Full wwPDB X-ray Structure Validation Report (i)

Feb 1, 2016 – 03:08 PM GMT

PDB ID	:	4BLR
Title	:	P4 PROTEIN FROM BACTERIOPHAGE PHI12 IN COMPLEX WITH UTP
Authors	:	El Omari, K.; Meier, C.; Kainov, D.; Sutton, G.; Grimes, J.M.; Poranen, M.M.; Bamford, D.H.; Tuma, R.; Stuart, D.I.; Mancini, E.J.
Deposited on	:	2013-05-04
Resolution	:	1.90 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

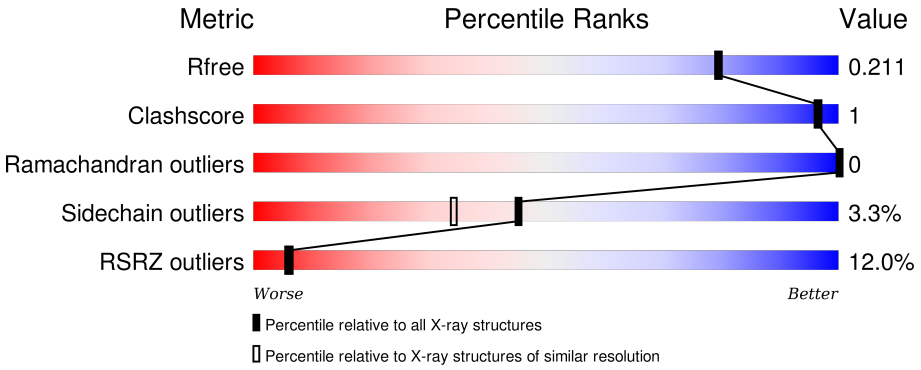
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 1.90 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	4755 (1.90-1.90)
Clashscore	102246	5398 (1.90-1.90)
Ramachandran outliers	100387	5338 (1.90-1.90)
Sidechain outliers	100360	5339 (1.90-1.90)
RSRZ outliers	91569	4766 (1.90-1.90)

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 <=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	331	9% 84% 6% 10%
1	B	331	11% 85% • 10%
1	C	331	12% 85% 5% • 9%

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
2	UTP	A	400	-	-	-	X
3	DTT	A	401	-	-	-	X

2 Entry composition

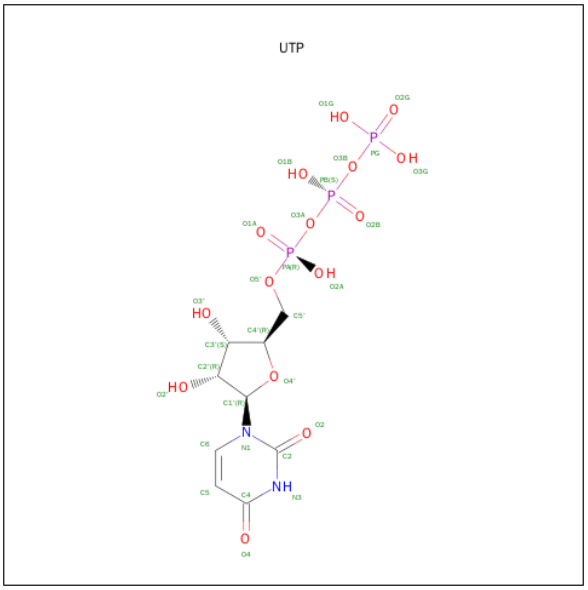
There are 4 unique types of molecules in this entry. The entry contains 7508 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 NTPASE P4.

