



wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 13, 2017 – 11:22 AM EST

PDB ID : 4QFR
Title : Structure of AMPK in complex with Cl-A769662 activator and STAU-ROSPORINE inhibitor
Authors : Calabrese, M.F.; Kurumbail, R.G.
Deposited on : unknown
Resolution : 3.34 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

<http://wwpdb.org/validation/2016/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 : 1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20030345
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
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) : rb-20030345

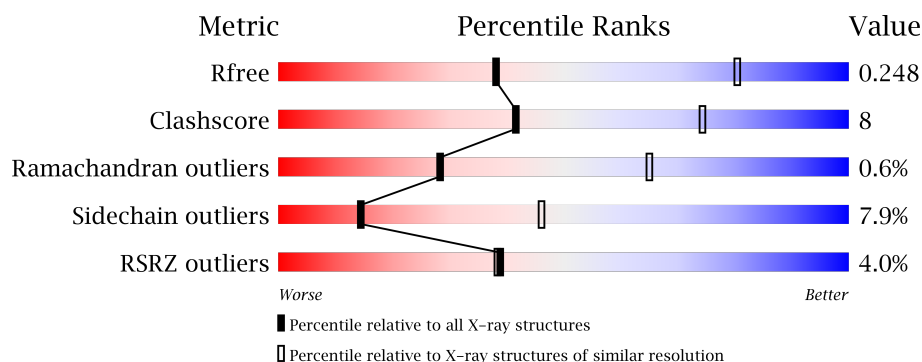
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.34 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}	100719	1167 (3.40-3.28)
Clashscore	112137	1239 (3.40-3.28)
Ramachandran outliers	110173	1219 (3.40-3.28)
Sidechain outliers	110143	1218 (3.40-3.28)
RSRZ outliers	101464	1176 (3.40-3.28)

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	A	503	<div> <div>2%</div> <div>59%</div> <div>12%</div> <div>28%</div> </div>
2	B	204	<div> <div>2%</div> <div>58%</div> <div>19%</div> <div>22%</div> </div>
3	C	330	<div> <div>6%</div> <div>64%</div> <div>17%</div> <div>15%</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
5	CL	A	604	-	-	-	X
5	CL	B	301	-	-	-	X

2 Entry composition

There are 9 unique types of molecules in this entry. The entry contains 6516 atoms, of which 26 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 5'-AMP-activated protein kinase catalytic subunit alpha-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	362	Total	C	N	O	P	S	0	0	0
			2943	1888	514	522	1	18			

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	EXPRESSION TAG	UNP P54645
A	517	ALA	-	SEE REMARK 999	UNP P54645
A	518	SER	-	SEE REMARK 999	UNP P54645
A	519	GLY	-	SEE REMARK 999	UNP P54645
A	520	GLY	-	SEE REMARK 999	UNP P54645
A	521	PRO	-	SEE REMARK 999	UNP P54645
A	522	GLY	-	SEE REMARK 999	UNP P54645
A	523	GLY	-	SEE REMARK 999	UNP P54645
A	524	SER	-	SEE REMARK 999	UNP P54645

- Molecule 2 is a protein called 5'-AMP-activated protein kinase subunit beta-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	159	Total	C	N	O	S	0	0	0
			1245	810	209	223	3			

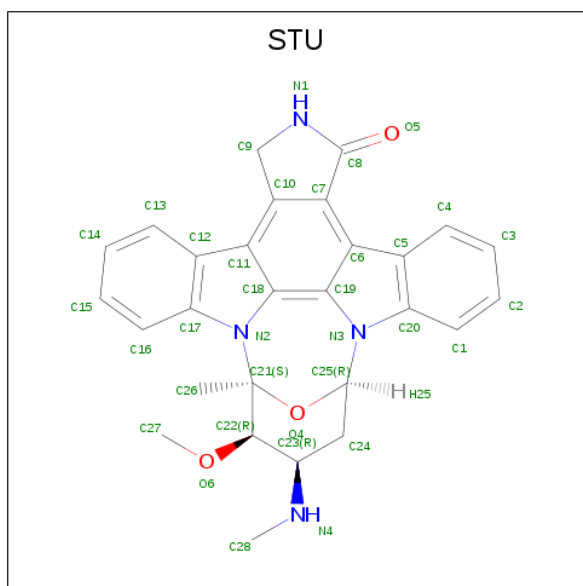
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	67	MET	-	EXPRESSION TAG	UNP P80386
B	108	ASP	SER	ENGINEERED MUTATION	UNP P80386

- Molecule 3 is a protein called 5'-AMP-activated protein kinase subunit gamma-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	279	Total	C	N	O	S	0	0	0
			2157	1402	362	387	6			

- Molecule 4 is STAUROSPORINE (three-letter code: STU) (formula: $C_{28}H_{26}N_4O_3$).

