



wwPDB EM Validation Summary Report ⓘ

Nov 20, 2022 – 06:42 PM JST

PDB ID : 7CGB
EMDB ID : EMD-30354
Title : Cryo-EM structure of the flagellar hook from Salmonella
Authors : Tan, J.X.; Chang, S.H.; Wang, X.F.; Xu, C.H.; Zhou, Y.; Zhang, X.; Zhu, Y.Q.
Deposited on : 2020-07-01
Resolution : 3.40 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

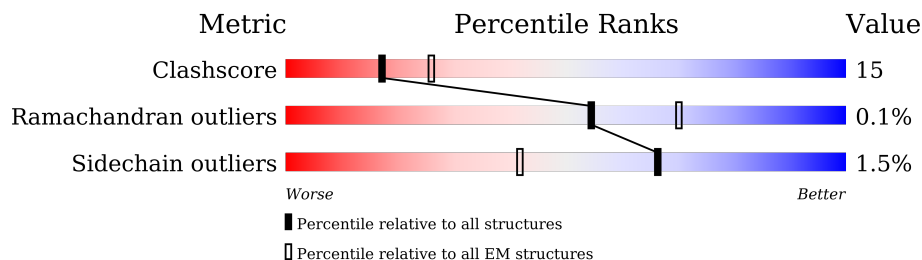
EMDB validation analysis : 0.0.1.dev43
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.9
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.3

1 Overall quality at a glance i

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

The reported resolution of this entry is 3.40 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	DL	403	
1	DM	403	
1	DN	403	
1	DO	403	
1	DP	403	
1	DQ	403	
1	DR	403	
1	DS	403	

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Mol	Chain	Length	Quality of chain
1	DT	403	 74% 25%
1	DU	403	 71% 28%
1	DV	403	 72% 27%
1	DW	403	 72% 27%
1	DX	403	 66% 33%
1	DY	403	 6% 72% 28%
1	DZ	403	 73% 27%
1	EA	403	 75% 24%
1	EB	403	 67% 33%
1	EC	403	 6% 73% 27%
1	ED	403	 15% 70% 30%
1	EE	403	 11% 73% 26%
1	EF	403	 9% 70% 29%
1	EG	403	 9% 71% 29%

2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 64834 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 Flagellar hook protein FlgE.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	DL	401	2947	1814	507	618	8	0	0
1	DM	401	2947	1814	507	618	8	0	0
1	DN	401	2947	1814	507	618	8	0	0
1	DO	401	2947	1814	507	618	8	0	0
1	DP	401	2947	1814	507	618	8	0	0
1	DQ	401	2947	1814	507	618	8	0	0
1	DR	401	2947	1814	507	618	8	0	0
1	DS	401	2947	1814	507	618	8	0	0
1	DT	401	2947	1814	507	618	8	0	0
1	DU	401	2947	1814	507	618	8	0	0
1	DV	401	2947	1814	507	618	8	0	0
1	DW	401	2947	1814	507	618	8	0	0
1	DX	401	2947	1814	507	618	8	0	0
1	DY	401	2947	1814	507	618	8	0	0
1	DZ	401	2947	1814	507	618	8	0	0
1	EA	401	2947	1814	507	618	8	0	0
1	EB	401	2947	1814	507	618	8	0	0

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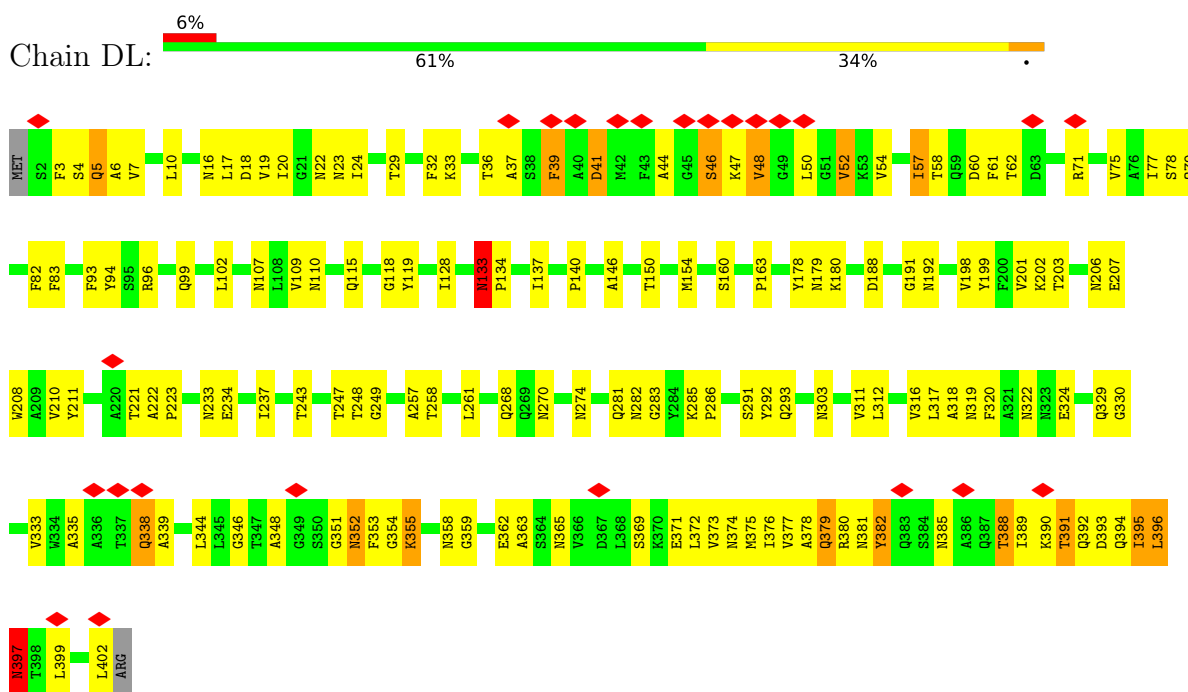
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Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	EC	401	Total 2947	C 1814	N 507	O 618	S 8	0	0
1	ED	401	Total 2947	C 1814	N 507	O 618	S 8	0	0
1	EE	401	Total 2947	C 1814	N 507	O 618	S 8	0	0
1	EF	401	Total 2947	C 1814	N 507	O 618	S 8	0	0
1	EG	401	Total 2947	C 1814	N 507	O 618	S 8	0	0

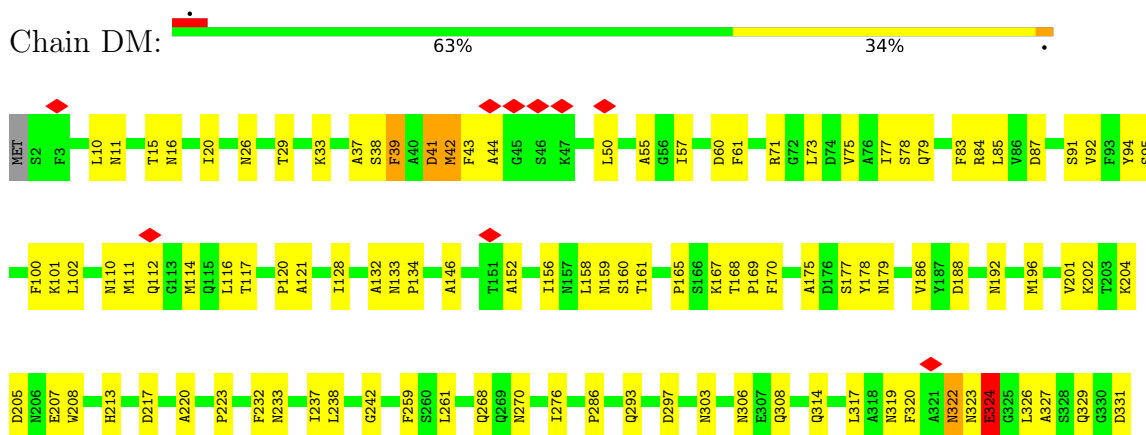
3 Residue-property plots

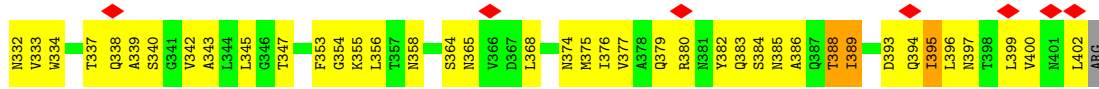
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion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

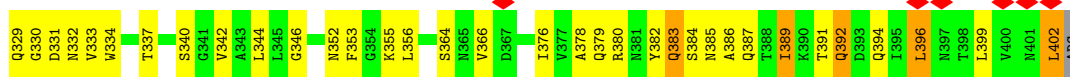
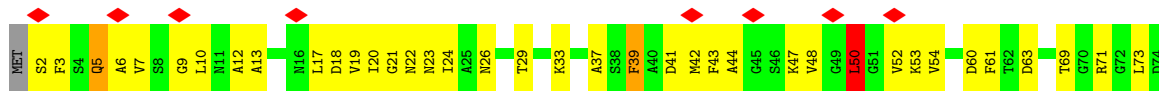


- Molecule 1: Flagellar hook protein FlgE

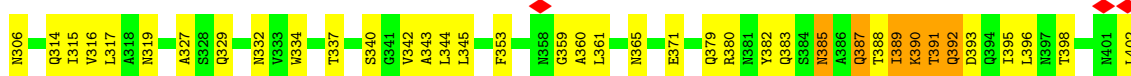
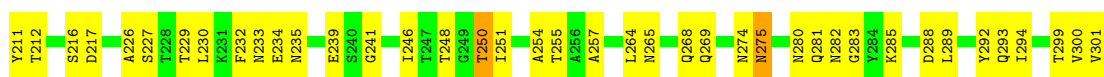




