



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 14, 2020 – 10:01 am BST

PDB ID : 2CVQ  
Title : Crystal structure of NAD(H)-dependent malate dehydrogenase complexed with NADPH  
Authors : Tomita, T.; Fushinobu, S.; Kuzuyama, T.; Nishiyama, M.  
Deposited on : 2005-06-13  
Resolution : 2.08 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

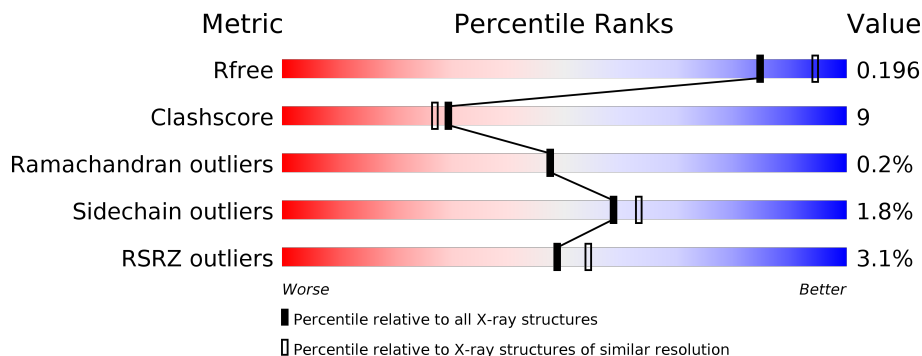
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.08 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	6189 (2.10-2.06)
Clashscore	141614	6738 (2.10-2.06)
Ramachandran outliers	138981	6663 (2.10-2.06)
Sidechain outliers	138945	6664 (2.10-2.06)
RSRZ outliers	127900	6057 (2.10-2.06)

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	327	 4% 83% 17%
1	B	327	 2% 81% 17%

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:

<b>Mol</b>	<b>Type</b>	<b>Chain</b>	<b>Res</b>	<b>Chirality</b>	<b>Geometry</b>	<b>Clashes</b>	<b>Electron density</b>
3	TRS	A	4619	-	X	-	-
3	TRS	B	4623	-	X	-	-

## 2 Entry composition [i](#)

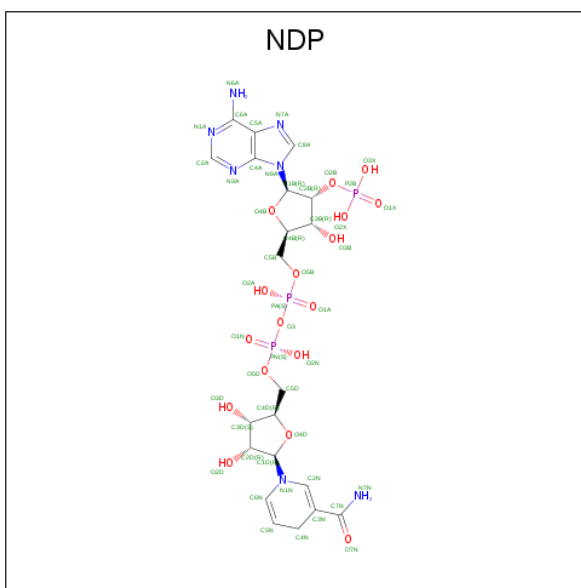
There are 4 unique types of molecules in this entry. The entry contains 5419 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Malate dehydrogenase.

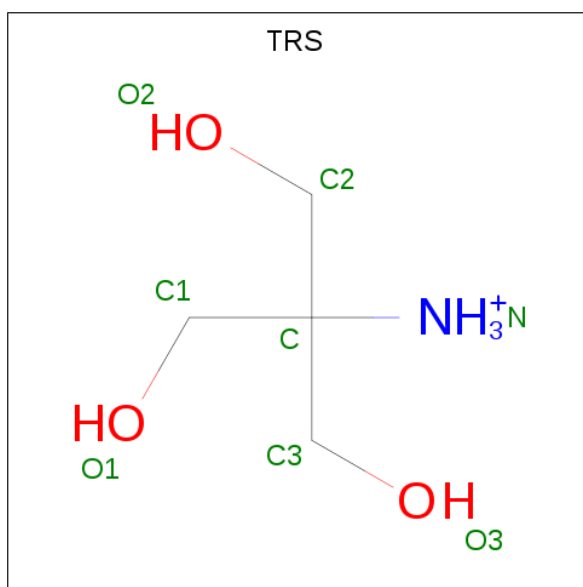
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	327	Total 2489	1576	437	463	13	0	0	0
1	B	327	Total 2489	1576	437	463	13	0	0	0

- Molecule 2 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NDP) (formula:  $C_{21}H_{30}N_7O_{17}P_3$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total 39	15	5	16	3	0	0
2	B	1	Total 39	15	5	16	3	0	0

