



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 08:38 PM UTC

PDB ID : 3MOI / pdb_00003moi
Title : The crystal structure of the putative dehydrogenase from Bordetella bronchiseptica RB50
Authors : Zhang, R.; Evdokimova, E.; Egorova, O.; Savchenko, A.; Edwards, A.; Joachimiak, A.; Midwest Center for Structural Genomics (MCSG)
Deposited on : 2010-04-22
Resolution : 2.50 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

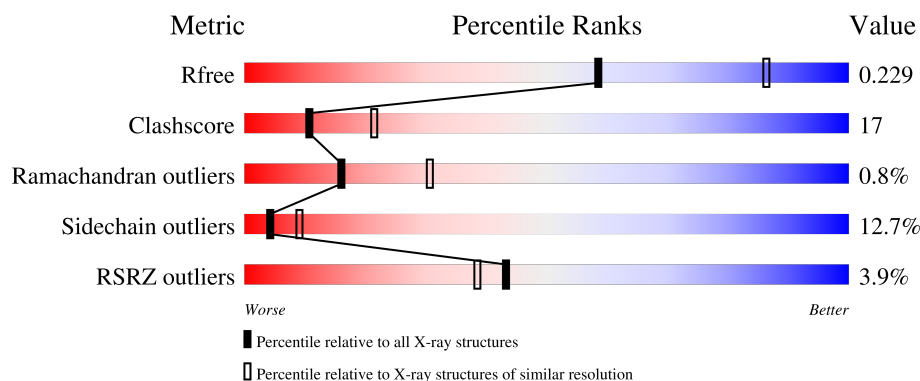
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	387	4% 72% 19% 6% ..

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2979 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 Probable dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	381	Total	C	N	O	S	0	0	0
			2934	1821	541	551	21			

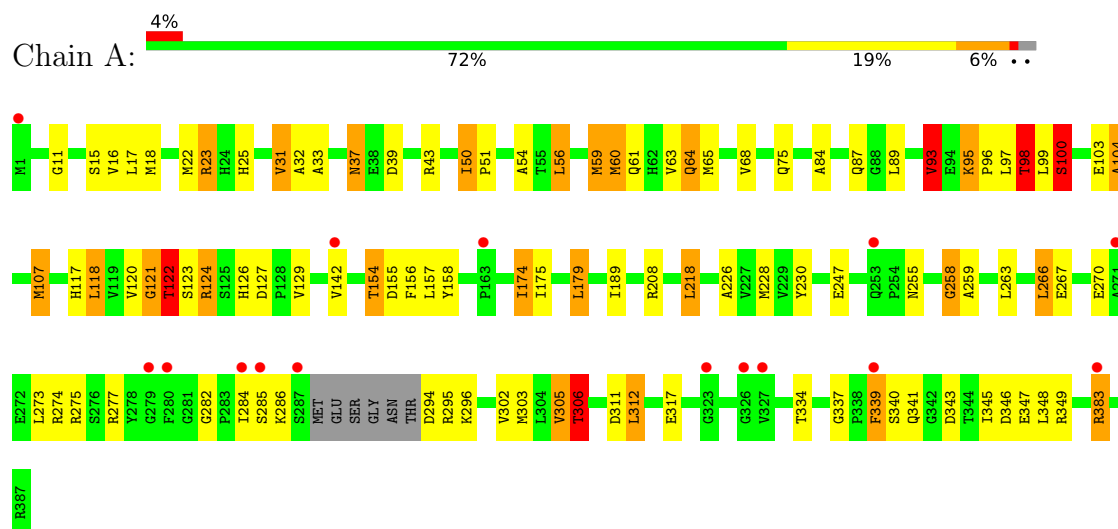
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	45	Total	O	0	0
			45	45		

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: Probable dehydrogenase



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	122.63Å 122.63Å 79.42Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	63.60 – 2.50 63.60 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.9 (63.60-2.50) 99.9 (63.60-2.50)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.01 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.197 , 0.236 0.198 , 0.229	Depositor DCC
R_{free} test set	1230 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å ²)	62.5	Xtriage
Anisotropy	0.087	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 39.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.027 for -h,-k,l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	2979	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.18% 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	A	1.31	9/2991 (0.3%)	1.26	23/4041 (0.6%)

