



Full wwPDB X-ray Structure Validation Report ⓘ

May 25, 2020 – 09:56 am BST

PDB ID : 1DGJ
Title : CRYSTAL STRUCTURE OF THE ALDEHYDE OXIDOREDUCTASE
FROM DESULFOVIBRIO DESULFURICANS ATCC 27774
Authors : Rebelo, J.M.; Macieira, S.; Dias, J.M.; Huber, R.; Romao, M.J.
Deposited on : 1999-11-24
Resolution : 2.80 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 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) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

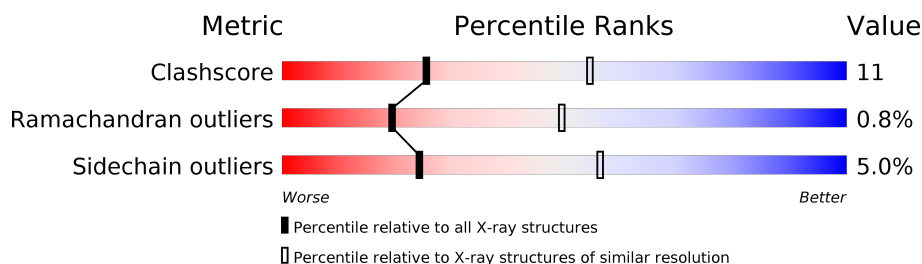
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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))
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)

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 ≥ 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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	907	

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	FES	A	909	-	-	X	-
3	2MO	A	910	-	-	X	-

2 Entry composition [i](#)

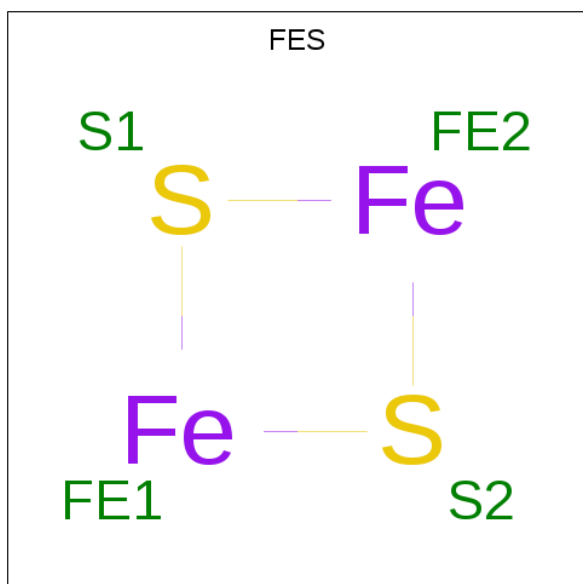
There are 5 unique types of molecules in this entry. The entry contains 7102 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 ALDEHYDE OXIDOREDUCTASE.

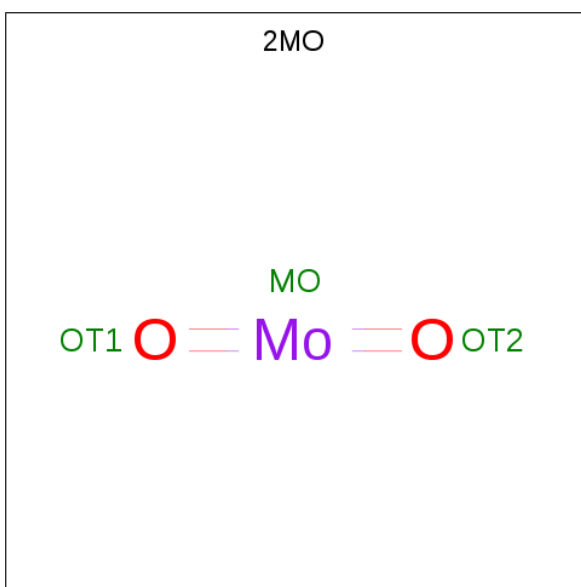
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	906	6854	4312	1187	1306	49	45	0	0

- Molecule 2 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe₂S₂).