- Molecule 3 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula:  $C_4H_{12}NO_3$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			8	4	1	3		
3	A	1	Total	C	N	O	0	0
			8	4	1	3		
3	B	1	Total	C	N	O	0	0
			8	4	1	3		
3	B	1	Total	C	N	O	0	0
			8	4	1	3		

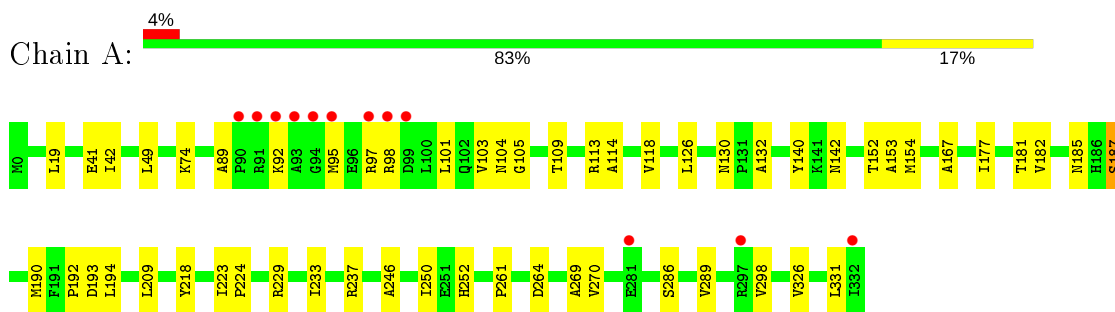
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	151	Total	O	0	0
			151	151		
4	B	180	Total	O	0	0
			180	180		

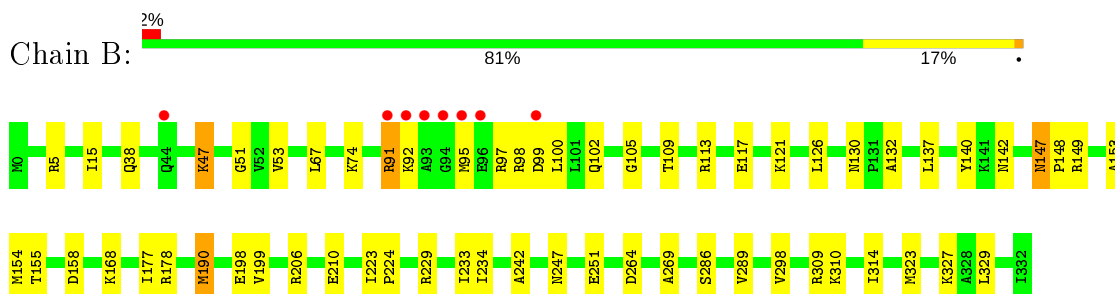
### 3 Residue-property plots [i](#)

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: Malate dehydrogenase



- Molecule 1: Malate dehydrogenase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	70.29Å 85.16Å 118.07Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.06 – 2.08 40.05 – 2.08	Depositor EDS
% Data completeness (in resolution range)	99.7 (40.06-2.08) 99.8 (40.05-2.08)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.49 (at 2.08Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.208 , 0.247 0.197 , 0.196	Depositor DCC
$R_{free}$ test set	2167 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	25.5	Xtrriage
Anisotropy	0.184	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 56.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	5419	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	27.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.34% of the height of the origin peak. No significant pseudotranslation is detected.*

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

<sup>2</sup> Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

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

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

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	0.30	0/2533	0.59	0/3429
1	B	0.31	0/2533	0.59	0/3429
All	All	0.31	0/5066	0.59	0/6858

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 [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	2489	0	2527	47	0
1	B	2489	0	2527	51	0
2	A	39	0	18	1	0
2	B	39	0	18	2	0
3	A	16	0	22	0	0
3	B	16	0	22	1	0
4	A	151	0	0	1	0
4	B	180	0	0	1	0
All	All	5419	0	5134	97	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 9.



