



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 01:34 PM UTC

PDB ID : 8CFR / pdb_00008cfr
Title : Crystal structure of S-adenosyl-L-homocysteine hydrolase from *P. aeruginosa* in complex with F2X-Entry library fragment G03
Authors : Malecki, P.H.; Gawel, M.; Stepniewska, M.; Brzezinski, K.
Deposited on : 2023-02-03
Resolution : 1.89 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

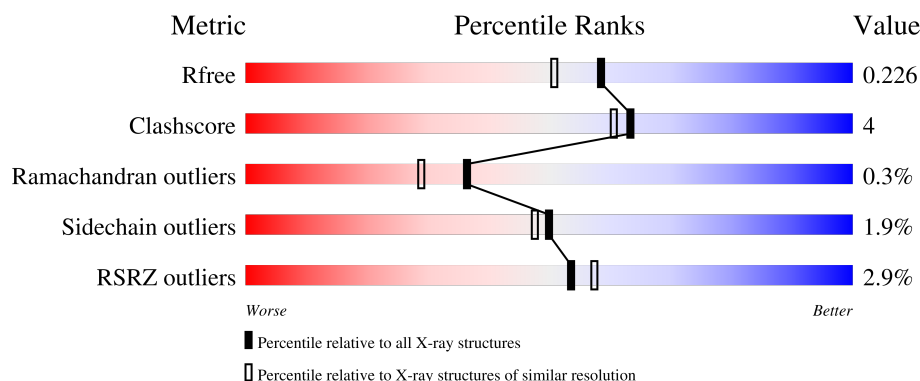
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.89 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	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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	472	
1	B	472	
1	C	472	
1	D	472	

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 15819 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.

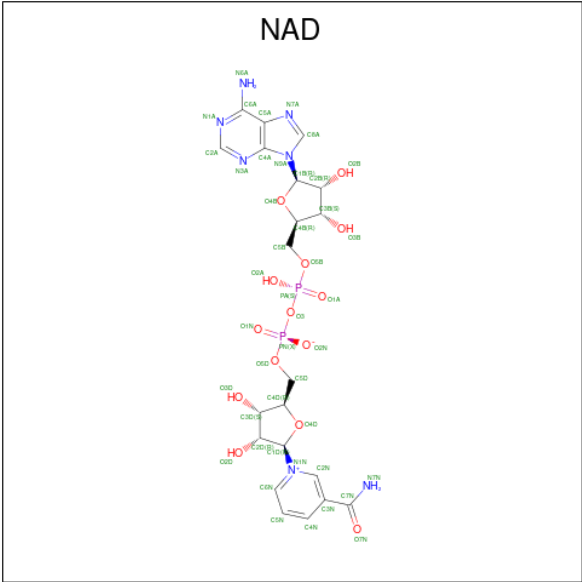
- Molecule 1 is a protein called Adenosylhomocysteinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	462	Total	C	N	O	S	0	3	0
			3578	2255	619	681	23			
1	B	461	Total	C	N	O	S	0	3	0
			3571	2251	618	680	22			
1	C	462	Total	C	N	O	S	0	5	0
			3590	2263	620	684	23			
1	D	464	Total	C	N	O	S	0	6	0
			3610	2277	624	686	23			

There are 12 discrepancies between the modelled and reference sequences:

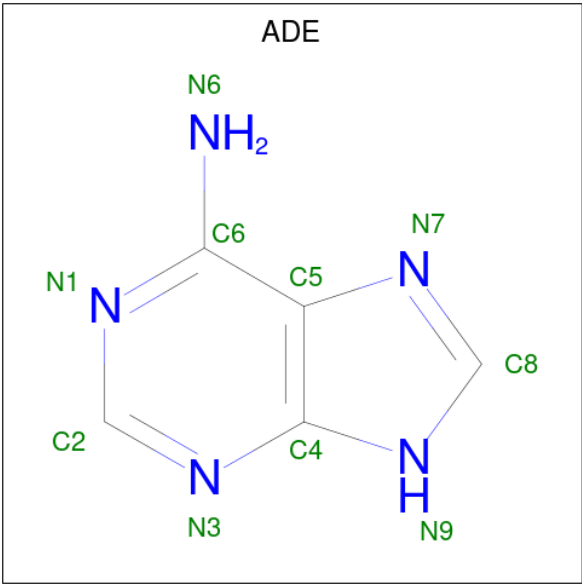
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	expression tag	UNP Q9I685
A	-1	ASN	-	expression tag	UNP Q9I685
A	0	ALA	-	expression tag	UNP Q9I685
B	-2	SER	-	expression tag	UNP Q9I685
B	-1	ASN	-	expression tag	UNP Q9I685
B	0	ALA	-	expression tag	UNP Q9I685
C	-2	SER	-	expression tag	UNP Q9I685
C	-1	ASN	-	expression tag	UNP Q9I685
C	0	ALA	-	expression tag	UNP Q9I685
D	-2	SER	-	expression tag	UNP Q9I685
D	-1	ASN	-	expression tag	UNP Q9I685
D	0	ALA	-	expression tag	UNP Q9I685

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (CCD ID: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).



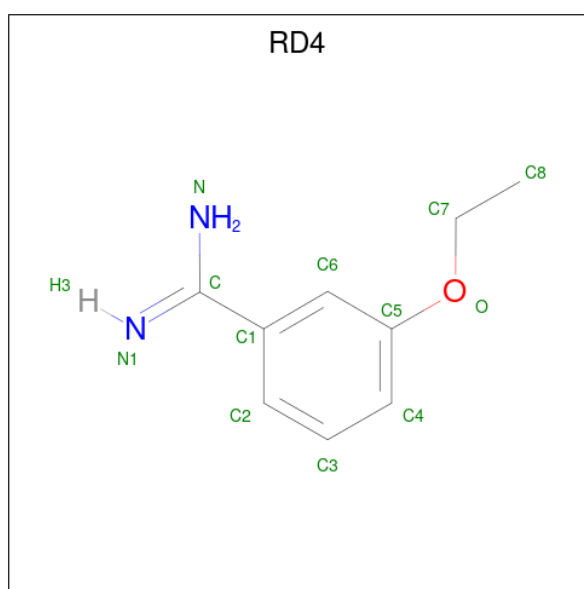
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	C	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	D	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 3 is ADENINE (CCD ID: ADE) (formula: C₅H₅N₅).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	N	0	0
			10	5	5		
3	B	1	Total	C	N	0	0
			10	5	5		
3	C	1	Total	C	N	0	0
			10	5	5		
3	D	1	Total	C	N	0	0
			10	5	5		

- Molecule 4 is 3-ethoxybenzene-1-carboximidamide (CCD ID: RD4) (formula: C₉H₁₂N₂O) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			12	9	2	1		
4	B	1	Total	C	N	O	0	0
			12	9	2	1		
4	C	1	Total	C	N	O	0	0
			12	9	2	1		

- Molecule 5 is POTASSIUM ION (CCD ID: K) (formula: K).

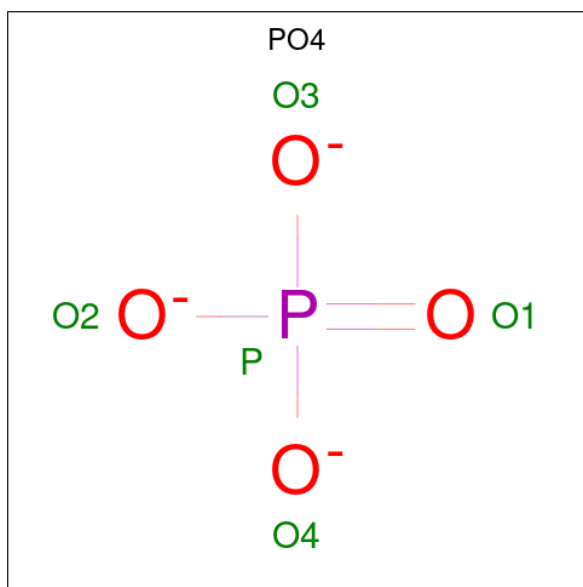
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	K	0	0
			1	1		
5	B	1	Total	K	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	1	Total	K	0	0
			1	1		
5	D	1	Total	K	0	0
			1	1		

- Molecule 6 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



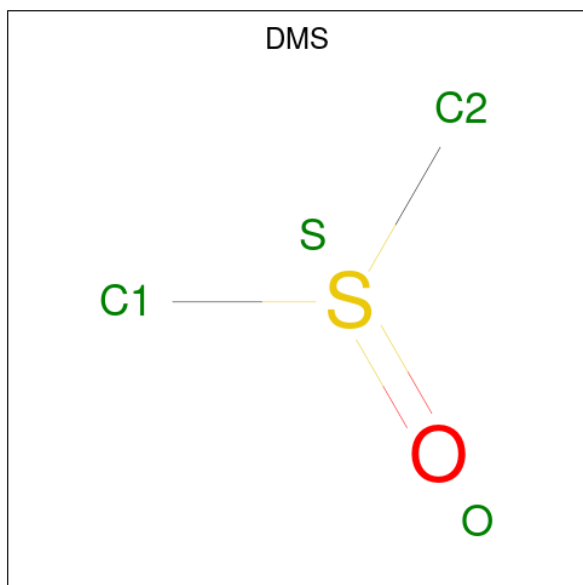
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	O	P	0	0
			5	4	1		
6	A	1	Total	O	P	0	0
			5	4	1		
6	A	1	Total	O	P	0	0
			5	4	1		
6	B	1	Total	O	P	0	0
			5	4	1		
6	B	1	Total	O	P	0	0
			5	4	1		
6	B	1	Total	O	P	0	0
			5	4	1		
6	C	1	Total	O	P	0	0
			5	4	1		
6	C	1	Total	O	P	0	0
			5	4	1		
6	C	1	Total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

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	C	1	Total	O	P	0	0
			5	4	1		
6	D	1	Total	O	P	0	0
			5	4	1		
6	D	1	Total	O	P	0	0
			5	4	1		

- Molecule 7 is DIMETHYL SULFOXIDE (CCD ID: DMS) (formula: C_2H_6OS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	C	1	Total	C	O	S	0	0
			4	2	1	1		

- Molecule 8 is water.

