



wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 24, 2024 – 06:52 AM EDT

PDB ID : 6Y1W
Title : Xcc4156, a flavin-dependent halogenase from *Xanthomonas campestris*
Authors : Widmann, C.; Ismail, M.; Sewald, N.; Niemann, H.H.
Deposited on : 2020-02-14
Resolution : 1.60 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 2.37.1
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.37.1

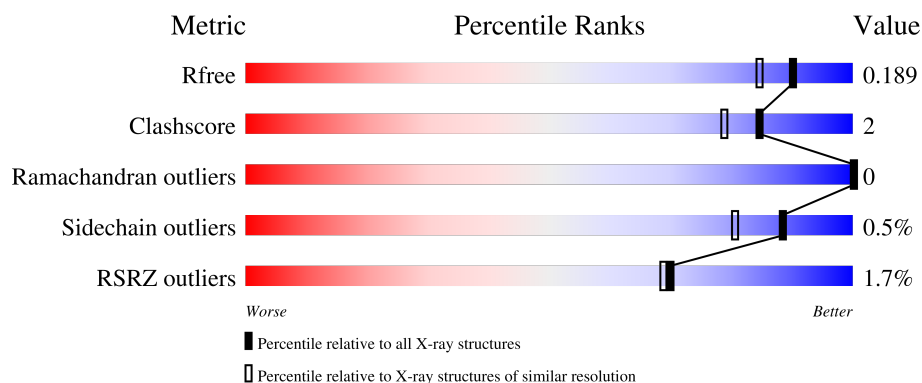
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.60 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}	130704	3398 (1.60-1.60)
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)
RSRZ outliers	127900	3321 (1.60-1.60)

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 of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. 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	523	<div> <div style="width: 100%; height: 10px; background: linear-gradient(to right, red 1%, orange 1%, yellow 1%, green 98%);"></div> <div style="display: flex; justify-content: space-between; width: 98%; margin-top: 2px;"> 2% 92% 5% </div> </div>
1	B	523	<div> <div style="width: 100%; height: 10px; background: linear-gradient(to right, red 2%, orange 1%, yellow 1%, green 96%);"></div> <div style="display: flex; justify-content: space-between; width: 98%; margin-top: 2px;"> 2% 89% 5% 6% </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
3	TLA	B	603	-	X	-	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 9532 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 Putative tryptophan halogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	505	Total	C	N	O	S	0	19	0
			4100	2595	759	731	15			
1	B	493	Total	C	N	O	S	0	26	0
			4054	2579	747	715	13			

There are 8 discrepancies between the modelled and reference sequences:

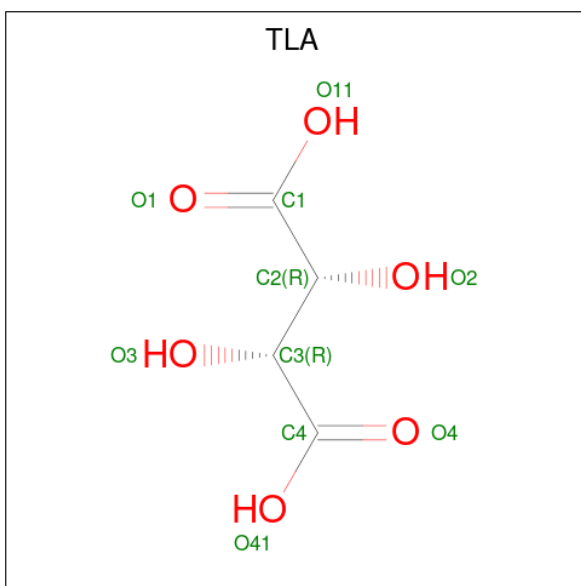
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP B0RXY9
A	-1	ALA	-	expression tag	UNP B0RXY9
A	0	MET	-	expression tag	UNP B0RXY9
A	1	GLY	-	expression tag	UNP B0RXY9
B	-2	GLY	-	expression tag	UNP B0RXY9
B	-1	ALA	-	expression tag	UNP B0RXY9
B	0	MET	-	expression tag	UNP B0RXY9
B	1	GLY	-	expression tag	UNP B0RXY9

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O₄P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	P	0	0
			5	4	1		

- Molecule 3 is L(+)-TARTARIC ACID (three-letter code: TLA) (formula: $C_4H_6O_6$).



