



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 17, 2023 – 02:09 PM JST

PDB ID : 8JFD
Title : V1/S quadruple mutant Plasmodium falciparum dihydrofolate reductase-thymidylate synthase (PfDHFR-TS) complexed with compound 8 (B21594), NADPH and dUMP
Authors : Vanichtanankul, J.; Saeyang, T.; Vitsupakorn, D.; Saepua, S.; Thongpanchang, C.; Yuthavong, Y.; Kamchonwongpaisan, S.; Hoarau, M.
Deposited on : 2023-05-17
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](#) ①) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.35
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.35

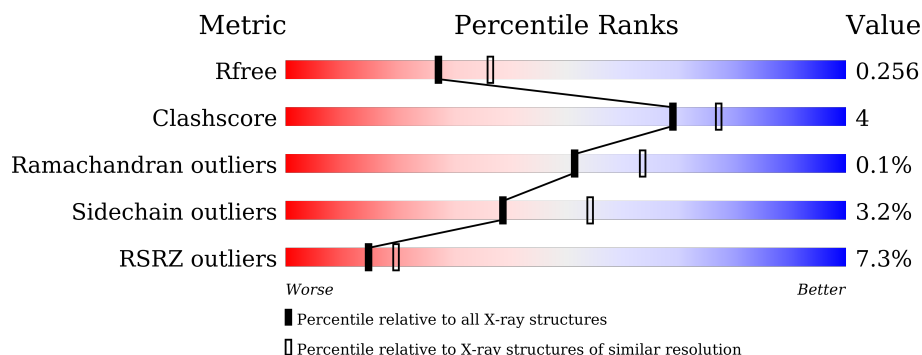
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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}	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (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	608	
1	B	608	

2 Entry composition [i](#)

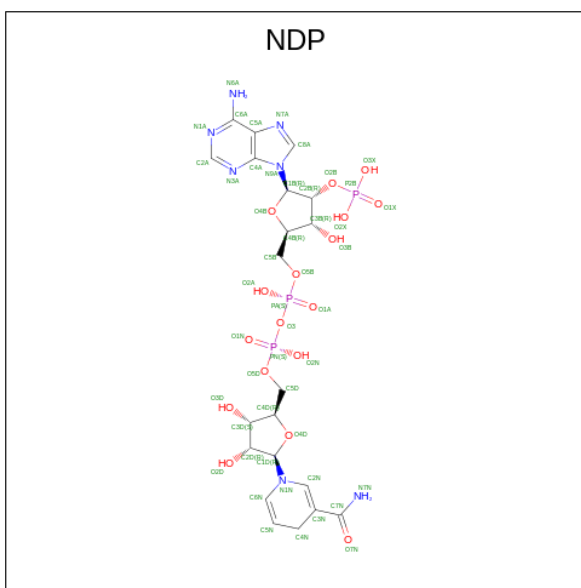
There are 6 unique types of molecules in this entry. The entry contains 9583 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 dihydrofolate reductase-thymidylate synthase.

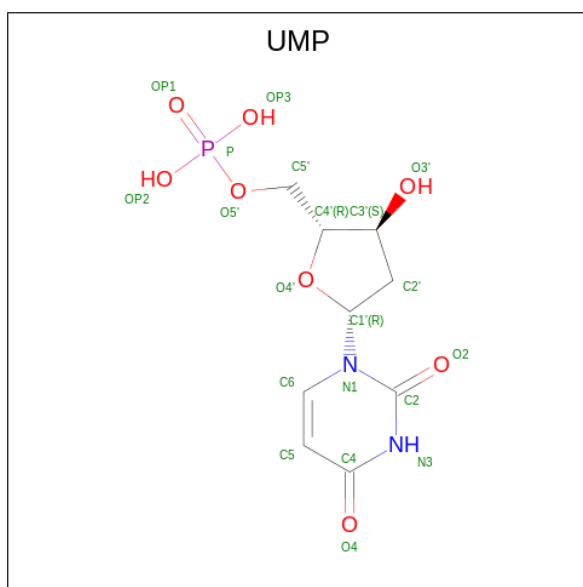
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	526	Total 4372	C 2835	N 721	O 792	S 24	0	0	0
1	B	528	Total 4391	C 2845	N 724	O 798	S 24	0	0	0

- Molecule 2 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NDP) (formula: $C_{21}H_{30}N_7O_{17}P_3$).



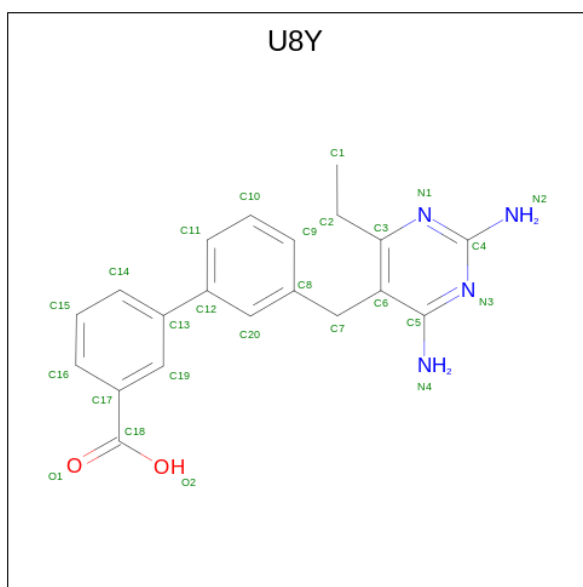
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total 48	C 21	N 7	O 17	P 3	0	0
2	B	1	Total 48	C 21	N 7	O 17	P 3	0	0

- Molecule 3 is 2'-DEOXYURIDINE 5'-MONOPHOSPHATE (three-letter code: UMP) (formula: $C_9H_{13}N_2O_8P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
3	A	1	20	9	2	8	1	0	0
3	B	1	20	9	2	8	1	0	0

- Molecule 4 is 3-[3-[[2,4-bis(azanyl)-6-ethyl-pyrimidin-5-yl]methyl]phenyl]benzoic acid (three-letter code: U8Y) (formula: C₂₀H₂₀N₄O₂) (labeled as "Ligand of Interest" by depositor).



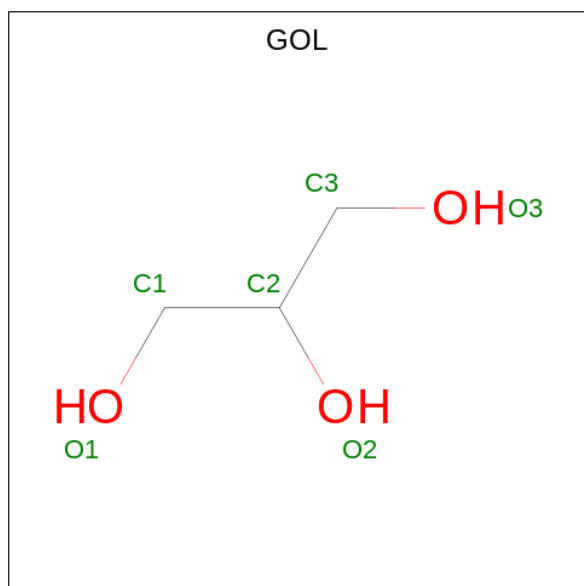
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	A	1	26	20	4	2	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	B	1	26	20	4	2	0	0

