



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 10, 2023 – 09:15 AM EDT

PDB ID : 7JX1  
Title : E. coli TSase complex with a bi-substrate reaction intermediate analog  
Authors : Finer-Moore, J.; Kholodar, S.A.; Stroud, R.M.; Kohen, A.  
Deposited on : 2020-08-26  
Resolution : 1.82 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](mailto: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>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
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

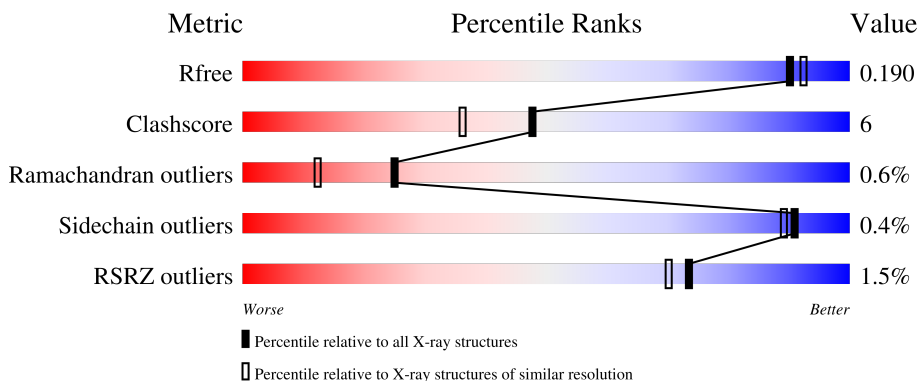
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

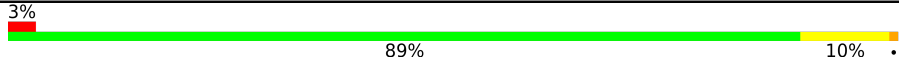

The reported resolution of this entry is 1.82 Å.

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	7484 (1.84-1.80)
Clashscore	141614	8401 (1.84-1.80)
Ramachandran outliers	138981	8290 (1.84-1.80)
Sidechain outliers	138945	8290 (1.84-1.80)
RSRZ outliers	127900	7371 (1.84-1.80)

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  $\geq 3$ , 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	264	 3% 89% 10% .
1	B	264	 91% 8% .

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
5	PO4	B	302[B]	-	-	X	-

## 2 Entry composition [i](#)

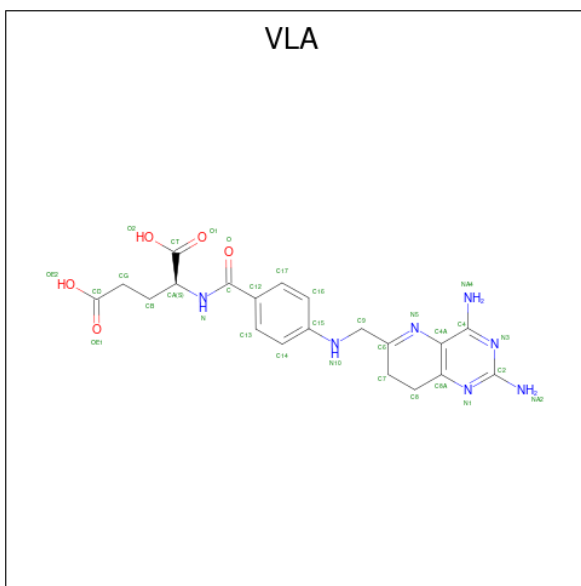
There are 6 unique types of molecules in this entry. The entry contains 9518 atoms, of which 4498 are hydrogens and 0 are deuteriums.

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 Thymidylate synthase.

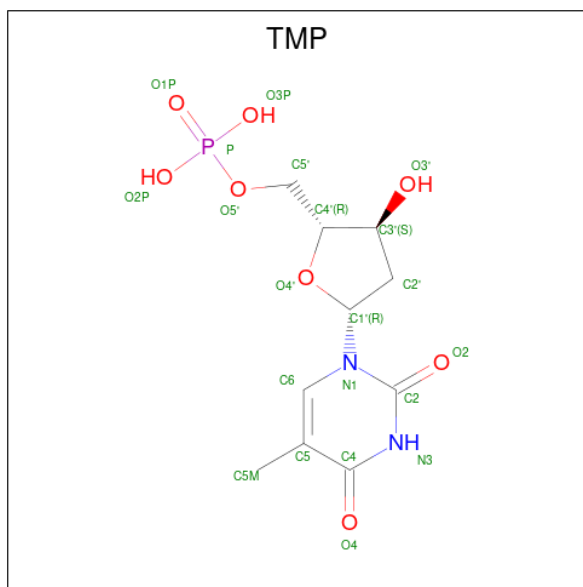
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	264	4646	1494	2300	410	428	14	0	39	0
1	B	264	4429	1434	2182	392	407	14	0	24	0

- Molecule 2 is N-(4-[(2,4-diamino-7,8-dihydropyrido[3,2-d]pyrimidin-6-yl)methyl]amino)benzene-1-carbonyl)-L-glutamic acid (three-letter code: VLA) (formula: C<sub>20</sub>H<sub>23</sub>N<sub>7</sub>O<sub>5</sub>) (labeled as "Ligand of Interest" by depositor).



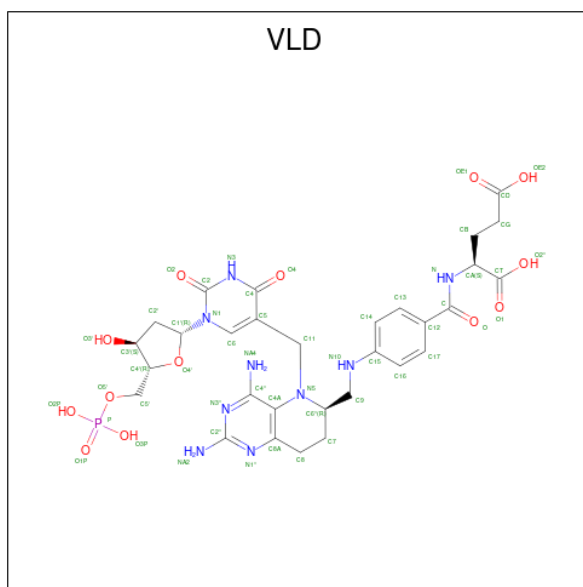
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	32	20	7	5	0	1

- Molecule 3 is THYMIDINE-5'-PHOSPHATE (three-letter code: TMP) (formula: C<sub>10</sub>H<sub>15</sub>N<sub>2</sub>O<sub>8</sub>P) (labeled as "Ligand of Interest" by depositor).



