



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 30, 2023 – 07:44 PM JST

PDB ID : 4YR9
Title : mouse TDH with NAD⁺ bound
Authors : He, C.; Li, F.
Deposited on : 2015-03-14
Resolution : 2.80 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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 : 2.36
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) : 2.36

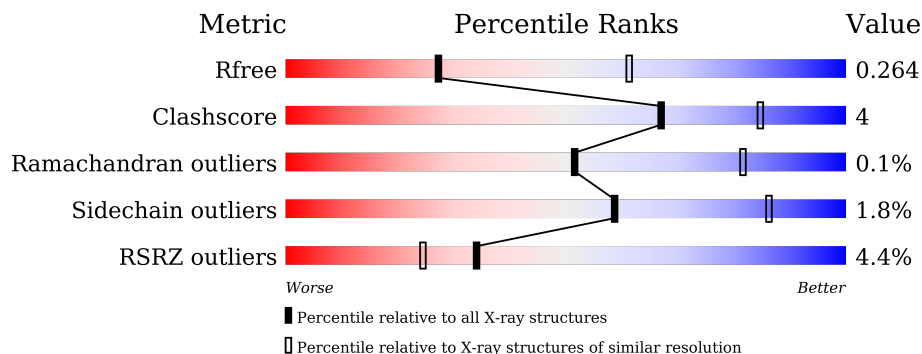
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. 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	329	
1	B	329	
1	C	329	
1	D	329	
1	E	329	
1	F	329	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 14852 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.

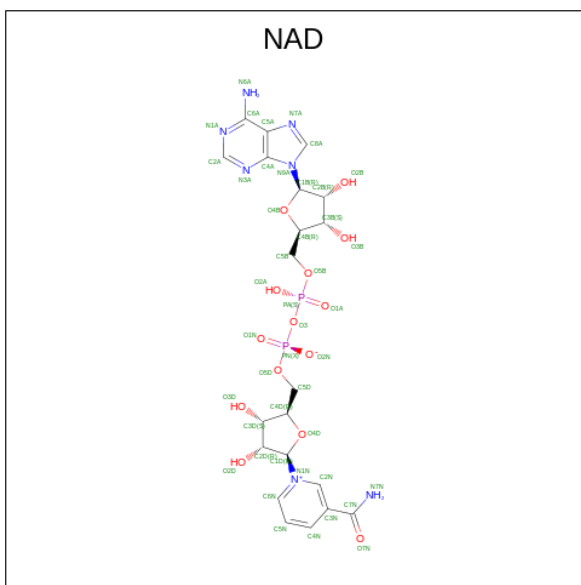
- Molecule 1 is a protein called L-threonine 3-dehydrogenase, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	308	2430	1555	424	438	13	0	0	0
1	B	307	2420	1549	422	436	13	0	0	0
1	C	307	2415	1545	420	437	13	0	0	0
1	D	308	2423	1551	423	436	13	0	0	0
1	E	308	2430	1555	424	438	13	0	0	0
1	F	301	2377	1521	413	430	13	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	45	HIS	-	expression tag	UNP Q8K3F7
A	46	MET	-	expression tag	UNP Q8K3F7
B	45	HIS	-	expression tag	UNP Q8K3F7
B	46	MET	-	expression tag	UNP Q8K3F7
C	45	HIS	-	expression tag	UNP Q8K3F7
C	46	MET	-	expression tag	UNP Q8K3F7
D	45	HIS	-	expression tag	UNP Q8K3F7
D	46	MET	-	expression tag	UNP Q8K3F7
E	45	HIS	-	expression tag	UNP Q8K3F7
E	46	MET	-	expression tag	UNP Q8K3F7
F	45	HIS	-	expression tag	UNP Q8K3F7
F	46	MET	-	expression tag	UNP Q8K3F7

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: C₂₁H₂₇N₇O₁₄P₂).



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

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



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

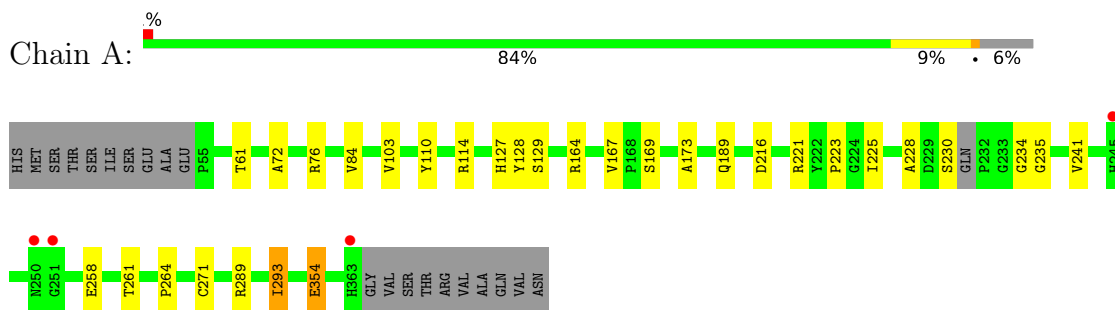
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	14	Total O 14 14	0	0
4	B	21	Total O 21 21	0	0
4	C	10	Total O 10 10	0	0
4	D	16	Total O 16 16	0	0
4	E	7	Total O 7 7	0	0
4	F	7	Total O 7 7	0	0

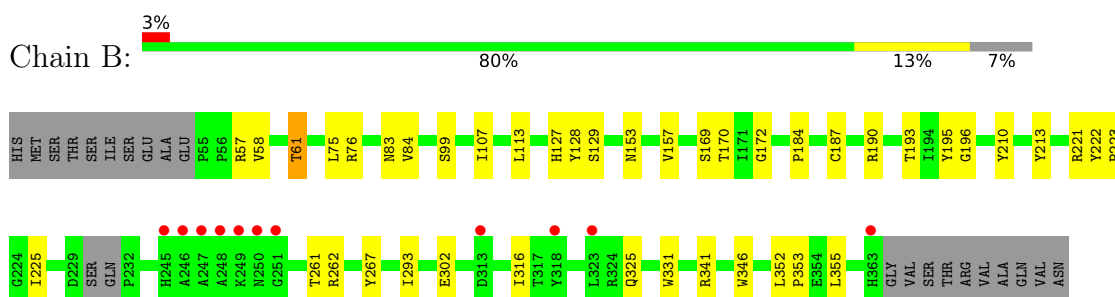
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

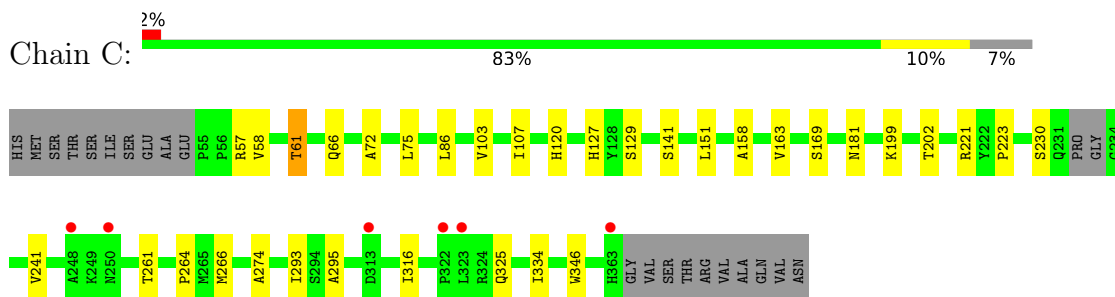
- Molecule 1: L-threonine 3-dehydrogenase, mitochondrial



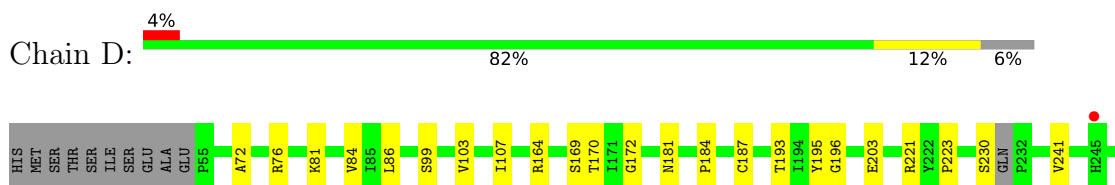
- Molecule 1: L-threonine 3-dehydrogenase, mitochondrial

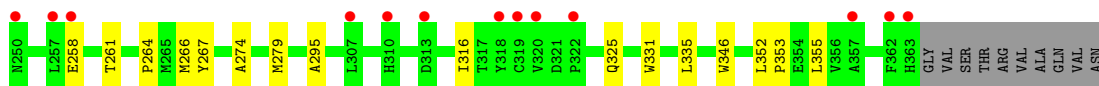


- Molecule 1: L-threonine 3-dehydrogenase, mitochondrial

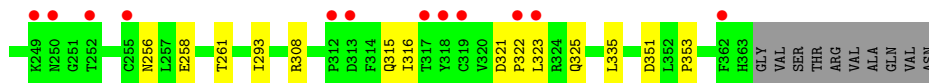
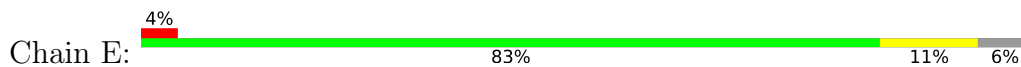