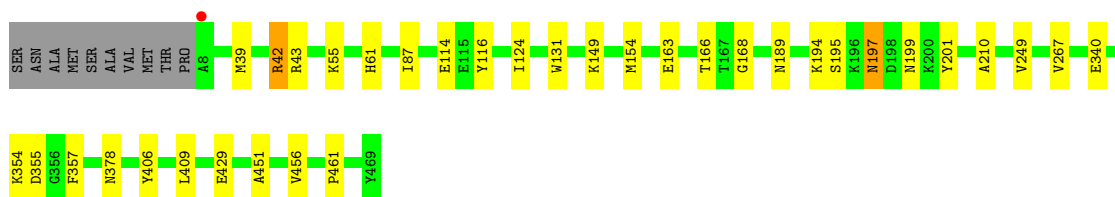
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	341	Total	O	0	9
			350	350		
8	B	216	Total	O	0	1
			217	217		
8	C	284	Total	O	0	3
			287	287		
8	D	292	Total	O	0	4
			296	296		

3 Residue-property plots

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.

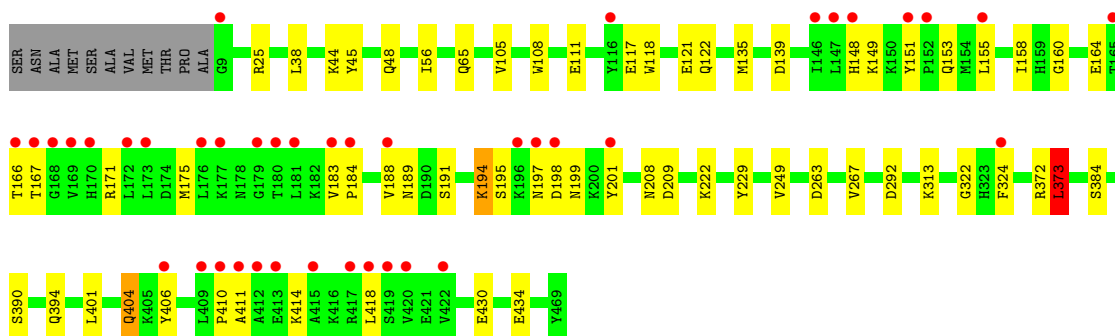
• Molecule 1: Adenosylhomocysteinase

Chain A: 



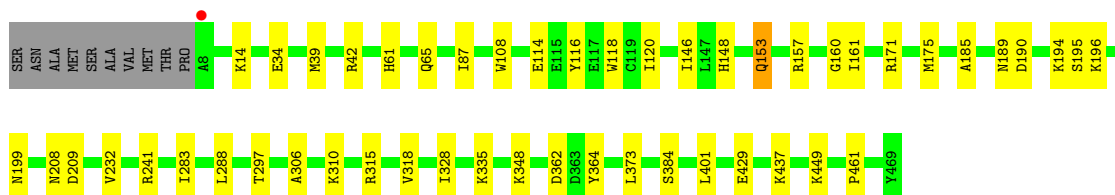
• Molecule 1: Adenosylhomocysteinase

Chain B: 



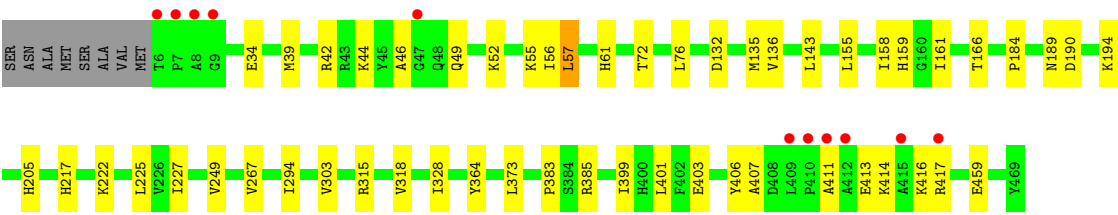
• Molecule 1: Adenosylhomocysteinase

Chain C: 



• Molecule 1: Adenosylhomocysteinase

Chain D: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	91.21Å 101.49Å 110.70Å 90.00° 114.42° 90.00°	Depositor
Resolution (Å)	37.03 – 1.89 37.03 – 1.89	Depositor EDS
% Data completeness (in resolution range)	99.0 (37.03-1.89) 99.2 (37.03-1.89)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.20 (at 1.90Å)	Xtriage
Refinement program	PHENIX 1.19.2-4158	Depositor
R, R_{free}	0.186 , 0.225 0.186 , 0.226	Depositor DCC
R_{free} test set	1042 reflections (0.72%)	wwPDB-VP
Wilson B-factor (Å ²)	29.8	Xtriage
Anisotropy	0.739	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 55.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.000 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	15819	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 42.32 % 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 2.0748e-04. 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ADE, DMS, PO4, RD4, K, 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	0.40	0/3644	0.58	0/4926
1	B	0.38	0/3640	0.59	0/4921
1	C	0.38	0/3662	0.58	0/4950
1	D	0.37	0/3680	0.55	0/4975
All	All	0.38	0/14626	0.58	0/19772

