



## wwPDB EM Validation Summary Report ⓘ

Mar 25, 2024 – 04:57 PM JST

PDB ID : 7YUV  
EMDB ID : EMD-34112  
Title : MtaLon-ADP for the spiral oligomers of tetramer  
Authors : Li, S.; Hsieh, K.; Kuo, C.; Lee, S.; Ho, M.; Wang, C.; Zhang, K.; Chang, C.I.  
Deposited on : 2022-08-17  
Resolution : 3.80 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](mailto: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>.

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

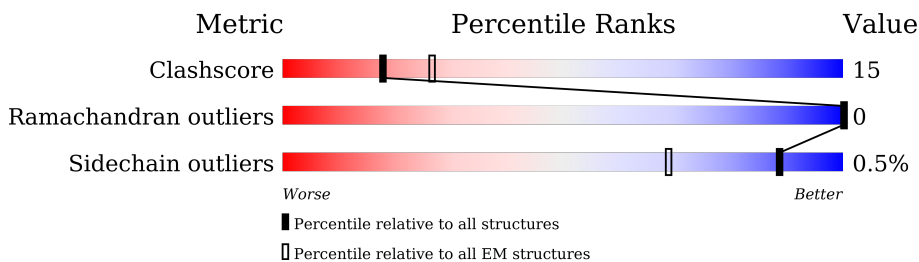
EMDB validation analysis : 0.0.1.dev70  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
MolProbity : 4.02b-467  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

# 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 3.80 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  $\geq 3$ , 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	793	 9% 44% 23% 33%
1	B	793	 41% 26% 33%
1	C	793	 42% 25% 33%
1	D	793	 43% 19% 33%

## 2 Entry composition [i](#)

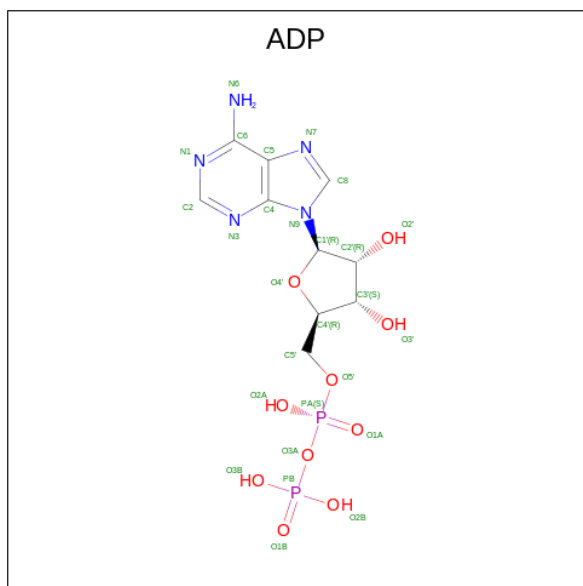
There are 2 unique types of molecules in this entry. The entry contains 16657 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Lon protease.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	532	Total 4144	C 2620	N 726	O 783	S 15	0	0
1	B	532	Total 4144	C 2620	N 726	O 783	S 15	0	0
1	C	532	Total 4144	C 2620	N 726	O 783	S 15	0	0
1	D	532	Total 4144	C 2620	N 726	O 783	S 15	0	0

- Molecule 2 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula:  $C_{10}H_{15}N_5O_{10}P_2$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
2	A	1	Total 27	C 10	N 5	O 10	P 2	0
2	B	1	Total 27	C 10	N 5	O 10	P 2	0

*Continued on next page...*

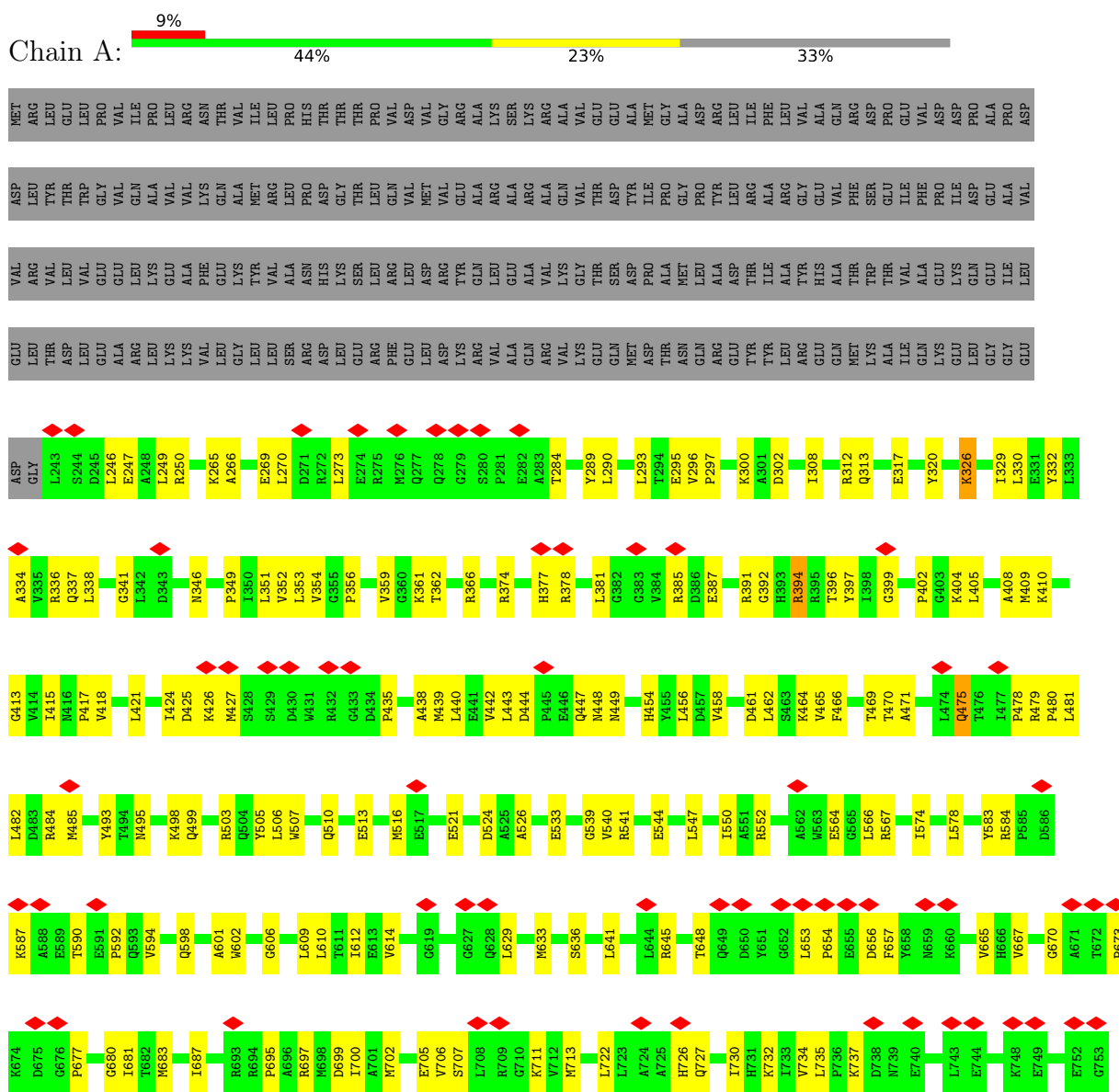
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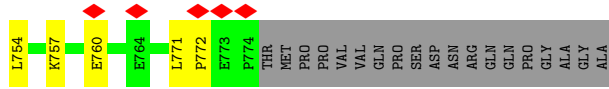
Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
2	C	1	27	10	5	10	2	0

### 3 Residue-property plots

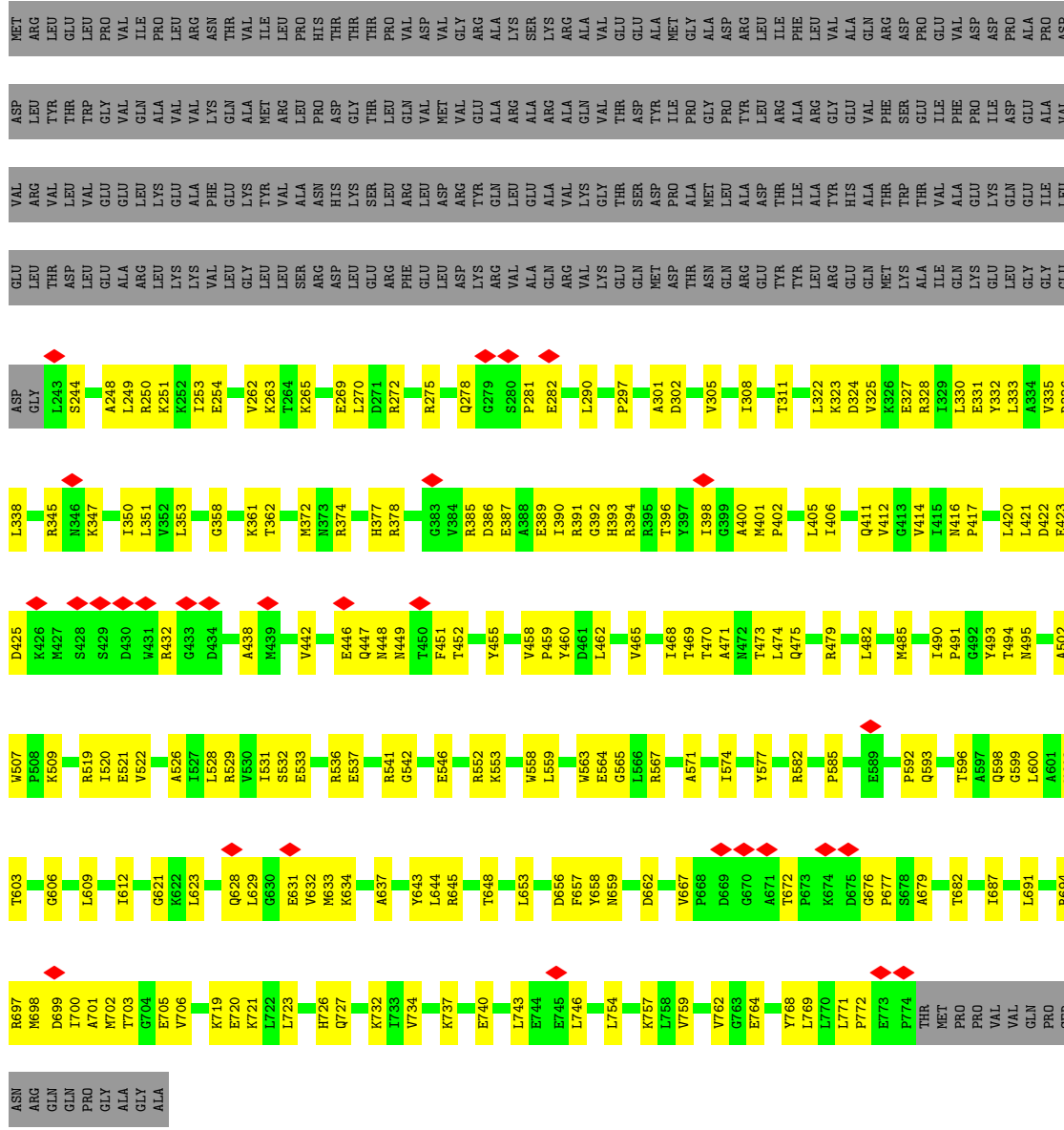
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion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

