



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 13, 2017 – 09:56 pm GMT

PDB ID : 4MSE
Title : Crystal structure of PDE10A2 with fragment ZT1597 (2-({[(2S)-2-methyl-2,3-dihydro-1,3-benzothiazol-5-yl]oxy}methyl)quinoline)
Authors : Sridhar, V.; Badger, J.; Logan, C.; Chie-Leon, B.; Nienaber, V.
Deposited on : 2013-09-18
Resolution : 2.81 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

<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 : trunk28620
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) : recalc28949

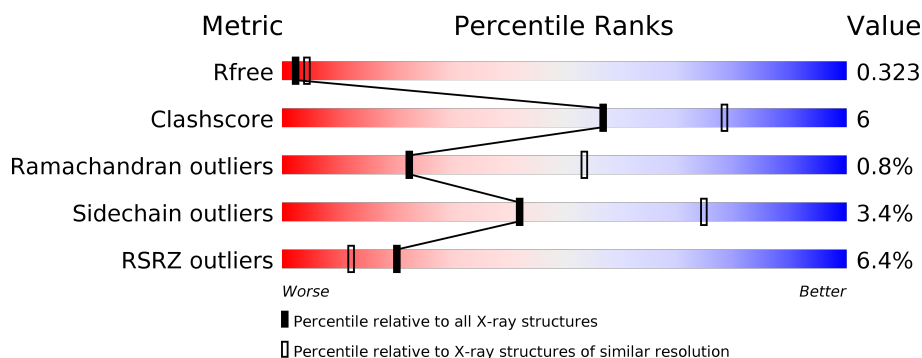
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.81 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	2917 (2.84-2.80)
Clashscore	112137	3382 (2.84-2.80)
Ramachandran outliers	110173	3324 (2.84-2.80)
Sidechain outliers	110143	3326 (2.84-2.80)
RSRZ outliers	101464	2948 (2.84-2.80)

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. 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	345	<div> <div>3%</div> <div> <div></div> <div>79%</div> <div>16%</div> <div>• •</div> </div> </div>
1	B	345	<div> <div>9%</div> <div> <div></div> <div>79%</div> <div>14%</div> <div>• 5%</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
2	2ZU	A	900	-	-	-	X
3	NI	A	901	-	-	-	X
3	NI	A	902	-	-	-	X

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5330 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.

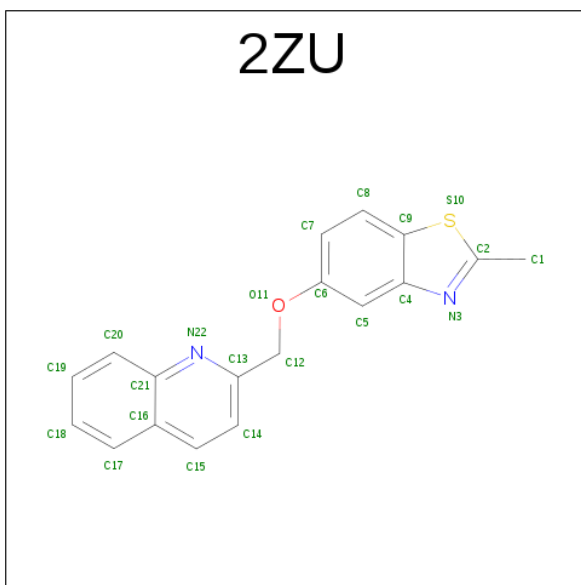
- Molecule 1 is a protein called cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	330	Total	C	N	O	S	0	13	0
			2669	1712	453	480	24			
1	B	327	Total	C	N	O	S	0	8	0
			2635	1689	445	475	26			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	445	GLY	-	EXPRESSION TAG	UNP Q9Y233
A	446	ALA	-	EXPRESSION TAG	UNP Q9Y233
A	447	GLY	-	EXPRESSION TAG	UNP Q9Y233
A	448	THR	-	EXPRESSION TAG	UNP Q9Y233
B	445	GLY	-	EXPRESSION TAG	UNP Q9Y233
B	446	ALA	-	EXPRESSION TAG	UNP Q9Y233
B	447	GLY	-	EXPRESSION TAG	UNP Q9Y233
B	448	THR	-	EXPRESSION TAG	UNP Q9Y233

- Molecule 2 is 2-[(2-METHYL-1,3-BENZOTHAZOL-5-YL)OXY]METHYL}QUINOLINE (three-letter code: 2ZU) (formula: C₁₈H₁₄N₂OS).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			22	18	2	1	1		

