



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 11:31 AM UTC

PDB ID : 4KY4 / pdb_00004ky4
Title : Crystal structure of non-classical TS inhibitor 2 in complex with Toxoplasma gondii TS-DHFR
Authors : Sharma, H.; Anderson, K.S.
Deposited on : 2013-05-28
Resolution : 2.79 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

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

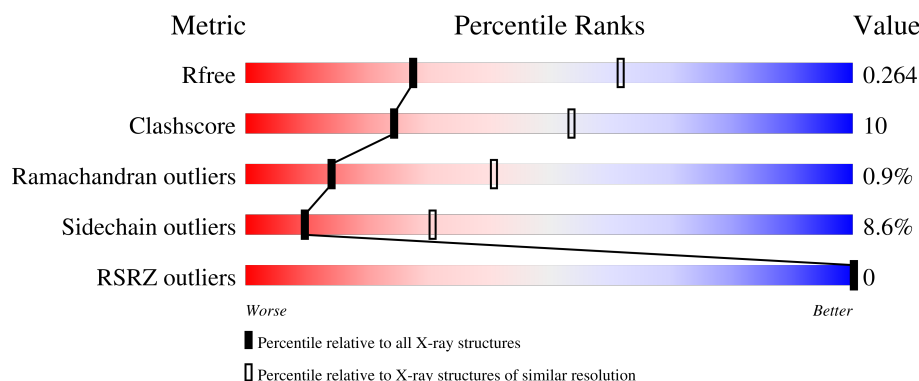
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.79 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	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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	610	
1	B	610	
1	C	610	
1	D	610	
1	E	610	

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Mol	Chain	Length	Quality of chain
1	F	610	
1	G	610	
1	H	610	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	UMP	F	701	-	-	X	-
3	04J	H	702	-	-	X	-
5	1UE	A	704	-	-	X	-
5	1UE	B	704	-	-	X	-
5	1UE	C	704	-	-	X	-
5	1UE	D	704	-	-	X	-
5	1UE	F	704	-	-	X	-
5	1UE	G	704	-	-	X	-

2 Entry composition

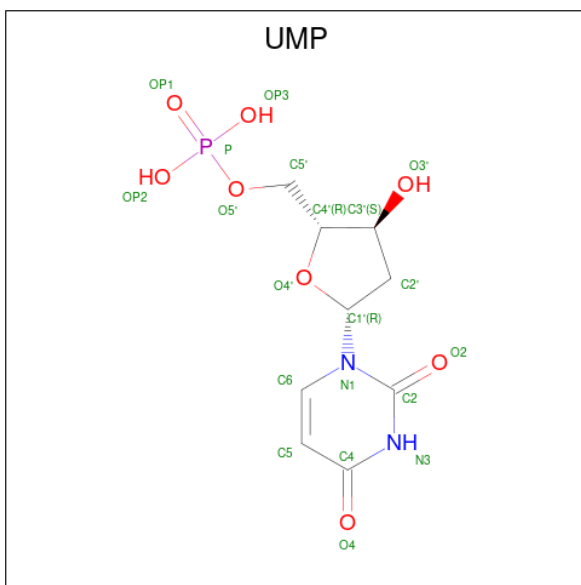
There are 5 unique types of molecules in this entry. The entry contains 32492 atoms, of which 0 are hydrogens and 0 are deuteriums.

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.

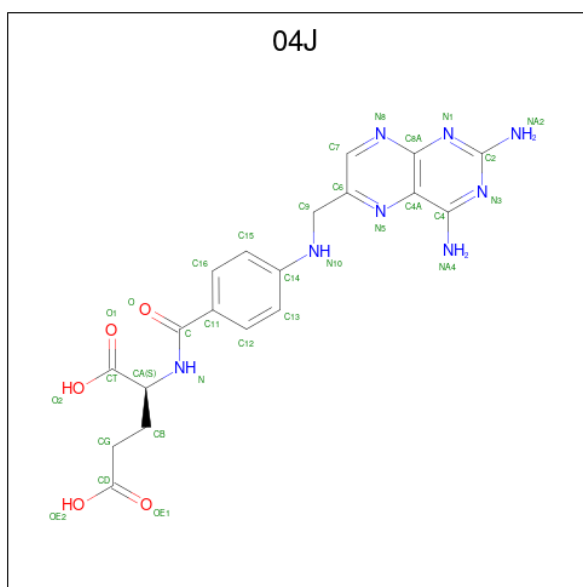
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	489	Total	C	N	O	S	0	1	0
			3931	2522	680	704	25			
1	B	491	Total	C	N	O	S	0	1	0
			3948	2531	682	710	25			
1	C	489	Total	C	N	O	S	0	1	0
			3931	2522	680	704	25			
1	D	491	Total	C	N	O	S	0	1	0
			3948	2531	682	710	25			
1	E	489	Total	C	N	O	S	0	1	0
			3931	2522	680	704	25			
1	F	491	Total	C	N	O	S	0	1	0
			3948	2531	682	710	25			
1	G	489	Total	C	N	O	S	0	1	0
			3931	2522	680	704	25			
1	H	491	Total	C	N	O	S	0	1	0
			3948	2531	682	710	25			

- Molecule 2 is 2'-DEOXYURIDINE 5'-MONOPHOSPHATE (CCD ID: UMP) (formula: C₉H₁₃N₂O₈P).



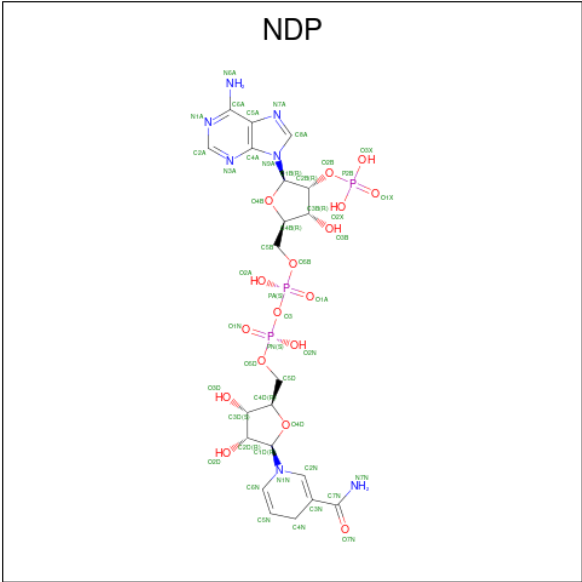
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	B	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	C	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	D	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	E	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	F	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	G	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	H	1	Total	C	N	O	P	0	0
			20	9	2	8	1		

- Molecule 3 is Aminopterin (CCD ID: 04J) (formula: C₁₉H₂₀N₈O₅).



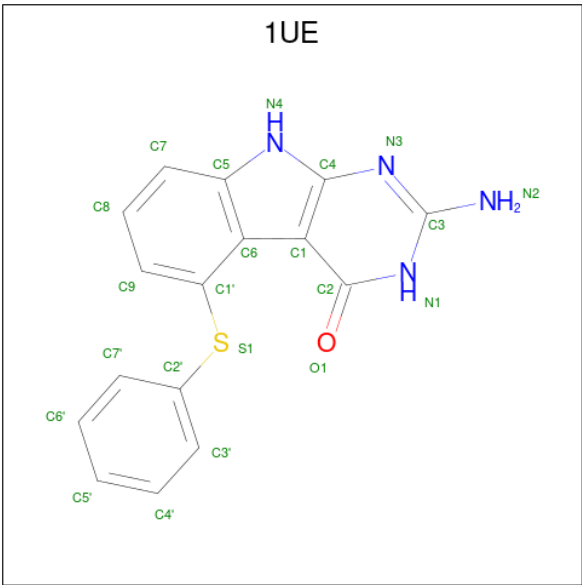
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			32	19	8	5		
3	B	1	Total	C	N	O	0	0
			32	19	8	5		
3	C	1	Total	C	N	O	0	0
			32	19	8	5		
3	D	1	Total	C	N	O	0	0
			32	19	8	5		
3	E	1	Total	C	N	O	0	0
			32	19	8	5		
3	F	1	Total	C	N	O	0	0
			32	19	8	5		
3	G	1	Total	C	N	O	0	0
			32	19	8	5		
3	H	1	Total	C	N	O	0	0
			32	19	8	5		

- Molecule 4 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (CCD ID: NDP) (formula: $C_{21}H_{30}N_7O_{17}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	B	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	C	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	D	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	E	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	F	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	G	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	H	1	Total	C	N	O	P	0	0
			48	21	7	17	3		

- Molecule 5 is 2-amino-5-(phenylsulfanyl)-3,9-dihydro-4H-pyrimido[4,5-b]indol-4-one (CCD ID: 1UE) (formula: C₁₆H₁₂N₄OS).

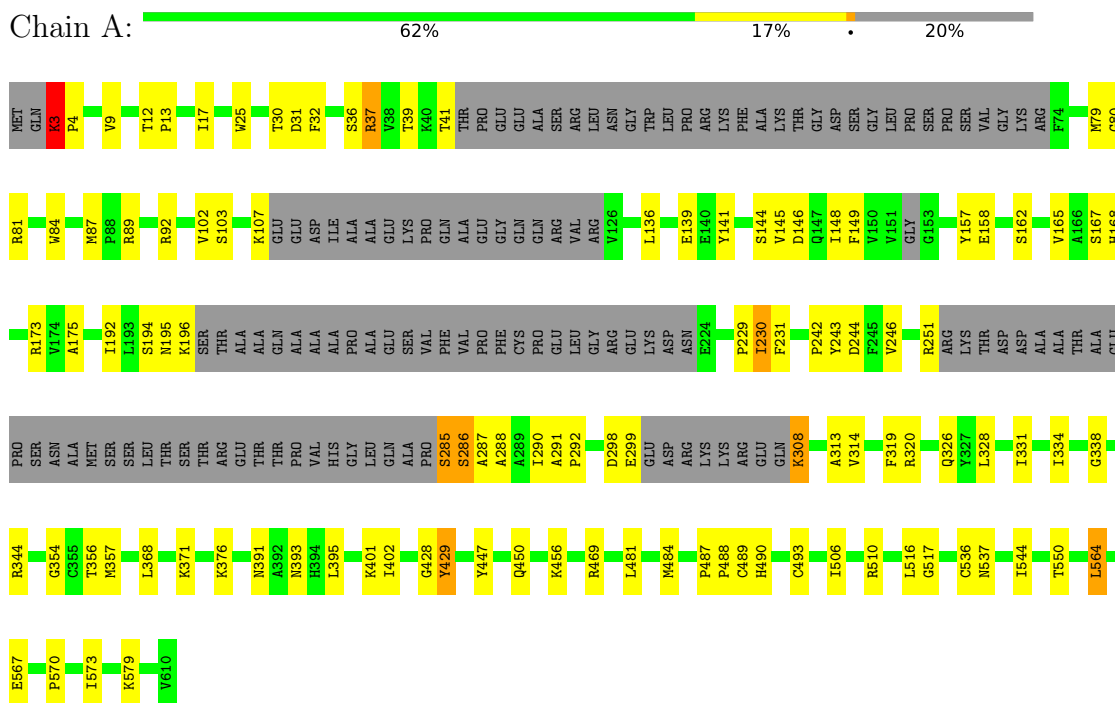


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	S	0	0
			22	16	4	1	1		
5	B	1	Total	C	N	O	S	0	0
			22	16	4	1	1		
5	C	1	Total	C	N	O	S	0	0
			22	16	4	1	1		
5	D	1	Total	C	N	O	S	0	0
			22	16	4	1	1		
5	E	1	Total	C	N	O	S	0	0
			22	16	4	1	1		
5	F	1	Total	C	N	O	S	0	0
			22	16	4	1	1		
5	G	1	Total	C	N	O	S	0	0
			22	16	4	1	1		
5	H	1	Total	C	N	O	S	0	0
			22	16	4	1	1		

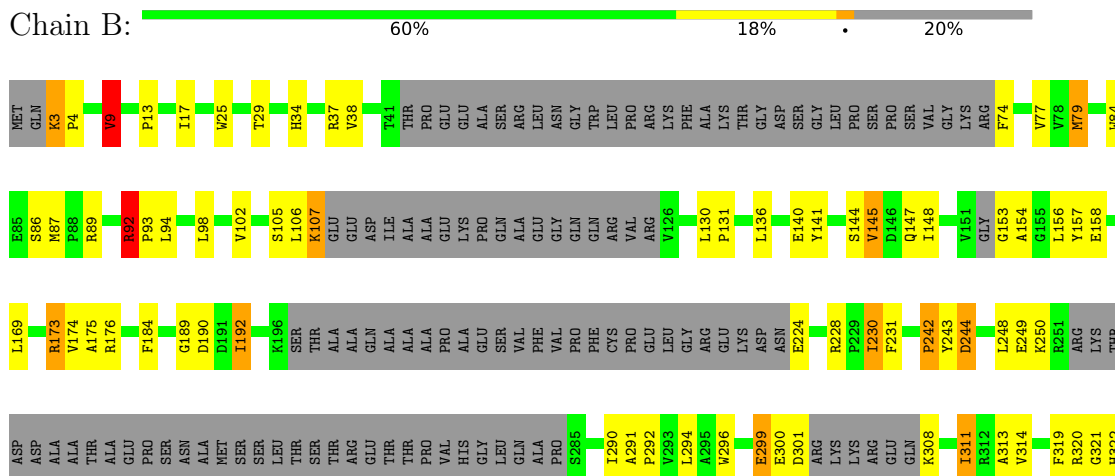
3 Residue-property plots

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: Bifunctional dihydrofolate reductase-thymidylate synthase



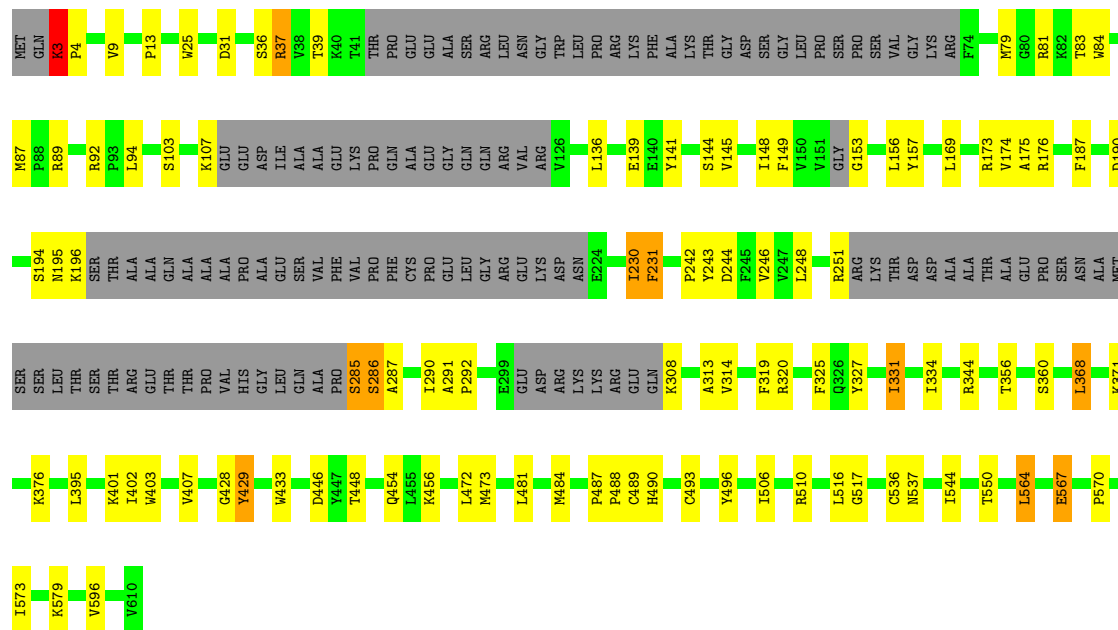
- Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase





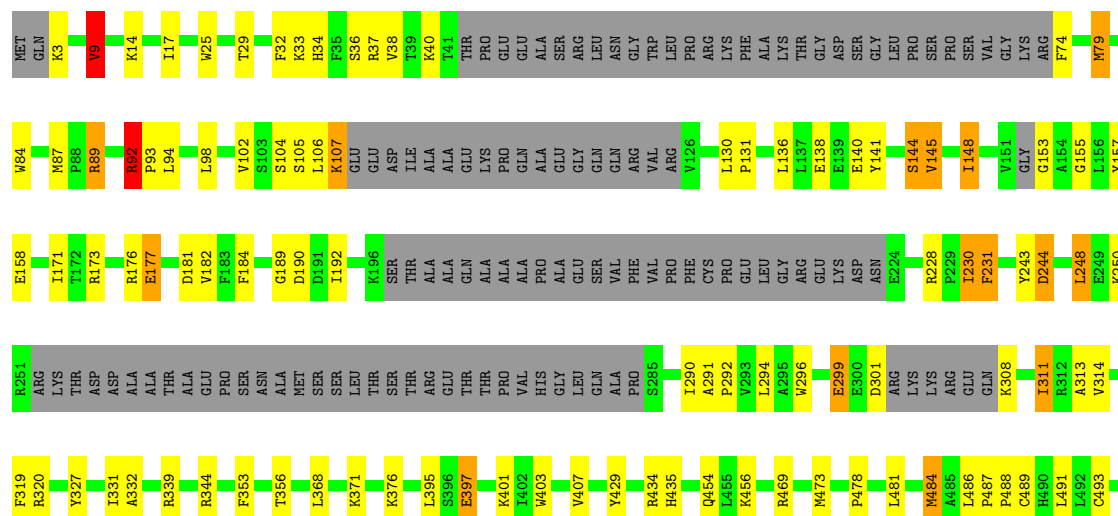
- Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase

Chain C: 63% 15% 20%



- Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase

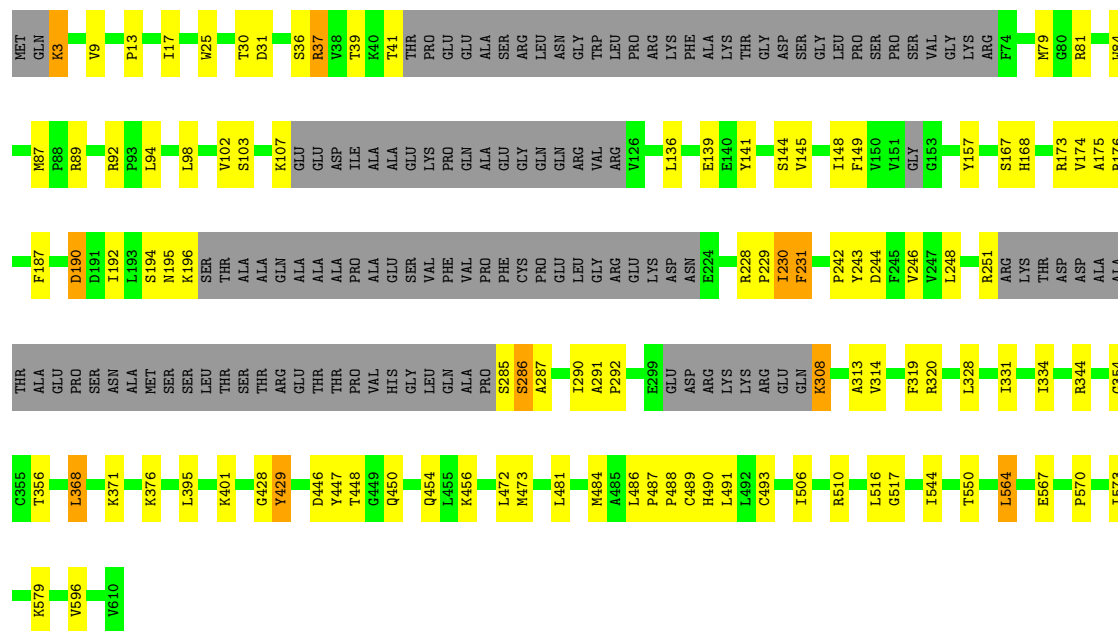
Chain D: 61% 16% 20%





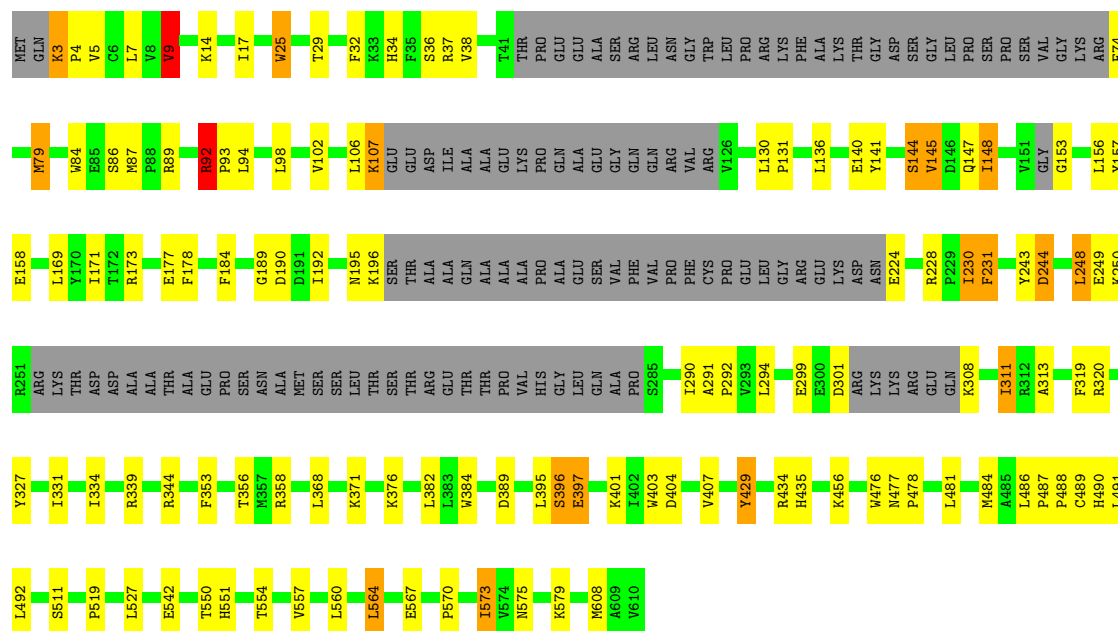
- Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase

Chain E: 63% 16% 20%



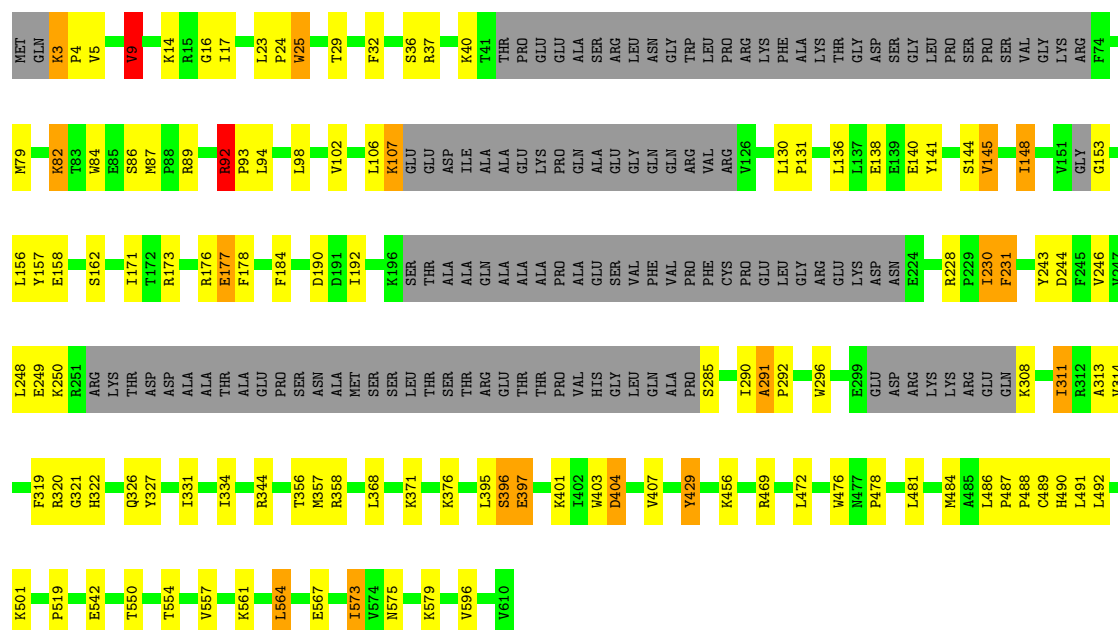
- Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase

