



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:43 PM UTC

PDB ID : 8QC2 / pdb_00008qc2
Title : Crystal structure of NAD-dependent glycoside hydrolase from *Flavobacterium* sp. (strain K172) in complex with co-factor NAD⁺ and sulfoquinovose (SQ)
Authors : Pickles, I.B.; Sharma, M.; Davies, G.J.
Deposited on : 2023-08-25
Resolution : 2.30 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

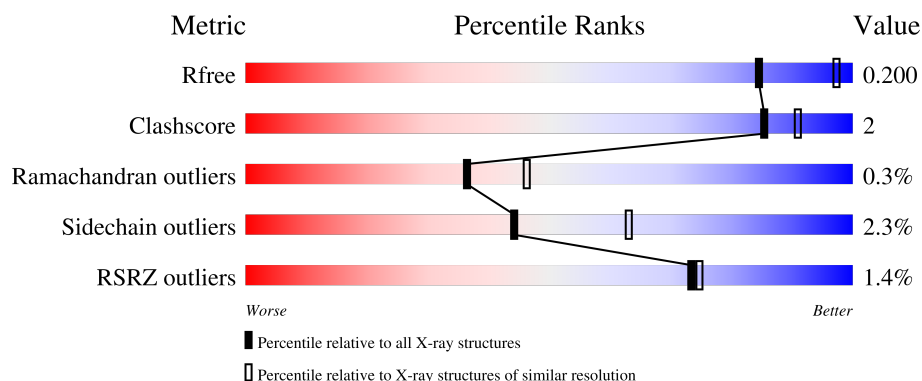
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	393	0% 84% 8% 8%
1	B	393	85% 7% 8%
1	C	393	2% 85% 7% 8%
1	D	393	3% 84% 8% 8%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12096 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 Gfo/Idh/MocA family oxidoreductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	363	Total	C	N	O	S	0	0	0
			2767	1751	472	531	13			
1	B	363	Total	C	N	O	S	0	0	0
			2771	1754	472	532	13			
1	C	363	Total	C	N	O	S	0	0	0
			2768	1753	473	529	13			
1	D	363	Total	C	N	O	S	0	0	0
			2766	1751	473	529	13			

There are 52 discrepancies between the modelled and reference sequences:

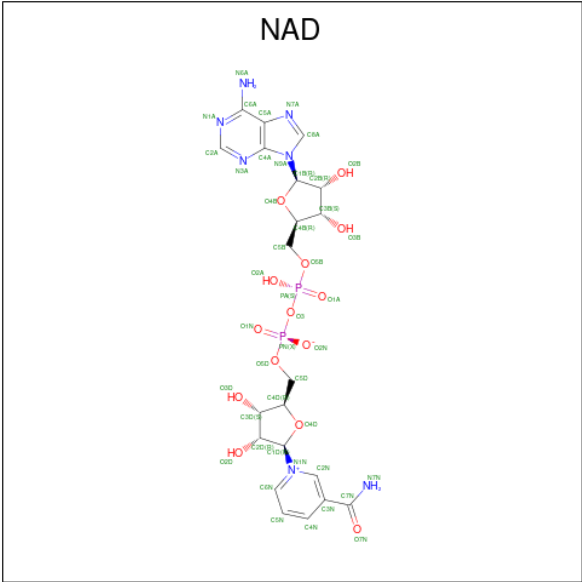
Chain	Residue	Modelled	Actual	Comment	Reference
A	-12	MET	-	initiating methionine	UNP A0A7D7VZ79
A	-11	GLY	-	expression tag	UNP A0A7D7VZ79
A	-10	SER	-	expression tag	UNP A0A7D7VZ79
A	-9	SER	-	expression tag	UNP A0A7D7VZ79
A	-8	HIS	-	expression tag	UNP A0A7D7VZ79
A	-7	HIS	-	expression tag	UNP A0A7D7VZ79
A	-6	HIS	-	expression tag	UNP A0A7D7VZ79
A	-5	HIS	-	expression tag	UNP A0A7D7VZ79
A	-4	HIS	-	expression tag	UNP A0A7D7VZ79
A	-3	HIS	-	expression tag	UNP A0A7D7VZ79
A	-2	SER	-	expression tag	UNP A0A7D7VZ79
A	-1	SER	-	expression tag	UNP A0A7D7VZ79
A	0	GLY	-	expression tag	UNP A0A7D7VZ79
B	-12	MET	-	initiating methionine	UNP A0A7D7VZ79
B	-11	GLY	-	expression tag	UNP A0A7D7VZ79
B	-10	SER	-	expression tag	UNP A0A7D7VZ79
B	-9	SER	-	expression tag	UNP A0A7D7VZ79
B	-8	HIS	-	expression tag	UNP A0A7D7VZ79
B	-7	HIS	-	expression tag	UNP A0A7D7VZ79
B	-6	HIS	-	expression tag	UNP A0A7D7VZ79
B	-5	HIS	-	expression tag	UNP A0A7D7VZ79

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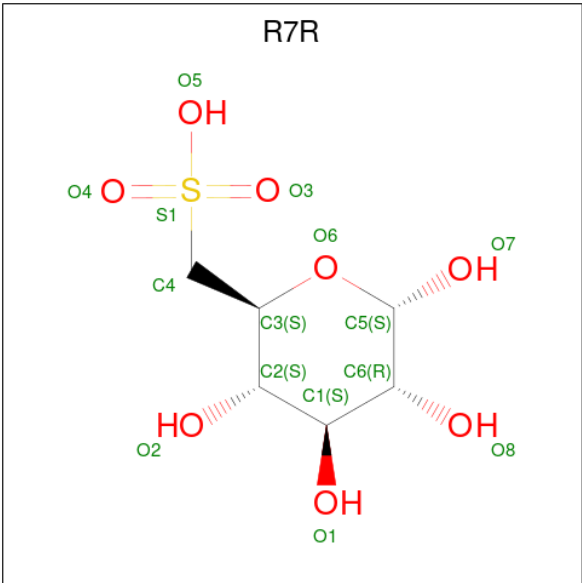
Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	HIS	-	expression tag	UNP A0A7D7VZ79
B	-3	HIS	-	expression tag	UNP A0A7D7VZ79
B	-2	SER	-	expression tag	UNP A0A7D7VZ79
B	-1	SER	-	expression tag	UNP A0A7D7VZ79
B	0	GLY	-	expression tag	UNP A0A7D7VZ79
C	-12	MET	-	initiating methionine	UNP A0A7D7VZ79
C	-11	GLY	-	expression tag	UNP A0A7D7VZ79
C	-10	SER	-	expression tag	UNP A0A7D7VZ79
C	-9	SER	-	expression tag	UNP A0A7D7VZ79
C	-8	HIS	-	expression tag	UNP A0A7D7VZ79
C	-7	HIS	-	expression tag	UNP A0A7D7VZ79
C	-6	HIS	-	expression tag	UNP A0A7D7VZ79
C	-5	HIS	-	expression tag	UNP A0A7D7VZ79
C	-4	HIS	-	expression tag	UNP A0A7D7VZ79
C	-3	HIS	-	expression tag	UNP A0A7D7VZ79
C	-2	SER	-	expression tag	UNP A0A7D7VZ79
C	-1	SER	-	expression tag	UNP A0A7D7VZ79
C	0	GLY	-	expression tag	UNP A0A7D7VZ79
D	-12	MET	-	initiating methionine	UNP A0A7D7VZ79
D	-11	GLY	-	expression tag	UNP A0A7D7VZ79
D	-10	SER	-	expression tag	UNP A0A7D7VZ79
D	-9	SER	-	expression tag	UNP A0A7D7VZ79
D	-8	HIS	-	expression tag	UNP A0A7D7VZ79
D	-7	HIS	-	expression tag	UNP A0A7D7VZ79
D	-6	HIS	-	expression tag	UNP A0A7D7VZ79
D	-5	HIS	-	expression tag	UNP A0A7D7VZ79
D	-4	HIS	-	expression tag	UNP A0A7D7VZ79
D	-3	HIS	-	expression tag	UNP A0A7D7VZ79
D	-2	SER	-	expression tag	UNP A0A7D7VZ79
D	-1	SER	-	expression tag	UNP A0A7D7VZ79
D	0	GLY	-	expression tag	UNP A0A7D7VZ79

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



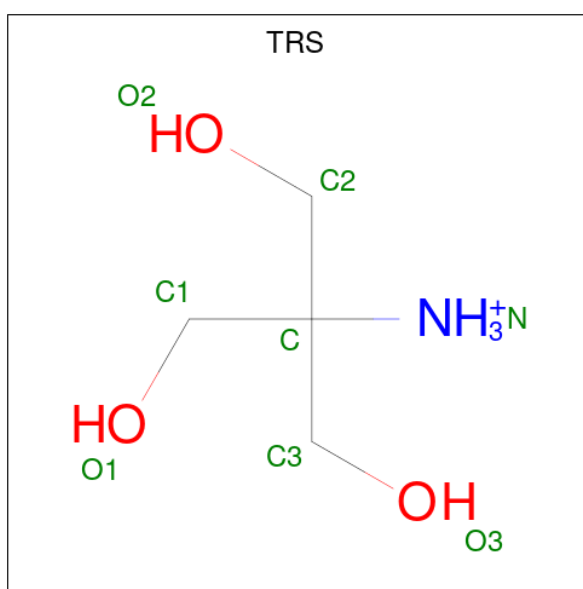
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	C	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	D	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 3 is sulfoquinovose (CCD ID: R7R) (formula: C₆H₁₂O₈S) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	O	S	0	0
			15	6	8	1		
3	B	1	Total	C	O	S	0	0
			15	6	8	1		
3	C	1	Total	C	O	S	0	0
			15	6	8	1		
3	D	1	Total	C	O	S	0	0
			15	6	8	1		

- Molecule 4 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: C₄H₁₂NO₃).



