



Full wwPDB EM Validation Report ⓘ

Dec 14, 2020 – 05:02 PM JST

PDB ID : 3A5X
EMDB ID : EMD-1641
Title : L-type straight flagellar filament made of full-length flagellin
Authors : Maki-Yonekura, S.; Yonekura, K.; Namba, K.
Deposited on : 2009-08-13
Resolution : 4.00 Å (reported)

This is a Full wwPDB EM Validation 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : 0.0.0.dev61
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.15.1

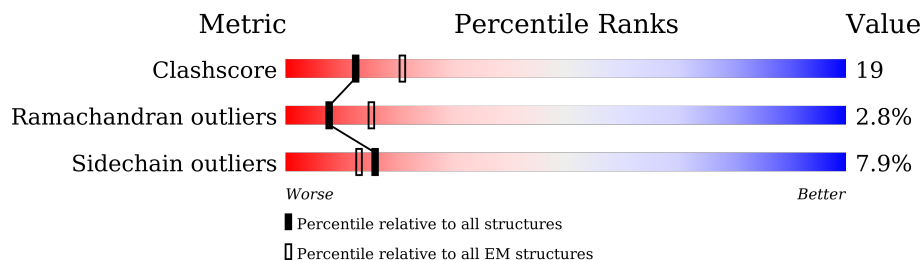
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.00 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	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	494	

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 3616 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 Flagellin.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	494	3616	2190	640	784	2	0	0

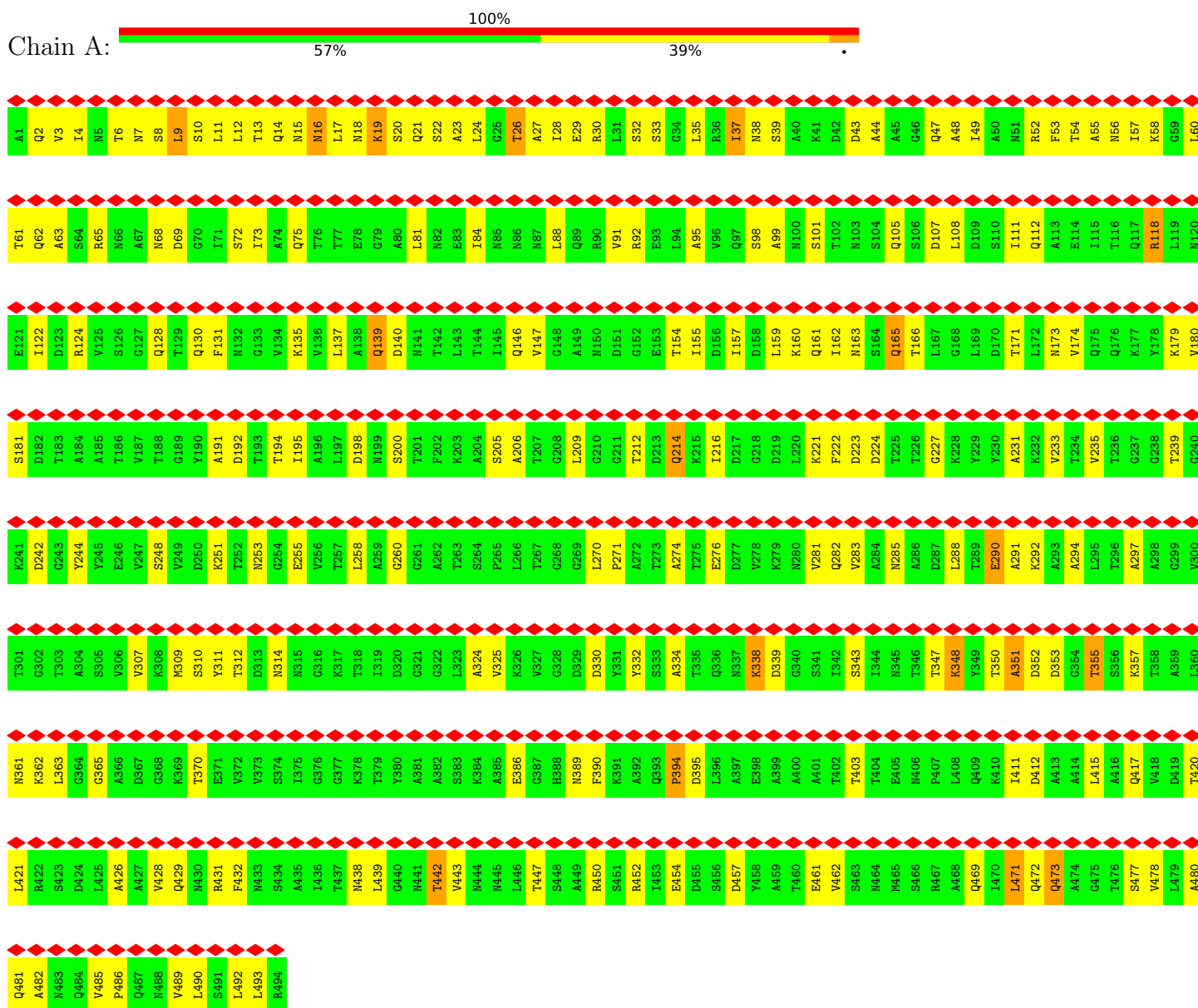
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	426	ALA	GLY	SEE REMARK 999	UNP P06179

