



Full wwPDB X-ray Structure Validation Report ⓘ

Jan 30, 2025 – 12:12 PM EST

PDB ID : 9E5W
Title : Proline utilization A (PutA) from *Sinorhizobium meliloti* inactivated by N-propargylglycine
Authors : Tanner, J.J.
Deposited on : 2024-10-28
Resolution : 1.52 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : 1.21
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.004 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.40

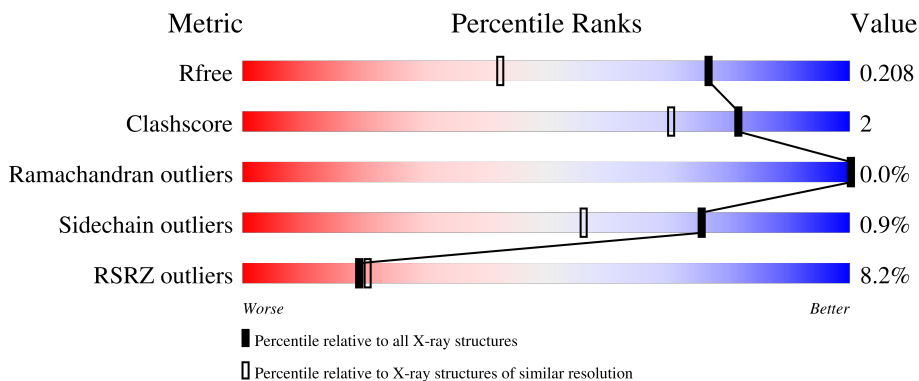
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

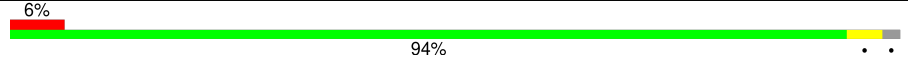
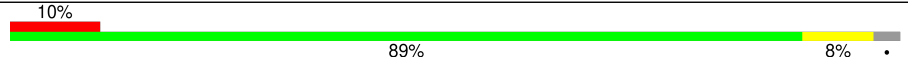
The reported resolution of this entry is 1.52 Å.

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}	164625	5293 (1.54-1.50)
Clashscore	180529	5759 (1.54-1.50)
Ramachandran outliers	177936	5653 (1.54-1.50)
Sidechain outliers	177891	5650 (1.54-1.50)
RSRZ outliers	164620	5293 (1.54-1.50)

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	1235	
1	B	1235	

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 19524 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.

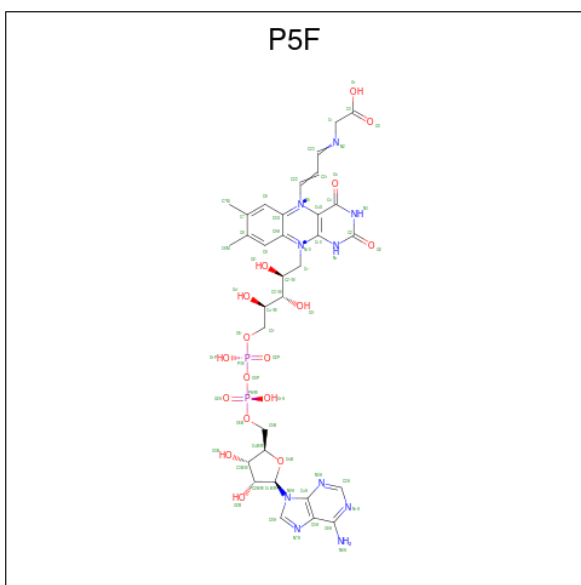
- Molecule 1 is a protein called Bifunctional protein PutA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1212	Total 8954	C 5638	N 1596	O 1687	S 33	0	17	0
1	B	1202	Total 8839	C 5566	N 1582	O 1659	S 32	0	6	0

There are 4 discrepancies between the modelled and reference sequences:

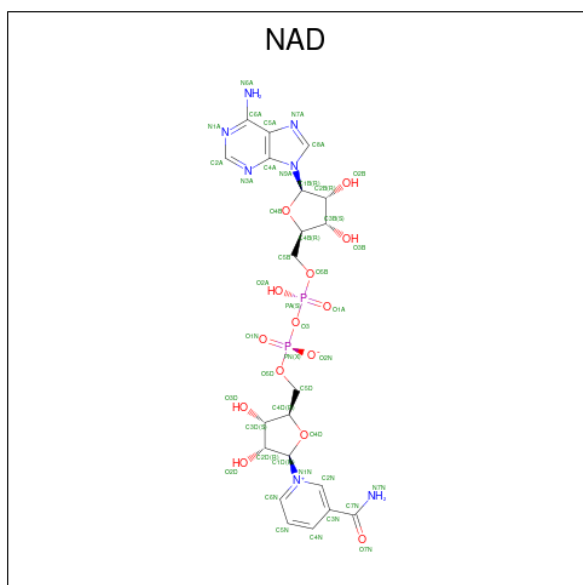
Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	SER	-	expression tag	UNP Q92SD7
A	0	MET	-	expression tag	UNP Q92SD7
B	-1	SER	-	expression tag	UNP Q92SD7
B	0	MET	-	expression tag	UNP Q92SD7

- Molecule 2 is N-propargylglycine-modified flavin adenine dinucleotide (three-letter code: P5F) (formula: $C_{32}H_{40}N_{10}O_{17}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			56	30	9	15	2		
2	B	1	Total	C	N	O	P	0	0
			56	30	9	15	2		

- Molecule 3 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: C₂₁H₂₇N₇O₁₄P₂) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 4 is SULFATE ION (three-letter code: SO₄) (formula: O₄S).



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

- Molecule 5 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

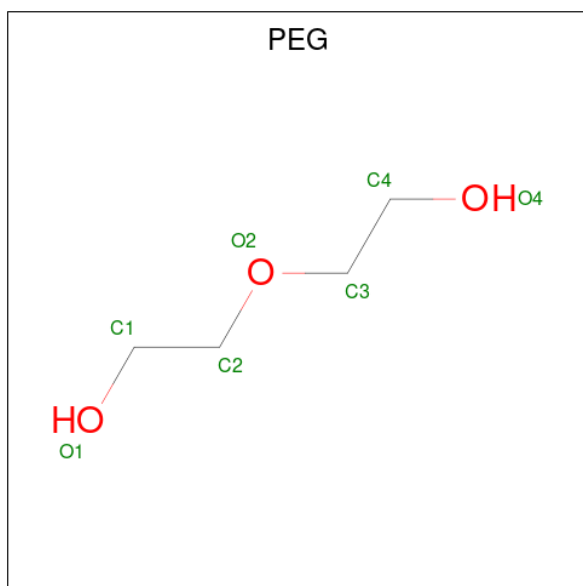
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total Mg 1 1	0	0
5	B	1	Total Mg 1 1	0	0

- Molecule 6 is FORMIC ACID (three-letter code: FMT) (formula: CH₂O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			3	1	2		
6	B	1	Total	C	O	0	0
			3	1	2		

- Molecule 7 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C₄H₁₀O₃).



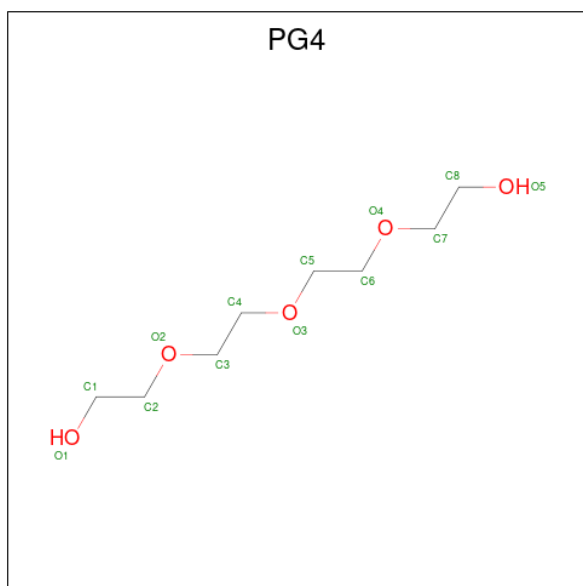
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			7	4	3		
7	A	1	Total	C	O	0	0
			7	4	3		

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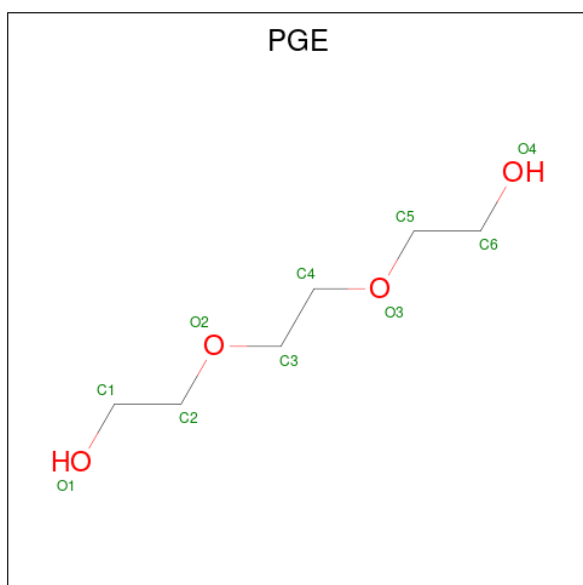
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	B	1	Total	C	O	0	0
			7	4	3		

