



wwPDB EM Validation Summary Report ⓘ

Dec 10, 2024 – 08:22 PM EST

PDB ID : 9EAG
EMDB ID : EMD-47801
Title : The Structure of ApoB100 from Human Low-Density Lipoprotein
Authors : Berndsen, Z.T.; Cassidy, C.K.
Deposited on : 2024-11-11
Resolution : 9.00 Å(reported)
Based on initial model : .

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.dev113
MolProbity : 4.02b-467
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.40

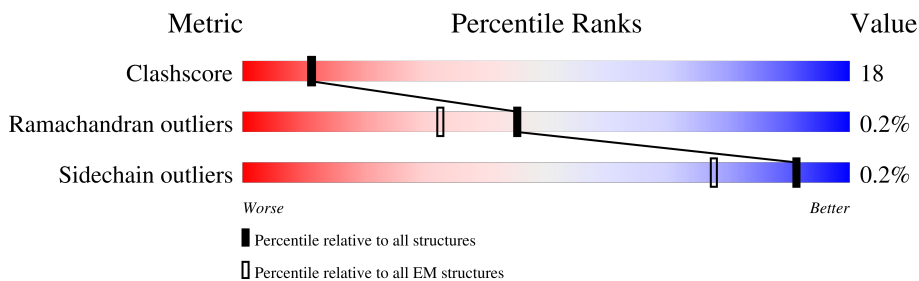
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 9.00 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	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 $\leq 5\%$. 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	4563	

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 36083 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.

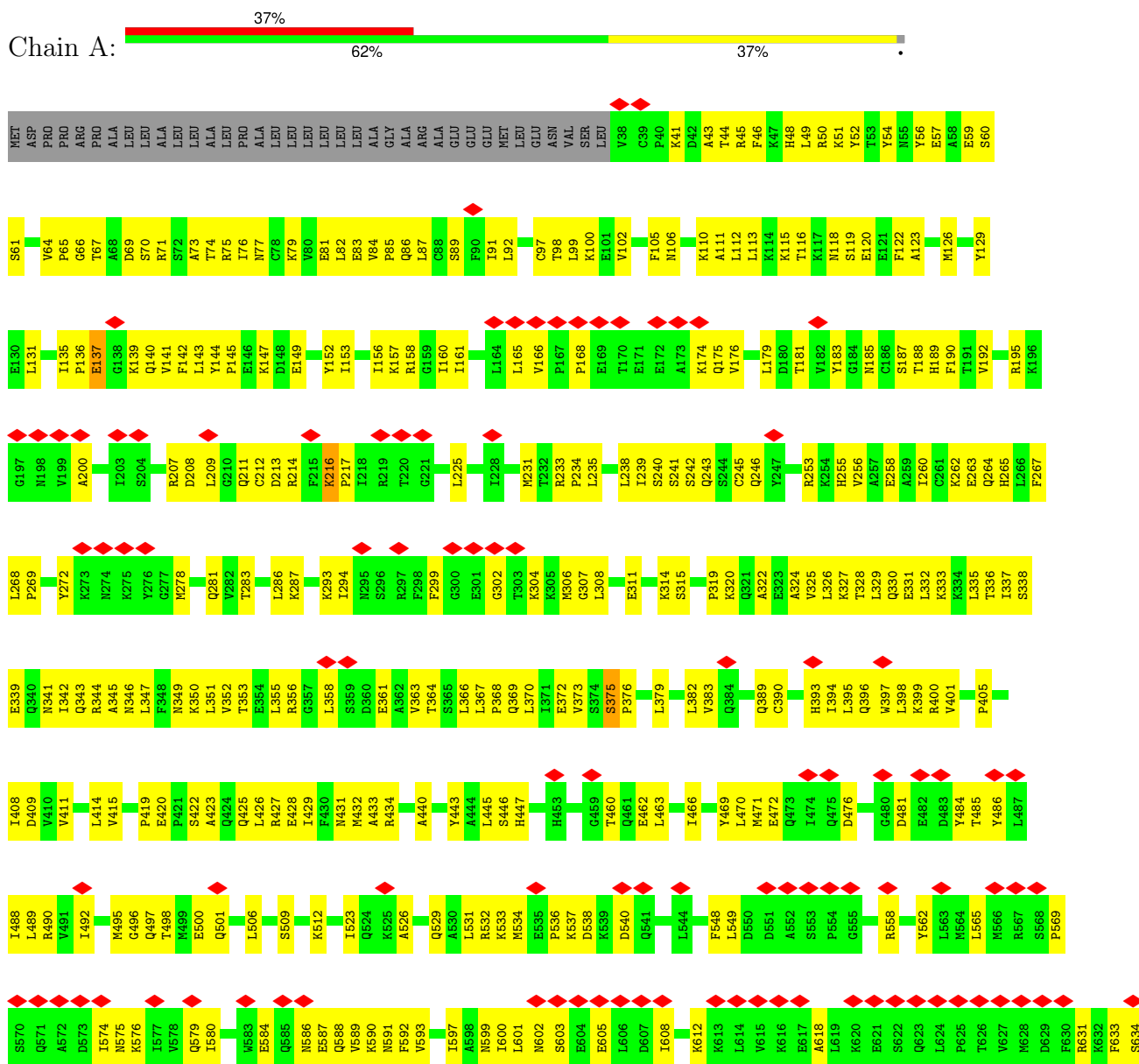
- Molecule 1 is a protein called Apolipoprotein B 100.

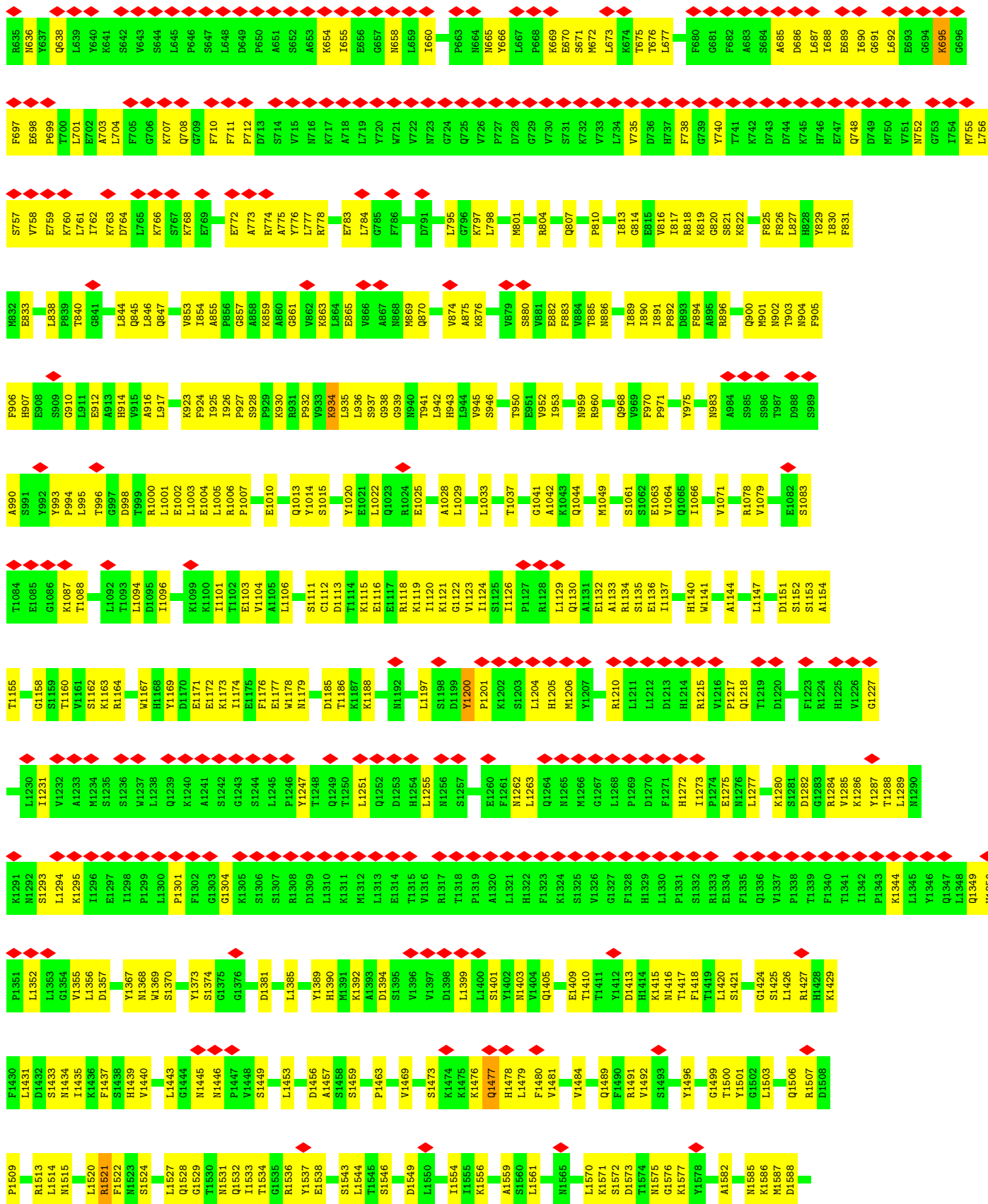
Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	4526	36083	23018	6066	6897	102	0	0

