Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 08:09 am BST

PDB ID	:	6G1M
Title	:	Amine Dehydrogenase from Petrotoga mobilis; open and closed form
Authors	:	Beloti, L.; Frese, A.; Mayol, O.; Vaxelaire-Vergne, C.; Grogan, G.
Deposited on	:	2018-03-21
Resolution	:	2.32 Å(reported)

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

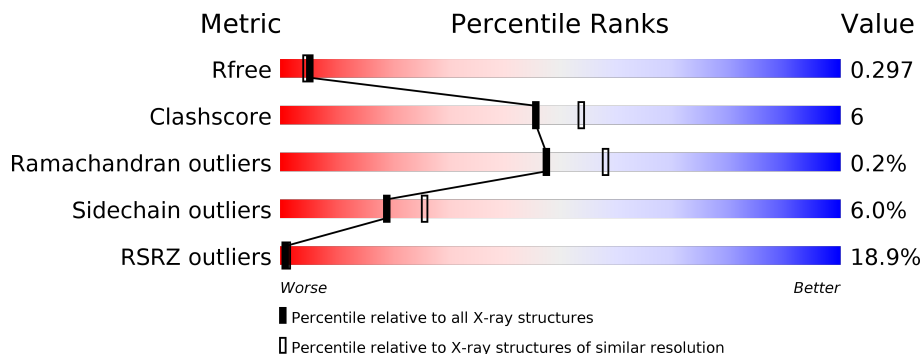|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.32 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	Percentile Ranks	Value
Rfree		0.297
Clashscore		6
Ramachandran outliers		0.2%
Sidechain outliers		6.0%
RSRZ outliers		18.9%

Worse					*Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	130704	5974 (2.34-2.30)
Clashscore	141614	6604 (2.34-2.30)
Ramachandran outliers	138981	6523 (2.34-2.30)
Sidechain outliers	138945	6523 (2.34-2.30)
RSRZ outliers	127900	5855 (2.34-2.30)

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 <=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	338	29% / 83% / 14% ••
1	B	338	15% / 80% / 16% ••
1	C	338	14% / 85% / 12% •••
1	D	338	16% / 83% / 15% ••

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	PO4	A	402	-	X	-	-
3	PO4	D	402	-	X	-	-

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 10224 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 Dihydrodipicolinate reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	334	Total 2402	C 1544	N 396	O 450	S 12	0	0	0
1	B	332	Total 2458	C 1580	N 404	O 462	S 12	0	0	0
1	C	335	Total 2485	C 1598	N 409	O 466	S 12	0	0	0
1	D	334	Total 2423	C 1559	N 402	O 450	S 12	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	SER	-	expression tag	UNP A9BHL2
B	1	SER	-	expression tag	UNP A9BHL2
C	1	SER	-	expression tag	UNP A9BHL2
D	1	SER	-	expression tag	UNP A9BHL2

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).

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

- Molecule 3 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).

| Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 5	O 4	P 1	0	0
3	D	1	Total 5	O 4	P 1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	51	Total 51	O 51	0	0
4	B	72	Total 72	O 72	0	0
4	C	84	Total 84	O 84	0	0
4	D	63	Total 63	O 63	0	0

3 Residue-property plots ⓘ

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.
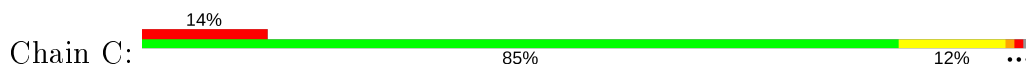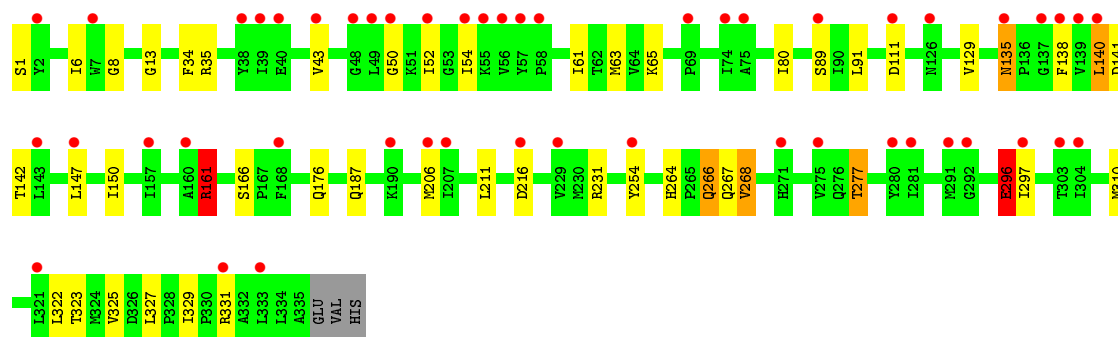
- Molecule 1: Dihydrodipicolinate reductase
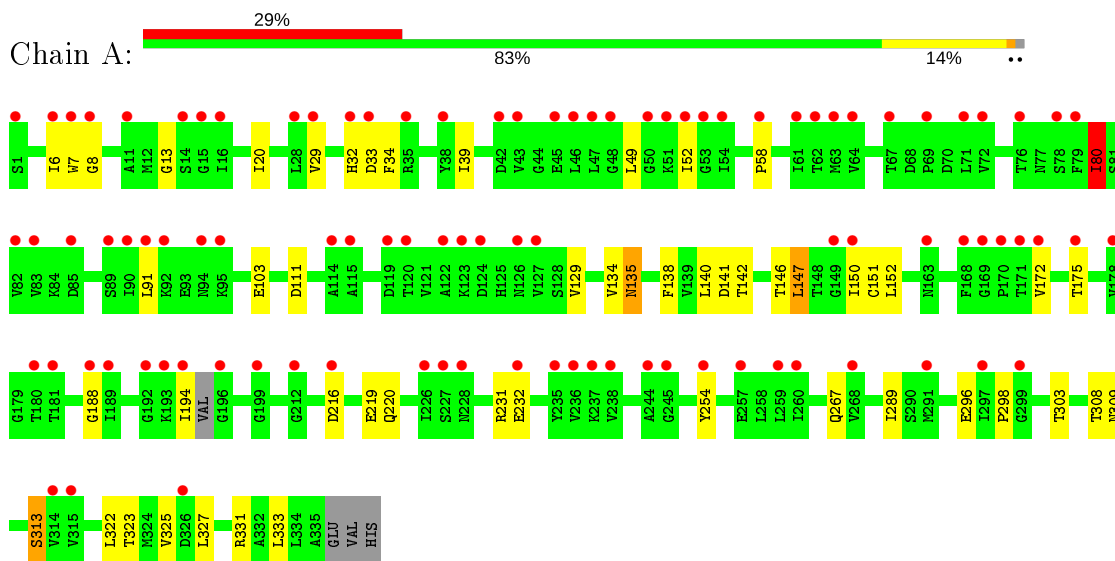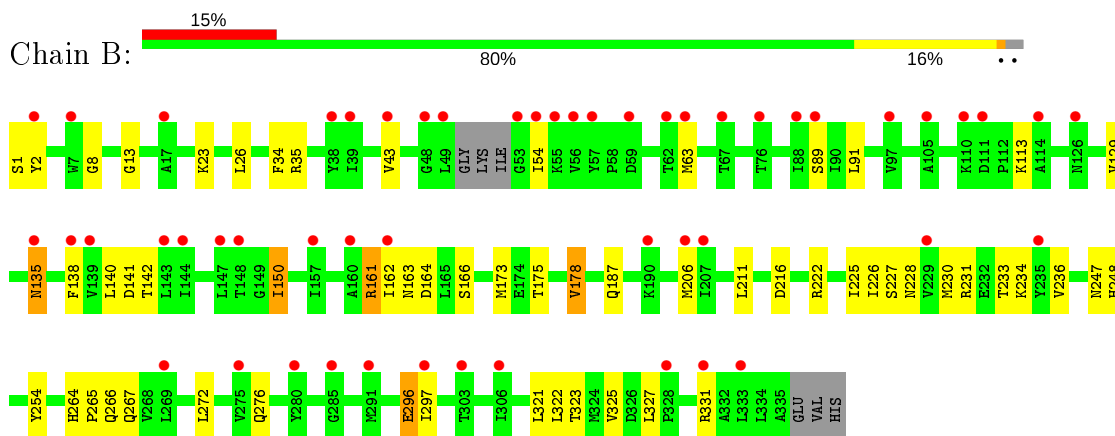
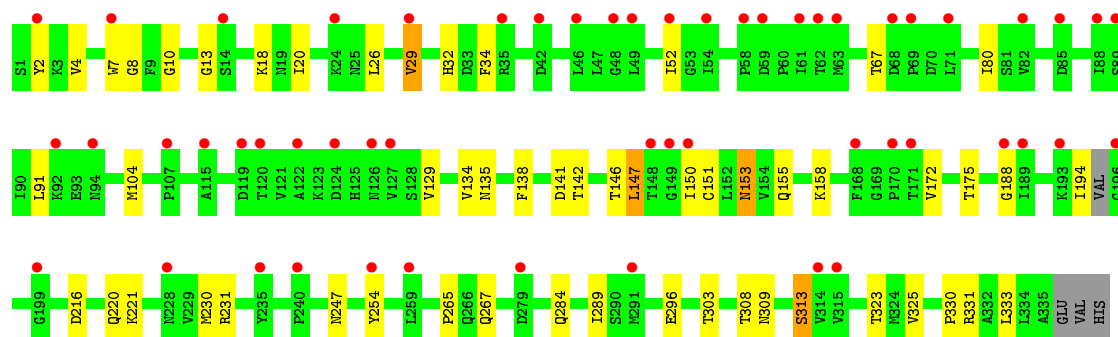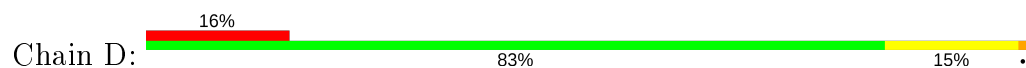- Molecule 1: Dihydrodipicolinate reductase

