Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 05:02 PM UTC

PDB ID	:	6VLO / pdb_00006vlo
Title	:	X-ray Structure of the R141 Sugar 4,6-dehydratase from Acanthamoeba polyphaga Minivirus
Authors	:	Thoden, J.B.; Ferek, J.D.; Holden, H.M.
Deposited on	:	2020-01-24
Resolution	:	2.05 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references ⓘ) were used in the production of this report:

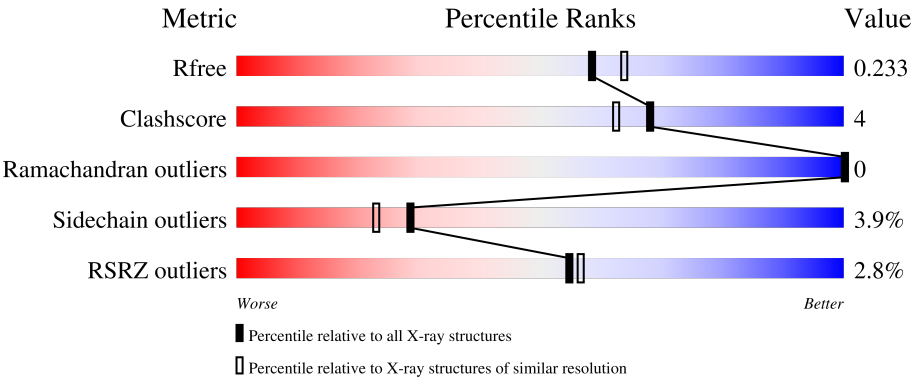
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.05 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	2260 (2.04-2.04)
Clashscore	190562	2333 (2.04-2.04)
Ramachandran outliers	187476	2318 (2.04-2.04)
Sidechain outliers	187428	2318 (2.04-2.04)
RSRZ outliers	180081	2260 (2.04-2.04)

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	326	2% 83% 12%
1	B	326	2% 87% 9%
1	C	326	3% 89% 6%
1	D	326	4% 85% 9% 6%

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 10883 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.

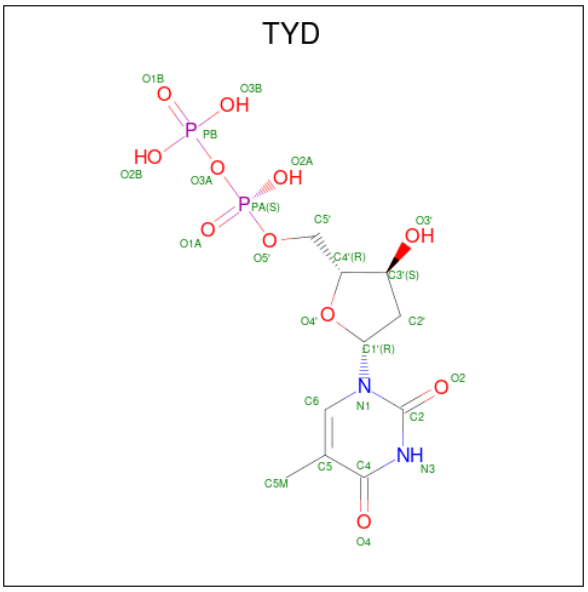
- Molecule 1 is a protein called Putative dTDP-D-glucose 4,6-dehydratase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	319	Total	C	N	O	S	0	2	0
			2582	1646	443	482	11			
1	B	319	Total	C	N	O	S	0	2	0
			2581	1644	443	483	11			
1	C	312	Total	C	N	O	S	0	0	0
			2518	1609	431	468	10			
1	D	307	Total	C	N	O	S	0	0	0
			2469	1576	421	462	10			

There are 12 discrepancies between the modelled and reference sequences:

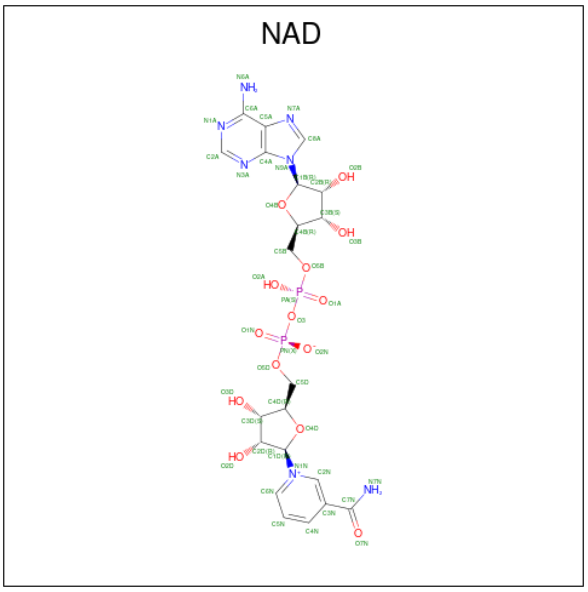
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP Q5UR12
A	-1	GLY	-	expression tag	UNP Q5UR12
A	0	HIS	-	expression tag	UNP Q5UR12
B	-2	GLY	-	expression tag	UNP Q5UR12
B	-1	GLY	-	expression tag	UNP Q5UR12
B	0	HIS	-	expression tag	UNP Q5UR12
C	-2	GLY	-	expression tag	UNP Q5UR12
C	-1	GLY	-	expression tag	UNP Q5UR12
C	0	HIS	-	expression tag	UNP Q5UR12
D	-2	GLY	-	expression tag	UNP Q5UR12
D	-1	GLY	-	expression tag	UNP Q5UR12
D	0	HIS	-	expression tag	UNP Q5UR12

- Molecule 2 is THYMIDINE-5'-DIPHOSPHATE (CCD ID: TYD) (formula: $C_{10}H_{16}N_2O_{11}P_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			25	10	2	11	2		
2	B	1	Total	C	N	O	P	0	0
			25	10	2	11	2		
2	C	1	Total	C	N	O	P	0	0
			25	10	2	11	2		
2	D	1	Total	C	N	O	P	0	0
			25	10	2	11	2		

- Molecule 3 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
3	A	1	Total	C	N	O	P	0	0
			36	15	6	13	2		
3	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
3	C	1	Total	C	N	O	P	0	0
			36	15	6	13	2		
3	D	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

- Molecule 4 is NICKEL (II) ION (CCD ID: NI) (formula: Ni).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Ni	0	0
			1	1		
4	C	1	Total	Ni	0	0
			1	1		

- Molecule 5 is water.

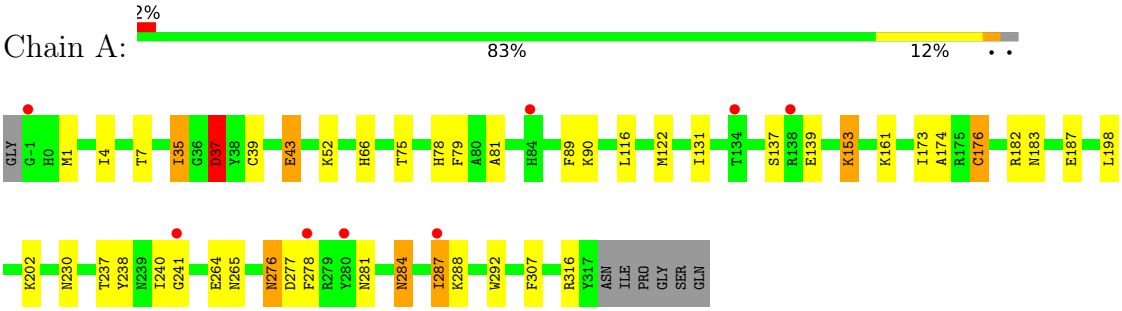
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	152	Total	O	0	0
			152	152		
5	B	127	Total	O	0	0
			127	127		
5	C	96	Total	O	0	0
			96	96		
5	D	113	Total	O	0	0
			113	113		

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.

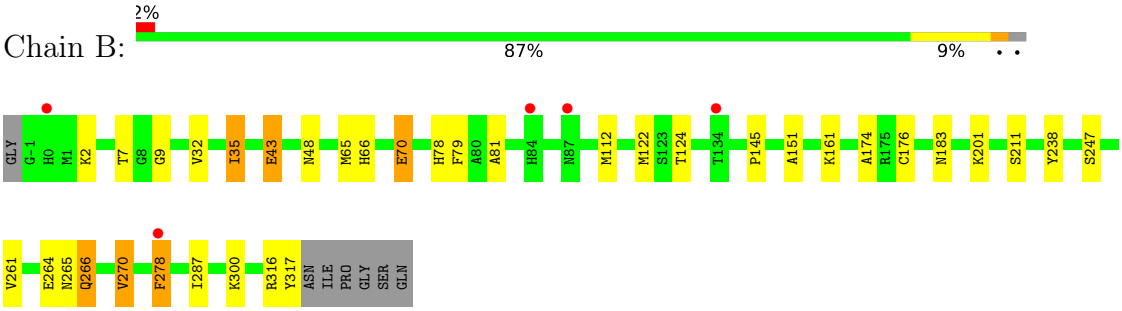
• Molecule 1: Putative dTDP-D-glucose 4,6-dehydratase

Chain A:



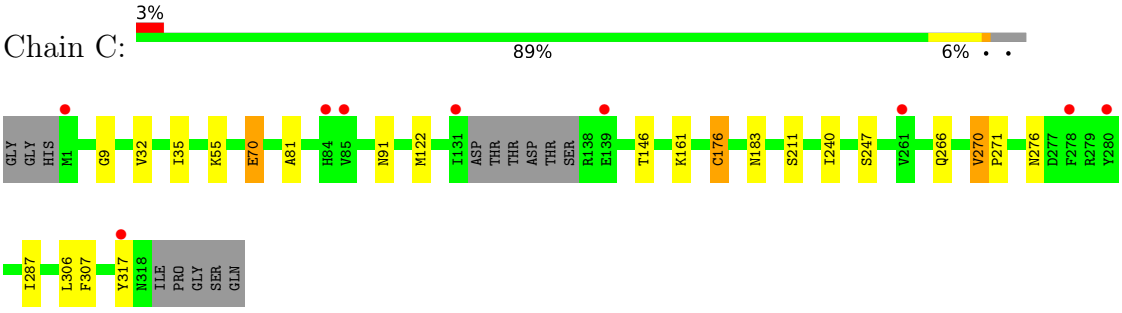
• Molecule 1: Putative dTDP-D-glucose 4,6-dehydratase

