



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 14, 2023 – 02:20 pm BST

PDB ID : 8OHA
Title : Crystal structure of Leptospira interrogans GAPDH
Authors : Navas-Yuste, S.; de la Paz, K.; Querol-Garcia, J.; Gomez-Quevedo, S.; Rodriguez de Cordoba, S.; Fernandez, F.J.; Vega, M.C.
Deposited on : 2023-03-20
Resolution : 2.37 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 1.8.4, 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

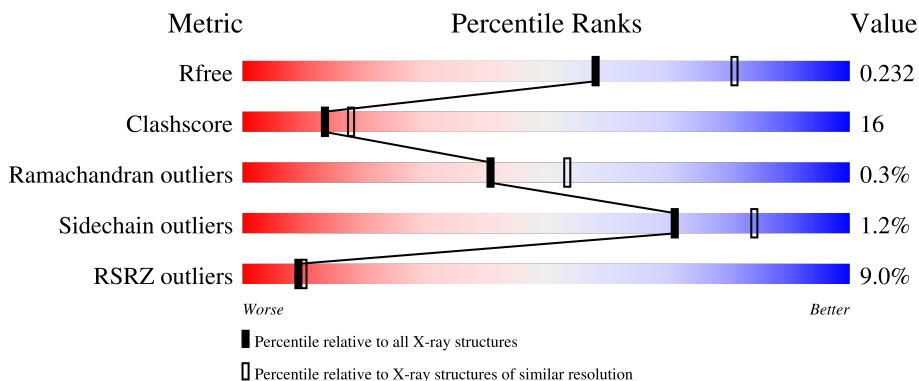
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

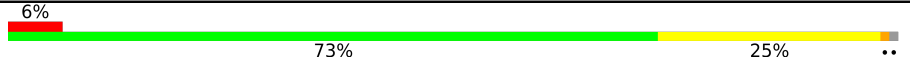
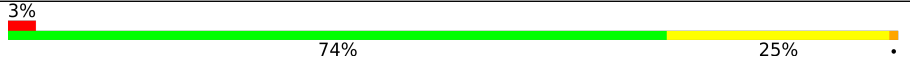



The reported resolution of this entry is 2.37 Å.

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	5509 (2.40-2.36)
Clashscore	141614	6082 (2.40-2.36)
Ramachandran outliers	138981	5973 (2.40-2.36)
Sidechain outliers	138945	5975 (2.40-2.36)
RSRZ outliers	127900	5397 (2.40-2.36)

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	337	
1	B	337	
1	C	337	
1	D	337	
1	F	337	

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Mol	Chain	Length	Quality of chain
1	G	337	
1	H	337	
2	E	337	

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 criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	PEG	B	402	-	-	X	-
4	GOL	B	409	-	-	X	-
4	GOL	D	405	-	-	X	-
4	GOL	D	408	-	-	X	-
4	GOL	E	402	-	-	-	X
4	GOL	H	403	-	-	X	-

2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 21537 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 Glyceraldehyde-3-phosphate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	334	2566	1620	437	493	16	0	0	0
1	B	336	2588	1632	440	500	16	0	2	0
1	C	334	2566	1620	437	493	16	0	0	0
1	D	333	2557	1614	435	492	16	0	0	0
1	F	335	2571	1623	438	494	16	0	0	0
1	G	334	2566	1620	437	493	16	0	0	0
1	H	334	2562	1617	436	493	16	0	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP Q72QM3
A	0	ALA	-	expression tag	UNP Q72QM3
B	-1	GLY	-	expression tag	UNP Q72QM3
B	0	ALA	-	expression tag	UNP Q72QM3
C	-1	GLY	-	expression tag	UNP Q72QM3
C	0	ALA	-	expression tag	UNP Q72QM3
D	-1	GLY	-	expression tag	UNP Q72QM3
D	0	ALA	-	expression tag	UNP Q72QM3
F	-1	GLY	-	expression tag	UNP Q72QM3
F	0	ALA	-	expression tag	UNP Q72QM3
G	-1	GLY	-	expression tag	UNP Q72QM3
G	0	ALA	-	expression tag	UNP Q72QM3
H	-1	GLY	-	expression tag	UNP Q72QM3
H	0	ALA	-	expression tag	UNP Q72QM3

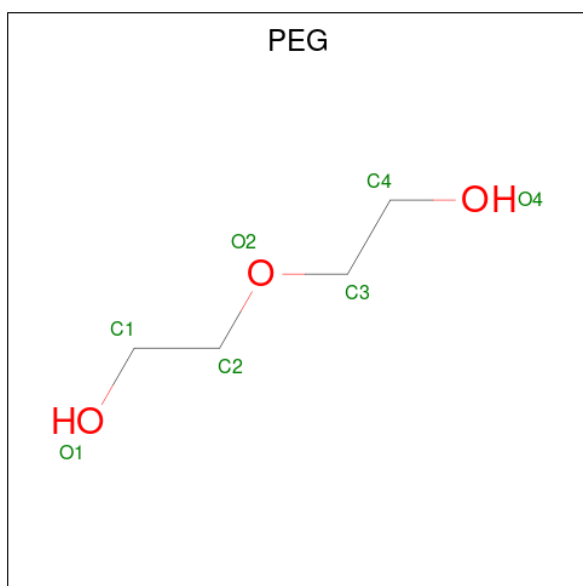
- Molecule 2 is a protein called Glyceraldehyde-3-phosphate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	E	334	2564	1620	437	491	16	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	-1	GLY	-	expression tag	UNP Q72QM3
E	0	ALA	-	expression tag	UNP Q72QM3

- Molecule 3 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C₄H₁₀O₃).



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

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



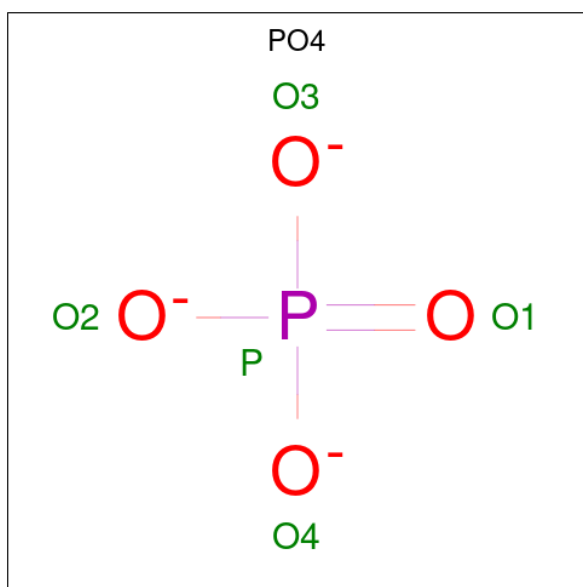
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0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

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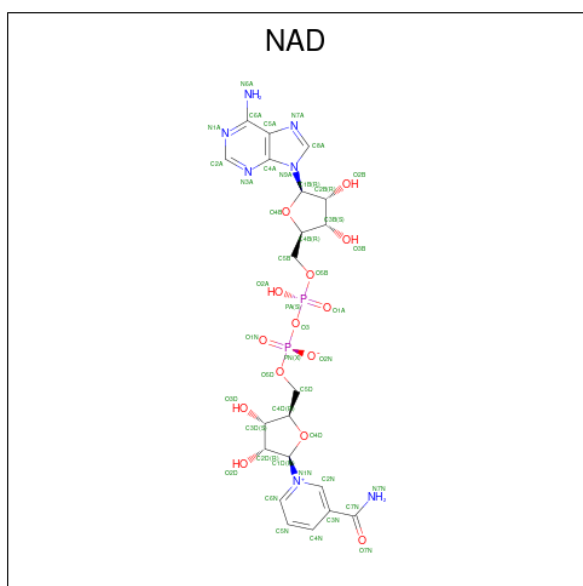
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total 6	C 3	O 3	0	0
4	B	1	Total 6	C 3	O 3	0	0
4	C	1	Total 6	C 3	O 3	0	0
4	C	1	Total 6	C 3	O 3	0	0
4	C	1	Total 6	C 3	O 3	0	0
4	C	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	E	1	Total 6	C 3	O 3	0	0
4	E	1	Total 6	C 3	O 3	0	0
4	F	1	Total 6	C 3	O 3	0	0
4	H	1	Total 6	C 3	O 3	0	0
4	H	1	Total 6	C 3	O 3	0	0
4	H	1	Total 6	C 3	O 3	0	0
4	H	1	Total 6	C 3	O 3	0	0

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O₄P).



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

- Molecule 6 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	62	Total	O	0	0
			62	62		
7	B	71	Total	O	0	0
			71	71		
7	C	53	Total	O	0	0
			53	53		
7	D	54	Total	O	0	1
			55	55		
7	E	28	Total	O	0	0
			28	28		
7	F	29	Total	O	0	1
			30	30		
7	G	34	Total	O	0	0
			34	34		
7	H	45	Total	O	0	0
			45	45		

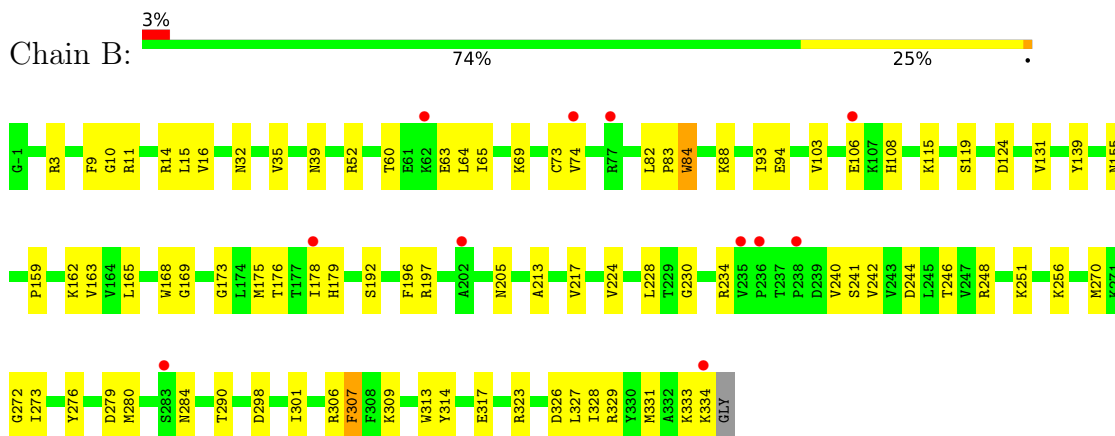
3 Residue-property plots [i](#)

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.

