



# Full wwPDB X-ray Structure Validation Report ⓘ

May 21, 2020 – 07:14 am BST

PDB ID : 3PNM  
Title : Crystal Structure of E.coli Dha kinase DhaK (H56A)  
Authors : Shi, R.; McDonald, L.; Matte, A.; Cygler, M.; Ekiel, I.; Montreal-Kingston  
Bacterial Structural Genomics Initiative (BSGI)  
Deposited on : 2010-11-19  
Resolution : 2.55 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 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

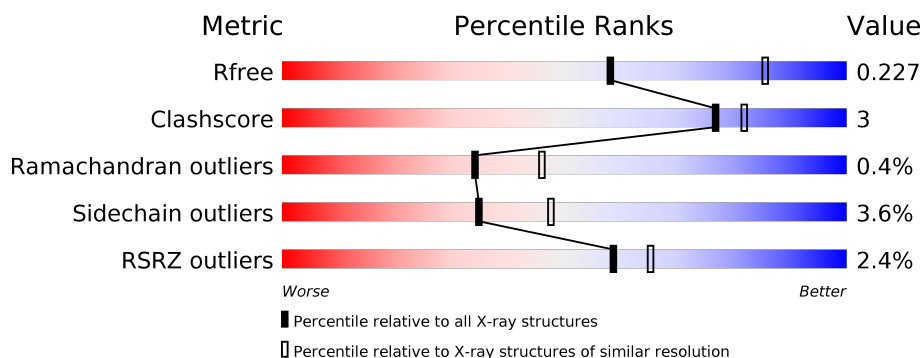
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.55 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	1284 (2.56-2.52)
Clashscore	141614	1332 (2.56-2.52)
Ramachandran outliers	138981	1315 (2.56-2.52)
Sidechain outliers	138945	1315 (2.56-2.52)
RSRZ outliers	127900	1272 (2.56-2.52)

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	357	<div> <div>3%</div> <div> <div></div> <div>86%</div> <div>9%</div> <div>• 5%</div> </div> </div>
1	B	357	<div> <div>2%</div> <div> <div></div> <div>86%</div> <div>9%</div> <div>5%</div> </div> </div>
1	C	357	<div> <div>2%</div> <div> <div></div> <div>83%</div> <div>11%</div> <div>5%</div> </div> </div>
1	D	357	<div> <div>3%</div> <div> <div></div> <div>87%</div> <div>9%</div> <div>•</div> </div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 10595 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 PTS-dependent dihydroxyacetone kinase, dihydroxyacetone-binding subunit dhaK.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	340	Total	C	N	O	S	0	1	0
			2568	1609	437	509	13			
1	B	340	Total	C	N	O	S	0	1	0
			2567	1606	439	509	13			
1	C	338	Total	C	N	O	S	0	2	0
			2562	1607	437	506	12			
1	D	341	Total	C	N	O	S	0	1	0
			2576	1611	441	511	13			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	GLY	-	EXPRESSION TAG	UNP P76015
A	1	SER	-	EXPRESSION TAG	UNP P76015
A	56	ALA	HIS	ENGINEERED MUTATION	UNP P76015
B	0	GLY	-	EXPRESSION TAG	UNP P76015
B	1	SER	-	EXPRESSION TAG	UNP P76015
B	56	ALA	HIS	ENGINEERED MUTATION	UNP P76015
C	0	GLY	-	EXPRESSION TAG	UNP P76015
C	1	SER	-	EXPRESSION TAG	UNP P76015
C	56	ALA	HIS	ENGINEERED MUTATION	UNP P76015
D	0	GLY	-	EXPRESSION TAG	UNP P76015
D	1	SER	-	EXPRESSION TAG	UNP P76015
D	56	ALA	HIS	ENGINEERED MUTATION	UNP P76015

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	92	Total	O	0	0
			92	92		
2	B	65	Total	O	0	0
			65	65		

*Continued on next page...*


*Continued from previous page...*

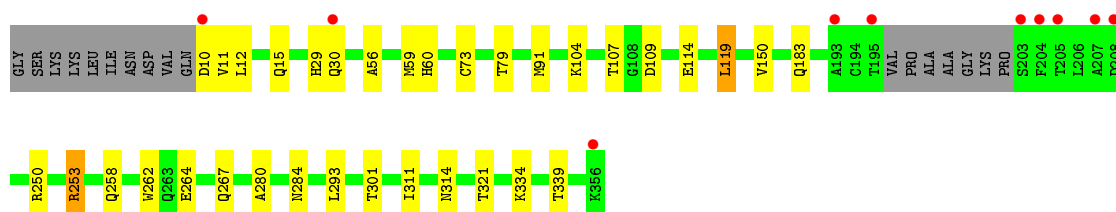
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	C	84	Total	O	0	0
			84	84		
2	D	81	Total	O	0	0
			81	81		

