Full wwPDB EM Validation Report ⓘ

Apr 5, 2026 – 09:32 PM UTC

PDB ID	:	9KQ0 / pdb_00009kq0
EMDB ID	:	EMD-62493
Title	:	Structure of TolQRA complex at pH 8.0 from E.coli
Authors	:	Dong, C.; Zhang, Z.
Deposited on	:	2024-11-24
Resolution	:	3.60 Å(reported)

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

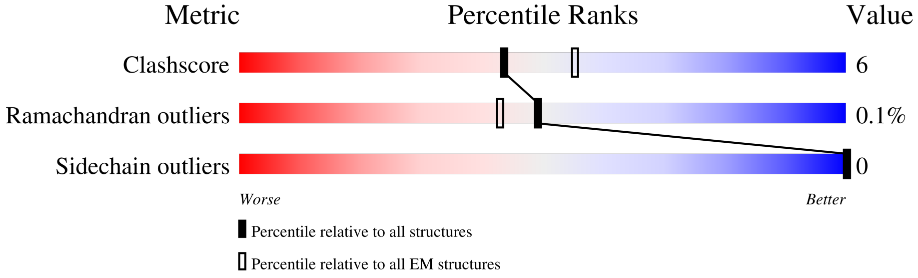
EMDB validation analysis	:	0.0.1.dev132
MolProbity	:	4-5-2 with Phenix2.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics	:	202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

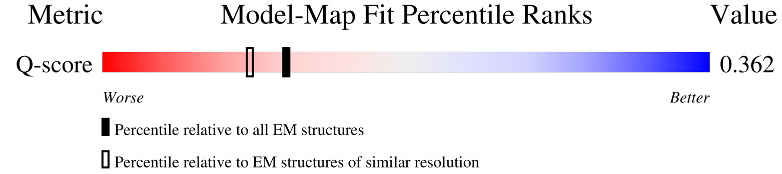
1 Overall quality at a glance

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

The reported resolution of this entry is 3.60 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)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	12797 (3.10 - 4.10)

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	A	232	
1	B	232	
1	C	232	
1	D	232	

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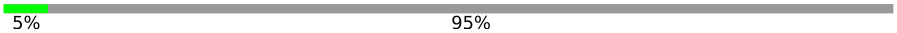
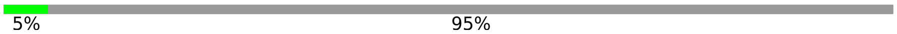
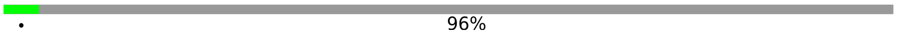
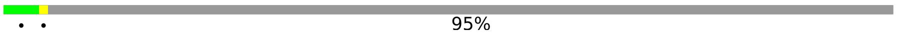
Mol	Chain	Length	Quality of chain
1	E	232	
2	F	142	
2	G	142	
3	H	557	
3	I	557	
3	J	557	
3	K	557	
3	L	557	

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 10048 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 Tol-Pal system protein TolQ.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	228	Total 1784	C 1148	N 307	O 321	S 8	0	0
1	B	221	Total 1738	C 1122	N 299	O 309	S 8	0	0
1	C	224	Total 1758	C 1134	N 302	O 314	S 8	0	0
1	D	219	Total 1705	C 1106	N 290	O 302	S 7	0	0
1	E	221	Total 1737	C 1123	N 299	O 307	S 8	0	0

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MET	-	initiating methionine	UNP P0ABU9
A	0	GLY	-	expression tag	UNP P0ABU9
A	1	VAL	-	expression tag	UNP P0ABU9
B	-1	MET	-	initiating methionine	UNP P0ABU9
B	0	GLY	-	expression tag	UNP P0ABU9
B	1	VAL	-	expression tag	UNP P0ABU9
C	-1	MET	-	initiating methionine	UNP P0ABU9
C	0	GLY	-	expression tag	UNP P0ABU9
C	1	VAL	-	expression tag	UNP P0ABU9
D	-1	MET	-	initiating methionine	UNP P0ABU9
D	0	GLY	-	expression tag	UNP P0ABU9
D	1	VAL	-	expression tag	UNP P0ABU9
E	-1	MET	-	initiating methionine	UNP P0ABU9
E	0	GLY	-	expression tag	UNP P0ABU9
E	1	VAL	-	expression tag	UNP P0ABU9

- Molecule 2 is a protein called Tol-Pal system protein TolR.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	F	23	179	123	25	30	1	0	0
2	G	25	191	131	27	32	1	0	0

- Molecule 3 is a protein called Ubiquitin-like protein SMT3,Tol-Pal system protein TolA.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
3	H	28	214	145	34	35	0	0
3	I	30	237	158	40	39	0	0
3	J	24	164	110	28	26	0	0
3	K	18	129	85	23	21	0	0
3	L	28	212	142	35	35	0	0

There are 200 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
H	-134	MET	-	initiating methionine	UNP Q12306
H	-133	GLY	-	expression tag	UNP Q12306
H	-132	HIS	-	expression tag	UNP Q12306
H	-131	HIS	-	expression tag	UNP Q12306
H	-130	HIS	-	expression tag	UNP Q12306
H	-129	HIS	-	expression tag	UNP Q12306
H	-128	HIS	-	expression tag	UNP Q12306
H	-127	HIS	-	expression tag	UNP Q12306
H	-126	HIS	-	expression tag	UNP Q12306
H	-125	HIS	-	expression tag	UNP Q12306
H	-124	GLY	-	expression tag	UNP Q12306
H	-123	SER	-	expression tag	UNP Q12306
H	-122	LEU	-	expression tag	UNP Q12306
H	-121	GLN	-	expression tag	UNP Q12306
H	-23	ALA	-	linker	UNP Q12306
H	-22	ALA	-	linker	UNP Q12306
H	-21	ASP	-	linker	UNP Q12306
H	-20	TYR	-	linker	UNP Q12306
H	-19	GLY	-	linker	UNP Q12306
H	-18	GLY	-	linker	UNP Q12306
H	-17	ASP	-	linker	UNP Q12306

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Chain	Residue	Modelled	Actual	Comment	Reference
H	-16	ILE	-	linker	UNP Q12306
H	-15	PRO	-	linker	UNP Q12306
H	-14	THR	-	linker	UNP Q12306
H	-13	THR	-	linker	UNP Q12306
H	-12	GLU	-	linker	UNP Q12306
H	-11	ASN	-	linker	UNP Q12306
H	-10	LEU	-	linker	UNP Q12306
H	-9	TYR	-	linker	UNP Q12306
H	-8	PHE	-	linker	UNP Q12306
H	-7	GLN	-	linker	UNP Q12306
H	-6	GLY	-	linker	UNP Q12306
H	-5	ALA	-	linker	UNP Q12306
H	-4	ALA	-	linker	UNP Q12306
H	-3	ALA	-	linker	UNP Q12306
H	-2	ASP	-	linker	UNP Q12306
H	-1	ILE	-	linker	UNP Q12306
H	0	GLY	-	linker	UNP Q12306
H	1	SER	-	linker	UNP Q12306
H	2	VAL	-	linker	UNP Q12306
I	-134	MET	-	initiating methionine	UNP Q12306
I	-133	GLY	-	expression tag	UNP Q12306
I	-132	HIS	-	expression tag	UNP Q12306
I	-131	HIS	-	expression tag	UNP Q12306
I	-130	HIS	-	expression tag	UNP Q12306
I	-129	HIS	-	expression tag	UNP Q12306
I	-128	HIS	-	expression tag	UNP Q12306
I	-127	HIS	-	expression tag	UNP Q12306
I	-126	HIS	-	expression tag	UNP Q12306
I	-125	HIS	-	expression tag	UNP Q12306
I	-124	GLY	-	expression tag	UNP Q12306
I	-123	SER	-	expression tag	UNP Q12306
I	-122	LEU	-	expression tag	UNP Q12306
I	-121	GLN	-	expression tag	UNP Q12306
I	-23	ALA	-	linker	UNP Q12306
I	-22	ALA	-	linker	UNP Q12306
I	-21	ASP	-	linker	UNP Q12306
I	-20	TYR	-	linker	UNP Q12306
I	-19	GLY	-	linker	UNP Q12306
I	-18	GLY	-	linker	UNP Q12306
I	-17	ASP	-	linker	UNP Q12306
I	-16	ILE	-	linker	UNP Q12306
I	-15	PRO	-	linker	UNP Q12306

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Chain	Residue	Modelled	Actual	Comment	Reference
I	-14	THR	-	linker	UNP Q12306
I	-13	THR	-	linker	UNP Q12306
I	-12	GLU	-	linker	UNP Q12306
I	-11	ASN	-	linker	UNP Q12306
I	-10	LEU	-	linker	UNP Q12306
I	-9	TYR	-	linker	UNP Q12306
I	-8	PHE	-	linker	UNP Q12306
I	-7	GLN	-	linker	UNP Q12306
I	-6	GLY	-	linker	UNP Q12306
I	-5	ALA	-	linker	UNP Q12306
I	-4	ALA	-	linker	UNP Q12306
I	-3	ALA	-	linker	UNP Q12306
I	-2	ASP	-	linker	UNP Q12306
I	-1	ILE	-	linker	UNP Q12306
I	0	GLY	-	linker	UNP Q12306
I	1	SER	-	linker	UNP Q12306
I	2	VAL	-	linker	UNP Q12306
J	-134	MET	-	initiating methionine	UNP Q12306
J	-133	GLY	-	expression tag	UNP Q12306
J	-132	HIS	-	expression tag	UNP Q12306
J	-131	HIS	-	expression tag	UNP Q12306
J	-130	HIS	-	expression tag	UNP Q12306
J	-129	HIS	-	expression tag	UNP Q12306
J	-128	HIS	-	expression tag	UNP Q12306
J	-127	HIS	-	expression tag	UNP Q12306
J	-126	HIS	-	expression tag	UNP Q12306
J	-125	HIS	-	expression tag	UNP Q12306
J	-124	GLY	-	expression tag	UNP Q12306
J	-123	SER	-	expression tag	UNP Q12306
J	-122	LEU	-	expression tag	UNP Q12306
J	-121	GLN	-	expression tag	UNP Q12306
J	-23	ALA	-	linker	UNP Q12306
J	-22	ALA	-	linker	UNP Q12306
J	-21	ASP	-	linker	UNP Q12306
J	-20	TYR	-	linker	UNP Q12306
J	-19	GLY	-	linker	UNP Q12306
J	-18	GLY	-	linker	UNP Q12306
J	-17	ASP	-	linker	UNP Q12306
J	-16	ILE	-	linker	UNP Q12306
J	-15	PRO	-	linker	UNP Q12306
J	-14	THR	-	linker	UNP Q12306
J	-13	THR	-	linker	UNP Q12306

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Chain	Residue	Modelled	Actual	Comment	Reference
J	-12	GLU	-	linker	UNP Q12306
J	-11	ASN	-	linker	UNP Q12306
J	-10	LEU	-	linker	UNP Q12306
J	-9	TYR	-	linker	UNP Q12306
J	-8	PHE	-	linker	UNP Q12306
J	-7	GLN	-	linker	UNP Q12306
J	-6	GLY	-	linker	UNP Q12306
J	-5	ALA	-	linker	UNP Q12306
J	-4	ALA	-	linker	UNP Q12306
J	-3	ALA	-	linker	UNP Q12306
J	-2	ASP	-	linker	UNP Q12306
J	-1	ILE	-	linker	UNP Q12306
J	0	GLY	-	linker	UNP Q12306
J	1	SER	-	linker	UNP Q12306
J	2	VAL	-	linker	UNP Q12306
K	-134	MET	-	initiating methionine	UNP Q12306
K	-133	GLY	-	expression tag	UNP Q12306
K	-132	HIS	-	expression tag	UNP Q12306
K	-131	HIS	-	expression tag	UNP Q12306
K	-130	HIS	-	expression tag	UNP Q12306
K	-129	HIS	-	expression tag	UNP Q12306
K	-128	HIS	-	expression tag	UNP Q12306
K	-127	HIS	-	expression tag	UNP Q12306
K	-126	HIS	-	expression tag	UNP Q12306
K	-125	HIS	-	expression tag	UNP Q12306
K	-124	GLY	-	expression tag	UNP Q12306
K	-123	SER	-	expression tag	UNP Q12306
K	-122	LEU	-	expression tag	UNP Q12306
K	-121	GLN	-	expression tag	UNP Q12306
K	-23	ALA	-	linker	UNP Q12306
K	-22	ALA	-	linker	UNP Q12306
K	-21	ASP	-	linker	UNP Q12306
K	-20	TYR	-	linker	UNP Q12306
K	-19	GLY	-	linker	UNP Q12306
K	-18	GLY	-	linker	UNP Q12306
K	-17	ASP	-	linker	UNP Q12306
K	-16	ILE	-	linker	UNP Q12306
K	-15	PRO	-	linker	UNP Q12306
K	-14	THR	-	linker	UNP Q12306
K	-13	THR	-	linker	UNP Q12306
K	-12	GLU	-	linker	UNP Q12306
K	-11	ASN	-	linker	UNP Q12306

