



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 10:38 AM UTC

PDB ID : 4MIY / pdb_00004miy
Title : Crystal Structure of myo-inositol dehydrogenase from *Lactobacillus casei* in complex with NAD and myo-inositol
Authors : Bertwistle, D.; Sanders, D.A.R.; Palmer, D.R.J.
Deposited on : 2013-09-02
Resolution : 1.42 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

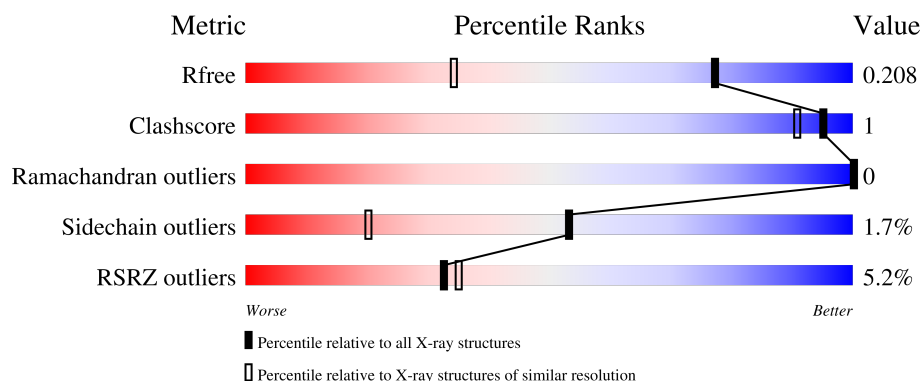
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.42 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}	180053	4041 (1.44-1.40)
Clashscore	190562	4154 (1.44-1.40)
Ramachandran outliers	187476	4083 (1.44-1.40)
Sidechain outliers	187428	4082 (1.44-1.40)
RSRZ outliers	180081	4039 (1.44-1.40)

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	339	14% 90% 10%
1	B	339	3% 91% 9%
1	C	339	2% 89% 11%
1	D	339	% 86% 14%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 12059 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.

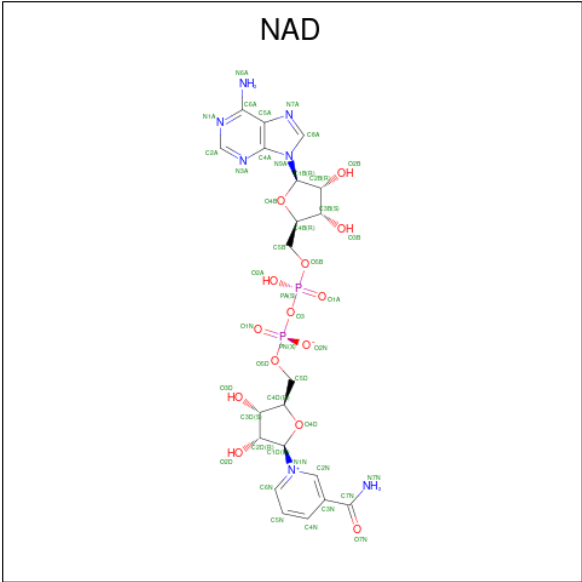
- Molecule 1 is a protein called Inositol 2-dehydrogenase/D-chiro-inositol 3-dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	339	Total	C	N	O	S	4	1	0
			2627	1660	447	514	6			
1	B	339	Total	C	N	O	S	6	3	0
			2646	1671	454	515	6			
1	C	339	Total	C	N	O	S	7	6	0
			2653	1678	450	518	7			
1	D	339	Total	C	N	O	S	1	4	0
			2647	1673	453	515	6			

There are 4 discrepancies between the modelled and reference sequences:

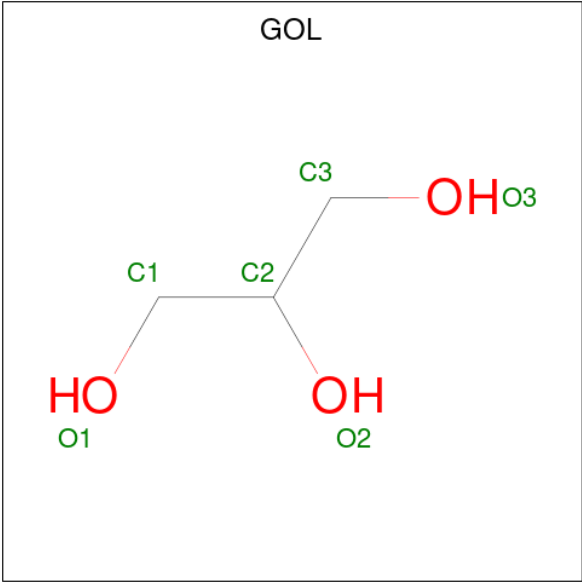
Chain	Residue	Modelled	Actual	Comment	Reference
A	292	GLU	GLN	conflict	UNP B3W8L3
B	292	GLU	GLN	conflict	UNP B3W8L3
C	292	GLU	GLN	conflict	UNP B3W8L3
D	292	GLU	GLN	conflict	UNP B3W8L3

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



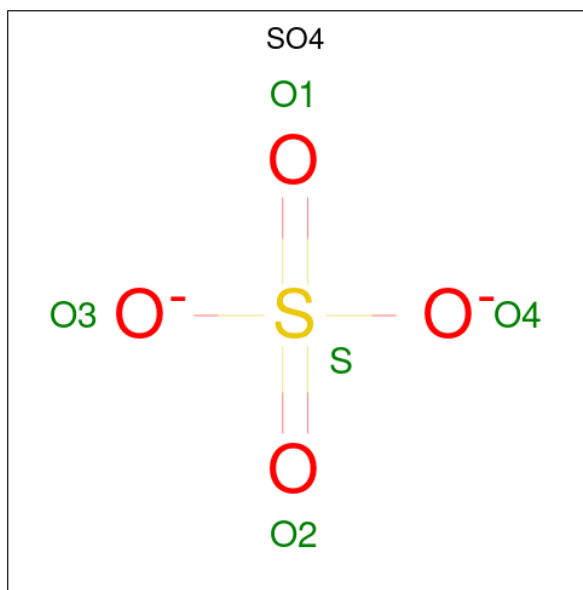
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	C	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	D	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



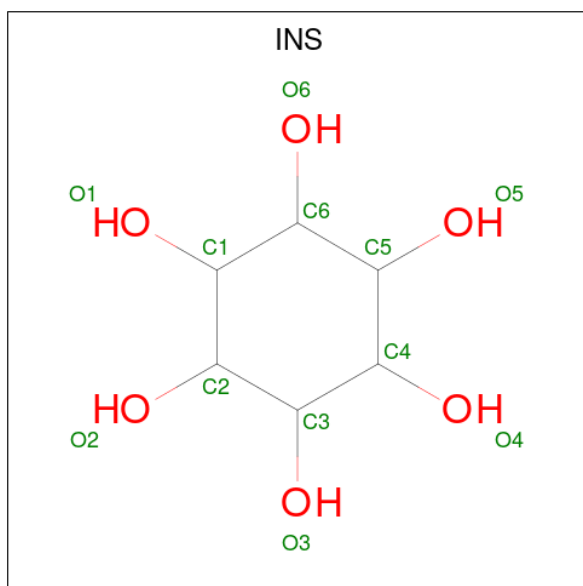
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	B	1	Total C O 6 3 3	0	0
3	B	1	Total C O 6 3 3	0	0
3	C	1	Total C O 6 3 3	0	0
3	C	1	Total C O 6 3 3	0	0
3	C	1	Total C O 6 3 3	0	0
3	C	1	Total C O 6 3 3	0	0
3	D	1	Total C O 6 3 3	0	0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

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

- Molecule 5 is 1,2,3,4,5,6-HEXAHYDROXY-CYCLOHEXANE (CCD ID: INS) (formula: $C_6H_{12}O_6$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	D	1	Total C O 12 6 6	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	270	Total O 270 270	0	0

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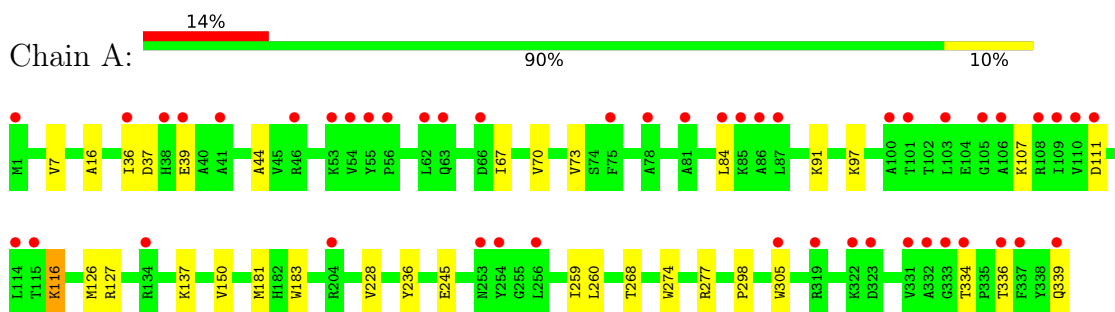
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	291	Total 291	O 291	0	0
6	C	287	Total 287	O 287	0	0
6	D	343	Total 343	O 343	0	0

