wwPDB X-ray Structure Validation Summary Report (i)

Sep 13, 2023 – 07:18 AM EDT

PDB ID	:	4QLC
Title	:	Crystal structure of chromatosome at 3.5 angstrom resolution
Authors	:	Jiang, J.S.; Zhou, B.R.; Xiao, T.S.; Bai, Y.W.
Deposited on	:	2014-06-11
Resolution	:	3.50 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (i)) were used in the production of this report:

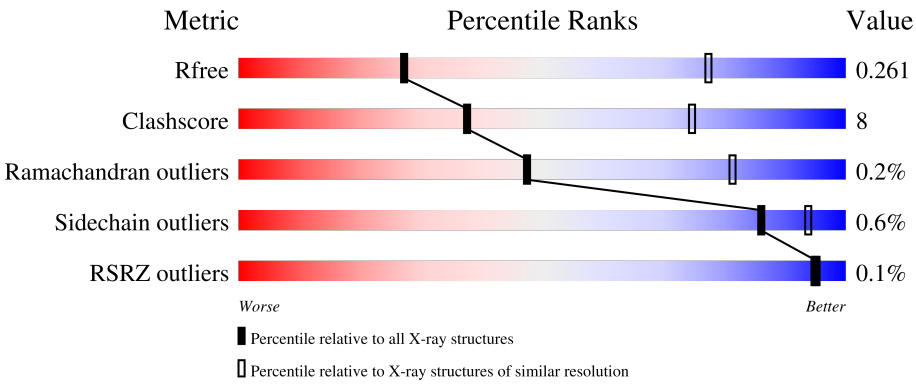
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.50 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	1659 (3.60-3.40)
Clashscore	141614	1036 (3.58-3.42)
Ramachandran outliers	138981	1005 (3.58-3.42)
Sidechain outliers	138945	1006 (3.58-3.42)
RSRZ outliers	127900	1559 (3.60-3.40)

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 of the lower bar indicate the fraction of residues that contain outliers for >=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 <=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	I	167	64% 35% ••
2	J	167	70% 27% ••
3	A	135	64% 9% 27%
3	E	135	61% 11% 27%
4	B	102	60% 17% 24%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
4	F	102	62% 17% 22%
5	C	123	73% 11% 15%
5	G	123	65% 20% 15%
6	D	122	% 61% 16% 24%
6	H	122	57% 20% 23%
7	U	77	81% 17% ••

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
8	CIT	G	201	-	-	-	X

2 Entry composition (i)

There are 8 unique types of molecules in this entry. The entry contains 13355 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 DNA chain called DNA (167-mer).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	I	166	3386	1607	616	997	166	0	0	0

- Molecule 2 is a DNA chain called DNA (167-mer).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	J	166	3421	1618	644	993	166	0	0	0

- Molecule 3 is a protein called Histone H3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	A	98	806	508	156	139	3	0	0	0
3	E	98	806	508	156	139	3	0	0	0

- Molecule 4 is a protein called Histone H4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	B	78	618	391	120	106	1	0	0	0
4	F	80	637	401	125	110	1	0	0	0

- Molecule 5 is a protein called Histone H2A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	C	104	798	503	155	139	1	0	0	0
5	G	104	794	500	154	139	1	0	0	0

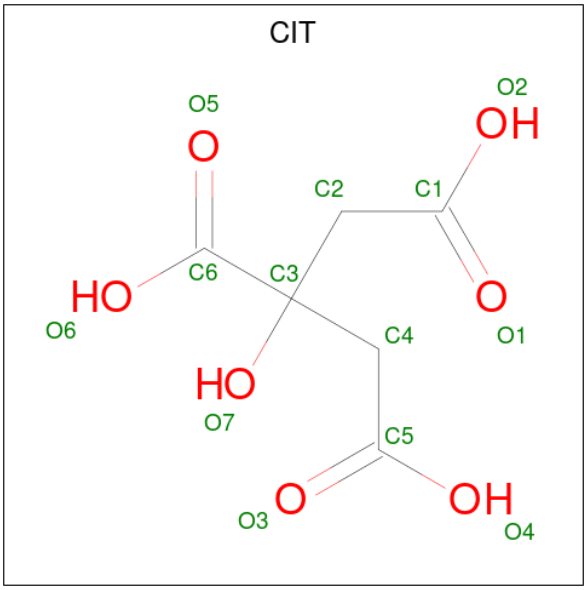
- Molecule 6 is a protein called Histone H2B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
6	D	93	732	462	131	137	2	0	0	0
			Total	C	N	O	S			
6	H	94	743	468	135	138	2	8	0	0