• Molecule 1: Flagellar hook protein FlgE

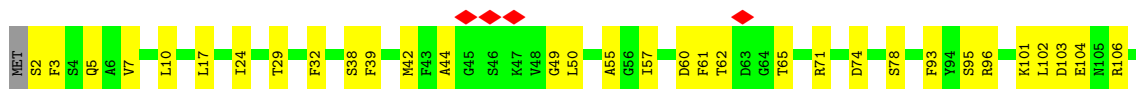
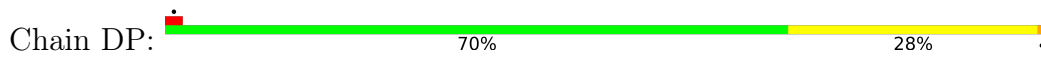


• Molecule 1: Flagellar hook protein FlgE



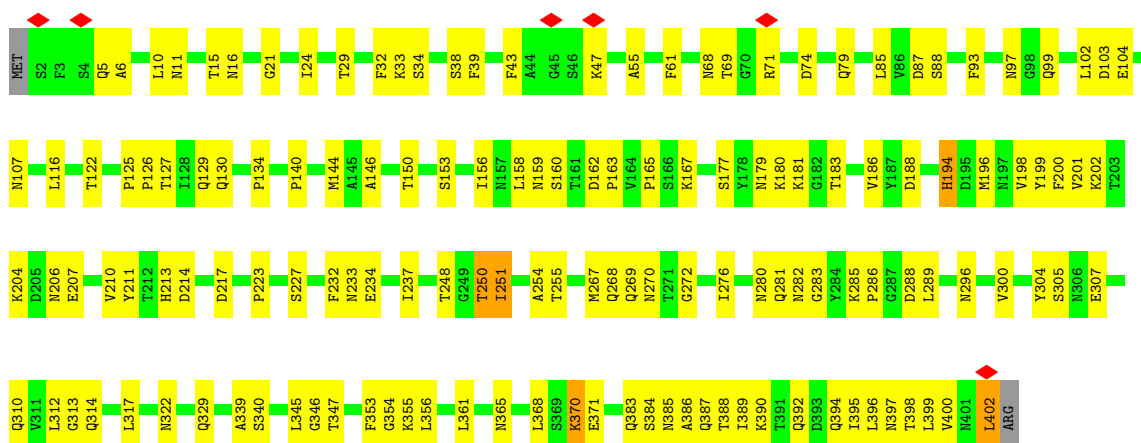
ARG

• Molecule 1: Flagellar hook protein FlgE

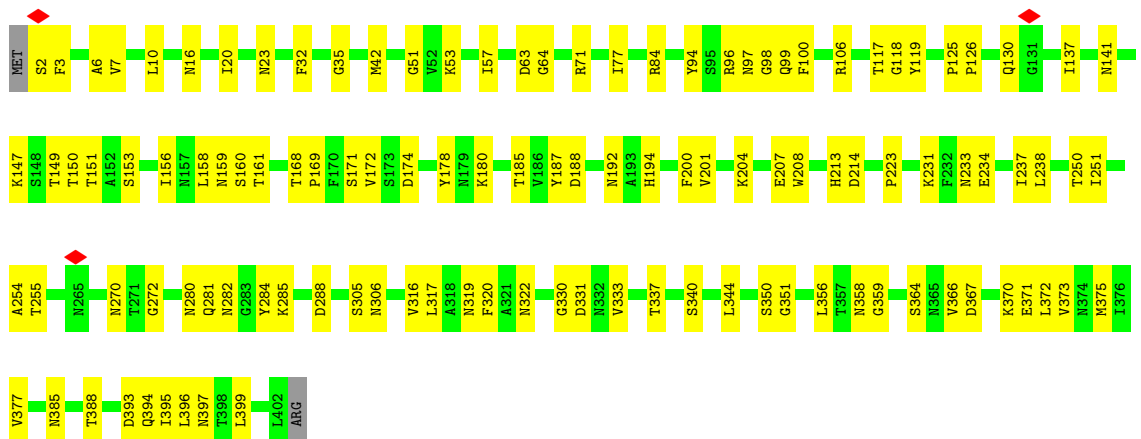




• Molecule 1: Flagellar hook protein FlgE

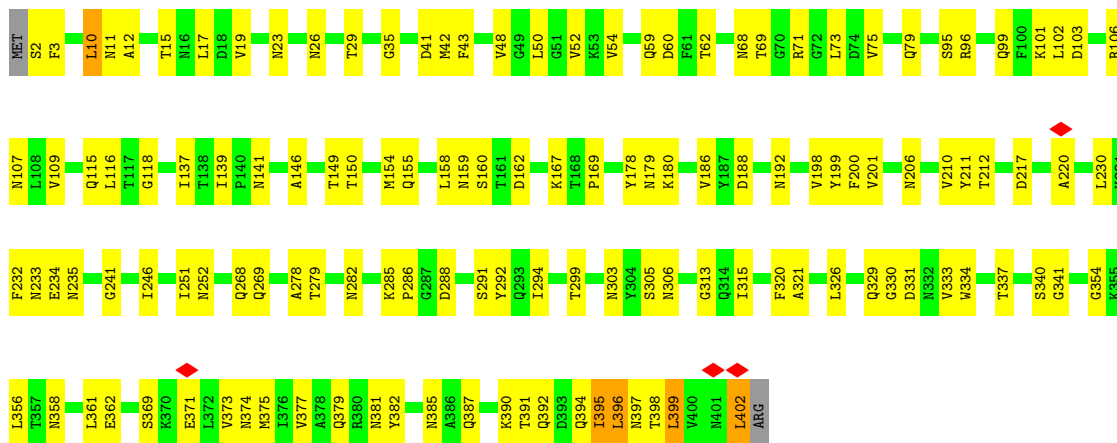


• Molecule 1: Flagellar hook protein FlgE

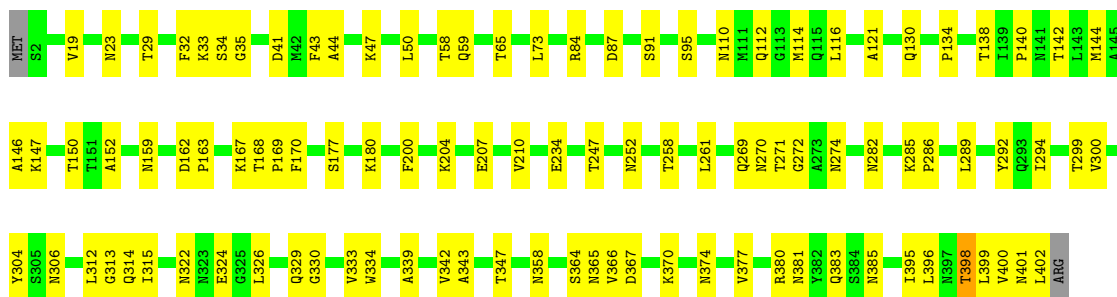
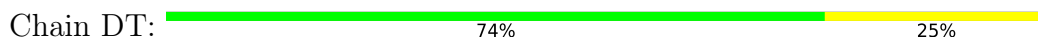


• Molecule 1: Flagellar hook protein FlgE





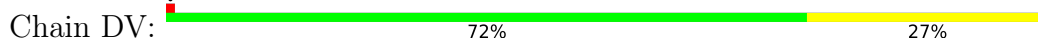
• Molecule 1: Flagellar hook protein FlgE

