



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 03:04 PM GMT

PDB ID : 4BEN  
Title : R39-imipenem Acyl-enzyme crystal structure  
Authors : Van Elder, D.; Sauvage, E.; Herman, R.; Kerff, F.; Rocaboy, M.; Charlier, P.  
Deposited on : 2013-03-11  
Resolution : 2.15 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  
<http://wwpdb.org/validation/2016/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 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

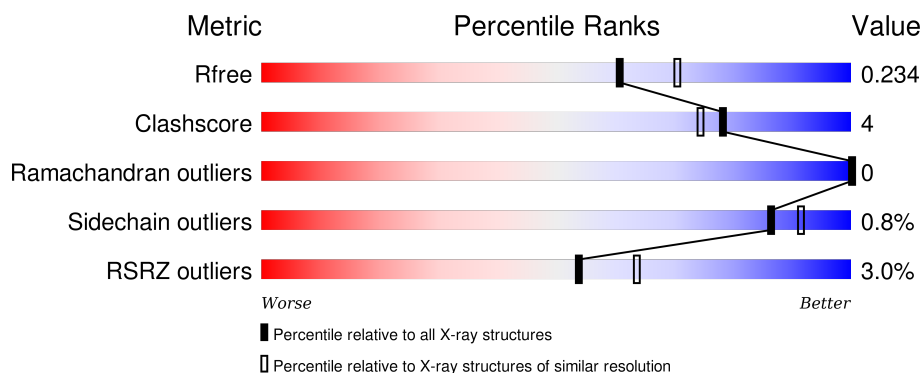
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.15 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))
$R_{free}$	91344	1045 (2.16-2.16)
Clashscore	102246	1152 (2.16-2.16)
Ramachandran outliers	100387	1131 (2.16-2.16)
Sidechain outliers	100360	1131 (2.16-2.16)
RSRZ outliers	91569	1050 (2.16-2.16)

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	466	<div> <div>3%</div> <div>94%</div> <div>6%</div> </div>
1	B	466	<div> <div>3%</div> <div>96%</div> <div>.</div> </div>
1	C	466	<div> <div>4%</div> <div>95%</div> <div>5%</div> </div>
1	D	466	<div> <div>2%</div> <div>91%</div> <div>9%</div> </div>

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
4	SO4	A	1470	-	-	-	X
4	SO4	A	1476	-	-	X	-
4	SO4	B	1469	-	-	-	X
4	SO4	B	1472	-	-	X	X
4	SO4	B	1473	-	-	-	X
4	SO4	C	1469	-	-	-	X
4	SO4	C	1472	-	-	X	X
4	SO4	D	1470	-	-	-	X
4	SO4	D	1474	-	-	X	-
6	MES	D	1475	-	-	-	X

## 2 Entry composition [i](#)

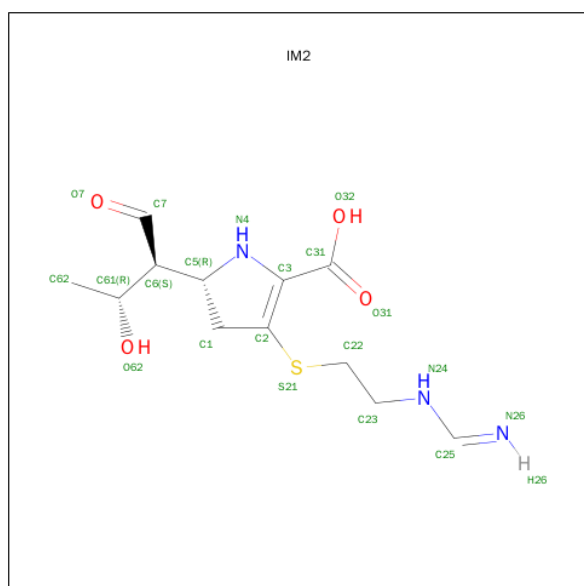
There are 7 unique types of molecules in this entry. The entry contains 14637 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 D-ALANYL-D-ALANINE CARBOXYPEPTIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	466	Total	C	N	O	S	0	0	0
			3353	2076	564	707	6			
1	B	466	Total	C	N	O	S	0	0	1
			3344	2071	564	703	6			
1	C	466	Total	C	N	O	S	0	0	1
			3344	2071	564	703	6			
1	D	466	Total	C	N	O	S	0	0	0
			3353	2076	564	707	6			