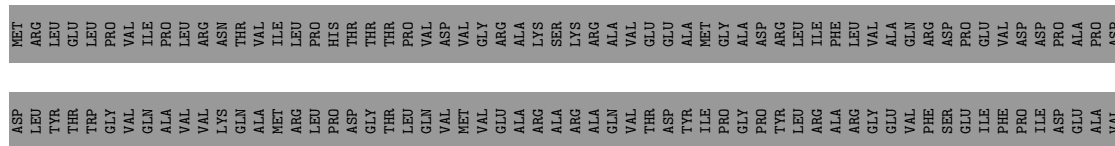


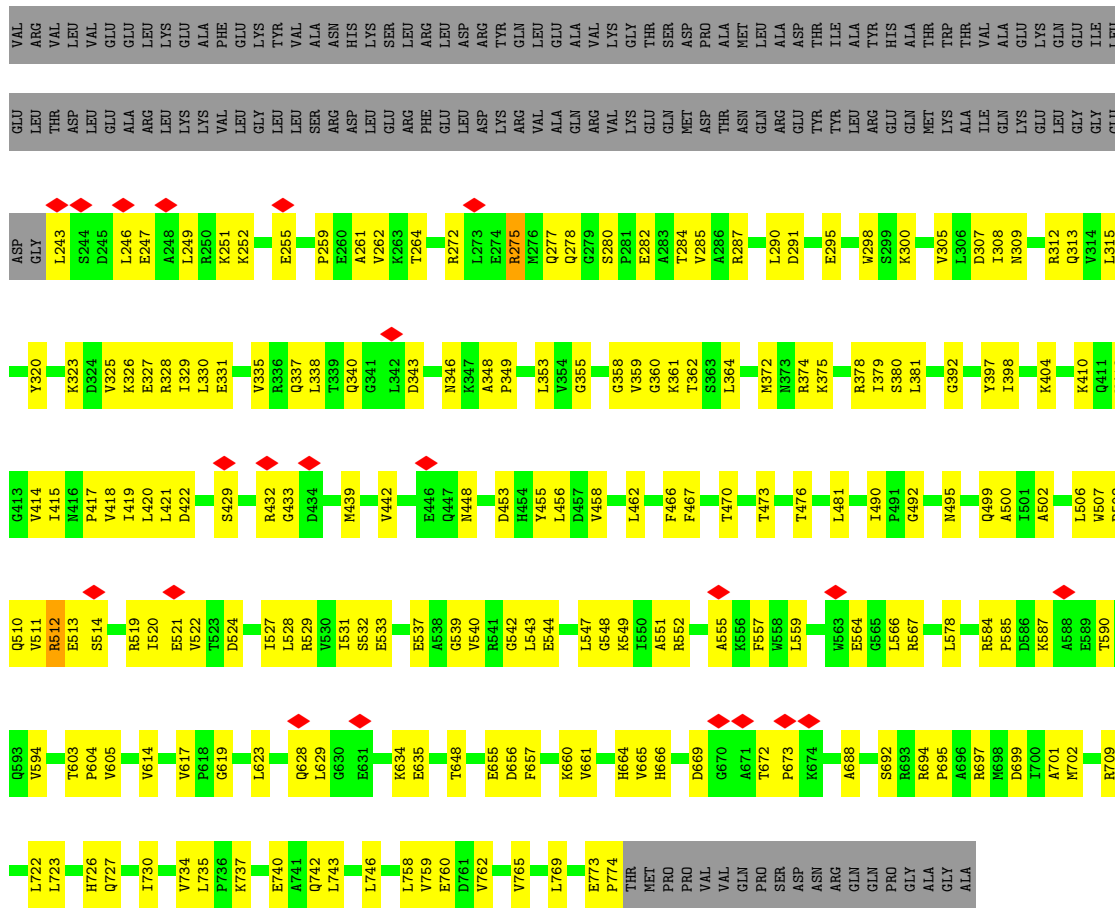


• Molecule 1: Lon protease

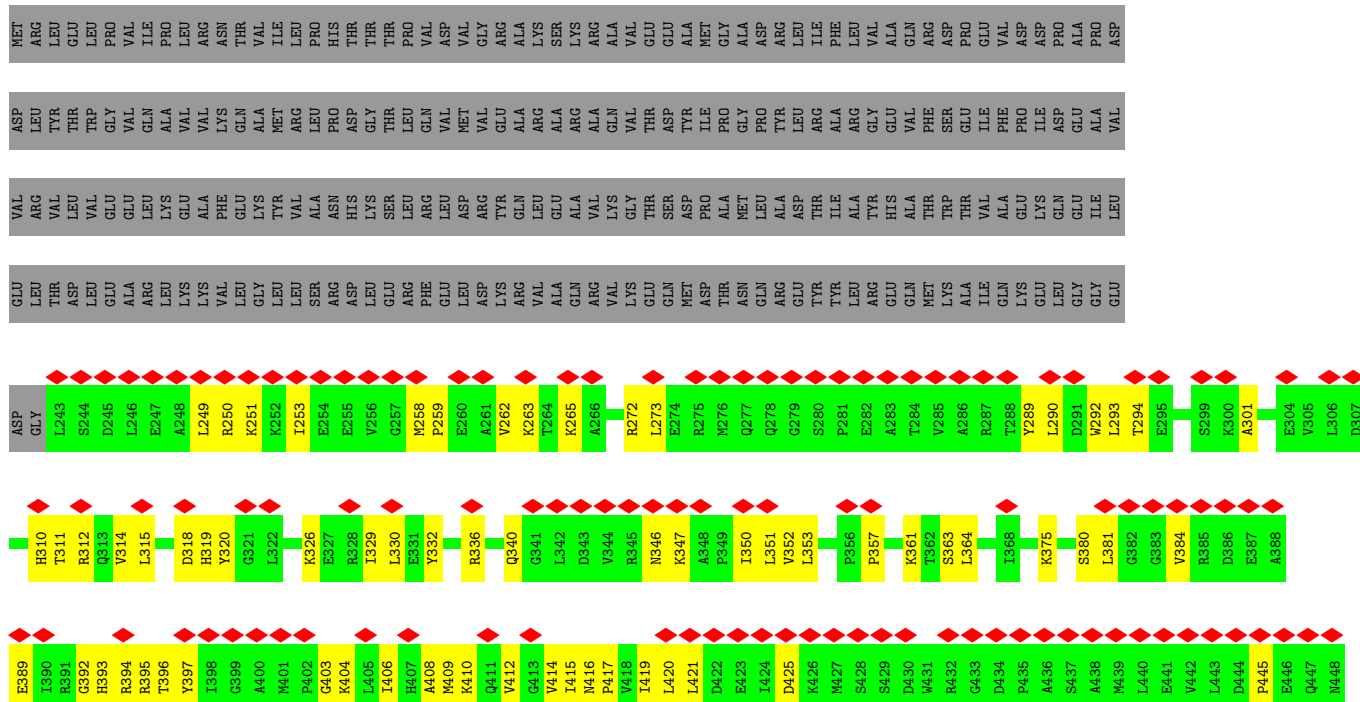
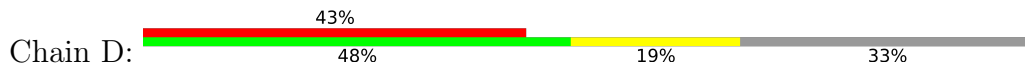


