



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 20, 2026 – 05:17 AM UTC

PDB ID : 4M0Q / pdb_00004m0q
Title : Ebola virus VP24 structure
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Deposited on : 2013-08-01
Resolution : 1.92 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

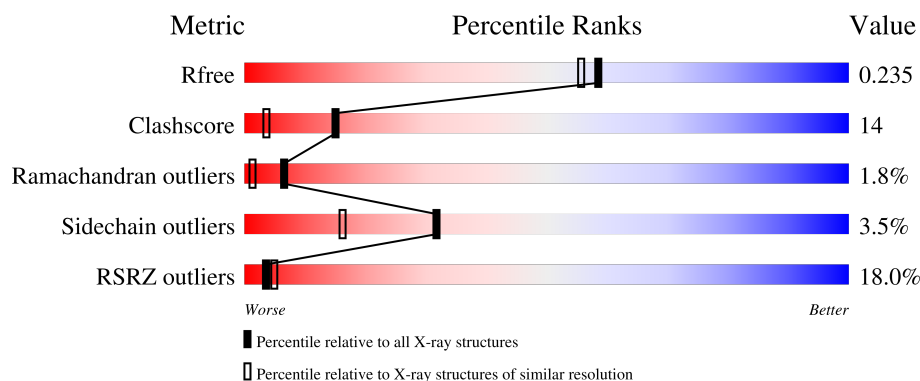
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.92 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	1188 (1.92-1.92)
Clashscore	190562	1209 (1.92-1.92)
Ramachandran outliers	187476	1195 (1.92-1.92)
Sidechain outliers	187428	1195 (1.92-1.92)
RSRZ outliers	180081	1188 (1.92-1.92)

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	230	19% 73% 19% 5%
1	B	230	16% 74% 19%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3703 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 Membrane-associated protein VP24.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	222	Total	C	N	O	S	0	0	0
			1764	1135	304	316	9			
1	B	222	Total	C	N	O	S	0	1	0
			1769	1138	305	317	9			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	8	GLY	-	expression tag	UNP Q05322
A	9	HIS	-	expression tag	UNP Q05322
A	10	MET	-	expression tag	UNP Q05322
B	8	GLY	-	expression tag	UNP Q05322
B	9	HIS	-	expression tag	UNP Q05322
B	10	MET	-	expression tag	UNP Q05322

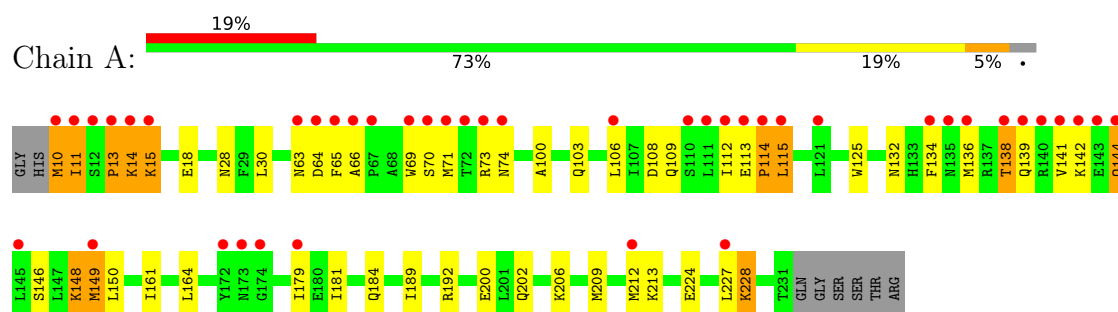
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	86	Total	O	0	0
			86	86		
2	B	84	Total	O	0	0
			84	84		

