WORLDWIDE PDB

PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Feb 28, 2014 – 12:30 PM GMT

PDB ID : 3VH6
Title : Crystal structure of the chicken CENP-T histone fold/CENP-W/CENP-S/C
ENP-Xheterotetrameric complex, crystal form II
Authors : Nishino, T.; Takeuchi, K.; Gascoigne, K.E.; Suzuki, A.; Hori, T.; Oyama, T.;
Morikawa, K.; Cheeseman, I.M.; Fukagawa, T.
Deposited on : 2011-08-23
Resolution : 3.35 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
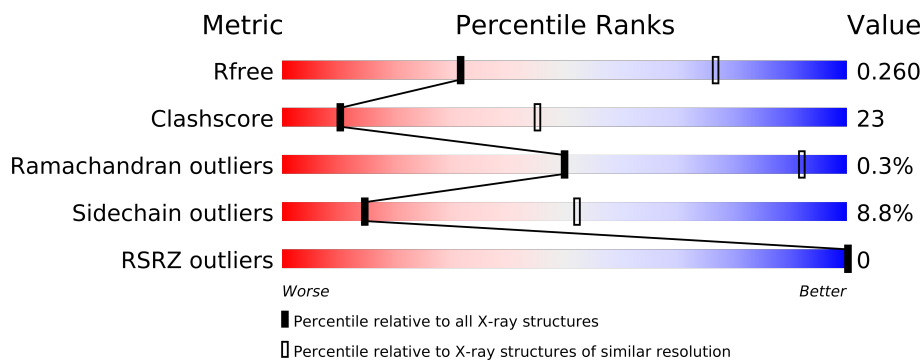A user guide is available at http://wwpdb.org/ValidationPDFNotes.html

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

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683
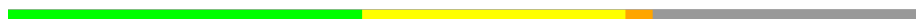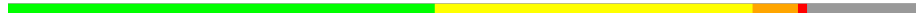
1 Overall quality at a glance ⓘ

The reported resolution of this entry is 3.35 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	Percentile Ranks	Value
Rfree		0.260
Clashscore		23
Ramachandran outliers		0.3%
Sidechain outliers		8.8%
RSRZ outliers		0

Worse — Better

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	66092	1141 (3.50-3.22)
Clashscore	79885	1030 (3.48-3.24)
Ramachandran outliers	78287	1008 (3.48-3.24)
Sidechain outliers	78261	1007 (3.48-3.24)
RSRZ outliers	66119	1141 (3.50-3.22)

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 on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	140	
2	D	81	
3	T	111	
4	W	77	

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 2758 atoms, of which 0 are hydrogen and 0 are deuterium.

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 CENP-S.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	98	774	480	143	150	1	0	0	0

- Molecule 2 is a protein called CENP-X.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	D	75	605	382	114	108	1	0	0	0

- Molecule 3 is a protein called CENP-T.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	T	97	792	508	138	143	3	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
T	529	GLY	-	EXPRESSION TAG	UNP F1NPG5
T	530	SER	-	EXPRESSION TAG	UNP F1NPG5
T	564	ALA	CYS	ENGINEERED MUTATION	UNP F1NPG5
T	638	ALA	CYS	ENGINEERED MUTATION	UNP F1NPG5

- Molecule 4 is a protein called CENP-W.

| Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	W	73	587	378	114	95	0	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.
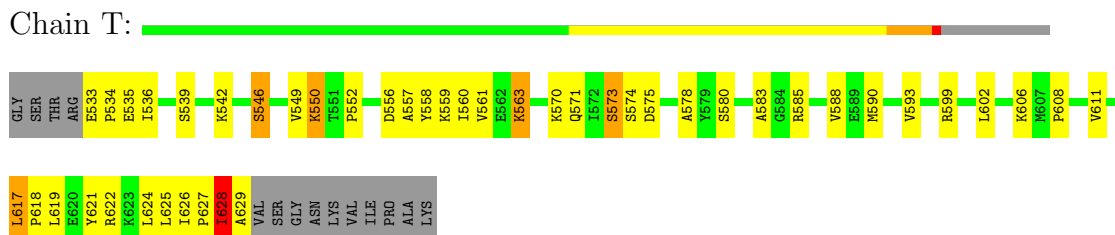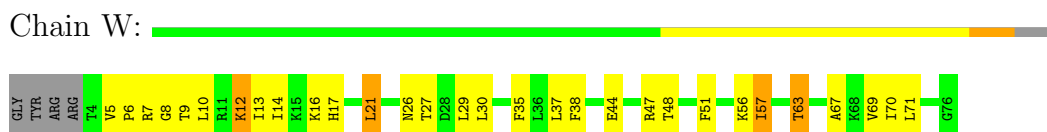
- Molecule 1: CENP-S