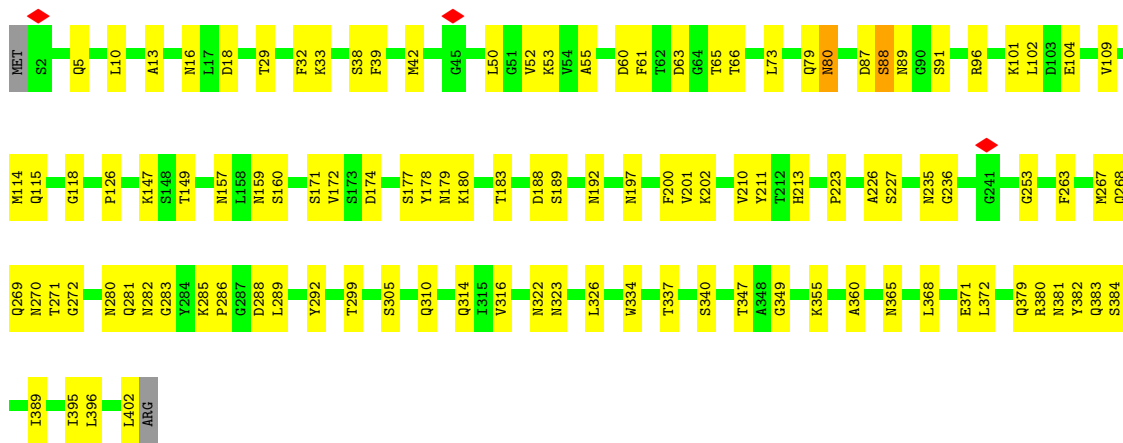


• Molecule 1: Flagellar hook protein FlgE

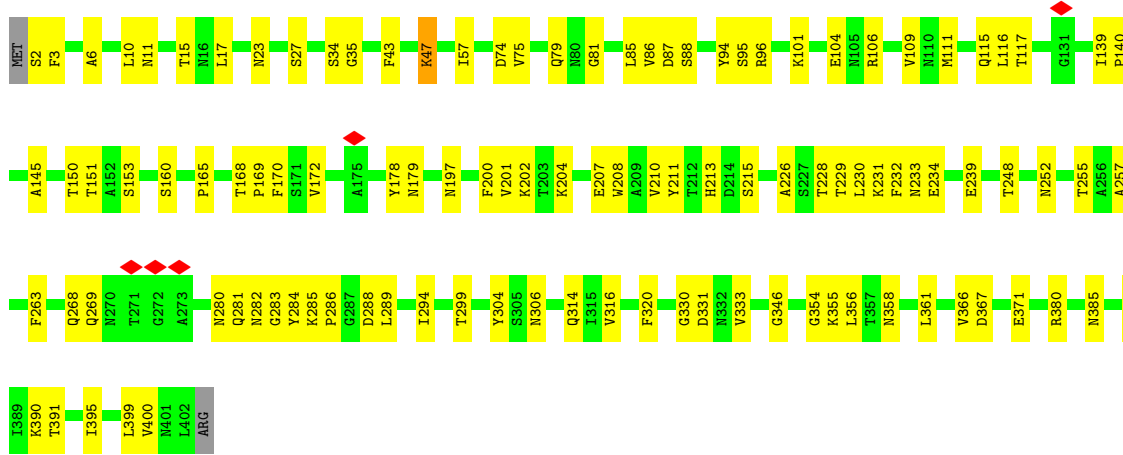
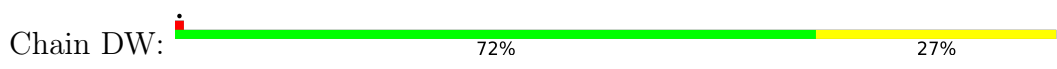


• Molecule 1: Flagellar hook protein FlgE

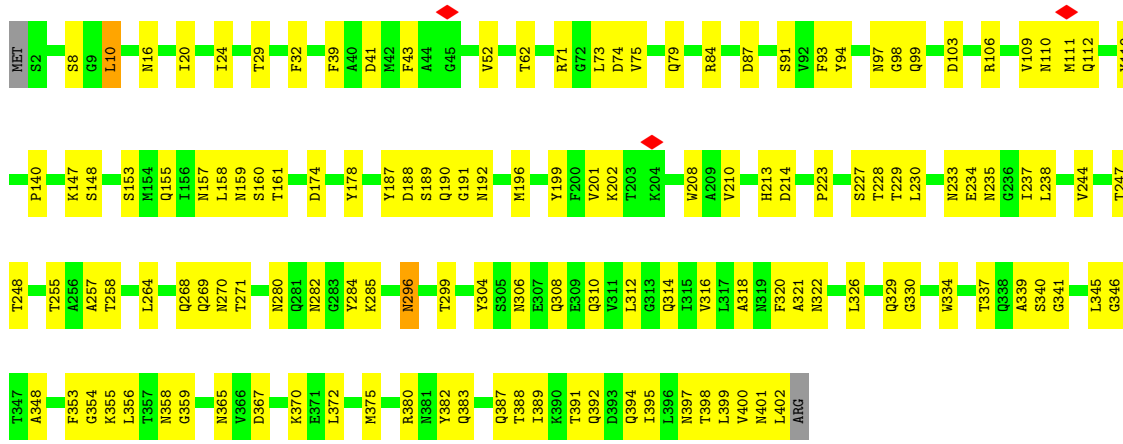




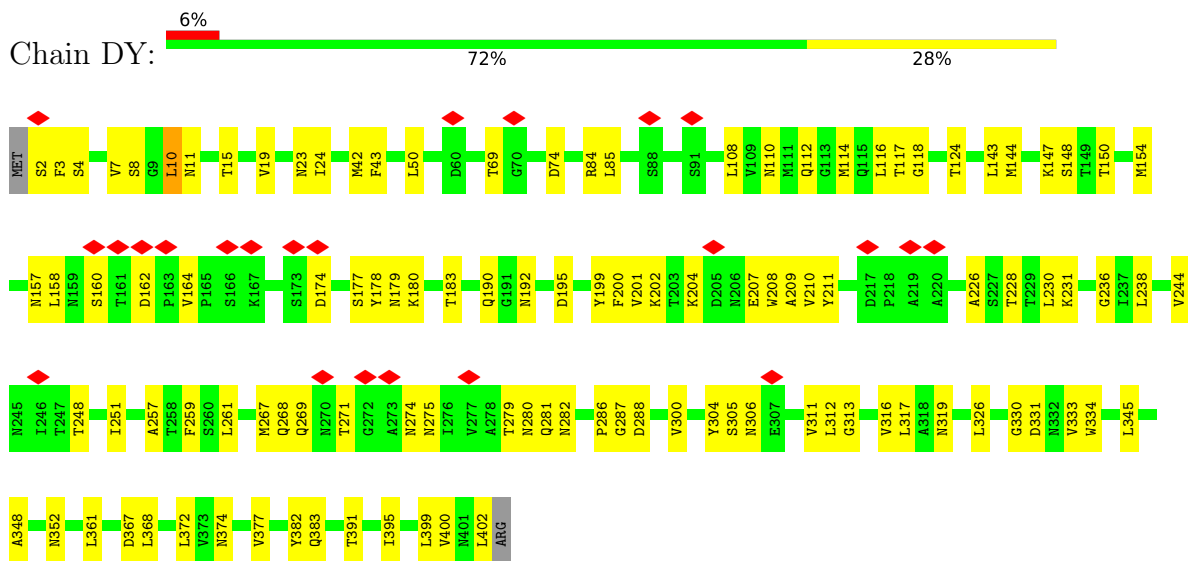
• Molecule 1: Flagellar hook protein FlgE



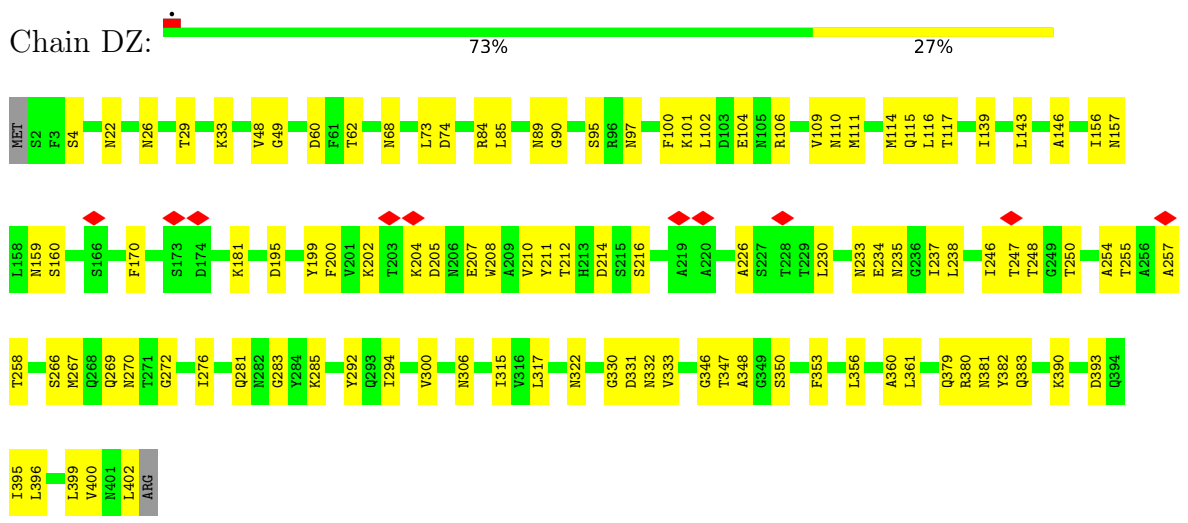
• Molecule 1: Flagellar hook protein FlgE



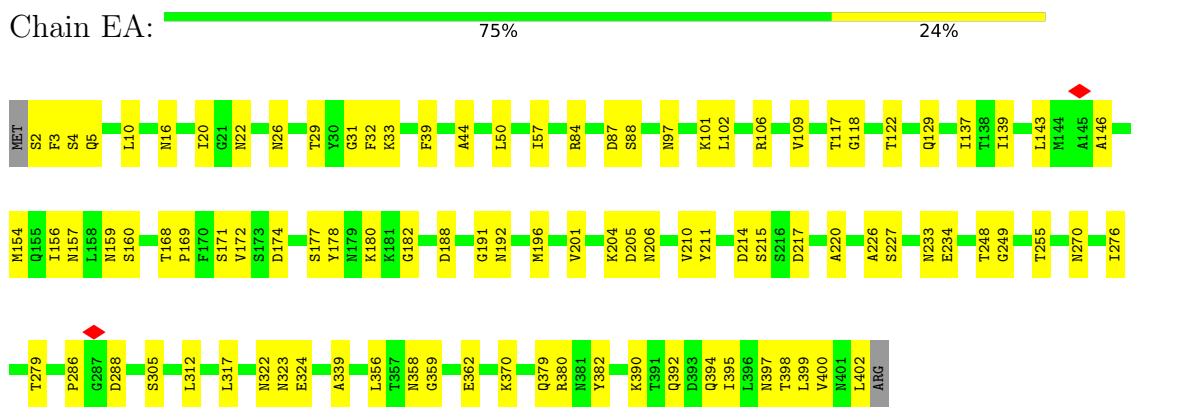
• Molecule 1: Flagellar hook protein FlgE