- Molecule 8 is TETRAETHYLENE GLYCOL (three-letter code: PG4) (formula: $C_8H_{18}O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	B	1	Total	C	O	0	0
			13	8	5		

- Molecule 9 is TRIETHYLENE GLYCOL (three-letter code: PGE) (formula: $C_6H_{14}O_4$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	C	O	0	0
			10	6	4		

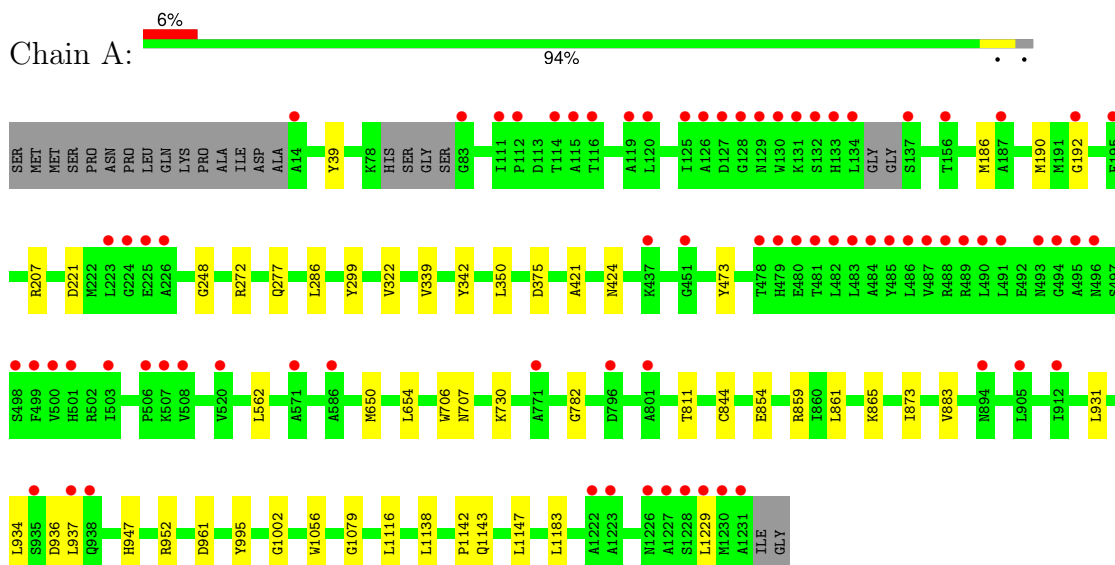
- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	719	Total	O	0	0
			719	719		
10	B	725	Total	O	0	0
			725	725		

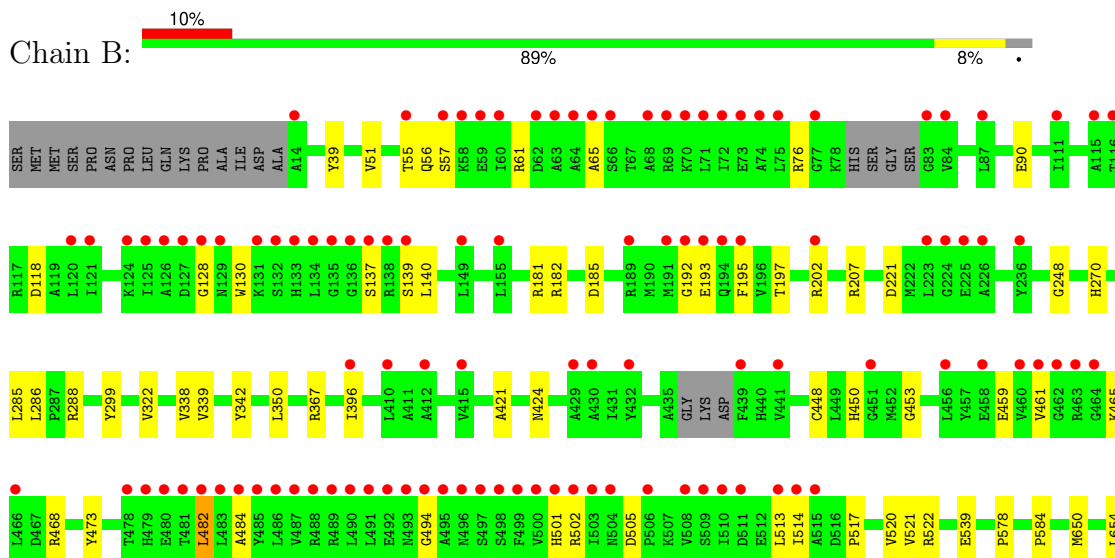
3 Residue-property plots [i](#)

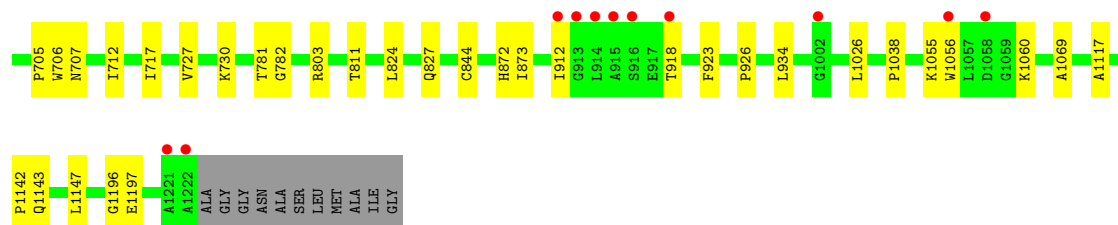
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Bifunctional protein PutA



- Molecule 1: Bifunctional protein PutA





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	100.85Å 101.97Å 126.57Å 90.00° 106.50° 90.00°	Depositor
Resolution (Å)	47.00 – 1.52 47.00 – 1.52	Depositor EDS
% Data completeness (in resolution range)	92.3 (47.00-1.52) 98.0 (47.00-1.52)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.38 (at 1.52Å)	Xtrriage
Refinement program	PHENIX 1.21rc1_5156	Depositor
R, R_{free}	0.191 , 0.211 0.188 , 0.208	Depositor DCC
R_{free} test set	18633 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	19.2	Xtrriage
Anisotropy	0.204	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 32.9	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	19524	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.60% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: PGE, FMT, PG4, NAD, MG, SO4, PEG, P5F

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	0.32	0/9143	0.59	0/12460
1	B	0.33	0/9012	0.59	0/12278
All	All	0.33	0/18155	0.59	0/24738