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: Apolipoprotein B 100

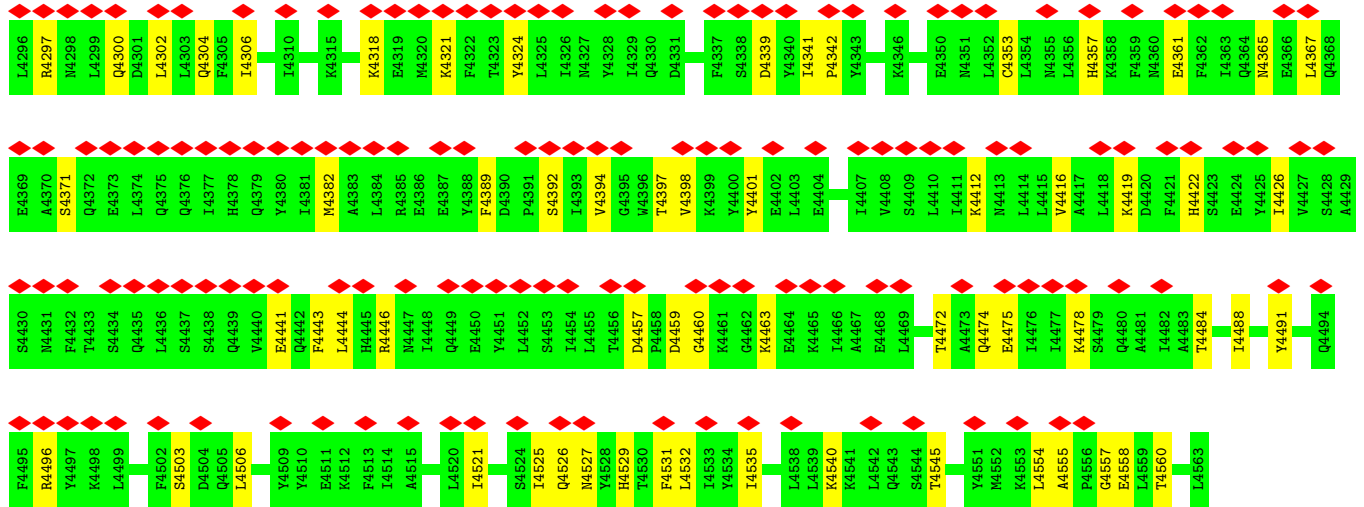






T2515	L2616	E2517	D2618	T2519	R2620	D2521	R2622	M2523	M2524	Q2525	D2526	D2527	L2528	E2531	L2532	Q2533	R2534	T2535	L2536	S2537	L2538	V2539	Q2540	Q2541	V2542	V2543	L2546	V2547	T2548	T2549	L2550	S2551	D2552	M2553	M2554	T2555	L2556	A2557	A2558	K2559	N2560	L2561	T2562	D2563	L2564	A2565	E2566	Q2567	N2568	S2569	Q2571	D2572	M2573	A2574	K2575	R2576					
M2577	K2578	A2579	L2580	E2582	Q2583	G2584	F2585	T2586	V2587	P2588	E2589	L2590	K2591	T2592	I2593	L2594	G2595	T2596	M2597	F2600	E2601	V2602	S2603	Q2604	Q2605	A2606	L2607	Q2608	K2609	A2610	T2611	F2612	Q2613	M2614	P2615	D2616	F2617	L2618	V2619	P2620	L2621	T2622	D2623	L2624	R2625	S2628	V2629	Q2630	L2631	N2632	F2633	K2634	D2635	L2636	K2637	N2638					
I2639	K2640	R2644	P2648	E2649	F2650	T2651	L2652	L2653	T2654	M2654	T2655	P2656	H2657	I2658	P2659	S2660	F2665	M2668	K2669	I2672	L2673	R2674	T2675	L2676	D2677	Q2678	M2679	L2680	N2681	S2682	E2683	L2684	Q2685	W2686	P2687	V2688	P2689	D2690	L2691	T2692	L2693	R2694	D2695	S2696	L2697	L2698	E2699	D2700	L2701	T2702	L2703	A2704	R2705	L2706	T2707						
L2708	P2709	D2710	F2711	R2712	L2713	P2714	E2715	A2716	L2717	I2718	P2719	E2720	F2721	L2722	L2723	P2724	T2725	L2726	M2727	L2728	N2729	D2730	F2731	V2732	Q2733	P2734	D2735	L2736	H2737	L2738	P2739	E2740	F2741	Q2742	H2745	I2746	L2750	E2751	V2752	P2753	T2754	K2757	L2758	S2759	S2760	L2761	K2762	L2764	Q2765	S2766	P2767	L2768	F2769	T2770	L2771						
D2772	A2773	M2774	A2775	G2780	T2781	T2782	L2783	A2784	M2785	E2786	A2787	G2788	I2789	A2790	A2791	S2792	L2793	T2794	A2795	K2796	G2797	E2798	S2799	K2800	L2801	E2802	V2803	L2804	N2805	F2806	D2807	Q2808	Q2809	A2810	N2811	A2812	Q2813	L2814	S2815	M2816	P2817	K2818	L2819	N2820	P2821	L2822	A2823	L2824	K2825	E2826	S2827	S2831	K2832	K2833	R2836						
H2839	Q2840	E2841	E2842	L2843	F2844	Q2845	L2846	Q2847	N2848	A2849	L2850	E2851	N2855	S2859	L2860	H2861	T2862	E2863	K2864	T2865	L2866	L2867	F2868	L2869	S2870	N2871	V2875	K2876	L2877	N2878	Q2879	L2880	L2881	T2882	L2883	D2884	S2885	T2886	L2887	Y2888	F2889	H2891	L2892	L2893	N2894	L2895	P2896	K2897	L2898	D2899	Q2903	K2904	L2905	L2906							
R2907	M2908	E2909	I2910	K2911	T2912	L2913	L2914	K2915	A2916	Q2917	H2918	L2919	A2920	W2921	T2922	G2927	S2928	V2929	K2930	W2931	P2934	R2935	F2936	S2937	D2938	E2939	H2942	S2944	Q2945	L2946	S2947	F2948	E2951	G2952	P2953	L2954	T2955	K2956	S2957	G2958	L2959	S2960	N2961	K2962	L2963	L2964	S2965	K2966	A2967	L2968	V2969	W2970	N2971	Q2972							
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I3046	T3047	A3048	S3049	V3115	N3050	K3051	M3052	E3053	L3056	F3060	P3061	L3062	R3063	L3064	T3065	G3066	K3067	L3068	D3069	F3070	L3071	N3072	N3073	L3074	A3075	L3076	F3077	L3078	S3079	A3082	Q3083	Q3084	A3085	S3086	W3087	Q3088	V3089	S3090	A3091	R3092	F3093	N3094	K3097	Y3098	N3099	Q3100	N3101	E3102	S3103	A3104	G3105	N3106	N3107	E3108	N3109	I3110					
M3111	H3114	G3115	I3117	E3120	L3123	D3124	F3125	L3126	N3127	I3128	P3129	L3130	T3131	I3132	P3133	E3134	M3135	R3136	L3137	P3138	F3139	T3140	I3141	T3142	I3143	T3144	P3145	P3146	L3147	K3148	D3149	N3211	R3212	N3213	N3214	A3215	S3151	L3152	W3153	E3154	K3155	L3158	K3159	E3160	F3161	L3162	K3163	T3164	T3165	K3166	Q3167	D3170	L3171	Q3176	Y3177	K3178					
K3179	N3180	R3183	H3184	S3185	I3186	T3187	N3188	P3189	L3190	A3191	V3192	L3193	C3194	E3195	F3196	L3197	S3198	Q3199	E3259	S3260	S3261	P3262	F3263	L3264	I3265	E3266	M3267	S3268	A3269	F3270	G3271	R3272	N3211	N3212	N3213	N3214	A3215	S3151	L3152	W3153	E3154	K3155	L3158	K3159	E3160	F3161	L3162	K3163	T3164	T3165	K3166	Q3167	D3170	L3171	Q3176	Y3177	K3178				
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F3300	S3301	L3302	E3303	L3304	P3305	V3306	L3307	K3308	V3309	P3310	R3311	N3312	L3313	K3314	L3315	S3316	L3317	P3318	D3319	F3320	K3321	E3322	L3323	C3324	I3325	L3326	S3327	H3328	L3329	F3330	P3331	L3332	A3333	K3334	G3335	N3336	I3337	T3338	F3343	K3344	S3345	S3346	V3347	S3282	F3283	S3284	I3285	L3286	G3287	S3288	D3289	V3290	R3291	V3292	P3293	S3294	Y3295	T3296	L3297	I3298	L3299