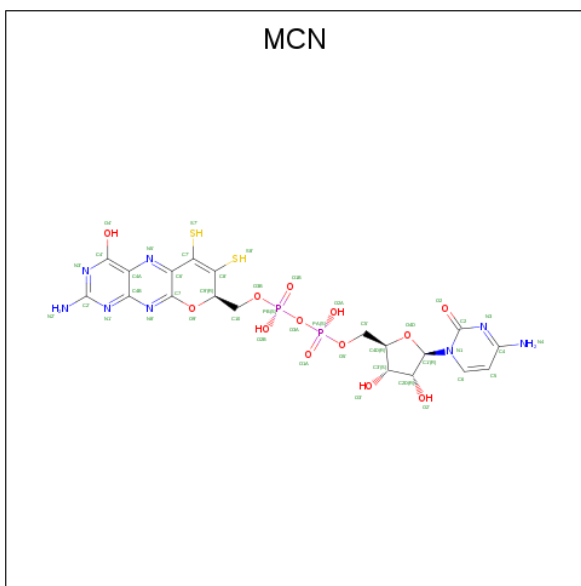
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	Fe	S		
2	A	1	4	2	2	0	0
2	A	1	4	2	2	0	0

- Molecule 3 is MOLYBDENUM (IV)OXIDE (three-letter code: 2MO) (formula: MoO₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	Mo	O	0	0
			3	1	2		

- Molecule 4 is PTERIN CYTOSINE DINUCLEOTIDE (three-letter code: MCN) (formula: $C_{19}H_{22}N_8O_{13}P_2S_2$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	S	0	0
			44	19	8	13	2	2		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	193	Total 193	O 193	0	0

Note EDS was not executed.

Chain A: 77% 21%

Residue labels (from top to bottom):

M1, L6, R14, L15, L16, T34, K37, G43, C48, T49, V50, R66, W265, E69, T75, A81, P82, H86, P87, L88, W92, A97, N118, V119, F130, N135, R138, Y142, K143, P144, L145, R157, G158, E159, K160, T161, E164, R174, I175, A199, M203, N206, T207, L208, L212, L221, R250, L251, C264, K261, W265, E266, R267, P268, L269, L270, N271, K274, L282, A287, A293, K299, F310, A313, P314, M317, Y332, Y333, V344, P345, F346, R347, N348, D349, P350, V353, Y359, T361, Q362, R363, H366, L367, D372, N379, E380, Q383, I386, H387, S388, K389, A392, L398, A401, P402, G403, L404, F408, P409, L414, V415, T419, T422, S428, W431, E432, A433, L434, M440, L448, R449, Q455, G460, S463, P464, W466, R470, R475, E483, W486, D489, P492, Y493, L500, R503, Q506, Y507, T523, V524, H528, C529, W530, G531, A532, A533, F534, R535, G536, Y537, G538, A539, P540, E541, F544, P545, L549, W550, D551, L557, D560, P561, R571, S577, E583, W584, M585, S586, L587, M594, Y597, S601, W605, T610, A611, E612, R615, Y624, G627, L628, S634, E635, A636, W637, W638, L648, W652, E653, H655, L671, R672, P673, L674, G677, P678, H682, T685, T691, P692, P696, A697, G698, R701, S702, V705, T706, R711, E715, P716, L717, I718, A721, R722, K723, P724, F729, E733, E737, G738, R739, P740, L772, A776, V786, G796, G811, S821, D822, E823, Y824, E825, M833, A836, G837, I838, P845, T855, S865, G866, V867, P871, A874, R892, P895, K900, A904, M905, P906, ARG

4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, α , β , γ	156.64Å 156.64Å 177.15Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	24.80 – 2.80	Depositor
% Data completeness (in resolution range)	98.2 (24.80-2.80)	Depositor
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.164 , 0.224	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7102	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

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: MCN, FES, 2MO

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	0.48	0/7003	0.74	3/9496 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	507	TYR	N-CA-C	5.37	125.50	111.00
1	A	821	SER	N-CA-C	5.35	125.46	111.00
1	A	557	LEU	CA-CB-CG	5.04	126.89	115.30

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	6854	0	6766	141	0
2	A	8	0	0	2	0
3	A	3	0	0	2	0
4	A	44	0	17	3	0
5	A	193	0	0	10	0
All	All	7102	0	6783	143	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 11.

