wwPDB EM Validation Summary Report (i)

Feb 27, 2024 – 02:14 AM EST

PDB ID	:	6VQC
EMDB ID	:	EMD-21348
Title	:	Mammalian V-ATPase from rat brain membrane-embedded Vo region rotational state 1 (from focused refinement)
Authors	:	Abbas, Y.M.; Rubinstein, J.L.
Deposited on	:	2020-02-04
Resolution	:	3.80 Å(reported)

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

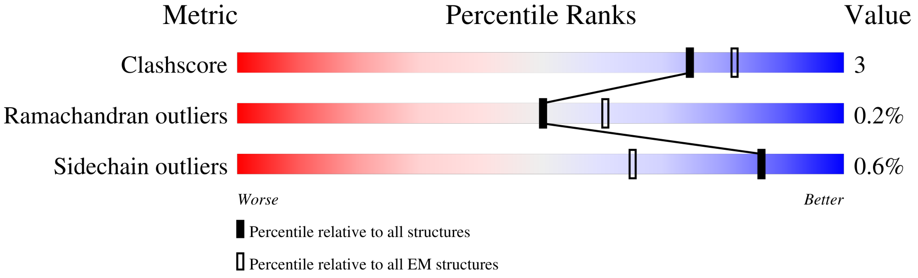
EMDB validation analysis	:	0.0.1.dev70
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

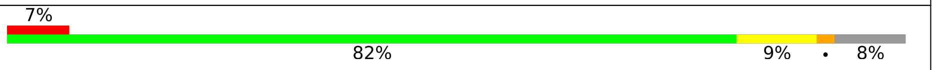
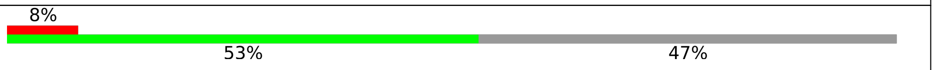
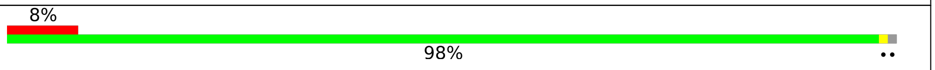
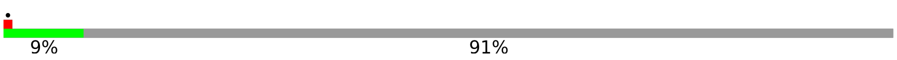
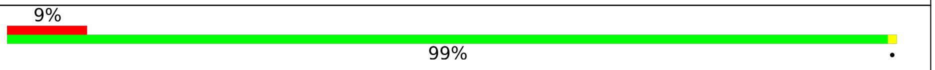
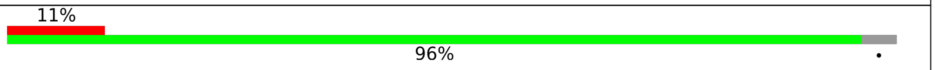
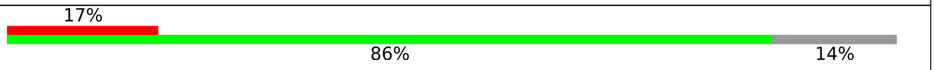
The reported resolution of this entry is 3.80 Å.

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 >=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	H	247	
2	L	119	
3	a	838	
4	b	205	
5	c	463	
6	d	351	
7	e	81	
8	f	98	

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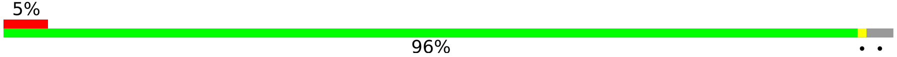
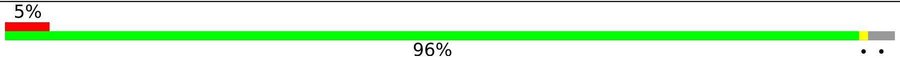
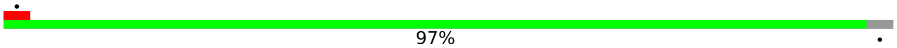
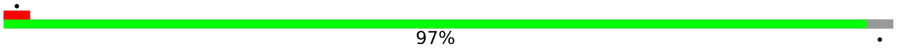
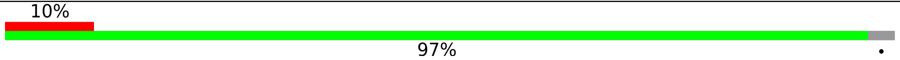
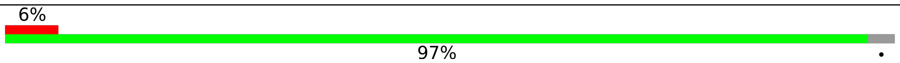
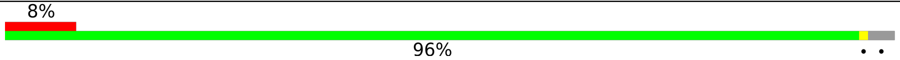
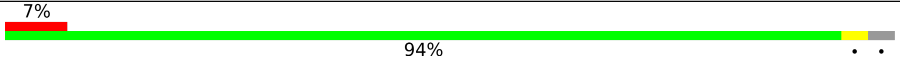
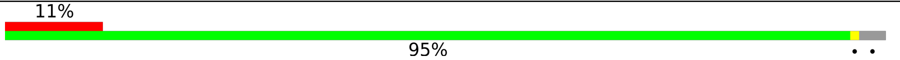
Mol	Chain	Length	Quality of chain
9	g	155	
9	h	155	
9	i	155	
9	j	155	
9	k	155	
9	l	155	
9	m	155	
9	n	155	
9	o	155	
10	p	350	

2 Entry composition

There are 10 unique types of molecules in this entry. The entry contains 20991 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 ATPase H+-transporting V1 subunit D.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	H	104	803	509	138	153	3	0	0

- Molecule 2 is a protein called V-type proton ATPase subunit F.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	L	110	875	553	157	163	2	0	0

- Molecule 3 is a protein called V-type proton ATPase 116 kDa subunit a isoform 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	a	441	3495	2337	556	579	23	0	0

- Molecule 4 is a protein called ATPase, H+ transporting, V0 subunit B (Predicted), isoform CRA_a.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	b	203	1503	996	237	259	11	0	0

- Molecule 5 is a protein called V-type proton ATPase subunit S1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	c	41	337	228	51	54	4	0	0

- Molecule 6 is a protein called V-type proton ATPase subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	d	350	2833	1829	460	530	14	0	0

- Molecule 7 is a protein called V-type proton ATPase subunit e 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
7	e	78	621	428	98	92	3	0	0

- Molecule 8 is a protein called Ribonuclease K.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
8	f	84	480	309	85	86	0	0

- Molecule 9 is a protein called V-type proton ATPase 16 kDa proteolipid subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
9	g	150	1068	699	171	190	8	0	0
9	h	150	1068	699	171	190	8	0	0
9	i	150	1068	699	171	190	8	0	0
9	j	150	1068	699	171	190	8	0	0
9	k	150	1068	699	171	190	8	0	0
9	l	150	1068	699	171	190	8	0	0
9	m	150	1068	699	171	190	8	0	0
9	n	150	1068	699	171	190	8	0	0
9	o	150	1068	699	171	190	8	0	0