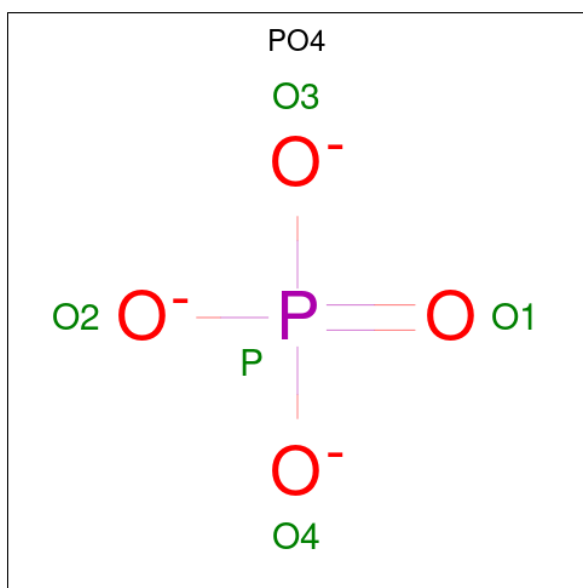
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	H	N	O			P
3	A	1	34	10	13	2	8	1	0	1

- Molecule 4 is (2S)-2-((4-(((6R)-2,4-diamino-5-[(1-((2R,4S,5R)-4-hydroxy-5-[(phosphono oxy)methyl]tetrahydrofuran-2-yl)-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-5-yl)methyl]-5,6,7,8-tetrahydropyrido[3,2-d]pyrimidin-6-yl)methyl)amino)benzoyl)amino)pentanedioic acid (non-preferred name) (three-letter code: VLD) (formula: C<sub>30</sub>H<sub>38</sub>N<sub>9</sub>O<sub>13</sub>P) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	H	N	O			P
4	B	1	109	60	3	18	26	2	0	1

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O<sub>4</sub>P).



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

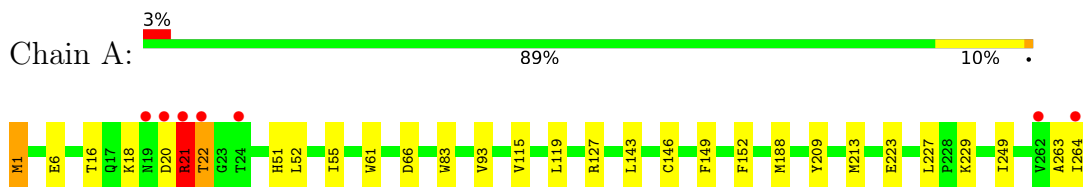
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	169	Total	O	0	3
			169	169		
6	B	94	Total	O	0	0
			94	94		

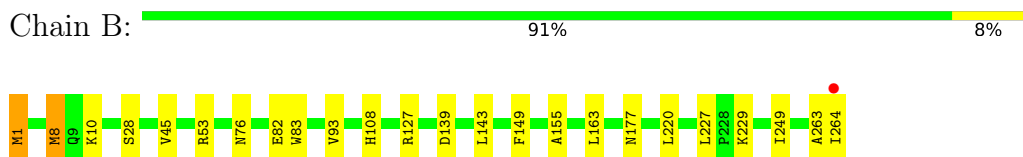
### 3 Residue-property plots [i](#)

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: Thymidylate synthase



- Molecule 1: Thymidylate synthase



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 63	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	125.98Å 125.98Å 67.34Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	109.10 – 1.82 109.10 – 1.82	Depositor EDS
% Data completeness (in resolution range)	97.4 (109.10-1.82) 97.4 (109.10-1.82)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.99 (at 1.82Å)	Xtrriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, $R_{free}$	0.151 , 0.190 0.151 , 0.190	Depositor DCC
$R_{free}$ test set	1984 reflections (3.72%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	35.3	Xtrriage
Anisotropy	0.064	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.46 , 57.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	0.030 for h,-h-k,-l	Xtrriage
$F_o, F_c$ correlation	0.98	EDS
Total number of atoms	9518	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.36% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: VLA, TMP, CXM, VLD, PO4

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	0.56	1/2516 (0.0%)	0.71	2/3414 (0.1%)
1	B	0.53	1/2388 (0.0%)	0.67	0/3240
All	All	0.54	2/4904 (0.0%)	0.69	2/6654 (0.0%)

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	A	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	229	LYS	CD-CE	6.57	1.67	1.51
1	B	8	MET	CG-SD	5.59	1.95	1.81

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	229	LYS	CD-CE-NZ	7.93	129.95	111.70
1	A	213	MET	CG-SD-CE	5.20	108.52	100.20

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	22[B]	THR	Peptide

## 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	2346	2300	2164	28	0
1	B	2247	2182	2087	22	0
2	A	32	0	0	1	0
3	A	21	13	13	3	0
4	B	106	3	0	6	0
5	B	5	0	0	3	0
6	A	169	0	0	4	0
6	B	94	0	0	10	0
All	All	5020	4498	4264	54	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 6.