- Molecule 1: Dihydrodipicolinate reductase

• Molecule 1: Dihydrodipicolinate reductase

Chain D:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	140.11Å 83.64Å 125.71Å 90.00° 94.28° 90.00°	Depositor
Resolution (Å)	125.36 – 2.32 48.49 – 2.32	Depositor EDS
% Data completeness (in resolution range)	99.4 (125.36-2.32) 99.4 (48.49-2.32)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	2.65 (at 2.32Å)	Xtriage
Refinement program	REFMAC 5.8.0189	Depositor
R, R_{free}	0.248 , 0.295 0.254 , 0.297	Depositor DCC
R_{free} test set	3155 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	33.9	Xtriage
Anisotropy	0.221	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 39.5	EDS
L-test for twinning[2]	$<|L|> = 0.49$, $<L^2> = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	10224	wwPDB-VP
Average B, all atoms (Å^2)	35.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.96% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $<|L|>$, $<L^2>$ 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: PO4, NAD

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	0.70	1/2446 (0.0%)	0.83	4/3347 (0.1%)
1	B	0.78	1/2503 (0.0%)	0.85	4/3410 (0.1%)
1	C	0.79	1/2531 (0.0%)	0.87	6/3448 (0.2%)
1	D	0.73	1/2468 (0.0%)	0.83	1/3372 (0.0%)
All	All	0.75	4/9948 (0.0%)	0.84	15/13577 (0.1%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	135	ASN	C-N	7.79	1.49	1.34
1	B	135	ASN	C-N	7.68	1.48	1.34
1	A	135	ASN	C-N	7.57	1.48	1.34
1	D	135	ASN	C-N	7.33	1.48	1.34

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	1	SER	O-C-N	8.00	135.50	122.70
1	C	206	MET	CG-SD-CE	-7.66	87.94	100.20
1	B	206	MET	CG-SD-CE	-7.54	88.14	100.20
1	C	268	VAL	CG1-CB-CG2	6.93	121.98	110.90
1	C	1	SER	CA-C-N	-6.33	103.26	117.20
1	B	164	ASP	CB-CG-OD1	5.94	123.65	118.30
1	C	161	ARG	CG-CD-NE	-5.93	99.35	111.80
1	D	147	LEU	CA-CB-CG	5.69	128.39	115.30
1	B	162	ILE	CG1-CB-CG2	-5.56	99.17	111.40
1	C	296	GLU	OE1-CD-OE2	-5.43	116.78	123.30
1	B	296	GLU	OE1-CD-OE2	-5.31	116.92	123.30
1	A	111	ASP	CB-CG-OD1	5.22	123.00	118.30
1	A	111	ASP	CB-CG-OD2	-5.19	113.63	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	147	LEU	CA-CB-CG	5.14	127.13	115.30
1	A	80	ILE	CA-CB-CG1	5.11	120.72	111.00

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	2402	0	2344	30	0
1	B	2458	0	2453	37	0
1	C	2485	0	2494	29	0
1	D	2423	0	2385	38	0
2	A	44	0	26	1	0
2	B	44	0	26	0	0
2	C	44	0	26	0	0
2	D	44	0	26	1	0
3	A	5	0	0	0	0
3	D	5	0	0	0	0
4	A	51	0	0	3	0
4	B	72	0	0	2	0
4	C	84	0	0	1	0
4	D	63	0	0	2	0
All	All	10224	0	9780	127	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 6.

All (127) 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:D:153:ASN:HD21	1:D:155:GLN:NE2	1.37	1.20
1:C:176:GLN:NE2	1:C:266:GLN:HG3	1.77	0.99
1:C:231:ARG:HH12	1:C:267:GLN:HE21	1.13	0.97
1:D:153:ASN:ND2	1:D:155:GLN:NE2	2.16	0.93

