



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 23, 2023 – 06:28 AM EDT

PDB ID : 3CGD  
Title : Pyridine Nucleotide Complexes with Bacillus anthracis Coenzyme A-Disulfide Reductase: A Structural Analysis of Dual NAD(P)H Specificity  
Authors : Wallen, J.R.  
Deposited on : 2008-03-05  
Resolution : 2.25 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](mailto: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>.

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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 : 2.35  
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) : 2.35

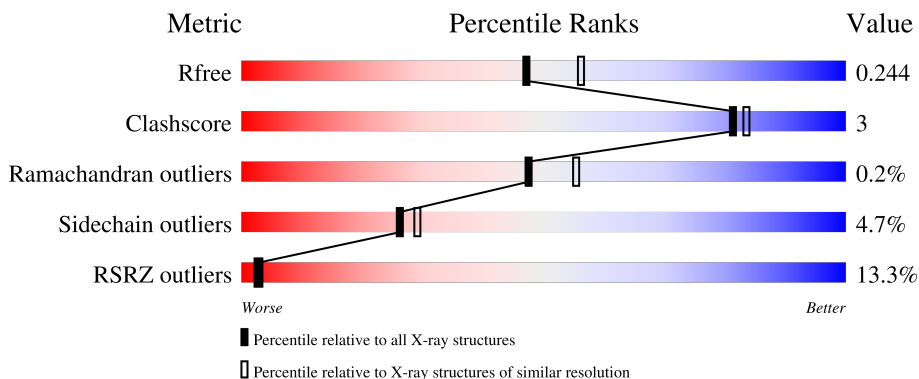
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.25 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	1377 (2.26-2.26)
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)
RSRZ outliers	127900	1356 (2.26-2.26)

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  $\geq 3$ , 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	480	 13% 83% 9% 8%
1	B	480	 11% 83% 9% 8%

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 7735 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 Pyridine nucleotide-disulfide oxidoreductase, class I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	444	3496	2208	603	670	15	0	3	0
1	B	444	3489	2203	603	668	15	0	2	0

There are 72 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-35	MET	-	expression tag	UNP Q81TK8
A	-34	GLY	-	expression tag	UNP Q81TK8
A	-33	GLY	-	expression tag	UNP Q81TK8
A	-32	SER	-	expression tag	UNP Q81TK8
A	-31	HIS	-	expression tag	UNP Q81TK8
A	-30	HIS	-	expression tag	UNP Q81TK8
A	-29	HIS	-	expression tag	UNP Q81TK8
A	-28	HIS	-	expression tag	UNP Q81TK8
A	-27	HIS	-	expression tag	UNP Q81TK8
A	-26	HIS	-	expression tag	UNP Q81TK8
A	-25	GLY	-	expression tag	UNP Q81TK8
A	-24	MET	-	expression tag	UNP Q81TK8
A	-23	ALA	-	expression tag	UNP Q81TK8
A	-22	SER	-	expression tag	UNP Q81TK8
A	-21	MET	-	expression tag	UNP Q81TK8
A	-20	THR	-	expression tag	UNP Q81TK8
A	-19	GLY	-	expression tag	UNP Q81TK8
A	-18	GLY	-	expression tag	UNP Q81TK8
A	-17	GLN	-	expression tag	UNP Q81TK8
A	-16	GLN	-	expression tag	UNP Q81TK8
A	-15	MET	-	expression tag	UNP Q81TK8
A	-14	GLY	-	expression tag	UNP Q81TK8
A	-13	ARG	-	expression tag	UNP Q81TK8
A	-12	THR	-	expression tag	UNP Q81TK8
A	-11	LEU	-	expression tag	UNP Q81TK8

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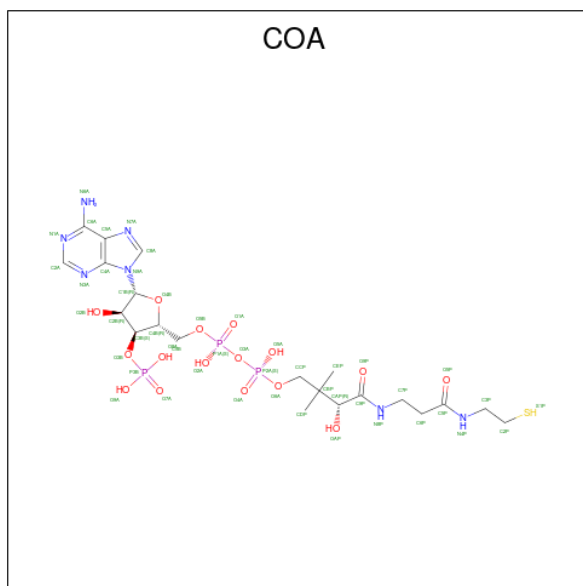
Chain	Residue	Modelled	Actual	Comment	Reference
A	-10	TYR	-	expression tag	UNP Q81TK8
A	-9	ASP	-	expression tag	UNP Q81TK8
A	-8	ASP	-	expression tag	UNP Q81TK8
A	-7	ASP	-	expression tag	UNP Q81TK8
A	-6	ASP	-	expression tag	UNP Q81TK8
A	-5	LYS	-	expression tag	UNP Q81TK8
A	-4	ASP	-	expression tag	UNP Q81TK8
A	-3	ARG	-	expression tag	UNP Q81TK8
A	-2	TRP	-	expression tag	UNP Q81TK8
A	-1	GLY	-	expression tag	UNP Q81TK8
A	0	SER	-	expression tag	UNP Q81TK8
B	-35	MET	-	expression tag	UNP Q81TK8
B	-34	GLY	-	expression tag	UNP Q81TK8
B	-33	GLY	-	expression tag	UNP Q81TK8
B	-32	SER	-	expression tag	UNP Q81TK8
B	-31	HIS	-	expression tag	UNP Q81TK8
B	-30	HIS	-	expression tag	UNP Q81TK8
B	-29	HIS	-	expression tag	UNP Q81TK8
B	-28	HIS	-	expression tag	UNP Q81TK8
B	-27	HIS	-	expression tag	UNP Q81TK8
B	-26	HIS	-	expression tag	UNP Q81TK8
B	-25	GLY	-	expression tag	UNP Q81TK8
B	-24	MET	-	expression tag	UNP Q81TK8
B	-23	ALA	-	expression tag	UNP Q81TK8
B	-22	SER	-	expression tag	UNP Q81TK8
B	-21	MET	-	expression tag	UNP Q81TK8
B	-20	THR	-	expression tag	UNP Q81TK8
B	-19	GLY	-	expression tag	UNP Q81TK8
B	-18	GLY	-	expression tag	UNP Q81TK8
B	-17	GLN	-	expression tag	UNP Q81TK8
B	-16	GLN	-	expression tag	UNP Q81TK8
B	-15	MET	-	expression tag	UNP Q81TK8
B	-14	GLY	-	expression tag	UNP Q81TK8
B	-13	ARG	-	expression tag	UNP Q81TK8
B	-12	THR	-	expression tag	UNP Q81TK8
B	-11	LEU	-	expression tag	UNP Q81TK8
B	-10	TYR	-	expression tag	UNP Q81TK8
B	-9	ASP	-	expression tag	UNP Q81TK8
B	-8	ASP	-	expression tag	UNP Q81TK8
B	-7	ASP	-	expression tag	UNP Q81TK8
B	-6	ASP	-	expression tag	UNP Q81TK8
B	-5	LYS	-	expression tag	UNP Q81TK8

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	ASP	-	expression tag	UNP Q81TK8
B	-3	ARG	-	expression tag	UNP Q81TK8
B	-2	TRP	-	expression tag	UNP Q81TK8
B	-1	GLY	-	expression tag	UNP Q81TK8
B	0	SER	-	expression tag	UNP Q81TK8

- Molecule 2 is COENZYME A (three-letter code: COA) (formula: C<sub>21</sub>H<sub>36</sub>N<sub>7</sub>O<sub>16</sub>P<sub>3</sub>S).