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

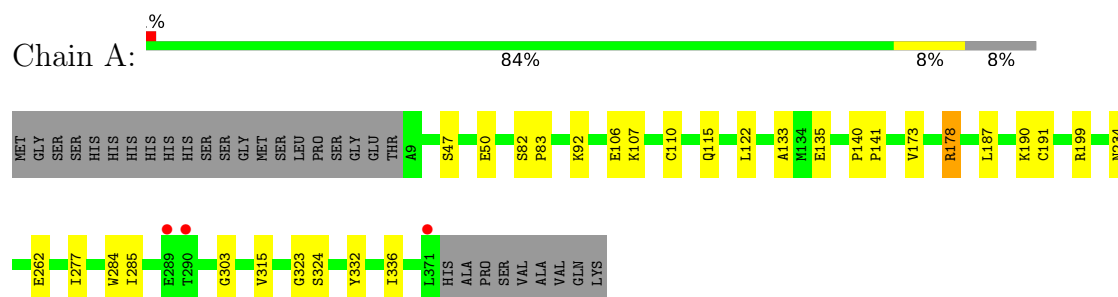
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	200	Total 200	O 200	0	0
5	B	182	Total 182	O 182	0	0
5	C	175	Total 175	O 175	0	0
5	D	183	Total 183	O 183	0	0

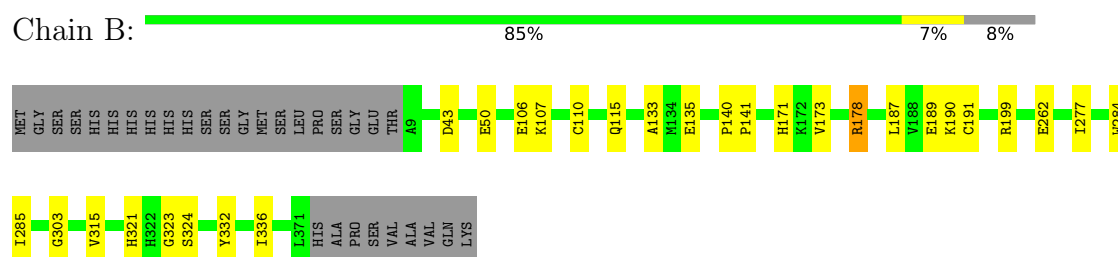
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

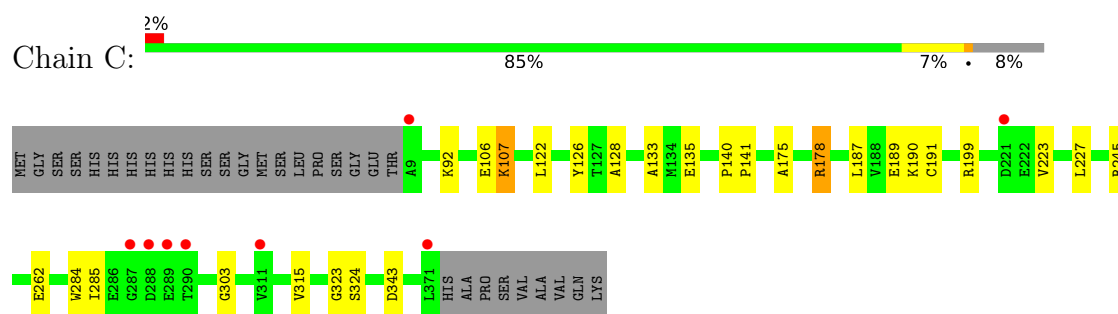
- Molecule 1: Gfo/Idh/MocA family oxidoreductase



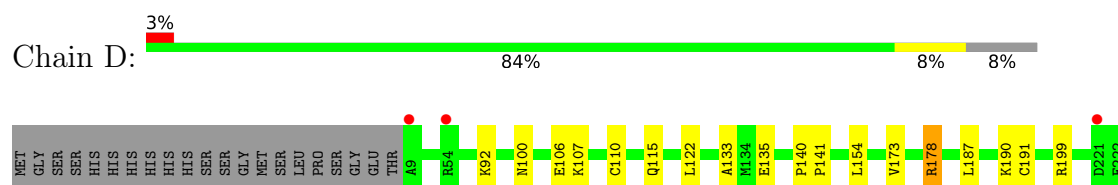
- Molecule 1: Gfo/Idh/MocA family oxidoreductase

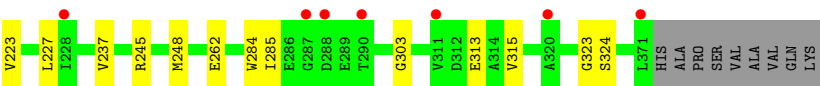


- Molecule 1: Gfo/Idh/MocA family oxidoreductase



- Molecule 1: Gfo/Idh/MocA family oxidoreductase





4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	110.52Å 160.38Å 185.75Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.06 – 2.30 49.06 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.9 (49.06-2.30) 99.9 (49.06-2.30)	Depositor EDS
R_{merge}	0.29	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.23 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.8.0419	Depositor
R, R_{free}	0.195 , 0.246 0.205 , 0.200	Depositor DCC
R_{free} test set	3605 reflections (4.91%)	wwPDB-VP
Wilson B-factor (Å ²)	25.9	Xtrriage
Anisotropy	0.884	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 43.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	12096	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 52.86 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 4.5792e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: TRS, NAD, R7R

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	0.64	0/2827	0.94	0/3848
1	B	0.65	0/2831	0.95	0/3853
1	C	0.63	0/2828	0.94	1/3848 (0.0%)
1	D	0.63	0/2826	0.95	0/3846
All	All	0.63	0/11312	0.95	1/15395 (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	A	0	2
1	B	0	2
1	C	0	2
1	D	0	2
All	All	0	8

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	343	ASP	CB-CA-C	-5.03	102.30	110.85

There are no chirality outliers.

All (8) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	178	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	A	199	ARG	Sidechain
1	B	178	ARG	Sidechain
1	B	199	ARG	Sidechain
1	C	178	ARG	Sidechain
1	C	199	ARG	Sidechain
1	D	178	ARG	Sidechain
1	D	199	ARG	Sidechain

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	2767	0	2683	11	0
1	B	2771	0	2692	12	0
1	C	2768	0	2692	13	0
1	D	2766	0	2688	13	0
2	A	44	0	26	0	0
2	B	44	0	26	1	0
2	C	44	0	26	0	0
2	D	44	0	26	1	0
3	A	15	0	0	0	0
3	B	15	0	0	2	0
3	C	15	0	0	1	0
3	D	15	0	0	0	0
4	A	8	0	12	0	0
4	B	16	0	24	0	0
4	C	16	0	24	0	0
4	D	8	0	12	0	0
5	A	200	0	0	0	0
5	B	182	0	0	0	0
5	C	175	0	0	1	0
5	D	183	0	0	1	0
All	All	12096	0	10931	48	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 2.

All (48) 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:315:VAL:HG12	1:A:323:GLY:HA2	1.89	0.53
1:C:315:VAL:HG12	1:C:323:GLY:HA2	1.92	0.51
1:C:223:VAL:HA	1:C:227:LEU:O	2.11	0.51
1:B:315:VAL:HG12	1:B:323:GLY:HA2	1.93	0.50
1:C:92:LYS:HG2	1:C:122:LEU:CD1	2.42	0.50
1:B:321:HIS:NE2	3:B:402:R7R:O7	2.39	0.49
1:B:189:GLU:OE2	3:B:402:R7R:O2	2.32	0.48
1:D:315:VAL:HG12	1:D:323:GLY:HA2	1.94	0.47
1:A:187:LEU:O	1:A:191:CYS:HB2	2.15	0.47
1:B:187:LEU:O	1:B:191:CYS:HB2	2.15	0.47
1:D:92:LYS:HG2	1:D:122:LEU:CD1	2.45	0.47
1:D:140:PRO:N	1:D:141:PRO:HD2	2.30	0.47
1:B:43:ASP:OD2	2:B:401:NAD:O3B	2.34	0.46
1:B:140:PRO:N	1:B:141:PRO:HD2	2.30	0.46
1:A:140:PRO:N	1:A:141:PRO:HD2	2.32	0.45
1:C:106:GLU:HA	1:C:133:ALA:HB3	1.97	0.45
1:D:223:VAL:HA	1:D:227:LEU:O	2.16	0.45
1:D:135:GLU:O	1:D:324:SER:HB2	2.17	0.45
1:C:140:PRO:N	1:C:141:PRO:HD2	2.32	0.45
1:A:106:GLU:HA	1:A:133:ALA:HB3	1.99	0.45
1:C:245:ARG:HG3	1:C:245:ARG:HH11	1.81	0.45
1:C:187:LEU:O	1:C:191:CYS:HB2	2.17	0.44
1:D:106:GLU:HA	1:D:133:ALA:HB3	1.98	0.44
1:D:187:LEU:O	1:D:191:CYS:HB2	2.17	0.44
1:B:135:GLU:O	1:B:324:SER:HB2	2.19	0.43
1:D:106:GLU:OE2	2:D:401:NAD:H2N	2.19	0.43
1:C:135:GLU:O	1:C:324:SER:HB2	2.18	0.43
1:B:284:TRP:CG	1:B:285:ILE:H	2.37	0.42
1:A:135:GLU:O	1:A:324:SER:HB2	2.19	0.42
1:D:284:TRP:CG	1:D:285:ILE:H	2.38	0.42
1:A:332:TYR:CE2	1:A:336:ILE:HD11	2.55	0.42
1:C:175:ALA:HA	5:C:547:HOH:O	2.18	0.42
1:A:47:SER:HB3	1:B:171:HIS:HB3	2.01	0.42
1:C:284:TRP:CG	1:C:285:ILE:H	2.38	0.42
1:D:245:ARG:HH11	1:D:245:ARG:HG3	1.84	0.42
1:B:106:GLU:HA	1:B:133:ALA:HB3	2.01	0.41
1:C:189:GLU:OE2	3:C:402:R7R:O2	2.38	0.41
1:A:284:TRP:CG	1:A:285:ILE:H	2.37	0.41
1:C:107:LYS:O	1:C:107:LYS:HD3	2.21	0.41
1:A:110:CYS:HB2	1:A:115:GLN:OE1	2.21	0.41
1:D:110:CYS:HB2	1:D:115:GLN:OE1	2.20	0.41
1:B:110:CYS:HB2	1:B:115:GLN:OE1	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:332:TYR:CE2	1:B:336:ILE:HD11	2.55	0.40
1:D:237:VAL:O	1:D:248:MET:HA	2.21	0.40
1:D:154:LEU:HB2	5:D:560:HOH:O	2.22	0.40
1:A:82:SER:HB2	1:A:83:PRO:CD	2.52	0.40
1:A:92:LYS:HG2	1:A:122:LEU:CD1	2.51	0.40
1:C:126:TYR:CE2	1:C:128:ALA:HB3	2.57	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	361/393 (92%)	358 (99%)	2 (1%)	1 (0%)	36	46
1	B	361/393 (92%)	357 (99%)	3 (1%)	1 (0%)	36	46
1	C	361/393 (92%)	357 (99%)	3 (1%)	1 (0%)	36	46
1	D	361/393 (92%)	358 (99%)	2 (1%)	1 (0%)	36	46
All	All	1444/1572 (92%)	1430 (99%)	10 (1%)	4 (0%)	36	46

