



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 18, 2024 – 11:51 AM EDT

PDB ID : 4D8M  
Title : Crystal structure of Bacillus thuringiensis Cry5B nematocidal toxin  
Authors : Fan, H.; Hu, Y.; Aroian, R.V.; Ghosh, P.; Berkeley Structural Genomics Center (BSGC)  
Deposited on : 2012-01-10  
Resolution : 2.30 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 : 4.02b-467  
Xtriage (Phenix) : 1.20.1  
EDS : 2.37.1  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.37.1

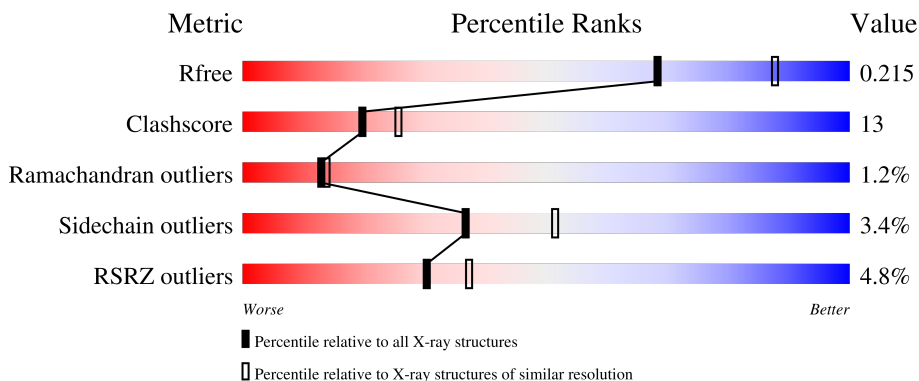
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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))
$R_{free}$	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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	587	<div style="display: flex; align-items: center;"> <div style="width: 5%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 79%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 18%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 0.5%; height: 10px; background-color: grey; margin-right: 5px;"></div> </div> <p style="margin-top: 5px;">5%      79%      18%      •</p>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5105 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 Pesticidal crystal protein cry5Ba.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	585	4624	2892	795	921	16	0	0	0

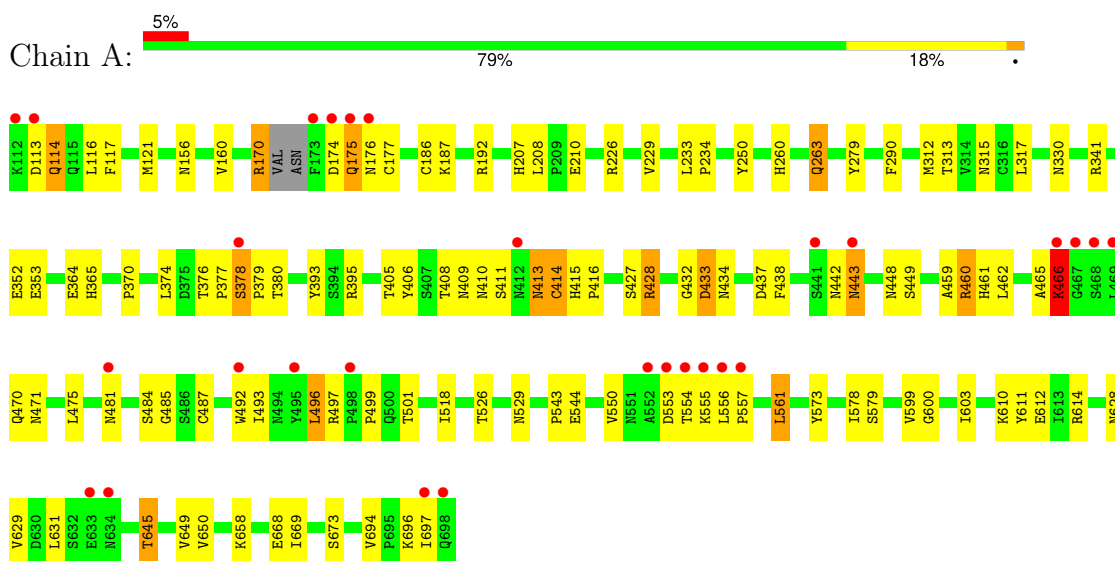
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	481	Total	O	0	0
			481	481		

### 3 Residue-property plots

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: Pesticidal crystal protein cry5Ba