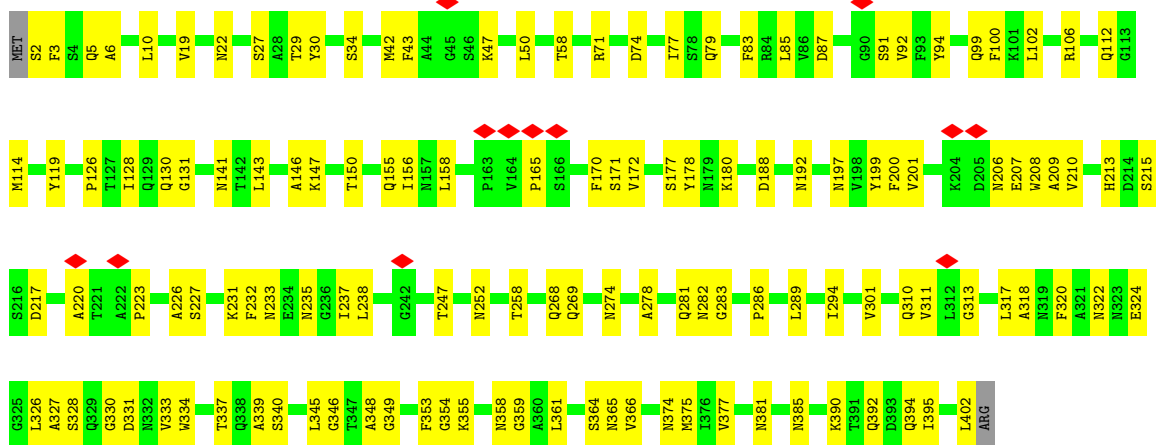
• Molecule 1: Flagellar hook protein FlgE



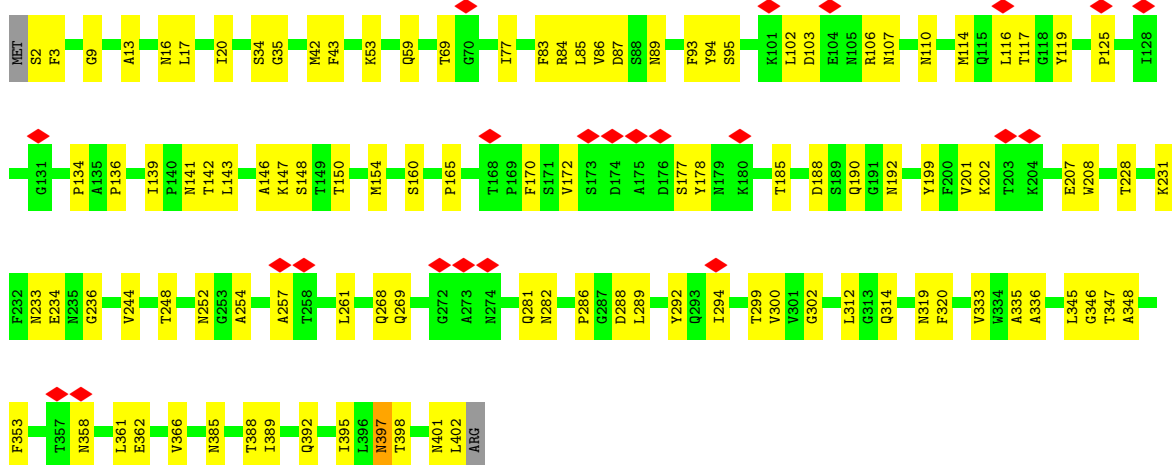
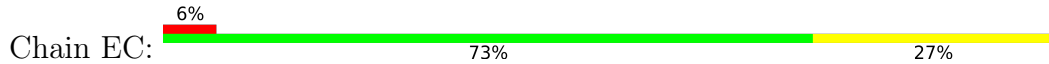
• Molecule 1: Flagellar hook protein FlgE



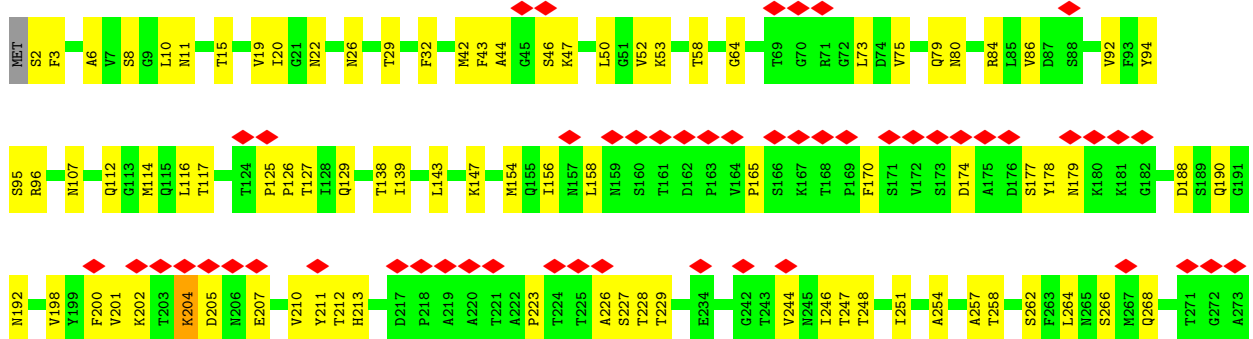
• Molecule 1: Flagellar hook protein FlgE

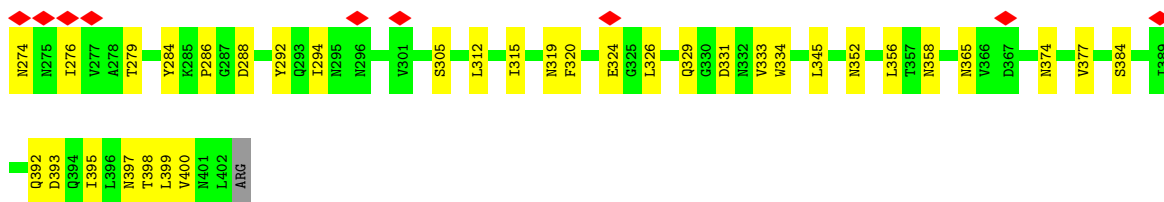


• Molecule 1: Flagellar hook protein FlgE

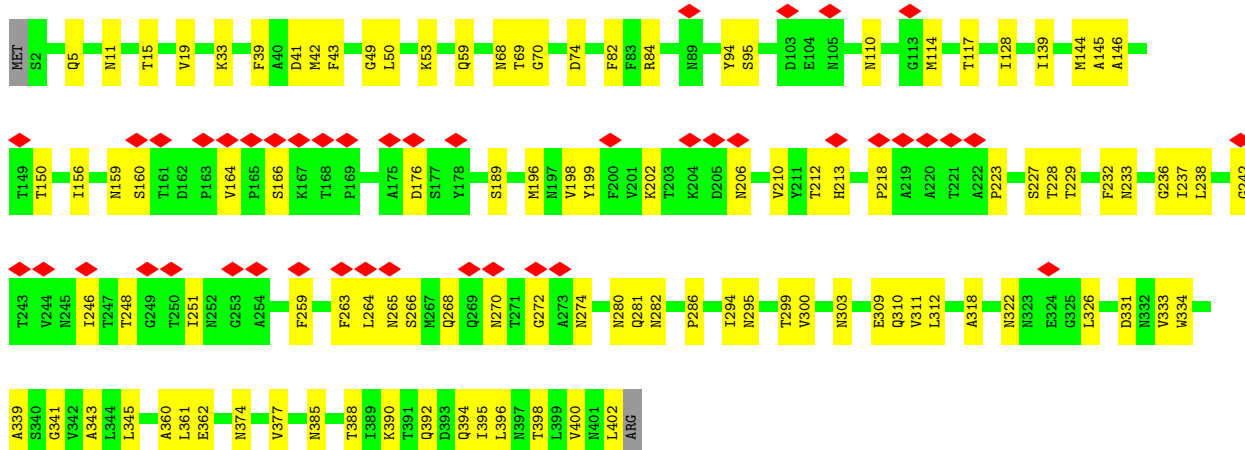
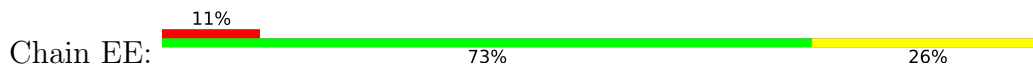


• Molecule 1: Flagellar hook protein FlgE

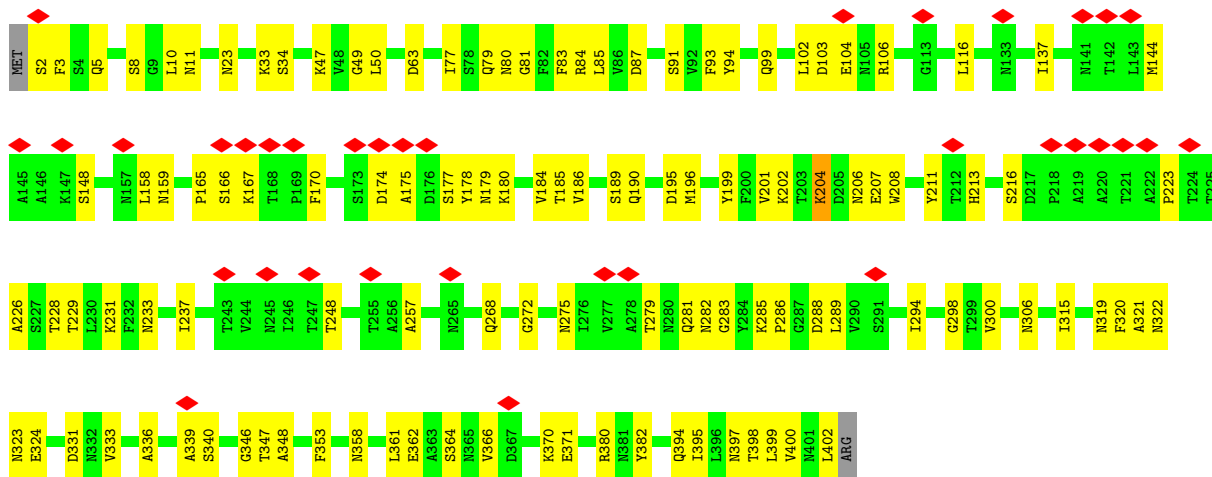
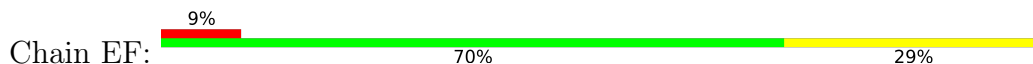