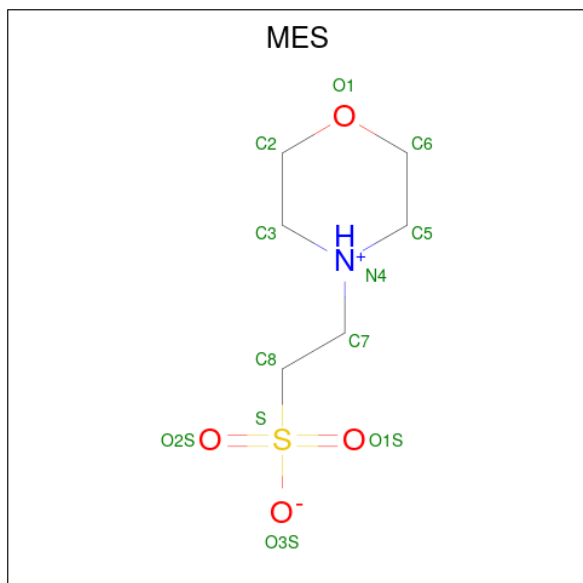
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			10	4	6		
3	B	1	Total	C	O	0	0
			10	4	6		
3	B	1	Total	C	O	0	0
			10	4	6		

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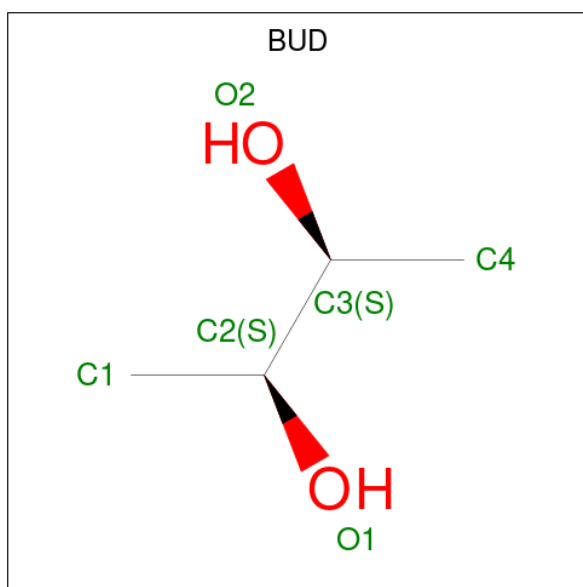
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	C	O	0	0
			10	4	6		
3	B	1	Total	C	O	0	0
			10	4	6		

- Molecule 4 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: $C_6H_{13}NO_4S$).



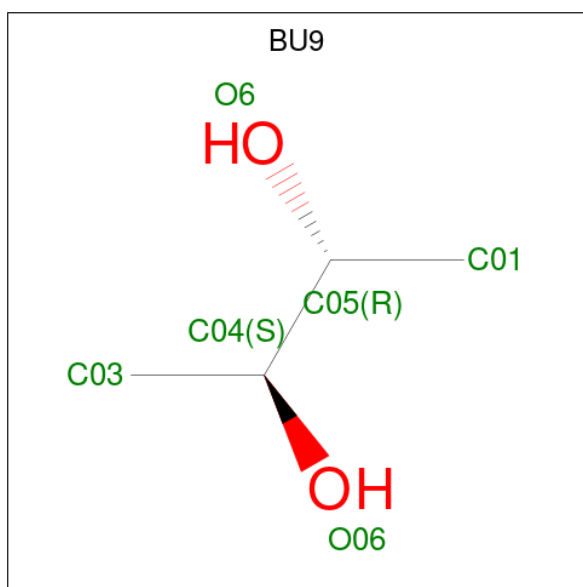
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	A	1	Total	C	N	O	S	0	1
			24	12	2	8	2		
4	B	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	B	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 5 is (2S,3S)-butane-2,3-diol (three-letter code: BUD) (formula: $C_4H_{10}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	4	2		
5	A	1	Total	C	O	0	0
			6	4	2		
5	A	1	Total	C	O	0	0
			6	4	2		
5	A	1	Total	C	O	0	0
			6	4	2		
5	B	1	Total	C	O	0	0
			6	4	2		
5	B	1	Total	C	O	0	0
			6	4	2		
5	B	1	Total	C	O	0	0
			6	4	2		