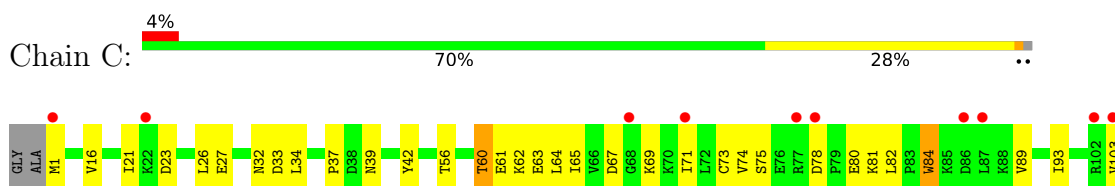
- Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

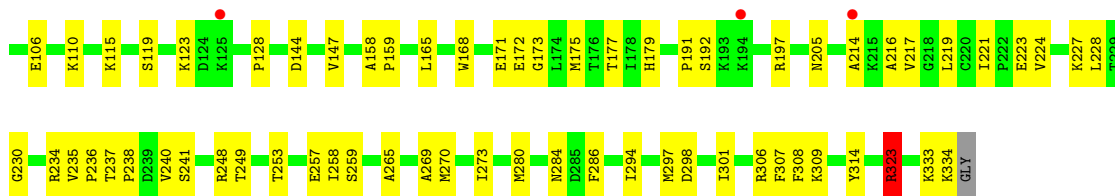


- Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

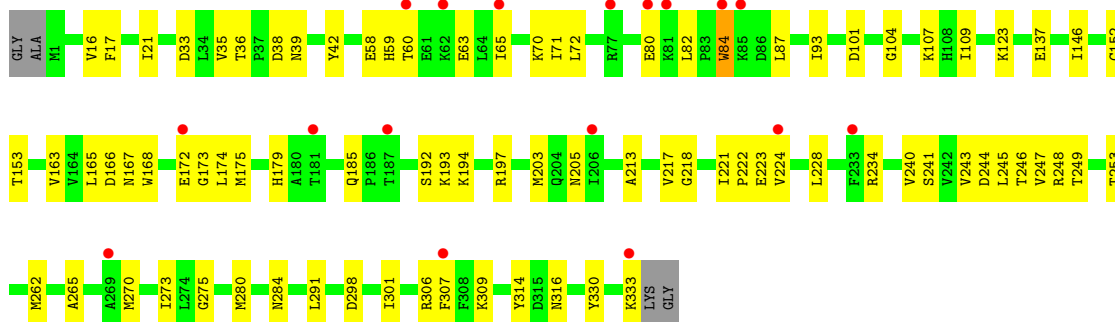
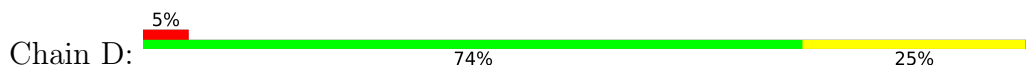


- Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

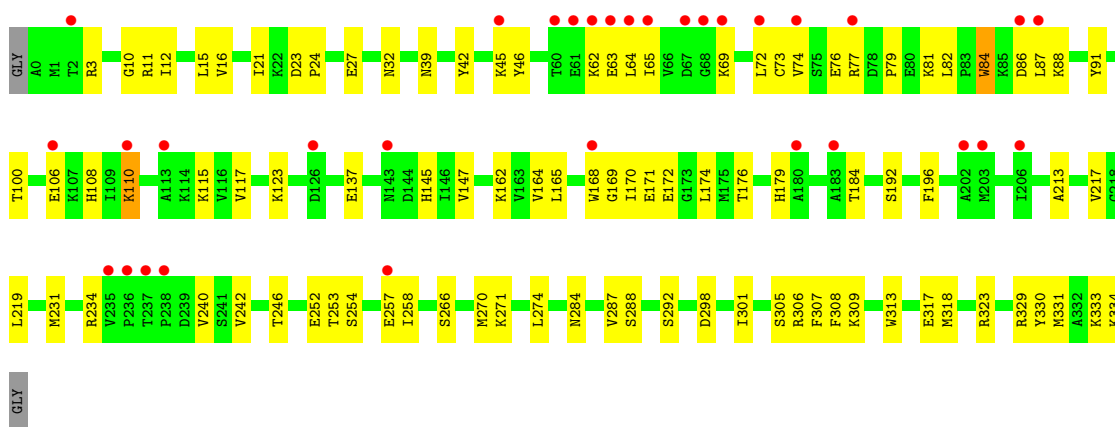




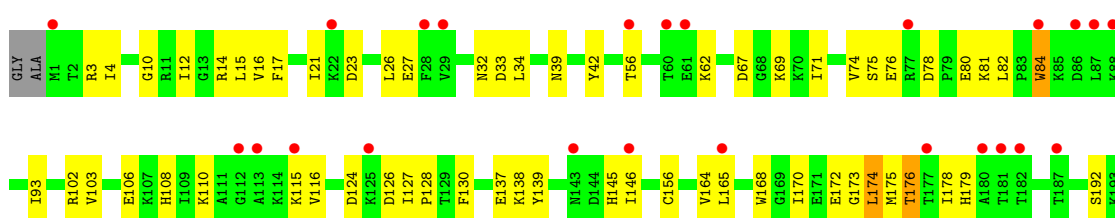
• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

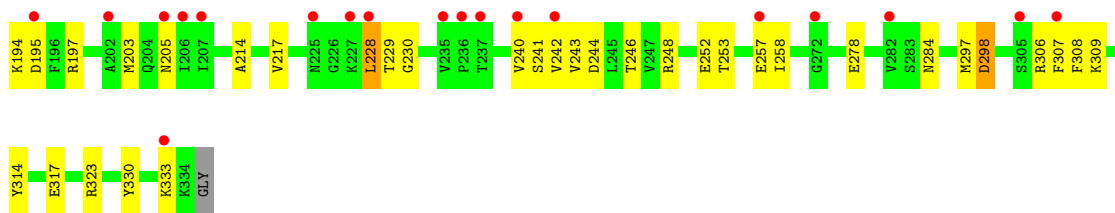


• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

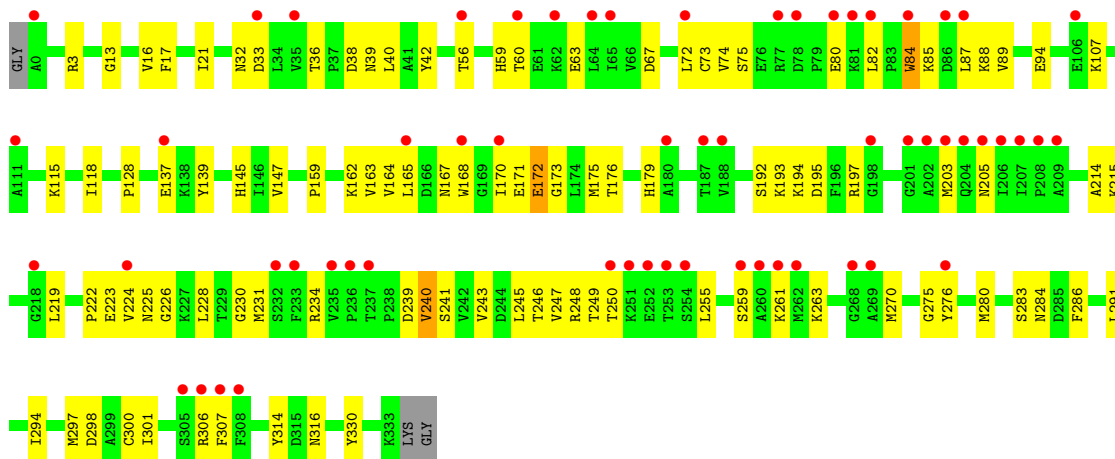


• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

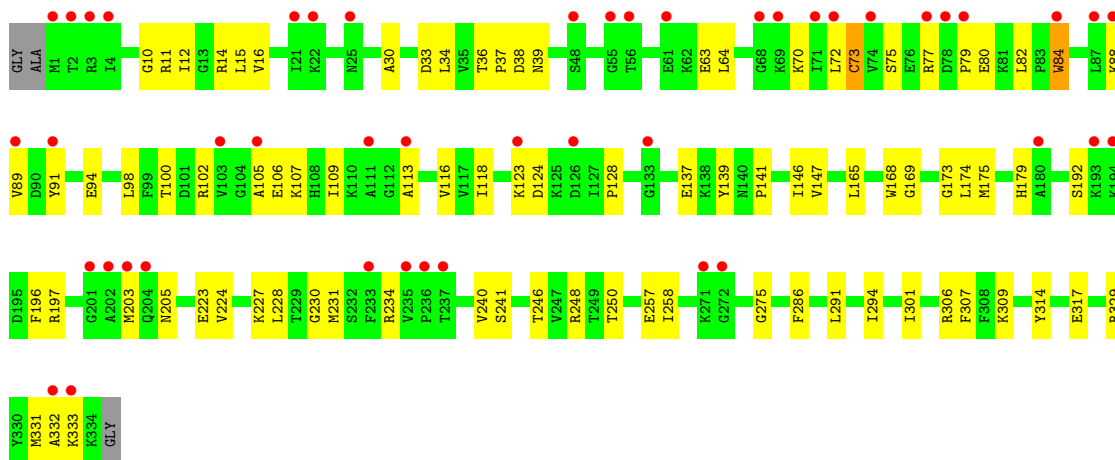




• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase



• Molecule 2: Glyceraldehyde-3-phosphate dehydrogenase



4 Data and refinement statistics i

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	79.80Å 82.04Å 123.18Å 94.02° 95.15° 112.52°	Depositor
Resolution (Å)	45.50 – 2.37 45.50 – 2.37	Depositor EDS
% Data completeness (in resolution range)	94.8 (45.50-2.37) 94.8 (45.50-2.37)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.58 (at 2.37Å)	Xtrriage
Refinement program	PHENIX (1.21rc1_4903: ???)	Depositor
R, R_{free}	0.191 , 0.234 0.191 , 0.232	Depositor DCC
R_{free} test set	2009 reflections (1.83%)	wwPDB-VP
Wilson B-factor (Å ²)	51.2	Xtrriage
Anisotropy	0.157	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 60.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	0.000 for -k,-h,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	21537	wwPDB-VP
Average B, all atoms (Å ²)	61.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.03% 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: PEG, GOL, CSD, PO4, NAD

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	0.55	0/2602	0.72	0/3519
1	B	0.52	0/2627	0.73	0/3553
1	C	0.55	0/2602	0.72	0/3519
1	D	0.55	0/2593	0.72	0/3508
1	F	0.54	2/2607 (0.1%)	0.70	0/3526
1	G	0.53	1/2602 (0.0%)	0.74	2/3519 (0.1%)
1	H	0.50	0/2598	0.70	0/3515
2	E	0.50	0/2608	0.68	0/3527
All	All	0.53	3/20839 (0.0%)	0.71	2/28186 (0.0%)