Chain F: 60% 17% 20%



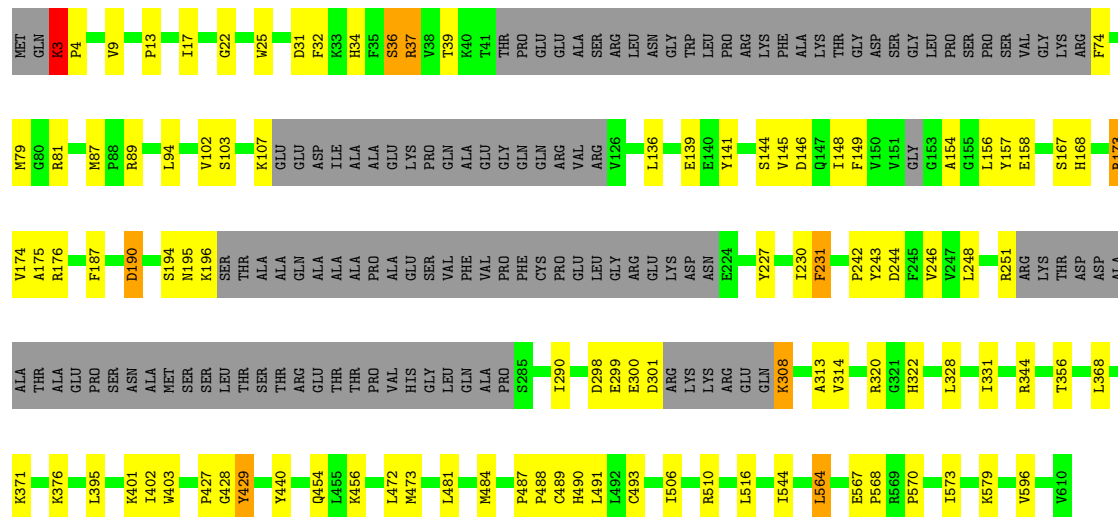
- Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase

Chain G:  61% 16% 20%



• Molecule 1: Bifunctional dihydrofolate reductase-thymidylate synthase

Chain H:  64% 15% 20%



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	53.54Å 145.12Å 176.16Å 89.97° 89.95° 89.89°	Depositor
Resolution (Å)	48.28 – 2.79 48.28 – 2.79	Depositor EDS
% Data completeness (in resolution range)	97.8 (48.28-2.79) 97.6 (48.28-2.79)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.21 (at 2.81Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.220 , 0.268 0.221 , 0.264	Depositor DCC
R_{free} test set	6476 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å ²)	73.2	Xtriage
Anisotropy	0.414	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 50.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.427 for h,-k,-l 0.427 for -h,k,-l 0.439 for -h,-k,l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	32492	wwPDB-VP
Average B, all atoms (Å ²)	79.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.34% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: 1UE, UMP, 04J, NDP

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	0.84	0/4026	0.95	4/5450 (0.1%)
1	B	0.93	3/4043 (0.1%)	1.10	9/5473 (0.2%)
1	C	0.83	0/4026	0.96	5/5450 (0.1%)
1	D	0.92	2/4043 (0.0%)	1.08	13/5473 (0.2%)
1	E	0.82	0/4026	0.94	2/5450 (0.0%)
1	F	0.90	1/4043 (0.0%)	1.09	11/5473 (0.2%)
1	G	0.91	2/4026 (0.0%)	1.07	8/5450 (0.1%)
1	H	0.83	0/4043	0.94	3/5473 (0.1%)
All	All	0.87	8/32276 (0.0%)	1.02	55/43692 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	D	0	1

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	153	GLY	N-CA	6.60	1.56	1.45
1	D	153	GLY	N-CA	6.18	1.55	1.45
1	G	153	GLY	N-CA	5.42	1.54	1.45
1	B	242	PRO	C-O	-5.39	1.18	1.23
1	F	153	GLY	N-CA	5.35	1.54	1.45

The worst 5 of 55 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	92	ARG	CA-C-N	-12.40	104.34	119.84
1	D	92	ARG	C-N-CA	-12.40	104.34	119.84
1	B	92	ARG	CA-C-N	-11.91	104.96	119.84
1	B	92	ARG	C-N-CA	-11.91	104.96	119.84
1	G	92	ARG	CA-C-N	-11.29	105.72	119.84

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	155	GLY	Peptide

5.2 Too-close contacts

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3931	0	3900	79	0
1	B	3948	0	3910	83	0
1	C	3931	0	3900	84	0
1	D	3948	0	3910	78	0
1	E	3931	0	3900	74	0
1	F	3948	0	3910	84	0
1	G	3931	0	3900	74	0
1	H	3948	0	3910	79	0
2	A	20	0	11	3	0
2	B	20	0	11	2	0
2	C	20	0	11	5	0
2	D	20	0	11	2	0
2	E	20	0	11	2	0
2	F	20	0	11	7	0
2	G	20	0	11	2	0
2	H	20	0	11	5	0
3	A	32	0	18	5	0
3	B	32	0	18	1	0
3	C	32	0	18	2	0
3	D	32	0	18	3	0
3	E	32	0	18	2	0
3	F	32	0	18	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	G	32	0	18	2	0
3	H	32	0	18	14	0
4	A	48	0	26	4	0
4	B	48	0	26	2	0
4	C	48	0	26	2	0
4	D	48	0	26	4	0
4	E	48	0	26	3	0
4	F	48	0	26	4	0
4	G	48	0	26	3	0
4	H	48	0	26	15	0
5	A	22	0	12	7	0
5	B	22	0	12	9	0
5	C	22	0	12	7	0
5	D	22	0	12	8	0
5	E	22	0	12	4	0
5	F	22	0	12	8	0
5	G	22	0	12	7	0
5	H	22	0	12	4	0
All	All	32492	0	31776	638	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 10.

The worst 5 of 638 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:516:LEU:HG	5:A:704:1UE:C6'	1.62	1.28
1:C:516:LEU:HG	5:C:704:1UE:C6'	1.70	1.21
4:D:703:NDP:H8A	4:D:703:NDP:H52A	1.25	1.14
1:C:516:LEU:HG	5:C:704:1UE:H11	1.18	1.13
1:A:516:LEU:HG	5:A:704:1UE:H11	1.18	1.11

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	476/610 (78%)	448 (94%)	23 (5%)	5 (1%)	11	36
1	B	478/610 (78%)	454 (95%)	21 (4%)	3 (1%)	21	51
1	C	476/610 (78%)	444 (93%)	28 (6%)	4 (1%)	16	44
1	D	478/610 (78%)	451 (94%)	22 (5%)	5 (1%)	12	38
1	E	476/610 (78%)	448 (94%)	24 (5%)	4 (1%)	16	44
1	F	478/610 (78%)	456 (95%)	18 (4%)	4 (1%)	16	44
1	G	476/610 (78%)	450 (94%)	22 (5%)	4 (1%)	16	44
1	H	478/610 (78%)	451 (94%)	23 (5%)	4 (1%)	16	44
All	All	3816/4880 (78%)	3602 (94%)	181 (5%)	33 (1%)	14	41

5 of 33 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	139	GLU
1	A	286	SER
1	A	429	TYR
1	B	190	ASP
1	B	429	TYR

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	429/525 (82%)	401 (94%)	28 (6%)	15	43
1	B	431/525 (82%)	386 (90%)	45 (10%)	7	22
1	C	429/525 (82%)	401 (94%)	28 (6%)	15	43
1	D	431/525 (82%)	384 (89%)	47 (11%)	6	21
1	E	429/525 (82%)	398 (93%)	31 (7%)	13	39
1	F	431/525 (82%)	387 (90%)	44 (10%)	7	23

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	G	429/525 (82%)	382 (89%)	47 (11%)	6	20
1	H	431/525 (82%)	402 (93%)	29 (7%)	15	42
All	All	3440/4200 (82%)	3141 (91%)	299 (9%)	10	30

5 of 299 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	92	ARG
1	H	344	ARG
1	G	145	VAL
1	G	401	LYS
1	C	564	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 40 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	435	HIS
1	G	545	HIS
1	F	450	GLN
1	G	168	HIS
1	H	450	GLN

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](#)

32 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	$\# Z > 2$
2	UMP	C	701	-	21,21,21	1.38	4 (19%)	30,31,31	2.14	9 (30%)
4	NDP	A	703	-	51,52,52	1.99	14 (27%)	71,80,80	1.67	12 (16%)
4	NDP	H	703	-	51,52,52	1.89	11 (21%)	71,80,80	1.82	16 (22%)
2	UMP	B	701	-	21,21,21	1.53	5 (23%)	30,31,31	2.09	9 (30%)
3	04J	A	702	-	34,34,34	1.83	5 (14%)	45,47,47	1.94	14 (31%)
5	1UE	B	704	-	25,25,25	2.87	10 (40%)	31,36,36	1.75	10 (32%)
4	NDP	D	703	-	51,52,52	1.99	15 (29%)	71,80,80	1.78	16 (22%)
2	UMP	A	701	-	21,21,21	1.34	4 (19%)	30,31,31	2.16	8 (26%)
2	UMP	D	701	-	21,21,21	1.52	6 (28%)	30,31,31	1.97	9 (30%)
4	NDP	F	703	-	51,52,52	2.01	15 (29%)	71,80,80	1.83	15 (21%)
2	UMP	H	701	-	21,21,21	1.34	4 (19%)	30,31,31	2.19	9 (30%)
5	1UE	F	704	-	25,25,25	2.91	10 (40%)	31,36,36	1.69	9 (29%)
4	NDP	E	703	-	51,52,52	1.95	14 (27%)	71,80,80	1.69	11 (15%)
3	04J	G	702	-	34,34,34	1.79	4 (11%)	45,47,47	1.75	9 (20%)
3	04J	E	702	-	34,34,34	1.73	3 (8%)	45,47,47	1.84	11 (24%)
2	UMP	E	701	-	21,21,21	1.47	5 (23%)	30,31,31	1.99	8 (26%)
3	04J	D	702	-	34,34,34	1.81	5 (14%)	45,47,47	1.63	8 (17%)
3	04J	H	702	-	34,34,34	1.73	4 (11%)	45,47,47	1.82	7 (15%)
5	1UE	E	704	-	25,25,25	2.80	10 (40%)	31,36,36	1.84	10 (32%)
3	04J	F	702	-	34,34,34	1.82	5 (14%)	45,47,47	1.70	9 (20%)
5	1UE	G	704	-	25,25,25	3.01	10 (40%)	31,36,36	1.70	8 (25%)
5	1UE	D	704	-	25,25,25	2.79	10 (40%)	31,36,36	1.74	10 (32%)
4	NDP	G	703	-	51,52,52	1.99	15 (29%)	71,80,80	1.77	17 (23%)
5	1UE	A	704	-	25,25,25	2.83	10 (40%)	31,36,36	1.80	9 (29%)
5	1UE	C	704	-	25,25,25	2.84	10 (40%)	31,36,36	1.79	10 (32%)
4	NDP	C	703	-	51,52,52	2.08	14 (27%)	71,80,80	1.74	17 (23%)
5	1UE	H	704	-	25,25,25	2.76	10 (40%)	31,36,36	1.78	9 (29%)
3	04J	C	702	-	34,34,34	1.76	3 (8%)	45,47,47	1.96	11 (24%)
4	NDP	B	703	-	51,52,52	2.31	12 (23%)	71,80,80	1.78	15 (21%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	04J	B	702	-	34,34,34	1.77	4 (11%)	45,47,47	1.68	7 (15%)
2	UMP	G	701	-	21,21,21	1.49	6 (28%)	30,31,31	1.99	9 (30%)
2	UMP	F	701	-	21,21,21	1.44	5 (23%)	30,31,31	1.95	4 (13%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	UMP	C	701	-	-	2/10/22/22	0/2/2/2
4	NDP	A	703	-	-	8/34/77/77	0/5/5/5
4	NDP	H	703	-	-	13/34/77/77	0/5/5/5
2	UMP	B	701	-	-	4/10/22/22	0/2/2/2
3	04J	A	702	-	-	4/22/22/22	0/3/3/3
5	1UE	B	704	-	-	0/4/4/4	0/4/4/4
4	NDP	D	703	-	-	4/34/77/77	0/5/5/5
2	UMP	A	701	-	-	5/10/22/22	0/2/2/2
2	UMP	D	701	-	-	4/10/22/22	0/2/2/2
4	NDP	F	703	-	-	3/34/77/77	0/5/5/5
2	UMP	H	701	-	-	2/10/22/22	0/2/2/2
5	1UE	F	704	-	-	0/4/4/4	0/4/4/4
4	NDP	E	703	-	-	3/34/77/77	0/5/5/5
3	04J	G	702	-	-	6/22/22/22	0/3/3/3
3	04J	E	702	-	-	6/22/22/22	0/3/3/3
2	UMP	E	701	-	-	6/10/22/22	0/2/2/2
3	04J	D	702	-	-	5/22/22/22	0/3/3/3
3	04J	H	702	-	-	8/22/22/22	0/3/3/3
5	1UE	E	704	-	-	0/4/4/4	0/4/4/4
3	04J	F	702	-	-	7/22/22/22	0/3/3/3
5	1UE	G	704	-	-	0/4/4/4	0/4/4/4
5	1UE	D	704	-	-	0/4/4/4	0/4/4/4
4	NDP	G	703	-	-	7/34/77/77	0/5/5/5
5	1UE	A	704	-	-	0/4/4/4	0/4/4/4
5	1UE	C	704	-	-	0/4/4/4	0/4/4/4
4	NDP	C	703	-	-	11/34/77/77	0/5/5/5
5	1UE	H	704	-	-	0/4/4/4	0/4/4/4

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	04J	C	702	-	-	8/22/22/22	0/3/3/3
4	NDP	B	703	-	-	9/34/77/77	0/5/5/5
3	04J	B	702	-	-	4/22/22/22	0/3/3/3
2	UMP	G	701	-	-	2/10/22/22	0/2/2/2
2	UMP	F	701	-	-	5/10/22/22	0/2/2/2

The worst 5 of 262 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	703	NDP	PN-O3	7.27	1.67	1.59
4	B	703	NDP	PA-O3	7.27	1.67	1.59
5	F	704	1UE	C1'-S1	-6.73	1.68	1.78
3	B	702	04J	C7-N8	6.65	1.43	1.31
5	E	704	1UE	C1'-S1	-6.64	1.68	1.78

The worst 5 of 335 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	E	703	NDP	N3A-C2A-N1A	-7.06	117.90	128.58
4	B	703	NDP	N3A-C2A-N1A	-7.02	117.95	128.58
4	C	703	NDP	N3A-C2A-N1A	-6.93	118.08	128.58
4	F	703	NDP	N3A-C2A-N1A	-6.88	118.16	128.58
4	D	703	NDP	N3A-C2A-N1A	-6.87	118.18	128.58

There are no chirality outliers.

5 of 136 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	701	UMP	C5'-O5'-P-OP2
2	A	701	UMP	C5'-O5'-P-OP3
2	E	701	UMP	C5'-O5'-P-OP1
2	E	701	UMP	C5'-O5'-P-OP3
4	A	703	NDP	PA-O3-PN-O5D

There are no ring outliers.

32 monomers are involved in 144 short contacts:

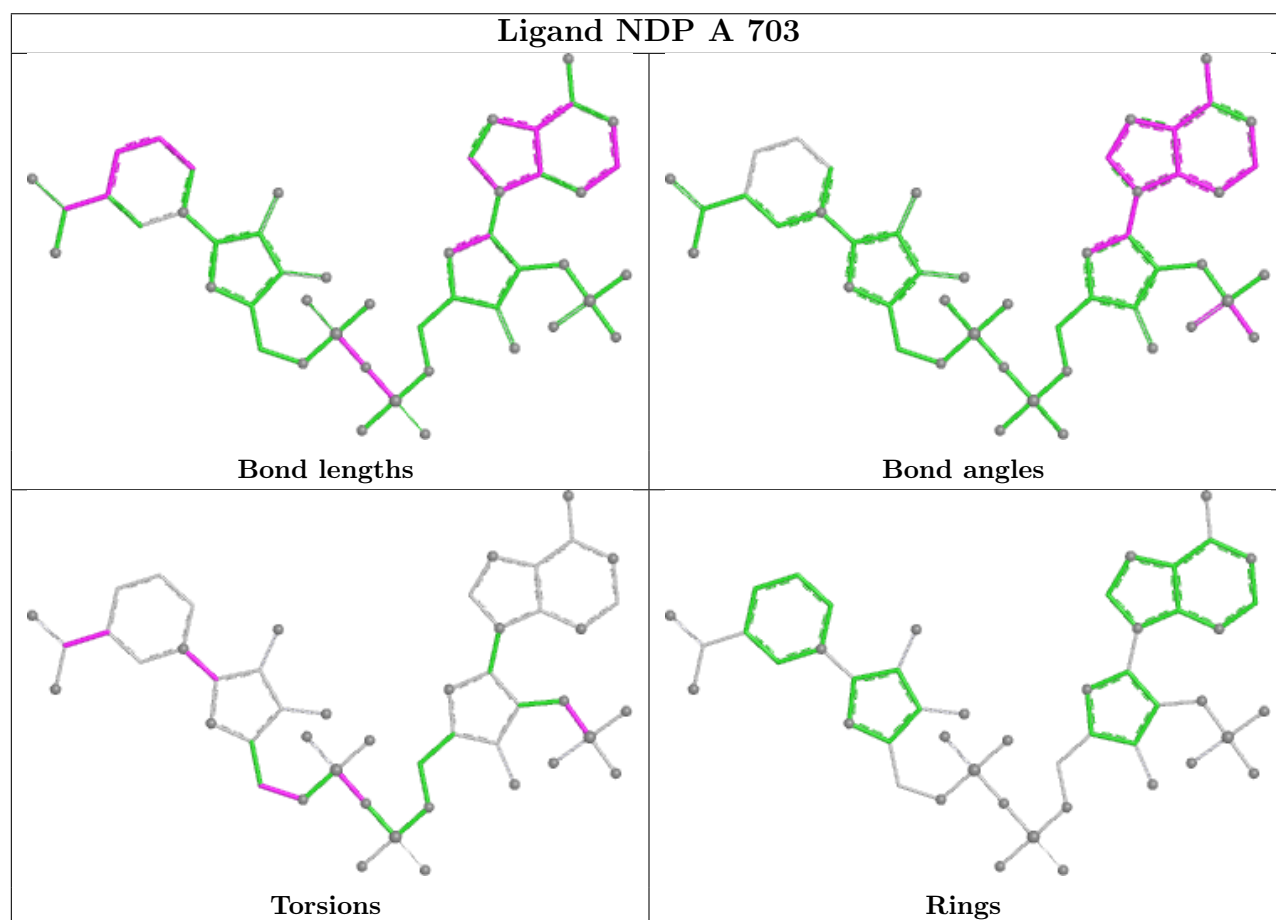
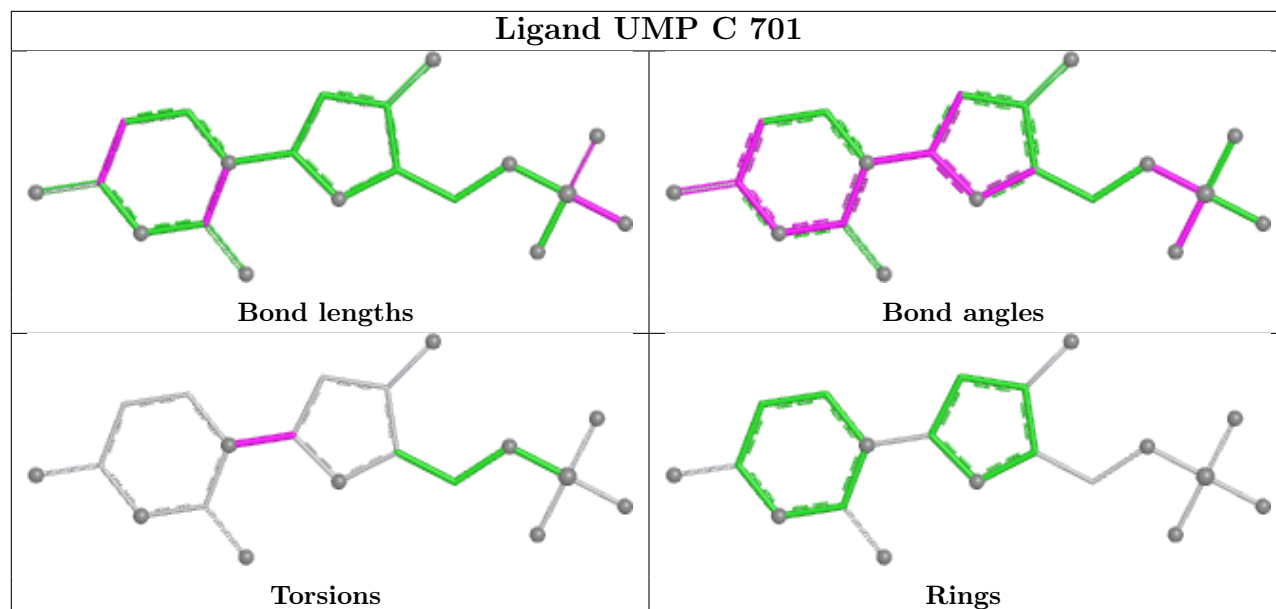
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	701	UMP	5	0
4	A	703	NDP	4	0

