



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 12:37 PM UTC

PDB ID : 1SJN / pdb_00001sjn
Title : Mycobacterium tuberculosis dUTPase complexed with magnesium and alpha, beta-imido-dUTP
Authors : Sawaya, M.R.; Chan, S.; Segelke, B.; Legin, T.; Krupka, H.; Cho, U.S.; Kim, M.-Y.; So, M.; Kim, C.-Y.; Naranjo, C.M.; Rogers, Y.C.; Park, M.S.; Waldo, G.S.; Pashkov, I.; Cascio, D.; Yeates, T.O.; Perry, J.L.; Terwilliger, T.C.; Eisenberg, D.; TB Structural Genomics Consortium (TBSGC)
Deposited on : 2004-03-04
Resolution : 1.80 Å(reported)

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

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

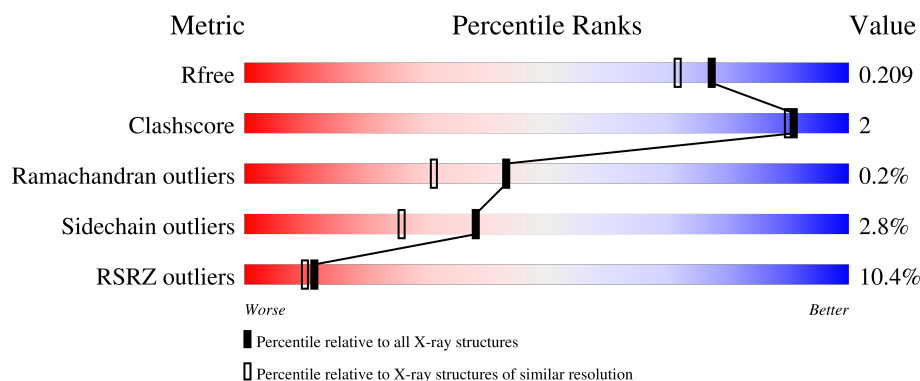
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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	170	8% 73% 23%
1	B	170	6% 76% 6% 18%
1	C	170	11% 81% 15%

Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 3374 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 Deoxyuridine 5'-triphosphate nucleotidohydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	131	Total	C	N	O	S	0	0	0
			968	610	175	182	1			
1	B	140	Total	C	N	O	S	0	0	0
			1028	645	187	194	2			
1	C	144	Total	C	N	O	S	0	0	1
			1041	650	191	199	1			

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	155	GLY	-	cloning artifact	UNP P0A552
A	156	VAL	-	cloning artifact	UNP P0A552
A	157	PRO	-	cloning artifact	UNP P0A552
A	158	ARG	-	cloning artifact	UNP P0A552
A	159	GLY	-	cloning artifact	UNP P0A552
A	160	ALA	-	cloning artifact	UNP P0A552
A	161	ALA	-	cloning artifact	UNP P0A552
A	162	ALA	-	cloning artifact	UNP P0A552
A	163	LEU	-	cloning artifact	UNP P0A552
A	164	GLU	-	cloning artifact	UNP P0A552
A	165	HIS	-	expression tag	UNP P0A552
A	166	HIS	-	expression tag	UNP P0A552
A	167	HIS	-	expression tag	UNP P0A552
A	168	HIS	-	expression tag	UNP P0A552
A	169	HIS	-	expression tag	UNP P0A552
A	170	HIS	-	expression tag	UNP P0A552
B	155	GLY	-	cloning artifact	UNP P0A552
B	156	VAL	-	cloning artifact	UNP P0A552
B	157	PRO	-	cloning artifact	UNP P0A552
B	158	ARG	-	cloning artifact	UNP P0A552
B	159	GLY	-	cloning artifact	UNP P0A552
B	160	ALA	-	cloning artifact	UNP P0A552
B	161	ALA	-	cloning artifact	UNP P0A552

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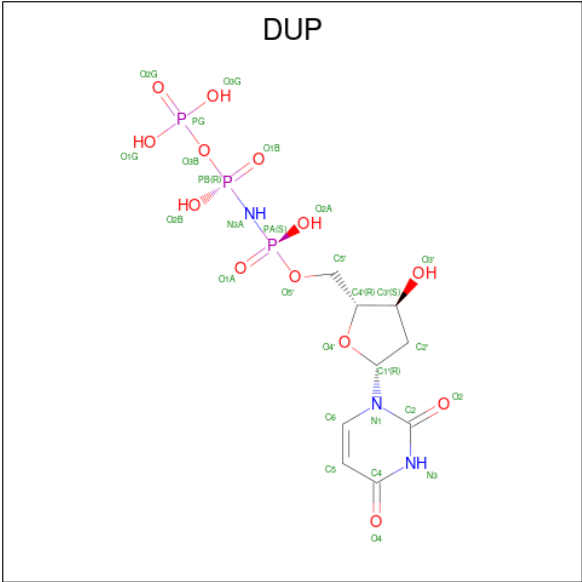
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Chain	Residue	Modelled	Actual	Comment	Reference
B	162	ALA	-	cloning artifact	UNP P0A552
B	163	LEU	-	cloning artifact	UNP P0A552
B	164	GLU	-	cloning artifact	UNP P0A552
B	165	HIS	-	expression tag	UNP P0A552
B	166	HIS	-	expression tag	UNP P0A552
B	167	HIS	-	expression tag	UNP P0A552
B	168	HIS	-	expression tag	UNP P0A552
B	169	HIS	-	expression tag	UNP P0A552
B	170	HIS	-	expression tag	UNP P0A552
C	155	GLY	-	cloning artifact	UNP P0A552
C	156	VAL	-	cloning artifact	UNP P0A552
C	157	PRO	-	cloning artifact	UNP P0A552
C	158	ARG	-	cloning artifact	UNP P0A552
C	159	GLY	-	cloning artifact	UNP P0A552
C	160	ALA	-	cloning artifact	UNP P0A552
C	161	ALA	-	cloning artifact	UNP P0A552
C	162	ALA	-	cloning artifact	UNP P0A552
C	163	LEU	-	cloning artifact	UNP P0A552
C	164	GLU	-	cloning artifact	UNP P0A552
C	165	HIS	-	expression tag	UNP P0A552
C	166	HIS	-	expression tag	UNP P0A552
C	167	HIS	-	expression tag	UNP P0A552
C	168	HIS	-	expression tag	UNP P0A552
C	169	HIS	-	expression tag	UNP P0A552
C	170	HIS	-	expression tag	UNP P0A552

