



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 6, 2023 – 02:23 AM EDT

PDB ID : 4DPK  
Title : Structure of malonyl-coenzyme A reductase from crenarchaeota  
Authors : Demmer, U.; Warkentin, E.; Srivastava, A.; Kockelkorn, D.; Fuchs, G.; Ermler, U.  
Deposited on : 2012-02-13  
Resolution : 2.05 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](mailto: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 : 2.35  
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

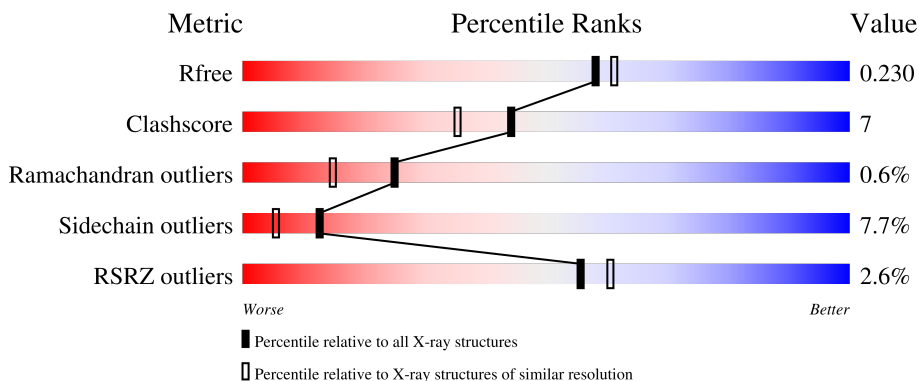
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.05 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	1692 (2.04-2.04)
Clashscore	141614	1773 (2.04-2.04)
Ramachandran outliers	138981	1752 (2.04-2.04)
Sidechain outliers	138945	1752 (2.04-2.04)
RSRZ outliers	127900	1672 (2.04-2.04)

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  $\geq 3$ , 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	359	 82% 15% ..
1	B	359	 78% 18% ..
1	C	359	 79% 18% ..
1	D	359	 83% 14% ..

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	PO4	A	403	-	-	X	-
2	PO4	B	403	-	-	X	-
2	PO4	C	401	-	-	X	-
2	PO4	D	401	-	-	X	-
2	PO4	D	403	-	-	X	-

## 2 Entry composition [i](#)

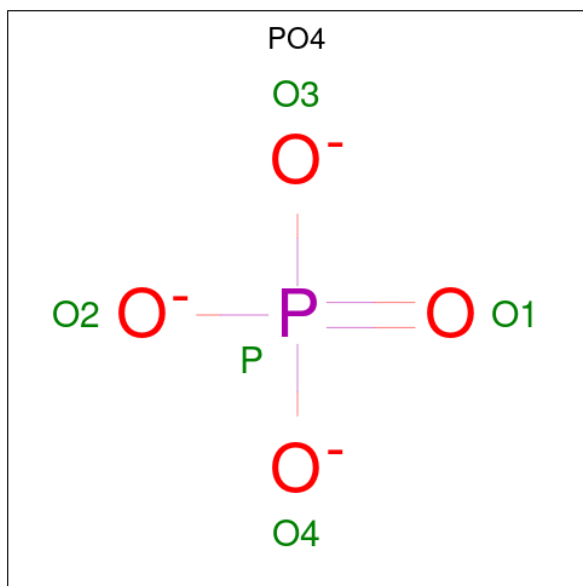
There are 3 unique types of molecules in this entry. The entry contains 11554 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Malonyl-CoA/succinyl-CoA reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	354	Total 2745	C 1760	N 466	O 510	S 9	0	1	0
1	B	354	Total 2752	C 1764	N 469	O 510	S 9	0	2	0
1	C	354	Total 2745	C 1760	N 466	O 510	S 9	0	1	0
1	D	354	Total 2752	C 1764	N 469	O 510	S 9	0	2	0

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O<sub>4</sub>P).