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



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

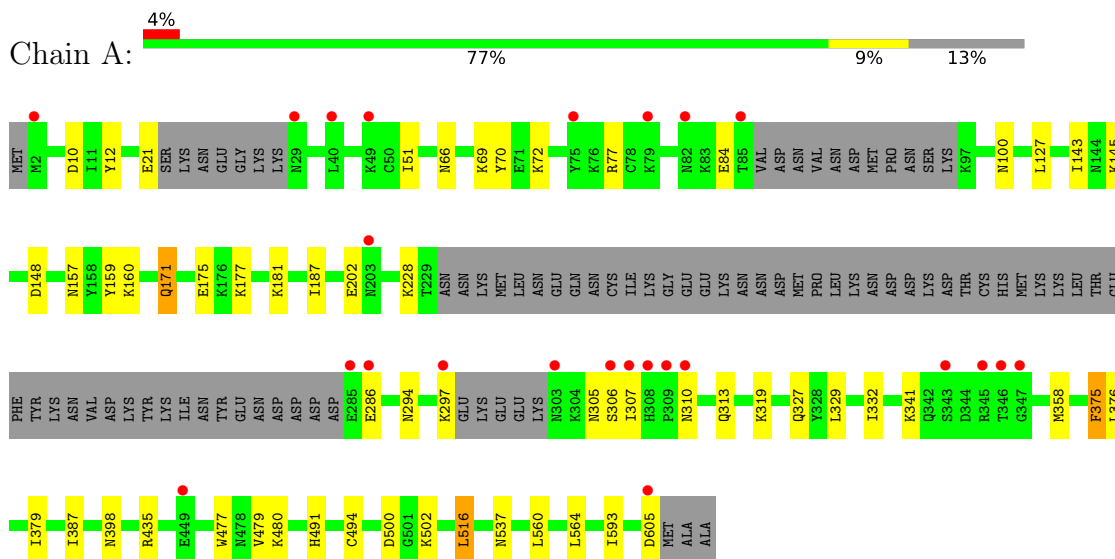
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	A	332	332	332	0	0
6	B	288	288	288	0	0

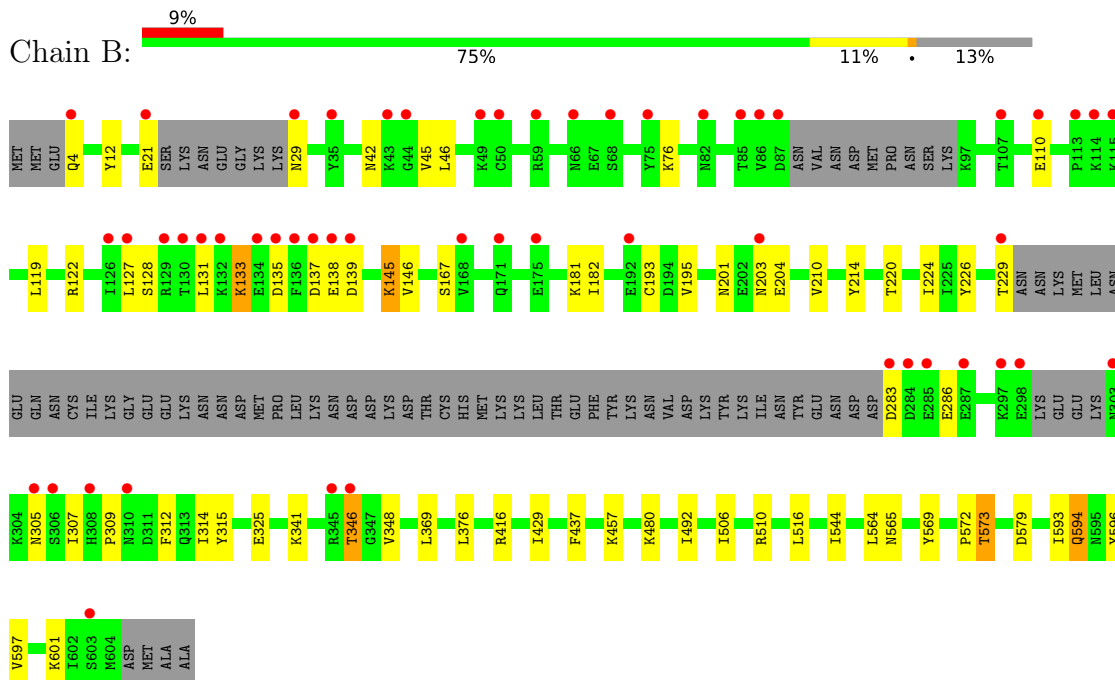
3 Residue-property plots i

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: Bifunctional dihydrofolate reductase-thymidylate synthase



- Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	57.35Å 156.50Å 165.27Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	16.79 – 2.30 16.79 – 2.30	Depositor EDS
% Data completeness (in resolution range)	98.5 (16.79-2.30) 98.5 (16.79-2.30)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.32 (at 2.30Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.202 , 0.256 0.202 , 0.256	Depositor DCC
R_{free} test set	3322 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	27.5	Xtrriage
Anisotropy	0.546	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 58.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	9583	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.61% 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: NDP, GOL, U8Y, UMP

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	0.43	1/4475 (0.0%)	0.59	0/6045
1	B	0.41	0/4494	0.58	0/6072
All	All	0.42	1/8969 (0.0%)	0.58	0/12117

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	494	CYS	CB-SG	-5.39	1.73	1.81

