



# Full wwPDB X-ray Structure Validation Report ⓘ

May 16, 2020 – 06:02 pm BST

PDB ID : 6DIO  
Title : Structure of class II HMG-CoA reductase from *Delftia acidovorans* with NAD bound  
Authors : Ragwan, E.R.; Arai, E.; Kung, Y.  
Deposited on : 2018-05-23  
Resolution : 2.14 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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.11  
buster-report : 1.1.7 (2018)  
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) : 2.11

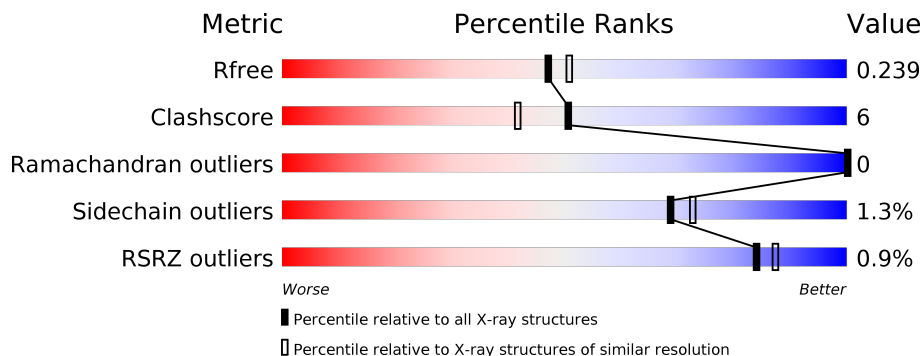
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.14 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	2523 (2.16-2.12)
Clashscore	141614	2653 (2.16-2.12)
Ramachandran outliers	138981	2618 (2.16-2.12)
Sidechain outliers	138945	2617 (2.16-2.12)
RSRZ outliers	127900	2485 (2.16-2.12)

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 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	429	
1	B	429	
1	C	429	

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
5	EDO	A	509	-	-	X	-

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 10349 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.

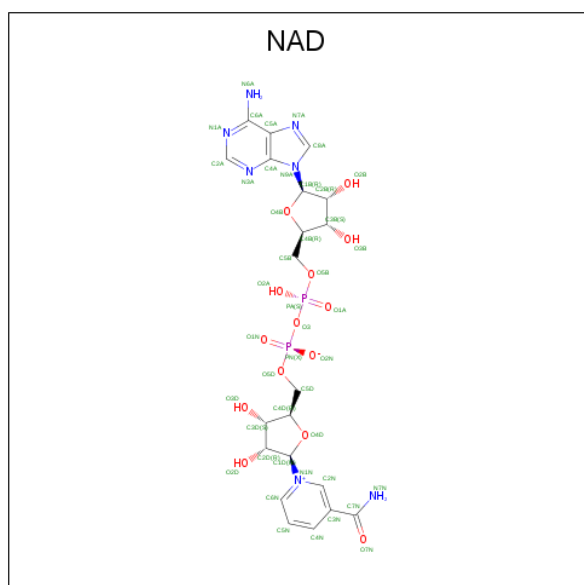
- Molecule 1 is a protein called 3-hydroxy-3-methylglutaryl coenzyme A reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	376	Total 2783	C 1740	N 510	O 521	S 12	0	1	0
1	B	427	Total 3154	C 1964	N 587	O 590	S 13	0	0	0
1	C	428	Total 3159	C 1967	N 588	O 591	S 13	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

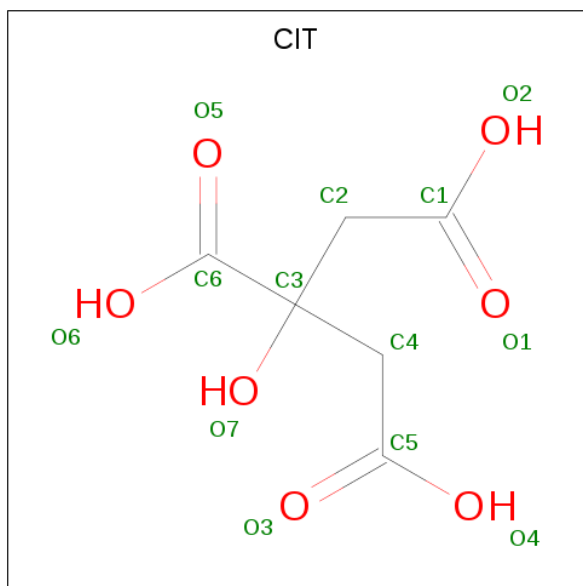
Chain	Residue	Modelled	Actual	Comment	Reference
A	203	LYS	GLN	conflict	UNP A0A291JGB7
B	203	LYS	GLN	conflict	UNP A0A291JGB7
C	203	LYS	GLN	conflict	UNP A0A291JGB7

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: C<sub>21</sub>H<sub>27</sub>N<sub>7</sub>O<sub>14</sub>P<sub>2</sub>) (labeled as "Ligand of Interest" by author).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total 44	C 21	N 7	O 14	P 2	0	0
2	B	1	Total 44	C 21	N 7	O 14	P 2	0	0
2	C	1	Total 44	C 21	N 7	O 14	P 2	0	0

- Molecule 3 is CITRIC ACID (three-letter code: CIT) (formula: C<sub>6</sub>H<sub>8</sub>O<sub>7</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	Total 13	C 6	O 7	0	0
3	B	1	Total 13	C 6	O 7	0	0
3	C	1	Total 13	C 6	O 7	0	0

- 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 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0
4	C	1	Total O S 5 4 1	0	0
4	C	1	Total O S 5 4 1	0	0

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



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

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

- Molecule 6 is water.

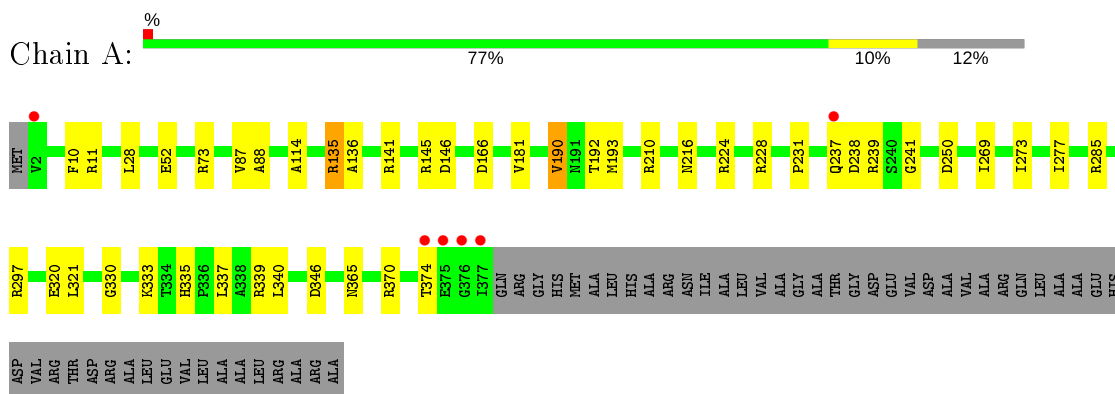
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	303	Total O 303 303	0	0
6	B	310	Total O 310 310	0	0
6	C	307	Total O 307 307	0	0



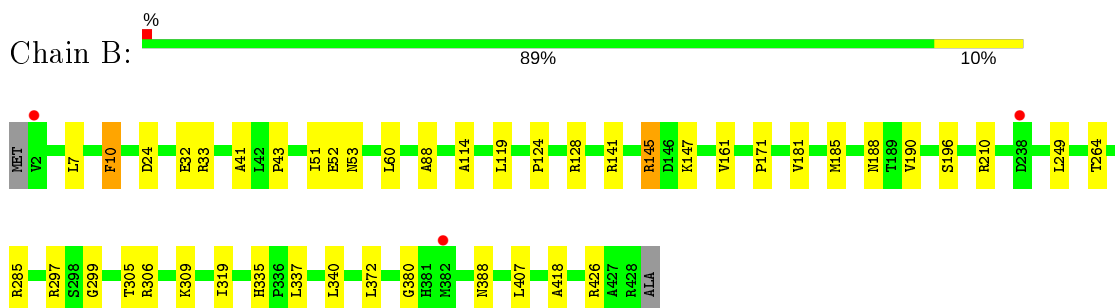
### 3 Residue-property plots [i](#)

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.