Chain B:



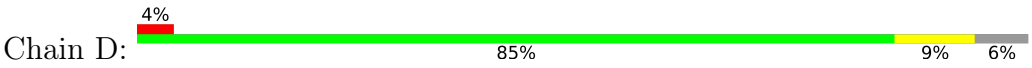
• Molecule 1: Putative dTDP-D-glucose 4,6-dehydratase

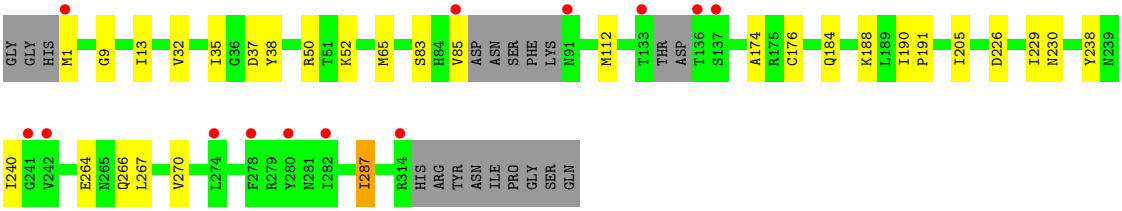
Chain C:



• Molecule 1: Putative dTDP-D-glucose 4,6-dehydratase

Chain D:




GLY GLY HIS M1 G9 I13 V32 I35 G36 D37 Y38 R50 T51 K52 M65 S83 H84 V85 ASP ASN SER PHE LYS N91 M112 T133 THR ASP T136 S137 A174 R175 C176 Q184 K188 L189 I190 P191 I205 D226 I229 N230 Y238 N239
I240 G241 V242 E264 N265 Q266 L267 V270 L274 F278 R279 Y280 N281 I282 I287 R314 HIS ARG TYR ASN ILE PRO GLY SER GLN

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	93.88Å 111.08Å 133.38Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.88 – 2.05 38.88 – 2.05	Depositor EDS
% Data completeness (in resolution range)	99.2 (38.88-2.05) 99.5 (38.88-2.05)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	5.77 (at 2.05Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, R_{free}	0.180 , 0.229 0.189 , 0.233	Depositor DCC
R_{free} test set	4517 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å^2)	30.7	Xtriage
Anisotropy	0.040	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 34.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	10883	wwPDB-VP
Average B, all atoms (Å^2)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.98% of the height of the origin peak. No significant pseudotranslation is detected.*

[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: NI, TYD, 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	1.06	0/2645	1.32	4/3582 (0.1%)
1	B	1.04	0/2644	1.35	3/3582 (0.1%)
1	C	1.04	0/2573	1.34	1/3484 (0.0%)
1	D	1.03	0/2520	1.38	1/3412 (0.0%)
All	All	1.04	0/10382	1.35	9/14060 (0.1%)

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	270	VAL	CB-CA-C	7.53	118.02	109.89
1	A	37	ASP	CB-CA-C	7.21	125.32	110.40
1	B	270	VAL	N-CA-CB	-6.64	104.57	111.87
1	A	37	ASP	CA-CB-CG	5.41	118.01	112.60
1	D	37	ASP	CA-CB-CG	5.40	118.00	112.60
1	B	278	PHE	CA-CB-CG	5.23	119.03	113.80
1	A	288	LYS	CA-C-N	5.12	128.09	120.31
1	A	288	LYS	C-N-CA	5.12	128.09	120.31
1	C	91	ASN	N-CA-C	-5.00	105.72	111.07

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2582	0	2538	27	0
1	B	2581	0	2531	24	0
1	C	2518	0	2470	11	0
1	D	2469	0	2431	12	0
2	A	25	0	13	0	0
2	B	25	0	13	0	0
2	C	25	0	13	0	0
2	D	25	0	13	0	0
3	A	36	0	20	2	0
3	B	44	0	24	6	0
3	C	36	0	20	1	0
3	D	27	0	12	1	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
5	A	152	0	0	1	0
5	B	127	0	0	0	0
5	C	96	0	0	0	0
5	D	113	0	0	2	0
All	All	10883	0	10098	73	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 4.

All (73) 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:1:MET:HB2	5:D:549:HOH:O	1.88	0.73
1:D:1:MET:HE3	1:D:229:ILE:HG21	1.73	0.70
1:B:81:ALA:HB3	3:B:402:NAD:H3D	1.75	0.68
1:B:43:GLU:HB2	1:B:316:ARG:HD2	1.78	0.66
1:B:176:CYS:HB3	3:B:402:NAD:C5N	2.28	0.64
1:B:124:THR:HG22	3:B:402:NAD:C6N	2.29	0.63
1:D:184:GLN:NE2	1:D:188:LYS:HG3	2.14	0.63
1:A:240:ILE:HG12	1:A:287:ILE:HD13	1.81	0.62
1:D:9:GLY:HA3	1:D:32:VAL:HG13	1.80	0.62
1:C:81:ALA:HB3	3:C:402:NAD:H3D	1.80	0.62
1:B:65:MET:HE2	1:B:112:MET:HE2	1.85	0.59
1:A:37:ASP:OD2	1:A:39[A]:CYS:SG	2.53	0.59
1:A:240:ILE:HG12	1:A:287:ILE:CD1	2.36	0.55
1:B:35:ILE:HD13	1:B:35:ILE:O	2.07	0.55
1:A:139:GLU:O	1:A:161:LYS:NZ	2.40	0.55
1:B:176:CYS:HB3	3:B:402:NAD:H5N	1.89	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:9:GLY:HA3	1:C:32:VAL:HG13	1.89	0.54
1:A:35:ILE:HD13	1:A:35:ILE:O	2.07	0.54
1:B:145:PRO:HG2	1:B:151:ALA:HA	1.90	0.53
1:C:122:MET:HE3	1:C:176:CYS:HB2	1.91	0.53
1:A:81:ALA:HB3	3:A:402:NAD:H3D	1.91	0.53
1:B:124:THR:HG22	3:B:402:NAD:C5N	2.40	0.51
1:B:261:VAL:CG1	1:B:266:GLN:NE2	2.75	0.50
1:B:264:GLU:O	1:B:265:ASN:HB2	2.13	0.49
1:B:174:ALA:HA	1:B:238:TYR:O	2.13	0.48
1:C:211:SER:O	1:C:247:SER:HA	2.14	0.48
1:D:205:ILE:HG13	1:D:267:LEU:HD22	1.95	0.48
1:C:270:VAL:HG22	1:C:271:PRO:CD	2.44	0.48
1:A:182:ARG:O	1:A:183:ASN:HB2	2.14	0.48
1:D:65:MET:HE2	1:D:112:MET:HE2	1.96	0.47
1:A:153[A]:LYS:HE3	5:A:618:HOH:O	2.13	0.47
1:A:198:LEU:HD21	1:A:307:PHE:CE2	2.49	0.47
1:A:241:GLY:O	1:A:284:ASN:HB3	2.14	0.47
1:C:270:VAL:HG22	1:C:271:PRO:HD2	1.97	0.47
1:B:65:MET:HE2	1:B:112:MET:CE	2.45	0.46
1:B:122:MET:HE3	1:B:176:CYS:HB2	1.97	0.46
1:A:284:ASN:C	1:A:284:ASN:HD22	2.23	0.46
1:B:9:GLY:HA3	1:B:32:VAL:HG13	1.97	0.46
1:B:66:HIS:O	1:B:70:GLU:HB2	2.16	0.45
1:B:261:VAL:HG11	1:B:266:GLN:NE2	2.32	0.45
1:A:43:GLU:HG3	1:A:316:ARG:HG3	1.99	0.45
1:A:66:HIS:NE2	1:C:70:GLU:OE2	2.48	0.45
1:C:240:ILE:HG12	1:C:287:ILE:HD13	1.98	0.45
1:A:287:ILE:HG23	1:A:292:TRP:HB3	1.97	0.45
1:D:240:ILE:HG12	1:D:287:ILE:HD13	1.98	0.44
1:B:48:ASN:OD1	1:B:48:ASN:C	2.60	0.44
1:A:79:PHE:O	3:A:402:NAD:H52N	2.17	0.44
1:A:176:CYS:HA	1:A:240:ILE:O	2.17	0.44
1:A:1:MET:HE2	1:A:230:ASN:HD21	1.82	0.44
1:A:174:ALA:HA	1:A:238:TYR:O	2.18	0.44
1:A:4:ILE:HG22	1:A:75:THR:HB	2.00	0.43
1:A:122:MET:HE3	1:A:176:CYS:HB2	2.01	0.43
1:C:306:LEU:HD23	1:C:306:LEU:HA	1.83	0.43
1:D:226:ASP:OD1	1:D:230:ASN:ND2	2.52	0.43
1:A:173:ILE:O	1:A:237:THR:HA	2.19	0.43
1:B:43:GLU:CB	1:B:316:ARG:HD2	2.48	0.43
1:A:264:GLU:O	1:A:265:ASN:HB2	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:277:ASP:C	1:A:277:ASP:OD2	2.62	0.43
1:B:43:GLU:H	1:B:43:GLU:HG2	1.66	0.42
1:A:7:THR:OG1	1:A:78:HIS:HA	2.20	0.42
1:B:7:THR:OG1	1:B:78:HIS:HA	2.20	0.42
1:D:38:TYR:O	5:D:501:HOH:O	2.22	0.42
1:B:183:ASN:HA	1:B:317:TYR:OH	2.19	0.41
1:B:79:PHE:O	3:B:402:NAD:H52N	2.19	0.41
1:D:174:ALA:HA	1:D:238:TYR:O	2.20	0.41
1:A:202:LYS:NZ	1:A:265:ASN:O	2.50	0.41
1:D:190:ILE:N	1:D:191:PRO:HD2	2.36	0.41
1:C:183:ASN:HA	1:C:317:TYR:OH	2.21	0.41
1:A:89:PHE:O	1:A:90:LYS:HB2	2.21	0.41
1:A:276:ASN:HD22	1:A:276:ASN:C	2.29	0.40
1:D:13:ILE:N	3:D:402:NAD:O1N	2.43	0.40
1:B:211:SER:O	1:B:247:SER:HA	2.21	0.40
1:C:146:THR:CB	1:C:276:ASN:HD22	2.35	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	319/326 (98%)	302 (95%)	17 (5%)	0	100	100
1	B	319/326 (98%)	304 (95%)	15 (5%)	0	100	100
1	C	308/326 (94%)	296 (96%)	12 (4%)	0	100	100
1	D	301/326 (92%)	289 (96%)	12 (4%)	0	100	100
All	All	1247/1304 (96%)	1191 (96%)	56 (4%)	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	287/290 (99%)	271 (94%)	16 (6%)	19	12
1	B	287/290 (99%)	276 (96%)	11 (4%)	29	24
1	C	278/290 (96%)	270 (97%)	8 (3%)	37	33
1	D	274/290 (94%)	264 (96%)	10 (4%)	31	26
All	All	1126/1160 (97%)	1081 (96%)	45 (4%)	28	22

