



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 10, 2026 – 01:09 PM JST

PDB ID : 22VI / pdb\_000022vi  
Title : PQQ-dependent alcohol dehydrogenase detoxifying DON  
Authors : Luo, H.; Zhu, P.; Chi, H.; Niu, J.; Lv, F.  
Deposited on : 2026-01-25  
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](mailto: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>.

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

MolProbity : 4-5-2 with Phenix2.0  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
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) : 2.48

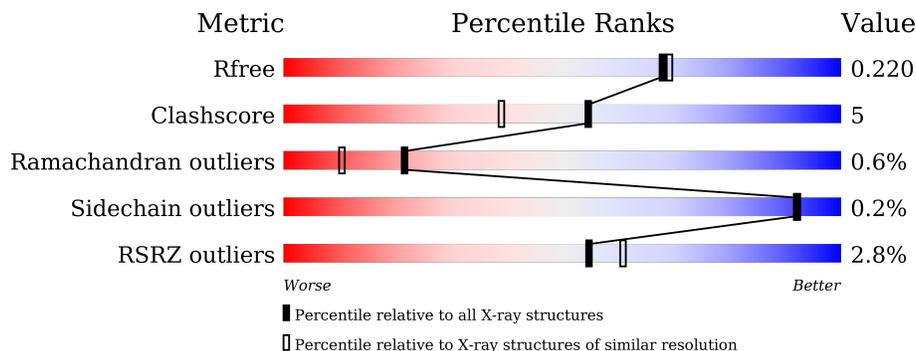
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

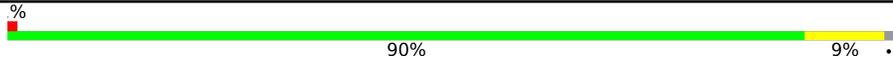
The reported resolution of this entry is 1.92 Å.

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))
$R_{free}$	164625	1028 (1.92-1.92)
Clashscore	180529	1100 (1.92-1.92)
Ramachandran outliers	177936	1087 (1.92-1.92)
Sidechain outliers	177891	1087 (1.92-1.92)
RSRZ outliers	164620	1028 (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  $\geq 3$ , 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	565	 90% 9% .
1	B	565	 5% 88% 11% .

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 9474 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 Quinohemoprotein alcohol dehydrogenase ADH-IIG.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	561	4283	2702	705	858	18	0	0	0
1	B	561	4283	2702	705	858	18	0	0	0

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP A0A447IEQ3
A	175	SER	CYS	conflict	UNP A0A447IEQ3
A	292	SER	CYS	conflict	UNP A0A447IEQ3
A	348	TYR	PHE	conflict	UNP A0A447IEQ3
A	369	VAL	ILE	conflict	UNP A0A447IEQ3
A	375	PRO	ALA	conflict	UNP A0A447IEQ3
A	385	SER	CYS	conflict	UNP A0A447IEQ3
A	411	THR	ASN	conflict	UNP A0A447IEQ3
A	417	ALA	TYR	conflict	UNP A0A447IEQ3
A	436	TYR	LEU	conflict	UNP A0A447IEQ3
A	437	ILE	VAL	conflict	UNP A0A447IEQ3
A	438	LEU	MET	conflict	UNP A0A447IEQ3
A	444	HIS	ASN	conflict	UNP A0A447IEQ3
A	445	ALA	THR	conflict	UNP A0A447IEQ3
A	476	ALA	GLY	conflict	UNP A0A447IEQ3
A	500	VAL	LEU	conflict	UNP A0A447IEQ3
A	535	SER	THR	conflict	UNP A0A447IEQ3
A	538	LEU	ILE	conflict	UNP A0A447IEQ3
B	1	MET	-	initiating methionine	UNP A0A447IEQ3
B	175	SER	CYS	conflict	UNP A0A447IEQ3
B	292	SER	CYS	conflict	UNP A0A447IEQ3
B	348	TYR	PHE	conflict	UNP A0A447IEQ3
B	369	VAL	ILE	conflict	UNP A0A447IEQ3
B	375	PRO	ALA	conflict	UNP A0A447IEQ3
B	385	SER	CYS	conflict	UNP A0A447IEQ3