• Molecule 1: Lon protease





• Molecule 1: Lon protease



M449	T450	F451	Y455	L456	D457	V458	P459	Y460	D461	L462	S463	K464	V465	F466	F467	I468	T469	T470	T473	L474	Q475	T476	I477	P478	R479	P480	L481	L482	D483	R484	M485	E486	V487	I488	E489	I490	P491	G492	Y493	T494	M495	M496	E497	K498	Q499	A500	I501	A502	R503	Q504	Y505	L506	M507	P508	K509	Q510	V511	
R512	E513	S514	G515	M516	E517	G518	R519	I520	E521	V522	T523	D524	A525	A526	I527	L528	R529	V530	I531	S532	E533	Y534	T535	R536	E537	A538	G539	V540	R541	G542	L543	E544	R545	E546	L547	G548	K549	I550	A551	R552	K553	G554	A555	K556	F557	W558	L559	E560	G561	A562	M563	E564	G565	L566	R567	T568	I569	A571
S572	D573	I574	P575	T576	Y577	L578	G579	I580	P581	R582	Y583	R584	P585	D586	K587	A588	E589	T590	E591	P592	Q593	G599	L600	A601	W602	T603	P604	V605	G606	G607	T608	L609	L610	T611	V614	V617	P618	G619	S620	G621	K622	L623	S624	L625	T626	G627	Q628	L629	G630	E631	V632	M633	A637	L641				
L644	R645	A646	H647	T648	Q649	D650	Y651	G652	L653	P654	E655	D656	F657	Y658	N659	K660	V661	D662	L663	H664	V665	H666	V667	P668	D669	G670	A671	T672	P673	K674	D675	G676	P677	S678	I681	T682	M683	A684	T685	A686	L687	A688	L691	S692	R693	R694	M698	D699	I700	A701	M702	T703	G704	E705	V706			
S707	L708	R709	G710	K711	P714	I715	G716	G717	V718	K719	E720	K721	L722	L723	A724	A725	H726	Q727	A728	I733	V734	L735	P736	K737	D738	M739	E740	A741	Q742	L743	L746	P747	K748	E749	V750	L751	E752	G753	L754	E755	L756	K757	E760	D761	V762	G763	E764	V765	L766	E767	Y768	L769	L770	L771	P772			
E773	P774	THR	MET	PRO	PRO	VAL	VAL	GLN	PRO	SER	ASP	ASN	ARG	GLN	GLN	PRO	PRO	GLY	ALA	GLY	ALA																																					



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	103394	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	48	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	1.711	Depositor
Minimum map value	-1.009	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.040	Depositor
Recommended contour level	0.203	Depositor
Map size ( $\text{\AA}$ )	275.52, 275.52, 275.52	wwPDB
Map dimensions	336, 336, 336	wwPDB
Map angles ( $^\circ$ )	90.0, 90.0, 90.0	wwPDB
Pixel spacing ( $\text{\AA}$ )	0.82, 0.82, 0.82	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: ADP

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	0.24	0/4221	0.51	0/5721
1	B	0.26	0/4221	0.55	0/5721
1	C	0.25	0/4221	0.53	0/5721
1	D	0.24	0/4221	0.50	0/5721
All	All	0.25	0/16884	0.52	0/22884

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	4144	0	4226	122	0
1	B	4144	0	4226	155	0
1	C	4144	0	4226	148	0
1	D	4144	0	4226	99	0
2	A	27	0	12	1	0
2	B	27	0	12	5	0
2	C	27	0	12	2	0
All	All	16657	0	16940	500	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 15.

The worst 5 of 500 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:698:MET:HE3	1:B:699:ASP:H	1.32	0.94
1:C:412:VAL:HG11	1:C:417:PRO:HG3	1.56	0.87
1:A:510:GLN:NE2	1:A:544:GLU:O	2.14	0.81
1:B:392:GLY:HA3	1:B:455:TYR:H	1.48	0.78
1:C:512:ARG:O	1:D:340:GLN:NE2	2.18	0.77

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	530/793 (67%)	500 (94%)	30 (6%)	0	100	100
1	B	530/793 (67%)	496 (94%)	34 (6%)	0	100	100
1	C	530/793 (67%)	495 (93%)	35 (7%)	0	100	100
1	D	530/793 (67%)	496 (94%)	34 (6%)	0	100	100
All	All	2120/3172 (67%)	1987 (94%)	133 (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	443/665 (67%)	439 (99%)	4 (1%)	78	88
1	B	443/665 (67%)	442 (100%)	1 (0%)	93	97
1	C	443/665 (67%)	440 (99%)	3 (1%)	84	91
1	D	443/665 (67%)	443 (100%)	0	100	100
All	All	1772/2660 (67%)	1764 (100%)	8 (0%)	89	94

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	519	ARG
1	C	512	ARG
1	B	385	ARG
1	A	475	GLN
1	C	275	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	598	GLN
1	C	499	GLN

### 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](#)

3 ligands are 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
2	ADP	A	801	-	24,29,29	0.95	1 (4%)	29,45,45	1.40	4 (13%)
2	ADP	B	801	-	24,29,29	0.92	1 (4%)	29,45,45	1.44	4 (13%)
2	ADP	C	801	-	24,29,29	0.93	1 (4%)	29,45,45	1.35	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
2	ADP	A	801	-	-	0/12/32/32	0/3/3/3
2	ADP	B	801	-	-	2/12/32/32	0/3/3/3
2	ADP	C	801	-	-	4/12/32/32	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	ADP	C5-C4	2.45	1.47	1.40
2	C	801	ADP	C5-C4	2.40	1.47	1.40
2	B	801	ADP	C5-C4	2.34	1.47	1.40

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	801	ADP	PA-O3A-PB	-3.85	119.63	132.83
2	A	801	ADP	PA-O3A-PB	-3.67	120.22	132.83
2	C	801	ADP	PA-O3A-PB	-3.21	121.82	132.83
2	B	801	ADP	N3-C2-N1	-3.00	123.98	128.68
2	B	801	ADP	C3'-C2'-C1'	2.99	105.49	100.98

There are no chirality outliers.

5 of 6 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	801	ADP	C5'-O5'-PA-O1A

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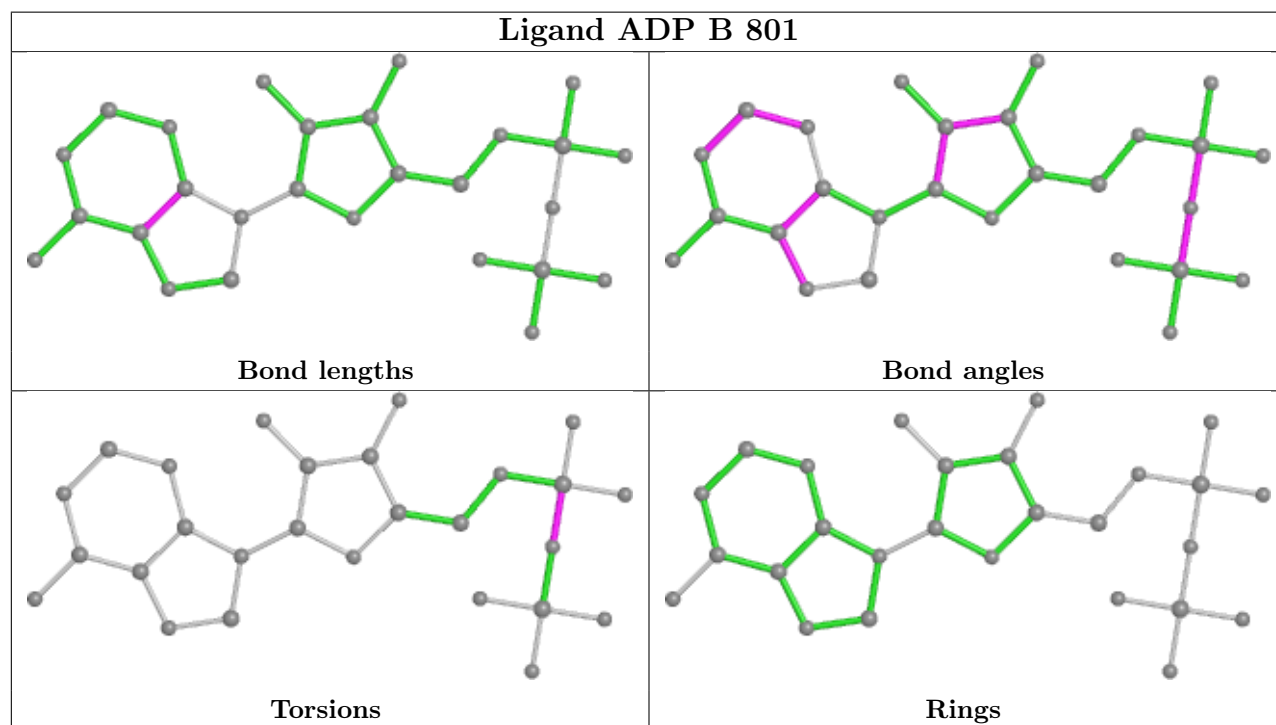
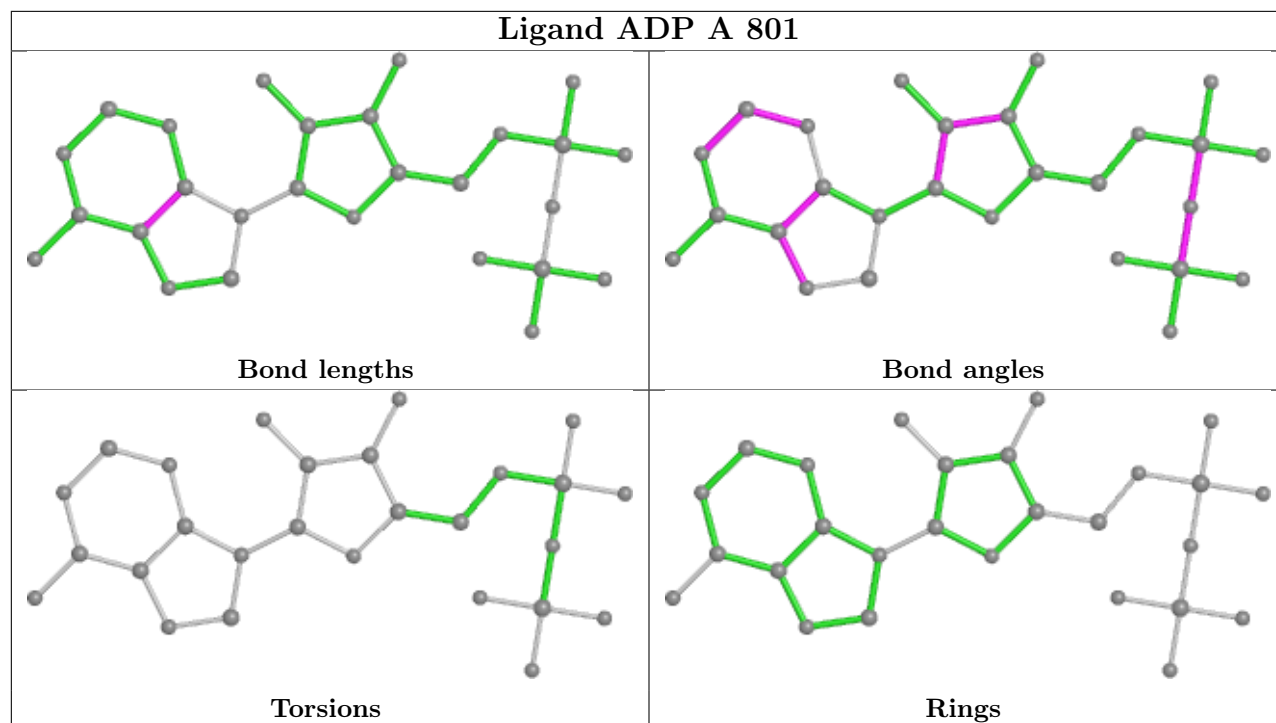
Mol	Chain	Res	Type	Atoms
2	C	801	ADP	O4'-C4'-C5'-O5'
2	C	801	ADP	C5'-O5'-PA-O3A
2	B	801	ADP	PB-O3A-PA-O2A
2	C	801	ADP	C3'-C4'-C5'-O5'