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	3578	0	3584	17	0
1	B	3571	0	3579	41	0
1	C	3590	0	3598	33	0
1	D	3610	0	3624	27	0
2	A	44	0	26	0	0
2	B	44	0	26	0	0
2	C	44	0	26	0	0
2	D	44	0	26	0	0
3	A	10	0	4	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	10	0	4	0	0
3	C	10	0	4	0	0
3	D	10	0	4	0	0
4	A	12	0	0	0	0
4	B	12	0	0	0	0
4	C	12	0	0	1	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
5	C	1	0	0	0	0
5	D	1	0	0	0	0
6	A	15	0	0	0	0
6	B	15	0	0	1	0
6	C	20	0	0	0	0
6	D	10	0	0	0	0
7	C	4	0	6	1	0
8	A	350	0	0	2	0
8	B	217	0	0	3	0
8	C	287	0	0	8	0
8	D	296	0	0	1	0
All	All	15819	0	14511	118	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 (118) 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:B:155:LEU:HA	1:B:158:ILE:HD12	1.63	0.79
1:C:189:ASN:HA	1:C:194:LYS:HD2	1.74	0.69
1:B:189:ASN:HA	1:B:194:LYS:HD2	1.73	0.69
1:D:189:ASN:HA	1:D:194:LYS:HD2	1.75	0.68
1:C:196:LYS:HE2	8:C:613:HOH:O	1.95	0.67
1:D:46:ALA:O	1:D:49:GLN:NE2	2.28	0.66
1:D:373:LEU:HD12	1:D:373:LEU:H	1.60	0.65
1:D:39[A]:MET:HE1	1:D:42:ARG:CZ	2.29	0.63
1:A:189:ASN:HA	1:A:194:LYS:HD2	1.81	0.62
1:B:197:ASN:HA	1:B:201:TYR:HD2	1.64	0.61
1:A:39[A]:MET:HE1	1:A:42:ARG:CZ	2.32	0.59
1:B:406:TYR:CE1	1:B:414:LYS:HB3	2.37	0.59
1:B:118:TRP:O	1:B:122:GLN:HG2	2.04	0.58
1:A:43:ARG:NH2	8:A:603:HOH:O	2.36	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:322:GLY:O	1:B:373:LEU:HD13	2.05	0.57
1:C:196:LYS:HE3	8:C:675:HOH:O	2.04	0.57
1:B:404:GLN:NE2	8:B:602:HOH:O	2.39	0.56
1:D:155:LEU:HD23	1:D:158:ILE:HD12	1.87	0.56
1:C:39[A]:MET:HE1	1:C:42:ARG:CZ	2.36	0.55
1:C:348:LYS:NZ	8:C:603:HOH:O	2.34	0.54
1:A:451:ALA:HB1	1:A:456:VAL:O	2.07	0.54
1:D:413:GLU:OE1	1:D:417:ARG:NH1	2.40	0.54
1:D:399:ILE:O	1:D:403:GLU:HG3	2.08	0.54
1:D:57[A]:LEU:HB3	1:D:143:LEU:HD21	1.89	0.53
1:B:56:ILE:HG12	1:B:135:MET:HB2	1.91	0.51
1:B:171:ARG:O	1:B:175:MET:HG3	2.10	0.51
1:C:157:ARG:NH1	8:C:607:HOH:O	2.44	0.51
1:D:194:LYS:HD3	1:D:194:LYS:C	2.36	0.50
1:A:340:GLU:HB2	1:A:357:PHE:CZ	2.47	0.50
1:C:283:ILE:HG23	1:C:288:LEU:HD12	1.93	0.50
1:D:56:ILE:HG12	1:D:135:MET:HB2	1.93	0.50
1:B:410:PRO:O	1:B:414:LYS:HG3	2.12	0.50
1:B:194:LYS:HG2	1:B:390:SER:HB3	1.94	0.50
1:C:148:HIS:CG	1:C:175:MET:HE1	2.47	0.50
1:D:136:VAL:HB	1:D:161:ILE:HG12	1.94	0.49
1:D:184:PRO:HD3	1:D:406:TYR:CG	2.48	0.49
1:A:87:ILE:HG22	1:A:116:TYR:HB2	1.94	0.48
1:B:167:THR:HG21	1:B:324:PHE:HE2	1.78	0.48
1:C:195:SER:O	1:C:199:ASN:HB2	2.14	0.48
1:A:197:ASN:HA	1:A:201:TYR:HD2	1.78	0.48
1:B:434:GLU:HG3	8:B:738:HOH:O	2.14	0.48
1:C:190:ASP:OD2	4:C:501:RD4:N1	2.46	0.48
1:D:249:VAL:O	1:D:267:VAL:HA	2.14	0.48
1:C:318:VAL:HG12	1:C:328:ILE:HD13	1.95	0.48
1:D:205:HIS:CD2	1:D:383:PRO:HD3	2.49	0.47
1:B:194:LYS:O	1:B:198:ASP:HB3	2.14	0.47
1:B:188:VAL:HG11	1:B:394:GLN:HG2	1.96	0.47
1:B:229:TYR:OH	1:B:263:ASP:OD2	2.26	0.47
1:B:222:LYS:NZ	8:B:609:HOH:O	2.48	0.47
1:C:171:ARG:O	1:C:175:MET:HG3	2.15	0.47
1:A:406:TYR:HA	1:A:409:LEU:HD12	1.97	0.47
1:B:292:ASP:OD1	1:B:313:LYS:NZ	2.38	0.47
1:C:148:HIS:CD2	1:C:175:MET:HE1	2.50	0.47
1:C:437:LYS:NZ	8:C:606:HOH:O	2.44	0.46
1:C:161:ILE:O	1:C:185:ALA:HA	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:44:LYS:NZ	1:B:430:GLU:OE2	2.47	0.46
1:B:197:ASN:O	1:B:201:TYR:HB2	2.16	0.46
1:A:249:VAL:O	1:A:267:VAL:HA	2.16	0.46
1:A:429:GLU:OE1	1:A:461:PRO:HA	2.15	0.46
1:B:372:ARG:O	1:B:373:LEU:C	2.59	0.46
1:B:188:VAL:HG12	1:B:194:LYS:HG3	1.97	0.46
1:C:114:GLU:H	1:C:114:GLU:CD	2.24	0.45
1:A:163:GLU:CD	1:A:168:GLY:HA3	2.40	0.45
1:A:195:SER:O	1:A:199:ASN:HB2	2.16	0.45
1:C:315:ARG:NH1	1:C:362:ASP:HB2	2.30	0.45
1:C:153:GLN:HB2	8:C:793:HOH:O	2.15	0.45
1:D:159:HIS:CE1	1:D:407:ALA:HB3	2.52	0.45
1:B:151:TYR:C	1:B:153:GLN:H	2.25	0.45
1:B:167:THR:HG21	1:B:324:PHE:CE2	2.51	0.45
1:B:167:THR:O	1:B:171:ARG:HG3	2.16	0.45
1:B:406:TYR:CZ	1:B:414:LYS:HB3	2.52	0.45
1:C:232:VAL:HG12	1:C:297:THR:HB	1.98	0.45
1:D:318:VAL:HG12	1:D:328:ILE:HD13	1.97	0.45
1:C:14:LYS:HD3	1:C:108:TRP:CZ3	2.52	0.45
1:B:249:VAL:O	1:B:267:VAL:HA	2.17	0.45
1:C:208[B]:ASN:OD1	1:C:209:ASP:N	2.50	0.44
1:D:55:LYS:HE2	1:D:132:ASP:OD2	2.18	0.44
1:A:124:ILE:HG23	1:A:154:MET:SD	2.57	0.44
1:D:315:ARG:HG2	1:D:364:TYR:CZ	2.52	0.44
1:D:227:ILE:HG21	1:D:303:VAL:HB	1.99	0.44
1:B:208[A]:ASN:OD1	1:B:209:ASP:N	2.51	0.43
1:D:401:LEU:HD23	1:D:401:LEU:HA	1.87	0.43
1:A:210:ALA:HB1	1:A:378:ASN:HB2	2.00	0.43
1:B:139:ASP:HA	1:B:164:GLU:HB3	1.99	0.43
1:B:195:SER:O	1:B:199:ASN:HB2	2.18	0.43
1:B:198:ASP:C	1:B:198:ASP:OD1	2.61	0.43
1:C:194:LYS:C	1:C:194:LYS:HD3	2.44	0.43
1:C:14:LYS:HD2	1:C:118:TRP:CH2	2.54	0.43
1:A:55:LYS:NZ	8:A:621:HOH:O	2.51	0.43
1:C:34:GLU:OE1	1:D:222:LYS:NZ	2.48	0.42
1:B:160:GLY:HA3	1:B:401:LEU:HD13	2.02	0.42
1:D:225:LEU:O	1:D:294:ILE:HA	2.20	0.42
1:B:148:HIS:HA	1:B:155:LEU:HD11	2.02	0.42
1:B:148:HIS:CD2	1:B:175:MET:HE1	2.55	0.42
1:C:429:GLU:OE1	1:C:461:PRO:HA	2.20	0.42
1:C:87:ILE:HG22	1:C:116:TYR:HB2	2.00	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:315:ARG:HG2	1:C:364:TYR:CZ	2.54	0.42
1:D:411:ALA:O	1:D:414:LYS:HB2	2.20	0.42
1:B:25:ARG:NH1	6:B:505:PO4:O3	2.53	0.41
1:C:160:GLY:HA3	1:C:401:LEU:HD13	2.02	0.41
1:D:72:THR:O	1:D:76:LEU:HG	2.20	0.41
1:B:194:LYS:HG2	1:B:390:SER:CB	2.50	0.41
1:C:306:ALA:O	1:C:310:LYS:HG3	2.21	0.41
1:A:55:LYS:HB3	1:A:131:TRP:CH2	2.55	0.41
1:C:241:ARG:HD2	8:C:834:HOH:O	2.20	0.41
1:C:288:LEU:HD23	1:C:288:LEU:HA	1.92	0.41
7:C:504:DMS:H21	8:C:845:HOH:O	2.19	0.41
1:B:108:TRP:O	1:B:111:GLU:HG3	2.21	0.41
1:D:184:PRO:HD3	1:D:406:TYR:CD1	2.55	0.41
1:C:120:ILE:HG21	1:C:146:ILE:HD12	2.03	0.41
1:B:44:LYS:HE2	1:B:45:TYR:CE1	2.56	0.41
1:B:65:GLN:HG3	1:B:384:SER:HA	2.03	0.41
1:D:44:LYS:NZ	8:D:622:HOH:O	2.54	0.41
1:A:114:GLU:H	1:A:114:GLU:CD	2.30	0.40
1:D:34:GLU:O	1:D:385:ARG:HA	2.21	0.40
1:B:183:VAL:HB	1:B:184:PRO:HD2	2.04	0.40
1:C:65:GLN:HG3	1:C:384:SER:HA	2.02	0.40
1:B:197:ASN:HA	1:B:201:TYR:CD2	2.50	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	463/472 (98%)	449 (97%)	12 (3%)	2 (0%)	30	22
1	B	462/472 (98%)	445 (96%)	15 (3%)	2 (0%)	30	22
1	C	465/472 (98%)	454 (98%)	10 (2%)	1 (0%)	43	36

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	468/472 (99%)	451 (96%)	16 (3%)	1 (0%)	43	36
All	All	1858/1888 (98%)	1799 (97%)	53 (3%)	6 (0%)	36	29

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	373	LEU
1	C	61	HIS
1	D	61	HIS
1	A	61	HIS
1	A	355	ASP
1	B	411	ALA

5.3.2 Protein sidechains ⓘ

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	380/385 (99%)	375 (99%)	5 (1%)	61	61
1	B	380/385 (99%)	368 (97%)	12 (3%)	34	27
1	C	382/385 (99%)	378 (99%)	4 (1%)	68	70
1	D	384/385 (100%)	376 (98%)	8 (2%)	47	44
All	All	1526/1540 (99%)	1497 (98%)	29 (2%)	50	47

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	ARG
1	A	149	LYS
1	A	166	THR
1	A	197	ASN
1	A	354	LYS
1	B	38	LEU
1	B	48	GLN
1	B	105	VAL

