



# Full wwPDB X-ray Structure Validation Report ⓘ

May 23, 2020 – 04:18 pm BST

PDB ID : 5H7C  
Title : Crystal structure of a repeat protein with two Protein A-DHR14 repeat modules  
Authors : Youn, S.J.; Kwon, N.Y.; Lee, J.H.; Kim, J.H.; Lee, H.; Lee, J.O.  
Deposited on : 2016-11-17  
Resolution : 2.70 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
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

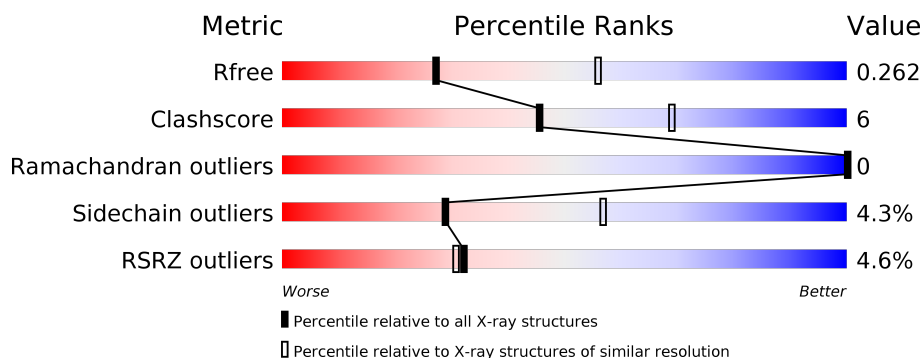
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.70 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	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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	404	<div> <div>2%</div> <div> <div></div> <div>83%</div> <div>16%</div> <div>..</div> </div> </div>
1	C	404	<div> <div>7%</div> <div> <div></div> <div>77%</div> <div>20%</div> <div>..</div> </div> </div>

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 6284 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 Immunoglobulin G-binding protein A, DHR14.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
1	A	400	Total	C	N	O	0	0	0
			3156	1987	507	662			
1	C	397	Total	C	N	O	0	0	0
			3128	1968	502	658			

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	GLY	-	expression tag	UNP P38507
A	1	SER	-	expression tag	UNP P38507
A	2	HIS	-	expression tag	UNP P38507
A	3	MET	-	expression tag	UNP P38507
A	29	ALA	GLY	engineered mutation	UNP P38507
A	50	SER	LYS	engineered mutation	UNP P38507
A	53	VAL	ASP	engineered mutation	UNP P38507
A	54	ASN	ALA	engineered mutation	UNP P38507
A	207	SER	ASN	engineered mutation	UNP P38507
A	214	SER	HIS	engineered mutation	UNP P38507
A	225	ALA	GLY	engineered mutation	UNP P38507
A	246	SER	LYS	engineered mutation	UNP P38507
A	249	VAL	ASP	engineered mutation	UNP P38507
A	250	ASN	ALA	engineered mutation	UNP P38507
C	0	GLY	-	expression tag	UNP P38507
C	1	SER	-	expression tag	UNP P38507
C	2	HIS	-	expression tag	UNP P38507
C	3	MET	-	expression tag	UNP P38507
C	29	ALA	GLY	engineered mutation	UNP P38507
C	50	SER	LYS	engineered mutation	UNP P38507
C	53	VAL	ASP	engineered mutation	UNP P38507
C	54	ASN	ALA	engineered mutation	UNP P38507
C	207	SER	ASN	engineered mutation	UNP P38507
C	214	SER	HIS	engineered mutation	UNP P38507
C	225	ALA	GLY	engineered mutation	UNP P38507

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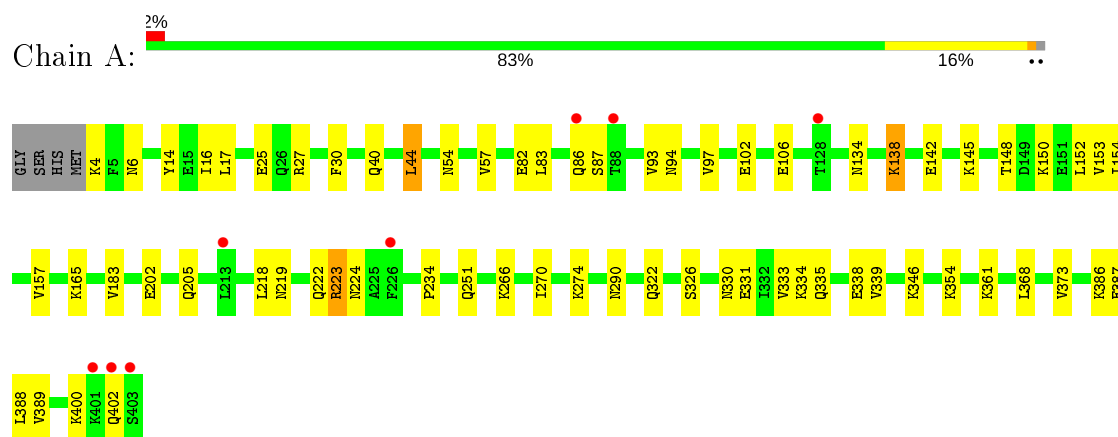
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Chain	Residue	Modelled	Actual	Comment	Reference
C	246	SER	LYS	engineered mutation	UNP P38507
C	249	VAL	ASP	engineered mutation	UNP P38507
C	250	ASN	ALA	engineered mutation	UNP P38507

