



## Full wwPDB EM Validation Report ⓘ

May 26, 2024 – 11:16 AM EDT

PDB ID : 7SN7  
EMDB ID : EMD-25213  
Title : Cryo-EM structure of the enteropathogenic E. coli O127:H6 flagellar filament  
Authors : Kreutzberger, M.A.B.; Chatterjee, S.; Frankel, G.; Egelman, E.H.  
Deposited on : 2021-10-27  
Resolution : 4.20 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

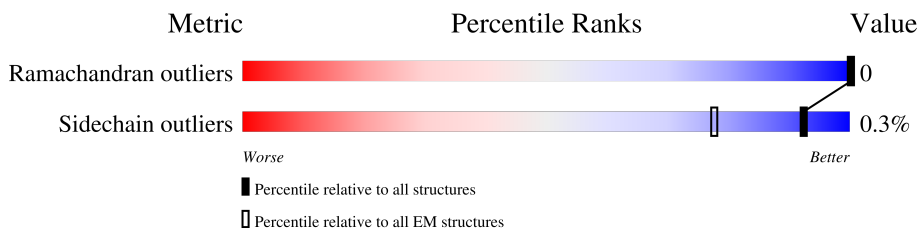
EMDB validation analysis : 0.0.1.dev92  
MolProbity : 4.02b-467  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36.2

# 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 4.20 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)
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion  $< 40\%$ ). The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	546	6% 99% .
1	B	546	9% 100%
1	C	546	12% 100%
1	D	546	8% 100%
1	E	546	20% 100%
1	F	546	10% 100%
1	G	546	24% 100%
1	H	546	24% 100%
1	I	546	14% 100%

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Mol	Chain	Length	Quality of chain
1	J	546	 33% 100%
1	K	546	 20% 100%
1	L	546	 16% 100%
1	M	546	 10% 99%
1	N	546	 12% 99%
1	O	546	 20% 99%
1	a	546	 36% 100%
1	b	546	 27% 99%
1	c	546	 22% 100%
1	d	546	 13% 99%
1	e	546	 18% 100%
1	f	546	 16% 100%
1	g	546	 14% 100%
1	h	546	 16% 100%

## 2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 90482 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	546	3934	2372	686	870	6	0	0
1	B	546	3934	2372	686	870	6	0	0
1	C	546	3934	2372	686	870	6	0	0
1	D	546	3934	2372	686	870	6	0	0
1	E	546	3934	2372	686	870	6	0	0
1	F	546	3934	2372	686	870	6	0	0
1	G	546	3934	2372	686	870	6	0	0
1	H	546	3934	2372	686	870	6	0	0
1	I	546	3934	2372	686	870	6	0	0
1	J	546	3934	2372	686	870	6	0	0
1	K	546	3934	2372	686	870	6	0	0
1	L	546	3934	2372	686	870	6	0	0
1	M	546	3934	2372	686	870	6	0	0
1	N	546	3934	2372	686	870	6	0	0
1	O	546	3934	2372	686	870	6	0	0
1	a	546	3934	2372	686	870	6	0	0
1	b	546	3934	2372	686	870	6	0	0

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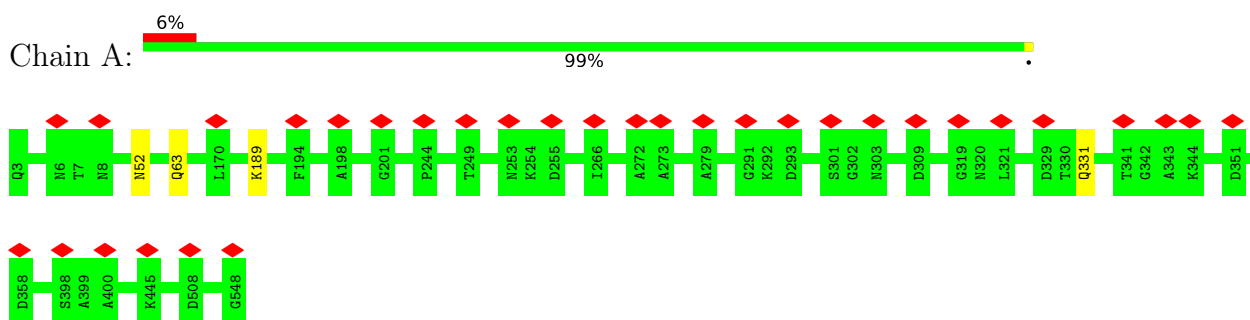
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Mol	Chain	Residues	Atoms					AltConf	Trace
1	c	546	Total 3934	C 2372	N 686	O 870	S 6	0	0
1	d	546	Total 3934	C 2372	N 686	O 870	S 6	0	0
1	e	546	Total 3934	C 2372	N 686	O 870	S 6	0	0
1	f	546	Total 3934	C 2372	N 686	O 870	S 6	0	0
1	g	546	Total 3934	C 2372	N 686	O 870	S 6	0	0
1	h	546	Total 3934	C 2372	N 686	O 870	S 6	0	0

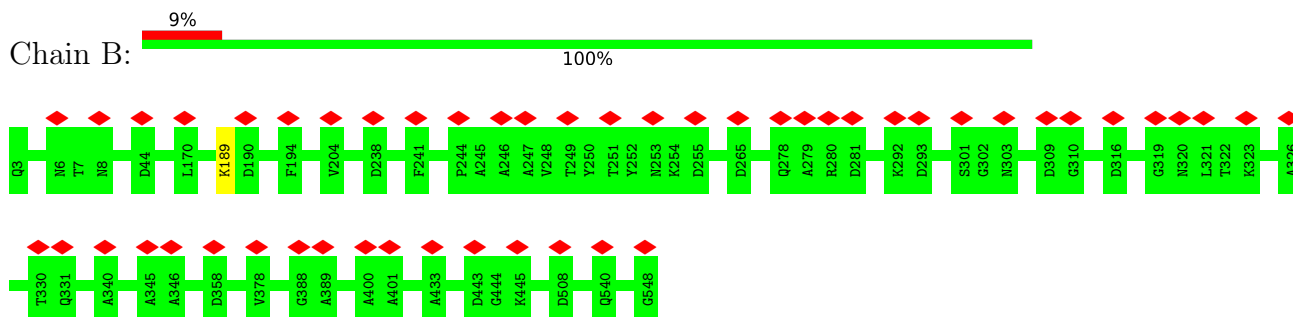
### 3 Residue-property plots [i](#)

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.