### 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.

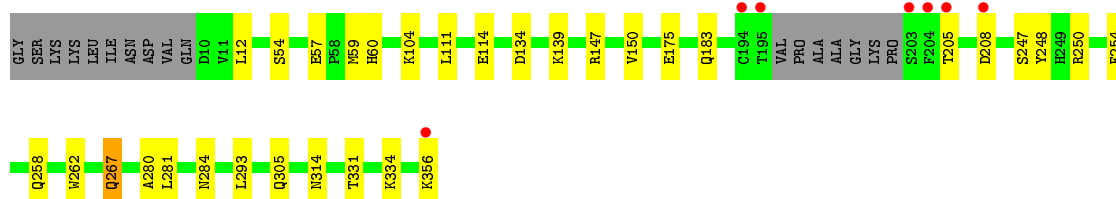
- Molecule 1: PTS-dependent dihydroxyacetone kinase, dihydroxyacetone-binding subunit dhaK

Chain A: 




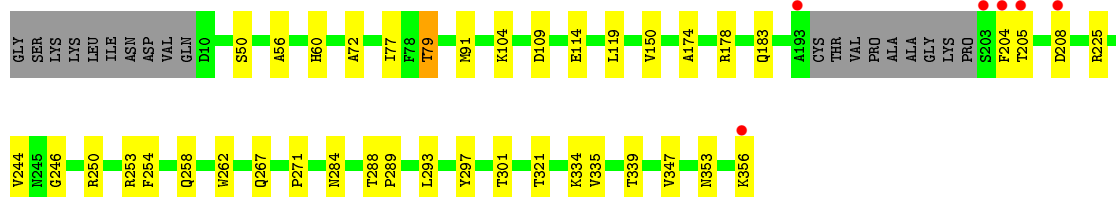
- Molecule 1: PTS-dependent dihydroxyacetone kinase, dihydroxyacetone-binding subunit dhaK

Chain B: 

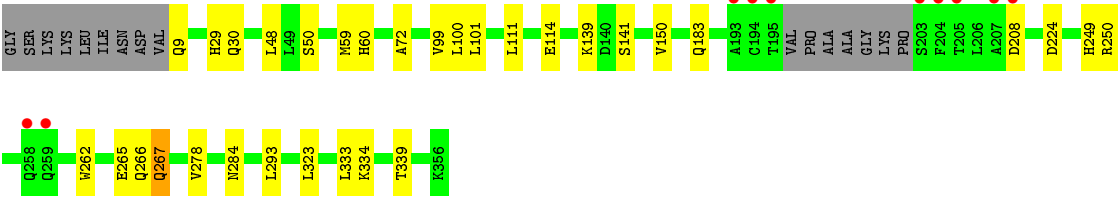
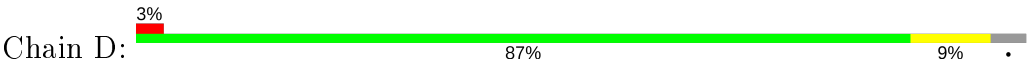


- Molecule 1: PTS-dependent dihydroxyacetone kinase, dihydroxyacetone-binding subunit dhaK

Chain C: 



- Molecule 1: PTS-dependent dihydroxyacetone kinase, dihydroxyacetone-binding subunit dhaK



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	59.76 Å 82.53 Å 93.07 Å 77.93° 77.90° 71.02°	Depositor
Resolution (Å)	41.71 – 2.55 41.71 – 2.55	Depositor EDS
% Data completeness (in resolution range)	98.2 (41.71-2.55) 98.2 (41.71-2.55)	Depositor EDS
$R_{merge}$	0.15	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.70 (at 2.54 Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.172 , 0.229 0.173 , 0.227	Depositor DCC
$R_{free}$ test set	2657 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.9	Xtriage
Anisotropy	0.640	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 35.4	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	0.94	EDS
Total number of atoms	10595	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.16% 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	0.62	1/2617 (0.0%)	0.68	0/3555
1	B	0.61	0/2616	0.65	0/3554
1	C	0.62	0/2615	0.66	0/3552
1	D	0.62	0/2625	0.67	0/3566
All	All	0.62	1/10473 (0.0%)	0.67	0/14227

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	D	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	73	CYS	CB-SG	-5.08	1.73	1.81

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	9	GLN	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	2568	0	2512	14	0
1	B	2567	0	2510	15	0
1	C	2562	0	2507	20	0
1	D	2576	0	2518	13	0
2	A	92	0	0	2	0
2	B	65	0	0	3	0
2	C	84	0	0	2	0
2	D	81	0	0	2	0
All	All	10595	0	10047	61	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 3.