- Molecule 1: L-threonine 3-dehydrogenase, mitochondrial

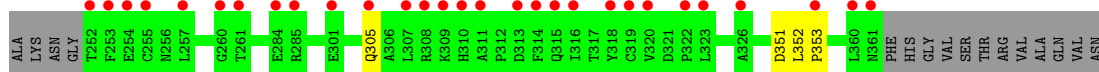
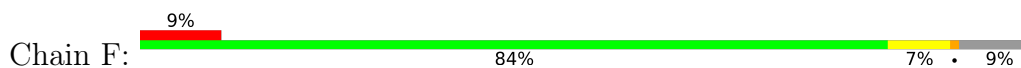




- Molecule 1: L-threonine 3-dehydrogenase, mitochondrial



- Molecule 1: L-threonine 3-dehydrogenase, mitochondrial



4 Data and refinement statistics

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, α , β , γ	74.15Å 160.13Å 194.30Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.42 – 2.80 36.42 – 2.80	Depositor EDS
% Data completeness (in resolution range)	92.4 (36.42-2.80) 92.4 (36.42-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.28 (at 2.81Å)	Xtrriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.216 , 0.264 0.215 , 0.264	Depositor DCC
R_{free} test set	2700 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	47.1	Xtrriage
Anisotropy	0.158	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 33.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	14852	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.78% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: NAD, GOL

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	0.29	0/2494	0.47	0/3391
1	B	0.29	0/2484	0.48	0/3379
1	C	0.29	0/2477	0.47	0/3370
1	D	0.29	0/2487	0.47	0/3383
1	E	0.28	0/2494	0.48	0/3391
1	F	0.29	0/2437	0.47	0/3314
All	All	0.29	0/14873	0.48	0/20228

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	2430	0	2401	19	0
1	B	2420	0	2385	24	0
1	C	2415	0	2376	21	0
1	D	2423	0	2388	20	0
1	E	2430	0	2401	17	0
1	F	2377	0	2348	13	0
2	A	44	0	26	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	44	0	26	0	0
2	C	44	0	26	1	0
2	D	44	0	26	0	0
2	E	44	0	26	2	0
2	F	44	0	26	0	0
3	A	6	0	8	0	0
3	B	6	0	8	0	0
3	C	6	0	8	0	0
4	A	14	0	0	0	0
4	B	21	0	0	0	0
4	C	10	0	0	0	0
4	D	16	0	0	0	0
4	E	7	0	0	1	0
4	F	7	0	0	0	0
All	All	14852	0	14479	113	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

All (113) 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:E:61:THR:HG22	1:E:129:SER:HB3	1.67	0.76
1:C:261:THR:HG21	1:C:325:GLN:HE22	1.51	0.76
1:D:164:ARG:NH2	1:D:279:MET:O	2.27	0.68
1:D:169:SER:HB3	1:D:221:ARG:HG2	1.74	0.67
1:E:261:THR:HG21	1:E:325:GLN:HE22	1.57	0.67
1:A:169:SER:HB3	1:A:221:ARG:HG2	1.75	0.67
1:B:169:SER:HB3	1:B:221:ARG:HG2	1.75	0.67
1:C:230:SER:HB3	1:C:241:VAL:HG11	1.79	0.63
1:E:256:ASN:HB2	1:E:321:ASP:HB2	1.83	0.59
1:F:67:LEU:HD21	1:F:225:ILE:HG21	1.84	0.59
1:E:66:GLN:NE2	2:E:1001:NAD:H72N	1.99	0.59
1:A:223:PRO:HD3	1:A:293:ILE:HG23	1.86	0.57
1:E:169:SER:HB3	1:E:221:ARG:HG2	1.85	0.57
1:A:221:ARG:O	1:A:293:ILE:HG22	2.05	0.57
1:F:169:SER:HB3	1:F:221:ARG:HG2	1.86	0.56
1:E:351:ASP:HB3	1:E:353:PRO:HD2	1.86	0.56
1:C:72:ALA:HB2	1:C:86:LEU:HD13	1.87	0.55
1:F:62:GLY:HA3	1:F:129:SER:HB3	1.89	0.55
1:B:184:PRO:HG2	1:B:187:CYS:HB3	1.89	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:61:THR:HG21	1:C:127:HIS:ND1	2.21	0.54
1:C:169:SER:HB3	1:C:221:ARG:HG2	1.90	0.54
1:B:190:ARG:HH12	1:D:203:GLU:HB3	1.73	0.53
1:B:170:THR:HG21	1:B:195:TYR:CE2	2.44	0.53
1:E:184:PRO:HG2	1:E:187:CYS:HB3	1.89	0.52
1:B:341:ARG:HG2	1:B:346:TRP:O	2.09	0.52
1:D:261:THR:HG21	1:D:325:GLN:HE22	1.74	0.52
1:A:230:SER:HB3	1:A:241:VAL:HG11	1.92	0.52
1:F:61:THR:HG21	1:F:127:HIS:ND1	2.25	0.52
1:D:274:ALA:HB2	1:D:346:TRP:CZ3	2.45	0.51
1:D:352:LEU:HB3	1:D:353:PRO:HD3	1.92	0.51
1:D:76:ARG:HG2	1:D:84:VAL:HB	1.91	0.51
1:D:266:MET:HE2	1:D:295:ALA:HB2	1.91	0.51
1:B:61:THR:HG22	1:B:129:SER:H	1.76	0.50
1:B:107:ILE:HG12	1:B:127:HIS:HE1	1.76	0.49
1:B:172:GLY:HA2	1:B:331:TRP:NE1	2.28	0.48
1:D:170:THR:HG21	1:D:195:TYR:CE2	2.48	0.48
1:D:264:PRO:HG2	1:D:335:LEU:HD13	1.94	0.48
1:A:258:GLU:HB2	1:A:261:THR:HG23	1.94	0.48
1:C:158:ALA:HA	1:C:163:VAL:HB	1.94	0.48
1:D:267:TYR:HB2	1:D:355:LEU:HD13	1.96	0.48
1:F:107:ILE:HG22	1:F:150:GLY:HA2	1.95	0.47
1:E:322:PRO:HG2	1:E:323:LEU:HD12	1.96	0.47
1:A:61:THR:O	1:A:128:TYR:HB2	2.14	0.47
1:B:113:LEU:HB3	1:B:157:VAL:HG21	1.95	0.47
1:C:223:PRO:HB3	1:C:264:PRO:HB2	1.97	0.47
1:B:61:THR:HG21	1:B:127:HIS:ND1	2.29	0.47
1:C:181:ASN:HD22	1:C:334:ILE:HD12	1.80	0.47
1:D:81:LYS:HE3	1:D:99:SER:O	2.14	0.47
1:D:72:ALA:HB2	1:D:86:LEU:HD13	1.96	0.46
1:C:66:GLN:NE2	2:C:1001:NAD:H72N	2.13	0.46
1:E:95:HIS:HB3	4:E:1103:HOH:O	2.14	0.46
1:E:193:THR:O	1:E:197:VAL:HG23	2.15	0.46
1:D:230:SER:HB3	1:D:241:VAL:HG11	1.97	0.46
1:F:145:ASP:O	1:F:149:THR:HB	2.14	0.46
1:A:61:THR:HG21	1:A:127:HIS:ND1	2.31	0.46
1:D:184:PRO:HG2	1:D:187:CYS:HB3	1.99	0.45
1:F:352:LEU:HB3	1:F:353:PRO:HD3	1.97	0.45
1:A:225:ILE:HD12	1:A:271:CYS:HB2	1.97	0.45
1:A:223:PRO:HB3	1:A:264:PRO:HB2	1.99	0.45
1:B:222:TYR:HB3	1:B:225:ILE:HD11	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:57:ARG:HD2	1:B:83:ASN:HD22	1.81	0.45
1:F:61:THR:HG22	1:F:129:SER:H	1.82	0.45
1:C:169:SER:HA	1:C:199:LYS:HD2	2.00	0.44
1:B:267:TYR:HB2	1:B:355:LEU:HD13	1.99	0.44
1:D:172:GLY:HA2	1:D:331:TRP:NE1	2.33	0.44
1:B:261:THR:HG21	1:B:325:GLN:HE22	1.82	0.44
1:C:61:THR:HG22	1:C:129:SER:H	1.83	0.44
1:A:61:THR:HG22	1:A:129:SER:H	1.82	0.44
1:C:266:MET:HE1	1:C:293:ILE:HG12	2.00	0.44
1:A:76:ARG:HG2	1:A:84:VAL:HB	2.00	0.43
1:C:107:ILE:HD12	1:C:107:ILE:HA	1.88	0.43
1:B:352:LEU:HB3	1:B:353:PRO:HD3	2.00	0.43
1:C:274:ALA:HB2	1:C:346:TRP:CZ3	2.54	0.43
1:B:153:ASN:O	1:B:157:VAL:HG23	2.19	0.43
1:F:184:PRO:HG2	1:F:187:CYS:HB3	2.00	0.43
1:E:144:ARG:HG3	1:E:148:ILE:HD12	2.01	0.43
1:A:354:GLU:H	1:A:354:GLU:HG2	1.59	0.43
1:E:129:SER:HB2	2:E:1001:NAD:N3A	2.34	0.43
1:D:193:THR:HG23	1:D:196:GLY:H	1.84	0.43
1:F:72:ALA:HB1	1:F:76:ARG:NH1	2.34	0.43
1:A:127:HIS:HB3	1:A:167:VAL:HG22	2.00	0.43
1:B:61:THR:O	1:B:128:TYR:HB2	2.19	0.43
1:E:258:GLU:HB2	1:E:261:THR:HG23	2.01	0.43
1:C:221:ARG:O	1:C:293:ILE:HG22	2.19	0.43
1:A:164:ARG:HG3	1:A:216:ASP:CG	2.40	0.42
1:E:113:LEU:HB3	1:E:157:VAL:HG21	2.01	0.42
1:A:234:GLY:HA3	1:A:235:GLY:HA3	1.72	0.42
1:A:173:ALA:O	1:A:189:GLN:NE2	2.51	0.42
1:C:151:LEU:HD21	1:C:202:THR:HA	2.01	0.42
1:F:72:ALA:HB1	1:F:76:ARG:HH11	1.85	0.42
1:D:258:GLU:HB2	1:D:261:THR:HG23	2.01	0.42
1:B:210:TYR:O	1:B:213:TYR:O	2.38	0.42
1:C:58:VAL:HG11	1:C:75:LEU:HD13	2.01	0.42
1:E:107:ILE:HG12	1:E:127:HIS:HE1	1.84	0.41
1:A:72:ALA:O	1:A:76:ARG:HG3	2.20	0.41
1:B:58:VAL:HG11	1:B:75:LEU:HD13	2.02	0.41
1:C:181:ASN:ND2	1:C:334:ILE:HD12	2.35	0.41
1:A:110:TYR:CE2	1:A:114:ARG:HD2	2.55	0.41
1:B:76:ARG:HG3	1:B:84:VAL:HB	2.01	0.41
1:B:107:ILE:HD12	1:B:107:ILE:HA	1.93	0.41
1:A:289:ARG:HA	1:A:289:ARG:HD2	1.94	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:308:ARG:HH21	1:E:315:GLN:HA	1.86	0.41
1:C:266:MET:HE3	1:C:295:ALA:HB2	2.01	0.41
1:F:107:ILE:HG22	1:F:150:GLY:CA	2.50	0.41
1:D:107:ILE:HD12	1:D:107:ILE:HA	1.81	0.41
1:B:262:ARG:NH2	1:B:302:GLU:OE2	2.54	0.41
1:C:57:ARG:NH1	1:C:120:HIS:O	2.51	0.41
1:D:223:PRO:HB3	1:D:264:PRO:HB2	2.02	0.41
1:E:117:VAL:HG13	1:E:122:ILE:HB	2.02	0.41
1:B:193:THR:HG23	1:B:196:GLY:H	1.86	0.40
1:B:223:PRO:O	1:B:225:ILE:HG13	2.21	0.40
1:F:181:ASN:HA	1:F:182:PRO:HA	1.89	0.40
1:C:261:THR:HG21	1:C:325:GLN:NE2	2.28	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	304/329 (92%)	294 (97%)	9 (3%)	1 (0%)	41	72
1	B	303/329 (92%)	292 (96%)	11 (4%)	0	100	100
1	C	303/329 (92%)	292 (96%)	11 (4%)	0	100	100
1	D	304/329 (92%)	288 (95%)	16 (5%)	0	100	100
1	E	304/329 (92%)	291 (96%)	13 (4%)	0	100	100
1	F	295/329 (90%)	280 (95%)	15 (5%)	0	100	100
All	All	1813/1974 (92%)	1737 (96%)	75 (4%)	1 (0%)	51	81