All (97) 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:74:LYS:HG3	1:A:118:VAL:HG11	1.56	0.87
1:B:149:ARG:HH11	1:B:149:ARG:HG2	1.37	0.87
1:A:89:ALA:H	1:A:104:ASN:HD21	1.19	0.86
1:A:89:ALA:H	1:A:104:ASN:ND2	1.89	0.70
1:A:97:ARG:HB3	1:A:98:ARG:HH11	1.57	0.69
1:A:261:PRO:HG2	1:A:264:ASP:HB3	1.76	0.66
1:A:105:GLY:O	1:A:109:THR:HG23	1.96	0.65
1:A:326:VAL:HG13	1:A:331:LEU:HD12	1.78	0.65
1:B:158:ASP:OD1	1:B:190:MET:HE2	1.99	0.63
1:B:47:LYS:HE2	1:B:47:LYS:HA	1.79	0.63
1:B:310:LYS:HE2	1:B:314:ILE:HD11	1.81	0.62
1:B:149:ARG:NH1	1:B:149:ARG:HG2	2.11	0.62
1:B:109:THR:O	1:B:113:ARG:HG2	2.00	0.61
1:A:269:ALA:HA	1:A:286:SER:HA	1.81	0.61
1:A:98:ARG:HD2	1:A:98:ARG:N	2.14	0.61
1:B:91:ARG:HD3	1:B:91:ARG:C	2.21	0.61
1:A:326:VAL:CG1	1:A:331:LEU:HB2	2.32	0.60
1:B:327:LYS:NZ	1:B:327:LYS:HB3	2.15	0.60
1:A:223:ILE:HB	1:A:224:PRO:HD3	1.84	0.59
1:A:326:VAL:HG13	1:A:331:LEU:HB2	1.85	0.58
1:B:5:ARG:HH11	1:B:38:GLN:NE2	2.01	0.58
1:B:269:ALA:HA	1:B:286:SER:HA	1.86	0.58
1:A:97:ARG:O	1:A:101:LEU:HD13	2.03	0.57
1:B:105:GLY:O	1:B:109:THR:HG23	2.05	0.56
1:A:192:PRO:HG2	1:A:223:ILE:CD1	2.38	0.54
1:A:192:PRO:HG2	1:A:223:ILE:HD13	1.90	0.53
1:A:126:LEU:HD11	1:A:154:MET:HB2	1.91	0.52
1:B:15:ILE:HD11	2:B:1334:NDP:C2A	2.39	0.52
1:A:218:TYR:O	1:A:223:ILE:HG12	2.08	0.52
1:B:310:LYS:HD3	1:B:310:LYS:O	2.10	0.52
1:A:42:ILE:HG12	2:A:334:NDP:O2D	2.10	0.52
1:B:74:LYS:NZ	1:B:117:GLU:OE1	2.44	0.51
1:B:178:ARG:NH1	1:B:198:GLU:OE1	2.44	0.51
1:B:158:ASP:HB3	1:B:190:MET:HE1	1.93	0.50
1:B:102:GLN:HG2	1:B:329:LEU:HD13	1.92	0.50
1:B:223:ILE:HB	1:B:224:PRO:HD3	1.92	0.50
1:A:152:THR:HG22	1:A:270:VAL:HG12	1.94	0.50
1:A:181:THR:HB	1:A:193:ASP:HB3	1.94	0.49
1:A:153:ALA:HB3	1:A:269:ALA:HB3	1.95	0.49
1:B:177:ILE:CD1	1:B:199:VAL:HG22	2.42	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:234:ILE:HD11	3:B:4621:TRS:H21	1.94	0.49
1:B:95:MET:HG3	1:B:99:ASP:OD2	2.13	0.48
1:B:289:VAL:HG12	1:B:298:VAL:HA	1.94	0.48
1:A:185:ASN:O	1:A:190:MET:HB2	2.14	0.48
1:B:92:LYS:HD3	1:B:95:MET:HE3	1.96	0.48
1:A:167:ALA:CA	1:A:177:ILE:HD11	2.44	0.48
1:A:89:ALA:HB2	1:A:103:VAL:HG22	1.96	0.47
1:B:310:LYS:HD3	1:B:310:LYS:C	2.35	0.47
1:A:182:VAL:HG13	1:A:190:MET:HG2	1.95	0.47
1:B:98:ARG:CZ	1:B:98:ARG:HB3	2.44	0.47
1:B:147:ASN:ND2	1:B:149:ARG:H	2.12	0.47
1:A:237:ARG:HG3	1:B:51:GLY:HA3	1.95	0.47
1:A:92:LYS:HG2	1:A:95:MET:SD	2.55	0.46
1:A:130:ASN:HA	1:A:132:ALA:N	2.30	0.46
1:A:218:TYR:CE1	1:A:223:ILE:HD11	2.50	0.46
1:A:109:THR:O	1:A:113:ARG:HG3	2.15	0.46
1:A:98:ARG:CD	1:A:98:ARG:H	2.29	0.46
1:A:252:HIS:HD2	4:A:4622:HOH:O	1.99	0.45
1:A:289:VAL:HG12	1:A:298:VAL:HA	1.98	0.45
1:B:5:ARG:HD3	1:B:38:GLN:HE22	1.82	0.45
1:A:98:ARG:CD	1:A:98:ARG:N	2.80	0.45
1:B:247:ASN:O	1:B:251:GLU:HG3	2.17	0.45
1:A:209:LEU:HD22	1:A:209:LEU:N	2.32	0.45
1:A:167:ALA:HB2	1:A:177:ILE:CD1	2.47	0.45
1:B:147:ASN:HD22	1:B:147:ASN:C	2.19	0.45
1:B:229:ARG:O	1:B:233:ILE:HG12	2.17	0.45
1:B:137:LEU:HD21	1:B:323:MET:HG3	1.98	0.45
1:B:153:ALA:HB3	1:B:269:ALA:HB3	1.99	0.45
1:A:98:ARG:HD2	1:A:98:ARG:H	1.80	0.44
1:B:98:ARG:NH1	1:B:98:ARG:HB3	2.32	0.44
1:A:19:LEU:HD12	1:A:250:ILE:HD11	2.00	0.44
1:B:327:LYS:HZ3	1:B:327:LYS:HB3	1.81	0.44
1:A:109:THR:HG22	1:A:142:ASN:ND2	2.33	0.44
1:B:109:THR:HG22	1:B:142:ASN:ND2	2.32	0.44
1:A:246:ALA:O	1:A:250:ILE:HG12	2.17	0.43
1:B:168:LYS:HG3	4:B:4747:HOH:O	2.17	0.43
1:A:114:ALA:O	1:A:118:VAL:HG22	2.17	0.43
1:A:126:LEU:HD13	1:A:252:HIS:CE1	2.53	0.43
1:B:147:ASN:HD22	1:B:148:PRO:N	2.17	0.43
1:B:53:VAL:HG13	1:B:67:LEU:HD21	2.01	0.43
1:B:126:LEU:HD11	1:B:154:MET:HB2	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:155:THR:HG21	1:B:286:SER:HB2	2.02	0.42
1:A:229:ARG:O	1:A:233:ILE:HG12	2.20	0.42
1:B:206:ARG:HD2	1:B:210:GLU:OE1	2.20	0.42
1:B:178:ARG:HB2	1:B:264:ASP:CG	2.40	0.42
1:B:97:ARG:O	1:B:100:LEU:HB3	2.20	0.42
1:B:15:ILE:HD13	2:B:1334:NDP:PA	2.60	0.42
1:B:147:ASN:HD22	1:B:148:PRO:CD	2.33	0.42
1:B:5:ARG:HH11	1:B:38:GLN:HE21	1.67	0.41
1:A:167:ALA:HB2	1:A:177:ILE:HD12	2.03	0.41
1:A:187:SER:O	1:A:190:MET:HB3	2.21	0.41
1:B:158:ASP:HB3	1:B:190:MET:CE	2.50	0.41
1:B:53:VAL:HG13	1:B:67:LEU:CD2	2.50	0.41
1:B:15:ILE:HD12	1:B:242:ALA:CB	2.51	0.40
1:B:130:ASN:HA	1:B:132:ALA:N	2.36	0.40
1:A:41:GLU:HB2	1:A:49:LEU:HD22	2.03	0.40
1:A:74:LYS:HG2	1:A:74:LYS:O	2.21	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	325/327 (99%)	319 (98%)	5 (2%)	1 (0%)	41 39
1	B	325/327 (99%)	323 (99%)	2 (1%)	0	100 100
All	All	650/654 (99%)	642 (99%)	7 (1%)	1 (0%)	47 47