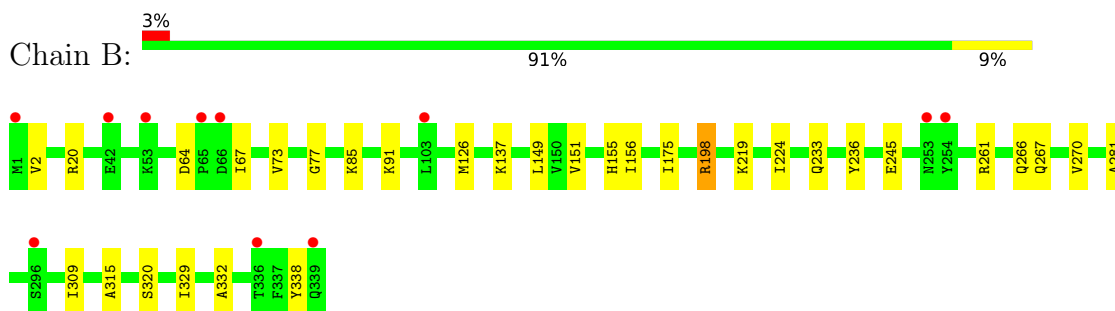
3 Residue-property plots [i](#)

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.

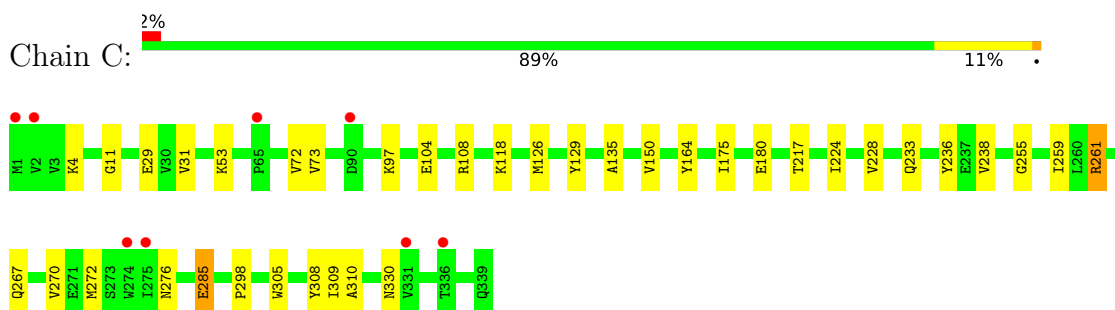
- Molecule 1: Inositol 2-dehydrogenase/D-chiro-inositol 3-dehydrogenase



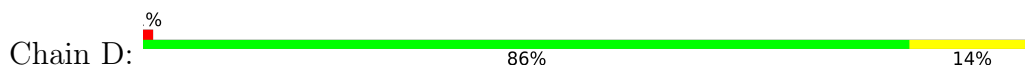
- Molecule 1: Inositol 2-dehydrogenase/D-chiro-inositol 3-dehydrogenase

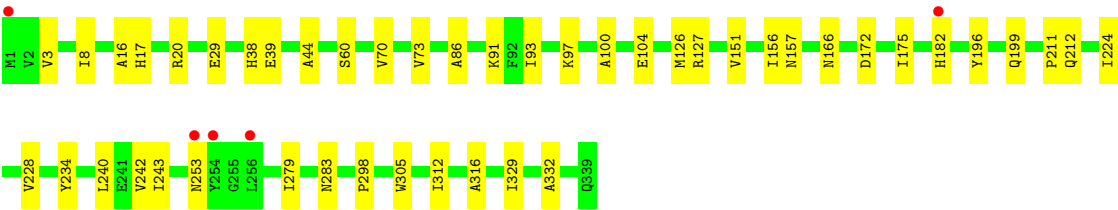


- Molecule 1: Inositol 2-dehydrogenase/D-chiro-inositol 3-dehydrogenase



- Molecule 1: Inositol 2-dehydrogenase/D-chiro-inositol 3-dehydrogenase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	106.71Å 110.62Å 127.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.06 – 1.42 48.06 – 1.42	Depositor EDS
% Data completeness (in resolution range)	99.2 (48.06-1.42) 99.2 (48.06-1.42)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.89 (at 1.42Å)	Xtriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, R_{free}	0.186 , 0.207 0.186 , 0.208	Depositor DCC
R_{free} test set	14114 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	17.6	Xtriage
Anisotropy	0.202	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 36.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.009 for k,h,-l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	12059	wwPDB-VP
Average B, all atoms (Å ²)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.65% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, NAD, GOL, INS

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	1.76	17/2677 (0.6%)	0.91	2/3645 (0.1%)
1	B	1.78	21/2699 (0.8%)	0.88	2/3673 (0.1%)
1	C	1.76	25/2715 (0.9%)	0.87	1/3694 (0.0%)
1	D	1.80	36/2707 (1.3%)	0.86	0/3685
All	All	1.77	99/10798 (0.9%)	0.88	5/14697 (0.0%)

