



wwPDB X-ray Structure Validation Summary Report i

May 6, 2014 – 11:32 AM EDT

PDB ID : 4O0M
Title : Crystal structure of T. Elongatus BP-1 Clock Protein KaiC
Authors : Pattanayek, R.; Egli, M.
Deposited on : 2013-12-13
Resolution : 2.84 Å(reported)

This is a wwPDB validation summary 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/ValidationPDFNotes.html>

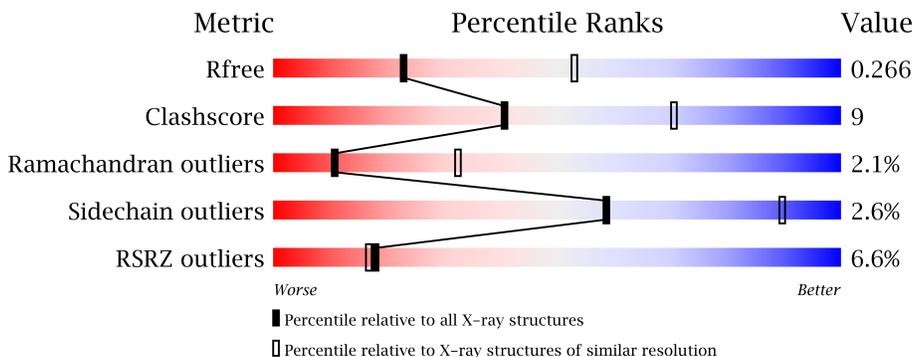
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.16 November 2013
Xtriage (Phenix) : dev-1439
EDS : stable22978
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22978

1 Overall quality at a glance

The reported resolution of this entry is 2.84 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}	66092	2270 (2.88-2.80)
Clashscore	79885	2848 (2.88-2.80)
Ramachandran outliers	78287	2786 (2.88-2.80)
Sidechain outliers	78261	2789 (2.88-2.80)
RSRZ outliers	66119	2274 (2.88-2.80)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	524	
1	B	524	
1	C	524	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
2	MG	A	801	-	X
2	MG	A	804	-	X
2	MG	C	601	-	X

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 11943 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Circadian clock protein kinase KaiC.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	P	S			
1	A	494	3873	2439	670	751	2	11	0	0	0
1	B	490	3841	2419	665	744	2	11	0	0	0
1	C	490	3832	2413	665	741	2	11	0	0	0

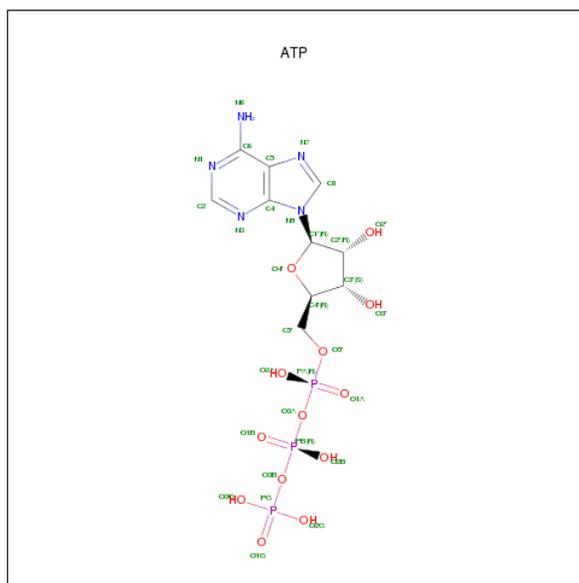
There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	519	HIS	-	EXPRESSION TAG	UNP Q79V60
A	520	HIS	-	EXPRESSION TAG	UNP Q79V60
A	521	HIS	-	EXPRESSION TAG	UNP Q79V60
A	522	HIS	-	EXPRESSION TAG	UNP Q79V60
A	523	HIS	-	EXPRESSION TAG	UNP Q79V60
A	524	HIS	-	EXPRESSION TAG	UNP Q79V60
B	519	HIS	-	EXPRESSION TAG	UNP Q79V60
B	520	HIS	-	EXPRESSION TAG	UNP Q79V60
B	521	HIS	-	EXPRESSION TAG	UNP Q79V60
B	522	HIS	-	EXPRESSION TAG	UNP Q79V60
B	523	HIS	-	EXPRESSION TAG	UNP Q79V60
B	524	HIS	-	EXPRESSION TAG	UNP Q79V60
C	519	HIS	-	EXPRESSION TAG	UNP Q79V60
C	520	HIS	-	EXPRESSION TAG	UNP Q79V60
C	521	HIS	-	EXPRESSION TAG	UNP Q79V60
C	522	HIS	-	EXPRESSION TAG	UNP Q79V60
C	523	HIS	-	EXPRESSION TAG	UNP Q79V60
C	524	HIS	-	EXPRESSION TAG	UNP Q79V60