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Chain	Residue	Modelled	Actual	Comment	Reference
K	-10	LEU	-	linker	UNP Q12306
K	-9	TYR	-	linker	UNP Q12306
K	-8	PHE	-	linker	UNP Q12306
K	-7	GLN	-	linker	UNP Q12306
K	-6	GLY	-	linker	UNP Q12306
K	-5	ALA	-	linker	UNP Q12306
K	-4	ALA	-	linker	UNP Q12306
K	-3	ALA	-	linker	UNP Q12306
K	-2	ASP	-	linker	UNP Q12306
K	-1	ILE	-	linker	UNP Q12306
K	0	GLY	-	linker	UNP Q12306
K	1	SER	-	linker	UNP Q12306
K	2	VAL	-	linker	UNP Q12306
L	-134	MET	-	initiating methionine	UNP Q12306
L	-133	GLY	-	expression tag	UNP Q12306
L	-132	HIS	-	expression tag	UNP Q12306
L	-131	HIS	-	expression tag	UNP Q12306
L	-130	HIS	-	expression tag	UNP Q12306
L	-129	HIS	-	expression tag	UNP Q12306
L	-128	HIS	-	expression tag	UNP Q12306
L	-127	HIS	-	expression tag	UNP Q12306
L	-126	HIS	-	expression tag	UNP Q12306
L	-125	HIS	-	expression tag	UNP Q12306
L	-124	GLY	-	expression tag	UNP Q12306
L	-123	SER	-	expression tag	UNP Q12306
L	-122	LEU	-	expression tag	UNP Q12306
L	-121	GLN	-	expression tag	UNP Q12306
L	-23	ALA	-	linker	UNP Q12306
L	-22	ALA	-	linker	UNP Q12306
L	-21	ASP	-	linker	UNP Q12306
L	-20	TYR	-	linker	UNP Q12306
L	-19	GLY	-	linker	UNP Q12306
L	-18	GLY	-	linker	UNP Q12306
L	-17	ASP	-	linker	UNP Q12306
L	-16	ILE	-	linker	UNP Q12306
L	-15	PRO	-	linker	UNP Q12306
L	-14	THR	-	linker	UNP Q12306
L	-13	THR	-	linker	UNP Q12306
L	-12	GLU	-	linker	UNP Q12306
L	-11	ASN	-	linker	UNP Q12306
L	-10	LEU	-	linker	UNP Q12306
L	-9	TYR	-	linker	UNP Q12306

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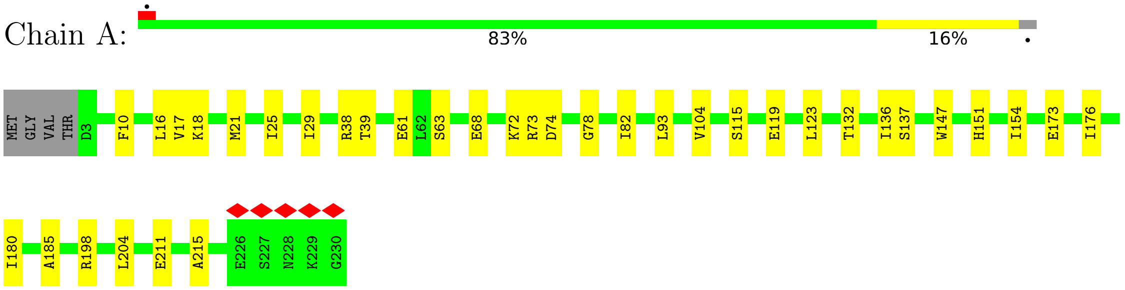
Chain	Residue	Modelled	Actual	Comment	Reference
L	-8	PHE	-	linker	UNP Q12306
L	-7	GLN	-	linker	UNP Q12306
L	-6	GLY	-	linker	UNP Q12306
L	-5	ALA	-	linker	UNP Q12306
L	-4	ALA	-	linker	UNP Q12306
L	-3	ALA	-	linker	UNP Q12306
L	-2	ASP	-	linker	UNP Q12306
L	-1	ILE	-	linker	UNP Q12306
L	0	GLY	-	linker	UNP Q12306
L	1	SER	-	linker	UNP Q12306
L	2	VAL	-	linker	UNP Q12306

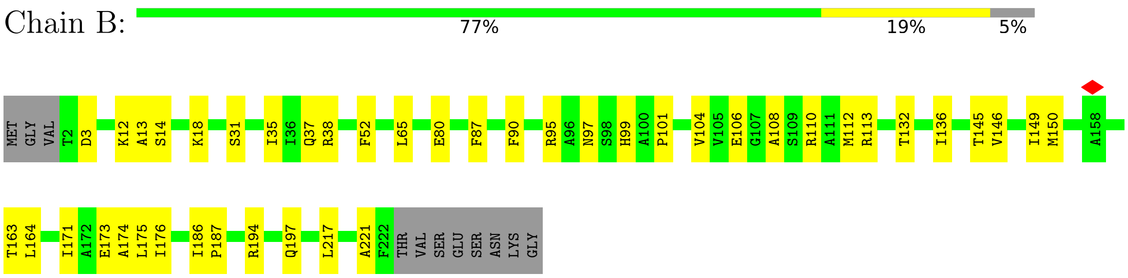
3 Residue-property plots ⓘ

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.

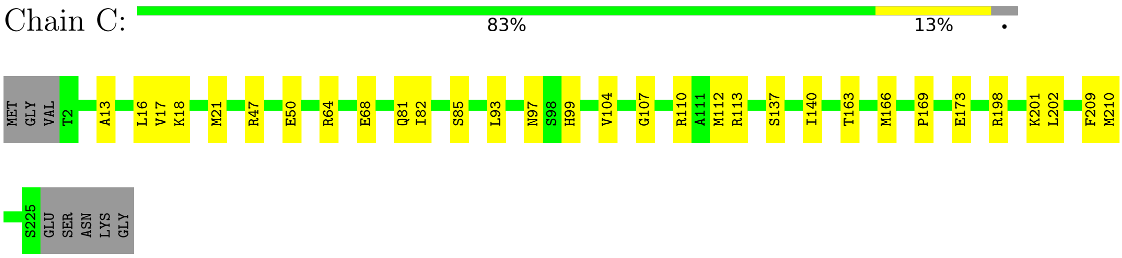
- Molecule 1: Tol-Pal system protein TolQ



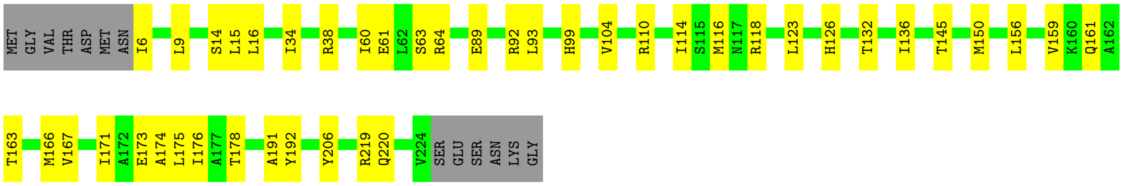
- Molecule 1: Tol-Pal system protein TolQ



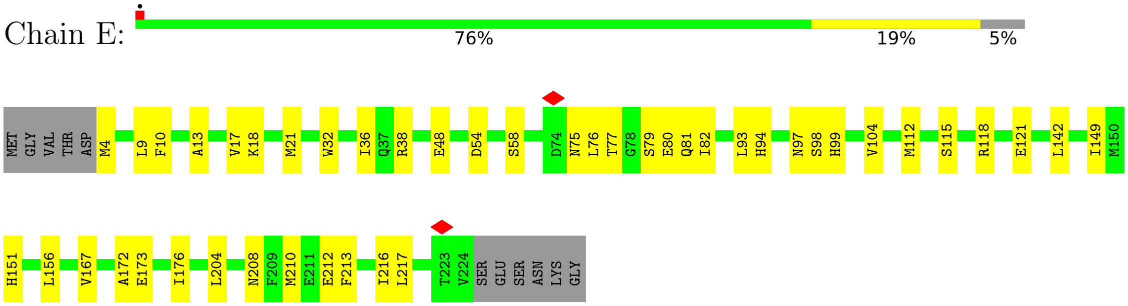
- Molecule 1: Tol-Pal system protein TolQ



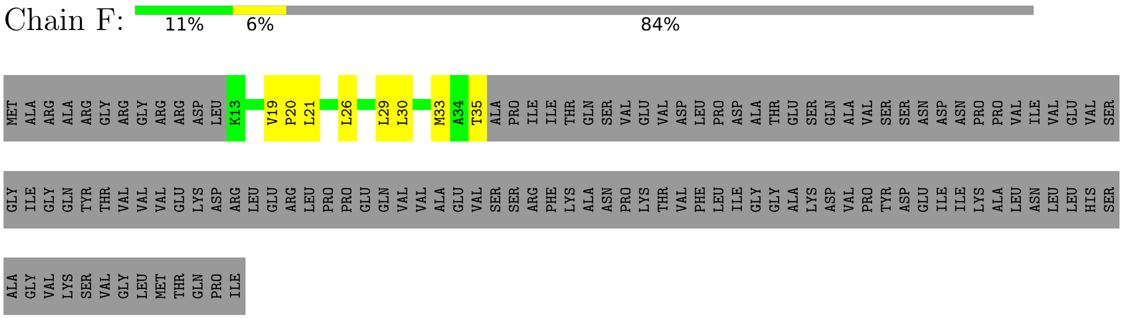
- Molecule 1: Tol-Pal system protein TolQ



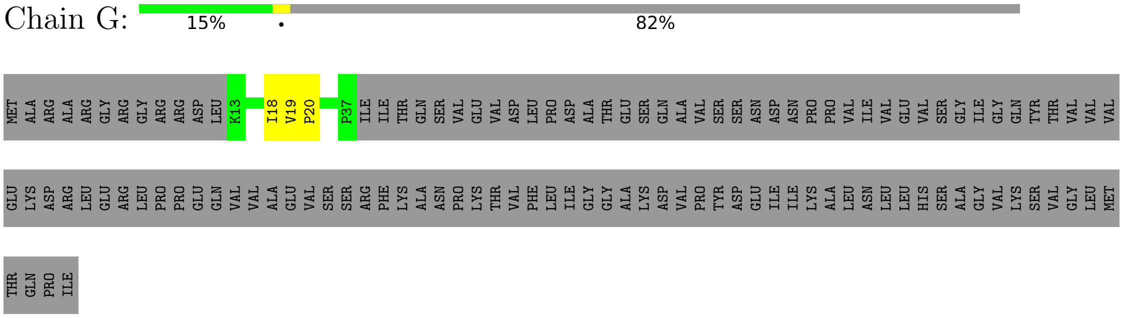
- Molecule 1: Tol-Pal system protein TolQ



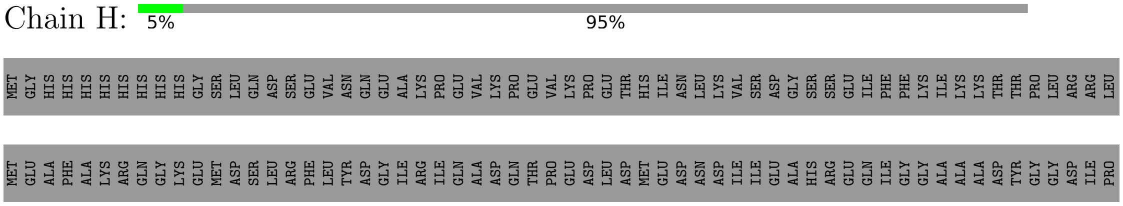
- Molecule 2: Tol-Pal system protein TolR