All (99) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	298	PRO	C-O	-9.07	1.17	1.25
1	B	338	TYR	C-N	-8.15	1.22	1.33
1	D	224	ILE	C-O	-7.64	1.15	1.24
1	D	3	VAL	C-O	-7.23	1.16	1.24
1	A	298	PRO	C-O	-6.99	1.19	1.25
1	C	259	ILE	C-O	-6.60	1.17	1.24
1	A	228	VAL	C-O	-6.55	1.17	1.24
1	C	228	VAL	C-O	-6.47	1.17	1.24
1	A	183	TRP	C-O	-6.44	1.16	1.24
1	A	277	ARG	C-O	-6.33	1.16	1.24
1	B	270	VAL	C-O	-6.32	1.17	1.24
1	C	270	VAL	C-O	-6.32	1.17	1.24
1	D	151	VAL	C-O	-6.25	1.17	1.24
1	B	329	ILE	C-O	-6.08	1.17	1.24
1	D	60	SER	C-O	-5.99	1.17	1.24
1	D	91	LYS	C-O	-5.95	1.16	1.23
1	D	29	GLU	C-O	-5.93	1.17	1.23
1	B	320	SER	C-O	-5.80	1.16	1.24
1	A	44	ALA	CA-CB	-5.80	1.44	1.53
1	A	150	VAL	C-O	-5.78	1.18	1.24
1	D	234	TYR	C-O	-5.73	1.16	1.24
1	C	180	GLU	C-O	-5.73	1.17	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	228	VAL	C-O	-5.72	1.18	1.24
1	D	157	ASN	C-O	-5.68	1.16	1.24
1	A	36	ILE	CA-CB	-5.65	1.47	1.54
1	B	156	ILE	C-O	-5.65	1.18	1.24
1	A	7	VAL	C-O	-5.59	1.18	1.24
1	C	298	PRO	C-O	-5.58	1.20	1.25
1	D	243	ILE	C-O	-5.58	1.17	1.24
1	D	93	ILE	C-O	-5.58	1.18	1.24
1	C	330	ASN	CA-C	-5.55	1.46	1.53
1	C	224	ILE	C-O	-5.53	1.18	1.24
1	D	196	TYR	C-O	-5.47	1.19	1.24
1	B	224	ILE	C-O	-5.46	1.18	1.24
1	A	259	ILE	C-O	-5.45	1.18	1.24
1	C	305	TRP	C-O	-5.44	1.17	1.24
1	D	242	VAL	C-O	-5.40	1.18	1.24
1	C	150	VAL	C-O	-5.39	1.18	1.24
1	D	240	LEU	C-O	-5.38	1.17	1.23
1	C	233	GLN	C-O	-5.38	1.17	1.24
1	C	72	VAL	C-O	-5.34	1.18	1.24
1	D	332	ALA	CA-CB	-5.33	1.44	1.53
1	C	308	TYR	C-O	-5.32	1.18	1.24
1	C	238	VAL	C-O	-5.31	1.18	1.24
1	B	233	GLN	C-O	-5.30	1.17	1.24
1	D	100	ALA	C-O	-5.30	1.17	1.23
1	C	11	GLY	C-O	-5.29	1.17	1.24
1	C	276	ASN	N-CA	-5.29	1.39	1.46
1	A	268	THR	C-O	-5.25	1.17	1.23
1	D	156	ILE	C-O	-5.24	1.18	1.24
1	A	245	GLU	C-O	-5.23	1.18	1.24
1	B	77	GLY	C-O	-5.23	1.18	1.24
1	B	245	GLU	C-O	-5.22	1.18	1.24
1	D	283	ASN	C-O	-5.21	1.18	1.24
1	D	86	ALA	C-O	-5.21	1.17	1.24
1	B	175	ILE	C-O	-5.21	1.17	1.24
1	D	20	ARG	C-O	-5.21	1.18	1.24
1	B	137	LYS	C-O	-5.20	1.18	1.24
1	A	260	LEU	C-O	-5.18	1.17	1.24
1	B	281	ALA	C-O	-5.17	1.18	1.24
1	D	70	VAL	C-O	-5.17	1.18	1.24
1	B	236	TYR	C-O	-5.17	1.17	1.24
1	A	70	VAL	C-O	-5.16	1.18	1.24
1	C	310	ALA	C-O	-5.16	1.18	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	198	ARG	CB-CG	-5.16	1.36	1.52
1	C	29	GLU	C-O	-5.15	1.18	1.23
1	C	175	ILE	C-O	-5.15	1.18	1.24
1	C	217	THR	C-O	-5.15	1.17	1.23
1	D	17	HIS	C-O	-5.13	1.18	1.24
1	D	166	ASN	C-O	-5.13	1.18	1.24
1	B	2	VAL	CA-CB	-5.12	1.48	1.54
1	B	332	ALA	CA-CB	-5.12	1.45	1.53
1	C	236	TYR	C-O	-5.12	1.17	1.24
1	C	164	TYR	C-O	-5.11	1.17	1.24
1	D	16	ALA	C-O	-5.09	1.18	1.24
1	D	279	ILE	C-O	-5.09	1.18	1.24
1	D	8	ILE	C-O	-5.09	1.18	1.24
1	D	316	ALA	C-O	-5.08	1.18	1.24
1	D	44	ALA	C-O	-5.08	1.18	1.24
1	B	261	ARG	C-O	-5.07	1.18	1.24
1	D	329	ILE	C-O	-5.07	1.18	1.24
1	C	309	ILE	C-O	-5.06	1.18	1.24
1	B	155	HIS	C-O	-5.06	1.18	1.24
1	A	84	LEU	C-O	-5.05	1.17	1.24
1	D	199	GLN	C-O	-5.05	1.17	1.23
1	A	137	LYS	C-O	-5.05	1.18	1.24
1	C	255	GLY	C-O	-5.05	1.19	1.23
1	D	175	ILE	C-O	-5.05	1.18	1.24
1	D	212	GLN	C-O	-5.05	1.17	1.23
1	D	312	ILE	C-O	-5.05	1.18	1.24
1	D	305	TRP	C-O	-5.04	1.18	1.24
1	B	315	ALA	C-O	-5.04	1.18	1.24
1	C	261	ARG	C-O	-5.04	1.17	1.24
1	D	127	ARG	C-O	-5.04	1.18	1.24
1	A	127	ARG	C-O	-5.02	1.17	1.24
1	A	16	ALA	C-O	-5.01	1.18	1.24
1	B	309	ILE	C-O	-5.01	1.18	1.24
1	B	151	VAL	C-O	-5.01	1.18	1.24
1	C	135	ALA	CA-CB	-5.01	1.45	1.53

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	2	VAL	N-CA-C	6.14	117.34	109.30
1	A	298	PRO	O-C-N	5.79	123.97	121.31
1	B	267	GLN	N-CA-C	5.49	117.61	108.99

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	181	MET	N-CA-C	5.33	117.17	111.36
1	C	267	GLN	N-CA-C	5.28	117.21	109.24

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2627	0	2620	8	0
1	B	2646	0	2645	7	0
1	C	2653	0	2659	4	0
1	D	2647	0	2646	4	0
2	A	44	0	26	0	0
2	B	44	0	26	0	0
2	C	44	0	26	0	0
2	D	44	0	26	2	0
3	A	18	0	24	0	0
3	B	12	0	16	1	0
3	C	24	0	32	0	0
3	D	18	0	24	3	0
4	A	10	0	0	0	0
4	B	10	0	0	1	0
4	C	10	0	0	0	0
4	D	5	0	0	1	0
5	D	12	0	12	2	0
6	A	270	0	0	0	0
6	B	291	0	0	2	0
6	C	287	0	0	0	0
6	D	343	0	0	3	0
All	All	12059	0	10782	26	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 1.

All (26) 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:B:198:ARG:NH2	4:B:405:SO4:O4	2.23	0.70
1:A:67:ILE:HB	1:A:91:LYS:HE3	1.83	0.60
1:C:104:GLU:O	1:C:108:ARG:HG3	2.02	0.60
1:B:67:ILE:HB	1:B:91:LYS:HE3	1.85	0.58
3:D:404:GOL:H2	4:D:406:SO4:O4	2.04	0.58
1:B:85:LYS:HE3	6:B:673:HOH:O	2.04	0.57
2:D:401:NAD:C4N	5:D:402:INS:H2	2.35	0.55
1:D:104:GLU:HG2	6:D:756:HOH:O	2.06	0.54
1:A:37:ASP:OD1	1:A:39:GLU:HB3	2.08	0.53
3:D:405:GOL:H12	6:D:734:HOH:O	2.07	0.53
1:A:336:THR:HG23	1:A:339:GLN:OE1	2.11	0.51
1:B:266:GLN:HG2	3:B:403:GOL:H11	1.93	0.50
1:A:305:TRP:CD1	1:A:334:THR:HG23	2.47	0.49
3:D:404:GOL:H31	6:D:805:HOH:O	2.12	0.49
1:C:129:TYR:CD2	1:C:285:GLU:HB2	2.49	0.47
1:A:116:LYS:HA	1:A:116:LYS:HD2	1.71	0.46
1:C:261:ARG:NH2	1:D:253:ASN:HD21	2.14	0.45
1:D:38[A]:HIS:CE1	1:D:39:GLU:HG2	2.52	0.45
1:A:107:LYS:HE3	1:A:111:ASP:OD1	2.17	0.44
1:A:236:TYR:CE1	1:A:274:TRP:HB3	2.53	0.43
1:B:64:ASP:HB3	1:B:67:ILE:HD12	2.00	0.43
2:D:401:NAD:C3N	5:D:402:INS:H2	2.48	0.43
1:B:20:ARG:NH1	6:B:701:HOH:O	2.47	0.43
1:C:4[B]:LYS:HD2	1:C:31:VAL:HG11	2.01	0.43
1:A:107:LYS:HE3	1:A:111:ASP:CG	2.46	0.41
1:B:149:LEU:HD13	1:D:211:PRO:HD3	2.03	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	338/339 (100%)	331 (98%)	7 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	340/339 (100%)	332 (98%)	8 (2%)	0	100	100
1	C	343/339 (101%)	336 (98%)	7 (2%)	0	100	100
1	D	341/339 (101%)	334 (98%)	7 (2%)	0	100	100
All	All	1362/1356 (100%)	1333 (98%)	29 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	283/282 (100%)	279 (99%)	4 (1%)	59	27
1	B	285/282 (101%)	282 (99%)	3 (1%)	65	35
1	C	288/282 (102%)	280 (97%)	8 (3%)	38	8
1	D	286/282 (101%)	281 (98%)	5 (2%)	53	20
All	All	1142/1128 (101%)	1122 (98%)	20 (2%)	53	18

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	73	VAL
1	A	97	LYS
1	A	116	LYS
1	A	126	MET
1	B	73	VAL
1	B	126	MET
1	B	219	LYS
1	C	53	LYS
1	C	73	VAL
1	C	97	LYS
1	C	118	LYS
1	C	126	MET
1	C	272[A]	MET

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Mol	Chain	Res	Type
1	C	272[B]	MET
1	C	285	GLU
1	D	73	VAL
1	D	97	LYS
1	D	126	MET
1	D	172	ASP
1	D	182	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	38	HIS
1	A	233	GLN
1	A	266	GLN
1	B	131	GLN
1	B	233	GLN
1	B	265	ASN
1	C	159	ASN
1	C	233	GLN
1	C	318	ASN
1	D	131	GLN
1	D	157	ASN
1	D	253	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