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:231:ARG:HH12	1:A:267:GLN:HE21	1.18	0.91
1:D:231:ARG:HH12	1:D:267:GLN:HE21	1.17	0.89
1:B:2:TYR:HB2	1:B:26:LEU:HD23	1.57	0.86
1:D:153:ASN:ND2	1:D:155:GLN:HE22	1.70	0.86
1:C:80:ILE:HD13	1:C:111:ASP:OD2	1.79	0.83
1:D:153:ASN:HD21	1:D:155:GLN:HE22	0.84	0.82
1:D:142:THR:O	1:D:146:THR:HG23	1.82	0.80
1:A:142:THR:O	1:A:146:THR:HG23	1.82	0.79
1:A:33:ASP:O	1:A:39:ILE:HD11	1.82	0.79
1:C:277:THR:HG23	1:C:296:GLU:HB3	1.65	0.78
1:C:329:ILE:HG23	1:D:146:THR:HG22	1.64	0.78
1:B:161:ARG:NH2	1:B:297:ILE:O	2.16	0.77
1:B:231:ARG:HH22	1:B:267:GLN:NE2	1.83	0.76
1:B:276:GLN:CD	1:B:276:GLN:H	1.88	0.76
1:C:176:GLN:HE22	1:C:266:GLN:HG3	1.51	0.75
1:D:7:TRP:O	1:D:32:HIS:O	2.05	0.75
1:A:7:TRP:O	1:A:32:HIS:O	2.05	0.74
1:B:231:ARG:NH2	1:B:267:GLN:HE21	1.86	0.73
1:B:276:GLN:H	1:B:276:GLN:NE2	1.85	0.73
1:D:80:ILE:HD11	1:D:104:MET:SD	2.30	0.71
1:C:80:ILE:HG21	1:C:111:ASP:OD2	1.90	0.70
1:D:313:SER:OG	4:D:501:HOH:O	1.99	0.69
1:A:219:GLU:OE1	4:A:502:HOH:O	2.10	0.69
1:B:231:ARG:HH22	1:B:267:GLN:HE21	1.36	0.66
1:D:80:ILE:CD1	1:D:104:MET:SD	2.83	0.66
1:B:163:ASN:HD22	1:B:266:GLN:HG2	1.61	0.64
1:A:231:ARG:HH12	1:A:267:GLN:NE2	1.94	0.63
1:A:313:SER:OG	4:A:501:HOH:O	2.09	0.63
1:B:227:SER:OG	1:B:231:ARG:HD2	1.98	0.62
1:B:231:ARG:NH2	1:B:267:GLN:NE2	2.47	0.61
1:D:231:ARG:HH12	1:D:267:GLN:NE2	1.93	0.60
1:D:134:VAL:HG13	1:D:303:THR:N	2.17	0.60
1:A:134:VAL:HG13	1:A:303:THR:N	2.17	0.59
2:A:401:NAD:H52N	2:A:401:NAD:H6N	1.85	0.58
1:B:2:TYR:HB2	1:B:26:LEU:CD2	2.32	0.58
1:C:176:GLN:HE22	1:C:266:GLN:CG	2.17	0.57
1:A:91:LEU:HD21	1:A:129:VAL:HG22	1.86	0.57
1:C:91:LEU:HD21	1:C:129:VAL:HG22	1.87	0.56
1:D:91:LEU:HD21	1:D:129:VAL:HG22	1.88	0.56
1:A:80:ILE:HG12	1:A:103:GLU:OE1	2.05	0.56
1:A:8:GLY:O	1:A:13:GLY:HA3	2.06	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:329:ILE:HD12	1:D:146:THR:HG22	1.89	0.55
1:B:178:VAL:HG23	1:B:236:VAL:HG21	1.89	0.55
1:B:216:ASP:OD2	1:B:254:TYR:O	2.25	0.55
1:C:8:GLY:O	1:C:13:GLY:HA3	2.07	0.55
1:D:8:GLY:O	1:D:13:GLY:HA3	2.07	0.55
1:A:188:GLY:HA3	1:A:194:ILE:HD12	1.89	0.54
1:B:226:ILE:O	1:B:226:ILE:HD12	2.08	0.54
1:B:8:GLY:O	1:B:13:GLY:HA3	2.07	0.54
1:B:91:LEU:HD21	1:B:129:VAL:HG22	1.89	0.54
1:A:231:ARG:NH1	1:A:267:GLN:HE21	1.99	0.54
1:A:216:ASP:OD2	1:A:254:TYR:O	2.27	0.53
1:A:39:ILE:HD12	1:A:58:PRO:HA	1.90	0.53
1:B:178:VAL:CG2	1:B:236:VAL:HG21	2.38	0.53
1:C:216:ASP:OD2	1:C:254:TYR:O	2.25	0.53
1:D:216:ASP:OD2	1:D:254:TYR:O	2.26	0.53
1:B:135:ASN:HD21	1:B:140:LEU:HD12	1.73	0.53
1:D:323:THR:OG1	1:D:325:VAL:HG22	2.08	0.53
1:D:231:ARG:NH1	1:D:267:GLN:HE21	1.98	0.53
1:A:323:THR:OG1	1:A:325:VAL:HG22	2.09	0.53
1:C:323:THR:OG1	1:C:325:VAL:HG22	2.09	0.52
1:D:221:LYS:CB	4:D:537:HOH:O	2.56	0.52
1:D:188:GLY:HA3	1:D:194:ILE:HD12	1.90	0.52
1:B:323:THR:OG1	1:B:325:VAL:HG22	2.10	0.52
1:B:43:VAL:HG22	1:B:54:ILE:HB	1.92	0.52
1:B:276:GLN:HG2	1:B:276:GLN:O	2.09	0.51
1:C:43:VAL:HG22	1:C:54:ILE:HB	1.91	0.51
1:C:322:LEU:HD13	1:C:327:LEU:HD21	1.93	0.51
1:B:138:PHE:HA	1:B:142:THR:HB	1.94	0.50
1:B:233:THR:HG22	1:B:234:LYS:N	2.25	0.50
1:C:161:ARG:NH2	1:C:297:ILE:O	2.37	0.49
1:A:138:PHE:HA	1:A:142:THR:HB	1.95	0.49
1:C:138:PHE:HA	1:C:142:THR:HB	1.93	0.48
1:A:172:VAL:HA	1:A:175:THR:HG22	1.96	0.48
1:B:264:HIS:N	1:B:265:PRO:HD3	2.28	0.48
1:B:91:LEU:HD21	1:B:129:VAL:CG2	2.44	0.48
1:B:231:ARG:HG2	1:B:272:LEU:HD12	1.96	0.48
1:D:172:VAL:O	1:D:175:THR:HG22	2.14	0.47
1:D:91:LEU:HD21	1:D:129:VAL:CG2	2.45	0.47
1:B:322:LEU:HD13	1:B:327:LEU:HD21	1.96	0.47
1:C:329:ILE:HD12	1:D:146:THR:CG2	2.44	0.47
1:A:322:LEU:HD13	1:A:327:LEU:HD21	1.95	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:61:ILE:HG22	1:C:65:LYS:HD2	1.97	0.47
1:D:2:TYR:HB2	1:D:26:LEU:HD23	1.97	0.47
1:D:138:PHE:HA	1:D:142:THR:HB	1.96	0.47
1:A:172:VAL:O	1:A:175:THR:HG22	2.15	0.46
1:D:80:ILE:HD13	1:D:104:MET:SD	2.55	0.46
1:B:175:THR:HA	4:B:504:HOH:O	2.15	0.46
1:C:91:LEU:HD21	1:C:129:VAL:CG2	2.44	0.46
1:A:138:PHE:CE2	1:B:150:ILE:CD1	2.99	0.46
1:A:91:LEU:HD21	1:A:129:VAL:CG2	2.45	0.46
1:D:158:LYS:CD	1:D:284:GLN:NE2	2.79	0.46
1:D:172:VAL:HA	1:D:175:THR:HG22	1.97	0.46
1:A:152:LEU:O	1:B:23:LYS:NZ	2.48	0.45
1:C:310:MET:HA	4:C:512:HOH:O	2.16	0.45
1:C:277:THR:HG23	1:C:296:GLU:H	1.81	0.45
1:B:247:ASN:HA	1:B:265:PRO:HA	1.99	0.45
1:A:135:ASN:ND2	1:A:140:LEU:HD12	2.31	0.44
1:A:151:CYS:SG	1:A:289:ILE:HD11	2.58	0.44
1:A:309:ASN:ND2	1:A:333:LEU:H	2.15	0.44
1:C:329:ILE:CG2	1:D:146:THR:HG22	2.41	0.44
1:D:151:CYS:SG	1:D:289:ILE:HD11	2.58	0.44
1:A:20:ILE:CD1	1:A:308:THR:HG23	2.48	0.44
1:D:309:ASN:ND2	1:D:333:LEU:H	2.16	0.43
1:D:20:ILE:CD1	1:D:308:THR:HG23	2.48	0.43
1:A:150:ILE:CD1	1:A:289:ILE:HD11	2.49	0.43
1:C:176:GLN:NE2	1:C:266:GLN:CG	2.65	0.43
1:A:298:PRO:HB3	4:A:540:HOH:O	2.19	0.43
1:B:163:ASN:ND2	1:B:266:GLN:HG2	2.30	0.42
1:C:147:LEU:HD23	1:C:147:LEU:HA	1.87	0.42
1:C:161:ARG:HB3	1:C:264:HIS:ND1	2.33	0.42
1:D:247:ASN:HA	1:D:265:PRO:HA	2.01	0.42
1:C:135:ASN:ND2	1:C:140:LEU:HD22	2.34	0.42
1:D:10:GLY:HA3	2:D:401:NAD:O5B	2.19	0.42
1:B:173:MET:HB3	1:B:178:VAL:HG22	2.02	0.42
1:A:138:PHE:CE2	1:B:150:ILE:HD12	2.55	0.41
1:B:228:ASN:ND2	4:B:501:HOH:O	2.22	0.41
1:B:225:ILE:HD13	1:B:267:GLN:HG3	2.02	0.41
1:C:111:ASP:N	1:C:111:ASP:OD1	2.53	0.41
1:D:151:CYS:SG	1:D:289:ILE:CD1	3.09	0.41
1:C:329:ILE:HD11	1:D:330:PRO:HD3	2.03	0.40
1:D:29:VAL:HG13	1:D:67:THR:HB	2.03	0.40
1:B:222:ARG:HD3	1:B:248:HIS:CE1	2.57	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	330/338 (98%)	319 (97%)	11 (3%)	0	100	100
1	B	328/338 (97%)	319 (97%)	9 (3%)	0	100	100
1	C	333/338 (98%)	319 (96%)	12 (4%)	2 (1%)	25	30
1	D	330/338 (98%)	320 (97%)	10 (3%)	0	100	100
All	All	1321/1352 (98%)	1277 (97%)	42 (3%)	2 (0%)	47	58

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	52	ILE
1	C	50	GLY

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	243/287 (85%)	230 (95%)	13 (5%)	22	31
1	B	258/287 (90%)	241 (93%)	17 (7%)	16	22
1	C	262/287 (91%)	245 (94%)	17 (6%)	17	22
1	D	247/287 (86%)	233 (94%)	14 (6%)	20	28
All	All	1010/1148 (88%)	949 (94%)	61 (6%)	19	26