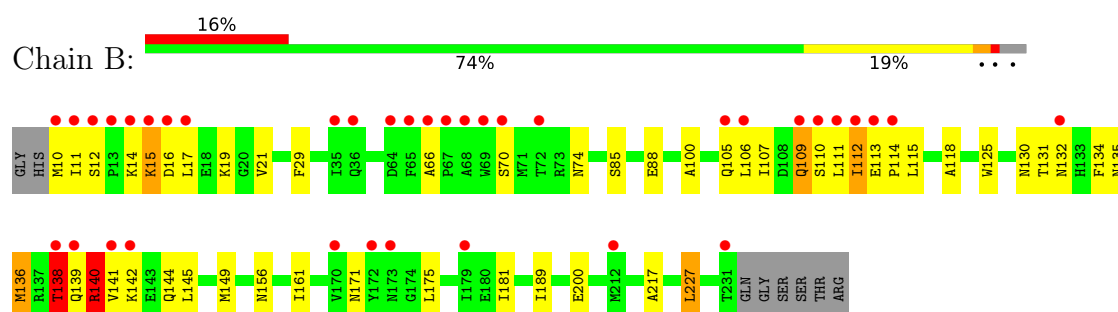
3 Residue-property plots [i](#)

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: Membrane-associated protein VP24



• Molecule 1: Membrane-associated protein VP24



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	71.78Å 71.78Å 191.16Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.60 – 1.92 33.60 – 1.92	Depositor EDS
% Data completeness (in resolution range)	100.0 (33.60-1.92) 99.9 (33.60-1.92)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.31 (at 1.92Å)	Xtriage
Refinement program	PHENIX 1.8.4_1496	Depositor
R, R_{free}	0.209 , 0.232 0.212 , 0.235	Depositor DCC
R_{free} test set	1960 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	31.6	Xtriage
Anisotropy	0.075	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 47.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3703	wwPDB-VP
Average B, all atoms (Å ²)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.52% 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	0.53	0/1801	0.95	5/2441 (0.2%)
1	B	0.66	0/1809	1.05	9/2452 (0.4%)
All	All	0.60	0/3610	1.00	14/4893 (0.3%)

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(°)	Ideal(°)
1	B	140	ARG	N-CA-C	-8.82	102.52	113.28
1	B	15	LYS	N-CA-C	7.59	118.58	107.88
1	A	148	LYS	N-CA-C	-6.99	100.09	110.23
1	A	15	LYS	N-CA-C	6.62	121.01	112.41
1	B	15	LYS	CA-C-N	6.46	131.51	120.72
1	B	15	LYS	C-N-CA	6.46	131.51	120.72
1	B	106	LEU	N-CA-C	-6.43	104.63	113.18
1	A	150	LEU	N-CA-C	-6.38	104.41	111.36
1	B	136	MET	CA-C-N	-6.28	112.50	122.29
1	B	136	MET	C-N-CA	-6.28	112.50	122.29
1	B	138	THR	N-CA-C	-6.08	96.92	108.17
1	B	111	LEU	N-CA-C	-5.82	100.14	109.39
1	A	115	LEU	N-CA-C	5.47	117.01	107.49
1	A	144	GLN	CA-CB-CG	-5.46	103.18	114.10

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	14	LYS	Peptide

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	1764	0	1815	52	0
1	B	1769	0	1821	57	0
2	A	86	0	0	1	0
2	B	84	0	0	6	0
All	All	3703	0	3636	98	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 14.