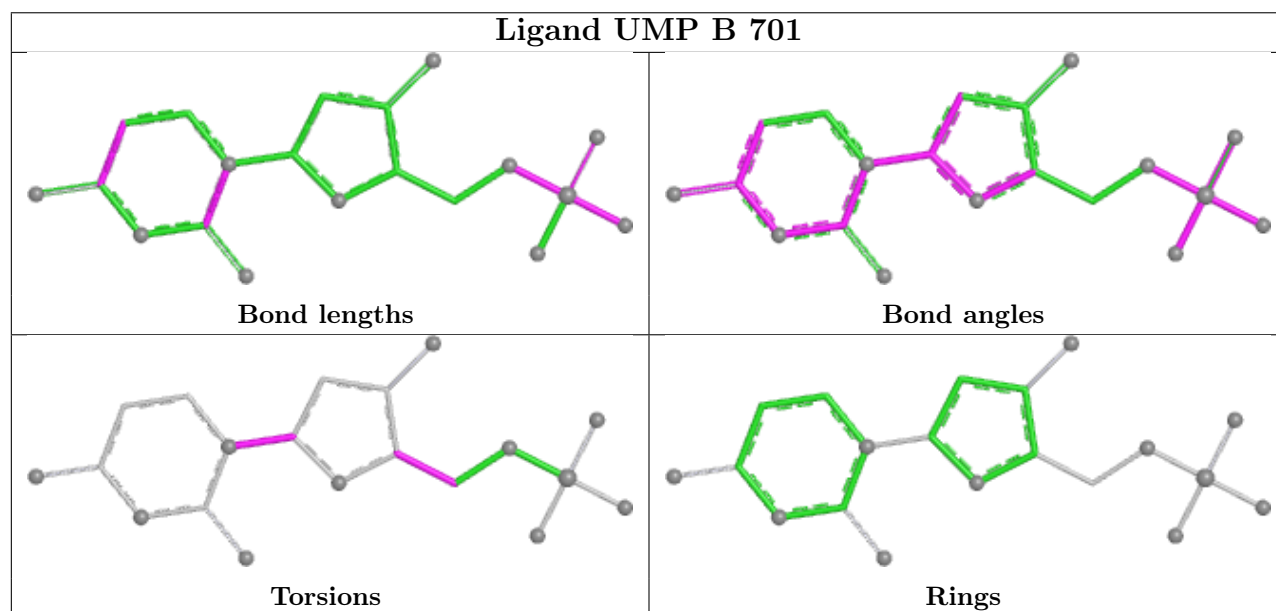
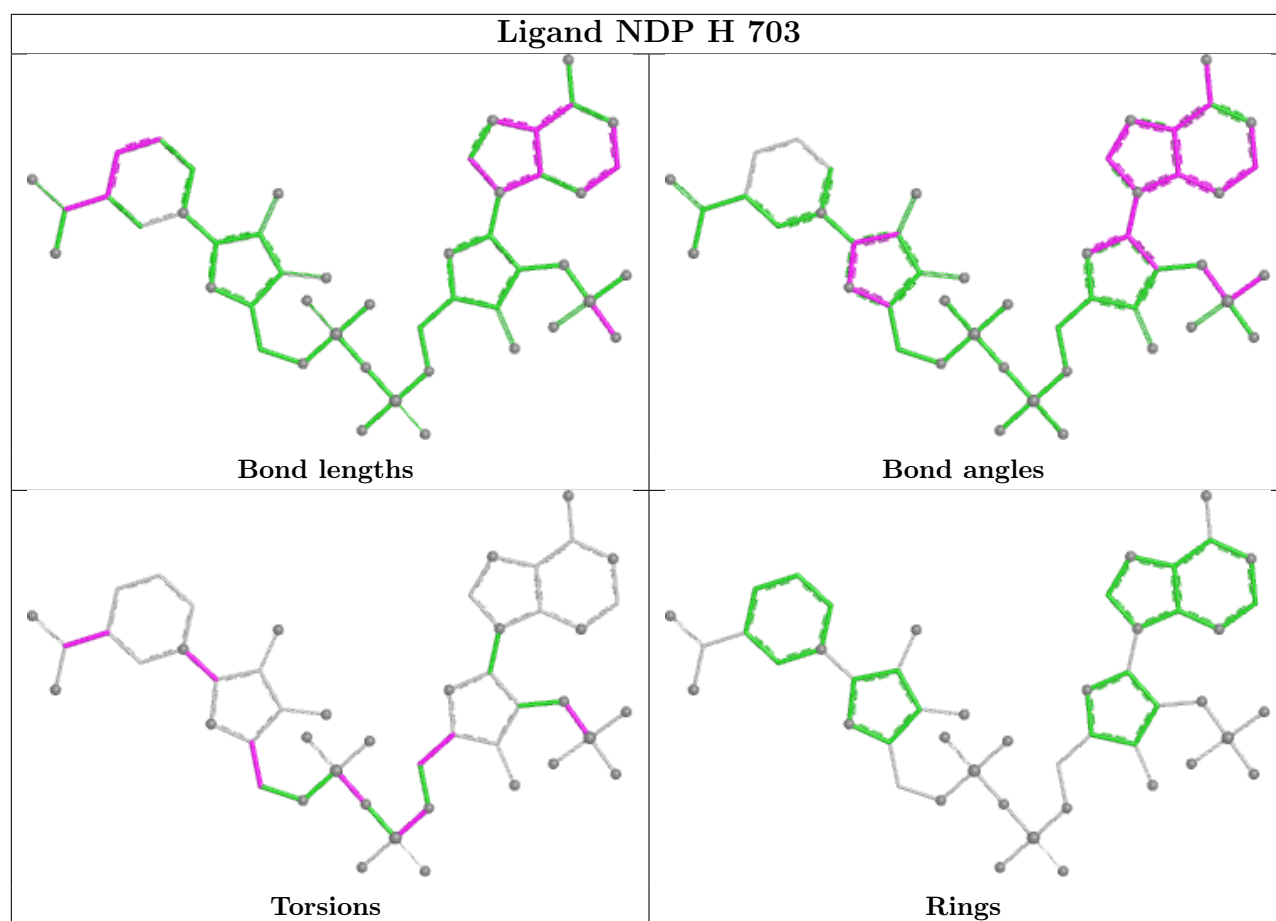
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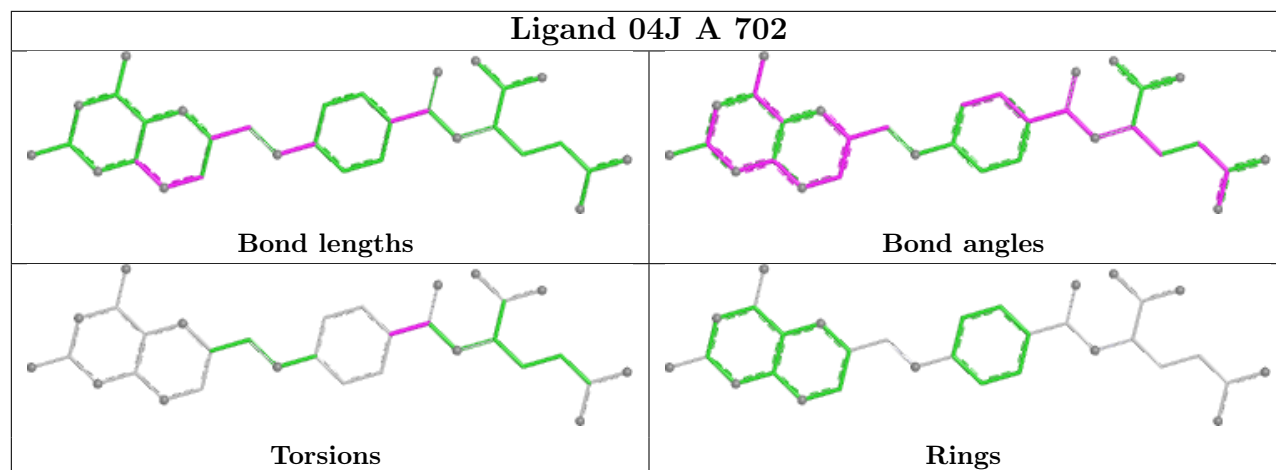
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	H	703	NDP	15	0
2	B	701	UMP	2	0
3	A	702	04J	5	0
5	B	704	1UE	9	0
4	D	703	NDP	4	0
2	A	701	UMP	3	0
2	D	701	UMP	2	0
4	F	703	NDP	4	0
2	H	701	UMP	5	0
5	F	704	1UE	8	0
4	E	703	NDP	3	0
3	G	702	04J	2	0
3	E	702	04J	2	0
2	E	701	UMP	2	0
3	D	702	04J	3	0
3	H	702	04J	14	0
5	E	704	1UE	4	0
3	F	702	04J	2	0
5	G	704	1UE	7	0
5	D	704	1UE	8	0
4	G	703	NDP	3	0
5	A	704	1UE	7	0
5	C	704	1UE	7	0
4	C	703	NDP	2	0
5	H	704	1UE	4	0
3	C	702	04J	2	0
4	B	703	NDP	2	0
3	B	702	04J	1	0
2	G	701	UMP	2	0
2	F	701	UMP	7	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.

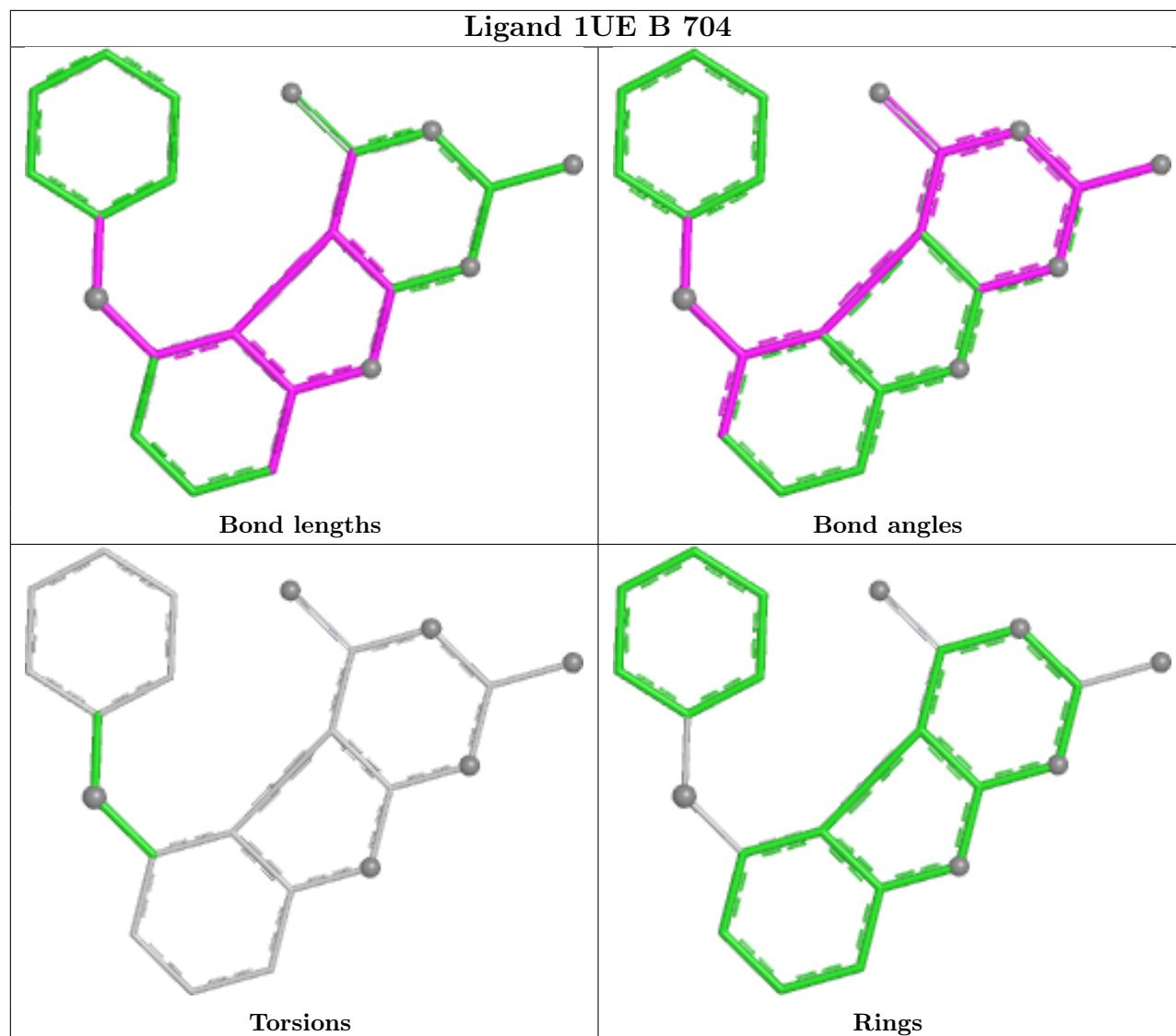


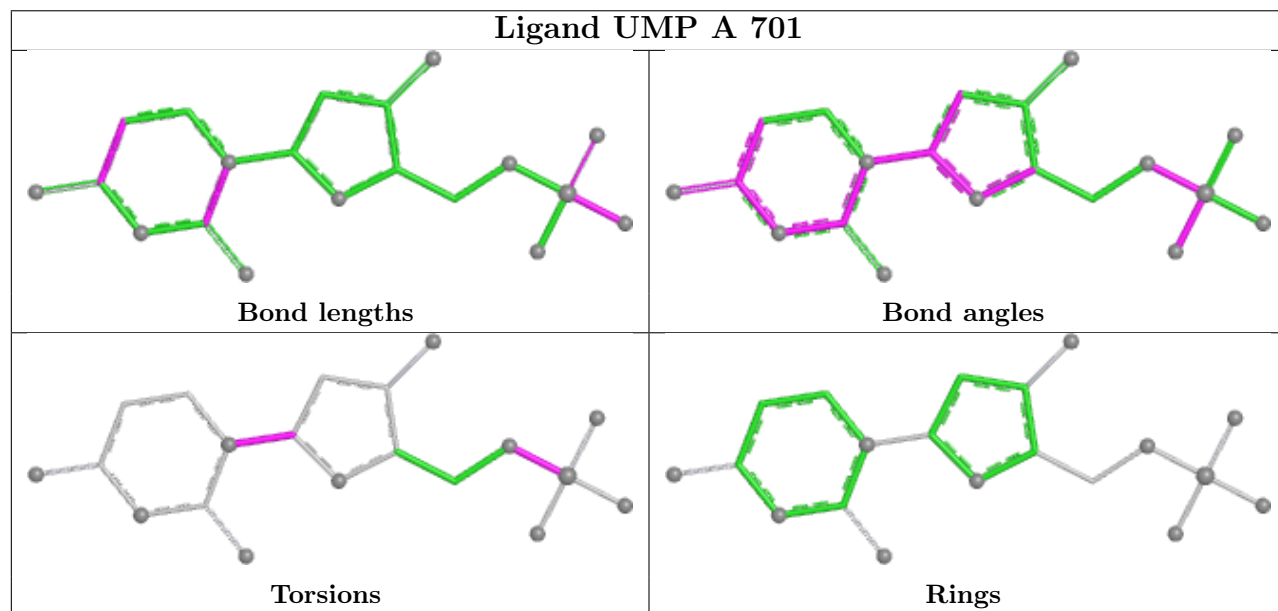
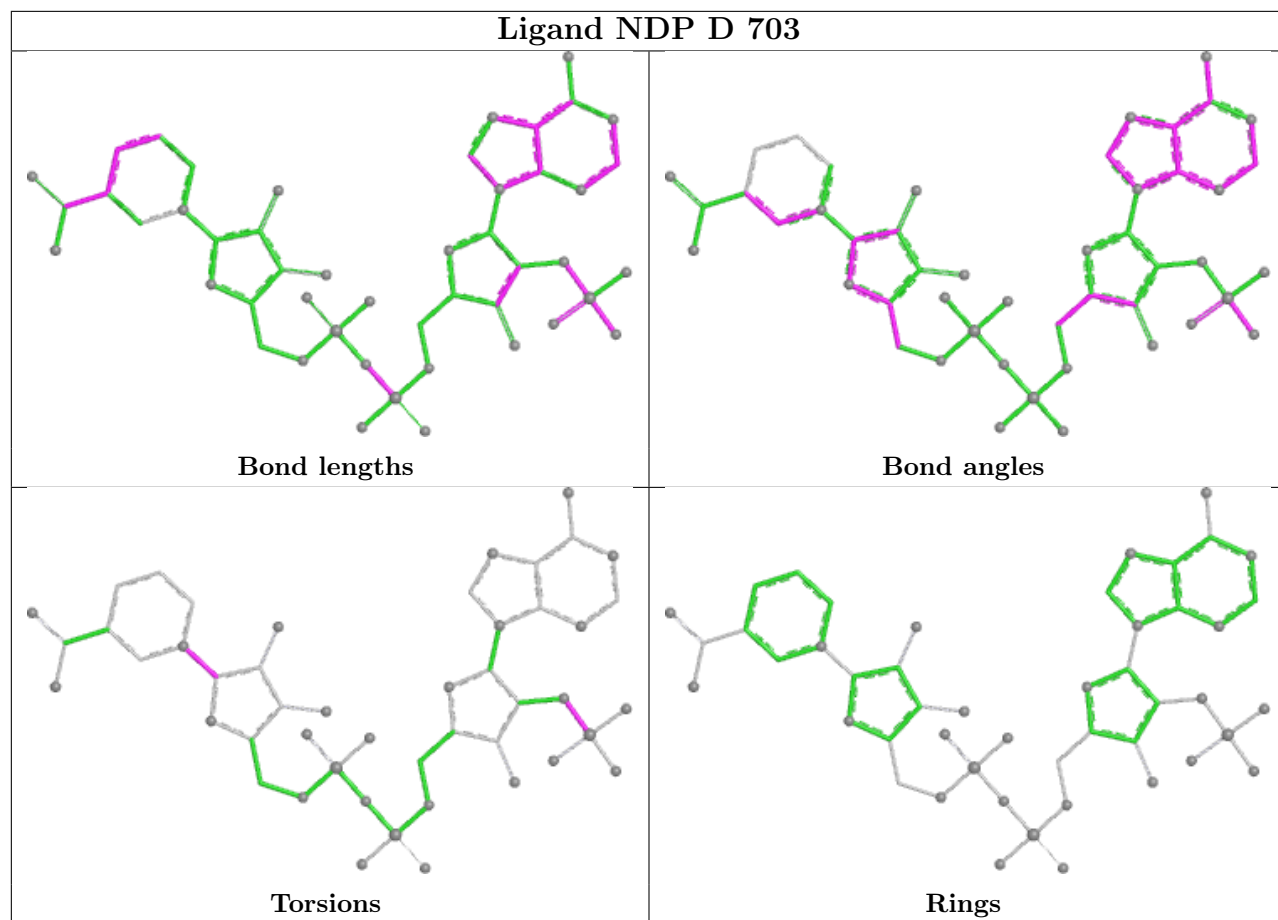


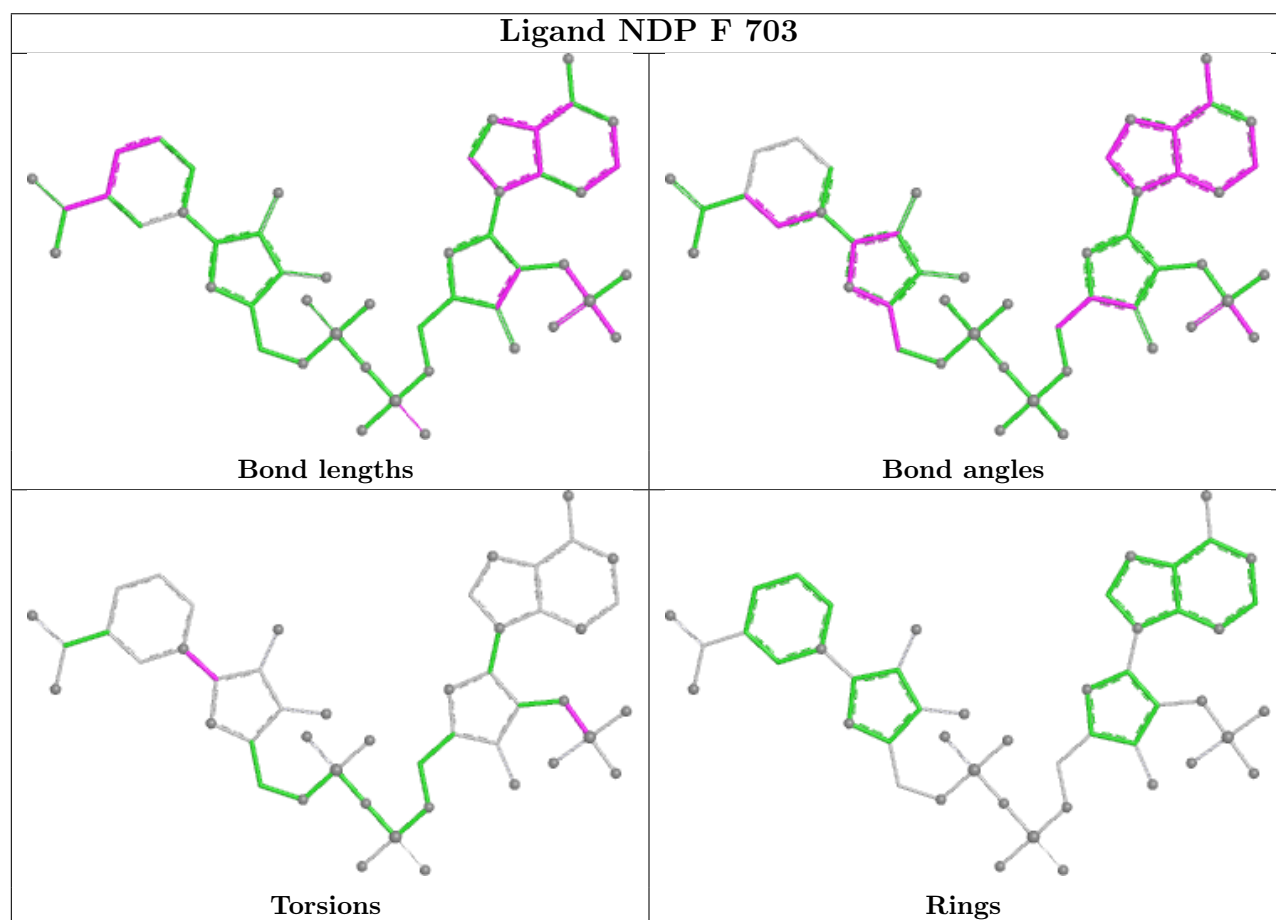
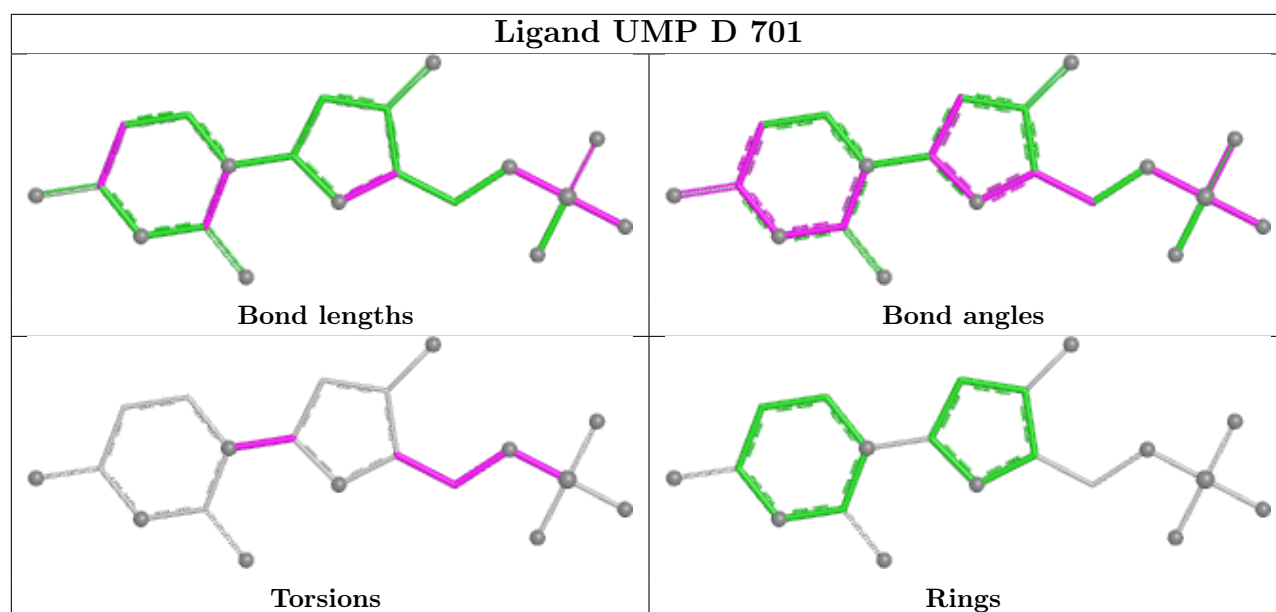
Ligand 04J A 702