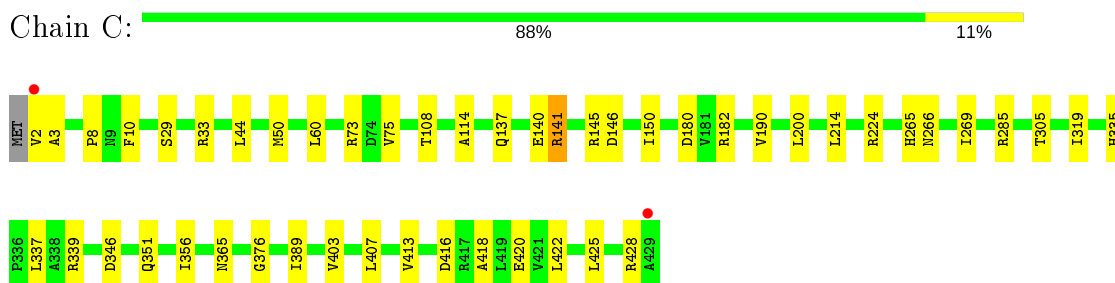
- Molecule 1: 3-hydroxy-3-methylglutaryl coenzyme A reductase



- Molecule 1: 3-hydroxy-3-methylglutaryl coenzyme A reductase



- Molecule 1: 3-hydroxy-3-methylglutaryl coenzyme A reductase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	113.00Å 113.00Å 437.48Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	97.86 – 2.14 97.86 – 2.14	Depositor EDS
% Data completeness (in resolution range)	99.9 (97.86-2.14) 99.9 (97.86-2.14)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.06 (at 2.14Å)	Xtrriage
Refinement program	PHENIX (1.12_2829: ???)	Depositor
R, $R_{free}$	0.191 , 0.239 0.191 , 0.239	Depositor DCC
$R_{free}$ test set	4723 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	21.7	Xtrriage
Anisotropy	0.346	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 51.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	10349	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	24.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.57% 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: CIT, EDO, NAD, 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	0.39	0/2824	0.57	0/3837
1	B	0.38	0/3198	0.55	0/4344
1	C	0.39	0/3203	0.56	0/4351
All	All	0.39	0/9225	0.56	0/12532

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	2783	0	2846	37	0
1	B	3154	0	3221	39	0
1	C	3159	0	3226	32	0
2	A	44	0	25	1	0
2	B	44	0	24	5	0
2	C	44	0	24	0	0
3	A	13	0	5	0	0
3	B	13	0	5	1	0
3	C	13	0	5	0	0
4	A	10	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	30	0	0	1	0
4	C	10	0	0	0	0
5	A	28	0	42	6	0
5	B	44	0	66	5	0
5	C	40	0	60	6	0
6	A	303	0	0	6	1
6	B	310	0	0	5	0
6	C	307	0	0	6	0
All	All	10349	0	9549	108	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 6.

