



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 4O6Y  
Title : Crystal Structure of Cytochrome b561  
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Deposited on : 2013-12-24  
Resolution : 1.70 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](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.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.7.3 (157068), CSD as539be (2018)  
Xtriage (Phenix) : 1.13  
EDS : trunk30967  
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)  
Refmac : 5.8.0158  
CCP4 : 7.0 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk30967

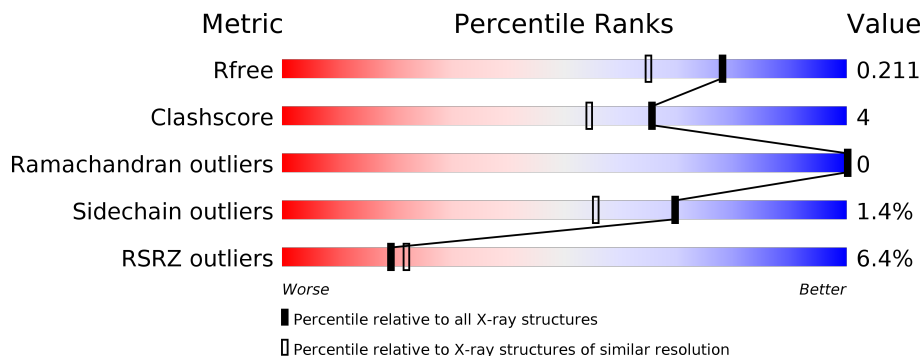
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.70 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.



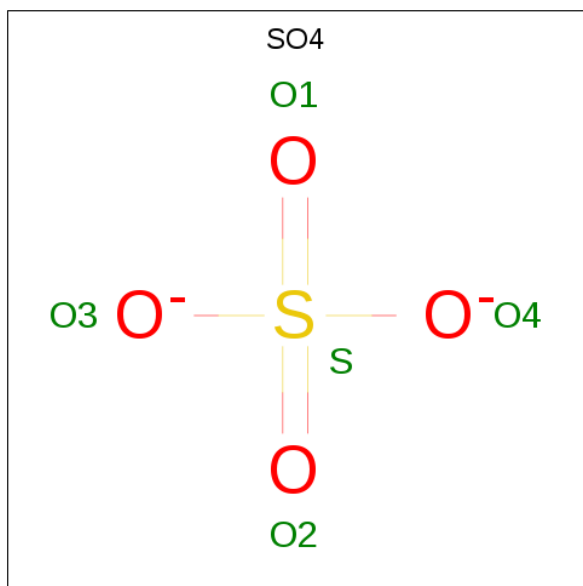
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	111664	3793 (1.70-1.70)
Clashscore	122126	4167 (1.70-1.70)
Ramachandran outliers	120053	4100 (1.70-1.70)
Sidechain outliers	120020	4100 (1.70-1.70)
RSRZ outliers	108989	3718 (1.70-1.70)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	230	
1	B	230	



- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

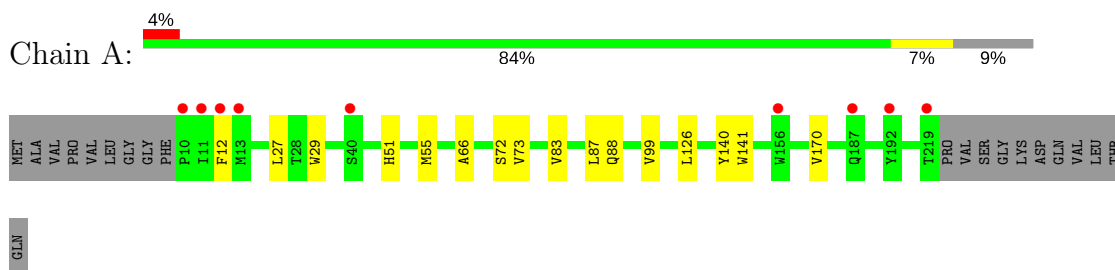
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	41	Total	O	0	0
			41	41		
4	B	35	Total	O	0	0
			35	35		

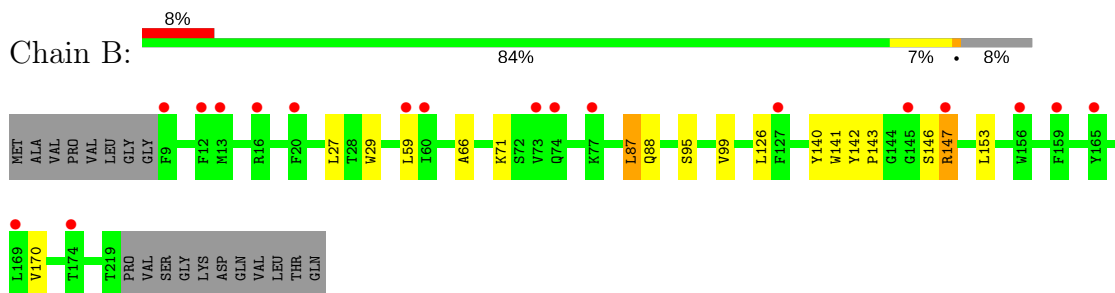
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Probable transmembrane ascorbate ferrereductase 2