24 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	SO4	A	406	-	4,4,4	0.59	0	6,6,6	0.22	0
4	SO4	B	405	-	4,4,4	0.62	0	6,6,6	0.36	0
3	GOL	D	405	-	5,5,5	0.81	0	5,5,5	1.20	0
2	NAD	D	401	-	46,48,48	1.68	11 (23%)	64,73,73	1.57	12 (18%)
3	GOL	C	405	-	5,5,5	0.74	0	5,5,5	1.54	1 (20%)
3	GOL	D	403	-	5,5,5	0.62	0	5,5,5	0.46	0
3	GOL	D	404	-	5,5,5	1.08	1 (20%)	5,5,5	0.53	0
4	SO4	C	407	-	4,4,4	0.41	0	6,6,6	0.58	0
3	GOL	C	402	-	5,5,5	0.48	0	5,5,5	0.82	0
4	SO4	B	404	-	4,4,4	0.54	0	6,6,6	0.78	0
3	GOL	B	402	-	5,5,5	0.72	0	5,5,5	1.62	2 (40%)
4	SO4	D	406	-	4,4,4	0.76	0	6,6,6	0.35	0
3	GOL	A	404	-	5,5,5	0.86	0	5,5,5	0.61	0
5	INS	D	402	-	12,12,12	0.98	0	18,18,18	0.93	0
4	SO4	C	406	-	4,4,4	0.58	0	6,6,6	0.33	0
3	GOL	C	404	-	5,5,5	0.78	0	5,5,5	0.95	0
4	SO4	A	405	-	4,4,4	0.80	0	6,6,6	0.58	0
2	NAD	B	401	-	46,48,48	1.58	7 (15%)	64,73,73	1.74	16 (25%)
2	NAD	A	401	-	46,48,48	1.90	11 (23%)	64,73,73	1.74	15 (23%)
3	GOL	A	403	-	5,5,5	0.88	0	5,5,5	0.54	0
2	NAD	C	401	-	46,48,48	1.49	7 (15%)	64,73,73	1.76	14 (21%)
3	GOL	A	402	-	5,5,5	1.15	1 (20%)	5,5,5	1.07	1 (20%)
3	GOL	C	403	-	5,5,5	0.72	0	5,5,5	0.65	0
3	GOL	B	403	-	5,5,5	0.61	0	5,5,5	1.27	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	D	401	-	-	3/30/62/62	0/5/5/5
3	GOL	C	405	-	-	2/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	B	402	-	-	2/4/4/4	-
2	NAD	B	401	-	-	2/30/62/62	0/5/5/5
3	GOL	C	404	-	-	0/4/4/4	-
3	GOL	D	403	-	-	0/4/4/4	-
2	NAD	A	401	-	-	4/30/62/62	0/5/5/5
3	GOL	D	405	-	-	2/4/4/4	-
3	GOL	A	404	-	-	1/4/4/4	-
3	GOL	A	403	-	-	0/4/4/4	-
3	GOL	D	404	-	-	4/4/4/4	-
2	NAD	C	401	-	-	1/30/62/62	0/5/5/5
5	INS	D	402	-	-	-	0/1/1/1
3	GOL	A	402	-	-	2/4/4/4	-
3	GOL	C	403	-	-	2/4/4/4	-
3	GOL	B	403	-	-	4/4/4/4	-
3	GOL	C	402	-	-	2/4/4/4	-

All (38) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	401	NAD	C4A-N9A	-4.42	1.28	1.37
2	A	401	NAD	C8A-N9A	-4.40	1.30	1.37
2	C	401	NAD	C5A-N7A	-4.33	1.31	1.39
2	A	401	NAD	PN-O3	4.32	1.64	1.59
2	B	401	NAD	C8A-N9A	-4.10	1.30	1.37
2	D	401	NAD	C5A-N7A	-3.96	1.31	1.39
2	B	401	NAD	C4A-N9A	-3.85	1.29	1.37
2	A	401	NAD	C5A-N7A	-3.70	1.32	1.39
2	B	401	NAD	C5A-N7A	-3.64	1.32	1.39
2	D	401	NAD	O7N-C7N	-3.55	1.17	1.24
2	A	401	NAD	PA-O2A	-3.49	1.39	1.55
2	A	401	NAD	C4A-N9A	-3.40	1.30	1.37
2	B	401	NAD	PA-O3	3.16	1.62	1.59
2	B	401	NAD	O7N-C7N	-3.08	1.18	1.24
2	C	401	NAD	C4A-N9A	-3.03	1.31	1.37
2	A	401	NAD	C2A-N1A	-3.02	1.28	1.33
2	A	401	NAD	C7N-N7N	-2.93	1.27	1.33
2	A	401	NAD	PN-O2N	-2.87	1.42	1.55
2	C	401	NAD	O7N-C7N	-2.78	1.19	1.24
2	C	401	NAD	C5A-C4A	2.70	1.43	1.39
2	D	401	NAD	C8A-N9A	-2.69	1.33	1.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	401	NAD	C2A-N3A	-2.63	1.29	1.33
2	C	401	NAD	PN-O2N	-2.59	1.43	1.55
2	B	401	NAD	PA-O1A	-2.54	1.42	1.50
2	A	401	NAD	O7N-C7N	-2.53	1.19	1.24
2	D	401	NAD	C2A-N1A	-2.50	1.29	1.33
2	C	401	NAD	C8A-N9A	-2.48	1.33	1.37
2	A	401	NAD	C6N-N1N	-2.40	1.29	1.35
2	D	401	NAD	C6A-N1A	-2.38	1.29	1.35
2	C	401	NAD	O4D-C4D	-2.37	1.39	1.45
2	A	401	NAD	O3B-C3B	-2.31	1.37	1.43
2	D	401	NAD	C4A-N3A	-2.29	1.30	1.34
3	A	402	GOL	O2-C2	-2.21	1.36	1.43
2	D	401	NAD	PA-O2A	-2.16	1.45	1.55
2	D	401	NAD	C3N-C7N	-2.09	1.47	1.50
2	D	401	NAD	O4B-C4B	-2.07	1.40	1.45
3	D	404	GOL	O2-C2	-2.07	1.37	1.43
2	B	401	NAD	C5A-C4A	2.00	1.42	1.39

All (61) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	401	NAD	C5A-C4A-N3A	-5.59	119.02	126.72
2	A	401	NAD	C5A-C4A-N3A	-4.96	119.88	126.72
2	D	401	NAD	C5A-C4A-N3A	-4.80	120.11	126.72
2	B	401	NAD	C4A-C5A-N7A	-4.76	105.14	110.58
2	C	401	NAD	N3A-C4A-N9A	4.69	135.14	127.17
2	B	401	NAD	C5A-C4A-N3A	-4.66	120.30	126.72
2	D	401	NAD	C4A-C5A-N7A	-3.97	106.05	110.58
2	A	401	NAD	C4A-C5A-N7A	-3.90	106.12	110.58
2	A	401	NAD	N3A-C2A-N1A	-3.85	122.75	128.58
2	C	401	NAD	N3A-C2A-N1A	-3.75	122.91	128.58
2	C	401	NAD	C2A-N3A-C4A	3.64	120.71	111.83
2	C	401	NAD	C4A-C5A-N7A	-3.52	106.56	110.58
2	C	401	NAD	C5A-N7A-C8A	3.52	108.98	103.45
2	A	401	NAD	C2A-N3A-C4A	3.49	120.34	111.83
2	B	401	NAD	C6N-N1N-C2N	-3.40	118.98	121.88
2	A	401	NAD	O4B-C1B-C2B	-3.37	99.41	106.62
2	C	401	NAD	C4A-N9A-C8A	3.29	109.19	105.74
2	C	401	NAD	N9A-C8A-N7A	-3.19	109.41	113.94
2	A	401	NAD	N3A-C4A-N9A	3.09	132.43	127.17
2	B	401	NAD	N3A-C4A-N9A	3.09	132.42	127.17
2	D	401	NAD	C6N-N1N-C2N	-3.07	119.26	121.88

