



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 2, 2024 – 06:17 PM JST

PDB ID : 8Y11
Title : Crystal structure of L-2-keto-3-deoxyfuconate 4-dehydrogenase bound to NAD(H) and sulfate ion
Authors : Akagashi, M.; Watanabe, S.
Deposited on : 2024-01-23
Resolution : 1.77 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 : 2.37.1
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) : 2.37.1

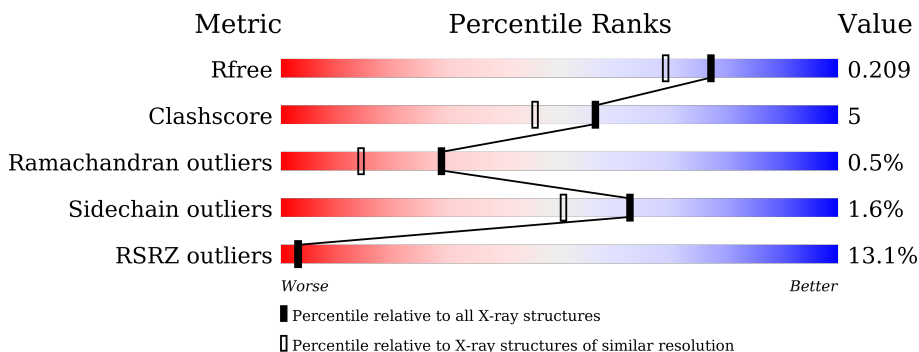
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.77 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	9185 (1.80-1.76)
Clashscore	141614	10184 (1.80-1.76)
Ramachandran outliers	138981	10051 (1.80-1.76)
Sidechain outliers	138945	10050 (1.80-1.76)
RSRZ outliers	127900	9032 (1.80-1.76)

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	264	 13% 86% 9% 6%
1	B	264	 12% 80% 9% 9%
1	C	264	 8% 81% 8% 10%
1	D	264	 15% 85% 9% 5%

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
4	PEG	B	304	-	-	X	-
5	TRS	B	305	-	X	-	-
6	GOL	D	304	-	X	-	-

2 Entry composition i

There are 7 unique types of molecules in this entry. The entry contains 7734 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 SDR family oxidoreductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	249	Total 1818	C 1135	N 321	O 354	S 8	0	0	0
1	B	239	Total 1732	C 1082	N 304	O 337	S 9	0	3	0
1	C	237	Total 1705	C 1068	N 300	O 329	S 8	0	1	0
1	D	250	Total 1793	C 1121	N 316	O 348	S 8	0	0	0

There are 44 discrepancies between the modelled and reference sequences:

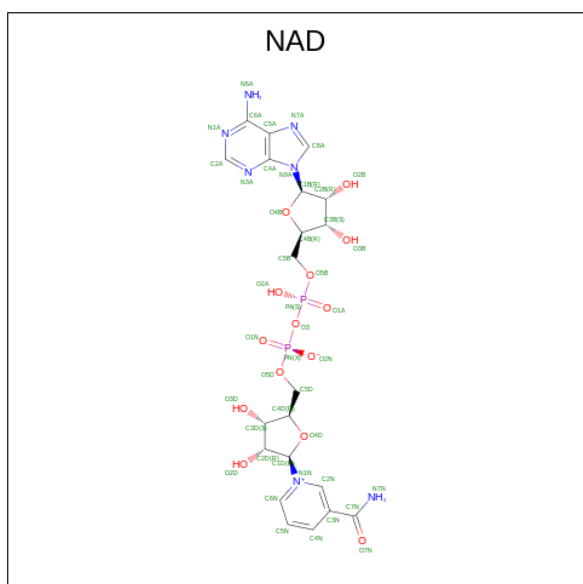
Chain	Residue	Modelled	Actual	Comment	Reference
A	-9	MET	-	initiating methionine	UNP A0A4P7ABK7
A	-8	ARG	-	expression tag	UNP A0A4P7ABK7
A	-7	GLY	-	expression tag	UNP A0A4P7ABK7
A	-6	SER	-	expression tag	UNP A0A4P7ABK7
A	-5	HIS	-	expression tag	UNP A0A4P7ABK7
A	-4	HIS	-	expression tag	UNP A0A4P7ABK7
A	-3	HIS	-	expression tag	UNP A0A4P7ABK7
A	-2	HIS	-	expression tag	UNP A0A4P7ABK7
A	-1	HIS	-	expression tag	UNP A0A4P7ABK7
A	0	HIS	-	expression tag	UNP A0A4P7ABK7
A	1	GLY	-	expression tag	UNP A0A4P7ABK7
B	-9	MET	-	initiating methionine	UNP A0A4P7ABK7
B	-8	ARG	-	expression tag	UNP A0A4P7ABK7
B	-7	GLY	-	expression tag	UNP A0A4P7ABK7
B	-6	SER	-	expression tag	UNP A0A4P7ABK7
B	-5	HIS	-	expression tag	UNP A0A4P7ABK7
B	-4	HIS	-	expression tag	UNP A0A4P7ABK7
B	-3	HIS	-	expression tag	UNP A0A4P7ABK7
B	-2	HIS	-	expression tag	UNP A0A4P7ABK7
B	-1	HIS	-	expression tag	UNP A0A4P7ABK7
B	0	HIS	-	expression tag	UNP A0A4P7ABK7

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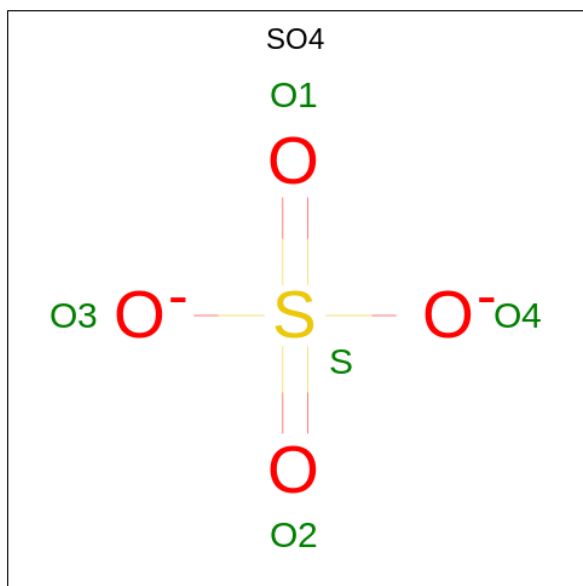
Chain	Residue	Modelled	Actual	Comment	Reference
B	1	GLY	-	expression tag	UNP A0A4P7ABK7
C	-9	MET	-	initiating methionine	UNP A0A4P7ABK7
C	-8	ARG	-	expression tag	UNP A0A4P7ABK7
C	-7	GLY	-	expression tag	UNP A0A4P7ABK7
C	-6	SER	-	expression tag	UNP A0A4P7ABK7
C	-5	HIS	-	expression tag	UNP A0A4P7ABK7
C	-4	HIS	-	expression tag	UNP A0A4P7ABK7
C	-3	HIS	-	expression tag	UNP A0A4P7ABK7
C	-2	HIS	-	expression tag	UNP A0A4P7ABK7
C	-1	HIS	-	expression tag	UNP A0A4P7ABK7
C	0	HIS	-	expression tag	UNP A0A4P7ABK7
C	1	GLY	-	expression tag	UNP A0A4P7ABK7
D	-9	MET	-	initiating methionine	UNP A0A4P7ABK7
D	-8	ARG	-	expression tag	UNP A0A4P7ABK7
D	-7	GLY	-	expression tag	UNP A0A4P7ABK7
D	-6	SER	-	expression tag	UNP A0A4P7ABK7
D	-5	HIS	-	expression tag	UNP A0A4P7ABK7
D	-4	HIS	-	expression tag	UNP A0A4P7ABK7
D	-3	HIS	-	expression tag	UNP A0A4P7ABK7
D	-2	HIS	-	expression tag	UNP A0A4P7ABK7
D	-1	HIS	-	expression tag	UNP A0A4P7ABK7
D	0	HIS	-	expression tag	UNP A0A4P7ABK7
D	1	GLY	-	expression tag	UNP A0A4P7ABK7