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	187	SER

### 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	252/252 (100%)	250 (99%)	2 (1%)	81	85
1	B	252/252 (100%)	245 (97%)	7 (3%)	43	46
All	All	504/504 (100%)	495 (98%)	9 (2%)	59	63

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	140	TYR
1	A	194	LEU
1	B	47	LYS
1	B	91	ARG
1	B	121	LYS
1	B	140	TYR
1	B	147	ASN
1	B	190	MET
1	B	309	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	104	ASN
1	A	165	GLN
1	A	252	HIS
1	A	273	GLN
1	B	38	GLN
1	B	147	ASN
1	B	159	HIS
1	B	273	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 [i](#)

6 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
3	TRS	A	4617	-	7,7,7	1.76	2 (28%)	9,9,9	1.92	3 (33%)
3	TRS	A	4619	-	7,7,7	1.85	2 (28%)	9,9,9	1.91	3 (33%)
3	TRS	B	4621	-	7,7,7	1.78	2 (28%)	9,9,9	1.87	2 (22%)
2	NDP	B	1334	-	36,42,52	1.97	8 (22%)	43,65,80	1.82	8 (18%)
3	TRS	B	4623	-	7,7,7	1.83	2 (28%)	9,9,9	1.89	3 (33%)
2	NDP	A	334	-	36,42,52	1.91	8 (22%)	43,65,80	1.78	8 (18%)

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
3	TRS	A	4617	-	-	3/9/9/9	-
3	TRS	A	4619	-	-	6/9/9/9	-
3	TRS	B	4621	-	-	4/9/9/9	-
2	NDP	B	1334	-	-	3/23/56/77	0/4/4/5
3	TRS	B	4623	-	-	6/9/9/9	-
2	NDP	A	334	-	-	7/23/56/77	0/4/4/5

