



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 07:57 PM UTC

PDB ID : 4Z2M / pdb_00004z2m
Title : Crystal structure of human SPT16 Mid-AID/H3-H4 tetramer FACT Histone complex
Authors : Tsunaka, Y.; Fujiwara, Y.; Oyama, T.; Hirose, S.; Morikawa, K.
Deposited on : 2015-03-30
Resolution : 2.98 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

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A user guide is available at

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

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:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

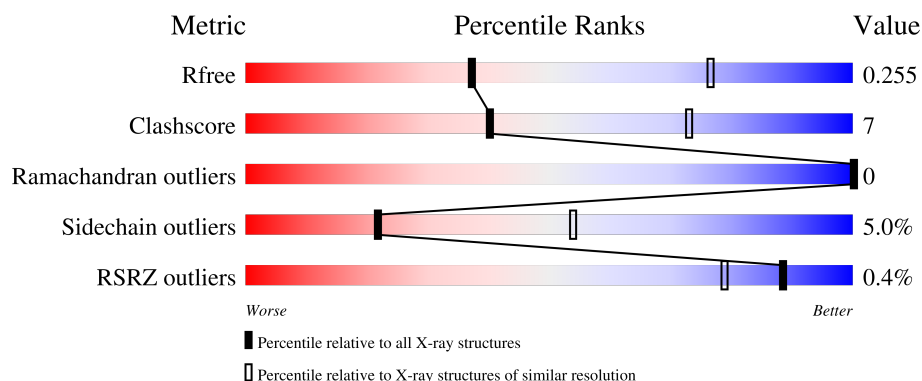
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.98 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	3580 (3.00-2.96)
Clashscore	190562	3904 (3.00-2.96)
Ramachandran outliers	187476	3761 (3.00-2.96)
Sidechain outliers	187428	3764 (3.00-2.96)
RSRZ outliers	180081	3579 (3.00-2.96)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower 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 electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	B	287	
2	G	102	
2	I	102	
3	H	103	
3	J	103	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4594 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 FACT complex subunit SPT16.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	271	Total	C	N	O	S	0	0	0
			2220	1429	371	409	11			

- Molecule 2 is a protein called Histone H3.1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	G	77	Total	C	N	O	S	0	0	0
			626	396	116	110	4			
2	I	76	Total	C	N	O	S	0	0	0
			615	390	115	106	4			

- Molecule 3 is a protein called Histone H4.

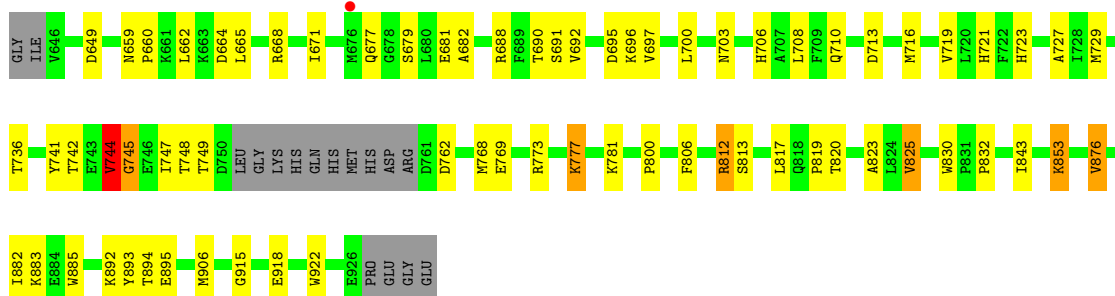
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	H	71	Total	C	N	O	S	0	0	0
			572	359	113	99	1			
3	J	70	Total	C	N	O	S	0	0	0
			561	353	109	98	1			

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron 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 dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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: FACT complex subunit SPT16

Chain B: 



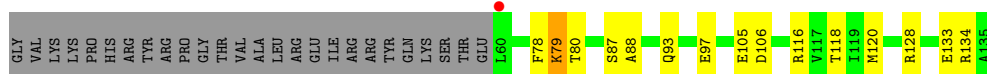
- Molecule 2: Histone H3.1

Chain G: 



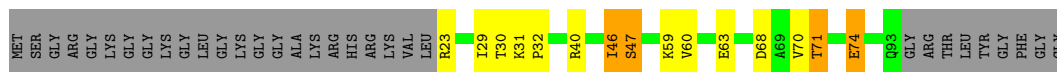
- Molecule 2: Histone H3.1

Chain I: 



- Molecule 3: Histone H4

Chain H: 



- Molecule 3: Histone H4

Chain J: 

MET	SER	GLY	ARG	GLY	LYS	GLY	GLY	LYS	GLY	LEU	GLY	LYS	GLY	ALA	LYS	ARG	HIS	ARG	LYS	VAL	LEU	ARG	D24	D25	I26	Q27	G28	I29	R45	I46	S47	G56	K59	T80	V81	T82	Q83	GLY	ARG	THR	LEU	TYR	GLY	PHE	GLY	GLY
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4 Data and refinement statistics