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V4171	F4172	D4173	G4174	L4175	V4176	T4177	F4178	T4179	F4182	H4183	V4186	K4187	H4188	L4189	I4190	L4193	I4194	D4195	F4196	E4197	L4198	L4199	F4199	P4200	R4201	F4202	Q4203	F4204	P4205	G4206	K4207	P4208	G4209	I4210	Y4211	T4212	R4213	E4214	E4215	L4216	C4217	T4218	M4219	F4220	I4221	R4222	E4223	V4224	G4225	T4226	V4227	L4228	V4231	Y4232	S4233	K4234	V4235	
S4101	S4102	K4103	L4104	R4105	R4106	Q4109	M4110	M4111	A4112	Y4116	Q4117	G4118	A4119	I4120	R4121	Q4122	I4123	D4124	L4126	D4127	V4128	R4129	F4130	T4137	T4138	Y4141	Q4142	E4143	V4144	K4145	D4146	L4147	A4148	L4151	Y4152	Q4153	E4154	L4155	L4156	T4157	Q4158	E4159	G4160	Q4161	A4162	S4163	G4166	L4167	K4168	D4169	M4170							
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K3401	S3402	K3403	K3404	F3405	N3411	L3416	T3417	V3425	A3426	T3427	T3428	T3429	Q3432	R3437	K3438	F3440	K3441	Q3442	E3443	L3444	K3449	S3450	K3451																																			



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	52843	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2800	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.148	Depositor
Minimum map value	-0.560	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.025	Depositor
Recommended contour level	0.182	Depositor
Map size (Å)	490.5, 490.5, 490.5	wwPDB
Map dimensions	450, 450, 450	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.09, 1.09, 1.09	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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	0/36813	0.48	0/49814

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	36083	0	36243	1282	0
All	All	36083	0	36243	1282	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 18.

The worst 5 of 1282 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:825:PHE:O	1:A:857:GLY:HA2	1.68	0.93
1:A:3918:SER:HA	1:A:3925:GLU:HG2	1.52	0.92
1:A:322:ALA:O	1:A:325:VAL:HB	1.70	0.92
1:A:4138:THR:HG22	1:A:4142:GLN:HE22	1.37	0.88
1:A:3965:GLU:O	1:A:3969:GLU:HB2	1.73	0.86

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	4524/4563 (99%)	4297 (95%)	219 (5%)	8 (0%)	44 78

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	137	GLU
1	A	1477	GLN
1	A	3828	PRO
1	A	375	SER
1	A	1200	TYR

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	4051/4080 (99%)	4041 (100%)	10 (0%)	92 94

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3389	ARG
1	A	3638	ARG
1	A	4071	LYS
1	A	934	LYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	1215	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 21 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3442	GLN
1	A	3824	GLN
1	A	4526	GLN
1	A	3987	HIS
1	A	3645	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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.

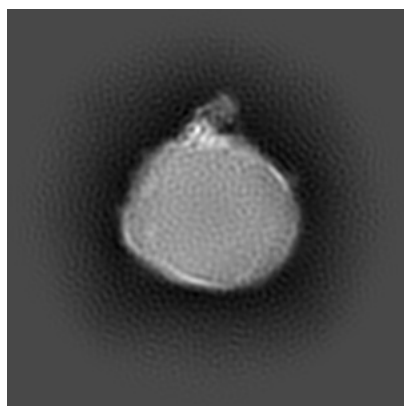
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-47801. These allow visual inspection of the internal detail of the map and identification of artifacts.

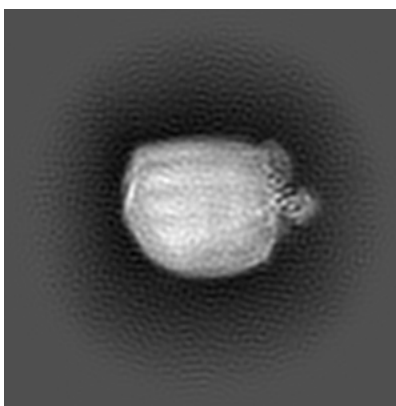
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

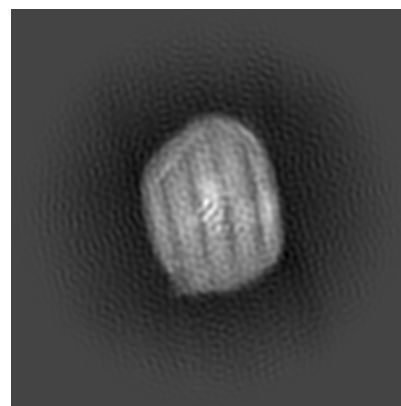
6.1.1 Primary map



X

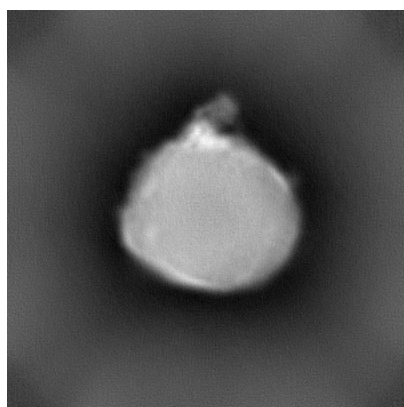


Y

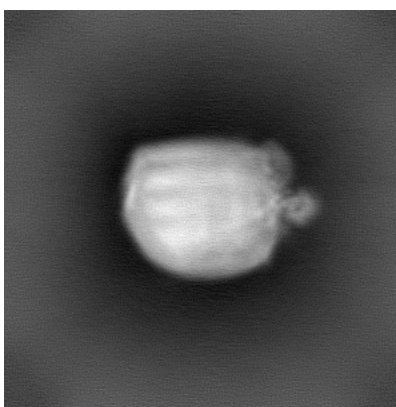


Z

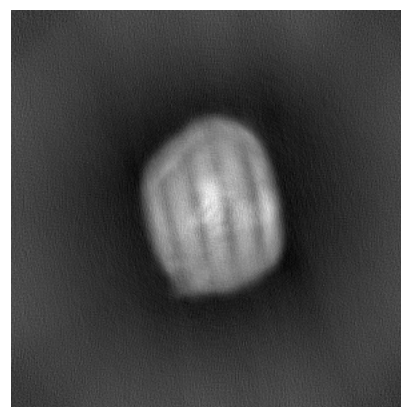
6.1.2 Raw map



X



Y

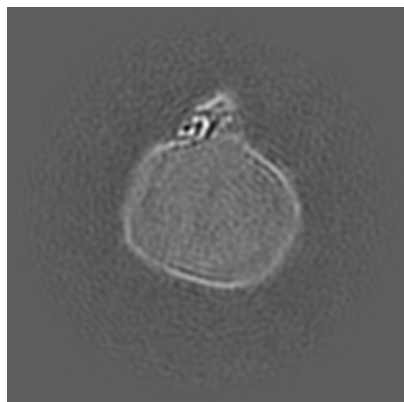


Z

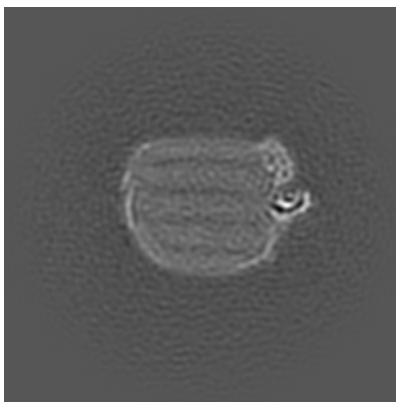
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