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	C	0	1
1	F	0	1
All	All	0	2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	G	174	LEU	C-N	5.84	1.47	1.34
1	F	110	LYS	CE-NZ	5.54	1.62	1.49
1	F	110	LYS	CD-CE	5.02	1.63	1.51

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	333	LYS	CD-CE-NZ	-11.28	85.76	111.70
1	G	174	LEU	O-C-N	5.38	131.31	122.70

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	323	ARG	Sidechain
1	F	77	ARG	Sidechain

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	2566	0	2608	92	0
1	B	2588	0	2623	92	0
1	C	2566	0	2608	96	0
1	D	2557	0	2595	84	0
1	F	2571	0	2613	90	0
1	G	2566	0	2608	102	0
1	H	2562	0	2600	99	0
2	E	2564	0	2608	92	0
3	A	14	0	20	3	0
3	B	21	0	30	7	0
3	D	7	0	10	1	0
3	H	7	0	10	1	0
4	A	54	0	72	6	0
4	B	36	0	48	8	0
4	C	24	0	32	4	0
4	D	42	0	56	15	0
4	E	12	0	16	3	0
4	F	6	0	8	0	0
4	H	24	0	32	6	0
5	A	5	0	0	0	0
5	B	10	0	0	0	0
5	D	5	0	0	0	0
6	A	44	0	26	1	0
6	B	44	0	26	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	C	44	0	26	2	0
6	D	44	0	26	2	0
6	E	44	0	26	3	0
6	F	44	0	26	1	0
6	G	44	0	26	1	0
6	H	44	0	26	3	0
7	A	62	0	0	2	0
7	B	71	0	0	1	0
7	C	53	0	0	1	0
7	D	55	0	0	1	0
7	E	28	0	0	0	0
7	F	30	0	0	3	0
7	G	34	0	0	1	0
7	H	45	0	0	1	0
All	All	21537	0	21405	681	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 16.

The worst 5 of 681 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:F:63:GLU:HG2	1:F:72:LEU:HA	1.18	1.09
1:F:42:TYR:HA	1:F:45:LYS:HE2	1.37	1.04
1:B:39:ASN:HD21	1:C:192:SER:H	1.08	0.97
1:A:192:SER:H	1:D:39:ASN:HD21	1.04	0.97
1:A:265:ALA:HB1	1:A:270:MET:HE2	1.43	0.97

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	331/337 (98%)	323 (98%)	6 (2%)	2 (1%)	25	34
1	B	335/337 (99%)	329 (98%)	5 (2%)	1 (0%)	41	53
1	C	331/337 (98%)	325 (98%)	5 (2%)	1 (0%)	41	53
1	D	330/337 (98%)	324 (98%)	5 (2%)	1 (0%)	41	53
1	F	332/337 (98%)	324 (98%)	7 (2%)	1 (0%)	41	53
1	G	331/337 (98%)	321 (97%)	9 (3%)	1 (0%)	41	53
1	H	331/337 (98%)	327 (99%)	3 (1%)	1 (0%)	41	53
2	E	332/337 (98%)	323 (97%)	8 (2%)	1 (0%)	41	53
All	All	2653/2696 (98%)	2596 (98%)	48 (2%)	9 (0%)	41	53

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	240	VAL
2	E	240	VAL
1	F	240	VAL
1	H	240	VAL
1	A	240	VAL

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	284/284 (100%)	281 (99%)	3 (1%)	73	86
1	B	286/284 (101%)	284 (99%)	2 (1%)	84	92
1	C	284/284 (100%)	281 (99%)	3 (1%)	73	86
1	D	283/284 (100%)	280 (99%)	3 (1%)	73	86
1	F	284/284 (100%)	281 (99%)	3 (1%)	73	86
1	G	284/284 (100%)	278 (98%)	6 (2%)	53	70
1	H	283/284 (100%)	279 (99%)	4 (1%)	67	81
2	E	285/285 (100%)	282 (99%)	3 (1%)	73	86

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	2273/2273 (100%)	2246 (99%)	27 (1%)	71 84

5 of 27 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	84	TRP
1	G	84	TRP
1	H	84	TRP
1	F	307	PHE
1	G	138	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 11 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	39	ASN
1	G	39	ASN
1	H	316	ASN
1	H	39	ASN
1	C	145	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](#)

7 non-standard protein/DNA/RNA residues 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	$\# Z > 2$
1	CSD	B	152	1	3,7,8	1.09	0	1,8,10	0.79	0
1	CSD	C	152	1	3,7,8	0.88	0	1,8,10	0.10	0
1	CSD	G	152	1	3,7,8	0.79	0	1,8,10	0.07	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
1	CSD	H	152	1	3,7,8	0.87	0	1,8,10	0.26	0
1	CSD	A	152	1	3,7,8	1.04	0	1,8,10	1.28	0
1	CSD	F	152	1	3,7,8	0.81	0	1,8,10	0.82	0
1	CSD	D	152	1	3,7,8	1.04	0	1,8,10	0.43	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
1	CSD	B	152	1	-	1/2/6/8	-
1	CSD	C	152	1	-	0/2/6/8	-
1	CSD	G	152	1	-	0/2/6/8	-
1	CSD	H	152	1	-	0/2/6/8	-
1	CSD	A	152	1	-	0/2/6/8	-
1	CSD	F	152	1	-	0/2/6/8	-
1	CSD	D	152	1	-	0/2/6/8	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	152	CSD	N-CA-CB-SG

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	D	152	CSD	1	0

5.5 Carbohydrates

There are no monosaccharides in this entry.

5.6 Ligand geometry

52 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	GOL	C	402	-	5,5,5	0.40	0	5,5,5	0.45	0
4	GOL	D	406	-	5,5,5	0.32	0	5,5,5	0.48	0
4	GOL	D	403	-	5,5,5	0.26	0	5,5,5	0.88	0
5	PO4	B	411	-	4,4,4	1.79	1 (25%)	6,6,6	0.54	0
4	GOL	C	401	-	5,5,5	0.33	0	5,5,5	0.39	0
6	NAD	E	403	-	42,48,48	0.68	1 (2%)	50,73,73	0.92	3 (6%)
3	PEG	A	402	-	6,6,6	0.33	0	5,5,5	0.40	0
3	PEG	B	402	-	6,6,6	0.34	0	5,5,5	0.64	0
6	NAD	H	406	-	42,48,48	0.88	2 (4%)	50,73,73	0.95	4 (8%)
4	GOL	B	409	-	5,5,5	0.52	0	5,5,5	0.39	0
4	GOL	B	405	-	5,5,5	0.30	0	5,5,5	0.91	0
3	PEG	H	401	-	6,6,6	0.25	0	5,5,5	0.30	0
4	GOL	F	401	-	5,5,5	0.31	0	5,5,5	0.56	0
5	PO4	A	410	-	4,4,4	1.73	1 (25%)	6,6,6	0.63	0
6	NAD	D	410	-	42,48,48	0.80	1 (2%)	50,73,73	1.47	5 (10%)
3	PEG	A	401	-	6,6,6	0.32	0	5,5,5	0.31	0
4	GOL	H	403	-	5,5,5	0.27	0	5,5,5	0.47	0
6	NAD	F	402	-	42,48,48	0.76	2 (4%)	50,73,73	1.05	4 (8%)
4	GOL	A	404	-	5,5,5	0.33	0	5,5,5	0.57	0
4	GOL	A	409	-	5,5,5	0.30	0	5,5,5	0.43	0
5	PO4	B	410	-	4,4,4	1.82	1 (25%)	6,6,6	0.76	0
6	NAD	C	405	-	42,48,48	1.00	3 (7%)	50,73,73	1.16	5 (10%)
6	NAD	A	411	-	42,48,48	0.92	3 (7%)	50,73,73	1.21	5 (10%)
4	GOL	B	407	-	5,5,5	0.32	0	5,5,5	0.37	0
4	GOL	E	401	-	5,5,5	0.24	0	5,5,5	0.32	0
4	GOL	A	413	-	5,5,5	0.25	0	5,5,5	0.35	0
5	PO4	D	409	-	4,4,4	1.71	1 (25%)	6,6,6	0.76	0
4	GOL	B	408	-	5,5,5	0.21	0	5,5,5	0.60	0
6	NAD	B	412	-	42,48,48	0.88	1 (2%)	50,73,73	1.28	5 (10%)
3	PEG	B	403	-	6,6,6	0.30	0	5,5,5	0.29	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	GOL	D	408	-	5,5,5	0.18	0	5,5,5	0.71	0
4	GOL	H	404	-	5,5,5	0.24	0	5,5,5	0.77	0
3	PEG	B	401	-	6,6,6	0.39	0	5,5,5	0.52	0
4	GOL	H	402	-	5,5,5	0.27	0	5,5,5	0.66	0
4	GOL	C	403	-	5,5,5	0.24	0	5,5,5	0.70	0
4	GOL	D	404	-	5,5,5	0.22	0	5,5,5	0.54	0
4	GOL	C	404	-	5,5,5	0.22	0	5,5,5	0.63	0
4	GOL	A	408	-	5,5,5	0.29	0	5,5,5	0.48	0
4	GOL	D	401	-	5,5,5	0.20	0	5,5,5	0.37	0
4	GOL	D	405	-	5,5,5	0.34	0	5,5,5	0.87	0
4	GOL	B	404	-	5,5,5	0.28	0	5,5,5	0.55	0
6	NAD	G	401	-	42,48,48	0.99	3 (7%)	50,73,73	1.46	5 (10%)
4	GOL	B	406	-	5,5,5	0.29	0	5,5,5	0.36	0
4	GOL	A	403	-	5,5,5	0.27	0	5,5,5	1.01	0
4	GOL	D	407	-	5,5,5	0.31	0	5,5,5	0.51	0
4	GOL	H	405	-	5,5,5	0.27	0	5,5,5	0.40	0
4	GOL	A	407	-	5,5,5	0.26	0	5,5,5	0.79	0
4	GOL	A	412	-	5,5,5	0.26	0	5,5,5	0.56	0
4	GOL	E	402	-	5,5,5	0.27	0	5,5,5	0.47	0
4	GOL	A	406	-	5,5,5	0.41	0	5,5,5	0.63	0
4	GOL	A	405	-	5,5,5	0.31	0	5,5,5	0.48	0
3	PEG	D	402	-	6,6,6	0.31	0	5,5,5	0.30	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
4	GOL	C	402	-	-	4/4/4/4	-
4	GOL	D	406	-	-	0/4/4/4	-
4	GOL	D	403	-	-	3/4/4/4	-
4	GOL	C	401	-	-	2/4/4/4	-
6	NAD	E	403	-	-	3/26/62/62	0/5/5/5
3	PEG	A	402	-	-	3/4/4/4	-
3	PEG	B	402	-	-	3/4/4/4	-
6	NAD	H	406	-	-	5/26/62/62	0/5/5/5
4	GOL	B	409	-	-	4/4/4/4	-
4	GOL	B	405	-	-	4/4/4/4	-
3	PEG	H	401	-	-	1/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	GOL	F	401	-	-	1/4/4/4	-
6	NAD	D	410	-	-	5/26/62/62	0/5/5/5
3	PEG	A	401	-	-	2/4/4/4	-
4	GOL	H	403	-	-	0/4/4/4	-
6	NAD	F	402	-	-	7/26/62/62	0/5/5/5
4	GOL	A	404	-	-	0/4/4/4	-
4	GOL	A	409	-	-	0/4/4/4	-
6	NAD	C	405	-	-	5/26/62/62	0/5/5/5
6	NAD	A	411	-	-	5/26/62/62	0/5/5/5
4	GOL	B	407	-	-	2/4/4/4	-
4	GOL	E	401	-	-	2/4/4/4	-
4	GOL	A	413	-	-	0/4/4/4	-
4	GOL	B	408	-	-	4/4/4/4	-
6	NAD	B	412	-	-	5/26/62/62	0/5/5/5
3	PEG	B	403	-	-	1/4/4/4	-
4	GOL	D	408	-	-	0/4/4/4	-
4	GOL	H	404	-	-	0/4/4/4	-
3	PEG	B	401	-	-	4/4/4/4	-
4	GOL	H	402	-	-	0/4/4/4	-
4	GOL	C	403	-	-	2/4/4/4	-
4	GOL	D	404	-	-	0/4/4/4	-
4	GOL	C	404	-	-	4/4/4/4	-
4	GOL	A	408	-	-	0/4/4/4	-
4	GOL	D	401	-	-	0/4/4/4	-
4	GOL	D	405	-	-	3/4/4/4	-
4	GOL	B	404	-	-	4/4/4/4	-
6	NAD	G	401	-	-	5/26/62/62	0/5/5/5
4	GOL	B	406	-	-	0/4/4/4	-
4	GOL	A	403	-	-	3/4/4/4	-
4	GOL	D	407	-	-	2/4/4/4	-
4	GOL	H	405	-	-	1/4/4/4	-
4	GOL	A	407	-	-	2/4/4/4	-
4	GOL	A	412	-	-	0/4/4/4	-
4	GOL	E	402	-	-	4/4/4/4	-
4	GOL	A	406	-	-	2/4/4/4	-
4	GOL	A	405	-	-	0/4/4/4	-
3	PEG	D	402	-	-	2/4/4/4	-