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	228	ALA

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	259/277 (94%)	256 (99%)	3 (1%)	71 92
1	B	257/277 (93%)	253 (98%)	4 (2%)	62 88
1	C	256/277 (92%)	252 (98%)	4 (2%)	62 88
1	D	257/277 (93%)	254 (99%)	3 (1%)	71 92
1	E	259/277 (94%)	253 (98%)	6 (2%)	50 82
1	F	254/277 (92%)	247 (97%)	7 (3%)	43 77
All	All	1542/1662 (93%)	1515 (98%)	27 (2%)	59 86

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	103	VAL
1	A	293	ILE
1	A	354	GLU
1	B	61	THR
1	B	99	SER
1	B	293	ILE
1	B	316	ILE
1	C	61	THR
1	C	103	VAL
1	C	141	SER
1	C	316	ILE
1	D	103	VAL
1	D	181	ASN
1	D	316	ILE
1	E	131	LEU
1	E	164	ARG
1	E	229	ASP
1	E	293	ILE
1	E	316	ILE
1	E	335	LEU
1	F	61	THR
1	F	74	LEU

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Mol	Chain	Res	Type
1	F	103	VAL
1	F	139	ASN
1	F	181	ASN
1	F	305	GLN
1	F	351	ASP

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

Mol	Chain	Res	Type
1	A	66	GLN
1	A	83	ASN
1	A	153	ASN
1	B	66	GLN
1	B	83	ASN
1	B	120	HIS
1	B	153	ASN
1	B	325	GLN
1	C	66	GLN
1	C	95	HIS
1	C	153	ASN
1	C	181	ASN
1	D	66	GLN
1	D	83	ASN
1	D	153	ASN
1	D	325	GLN
1	E	66	GLN
1	E	127	HIS
1	E	139	ASN
1	E	153	ASN
1	E	325	GLN
1	F	66	GLN
1	F	153	ASN
1	F	305	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

9 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	D	1001	-	42,48,48	0.85	2 (4%)	50,73,73	1.17	3 (6%)
3	GOL	C	1002	-	5,5,5	0.29	0	5,5,5	0.28	0
3	GOL	B	1002	-	5,5,5	0.32	0	5,5,5	0.24	0
2	NAD	A	1001	-	42,48,48	0.82	1 (2%)	50,73,73	1.21	4 (8%)
2	NAD	C	1001	-	42,48,48	0.80	1 (2%)	50,73,73	1.13	4 (8%)
2	NAD	F	1001	-	42,48,48	0.81	1 (2%)	50,73,73	1.18	4 (8%)
2	NAD	E	1001	-	42,48,48	0.80	1 (2%)	50,73,73	1.23	4 (8%)
3	GOL	A	1002	-	5,5,5	0.35	0	5,5,5	0.38	0
2	NAD	B	1001	-	42,48,48	0.86	2 (4%)	50,73,73	1.16	4 (8%)

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	D	1001	-	-	3/26/62/62	0/5/5/5
3	GOL	C	1002	-	-	4/4/4/4	-
3	GOL	B	1002	-	-	2/4/4/4	-
2	NAD	A	1001	-	-	3/26/62/62	0/5/5/5

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAD	C	1001	-	-	4/26/62/62	0/5/5/5
2	NAD	F	1001	-	-	3/26/62/62	0/5/5/5
2	NAD	E	1001	-	-	3/26/62/62	0/5/5/5
3	GOL	A	1002	-	-	2/4/4/4	-
2	NAD	B	1001	-	-	1/26/62/62	0/5/5/5

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1001	NAD	C5A-C4A	2.57	1.47	1.40
2	C	1001	NAD	C5A-C4A	2.46	1.47	1.40
2	E	1001	NAD	C5A-C4A	2.46	1.47	1.40
2	D	1001	NAD	C5A-C4A	2.46	1.47	1.40
2	F	1001	NAD	C5A-C4A	2.44	1.47	1.40
2	A	1001	NAD	C5A-C4A	2.44	1.47	1.40
2	B	1001	NAD	O4D-C1D	2.13	1.44	1.41
2	D	1001	NAD	O4D-C1D	2.05	1.43	1.41

