



Full wwPDB X-ray Structure Validation Report ⓘ

Jan 31, 2016 – 07:31 PM GMT

PDB ID : 1FZR
Title : CRYSTAL STRUCTURE OF BACTERIOPHAGE T7 ENDONUCLEASE I
Authors : Hadden, J.M.; Convery, M.A.; Declais, A.C.; Lilley, D.M.J.; Phillips, S.E.V.
Deposited on : 2000-10-04
Resolution : 2.10 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
A user guide is available at
<http://wwpdb.org/validation/2016/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
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

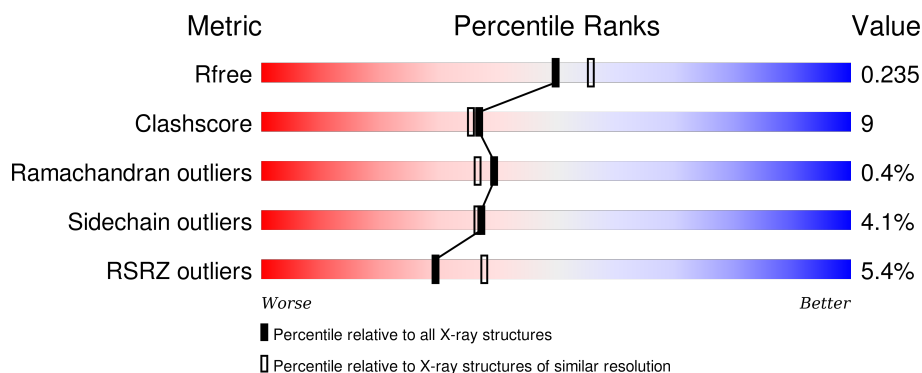
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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}	91344	3939 (2.10-2.10)
Clashscore	102246	4460 (2.10-2.10)
Ramachandran outliers	100387	4413 (2.10-2.10)
Sidechain outliers	100360	4414 (2.10-2.10)
RSRZ outliers	91569	3948 (2.10-2.10)

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 ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	138	<div> <div>6%</div> <div> <div></div> <div>68%</div> <div>25%</div> <div>• 7%</div> </div> </div>
1	B	138	<div> <div>4%</div> <div> <div></div> <div>78%</div> <div>15%</div> <div>7%</div> </div> </div>
1	C	138	<div> <div>6%</div> <div> <div></div> <div>63%</div> <div>30%</div> <div>• 7%</div> </div> </div>
1	D	138	<div> <div>5%</div> <div> <div></div> <div>71%</div> <div>20%</div> <div>• 7%</div> </div> </div>

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4702 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 ENDONUCLEASE I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	129	Total	C	N	O	S	0	0	0
			1049	681	178	189	1			
1	B	129	Total	C	N	O	S	0	0	0
			1060	688	178	193	1			
1	C	129	Total	C	N	O	S	0	0	0
			1048	680	176	191	1			
1	D	129	Total	C	N	O	S	0	0	0
			1060	689	179	191	1			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	65	LYS	GLU	ENGINEERED	UNP P00641
B	65	LYS	GLU	ENGINEERED	UNP P00641
C	65	LYS	GLU	ENGINEERED	UNP P00641
D	65	LYS	GLU	ENGINEERED	UNP P00641

