



# Full wwPDB X-ray Structure Validation Report ⓘ

May 13, 2020 – 02:24 am BST

PDB ID : 3RMR  
Title : Crystal structure of Hyaloperonospora arabidopsidis ATR1 effector domain  
Authors : Chou, S.; Krasileva, K.V.; Holton, J.M.; Staskawicz, B.J.; Alber, T.  
Deposited on : 2011-04-21  
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.

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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  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.11  
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) : 2.11

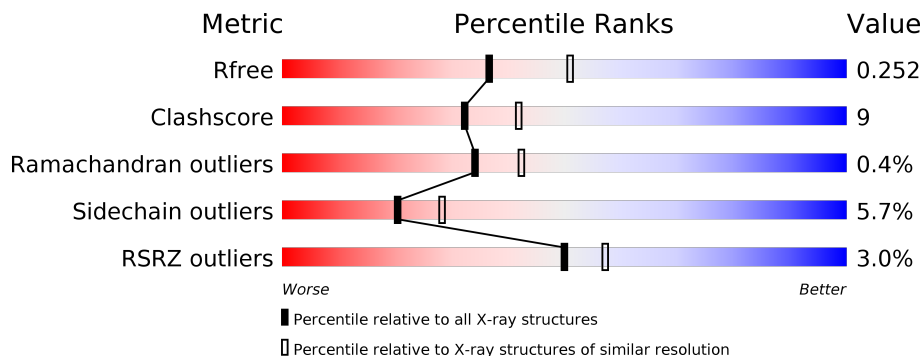
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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 on 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	260	
1	B	260	
1	C	260	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5846 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 Avirulence protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	236	Total 1863	C 1188	N 319	O 351	S 2	Se 3	0	2	0
1	B	231	Total 1774	C 1128	N 299	O 342	S 2	Se 3	0	0	0
1	C	235	Total 1844	C 1172	N 313	O 354	S 2	Se 3	0	0	0

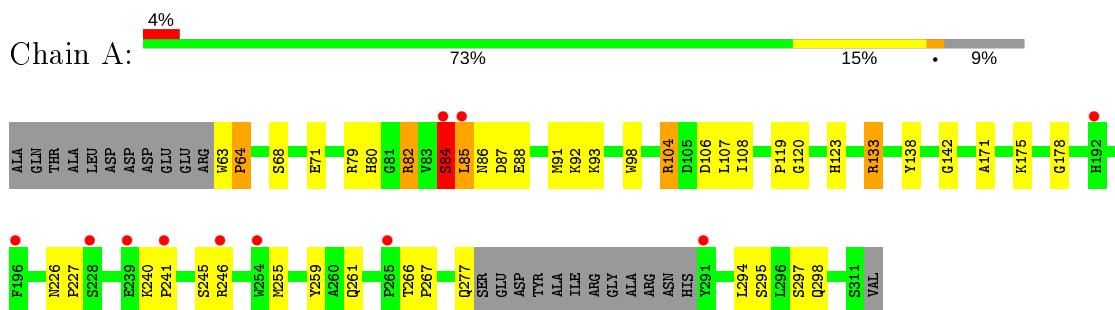
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	113	Total 113	O 113	0	0
2	B	114	Total 114	O 114	0	0
2	C	138	Total 138	O 138	0	0

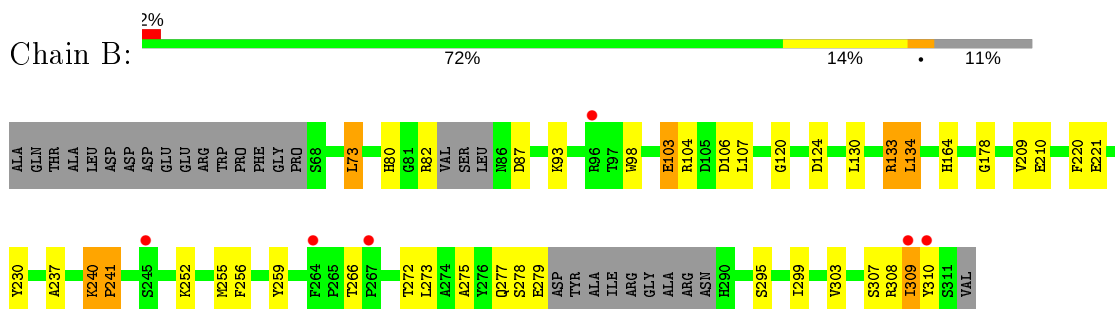
### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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.