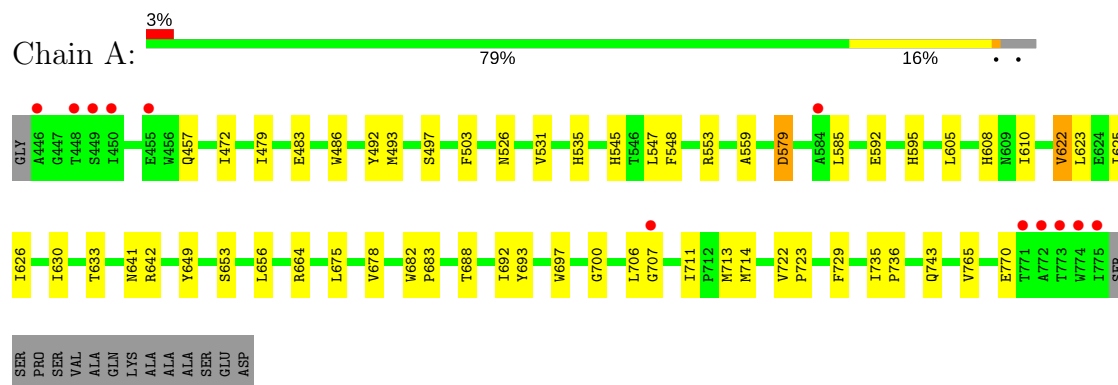
- Molecule 3 is NICKEL (II) ION (three-letter code: NI) (formula: Ni).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	2	Total	Ni	0	0
			2	2		
3	A	2	Total	Ni	0	0
			2	2		

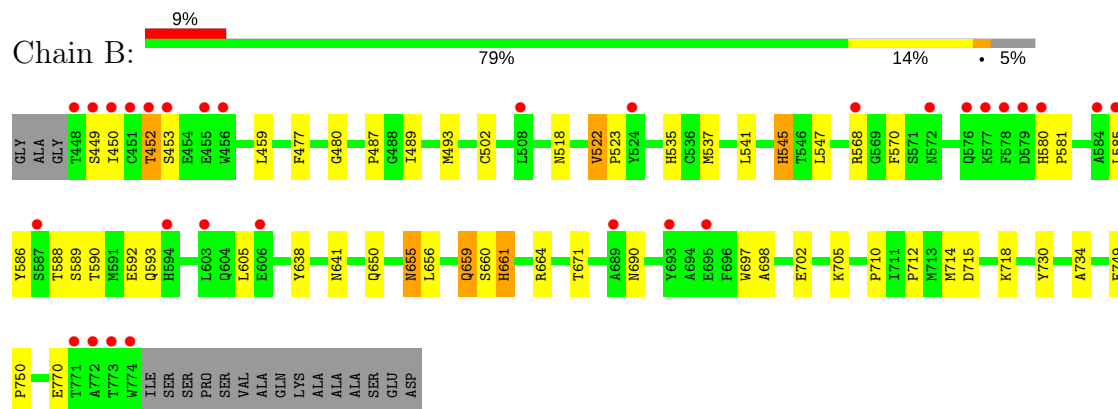
3 Residue-property plots [i](#)

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: cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A



- Molecule 1: cAMP and cAMP-inhibited cGMP 3',5'-cyclic phosphodiesterase 10A



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	50.65Å 81.82Å 156.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.20 – 2.81 48.20 – 2.81	Depositor EDS
% Data completeness (in resolution range)	(Not available) (48.20-2.81) 99.2 (48.20-2.81)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.75 (at 2.81Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.271 , 0.343 0.255 , 0.323	Depositor DCC
R_{free} test set	829 reflections (5.33%)	DCC
Wilson B-factor (Å ²)	75.4	Xtriage
Anisotropy	0.774	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 46.6	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	5330	wwPDB-VP
Average B, all atoms (Å ²)	88.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.17% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NI, 2ZU

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	0.36	0/2800	0.51	0/3796
1	B	0.36	0/2741	0.51	0/3718
All	All	0.36	0/5541	0.51	0/7514

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	2669	0	2628	31	0
1	B	2635	0	2582	29	0
2	A	22	0	14	1	0
3	A	2	0	0	0	0
3	B	2	0	0	0	0
All	All	5330	0	5224	60	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 6.

