wwPDB X-ray Structure Validation Summary Report (i)

Sep 12, 2023 – 01:14 PM EDT

PDB ID	:	4N0W
Title	:	X-ray crystal structure of a serine hydroxymethyltransferase from Burkholderia cenocepacia with covalently attached pyridoxal phosphate
Authors	:	Seattle Structural Genomics Center for Infectious Disease (SSGCID)
Deposited on	:	2013-10-02
Resolution	:	1.65 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 (i) 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 (i)) were used in the production of this report:

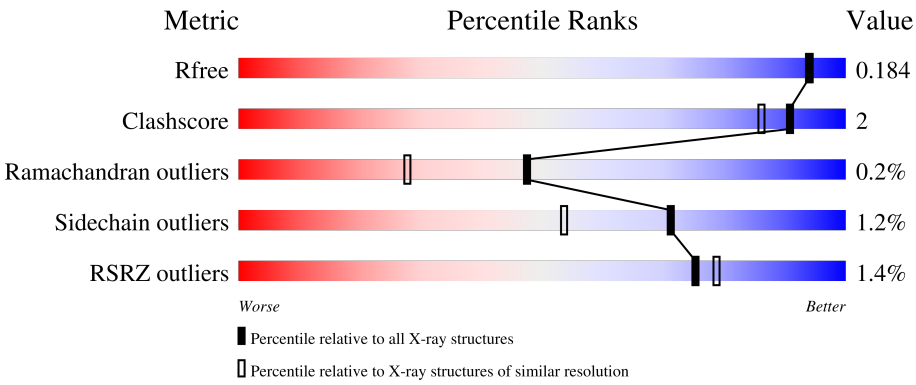
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 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	1827 (1.66-1.66)
Clashscore	141614	1931 (1.66-1.66)
Ramachandran outliers	138981	1891 (1.66-1.66)
Sidechain outliers	138945	1891 (1.66-1.66)
RSRZ outliers	127900	1791 (1.66-1.66)

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	424	2% 95%
1	B	424	2% 94%
1	C	424	% 93%
1	D	424	% 95%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 14215 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 Serine hydroxymethyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	416	3182	2012	554	603	13	0	10	0
1	B	414	3144	1991	550	590	13	0	9	0
1	C	415	3160	1998	555	594	13	0	8	0
1	D	414	3155	1994	557	592	12	0	9	0

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-8	MET	-	expression tag	UNP B4ECY9
A	-7	ALA	-	expression tag	UNP B4ECY9
A	-6	HIS	-	expression tag	UNP B4ECY9
A	-5	HIS	-	expression tag	UNP B4ECY9
A	-4	HIS	-	expression tag	UNP B4ECY9
A	-3	HIS	-	expression tag	UNP B4ECY9
A	-2	HIS	-	expression tag	UNP B4ECY9
A	-1	HIS	-	expression tag	UNP B4ECY9
A	0	SER	-	expression tag	UNP B4ECY9
B	-8	MET	-	expression tag	UNP B4ECY9
B	-7	ALA	-	expression tag	UNP B4ECY9
B	-6	HIS	-	expression tag	UNP B4ECY9
B	-5	HIS	-	expression tag	UNP B4ECY9
B	-4	HIS	-	expression tag	UNP B4ECY9
B	-3	HIS	-	expression tag	UNP B4ECY9
B	-2	HIS	-	expression tag	UNP B4ECY9
B	-1	HIS	-	expression tag	UNP B4ECY9
B	0	SER	-	expression tag	UNP B4ECY9
C	-8	MET	-	expression tag	UNP B4ECY9
C	-7	ALA	-	expression tag	UNP B4ECY9
C	-6	HIS	-	expression tag	UNP B4ECY9

