Full wwPDB X-ray Structure Validation Report ⓘ

Jul 20, 2022 – 02:23 pm BST

PDB ID	:	7R3X
Title	:	The crystal structure of the L439V variant of Pol2CORE in complex with DNA and an incoming nucleotide
Authors	:	Barbari, S.R.; Beach, A.K.; Markgren, J.G.; Parkash, V.; Johansson, E.; Shcherbakova, P.V.
Deposited on	:	2022-02-08
Resolution	:	2.46 Å(reported)

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

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at http://www.wwpdb.org/validation/2017/FAQs#types.

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

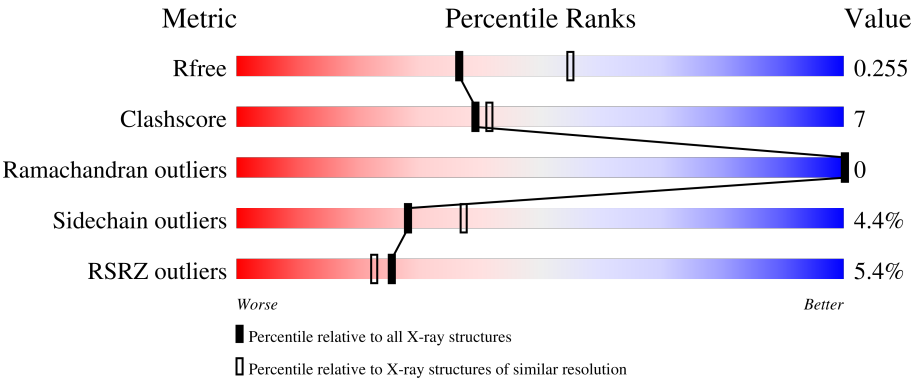
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.29
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.29

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.46 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	1544 (2.48-2.44)
Clashscore	141614	1613 (2.48-2.44)
Ramachandran outliers	138981	1598 (2.48-2.44)
Sidechain outliers	138945	1598 (2.48-2.44)
RSRZ outliers	127900	1523 (2.48-2.44)

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 <=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	1185	5%, 77%, 17%, • 5%
2	P	11	18%, 82%
3	T	16	31%, 44%, 19%, 6%

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
6	ACT	A	1304	-	-	X	-

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 9697 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 DNA polymerase epsilon catalytic subunit A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	1122	Total	C	N	O	S	0	0	0
			9036	5789	1509	1696	42			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	439	VAL	LEU	engineered mutation	UNP P21951

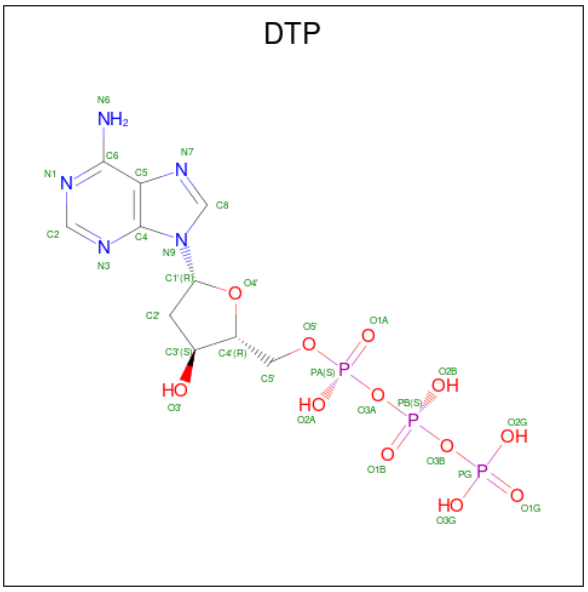
- Molecule 2 is a DNA chain called DNA Primer.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	P	11	Total	C	N	O	P	0	0	0
			221	106	38	66	11			

- Molecule 3 is a DNA chain called DNA Template.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	T	15	Total	C	N	O	P	0	0	0
			308	147	54	92	15			

- Molecule 4 is 2'-DEOXYADENOSINE 5'-TRIPHOSPHATE (three-letter code: DTP) (formula: $C_{10}H_{16}N_5O_{12}P_3$) (labeled as "Ligand of Interest" by depositor).