- Molecule 2 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

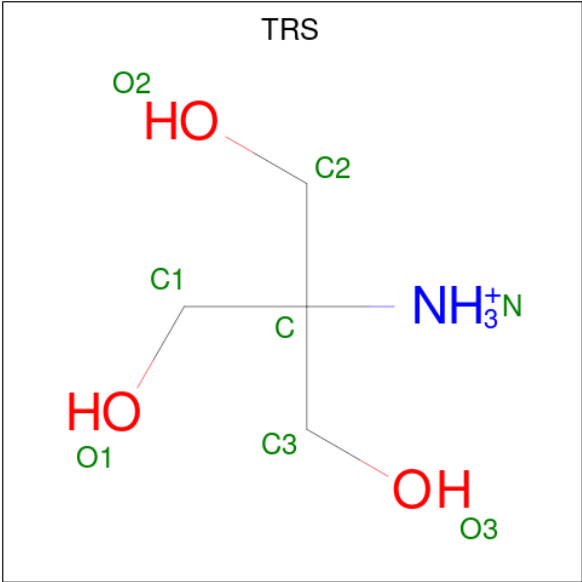
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Mg 1 1	0	0
2	B	1	Total Mg 1 1	0	0
2	C	1	Total Mg 1 1	0	0

- Molecule 3 is 2'-DEOXYURIDINE 5'-ALPHA,BETA-IMIDO-TRIPHOSPHATE (CCD ID: DUP) (formula: C₉H₁₆N₃O₁₃P₃).



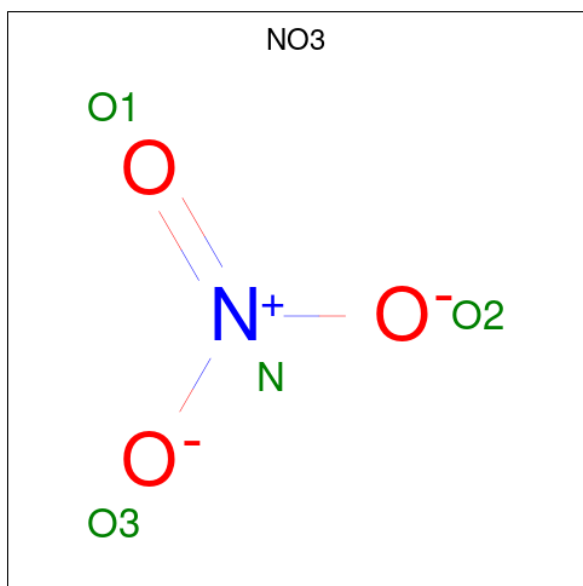
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			28	9	3	13	3		
3	B	1	Total	C	N	O	P	0	1
			56	18	6	26	6		
3	B	1	Total	C	N	O	P	0	0
			28	9	3	13	3		

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



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

- Molecule 5 is NITRATE ION (CCD ID: NO3) (formula: NO₃).



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

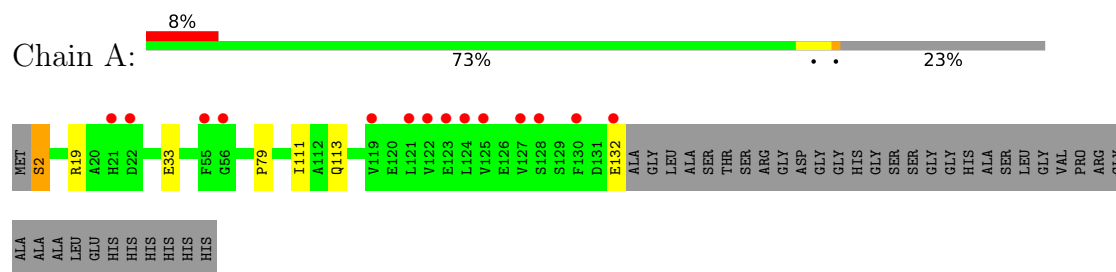
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	68	Total	O	0	0
			68	68		
6	B	73	Total	O	0	0
			73	73		
6	C	65	Total	O	0	0
			65	65		

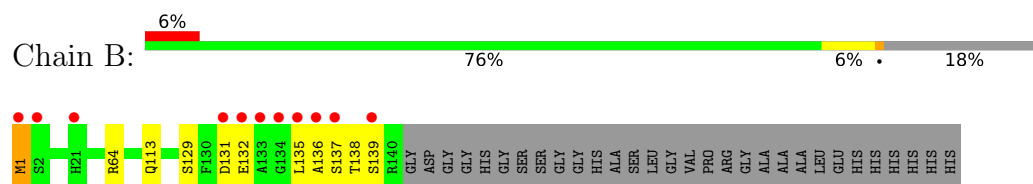
3 Residue-property plots

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.