The worst 5 of 20 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	C	405	NAD	C2N-N1N	4.53	1.40	1.35
6	B	412	NAD	C2N-N1N	3.76	1.39	1.35
6	H	406	NAD	C2N-N1N	3.75	1.39	1.35
6	A	411	NAD	C2N-N1N	3.51	1.39	1.35
6	G	401	NAD	O4D-C1D	3.34	1.45	1.41

The worst 5 of 36 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	G	401	NAD	O2B-C2B-C1B	6.69	135.56	110.85
6	D	410	NAD	O2B-C2B-C1B	6.30	134.11	110.85
6	A	411	NAD	O2B-C2B-C1B	3.67	124.40	110.85
6	D	410	NAD	O3B-C3B-C4B	-3.56	100.77	111.05
6	B	412	NAD	C6N-N1N-C2N	-3.41	118.87	121.97

There are no chirality outliers.

5 of 109 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	403	GOL	O1-C1-C2-C3
4	A	406	GOL	C1-C2-C3-O3
4	A	407	GOL	O1-C1-C2-O2
4	A	407	GOL	O1-C1-C2-C3
4	B	404	GOL	C1-C2-C3-O3

There are no ring outliers.

28 monomers are involved in 64 short contacts:

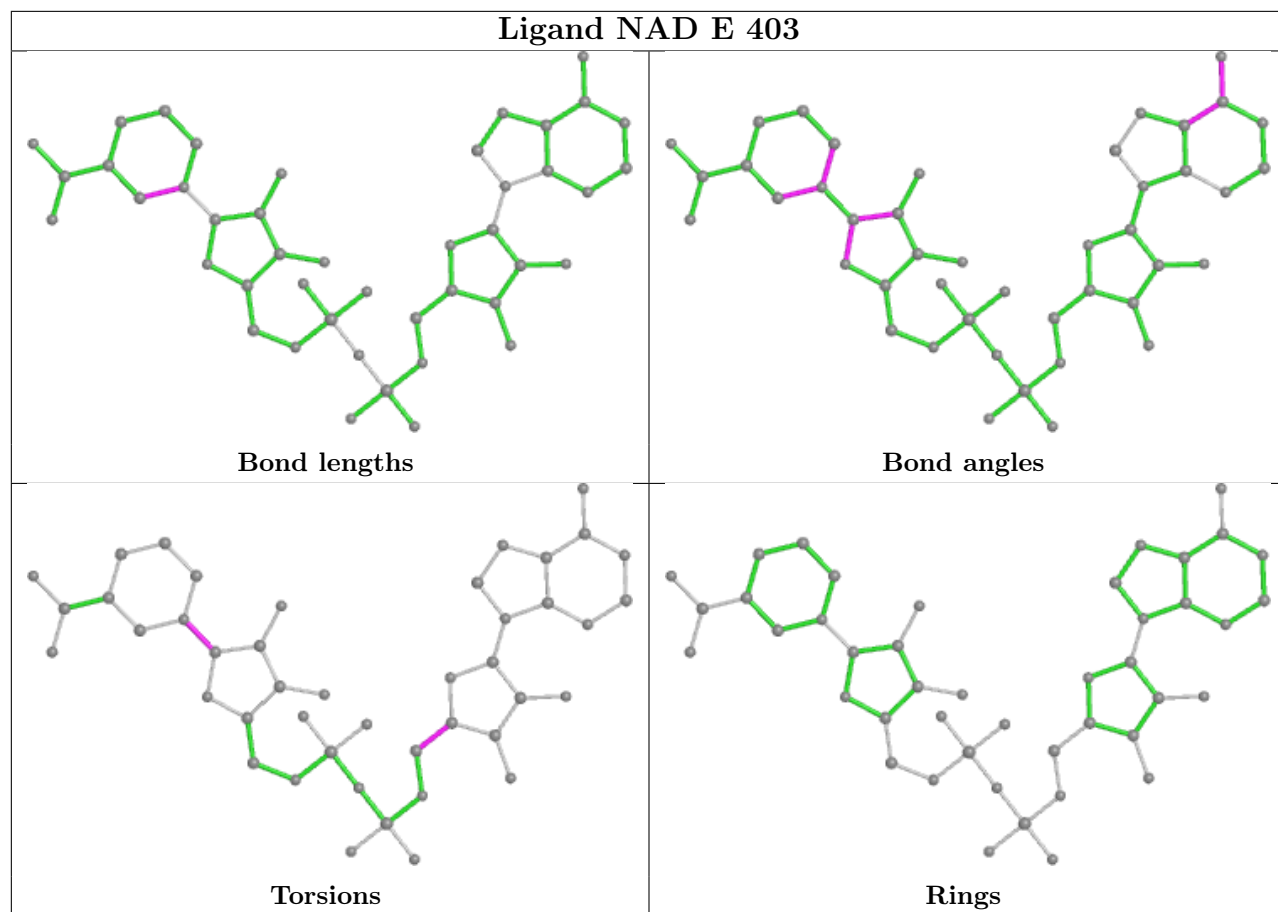
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	C	402	GOL	3	0
6	E	403	NAD	3	0
3	A	402	PEG	1	0
3	B	402	PEG	4	0
6	H	406	NAD	3	0
4	B	409	GOL	4	0
3	H	401	PEG	1	0
6	D	410	NAD	2	0
3	A	401	PEG	2	0
4	H	403	GOL	6	0
6	F	402	NAD	1	0