All (61) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	ILE
1	A	29	VAL
1	A	34	PHE
1	A	49	LEU
1	A	52	ILE
1	A	80	ILE
1	A	141	ASP
1	A	147	LEU
1	A	220	GLN
1	A	232	GLU
1	A	296	GLU
1	A	313	SER
1	A	331	ARG
1	B	1	SER
1	B	34	PHE
1	B	35	ARG
1	B	63	MET
1	B	89	SER
1	B	113	LYS
1	B	141	ASP
1	B	150	ILE
1	B	161	ARG
1	B	166	SER
1	B	178	VAL
1	B	187	GLN
1	B	211	LEU
1	B	230	MET
1	B	296	GLU
1	B	321	LEU
1	B	331	ARG
1	C	6	ILE
1	C	34	PHE
1	C	35	ARG
1	C	63	MET
1	C	89	SER
1	C	140	LEU
1	C	141	ASP
1	C	150	ILE
1	C	161	ARG
1	C	166	SER
1	C	187	GLN
1	C	211	LEU

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Mol	Chain	Res	Type
1	C	266	GLN
1	C	268	VAL
1	C	277	THR
1	C	296	GLU
1	C	331	ARG
1	D	4	VAL
1	D	18	LYS
1	D	29	VAL
1	D	34	PHE
1	D	52	ILE
1	D	141	ASP
1	D	147	LEU
1	D	150	ILE
1	D	153	ASN
1	D	220	GLN
1	D	230	MET
1	D	296	GLU
1	D	313	SER
1	D	331	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	94	ASN
1	A	135	ASN
1	A	266	GLN
1	A	267	GLN
1	A	271	HIS
1	A	309	ASN
1	B	94	ASN
1	B	135	ASN
1	B	155	GLN
1	B	163	ASN
1	B	267	GLN
1	B	271	HIS
1	B	276	GLN
1	C	94	ASN
1	C	135	ASN
1	C	176	GLN
1	C	267	GLN
1	D	94	ASN
1	D	135	ASN

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Mol	Chain	Res	Type
1	D	155	GLN
1	D	267	GLN
1	D	271	HIS
1	D	284	GLN
1	D	309	ASN

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 ⓘ

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	#$|Z| > 2$
2	NAD	C	401	-	42,48,48	0.95	2 (4%)	50,73,73	1.03	4 (8%)
3	PO4	A	402	-	4,4,4	3.83	4 (100%)	6,6,6	0.54	0
2	NAD	A	401	-	42,48,48	0.94	2 (4%)	50,73,73	1.12	4 (8%)
2	NAD	D	401	-	42,48,48	0.93	1 (2%)	50,73,73	0.92	2 (4%)
2	NAD	B	401	-	42,48,48	0.98	2 (4%)	50,73,73	1.07	5 (10%)
3	PO4	D	402	-	4,4,4	3.42	4 (100%)	6,6,6	0.49	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
2	NAD	B	401	-	-	5/26/62/62	0/5/5/5
2	NAD	C	401	-	-	6/26/62/62	0/5/5/5
2	NAD	A	401	-	-	8/26/62/62	0/5/5/5
2	NAD	D	401	-	-	8/26/62/62	0/5/5/5

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	402	PO4	P-O2	-4.69	1.40	1.54
3	D	402	PO4	P-O1	-4.14	1.41	1.50
3	A	402	PO4	P-O4	-4.08	1.42	1.54
3	D	402	PO4	P-O3	-3.63	1.43	1.54
3	A	402	PO4	P-O3	-3.29	1.44	1.54
3	A	402	PO4	P-O1	-3.01	1.43	1.50
3	D	402	PO4	P-O2	-2.94	1.45	1.54
2	B	401	NAD	C8A-N7A	-2.84	1.29	1.34
3	D	402	PO4	P-O4	-2.78	1.46	1.54
2	C	401	NAD	C8A-N7A	-2.44	1.30	1.34
2	A	401	NAD	C8A-N7A	-2.40	1.30	1.34
2	D	401	NAD	C8A-N7A	-2.33	1.30	1.34
2	A	401	NAD	O5D-C5D	-2.17	1.36	1.44
2	C	401	NAD	PN-O2N	-2.11	1.45	1.55
2	B	401	NAD	PN-O2N	-2.09	1.45	1.55

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	401	NAD	C5A-C6A-N6A	3.10	125.06	120.35
2	A	401	NAD	C6N-N1N-C2N	-2.99	119.25	121.97
2	A	401	NAD	PN-O5D-C5D	-2.83	105.08	121.68
2	B	401	NAD	C6N-N1N-C2N	-2.80	119.42	121.97
2	C	401	NAD	O3B-C3B-C4B	-2.66	103.37	111.05
2	A	401	NAD	C2D-C3D-C4D	-2.58	97.64	102.64
2	C	401	NAD	C6N-N1N-C2N	-2.50	119.69	121.97
2	B	401	NAD	O4B-C1B-C2B	-2.46	103.33	106.93
2	C	401	NAD	C5A-C6A-N6A	2.40	124.00	120.35
2	B	401	NAD	C5A-C6A-N6A	2.40	124.00	120.35
2	D	401	NAD	O3B-C3B-C2B	2.39	119.55	111.82

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	401	NAD	C5A-C6A-N6A	2.32	123.87	120.35
2	B	401	NAD	O3B-C3B-C2B	2.27	119.15	111.82
2	B	401	NAD	O4D-C1D-C2D	-2.08	103.89	106.93
2	C	401	NAD	O4D-C1D-C2D	-2.01	103.98	106.93

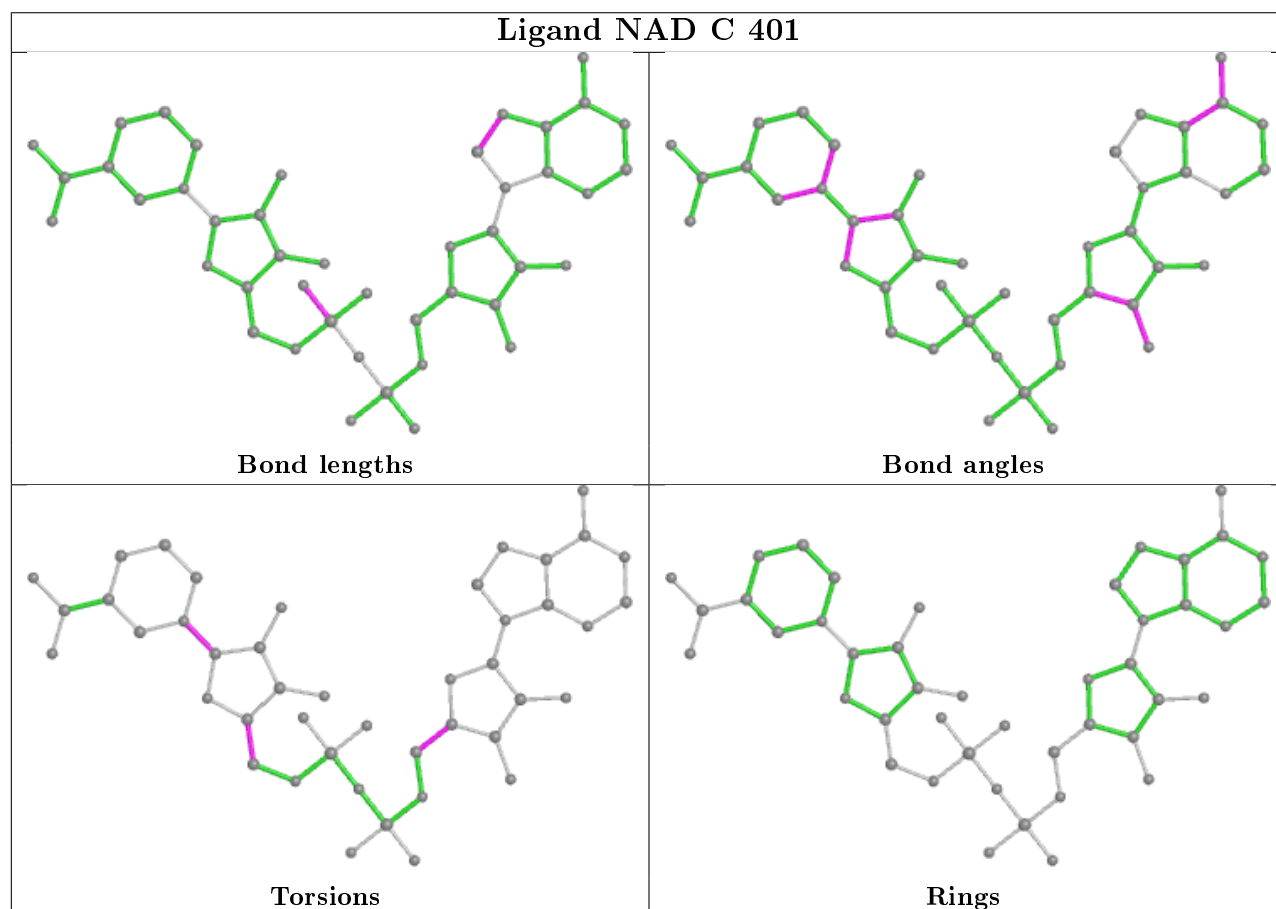There are no chirality outliers.