Chain A:

- Molecule 2: CENP-X

Chain D:

- Molecule 3: CENP-T

Chain T:
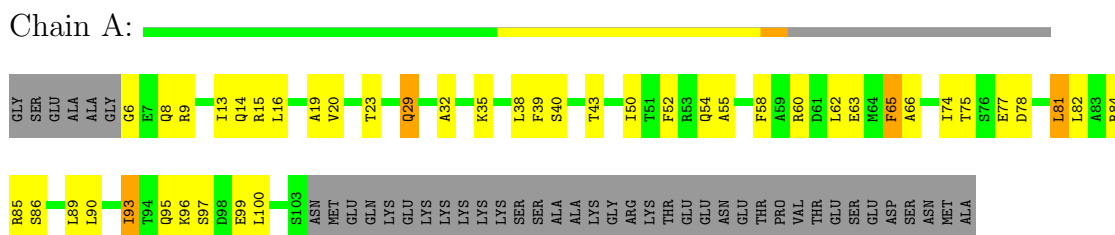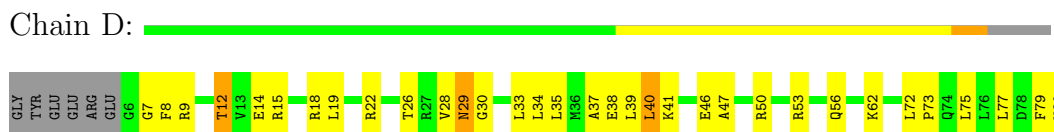
- Molecule 4: CENP-W

Chain W:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	I 21 3	Depositor
Cell constants a, b, c, α, β, γ	158.51Å 158.51Å 158.51Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.36 – 3.35 37.36 – 3.35	Depositor EDS
% Data completeness (in resolution range)	99.3 (37.36-3.35) 95.8 (37.36-3.35)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.84 (at 3.32Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7.1_743)	Depositor
R, R_{free}	0.211 , 0.273 0.198 , 0.260	Depositor DCC
R_{free} test set	1851 reflections (19.97%)	DCC
Wilson B-factor (Å^2)	112.4	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 79.8	EDS
Estimated twinning fraction	0.043 for -l,-k,-h	Xtriage
L-test for twinning	$< |L| > = 0.48, < L^2 > = 0.31$	Xtriage
Outliers	0 of 9621 reflections	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	2758	wwPDB-VP
Average B, all atoms (Å^2)	117.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.80% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

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	0.47	0/781	0.70	1/1048 (0.1%)
2	D	0.55	0/611	0.68	0/818
3	T	0.50	0/807	0.69	0/1088
4	W	0.52	0/597	0.69	0/799
All	All	0.51	0/2796	0.69	1/3753 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	38	LEU	CB-CG-CD1	10.77	129.32	111.00

There are no chirality outliers.

There are no planarity outliers.

5.2   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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	774	0	788	51	0
2	D	605	0	629	47	0
3	T	792	0	823	49	0
4	W	587	0	646	38	0
All	All	2758	0	2886	132	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 23.