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1001	NAD	PN-O3-PA	-3.97	119.19	132.83
2	B	1001	NAD	N3A-C2A-N1A	-3.65	122.98	128.68
2	C	1001	NAD	N3A-C2A-N1A	-3.60	123.05	128.68
2	F	1001	NAD	N3A-C2A-N1A	-3.47	123.26	128.68
2	A	1001	NAD	N3A-C2A-N1A	-3.45	123.28	128.68
2	E	1001	NAD	N3A-C2A-N1A	-3.45	123.29	128.68
2	D	1001	NAD	N3A-C2A-N1A	-3.40	123.36	128.68
2	D	1001	NAD	PN-O3-PA	-3.35	121.34	132.83
2	E	1001	NAD	PN-O3-PA	-3.32	121.44	132.83
2	F	1001	NAD	PN-O3-PA	-3.30	121.52	132.83
2	C	1001	NAD	PN-O3-PA	-2.99	122.58	132.83
2	F	1001	NAD	C4A-C5A-N7A	-2.92	106.36	109.40
2	B	1001	NAD	PN-O3-PA	-2.87	122.99	132.83
2	D	1001	NAD	C4A-C5A-N7A	-2.83	106.45	109.40
2	A	1001	NAD	C4A-C5A-N7A	-2.82	106.46	109.40
2	E	1001	NAD	C4A-C5A-N7A	-2.74	106.54	109.40
2	B	1001	NAD	C4A-C5A-N7A	-2.61	106.68	109.40
2	E	1001	NAD	C3D-C2D-C1D	2.41	104.61	100.98
2	C	1001	NAD	C4A-C5A-N7A	-2.27	107.03	109.40
2	A	1001	NAD	C1B-N9A-C4A	-2.27	122.65	126.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	1001	NAD	C3D-C2D-C1D	2.18	104.25	100.98
2	B	1001	NAD	C2A-N1A-C6A	2.03	122.23	118.75
2	C	1001	NAD	C2A-N1A-C6A	2.01	122.20	118.75

There are no chirality outliers.

All (25) torsion outliers are listed below:

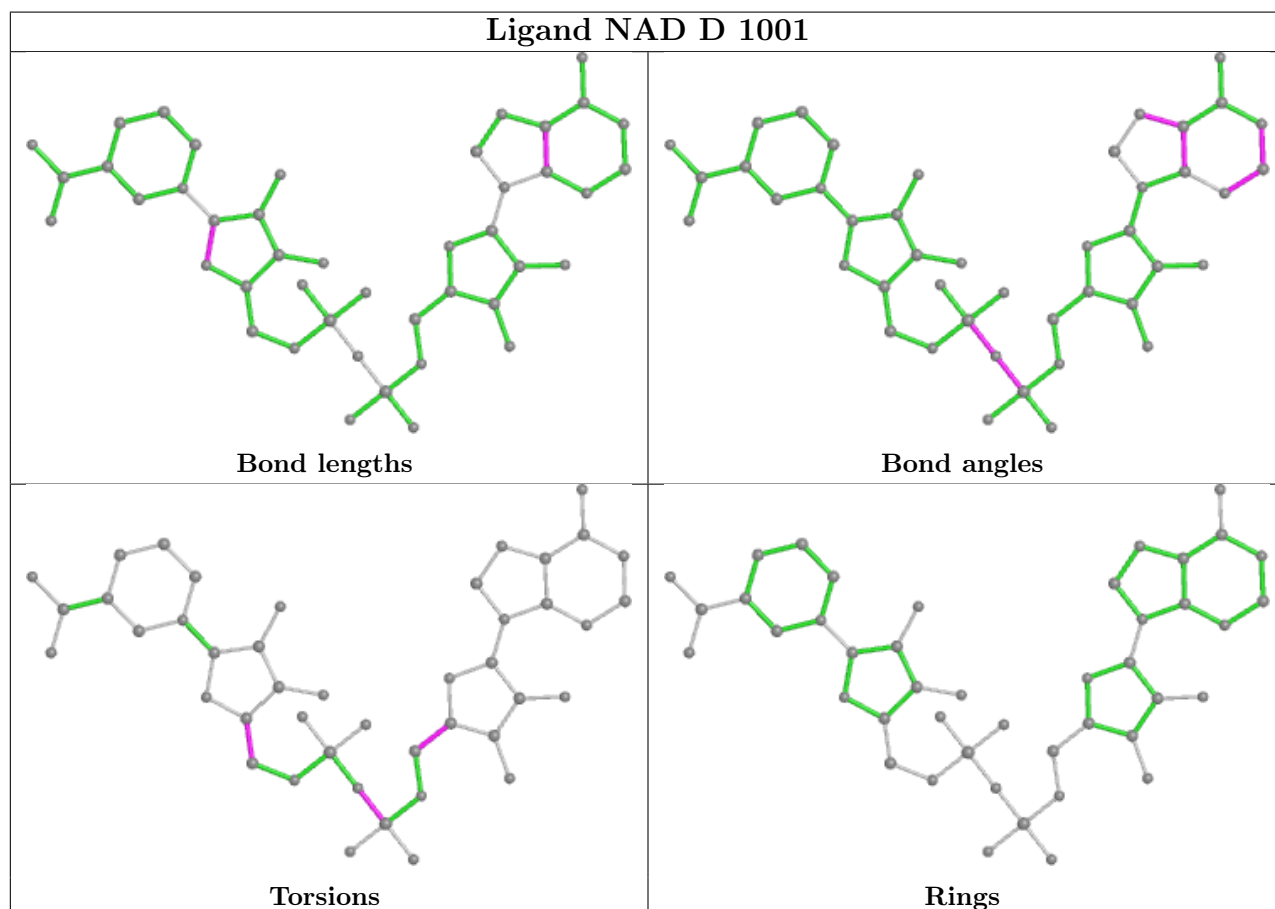
Mol	Chain	Res	Type	Atoms
2	C	1001	NAD	C5D-O5D-PN-O2N
3	B	1002	GOL	C1-C2-C3-O3
3	C	1002	GOL	O1-C1-C2-O2
3	C	1002	GOL	O1-C1-C2-C3
3	C	1002	GOL	C1-C2-C3-O3
3	A	1002	GOL	O1-C1-C2-C3
3	B	1002	GOL	O2-C2-C3-O3
3	C	1002	GOL	O2-C2-C3-O3
3	A	1002	GOL	O1-C1-C2-O2
2	C	1001	NAD	C5D-O5D-PN-O3
2	A	1001	NAD	PN-O3-PA-O1A
2	E	1001	NAD	PN-O3-PA-O1A
2	C	1001	NAD	C5D-O5D-PN-O1N
2	F	1001	NAD	C4N-C3N-C7N-N7N
2	A	1001	NAD	O4B-C4B-C5B-O5B
2	F	1001	NAD	C4N-C3N-C7N-O7N
2	C	1001	NAD	O4B-C4B-C5B-O5B
2	D	1001	NAD	O4D-C4D-C5D-O5D
2	F	1001	NAD	O4B-C4B-C5B-O5B
2	A	1001	NAD	PN-O3-PA-O2A
2	D	1001	NAD	PN-O3-PA-O1A
2	E	1001	NAD	PN-O3-PA-O2A
2	B	1001	NAD	O4B-C4B-C5B-O5B
2	D	1001	NAD	O4B-C4B-C5B-O5B
2	E	1001	NAD	O4B-C4B-C5B-O5B