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	8954	0	8883	30	0
1	B	8839	0	8787	56	0
2	A	56	0	35	4	0
2	B	56	0	35	3	0
3	A	44	0	26	2	0
3	B	44	0	26	2	0
4	A	25	0	0	0	0
4	B	10	0	0	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
6	A	3	0	1	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	3	0	1	0	0
7	A	14	0	20	2	0
7	B	7	0	10	1	0
8	B	13	0	18	0	0
9	B	10	0	14	0	0
10	A	719	0	0	1	0
10	B	725	0	0	2	0
All	All	19524	0	17856	86	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 (86) 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:1079:GLY:HA2	7:A:1310:PEG:H41	1.48	0.94
1:B:55:THR:HG22	1:B:522:ARG:HH22	1.35	0.91
1:A:473:TYR:HB2	2:A:1301:P5F:H18	1.60	0.81
1:B:1196:GLY:HA3	7:B:1307:PEG:H12	1.64	0.78
1:B:473:TYR:HB2	2:B:1301:P5F:H18	1.64	0.77
1:B:844:CYS:SG	3:B:1302:NAD:C4N	2.79	0.70
1:B:539:GLU:OE1	10:B:1401:HOH:O	2.10	0.67
1:A:873:ILE:HG13	1:A:883:VAL:HB	1.77	0.66
1:A:844:CYS:SG	3:A:1302:NAD:C4N	2.83	0.65
1:A:1183:LEU:O	10:A:1401:HOH:O	2.13	0.65
1:B:286:LEU:HD21	1:B:322:VAL:HG11	1.80	0.64
1:A:961:ASP:OD2	1:B:1055:LYS:NZ	2.30	0.63
1:B:421:ALA:HB1	2:B:1301:P5F:H22	1.81	0.62
1:B:56:GLN:O	1:B:61:ARG:NH1	2.33	0.60
1:A:854:GLU:HG2	1:A:952:ARG:HE	1.66	0.60
1:A:286:LEU:HD21	1:A:322:VAL:HG11	1.85	0.59
1:B:339:VAL:HG21	1:B:350:LEU:HD21	1.85	0.59
1:B:51:VAL:O	1:B:55:THR:HG23	2.03	0.59
1:B:502:ARG:HB3	1:B:513:LEU:HD21	1.83	0.58
1:B:192:GLY:O	1:B:207:ARG:NH1	2.37	0.57
1:B:650:MET:O	1:B:654:LEU:HG	2.04	0.57
1:B:195:PHE:HB3	1:B:482:LEU:HD11	1.87	0.55
1:A:1116[B]:LEU:HD11	1:A:1138:LEU:HD11	1.89	0.55
1:B:396:ILE:HD11	1:B:517:PRO:HA	1.91	0.53
1:B:459:GLU:OE1	1:B:465:LYS:NZ	2.39	0.52
1:B:1026:LEU:HD23	1:B:1038:PRO:HG2	1.92	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:824:LEU:HD23	1:B:827:GLN:HG3	1.92	0.51
1:B:494:GLY:HA2	1:B:501:HIS:HB2	1.93	0.51
1:A:995:TYR:OH	1:A:1002[A]:GLY:O	2.20	0.51
1:B:90:GLU:OE1	1:B:182:ARG:NH2	2.41	0.50
1:A:562:LEU:HD11	1:A:654:LEU:HD12	1.94	0.49
1:B:803:ARG:NH2	1:B:1197:GLU:OE1	2.28	0.49
1:B:1056:TRP:CD1	1:B:1142:PRO:HD3	2.49	0.47
1:B:65:ALA:HB1	1:B:514:ILE:HD12	1.95	0.47
1:A:706:TRP:CE3	1:A:707:ASN:HA	2.50	0.47
1:A:1056:TRP:CD1	1:A:1142:PRO:HD3	2.50	0.47
1:B:424:ASN:HB2	2:B:1301:P5F:H1	1.79	0.47
1:A:339:VAL:HG21	1:A:350:LEU:HD21	1.97	0.47
1:B:181:ARG:NH1	1:B:185:ASP:OD1	2.46	0.47
1:A:421:ALA:HB1	2:A:1301:P5F:H22	1.97	0.47
2:A:1301:P5F:C4	2:A:1301:P5F:H35	2.45	0.47
1:A:424:ASN:HB2	2:A:1301:P5F:H1	1.80	0.46
1:B:270:HIS:HB2	1:B:285:LEU:HG	1.96	0.46
1:A:221:ASP:HB2	1:A:473:TYR:CZ	2.51	0.46
1:B:288:ARG:HD3	10:B:1707:HOH:O	2.16	0.46
1:B:197:THR:O	1:B:207:ARG:HD2	2.15	0.46
1:B:706:TRP:CE3	1:B:707:ASN:HA	2.51	0.46
1:B:1056:TRP:CZ2	1:B:1060:LYS:HD2	2.50	0.46
1:A:844:CYS:SG	3:A:1302:NAD:C3N	3.04	0.46
1:A:931:LEU:HD13	1:A:936:ASP:HB2	1.98	0.45
1:A:272:ARG:HB3	1:A:277:GLN:HG3	1.97	0.45
1:A:650:MET:O	1:A:654:LEU:HG	2.17	0.45
1:B:118:ASP:OD1	1:B:181:ARG:NH2	2.49	0.45
1:A:782:GLY:O	1:A:811:THR:HA	2.17	0.45
7:A:1310:PEG:H42	7:A:1310:PEG:H21	1.71	0.45
1:B:128:GLY:O	1:B:130:TRP:N	2.46	0.45
1:A:1147:LEU:HD22	1:B:1147:LEU:HD13	1.99	0.45
1:B:782:GLY:O	1:B:811:THR:HA	2.17	0.44
1:B:448:CYS:HB2	1:B:453:GLY:HA3	2.00	0.44
1:B:1143:GLN:O	1:B:1147:LEU:HG	2.18	0.44
1:A:192:GLY:O	1:A:207:ARG:NH1	2.46	0.43
1:B:1060:LYS:HB3	1:B:1060:LYS:HE3	1.72	0.43
1:B:844:CYS:SG	3:B:1302:NAD:C3N	3.06	0.43
1:A:1143:GLN:O	1:A:1147:LEU:HG	2.19	0.43
1:A:248:GLY:HA3	1:A:299:TYR:CG	2.54	0.42
1:A:375[A]:ASP:OD1	1:A:1229:LEU:HB3	2.19	0.42
1:B:221:ASP:HB2	1:B:473:TYR:CZ	2.54	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:578:PRO:O	1:B:584:PRO:HA	2.19	0.42
1:B:76:ARG:NH2	1:B:505:ASP:O	2.52	0.42
1:B:193:GLU:O	1:B:450:HIS:NE2	2.43	0.42
1:B:248:GLY:HA3	1:B:299:TYR:CG	2.55	0.42
1:A:937:LEU:HD21	1:A:947:HIS:CD2	2.54	0.41
1:B:717:ILE:HG12	1:B:727:VAL:HG11	2.02	0.41
1:A:186:MET:O	1:A:190:MET:HG3	2.20	0.41
1:B:396:ILE:HG12	1:B:521:VAL:HG23	2.01	0.41
1:A:861:LEU:HG	1:A:865:LYS:HE3	2.01	0.41
1:B:918:THR:HB	1:B:923:PHE:CD1	2.55	0.41
1:B:461:VAL:HG12	1:B:468:ARG:O	2.21	0.41
1:B:712:ILE:HD13	1:B:781:THR:HG21	2.03	0.41
1:B:1069:ALA:HA	1:B:1117:ALA:HB1	2.02	0.41
1:B:338:VAL:HG22	1:B:367:ARG:HB3	2.01	0.41
1:B:396:ILE:HD11	1:B:520:VAL:HB	2.03	0.41
1:B:912:ILE:HD11	1:B:926:PRO:HD2	2.02	0.41
1:B:705:PRO:HD3	1:B:781:THR:HB	2.03	0.40
1:B:873:ILE:HD11	1:B:912:ILE:HD11	2.02	0.40
1:B:57:SER:O	1:B:61:ARG:HG3	2.20	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	1223/1235 (99%)	1204 (98%)	19 (2%)	0	100	100
1	B	1202/1235 (97%)	1174 (98%)	27 (2%)	1 (0%)	48	25
All	All	2425/2470 (98%)	2378 (98%)	46 (2%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	484	ALA

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	886/951 (93%)	881 (99%)	5 (1%)	84	70
1	B	875/951 (92%)	864 (99%)	11 (1%)	65	39
All	All	1761/1902 (93%)	1745 (99%)	16 (1%)	75	56

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	39	TYR
1	A	342	TYR
1	A	730	LYS
1	A	859	ARG
1	A	934	LEU
1	B	39	TYR
1	B	137	SER
1	B	139	SER
1	B	140[A]	LEU
1	B	140[B]	LEU
1	B	202	ARG
1	B	342	TYR
1	B	482	LEU
1	B	730	LYS
1	B	872	HIS
1	B	934	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 20 ligands modelled in this entry, 2 are monoatomic - leaving 18 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
3	NAD	A	1302	5	42,48,48	3.77	17 (40%)	50,73,73	1.95	6 (12%)
4	SO4	A	1307	-	4,4,4	0.66	0	6,6,6	0.19	0
4	SO4	B	1304	-	4,4,4	0.67	0	6,6,6	0.11	0
7	PEG	A	1311	-	6,6,6	0.24	0	5,5,5	0.11	0
4	SO4	A	1303	-	4,4,4	0.59	0	6,6,6	0.32	0
4	SO4	A	1305	-	4,4,4	0.66	0	6,6,6	0.28	0
3	NAD	B	1302	5	42,48,48	3.62	16 (38%)	50,73,73	1.76	4 (8%)
6	FMT	A	1309	-	2,2,2	0.54	0	1,1,1	0.31	0
7	PEG	B	1307	-	6,6,6	0.24	0	5,5,5	0.40	0
8	PG4	B	1308	-	12,12,12	0.30	0	11,11,11	0.25	0
4	SO4	A	1304	-	4,4,4	0.62	0	6,6,6	0.29	0
7	PEG	A	1310	-	6,6,6	0.25	0	5,5,5	0.15	0
9	PGE	B	1309	-	9,9,9	0.30	0	8,8,8	0.54	0
2	P5F	B	1301	1	53,61,66	2.58	18 (33%)	62,93,99	2.52	15 (24%)
4	SO4	A	1306	-	4,4,4	0.67	0	6,6,6	0.14	0
2	P5F	A	1301	1	53,61,66	2.48	16 (30%)	62,93,99	2.25	17 (27%)
6	FMT	B	1306	-	2,2,2	0.82	0	1,1,1	0.16	0
4	SO4	B	1303	-	4,4,4	0.62	0	6,6,6	0.21	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	NAD	A	1302	5	-	3/26/62/62	0/5/5/5
7	PEG	A	1311	-	-	0/4/4/4	-
3	NAD	B	1302	5	-	2/26/62/62	0/5/5/5
7	PEG	B	1307	-	-	1/4/4/4	-
8	PG4	B	1308	-	-	1/10/10/10	-
7	PEG	A	1310	-	-	2/4/4/4	-
9	PGE	B	1309	-	-	2/7/7/7	-
2	P5F	B	1301	1	-	1/31/53/58	0/6/6/6
2	P5F	A	1301	1	-	3/31/53/58	0/6/6/6

