



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2018 – 05:42 pm GMT

PDB ID : 2GDI
Title : Crystal structure of thiamine pyrophosphate-specific riboswitch in complex with thiamine pyrophosphate
Authors : Serganov, A.
Deposited on : 2006-03-16
Resolution : 2.05 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

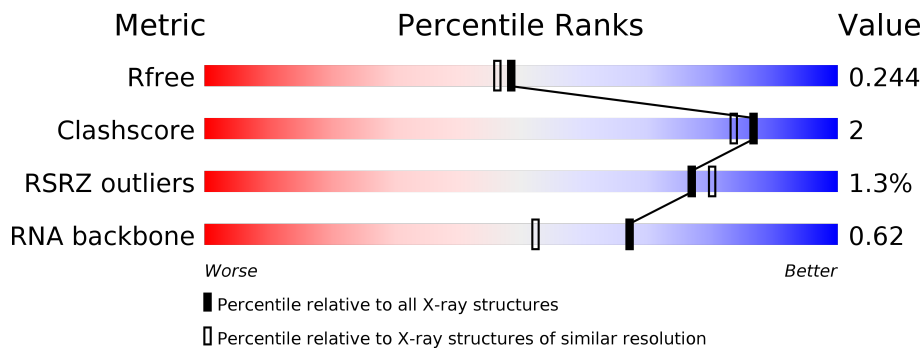
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.05 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	1449 (2.04-2.04)
Clashscore	122126	1524 (2.04-2.04)
RSRZ outliers	108989	1429 (2.04-2.04)
RNA backbone	2636	1046 (2.60-1.48)

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	X	80	
1	Y	80	

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 3817 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 RNA chain called TPP riboswitch.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	X	80	1719	763	308	566	82	0	0	0
1	Y	80	1723	763	308	569	83	0	0	0

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	X	2	Total	Na	0	0
			2	2		

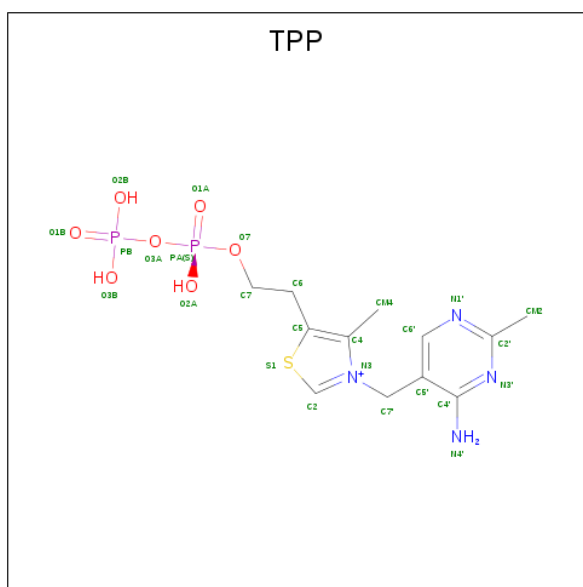
- Molecule 3 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	X	3	Total	K	0	0
			3	3		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	X	3	Total	Mg	0	0
			3	3		
4	Y	3	Total	Mg	0	0
			3	3		

- Molecule 5 is THIAMINE DIPHOSPHATE (three-letter code: TPP) (formula: C₁₂H₁₉N₄O₇P₂S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	N	O	P			S
5	X	1	26	12	4	7	2	1	0	0
5	Y	1	26	12	4	7	2	1	0	0

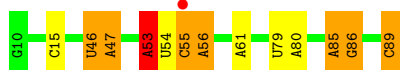
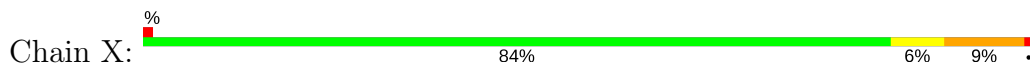
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	X	191	Total	O	0	0
			191	191		
6	Y	121	Total	O	0	0
			121	121		

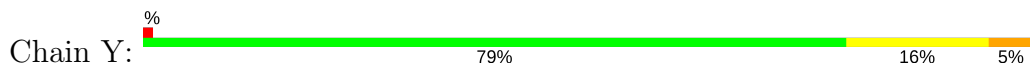
3 Residue-property plots [i](#)

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: TPP riboswitch



- Molecule 1: TPP riboswitch



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	148.82Å 29.56Å 95.17Å 90.00° 94.55° 90.00°	Depositor
Resolution (Å)	20.00 – 2.05 19.57 – 2.04	Depositor EDS
% Data completeness (in resolution range)	99.8 (20.00-2.05) 99.2 (19.57-2.04)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.80 (at 2.04Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.208 , 0.241 0.209 , 0.244	Depositor DCC
R_{free} test set	1353 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	36.9	Xtrriage
Anisotropy	0.309	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 39.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3817	wwPDB-VP
Average B, all atoms (Å ²)	35.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.59% 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: MG, NA, K, GTP, TPP, CCC