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	2	Total Mg 2 2	0	0
2	A	2	Total Mg 2 2	0	0
2	C	2	Total Mg 2 2	0	0

- Molecule 3 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N O P 31 10 5 13 3	0	0
3	A	1	Total C N O P 31 10 5 13 3	0	0
3	B	1	Total C N O P 31 10 5 13 3	0	0
3	B	1	Total C N O P 31 10 5 13 3	0	0
3	C	1	Total C N O P 31 10 5 13 3	0	0
3	C	1	Total C N O P 31 10 5 13 3	0	0

- Molecule 4 is water.

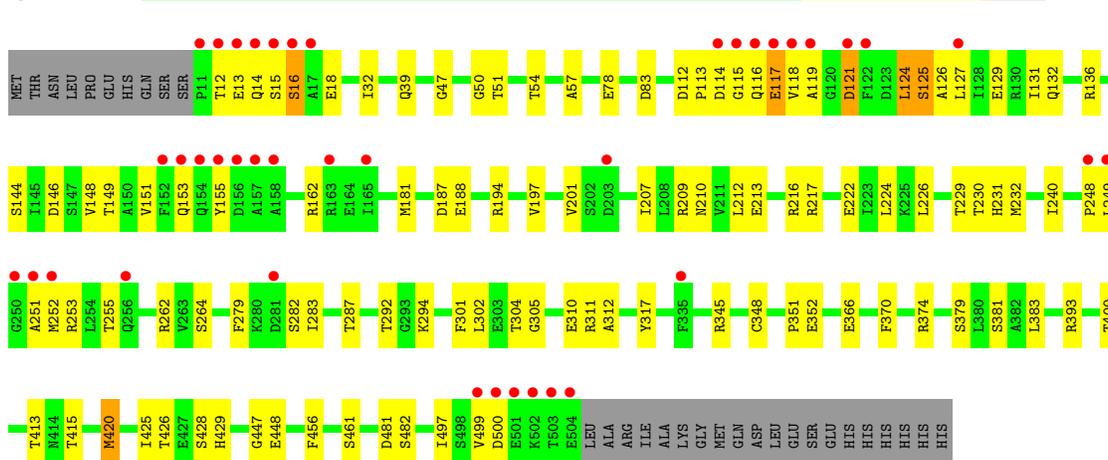
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	80	Total 80	O 80	0	0
4	B	66	Total 66	O 66	0	0
4	C	59	Total 59	O 59	0	0

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.