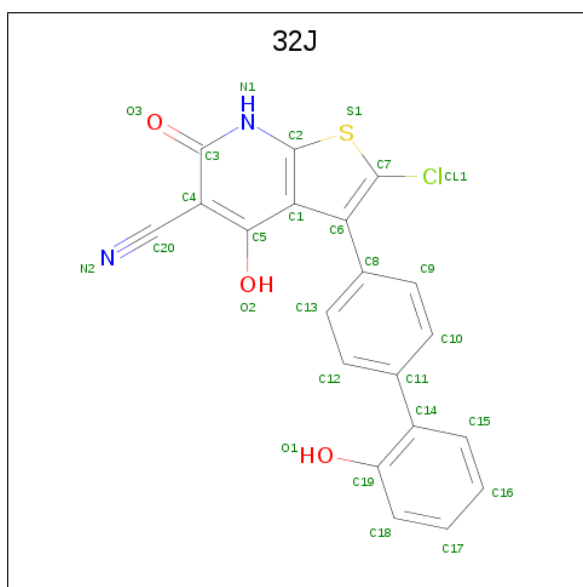


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	H	N	O	0	0
			61	28	26	4	3		

- Molecule 5 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

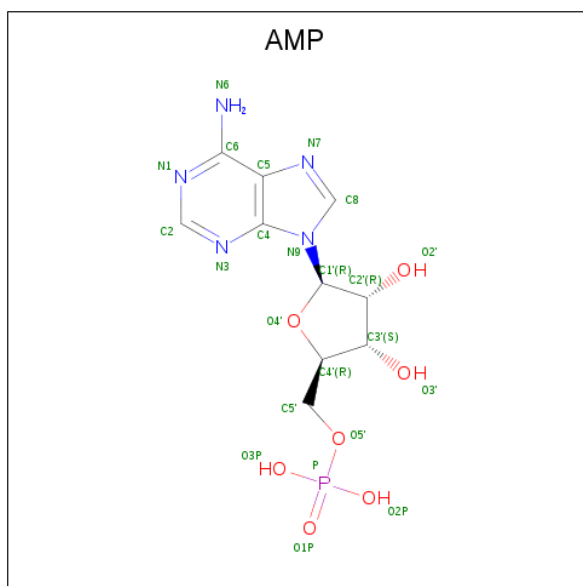
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total Cl 1 1	0	0
5	A	4	Total Cl 4 4	0	0

- Molecule 6 is 2-chloro-4-hydroxy-3-(2'-hydroxybiphenyl-4-yl)-6-oxo-6,7-dihydrothieno[2,3-b]pyridine-5-carbonitrile (three-letter code: 32J) (formula: $C_{20}H_{11}ClN_2O_3S$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
6	A	1	Total	C	Cl	N	O	S	0	0
			27	20	1	2	3	1		

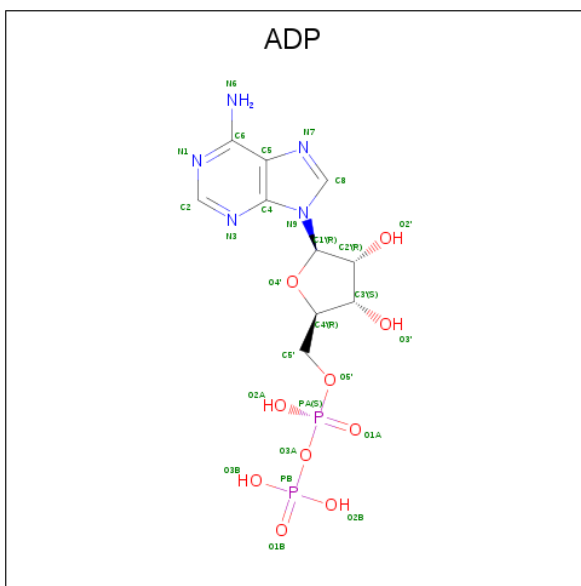
- Molecule 7 is ADENOSINE MONOPHOSPHATE (three-letter code: AMP) (formula: $C_{10}H_{14}N_5O_7P$).