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	4372	0	4322	32	0
1	B	4391	0	4342	36	0
2	A	48	0	26	0	0
2	B	48	0	26	2	0
3	A	20	0	11	0	0
3	B	20	0	11	0	0
4	A	26	0	0	0	0
4	B	26	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	6	0	8	0	0
5	B	6	0	8	0	0
6	A	332	0	0	4	0
6	B	288	0	0	3	0
All	All	9583	0	8754	66	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 (66) 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:319:LYS:HG2	1:B:286:GLU:HG2	1.58	0.85
1:A:70:TYR:OH	1:A:157:ASN:ND2	2.20	0.71
1:A:491:HIS:HD2	6:A:1003:HOH:O	1.78	0.67
1:B:182:ILE:HB	1:B:226:TYR:HB2	1.78	0.66
1:B:133:LYS:H	1:B:133:LYS:HE2	1.61	0.65
1:A:332:ILE:HD13	1:A:560:LEU:HD22	1.80	0.62
1:A:376:LEU:HD22	1:A:379:ILE:HD11	1.83	0.60
1:A:51:ILE:HD13	1:A:187:ILE:HD12	1.83	0.60
1:B:12:TYR:HE1	1:B:181:LYS:HD3	1.69	0.57
1:A:177:LYS:HB3	1:A:228:LYS:HZ1	1.69	0.57
1:B:4:GLN:N	6:B:808:HOH:O	2.38	0.57
1:B:145:LYS:HD3	1:B:146:VAL:H	1.69	0.56
1:A:127:LEU:HD23	1:A:143:ILE:HG13	1.87	0.56
1:A:376:LEU:HD12	1:A:593:ILE:HG13	1.89	0.55
1:B:312:PHE:HA	1:B:565:ASN:HD21	1.72	0.53
1:A:329:LEU:HD22	1:A:564:LEU:HD12	1.91	0.53
1:B:195:VAL:HG21	2:B:701:NDP:H4D	1.90	0.53
1:A:12:TYR:HD2	1:A:181:LYS:HB2	1.75	0.52
1:B:573:THR:HG22	1:B:594:GLN:HB2	1.91	0.52
1:B:506:ILE:HG12	1:B:544:ILE:HB	1.91	0.52
1:B:201:ASN:HD22	1:B:204:GLU:HG3	1.75	0.52
1:A:66:ASN:HB3	1:A:69:LYS:HD2	1.93	0.51
1:B:309:PRO:HA	1:B:312:PHE:HD2	1.77	0.50
1:A:171:GLN:HE21	1:A:175:GLU:HG3	1.77	0.50
1:A:145:LYS:HE2	1:A:148:ASP:OD2	2.13	0.49
1:B:167:SER:OG	2:B:701:NDP:O2N	2.25	0.49
1:B:42:ASN:HB2	1:B:193:CYS:HA	1.96	0.48
1:B:480:LYS:NZ	6:B:806:HOH:O	2.37	0.48
1:B:572:PRO:HB3	1:B:596:TYR:HA	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:480:LYS:HD3	6:A:1046:HOH:O	2.14	0.47
1:B:128:SER:OG	1:B:131:LEU:HB2	2.15	0.46
1:A:171:GLN:NE2	1:A:175:GLU:HG3	2.31	0.46
1:B:305:ASN:O	1:B:307:ILE:HG12	2.15	0.46
1:A:72:LYS:HD3	1:A:72:LYS:HA	1.61	0.46
1:A:516:LEU:HD23	1:A:516:LEU:HA	1.83	0.46
1:A:375:PHE:CD1	1:A:375:PHE:N	2.85	0.45
1:B:325:GLU:HG3	1:B:369:LEU:HD22	1.99	0.44
1:A:10:ASP:OD2	1:A:77:ARG:NH2	2.50	0.44
1:A:387:ILE:O	1:A:435:ARG:NH1	2.45	0.44
1:A:479:VAL:HB	1:B:437:PHE:CD1	2.52	0.44
1:A:500:ASP:HB3	1:A:502:LYS:HE2	1.98	0.44
1:B:214:TYR:O	1:B:220:THR:HA	2.18	0.44
1:B:201:ASN:HD21	1:B:203:ASN:HB2	1.83	0.43
1:B:346:THR:HB	1:B:348:VAL:HG23	2.00	0.43
1:B:46:LEU:HD23	1:B:46:LEU:HA	1.90	0.43
1:A:310:ASN:HA	1:A:313:GLN:HG3	2.00	0.43
1:A:100:ASN:OD1	1:A:159:TYR:HB3	2.19	0.43
1:A:159:TYR:CD2	1:A:160:LYS:HG3	2.54	0.42
1:A:305:ASN:OD1	1:A:341:LYS:NZ	2.52	0.42
1:A:294:ASN:HD22	1:A:297:LYS:HG3	1.84	0.42
1:B:601:LYS:HE3	1:B:601:LYS:HB2	1.73	0.42
1:A:398:ASN:ND2	6:A:807:HOH:O	2.35	0.42
1:B:12:TYR:HD1	1:B:181:LYS:HB2	1.84	0.42
1:A:21:GLU:H	1:A:21:GLU:HG2	1.72	0.41
1:A:327:GLN:HB3	1:A:358:MET:HG2	2.02	0.41
1:B:376:LEU:HD12	1:B:593:ILE:HG13	2.02	0.41
1:B:569:TYR:CG	1:B:597:VAL:HG12	2.55	0.41
1:A:477:TRP:O	6:A:801:HOH:O	2.22	0.41
1:B:119:LEU:HB3	1:B:122:ARG:CZ	2.51	0.41
1:B:312:PHE:HB3	1:B:315:TYR:HB3	2.02	0.41
1:B:131:LEU:HD23	1:B:131:LEU:HA	1.92	0.41
1:B:314:ILE:H	1:B:314:ILE:HD12	1.86	0.40
1:B:492:ILE:HD11	1:B:510:ARG:HD3	2.03	0.40
1:B:210:VAL:HG12	1:B:224:ILE:HG22	2.02	0.40
1:B:579:ASP:OD2	6:B:801:HOH:O	2.22	0.40
1:B:76:LYS:HE2	1:B:76:LYS:HB3	1.94	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	516/608 (85%)	499 (97%)	17 (3%)	0	100	100
1	B	518/608 (85%)	500 (96%)	17 (3%)	1 (0%)	47	58
All	All	1034/1216 (85%)	999 (97%)	34 (3%)	1 (0%)	51	64

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	429	ILE

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	488/570 (86%)	478 (98%)	10 (2%)	55	72
1	B	492/570 (86%)	471 (96%)	21 (4%)	29	40
All	All	980/1140 (86%)	949 (97%)	31 (3%)	39	54

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	84	GLU
1	A	171	GLN
1	A	202	GLU
1	A	286	GLU
1	A	306	SER

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Mol	Chain	Res	Type
1	A	307	ILE
1	A	375	PHE
1	A	516	LEU
1	A	537	ASN
1	A	605	ASP
1	B	21	GLU
1	B	29	ASN
1	B	45	VAL
1	B	110	GLU
1	B	127	LEU
1	B	133	LYS
1	B	135	ASP
1	B	137	ASP
1	B	138	GLU
1	B	139	ASP
1	B	145	LYS
1	B	229	THR
1	B	283	ASP
1	B	341	LYS
1	B	346	THR
1	B	416	ARG
1	B	457	LYS
1	B	516	LEU
1	B	564	LEU
1	B	573	THR
1	B	594	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	4	GLN
1	A	157	ASN
1	A	171	GLN
1	A	294	ASN
1	A	316	ASN
1	A	447	ASN
1	A	491	HIS
1	B	201	ASN
1	B	203	ASN
1	B	316	ASN
1	B	491	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

8 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	U8Y	B	703	-	27,28,28	0.48	0	34,39,39	0.69	1 (2%)
5	GOL	B	704	-	5,5,5	0.86	0	5,5,5	0.96	0
4	U8Y	A	703	-	27,28,28	0.51	0	34,39,39	0.83	2 (5%)
2	NDP	A	701	-	45,52,52	2.00	6 (13%)	53,80,80	1.53	6 (11%)
2	NDP	B	701	-	45,52,52	2.49	7 (15%)	53,80,80	1.58	12 (22%)
3	UMP	A	702	-	21,21,21	0.88	0	31,31,31	1.76	9 (29%)
3	UMP	B	702	-	21,21,21	0.91	0	31,31,31	1.56	5 (16%)
5	GOL	A	704	-	5,5,5	0.96	0	5,5,5	0.95	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	U8Y	B	703	-	-	3/14/14/14	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	GOL	B	704	-	-	0/4/4/4	-
4	U8Y	A	703	-	-	3/14/14/14	0/3/3/3
2	NDP	A	701	-	-	8/30/77/77	0/5/5/5
2	NDP	B	701	-	-	15/30/77/77	0/5/5/5
3	UMP	A	702	-	-	1/10/22/22	0/2/2/2
3	UMP	B	702	-	-	5/10/22/22	0/2/2/2
5	GOL	A	704	-	-	0/4/4/4	-

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	701	NDP	P2B-O2B	13.94	1.85	1.59
2	A	701	NDP	P2B-O2B	9.59	1.77	1.59
2	A	701	NDP	PN-O5D	4.71	1.78	1.59
2	B	701	NDP	PN-O5D	4.15	1.76	1.59
2	A	701	NDP	O4B-C1B	3.65	1.46	1.41
2	A	701	NDP	O2B-C2B	-3.30	1.32	1.44
2	B	701	NDP	C2A-N1A	2.69	1.38	1.33
2	B	701	NDP	O4B-C1B	2.62	1.44	1.41
2	B	701	NDP	O2B-C2B	-2.58	1.34	1.44
2	B	701	NDP	C7N-N7N	2.44	1.39	1.33
2	B	701	NDP	C4A-N3A	2.43	1.39	1.35
2	A	701	NDP	C2A-N1A	2.39	1.38	1.33
2	A	701	NDP	C7N-N7N	2.37	1.39	1.33