All (45) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	35	ILE
1	A	37	ASP
1	A	43	GLU
1	A	52	LYS
1	A	116	LEU
1	A	131	ILE
1	A	137	SER
1	A	153[A]	LYS
1	A	153[B]	LYS
1	A	176	CYS
1	A	187	GLU
1	A	276	ASN
1	A	278	PHE
1	A	281	ASN
1	A	284	ASN
1	A	287	ILE
1	B	2	LYS
1	B	35	ILE
1	B	43	GLU
1	B	70	GLU
1	B	161	LYS
1	B	201	LYS
1	B	266	GLN
1	B	270	VAL

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Mol	Chain	Res	Type
1	B	278	PHE
1	B	287	ILE
1	B	300	LYS
1	C	35	ILE
1	C	55	LYS
1	C	70	GLU
1	C	161	LYS
1	C	176	CYS
1	C	266	GLN
1	C	270	VAL
1	C	307	PHE
1	D	35	ILE
1	D	50	ARG
1	D	52	LYS
1	D	83	SER
1	D	85	VAL
1	D	176	CYS
1	D	264	GLU
1	D	266	GLN
1	D	270	VAL
1	D	287	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	49	ASN
1	A	230	ASN
1	A	276	ASN
1	A	284	ASN
1	B	49	ASN
1	B	66	HIS
1	B	266	GLN
1	C	20	HIS
1	C	82	HIS
1	C	265	ASN
1	C	276	ASN
1	D	29	ASN
1	D	82	HIS
1	D	210	ASN
1	D	230	ASN

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

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 10 ligands modelled in this entry, 2 are monoatomic - leaving 8 for Mogul analysis.

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	$\#\|Z\| > 2$
2	TYD	D	401	-	25,26,26	1.15	2 (8%)	38,40,40	0.52	0
2	TYD	C	401	-	25,26,26	0.54	0	38,40,40	0.60	0
2	TYD	B	401	-	25,26,26	0.51	0	38,40,40	0.95	2 (5%)
3	NAD	C	402	-	38,39,48	0.64	1 (2%)	55,60,73	0.76	0
2	TYD	A	401	-	25,26,26	0.63	0	38,40,40	0.79	1 (2%)
3	NAD	B	402	-	46,48,48	1.25	4 (8%)	64,73,73	1.01	4 (6%)
3	NAD	D	402	-	28,29,48	0.70	1 (3%)	43,45,73	0.61	0
3	NAD	A	402	-	38,39,48	0.55	0	55,60,73	0.69	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	TYD	D	401	-	-	2/16/28/28	0/2/2/2

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	TYD	C	401	-	-	0/16/28/28	0/2/2/2
2	TYD	B	401	-	-	0/16/28/28	0/2/2/2
3	NAD	C	402	-	-	3/22/54/62	0/4/4/5
2	TYD	A	401	-	-	0/16/28/28	0/2/2/2
3	NAD	B	402	-	-	3/30/62/62	0/5/5/5
3	NAD	D	402	-	-	6/16/32/62	0/3/3/5
3	NAD	A	402	-	-	3/22/54/62	0/4/4/5

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	402	NAD	C7N-N7N	-4.93	1.23	1.33
3	B	402	NAD	O7N-C7N	3.94	1.31	1.24
3	B	402	NAD	C2N-N1N	3.39	1.38	1.35
2	D	401	TYD	PB-O3B	-3.15	1.43	1.54
2	D	401	TYD	PB-O2B	-2.65	1.45	1.54
3	C	402	NAD	PN-O3	2.50	1.62	1.59
3	D	402	NAD	PA-O3	2.25	1.61	1.59
3	B	402	NAD	PN-O3	2.16	1.61	1.59

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	B	402	NAD	C6N-N1N-C2N	-4.26	118.25	121.88
2	B	401	TYD	O3A-PA-O1A	-2.97	101.78	110.70
2	B	401	TYD	O2A-PA-O1A	2.67	124.87	112.44
3	B	402	NAD	C3N-C7N-N7N	2.34	120.62	117.74
3	B	402	NAD	O3-PN-O1N	-2.18	104.15	110.70
3	B	402	NAD	O7N-C7N-C3N	-2.17	116.94	119.60
2	A	401	TYD	O3B-PB-O2B	2.03	115.43	107.80

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	401	TYD	C5'-O5'-PA-O1A
2	D	401	TYD	C5'-O5'-PA-O3A
3	B	402	NAD	O4D-C1D-N1N-C2N
3	C	402	NAD	C5D-O5D-PN-O3
3	C	402	NAD	C5D-O5D-PN-O1N

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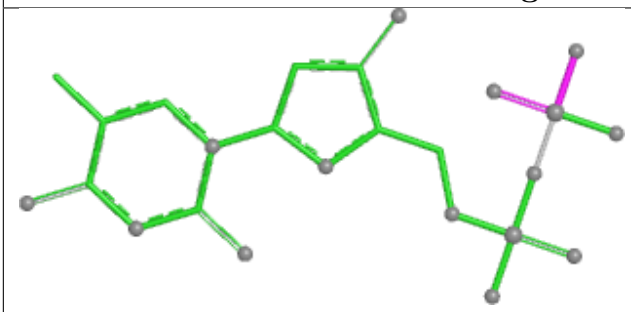
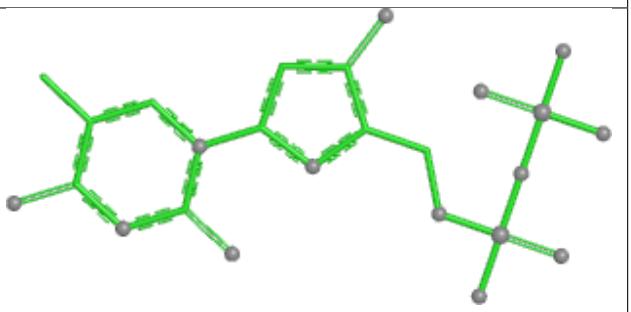
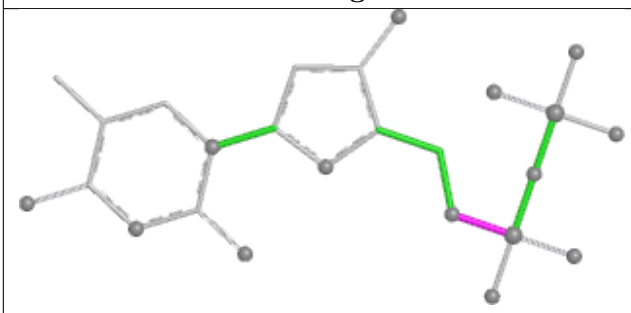
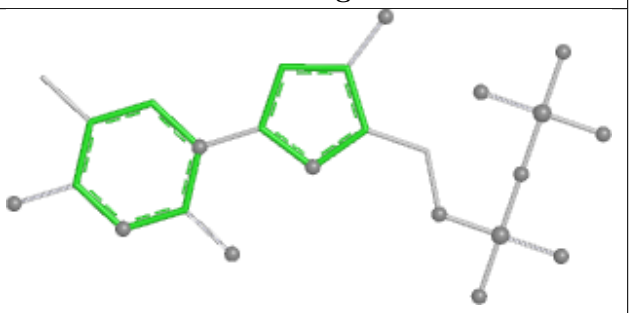
Mol	Chain	Res	Type	Atoms
3	D	402	NAD	C5B-O5B-PA-O1A
3	D	402	NAD	C5B-O5B-PA-O2A
3	D	402	NAD	C5B-O5B-PA-O3
3	D	402	NAD	PN-O3-PA-O5B
3	D	402	NAD	O4B-C4B-C5B-O5B
3	D	402	NAD	C3B-C4B-C5B-O5B
3	C	402	NAD	C5D-O5D-PN-O2N
3	A	402	NAD	O4D-C4D-C5D-O5D
3	B	402	NAD	O4D-C1D-N1N-C6N
3	A	402	NAD	PN-O3-PA-O1A
3	B	402	NAD	O4D-C4D-C5D-O5D
3	A	402	NAD	PN-O3-PA-O2A