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: Flagellin



4 Experimental information

Property	Value	Source
EM reconstruction method	HELICAL	Depositor
Imposed symmetry	HELICAL, twist=Not provided°, rise=Not provided Å, axial sym=Not provided	Depositor
Number of segments used	Not provided	
Resolution determination method	Not provided	
CTF correction method	Both amplitude and phase	Depositor
Microscope	JEOL 3000SFF	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{Å}^2$)	20	Depositor
Minimum defocus (nm)	1080.00	Depositor
Maximum defocus (nm)	2220.00	Depositor
Magnification	50000	Depositor
Image detector	KODAK SO-163 FILM	Depositor
Maximum map value	2134.490	Depositor
Minimum map value	-948.453	Depositor
Average map value	4.558	Depositor
Map value standard deviation	60.601	Depositor
Recommended contour level	550.0	Depositor
Map size (Å)	131, 261, 251	wwPDB
Map dimensions	261, 131, 251	wwPDB
Map angles (°)	90, 90, 90	wwPDB
Pixel spacing (Å)	1, 1, 1	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	0.63	0/3639	0.75	1/4940 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	492	LEU	CA-CB-CG	5.15	127.14	115.30

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	3616	0	3578	136	0
All	All	3616	0	3578	136	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 19.

All (136) 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:130:GLN:HB3	1:A:135:LYS:HD3	1.56	0.88
1:A:288:LEU:HB2	1:A:292:LYS:HE3	1.54	0.86

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:146:GLN:HA	1:A:154:THR:HG22	1.57	0.85
1:A:55:ALA:HA	1:A:58:LYS:HD2	1.61	0.83
1:A:216:ILE:HG23	1:A:231:ALA:HB1	1.62	0.81
1:A:160:LYS:HG3	1:A:421:LEU:HD22	1.63	0.79
1:A:157:ILE:HG12	1:A:428:VAL:HG11	1.64	0.78
1:A:338:LYS:HD2	1:A:339:ASP:H	1.50	0.77
1:A:270:LEU:HD12	1:A:271:PRO:HD2	1.68	0.74
1:A:92:ARG:HH21	1:A:415:LEU:HD12	1.53	0.73
1:A:139:GLN:HA	1:A:161:GLN:HB2	1.71	0.72
1:A:37:ILE:HG23	1:A:44:ALA:HB2	1.71	0.72
1:A:163:ASN:OD1	1:A:165:GLN:HB3	1.91	0.70
1:A:23:ALA:O	1:A:26:THR:HG22	1.92	0.70
1:A:457:ASP:HA	1:A:461:GLU:HB2	1.74	0.69
1:A:11:LEU:O	1:A:14:GLN:HB2	1.92	0.69
1:A:206:ALA:HA	1:A:258:LEU:HD22	1.75	0.68
1:A:62:GLN:HA	1:A:65:ARG:HD2	1.77	0.67
1:A:9:LEU:HA	1:A:12:LEU:HD12	1.77	0.66
1:A:35:LEU:HD13	1:A:454:GLU:HA	1.76	0.66
1:A:192:ASP:HB3	1:A:282:GLN:HE22	1.62	0.65
1:A:60:LEU:HA	1:A:63:ALA:HB3	1.77	0.65
1:A:60:LEU:HD22	1:A:439:LEU:HD13	1.78	0.65
1:A:155:ILE:HG23	1:A:431:ARG:HD2	1.77	0.65
1:A:288:LEU:HB3	1:A:291:ALA:HB3	1.79	0.65
1:A:362:LYS:HG2	1:A:363:LEU:N	2.12	0.64
1:A:216:ILE:CG2	1:A:231:ALA:HB1	2.26	0.64
1:A:253:ASN:OD1	1:A:255:GLU:HG3	1.95	0.64
1:A:439:LEU:O	1:A:443:VAL:HG23	1.97	0.63
1:A:92:ARG:HG2	1:A:411:ILE:HG21	1.79	0.63
1:A:457:ASP:HB3	1:A:462:VAL:HA	1.81	0.63
1:A:118:ARG:O	1:A:122:ILE:HG13	2.01	0.61
1:A:351:ALA:O	1:A:390:PHE:HB2	2.01	0.60
1:A:222:PHE:HB3	1:A:276:GLU:HB2	1.83	0.60
1:A:53:PHE:HA	1:A:56:ASN:HD22	1.68	0.59
1:A:3:VAL:O	1:A:6:THR:HG22	2.02	0.59
1:A:92:ARG:NH2	1:A:415:LEU:HD12	2.17	0.59
1:A:457:ASP:HB3	1:A:462:VAL:CA	2.33	0.57
1:A:8:SER:O	1:A:12:LEU:HG	2.03	0.57
1:A:49:ILE:HA	1:A:52:ARG:HD2	1.86	0.57
1:A:69:ASP:O	1:A:73:ILE:HG13	2.04	0.57
1:A:147:VAL:HG11	1:A:155:ILE:HD12	1.86	0.57
1:A:469:GLN:O	1:A:473:GLN:HB2	2.06	0.56