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	60	MET	SD-CE	-6.95	1.62	1.79
1	A	306	THR	CA-CB	6.36	1.61	1.53
1	A	59	MET	SD-CE	-6.05	1.64	1.79
1	A	107	MET	SD-CE	-5.86	1.64	1.79
1	A	54	ALA	C-O	-5.75	1.16	1.24
1	A	104	ALA	CA-CB	-5.49	1.44	1.53
1	A	118	LEU	C-O	-5.37	1.17	1.23
1	A	100	SER	CA-C	5.26	1.58	1.52
1	A	226	ALA	CA-CB	-5.09	1.44	1.53

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	93	VAL	CB-CA-C	-9.09	97.18	110.63
1	A	60	MET	CG-SD-CE	-8.13	83.02	100.90
1	A	98	THR	CB-CA-C	-7.80	95.88	111.17
1	A	337	GLY	CA-C-N	-6.75	113.73	120.21
1	A	337	GLY	C-N-CA	-6.75	113.73	120.21
1	A	122	THR	N-CA-CB	6.04	120.69	110.49
1	A	282	GLY	CA-C-N	5.51	124.97	119.24
1	A	282	GLY	C-N-CA	5.51	124.97	119.24
1	A	305	VAL	CA-C-N	-5.49	115.70	122.84
1	A	305	VAL	C-N-CA	-5.49	115.70	122.84
1	A	23	ARG	N-CA-C	-5.49	104.98	110.97
1	A	50	ILE	N-CA-C	5.42	114.96	108.45
1	A	383	ARG	NE-CZ-NH2	-5.38	114.36	119.20
1	A	339	PHE	CA-C-N	-5.35	112.54	122.60
1	A	339	PHE	C-N-CA	-5.35	112.54	122.60

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	64	GLN	N-CA-C	-5.27	102.10	109.96
1	A	11	GLY	N-CA-C	-5.22	103.68	112.77
1	A	124	ARG	N-CA-C	-5.13	106.86	113.01
1	A	121	GLY	CA-C-N	5.07	131.23	121.54
1	A	121	GLY	C-N-CA	5.07	131.23	121.54
1	A	25	HIS	CA-C-N	5.05	124.74	119.64
1	A	25	HIS	C-N-CA	5.05	124.74	119.64
1	A	383	ARG	CG-CD-NE	-5.03	100.93	112.00

There are no chirality outliers.

There are no planarity outliers.

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	2934	0	2880	97	0
2	A	45	0	0	6	0
All	All	2979	0	2880	97	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 17.

All (97) 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:33:ALA:CA	1:A:59:MET:HE1	1.73	1.19
1:A:56:LEU:HD21	1:A:60:MET:HE3	1.27	1.14
1:A:56:LEU:CD2	1:A:60:MET:HE3	1.77	1.14
1:A:33:ALA:HA	1:A:59:MET:HE1	1.45	0.98
1:A:33:ALA:C	1:A:59:MET:HE1	1.96	0.89
1:A:218:LEU:HD21	1:A:228:MET:HE1	1.54	0.89
1:A:33:ALA:N	1:A:59:MET:CE	2.37	0.87
1:A:33:ALA:CA	1:A:59:MET:CE	2.51	0.87
1:A:266:LEU:HD12	2:A:429:HOH:O	1.72	0.86
1:A:33:ALA:C	1:A:59:MET:CE	2.49	0.85