All (143) 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:A:610:THR:HG22	1:A:612:GLU:H	1.37	0.89
1:A:271:ASN:HD22	1:A:271:ASN:H	1.34	0.75
1:A:206:ASN:HD22	1:A:206:ASN:H	1.34	0.75
1:A:786:VAL:O	1:A:845:PRO:HG3	1.87	0.74
1:A:627:GLY:HA2	1:A:701:ARG:HB3	1.70	0.72
1:A:206:ASN:N	1:A:206:ASN:HD22	1.88	0.72
1:A:379:ASN:ND2	1:A:383:GLN:HE21	1.87	0.71
1:A:372:ASP:H	1:A:455:GLN:HE21	1.37	0.71
1:A:344:VAL:HG12	1:A:345:PRO:HD3	1.74	0.68
1:A:43:GLY:HA2	2:A:909:FES:S1	2.36	0.66
1:A:637:TRP:CD1	1:A:692:PRO:HD3	2.31	0.66
1:A:392:ALA:HB2	1:A:696:PRO:HB3	1.79	0.64
1:A:500:LEU:O	1:A:503:ARG:HB2	1.98	0.64
1:A:635:GLU:HB3	1:A:692:PRO:HB2	1.81	0.63
3:A:910:2MO:OT1	3:A:910:2MO:MO	1.68	0.63
3:A:910:2MO:MO	3:A:910:2MO:OT2	1.71	0.62
1:A:389:LYS:HE3	1:A:419:THR:HG23	1.81	0.62
1:A:464:PRO:HG2	1:A:489:ASP:HB3	1.81	0.62
1:A:267:ARG:HD3	5:A:1072:HOH:O	2.00	0.61
1:A:585:MET:HE3	5:A:1162:HOH:O	2.01	0.61
1:A:465:PHE:CE1	1:A:541:GLU:HG3	2.38	0.59
1:A:161:THR:CG2	1:A:164:GLU:HB2	2.33	0.59
1:A:528:HIS:CD2	1:A:529:CYS:H	2.21	0.59
1:A:528:HIS:HD2	1:A:529:CYS:H	1.51	0.59
1:A:627:GLY:HA2	1:A:701:ARG:CB	2.33	0.59
1:A:97:ALA:HB1	1:A:145:LEU:HD12	1.84	0.58
1:A:359:TYR:CE2	1:A:892:ARG:HD2	2.40	0.57
1:A:361:THR:HG21	1:A:541:GLU:HA	1.86	0.57
1:A:138:ARG:HD2	5:A:1055:HOH:O	2.04	0.57
1:A:682:HIS:HB3	5:A:1117:HOH:O	2.05	0.56
1:A:594:MET:HE3	1:A:597:TYR:HB2	1.87	0.56
1:A:460:GLY:HA3	1:A:532:ALA:HB2	1.88	0.56
1:A:674:LEU:HD13	1:A:721:MET:HE1	1.88	0.56
1:A:372:ASP:H	1:A:455:GLN:NE2	2.04	0.55
1:A:865:SER:O	4:A:914:MCN:H5	2.07	0.55
1:A:610:THR:HG21	1:A:612:GLU:HG2	1.89	0.55
1:A:81:ALA:HB1	1:A:82:PRO:HD2	1.88	0.55
1:A:372:ASP:N	1:A:455:GLN:HE21	2.02	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:594:MET:CE	1:A:597:TYR:HB2	2.38	0.54
1:A:271:ASN:ND2	1:A:271:ASN:H	2.03	0.54
1:A:702:SER:O	1:A:706:THR:HB	2.08	0.54
1:A:540:PRO:HD2	1:A:541:GLU:OE1	2.08	0.54
1:A:711:ARG:O	1:A:715:GLU:HG3	2.07	0.54
1:A:698:GLY:HA2	4:A:914:MCN:S8'	2.48	0.53
1:A:610:THR:CG2	1:A:612:GLU:HG2	2.39	0.53
1:A:367:LEU:HD13	1:A:838:ILE:HB	1.91	0.53
1:A:634:SER:HB2	1:A:705:VAL:HG12	1.91	0.52