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

*Continued on next page...*

*Continued from previous page...*

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

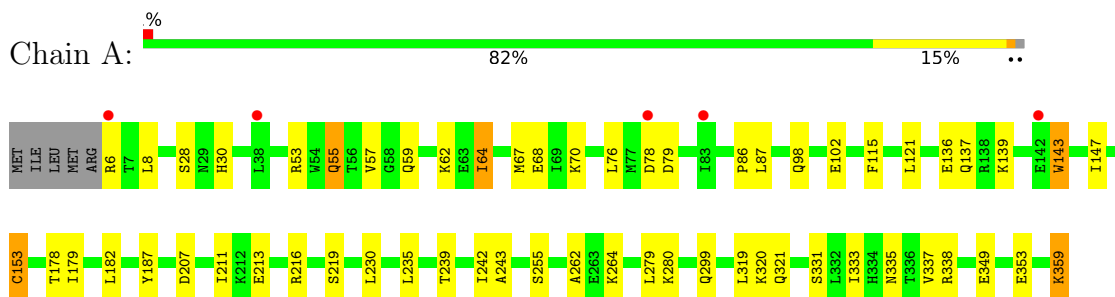
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	148	Total	O	0	0
			148	148		
3	B	109	Total	O	0	0
			109	109		
3	C	115	Total	O	0	0
			115	115		
3	D	128	Total	O	0	0
			128	128		

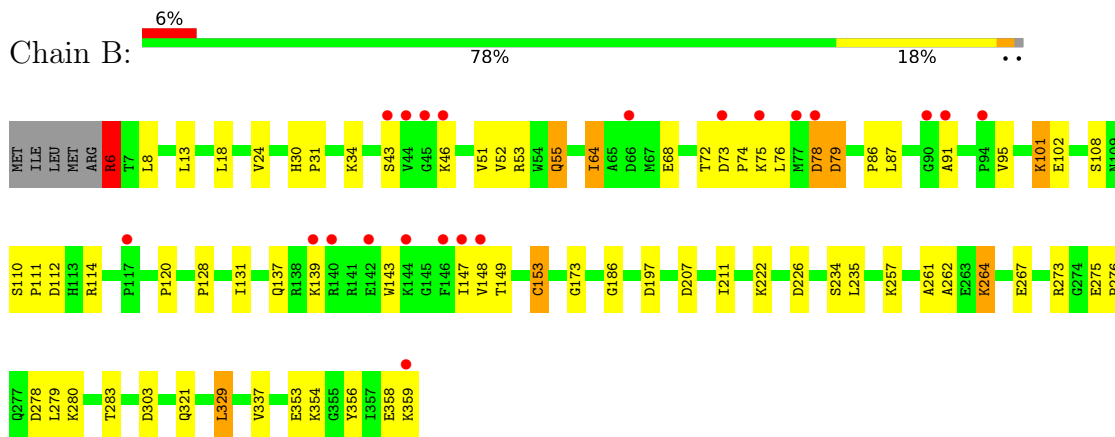
### 3 Residue-property plots [i](#)

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.

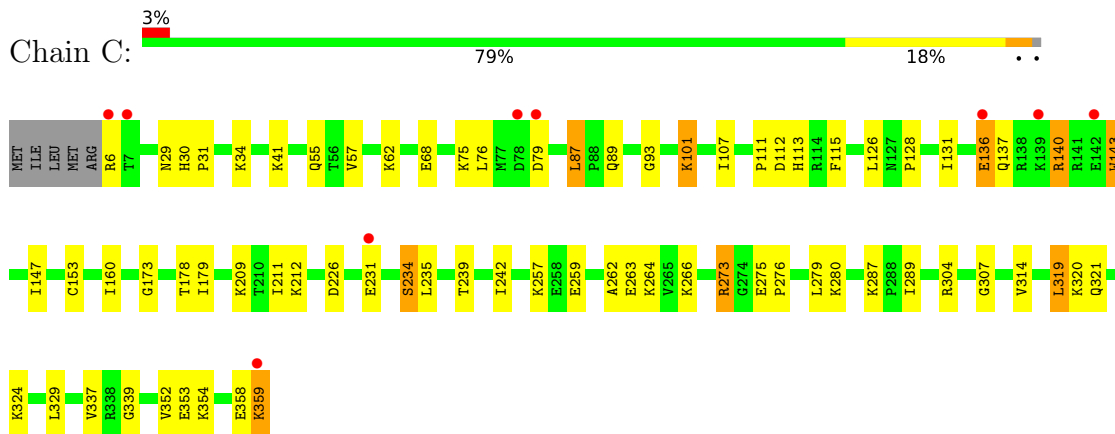
- Molecule 1: Malonyl-CoA/succinyl-CoA reductase