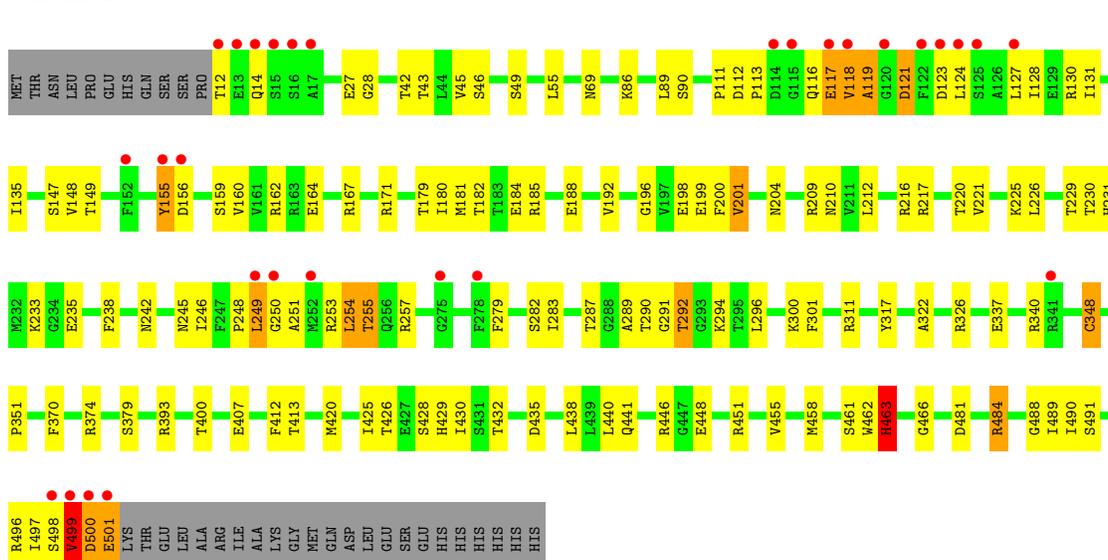
- Molecule 1: Circadian clock protein kinase KaiC

Chain A:



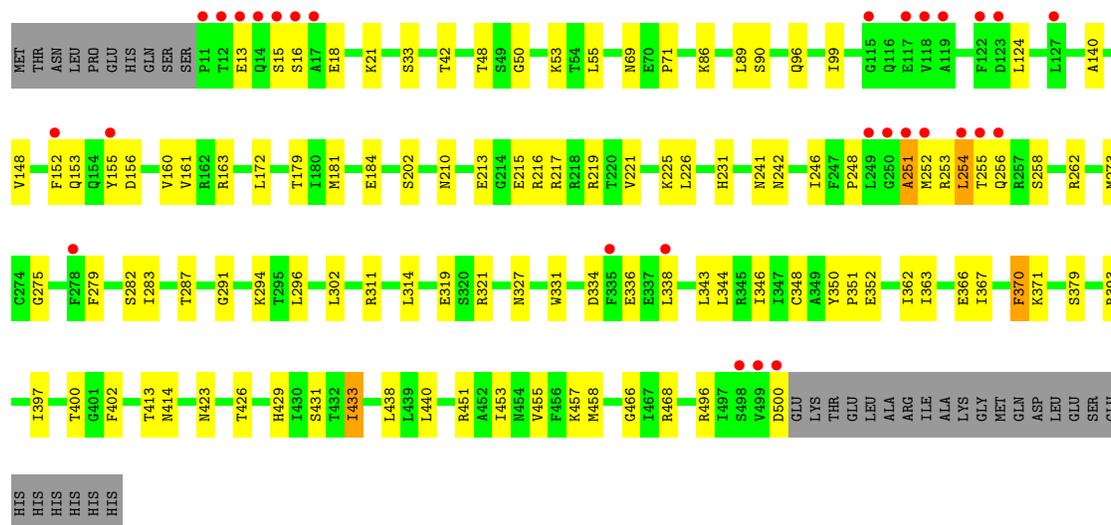
- Molecule 1: Circadian clock protein kinase KaiC

Chain B:



- Molecule 1: Circadian clock protein kinase KaiC

Chain C:



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	130.81Å 195.29Å 136.64Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	58.99 – 2.84 68.32 – 2.84	Depositor EDS
% Data completeness (in resolution range)	99.4 (58.99-2.84) 94.6 (68.32-2.84)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.03 (at 2.86Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.8.4_1496)	Depositor
R, R_{free}	0.225 , 0.270 0.224 , 0.266	Depositor DCC
R_{free} test set	1977 reflections (5.03%)	DCC
Wilson B-factor (Å ²)	45.8	Xtrriage
Anisotropy	0.688	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 29.7	EDS
Estimated twinning fraction	No twinning to report.	Xtrriage
L-test for twinning	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Outliers	2 of 41357 reflections (0.005%)	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	11943	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 13.51% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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: TPO, MG, ATP, SEP

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	0.26	0/3915	0.45	0/5279
1	B	0.27	0/3882	0.44	0/5235
1	C	0.24	0/3873	0.41	0/5223
All	All	0.26	0/11670	0.43	0/15737

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3873	0	3858	72	0
1	B	3841	0	3824	92	0
1	C	3832	0	3820	69	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
3	A	62	0	24	0	0
3	B	62	0	24	2	0
3	C	62	0	24	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	80	0	0	1	0
4	B	66	0	0	3	0
4	C	59	0	0	4	0
All	All	11943	0	11574	217	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 9.