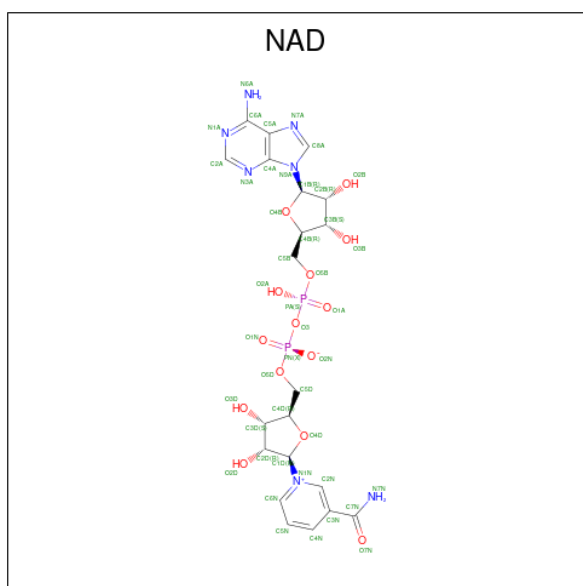
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	N	O	P			S
2	A	1	Total	C	N	O	P	S	0	0
			48	21	7	16	3	1		
2	B	1	Total	C	N	O	P	S	0	0
			48	21	7	16	3	1		

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: C<sub>27</sub>H<sub>33</sub>N<sub>9</sub>O<sub>15</sub>P<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
3	A	1	53	27	9	15	2	0	0
3	B	1	53	27	9	15	2	0	0

- Molecule 4 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula:  $C_{21}H_{27}N_7O_{14}P_2$ ).



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

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

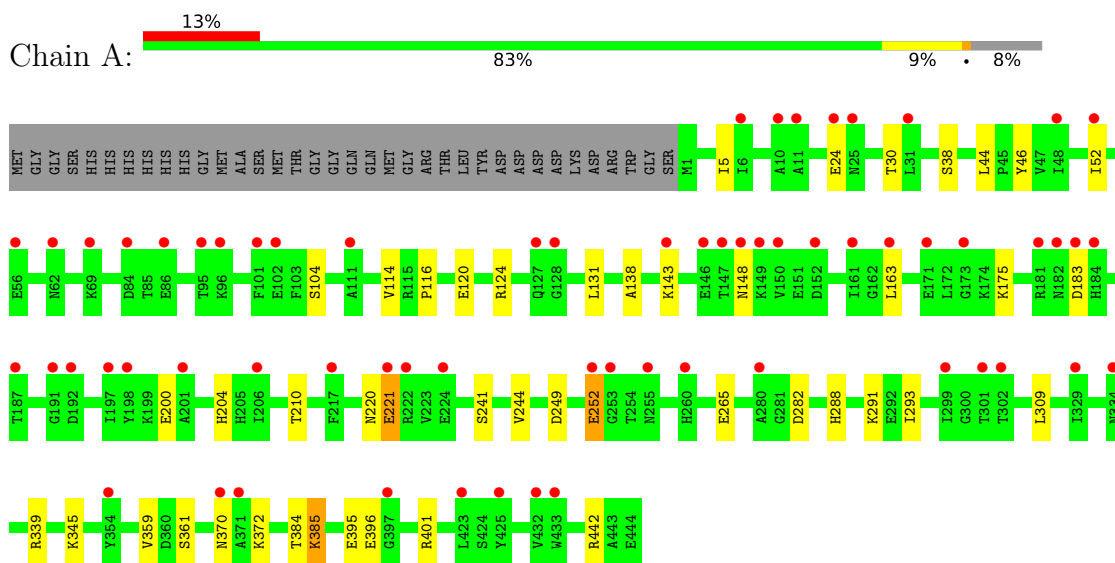
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	229	Total	O	0	0
			229	229		
5	B	231	Total	O	0	0
			231	231		

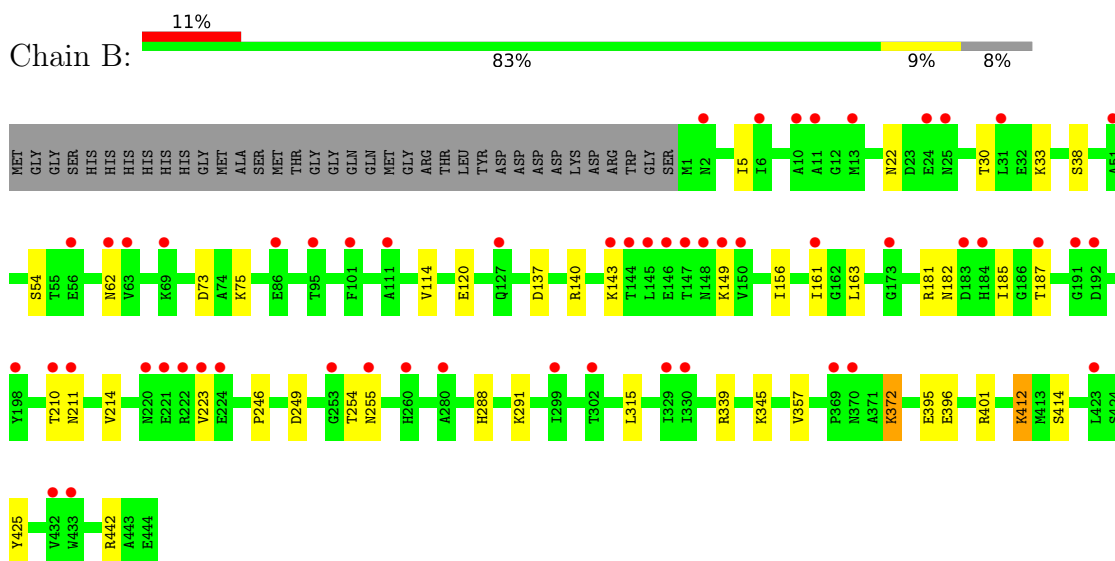
### 3 Residue-property plots [i](#)

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: Pyridine nucleotide-disulfide oxidoreductase, class I



- Molecule 1: Pyridine nucleotide-disulfide oxidoreductase, class I





## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	169.61Å 81.17Å 98.05Å 90.00° 104.01° 90.00°	Depositor
Resolution (Å)	37.45 – 2.25 37.44 – 2.25	Depositor EDS
% Data completeness (in resolution range)	96.0 (37.45-2.25) 96.0 (37.44-2.25)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.50 (at 2.24Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.206 , 0.248 0.206 , 0.244	Depositor DCC
$R_{free}$ test set	3006 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	32.7	Xtrriage
Anisotropy	0.611	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 54.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.54$ , $\langle L^2 \rangle = 0.38$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	7735	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.09% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: FAD, NAD, COA

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	0.47	0/3563	0.59	0/4812
1	B	0.45	0/3553	0.59	0/4799
All	All	0.46	0/7116	0.59	0/9611

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.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	425	TYR	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	3496	0	3527	20	0
1	B	3489	0	3519	18	0
2	A	48	0	32	0	0
2	B	48	0	32	0	0
3	A	53	0	31	0	0
3	B	53	0	31	0	0
4	A	44	0	26	1	0
4	B	44	0	26	2	0
5	A	229	0	0	4	0
5	B	231	0	0	2	0
All	All	7735	0	7224	38	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 3.