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	NAD	C5A-N7A-C8A	3.06	108.25	103.45
2	A	401	NAD	C5N-C4N-C3N	-3.03	117.38	120.36
2	A	401	NAD	C2A-N1A-C6A	3.02	123.69	118.73
2	D	401	NAD	N3A-C4A-N9A	2.97	132.22	127.17
2	B	401	NAD	O3-PA-O1A	-2.96	101.81	110.70
2	B	401	NAD	O4B-C1B-C2B	-2.88	100.45	106.62
2	A	401	NAD	C6A-C5A-N7A	2.87	137.62	132.09
2	A	401	NAD	O2A-PA-O3	2.84	114.94	107.27
2	B	401	NAD	N3A-C2A-N1A	-2.78	124.37	128.58
2	B	401	NAD	C4A-N9A-C8A	2.75	108.63	105.74
2	D	401	NAD	O4B-C1B-C2B	-2.72	100.79	106.62
2	B	401	NAD	C5N-C4N-C3N	-2.69	117.72	120.36
2	C	401	NAD	N6A-C6A-N1A	2.68	124.35	118.38
2	B	401	NAD	N6A-C6A-N1A	2.63	124.23	118.38
2	D	401	NAD	C5A-N7A-C8A	2.62	107.57	103.45
2	B	401	NAD	C2A-N3A-C4A	2.60	118.18	111.83
2	D	401	NAD	O7N-C7N-C3N	-2.56	116.47	119.60
2	C	401	NAD	C2A-N1A-C6A	2.55	122.91	118.73
2	D	401	NAD	C5N-C4N-C3N	-2.52	117.88	120.36
2	D	401	NAD	C2A-N3A-C4A	2.51	117.97	111.83
2	A	401	NAD	O3-PA-O1A	-2.48	103.23	110.70
2	D	401	NAD	N6A-C6A-N1A	2.48	123.90	118.38
2	B	401	NAD	C2A-N1A-C6A	2.48	122.80	118.73
2	C	401	NAD	C5N-C4N-C3N	-2.46	117.95	120.36
2	A	401	NAD	C6N-N1N-C2N	-2.43	119.81	121.88
2	D	401	NAD	C6A-C5A-N7A	2.38	136.68	132.09
2	C	401	NAD	O3-PA-O1A	-2.31	103.75	110.70
2	B	401	NAD	N9A-C8A-N7A	-2.29	110.69	113.94
2	A	401	NAD	O2N-PN-O5D	2.29	117.94	107.57
2	B	401	NAD	C6A-C5A-N7A	2.28	136.49	132.09
3	B	402	GOL	C3-C2-C1	-2.27	103.46	111.80
3	B	402	GOL	O1-C1-C2	2.21	120.31	110.38
2	C	401	NAD	C4A-N9A-C1B	-2.19	121.51	126.63
2	B	401	NAD	O2A-PA-O3	2.17	113.14	107.27
2	D	401	NAD	N9A-C8A-N7A	-2.16	110.87	113.94
2	A	401	NAD	O2A-PA-O1A	2.10	122.19	112.44
3	A	402	GOL	C3-C2-C1	-2.09	104.12	111.80
2	A	401	NAD	O2A-PA-O5B	-2.04	98.33	107.57
2	C	401	NAD	C6N-N1N-C2N	-2.03	120.15	121.88
3	C	405	GOL	O2-C2-C1	2.02	117.53	109.18

There are no chirality outliers.

All (31) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	NAD	O4D-C1D-N1N-C6N
2	D	401	NAD	O4D-C1D-N1N-C6N
3	A	402	GOL	O1-C1-C2-C3
3	B	402	GOL	O1-C1-C2-C3
3	B	403	GOL	O1-C1-C2-C3
3	C	405	GOL	O1-C1-C2-O2
3	C	405	GOL	O1-C1-C2-C3
3	D	404	GOL	O1-C1-C2-C3
3	D	404	GOL	C1-C2-C3-O3
3	D	405	GOL	O1-C1-C2-C3
3	D	404	GOL	O1-C1-C2-O2
3	B	403	GOL	C1-C2-C3-O3
3	C	402	GOL	C1-C2-C3-O3
3	C	403	GOL	O1-C1-C2-C3
3	A	402	GOL	O1-C1-C2-O2
3	D	404	GOL	O2-C2-C3-O3
3	B	403	GOL	O2-C2-C3-O3
3	C	402	GOL	O2-C2-C3-O3
3	B	403	GOL	O1-C1-C2-O2
3	C	403	GOL	O1-C1-C2-O2
3	D	405	GOL	O1-C1-C2-O2
3	B	402	GOL	O1-C1-C2-O2
3	A	404	GOL	C1-C2-C3-O3
2	A	401	NAD	O4D-C1D-N1N-C2N
2	D	401	NAD	O4D-C1D-N1N-C2N
2	B	401	NAD	C2B-C1B-N9A-C8A
2	C	401	NAD	C2B-C1B-N9A-C8A
2	A	401	NAD	PA-O3-PN-O2N
2	A	401	NAD	O4B-C4B-C5B-O5B
2	B	401	NAD	O4B-C4B-C5B-O5B
2	D	401	NAD	O4B-C4B-C5B-O5B

There are no ring outliers.

7 monomers are involved in 7 short contacts:

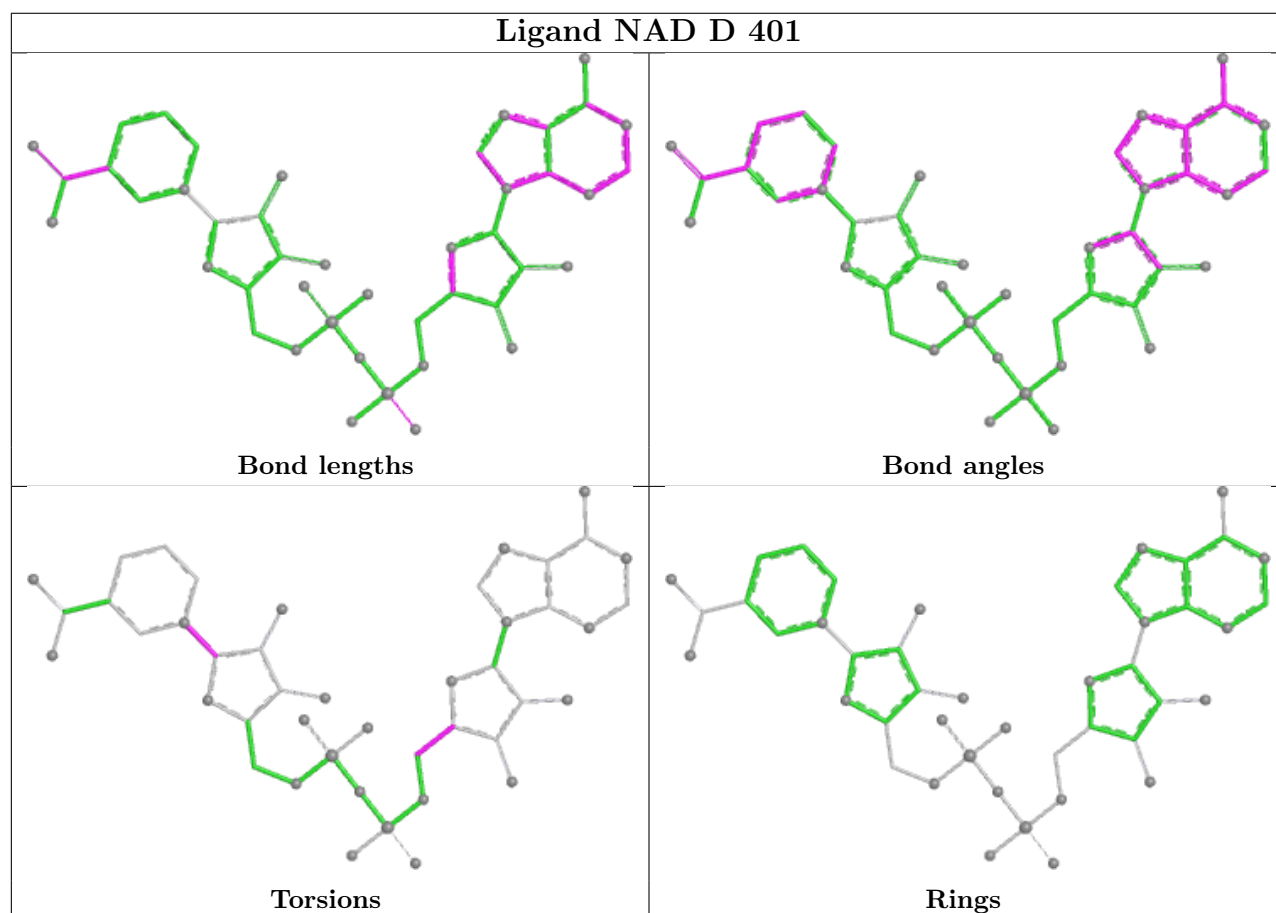
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	405	SO4	1	0
3	D	405	GOL	1	0
2	D	401	NAD	2	0
3	D	404	GOL	2	0
4	D	406	SO4	1	0