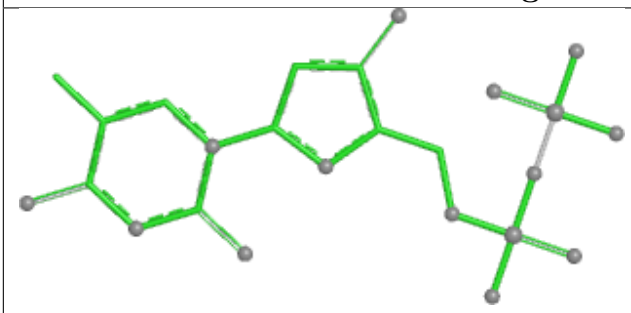
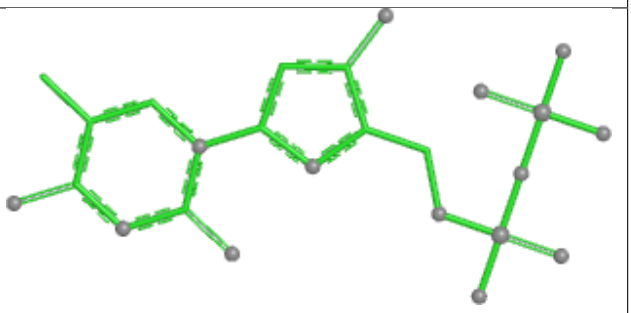
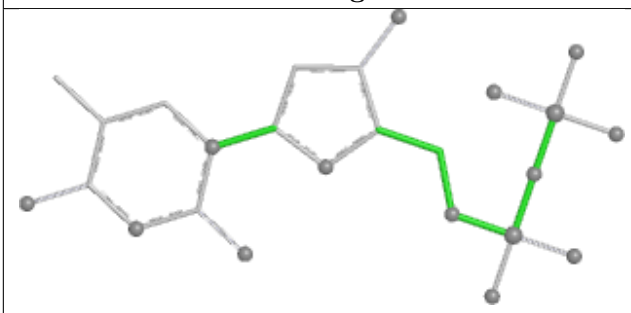
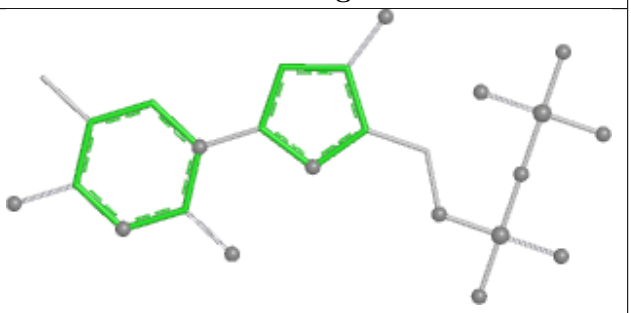
There are no ring outliers.

4 monomers are involved in 10 short contacts:

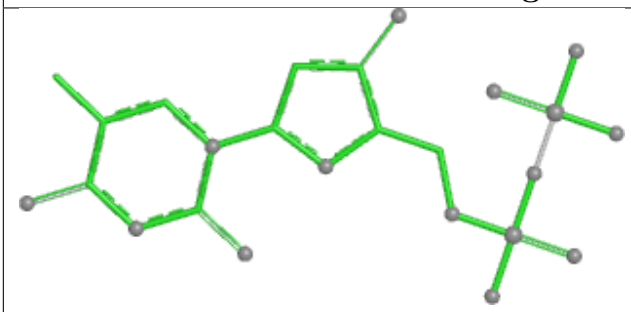
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	402	NAD	1	0
3	B	402	NAD	6	0
3	D	402	NAD	1	0
3	A	402	NAD	2	0

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.

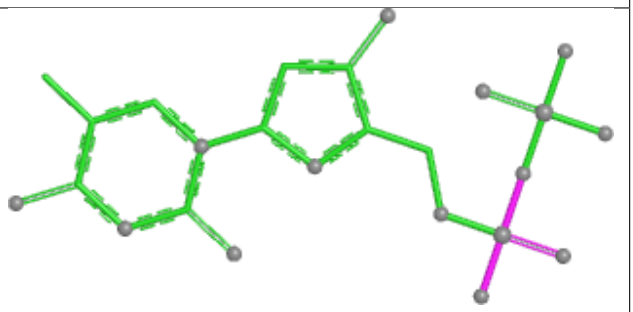
Ligand TYD D 401	
	
Bond lengths	Bond angles
	
Torsions	Rings

Ligand TYD C 401	
	
Bond lengths	Bond angles
	
Torsions	Rings

Ligand TYD B 401



Bond lengths



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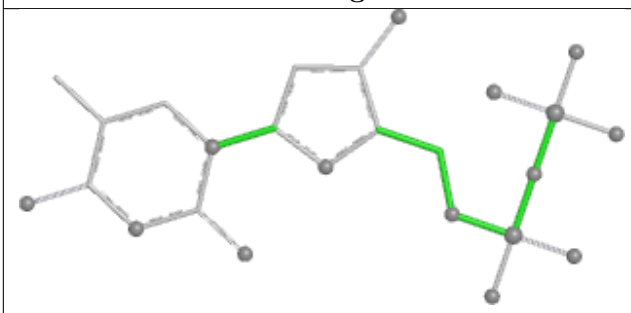

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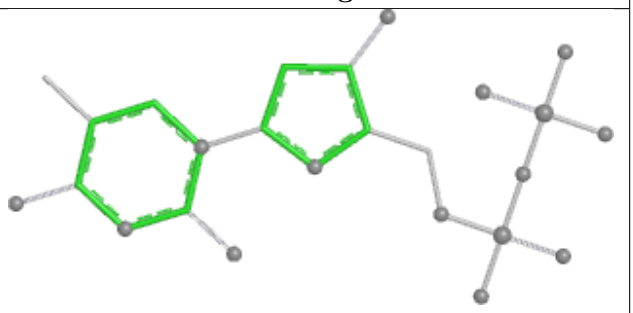
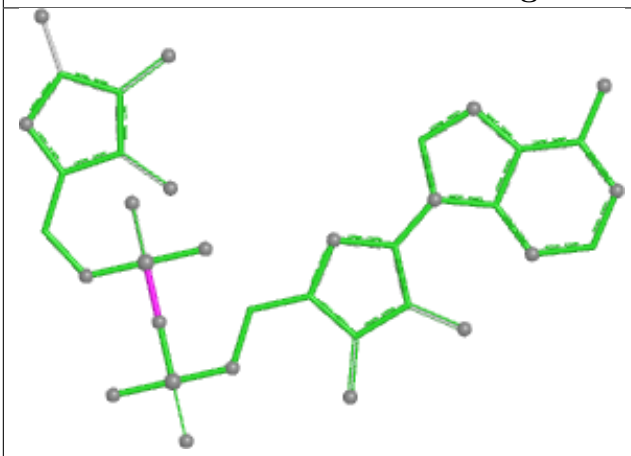


Rings

Ligand NAD C 402



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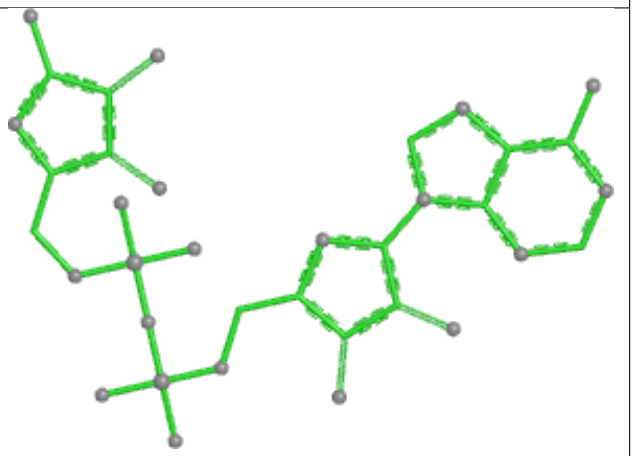
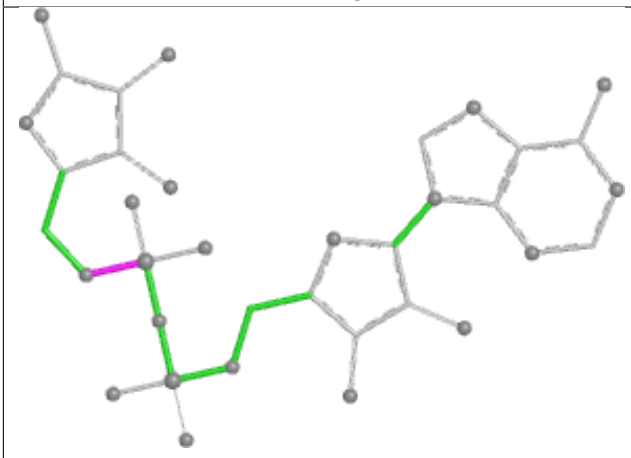


Bond angles



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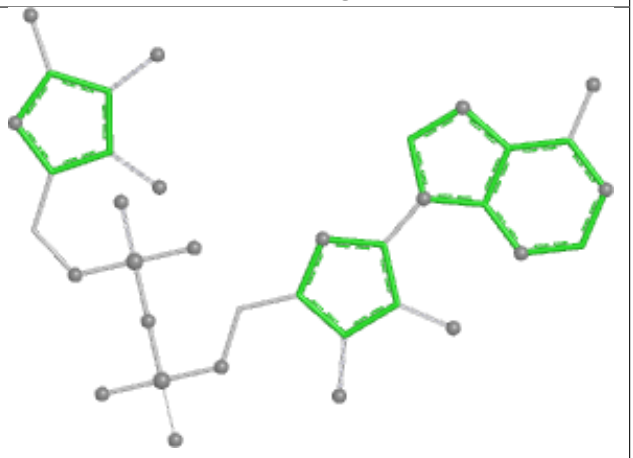
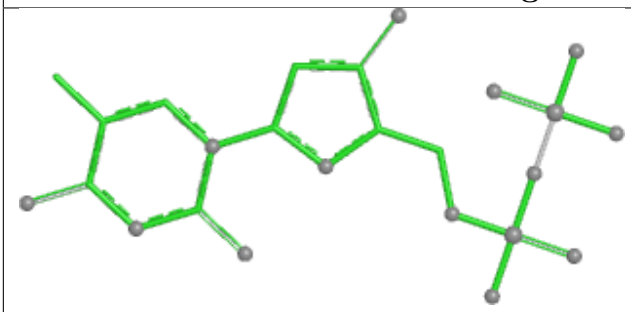


