WORLDWIDE PDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Jun 18, 2024 – 01:05 AM EDT

PDB ID	:	3CZB
Title	:	Crystal structure of putative transglycosylase from Caulobacter crescentus
Authors	:	Ramagopal, U.A.; Chattopadhyay, K.; Toro, R.; Wasserman, S.; Freeman, J.; Logan, C.; Bain, K.; Gheyi, T.; Sauder, J.M.; Burley, S.K.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on	:	2008-04-28
Resolution	:	2.50 Å(reported)

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:
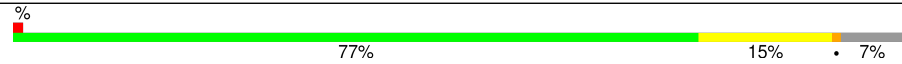*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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.
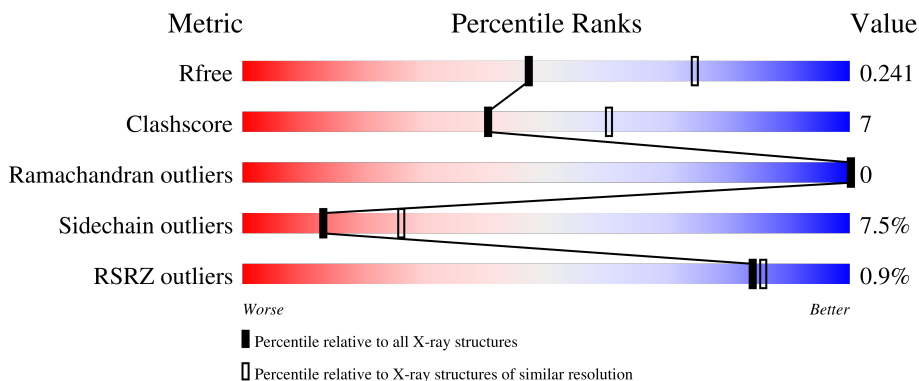
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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 <=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	351	74% 18% • 7%
1	B	351	77% 15% • 7%

2　Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 5076 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 transglycosylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	325	Total	C	N	O	S	0	1	0
			2443	1559	436	440	8			
1	B	326	Total	C	N	O	S	0	0	0
			2434	1555	432	440	7			

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	53	MET	-	expression tag	UNP Q9A226
A	54	SER	-	expression tag	UNP Q9A226
A	55	LEU	-	expression tag	UNP Q9A226
A	396	GLU	-	expression tag	UNP Q9A226
A	397	GLY	-	expression tag	UNP Q9A226
A	398	HIS	-	expression tag	UNP Q9A226
A	399	HIS	-	expression tag	UNP Q9A226
A	400	HIS	-	expression tag	UNP Q9A226
A	401	HIS	-	expression tag	UNP Q9A226
A	402	HIS	-	expression tag	UNP Q9A226
A	403	HIS	-	expression tag	UNP Q9A226
B	53	MET	-	expression tag	UNP Q9A226
B	54	SER	-	expression tag	UNP Q9A226
B	55	LEU	-	expression tag	UNP Q9A226
B	396	GLU	-	expression tag	UNP Q9A226
B	397	GLY	-	expression tag	UNP Q9A226
B	398	HIS	-	expression tag	UNP Q9A226
B	399	HIS	-	expression tag	UNP Q9A226
B	400	HIS	-	expression tag	UNP Q9A226
B	401	HIS	-	expression tag	UNP Q9A226
B	402	HIS	-	expression tag	UNP Q9A226
B	403	HIS	-	expression tag	UNP Q9A226

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

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

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	87	Total 87	O 87	0	0
3	B	77	Total 77	O 77	0	0

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: Putative transglycosylase

Chain A:

- Molecule 1: Putative transglycosylase

Chain B:
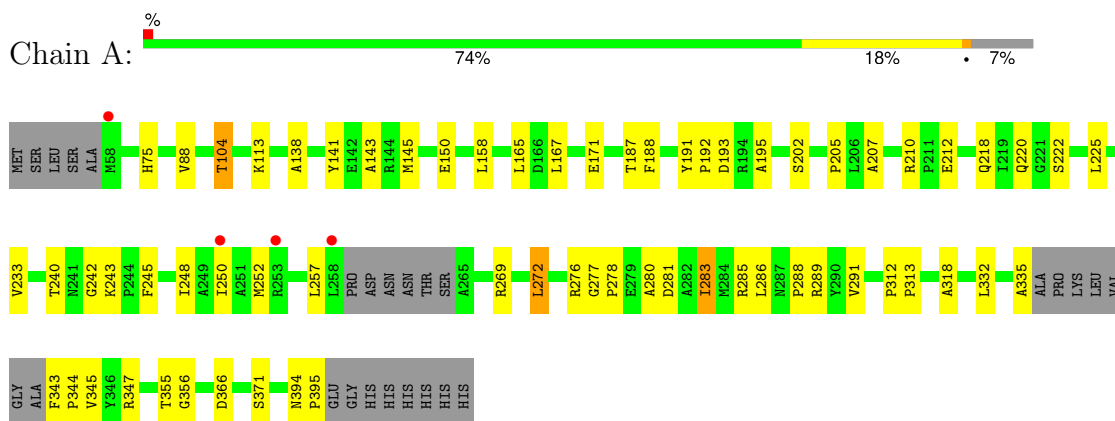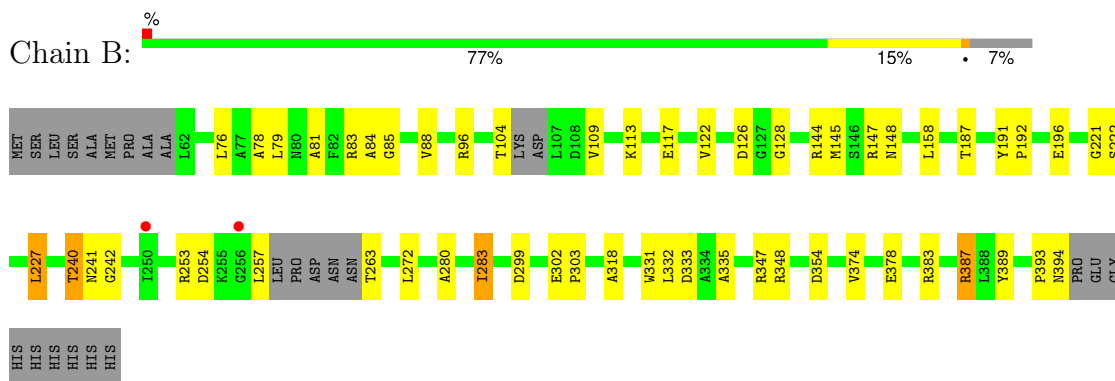
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α, β, γ	129.60Å 129.60Å 88.74Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.43 – 2.50 28.60 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.9 (30.43-2.50) 100.0 (28.60-2.50)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.76 (at 2.51Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.199 , 0.250 0.193 , 0.241	Depositor DCC
R_{free} test set	1544 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å^2)	45.7	Xtriage
Anisotropy	0.338	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 38.3	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.026 for -h,-k,l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5076	wwPDB-VP
Average B, all atoms (Å^2)	43.0	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.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ 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:
SO4

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	0.53	0/2503	0.69	0/3401
1	B	0.53	0/2493	0.67	0/3387
All	All	0.53	0/4996	0.68	0/6788

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	2443	0	2410	38	0
1	B	2434	0	2411	32	0
2	A	10	0	0	0	0
2	B	25	0	0	1	0
3	A	87	0	0	0	0
3	B	77	0	0	0	0
All	All	5076	0	4821	70	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 7.