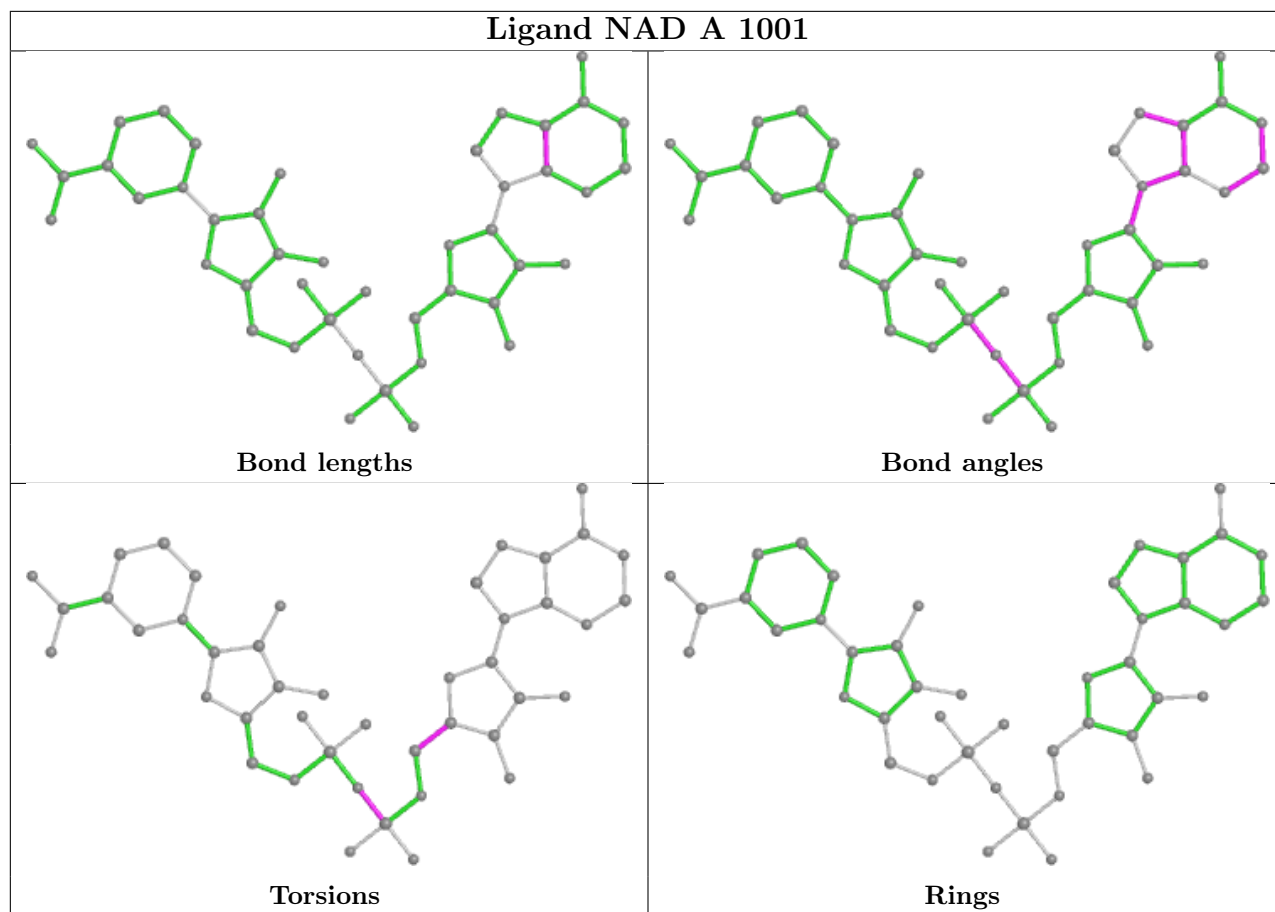
There are no ring outliers.

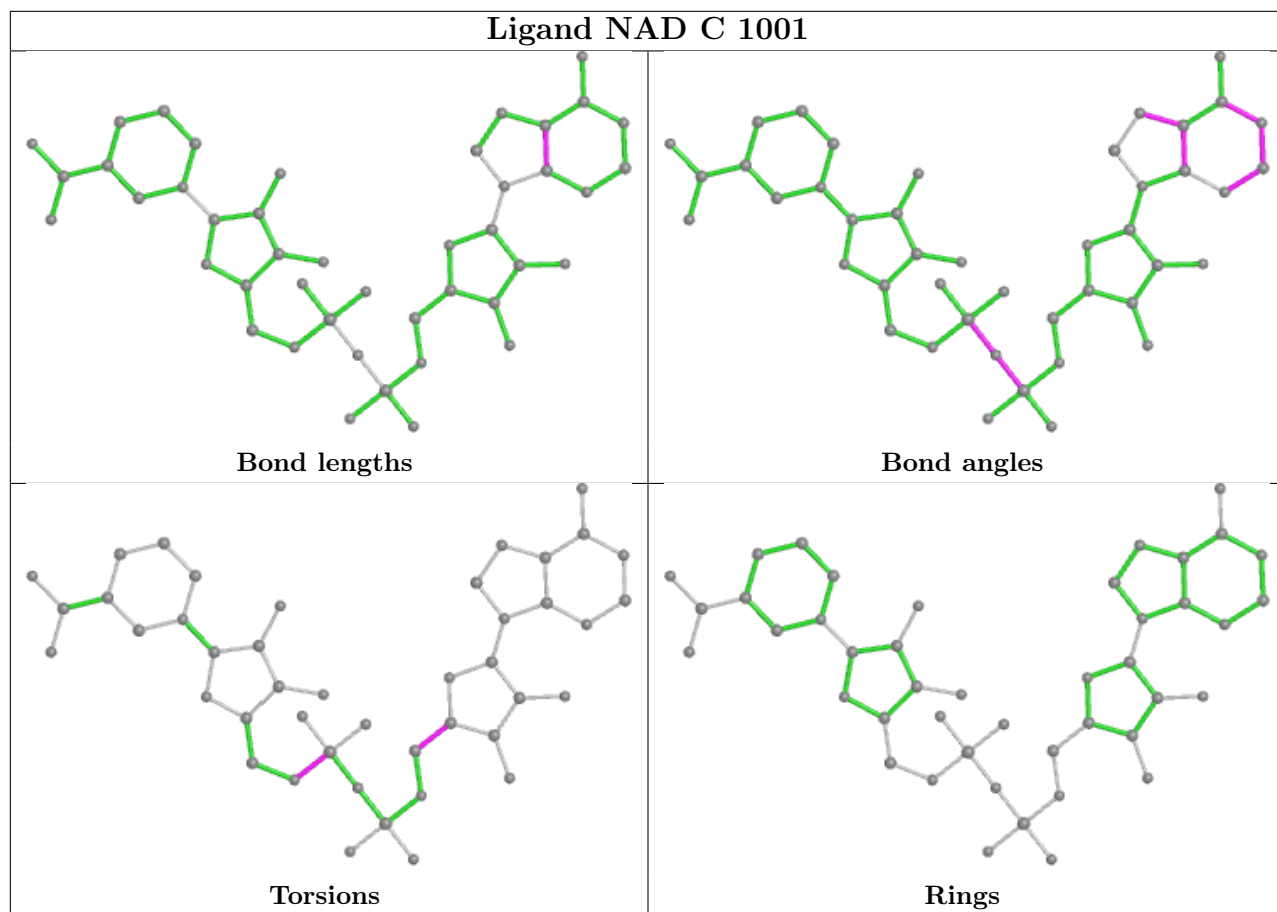
2 monomers are involved in 3 short contacts:

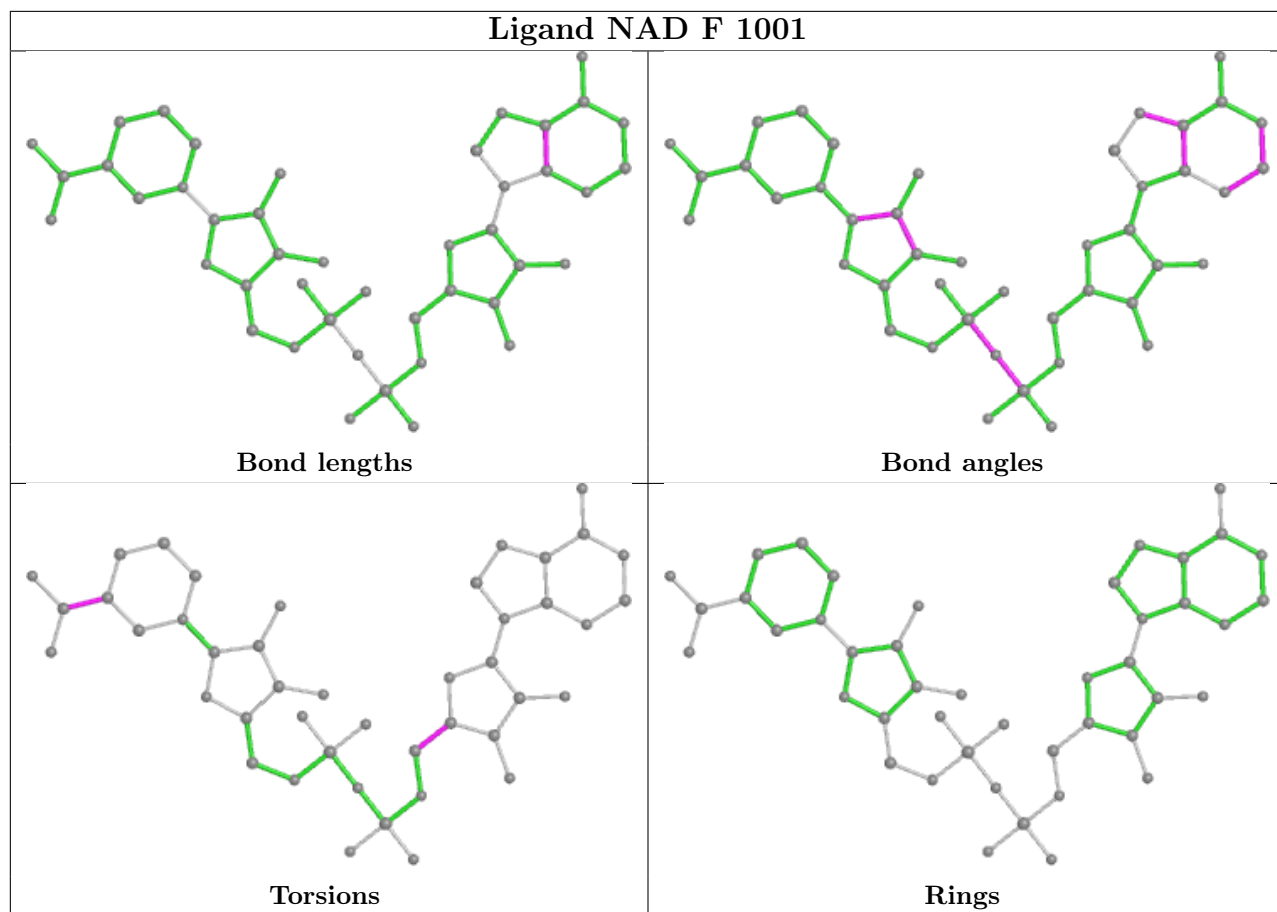
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	1001	NAD	1	0
2	E	1001	NAD	2	0

