



Full wwPDB X-ray Structure Validation Report

Mar 9, 2018 – 05:27 am GMT

PDB ID : 4KZD
Title : Crystal structure of an RNA aptamer in complex with fluorophore and Fab
Authors : Huang, H.; Suslov, N.B.; Li, N.; Koldobskaya, Y.; Rice, P.A.; Piccirilli, J.A.
Deposited on : 2013-05-29
Resolution : 2.19 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

<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
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : trunk30967
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk30967

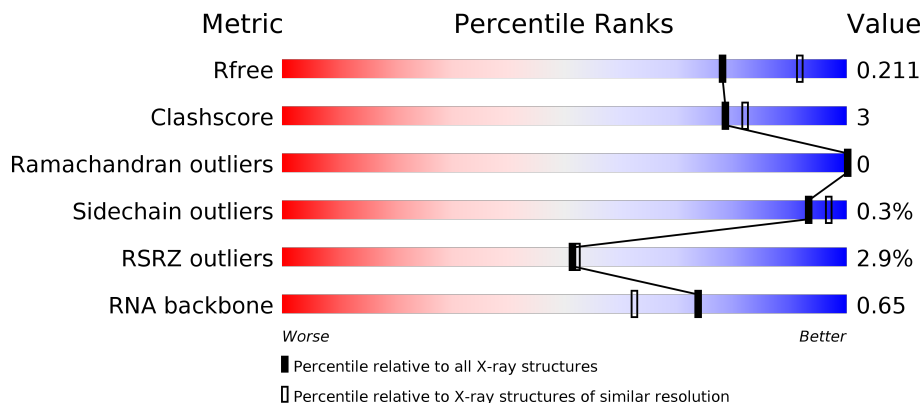
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

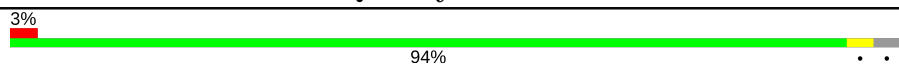
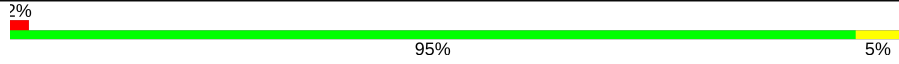

The reported resolution of this entry is 2.19 Å.

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}	111664	6027 (2.20-2.16)
Clashescore	122126	6837 (2.20-2.16)
Ramachandran outliers	120053	6731 (2.20-2.16)
Sidechain outliers	120020	6731 (2.20-2.16)
RSRZ outliers	108989	5899 (2.20-2.16)
RNA backbone	2636	1001 (2.68-1.68)

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	H	232	
2	L	215	
3	R	84	

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 5645 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 BL3-6 Fab antibody, heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	H	225	Total 1678	C 1055	N 287	O 330	S 6	0	0	0

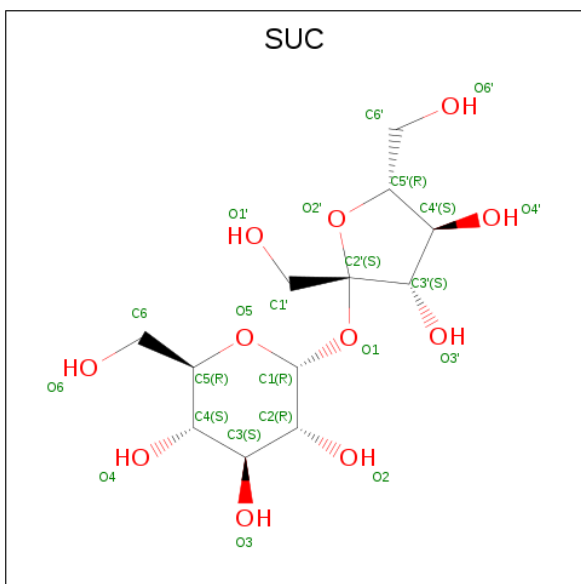
- Molecule 2 is a protein called BL3-6 Fab antibody, light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	L	215	Total 1643	C 1025	N 275	O 337	S 6	0	0	0

- Molecule 3 is a RNA chain called RNA (84-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	R	84	Total 1815	C 806	N 337	O 587	P 85	0	0	0