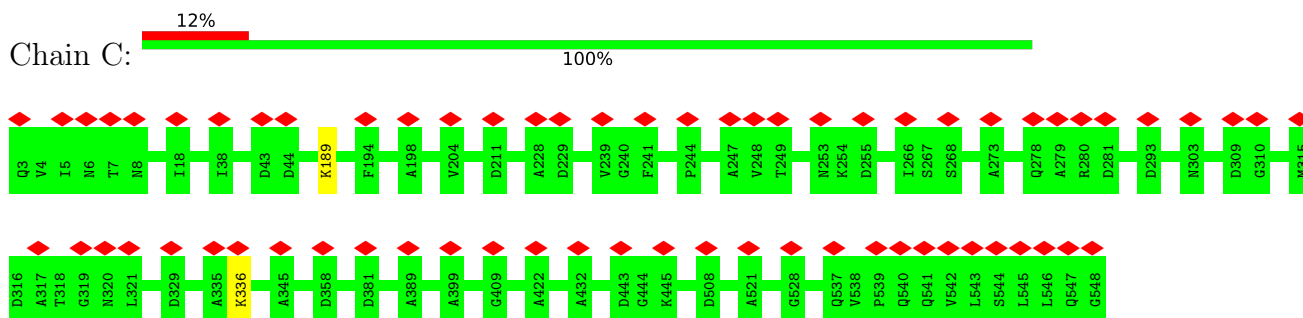
- Molecule 1: Flagellin



- Molecule 1: Flagellin

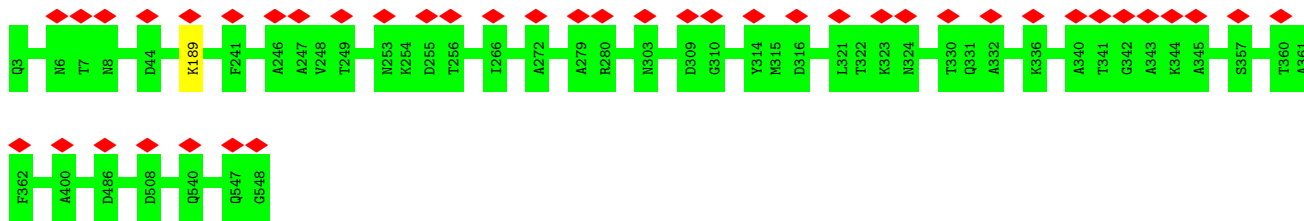


- Molecule 1: Flagellin

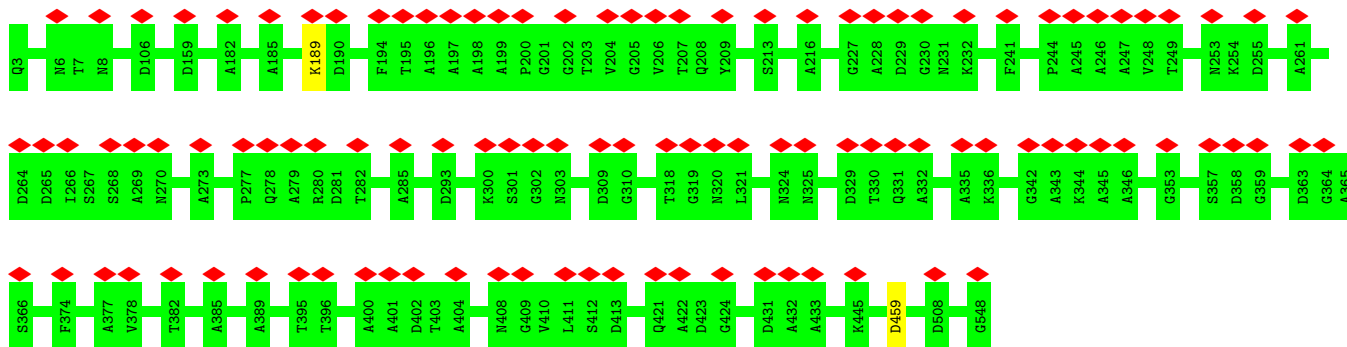


- Molecule 1: Flagellin

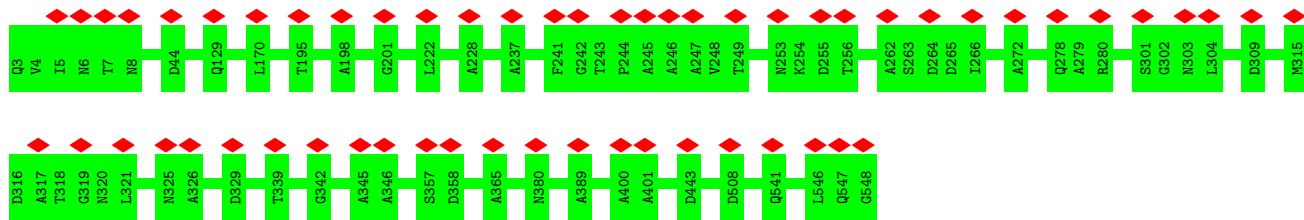




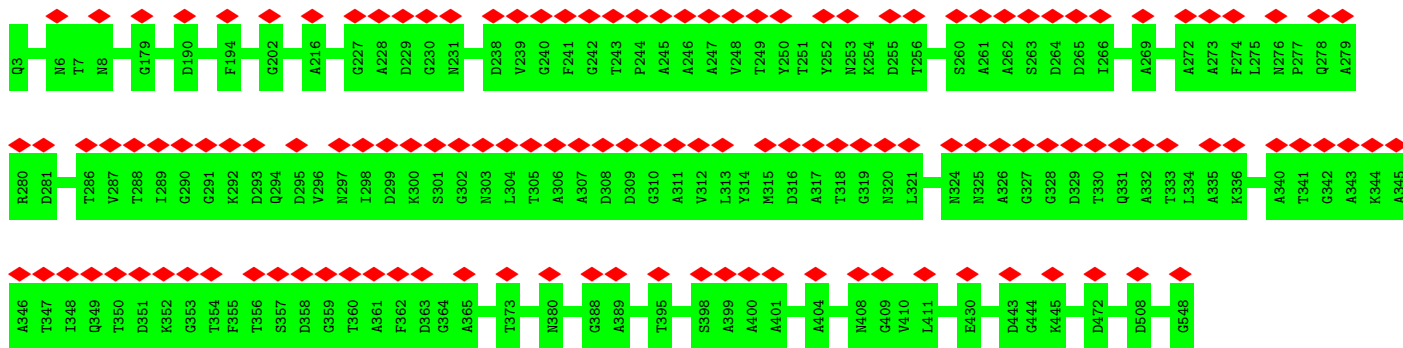
• Molecule 1: Flagellin



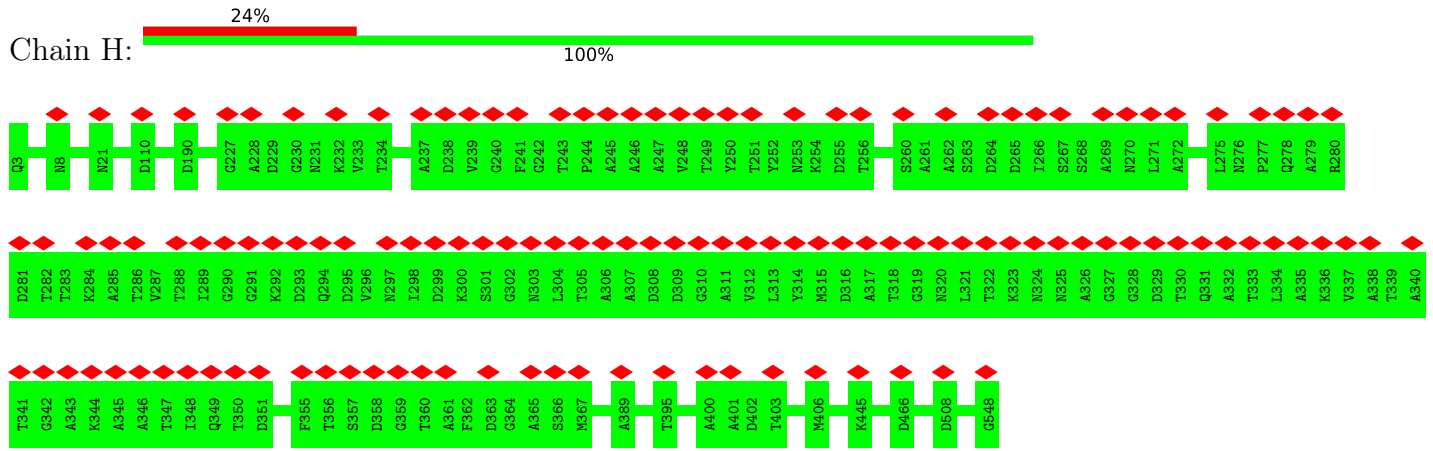
• Molecule 1: Flagellin



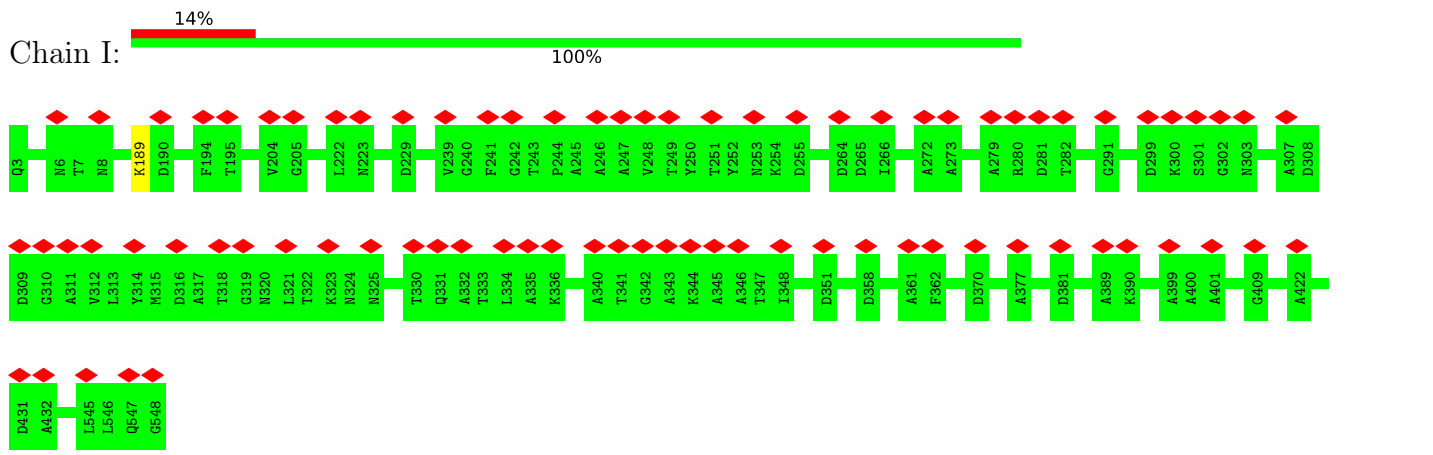
• Molecule 1: Flagellin



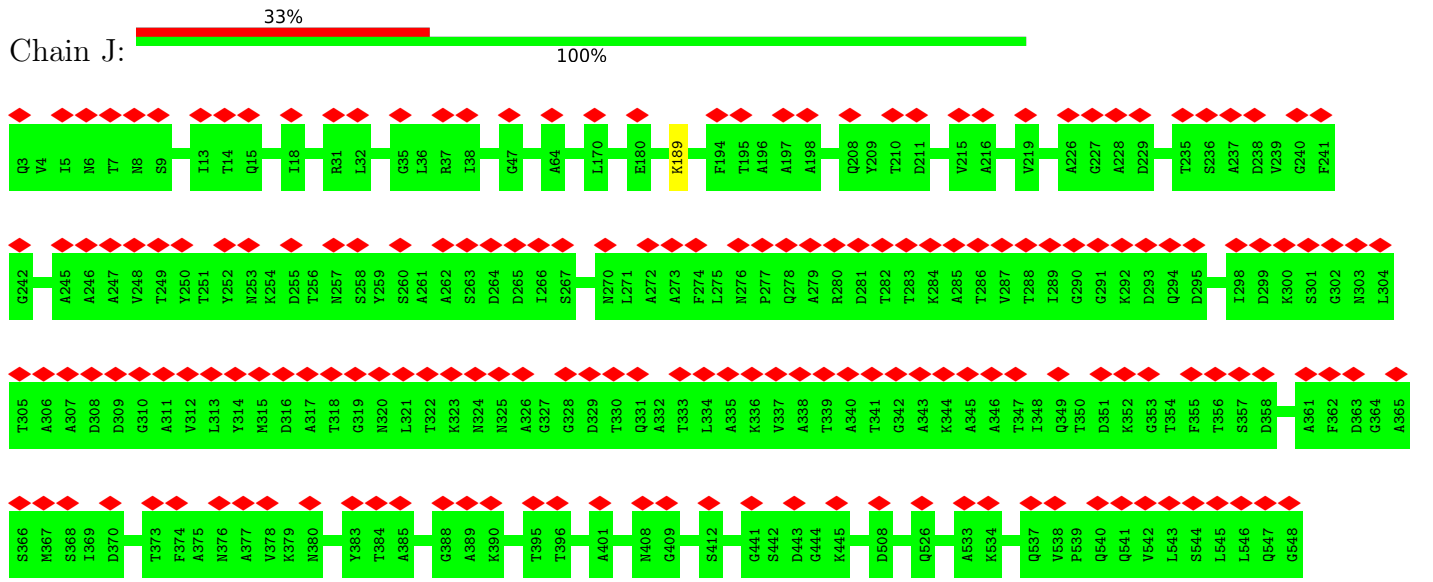
• Molecule 1: Flagellin



• Molecule 1: Flagellin



• Molecule 1: Flagellin

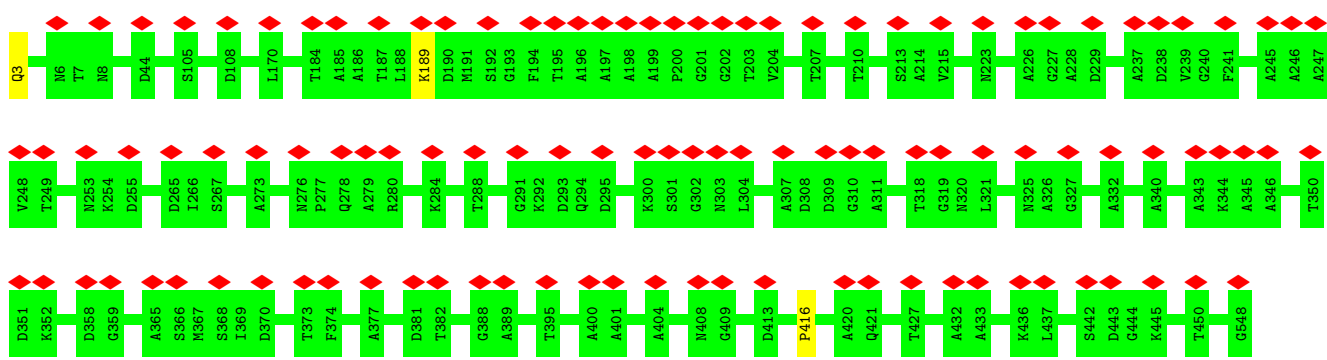


• Molecule 1: Flagellin





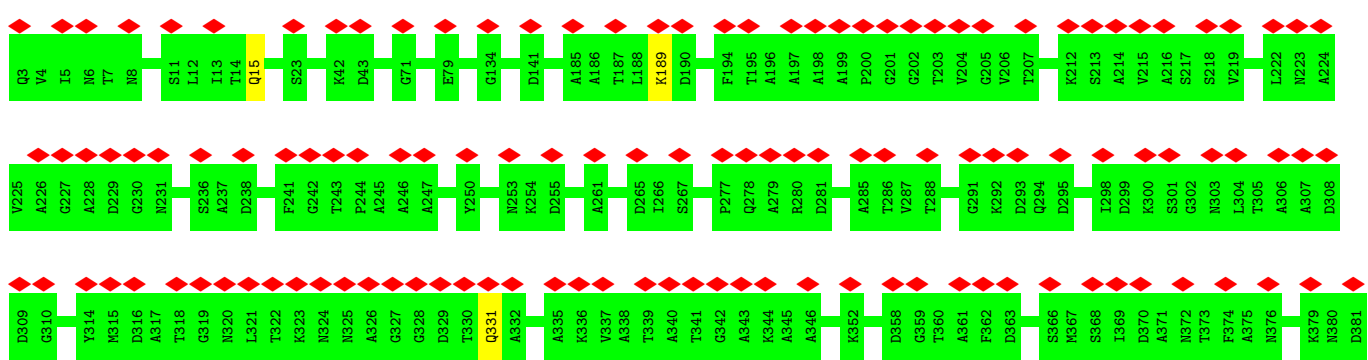


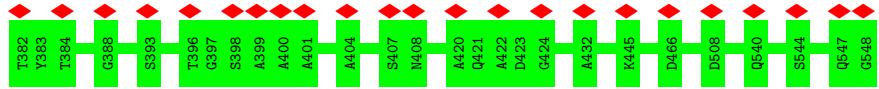


• Molecule 1: Flagellin

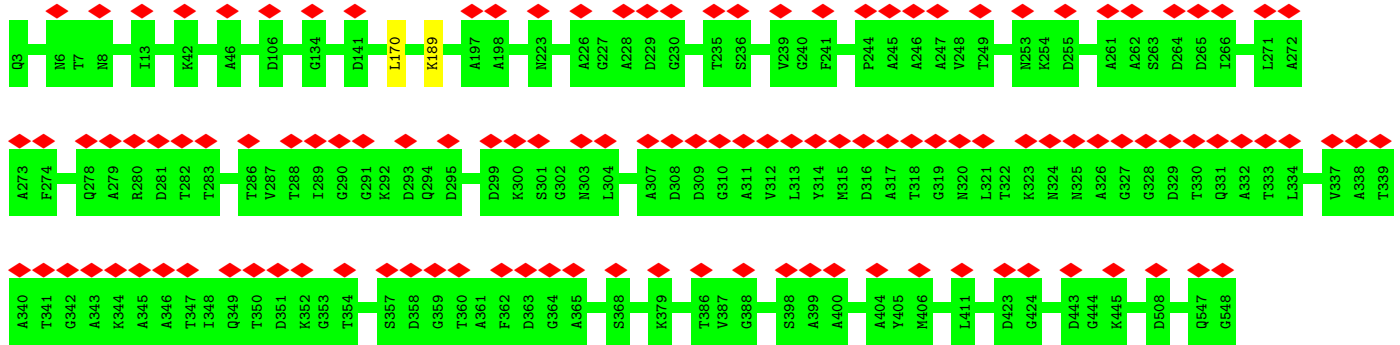


• Molecule 1: Flagellin

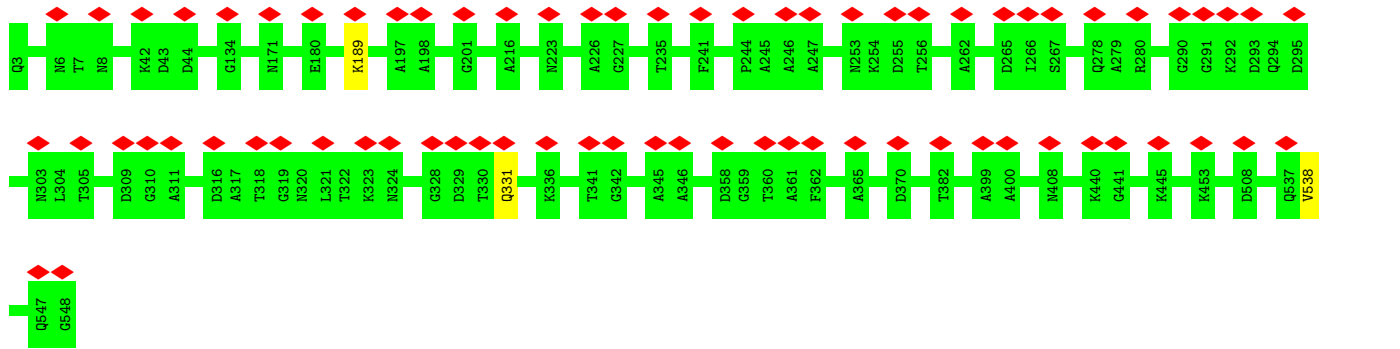




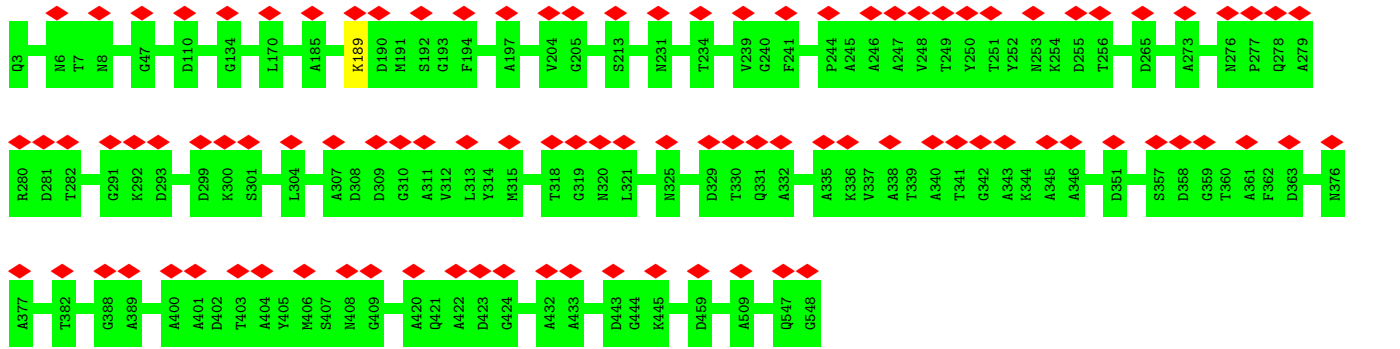
• Molecule 1: Flagellin



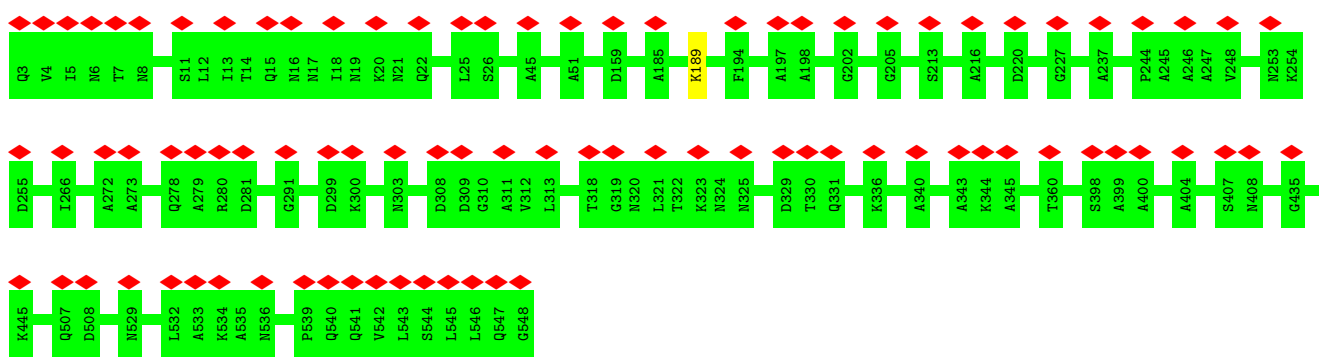