All (67) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1301	P5F	PA-O3P	-9.54	1.49	1.59
3	B	1302	NAD	O4D-C1D	-9.52	1.28	1.40
3	A	1302	NAD	O4D-C1D	-9.03	1.29	1.40
2	A	1301	P5F	PA-O3P	-8.47	1.50	1.59
3	A	1302	NAD	PN-O3	8.36	1.68	1.59
3	B	1302	NAD	C3B-C4B	-8.32	1.31	1.53
3	A	1302	NAD	C3B-C4B	-8.31	1.31	1.53
3	B	1302	NAD	C7N-N7N	8.21	1.48	1.33
3	A	1302	NAD	C7N-N7N	7.91	1.47	1.33
3	A	1302	NAD	C3D-C4D	-7.55	1.33	1.53
3	A	1302	NAD	O4B-C4B	7.26	1.61	1.45
3	B	1302	NAD	C3D-C4D	-7.18	1.34	1.53
3	B	1302	NAD	PN-O3	6.82	1.66	1.59
3	A	1302	NAD	O4D-C4D	6.79	1.60	1.45
3	B	1302	NAD	O4B-C4B	6.70	1.59	1.45
3	B	1302	NAD	O4D-C4D	6.54	1.59	1.45
2	A	1301	P5F	P-O3P	6.16	1.66	1.59
2	B	1301	P5F	O2-C2	5.93	1.36	1.23
2	B	1301	P5F	O4-C4	5.74	1.36	1.23
2	A	1301	P5F	O4-C4	5.31	1.35	1.23
3	A	1302	NAD	O4B-C1B	-5.29	1.34	1.40
2	A	1301	P5F	O2-C2	5.27	1.34	1.23
3	B	1302	NAD	O4B-C1B	-5.19	1.34	1.40
3	B	1302	NAD	C6A-N6A	4.44	1.50	1.34
2	B	1301	P5F	C6-C5X	4.33	1.49	1.40
2	A	1301	P5F	C6-C5X	4.32	1.49	1.40
2	B	1301	P5F	C2-N1	4.30	1.44	1.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1302	NAD	PA-O3	4.16	1.64	1.59
3	A	1302	NAD	C6A-N6A	4.06	1.48	1.34
3	B	1302	NAD	C3N-C7N	4.03	1.56	1.50
3	B	1302	NAD	O3D-C3D	4.01	1.52	1.43
2	B	1301	P5F	C9A-N10	3.99	1.45	1.40
3	A	1302	NAD	C3N-C7N	3.91	1.56	1.50
3	A	1302	NAD	O3D-C3D	3.80	1.52	1.43
2	B	1301	P5F	C9-C9A	3.76	1.48	1.40
2	A	1301	P5F	C2-N1	3.63	1.43	1.36
2	B	1301	P5F	P-O3P	3.57	1.63	1.59
2	B	1301	P5F	C10-N10	3.53	1.44	1.36
2	A	1301	P5F	C9-C9A	3.49	1.47	1.40
2	B	1301	P5F	C2A-N3A	3.29	1.37	1.32
2	A	1301	P5F	C9A-N10	3.24	1.44	1.40
3	B	1302	NAD	C2N-N1N	3.10	1.38	1.35
3	A	1302	NAD	O3B-C3B	3.09	1.50	1.43
2	A	1301	P5F	C10-N10	3.06	1.43	1.36
3	A	1302	NAD	C2N-N1N	2.99	1.38	1.35
2	A	1301	P5F	PA-O5B	-2.87	1.48	1.59
3	B	1302	NAD	O3B-C3B	2.86	1.50	1.43
2	A	1301	P5F	C6A-N6A	2.83	1.44	1.34
2	A	1301	P5F	C2A-N3A	2.78	1.36	1.32
2	B	1301	P5F	C6A-N6A	2.77	1.44	1.34
2	A	1301	P5F	C9A-C5X	-2.73	1.36	1.42
2	B	1301	P5F	C9A-C5X	-2.73	1.36	1.42
3	A	1302	NAD	C2A-N1A	2.70	1.38	1.33
3	B	1302	NAD	C2A-N1A	2.63	1.38	1.33
2	A	1301	P5F	O2'-C2'	-2.61	1.37	1.43
3	A	1302	NAD	O7N-C7N	-2.55	1.19	1.24
2	B	1301	P5F	C23-C21	-2.53	1.39	1.49
3	A	1302	NAD	C2A-N3A	2.49	1.35	1.32
2	A	1301	P5F	C23-C21	-2.39	1.39	1.49
2	B	1301	P5F	PA-O2A	-2.19	1.43	1.50
3	B	1302	NAD	C2A-N3A	2.12	1.35	1.32
2	B	1301	P5F	C10-N1	2.11	1.44	1.37
2	A	1301	P5F	C2B-C3B	-2.10	1.47	1.53
2	B	1301	P5F	O3B-C3B	-2.02	1.38	1.43
2	B	1301	P5F	C2B-C3B	-2.02	1.47	1.53
3	B	1302	NAD	O7N-C7N	-2.01	1.20	1.24
2	B	1301	P5F	O2'-C2'	-2.00	1.39	1.43

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1301	P5F	C4X-N5-C5X	-8.56	111.80	121.85
3	A	1302	NAD	C1B-N9A-C4A	-8.11	112.40	126.64
2	A	1301	P5F	C4X-N5-C5X	-7.75	112.75	121.85
2	B	1301	P5F	C1'-N10-C9A	7.56	123.88	118.34
3	A	1302	NAD	N3A-C2A-N1A	-6.69	119.59	128.67
2	B	1301	P5F	C10-N1-C2	-6.47	118.00	128.11
3	B	1302	NAD	C1B-N9A-C4A	-6.46	115.28	126.64
3	B	1302	NAD	N3A-C2A-N1A	-6.43	119.94	128.67
2	A	1301	P5F	C1'-N10-C9A	6.27	122.94	118.34
2	B	1301	P5F	N3A-C2A-N1A	-6.18	120.29	128.67
2	A	1301	P5F	N3A-C2A-N1A	-6.10	120.39	128.67
2	B	1301	P5F	O3P-PA-O2A	-5.75	93.41	110.70
2	A	1301	P5F	C10-N1-C2	-5.68	119.24	128.11
2	B	1301	P5F	O1A-PA-O3P	5.35	121.72	107.27
3	A	1302	NAD	C4D-O4D-C1D	-5.15	105.20	109.92
2	A	1301	P5F	O3P-PA-O2A	-3.98	98.72	110.70
3	B	1302	NAD	C4B-O4B-C1B	-3.86	106.39	109.92
2	B	1301	P5F	O1P-P-O3P	3.65	117.15	107.27
2	A	1301	P5F	O1A-PA-O3P	3.62	117.05	107.27
2	A	1301	P5F	O1P-P-O3P	3.56	116.89	107.27
3	B	1302	NAD	C4D-O4D-C1D	-3.55	106.67	109.92
2	A	1301	P5F	C4-N3-C2	-3.52	118.59	126.47
2	B	1301	P5F	N1-C2-N3	3.50	122.21	116.17
2	A	1301	P5F	N1-C2-N3	3.43	122.09	116.17
3	A	1302	NAD	C4B-O4B-C1B	-3.03	107.15	109.92
2	B	1301	P5F	C4-N3-C2	-2.91	119.97	126.47
2	B	1301	P5F	C4'-C3'-C2'	2.86	118.33	113.57
2	B	1301	P5F	C6-C5X-N5	-2.69	118.56	121.68
2	B	1301	P5F	O5B-PA-O2A	-2.61	98.57	108.94
2	B	1301	P5F	C1B-N9A-C4A	-2.60	122.07	126.64
2	A	1301	P5F	C1B-N9A-C4A	-2.39	122.44	126.64
2	A	1301	P5F	O3P-P-O2P	-2.38	103.54	110.70
2	B	1301	P5F	O5'-P-O2P	-2.35	99.62	108.94
3	A	1302	NAD	C2D-C3D-C4D	2.30	107.06	102.61
2	A	1301	P5F	C9-C9A-C5X	2.30	121.42	119.07
2	B	1301	P5F	O2-C2-N1	-2.29	118.88	122.12
2	A	1301	P5F	O5'-C5'-C4'	2.28	115.43	109.36
2	A	1301	P5F	O2-C2-N1	-2.17	119.05	122.12
2	A	1301	P5F	C4A-C5A-N7A	-2.14	107.08	109.34
2	A	1301	P5F	O5'-P-O2P	-2.03	100.88	108.94
3	A	1302	NAD	C2N-C3N-C4N	2.02	120.61	118.26
2	A	1301	P5F	O5B-PA-O2A	-2.01	100.97	108.94

There are no chirality outliers.