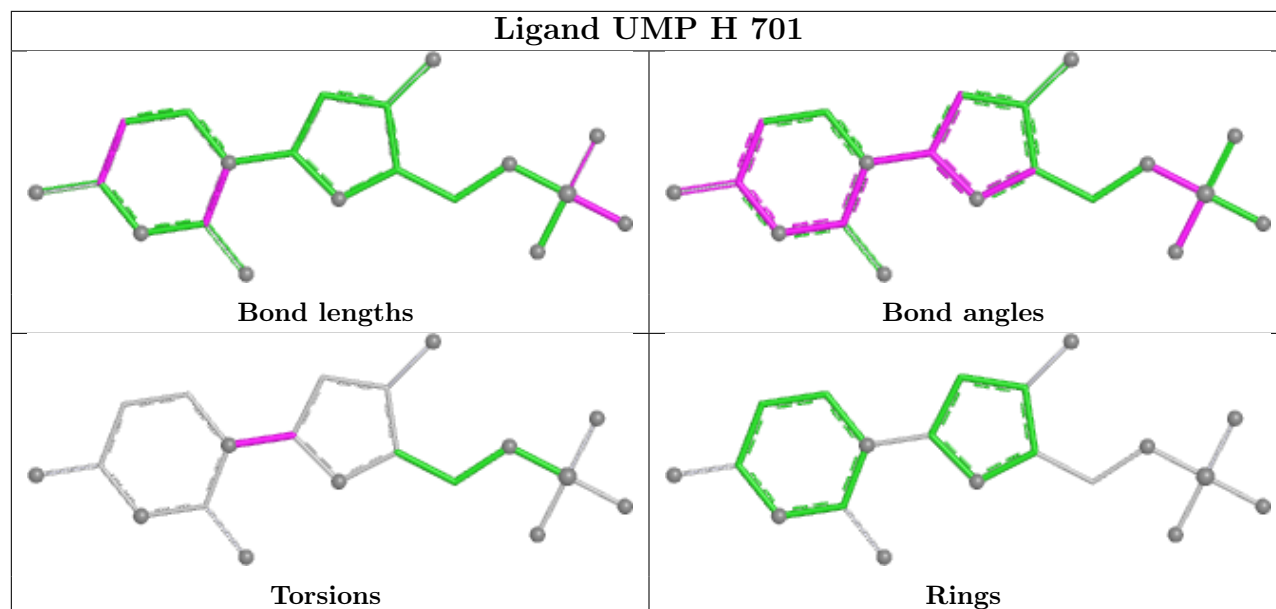
Ligand 1UE B 704



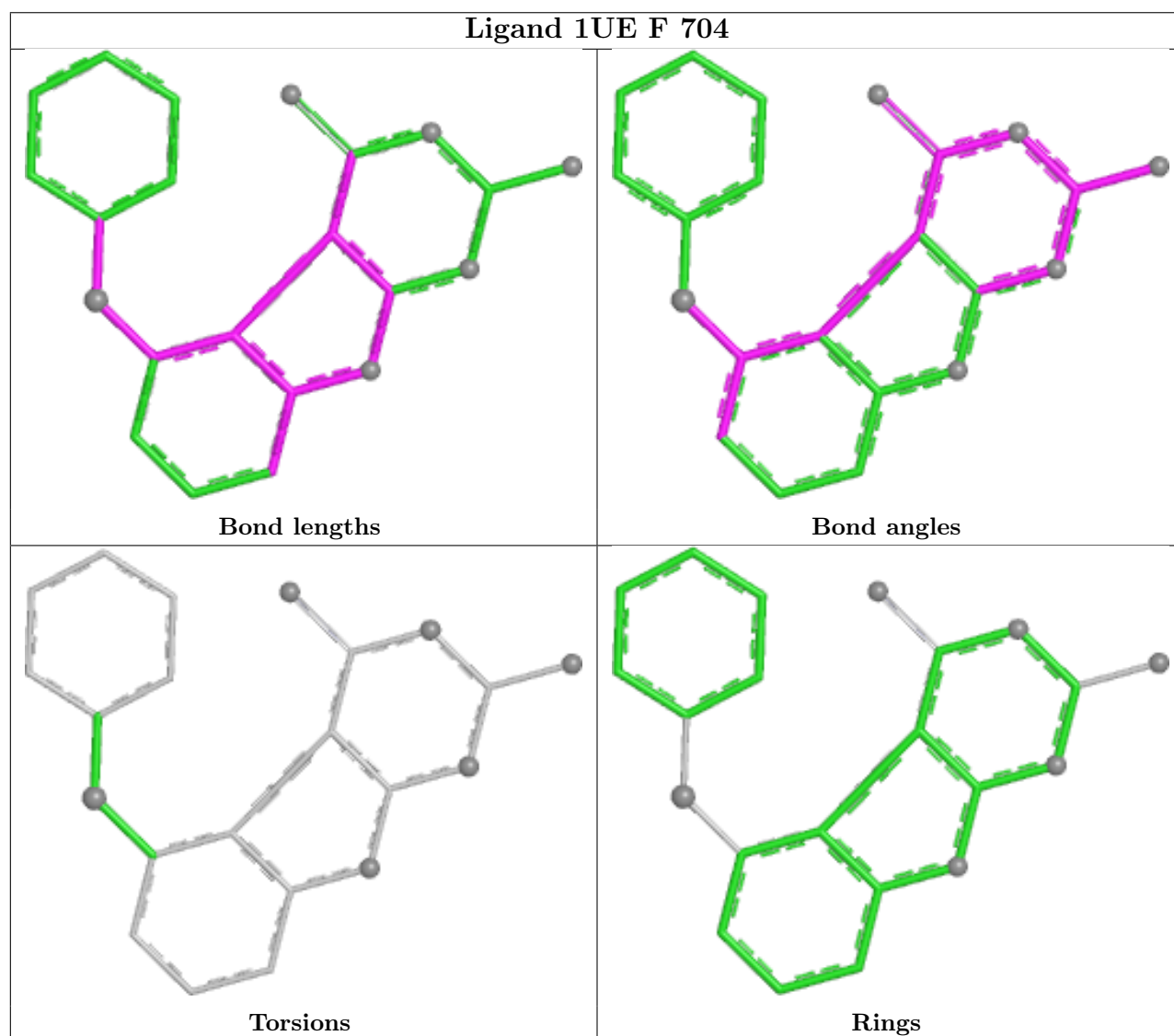


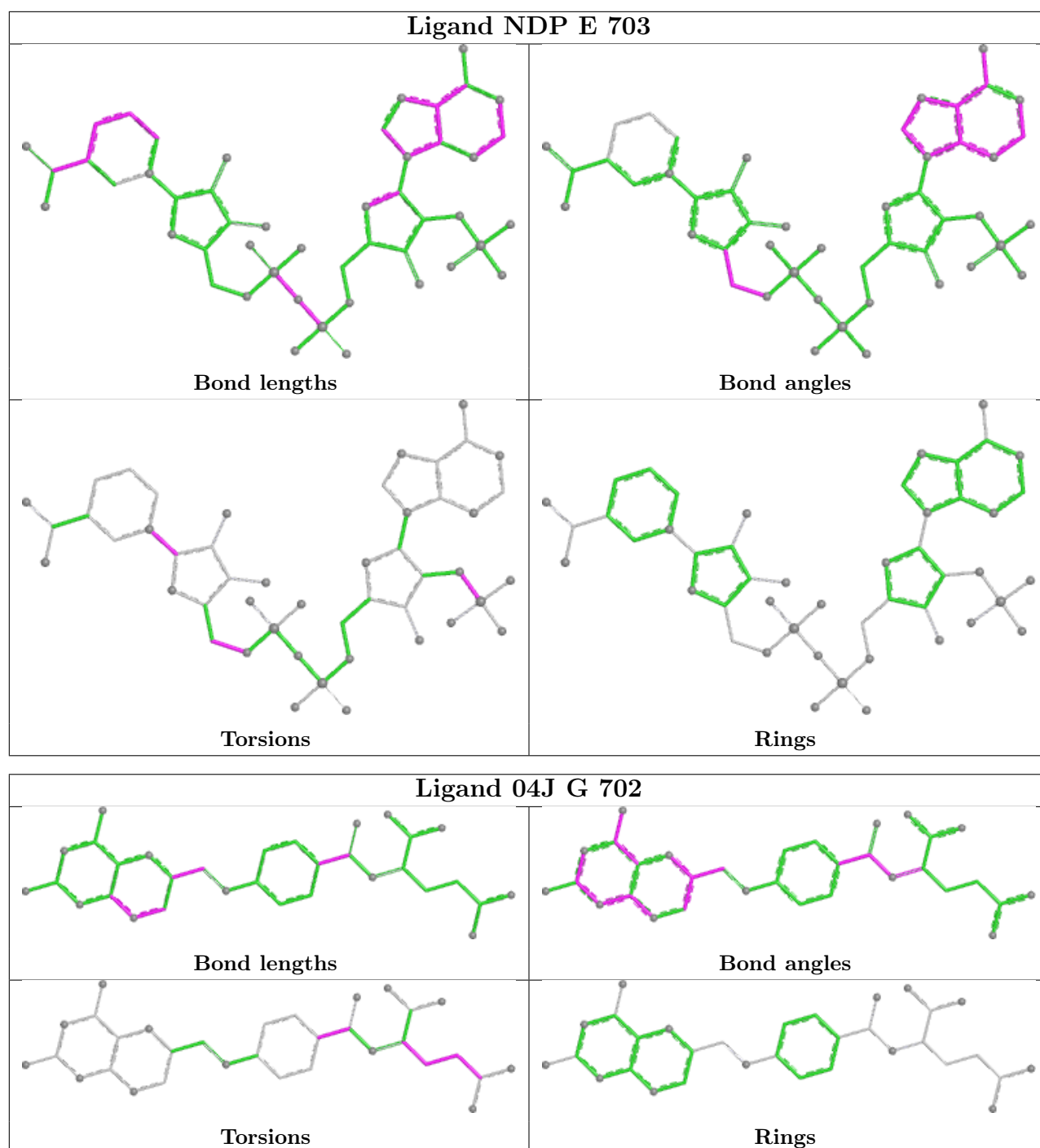


Ligand UMP H 701

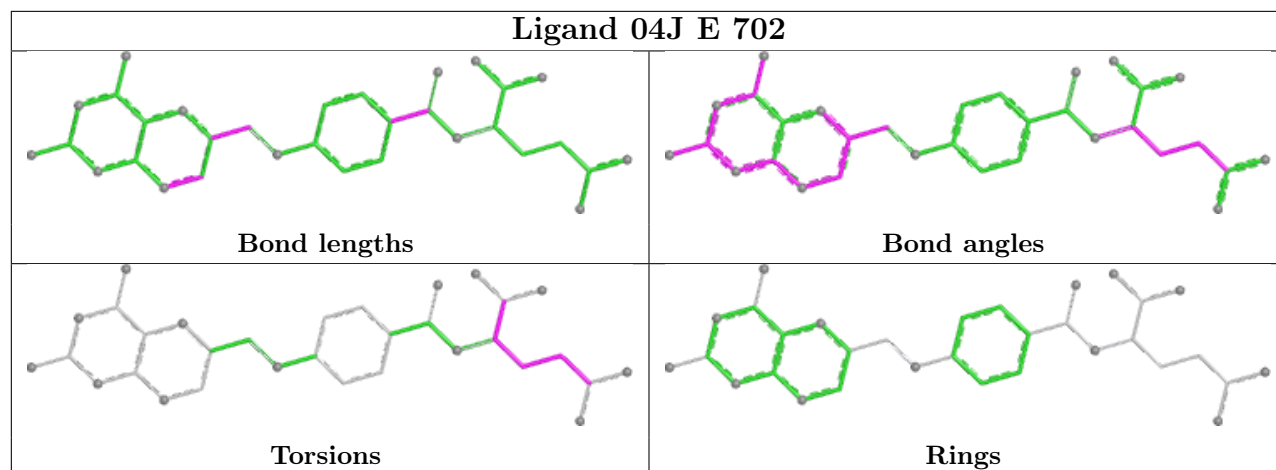


Ligand 1UE F 704

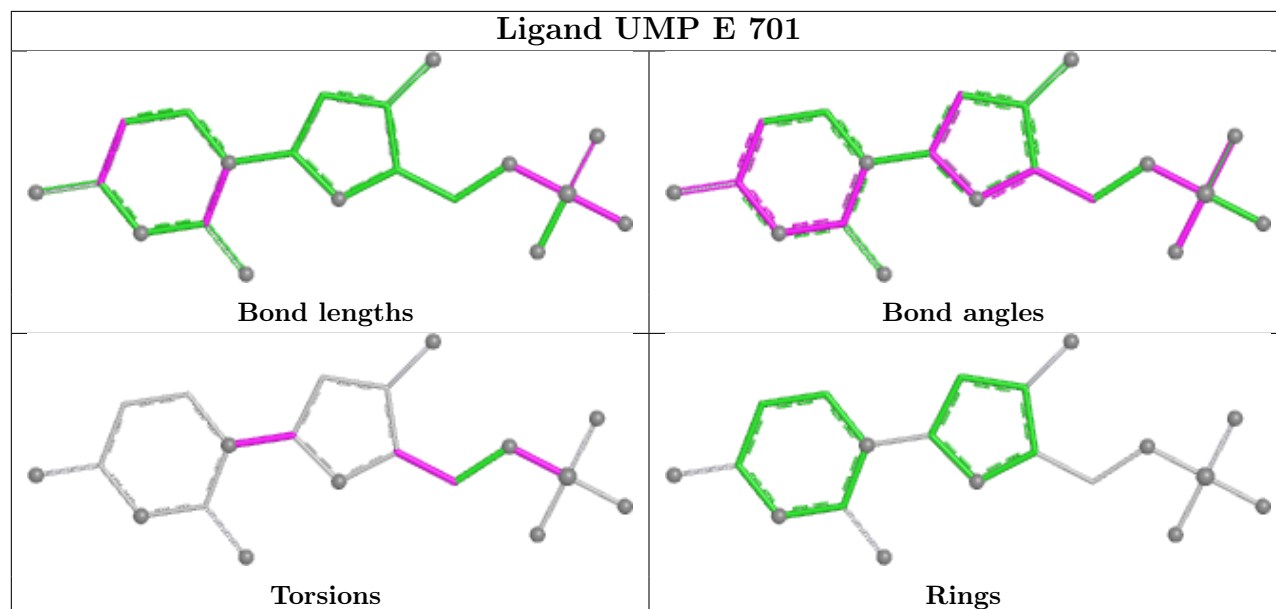




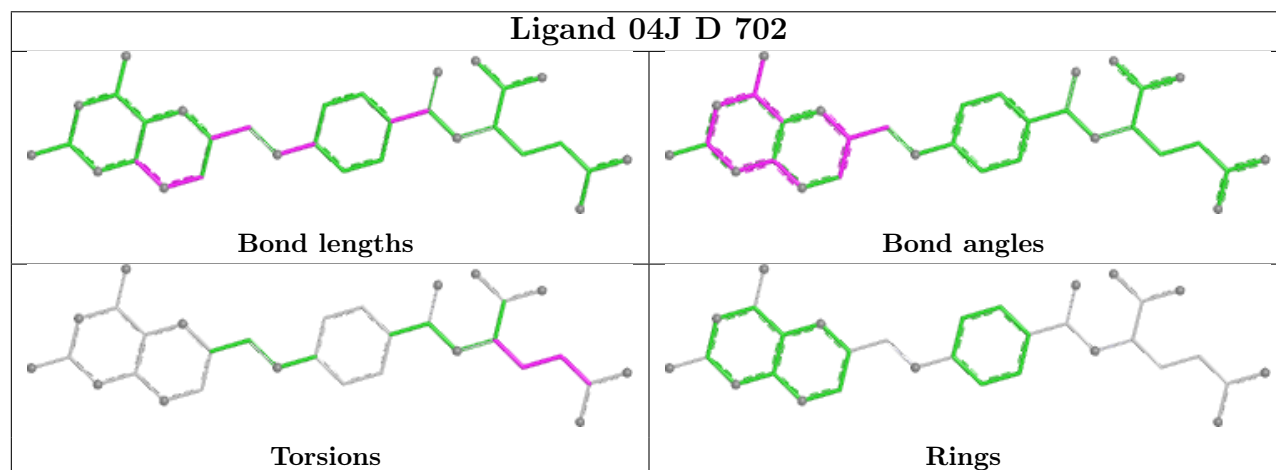
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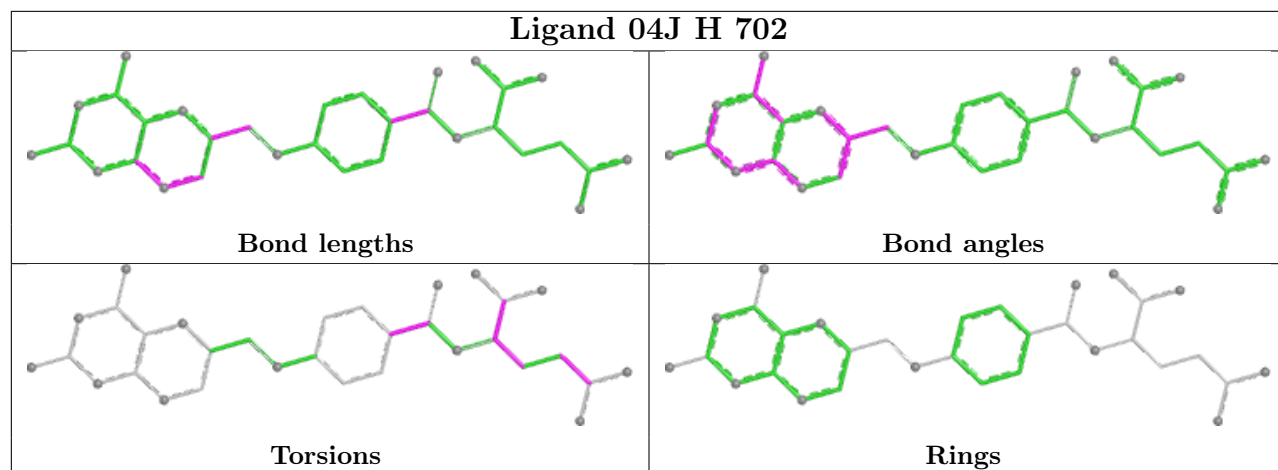
Ligand UMP E 701