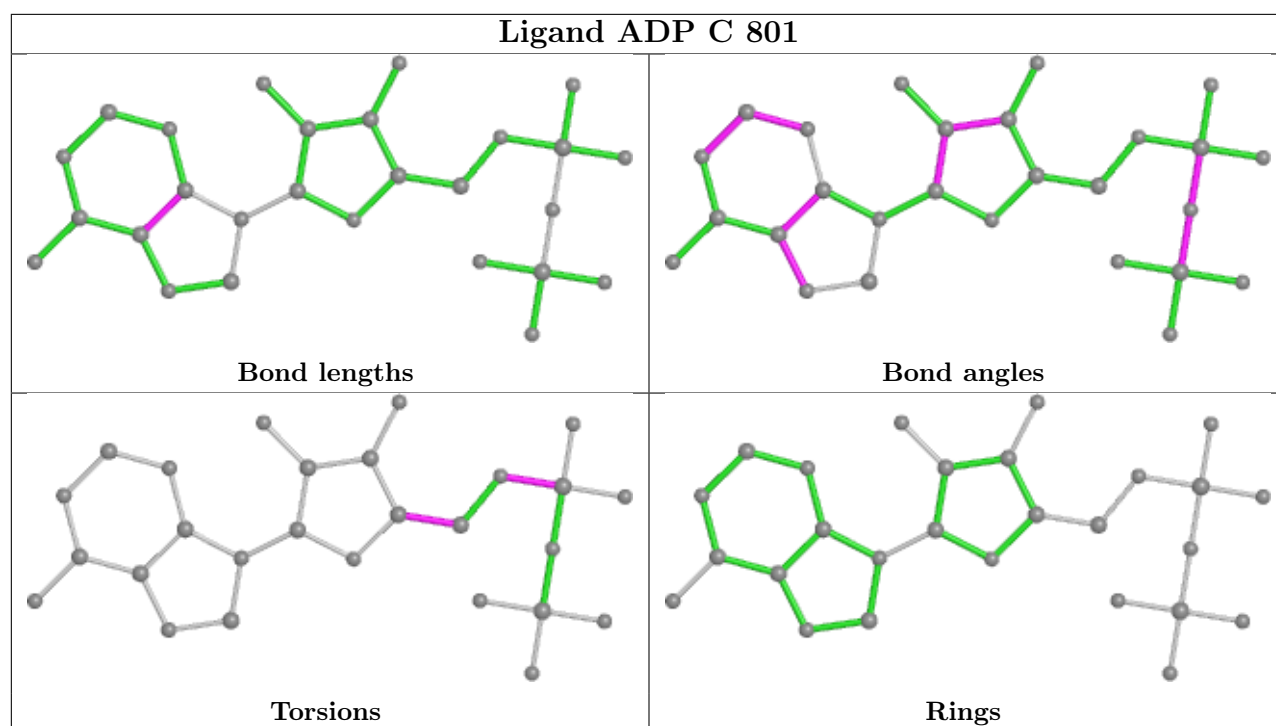
There are no ring outliers.

3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	801	ADP	1	0
2	B	801	ADP	5	0
2	C	801	ADP	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.



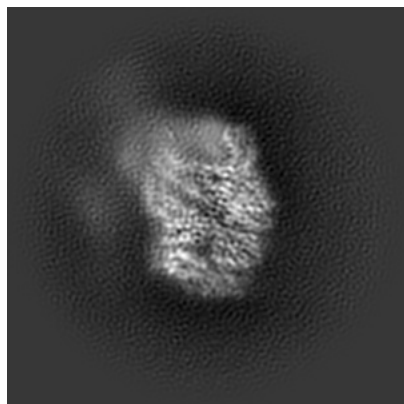
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-34112. These allow visual inspection of the internal detail of the map and identification of artifacts.

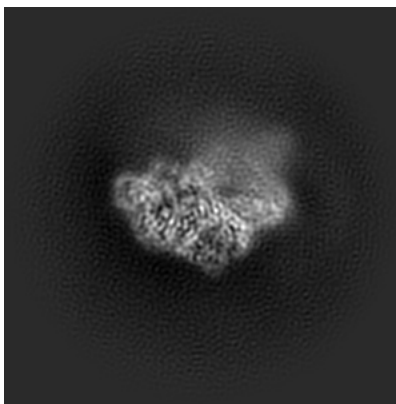
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

### 6.1 Orthogonal projections [i](#)

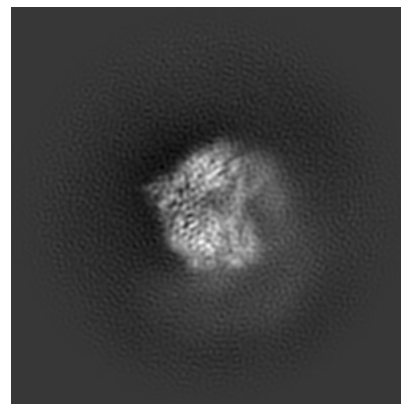
#### 6.1.1 Primary map



X

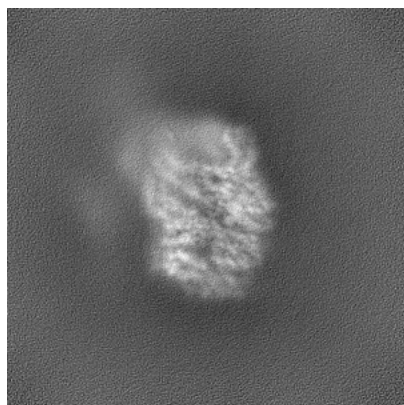


Y

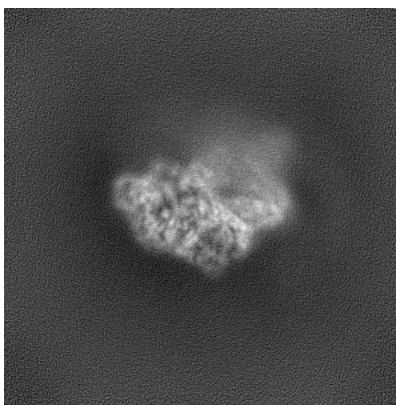


Z

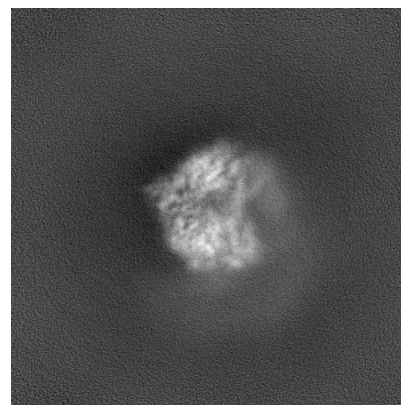
#### 6.1.2 Raw map



X



Y

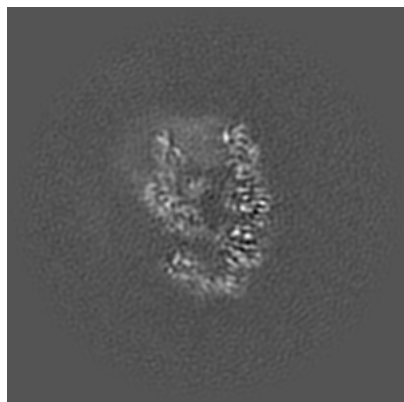


Z

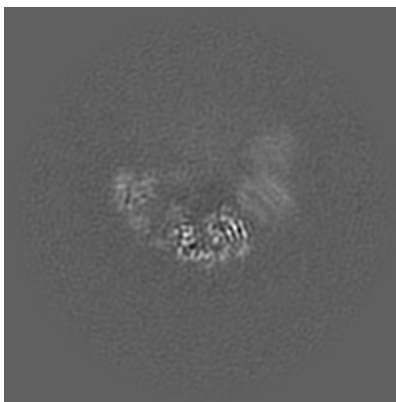
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