- Molecule 2 is (5R)-5-[(1S,2R)-1-FORMYL-2-HYDROXYPROPYL]-3-[(2-{[(E)-IMINOMETHYL]AMINO}ETHYL)SULFANYL]-4,5-DIHYDRO-1H-PYRROLE-2-CARBOXYLIC ACID (three-letter code: IM2) (formula: C<sub>12</sub>H<sub>19</sub>N<sub>3</sub>O<sub>4</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	5	0
			20	12	3	4	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	S	5	0
			20	12	3	4	1		
2	C	1	Total	C	N	O	S	5	0
			20	12	3	4	1		
2	D	1	Total	C	N	O	S	5	0
			20	12	3	4	1		

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Mg	0	0
			2	2		
3	D	2	Total	Mg	0	0
			2	2		

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



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

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

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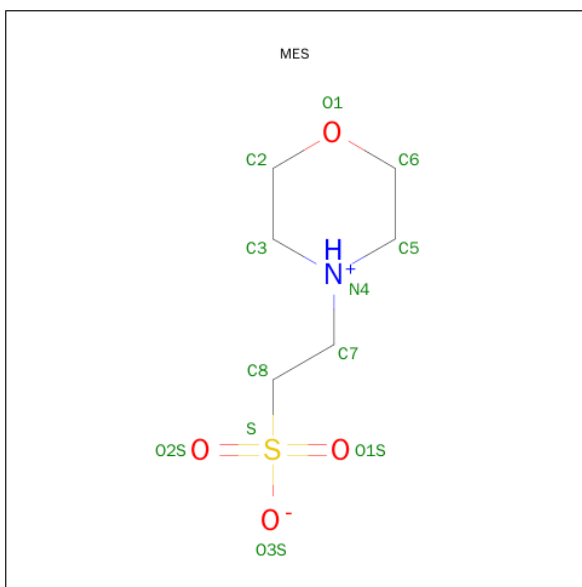
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	C	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	3	3		
5	D	1	Total	C	O	0	0
			6	3	3		

- Molecule 6 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula:  $C_6H_{13}NO_4S$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	D	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	244	Total	O	0	0
			244	244		
7	B	221	Total	O	0	0
			221	221		
7	C	236	Total	O	0	0
			236	236		
7	D	269	Total	O	0	0
			269	269		





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	103.62Å 91.91Å 106.92Å 90.00° 94.50° 90.00°	Depositor
Resolution (Å)	35.72 – 2.15 35.72 – 2.15	Depositor EDS
% Data completeness (in resolution range)	99.8 (35.72-2.15) 99.8 (35.72-2.15)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.35 (at 2.16Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, $R_{free}$	0.187 , 0.234 0.187 , 0.234	Depositor DCC
$R_{free}$ test set	5434 reflections (5.27%)	DCC
Wilson B-factor (Å <sup>2</sup> )	30.7	Xtriage
Anisotropy	0.062	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 42.5	EDS
Estimated twinning fraction	0.014 for l,-k,h	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 108595 reflections	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	14637	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.86% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: GOL, MG, IM2, SO4, MES

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	0.63	0/3412	0.66	0/4666
1	B	0.61	0/3403	0.63	0/4656
1	C	0.63	0/3403	0.63	0/4656
1	D	0.68	0/3412	0.66	1/4666 (0.0%)
All	All	0.64	0/13630	0.65	1/18644 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	387	ASP	CB-CG-OD1	5.46	123.22	118.30