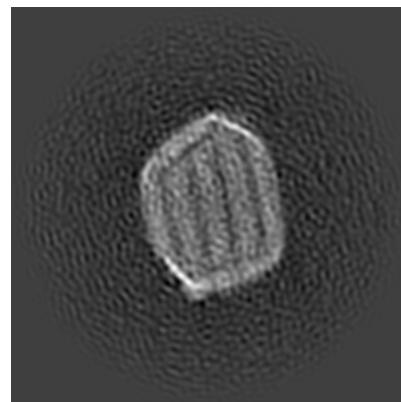
6.2.1 Primary map



X Index: 225

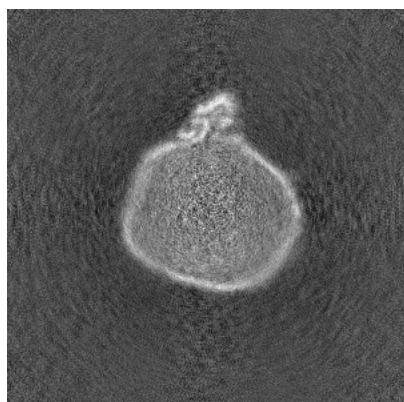


Y Index: 225

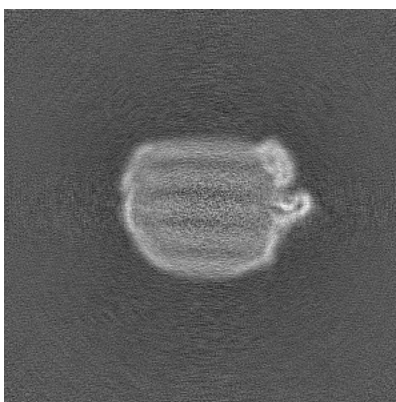


Z Index: 225

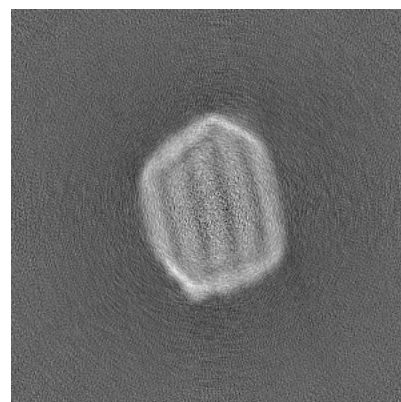
6.2.2 Raw map



X Index: 225



Y Index: 225

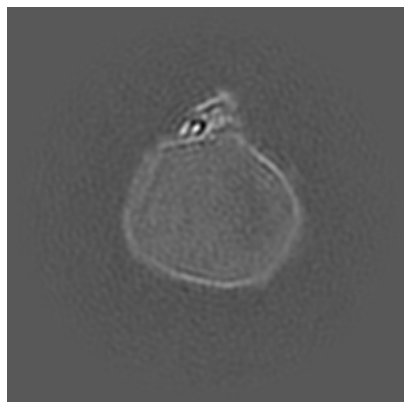


Z Index: 225

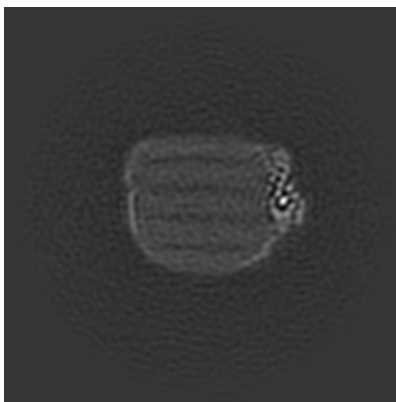
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

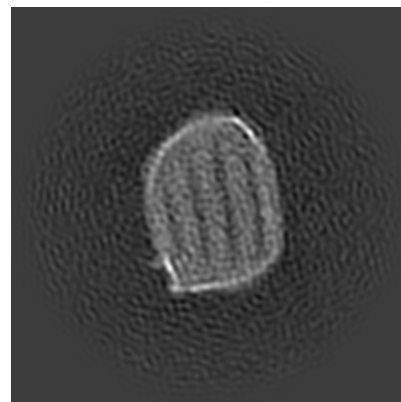
6.3.1 Primary map



X Index: 230



Y Index: 213

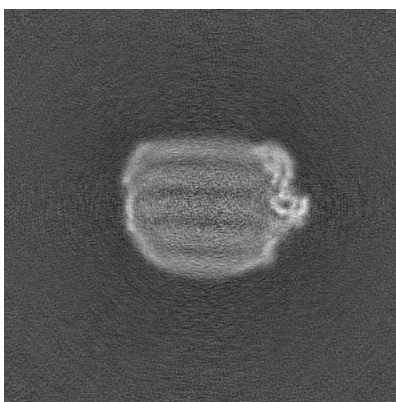


Z Index: 196

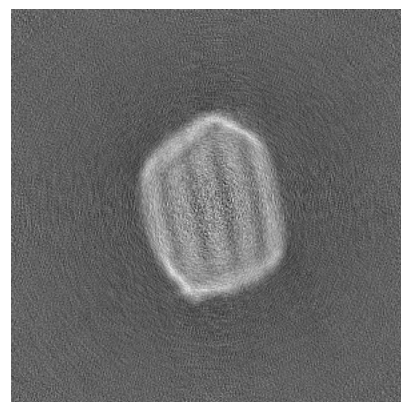
6.3.2 Raw map



X Index: 227



Y Index: 219

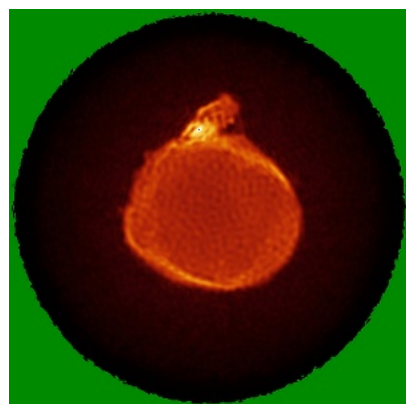


Z Index: 219

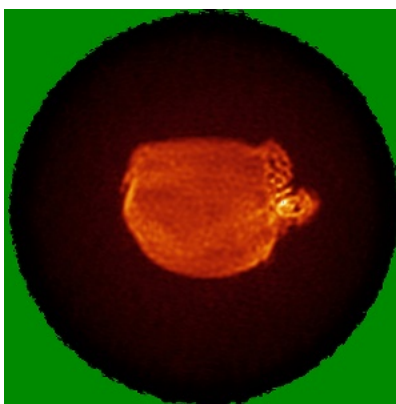
The images above show the largest variance slices of the map in three orthogonal directions.