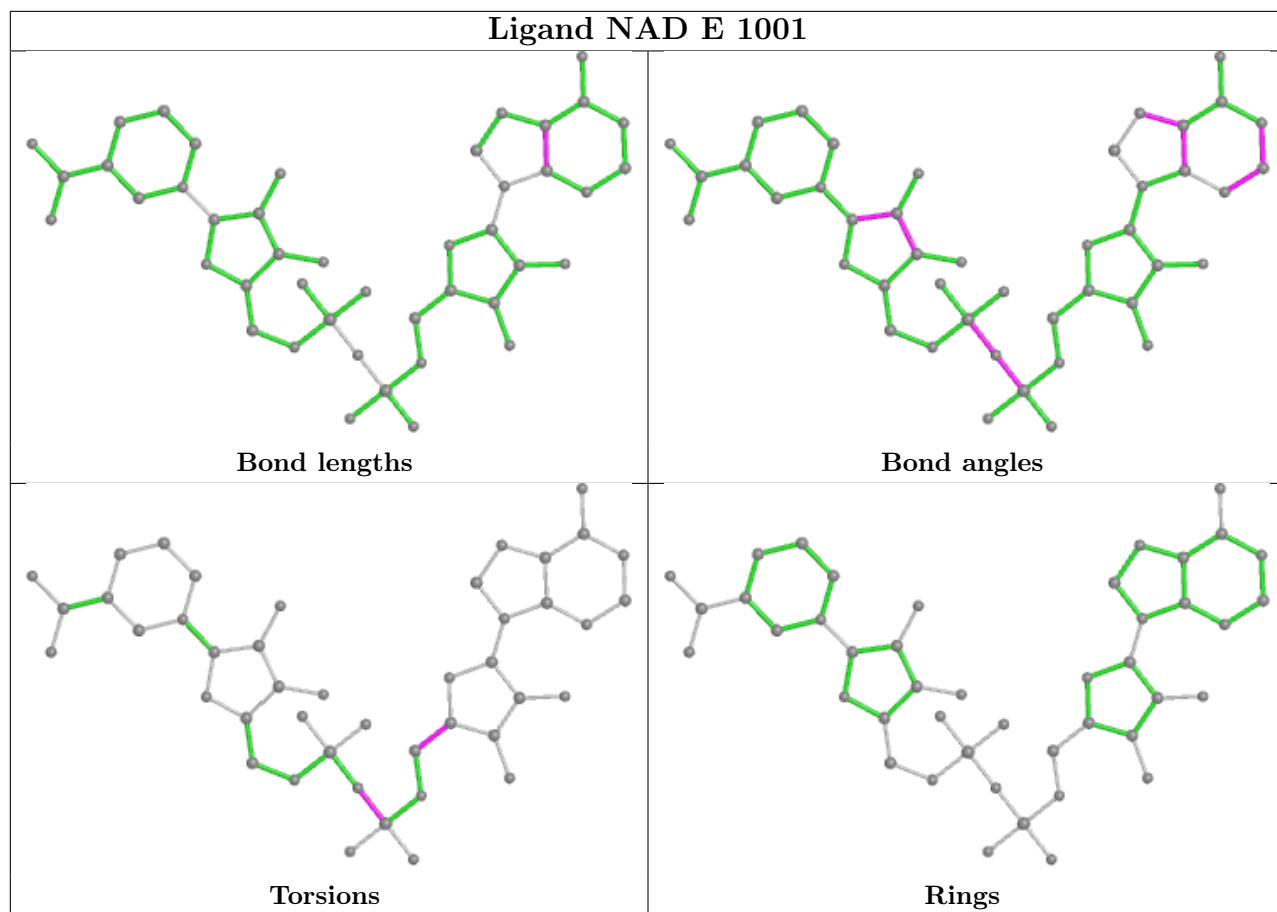
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

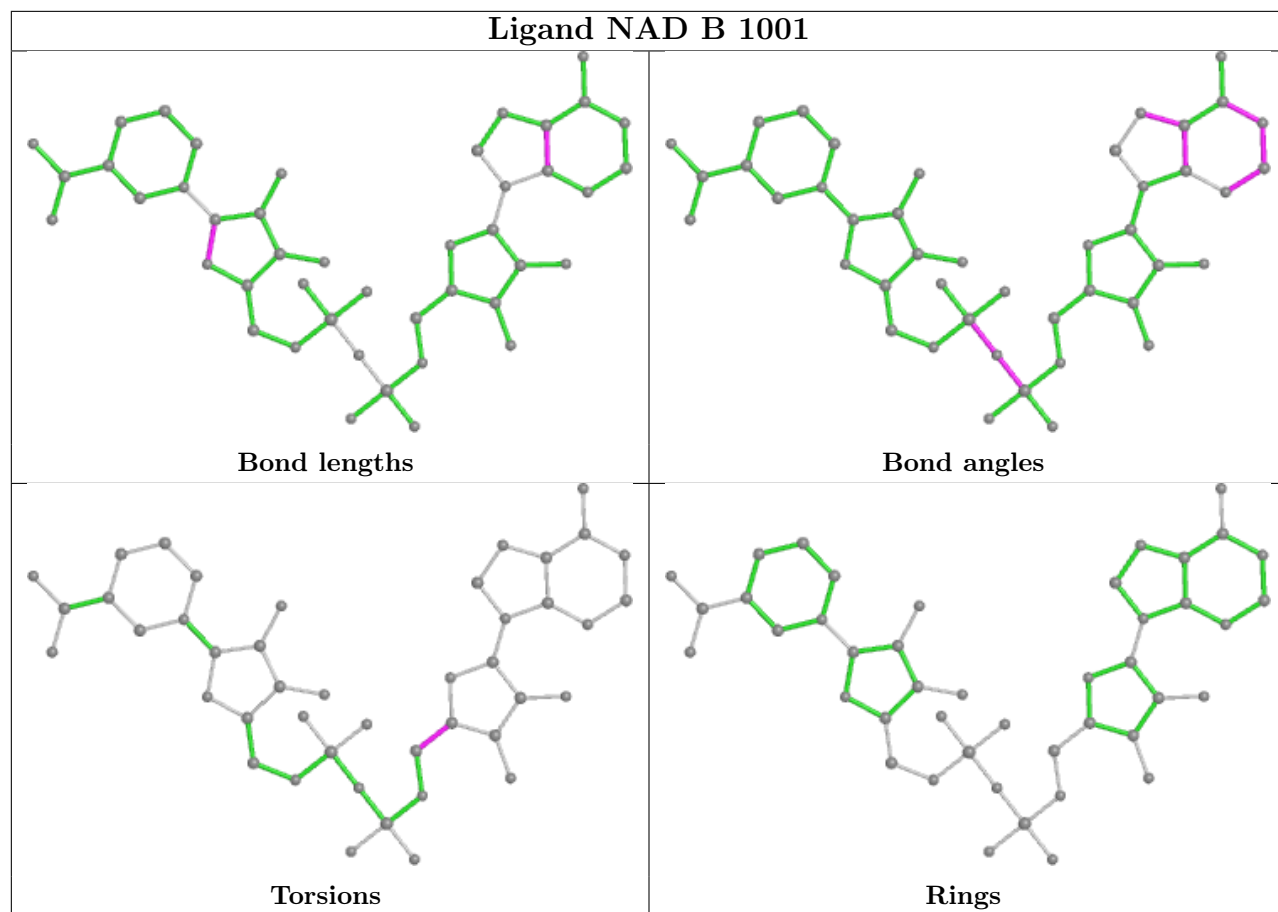












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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(Å ²)	Q<0.9
1	A	308/329 (93%)	-0.23	4 (1%) 77 72	21, 34, 57, 71	0
1	B	307/329 (93%)	-0.02	11 (3%) 42 32	24, 37, 74, 110	0
1	C	307/329 (93%)	-0.10	6 (1%) 65 56	23, 38, 83, 104	0
1	D	308/329 (93%)	0.15	14 (4%) 33 23	26, 48, 115, 133	0
1	E	308/329 (93%)	0.07	14 (4%) 33 23	31, 49, 107, 124	0
1	F	301/329 (91%)	0.35	31 (10%) 6 3	30, 56, 116, 134	0
All	All	1839/1974 (93%)	0.04	80 (4%) 34 24	21, 42, 104, 134	0