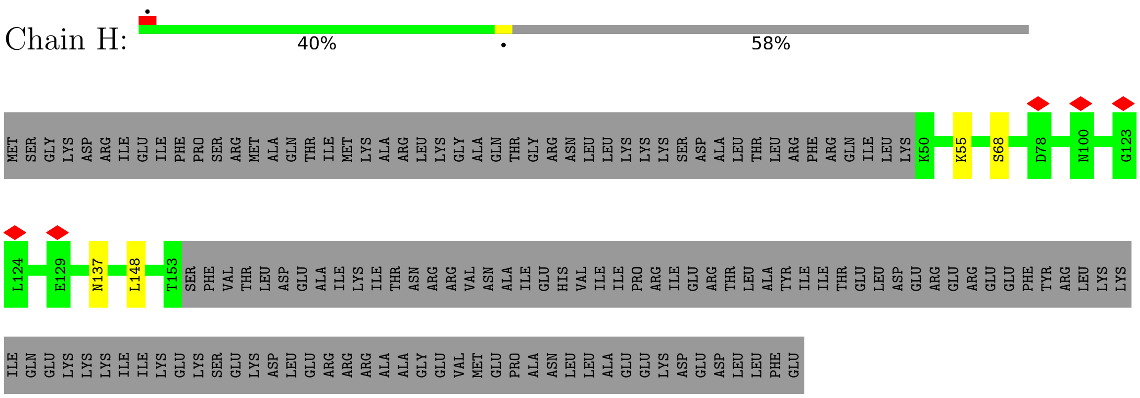
- Molecule 10 is a protein called Renin receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	p	52	432	290	63	76	3	0	0

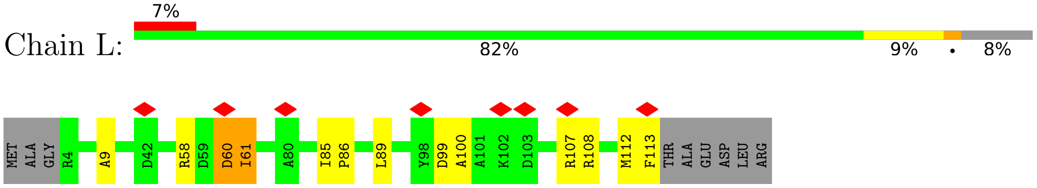
3 Residue-property plots ⓘ

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.

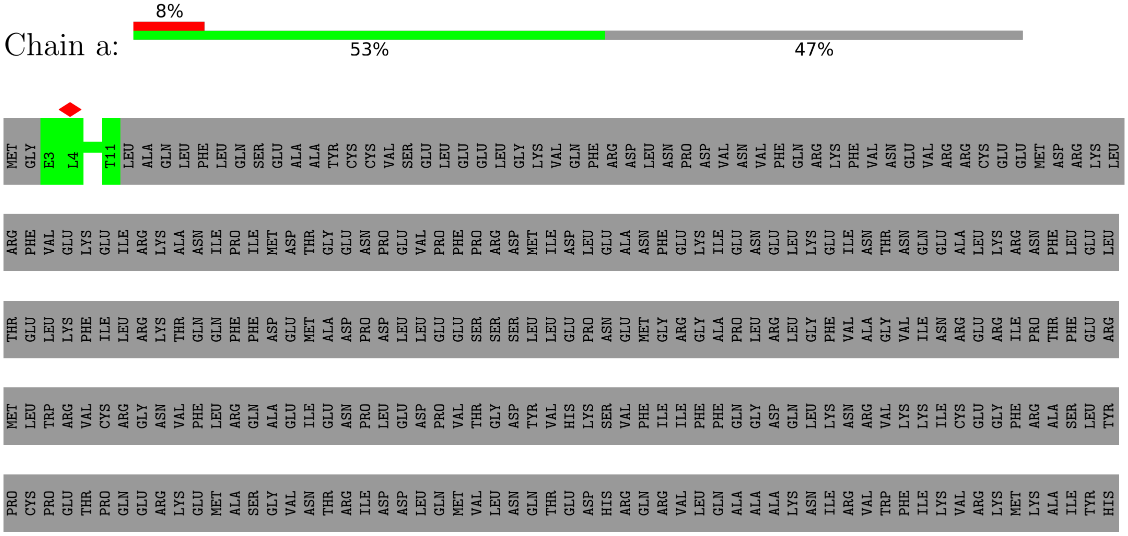
- Molecule 1: ATPase H+-transporting V1 subunit D

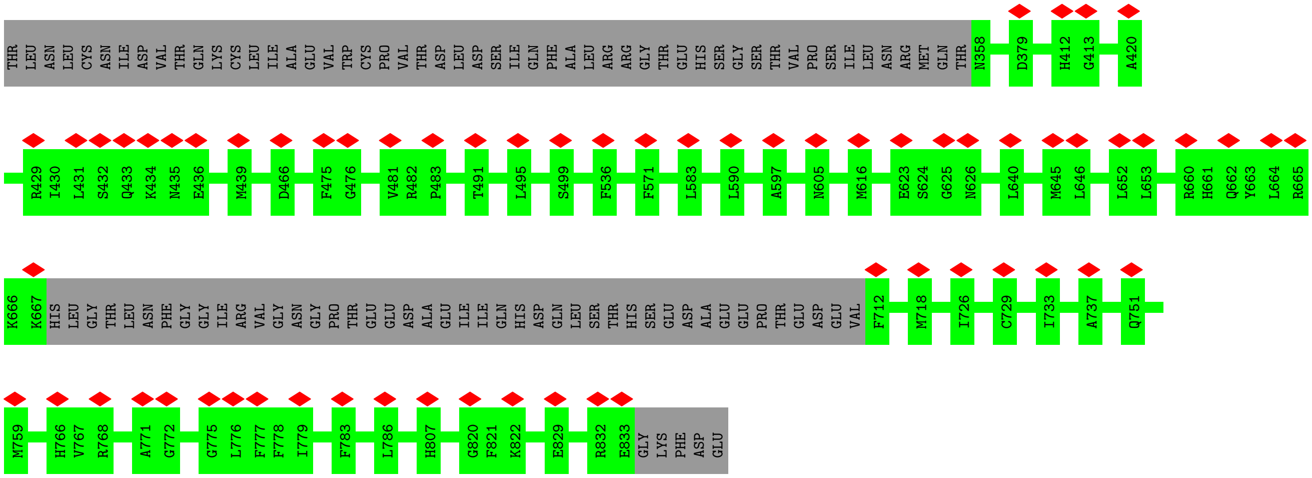


- Molecule 2: V-type proton ATPase subunit F



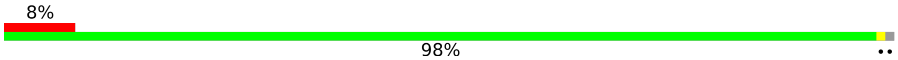
- Molecule 3: V-type proton ATPase 116 kDa subunit a isoform 1