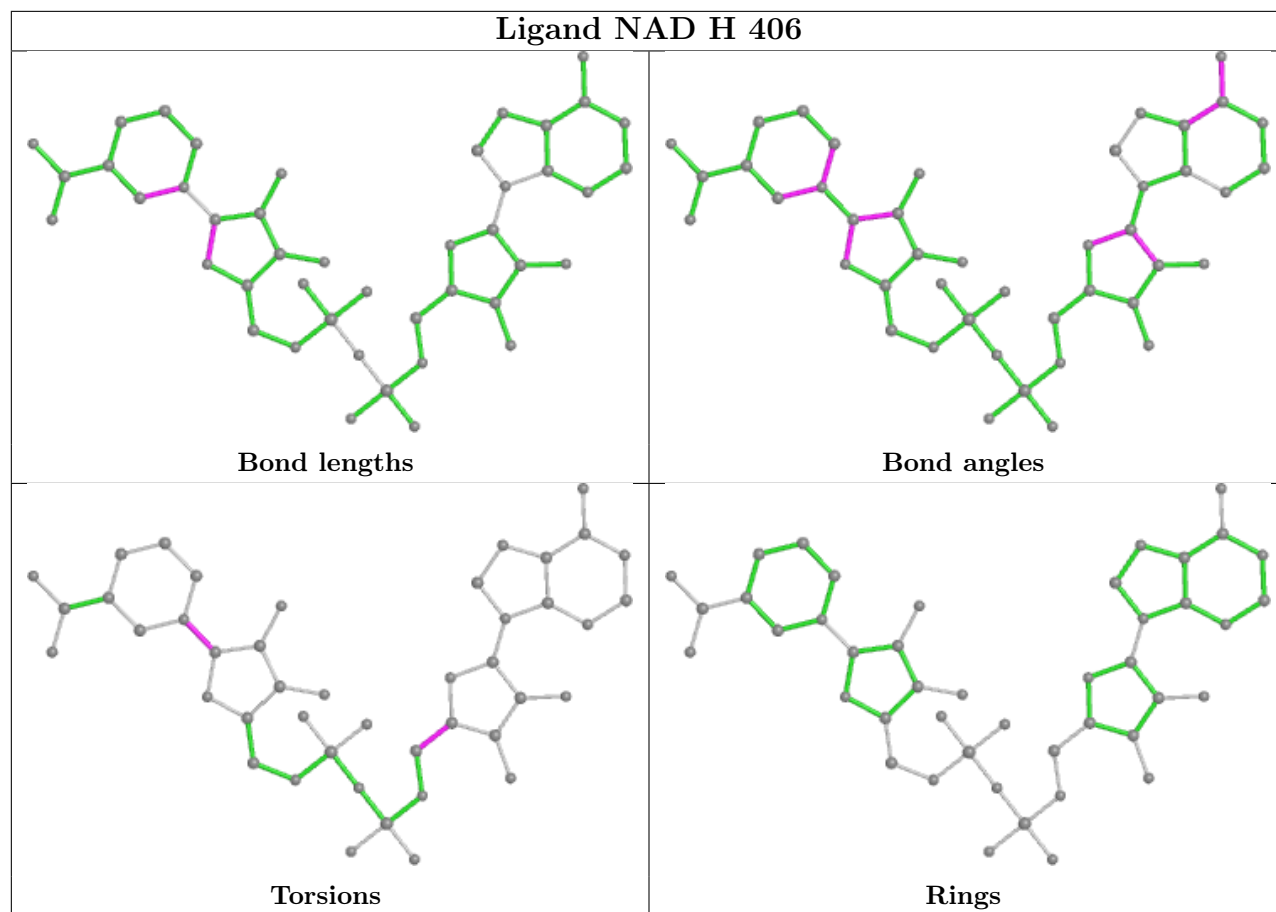
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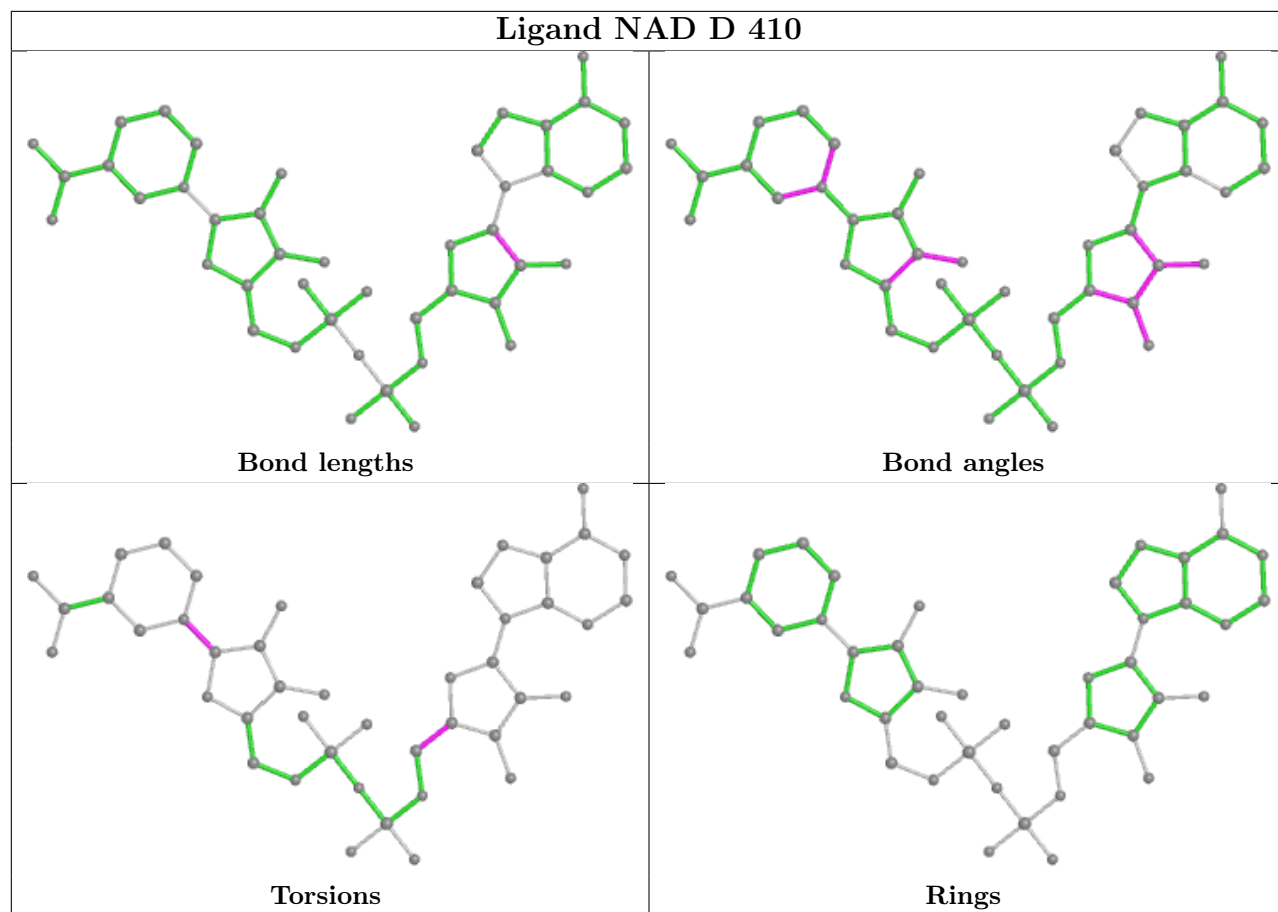
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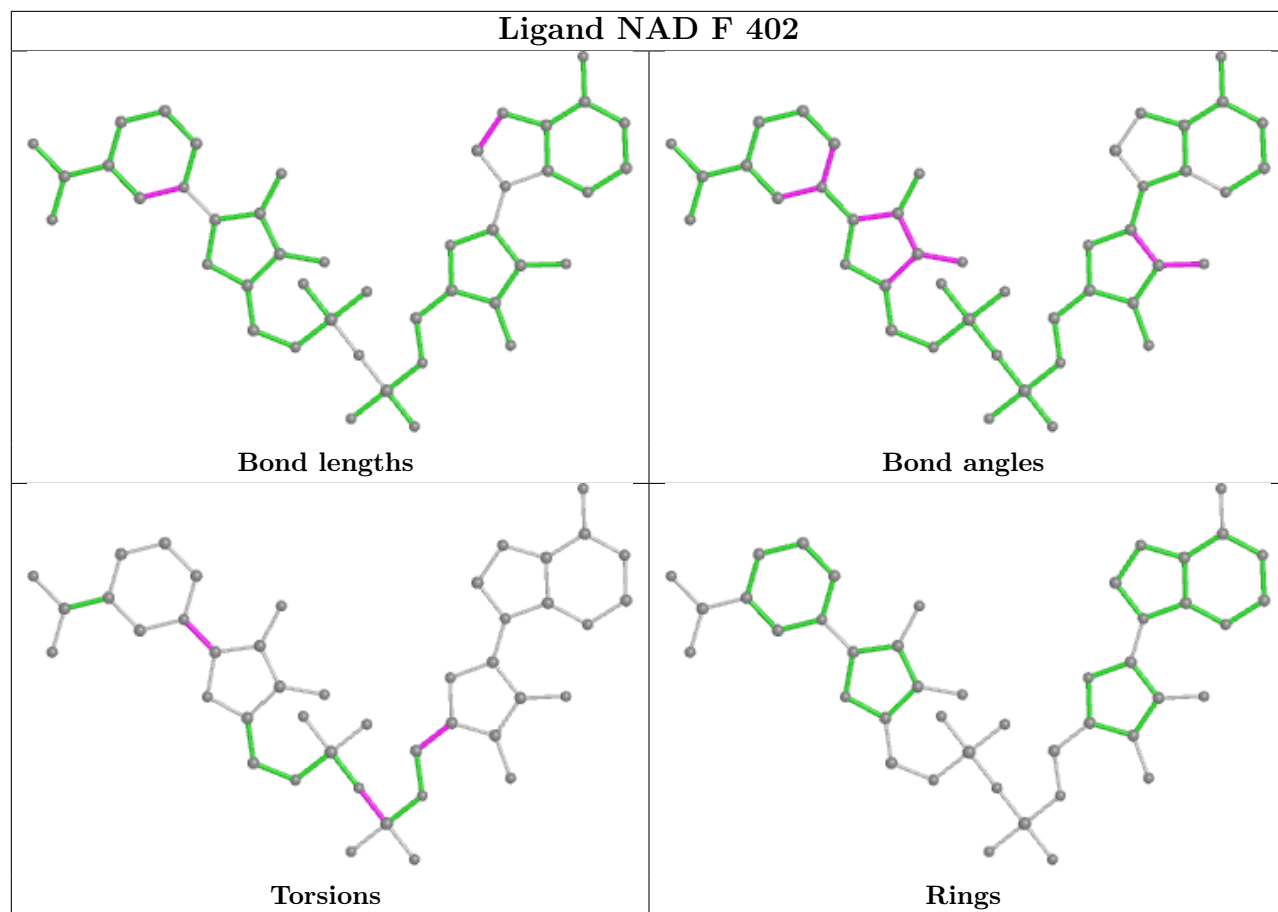
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	404	GOL	1	0
6	C	405	NAD	2	0
6	A	411	NAD	1	0
6	B	412	NAD	2	0
3	B	403	PEG	3	0
4	D	408	GOL	9	0
4	D	404	GOL	2	0
4	C	404	GOL	1	0
4	D	405	GOL	4	0
4	B	404	GOL	1	0
6	G	401	NAD	1	0
4	B	406	GOL	3	0
4	A	407	GOL	2	0
4	A	412	GOL	3	0
4	E	402	GOL	3	0
4	A	406	GOL	1	0
3	D	402	PEG	1	0