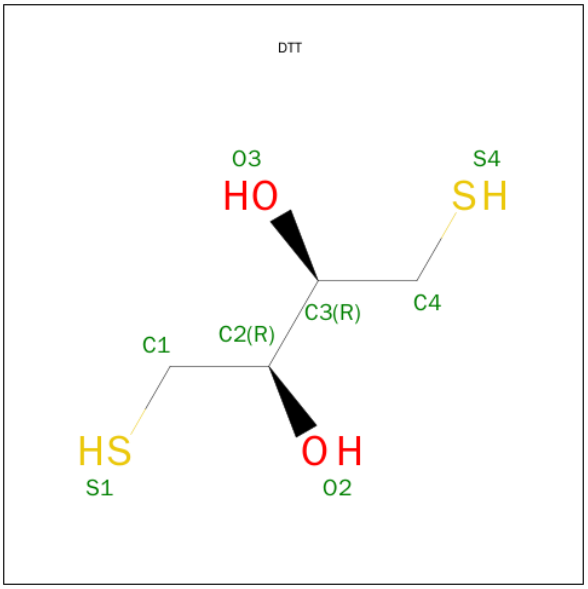
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	297	Total	C	N	O	S	0	0	0
			2251	1415	394	435	7			
1	B	297	Total	C	N	O	S	0	0	0
			2251	1415	394	435	7			
1	C	300	Total	C	N	O	S	0	0	0
			2271	1427	398	439	7			

- Molecule 2 is URIDINE 5'-TRIPHOSPHATE (three-letter code: UTP) (formula: $C_9H_{15}N_2O_{15}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			29	9	2	15	3		
2	B	1	Total	C	N	O	P	0	0
			29	9	2	15	3		
2	C	1	Total	C	N	O	P	0	0
			29	9	2	15	3		

- Molecule 3 is 2,3-DIHYDROXY-1,4-DITHIOBUTANE (three-letter code: DTT) (formula: $C_4H_{10}O_2S_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	O	S	0	0
			8	4	2	2		

- Molecule 4 is water.

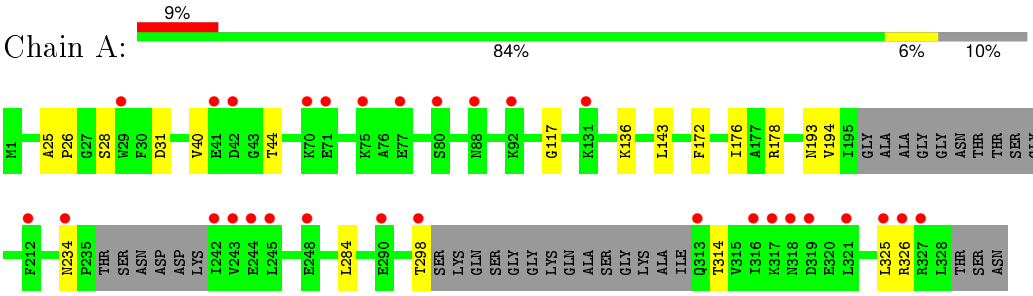
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	230	Total	O	0	0
			230	230		
4	B	216	Total	O	0	0
			216	216		
4	C	194	Total	O	0	0
			194	194		

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 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.

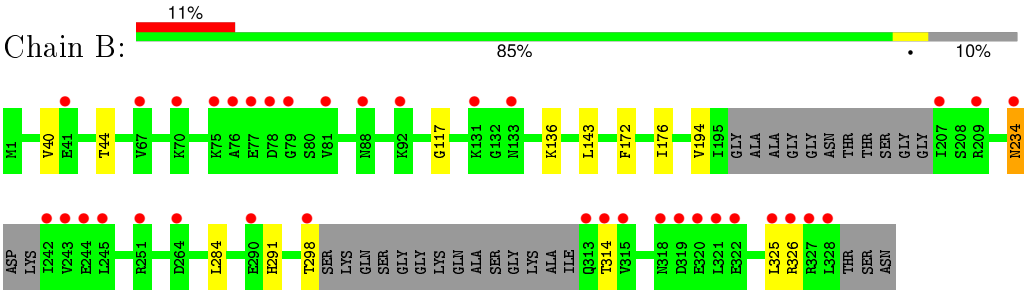
- Molecule 1: NTPASE P4

Chain A:



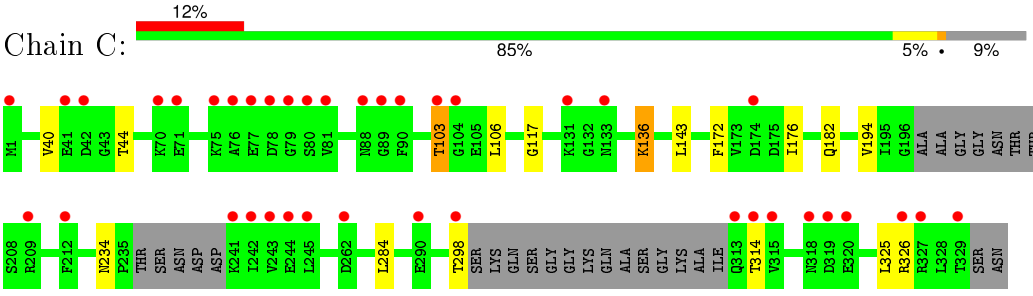
- Molecule 1: NTPASE P4

Chain B:



- Molecule 1: NTPASE P4

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α, β, γ	105.39Å 129.33Å 159.07Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.96 – 1.90 19.95 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.6 (19.96-1.90) 99.7 (19.95-1.90)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.89 (at 1.90Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.193 , 0.204 0.199 , 0.211	Depositor DCC
R_{free} test set	4263 reflections (5.26%)	DCC
Wilson B-factor (Å^2)	20.9	Xtriage
Anisotropy	0.181	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 50.6	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.51$, $< L^2 > = 0.34$	Xtriage
Outliers	1 of 85262 reflections (0.001%)	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	7508	wwPDB-VP
Average B, all atoms (Å^2)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.05% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: UTP, DTT

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	0.28	0/2286	0.52	0/3092
1	B	0.28	0/2286	0.52	0/3092
1	C	0.28	0/2306	0.52	0/3118
All	All	0.28	0/6878	0.52	0/9302

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

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	2251	0	2244	8	0
1	B	2251	0	2244	5	0
1	C	2271	0	2267	6	0
2	A	29	0	11	0	0
2	B	29	0	11	0	0
2	C	29	0	11	0	0
3	A	8	0	10	2	0
4	A	230	0	0	2	0
4	B	216	0	0	1	0
4	C	194	0	0	2	0
All	All	7508	0	6798	19	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 1.

All (19) 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:103:THR:HG22	1:C:106:LEU:O	1.83	0.79
1:A:178:ARG:NH1	4:A:2178:HOH:O	2.13	0.78
1:A:193:ASN:ND2	4:A:2169:HOH:O	2.19	0.60
1:A:31:ASP:OD2	3:A:401:DTT:S1	2.64	0.55
1:B:40:VAL:CG1	1:B:44:THR:HB	2.39	0.53
1:C:40:VAL:CG1	1:C:44:THR:HB	2.39	0.52
1:A:40:VAL:CG1	1:A:44:THR:HB	2.39	0.52
1:C:136:LYS:HE3	4:C:2120:HOH:O	2.11	0.51
1:A:26:PRO:O	3:A:401:DTT:S4	2.68	0.49
1:C:172:PHE:CZ	1:C:176:ILE:HD11	2.49	0.48
1:A:172:PHE:CZ	1:A:176:ILE:HD11	2.49	0.47
1:B:172:PHE:CZ	1:B:176:ILE:HD11	2.50	0.47
1:A:117:GLY:HA2	1:A:298:THR:HG23	1.98	0.45
1:B:117:GLY:HA2	1:B:298:THR:HG23	1.98	0.45
1:A:25:ALA:HB3	1:A:28:SER:OG	2.17	0.45
1:C:182:GLN:NE2	4:C:2155:HOH:O	2.49	0.45
1:C:117:GLY:HA2	1:C:298:THR:HG23	1.99	0.44
1:B:136:LYS:HD2	1:B:234:ASN:OD1	2.18	0.44
1:B:291:HIS:HA	4:B:2209:HOH:O	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	289/331 (87%)	288 (100%)	1 (0%)	0	100	100
1	B	289/331 (87%)	288 (100%)	1 (0%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	292/331 (88%)	290 (99%)	2 (1%)	0	100	100
All	All	870/993 (88%)	866 (100%)	4 (0%)	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	243/265 (92%)	235 (97%)	8 (3%)	45	34
1	B	243/265 (92%)	236 (97%)	7 (3%)	50	40
1	C	245/265 (92%)	236 (96%)	9 (4%)	41	29
All	All	731/795 (92%)	707 (97%)	24 (3%)	45	34