Rings

Ligand TYD A 401



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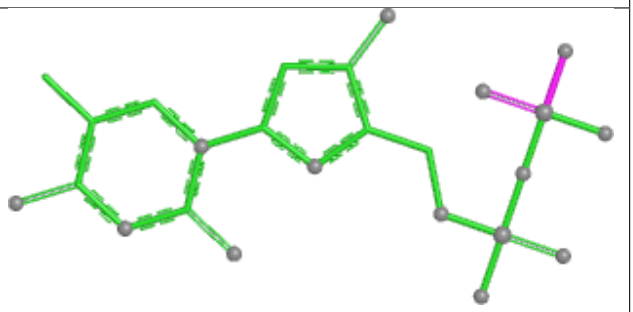

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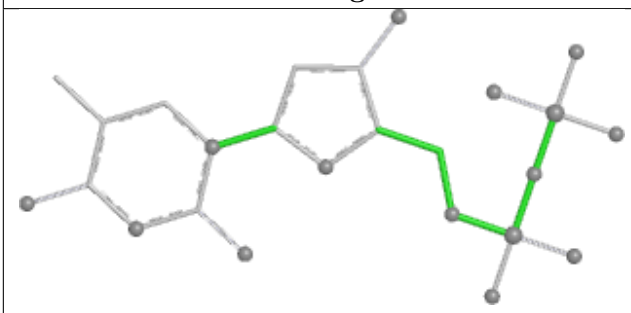

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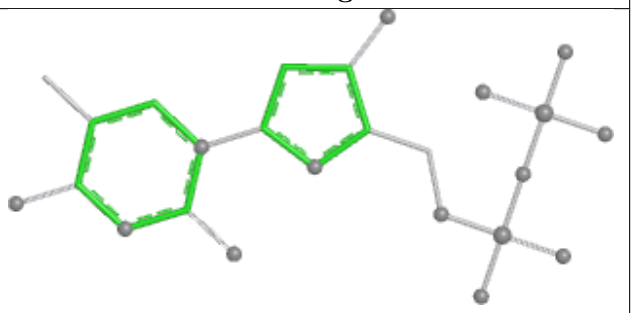
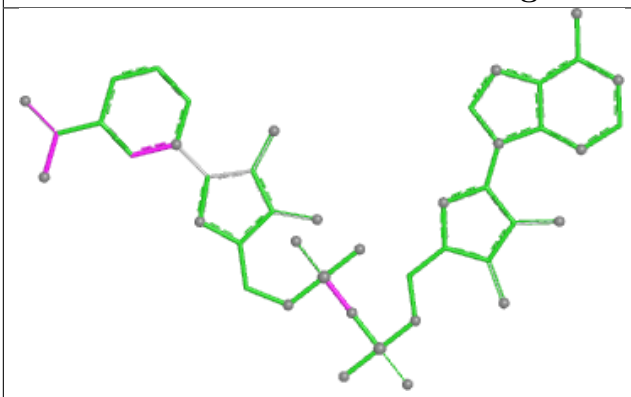


Rings

Ligand NAD B 402



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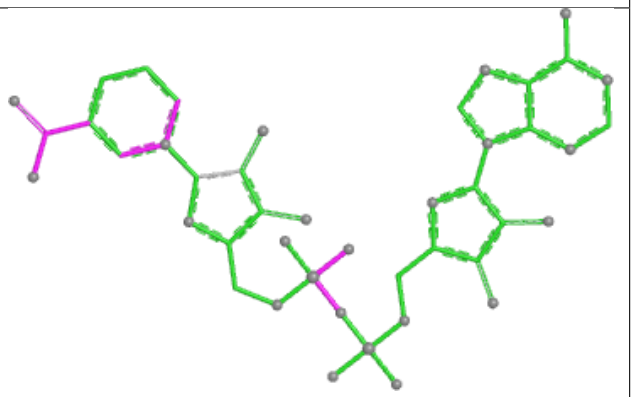

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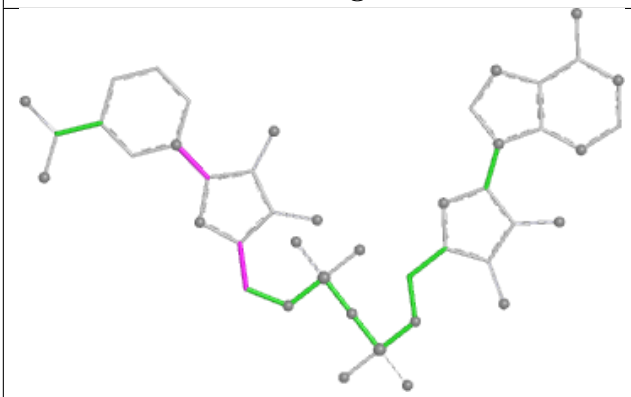

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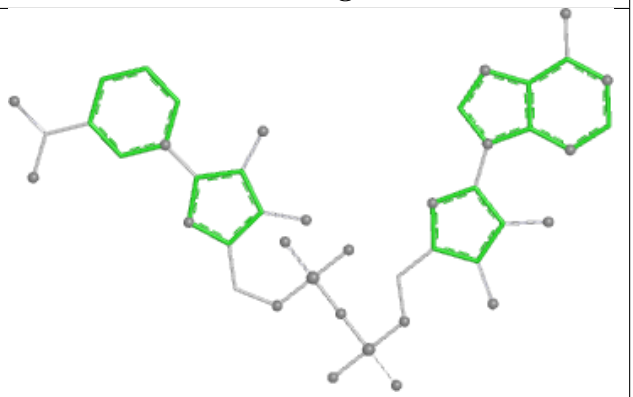
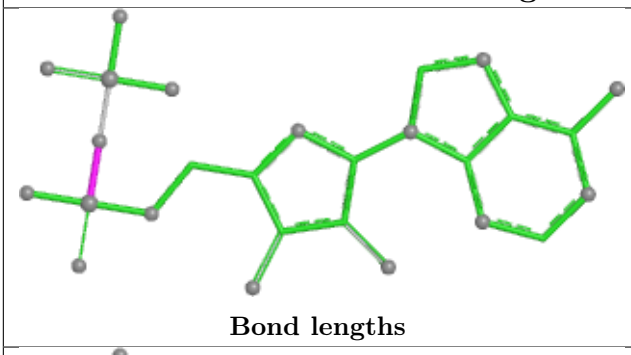


Rings

Ligand NAD D 402



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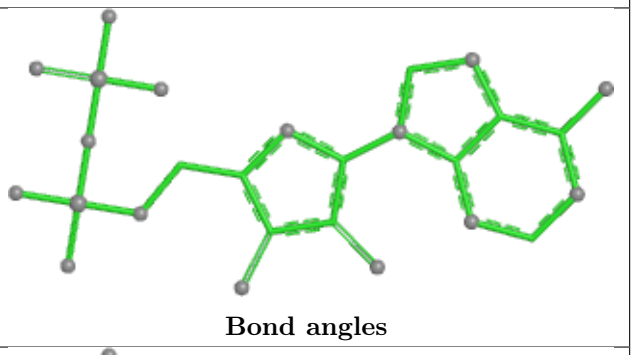

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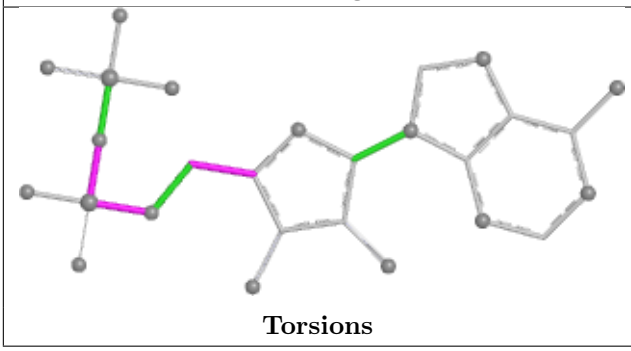

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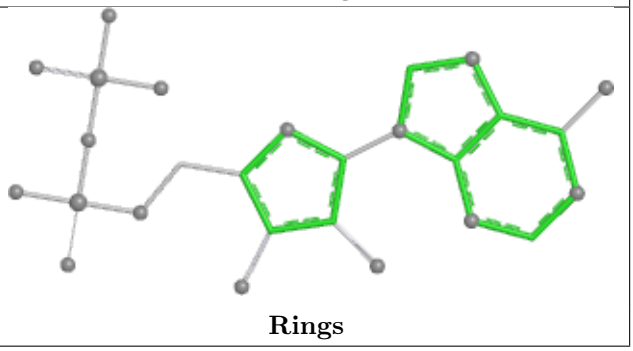
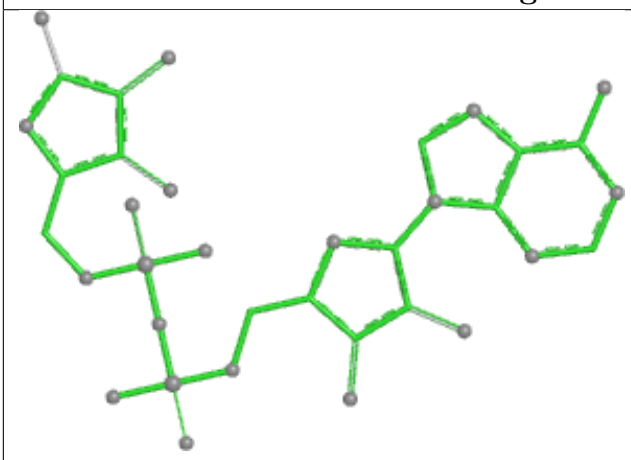