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:472:GLN:HA	1:A:472:GLN:OE1	2.06	0.55
1:A:140:ASP:HA	1:A:159:LEU:O	2.07	0.55
1:A:362:LYS:HG2	1:A:363:LEU:H	1.71	0.54
1:A:417:GLN:O	1:A:420:THR:HG22	2.07	0.54
1:A:221:LYS:HD2	1:A:221:LYS:N	2.23	0.53
1:A:55:ALA:O	1:A:58:LYS:HB2	2.08	0.53
1:A:309:MET:SD	1:A:324:ALA:HB3	2.49	0.53
1:A:160:LYS:HB2	1:A:421:LEU:HD13	1.91	0.53
1:A:198:ASP:HB3	1:A:255:GLU:HA	1.91	0.52
1:A:124:ARG:O	1:A:128:GLN:HB2	2.09	0.52
1:A:347:THR:HG23	1:A:361:ASN:OD1	2.10	0.51
1:A:353:ASP:H	1:A:357:LYS:NZ	2.07	0.51
1:A:72:SER:HA	1:A:75:GLN:HE21	1.75	0.51
1:A:112:GLN:OE1	1:A:173:ASN:HA	2.10	0.51
1:A:6:THR:O	1:A:9:LEU:HB3	2.11	0.50
1:A:9:LEU:HD13	1:A:10:SER:N	2.26	0.50
1:A:10:SER:O	1:A:13:THR:HG22	2.12	0.50
1:A:2:GLN:OE1	1:A:2:GLN:N	2.45	0.50
1:A:7:ASN:HD22	1:A:490:LEU:HD21	1.77	0.50
1:A:55:ALA:HA	1:A:58:LYS:CD	2.36	0.49
1:A:244:TYR:CE2	1:A:270:LEU:HD22	2.47	0.49
1:A:471:LEU:HD13	1:A:472:GLN:N	2.27	0.49
1:A:181:SER:OG	1:A:310:SER:HB2	2.12	0.49
1:A:350:THR:O	1:A:389:ASN:HA	2.13	0.49
1:A:485:VAL:O	1:A:489:VAL:HG23	2.13	0.49
1:A:223:ASP:HA	1:A:274:ALA:HA	1.95	0.49
1:A:351:ALA:HA	1:A:355:THR:O	2.13	0.48
1:A:482:ALA:O	1:A:486:PRO:HD2	2.13	0.48
1:A:478:VAL:O	1:A:481:GLN:HG2	2.13	0.48
1:A:307:VAL:HG22	1:A:324:ALA:O	2.14	0.48
1:A:24:LEU:O	1:A:28:ILE:HG12	2.14	0.47
1:A:180:VAL:HG22	1:A:311:TYR:CE2	2.50	0.47
1:A:162:ILE:HD11	1:A:421:LEU:CD1	2.44	0.47
1:A:137:LEU:O	1:A:161:GLN:HA	2.13	0.47
1:A:209:LEU:HB2	1:A:214:GLN:HE21	1.79	0.47
1:A:4:ILE:O	1:A:8:SER:HB2	2.15	0.47
1:A:57:ILE:O	1:A:61:THR:HG23	2.14	0.47
1:A:330:ASP:HB3	1:A:362:LYS:HZ2	1.81	0.46
1:A:352:ASP:H	1:A:357:LYS:HZ2	1.63	0.46
1:A:54:THR:HG22	1:A:58:LYS:HE3	1.97	0.46
1:A:88:LEU:O	1:A:91:VAL:HB	2.15	0.46