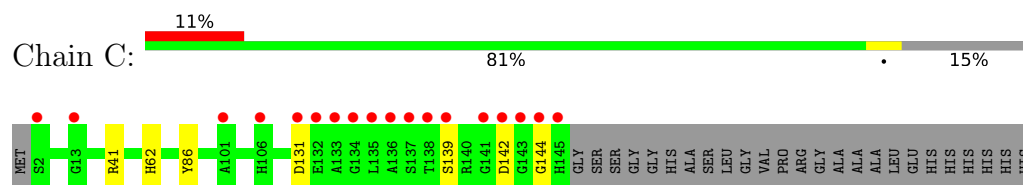
- Molecule 1: Deoxyuridine 5'-triphosphate nucleotidohydrolase



- Molecule 1: Deoxyuridine 5'-triphosphate nucleotidohydrolase



- Molecule 1: Deoxyuridine 5'-triphosphate nucleotidohydrolase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	57.52Å 78.51Å 94.51Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	60.86 – 1.80 60.39 – 1.80	Depositor EDS
% Data completeness (in resolution range)	98.8 (60.86-1.80) 98.8 (60.39-1.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.39 (at 1.79Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.168 , 0.198 0.180 , 0.209	Depositor DCC
R_{free} test set	2018 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	23.5	Xtriage
Anisotropy	0.286	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 34.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3374	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.62% 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: DUP, TRS, MG, NO3

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	1.05	0/983	1.01	2/1342 (0.1%)
1	B	1.10	1/1043 (0.1%)	1.04	0/1422
1	C	1.09	0/1056	1.07	2/1440 (0.1%)
All	All	1.08	1/3082 (0.0%)	1.04	4/4204 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	1	MET	SD-CE	5.49	1.93	1.79

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	111	ILE	N-CA-C	5.85	118.52	112.90
1	C	131	ASP	CA-C-N	5.72	130.27	120.72
1	C	131	ASP	C-N-CA	5.72	130.27	120.72
1	A	33	GLU	N-CA-C	5.24	117.35	109.23

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	968	0	998	3	0
1	B	1028	0	1064	4	0
1	C	1041	0	1065	4	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
3	A	28	0	12	0	0
3	B	84	0	36	5	0
4	A	8	0	12	0	0
5	B	4	0	0	0	0
5	C	4	0	0	0	0
6	A	68	0	0	2	0
6	B	73	0	0	1	0
6	C	65	0	0	0	0
All	All	3374	0	3187	11	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 (11) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:113:GLN:NE2	3:B:2170[B]:DUP:O3G	1.97	0.98
1:A:2:SER:N	6:A:1208:HOH:O	2.20	0.74
3:B:3170:DUP:O2G	1:C:144:GLY:HA2	1.90	0.71
3:B:2170[A]:DUP:O2A	6:B:3238:HOH:O	2.10	0.68
1:B:136:ALA:O	1:B:138:THR:HG23	1.95	0.66
6:A:1195:HOH:O	1:C:139:SER:HB2	2.14	0.47
1:A:79:PRO:HG2	1:C:62:HIS:CE1	2.49	0.47
1:B:64:ARG:HA	3:B:2170[B]:DUP:O3G	2.16	0.46
1:A:113:GLN:HE21	1:A:113:GLN:HB3	1.67	0.43
1:B:129:SER:OG	1:B:132:GLU:HB2	2.19	0.42
3:B:2170[A]:DUP:H2'2	1:C:86:TYR:CD2	2.55	0.41

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	129/170 (76%)	129 (100%)	0	0	100	100
1	B	138/170 (81%)	130 (94%)	7 (5%)	1 (1%)	18	8
1	C	142/170 (84%)	139 (98%)	3 (2%)	0	100	100
All	All	409/510 (80%)	398 (97%)	10 (2%)	1 (0%)	43	31

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	139	SER

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	104/128 (81%)	101 (97%)	3 (3%)	37	25
1	B	110/128 (86%)	106 (96%)	4 (4%)	31	18
1	C	110/128 (86%)	108 (98%)	2 (2%)	51	43
All	All	324/384 (84%)	315 (97%)	9 (3%)	38	26

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	SER
1	A	19	ARG

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Mol	Chain	Res	Type
1	A	132	GLU
1	B	1	MET
1	B	131	ASP
1	B	135	LEU
1	B	137	SER
1	C	41	ARG
1	C	142	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	21	HIS
1	A	113	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](#)

Of 10 ligands modelled in this entry, 3 are monoatomic - leaving 7 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
5	NO3	C	172	-	1,3,3	2.22	1 (100%)	0,3,3	-	-
5	NO3	B	172	-	1,3,3	3.14	1 (100%)	0,3,3	-	-
3	DUP	B	2170[A]	2	28,29,29	2.67	6 (21%)	39,45,45	2.05	13 (33%)
3	DUP	B	3170	2	28,29,29	1.78	7 (25%)	39,45,45	2.16	9 (23%)
3	DUP	B	2170[B]	2	28,29,29	2.38	10 (35%)	39,45,45	2.05	10 (25%)
3	DUP	A	1170	2	28,29,29	2.23	8 (28%)	39,45,45	2.14	13 (33%)
4	TRS	A	1171	-	7,7,7	0.61	0	9,9,9	0.63	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	DUP	B	2170[A]	2	-	2/19/34/34	0/2/2/2
3	DUP	B	3170	2	-	2/19/34/34	0/2/2/2
3	DUP	B	2170[B]	2	-	8/19/34/34	0/2/2/2
3	DUP	A	1170	2	-	1/19/34/34	0/2/2/2
4	TRS	A	1171	-	-	0/9/9/9	-

All (33) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	2170[A]	DUP	PB-O1B	9.99	1.61	1.46
3	B	2170[B]	DUP	C5-C4	-7.34	1.27	1.43
3	A	1170	DUP	C5-C4	-6.52	1.29	1.43
3	B	2170[A]	DUP	C5-C4	-5.68	1.31	1.43
3	A	1170	DUP	PB-O1B	4.47	1.53	1.46
3	B	2170[B]	DUP	PB-O1B	4.30	1.52	1.46
3	B	3170	DUP	C5-C4	-4.29	1.34	1.43
3	A	1170	DUP	PA-O1A	4.22	1.52	1.46
3	B	3170	DUP	PB-O1B	4.17	1.52	1.46
3	B	2170[B]	DUP	C6-N1	-4.09	1.28	1.38
3	B	2170[A]	DUP	PB-O3B	4.00	1.64	1.59
3	B	2170[B]	DUP	PA-O1A	3.46	1.51	1.46
3	B	2170[A]	DUP	C6-N1	-3.29	1.30	1.38
3	B	2170[A]	DUP	PA-O1A	3.26	1.51	1.46
3	A	1170	DUP	PB-O3B	3.21	1.63	1.59
5	B	172	NO3	O1-N	3.14	1.39	1.24
3	B	3170	DUP	PB-N3A	3.14	1.71	1.63