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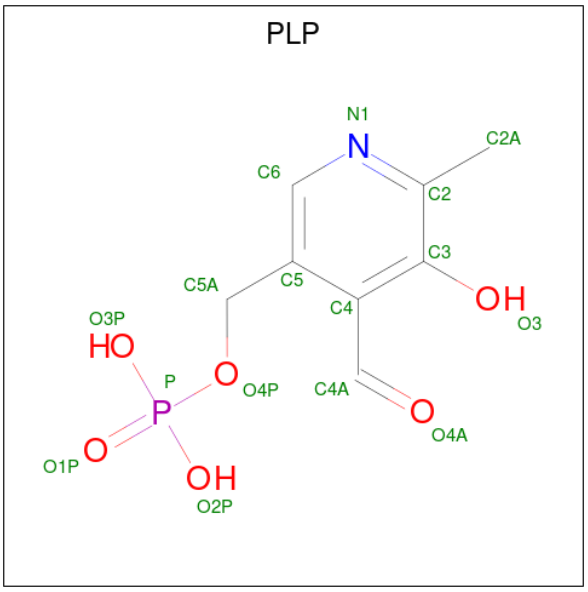
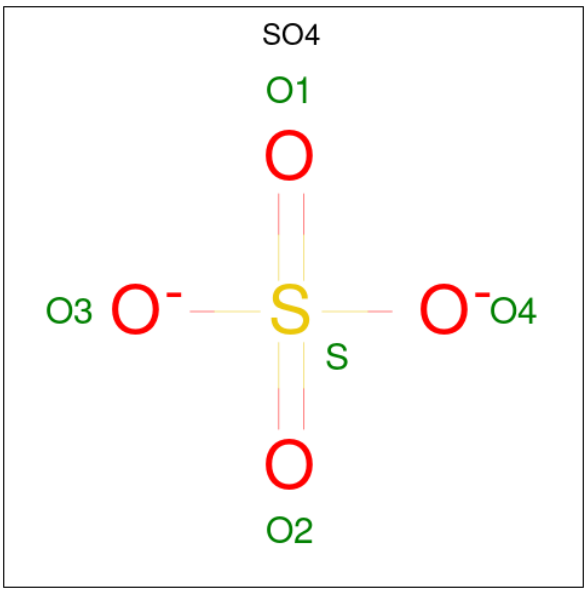
Chain	Residue	Modelled	Actual	Comment	Reference
C	-5	HIS	-	expression tag	UNP B4ECY9
C	-4	HIS	-	expression tag	UNP B4ECY9
C	-3	HIS	-	expression tag	UNP B4ECY9
C	-2	HIS	-	expression tag	UNP B4ECY9
C	-1	HIS	-	expression tag	UNP B4ECY9
C	0	SER	-	expression tag	UNP B4ECY9
D	-8	MET	-	expression tag	UNP B4ECY9
D	-7	ALA	-	expression tag	UNP B4ECY9
D	-6	HIS	-	expression tag	UNP B4ECY9
D	-5	HIS	-	expression tag	UNP B4ECY9
D	-4	HIS	-	expression tag	UNP B4ECY9
D	-3	HIS	-	expression tag	UNP B4ECY9
D	-2	HIS	-	expression tag	UNP B4ECY9
D	-1	HIS	-	expression tag	UNP B4ECY9
D	0	SER	-	expression tag	UNP B4ECY9

- Molecule 2 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: PLP) (formula: $C_8H_{10}NO_6P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	15	8	1	5	1	0	0
2	B	1	15	8	1	5	1	0	0
2	C	1	15	8	1	5	1	0	0
2	D	1	15	8	1	5	1	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	D	1	Total O S 5 4 1	0	0

- Molecule 4 is water.

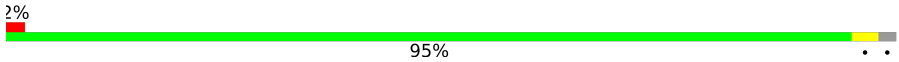
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	451	Total O 451 451	0	0
4	B	264	Total O 264 264	0	0
4	C	375	Total O 375 375	0	0
4	D	404	Total O 404 404	0	0

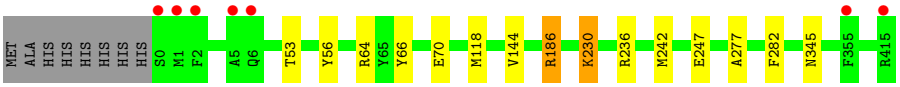
3 Residue-property plots (i)

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: Serine hydroxymethyltransferase

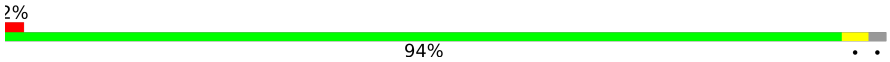
Chain A:

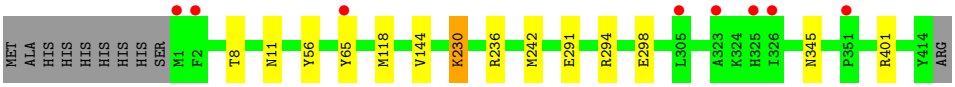




• Molecule 1: Serine hydroxymethyltransferase

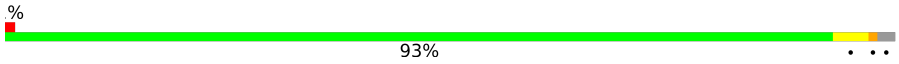
Chain B:

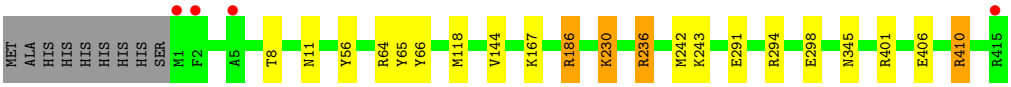




• Molecule 1: Serine hydroxymethyltransferase

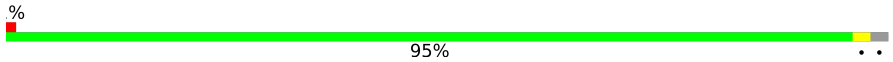
Chain C:





• Molecule 1: Serine hydroxymethyltransferase

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	65.58Å 178.65Å 75.66Å 90.00° 114.70° 90.00°	Depositor
Resolution (Å)	45.05 – 1.65 45.01 – 1.65	Depositor EDS
% Data completeness (in resolution range)	99.7 (45.05-1.65) 99.7 (45.01-1.65)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.18 (at 1.65Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.156 , 0.175 0.168 , 0.184	Depositor DCC
R_{free} test set	9470 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	18.4	Xtriage
Anisotropy	0.036	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 43.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.024 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	14215	wwPDB-VP
Average B, all atoms (Å^2)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.26% of the height of the origin peak. No significant pseudotranslation is detected.*

[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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, PLP

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	0/3273	0.71	3/4441 (0.1%)
1	B	0.48	0/3235	0.71	4/4394 (0.1%)
1	C	0.53	0/3247	0.74	6/4405 (0.1%)
1	D	0.52	0/3245	0.69	0/4402
All	All	0.52	0/13000	0.71	13/17642 (0.1%)

There are no bond length outliers.

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	401	ARG	NE-CZ-NH1	7.06	123.83	120.30
1	B	401	ARG	NE-CZ-NH1	7.05	123.83	120.30
1	A	236[A]	ARG	NE-CZ-NH1	-6.46	117.07	120.30
1	A	236[B]	ARG	NE-CZ-NH1	-6.46	117.07	120.30
1	C	65	TYR	CA-CB-CG	-6.17	101.67	113.40

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

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	3182	0	3143	12	0
1	B	3144	0	3106	10	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	3160	0	3133	17	0
1	D	3155	0	3126	7	0
2	A	15	0	6	1	0
2	B	15	0	7	1	0
2	C	15	0	6	1	0
2	D	15	0	6	1	0
3	A	5	0	0	1	0
3	B	5	0	0	1	0
3	C	5	0	0	1	0
3	D	5	0	0	0	0
4	A	451	0	0	4	0
4	B	264	0	0	1	0
4	C	375	0	0	3	0
4	D	404	0	0	2	0
All	All	14215	0	12533	44	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 44 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:291[A]:GLU:CD	1:B:294[A]:ARG:HH12	1.47	1.16
1:A:186[B]:ARG:NH1	4:A:764:HOH:O	1.92	1.00
1:C:291[A]:GLU:OE2	1:C:294[A]:ARG:NH2	1.96	0.98
1:C:298[B]:GLU:HG3	4:C:809:HOH:O	1.62	0.98
1:B:8[B]:THR:HG21	4:B:772:HOH:O	1.73	0.85

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	424/424 (100%)	415 (98%)	8 (2%)	1 (0%)	47	28
1	B	421/424 (99%)	411 (98%)	9 (2%)	1 (0%)	47	28
1	C	421/424 (99%)	412 (98%)	8 (2%)	1 (0%)	47	28
1	D	421/424 (99%)	412 (98%)	8 (2%)	1 (0%)	47	28
All	All	1687/1696 (100%)	1650 (98%)	33 (2%)	4 (0%)	47	28