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:221:LYS:HB3	1:A:274:ALA:O	2.16	0.46
1:A:155:ILE:CG2	1:A:431:ARG:HD2	2.45	0.46
1:A:20:SER:O	1:A:23:ALA:HB3	2.16	0.46
1:A:338:LYS:HD2	1:A:339:ASP:N	2.25	0.45
1:A:9:LEU:O	1:A:12:LEU:HB2	2.17	0.45
1:A:477:SER:O	1:A:480:ALA:HB3	2.16	0.45
1:A:222:PHE:CZ	1:A:227:GLY:HA2	2.51	0.45
1:A:325:VAL:O	1:A:332:TYR:HD1	2.00	0.45
1:A:48:ALA:O	1:A:52:ARG:HG3	2.17	0.45
1:A:179:LYS:HB3	1:A:312:THR:HB	1.98	0.45
1:A:24:LEU:O	1:A:27:ALA:HB3	2.17	0.45
1:A:16:ASN:O	1:A:19:LYS:HB3	2.16	0.44
1:A:18:ASN:O	1:A:21:GLN:HB3	2.17	0.44
1:A:57:ILE:HA	1:A:60:LEU:HB2	1.98	0.44
1:A:27:ALA:O	1:A:30:ARG:HB2	2.17	0.44
1:A:348:LYS:NZ	1:A:348:LYS:HB2	2.32	0.44
1:A:365:GLY:HA3	1:A:370:THR:HB	2.00	0.44
1:A:47:GLN:NE2	1:A:47:GLN:HA	2.32	0.44
1:A:73:ILE:HG12	1:A:131:PHE:CD2	2.52	0.44
1:A:8:SER:O	1:A:12:LEU:N	2.50	0.43
1:A:163:ASN:HD21	1:A:166:THR:HG23	1.82	0.43
1:A:447:THR:HA	1:A:450:ARG:HE	1.83	0.43
1:A:195:ILE:HB	1:A:281:VAL:HB	2.01	0.43
1:A:65:ARG:O	1:A:68:ASN:HB2	2.18	0.43
1:A:233:VAL:HG12	1:A:235:VAL:HG23	2.00	0.43
1:A:81:LEU:HD23	1:A:84:ILE:HD12	2.00	0.42
1:A:49:ILE:O	1:A:52:ARG:HB2	2.19	0.42
1:A:105:GLN:O	1:A:108:LEU:HB2	2.20	0.42
1:A:426:ALA:O	1:A:429:GLN:HB2	2.19	0.42
1:A:294:ALA:O	1:A:297:ALA:HB3	2.20	0.42
1:A:290:GLU:O	1:A:291:ALA:C	2.58	0.42
1:A:394:PRO:HG2	1:A:395:ASP:H	1.85	0.42
1:A:57:ILE:HA	1:A:60:LEU:HD12	2.02	0.42
1:A:325:VAL:HG23	1:A:334:ALA:HB2	2.03	0.41
1:A:415:LEU:HD23	1:A:415:LEU:HA	1.91	0.41
1:A:15:ASN:O	1:A:18:ASN:HB2	2.21	0.41
1:A:485:VAL:HB	1:A:486:PRO:CD	2.51	0.41
1:A:107:ASP:O	1:A:111:ILE:HG13	2.21	0.41
1:A:439:LEU:HA	1:A:442:THR:OG1	2.20	0.41
1:A:53:PHE:HA	1:A:56:ASN:ND2	2.33	0.41
1:A:19:LYS:O	1:A:22:SER:HB3	2.20	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:330:ASP:HB3	1:A:362:LYS:NZ	2.36	0.41
1:A:160:LYS:HG3	1:A:421:LEU:CD2	2.43	0.41
1:A:191:ALA:O	1:A:283:VAL:HG12	2.21	0.41
1:A:180:VAL:HG22	1:A:311:TYR:CD2	2.56	0.41
1:A:174:VAL:HA	1:A:403:THR:HG23	2.03	0.41
1:A:118:ARG:HD3	1:A:118:ARG:HA	1.66	0.41
1:A:38:ASN:OD1	1:A:39:SER:N	2.54	0.40
1:A:12:LEU:HD23	1:A:12:LEU:HA	1.96	0.40
1:A:60:LEU:HA	1:A:63:ALA:CB	2.49	0.40
1:A:95:ALA:O	1:A:98:SER:OG	2.38	0.40
1:A:56:ASN:O	1:A:60:LEU:HG	2.22	0.40

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	492/494 (100%)	426 (87%)	52 (11%)	14 (3%)	5 33