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1334	NDP	PN-O2N	-4.88	1.32	1.55
2	A	334	NDP	PN-O2N	-4.81	1.32	1.55
2	B	1334	NDP	O4B-C4B	4.80	1.55	1.45
2	A	334	NDP	O4B-C4B	4.47	1.55	1.45
3	B	4623	TRS	C2-C	-4.04	1.40	1.53
3	A	4619	TRS	C2-C	-4.01	1.40	1.53
2	A	334	NDP	O4D-C1D	3.93	1.52	1.43
3	B	4621	TRS	C2-C	-3.86	1.41	1.53
3	A	4617	TRS	C2-C	-3.79	1.41	1.53
2	B	1334	NDP	O4D-C1D	3.78	1.52	1.43
2	B	1334	NDP	C3B-C4B	3.60	1.62	1.53
2	A	334	NDP	C3B-C4B	3.45	1.61	1.53
2	B	1334	NDP	C1D-C2D	3.20	1.57	1.51
2	B	1334	NDP	C2A-N3A	3.15	1.37	1.32
2	A	334	NDP	C2A-N3A	2.99	1.36	1.32
2	A	334	NDP	C1D-C2D	2.77	1.56	1.51
2	A	334	NDP	P2B-O2X	-2.54	1.45	1.54
2	B	1334	NDP	P2B-O2X	-2.52	1.45	1.54
2	B	1334	NDP	C8A-N7A	-2.52	1.30	1.34
2	A	334	NDP	C8A-N7A	-2.48	1.30	1.34
3	A	4619	TRS	O1-C1	-2.37	1.34	1.42
3	A	4617	TRS	O1-C1	-2.28	1.34	1.42
3	B	4623	TRS	O1-C1	-2.26	1.34	1.42
3	B	4621	TRS	O1-C1	-2.24	1.34	1.42

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	334	NDP	O4D-C4D-C3D	5.99	110.00	104.70
2	B	1334	NDP	O4D-C4D-C3D	5.98	110.00	104.70
2	A	334	NDP	PN-O3-PA	5.59	152.00	132.83
2	B	1334	NDP	PN-O3-PA	5.56	151.89	132.83
3	A	4617	TRS	O3-C3-C	4.01	123.70	111.00
3	B	4623	TRS	O3-C3-C	3.90	123.37	111.00
3	B	4621	TRS	O3-C3-C	3.85	123.19	111.00
3	A	4619	TRS	O3-C3-C	3.71	122.77	111.00
2	A	334	NDP	O5D-C5D-C4D	-3.48	97.01	108.99
2	B	1334	NDP	O5D-C5D-C4D	-3.32	97.57	108.99
2	B	1334	NDP	C1D-C2D-C3D	3.08	106.33	101.63
2	B	1334	NDP	O4B-C4B-C5B	3.03	119.34	109.37
2	A	334	NDP	O4B-C4B-C5B	2.82	118.64	109.37
2	B	1334	NDP	O3D-C3D-C4D	-2.80	102.96	111.05

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	334	NDP	O3D-C3D-C4D	-2.69	103.28	111.05
3	B	4621	TRS	C3-C-N	2.59	115.71	107.98
3	A	4619	TRS	C3-C-N	2.55	115.60	107.98
3	B	4623	TRS	C3-C-N	2.55	115.59	107.98
2	B	1334	NDP	C5D-C4D-C3D	-2.50	105.80	115.18
3	A	4617	TRS	C3-C-N	2.49	115.40	107.98
2	A	334	NDP	C5D-C4D-C3D	-2.47	105.94	115.18
3	A	4619	TRS	C2-C-C1	-2.44	103.25	110.81
3	B	4623	TRS	C2-C-C1	-2.31	103.66	110.81
2	A	334	NDP	C1D-C2D-C3D	2.28	105.10	101.63
2	B	1334	NDP	O3X-P2B-O2X	2.14	115.80	107.64
2	A	334	NDP	O3X-P2B-O2X	2.07	115.54	107.64
3	A	4617	TRS	C2-C-C1	-2.06	104.44	110.81

There are no chirality outliers.