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	3170	DUP	PA-O2A	-3.08	1.48	1.56
3	B	2170[B]	DUP	C6-C5	-3.01	1.28	1.35
3	A	1170	DUP	PB-O2B	-2.97	1.48	1.56
3	A	1170	DUP	C2-N1	-2.93	1.33	1.38
3	B	2170[B]	DUP	C2-N3	-2.78	1.33	1.38
3	B	2170[B]	DUP	C2-N1	-2.75	1.34	1.38
3	B	2170[B]	DUP	C4-N3	-2.68	1.34	1.38
3	B	2170[A]	DUP	C2-N3	-2.48	1.33	1.38
3	B	3170	DUP	PA-O1A	2.38	1.49	1.46
3	B	2170[B]	DUP	PA-O2A	-2.34	1.50	1.56
3	B	3170	DUP	PB-O2B	-2.31	1.50	1.56
3	B	3170	DUP	PA-N3A	2.30	1.69	1.63
5	C	172	NO3	O1-N	2.22	1.35	1.24
3	A	1170	DUP	PB-N3A	2.10	1.68	1.63
3	B	2170[B]	DUP	PB-N3A	2.09	1.68	1.63
3	A	1170	DUP	C6-N1	-2.00	1.33	1.38

All (45) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	3170	DUP	O2B-PB-O1B	7.13	125.17	109.87
3	A	1170	DUP	C4-N3-C2	-5.40	119.91	126.61
3	B	3170	DUP	O2A-PA-O1A	5.34	121.32	109.87
3	B	2170[A]	DUP	O1A-PA-N3A	-4.83	104.65	111.77
3	A	1170	DUP	O2A-PA-O1A	4.80	120.17	109.87
3	B	2170[B]	DUP	O2A-PA-O1A	4.52	119.56	109.87
3	B	2170[B]	DUP	C4-N3-C2	-4.45	121.08	126.61
3	B	2170[B]	DUP	O1A-PA-N3A	-4.43	105.24	111.77
3	B	2170[A]	DUP	O2A-PA-O1A	4.31	119.12	109.87
3	B	3170	DUP	O5'-PA-O1A	-3.94	102.58	114.27
3	B	2170[A]	DUP	C2'-C1'-N1	-3.94	103.96	113.81
3	B	2170[B]	DUP	C2'-C1'-N1	-3.94	103.97	113.81
3	A	1170	DUP	C2'-C1'-N1	-3.85	104.18	113.81
3	B	2170[B]	DUP	O5'-PA-O1A	-3.65	103.44	114.27
3	B	2170[B]	DUP	C5-C4-N3	3.63	119.89	114.80
3	B	2170[A]	DUP	C4-N3-C2	-3.63	122.10	126.61
3	A	1170	DUP	N3-C2-N1	3.56	119.53	114.89
3	B	3170	DUP	C2'-C1'-N1	-3.56	104.91	113.81
3	B	2170[A]	DUP	O4'-C1'-N1	3.33	113.78	107.86
3	B	2170[B]	DUP	O2B-PB-O1B	3.27	116.89	109.87
3	B	3170	DUP	C4-N3-C2	-3.23	122.60	126.61
3	A	1170	DUP	C5-C4-N3	3.20	119.28	114.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	2170[A]	DUP	O2B-PB-O1B	3.16	116.64	109.87
3	B	2170[A]	DUP	O3'-C3'-C2'	3.14	121.78	110.88
3	A	1170	DUP	O2B-PB-O1B	3.13	116.58	109.87
3	A	1170	DUP	C6-N1-C2	-3.06	117.27	121.00
3	B	3170	DUP	O1A-PA-N3A	3.02	116.21	111.77
3	B	3170	DUP	C6-N1-C2	-3.00	117.35	121.00
3	A	1170	DUP	O3'-C3'-C4'	2.98	121.37	110.07
3	B	2170[B]	DUP	O4-C4-C5	-2.92	120.12	125.16
3	B	2170[B]	DUP	O4'-C1'-N1	2.92	113.04	107.86
3	B	3170	DUP	N3-C2-N1	2.90	118.67	114.89
3	B	2170[A]	DUP	O4'-C4'-C5'	2.72	118.05	109.33
3	A	1170	DUP	O1B-PB-N3A	2.60	115.61	111.77
3	A	1170	DUP	O3B-PG-O2G	-2.60	97.36	111.04
3	B	2170[A]	DUP	C5-C4-N3	2.53	118.34	114.80
3	B	2170[A]	DUP	O3'-C3'-C4'	2.53	119.65	110.07
3	B	2170[A]	DUP	O3B-PG-O2G	-2.43	98.27	111.04
3	B	2170[B]	DUP	O1B-PB-N3A	-2.42	108.21	111.77
3	A	1170	DUP	O1G-PG-O3B	2.41	112.71	104.64
3	A	1170	DUP	O3'-C3'-C2'	2.29	118.84	110.88
3	A	1170	DUP	C3'-C2'-C1'	2.29	108.20	102.60
3	B	3170	DUP	O3'-C3'-C4'	2.20	118.40	110.07
3	B	2170[A]	DUP	O3G-PG-O2G	2.09	118.96	110.83
3	B	2170[A]	DUP	O5'-C5'-C4'	2.06	116.00	108.99

There are no chirality outliers.