All (54) 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:21[B]:ARG:NH2	5:B:302[B]:PO4:O3	1.99	0.95
1:B:53[A]:ARG:NH2	1:B:76:ASN:O	2.14	0.80
1:B:139:ASP:OD2	6:B:401:HOH:O	1.98	0.80
1:A:21[B]:ARG:O	1:A:22[B]:THR:OG1	2.02	0.76
1:A:6:GLU:OE2	6:A:401:HOH:O	2.06	0.73
1:A:223[B]:GLU:OE2	6:A:402:HOH:O	2.15	0.64
1:A:16[A]:THR:HG21	1:B:155:ALA:HB1	1.80	0.63
1:A:263:ALA:O	2:A:301[A]:VLA:NA2	2.32	0.63
3:A:302[A]:TMP:O3P	1:B:127:ARG:NH2	2.31	0.63
1:A:22[A]:THR:HG21	1:A:263:ALA:HB1	1.87	0.57
1:B:229:LYS:HD2	6:B:475:HOH:O	2.06	0.56
1:A:18[A]:LYS:HE2	6:A:455:HOH:O	2.07	0.55
1:A:146:CYS:SG	3:A:302[A]:TMP:C6	3.00	0.54
1:B:177:ASN:ND2	4:B:301[B]:VLD:O4	2.36	0.54
1:A:21[B]:ARG:HH21	1:B:127:ARG:HH22	1.55	0.53
1:A:152:PHE:CZ	1:A:188[A]:MET:SD	3.02	0.52
1:B:108:HIS:HE1	6:B:488:HOH:O	1.93	0.51
1:B:127:ARG:NH2	5:B:302[B]:PO4:O4	2.43	0.51
1:B:8:MET:HE3	1:B:220:LEU:HG	1.92	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:143[B]:LEU:HD23	6:B:412:HOH:O	2.10	0.50
1:A:83:TRP:NE1	1:A:143[B]:LEU:HD11	2.27	0.50
1:B:82:GLU:HG2	1:B:264:ILE:HG23	1.94	0.49
1:A:52[B]:LEU:HD22	1:A:249[B]:ILE:HG13	1.96	0.48
1:B:1:CXM:HG3	1:B:227:LEU:HD21	1.95	0.48
1:A:1:CXM:HG3	1:A:227:LEU:HD21	1.95	0.47
1:B:10:LYS:HE2	6:B:415:HOH:O	2.14	0.47
5:B:302[B]:PO4:O2	6:B:402:HOH:O	2.20	0.47
1:A:22[A]:THR:HG23	1:A:264:ILE:O	2.15	0.47
1:A:115[A]:VAL:HG11	1:A:188[A]:MET:HE1	1.97	0.45
1:A:52[B]:LEU:HA	1:A:55:ILE:HD12	1.97	0.45
1:B:263:ALA:O	4:B:301[A]:VLD:NA2	2.50	0.45
1:B:1:CXM:ON2	1:B:45:VAL:HG13	2.17	0.45
1:A:61:TRP:CD1	1:A:66:ASP:HB3	2.52	0.44
1:A:20[A]:ASP:OD2	1:A:22[A]:THR:HB	2.18	0.44
4:B:301[A]:VLD:C5	6:B:476:HOH:O	2.66	0.44
4:B:301[A]:VLD:N1"	6:B:404:HOH:O	2.33	0.44
1:A:20[A]:ASP:OD2	1:A:209:TYR:HE1	2.01	0.44
1:A:119:LEU:HD12	1:A:188[B]:MET:HE2	1.99	0.44
1:A:149:PHE:CD1	1:B:149[A]:PHE:HE1	2.36	0.43
4:B:301[B]:VLD:C6	4:B:301[B]:VLD:C4A	2.97	0.43
1:A:20[B]:ASP:O	1:A:22[B]:THR:N	2.51	0.42
1:A:143[A]:LEU:HD11	3:A:302[A]:TMP:H5'2	2.01	0.42
1:B:8:MET:CE	1:B:220:LEU:HG	2.50	0.41
1:B:83:TRP:CE2	1:B:143[A]:LEU:HD11	2.56	0.41
1:A:223[A]:GLU:OE2	6:A:403:HOH:O	2.22	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	301/264 (114%)	292 (97%)	6 (2%)	3 (1%)	15	5
1	B	286/264 (108%)	280 (98%)	5 (2%)	1 (0%)	41	27
All	All	587/528 (111%)	572 (97%)	11 (2%)	4 (1%)	25	10

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	21[A]	ARG
1	A	21[B]	ARG
1	A	93	VAL
1	B	93	VAL

### 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	265/232 (114%)	262 (99%)	3 (1%)	73	67
1	B	250/232 (108%)	250 (100%)	0	100	100
All	All	515/464 (111%)	512 (99%)	3 (1%)	91	83

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21[A]	ARG
1	A	21[B]	ARG
1	A	127	ARG

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	117	ASN
1	B	108	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](#)

2 non-standard protein/DNA/RNA residues 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
1	CXM	B	1	1	8,10,11	3.68	2 (25%)	7,11,13	1.78	1 (14%)
1	CXM	A	1	1	8,10,11	3.34	2 (25%)	7,11,13	2.49	5 (71%)

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
1	CXM	B	1	1	-	1/9/10/12	-
1	CXM	A	1	1	-	1/9/10/12	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	1	CXM	ON1-CN	9.48	1.39	1.21
1	A	1	CXM	ON1-CN	8.31	1.37	1.21
1	A	1	CXM	CN-N	4.35	1.42	1.35
1	B	1	CXM	CN-N	4.15	1.42	1.35

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1	CXM	C-CA-N	-3.96	102.59	109.73
1	B	1	CXM	C-CA-N	-3.78	102.92	109.73
1	A	1	CXM	ON1-CN-N	-2.93	120.05	124.85

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1	CXM	CA-N-CN	-2.89	117.14	122.44
1	A	1	CXM	CE-SD-CG	2.26	108.16	100.40
1	A	1	CXM	O-C-CA	-2.04	119.44	124.78

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	1	CXM	O-C-CA-CB
1	A	1	CXM	C-CA-CB-CG

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	1	CXM	2	0
1	A	1	CXM	1	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

5 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	VLD	B	301[B]	-	55,57,57	1.14	4 (7%)	74,83,83	1.95	19 (25%)
3	TMP	A	302[A]	-	22,22,22	4.24	12 (54%)	33,33,33	2.08	9 (27%)
4	VLD	B	301[A]	1	55,57,57	1.45	6 (10%)	74,83,83	2.35	16 (21%)
5	PO4	B	302[B]	-	4,4,4	0.94	0	6,6,6	0.47	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	VLA	A	301[A]	-	31,34,34	3.09	21 (67%)	39,47,47	1.84	10 (25%)

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	VLD	B	301[B]	-	-	7/36/61/61	0/5/5/5
2	VLA	A	301[A]	-	-	4/20/31/31	0/3/3/3
4	VLD	B	301[A]	1	-	7/36/61/61	0/5/5/5
3	TMP	A	302[A]	-	-	4/10/22/22	0/2/2/2