- Molecule 6 is Meso-2,3-Butanediol (three-letter code: BU9) (formula: C₄H₁₀O₂).

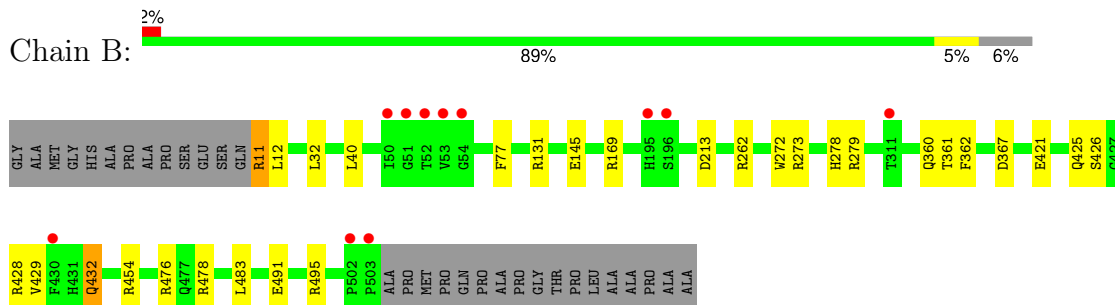
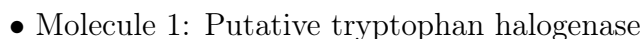


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			6	4	2		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	597	Total	O	0	20
			617	617		
7	B	563	Total	O	0	17
			580	580		

- Molecule 1: Putative tryptophan halogenase



4 Data and refinement statistics

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α , β , γ	119.96Å 119.96Å 70.40Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.66 – 1.60 45.66 – 1.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (45.66-1.60) 100.0 (45.66-1.60)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.14 (at 1.60Å)	Xtriage
Refinement program	PHENIX 1.14rc3_3199	Depositor
R, R_{free}	0.158 , 0.189 0.158 , 0.189	Depositor DCC
R_{free} test set	7318 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å ²)	18.8	Xtriage
Anisotropy	0.079	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 53.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.015 for -h,-k,l 0.025 for h,-h-k,-l 0.015 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	9532	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.35% 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: PO4, BUD, BU9, MES, TLA

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	0.56	0/4258	0.68	0/5775
1	B	0.52	0/4232	0.68	1/5738 (0.0%)
All	All	0.54	0/8490	0.68	1/11513 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	1
All	All	0	2

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	B	432	GLN	N-CA-CB	5.01	119.61	110.60

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	363	PRO	Peptide
1	B	432	GLN	Sidechain

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	4100	0	4032	17	0
1	B	4054	0	4033	20	0
2	A	5	0	0	0	0
3	A	10	0	4	0	0
3	B	40	0	16	0	0
4	A	48	0	48	0	0
4	B	24	0	24	2	0
5	A	30	0	50	2	0
5	B	18	0	30	0	0
6	A	6	0	10	2	0
7	A	617	0	0	4	0
7	B	580	0	0	3	0
All	All	9532	0	8247	38	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.