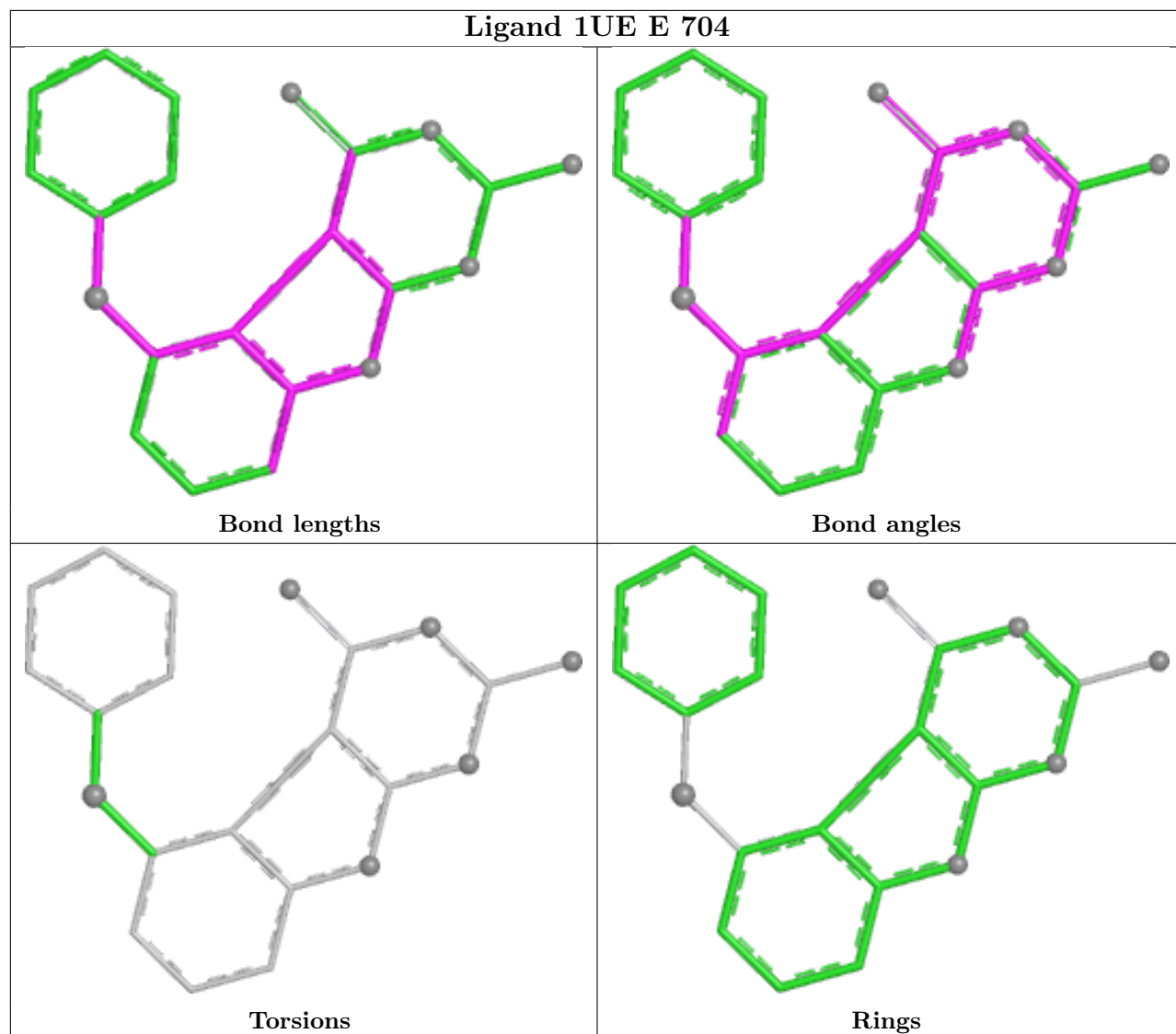
Ligand 04J D 702



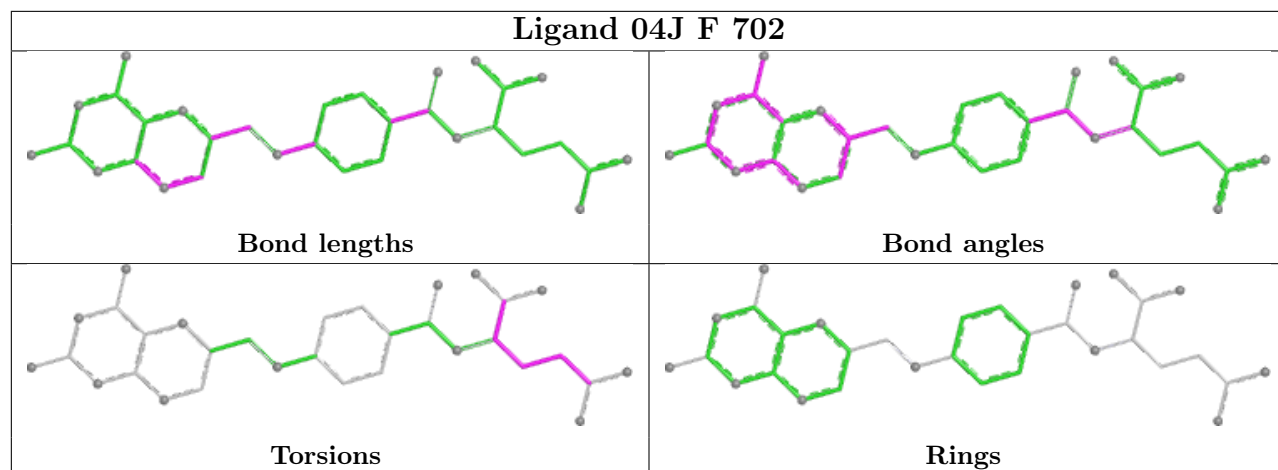
Ligand 04J H 702



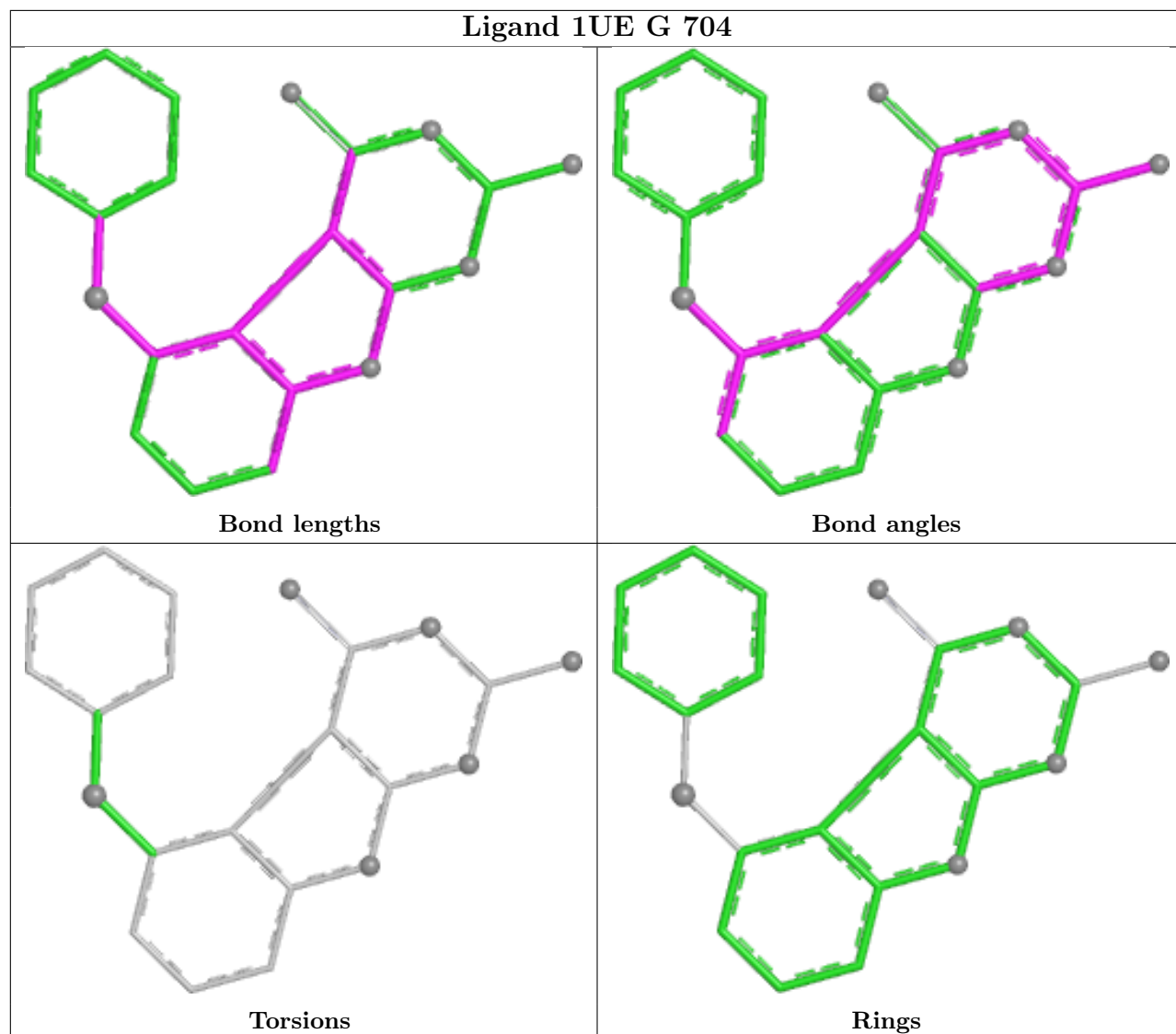
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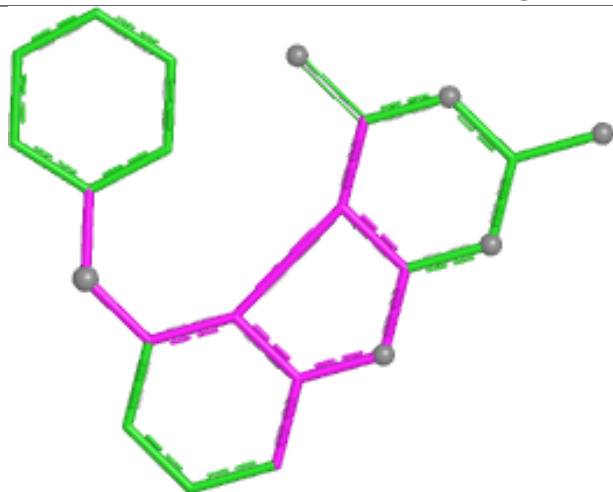
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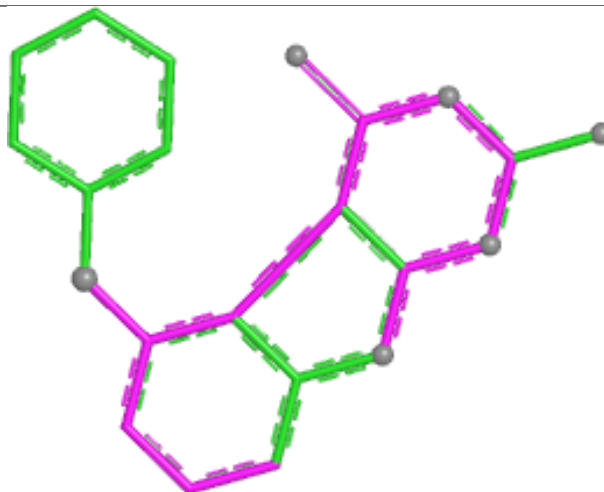
Ligand 1UE G 704