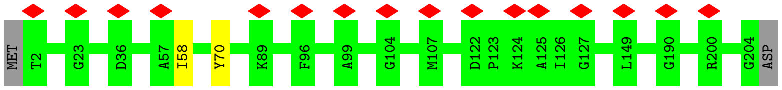




- Molecule 4: ATPase, H+ transporting, V0 subunit B (Predicted), isoform CRA_a

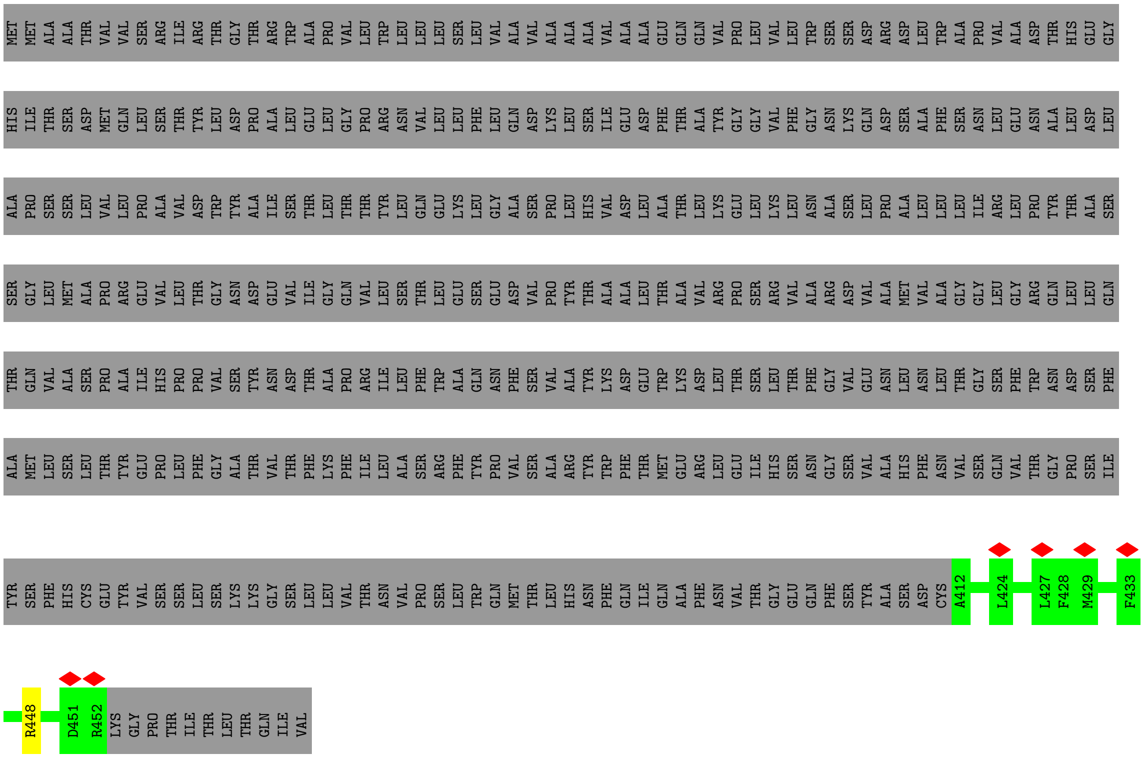
Chain b:





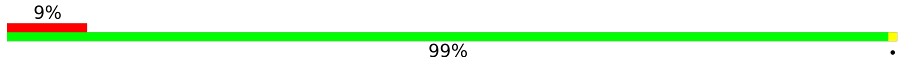
- Molecule 5: V-type proton ATPase subunit S1

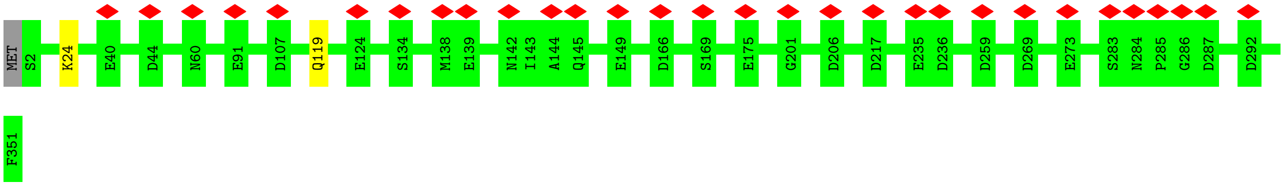
Chain c:



- Molecule 6: V-type proton ATPase subunit

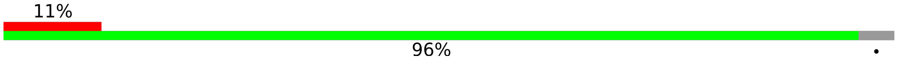
Chain d:

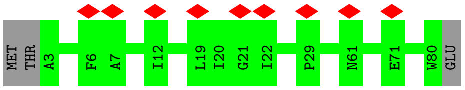




- Molecule 7: V-type proton ATPase subunit e 2

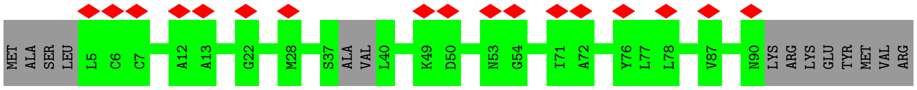
Chain e:





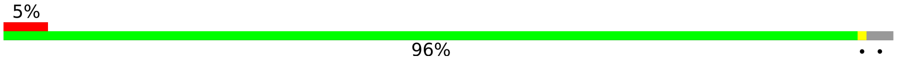
- Molecule 8: Ribonuclease K

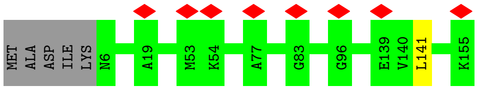
Chain f:



- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

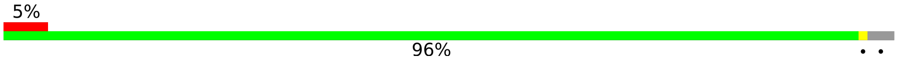
Chain g:

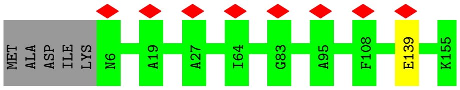




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

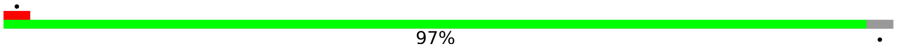
Chain h:

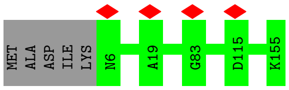




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

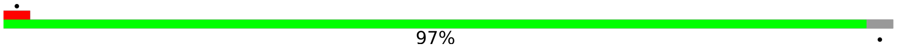
Chain i:

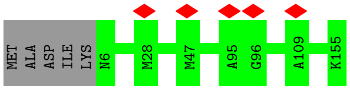




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

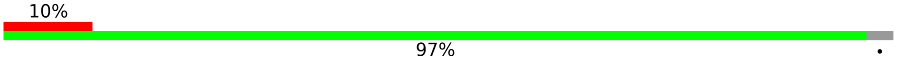
Chain j:

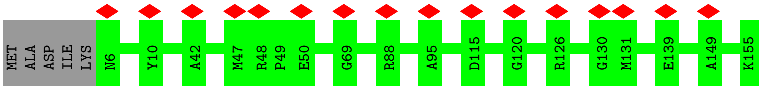




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

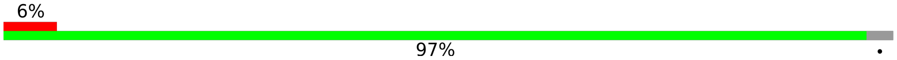
Chain k:

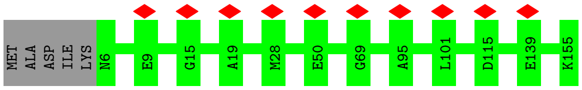




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

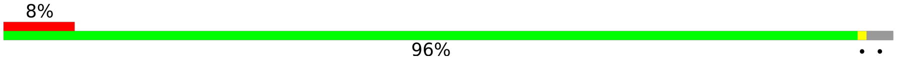
Chain l:

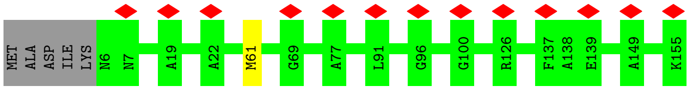




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

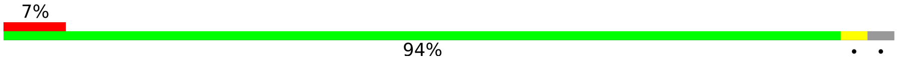
Chain m:

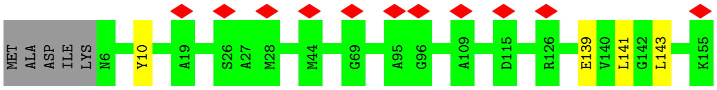




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

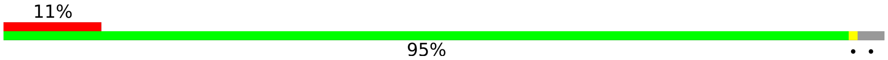
Chain n:

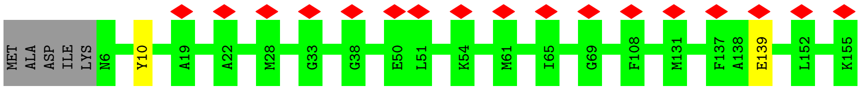




- Molecule 9: V-type proton ATPase 16 kDa proteolipid subunit

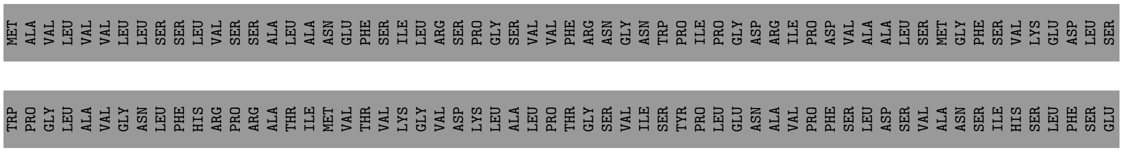
Chain o:

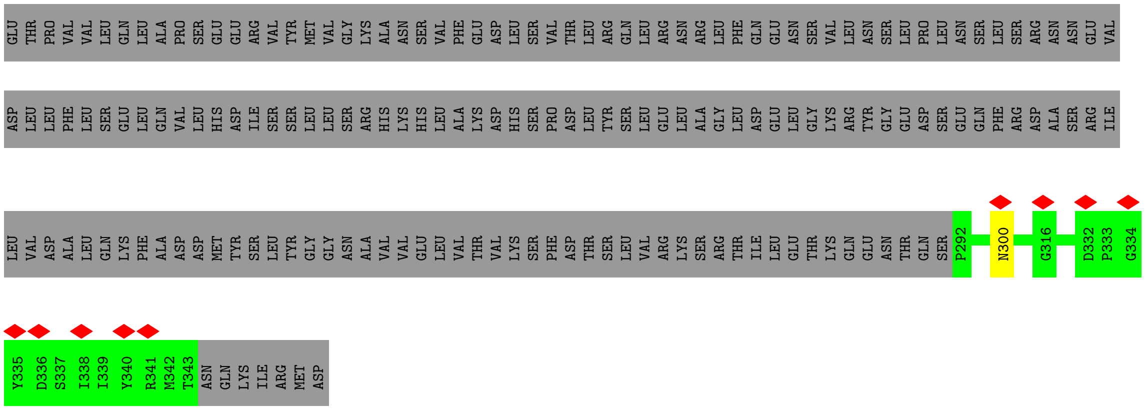




- Molecule 10: Renin receptor

Chain p:




GLU THR PRO VAL VAL LEU GLN LEU ALA PRO SER GLU GLU ARG VAL TYR MET VAL GLY LYS ALA ASN SER VAL PHE GLU ASP LEU SER VAL THR LEU ARG GLN LEU ARG ASN ARG LEU PHE GLN GLU ASN SER VAL LEU ASN SER LEU PRO LEU ASN SER LEU SER ARG ASN ASN GLU VAL
ASP LEU LEU PHE LEU SER GLU LEU GLN VAL LEU HIS ASP ILE SER SER LEU LEU SER ARG HIS LYS HIS LEU ALA LYS ASP HIS SER PRO ASP LEU TYR SER LEU GLU LEU ALA GLY LEU ASP GLU LEU GLY LYS ARG TYR GLY GLU ASP SER GLU GLN PHE ARG ASP ALA SER ARG ILE
LEU VAL ASP ALA LEU GLN LYS PHE ALA ASP ASP MET TYR SER LEU TYR GLY GLY ASN ALA VAL VAL GLU LEU VAL THR VAL LYS SER PHE ASP THR SER LEU VAL ARG LYS SER ARG THR ILE LEU GLU THR LYS GLN GLU ASN THR GLN SER P292 N300 G316 D332 P333 G334
Y335 D336 S337 I338 I339 Y340 R341 M342 T343 ASN GLN LYS ILE ARG MET ASP

4 Experimental information

Property	**Value**	**Source**
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	90648	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 $(e^-/\text{Å}^2)$	43	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	2.773	Depositor
Minimum map value	-1.050	Depositor
Average map value	-0.002	Depositor
Map value standard deviation	0.069	Depositor
Recommended contour level	0.5	Depositor
Map size (Å)	360.4, 360.4, 360.4	wwPDB
Map dimensions	340, 340, 340	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.06, 1.06, 1.06	Depositor

5 Model quality

5.1 Standard geometry

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	H	0.84	0/812	0.64	0/1091
2	L	0.80	0/889	0.74	0/1199
3	a	0.52	0/3603	0.49	0/4888
4	b	0.51	0/1537	0.49	0/2088
5	c	0.48	0/347	0.54	0/466
6	d	0.73	0/2899	0.53	0/3927
7	e	0.47	0/645	0.44	0/887
8	f	0.40	0/490	0.50	0/676
9	g	0.50	0/1083	0.56	0/1466
9	h	0.47	0/1083	0.52	0/1466
9	i	0.49	0/1083	0.52	0/1466
9	j	0.47	0/1083	0.49	0/1466
9	k	0.49	0/1083	0.53	0/1466
9	l	0.48	0/1083	0.51	0/1466
9	m	0.49	0/1083	0.55	0/1466
9	n	0.47	0/1083	0.51	0/1466
9	o	0.49	0/1083	0.51	0/1466
10	p	0.49	0/445	0.60	0/609
All	All	0.56	0/21414	0.53	0/29025

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	H	803	0	828	4	0
2	L	875	0	883	12	0
3	a	3495	0	3434	0	0
4	b	1503	0	1551	0	0
5	c	337	0	338	0	0
6	d	2833	0	2770	0	0
7	e	621	0	639	0	0
8	f	480	0	288	0	0
9	g	1068	0	1136	0	0
9	h	1068	0	1136	0	0
9	i	1068	0	1136	0	0
9	j	1068	0	1136	0	0
9	k	1068	0	1136	0	0
9	l	1068	0	1136	0	0
9	m	1068	0	1136	0	0
9	n	1068	0	1136	0	0
9	o	1068	0	1136	0	0
10	p	432	0	428	0	0
All	All	20991	0	21383	13	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 3.

The worst 5 of 13 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:L:58:ARG:HG2	2:L:60:ASP:H	1.65	0.61
2:L:85:ILE:N	2:L:86:PRO:CD	2.67	0.58
2:L:85:ILE:N	2:L:86:PRO:HD2	2.23	0.54
1:H:68:SER:OG	1:H:137:ASN:ND2	2.41	0.53
1:H:55:LYS:NZ	2:L:99:ASP:OD2	2.32	0.53

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	H	102/247 (41%)	97 (95%)	5 (5%)	0	100	100
2	L	108/119 (91%)	101 (94%)	5 (5%)	2 (2%)	8	42
3	a	435/838 (52%)	424 (98%)	11 (2%)	0	100	100
4	b	201/205 (98%)	197 (98%)	4 (2%)	0	100	100
5	c	39/463 (8%)	39 (100%)	0	0	100	100
6	d	348/351 (99%)	328 (94%)	19 (6%)	1 (0%)	41	74
7	e	76/81 (94%)	75 (99%)	1 (1%)	0	100	100
8	f	80/98 (82%)	77 (96%)	3 (4%)	0	100	100
9	g	148/155 (96%)	146 (99%)	2 (1%)	0	100	100
9	h	148/155 (96%)	145 (98%)	3 (2%)	0	100	100
9	i	148/155 (96%)	145 (98%)	3 (2%)	0	100	100
9	j	148/155 (96%)	146 (99%)	2 (1%)	0	100	100
9	k	148/155 (96%)	146 (99%)	2 (1%)	0	100	100
9	l	148/155 (96%)	145 (98%)	3 (2%)	0	100	100
9	m	148/155 (96%)	146 (99%)	2 (1%)	0	100	100
9	n	148/155 (96%)	145 (98%)	2 (1%)	1 (1%)	22	60
9	o	148/155 (96%)	143 (97%)	4 (3%)	1 (1%)	22	60
10	p	50/350 (14%)	47 (94%)	2 (4%)	1 (2%)	7	41
All	All	2771/4147 (67%)	2692 (97%)	73 (3%)	6 (0%)	50	79