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	355	THR
1	A	33	SER
1	A	314	ASN
1	A	32	SER
1	A	260	GLY
1	A	285	ASN
1	A	290	GLU
1	A	351	ALA
1	A	394	PRO
1	A	101	SER

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	224	ASP
1	A	251	LYS
1	A	493	LEU
1	A	99	ALA

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	390/390 (100%)	359 (92%)	31 (8%)	12 39

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	LEU
1	A	16	ASN
1	A	17	LEU
1	A	19	LYS
1	A	26	THR
1	A	29	GLU
1	A	37	ILE
1	A	43	ASP
1	A	118	ARG
1	A	139	GLN
1	A	165	GLN
1	A	171	THR
1	A	194	THR
1	A	200	SER
1	A	205	SER
1	A	212	THR
1	A	214	GLN
1	A	239	THR
1	A	242	ASP
1	A	248	SER
1	A	338	LYS
1	A	343	SER

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	348	LYS
1	A	386	GLU
1	A	412	ASP
1	A	432	PHE
1	A	438	ASN
1	A	442	THR
1	A	452	ARG
1	A	471	LEU
1	A	473	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	7	ASN
1	A	56	ASN
1	A	62	GLN
1	A	75	GLN
1	A	89	GLN
1	A	117	GLN
1	A	120	ASN
1	A	282	GLN
1	A	388	HIS
1	A	433	ASN
1	A	464	ASN
1	A	481	GLN
1	A	487	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](#)

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.

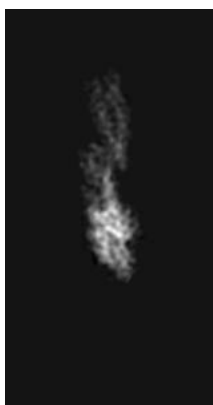
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-1641. 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](#)

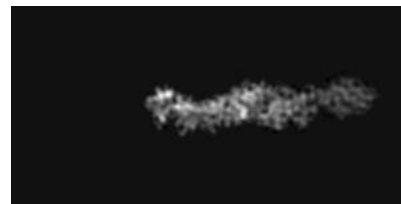
6.1.1 Primary map



X



Y



Z

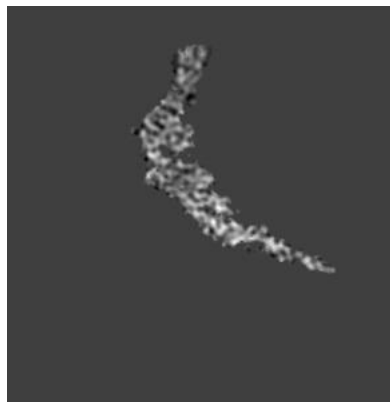
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

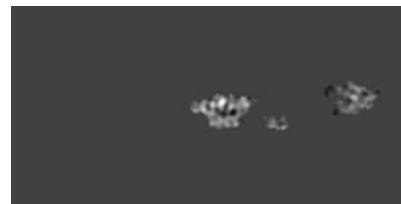
6.2.1 Primary map



X Index: 130



Y Index: 65

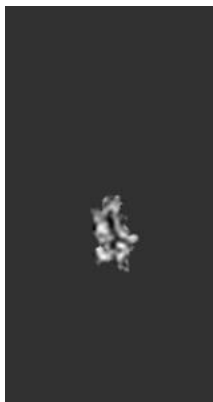


Z Index: 125

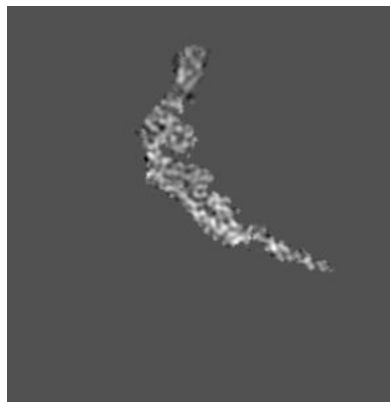
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

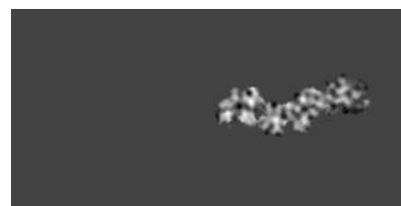
6.3.1 Primary map



X Index: 152



Y Index: 64



Z Index: 109

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 550.0. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