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	303	GLY
1	B	303	GLY
1	C	303	GLY
1	A	303	GLY

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	287/320 (90%)	279 (97%)	8 (3%)	38	56
1	B	288/320 (90%)	281 (98%)	7 (2%)	43	62
1	C	287/320 (90%)	283 (99%)	4 (1%)	59	76
1	D	287/320 (90%)	280 (98%)	7 (2%)	43	62
All	All	1149/1280 (90%)	1123 (98%)	26 (2%)	44	63

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	50	GLU
1	A	107	LYS
1	A	173	VAL
1	A	178	ARG
1	A	190	LYS
1	A	234	ASN
1	A	262	GLU
1	A	277	ILE
1	B	50	GLU
1	B	107	LYS
1	B	173	VAL
1	B	178	ARG
1	B	190	LYS
1	B	262	GLU
1	B	277	ILE
1	C	107	LYS
1	C	178	ARG
1	C	190	LYS
1	C	262	GLU
1	D	100	ASN
1	D	107	LYS
1	D	173	VAL
1	D	178	ARG
1	D	190	LYS
1	D	262	GLU
1	D	313	GLU

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	21	HIS
1	A	158	HIS
1	A	261	GLN
1	C	158	HIS
1	C	219	HIS
1	C	322	HIS
1	D	100	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 ⓘ

14 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	R7R	C	402	-	13,15,15	0.69	0	20,23,23	1.95	7 (35%)
3	R7R	A	402	-	13,15,15	0.70	0	20,23,23	1.89	7 (35%)
4	TRS	B	404	-	7,7,7	0.38	0	9,9,9	0.48	0
4	TRS	C	404	-	7,7,7	0.33	0	9,9,9	0.51	0
2	NAD	B	401	-	46,48,48	0.97	4 (8%)	64,73,73	0.70	1 (1%)
2	NAD	C	401	-	46,48,48	0.76	2 (4%)	64,73,73	0.76	1 (1%)
3	R7R	D	402	-	13,15,15	0.67	0	20,23,23	2.20	8 (40%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	TRS	B	403	-	7,7,7	0.32	0	9,9,9	0.42	0
2	NAD	D	401	-	46,48,48	0.69	1 (2%)	64,73,73	0.79	1 (1%)
3	R7R	B	402	-	13,15,15	0.44	0	20,23,23	1.66	5 (25%)
2	NAD	A	401	-	46,48,48	0.69	1 (2%)	64,73,73	0.80	4 (6%)
4	TRS	D	403	-	7,7,7	0.25	0	9,9,9	0.27	0
4	TRS	C	403	-	7,7,7	0.28	0	9,9,9	0.50	0
4	TRS	A	403	-	7,7,7	0.24	0	9,9,9	0.35	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	R7R	C	402	-	-	0/5/25/25	0/1/1/1
3	R7R	A	402	-	-	0/5/25/25	0/1/1/1
4	TRS	B	404	-	-	3/9/9/9	-
4	TRS	C	404	-	-	0/9/9/9	-
2	NAD	B	401	-	-	5/30/62/62	0/5/5/5
2	NAD	C	401	-	-	4/30/62/62	0/5/5/5
3	R7R	D	402	-	-	0/5/25/25	0/1/1/1
4	TRS	B	403	-	-	8/9/9/9	-
2	NAD	D	401	-	-	5/30/62/62	0/5/5/5
3	R7R	B	402	-	-	0/5/25/25	0/1/1/1
2	NAD	A	401	-	-	5/30/62/62	0/5/5/5
4	TRS	D	403	-	-	4/9/9/9	-
4	TRS	C	403	-	-	6/9/9/9	-
4	TRS	A	403	-	-	3/9/9/9	-

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	401	NAD	PA-O3	3.51	1.63	1.59
2	A	401	NAD	C2N-N1N	2.95	1.38	1.35
2	B	401	NAD	O4D-C1D	2.91	1.44	1.40
2	D	401	NAD	C2N-N1N	2.90	1.38	1.35
2	C	401	NAD	O4D-C1D	2.86	1.44	1.40
2	C	401	NAD	C2N-N1N	2.62	1.37	1.35
2	B	401	NAD	C2N-N1N	2.59	1.37	1.35
2	B	401	NAD	PN-O3	2.40	1.62	1.59

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	402	R7R	O4-S1-C4	4.75	113.85	106.76
3	C	402	R7R	O6-C5-C6	4.48	118.17	110.30
3	D	402	R7R	O7-C5-C6	4.24	121.29	108.98
3	C	402	R7R	C5-O6-C3	3.61	120.64	113.65
3	A	402	R7R	O1-C1-C2	-3.51	102.11	110.38
3	A	402	R7R	O4-S1-C4	3.24	111.59	106.76
3	B	402	R7R	O4-S1-C4	3.08	111.35	106.76
3	D	402	R7R	C5-C6-C1	2.98	116.44	110.36
3	A	402	R7R	O3-S1-C4	-2.92	102.39	106.76
3	A	402	R7R	O5-S1-O3	2.88	118.59	111.40
3	A	402	R7R	O7-C5-C6	2.87	117.32	108.98
3	B	402	R7R	O5-S1-O3	2.84	118.50	111.40
3	D	402	R7R	C5-O6-C3	2.76	119.00	113.65
3	D	402	R7R	C2-C1-C6	2.70	115.57	110.83
3	D	402	R7R	O6-C3-C2	2.65	114.47	109.70
3	C	402	R7R	O6-C3-C2	2.60	114.39	109.70
3	D	402	R7R	O7-C5-O6	-2.52	102.92	110.41
2	A	401	NAD	O2A-PA-O1A	2.46	123.87	112.44
2	A	401	NAD	O3-PA-O1A	-2.40	103.49	110.70
2	B	401	NAD	C6N-N1N-C2N	-2.36	119.87	121.88
2	D	401	NAD	C6N-N1N-C2N	-2.32	119.90	121.88
3	B	402	R7R	O7-C5-C6	2.24	115.47	108.98
3	B	402	R7R	O5-S1-C4	-2.22	101.69	105.97
3	C	402	R7R	O4-S1-C4	2.22	110.06	106.76
2	A	401	NAD	O3B-C3B-C2B	2.21	118.90	111.82
3	C	402	R7R	O2-C2-C1	-2.17	105.25	110.38
3	C	402	R7R	O5-S1-O3	2.17	116.82	111.40
3	C	402	R7R	O7-C5-O6	-2.15	104.01	110.41
3	B	402	R7R	O1-C1-C2	-2.12	105.39	110.38
3	D	402	R7R	O5-S1-O3	2.12	116.69	111.40
3	A	402	R7R	O4-S1-O3	-2.11	106.97	113.82
3	A	402	R7R	C5-C6-C1	2.04	114.51	110.36
2	C	401	NAD	O2A-PA-O1A	2.04	121.92	112.44
2	A	401	NAD	C6N-N1N-C2N	-2.02	120.16	121.88

There are no chirality outliers.