All (43) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	302[A]	TMP	C6-C5	9.38	1.50	1.34
3	A	302[A]	TMP	C3'-C4'	-8.23	1.30	1.53
3	A	302[A]	TMP	O4'-C4'	7.98	1.62	1.45
3	A	302[A]	TMP	C2-N1	6.50	1.48	1.38
3	A	302[A]	TMP	C2-N3	6.38	1.49	1.38
4	B	301[A]	VLD	C6-C5	6.20	1.52	1.34
4	B	301[A]	VLD	C6-N1	5.78	1.47	1.38
2	A	301[A]	VLA	C2-NA2	5.75	1.45	1.33
2	A	301[A]	VLA	C4A-N5	5.47	1.49	1.38
4	B	301[B]	VLD	C6-N1	5.25	1.47	1.38
2	A	301[A]	VLA	C12-C	5.00	1.60	1.50
2	A	301[A]	VLA	C7-C6	4.82	1.55	1.50
3	A	302[A]	TMP	O4'-C1'	-4.56	1.32	1.42
3	A	302[A]	TMP	C6-N1	4.39	1.45	1.38
2	A	301[A]	VLA	C4-N3	4.38	1.41	1.35
2	A	301[A]	VLA	C4-NA4	3.88	1.43	1.34
2	A	301[A]	VLA	C2-N3	3.83	1.42	1.35
3	A	302[A]	TMP	C4-N3	3.61	1.45	1.38
2	A	301[A]	VLA	C8A-N1	3.56	1.40	1.34
2	A	301[A]	VLA	C9-N10	3.53	1.51	1.45
2	A	301[A]	VLA	C15-N10	3.45	1.48	1.38
2	A	301[A]	VLA	CB-CA	3.43	1.61	1.53
2	A	301[A]	VLA	C8-C8A	3.13	1.55	1.50
3	A	302[A]	TMP	O2-C2	-3.05	1.17	1.23
2	A	301[A]	VLA	CG-CD	3.01	1.57	1.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	302[A]	TMP	O3'-C3'	2.93	1.49	1.43
4	B	301[A]	VLD	C4-N3	-2.77	1.33	1.38
3	A	302[A]	TMP	O4-C4	-2.77	1.18	1.23
2	A	301[A]	VLA	CA-N	2.76	1.51	1.45
4	B	301[A]	VLD	C2-N1	2.72	1.42	1.38
2	A	301[A]	VLA	C17-C16	2.71	1.43	1.38
4	B	301[B]	VLD	C2-N1	2.62	1.42	1.38
2	A	301[A]	VLA	C14-C13	2.53	1.43	1.38
3	A	302[A]	TMP	C4-C5	2.52	1.49	1.44
2	A	301[A]	VLA	C4A-C4	2.45	1.47	1.41
4	B	301[B]	VLD	C4-N3	-2.40	1.34	1.38
4	B	301[A]	VLD	C4-C5	2.30	1.50	1.45
2	A	301[A]	VLA	C13-C12	2.27	1.43	1.39
4	B	301[A]	VLD	C2-N3	-2.20	1.34	1.38
4	B	301[B]	VLD	C4-C5	2.17	1.49	1.45
2	A	301[A]	VLA	C16-C15	2.17	1.42	1.39
2	A	301[A]	VLA	CB-CG	2.11	1.59	1.52
2	A	301[A]	VLA	CA-CT	2.05	1.58	1.52

All (54) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	301[A]	VLD	C5-C6-N1	-11.20	107.86	122.91
3	A	302[A]	TMP	C4-N3-C2	-5.64	120.05	127.35
4	B	301[A]	VLD	C4-N3-C2	-5.42	120.34	127.35
4	B	301[A]	VLD	C6-C5-C4	-5.32	108.28	118.46
3	A	302[A]	TMP	C5-C4-N3	5.09	119.66	115.31
2	A	301[A]	VLA	C12-C-N	5.08	126.80	117.06
4	B	301[B]	VLD	"C8-C8A-N1""	4.97	122.49	115.85
4	B	301[A]	VLD	"C8-C8A-N1""	4.95	122.47	115.85
4	B	301[B]	VLD	N3-C2-N1	4.92	121.42	114.89
4	B	301[A]	VLD	O4-C4-C5	-4.67	118.01	124.96
4	B	301[A]	VLD	N3-C2-N1	4.63	121.03	114.89
4	B	301[B]	VLD	O4-C4-C5	-4.57	118.16	124.96
4	B	301[B]	VLD	C4-N3-C2	-4.54	121.47	127.35
3	A	302[A]	TMP	O4-C4-C5	-4.45	119.74	124.90
3	A	302[A]	TMP	N3-C2-N1	4.41	120.74	114.89
4	B	301[A]	VLD	"C2""-N1""-C8A"	4.39	119.90	116.24
4	B	301[A]	VLD	C11-C5-C6	-4.38	114.53	121.24
4	B	301[B]	VLD	C6-N1-C2	-4.34	116.90	121.30
4	B	301[B]	VLD	C5-C6-N1	-4.24	117.22	122.91
4	B	301[B]	VLD	"C2""-N1""-C8A"	4.14	119.69	116.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	301[A]	VLA	O-C-C12	-3.85	114.08	120.94
4	B	301[B]	VLD	C8-C8A-C4A	-3.78	117.15	121.41
4	B	301[A]	VLD	C8-C8A-C4A	-3.64	117.31	121.41
2	A	301[A]	VLA	C2-N1-C8A	3.37	119.05	116.24
4	B	301[A]	VLD	"C2"-N3"-C4"'''	3.29	120.62	116.99
4	B	301[B]	VLD	"C2"-N3"-C4"'''	3.26	120.58	116.99
4	B	301[B]	VLD	C8A-C4A-N5	-3.12	116.71	120.45
4	B	301[A]	VLD	C8A-C4A-N5	-3.10	116.73	120.45
2	A	301[A]	VLA	OE2-CD-OE1	-2.98	115.88	123.30
4	B	301[A]	VLD	"N3"-C2"-N1"'''	-2.96	120.78	125.42
4	B	301[B]	VLD	"N3"-C2"-N1"'''	-2.94	120.81	125.42
4	B	301[B]	VLD	CB-CA-N	-2.86	105.09	110.88
4	B	301[B]	VLD	C6-C5-C4	-2.81	113.08	118.46
3	A	302[A]	TMP	C5-C6-N1	-2.76	120.50	123.34
4	B	301[A]	VLD	CB-CA-N	-2.75	105.32	110.88
2	A	301[A]	VLA	OE2-CD-CG	2.68	122.64	114.03
2	A	301[A]	VLA	C8-C7-C6	2.65	113.83	111.08
4	B	301[B]	VLD	C1'-N1-C2	2.63	122.82	117.64
4	B	301[B]	VLD	O2-C2-N3	-2.47	116.90	121.50
3	A	302[A]	TMP	O4'-C1'-N1	2.46	112.26	107.86
2	A	301[A]	VLA	C7-C8-C8A	2.42	116.55	110.66
4	B	301[B]	VLD	O4'-C1'-N1	2.40	112.16	107.86
4	B	301[B]	VLD	"C11-N5-C6"'''	-2.37	112.99	117.70
3	A	302[A]	TMP	C6-C5-C4	2.32	119.97	118.03
4	B	301[A]	VLD	O4'-C1'-N1	2.31	112.00	107.86
2	A	301[A]	VLA	O2-CT-O1	-2.20	119.10	124.09
3	A	302[A]	TMP	C6-N1-C2	-2.20	119.07	121.30
4	B	301[A]	VLD	O2-C2-N3	-2.18	117.44	121.50
2	A	301[A]	VLA	C16-C15-C14	-2.15	116.09	119.03
2	A	301[A]	VLA	O2-CT-CA	2.12	120.46	113.40
3	A	302[A]	TMP	O2-C2-N1	-2.08	120.02	122.79
4	B	301[B]	VLD	"NA4-C4"-N3"'''	2.08	119.97	117.03
4	B	301[A]	VLD	"C11-N5-C6"'''	-2.07	113.59	117.70
4	B	301[B]	VLD	C5-C4-N3	2.06	117.87	114.97