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: C₂₁H₂₇N₇O₁₄P₂) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



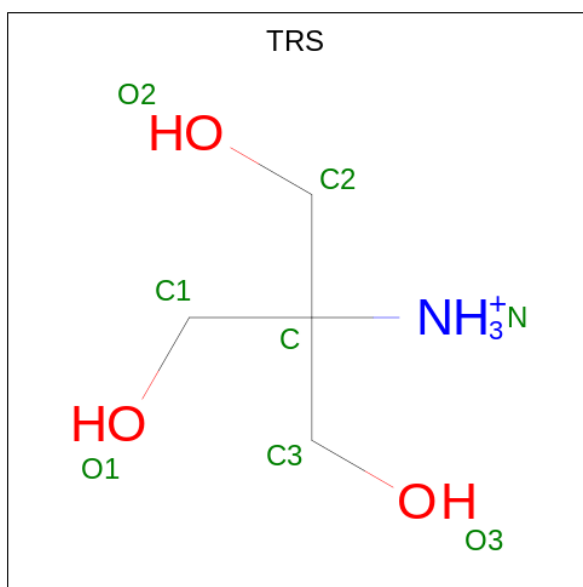
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O S		
3	A	1	5	4 1	0	0
3	A	1	5	4 1	0	0
3	B	1	5	4 1	0	0
3	B	1	5	4 1	0	0
3	C	1	5	4 1	0	0
3	D	1	5	4 1	0	0
3	D	1	5	4 1	0	0

- Molecule 4 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C₄H₁₀O₃).



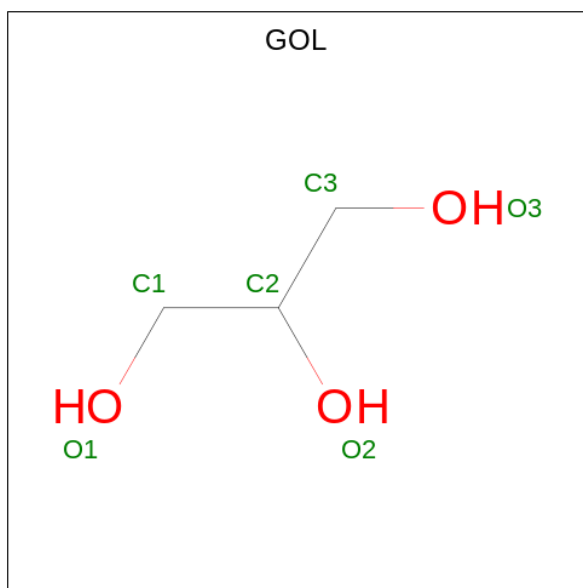
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 7 4 3	0	0
4	B	1	Total C O 7 4 3	0	0
4	D	1	Total C O 7 4 3	0	0
4	D	1	Total C O 7 4 3	0	0
4	D	1	Total C O 7 4 3	0	0

- Molecule 5 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula: C₄H₁₂NO₃).



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

- Molecule 6 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



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

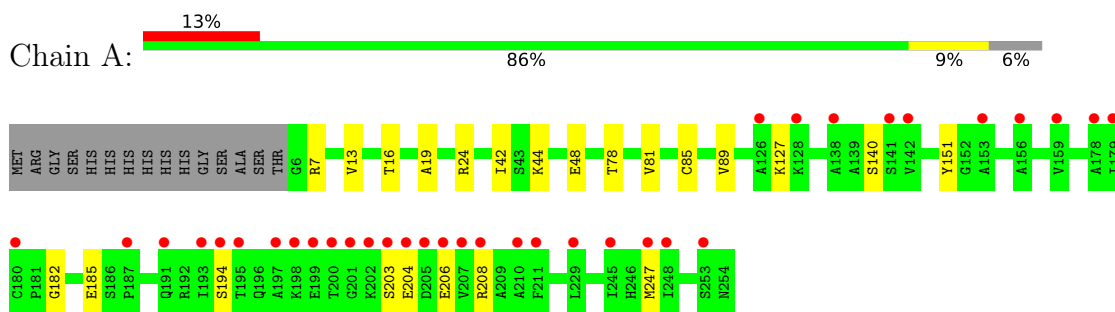
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	110	Total 110	O 110	0	0
7	B	111	Total 111	O 111	0	0
7	C	142	Total 142	O 142	0	0
7	D	101	Total 101	O 101	0	0

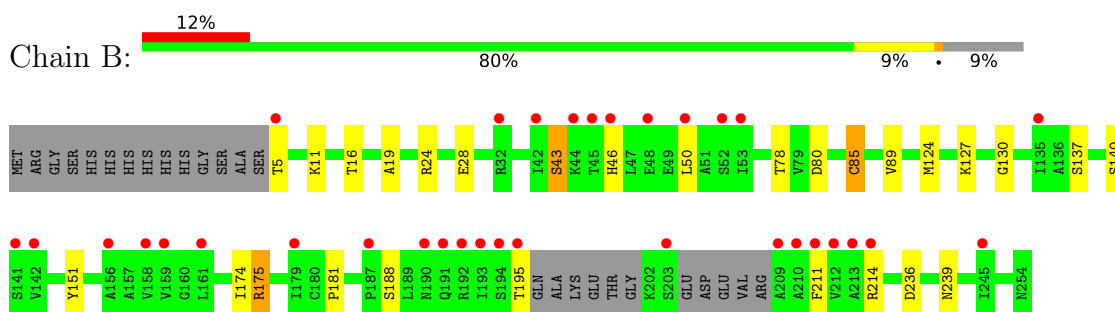
3 Residue-property plots [i](#)

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.