All (43) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	NAD	O4D-C1D-N1N-C6N
2	B	401	NAD	O4D-C1D-N1N-C2N

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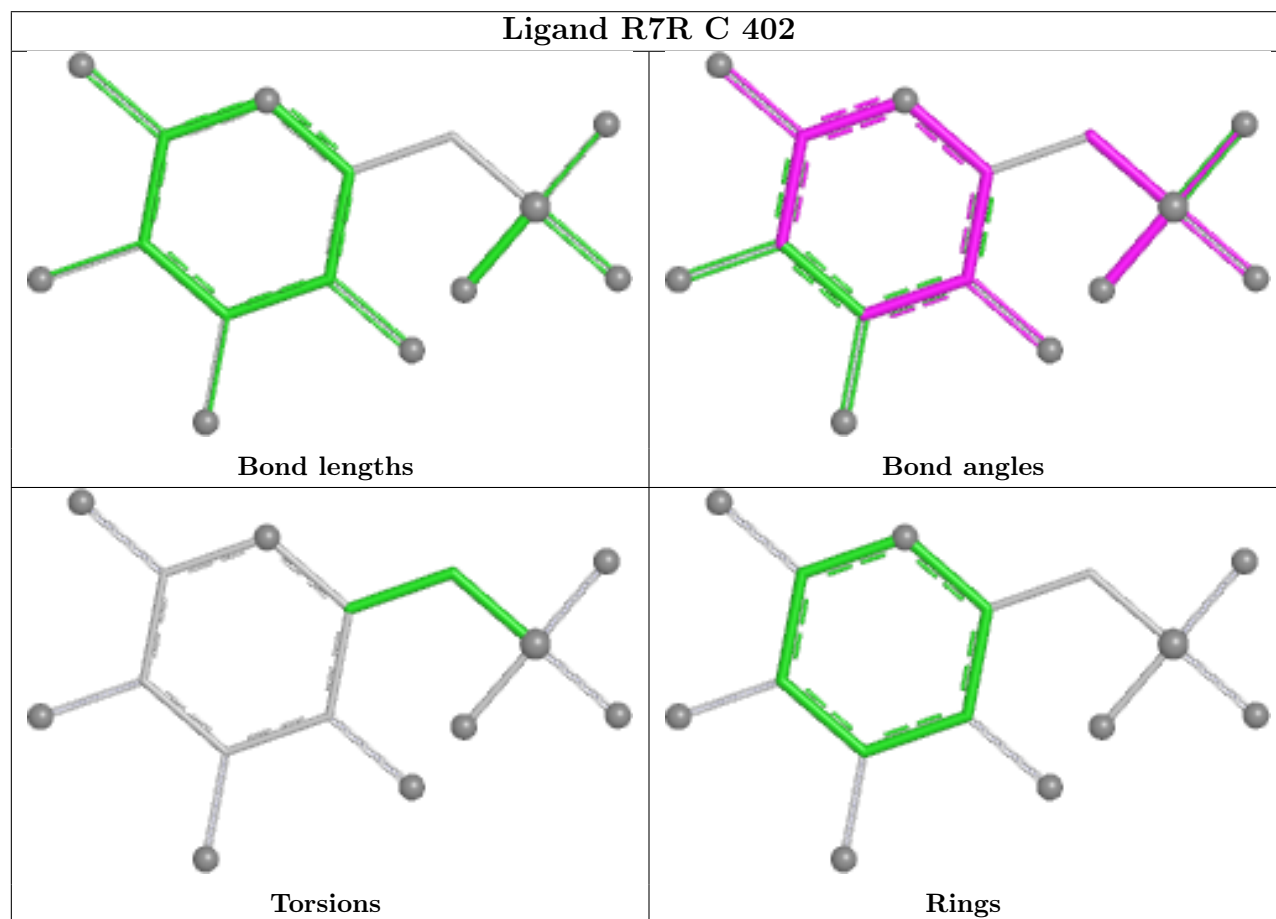
Mol	Chain	Res	Type	Atoms
2	B	401	NAD	O4D-C1D-N1N-C6N
2	B	401	NAD	C2D-C1D-N1N-C2N
2	C	401	NAD	O4D-C1D-N1N-C6N
2	D	401	NAD	O4D-C1D-N1N-C6N
4	B	403	TRS	C1-C-C2-O2
4	B	403	TRS	C3-C-C2-O2
4	B	403	TRS	N-C-C2-O2
4	B	403	TRS	C2-C-C3-O3
4	C	403	TRS	C2-C-C1-O1
4	C	403	TRS	N-C-C3-O3
4	D	403	TRS	N-C-C3-O3
4	B	403	TRS	C1-C-C3-O3
4	B	404	TRS	C3-C-C1-O1
4	A	403	TRS	C2-C-C3-O3
4	A	403	TRS	N-C-C3-O3
4	B	403	TRS	N-C-C1-O1
4	B	403	TRS	N-C-C3-O3
4	B	404	TRS	N-C-C1-O1
4	C	403	TRS	C3-C-C1-O1
4	C	403	TRS	N-C-C1-O1
2	A	401	NAD	C2B-C1B-N9A-C8A
2	B	401	NAD	C2B-C1B-N9A-C8A
2	D	401	NAD	C2B-C1B-N9A-C8A
2	C	401	NAD	C2B-C1B-N9A-C8A
4	A	403	TRS	C1-C-C3-O3
4	B	403	TRS	C3-C-C1-O1
4	B	404	TRS	C2-C-C1-O1
4	C	403	TRS	C2-C-C3-O3
4	D	403	TRS	C2-C-C3-O3
2	D	401	NAD	C2B-C1B-N9A-C4A
2	A	401	NAD	O4D-C1D-N1N-C2N
2	C	401	NAD	O4D-C1D-N1N-C2N
2	D	401	NAD	O4D-C1D-N1N-C2N
2	B	401	NAD	O4B-C1B-N9A-C8A
4	D	403	TRS	C3-C-C1-O1
2	A	401	NAD	O4B-C1B-N9A-C8A
2	D	401	NAD	O4B-C1B-N9A-C8A
2	A	401	NAD	O4B-C4B-C5B-O5B
2	C	401	NAD	C2B-C1B-N9A-C4A
4	C	403	TRS	C1-C-C3-O3
4	D	403	TRS	N-C-C1-O1

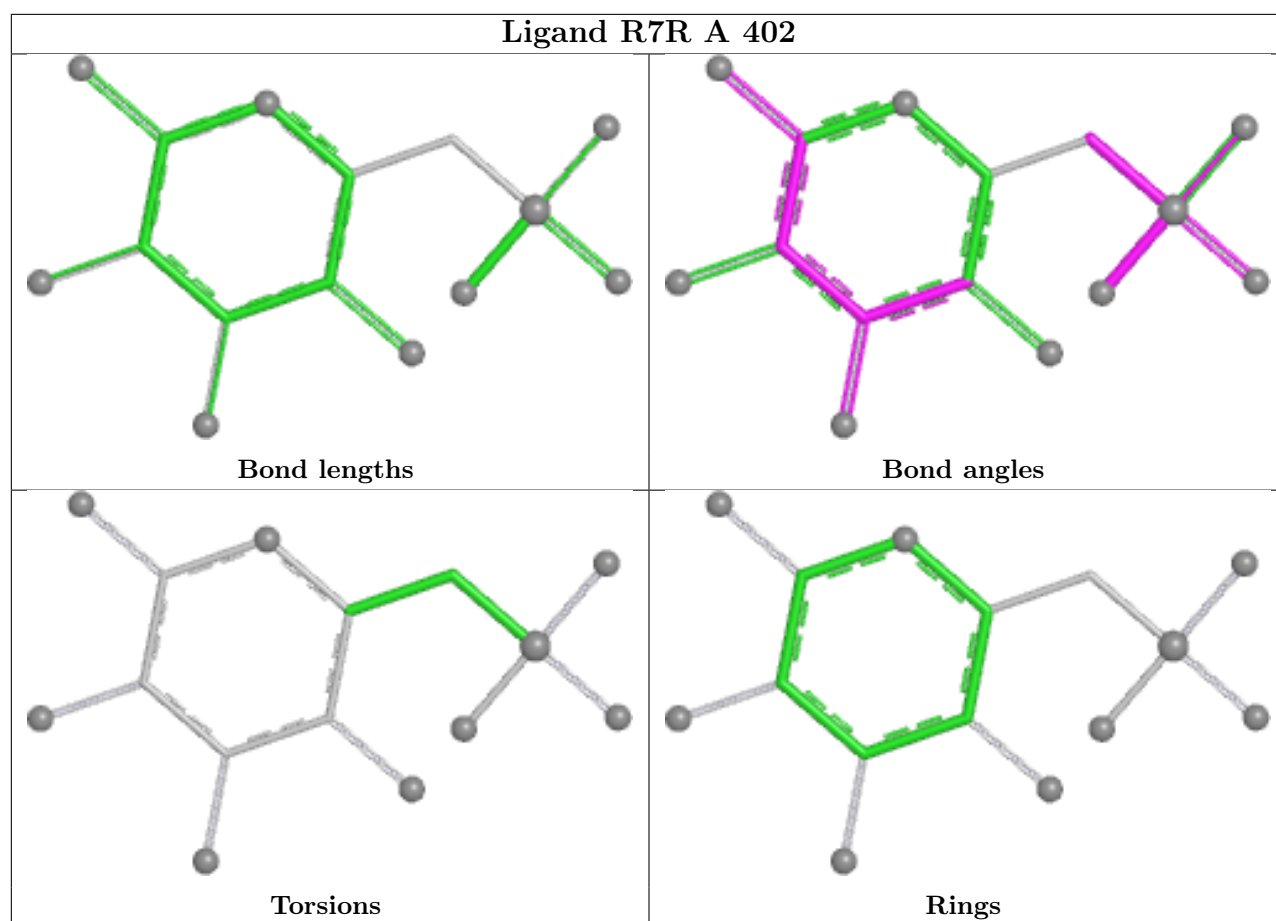
There are no ring outliers.