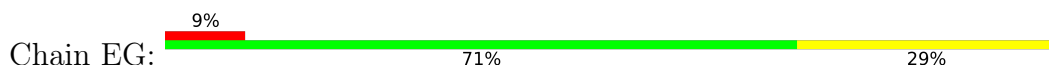
• Molecule 1: Flagellar hook protein FlgE

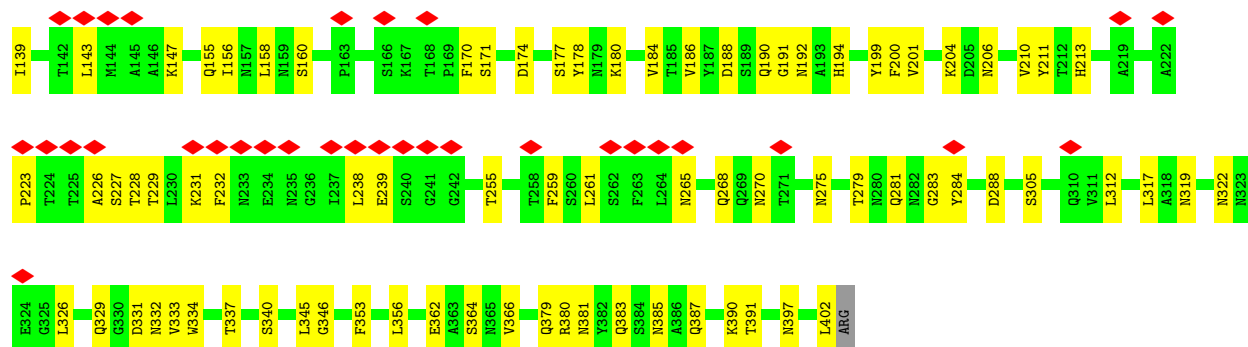


• Molecule 1: Flagellar hook protein FlgE



• Molecule 1: Flagellar hook protein FlgE





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	148517	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 ($e^-/\text{\AA}^2$)	47	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	1.394	Depositor
Minimum map value	-0.674	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.040	Depositor
Recommended contour level	0.263	Depositor
Map size (Å)	669.184, 669.184, 669.184	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.307, 1.307, 1.307	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	DL	0.45	1/2991 (0.0%)	0.67	3/4076 (0.1%)
1	DM	0.34	0/2991	0.60	1/4076 (0.0%)
1	DN	0.41	1/2991 (0.0%)	0.65	1/4076 (0.0%)
1	DO	0.39	0/2991	0.65	0/4076
1	DP	0.29	0/2991	0.55	1/4076 (0.0%)
1	DQ	0.33	1/2991 (0.0%)	0.55	0/4076
1	DR	0.26	0/2991	0.51	0/4076
1	DS	0.28	0/2991	0.53	1/4076 (0.0%)
1	DT	0.27	0/2991	0.49	0/4076
1	DU	0.28	0/2991	0.54	1/4076 (0.0%)
1	DV	0.27	0/2991	0.52	0/4076
1	DW	0.26	0/2991	0.51	1/4076 (0.0%)
1	DX	0.26	0/2991	0.49	1/4076 (0.0%)
1	DY	0.27	0/2991	0.51	1/4076 (0.0%)
1	DZ	0.27	0/2991	0.50	0/4076
1	EA	0.26	0/2991	0.50	0/4076
1	EB	0.26	0/2991	0.50	0/4076
1	EC	0.27	0/2991	0.51	1/4076 (0.0%)
1	ED	0.26	0/2991	0.49	0/4076
1	EE	0.26	0/2991	0.49	0/4076
1	EF	0.26	0/2991	0.49	0/4076
1	EG	0.26	0/2991	0.50	0/4076
All	All	0.30	3/65802 (0.0%)	0.54	12/89672 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	DL	133	ASN	C-N	8.75	1.50	1.34
1	DQ	285	LYS	C-N	8.73	1.50	1.34
1	DN	384	SER	CA-CB	-5.38	1.44	1.52

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	DS	10	LEU	CA-CB-CG	8.05	133.81	115.30
1	DW	284	TYR	C-N-CA	6.99	139.17	121.70
1	DY	10	LEU	CA-CB-CG	6.84	131.03	115.30
1	DU	401	ASN	CB-CA-C	6.83	124.06	110.40
1	DM	323	ASN	C-N-CA	6.58	138.15	121.70

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	DL	2947	0	2839	143	0
1	DM	2947	0	2839	135	0
1	DN	2947	0	2839	137	0
1	DO	2947	0	2839	136	0
1	DP	2947	0	2839	99	0
1	DQ	2947	0	2839	113	0
1	DR	2947	0	2839	82	0
1	DS	2947	0	2839	113	0
1	DT	2947	0	2839	84	0
1	DU	2947	0	2839	124	0
1	DV	2947	0	2839	87	0
1	DW	2947	0	2839	81	0
1	DX	2947	0	2839	98	0
1	DY	2947	0	2839	88	0
1	DZ	2947	0	2839	79	0
1	EA	2947	0	2839	76	0
1	EB	2947	0	2839	91	0
1	EC	2947	0	2839	75	0
1	ED	2947	0	2839	83	0
1	EE	2947	0	2839	68	0
1	EF	2947	0	2839	83	0
1	EG	2947	0	2839	80	0
All	All	64834	0	62458	1949	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 1949 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:DN:146:ALA:HB3	1:DN:189:SER:O	1.21	1.30
1:DM:385:ASN:HA	1:DM:388:THR:CG2	1.60	1.29
1:DL:372:LEU:O	1:DL:376:ILE:HG12	1.36	1.21
1:DM:385:ASN:O	1:DM:388:THR:HG23	1.45	1.15
1:DU:396:LEU:O	1:DU:400:VAL:HG13	1.50	1.11

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	DL	399/403 (99%)	369 (92%)	27 (7%)	3 (1%)	19	51
1	DM	399/403 (99%)	383 (96%)	14 (4%)	2 (0%)	29	61
1	DN	399/403 (99%)	366 (92%)	31 (8%)	2 (0%)	29	61
1	DO	399/403 (99%)	373 (94%)	23 (6%)	3 (1%)	19	51
1	DP	399/403 (99%)	375 (94%)	24 (6%)	0	100	100
1	DQ	399/403 (99%)	379 (95%)	20 (5%)	0	100	100
1	DR	399/403 (99%)	382 (96%)	17 (4%)	0	100	100
1	DS	399/403 (99%)	381 (96%)	18 (4%)	0	100	100
1	DT	399/403 (99%)	377 (94%)	22 (6%)	0	100	100
1	DU	399/403 (99%)	381 (96%)	18 (4%)	0	100	100
1	DV	399/403 (99%)	374 (94%)	23 (6%)	2 (0%)	29	61
1	DW	399/403 (99%)	381 (96%)	18 (4%)	0	100	100
1	DX	399/403 (99%)	380 (95%)	19 (5%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	DY	399/403 (99%)	378 (95%)	21 (5%)	0	100	100
1	DZ	399/403 (99%)	377 (94%)	22 (6%)	0	100	100
1	EA	399/403 (99%)	378 (95%)	21 (5%)	0	100	100
1	EB	399/403 (99%)	373 (94%)	26 (6%)	0	100	100
1	EC	399/403 (99%)	385 (96%)	14 (4%)	0	100	100
1	ED	399/403 (99%)	380 (95%)	19 (5%)	0	100	100
1	EE	399/403 (99%)	379 (95%)	20 (5%)	0	100	100
1	EF	399/403 (99%)	379 (95%)	20 (5%)	0	100	100
1	EG	399/403 (99%)	376 (94%)	23 (6%)	0	100	100
All	All	8778/8866 (99%)	8306 (95%)	460 (5%)	12 (0%)	54	82

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	DN	22	ASN
1	DM	324	GLU
1	DO	52	VAL
1	DL	39	PHE
1	DL	352	ASN

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	DL	321/323 (99%)	300 (94%)	21 (6%)	17	46
1	DM	321/323 (99%)	307 (96%)	14 (4%)	28	58
1	DN	321/323 (99%)	308 (96%)	13 (4%)	31	60
1	DO	321/323 (99%)	298 (93%)	23 (7%)	14	43
1	DP	321/323 (99%)	316 (98%)	5 (2%)	62	81
1	DQ	321/323 (99%)	315 (98%)	6 (2%)	57	78
1	DR	321/323 (99%)	321 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	DS	321/323 (99%)	314 (98%)	7 (2%)	52	75
1	DT	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	DU	321/323 (99%)	317 (99%)	4 (1%)	71	85
1	DV	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	DW	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	DX	321/323 (99%)	319 (99%)	2 (1%)	86	94
1	DY	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	DZ	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	EA	321/323 (99%)	321 (100%)	0	100	100
1	EB	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	EC	321/323 (99%)	319 (99%)	2 (1%)	86	94
1	ED	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	EE	321/323 (99%)	320 (100%)	1 (0%)	92	97
1	EF	321/323 (99%)	319 (99%)	2 (1%)	86	94
1	EG	321/323 (99%)	319 (99%)	2 (1%)	86	94
All	All	7062/7106 (99%)	6953 (98%)	109 (2%)	66	82

5 of 109 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	DO	48	VAL
1	DP	204	LYS
1	DZ	181	LYS
1	DO	54	VAL
1	DO	387	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 70 such sidechains are listed below:

Mol	Chain	Res	Type
1	EC	268	GLN
1	ED	26	ASN
1	EG	5	GLN
1	DP	379	GLN
1	DO	392	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.

