



wwPDB EM Validation Summary Report ⓘ

Aug 6, 2026 – 08:45 AM JST

PDB ID : 23IL / pdb_000023il
EMDB ID : EMD-68999
Title : Cryo-EM structure of Chaetomium thermophilum SWI/SNF bound to a nucleosome
Authors : Ma, S.S.; Liu, M.D.; Shen, Q.T.; Chen, Y.
Deposited on : 2026-02-07
Resolution : 3.46 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.dev133
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
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) : 2.50

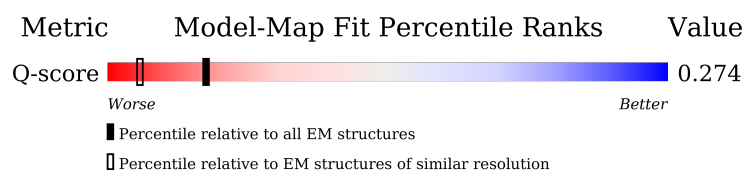
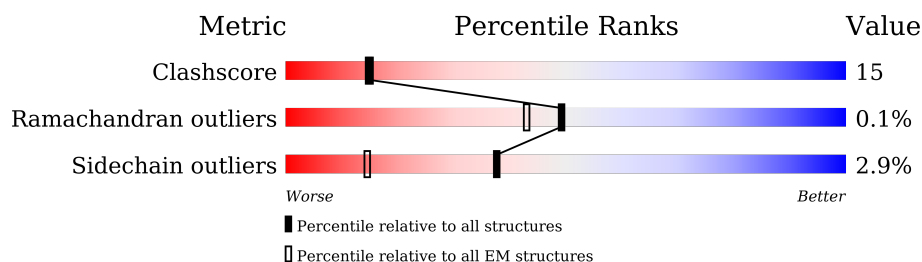
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.46 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.



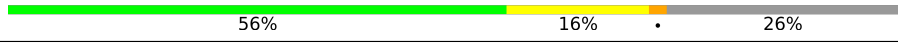
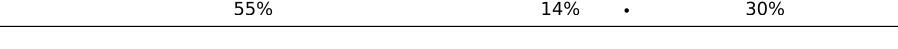
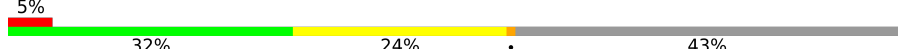
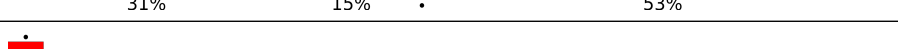
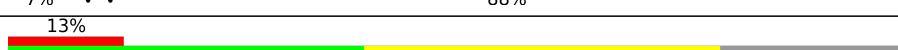
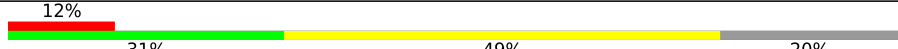
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	13788 (2.96 - 3.96)

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

Mol	Chain	Length	Quality of chain
1	A	135	
1	E	135	
2	B	102	
2	F	102	

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Mol	Chain	Length	Quality of chain
3	C	129	
3	G	129	
4	D	125	
4	H	125	
5	K	1595	
6	L	733	
7	M	476	
8	N	694	
8	O	694	
9	P	547	
10	Q	769	
11	R	1301	
12	S	785	
13	T	722	
14	U	627	
15	I	167	
16	J	167	

2 Entry composition [i](#)

There are 17 unique types of molecules in this entry. The entry contains 41626 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 Histone H3.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	91	Total	C	N	O	S	0	0
			744	469	141	131	3		
1	E	91	Total	C	N	O	S	0	0
			744	469	141	131	3		

- Molecule 2 is a protein called Histone H4.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	81	Total	C	N	O	S	0	0
			648	410	126	111	1		
2	F	77	Total	C	N	O	S	0	0
			614	389	119	105	1		

- Molecule 3 is a protein called Histone H2A.

Mol	Chain	Residues	Atoms				AltConf	Trace
3	C	95	Total	C	N	O	0	0
			733	459	145	129		
3	G	95	Total	C	N	O	0	0
			734	461	145	128		

- Molecule 4 is a protein called Histone H2B.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	88	Total	C	N	O	S	0	0
			685	433	121	129	2		
4	H	90	Total	C	N	O	S	0	0
			703	444	124	133	2		

- Molecule 5 is a protein called WD40 repeat-containing protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	K	801	Total	C	N	O	S	0	0
			6611	4184	1201	1195	31		

There are 64 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
K	-58	GLY	-	expression tag	UNP G0SHD8
K	-57	SER	-	expression tag	UNP G0SHD8
K	-56	PRO	-	expression tag	UNP G0SHD8
K	-55	GLN	-	expression tag	UNP G0SHD8
K	-54	GLN	-	expression tag	UNP G0SHD8
K	-53	ASN	-	expression tag	UNP G0SHD8
K	-52	LYS	-	expression tag	UNP G0SHD8
K	-51	THR	-	expression tag	UNP G0SHD8
K	-50	ALA	-	expression tag	UNP G0SHD8
K	-49	ALA	-	expression tag	UNP G0SHD8
K	-48	LEU	-	expression tag	UNP G0SHD8
K	-47	ALA	-	expression tag	UNP G0SHD8
K	-46	GLN	-	expression tag	UNP G0SHD8
K	-45	HIS	-	expression tag	UNP G0SHD8
K	-44	ASP	-	expression tag	UNP G0SHD8
K	-43	GLU	-	expression tag	UNP G0SHD8
K	-42	ALA	-	expression tag	UNP G0SHD8
K	-41	ASP	-	expression tag	UNP G0SHD8
K	-40	TYR	-	expression tag	UNP G0SHD8
K	-39	LYS	-	expression tag	UNP G0SHD8
K	-38	ASP	-	expression tag	UNP G0SHD8
K	-37	HIS	-	expression tag	UNP G0SHD8
K	-36	ASP	-	expression tag	UNP G0SHD8
K	-35	GLY	-	expression tag	UNP G0SHD8
K	-34	ASP	-	expression tag	UNP G0SHD8
K	-33	TYR	-	expression tag	UNP G0SHD8
K	-32	LYS	-	expression tag	UNP G0SHD8
K	-31	ASP	-	expression tag	UNP G0SHD8
K	-30	HIS	-	expression tag	UNP G0SHD8
K	-29	ASP	-	expression tag	UNP G0SHD8
K	-28	ILE	-	expression tag	UNP G0SHD8
K	-27	ASP	-	expression tag	UNP G0SHD8
K	-26	TYR	-	expression tag	UNP G0SHD8
K	-25	LYS	-	expression tag	UNP G0SHD8
K	-24	ASP	-	expression tag	UNP G0SHD8
K	-23	ASP	-	expression tag	UNP G0SHD8
K	-22	ASP	-	expression tag	UNP G0SHD8

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Chain	Residue	Modelled	Actual	Comment	Reference
K	-21	ASP	-	expression tag	UNP G0SHD8
K	-20	LYS	-	expression tag	UNP G0SHD8
K	-19	GLY	-	expression tag	UNP G0SHD8
K	-18	GLY	-	expression tag	UNP G0SHD8
K	-17	SER	-	expression tag	UNP G0SHD8
K	-16	GLY	-	expression tag	UNP G0SHD8
K	-15	GLY	-	expression tag	UNP G0SHD8
K	-14	SER	-	expression tag	UNP G0SHD8
K	-13	LEU	-	expression tag	UNP G0SHD8
K	-12	GLU	-	expression tag	UNP G0SHD8
K	-11	VAL	-	expression tag	UNP G0SHD8
K	-10	LEU	-	expression tag	UNP G0SHD8
K	-9	PHE	-	expression tag	UNP G0SHD8
K	-8	GLN	-	expression tag	UNP G0SHD8
K	-7	GLY	-	expression tag	UNP G0SHD8
K	-6	PRO	-	expression tag	UNP G0SHD8
K	-5	GLY	-	expression tag	UNP G0SHD8
K	-4	GLY	-	expression tag	UNP G0SHD8
K	-3	SER	-	expression tag	UNP G0SHD8
K	-2	GLY	-	expression tag	UNP G0SHD8
K	-1	GLY	-	expression tag	UNP G0SHD8
K	0	SER	-	expression tag	UNP G0SHD8
K	1	GLY	-	expression tag	UNP G0SHD8
K	2	THR	-	expression tag	UNP G0SHD8
K	114	VAL	ILE	conflict	UNP G0SHD8
K	282	ILE	VAL	conflict	UNP G0SHD8
K	1513	THR	ALA	conflict	UNP G0SHD8

- Molecule 6 is a protein called Putative chromatin structure remodeling complex protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	L	418	Total	C	N	O	S	0	0
			3374	2144	595	617	18		

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
L	374	PRO	ALA	conflict	UNP G0S882
L	375	ALA	THR	conflict	UNP G0S882
L	415	LYS	ARG	conflict	UNP G0S882
L	428	SER	PRO	conflict	UNP G0S882
L	712	GLU	-	expression tag	UNP G0S882

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Chain	Residue	Modelled	Actual	Comment	Reference
L	713	LEU	-	expression tag	UNP G0S882
L	714	GLY	-	expression tag	UNP G0S882
L	715	PRO	-	expression tag	UNP G0S882
L	716	LYS	-	expression tag	UNP G0S882
L	717	GLY	-	expression tag	UNP G0S882
L	718	ILE	-	expression tag	UNP G0S882
L	719	ARG	-	expression tag	UNP G0S882
L	720	SER	-	expression tag	UNP G0S882
L	721	HIS	-	expression tag	UNP G0S882
L	722	SER	-	expression tag	UNP G0S882
L	723	MET	-	expression tag	UNP G0S882
L	724	LEU	-	expression tag	UNP G0S882
L	725	ALA	-	expression tag	UNP G0S882
L	726	LEU	-	expression tag	UNP G0S882
L	727	GLU	-	expression tag	UNP G0S882
L	728	HIS	-	expression tag	UNP G0S882
L	729	HIS	-	expression tag	UNP G0S882
L	730	HIS	-	expression tag	UNP G0S882
L	731	HIS	-	expression tag	UNP G0S882
L	732	HIS	-	expression tag	UNP G0S882
L	733	HIS	-	expression tag	UNP G0S882