All (38) 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:A:345:LYS:HE2	5:A:977:HOH:O	1.60	1.01
1:B:137:ASP:OD1	1:B:140:ARG:NH2	2.36	0.58
1:A:244:VAL:HG13	4:A:818:NAD:H51N	1.90	0.53
1:A:395:GLU:HG2	5:A:833:HOH:O	2.09	0.53
1:A:288:HIS:HB3	1:A:291:LYS:HB2	1.92	0.52
1:A:5:ILE:HB	1:A:30:THR:HG22	1.91	0.52
1:A:120:GLU:HA	1:A:124:ARG:HD2	1.92	0.51
1:B:5:ILE:HB	1:B:30:THR:HG22	1.93	0.50
1:A:359:VAL:HG12	1:A:361:SER:HB2	1.94	0.50
1:A:114:VAL:HG13	1:A:282:ASP:HB3	1.94	0.49
1:B:156:ILE:HD12	1:B:214:VAL:HG21	1.94	0.49
1:B:372:LYS:HD3	1:B:395:GLU:OE2	2.12	0.48
1:A:384:THR:O	1:A:385:LYS:HB2	2.14	0.48
1:A:220:ASN:H	1:A:220:ASN:ND2	2.11	0.47
1:B:181:ARG:HE	1:B:182:ASN:ND2	2.12	0.47
1:A:200:GLU:O	1:A:204:HIS:HD2	1.97	0.47
1:B:254:THR:O	1:B:255[B]:ASN:HB3	2.15	0.46
1:B:163:LEU:HD21	1:B:185:ILE:HD12	1.97	0.45
1:A:104:SER:HB2	5:A:979:HOH:O	2.15	0.45
1:B:412:LYS:HA	5:B:911:HOH:O	2.17	0.45
1:A:220:ASN:CG	1:A:221:GLU:H	2.19	0.45
1:B:187:THR:O	1:B:345:LYS:HE3	2.17	0.45
1:B:288:HIS:HB3	1:B:291:LYS:HB2	1.99	0.44
1:A:46:TYR:HB2	1:A:52:ILE:HD12	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:114:VAL:HG12	1:B:246:PRO:HA	2.00	0.44
1:B:22:ASN:HB2	1:B:315:LEU:HD13	2.00	0.44
1:A:116:PRO:HB2	1:A:131:LEU:HD22	2.00	0.44
1:B:161:ILE:CG1	4:B:819:NAD:H6N	2.48	0.43
1:B:33:LYS:HB3	1:B:33:LYS:HE2	1.79	0.43
1:A:370:ASN:O	1:A:372:LYS:HG2	2.19	0.42
1:B:73:ASP:OD1	1:B:75:LYS:HE3	2.18	0.42
1:A:345:LYS:HE3	5:A:970:HOH:O	2.19	0.42
1:A:44:LEU:HD22	1:A:138:ALA:HB2	2.02	0.42
1:B:54:SER:HB2	5:B:912:HOH:O	2.20	0.42
1:B:161:ILE:HG12	4:B:819:NAD:H6N	2.03	0.41
1:B:345:LYS:H	1:B:345:LYS:HG2	1.67	0.41

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	445/480 (93%)	429 (96%)	15 (3%)	1 (0%)	47	55
1	B	444/480 (92%)	425 (96%)	18 (4%)	1 (0%)	47	55
All	All	889/960 (93%)	854 (96%)	33 (4%)	2 (0%)	47	55

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	38	SER
1	B	38	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	373/398 (94%)	352 (94%)	21 (6%)	21	21
1	B	372/398 (94%)	355 (95%)	17 (5%)	27	30
All	All	745/796 (94%)	707 (95%)	38 (5%)	26	25

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	GLU
1	A	143	LYS
1	A	148	ASN
1	A	163	LEU
1	A	175	LYS
1	A	183	ASP
1	A	210	THR
1	A	221	GLU
1	A	241	SER
1	A	249[A]	ASP
1	A	249[B]	ASP
1	A	252	GLU
1	A	265[A]	GLU
1	A	265[B]	GLU
1	A	293	ILE
1	A	309	LEU
1	A	339	ARG
1	A	385	LYS
1	A	396	GLU
1	A	401	ARG
1	A	442	ARG
1	B	62	ASN
1	B	120	GLU
1	B	143	LYS
1	B	149	LYS
1	B	210	THR
1	B	211	ASN

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Mol	Chain	Res	Type
1	B	223	VAL
1	B	249[A]	ASP
1	B	249[B]	ASP
1	B	339	ARG
1	B	357	VAL
1	B	372	LYS
1	B	396	GLU
1	B	401	ARG
1	B	412	LYS
1	B	414	SER
1	B	442	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	22	ASN
1	A	184	HIS
1	B	62	ASN
1	B	182	ASN
1	B	184	HIS
1	B	334	ASN
1	B	370	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 monosaccharides 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
4	NAD	B	819	-	42,48,48	1.72	4 (9%)	50,73,73	1.29	5 (10%)
2	COA	A	445	-	41,50,50	0.70	1 (2%)	52,75,75	1.42	9 (17%)
2	COA	B	445	-	41,50,50	0.73	1 (2%)	52,75,75	1.39	7 (13%)
4	NAD	A	818	-	42,48,48	1.73	4 (9%)	50,73,73	1.20	3 (6%)
3	FAD	B	446	-	53,58,58	0.99	4 (7%)	68,89,89	1.35	11 (16%)
3	FAD	A	446	-	53,58,58	0.98	3 (5%)	68,89,89	1.34	9 (13%)

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	NAD	B	819	-	-	6/26/62/62	0/5/5/5
2	COA	A	445	-	-	7/44/64/64	0/3/3/3
2	COA	B	445	-	-	6/44/64/64	0/3/3/3
4	NAD	A	818	-	-	8/26/62/62	0/5/5/5
3	FAD	B	446	-	-	1/30/50/50	0/6/6/6
3	FAD	A	446	-	-	1/30/50/50	0/6/6/6

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	819	NAD	C7N-N7N	8.19	1.48	1.33
4	A	818	NAD	C7N-N7N	8.01	1.48	1.33
4	A	818	NAD	C2A-N3A	4.52	1.39	1.32
4	B	819	NAD	C2A-N3A	4.18	1.38	1.32
3	A	446	FAD	C4X-N5	3.17	1.36	1.30
3	B	446	FAD	C4X-N5	3.04	1.36	1.30
4	A	818	NAD	C2A-N1A	2.68	1.38	1.33
4	B	819	NAD	C2A-N1A	2.67	1.38	1.33
4	A	818	NAD	C2N-N1N	2.60	1.38	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	819	NAD	C2N-N1N	2.60	1.38	1.35
3	A	446	FAD	O4B-C1B	2.45	1.44	1.41
3	B	446	FAD	C10-N10	2.40	1.42	1.37
3	A	446	FAD	C10-N10	2.35	1.42	1.37
3	B	446	FAD	C5X-N5	-2.12	1.35	1.39
2	A	445	COA	C2A-N3A	2.10	1.35	1.32
3	B	446	FAD	C2A-N3A	2.08	1.35	1.32
2	B	445	COA	C2A-N3A	2.08	1.35	1.32