• Molecule 1: Flagellin



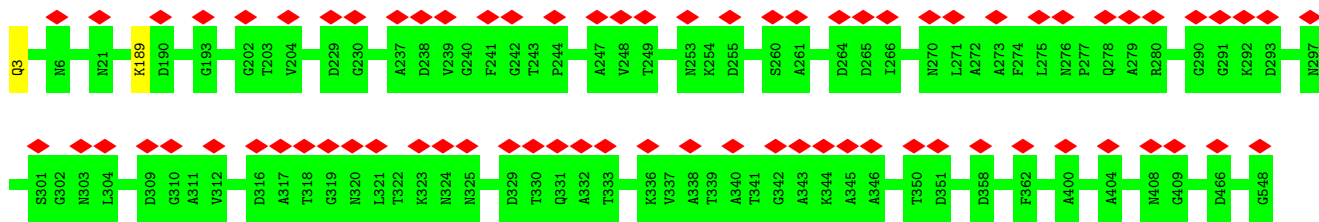
• Molecule 1: Flagellin



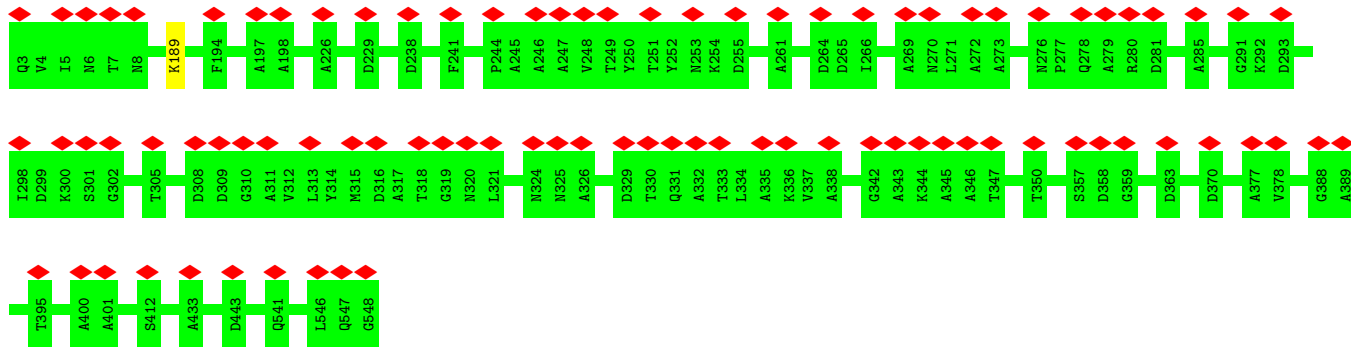
• Molecule 1: Flagellin



• Molecule 1: Flagellin



• Molecule 1: Flagellin



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	269269	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)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.807	Depositor
Minimum map value	-1.047	Depositor
Average map value	0.004	Depositor
Map value standard deviation	0.070	Depositor
Recommended contour level	0.203	Depositor
Map size ( $\text{\AA}$ )	414.72003, 414.72003, 414.72003	wwPDB
Map dimensions	384, 384, 384	wwPDB
Map angles ( $^\circ$ )	90.0, 90.0, 90.0	wwPDB
Pixel spacing ( $\text{\AA}$ )	1.08, 1.08, 1.08	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	0/3962	0.50	0/5384
1	B	0.26	0/3962	0.50	0/5384
1	C	0.26	0/3962	0.51	0/5384
1	D	0.26	0/3962	0.52	0/5384
1	E	0.26	0/3962	0.52	1/5384 (0.0%)
1	F	0.26	0/3962	0.50	0/5384