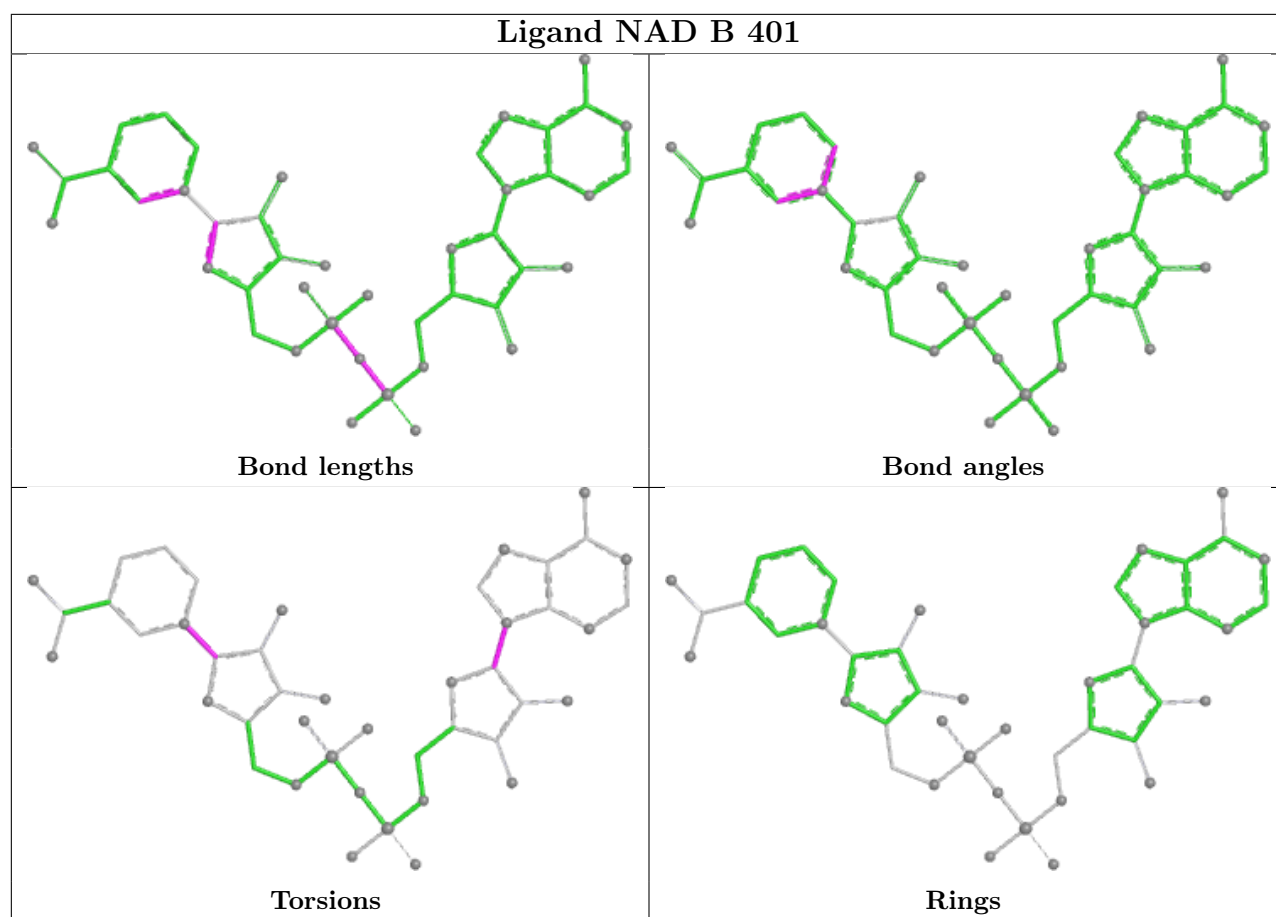
4 monomers are involved in 5 short contacts:

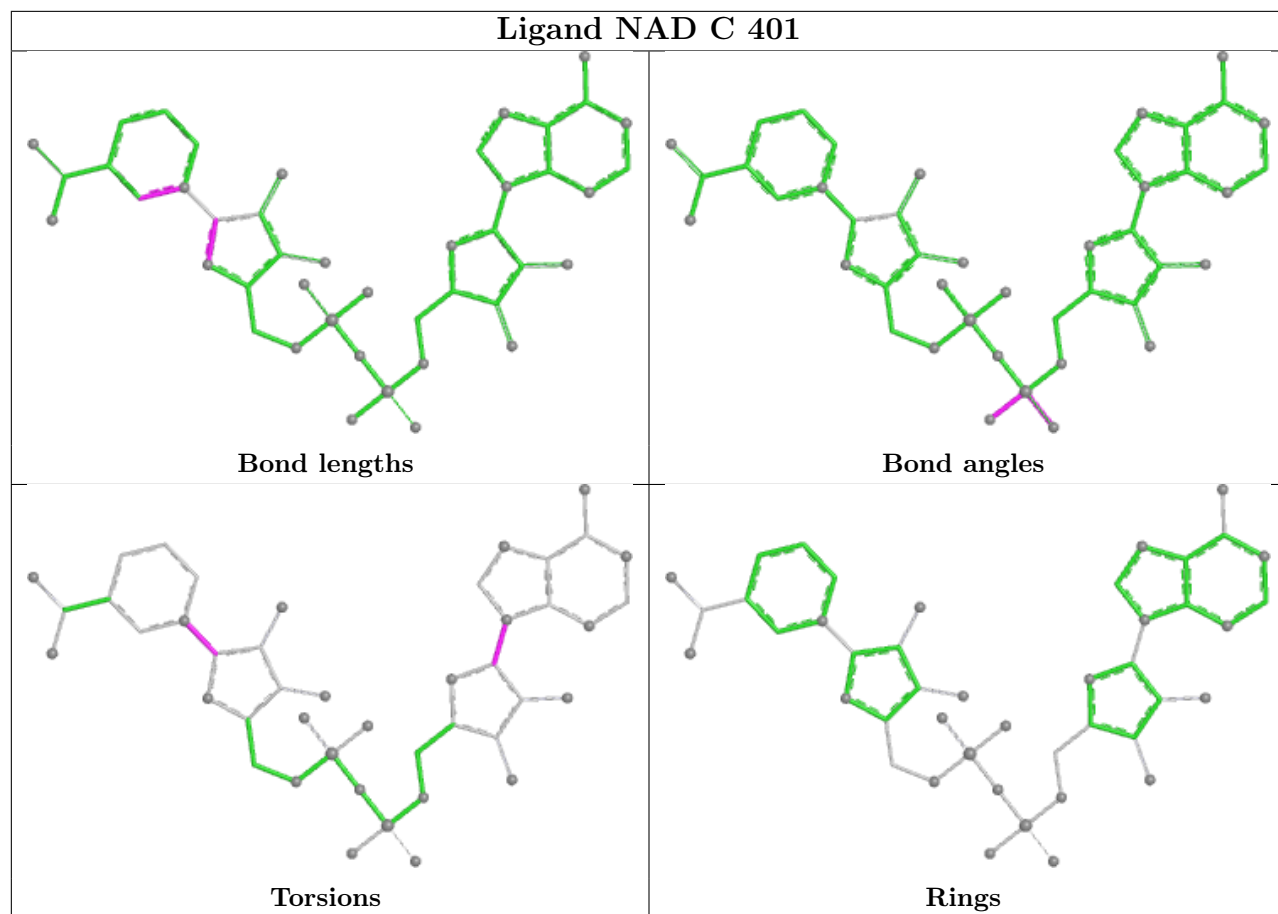
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	402	R7R	1	0
2	B	401	NAD	1	0
2	D	401	NAD	1	0
3	B	402	R7R	2	0

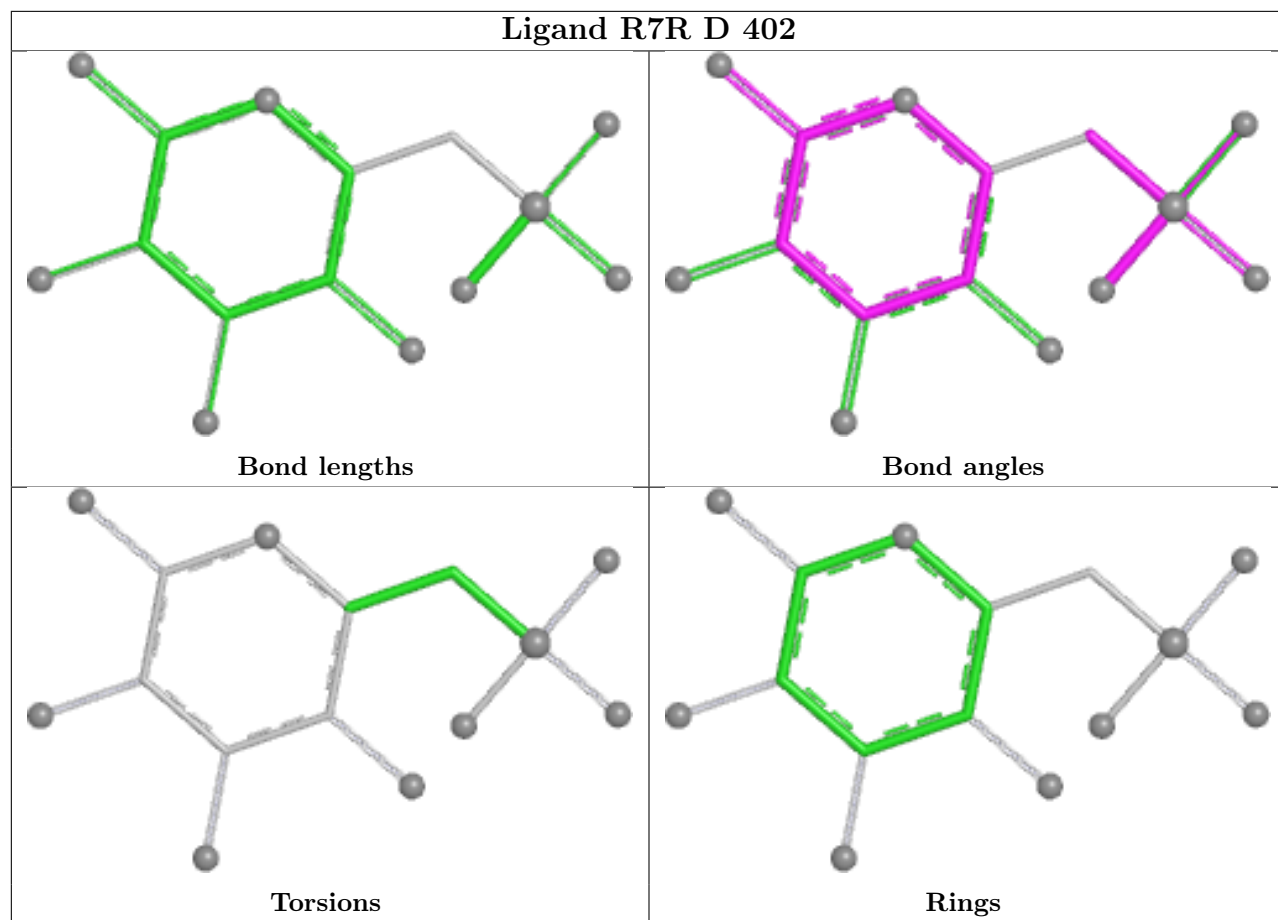
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

