



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 02:05 AM UTC

PDB ID : 8T2C / pdb_00008t2c
Title : Crystal structure of O-acetyl-L-serine sulfhydrylase A (CysK) from Staphylococcus aureus NCTC 8325 complexed with a CymR pentapeptide
Authors : Pederick, J.L.; Bruning, J.B.; Vandborg, B.
Deposited on : 2023-06-05
Resolution : 1.80 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

<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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

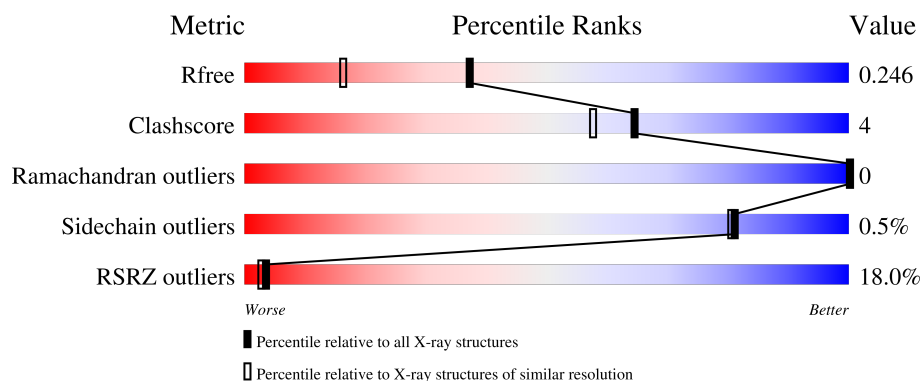
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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}	180053	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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 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	306	17% 92% 8%
1	B	306	18% 89% 10%
2	C	5	80% 20%
2	D	5	40% 80% 20%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4610 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 Cysteine synthase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	306	Total	C	N	O	P	S	0	0	0
			2192	1394	362	429	1	6			
1	B	305	Total	C	N	O	P	S	0	0	0
			2190	1391	367	424	1	7			

- Molecule 2 is a protein called TYR-MET-PHE-TYR-ILE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	4	Total	C	N	O	S	0	0	0
			40	29	4	6	1			
2	D	4	Total	C	N	O	S	0	0	0
			40	29	4	6	1			

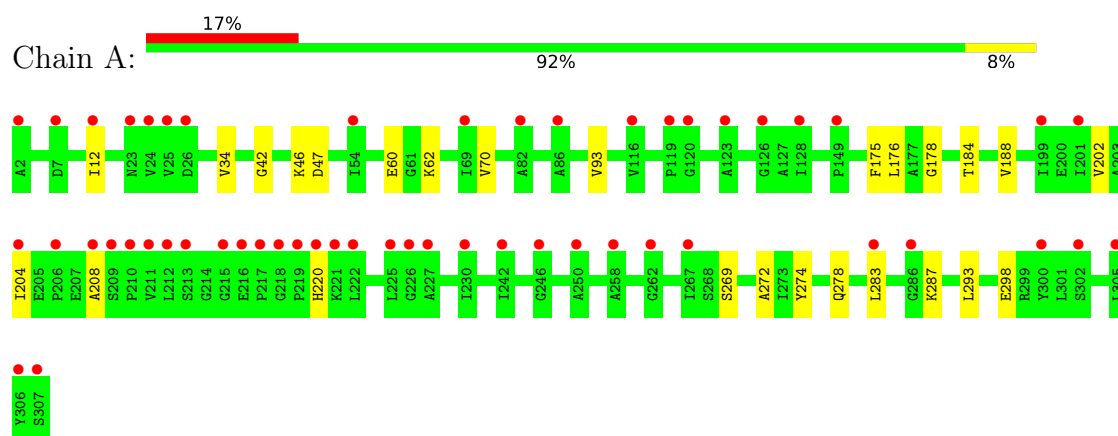
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	70	Total	O	0	0
			70	70		
3	B	72	Total	O	0	0
			72	72		
3	C	3	Total	O	0	0
			3	3		
3	D	3	Total	O	0	0
			3	3		