- Molecule 4 is SUCROSE (three-letter code: SUC) (formula: $C_{12}H_{22}O_{11}$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	H	1	Total	C	O	0	0
			23	12	11		

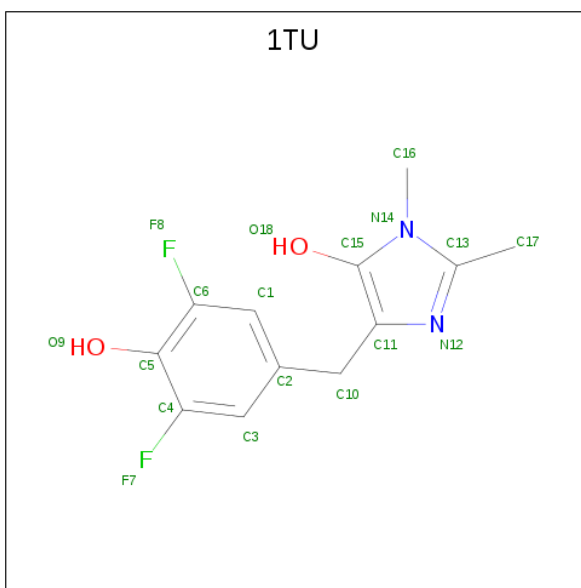
- Molecule 5 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	R	1	Total	K	0	0
			1	1		

- Molecule 6 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	R	1	Total	Mg	0	0
			1	1		

- Molecule 7 is 4-(3,5-difluoro-4-hydroxybenzyl)-1,2-dimethyl-1H-imidazol-5-ol (three-letter code: 1TU) (formula: C₁₂H₁₂F₂N₂O₂).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
7	R	1	Total	C	F	N	O	0	0
			18	12	2	2	2		

- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	H	161	Total	O	0	0
			161	161		

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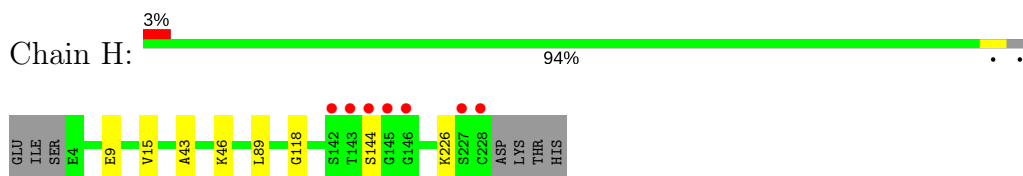
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	L	192	Total 192	O 192	0	0
8	R	113	Total 113	O 113	0	0

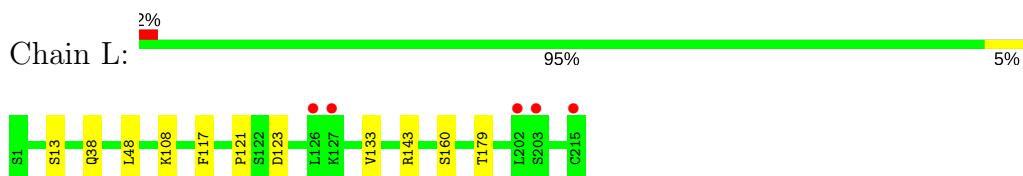
3 Residue-property plots [i](#)

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.

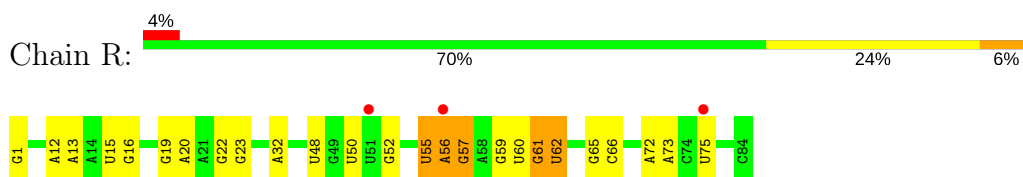
- Molecule 1: BL3-6 Fab antibody, heavy chain



- Molecule 2: BL3-6 Fab antibody, light chain



- Molecule 3: RNA (84-MER)



