Full wwPDB X-ray Structure Validation Report (i)

Nov 19, 2026 – 08:12 AM JST

PDB ID	:	46DY / pdb_000046dy
Title	:	Crystal structure of BcABA4 from Botrytis cinerea in complex with NAD+
Authors	:	Li, S.Y.; Liang, B.Y.; Huang, J.-W.; Chen, C.-C.; Guo, R.-T.
Deposited on	:	2026-09-19
Resolution	:	2.09 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 (i) 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 (i)) were used in the production of this report:

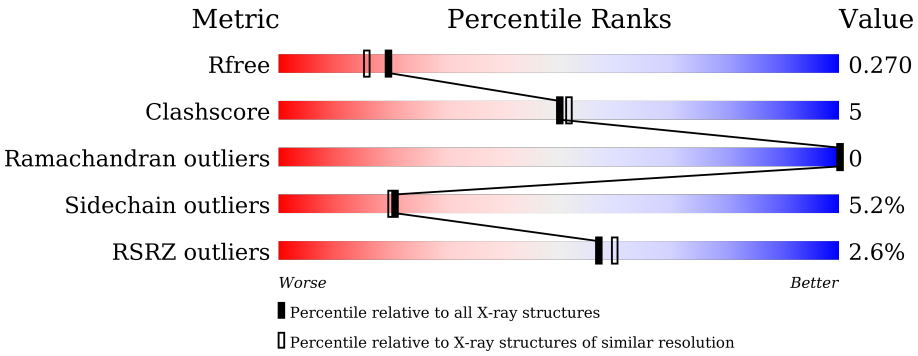
MolProbity	:	4-5-2 with Phenix2.2
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.09 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	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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 <=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	281	2% 79% 13% 8%
1	B	281	3% 75% 14% • 9%
1	C	281	3% 75% 13% • 10%
1	D	281	% 76% 13% • 11%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 8023 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 Short-chain dehydrogenase/reductase aba4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	258	Total	C	N	O	S	0	0	0
			1906	1193	330	377	6			
1	B	255	Total	C	N	O	S	0	0	0
			1887	1181	327	373	6			
1	C	253	Total	C	N	O	S	0	0	0
			1878	1176	325	371	6			
1	D	251	Total	C	N	O	S	0	0	0
			1862	1167	320	369	6			

There are 92 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-22	HIS	-	expression tag	UNP A0A384JQF5
A	-21	HIS	-	expression tag	UNP A0A384JQF5
A	-20	HIS	-	expression tag	UNP A0A384JQF5
A	-19	HIS	-	expression tag	UNP A0A384JQF5
A	-18	HIS	-	expression tag	UNP A0A384JQF5
A	-17	HIS	-	expression tag	UNP A0A384JQF5
A	-16	GLU	-	expression tag	UNP A0A384JQF5
A	-15	ASN	-	expression tag	UNP A0A384JQF5
A	-14	LEU	-	expression tag	UNP A0A384JQF5
A	-13	TYR	-	expression tag	UNP A0A384JQF5
A	-12	PHE	-	expression tag	UNP A0A384JQF5
A	-11	GLN	-	expression tag	UNP A0A384JQF5
A	-10	GLY	-	expression tag	UNP A0A384JQF5
A	-9	ALA	-	expression tag	UNP A0A384JQF5
A	-8	GLY	-	expression tag	UNP A0A384JQF5
A	-7	ALA	-	expression tag	UNP A0A384JQF5
A	-6	GLY	-	expression tag	UNP A0A384JQF5
A	-5	ALA	-	expression tag	UNP A0A384JQF5
A	-4	GLY	-	expression tag	UNP A0A384JQF5
A	-3	ALA	-	expression tag	UNP A0A384JQF5
A	-2	GLY	-	expression tag	UNP A0A384JQF5

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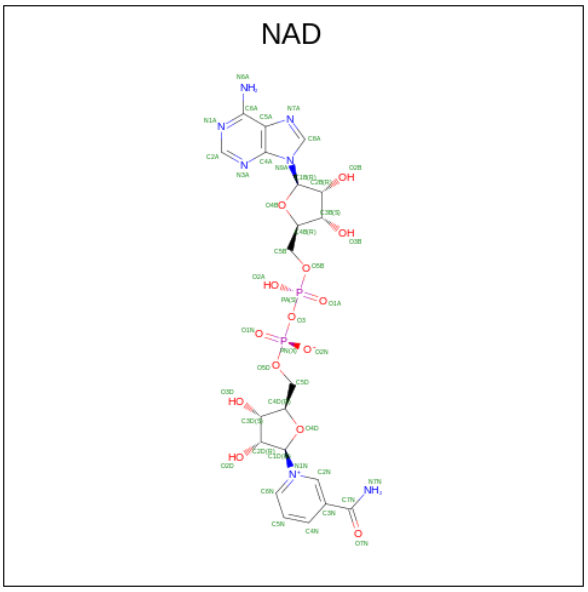
Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	ALA	-	expression tag	UNP A0A384JQF5
A	0	GLY	-	expression tag	UNP A0A384JQF5
B	-22	HIS	-	expression tag	UNP A0A384JQF5
B	-21	HIS	-	expression tag	UNP A0A384JQF5
B	-20	HIS	-	expression tag	UNP A0A384JQF5
B	-19	HIS	-	expression tag	UNP A0A384JQF5
B	-18	HIS	-	expression tag	UNP A0A384JQF5
B	-17	HIS	-	expression tag	UNP A0A384JQF5
B	-16	GLU	-	expression tag	UNP A0A384JQF5
B	-15	ASN	-	expression tag	UNP A0A384JQF5
B	-14	LEU	-	expression tag	UNP A0A384JQF5
B	-13	TYR	-	expression tag	UNP A0A384JQF5
B	-12	PHE	-	expression tag	UNP A0A384JQF5
B	-11	GLN	-	expression tag	UNP A0A384JQF5
B	-10	GLY	-	expression tag	UNP A0A384JQF5
B	-9	ALA	-	expression tag	UNP A0A384JQF5
B	-8	GLY	-	expression tag	UNP A0A384JQF5
B	-7	ALA	-	expression tag	UNP A0A384JQF5
B	-6	GLY	-	expression tag	UNP A0A384JQF5
B	-5	ALA	-	expression tag	UNP A0A384JQF5
B	-4	GLY	-	expression tag	UNP A0A384JQF5
B	-3	ALA	-	expression tag	UNP A0A384JQF5
B	-2	GLY	-	expression tag	UNP A0A384JQF5
B	-1	ALA	-	expression tag	UNP A0A384JQF5
B	0	GLY	-	expression tag	UNP A0A384JQF5
C	-22	HIS	-	expression tag	UNP A0A384JQF5
C	-21	HIS	-	expression tag	UNP A0A384JQF5
C	-20	HIS	-	expression tag	UNP A0A384JQF5
C	-19	HIS	-	expression tag	UNP A0A384JQF5
C	-18	HIS	-	expression tag	UNP A0A384JQF5
C	-17	HIS	-	expression tag	UNP A0A384JQF5
C	-16	GLU	-	expression tag	UNP A0A384JQF5
C	-15	ASN	-	expression tag	UNP A0A384JQF5
C	-14	LEU	-	expression tag	UNP A0A384JQF5
C	-13	TYR	-	expression tag	UNP A0A384JQF5
C	-12	PHE	-	expression tag	UNP A0A384JQF5
C	-11	GLN	-	expression tag	UNP A0A384JQF5
C	-10	GLY	-	expression tag	UNP A0A384JQF5
C	-9	ALA	-	expression tag	UNP A0A384JQF5
C	-8	GLY	-	expression tag	UNP A0A384JQF5
C	-7	ALA	-	expression tag	UNP A0A384JQF5
C	-6	GLY	-	expression tag	UNP A0A384JQF5