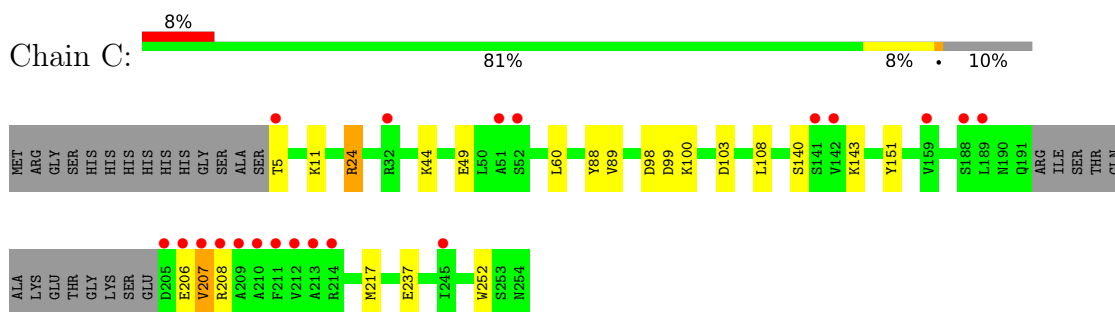
- Molecule 1: SDR family oxidoreductase



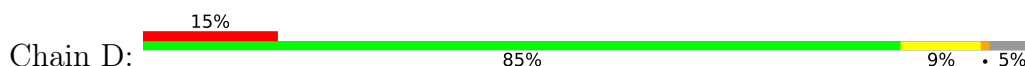
- Molecule 1: SDR family oxidoreductase

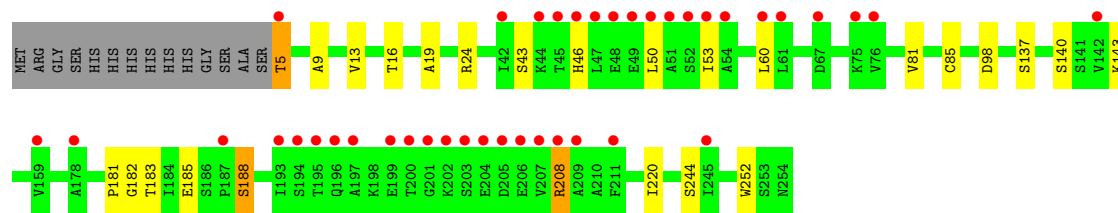


- Molecule 1: SDR family oxidoreductase



- Molecule 1: SDR family oxidoreductase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	84.34Å 103.89Å 133.06Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.39 – 1.77 48.39 – 1.77	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.39-1.77) 90.8 (48.39-1.77)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.91 (at 1.77Å)	Xtrriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, R_{free}	0.182 , 0.211 0.182 , 0.209	Depositor DCC
R_{free} test set	5685 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	22.7	Xtrriage
Anisotropy	0.475	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 49.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7734	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.98% 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: TRS, NAD, PEG, SO4, 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	0.77	0/1841	0.80	0/2489
1	B	0.76	2/1751 (0.1%)	0.78	1/2369 (0.0%)
1	C	0.81	1/1726 (0.1%)	0.83	1/2338 (0.0%)
1	D	0.69	0/1816	0.75	1/2461 (0.0%)
All	All	0.76	3/7134 (0.0%)	0.79	3/9657 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	237	GLU	CB-CG	-5.12	1.42	1.52
1	B	85[A]	CYS	CB-SG	-5.01	1.73	1.81
1	B	85[B]	CYS	CB-SG	-5.01	1.73	1.81

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	98	ASP	CB-CG-OD1	5.69	123.42	118.30
1	B	175	ARG	NE-CZ-NH1	5.15	122.88	120.30
1	C	103	ASP	CB-CG-OD1	5.11	122.90	118.30

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	1818	0	1835	14	0
1	B	1732	0	1725	23	0
1	C	1705	0	1709	10	0
1	D	1793	0	1786	21	0
2	A	44	0	26	4	0
2	B	44	0	26	1	0
2	D	44	0	26	3	0
3	A	10	0	0	0	0
3	B	10	0	0	0	0
3	C	5	0	0	0	0
3	D	10	0	0	0	0
4	A	7	0	10	0	0
4	B	7	0	10	10	0
4	D	21	0	30	6	0
5	B	8	0	12	1	0
6	C	6	0	8	0	0
6	D	6	0	8	3	0
7	A	110	0	0	1	0
7	B	111	0	0	1	0
7	C	142	0	0	2	0
7	D	101	0	0	2	0
All	All	7734	0	7211	72	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 5.

All (72) 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:175:ARG:HH21	4:B:304:PEG:H11	1.25	1.00
1:D:60:LEU:H	4:D:307:PEG:H42	1.38	0.88
1:B:175:ARG:NH2	4:B:304:PEG:H11	1.98	0.79
1:B:78:THR:HG21	1:B:127:LYS:HD2	1.69	0.74
1:A:7:ARG:HD2	4:D:305:PEG:H12	1.70	0.73
1:B:239:ASN:OD1	4:B:304:PEG:H22	1.89	0.73
6:D:304:GOL:H12	7:D:411:HOH:O	1.90	0.71
1:B:236:ASP:OD1	4:B:304:PEG:H12	1.93	0.69
1:C:217:MET:HB2	7:C:436:HOH:O	1.95	0.66
1:B:175:ARG:HH21	4:B:304:PEG:C1	2.05	0.65
1:D:143:LYS:HE2	1:D:252:TRP:CZ2	2.34	0.63
1:B:211:PHE:HA	1:B:214:ARG:HD2	1.79	0.62
1:A:182:GLY:O	2:A:301:NAD:H4N	2.01	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:5:THR:O	1:D:5:THR:OG1	2.09	0.60
1:A:44:LYS:O	1:A:48:GLU:HG3	2.01	0.60
1:C:88:TYR:HB2	1:C:108:LEU:HD23	1.85	0.58
1:D:185:GLU:CD	1:D:208:ARG:HH22	2.07	0.58
1:B:130:GLY:N	4:B:304:PEG:H32	2.19	0.57
1:B:80:ASP:O	4:B:304:PEG:H42	2.05	0.57
1:B:236:ASP:HA	4:B:304:PEG:H12	1.85	0.57
1:C:24:ARG:NH1	1:C:49:GLU:OE2	2.38	0.56
1:B:19:ALA:HB1	1:B:46:HIS:HB2	1.88	0.56
1:A:19:ALA:O	1:A:24:ARG:HD2	2.04	0.55
1:D:50:LEU:O	1:D:53:ILE:HG12	2.07	0.55
1:D:183:THR:OG1	4:D:306:PEG:H11	2.07	0.54
1:D:16:THR:O	1:D:85:CYS:HB2	2.07	0.54
1:D:252:TRP:CD2	4:D:306:PEG:H21	2.44	0.53
1:A:16:THR:O	1:A:85:CYS:HB2	2.10	0.51
1:A:247:MET:HG3	6:D:304:GOL:H2	1.93	0.51
1:A:78:THR:HG21	1:A:127:LYS:HD3	1.92	0.51
1:A:13:VAL:HG22	1:A:81:VAL:HB	1.92	0.50
1:D:185:GLU:OE2	1:D:208:ARG:NH2	2.44	0.50
1:A:85:CYS:O	2:A:301:NAD:H4D	2.11	0.50
2:B:301:NAD:H2A	7:B:439:HOH:O	2.11	0.50
1:D:85:CYS:O	2:D:301:NAD:H4D	2.12	0.50
1:D:185:GLU:CD	1:D:220:ILE:HD11	2.32	0.49
1:A:194:SER:OG	1:A:204:GLU:OE2	2.24	0.49
5:B:305:TRS:H12	7:D:453:HOH:O	2.13	0.49
1:C:206:GLU:O	1:C:207:VAL:HG12	2.12	0.49
1:D:244:SER:HA	6:D:304:GOL:H11	1.94	0.49
1:B:130:GLY:CA	4:B:304:PEG:H32	2.43	0.49
1:C:44:LYS:HE2	1:C:60:LEU:HD11	1.95	0.48
1:B:11:LYS:NZ	4:B:304:PEG:O4	2.41	0.48
1:D:19:ALA:HB1	1:D:46:HIS:HB2	1.95	0.47
1:B:24:ARG:CZ	1:B:50:LEU:HD21	2.44	0.46
1:C:98:ASP:OD1	1:C:100:LYS:HG2	2.16	0.46
1:A:89:VAL:HG22	1:A:151:TYR:CE1	2.51	0.46
1:B:43:SER:O	1:B:43:SER:OG	2.34	0.46
1:D:5:THR:HG23	1:D:9:ALA:HB1	1.97	0.46
1:C:143:LYS:HE2	1:C:252:TRP:CZ2	2.51	0.45
1:C:89:VAL:HG22	1:C:151:TYR:CE1	2.52	0.45
1:B:16:THR:O	1:B:85[A]:CYS:HB2	2.17	0.45
1:D:252:TRP:CG	4:D:306:PEG:H21	2.53	0.44
1:D:182:GLY:O	2:D:301:NAD:H4N	2.18	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:42:ILE:HG23	2:A:301:NAD:C2A	2.47	0.44
1:B:24:ARG:NH1	1:B:50:LEU:HD21	2.32	0.44
2:A:301:NAD:H2A	7:A:444:HOH:O	2.18	0.43
1:B:24:ARG:O	1:B:28:GLU:HG3	2.18	0.43
1:B:89:VAL:HG22	1:B:151:TYR:CE1	2.54	0.43
1:A:203:SER:OG	1:A:206:GLU:HB2	2.18	0.42
1:B:124:MET:HB3	1:B:174:ILE:HD12	2.01	0.42
1:D:188:SER:HB2	2:D:301:NAD:O1A	2.19	0.42
1:D:137:SER:HA	1:D:181:PRO:HD2	2.02	0.42
1:B:50:LEU:N	1:B:50:LEU:HD23	2.35	0.41
1:D:60:LEU:N	4:D:307:PEG:H42	2.20	0.41
1:A:185:GLU:CD	1:A:208:ARG:HH22	2.24	0.41
1:B:16:THR:O	1:B:85[B]:CYS:HB3	2.21	0.41
1:D:13:VAL:HG22	1:D:81:VAL:HB	2.02	0.41
1:D:24:ARG:HG3	1:D:50:LEU:HD11	2.03	0.40
1:B:137:SER:HA	1:B:181:PRO:HD2	2.03	0.40
1:C:11:LYS:NZ	7:C:406:HOH:O	2.54	0.40
1:C:206:GLU:C	1:C:208:ARG:H	2.24	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	247/264 (94%)	241 (98%)	5 (2%)	1 (0%)	34	19
1	B	236/264 (89%)	229 (97%)	6 (2%)	1 (0%)	34	19
1	C	234/264 (89%)	226 (97%)	6 (3%)	2 (1%)	17	5
1	D	248/264 (94%)	241 (97%)	6 (2%)	1 (0%)	34	19
All	All	965/1056 (91%)	937 (97%)	23 (2%)	5 (0%)	29	14