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	701	NDP	PN-O3-PA	-5.43	114.20	132.83
2	A	701	NDP	PN-O3-PA	-5.29	114.68	132.83
3	A	702	UMP	C4-N3-C2	-4.41	120.76	126.58
3	B	702	UMP	C4-N3-C2	-3.77	121.60	126.58
3	A	702	UMP	C5-C4-N3	3.59	120.21	114.84
3	B	702	UMP	C5-C4-N3	3.43	119.98	114.84
3	B	702	UMP	C1'-N1-C6	-3.41	114.81	121.55
2	A	701	NDP	O2B-P2B-O1X	-3.34	96.50	109.39
3	B	702	UMP	O4-C4-C5	-3.34	119.29	125.16
2	B	701	NDP	O2B-P2B-O1X	-3.31	96.61	109.39
3	A	702	UMP	C1'-N1-C6	-3.22	115.20	121.55
3	B	702	UMP	C1'-N1-C2	3.12	123.79	117.64
3	A	702	UMP	C1'-N1-C2	3.08	123.72	117.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	702	UMP	P-O5'-C5'	2.86	126.16	118.30
3	A	702	UMP	O4-C4-C5	-2.84	120.16	125.16
3	A	702	UMP	N3-C2-N1	2.83	118.65	114.89
2	B	701	NDP	PA-O5B-C5B	-2.82	105.12	121.68
2	A	701	NDP	O3X-P2B-O2X	2.70	117.95	107.64
4	A	703	U8Y	C6-C3-N1	-2.63	121.27	123.49
2	B	701	NDP	O3X-P2B-O2X	2.62	117.67	107.64
2	B	701	NDP	PN-O5D-C5D	-2.59	106.49	121.68
2	B	701	NDP	C3N-C2N-N1N	-2.41	119.66	123.10
4	B	703	U8Y	C6-C3-N1	-2.33	121.53	123.49
2	A	701	NDP	PA-O5B-C5B	-2.30	108.17	121.68
3	A	702	UMP	O2-C2-N3	-2.24	117.33	121.50
2	B	701	NDP	O5D-PN-O1N	-2.19	100.52	109.07
2	B	701	NDP	O4B-C4B-C3B	2.18	109.43	105.11
2	B	701	NDP	O2N-PN-O1N	2.15	122.88	112.24
3	A	702	UMP	OP3-P-O5'	2.07	112.24	106.73
2	B	701	NDP	C2A-N1A-C6A	-2.07	115.22	118.75
2	A	701	NDP	O3X-P2B-O2B	-2.06	96.74	105.99
2	A	701	NDP	C2A-N1A-C6A	-2.06	115.22	118.75
2	B	701	NDP	O2A-PA-O1A	2.04	122.33	112.24
2	B	701	NDP	O7N-C7N-C3N	2.01	124.67	120.90
4	A	703	U8Y	C1-C2-C3	-2.00	109.94	114.88

There are no chirality outliers.

All (35) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	701	NDP	C5B-O5B-PA-O1A
2	A	701	NDP	C5B-O5B-PA-O3
2	A	701	NDP	PA-O3-PN-O5D
2	B	701	NDP	C5D-O5D-PN-O3
2	B	701	NDP	C5D-O5D-PN-O1N
3	B	702	UMP	C5'-O5'-P-OP2
3	B	702	UMP	C5'-O5'-P-OP3
2	B	701	NDP	O4B-C4B-C5B-O5B
2	B	701	NDP	C3B-C4B-C5B-O5B
2	B	701	NDP	C3D-C4D-C5D-O5D
3	B	702	UMP	C3'-C4'-C5'-O5'
3	B	702	UMP	O4'-C4'-C5'-O5'
4	B	703	U8Y	C20-C12-C13-C19
4	A	703	U8Y	C20-C12-C13-C19
2	B	701	NDP	O4D-C4D-C5D-O5D

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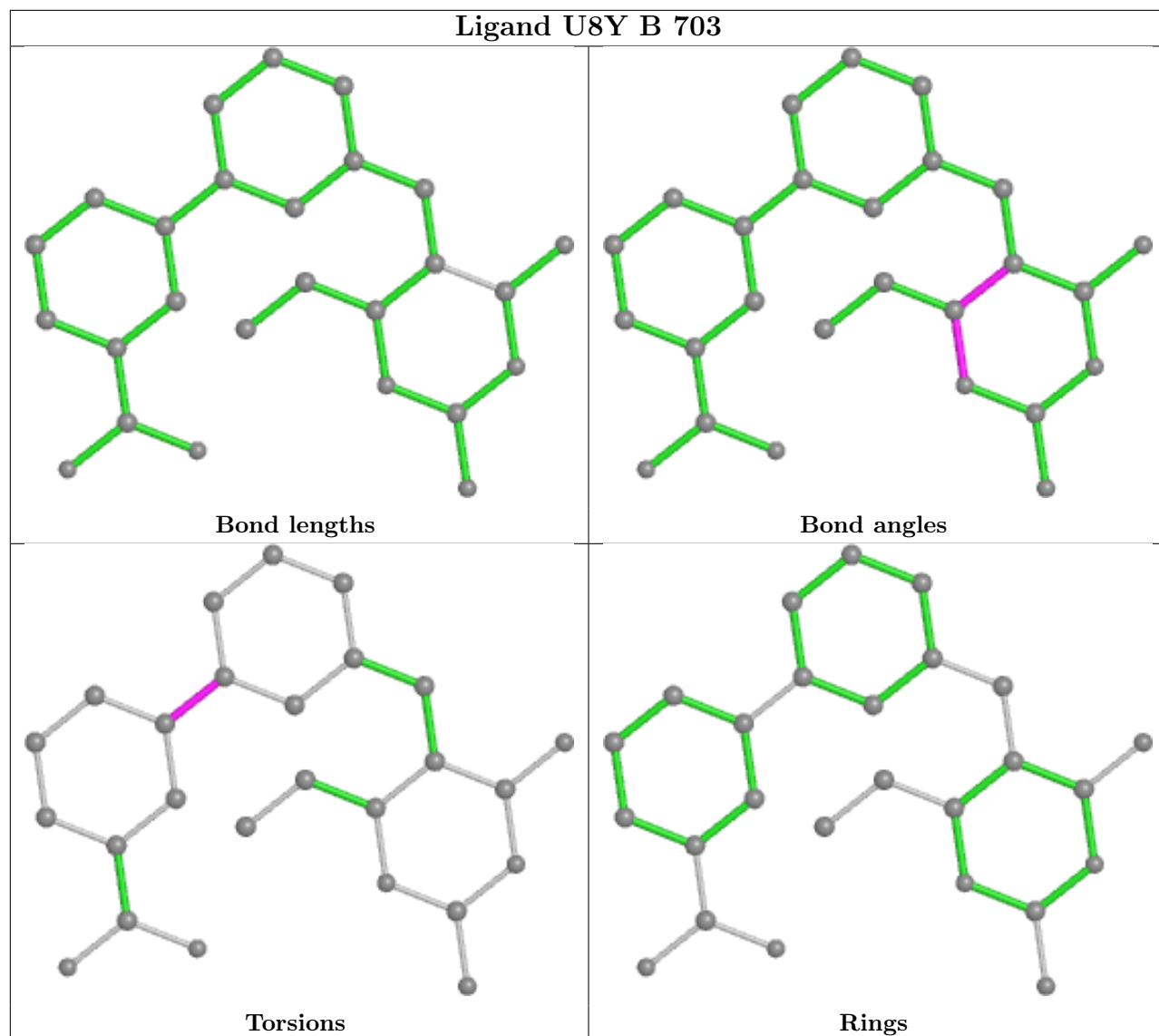
Mol	Chain	Res	Type	Atoms
3	B	702	UMP	C5'-O5'-P-OP1
4	A	703	U8Y	C20-C12-C13-C14
2	B	701	NDP	C2D-C1D-N1N-C2N
2	B	701	NDP	C5B-O5B-PA-O2A
2	A	701	NDP	O4B-C4B-C5B-O5B
2	A	701	NDP	C3B-C4B-C5B-O5B
4	A	703	U8Y	C11-C12-C13-C19
2	B	701	NDP	O4D-C1D-N1N-C2N
4	B	703	U8Y	C20-C12-C13-C14
4	B	703	U8Y	C11-C12-C13-C19
2	A	701	NDP	O4D-C1D-N1N-C2N
2	A	701	NDP	C2D-C1D-N1N-C2N
2	B	701	NDP	C2D-C1D-N1N-C6N
2	B	701	NDP	C2B-O2B-P2B-O1X
2	B	701	NDP	C5B-O5B-PA-O3
2	B	701	NDP	C2B-O2B-P2B-O2X
2	B	701	NDP	C2B-O2B-P2B-O3X
3	A	702	UMP	O4'-C4'-C5'-O5'
2	A	701	NDP	C5B-O5B-PA-O2A
2	B	701	NDP	O4D-C1D-N1N-C6N