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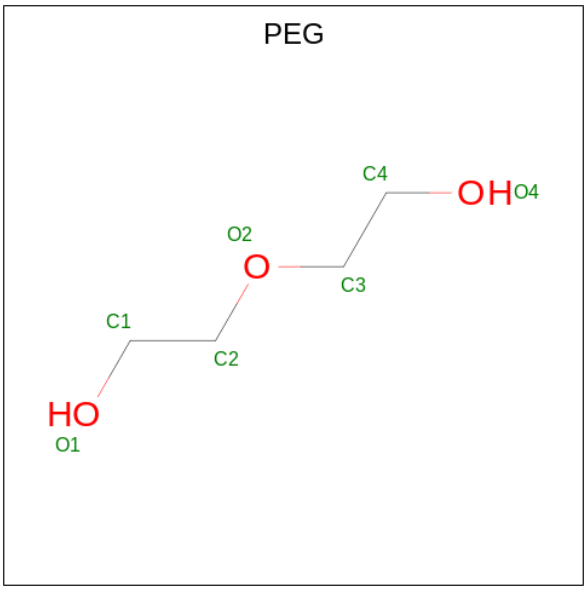
Chain	Residue	Modelled	Actual	Comment	Reference
C	-5	ALA	-	expression tag	UNP A0A384JQF5
C	-4	GLY	-	expression tag	UNP A0A384JQF5
C	-3	ALA	-	expression tag	UNP A0A384JQF5
C	-2	GLY	-	expression tag	UNP A0A384JQF5
C	-1	ALA	-	expression tag	UNP A0A384JQF5
C	0	GLY	-	expression tag	UNP A0A384JQF5
D	-22	HIS	-	expression tag	UNP A0A384JQF5
D	-21	HIS	-	expression tag	UNP A0A384JQF5
D	-20	HIS	-	expression tag	UNP A0A384JQF5
D	-19	HIS	-	expression tag	UNP A0A384JQF5
D	-18	HIS	-	expression tag	UNP A0A384JQF5
D	-17	HIS	-	expression tag	UNP A0A384JQF5
D	-16	GLU	-	expression tag	UNP A0A384JQF5
D	-15	ASN	-	expression tag	UNP A0A384JQF5
D	-14	LEU	-	expression tag	UNP A0A384JQF5
D	-13	TYR	-	expression tag	UNP A0A384JQF5
D	-12	PHE	-	expression tag	UNP A0A384JQF5
D	-11	GLN	-	expression tag	UNP A0A384JQF5
D	-10	GLY	-	expression tag	UNP A0A384JQF5
D	-9	ALA	-	expression tag	UNP A0A384JQF5
D	-8	GLY	-	expression tag	UNP A0A384JQF5
D	-7	ALA	-	expression tag	UNP A0A384JQF5
D	-6	GLY	-	expression tag	UNP A0A384JQF5
D	-5	ALA	-	expression tag	UNP A0A384JQF5
D	-4	GLY	-	expression tag	UNP A0A384JQF5
D	-3	ALA	-	expression tag	UNP A0A384JQF5
D	-2	GLY	-	expression tag	UNP A0A384JQF5
D	-1	ALA	-	expression tag	UNP A0A384JQF5
D	0	GLY	-	expression tag	UNP A0A384JQF5

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (CCD ID: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$) (labeled as "Ligand of Interest" by depositor).



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 DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



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

- Molecule 4 is water.

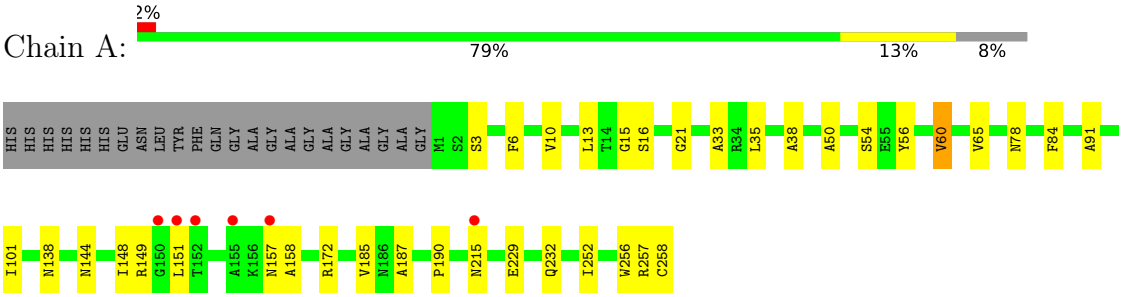
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	108	Total O 108 108	0	0
4	B	113	Total O 113 113	0	0
4	C	35	Total O 35 35	0	0
4	D	44	Total O 44 44	0	0

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.

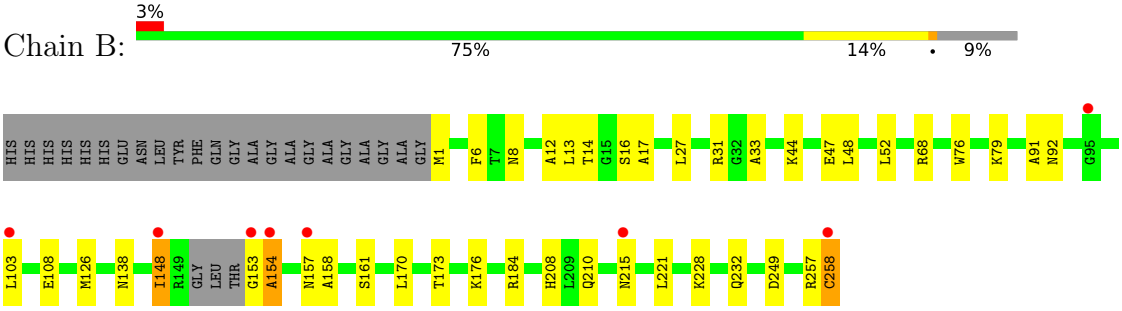
• Molecule 1: Short-chain dehydrogenase/reductase aba4

Chain A:



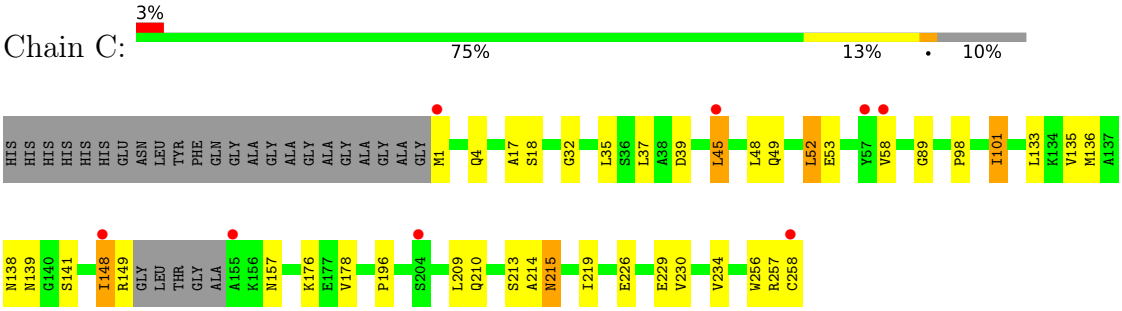
• Molecule 1: Short-chain dehydrogenase/reductase aba4

Chain B:



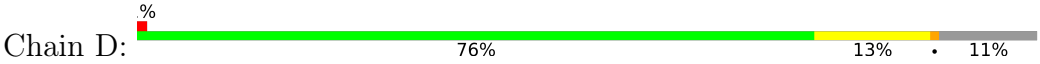
• Molecule 1: Short-chain dehydrogenase/reductase aba4

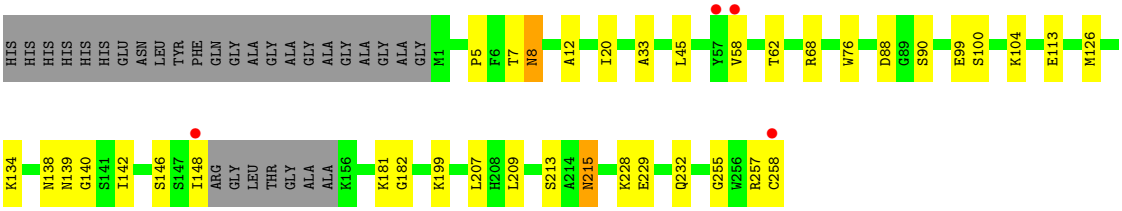
Chain C:



• Molecule 1: Short-chain dehydrogenase/reductase aba4

Chain D:




HIS HIS HIS HIS HIS GLU ASN LEU TYR PHE GLN GLY ALA GLY ALA GLY ALA GLY ALA GLY ALA GLY
M1 P5 F6 T7 M8 A12 I20 A33 L45 Y57 V58 T62 R68 W76 D88 G89 S90 E99 S100 K104 E113 M126
K134 N138 N139 G140 S141 I142 S146 S147 I148 ARG GLY LEU THR GLY ALA ALA K156 K181 G182 K199 L207 H208 L209 S213 A214 N215 K228 E229 Q232 G255 W256 R257 C258

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	71.81Å 100.16Å 167.89Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	24.78 – 2.09 24.78 – 2.09	Depositor EDS
% Data completeness (in resolution range)	96.5 (24.78-2.09) 96.5 (24.78-2.09)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.76 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, R_{free}	0.207 , 0.267 0.216 , 0.270	Depositor DCC
R_{free} test set	3477 reflections (4.83%)	wwPDB-VP
Wilson B-factor (Å^2)	29.9	Xtriage
Anisotropy	1.536	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 42.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	8023	wwPDB-VP
Average B, all atoms (Å^2)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 32.18 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.8008e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

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

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	1.19	0/1930	1.52	4/2608 (0.2%)
1	B	1.17	0/1910	1.49	2/2579 (0.1%)
1	C	1.11	0/1901	1.53	4/2567 (0.2%)
1	D	1.10	0/1885	1.50	0/2546
All	All	1.14	0/7626	1.51	10/10300 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	148	ILE	N-CA-C	-6.56	107.11	113.53
1	B	148	ILE	CB-CA-C	5.79	117.30	110.93
1	B	158	ALA	CA-C-O	-5.68	114.85	120.82
1	C	214	ALA	CA-C-N	5.63	128.39	120.28
1	C	214	ALA	C-N-CA	5.63	128.39	120.28
1	A	148	ILE	N-CA-C	-5.48	107.78	113.10
1	C	139	ASN	N-CA-C	-5.33	106.72	113.23
1	A	172	ARG	CA-C-N	5.06	127.02	120.44
1	A	172	ARG	C-N-CA	5.06	127.02	120.44
1	A	157	ASN	CA-C-O	-5.01	117.01	121.67