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	136	LYS
1	A	143	LEU
1	A	194	VAL
1	A	234	ASN
1	A	284	LEU
1	A	314	THR
1	A	325	LEU
1	A	326	ARG
1	B	143	LEU
1	B	194	VAL
1	B	234	ASN
1	B	284	LEU
1	B	314	THR
1	B	325	LEU
1	B	326	ARG
1	C	103	THR
1	C	136	LYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	C	143	LEU
1	C	194	VAL
1	C	234	ASN
1	C	284	LEU
1	C	314	THR
1	C	325	LEU
1	C	326	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	32	HIS
1	A	95	HIS
1	A	318	ASN
1	B	95	HIS
1	B	182	GLN
1	B	318	ASN
1	C	95	HIS
1	C	182	GLN
1	C	318	ASN

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)

4 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	$\#\|Z\| > 2$
2	UTP	A	400	-	20,30,30	0.70	0	30,47,47	1.63	3 (10%)
3	DTT	A	401	-	7,7,7	0.46	0	4,8,8	0.95	0
2	UTP	B	400	-	20,30,30	0.72	0	30,47,47	1.58	2 (6%)
2	UTP	C	400	-	20,30,30	0.68	0	30,47,47	1.62	3 (10%)

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
2	UTP	A	400	-	-	0/18/38/38	0/2/2/2
3	DTT	A	401	-	-	0/8/8/8	0/0/0/0
2	UTP	B	400	-	-	0/18/38/38	0/2/2/2
2	UTP	C	400	-	-	0/18/38/38	0/2/2/2

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	400	UTP	PB-O3A-PA	-2.92	124.54	132.73
2	B	400	UTP	PB-O3A-PA	-2.73	125.05	132.73
2	C	400	UTP	PB-O3A-PA	-2.65	125.30	132.73
2	A	400	UTP	PB-O3B-PG	-2.49	124.32	132.67
2	C	400	UTP	PB-O3B-PG	-2.23	125.20	132.67
2	A	400	UTP	C4-N3-C2	6.61	120.69	114.14
2	B	400	UTP	C4-N3-C2	6.62	120.70	114.14
2	C	400	UTP	C4-N3-C2	6.66	120.74	114.14

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	401	DTT	2	0

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, 95^{th} 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	297/331 (89%)	0.56	31 (10%)	8 9	12, 21, 47, 64	0
1	B	297/331 (89%)	0.60	36 (12%)	6 6	13, 21, 49, 59	0
1	C	300/331 (90%)	0.69	40 (13%)	4 5	14, 22, 49, 65	0
All	All	894/993 (90%)	0.62	107 (11%)	6 6	12, 21, 48, 65	0