All (80) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	249	LYS	5.6
1	F	260	GLY	5.3
1	B	250	ASN	5.1
1	F	253	PHE	5.0
1	B	248	ALA	4.4
1	E	250	ASN	4.4
1	F	254	GLU	4.3
1	C	248	ALA	4.2
1	F	319	CYS	3.9
1	D	250	ASN	3.7
1	F	257	LEU	3.7
1	F	310	HIS	3.7
1	C	250	ASN	3.7
1	E	245	HIS	3.5
1	F	318	TYR	3.5
1	E	323	LEU	3.5
1	F	326	ALA	3.4
1	F	323	LEU	3.4
1	D	319	CYS	3.4

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Mol	Chain	Res	Type	RSRZ
1	C	323	LEU	3.4
1	F	316	ILE	3.3
1	B	245	HIS	3.3
1	F	308	ARG	3.3
1	D	322	PRO	3.3
1	C	322	PRO	3.3
1	D	245	HIS	3.2
1	E	252	THR	3.2
1	F	322	PRO	3.2
1	E	317	THR	3.2
1	B	363	HIS	3.2
1	A	250	ASN	3.1
1	E	312	PRO	3.1
1	F	245	HIS	3.1
1	E	313	ASP	3.1
1	E	249	LYS	3.1
1	F	311	ALA	3.0
1	E	322	PRO	2.8
1	F	314	PHE	2.8
1	D	310	HIS	2.7
1	F	313	ASP	2.7
1	A	245	HIS	2.7
1	F	301	GLU	2.7
1	F	309	LYS	2.7
1	B	251	GLY	2.7
1	D	363	HIS	2.7
1	F	320	VAL	2.6
1	D	318	TYR	2.6
1	B	313	ASP	2.5
1	B	323	LEU	2.5
1	D	307	LEU	2.5
1	A	363	HIS	2.5
1	C	313	ASP	2.5
1	B	246	ALA	2.5
1	F	284	GLU	2.4
1	D	320	VAL	2.4
1	F	285	ARG	2.4
1	D	257	LEU	2.4
1	F	261	THR	2.4
1	F	255	CYS	2.4
1	F	307	LEU	2.3
1	E	319	CYS	2.3

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Mol	Chain	Res	Type	RSRZ
1	F	353	PRO	2.3
1	F	360	LEU	2.3
1	D	258	GLU	2.3
1	E	139	ASN	2.2
1	C	363	HIS	2.2
1	E	318	TYR	2.2
1	B	318	TYR	2.2
1	F	305	GLN	2.2
1	A	251	GLY	2.1
1	E	362	PHE	2.1
1	D	357	ALA	2.1
1	F	315	GLN	2.1
1	F	361	ASN	2.1
1	D	313	ASP	2.1
1	E	255	CYS	2.1
1	D	362	PHE	2.1
1	F	230	SER	2.0
1	F	252	THR	2.0
1	B	247	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 monosaccharides 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.

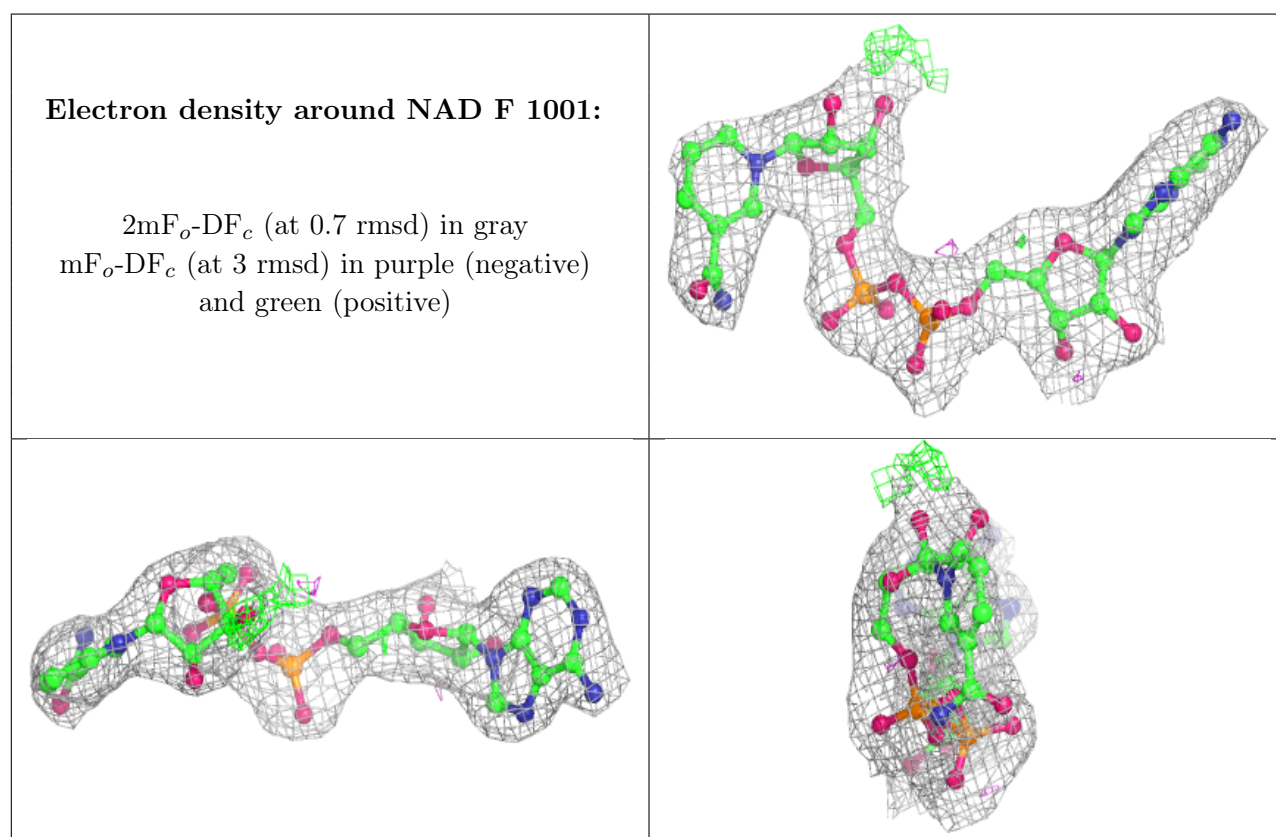
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	GOL	C	1002	6/6	0.89	0.29	54,55,55,55	0
3	GOL	A	1002	6/6	0.90	0.37	42,43,43,43	0
3	GOL	B	1002	6/6	0.91	0.29	41,43,44,44	0
2	NAD	F	1001	44/44	0.95	0.19	34,45,59,60	0

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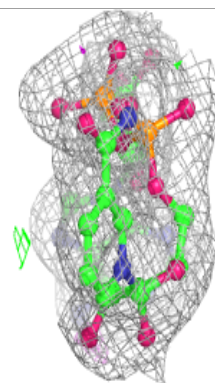
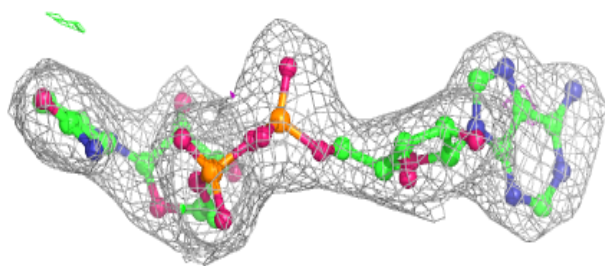
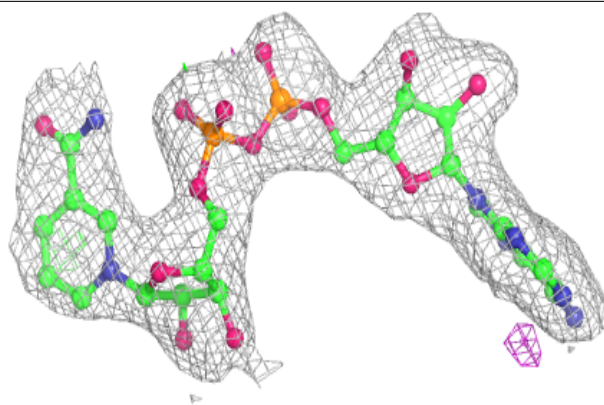
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	NAD	E	1001	44/44	0.96	0.16	25,34,40,41	0
2	NAD	D	1001	44/44	0.97	0.15	26,33,40,41	0
2	NAD	B	1001	44/44	0.97	0.16	28,31,33,33	0
2	NAD	C	1001	44/44	0.97	0.15	19,23,33,35	0
2	NAD	A	1001	44/44	0.98	0.16	19,22,28,28	0

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.