All (98) 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:11:ILE:HA	1:B:132:ASN:HB3	1.47	0.95
1:B:136:MET:O	1:B:142:LYS:NZ	2.05	0.90
1:A:114:PRO:HA	1:A:144:GLN:HE22	1.45	0.81
1:A:10:MET:HA	1:B:131:THR:HA	1.65	0.78
1:A:70:SER:O	1:A:74:ASN:ND2	2.18	0.76
1:B:70:SER:O	1:B:74:ASN:ND2	2.16	0.76
1:A:139:GLN:NE2	1:A:142:LYS:HD2	2.04	0.72
1:B:88:GLU:OE1	2:B:383:HOH:O	2.06	0.72
1:A:14:LYS:HG2	1:A:15:LYS:N	2.05	0.72
1:A:139:GLN:HA	1:A:142:LYS:HG3	1.73	0.70
1:A:146:SER:OG	1:A:148:LYS:O	2.09	0.69
1:A:192:ARG:NH2	1:A:224:GLU:OE1	2.25	0.69
1:A:202:GLN:HE22	1:A:209:MET:HE3	1.58	0.68
1:A:228:LYS:NZ	2:A:382:HOH:O	2.27	0.67
1:B:136:MET:C	1:B:142:LYS:HZ1	2.01	0.67
1:A:139:GLN:HE21	1:A:142:LYS:HD2	1.60	0.66
1:B:113:GLU:N	1:B:114:PRO:HD2	2.11	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:148:LYS:O	1:A:149:MET:HB3	1.98	0.64
1:B:139:GLN:HB3	1:B:142:LYS:HG3	1.80	0.64
1:B:12:SER:O	2:B:301:HOH:O	2.16	0.64
1:B:107:ILE:HD11	2:B:367:HOH:O	1.98	0.63
1:B:109:GLN:N	1:B:109:GLN:OE1	2.31	0.63
1:A:139:GLN:HE21	1:A:142:LYS:CD	2.12	0.62
1:B:140:ARG:HH11	1:B:140:ARG:HG2	1.65	0.61
1:A:14:LYS:HG2	1:A:15:LYS:H	1.64	0.61
1:B:141:VAL:HA	1:B:144:GLN:HG2	1.82	0.60
1:B:19:LYS:NZ	1:B:145:LEU:O	2.30	0.60
1:B:100:ALA:HB1	1:B:181:ILE:HD13	1.84	0.60
1:B:138:THR:O	1:B:141:VAL:HG22	2.01	0.60
1:A:64:ASP:OD1	1:A:65:PHE:N	2.35	0.59
1:B:15:LYS:HG3	1:B:16:ASP:H	1.68	0.59
1:A:11:ILE:HG21	1:B:29:PHE:HD2	1.69	0.58
1:A:113:GLU:HA	1:A:114:PRO:C	2.29	0.58
1:A:161:ILE:HG23	1:A:227:LEU:HD22	1.85	0.57
1:A:132:ASN:HB3	1:B:11:ILE:HA	1.86	0.57
1:B:189:ILE:HB	1:B:200:GLU:HG3	1.88	0.56
1:A:28:ASN:OD1	1:B:17:LEU:HD11	2.06	0.55
1:B:138:THR:O	1:B:138:THR:OG1	2.25	0.55
1:A:114:PRO:HA	1:A:144:GLN:NE2	2.19	0.54
1:A:103:GLN:NE2	1:A:108:ASP:OD1	2.37	0.54
1:B:112:ILE:N	1:B:113:GLU:HA	2.22	0.54
1:A:138:THR:HG1	1:A:141:VAL:HG22	1.72	0.53
1:A:66:ALA:HB1	1:A:69:TRP:HB2	1.90	0.53
1:A:10:MET:O	1:A:13:PRO:HD3	2.08	0.53
1:A:11:ILE:HG21	1:B:29:PHE:CD2	2.45	0.52
1:A:212:MET:HB3	1:A:213:LYS:HE2	1.90	0.52
1:A:11:ILE:HD11	2:B:305:HOH:O	2.09	0.52
1:A:30:LEU:HD21	1:B:17:LEU:HD12	1.92	0.51
1:A:189:ILE:HB	1:A:200:GLU:HG3	1.91	0.51
1:A:64:ASP:CG	1:A:65:PHE:H	2.18	0.51
1:B:142:LYS:HA	1:B:145:LEU:HG	1.92	0.51