Property	Value	Source
Space group	P 21 2 21	Depositor
Cell constants a, b, c, α , β , γ	65.44Å 69.78Å 187.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.96 – 2.98 46.96 – 2.98	Depositor EDS
% Data completeness (in resolution range)	97.6 (46.96-2.98) 94.2 (46.96-2.98)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.85 (at 2.96Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1692)	Depositor
R, R_{free}	0.190 , 0.246 0.198 , 0.255	Depositor DCC
R_{free} test set	1799 reflections (9.86%)	wwPDB-VP
Wilson B-factor (Å ²)	72.7	Xtriage
Anisotropy	0.483	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 57.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4594	wwPDB-VP
Average B, all atoms (Å ²)	80.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.84% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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	B	0.56	0/2271	0.92	6/3068 (0.2%)
2	G	0.59	0/633	0.90	0/849
2	I	0.62	0/622	0.94	2/834 (0.2%)
3	H	0.55	0/577	0.94	2/773 (0.3%)
3	J	0.56	0/566	0.96	2/759 (0.3%)
All	All	0.57	0/4669	0.93	12/6283 (0.2%)

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	825	VAL	N-CA-C	5.89	117.17	108.45
1	B	876	VAL	CB-CA-C	-5.87	103.49	112.05
3	H	31	LYS	CA-C-N	-5.82	112.88	119.28
3	H	31	LYS	C-N-CA	-5.82	112.88	119.28
1	B	744	VAL	N-CA-C	5.73	118.40	112.90
1	B	747	ILE	N-CA-C	5.50	116.03	107.28
2	I	79	LYS	N-CA-C	5.32	117.88	111.40
3	J	26	ILE	CA-C-N	-5.20	115.08	122.77
3	J	26	ILE	C-N-CA	-5.20	115.08	122.77
2	I	78	PHE	N-CA-C	5.15	118.85	111.02
1	B	745	GLY	N-CA-C	5.05	118.49	110.96
1	B	823	ALA	N-CA-C	5.02	116.47	108.79

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	B	2220	0	2203	35	1
2	G	626	0	656	13	0
2	I	615	0	648	11	1
3	H	572	0	615	10	0
3	J	561	0	602	5	0
All	All	4594	0	4724	61	1

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.

All (61) 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:660:PRO:HG2	1:B:682:ALA:HB3	1.52	0.92
1:B:708:LEU:HB2	1:B:721:HIS:HB3	1.65	0.79
3:H:30:THR:HB	3:H:32:PRO:HD2	1.69	0.73
1:B:659:ASN:ND2	1:B:681:GLU:OE2	2.29	0.65
1:B:688:ARG:HH11	1:B:696:LYS:HD2	1.64	0.63
1:B:915:GLY:HA2	1:B:918:GLU:HG3	1.79	0.63
1:B:906:MET:HE1	1:B:922:TRP:HH2	1.62	0.63
1:B:664:ASP:O	1:B:742:THR:OG1	2.18	0.62
1:B:691:SER:HB3	1:B:695:ASP:O	1.99	0.61
2:I:79:LYS:N	2:I:80:THR:HA	2.15	0.60
1:B:812:ARG:HD2	2:I:116:ARG:O	2.04	0.57
1:B:662:LEU:HB3	1:B:665:LEU:HD11	1.87	0.57
2:G:76:GLN:OE1	3:H:23:ARG:NH1	2.39	0.55
2:G:99:TYR:OH	2:G:133:GLU:OE1	2.17	0.55
1:B:883:LYS:NZ	1:B:895:GLU:OE2	2.30	0.54
1:B:710:GLN:HB3	1:B:719:VAL:HB	1.91	0.53
1:B:800:PRO:HA	1:B:820:THR:HG22	1.92	0.52
3:J:56:GLY:HA2	3:J:59:LYS:HE2	1.91	0.52
1:B:744:VAL:HG21	1:B:773:ARG:HG2	1.93	0.50
2:G:120:MET:HE3	3:H:47:SER:HB2	1.95	0.48
3:J:28:GLY:O	3:J:29:ILE:HD13	2.13	0.48
1:B:668:ARG:HD2	1:B:741:TYR:CE2	2.49	0.48
1:B:892:LYS:HA	1:B:892:LYS:HD3	1.73	0.47
2:G:97:GLU:O	2:G:101:VAL:HG23	2.13	0.47
2:G:134:ARG:NH2	3:H:60:VAL:HG13	2.29	0.47
2:G:128:ARG:NH1	2:G:133:GLU:OE1	2.48	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:G:70:LEU:O	2:G:74:ILE:HG13	2.15	0.47
1:B:716:MET:SD	1:B:745:GLY:HA3	2.55	0.46
1:B:748:THR:HB	3:H:46:ILE:CG2	2.46	0.46
2:G:73:GLU:HG3	3:H:23:ARG:HB2	1.96	0.45
1:B:664:ASP:HA	1:B:677:GLN:HE21	1.81	0.45
1:B:679:SER:O	1:B:690:THR:N	2.43	0.45
3:H:70:VAL:O	3:H:74:GLU:HG2	2.16	0.45
1:B:777:LYS:HG3	1:B:781:LYS:HE3	1.98	0.45
1:B:700:LEU:O	1:B:703:ASN:N	2.42	0.45
2:I:128:ARG:NH2	2:I:134:ARG:HB2	2.32	0.44
3:H:68:ASP:O	3:H:71:THR:HB	2.18	0.44
2:I:93:GLN:O	2:I:97:GLU:HG3	2.17	0.44
2:G:130:ILE:HG12	2:I:106:ASP:HB3	2.00	0.44
2:I:120:MET:HE3	3:J:47:SER:HB2	2.00	0.44
2:I:118:THR:HA	3:J:45:ARG:HB3	1.99	0.43
2:I:88:ALA:HB2	3:J:82:THR:C	2.43	0.43
2:G:100:LEU:HD23	2:G:100:LEU:HA	1.84	0.43
1:B:713:ASP:OD1	1:B:777:LYS:NZ	2.41	0.43
2:I:128:ARG:HG2	2:I:133:GLU:OE1	2.20	0.42
1:B:812:ARG:HD2	2:I:116:ARG:C	2.43	0.42
1:B:819:PRO:HB3	1:B:885:TRP:CZ2	2.54	0.42
1:B:769:GLU:O	1:B:773:ARG:HG3	2.20	0.42
1:B:806:PHE:CG	1:B:882:ILE:HD11	2.54	0.42
1:B:744:VAL:CG2	1:B:773:ARG:HG2	2.50	0.42
1:B:768:MET:HE3	1:B:768:MET:HB3	1.93	0.41
1:B:830:TRP:CD2	1:B:832:PRO:HD3	2.55	0.41
1:B:843:ILE:O	1:B:893:TYR:HA	2.20	0.41
1:B:830:TRP:CE3	1:B:832:PRO:HD3	2.55	0.41
3:H:59:LYS:HE2	3:H:63:GLU:OE2	2.19	0.41
1:B:853:LYS:HG3	2:I:105:GLU:OE1	2.21	0.41
2:G:59:GLU:HB2	3:H:40:ARG:HH12	1.87	0.40
1:B:706:HIS:HB2	1:B:723:HIS:HB3	2.03	0.40
1:B:727:ALA:HB2	1:B:736:THR:HG22	2.03	0.40
2:G:82:LEU:HD23	2:G:82:LEU:HA	1.92	0.40
2:G:125:GLN:O	2:G:129:ARG:HB2	2.22	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:762:ASP:OD1	2:I:87:SER:OG[1_545]	2.17	0.03