All (107) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	207	ILE	7.4
1	A	242	ILE	6.6
1	B	207	ILE	6.6
1	C	329	THR	6.5
1	B	326	ARG	6.2
1	A	207	ILE	6.1
1	A	326	ARG	6.0
1	A	243	VAL	5.8
1	B	313	GLN	5.8
1	C	41	GLU	5.5
1	B	242	ILE	5.4
1	A	313	GLN	5.3
1	A	245	LEU	5.2
1	B	243	VAL	5.2
1	C	77	GLU	5.0
1	C	76	ALA	4.9
1	C	241	LYS	4.8
1	C	75	LYS	4.4
1	A	319	ASP	4.3
1	C	103	THR	4.3
1	A	244	GLU	4.3
1	B	76	ALA	4.1
1	C	42	ASP	4.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	78	ASP	4.0
1	C	243	VAL	4.0
1	B	41	GLU	3.9
1	A	298	THR	3.9
1	A	41	GLU	3.9
1	B	244	GLU	3.9
1	C	313	GLN	3.8
1	C	326	ARG	3.8
1	B	245	LEU	3.6
1	C	315	VAL	3.5
1	C	242	ILE	3.5
1	B	75	LYS	3.5
1	A	42	ASP	3.4
1	C	88	ASN	3.4
1	B	318	ASN	3.4
1	C	298	THR	3.3
1	C	212	PHE	3.3
1	A	77	GLU	3.3
1	C	318	ASN	3.3
1	B	131	LYS	3.2
1	B	325	LEU	3.2
1	C	104	GLY	3.1
1	A	317	LYS	3.1
1	B	290	GLU	3.1
1	C	78	ASP	3.1
1	B	234	ASN	3.0
1	C	319	ASP	2.9
1	B	298	THR	2.9
1	B	77	GLU	2.9
1	B	319	ASP	2.8
1	C	81	VAL	2.8
1	A	325	LEU	2.8
1	C	70	LYS	2.8
1	C	209	ARG	2.8
1	C	327	ARG	2.8
1	C	80	SER	2.8
1	B	264	ASP	2.7
1	A	29	TRP	2.7
1	C	314	THR	2.7
1	B	328	LEU	2.7
1	B	88	ASN	2.7
1	B	321	LEU	2.7

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	79	GLY	2.6
1	C	90	PHE	2.6
1	A	75	LYS	2.5
1	A	131	LYS	2.5
1	B	315	VAL	2.4
1	B	209	ARG	2.4
1	A	248	GLU	2.4
1	A	318	ASN	2.4
1	B	314	THR	2.4
1	A	327	ARG	2.4
1	C	133	ASN	2.4
1	A	212	PHE	2.4
1	A	92	LYS	2.3
1	A	88	ASN	2.3
1	B	70	LYS	2.3
1	C	131	LYS	2.3
1	A	290	GLU	2.3
1	C	320	GLU	2.3
1	A	321	LEU	2.3
1	B	81	VAL	2.3
1	A	316	ILE	2.3
1	B	320	GLU	2.2
1	A	70	LYS	2.2
1	B	251	ARG	2.2
1	C	1	MET	2.2
1	C	89	GLY	2.2
1	C	245	LEU	2.2
1	C	79	GLY	2.2
1	A	209	ARG	2.2
1	A	234	ASN	2.1
1	C	71	GLU	2.1
1	B	92	LYS	2.1
1	C	244	GLU	2.1
1	B	327	ARG	2.1
1	A	80	SER	2.1
1	C	262	ASP	2.0
1	B	67	VAL	2.0
1	B	133	ASN	2.0
1	A	71	GLU	2.0
1	B	322	GLU	2.0
1	C	290	GLU	2.0
1	C	174	ASP	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)

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95^{th} 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	LLDF	B-factors(Å^2)	Q<0.9
3	DTT	A	401	8/8	0.48	0.34	13.93	36,39,41,44	0
2	UTP	A	400	29/29	0.73	0.30	2.26	45,48,54,55	0
2	UTP	C	400	29/29	0.83	0.26	1.51	38,40,45,46	0
2	UTP	B	400	29/29	0.76	0.28	1.36	41,45,48,49	0

6.5 Other polymers (i)

There are no such residues in this entry.