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	L	61	ILE
6	d	119	GLN
9	o	10	TYR
10	p	300	ASN
2	L	100	ALA

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	H	84/212 (40%)	84 (100%)	0	100	100
2	L	94/100 (94%)	93 (99%)	1 (1%)	73	85
3	a	362/743 (49%)	362 (100%)	0	100	100
4	b	156/158 (99%)	154 (99%)	2 (1%)	69	82
5	c	36/395 (9%)	35 (97%)	1 (3%)	43	68
6	d	305/306 (100%)	304 (100%)	1 (0%)	92	96
7	e	64/68 (94%)	64 (100%)	0	100	100
8	f	14/83 (17%)	14 (100%)	0	100	100
9	g	109/113 (96%)	108 (99%)	1 (1%)	78	88
9	h	109/113 (96%)	108 (99%)	1 (1%)	78	88
9	i	109/113 (96%)	109 (100%)	0	100	100
9	j	109/113 (96%)	109 (100%)	0	100	100
9	k	109/113 (96%)	109 (100%)	0	100	100
9	l	109/113 (96%)	109 (100%)	0	100	100
9	m	109/113 (96%)	108 (99%)	1 (1%)	78	88
9	n	109/113 (96%)	106 (97%)	3 (3%)	43	68
9	o	109/113 (96%)	108 (99%)	1 (1%)	78	88
10	p	47/313 (15%)	47 (100%)	0	100	100
All	All	2143/3395 (63%)	2131 (99%)	12 (1%)	86	92

5 of 12 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
9	m	61	MET
9	n	139	GLU
9	o	139	GLU
9	n	141	LEU
5	c	448	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	H	137	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
3	a	751	GLN
6	d	297	HIS
6	d	340	HIS
9	m	123	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

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.

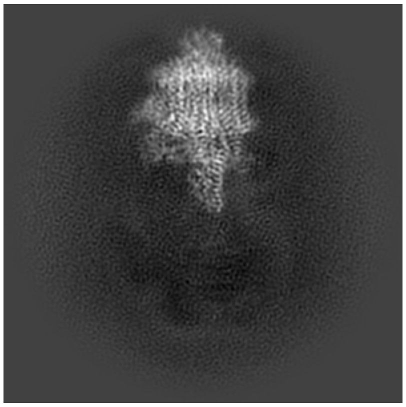
6 Map visualisation

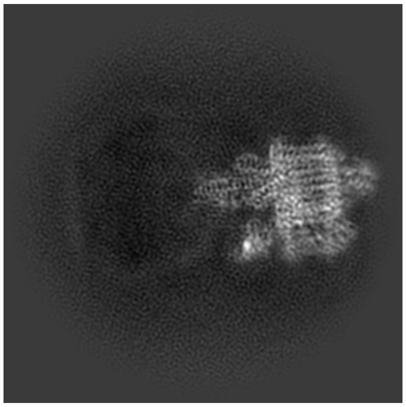
This section contains visualisations of the EMDB entry EMD-21348. These allow visual inspection of the internal detail of the map and identification of artifacts.

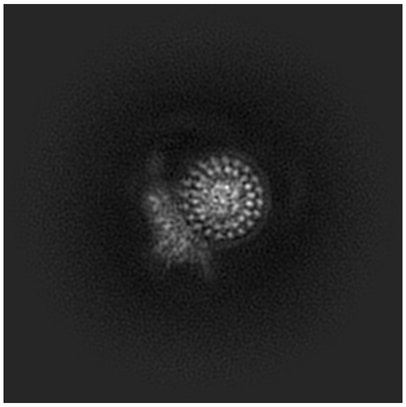
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections

6.1.1 Primary map


X


Y

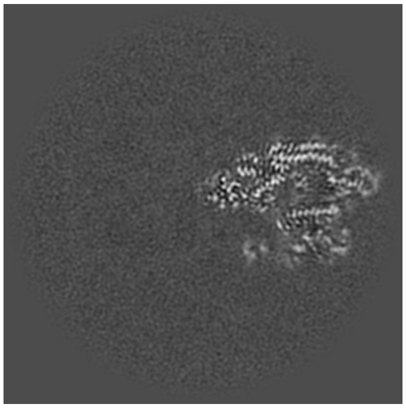

Z

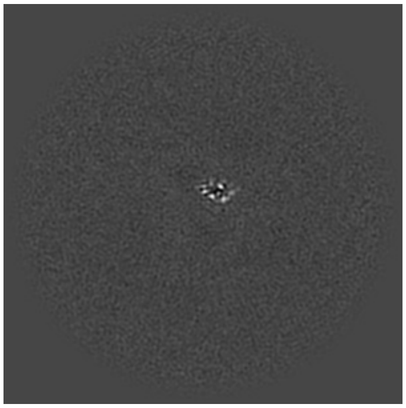
The images above show the map projected in three orthogonal directions.