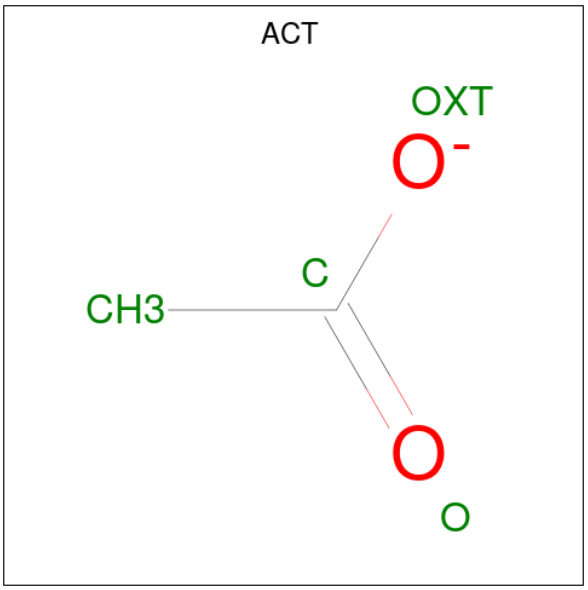


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			30	10	5	12	3		

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	2	Total	Ca	0	0
			2	2		

- Molecule 6 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C O 4 2 2	0	0

- Molecule 7 is water.

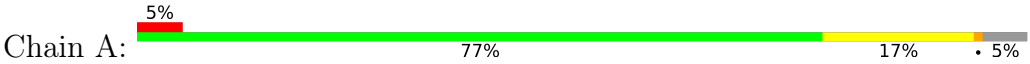
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	87	Total O 87 87	0	0
7	P	1	Total O 1 1	0	0
7	T	8	Total O 8 8	0	0

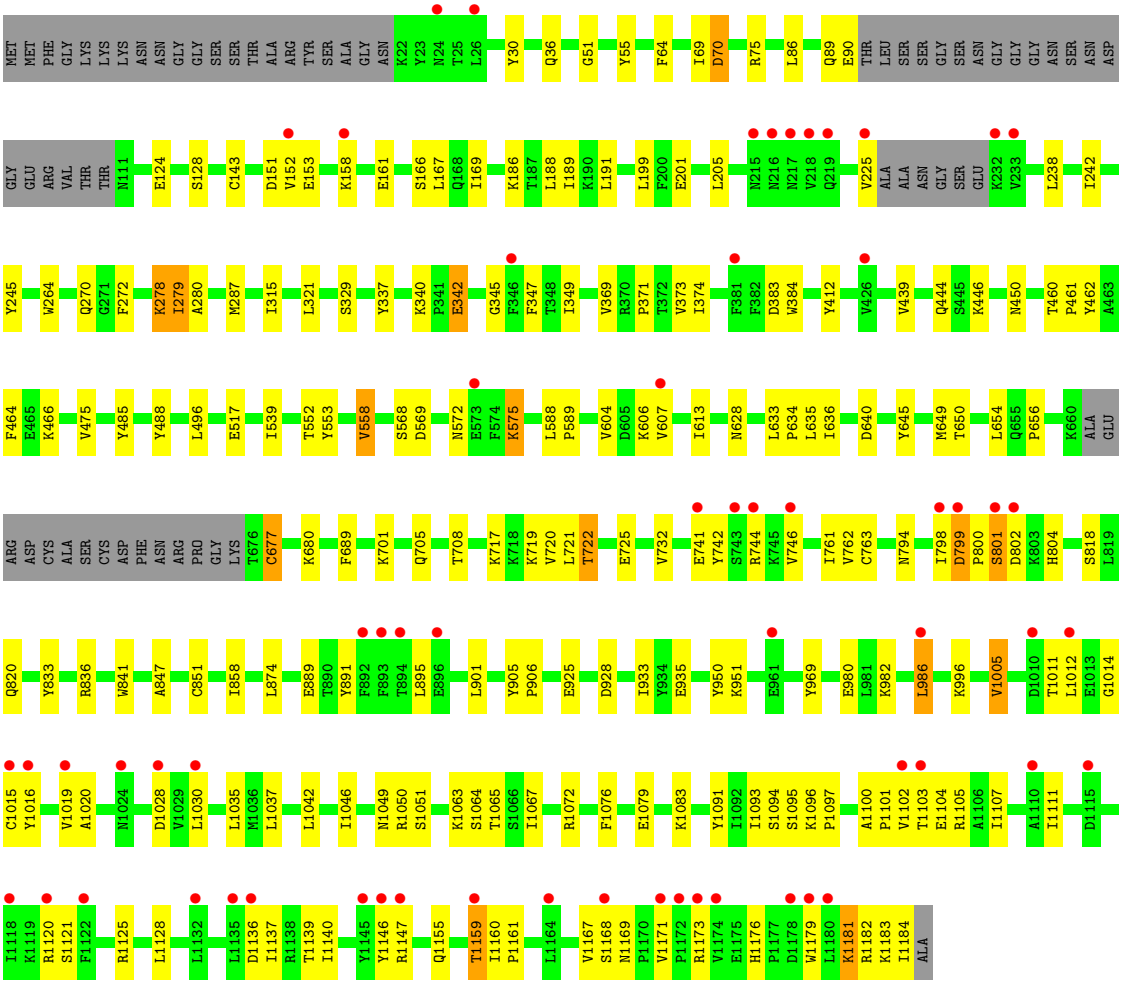
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: DNA polymerase epsilon catalytic subunit A

