



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 03:00 AM UTC

PDB ID : 4Z96 / pdb_00004z96
Title : Crystal structure of DNMT1 in complex with USP7
Authors : Zhang, Z.M.; Song, J.
Deposited on : 2015-04-09
Resolution : 2.85 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

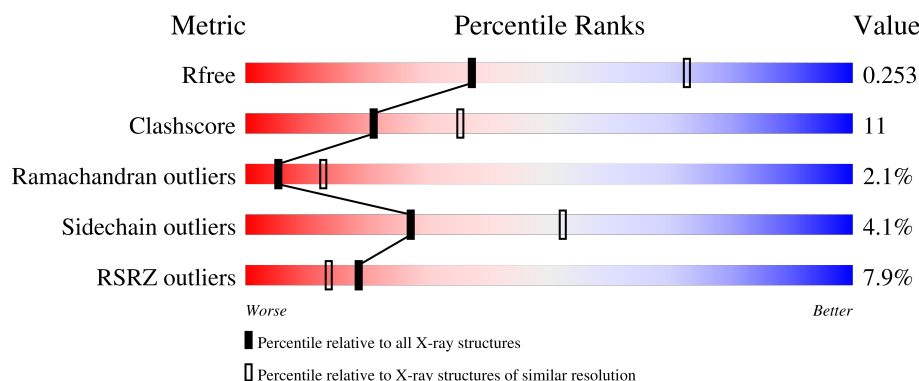
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.85 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	1407 (2.88-2.84)
Clashscore	190562	1446 (2.88-2.84)
Ramachandran outliers	187476	1406 (2.88-2.84)
Sidechain outliers	187428	1407 (2.88-2.84)
RSRZ outliers	180081	1408 (2.88-2.84)

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	530	
2	C	33	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4119 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 Ubiquitin carboxyl-terminal hydrolase 7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	523	Total	C	N	O	S	0	0	0
			4041	2577	678	760	26			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	554	SER	-	expression tag	UNP Q93009
A	555	GLY	-	expression tag	UNP Q93009
A	556	PRO	-	expression tag	UNP Q93009
A	557	LEU	-	expression tag	UNP Q93009
A	558	GLY	-	expression tag	UNP Q93009
A	559	SER	-	expression tag	UNP Q93009

- Molecule 2 is a protein called DNA (cytosine-5)-methyltransferase 1.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	8	Total	C	N	O	0	5	0
			78	48	18	12			

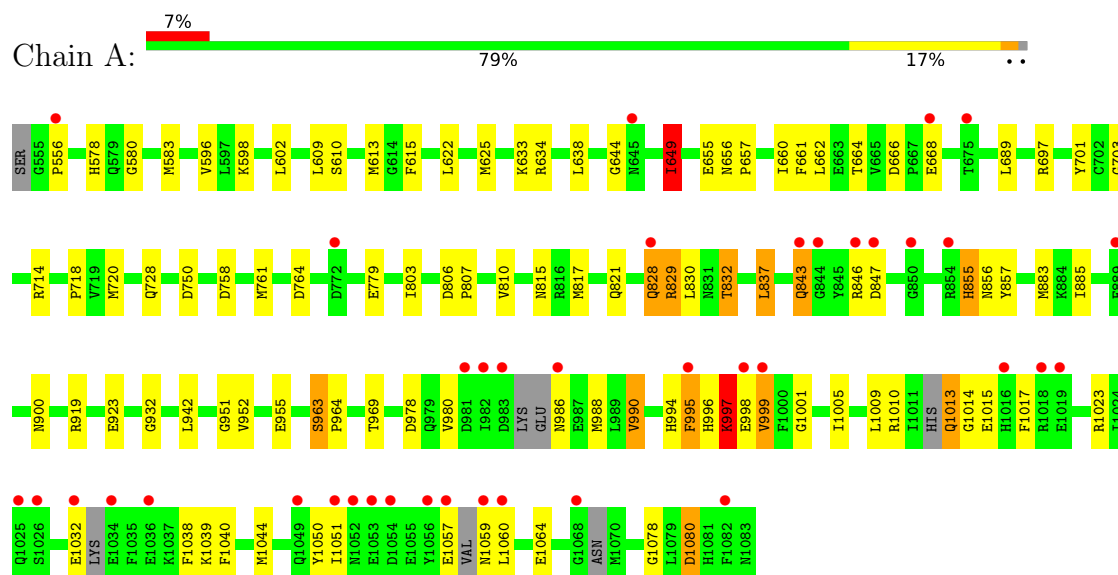
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	1097	SER	GLU	conflict	UNP P26358
C	1099	TRP	PRO	conflict	UNP P26358