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

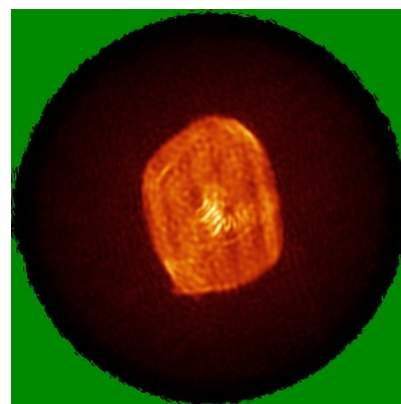
6.4.1 Primary map



X

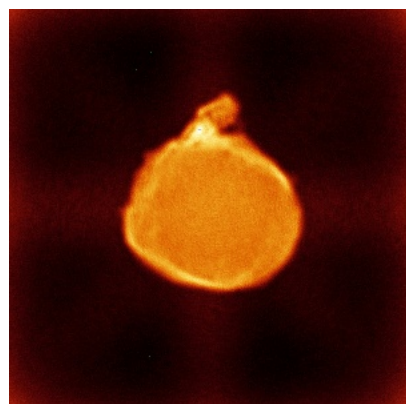


Y

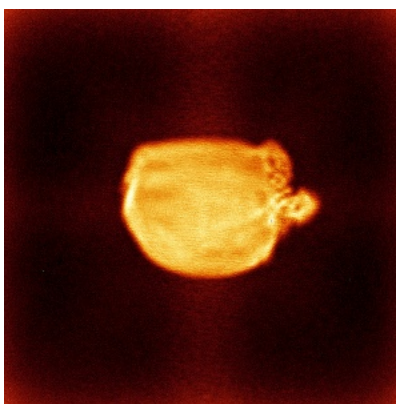


Z

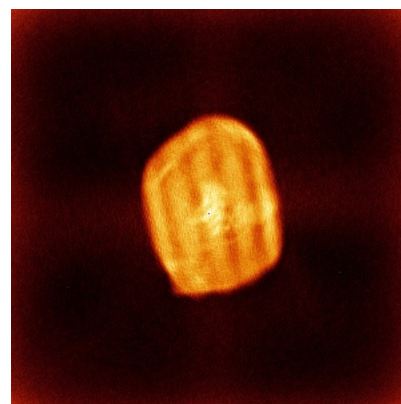
6.4.2 Raw map



X



Y

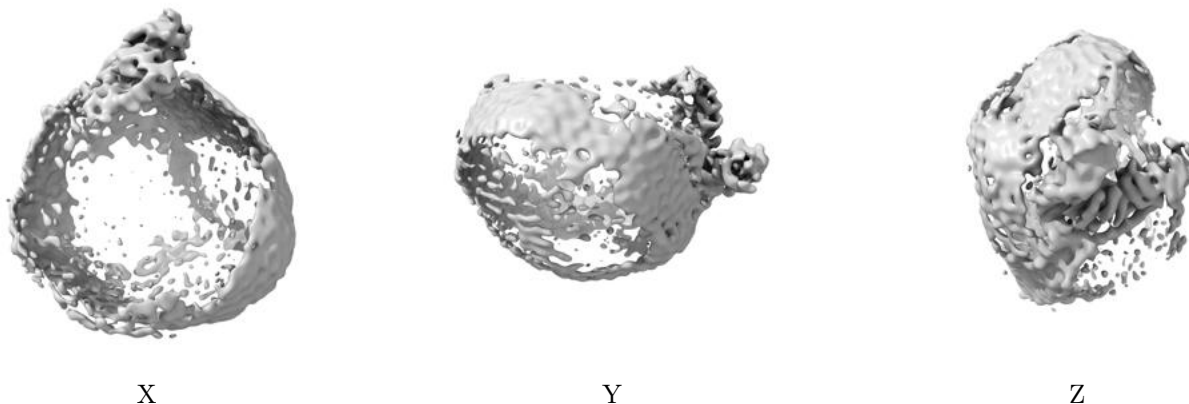


Z

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.

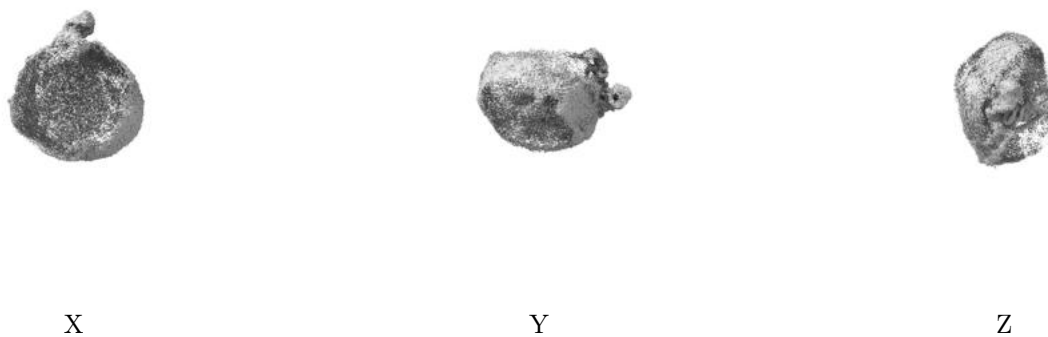
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.182. 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.

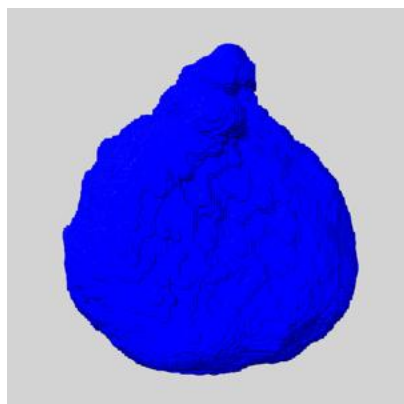
6.6 Mask visualisation [i](#)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

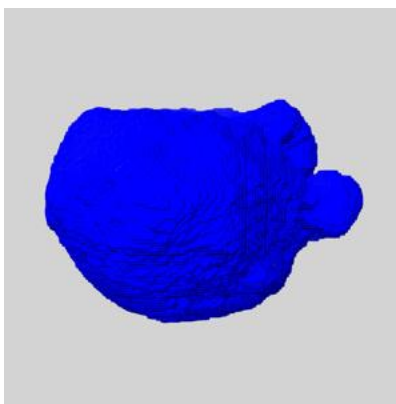
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

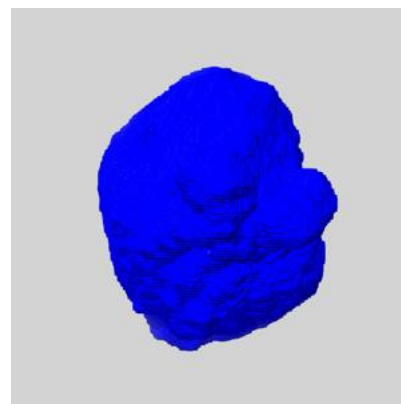
6.6.1 emd_47801_msk_1.map [i](#)