All (44) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	818	NAD	N3A-C2A-N1A	-5.43	120.19	128.68
4	B	819	NAD	N3A-C2A-N1A	-5.43	120.19	128.68
3	A	446	FAD	N3A-C2A-N1A	-5.30	120.39	128.68
3	B	446	FAD	N3A-C2A-N1A	-4.83	121.13	128.68
2	B	445	COA	N3A-C2A-N1A	-4.72	121.31	128.68
2	A	445	COA	N3A-C2A-N1A	-4.52	121.62	128.68
2	A	445	COA	C6P-C7P-N8P	-3.51	104.81	111.90
4	B	819	NAD	C6N-N1N-C2N	-3.12	119.13	121.97
4	B	819	NAD	PN-O3-PA	-3.04	122.39	132.83
2	A	445	COA	P2A-O3A-P1A	-2.99	122.57	132.83
2	A	445	COA	C7P-N8P-C9P	2.82	127.62	122.59
2	B	445	COA	C6P-C7P-N8P	-2.78	106.28	111.90
2	B	445	COA	C3P-N4P-C5P	2.73	127.91	122.84
2	A	445	COA	C2P-C3P-N4P	-2.64	106.26	112.31
4	A	818	NAD	C6N-N1N-C2N	-2.62	119.58	121.97
3	A	446	FAD	C5X-N5-C4X	2.61	122.41	118.07
2	B	445	COA	C7P-C6P-C5P	-2.59	108.05	112.36
4	B	819	NAD	C3D-C2D-C1D	2.57	104.84	100.98
3	A	446	FAD	C4-N3-C2	-2.56	120.92	125.64
3	A	446	FAD	C4X-C4-N3	2.54	119.64	113.19
2	B	445	COA	C2P-C3P-N4P	-2.52	106.56	112.31
3	B	446	FAD	C5X-N5-C4X	2.47	122.18	118.07
3	B	446	FAD	C4-N3-C2	-2.47	121.08	125.64
3	B	446	FAD	C4X-C4-N3	2.44	119.40	113.19
2	B	445	COA	P2A-O3A-P1A	-2.44	124.46	132.83
2	B	445	COA	C7P-N8P-C9P	2.44	126.93	122.59
2	A	445	COA	O6A-CCP-CBP	2.37	114.35	110.55
3	B	446	FAD	C4A-C5A-N7A	-2.31	106.99	109.40
3	B	446	FAD	C4X-C10-N1	-2.31	119.38	124.73
2	A	445	COA	C7P-C6P-C5P	-2.27	108.57	112.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	446	FAD	C10-N1-C2	2.26	121.42	116.90
3	A	446	FAD	O4-C4-C4X	-2.24	120.66	126.60
3	A	446	FAD	C4X-C10-N1	-2.24	119.54	124.73
3	B	446	FAD	C10-N1-C2	2.15	121.21	116.90
2	A	445	COA	C3P-N4P-C5P	2.15	126.83	122.84
3	A	446	FAD	C10-C4X-N5	-2.14	120.31	124.86
3	B	446	FAD	C4X-C10-N10	2.12	119.59	116.48
3	B	446	FAD	O4-C4-C4X	-2.09	121.05	126.60
3	B	446	FAD	C10-C4X-N5	-2.09	120.42	124.86
4	A	818	NAD	PN-O3-PA	-2.07	125.74	132.83
3	B	446	FAD	C3B-C2B-C1B	2.05	104.06	100.98
4	B	819	NAD	C1B-N9A-C4A	-2.05	123.05	126.64
3	A	446	FAD	C9A-C5X-N5	-2.04	120.21	122.43
2	A	445	COA	C3B-C2B-C1B	2.02	104.37	99.89

There are no chirality outliers.

All (29) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	445	COA	C5B-O5B-P1A-O1A
2	A	445	COA	C5B-O5B-P1A-O3A
2	A	445	COA	CAP-CBP-CCP-O6A
2	B	445	COA	CAP-CBP-CCP-O6A
4	A	818	NAD	O4B-C4B-C5B-O5B
4	A	818	NAD	C2D-C1D-N1N-C2N
4	A	818	NAD	C2D-C1D-N1N-C6N
4	B	819	NAD	C2D-C1D-N1N-C2N
4	B	819	NAD	C2D-C1D-N1N-C6N
4	B	819	NAD	O4B-C4B-C5B-O5B
4	B	819	NAD	C3B-C4B-C5B-O5B
4	A	818	NAD	C3B-C4B-C5B-O5B
2	A	445	COA	CDP-CBP-CCP-O6A
2	A	445	COA	CEP-CBP-CCP-O6A
4	A	818	NAD	O4D-C4D-C5D-O5D
2	B	445	COA	CDP-CBP-CCP-O6A
2	B	445	COA	CEP-CBP-CCP-O6A
2	B	445	COA	C5B-O5B-P1A-O3A
2	A	445	COA	C5B-O5B-P1A-O2A
3	B	446	FAD	O4B-C4B-C5B-O5B
4	A	818	NAD	PA-O3-PN-O2N
4	B	819	NAD	PA-O3-PN-O1N
4	A	818	NAD	C3D-C4D-C5D-O5D

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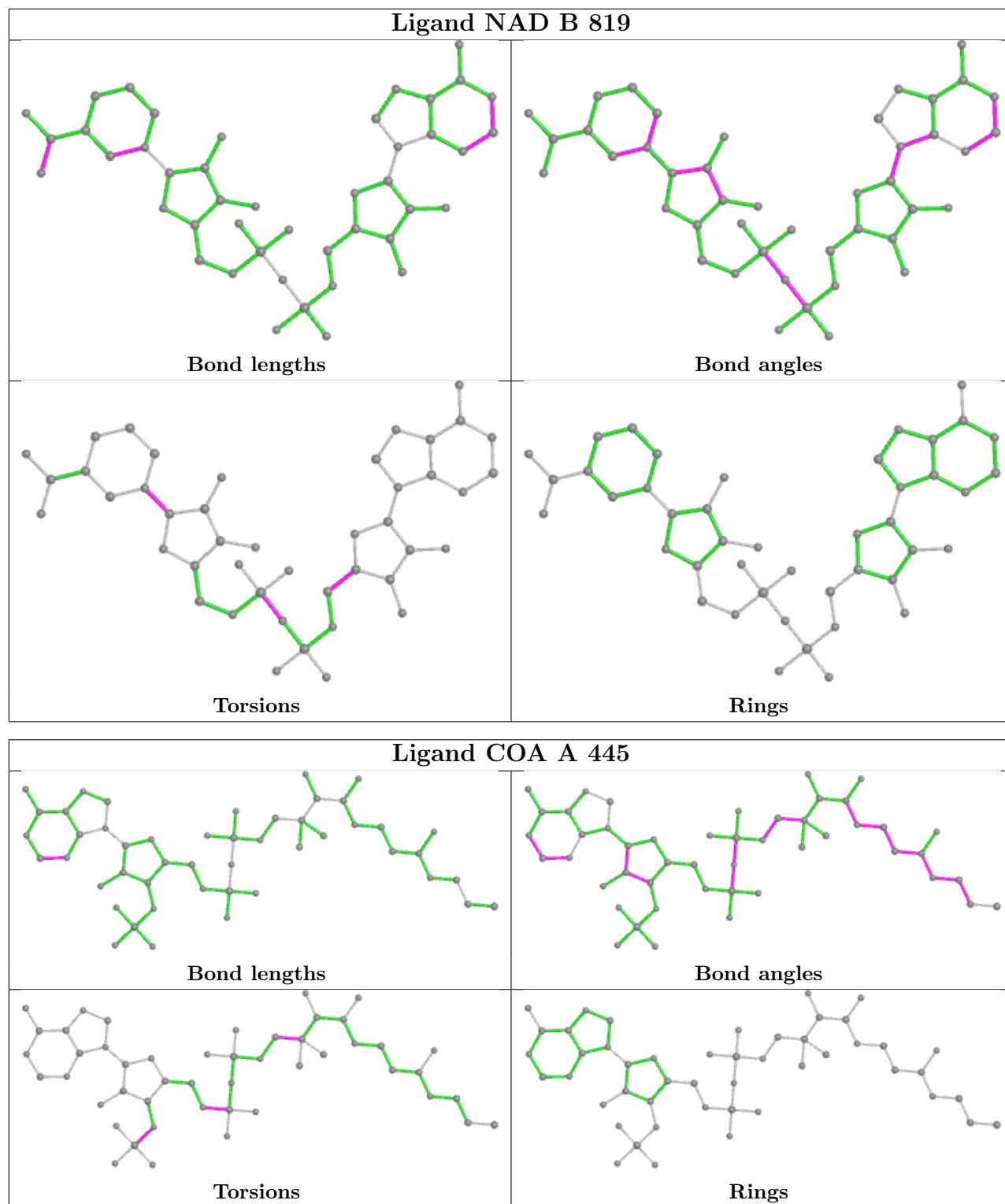
Mol	Chain	Res	Type	Atoms
2	A	445	COA	C3B-O3B-P3B-O9A
2	B	445	COA	C3B-O3B-P3B-O9A
4	B	819	NAD	PA-O3-PN-O2N
2	B	445	COA	C5B-O5B-P1A-O1A
4	A	818	NAD	C5D-O5D-PN-O1N
3	A	446	FAD	O4B-C4B-C5B-O5B