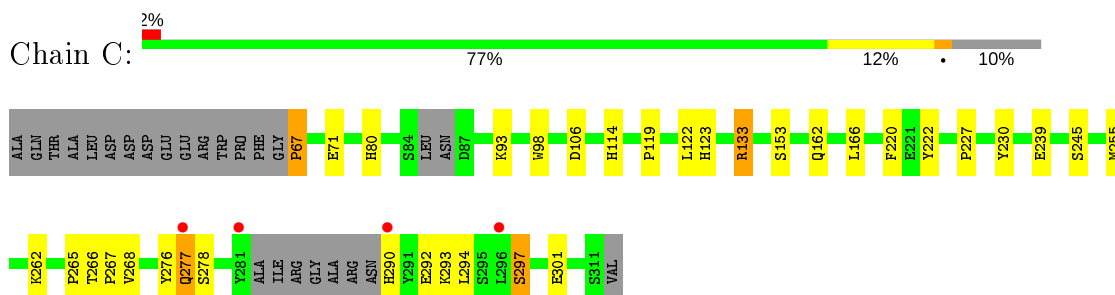
- Molecule 1: Avirulence protein



- Molecule 1: Avirulence protein



- Molecule 1: Avirulence protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	119.43Å 119.43Å 312.57Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	62.35 – 2.30 62.35 – 2.30	Depositor EDS
% Data completeness (in resolution range)	93.5 (62.35-2.30) 97.5 (62.35-2.30)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.03 (at 2.29Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.7_650), ELVES	Depositor
R, $R_{free}$	0.223 , 0.260 0.222 , 0.252	Depositor DCC
$R_{free}$ test set	2911 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	45.6	Xtrriage
Anisotropy	0.121	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 45.4	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	0.94	EDS
Total number of atoms	5846	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.42% 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	0.41	0/1913	0.54	1/2589 (0.0%)
1	B	0.39	0/1811	0.51	1/2454 (0.0%)
1	C	0.41	0/1884	0.52	1/2548 (0.0%)
All	All	0.40	0/5608	0.52	3/7591 (0.0%)

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 (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	67	PRO	N-CA-CB	6.28	110.83	103.30
1	A	64	PRO	N-CA-CB	6.23	110.78	103.30
1	B	241	PRO	N-CA-CB	5.81	110.28	103.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	85	LEU	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	1863	0	1795	28	0
1	B	1774	0	1653	36	0
1	C	1844	0	1747	33	0
2	A	113	0	0	4	0
2	B	114	0	0	4	0
2	C	138	0	0	2	1
All	All	5846	0	5195	94	1

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 9.