Rings

Ligand NAD A 402



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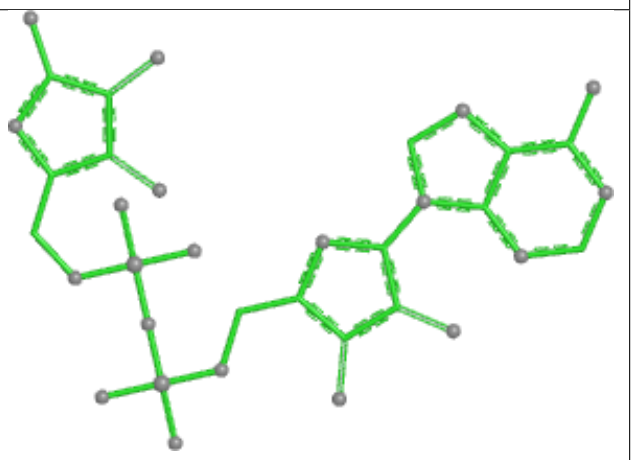
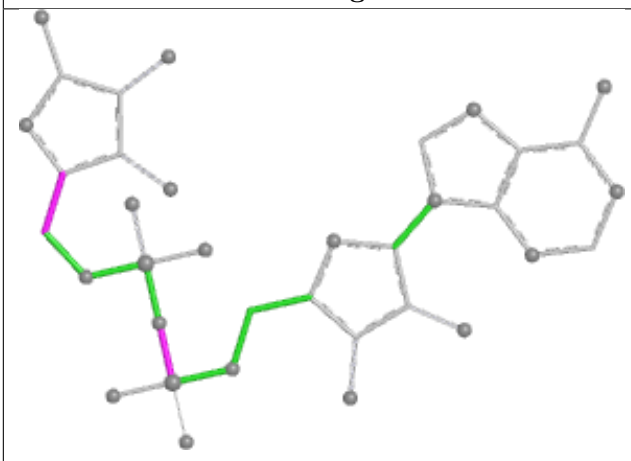
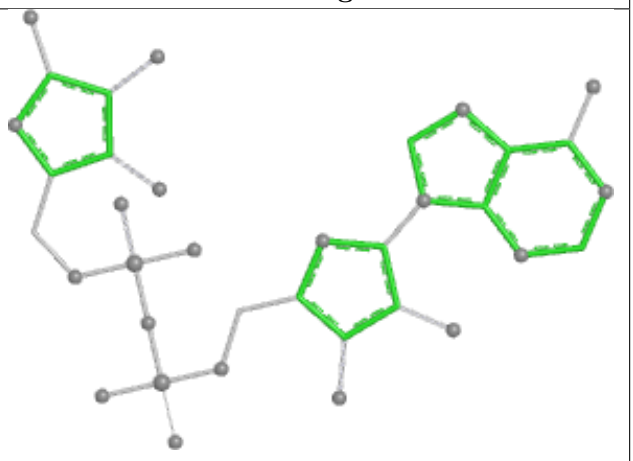


Bond angles



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	319/326 (97%)	-0.00	8 (2%)	58	60	14, 30, 55, 79	2 (0%)
1	B	319/326 (97%)	0.01	5 (1%)	70	72	20, 32, 53, 80	2 (0%)
1	C	312/326 (95%)	0.14	9 (2%)	53	55	21, 35, 59, 80	0
1	D	307/326 (94%)	0.26	13 (4%)	40	40	22, 38, 61, 76	0
All	All	1257/1304 (96%)	0.10	35 (2%)	55	57	14, 34, 58, 80	4 (0%)

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	278	PHE	4.0
1	A	278	PHE	3.8
1	C	131	ILE	3.6
1	B	84	HIS	3.6
1	D	85	VAL	3.5
1	D	274	LEU	3.4
1	A	280	TYR	3.3
1	D	136	THR	3.1
1	A	134	THR	2.7
1	C	280	TYR	2.7
1	D	278	PHE	2.6
1	C	278	PHE	2.5
1	B	87	ASN	2.5
1	C	261	VAL	2.5
1	C	84	HIS	2.5
1	B	0	HIS	2.4
1	D	1	MET	2.4
1	D	280	TYR	2.3
1	D	133	THR	2.3
1	A	84	HIS	2.2
1	D	242	VAL	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	241	GLY	2.2
1	A	287	ILE	2.2
1	A	-1	GLY	2.2
1	D	91	ASN	2.2
1	C	139	GLU	2.1
1	D	282	ILE	2.1
1	D	137	SER	2.1
1	D	314	ARG	2.1
1	C	317	TYR	2.1
1	C	1	MET	2.1
1	B	134	THR	2.1
1	C	85	VAL	2.0
1	A	138	ARG	2.0
1	D	241	GLY	2.0

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

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

6.3 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.4 Ligands (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 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
4	NI	B	403	1/1	0.86	0.09	70,70,70,70	0
3	NAD	C	402	36/44	0.87	0.12	26,39,62,68	0
3	NAD	D	402	27/44	0.88	0.11	34,41,80,88	0
3	NAD	B	402	44/44	0.89	0.11	26,40,59,65	0
3	NAD	A	402	36/44	0.89	0.10	27,34,49,53	0
2	TYD	B	401	25/25	0.95	0.07	25,31,41,43	0
2	TYD	D	401	25/25	0.96	0.07	32,37,43,45	0
4	NI	C	403	1/1	0.97	0.09	47,47,47,47	0
2	TYD	C	401	25/25	0.98	0.05	27,30,32,33	0

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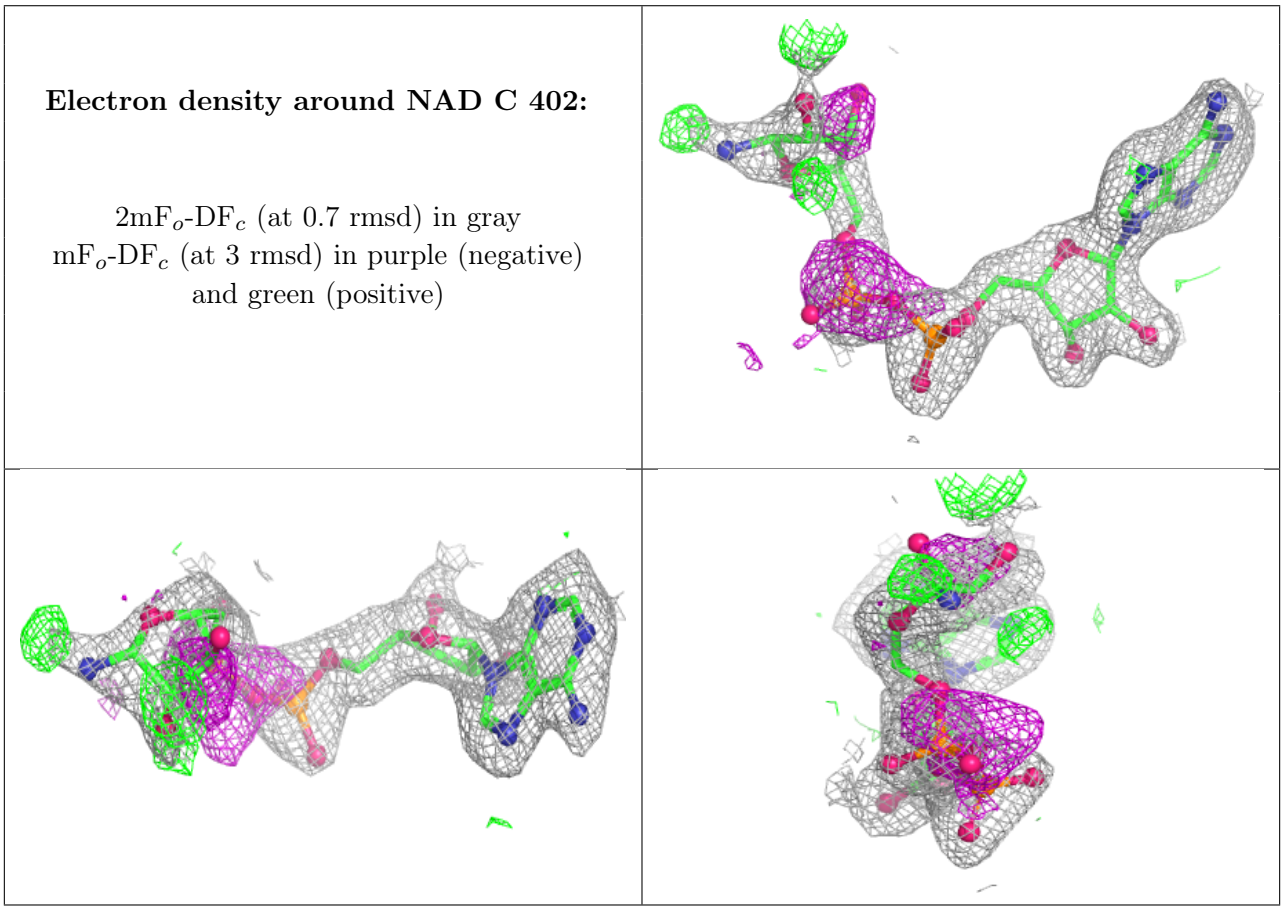
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	TYD	A	401	25/25	0.98	0.05	26,29,31,32	0

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.