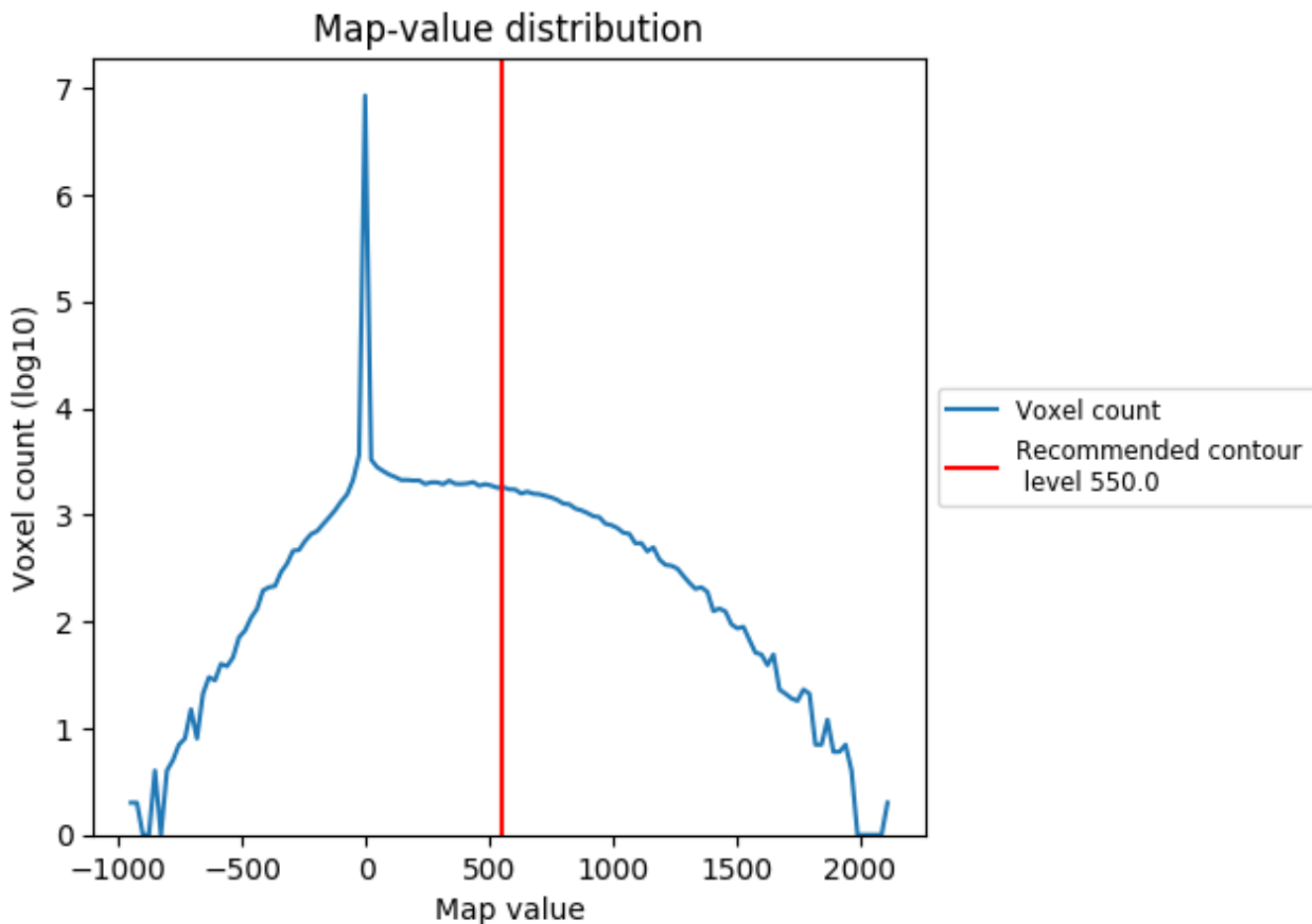
6.5 Mask visualisation

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

7 Map analysis [i](#)

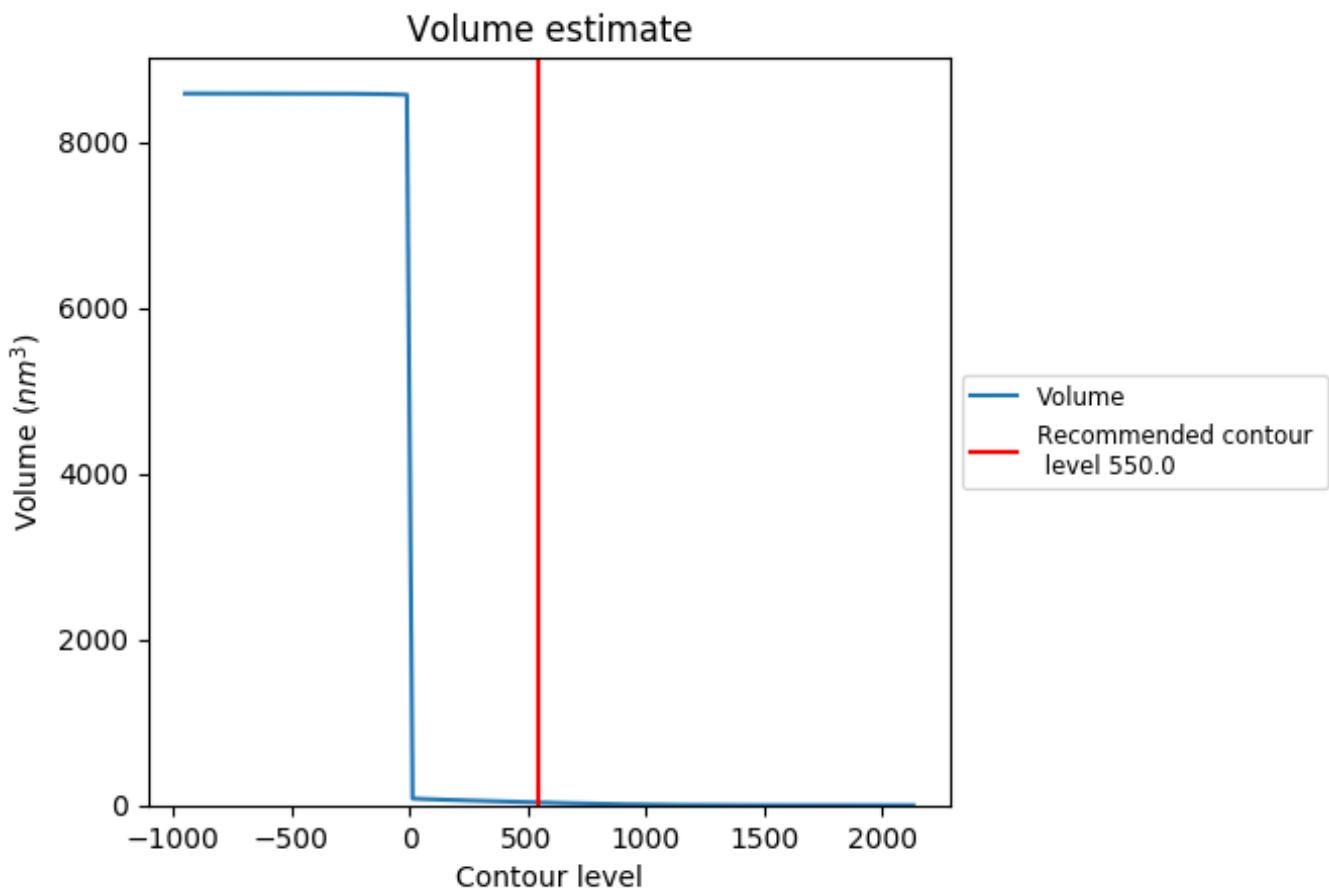
This section contains the results of statistical analysis of the map.

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 33 nm³; this corresponds to an approximate mass of 30 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](#)

This section was not generated. The rotationally averaged power spectrum is only generated for cubic maps.