All (29) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	4617	TRS	C1-C-C3-O3
3	A	4617	TRS	C2-C-C3-O3
3	A	4617	TRS	N-C-C3-O3
3	A	4619	TRS	C2-C-C1-O1
3	A	4619	TRS	C3-C-C1-O1
3	A	4619	TRS	C1-C-C3-O3
3	A	4619	TRS	C2-C-C3-O3
3	A	4619	TRS	N-C-C3-O3
3	B	4621	TRS	C1-C-C3-O3
3	B	4621	TRS	C2-C-C3-O3
3	B	4621	TRS	N-C-C3-O3
2	B	1334	NDP	C2B-O2B-P2B-O1X
2	B	1334	NDP	C5D-O5D-PN-O3
3	B	4623	TRS	C2-C-C1-O1
3	B	4623	TRS	C3-C-C1-O1
3	B	4623	TRS	C1-C-C3-O3
3	B	4623	TRS	C2-C-C3-O3
3	B	4623	TRS	N-C-C3-O3
2	A	334	NDP	C2B-O2B-P2B-O1X
2	A	334	NDP	C5D-O5D-PN-O2N
2	A	334	NDP	O4D-C4D-C5D-O5D
2	A	334	NDP	C3D-C4D-C5D-O5D
2	A	334	NDP	C5D-O5D-PN-O3
3	A	4619	TRS	N-C-C1-O1

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Mol	Chain	Res	Type	Atoms
3	B	4623	TRS	N-C-C1-O1
2	B	1334	NDP	C5D-O5D-PN-O1N
3	B	4621	TRS	C3-C-C1-O1
2	A	334	NDP	PA-O3-PN-O1N
2	A	334	NDP	C5D-O5D-PN-O1N

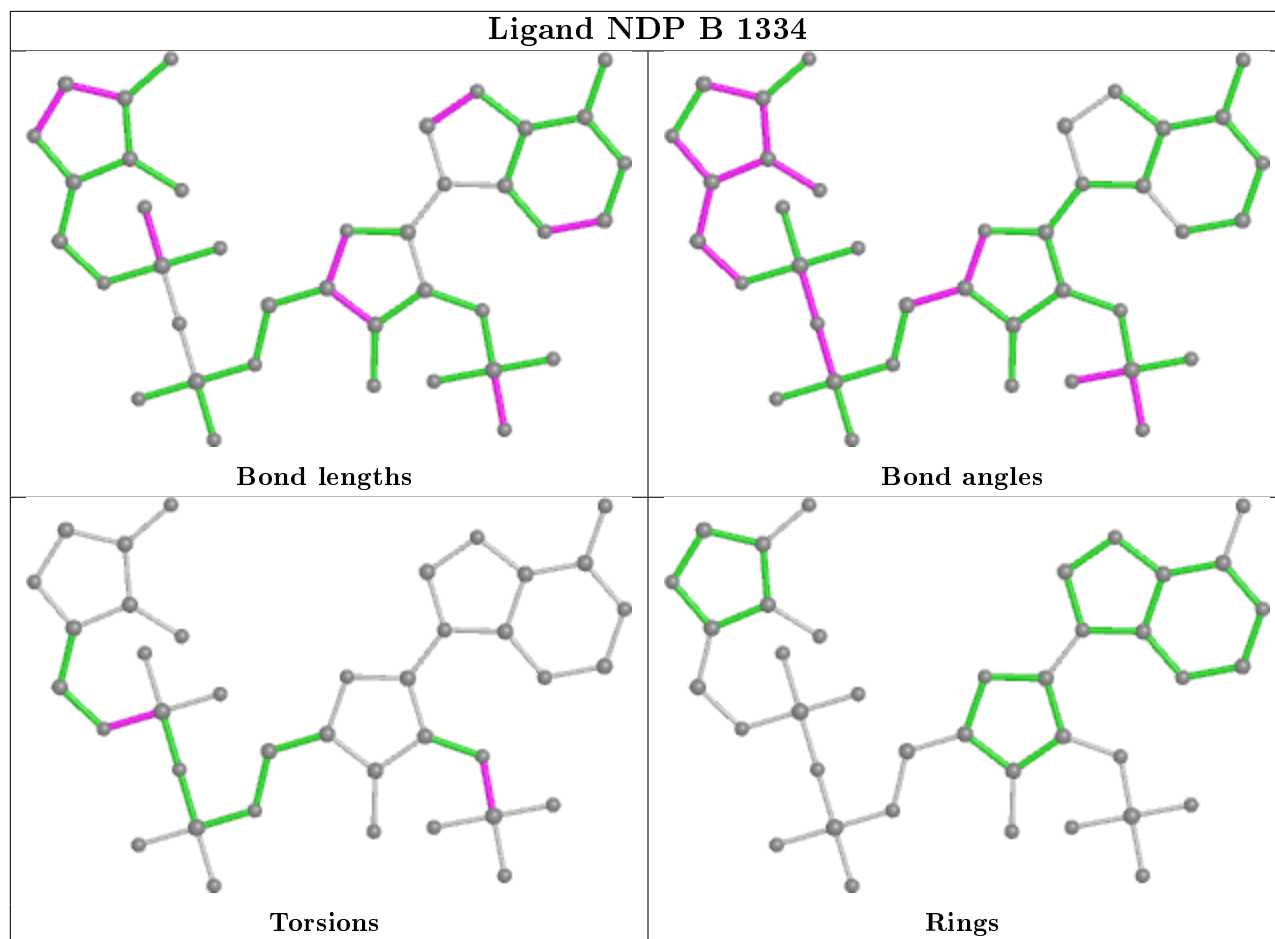
There are no ring outliers.