All (13) torsion outliers are listed below:

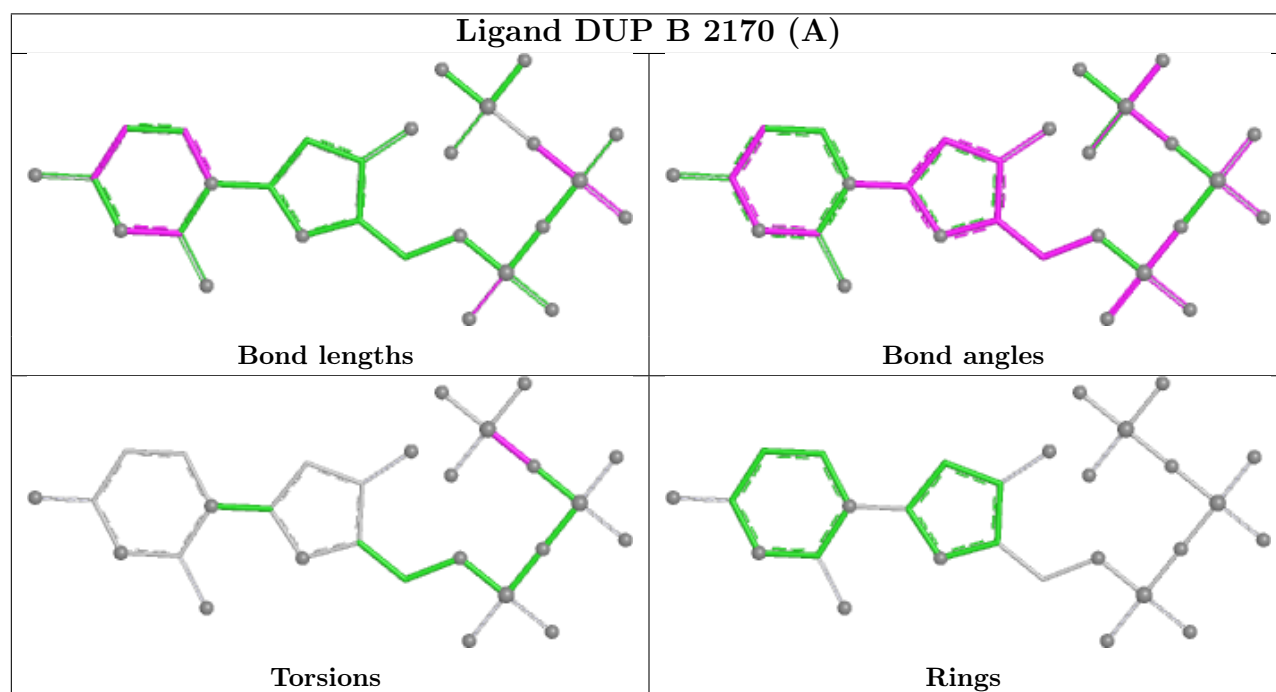
Mol	Chain	Res	Type	Atoms
3	B	2170[A]	DUP	PB-O3B-PG-O2G
3	B	2170[A]	DUP	PB-O3B-PG-O1G
3	B	2170[B]	DUP	C5'-O5'-PA-O2A
3	B	2170[B]	DUP	C5'-O5'-PA-N3A
3	B	2170[B]	DUP	PB-N3A-PA-O1A
3	B	2170[B]	DUP	PA-N3A-PB-O1B
3	B	2170[B]	DUP	PG-O3B-PB-O2B
3	B	3170	DUP	PG-O3B-PB-O1B
3	B	2170[B]	DUP	O4'-C4'-C5'-O5'
3	B	2170[B]	DUP	C3'-C4'-C5'-O5'
3	A	1170	DUP	PB-O3B-PG-O2G
3	B	3170	DUP	PB-O3B-PG-O2G
3	B	2170[B]	DUP	C5'-O5'-PA-O1A

There are no ring outliers.

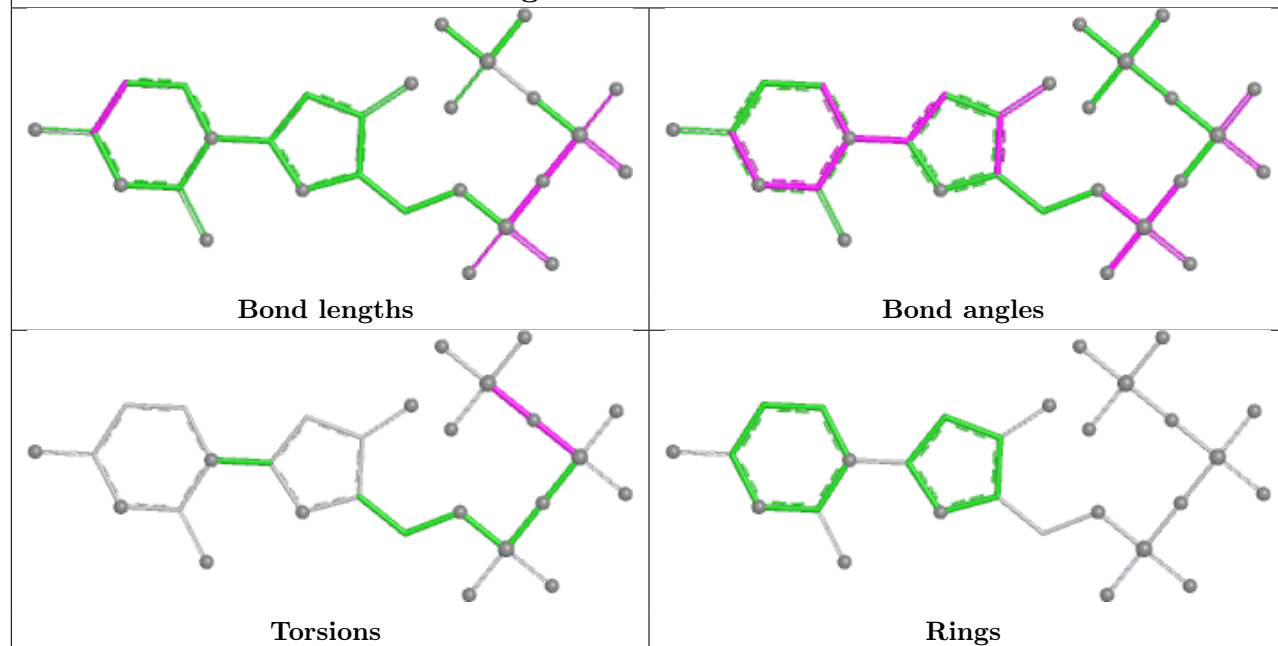
3 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	2170[A]	DUP	2	0
3	B	3170	DUP	1	0
3	B	2170[B]	DUP	2	0