6.2 Central slices

6.2.1 Primary map


X Index: 170

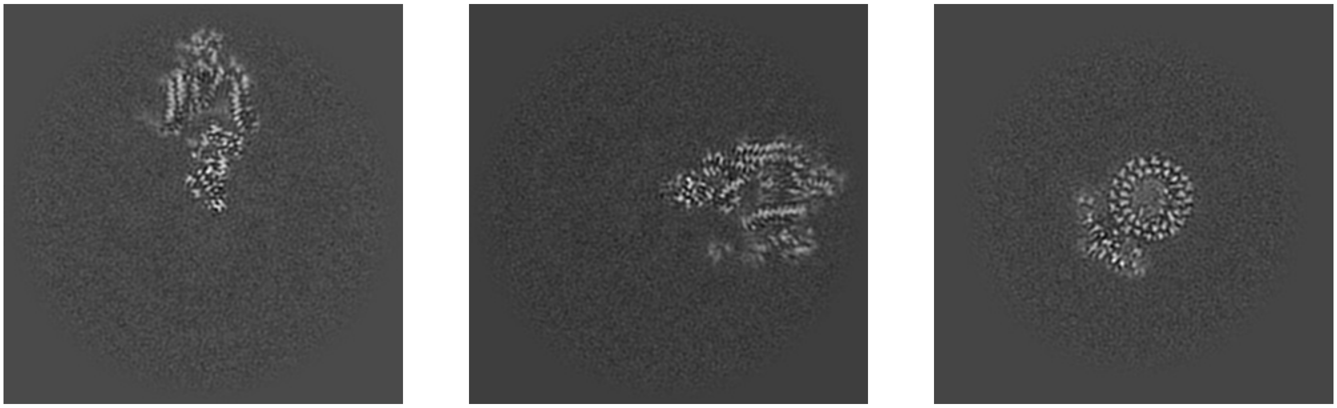

Y Index: 170


Z Index: 170

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

6.3 Largest variance slices

6.3.1 Primary map

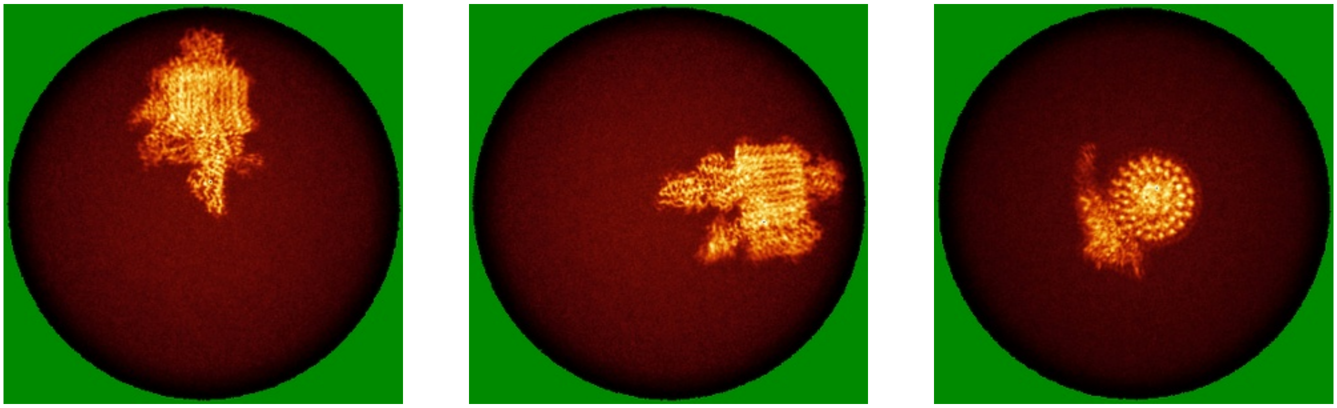


X Index: 183 Y Index: 171 Z Index: 247

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

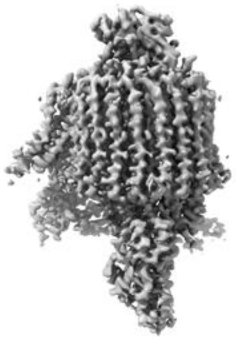


X Y Z

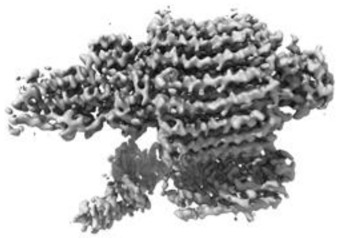
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views ⓘ

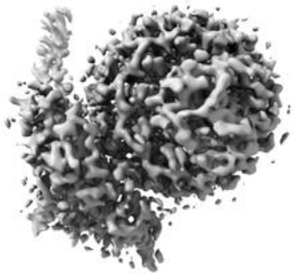
6.5.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.5. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