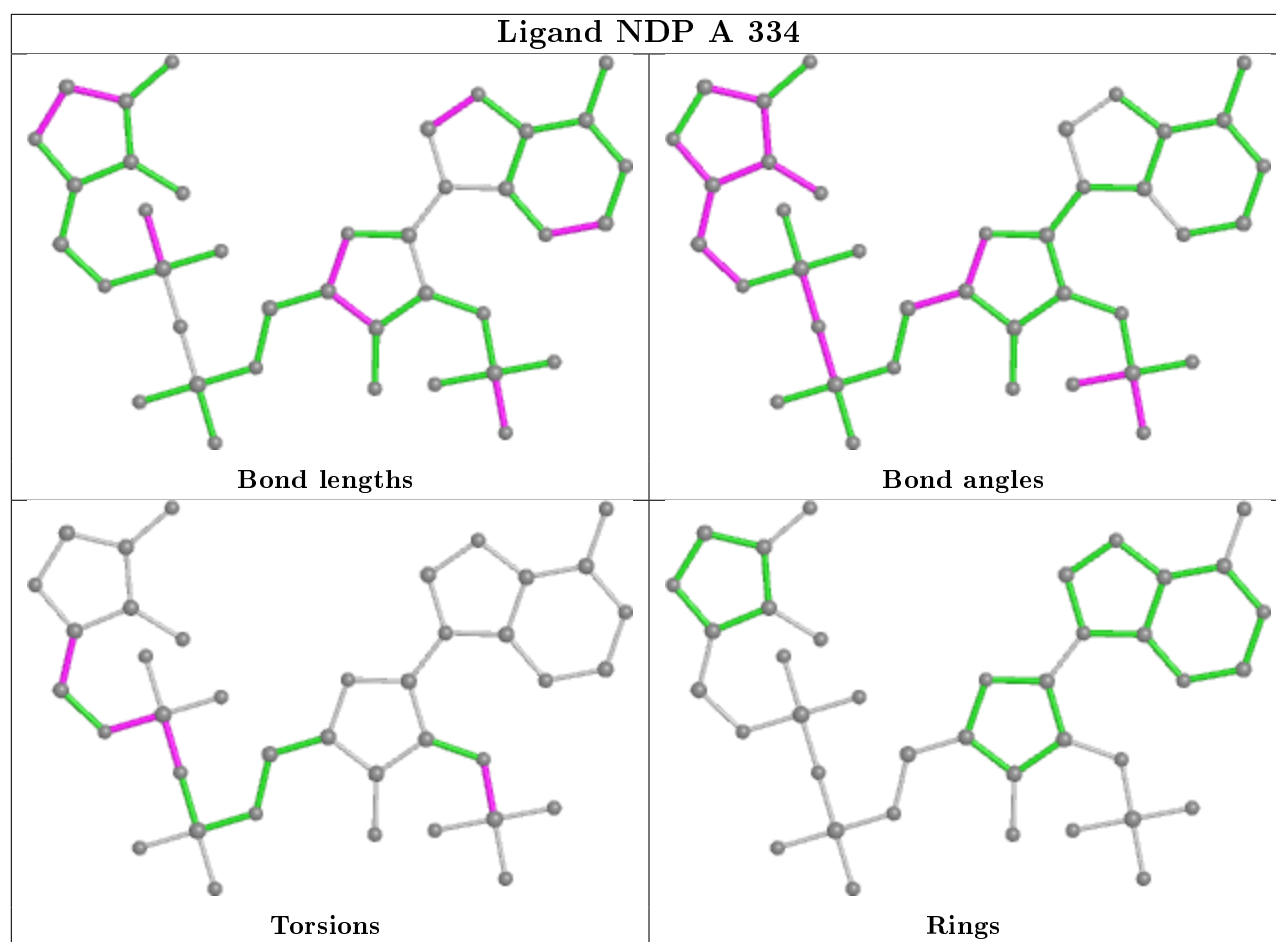
3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	4621	TRS	1	0
2	B	1334	NDP	2	0
2	A	334	NDP	1	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

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	327/327 (100%)	-0.09	12 (3%) 41 46	17, 26, 44, 66	1 (0%)
1	B	327/327 (100%)	-0.21	8 (2%) 59 63	16, 23, 40, 68	2 (0%)
All	All	654/654 (100%)	-0.15	20 (3%) 49 54	16, 24, 42, 68	3 (0%)