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	140	SER
1	C	207	VAL
1	B	140	SER
1	C	140	SER
1	D	140	SER

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	185/197 (94%)	185 (100%)	0	100	100
1	B	173/197 (88%)	169 (98%)	4 (2%)	50	34
1	C	170/197 (86%)	167 (98%)	3 (2%)	59	45
1	D	178/197 (90%)	174 (98%)	4 (2%)	52	36
All	All	706/788 (90%)	695 (98%)	11 (2%)	62	51

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	5	THR
1	B	43	SER
1	B	188	SER
1	B	195	THR
1	C	5	THR
1	C	24	ARG
1	C	99	ASP
1	D	5	THR
1	D	43	SER
1	D	188	SER
1	D	208	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	20	GLN

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Mol	Chain	Res	Type
1	C	246	HIS

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

18 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
6	GOL	C	302	-	5,5,5	0.70	0	5,5,5	1.36	0
4	PEG	A	304	-	6,6,6	0.45	0	5,5,5	0.60	0
3	SO4	D	303	-	4,4,4	1.14	0	6,6,6	0.59	0
3	SO4	A	302	-	4,4,4	1.13	0	6,6,6	0.57	0
2	NAD	A	301	-	42,48,48	4.92	18 (42%)	50,73,73	2.34	12 (24%)
2	NAD	B	301	-	42,48,48	4.99	18 (42%)	50,73,73	2.37	12 (24%)
3	SO4	A	303	-	4,4,4	0.82	0	6,6,6	0.92	0
3	SO4	B	303	-	4,4,4	1.14	0	6,6,6	0.73	0
4	PEG	D	305	-	6,6,6	0.45	0	5,5,5	0.49	0
4	PEG	D	307	-	6,6,6	0.44	0	5,5,5	0.64	0
6	GOL	D	304	-	5,5,5	1.28	1 (20%)	5,5,5	1.35	1 (20%)
3	SO4	B	302	-	4,4,4	0.83	0	6,6,6	0.61	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	PEG	D	306	-	6,6,6	0.55	0	5,5,5	0.43	0
2	NAD	D	301	-	42,48,48	5.00	16 (38%)	50,73,73	2.27	8 (16%)
5	TRS	B	305	-	7,7,7	0.15	0	9,9,9	7.35	7 (77%)
3	SO4	C	301	-	4,4,4	0.56	0	6,6,6	0.70	0
3	SO4	D	302	-	4,4,4	0.70	0	6,6,6	1.31	1 (16%)
4	PEG	B	304	-	6,6,6	0.64	0	5,5,5	1.39	1 (20%)

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
4	PEG	A	304	-	-	1/4/4/4	-
2	NAD	A	301	-	-	2/26/62/62	0/5/5/5
2	NAD	B	301	-	-	6/26/62/62	0/5/5/5
4	PEG	D	305	-	-	4/4/4/4	-
4	PEG	D	307	-	-	4/4/4/4	-
6	GOL	D	304	-	-	4/4/4/4	-
4	PEG	D	306	-	-	3/4/4/4	-
2	NAD	D	301	-	-	8/26/62/62	0/5/5/5
5	TRS	B	305	-	-	8/9/9/9	-
6	GOL	C	302	-	-	4/4/4/4	-
4	PEG	B	304	-	-	2/4/4/4	-

All (53) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	301	NAD	C2D-C1D	-15.62	1.30	1.53
2	D	301	NAD	C2B-C1B	-15.04	1.30	1.53
2	B	301	NAD	C2B-C1B	-14.77	1.31	1.53
2	D	301	NAD	C2D-C1D	-14.72	1.31	1.53
2	B	301	NAD	C2D-C1D	-14.66	1.31	1.53
2	A	301	NAD	C2B-C1B	-13.95	1.32	1.53
2	D	301	NAD	O4D-C1D	13.10	1.59	1.41
2	B	301	NAD	O4D-C1D	12.03	1.57	1.41
2	A	301	NAD	O4D-C1D	11.10	1.56	1.41
2	A	301	NAD	O4B-C1B	9.97	1.55	1.41
2	B	301	NAD	O4B-C1B	9.84	1.54	1.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	301	NAD	C3B-C4B	-8.92	1.30	1.53
2	B	301	NAD	C3B-C4B	-8.81	1.30	1.53
2	A	301	NAD	C3B-C4B	-8.78	1.30	1.53
2	D	301	NAD	O4B-C1B	8.66	1.53	1.41
2	A	301	NAD	C7N-N7N	8.31	1.48	1.33
2	D	301	NAD	C7N-N7N	7.95	1.48	1.33
2	B	301	NAD	C7N-N7N	7.85	1.48	1.33
2	D	301	NAD	C3D-C4D	-7.69	1.33	1.53
2	B	301	NAD	C3D-C4D	-7.37	1.34	1.53
2	A	301	NAD	C3D-C4D	-6.80	1.35	1.53
2	B	301	NAD	O4D-C4D	5.52	1.57	1.45
2	A	301	NAD	O4B-C4B	5.21	1.56	1.45
2	B	301	NAD	O4B-C4B	5.21	1.56	1.45
2	D	301	NAD	O4D-C4D	5.21	1.56	1.45
2	D	301	NAD	O4B-C4B	5.15	1.56	1.45
2	A	301	NAD	C2A-N3A	4.72	1.39	1.32
2	B	301	NAD	C2A-N3A	4.72	1.39	1.32
2	B	301	NAD	C2B-C3B	4.62	1.66	1.53
2	D	301	NAD	C2A-N3A	4.54	1.39	1.32
2	D	301	NAD	C2B-C3B	4.43	1.65	1.53
2	A	301	NAD	C2B-C3B	4.40	1.65	1.53
2	B	301	NAD	C2D-C3D	4.20	1.64	1.53
2	A	301	NAD	C2D-C3D	4.06	1.64	1.53
2	D	301	NAD	C2D-C3D	4.04	1.64	1.53
2	A	301	NAD	O4D-C4D	3.94	1.53	1.45
2	B	301	NAD	C6A-N6A	3.25	1.45	1.34
2	A	301	NAD	C6A-N6A	3.18	1.45	1.34
2	D	301	NAD	C6A-N6A	2.84	1.44	1.34
2	A	301	NAD	C6N-N1N	2.39	1.41	1.35
2	B	301	NAD	C2N-N1N	2.38	1.37	1.35
2	A	301	NAD	C5D-C4D	2.31	1.58	1.51
2	D	301	NAD	C5A-C4A	-2.26	1.35	1.40
2	A	301	NAD	O2B-C2B	2.19	1.48	1.43
2	D	301	NAD	C6N-N1N	2.18	1.40	1.35
2	D	301	NAD	PN-O5D	2.15	1.68	1.59
2	A	301	NAD	PN-O5D	2.14	1.68	1.59
2	B	301	NAD	C5A-C4A	-2.09	1.35	1.40
6	D	304	GOL	C1-C2	2.07	1.60	1.51
2	B	301	NAD	C6N-N1N	2.06	1.40	1.35
2	B	301	NAD	C5B-C4B	2.05	1.58	1.51
2	B	301	NAD	PN-O5D	2.03	1.67	1.59
2	A	301	NAD	C5A-C4A	-2.00	1.35	1.40