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Chain	Residue	Modelled	Actual	Comment	Reference
B	411	THR	ASN	conflict	UNP A0A447IEQ3
B	417	ALA	TYR	conflict	UNP A0A447IEQ3
B	436	TYR	LEU	conflict	UNP A0A447IEQ3
B	437	ILE	VAL	conflict	UNP A0A447IEQ3
B	438	LEU	MET	conflict	UNP A0A447IEQ3
B	444	HIS	ASN	conflict	UNP A0A447IEQ3
B	445	ALA	THR	conflict	UNP A0A447IEQ3
B	476	ALA	GLY	conflict	UNP A0A447IEQ3
B	500	VAL	LEU	conflict	UNP A0A447IEQ3
B	535	SER	THR	conflict	UNP A0A447IEQ3
B	538	LEU	ILE	conflict	UNP A0A447IEQ3

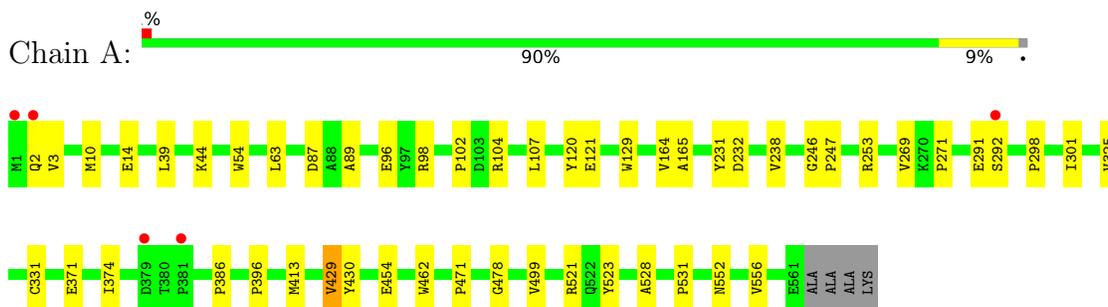
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	499	Total O 499 499	0	0
2	B	409	Total O 409 409	0	0

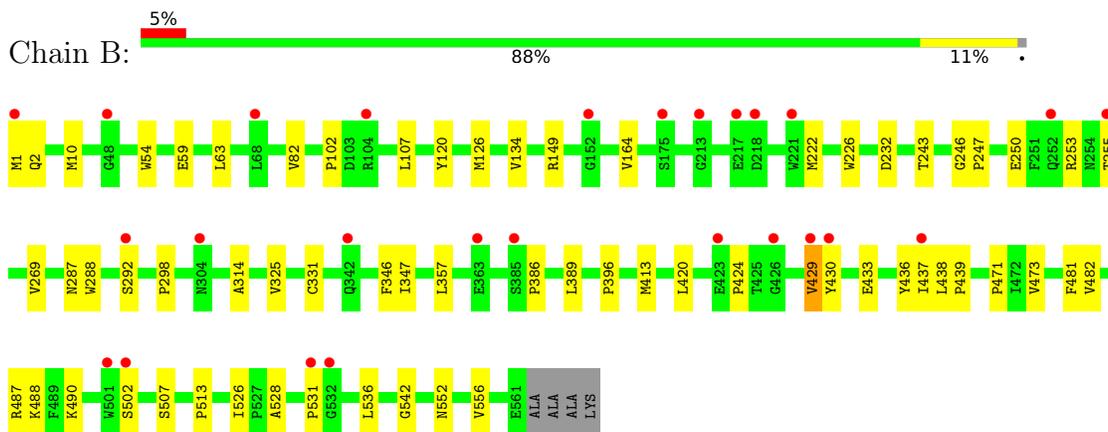
### 3 Residue-property plots [i](#)

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: Quinohemoprotein alcohol dehydrogenase ADH-IIG



- Molecule 1: Quinohemoprotein alcohol dehydrogenase ADH-IIG



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	87.04Å 57.56Å 111.51Å 90.00° 96.71° 90.00°	Depositor
Resolution (Å)	44.33 – 1.92 44.33 – 1.92	Depositor EDS
% Data completeness (in resolution range)	98.7 (44.33-1.92) 98.8 (44.33-1.92)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.19 (at 1.92Å)	Xtrriage
Refinement program	PHENIX 2.0_5936	Depositor
R, $R_{free}$	0.194 , 0.220 0.194 , 0.220	Depositor DCC
$R_{free}$ test set	4159 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	25.4	Xtrriage
Anisotropy	0.606	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 53.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	9474	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.36% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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	0.26	0/4390	0.52	0/6006
1	B	0.28	0/4390	0.55	0/6006
All	All	0.27	0/8780	0.54	0/12012

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 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	4283	0	4080	36	0
1	B	4283	0	4080	43	0
2	A	499	0	0	4	0
2	B	409	0	0	8	0
All	All	9474	0	8160	79	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 5.