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

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	B	267/287 (93%)	260 (97%)	7 (3%)	0	100	100
2	G	75/102 (74%)	72 (96%)	3 (4%)	0	100	100
2	I	74/102 (72%)	72 (97%)	2 (3%)	0	100	100
3	H	69/103 (67%)	69 (100%)	0	0	100	100
3	J	68/103 (66%)	67 (98%)	1 (2%)	0	100	100
All	All	553/697 (79%)	540 (98%)	13 (2%)	0	100	100

There are no Ramachandran outliers to report.

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 X-ray entries followed by that with respect to entries of similar resolution.

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	B	247/260 (95%)	232 (94%)	15 (6%)	17	47
2	G	67/88 (76%)	64 (96%)	3 (4%)	24	57
2	I	65/88 (74%)	65 (100%)	0	100	100
3	H	60/79 (76%)	55 (92%)	5 (8%)	10	35
3	J	59/79 (75%)	57 (97%)	2 (3%)	32	64
All	All	498/594 (84%)	473 (95%)	25 (5%)	22	54

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	649	ASP
1	B	671	ILE
1	B	692	VAL
1	B	697	VAL
1	B	729	MET
1	B	744	VAL
1	B	749	THR
1	B	777	LYS
1	B	812	ARG
1	B	813	SER
1	B	817	LEU
1	B	825	VAL
1	B	853	LYS
1	B	876	VAL
1	B	894	THR
2	G	76	GLN
2	G	77	ASP
2	G	118	THR
3	H	29	ILE
3	H	46	ILE
3	H	47	SER
3	H	71	THR
3	H	74	GLU
3	J	59	LYS
3	J	80	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	735	HIS
1	B	818	GLN
3	H	25	ASN
2	I	108	ASN
3	J	27	GLN

5.3.3 RNA ⓘ

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.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	B	271/287 (94%)	-0.35	1 (0%) 88 79	41, 80, 128, 158	0
2	G	77/102 (75%)	-0.50	0 100 100	44, 61, 106, 130	0
2	I	76/102 (74%)	-0.34	1 (1%) 75 57	45, 71, 126, 144	0
3	H	71/103 (68%)	-0.48	0 100 100	52, 76, 107, 114	0
3	J	70/103 (67%)	-0.36	0 100 100	52, 78, 117, 127	0
All	All	565/697 (81%)	-0.39	2 (0%) 88 79	41, 76, 124, 158	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	I	60	LEU	2.9
1	B	676	MET	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.