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	3353	0	3200	19	0
1	B	3344	0	3194	19	0
1	C	3344	0	3194	22	0
1	D	3353	0	3200	32	0
2	A	20	0	16	0	0
2	B	20	0	16	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	20	0	16	1	0
2	D	20	0	16	2	0
3	A	2	0	0	0	0
3	D	2	0	0	0	0
4	A	55	0	0	5	0
4	B	40	0	0	6	0
4	C	35	0	0	8	0
4	D	35	0	0	7	0
5	A	6	0	8	1	0
5	D	6	0	8	0	0
6	D	12	0	12	3	0
7	A	244	0	0	1	0
7	B	221	0	0	0	0
7	C	236	0	0	2	0
7	D	269	0	0	4	0
All	All	14637	0	12880	94	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 (94) 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:C:168:GLU:OE1	4:C:1472:SO4:S	2.08	1.11
1:C:158:HIS:NE2	4:C:1472:SO4:S	2.24	1.09
1:B:168:GLU:OE1	4:B:1472:SO4:S	2.18	1.00
1:B:158:HIS:NE2	4:B:1472:SO4:O3	1.97	0.98
1:B:158:HIS:NE2	4:B:1472:SO4:S	2.41	0.93
1:C:168:GLU:OE1	4:C:1472:SO4:O3	1.88	0.92
1:B:168:GLU:OE1	4:B:1472:SO4:O3	1.90	0.89
2:B:500:IM2:S21	2:B:500:IM2:O31	2.38	0.82
1:A:427:PRO:HD2	1:A:460:ALA:O	1.81	0.81
1:C:158:HIS:NE2	4:C:1472:SO4:O3	2.17	0.78
1:C:158:HIS:NE2	4:C:1472:SO4:O2	2.19	0.74
1:C:250:GLU:OE1	7:C:2167:HOH:O	2.06	0.73
1:D:51:MET:CE	1:D:353:ASN:HB3	2.22	0.70
1:C:51:MET:CE	1:C:353:ASN:HB3	2.21	0.69
1:C:158:HIS:CE1	4:C:1472:SO4:O3	2.46	0.69
1:A:158:HIS:NE2	4:A:1476:SO4:S	2.66	0.69
1:A:158:HIS:CE1	4:A:1476:SO4:O4	2.46	0.68
1:D:51:MET:HE2	1:D:353:ASN:HB3	1.77	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:84:GLU:OE2	1:D:119:ARG:NH1	2.27	0.67
1:A:158:HIS:NE2	4:A:1476:SO4:O1	2.21	0.66
1:C:168:GLU:OE1	4:C:1472:SO4:O2	2.14	0.65
1:A:51:MET:HE2	1:A:353:ASN:HB3	1.78	0.65
1:B:158:HIS:CE1	4:B:1472:SO4:O3	2.49	0.65
1:D:158:HIS:CE1	4:D:1474:SO4:O4	2.49	0.65
1:C:437:ASN:HD22	1:C:449:GLN:HE21	1.44	0.64
1:C:341:LEU:HD13	1:C:343:LEU:HD21	1.80	0.63
1:B:51:MET:CE	1:B:353:ASN:HB3	2.28	0.63
1:C:437:ASN:ND2	1:C:449:GLN:HE21	1.98	0.61
1:C:51:MET:HE3	1:C:353:ASN:HB3	1.83	0.61
1:D:158:HIS:HE1	4:D:1474:SO4:O4	1.83	0.61
1:B:437:ASN:ND2	1:B:449:GLN:HE21	2.00	0.60
1:D:368:GLY:HA2	6:D:1475:MES:H61	1.83	0.59
1:C:47:PRO:HG3	1:C:51:MET:HE1	1.84	0.59
1:B:437:ASN:HD22	1:B:449:GLN:HE21	1.51	0.59
1:D:351:ARG:NH2	1:D:415:SER:O	2.34	0.59
1:C:81:ARG:HG3	7:C:2049:HOH:O	2.05	0.56
1:D:150:GLN:HE22	1:D:240:GLU:H	1.52	0.56
1:D:397:ARG:HH22	1:D:449:GLN:HE21	1.54	0.55
1:C:160:GLU:HG2	4:C:1469:SO4:O2	2.05	0.55
1:D:158:HIS:NE2	4:D:1474:SO4:O3	2.30	0.54
1:A:51:MET:CE	1:A:353:ASN:HB3	2.37	0.54
1:A:30:THR:HG22	1:A:430:GLU:O	2.08	0.54
1:B:288:SER:HB2	1:B:375:THR:HG21	1.90	0.54
1:A:198:VAL:HG22	1:A:199:THR:N	2.23	0.53
1:B:461:GLY:HA2	1:D:3:THR:HG21	1.90	0.53
1:B:47:PRO:HG3	1:B:51:MET:CE	2.39	0.52