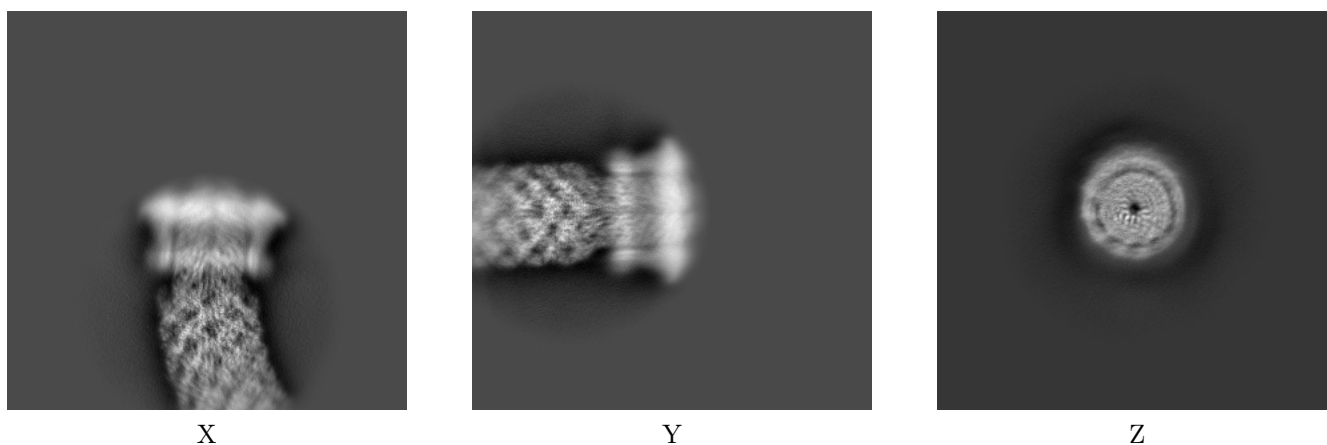
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-30354. 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](#)

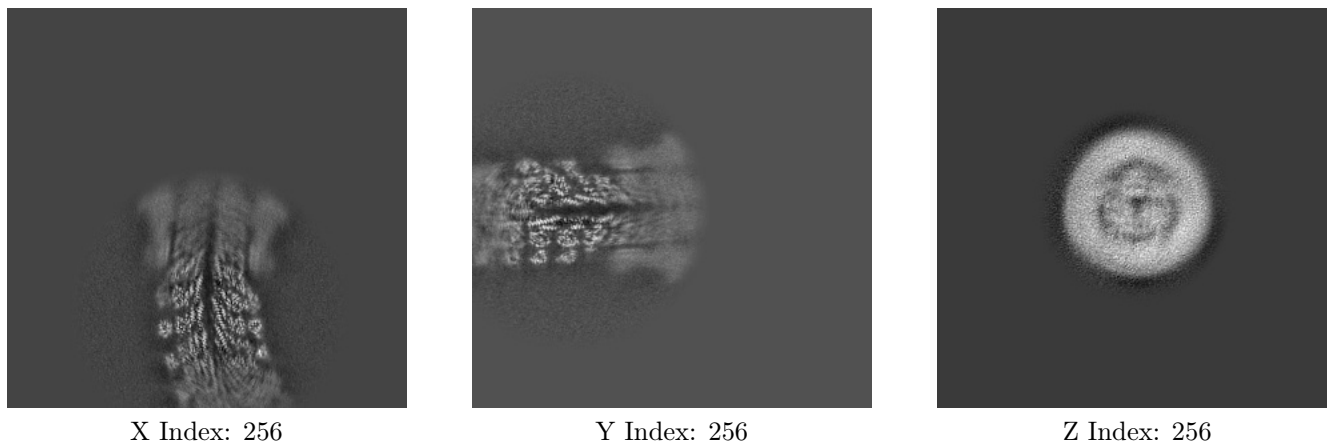
6.1.1 Primary map



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

6.2 Central slices [i](#)

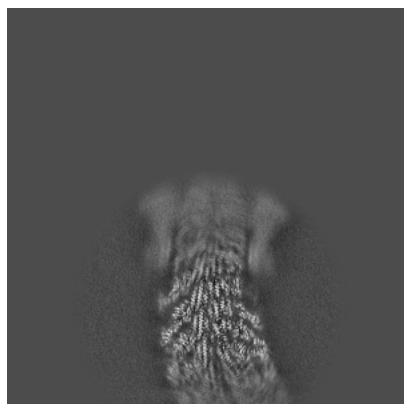
6.2.1 Primary map



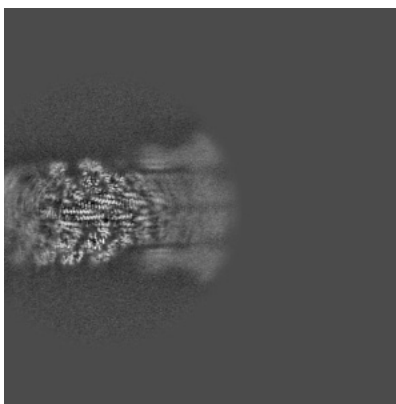
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

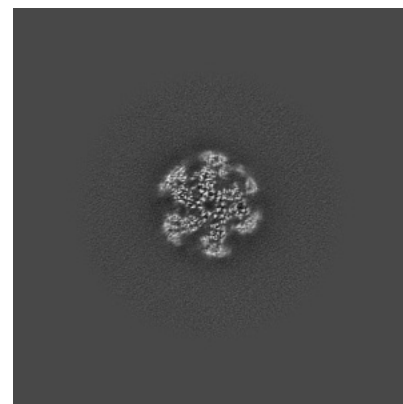
6.3.1 Primary map



X Index: 243



Y Index: 248



Z Index: 102

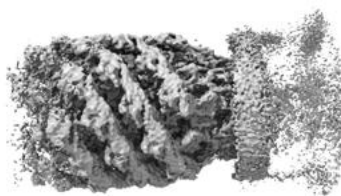
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal surface views [i](#)

6.4.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.263. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