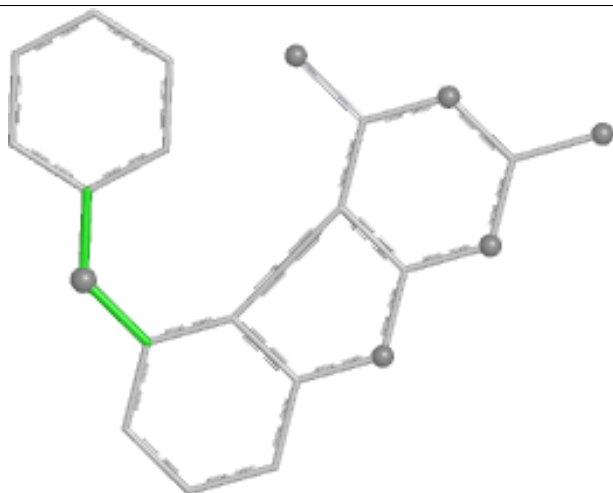
Ligand 1UE D 704



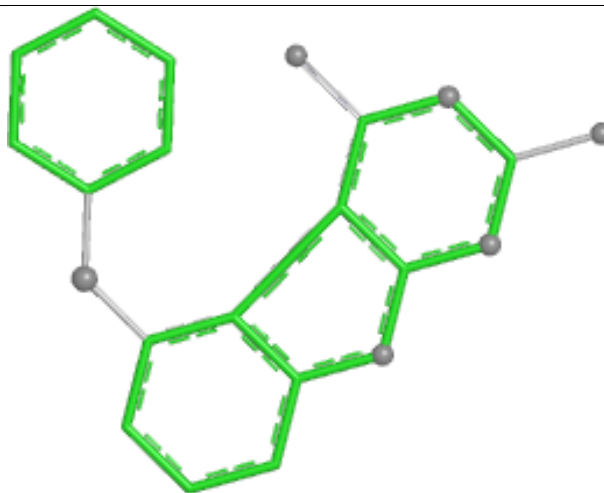
Bond lengths



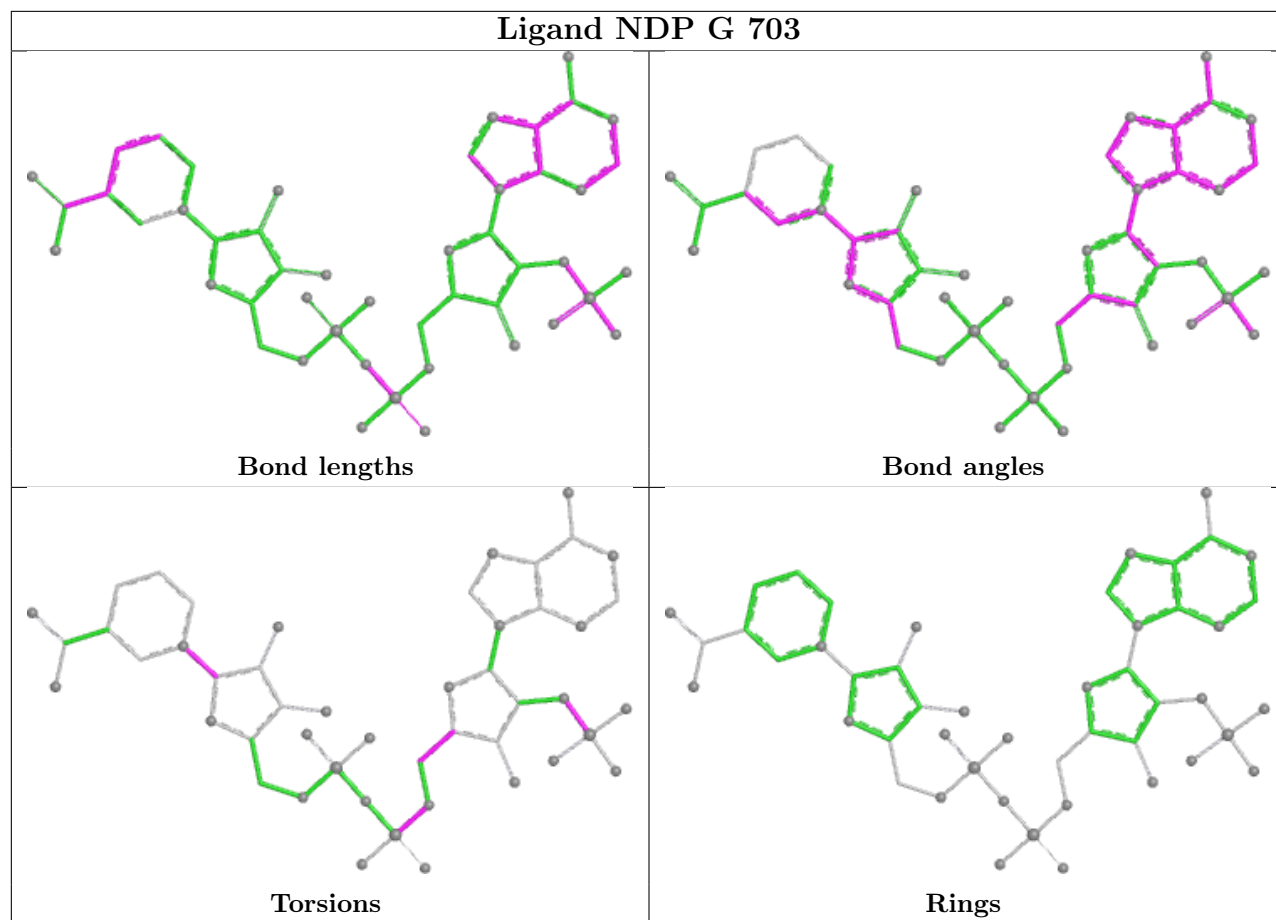
Bond angles



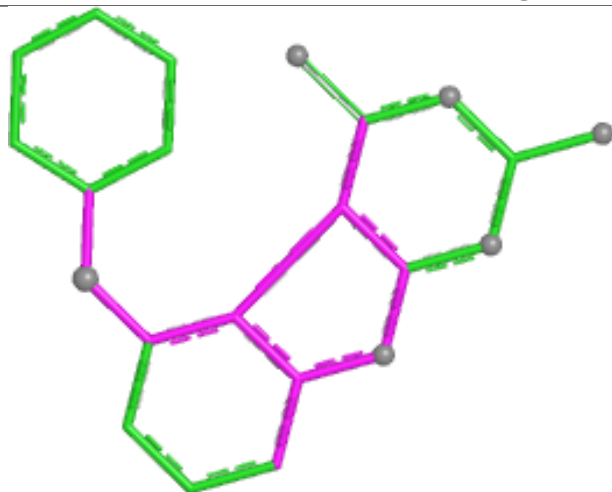
Torsions



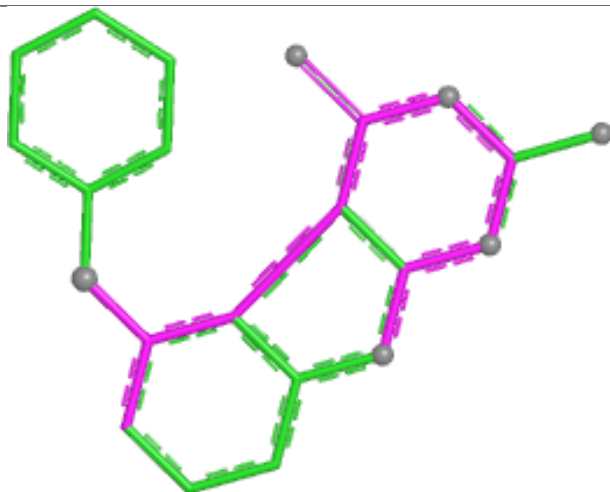
Rings



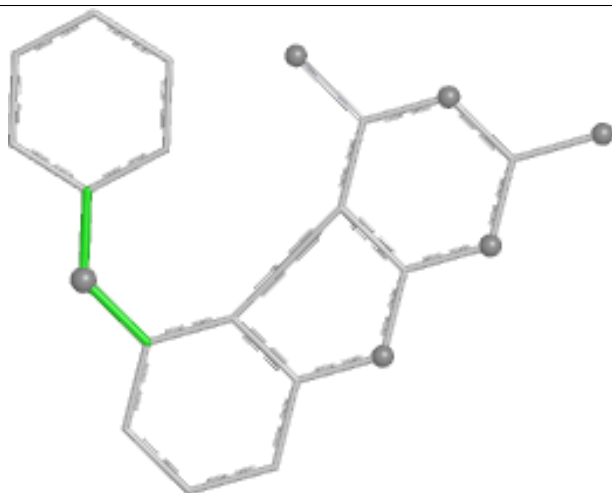
Ligand 1UE A 704



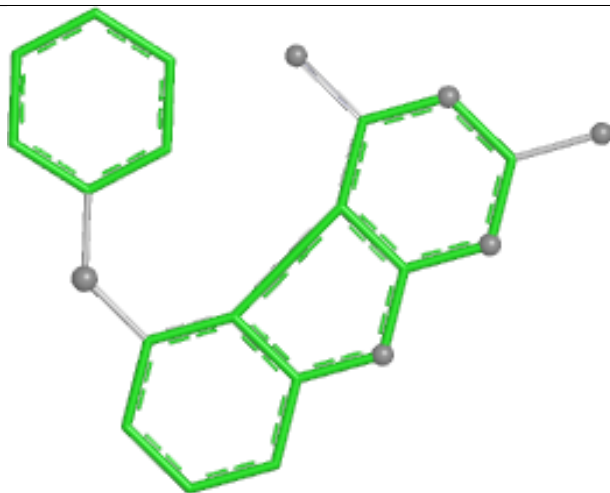
Bond lengths



Bond angles

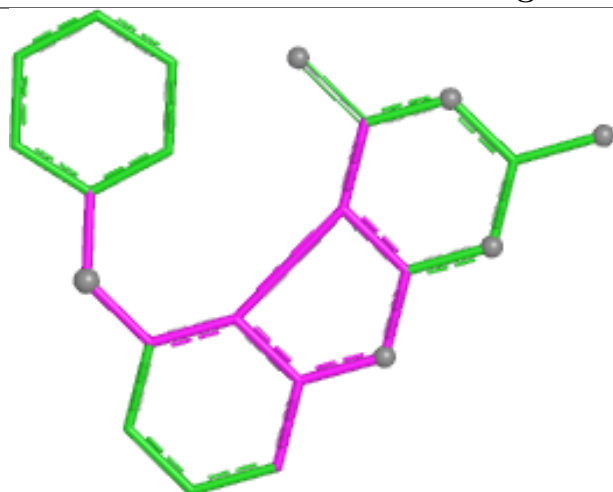


Torsions

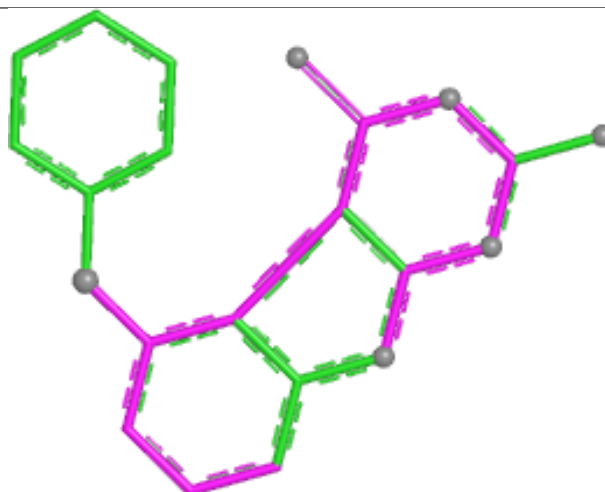


Rings

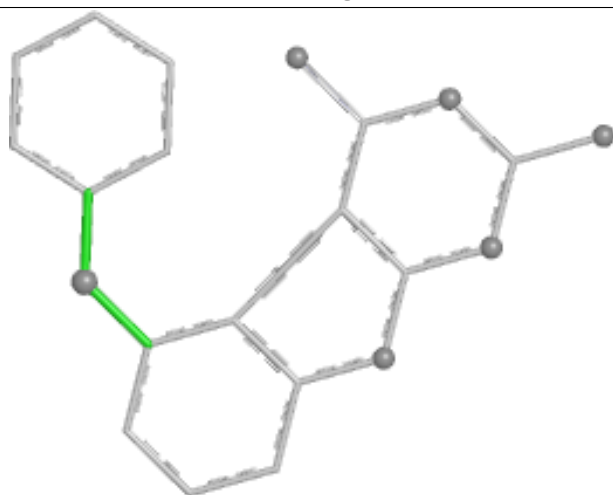
Ligand 1UE C 704



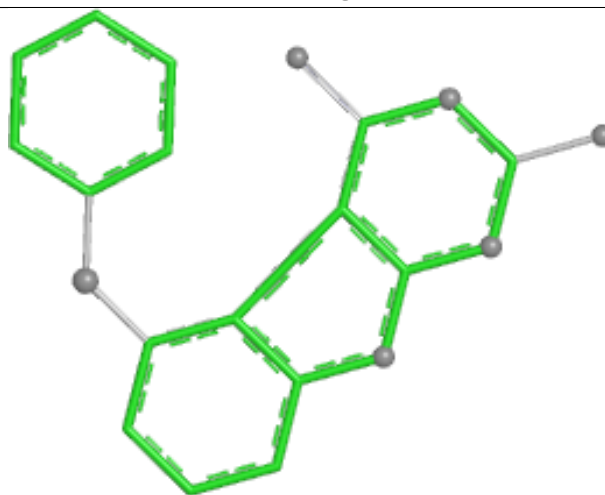
Bond lengths



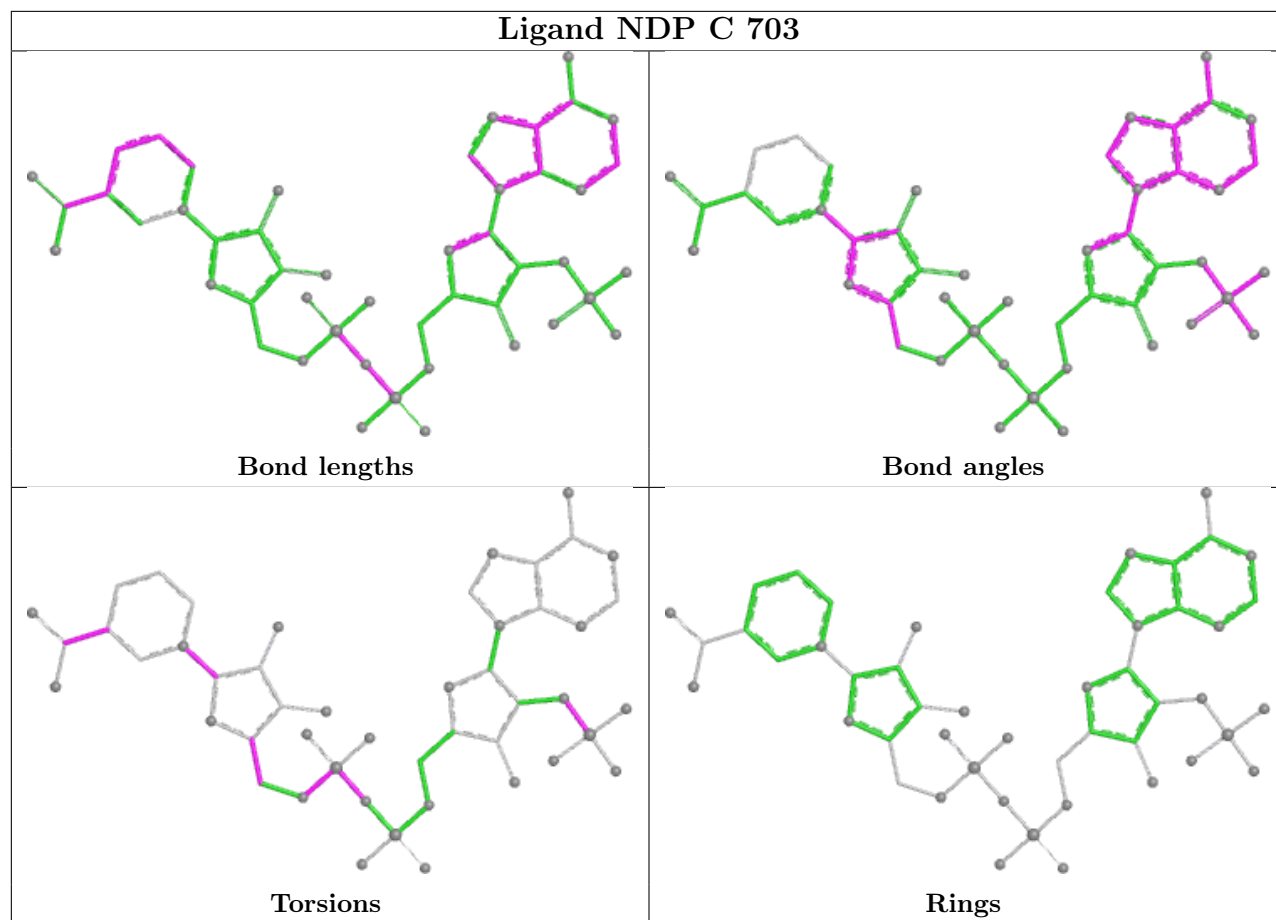
Bond angles



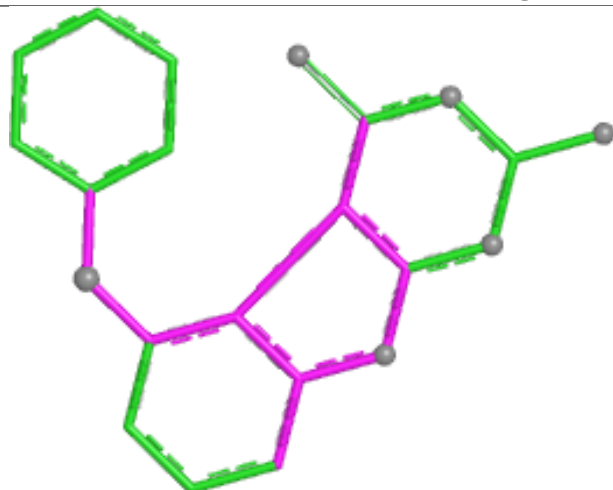
Torsions



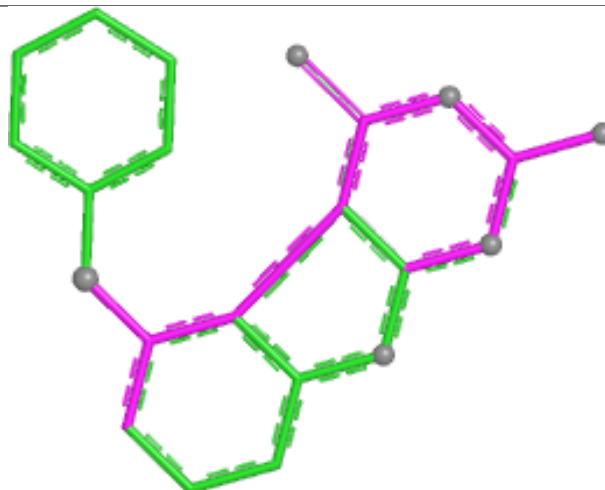
Rings



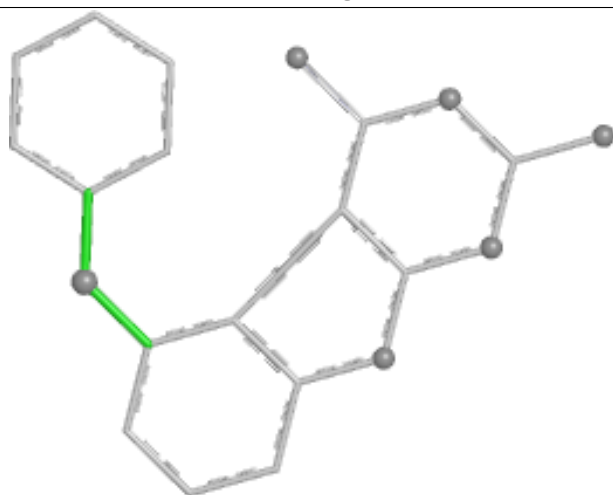
Ligand 1UE H 704



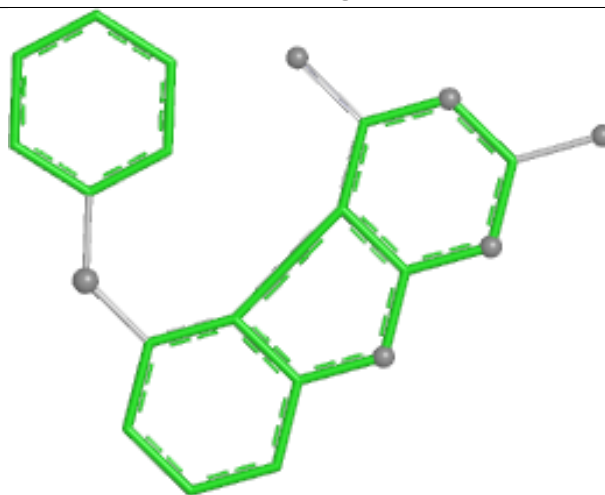
Bond lengths



Bond angles

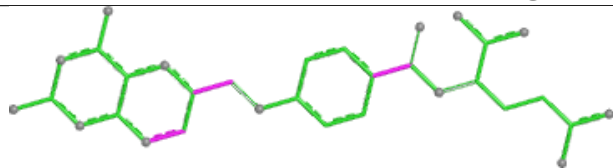


Torsions

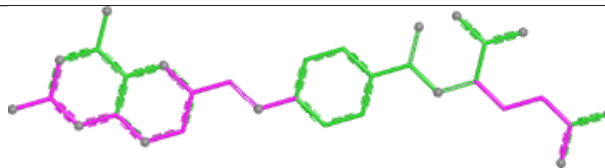


Rings

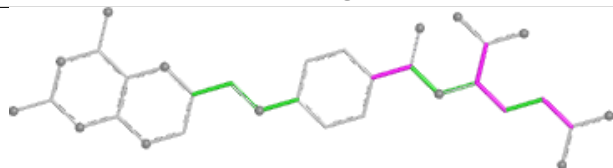
Ligand 04J C 702



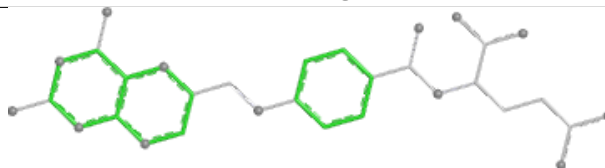
Bond lengths



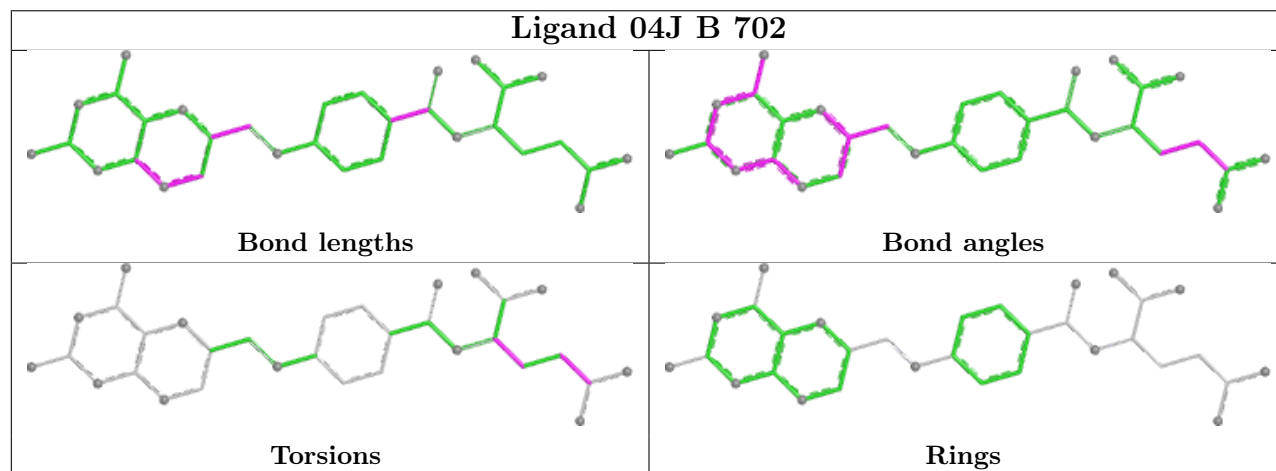
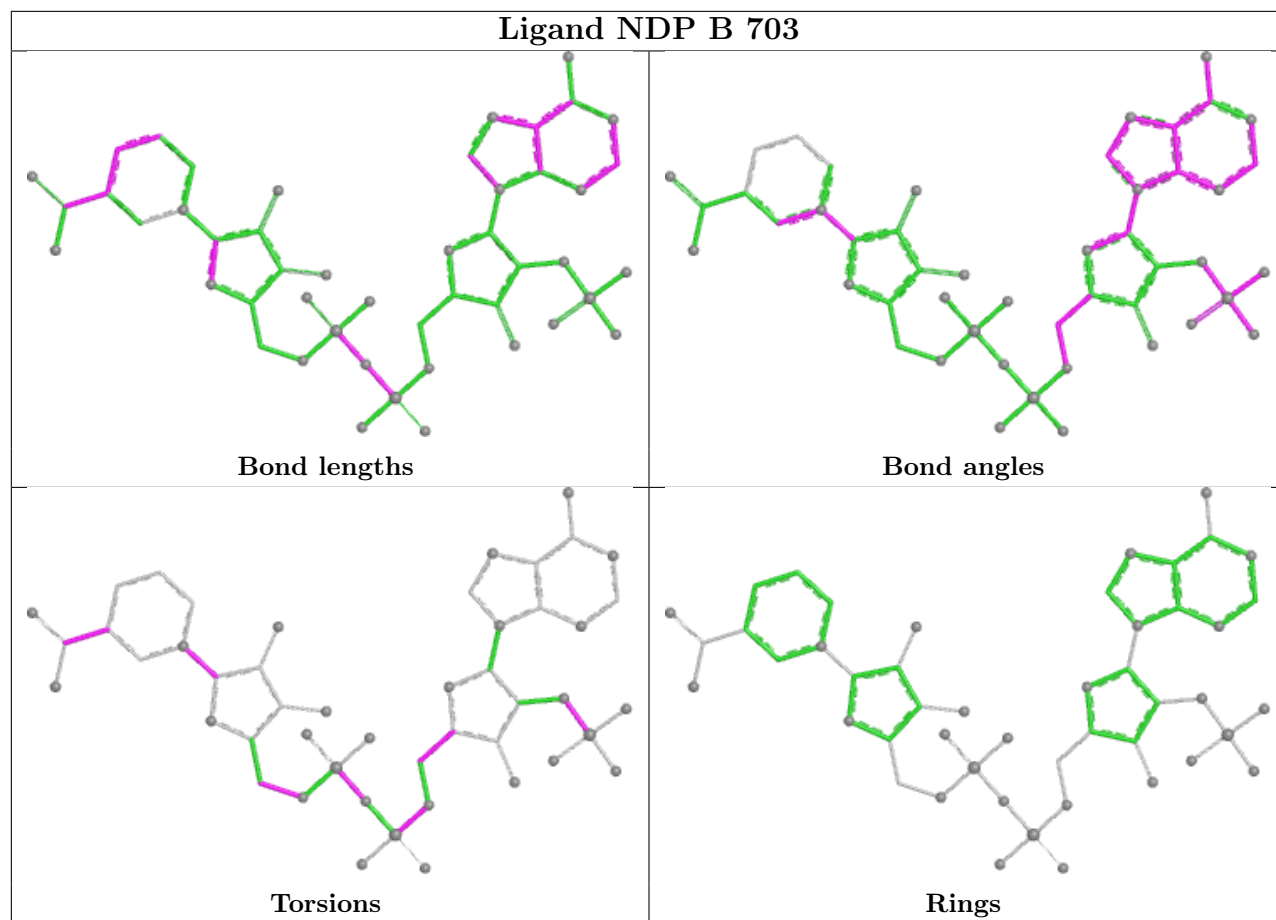
Bond angles

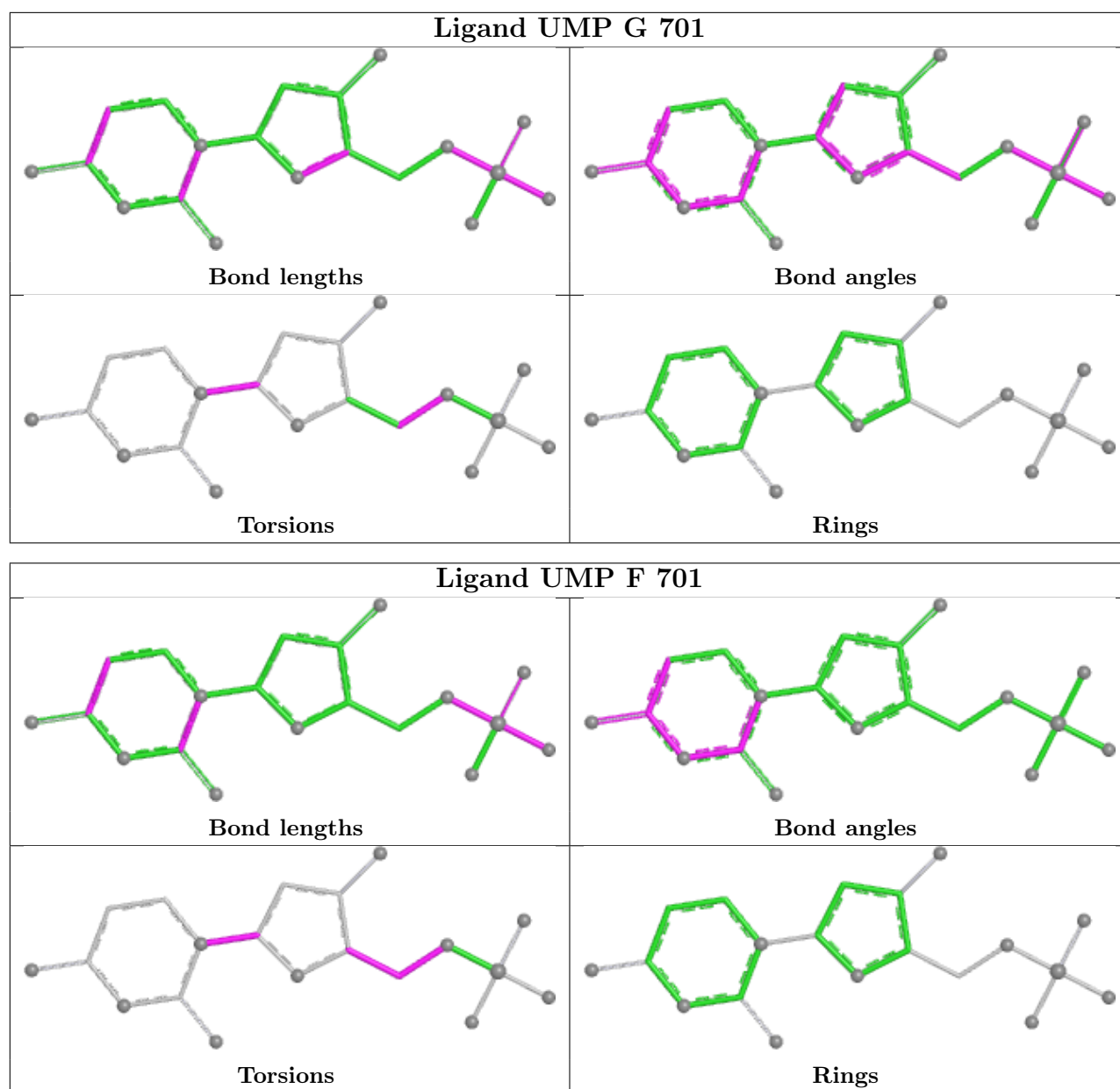


Torsions



Rings





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	489/610 (80%)	-1.20	0 100 100	35, 71, 125, 144	1 (0%)
1	B	491/610 (80%)	-1.19	0 100 100	41, 69, 118, 180	1 (0%)
1	C	489/610 (80%)	-1.21	0 100 100	35, 71, 125, 148	1 (0%)
1	D	491/610 (80%)	-1.17	0 100 100	42, 69, 119, 180	1 (0%)
1	E	489/610 (80%)	-1.20	0 100 100	36, 72, 125, 146	1 (0%)
1	F	491/610 (80%)	-1.22	0 100 100	43, 70, 120, 178	1 (0%)
1	G	489/610 (80%)	-1.20	0 100 100	44, 70, 117, 170	1 (0%)
1	H	491/610 (80%)	-1.20	0 100 100	36, 72, 126, 144	1 (0%)
All	All	3920/4880 (80%)	-1.20	0 100 100	35, 71, 124, 180	8 (0%)

There are no RSRZ outliers to report.

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

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

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

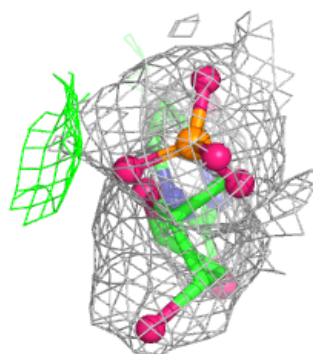
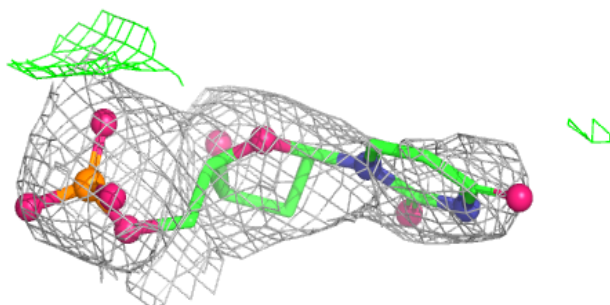
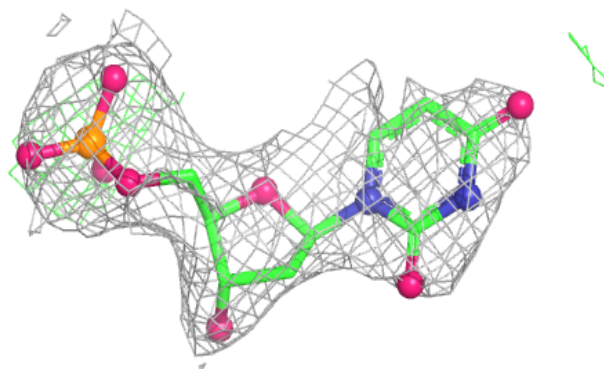
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	UMP	F	701	20/20	0.94	0.07	113,125,142,151	0
2	UMP	B	701	20/20	0.97	0.06	106,122,134,136	0
2	UMP	D	701	20/20	0.98	0.06	114,125,138,148	0
2	UMP	E	701	20/20	0.98	0.05	95,120,129,130	0
2	UMP	A	701	20/20	0.98	0.05	103,124,135,135	0
2	UMP	G	701	20/20	0.98	0.05	110,127,134,138	0
2	UMP	H	701	20/20	0.98	0.05	107,132,138,138	0
3	04J	A	702	32/32	0.98	0.06	95,139,161,161	0
3	04J	C	702	32/32	0.98	0.08	101,142,157,165	0
3	04J	E	702	32/32	0.98	0.07	89,134,162,165	0
4	NDP	E	703	48/48	0.98	0.05	112,149,190,194	0
5	1UE	D	704	22/22	0.98	0.08	110,153,164,166	0
5	1UE	E	704	22/22	0.98	0.05	115,130,146,151	0
3	04J	F	702	32/32	0.99	0.05	95,122,152,157	0
3	04J	G	702	32/32	0.99	0.05	94,122,156,162	0
3	04J	H	702	32/32	0.99	0.05	98,136,154,156	0
4	NDP	A	703	48/48	0.99	0.04	118,149,185,188	0
4	NDP	B	703	48/48	0.99	0.05	81,120,132,139	0
4	NDP	C	703	48/48	0.99	0.04	117,144,185,186	0
4	NDP	D	703	48/48	0.99	0.04	93,117,133,137	0
2	UMP	C	701	20/20	0.99	0.04	93,116,131,135	0
4	NDP	F	703	48/48	0.99	0.04	87,120,132,135	0
4	NDP	G	703	48/48	0.99	0.04	91,123,130,133	0
4	NDP	H	703	48/48	0.99	0.04	116,151,181,187	0
5	1UE	A	704	22/22	0.99	0.05	110,125,139,154	0
5	1UE	B	704	22/22	0.99	0.06	112,144,163,169	0
5	1UE	C	704	22/22	0.99	0.05	106,130,152,161	0
3	04J	D	702	32/32	0.99	0.05	98,122,153,155	0
3	04J	B	702	32/32	0.99	0.06	96,128,152,156	0
5	1UE	F	704	22/22	0.99	0.07	127,153,164,169	0
5	1UE	G	704	22/22	0.99	0.07	120,150,162,169	0
5	1UE	H	704	22/22	0.99	0.05	117,133,144,149	0

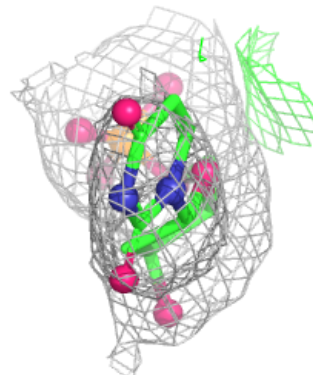
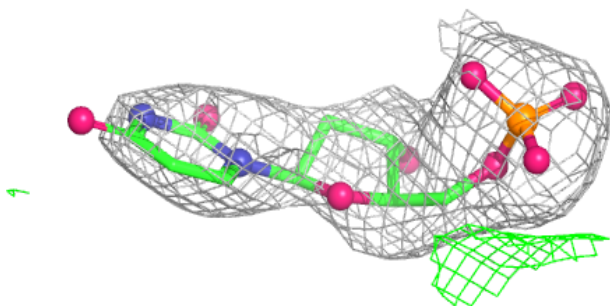
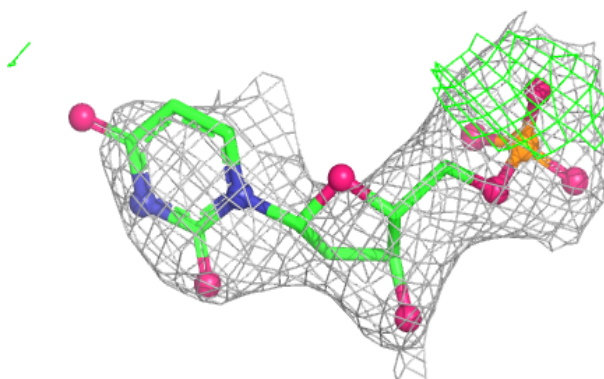
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around UMP F 701:

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

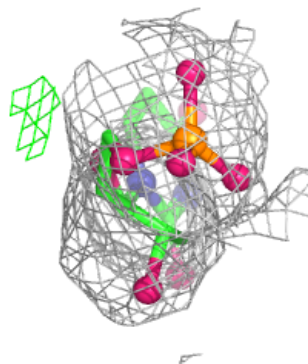
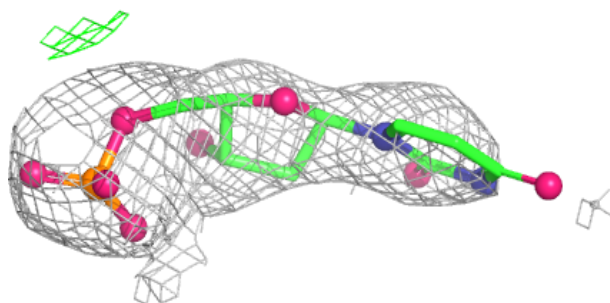
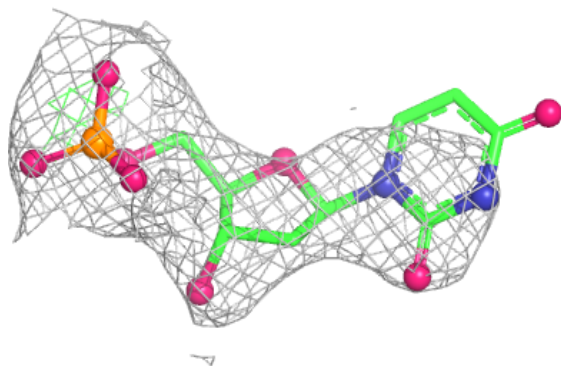
**Electron density around UMP B 701:**

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and green (positive)

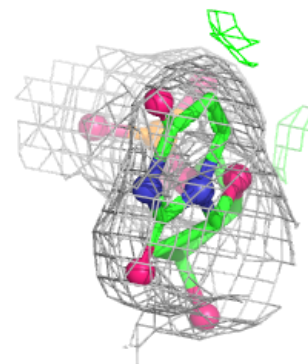
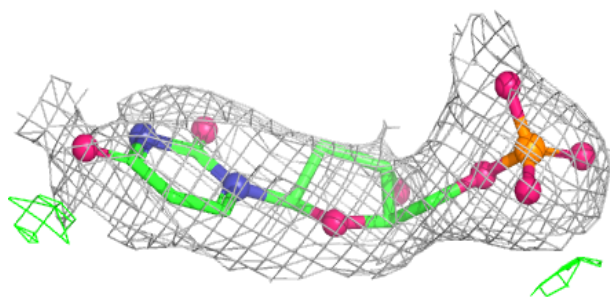
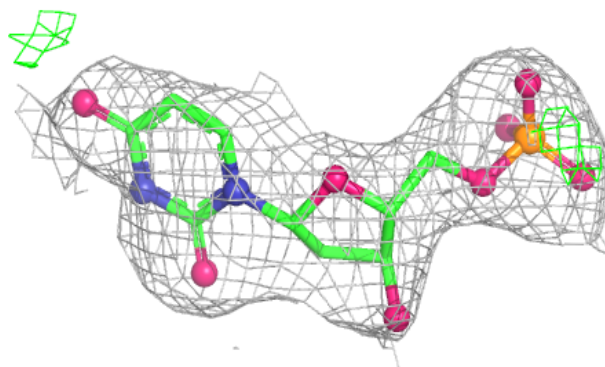