- Molecule 7 is a protein called Actin-related protein 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	M	425	Total	C	N	O	S	0	0
			3327	2112	584	616	15		

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
M	469	LEU	-	expression tag	UNP G0SBW4
M	470	GLU	-	expression tag	UNP G0SBW4
M	471	HIS	-	expression tag	UNP G0SBW4
M	472	HIS	-	expression tag	UNP G0SBW4
M	473	HIS	-	expression tag	UNP G0SBW4
M	474	HIS	-	expression tag	UNP G0SBW4
M	475	HIS	-	expression tag	UNP G0SBW4
M	476	HIS	-	expression tag	UNP G0SBW4

- Molecule 8 is a protein called Ssr1.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	N	347	Total	C	N	O	S	0	0
			2739	1719	498	508	14		
8	O	325	Total	C	N	O	S	0	0
			2611	1643	464	492	12		

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
N	687	ASP	-	expression tag	UNP G0S647
N	688	TYR	-	expression tag	UNP G0S647
N	689	LYS	-	expression tag	UNP G0S647
N	690	ASP	-	expression tag	UNP G0S647
N	691	ASP	-	expression tag	UNP G0S647
N	692	ASP	-	expression tag	UNP G0S647
N	693	ASP	-	expression tag	UNP G0S647
N	694	LYS	-	expression tag	UNP G0S647
O	687	ASP	-	expression tag	UNP G0S647
O	688	TYR	-	expression tag	UNP G0S647
O	689	LYS	-	expression tag	UNP G0S647
O	690	ASP	-	expression tag	UNP G0S647
O	691	ASP	-	expression tag	UNP G0S647
O	692	ASP	-	expression tag	UNP G0S647
O	693	ASP	-	expression tag	UNP G0S647
O	694	LYS	-	expression tag	UNP G0S647

- Molecule 9 is a protein called DM2 domain-containing protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	P	308	Total	C	N	O	S	0	0
			2439	1510	456	465	8		

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
P	191	ASP	ASN	conflict	UNP G0RYN3
P	540	ASP	-	expression tag	UNP G0RYN3
P	541	TYR	-	expression tag	UNP G0RYN3
P	542	LYS	-	expression tag	UNP G0RYN3
P	543	ASP	-	expression tag	UNP G0RYN3
P	544	ASP	-	expression tag	UNP G0RYN3
P	545	ASP	-	expression tag	UNP G0RYN3
P	546	ASP	-	expression tag	UNP G0RYN3
P	547	LYS	-	expression tag	UNP G0RYN3

- Molecule 10 is a protein called DUF1750-domain-containing protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	Q	168	Total	C	N	O	S	0	0
			1333	836	231	261	5		

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
Q	763	ASP	-	expression tag	UNP G0SEZ9
Q	764	TYR	-	expression tag	UNP G0SEZ9
Q	765	LYS	-	expression tag	UNP G0SEZ9
Q	766	ASP	-	expression tag	UNP G0SEZ9
Q	767	ASP	-	expression tag	UNP G0SEZ9
Q	768	ASP	-	expression tag	UNP G0SEZ9
Q	769	ASP	-	expression tag	UNP G0SEZ9
Q	770	LYS	-	expression tag	UNP G0SEZ9

- Molecule 11 is a protein called ARID domain-containing protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	R	477	Total	C	N	O	S	0	0
			3718	2366	630	700	22		

There are 67 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-68	GLY	-	expression tag	UNP G0S385
R	-67	SER	-	expression tag	UNP G0S385
R	-66	PRO	-	expression tag	UNP G0S385
R	-65	GLN	-	expression tag	UNP G0S385
R	-64	GLN	-	expression tag	UNP G0S385
R	-63	ASN	-	expression tag	UNP G0S385
R	-62	LYS	-	expression tag	UNP G0S385
R	-61	THR	-	expression tag	UNP G0S385
R	-60	ALA	-	expression tag	UNP G0S385
R	-59	ALA	-	expression tag	UNP G0S385
R	-58	LEU	-	expression tag	UNP G0S385
R	-57	ALA	-	expression tag	UNP G0S385
R	-56	GLN	-	expression tag	UNP G0S385
R	-55	HIS	-	expression tag	UNP G0S385
R	-54	ASP	-	expression tag	UNP G0S385
R	-53	GLU	-	expression tag	UNP G0S385
R	-52	ALA	-	expression tag	UNP G0S385

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Chain	Residue	Modelled	Actual	Comment	Reference
R	-51	ASP	-	expression tag	UNP G0S385
R	-50	TYR	-	expression tag	UNP G0S385
R	-49	LYS	-	expression tag	UNP G0S385
R	-48	ASP	-	expression tag	UNP G0S385
R	-47	HIS	-	expression tag	UNP G0S385
R	-46	ASP	-	expression tag	UNP G0S385
R	-45	GLY	-	expression tag	UNP G0S385
R	-44	ASP	-	expression tag	UNP G0S385
R	-43	TYR	-	expression tag	UNP G0S385
R	-42	LYS	-	expression tag	UNP G0S385
R	-41	ASP	-	expression tag	UNP G0S385
R	-40	HIS	-	expression tag	UNP G0S385
R	-39	ASP	-	expression tag	UNP G0S385
R	-38	ILE	-	expression tag	UNP G0S385
R	-37	ASP	-	expression tag	UNP G0S385
R	-36	TYR	-	expression tag	UNP G0S385
R	-35	LYS	-	expression tag	UNP G0S385
R	-34	ASP	-	expression tag	UNP G0S385
R	-33	ASP	-	expression tag	UNP G0S385
R	-32	ASP	-	expression tag	UNP G0S385
R	-31	ASP	-	expression tag	UNP G0S385
R	-30	LYS	-	expression tag	UNP G0S385
R	-29	GLY	-	expression tag	UNP G0S385
R	-28	GLY	-	expression tag	UNP G0S385
R	-27	SER	-	expression tag	UNP G0S385
R	-26	GLY	-	expression tag	UNP G0S385
R	-25	GLY	-	expression tag	UNP G0S385
R	-24	SER	-	expression tag	UNP G0S385
R	-23	LEU	-	expression tag	UNP G0S385
R	-22	GLU	-	expression tag	UNP G0S385
R	-21	VAL	-	expression tag	UNP G0S385
R	-20	LEU	-	expression tag	UNP G0S385
R	-19	PHE	-	expression tag	UNP G0S385
R	-18	GLN	-	expression tag	UNP G0S385
R	-17	GLY	-	expression tag	UNP G0S385
R	-16	PRO	-	expression tag	UNP G0S385
R	-15	GLY	-	expression tag	UNP G0S385
R	-14	GLY	-	expression tag	UNP G0S385
R	-13	SER	-	expression tag	UNP G0S385
R	-12	GLY	-	expression tag	UNP G0S385
R	-11	GLY	-	expression tag	UNP G0S385
R	-10	SER	-	expression tag	UNP G0S385

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Chain	Residue	Modelled	Actual	Comment	Reference
R	-9	GLY	-	expression tag	UNP G0S385
R	-8	THR	-	expression tag	UNP G0S385
R	397	ALA	VAL	conflict	UNP G0S385
R	512	GLY	VAL	conflict	UNP G0S385
R	632	PRO	SER	conflict	UNP G0S385
R	724	ILE	VAL	conflict	UNP G0S385
R	878	SER	GLY	conflict	UNP G0S385
R	1036	SER	ALA	conflict	UNP G0S385

- Molecule 12 is a protein called Snf5.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	S	388	Total	C	N	O	S	0	0
			3173	1995	563	603	12		

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
S	778	ASP	-	expression tag	UNP G0S4S8
S	779	TYR	-	expression tag	UNP G0S4S8
S	780	LYS	-	expression tag	UNP G0S4S8
S	781	ASP	-	expression tag	UNP G0S4S8
S	782	ASP	-	expression tag	UNP G0S4S8
S	783	ASP	-	expression tag	UNP G0S4S8
S	784	ASP	-	expression tag	UNP G0S4S8
S	785	LYS	-	expression tag	UNP G0S4S8

- Molecule 13 is a protein called Nuclear localization protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	T	66	Total	C	N	O	S	0	0
			542	332	107	101	2		

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
T	-7	SER	GLY	conflict	UNP G0SEX4
T	682	SER	PRO	conflict	UNP G0SEX4
T	697	ASP	-	expression tag	UNP G0SEX4
T	698	TYR	-	expression tag	UNP G0SEX4
T	699	LYS	-	expression tag	UNP G0SEX4
T	700	ASP	-	expression tag	UNP G0SEX4

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Chain	Residue	Modelled	Actual	Comment	Reference
T	701	ASP	-	expression tag	UNP G0SEX4
T	702	ASP	-	expression tag	UNP G0SEX4
T	703	ASP	-	expression tag	UNP G0SEX4
T	704	LYS	-	expression tag	UNP G0SEX4

- Molecule 14 is a protein called LYR family protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
14	U	75	Total	C	N	O	S	0	0
			633	409	116	107	1		