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	302[A]	TMP	C5'-O5'-P-O2P
4	B	301[A]	VLD	N5-C11-C5-C6
4	B	301[B]	VLD	"N5-C6"-C9-N10"

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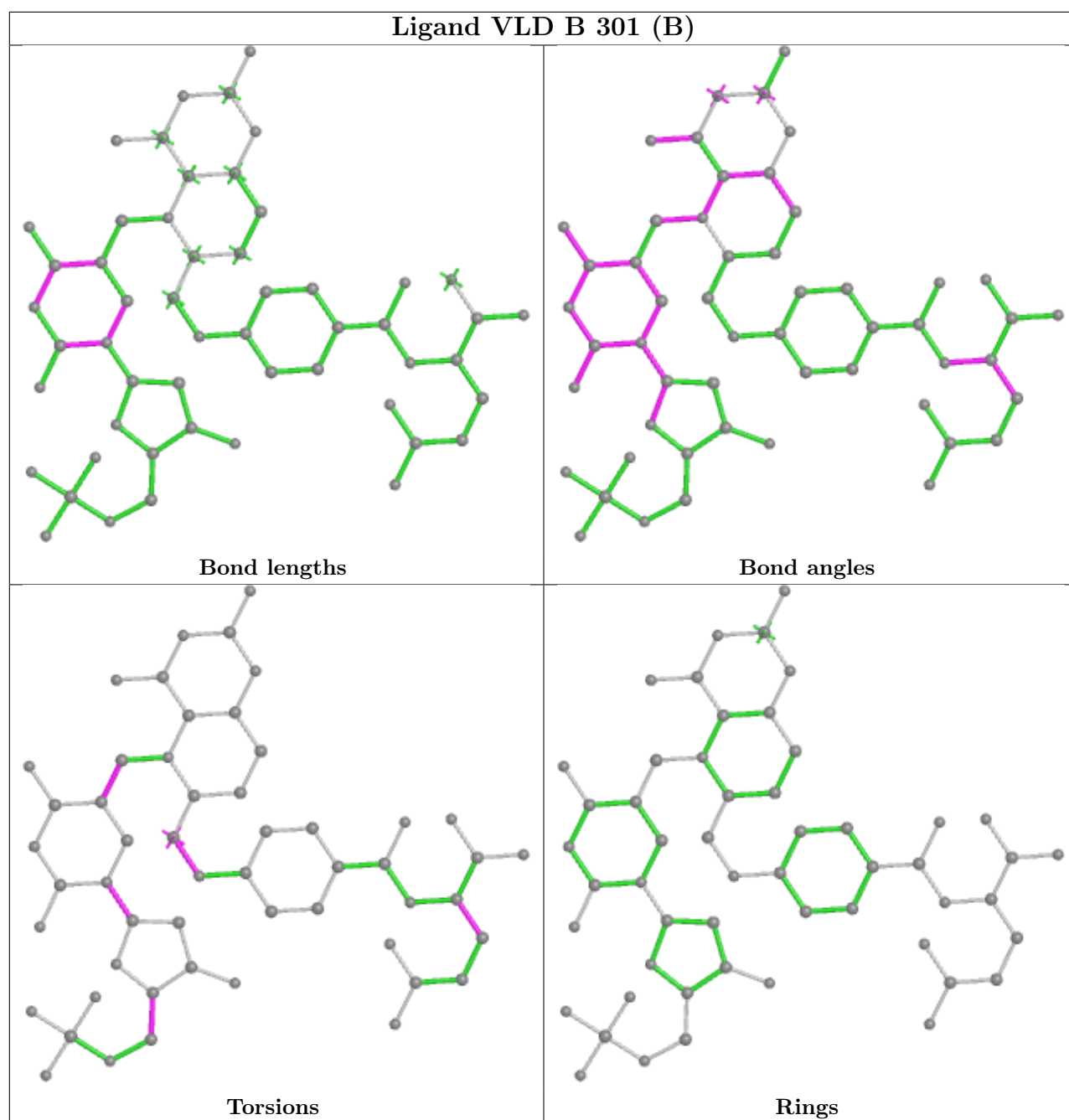
Mol	Chain	Res	Type	Atoms
2	A	301[A]	VLA	N-CA-CB-CG
3	A	302[A]	TMP	O4'-C4'-C5'-O5'
3	A	302[A]	TMP	C3'-C4'-C5'-O5'
2	A	301[A]	VLA	CT-CA-CB-CG
4	B	301[B]	VLD	"C7-C6"-C9-N10"
4	B	301[A]	VLD	"C6"-C9-N10-C15"
3	A	302[A]	TMP	C5'-O5'-P-O3P
4	B	301[A]	VLD	"N5-C6"-C9-N10"
4	B	301[B]	VLD	O4'-C4'-C5'-O5'
4	B	301[A]	VLD	CT-CA-CB-CG
4	B	301[B]	VLD	CT-CA-CB-CG
4	B	301[B]	VLD	"C6"-C9-N10-C15"
2	A	301[A]	VLA	OE2-CD-CG-CB
4	B	301[A]	VLD	O4'-C4'-C5'-O5'
2	A	301[A]	VLA	OE1-CD-CG-CB
4	B	301[B]	VLD	C2'-C1'-N1-C2
4	B	301[A]	VLD	"C7-C6"-C9-N10"
4	B	301[A]	VLD	N5-C11-C5-C4
4	B	301[B]	VLD	N5-C11-C5-C4