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	230	LYS
1	B	230	LYS
1	C	230	LYS
1	D	230	LYS

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	325/333 (98%)	321 (99%)	4 (1%)	71	53
1	B	318/333 (96%)	315 (99%)	3 (1%)	78	66
1	C	321/333 (96%)	315 (98%)	6 (2%)	57	34
1	D	320/333 (96%)	316 (99%)	4 (1%)	69	50
All	All	1284/1332 (96%)	1267 (99%)	17 (1%)	71	50

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	136	MET
1	D	345	ASN
1	C	56	TYR
1	C	186[A]	ARG
1	C	186[B]	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are

no such sidechains identified.

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)

8 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	PLP	A	501	1	15,15,16	2.98	3 (20%)	20,22,23	1.55	5 (25%)
2	PLP	C	501	1	15,15,16	2.89	3 (20%)	20,22,23	2.51	11 (55%)
3	SO4	B	502	-	4,4,4	0.37	0	6,6,6	0.42	0
2	PLP	B	501	1	15,15,16	3.39	3 (20%)	20,22,23	2.10	7 (35%)
3	SO4	C	502	-	4,4,4	0.40	0	6,6,6	0.54	0
2	PLP	D	501	1	15,15,16	2.78	3 (20%)	20,22,23	1.97	5 (25%)
3	SO4	A	502	-	4,4,4	0.60	0	6,6,6	0.38	0
3	SO4	D	502	-	4,4,4	0.42	0	6,6,6	0.52	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
2	PLP	B	501	1	-	0/6/6/8	0/1/1/1
2	PLP	A	501	1	-	0/6/6/8	0/1/1/1
2	PLP	C	501	1	-	0/6/6/8	0/1/1/1
2	PLP	D	501	1	-	1/6/6/8	0/1/1/1

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	501	PLP	C5-C4	9.12	1.50	1.40
2	C	501	PLP	C5-C4	8.99	1.50	1.40
2	D	501	PLP	C5-C4	7.97	1.49	1.40
2	B	501	PLP	C3-C2	7.82	1.48	1.40
2	A	501	PLP	C5-C4	7.74	1.49	1.40

The worst 5 of 28 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	501	PLP	C4A-C4-C5	6.29	127.41	120.94
2	B	501	PLP	C4A-C4-C5	5.34	126.43	120.94
2	D	501	PLP	C4A-C4-C5	4.33	125.40	120.94
2	D	501	PLP	C3-C4-C5	-3.80	114.63	118.74
2	D	501	PLP	O4P-C5A-C5	3.59	116.19	109.35

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	501	PLP	C5A-O4P-P-O1P

There are no ring outliers.

7 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	501	PLP	1	0
2	C	501	PLP	1	0
3	B	502	SO4	1	0
2	B	501	PLP	1	0
3	C	502	SO4	1	0
2	D	501	PLP	1	0
3	A	502	SO4	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	416/424 (98%)	-0.30	7 (1%)	70	73	9, 17, 31, 43	0
1	B	414/424 (97%)	-0.09	8 (1%)	66	69	12, 31, 50, 62	0
1	C	415/424 (97%)	-0.33	4 (0%)	82	85	10, 20, 34, 58	0
1	D	414/424 (97%)	-0.27	5 (1%)	79	81	10, 19, 36, 76	0
All	All	1659/1696 (97%)	-0.25	24 (1%)	75	79	9, 20, 43, 76	0

The worst 5 of 24 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	2	PHE	6.2
1	D	5	ALA	5.3
1	A	2	PHE	4.4
1	C	5	ALA	3.9
1	A	0	SER	3.8

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	SO4	D	502	5/5	0.94	0.14	33,34,39,40	5
3	SO4	B	502	5/5	0.95	0.12	37,37,38,40	5
3	SO4	C	502	5/5	0.95	0.10	34,36,36,37	5
3	SO4	A	502	5/5	0.95	0.14	30,31,33,33	5
2	PLP	B	501	15/16	0.96	0.09	18,21,24,25	0
2	PLP	C	501	15/16	0.98	0.07	13,16,19,23	0
2	PLP	D	501	15/16	0.98	0.09	13,15,19,20	0
2	PLP	A	501	15/16	0.99	0.06	11,16,18,21	0

6.5 Other polymers (i)

There are no such residues in this entry.