



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 16, 2024 – 10:25 PM EDT

PDB ID : 5OLN
Title : X-Ray Structure of the Complex Pyrimidine-nucleoside phosphorylase from Bacillus subtilis at 1.88 Å
Authors : Balaev, V.V.; Prokofev, I.I.; Gabdoukhakov, A.G.; Betzel, C.; Lashkov, A.A.
Deposited on : 2017-07-28
Resolution : 1.88 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
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

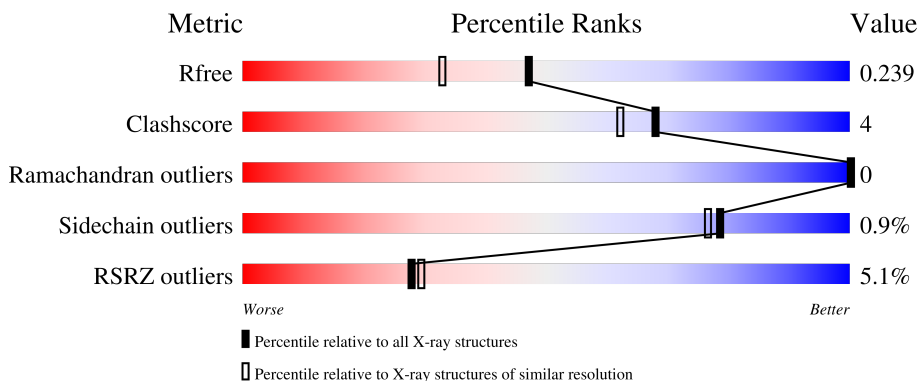
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.88 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	9470 (1.90-1.86)
Clashscore	141614	10282 (1.90-1.86)
Ramachandran outliers	138981	10152 (1.90-1.86)
Sidechain outliers	138945	10152 (1.90-1.86)
RSRZ outliers	127900	9303 (1.90-1.86)

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	434	
1	B	434	

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	IMD	B	501	-	-	X	-

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 7096 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.

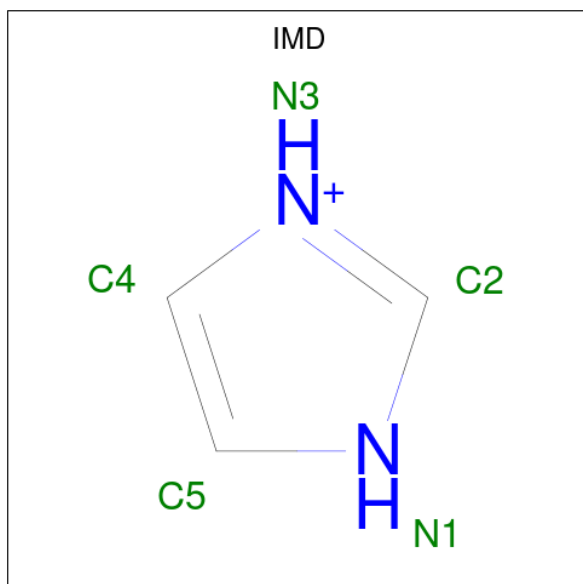
- Molecule 1 is a protein called Pyrimidine-nucleoside phosphorylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	433	Total 3345	C 2104	N 568	O 654	S 19	0	16	0
1	B	434	Total 3273	C 2060	N 548	O 646	S 19	0	6	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	ALA	-	expression tag	UNP P39142
B	0	ALA	-	expression tag	UNP P39142

- Molecule 2 is IMIDAZOLE (three-letter code: IMD) (formula: C₃H₅N₂).



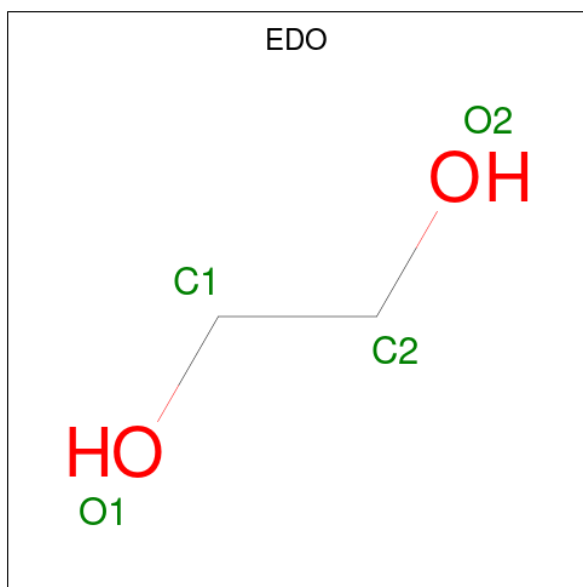
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	N		
2	A	1	Total 5	C 3	N 2	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	C	N	0	0
			5	3	2		
2	B	1	Total	C	N	0	0
			5	3	2		