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	X	0.42	0/1865	0.93	2/2906 (0.1%)
1	Y	0.40	0/1865	0.89	1/2906 (0.0%)
All	All	0.41	0/3730	0.91	3/5812 (0.1%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	X	86	G	C4'-C3'-C2'	-5.88	96.72	102.60
1	Y	86	G	C4'-C3'-C2'	-5.33	97.27	102.60
1	X	53	A	C1'-O4'-C4'	-5.33	105.64	109.90

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	X	1719	0	858	5	0
1	Y	1723	0	861	5	0
2	X	2	0	0	0	0
3	X	3	0	0	0	0
4	X	3	0	0	0	0
4	Y	3	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	X	26	0	16	1	0
5	Y	26	0	16	1	0
6	X	191	0	0	0	0
6	Y	121	0	0	0	0
All	All	3817	0	1751	12	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 2.

All (12) 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:Y:46:U:H4'	1:Y:47:A:O5'	1.73	0.88
1:X:46:U:H4'	1:X:47:A:O5'	1.92	0.70
1:X:55:C:O2'	1:X:56:A:H5'	1.97	0.64
1:X:85:A:H1'	1:X:86:G:C8	2.44	0.53
1:Y:58:C:H2'	1:Y:59:U:H6	1.76	0.51
5:X:100:TPP:C2	5:X:100:TPP:H6'	2.42	0.49
1:Y:79:U:H4'	1:Y:80:A:OP2	2.13	0.48
1:Y:58:C:H2'	1:Y:59:U:C6	2.49	0.47
1:X:53:A:N3	1:X:53:A:H2'	2.31	0.45
5:Y:100:TPP:H6'	5:Y:100:TPP:C2	2.48	0.43
1:X:89:CCC:O1C	1:X:89:CCC:H4'	2.19	0.41
1:Y:53:A:H2'	1:Y:53:A:N3	2.35	0.41

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein molecules in this entry.

5.3.2 Protein sidechains [i](#)

There are no protein molecules in this entry.

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	X	78/80 (97%)	11 (14%)	4 (5%)
1	Y	78/80 (97%)	12 (15%)	4 (5%)
All	All	156/160 (97%)	23 (14%)	8 (5%)

All (23) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	X	15	C
1	X	46	U
1	X	47	A
1	X	54	U
1	X	55	C
1	X	56	A
1	X	61	A
1	X	79	U
1	X	80	A
1	X	85	A
1	X	89	CCC
1	Y	15	C
1	Y	24	C
1	Y	43	A
1	Y	44	A
1	Y	45	A
1	Y	46	U
1	Y	47	A
1	Y	55	C
1	Y	56	A
1	Y	61	A
1	Y	85	A
1	Y	86	G

All (8) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	X	46	U
1	X	53	A
1	X	54	U
1	X	79	U
1	Y	43	A
1	Y	44	A
1	Y	46	U
1	Y	53	A

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

4 non-standard protein/DNA/RNA residues 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
1	GTP	X	10	1	25,30,34	1.55	3 (12%)	27,47,54	2.37	5 (18%)
1	CCC	X	89	1	16,25,26	0.84	0	19,38,41	1.72	3 (15%)
1	GTP	Y	10	1	27,34,34	1.03	1 (3%)	29,54,54	2.23	5 (17%)
1	CCC	Y	89	1	16,25,26	0.85	0	19,38,41	1.76	5 (26%)

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
1	GTP	X	10	1	-	0/12/32/38	0/3/3/3
1	CCC	X	89	1	-	0/3/35/36	0/3/3/3
1	GTP	Y	10	1	-	0/18/38/38	0/3/3/3
1	CCC	Y	89	1	-	0/3/35/36	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	X	10	GTP	PB-O3A	-5.62	1.51	1.60
1	X	10	GTP	C8-N7	-2.05	1.30	1.34
1	Y	10	GTP	C6-N1	3.78	1.39	1.33
1	X	10	GTP	C6-N1	3.78	1.39	1.33

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	Y	10	GTP	C5-C6-N1	-8.23	111.76	123.47
1	X	10	GTP	C5-C6-N1	-8.09	111.97	123.47
1	X	89	CCC	O3'-C3'-C2'	-3.96	97.66	105.13