- Molecule 1: Probable transmembrane ascorbate ferrereductase 2



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	73.28Å 108.51Å 110.78Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	27.13 – 1.70 27.13 – 1.70	Depositor EDS
% Data completeness (in resolution range)	99.1 (27.13-1.70) 99.1 (27.13-1.70)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.91 (at 1.70Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.7.3_928)	Depositor
R, $R_{free}$	0.202 , 0.216 0.196 , 0.211	Depositor DCC
$R_{free}$ test set	2447 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	27.5	Xtrriage
Anisotropy	0.427	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.42 , 73.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.013 for -h,-l,-k	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	3550	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	36.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.05% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: HEM, 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	0.35	0/1686	0.49	0/2295
1	B	0.36	0/1698	0.49	0/2312
All	All	0.36	0/3384	0.49	0/4607

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	1643	0	1711	11	0
1	B	1654	0	1719	15	0
2	A	86	0	60	8	0
2	B	86	0	60	8	0
3	A	5	0	0	0	0
4	A	41	0	0	0	0
4	B	35	0	0	0	0
All	All	3550	0	3550	31	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 (31) 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:99:VAL:HG21	1:B:126:LEU:HD11	1.68	0.75
1:A:29:TRP:HH2	2:A:301:HEM:HBC1	1.57	0.70
1:A:99:VAL:HG21	1:A:126:LEU:HD11	1.74	0.68
2:A:301:HEM:HBB2	2:A:301:HEM:HHC	1.78	0.66
1:B:146:SER:HB2	1:B:147:ARG:HE	1.61	0.66
2:A:301:HEM:HHH	2:A:301:HEM:HBC2	1.80	0.63
1:A:170:VAL:HG22	1:B:170:VAL:HG22	1.79	0.63
1:B:66:ALA:HB2	1:B:87:LEU:HB3	1.81	0.63
1:A:29:TRP:CH2	2:A:301:HEM:HBC1	2.38	0.59
2:A:302:HEM:HBC2	2:A:302:HEM:HHH	1.85	0.59
2:B:302:HEM:HHH	2:B:302:HEM:HBC2	1.85	0.58
2:B:301:HEM:HBC2	2:B:301:HEM:HHH	1.86	0.58
1:B:140:TYR:HB2	2:B:302:HEM:CBC	2.34	0.57
1:B:29:TRP:HH2	2:B:301:HEM:HBC1	1.69	0.57
1:A:51:HIS:O	1:A:55:MET:HG2	2.04	0.57
1:A:73:VAL:HG21	1:A:83:VAL:HG11	1.88	0.54
1:B:59:LEU:HD23	2:B:301:HEM:HBB2	1.92	0.51
1:B:88:GLN:HA	1:B:88:GLN:OE1	2.11	0.51
1:B:99:VAL:HG21	1:B:126:LEU:CD1	2.40	0.51
1:A:12:PHE:CE1	1:A:72:SER:HB3	2.47	0.49
1:A:140:TYR:HB2	2:A:302:HEM:CBC	2.45	0.46
1:A:66:ALA:HB2	1:A:87:LEU:HB3	1.98	0.46
1:B:142:TYR:CD2	1:B:143:PRO:HA	2.52	0.45
1:A:88:GLN:HA	1:A:88:GLN:OE1	2.17	0.44
1:B:147:ARG:H	1:B:147:ARG:NE	2.15	0.43
1:A:141:TRP:HB2	2:A:302:HEM:HBC1	2.01	0.43
1:B:141:TRP:HB2	2:B:302:HEM:HBC1	2.00	0.43
1:B:95:SER:O	1:B:99:VAL:HG23	2.19	0.42
2:A:302:HEM:HBB2	2:A:302:HEM:HMB2	2.02	0.41
1:B:29:TRP:CH2	2:B:301:HEM:HBC1	2.52	0.41
1:B:71:LYS:NZ	2:B:302:HEM:O2A	2.53	0.41

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	208/230 (90%)	205 (99%)	3 (1%)	0	100	100
1	B	209/230 (91%)	206 (99%)	3 (1%)	0	100	100
All	All	417/460 (91%)	411 (99%)	6 (1%)	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	174/191 (91%)	173 (99%)	1 (1%)	87	82
1	B	175/191 (92%)	171 (98%)	4 (2%)	53	34
All	All	349/382 (91%)	344 (99%)	5 (1%)	69	55