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:339:PHE:O	1:A:343:ASP:OD2	1.96	0.84
1:A:154:THR:HG22	1:A:156:PHE:H	1.45	0.82
1:A:157:LEU:O	1:A:208:ARG:NH1	2.15	0.80
1:A:56:LEU:HD22	1:A:60:MET:HE3	1.65	0.78
1:A:33:ALA:N	1:A:59:MET:HE2	2.01	0.75
1:A:104:ALA:HA	1:A:107:MET:HE3	1.70	0.74
1:A:306:THR:CG2	2:A:432:HOH:O	2.37	0.72
1:A:306:THR:HB	1:A:311:ASP:OD1	1.89	0.72
1:A:266:LEU:C	1:A:266:LEU:HD13	2.16	0.71
1:A:60:MET:HE2	1:A:89:LEU:HD12	1.74	0.70
1:A:98:THR:HG21	1:A:103:GLU:CB	2.23	0.69
1:A:33:ALA:N	1:A:59:MET:HE1	2.04	0.69
1:A:98:THR:HG21	1:A:103:GLU:HB2	1.75	0.68
1:A:37:ASN:HD22	1:A:37:ASN:C	2.01	0.67
1:A:218:LEU:CD2	1:A:228:MET:HE1	2.24	0.66
1:A:37:ASN:HD21	1:A:39:ASP:HB3	1.60	0.66
1:A:218:LEU:CD2	1:A:228:MET:CE	2.73	0.66
1:A:18:MET:HE3	1:A:22:MET:HE3	1.77	0.65
1:A:32:ALA:C	1:A:59:MET:HE2	2.21	0.65
1:A:117:HIS:HD2	2:A:416:HOH:O	1.80	0.65
1:A:154:THR:CG2	1:A:156:PHE:H	2.11	0.62
1:A:33:ALA:C	1:A:59:MET:HE3	2.24	0.61
1:A:154:THR:HG21	1:A:230:TYR:OH	2.01	0.61
1:A:154:THR:CG2	1:A:155:ASP:N	2.64	0.60
1:A:60:MET:HE1	1:A:84:ALA:HA	1.85	0.58
1:A:218:LEU:HD22	1:A:228:MET:CE	2.34	0.57
1:A:189:ILE:HD11	1:A:303:MET:CE	2.36	0.55
1:A:60:MET:HE2	1:A:89:LEU:CD1	2.37	0.55
1:A:98:THR:CG2	1:A:103:GLU:OE1	2.55	0.55
1:A:18:MET:HE3	1:A:22:MET:HG3	1.89	0.54
1:A:122:THR:HG21	1:A:341:GLN:NE2	2.22	0.54
1:A:56:LEU:HD21	1:A:60:MET:CE	2.18	0.54
1:A:126:HIS:HE1	1:A:347:GLU:OE2	1.91	0.54
1:A:294:ASP:OD2	1:A:294:ASP:O	2.27	0.53
1:A:18:MET:HE1	1:A:345:ILE:HD11	1.91	0.53
1:A:189:ILE:HD11	1:A:303:MET:HE1	1.89	0.53
1:A:123:SER:H	1:A:126:HIS:HD2	1.57	0.53
1:A:306:THR:HG23	2:A:432:HOH:O	2.06	0.52
1:A:32:ALA:HB1	1:A:59:MET:HE2	1.92	0.52
1:A:37:ASN:C	1:A:37:ASN:ND2	2.68	0.52
1:A:98:THR:OG1	1:A:107:MET:HE1	2.10	0.51