All (132) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
3:T:552:PRO:HB2	4:W:57:ILE:HD11	1.40	1.02
3:T:552:PRO:HB2	4:W:57:ILE:CD1	1.99	0.92
3:T:608:PRO:HG2	3:T:611:VAL:HG23	1.59	0.84
3:T:618:PRO:HG2	3:T:621:TYR:HD2	1.43	0.84
2:D:14:GLU:HB2	2:D:33:LEU:HD11	1.60	0.82
2:D:29:ASN:OD1	2:D:30:GLY:N	2.11	0.82
4:W:69:VAL:HG12	4:W:70:ILE:HD13	1.62	0.81
2:D:19:LEU:O	2:D:19:LEU:HD12	1.80	0.80
3:T:534:PRO:CG	4:W:16:LYS:HG3	2.12	0.78
3:T:626:ILE:O	3:T:626:ILE:HG13	1.83	0.78
1:A:15:ARG:HH22	2:D:15:ARG:HG3	1.47	0.77
3:T:546:SER:HA	3:T:549:VAL:HG12	1.65	0.77
2:D:9:ARG:HB2	2:D:12:THR:OG1	1.84	0.77
2:D:14:GLU:HB2	2:D:33:LEU:CD1	2.17	0.74
4:W:9:THR:O	4:W:13:ILE:HG13	1.87	0.74
3:T:608:PRO:HG2	3:T:611:VAL:CG2	2.20	0.71
3:T:583:ALA:HB3	3:T:585:ARG:NH2	2.05	0.71
3:T:534:PRO:HG2	4:W:16:LYS:HG3	1.74	0.70
1:A:86:SER:HB3	1:A:89:LEU:HB3	1.75	0.69
3:T:590:MET:HG2	4:W:27:THR:HG22	1.76	0.68
3:T:556:ASP:O	3:T:559:LYS:HB2	1.95	0.67
1:A:39:PHE:HD1	1:A:43:THR:HG21	1.60	0.66
1:A:63:GLU:HG3	2:D:26:THR:HG21	1.77	0.66
1:A:15:ARG:NH2	2:D:15:ARG:HG3	2.10	0.66
4:W:67:ALA:O	4:W:71:LEU:HB2	1.97	0.65
1:A:35:LYS:O	2:D:56:GLN:NE2	2.31	0.64
3:T:536:ILE:HG23	4:W:6:PRO:HG3	1.78	0.64
3:T:617:LEU:HD22	3:T:618:PRO:HD2	1.79	0.63
4:W:7:ARG:CZ	4:W:29:LEU:HD21	2.28	0.63
1:A:40:SER:HB3	2:D:62:LYS:HE2	1.80	0.62
1:A:8:GLN:OE1	1:A:8:GLN:HA	1.99	0.62
2:D:72:LEU:HB3	2:D:73:PRO:HD3	1.80	0.62
1:A:84:ARG:NH2	3:T:575:ASP:OD1	2.33	0.61
3:T:618:PRO:HG2	3:T:621:TYR:CD2	2.32	0.61
1:A:93:ILE:HD13	2:D:39:LEU:HD12	1.81	0.61
1:A:6:GLY:HA2	1:A:9:ARG:HD2	1.81	0.61
3:T:624:LEU:HB3	4:W:26:ASN:ND2	2.15	0.61
4:W:5:VAL:HG12	4:W:7:ARG:N	2.16	0.61
3:T:602:LEU:HD13	4:W:37:LEU:HD13	1.83	0.60