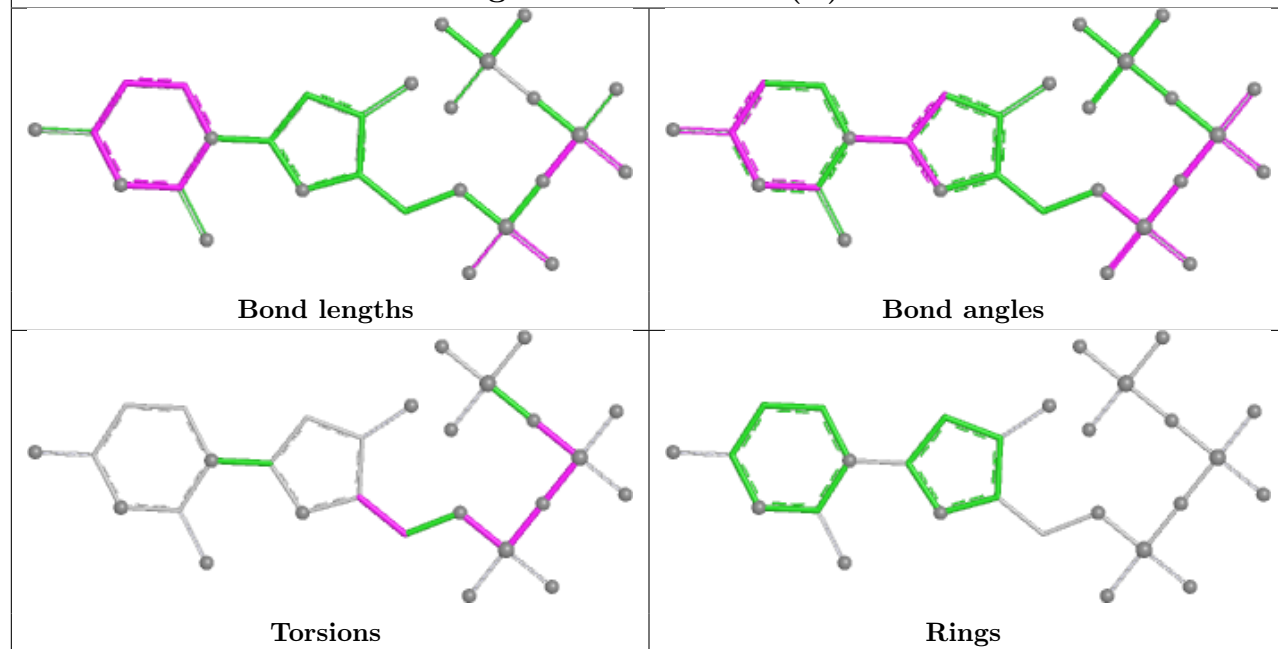
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