1	G	0.26	0/3962	0.50	0/5384
1	H	0.26	0/3962	0.50	0/5384
1	I	0.25	0/3962	0.51	0/5384
1	J	0.25	0/3962	0.49	0/5384
1	K	0.25	0/3962	0.49	0/5384
1	L	0.26	0/3962	0.51	0/5384
1	M	0.26	0/3962	0.50	0/5384
1	N	0.25	0/3962	0.51	1/5384 (0.0%)
1	O	0.26	0/3962	0.52	1/5384 (0.0%)
1	a	0.25	0/3962	0.50	0/5384
1	b	0.26	0/3962	0.51	0/5384
1	c	0.26	0/3962	0.52	1/5384 (0.0%)
1	d	0.26	0/3962	0.51	0/5384
1	e	0.26	0/3962	0.52	0/5384
1	f	0.26	0/3962	0.51	0/5384
1	g	0.27	0/3962	0.50	0/5384
1	h	0.26	0/3962	0.50	0/5384
All	All	0.26	0/91126	0.51	4/123832 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	d	0	1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	O	416	PRO	CA-N-CD	-6.85	101.92	111.50
1	E	459	ASP	CB-CG-OD1	6.74	124.37	118.30
1	c	170	LEU	CA-CB-CG	5.59	128.17	115.30
1	N	170	LEU	CA-CB-CG	5.40	127.72	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	d	538	VAL	Peptide

## 5.2 Too-close contacts [i](#)

Due to software issues we are unable to calculate clashes - this section is therefore empty.