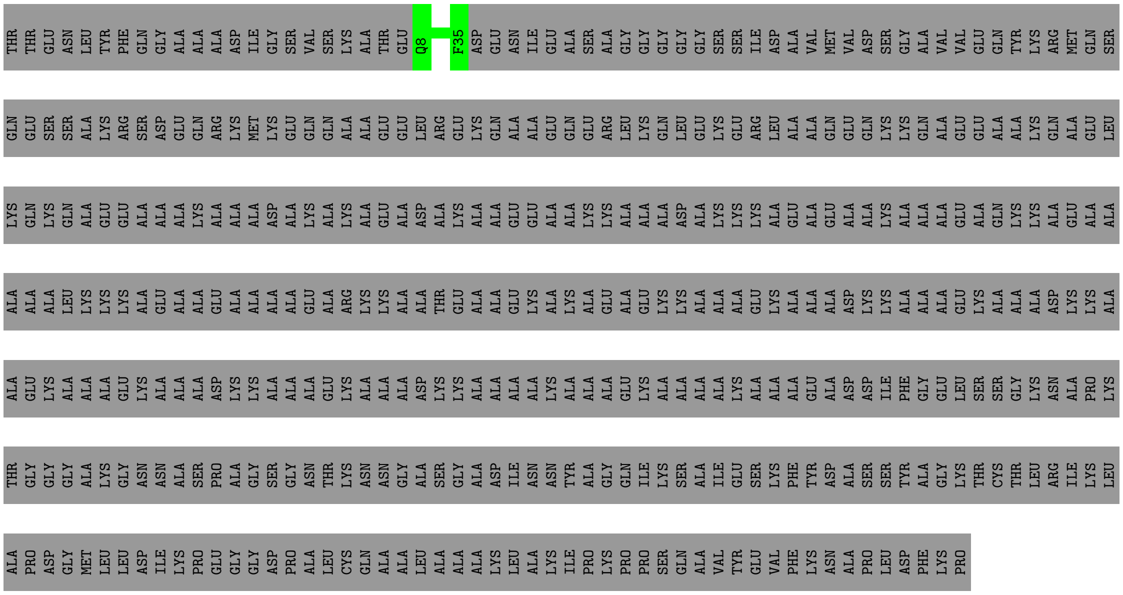


- Molecule 2: Tol-Pal system protein TolR

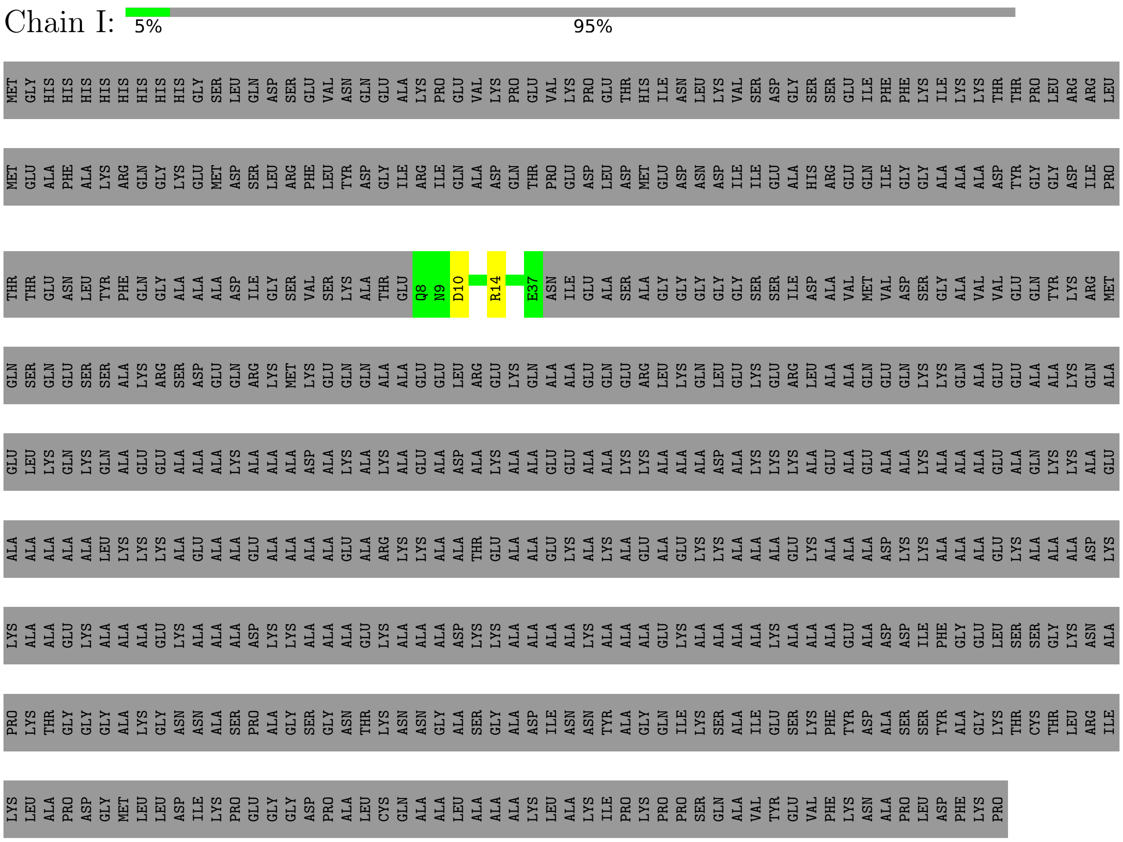


- Molecule 3: Ubiquitin-like protein SMT3,Tol-Pal system protein TolA

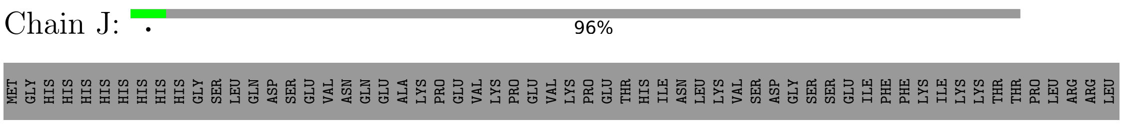


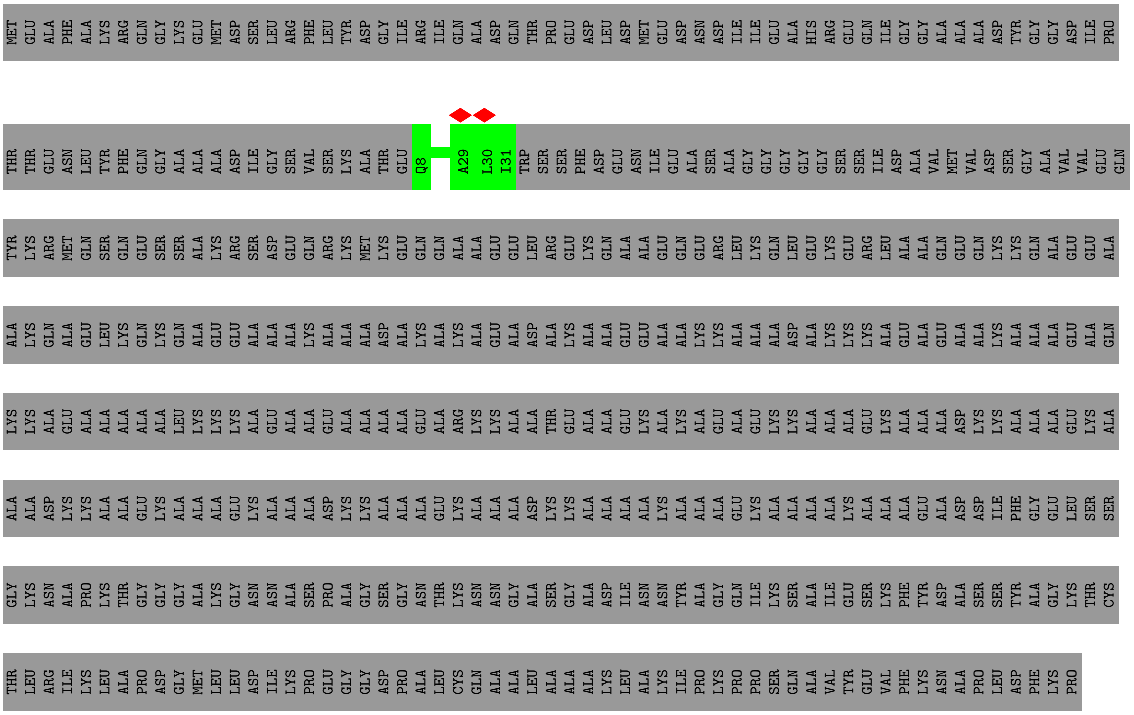


- Molecule 3: Ubiquitin-like protein SMT3,Tol-Pal system protein TolA

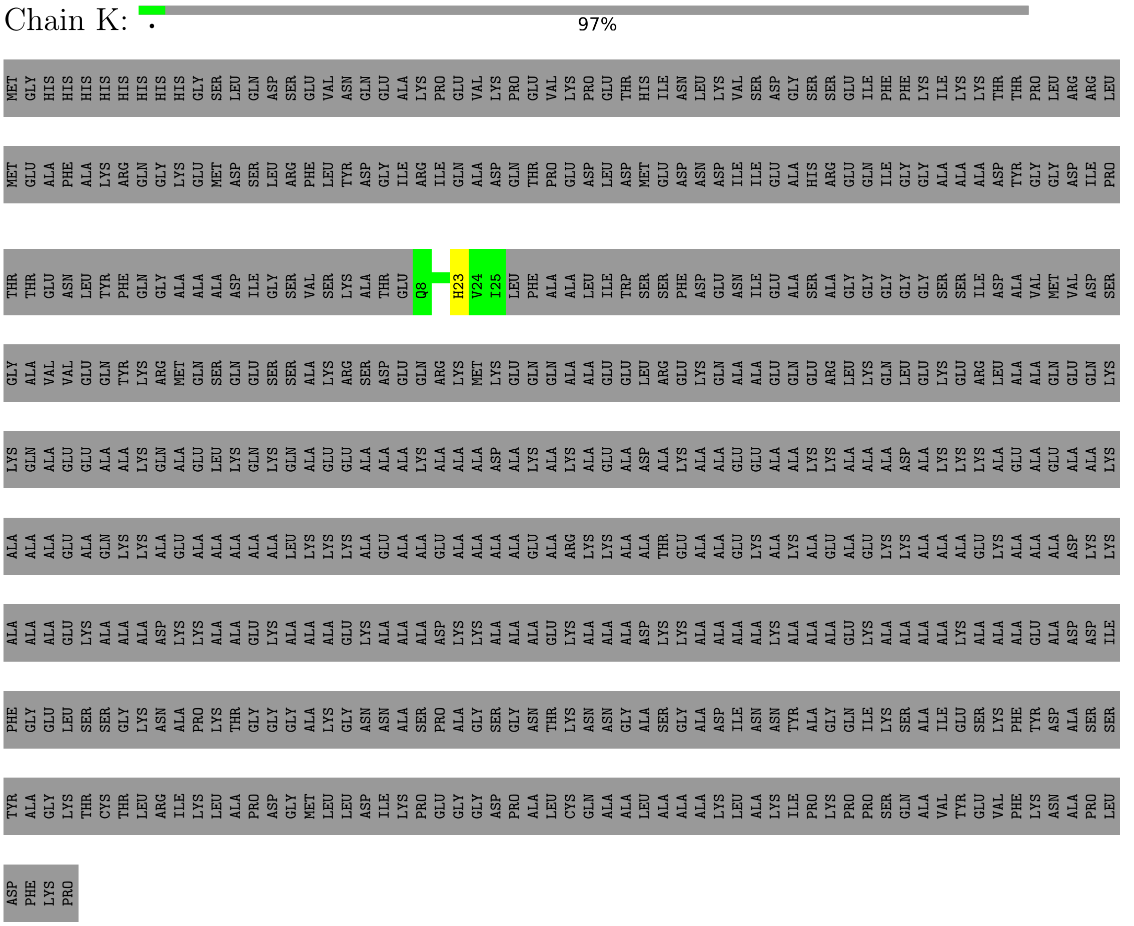


- Molecule 3: Ubiquitin-like protein SMT3,Tol-Pal system protein TolA





- Molecule 3: Ubiquitin-like protein SMT3,Tol-Pal system protein TolA



- Molecule 3: Ubiquitin-like protein SMT3,Tol-Pal system protein TolA


Chain L:

MET GLY HIS HIS HIS HIS HIS HIS HIS HIS GLY SER LEU GLN ASP SER GLU VAL ASN GLN GLU ALA LYS PRO GLU VAL LYS PRO GLU VAL LYS PRO GLU THR HIS ILE ASN LEU LYS VAL SER ASP GLY SER SER GLU ILE PHE PHE LYS ILE LYS LYS THR THR PRO LEU ARG ARG LEU