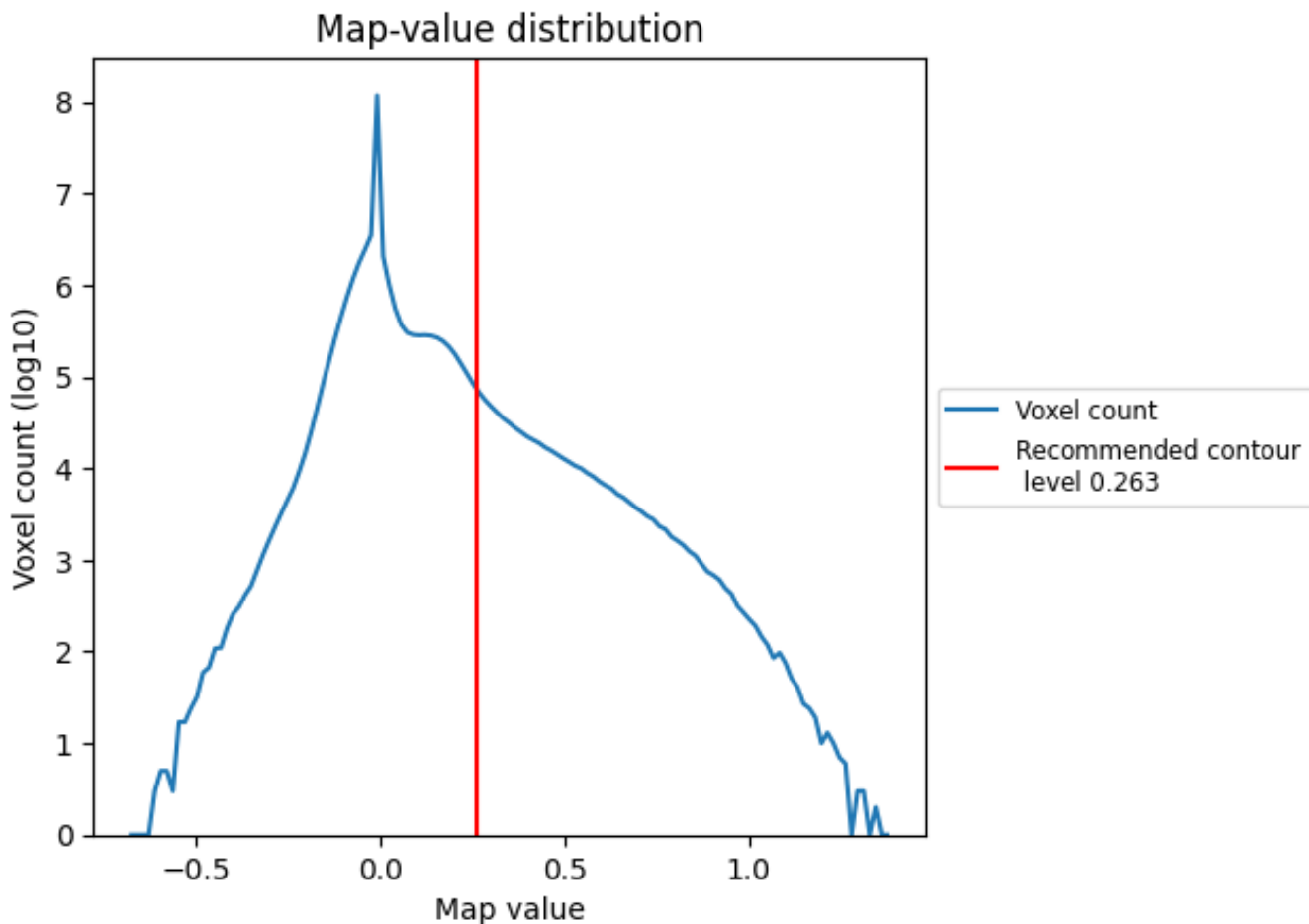
6.5 Mask visualisation

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

7 Map analysis [i](#)

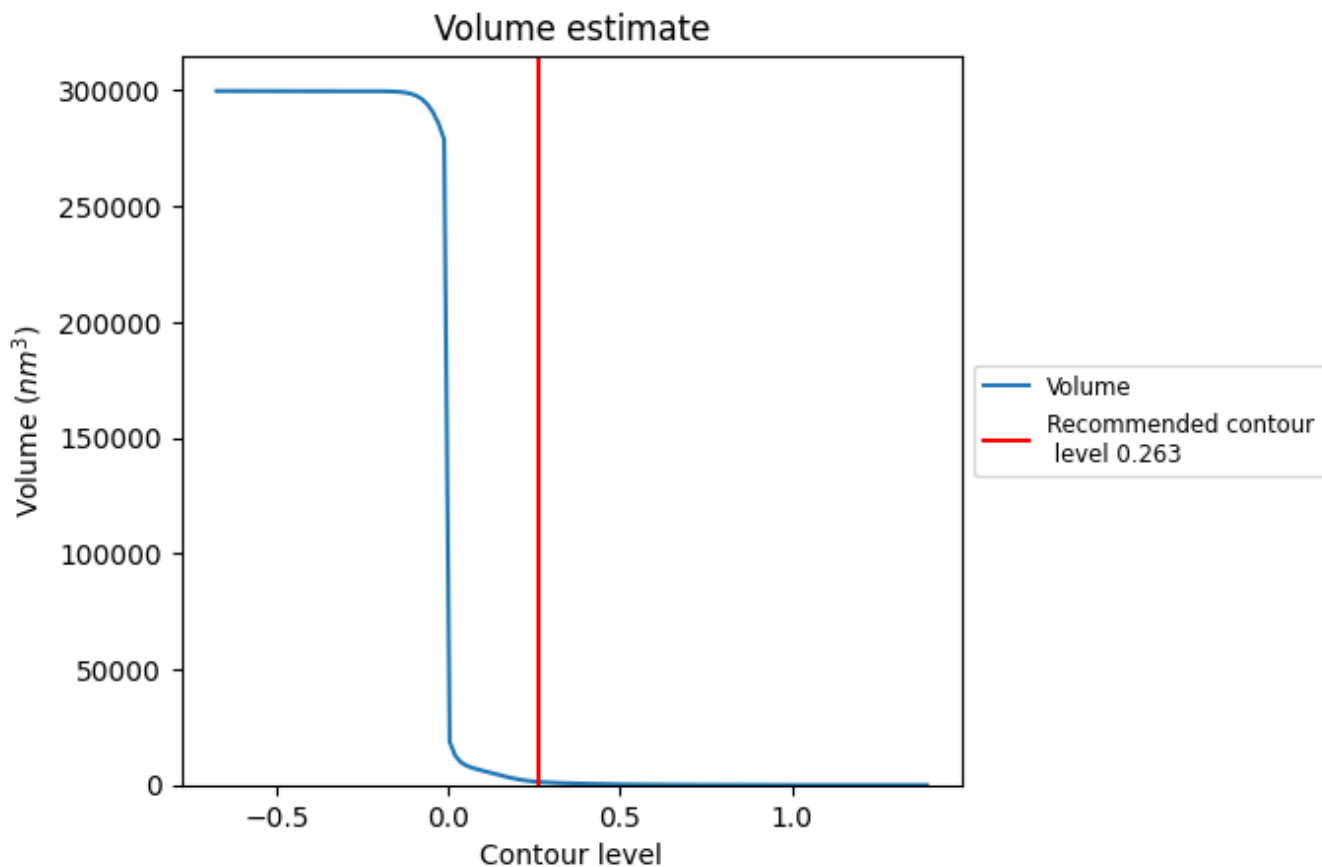
This section contains the results of statistical analysis of the map.

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.

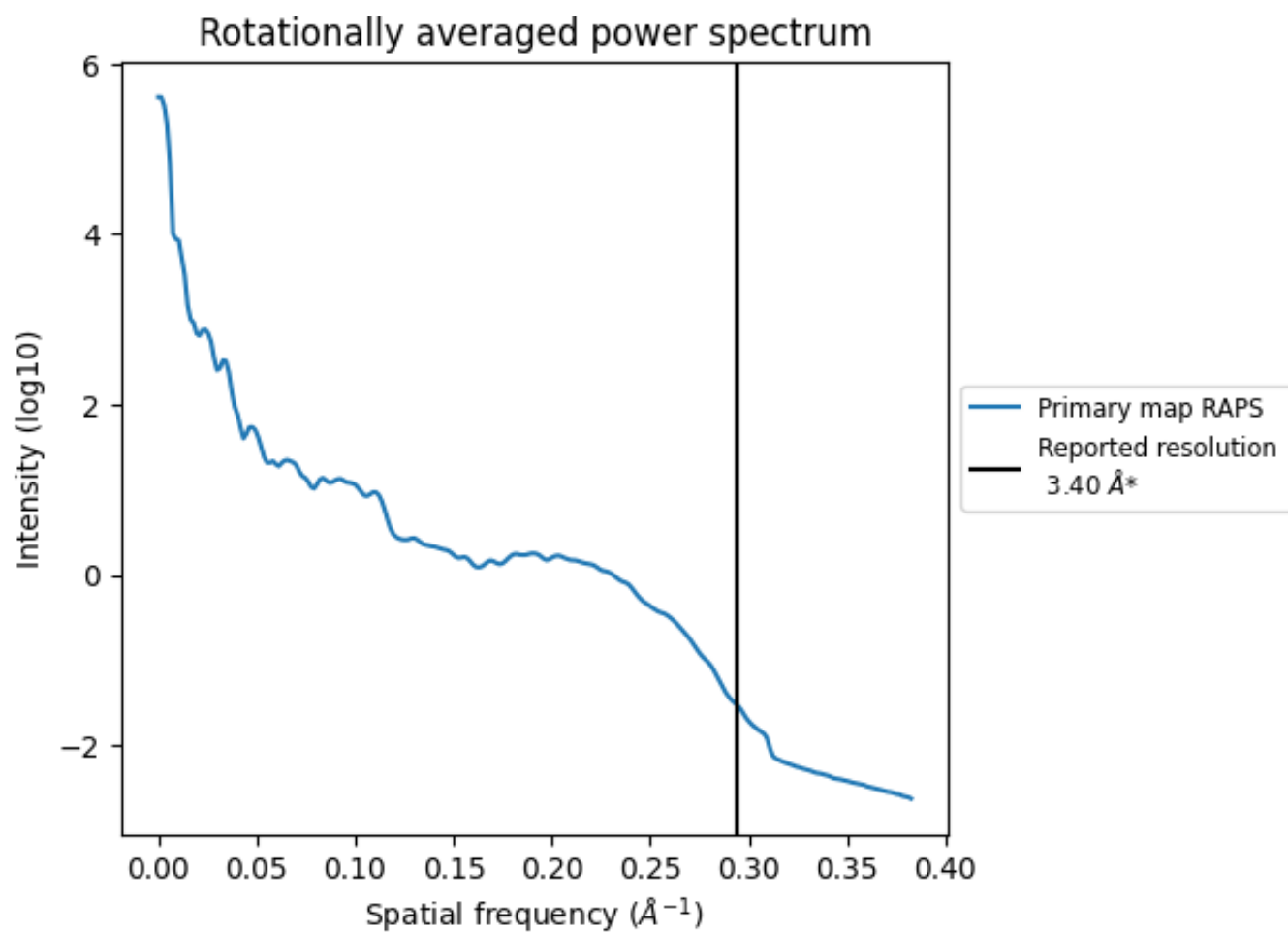
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 1333 nm^3 ; this corresponds to an approximate mass of 1205 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 0.294 \AA^{-1}