Electron density around UMP D 701:

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and green (positive)

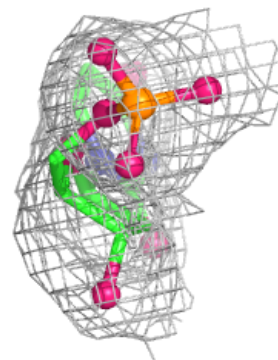
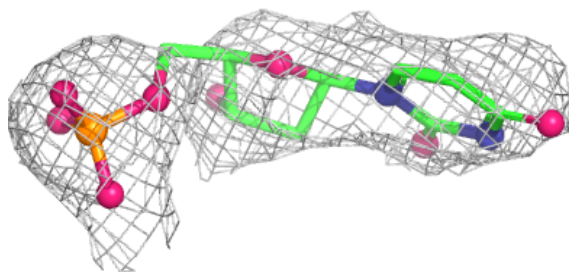
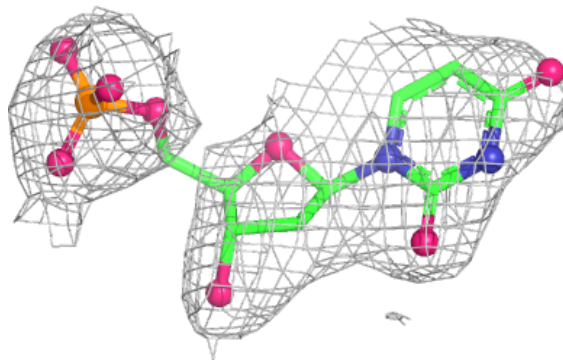
**Electron density around UMP E 701:**

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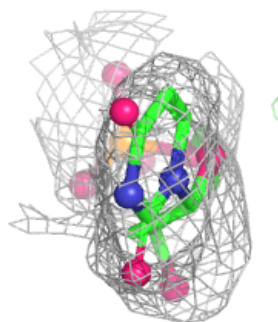
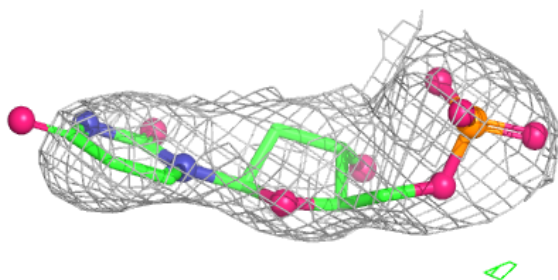
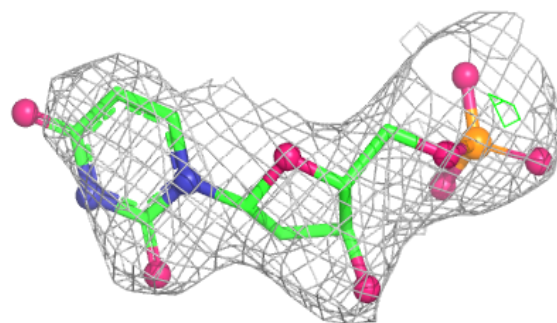


Electron density around UMP A 701:

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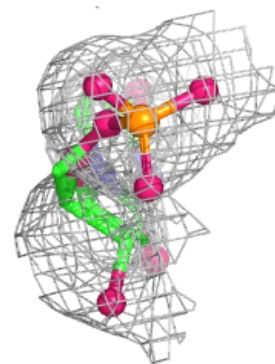
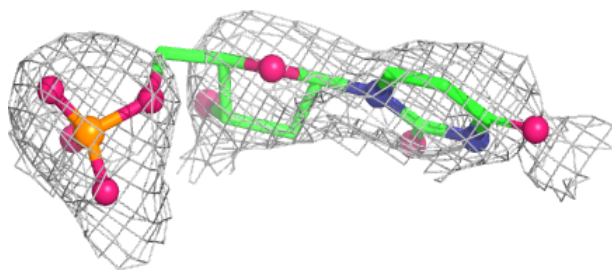
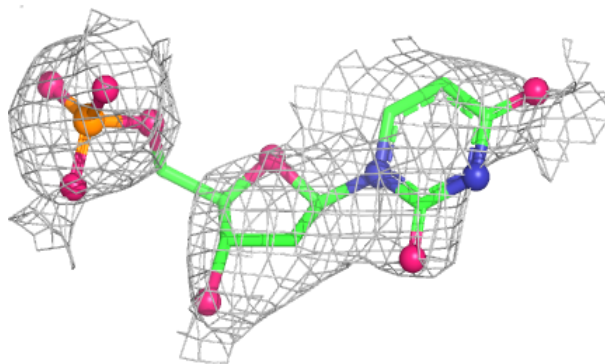
**Electron density around UMP G 701:**

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

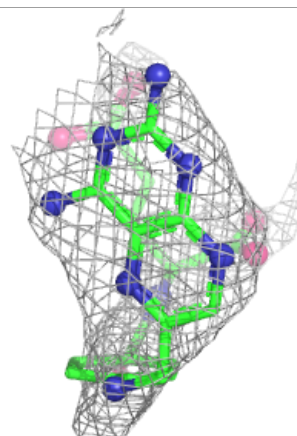
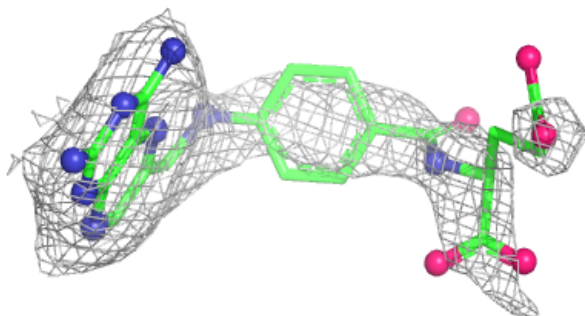
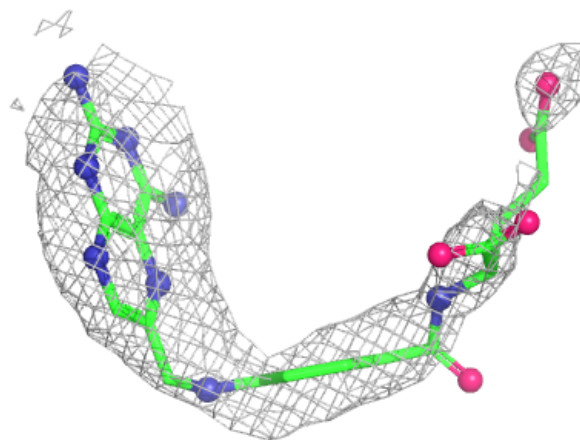


Electron density around UMP H 701:

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and green (positive)

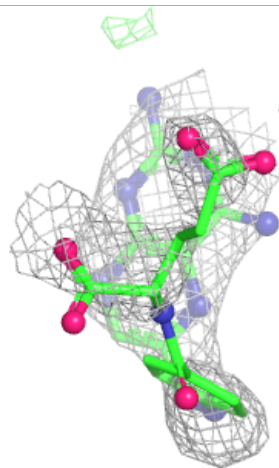
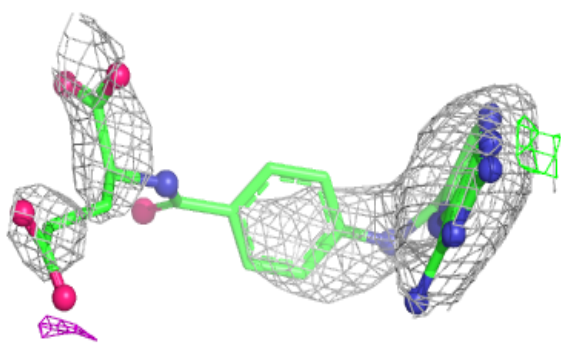
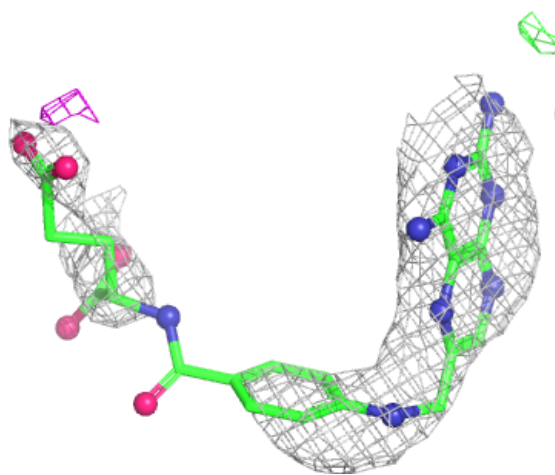
**Electron density around 04J A 702:**

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and green (positive)



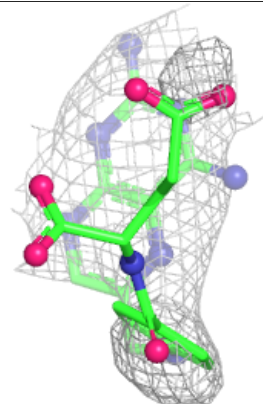
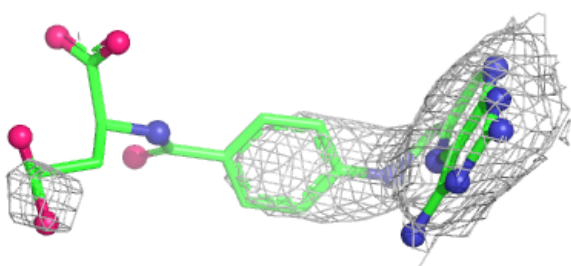
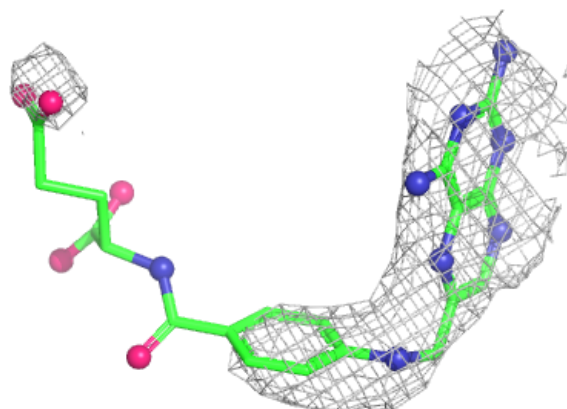
Electron density around 04J C 702:

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and green (positive)

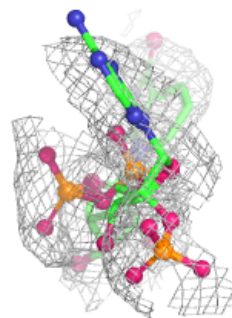
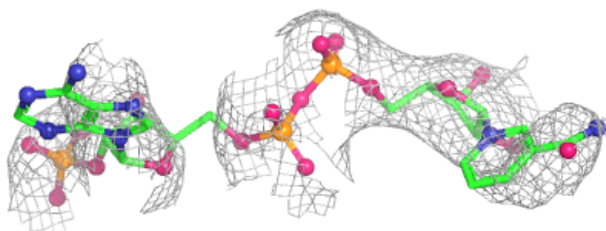
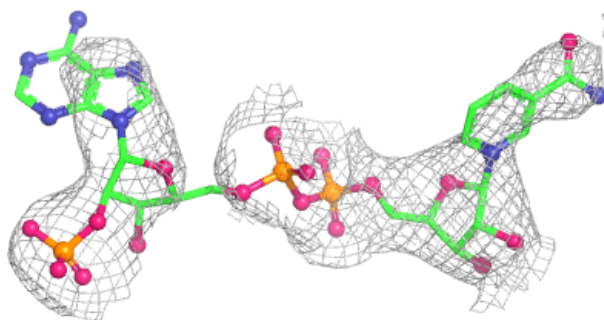


Electron density around 04J E 702:

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

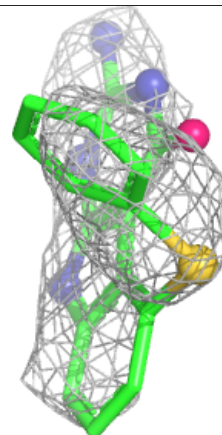
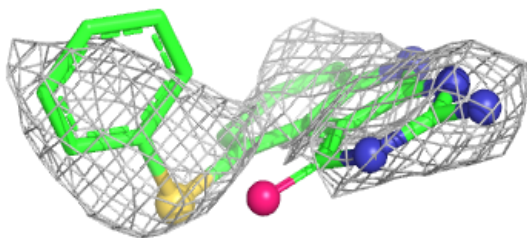
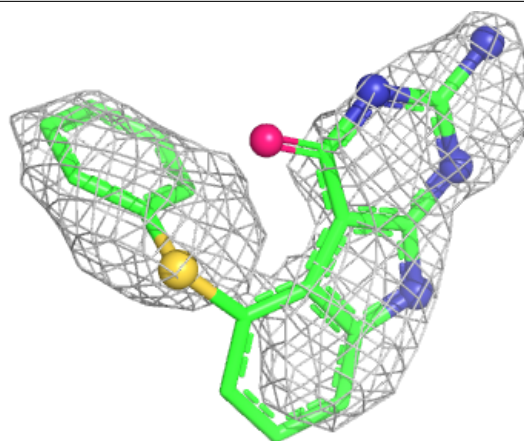
**Electron density around NDP E 703:**

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and green (positive)



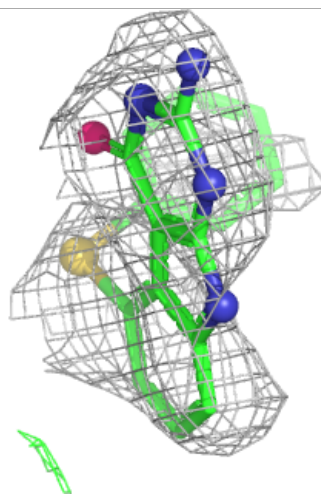
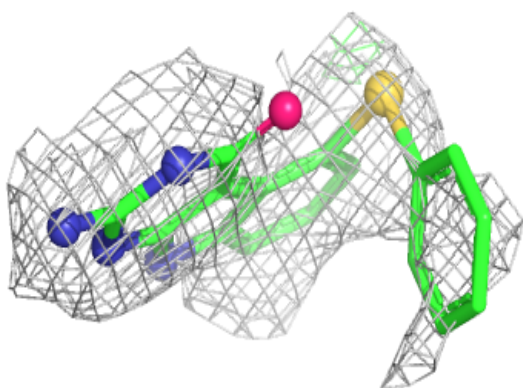
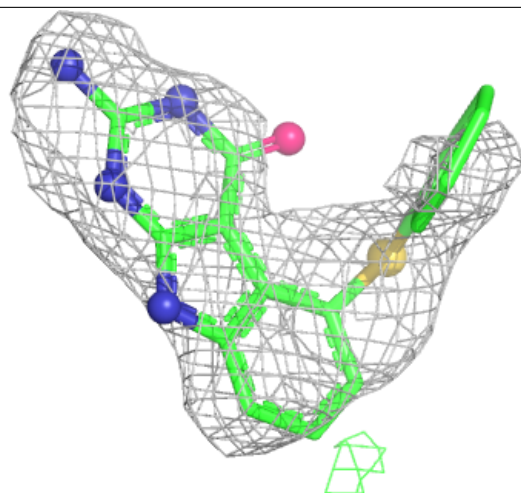
Electron density around 1UE D 704:

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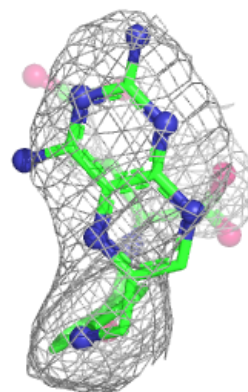
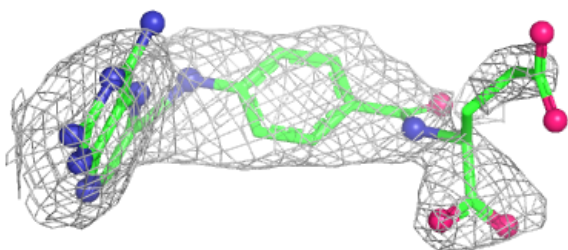
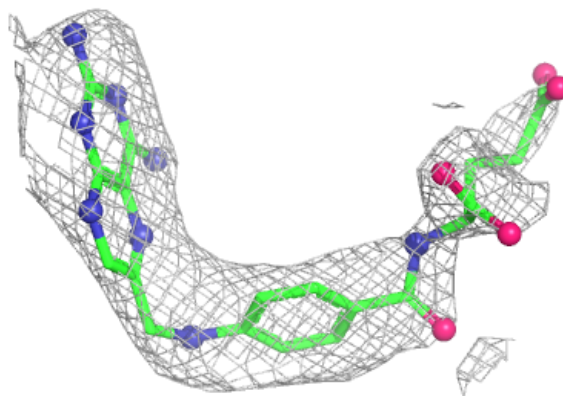
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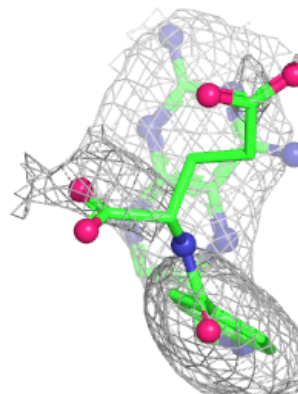
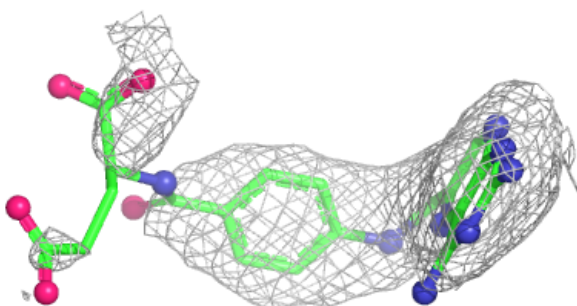
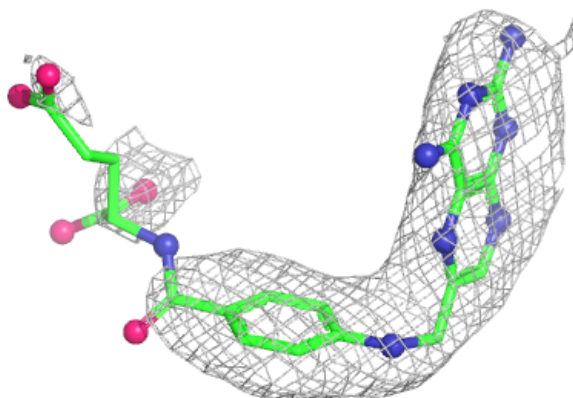


Electron density around 04J F 702:

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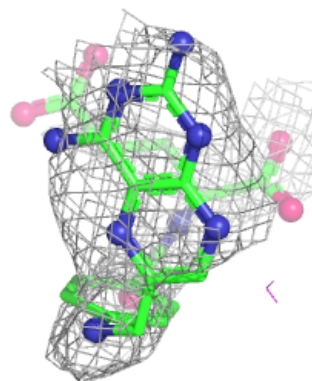
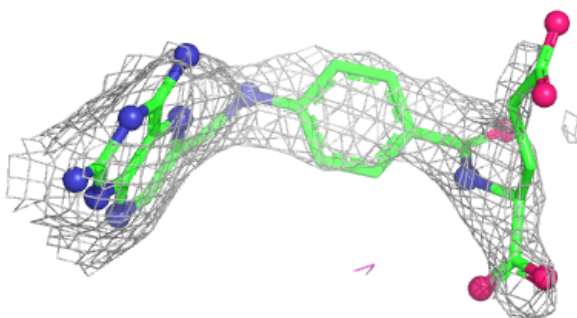
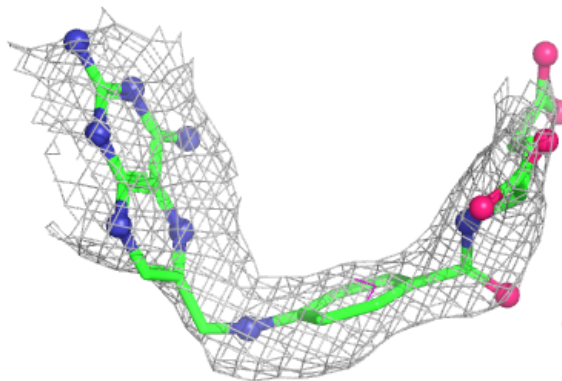
**Electron density around 04J G 702:**

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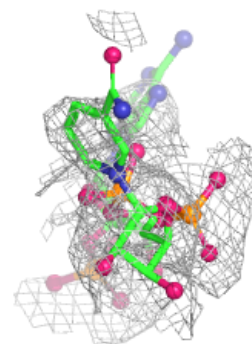
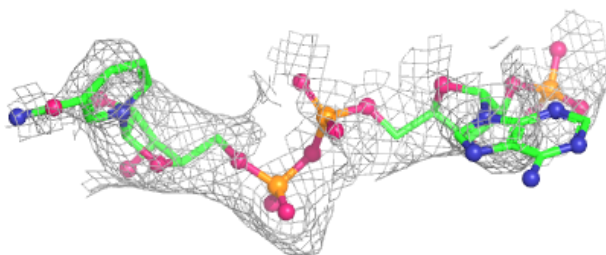
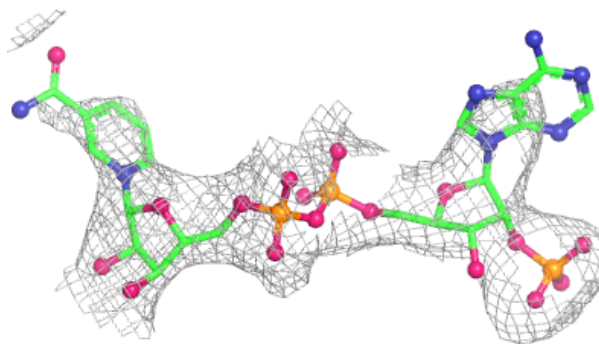


Electron density around 04J H 702:

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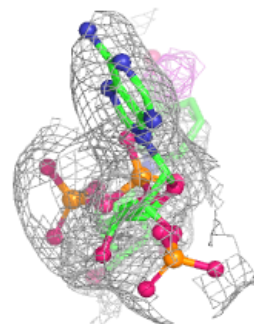
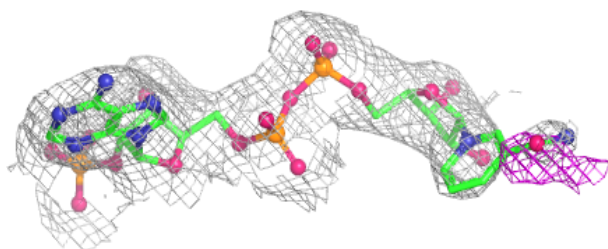
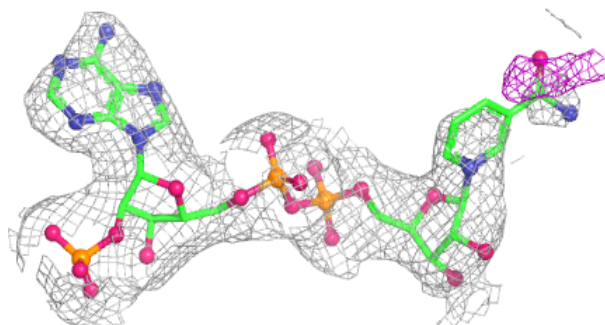
**Electron density around NDP A 703:**