All (27) torsion outliers are listed below:

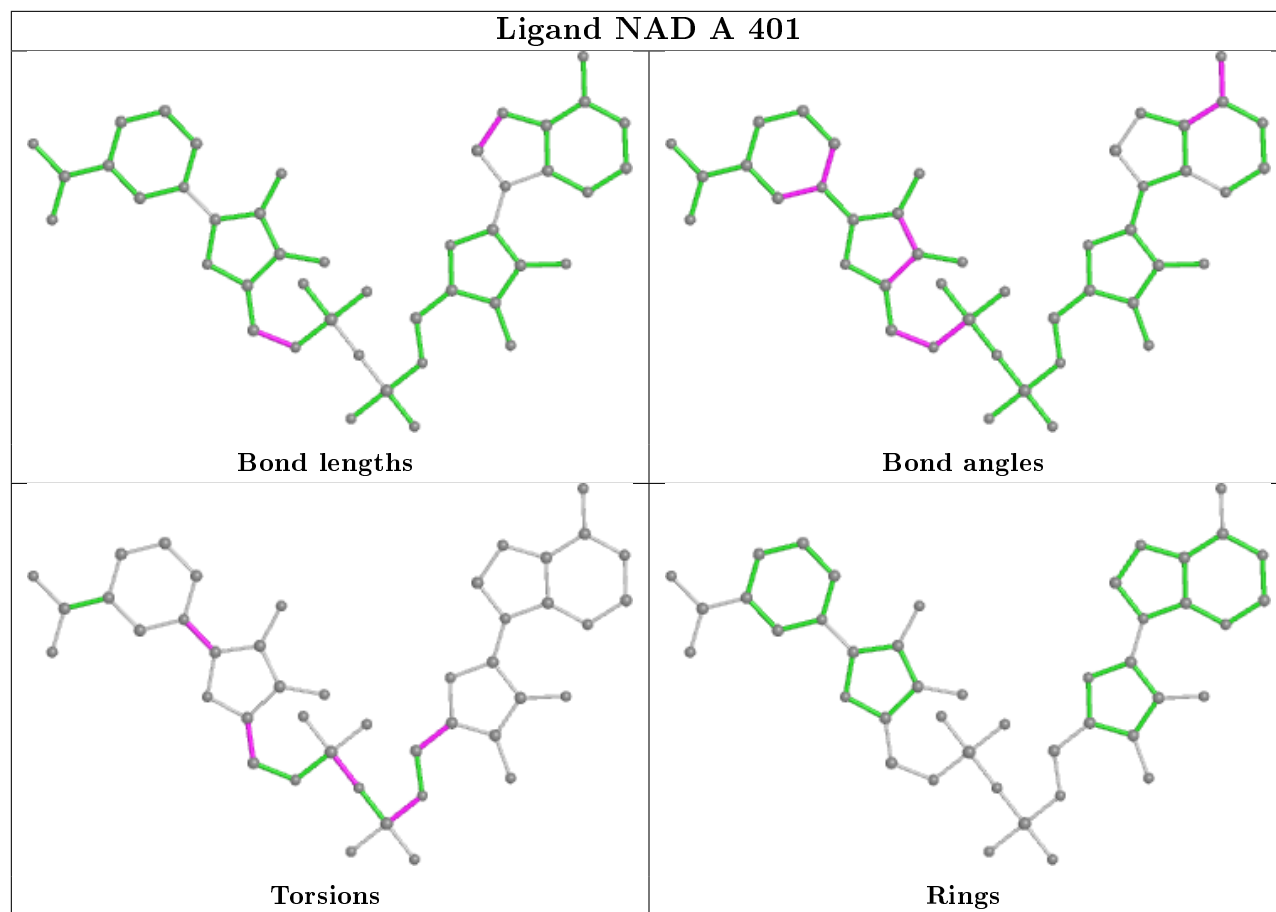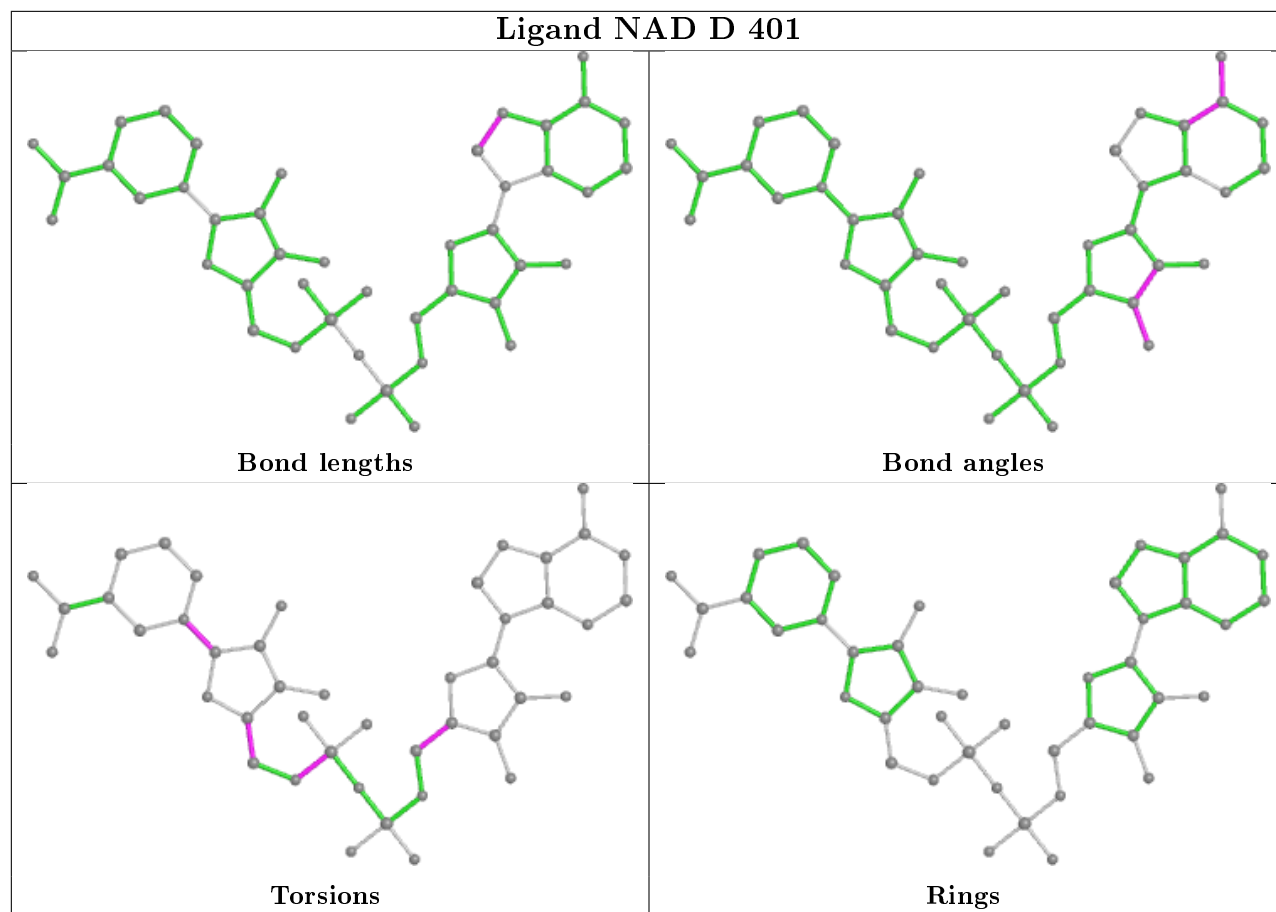| Mol	Chain	Res	Type	Atoms
2	C	401	NAD	O4D-C1D-N1N-C2N
2	C	401	NAD	O4D-C1D-N1N-C6N
2	C	401	NAD	C2D-C1D-N1N-C2N
2	C	401	NAD	C2D-C1D-N1N-C6N
2	A	401	NAD	C5B-O5B-PA-O1A
2	A	401	NAD	O4D-C1D-N1N-C6N
2	D	401	NAD	O4D-C1D-N1N-C2N
2	D	401	NAD	O4D-C1D-N1N-C6N
2	D	401	NAD	C2D-C1D-N1N-C2N
2	D	401	NAD	C2D-C1D-N1N-C6N
2	B	401	NAD	O4D-C1D-N1N-C2N
2	B	401	NAD	O4D-C1D-N1N-C6N
2	B	401	NAD	C2D-C1D-N1N-C2N
2	B	401	NAD	C2D-C1D-N1N-C6N
2	A	401	NAD	O4B-C4B-C5B-O5B
2	A	401	NAD	C3B-C4B-C5B-O5B
2	A	401	NAD	O4D-C4D-C5D-O5D
2	A	401	NAD	C3D-C4D-C5D-O5D
2	D	401	NAD	O4D-C4D-C5D-O5D
2	D	401	NAD	C3D-C4D-C5D-O5D
2	C	401	NAD	O4D-C4D-C5D-O5D
2	A	401	NAD	C5B-O5B-PA-O3
2	D	401	NAD	C5D-O5D-PN-O3
2	C	401	NAD	O4B-C4B-C5B-O5B
2	A	401	NAD	PA-O3-PN-O1N
2	D	401	NAD	O4B-C4B-C5B-O5B
2	B	401	NAD	O4B-C4B-C5B-O5B

