



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 09:11 AM EDT

PDB ID : 5LNC / pdb_00005lnc
Title : Structure of SPX domain of the yeast inorganic polyphosphate polymerase Vtc4 crystallized by carrier-driven crystallization in fusion with the macro domain of human histone macroH2A1.1
Authors : Wild, R.; Hothorn, M.
Deposited on : 2016-08-03
Resolution : 3.29 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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/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

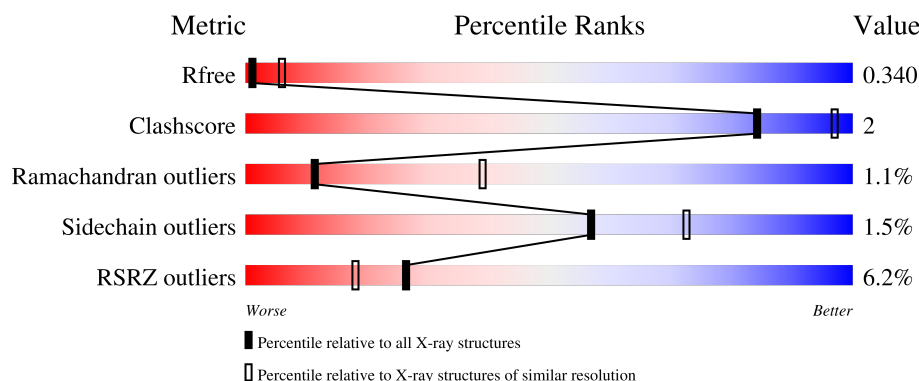
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.29 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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	A	374	6% 90% 7% ••
1	B	374	6% 92% 6% •

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 4673 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 Vacuolar transporter chaperone 4,Core histone macro-H2A.1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	364	Total	C	N	O	S	0	0	0
			2303	1420	404	474	5			
1	B	367	Total	C	N	O	S	0	0	0
			2370	1469	411	484	6			

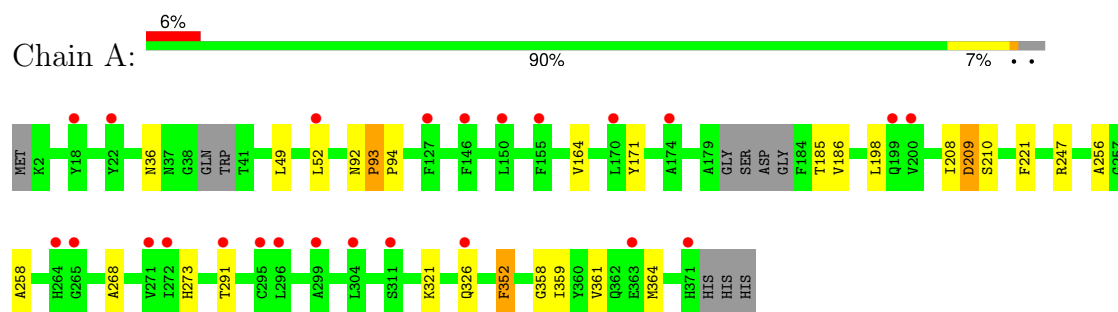
There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	179	ALA	-	linker	UNP P47075
A	180	GLY	-	linker	UNP P47075
A	181	SER	-	linker	UNP P47075
A	182	ASP	-	linker	UNP P47075
A	368	GLU	-	expression tag	UNP O75367
A	369	HIS	-	expression tag	UNP O75367
A	370	HIS	-	expression tag	UNP O75367
A	371	HIS	-	expression tag	UNP O75367
A	372	HIS	-	expression tag	UNP O75367
A	373	HIS	-	expression tag	UNP O75367
A	374	HIS	-	expression tag	UNP O75367
B	179	ALA	-	linker	UNP P47075
B	180	GLY	-	linker	UNP P47075
B	181	SER	-	linker	UNP P47075
B	182	ASP	-	linker	UNP P47075
B	368	GLU	-	expression tag	UNP O75367
B	369	HIS	-	expression tag	UNP O75367
B	370	HIS	-	expression tag	UNP O75367
B	371	HIS	-	expression tag	UNP O75367
B	372	HIS	-	expression tag	UNP O75367
B	373	HIS	-	expression tag	UNP O75367
B	374	HIS	-	expression tag	UNP O75367