All (79) 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:436:TYR:O	1:B:437:ILE:HD13	1.71	0.91

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:253:ARG:HE	1:B:255:THR:HG21	1.34	0.90
1:A:104:ARG:NH1	2:A:601:HOH:O	1.82	0.84
1:A:96:GLU:OE1	1:A:98:ARG:HD2	1.78	0.83
1:B:1:MET:HE3	1:B:2:GLN:O	1.86	0.74
1:A:44:LYS:HE2	1:A:478:GLY:HA3	1.71	0.72
1:B:292:SER:OG	1:B:331:CYS:SG	2.45	0.72
1:A:104:ARG:HH11	1:A:104:ARG:HG3	1.54	0.71
1:B:288:TRP:CE2	1:B:357:LEU:HD22	2.27	0.69
1:A:301:ILE:HB	1:A:454:GLU:HG2	1.74	0.69
1:B:473:VAL:HG12	2:B:601:HOH:O	1.95	0.66
1:A:292:SER:CB	1:A:331:CYS:HG	2.10	0.65
1:B:314:ALA:HB3	2:B:701:HOH:O	1.98	0.64
1:A:104:ARG:NH1	1:A:104:ARG:HG3	2.13	0.62
1:A:247:PRO:HD2	1:A:253:ARG:HB3	1.82	0.60
1:A:271:PRO:HD3	2:A:622:HOH:O	2.01	0.60
1:A:44:LYS:CE	1:A:478:GLY:HA3	2.32	0.58
1:B:126:MET:HG2	1:B:134:VAL:HB	1.85	0.58
1:B:149:ARG:HA	2:B:607:HOH:O	2.04	0.58
1:A:63:LEU:HD13	1:A:552:ASN:HB3	1.85	0.57
1:A:521:ARG:HD3	1:A:523:TYR:OH	2.05	0.57
1:A:10:MET:HG3	1:A:121:GLU:HA	1.87	0.56
1:A:120:TYR:CD2	1:A:121:GLU:HG3	2.41	0.56
1:B:54:TRP:CZ2	1:B:556:VAL:HG21	2.42	0.55
1:B:1:MET:HE3	1:B:2:GLN:C	2.32	0.54
1:A:54:TRP:CZ2	1:A:556:VAL:HG21	2.42	0.54
1:B:420:LEU:HD21	1:B:433:GLU:HG3	1.91	0.53
1:A:238:VAL:HG23	2:A:622:HOH:O	2.10	0.52
1:B:542:GLY:HA2	2:B:902:HOH:O	2.10	0.51
1:B:488:LYS:HD3	1:B:502:SER:OG	2.09	0.51
1:A:63:LEU:HD22	1:A:528:ALA:O	2.11	0.51
1:B:63:LEU:HD13	1:B:552:ASN:HB3	1.92	0.51
1:B:59:GLU:HG3	1:B:82:VAL:HG21	1.94	0.50
1:B:232:ASP:HB2	1:B:298:PRO:HG3	1.94	0.49
1:B:481:PHE:HB2	2:B:601:HOH:O	2.11	0.49
1:A:10:MET:HE3	1:A:121:GLU:HB3	1.95	0.48
1:B:253:ARG:NE	1:B:255:THR:HG21	2.15	0.48
1:A:165:ALA:HB1	1:A:231:TYR:CD1	2.48	0.48
1:B:292:SER:CB	1:B:331:CYS:SG	3.03	0.47
1:A:39:LEU:HD23	1:A:39:LEU:HA	1.61	0.47
1:B:424:PRO:HD3	2:B:603:HOH:O	2.14	0.47
1:A:102:PRO:HG2	1:A:107:LEU:HD21	1.98	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:429:VAL:HG12	1:B:430:TYR:CD2	2.51	0.46
1:B:226:TRP:CD1	1:B:243:THR:HG21	2.51	0.46
1:B:120:TYR:CG	1:B:164:VAL:HG11	2.51	0.46
1:B:389:LEU:HD11	1:B:536:LEU:HD12	1.97	0.46
1:B:473:VAL:CG1	2:B:601:HOH:O	2.59	0.46
1:B:481:PHE:HA	1:B:490:LYS:O	2.16	0.45
1:A:396:PRO:HD2	1:A:471:PRO:HB3	1.98	0.45
1:A:429:VAL:HG12	1:A:430:TYR:CD2	2.51	0.45
1:B:63:LEU:HD22	1:B:528:ALA:O	2.16	0.45
1:B:437:ILE:HG22	1:B:438:LEU:O	2.17	0.45
1:A:298:PRO:HA	1:A:325:VAL:O	2.18	0.44
1:A:14:GLU:N	1:A:14:GLU:CD	2.76	0.44
1:A:44:LYS:HE2	1:A:478:GLY:CA	2.44	0.44
1:B:346:PHE:CZ	2:B:701:HOH:O	2.68	0.43
1:B:513:PRO:HB3	1:B:526:ILE:HD13	2.00	0.43
1:A:232:ASP:HB2	1:A:298:PRO:HG3	2.00	0.43
1:B:10:MET:HE3	1:B:10:MET:HB3	1.87	0.43
1:A:120:TYR:CG	1:A:164:VAL:HG11	2.53	0.43
1:B:298:PRO:HA	1:B:325:VAL:O	2.19	0.43
1:B:247:PRO:HD2	1:B:253:ARG:HB3	2.01	0.43
1:B:413:MET:HA	1:B:439:PRO:HD3	2.01	0.43
1:B:102:PRO:HG2	1:B:107:LEU:HD21	2.01	0.43
1:A:87:ASP:OD1	1:A:89:ALA:HB3	2.19	0.42
1:A:462:TRP:HE1	1:A:499:VAL:HG23	1.83	0.42
1:A:523:TYR:CD2	1:A:523:TYR:N	2.87	0.42
1:B:250:GLU:N	1:B:287:ASN:OD1	2.52	0.42
1:B:396:PRO:HD2	1:B:471:PRO:HB3	2.00	0.42
1:B:482:VAL:HG13	1:B:490:LYS:HE2	2.02	0.41
1:A:129:TRP:HA	2:A:711:HOH:O	2.20	0.41
1:A:246:GLY:HA2	1:A:247:PRO:C	2.46	0.41
1:B:436:TYR:C	1:B:437:ILE:HD13	2.43	0.41
1:B:487:ARG:HD2	1:B:507:SER:HA	2.02	0.41
1:A:371:GLU:HA	1:A:374:ILE:HD12	2.03	0.41
1:A:2:GLN:HG3	1:A:3:VAL:N	2.36	0.40
1:A:413:MET:HE2	1:A:413:MET:HB2	1.91	0.40
1:B:222:MET:SD	1:B:246:GLY:HA3	2.62	0.40
1:B:347:ILE:HD13	1:B:347:ILE:HG21	1.90	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	559/565 (99%)	532 (95%)	23 (4%)	4 (1%)	19	9
1	B	559/565 (99%)	532 (95%)	24 (4%)	3 (0%)	25	13
All	All	1118/1130 (99%)	1064 (95%)	47 (4%)	7 (1%)	22	10