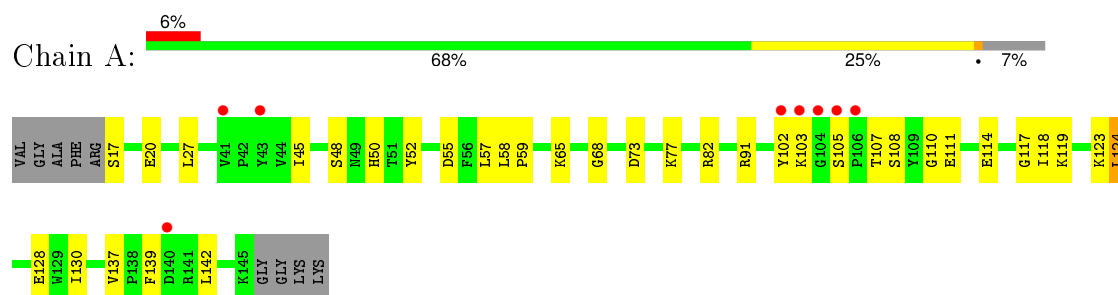
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	111	Total	O	0	0
			111	111		
2	B	151	Total	O	0	0
			151	151		
2	C	77	Total	O	0	0
			77	77		
2	D	146	Total	O	0	0
			146	146		

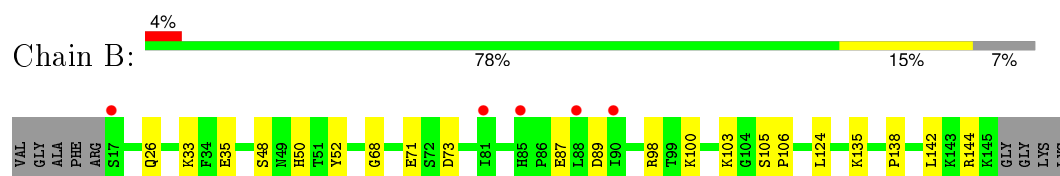
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

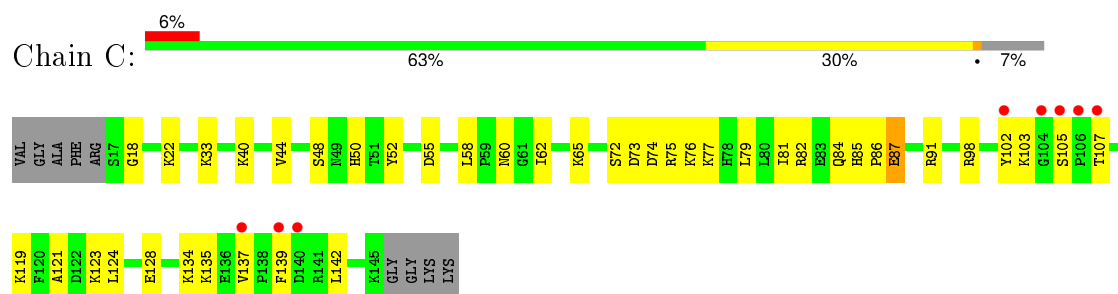
• Molecule 1: ENDONUCLEASE I



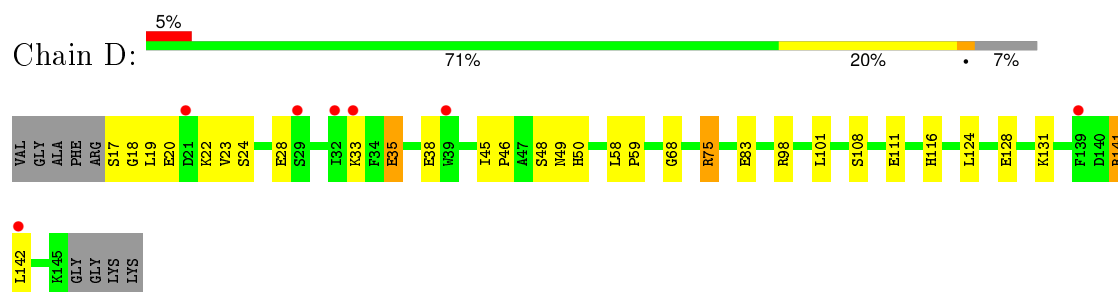
• Molecule 1: ENDONUCLEASE I



• Molecule 1: ENDONUCLEASE I



• Molecule 1: ENDONUCLEASE I



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	123.66 Å 135.19 Å 61.58 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.81 – 2.10 29.88 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.1 (28.81-2.10) 99.1 (29.88-2.10)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.45 (at 2.10 Å)	Xtriage
Refinement program	CNS 0.9	Depositor
R, R_{free}	0.198 , 0.235 0.200 , 0.235	Depositor DCC
R_{free} test set	6061 reflections (10.02%)	DCC
Wilson B-factor (Å ²)	46.8	Xtriage
Anisotropy	0.022	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 58.3	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	1 of 60475 reflections (0.002%)	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4702	wwPDB-VP
Average B, all atoms (Å ²)	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.44% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

