



wwPDB EM Validation Summary Report i

Jul 13, 2025 – 12:11 AM JST

PDB ID : 9K43 / pdb_00009k43
EMDB ID : EMD-62042
Title : Cryo-EM structure of Arabidopsis thaliana H2A.Z-nucleosome with 147bp Widom 601 DNA (C2 symmetry)
Authors : Wang, Y.; Dong, A.
Deposited on : 2024-10-21
Resolution : 2.87 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 i 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](#) i) were used in the production of this report:

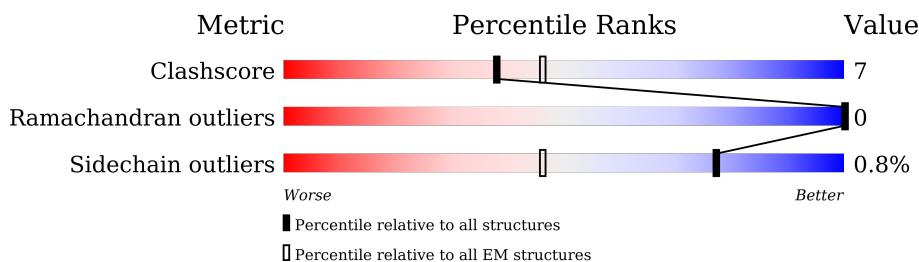
EMDB validation analysis : **FAILED**
MolProbitY : 4-5-2 with Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

1 Overall quality at a glance

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

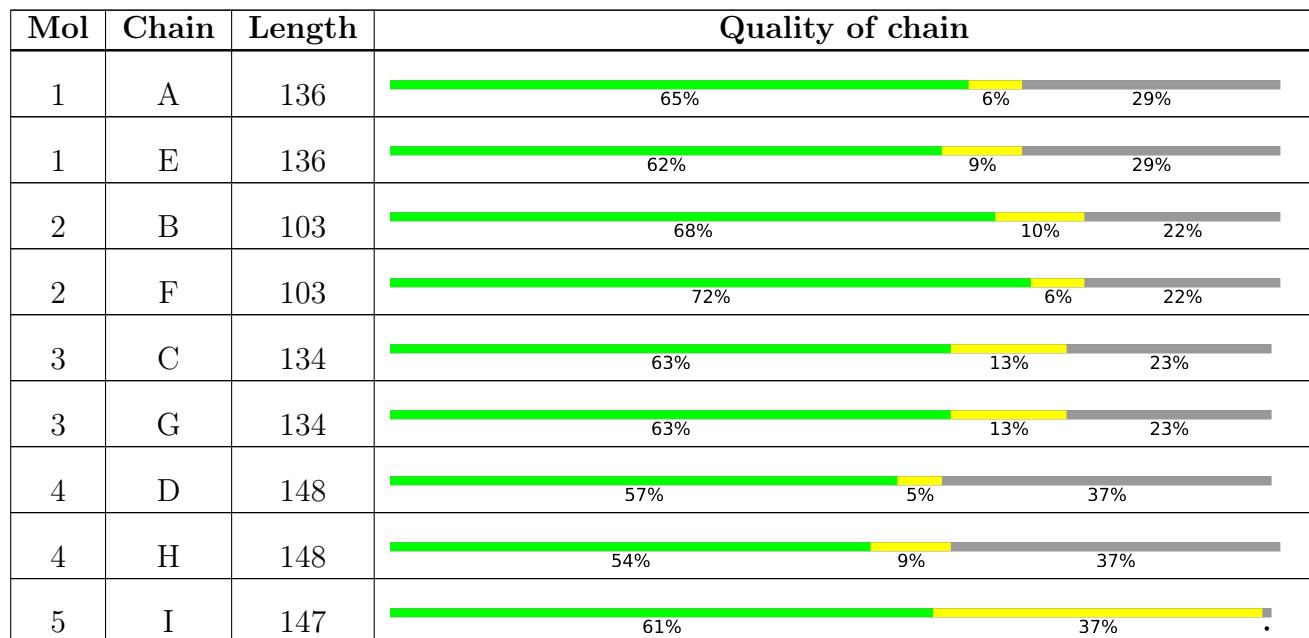
The reported resolution of this entry is 2.87 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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 $\leq 5\%$



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Mol	Chain	Length	Quality of chain
6	J	147	<div style="width: 49%;">49%</div> <div style="width: 50%;">50%</div>

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 11814 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 H3.1.

