



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2018 – 08:58 pm GMT

PDB ID : 1C0A
Title : CRYSTAL STRUCTURE OF THE E. COLI ASPARTYL-TRNA SYN-
THETASE : TRNAASP : ASPARTYL-ADENYLATE COMPLEX
Authors : Eiler, S.; Dock-Bregeon, A.-C.; Moulinier, L.; Thierry, J.-C.; Moras, D.
Deposited on : 1999-07-15
Resolution : 2.40 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 ⓘ 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

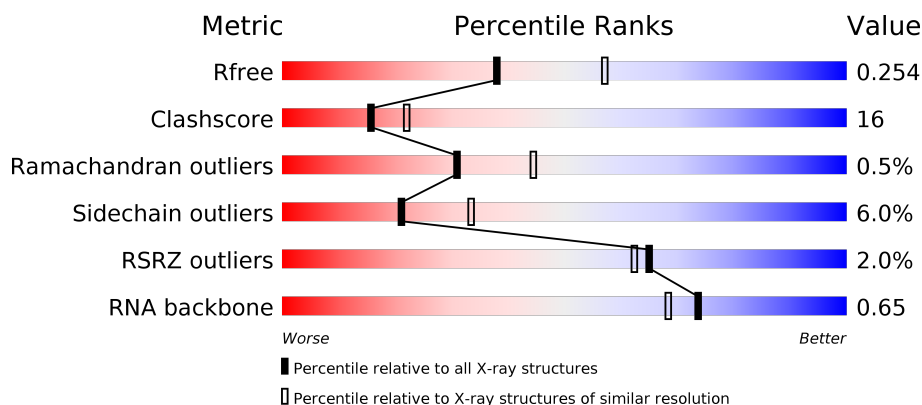
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	3481 (2.40-2.40)
Clashscore	122126	3956 (2.40-2.40)
Ramachandran outliers	120053	3897 (2.40-2.40)
Sidechain outliers	120020	3898 (2.40-2.40)
RSRZ outliers	108989	3386 (2.40-2.40)
RNA backbone	2636	1023 (2.80-2.00)

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	B	77	<div> <div>5%</div> <div> <div></div> <div>36%</div> <div>52%</div> <div>12%</div> </div> </div>
2	A	585	<div> <div>2%</div> <div> <div></div> <div>69%</div> <div>28%</div> <div>.</div> </div> </div>

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
1	H2U	B	620	-	-	-	X
1	H2U	B	620(A)	-	-	-	X

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 6820 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 ASPARTYL TRNA.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	B	77	Total	C	N	O	P	S	0	0	0
			1655	740	290	547	77	1			

- Molecule 2 is a protein called ASPARTYL TRNA SYNTHETASE.

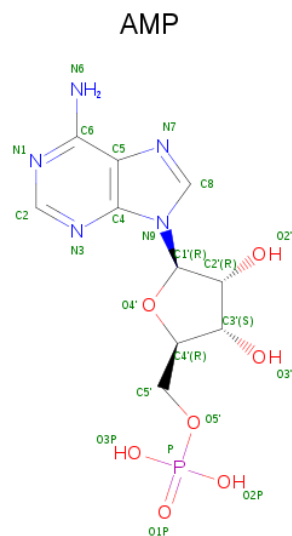
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	585	Total	C	N	O	S	0	0	0
			4592	2900	804	862	26			

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



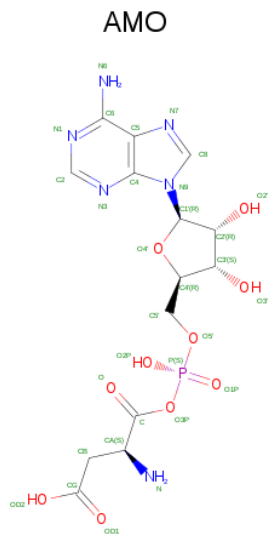
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is ADENOSINE MONOPHOSPHATE (three-letter code: AMP) (formula: C₁₀H₁₄N₅O₇P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			23	10	5	7	1		

- Molecule 5 is ASPARTYL-ADENOSINE-5'-MONOPHOSPHATE (three-letter code: AMO) (formula: $C_{14}H_{19}N_6O_{10}P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	P	0	0
			31	14	6	10	1		