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Mol	Chain	Res	Type
1	B	117	GLU
1	B	121	GLU
1	B	149	LYS
1	B	166	THR
1	B	191	SER
1	B	194	LYS
1	B	373	LEU
1	B	404	GLN
1	B	418	LEU
1	C	153	GLN
1	C	335	LYS
1	C	373	LEU
1	C	449	LYS
1	D	52	LYS
1	D	57[A]	LEU
1	D	57[B]	LEU
1	D	166	THR
1	D	190	ASP
1	D	217	HIS
1	D	416	LYS
1	D	459	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	197	ASN
1	A	336	ASN
1	A	345	GLN
1	A	361	ASN
1	B	336	ASN
1	B	400	HIS
1	C	217	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 28 ligands modelled in this entry, 4 are monoatomic - leaving 24 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
4	RD4	B	501	-	12,12,12	1.87	3 (25%)	12,15,15	1.02	0
4	RD4	C	501	-	12,12,12	2.00	3 (25%)	12,15,15	1.00	1 (8%)
6	PO4	B	507	-	4,4,4	0.71	0	6,6,6	1.18	0
2	NAD	B	502	-	46,48,48	0.44	0	64,73,73	0.57	0
6	PO4	C	507	-	4,4,4	0.98	0	6,6,6	0.91	0
7	DMS	C	504	-	3,3,3	0.71	0	3,3,3	0.61	0
6	PO4	D	505	-	4,4,4	0.98	0	6,6,6	0.52	0
3	ADE	B	503	-	11,11,11	0.54	0	15,15,15	0.51	0
3	ADE	D	502	-	11,11,11	0.70	0	15,15,15	0.42	0
2	NAD	A	501	-	46,48,48	0.37	0	64,73,73	0.54	0
3	ADE	C	503	-	11,11,11	0.63	0	15,15,15	0.45	0
4	RD4	A	503	-	12,12,12	2.02	3 (25%)	12,15,15	1.40	2 (16%)
2	NAD	C	502	-	46,48,48	0.34	0	64,73,73	0.61	0
6	PO4	B	505	-	4,4,4	0.89	0	6,6,6	0.85	0
3	ADE	A	502	-	11,11,11	0.49	0	15,15,15	0.38	0
6	PO4	D	504	-	4,4,4	0.80	0	6,6,6	0.67	0
6	PO4	A	505	-	4,4,4	0.89	0	6,6,6	0.49	0
6	PO4	C	509	-	4,4,4	0.86	0	6,6,6	0.78	0
6	PO4	A	507	-	4,4,4	1.06	0	6,6,6	1.01	0
6	PO4	C	506	-	4,4,4	0.96	0	6,6,6	0.30	0
6	PO4	B	506	-	4,4,4	0.99	0	6,6,6	0.54	0
6	PO4	C	508	-	4,4,4	0.74	0	6,6,6	0.85	0
6	PO4	A	506	-	4,4,4	1.12	0	6,6,6	0.39	0
2	NAD	D	501	-	46,48,48	0.43	0	64,73,73	0.53	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	RD4	A	503	-	-	0/7/7/7	0/1/1/1
4	RD4	B	501	-	-	4/7/7/7	0/1/1/1
2	NAD	A	501	-	-	5/30/62/62	0/5/5/5
4	RD4	C	501	-	-	2/7/7/7	0/1/1/1
3	ADE	B	503	-	-	-	0/2/2/2
3	ADE	C	503	-	-	-	0/2/2/2
3	ADE	D	502	-	-	-	0/2/2/2
2	NAD	C	502	-	-	4/30/62/62	0/5/5/5
2	NAD	D	501	-	-	5/30/62/62	0/5/5/5
2	NAD	B	502	-	-	4/30/62/62	0/5/5/5
3	ADE	A	502	-	-	-	0/2/2/2

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	503	RD4	C-N1	4.58	1.46	1.27
4	C	501	RD4	C-N1	4.55	1.46	1.27
4	B	501	RD4	C-N1	4.41	1.45	1.27
4	C	501	RD4	C1-C	3.87	1.54	1.47
4	A	503	RD4	C1-C	3.55	1.54	1.47
4	A	503	RD4	C-N	-3.03	1.26	1.33
4	B	501	RD4	C-N	-3.01	1.26	1.33
4	C	501	RD4	C-N	-2.79	1.26	1.33
4	B	501	RD4	C1-C	2.73	1.52	1.47

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	503	RD4	O-C7-C8	2.39	115.50	108.04
4	C	501	RD4	C1-C-N	2.07	121.16	118.01
4	A	503	RD4	C4-C5-C6	-2.00	117.81	120.50

There are no chirality outliers.

All (24) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	NAD	O4D-C1D-N1N-C2N

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Mol	Chain	Res	Type	Atoms
2	A	501	NAD	O4D-C1D-N1N-C6N
2	A	501	NAD	C2D-C1D-N1N-C2N
2	A	501	NAD	C2D-C1D-N1N-C6N
2	B	502	NAD	O4D-C1D-N1N-C2N
2	B	502	NAD	O4D-C1D-N1N-C6N
2	B	502	NAD	C2D-C1D-N1N-C2N
2	B	502	NAD	C2D-C1D-N1N-C6N
2	C	502	NAD	O4D-C1D-N1N-C2N
2	C	502	NAD	O4D-C1D-N1N-C6N
2	C	502	NAD	C2D-C1D-N1N-C2N
2	C	502	NAD	C2D-C1D-N1N-C6N
2	D	501	NAD	O4D-C1D-N1N-C2N
2	D	501	NAD	O4D-C1D-N1N-C6N
2	D	501	NAD	C2D-C1D-N1N-C2N
2	D	501	NAD	C2D-C1D-N1N-C6N
2	D	501	NAD	O4B-C4B-C5B-O5B
4	B	501	RD4	N-C-C1-C6
4	B	501	RD4	N-C-C1-C2
4	C	501	RD4	C4-C5-O-C7
4	B	501	RD4	N1-C-C1-C6
4	B	501	RD4	N1-C-C1-C2
4	C	501	RD4	C6-C5-O-C7
2	A	501	NAD	O4B-C4B-C5B-O5B

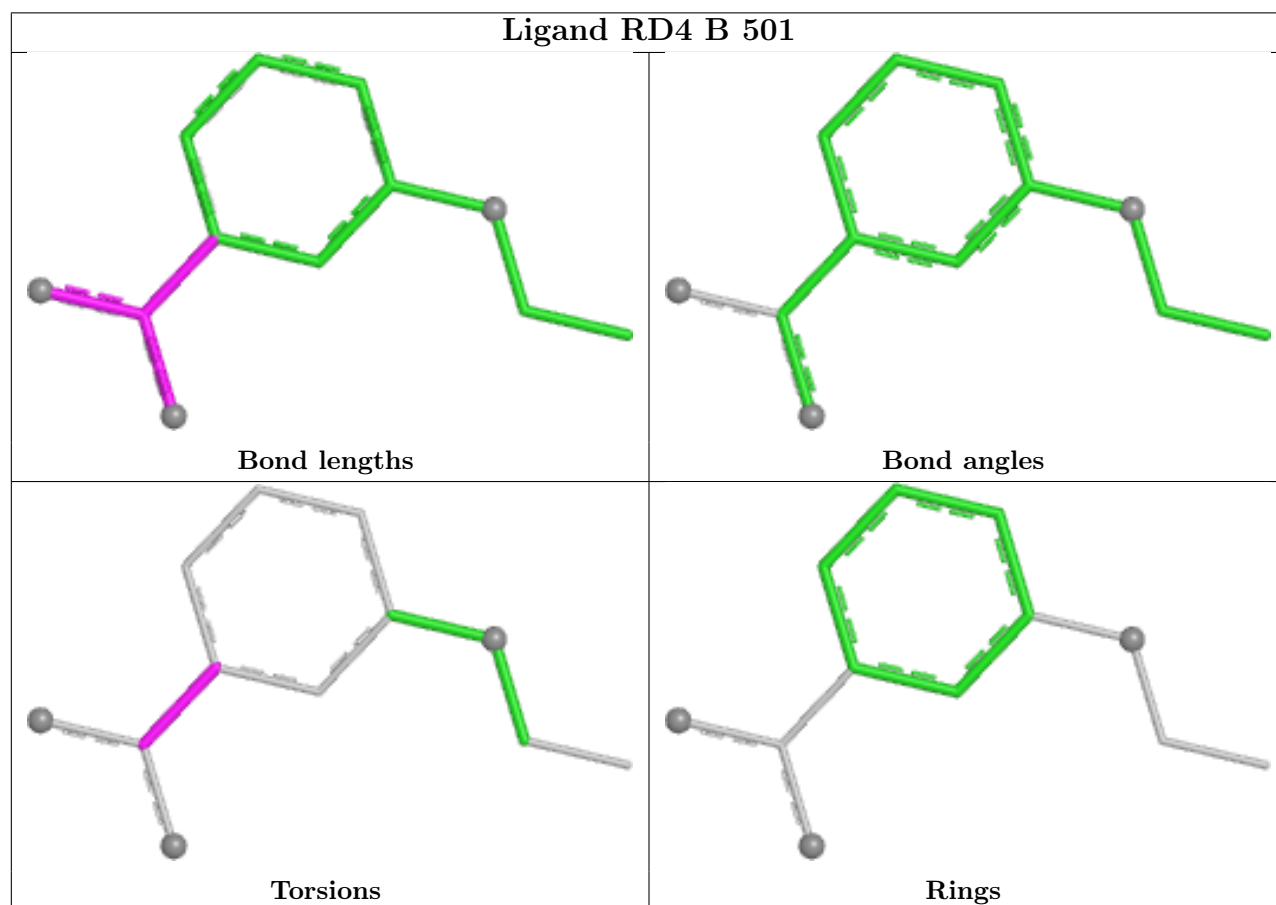
There are no ring outliers.