All (61) 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:60:HIS:NE2	1:A:104:LYS:NZ	2.23	0.86
1:B:59:MET:CE	1:B:104:LYS:HE2	2.15	0.77
1:D:249[A]:HIS:CE1	1:D:266:GLN:HG2	2.24	0.72
1:C:114:GLU:HG2	1:C:262:TRP:CZ2	2.26	0.71
1:D:284:ASN:HB2	1:D:293:LEU:HD11	1.73	0.71
1:A:284:ASN:HB2	1:A:293:LEU:HD11	1.75	0.68
1:C:60:HIS:NE2	1:C:104:LYS:NZ	2.41	0.67
1:C:356:LYS:HG2	2:C:398:HOH:O	1.96	0.66
1:B:59:MET:HE1	1:B:104:LYS:HE2	1.78	0.63
1:B:114:GLU:HG2	1:B:262:TRP:CZ2	2.36	0.60
1:C:284:ASN:HB2	1:C:293:LEU:HD11	1.83	0.60
1:B:284:ASN:HB2	1:B:293:LEU:HD11	1.83	0.60
1:A:119:LEU:HD12	1:C:244:VAL:HG21	1.84	0.59
1:D:265:GLU:OE2	1:D:267:GLN:NE2	2.35	0.58
1:A:114:GLU:HG2	1:A:262:TRP:CH2	2.38	0.58
1:C:246:GLY:HA3	1:C:271:PRO:HB3	1.88	0.55
1:A:107:THR:HG22	2:A:387:HOH:O	2.06	0.55
1:B:57:GLU:HG3	2:B:367:HOH:O	2.08	0.54
1:C:335:VAL:HG12	1:C:339:THR:HG21	1.90	0.54
1:D:48:LEU:HD12	1:D:100:LEU:HB3	1.91	0.53
1:D:114:GLU:HG2	1:D:262:TRP:CH2	2.43	0.53
1:A:253:ARG:HG3	1:A:264:GLU:HG3	1.92	0.52
1:D:50:SER:O	1:D:72:ALA:HA	2.10	0.52
1:A:301:THR:HG22	1:A:311:ILE:HD12	1.92	0.51

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:183:GLN:HB3	1:C:334:LYS:HB3	1.91	0.51
1:C:114:GLU:CG	1:C:262:TRP:CZ2	2.92	0.51
1:C:174:ALA:O	1:C:178:ARG:HG3	2.11	0.50
1:C:56:ALA:HA	1:C:321:THR:O	2.12	0.49
1:C:297:TYR:O	1:C:301:THR:HG23	2.13	0.48
1:D:29:HIS:HB3	2:D:374:HOH:O	2.14	0.48
1:C:50:SER:O	1:C:72:ALA:HA	2.13	0.47
1:B:183:GLN:HB3	1:B:334:LYS:HB3	1.96	0.47
1:D:48:LEU:HD11	1:D:100:LEU:HD23	1.97	0.47
1:C:204:PHE:HB3	2:C:383:HOH:O	2.13	0.47
1:D:59:MET:HA	1:D:60:HIS:HA	1.60	0.46
1:B:59:MET:SD	1:B:104:LYS:HE2	2.56	0.45
1:D:99:VAL:HG12	1:D:101:LEU:HD12	1.97	0.45
1:B:59:MET:HA	1:B:60:HIS:HA	1.59	0.45
1:A:114:GLU:HG2	1:A:262:TRP:CZ2	2.52	0.45
1:A:56:ALA:HA	1:A:321:THR:O	2.17	0.44
1:C:254[A]:PHE:HE2	1:C:267:GLN:HE22	1.65	0.44
1:C:347:VAL:O	1:C:353:ASN:HA	2.18	0.44
1:A:11:VAL:O	1:A:15:GLN:HG3	2.18	0.43
1:B:147:ARG:HD2	1:B:248:TYR:CE2	2.54	0.43
1:A:183:GLN:HB3	1:A:334:LYS:HB3	2.01	0.43
1:A:29:HIS:HB3	2:A:380:HOH:O	2.19	0.43
1:C:205:THR:O	1:C:225:ARG:NH1	2.52	0.43
1:C:77:ILE:O	1:C:79:THR:HG23	2.19	0.43
1:C:288:THR:HA	1:C:289:PRO:HD2	1.81	0.43
1:B:247:SER:HB3	2:B:402:HOH:O	2.19	0.42
1:C:114:GLU:HG2	1:C:262:TRP:CE2	2.54	0.42
1:B:281:LEU:HB3	1:B:331:THR:HB	2.01	0.42
1:B:134:ASP:HB3	2:B:363:HOH:O	2.20	0.42
1:B:60:HIS:CE1	1:B:104:LYS:HE3	2.55	0.42
1:B:254:PHE:HE2	1:B:267:GLN:NE2	2.18	0.41
1:D:224:ASP:HB2	2:D:418:HOH:O	2.20	0.41
1:A:280:ALA:O	1:A:314:ASN:HA	2.20	0.41
1:A:59:MET:HA	1:A:60:HIS:HA	1.62	0.41
1:D:183:GLN:HB3	1:D:334:LYS:HB3	2.02	0.41
1:D:278:VAL:HA	1:D:333:LEU:O	2.21	0.40
1:B:280:ALA:O	1:B:314:ASN:HA	2.21	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	337/357 (94%)	322 (96%)	14 (4%)	1 (0%)	41	51
1	B	337/357 (94%)	326 (97%)	10 (3%)	1 (0%)	41	51
1	C	336/357 (94%)	325 (97%)	10 (3%)	1 (0%)	41	51
1	D	338/357 (95%)	327 (97%)	8 (2%)	3 (1%)	17	24
All	All	1348/1428 (94%)	1300 (96%)	42 (3%)	6 (0%)	34	46