1:B:51:MET:HE2	1:B:353:ASN:HB3	1.90	0.52
1:D:150:GLN:NE2	1:D:240:GLU:H	2.09	0.51
1:C:47:PRO:HG3	1:C:51:MET:CE	2.41	0.50
1:D:368:GLY:HA2	6:D:1475:MES:C6	2.41	0.50
1:D:184:LEU:HD11	1:D:193:LEU:HB2	1.93	0.50
1:A:158:HIS:HE1	4:A:1476:SO4:O4	1.93	0.50
1:A:78:ALA:HB1	1:A:79:PRO:HD2	1.93	0.50
2:D:500:IM2:H11	7:D:2033:HOH:O	2.12	0.50
1:A:48:ALA:HA	1:A:414:MET:HE3	1.95	0.48
1:B:168:GLU:OE1	4:B:1472:SO4:O2	2.31	0.48
1:D:6:ARG:NH1	7:D:2002:HOH:O	2.46	0.48
1:A:437:ASN:ND2	1:A:449:GLN:HE21	2.12	0.48
1:D:197:ALA:HB2	1:D:221:VAL:HG12	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:47:PRO:HG3	1:B:51:MET:HE1	1.96	0.47
1:A:160:GLU:HG2	4:A:1470:SO4:O2	2.15	0.47
1:D:1:ARG:HA	1:D:4:GLU:HB2	1.96	0.47
1:B:349:LEU:HA	2:B:500:IM2:H621	1.96	0.47
1:D:430:GLU:OE1	6:D:1475:MES:H71	2.14	0.47
1:B:63:LEU:O	1:B:67:HIS:HB2	2.15	0.47
1:C:270:PRO:HB2	1:C:272:ASP:HB3	1.97	0.46
2:C:500:IM2:O31	2:C:500:IM2:S21	2.73	0.46
1:D:158:HIS:NE2	4:D:1474:SO4:S	2.86	0.46
1:D:349:LEU:HA	2:D:500:IM2:H621	1.97	0.46
1:D:66:ASP:HB3	7:D:2041:HOH:O	2.15	0.45
1:A:1:ARG:HH12	1:A:455:ARG:HH22	1.64	0.45
1:D:116:ARG:NH1	7:D:2055:HOH:O	2.49	0.45
1:C:450:ASP:O	1:C:454:VAL:HG23	2.17	0.45
1:A:426:GLY:C	1:A:428:GLU:H	2.21	0.44
1:D:160:GLU:HG2	4:D:1470:SO4:O2	2.17	0.44
1:D:18:LEU:HD11	1:D:448:VAL:HG11	1.99	0.44
1:C:172:THR:HG22	1:C:231:PRO:HB3	1.99	0.43
1:C:298:SER:HG	1:C:410:LYS:HZ1	1.66	0.43
1:A:349:LEU:HA	1:A:414:MET:HE1	2.01	0.42
1:A:267:GLY:HA2	5:A:1471:GOL:H2	2.00	0.42
1:D:168:GLU:OE1	4:D:1474:SO4:S	2.77	0.42
1:B:424:VAL:HB	1:B:431:LEU:HB2	2.00	0.42
1:B:8:ASP:O	1:B:12:ILE:HG13	2.19	0.42
1:D:1:ARG:CG	1:D:455:ARG:HH22	2.33	0.41
1:D:168:GLU:OE1	4:D:1474:SO4:O3	2.38	0.41
1:A:30:THR:HG21	7:A:2014:HOH:O	2.20	0.41
1:D:51:MET:HE3	1:D:353:ASN:HB3	1.99	0.41
1:D:47:PRO:HG3	1:D:51:MET:CE	2.51	0.41
1:D:464:ALA:HA	1:D:465:PRO:HD3	1.88	0.41
1:C:63:LEU:O	1:C:67:HIS:HB2	2.22	0.40
1:A:63:LEU:O	1:A:67:HIS:HB2	2.21	0.40
1:B:51:MET:HE3	1:B:353:ASN:HB3	2.03	0.40
1:D:342:VAL:HB	1:D:354:LEU:HB2	2.04	0.40
1:D:139:TRP:HA	1:D:140:PRO:HD3	1.98	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	464/466 (100%)	451 (97%)	13 (3%)	0	100	100
1	B	464/466 (100%)	449 (97%)	15 (3%)	0	100	100
1	C	464/466 (100%)	453 (98%)	11 (2%)	0	100	100
1	D	464/466 (100%)	452 (97%)	12 (3%)	0	100	100
All	All	1856/1864 (100%)	1805 (97%)	51 (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	339/339 (100%)	334 (98%)	5 (2%)	72	78
1	B	338/339 (100%)	338 (100%)	0	100	100
1	C	338/339 (100%)	336 (99%)	2 (1%)	90	94
1	D	339/339 (100%)	335 (99%)	4 (1%)	78	83
All	All	1354/1356 (100%)	1343 (99%)	11 (1%)	86	91