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	305	TRS	C3-C-C1	-12.06	73.43	110.81
5	B	305	TRS	C3-C-C2	-10.91	76.99	110.81
2	D	301	NAD	C1B-N9A-C4A	-8.71	111.33	126.64
5	B	305	TRS	C2-C-C1	8.34	136.67	110.81
2	D	301	NAD	C5A-C6A-N6A	7.70	132.05	120.35
2	B	301	NAD	C5A-C6A-N6A	7.55	131.83	120.35
5	B	305	TRS	C1-C-N	-7.20	86.48	107.98
5	B	305	TRS	C2-C-N	-7.06	86.89	107.98
2	A	301	NAD	C5A-C6A-N6A	6.91	130.85	120.35
2	B	301	NAD	C1B-N9A-C4A	-6.84	114.62	126.64
5	B	305	TRS	C3-C-N	6.44	127.21	107.98
2	A	301	NAD	C1B-N9A-C4A	-6.12	115.88	126.64
2	B	301	NAD	N6A-C6A-N1A	-5.47	107.22	118.57
2	D	301	NAD	N6A-C6A-N1A	-5.34	107.49	118.57
2	A	301	NAD	N3A-C2A-N1A	-5.30	120.40	128.68
2	B	301	NAD	O4B-C1B-C2B	-5.19	99.34	106.93
2	B	301	NAD	N3A-C2A-N1A	-5.18	120.58	128.68
2	D	301	NAD	N3A-C2A-N1A	-5.03	120.81	128.68
2	A	301	NAD	O7N-C7N-C3N	-4.91	113.76	119.63
2	A	301	NAD	C3N-C7N-N7N	4.74	123.44	117.75
2	A	301	NAD	N6A-C6A-N1A	-4.47	109.30	118.57
2	B	301	NAD	C3N-C7N-N7N	4.03	122.58	117.75
2	B	301	NAD	O7N-C7N-C3N	-3.62	115.31	119.63
2	A	301	NAD	C3N-C2N-N1N	-3.60	116.91	120.43
2	D	301	NAD	C3N-C7N-N7N	3.25	121.65	117.75
2	A	301	NAD	PN-O3-PA	-3.24	121.71	132.83
2	B	301	NAD	O4D-C1D-C2D	-3.09	102.41	106.93
4	B	304	PEG	O2-C3-C4	2.95	123.04	110.07
5	B	305	TRS	O2-C2-C	-2.95	101.64	111.00
3	D	302	SO4	O3-S-O1	-2.93	94.00	109.31
2	A	301	NAD	C5N-C4N-C3N	2.80	123.65	120.34
2	B	301	NAD	C3B-C2B-C1B	2.73	105.08	100.98
2	D	301	NAD	C3B-C2B-C1B	2.69	105.02	100.98
2	A	301	NAD	C3B-C2B-C1B	2.62	104.93	100.98
2	A	301	NAD	C6N-N1N-C2N	2.55	124.30	121.97
2	B	301	NAD	C3N-C2N-N1N	-2.34	118.14	120.43
2	D	301	NAD	O4D-C1D-C2D	-2.22	103.69	106.93
6	D	304	GOL	O2-C2-C1	2.19	118.76	109.12
2	B	301	NAD	O3D-C3D-C2D	-2.18	104.77	111.82
2	D	301	NAD	O2D-C2D-C3D	-2.05	105.19	111.82
2	A	301	NAD	C2B-C3B-C4B	2.05	106.62	102.64
2	B	301	NAD	C2B-C3B-C4B	2.02	106.56	102.64

There are no chirality outliers.

All (46) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	NAD	O4D-C1D-N1N-C2N
2	B	301	NAD	C5B-O5B-PA-O3
2	D	301	NAD	C3D-C4D-C5D-O5D
2	D	301	NAD	O4D-C1D-N1N-C2N
5	B	305	TRS	N-C-C1-O1
5	B	305	TRS	C3-C-C2-O2
5	B	305	TRS	N-C-C2-O2
5	B	305	TRS	C1-C-C3-O3
5	B	305	TRS	N-C-C3-O3
6	C	302	GOL	O1-C1-C2-C3
6	D	304	GOL	O1-C1-C2-O2
6	D	304	GOL	O1-C1-C2-C3
2	D	301	NAD	O4D-C4D-C5D-O5D
4	D	305	PEG	C4-C3-O2-C2
6	C	302	GOL	O1-C1-C2-O2
6	D	304	GOL	O2-C2-C3-O3
4	A	304	PEG	O2-C3-C4-O4
4	D	305	PEG	O2-C3-C4-O4
6	D	304	GOL	C1-C2-C3-O3
2	B	301	NAD	C3B-C4B-C5B-O5B
4	D	307	PEG	O2-C3-C4-O4
2	B	301	NAD	O4B-C4B-C5B-O5B
5	B	305	TRS	C3-C-C1-O1
4	D	306	PEG	O1-C1-C2-O2
4	D	307	PEG	O1-C1-C2-O2
6	C	302	GOL	O2-C2-C3-O3
4	D	305	PEG	O1-C1-C2-O2
4	D	307	PEG	C4-C3-O2-C2
2	D	301	NAD	C5B-O5B-PA-O3
4	B	304	PEG	C4-C3-O2-C2
5	B	305	TRS	C2-C-C1-O1
2	B	301	NAD	C5B-O5B-PA-O1A
2	B	301	NAD	C5B-O5B-PA-O2A
4	D	306	PEG	O2-C3-C4-O4
2	D	301	NAD	PA-O3-PN-O1N
4	D	307	PEG	C1-C2-O2-C3
4	B	304	PEG	O1-C1-C2-O2
4	D	306	PEG	C1-C2-O2-C3
5	B	305	TRS	C2-C-C3-O3
2	D	301	NAD	PA-O3-PN-O2N