1:A:539:ALA:HB3	1:A:540:PRO:HD3	1.91	0.52
1:A:610:THR:HG22	1:A:611:ALA:N	2.24	0.52
1:A:833:MET:HG2	1:A:838:ILE:HG21	1.92	0.52
1:A:470:ARG:HA	1:A:549:LEU:HD21	1.90	0.52
1:A:161:THR:HG22	1:A:164:GLU:HB2	1.91	0.52
1:A:333:TYR:HB3	1:A:523:THR:OG1	2.09	0.52
1:A:379:ASN:HB3	1:A:383:GLN:H	1.75	0.52
1:A:571:ARG:HG3	1:A:571:ARG:HH11	1.75	0.52
1:A:130:PHE:HA	1:A:135:ASN:HD22	1.74	0.51
1:A:251:ILE:HD12	1:A:267:ARG:HD2	1.93	0.51
1:A:271:ASN:HB2	1:A:282:LEU:HD22	1.91	0.51
1:A:402:PRO:HD2	5:A:1142:HOH:O	2.10	0.51
1:A:534:PHE:HD1	1:A:535:ARG:N	2.08	0.51
1:A:206:ASN:N	1:A:206:ASN:ND2	2.58	0.51
1:A:601:SER:O	1:A:605:VAL:HB	2.10	0.51
1:A:655:HIS:HB3	4:A:914:MCN:O4'	2.10	0.51
1:A:313:ALA:O	1:A:317:MET:HG3	2.12	0.50
1:A:892:ARG:CG	1:A:892:ARG:HH11	2.25	0.50
1:A:142:TYR:HA	1:A:145:LEU:HD22	1.93	0.50
1:A:389:LYS:CE	1:A:419:THR:HG23	2.42	0.50
1:A:503:ARG:HD3	1:A:506:GLN:NE2	2.27	0.50
1:A:638:VAL:HG12	1:A:717:LEU:HD22	1.95	0.49
1:A:448:LEU:HD12	1:A:449:ARG:N	2.28	0.49
1:A:637:TRP:NE1	1:A:692:PRO:HD3	2.27	0.49
1:A:267:ARG:HG3	1:A:493:TYR:CG	2.48	0.49
1:A:14:ARG:HD3	5:A:1119:HOH:O	2.13	0.49
1:A:674:LEU:CD1	1:A:721:MET:HE1	2.43	0.49
1:A:143:LYS:HB3	1:A:144:PRO:HD3	1.95	0.48
1:A:199:ALA:O	1:A:203:MET:HG3	2.13	0.48
1:A:363:ARG:NH2	1:A:825:GLU:OE1	2.47	0.48
1:A:539:ALA:HB2	1:A:624:TYR:CD2	2.48	0.48
1:A:652:TRP:NE1	1:A:702:SER:HB3	2.28	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:372:ASP:N	1:A:455:GLN:NE2	2.61	0.48
1:A:739:ARG:HD3	1:A:740:PRO:HD2	1.97	0.47
1:A:174:ARG:HG2	1:A:672:ARG:HD2	1.96	0.47
1:A:313:ALA:HB3	1:A:314:PRO:HD3	1.97	0.47
1:A:652:TRP:CE2	1:A:702:SER:HB3	2.49	0.47
1:A:266:GLU:HG3	5:A:1145:HOH:O	2.15	0.46
1:A:379:ASN:HD22	1:A:383:GLN:HE21	1.62	0.46
1:A:822:GLU:HA	1:A:836:ALA:O	2.15	0.46
1:A:392:ALA:CB	1:A:696:PRO:HB3	2.45	0.46
1:A:615:ARG:HH11	1:A:776:ALA:CB	2.28	0.46
1:A:174:ARG:NH1	5:A:1139:HOH:O	2.49	0.46
1:A:175:ILE:HD13	1:A:678:PRO:HG3	1.98	0.46
1:A:344:VAL:HG22	1:A:348:ASN:ND2	2.31	0.46
1:A:796:GLY:HA2	1:A:855:THR:O	2.16	0.46
1:A:161:THR:HG23	1:A:164:GLU:HB2	1.98	0.45
1:A:610:THR:CG2	1:A:611:ALA:N	2.79	0.45
1:A:206:ASN:ND2	1:A:206:ASN:H	2.08	0.45