All (15) torsion outliers are listed below:

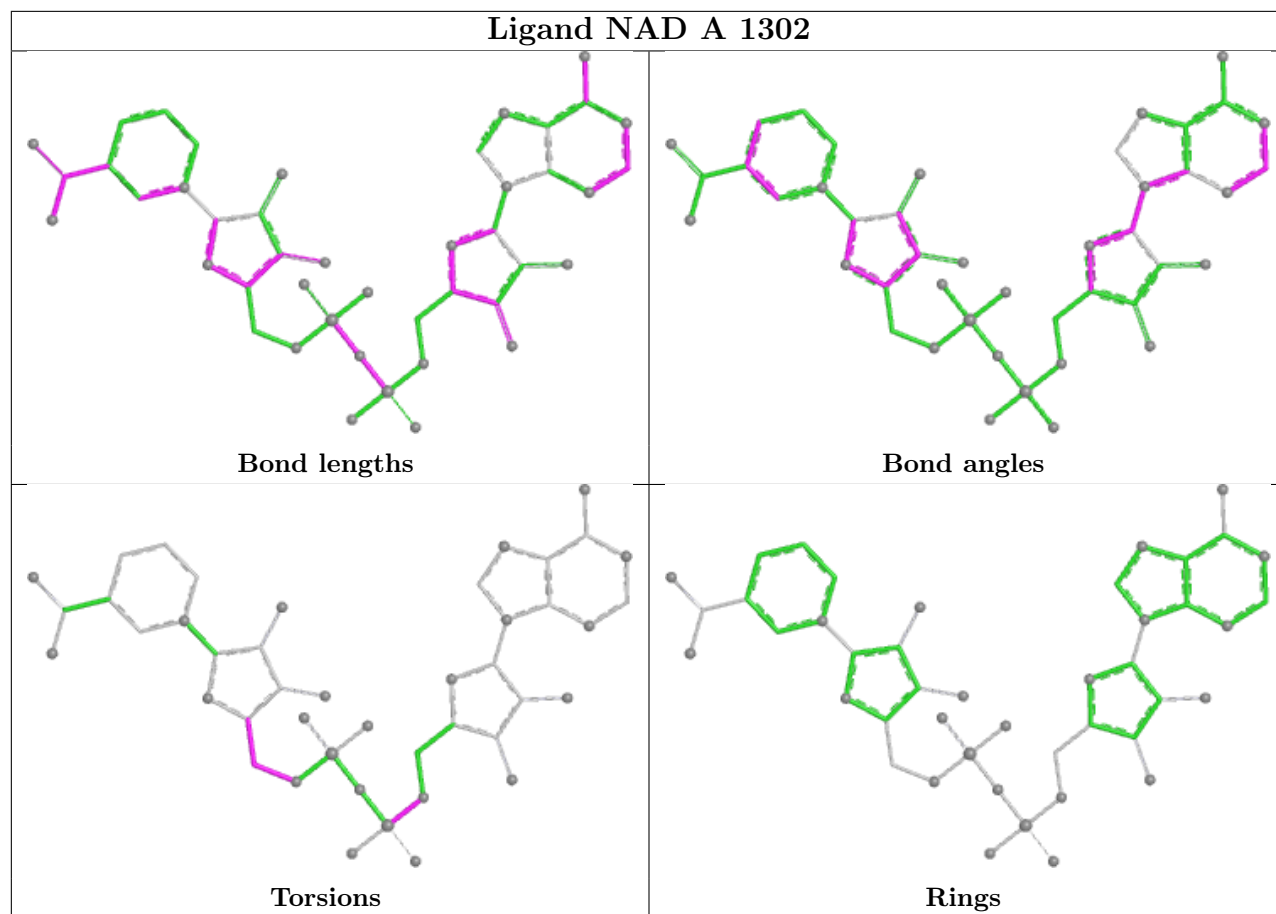
Mol	Chain	Res	Type	Atoms
7	B	1307	PEG	O2-C3-C4-O4
2	A	1301	P5F	C2'-C3'-C4'-O4'
3	B	1302	NAD	C4D-C5D-O5D-PN
7	A	1310	PEG	C4-C3-O2-C2
8	B	1308	PG4	O4-C7-C8-O5
3	A	1302	NAD	C5B-O5B-PA-O1A
3	B	1302	NAD	C5B-O5B-PA-O1A
3	A	1302	NAD	C4D-C5D-O5D-PN
9	B	1309	PGE	O3-C5-C6-O4
9	B	1309	PGE	C4-C3-O2-C2
3	A	1302	NAD	C3D-C4D-C5D-O5D
2	A	1301	P5F	PA-O3P-P-O1P
2	B	1301	P5F	PA-O3P-P-O1P
2	A	1301	P5F	C4'-C5'-O5'-P
7	A	1310	PEG	C1-C2-O2-C3

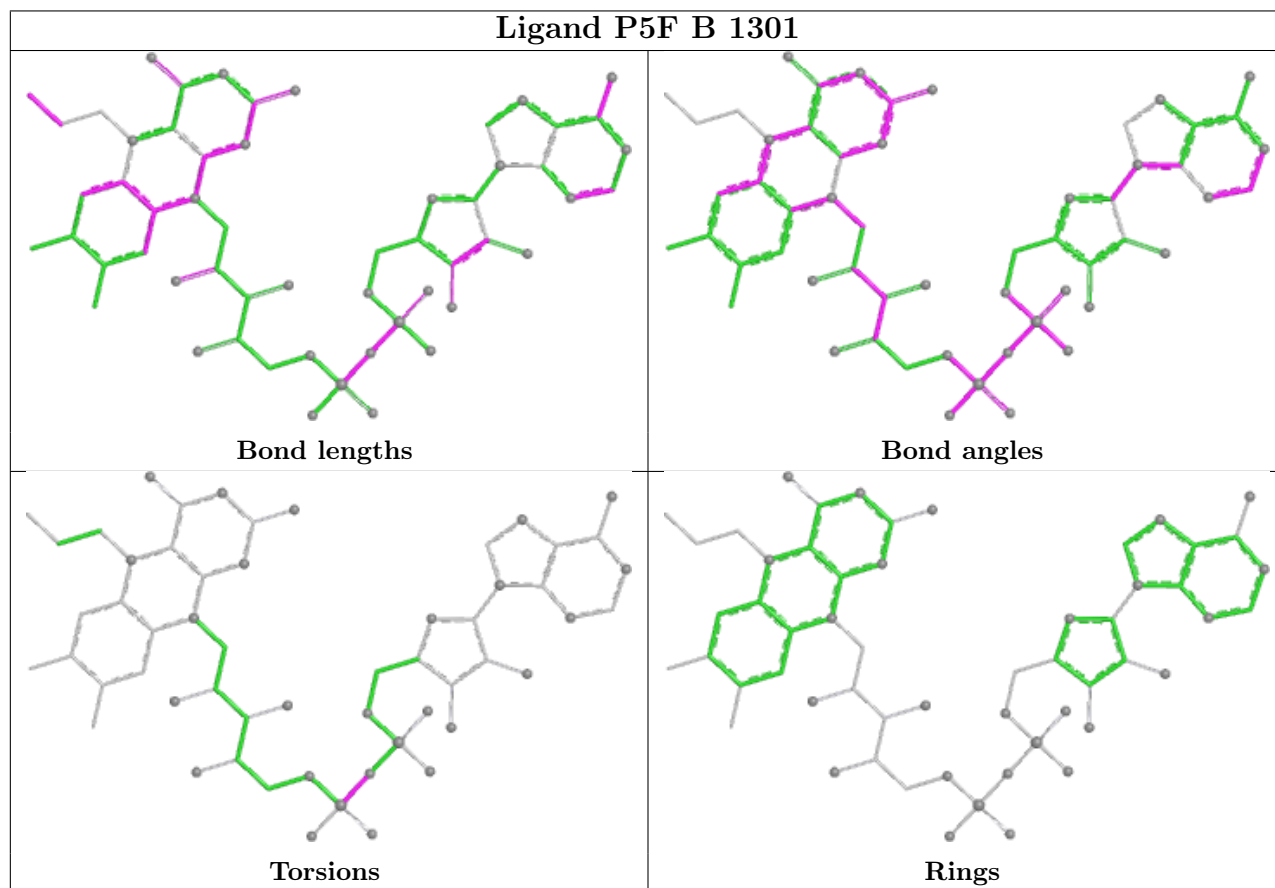
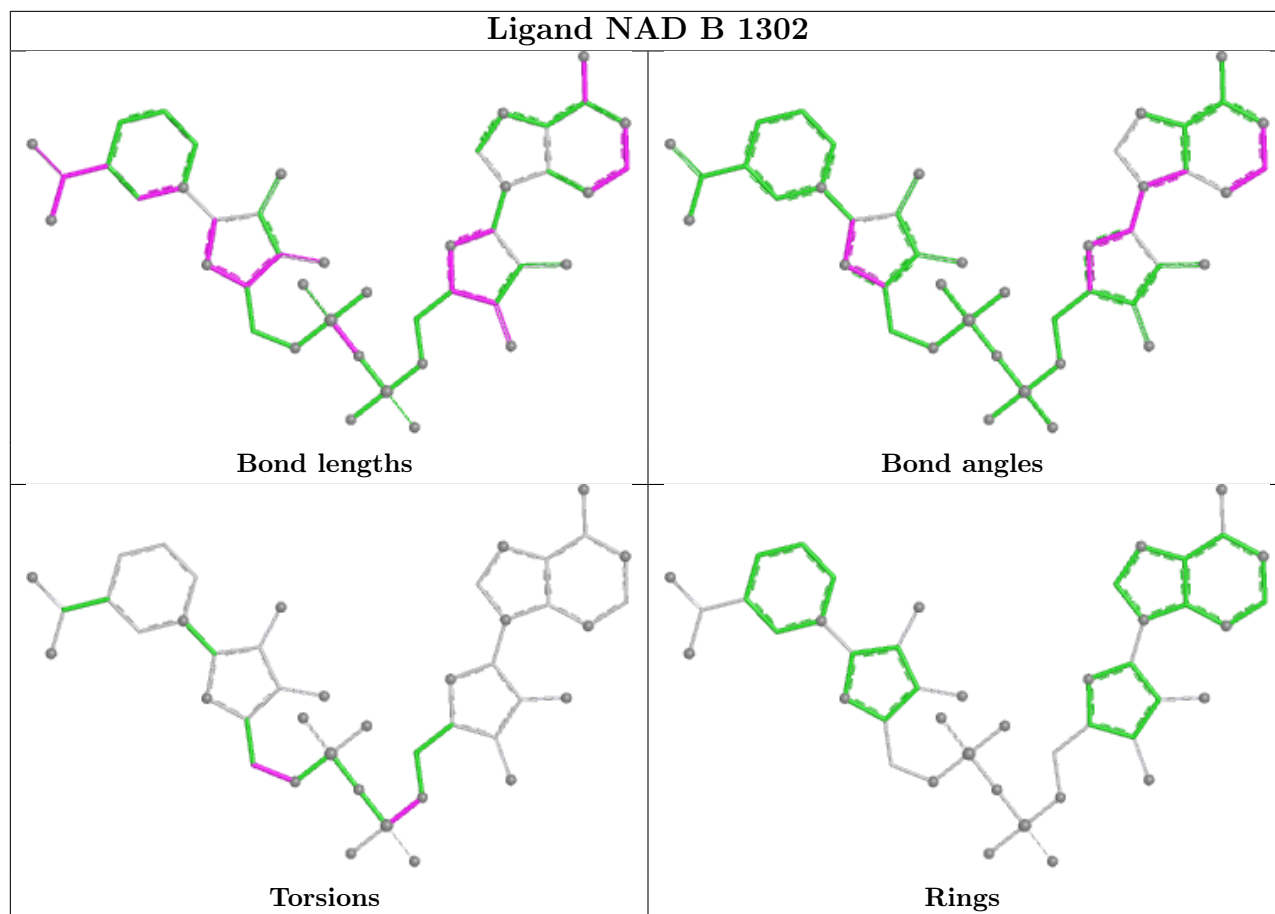
There are no ring outliers.