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	148.43Å 79.60Å 95.21Å 90.00° 111.65° 90.00°	Depositor
Resolution (Å)	46.69 – 2.19 46.69 – 2.19	Depositor EDS
% Data completeness (in resolution range)	98.0 (46.69-2.19) 90.0 (46.69-2.19)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.69 (at 2.18Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.8.2_1309)	Depositor
R, R_{free}	0.179 , 0.211 0.179 , 0.211	Depositor DCC
R_{free} test set	2000 reflections (3.81%)	wwPDB-VP
Wilson B-factor (Å ²)	36.0	Xtrriage
Anisotropy	0.404	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 48.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5645	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.61% 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, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GDP, MG, 1TU, SUC, K

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	H	0.44	0/1719	0.56	0/2339
2	L	0.44	0/1678	0.59	0/2277
3	R	0.43	0/2001	0.85	0/3121
All	All	0.44	0/5398	0.70	0/7737

There are no bond length outliers.

There are no bond angle outliers.

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	H	1678	0	1637	6	0
2	L	1643	0	1594	7	0
3	R	1815	0	910	16	0
4	H	23	0	22	0	0
5	R	1	0	0	0	0
6	R	1	0	0	0	0
7	R	18	0	10	1	0
8	H	161	0	0	0	0
8	L	192	0	0	0	0
8	R	113	0	0	0	0
All	All	5645	0	4173	27	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 (27) 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)
3:R:56:A:H3'	3:R:57:G:H4'	1.63	0.78
3:R:19:G:HO2'	3:R:20:A:H8	1.49	0.61
1:H:15:VAL:HG11	1:H:89:LEU:HD13	1.86	0.57
3:R:32:A:H61	3:R:48:U:H3	1.53	0.56
7:R:103:1TU:H2	7:R:103:1TU:N12	2.20	0.56
1:H:226:LYS:NZ	2:L:123:ASP:OD2	2.25	0.54
3:R:13:A:N7	3:R:72:A:H2	2.05	0.54
3:R:59:G:O2'	3:R:62:U:OP2	2.26	0.54
2:L:121:PRO:HD3	2:L:133:VAL:HG22	1.90	0.53
3:R:22:G:H1'	3:R:23:G:C8	2.44	0.53
3:R:52:G:OP2	3:R:52:G:H4'	2.11	0.49
2:L:38:GLN:HB2	2:L:48:LEU:HD11	1.94	0.48
3:R:50:U:H4'	3:R:52:G:H5''	1.96	0.47
3:R:15:U:H2'	3:R:16:G:H8	1.79	0.46
2:L:13:SER:HB3	2:L:108:LYS:HG2	1.99	0.45
3:R:65:G:H2'	3:R:66:C:O4'	2.17	0.44
3:R:61:G:H3'	3:R:61:G:N3	2.33	0.44
1:H:9:GLU:CD	1:H:118:GLY:H	2.21	0.43
1:H:144:SER:HB3	2:L:117:PHE:CE1	2.53	0.43
3:R:12:A:H2	3:R:73:A:N7	2.15	0.43
3:R:15:U:H2'	3:R:16:G:C8	2.54	0.43
1:H:43:ALA:HB3	1:H:46:LYS:HG3	1.99	0.43
3:R:56:A:H3'	3:R:57:G:C4'	2.43	0.42
3:R:32:A:N6	3:R:48:U:H3	2.16	0.41
3:R:22:G:C8	3:R:55:U:C6	3.08	0.41
1:H:144:SER:HB3	2:L:117:PHE:CZ	2.57	0.40
2:L:160:SER:HA	2:L:179:THR:O	2.22	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	H	223/232 (96%)	217 (97%)	6 (3%)	0	100	100
2	L	213/215 (99%)	208 (98%)	5 (2%)	0	100	100
All	All	436/447 (98%)	425 (98%)	11 (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	H	186/193 (96%)	186 (100%)	0	100	100
2	L	190/190 (100%)	189 (100%)	1 (0%)	90	95
All	All	376/383 (98%)	375 (100%)	1 (0%)	93	97

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	L	143	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
3	R	83/84 (98%)	7 (8%)	1 (1%)

All (7) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
3	R	55	U

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Mol	Chain	Res	Type
3	R	56	A
3	R	57	G
3	R	60	U
3	R	61	G
3	R	62	U
3	R	75	U