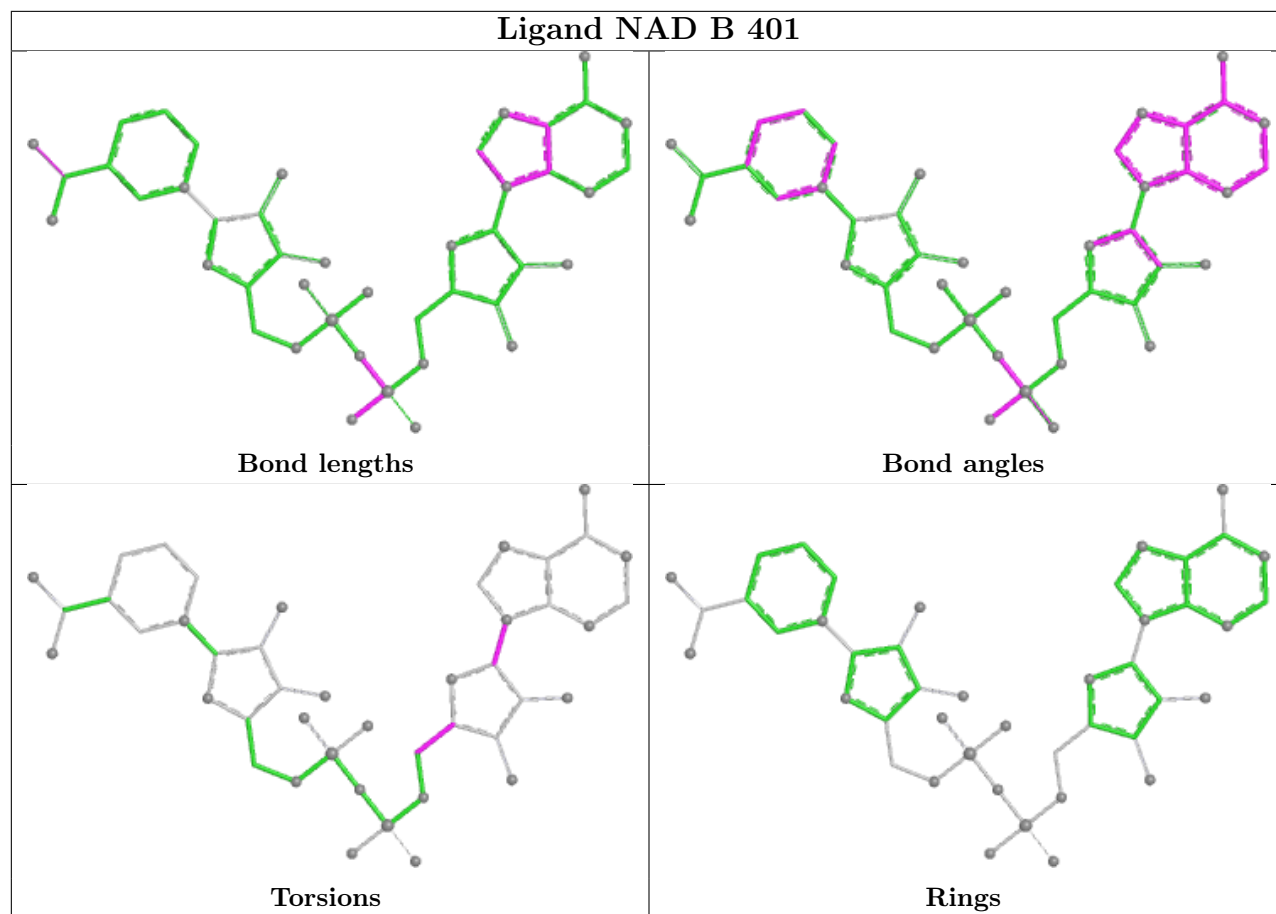
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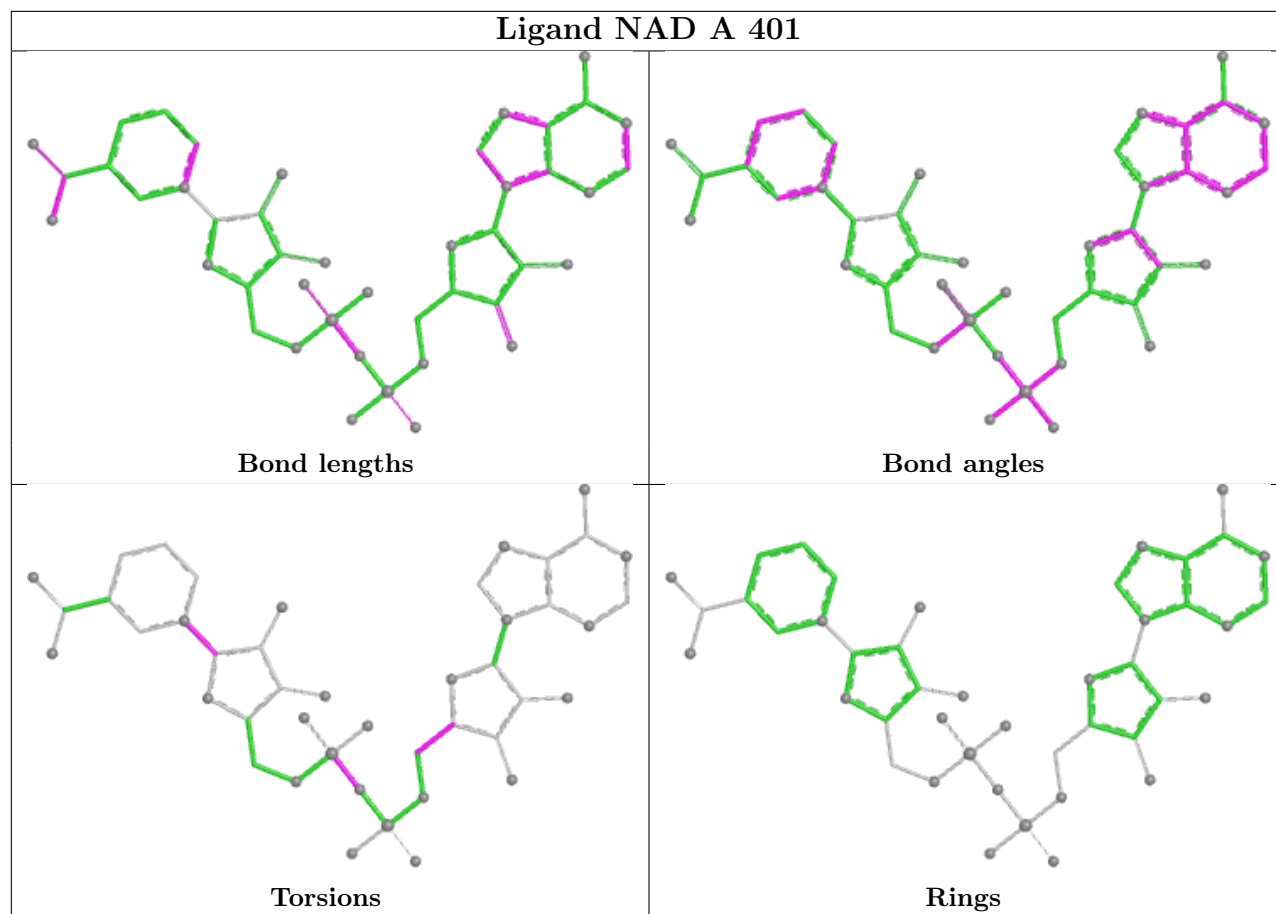
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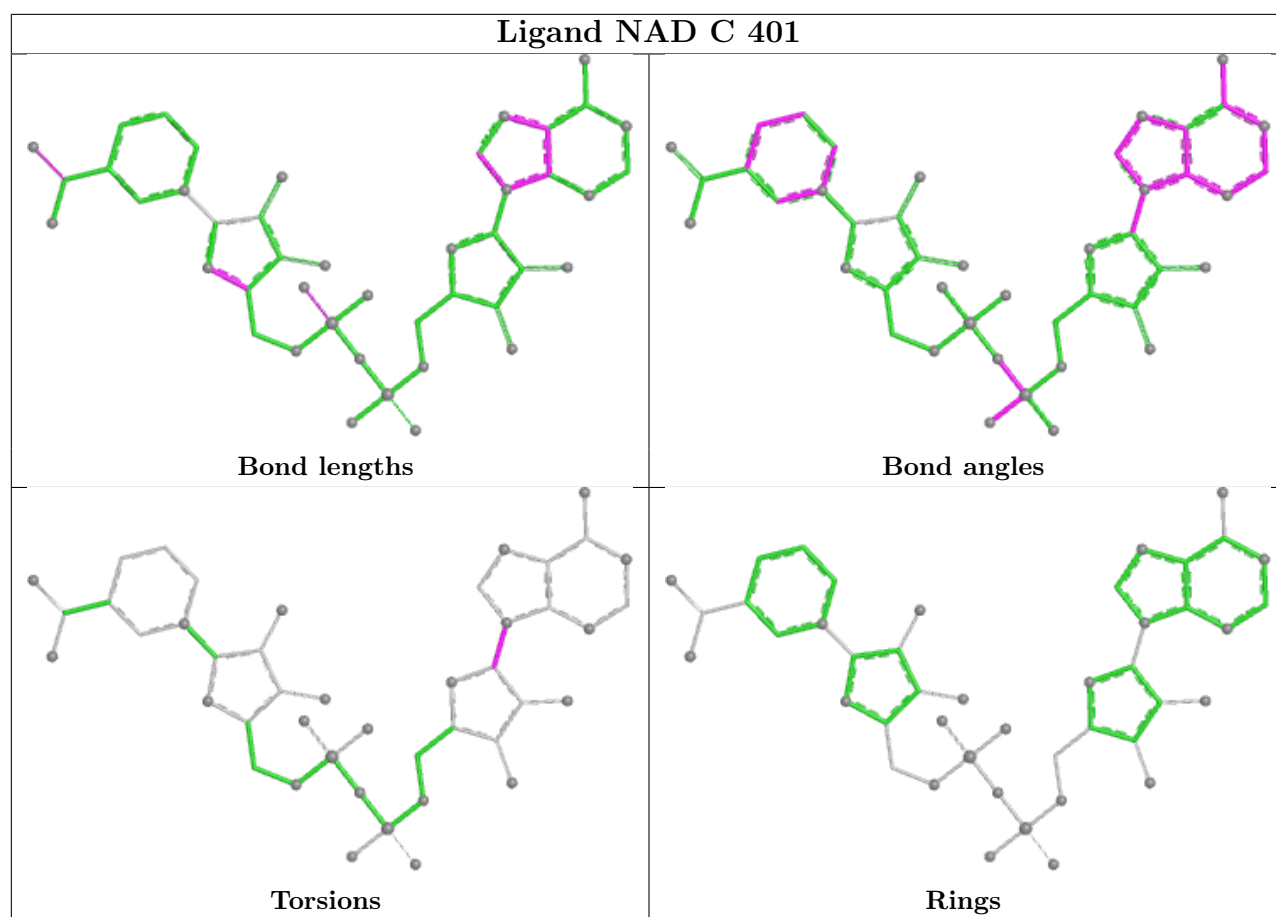
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	402	INS	2	0
3	B	403	GOL	1	0