MET GLU ALA PHE ALA LYS ARG GLN GLY LYS GLU MET ASP SER LEU ARG PHE LEU TYR ASP GLY ILE ARG ILE GLN ALA ASP GLN THR PRO GLU ASP LEU ASP MET GLU ASP ASN ASP ILE ILE GLU ALA HIS ARG GLU GLN ILE GLY GLY ALA ALA ALA ASP TYR GLY GLY ASP ILE PRO

THR THR GLU ASN LEU TYR PHE GLN GLY ALA ALA ALA ASP ILE GLY SER VAL SER LYS ALA THR GLU Q8 K11 L30 S34 F35 ASP GLU ASN ILE GLU ALA SER ALA GLY GLY GLY GLY SER SER ILE ASP ALA VAL MET VAL ASP SER GLY ALA VAL VAL GLU GLN TYR

LYS ARG MET GLN SER GLN GLU SER SER ALA LYS ARG SER ASP GLU GLN ARG LYS MET LYS GLU GLN GLN ALA ALA GLU GLU LEU ARG GLU LYS GLN ALA ALA GLU GLN GLU ARG LEU LYS GLN LEU GLU LYS GLU ARG LEU ALA ALA GLN GLU GLN LYS LYS GLN ALA GLU GLU ALA ALA

LYS GLN ALA GLU LEU LYS GLN LYS GLN ALA GLU GLU ALA ALA ALA LYS ALA ALA ALA ASP ALA LYS ALA LYS ALA GLU ALA ASP ALA LYS ALA ALA GLU GLU ALA ALA LYS LYS ALA ALA ALA ASP ALA LYS LYS LYS ALA GLU ALA GLU ALA ALA LYS ALA ALA ALA GLU ALA GLN LYS

LYS ALA GLU ALA ALA ALA ALA ALA LEU LYS LYS LYS ALA GLU ALA ALA GLU ALA ALA ALA ALA GLU ALA ARG LYS LYS ALA ALA THR GLU ALA ALA GLU LYS ALA LYS ALA GLU ALA GLU LYS LYS ALA ALA ALA GLU LYS ALA ALA ALA ASP LYS LYS ALA ALA ALA GLU LYS ALA ALA

ALA ASP LYS LYS ALA ALA GLU LYS ALA ALA ALA GLU LYS ALA ALA ALA ASP LYS LYS ALA ALA ALA GLU LYS ALA ALA ALA ASP LYS LYS ALA ALA ALA ALA LYS ALA ALA ALA GLU LYS ALA ALA ALA ALA LYS ALA ALA ALA GLU ALA ASP ASP ILE PHE GLY GLU LEU SER SER GLY

LYS ASN ALA PRO LYS THR GLY GLY GLY ALA LYS GLY ASN ASN ALA SER PRO ALA GLY SER GLY ASN THR LYS ASN ASN GLY ALA SER GLY ALA ASP ILE ASN ASN TYR ALA GLY GLN ILE LYS SER ALA ILE GLU SER LYS PHE TYR ASP ALA SER SER TYR ALA GLY LYS THR CYS THR

LEU ARG ILE LYS LEU ALA PRO ASP GLY MET LEU LEU ASP ILE LYS PRO GLU GLY GLY ASP PRO ALA LEU CYS GLN ALA ALA LEU ALA ALA ALA LYS LEU ALA LYS ILE PRO LYS PRO PRO SER GLN ALA VAL TYR GLU VAL PHE LYS ASN ALA PRO LEU ASP PHE LYS PRO

4 Experimental information ⓘ

Property	**Value**	**Source**
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	160613	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 $(e^-/\text{Å}^2)$	50	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	0.573	Depositor
Minimum map value	-0.434	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.016	Depositor
Recommended contour level	0.05	Depositor
Map size (Å)	251.99998, 251.99998, 251.99998	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.84, 0.84, 0.84	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	A	0.11	0/1818	0.26	0/2455
1	B	0.13	0/1772	0.28	0/2395
1	C	0.12	0/1792	0.30	0/2423
1	D	0.13	0/1738	0.32	0/2352
1	E	0.11	0/1771	0.26	0/2394
2	F	0.15	0/180	0.31	0/245
2	G	0.16	0/193	0.36	0/264
3	H	0.04	0/218	0.13	0/297
3	I	0.06	0/241	0.16	0/326
3	J	0.05	0/164	0.17	0/224
3	K	0.05	0/129	0.15	0/175
3	L	0.05	0/215	0.13	0/292
All	All	0.12	0/10231	0.28	0/13842

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	A	1784	0	1806	22	0
1	B	1738	0	1765	29	0
1	C	1758	0	1786	21	0
1	D	1705	0	1730	27	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	E	1737	0	1770	32	0
2	F	179	0	207	10	0
2	G	191	0	219	2	0
3	H	214	0	221	0	0
3	I	237	0	249	1	0
3	J	164	0	177	0	0
3	K	129	0	138	1	0
3	L	212	0	225	3	0
All	All	10048	0	10293	132	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 6.

All (132) 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:B:149:ILE:HD13	2:F:26:LEU:HD13	1.57	0.87
1:B:145:THR:HG23	1:B:174:ALA:HB1	1.69	0.74
1:A:215:ALA:HB2	1:D:110:ARG:HH21	1.54	0.73
1:C:17:VAL:HG12	1:C:21:MET:HE2	1.73	0.70
1:C:93:LEU:HD23	1:C:104:VAL:HA	1.73	0.70
1:D:156:LEU:HB2	1:D:167:VAL:HG11	1.74	0.69
1:B:37:GLN:HE22	1:B:38:ARG:HH21	1.39	0.69
1:E:142:LEU:HD23	2:F:20:PRO:HB2	1.75	0.67
1:C:17:VAL:HG11	1:C:173:GLU:HB2	1.76	0.67
2:F:26:LEU:HA	2:F:29:LEU:HD12	1.77	0.67
1:B:31:SER:O	1:B:35:ILE:HG12	1.95	0.66
1:E:17:VAL:HG12	1:E:21:MET:HE1	1.79	0.66
1:E:93:LEU:HB3	1:E:104:VAL:HG22	1.78	0.66
1:D:38:ARG:NH1	1:D:123:LEU:O	2.29	0.65
1:D:219:ARG:HH21	1:D:220:GLN:HB3	1.60	0.65
1:A:17:VAL:HG12	1:A:21:MET:HE2	1.79	0.64
1:A:93:LEU:HD23	1:A:104:VAL:HA	1.78	0.64
1:E:112:MET:HE2	1:E:210:MET:HG3	1.80	0.63
1:D:93:LEU:HD23	1:D:104:VAL:HG13	1.81	0.63
1:D:145:THR:HG1	1:D:178:THR:HG1	1.44	0.62
1:B:106:GLU:OE1	1:B:110:ARG:NH2	2.33	0.62
1:A:68:GLU:OE1	1:A:72:LYS:NZ	2.30	0.62
1:A:211:GLU:OE1	1:D:110:ARG:NH1	2.32	0.62
1:A:39:THR:HG23	1:A:198:ARG:HH12	1.65	0.61
1:D:145:THR:HG23	1:D:174:ALA:HB1	1.82	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:164:LEU:HD11	2:F:35:THR:HG22	1.83	0.60
1:A:78:GLY:N	1:A:119:GLU:OE2	2.34	0.60
1:C:13:ALA:O	1:C:18:LYS:NZ	2.35	0.60
1:E:204:LEU:O	1:E:208:ASN:ND2	2.35	0.60
1:E:156:LEU:HB2	1:E:167:VAL:HG11	1.84	0.60
1:E:81:GLN:OE1	1:E:115:SER:OG	2.23	0.57
1:B:194:ARG:O	1:B:197:GLN:HG2	2.05	0.57
1:E:76:LEU:HD22	1:E:80:GLU:HB3	1.87	0.57
1:A:211:GLU:O	1:D:110:ARG:NH2	2.38	0.57
1:B:52:PHE:HE1	1:B:65:LEU:HD21	1.71	0.56
1:C:81:GLN:OE1	1:C:85:SER:OG	2.24	0.56
1:C:113:ARG:NH2	1:E:212:GLU:OE2	2.39	0.56
1:C:137:SER:HA	1:C:140:ILE:HD12	1.90	0.54
1:C:82:ILE:HB	1:C:209:PHE:HE2	1.74	0.53
1:B:108:ALA:HB1	1:B:112:MET:HE3	1.91	0.52
1:A:38:ARG:NH1	1:A:123:LEU:O	2.43	0.52
1:B:146:VAL:HA	1:B:149:ILE:HG12	1.92	0.52
1:A:137:SER:HB2	1:A:185:ALA:HB2	1.92	0.51
1:E:97:ASN:OD1	1:E:99:HIS:NE2	2.43	0.51
1:E:173:GLU:HA	1:E:176:ILE:HD12	1.91	0.51
1:B:101:PRO:HB3	1:B:221:ALA:HB1	1.93	0.51
1:E:142:LEU:HD21	2:F:21:LEU:HB2	1.93	0.51
1:C:112:MET:HE2	1:C:210:MET:HG3	1.93	0.50
1:E:54:ASP:O	1:E:58:SER:OG	2.29	0.50
1:D:60:ILE:HD12	1:D:64:ARG:HH12	1.76	0.50
2:G:19:VAL:HB	2:G:20:PRO:HD3	1.94	0.49
2:F:30:LEU:HA	2:F:33:MET:HG2	1.93	0.49
1:A:82:ILE:HG22	1:A:115:SER:HB3	1.93	0.49
1:A:29:ILE:HA	3:K:23:HIS:CE1	2.48	0.49
1:D:6:ILE:HG23	1:D:9:LEU:HD23	1.94	0.48
1:B:175:LEU:HD13	1:E:149:ILE:HG23	1.95	0.48
1:C:64:ARG:NH2	1:C:68:GLU:OE2	2.46	0.48
1:E:118:ARG:O	1:E:121:GLU:HG3	2.14	0.48
1:E:9:LEU:HD23	1:E:176:ILE:HD11	1.96	0.47
1:A:25:ILE:HG13	1:A:180:ILE:HD11	1.96	0.47
1:A:173:GLU:O	1:A:176:ILE:HG22	2.15	0.47
1:E:94:HIS:O	1:E:98:SER:HB3	2.15	0.47
1:E:48:GLU:OE2	1:E:77:THR:OG1	2.32	0.47
1:D:14:SER:OG	1:D:15:LEU:N	2.47	0.46
1:A:151:HIS:HA	1:A:154:ILE:HG12	1.98	0.46
1:E:172:ALA:O	1:E:176:ILE:HG13	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:95:ARG:HD3	1:B:95:ARG:HA	1.69	0.46
2:F:19:VAL:O	2:F:20:PRO:C	2.59	0.46
1:A:61:GLU:HG3	1:A:63:SER:H	1.81	0.45
1:B:173:GLU:O	1:B:176:ILE:HG22	2.17	0.45
1:E:38:ARG:HA	1:E:38:ARG:HD3	1.77	0.45
1:C:17:VAL:HG21	1:C:173:GLU:HG3	1.99	0.45
1:D:114:ILE:HG22	1:D:118:ARG:NE	2.31	0.45
2:F:19:VAL:HG22	2:G:18:ILE:HD11	1.99	0.44
1:B:110:ARG:HA	1:B:113:ARG:HG2	1.99	0.44
1:A:16:LEU:HD23	1:A:147:TRP:CD1	2.53	0.44
1:A:132:THR:O	1:A:136:ILE:HG12	2.16	0.44
1:E:4:MET:N	3:L:34:SER:HB2	2.32	0.44
2:F:26:LEU:O	2:F:29:LEU:HB2	2.17	0.44
1:A:10:PHE:O	1:A:18:LYS:NZ	2.44	0.44
1:B:12:LYS:HA	1:B:12:LYS:HD2	1.72	0.44
1:B:14:SER:O	1:B:18:LYS:HG3	2.18	0.44
1:C:16:LEU:HB2	3:L:30:LEU:HD11	1.99	0.44
1:C:18:LYS:HA	1:C:21:MET:HE3	2.00	0.43
1:D:173:GLU:O	1:D:176:ILE:HG22	2.17	0.43
1:A:73:ARG:HH11	1:A:74:ASP:HB2	1.82	0.43
1:D:34:ILE:HD13	1:D:126:HIS:HB3	2.01	0.43
1:E:216:ILE:HG23	1:E:217:LEU:HD12	2.00	0.43
1:C:198:ARG:O	1:C:201:LYS:HG2	2.19	0.43
1:D:61:GLU:HG3	1:D:63:SER:H	1.83	0.43
1:D:89:GLU:HG2	1:D:92:ARG:HH21	1.84	0.43
1:D:92:ARG:NH2	1:D:93:LEU:HB2	2.34	0.43
1:E:13:ALA:O	1:E:18:LYS:NZ	2.51	0.43
1:B:132:THR:O	1:B:136:ILE:HG12	2.19	0.43
1:D:171:ILE:O	1:D:175:LEU:HG	2.19	0.42
1:A:72:LYS:O	1:A:74:ASP:N	2.50	0.42
1:C:47:ARG:O	1:C:50:GLU:HG3	2.19	0.42
1:D:15:LEU:HG	1:D:16:LEU:HD22	2.01	0.42
1:C:107:GLY:HA2	1:C:110:ARG:HG2	2.01	0.42
1:C:163:THR:H	1:C:166:MET:HE2	1.85	0.42
1:D:132:THR:O	1:D:136:ILE:HG12	2.20	0.42
1:D:163:THR:HG21	1:D:166:MET:HE3	2.01	0.42
1:D:159:VAL:HG12	1:D:161:GLN:H	1.85	0.42
1:A:204:LEU:HD23	1:A:204:LEU:HA	1.86	0.42
1:B:97:ASN:HB2	1:B:99:HIS:CD2	2.55	0.42
1:C:202:LEU:HD23	1:C:202:LEU:HA	1.85	0.42
1:B:104:VAL:HG12	1:B:217:LEU:HD21	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:149:ILE:HG13	1:B:150:MET:N	2.34	0.42
1:C:97:ASN:HB2	1:C:99:HIS:CD2	2.54	0.42
1:E:79:SER:HA	1:E:82:ILE:HD12	2.02	0.41
1:E:32:TRP:O	1:E:36:ILE:HG12	2.20	0.41
1:E:75:ASN:OD1	1:E:75:ASN:N	2.53	0.41
1:D:171:ILE:HD12	1:D:171:ILE:H	1.85	0.41
1:B:52:PHE:CG	1:B:80:GLU:HG3	2.56	0.41
1:C:169:PRO:O	1:C:173:GLU:OE1	2.38	0.41
1:B:171:ILE:O	1:B:175:LEU:HG	2.21	0.41
1:B:149:ILE:HB	2:F:30:LEU:HD11	2.03	0.41
1:B:186:ILE:HB	1:B:187:PRO:HD3	2.02	0.41
1:D:191:ALA:O	1:D:192:TYR:C	2.63	0.41
1:E:17:VAL:HG12	1:E:21:MET:CE	2.49	0.41
1:E:18:LYS:HA	1:E:21:MET:HE2	2.03	0.41
1:C:113:ARG:NH2	1:E:208:ASN:HB3	2.36	0.41
1:B:13:ALA:O	1:B:18:LYS:NZ	2.37	0.40
1:B:87:PHE:HA	1:B:90:PHE:HB3	2.03	0.40
1:D:150:MET:HE3	1:D:150:MET:HB3	2.00	0.40
1:E:112:MET:HE1	1:E:213:PHE:HB3	2.03	0.40
1:E:10:PHE:O	1:E:18:LYS:HE3	2.22	0.40
1:B:163:THR:OG1	1:B:164:LEU:N	2.54	0.40
1:D:116:MET:SD	1:D:206:TYR:HB3	2.61	0.40
3:I:10:ASP:O	3:I:14:ARG:HG3	2.21	0.40
1:B:3:ASP:HB3	1:E:151:HIS:CE1	2.57	0.40
3:L:11:LYS:HA	3:L:11:LYS:HD3	1.96	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	226/232 (97%)	222 (98%)	4 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	219/232 (94%)	211 (96%)	8 (4%)	0	100	100
1	C	222/232 (96%)	212 (96%)	10 (4%)	0	100	100
1	D	217/232 (94%)	207 (95%)	9 (4%)	1 (0%)	24	57
1	E	219/232 (94%)	217 (99%)	2 (1%)	0	100	100
2	F	21/142 (15%)	20 (95%)	1 (5%)	0	100	100
2	G	23/142 (16%)	23 (100%)	0	0	100	100
3	H	26/557 (5%)	26 (100%)	0	0	100	100
3	I	28/557 (5%)	28 (100%)	0	0	100	100
3	J	22/557 (4%)	22 (100%)	0	0	100	100
3	K	16/557 (3%)	16 (100%)	0	0	100	100
3	L	26/557 (5%)	26 (100%)	0	0	100	100
All	All	1265/4229 (30%)	1230 (97%)	34 (3%)	1 (0%)	49	79