There are no ring outliers.
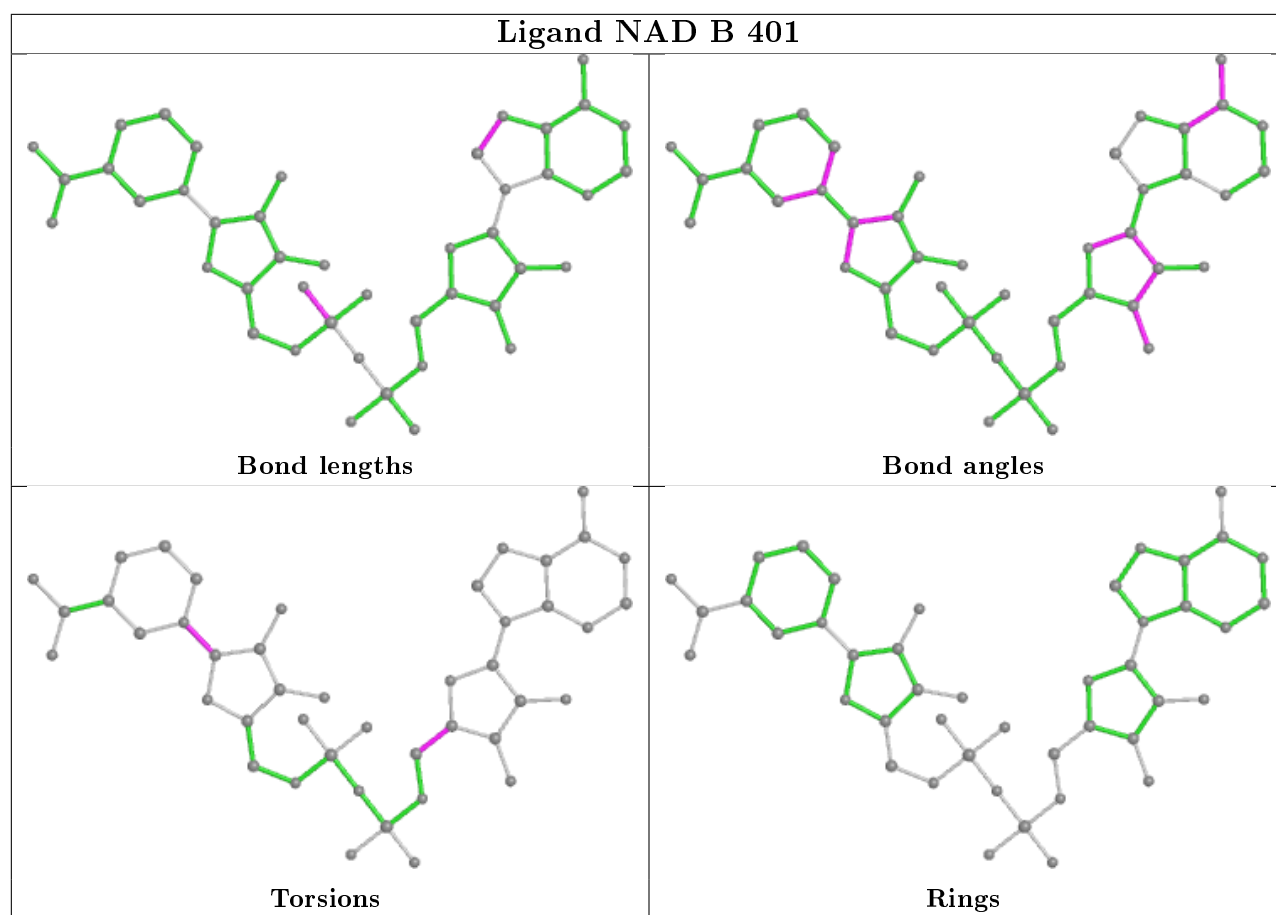
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	NAD	1	0
2	D	401	NAD	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 then 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.

Ligand NAD C 401

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD A 401

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD D 401

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD B 401

Bond lengths

Bond angles

Torsions

Rings

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, 95th 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(Å²)	Q<0.9
1	A	334/338 (98%)	1.63	97 (29%)	0	0	23, 41, 63, 86	0
1	B	332/338 (98%)	1.21	52 (15%)	2	2	18, 32, 53, 66	0
1	C	335/338 (99%)	1.15	49 (14%)	2	3	18, 29, 45, 70	0
1	D	334/338 (98%)	1.17	54 (16%)	1	2	20, 34, 53, 69	0
All	All	1335/1352 (98%)	1.29	252 (18%)	1	1	18, 34, 56, 86	0

All (252) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	227	SER	7.2
1	D	48	GLY	5.6
1	A	169	GLY	5.6
1	A	254	TYR	5.5
1	A	67	THR	5.3
1	A	235	TYR	5.3
1	A	46	LEU	5.3
1	A	83	VAL	5.1
1	A	89	SER	4.9
1	A	58	PRO	4.9
1	B	285	GLY	4.6
1	B	54	ILE	4.5
1	A	71	LEU	4.4
1	A	170	PRO	4.4
1	D	120	THR	4.4
1	B	43	VAL	4.2
1	B	48	GLY	4.2
1	D	189	ILE	4.2
1	A	181	THR	4.2
1	D	171	THR	4.2
1	A	63	MET	4.1

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Mol	Chain	Res	Type	RSRZ
1	A	82	VAL	4.0
1	C	89	SER	4.0
1	A	228	ASN	4.0
1	A	189	ILE	3.9
1	A	85	ASP	3.9
1	A	33	ASP	3.9
1	A	127	VAL	3.9
1	C	275	VAL	3.9
1	A	61	ILE	3.9
1	B	57	TYR	3.8
1	D	94	ASN	3.8
1	A	7	TRP	3.8
1	A	11	ALA	3.6
1	A	236	VAL	3.6
1	D	254	TYR	3.6
1	C	54	ILE	3.6
1	D	228	ASN	3.6
1	A	122	ALA	3.6
1	D	62	THR	3.6
1	D	42	ASP	3.5
1	C	57	TYR	3.5
1	D	235	TYR	3.5
1	A	45	GLU	3.5
1	C	43	VAL	3.5
1	A	48	GLY	3.5
1	A	193	LYS	3.5
1	A	226	ILE	3.4
1	D	193	LYS	3.4
1	A	47	LEU	3.4
1	D	127	VAL	3.4
1	D	279	ASP	3.4
1	D	119	ASP	3.4
1	A	52	ILE	3.4
1	D	170	PRO	3.3
1	A	178	VAL	3.3
1	A	123	LYS	3.3
1	A	119	ASP	3.3
1	B	39	ILE	3.3
1	D	240	PRO	3.3
1	B	56	VAL	3.3
1	A	114	ALA	3.3
1	C	39	ILE	3.3