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, 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	339/339 (100%)	0.61	47 (13%) 6 8	12, 20, 35, 47	31 (9%)
1	B	339/339 (100%)	0.31	11 (3%) 50 53	10, 18, 31, 52	16 (4%)
1	C	339/339 (100%)	0.17	8 (2%) 59 63	9, 18, 29, 37	18 (5%)
1	D	339/339 (100%)	-0.12	5 (1%) 72 76	9, 15, 25, 36	20 (5%)
All	All	1356/1356 (100%)	0.24	71 (5%) 33 35	9, 18, 32, 52	85 (6%)

All (71) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	256	LEU	4.4
1	C	1	MET	4.1
1	A	333	GLY	3.9
1	C	274	TRP	3.8
1	B	1	MET	3.8
1	D	254	TYR	3.7
1	C	275	ILE	3.6
1	B	339	GLN	3.4
1	A	256	LEU	3.4
1	A	336	THR	3.3
1	A	38	HIS	3.2
1	A	334	THR	3.0
1	D	182	HIS	2.9
1	A	56	PRO	2.9
1	A	253	ASN	2.8
1	D	253	ASN	2.8
1	A	53	LYS	2.8
1	A	55	TYR	2.8
1	A	339	GLN	2.7
1	B	65	PRO	2.7
1	A	319	ARG	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	87	LEU	2.6
1	C	90	ASP	2.6
1	A	39	GLU	2.6
1	A	254	TYR	2.5
1	A	81	ALA	2.5
1	B	336	THR	2.5
1	A	1	MET	2.5
1	A	78	ALA	2.5
1	A	100	ALA	2.5
1	A	332	ALA	2.5
1	A	54	VAL	2.5
1	A	41	ALA	2.4
1	A	36	ILE	2.4
1	A	115	THR	2.4
1	A	134	ARG	2.4
1	A	109	ILE	2.4
1	A	85	LYS	2.4
1	A	114	LEU	2.4
1	B	254	TYR	2.4
1	B	42	GLU	2.4
1	A	66	ASP	2.3
1	A	111	ASP	2.3
1	A	108	ARG	2.3
1	A	204	ARG	2.3
1	B	253	ASN	2.3
1	A	75	PHE	2.3
1	A	110	VAL	2.3
1	A	331	VAL	2.3
1	B	66	ASP	2.3
1	A	106	ALA	2.3
1	D	1	MET	2.3
1	A	84	LEU	2.3
1	C	2	VAL	2.2
1	A	305	TRP	2.2
1	B	53	LYS	2.2
1	A	337	PHE	2.2
1	A	63	GLN	2.2
1	A	105	GLY	2.2
1	A	322	LYS	2.2
1	A	62	LEU	2.1
1	C	65	PRO	2.1
1	A	101	THR	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	103	LEU	2.1
1	B	296	SER	2.1
1	C	331	VAL	2.1
1	A	46	ARG	2.1
1	A	323	ASP	2.1
1	C	336	THR	2.0
1	A	86	ALA	2.0
1	B	103	LEU	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 oligosaccharides 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.

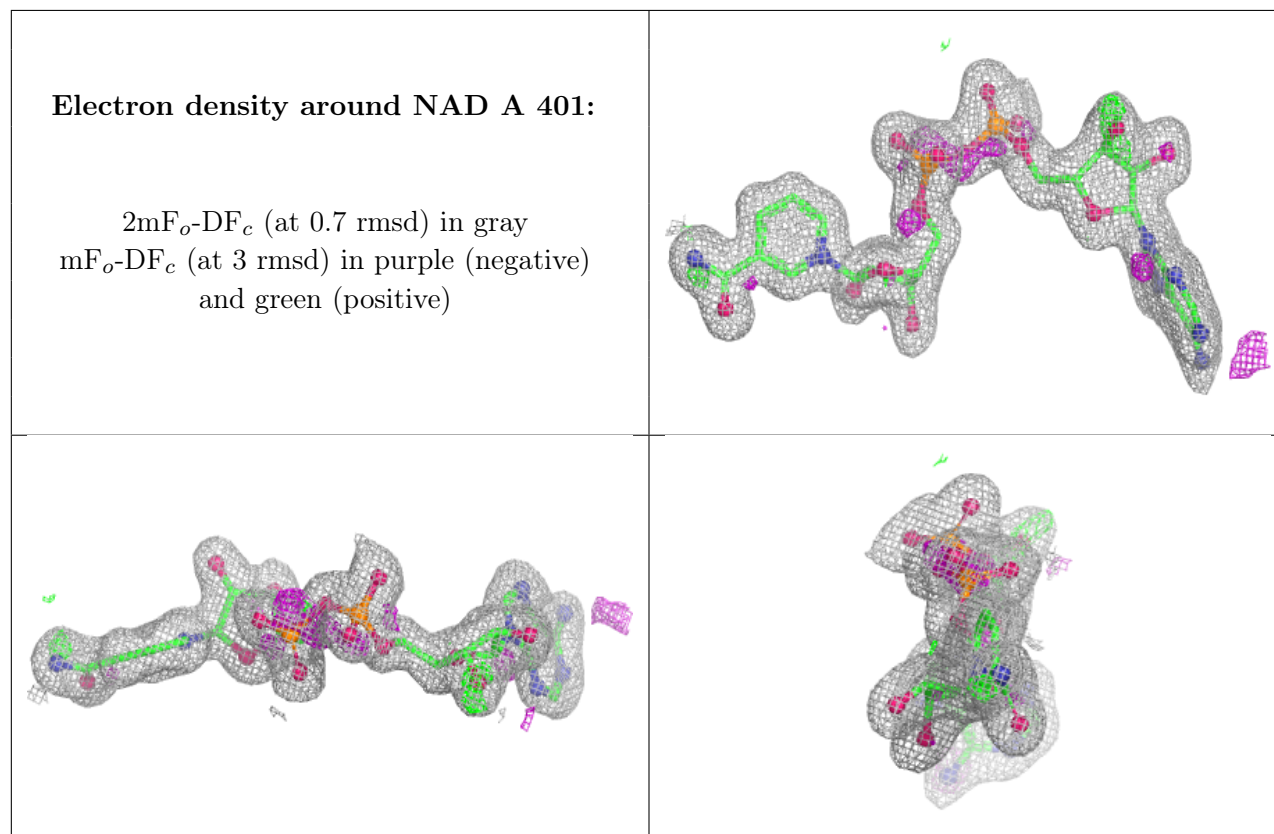
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	GOL	C	405	6/6	0.69	0.17	30,32,38,40	0
4	SO4	B	404	5/5	0.80	0.12	44,45,50,55	0
3	GOL	D	403	6/6	0.81	0.14	24,26,30,35	0
3	GOL	A	402	6/6	0.83	0.12	32,34,38,46	0
3	GOL	C	403	6/6	0.84	0.13	27,31,32,33	0
3	GOL	D	404	6/6	0.84	0.15	29,32,34,42	0
3	GOL	B	403	6/6	0.84	0.12	29,33,34,34	0
3	GOL	C	402	6/6	0.85	0.13	27,30,32,33	0
3	GOL	B	402	6/6	0.85	0.12	28,31,36,41	0
3	GOL	D	405	6/6	0.85	0.12	28,30,31,33	0
3	GOL	A	404	6/6	0.85	0.12	25,26,32,33	0
3	GOL	C	404	6/6	0.86	0.11	21,25,27,28	0
4	SO4	C	407	5/5	0.88	0.20	14,19,26,27	5
3	GOL	A	403	6/6	0.89	0.10	23,26,27,30	0
2	NAD	A	401	44/44	0.93	0.09	19,26,32,34	0