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	0.50	0/1079	0.71	1/1456 (0.1%)
1	B	0.58	0/1090	0.76	2/1470 (0.1%)
1	C	0.45	0/1078	0.66	0/1457
1	D	0.55	0/1090	0.75	2/1469 (0.1%)
All	All	0.52	0/4337	0.72	5/5852 (0.1%)

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
1	B	0	1
1	C	0	1
All	All	0	3

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	75	ARG	NE-CZ-NH2	-7.12	116.74	120.30
1	D	68	GLY	N-CA-C	-6.30	97.36	113.10
1	B	68	GLY	N-CA-C	-6.05	97.97	113.10
1	A	68	GLY	N-CA-C	-5.30	99.84	113.10
1	B	144	ARG	NE-CZ-NH2	-5.21	117.69	120.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	52	TYR	Sidechain

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Group
1	B	52	TYR	Sidechain
1	C	52	TYR	Sidechain

5.2 Too-close contacts

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	1049	0	1037	21	0
1	B	1060	0	1054	14	0
1	C	1048	0	1028	28	0
1	D	1060	0	1061	25	0
2	A	111	0	0	0	0
2	B	151	0	0	4	0
2	C	77	0	0	3	0
2	D	146	0	0	5	0
All	All	4702	0	4180	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 9.

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:D:141:ARG:HB3	1:D:141:ARG:HH11	1.30	0.92
1:D:141:ARG:CB	1:D:141:ARG:HH11	1.94	0.80
1:A:108:SER:OG	1:A:111:GLU:HG3	1.83	0.78
1:B:48:SER:OG	1:B:50:HIS:HE1	1.68	0.76
1:A:82:ARG:HH22	1:A:118:ILE:HA	1.50	0.76
1:A:73:ASP:O	1:A:77:LYS:HG2	1.92	0.69
1:B:89:ASP:HB2	1:B:135:LYS:HE3	1.73	0.69
1:C:48:SER:OG	1:C:50:HIS:HE1	1.76	0.69
1:C:72:SER:O	1:C:76:LYS:HG3	1.94	0.68
1:A:82:ARG:NH2	1:A:118:ILE:HA	2.11	0.65
1:D:141:ARG:CG	1:D:141:ARG:HH11	2.10	0.64
1:C:137:VAL:HB	1:C:139:PHE:CE1	2.33	0.63
1:C:33:LYS:O	1:D:59:PRO:HG3	1.99	0.62