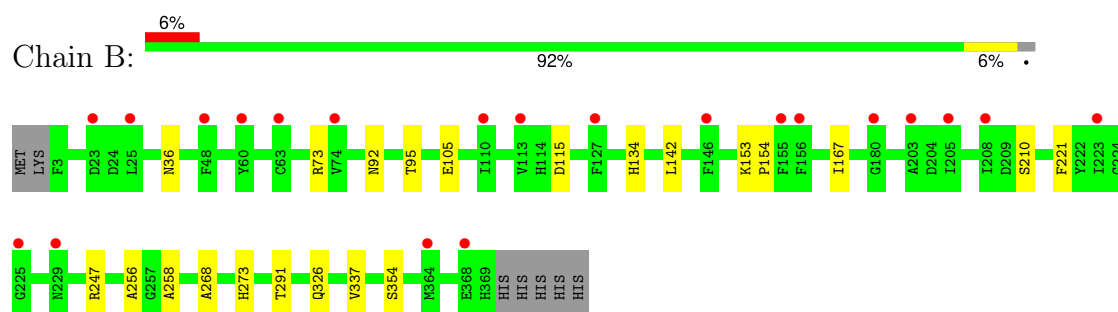
3 Residue-property plots

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 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: Vacuolar transporter chaperone 4,Core histone macro-H2A.1



- Molecule 1: Vacuolar transporter chaperone 4,Core histone macro-H2A.1



4 Data and refinement statistics

Property	Value	Source
Space group	I 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	114.02Å 130.05Å 158.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.90 – 3.29 48.90 – 3.29	Depositor EDS
% Data completeness (in resolution range)	98.4 (48.90-3.29) 98.4 (48.90-3.29)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.02 (at 3.33Å)	Xtriage
Refinement program	BUSTER 2.10.3	Depositor
R, R_{free}	0.279 , 0.302 0.311 , 0.340	Depositor DCC
R_{free} test set	909 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	153.1	Xtriage
Anisotropy	0.531	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 226.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	4673	wwPDB-VP
Average B, all atoms (Å ²)	179.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.21% 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

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	0.99	0/2339	1.40	5/3219 (0.2%)
1	B	0.95	0/2407	1.41	3/3304 (0.1%)
All	All	0.97	0/4746	1.41	8/6523 (0.1%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2
1	B	0	3
All	All	0	5

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	208	ILE	CA-C-N	5.83	132.68	121.54
1	A	208	ILE	C-N-CA	5.83	132.68	121.54
1	B	167	ILE	CA-C-N	5.62	128.08	120.38
1	B	167	ILE	C-N-CA	5.62	128.08	120.38
1	A	209	ASP	CA-CB-CG	5.45	118.05	112.60
1	A	185	THR	CA-C-N	5.42	131.72	121.97
1	A	185	THR	C-N-CA	5.42	131.72	121.97
1	B	115	ASP	CA-CB-CG	5.14	117.74	112.60

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	92	ASN	Mainchain

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Group
1	A	93	PRO	Mainchain
1	B	153	LYS	Mainchain,Peptide
1	B	92	ASN	Mainchain

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	2303	0	1654	12	0
1	B	2370	0	1777	11	0
All	All	4673	0	3431	19	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 2.