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
U	260	ILE	VAL	conflict	UNP G0S145
U	459	PRO	LEU	conflict	UNP G0S145
U	486	VAL	ALA	conflict	UNP G0S145
U	544	ASP	GLY	conflict	UNP G0S145
U	607	GLU	GLY	conflict	UNP G0S145
U	609	ALA	-	expression tag	UNP G0S145
U	610	THR	-	expression tag	UNP G0S145
U	611	GLN	-	expression tag	UNP G0S145
U	612	GLU	-	expression tag	UNP G0S145
U	613	VAL	-	expression tag	UNP G0S145
U	614	LYS	-	expression tag	UNP G0S145
U	615	THR	-	expression tag	UNP G0S145
U	616	GLU	-	expression tag	UNP G0S145
U	617	GLY	-	expression tag	UNP G0S145
U	618	GLU	-	expression tag	UNP G0S145
U	619	LYS	-	expression tag	UNP G0S145
U	620	PRO	-	expression tag	UNP G0S145
U	621	GLU	-	expression tag	UNP G0S145
U	622	HIS	-	expression tag	UNP G0S145
U	623	HIS	-	expression tag	UNP G0S145
U	624	HIS	-	expression tag	UNP G0S145
U	625	HIS	-	expression tag	UNP G0S145
U	626	HIS	-	expression tag	UNP G0S145
U	627	HIS	-	expression tag	UNP G0S145

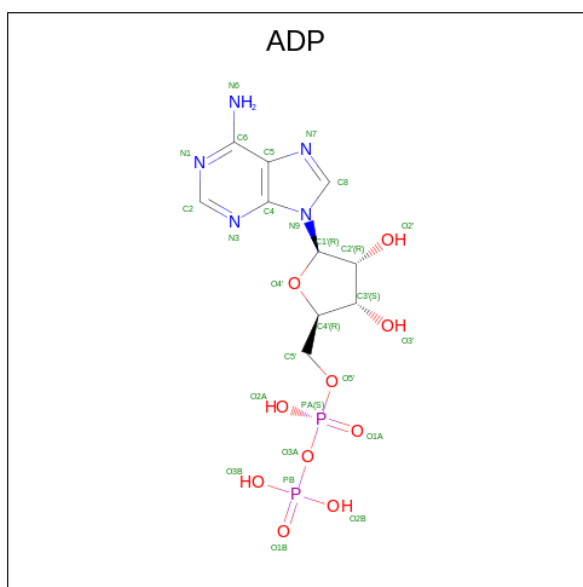
- Molecule 15 is a DNA chain called DNA (167-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
15	I	134	Total	C	N	O	P	0	0
			2734	1297	500	803	134		

- Molecule 16 is a DNA chain called DNA (167-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
16	J	134	Total	C	N	O	P	0	0
			2760	1306	515	805	134		

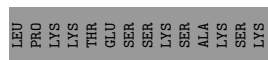
- Molecule 17 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).



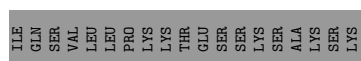
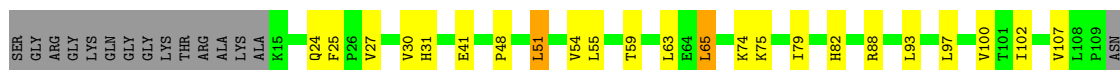
Mol	Chain	Residues	Atoms					AltConf
17	K	1	Total	C	N	O	P	0
			27	10	5	10	2	



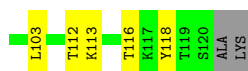
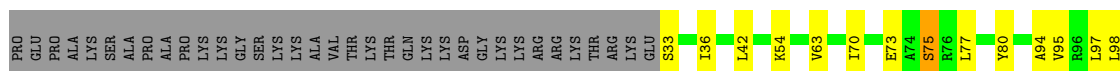
• Molecule 3: Histone H2A



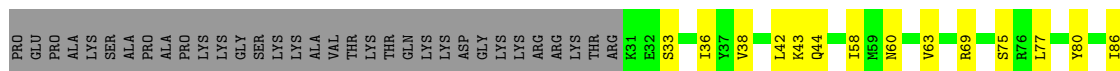
• Molecule 3: Histone H2A



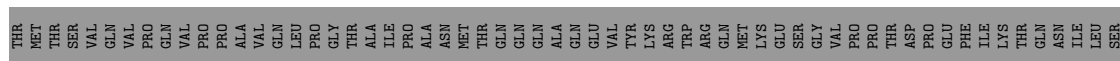
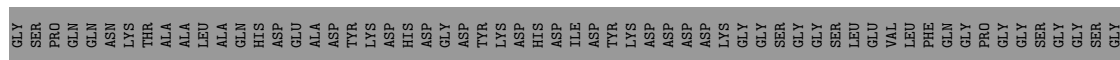
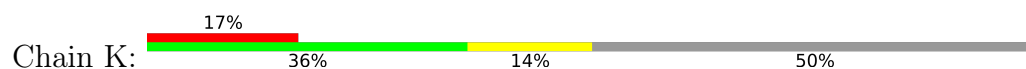
• Molecule 4: Histone H2B



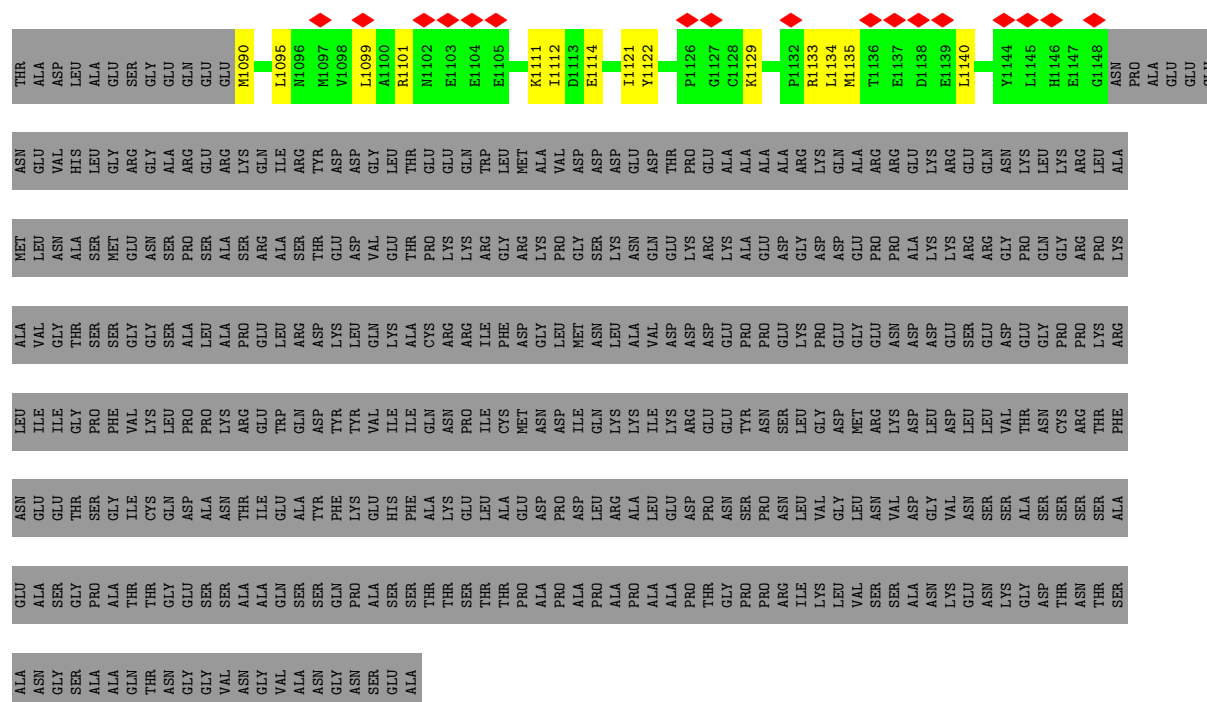
• Molecule 4: Histone H2B



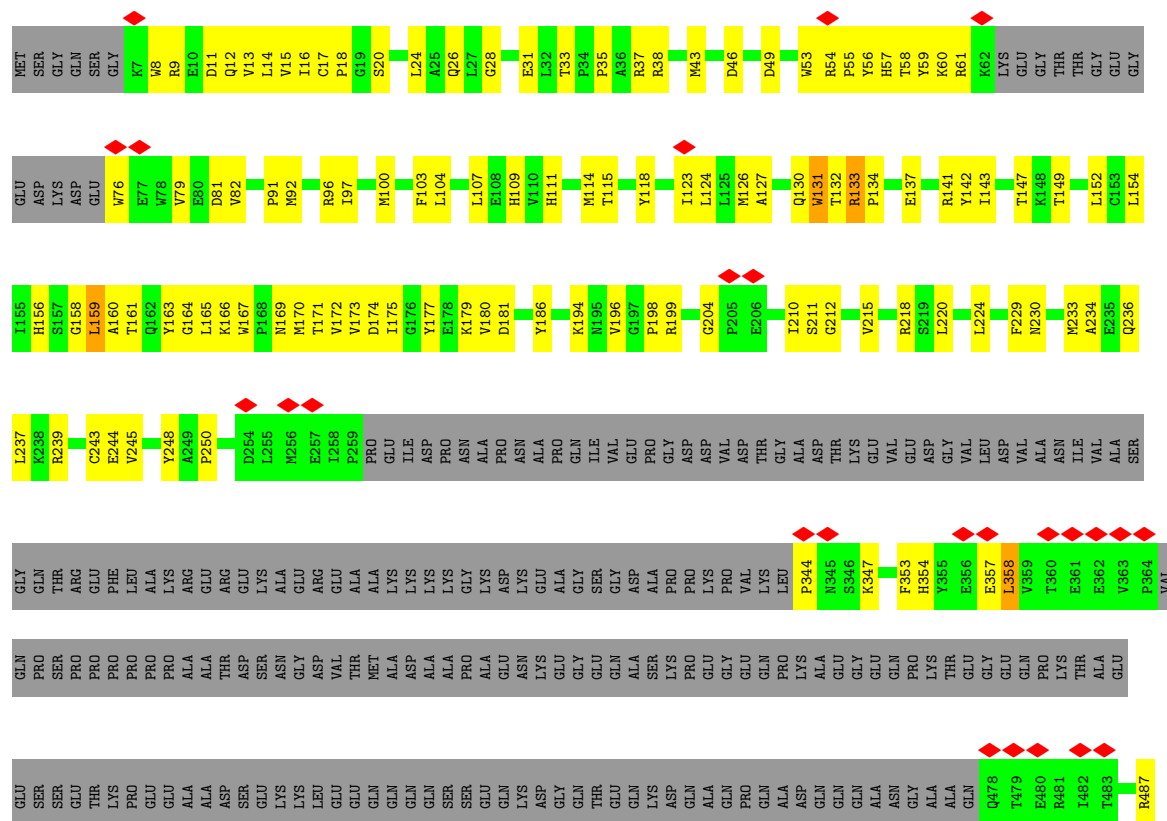
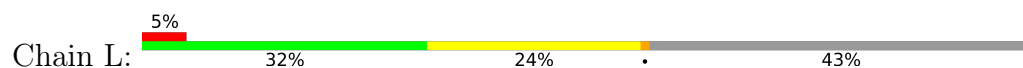
• Molecule 5: WD40 repeat-containing protein