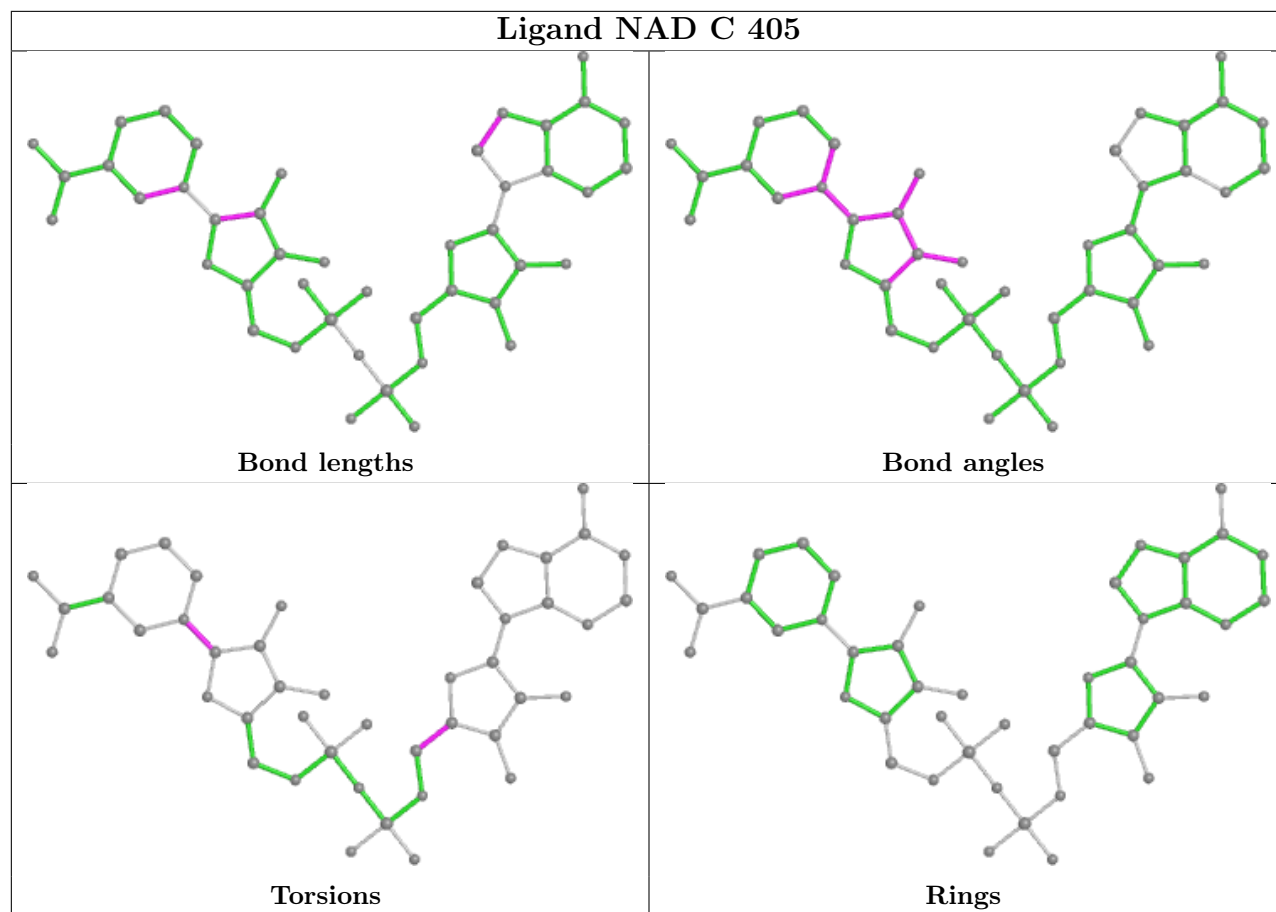
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