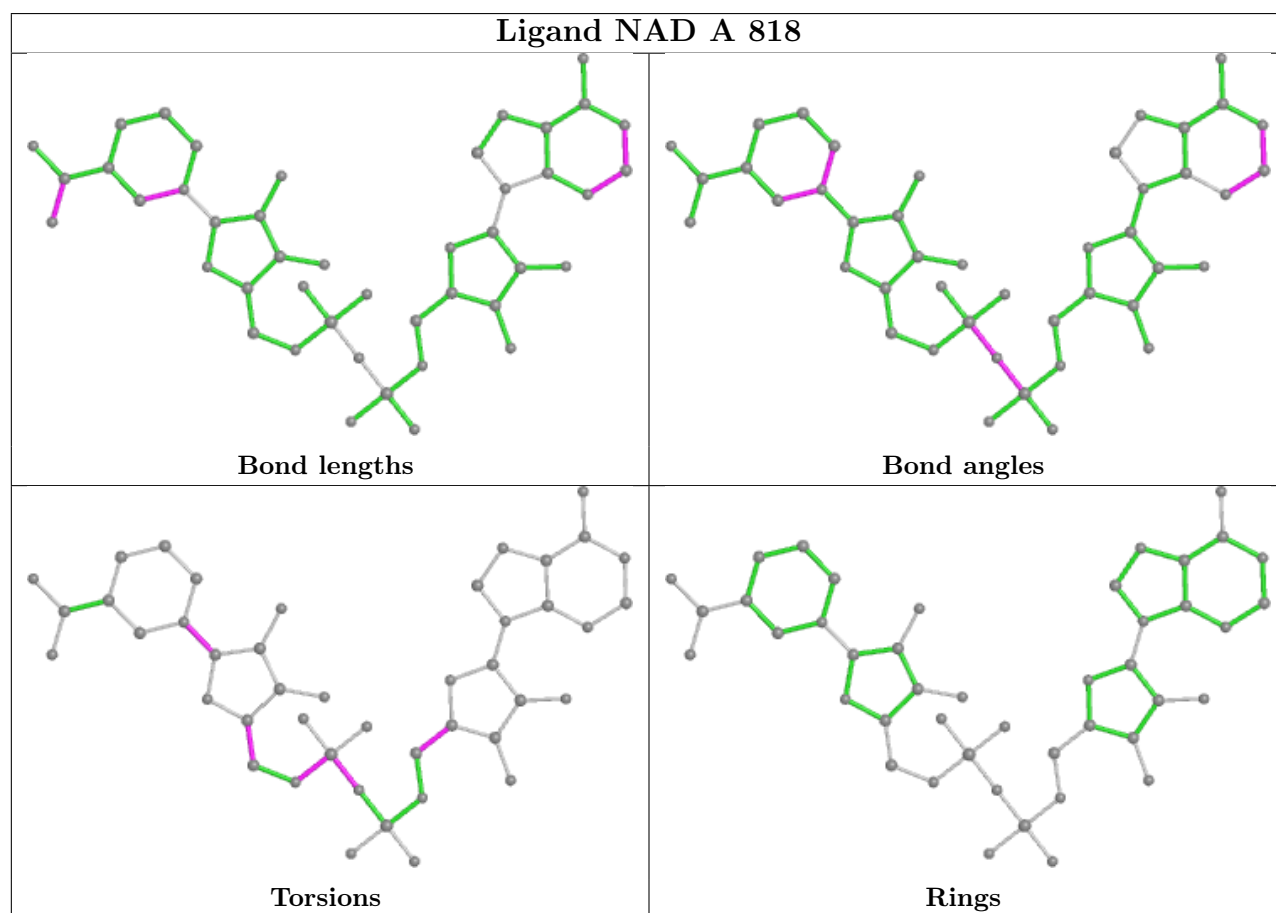
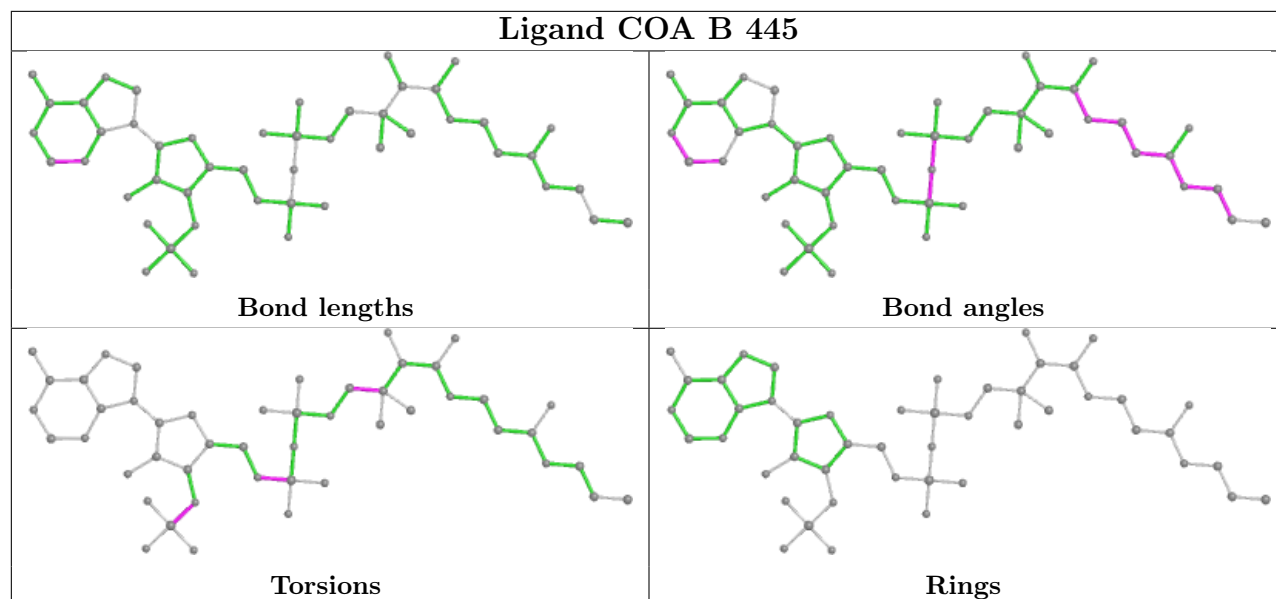
There are no ring outliers.