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	323	LEU
1	D	141	SER
1	B	150	VAL
1	C	150	VAL
1	D	150	VAL
1	A	150	VAL

### 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	275/287 (96%)	263 (96%)	12 (4%)	28	38
1	B	275/287 (96%)	263 (96%)	12 (4%)	28	38
1	C	274/287 (96%)	266 (97%)	8 (3%)	42	57
1	D	276/287 (96%)	269 (98%)	7 (2%)	47	62

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1100/1148 (96%)	1061 (96%)	39 (4%)	35 49

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

Mol	Chain	Res	Type
1	A	10	ASP
1	A	12	LEU
1	A	30	GLN
1	A	79	THR
1	A	91	MET
1	A	109	ASP
1	A	119	LEU
1	A	250	ARG
1	A	253	ARG
1	A	258	GLN
1	A	267	GLN
1	A	339	THR
1	B	12	LEU
1	B	54	SER
1	B	111	LEU
1	B	139	LYS
1	B	175	GLU
1	B	205	THR
1	B	208	ASP
1	B	250	ARG
1	B	258	GLN
1	B	267	GLN
1	B	305	GLN
1	B	356	LYS
1	C	79	THR
1	C	91	MET
1	C	109	ASP
1	C	119	LEU
1	C	208	ASP
1	C	250	ARG
1	C	253	ARG
1	C	258	GLN
1	D	30	GLN
1	D	111	LEU
1	D	139	LYS
1	D	208	ASP
1	D	250	ARG

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	D	267	GLN
1	D	339	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	183	GLN
1	C	263	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	340/357 (95%)	-0.42	10 (2%)	51	59	7, 17, 36, 61	0
1	B	340/357 (95%)	-0.35	7 (2%)	63	70	10, 20, 38, 61	0
1	C	338/357 (94%)	-0.39	6 (1%)	68	74	7, 17, 35, 56	0
1	D	341/357 (95%)	-0.31	10 (2%)	51	59	7, 19, 37, 57	0
All	All	1359/1428 (95%)	-0.36	33 (2%)	59	65	7, 18, 37, 61	0

All (33) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	205	THR	6.9
1	D	205	THR	4.1
1	C	205	THR	4.1
1	A	193	ALA	4.0
1	D	195	THR	3.8
1	A	208	ASP	3.6
1	C	208	ASP	3.4
1	C	204	PHE	3.4
1	D	208	ASP	3.4
1	A	356	LYS	3.3
1	A	204	PHE	3.1
1	B	208	ASP	3.1
1	D	203	SER	3.1
1	C	203	SER	3.0
1	B	195	THR	3.0
1	D	194	CYS	2.9
1	A	10	ASP	2.8
1	C	193	ALA	2.8
1	A	203	SER	2.7
1	D	204	PHE	2.7
1	B	356	LYS	2.6

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	B	204	PHE	2.5
1	A	207	ALA	2.5
1	C	356	LYS	2.4
1	B	203	SER	2.4
1	B	194	CYS	2.3
1	A	195	THR	2.3
1	D	193	ALA	2.2
1	A	30	GLN	2.2
1	D	259	GLN	2.1
1	A	205	THR	2.1
1	D	207	ALA	2.0
1	D	258	GLN	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.