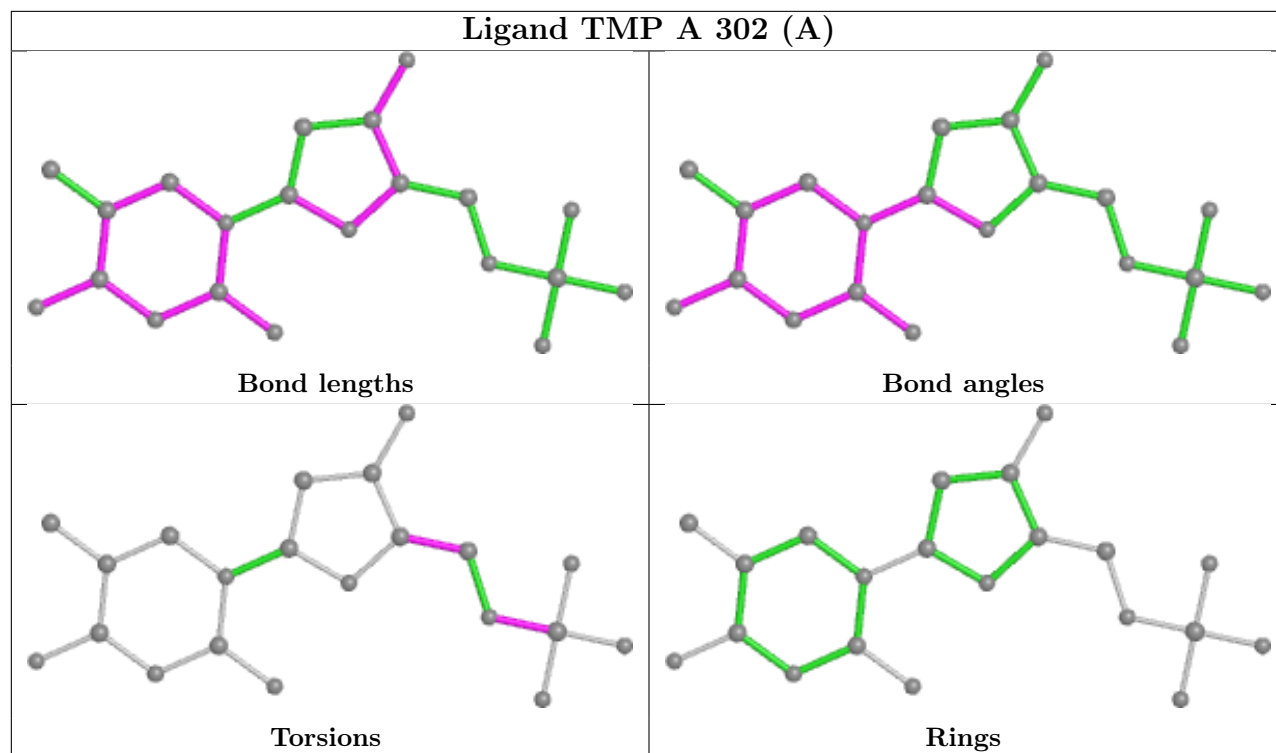
There are no ring outliers.

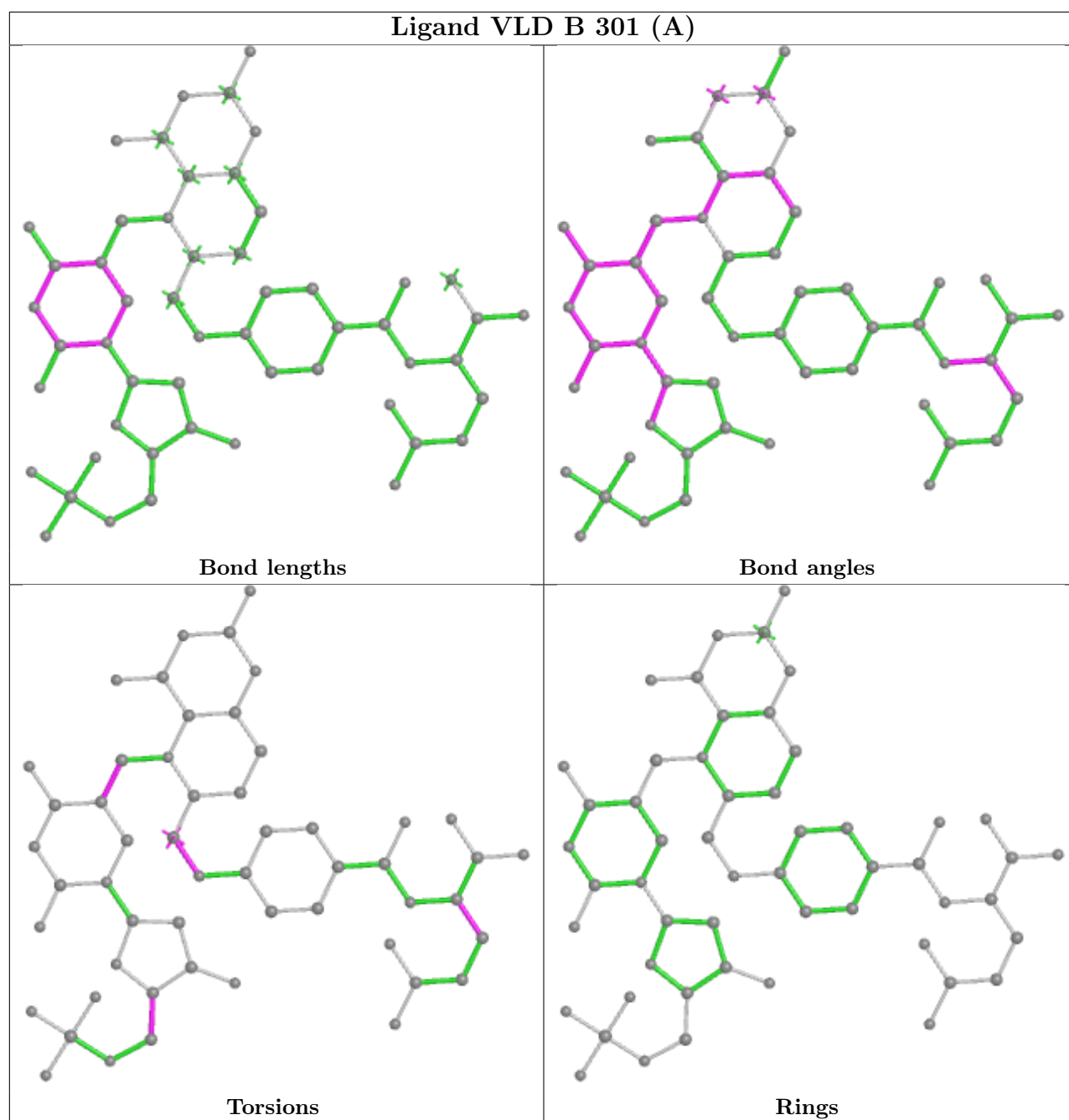
5 monomers are involved in 13 short contacts:

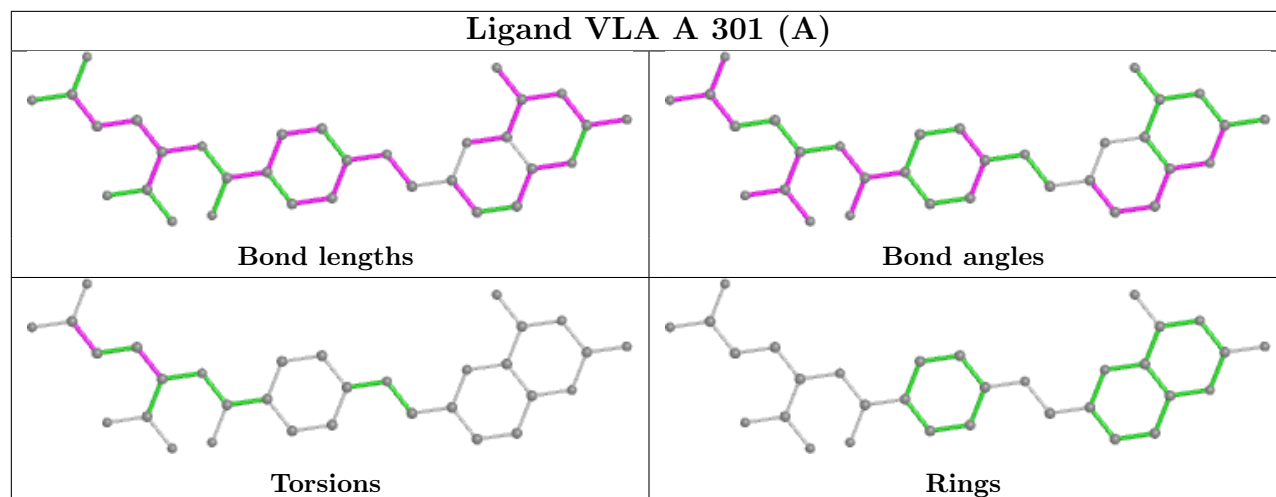
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	301[B]	VLD	2	0
3	A	302[A]	TMP	3	0
4	B	301[A]	VLD	4	0
5	B	302[B]	PO4	3	0
2	A	301[A]	VLA	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	263/264 (99%)	-0.16	7 (2%) 54 49	27, 34, 65, 120	0
1	B	263/264 (99%)	-0.19	1 (0%) 92 91	28, 42, 66, 96	0
All	All	526/528 (99%)	-0.17	8 (1%) 73 70	27, 38, 66, 120	0

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	264	ILE	7.1
1	A	22[A]	THR	7.1
1	B	264	ILE	6.5
1	A	21[A]	ARG	4.9
1	A	262	VAL	2.8
1	A	20[A]	ASP	2.6
1	A	19[A]	ASN	2.4
1	A	24[A]	THR	2.0

### 6.2 Non-standard residues in protein, DNA, RNA chains [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	CXM	A	1	11/12	0.97	0.11	25,35,51,51	0
1	CXM	B	1	11/12	0.98	0.10	35,42,52,52	0

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

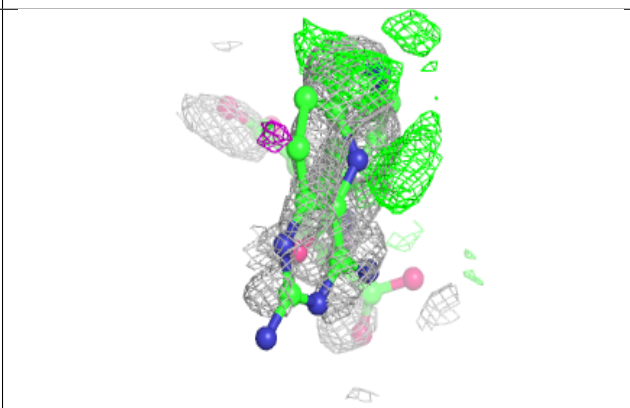
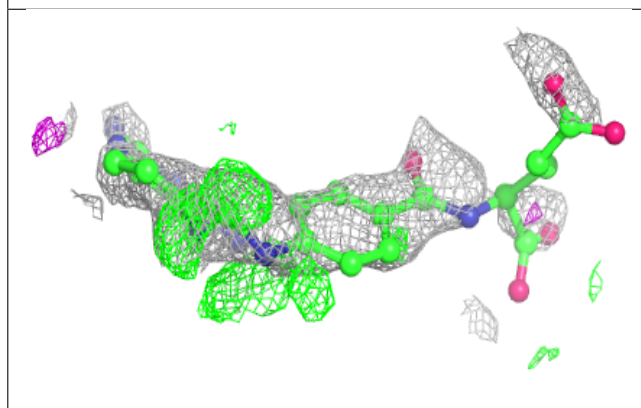
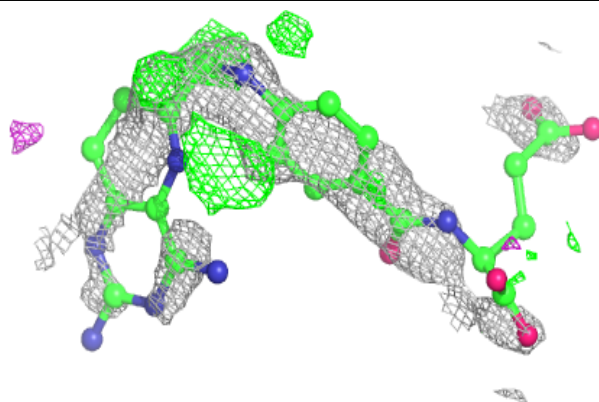
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	VLA	A	301[A]	32/32	0.65	0.34	85,111,127,130	0
4	VLD	B	301[A]	53/53	0.83	0.29	46,88,101,111	53
4	VLD	B	301[B]	53/53	0.83	0.29	44,89,104,109	56
3	TMP	A	302[A]	21/21	0.88	0.25	41,70,84,94	34
5	PO4	B	302[B]	5/5	0.96	0.17	62,63,75,90	5