1:A:37:LYS:O	1:A:48:CYS:HB3	2.17	0.45
1:A:386:ILE:HD13	1:A:432:GLU:O	2.17	0.45
1:A:344:VAL:HG22	1:A:348:ASN:HD21	1.81	0.44
1:A:723:LYS:HA	1:A:729:PHE:CE1	2.51	0.44
1:A:269:ILE:HD13	1:A:433:ALA:HB1	1.99	0.44
1:A:349:ASP:HA	1:A:350:PRO:HD3	1.82	0.44
1:A:733:GLU:O	1:A:737:GLU:HG2	2.17	0.44
1:A:50:VAL:HG12	1:A:75:THR:HG22	2.00	0.44
1:A:43:GLY:CA	2:A:909:FES:S1	3.05	0.44
1:A:92:TRP:CD1	1:A:97:ALA:HB3	2.53	0.44
1:A:130:PHE:HD2	1:A:135:ASN:HD22	1.65	0.44
1:A:460:GLY:HA3	1:A:532:ALA:CB	2.47	0.44
1:A:401:ALA:HB3	1:A:402:PRO:HD3	1.99	0.43
1:A:811:GLY:HA3	1:A:871:PRO:HG2	2.01	0.43
1:A:287:ALA:HB3	1:A:293:ALA:HB2	2.00	0.43
1:A:347:PHE:CE1	1:A:483:GLU:HG3	2.53	0.43
1:A:221:LEU:HD23	1:A:274:LYS:HG2	2.00	0.43
1:A:673:PRO:HG2	1:A:718:ILE:HD13	2.00	0.43
1:A:904:ALA:O	1:A:906:PRO:HD3	2.18	0.43
1:A:544:PHE:N	1:A:545:PRO:HD2	2.35	0.42
1:A:615:ARG:NH1	1:A:776:ALA:CB	2.83	0.42
1:A:276:PHE:HB3	1:A:492:PRO:CB	2.50	0.42
1:A:717:LEU:HG	1:A:721:MET:CE	2.49	0.42
1:A:587:LEU:HD23	1:A:587:LEU:HA	1.79	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:628:LEU:HA	1:A:628:LEU:HD23	1.93	0.42
1:A:157:ARG:HD2	1:A:159:GLU:OE2	2.19	0.42
1:A:344:VAL:CG1	1:A:345:PRO:HD3	2.46	0.42
1:A:466:TRP:O	1:A:486:TRP:HA	2.20	0.42
1:A:463:SER:HB3	1:A:489:ASP:O	2.20	0.41
1:A:685:MET:HA	1:A:691:THR:HG21	2.01	0.41
1:A:366:HIS:H	1:A:366:HIS:CD2	2.39	0.41
1:A:366:HIS:HD2	5:A:1026:HOH:O	2.03	0.41
1:A:408:PHE:HA	1:A:409:PRO:HA	1.78	0.41
1:A:717:LEU:HD11	1:A:721:MET:HE2	2.03	0.41
1:A:387:HIS:HA	1:A:415:VAL:O	2.21	0.41
1:A:822:GLU:O	1:A:823:ASP:HB2	2.21	0.41
1:A:895:PRO:O	1:A:900:LYS:HD2	2.21	0.41
1:A:86:HIS:ND1	1:A:88:LEU:HB2	2.35	0.41
1:A:250:ARG:HD2	1:A:265:TRP:O	2.21	0.41
1:A:560:ASP:HA	1:A:561:PRO:HD3	1.94	0.41
1:A:615:ARG:HH11	1:A:776:ALA:HB2	1.85	0.41
1:A:261:LYS:HD3	1:A:332:TYR:C	2.41	0.41
1:A:892:ARG:HG2	1:A:892:ARG:HH11	1.86	0.41
1:A:353:VAL:HG21	1:A:557:LEU:CD1	2.50	0.40
1:A:404:LEU:O	1:A:440:MET:HE1	2.21	0.40
1:A:212:LEU:HD21	1:A:434:LEU:HD13	2.02	0.40
1:A:380:GLU:HB3	5:A:1040:HOH:O	2.22	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	904/907 (100%)	860 (95%)	37 (4%)	7 (1%)	19	49