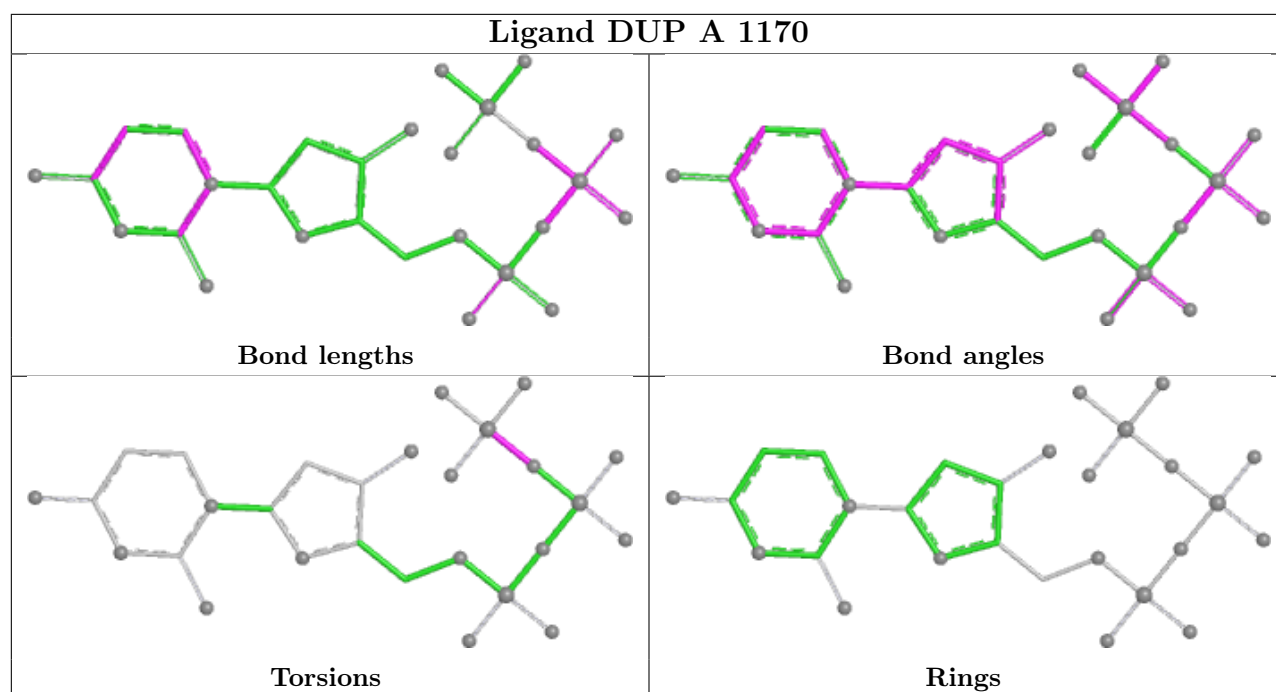


Ligand DUP B 3170



Ligand DUP B 2170 (B)





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	131/170 (77%)	0.59	14 (10%) 11 9	14, 18, 32, 53	0
1	B	140/170 (82%)	0.35	11 (7%) 18 16	16, 25, 56, 65	0
1	C	144/170 (84%)	0.57	18 (12%) 8 6	17, 25, 76, 79	0
All	All	415/510 (81%)	0.50	43 (10%) 11 10	14, 22, 56, 79	0

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	141	GLY	8.9
1	C	135	LEU	6.0
1	C	143	GLY	5.9
1	B	135	LEU	5.6
1	C	133	ALA	5.0
1	B	1	MET	4.7
1	A	130	PHE	4.6
1	C	2	SER	4.6
1	C	136	ALA	4.5
1	C	138	THR	4.4
1	A	127	VAL	4.3
1	B	137	SER	3.9
1	B	134	GLY	3.9
1	A	122	VAL	3.9
1	C	144	GLY	3.6
1	C	139	SER	3.6
1	C	142	ASP	3.5
1	C	145	HIS	3.5
1	C	134	GLY	3.4
1	B	2	SER	3.3
1	B	136	ALA	3.3
1	A	125	VAL	3.2
1	A	22	ASP	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	124	LEU	2.9
1	B	132	GLU	2.8
1	A	128	SER	2.8
1	C	131	ASP	2.8
1	B	133	ALA	2.8
1	C	13	GLY	2.8
1	A	56	GLY	2.7
1	B	139	SER	2.7
1	C	137	SER	2.6
1	A	55	PHE	2.5
1	A	121	LEU	2.5
1	C	132	GLU	2.5
1	B	131	ASP	2.5
1	A	132	GLU	2.4
1	A	21	HIS	2.4
1	A	123	GLU	2.3
1	A	119	VAL	2.3
1	B	21	HIS	2.1
1	C	106	HIS	2.1
1	C	101	ALA	2.1

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	NO3	B	172	4/4	0.83	0.22	43,43,43,45	0
2	MG	B	171	1/1	0.89	0.13	40,40,40,40	0
5	NO3	C	172	4/4	0.92	0.13	34,36,37,38	0

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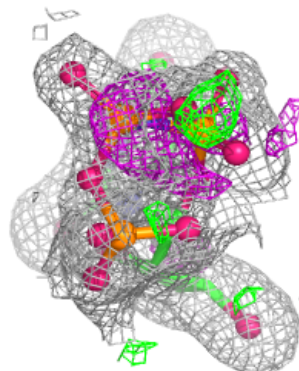
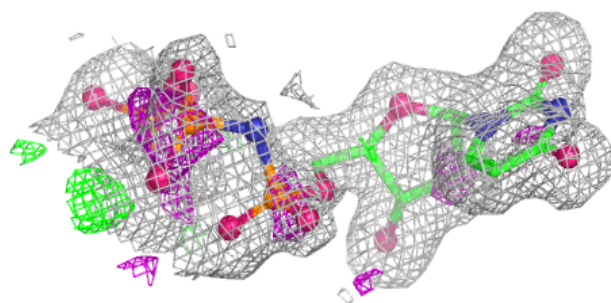
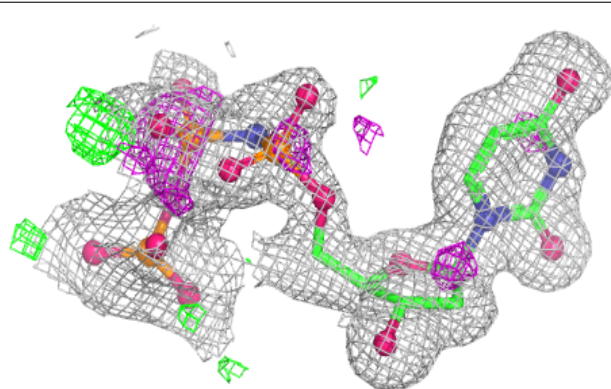
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	DUP	B	2170[A]	28/28	0.93	0.09	16,20,33,34	28
3	DUP	B	2170[B]	28/28	0.93	0.09	16,29,50,52	28
4	TRS	A	1171	8/8	0.94	0.08	24,25,28,31	0
2	MG	C	171	1/1	0.98	0.04	21,21,21,21	0
3	DUP	A	1170	28/28	0.98	0.06	17,21,23,24	0
3	DUP	B	3170	28/28	0.98	0.05	17,20,27,31	0
2	MG	A	171	1/1	0.99	0.03	24,24,24,24	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.