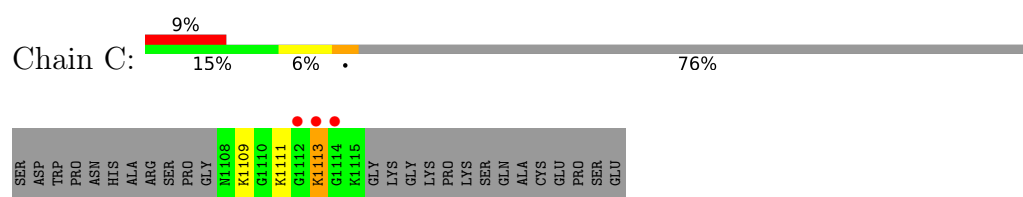
3 Residue-property plots [i](#)

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: Ubiquitin carboxyl-terminal hydrolase 7



- Molecule 2: DNA (cytosine-5)-methyltransferase 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α , β , γ	124.04Å 124.04Å 153.01Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	43.96 – 2.85 43.96 – 2.85	Depositor EDS
% Data completeness (in resolution range)	92.1 (43.96-2.85) 92.0 (43.96-2.85)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.10 (at 2.81Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.201 , 0.246 0.209 , 0.253	Depositor DCC
R_{free} test set	1998 reflections (5.94%)	wwPDB-VP
Wilson B-factor (Å ²)	86.5	Xtriage
Anisotropy	0.022	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 84.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.024 for -h,-k,l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4119	wwPDB-VP
Average B, all atoms (Å ²)	102.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.80% 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	0.58	0/4132	1.00	14/5611 (0.2%)
2	C	0.32	0/75	0.80	0/88
All	All	0.58	0/4207	1.00	14/5699 (0.2%)

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	1

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	829	ARG	N-CA-CB	-11.89	91.68	111.17
1	A	829	ARG	N-CA-C	-10.68	98.17	112.26
1	A	828	GLN	N-CA-C	8.94	129.84	110.80
1	A	951	GLY	N-CA-C	8.31	122.67	110.38
1	A	995	PHE	N-CA-C	6.69	118.31	108.14
1	A	963	SER	CA-C-N	6.57	126.26	119.56
1	A	963	SER	C-N-CA	6.57	126.26	119.56
1	A	997	LYS	N-CA-C	6.23	124.07	110.80
1	A	649	ILE	CB-CA-C	-6.05	103.87	112.22
1	A	990	VAL	N-CA-C	5.81	117.80	108.85
1	A	1013	GLN	CA-C-N	5.72	125.42	119.92
1	A	1013	GLN	C-N-CA	5.72	125.42	119.92
1	A	1005	ILE	N-CA-C	5.67	113.16	107.55
1	A	1080	ASP	N-CA-C	5.02	116.45	108.67

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	996	HIS	Peptide

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	4041	0	3732	86	0
2	C	78	0	95	3	0
All	All	4119	0	3827	87	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 11.