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Mol	Chain	Res	Type	RSRZ
1	D	54	ILE	3.2
1	A	91	LEU	3.2
1	B	38	TYR	3.2
1	B	111	ASP	3.2
1	A	14	SER	3.2
1	C	48	GLY	3.2
1	D	85	ASP	3.2
1	A	90	ILE	3.2
1	A	188	GLY	3.2
1	A	171	THR	3.1
1	D	46	LEU	3.1
1	A	94	ASN	3.1
1	A	245	GLY	3.1
1	A	69	PRO	3.1
1	D	69	PRO	3.1
1	A	196	GLY	3.1
1	B	53	GLY	3.0
1	C	50	GLY	3.0
1	A	237	LYS	3.0
1	A	35	ARG	3.0
1	C	49	LEU	3.0
1	D	35	ARG	3.0
1	C	40	GLU	3.0
1	C	111	ASP	2.9
1	A	43	VAL	2.9
1	A	192	GLY	2.9
1	A	260	ILE	2.9
1	B	206	MET	2.9
1	B	207	ILE	2.8
1	C	280	TYR	2.8
1	D	92	LYS	2.8
1	D	149	GLY	2.8
1	C	138	PHE	2.8
1	D	29	VAL	2.8
1	A	212	GLY	2.7
1	D	122	ALA	2.7
1	A	238	VAL	2.7
1	A	72	VAL	2.7
1	A	95	LYS	2.7
1	B	49	LEU	2.7
1	A	175	THR	2.7
1	B	147	LEU	2.7

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Mol	Chain	Res	Type	RSRZ
1	C	55	LYS	2.7
1	D	199	GLY	2.7
1	A	42	ASP	2.7
1	A	62	THR	2.6
1	A	259	LEU	2.6
1	A	16	ILE	2.6
1	C	69	PRO	2.6
1	C	52	ILE	2.6
1	A	163	ASN	2.6
1	A	6	ILE	2.6
1	A	149	GLY	2.6
1	B	76	THR	2.6
1	C	147	LEU	2.6
1	D	315	VAL	2.6
1	C	137	GLY	2.6
1	A	28	LEU	2.5
1	B	229	VAL	2.5
1	A	38	TYR	2.5
1	D	52	ILE	2.5
1	A	8	GLY	2.5
1	A	15	GLY	2.5
1	A	79	PHE	2.5
1	C	75	ALA	2.5
1	B	162	ILE	2.5
1	B	63	MET	2.5
1	B	7	TRP	2.5
1	C	56	VAL	2.5
1	B	2	TYR	2.5
1	C	207	ILE	2.5
1	C	331	ARG	2.4
1	B	280	TYR	2.4
1	C	140	LEU	2.4
1	A	172	VAL	2.4
1	C	126	ASN	2.4
1	D	49	LEU	2.4
1	B	275	VAL	2.4
1	B	148	THR	2.4
1	B	333	LEU	2.4
1	C	333	LEU	2.4
1	A	76	THR	2.4
1	C	7	TRP	2.4
1	A	78	SER	2.4

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Mol	Chain	Res	Type	RSRZ
1	D	61	ILE	2.4
1	A	199	GLY	2.4
1	C	160	ALA	2.4
1	D	63	MET	2.4
1	B	303	THR	2.4
1	D	126	ASN	2.4
1	D	2	TYR	2.3
1	B	190	LYS	2.3
1	B	17	ALA	2.3
1	A	50	GLY	2.3
1	B	55	LYS	2.3
1	B	157	ILE	2.3
1	A	315	VAL	2.3
1	D	82	VAL	2.3
1	A	244	ALA	2.3
1	C	303	THR	2.3
1	C	190	LYS	2.3
1	B	139	VAL	2.3
1	B	59	ASP	2.3
1	A	180	THR	2.3
1	B	138	PHE	2.3
1	C	291	MET	2.2
1	A	126	ASN	2.2
1	A	29	VAL	2.2
1	C	168	PHE	2.2
1	B	331	ARG	2.2
1	C	297	ILE	2.2
1	C	292	GLY	2.2
1	D	259	LEU	2.2
1	A	291	MET	2.2
1	B	126	ASN	2.2
1	A	168	PHE	2.2
1	B	62	THR	2.2
1	B	105	ALA	2.2
1	B	306	ILE	2.2
1	C	74	ILE	2.2
1	C	2	TYR	2.2
1	A	194	ILE	2.2
1	C	143	LEU	2.2
1	B	110	LYS	2.2
1	D	89	SER	2.2
1	D	188	GLY	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	120	THR	2.2
1	C	271	HIS	2.2
1	C	281	ILE	2.2
1	D	7	TRP	2.2
1	D	150	ILE	2.2
1	D	291	MET	2.2
1	D	59	ASP	2.2
1	D	314	VAL	2.2
1	A	92	LYS	2.2
1	B	114	ALA	2.2
1	D	88	ILE	2.2
1	C	321	LEU	2.2
1	B	328	PRO	2.2
1	D	124	ASP	2.2
1	A	64	VAL	2.1
1	A	268	VAL	2.1
1	B	160	ALA	2.1
1	A	54	ILE	2.1
1	A	297	ILE	2.1
1	B	297	ILE	2.1
1	C	157	ILE	2.1
1	A	326	ASP	2.1
1	D	71	LEU	2.1
1	B	135	ASN	2.1
1	C	38	TYR	2.1
1	C	254	TYR	2.1
1	C	216	ASP	2.1
1	B	89	SER	2.1
1	C	58	PRO	2.1
1	D	107	PRO	2.1
1	A	53	GLY	2.1
1	A	51	LYS	2.1
1	B	67	THR	2.1
1	C	229	VAL	2.1
1	A	216	ASP	2.1
1	A	150	ILE	2.1
1	A	232	GLU	2.1
1	B	144	ILE	2.1
1	B	291	MET	2.1
1	A	115	ALA	2.1
1	B	235	TYR	2.1
1	B	143	LEU	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	314	VAL	2.1
1	C	139	VAL	2.1
1	D	24	LYS	2.1
1	D	168	PHE	2.1
1	C	304	ILE	2.1
1	A	32	HIS	2.1
1	D	148	THR	2.1
1	D	196	GLY	2.1
1	D	58	PRO	2.1
1	A	257	GLU	2.0
1	D	68	ASP	2.0
1	A	1	SER	2.0
1	D	14	SER	2.0
1	B	88	ILE	2.0
1	B	269	LEU	2.0
1	C	206	MET	2.0
1	A	299	GLY	2.0
1	B	97	VAL	2.0
1	C	135	ASN	2.0
1	A	124	ASP	2.0
1	D	115	ALA	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no carbohydrates in this entry.