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	154	ALA	Peptide

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	1906	0	1942	20	0
1	B	1887	0	1920	23	0
1	C	1878	0	1912	24	0
1	D	1862	0	1894	22	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	7	0	10	2	0
3	B	7	0	10	0	0
4	A	108	0	0	1	0
4	B	113	0	0	7	0
4	C	35	0	0	2	0
4	D	44	0	0	4	0
All	All	8023	0	7792	82	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 (82) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:138:ASN:ND2	4:D:401:HOH:O	2.20	0.72
1:B:157:ASN:HB3	4:B:401:HOH:O	1.93	0.68
1:A:258:CYS:SG	1:D:258:CYS:N	2.69	0.65
1:A:149:ARG:NH2	1:A:256:TRP:O	2.31	0.64
1:B:154:ALA:O	4:B:401:HOH:O	2.15	0.64
1:A:10:VAL:HG21	1:A:84:PHE:HB3	1.81	0.63
1:C:49:GLN:O	1:C:53:GLU:HG2	2.01	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:258:CYS:O	1:C:258:CYS:SG	2.59	0.61
1:B:176:LYS:NZ	4:B:403:HOH:O	2.29	0.60
1:C:39:ASP:HB3	1:C:45:LEU:CD1	2.32	0.59
1:B:79:LYS:NZ	4:B:404:HOH:O	2.35	0.58
1:B:1:MET:HE2	1:D:5:PRO:HG3	1.85	0.58
1:A:101:ILE:HD13	1:A:151:LEU:HD23	1.85	0.57
1:C:133:LEU:HD22	1:C:178:VAL:HG11	1.87	0.57
1:C:138:ASN:ND2	4:C:403:HOH:O	2.37	0.57
1:C:17:ALA:HB2	1:C:45:LEU:HD12	1.87	0.57
1:D:68:ARG:HD3	4:D:436:HOH:O	2.05	0.56
1:B:13:LEU:CD2	1:B:91:ALA:HB3	2.35	0.56
1:C:48:LEU:HD22	1:C:52:LEU:HD22	1.91	0.53
1:B:27:LEU:HD11	1:B:31:ARG:NH2	2.24	0.53
1:C:209:LEU:HD22	1:C:215:ASN:HB3	1.91	0.52
1:A:13:LEU:CD2	1:A:91:ALA:HB3	2.41	0.50
1:A:6:PHE:HB3	1:A:33:ALA:HB2	1.93	0.50
1:C:136:MET:CE	1:C:141:SER:N	2.74	0.50
1:C:48:LEU:CD2	1:C:52:LEU:HD22	2.41	0.50
1:A:56:TYR:O	4:A:401:HOH:O	2.20	0.49
1:D:139:ASN:HD22	1:D:182:GLY:HA3	1.76	0.48
1:A:257:ARG:HD2	4:C:425:HOH:O	2.14	0.47
1:D:100:SER:OG	1:D:104:LYS:HB2	2.15	0.47
1:C:35:LEU:HB3	1:C:37:LEU:CD1	2.45	0.47
1:B:6:PHE:HB3	1:B:33:ALA:HB2	1.97	0.46
1:B:17:ALA:O	1:B:44:LYS:HE3	2.14	0.46
1:C:48:LEU:HD23	1:C:48:LEU:O	2.15	0.46
1:C:136:MET:CE	1:C:141:SER:H	2.29	0.46
1:C:39:ASP:CB	1:C:45:LEU:HD11	2.46	0.46
1:A:78:ASN:HD22	1:A:78:ASN:HA	1.59	0.45
1:C:230:VAL:O	1:C:234:VAL:HG23	2.16	0.45
1:B:157:ASN:CB	4:B:401:HOH:O	2.58	0.45
1:B:232:GLN:NE2	4:B:419:HOH:O	2.48	0.45
1:B:176:LYS:HE2	1:D:255:GLY:O	2.16	0.45
1:A:158:ALA:HB2	1:B:173:THR:HG21	1.98	0.45
1:D:12:ALA:HB1	1:D:76:TRP:CZ2	2.52	0.45
1:A:229:GLU:HA	1:A:232:GLN:HE21	1.81	0.45
1:A:54:SER:HB2	3:A:301:PEG:O1	2.17	0.45
1:D:232:GLN:NE2	4:D:404:HOH:O	2.50	0.44
1:B:208:HIS:O	1:B:210:GLN:NE2	2.33	0.44
1:B:8:ASN:ND2	4:B:420:HOH:O	2.49	0.44
1:D:90:SER:O	1:D:142:ILE:HA	2.18	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:229:GLU:HA	1:D:232:GLN:HE21	1.82	0.44
1:B:12:ALA:HB1	1:B:76:TRP:CZ2	2.53	0.44
1:D:33:ALA:O	1:D:58:VAL:CG2	2.66	0.43
1:A:144:ASN:O	1:A:187:ALA:HA	2.18	0.43
1:C:98:PRO:HG2	1:C:101:ILE:HG23	2.00	0.43
1:D:100:SER:HB3	1:D:113:GLU:OE2	2.18	0.43
1:A:3:SER:HA	1:C:1:MET:O	2.18	0.43
1:A:13:LEU:HD22	1:A:91:ALA:HB3	1.99	0.43
1:A:15:GLY:O	1:A:21:GLY:HA3	2.18	0.43
1:A:50:ALA:HA	3:A:301:PEG:H11	2.00	0.43
1:B:176:LYS:HE3	1:D:257:ARG:HB2	2.01	0.43
1:D:146:SER:O	2:D:300:NAD:H6N	2.19	0.43
1:B:126:MET:HA	1:B:170:LEU:HD21	2.00	0.43
1:C:18:SER:OG	1:C:196:PRO:HG2	2.19	0.42
1:A:38:ALA:HB1	1:A:65:VAL:HB	2.01	0.42
1:C:226:GLU:O	1:C:229:GLU:HB2	2.19	0.42
1:C:89:GLY:HA2	1:C:141:SER:O	2.20	0.42
1:D:215:ASN:HD22	1:D:215:ASN:HA	1.68	0.42
1:A:190:PRO:HA	1:A:252:ILE:HG23	2.02	0.42
1:B:14:THR:OG1	1:B:92:ASN:HA	2.20	0.42
1:D:181:LYS:HE2	4:D:401:HOH:O	2.20	0.42
1:B:153:GLY:HA3	1:B:161:SER:OG	2.20	0.41
1:C:101:ILE:HG22	1:C:157:ASN:OD1	2.20	0.41
1:C:39:ASP:HB2	1:C:45:LEU:HD11	2.01	0.41
1:D:88:ASP:O	1:D:140:GLY:HA2	2.20	0.41
1:A:35:LEU:O	1:A:60:VAL:HA	2.19	0.41
1:D:20:ILE:HD12	2:D:300:NAD:H51N	2.03	0.41
1:D:45:LEU:HD12	1:D:45:LEU:HA	1.90	0.41
1:B:48:LEU:O	1:B:52:LEU:HG	2.21	0.40
1:C:4:GLN:HE22	1:C:32:GLY:CA	2.34	0.40
1:D:126:MET:HE3	1:D:126:MET:HB3	1.99	0.40
1:B:13:LEU:HD22	1:B:91:ALA:HB3	2.04	0.40
1:D:7:THR:O	1:D:8:ASN:HB2	2.22	0.40
1:C:219:ILE:HG12	1:C:256:TRP:HB2	2.04	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	256/281 (91%)	247 (96%)	9 (4%)	0	100	100
1	B	251/281 (89%)	240 (96%)	11 (4%)	0	100	100
1	C	249/281 (89%)	232 (93%)	17 (7%)	0	100	100
1	D	247/281 (88%)	231 (94%)	16 (6%)	0	100	100
All	All	1003/1124 (89%)	950 (95%)	53 (5%)	0	100	100

There are no Ramachandran outliers to report.

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	202/214 (94%)	197 (98%)	5 (2%)	42	48
1	B	200/214 (94%)	186 (93%)	14 (7%)	14	11
1	C	200/214 (94%)	188 (94%)	12 (6%)	17	15
1	D	199/214 (93%)	188 (94%)	11 (6%)	19	18
All	All	801/856 (94%)	759 (95%)	42 (5%)	21	20

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	16	SER
1	A	60	VAL

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Mol	Chain	Res	Type
1	A	138	ASN
1	A	185	VAL
1	A	215	ASN
1	B	16	SER
1	B	47	GLU
1	B	68	ARG
1	B	103	LEU
1	B	108	GLU
1	B	138	ASN
1	B	148	ILE
1	B	184	ARG
1	B	215	ASN
1	B	221	LEU
1	B	228	LYS
1	B	249	ASP
1	B	257	ARG
1	B	258	CYS
1	C	45	LEU
1	C	52	LEU
1	C	58	VAL
1	C	101	ILE
1	C	135	VAL
1	C	148	ILE
1	C	149	ARG
1	C	176	LYS
1	C	210	GLN
1	C	213	SER
1	C	215	ASN
1	C	257	ARG
1	D	8	ASN
1	D	62	THR
1	D	99	GLU
1	D	134	LYS
1	D	148	ILE
1	D	199	LYS
1	D	207	LEU
1	D	209	LEU
1	D	213	SER
1	D	215	ASN
1	D	228	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (34) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	4	GLN
1	A	8	ASN
1	A	78	ASN
1	A	83	ASN
1	A	127	ASN
1	A	138	ASN
1	A	139	ASN
1	A	215	ASN
1	A	232	GLN
1	B	8	ASN
1	B	51	GLN
1	B	78	ASN
1	B	127	ASN
1	B	138	ASN
1	B	215	ASN
1	B	232	GLN
1	C	4	GLN
1	C	8	ASN
1	C	78	ASN
1	C	83	ASN
1	C	109	GLN
1	C	127	ASN
1	C	138	ASN
1	C	139	ASN
1	C	215	ASN
1	C	232	GLN
1	D	4	GLN
1	D	8	ASN
1	D	78	ASN
1	D	83	ASN
1	D	127	ASN
1	D	139	ASN
1	D	215	ASN
1	D	232	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