- Molecule 3 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	1
			8	4	4		

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



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

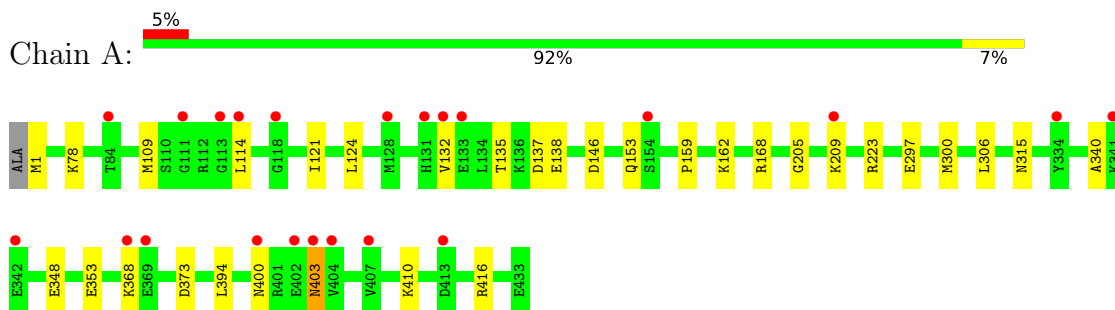
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	241	Total	O	0	0
			241	241		
5	B	209	Total	O	0	0
			209	209		

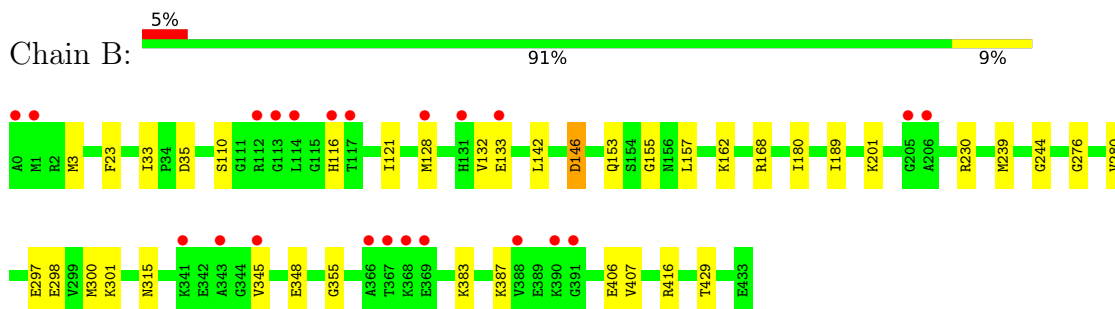
3 Residue-property plots [i](#)

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: Pyrimidine-nucleoside phosphorylase



- Molecule 1: Pyrimidine-nucleoside phosphorylase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	64.37Å 93.01Å 139.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.51 – 1.88 46.51 – 1.88	Depositor EDS
% Data completeness (in resolution range)	98.1 (46.51-1.88) 98.1 (46.51-1.88)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.20	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.34 (at 1.88Å)	Xtrriage
Refinement program	PHENIX 1.8.1_1168	Depositor
R, R_{free}	0.200 , 0.239 0.201 , 0.239	Depositor DCC
R_{free} test set	3363 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	19.2	Xtrriage
Anisotropy	1.034	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 42.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	7096	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 43.00 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.8801e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: IMD, EDO, 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	0.39	0/3413	0.57	0/4592
1	B	0.40	0/3320	0.58	0/4472
All	All	0.40	0/6733	0.58	0/9064