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	LEU
1	A	30	THR

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Mol	Chain	Res	Type
1	A	312	GLN
1	A	320	TRP
1	A	374	GLN
1	C	320	TRP
1	C	438	ASN
1	D	30	THR
1	D	298	SER
1	D	312	GLN
1	D	320	TRP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	50	ASN
1	A	312	GLN
1	A	437	ASN
1	A	462	HIS
1	B	44	GLN
1	B	50	ASN
1	B	396	ASN
1	B	437	ASN
1	C	50	ASN
1	C	437	ASN
1	D	50	ASN
1	D	150	GLN
1	D	312	GLN
1	D	437	ASN
1	D	449	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 carbohydrates in this entry.



## 5.6 Ligand geometry ⓘ

Of 44 ligands modelled in this entry, 4 are monoatomic - leaving 40 for Mogul analysis.

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$
4	SO4	A	1467	-	4,4,4	0.71	0	6,6,6	0.82	0
4	SO4	A	1468	-	4,4,4	0.08	0	6,6,6	0.29	0
4	SO4	A	1469	-	4,4,4	0.75	0	6,6,6	0.60	0
4	SO4	A	1470	-	4,4,4	0.50	0	6,6,6	0.38	0
5	GOL	A	1471	-	5,5,5	0.47	0	5,5,5	0.52	0
4	SO4	A	1472	-	4,4,4	0.26	0	6,6,6	0.09	0
4	SO4	A	1473	-	4,4,4	0.51	0	6,6,6	0.50	0
4	SO4	A	1474	-	4,4,4	0.08	0	6,6,6	0.25	0
4	SO4	A	1475	-	4,4,4	0.14	0	6,6,6	0.61	0
4	SO4	A	1476	-	4,4,4	0.77	0	6,6,6	0.48	0
4	SO4	A	1477	-	4,4,4	0.28	0	6,6,6	0.76	0
4	SO4	A	1478	-	4,4,4	0.10	0	6,6,6	0.19	0
2	IM2	A	500	1	13,20,20	1.71	3 (23%)	10,26,26	1.56	2 (20%)
4	SO4	B	1466	-	4,4,4	0.44	0	6,6,6	0.83	0
4	SO4	B	1467	-	4,4,4	0.26	0	6,6,6	0.33	0
4	SO4	B	1468	-	4,4,4	0.92	0	6,6,6	0.58	0
4	SO4	B	1469	-	4,4,4	0.14	0	6,6,6	0.25	0
4	SO4	B	1470	-	4,4,4	0.15	0	6,6,6	0.61	0
4	SO4	B	1471	-	4,4,4	0.22	0	6,6,6	0.46	0
4	SO4	B	1472	-	4,4,4	1.28	0	6,6,6	0.73	0
4	SO4	B	1473	-	4,4,4	0.07	0	6,6,6	0.09	0
2	IM2	B	500	1	13,20,20	1.58	3 (23%)	10,26,26	1.93	4 (40%)
4	SO4	C	1466	-	4,4,4	0.53	0	6,6,6	0.47	0
4	SO4	C	1467	-	4,4,4	0.05	0	6,6,6	0.25	0
4	SO4	C	1468	-	4,4,4	0.56	0	6,6,6	0.86	0
4	SO4	C	1469	-	4,4,4	0.70	0	6,6,6	0.32	0
4	SO4	C	1470	-	4,4,4	0.30	0	6,6,6	0.26	0
4	SO4	C	1471	-	4,4,4	0.26	0	6,6,6	0.11	0
4	SO4	C	1472	-	4,4,4	1.18	0	6,6,6	0.55	0
2	IM2	C	500	1	13,20,20	1.82	4 (30%)	10,26,26	2.41	5 (50%)
4	SO4	D	1467	-	4,4,4	0.60	0	6,6,6	0.35	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	SO4	D	1468	-	4,4,4	0.30	0	6,6,6	0.41	0
4	SO4	D	1469	-	4,4,4	0.58	0	6,6,6	0.61	0
4	SO4	D	1470	-	4,4,4	0.70	0	6,6,6	0.22	0
5	GOL	D	1471	-	5,5,5	0.43	0	5,5,5	0.34	0
4	SO4	D	1472	-	4,4,4	0.37	0	6,6,6	0.23	0
4	SO4	D	1473	-	4,4,4	0.18	0	6,6,6	0.21	0
4	SO4	D	1474	-	4,4,4	0.18	0	6,6,6	0.39	0
6	MES	D	1475	-	11,12,12	1.00	0	14,16,16	2.45	5 (35%)
2	IM2	D	500	1	13,20,20	1.48	4 (30%)	10,26,26	1.93	3 (30%)