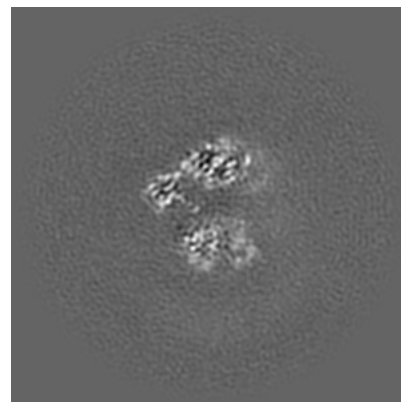
### 6.2.1 Primary map



X Index: 168

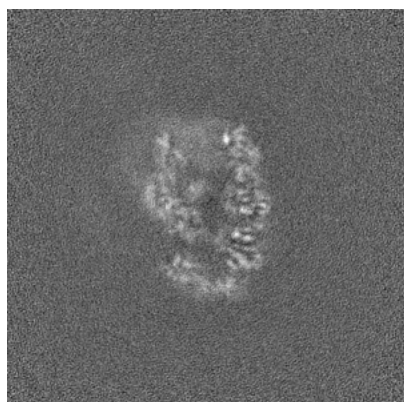


Y Index: 168

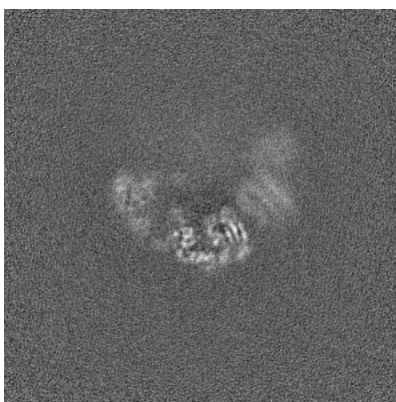


Z Index: 168

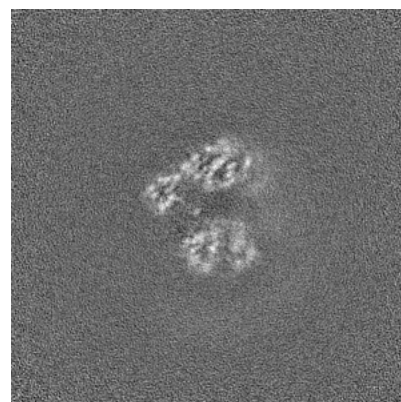
### 6.2.2 Raw map



X Index: 168



Y Index: 168

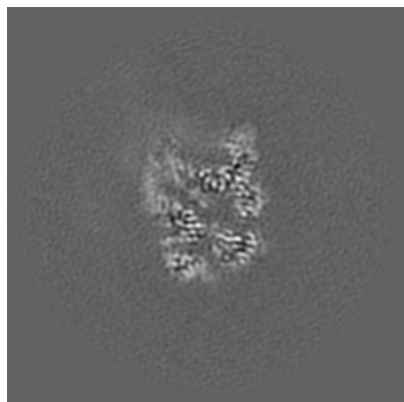


Z Index: 168

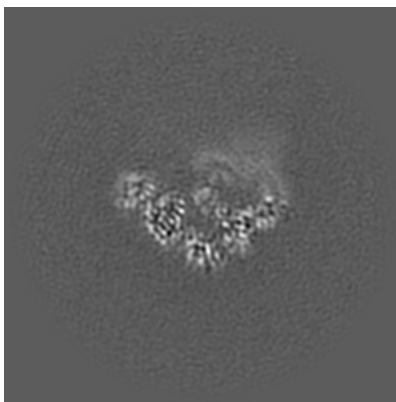
The images above show central slices of the map in three orthogonal directions.

## 6.3 Largest variance slices [i](#)

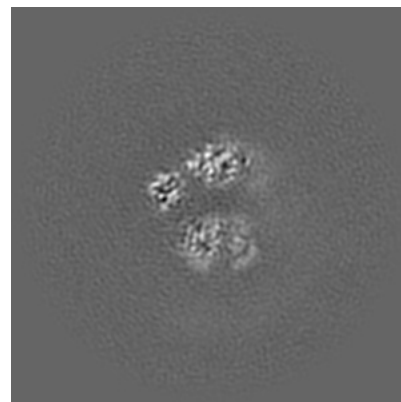
### 6.3.1 Primary map



X Index: 155

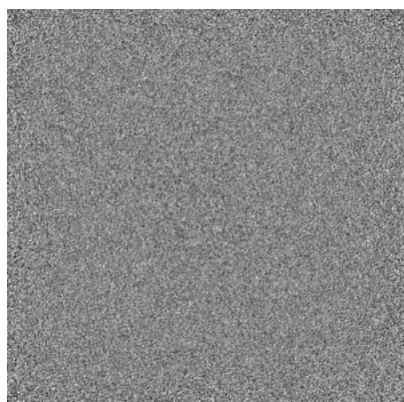


Y Index: 188

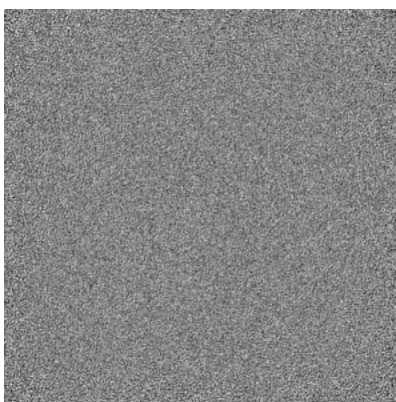


Z Index: 166

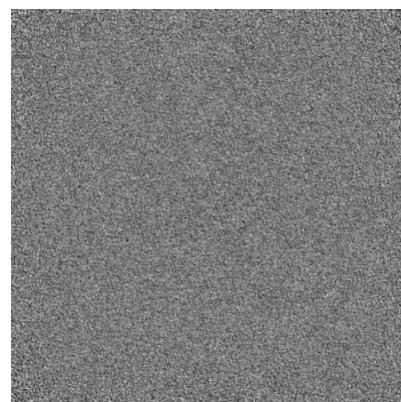
### 6.3.2 Raw map



X Index: 0



Y Index: 0

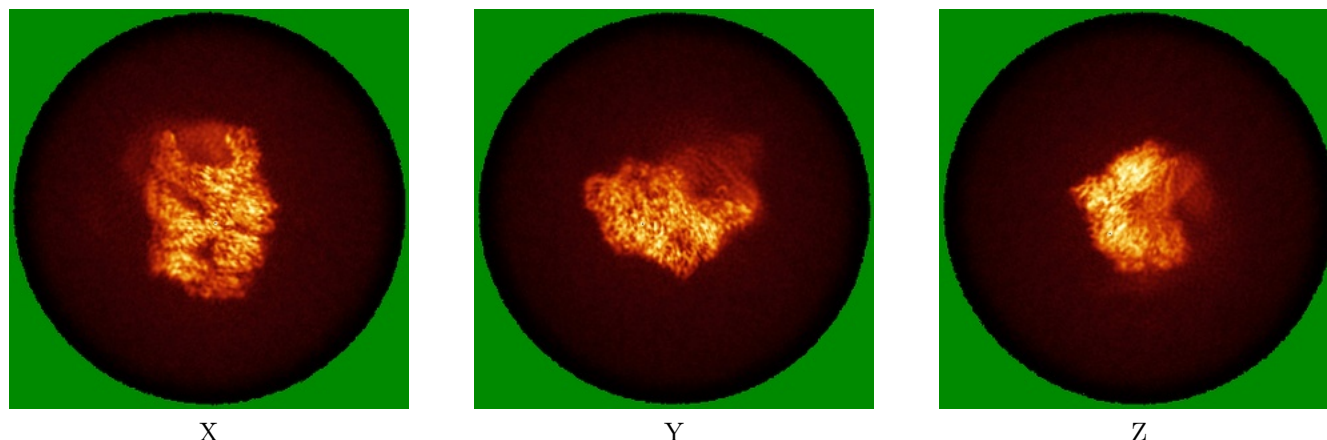


Z Index: 0

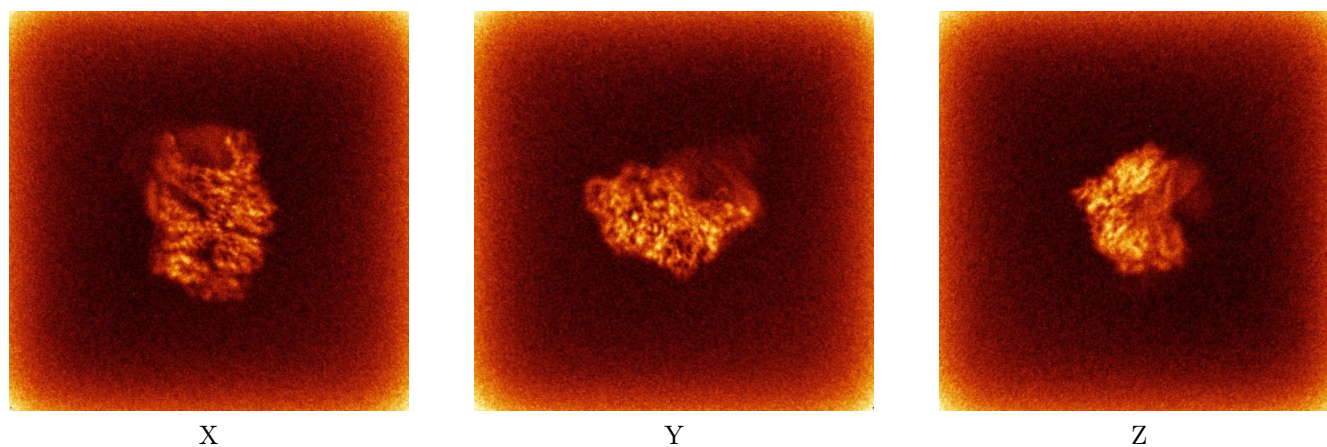
The images above show the largest variance slices of the map in three orthogonal directions.