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	3345	0	3493	21	0
1	B	3273	0	3397	31	0
2	A	5	0	5	2	0
2	B	10	0	10	6	0
3	A	8	0	12	0	0
4	B	5	0	0	0	0
5	A	241	0	0	1	0
5	B	209	0	0	1	0
All	All	7096	0	6917	52	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 (52) 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:168:ARG:HH12	2:B:501:IMD:H2	1.53	0.72
1:B:146:ASP:OD2	1:B:315:ASN:ND2	2.23	0.70
1:A:168:ARG:HH12	2:A:501:IMD:H2	1.56	0.69
1:B:155:GLY:O	1:B:162:LYS:NZ	2.26	0.69
1:A:297:GLU:HA	1:A:300[A]:MET:HE2	1.76	0.67
1:A:223[A]:ARG:NH1	5:A:602:HOH:O	2.29	0.66
1:B:168:ARG:HH22	2:B:501:IMD:HN1	1.45	0.65
1:B:297:GLU:HA	1:B:300:MET:HE2	1.77	0.64
1:A:373:ASP:OD2	1:A:400:ASN:ND2	2.31	0.64
1:A:403:ASN:ND2	1:A:403:ASN:H	1.96	0.64
1:B:157:LEU:O	1:B:162:LYS:HE3	1.99	0.61
1:A:168:ARG:HH22	2:A:501:IMD:HN3	1.51	0.58
1:B:298:GLU:OE1	1:B:301:LYS:HE3	2.03	0.58
1:B:201:LYS:HD2	1:B:239:MET:HG2	1.85	0.57
1:B:142:LEU:HD11	1:B:315:ASN:HB3	1.87	0.57
1:A:205:GLY:H	1:A:209[A]:LYS:HE3	1.70	0.56
1:B:244:GLY:O	1:B:383[B]:LYS:HE3	2.06	0.55
1:B:345:VAL:HG12	1:B:387[A]:LYS:HG2	1.89	0.55
1:B:3:MET:CE	1:B:33:ILE:HD13	2.36	0.55
1:B:297:GLU:HA	1:B:300:MET:CE	2.37	0.53
1:A:114:LEU:HD21	1:A:368:LYS:HA	1.90	0.53
1:A:109:MET:HB3	1:A:153:GLN:HG3	1.91	0.52
1:B:168:ARG:NH1	2:B:501:IMD:H2	2.23	0.52
1:B:133:GLU:O	1:B:133:GLU:HG3	2.11	0.51
1:A:146:ASP:OD2	1:A:315:ASN:ND2	2.43	0.50
1:B:3:MET:HE3	1:B:33:ILE:HD13	1.92	0.50
1:B:3:MET:HE2	1:B:23:PHE:CE2	2.47	0.50
1:B:3:MET:HE2	1:B:23:PHE:HE2	1.77	0.49
1:B:35:ASP:HB3	5:B:623:HOH:O	2.12	0.48
1:B:110:SER:HB2	1:B:121:ILE:HD11	1.97	0.47
1:A:135:THR:OG1	1:A:138:GLU:HG3	2.14	0.47
1:B:189:ILE:HG12	1:B:230:ARG:HG3	1.97	0.46
1:A:209[A]:LYS:HD3	1:A:209[A]:LYS:HA	1.82	0.45
1:B:180:ILE:HG23	2:B:501:IMD:C5	2.47	0.45
1:B:121:ILE:HG23	1:B:132:VAL:HG11	1.99	0.45
1:A:353:GLU:OE2	1:A:410:LYS:HE3	2.17	0.44
1:B:276:GLY:O	1:B:280:VAL:HG23	2.18	0.43
1:A:124:LEU:HD23	1:A:124:LEU:HA	1.85	0.43
1:A:340:ALA:HB2	1:A:394:LEU:HG	1.99	0.43
1:A:348:GLU:HB3	1:A:416[A]:ARG:HG2	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:180:ILE:HG23	2:B:501:IMD:H5	2.01	0.43
1:A:403:ASN:ND2	1:A:403:ASN:N	2.64	0.43
1:B:301:LYS:HB3	1:B:301:LYS:NZ	2.34	0.43
1:B:110:SER:C	1:B:153:GLN:HG2	2.39	0.43
1:B:116:HIS:HB3	1:B:355:GLY:CA	2.49	0.43
1:A:121:ILE:HG13	1:A:132:VAL:HG11	2.00	0.42
1:B:348:GLU:HB3	1:B:416:ARG:HB2	2.02	0.42
1:B:406[B]:GLU:HG3	1:B:407:VAL:N	2.35	0.41
1:A:306:LEU:HD12	1:A:306:LEU:HA	1.85	0.41
1:A:159:PRO:HA	1:A:162:LYS:HE2	2.02	0.41
1:A:78:LYS:HE2	1:A:78:LYS:HB2	1.92	0.41
1:B:168:ARG:HH12	2:B:501:IMD:C2	2.30	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	446/434 (103%)	437 (98%)	9 (2%)	0	100	100
1	B	438/434 (101%)	429 (98%)	9 (2%)	0	100	100
All	All	884/868 (102%)	866 (98%)	18 (2%)	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	361/345 (105%)	356 (99%)	5 (1%)	67	62
1	B	351/345 (102%)	348 (99%)	3 (1%)	78	76
All	All	712/690 (103%)	704 (99%)	8 (1%)	78	70