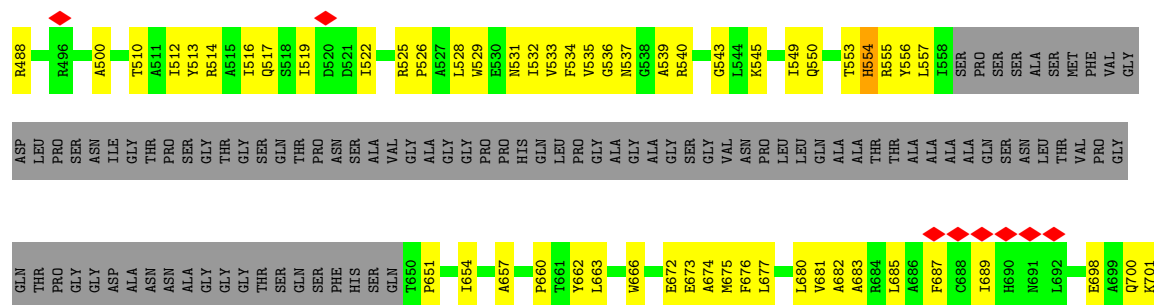




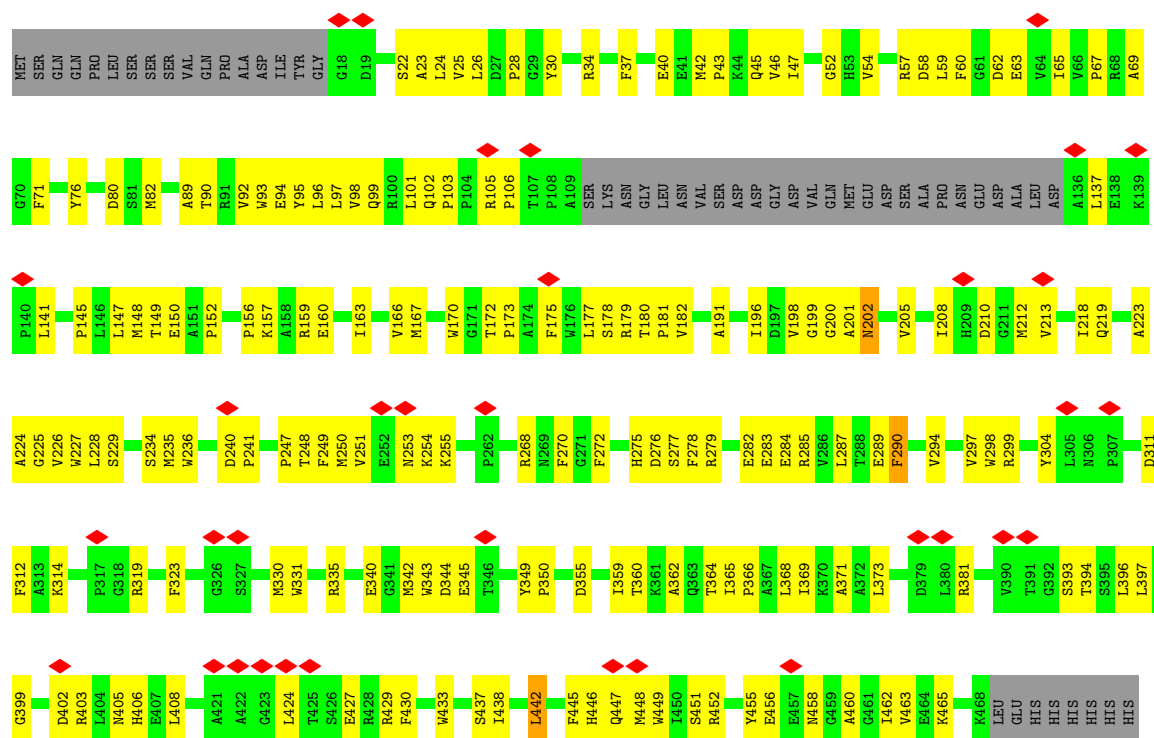


• Molecule 6: Putative chromatin structure remodeling complex protein

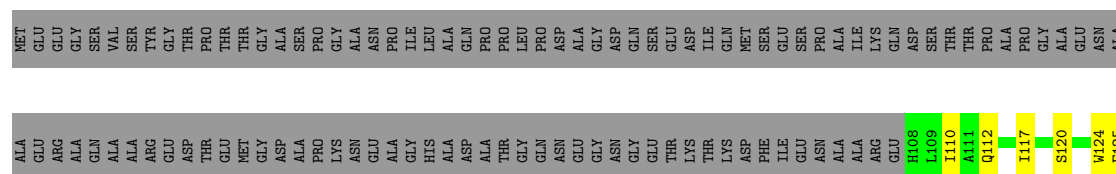
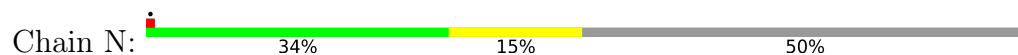


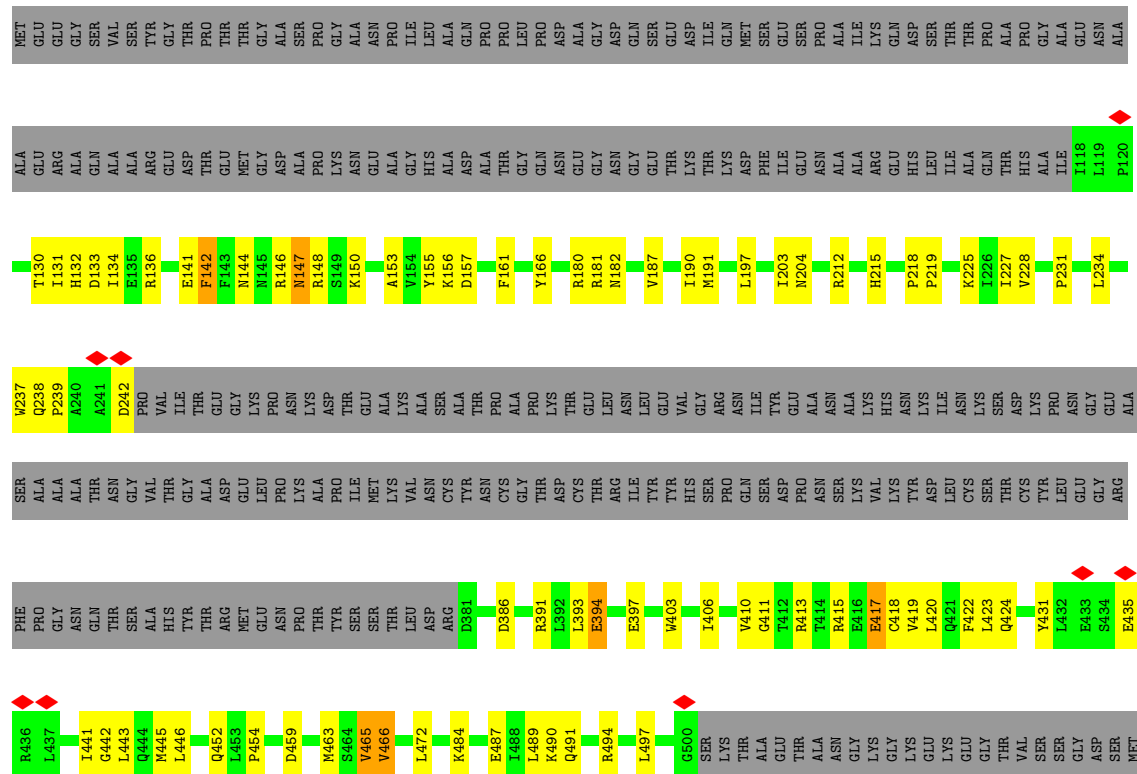


• Molecule 7: Actin-related protein 4

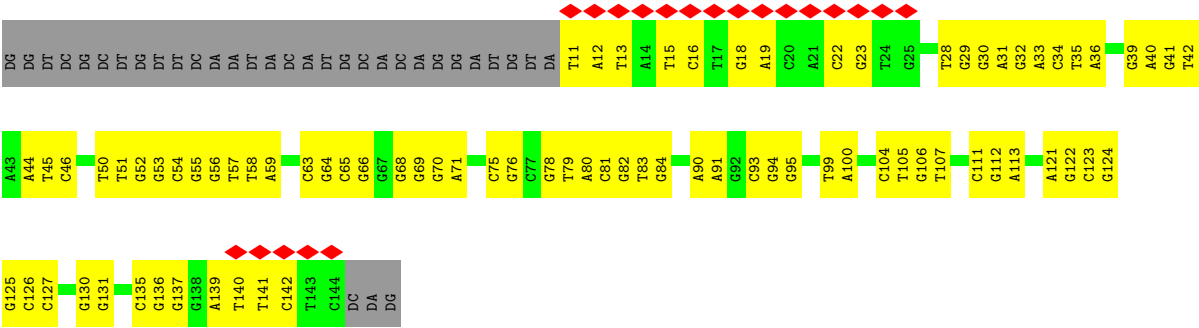


• Molecule 8: Ssr1









4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	108901	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)	1000	Depositor
Maximum defocus (nm)	2400	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	115.604	Depositor
Minimum map value	-1.400	Depositor
Average map value	0.041	Depositor
Map value standard deviation	1.431	Depositor
Recommended contour level	1.4	Depositor
Map size (Å)	445.19998, 445.19998, 445.19998	wwPDB
Map dimensions	420, 420, 420	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.06, 1.06, 1.06	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ADP