- Molecule 7 is a protein called H5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
7	U	76	575	358	113	103	1	0	0	0

- Molecule 8 is CITRIC ACID (three-letter code: CIT) (formula: $C_6H_8O_7$).



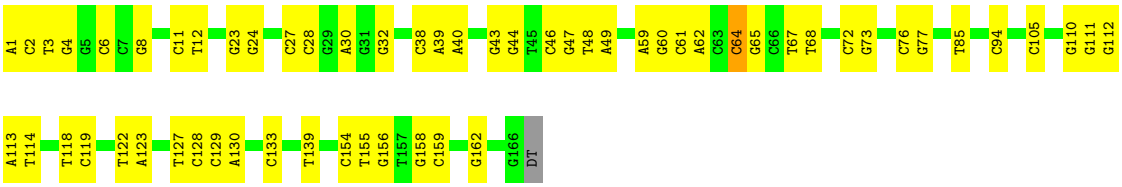
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
8	A	1	13	6	7	0	0
			Total	C	O		
8	G	1	13	6	7	0	0
			Total	C	O		
8	G	1	13	6	7	2	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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: DNA (167-mer)

Chain I:

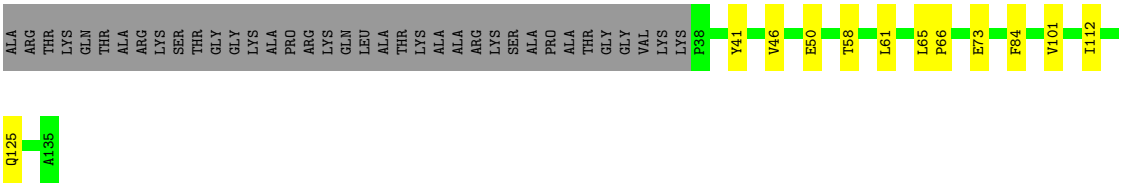


- Molecule 2: DNA (167-mer)

Chain J:

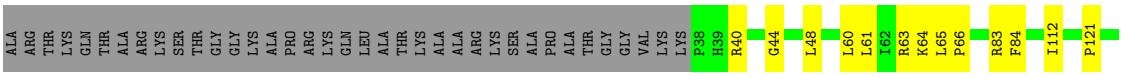
- Molecule 3: Histone H3

Chain A:



- Molecule 3: Histone H3

Chain E:

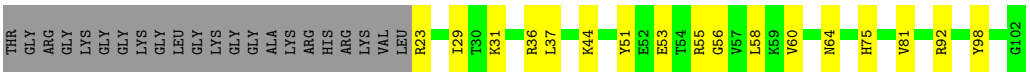


- Molecule 4: Histone H4

Chain B:

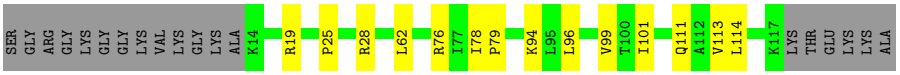
- Molecule 4: Histone H4

Chain F:



- Molecule 5: Histone H2A

Chain C:

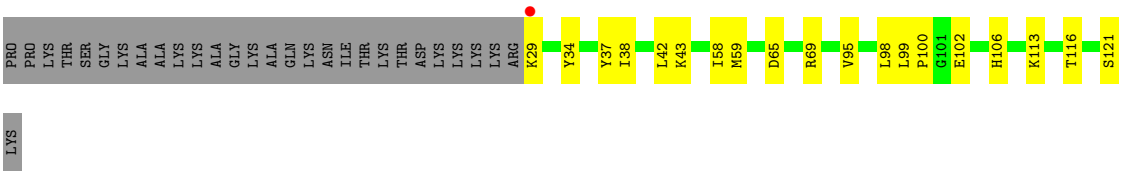


- Molecule 5: Histone H2A

Chain G:

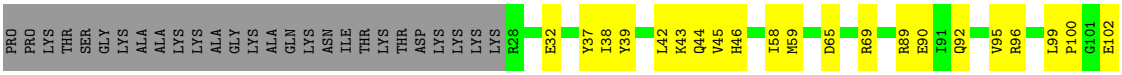
- Molecule 6: Histone H2B

Chain D:



- Molecule 6: Histone H2B

Chain H:



- Molecule 7: H5

Chain U:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α, β, γ	262.87Å 262.87Å 91.79Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.39 – 3.50 45.39 – 3.50	Depositor EDS
% Data completeness (in resolution range)	98.5 (45.39-3.50) 98.4 (45.39-3.50)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.09 (at 3.48Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1690)	Depositor
R, R_{free}	0.218 , 0.243 0.230 , 0.261	Depositor DCC
R_{free} test set	2263 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å^2)	95.2	Xtriage
Anisotropy	0.215	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 72.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.42$, $< L^2 > = 0.24$	Xtriage
Estimated twinning fraction	0.075 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	13355	wwPDB-VP
Average B, all atoms (Å^2)	113.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.25% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: CIT

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	I	0.51	0/3794	0.92	0/5849
2	J	0.52	0/3842	0.90	5/5932 (0.1%)
3	A	0.22	0/818	0.45	0/1097
3	E	0.22	0/818	0.46	0/1097
4	B	0.24	0/625	0.48	0/837
4	F	0.23	0/644	0.45	0/862
5	C	0.23	0/808	0.49	0/1090
5	G	0.23	0/804	0.47	0/1086
6	D	0.23	0/743	0.47	0/999
6	H	0.23	0/754	0.45	0/1013
7	U	0.29	0/582	0.61	0/775
All	All	0.41	0/14232	0.76	5/20637 (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	I	0	1

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	J	78	DG	O4'-C4'-C3'	-6.87	101.75	104.50
2	J	100	DA	O4'-C1'-N9	6.58	112.61	108.00
2	J	1	DA	O4'-C1'-N9	5.71	112.00	108.00
2	J	99	DT	O4'-C1'-N1	5.66	111.96	108.00
2	J	108	DC	O4'-C1'-N1	5.13	111.59	108.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	I	64	DC	Sidechain

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	I	3386	0	1863	51	0
2	J	3421	0	1861	45	0
3	A	806	0	844	12	0
3	E	806	0	844	15	0
4	B	618	0	659	14	0
4	F	637	0	676	15	0
5	C	798	0	848	16	0
5	G	794	0	840	29	0
6	D	732	0	759	13	0
6	H	743	0	772	22	0
7	U	575	0	607	13	0
8	A	13	0	5	0	0
8	G	26	0	10	1	0
All	All	13355	0	10588	175	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 8.

The worst 5 of 175 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)
2:J:99:DT:H2"	2:J:100:DA:C8	2.14	0.82
1:I:154:DC:H5"	3:A:41:TYR:HA	1.70	0.74
1:I:122:DT:H4'	5:G:41:ARG:HE	1.54	0.73
1:I:162:DG:N2	2:J:6:DC:N3	2.39	0.71
1:I:48:DT:H2"	1:I:49:DA:C8	2.26	0.71

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	
3	A	96/135 (71%)	94 (98%)	2 (2%)	0	100	100
3	E	96/135 (71%)	92 (96%)	4 (4%)	0	100	100
4	B	76/102 (74%)	74 (97%)	2 (3%)	0	100	100
4	F	78/102 (76%)	75 (96%)	3 (4%)	0	100	100
5	C	102/123 (83%)	100 (98%)	2 (2%)	0	100	100
5	G	102/123 (83%)	101 (99%)	1 (1%)	0	100	100
6	D	91/122 (75%)	90 (99%)	1 (1%)	0	100	100
6	H	92/122 (75%)	91 (99%)	1 (1%)	0	100	100
7	U	74/77 (96%)	67 (90%)	5 (7%)	2 (3%)	5	33
All	All	807/1041 (78%)	784 (97%)	21 (3%)	2 (0%)	47	81