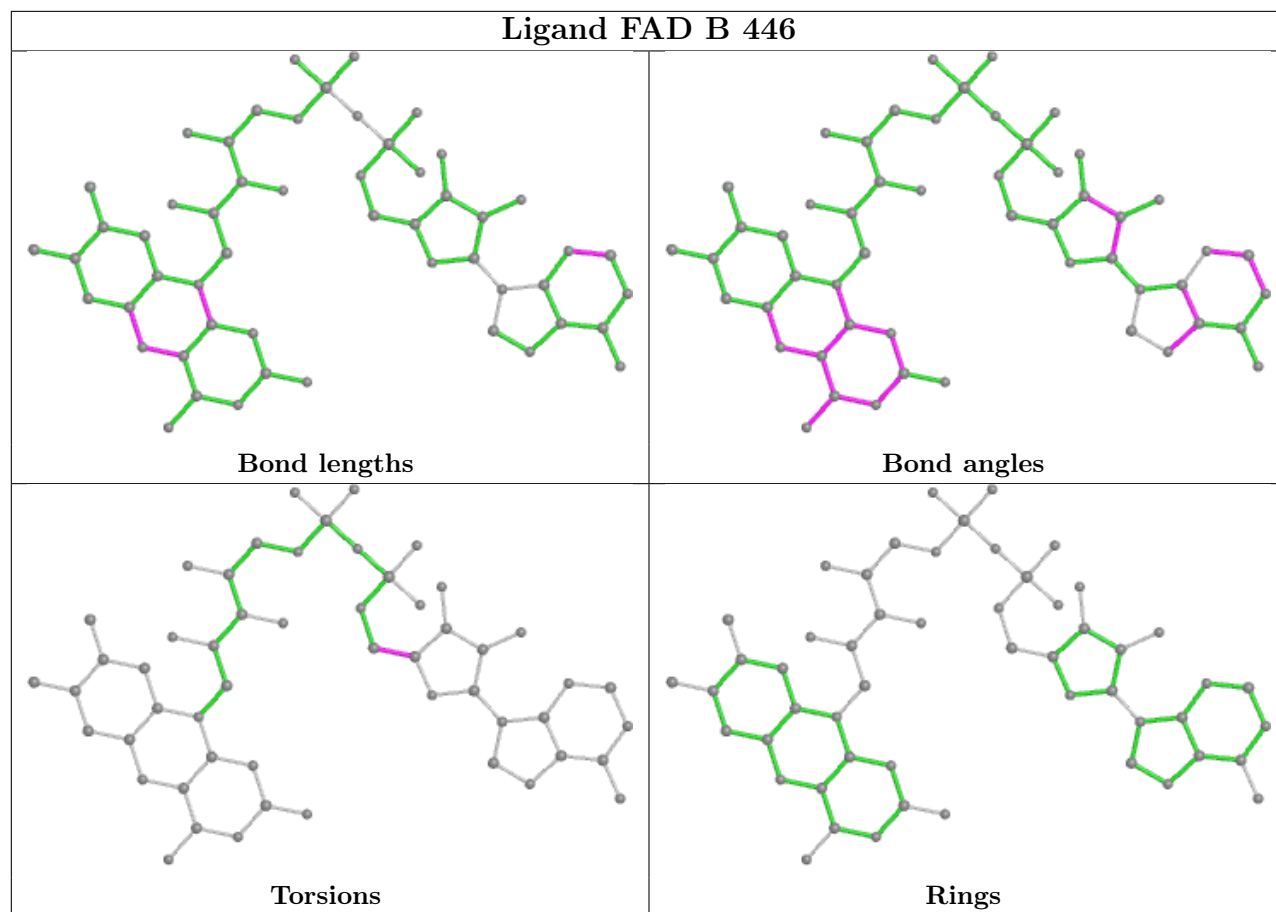
2 monomers are involved in 3 short contacts:

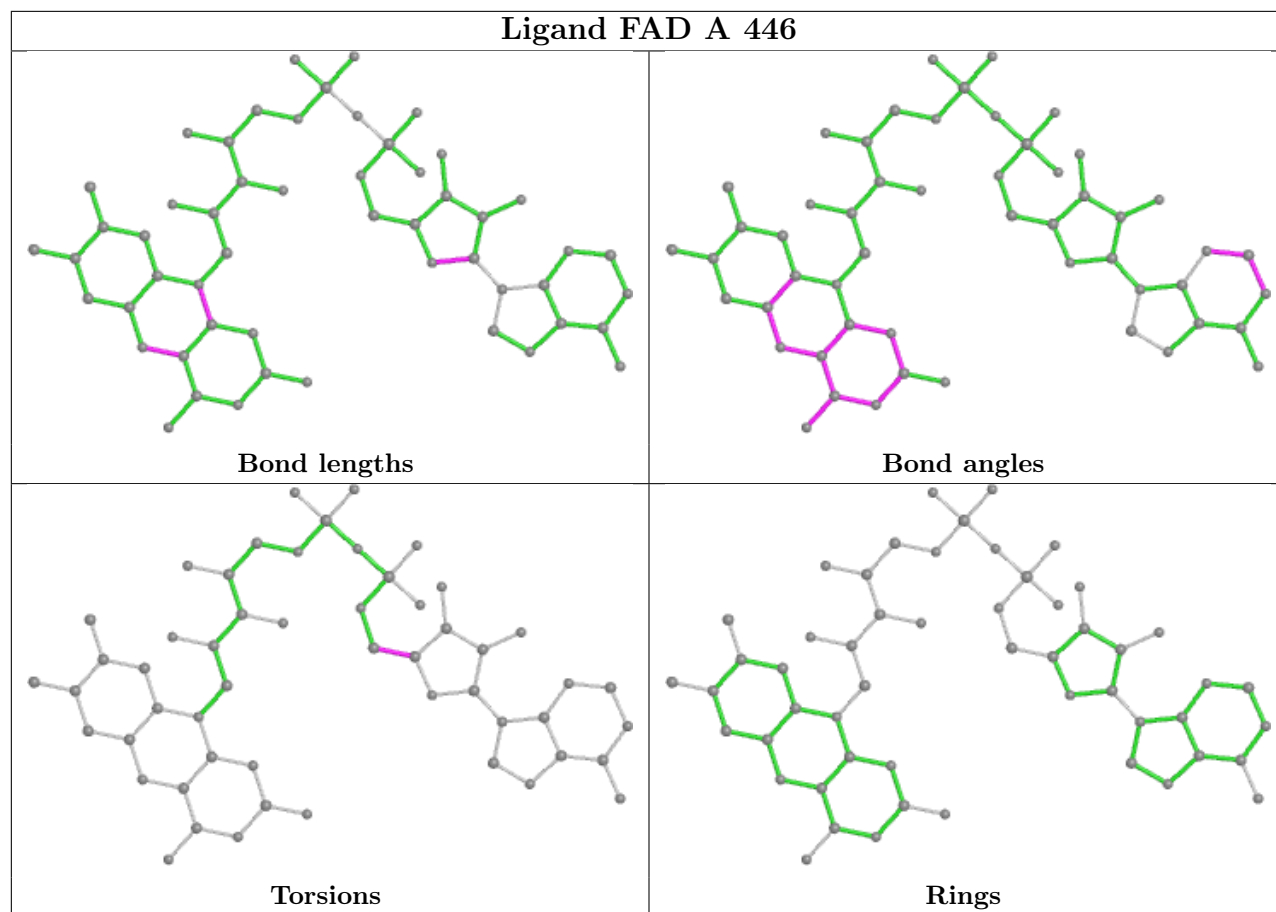
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	819	NAD	2	0
4	A	818	NAD	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	444/480 (92%)	0.96	64 (14%) <b>2</b> <b>2</b>	39, 46, 55, 62	0
1	B	444/480 (92%)	0.93	54 (12%) <b>4</b> <b>3</b>	40, 46, 54, 61	0
All	All	888/960 (92%)	0.95	118 (13%) <b>3</b> <b>3</b>	39, 46, 55, 62	0