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	0.15	0/752	0.33	0/1008
1	E	0.15	0/752	0.32	0/1008
2	B	0.16	0/655	0.38	0/878
2	F	0.16	0/621	0.38	0/832
3	C	0.16	0/742	0.34	0/1002
3	G	0.15	0/743	0.35	0/1002
4	D	0.16	0/696	0.34	0/939
4	H	0.16	0/714	0.37	0/962
5	K	0.12	0/6724	0.35	0/9026
6	L	0.16	0/3454	0.48	0/4681
7	M	0.20	0/3413	0.47	0/4641
8	N	0.17	0/2790	0.42	0/3775
8	O	0.19	0/2662	0.50	1/3602 (0.0%)
9	P	0.16	0/2479	0.41	0/3341
10	Q	0.23	0/1352	0.56	1/1811 (0.1%)
11	R	0.17	0/3801	0.41	0/5179
12	S	0.19	0/3248	0.51	1/4393 (0.0%)
13	T	0.16	0/556	0.45	0/754
14	U	0.19	0/655	0.65	2/889 (0.2%)
15	I	0.24	0/3064	0.44	0/4723
16	J	0.24	0/3098	0.41	0/4783
All	All	0.18	0/42971	0.43	5/59229 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
14	U	30	PRO	CA-C-N	5.73	132.28	121.97
14	U	30	PRO	C-N-CA	5.73	132.28	121.97
8	O	465	VAL	N-CA-C	-5.16	107.80	112.96

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	Q	377	ARG	CA-CB-CG	5.10	124.31	114.10
12	S	123	SER	CB-CA-C	-5.01	109.82	115.79

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	744	0	784	25	0
1	E	744	0	784	16	0
2	B	648	0	693	27	0
2	F	614	0	656	18	0
3	C	733	0	771	20	0
3	G	734	0	778	20	0
4	D	685	0	703	17	0
4	H	703	0	722	19	0
5	K	6611	0	6752	176	0
6	L	3374	0	3352	147	0
7	M	3327	0	3263	168	0
8	N	2739	0	2705	102	0
8	O	2611	0	2565	128	0
9	P	2439	0	2426	96	0
10	Q	1333	0	1322	50	0
11	R	3718	0	3727	103	0
12	S	3173	0	3083	134	0
13	T	542	0	516	20	0
14	U	633	0	611	34	0
15	I	2734	0	1503	50	0
16	J	2760	0	1504	61	0
17	K	27	0	12	1	0
All	All	41626	0	39232	1210	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 1210 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)
7:M:179:ARG:HD3	7:M:181:PRO:HD2	1.39	1.03
9:P:336:LYS:HE3	9:P:337:ARG:HD3	1.50	0.93
6:L:707:ARG:HH21	14:U:30:PRO:HA	1.39	0.88
14:U:73:PRO:HA	14:U:76:GLN:HE22	1.39	0.88
6:L:522:ILE:HA	6:L:525:ARG:HD2	1.55	0.86

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	89/135 (66%)	89 (100%)	0	0	100	100
1	E	89/135 (66%)	89 (100%)	0	0	100	100
2	B	79/102 (78%)	78 (99%)	1 (1%)	0	100	100
2	F	75/102 (74%)	75 (100%)	0	0	100	100
3	C	93/129 (72%)	92 (99%)	1 (1%)	0	100	100
3	G	93/129 (72%)	93 (100%)	0	0	100	100
4	D	86/125 (69%)	83 (96%)	3 (4%)	0	100	100
4	H	88/125 (70%)	86 (98%)	2 (2%)	0	100	100
5	K	789/1595 (50%)	759 (96%)	30 (4%)	0	100	100
6	L	408/733 (56%)	396 (97%)	12 (3%)	0	100	100
7	M	421/476 (88%)	403 (96%)	18 (4%)	0	100	100
8	N	339/694 (49%)	315 (93%)	23 (7%)	1 (0%)	36	67
8	O	319/694 (46%)	299 (94%)	19 (6%)	1 (0%)	36	67
9	P	302/547 (55%)	277 (92%)	24 (8%)	1 (0%)	36	67
10	Q	164/769 (21%)	151 (92%)	13 (8%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
11	R	473/1301 (36%)	453 (96%)	20 (4%)	0	100	100
12	S	386/785 (49%)	350 (91%)	36 (9%)	0	100	100
13	T	64/722 (9%)	58 (91%)	6 (9%)	0	100	100
14	U	69/627 (11%)	56 (81%)	11 (16%)	2 (3%)	3	26
All	All	4426/9925 (45%)	4202 (95%)	219 (5%)	5 (0%)	49	79

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
14	U	31	VAL
8	O	130	THR
14	U	24	ASP
9	P	336	LYS
8	N	215	VAL

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	79/110 (72%)	77 (98%)	2 (2%)	42	64
1	E	79/110 (72%)	75 (95%)	4 (5%)	21	49
2	B	67/78 (86%)	64 (96%)	3 (4%)	24	52
2	F	63/78 (81%)	61 (97%)	2 (3%)	34	60
3	C	74/101 (73%)	70 (95%)	4 (5%)	20	47
3	G	74/101 (73%)	72 (97%)	2 (3%)	39	63
4	D	75/105 (71%)	72 (96%)	3 (4%)	28	55
4	H	77/105 (73%)	76 (99%)	1 (1%)	61	73
5	K	717/1356 (53%)	707 (99%)	10 (1%)	59	72
6	L	366/605 (60%)	356 (97%)	10 (3%)	39	63
7	M	350/395 (89%)	340 (97%)	10 (3%)	37	62

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
8	N	285/562 (51%)	275 (96%)	10 (4%)	32	58
8	O	277/562 (49%)	265 (96%)	12 (4%)	26	52
9	P	260/462 (56%)	251 (96%)	9 (4%)	32	58
10	Q	139/598 (23%)	130 (94%)	9 (6%)	15	43
11	R	413/1070 (39%)	404 (98%)	9 (2%)	45	66
12	S	345/675 (51%)	338 (98%)	7 (2%)	48	67
13	T	58/562 (10%)	56 (97%)	2 (3%)	32	59
14	U	66/508 (13%)	62 (94%)	4 (6%)	17	44
All	All	3864/8143 (48%)	3751 (97%)	113 (3%)	38	62

5 of 113 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
8	N	424	GLN
14	U	60	LEU
8	O	568	GLU
14	U	25	ASP
11	R	1171	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 54 such sidechains are listed below:

Mol	Chain	Res	Type
7	M	458	ASN
9	P	58	GLN
12	S	284	HIS
8	N	222	HIS
9	P	52	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
17	ADP	K	3000	-	27,29,29	0.41	0	42,45,45	0.47	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
17	ADP	K	3000	-	-	5/16/32/32	0/3/3/3

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (5) torsion outliers are listed below:

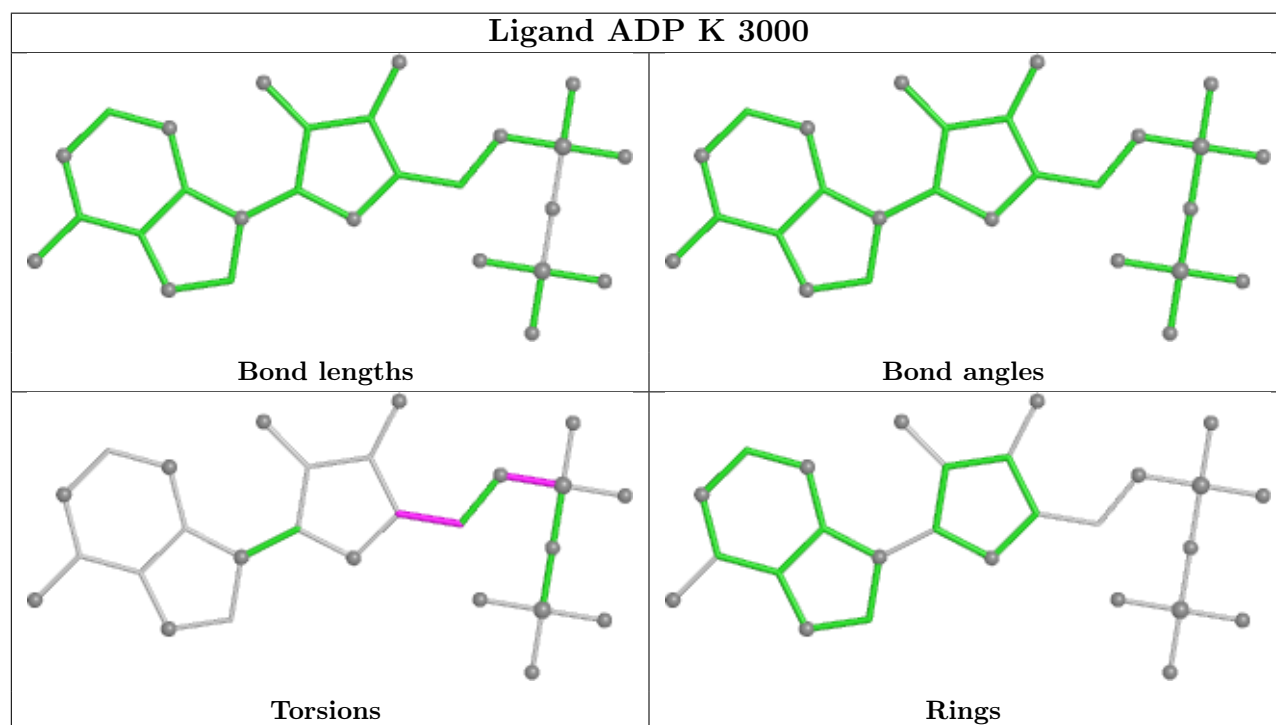
Mol	Chain	Res	Type	Atoms
17	K	3000	ADP	C5'-O5'-PA-O1A
17	K	3000	ADP	C5'-O5'-PA-O2A
17	K	3000	ADP	O4'-C4'-C5'-O5'
17	K	3000	ADP	C3'-C4'-C5'-O5'
17	K	3000	ADP	C5'-O5'-PA-O3A