X



Y

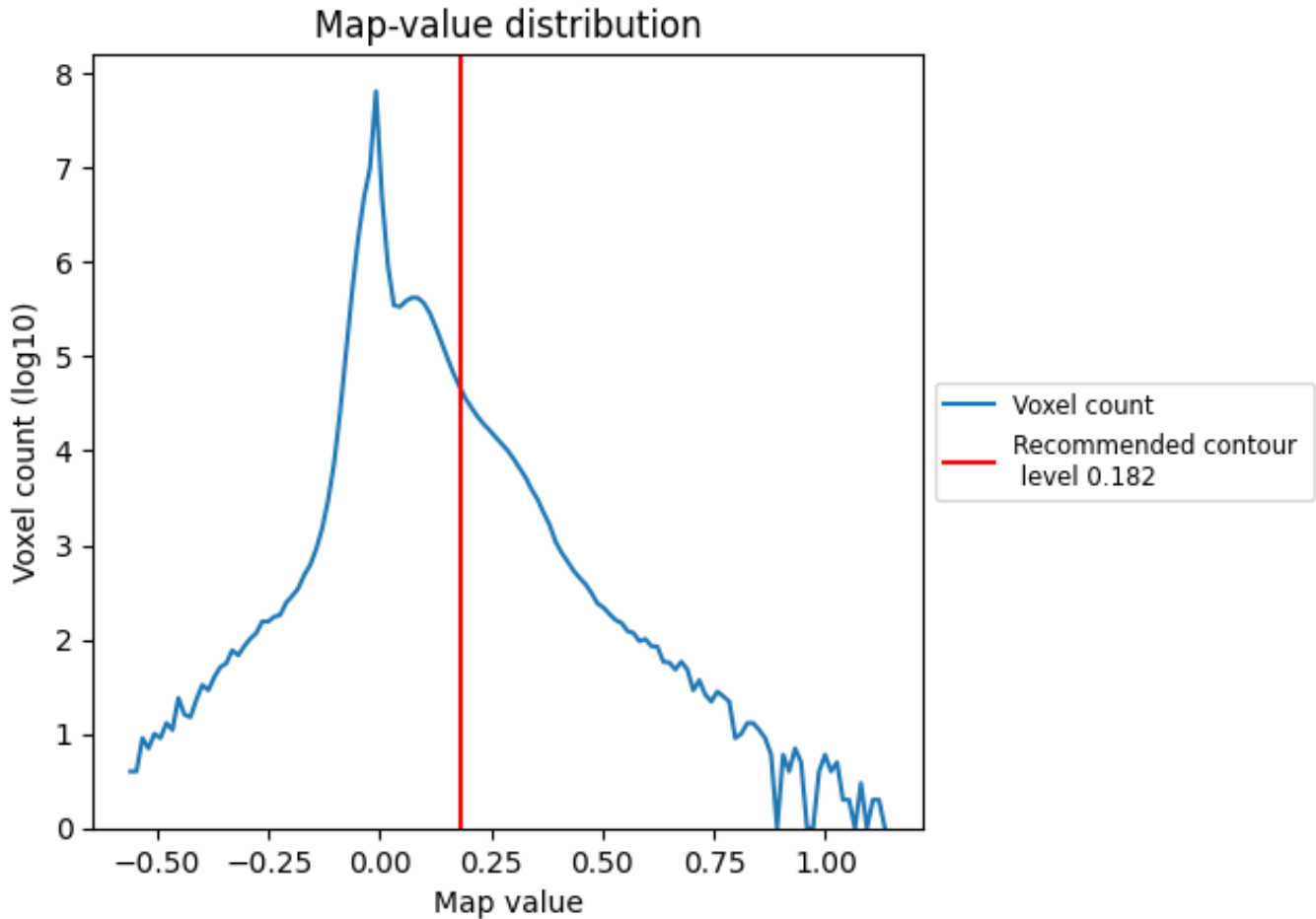


Z

7 Map analysis [i](#)

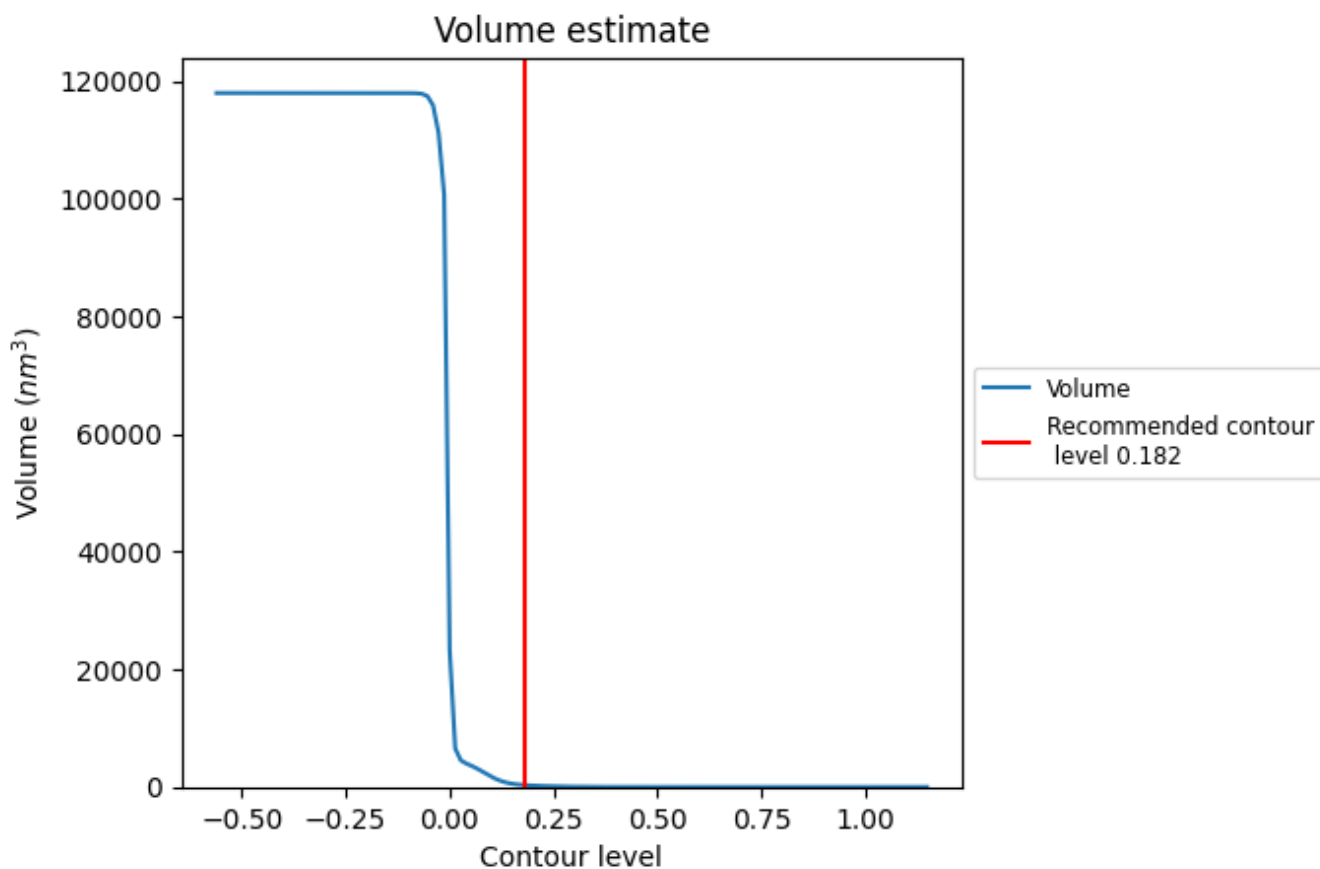
This section contains the results of statistical analysis of the map.

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.