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	99	HIS

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	A	184/188 (98%)	184 (100%)	0	100	100
1	B	179/188 (95%)	179 (100%)	0	100	100
1	C	182/188 (97%)	182 (100%)	0	100	100
1	D	173/188 (92%)	173 (100%)	0	100	100
1	E	179/188 (95%)	179 (100%)	0	100	100
2	F	22/123 (18%)	22 (100%)	0	100	100
2	G	23/123 (19%)	23 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	H	22/384 (6%)	22 (100%)	0	100	100
3	I	25/384 (6%)	25 (100%)	0	100	100
3	J	15/384 (4%)	15 (100%)	0	100	100
3	K	13/384 (3%)	13 (100%)	0	100	100
3	L	22/384 (6%)	22 (100%)	0	100	100
All	All	1039/3106 (34%)	1039 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	5	ASN
1	A	193	ASN
1	B	200	ASN
1	C	43	ASN
1	C	75	ASN
1	C	151	HIS
1	C	220	GLN
1	D	75	ASN
1	D	97	ASN
1	D	126	HIS
1	D	151	HIS
1	D	200	ASN
1	D	208	ASN
1	D	220	GLN
1	E	117	ASN
1	E	193	ASN
1	E	220	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 oligosaccharides 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.

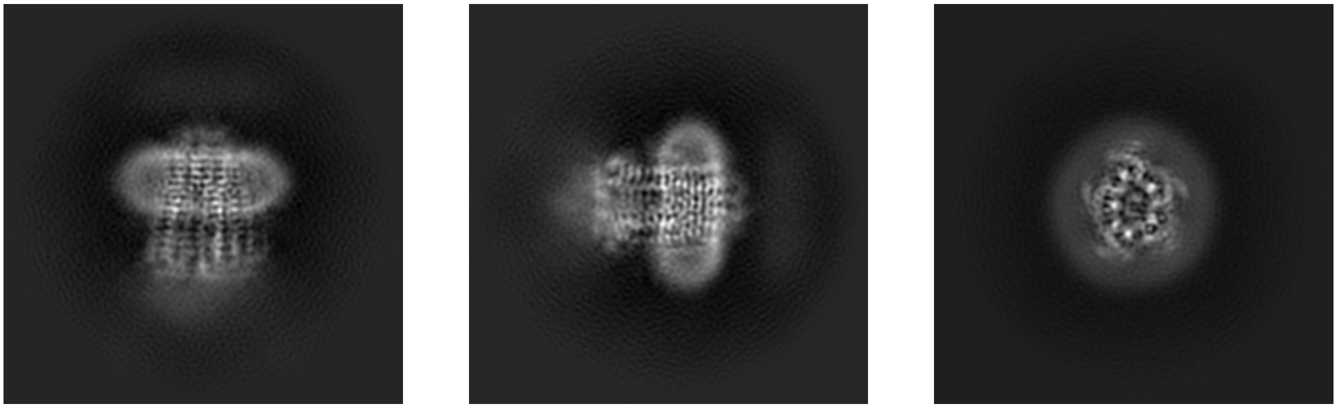
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-62493. These allow visual inspection of the internal detail of the map and identification of artifacts.

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

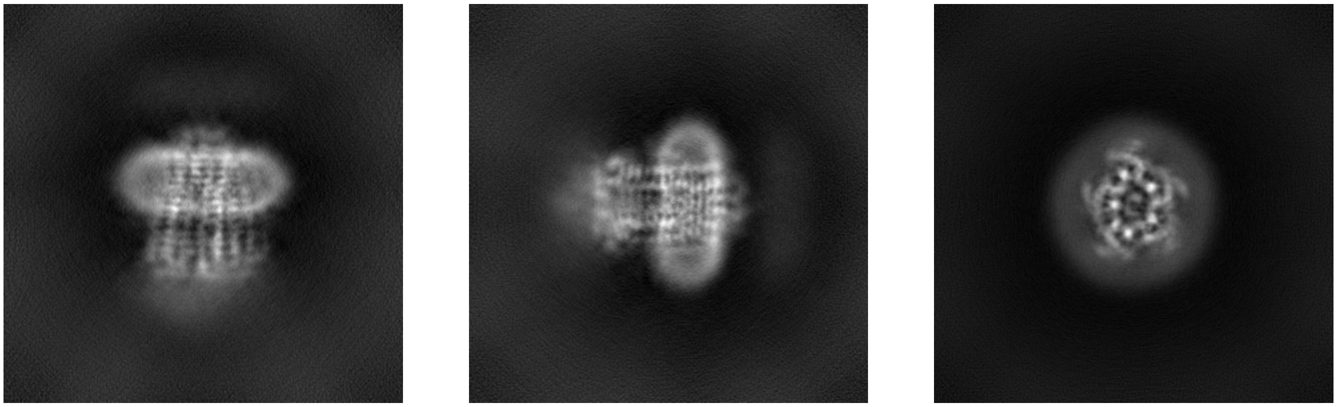
6.1 Orthogonal projections

6.1.1 Primary map



X Y Z

6.1.2 Raw map

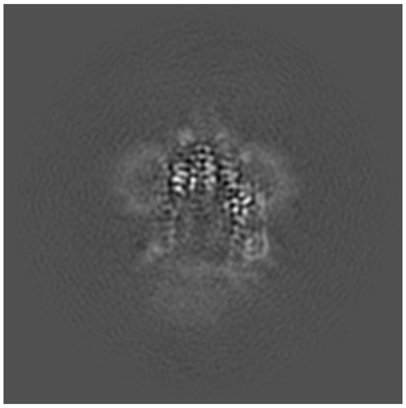


X Y Z

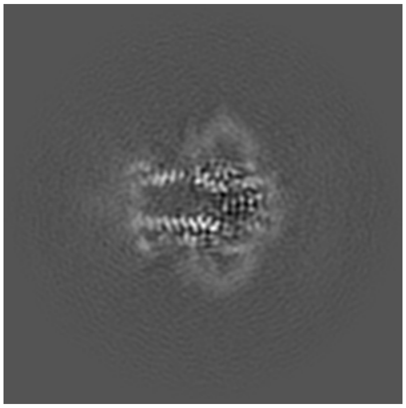
The images above show the map projected in three orthogonal directions.