All (19) 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:134:HIS:CE1	1:B:142:LEU:HD13	2.36	0.61
1:A:198:LEU:HB3	1:A:364:MET:HE2	1.85	0.58
1:A:164:VAL:HG11	1:B:337:VAL:HB	1.86	0.57
1:B:134:HIS:HE1	1:B:142:LEU:HD13	1.71	0.54
1:A:164:VAL:CG1	1:B:337:VAL:HB	2.43	0.49
1:A:352:PHE:CD1	1:A:352:PHE:N	2.79	0.47
1:B:258:ALA:HA	1:B:273:HIS:O	2.16	0.46
1:A:359:ILE:HG13	1:B:354:SER:HB3	1.98	0.46
1:A:258:ALA:HA	1:A:273:HIS:O	2.17	0.45
1:A:358:GLY:HA3	1:B:354:SER:O	2.18	0.43
1:A:49:LEU:HA	1:A:52:LEU:HD12	1.99	0.43
1:A:321:LYS:HB2	1:A:359:ILE:HD13	2.00	0.43
1:B:73:ARG:HD2	1:B:105:GLU:OE2	2.20	0.42
1:A:210:SER:O	1:A:268:ALA:HA	2.20	0.42
1:B:256:ALA:HA	1:B:291:THR:OG1	2.21	0.41
1:A:221:PHE:HB2	1:A:247:ARG:HE	1.86	0.41
1:B:221:PHE:HB2	1:B:247:ARG:HE	1.85	0.41
1:A:256:ALA:HA	1:A:291:THR:OG1	2.20	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:210:SER:O	1:B:268:ALA:HA	2.21	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 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	A	358/374 (96%)	344 (96%)	9 (2%)	5 (1%)	9	33
1	B	365/374 (98%)	348 (95%)	14 (4%)	3 (1%)	16	45
All	All	723/748 (97%)	692 (96%)	23 (3%)	8 (1%)	11	39

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	186	VAL
1	A	36	ASN
1	B	36	ASN
1	A	94	PRO
1	A	209	ASP
1	B	95	THR
1	B	154	PRO
1	A	93	PRO

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 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	A	156/331 (47%)	152 (97%)	4 (3%)	40	64
1	B	169/331 (51%)	168 (99%)	1 (1%)	78	81
All	All	325/662 (49%)	320 (98%)	5 (2%)	57	72

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

Mol	Chain	Res	Type
1	A	171	TYR
1	A	326	GLN
1	A	352	PHE
1	A	361	VAL
1	B	326	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	92	ASN
1	A	264	HIS
1	A	326	GLN
1	A	369	HIS
1	B	159	ASN
1	B	326	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 [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

6.1 Protein, DNA and RNA chains

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	A	364/374 (97%)	0.44	24 (6%) 24 16	132, 180, 236, 262	0
1	B	367/374 (98%)	0.43	21 (5%) 29 20	130, 170, 235, 251	0
All	All	731/748 (97%)	0.44	45 (6%) 26 18	130, 175, 235, 262	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	364	MET	4.9
1	A	127	PHE	4.6
1	B	229	ASN	3.8
1	B	203	ALA	3.6
1	A	311	SER	3.6
1	A	299	ALA	3.5
1	B	225	GLY	3.4
1	B	127	PHE	3.4
1	A	52	LEU	3.3
1	A	265	GLY	3.3
1	B	113	VAL	3.0
1	A	170	LEU	2.9
1	B	180	GLY	2.8
1	A	22	TYR	2.8
1	A	304	LEU	2.7
1	A	291	THR	2.7
1	B	60	TYR	2.6
1	B	48	PHE	2.5
1	A	200	VAL	2.5
1	A	155	PHE	2.5
1	A	146	PHE	2.5
1	A	296	LEU	2.5
1	B	74	VAL	2.5
1	B	146	PHE	2.5

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	205	ILE	2.5
1	B	156	PHE	2.4
1	A	272	ILE	2.4
1	A	371	HIS	2.3
1	A	295	CYS	2.3
1	A	264	HIS	2.3
1	B	63	CYS	2.3
1	B	155	PHE	2.3
1	A	199	GLN	2.3
1	A	271	VAL	2.3
1	B	110	ILE	2.2
1	B	368	GLU	2.2
1	A	150	LEU	2.2
1	A	363	GLU	2.2
1	B	23	ASP	2.1
1	A	174	ALA	2.1
1	B	208	ILE	2.1
1	B	25	LEU	2.1
1	B	223	ILE	2.1
1	A	326	GLN	2.1
1	A	18	TYR	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.