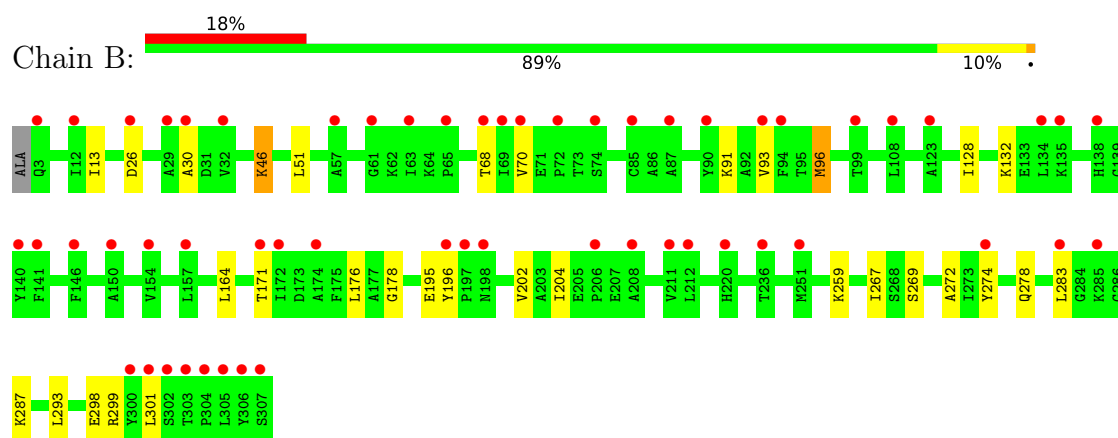
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

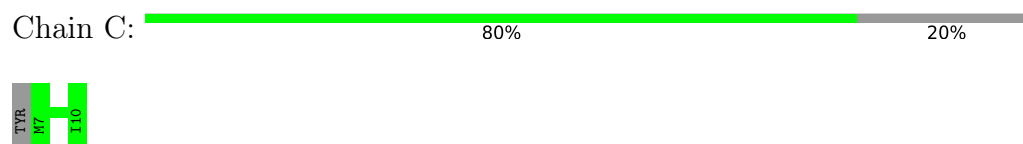
• Molecule 1: Cysteine synthase



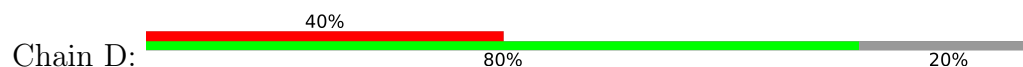
• Molecule 1: Cysteine synthase



• Molecule 2: TYR-MET-PHE-TYR-ILE



• Molecule 2: TYR-MET-PHE-TYR-ILE



TYR	
M7	
F8	
Y9	
I10	

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	50.61Å 94.52Å 56.08Å 90.00° 108.50° 90.00°	Depositor
Resolution (Å)	43.07 – 1.80 43.07 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.7 (43.07-1.80) 99.7 (43.07-1.80)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.09 (at 1.79Å)	Xtriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, R_{free}	0.223 , 0.245 0.223 , 0.246	Depositor DCC
R_{free} test set	2000 reflections (4.32%)	wwPDB-VP
Wilson B-factor (Å ²)	31.0	Xtriage
Anisotropy	0.394	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 52.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4610	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.83% 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: LLP

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	0.13	0/2205	0.34	0/3000
1	B	0.12	0/2202	0.30	0/2995
2	C	0.08	0/41	0.20	0/52
2	D	0.08	0/41	0.16	0/52
All	All	0.12	0/4489	0.32	0/6099

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	2192	0	2140	14	0
1	B	2190	0	2146	21	0
2	C	40	0	37	0	0
2	D	40	0	37	0	0
3	A	70	0	0	0	0
3	B	72	0	0	3	0
3	C	3	0	0	0	0
3	D	3	0	0	0	0
All	All	4610	0	4360	34	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 4.