The worst 5 of 38 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:A:456:HIS:HE1	7:A:1185:HOH:O	1.78	0.66
1:A:373:GLU:OE1	1:A:376:ARG:NH1	2.30	0.64
1:B:360:GLN:HE22	4:B:605:MES:H62	1.61	0.64
6:A:611:BU9:H012	7:A:1214:HOH:O	1.98	0.64
1:A:151:LEU:HD12	1:A:156:MET:HG2	1.78	0.64

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	522/523 (100%)	514 (98%)	8 (2%)	0	100	100
1	B	517/523 (99%)	507 (98%)	10 (2%)	0	100	100
All	All	1039/1046 (99%)	1021 (98%)	18 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	424/414 (102%)	423 (100%)	1 (0%)	93	88
1	B	422/414 (102%)	419 (99%)	3 (1%)	84	73
All	All	846/828 (102%)	842 (100%)	4 (0%)	88	80

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	77	PHE
1	B	11	ARG
1	B	77	PHE
1	B	478	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	181	GLN
1	A	456	HIS
1	B	321	GLN
1	B	360	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

21 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	MES	B	606	-	12,12,12	2.31	1 (8%)	15,16,16	2.26	5 (33%)
5	BUD	B	609	-	4,5,5	0.93	0	6,6,6	0.66	0
2	PO4	A	601	-	4,4,4	0.90	0	6,6,6	1.09	1 (16%)
4	MES	B	605	-	12,12,12	2.35	1 (8%)	15,16,16	2.15	6 (40%)
6	BU9	A	611	-	4,5,5	0.71	0	6,6,6	0.27	0
5	BUD	A	608	-	4,5,5	0.82	0	6,6,6	0.83	0
3	TLA	B	603	-	9,9,9	1.32	1 (11%)	12,12,12	1.17	1 (8%)
5	BUD	A	609	-	4,5,5	0.81	0	6,6,6	0.70	0
4	MES	A	603	-	12,12,12	1.96	1 (8%)	15,16,16	3.08	9 (60%)
3	TLA	B	602	-	9,9,9	1.34	0	12,12,12	1.23	2 (16%)
4	MES	A	605[B]	-	12,12,12	2.24	1 (8%)	15,16,16	1.80	2 (13%)
4	MES	A	605[A]	-	12,12,12	1.90	1 (8%)	15,16,16	2.26	5 (33%)
5	BUD	B	607	-	4,5,5	1.10	0	6,6,6	0.81	0
5	BUD	A	610	-	4,5,5	0.66	0	6,6,6	0.61	0
5	BUD	B	608	-	4,5,5	0.66	0	6,6,6	0.83	0
3	TLA	B	604	-	9,9,9	1.37	1 (11%)	12,12,12	1.10	1 (8%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	BUD	A	606	-	4,5,5	0.58	0	6,6,6	0.45	0
3	TLA	A	602	-	9,9,9	1.26	1 (11%)	12,12,12	1.18	1 (8%)
3	TLA	B	601	-	9,9,9	1.09	0	12,12,12	0.87	0
4	MES	A	604	-	12,12,12	2.08	1 (8%)	15,16,16	2.64	7 (46%)
5	BUD	A	607	-	4,5,5	0.96	0	6,6,6	0.59	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	MES	B	606	-	-	5/6/14/14	0/1/1/1
5	BUD	B	609	-	-	0/4/4/4	-
4	MES	B	605	-	-	3/6/14/14	0/1/1/1
6	BU9	A	611	-	-	0/4/4/4	-
5	BUD	A	608	-	-	0/4/4/4	-
3	TLA	B	603	-	-	12/12/12/12	-
5	BUD	A	609	-	-	0/4/4/4	-
4	MES	A	603	-	-	1/6/14/14	0/1/1/1
3	TLA	B	602	-	-	0/12/12/12	-
4	MES	A	605[B]	-	-	1/6/14/14	0/1/1/1
4	MES	A	605[A]	-	-	5/6/14/14	0/1/1/1
5	BUD	B	607	-	-	0/4/4/4	-
5	BUD	A	610	-	-	0/4/4/4	-
5	BUD	B	608	-	-	0/4/4/4	-
3	TLA	B	604	-	-	0/12/12/12	-
5	BUD	A	606	-	-	0/4/4/4	-
3	TLA	A	602	-	-	0/12/12/12	-
3	TLA	B	601	-	-	0/12/12/12	-
4	MES	A	604	-	-	4/6/14/14	0/1/1/1
5	BUD	A	607	-	-	0/4/4/4	-