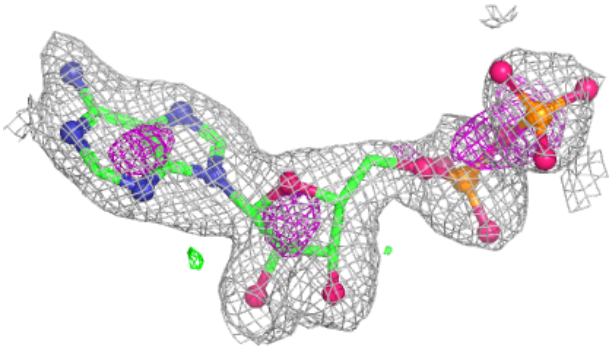
Electron density around NAD C 402:

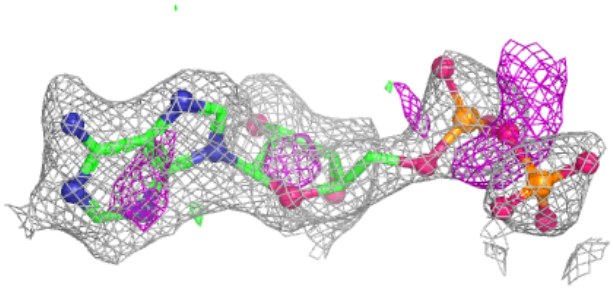
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

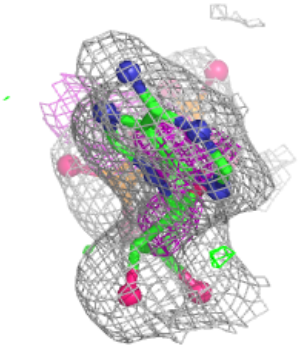


Electron density around NAD D 402:

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

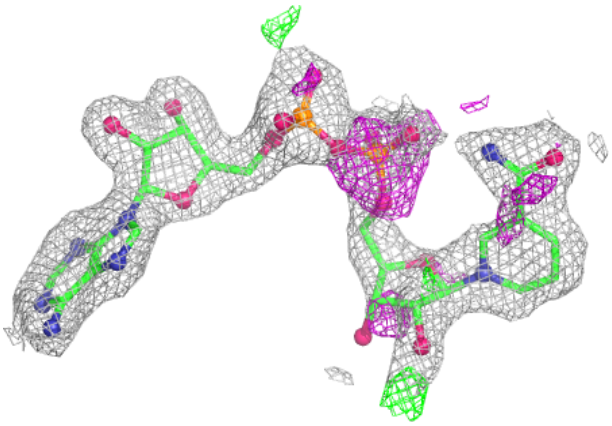


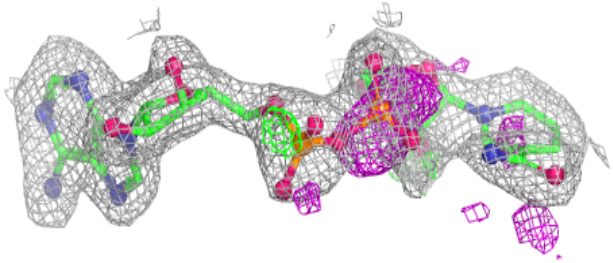


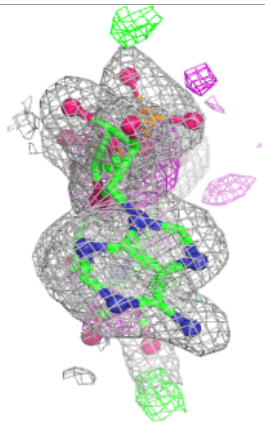


Electron density around NAD B 402:

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

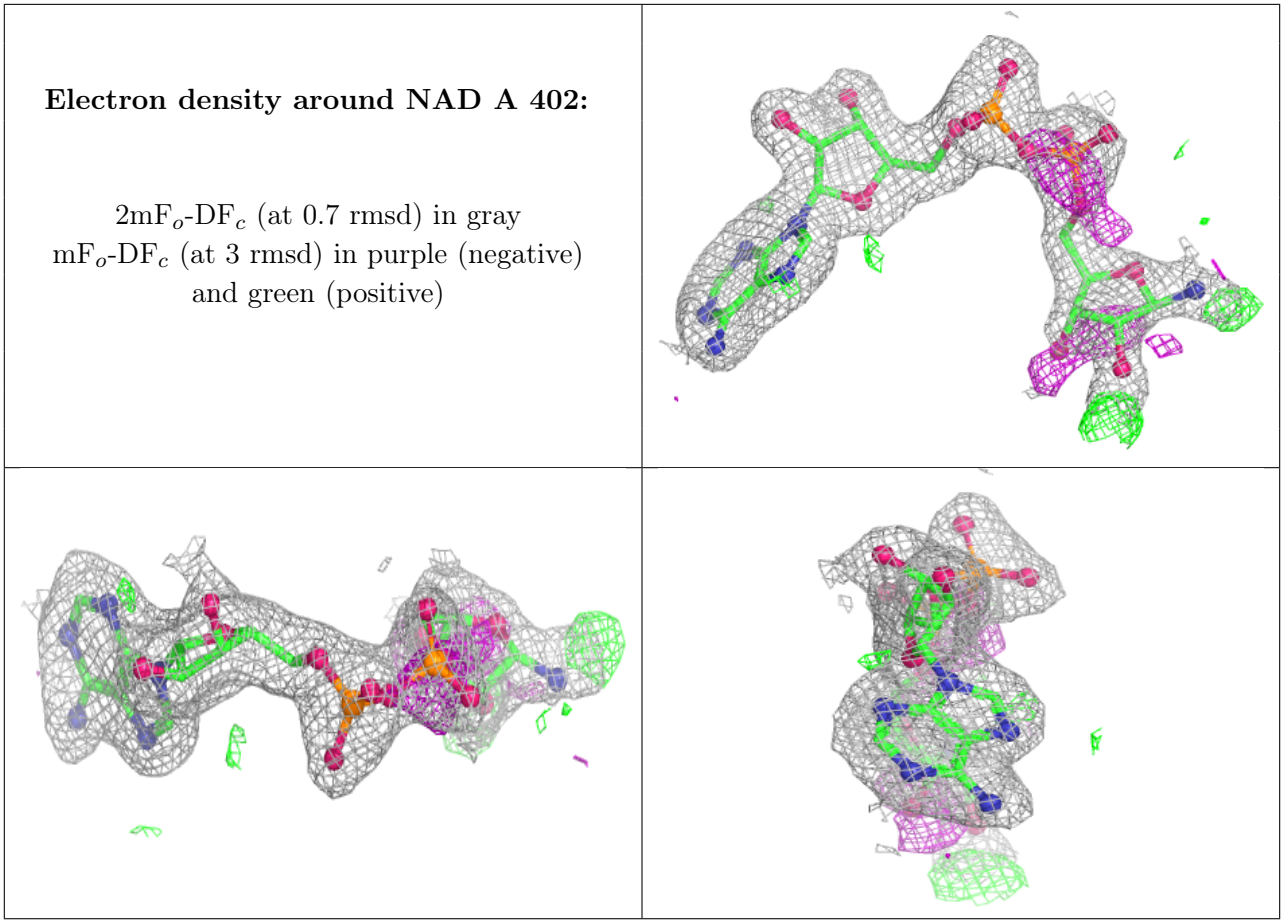






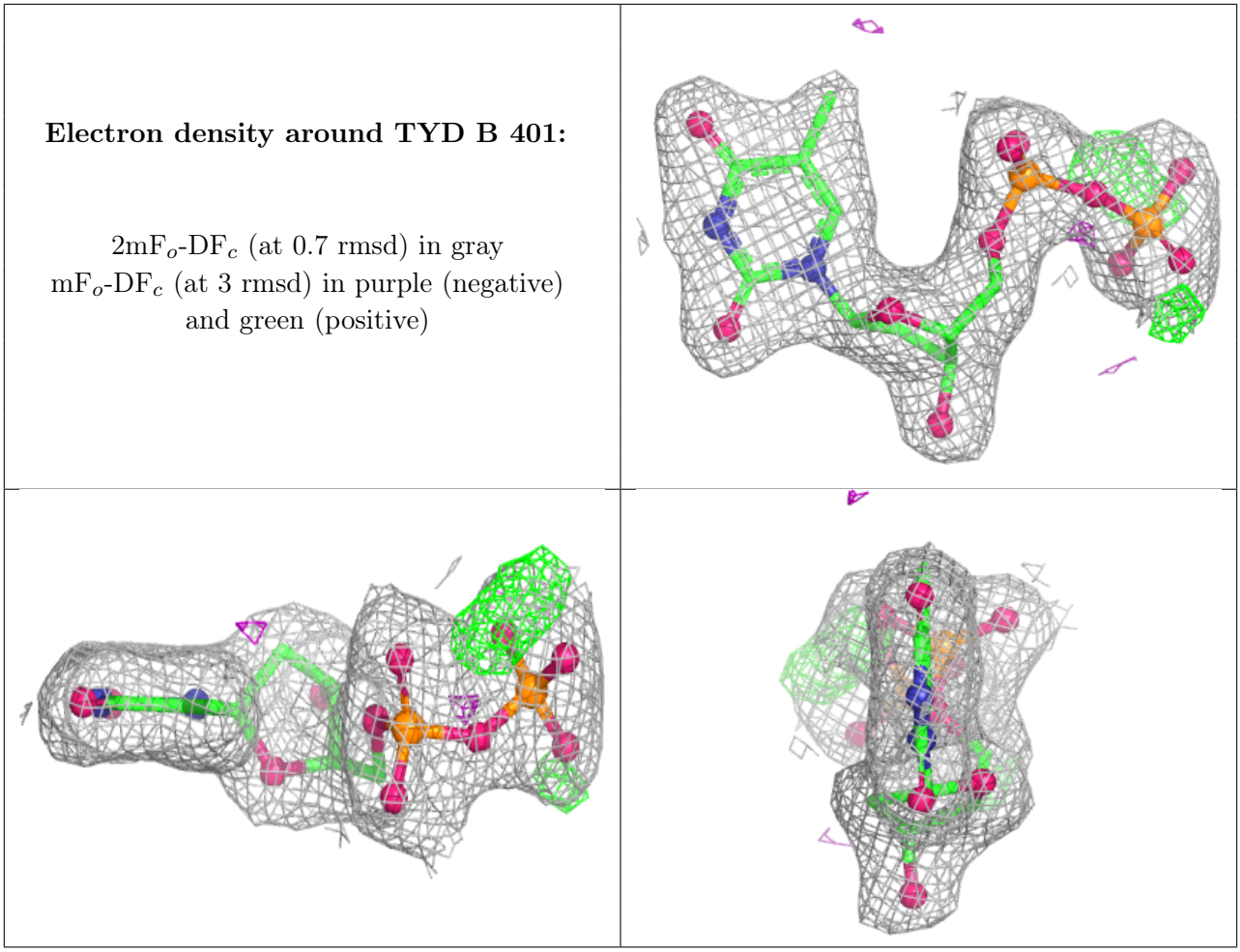
Electron density around NAD A 402:

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



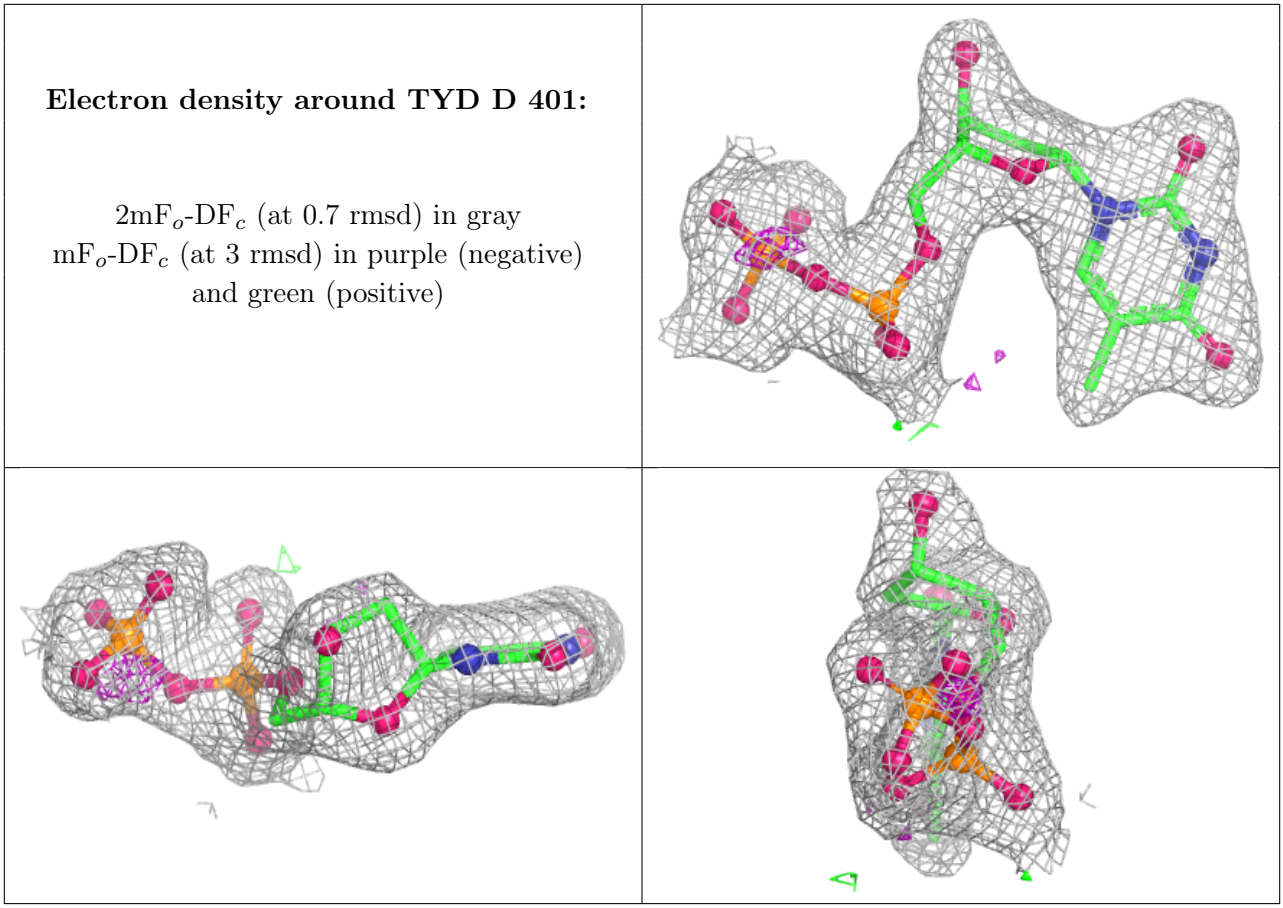
Electron density around TYD B 401:

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



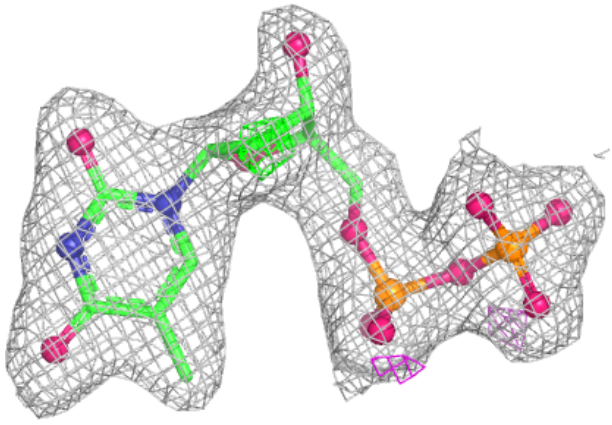
Electron density around TYD D 401:

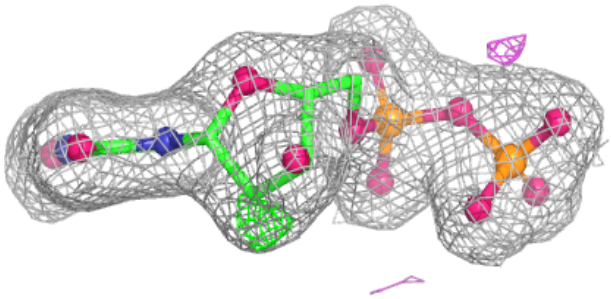
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

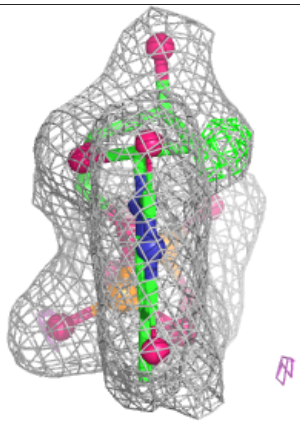


Electron density around TYD C 401:

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

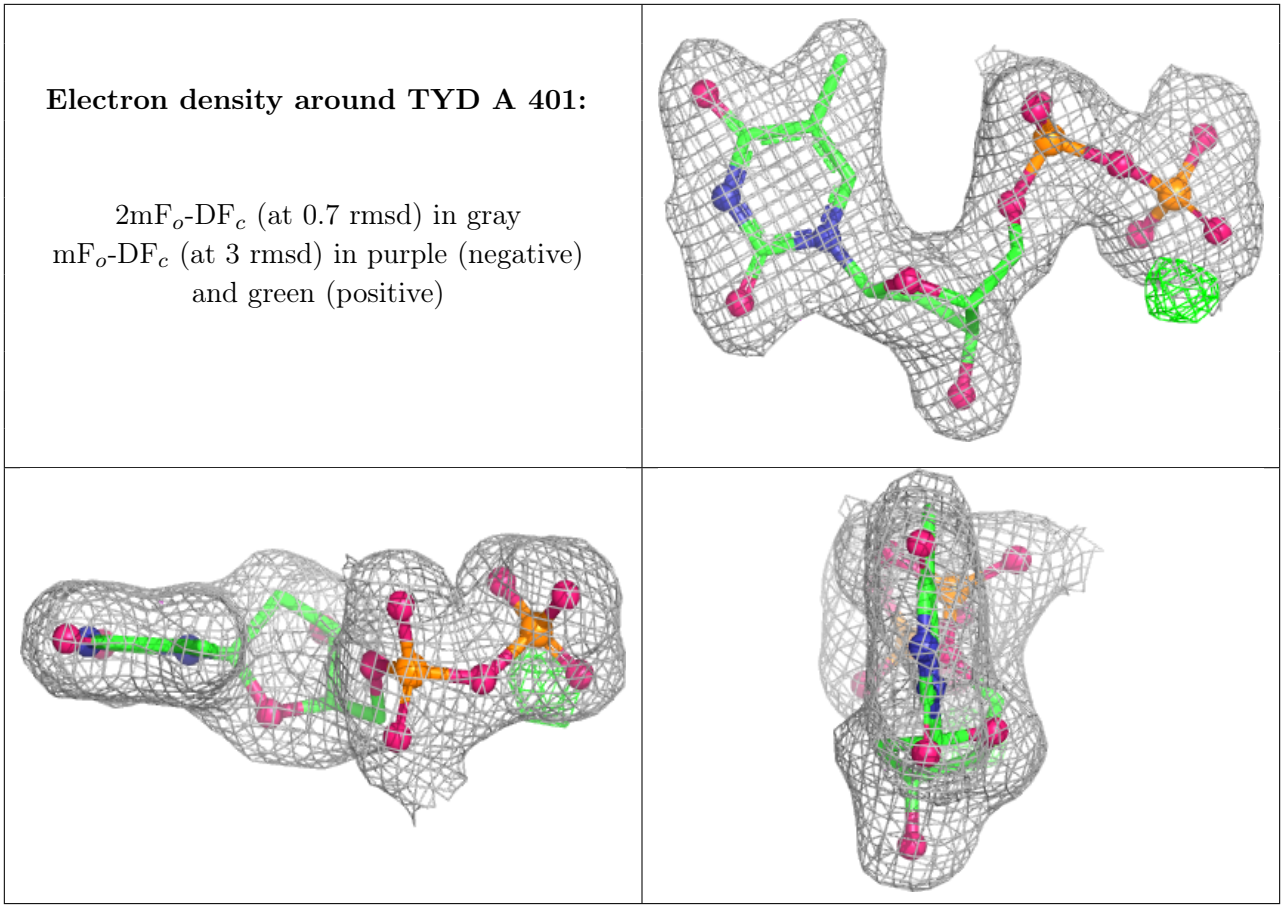






Electron density around TYD A 401:

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



6.5 Other polymers

There are no such residues in this entry.