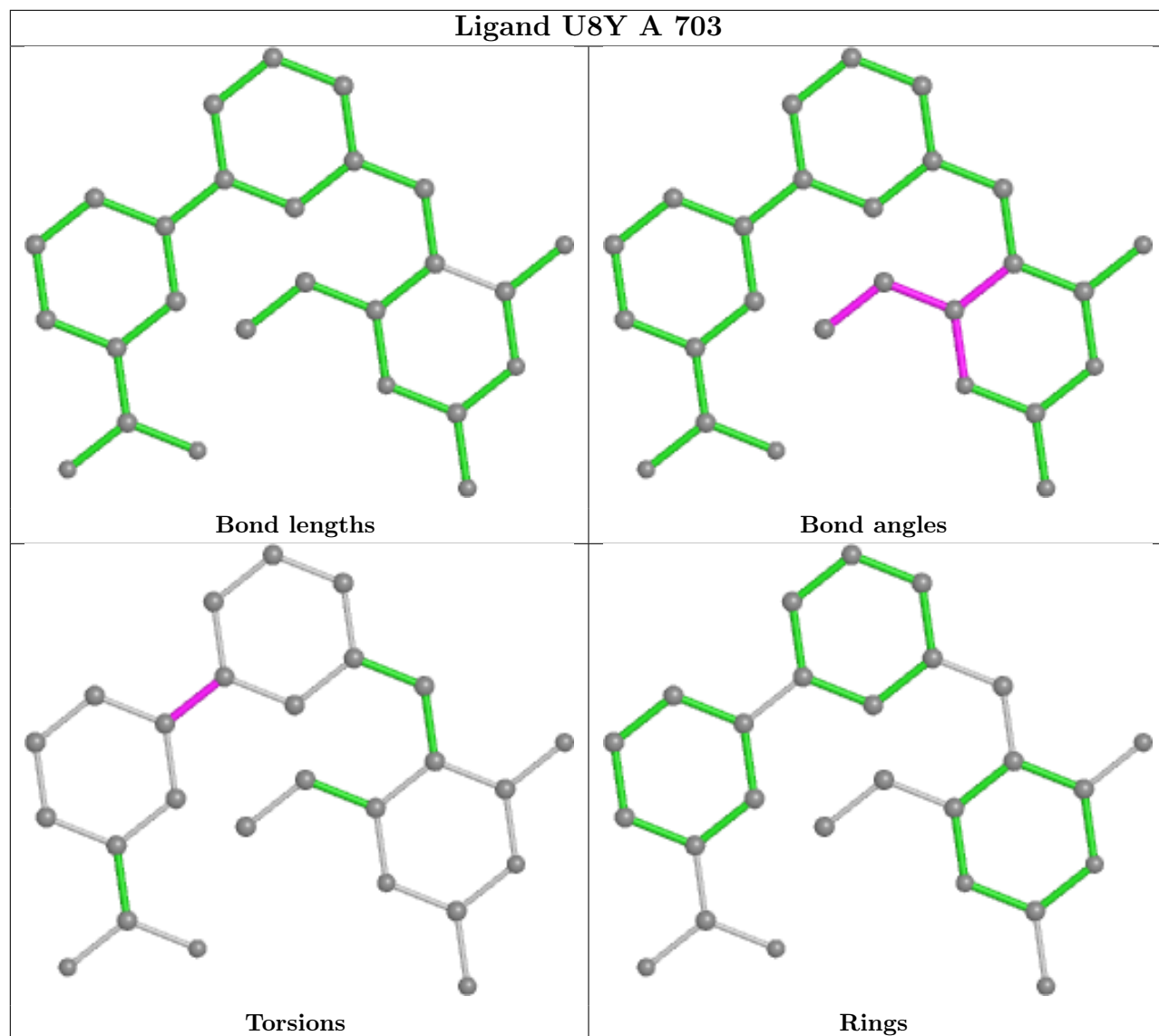
There are no ring outliers.

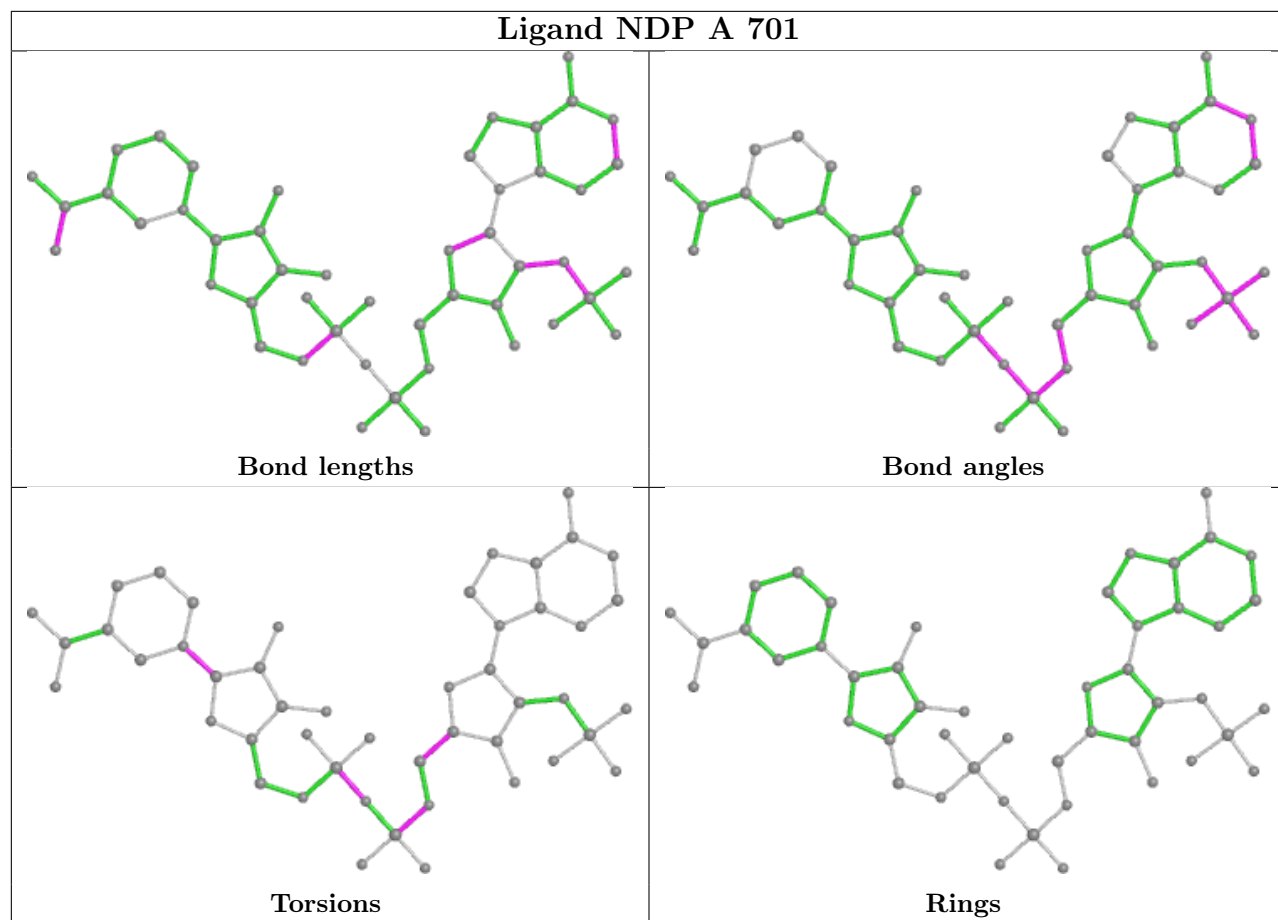
1 monomer is involved in 2 short contacts:

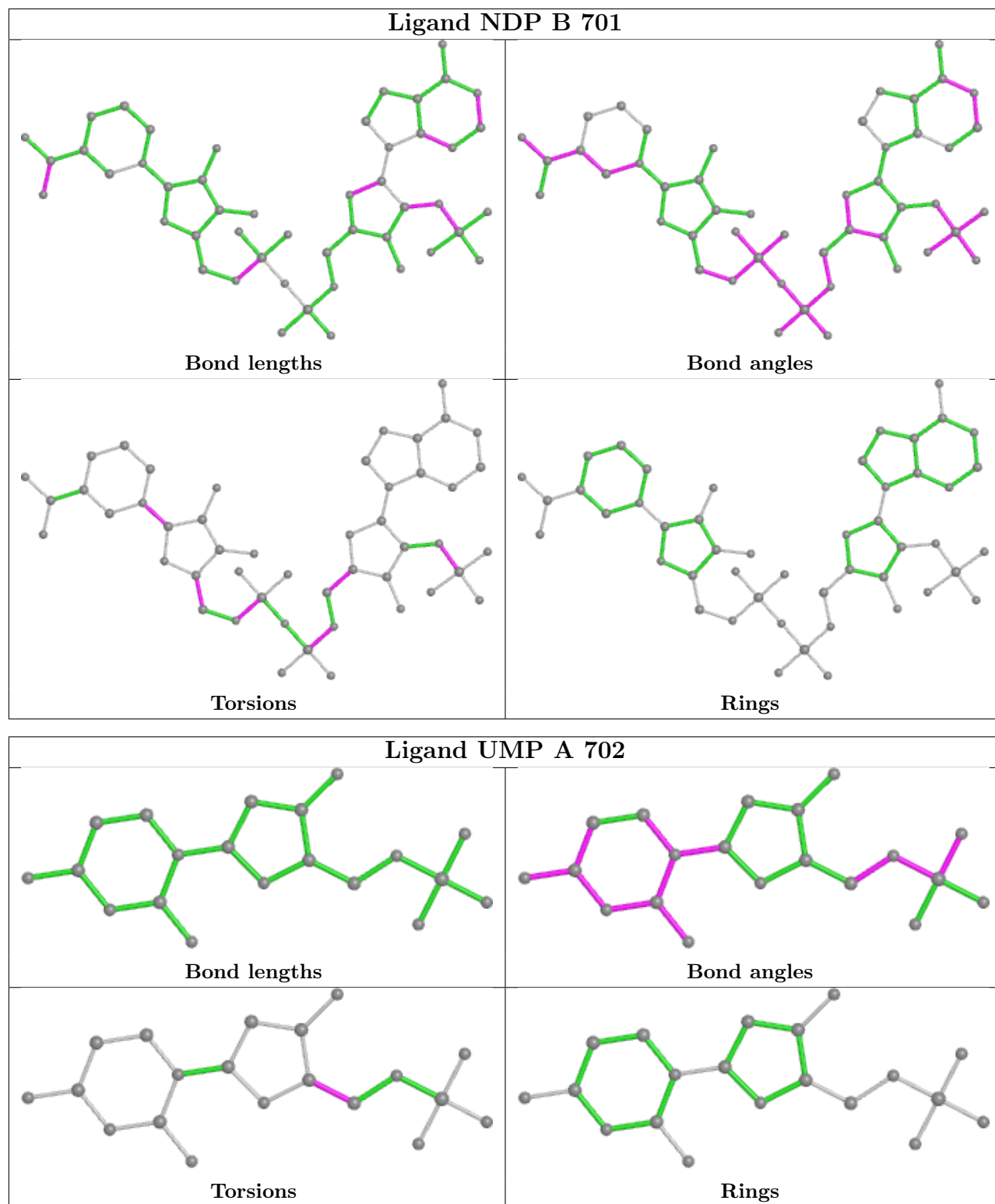
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	701	NDP	2	0

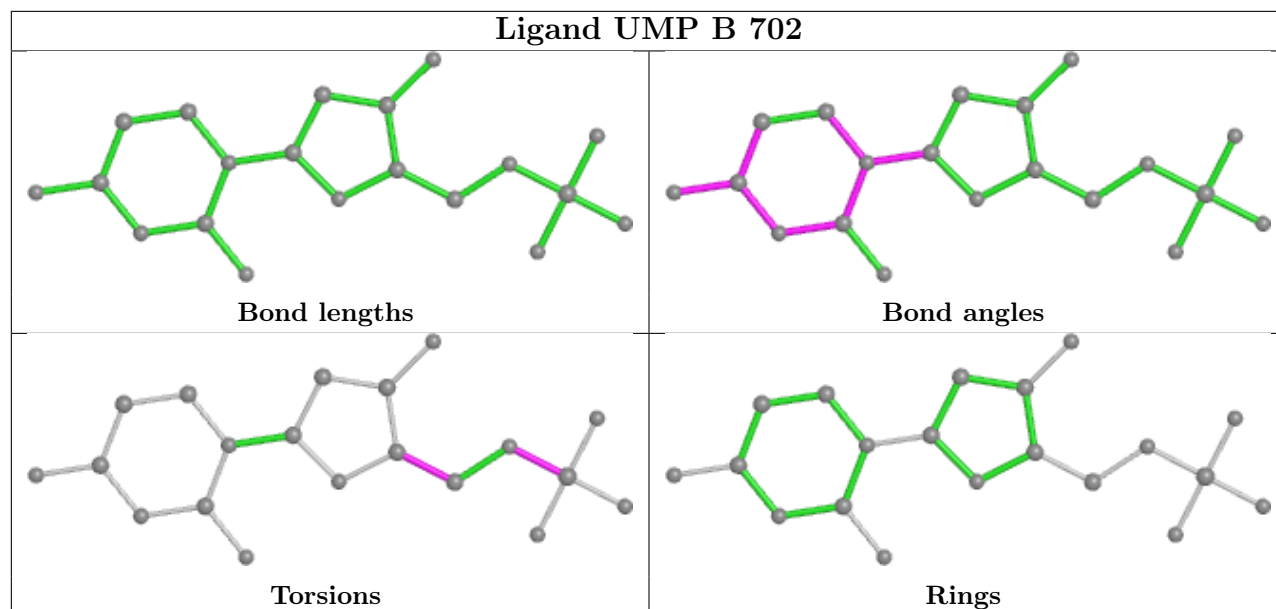
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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	526/608 (86%)	-0.06	24 (4%) 32 39	15, 28, 56, 75	0
1	B	528/608 (86%)	0.25	53 (10%) 7 10	16, 32, 65, 95	0
All	All	1054/1216 (86%)	0.09	77 (7%) 15 20	15, 29, 62, 95	0