6.2 Central slices ⓘ

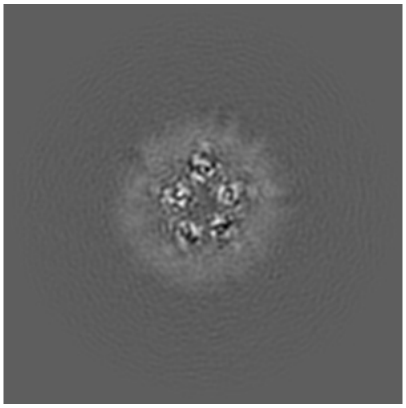
6.2.1 Primary map



X Index: 150

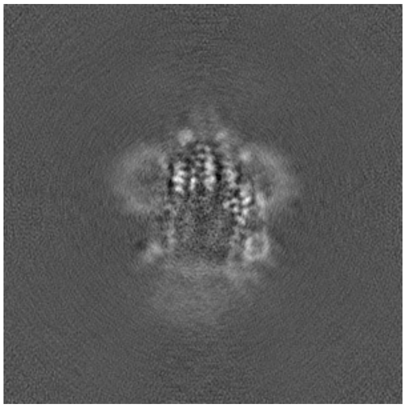


Y Index: 150

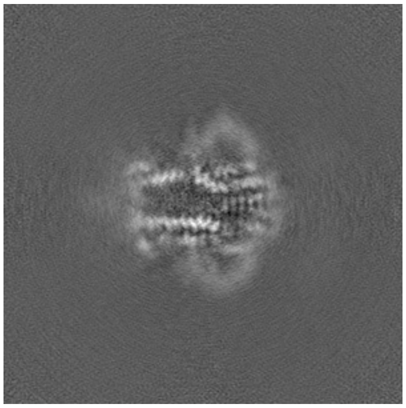


Z Index: 150

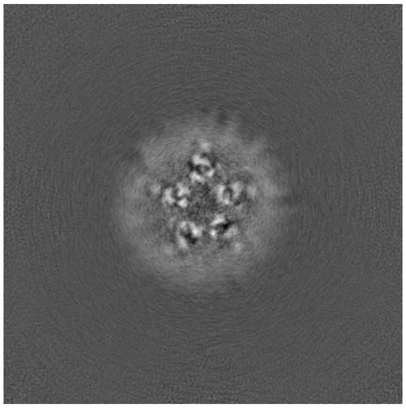
6.2.2 Raw map



X Index: 150



Y Index: 150

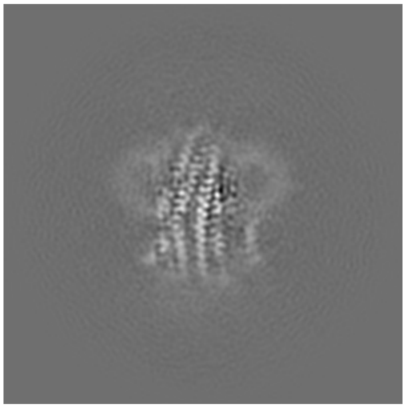


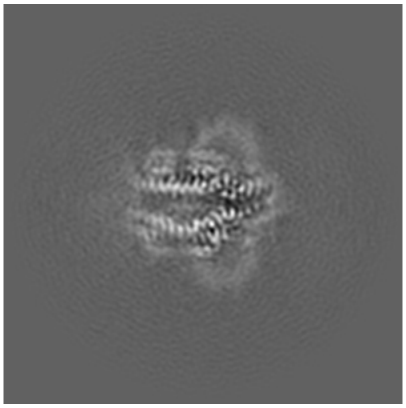
Z Index: 150

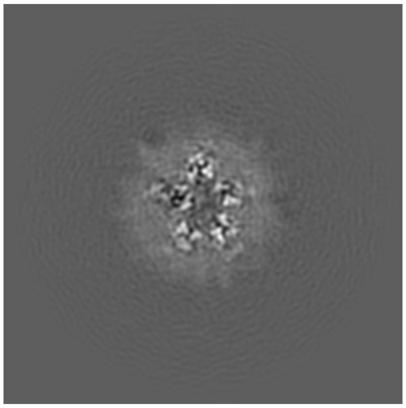
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices

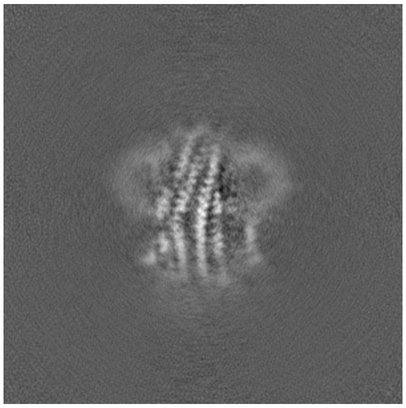
6.3.1 Primary map

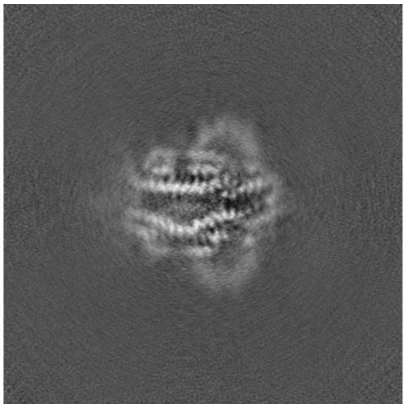

X Index: 135

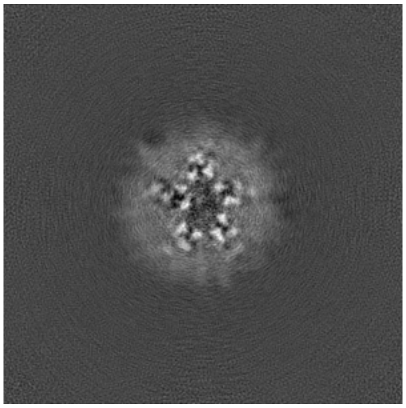

Y Index: 161


Z Index: 146

6.3.2 Raw map


X Index: 135

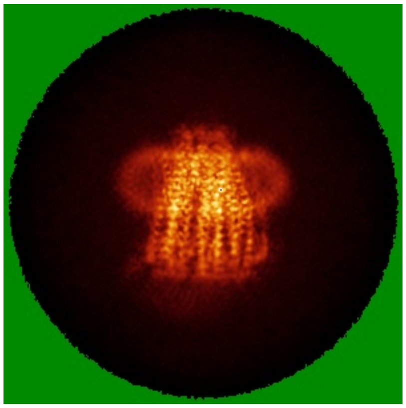

Y Index: 161

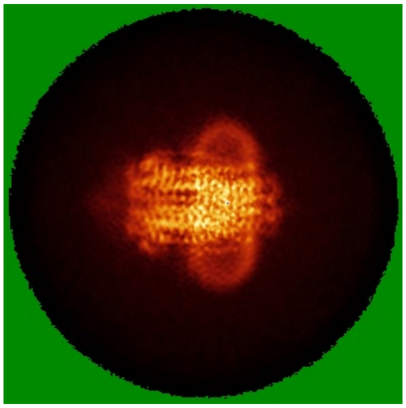

Z Index: 146

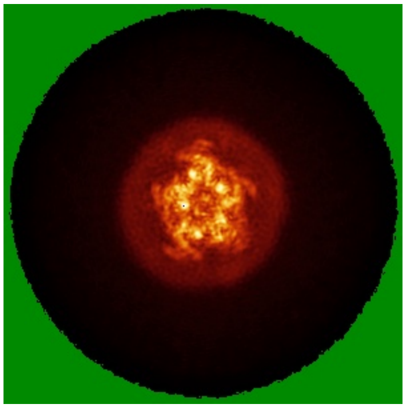
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) ⓘ

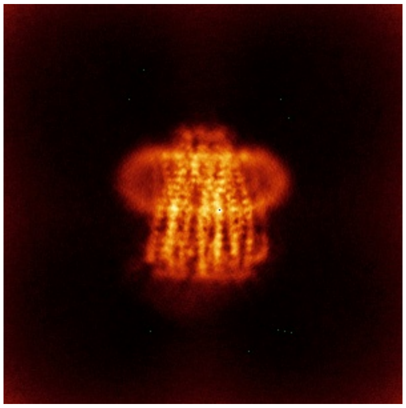
6.4.1 Primary map

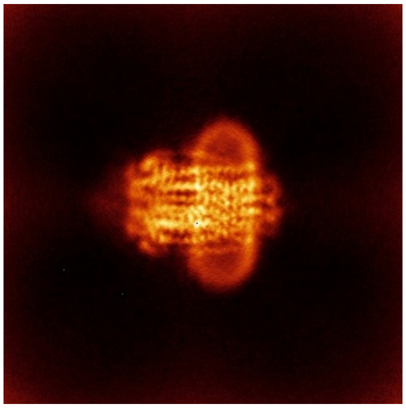

X

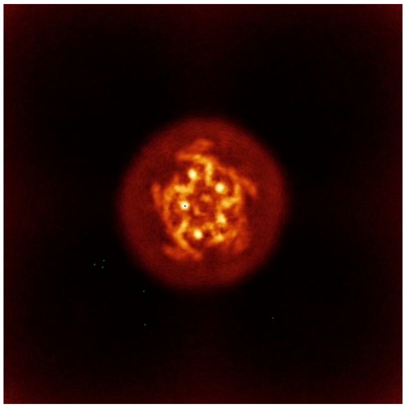

Y


Z

6.4.2 Raw map


X

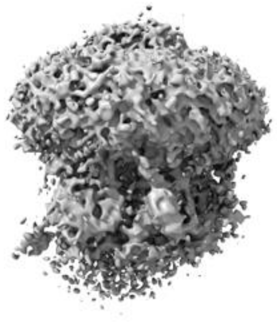

Y


Z

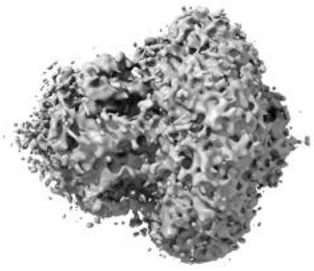
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views

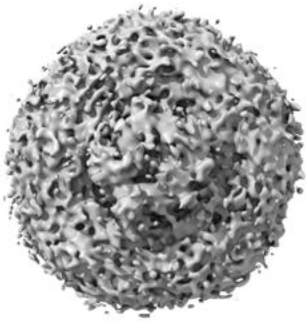
6.5.1 Primary map



X



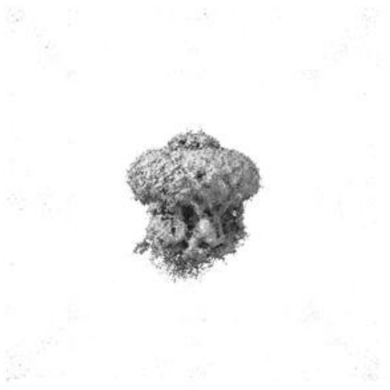
Y



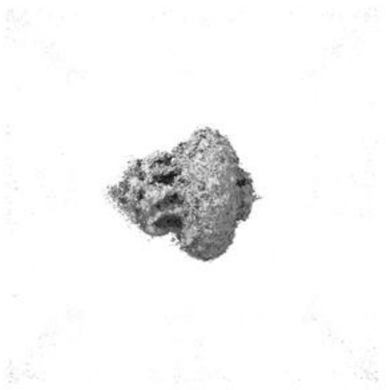
Z

The images above show the 3D surface view of the map at the recommended contour level 0.05. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

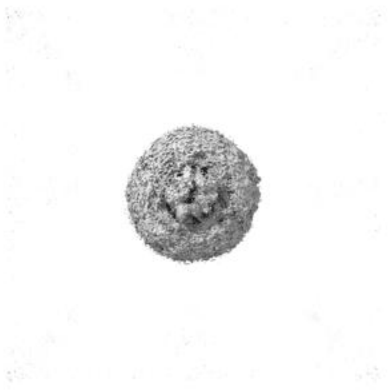
6.5.2 Raw map



X



Y



Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

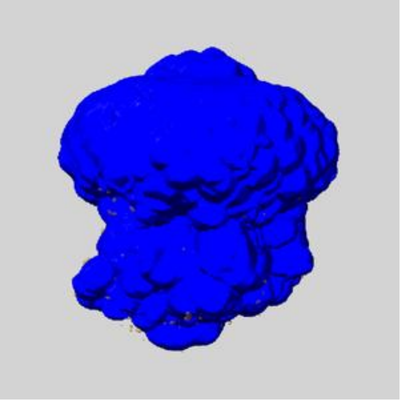
6.6 Mask visualisation ⓘ

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

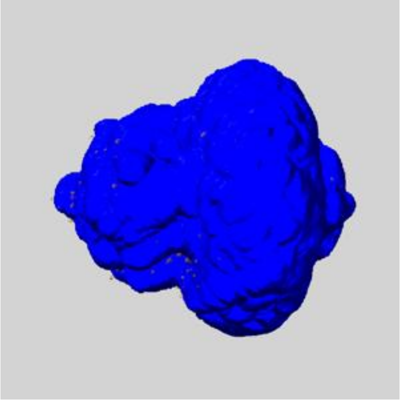
A mask typically either:

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

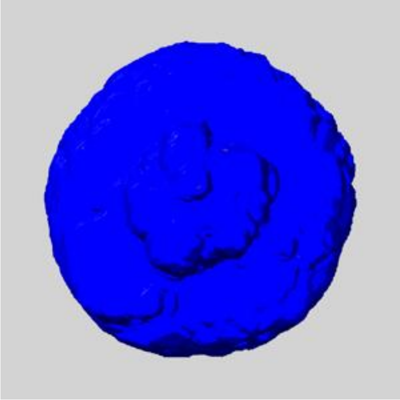
6.6.1 emd_62493_msk_1.map ⓘ



X



Y

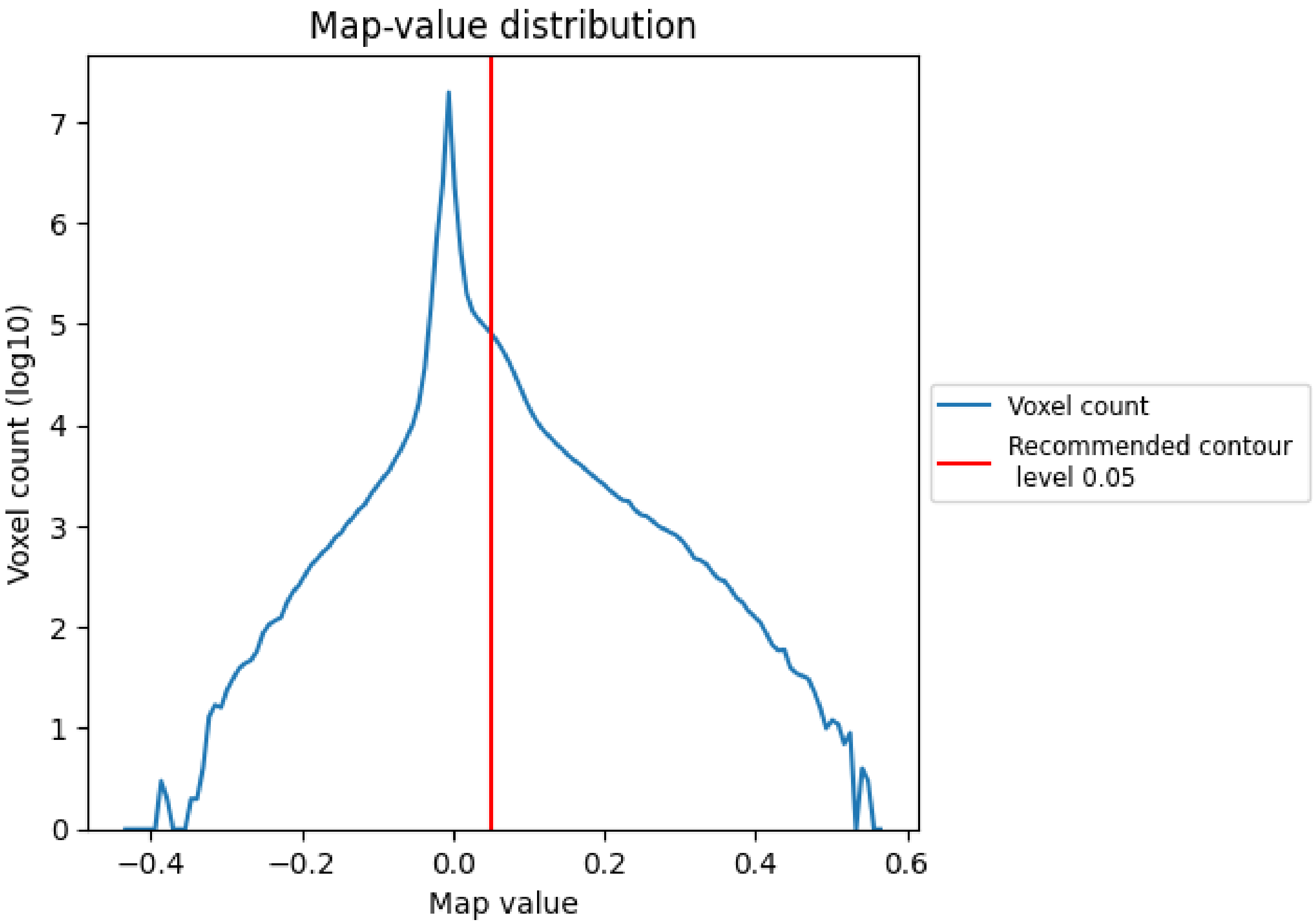


Z

7 Map analysis (i)

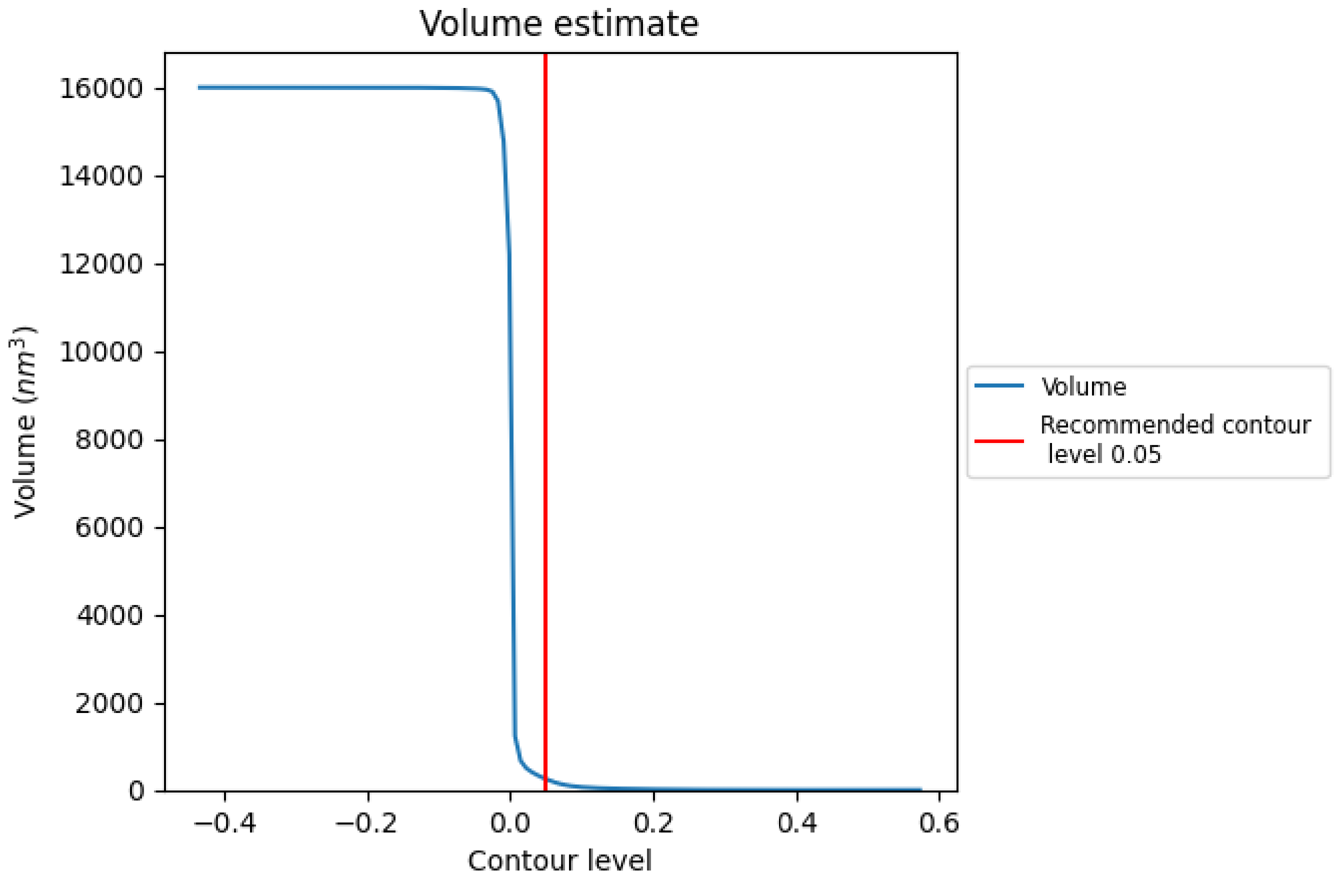
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution (i)



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

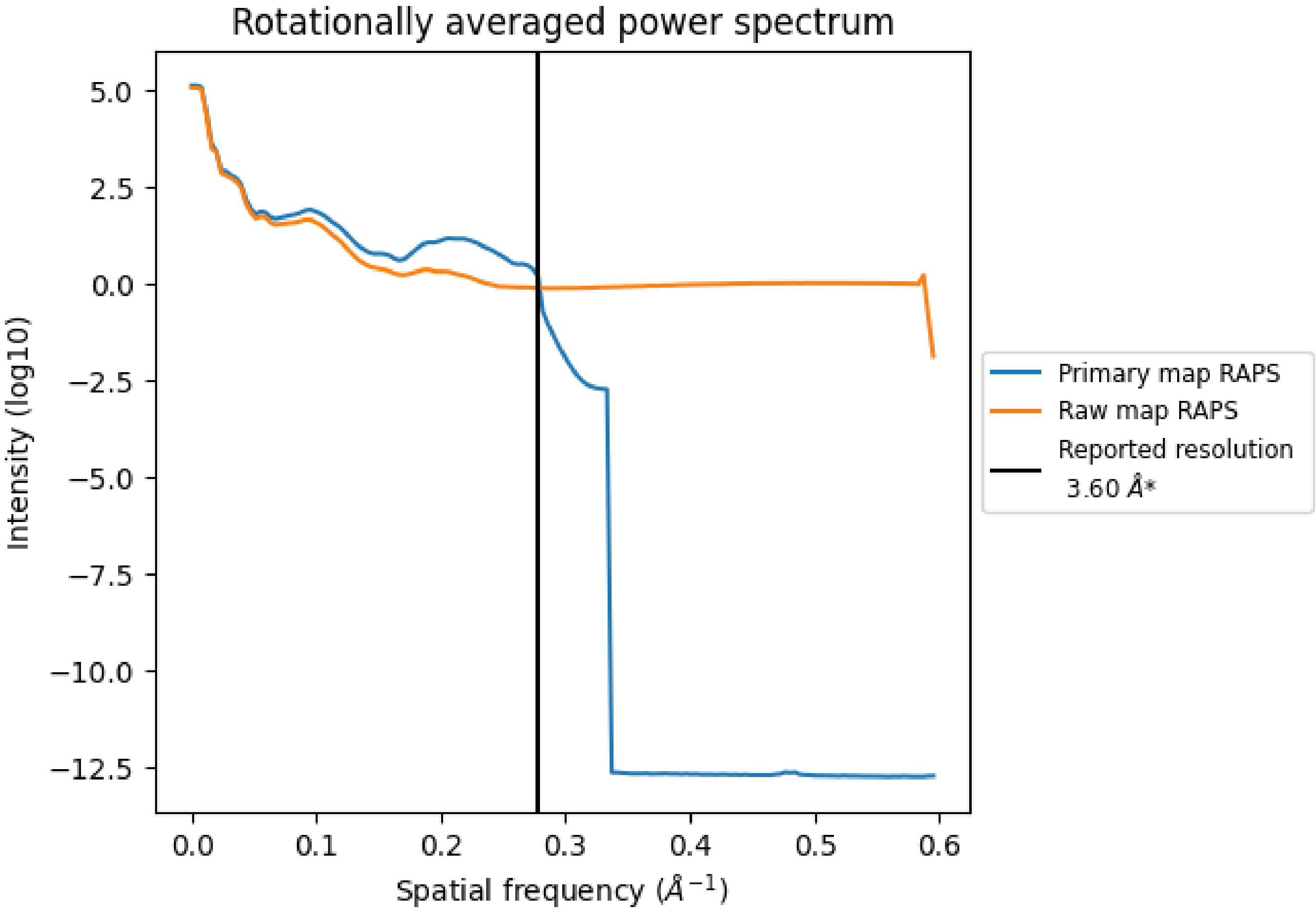
7.2 Volume estimate ⓘ



The volume at the recommended contour level is 248 nm^3; this corresponds to an approximate mass of 224 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 ⓘ