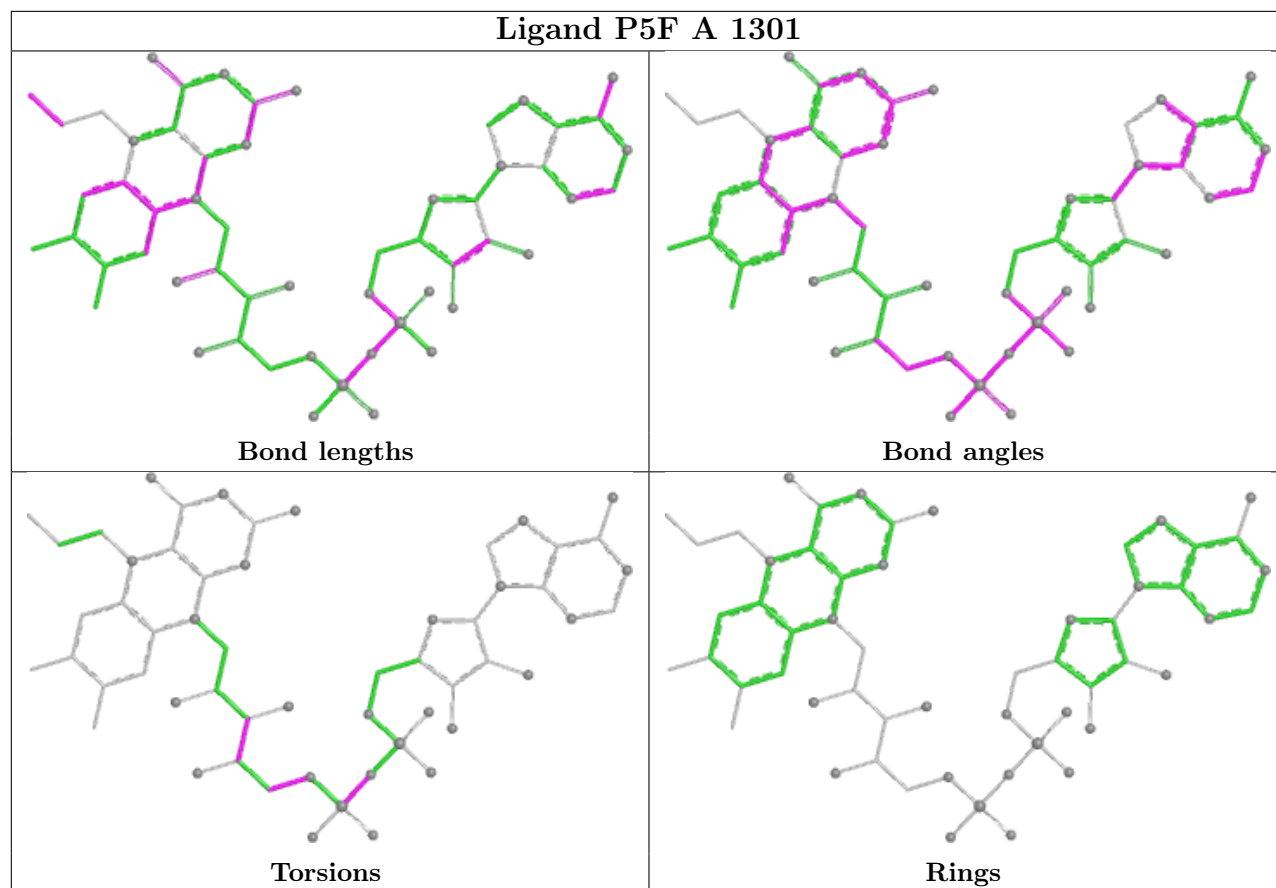
6 monomers are involved in 14 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1302	NAD	2	0
3	B	1302	NAD	2	0
7	B	1307	PEG	1	0
7	A	1310	PEG	2	0
2	B	1301	P5F	3	0
2	A	1301	P5F	4	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	1212/1235 (98%)	0.23	76 (6%) 27 30	8, 23, 45, 90	17 (1%)
1	B	1202/1235 (97%)	0.37	121 (10%) 14 15	10, 22, 48, 83	6 (0%)
All	All	2414/2470 (97%)	0.30	197 (8%) 19 20	8, 22, 47, 90	23 (0%)

All (197) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	485	TYR	9.0
1	B	491	LEU	8.4
1	B	487	VAL	8.1
1	B	486	LEU	7.7
1	A	483	LEU	6.9
1	B	488	ARG	6.9
1	A	490	LEU	6.8
1	B	490	LEU	6.8
1	B	484	ALA	6.4
1	A	485	TYR	6.3
1	B	494	GLY	6.3
1	B	500	VAL	6.1
1	A	486	LEU	6.1
1	B	495	ALA	5.9
1	A	487	VAL	5.9
1	A	484	ALA	5.8
1	B	508	VAL	5.8
1	B	483	LEU	5.6
1	A	491	LEU	5.5
1	B	493	ASN	5.5
1	B	192	GLY	5.4
1	B	1222	ALA	5.1
1	A	503	ILE	5.1
1	A	1231	ALA	5.0