All (94) 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:C:277:GLN:NE2	1:C:294:LEU:H	1.35	1.24
1:C:277:GLN:HE22	1:C:294:LEU:H	1.04	0.97
1:C:230:TYR:CG	1:C:255:MSE:HE2	2.05	0.91
1:C:277:GLN:NE2	1:C:294:LEU:N	2.19	0.90
1:C:227:PRO:HA	1:C:255:MSE:HE3	1.60	0.83
1:B:133:ARG:O	1:B:133:ARG:HD3	1.81	0.81
1:C:277:GLN:HE22	1:C:294:LEU:N	1.77	0.80
1:C:220:PHE:CD1	1:C:255:MSE:HE1	2.15	0.80
1:B:279:GLU:O	2:B:383:HOH:O	2.00	0.80
1:C:230:TYR:CD2	1:C:255:MSE:HE2	2.18	0.78
1:B:220:PHE:CD1	1:B:255:MSE:HE1	2.21	0.75
1:A:104:ARG:HD3	1:A:106:ASP:OD1	1.86	0.75
1:A:82:ARG:HD2	2:A:357:HOH:O	1.86	0.73
1:B:124:ASP:OD2	2:B:401:HOH:O	2.06	0.73
1:A:133:ARG:HD3	1:A:133:ARG:O	1.90	0.72
1:B:230:TYR:CD2	1:B:255:MSE:HE2	2.25	0.71
1:A:277:GLN:HE22	1:A:294:LEU:H	1.38	0.70
1:C:277:GLN:HE22	1:C:294:LEU:CB	2.05	0.69
1:B:133:ARG:C	1:B:133:ARG:HD3	2.12	0.68
1:A:133:ARG:HD3	1:A:133:ARG:C	2.15	0.68
1:C:277:GLN:HG2	1:C:293:LYS:HB3	1.76	0.68
1:B:230:TYR:CG	1:B:255:MSE:CE	2.79	0.66
1:C:222:TYR:OH	2:C:362:HOH:O	2.12	0.66
1:C:133:ARG:O	1:C:133:ARG:HD3	1.96	0.65
1:B:230:TYR:HB3	1:B:255:MSE:HE3	1.82	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:299:ILE:O	1:B:303:VAL:HG13	1.99	0.61
1:C:220:PHE:CE1	1:C:255:MSE:HE1	2.35	0.61
1:B:230:TYR:CG	1:B:255:MSE:HE2	2.36	0.60
1:A:85:LEU:CD1	1:A:86:ASN:H	2.14	0.60
1:B:230:TYR:CB	1:B:255:MSE:HE3	2.32	0.59
2:A:313:HOH:O	1:B:82:ARG:HA	2.02	0.59
1:B:164:HIS:CE1	2:B:408:HOH:O	2.56	0.58
1:C:277:GLN:HE22	1:C:294:LEU:HB2	1.68	0.58
1:B:266:THR:HG21	1:B:307:SER:HB3	1.85	0.57
1:B:252:LYS:HE3	1:B:256:PHE:HE2	1.70	0.57
1:C:297:SER:O	1:C:301:GLU:HG3	2.05	0.56
1:A:255:MSE:HE3	1:A:255:MSE:HA	1.88	0.56
1:B:230:TYR:CD2	1:B:255:MSE:CE	2.91	0.54
1:B:309:ILE:HG12	1:B:310:TYR:CD2	2.43	0.53
1:A:171:ALA:O	1:A:175:LYS:HG3	2.08	0.53
1:C:133:ARG:C	1:C:133:ARG:HD3	2.30	0.53
1:C:277:GLN:CG	1:C:293:LYS:HB3	2.39	0.52
1:C:114:HIS:HE1	2:C:427:HOH:O	1.91	0.51
1:A:108:ILE:HD12	1:C:162:GLN:HG3	1.92	0.51
1:A:79[A]:ARG:NH2	2:A:1:HOH:O	2.41	0.50
1:C:230:TYR:HB3	1:C:255:MSE:CE	2.42	0.50
1:A:85:LEU:HD13	1:A:86:ASN:H	1.76	0.50
1:C:80:HIS:CE1	1:C:93:LYS:HD3	2.46	0.50
1:C:227:PRO:HA	1:C:255:MSE:CE	2.37	0.49
1:C:265:PRO:HD2	1:C:268:VAL:HG21	1.94	0.49
1:A:80:HIS:CD2	1:A:93:LYS:HD3	2.48	0.48
1:A:86:ASN:OD1	1:A:88:GLU:HG3	2.12	0.48
1:A:84:SER:O	1:A:85:LEU:HD12	2.13	0.48
1:B:259:TYR:OH	1:B:272:THR:HG21	2.14	0.48
1:B:295:SER:O	1:B:299:ILE:HG13	2.14	0.47
1:B:103:GLU:HG2	1:B:104:ARG:HG2	1.97	0.47
1:A:138:TYR:O	1:A:142:GLY:HA3	2.13	0.47
1:C:227:PRO:HD2	1:C:276:TYR:CD2	2.50	0.47
1:A:68:SER:OG	1:A:71:GLU:HG3	2.16	0.46
1:B:230:TYR:CG	1:B:255:MSE:HE3	2.50	0.46
1:C:67:PRO:HA	1:C:71:GLU:OE1	2.16	0.46
1:C:230:TYR:CB	1:C:255:MSE:CE	2.93	0.46
1:C:230:TYR:CB	1:C:255:MSE:HE2	2.46	0.45
1:B:275:ALA:C	1:B:277:GLN:H	2.20	0.45
1:C:230:TYR:CE2	1:C:255:MSE:HB2	2.51	0.45
1:A:63:TRP:N	2:A:405:HOH:O	2.50	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:221:GLU:OE1	2:B:376:HOH:O	2.21	0.44
1:C:277:GLN:HE22	1:C:294:LEU:CA	2.30	0.44
1:A:87:ASP:O	1:A:91:MSE:HG2	2.17	0.44
1:B:237:ALA:O	1:B:240:LYS:HB2	2.17	0.44
1:B:309:ILE:HD11	1:B:310:TYR:CZ	2.53	0.44
1:A:227:PRO:HG3	1:A:259:TYR:OH	2.17	0.43
1:B:230:TYR:CE2	1:B:255:MSE:HB2	2.54	0.43
1:C:230:TYR:CG	1:C:255:MSE:CE	2.91	0.43
1:B:209:VAL:O	1:B:210:GLU:HB2	2.18	0.43
1:A:104:ARG:HD2	1:A:107[C]:LEU:HG	2.01	0.43
1:A:266:THR:HB	1:A:267:PRO:HD3	2.01	0.43
1:B:73:LEU:HD12	1:B:107:LEU:HD13	2.01	0.42
1:A:226:ASN:C	1:A:226:ASN:OD1	2.57	0.42
1:A:88:GLU:OE1	1:A:92:LYS:NZ	2.51	0.42
1:B:80:HIS:CE1	1:B:93:LYS:HD3	2.54	0.42
1:B:130:LEU:HG	1:B:134:LEU:HD22	2.02	0.42
1:A:295:SER:O	1:A:298:GLN:N	2.53	0.42
1:A:240:LYS:HB3	1:A:241:PRO:HD2	2.02	0.41
1:A:178:GLY:HA2	1:B:120:GLY:HA3	2.02	0.41
1:B:259:TYR:OH	1:B:272:THR:CG2	2.68	0.41
1:C:266:THR:N	1:C:267:PRO:HD2	2.36	0.41
1:A:119:PRO:HD2	1:A:123:HIS:CG	2.56	0.41
1:C:119:PRO:HD2	1:C:123:HIS:CG	2.56	0.41
1:C:166:LEU:HA	1:C:166:LEU:HD23	1.92	0.41
1:A:120:GLY:HA3	1:B:178:GLY:HA2	2.03	0.41
1:B:278:SER:HA	1:B:279:GLU:HA	1.84	0.40
1:B:80:HIS:CE1	1:B:93:LYS:HB3	2.57	0.40
1:B:308:ARG:HG2	1:B:309:ILE:HG22	2.03	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:369:HOH:O	2:C:374:HOH:O[12_565]	2.09	0.11