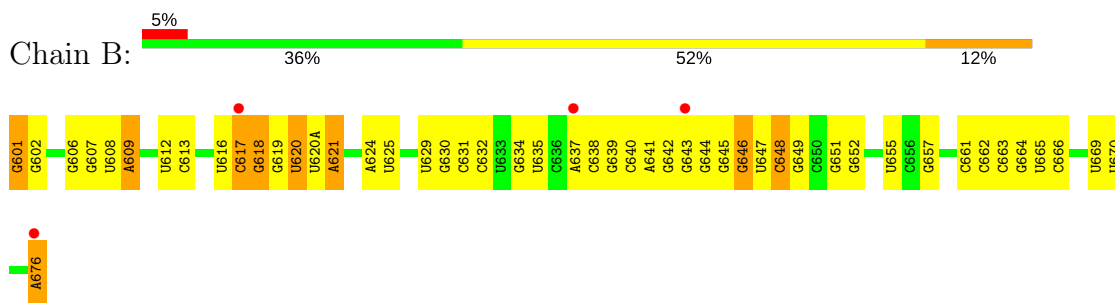
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	107	Total 107	O 107	0	0
6	A	407	Total 407	O 407	0	0

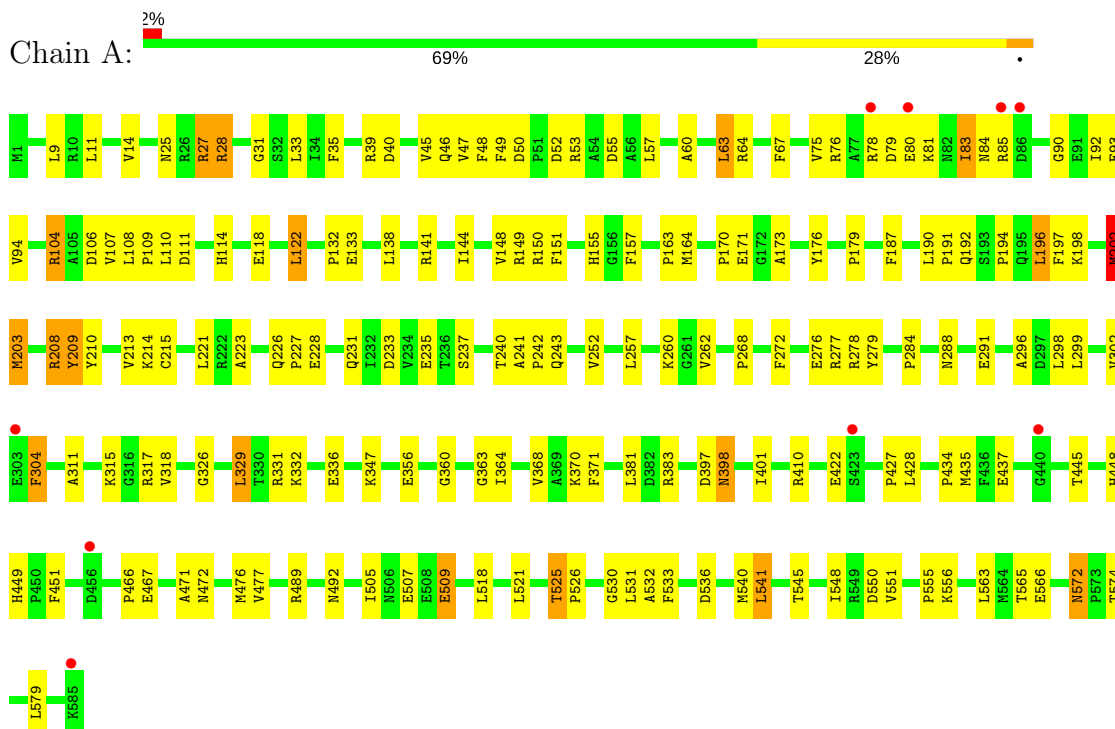
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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: ASPARTYL TRNA