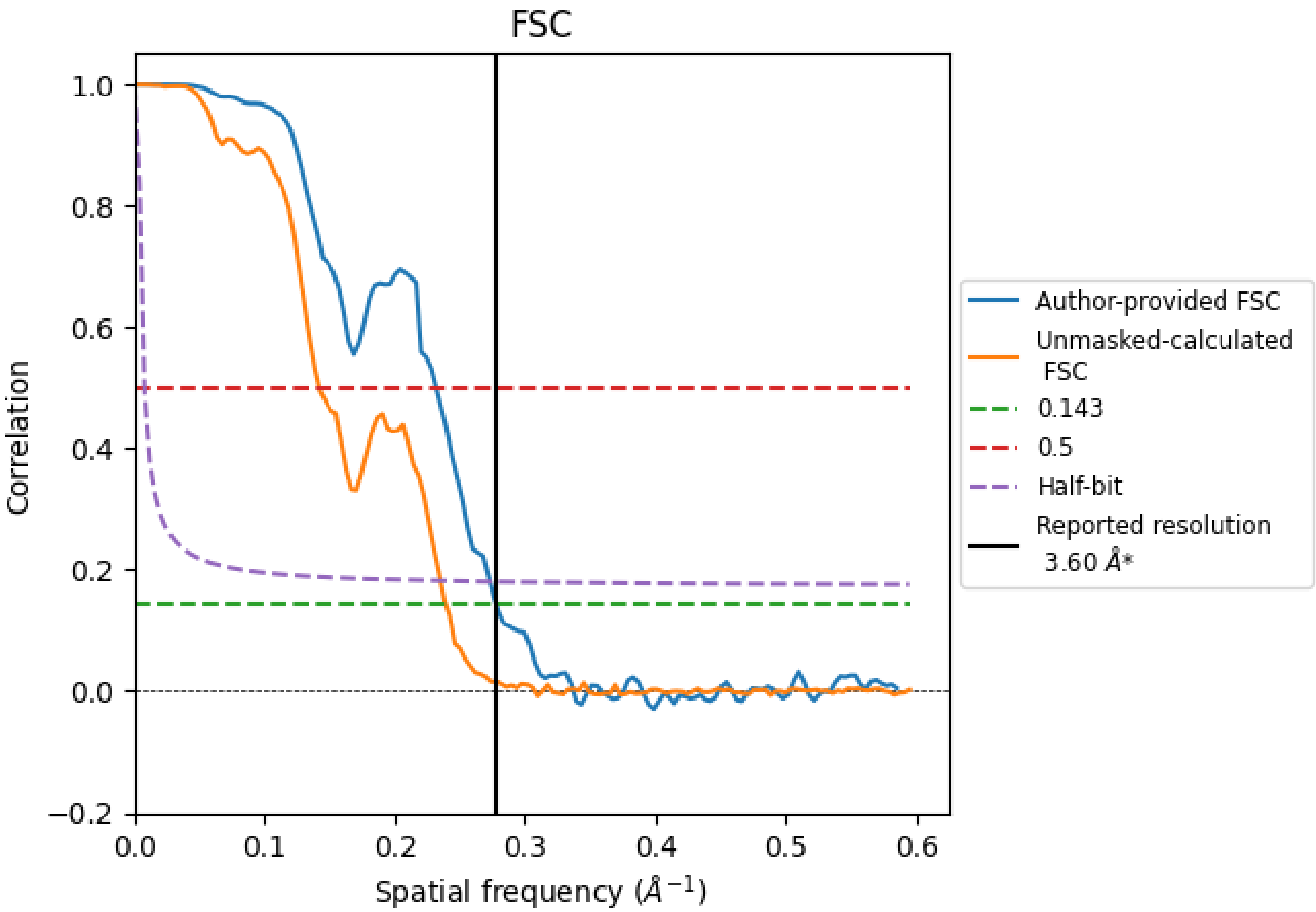


*Reported resolution corresponds to spatial frequency of 0.278 Å^{-1}

8 Fourier-Shell correlation ⓘ

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

8.1 FSC ⓘ



*Reported resolution corresponds to spatial frequency of 0.278 $Å^{-1}$

8.2 Resolution estimates ⓘ

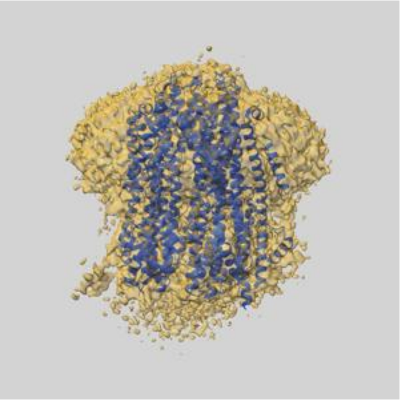
Resolution estimate (Å)	**Estimation criterion (FSC cut-off)**		
	0.143	0.5	Half-bit
Reported by author	3.60	-	-
Author-provided FSC curve	3.60	4.31	3.66
Unmasked-calculated*	4.18	7.04	4.25

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 4.18 differs from the reported value 3.6 by more than 10 %

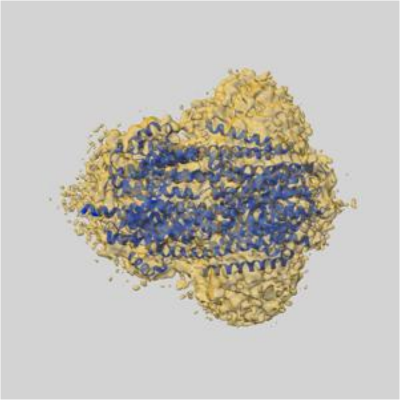
9 Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-62493 and PDB model 9KQ0. Per-residue inclusion information can be found in section 3 on page 11.

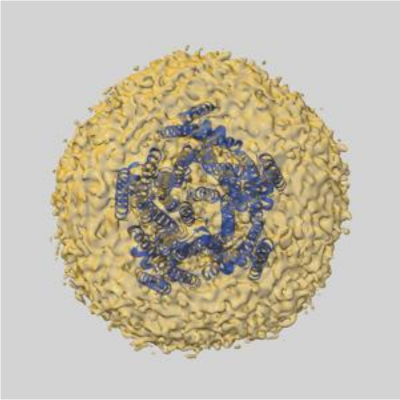
9.1 Map-model overlay ⓘ



X



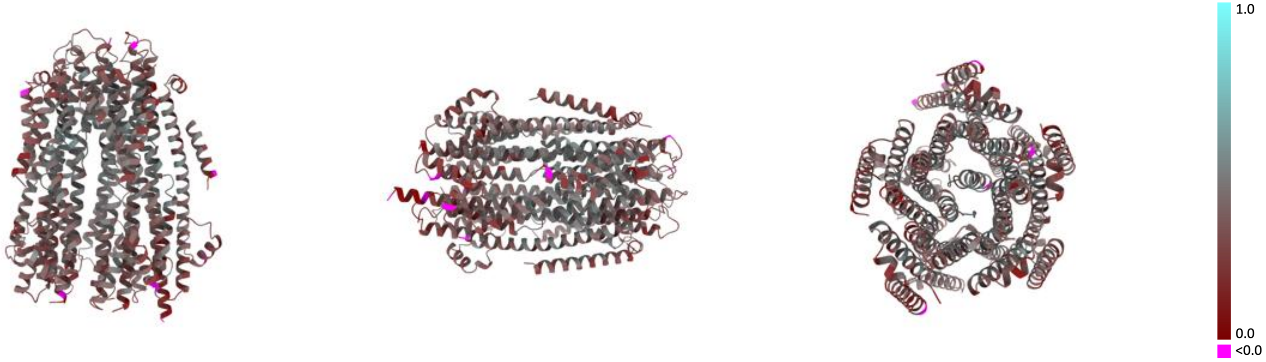
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.05 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.

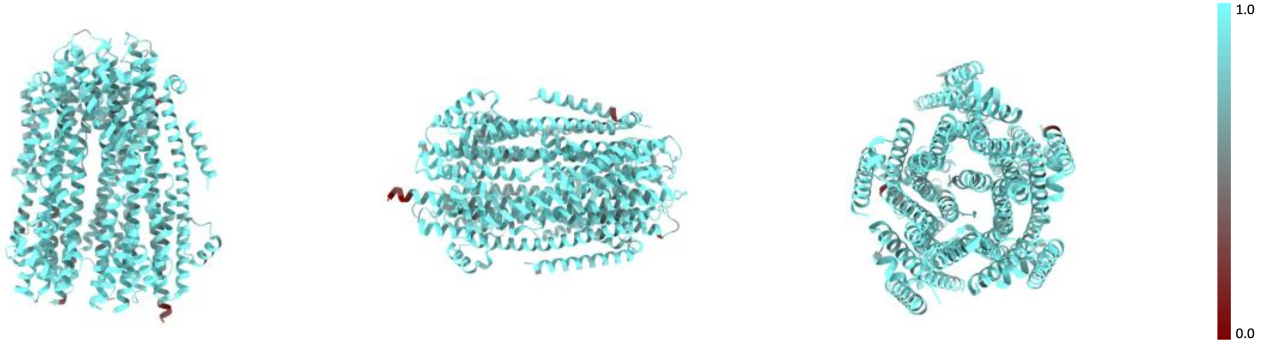
9.2 Q-score mapped to coordinate model ⓘ



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.

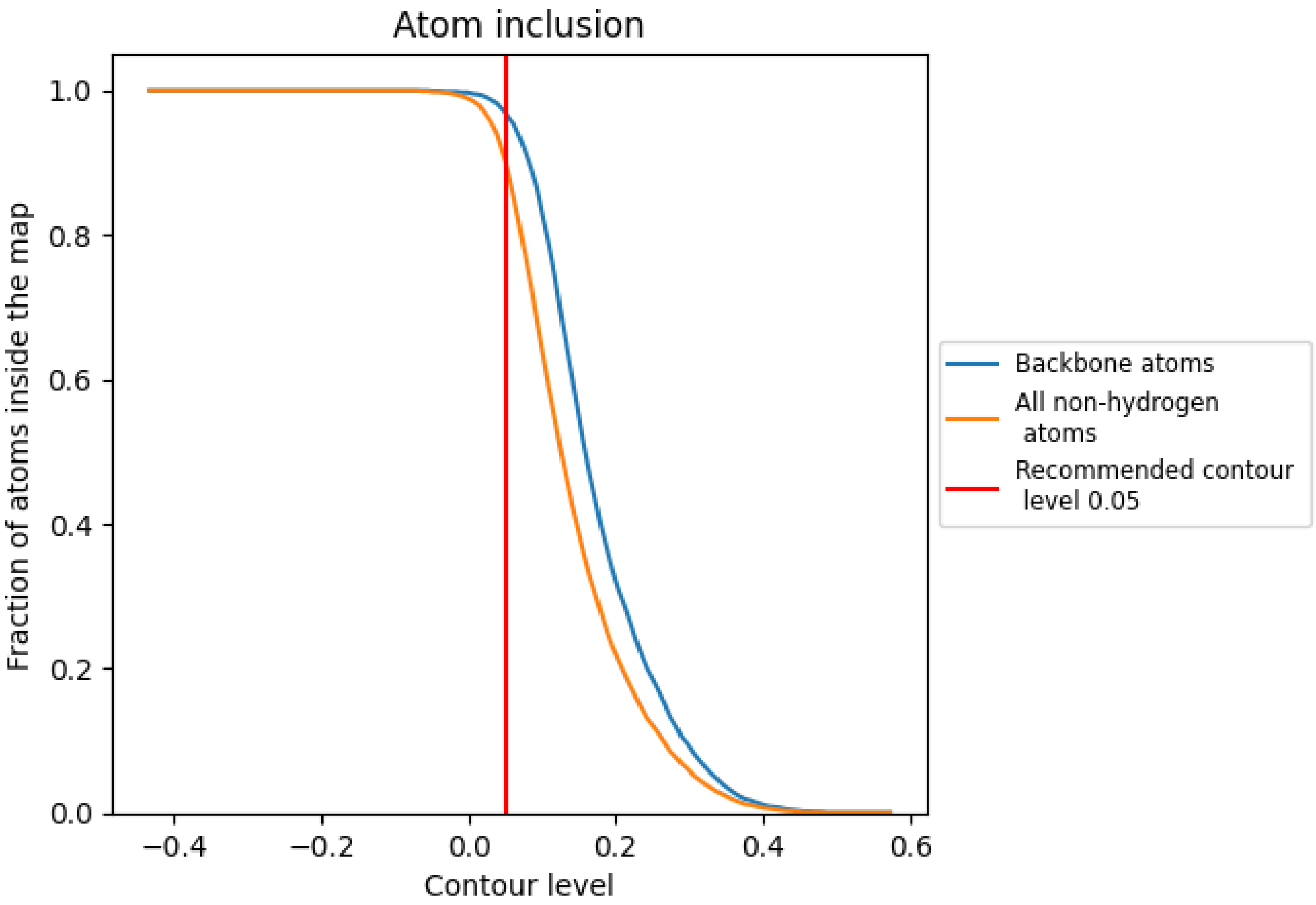
9.3 Atom inclusion mapped to coordinate model ⓘ



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 (0.05).

9.4 Atom inclusion ⓘ



At the recommended contour level, 97% of all backbone atoms, 90% 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 (0.05) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	▬ 0.9020	▬ 0.3620
A	▬ 0.8950	▬ 0.3440
B	▬ 0.9010	▬ 0.3540
C	▬ 0.9230	▬ 0.3820
D	▬ 0.9070	▬ 0.3690
E	▬ 0.9180	▬ 0.3850
F	▬ 0.8380	▬ 0.4370
G	▬ 0.8530	▬ 0.4300
H	▬ 0.8310	▬ 0.2410
I	▬ 0.8890	▬ 0.3150
J	▬ 0.8350	▬ 0.3010
K	▬ 0.8680	▬ 0.3040
L	▬ 0.8860	▬ 0.3290