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	386	PRO
1	B	386	PRO
1	A	291	GLU
1	A	429	VAL
1	A	531	PRO
1	B	429	VAL
1	B	531	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	454/455 (100%)	453 (100%)	1 (0%)	92	92
1	B	454/455 (100%)	453 (100%)	1 (0%)	92	92
All	All	908/910 (100%)	906 (100%)	2 (0%)	92	92

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	269	VAL
1	B	269	VAL

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	304	ASN
1	A	416	ASN
1	B	304	ASN
1	B	338	GLN
1	B	342	GLN
1	B	416	ASN

### 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	561/565 (99%)	0.08	5 (0%) 81 85	15, 24, 39, 101	0
1	B	561/565 (99%)	0.41	26 (4%) 38 43	13, 29, 49, 89	0
All	All	1122/1130 (99%)	0.24	31 (2%) 55 61	13, 26, 45, 101	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	532	GLY	3.9
1	A	1	MET	3.3
1	B	152	GLY	3.1
1	B	429	VAL	3.1
1	B	1	MET	2.8
1	B	531	PRO	2.8
1	A	381	PRO	2.8
1	B	292	SER	2.8
1	B	221	TRP	2.7
1	B	255	THR	2.6
1	A	292	SER	2.6
1	B	218	ASP	2.6
1	B	437	ILE	2.5
1	B	175	SER	2.4
1	A	379	ASP	2.4
1	B	502	SER	2.4
1	A	2	GLN	2.3
1	B	501	TRP	2.3
1	B	304	ASN	2.2
1	B	252	GLN	2.2
1	B	48	GLY	2.1
1	B	68	LEU	2.1
1	B	423	GLU	2.1
1	B	426	GLY	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	385	SER	2.1
1	B	363	GLU	2.1
1	B	213	GLY	2.1
1	B	342	GLN	2.0
1	B	430	TYR	2.0
1	B	217	GLU	2.0
1	B	104	ARG	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.