6 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	PEG	B	302	-	6,6,6	0.34	0	5,5,5	0.20	0
2	NAD	D	300	-	45,48,48	0.75	1 (2%)	63,73,73	0.89	1 (1%)
2	NAD	C	300	-	45,48,48	0.59	1 (2%)	63,73,73	0.84	2 (3%)
2	NAD	B	301	-	45,48,48	0.68	1 (2%)	63,73,73	0.83	1 (1%)
2	NAD	A	300	-	45,48,48	0.75	1 (2%)	63,73,73	1.00	2 (3%)
3	PEG	A	301	-	6,6,6	0.17	0	5,5,5	0.20	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
3	PEG	B	302	-	-	3/4/4/4	-
2	NAD	D	300	-	-	7/30/62/62	0/5/5/5
2	NAD	C	300	-	-	8/30/62/62	0/5/5/5
2	NAD	B	301	-	-	5/30/62/62	0/5/5/5
2	NAD	A	300	-	-	5/30/62/62	0/5/5/5
3	PEG	A	301	-	-	2/4/4/4	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	300	NAD	C2N-N1N	4.08	1.39	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	300	NAD	C2N-N1N	3.55	1.39	1.35
2	B	301	NAD	C2N-N1N	2.87	1.38	1.35
2	C	300	NAD	C2N-N1N	2.76	1.38	1.35

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	300	NAD	C6N-N1N-C2N	-4.68	117.71	121.97
2	A	300	NAD	C6N-N1N-C2N	-4.08	118.25	121.97
2	C	300	NAD	C6N-N1N-C2N	-3.34	118.93	121.97
2	B	301	NAD	C6N-N1N-C2N	-3.17	119.08	121.97
2	A	300	NAD	O4D-C1D-C2D	-2.48	103.30	106.93
2	C	300	NAD	O4B-C1B-N9A	2.09	112.18	108.06

There are no chirality outliers.

All (30) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	300	NAD	C5D-O5D-PN-O1N
2	A	300	NAD	C5D-O5D-PN-O2N
2	B	301	NAD	C5D-O5D-PN-O3
2	C	300	NAD	C5B-O5B-PA-O1A
2	C	300	NAD	C5B-O5B-PA-O3
2	C	300	NAD	C5D-O5D-PN-O2N
2	D	300	NAD	C5D-O5D-PN-O3
3	A	301	PEG	O1-C1-C2-O2
2	C	300	NAD	O4B-C4B-C5B-O5B
2	C	300	NAD	C3B-C4B-C5B-O5B
3	B	302	PEG	O1-C1-C2-O2
3	A	301	PEG	O2-C3-C4-O4
2	D	300	NAD	O4D-C4D-C5D-O5D
2	D	300	NAD	PA-O3-PN-O1N
2	C	300	NAD	C5D-O5D-PN-O3
2	B	301	NAD	PA-O3-PN-O2N
2	B	301	NAD	C5D-O5D-PN-O1N
2	C	300	NAD	C5B-O5B-PA-O2A
2	D	300	NAD	C5D-O5D-PN-O1N
2	D	300	NAD	C3D-C4D-C5D-O5D
2	D	300	NAD	PA-O3-PN-O2N
2	A	300	NAD	O4B-C4B-C5B-O5B
3	B	302	PEG	C4-C3-O2-C2
2	B	301	NAD	PA-O3-PN-O1N

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Mol	Chain	Res	Type	Atoms
3	B	302	PEG	C1-C2-O2-C3
2	A	300	NAD	C5D-O5D-PN-O3
2	A	300	NAD	PA-O3-PN-O2N
2	C	300	NAD	C5D-O5D-PN-O1N
2	B	301	NAD	O4B-C4B-C5B-O5B
2	D	300	NAD	O4B-C4B-C5B-O5B

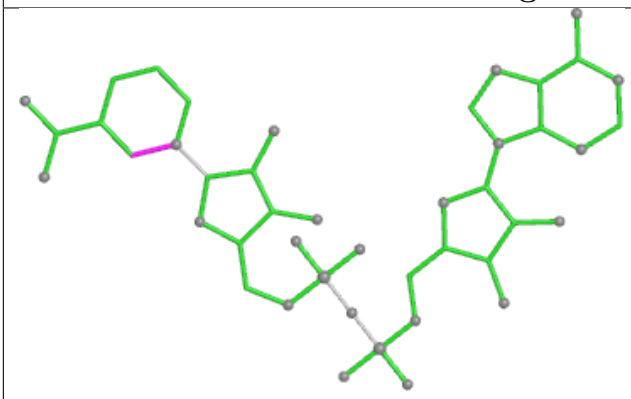
There are no ring outliers.

2 monomers are involved in 4 short contacts:

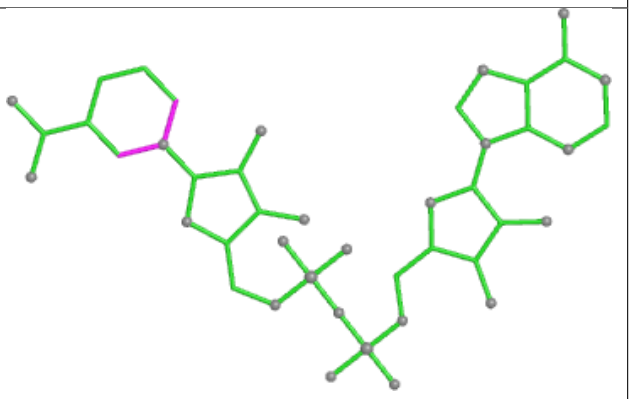
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	300	NAD	2	0
3	A	301	PEG	2	0

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 then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