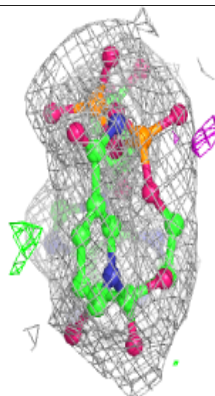
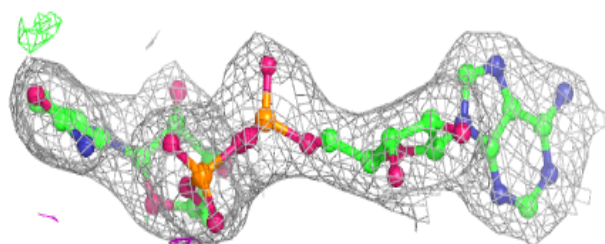
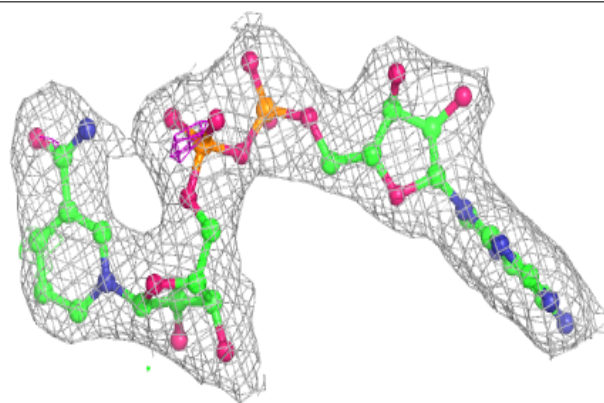


Electron density around NAD E 1001:

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

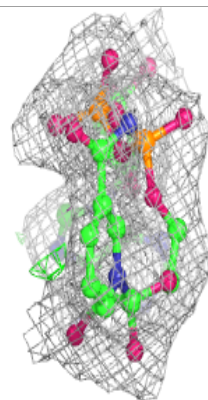
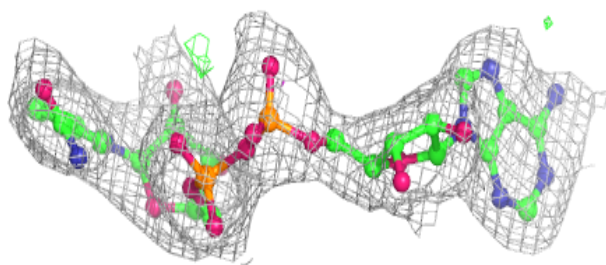
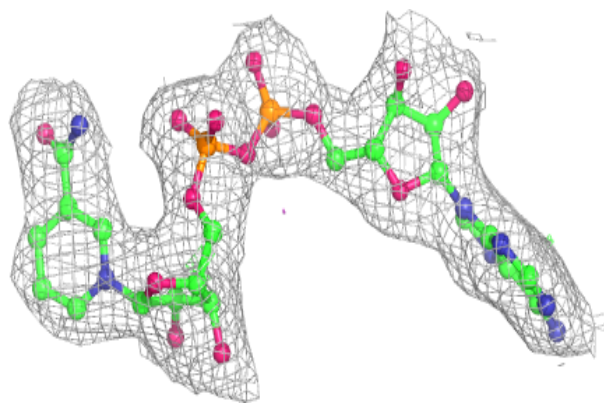
**Electron density around NAD D 1001:**

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

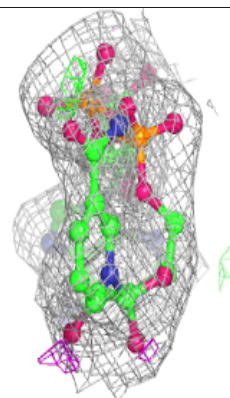
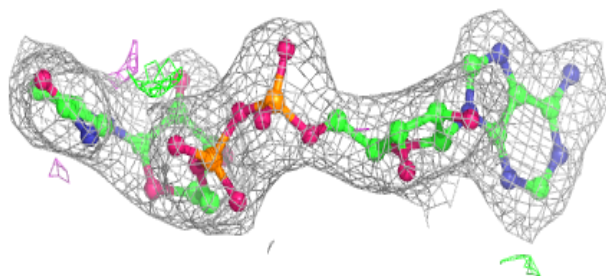
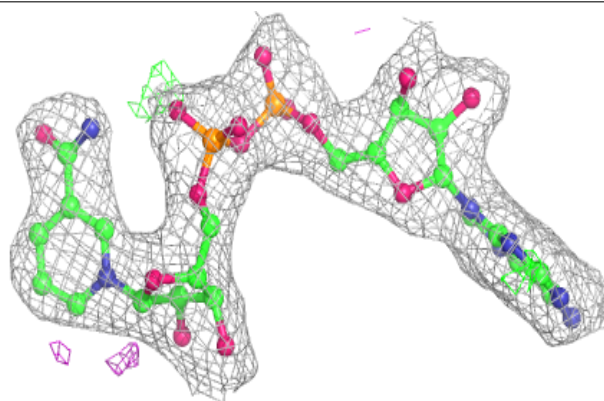


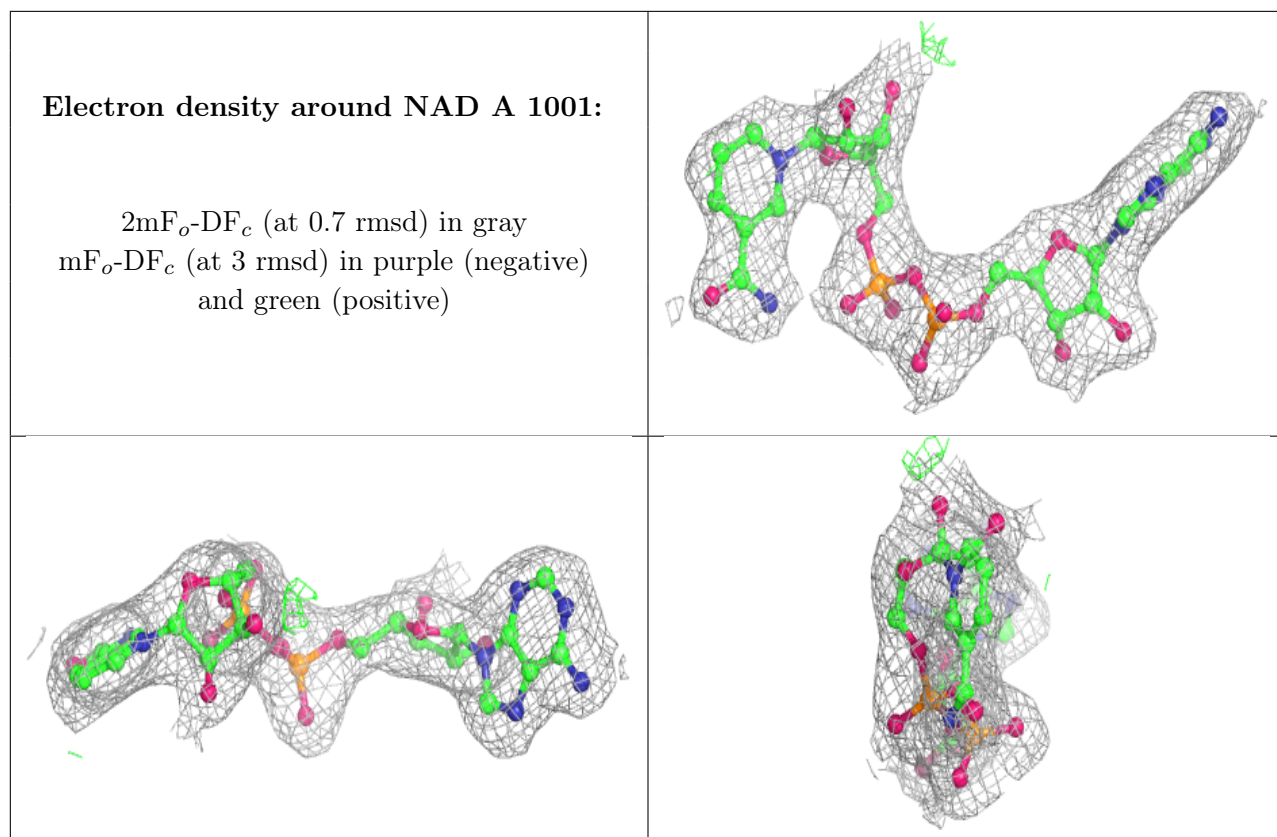
Electron density around NAD B 1001:

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

**Electron density around NAD C 1001:**

$2mF_o-DF_c$ (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.