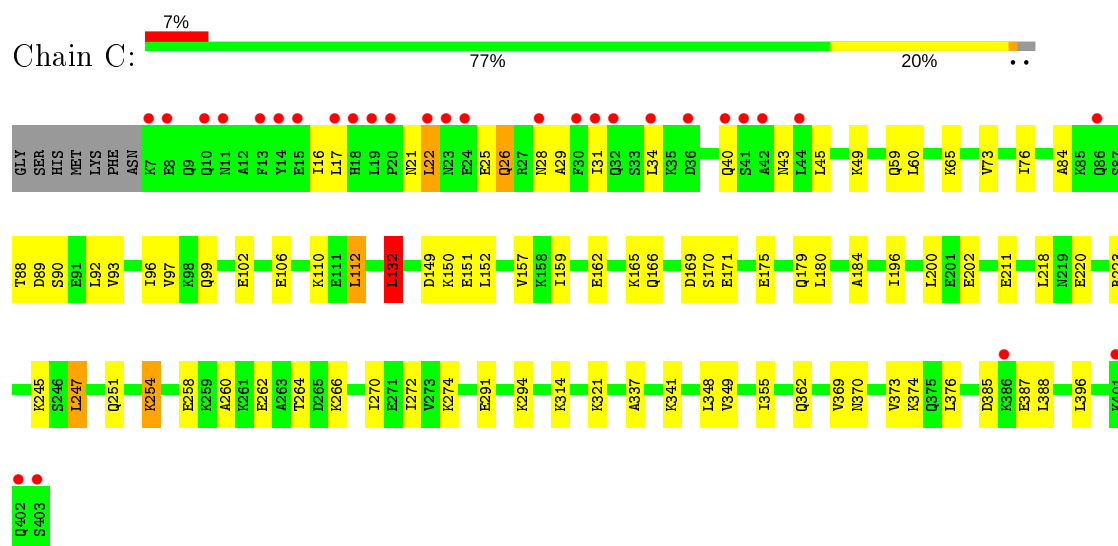
### 3 Residue-property plots [i](#)

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: Immunoglobulin G-binding protein A, DHR14



- Molecule 1: Immunoglobulin G-binding protein A, DHR14



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	48.66 Å   75.53 Å   80.01 Å 84.19°   83.72°   75.21°	Depositor
Resolution (Å)	29.05 – 2.70 29.05 – 2.70	Depositor EDS
% Data completeness (in resolution range)	96.0 (29.05-2.70) 96.0 (29.05-2.70)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.68 (at 2.72 Å)	Xtriage
Refinement program	PHENIX 1.10.1 _2155	Depositor
R, $R_{free}$	0.203   ,   0.262 0.202   ,   0.262	Depositor DCC
$R_{free}$ test set	1437 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	59.0	Xtriage
Anisotropy	0.409	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 64.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6284	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	86.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.47% 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	0.27	0/3173	0.45	0/4278
1	C	0.27	0/3144	0.45	1/4240 (0.0%)
All	All	0.27	0/6317	0.45	1/8518 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	132	LEU	CA-CB-CG	5.37	127.66	115.30

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	3156	0	3260	35	1
1	C	3128	0	3232	47	1
All	All	6284	0	6492	82	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 6.