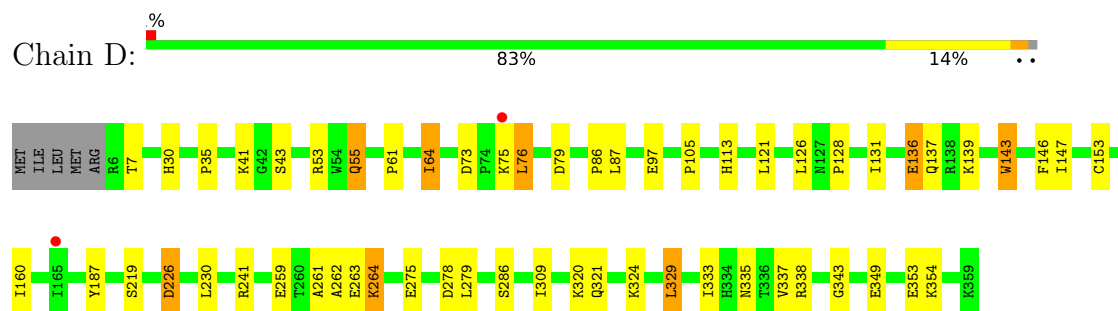
- Molecule 1: Malonyl-CoA/succinyl-CoA reductase



- Molecule 1: Malonyl-CoA/succinyl-CoA reductase



- Molecule 1: Malonyl-CoA/succinyl-CoA reductase



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	167.09Å 81.94Å 124.61Å 90.00° 104.95° 90.00°	Depositor
Resolution (Å)	20.00 – 2.05 20.00 – 2.05	Depositor EDS
% Data completeness (in resolution range)	95.9 (20.00-2.05) 96.0 (20.00-2.05)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.06	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.92 (at 2.06Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.185 , 0.231 0.184 , 0.230	Depositor DCC
$R_{free}$ test set	4859 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	31.5	Xtrriage
Anisotropy	0.119	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 54.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	11554	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	43.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.50% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: PO4

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	0.84	0/2810	0.78	1/3816 (0.0%)
1	B	0.77	4/2821 (0.1%)	0.79	6/3830 (0.2%)
1	C	0.75	0/2810	0.73	1/3816 (0.0%)
1	D	0.77	0/2821	0.76	1/3830 (0.0%)
All	All	0.79	4/11262 (0.0%)	0.77	9/15292 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	D	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	6	ARG	NE-CZ	7.71	1.43	1.33
1	B	356	TYR	CG-CD1	6.89	1.48	1.39
1	B	356	TYR	CE1-CZ	5.44	1.45	1.38
1	B	6	ARG	CZ-NH1	5.22	1.39	1.33

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	329	LEU	CA-CB-CG	7.19	131.83	115.30
1	B	6	ARG	NE-CZ-NH1	7.16	123.88	120.30
1	B	329	LEU	CA-CB-CG	7.05	131.53	115.30
1	B	303	ASP	CB-CG-OD2	5.80	123.52	118.30
1	B	197	ASP	CB-CG-OD1	5.24	123.02	118.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	121	LEU	Peptide

## 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	2745	0	2800	37	0
1	B	2752	0	2809	38	0
1	C	2745	0	2800	36	0
1	D	2752	0	2809	34	0
2	A	15	0	0	5	0
2	B	15	0	0	4	0
2	C	15	0	0	3	0
2	D	15	0	0	6	0
3	A	148	0	0	1	0
3	B	109	0	0	2	0
3	C	115	0	0	7	1
3	D	128	0	0	2	1
All	All	11554	0	11218	146	1

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.

The worst 5 of 146 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:153[B]:CYS:SG	2:B:403:PO4:O3	2.25	0.95
1:C:262:ALA:H	1:C:321:GLN:HE22	1.16	0.93
1:D:137:GLN:HE22	1:D:147:ILE:H	1.18	0.89
1:A:262:ALA:H	1:A:321:GLN:HE22	1.21	0.88
1:A:137:GLN:HE22	1:A:147:ILE:H	1.19	0.85

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:584:HOH:O	3:D:543:HOH:O[1_565]	2.13	0.07

### 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	353/359 (98%)	339 (96%)	12 (3%)	2 (1%)	25 15
1	B	354/359 (99%)	337 (95%)	13 (4%)	4 (1%)	14 5
1	C	353/359 (98%)	338 (96%)	14 (4%)	1 (0%)	41 31
1	D	354/359 (99%)	342 (97%)	10 (3%)	2 (1%)	25 15
All	All	1414/1436 (98%)	1356 (96%)	49 (4%)	9 (1%)	25 15

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	358	GLU
1	B	79	ASP
1	A	86	PRO
1	B	86	PRO
1	D	86	PRO

#### 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	298/302 (99%)	275 (92%)	23 (8%)	13 5

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	B	299/302 (99%)	273 (91%)	26 (9%)	10 4
1	C	298/302 (99%)	270 (91%)	28 (9%)	8 3
1	D	299/302 (99%)	282 (94%)	17 (6%)	20 12
All	All	1194/1208 (99%)	1100 (92%)	94 (8%)	13 5

5 of 94 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	101	LYS
1	C	287	LYS
1	C	112	ASP
1	C	231	GLU
1	C	358	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	321	GLN
1	D	180	GLN
1	D	321	GLN
1	D	293	ASN
1	B	137	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 monosaccharides in this entry.