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Mol	Chain	Res	Type	RSRZ
1	B	503	ILE	5.0
1	B	912	ILE	5.0
1	B	14	ALA	4.9
1	B	496	ASN	4.7
1	A	127	ASP	4.6
1	A	482	LEU	4.5
1	B	915	ALA	4.4
1	A	496	ASN	4.4
1	A	493	ASN	4.4
1	B	129	ASN	4.3
1	B	489	ARG	4.3
1	B	224	GLY	4.3
1	A	195	PHE	4.2
1	A	134	LEU	4.2
1	B	497	SER	4.1
1	B	913	GLY	4.1
1	B	75	LEU	4.1
1	B	138	ARG	4.0
1	B	74	ALA	4.0
1	B	510	ILE	3.9
1	A	488	ARG	3.9
1	B	513	LEU	3.8
1	B	66	SER	3.8
1	B	499	PHE	3.8
1	A	132	SER	3.7
1	A	489	ARG	3.6
1	A	130	TRP	3.6
1	B	65	ALA	3.6
1	A	129	ASN	3.6
1	B	439	PHE	3.6
1	B	415	VAL	3.5
1	B	479	HIS	3.5
1	A	796	ASP	3.5
1	A	14	ALA	3.5
1	B	132	SER	3.5
1	B	482	LEU	3.5
1	B	71	LEU	3.4
1	B	194	GLN	3.4
1	B	456	LEU	3.4
1	B	137	SER	3.4
1	A	115	ALA	3.4
1	A	508	VAL	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	223	LEU	3.4
1	A	506	PRO	3.4
1	B	506	PRO	3.4
1	A	500	VAL	3.4
1	B	72	ILE	3.3
1	A	114	THR	3.3
1	B	515	ALA	3.3
1	B	504	ASN	3.3
1	B	492	GLU	3.3
1	B	498	SER	3.3
1	A	494	GLY	3.2
1	B	461	VAL	3.2
1	B	191	MET	3.2
1	A	192	GLY	3.2
1	A	495	ALA	3.1
1	B	193	GLU	3.1
1	B	225	GLU	3.1
1	B	120	LEU	3.1
1	B	918	THR	3.1
1	B	128	GLY	3.1
1	B	133	HIS	3.1
1	A	119	ALA	3.0
1	B	64	ALA	3.0
1	A	137	SER	3.0
1	B	70	LYS	3.0
1	B	460	VAL	3.0
1	A	1222	ALA	3.0
1	B	60	ILE	3.0
1	A	481	THR	3.0
1	B	501	HIS	3.0
1	B	223	LEU	3.0
1	A	938	GLN	3.0
1	A	499	PHE	3.0
1	B	481	THR	2.9
1	A	120	LEU	2.9
1	B	68	ALA	2.9
1	A	905	LEU	2.9
1	B	466	LEU	2.9
1	A	437	LYS	2.9
1	B	55	THR	2.9
1	B	1221	ALA	2.9
1	B	73	GLU	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	1226	ASN	2.8
1	A	501	HIS	2.8
1	B	464	GLY	2.8
1	B	509	SER	2.8
1	B	514	ILE	2.8
1	A	116	THR	2.8
1	A	1230	MET	2.7
1	B	69	ARG	2.7
1	B	77	GLY	2.7
1	B	914	LEU	2.7
1	B	412	ALA	2.6
1	B	134	LEU	2.6
1	A	451	GLY	2.6
1	A	226	ALA	2.6
1	A	1228	SER	2.6
1	B	202	ARG	2.6
1	B	83	GLY	2.5
1	B	502	ARG	2.5
1	B	139	SER	2.5
1	A	133	HIS	2.5
1	B	116	THR	2.5
1	A	1229	LEU	2.5
1	B	155	LEU	2.5
1	B	57	SER	2.5
1	B	462	GLY	2.5
1	B	478	THR	2.5
1	A	912	ILE	2.5
1	B	236	TYR	2.5
1	A	1223	ALA	2.5
1	B	430	ALA	2.5
1	A	125	ILE	2.4
1	B	432	TYR	2.4
1	A	894	ASN	2.4
1	B	410	LEU	2.4
1	B	115	ALA	2.4
1	B	429	ALA	2.4
1	B	189	ARG	2.4
1	B	125	ILE	2.4
1	B	136	GLY	2.4
1	B	84	VAL	2.4
1	B	126	ALA	2.4
1	A	224	GLY	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	463	ARG	2.3
1	A	801	ALA	2.3
1	B	63	ALA	2.3
1	A	83	GLY	2.3
1	A	126	ALA	2.3
1	A	498	SER	2.3
1	A	128	GLY	2.3
1	A	479	HIS	2.3
1	A	586	ALA	2.3
1	B	121	ILE	2.3
1	A	935	SER	2.3
1	B	195	PHE	2.2
1	B	87	LEU	2.2
1	B	149	LEU	2.2
1	A	478	THR	2.2
1	A	1227	ALA	2.2
1	A	225	GLU	2.2
1	B	59	GLU	2.2
1	B	480	GLU	2.2
1	B	62	ASP	2.2
1	A	480	GLU	2.2
1	A	571	ALA	2.2
1	B	451	GLY	2.2
1	B	1002	GLY	2.2
1	B	396	ILE	2.2
1	B	58	LYS	2.2
1	B	135	GLY	2.1
1	B	124	LYS	2.1
1	A	520	VAL	2.1
1	B	441	VAL	2.1
1	A	507	LYS	2.1
1	B	511	ASP	2.1
1	A	111	ILE	2.1
1	B	916	SER	2.1
1	B	131	LYS	2.1
1	B	458	GLU	2.1
1	A	187	ALA	2.1
1	B	226	ALA	2.1
1	B	127	ASP	2.1
1	A	156	THR	2.1
1	A	937	LEU	2.1
1	A	131	LYS	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	771	ALA	2.0
1	B	111	ILE	2.0
1	A	112	PRO	2.0
1	B	1058	ASP	2.0
1	B	1056	TRP	2.0

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

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 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.

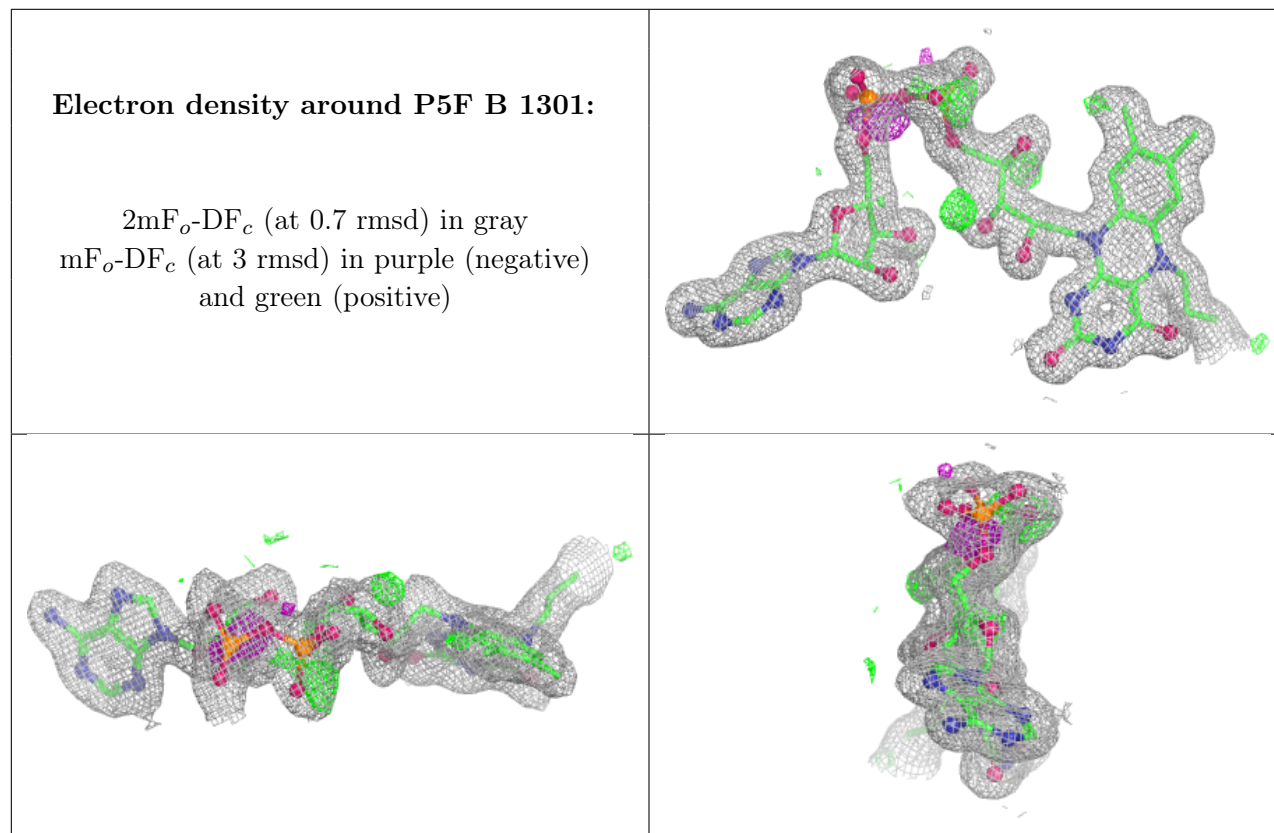
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
7	PEG	B	1307	7/7	0.75	0.18	34,38,44,46	0
4	SO4	A	1306	5/5	0.82	0.15	41,42,44,53	5
7	PEG	A	1311	7/7	0.86	0.12	30,30,36,38	0
8	PG4	B	1308	13/13	0.87	0.12	29,36,43,49	0
4	SO4	B	1304	5/5	0.89	0.12	44,44,45,45	5
4	SO4	A	1307	5/5	0.89	0.13	25,27,31,38	5
4	SO4	A	1305	5/5	0.90	0.11	31,34,37,41	5
7	PEG	A	1310	7/7	0.91	0.10	21,32,35,44	0
9	PGE	B	1309	10/10	0.92	0.10	30,32,36,38	0
6	FMT	B	1306	3/3	0.94	0.10	15,15,28,31	0
2	P5F	B	1301	56/61	0.94	0.08	19,23,30,33	0
6	FMT	A	1309	3/3	0.94	0.09	25,25,30,32	0
4	SO4	A	1304	5/5	0.95	0.09	27,31,36,36	5
3	NAD	A	1302	44/44	0.95	0.08	17,23,25,27	0
2	P5F	A	1301	56/61	0.97	0.06	15,19,25,30	0
5	MG	B	1305	1/1	0.97	0.12	27,27,27,27	0
3	NAD	B	1302	44/44	0.97	0.06	14,16,18,23	0
5	MG	A	1308	1/1	0.99	0.09	26,26,26,26	0