All (77) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	136	PHE	7.8
1	B	303	ASN	6.6
1	B	346	THR	5.9
1	A	303	ASN	5.2
1	B	132	LYS	5.0
1	B	283	ASP	5.0
1	B	138	GLU	4.9
1	A	85	THR	4.7
1	B	134	GLU	4.6
1	A	2	MET	4.6
1	B	135	ASP	4.5
1	B	284	ASP	4.3
1	B	137	ASP	4.1
1	B	131	LEU	4.0
1	A	346	THR	4.0
1	B	110	GLU	3.8
1	B	345	ARG	3.8
1	B	44	GLY	3.6
1	B	114	LYS	3.6
1	A	343	SER	3.6
1	B	298	GLU	3.5
1	B	139	ASP	3.5
1	B	82	ASN	3.4
1	B	130	THR	3.4

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Mol	Chain	Res	Type	RSRZ
1	B	285	GLU	3.3
1	B	85	THR	3.3
1	A	29	ASN	3.2
1	B	203	ASN	3.2
1	A	82	ASN	3.2
1	A	605	ASP	3.1
1	A	203	ASN	3.0
1	B	175	GLU	3.0
1	B	29	ASN	3.0
1	A	285	GLU	3.0
1	B	87	ASP	2.9
1	B	306	SER	2.9
1	A	310	ASN	2.9
1	A	306	SER	2.9
1	A	297	LYS	2.9
1	B	129	ARG	2.8
1	A	449	GLU	2.8
1	B	43	LYS	2.8
1	A	309	PRO	2.7
1	B	308	HIS	2.7
1	A	286	GLU	2.6
1	A	307	ILE	2.6
1	B	305	ASN	2.5
1	A	75	TYR	2.5
1	B	297	LYS	2.5
1	B	75	TYR	2.5
1	B	229	THR	2.5
1	A	79	LYS	2.5
1	A	308	HIS	2.4
1	B	310	ASN	2.4
1	A	347	GLY	2.4
1	B	115	LYS	2.4
1	B	127	LEU	2.4
1	B	107	THR	2.3
1	B	4	GLN	2.3
1	B	113	PRO	2.3
1	A	40	LEU	2.3
1	B	21	GLU	2.3
1	B	603	SER	2.3
1	B	49	LYS	2.3
1	B	50	CYS	2.2
1	B	171	GLN	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	126	ILE	2.2
1	B	35	TYR	2.1
1	B	59	ARG	2.1
1	B	86	VAL	2.1
1	B	168	VAL	2.1
1	B	68	SER	2.1
1	B	66	ASN	2.1
1	B	192	GLU	2.1
1	A	345	ARG	2.1
1	B	287	GLU	2.0
1	A	49	LYS	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](#)

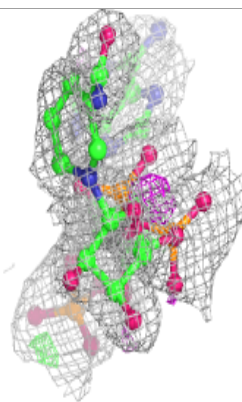
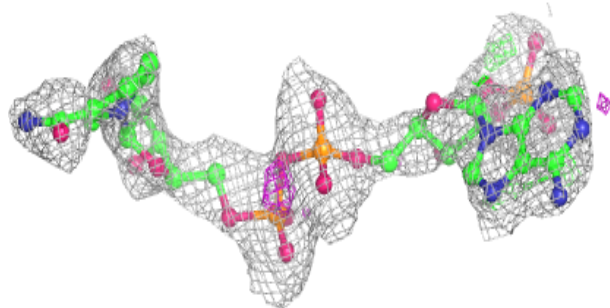
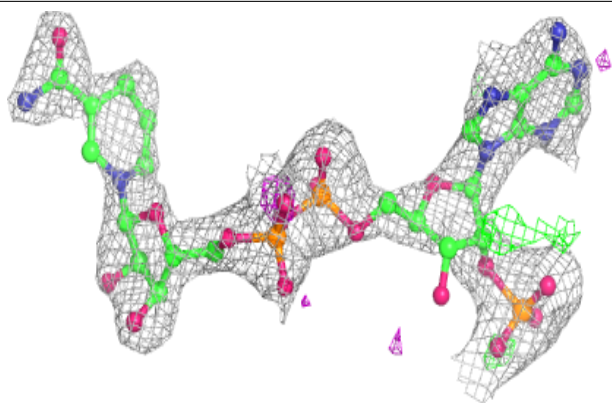
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NDP	B	701	48/48	0.88	0.20	36,62,72,75	0
5	GOL	A	704	6/6	0.88	0.16	22,26,27,32	0
4	U8Y	B	703	26/26	0.89	0.15	33,41,55,60	0
5	GOL	B	704	6/6	0.89	0.13	23,27,29,32	0
3	UMP	A	702	20/20	0.94	0.17	28,33,38,40	0
4	U8Y	A	703	26/26	0.95	0.13	17,22,32,35	0
3	UMP	B	702	20/20	0.95	0.20	27,36,42,43	0
2	NDP	A	701	48/48	0.96	0.10	20,32,37,38	0

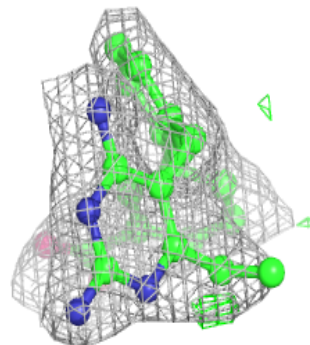
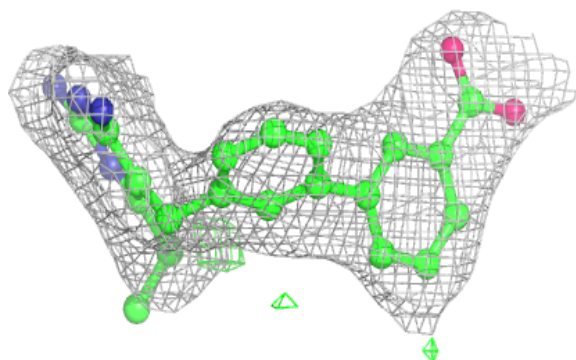
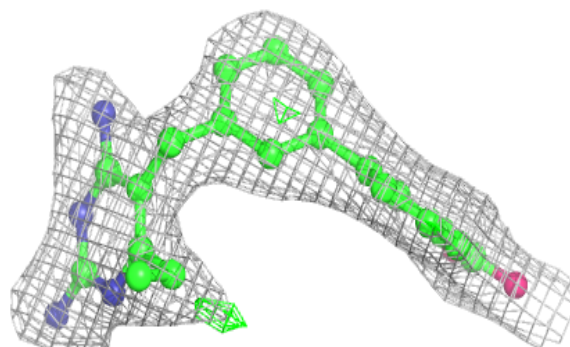
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around NDP B 701:

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

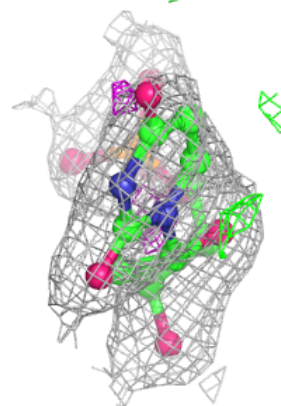
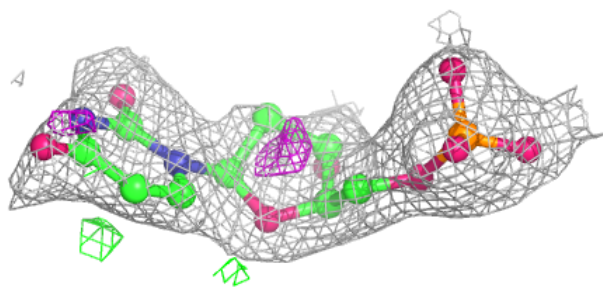
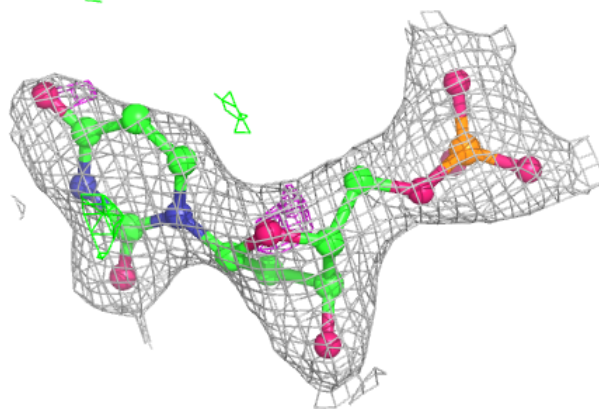
**Electron density around U8Y B 703:**

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

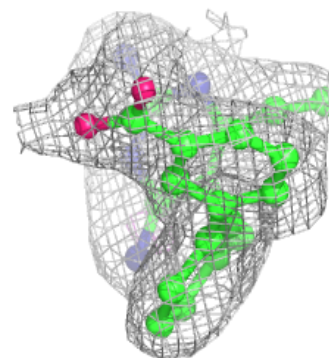
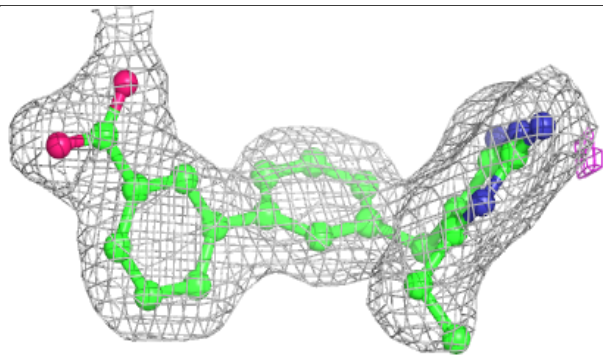
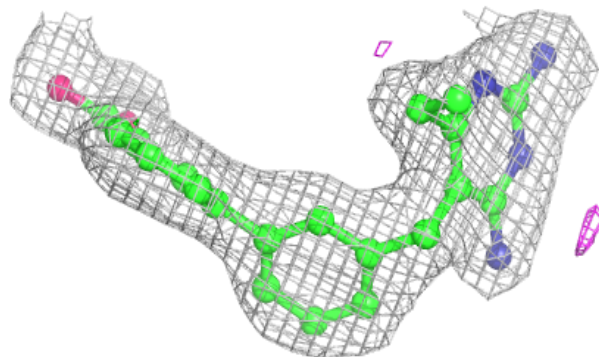


Electron density around UMP A 702:

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

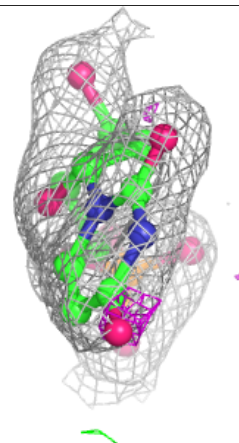
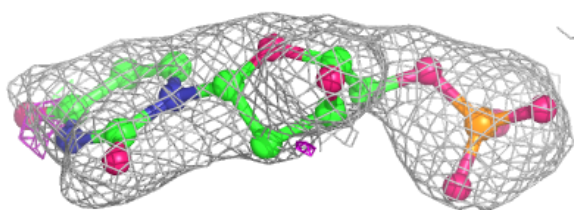
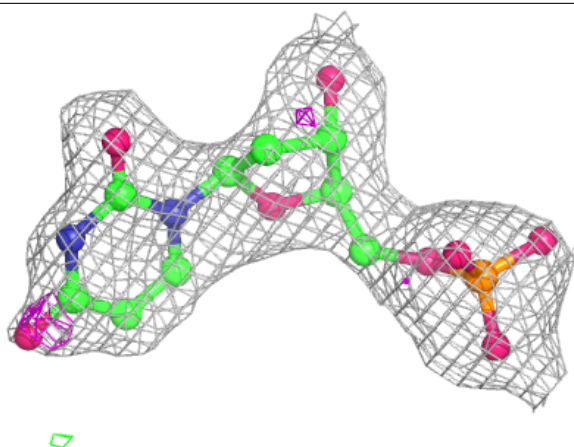
**Electron density around U8Y A 703:**

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

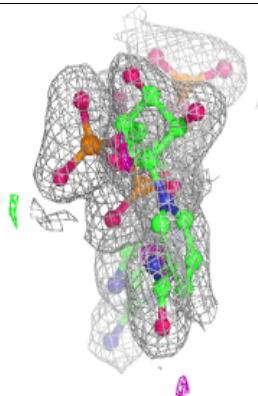
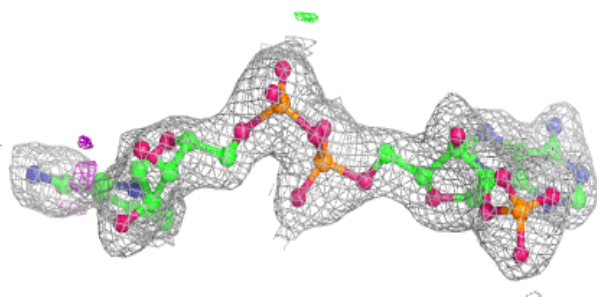
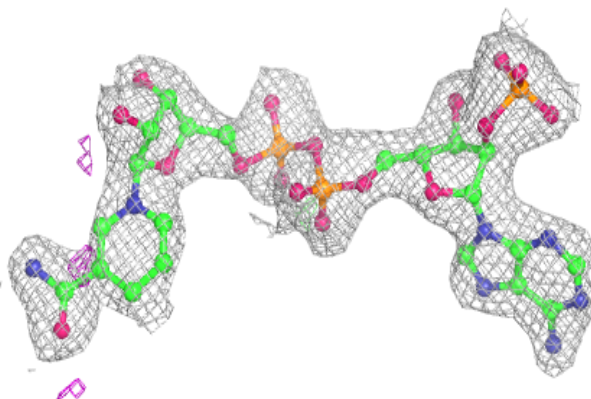


Electron density around UMP B 702:

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

**Electron density around NDP A 701:**

$2mF_o-DF_c$ (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.