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	27	LEU
1	B	27	LEU
1	B	87	LEU
1	B	147	ARG
1	B	153	LEU

Some 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

5 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	HEM	A	301	1	27,50,50	1.88	12 (44%)	17,82,82	2.44	7 (41%)
2	HEM	A	302	1	27,50,50	1.92	11 (40%)	17,82,82	2.83	9 (52%)
3	SO4	A	303	-	4,4,4	0.18	0	6,6,6	0.27	0
2	HEM	B	301	1	27,50,50	1.97	12 (44%)	17,82,82	2.69	8 (47%)
2	HEM	B	302	1	27,50,50	2.09	13 (48%)	17,82,82	3.04	8 (47%)

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	HEM	A	301	1	-	0/6/54/54	0/0/8/8
2	HEM	A	302	1	-	0/6/54/54	0/0/8/8
3	SO4	A	303	-	-	0/0/0/0	0/0/0/0
2	HEM	B	301	1	-	0/6/54/54	0/0/8/8

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	HEM	B	302	1	-	0/6/54/54	0/0/8/8

All (48) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	301	HEM	C1B-C2B	2.02	1.47	1.42
2	A	302	HEM	C4B-CHC	2.02	1.45	1.40
2	B	301	HEM	C4D-C3D	2.03	1.47	1.42
2	B	301	HEM	C1C-C2C	2.03	1.47	1.42
2	B	301	HEM	C4B-CHC	2.05	1.45	1.40
2	A	301	HEM	C4A-CHB	2.09	1.45	1.40
2	B	302	HEM	C4D-C3D	2.13	1.47	1.42
2	A	302	HEM	C1A-CHA	2.20	1.46	1.40
2	B	302	HEM	C4B-CHC	2.21	1.46	1.40
2	B	302	HEM	C1A-CHA	2.21	1.46	1.40
2	A	302	HEM	C1C-C2C	2.24	1.47	1.42
2	A	301	HEM	C1A-CHA	2.30	1.46	1.40
2	B	302	HEM	C1C-C2C	2.30	1.47	1.42
2	A	301	HEM	C1C-C2C	2.32	1.48	1.42
2	A	302	HEM	C1D-CHD	2.32	1.46	1.40
2	A	301	HEM	C1D-CHD	2.32	1.46	1.40
2	B	301	HEM	C1B-C2B	2.32	1.48	1.42
2	A	302	HEM	C4A-CHB	2.33	1.46	1.40
2	A	301	HEM	C4B-CHC	2.36	1.46	1.40
2	B	302	HEM	C4A-CHB	2.41	1.46	1.40
2	B	301	HEM	C4A-CHB	2.49	1.46	1.40
2	B	302	HEM	C1B-C2B	2.49	1.48	1.42
2	B	302	HEM	C1D-CHD	2.53	1.46	1.40
2	A	301	HEM	C3C-C2C	2.60	1.44	1.40
2	A	301	HEM	CBC-CAC	2.68	1.47	1.29
2	B	301	HEM	C1A-CHA	2.70	1.47	1.40
2	A	301	HEM	C2A-C3A	2.71	1.45	1.37
2	B	301	HEM	CBC-CAC	2.79	1.48	1.29
2	A	302	HEM	C2A-C3A	2.82	1.46	1.37
2	B	302	HEM	C2A-C3A	2.88	1.46	1.37
2	B	301	HEM	C3D-C2D	2.95	1.46	1.37
2	A	301	HEM	C3D-C2D	2.96	1.46	1.37
2	A	302	HEM	CBC-CAC	2.97	1.49	1.29
2	B	301	HEM	C2A-C3A	2.97	1.46	1.37
2	A	302	HEM	CBB-CAB	3.00	1.49	1.29
2	B	302	HEM	CBB-CAB	3.00	1.49	1.29
2	B	301	HEM	C3C-C2C	3.05	1.44	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	302	HEM	C3D-C2D	3.06	1.46	1.37
2	B	302	HEM	C3D-C2D	3.12	1.46	1.37
2	B	302	HEM	CBC-CAC	3.13	1.50	1.29
2	B	301	HEM	CBB-CAB	3.15	1.50	1.29
2	A	301	HEM	CBB-CAB	3.23	1.51	1.29
2	A	302	HEM	C3C-C2C	3.32	1.45	1.40
2	A	302	HEM	C3B-C2B	4.15	1.46	1.40
2	B	302	HEM	C3C-C2C	4.19	1.46	1.40
2	A	301	HEM	C3B-C2B	4.33	1.46	1.40
2	B	301	HEM	C3B-C2B	4.58	1.46	1.40
2	B	302	HEM	C3B-C2B	4.65	1.46	1.40