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

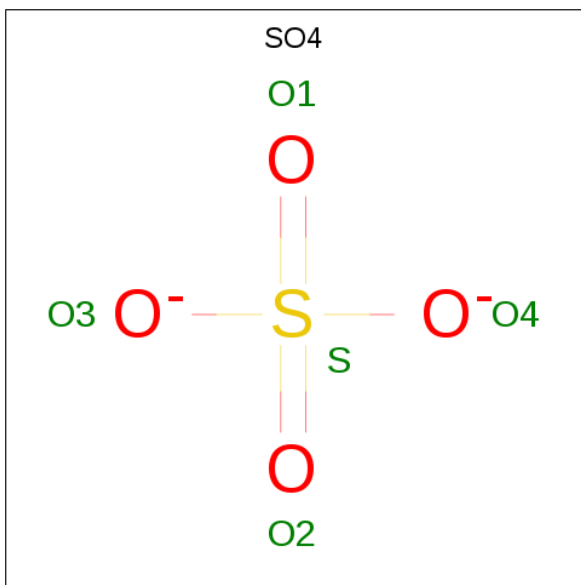
- Molecule 8 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula:

$C_{10}H_{15}N_5O_{10}P_2$).

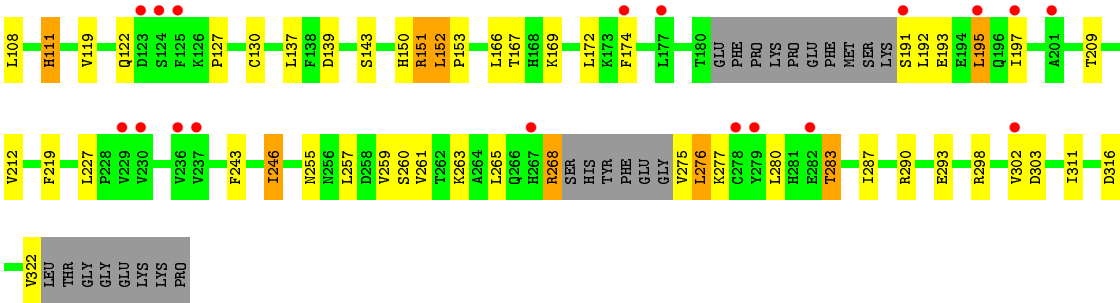


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
8	C	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

- Molecule 9 is SULFATE ION (three-letter code: SO₄) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	C	1	Total	O	S	0	0
			5	4	1		



4 Data and refinement statistics

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, α , β , γ	124.62Å 124.62Å 402.92Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.85 – 3.34 29.85 – 3.34	Depositor EDS
% Data completeness (in resolution range)	97.1 (29.85-3.34) 96.6 (29.85-3.34)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.01 (at 3.31Å)	Xtriage
Refinement program	BUSTER-TNT BUSTER 2.11.5, BUSTER 2.11.5	Depositor
R, R_{free}	0.210 , 0.249 0.205 , 0.248	Depositor DCC
R_{free} test set	1344 reflections (5.26%)	DCC
Wilson B-factor (Å ²)	84.1	Xtriage
Anisotropy	0.477	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 97.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6516	wwPDB-VP
Average B, all atoms (Å ²)	104.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.19% 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: ADP, STU, TPO, CL, 32J, SO4, AMP

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	0.51	0/2997	0.77	1/4040 (0.0%)
2	B	0.52	0/1279	0.75	0/1745
3	C	0.46	0/2197	0.67	0/2995
All	All	0.49	0/6473	0.73	1/8780 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	14	GLY	N-CA-C	-5.92	98.29	113.10

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	A	2943	0	2974	37	0
2	B	1245	0	1232	18	0
3	C	2157	0	2171	45	0
4	A	35	26	26	6	0
5	A	4	0	0	0	0
5	B	1	0	0	0	0
6	A	27	0	9	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	C	46	0	24	3	0
8	C	27	0	12	1	0
9	C	5	0	0	0	0
All	All	6490	26	6448	103	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 103 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)
3:C:152:LEU:HD12	3:C:153:PRO:N	1.54	1.21
3:C:152:LEU:HD12	3:C:153:PRO:CD	1.77	1.12
3:C:152:LEU:CD1	3:C:153:PRO:HD2	1.89	1.03
3:C:152:LEU:HD12	3:C:153:PRO:HD2	1.47	0.95
3:C:151:ARG:NH1	3:C:167:THR:HG21	1.95	0.81

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	355/503 (71%)	333 (94%)	21 (6%)	1 (0%)	44	78
2	B	153/204 (75%)	137 (90%)	15 (10%)	1 (1%)	25	62
3	C	273/330 (83%)	250 (92%)	20 (7%)	3 (1%)	17	53
All	All	781/1037 (75%)	720 (92%)	56 (7%)	5 (1%)	28	65

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	120	GLU
3	C	122	GLN
3	C	127	PRO
1	A	427	VAL
3	C	293	GLU

5.3.2 Protein sidechains ⓘ

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	325/448 (72%)	309 (95%)	16 (5%)	29	65
2	B	137/185 (74%)	123 (90%)	14 (10%)	8	32
3	C	232/299 (78%)	207 (89%)	25 (11%)	7	29
All	All	694/932 (74%)	639 (92%)	55 (8%)	14	46