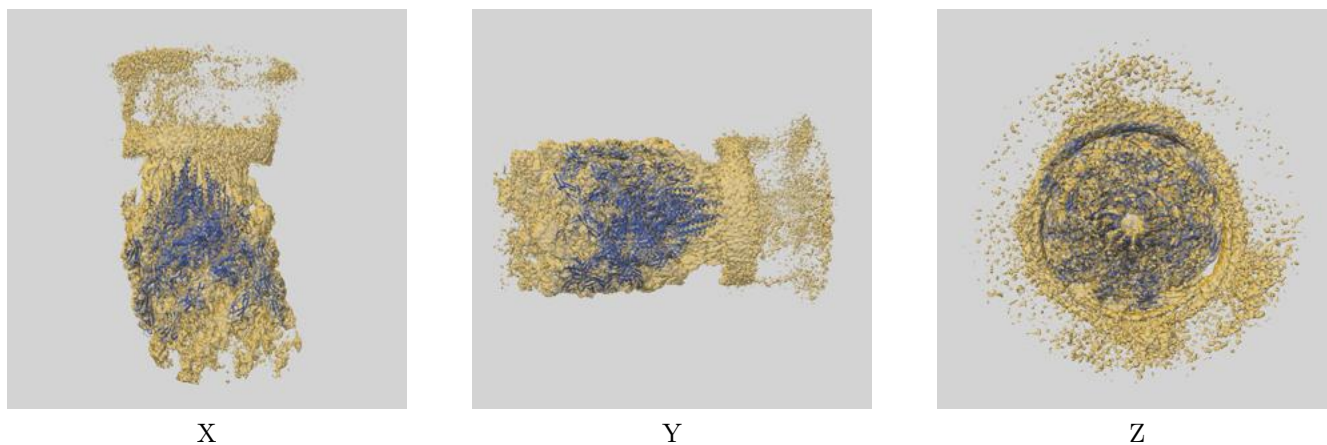
8 Fourier-Shell correlation

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

9 Map-model fit [i](#)

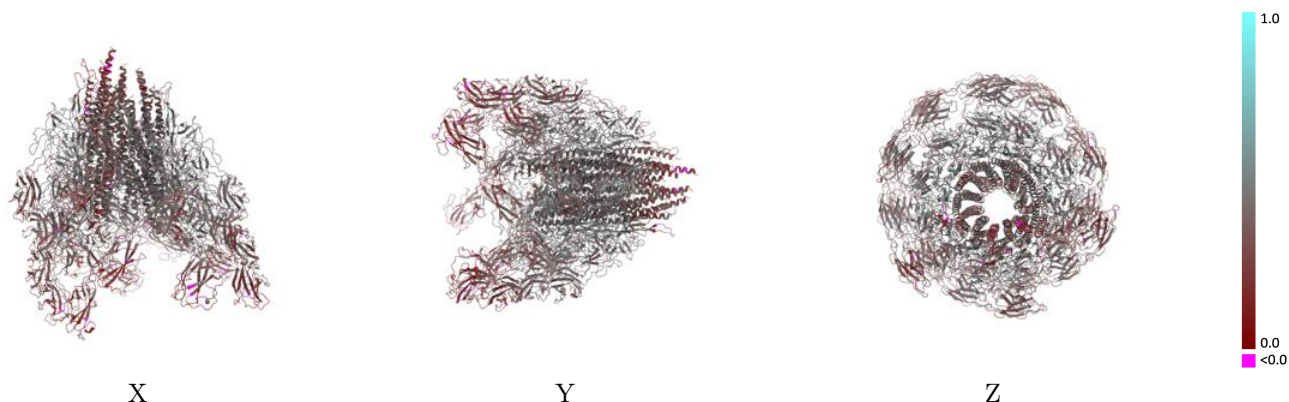
This section contains information regarding the fit between EMDB map EMD-30354 and PDB model 7CGB. Per-residue inclusion information can be found in section 3 on page 6.

9.1 Map-model overlay [i](#)



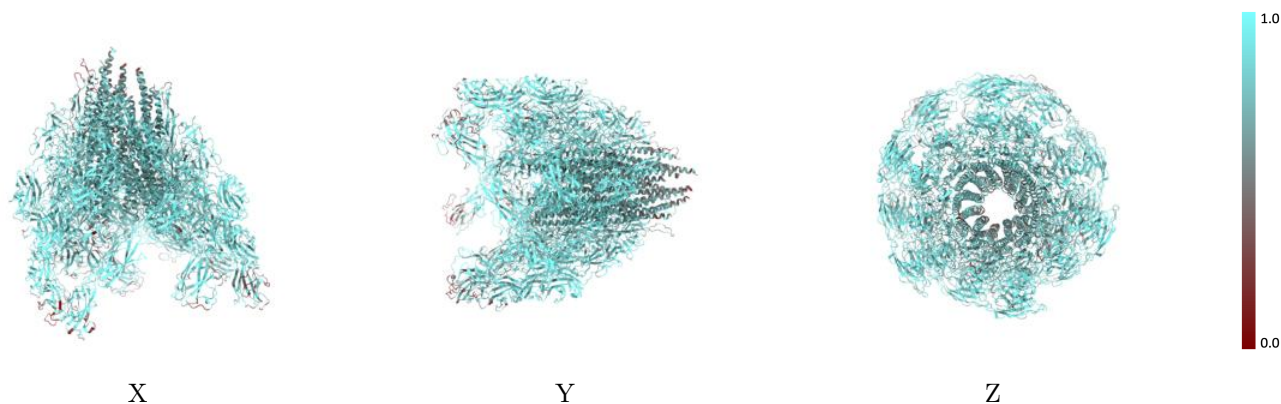
The images above show the 3D surface view of the map at the recommended contour level 0.263 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



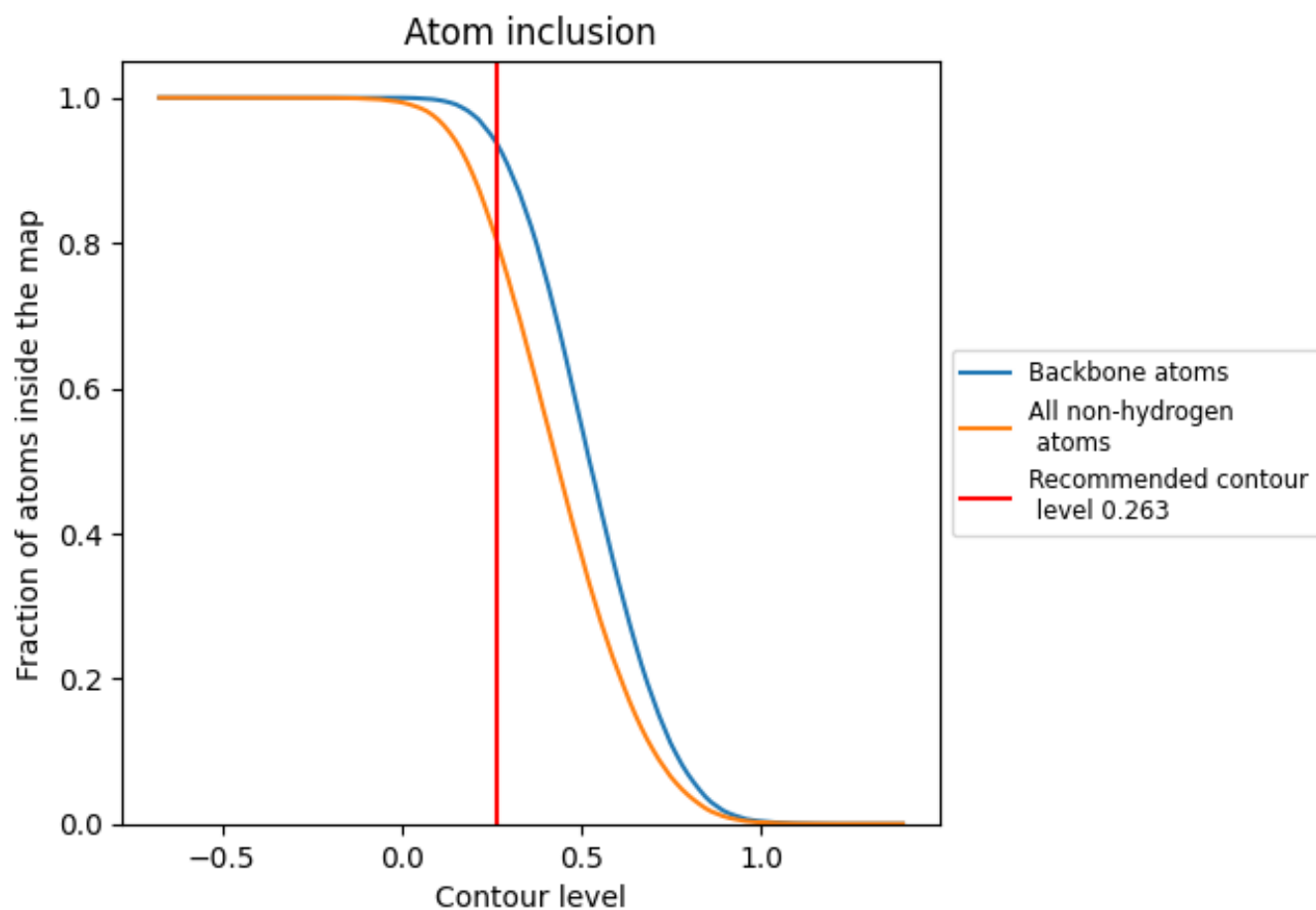
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.263).















































9.4 Atom inclusion [i](#)



At the recommended contour level, 94% of all backbone atoms, 80% 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 (0.263) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8048	 0.3780
DL	 0.7709	 0.3020
DM	 0.7931	 0.3490
DN	 0.7945	 0.3460
DO	 0.8109	 0.3990
DP	 0.8543	 0.4160
DQ	 0.8211	 0.3850
DR	 0.8410	 0.3930
DS	 0.8328	 0.4000
DT	 0.8547	 0.4330
DU	 0.8447	 0.4160
DV	 0.8376	 0.4070
DW	 0.8304	 0.3850
DX	 0.8386	 0.3980
DY	 0.7958	 0.3500
DZ	 0.8143	 0.3920
EA	 0.8447	 0.4190
EB	 0.7890	 0.3620
EC	 0.7733	 0.3470
ED	 0.7127	 0.3460
EE	 0.7367	 0.3370
EF	 0.7733	 0.3700
EG	 0.7425	 0.3580