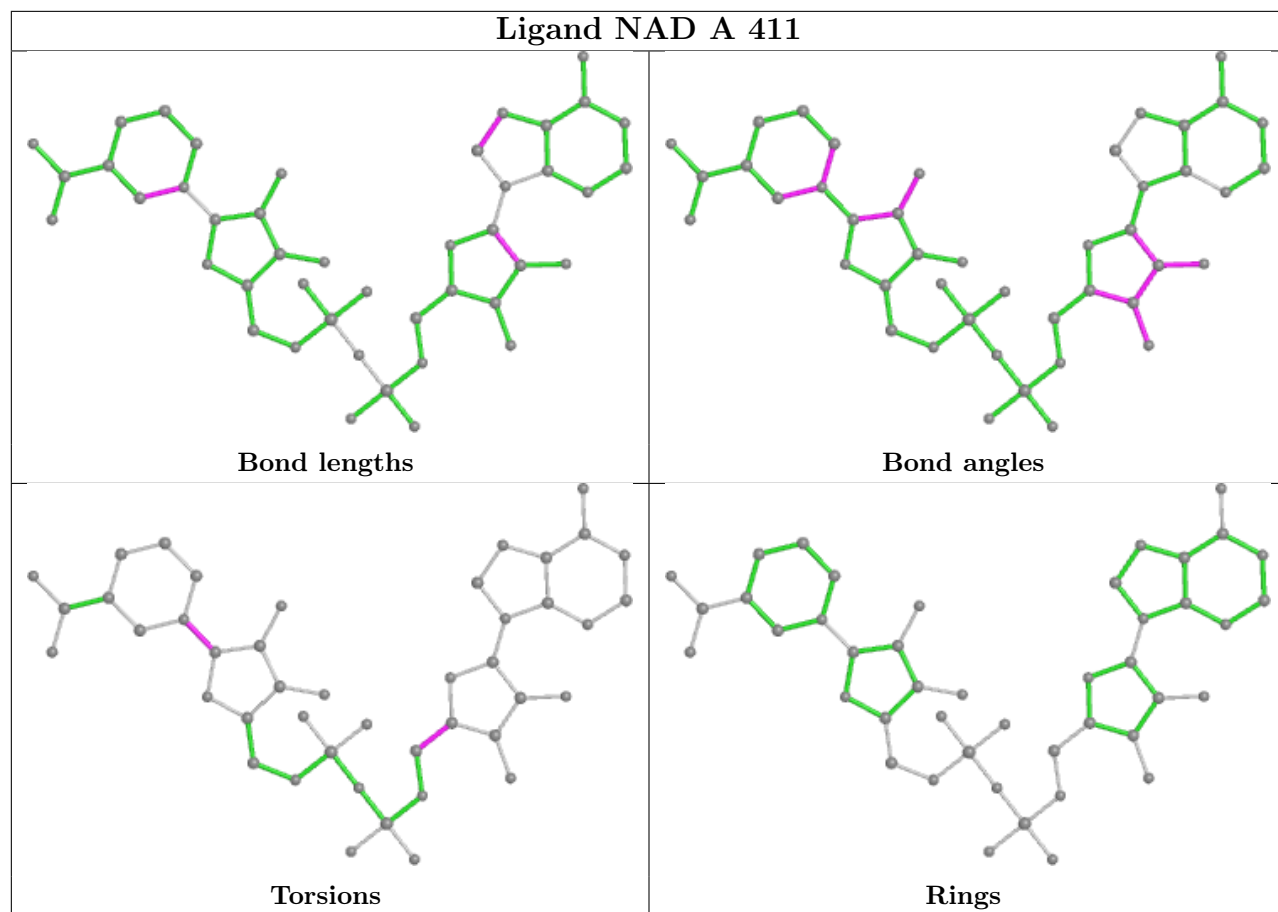


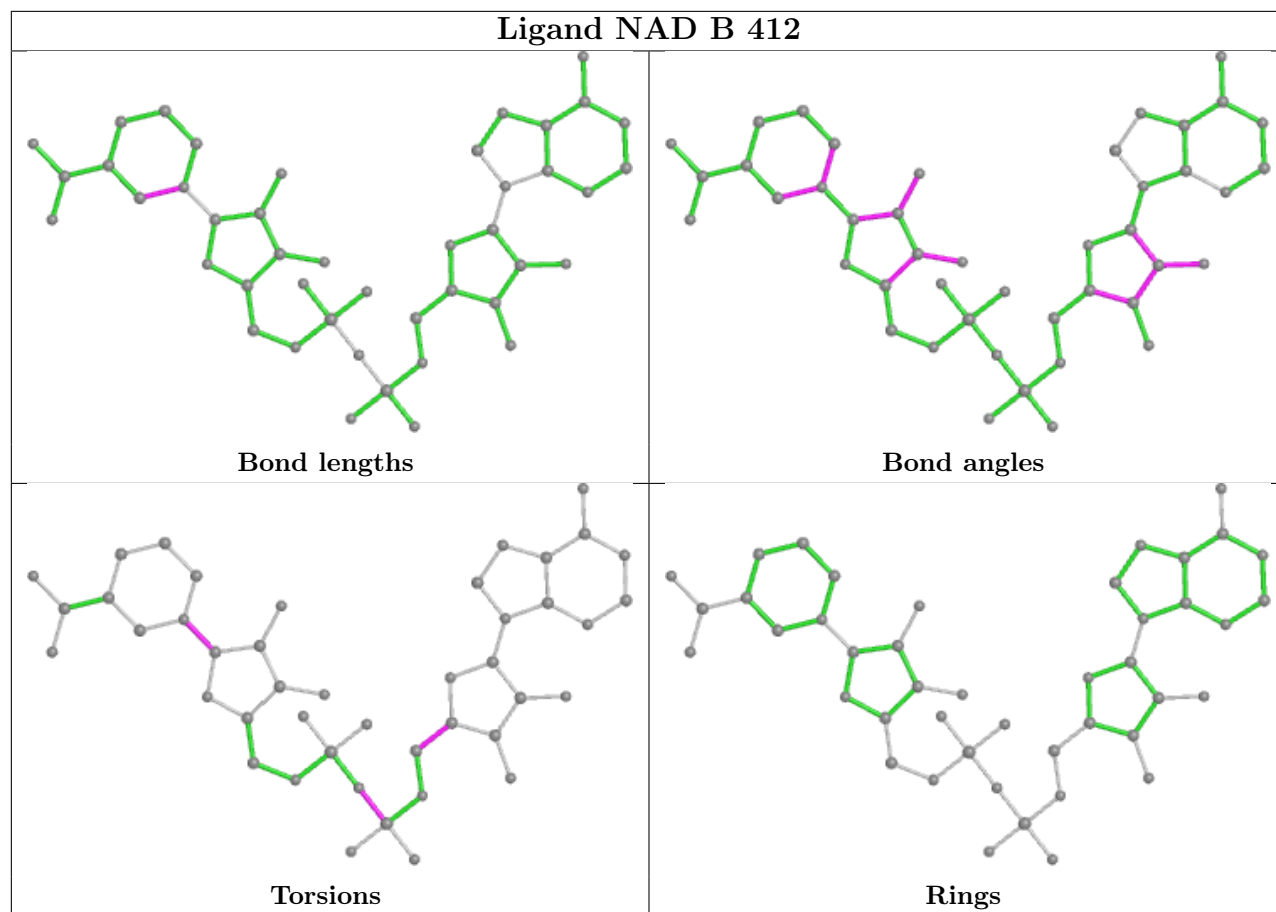


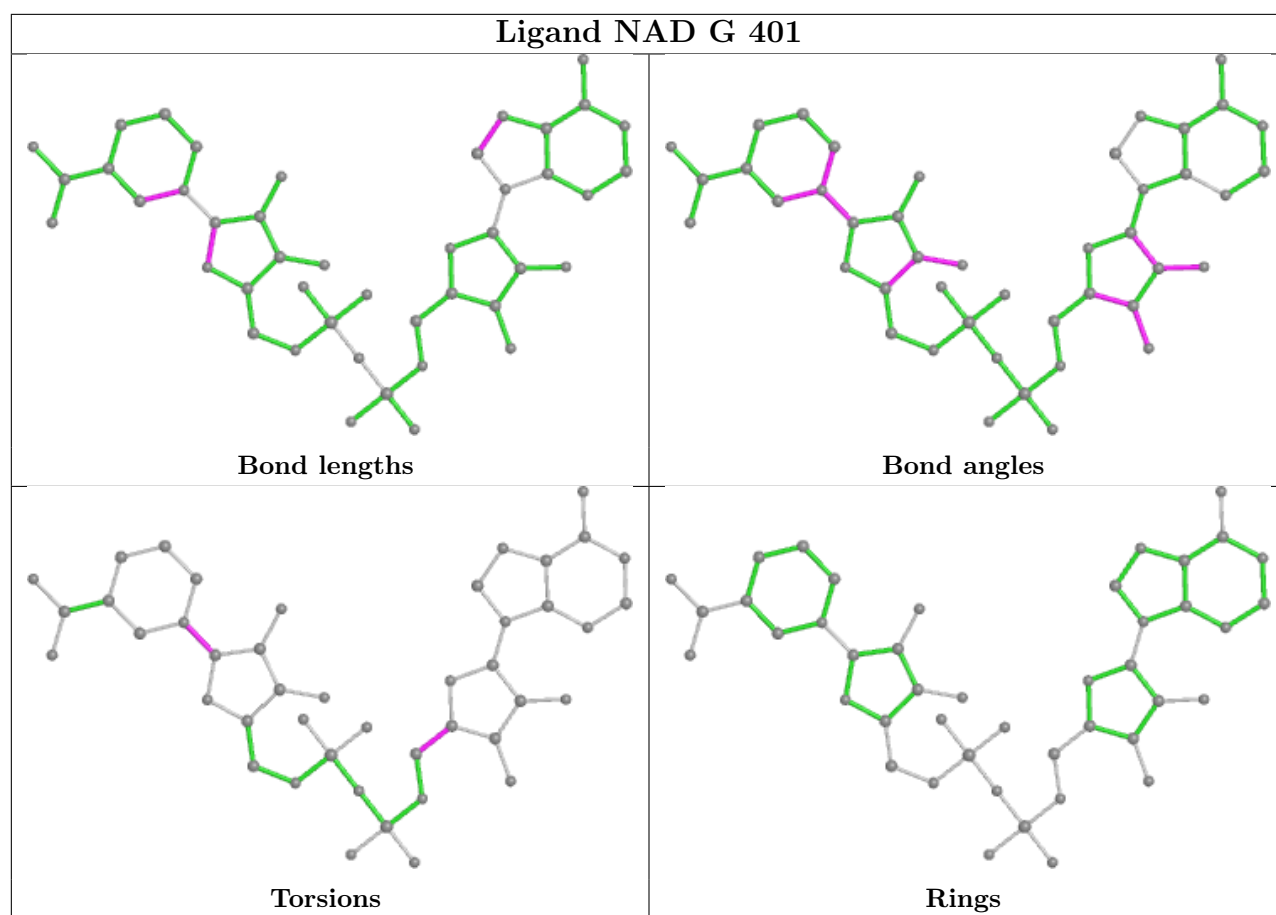












5.7 Other polymers [i](#)

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	333/337 (98%)	0.59	19 (5%) 23 26	36, 50, 81, 108	0
1	B	335/337 (99%)	0.48	11 (3%) 46 49	36, 54, 79, 112	0
1	C	333/337 (98%)	0.52	13 (3%) 39 42	36, 56, 86, 115	0
1	D	332/337 (98%)	0.58	17 (5%) 28 30	35, 55, 76, 95	0
1	F	334/337 (99%)	0.71	32 (9%) 8 9	43, 63, 90, 124	0
1	G	333/337 (98%)	0.95	43 (12%) 3 4	46, 67, 92, 115	0
1	H	333/337 (98%)	0.93	59 (17%) 1 1	45, 61, 84, 99	0
2	E	334/337 (99%)	0.80	46 (13%) 2 3	43, 64, 100, 116	0
All	All	2667/2696 (98%)	0.70	240 (8%) 9 10	35, 58, 89, 124	0

The worst 5 of 240 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	307	PHE	5.7
2	E	69	LYS	5.1
1	H	168	TRP	5.1
2	E	22	LYS	5.0
1	F	64	LEU	4.9

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

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	CSD	C	152	8/9	0.96	0.14	44,46,50,51	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	CSD	A	152	8/9	0.97	0.14	37,43,46,49	0
1	CSD	D	152	8/9	0.97	0.16	43,44,47,57	0
1	CSD	F	152	8/9	0.97	0.13	48,48,51,55	0
1	CSD	B	152	8/9	0.98	0.17	40,46,50,59	0
1	CSD	G	152	8/9	0.98	0.15	52,56,57,58	0
1	CSD	H	152	8/9	0.98	0.13	47,48,50,50	0

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	PEG	H	401	7/7	0.53	0.37	77,77,84,85	0
4	GOL	E	402	6/6	0.63	0.46	84,85,89,92	0
4	GOL	A	409	6/6	0.67	0.30	73,75,77,80	0
4	GOL	B	408	6/6	0.69	0.36	64,79,82,86	0
3	PEG	A	402	7/7	0.72	0.19	57,63,67,70	0
4	GOL	A	408	6/6	0.73	0.35	77,78,81,84	0
3	PEG	D	402	7/7	0.73	0.19	66,68,73,77	0
3	PEG	B	402	7/7	0.76	0.22	50,53,61,65	0
4	GOL	H	405	6/6	0.76	0.17	63,66,71,75	0
4	GOL	B	406	6/6	0.77	0.19	66,67,70,71	0
4	GOL	E	401	6/6	0.77	0.20	63,66,69,70	0
4	GOL	D	407	6/6	0.78	0.18	59,67,70,70	0
4	GOL	A	403	6/6	0.80	0.20	58,62,66,66	0
4	GOL	B	407	6/6	0.81	0.34	72,76,81,87	0
4	GOL	A	407	6/6	0.81	0.23	60,66,71,72	0
4	GOL	A	406	6/6	0.82	0.31	57,64,66,67	0
4	GOL	B	404	6/6	0.83	0.19	56,63,69,69	0
3	PEG	B	403	7/7	0.84	0.22	54,58,60,61	0
4	GOL	A	413	6/6	0.84	0.19	54,60,62,68	0
4	GOL	D	405	6/6	0.85	0.20	50,54,57,60	0
4	GOL	D	406	6/6	0.85	0.13	67,71,74,79	0
4	GOL	F	401	6/6	0.85	0.17	72,72,73,78	0

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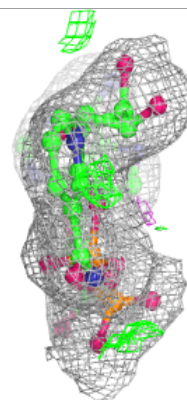
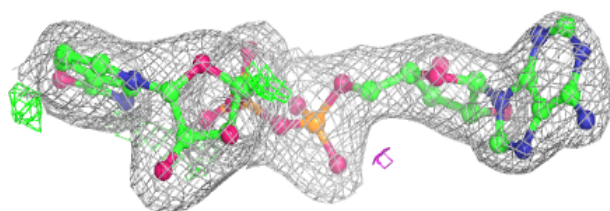
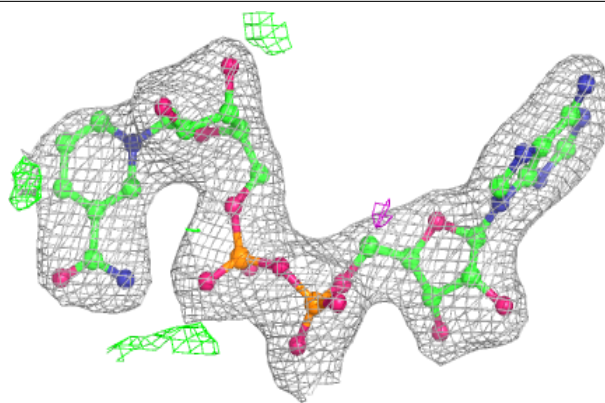
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	GOL	D	404	6/6	0.85	0.17	54,56,59,62	0
5	PO4	B	410	5/5	0.85	0.24	53,54,61,65	5
4	GOL	C	403	6/6	0.86	0.16	73,79,80,85	0
3	PEG	B	401	7/7	0.87	0.15	54,57,60,61	0
4	GOL	C	401	6/6	0.87	0.19	56,59,61,64	0
4	GOL	C	402	6/6	0.88	0.14	57,58,62,63	0
4	GOL	H	402	6/6	0.88	0.13	67,69,73,75	0
3	PEG	A	401	7/7	0.88	0.17	55,56,61,63	0
4	GOL	D	403	6/6	0.88	0.16	55,58,64,64	0
4	GOL	H	403	6/6	0.89	0.21	55,56,58,62	0
5	PO4	D	409	5/5	0.89	0.25	49,51,53,54	5
4	GOL	H	404	6/6	0.90	0.16	57,58,60,62	0
4	GOL	A	404	6/6	0.90	0.31	55,59,61,62	0
5	PO4	A	410	5/5	0.92	0.30	47,48,49,53	5
4	GOL	A	405	6/6	0.92	0.18	55,56,57,59	0
5	PO4	B	411	5/5	0.92	0.20	55,58,65,69	5
4	GOL	D	401	6/6	0.92	0.16	61,63,68,68	0
4	GOL	D	408	6/6	0.93	0.23	56,62,66,68	0
4	GOL	B	405	6/6	0.93	0.12	64,66,69,70	0
6	NAD	E	403	44/44	0.93	0.17	50,58,73,76	0
4	GOL	B	409	6/6	0.94	0.18	57,60,66,67	0
4	GOL	C	404	6/6	0.95	0.12	56,59,61,62	0
6	NAD	A	411	44/44	0.95	0.15	36,45,54,55	0
6	NAD	B	412	44/44	0.95	0.16	41,46,53,56	0
6	NAD	C	405	44/44	0.95	0.13	45,49,56,63	0
4	GOL	A	412	6/6	0.95	0.11	55,61,66,67	0
6	NAD	G	401	44/44	0.95	0.13	51,57,62,65	0
6	NAD	H	406	44/44	0.95	0.14	43,51,56,59	0
6	NAD	D	410	44/44	0.96	0.15	37,46,56,65	0
6	NAD	F	402	44/44	0.97	0.14	44,52,63,64	0

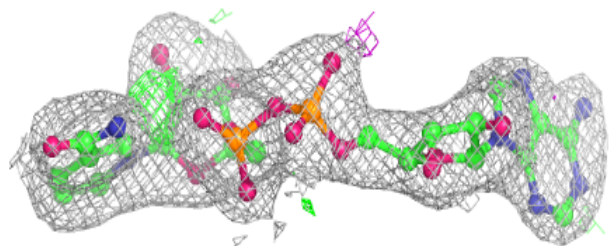
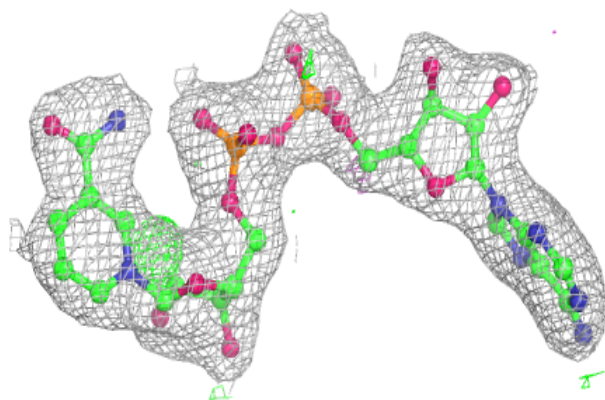
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around NAD E 403:

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

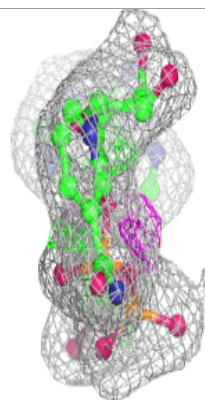
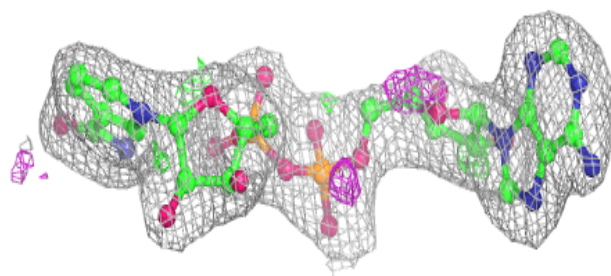
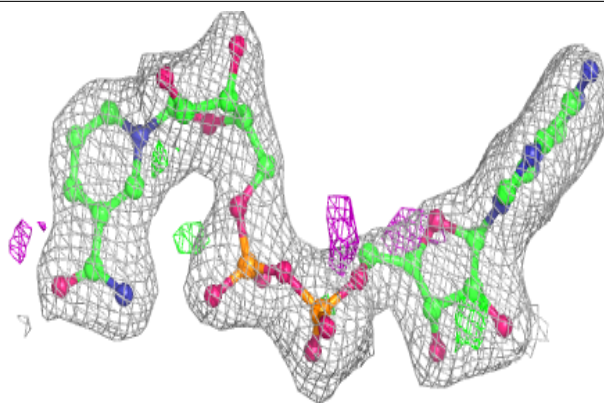
**Electron density around NAD A 411:**

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

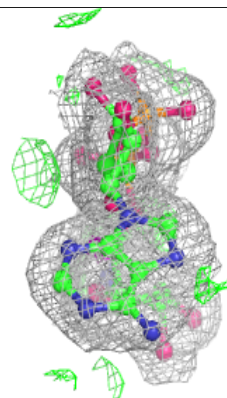
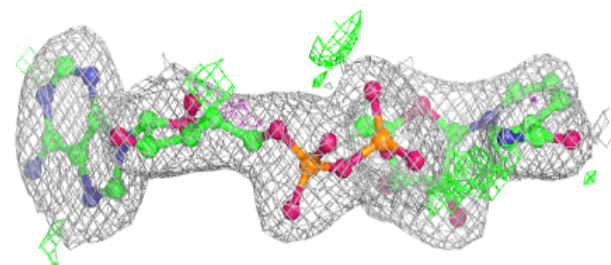
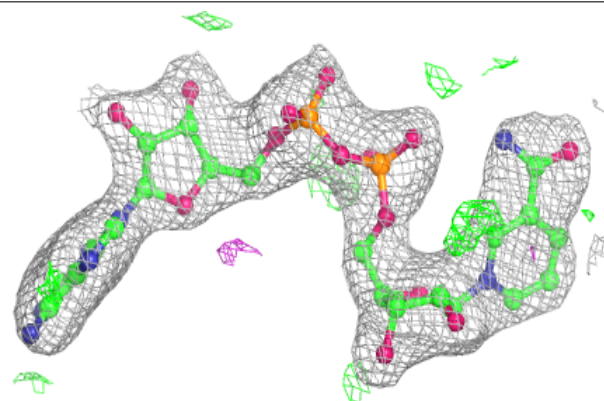


Electron density around NAD B 412:

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

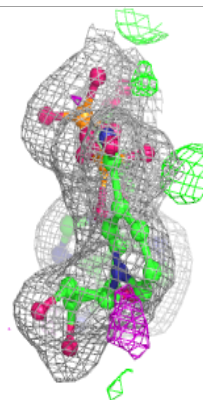
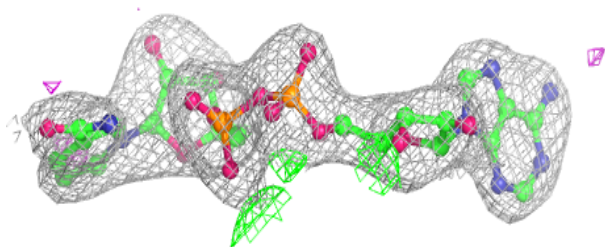
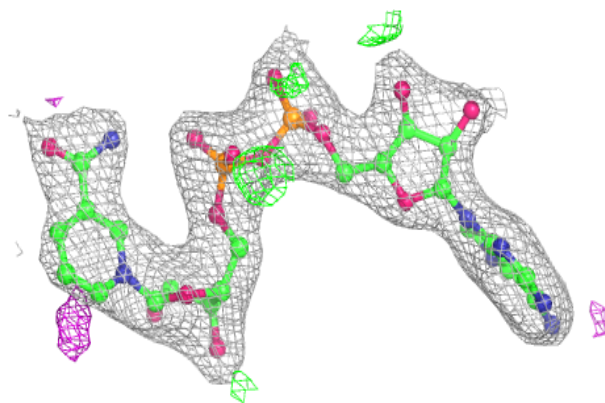
**Electron density around NAD C 405:**

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

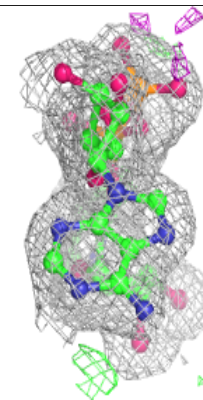
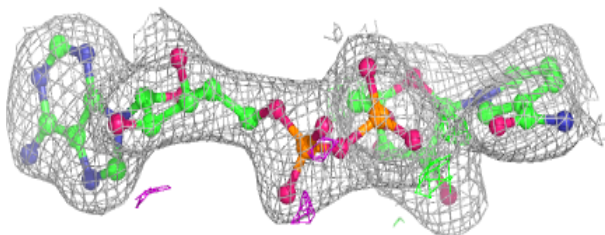
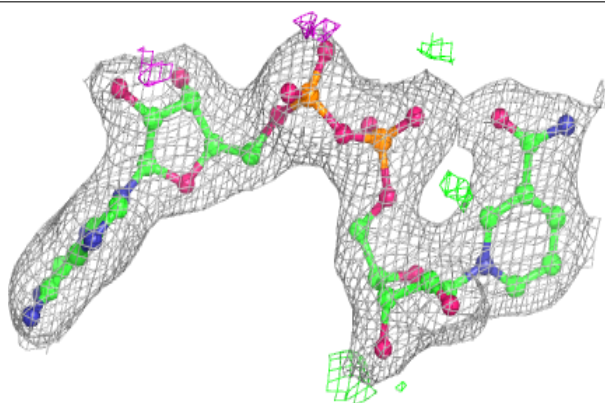


Electron density around NAD G 401:

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

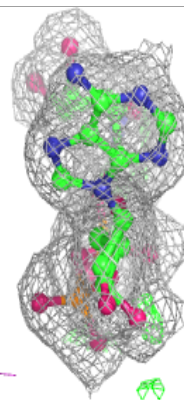
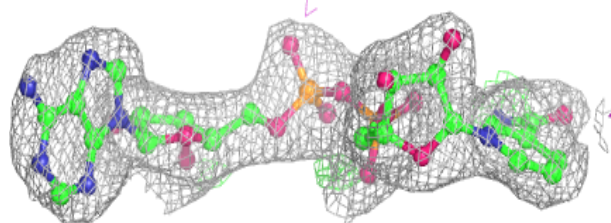
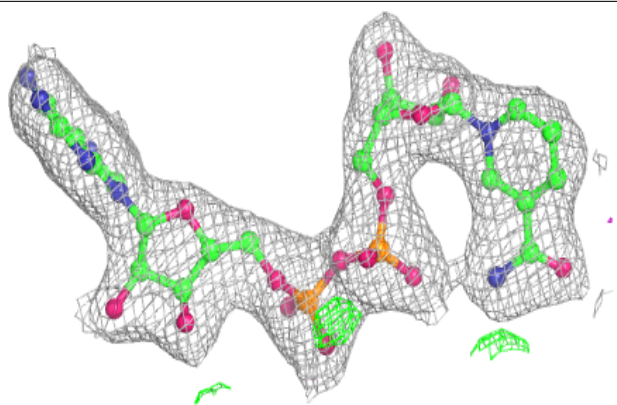
**Electron density around NAD H 406:**

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

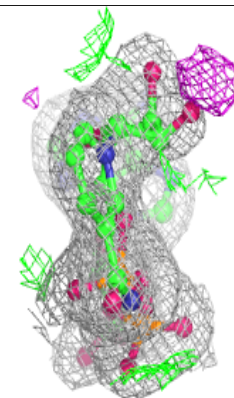
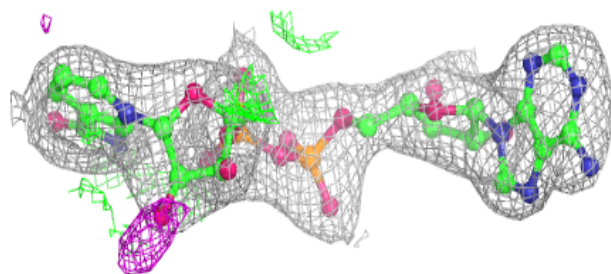
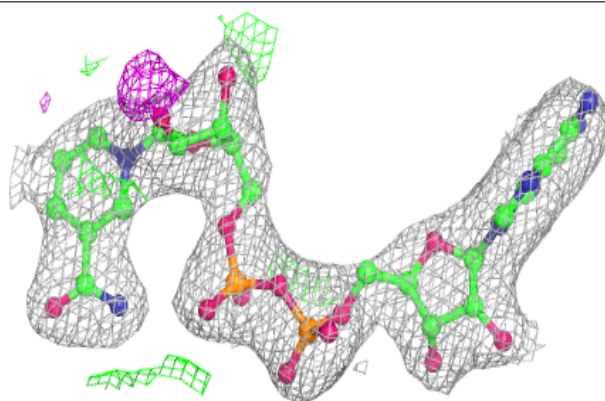


Electron density around NAD D 410:

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

**Electron density around NAD F 402:**

$2mF_o-DF_c$ (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.