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	605	MES	C8-S	-7.82	1.66	1.77
4	B	606	MES	C8-S	-7.74	1.66	1.77
4	A	605[B]	MES	C8-S	-7.52	1.67	1.77
4	A	604	MES	C8-S	-6.85	1.68	1.77
4	A	603	MES	C8-S	-6.51	1.68	1.77

The worst 5 of 40 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	603	MES	O1S-S-C8	5.74	115.40	106.73
4	A	605[A]	MES	C5-N4-C3	5.47	120.61	108.84
4	A	605[B]	MES	C5-N4-C3	5.44	120.55	108.84
4	A	604	MES	C6-C5-N4	-5.44	101.86	110.12
4	B	606	MES	C5-N4-C3	5.42	120.52	108.84

There are no chirality outliers.

5 of 31 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	605[A]	MES	C8-C7-N4-C5
4	A	605[A]	MES	N4-C7-C8-S
4	A	605[A]	MES	C7-C8-S-O1S
4	A	605[A]	MES	C7-C8-S-O3S
4	B	605	MES	C8-C7-N4-C5

There are no ring outliers.

5 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	606	MES	1	0
4	B	605	MES	1	0
6	A	611	BU9	2	0
5	A	609	BUD	2	0
5	A	610	BUD	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	505/523 (96%)	-0.60	6 (1%) 79 78	13, 19, 39, 67	0
1	B	493/523 (94%)	-0.56	11 (2%) 62 60	14, 20, 40, 77	0
All	All	998/1046 (95%)	-0.58	17 (1%) 70 69	13, 20, 39, 77	0

The worst 5 of 17 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	54	GLY	6.9
1	B	52	THR	5.7
1	B	430[A]	PHE	4.7
1	B	503	PRO	4.4
1	B	51	GLY	4.2

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 monosaccharides 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
3	TLA	B	603	10/10	0.79	0.17	32,45,51,59	10
4	MES	A	604	12/12	0.84	0.16	39,50,75,79	12
5	BUD	A	610	6/6	0.85	0.14	21,25,27,32	6
2	PO4	A	601	5/5	0.86	0.15	29,32,60,61	5
3	TLA	B	604	10/10	0.86	0.18	26,42,47,54	10
6	BU9	A	611	6/6	0.86	0.15	25,31,37,38	6
5	BUD	A	609	6/6	0.87	0.12	20,25,29,36	0
5	BUD	B	609	6/6	0.93	0.13	27,36,45,52	0
3	TLA	B	602	10/10	0.93	0.07	21,24,37,39	10
5	BUD	A	608	6/6	0.94	0.06	23,35,40,42	0
5	BUD	A	606	6/6	0.95	0.08	20,23,25,26	0
4	MES	B	605	12/12	0.96	0.09	25,46,52,56	12
4	MES	A	605[A]	12/12	0.96	0.14	17,27,33,42	12
5	BUD	B	607	6/6	0.96	0.08	17,20,24,29	6
5	BUD	B	608	6/6	0.96	0.10	19,22,23,24	6
5	BUD	A	607	6/6	0.96	0.09	15,24,26,27	6
4	MES	A	605[B]	12/12	0.96	0.14	15,26,34,37	12
3	TLA	B	601	10/10	0.97	0.05	15,20,22,28	0
4	MES	A	603	12/12	0.97	0.09	20,41,46,51	12
4	MES	B	606	12/12	0.97	0.11	18,32,43,48	12
3	TLA	A	602	10/10	0.98	0.04	16,19,24,24	0

6.5 Other polymers

There are no such residues in this entry.