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	93	ALA	6.6
1	B	93	ALA	6.1
1	A	94	GLY	6.0
1	B	94	GLY	5.5
1	B	91	ARG	4.6
1	A	95	MET	4.5
1	B	92	LYS	4.2
1	B	95	MET	4.2
1	A	91	ARG	3.7
1	A	92	LYS	3.3
1	A	297	ARG	3.3
1	B	96	GLU	3.3
1	A	99	ASP	3.2
1	B	44	GLN	3.0
1	A	98	ARG	2.7
1	A	332	ILE	2.6
1	B	99	ASP	2.5
1	A	97	ARG	2.4
1	A	281	GLU	2.4
1	A	90	PRO	2.3

## 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](#)

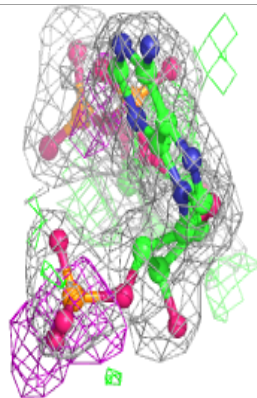
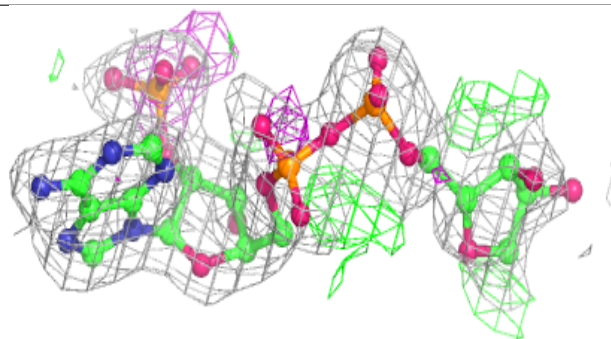
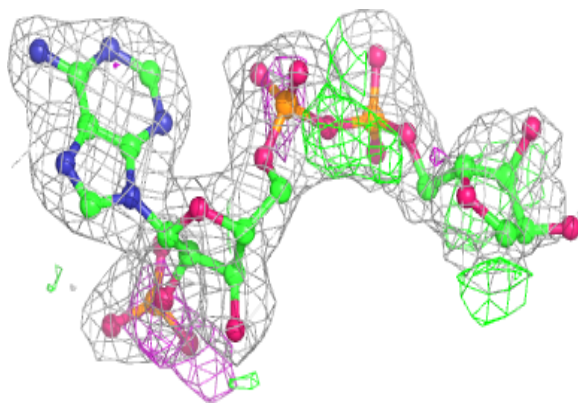
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	TRS	A	4619	8/8	0.86	0.19	28,32,33,36	0
3	TRS	B	4623	8/8	0.86	0.15	29,31,32,34	0
3	TRS	B	4621	8/8	0.87	0.15	32,33,35,35	0
3	TRS	A	4617	8/8	0.89	0.15	30,34,35,38	0
2	NDP	A	334	39/48	0.92	0.14	23,31,50,51	0
2	NDP	B	1334	39/48	0.93	0.12	23,32,54,56	0

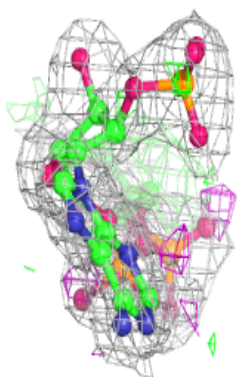
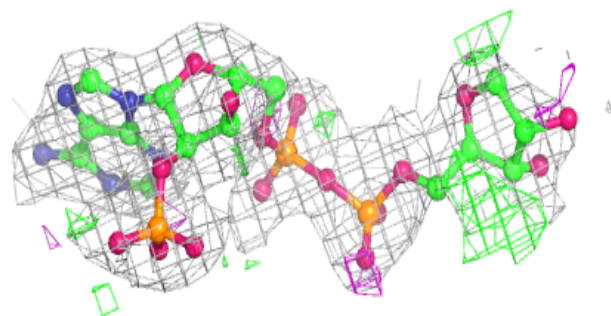
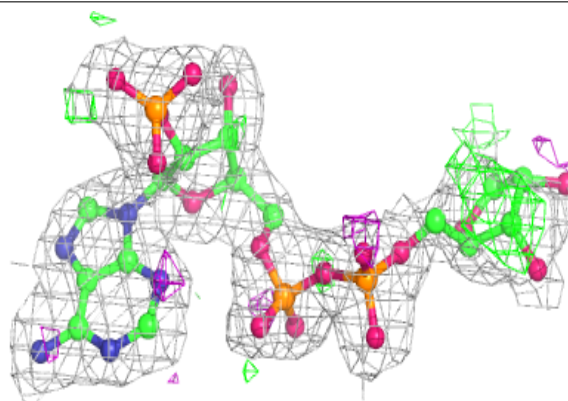
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

**Electron density around NDP A 334:**

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

**Electron density around NDP B 1334:**

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



## 6.5 Other polymers [i](#)

There are no such residues in this entry.