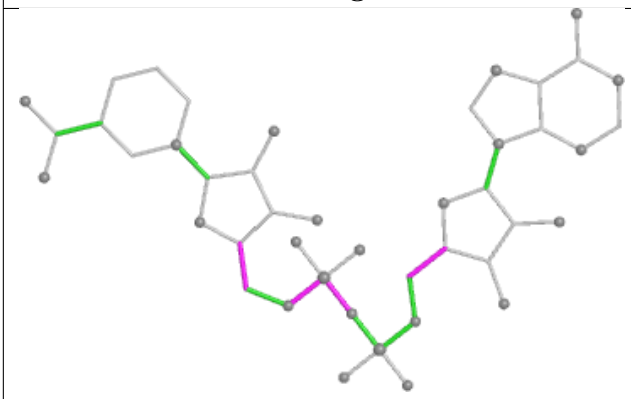
Ligand NAD D 300



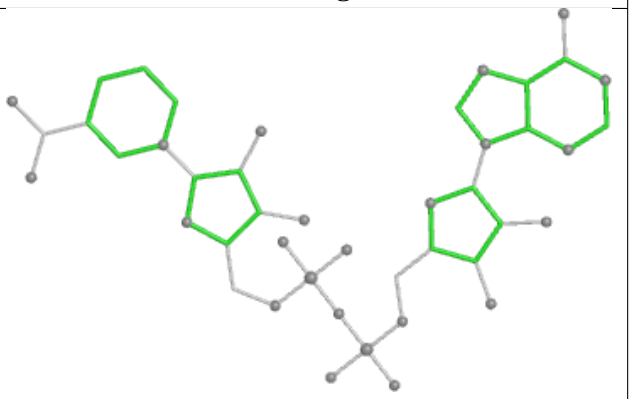
Bond lengths



Bond angles

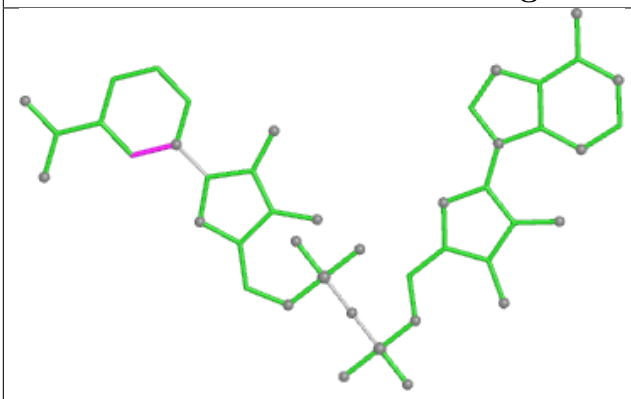


Torsions

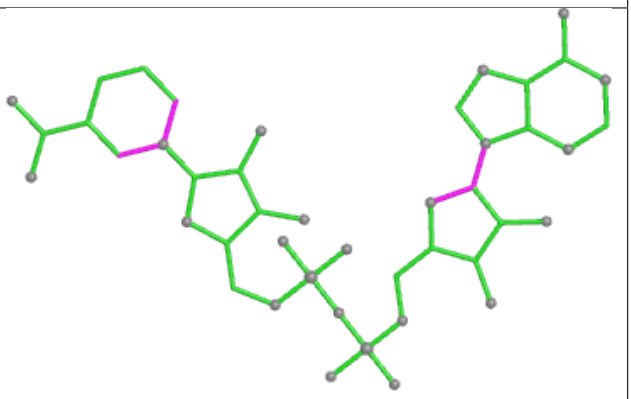


Rings

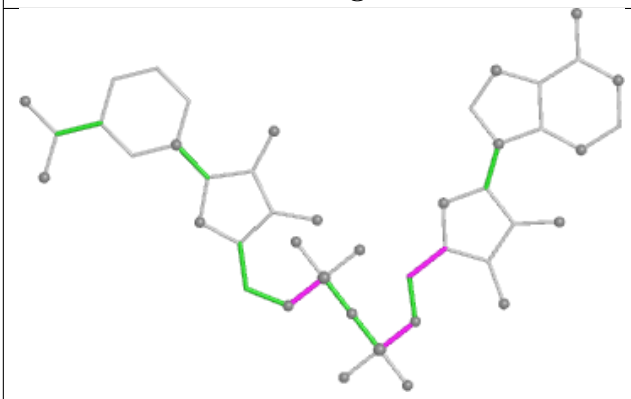
Ligand NAD C 300



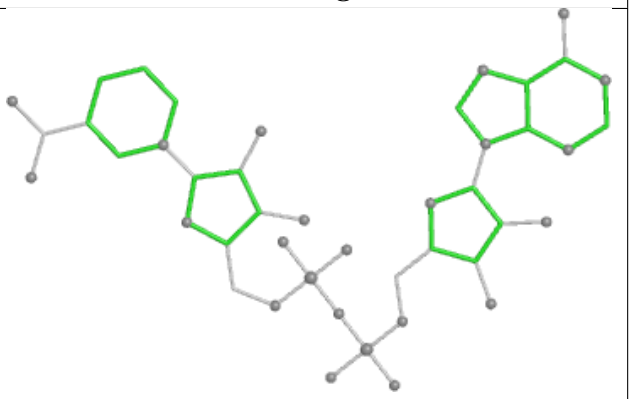
Bond lengths



Bond angles

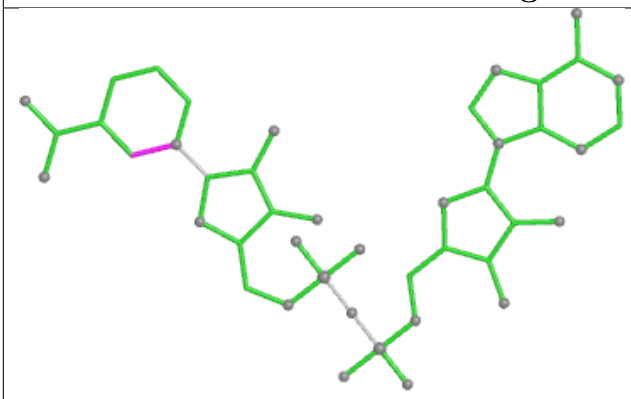


Torsions

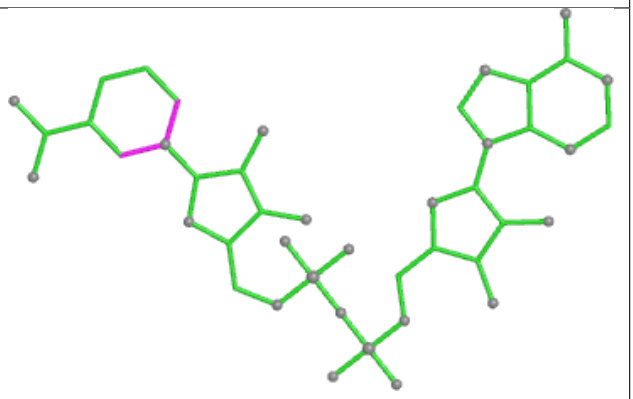


Rings

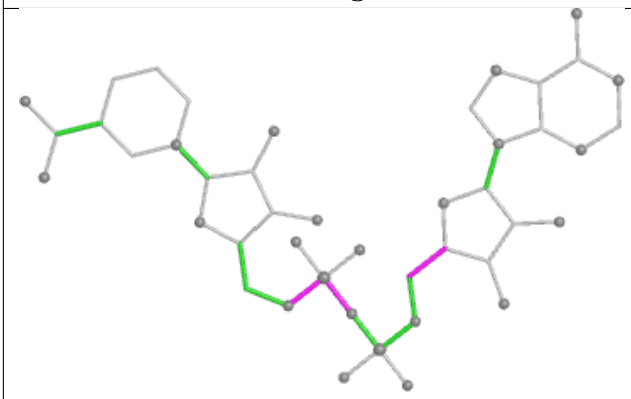
Ligand NAD B 301



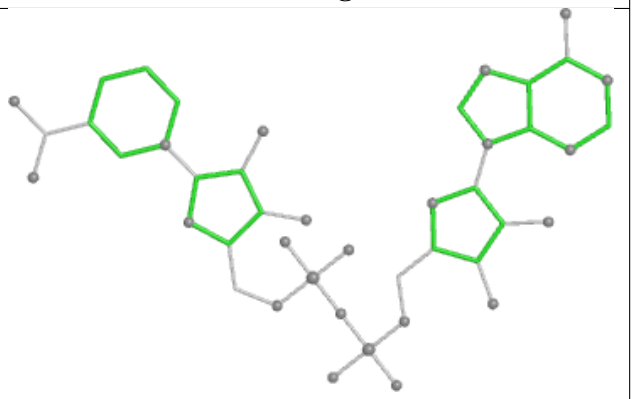
Bond lengths



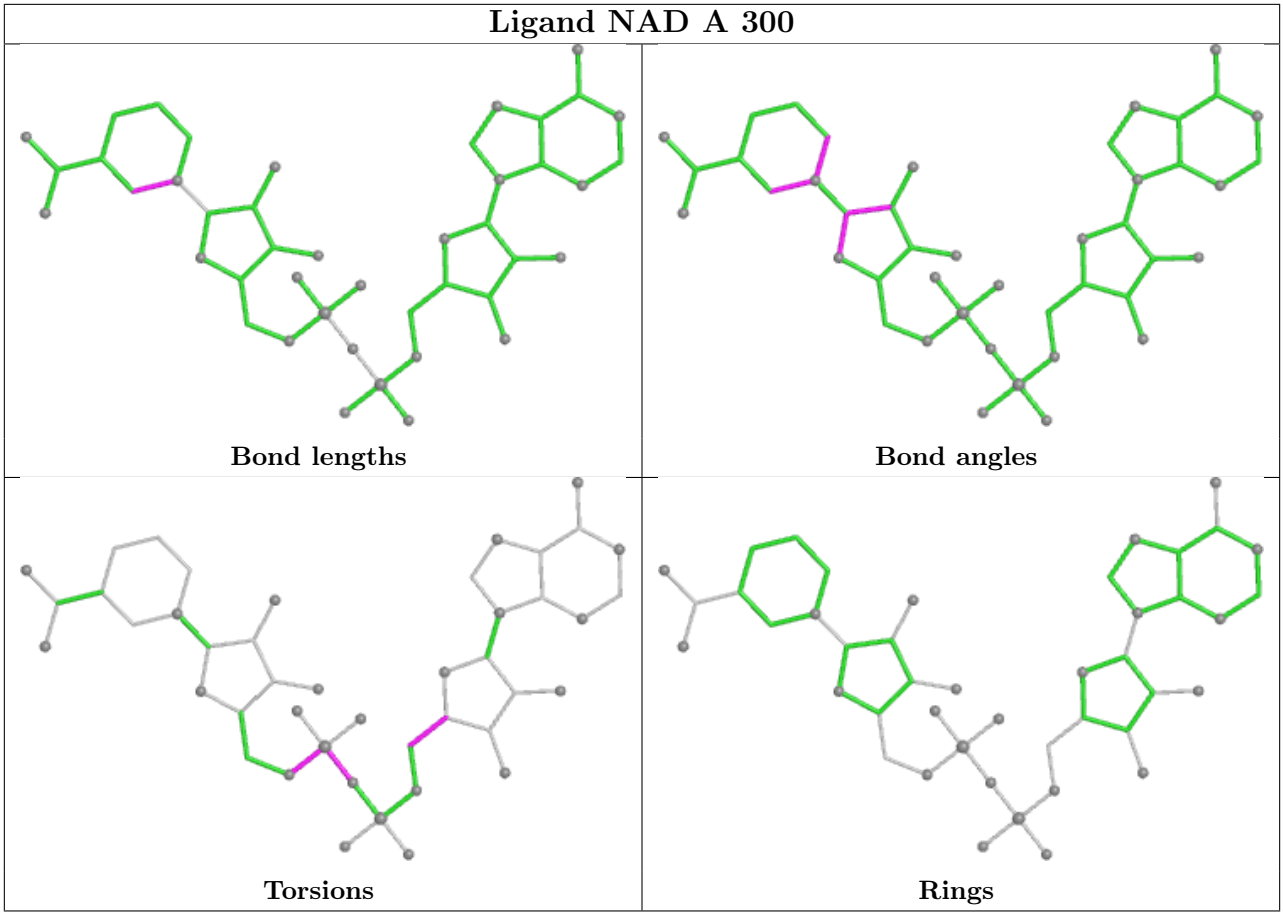
Bond angles



Torsions



Rings



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} 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	258/281 (91%)	0.19	6 (2%)	61	64	31, 41, 75, 99	0
1	B	255/281 (90%)	0.19	8 (3%)	51	54	29, 40, 66, 96	0