Mol	Chain	Residues	Atoms				AltConf	Trace
1	A	96	Total	C	N	O	S	
			783	497	149	135	2	0
1	E	96	Total	C	N	O	S	
			783	497	149	135	2	0

- Molecule 2 is a protein called Histone H4.

Mol	Chain	Residues	Atoms				AltConf	Trace
2	B	80	Total	C	N	O	S	
			644	406	127	110	1	0
2	F	80	Total	C	N	O	S	
			644	406	127	110	1	0

- Molecule 3 is a protein called Probable histone H2A variant 3.

Mol	Chain	Residues	Atoms				AltConf	Trace
3	C	103	Total	C	N	O		
			778	491	149	138	0	0
3	G	103	Total	C	N	O		
			778	491	149	138	0	0

- Molecule 4 is a protein called Histone H2B.1.

Mol	Chain	Residues	Atoms				AltConf	Trace
4	D	93	Total	C	N	O	S	
			731	468	125	136	2	0
4	H	93	Total	C	N	O	S	
			731	468	125	136	2	0

- Molecule 5 is a DNA chain called Widom 601 DNA (147-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
5	I	145	Total	C	N	O	P	0	0
			2957	1404	537	871	145		

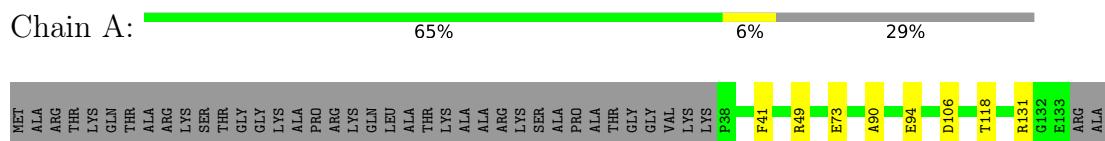
- Molecule 6 is a DNA chain called Widom 601 DNA (147-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
6	J	145	Total	C	N	O	P	0	0
			2985	1414	560	867	144		

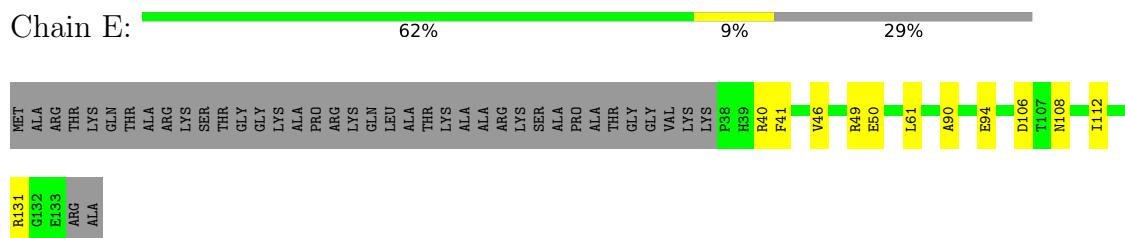
3 Residue-property plots [i](#)

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. 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. 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.

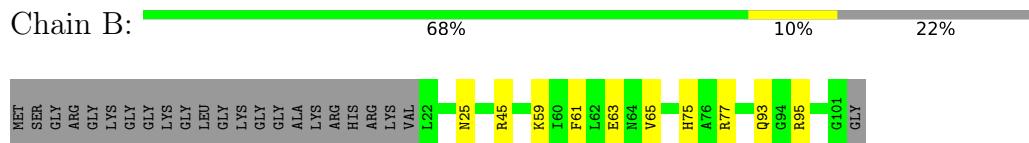
- Molecule 1: Histone H3.1



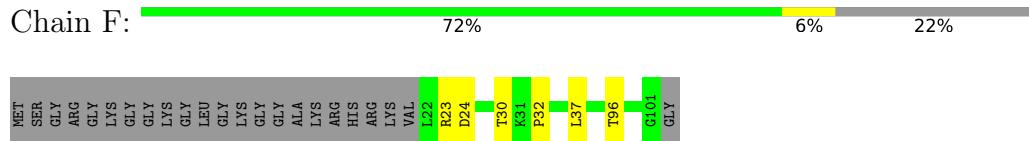
- Molecule 1: Histone H3.1



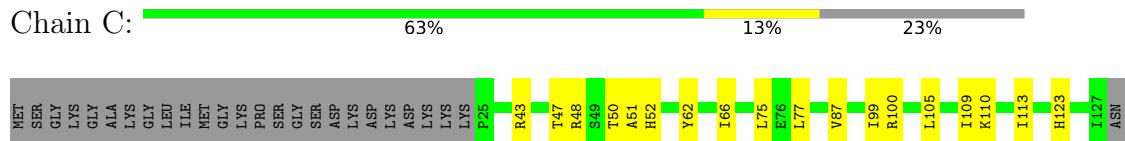
- Molecule 2: Histone H4



- Molecule 2: Histone H4



- Molecule 3: Probable histone H2A variant 3



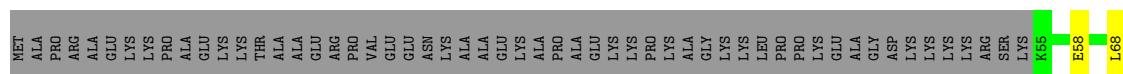
- Molecule 3: Probable histone H2A variant 3