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
17	K	3000	ADP	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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.

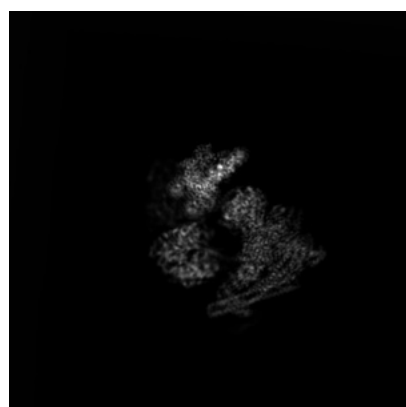
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-68999. These allow visual inspection of the internal detail of the map and identification of artifacts.

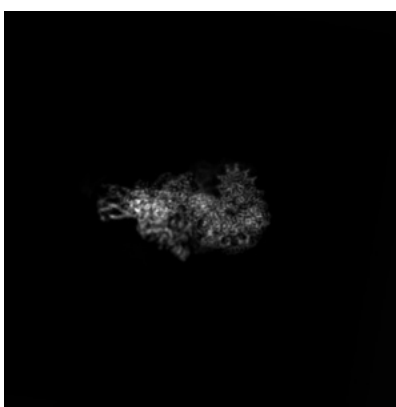
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

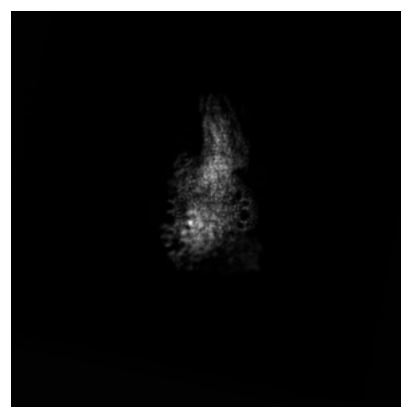
6.1.1 Primary map



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: 210



Y Index: 210



Z Index: 210

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: 215



Y Index: 196

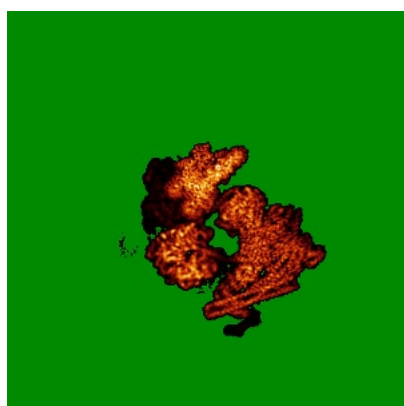


Z Index: 160

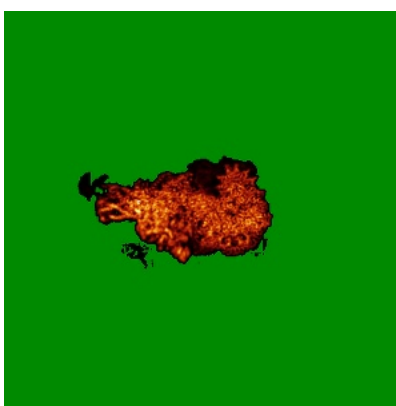
The images above show the largest variance slices of the map in three orthogonal directions.

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

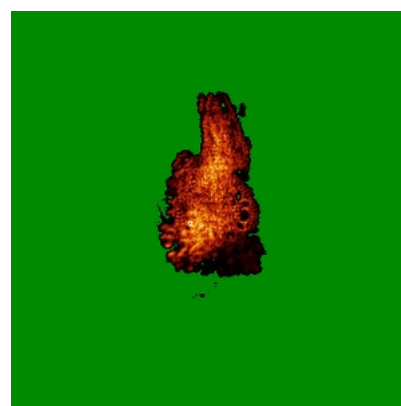
6.4.1 Primary map



X



Y

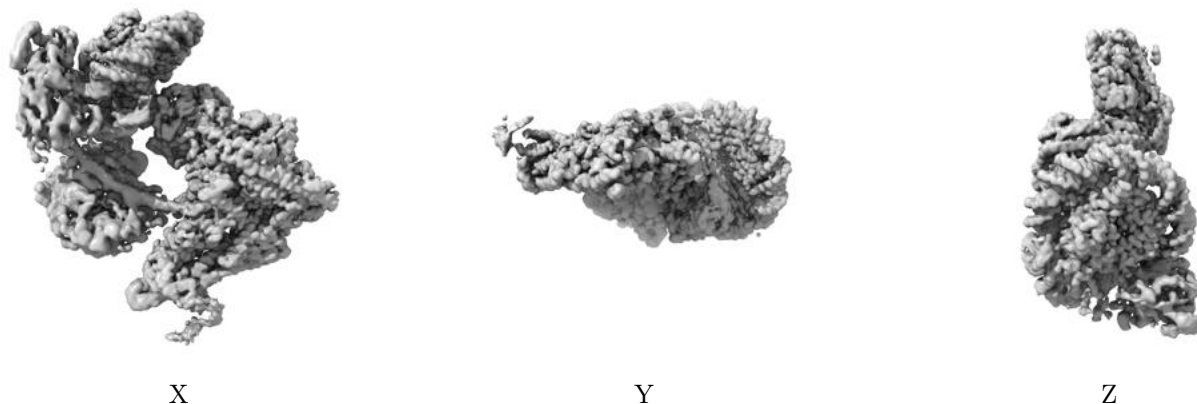


Z

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

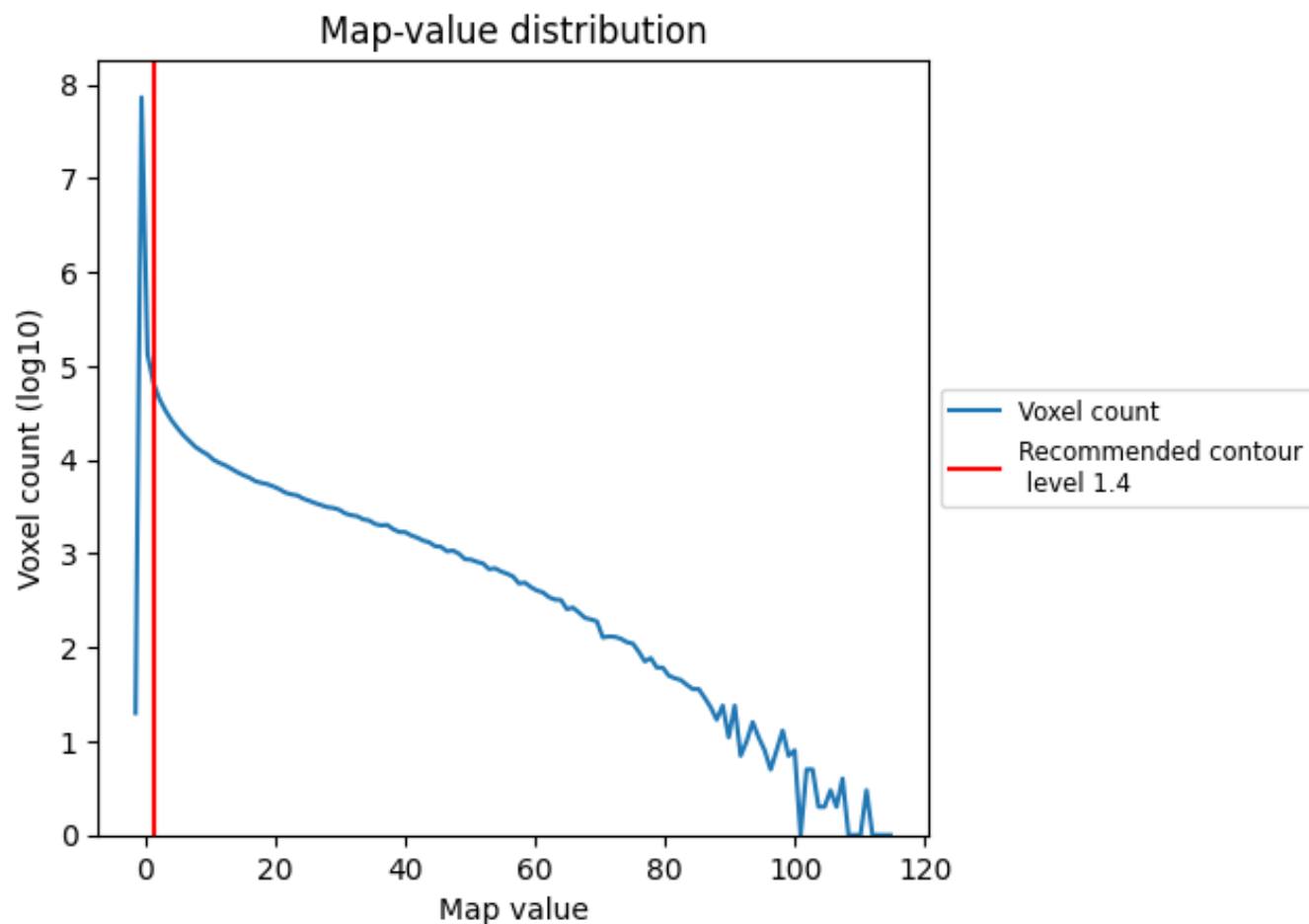
6.6 Mask visualisation [i](#)