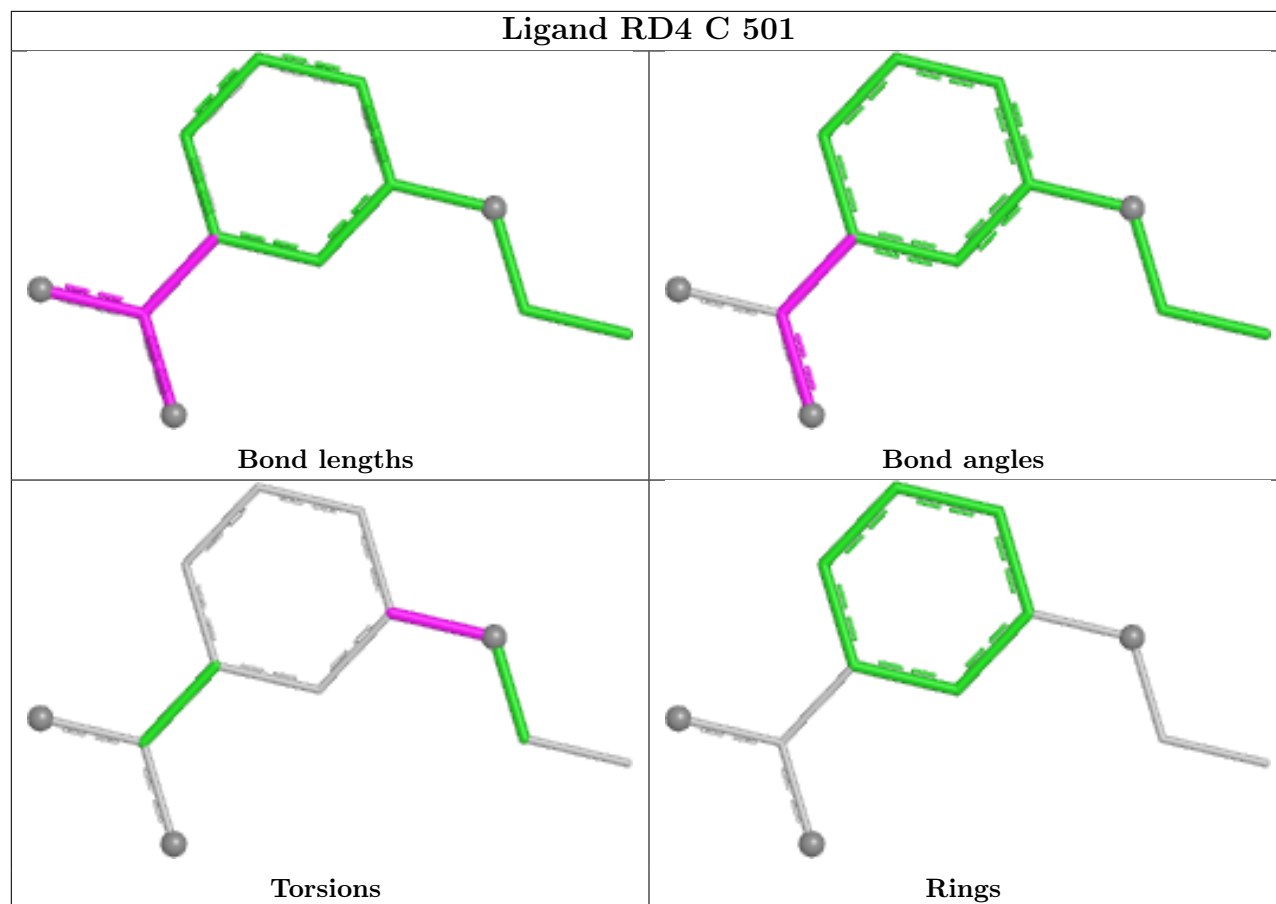
3 monomers are involved in 3 short contacts:

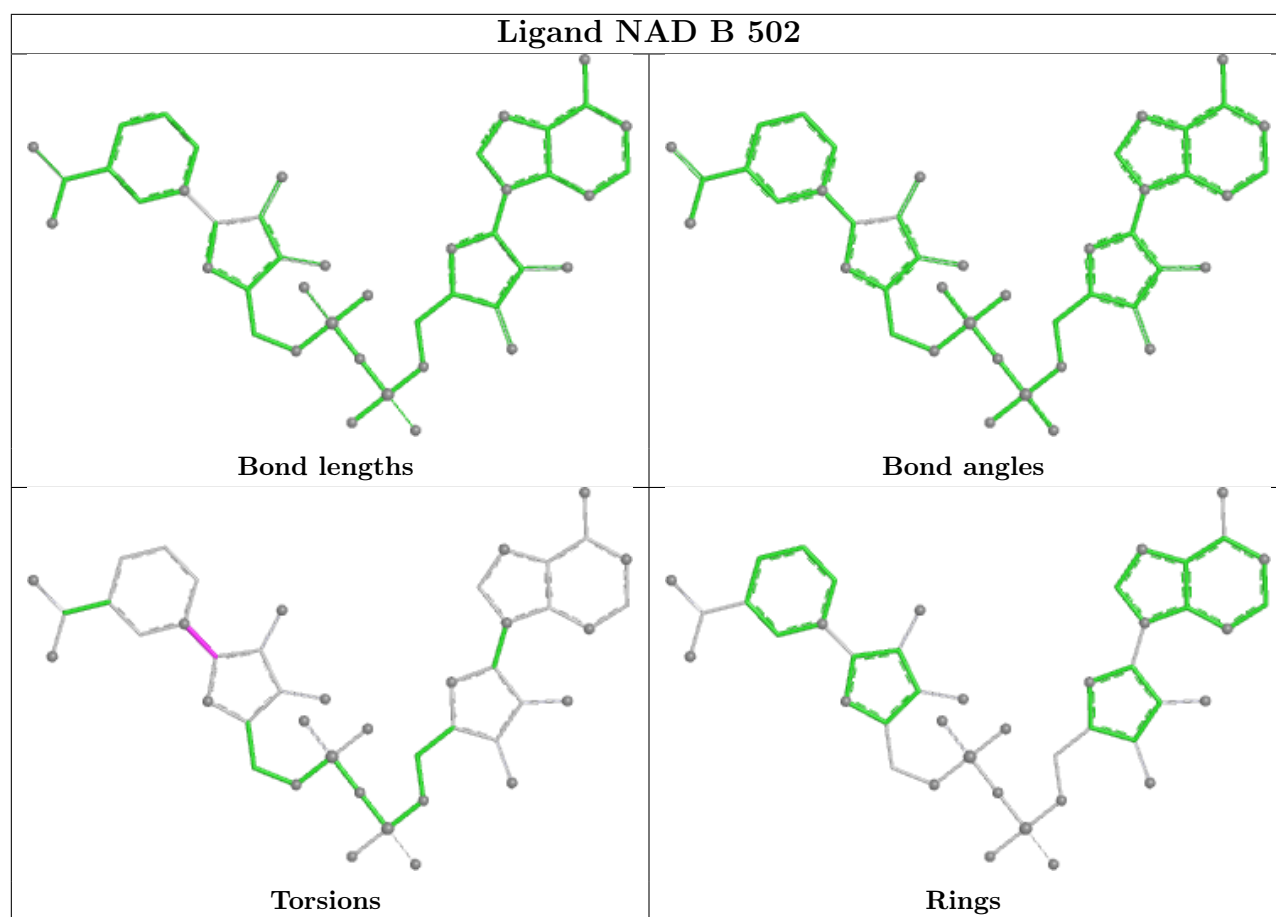
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	C	501	RD4	1	0
7	C	504	DMS	1	0
6	B	505	PO4	1	0

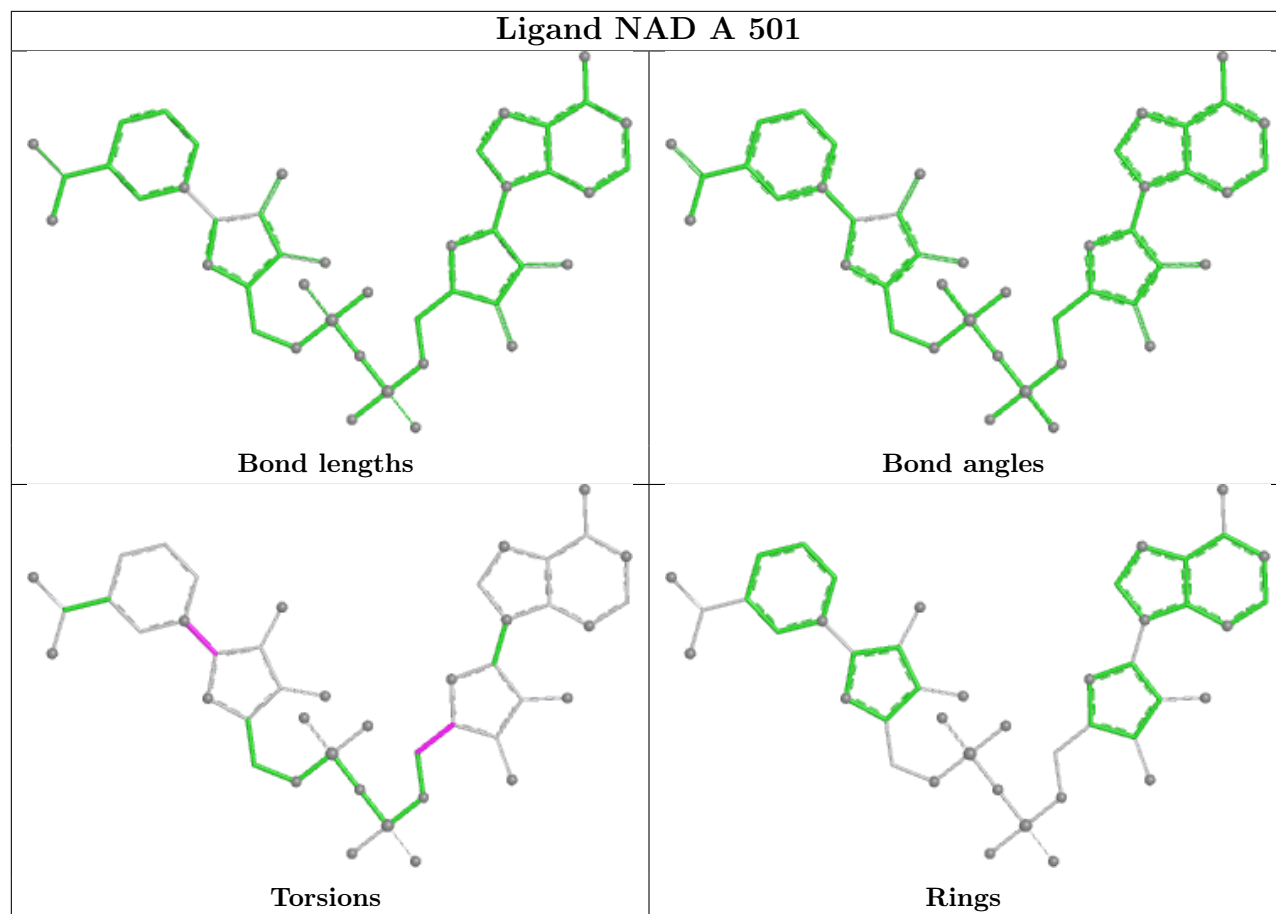
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier.