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 63	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	115.53Å 115.53Å 110.33Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	39.89 – 2.30 39.89 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.9 (39.89-2.30) 99.9 (39.89-2.30)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.88 (at 2.29Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.6.1_357)	Depositor
R, $R_{free}$	0.173 , 0.218 0.171 , 0.215	Depositor DCC
$R_{free}$ test set	1857 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	26.0	Xtrriage
Anisotropy	0.226	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 44.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.045 for h,-h-k,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	5105	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.85% 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	0.40	0/4724	0.57	0/6431

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.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	432	GLY	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	4624	0	4436	115	0
2	A	481	0	0	7	0
All	All	5105	0	4436	115	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 13.

All (115) 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:175:GLN:HB2	1:A:176:ASN:HB3	1.30	1.07
1:A:428:ARG:HH11	1:A:428:ARG:HG3	1.29	0.97
1:A:175:GLN:HB2	1:A:176:ASN:CB	1.94	0.96
1:A:175:GLN:CB	1:A:176:ASN:HB3	1.97	0.94
1:A:410:ASN:HB2	1:A:411:SER:O	1.68	0.92
1:A:484:SER:HB2	1:A:485:GLY:HA3	1.54	0.89
1:A:428:ARG:HH11	1:A:428:ARG:CG	1.89	0.85
1:A:175:GLN:HB2	1:A:176:ASN:CA	2.08	0.84
1:A:610:LYS:HD3	1:A:697:ILE:HD13	1.60	0.83
1:A:170:ARG:HG3	1:A:170:ARG:HH11	1.40	0.82
1:A:462:LEU:HD23	1:A:493:ILE:HG12	1.62	0.81
1:A:554:THR:HG22	1:A:556:LEU:HD13	1.64	0.80
1:A:612:GLU:HB3	1:A:694:VAL:HG22	1.64	0.79
1:A:645:THR:HG21	1:A:658:LYS:O	1.86	0.76
1:A:428:ARG:HG3	1:A:428:ARG:NH1	1.96	0.75
1:A:207:HIS:NE2	2:A:1152:HOH:O	2.20	0.75
1:A:694:VAL:HG23	1:A:696:LYS:HG3	1.70	0.74
1:A:578:ILE:HD13	1:A:599:VAL:HG23	1.67	0.73
1:A:413:ASN:O	1:A:471:ASN:O	2.07	0.72
1:A:207:HIS:HD2	1:A:210:GLU:OE2	1.72	0.72
1:A:170:ARG:HG3	1:A:170:ARG:NH1	2.07	0.68
1:A:492:TRP:O	1:A:496:LEU:HD13	1.94	0.68
1:A:208:LEU:HD23	1:A:279:TYR:CZ	2.28	0.68
1:A:410:ASN:HB2	1:A:411:SER:C	2.14	0.66
1:A:170:ARG:HG2	2:A:1141:HOH:O	1.94	0.66
1:A:174:ASP:O	1:A:177:CYS:N	2.29	0.66
1:A:353:GLU:H	1:A:461:HIS:HD2	1.42	0.66
1:A:462:LEU:HD12	1:A:497:ARG:CZ	2.27	0.65
1:A:645:THR:CG2	1:A:658:LYS:O	2.45	0.64
1:A:610:LYS:HB2	1:A:697:ILE:HB	1.78	0.63
1:A:462:LEU:HD22	1:A:499:PRO:HB3	1.80	0.62
1:A:208:LEU:CD2	1:A:279:TYR:CZ	2.83	0.62
1:A:561:LEU:HD12	1:A:694:VAL:CG1	2.31	0.61
1:A:470:GLN:NE2	1:A:496:LEU:HD23	2.16	0.60
1:A:175:GLN:HB2	1:A:176:ASN:C	2.22	0.60
1:A:113:ASP:O	1:A:114:GLN:CB	2.50	0.59
1:A:250:TYR:OH	1:A:260:HIS:HE1	1.85	0.59
1:A:174:ASP:O	1:A:177:CYS:HB2	2.03	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:561:LEU:HB2	1:A:694:VAL:HG12	1.86	0.58
1:A:378:SER:O	1:A:379:PRO:C	2.43	0.57
1:A:408:THR:OG1	1:A:411:SER:O	2.23	0.57
1:A:448:ASN:HD21	1:A:487:CYS:H	1.50	0.57