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:72:SER:HA	1:C:75:ARG:NH1	2.14	0.62
1:D:131:LYS:HE3	2:D:193:HOH:O	1.99	0.62
1:D:141:ARG:HB3	1:D:141:ARG:NH1	2.11	0.60
1:C:91:ARG:HG2	1:C:119:LYS:HB2	1.84	0.60
1:C:79:LEU:O	1:C:82:ARG:HB3	2.03	0.59
1:D:18:GLY:O	1:D:22:LYS:HG3	2.02	0.59
1:A:55:ASP:OD2	1:A:65:LYS:HD2	2.03	0.58
1:A:17:SER:OG	1:A:20:GLU:HB2	2.06	0.55
1:C:60:ASN:HA	1:C:134:LYS:HG3	1.87	0.55
1:C:87:GLU:H	1:C:87:GLU:CD	2.08	0.55
1:C:135:LYS:HE3	2:C:185:HOH:O	2.06	0.55
1:C:77:LYS:O	1:C:81:ILE:HG13	2.07	0.54
1:C:60:ASN:HB2	1:C:134:LYS:HA	1.90	0.53
1:D:108:SER:OG	1:D:111:GLU:HG3	2.08	0.53
1:A:48:SER:OG	1:A:50:HIS:HE1	1.90	0.53
1:D:116:HIS:HE1	2:D:192:HOH:O	1.92	0.53
1:A:107:THR:HA	1:A:111:GLU:OE2	2.10	0.52
1:A:45:ILE:HD12	1:B:50:HIS:CE1	2.45	0.52
1:A:130:ILE:CD1	2:B:189:HOH:O	2.57	0.51
1:D:19:LEU:O	1:D:23:VAL:HG23	2.10	0.51
1:C:62:ILE:HD13	1:C:91:ARG:CZ	2.41	0.51
1:D:24:SER:O	1:D:28:GLU:HG3	2.11	0.51
1:C:85:HIS:N	1:C:86:PRO:HD3	2.26	0.51
1:D:17:SER:OG	1:D:20:GLU:HB2	2.11	0.50
1:A:82:ARG:NH2	1:A:117:GLY:O	2.45	0.50
1:C:50:HIS:CE1	1:D:45:ILE:HD12	2.47	0.50
1:D:75:ARG:NH2	1:D:101:LEU:O	2.45	0.49
1:D:35:GLU:HG2	1:D:38:GLU:CB	2.42	0.49
1:C:135:LYS:HD3	2:C:187:HOH:O	2.12	0.48
1:D:141:ARG:CG	1:D:141:ARG:NH1	2.73	0.48
1:C:123:LYS:C	1:C:124:LEU:HD22	2.34	0.47
1:A:137:VAL:HB	1:A:139:PHE:CE1	2.50	0.47
1:C:123:LYS:HB3	1:C:124:LEU:HD22	1.97	0.47
1:C:85:HIS:HA	1:C:87:GLU:OE2	2.15	0.46
1:B:100:LYS:HE3	1:B:106:PRO:O	2.16	0.46
1:C:40:LYS:NZ	2:C:163:HOH:O	2.49	0.46
1:B:48:SER:OG	1:B:50:HIS:CE1	2.58	0.46
1:A:130:ILE:HD11	2:B:189:HOH:O	2.16	0.45
1:A:110:GLY:O	1:A:114:GLU:HG3	2.17	0.45
1:A:123:LYS:O	1:A:124:LEU:HD13	2.17	0.45
1:D:48:SER:OG	1:D:50:HIS:HE1	2.00	0.45

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:44:VAL:HG22	1:D:49:ASN:ND2	2.32	0.44
1:D:33:LYS:HD2	1:D:33:LYS:HA	1.68	0.44
1:C:102:TYR:CE1	1:C:105:SER:HB2	2.52	0.44
1:A:128:GLU:H	1:A:128:GLU:CD	2.21	0.44
1:A:124:LEU:HG	1:B:26:GLN:HG3	2.00	0.44
1:B:103:LYS:HG3	1:C:121:ALA:HA	2.00	0.44
1:A:57:LEU:HB3	1:B:35:GLU:HB2	2.00	0.43
1:D:98:ARG:NH1	2:D:245:HOH:O	2.51	0.43
1:A:91:ARG:HG2	1:A:119:LYS:HB2	2.01	0.43
1:B:73:ASP:HB3	2:B:191:HOH:O	2.18	0.42
1:B:89:ASP:CB	1:B:135:LYS:HE3	2.47	0.42
1:C:128:GLU:H	1:C:128:GLU:CD	2.22	0.42
1:B:105:SER:HA	1:B:106:PRO:HD3	1.77	0.42
1:C:44:VAL:HG22	1:D:49:ASN:HD22	1.83	0.42
1:D:128:GLU:HG3	2:D:246:HOH:O	2.20	0.42
1:A:102:TYR:CE1	1:A:105:SER:HB2	2.55	0.42
1:D:98:ARG:HA	1:D:98:ARG:HD3	1.67	0.42
1:C:18:GLY:O	1:C:22:LYS:HG3	2.20	0.41
1:C:84:GLN:C	1:C:86:PRO:HD3	2.42	0.41
1:D:83:GLU:HG3	2:D:239:HOH:O	2.20	0.41
1:B:87:GLU:HG3	1:B:138:PRO:HG3	2.03	0.40
1:A:59:PRO:HG3	1:B:33:LYS:O	2.20	0.40
1:B:71:GLU:HB2	2:B:191:HOH:O	2.21	0.40
1:C:55:ASP:OD2	1:C:65:LYS:HD2	2.22	0.40
1:D:45:ILE:HA	1:D:46:PRO:HD3	1.87	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	127/138 (92%)	123 (97%)	3 (2%)	1 (1%)	24 17