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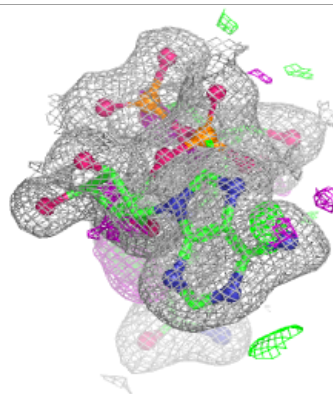
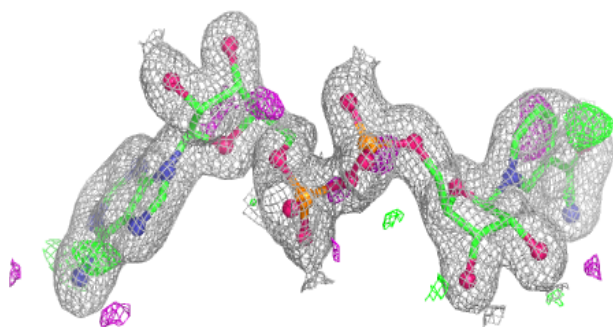
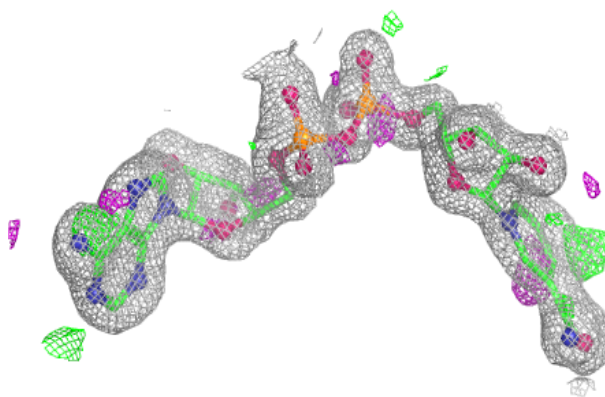
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	B	1303	5/5	0.99	0.04	17,19,20,22	0
4	SO4	A	1303	5/5	0.99	0.05	19,20,22,23	0

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.

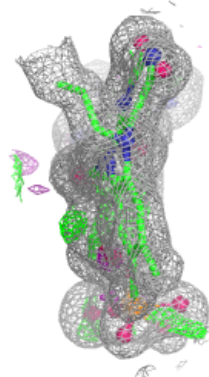
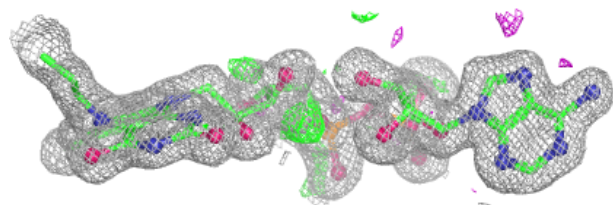
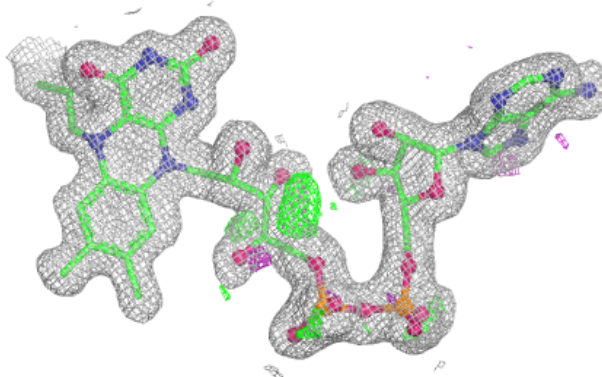


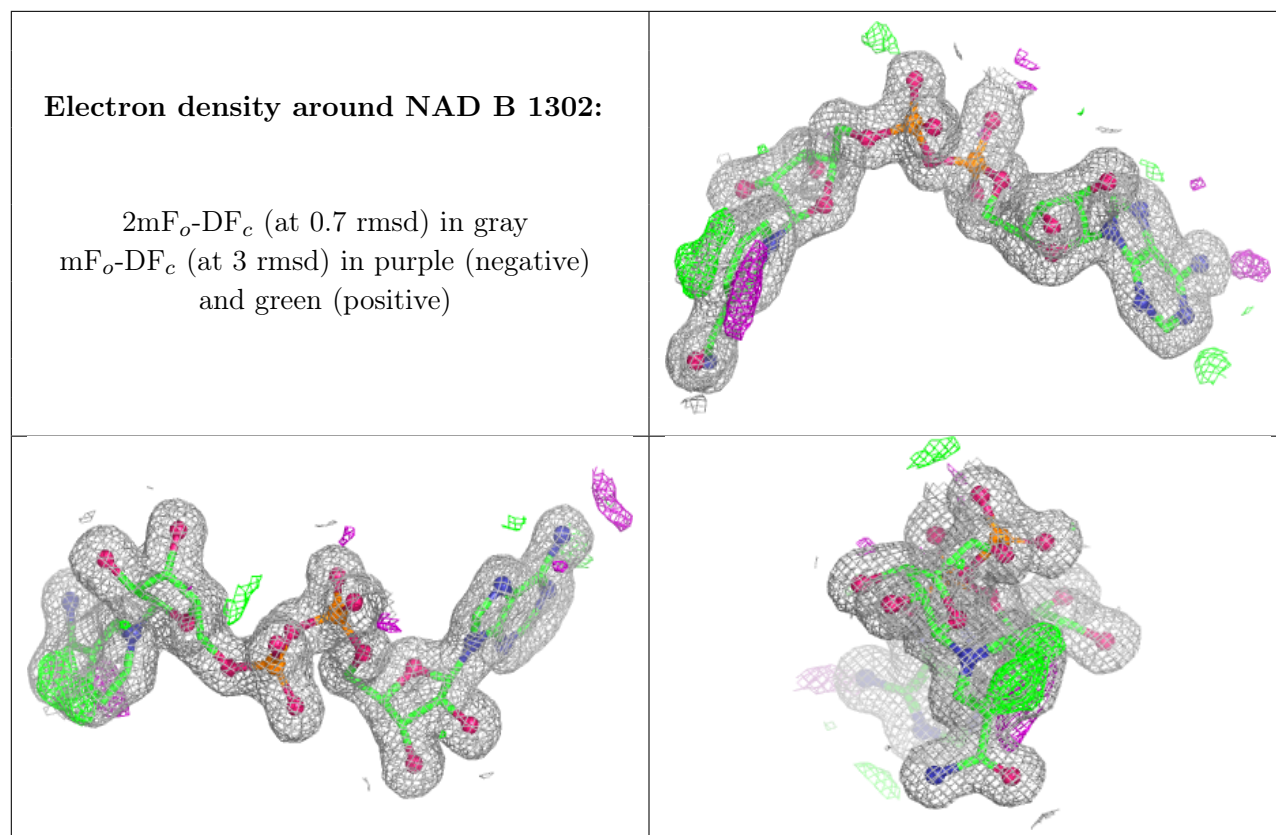
Electron density around NAD A 1302:

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

**Electron density around P5F A 1301:**

$2mF_o-DF_c$ (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.