All (118) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	147	THR	7.8
1	B	25	ASN	5.5
1	B	370	ASN	5.3
1	A	25	ASN	5.2
1	A	96	LYS	4.7
1	A	198	TYR	4.6
1	A	370	ASN	4.5
1	B	260	HIS	4.5
1	A	147	THR	4.4
1	A	150	VAL	4.4
1	A	221	GLU	4.4
1	A	95	THR	4.3
1	B	150	VAL	4.2
1	B	220	ASN	4.1
1	A	260	HIS	4.1
1	B	221	GLU	4.0
1	B	24	GLU	4.0
1	B	369	PRO	3.7
1	B	11	ALA	3.6
1	A	24	GLU	3.6
1	A	62	ASN	3.6
1	A	187	THR	3.4
1	A	127	GLN	3.4
1	A	206	ILE	3.4

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Mol	Chain	Res	Type	RSRZ
1	B	69	LYS	3.3
1	B	198	TYR	3.3
1	B	10	ALA	3.3
1	B	222	ARG	3.2
1	B	62	ASN	3.2
1	A	128	GLY	3.1
1	A	149	LYS	3.1
1	A	255	ASN	3.1
1	B	144	THR	3.1
1	B	423	LEU	3.0
1	A	148	ASN	3.0
1	A	86	GLU	3.0
1	B	6	ILE	2.9
1	B	145	LEU	2.9
1	B	280	ALA	2.9
1	A	329	ILE	2.9
1	B	223	VAL	2.9
1	B	299	ILE	2.9
1	B	86	GLU	2.9
1	B	329	ILE	2.8
1	B	51	ALA	2.8
1	B	143	LYS	2.8
1	B	191	GLY	2.8
1	A	11	ALA	2.8
1	A	181	ARG	2.8
1	A	152	ASP	2.7
1	B	161	ILE	2.7
1	A	56	GLU	2.7
1	A	52	ILE	2.7
1	A	101	PHE	2.7
1	B	255[A]	ASN	2.7
1	A	299	ILE	2.7
1	B	224	GLU	2.7
1	A	146	GLU	2.6
1	A	423	LEU	2.6
1	A	280	ALA	2.6
1	B	253	GLY	2.6
1	B	211	ASN	2.6
1	A	334	ASN	2.6
1	B	127	GLN	2.5
1	B	330	ILE	2.5
1	A	222	ARG	2.5

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	A	10	ALA	2.5
1	B	111	ALA	2.5
1	A	161	ILE	2.5
1	A	69	LYS	2.5
1	A	143	LYS	2.5
1	A	425	TYR	2.5
1	B	184	HIS	2.5
1	A	31	LEU	2.5
1	B	183	ASP	2.5
1	A	173	GLY	2.4
1	B	95	THR	2.4
1	A	171	GLU	2.4
1	A	183	ASP	2.4
1	A	163	LEU	2.4
1	A	197	ILE	2.4
1	B	149	LYS	2.4
1	B	210	THR	2.4
1	A	224	GLU	2.4
1	B	148	ASN	2.4
1	B	101	PHE	2.3
1	A	432	VAL	2.3
1	B	31	LEU	2.3
1	A	184	HIS	2.3
1	B	187	THR	2.3
1	B	433	TRP	2.3
1	B	302	THR	2.2
1	A	192	ASP	2.2
1	B	13	MET	2.2
1	A	371	ALA	2.2
1	B	192	ASP	2.2
1	A	191	GLY	2.2
1	A	6	ILE	2.2
1	A	302	THR	2.2
1	B	146	GLU	2.2
1	A	397	GLY	2.2
1	A	217	PHE	2.1
1	B	173	GLY	2.1
1	A	111	ALA	2.1
1	A	252	GLU	2.1
1	A	182	ASN	2.1
1	B	63	VAL	2.1
1	B	2	ASN	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	253	GLY	2.1
1	A	433	TRP	2.1
1	B	432	VAL	2.1
1	A	102	GLU	2.0
1	A	48	ILE	2.0
1	A	301	THR	2.0
1	B	56	GLU	2.0
1	A	201	ALA	2.0
1	A	84	ASP	2.0
1	A	354	TYR	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](#)

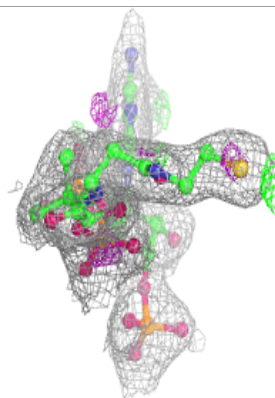
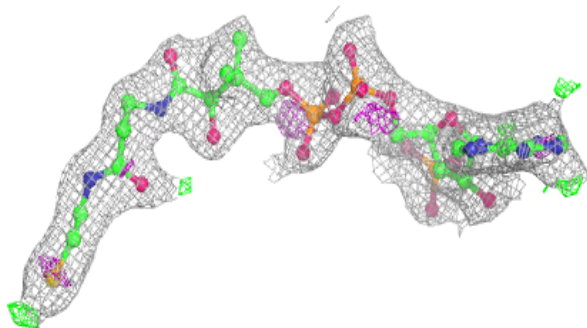
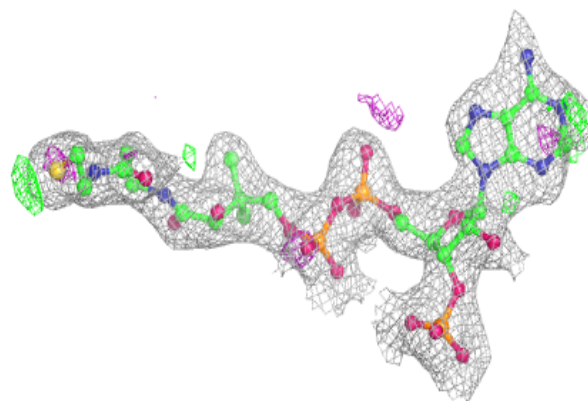
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	COA	A	445	48/48	0.89	0.17	50,59,70,70	0
2	COA	B	445	48/48	0.89	0.19	48,58,69,70	0
4	NAD	A	818	44/44	0.90	0.19	53,57,62,62	0
4	NAD	B	819	44/44	0.92	0.16	53,56,60,60	0
3	FAD	B	446	53/53	0.93	0.14	36,43,52,52	0
3	FAD	A	446	53/53	0.94	0.13	37,45,54,54	0

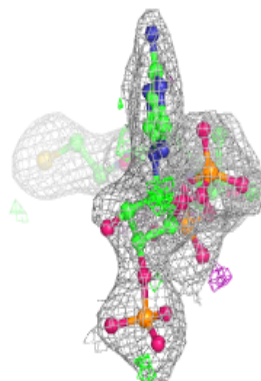
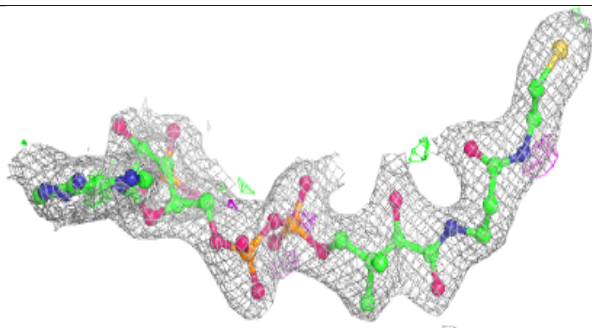
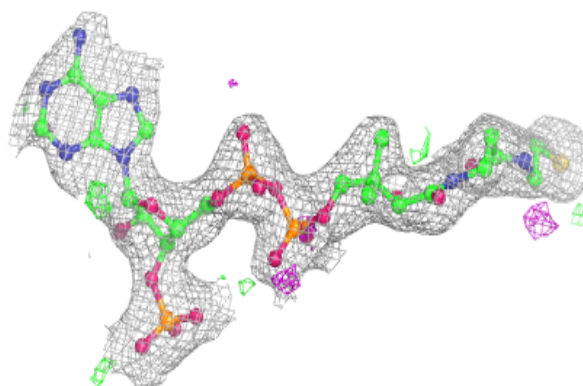
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