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

### 6.4.1 Primary map



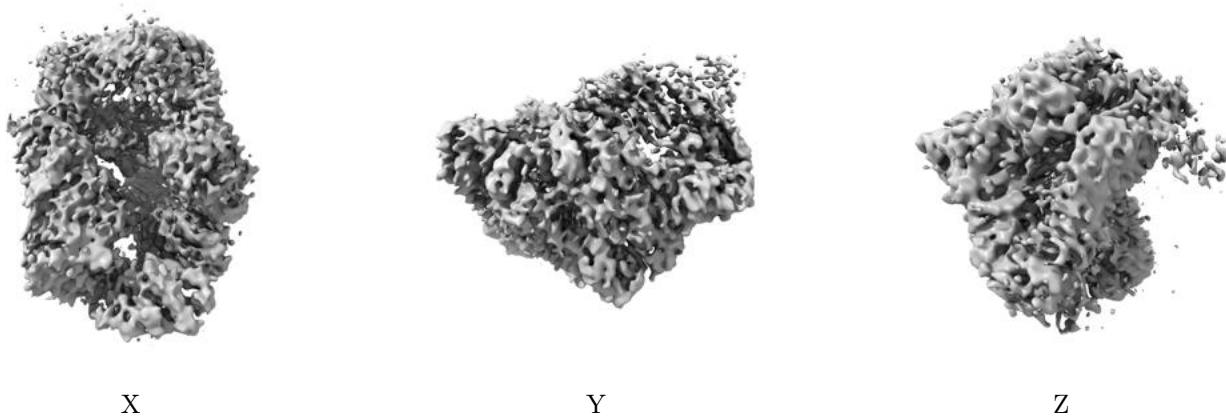
### 6.4.2 Raw map



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

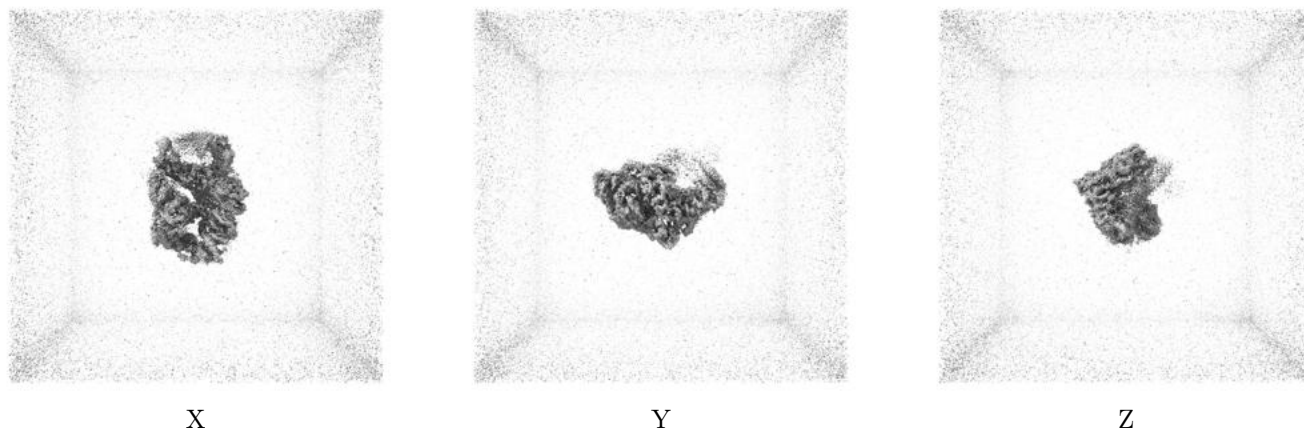
## 6.5 Orthogonal surface views [i](#)

### 6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.203. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

### 6.5.2 Raw map



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

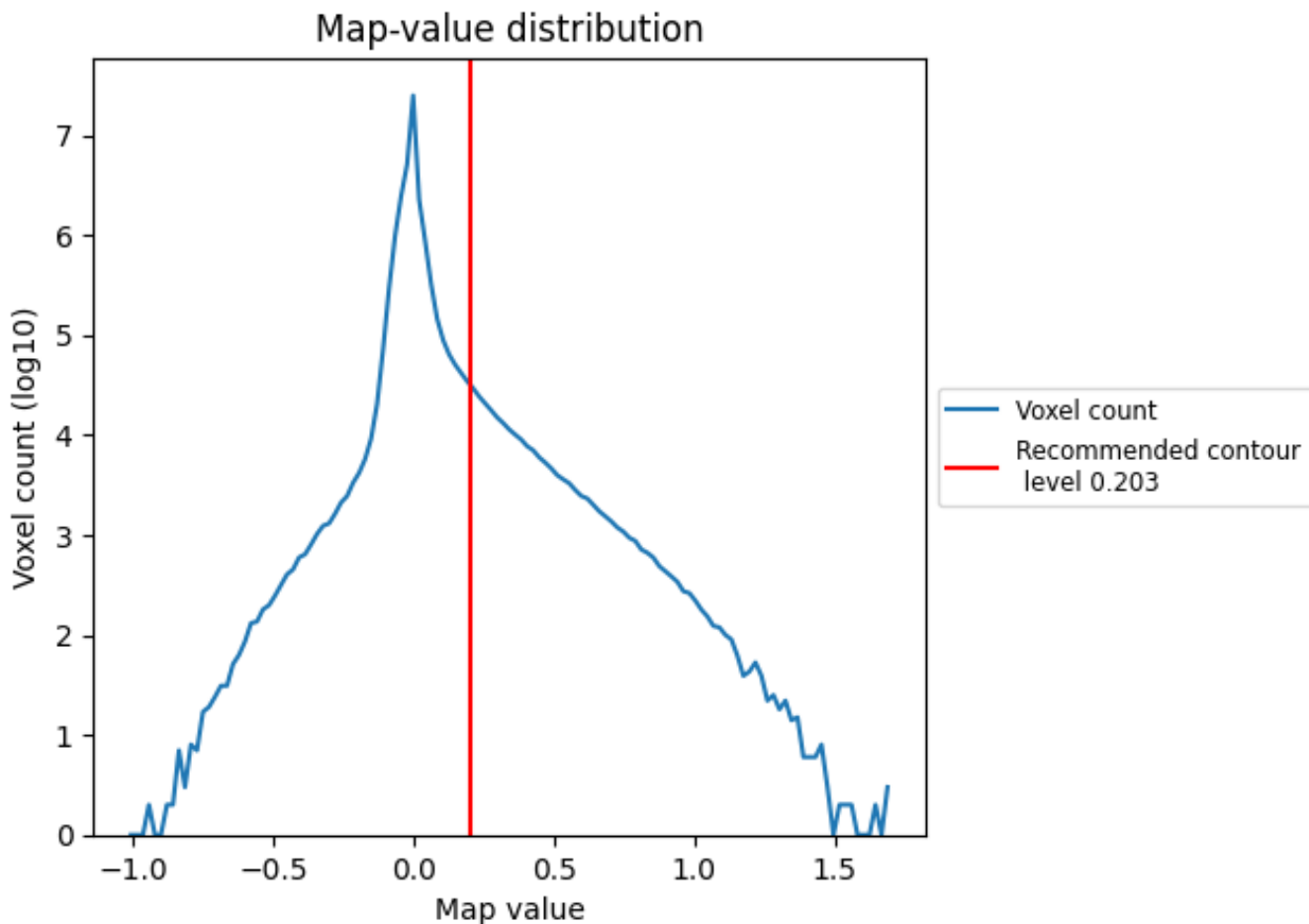
## 6.6 Mask visualisation [i](#)

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

## 7 Map analysis [i](#)

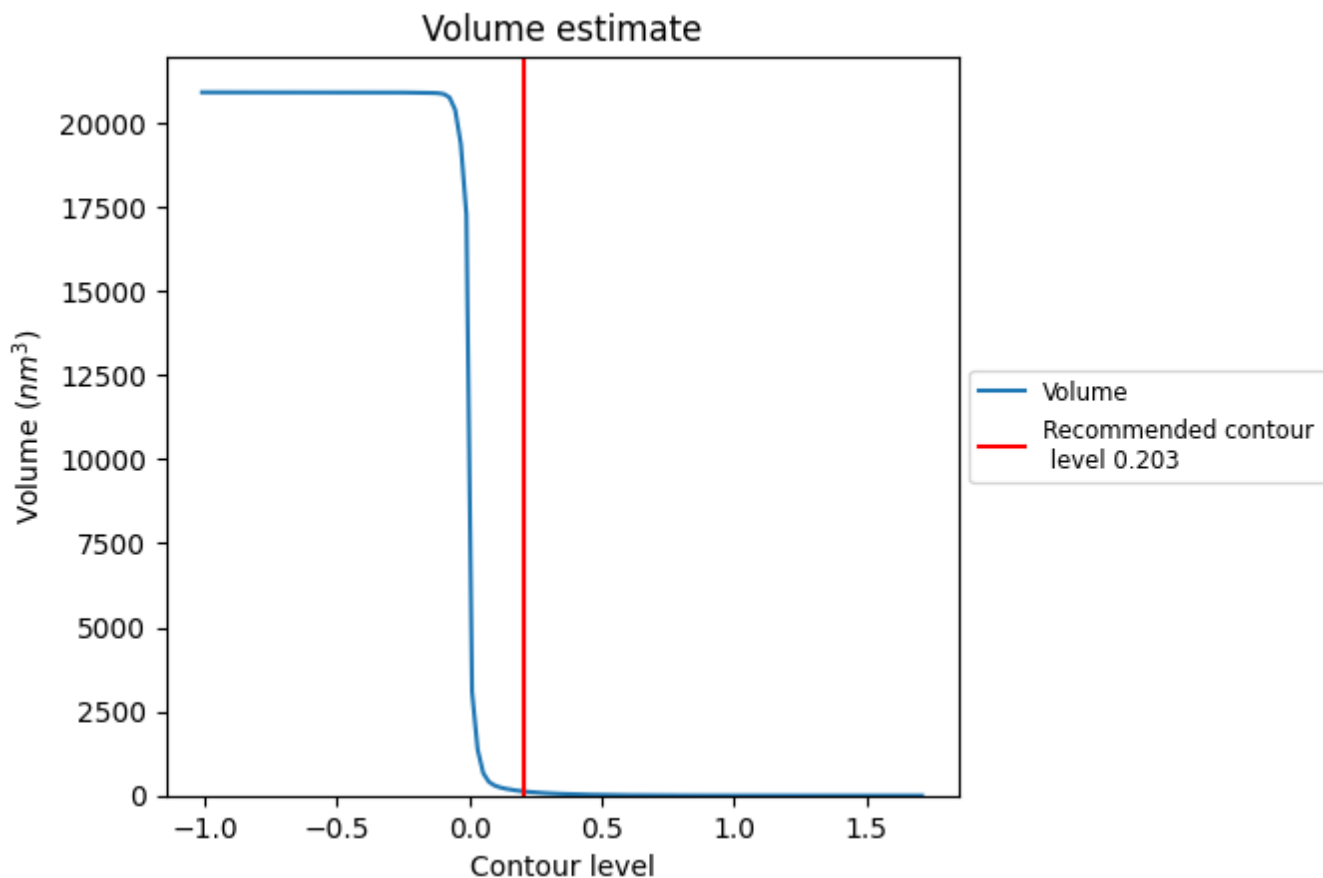
This section contains the results of statistical analysis of the map.