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
4	SO4	A	1467	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1468	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1469	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1470	-	-	0/0/0/0	0/0/0/0
5	GOL	A	1471	-	-	0/4/4/4	0/0/0/0
4	SO4	A	1472	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1473	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1474	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1475	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1476	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1477	-	-	0/0/0/0	0/0/0/0
4	SO4	A	1478	-	-	0/0/0/0	0/0/0/0
2	IM2	A	500	1	-	0/13/32/32	0/1/1/1
4	SO4	B	1466	-	-	0/0/0/0	0/0/0/0
4	SO4	B	1467	-	-	0/0/0/0	0/0/0/0
4	SO4	B	1468	-	-	0/0/0/0	0/0/0/0
4	SO4	B	1469	-	-	0/0/0/0	0/0/0/0
4	SO4	B	1470	-	-	0/0/0/0	0/0/0/0
4	SO4	B	1471	-	-	0/0/0/0	0/0/0/0
4	SO4	B	1472	-	-	0/0/0/0	0/0/0/0
4	SO4	B	1473	-	-	0/0/0/0	0/0/0/0
2	IM2	B	500	1	-	0/13/32/32	0/1/1/1
4	SO4	C	1466	-	-	0/0/0/0	0/0/0/0
4	SO4	C	1467	-	-	0/0/0/0	0/0/0/0
4	SO4	C	1468	-	-	0/0/0/0	0/0/0/0
4	SO4	C	1469	-	-	0/0/0/0	0/0/0/0

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	SO4	C	1470	-	-	0/0/0/0	0/0/0/0
4	SO4	C	1471	-	-	0/0/0/0	0/0/0/0
4	SO4	C	1472	-	-	0/0/0/0	0/0/0/0
2	IM2	C	500	1	-	0/13/32/32	0/1/1/1
4	SO4	D	1467	-	-	0/0/0/0	0/0/0/0
4	SO4	D	1468	-	-	0/0/0/0	0/0/0/0
4	SO4	D	1469	-	-	0/0/0/0	0/0/0/0
4	SO4	D	1470	-	-	0/0/0/0	0/0/0/0
5	GOL	D	1471	-	-	0/4/4/4	0/0/0/0
4	SO4	D	1472	-	-	0/0/0/0	0/0/0/0
4	SO4	D	1473	-	-	0/0/0/0	0/0/0/0
4	SO4	D	1474	-	-	0/0/0/0	0/0/0/0
6	MES	D	1475	-	-	0/6/14/14	0/1/1/1
2	IM2	D	500	1	-	0/13/32/32	0/1/1/1

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	500	IM2	C31-C3	-4.08	1.45	1.52
2	B	500	IM2	C3-C2	-3.83	1.28	1.36
2	C	500	IM2	C31-C3	-3.65	1.45	1.52
2	C	500	IM2	C22-S21	-3.27	1.67	1.81
2	C	500	IM2	C3-C2	-3.01	1.30	1.36
2	A	500	IM2	C22-S21	-2.98	1.68	1.81
2	D	500	IM2	C31-C3	-2.87	1.47	1.52
2	B	500	IM2	C31-C3	-2.77	1.47	1.52
2	B	500	IM2	C6-C61	-2.47	1.49	1.53
2	D	500	IM2	C22-S21	-2.47	1.70	1.81
2	A	500	IM2	C3-C2	-2.28	1.31	1.36
2	D	500	IM2	C3-C2	-2.12	1.31	1.36
2	C	500	IM2	C6-C61	-2.06	1.50	1.53
2	D	500	IM2	C1-C5	2.02	1.54	1.52