**Electron density around COA A 445:**

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

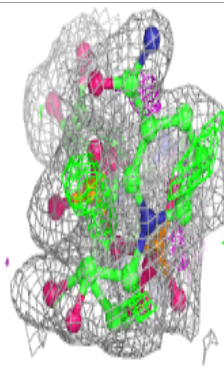
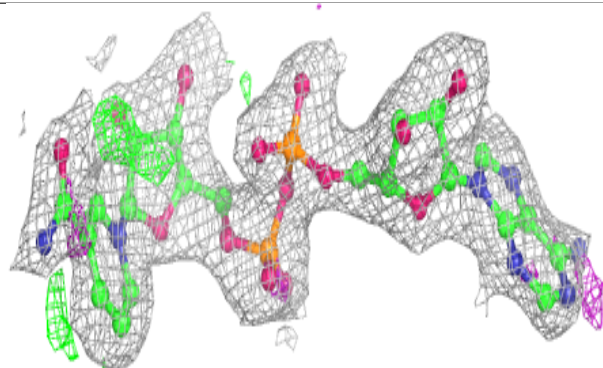
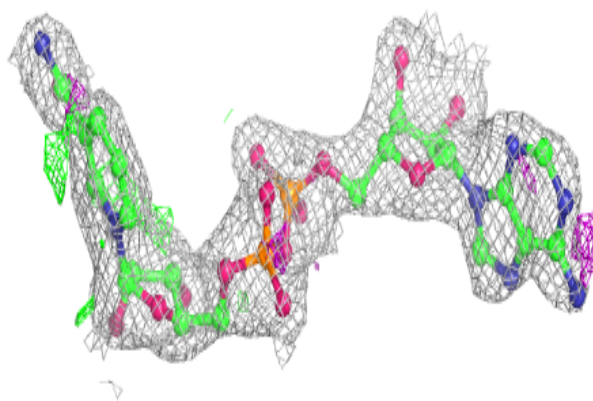
**Electron density around COA B 445:**

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

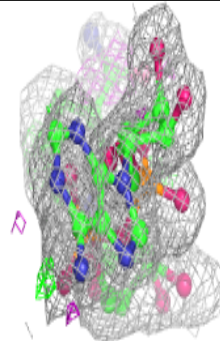
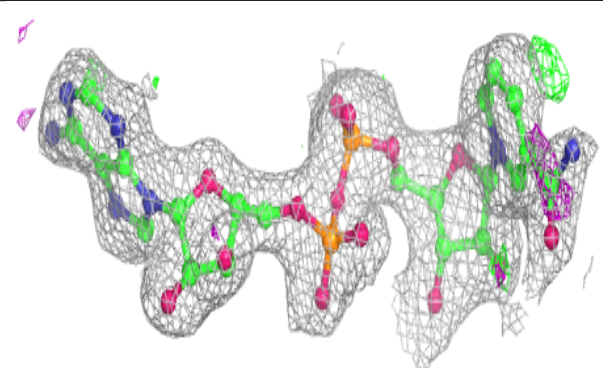
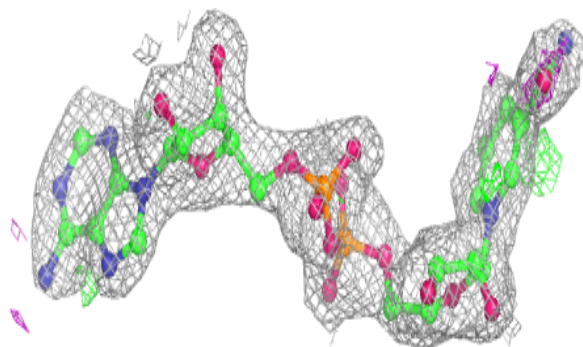


**Electron density around NAD A 818:**

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

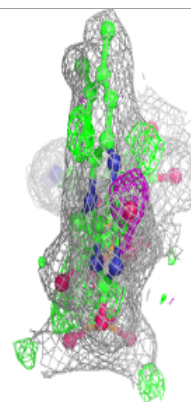
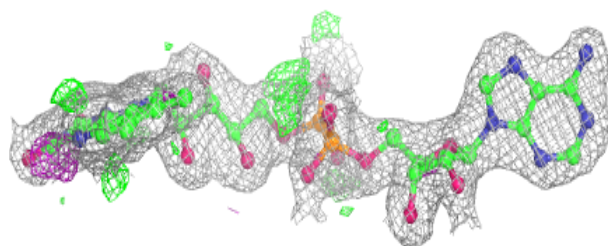
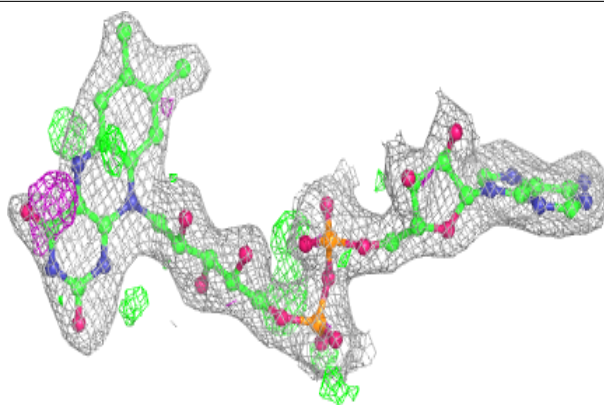
**Electron density around NAD B 819:**

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

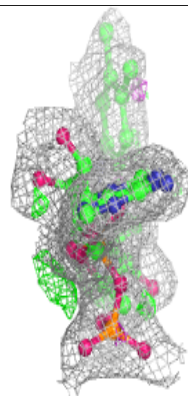
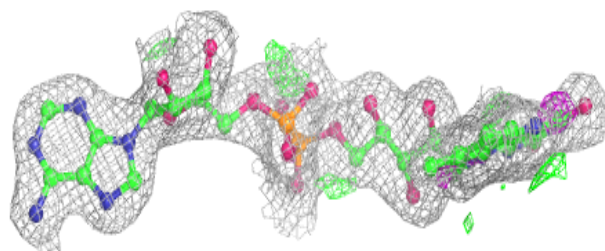
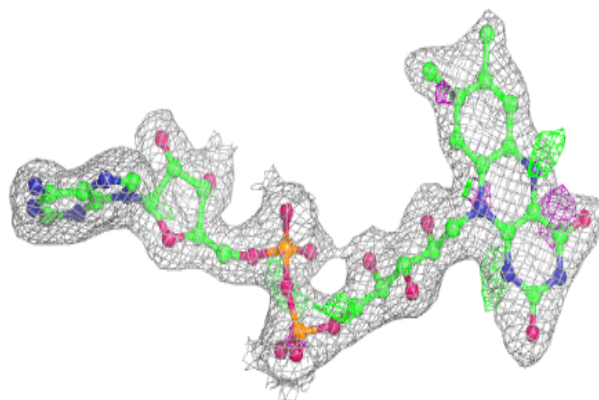


**Electron density around FAD B 446:**

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

**Electron density around FAD A 446:**

$2mF_o-DF_c$  (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.