All (34) 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:269:SER:HB3	1:A:293:LEU:HD22	1.73	0.71
1:B:298:GLU:HA	1:B:301:LEU:HD23	1.78	0.65
1:A:204:ILE:HD13	1:A:272:ALA:HA	1.79	0.64
1:B:259:LYS:NZ	3:B:402:HOH:O	2.34	0.61
1:A:298:GLU:OE2	1:B:299:ARG:NH2	2.27	0.61
1:A:176:LEU:HG	1:A:202:VAL:HB	1.86	0.58
1:B:68:THR:HG22	1:B:91:LYS:HB2	1.85	0.57
1:B:204:ILE:HD13	1:B:272:ALA:HA	1.87	0.56
1:A:208:ALA:HB3	1:A:220:HIS:HB3	1.88	0.56
1:B:269:SER:HB3	1:B:293:LEU:HD22	1.89	0.55
1:B:283:LEU:HB3	1:B:287:LYS:HG3	1.92	0.51
1:B:176:LEU:HG	1:B:202:VAL:HB	1.96	0.48
1:A:283:LEU:HB3	1:A:287:LYS:HG3	1.96	0.48
1:B:178:GLY:HA2	1:B:204:ILE:HB	1.95	0.48
1:B:30:ALA:HB2	1:B:287:LYS:HB2	1.97	0.47
1:A:175:PHE:CZ	1:A:188:VAL:HG21	2.50	0.46
1:B:259:LYS:NZ	3:B:407:HOH:O	2.49	0.46
1:B:171:THR:HA	1:B:196:TYR:CE1	2.52	0.44
1:A:274:TYR:O	1:A:278:GLN:HG2	2.18	0.43
1:A:60:GLU:OE1	1:A:62:LYS:NZ	2.46	0.43
1:B:164:LEU:HD22	1:B:195:GLU:HG2	2.02	0.42
1:A:12:ILE:HD13	1:A:12:ILE:HA	1.85	0.42
1:B:70:VAL:HA	1:B:93:VAL:O	2.18	0.42
1:B:274:TYR:O	1:B:278:GLN:HG2	2.20	0.41
1:A:70:VAL:HA	1:A:93:VAL:O	2.20	0.41
1:B:96:MET:HE2	1:B:96:MET:HB3	1.63	0.41
1:B:128:ILE:O	1:B:132:LYS:HG2	2.21	0.41
1:B:46:LLP:OP3	1:B:46:LLP:H4'1	2.21	0.41
1:B:267:ILE:HG22	3:B:426:HOH:O	2.21	0.40
1:B:13:ILE:HD12	1:B:51:LEU:HD22	2.03	0.40
1:A:184:THR:O	1:A:188:VAL:HG22	2.21	0.40
1:A:42:GLY:N	1:A:47:ASP:OD2	2.44	0.40
1:A:178:GLY:HA2	1:A:204:ILE:HB	2.03	0.40
1:B:26:ASP:OD1	1:B:26:ASP:N	2.52	0.40

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	303/306 (99%)	294 (97%)	9 (3%)	0	100	100
1	B	302/306 (99%)	297 (98%)	5 (2%)	0	100	100
2	C	2/5 (40%)	1 (50%)	1 (50%)	0	100	100
2	D	2/5 (40%)	1 (50%)	1 (50%)	0	100	100
All	All	609/622 (98%)	593 (97%)	16 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	212/240 (88%)	211 (100%)	1 (0%)	81	80
1	B	211/240 (88%)	210 (100%)	1 (0%)	81	80
2	C	4/5 (80%)	4 (100%)	0	100	100
2	D	4/5 (80%)	4 (100%)	0	100	100
All	All	431/490 (88%)	429 (100%)	2 (0%)	81	80

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	VAL
1	B	96	MET

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	39	GLN
1	A	138	HIS
1	A	278	GLN
1	B	39	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 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	LLP	B	46	1	23,24,25	2.45	6 (26%)	25,32,34	1.29	3 (12%)
1	LLP	A	46	1	23,24,25	2.45	6 (26%)	25,32,34	1.35	4 (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	LLP	B	46	1	-	1/16/17/19	0/1/1/1
1	LLP	A	46	1	-	1/16/17/19	0/1/1/1

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	46	LLP	C4-C4'	7.22	1.62	1.46
1	A	46	LLP	C4-C4'	7.10	1.61	1.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	46	LLP	C4'-NZ	4.88	1.43	1.27
1	B	46	LLP	C4'-NZ	4.87	1.43	1.27
1	B	46	LLP	C2'-C2	3.78	1.56	1.50
1	A	46	LLP	C2'-C2	3.65	1.56	1.50
1	B	46	LLP	C4-C5	-3.51	1.37	1.42
1	A	46	LLP	C4-C5	-3.44	1.37	1.42
1	A	46	LLP	C6-N1	3.01	1.40	1.34
1	B	46	LLP	C6-N1	2.84	1.40	1.34
1	A	46	LLP	C5'-C5	2.27	1.56	1.50
1	B	46	LLP	C5'-C5	2.22	1.56	1.50

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	46	LLP	CE-NZ-C4'	-3.55	107.35	118.72
1	B	46	LLP	CE-NZ-C4'	-3.53	107.42	118.72
1	A	46	LLP	C4-C4'-NZ	-2.65	111.82	124.04
1	B	46	LLP	C4-C4'-NZ	-2.49	112.54	124.04
1	B	46	LLP	C5-C6-N1	-2.36	119.98	123.83
1	A	46	LLP	OP4-C5'-C5	2.33	113.71	109.36
1	A	46	LLP	C5-C6-N1	-2.09	120.44	123.83

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	46	LLP	CG-CD-CE-NZ
1	A	46	LLP	CG-CD-CE-NZ

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	46	LLP	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