## 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	235/260 (90%)	226 (96%)	7 (3%)	2 (1%)	17	20
1	B	225/260 (86%)	215 (96%)	9 (4%)	1 (0%)	34	42
1	C	229/260 (88%)	223 (97%)	6 (3%)	0	100	100
All	All	689/780 (88%)	664 (96%)	22 (3%)	3 (0%)	34	42

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	64	PRO
1	A	84	SER
1	B	241	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	194/218 (89%)	185 (95%)	9 (5%)	27	38
1	B	178/218 (82%)	168 (94%)	10 (6%)	21	29
1	C	190/218 (87%)	177 (93%)	13 (7%)	16	21
All	All	562/654 (86%)	530 (94%)	32 (6%)	20	28

All (32) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	82	ARG
1	A	84	SER
1	A	98	TRP
1	A	104	ARG
1	A	133	ARG
1	A	245	SER
1	A	246	ARG
1	A	261	GLN
1	A	297	SER
1	B	73	LEU
1	B	87	ASP
1	B	98	TRP
1	B	103	GLU
1	B	106	ASP
1	B	133	ARG
1	B	134	LEU
1	B	240	LYS
1	B	273	LEU
1	B	309	ILE
1	C	98	TRP
1	C	106	ASP
1	C	122	LEU
1	C	133	ARG
1	C	153	SER
1	C	239	GLU
1	C	245	SER
1	C	262	LYS
1	C	277	GLN
1	C	278	SER
1	C	290	HIS
1	C	292	GLU
1	C	297	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	277	GLN
1	B	236	HIS
1	C	114	HIS
1	C	277	GLN

### 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 carbohydrates 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	233/260 (89%)	0.37	11 (4%) 31 38	28, 47, 71, 90	0
1	B	228/260 (87%)	0.29	6 (2%) 56 63	27, 48, 72, 92	0
1	C	232/260 (89%)	0.34	4 (1%) 70 76	24, 40, 68, 101	0
All	All	693/780 (88%)	0.33	21 (3%) 50 57	24, 45, 71, 101	0

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	85	LEU	4.7
1	C	290	HIS	4.5
1	C	281	TYR	4.4
1	B	309	ILE	3.4
1	A	246	ARG	3.2
1	B	264	PHE	2.9
1	A	84	SER	2.8
1	A	228	SER	2.8
1	A	192	HIS	2.6
1	C	296	LEU	2.5
1	A	265	PRO	2.5
1	A	196	PHE	2.4
1	A	291	TYR	2.3
1	A	239	GLU	2.3
1	C	277	GLN	2.3
1	B	267	PRO	2.2
1	B	245	SER	2.2
1	B	310	TYR	2.2
1	A	254	TRP	2.1
1	B	96	ARG	2.1
1	A	241	PRO	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 carbohydrates 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.