All (87) 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:A:855:HIS:ND1	1:A:856:ASN:N	2.08	1.02
1:A:997:LYS:HE2	1:A:999:VAL:HA	1.45	0.98
1:A:997:LYS:CE	1:A:999:VAL:HA	2.00	0.91
1:A:997:LYS:HE2	1:A:999:VAL:CA	2.03	0.87
1:A:1038:PHE:HB3	1:A:1040:PHE:HE1	1.40	0.86
1:A:997:LYS:HE2	1:A:999:VAL:C	2.02	0.83
1:A:995:PHE:HB2	1:A:997:LYS:HD3	1.60	0.81
1:A:625:MET:HE1	1:A:661:PHE:HB2	1.64	0.80
1:A:598:LYS:HB3	1:A:649:ILE:HD11	1.65	0.79
1:A:995:PHE:HB2	1:A:997:LYS:CD	2.16	0.74
1:A:919:ARG:HB2	1:A:955:GLU:HB3	1.72	0.70
1:A:1009:LEU:HG	1:A:1010:ARG:H	1.55	0.70
1:A:697:ARG:NH2	1:A:779:GLU:OE1	2.25	0.70
1:A:758:ASP:HB2	2:C:1109:LYS:HE2	1.75	0.69
1:A:1013:GLN:CD	1:A:1014:GLY:H	2.01	0.68
1:A:697:ARG:O	1:A:697:ARG:HG3	1.92	0.68
1:A:1039:LYS:C	1:A:1040:PHE:HD1	2.02	0.67
1:A:997:LYS:NZ	1:A:999:VAL:HA	2.09	0.66
1:A:602:LEU:HB3	1:A:644:GLY:HA2	1.78	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1017:PHE:HZ	1:A:1040:PHE:HD2	1.47	0.63
1:A:1017:PHE:CZ	1:A:1040:PHE:HD2	2.18	0.62
1:A:1050:TYR:OH	1:A:1080:ASP:OD2	2.17	0.62
1:A:995:PHE:HE2	1:A:1078:GLY:HA3	1.66	0.61
1:A:583:MET:HE1	1:A:634:ARG:HD3	1.83	0.60
1:A:843:GLN:HE22	1:A:846:ARG:C	2.09	0.59
1:A:855:HIS:C	1:A:857:TYR:H	2.11	0.57
1:A:855:HIS:C	1:A:857:TYR:N	2.61	0.57
1:A:997:LYS:HG2	1:A:998:GLU:N	2.19	0.56
1:A:997:LYS:HG3	1:A:1001:GLY:H	1.71	0.56
1:A:855:HIS:O	1:A:857:TYR:N	2.39	0.56
1:A:830:LEU:HD12	1:A:837:LEU:HD21	1.88	0.56
1:A:942:LEU:HD22	1:A:952:VAL:HG22	1.88	0.55
1:A:997:LYS:HG2	1:A:998:GLU:C	2.32	0.54
1:A:810:VAL:O	1:A:829:ARG:NH2	2.41	0.54
1:A:995:PHE:CG	1:A:997:LYS:HE3	2.43	0.54
1:A:843:GLN:NE2	1:A:846:ARG:O	2.35	0.54
1:A:995:PHE:CE2	1:A:1078:GLY:HA3	2.44	0.53
1:A:997:LYS:HZ3	1:A:999:VAL:HA	1.75	0.52
1:A:1038:PHE:HB3	1:A:1040:PHE:CE1	2.32	0.52
1:A:625:MET:HB3	1:A:633:LYS:HE2	1.91	0.51
1:A:1009:LEU:CG	1:A:1010:ARG:H	2.19	0.51
1:A:1010:ARG:HD3	1:A:1023:ARG:NH1	2.25	0.51
1:A:986:ASN:O	1:A:1013:GLN:HB2	2.10	0.51
1:A:609:LEU:HD21	1:A:662:LEU:HD13	1.94	0.49
1:A:988:MET:HE3	1:A:990:VAL:HG13	1.93	0.49
1:A:1014:GLY:HA2	1:A:1059:ASN:N	2.27	0.49
1:A:613:MET:HE3	1:A:662:LEU:HD22	1.94	0.49
1:A:995:PHE:CD2	1:A:997:LYS:HE3	2.48	0.49
1:A:997:LYS:CG	1:A:998:GLU:N	2.77	0.48
1:A:843:GLN:OE1	1:A:846:ARG:N	2.47	0.48
1:A:855:HIS:ND1	1:A:855:HIS:C	2.72	0.48
1:A:610:SER:OG	1:A:615:PHE:O	2.19	0.47
1:A:598:LYS:HG2	1:A:649:ILE:HG12	1.96	0.47
1:A:625:MET:HE2	1:A:625:MET:HB2	1.70	0.47
1:A:622:LEU:HB3	1:A:660:ILE:HG21	1.97	0.46
1:A:830:LEU:C	1:A:832:THR:H	2.24	0.46
1:A:995:PHE:CG	1:A:997:LYS:CE	2.99	0.46
1:A:583:MET:H	1:A:583:MET:HE2	1.81	0.46
1:A:990:VAL:HG23	1:A:1009:LEU:HB3	1.97	0.46
1:A:855:HIS:O	1:A:856:ASN:C	2.57	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:764:ASP:OD1	2:C:1111[A]:LYS:NZ	2.50	0.45
1:A:1013:GLN:OE1	1:A:1014:GLY:N	2.47	0.45
1:A:666:ASP:O	1:A:668:GLU:N	2.50	0.44
1:A:701:TYR:CE2	1:A:703:GLY:HA2	2.52	0.44
1:A:997:LYS:HE2	1:A:999:VAL:O	2.17	0.44
1:A:817:MET:HE2	1:A:821:GLN:HB3	1.99	0.44
1:A:625:MET:HG3	1:A:633:LYS:HG2	1.99	0.44
1:A:761:MET:HE3	1:A:761:MET:HB2	1.87	0.44
1:A:1040:PHE:N	1:A:1040:PHE:CD1	2.85	0.44
2:C:1113[B]:LYS:H	2:C:1113[B]:LYS:HG2	1.58	0.43
1:A:994:HIS:O	1:A:995:PHE:HB3	2.18	0.43
1:A:578:HIS:CE1	1:A:580:GLY:H	2.36	0.43
1:A:656:ASN:HA	1:A:657:PRO:HA	1.86	0.42
1:A:997:LYS:HB2	1:A:1001:GLY:HA3	2.00	0.42
1:A:803:ILE:O	1:A:806:ASP:HB2	2.19	0.42
1:A:855:HIS:CG	1:A:856:ASN:N	2.83	0.42
1:A:999:VAL:O	1:A:999:VAL:HG13	2.18	0.42
1:A:718:PRO:HB3	1:A:728:GLN:OE1	2.20	0.42
1:A:806:ASP:HA	1:A:807:PRO:HD2	1.81	0.41
1:A:990:VAL:O	1:A:1009:LEU:N	2.51	0.41
1:A:598:LYS:O	1:A:649:ILE:HG13	2.21	0.41
1:A:689:LEU:HD22	1:A:720:MET:HG2	2.02	0.41
1:A:837:LEU:O	1:A:885:ILE:HD13	2.20	0.41
1:A:883:MET:HE2	1:A:883:MET:HB3	1.95	0.41
1:A:714:ARG:NH2	1:A:750:ASP:OD2	2.42	0.40
1:A:963:SER:HA	1:A:964:PRO:HD2	1.69	0.40
1:A:978:ASP:O	1:A:1010:ARG:NH1	2.55	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	511/530 (96%)	462 (90%)	39 (8%)	10 (2%)	6	13
2	C	9/33 (27%)	5 (56%)	2 (22%)	2 (22%)	0	0
All	All	520/563 (92%)	467 (90%)	41 (8%)	12 (2%)	5	11