## 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	544/546 (100%)	503 (92%)	41 (8%)	0	100	100
1	B	544/546 (100%)	500 (92%)	44 (8%)	0	100	100
1	C	544/546 (100%)	497 (91%)	47 (9%)	0	100	100
1	D	544/546 (100%)	495 (91%)	49 (9%)	0	100	100
1	E	544/546 (100%)	500 (92%)	44 (8%)	0	100	100
1	F	544/546 (100%)	499 (92%)	45 (8%)	0	100	100
1	G	544/546 (100%)	499 (92%)	45 (8%)	0	100	100
1	H	544/546 (100%)	499 (92%)	45 (8%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	I	544/546 (100%)	496 (91%)	48 (9%)	0	100	100
1	J	544/546 (100%)	504 (93%)	40 (7%)	0	100	100
1	K	544/546 (100%)	503 (92%)	41 (8%)	0	100	100
1	L	544/546 (100%)	493 (91%)	51 (9%)	0	100	100
1	M	544/546 (100%)	505 (93%)	39 (7%)	0	100	100
1	N	544/546 (100%)	494 (91%)	50 (9%)	0	100	100
1	O	544/546 (100%)	499 (92%)	45 (8%)	0	100	100
1	a	544/546 (100%)	496 (91%)	48 (9%)	0	100	100
1	b	544/546 (100%)	496 (91%)	48 (9%)	0	100	100
1	c	544/546 (100%)	495 (91%)	49 (9%)	0	100	100
1	d	544/546 (100%)	501 (92%)	43 (8%)	0	100	100
1	e	544/546 (100%)	504 (93%)	40 (7%)	0	100	100
1	f	544/546 (100%)	495 (91%)	49 (9%)	0	100	100
1	g	544/546 (100%)	500 (92%)	44 (8%)	0	100	100
1	h	544/546 (100%)	504 (93%)	40 (7%)	0	100	100
All	All	12512/12558 (100%)	11477 (92%)	1035 (8%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	424/424 (100%)	420 (99%)	4 (1%)	78	87
1	B	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	C	424/424 (100%)	422 (100%)	2 (0%)	88	93
1	D	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	E	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	F	424/424 (100%)	424 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	G	424/424 (100%)	424 (100%)	0	100	100
1	H	424/424 (100%)	424 (100%)	0	100	100
1	I	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	J	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	K	424/424 (100%)	422 (100%)	2 (0%)	88	93
1	L	424/424 (100%)	424 (100%)	0	100	100
1	M	424/424 (100%)	421 (99%)	3 (1%)	84	90
1	N	424/424 (100%)	422 (100%)	2 (0%)	88	93
1	O	424/424 (100%)	422 (100%)	2 (0%)	88	93
1	a	424/424 (100%)	422 (100%)	2 (0%)	88	93
1	b	424/424 (100%)	421 (99%)	3 (1%)	84	90
1	c	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	d	424/424 (100%)	422 (100%)	2 (0%)	88	93
1	e	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	f	424/424 (100%)	423 (100%)	1 (0%)	93	96
1	g	424/424 (100%)	422 (100%)	2 (0%)	88	93
1	h	424/424 (100%)	423 (100%)	1 (0%)	93	96
All	All	9752/9752 (100%)	9719 (100%)	33 (0%)	92	95

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	52	ASN
1	A	63	GLN
1	A	189	LYS
1	A	331	GLN
1	B	189	LYS
1	C	189	LYS
1	C	336	LYS
1	D	189	LYS
1	E	189	LYS
1	I	189	LYS
1	J	189	LYS
1	K	63	GLN
1	K	189	LYS
1	M	3	GLN

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Mol	Chain	Res	Type
1	M	63	GLN
1	M	189	LYS
1	N	189	LYS
1	N	331	GLN
1	O	3	GLN
1	O	189	LYS
1	a	86	ASN
1	a	189	LYS
1	b	15	GLN
1	b	189	LYS
1	b	331	GLN
1	c	189	LYS
1	d	189	LYS
1	d	331	GLN
1	e	189	LYS
1	f	189	LYS
1	g	3	GLN
1	g	189	LYS
1	h	189	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (79) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	90	GLN
1	A	98	GLN
1	A	324	ASN
1	B	52	ASN
1	B	129	GLN
1	B	154	GLN
1	C	98	GLN
1	D	63	GLN
1	D	129	GLN
1	D	331	GLN
1	D	529	ASN
1	E	63	GLN
1	E	331	GLN
1	F	6	ASN
1	F	15	GLN
1	F	90	GLN
1	F	133	ASN
1	F	331	GLN
1	F	491	ASN

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	F	507	GLN
1	G	331	GLN
1	H	52	ASN
1	H	131	GLN
1	H	174	ASN
1	H	331	GLN
1	H	491	ASN
1	I	15	GLN
1	I	63	GLN
1	I	278	GLN
1	I	331	GLN
1	J	86	ASN
1	J	331	GLN
1	K	52	ASN
1	K	331	GLN
1	K	522	GLN
1	K	525	GLN
1	K	529	ASN
1	L	86	ASN
1	L	90	GLN
1	L	154	GLN
1	L	176	ASN
1	L	331	GLN
1	M	67	ASN
1	M	331	GLN
1	M	529	ASN
1	N	278	GLN
1	O	331	GLN
1	O	503	GLN
1	O	507	GLN
1	a	52	ASN
1	a	63	GLN
1	a	276	ASN
1	b	86	ASN
1	b	294	GLN
1	b	525	GLN
1	c	67	ASN
1	c	86	ASN
1	c	98	GLN
1	c	133	ASN
1	c	331	GLN
1	d	67	ASN

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Mol	Chain	Res	Type
1	d	86	ASN
1	d	90	GLN
1	d	98	GLN
1	e	21	ASN
1	e	63	GLN
1	e	86	ASN
1	e	174	ASN
1	e	324	ASN
1	e	331	GLN
1	e	529	ASN
1	f	320	ASN
1	f	331	GLN
1	g	17	ASN
1	g	90	GLN
1	g	151	ASN
1	g	331	GLN
1	g	525	GLN
1	h	331	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

There are no chain breaks in this entry.

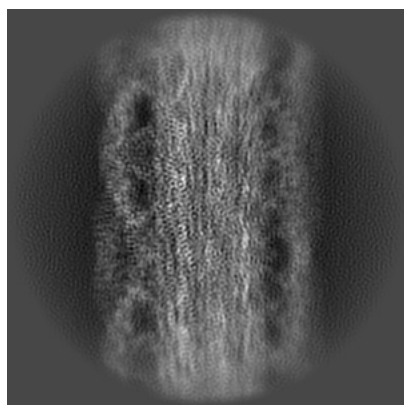
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-25213. These allow visual inspection of the internal detail of the map and identification of artifacts.

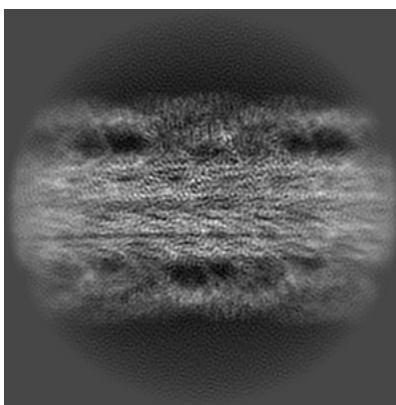
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

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

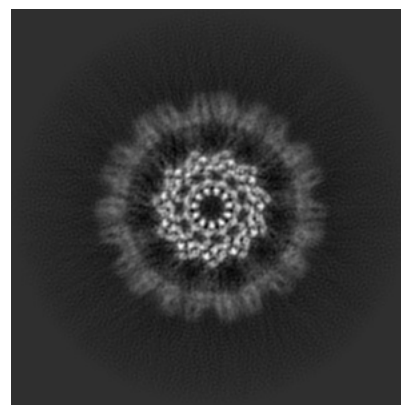
#### 6.1.1 Primary map



X



Y

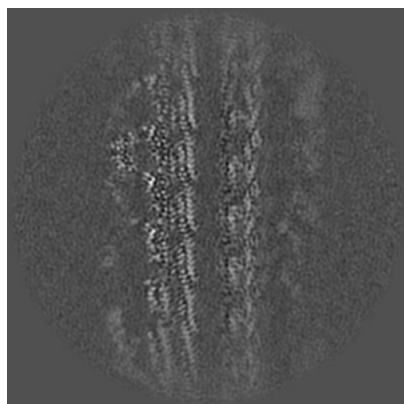


Z

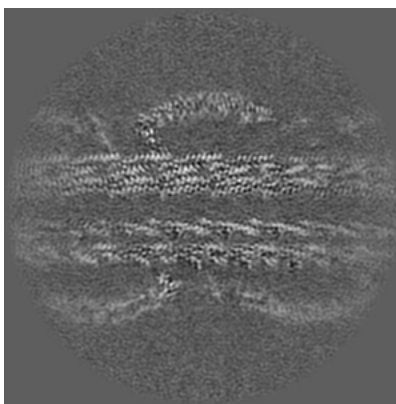
The images above show the map projected in three orthogonal directions.

### 6.2 Central slices [i](#)

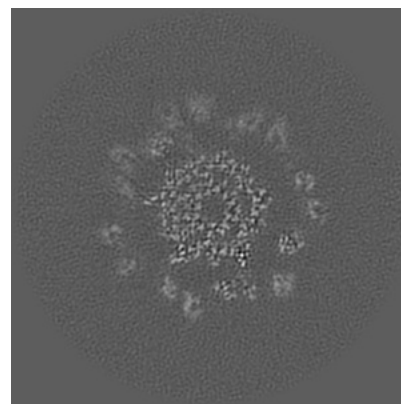
#### 6.2.1 Primary map



X Index: 192



Y Index: 192

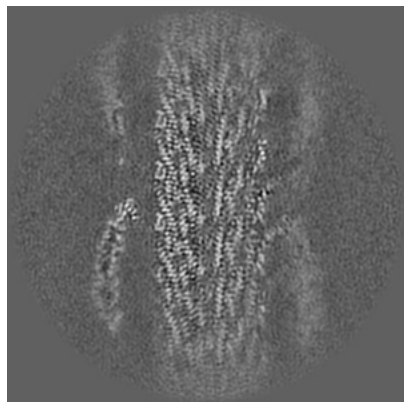


Z Index: 192

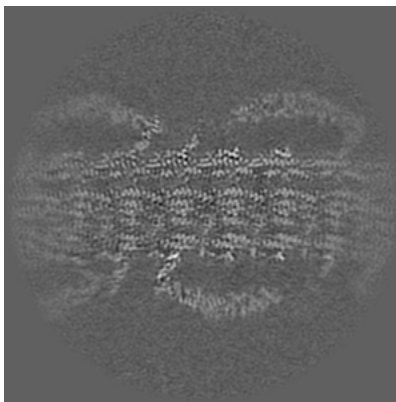
The images above show central slices of the map in three orthogonal directions.