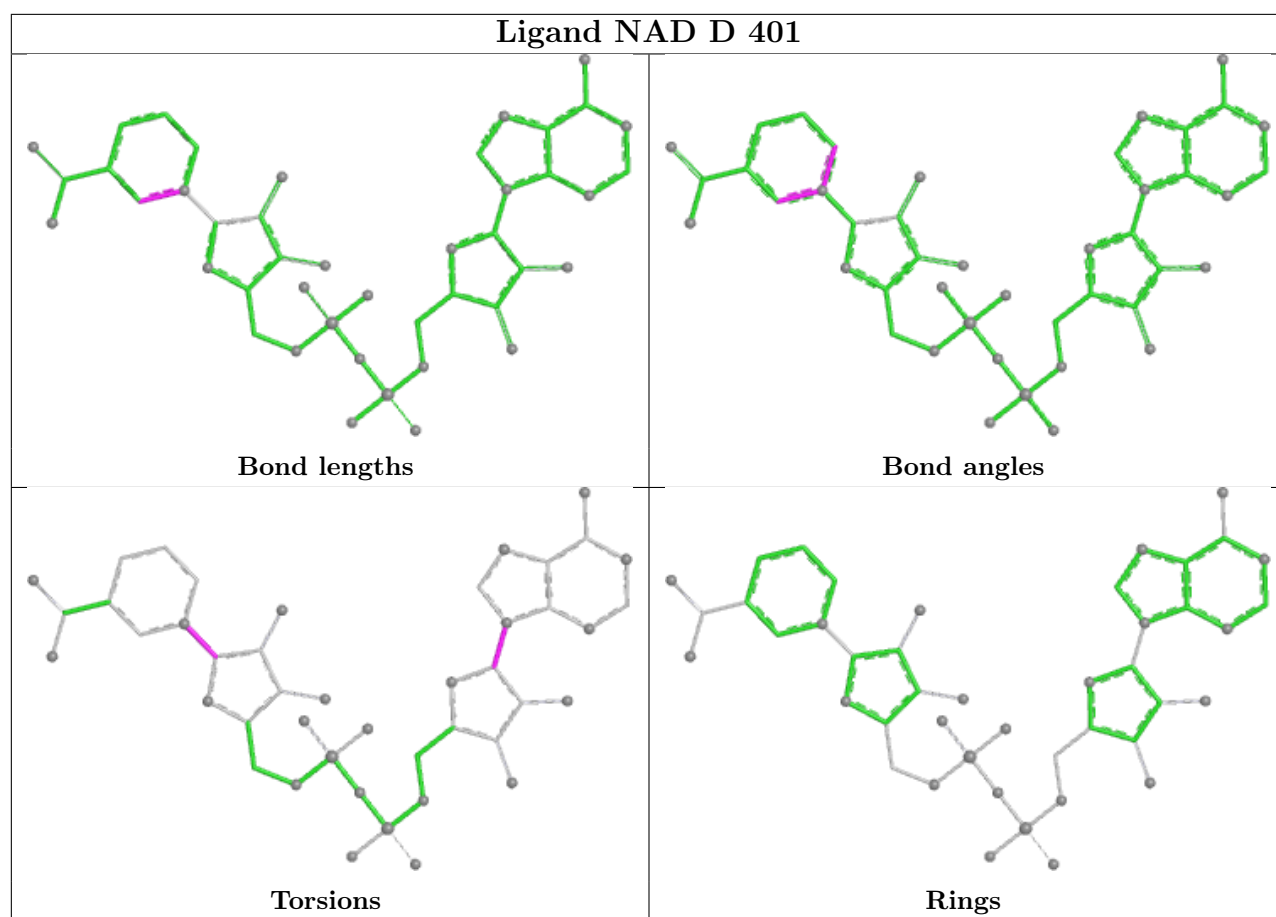


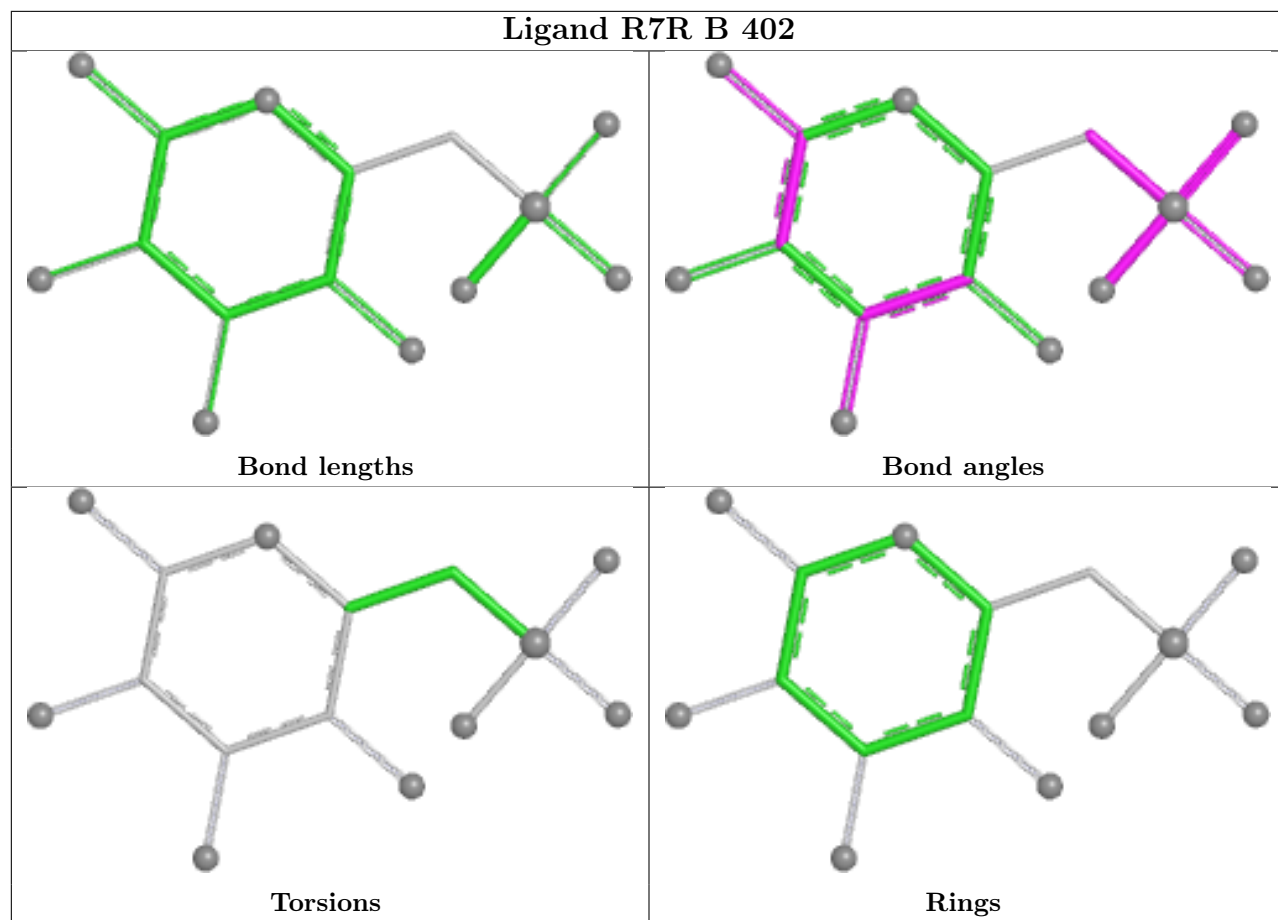


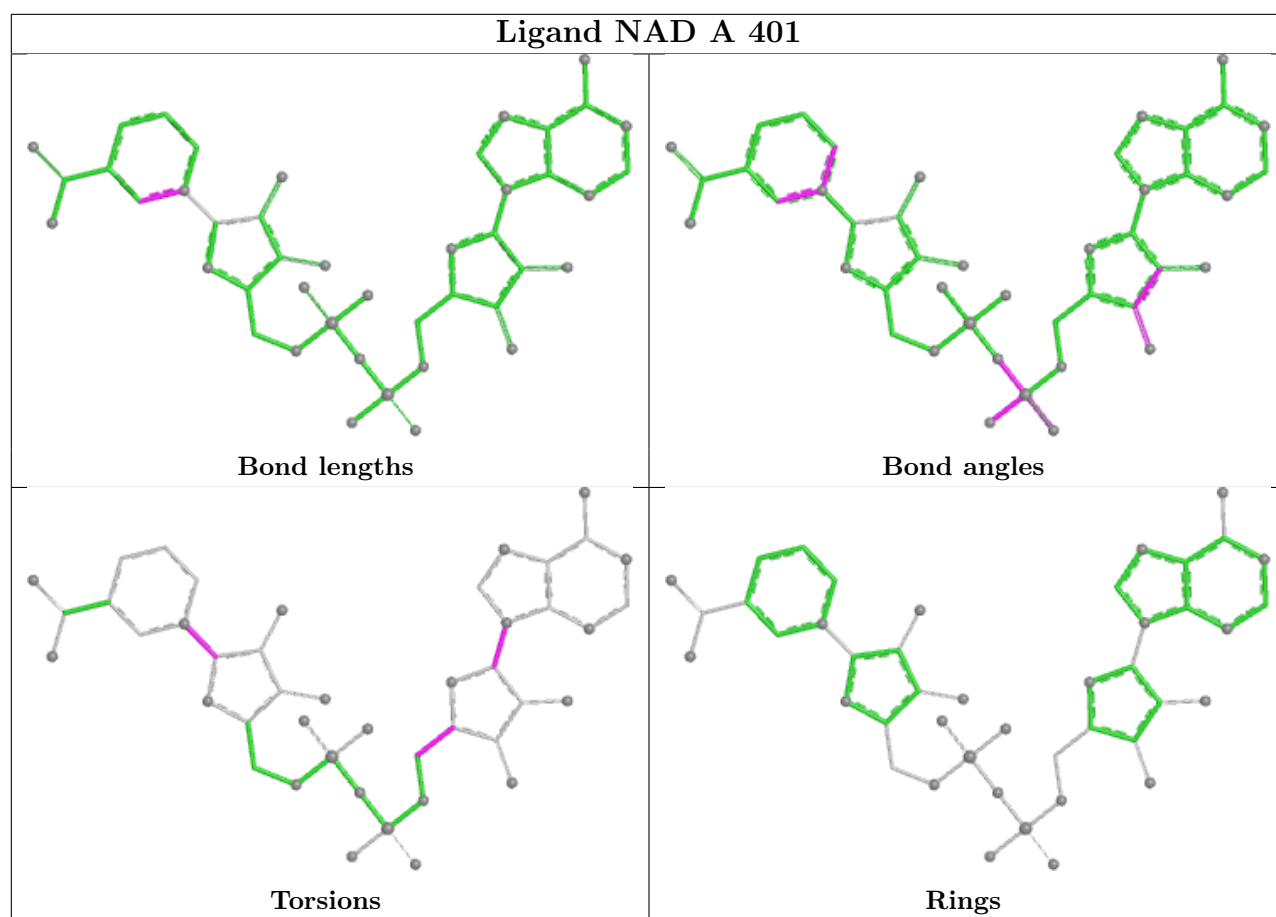












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	363/393 (92%)	-0.12	3 (0%) 82 83	17, 30, 49, 78	0
1	B	363/393 (92%)	-0.14	0 100 100	17, 29, 48, 81	0
1	C	363/393 (92%)	0.04	8 (2%) 62 64	20, 32, 54, 108	0
1	D	363/393 (92%)	0.02	10 (2%) 55 57	21, 31, 53, 96	0
All	All	1452/1572 (92%)	-0.05	21 (1%) 73 75	17, 30, 52, 108	0

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	221	ASP	4.0
1	C	290	THR	3.4
1	D	287	GLY	3.1
1	C	9	ALA	3.1
1	C	287	GLY	2.9
1	D	290	THR	2.8
1	D	54	ARG	2.6
1	C	371	LEU	2.6
1	C	311	VAL	2.4
1	D	228	ILE	2.4
1	A	371	LEU	2.3
1	C	288	ASP	2.3
1	D	288	ASP	2.3
1	D	311	VAL	2.3
1	D	9	ALA	2.2
1	A	289	GLU	2.2
1	D	221	ASP	2.1
1	D	371	LEU	2.1
1	D	320	ALA	2.1
1	A	290	THR	2.1
1	C	289	GLU	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](#)