1:A:114:PRO:CA	1:A:144:GLN:HE22	2.20	0.50
1:B:105:GLN:HG3	1:B:156:ASN:HB3	1.93	0.50
1:A:136:MET:O	1:A:142:LYS:NZ	2.33	0.49
1:B:114:PRO:HB2	1:B:144:GLN:HG3	1.95	0.49
1:B:113:GLU:N	1:B:114:PRO:CD	2.76	0.47
1:A:164:LEU:HD23	1:A:179:ILE:HD12	1.96	0.47
1:A:100:ALA:HB1	1:A:181:ILE:HD13	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:189:ILE:HD11	1:A:206:LYS:HE3	1.97	0.47
1:B:114:PRO:HB2	1:B:144:GLN:CG	2.45	0.47
1:B:15:LYS:HB3	2:B:379:HOH:O	2.14	0.46
1:B:125:TRP:CD2	1:B:134:PHE:HB2	2.51	0.46
1:B:161:ILE:HG23	1:B:227:LEU:HG	1.97	0.46
1:A:10:MET:HE2	1:A:10:MET:HB2	1.71	0.45
1:A:10:MET:HG3	1:A:11:ILE:N	2.31	0.45
1:A:192:ARG:HH21	1:A:224:GLU:CD	2.24	0.45
1:B:105:GLN:HA	2:B:351:HOH:O	2.17	0.45
1:B:114:PRO:HB2	1:B:144:GLN:CD	2.41	0.45
1:B:118:ALA:HB2	1:B:141:VAL:HB	1.99	0.44
1:A:28:ASN:CG	1:B:17:LEU:HD11	2.43	0.44
1:B:139:GLN:CB	1:B:142:LYS:HG3	2.46	0.44
1:A:15:LYS:HE2	1:A:18:GLU:OE1	2.17	0.44
1:B:171:ASN:ND2	1:B:175:LEU:H	2.15	0.44
1:A:189:ILE:HB	1:A:200:GLU:CG	2.48	0.43
1:B:138:THR:OG1	1:B:141:VAL:HG22	2.19	0.43
1:B:145:LEU:HA	1:B:149:MET:SD	2.58	0.43
1:B:15:LYS:CG	1:B:16:ASP:H	2.32	0.43
1:A:138:THR:O	1:A:138:THR:OG1	2.37	0.43
1:B:139:GLN:HA	1:B:142:LYS:HG3	1.99	0.42
1:A:11:ILE:HG12	1:B:130:ASN:O	2.18	0.42
1:B:110:SER:C	1:B:112:ILE:N	2.77	0.42
1:A:30:LEU:HD11	1:B:21:VAL:HB	2.02	0.42
1:B:112:ILE:HG23	1:B:113:GLU:HA	2.02	0.42
1:B:85:SER:HA	1:B:217:ALA:O	2.19	0.42
1:B:105:GLN:N	1:B:105:GLN:OE1	2.53	0.42
1:B:141:VAL:O	1:B:144:GLN:HB2	2.19	0.42
1:A:63:ASN:OD1	1:A:64:ASP:N	2.52	0.42
1:B:15:LYS:HG2	1:B:17:LEU:H	1.85	0.41
1:B:141:VAL:HA	1:B:144:GLN:CG	2.48	0.41
1:A:125:TRP:CD2	1:A:134:PHE:HB2	2.56	0.41
1:B:10:MET:HE3	1:B:15:LYS:NZ	2.36	0.41
1:A:70:SER:HA	1:A:73:ARG:HB3	2.02	0.41
1:A:138:THR:O	1:A:141:VAL:HG22	2.21	0.41
1:B:110:SER:C	1:B:112:ILE:H	2.29	0.41
1:B:189:ILE:HB	1:B:200:GLU:CG	2.50	0.41
1:A:114:PRO:C	1:A:144:GLN:NE2	2.79	0.40
1:A:132:ASN:HA	1:B:11:ILE:HG22	2.03	0.40
1:B:15:LYS:CG	1:B:16:ASP:N	2.84	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	220/230 (96%)	205 (93%)	9 (4%)	6 (3%)	4	0
1	B	221/230 (96%)	207 (94%)	12 (5%)	2 (1%)	14	5
All	All	441/460 (96%)	412 (93%)	21 (5%)	8 (2%)	6	1