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	Y	89	CCC	O3'-C3'-C2'	-3.69	98.18	105.13
1	Y	10	GTP	PB-O3B-PG	-3.38	121.28	132.63
1	Y	10	GTP	C2-N3-C4	-2.86	111.82	115.16
1	X	10	GTP	C2-N3-C4	-2.53	112.21	115.16
1	Y	89	CCC	O3'-PC-O1C	-2.44	109.31	115.76
1	Y	10	GTP	N3-C2-N1	-2.36	123.94	127.41
1	X	10	GTP	N3-C2-N1	-2.34	123.98	127.41
1	X	89	CCC	O2'-PC-O1C	-2.29	109.72	115.76
1	Y	89	CCC	O2'-PC-O1C	-2.21	109.94	115.76
1	Y	89	CCC	O4'-C1'-N1	2.54	113.10	108.05
1	Y	89	CCC	O2C-PC-O1C	3.61	121.54	109.89
1	X	89	CCC	O2C-PC-O1C	3.81	122.20	109.89
1	X	10	GTP	PA-O3A-PB	5.16	149.97	132.63
1	X	10	GTP	C6-N1-C2	5.98	124.67	116.06
1	Y	10	GTP	C6-N1-C2	6.12	124.87	116.06

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
1	X	89	CCC	1	0

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 13 ligands modelled in this entry, 11 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
5	TPP	X	100	4	21,27,27	1.19	2 (9%)	26,40,40	2.32	7 (26%)
5	TPP	Y	100	4	21,27,27	1.15	3 (14%)	26,40,40	2.56	9 (34%)

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
5	TPP	X	100	4	-	0/16/17/17	0/2/2/2
5	TPP	Y	100	4	-	0/16/17/17	0/2/2/2

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	X	100	TPP	C4-N3	-3.58	1.36	1.39
5	Y	100	TPP	C4-N3	-3.27	1.36	1.39
5	X	100	TPP	C5'-C4'	-2.28	1.39	1.42
5	Y	100	TPP	C5'-C4'	-2.25	1.39	1.42
5	Y	100	TPP	PB-O3A	2.14	1.63	1.60

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	Y	100	TPP	PA-O3A-PB	-3.86	119.64	132.63
5	X	100	TPP	N1'-C2'-N3'	-2.82	120.58	125.55
5	Y	100	TPP	N1'-C2'-N3'	-2.79	120.63	125.55
5	Y	100	TPP	C5'-C6'-N1'	-2.38	119.80	123.83
5	X	100	TPP	C5'-C6'-N1'	-2.17	120.16	123.83
5	Y	100	TPP	C5'-C7'-N3	-2.12	109.78	113.33
5	X	100	TPP	C6'-C5'-C4'	2.14	118.69	115.72
5	X	100	TPP	C5-C4-N3	2.24	112.06	107.57
5	Y	100	TPP	C6'-C5'-C4'	2.30	118.90	115.72
5	Y	100	TPP	CM2-C2'-N1'	2.35	119.68	117.07
5	Y	100	TPP	C5-C4-N3	2.44	112.46	107.57
5	X	100	TPP	C6'-N1'-C2'	2.53	120.36	115.95
5	X	100	TPP	CM2-C2'-N1'	2.53	119.88	117.07
5	Y	100	TPP	C6'-N1'-C2'	2.70	120.66	115.95
5	X	100	TPP	C6-C5-C4	8.94	134.61	127.43
5	Y	100	TPP	C6-C5-C4	9.46	135.02	127.43

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	X	100	TPP	1	0
5	Y	100	TPP	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	X	78/80 (97%)	-0.22	1 (1%) 77 80	27, 34, 48, 62	0
1	Y	78/80 (97%)	-0.14	1 (1%) 77 80	28, 33, 44, 56	0
All	All	156/160 (97%)	-0.18	2 (1%) 77 80	27, 34, 45, 62	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	X	55	C	5.6
1	Y	55	C	4.7

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	GTP	Y	10	32/32	0.85	0.23	37,39,51,52	0
1	CCC	X	89	23/24	0.87	0.19	35,37,39,40	0
1	GTP	X	10	28/32	0.88	0.17	29,33,42,42	0
1	CCC	Y	89	23/24	0.94	0.12	32,33,35,35	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(Å ²)	Q<0.9
4	MG	Y	112	1/1	0.68	0.15	31,31,31,31	0
4	MG	X	102	1/1	0.73	0.22	34,34,34,34	0
4	MG	Y	113	1/1	0.74	0.18	38,38,38,38	0
4	MG	X	101	1/1	0.89	0.20	32,32,32,32	0
4	MG	Y	111	1/1	0.89	0.15	32,32,32,32	0
2	NA	X	122	1/1	0.92	0.16	36,36,36,36	0
5	TPP	Y	100	26/26	0.93	0.19	23,31,38,40	0
4	MG	X	103	1/1	0.93	0.09	42,42,42,42	0
3	K	X	125	1/1	0.94	0.12	39,39,39,39	0
2	NA	X	121	1/1	0.95	0.22	40,40,40,40	0
5	TPP	X	100	26/26	0.95	0.19	25,32,34,34	0
3	K	X	123	1/1	0.97	0.07	38,38,38,38	0
3	K	X	124	1/1	0.99	0.10	39,39,39,39	0

6.5 Other polymers [i](#)

There are no such residues in this entry.