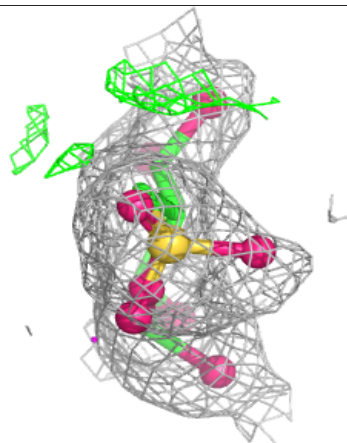
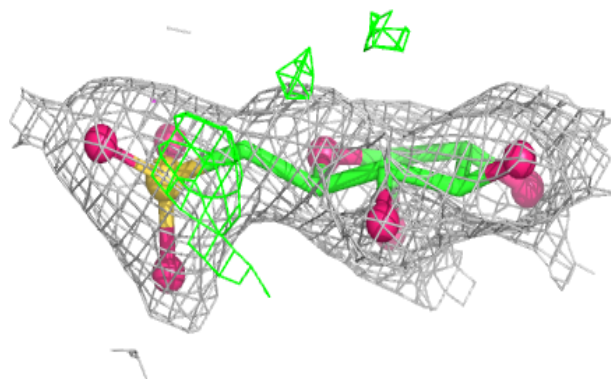
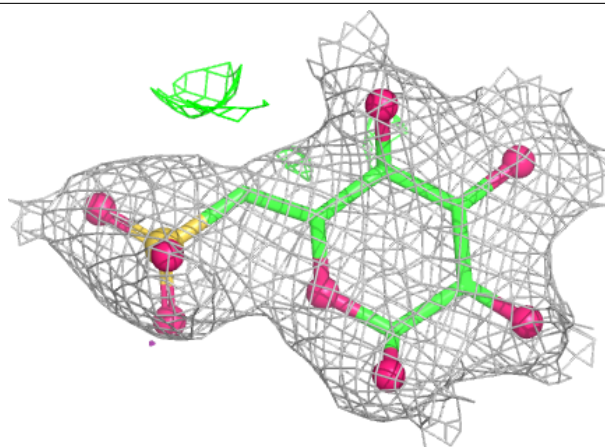
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	TRS	B	403	8/8	0.82	0.17	49,57,60,61	0
4	TRS	D	403	8/8	0.83	0.14	35,38,40,41	0
4	TRS	C	403	8/8	0.86	0.15	48,61,64,67	0
4	TRS	C	404	8/8	0.87	0.11	28,38,41,44	0
4	TRS	B	404	8/8	0.89	0.09	26,28,29,30	0
3	R7R	C	402	15/15	0.91	0.11	33,39,47,57	0
3	R7R	D	402	15/15	0.92	0.10	30,39,48,53	0
4	TRS	A	403	8/8	0.93	0.07	29,31,33,36	0
3	R7R	B	402	15/15	0.95	0.08	18,26,31,39	0
3	R7R	A	402	15/15	0.96	0.07	19,23,26,28	15
2	NAD	C	401	44/44	0.98	0.05	21,27,31,33	0
2	NAD	D	401	44/44	0.98	0.05	21,27,31,32	0
2	NAD	A	401	44/44	0.98	0.05	17,20,24,28	0
2	NAD	B	401	44/44	0.98	0.05	14,20,23,26	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.

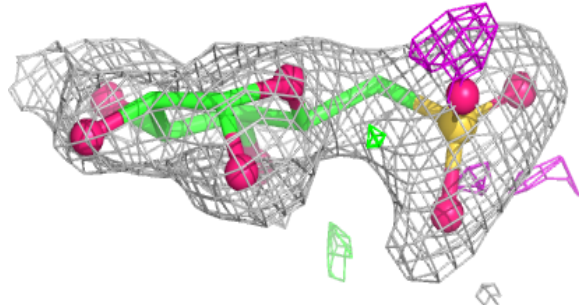
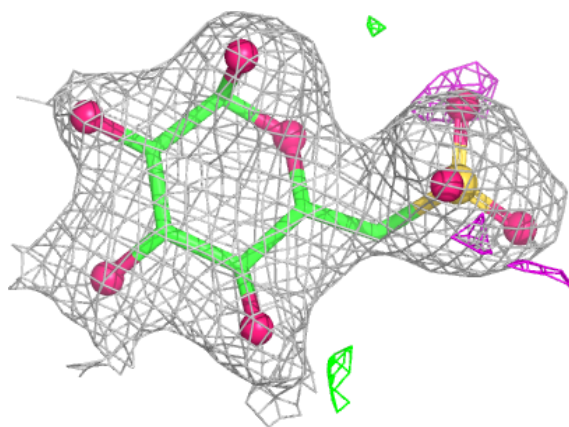
Electron density around R7R C 402:

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



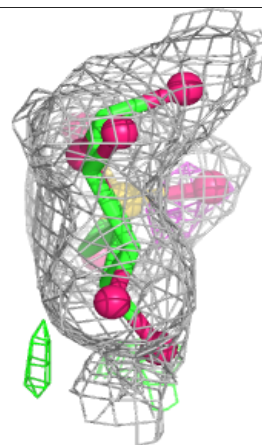
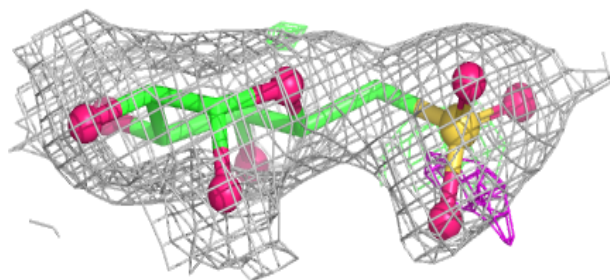
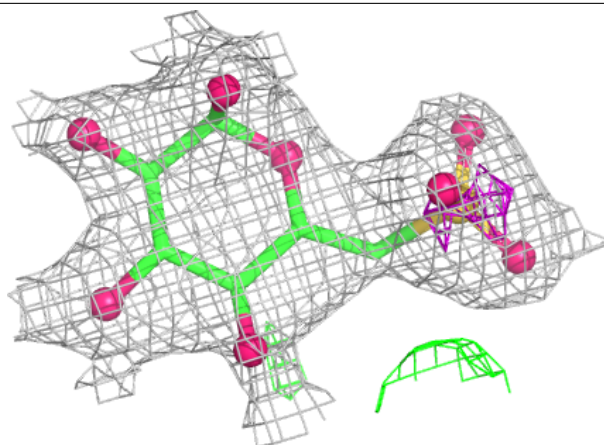
Electron density around R7R D 402:

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

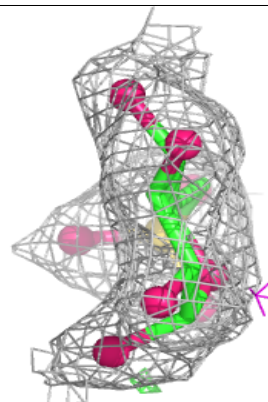
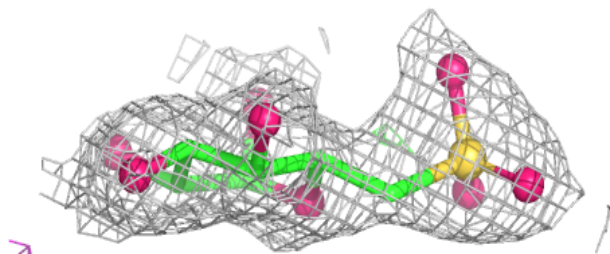
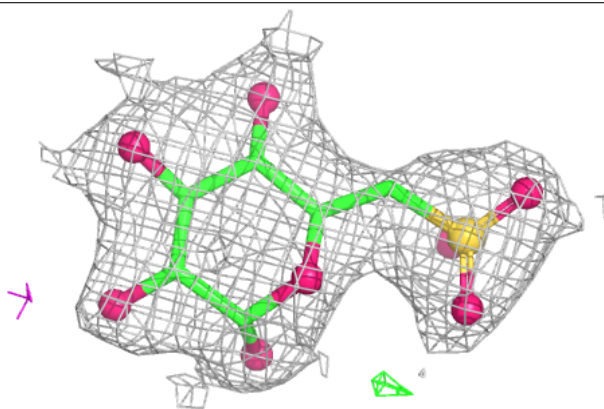


Electron density around R7R B 402:

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

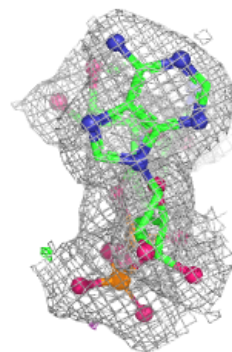
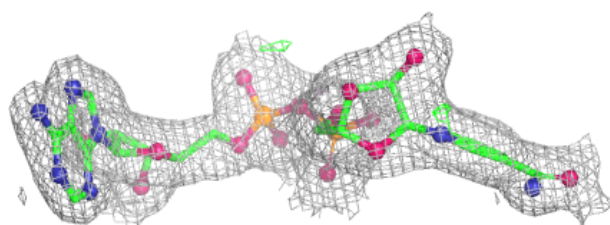
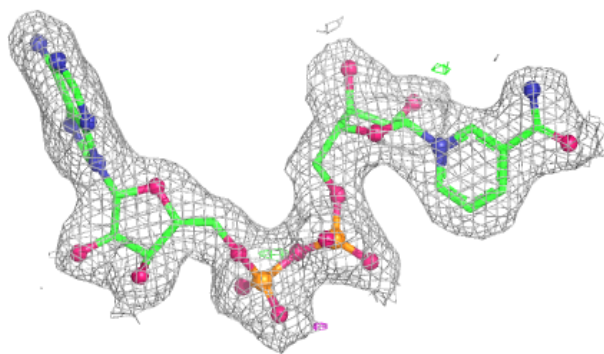
**Electron density around R7R A 402:**

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

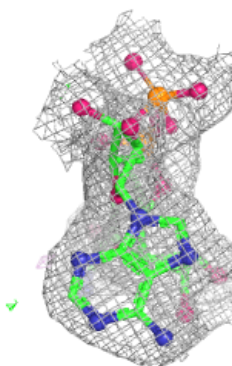
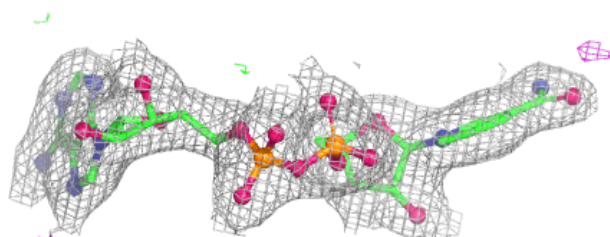
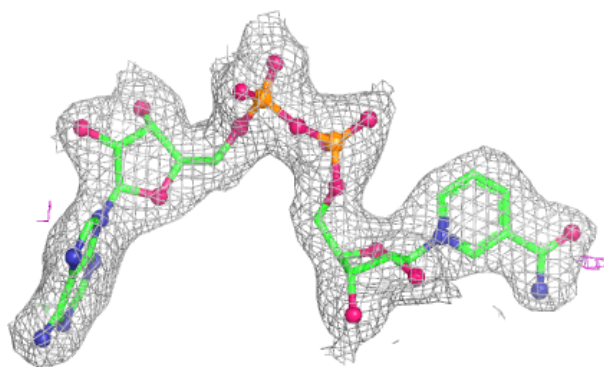


Electron density around NAD C 401:

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

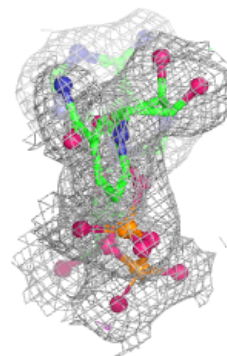
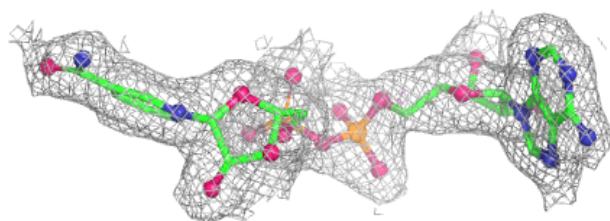
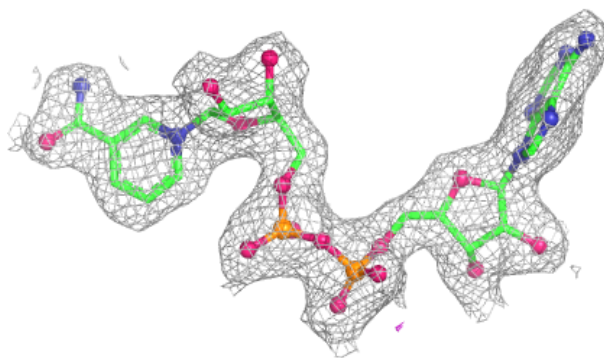
**Electron density around NAD D 401:**

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

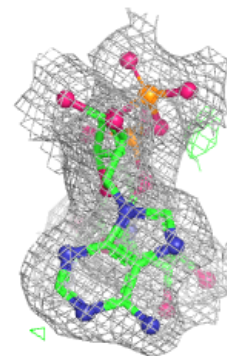
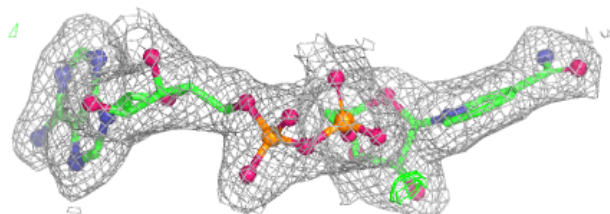
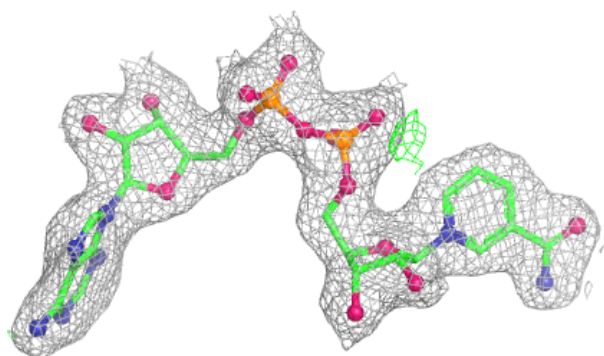


Electron density around NAD A 401:

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

**Electron density around NAD 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)



6.5 Other polymers [i](#)

There are no such residues in this entry.