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

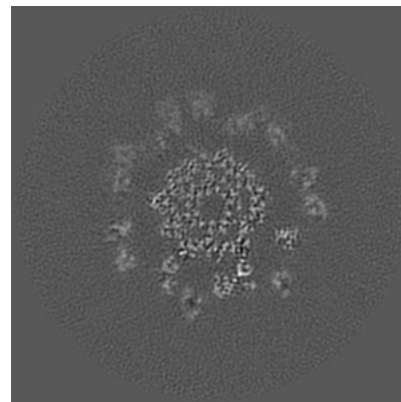
### 6.3.1 Primary map



X Index: 205



Y Index: 170

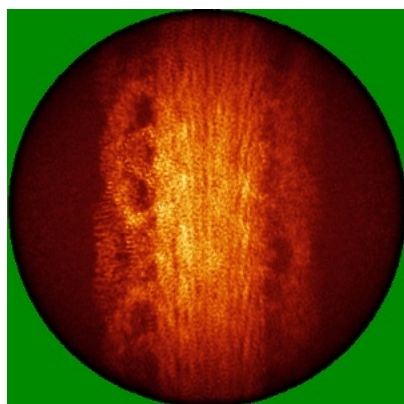


Z Index: 187

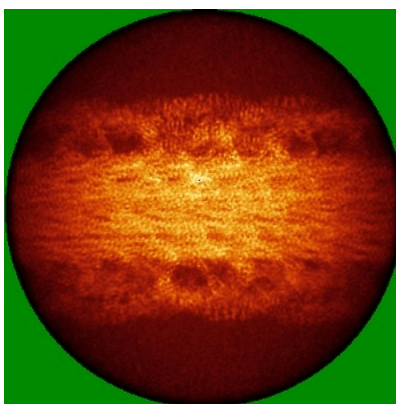
The images above show the largest variance slices of the map in three orthogonal directions.

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

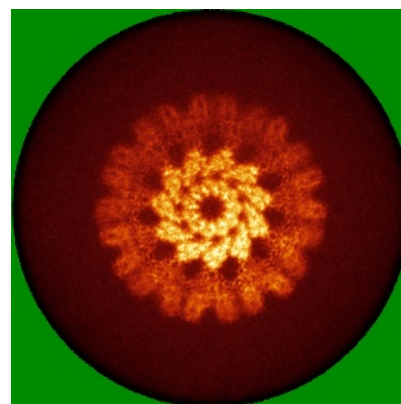
### 6.4.1 Primary map



X



Y

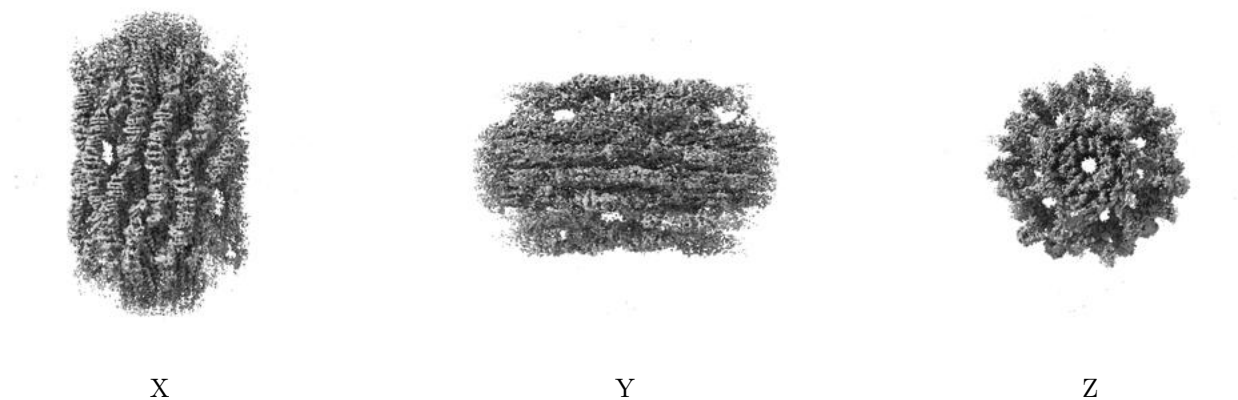


Z

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

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

### 6.5.1 Primary map



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

## 6.6 Mask visualisation [i](#)

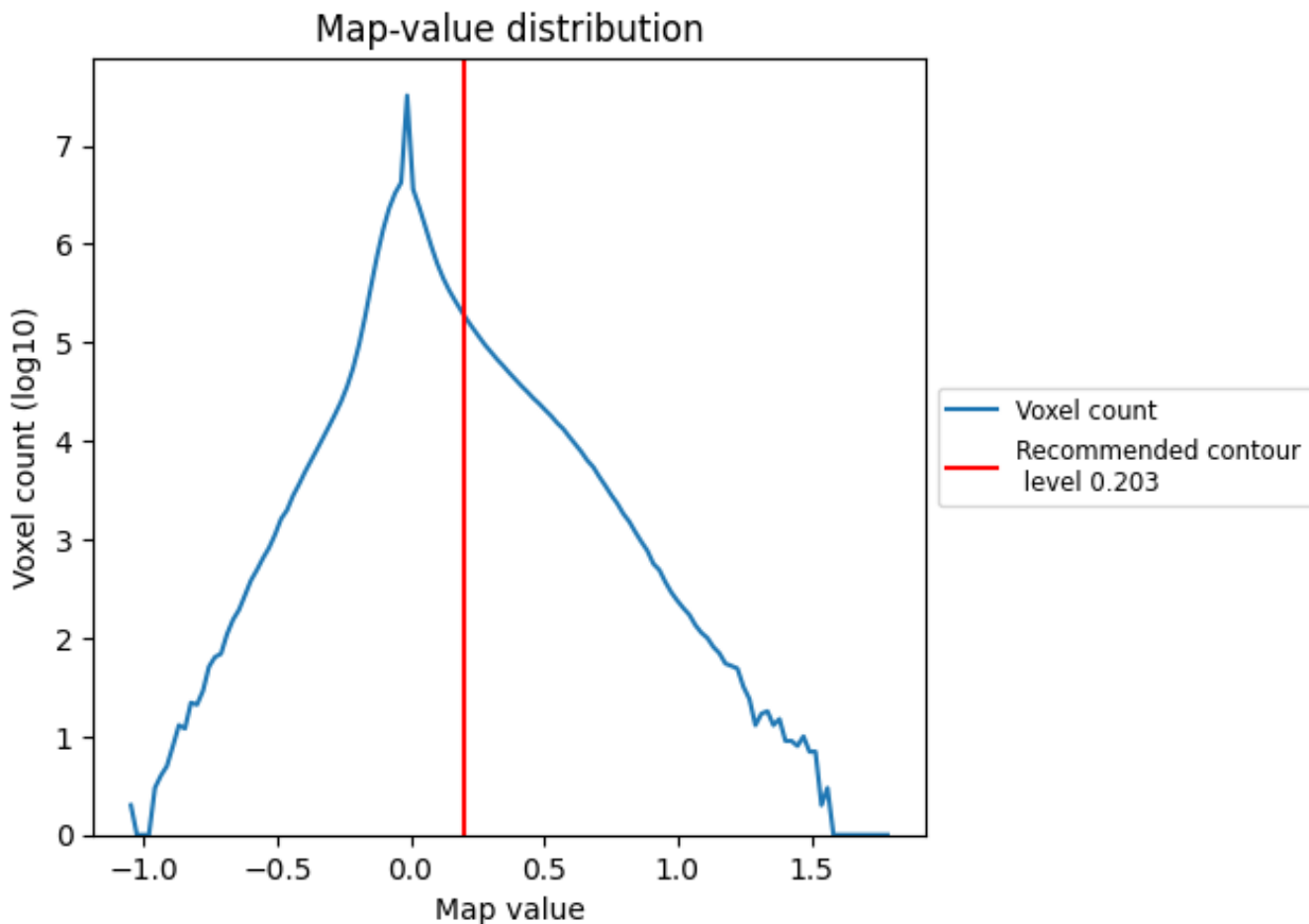
This section was not generated. No masks/segmentation were deposited.