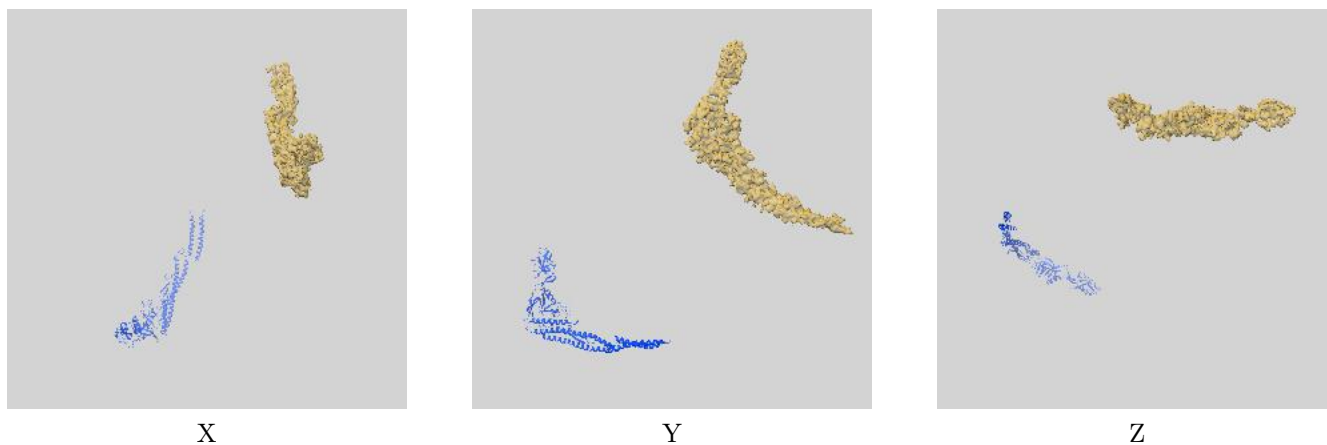
8 Fourier-Shell correlation

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

9 Map-model fit [i](#)

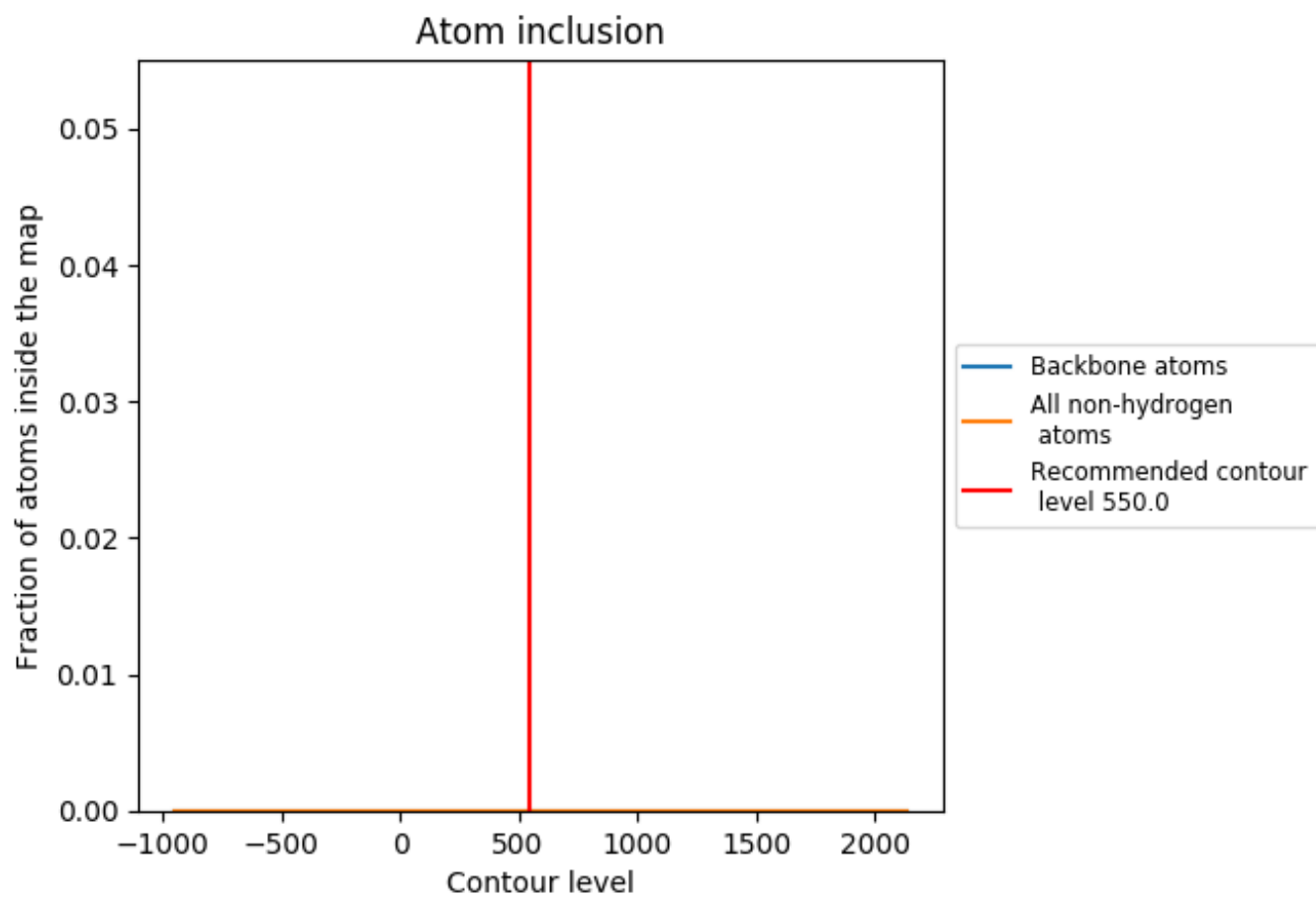
This section contains information regarding the fit between EMDB map EMD-1641 and PDB model 3A5X. Per-residue inclusion information can be found in section 3 on page 4.

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 550.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2 Atom inclusion [i](#)



At the recommended contour level, 0% of all backbone atoms, 0% of all non-hydrogen atoms, are inside the map.