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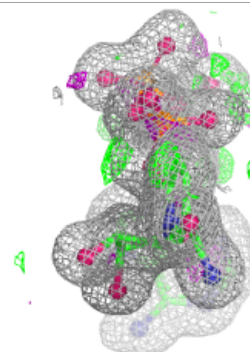
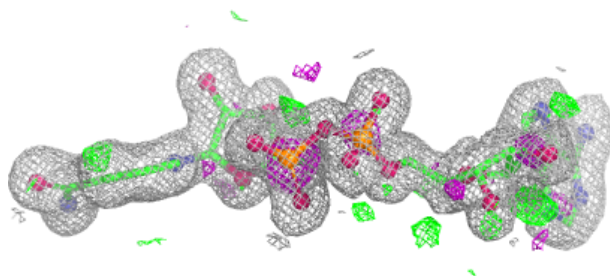
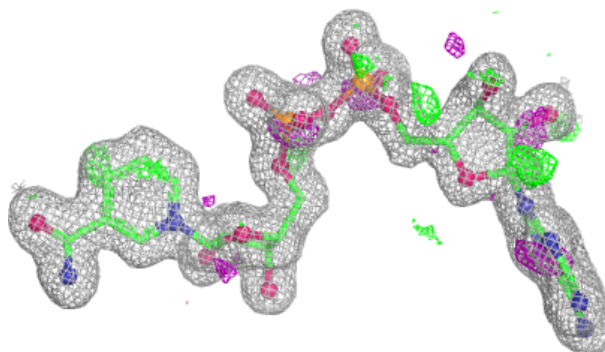
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	SO4	C	406	5/5	0.94	0.09	19,22,25,28	5
4	SO4	A	405	5/5	0.94	0.15	19,19,25,25	5
4	SO4	D	406	5/5	0.94	0.10	21,25,27,30	5
5	INS	D	402	12/12	0.94	0.08	16,19,22,22	0
4	SO4	B	405	5/5	0.95	0.10	19,23,29,30	5
2	NAD	B	401	44/44	0.96	0.08	15,18,22,27	0
4	SO4	A	406	5/5	0.96	0.14	18,19,22,23	5
2	NAD	C	401	44/44	0.98	0.05	13,17,21,23	0
2	NAD	D	401	44/44	0.98	0.05	11,14,18,25	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.

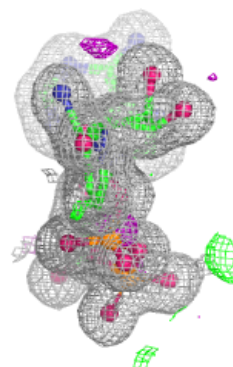
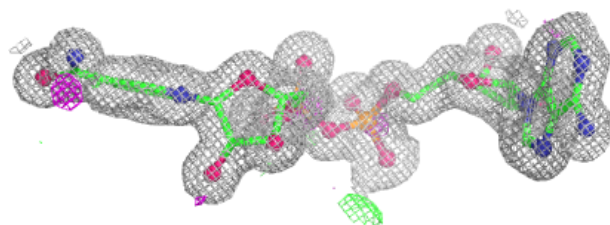
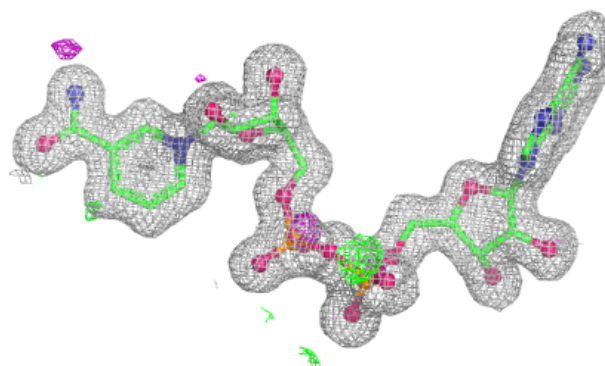


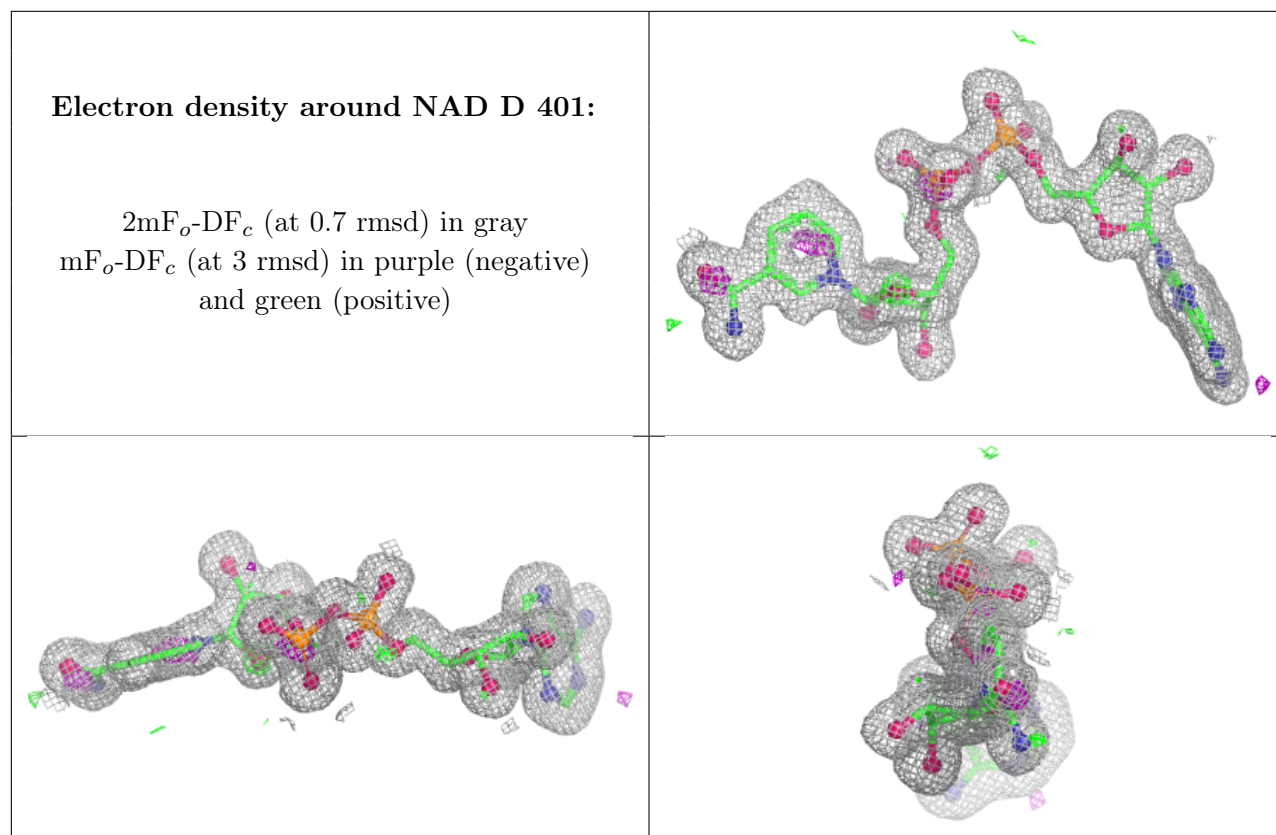
Electron density around NAD B 401:

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

**Electron density around NAD C 401:**

$2mF_o-DF_c$ (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.