All (108) 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)
2:B:501:NAD:C1B	2:B:501:NAD:O4B	1.64	1.25
1:B:114:ALA:HB2	1:B:190:VAL:HG13	1.34	1.08
1:B:141:ARG:HH11	1:B:145:ARG:HH22	1.26	0.83
1:A:114:ALA:HB2	1:A:190:VAL:HG13	1.66	0.78
1:A:237:GLN:NE2	6:A:601:HOH:O	2.21	0.73
1:B:114:ALA:HB2	1:B:190:VAL:CG1	2.19	0.69
1:A:73:ARG:NH1	1:A:346:ASP:O	2.26	0.69
1:A:250:ASP:OD2	1:B:210:ARG:NH1	2.28	0.67
1:A:192:THR:HB	5:A:509:EDO:H12	1.81	0.62
1:A:88:ALA:HB2	1:B:52:GLU:HG2	1.82	0.62
1:C:339:ARG:HH21	5:C:510:EDO:H22	1.64	0.61
5:A:507:EDO:H12	1:B:372:LEU:HD21	1.83	0.61
1:C:33:ARG:NH2	6:C:603:HOH:O	2.34	0.61
1:B:297:ARG:NH1	6:B:601:HOH:O	2.27	0.60
1:A:228:ARG:NH2	4:A:504:SO4:O1	2.35	0.60
1:C:180:ASP:OD1	1:C:182:ARG:HD2	2.02	0.59
1:C:335:HIS:CE1	1:C:337:LEU:HB2	2.37	0.59
1:C:75:VAL:HG21	1:C:356:ILE:HD13	1.84	0.59
1:A:193:MET:HG3	5:A:509:EDO:H21	1.85	0.59
1:B:141:ARG:NH1	1:B:145:ARG:HH22	2.00	0.58
1:A:146:ASP:HB2	5:A:509:EDO:H22	1.85	0.57
1:A:141:ARG:HH11	1:A:145:ARG:HH12	1.52	0.57
1:B:335:HIS:CE1	1:B:337:LEU:HB2	2.40	0.57
1:A:145:ARG:HD3	6:A:694:HOH:O	2.05	0.56
1:A:141:ARG:NH2	6:A:607:HOH:O	2.37	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:407:LEU:HD21	1:C:418:ALA:HB2	1.86	0.55
1:B:388:ASN:ND2	4:B:506:SO4:O4	2.38	0.55
1:A:141:ARG:HE	1:A:145:ARG:HH22	1.53	0.54
1:A:335:HIS:CE1	1:A:337:LEU:HB2	2.43	0.54
1:A:269:ILE:HG12	1:A:365:ASN:HB2	1.90	0.53
1:C:376:GLY:H	5:C:513:EDO:H11	1.74	0.52
5:C:508:EDO:H21	6:C:609:HOH:O	2.08	0.52
1:C:141:ARG:HH11	5:C:507:EDO:H11	1.73	0.52
1:A:297:ARG:HD2	6:A:866:HOH:O	2.09	0.51
1:B:141:ARG:HH11	1:B:145:ARG:NH2	2.00	0.51
1:B:188:ASN:ND2	2:B:501:NAD:O1A	2.34	0.51
1:C:146:ASP:O	1:C:150:ILE:HG12	2.11	0.51
1:C:2:VAL:HG22	1:C:3:ALA:H	1.75	0.51
5:A:509:EDO:H11	6:A:795:HOH:O	2.11	0.50
1:A:52:GLU:HG2	1:B:88:ALA:HB2	1.94	0.50
1:C:50:MET:HG2	5:C:508:EDO:H22	1.93	0.50
1:A:239:ARG:HH11	1:A:374:THR:HB	1.78	0.49
1:B:7:LEU:HB3	1:B:10:PHE:CG	2.47	0.49
1:A:87:VAL:HG21	1:B:51:ILE:HD12	1.95	0.49
1:A:370:ARG:O	1:A:374:THR:HG23	2.12	0.48
1:B:7:LEU:HB3	1:B:10:PHE:CD2	2.48	0.48
1:C:266:ASN:HA	1:C:269:ILE:HD12	1.94	0.48
1:A:239:ARG:NH1	1:A:374:THR:HB	2.29	0.48
1:A:330:GLY:HA2	5:B:512:EDO:H21	1.95	0.48
1:A:238:ASP:N	1:A:238:ASP:OD2	2.45	0.47
1:C:60:LEU:HD23	6:C:760:HOH:O	2.13	0.47
1:C:140:GLU:HG3	1:C:141:ARG:N	2.28	0.47
1:C:224:ARG:NH1	6:C:606:HOH:O	2.42	0.47
1:C:403:VAL:HG21	1:C:422:LEU:HD13	1.96	0.47
1:A:141:ARG:HE	1:A:145:ARG:NH2	2.12	0.47
1:A:135:ARG:HG3	1:A:136:ALA:N	2.31	0.46
1:B:210:ARG:HA	1:B:210:ARG:HD3	1.85	0.46
1:A:141:ARG:NE	1:A:145:ARG:HH22	2.13	0.45
1:B:124:PRO:HG3	1:B:171:PRO:HB2	1.97	0.45
1:A:181:VAL:O	2:A:501:NAD:H2A	2.17	0.45
1:A:28:LEU:HD13	1:A:340:LEU:HD11	1.99	0.45
1:B:380:GLY:HA3	5:B:513:EDO:H22	1.99	0.44
1:C:29:SER:O	1:C:33:ARG:HG3	2.15	0.44
1:B:41:ALA:O	1:B:43:PRO:HD3	2.17	0.44
1:C:425:LEU:O	1:C:428:ARG:HG2	2.16	0.44
1:B:380:GLY:H	5:B:513:EDO:H12	1.82	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:214:LEU:HD23	1:C:214:LEU:H	1.82	0.44
1:A:210:ARG:HD3	5:A:510:EDO:O2	2.18	0.44
1:B:119:LEU:HD12	1:B:210:ARG:HG3	2.00	0.44
1:B:181:VAL:O	2:B:501:NAD:H2A	2.17	0.44
1:C:141:ARG:HH21	1:C:145:ARG:HH11	1.65	0.43
1:C:416:ASP:O	1:C:420:GLU:HG3	2.17	0.43
1:B:32:GLU:HG2	1:B:340:LEU:HD13	2.01	0.43
1:A:11:ARG:NH2	1:B:53:ASN:H	2.17	0.43
1:A:273:ILE:O	1:A:277:ILE:HG12	2.18	0.43
2:B:501:NAD:H2D	2:B:501:NAD:H2N	1.80	0.43
1:A:224:ARG:HG2	1:A:320:GLU:HG3	2.00	0.42
1:B:426:ARG:HD2	6:B:613:HOH:O	2.19	0.42
1:C:108:THR:O	1:C:351:GLN:NE2	2.49	0.42
1:B:297:ARG:HD2	6:B:871:HOH:O	2.20	0.42
1:C:8:PRO:HD2	1:C:10:PHE:CE2	2.54	0.42
3:B:502:CIT:H21	6:B:733:HOH:O	2.19	0.42
1:B:60:LEU:HD23	6:B:845:HOH:O	2.20	0.42
1:C:114:ALA:HB2	1:C:190:VAL:HB	2.02	0.41
1:B:185:MET:CE	2:B:501:NAD:H52N	2.51	0.41
1:A:231:PRO:O	1:A:241:GLY:HA3	2.20	0.41
1:A:141:ARG:HD2	1:A:141:ARG:HA	1.94	0.41
1:B:141:ARG:HD2	1:B:141:ARG:HA	1.69	0.41
1:B:249:LEU:HD11	1:B:309:LYS:HG3	2.02	0.41
1:B:305:THR:HG22	1:B:319:ILE:HB	2.02	0.41
1:C:73:ARG:HH22	1:C:346:ASP:HB3	1.86	0.41
1:C:265:HIS:CE1	1:C:365:ASN:HD21	2.39	0.41
1:B:128:ARG:HG3	1:B:161:VAL:HB	2.02	0.41
1:B:306:ARG:HG2	5:B:511:EDO:H21	2.01	0.41
1:A:333:LYS:HA	1:A:339:ARG:HG2	2.02	0.41
1:B:24:ASP:OD1	1:B:33:ARG:NH2	2.52	0.41
1:C:137:GLN:HG2	1:C:200:LEU:HD21	2.01	0.41
1:A:216:ASN:OD1	1:B:264:THR:HG23	2.21	0.40
1:B:299:GLY:HA2	5:B:517:EDO:O2	2.21	0.40
1:C:44:LEU:HA	1:C:44:LEU:HD12	1.92	0.40
1:C:305:THR:HG22	1:C:319:ILE:HB	2.04	0.40
1:C:73:ARG:NH2	1:C:346:ASP:O	2.54	0.40
1:C:351:GLN:HG3	6:C:886:HOH:O	2.21	0.40
1:A:166:ASP:HA	6:A:779:HOH:O	2.20	0.40
1:B:7:LEU:HD22	1:B:10:PHE:CZ	2.56	0.40
1:B:407:LEU:HD11	1:B:418:ALA:HB2	2.04	0.40
1:C:389:ILE:HG13	1:C:413:VAL:HG12	2.03	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:C:511:EDO:H11	6:C:812:HOH:O	2.21	0.40

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)
6:A:703:HOH:O	6:A:827:HOH:O 12_564	2.15	0.05

## 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	375/429 (87%)	364 (97%)	11 (3%)	0	100	100
1	B	425/429 (99%)	415 (98%)	10 (2%)	0	100	100
1	C	426/429 (99%)	412 (97%)	14 (3%)	0	100	100
All	All	1226/1287 (95%)	1191 (97%)	35 (3%)	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	284/319 (89%)	279 (98%)	5 (2%)	59	60

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	318/319 (100%)	313 (98%)	5 (2%)	62	65
1	C	318/319 (100%)	316 (99%)	2 (1%)	86	89
All	All	920/957 (96%)	908 (99%)	12 (1%)	69	73

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	PHE
1	A	135	ARG
1	A	190	VAL
1	A	285	ARG
1	A	321	LEU
1	B	10	PHE
1	B	145	ARG
1	B	147	LYS
1	B	196	SER
1	B	285	ARG
1	C	141	ARG
1	C	285	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	237	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 carbohydrates in this entry.