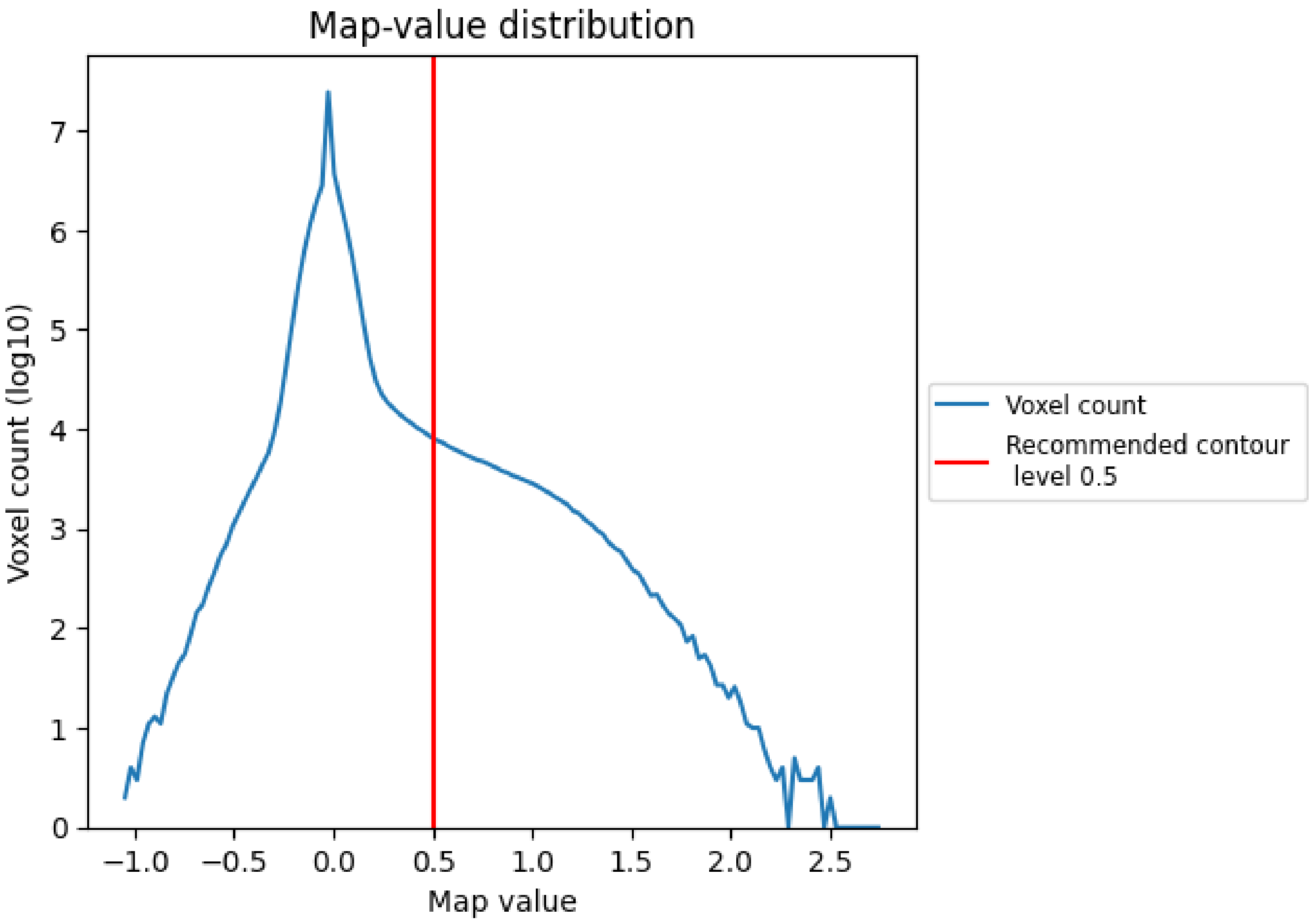
6.6 Mask visualisation ⓘ

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

7 Map analysis ⓘ

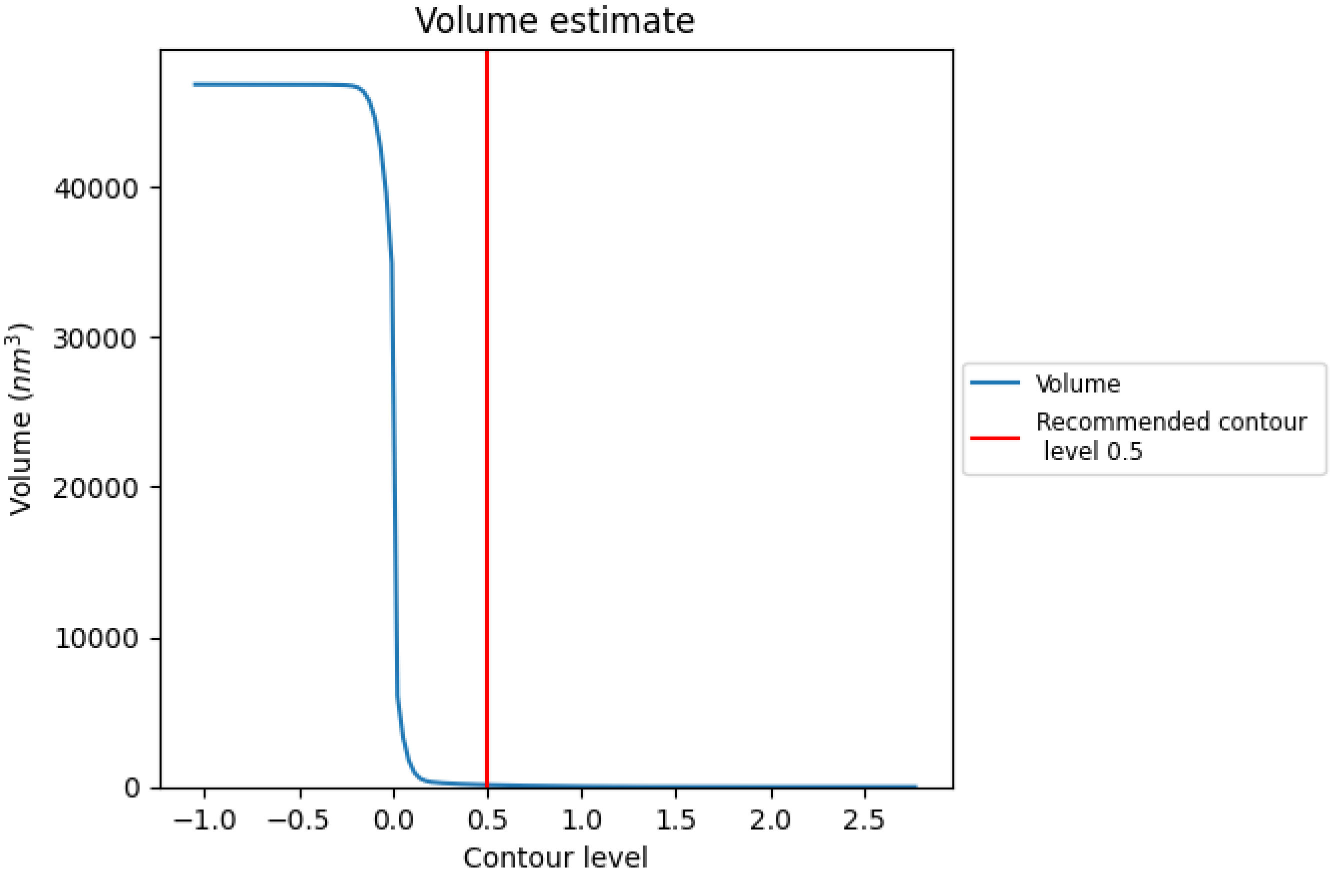
This section contains the results of statistical analysis of the map.

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.

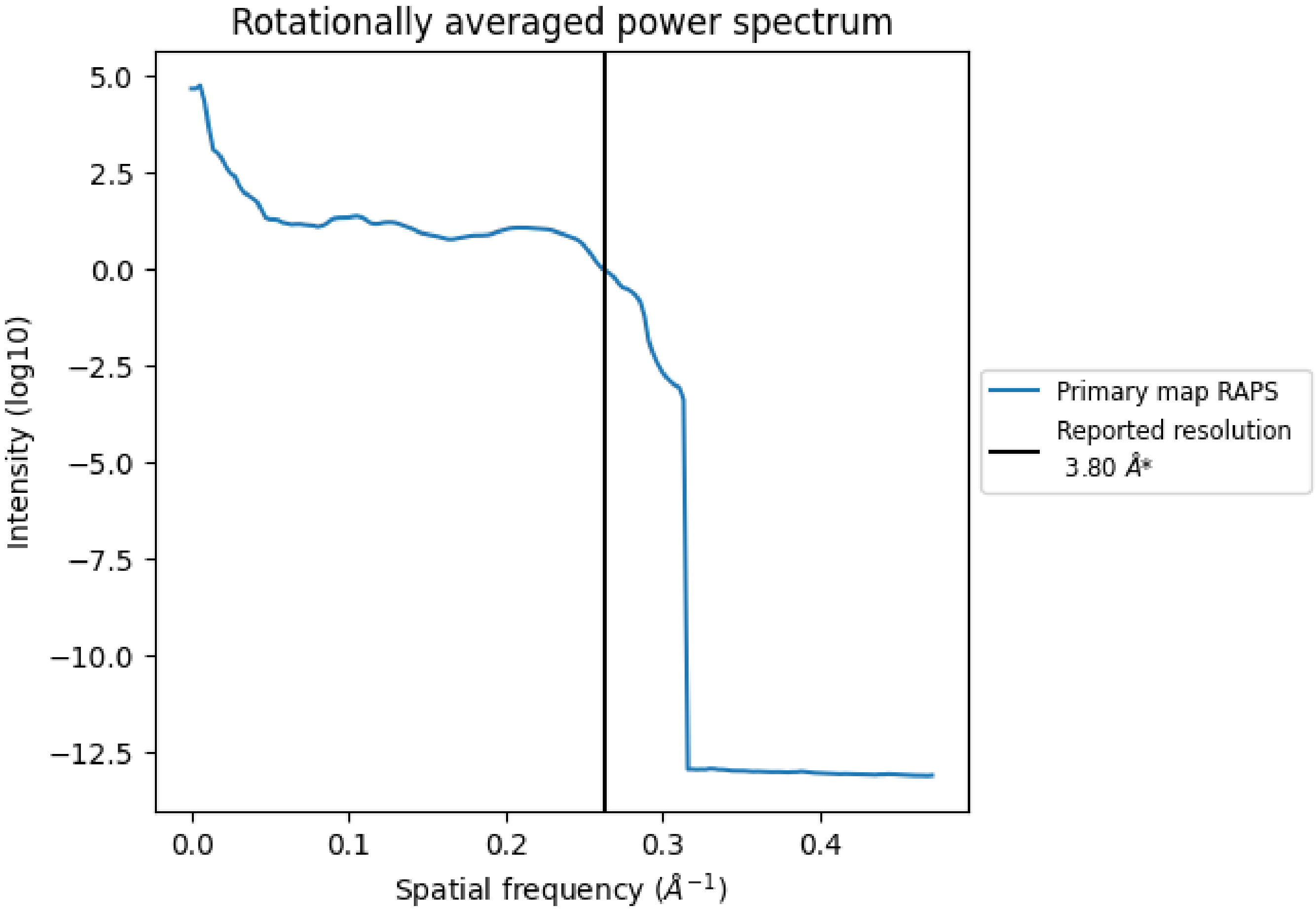
7.2 Volume estimate ⓘ



The volume at the recommended contour level is 134 nm^3; this corresponds to an approximate mass of 121 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 0.263 Å^{-1}

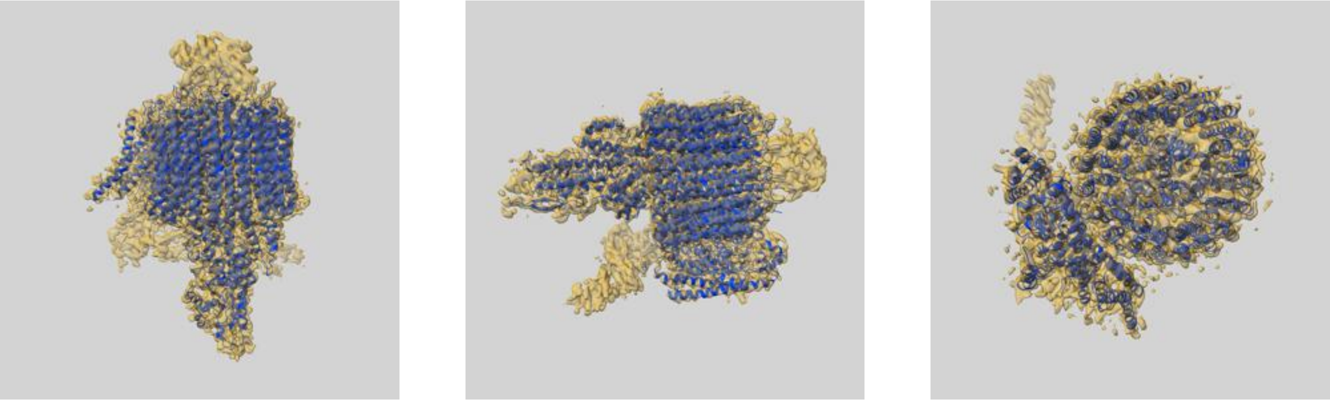
8 Fourier-Shell correlation ⓘ

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-21348 and PDB model 6VQC. Per-residue inclusion information can be found in section 3 on page 6.