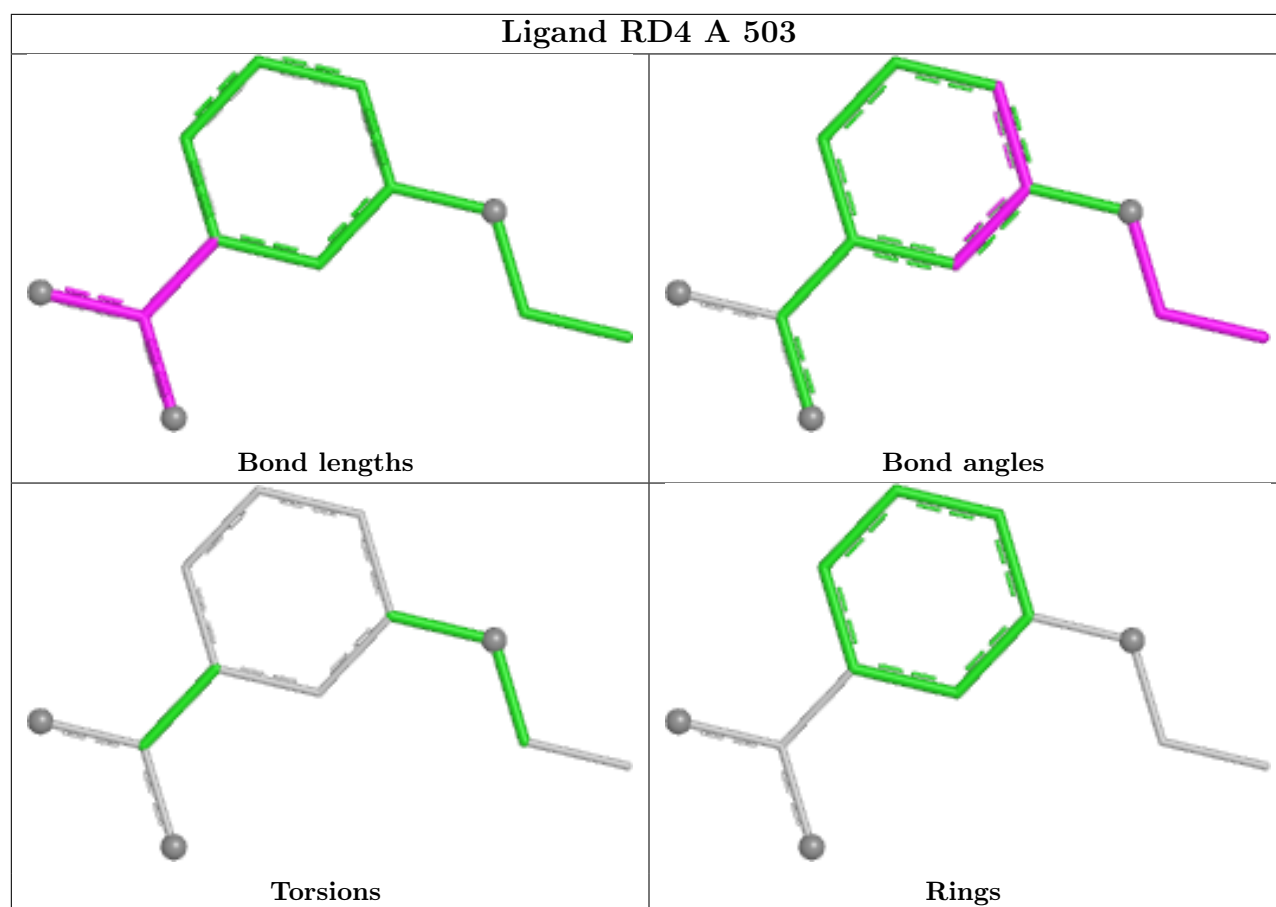
The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