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
3	R	1	GDP

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

1 non-standard protein/DNA/RNA residue is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	GDP	R	1	3	25,30,30	1.49	4 (16%)	27,47,47	2.17	10 (37%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GDP	R	1	3	-	0/12/32/32	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	R	1	GDP	O4'-C1'	2.13	1.44	1.41
3	R	1	GDP	PB-O3A	3.23	1.65	1.60
3	R	1	GDP	C5-C4	3.41	1.48	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	R	1	GDP	C6-C5	4.62	1.49	1.41

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	R	1	GDP	C5-C6-N1	-3.76	118.12	123.47
3	R	1	GDP	C6-C5-C4	-3.57	117.34	120.85
3	R	1	GDP	C4-C5-N7	-3.22	106.30	109.41
3	R	1	GDP	N3-C2-N1	-2.97	123.06	127.41
3	R	1	GDP	PA-O3A-PB	-2.64	123.76	132.63
3	R	1	GDP	C2'-C3'-C4'	2.09	106.63	102.62
3	R	1	GDP	O5'-C5'-C4'	2.12	116.36	109.00
3	R	1	GDP	C4'-O4'-C1'	2.32	112.24	109.83
3	R	1	GDP	C6-N1-C2	4.22	122.13	116.06
3	R	1	GDP	C2-N3-C4	5.25	121.29	115.16

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	SUC	H	301	-	24,24,24	0.34	0	36,36,36	0.87	1 (2%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
7	1TU	R	103	-	17,19,19	2.88	4 (23%)	18,28,28	3.28	8 (44%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	SUC	H	301	-	-	0/12/51/51	0/2/2/2
7	1TU	R	103	-	-	0/4/4/4	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	R	103	1TU	C10-C11	-2.81	1.49	1.51
7	R	103	1TU	C15-N14	-2.33	1.33	1.36
7	R	103	1TU	C5-C4	7.08	1.48	1.39
7	R	103	1TU	C5-C6	8.05	1.49	1.39

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	R	103	1TU	C1-C6-C5	-6.30	118.73	123.71
7	R	103	1TU	C3-C4-C5	-6.17	118.84	123.71
4	H	301	SUC	C6-C5-C4	-3.12	105.61	112.99
7	R	103	1TU	C16-N14-C15	2.09	126.47	123.89
7	R	103	1TU	C2-C1-C6	3.09	121.18	119.32
7	R	103	1TU	C2-C3-C4	3.84	121.64	119.32
7	R	103	1TU	F7-C4-C5	4.33	120.45	117.11
7	R	103	1TU	C2-C10-C11	5.27	126.21	112.21
7	R	103	1TU	F8-C6-C5	5.38	121.27	117.11

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	R	103	1TU	1	0

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, 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	H	225/232 (96%)	0.26	7 (3%) 49 49	17, 29, 59, 96	0
2	L	215/215 (100%)	0.26	5 (2%) 60 60	14, 25, 42, 88	0
3	R	83/84 (98%)	-0.16	3 (3%) 42 43	18, 76, 106, 134	0
All	All	523/531 (98%)	0.20	15 (2%) 51 52	14, 28, 86, 134	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	L	215	CYS	9.3
1	H	142	SER	6.7
1	H	228	CYS	6.6
1	H	144	SER	6.5
1	H	143	THR	5.8
1	H	145	GLY	5.8
1	H	146	GLY	3.8
3	R	75	U	3.3
3	R	56	A	3.0
2	L	127	LYS	2.8
3	R	51	U	2.8
2	L	203	SER	2.3
2	L	126	LEU	2.1
2	L	202	LEU	2.1
1	H	227	SER	2.1

6.2 Non-standard residues in protein, DNA, RNA chains

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q < 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	GDP	R	1	28/28	0.71	0.31	68,86,98,108	0

6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
5	K	R	101	1/1	0.78	0.32	99,99,99,99	0
7	1TU	R	103	18/18	0.81	0.23	84,90,94,95	0
6	MG	R	102	1/1	0.93	0.08	31,31,31,31	0
4	SUC	H	301	23/23	0.98	0.11	18,21,26,29	0

6.5 Other polymers [i](#)

There are no such residues in this entry.