• Molecule 2: ASPARTYL TRNA SYNTHETASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	101.20Å 101.20Å 231.81Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	12.00 – 2.40 14.89 – 2.40	Depositor EDS
% Data completeness (in resolution range)	98.0 (12.00-2.40) 98.1 (14.89-2.40)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.78 (at 2.39Å)	Xtriage
Refinement program	CNS 0.4	Depositor
R, R_{free}	0.208 , 0.249 0.213 , 0.254	Depositor DCC
R_{free} test set	3555 reflections (7.59%)	wwPDB-VP
Wilson B-factor (Å ²)	25.5	Xtriage
Anisotropy	0.172	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 47.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6820	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.61% 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: 5MU, AMO, G7M, H2U, SO4, AMP, 4SU, QUO, PSU

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	B	0.73	3/1628 (0.2%)	0.99	6/2534 (0.2%)
2	A	0.52	1/4678 (0.0%)	0.79	7/6320 (0.1%)
All	All	0.58	4/6306 (0.1%)	0.85	13/8854 (0.1%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	648	C	O3'-P	-18.15	1.39	1.61
1	B	646	G7M	O3'-P	-10.43	1.48	1.61
1	B	601	G	OP3-P	-7.26	1.52	1.61
2	A	398	ASN	C-N	-7.18	1.17	1.34

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	648	C	P-O3'-C3'	26.13	151.06	119.70
1	B	648	C	OP2-P-O3'	-13.40	75.72	105.20
2	A	398	ASN	O-C-N	-10.16	106.44	122.70
1	B	648	C	OP1-P-O3'	8.89	124.77	105.20
1	B	646	G7M	P-O3'-C3'	8.72	130.16	119.70

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	B	1655	0	850	43	0
2	A	4592	0	4589	144	0
3	B	5	0	0	0	0
4	A	23	0	12	2	0
5	A	31	0	17	0	0
6	A	407	0	0	12	0
6	B	107	0	0	1	0
All	All	6820	0	5468	185	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 16.

The worst 5 of 185 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:A:202:MET:HG3	2:A:237:SER:OG	1.65	0.96
2:A:78:ARG:HD2	2:A:83:ILE:HA	1.48	0.95
2:A:202:MET:HA	2:A:202:MET:HE2	1.50	0.94
2:A:505:ILE:HG23	2:A:509:GLU:HG2	1.51	0.92
1:B:647:U:H4'	1:B:648:C:H5'	1.56	0.86

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	
2	A	583/585 (100%)	551 (94%)	29 (5%)	3 (0%)	31	44

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	80	GLU
2	A	304	PHE
2	A	106	ASP

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	
2	A	486/486 (100%)	457 (94%)	29 (6%)	21	33

5 of 29 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	331	ARG
2	A	397	ASP
2	A	555	PRO
2	A	368	VAL
2	A	422	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
2	A	226	GLN
2	A	312	ASN
2	A	387	GLN
2	A	155	HIS
2	A	365	ASN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	B	75/77 (97%)	8 (10%)	2 (2%)

5 of 8 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	B	609	A
1	B	617	C
1	B	618	G
1	B	619	G
1	B	620	H2U

All (2) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	B	617	C
1	B	619	G

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

9 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	4SU	B	608	1	13,21,22	5.98	2 (15%)	14,30,33	3.09	2 (14%)
1	H2U	B	616	1	17,21,22	0.98	1 (5%)	21,30,33	1.50	2 (9%)
1	H2U	B	620	1	17,21,22	0.68	1 (5%)	21,30,33	1.41	2 (9%)
1	H2U	B	620(A)	1	17,21,22	0.60	0	21,30,33	1.23	2 (9%)
1	QUO	B	634	1	27,35,36	1.25	3 (11%)	32,52,55	3.77	9 (28%)
1	G7M	B	646	1	18,26,27	1.40	3 (16%)	18,39,42	2.76	4 (22%)
1	5MU	B	654	1	13,22,23	1.22	2 (15%)	14,32,35	3.82	2 (14%)
1	PSU	B	655	1	16,21,22	1.92	4 (25%)	20,30,33	5.70	5 (25%)
1	PSU	B	665	1	16,21,22	2.19	4 (25%)	20,30,33	5.63	5 (25%)