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
3:T:573:SER:OG	4:W:14:ILE:HG23	2.01	0.60
4:W:7:ARG:O	4:W:10:LEU:HB2	2.01	0.60
1:A:54:GLN:HB3	1:A:58:PHE:CE2	2.36	0.59
1:A:54:GLN:NE2	2:D:80:VAL:O	2.34	0.59
3:T:621:TYR:CE2	4:W:5:VAL:HG23	2.39	0.58
3:T:588:VAL:CG2	4:W:21:LEU:HD11	2.33	0.58
3:T:619:LEU:HD23	3:T:622:ARG:NH1	2.18	0.58
1:A:60:ARG:NE	2:D:22:ARG:HE	2.02	0.58
1:A:60:ARG:CZ	2:D:22:ARG:HE	2.17	0.57
1:A:84:ARG:HA	1:A:90:LEU:HD13	1.87	0.57
3:T:570:LYS:HG3	4:W:17:HIS:CD2	2.40	0.56
1:A:85:ARG:HH11	2:D:80:VAL:HB	1.70	0.56
4:W:44:GLU:O	4:W:48:THR:HG23	2.05	0.56
1:A:97:SER:HB2	2:D:35:LEU:HD11	1.87	0.56
2:D:50:ARG:NH1	2:D:75:LEU:HA	2.20	0.56
1:A:100:LEU:HD11	2:D:34:LEU:CB	2.36	0.55
3:T:608:PRO:HD2	3:T:611:VAL:HG21	1.89	0.55
1:A:58:PHE:HE1	2:D:80:VAL:HG22	1.71	0.55
1:A:93:ILE:CD1	2:D:39:LEU:HD12	2.36	0.55
1:A:81:LEU:HD22	1:A:84:ARG:HD3	1.89	0.54
1:A:93:ILE:HD11	2:D:39:LEU:HB2	1.90	0.54
3:T:621:TYR:CE1	4:W:7:ARG:HD2	2.43	0.53
3:T:602:LEU:HD13	4:W:37:LEU:CD1	2.37	0.53
2:D:77:LEU:HD21	4:W:69:VAL:HG22	1.91	0.52
3:T:588:VAL:HG21	4:W:21:LEU:HD11	1.91	0.52
1:A:62:LEU:HD22	1:A:78:ASP:HB3	1.92	0.52
1:A:66:ALA:HB2	1:A:78:ASP:OD2	2.10	0.52
1:A:96:LYS:HE2	2:D:38:GLU:OE2	2.09	0.52
3:T:624:LEU:HB3	4:W:26:ASN:HD21	1.75	0.51
3:T:627:PRO:O	3:T:628:ILE:HB	2.09	0.51
4:W:47:ARG:HD3	4:W:51:PHE:CE2	2.46	0.51
4:W:7:ARG:NH2	4:W:29:LEU:HD21	2.25	0.51
3:T:622:ARG:O	3:T:626:ILE:N	2.24	0.51
1:A:95:GLN:NE2	1:A:99:GLU:OE2	2.40	0.50
1:A:50:ILE:HD13	2:D:72:LEU:HD13	1.95	0.49
1:A:85:ARG:CG	2:D:80:VAL:HG12	2.43	0.48
4:W:8:GLY:O	4:W:12:LYS:HD3	2.13	0.48
3:T:583:ALA:CB	3:T:585:ARG:NH2	2.74	0.48
3:T:575:ASP:O	3:T:578:ALA:N	2.46	0.48
3:T:542:LYS:HG3	3:T:558:TYR:CD1	2.48	0.48
3:T:561:VAL:HG23	4:W:63:THR:HG21	1.96	0.48
3:T:628:ILE:O	3:T:629:ALA:HB2	2.13	0.48

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
3:T:557:ALA:O	3:T:560:ILE:HB	2.14	0.48
1:A:86:SER:CB	1:A:89:LEU:HB3	2.43	0.47
1:A:58:PHE:HE1	2:D:80:VAL:CG2	2.26	0.47
3:T:546:SER:HA	3:T:549:VAL:CG1	2.40	0.47
4:W:35:PHE:O	4:W:38:PHE:HB3	2.15	0.47
2:D:40:LEU:HD23	2:D:40:LEU:N	2.29	0.47
1:A:74:ILE:HD13	2:D:28:VAL:HG22	1.96	0.47
2:D:34:LEU:O	2:D:37:ALA:HB3	2.15	0.47
3:T:593:VAL:HG11	4:W:30:LEU:HB3	1.96	0.46
1:A:63:GLU:OE2	2:D:22:ARG:N	2.49	0.46
2:D:28:VAL:HG11	2:D:33:LEU:CD2	2.45	0.46
1:A:100:LEU:HD23	1:A:100:LEU:HA	1.72	0.46
1:A:62:LEU:CD2	1:A:78:ASP:HB3	2.46	0.46
2:D:14:GLU:CB	2:D:33:LEU:HD11	2.39	0.46
3:T:533:GLU:N	3:T:534:PRO:HD2	2.31	0.46
1:A:39:PHE:HD1	1:A:43:THR:CG2	2.25	0.46
1:A:65:PHE:HE2	1:A:82:LEU:HA	1.79	0.45
3:T:570:LYS:O	3:T:573:SER:HB2	2.17	0.45
3:T:536:ILE:HG13	4:W:13:ILE:HD11	1.98	0.45
3:T:563:LYS:HD3	3:T:563:LYS:HA	1.43	0.45
4:W:5:VAL:HB	4:W:7:ARG:HG2	1.98	0.44
1:A:39:PHE:CD1	1:A:43:THR:HG21	2.48	0.44
4:W:7:ARG:O	4:W:10:LEU:N	2.51	0.44
1:A:75:THR:HA	2:D:29:ASN:HD22	1.83	0.44
1:A:100:LEU:HD11	2:D:34:LEU:HB3	2.00	0.44
3:T:618:PRO:O	3:T:621:TYR:N	2.50	0.43
1:A:52:PHE:O	1:A:55:ALA:HB3	2.19	0.43
1:A:100:LEU:HD11	2:D:34:LEU:HB2	2.00	0.43
3:T:593:VAL:HG11	4:W:30:LEU:CB	2.48	0.43
4:W:69:VAL:HG12	4:W:70:ILE:N	2.34	0.43
3:T:536:ILE:H	4:W:13:ILE:HD11	1.84	0.43
2:D:14:GLU:HG2	2:D:18:ARG:HD2	2.01	0.43
3:T:549:VAL:C	3:T:550:LYS:HG2	2.39	0.42
1:A:75:THR:OG1	1:A:77:GLU:HB2	2.20	0.42
1:A:16:LEU:HD21	2:D:15:ARG:HB2	2.02	0.42
3:T:535:GLU:HA	4:W:13:ILE:HG12	2.01	0.42
2:D:33:LEU:HA	2:D:33:LEU:HD23	1.63	0.42
2:D:50:ARG:HD2	2:D:75:LEU:HD13	2.01	0.42
3:T:625:LEU:C	3:T:627:PRO:HD3	2.40	0.42
1:A:29:GLN:O	1:A:32:ALA:HB3	2.20	0.42
2:D:41:LYS:HE3	2:D:41:LYS:HB2	1.76	0.42
1:A:65:PHE:CE2	1:A:81:LEU:HB3	2.55	0.42