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1[A]	MET
1	A	1[B]	MET
1	A	137[A]	ASP
1	A	137[B]	ASP
1	A	403	ASN
1	B	128	MET
1	B	146	ASP
1	B	429	THR

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	403	ASN

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

6 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	$\# Z > 2$
3	EDO	A	502[A]	-	3,3,3	0.45	0	2,2,2	0.35	0
2	IMD	A	501	-	3,5,5	0.35	0	4,5,5	0.53	0
2	IMD	B	501	-	3,5,5	0.43	0	4,5,5	0.40	0
2	IMD	B	502	-	3,5,5	0.37	0	4,5,5	0.62	0
3	EDO	A	502[B]	-	3,3,3	0.49	0	2,2,2	0.42	0
4	SO4	B	503	-	4,4,4	0.46	0	6,6,6	0.49	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
3	EDO	A	502[A]	-	-	0/1/1/1	-
2	IMD	A	501	-	-	-	0/1/1/1
2	IMD	B	501	-	-	-	0/1/1/1
2	IMD	B	502	-	-	-	0/1/1/1
3	EDO	A	502[B]	-	-	1/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	502[B]	EDO	O1-C1-C2-O2

There are no ring outliers.

2 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	501	IMD	2	0
2	B	501	IMD	6	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

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	433/434 (99%)	0.30	22 (5%) 28 29	11, 26, 58, 103	0
1	B	434/434 (100%)	0.41	22 (5%) 28 29	12, 27, 55, 85	0
All	All	867/868 (99%)	0.35	44 (5%) 28 29	11, 26, 57, 103	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	117	THR	5.9
1	A	128	MET	4.8
1	B	116	HIS	4.0
1	B	128	MET	3.8
1	B	114	LEU	3.6
1	B	367	THR	3.5
1	A	400	ASN	3.4
1	A	132	VAL	3.4
1	A	368	LYS	3.3
1	A	404	VAL	3.3
1	A	402	GLU	3.2
1	B	0	ALA	3.2
1	B	133	GLU	3.1
1	A	111	GLY	3.0
1	A	369	GLU	3.0
1	A	407	VAL	3.0
1	B	341	LYS	2.9
1	A	403	ASN	2.9
1	B	366	ALA	2.8
1	B	205	GLY	2.8
1	B	112	ARG	2.6
1	B	343	ALA	2.6
1	B	1	MET	2.6
1	A	154	SER	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	341	LYS	2.5
1	B	368	LYS	2.5
1	B	206	ALA	2.5
1	A	413	ASP	2.4
1	A	118	GLY	2.4
1	A	334	TYR	2.4
1	A	113	GLY	2.4
1	B	369	GLU	2.4
1	A	114	LEU	2.3
1	A	131	HIS	2.3
1	B	388	VAL	2.2
1	B	390	LYS	2.2
1	B	391	GLY	2.2
1	A	342	GLU	2.2
1	B	131	HIS	2.1
1	A	209[A]	LYS	2.1
1	B	345	VAL	2.1
1	B	113	GLY	2.1
1	A	133[A]	GLU	2.0
1	A	84	THR	2.0

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(Å ²)	Q<0.9
3	EDO	A	502[A]	4/4	0.80	0.17	21,21,21,21	4
3	EDO	A	502[B]	4/4	0.80	0.17	21,21,21,21	4
2	IMD	B	502	5/5	0.85	0.14	49,51,51,52	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	B	503	5/5	0.87	0.24	31,31,31,31	5
2	IMD	A	501	5/5	0.88	0.17	26,27,31,34	0
2	IMD	B	501	5/5	0.91	0.17	27,28,34,39	0

6.5 Other polymers [i](#)

There are no such residues in this entry.