All (70) 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:240:THR:HG22	1:B:242:GLY:H	0.98	1.09
1:A:240:THR:HG22	1:A:242:GLY:H	1.07	1.08
1:B:272:LEU:HD21	1:B:283:ILE:HD11	1.36	1.04
1:B:240:THR:CG2	1:B:242:GLY:H	1.77	0.96
1:B:240:THR:HG22	1:B:242:GLY:N	1.83	0.92
1:B:272:LEU:CD2	1:B:283:ILE:HD11	2.02	0.88
1:A:240:THR:HG22	1:A:242:GLY:N	1.88	0.87
1:B:387:ARG:HG2	1:B:387:ARG:HH11	1.44	0.82
1:A:240:THR:CG2	1:A:242:GLY:H	1.92	0.77
1:A:191:TYR:CD1	1:A:192:PRO:HD2	2.21	0.74
1:A:277:GLY:H	1:A:278:PRO:HD2	1.53	0.73
1:B:145:MET:HG2	1:B:227:LEU:HD21	1.78	0.66
1:B:335:ALA:HB3	1:B:387:ARG:HH22	1.61	0.65
1:B:332:LEU:O	1:B:347:ARG:HA	1.97	0.64
1:A:272:LEU:HD12	1:A:280:ALA:HB1	1.79	0.64
1:A:248:ILE:HD12	1:A:283:ILE:HD11	1.79	0.64
1:A:343:PHE:N	1:A:344:PRO:CD	2.63	0.62
1:B:113:LYS:O	1:B:117:GLU:HG3	2.00	0.60
1:A:343:PHE:N	1:A:344:PRO:HD2	2.17	0.60
1:A:248:ILE:O	1:A:252:MET:HG3	2.03	0.59
1:B:191:TYR:CD1	1:B:192:PRO:HD2	2.38	0.58
1:B:387:ARG:HG2	1:B:387:ARG:NH1	2.13	0.58
1:A:143:ALA:HB2	1:A:225:LEU:HD13	1.86	0.58
1:A:193:ASP:HB3	1:A:243:LYS:HE2	1.86	0.57
1:A:104:THR:O	1:A:104:THR:HG23	2.05	0.56
1:B:253:ARG:NH1	1:B:254:ASP:OD1	2.37	0.56
1:A:104:THR:O	1:A:104:THR:CG2	2.55	0.54
1:B:272:LEU:CD2	1:B:283:ILE:CD1	2.83	0.54
1:A:138:ALA:HB3	1:A:371:SER:HB3	1.89	0.53
1:B:331:TRP:HB3	1:B:389:TYR:HB2	1.90	0.53
1:A:145:MET:HE1	1:A:207:ALA:HA	1.93	0.51
1:B:79:LEU:CD2	1:B:83:ARG:HE	2.23	0.50
1:A:150:GLU:OE2	1:A:210:ARG:NE	2.43	0.50
1:B:333:ASP:O	1:B:387:ARG:NH1	2.44	0.50
1:B:240:THR:CG2	1:B:241:ASN:N	2.75	0.49
1:A:150:GLU:OE2	1:A:210:ARG:NH2	2.45	0.48
1:B:240:THR:HG21	2:B:5:SO4:O4	2.12	0.48
1:A:245:PHE:HB2	1:A:289[A]:ARG:HD2	1.94	0.48
1:B:147:ARG:HG2	1:B:148:ASN:N	2.27	0.48
1:A:202:SER:HB3	1:A:205:PRO:HG3	1.96	0.47
1:A:335:ALA:HB2	1:A:345:VAL:HG23	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:318:ALA:HB3	1:A:366:ASP:HB3	1.97	0.46
1:A:191:TYR:CE1	1:A:192:PRO:HD2	2.51	0.45
1:A:191:TYR:CG	1:A:192:PRO:HD2	2.50	0.45
1:A:277:GLY:N	1:A:278:PRO:HD2	2.27	0.45
1:B:280:ALA:O	1:B:283:ILE:HD13	2.17	0.45
1:B:318:ALA:HA	1:B:354:ASP:O	2.17	0.45
1:A:312:PRO:HA	1:A:313:PRO:HD3	1.78	0.45
1:A:141:TYR:O	1:A:225:LEU:HA	2.17	0.45
1:A:195:ALA:CB	1:A:285:ARG:HD2	2.46	0.44
1:B:393:PRO:O	1:B:394:ASN:HB2	2.17	0.44
1:A:276:ARG:HA	1:A:277:GLY:HA2	1.64	0.44
1:B:191:TYR:CG	1:B:192:PRO:HD2	2.53	0.43
1:A:75:HIS:CE1	1:A:113:LYS:HE2	2.54	0.43
1:A:138:ALA:HB3	1:A:371:SER:CB	2.49	0.42
1:B:78:ALA:O	1:B:81:ALA:HB3	2.19	0.42
1:B:126:ASP:C	1:B:128:GLY:H	2.22	0.42
1:A:281:ASP:O	1:A:285:ARG:HG3	2.20	0.42
1:A:218:GLN:HG2	1:A:291:VAL:HB	2.01	0.42
1:A:394:ASN:HA	1:A:395:PRO:HD2	1.86	0.42
1:A:355:THR:OG1	1:A:356:GLY:N	2.52	0.41
1:B:84:ALA:N	1:B:85:GLY:HA3	2.36	0.41
1:B:374:VAL:O	1:B:378:GLU:HG3	2.20	0.41
1:A:195:ALA:HB2	1:A:285:ARG:HD2	2.02	0.41
1:A:332:LEU:O	1:A:347:ARG:HA	2.20	0.41
1:B:221:GLY:O	1:B:222:SER:HB3	2.21	0.41
1:B:240:THR:CG2	1:B:242:GLY:N	2.60	0.41
1:A:187:THR:OG1	1:A:188:PHE:N	2.51	0.40
1:B:302:GLU:HB3	1:B:303:PRO:HD2	2.02	0.40
1:B:192:PRO:HB3	1:B:196:GLU:HB3	2.02	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	320/351 (91%)	311 (97%)	9 (3%)	0	100	100
1	B	320/351 (91%)	308 (96%)	12 (4%)	0	100	100
All	All	640/702 (91%)	619 (97%)	21 (3%)	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	234/256 (91%)	217 (93%)	17 (7%)	14	27
1	B	234/256 (91%)	216 (92%)	18 (8%)	13	25
All	All	468/512 (91%)	433 (92%)	35 (8%)	13	26