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	127/138 (92%)	123 (97%)	4 (3%)	0	100	100
1	C	127/138 (92%)	123 (97%)	3 (2%)	1 (1%)	24	17
1	D	127/138 (92%)	124 (98%)	3 (2%)	0	100	100
All	All	508/552 (92%)	493 (97%)	13 (3%)	2 (0%)	39	37

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	103	LYS
1	C	103	LYS

5.3.2 Protein sidechains ⓘ

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	113/124 (91%)	109 (96%)	4 (4%)	43	44
1	B	116/124 (94%)	113 (97%)	3 (3%)	54	58
1	C	113/124 (91%)	106 (94%)	7 (6%)	23	19
1	D	116/124 (94%)	111 (96%)	5 (4%)	35	34
All	All	458/496 (92%)	439 (96%)	19 (4%)	37	36

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	27	LEU
1	A	58	LEU
1	A	124	LEU
1	A	142	LEU
1	B	98	ARG
1	B	124	LEU
1	B	142	LEU
1	C	58	LEU
1	C	73	ASP

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	C	74	ASP
1	C	87	GLU
1	C	98	ARG
1	C	107	THR
1	C	142	LEU
1	D	35	GLU
1	D	58	LEU
1	D	124	LEU
1	D	141	ARG
1	D	142	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	50	HIS
1	B	49	ASN
1	B	50	HIS
1	C	50	HIS
1	D	49	ASN
1	D	50	HIS

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

There are no such residues in this entry.

5.8 Polymer linkage issues

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, 95th 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 ²)	Q<0.9
1	A	129/138 (93%)	0.07	8 (6%) 24 32	33, 49, 75, 95	0
1	B	129/138 (93%)	0.05	5 (3%) 43 52	33, 42, 63, 73	0
1	C	129/138 (93%)	0.22	8 (6%) 24 32	37, 59, 88, 108	0
1	D	129/138 (93%)	0.22	7 (5%) 29 38	32, 45, 92, 102	0
All	All	516/552 (93%)	0.14	28 (5%) 29 38	32, 50, 86, 108	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	102	TYR	6.7
1	C	102	TYR	4.3
1	A	103	LYS	3.9
1	D	39	TRP	3.9
1	C	105	SER	3.6
1	C	140	ASP	3.5
1	C	106	PRO	3.4
1	D	32	ILE	3.2
1	D	142	LEU	3.2
1	B	81	ILE	3.1
1	B	88	LEU	3.1
1	A	140	ASP	3.1
1	A	104	GLY	3.0
1	C	137	VAL	2.9
1	B	90	ILE	2.8
1	C	104	GLY	2.7
1	C	107	THR	2.7
1	B	17	SER	2.4
1	A	41	VAL	2.4
1	D	29	SER	2.3
1	A	105	SER	2.3

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	43	TYR	2.2
1	B	85	HIS	2.2
1	A	106	PRO	2.1
1	D	33	LYS	2.1
1	C	139	PHE	2.1
1	D	21	ASP	2.0
1	D	139	PHE	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.