1	C	253/281 (90%)	0.50	8 (3%)	50	53	40, 64, 88, 115	0
1	D	251/281 (89%)	0.46	4 (1%)	70	73	38, 61, 88, 107	0
All	All	1017/1124 (90%)	0.33	26 (2%)	57	60	29, 49, 84, 115	0

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	258	CYS	4.9
1	A	150	GLY	3.7
1	B	154	ALA	3.7
1	A	155	ALA	3.6
1	B	153	GLY	3.4
1	A	151	LEU	3.3
1	B	157	ASN	3.2
1	A	157	ASN	2.9
1	B	258	CYS	2.9
1	C	258	CYS	2.9
1	C	155	ALA	2.9
1	D	148	ILE	2.8
1	A	215	ASN	2.7
1	A	152	THR	2.6
1	D	58	VAL	2.5
1	D	57	TYR	2.3
1	B	215	ASN	2.3
1	B	95	GLY	2.3
1	C	148	ILE	2.2
1	B	148	ILE	2.2
1	C	58	VAL	2.2

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Mol	Chain	Res	Type	RSRZ
1	C	1	MET	2.2
1	C	57	TYR	2.1
1	B	103	LEU	2.1
1	C	45	LEU	2.1
1	C	204	SER	2.1

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)

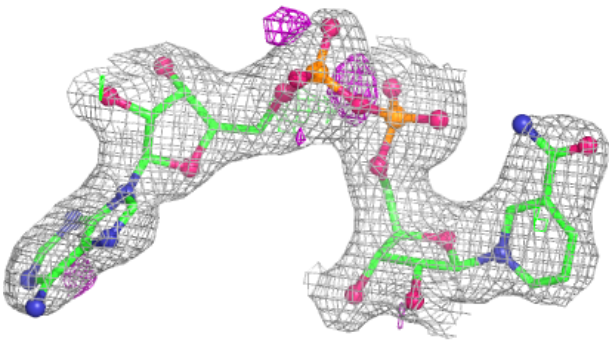
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