1:A:175:GLN:HG3	2:A:994:HOH:O	2.03	0.56
1:A:578:ILE:CD1	1:A:599:VAL:HG23	2.36	0.56
1:A:116:LEU:O	1:A:117:PHE:HB3	2.05	0.55
1:A:378:SER:HB2	1:A:428:ARG:HB2	1.88	0.55
1:A:561:LEU:C	1:A:561:LEU:HD23	2.27	0.55
1:A:694:VAL:HG23	1:A:696:LYS:CG	2.37	0.55
1:A:645:THR:HG22	2:A:717:HOH:O	2.08	0.54
1:A:413:ASN:ND2	1:A:471:ASN:HD22	2.06	0.53
1:A:611:TYR:CD2	1:A:669:ILE:HD12	2.43	0.53
1:A:370:PRO:HA	1:A:518:ILE:HG22	1.90	0.53
1:A:330:ASN:O	1:A:614:ARG:NH2	2.34	0.52
1:A:462:LEU:HD21	1:A:493:ILE:HG23	1.90	0.52
1:A:353:GLU:H	1:A:461:HIS:CD2	2.23	0.52
1:A:263:GLN:NE2	2:A:1110:HOH:O	2.43	0.52
1:A:561:LEU:HD12	1:A:694:VAL:HG12	1.91	0.52
1:A:378:SER:HB3	1:A:379:PRO:HD3	1.91	0.52
1:A:313:THR:HA	1:A:317:LEU:HB2	1.92	0.52
1:A:526:THR:O	1:A:529:ASN:HB2	2.10	0.52
1:A:610:LYS:HA	1:A:668:GLU:HA	1.92	0.52
1:A:612:GLU:HB3	1:A:694:VAL:CG2	2.37	0.51
1:A:117:PHE:O	1:A:121:MET:HG2	2.11	0.51
1:A:114:GLN:C	1:A:116:LEU:O	2.49	0.50
1:A:553:ASP:O	1:A:555:LYS:N	2.40	0.50
1:A:573:TYR:CE1	1:A:600:GLY:HA3	2.47	0.50
1:A:694:VAL:CG2	1:A:696:LYS:HG3	2.40	0.50
1:A:428:ARG:HH11	1:A:428:ARG:CB	2.23	0.50
1:A:484:SER:HB2	1:A:485:GLY:CA	2.33	0.50
1:A:465:ALA:O	1:A:466:LYS:O	2.30	0.50
1:A:460:ARG:HB3	1:A:501:THR:HG22	1.93	0.49
1:A:233:LEU:HD23	1:A:312:MET:CE	2.43	0.48
1:A:462:LEU:CD2	1:A:499:PRO:HB3	2.42	0.48
1:A:543:PRO:HD2	1:A:544:GLU:OE2	2.14	0.48
1:A:378:SER:O	1:A:380:THR:O	2.31	0.48
1:A:649:VAL:HG23	1:A:650:VAL:HG13	1.96	0.48
1:A:427:SER:C	1:A:428:ARG:HG2	2.34	0.47
1:A:550:VAL:HA	1:A:557:PRO:HA	1.97	0.47
1:A:352:GLU:H	1:A:461:HIS:CD2	2.33	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:229:VAL:HG21	1:A:290:PHE:CE2	2.50	0.47
1:A:250:TYR:OH	1:A:260:HIS:CE1	2.67	0.46
1:A:364:GLU:HG2	1:A:365:HIS:CD2	2.50	0.46
1:A:116:LEU:HG	1:A:117:PHE:H	1.81	0.46
1:A:462:LEU:CD2	1:A:493:ILE:HG23	2.46	0.46
1:A:208:LEU:HD23	1:A:279:TYR:CE1	2.51	0.46
1:A:113:ASP:O	1:A:114:GLN:HB3	2.15	0.45
1:A:406:TYR:O	1:A:414:CYS:HA	2.16	0.45
1:A:409:ASN:ND2	1:A:409:ASN:H	2.15	0.45
1:A:413:ASN:HD21	1:A:471:ASN:HD22	1.64	0.45
1:A:174:ASP:C	1:A:175:GLN:HG2	2.36	0.45
1:A:226:ARG:HD2	2:A:809:HOH:O	2.16	0.45
1:A:694:VAL:HG23	1:A:694:VAL:O	2.16	0.45
1:A:376:THR:HA	1:A:377:PRO:HD3	1.77	0.44
1:A:437:ASP:O	1:A:438:PHE:HB2	2.17	0.44
1:A:393:TYR:CE2	1:A:395:ARG:HA	2.53	0.44
1:A:405:THR:HA	1:A:416:PRO:HA	1.99	0.44
1:A:629:VAL:HG12	1:A:631:LEU:HG	1.99	0.44
1:A:553:ASP:C	1:A:555:LYS:H	2.21	0.44
1:A:603:ILE:O	1:A:673:SER:HA	2.18	0.43
1:A:263:GLN:HE21	1:A:263:GLN:HB3	1.66	0.43
1:A:481:ASN:HB2	2:A:1064:HOH:O	2.18	0.43
1:A:470:GLN:HE21	1:A:496:LEU:HD23	1.82	0.42
1:A:413:ASN:ND2	1:A:415:HIS:HD2	2.16	0.42
1:A:694:VAL:CG2	1:A:694:VAL:O	2.68	0.42
1:A:176:ASN:O	1:A:186:CYS:HB2	2.20	0.41
1:A:156:ASN:O	1:A:160:VAL:HG23	2.21	0.41
1:A:459:ALA:O	1:A:501:THR:HA	2.21	0.41
1:A:234:PRO:HB3	1:A:315:ASN:HB3	2.02	0.41
1:A:352:GLU:HB2	1:A:461:HIS:HB3	2.03	0.41
1:A:518:ILE:O	1:A:518:ILE:HG13	2.20	0.41
1:A:428:ARG:CG	1:A:428:ARG:NH1	2.59	0.41
1:A:697:ILE:HG13	1:A:697:ILE:O	2.20	0.41
1:A:116:LEU:O	1:A:117:PHE:CB	2.69	0.41
1:A:433:ASP:HB3	1:A:434:ASN:H	1.49	0.41
1:A:443:ASN:ND2	1:A:443:ASN:H	2.19	0.41