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	302	HEM	C4A-C3A-C2A	-6.35	102.58	107.00
2	A	301	HEM	C4A-C3A-C2A	-5.91	102.88	107.00
2	B	302	HEM	C1D-C2D-C3D	-5.89	102.90	107.00
2	B	301	HEM	C1D-C2D-C3D	-5.69	103.03	107.00
2	B	301	HEM	C4A-C3A-C2A	-5.40	103.24	107.00
2	A	302	HEM	C4A-C3A-C2A	-5.21	103.37	107.00
2	A	302	HEM	C1D-C2D-C3D	-5.01	103.51	107.00
2	B	302	HEM	CBA-CAA-C2A	-4.79	103.32	112.48
2	A	301	HEM	C1D-C2D-C3D	-4.74	103.69	107.00
2	A	302	HEM	CBA-CAA-C2A	-4.58	103.72	112.48
2	A	302	HEM	CAD-CBD-CGD	-3.70	106.33	112.66
2	B	301	HEM	CAA-CBA-CGA	-3.45	106.77	112.66
2	A	301	HEM	CAA-CBA-CGA	-2.85	107.79	112.66
2	B	302	HEM	C4C-C3C-C2C	-2.75	104.97	106.90
2	A	302	HEM	C4C-C3C-C2C	-2.73	104.99	106.90
2	B	302	HEM	CAD-CBD-CGD	-2.71	108.03	112.66
2	A	302	HEM	CMA-C3A-C2A	2.06	128.83	124.94
2	B	301	HEM	CMD-C2D-C3D	2.22	129.12	124.94
2	A	302	HEM	CMC-C2C-C3C	2.25	128.98	124.88
2	A	301	HEM	CMC-C2C-C3C	2.28	129.03	124.88
2	A	301	HEM	CMA-C3A-C2A	2.45	129.55	124.94
2	B	301	HEM	CMA-C3A-C2A	2.45	129.56	124.94
2	B	301	HEM	CMC-C2C-C3C	2.49	129.41	124.88
2	A	301	HEM	CMB-C2B-C3B	2.64	129.68	124.88
2	A	301	HEM	C3B-C4B-NB	2.70	112.70	109.21
2	B	302	HEM	CMC-C2C-C3C	2.96	130.27	124.88
2	A	302	HEM	C3B-C4B-NB	3.14	113.27	109.21

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	301	HEM	C3B-C4B-NB	3.29	113.47	109.21
2	B	302	HEM	CMB-C2B-C3B	3.43	131.13	124.88
2	B	301	HEM	CMB-C2B-C3B	3.61	131.45	124.88
2	B	302	HEM	C3B-C4B-NB	3.79	114.11	109.21
2	A	302	HEM	CMB-C2B-C3B	4.03	132.22	124.88

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 16 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	301	HEM	4	0
2	A	302	HEM	4	0
2	B	301	HEM	4	0
2	B	302	HEM	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

### 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, 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	210/230 (91%)	0.27	9 (4%) 35 40	22, 33, 54, 69	0
1	B	211/230 (91%)	0.37	18 (8%) 11 12	22, 34, 55, 77	0
All	All	421/460 (91%)	0.32	27 (6%) 19 22	22, 34, 55, 77	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	147	ARG	5.2
1	A	11	ILE	5.2
1	B	74	GLN	4.4
1	B	20	PHE	4.3
1	A	156	TRP	4.0
1	A	12	PHE	4.0
1	B	77	LYS	3.7
1	A	192	TYR	3.7
1	A	219	THR	3.2
1	B	159	PHE	3.1
1	B	169	LEU	3.1
1	B	12	PHE	3.0
1	A	40	SER	2.9
1	B	156	TRP	2.9
1	B	9	PHE	2.8
1	A	10	PRO	2.7
1	B	60	ILE	2.5
1	B	145	GLY	2.5
1	A	187	GLN	2.4
1	B	16	ARG	2.2
1	B	59	LEU	2.2
1	A	13	MET	2.2
1	B	127	PHE	2.2
1	B	13	MET	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	73	VAL	2.1
1	B	165	TYR	2.1
1	B	174	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 carbohydrates 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(Å <sup>2</sup> )	Q<0.9
2	HEM	B	301	43/43	0.96	0.16	19,25,32,42	0
2	HEM	B	302	43/43	0.96	0.10	24,30,51,53	0
2	HEM	A	301	43/43	0.96	0.15	21,26,38,42	0
2	HEM	A	302	43/43	0.97	0.11	23,27,44,52	0
3	SO4	A	303	5/5	0.97	0.09	38,43,46,50	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.