## 5.6 Ligand geometry

44 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
4	SO4	B	503	-	4,4,4	0.15	0	6,6,6	0.16	0
5	EDO	C	509	-	3,3,3	0.50	0	2,2,2	0.17	0
5	EDO	C	506	-	3,3,3	0.54	0	2,2,2	0.19	0
4	SO4	B	504	-	4,4,4	0.13	0	6,6,6	0.30	0
5	EDO	B	518	-	3,3,3	0.64	0	2,2,2	0.24	0
5	EDO	B	512	-	3,3,3	0.61	0	2,2,2	0.18	0
4	SO4	B	506	-	4,4,4	0.19	0	6,6,6	0.33	0
5	EDO	C	507	-	3,3,3	0.54	0	2,2,2	0.23	0
5	EDO	C	508	-	3,3,3	0.49	0	2,2,2	0.30	0
3	CIT	A	502	-	3,12,12	1.14	0	3,17,17	0.84	0
3	CIT	B	502	-	3,12,12	0.92	0	3,17,17	0.31	0
5	EDO	B	514	-	3,3,3	0.57	0	2,2,2	0.52	0
5	EDO	B	519	-	3,3,3	0.36	0	2,2,2	0.99	0
5	EDO	C	505	-	3,3,3	0.42	0	2,2,2	0.56	0
5	EDO	B	516	-	3,3,3	0.52	0	2,2,2	0.29	0
2	NAD	C	501	-	42,48,48	5.06	16 (38%)	50,73,73	1.70	8 (16%)
5	EDO	A	510	-	3,3,3	0.48	0	2,2,2	0.56	0
4	SO4	A	504	-	4,4,4	0.17	0	6,6,6	0.13	0
5	EDO	B	515	-	3,3,3	0.51	0	2,2,2	0.39	0
5	EDO	A	506	-	3,3,3	0.56	0	2,2,2	0.13	0
4	SO4	B	508	-	4,4,4	0.11	0	6,6,6	0.12	0
5	EDO	C	511	-	3,3,3	0.40	0	2,2,2	0.87	0
3	CIT	C	502	-	3,12,12	1.33	0	3,17,17	0.65	0
4	SO4	B	505	-	4,4,4	0.16	0	6,6,6	0.27	0
5	EDO	B	517	-	3,3,3	0.50	0	2,2,2	0.46	0
5	EDO	B	513	-	3,3,3	0.45	0	2,2,2	0.42	0
5	EDO	C	514	-	3,3,3	0.54	0	2,2,2	0.52	0
2	NAD	A	501	-	42,48,48	5.08	15 (35%)	50,73,73	1.68	9 (18%)
5	EDO	C	510	-	3,3,3	0.46	0	2,2,2	0.27	0
4	SO4	B	507	-	4,4,4	0.17	0	6,6,6	0.14	0
5	EDO	B	511	-	3,3,3	0.48	0	2,2,2	0.27	0
5	EDO	A	508	-	3,3,3	0.47	0	2,2,2	0.51	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
5	EDO	A	505	-	3,3,3	0.41	0	2,2,2	0.58	0
5	EDO	C	512	-	3,3,3	0.53	0	2,2,2	0.25	0
5	EDO	B	510	-	3,3,3	0.49	0	2,2,2	0.45	0
5	EDO	C	513	-	3,3,3	0.45	0	2,2,2	0.37	0
4	SO4	C	503	-	4,4,4	0.15	0	6,6,6	0.06	0
4	SO4	C	504	-	4,4,4	0.19	0	6,6,6	0.29	0
4	SO4	A	503	-	4,4,4	0.15	0	6,6,6	0.39	0
2	NAD	B	501	-	42,48,48	5.29	17 (40%)	50,73,73	1.68	9 (18%)
5	EDO	B	509	-	3,3,3	0.48	0	2,2,2	0.32	0
5	EDO	A	507	-	3,3,3	0.71	0	2,2,2	0.24	0
5	EDO	A	509	-	3,3,3	0.41	0	2,2,2	0.34	0
5	EDO	A	511	-	3,3,3	0.53	0	2,2,2	0.47	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
5	EDO	C	506	-	-	0/1/1/1	-
5	EDO	B	518	-	-	1/1/1/1	-
5	EDO	B	512	-	-	0/1/1/1	-
5	EDO	C	507	-	-	1/1/1/1	-
5	EDO	C	508	-	-	0/1/1/1	-
3	CIT	A	502	-	-	0/6/16/16	-
3	CIT	B	502	-	-	0/6/16/16	-
5	EDO	B	514	-	-	1/1/1/1	-
5	EDO	B	519	-	-	0/1/1/1	-
5	EDO	C	505	-	-	1/1/1/1	-
5	EDO	B	516	-	-	0/1/1/1	-
2	NAD	C	501	-	-	5/26/62/62	0/5/5/5
5	EDO	A	510	-	-	0/1/1/1	-
5	EDO	B	515	-	-	0/1/1/1	-
5	EDO	A	506	-	-	0/1/1/1	-
5	EDO	C	509	-	-	0/1/1/1	-
5	EDO	C	511	-	-	1/1/1/1	-
5	EDO	B	517	-	-	0/1/1/1	-
5	EDO	B	513	-	-	0/1/1/1	-
5	EDO	C	514	-	-	0/1/1/1	-
2	NAD	A	501	-	-	4/26/62/62	0/5/5/5
5	EDO	C	510	-	-	0/1/1/1	-
5	EDO	B	511	-	-	0/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	EDO	A	508	-	-	0/1/1/1	-
5	EDO	A	505	-	-	1/1/1/1	-
5	EDO	C	512	-	-	1/1/1/1	-
5	EDO	B	510	-	-	0/1/1/1	-
5	EDO	C	513	-	-	0/1/1/1	-
3	CIT	C	502	-	-	0/6/16/16	-
2	NAD	B	501	-	-	9/26/62/62	0/5/5/5
5	EDO	B	509	-	-	1/1/1/1	-
5	EDO	A	507	-	-	1/1/1/1	-
5	EDO	A	509	-	-	1/1/1/1	-
5	EDO	A	511	-	-	0/1/1/1	-