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:20:VAL:HG22	2:D:8:PHE:HE2	1.85	0.42
2:D:28:VAL:HG12	2:D:29:ASN:O	2.21	0.41
1:A:96:LYS:HG2	2:D:38:GLU:HG3	2.03	0.41
3:T:621:TYR:HE1	4:W:7:ARG:HD2	1.84	0.40
2:D:34:LEU:HD23	2:D:34:LEU:HA	1.87	0.40
1:A:13:ILE:HG22	1:A:14:GLN:NE2	2.35	0.40
2:D:46:GLU:O	2:D:47:ALA:C	2.59	0.40
1:A:23:THR:CG2	2:D:7:GLY:O	2.70	0.40
1:A:16:LEU:O	1:A:19:ALA:N	2.55	0.40

There are no symmetry-related clashes.

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	A	96/140 (69%)	93 (97%)	3 (3%)	0	100	100
2	D	73/81 (90%)	68 (93%)	5 (7%)	0	100	100
3	T	95/111 (86%)	91 (96%)	3 (3%)	1 (1%)	21	72
4	W	71/77 (92%)	69 (97%)	2 (3%)	0	100	100
All	All	335/409 (82%)	321 (96%)	13 (4%)	1 (0%)	50	92

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	T	628	ILE

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	A	82/116 (71%)	78 (95%)	4 (5%)	35	77
2	D	62/67 (92%)	57 (92%)	5 (8%)	17	57
3	T	88/99 (89%)	76 (86%)	12 (14%)	5	26
4	W	63/66 (96%)	58 (92%)	5 (8%)	18	59
All	All	295/348 (85%)	269 (91%)	26 (9%)	14	52

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	29	GLN
1	A	65	PHE
1	A	81	LEU
1	A	93	ILE
2	D	12	THR
2	D	29	ASN
2	D	40	LEU
2	D	53	ARG
2	D	79	PHE
3	T	539	SER
3	T	546	SER
3	T	550	LYS
3	T	563	LYS
3	T	571	GLN
3	T	573	SER
3	T	574	SER
3	T	580	SER
3	T	599	ARG
3	T	606	LYS
3	T	617	LEU
3	T	628	ILE
4	W	12	LYS
4	W	21	LEU
4	W	56	LYS
4	W	57	ILE
4	W	63	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	21	HIS

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Mol	Chain	Res	Type
1	A	68	HIS
3	T	571	GLN
4	W	17	HIS

5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates 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 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	98/140 (70%)	-0.10	0	100	100	70, 122, 191, 209	0
2	D	75/81 (92%)	-0.10	0	100	100	65, 105, 170, 182	0
3	T	97/111 (87%)	-0.12	0	100	100	70, 109, 163, 202	0
4	W	73/77 (94%)	-0.03	0	100	100	69, 103, 166, 346	0
All	All	343/409 (83%)	-0.09	0	100	100	65, 111, 175, 346	0

There are no RSRZ outliers to report.

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.