## 7 Map analysis [i](#)

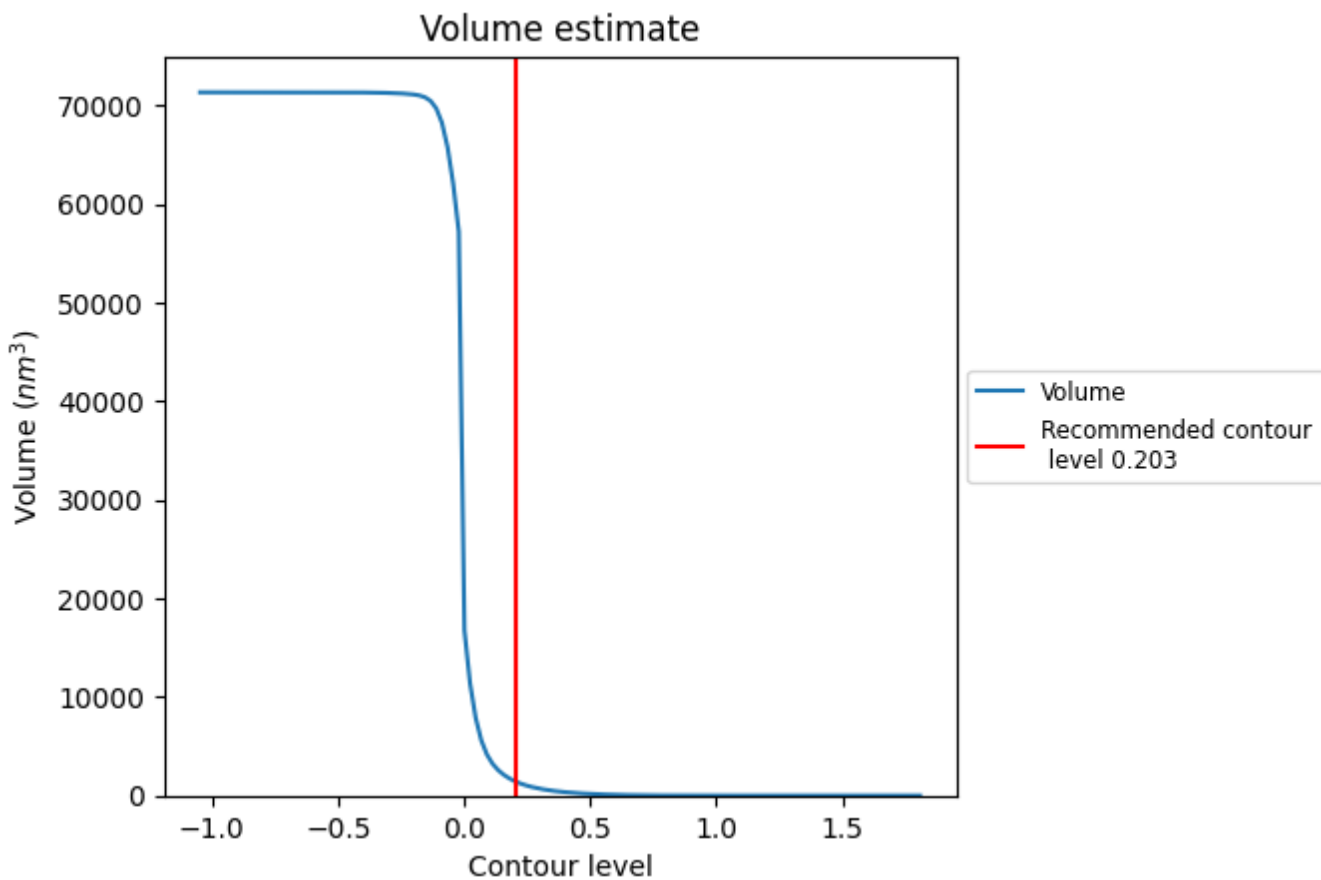
This section contains the results of statistical analysis of the map.

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



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

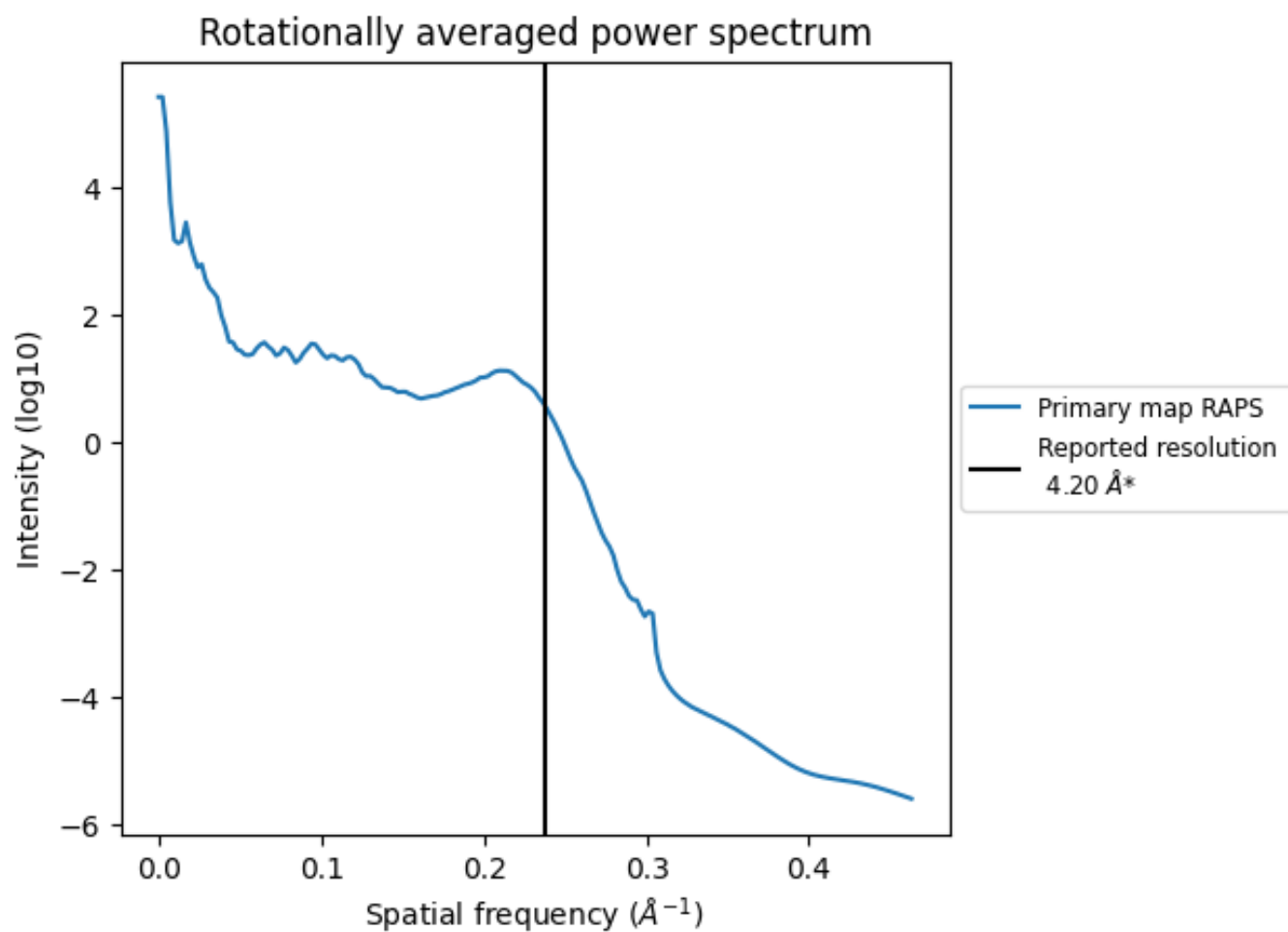
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 1436 nm<sup>3</sup>; this corresponds to an approximate mass of 1297 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  $0.238 \text{\AA}^{-1}$