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	13	PRO
1	A	112	ILE
1	A	114	PRO
1	A	149	MET
1	B	14	LYS
1	B	66	ALA
1	A	109	GLN
1	A	138	THR

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	198/204 (97%)	191 (96%)	7 (4%)	32	16
1	B	199/204 (98%)	192 (96%)	7 (4%)	32	16
All	All	397/408 (97%)	383 (96%)	14 (4%)	32	16

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	MET
1	A	11	ILE
1	A	71	MET
1	A	106	LEU
1	A	115	LEU
1	A	184	GLN
1	A	228	LYS
1	B	109	GLN
1	B	112	ILE
1	B	115	LEU
1	B	135	ASN
1	B	138	THR
1	B	140	ARG
1	B	227	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	139	GLN
1	A	144	GLN
1	A	202	GLN
1	B	58	HIS
1	B	144	GLN
1	B	171	ASN
1	B	186	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

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	222/230 (96%)	0.80	43 (19%) 3 4	21, 39, 81, 109	0
1	B	222/230 (96%)	0.81	37 (16%) 4 6	20, 38, 76, 102	1 (0%)
All	All	444/460 (96%)	0.81	80 (18%) 3 5	20, 38, 80, 109	1 (0%)

All (80) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	13	PRO	6.9
1	B	65	PHE	6.8
1	A	65	PHE	6.7
1	B	112	ILE	5.7
1	B	66	ALA	5.6
1	A	11	ILE	5.4
1	A	66	ALA	5.3
1	A	114	PRO	5.3
1	B	114	PRO	5.3
1	A	111	LEU	5.1
1	B	14	LYS	5.0
1	B	13	PRO	4.8
1	A	115	LEU	4.6
1	B	105	GLN	4.5
1	A	12	SER	4.5
1	A	10	MET	4.0
1	B	111	LEU	4.0
1	B	10	MET	4.0
1	B	11	ILE	4.0
1	B	141	VAL	3.8
1	A	14	LYS	3.8
1	A	145	LEU	3.6
1	A	149	MET	3.5
1	B	17	LEU	3.5

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Mol	Chain	Res	Type	RSRZ
1	A	174	GLY	3.5
1	A	112	ILE	3.4
1	B	138	THR	3.4
1	B	139	GLN	3.3
1	A	141	VAL	3.3
1	A	69	TRP	3.3
1	A	71	MET	3.2
1	B	15	LYS	3.2
1	B	106	LEU	3.2
1	A	110	SER	3.2
1	B	109	GLN	3.2
1	B	69	TRP	3.0
1	A	67	PRO	2.9
1	B	67	PRO	2.8
1	B	68	ALA	2.8
1	A	144	GLN	2.7
1	A	72	THR	2.7
1	A	138	THR	2.7
1	B	212	MET	2.7
1	B	172	TYR	2.6
1	A	139	GLN	2.6
1	A	70	SER	2.6
1	A	172	TYR	2.6
1	B	12	SER	2.6
1	B	132	ASN	2.6
1	B	179	ILE	2.6
1	B	231	THR	2.5
1	A	64	ASP	2.5
1	B	35	ILE	2.4
1	B	113	GLU	2.4
1	A	106	LEU	2.4
1	B	36	GLN	2.4
1	A	212	MET	2.4
1	B	72	THR	2.3
1	B	110	SER	2.3
1	B	170	VAL	2.3
1	A	15	LYS	2.3
1	B	142	LYS	2.2
1	A	142	LYS	2.2
1	A	136	MET	2.2
1	A	140	ARG	2.2
1	B	16	ASP	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	227	LEU	2.2
1	A	173	ASN	2.1
1	A	179	ILE	2.1
1	B	70	SER	2.1
1	A	63	ASN	2.1
1	A	74	ASN	2.1
1	B	64	ASP	2.1
1	A	121	LEU	2.0
1	A	73	ARG	2.0
1	A	113	GLU	2.0
1	A	143	GLU	2.0
1	A	134	PHE	2.0
1	A	135	ASN	2.0
1	B	173	ASN	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.