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	535	ARG
1	A	34	THR
1	A	254	LEU
1	A	537	TYR
1	A	874	ALA
1	A	724	PRO
1	A	867	VAL

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	719/720 (100%)	683 (95%)	36 (5%)	24 56

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	LEU
1	A	14	ARG
1	A	16	LEU
1	A	66	ARG
1	A	69	GLU
1	A	92	TRP
1	A	118	ASN
1	A	119	VAL
1	A	145	LEU
1	A	206	ASN
1	A	208	LEU
1	A	266	GLU
1	A	267	ARG
1	A	271	ASN
1	A	299	LYS
1	A	344	VAL
1	A	398	LEU
1	A	414	LEU
1	A	422	THR
1	A	428	SER

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Mol	Chain	Res	Type
1	A	431	MET
1	A	475	ARG
1	A	523	THR
1	A	524	VAL
1	A	530	TRP
1	A	534	PHE
1	A	551	ASP
1	A	557	LEU
1	A	577	SER
1	A	583	GLU
1	A	605	VAL
1	A	635	GLU
1	A	648	LEU
1	A	671	LEU
1	A	772	LEU
1	A	892	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	118	ASN
1	A	135	ASN
1	A	206	ASN
1	A	271	ASN
1	A	292	ASN
1	A	348	ASN
1	A	366	HIS
1	A	379	ASN
1	A	455	GLN
1	A	456	GLN
1	A	506	GLN
1	A	528	HIS
1	A	703	GLN
1	A	807	GLN

5.3.3 RNA ⓘ

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](#)

4 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	FES	A	909	1	0,4,4	0.00	-	-		
4	MCN	A	914	3	38,48,48	2.74	9 (23%)	40,74,74	2.52	9 (22%)
3	2MO	A	910	5,4	0,2,2	0.00	-	-		
2	FES	A	908	1	0,4,4	0.00	-	-		

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	FES	A	909	1	-	-	0/1/1/1
4	MCN	A	914	3	-	1/20/54/54	0/5/5/5
2	FES	A	908	1	-	-	0/1/1/1

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	914	MCN	C6'-N5'	11.19	1.48	1.32
4	A	914	MCN	C6'-C7	5.85	1.52	1.43
4	A	914	MCN	O9'-C7	5.56	1.42	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	914	MCN	C2'-N3'	4.97	1.44	1.35
4	A	914	MCN	C7-N8'	4.33	1.41	1.30
4	A	914	MCN	C4A-N5'	3.28	1.43	1.37
4	A	914	MCN	O5'-C5'	3.17	1.57	1.44
4	A	914	MCN	C5-C4	2.65	1.47	1.41
4	A	914	MCN	O4D-C1'	2.24	1.44	1.41