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

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	305/306 (99%)	1.34	53 (17%)  	30, 42, 70, 86	0
1	B	304/306 (99%)	1.41	56 (18%)  	29, 44, 67, 83	0
2	C	4/5 (80%)	1.50	0  	42, 47, 50, 53	0
2	D	4/5 (80%)	1.91	2 (50%)  	49, 58, 60, 66	0
All	All	617/622 (99%)	1.38	111 (17%)  	29, 44, 69, 86	0

All (111) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	306	TYR	4.3
1	A	69	ILE	4.2
1	B	301	LEU	3.9
1	A	219	PRO	3.7
1	A	206	PRO	3.7
1	B	305	LEU	3.6
1	B	300	TYR	3.6
1	B	12	ILE	3.6
1	A	208	ALA	3.5
1	B	306	TYR	3.4
1	B	211	VAL	3.4
1	B	138	HIS	3.3
1	A	217	PRO	3.3
1	B	57	ALA	3.2
1	B	303	THR	3.1
1	A	267	ILE	3.0
1	B	26	ASP	3.0
1	A	7	ASP	3.0
1	B	74	SER	2.9
1	A	215	GLY	2.9
1	A	218	GLY	2.9

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Mol	Chain	Res	Type	RSRZ
1	B	123	ALA	2.9
1	B	150	ALA	2.9
1	A	286	GLY	2.9
1	B	63	ILE	2.9
1	B	208	ALA	2.9
1	A	216	GLU	2.9
1	B	61	GLY	2.9
1	A	12	ILE	2.8
1	A	211	VAL	2.8
1	B	3	GLN	2.8
1	B	157	LEU	2.8
1	A	305	LEU	2.8
1	B	171	THR	2.8
1	A	119	PRO	2.7
1	A	24	VAL	2.7
1	B	140	TYR	2.7
1	A	222	LEU	2.7
1	B	108	LEU	2.7
1	B	307	SER	2.7
1	B	69	ILE	2.7
1	B	285	LYS	2.6
1	A	230	ILE	2.6
1	A	2	ALA	2.6
1	B	274	TYR	2.6
1	B	65	PRO	2.6
1	A	221	LYS	2.6
1	A	307	SER	2.6
1	B	302	SER	2.6
1	A	149	PRO	2.5
1	A	86	ALA	2.5
1	A	250	ALA	2.5
1	A	258	ALA	2.5
1	A	213	SER	2.5
1	A	283	LEU	2.5
1	A	242	ILE	2.5
1	B	32	VAL	2.5
1	B	304	PRO	2.5
1	A	300	TYR	2.5
1	B	134	LEU	2.5
1	B	29	ALA	2.5
1	B	251	MET	2.5
1	B	172	ILE	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	283	LEU	2.4
1	B	30	ALA	2.4
1	A	210	PRO	2.4
1	A	246	GLY	2.4
1	A	302	SER	2.4
1	B	141	PHE	2.4
1	B	87	ALA	2.4
1	A	201	ILE	2.3
1	B	174	ALA	2.3
1	A	226	GLY	2.3
1	A	123	ALA	2.3
1	A	120	GLY	2.3
1	B	198	ASN	2.3
1	A	227	ALA	2.2
2	D	8	PHE	2.2
1	B	93	VAL	2.2
1	B	154	VAL	2.2
1	B	135	LYS	2.2
1	B	99	THR	2.2
1	A	262	GLY	2.2
1	A	26	ASP	2.2
1	A	220	HIS	2.2
1	B	220	HIS	2.2
1	A	82	ALA	2.2
1	B	90	TYR	2.2
2	D	10	ILE	2.2
1	B	197	PRO	2.2
1	B	146	PHE	2.1
1	A	25	VAL	2.1
1	A	116	VAL	2.1
1	B	70	VAL	2.1
1	A	126	GLY	2.1
1	B	206	PRO	2.1
1	B	212	LEU	2.1
1	A	23	ASN	2.1
1	A	128	ILE	2.1
1	A	199	ILE	2.1
1	B	85	CYS	2.1
1	A	225	LEU	2.1
1	B	94	PHE	2.1
1	A	212	LEU	2.1
1	A	54	ILE	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	204	ILE	2.0
1	B	68	THR	2.0
1	A	209	SER	2.0
1	B	236	THR	2.0
1	B	196	TYR	2.0
1	B	72	PRO	2.0

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($\text{\AA}^2$)	Q<0.9
1	LLP	B	46	24/25	0.91	0.10	30,34,38,39	0
1	LLP	A	46	24/25	0.93	0.11	28,37,43,44	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.