All (35) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	88	VAL
1	A	104	THR
1	A	158	LEU
1	A	165	LEU
1	A	167	LEU
1	A	171	GLU
1	A	212	GLU
1	A	220	GLN
1	A	222	SER
1	A	233	VAL
1	A	250	ILE
1	A	257	LEU
1	A	269	ARG
1	A	272	LEU
1	A	283	ILE
1	A	286	LEU
1	A	288	PRO
1	B	76	LEU

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Mol	Chain	Res	Type
1	B	88	VAL
1	B	96	ARG
1	B	104	THR
1	B	109	VAL
1	B	122	VAL
1	B	144	ARG
1	B	158	LEU
1	B	187	THR
1	B	227	LEU
1	B	240	THR
1	B	257	LEU
1	B	263	THR
1	B	283	ILE
1	B	299	ASP
1	B	348	ARG
1	B	383	ARG
1	B	387	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	220	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 ⓘ

7 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	$\#|Z| > 2$
2	SO4	A	1	-	4,4,4	0.27	0	6,6,6	0.11	0
2	SO4	B	3	-	4,4,4	0.36	0	6,6,6	0.27	0
2	SO4	B	6	-	4,4,4	0.27	0	6,6,6	0.16	0
2	SO4	B	4	-	4,4,4	0.23	0	6,6,6	0.40	0
2	SO4	B	2	-	4,4,4	0.25	0	6,6,6	0.29	0
2	SO4	B	5	-	4,4,4	0.38	0	6,6,6	0.23	0
2	SO4	A	7	-	4,4,4	0.26	0	6,6,6	0.21	0

There are no bond length outliers.

There are no bond angle outliers.

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	B	5	SO4	1	0

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	325/351 (92%)	-0.42	4 (1%)	79	80	17, 36, 75, 100	0
1	B	326/351 (92%)	-0.36	2 (0%)	89	90	19, 40, 80, 102	0
All	All	651/702 (92%)	-0.39	6 (0%)	84	86	17, 39, 78, 102	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	253	ARG	3.0
1	A	258	LEU	2.9
1	A	250	ILE	2.5
1	A	58	MET	2.4
1	B	256	GLY	2.2
1	B	250	ILE	2.0

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

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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
2	SO4	B	6	5/5	0.91	0.21	56,57,61,62	5
2	SO4	A	7	5/5	0.93	0.22	32,37,41,43	5
2	SO4	B	5	5/5	0.94	0.14	68,69,73,73	0
2	SO4	B	3	5/5	0.94	0.13	59,60,64,65	0
2	SO4	A	1	5/5	0.95	0.09	73,77,77,81	0
2	SO4	B	2	5/5	0.96	0.11	53,53,57,61	0
2	SO4	B	4	5/5	0.97	0.09	40,45,46,47	5

6.5 Other polymers ⓘ

There are no such residues in this entry.