6.4 Ligands (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th 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.
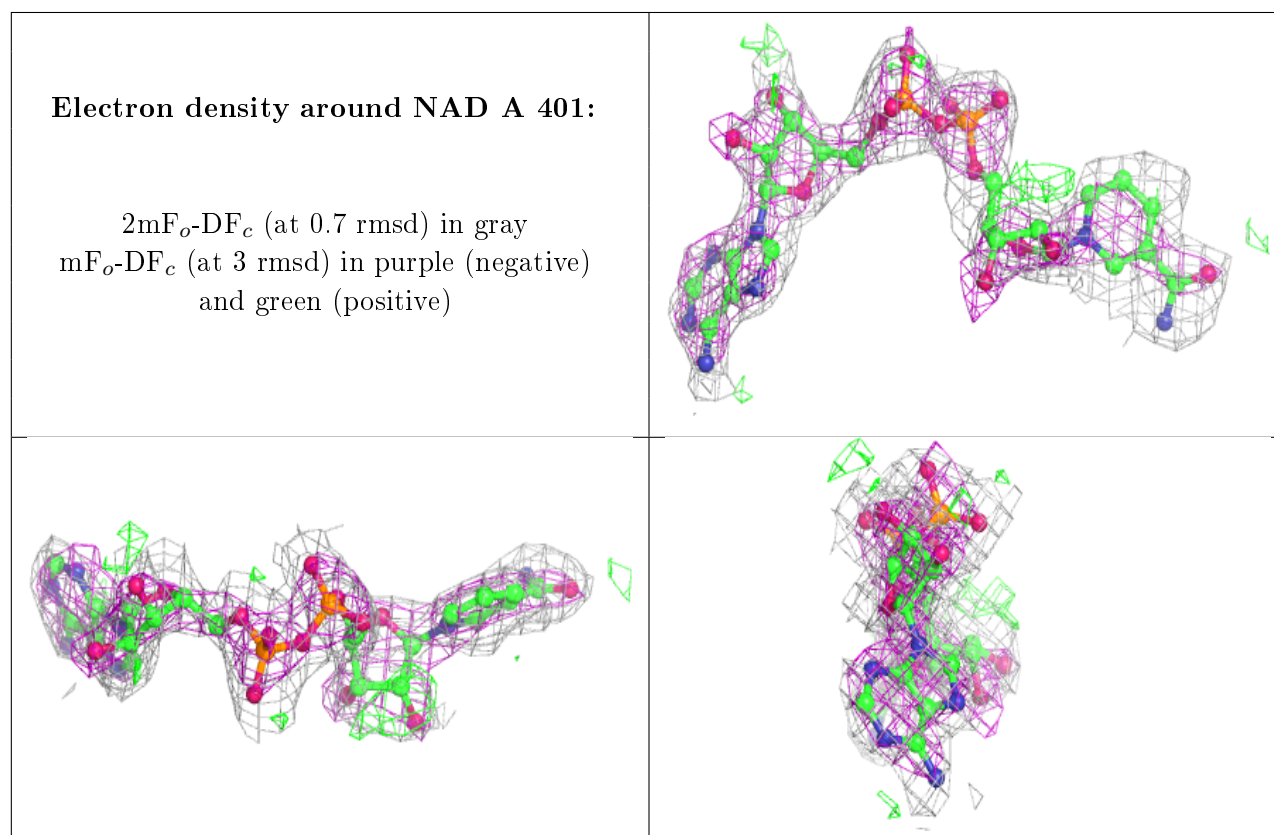
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	NAD	A	401	44/44	0.85	0.30	20,20,20,20	0
2	NAD	C	401	44/44	0.90	0.15	20,20,20,20	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\mathrm{\AA}^2$)	Q<0.9
2	NAD	D	401	44/44	0.91	0.21	20,20,20,20	0
2	NAD	B	401	44/44	0.91	0.15	20,20,20,20	0
3	PO4	D	402	5/5	0.94	0.18	37,38,40,50	0
3	PO4	A	402	5/5	0.96	0.15	44,44,53,56	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.
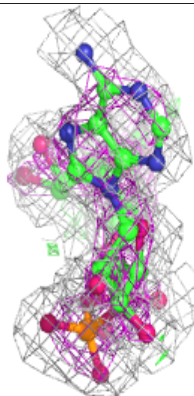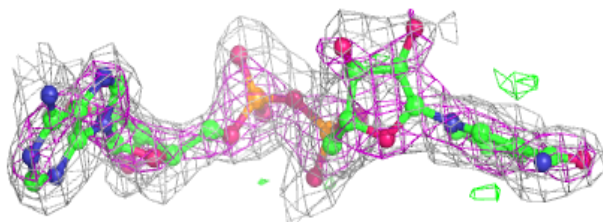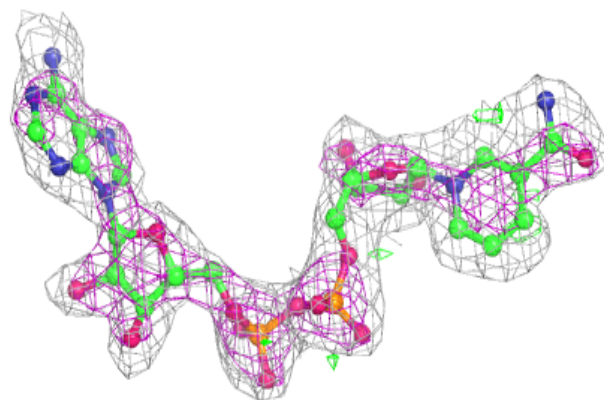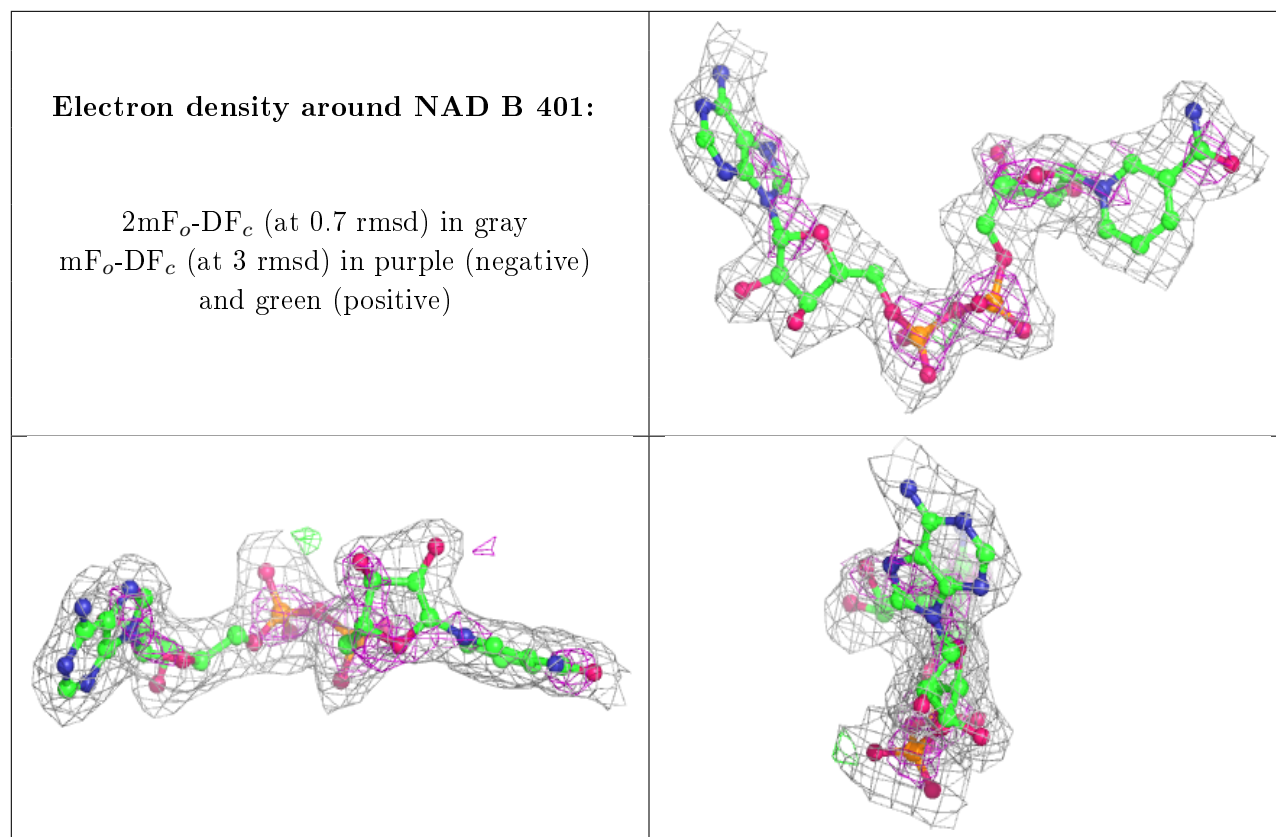

Electron density around NAD A 401:

$2\mathrm{mF}_o\text{-DF}_c$ (at 0.7 rmsd) in gray
$\mathrm{mF}_o\text{-DF}_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around NAD C 401:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
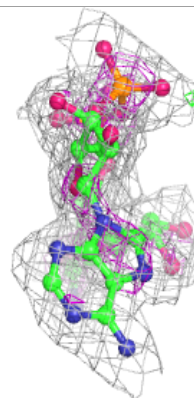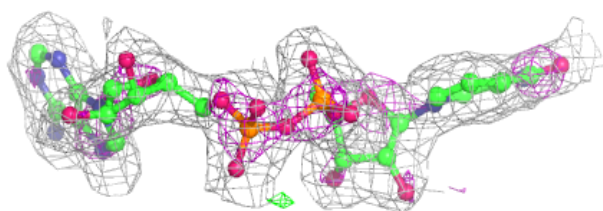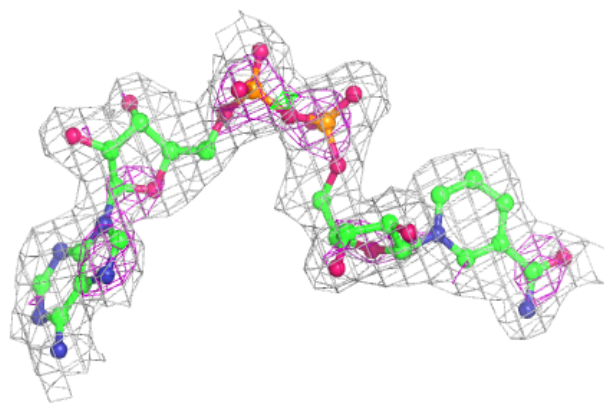
Electron density around NAD D 401:

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

Electron density around NAD B 401:

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

6.5 Other polymers (i)

There are no such residues in this entry.