All (48) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	501	NAD	O4B-C1B	16.91	1.64	1.41
2	A	501	NAD	O4B-C1B	15.92	1.63	1.41
2	B	501	NAD	O4D-C1D	15.87	1.63	1.41
2	C	501	NAD	O4B-C1B	15.85	1.63	1.41
2	C	501	NAD	O4D-C1D	15.08	1.62	1.41
2	A	501	NAD	C2D-C1D	-14.75	1.31	1.53
2	A	501	NAD	C2B-C1B	-14.44	1.31	1.53
2	B	501	NAD	C2B-C1B	-14.43	1.31	1.53
2	A	501	NAD	O4D-C1D	14.15	1.60	1.41
2	C	501	NAD	C2B-C1B	-13.97	1.32	1.53
2	B	501	NAD	C2D-C1D	-13.92	1.32	1.53
2	C	501	NAD	C2D-C1D	-13.17	1.33	1.53
2	B	501	NAD	C7N-N7N	8.11	1.48	1.33
2	C	501	NAD	C7N-N7N	7.68	1.47	1.33
2	A	501	NAD	C7N-N7N	7.07	1.46	1.33
2	A	501	NAD	O4D-C4D	-6.02	1.31	1.45
2	C	501	NAD	O4D-C4D	-5.88	1.31	1.45
2	B	501	NAD	O4D-C4D	-5.53	1.32	1.45
2	A	501	NAD	O4B-C4B	-5.52	1.32	1.45
2	B	501	NAD	O4B-C4B	-5.46	1.32	1.45
2	C	501	NAD	O4B-C4B	-5.25	1.33	1.45
2	B	501	NAD	C3N-C7N	4.67	1.57	1.50
2	C	501	NAD	C3N-C7N	4.49	1.57	1.50
2	A	501	NAD	C3N-C7N	3.91	1.56	1.50
2	C	501	NAD	O3B-C3B	-3.51	1.34	1.43
2	B	501	NAD	O3B-C3B	-3.46	1.34	1.43
2	B	501	NAD	O2B-C2B	3.19	1.50	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	501	NAD	C2N-N1N	3.14	1.38	1.35
2	C	501	NAD	O2B-C2B	3.04	1.50	1.43
2	A	501	NAD	O3B-C3B	-2.98	1.36	1.43
2	C	501	NAD	C5A-C4A	-2.89	1.33	1.40
2	B	501	NAD	C5A-C4A	-2.83	1.33	1.40
2	B	501	NAD	O3D-C3D	-2.81	1.36	1.43
2	C	501	NAD	O3D-C3D	-2.81	1.36	1.43
2	A	501	NAD	C2A-N3A	2.81	1.36	1.32
2	B	501	NAD	O2D-C2D	2.76	1.49	1.43
2	A	501	NAD	C5A-C4A	-2.69	1.33	1.40
2	B	501	NAD	PN-O5D	2.67	1.70	1.59
2	A	501	NAD	O2B-C2B	2.64	1.49	1.43
2	C	501	NAD	C2A-N3A	2.51	1.36	1.32
2	A	501	NAD	O3D-C3D	-2.32	1.37	1.43
2	A	501	NAD	PN-O5D	2.28	1.68	1.59
2	A	501	NAD	C2B-C3B	2.26	1.59	1.53
2	B	501	NAD	C2A-N3A	2.25	1.35	1.32
2	C	501	NAD	O2D-C2D	2.22	1.48	1.43
2	B	501	NAD	C6A-N6A	2.20	1.42	1.34
2	C	501	NAD	C6A-N6A	2.05	1.41	1.34
2	B	501	NAD	C2B-C3B	2.02	1.58	1.53

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	501	NAD	N3A-C2A-N1A	-5.65	119.85	128.68
2	B	501	NAD	C5A-C6A-N6A	5.28	128.37	120.35
2	B	501	NAD	N3A-C2A-N1A	-5.23	120.50	128.68
2	A	501	NAD	O4D-C1D-C2D	-4.93	99.73	106.93
2	C	501	NAD	C5A-C6A-N6A	4.92	127.84	120.35
2	A	501	NAD	N3A-C2A-N1A	-4.74	121.27	128.68
2	A	501	NAD	C5A-C6A-N6A	4.56	127.28	120.35
2	A	501	NAD	C3B-C2B-C1B	4.54	107.82	100.98
2	C	501	NAD	C3B-C2B-C1B	4.24	107.36	100.98
2	B	501	NAD	C3B-C2B-C1B	3.81	106.71	100.98
2	B	501	NAD	N6A-C6A-N1A	-3.42	111.47	118.57
2	C	501	NAD	N6A-C6A-N1A	-3.24	111.85	118.57
2	A	501	NAD	C3N-C7N-N7N	3.02	121.38	117.75
2	A	501	NAD	N6A-C6A-N1A	-3.00	112.34	118.57
2	B	501	NAD	O4D-C1D-C2D	-2.89	102.70	106.93
2	C	501	NAD	O4D-C1D-C2D	-2.64	103.07	106.93
2	A	501	NAD	C6N-N1N-C2N	-2.55	119.65	121.97

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	501	NAD	PN-O3-PA	-2.47	124.36	132.83
2	C	501	NAD	C6N-N1N-C2N	-2.47	119.72	121.97
2	B	501	NAD	C5B-C4B-C3B	-2.25	106.75	115.18
2	C	501	NAD	C2N-N1N-C1D	2.18	123.99	119.14
2	B	501	NAD	C2N-C3N-C4N	2.17	120.72	118.26
2	C	501	NAD	C2N-C3N-C4N	2.15	120.70	118.26
2	A	501	NAD	C2N-C3N-C4N	2.08	120.61	118.26
2	A	501	NAD	O7N-C7N-N7N	-2.06	119.64	122.58
2	B	501	NAD	C3N-C7N-N7N	2.05	120.22	117.75

There are no chirality outliers.

All (28) torsion outliers are listed below:

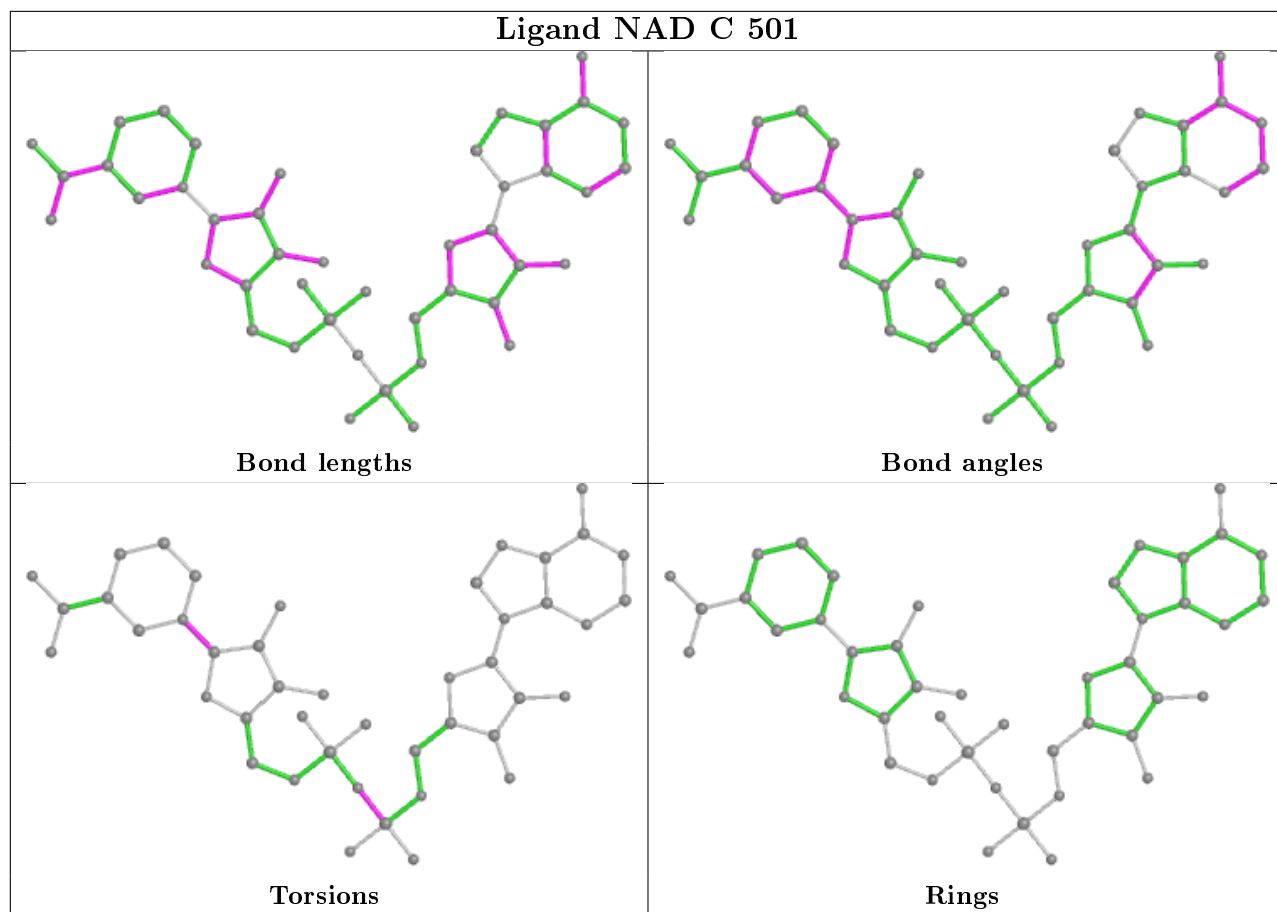
Mol	Chain	Res	Type	Atoms
2	C	501	NAD	O4D-C1D-N1N-C6N
2	C	501	NAD	C2D-C1D-N1N-C6N
2	A	501	NAD	O4D-C1D-N1N-C2N
2	A	501	NAD	O4D-C1D-N1N-C6N
2	A	501	NAD	C2D-C1D-N1N-C6N
2	B	501	NAD	PN-O3-PA-O5B
2	B	501	NAD	C3B-C4B-C5B-O5B
2	B	501	NAD	O4D-C1D-N1N-C2N
2	B	501	NAD	O4D-C1D-N1N-C6N
2	B	501	NAD	C2D-C1D-N1N-C6N
2	B	501	NAD	O4B-C4B-C5B-O5B
5	C	507	EDO	O1-C1-C2-O2
5	B	509	EDO	O1-C1-C2-O2
2	C	501	NAD	PN-O3-PA-O1A
2	B	501	NAD	PA-O3-PN-O1N
2	B	501	NAD	C3D-C4D-C5D-O5D
5	C	505	EDO	O1-C1-C2-O2
5	A	509	EDO	O1-C1-C2-O2
5	C	512	EDO	O1-C1-C2-O2
5	C	511	EDO	O1-C1-C2-O2
5	B	518	EDO	O1-C1-C2-O2
5	B	514	EDO	O1-C1-C2-O2
5	A	505	EDO	O1-C1-C2-O2
5	A	507	EDO	O1-C1-C2-O2
2	C	501	NAD	C2D-C1D-N1N-C2N
2	A	501	NAD	C2D-C1D-N1N-C2N
2	B	501	NAD	C2D-C1D-N1N-C2N
2	C	501	NAD	PN-O3-PA-O2A