5 of 55 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	234	VAL
3	C	28	TYR
3	C	290	ARG
2	B	235	MET
2	B	242	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	212	GLN
3	C	221	GLN
2	B	216	ASN
1	A	403	GLN
3	C	168	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	TPO	A	172	1	9,10,11	1.36	1 (11%)	10,14,16	1.60	3 (30%)

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	TPO	A	172	1	-	0/8/11/13	0/0/0/0

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	172	TPO	P-OG1	-3.42	1.53	1.59

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	172	TPO	O3P-P-O1P	-2.37	101.24	110.50
1	A	172	TPO	O-C-CA	-2.23	119.94	125.15
1	A	172	TPO	O3P-P-O2P	2.62	118.20	107.61

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 5 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	$\# Z > 2$
4	STU	A	601	-	29,42,42	2.49	11 (37%)	27,68,68	1.52	6 (22%)
6	32J	A	606	-	27,30,30	0.95	2 (7%)	28,44,44	2.01	2 (7%)
7	AMP	C	401	-	22,25,25	0.52	0	24,38,38	1.06	1 (4%)
7	AMP	C	402	-	22,25,25	0.62	0	24,38,38	1.18	1 (4%)
8	ADP	C	403	-	25,29,29	0.64	0	24,45,45	0.67	0
9	SO4	C	404	-	4,4,4	0.22	0	6,6,6	0.11	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	STU	A	601	-	-	0/4/42/42	0/0/8/8
6	32J	A	606	-	-	0/9/10/10	0/4/4/4
7	AMP	C	401	-	-	0/6/26/26	0/3/3/3
7	AMP	C	402	-	-	0/6/26/26	0/3/3/3
8	ADP	C	403	-	-	0/12/32/32	0/3/3/3
9	SO4	C	404	-	-	0/0/0/0	0/0/0/0

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	601	STU	C9-C10	-5.18	1.46	1.50
6	A	606	32J	C4-C5	2.46	1.40	1.38
6	A	606	32J	C3-N1	2.66	1.37	1.33
4	A	601	STU	O5-C8	2.68	1.28	1.23
4	A	601	STU	C6-C19	3.03	1.46	1.42

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	606	32J	C4-C3-N1	-9.64	114.87	124.12
4	A	601	STU	C1-C20-C5	-2.84	116.64	120.73
4	A	601	STU	C16-C17-C12	-2.67	116.89	120.73
4	A	601	STU	C9-N1-C8	-2.20	111.41	113.78
4	A	601	STU	C3-C4-C5	-2.05	117.35	120.81

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	601	STU	6	0
6	A	606	32J	1	0
7	C	402	AMP	3	0
8	C	403	ADP	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	A	361/503 (71%)	-0.04	9 (2%) 58 57	43, 76, 158, 182	0
2	B	159/204 (77%)	0.05	4 (2%) 58 57	61, 89, 129, 152	0
3	C	279/330 (84%)	0.23	19 (6%) 18 19	72, 135, 181, 194	0
All	All	799/1037 (77%)	0.07	32 (4%) 39 38	43, 94, 171, 194	0

The worst 5 of 32 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	230	VAL	5.2
1	A	444	PHE	4.7
3	C	177	LEU	3.6
3	C	197	ILE	3.6
1	A	441	THR	3.5

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	RSCC	RSR	LLDF	B-factors(Å ²)	Q<0.9
1	TPO	A	172	11/12	0.97	0.12	-	81,82,86,89	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. 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	RSCC	RSR	LLDF	B-factors(Å ²)	Q<0.9
5	CL	B	301	1/1	0.85	0.53	9.77	90,90,90,90	0
5	CL	A	604	1/1	0.99	0.33	3.98	70,70,70,70	0
6	32J	A	606	27/27	0.94	0.23	0.67	57,65,82,91	0
7	AMP	C	401	23/23	0.87	0.29	0.57	143,169,171,171	0
4	STU	A	601	35/35	0.97	0.24	0.57	54,59,70,72	0
8	ADP	C	403	27/27	0.83	0.29	0.42	166,179,185,188	0
7	AMP	C	402	23/23	0.79	0.25	-0.33	154,169,181,182	0
9	SO4	C	404	5/5	0.78	0.56	-	200,202,202,203	0
5	CL	A	603	1/1	0.75	0.08	-	112,112,112,112	0
5	CL	A	605	1/1	0.86	0.16	-	84,84,84,84	0
5	CL	A	602	1/1	0.96	0.18	-	61,61,61,61	0

6.5 Other polymers [i](#)

There are no such residues in this entry.