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	4SU	B	608	1	-	0/3/25/26	0/2/2/2
1	H2U	B	616	1	-	0/7/38/39	0/2/2/2
1	H2U	B	620	1	-	0/7/38/39	0/2/2/2
1	H2U	B	620(A)	1	-	0/7/38/39	0/2/2/2
1	QUO	B	634	1	-	0/6/43/44	0/4/4/4
1	G7M	B	646	1	-	0/3/25/26	0/3/3/3
1	5MU	B	654	1	-	0/3/25/26	0/2/2/2
1	PSU	B	655	1	-	0/7/25/26	0/2/2/2
1	PSU	B	665	1	-	0/7/25/26	0/2/2/2

The worst 5 of 20 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	608	4SU	C4-S4	-20.77	1.29	1.67
1	B	665	PSU	C5-C1'	-6.08	1.47	1.52
1	B	655	PSU	C6-N1	-4.70	1.24	1.34
1	B	665	PSU	C6-N1	-4.68	1.24	1.34
1	B	655	PSU	C5-C1'	-4.49	1.48	1.52

The worst 5 of 33 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	655	PSU	N1-C2-N3	-17.17	114.61	128.41
1	B	665	PSU	N1-C2-N3	-16.85	114.87	128.41
1	B	634	QUO	C5-C6-N1	-14.53	110.73	124.07
1	B	665	PSU	C5-C4-N3	-8.83	113.98	125.36
1	B	655	PSU	C5-C4-N3	-8.81	114.01	125.36

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

8 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	608	4SU	1	0
1	B	616	H2U	2	0
1	B	620	H2U	1	0
1	B	620(A)	H2U	1	0
1	B	634	QUO	1	0
1	B	646	G7M	1	0
1	B	655	PSU	1	0
1	B	665	PSU	1	0

5.5 Carbohydrates [i](#)

There are no carbohydrates 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	$\# Z > 2$
4	AMP	A	800	-	22,25,25	0.66	0	23,38,38	0.92	2 (8%)
5	AMO	A	831	-	26,33,33	1.02	1 (3%)	26,49,49	1.61	2 (7%)
3	SO4	B	701	-	4,4,4	0.56	0	6,6,6	0.29	0

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	AMP	A	800	-	-	0/6/26/26	0/3/3/3
5	AMO	A	831	-	-	0/15/39/39	0/3/3/3
3	SO4	B	701	-	-	0/0/0/0	0/0/0/0

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	831	AMO	P-O3P	4.06	1.68	1.61

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	831	AMO	O2P-P-O3P	-3.97	90.44	103.72
4	A	800	AMP	O3P-P-O5'	-2.03	101.34	106.73
4	A	800	AMP	O2P-P-O1P	2.34	119.74	110.60
5	A	831	AMO	O3P-P-O5'	6.54	121.70	103.08

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
4	A	800	AMP	2	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	1
2	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	648:C	O3'	649:G	P	1.39
1	A	398:ASN	C	399:LYS	N	1.17

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	B	68/77 (88%)	0.08	4 (5%) 22 21	16, 38, 67, 89	0
2	A	585/585 (100%)	-0.40	9 (1%) 73 71	7, 22, 45, 65	0
All	All	653/662 (98%)	-0.35	13 (1%) 65 62	7, 24, 50, 89	0

The worst 5 of 13 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	617	C	7.4
2	A	585	LYS	4.0
1	B	643	G	3.6
2	A	440	GLY	3.1
2	A	85	ARG	2.6

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. 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	H2U	B	620	20/21	0.71	0.40	72,82,83,83	0
1	H2U	B	620(A)	20/21	0.76	0.41	72,80,83,83	0
1	H2U	B	616	20/21	0.79	0.37	51,79,83,83	0
1	QUO	B	634	32/33	0.80	0.25	59,65,76,76	0
1	PSU	B	655	20/21	0.81	0.23	35,46,51,52	0
1	5MU	B	654	21/22	0.84	0.24	37,44,47,50	0
1	PSU	B	665	20/21	0.91	0.15	27,33,36,38	0
1	G7M	B	646	24/25	0.92	0.16	42,45,47,48	0
1	4SU	B	608	20/21	0.98	0.09	23,26,29,31	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
4	AMP	A	800	23/23	0.73	0.27	77,79,89,89	0
5	AMO	A	831	31/31	0.87	0.17	8,15,32,40	0
3	SO4	B	701	5/5	0.97	0.20	50,51,51,52	0

6.5 Other polymers [i](#)

There are no such residues in this entry.