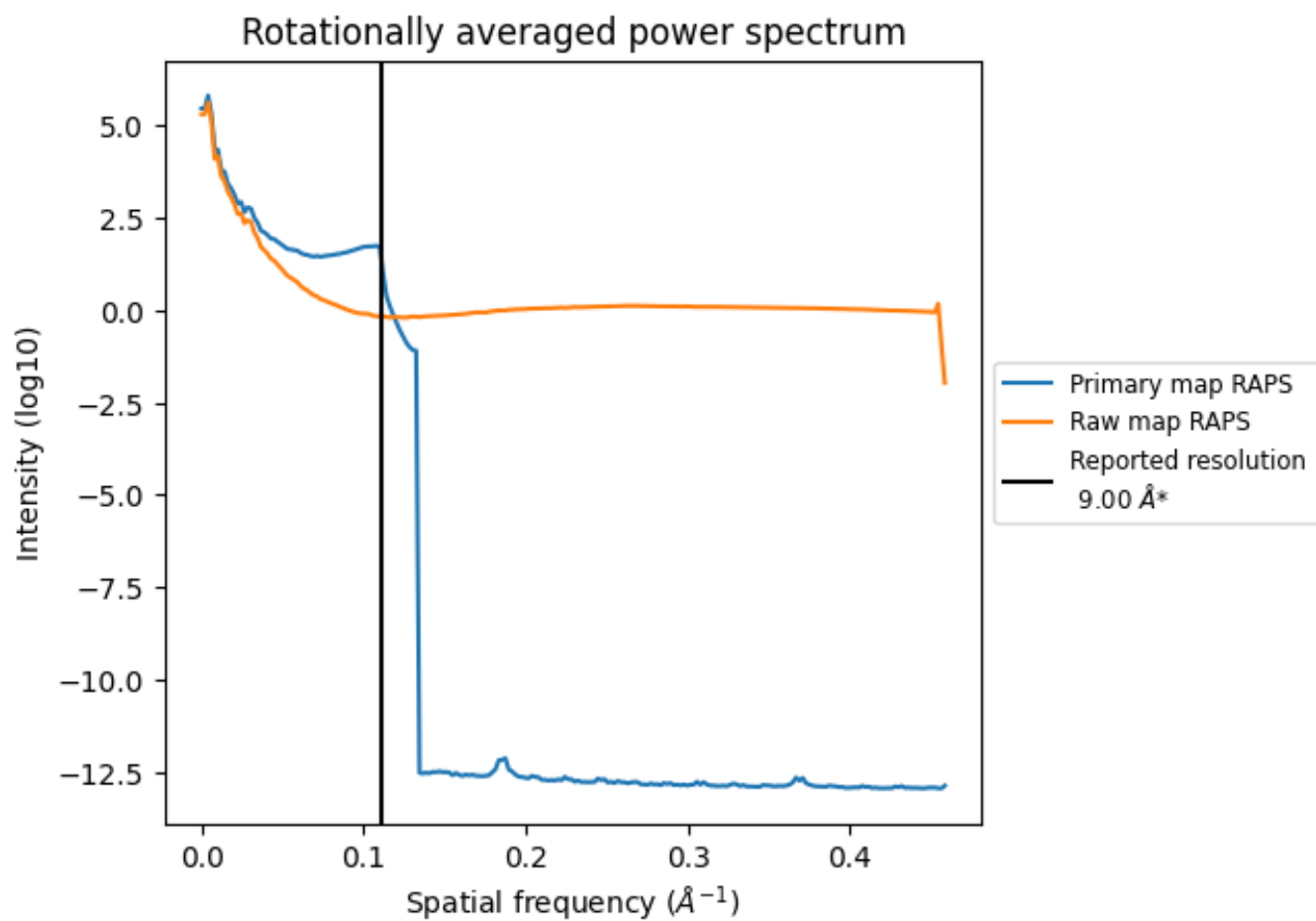
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 304 nm³; this corresponds to an approximate mass of 275 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](#)

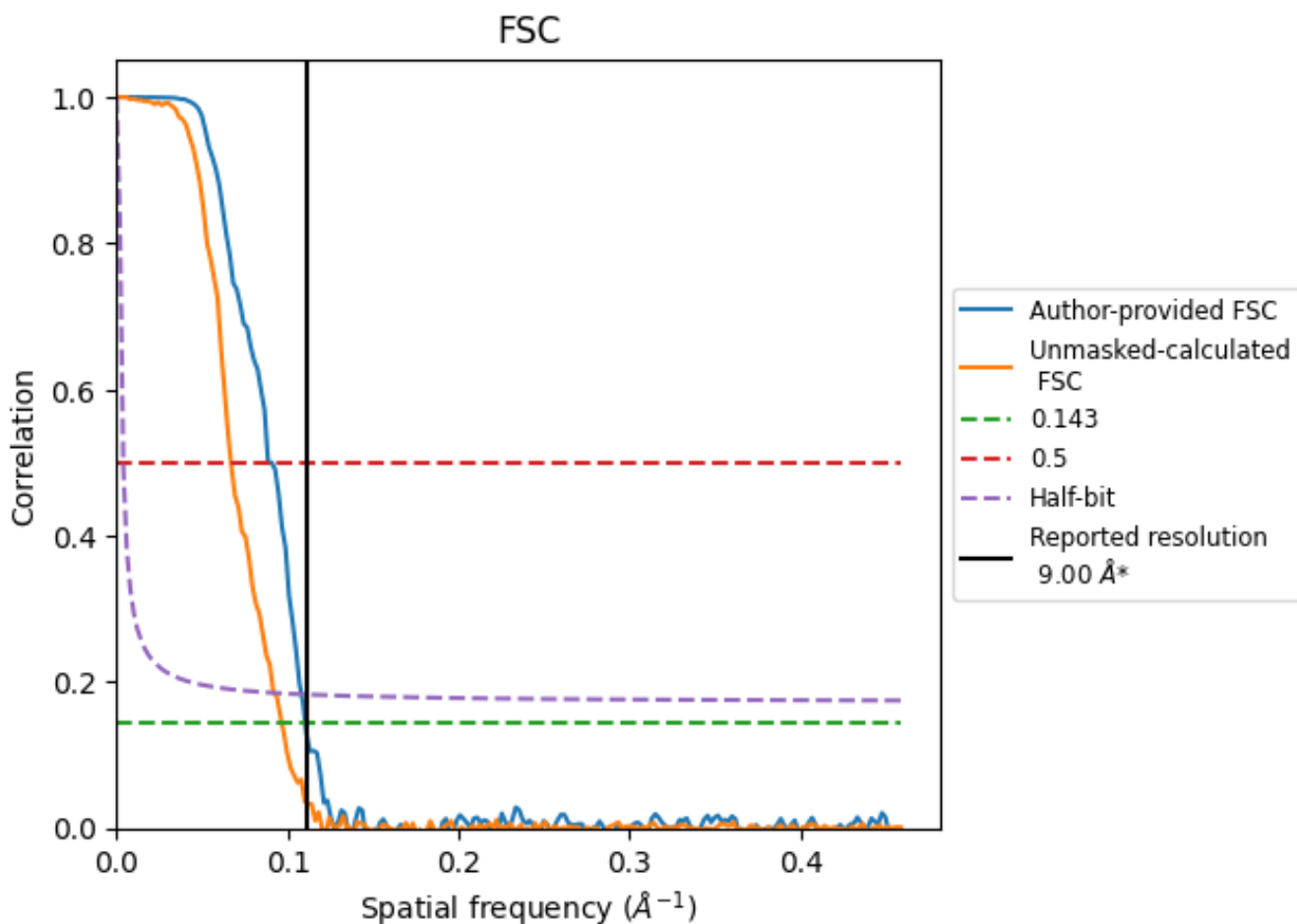


*Reported resolution corresponds to spatial frequency of 0.111 Å⁻¹

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 0.111 Å⁻¹

8.2 Resolution estimates [i](#)

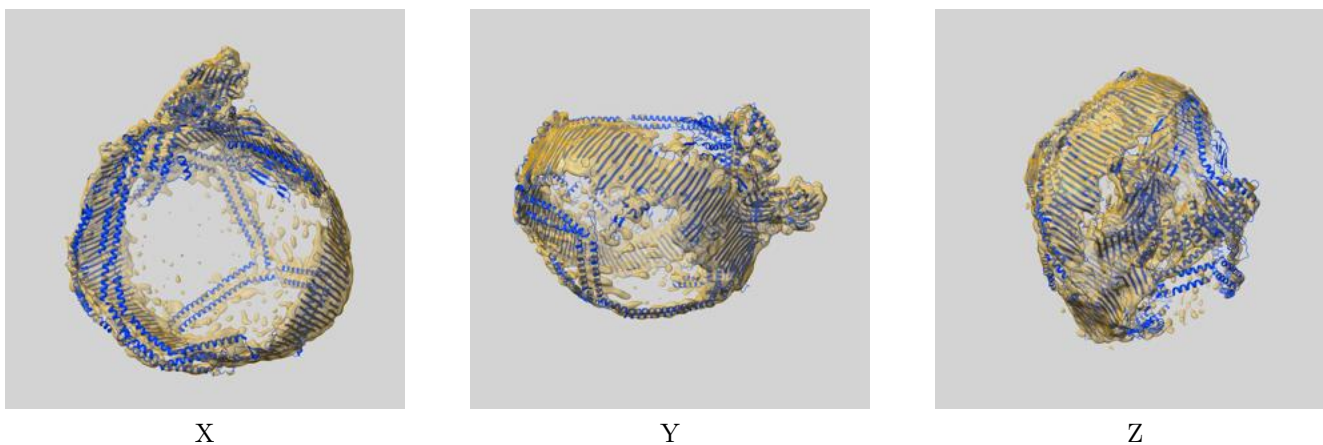
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	9.00	-	-
Author-provided FSC curve	9.06	11.27	9.24
Unmasked-calculated*	10.34	14.93	10.85