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
7	U	43	GLY
7	U	42	ARG

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	
3	A	85/110 (77%)	85 (100%)	0	100	100
3	E	85/110 (77%)	85 (100%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
4	B	63/78 (81%)	63 (100%)	0	100	100
4	F	65/78 (83%)	64 (98%)	1 (2%)	65	84
5	C	81/93 (87%)	81 (100%)	0	100	100
5	G	80/93 (86%)	80 (100%)	0	100	100
6	D	80/103 (78%)	80 (100%)	0	100	100
6	H	81/103 (79%)	81 (100%)	0	100	100
7	U	59/60 (98%)	56 (95%)	3 (5%)	24	57
All	All	679/828 (82%)	675 (99%)	4 (1%)	86	94

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	F	92	ARG
7	U	42	ARG
7	U	60	VAL
7	U	93	PHE

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

Mol	Chain	Res	Type
5	C	23	GLN
7	U	51	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

3 ligands are 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	$\#\|Z\| > 2$
8	CIT	A	201	-	12,12,12	1.03	0	17,17,17	1.55	1 (5%)
8	CIT	G	201	-	12,12,12	1.02	0	17,17,17	1.50	1 (5%)
8	CIT	G	202	-	12,12,12	1.03	0	17,17,17	1.51	1 (5%)

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
8	CIT	A	201	-	-	10/16/16/16	-
8	CIT	G	201	-	-	8/16/16/16	-
8	CIT	G	202	-	-	9/16/16/16	-

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
8	A	201	CIT	O6-C6-C3	4.08	120.14	113.05
8	G	201	CIT	O6-C6-C3	4.06	120.10	113.05
8	G	202	CIT	O6-C6-C3	4.00	120.00	113.05

There are no chirality outliers.

5 of 27 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	A	201	CIT	C2-C3-C6-O5
8	A	201	CIT	C2-C3-C6-O6
8	A	201	CIT	O7-C3-C6-O5

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms
8	A	201	CIT	O7-C3-C6-O6
8	G	201	CIT	O7-C3-C6-O5

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	G	202	CIT	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 (i)

6.1 Protein, DNA and RNA chains (i)

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	I	166/167 (99%)	-0.59	0	100	100	72, 143, 173, 180	0
2	J	166/167 (99%)	-0.55	0	100	100	65, 147, 181, 206	0
3	A	98/135 (72%)	-0.45	0	100	100	41, 63, 106, 135	0
3	E	98/135 (72%)	-0.33	0	100	100	43, 82, 132, 153	0
4	B	78/102 (76%)	-0.39	0	100	100	35, 65, 103, 156	0
4	F	80/102 (78%)	-0.39	0	100	100	58, 77, 116, 156	0
5	C	104/123 (84%)	-0.22	0	100	100	58, 86, 134, 148	0
5	G	104/123 (84%)	-0.36	0	100	100	53, 78, 123, 147	0
6	D	93/122 (76%)	-0.28	1 (1%)	80	75	65, 93, 128, 158	0
6	H	94/122 (77%)	-0.26	0	100	100	50, 90, 132, 170	1 (1%)
7	U	76/77 (98%)	-0.33	0	100	100	61, 94, 133, 143	1 (1%)
All	All	1157/1375 (84%)	-0.40	1 (0%)	95	95	35, 92, 167, 206	2 (0%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
6	D	29	LYS	2.8

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 monosaccharides 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(Å^2)	Q<0.9
8	CIT	G	201	13/13	0.74	0.42	108,149,164,165	0
8	CIT	A	201	13/13	0.87	0.24	106,128,148,151	0
8	CIT	G	202	13/13	0.87	0.30	88,101,110,121	7

6.5 Other polymers (i)

There are no such residues in this entry.