All (60) 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:B:655:ASN:H	1:B:661:HIS:HD2	1.19	0.85
1:A:605:LEU:HB2	1:A:608:HIS:HD2	1.46	0.79
1:B:655:ASN:H	1:B:661:HIS:CD2	2.08	0.68
1:B:568:ARG:O	1:B:570:PHE:HD1	1.76	0.68
1:B:522:VAL:HB	1:B:523:PRO:HD2	1.75	0.67
1:A:472[A]:ILE:HG21	1:A:492:TYR:HE2	1.62	0.63
1:A:735:ILE:HB	1:A:736:PRO:HD3	1.82	0.61
1:B:715:ASP:OD2	1:B:718:LYS:HE3	2.04	0.58
1:A:483:GLU:HA	1:A:486:TRP:CE2	2.41	0.56
1:B:450:ILE:HG22	1:B:605:LEU:HD13	1.90	0.54
1:A:700:GLY:HA3	1:A:714:MET:O	2.08	0.54
1:B:589:SER:HB3	1:B:592:GLU:HB2	1.90	0.54
1:B:580:HIS:CG	1:B:581:PRO:HD2	2.43	0.54
1:B:489:ILE:O	1:B:493:MET:HG3	2.08	0.54
1:A:605:LEU:HB2	1:A:608:HIS:CD2	2.37	0.53
1:A:711:ILE:HD12	1:A:713:MET:HB3	1.90	0.52
1:B:568:ARG:O	1:B:570:PHE:CD1	2.63	0.51
1:A:722:VAL:HB	1:A:723:PRO:HD3	1.93	0.51
1:B:477:PHE:HB3	1:B:535:HIS:CE1	2.46	0.51
1:B:659:GLN:HE21	1:B:660:SER:N	2.09	0.50
1:B:547[B]:LEU:HD11	1:B:656:LEU:HD13	1.92	0.50
1:A:675:LEU:O	1:A:678:VAL:HG22	2.12	0.49
1:B:730:TYR:HA	1:B:734:ALA:HB3	1.95	0.48
1:B:690:ASN:HB3	1:B:697:TRP:HZ3	1.77	0.48
1:B:638:TYR:CD1	1:B:671:THR:HG21	2.48	0.48
1:B:588:THR:O	1:B:593:GLN:NE2	2.47	0.48
1:B:710:PRO:HB2	1:B:714[A]:MET:HB2	1.95	0.47
1:A:630:ILE:O	1:A:633:THR:OG1	2.26	0.47
1:A:547[A]:LEU:HD22	1:A:656[A]:LEU:HD12	1.97	0.47
1:A:545:HIS:O	1:A:553:ARG:NH1	2.48	0.47
1:B:537:MET:O	1:B:541:LEU:HG	2.15	0.47
1:A:548:PHE:O	1:A:553:ARG:NH1	2.48	0.47
1:B:459[B]:LEU:HD21	1:B:487:PRO:HB2	1.97	0.46
1:A:526:ASN:C	1:A:526:ASN:OD1	2.54	0.46
1:A:649:TYR:CE2	1:A:743:GLN:HB3	2.51	0.45
1:A:682:TRP:HB3	1:A:683:PRO:HD3	1.97	0.45
1:A:641:ASN:HD22	1:A:664:ARG:HH11	1.63	0.45
1:A:493:MET:SD	1:A:535:HIS:HA	2.56	0.45
1:A:713:MET:HG3	2:A:900:2ZU:N22	2.32	0.45
1:A:592:GLU:HA	1:A:595:HIS:HD2	1.80	0.45
1:B:650:GLN:HA	1:B:650:GLN:OE1	2.16	0.44
1:A:486:TRP:HB3	1:A:531:VAL:HG21	2.00	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:702:GLU:HA	1:B:705:LYS:HD2	1.98	0.44
1:A:622:VAL:HA	1:A:625:ILE:HD12	2.00	0.43
1:B:586:TYR:HB2	1:B:590:THR:HG23	2.00	0.43
1:A:472[A]:ILE:HG21	1:A:492:TYR:CE2	2.48	0.43
1:B:585:LEU:HD23	1:B:585:LEU:H	1.83	0.43
1:A:559:ALA:HB2	1:A:626:ILE:HG12	2.00	0.42
1:A:503:PHE:CD1	1:A:610:ILE:HB	2.55	0.42
1:B:641:ASN:HD21	1:B:664:ARG:HA	1.84	0.42
1:A:479:ILE:HD12	1:A:486:TRP:CE2	2.55	0.41
1:A:765:VAL:HG13	1:A:770:GLU:HB2	2.02	0.41
1:A:675:LEU:HD22	1:A:729:PHE:HZ	1.85	0.41
1:B:698:ALA:O	1:B:702:GLU:HG2	2.21	0.41
1:B:749:GLU:O	1:B:750:PRO:C	2.59	0.41
1:A:693:TYR:HB3	1:A:697:TRP:CE2	2.56	0.41
1:A:735:ILE:HB	1:A:736:PRO:CD	2.48	0.41
1:B:449:SER:HB2	1:B:518:ASN:HD21	1.87	0.40
1:B:452:THR:HG22	1:B:453:SER:H	1.87	0.40

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	341/345 (99%)	319 (94%)	20 (6%)	2 (1%)	28	61
1	B	333/345 (96%)	304 (91%)	26 (8%)	3 (1%)	20	50
All	All	674/690 (98%)	623 (92%)	46 (7%)	5 (1%)	22	57