*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 10.34 differs from the reported value 9.0 by more than 10 %

9 Map-model fit [i](#)

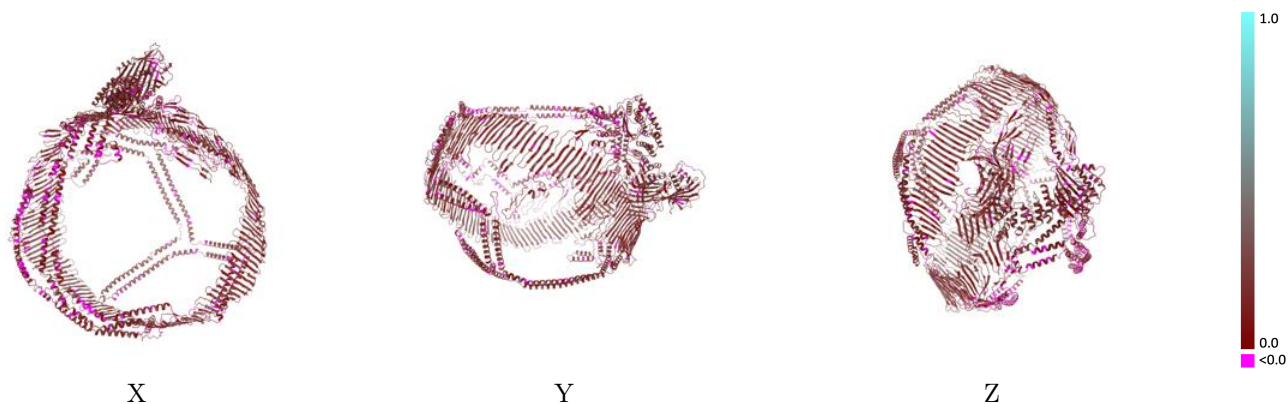
This section contains information regarding the fit between EMDB map EMD-47801 and PDB model 9EAG. Per-residue inclusion information can be found in section 3 on page 4.

9.1 Map-model overlay [i](#)



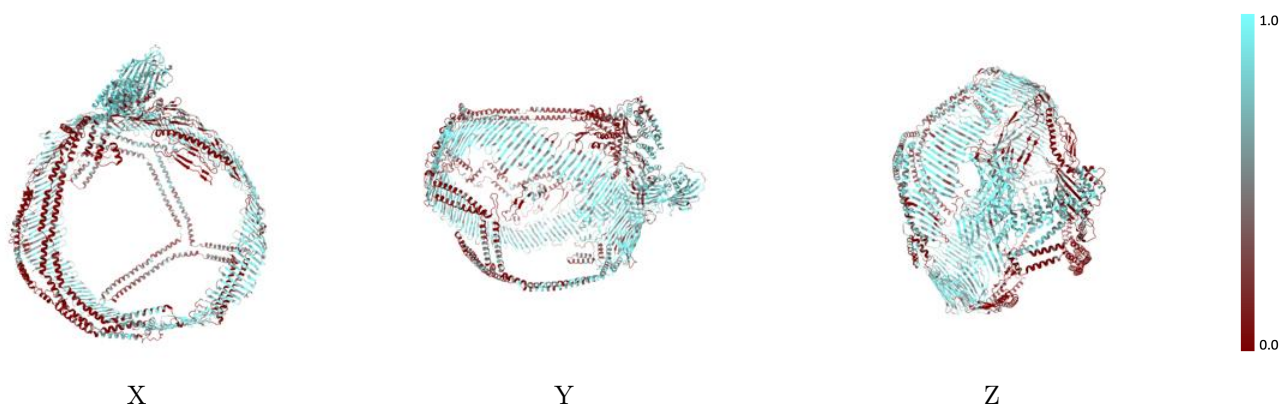
The images above show the 3D surface view of the map at the recommended contour level 0.182 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



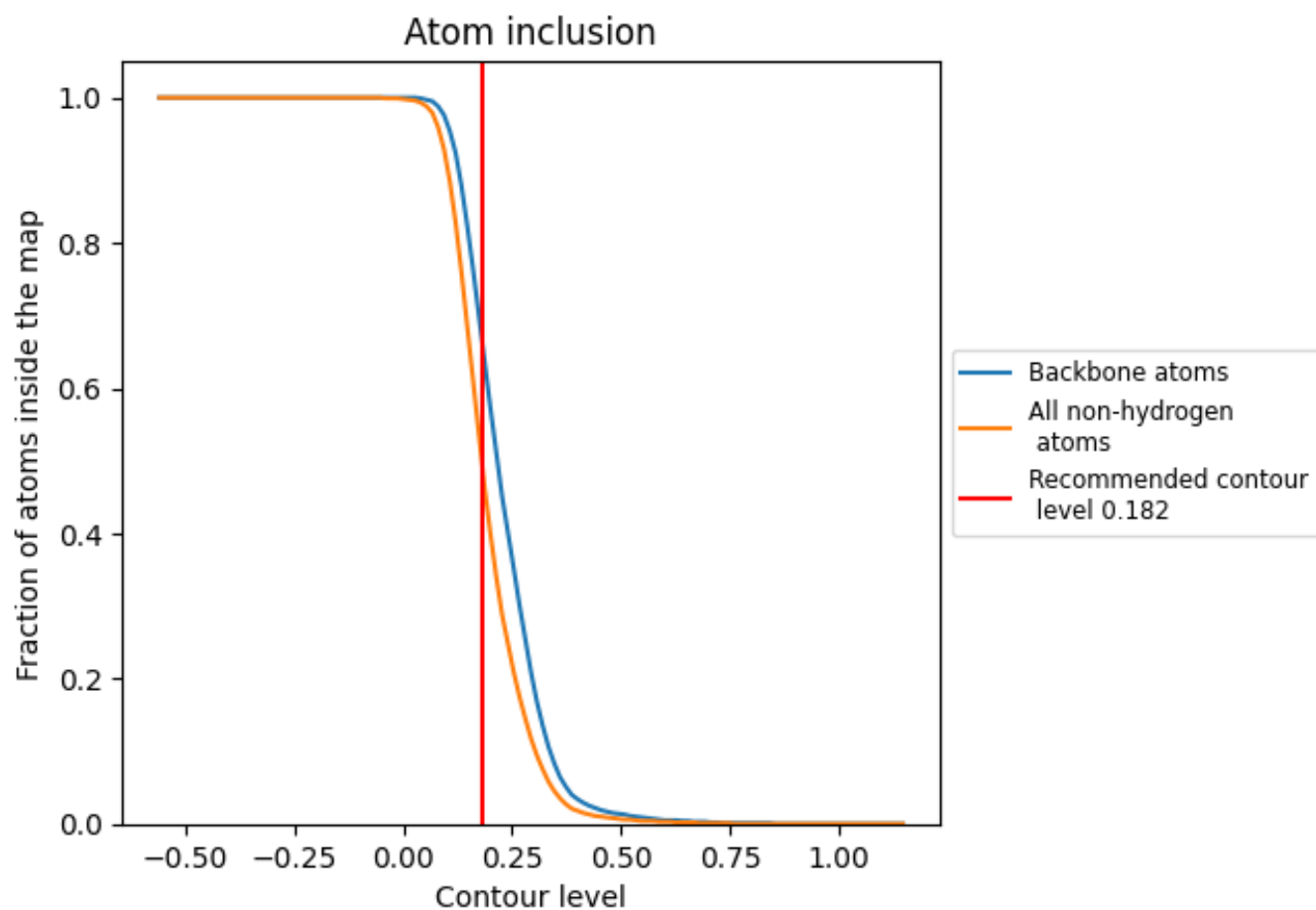
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.182).





9.4 Atom inclusion [i](#)



At the recommended contour level, 66% of all backbone atoms, 49% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary [i](#)

The table lists the average atom inclusion at the recommended contour level (0.182) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.4900	 0.1570
A	 0.4900	 0.1570