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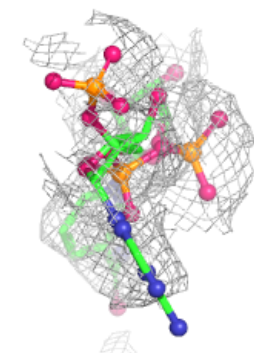
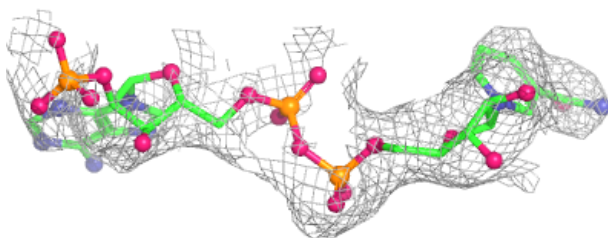
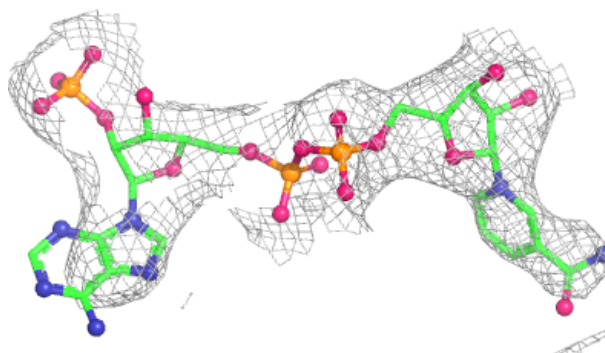


Electron density around NDP B 703:

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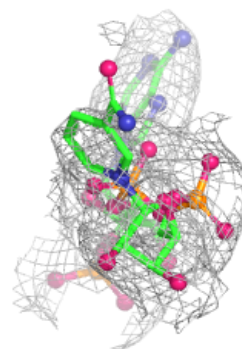
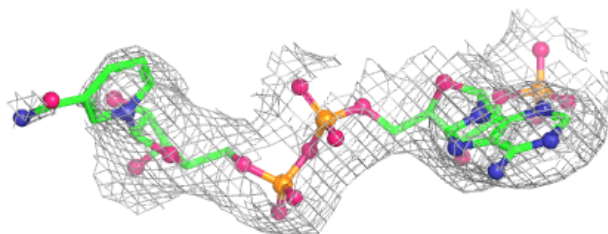
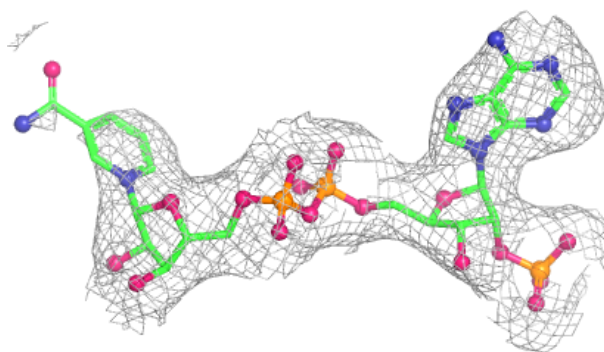
**Electron density around NDP C 703:**

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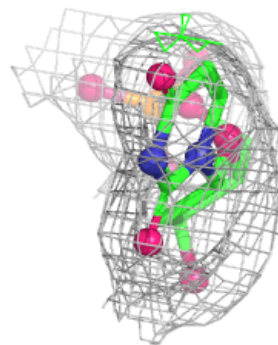
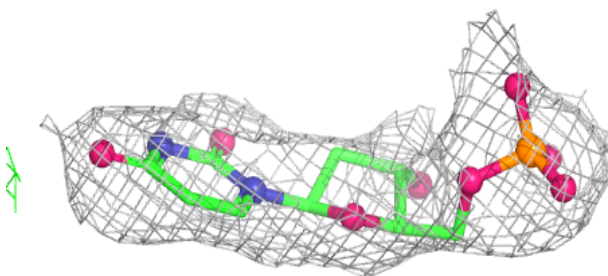
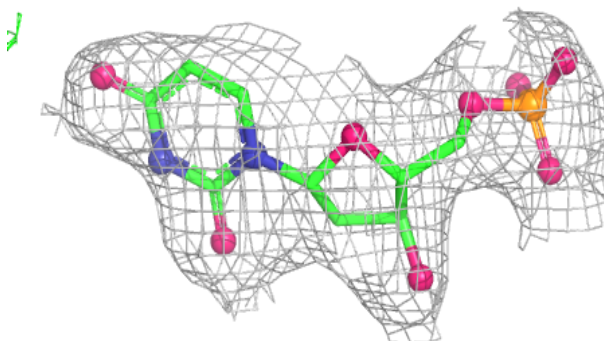


Electron density around NDP D 703:

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

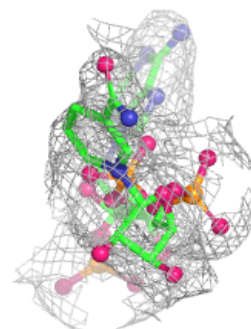
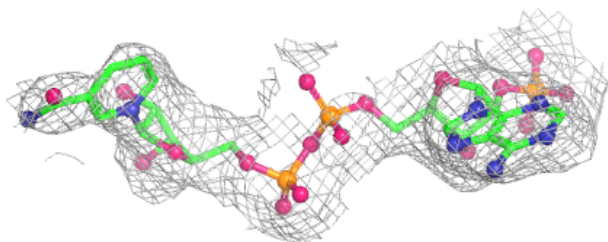
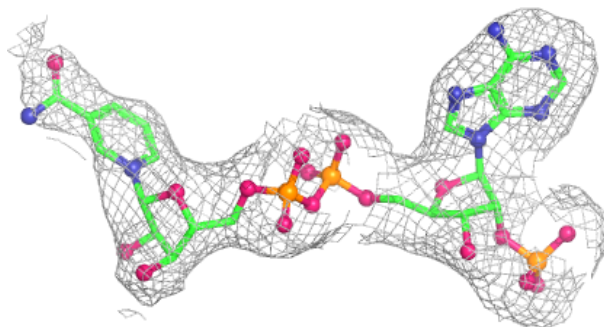
**Electron density around UMP C 701:**

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

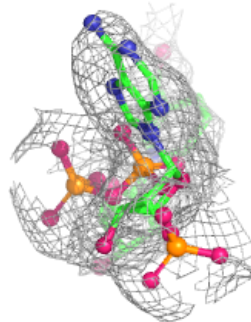
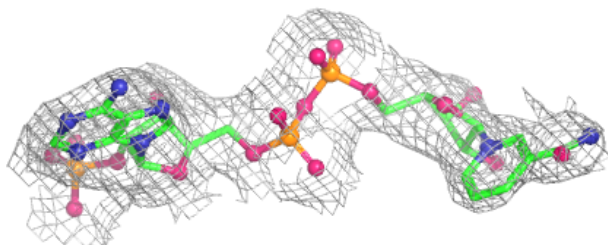
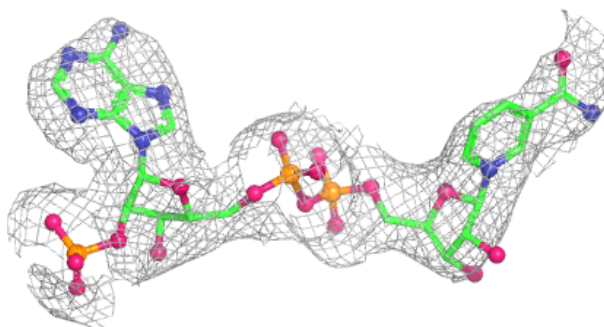


Electron density around NDP F 703:

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

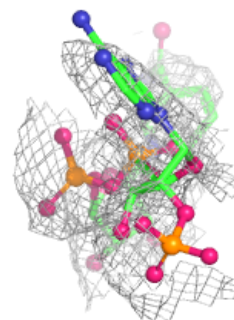
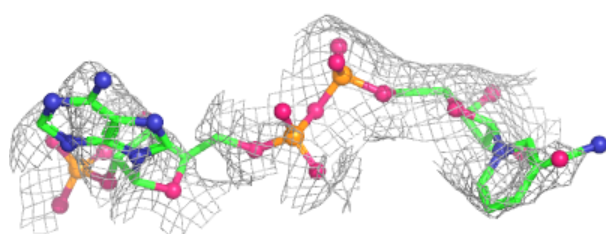
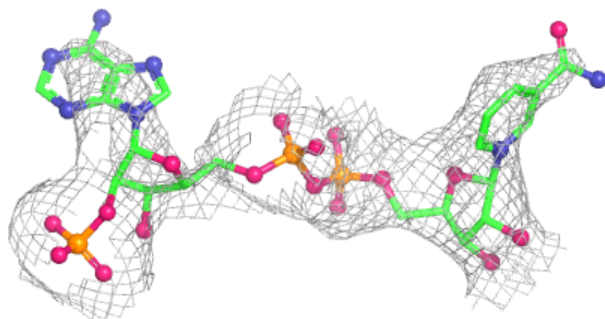
**Electron density around NDP G 703:**

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



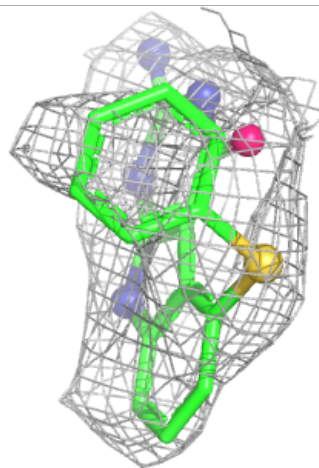
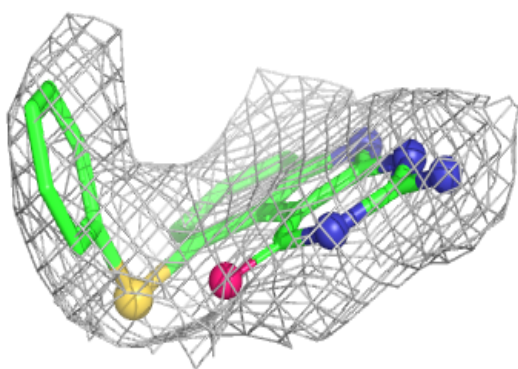
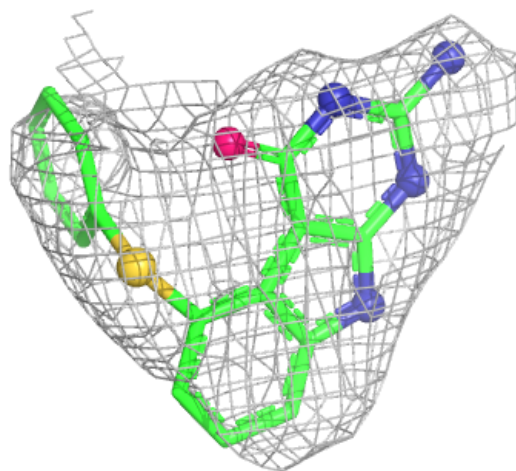
Electron density around NDP H 703:

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



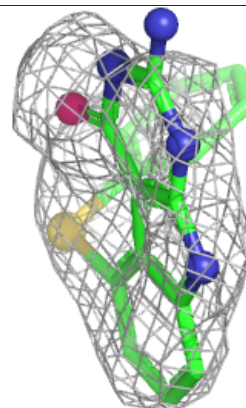
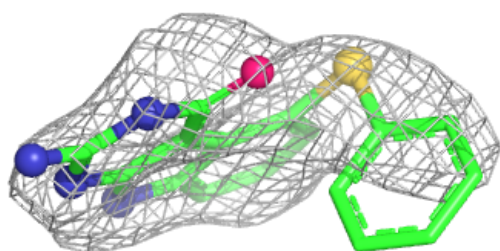
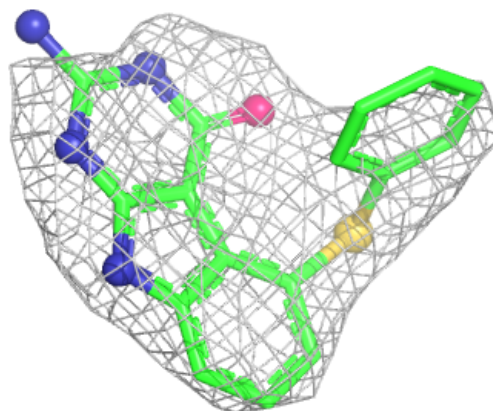
Electron density around 1UE A 704:

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



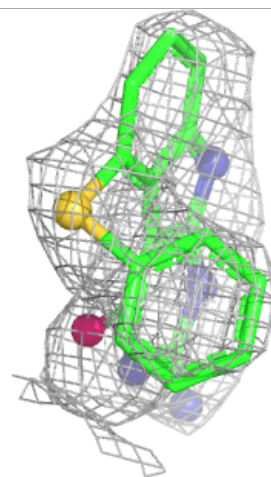
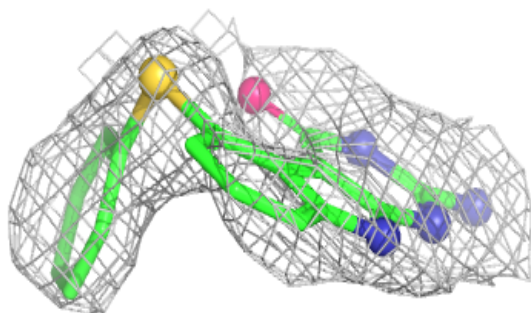
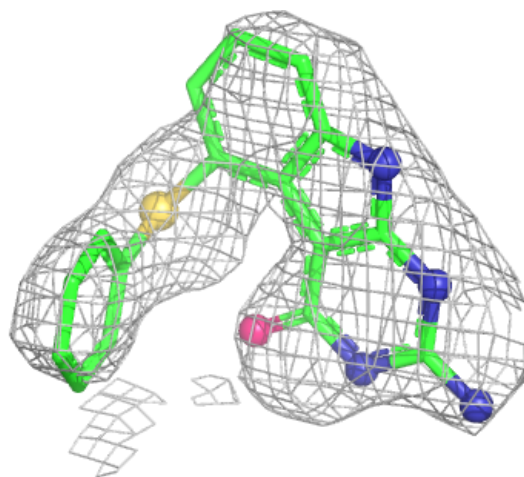
Electron density around 1UE B 704:

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



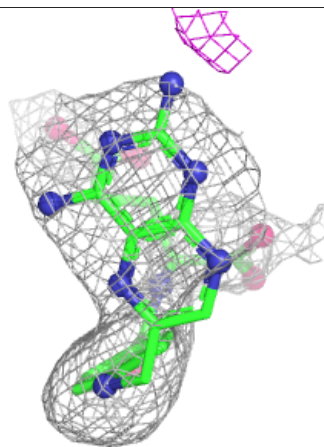
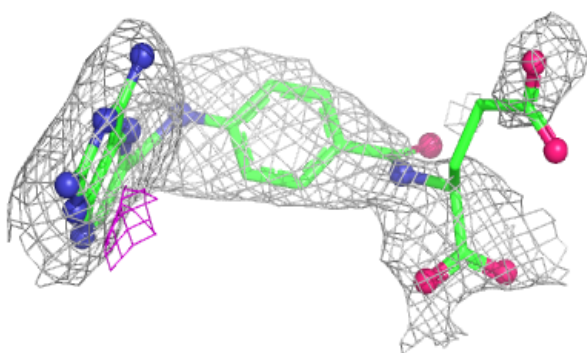
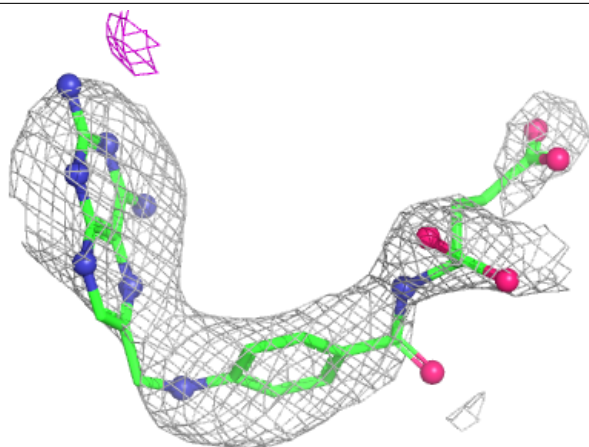
Electron density around 1UE C 704:

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



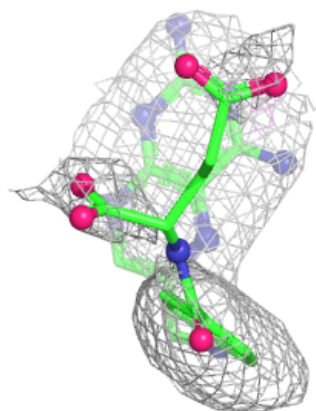
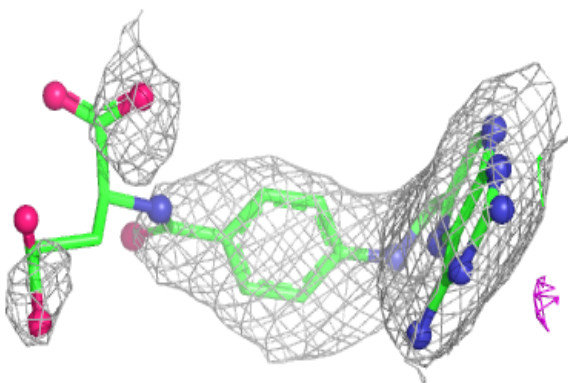
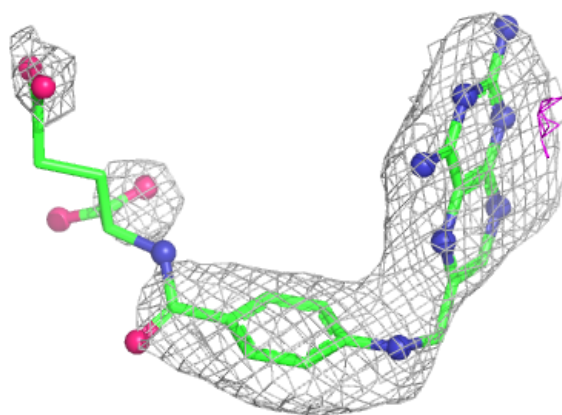
Electron density around 04J D 702:

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



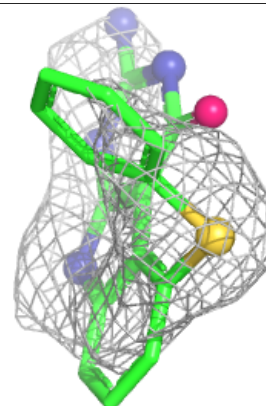
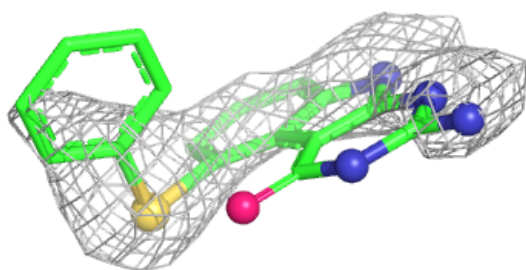
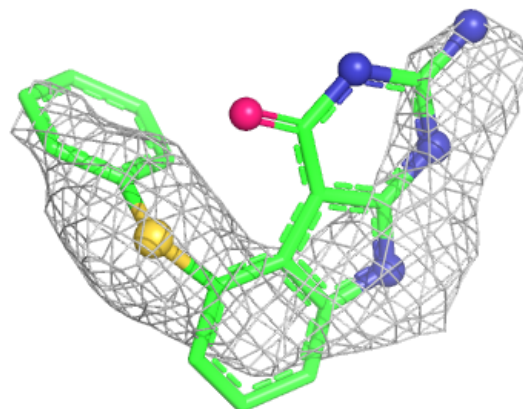
Electron density around 04J B 702:

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

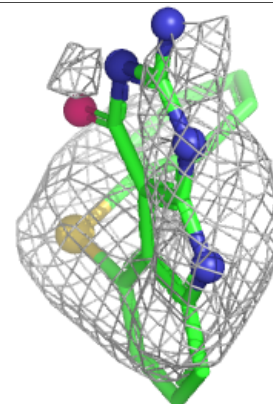
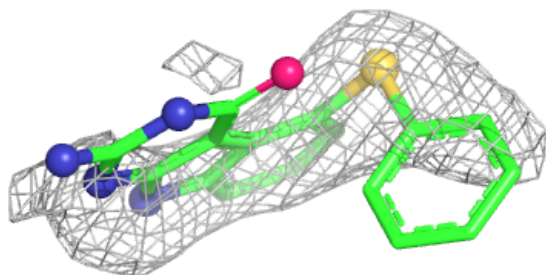
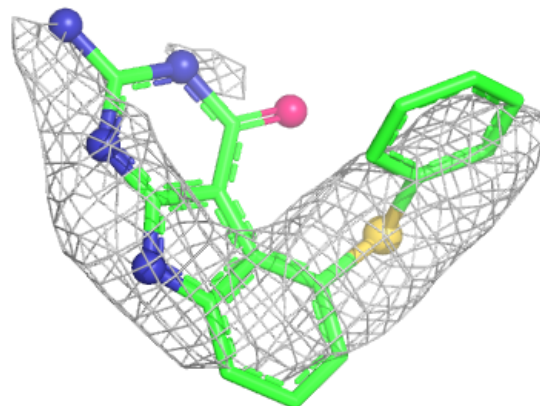


Electron density around 1UE F 704:

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

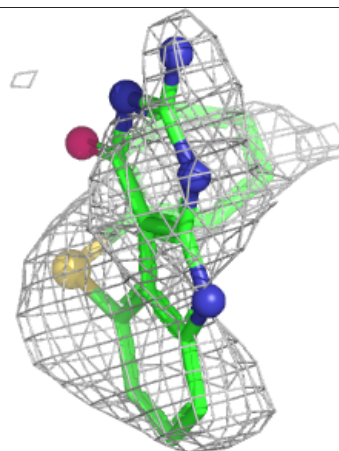
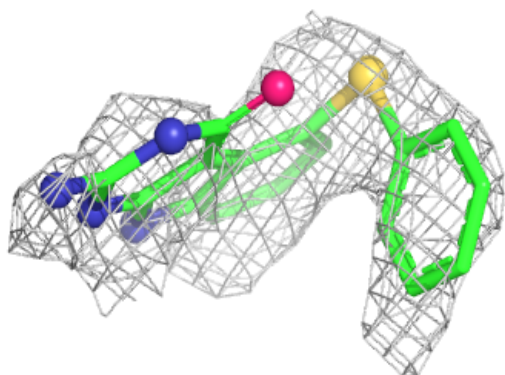
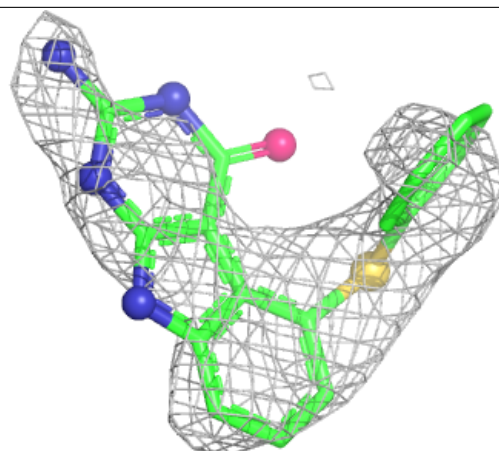
**Electron density around 1UE G 704:**

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



Electron density around 1UE H 704:

$2mF_o - DF_c$ (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.