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:129:VAL:HG13	2:A:415:HOH:O	2.10	0.51
1:A:103:GLU:HB3	1:A:107:MET:HE2	1.91	0.51
1:A:305:VAL:HB	1:A:312:LEU:HB2	1.91	0.51
1:A:68:VAL:HG23	1:A:89:LEU:HD13	1.93	0.50
1:A:33:ALA:O	1:A:59:MET:HE3	2.11	0.49
1:A:104:ALA:CA	1:A:107:MET:HE3	2.40	0.49
1:A:32:ALA:CB	1:A:59:MET:HE2	2.43	0.49
1:A:18:MET:HE1	1:A:345:ILE:CG1	2.43	0.49
1:A:154:THR:HG23	1:A:155:ASP:N	2.28	0.48
1:A:93:VAL:O	1:A:121:GLY:HA3	2.13	0.48
1:A:334:THR:HG23	1:A:334:THR:O	2.13	0.48
1:A:124:ARG:NH2	1:A:247:GLU:OE1	2.47	0.48
1:A:127:ASP:OD1	1:A:340:SER:OG	2.30	0.48
1:A:259:ALA:O	1:A:263:LEU:HD13	2.14	0.47
1:A:266:LEU:HD13	1:A:266:LEU:O	2.14	0.47
1:A:218:LEU:HD21	1:A:228:MET:CE	2.29	0.46
1:A:95:LYS:HA	1:A:96:PRO:C	2.39	0.46
1:A:56:LEU:HD22	1:A:60:MET:HG3	1.97	0.45
1:A:158:TYR:O	1:A:259:ALA:HB1	2.16	0.45
1:A:32:ALA:C	1:A:59:MET:CE	2.83	0.45
1:A:98:THR:HG21	1:A:103:GLU:HB3	1.97	0.45
1:A:18:MET:HE1	1:A:345:ILE:HG13	1.99	0.45
1:A:56:LEU:HD22	1:A:60:MET:CE	2.43	0.44
1:A:174:ILE:HD12	1:A:179:LEU:HD13	1.97	0.44
1:A:37:ASN:HD21	1:A:39:ASP:CB	2.29	0.44
1:A:334:THR:O	1:A:334:THR:CG2	2.65	0.44
1:A:18:MET:CE	1:A:345:ILE:HD11	2.49	0.43
1:A:175:ILE:HA	1:A:179:LEU:HD22	2.00	0.43
1:A:208:ARG:NH2	1:A:270:GLU:OE2	2.52	0.43
1:A:266:LEU:C	1:A:266:LEU:CD1	2.86	0.43
1:A:103:GLU:C	1:A:107:MET:HE3	2.44	0.43
1:A:31:VAL:HG13	1:A:63:VAL:HG11	2.00	0.43
1:A:50:ILE:HB	1:A:51:PRO:HD2	2.01	0.42
1:A:346:ASP:OD1	1:A:349:ARG:NH2	2.53	0.42
1:A:103:GLU:C	1:A:107:MET:CE	2.92	0.42
1:A:306:THR:HG22	2:A:432:HOH:O	2.15	0.42
1:A:59:MET:HG2	1:A:65:MET:HE1	2.02	0.41
1:A:37:ASN:HD22	1:A:39:ASP:N	2.18	0.41
1:A:118:LEU:C	1:A:118:LEU:HD23	2.45	0.41
1:A:255:ASN:ND2	1:A:258:GLY:HA2	2.36	0.41
1:A:37:ASN:ND2	1:A:39:ASP:HB3	2.31	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:98:THR:HB	1:A:100:SER:H	1.85	0.41
1:A:18:MET:HE1	1:A:345:ILE:CD1	2.50	0.41
1:A:37:ASN:ND2	1:A:39:ASP:N	2.69	0.41
1:A:230:TYR:CD2	1:A:230:TYR:C	2.99	0.40
1:A:60:MET:SD	1:A:87:GLN:HG3	2.61	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	377/387 (97%)	356 (94%)	18 (5%)	3 (1%)	16 31

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	258	GLY
1	A	122	THR
1	A	285	SER

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	308/314 (98%)	269 (87%)	39 (13%)	4 9

All (39) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	SER
1	A	16	VAL
1	A	17	LEU
1	A	23	ARG
1	A	31	VAL
1	A	37	ASN
1	A	43	ARG
1	A	56	LEU
1	A	61	GLN
1	A	64	GLN
1	A	75	GLN
1	A	93	VAL
1	A	95	LYS
1	A	97	LEU
1	A	98	THR
1	A	99	LEU
1	A	100	SER
1	A	120	VAL
1	A	142	VAL
1	A	154	THR
1	A	174	ILE
1	A	179	LEU
1	A	218	LEU
1	A	266	LEU
1	A	267	GLU
1	A	273	LEU
1	A	274	ARG
1	A	275	ARG
1	A	277	ARG
1	A	284	ILE
1	A	286	LYS
1	A	295	ARG
1	A	296	LYS
1	A	302	VAL
1	A	306	THR
1	A	312	LEU
1	A	317	GLU
1	A	348	LEU
1	A	383	ARG

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	37	ASN
1	A	117	HIS
1	A	126	HIS
1	A	235	HIS
1	A	242	HIS
1	A	255	ASN
1	A	256	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 [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	A	381/387 (98%)	0.31	15 (3%) 43 38	26, 38, 59, 84	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	287	SER	5.6
1	A	1	MET	4.7
1	A	279	GLY	3.5
1	A	285	SER	3.2
1	A	142	VAL	2.8
1	A	327	VAL	2.4
1	A	253	GLN	2.3
1	A	326	GLY	2.2
1	A	280	PHE	2.2
1	A	271	ALA	2.1
1	A	339	PHE	2.1
1	A	163	PRO	2.1
1	A	383	ARG	2.0
1	A	323	GLY	2.0
1	A	284	ILE	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.