### 7.1 Map-value distribution [i](#)



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

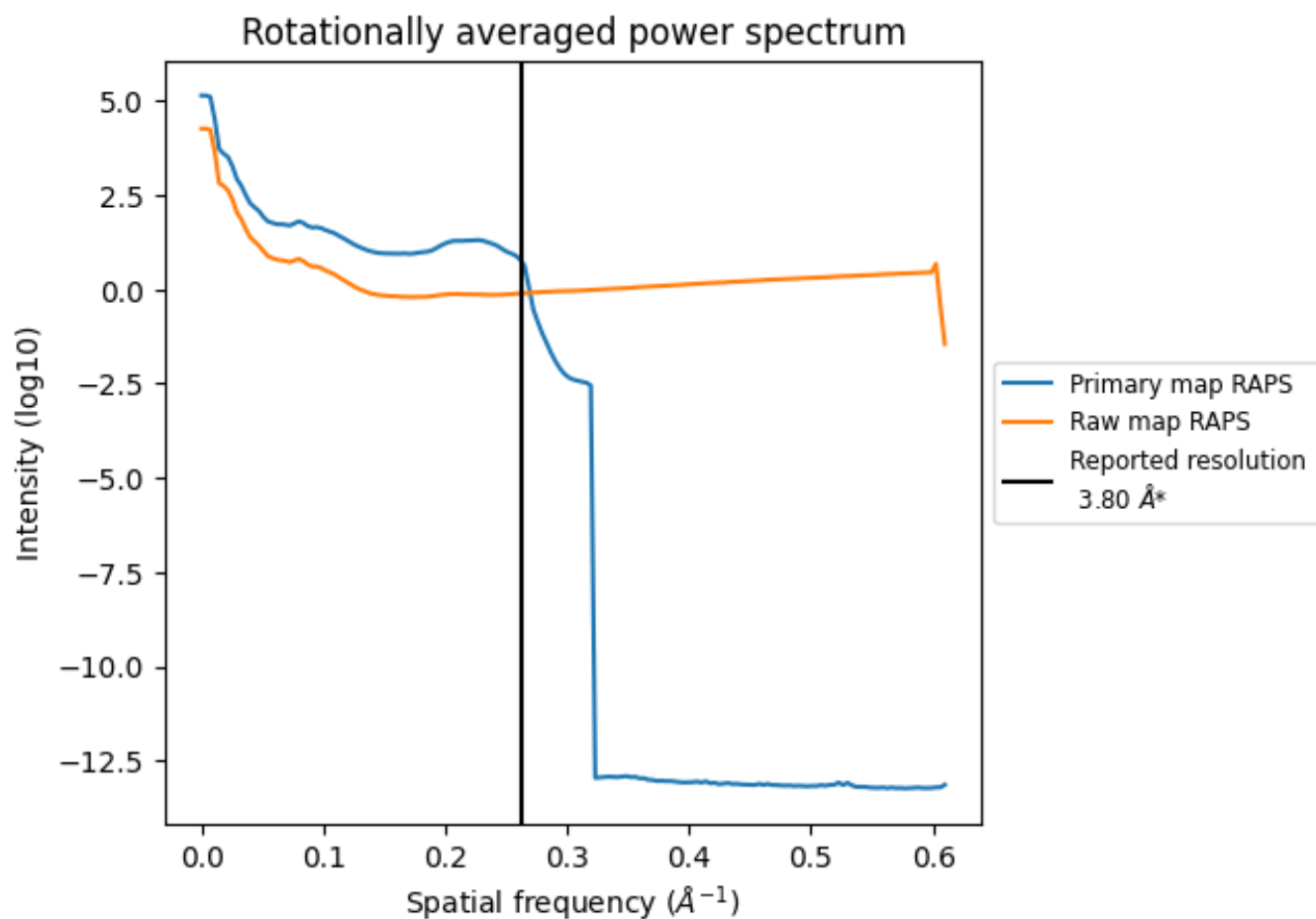
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 126 nm<sup>3</sup>; this corresponds to an approximate mass of 114 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](#)



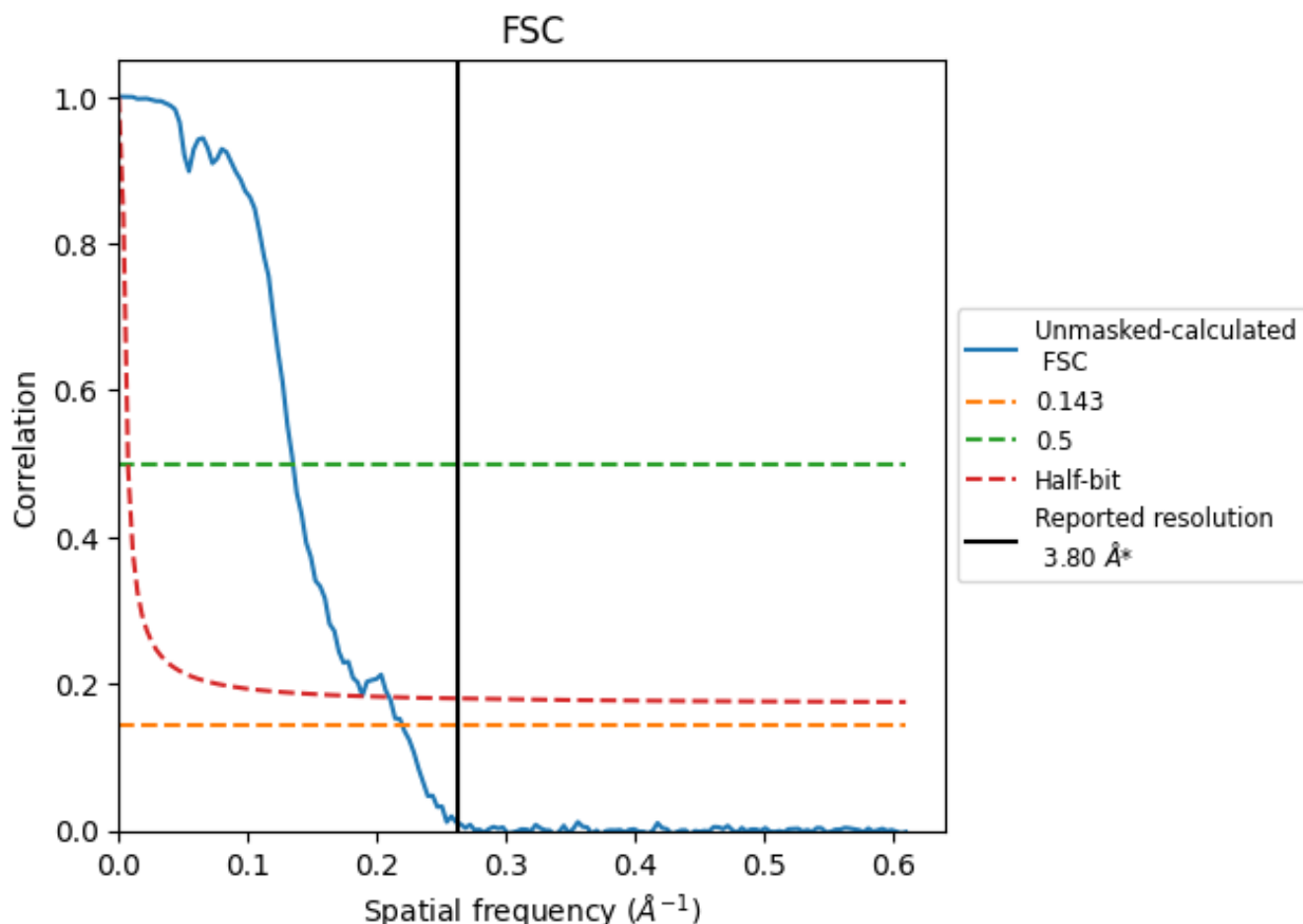
\*Reported resolution corresponds to spatial frequency of 0.263 Å<sup>-1</sup>