All (82) 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:162:GLU:OE2	1:C:166:GLN:NE2	2.13	0.82
1:A:165:LYS:NZ	1:A:202:GLU:OE1	2.14	0.79
1:C:169:ASP:OD1	1:C:170:SER:N	2.17	0.76
1:C:251:GLN:HA	1:C:254:LYS:HG3	1.72	0.70
1:C:21:ASN:ND2	1:C:59:GLN:HE22	1.92	0.66
1:A:326:SER:O	1:A:330:ASN:ND2	2.32	0.61
1:A:25:GLU:N	1:A:25:GLU:OE1	2.34	0.58
1:C:60:LEU:HG	1:C:76:ILE:HG23	1.86	0.58
1:C:349:VAL:HG11	1:C:388:LEU:HD21	1.87	0.56
1:A:222:GLN:HE22	1:A:251:GLN:HE22	1.51	0.56
1:C:92:LEU:O	1:C:96:ILE:HG23	2.07	0.55
1:C:370:ASN:HA	1:C:373:VAL:HG22	1.90	0.54
1:C:211:GLU:OE1	1:C:245:LYS:NZ	2.40	0.54
1:C:218:LEU:HD22	1:C:247:LEU:HD23	1.89	0.54
1:C:93:VAL:HG11	1:C:132:LEU:HD22	1.89	0.54
1:A:145:LYS:HG3	1:A:183:VAL:HG22	1.91	0.53
1:A:334:LYS:HG3	1:A:335:GLN:N	2.23	0.52
1:A:205:GLN:CD	1:A:234:PRO:HB2	2.30	0.52
1:C:45:LEU:HD11	1:C:49:LYS:HE3	1.92	0.52
1:C:165:LYS:NZ	1:C:202:GLU:OE1	2.43	0.52
1:C:25:GLU:O	1:C:29:ALA:HB2	2.09	0.52
1:C:258:GLU:O	1:C:262:GLU:HG2	2.09	0.51
1:C:16:ILE:HD12	1:C:34:LEU:HD11	1.93	0.51
1:A:205:GLN:NE2	1:A:234:PRO:HB2	2.25	0.51
1:A:219:ASN:H	1:A:222:GLN:HE21	1.58	0.51
1:C:266:LYS:O	1:C:270:ILE:HG12	2.11	0.51
1:C:291:GLU:HA	1:C:294:LYS:HG2	1.94	0.50
1:A:153:VAL:O	1:A:157:VAL:HG13	2.10	0.50
1:A:386:LYS:HA	1:A:389:VAL:HG22	1.94	0.50
1:C:73:VAL:HB	1:C:112:LEU:HD11	1.93	0.50
1:C:73:VAL:HG11	1:C:112:LEU:HD21	1.93	0.50
1:A:83:LEU:O	1:A:87:SER:HB3	2.12	0.50
1:C:369:VAL:O	1:C:373:VAL:HG13	2.12	0.50
1:C:376:LEU:HB2	1:C:396:LEU:HD21	1.93	0.50
1:C:184:ALA:HB2	1:C:196:ILE:HG21	1.94	0.49
1:A:134:ASN:O	1:A:138:LYS:HD3	2.13	0.49
1:C:65:LYS:HD3	1:C:106:GLU:OE1	2.13	0.48
1:A:223:ARG:HG3	1:A:224:ASN:N	2.27	0.48
1:C:40:GLN:O	1:C:43:ASN:HB3	2.13	0.48
1:A:54:ASN:O	1:A:57:VAL:HG22	2.14	0.47
1:A:346:LYS:NZ	1:A:388:LEU:HD22	2.29	0.47
1:A:222:GLN:HE22	1:A:251:GLN:NE2	2.11	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:157:VAL:HG13	1:C:180:LEU:HD22	1.97	0.47
1:A:333:VAL:HG21	1:A:368:LEU:HD11	1.96	0.47
1:C:180:LEU:HB2	1:C:200:LEU:HD21	1.96	0.47
1:A:335:GLN:O	1:A:339:VAL:HG23	2.15	0.47
1:C:25:GLU:O	1:C:29:ALA:CB	2.63	0.47
1:C:321:LYS:HD3	1:C:362:GLN:HE22	1.80	0.47
1:A:331:GLU:CD	1:A:334:LYS:NZ	2.68	0.46
1:C:17:LEU:HD13	1:C:31:ILE:HD11	1.96	0.46
1:A:266:LYS:O	1:A:270:ILE:HG12	2.15	0.46
1:C:89:ASP:OD1	1:C:90:SER:N	2.49	0.46
1:A:40:GLN:O	1:A:44:LEU:HD22	2.16	0.45
1:C:28:ASN:HA	1:C:31:ILE:HD12	1.98	0.45
1:C:102:GLU:O	1:C:106:GLU:HG3	2.16	0.45
1:C:93:VAL:O	1:C:97:VAL:HG13	2.17	0.44
1:A:334:LYS:O	1:A:338:GLU:HG2	2.18	0.44
1:A:16:ILE:HD13	1:A:30:PHE:HB3	1.99	0.44
1:A:93:VAL:O	1:A:97:VAL:HG13	2.17	0.44
1:C:385:ASP:OD1	1:C:387:GLU:HG2	2.17	0.44
1:A:17:LEU:HA	1:A:27:ARG:HD3	2.00	0.44
1:A:102:GLU:O	1:A:106:GLU:HG3	2.17	0.43
1:C:270:ILE:O	1:C:274:LYS:HG3	2.17	0.43
1:C:337:ALA:O	1:C:341:LYS:HG3	2.19	0.43
1:C:22:LEU:HB2	1:C:26:GLN:HG3	2.00	0.43
1:C:374:LYS:HA	1:C:374:LYS:HD2	1.78	0.43
1:A:94:ASN:O	1:A:97:VAL:HG22	2.19	0.42
1:A:361:LYS:HA	1:A:402:GLN:OE1	2.19	0.42
1:C:149:ASP:OD1	1:C:151:GLU:HB2	2.19	0.42
1:C:84:ALA:HB1	1:C:93:VAL:HG22	2.01	0.42
1:A:270:ILE:O	1:A:274:LYS:HG3	2.18	0.42
1:A:400:LYS:HD3	1:A:400:LYS:HA	1.84	0.42
1:C:17:LEU:HA	1:C:17:LEU:HD12	1.92	0.42
1:A:373:VAL:HG11	1:A:400:LYS:HE2	2.01	0.41
1:C:260:ALA:HB2	1:C:272:ILE:HG21	2.03	0.41
1:C:220:GLU:OE1	1:C:223:ARG:NH1	2.54	0.41
1:A:219:ASN:OD1	1:A:222:GLN:HG2	2.21	0.41
1:C:175:GLU:O	1:C:179:GLN:HG2	2.22	0.40
1:A:150:LYS:O	1:A:154:ILE:HG13	2.22	0.40
1:A:82:GLU:O	1:A:86:GLN:HB2	2.21	0.40
1:C:218:LEU:CD2	1:C:247:LEU:HD23	2.52	0.40
1:C:387:GLU:HG3	1:C:388:LEU:N	2.36	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the sym-