## 5.6 Ligand geometry

12 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	PO4	D	402	-	4,4,4	1.22	1 (25%)	6,6,6	1.34	1 (16%)
2	PO4	B	402	-	4,4,4	0.98	0	6,6,6	1.73	2 (33%)
2	PO4	B	403	-	4,4,4	1.04	0	6,6,6	1.05	0
2	PO4	A	401	-	4,4,4	1.09	0	6,6,6	1.12	1 (16%)
2	PO4	D	403	-	4,4,4	1.02	0	6,6,6	0.95	0
2	PO4	B	401	-	4,4,4	0.91	0	6,6,6	0.52	0
2	PO4	A	402	-	4,4,4	1.48	1 (25%)	6,6,6	1.30	1 (16%)
2	PO4	C	402	-	4,4,4	0.90	0	6,6,6	1.49	1 (16%)
2	PO4	C	403	-	4,4,4	0.89	0	6,6,6	0.77	0
2	PO4	D	401	-	4,4,4	1.14	0	6,6,6	0.80	0
2	PO4	C	401	-	4,4,4	0.90	0	6,6,6	0.56	0
2	PO4	A	403	-	4,4,4	0.94	0	6,6,6	0.81	0

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	402	PO4	P-O2	-2.59	1.46	1.54
2	D	402	PO4	P-O3	-2.25	1.47	1.54

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	402	PO4	O4-P-O3	-2.78	99.05	107.97
2	C	402	PO4	O4-P-O2	-2.67	99.38	107.97
2	B	402	PO4	O4-P-O3	2.58	116.26	107.97
2	A	401	PO4	O4-P-O3	2.28	115.30	107.97
2	D	402	PO4	O4-P-O2	-2.27	100.68	107.97

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

9 monomers are involved in 18 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	402	PO4	1	0
2	B	403	PO4	2	0
2	D	403	PO4	4	0
2	B	401	PO4	1	0
2	A	402	PO4	1	0
2	C	403	PO4	1	0
2	D	401	PO4	2	0
2	C	401	PO4	2	0
2	A	403	PO4	4	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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	354/359 (98%)	-0.22	5 (1%) 75 78	17, 36, 65, 89	0
1	B	354/359 (98%)	0.10	21 (5%) 22 24	21, 48, 91, 108	0
1	C	354/359 (98%)	-0.12	9 (2%) 57 61	21, 43, 72, 101	0
1	D	354/359 (98%)	-0.28	2 (0%) 89 91	20, 37, 60, 76	0
All	All	1416/1436 (98%)	-0.13	37 (2%) 56 60	17, 40, 75, 108	0

The worst 5 of 37 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	147	ILE	4.1
1	B	90	GLY	3.8
1	B	66	ASP	3.5
1	C	136	GLU	3.3
1	C	6	ARG	3.1

### 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 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, 95<sup>th</sup> 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
2	PO4	C	403	5/5	0.86	0.23	33,51,60,63	5
2	PO4	B	403	5/5	0.87	0.34	29,36,39,50	5
2	PO4	A	403	5/5	0.89	0.20	32,36,49,58	5
2	PO4	D	403	5/5	0.89	0.24	37,45,54,58	5
2	PO4	A	401	5/5	0.91	0.21	36,44,55,58	5
2	PO4	B	401	5/5	0.92	0.13	44,47,56,61	5
2	PO4	B	402	5/5	0.93	0.16	35,39,45,53	5
2	PO4	C	402	5/5	0.94	0.22	34,49,51,51	5
2	PO4	D	402	5/5	0.95	0.20	24,29,36,42	5
2	PO4	A	402	5/5	0.96	0.20	26,27,38,46	5
2	PO4	D	401	5/5	0.96	0.16	29,33,45,52	5
2	PO4	C	401	5/5	0.97	0.34	38,50,54,62	5

## 6.5 Other polymers [\(i\)](#)

There are no such residues in this entry.