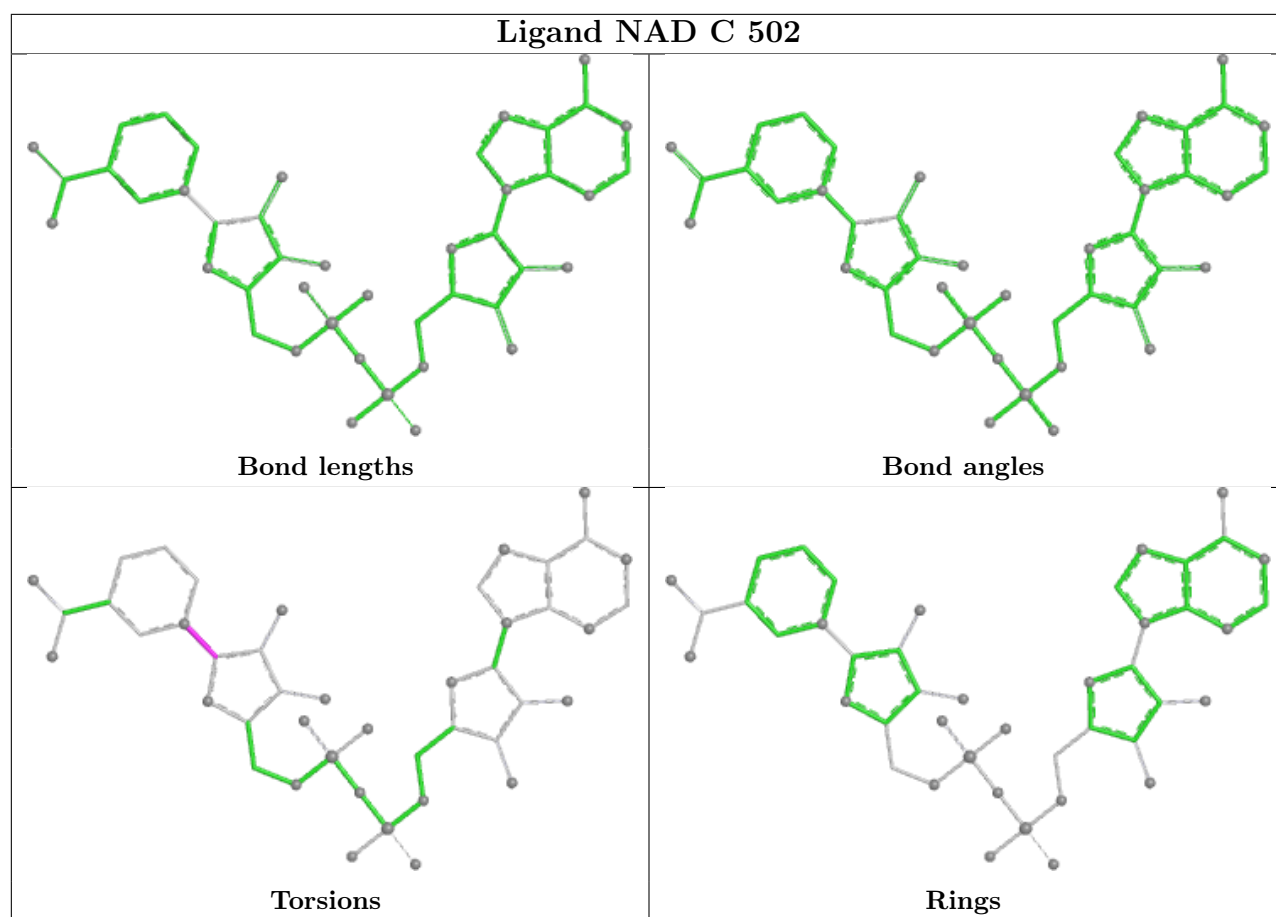


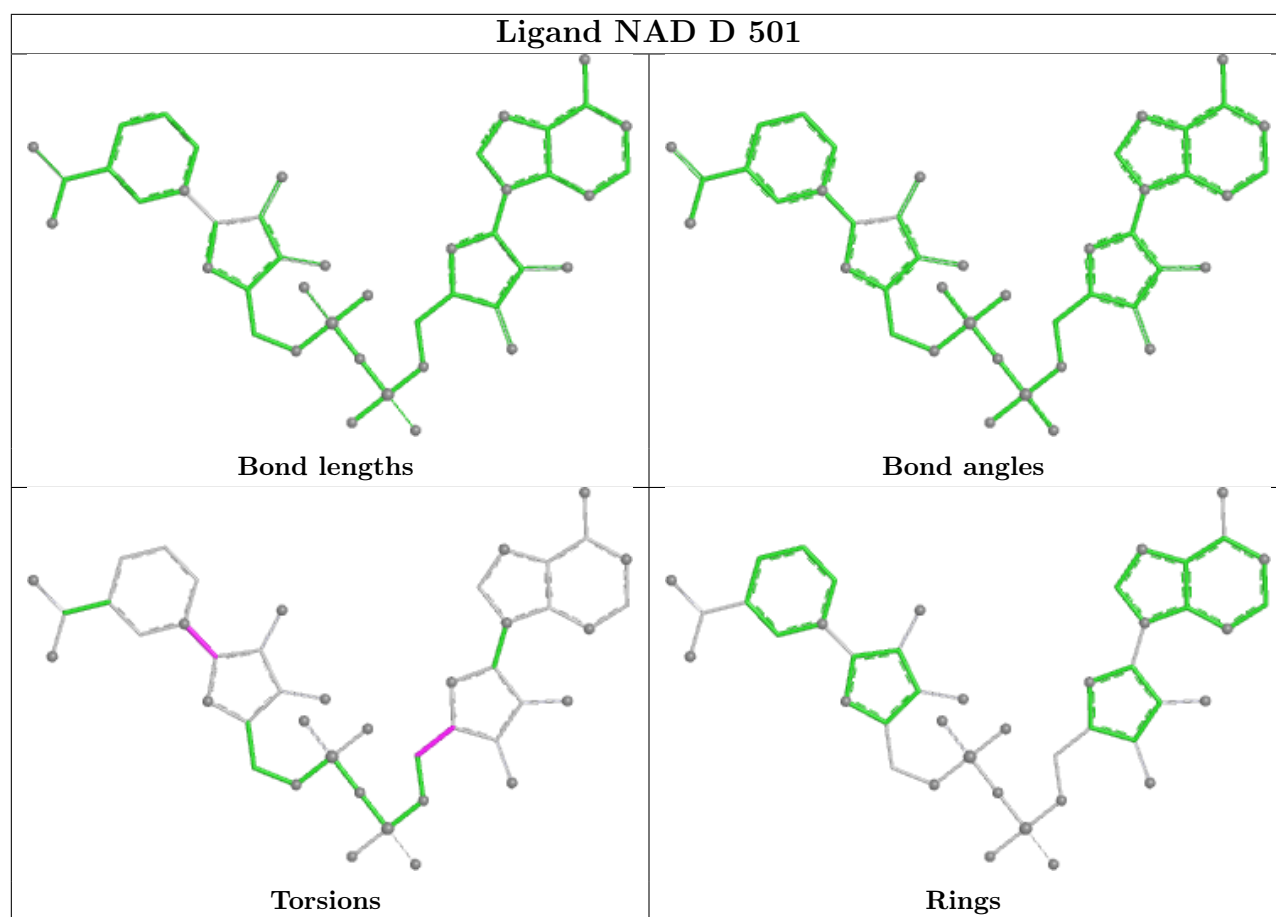












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	462/472 (97%)	-0.17	1 (0%) 91 92	14, 31, 52, 92	3 (0%)
1	B	461/472 (97%)	0.42	41 (8%) 15 16	14, 41, 88, 145	3 (0%)
1	C	462/472 (97%)	0.05	1 (0%) 91 92	16, 40, 62, 124	5 (1%)
1	D	464/472 (98%)	0.06	11 (2%) 59 63	12, 38, 67, 135	6 (1%)
All	All	1849/1888 (97%)	0.09	54 (2%) 53 57	12, 37, 68, 145	17 (0%)

All (54) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	181	LEU	5.2
1	B	176	LEU	5.1
1	B	412	ALA	4.5
1	B	410	PRO	4.4
1	B	411	ALA	4.0
1	B	173	LEU	3.7
1	B	420	VAL	3.7
1	B	151	TYR	3.6
1	B	146	ILE	3.6
1	D	409	LEU	3.6
1	B	183	VAL	3.6
1	B	165	THR	3.4
1	D	410	PRO	3.3
1	B	169	VAL	3.3
1	C	8	ALA	3.3
1	B	152	PRO	3.3
1	B	418	LEU	3.1
1	D	415	ALA	3.1
1	B	172	LEU	3.1
1	D	411	ALA	3.1
1	B	180	THR	3.0

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Mol	Chain	Res	Type	RSRZ
1	D	6	THR	3.0
1	D	412	ALA	3.0
1	B	168	GLY	2.9
1	B	9	GLY	2.9
1	D	7	PRO	2.8
1	B	177	LYS	2.7
1	B	406	TYR	2.7
1	B	196	LYS	2.6
1	B	167	THR	2.6
1	B	147	LEU	2.5
1	B	415	ALA	2.5
1	B	170	HIS	2.5
1	B	166	THR	2.5
1	B	413	GLU	2.4
1	D	8	ALA	2.4
1	B	197	ASN	2.4
1	D	9	GLY	2.4
1	B	188	VAL	2.3
1	B	198	ASP	2.3
1	B	409	LEU	2.3
1	D	417	ARG	2.3
1	B	116	TYR	2.2
1	B	419	SER	2.2
1	D	47	GLY	2.2
1	A	8	ALA	2.2
1	B	324	PHE	2.2
1	B	422	VAL	2.2
1	B	179	GLY	2.1
1	B	155	LEU	2.1
1	B	148	HIS	2.0
1	B	184	PRO	2.0
1	B	417	ARG	2.0
1	B	201	TYR	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands

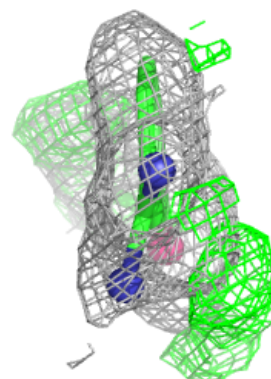
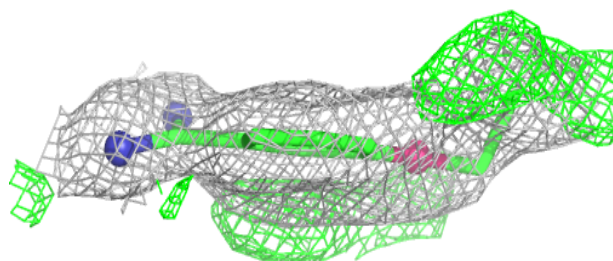
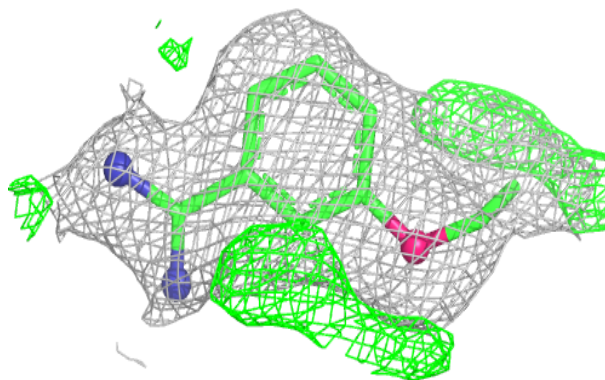
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	PO4	B	507	5/5	0.75	0.16	47,53,57,62	0
4	RD4	A	503	12/12	0.76	0.15	37,43,51,51	0
4	RD4	B	501	12/12	0.80	0.12	39,47,60,64	0
4	RD4	C	501	12/12	0.81	0.12	42,45,48,52	0
6	PO4	A	505	5/5	0.82	0.12	57,63,68,77	0
6	PO4	C	509	5/5	0.84	0.10	57,58,68,71	0
6	PO4	D	504	5/5	0.84	0.10	59,62,67,71	0
6	PO4	B	506	5/5	0.87	0.10	52,56,59,67	0
6	PO4	C	507	5/5	0.91	0.08	43,52,56,57	0
7	DMS	C	504	4/4	0.91	0.12	53,61,64,64	0
6	PO4	D	505	5/5	0.92	0.12	37,38,39,45	0
6	PO4	C	508	5/5	0.92	0.11	34,38,41,44	0
6	PO4	A	507	5/5	0.93	0.09	30,30,37,39	0
3	ADE	C	503	10/10	0.95	0.06	28,31,36,36	0
6	PO4	B	505	5/5	0.95	0.09	40,43,52,52	0
6	PO4	C	506	5/5	0.95	0.11	39,44,48,51	0
2	NAD	C	502	44/44	0.96	0.07	22,31,36,47	0
3	ADE	A	502	10/10	0.96	0.05	21,22,23,24	0
2	NAD	B	502	44/44	0.96	0.06	23,28,33,37	0
6	PO4	A	506	5/5	0.97	0.08	32,35,40,41	0
2	NAD	D	501	44/44	0.97	0.05	20,26,31,33	0
3	ADE	D	502	10/10	0.97	0.06	32,35,40,41	0
3	ADE	B	503	10/10	0.97	0.06	32,35,39,42	0
5	K	B	504	1/1	0.98	0.11	32,32,32,32	0
5	K	C	505	1/1	0.98	0.07	29,29,29,29	0
2	NAD	A	501	44/44	0.98	0.05	21,26,31,34	0
5	K	D	503	1/1	0.99	0.06	24,24,24,24	0
5	K	A	504	1/1	1.00	0.03	26,26,26,26	0

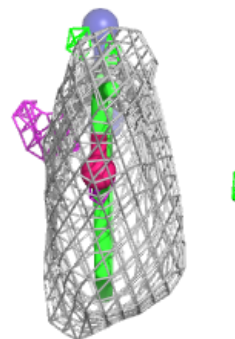
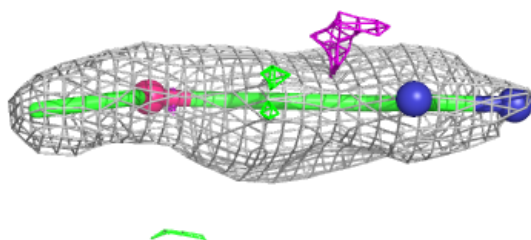
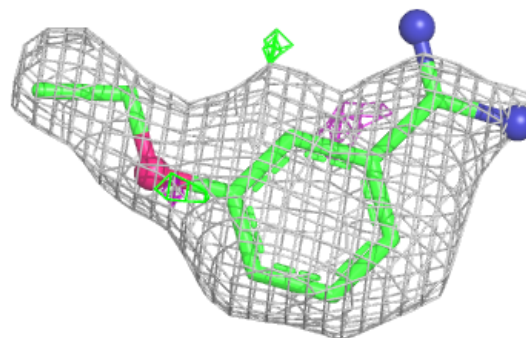
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around RD4 A 503:

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

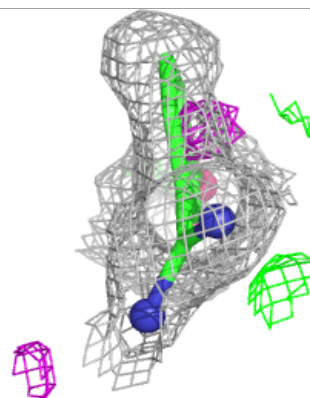
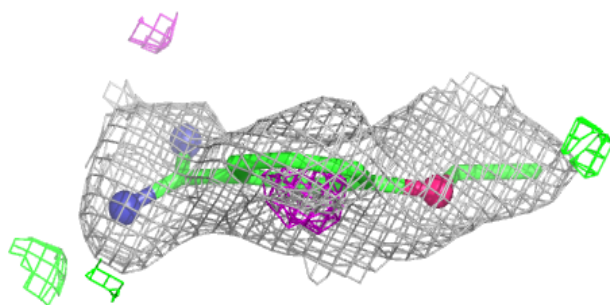
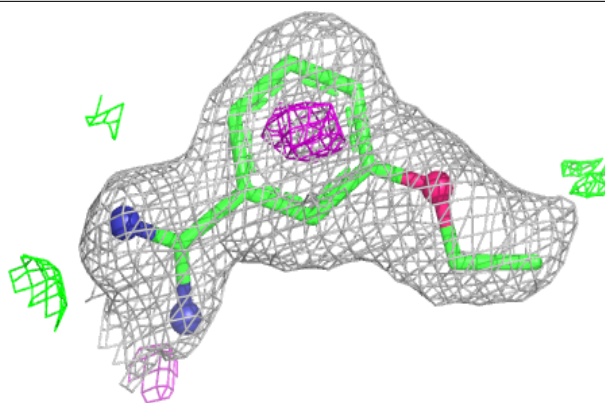
**Electron density around RD4 B 501:**

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

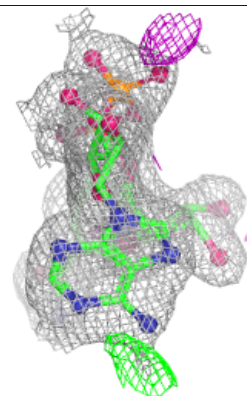
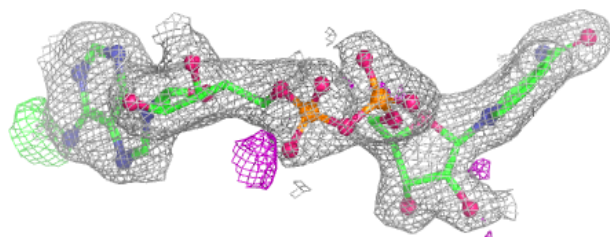
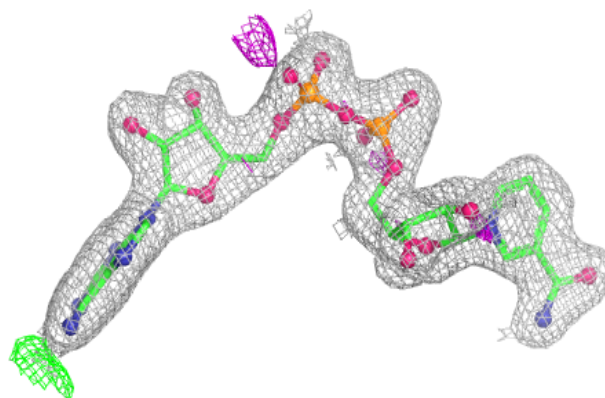


Electron density around RD4 C 501:

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

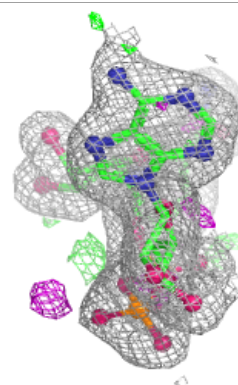
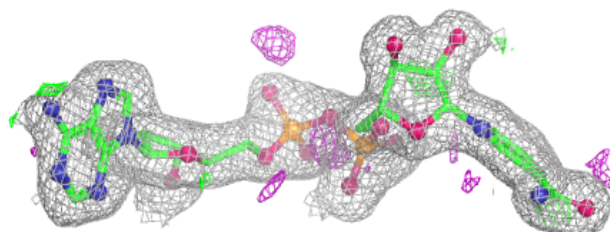
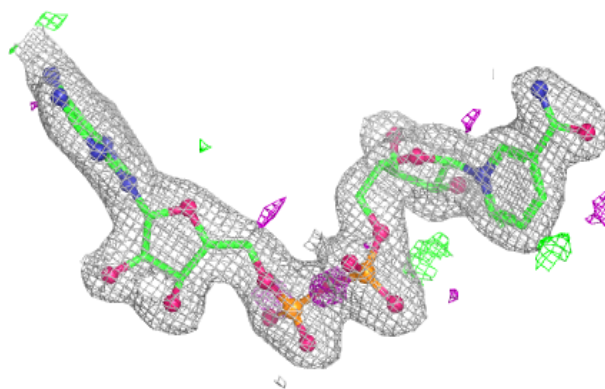
**Electron density around NAD C 502:**

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

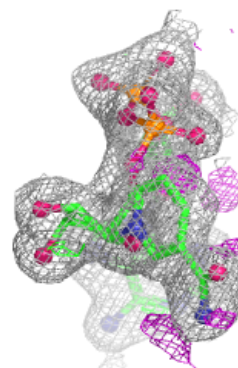
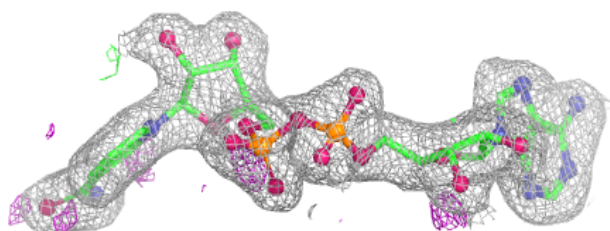
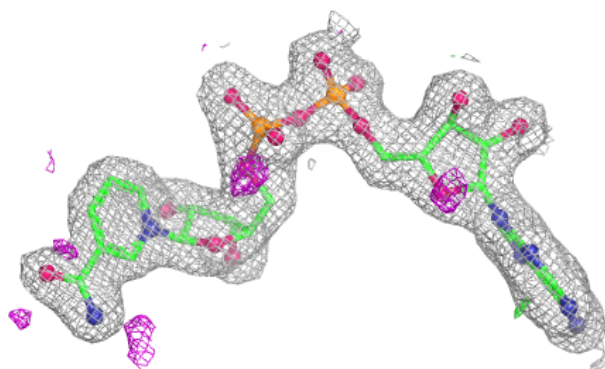


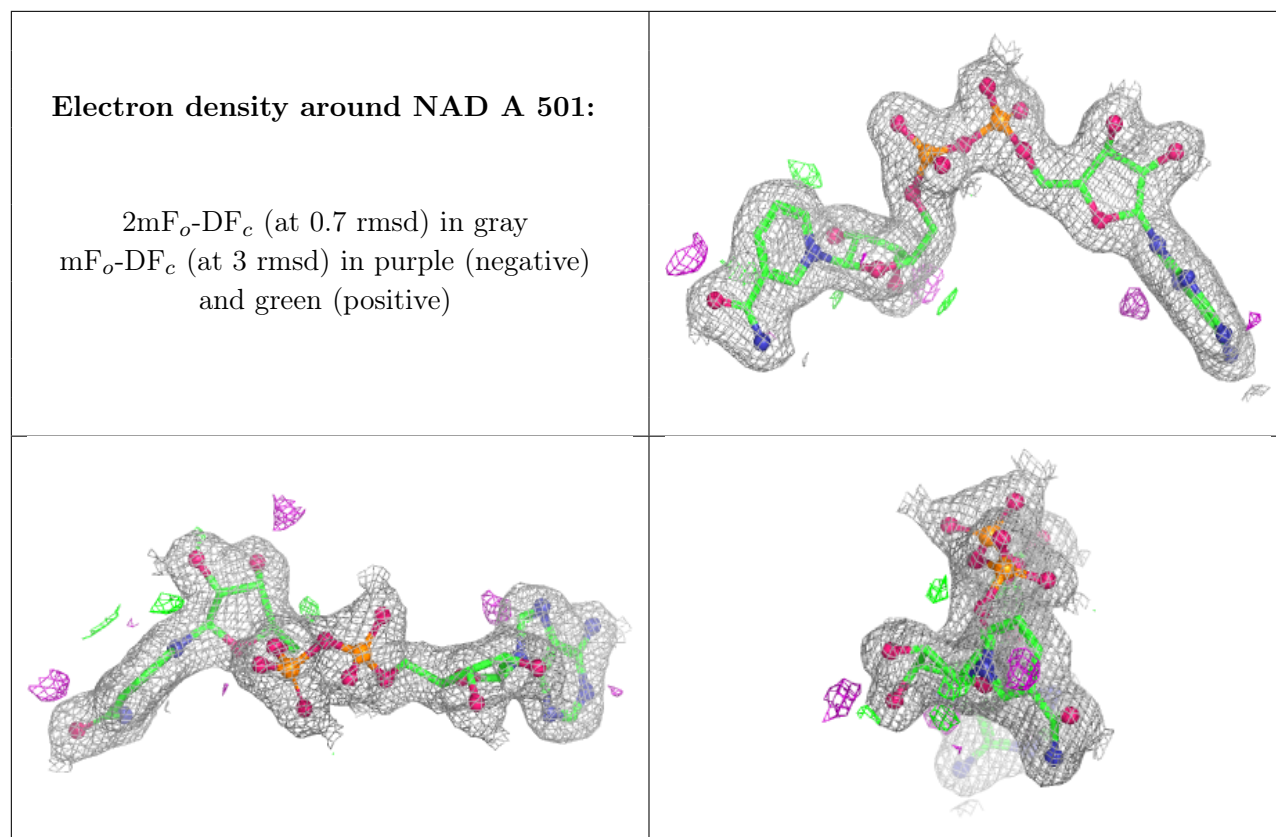
Electron density around NAD B 502:

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

**Electron density around NAD D 501:**

$2mF_o-DF_c$ (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.