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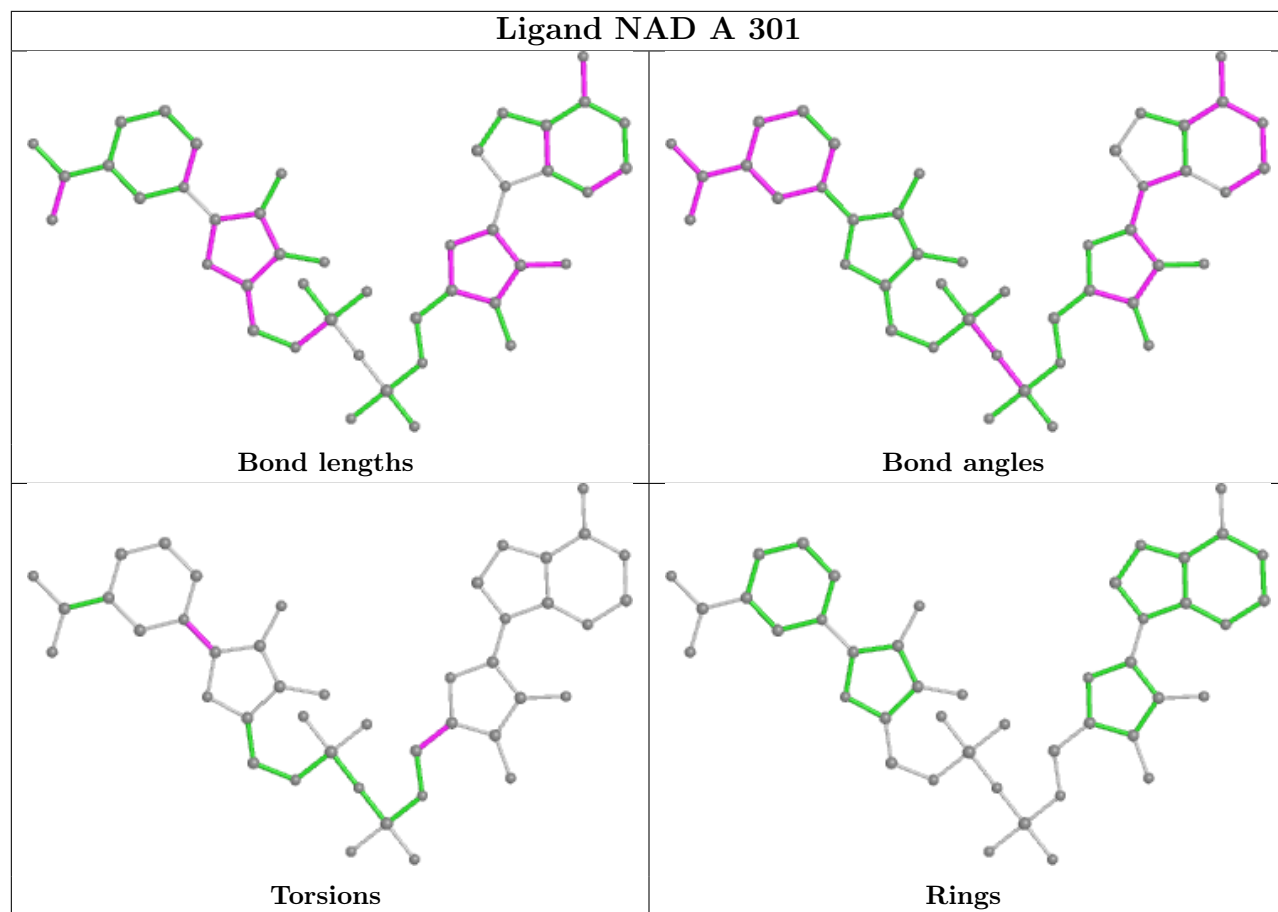
Mol	Chain	Res	Type	Atoms
6	C	302	GOL	C1-C2-C3-O3
2	D	301	NAD	O4B-C4B-C5B-O5B
2	B	301	NAD	C5D-O5D-PN-O1N
2	D	301	NAD	C5B-O5B-PA-O2A
2	A	301	NAD	O4B-C4B-C5B-O5B
4	D	305	PEG	C1-C2-O2-C3

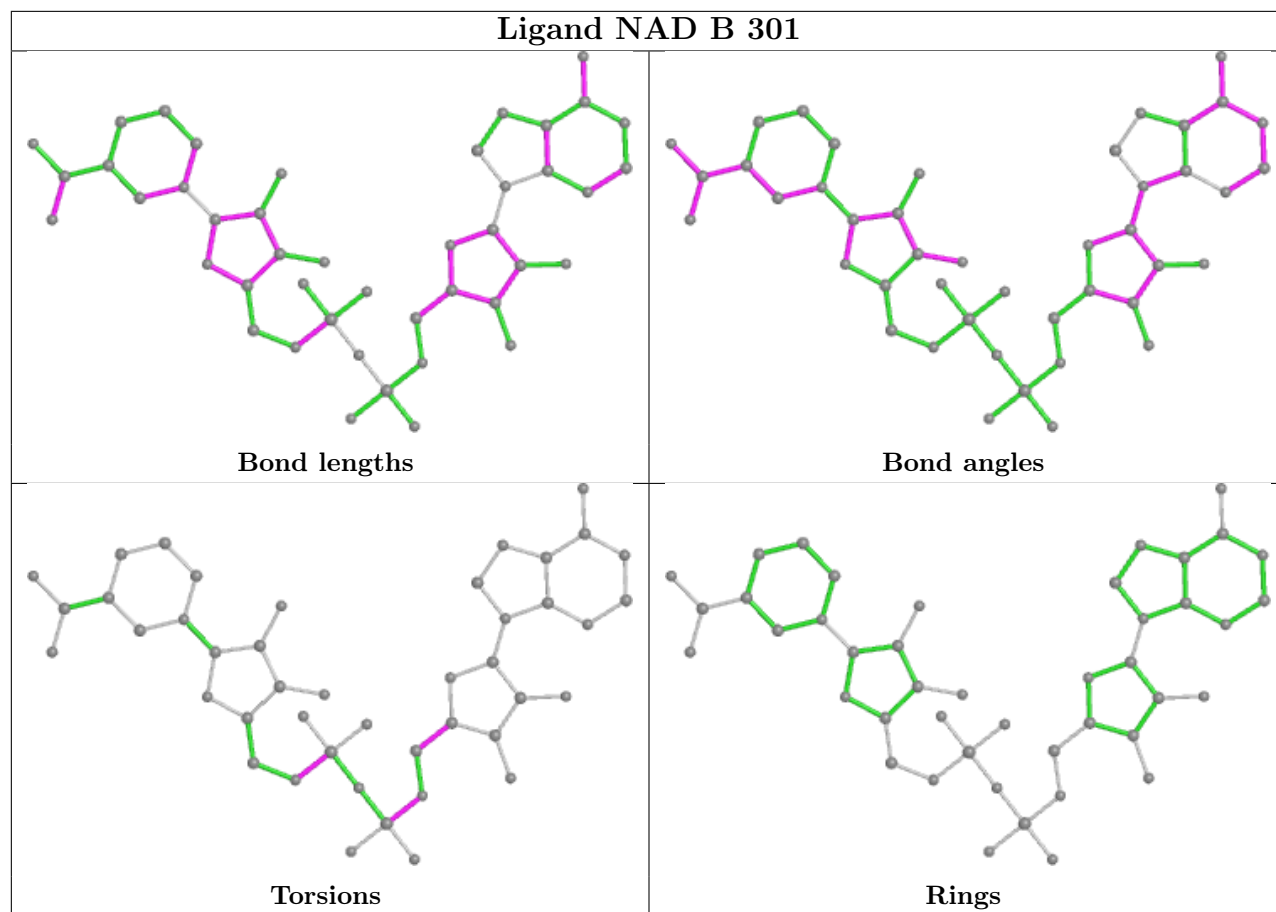
There are no ring outliers.