## 8 Fourier-Shell correlation [i](#)

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

### 8.1 FSC [i](#)



\*Reported resolution corresponds to spatial frequency of 0.263 Å<sup>-1</sup>

## 8.2 Resolution estimates [i](#)

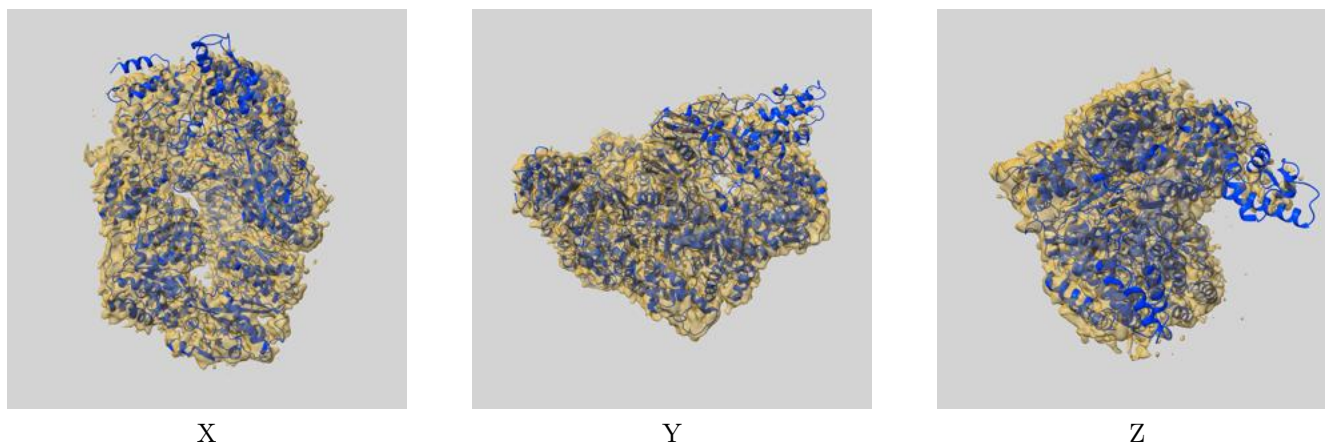
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.80	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	4.55	7.41	4.78

\*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 4.55 differs from the reported value 3.8 by more than 10 %

## 9 Map-model fit [i](#)

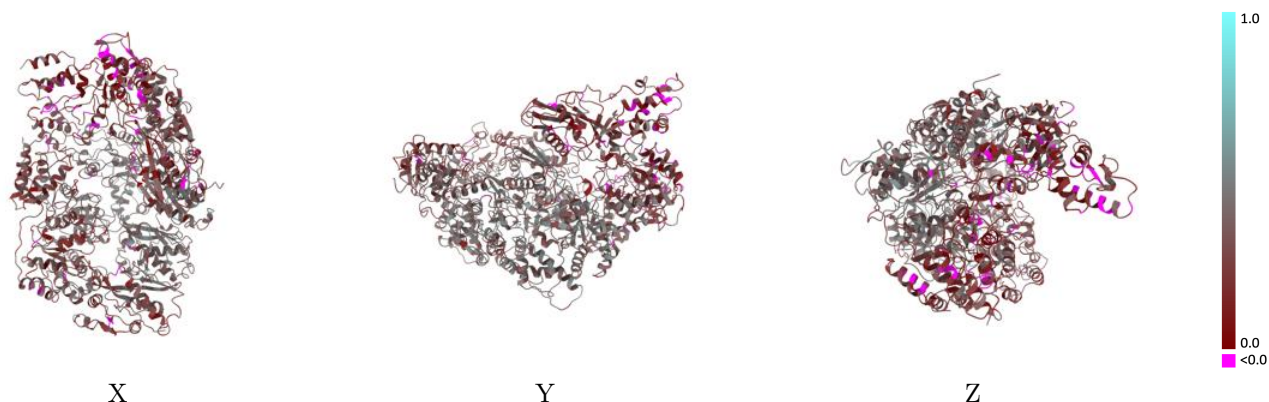
This section contains information regarding the fit between EMDB map EMD-34112 and PDB model 7YUV. Per-residue inclusion information can be found in section [3](#) on page [5](#).

### 9.1 Map-model overlay [i](#)



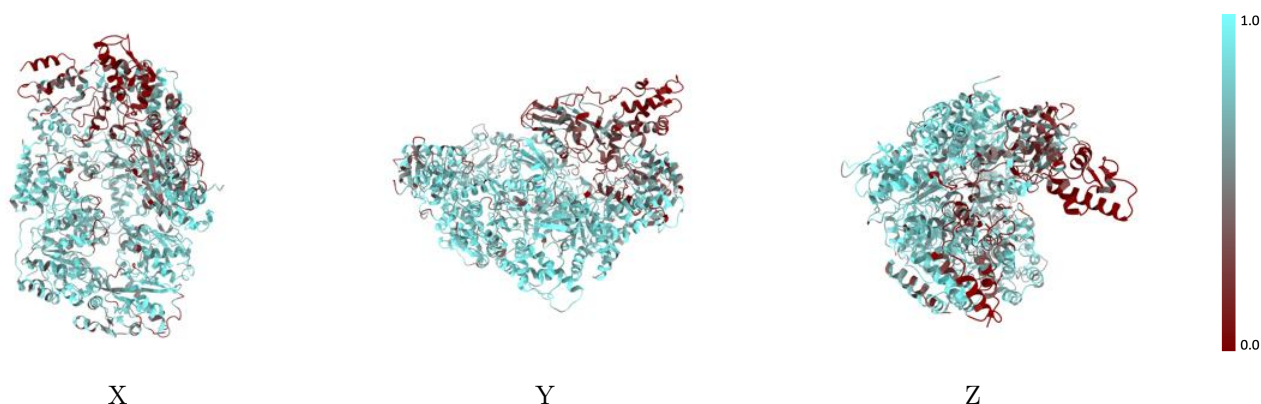
The images above show the 3D surface view of the map at the recommended contour level 0.203 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



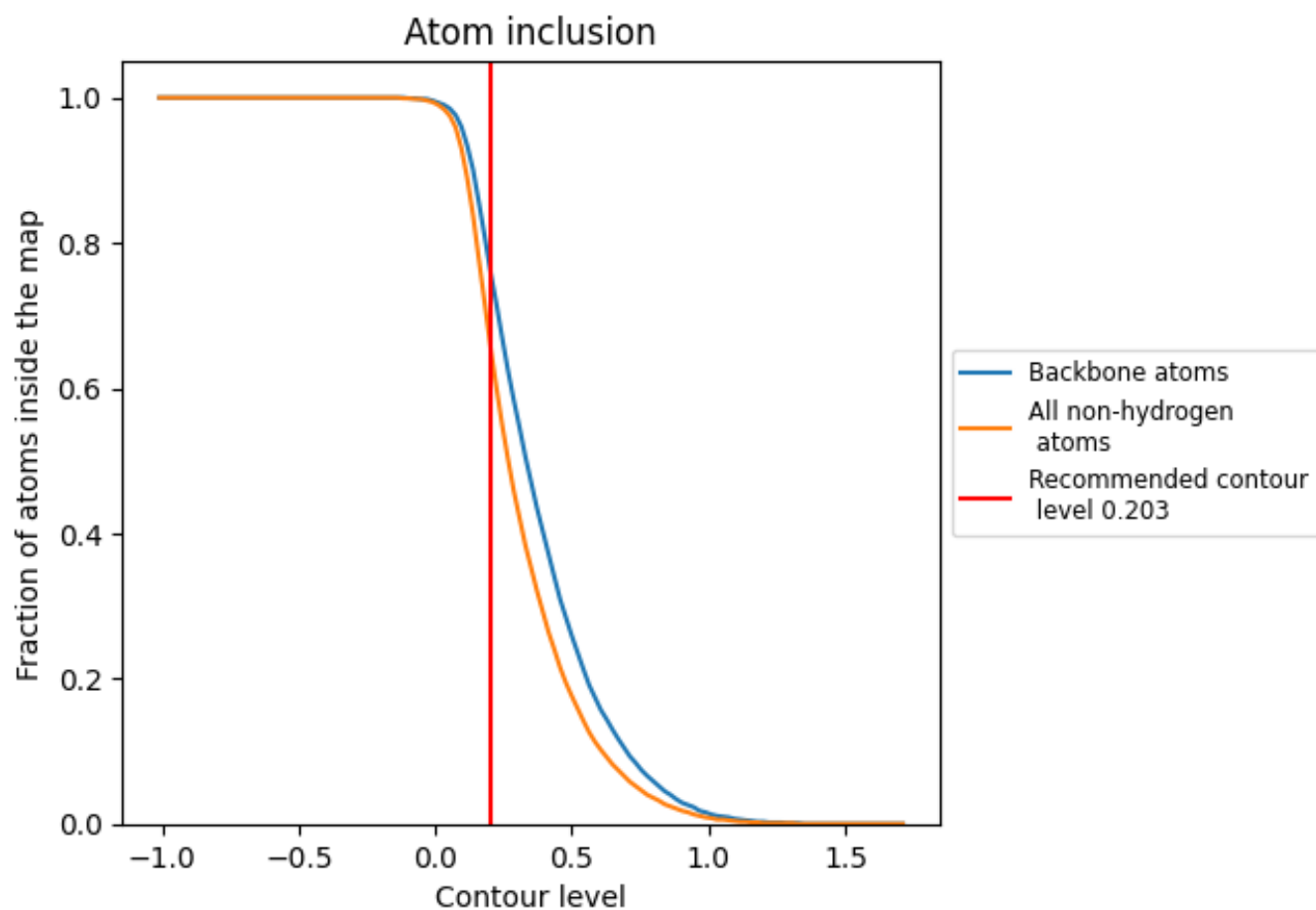
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.203).











## 9.4 Atom inclusion [i](#)



At the recommended contour level, 76% of all backbone atoms, 65% 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 (0.203) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.6540	 0.3150
A	 0.7150	 0.3080
B	 0.7950	 0.3820
C	 0.7830	 0.3630
D	 0.3210	 0.2070