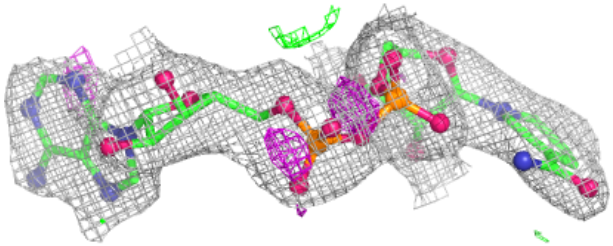
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	PEG	A	301	7/7	0.55	0.22	67,80,98,101	0
3	PEG	B	302	7/7	0.87	0.12	64,77,84,88	0
2	NAD	D	300	44/44	0.90	0.09	54,66,72,80	0
2	NAD	C	300	44/44	0.92	0.08	51,64,73,85	0
2	NAD	A	300	44/44	0.96	0.07	34,39,54,64	0
2	NAD	B	301	44/44	0.96	0.07	34,39,50,62	0

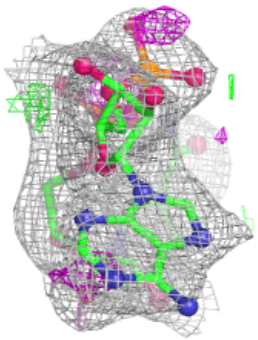
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around NAD D 300:

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

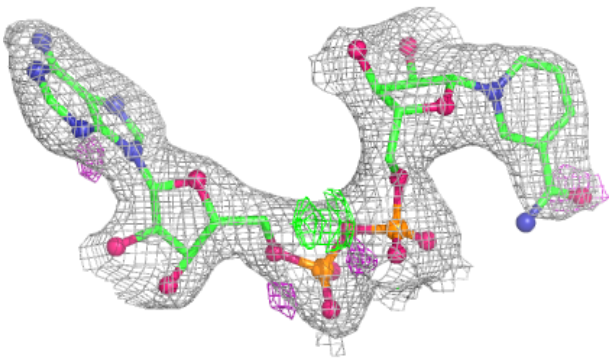


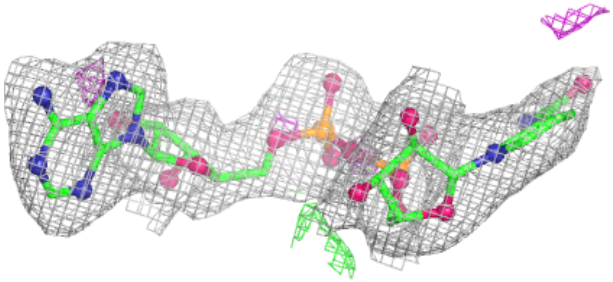


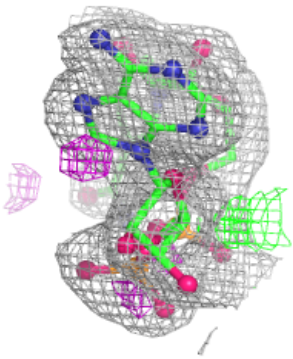


Electron density around NAD C 300:

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

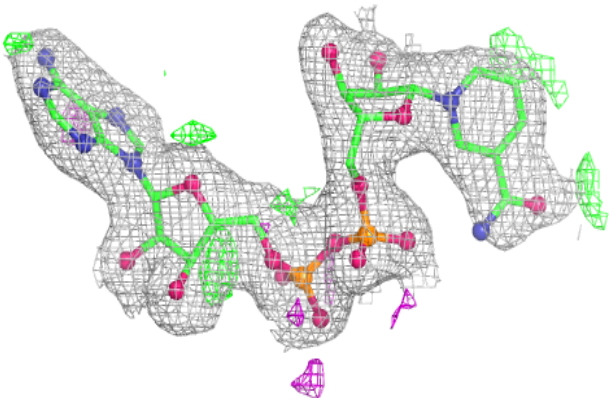


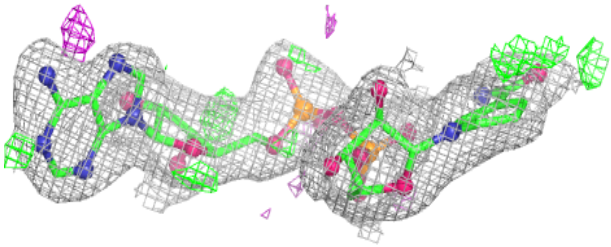


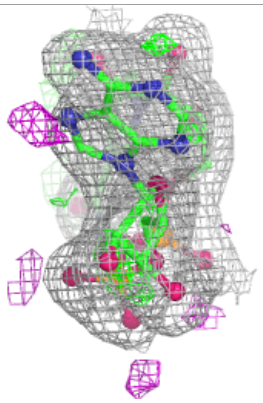


Electron density around NAD A 300:

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

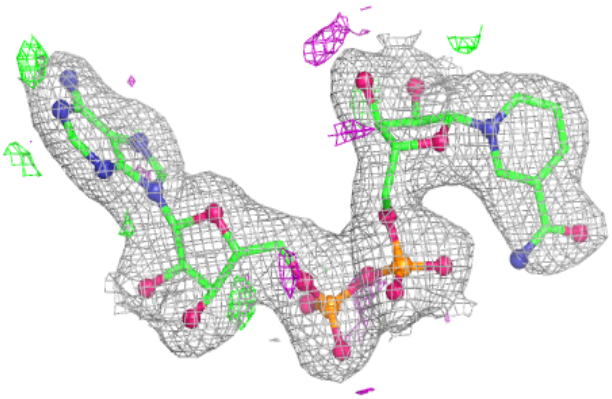


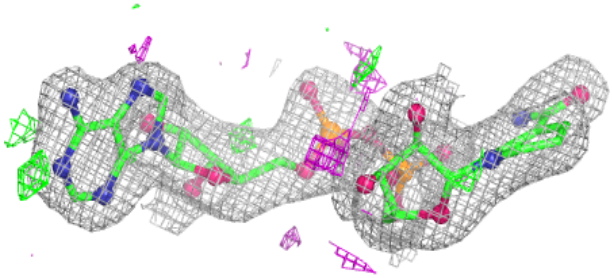


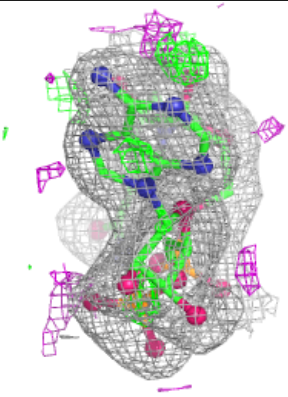


Electron density around NAD B 301:

$2mF_o$-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.