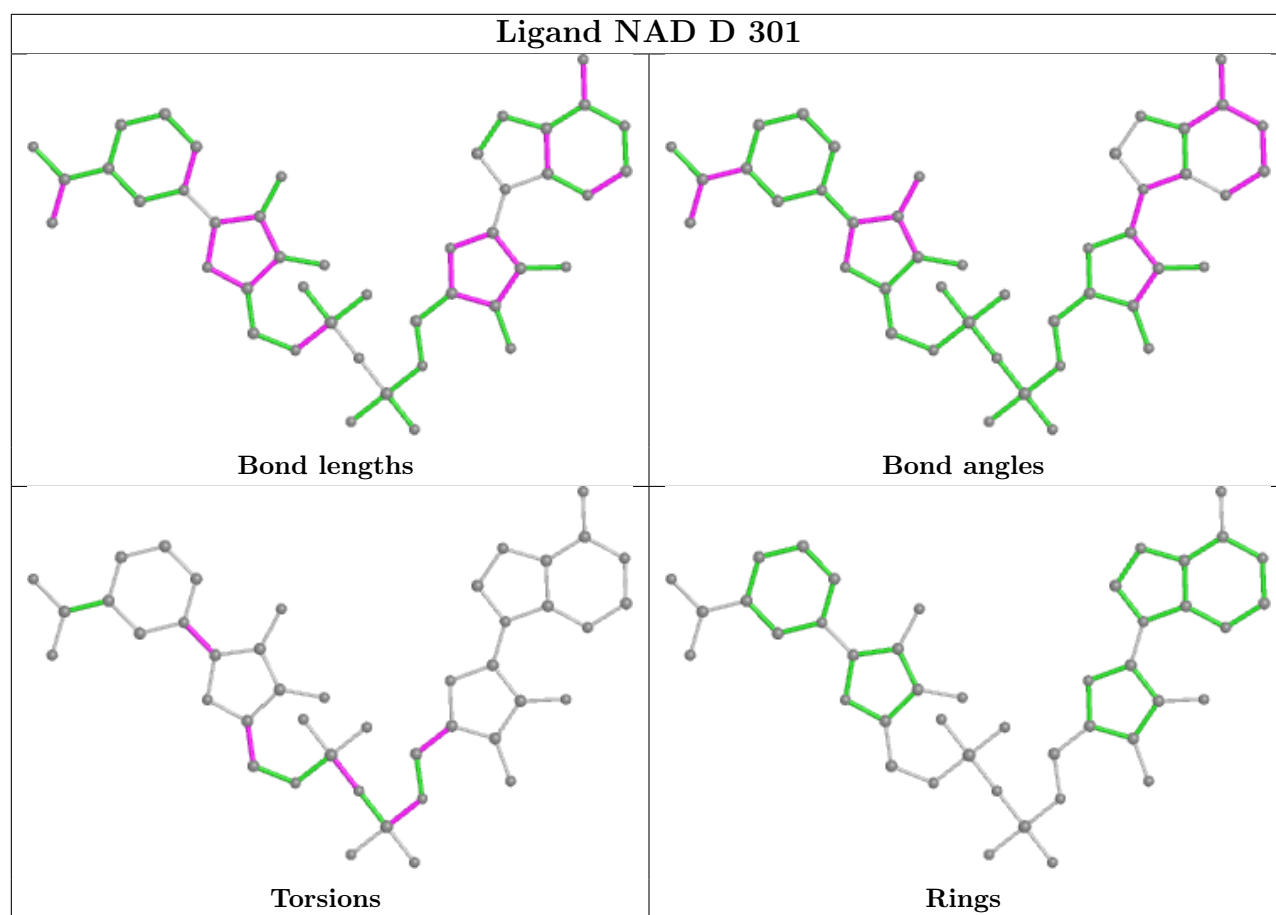
9 monomers are involved in 28 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	301	NAD	4	0
2	B	301	NAD	1	0
4	D	305	PEG	1	0
4	D	307	PEG	2	0
6	D	304	GOL	3	0
4	D	306	PEG	3	0
2	D	301	NAD	3	0
5	B	305	TRS	1	0
4	B	304	PEG	10	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	249/264 (94%)	0.69	35 (14%) 2 2	18, 29, 49, 56	0
1	B	239/264 (90%)	0.67	33 (13%) 2 2	18, 28, 57, 69	0
1	C	237/264 (89%)	0.44	20 (8%) 11 10	16, 25, 60, 80	0
1	D	250/264 (94%)	0.86	40 (16%) 1 1	20, 33, 55, 64	0
All	All	975/1056 (92%)	0.67	128 (13%) 3 3	16, 29, 55, 80	0

All (128) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	5	THR	9.5
1	C	207	VAL	8.2
1	C	211	PHE	6.6
1	D	207	VAL	6.5
1	B	203	SER	6.2
1	B	5	THR	5.5
1	D	5	THR	5.3
1	C	209	ALA	5.2
1	C	210	ALA	5.1
1	B	211	PHE	5.1
1	D	53	ILE	5.0
1	D	60	LEU	5.0
1	A	203	SER	4.4
1	A	195	THR	4.4
1	B	193	ILE	4.1
1	D	205	ASP	4.1
1	A	211	PHE	4.1
1	B	52	SER	4.1
1	D	42	ILE	4.1
1	A	207	VAL	4.0
1	B	159	VAL	4.0

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Mol	Chain	Res	Type	RSRZ
1	B	187	PRO	4.0
1	A	198	LYS	3.9
1	A	200	THR	3.9
1	D	51	ALA	3.8
1	A	142	VAL	3.8
1	B	209	ALA	3.7
1	A	187	PRO	3.7
1	D	245	ILE	3.7
1	D	50	LEU	3.7
1	D	203	SER	3.6
1	A	206	GLU	3.6
1	C	52	SER	3.6
1	D	199	GLU	3.5
1	D	201	GLY	3.5
1	A	191	GLN	3.5
1	B	194	SER	3.5
1	D	52	SER	3.5
1	B	245	ILE	3.5
1	A	205	ASP	3.5
1	B	210	ALA	3.5
1	B	50	LEU	3.4
1	A	199	GLU	3.4
1	C	213	ALA	3.4
1	C	206	GLU	3.4
1	D	44	LYS	3.4
1	B	213	ALA	3.4
1	A	202	LYS	3.2
1	D	142	VAL	3.2
1	A	245	ILE	3.2
1	C	245	ILE	3.2
1	B	44	LYS	3.2
1	D	211	PHE	3.2
1	D	200	THR	3.1
1	B	142	VAL	3.1
1	B	195	THR	3.1
1	A	126	ALA	3.1
1	C	214	ARG	3.0
1	A	159	VAL	3.0
1	C	142	VAL	3.0
1	B	161	LEU	2.9
1	D	194	SER	2.9
1	D	208	ARG	2.9

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Mol	Chain	Res	Type	RSRZ
1	C	208	ARG	2.9
1	D	202	LYS	2.9
1	D	48	GLU	2.8
1	D	46	HIS	2.8
1	B	45	THR	2.8
1	D	54	ALA	2.8
1	D	209	ALA	2.8
1	D	159	VAL	2.8
1	D	195	THR	2.8
1	A	138	ALA	2.7
1	B	48	GLU	2.7
1	B	158	VAL	2.7
1	D	193	ILE	2.7
1	A	197	ALA	2.7
1	B	190	ASN	2.7
1	A	210	ALA	2.6
1	D	45	THR	2.6
1	D	187	PRO	2.6
1	A	156	ALA	2.6
1	A	201	GLY	2.6
1	C	159	VAL	2.6
1	A	194	SER	2.6
1	A	178	ALA	2.5
1	D	75	LYS	2.5
1	B	156	ALA	2.5
1	A	208	ARG	2.5
1	D	196	GLN	2.5
1	B	191	GLN	2.5
1	C	205	ASP	2.4
1	A	253	SER	2.4
1	B	192	ARG	2.4
1	A	204	GLU	2.4
1	C	51	ALA	2.4
1	D	197	ALA	2.4
1	B	212	VAL	2.3
1	B	53	ILE	2.3
1	B	42	ILE	2.3
1	A	247	MET	2.3
1	A	153	ALA	2.3
1	B	32	ARG	2.3
1	B	214	ARG	2.3
1	D	67	ASP	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	248	ILE	2.2
1	B	135	ILE	2.2
1	A	141	SER	2.2
1	C	141	SER	2.2
1	C	188	SER	2.2
1	D	76	VAL	2.2
1	B	141	SER	2.2
1	B	179	ILE	2.2
1	B	46	HIS	2.2
1	D	47	LEU	2.2
1	D	49	GLU	2.2
1	D	206	GLU	2.2
1	C	32	ARG	2.1
1	D	204	GLU	2.1
1	C	189	LEU	2.1
1	A	180	CYS	2.1
1	A	193	ILE	2.1
1	A	128	LYS	2.1
1	D	178	ALA	2.1
1	A	229	LEU	2.1
1	A	179	ILE	2.0
1	C	212	VAL	2.0
1	D	61	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 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.