All (12) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	815	ASN
1	A	900	ASN
1	A	932	GLY
1	A	1060	LEU
1	A	828	GLN
1	A	847	ASP
2	C	1113[A]	LYS
2	C	1113[B]	LYS
1	A	1015	GLU
1	A	1064	GLU
1	A	1051	ILE
1	A	556	PRO

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	413/485 (85%)	396 (96%)	17 (4%)	27	52
2	C	7/25 (28%)	7 (100%)	0	100	100
All	All	420/510 (82%)	403 (96%)	17 (4%)	27	53

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	596	VAL
1	A	638	LEU
1	A	649	ILE
1	A	655	GLU

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Mol	Chain	Res	Type
1	A	664	THR
1	A	832	THR
1	A	837	LEU
1	A	843	GLN
1	A	855	HIS
1	A	923	GLU
1	A	969	THR
1	A	980	VAL
1	A	997	LYS
1	A	999	VAL
1	A	1032	GLU
1	A	1044	MET
1	A	1057	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	568	GLN
1	A	654	ASN
1	A	683	HIS

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.

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	523/530 (98%)	0.31	39 (7%) 20 14	63, 98, 154, 199	0
2	C	8/33 (24%)	1.52	3 (37%) 1 1	44, 89, 113, 136	4 (50%)
All	All	531/563 (94%)	0.32	42 (7%) 18 14	44, 98, 154, 199	4 (0%)

All (42) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	986	ASN	7.0
2	C	1113[A]	LYS	6.6
1	A	983	ASP	6.6
1	A	981	ASP	6.1
1	A	828	GLN	5.5
1	A	1019	GLU	5.1
1	A	1068	GLY	5.1
1	A	645	ASN	4.4
1	A	889	GLU	4.2
1	A	1052	ASN	4.1
1	A	847	ASP	4.0
1	A	772	ASP	3.8
1	A	998	GLU	3.7
1	A	1059	ASN	3.5
1	A	1036	GLU	3.3
1	A	982	ILE	3.2
1	A	1054	ASP	3.2
1	A	999	VAL	3.1
1	A	1056	TYR	3.1
1	A	1053	GLU	3.1
1	A	668	GLU	3.0
1	A	675	THR	3.0
1	A	1025	GLN	2.9
1	A	556	PRO	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	1034	GLU	2.8
1	A	854	ARG	2.8
1	A	1018	ARG	2.7
1	A	1082	PHE	2.7
1	A	843	GLN	2.7
1	A	1049	GLN	2.7
2	C	1112[A]	GLY	2.6
2	C	1114[B]	GLY	2.5
1	A	1016	HIS	2.5
1	A	1051	ILE	2.5
1	A	844	GLY	2.4
1	A	846	ARG	2.4
1	A	995	PHE	2.3
1	A	1060	LEU	2.2
1	A	1032	GLU	2.2
1	A	850	GLY	2.1
1	A	1057	GLU	2.0
1	A	1026	SER	2.0

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.