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	500	IM2	O7-C7-C6	-4.37	112.22	125.92
2	D	500	IM2	O7-C7-C6	-4.22	112.67	125.92
2	B	500	IM2	O7-C7-C6	-3.89	113.70	125.92
2	A	500	IM2	O7-C7-C6	-3.85	113.83	125.92
2	D	500	IM2	C61-C6-C7	-3.27	103.65	110.61
2	A	500	IM2	C61-C6-C7	-2.84	104.56	110.61

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	500	IM2	C62-C61-C6	-2.71	108.23	112.19
2	B	500	IM2	C62-C61-C6	-2.45	108.61	112.19
6	D	1475	MES	O1S-S-C8	-2.42	104.84	106.91
2	B	500	IM2	C61-C6-C7	-2.38	105.54	110.61
6	D	1475	MES	C2-C3-N4	-2.35	106.56	110.12
2	C	500	IM2	C61-C6-C7	-2.09	106.17	110.61
2	D	500	IM2	C23-C22-S21	-2.04	105.91	111.36
2	B	500	IM2	C1-C2-S21	2.51	129.02	123.93
2	C	500	IM2	C22-C23-N24	2.58	117.40	112.31
2	C	500	IM2	C1-C5-C6	2.70	119.36	113.79
6	D	1475	MES	O2S-S-C8	2.86	109.34	106.91
6	D	1475	MES	C7-N4-C5	4.57	122.98	111.27
6	D	1475	MES	C5-N4-C3	5.52	120.86	108.90

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

12 monomers are involved in 35 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1470	SO4	1	0
5	A	1471	GOL	1	0
4	A	1476	SO4	4	0
4	B	1472	SO4	6	0
2	B	500	IM2	2	0
4	C	1469	SO4	1	0
4	C	1472	SO4	7	0
2	C	500	IM2	1	0
4	D	1470	SO4	1	0
4	D	1474	SO4	6	0
6	D	1475	MES	3	0
2	D	500	IM2	2	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	466/466 (100%)	0.09	13 (2%) 56 66	21, 38, 72, 135	0
1	B	466/466 (100%)	0.03	16 (3%) 49 59	23, 43, 74, 105	0
1	C	466/466 (100%)	-0.02	17 (3%) 46 57	24, 40, 70, 111	0
1	D	466/466 (100%)	-0.10	10 (2%) 67 74	19, 36, 70, 99	0
All	All	1864/1864 (100%)	-0.00	56 (3%) 54 64	19, 39, 72, 135	0

All (56) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	82	ARG	5.9
1	C	81	ARG	5.6
1	A	2	LEU	5.5
1	C	117	THR	4.5
1	A	429	GLY	4.5
1	C	2	LEU	4.3
1	A	428	GLU	4.3
1	B	464	ALA	4.2
1	D	2	LEU	4.0
1	C	119	ARG	3.9
1	C	254	GLU	3.8
1	C	259	THR	3.7
1	C	1	ARG	3.7
1	B	426	GLY	3.5
1	B	427	PRO	3.4
1	B	428	GLU	3.4
1	A	82	ARG	3.4
1	C	428	GLU	3.4
1	C	116	ARG	3.4
1	A	1	ARG	3.3
1	B	465	PRO	3.3