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

7 Map analysis ⓘ

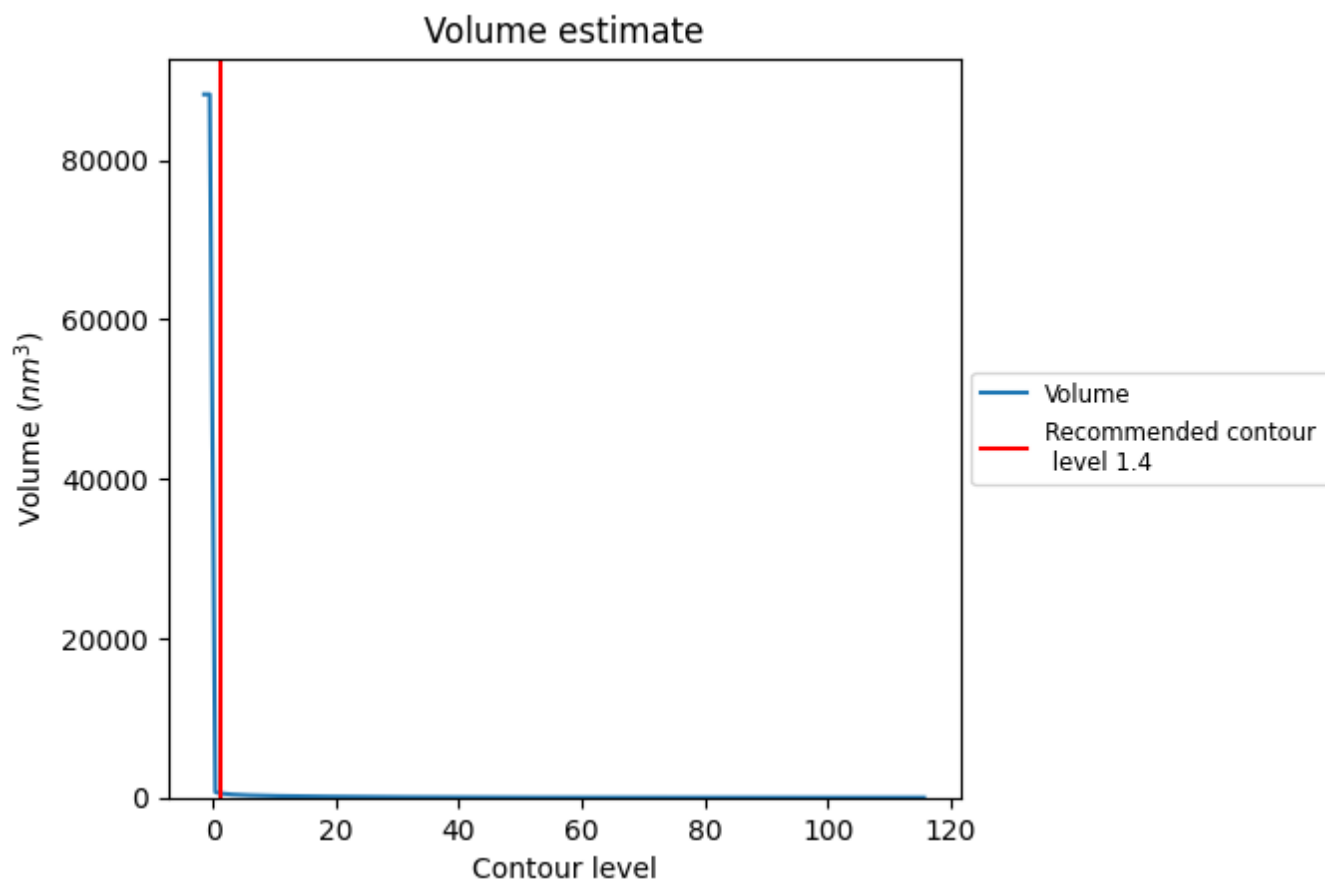
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution ⓘ



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

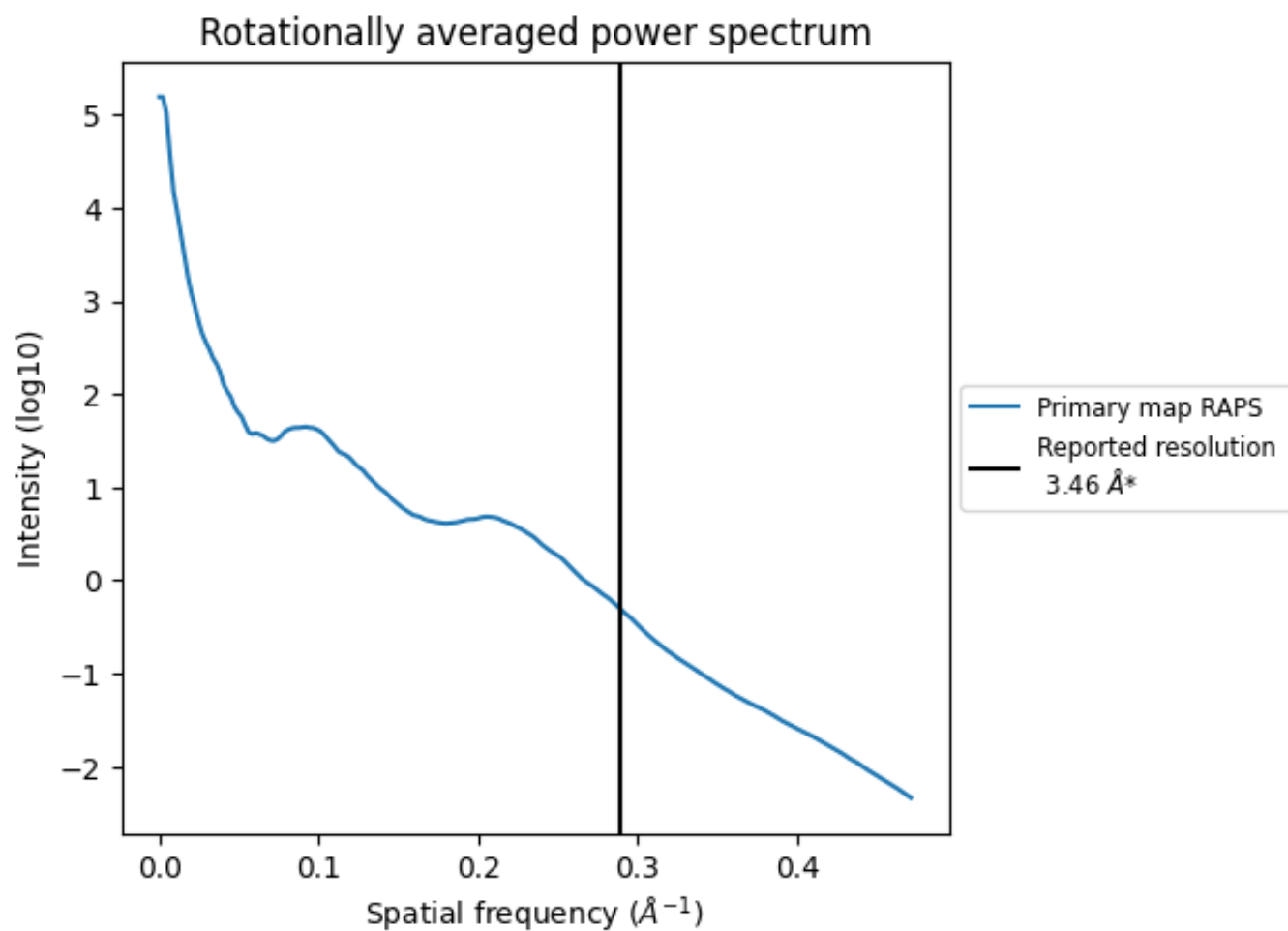
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 512 nm^3 ; this corresponds to an approximate mass of 462 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 0.289 Å⁻¹