metry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:14:TYR:OH	1:C:220:GLU:OE2[1_456]	2.15	0.05

## 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	398/404 (98%)	392 (98%)	6 (2%)	0	100	100
1	C	395/404 (98%)	389 (98%)	6 (2%)	0	100	100
All	All	793/808 (98%)	781 (98%)	12 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	354/357 (99%)	341 (96%)	13 (4%)	34	63
1	C	351/357 (98%)	334 (95%)	17 (5%)	25	53
All	All	705/714 (99%)	675 (96%)	30 (4%)	29	57

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	LYS

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Mol	Chain	Res	Type
1	A	6	ASN
1	A	44	LEU
1	A	138	LYS
1	A	142	GLU
1	A	148	THR
1	A	152	LEU
1	A	218	LEU
1	A	223	ARG
1	A	290	ASN
1	A	322	GLN
1	A	354	LYS
1	A	387	GLU
1	C	22	LEU
1	C	26	GLN
1	C	88	THR
1	C	99	GLN
1	C	110	LYS
1	C	112	LEU
1	C	132	LEU
1	C	150	LYS
1	C	152	LEU
1	C	159	ILE
1	C	171	GLU
1	C	247	LEU
1	C	254	LYS
1	C	264	THR
1	C	314	LYS
1	C	348	LEU
1	C	355	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	222	GLN
1	C	21	ASN
1	C	26	GLN
1	C	55	GLN
1	C	59	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	400/404 (99%)	-0.10	8 (2%) 65 67	42, 77, 127, 215	0
1	C	397/404 (98%)	0.13	29 (7%) 15 13	39, 78, 177, 225	0
All	All	797/808 (98%)	0.01	37 (4%) 32 31	39, 78, 155, 225	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	11	ASN	8.3
1	C	36	ASP	7.5
1	C	7	LYS	7.1
1	C	13	PHE	6.9
1	C	10	GLN	5.3
1	C	14	TYR	4.7
1	C	41	SER	4.6
1	A	86	GLN	4.5
1	A	403	SER	4.4
1	C	8	GLU	4.3
1	A	402	GLN	4.2
1	C	403	SER	4.1
1	C	22	LEU	4.1
1	C	42	ALA	4.1
1	C	40	GLN	3.8
1	C	17	LEU	3.6
1	C	44	LEU	3.6
1	C	401	LYS	3.6
1	C	28	ASN	3.2
1	C	18	HIS	3.2
1	C	30	PHE	3.1
1	A	128	THR	3.1
1	C	15	GLU	3.1
1	C	86	GLN	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	226	PHE	2.9
1	C	31	ILE	2.9
1	C	20	PRO	2.8
1	A	213	LEU	2.7
1	A	88	THR	2.6
1	C	34	LEU	2.4
1	C	24	GLU	2.4
1	C	402	GLN	2.4
1	C	23	ASN	2.3
1	C	32	GLN	2.2
1	A	401	LYS	2.2
1	C	19	LEU	2.1
1	C	386	LYS	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.