Chain G:



- Molecule 4: Histone H2B.1

Chain D:



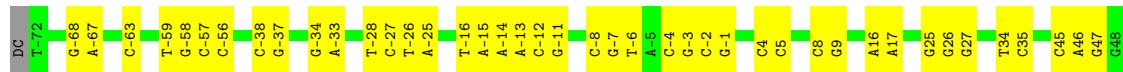
- Molecule 4: Histone H2B.1

Chain H:



- Molecule 5: Widom 601 DNA (147-MER)

Chain I:



- Molecule 6: Widom 601 DNA (147-MER)

Chain J:



4 Experimental information i

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	114381	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	900	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	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	0.13	0/795	0.24	0/1067
1	E	0.13	0/795	0.24	0/1067
2	B	0.16	0/651	0.31	0/872
2	F	0.18	0/651	0.39	0/872
3	C	0.16	0/789	0.33	0/1065
3	G	0.16	0/789	0.35	0/1065
4	D	0.15	0/742	0.33	0/995
4	H	0.13	0/742	0.30	0/995
5	I	0.22	0/3313	0.44	0/5107
6	J	0.27	0/3352	0.43	1/5176 (0.0%)
All	All	0.20	0/12619	0.38	1/18281 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	J	4	DG	C2'-C3'-O3'	-5.32	103.52	111.50

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts i

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	783	0	822	5	0
1	E	783	0	822	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	644	0	686	12	0
2	F	644	0	686	2	0
3	C	778	0	830	17	0
3	G	778	0	830	19	0
4	D	731	0	771	11	0
4	H	731	0	771	16	0
5	I	2957	0	1628	40	0
6	J	2985	0	1628	57	0
All	All	11814	0	9474	153	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 7.

The worst 5 of 153 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)
3:G:66:ILE:HD13	4:H:121:VAL:HG21	1.40	1.01
4:H:109:LYS:HG2	6:J:-34:DA:OP1	1.73	0.88
3:G:35:GLN:NE2	4:H:70:GLN:HE22	1.76	0.83
6:J:69:DT:H2"	6:J:70:DC:C5	2.16	0.81
3:C:48:ARG:HB2	3:C:48:ARG:HH11	1.55	0.72

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	94/136 (69%)	94 (100%)	0	0	100 100
1	E	94/136 (69%)	93 (99%)	1 (1%)	0	100 100
2	B	78/103 (76%)	77 (99%)	1 (1%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
2	F	78/103 (76%)	77 (99%)	1 (1%)	0	100 100
3	C	101/134 (75%)	100 (99%)	1 (1%)	0	100 100
3	G	101/134 (75%)	101 (100%)	0	0	100 100
4	D	91/148 (62%)	90 (99%)	1 (1%)	0	100 100
4	H	91/148 (62%)	90 (99%)	1 (1%)	0	100 100
All	All	728/1042 (70%)	722 (99%)	6 (1%)	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	82/109 (75%)	82 (100%)	0	100 100
1	E	82/109 (75%)	82 (100%)	0	100 100
2	B	66/79 (84%)	66 (100%)	0	100 100
2	F	66/79 (84%)	63 (96%)	3 (4%)	23 53
3	C	81/105 (77%)	80 (99%)	1 (1%)	67 87
3	G	81/105 (77%)	81 (100%)	0	100 100
4	D	82/124 (66%)	81 (99%)	1 (1%)	67 87
4	H	82/124 (66%)	82 (100%)	0	100 100
All	All	622/834 (75%)	617 (99%)	5 (1%)	77 92

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	C	87	VAL
4	D	113	THR
2	F	23	ARG
2	F	24	ASP
2	F	96	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	68	GLN
2	F	64	ASN
4	H	107	ASN
3	G	35	GLN
2	B	93	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 oligosaccharides in this entry.

5.6 Ligand geometry [\(i\)](#)

There are no ligands in this entry.

5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [\(i\)](#)

There are no chain breaks in this entry.