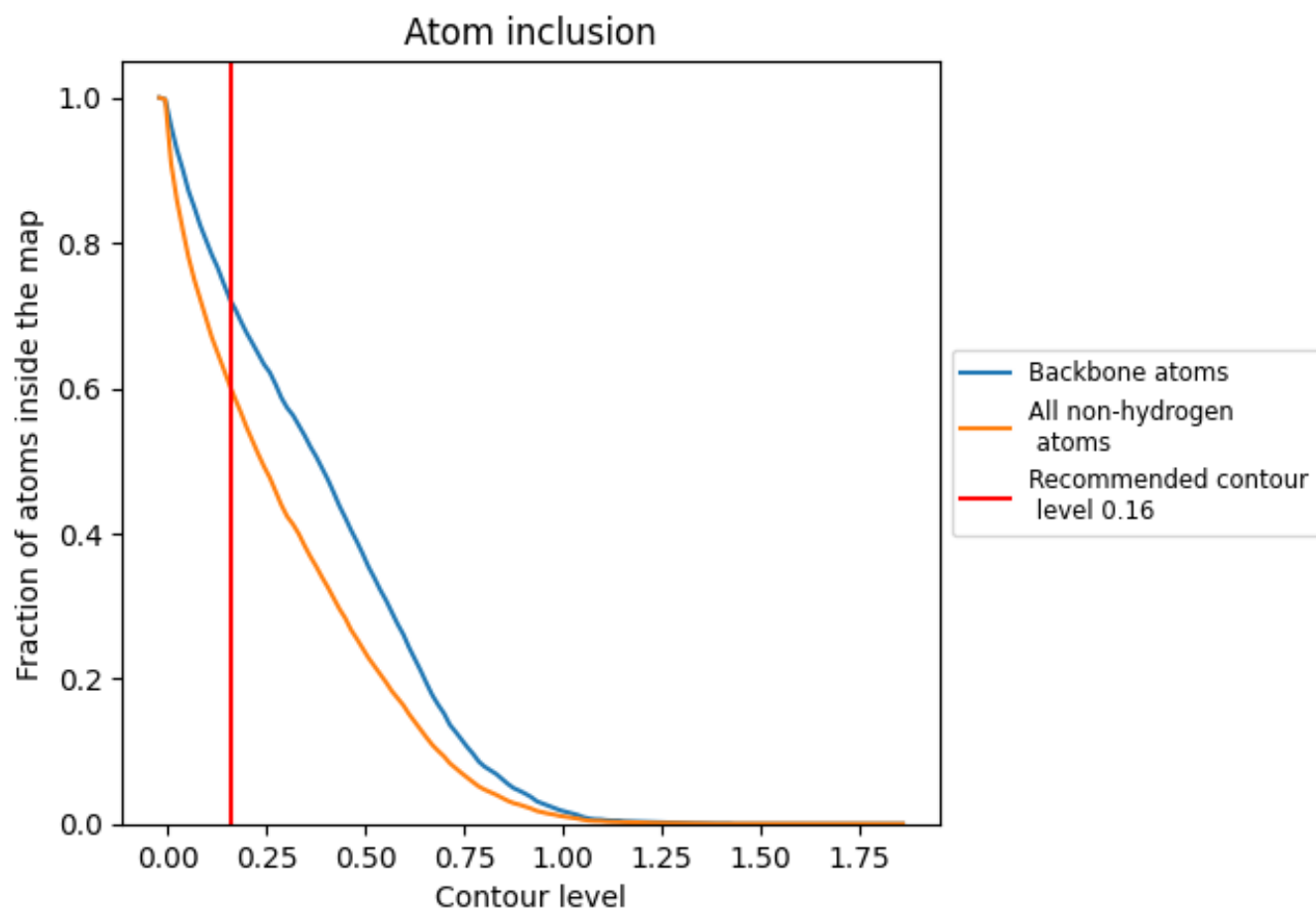
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.16).













9.4 Atom inclusion [i](#)



At the recommended contour level, 72% of all backbone atoms, 60% 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 (0.16) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.6002	 0.4090
A	 0.6425	 0.4360
B	 0.6547	 0.4630
G	 0.4522	 0.3080
N	 0.6279	 0.4160
R	 0.5204	 0.3400