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	581/587 (99%)	540 (93%)	34 (6%)	7 (1%)	13 14

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	466	LYS
1	A	496	LEU
1	A	114	GLN
1	A	414	CYS
1	A	433	ASP
1	A	442	ASN
1	A	378	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	527/532 (99%)	509 (97%)	18 (3%)	37 51

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	170	ARG
1	A	175	GLN
1	A	187	LYS
1	A	192	ARG

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Mol	Chain	Res	Type
1	A	263	GLN
1	A	341	ARG
1	A	374	LEU
1	A	413	ASN
1	A	428	ARG
1	A	443	ASN
1	A	449	SER
1	A	460	ARG
1	A	466	LYS
1	A	475	LEU
1	A	561	LEU
1	A	579	SER
1	A	628	ASN
1	A	645	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	156	ASN
1	A	207	HIS
1	A	222	GLN
1	A	258	ASN
1	A	260	HIS
1	A	263	GLN
1	A	365	HIS
1	A	409	ASN
1	A	413	ASN
1	A	435	GLN
1	A	443	ASN
1	A	448	ASN
1	A	461	HIS
1	A	595	ASN
1	A	628	ASN

### 5.3.3 RNA

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 monosaccharides 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	585/587 (99%)	-0.24	28 (4%) 30 37	14, 28, 62, 91	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	697	ILE	6.1
1	A	698	GLN	5.6
1	A	174	ASP	4.6
1	A	495	TYR	3.7
1	A	469	LEU	3.6
1	A	466	LYS	3.6
1	A	176	ASN	3.5
1	A	468	SER	3.4
1	A	467	GLY	3.2
1	A	441	SER	3.2
1	A	553	ASP	3.1
1	A	173	PHE	3.1
1	A	481	ASN	3.1
1	A	492	TRP	3.0
1	A	556	LEU	2.9
1	A	175	GLN	2.9
1	A	554	THR	2.8
1	A	552	ALA	2.8
1	A	112	LYS	2.8
1	A	378	SER	2.8
1	A	557	PRO	2.8
1	A	634	ASN	2.5
1	A	113	ASP	2.4
1	A	443	ASN	2.3
1	A	633	GLU	2.2
1	A	498	PRO	2.2
1	A	412	ASN	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	555	LYS	2.1

## 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 monosaccharides 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.