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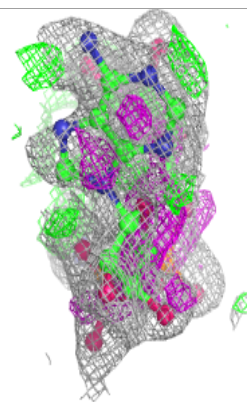
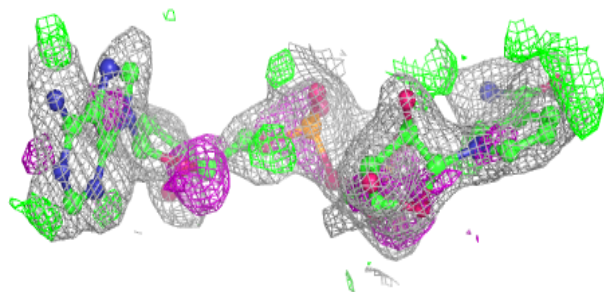
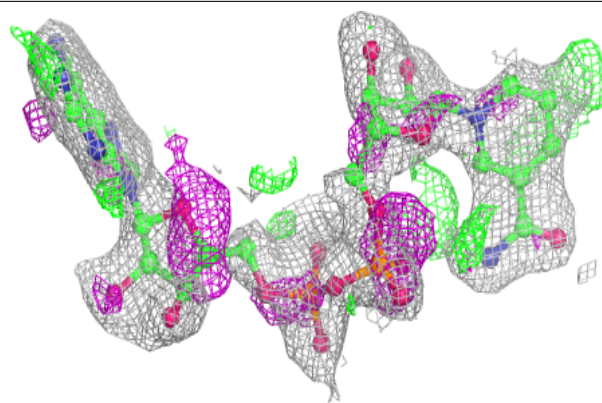
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NAD	D	301	44/44	0.72	0.30	33,53,61,66	0
2	NAD	B	301	44/44	0.75	0.29	36,49,60,67	0
4	PEG	D	306	7/7	0.78	0.17	38,44,49,50	0
3	SO4	A	302	5/5	0.80	0.20	41,47,53,73	0
5	TRS	B	305	8/8	0.80	0.19	39,45,45,46	0
6	GOL	C	302	6/6	0.80	0.23	40,46,48,48	0
4	PEG	A	304	7/7	0.82	0.12	39,42,50,51	0
6	GOL	D	304	6/6	0.82	0.21	35,40,43,50	0
2	NAD	A	301	44/44	0.83	0.23	29,43,50,51	0
4	PEG	B	304	7/7	0.83	0.24	30,33,41,46	0
4	PEG	D	305	7/7	0.85	0.27	47,48,53,53	0
4	PEG	D	307	7/7	0.87	0.35	51,57,61,62	0
3	SO4	B	303	5/5	0.87	0.23	48,54,62,73	0
3	SO4	D	303	5/5	0.90	0.19	49,52,57,75	0
3	SO4	B	302	5/5	0.96	0.15	45,47,52,57	0
3	SO4	C	301	5/5	0.98	0.10	47,48,49,59	0
3	SO4	D	302	5/5	0.99	0.09	42,45,47,48	0
3	SO4	A	303	5/5	0.99	0.09	38,38,46,46	0

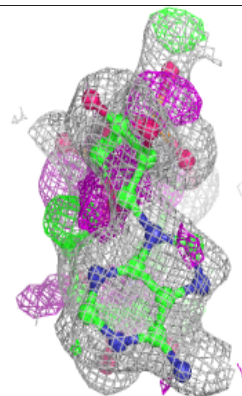
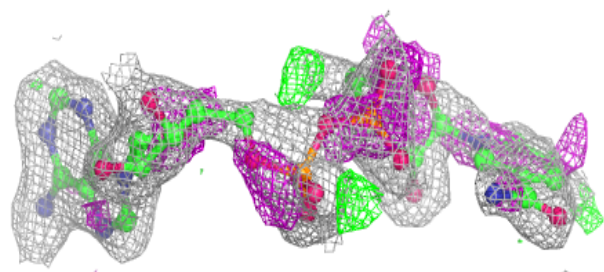
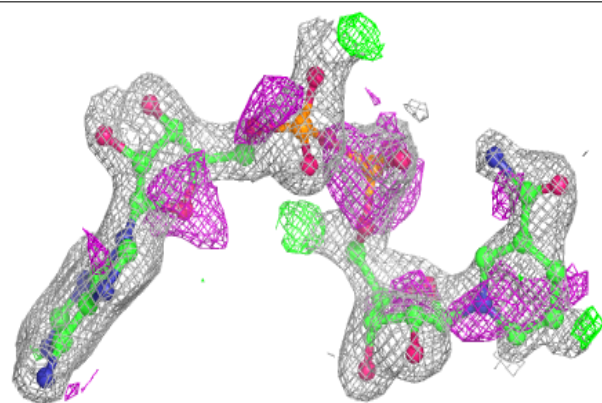
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

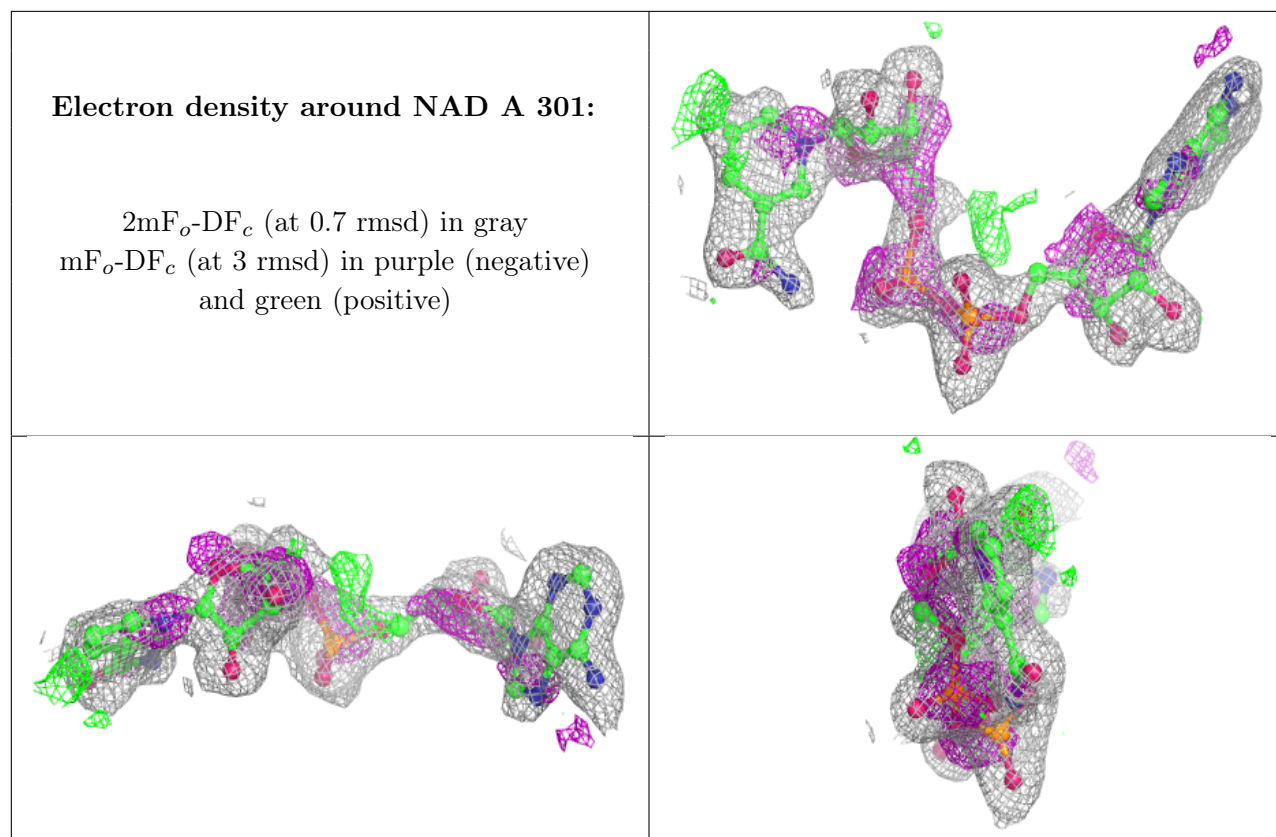
Electron density around NAD D 301:

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

**Electron density around NAD B 301:**

$2mF_o-DF_c$ (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.