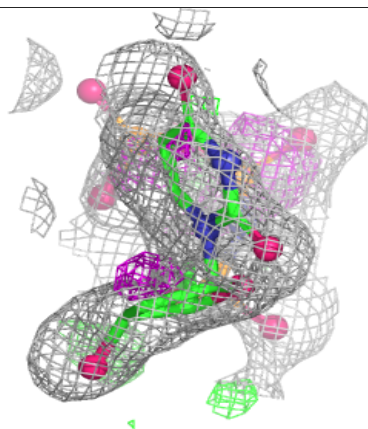
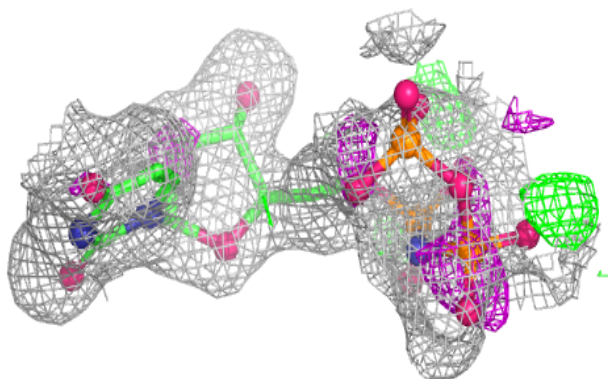
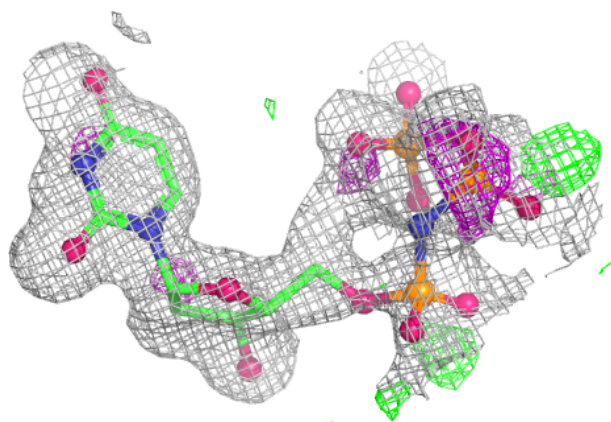
Electron density around DUP B 2170 (A):

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

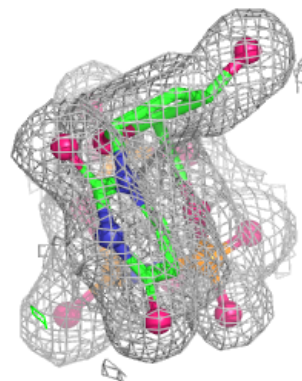
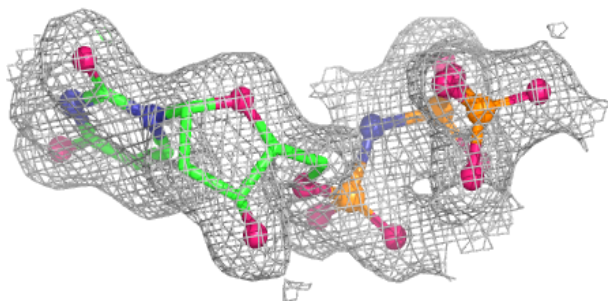
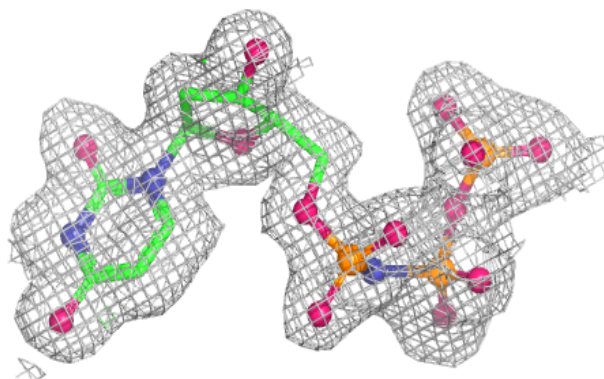


Electron density around DUP B 2170 (B):

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

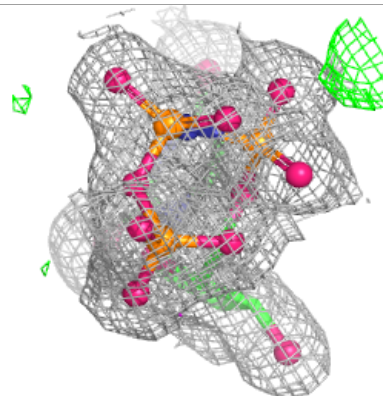
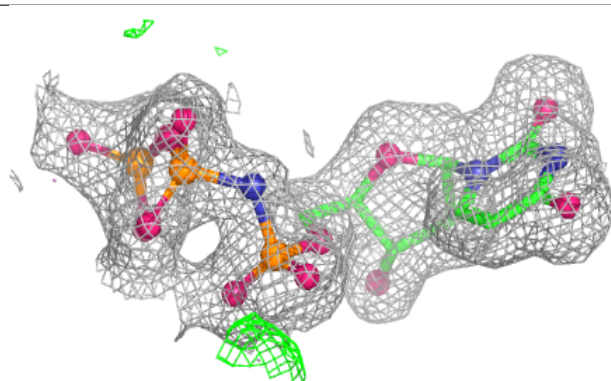
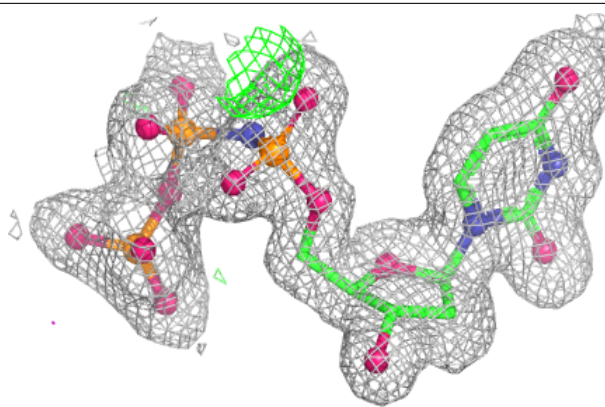
**Electron density around DUP A 1170:**

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



Electron density around DUP B 3170:

$2mF_o-DF_c$ (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.