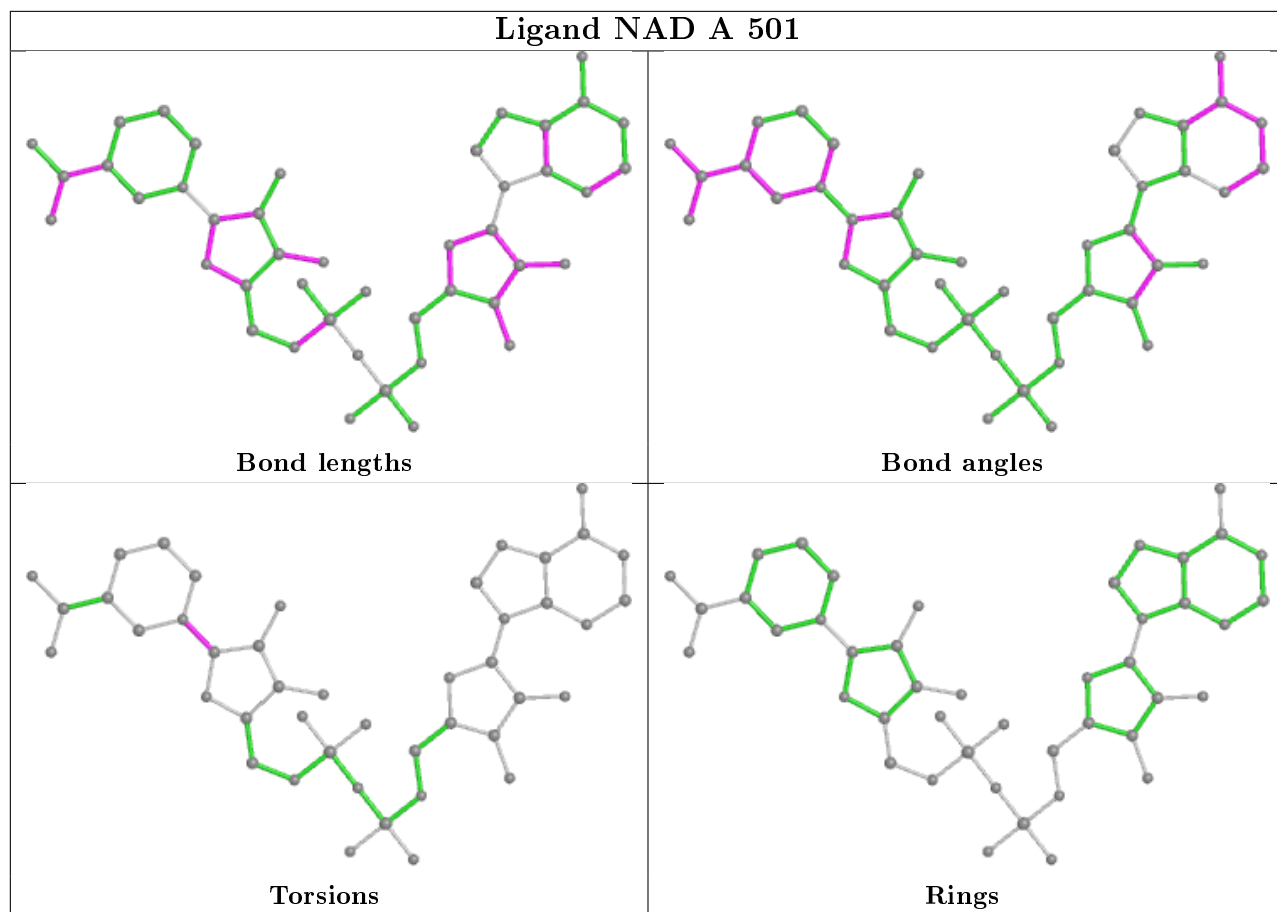
There are no ring outliers.

17 monomers are involved in 26 short contacts:

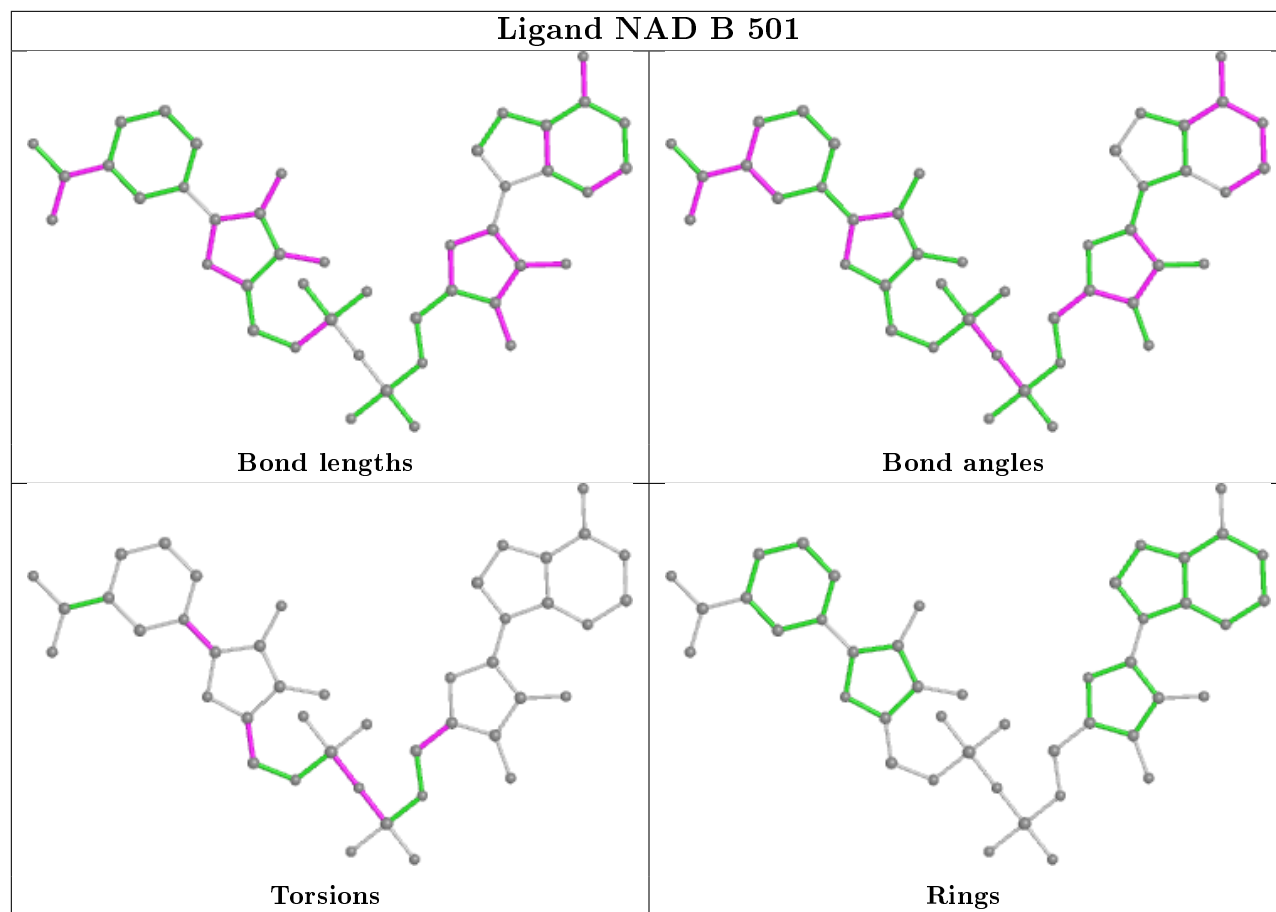
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	512	EDO	1	0
4	B	506	SO4	1	0
5	C	507	EDO	1	0
5	C	508	EDO	2	0
3	B	502	CIT	1	0
5	A	510	EDO	1	0
4	A	504	SO4	1	0
5	C	511	EDO	1	0
5	B	517	EDO	1	0
5	B	513	EDO	2	0
2	A	501	NAD	1	0
5	C	510	EDO	1	0
5	B	511	EDO	1	0
5	C	513	EDO	1	0
2	B	501	NAD	5	0
5	A	507	EDO	1	0
5	A	509	EDO	4	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 [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	376/429 (87%)	-0.28	6 (1%) 72 77	14, 20, 36, 71	0
1	B	427/429 (99%)	-0.24	3 (0%) 87 90	13, 22, 40, 60	0
1	C	428/429 (99%)	-0.27	2 (0%) 91 93	14, 20, 36, 60	0
All	All	1231/1287 (95%)	-0.26	11 (0%) 84 87	13, 21, 38, 71	0

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	2	VAL	4.3
1	B	2	VAL	4.3
1	A	374	THR	3.6
1	C	2	VAL	3.4
1	C	429	ALA	3.0
1	B	238	ASP	2.7
1	A	375	GLU	2.6
1	A	376	GLY	2.4
1	B	382	MET	2.3
1	A	237	GLN	2.1
1	A	377	ILE	2.1

### 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 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.

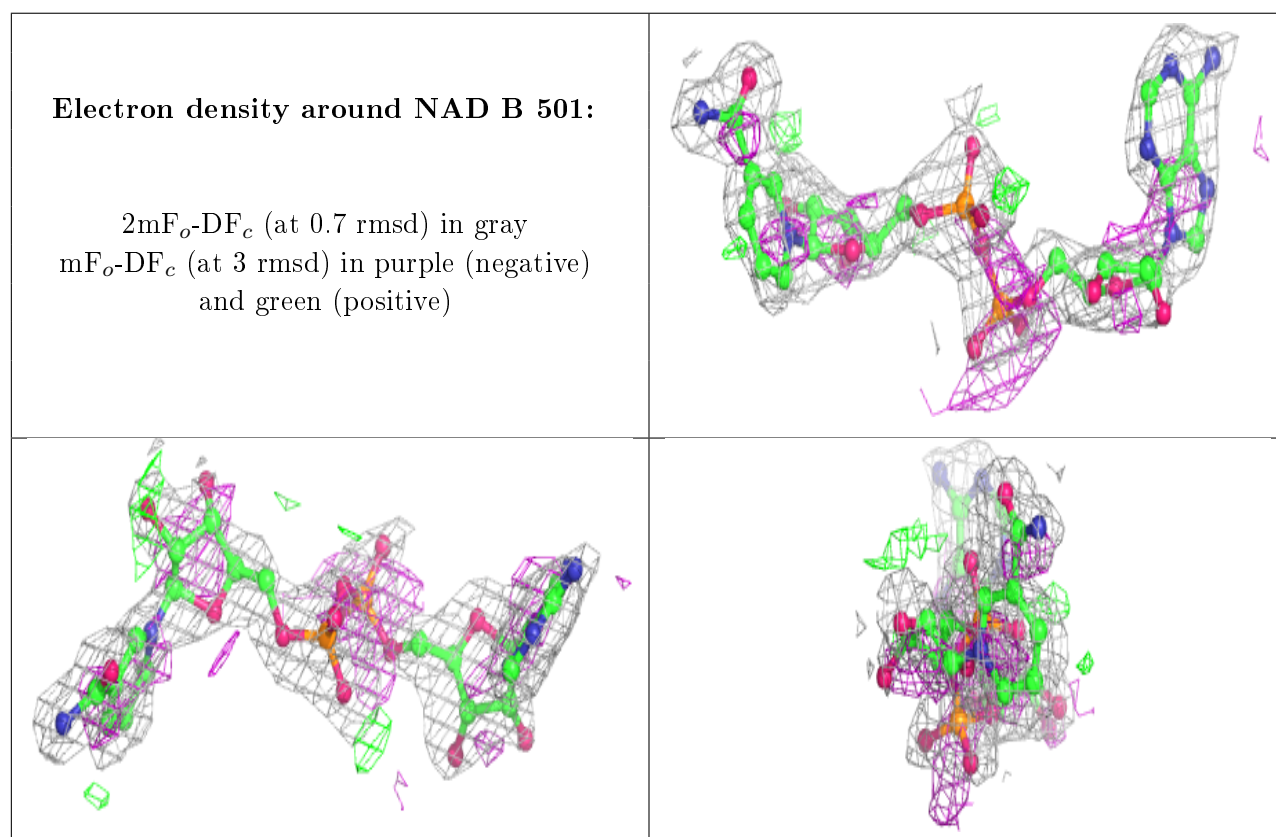
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
5	EDO	C	511	4/4	0.76	0.14	38,43,44,48	0
5	EDO	C	512	4/4	0.79	0.25	42,43,45,49	0
5	EDO	B	512	4/4	0.80	0.27	28,35,38,45	0
5	EDO	C	506	4/4	0.83	0.42	36,40,41,51	0
4	SO4	B	503	5/5	0.84	0.21	65,66,86,94	0
4	SO4	B	508	5/5	0.84	0.31	60,66,83,91	0
5	EDO	C	507	4/4	0.84	0.18	37,37,38,40	0
5	EDO	B	514	4/4	0.85	0.15	33,42,44,50	0
4	SO4	B	506	5/5	0.85	0.20	57,65,80,87	0
5	EDO	B	517	4/4	0.87	0.44	37,40,44,45	0
5	EDO	B	513	4/4	0.88	0.15	37,45,45,49	0
5	EDO	B	518	4/4	0.88	0.15	29,36,38,41	0
5	EDO	C	510	4/4	0.89	0.13	44,46,48,55	0
5	EDO	B	519	4/4	0.89	0.14	31,33,38,41	0
4	SO4	C	504	5/5	0.89	0.22	49,54,77,82	0
5	EDO	A	511	4/4	0.89	0.33	29,33,36,38	0
5	EDO	A	507	4/4	0.91	0.23	27,33,34,36	0
2	NAD	B	501	44/44	0.91	0.23	18,42,51,58	0
5	EDO	B	516	4/4	0.92	0.24	41,45,47,55	0
5	EDO	C	513	4/4	0.92	0.14	39,42,44,45	0
5	EDO	B	515	4/4	0.92	0.17	38,40,45,46	0
5	EDO	C	505	4/4	0.93	0.13	26,32,33,49	0
4	SO4	B	507	5/5	0.93	0.21	44,44,66,68	0
5	EDO	A	510	4/4	0.94	0.19	25,29,30,35	0
4	SO4	A	504	5/5	0.94	0.16	50,55,67,71	0
5	EDO	A	505	4/4	0.94	0.13	31,32,36,37	0
5	EDO	B	509	4/4	0.94	0.12	24,31,32,46	0
5	EDO	C	508	4/4	0.94	0.15	30,32,35,43	0
5	EDO	B	510	4/4	0.94	0.19	31,33,33,41	0
5	EDO	C	509	4/4	0.95	0.18	27,42,47,50	0
4	SO4	A	503	5/5	0.96	0.11	29,36,40,43	0
5	EDO	A	506	4/4	0.96	0.14	32,32,35,35	0
5	EDO	B	511	4/4	0.96	0.14	25,25,26,34	0
4	SO4	C	503	5/5	0.97	0.23	53,57,64,68	0
5	EDO	C	514	4/4	0.97	0.13	19,21,21,26	0
2	NAD	C	501	44/44	0.97	0.11	15,21,27,28	0
3	CIT	C	502	13/13	0.98	0.08	14,16,19,21	0