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Mol	Chain	Res	Type	RSRZ
1	A	80	GLY	3.2
1	D	428	GLU	3.2
1	B	2	LEU	3.1
1	A	81	ARG	3.1
1	B	274	GLN	3.0
1	D	1	ARG	2.9
1	A	53	LEU	2.9
1	D	116	ARG	2.8
1	D	465	PRO	2.7
1	C	84	GLU	2.7
1	A	14	GLU	2.7
1	C	114	GLY	2.7
1	A	427	PRO	2.6
1	B	463	GLN	2.5
1	A	31	ALA	2.4
1	D	6	ARG	2.4
1	A	39	ARG	2.3
1	B	466	GLU	2.3
1	D	3	THR	2.3
1	D	427	PRO	2.3
1	A	441	SER	2.2
1	D	274	GLN	2.2
1	B	374	GLN	2.2
1	B	116	ARG	2.2
1	D	119	ARG	2.2
1	C	66	ASP	2.2
1	B	4	GLU	2.2
1	C	429	GLY	2.1
1	C	83	GLY	2.1
1	B	66	ASP	2.1
1	B	429	GLY	2.1
1	C	80	GLY	2.1
1	C	120	GLY	2.0
1	B	192	GLU	2.0
1	B	261	LYS	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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
4	SO4	B	1473	5/5	0.86	0.28	9.72	97,97,98,98	0
4	SO4	D	1470	5/5	0.91	0.24	8.46	56,56,59,60	0
4	SO4	C	1469	5/5	0.96	0.23	6.21	48,51,53,55	0
4	SO4	B	1469	5/5	0.88	0.23	5.54	84,85,86,86	0
4	SO4	C	1472	5/5	0.97	0.15	4.98	22,22,25,27	0
6	MES	D	1475	12/12	0.96	0.19	3.96	30,32,35,35	0
4	SO4	B	1472	5/5	0.98	0.15	2.58	19,22,26,26	0
4	SO4	A	1470	5/5	0.92	0.18	2.13	54,57,58,60	0
2	IM2	D	500	20/20	0.94	0.12	0.31	11,31,54,59	5
2	IM2	C	500	20/20	0.91	0.11	0.09	12,28,58,59	5
3	MG	A	611	1/1	0.96	0.14	0.00	36,36,36,36	0
2	IM2	B	500	20/20	0.93	0.10	-1.03	11,28,59,61	5
2	IM2	A	500	20/20	0.96	0.11	-1.06	11,28,51,59	5
3	MG	D	611	1/1	0.97	0.09	-1.12	33,33,33,33	0
3	MG	D	610	1/1	0.97	0.04	-1.58	13,13,13,13	0
3	MG	A	610	1/1	0.98	0.04	-4.02	12,12,12,12	0
4	SO4	C	1470	5/5	0.92	0.25	-	62,62,65,65	0
4	SO4	D	1473	5/5	0.89	0.32	-	69,69,71,71	0
4	SO4	A	1478	5/5	0.91	0.30	-	94,94,95,96	0
4	SO4	D	1468	5/5	0.97	0.11	-	49,50,51,53	0
4	SO4	C	1466	5/5	0.97	0.14	-	31,34,34,36	0
4	SO4	B	1470	5/5	0.90	0.37	-	78,78,79,79	0
4	SO4	A	1473	5/5	0.92	0.39	-	56,57,58,59	0
4	SO4	D	1467	5/5	0.98	0.14	-	35,38,39,39	0
4	SO4	A	1474	5/5	0.88	0.30	-	86,87,87,88	0
4	SO4	B	1466	5/5	0.97	0.22	-	39,40,41,43	0
4	SO4	A	1475	5/5	0.84	0.30	-	83,84,84,84	0
4	SO4	B	1471	5/5	0.93	0.22	-	69,70,72,72	0
4	SO4	C	1467	5/5	0.93	0.17	-	72,73,73,74	0
5	GOL	D	1471	6/6	0.88	0.17	-	51,53,54,54	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
4	SO4	B	1468	5/5	0.99	0.20	-	23,24,25,25	0
4	SO4	A	1476	5/5	0.88	0.16	-	47,48,53,53	0
4	SO4	C	1471	5/5	0.94	0.28	-	69,69,70,71	0
4	SO4	D	1469	5/5	0.98	0.18	-	16,17,20,21	0
4	SO4	A	1469	5/5	0.97	0.22	-	32,36,38,39	0
4	SO4	C	1468	5/5	0.98	0.23	-	19,22,24,24	0
4	SO4	A	1472	5/5	0.94	0.17	-	56,58,59,59	0
4	SO4	D	1472	5/5	0.95	0.37	-	54,55,56,56	0
4	SO4	B	1467	5/5	0.96	0.20	-	62,63,65,66	0
5	GOL	A	1471	6/6	0.85	0.18	-	43,48,48,50	0
4	SO4	A	1468	5/5	0.92	0.19	-	64,64,66,66	0
4	SO4	D	1474	5/5	0.82	0.16	-	78,78,81,82	0
4	SO4	A	1467	5/5	0.98	0.17	-	20,23,23,23	0
4	SO4	A	1477	5/5	0.90	0.26	-	64,64,65,65	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.