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	914	MCN	N1'-C2'-N3'	-7.13	117.72	127.22
4	A	914	MCN	C2-N3-C4	6.11	122.54	116.34
4	A	914	MCN	C2'-N1'-C4B	5.71	121.88	115.36
4	A	914	MCN	O9'-C7-N8'	-5.60	108.35	115.30
4	A	914	MCN	N4-C4-N3	5.02	124.43	116.49
4	A	914	MCN	C5-C4-N4	-4.18	113.89	121.14
4	A	914	MCN	N2'-C2'-N1'	3.92	124.18	117.79
4	A	914	MCN	C7-N8'-C4B	-2.90	114.15	116.61
4	A	914	MCN	O4D-C1'-C2D	-2.34	103.51	106.93

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	914	MCN	C9'-C10-O3B-PB

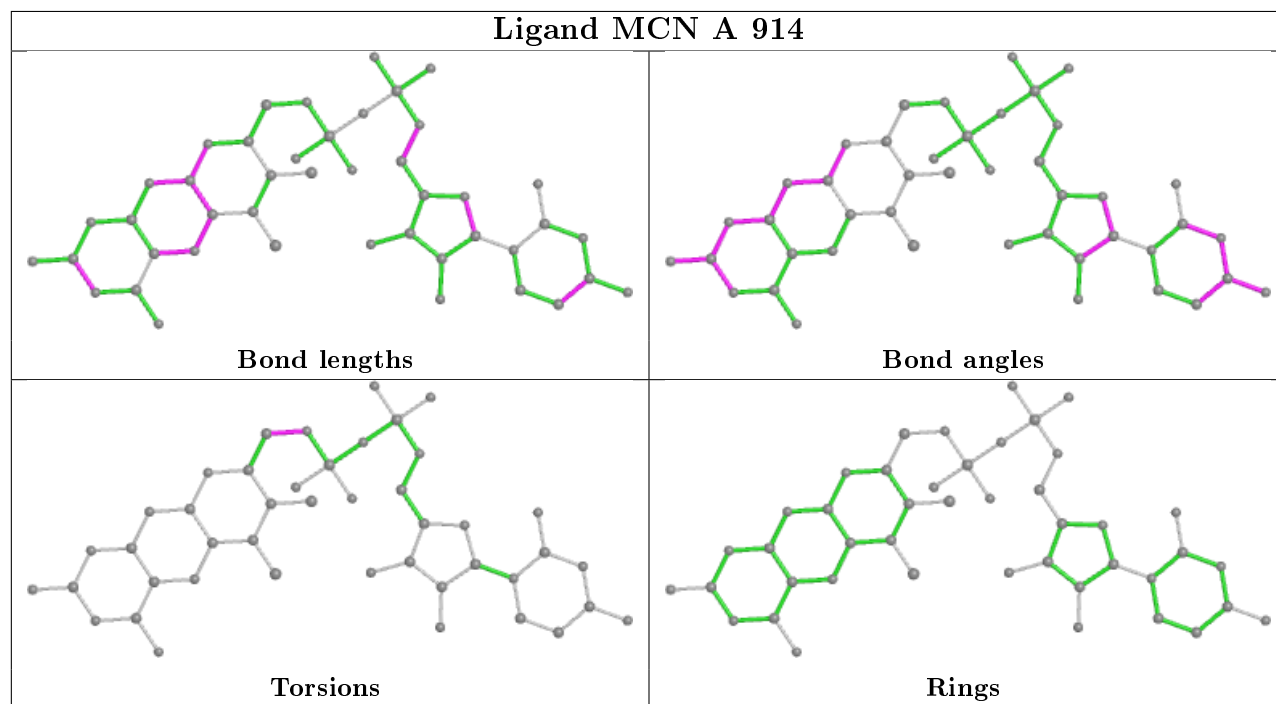
There are no ring outliers.

3 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	909	FES	2	0
4	A	914	MCN	3	0
3	A	910	2MO	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring

in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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 ⓘ

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

6.4 Ligands ⓘ

EDS was not executed - this section is therefore empty.

6.5 Other polymers ⓘ

EDS was not executed - this section is therefore empty.