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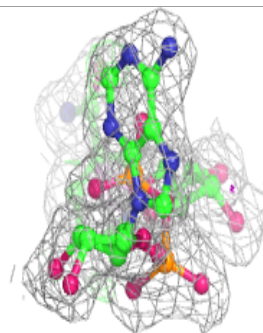
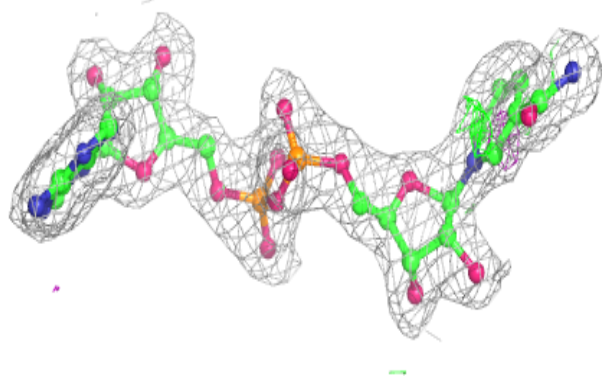
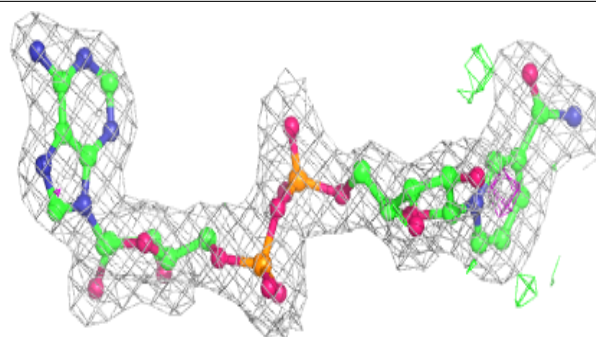
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	SO4	B	505	5/5	0.98	0.12	32,33,44,50	0
4	SO4	B	504	5/5	0.98	0.11	33,35,36,40	0
5	EDO	A	508	4/4	0.98	0.12	17,18,22,27	0
3	CIT	A	502	13/13	0.98	0.11	13,18,20,22	0
3	CIT	B	502	13/13	0.98	0.12	14,16,22,23	0
2	NAD	A	501	44/44	0.98	0.10	14,19,23,24	0
5	EDO	A	509	4/4	0.99	0.37	23,25,25,34	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

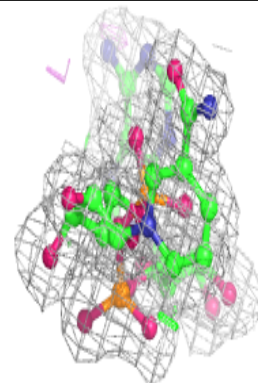
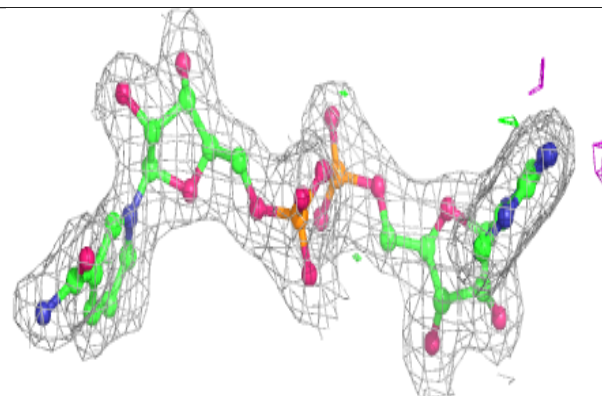
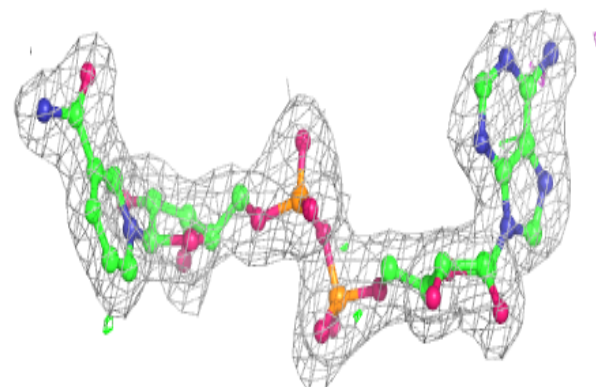


**Electron density around NAD C 501:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

**Electron density around NAD A 501:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



## 6.5 Other polymers

There are no such residues in this entry.