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 VLA A 301 (A):

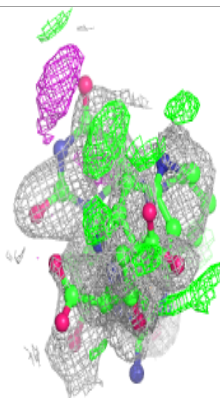
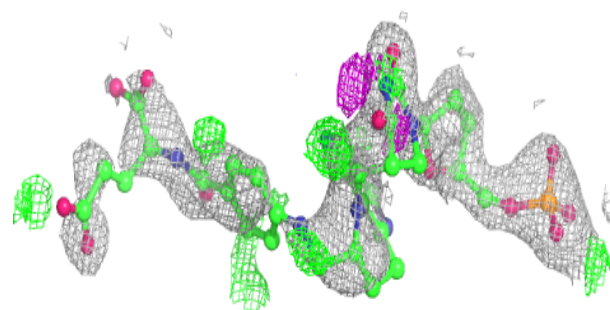
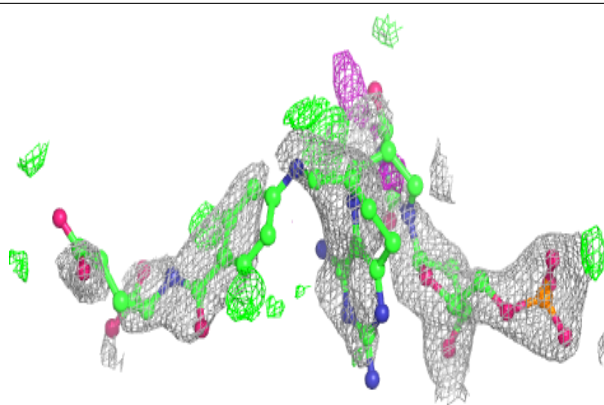
2mF<sub>o</sub>-DF<sub>c</sub> (at 0.7 rmsd) in gray  
 mF<sub>o</sub>-DF<sub>c</sub> (at 3 rmsd) in purple (negative)  
 and green (positive)



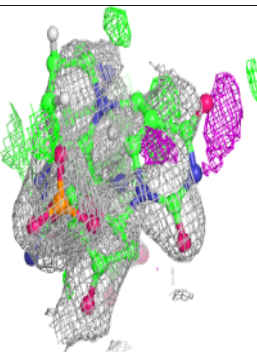
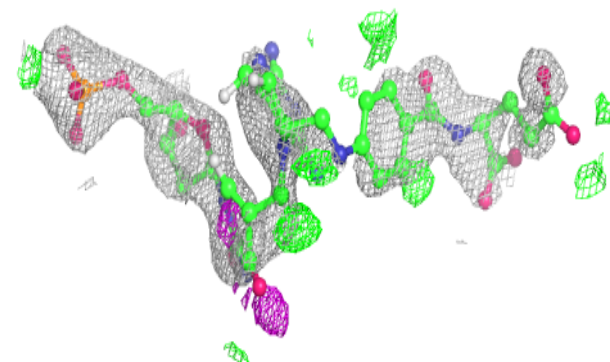
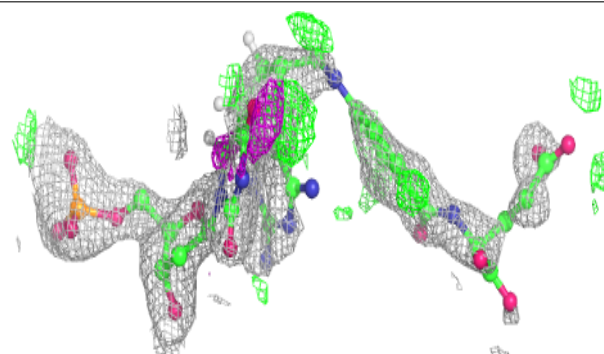


**Electron density around VLD B 301 (A):**

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

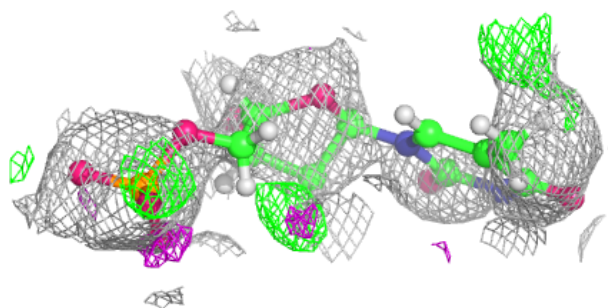
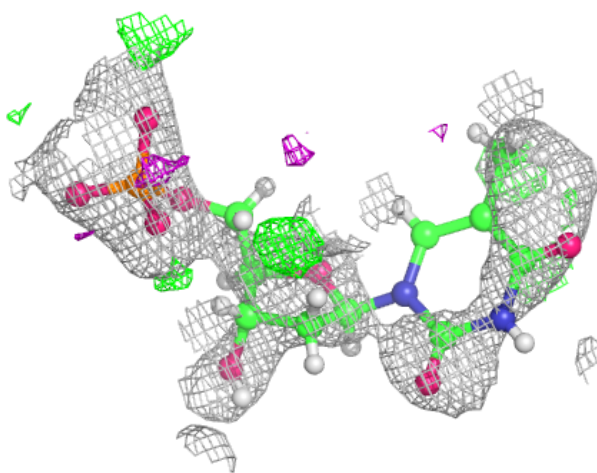
**Electron density around VLD B 301 (B):**

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



**Electron density around TMP A 302 (A):**

$2mF_o-DF_c$  (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.