The worst 5 of 217 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:C:438:LEU:CD2	1:C:455:VAL:HG22	1.78	1.13
1:C:438:LEU:HD21	1:C:455:VAL:HG22	1.57	0.86
1:A:116:GLN:HB2	1:A:117:GLU:HB2	1.58	0.85
1:B:379:SER:H	1:B:413:THR:HB	1.43	0.83
1:A:415:THR:HG21	1:B:432:TPO:HG21	1.60	0.82

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	490/524 (94%)	455 (93%)	24 (5%)	11 (2%)	10	31
1	B	486/524 (93%)	443 (91%)	31 (6%)	12 (2%)	9	27
1	C	486/524 (93%)	447 (92%)	32 (7%)	7 (1%)	16	47
All	All	1462/1572 (93%)	1345 (92%)	87 (6%)	30 (2%)	11	32

5 of 30 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	119	ALA
1	B	117	GLU
1	B	118	VAL

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Mol	Chain	Res	Type
1	B	500	ASP
1	C	254	LEU

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	418/445 (94%)	410 (98%)	8 (2%)	69	94
1	B	414/445 (93%)	396 (96%)	18 (4%)	40	76
1	C	413/445 (93%)	407 (98%)	6 (2%)	76	96
All	All	1245/1335 (93%)	1213 (97%)	32 (3%)	59	89

5 of 32 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	155	TYR
1	B	201	VAL
1	C	453	ILE
1	B	199	GLU
1	B	220	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	231	HIS
1	A	323	GLN
1	B	361	GLN

5.3.3 RNA [i](#)

There are no RNA chains in this entry.

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

6 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	SEP	A	431	1	9,9,10	5.95	2 (22%)	10,12,14	1.17	1 (10%)
1	TPO	A	432	1	10,10,11	5.64	1 (10%)	12,14,16	1.32	2 (16%)
1	SEP	B	431	1	9,9,10	5.93	2 (22%)	10,12,14	1.25	1 (10%)
1	TPO	B	432	1	10,10,11	5.66	1 (10%)	12,14,16	1.59	2 (16%)
1	SEP	C	431	1	9,9,10	6.08	2 (22%)	10,12,14	1.45	2 (20%)
1	TPO	C	432	1	10,10,11	5.63	1 (10%)	12,14,16	1.25	2 (16%)

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	SEP	A	431	1	-	0/6/8/10	0/0/0/0
1	TPO	A	432	1	-	0/9/11/13	0/0/0/0
1	SEP	B	431	1	-	0/6/8/10	0/0/0/0
1	TPO	B	432	1	-	0/9/11/13	0/0/0/0
1	SEP	C	431	1	-	0/6/8/10	0/0/0/0
1	TPO	C	432	1	-	0/9/11/13	0/0/0/0

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	431	SEP	O-C	17.70	1.23	1.11
1	B	432	TPO	O-C	17.44	1.23	1.11
1	A	432	TPO	O-C	17.39	1.23	1.11
1	C	432	TPO	O-C	17.36	1.23	1.11
1	A	431	SEP	O-C	17.28	1.23	1.11

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	432	TPO	CG2-CB-CA	-4.06	104.91	113.22
1	A	432	TPO	P-OG1-CB	-2.93	106.94	120.44
1	B	431	SEP	P-OG-CB	-2.91	111.19	118.63
1	C	431	SEP	P-OG-CB	-2.86	111.33	118.63
1	B	432	TPO	P-OG1-CB	-2.70	107.97	120.44