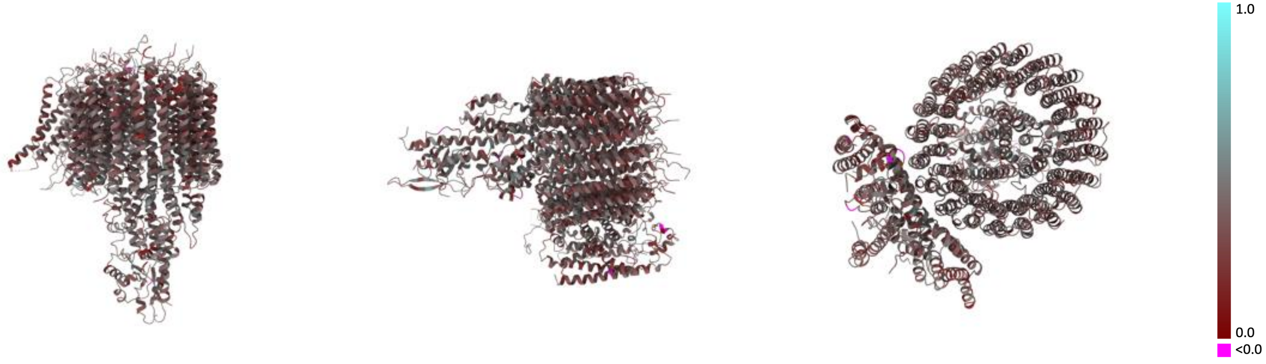
9.1 Map-model overlay (i)



X Y Z

The images above show the 3D surface view of the map at the recommended contour level 0.5 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

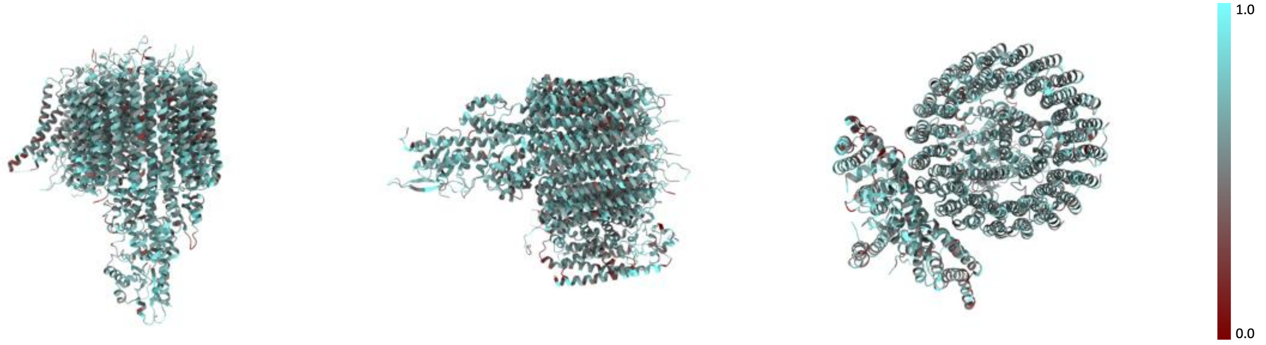
9.2 Q-score mapped to coordinate model ⓘ



X Y Z

The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

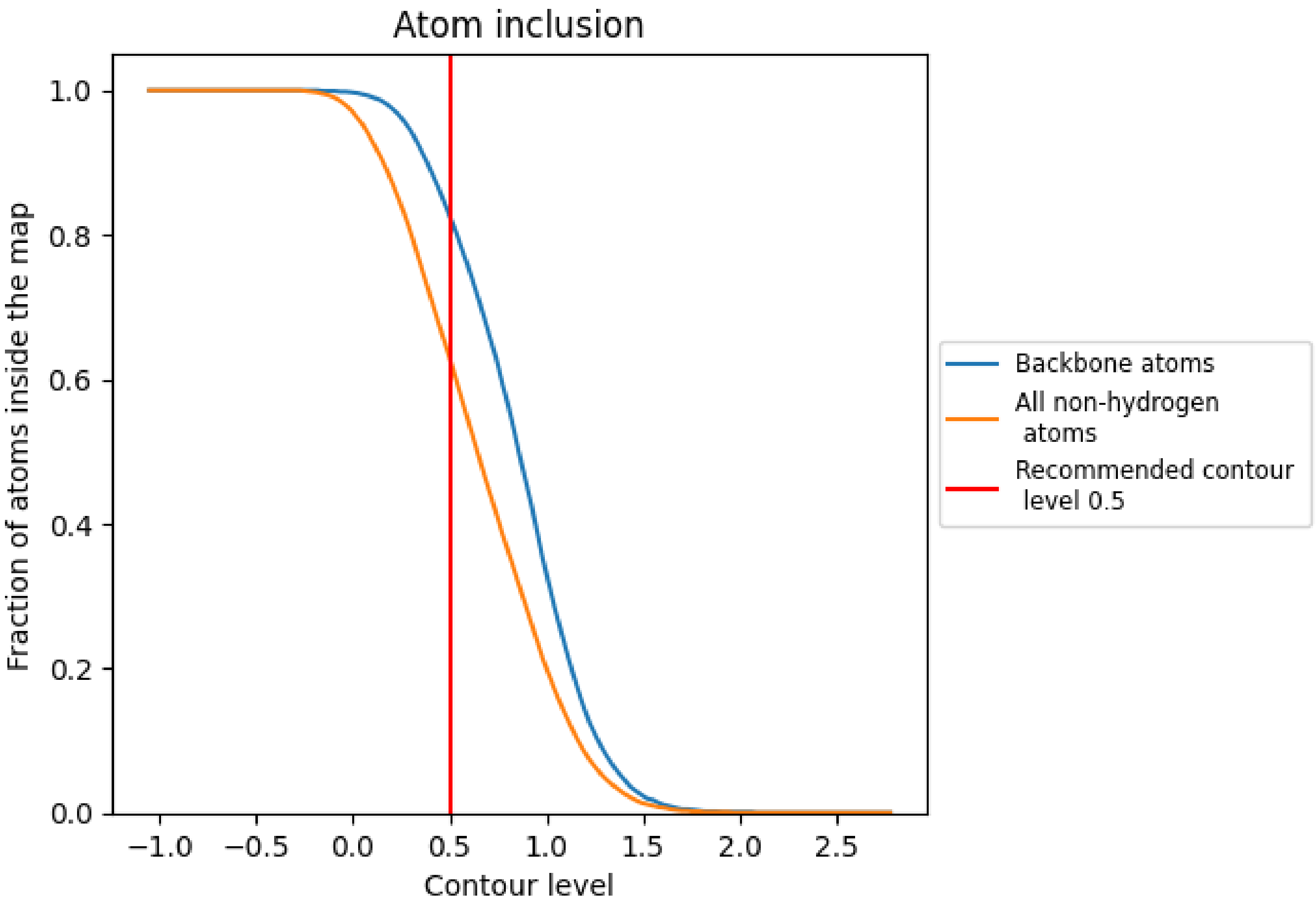
9.3 Atom inclusion mapped to coordinate model ⓘ



X Y Z

The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.5).

9.4 Atom inclusion ⓘ



At the recommended contour level, 83% of all backbone atoms, 63% 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 (0.5) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6290	0.3690
H	0.6690	0.3820
L	0.6420	0.3750
a	0.6060	0.3590
b	0.6170	0.3700
c	0.5980	0.3950
d	0.6530	0.3910
e	0.6040	0.3530
f	0.6410	0.3270
g	0.6340	0.3680
h	0.6370	0.3770
i	0.6440	0.3750
j	0.6420	0.3830
k	0.6030	0.3650
l	0.6260	0.3590
m	0.6210	0.3610
n	0.6370	0.3550
o	0.6290	0.3590
p	0.6010	0.3750