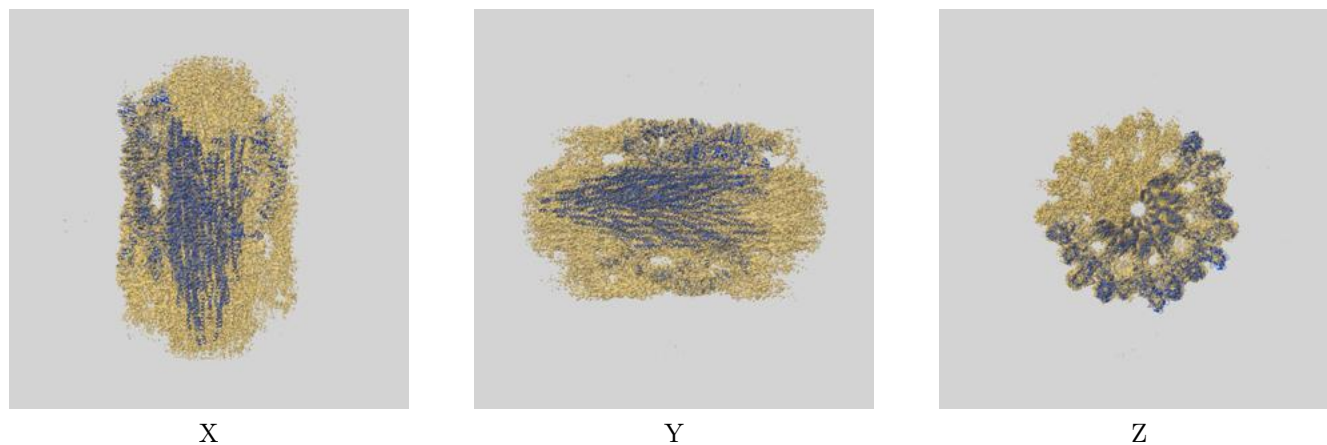
## 8 Fourier-Shell correlation

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

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

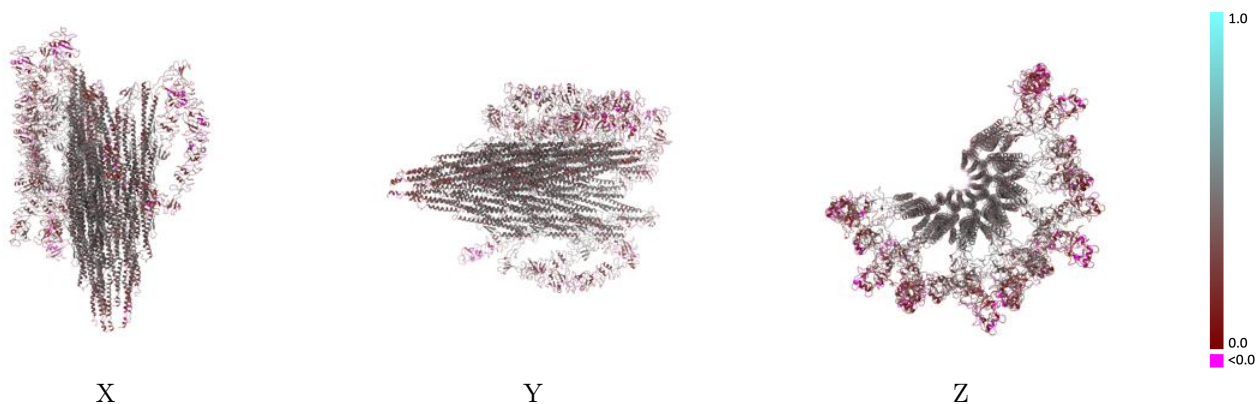
This section contains information regarding the fit between EMDB map EMD-25213 and PDB model 7SN7. Per-residue inclusion information can be found in section 3 on page 6.

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



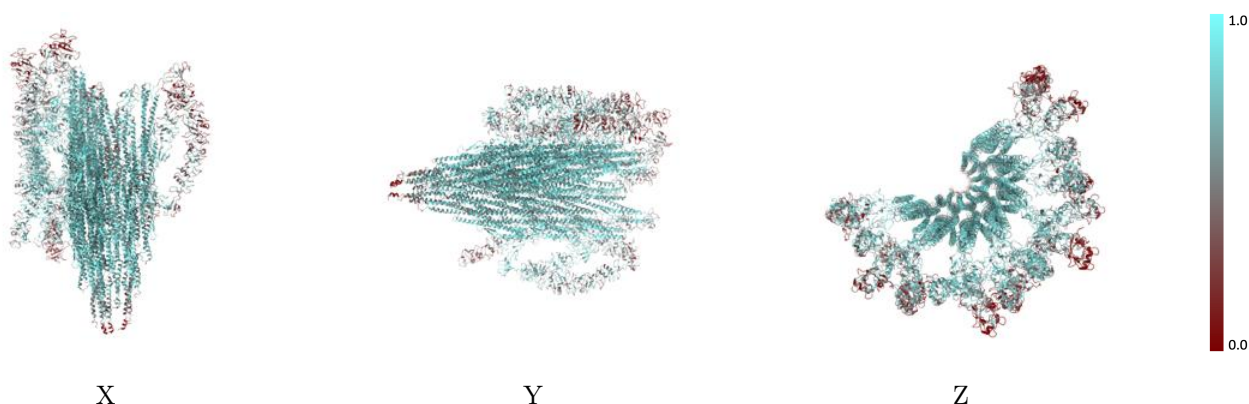
The images above show the 3D surface view of the map at the recommended contour level 0.203 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



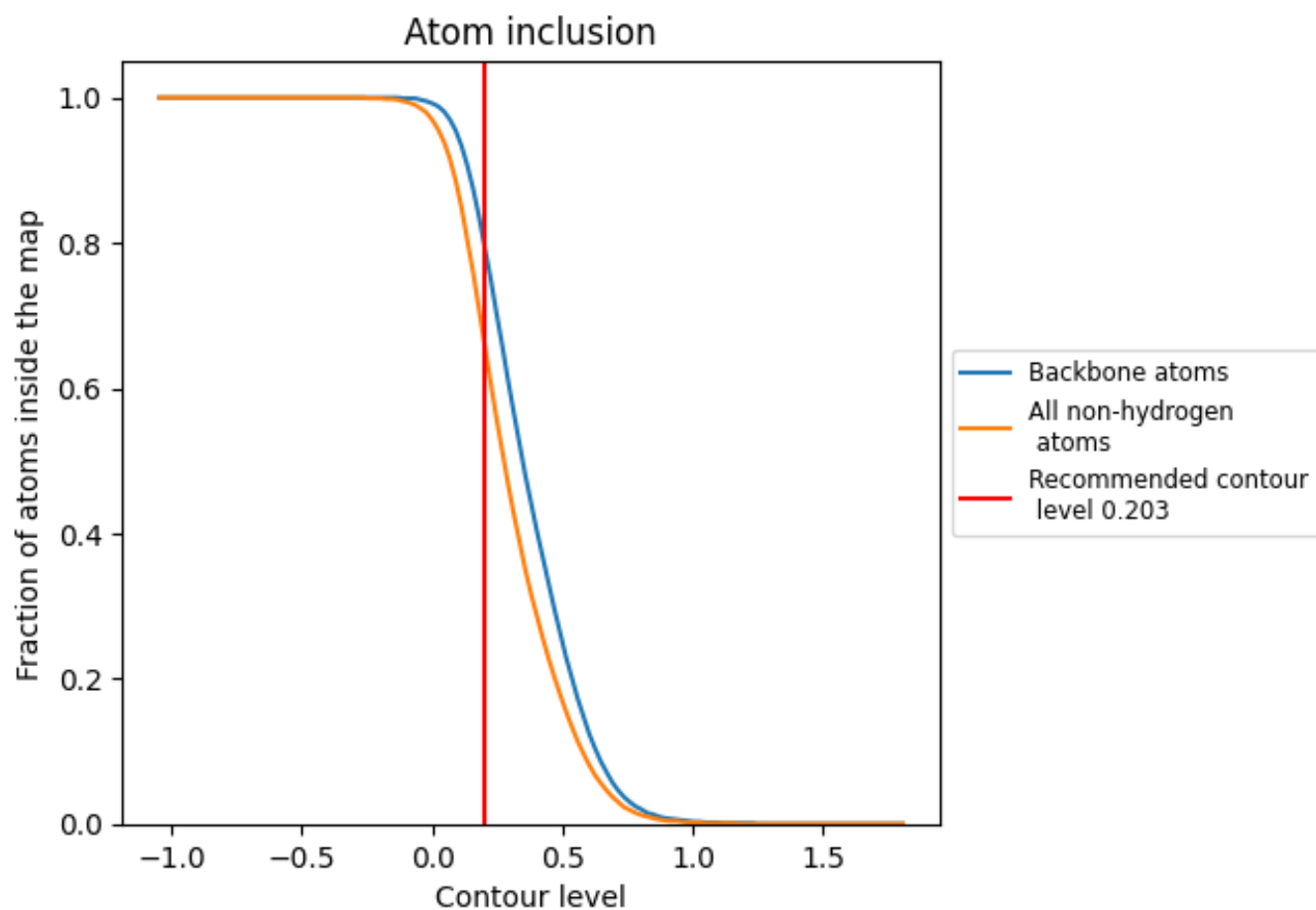
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

## 9.3 Atom inclusion mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.203).

















































## 9.4 Atom inclusion [i](#)



At the recommended contour level, 79% of all backbone atoms, 66% of all non-hydrogen atoms, are inside the map.

## 9.5 Map-model fit summary

The table lists the average atom inclusion at the recommended contour level (0.203) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.6570	 0.3430
A	 0.7600	 0.4000
B	 0.7310	 0.3710
C	 0.6900	 0.3640
D	 0.7430	 0.3880
E	 0.6320	 0.3370
F	 0.7120	 0.3610
G	 0.6220	 0.3400
H	 0.6190	 0.3280
I	 0.6880	 0.3580
J	 0.5420	 0.2860
K	 0.6230	 0.3330
L	 0.6680	 0.3500
M	 0.7120	 0.3510
N	 0.6790	 0.3380
O	 0.6450	 0.3250
a	 0.5210	 0.2830
b	 0.5730	 0.2960
c	 0.6110	 0.3280
d	 0.6800	 0.3630
e	 0.6470	 0.3330
f	 0.6540	 0.3430
g	 0.6850	 0.3610
h	 0.6640	 0.3480