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	579	ASP

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Mol	Chain	Res	Type
1	A	707	GLY
1	B	480	GLY
1	B	545	HIS
1	B	712	PRO

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	296/306 (97%)	284 (96%)	12 (4%)	35	68
1	B	291/306 (95%)	283 (97%)	8 (3%)	50	82
All	All	587/612 (96%)	567 (97%)	20 (3%)	42	75

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	457	GLN
1	A	497	SER
1	A	579	ASP
1	A	585	LEU
1	A	622	VAL
1	A	623[A]	LEU
1	A	623[B]	LEU
1	A	642	ARG
1	A	653	SER
1	A	688	THR
1	A	692	ILE
1	A	706	LEU
1	B	452	THR
1	B	502	CYS
1	B	522	VAL
1	B	545	HIS
1	B	655	ASN
1	B	659	GLN
1	B	661	HIS

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Mol	Chain	Res	Type
1	B	770	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	495	HIS
1	A	608	HIS
1	A	641	ASN
1	A	657	ASN
1	B	461	GLN
1	B	518	ASN
1	B	526	ASN
1	B	641	ASN
1	B	655	ASN
1	B	659	GLN
1	B	661	HIS
1	B	761	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 5 ligands modelled in this entry, 4 are monoatomic - leaving 1 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	$\# Z > 2$
2	2ZU	A	900	-	23,25,25	1.17	0	31,35,35	2.59	10 (32%)

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
2	2ZU	A	900	-	-	0/5/5/5	0/4/4/4

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	900	2ZU	C4-C9-S10	-8.00	101.98	112.03
2	A	900	2ZU	C7-C8-C9	-4.99	115.00	118.81
2	A	900	2ZU	C6-C5-C4	-3.53	116.92	119.13
2	A	900	2ZU	C5-C4-C9	-2.77	118.00	121.01
2	A	900	2ZU	C14-C13-N22	-2.16	119.98	122.98
2	A	900	2ZU	C7-C6-C5	2.53	124.24	120.82
2	A	900	2ZU	C1-C2-N3	3.47	132.68	123.87
2	A	900	2ZU	C9-C4-N3	3.70	116.56	108.04
2	A	900	2ZU	C1-C2-S10	3.92	125.39	120.12
2	A	900	2ZU	C8-C9-C4	5.15	126.15	120.83

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
2	A	900	2ZU	1	0

5.7 Other polymers [i](#)

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

6.1 Protein, DNA and RNA chains

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	330/345 (95%)	0.19	12 (3%) 43 32	56, 80, 122, 147	0
1	B	327/345 (94%)	0.52	30 (9%) 10 5	59, 89, 128, 142	0
All	All	657/690 (95%)	0.35	42 (6%) 20 12	56, 85, 128, 147	0

All (42) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	451	CYS	10.0
1	B	450	ILE	8.6
1	A	450	ILE	7.7
1	B	452	THR	7.7
1	B	771	THR	7.1
1	B	453	SER	6.2
1	A	771	THR	5.8
1	A	449	SER	5.0
1	A	446	ALA	4.9
1	A	774	TRP	4.7
1	B	695	GLU	4.7
1	A	772	ALA	4.7
1	B	455	GLU	4.5
1	B	585	LEU	4.2
1	B	584	ALA	4.1
1	A	773	THR	3.9
1	B	449	SER	3.9
1	B	456	TRP	3.5
1	A	448	THR	3.5
1	B	773	THR	3.4
1	B	579	ASP	3.3
1	B	572	ASN	3.2
1	B	524	TYR	3.2
1	B	772	ALA	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	775	ILE	3.1
1	B	594	HIS	3.0
1	A	707	GLY	2.9
1	B	689	ALA	2.9
1	A	455	GLU	2.9
1	B	576	GLN	2.8
1	B	587	SER	2.7
1	B	693	TYR	2.6
1	B	568	ARG	2.6
1	B	508	LEU	2.5
1	B	603	LEU	2.5
1	B	580	HIS	2.4
1	B	577	LYS	2.3
1	B	774	TRP	2.3
1	A	584	ALA	2.3
1	B	578	PHE	2.2
1	B	606	GLU	2.2
1	B	448	THR	2.1

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 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
3	NI	A	902	1/1	0.96	0.31	4.46	100,100,100,100	0
2	2ZU	A	900	22/22	0.86	0.40	3.80	91,93,98,98	0
3	NI	A	901	1/1	0.92	0.21	2.14	72,72,72,72	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(\AA^2)	Q<0.9
3	NI	B	902	1/1	0.90	0.18	-0.09	124,124,124,124	0
3	NI	B	901	1/1	0.97	0.13	-1.48	73,73,73,73	0

6.5 Other polymers [i](#)

There are no such residues in this entry.