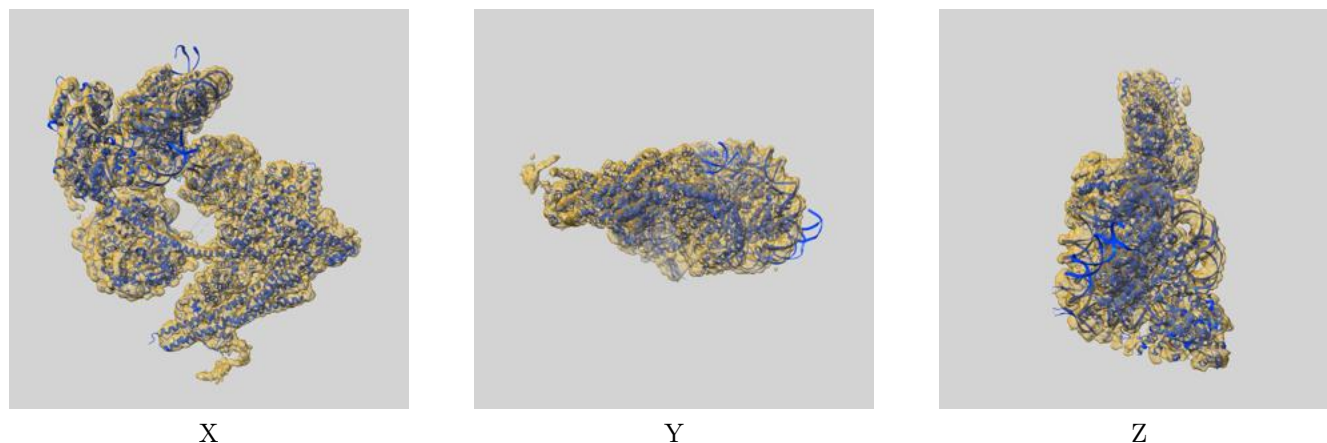
8 Fourier-Shell correlation

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

9 Map-model fit [i](#)

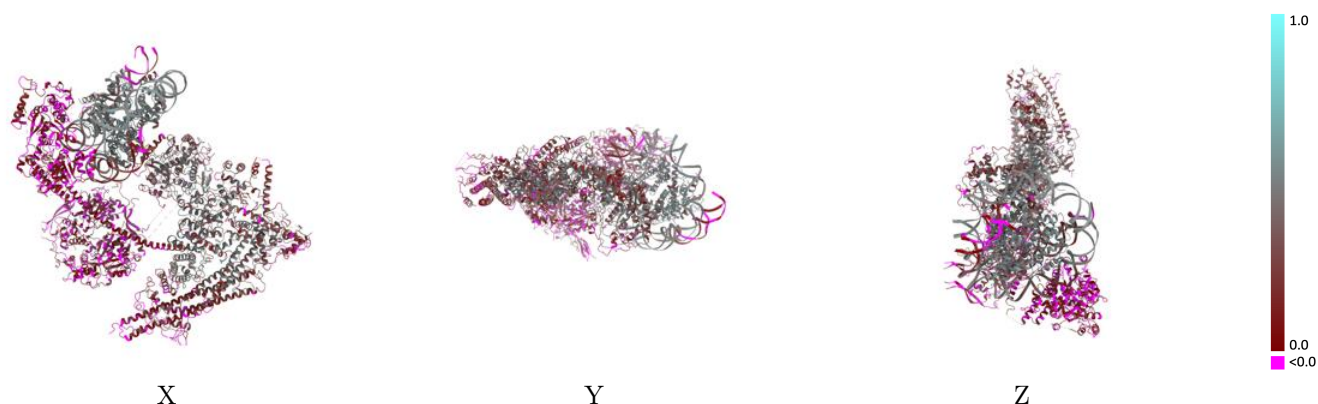
This section contains information regarding the fit between EMDB map EMD-68999 and PDB model 23IL. Per-residue inclusion information can be found in section [3](#) on page [14](#).

9.1 Map-model overlay [i](#)



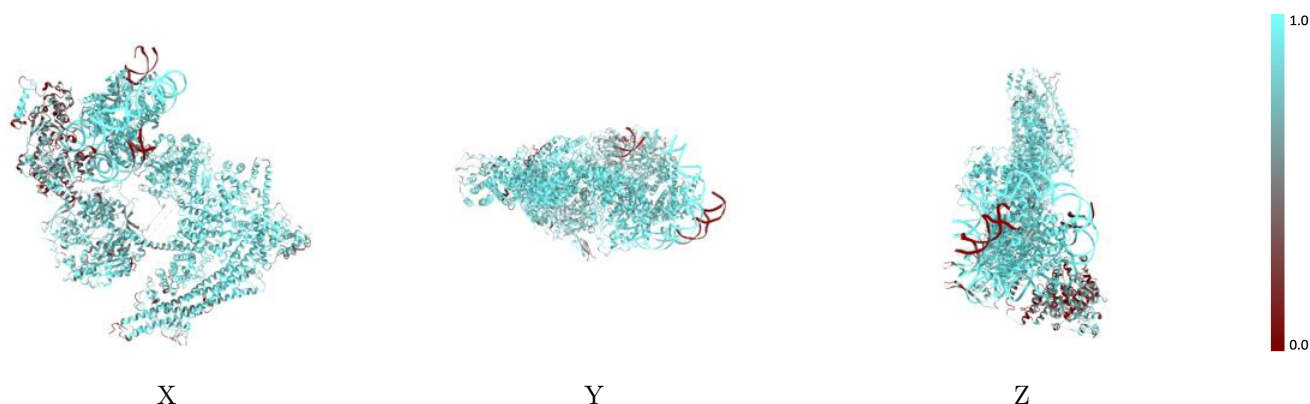
The images above show the 3D surface view of the map at the recommended contour level 1.4 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



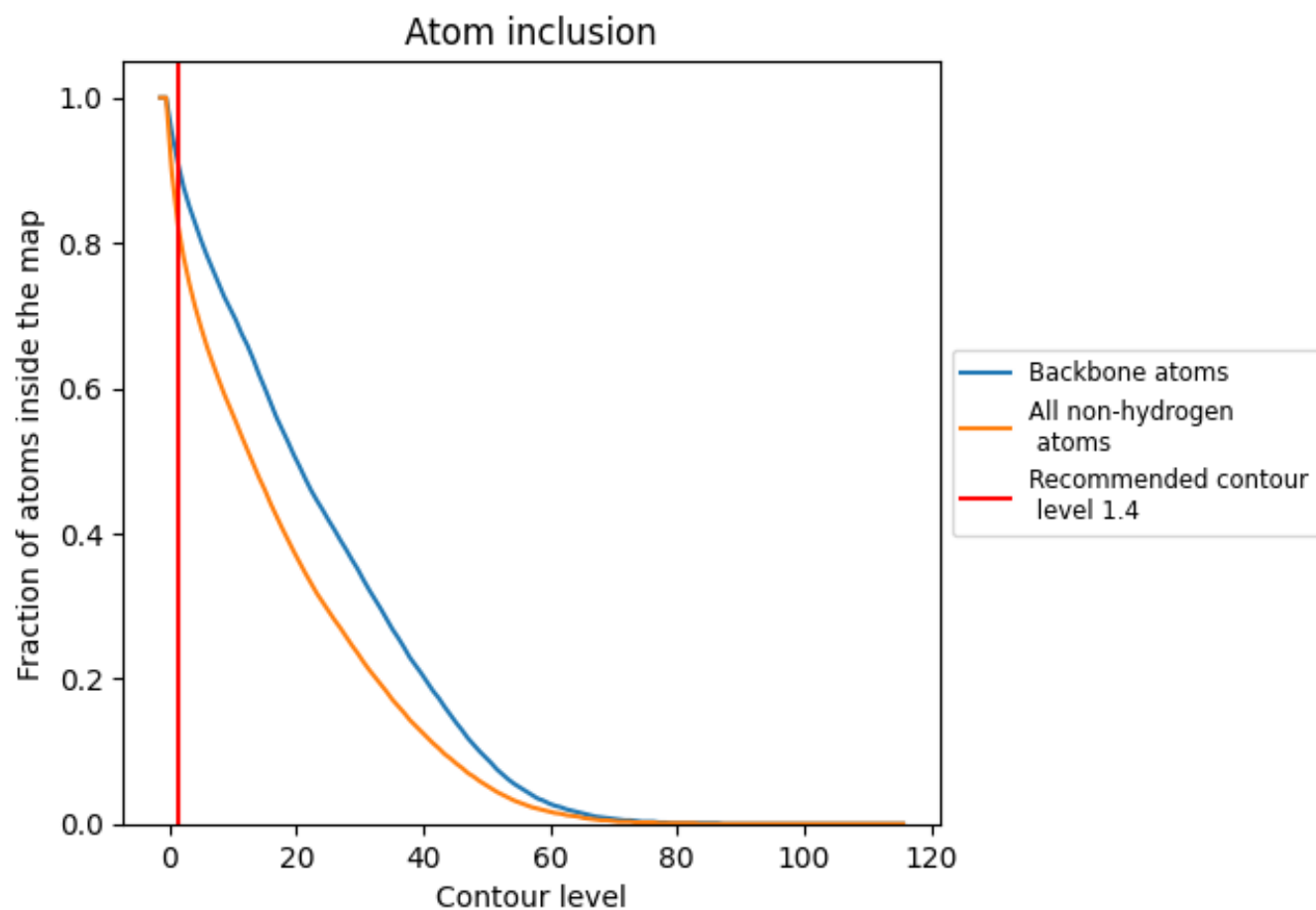
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (1.4).

9.4 Atom inclusion [i](#)



At the recommended contour level, 91% of all backbone atoms, 82% 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 (1.4) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8240	 0.2740
A	 0.9500	 0.4780
B	 0.9420	 0.4770
C	 0.9610	 0.4880
D	 0.9720	 0.4870
E	 0.9260	 0.4710
F	 0.9700	 0.4960
G	 0.9590	 0.4680
H	 0.9740	 0.4770
I	 0.8190	 0.3690
J	 0.8330	 0.3650
K	 0.5700	 0.0940
L	 0.7970	 0.1030
M	 0.8130	 0.0950
N	 0.9020	 0.3210
O	 0.8950	 0.3000
P	 0.8340	 0.2690
Q	 0.8770	 0.2830
R	 0.9170	 0.3940
S	 0.9020	 0.3260
T	 0.8150	 0.2170
U	 0.7870	 0.1580