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 12 ligands modelled in this entry, 6 are monoatomic - leaving 6 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
3	ATP	A	802	2	33,33,33	1.05	2 (6%)	52,52,52	2.02	9 (17%)
3	ATP	A	803	-	33,33,33	1.04	2 (6%)	52,52,52	1.99	8 (15%)
3	ATP	B	602	2	33,33,33	1.02	2 (6%)	52,52,52	2.04	9 (17%)
3	ATP	B	604	2	33,33,33	1.02	2 (6%)	52,52,52	2.00	9 (17%)
3	ATP	C	602	2	33,33,33	1.07	2 (6%)	52,52,52	2.04	10 (19%)
3	ATP	C	603	2	33,33,33	1.05	2 (6%)	52,52,52	1.98	8 (15%)

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	ATP	A	802	2	-	0/22/38/38	0/3/3/3
3	ATP	A	803	-	-	0/22/38/38	0/3/3/3
3	ATP	B	602	2	-	0/22/38/38	0/3/3/3
3	ATP	B	604	2	-	0/22/38/38	0/3/3/3
3	ATP	C	602	2	-	0/22/38/38	0/3/3/3
3	ATP	C	603	2	-	0/22/38/38	0/3/3/3

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	802	ATP	C5-C4	3.11	1.47	1.40
3	C	602	ATP	C5-C4	3.05	1.47	1.40
3	B	602	ATP	C5-C4	3.04	1.47	1.40
3	C	603	ATP	C5-C4	3.01	1.47	1.40
3	A	803	ATP	C5-C4	3.00	1.47	1.40

The worst 5 of 53 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	802	ATP	C5-C4-N3	-7.72	118.45	125.98
3	B	604	ATP	C5-C4-N3	-7.57	118.60	125.98
3	C	602	ATP	C5-C4-N3	-7.49	118.68	125.98
3	C	603	ATP	C5-C4-N3	-7.43	118.74	125.98
3	A	803	ATP	C5-C4-N3	-7.40	118.76	125.98

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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 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	A	494/524 (94%)	0.40	40 (8%) 12 11	24, 44, 109, 151	0
1	B	490/524 (93%)	0.39	29 (5%) 22 22	25, 45, 99, 141	0
1	C	490/524 (93%)	0.44	29 (5%) 22 22	23, 51, 106, 143	0
All	All	1474/1572 (93%)	0.41	98 (6%) 18 17	23, 47, 107, 151	0

The worst 5 of 98 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	155	TYR	12.5
1	A	15	SER	9.8
1	C	15	SER	9.3
1	B	15	SER	9.2
1	B	124	LEU	7.6

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. 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, 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
1	SEP	B	431	10/11	0.25	1.44	43,50,79,90	0
1	TPO	C	432	11/12	0.23	0.90	59,67,78,85	0
1	SEP	C	431	10/11	0.21	-0.04	56,60,78,92	0
1	TPO	B	432	11/12	0.16	-1.21	44,47,64,69	0
1	TPO	A	432	11/12	0.13	-1.96	51,53,65,66	0
1	SEP	A	431	10/11	0.15	-2.12	47,54,67,76	0

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

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, 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
2	MG	A	804	1/1	0.43	13.06	64,64,64,64	0
2	MG	A	801	1/1	0.27	3.23	32,32,32,32	0
2	MG	C	601	1/1	0.32	3.20	44,44,44,44	0
2	MG	B	603	1/1	0.27	1.50	41,41,41,41	0
2	MG	C	604	1/1	0.16	0.46	45,45,45,45	0
3	ATP	C	602	31/31	0.19	0.19	31,36,58,77	0
3	ATP	B	604	31/31	0.19	0.11	28,37,61,67	0
3	ATP	C	603	31/31	0.18	-0.04	26,37,59,68	0
3	ATP	B	602	31/31	0.18	-0.05	32,41,63,75	0
3	ATP	A	803	31/31	0.18	-0.63	24,32,63,74	0
3	ATP	A	802	31/31	0.16	-0.74	26,33,47,65	0
2	MG	B	601	1/1	0.19	-1.15	47,47,47,47	0

6.5 Other polymers

There are no such residues in this entry.