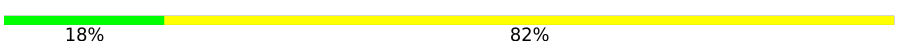
Chain A:

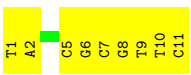




• Molecule 2: DNA Primer

Chain P:





• Molecule 3: DNA Template

Chain T:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	221.50Å 70.69Å 111.64Å 90.00° 100.14° 90.00°	Depositor
Resolution (Å)	45.78 – 2.46 45.73 – 2.46	Depositor EDS
% Data completeness (in resolution range)	99.8 (45.78-2.46) 99.9 (45.73-2.46)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.84 (at 2.45Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.209 , 0.256 0.213 , 0.255	Depositor DCC
R_{free} test set	3070 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å^2)	56.4	Xtriage
Anisotropy	0.346	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< \|L\| > = 0.51$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	9697	wwPDB-VP
Average B, all atoms (Å^2)	78.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.01% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: DOC, ACT, CA, DTP

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	0.76	0/9243	0.87	0/12511
2	P	1.13	0/226	1.60	6/346 (1.7%)
3	T	1.15	0/344	1.46	6/529 (1.1%)
All	All	0.79	0/9813	0.93	12/13386 (0.1%)

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	T	2	DT	P-O3'-C3'	-7.43	110.78	119.70
2	P	9	DT	OP1-P-OP2	-7.32	108.62	119.60
3	T	4	DT	O4'-C4'-C3'	-6.95	101.72	104.50
3	T	5	DT	O5'-P-OP2	-6.75	99.62	105.70
2	P	7	DC	OP1-P-O3'	6.54	119.59	105.20
2	P	8	DG	OP1-P-OP2	-6.39	110.01	119.60
3	T	15	DT	P-O3'-C3'	-6.27	112.17	119.70
2	P	8	DG	OP1-P-O3'	6.16	118.74	105.20
2	P	8	DG	OP2-P-O3'	5.40	117.09	105.20
3	T	11	DC	O5'-P-OP2	-5.32	100.91	105.70
3	T	4	DT	OP2-P-O3'	5.19	116.61	105.20
2	P	9	DT	OP2-P-O3'	5.07	116.36	105.20

There are no chirality outliers.

There are no planarity outliers.

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	9036	0	8845	132	0
2	P	221	0	125	3	0
3	T	308	0	171	7	0
4	A	30	0	12	2	0
5	A	2	0	0	0	0
6	A	4	0	3	3	0
7	A	87	0	0	0	0
7	P	1	0	0	0	0
7	T	8	0	0	0	0
All	All	9697	0	9156	138	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 7.

All (138) 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:345:GLY:O	1:A:347:PHE:CD1	2.33	0.80
1:A:1101:PRO:HB2	1:A:1103:THR:HG22	1.63	0.79
1:A:345:GLY:O	1:A:347:PHE:HD1	1.68	0.74
1:A:1103:THR:HG23	1:A:1104:GLU:N	2.01	0.74
2:P:10:DT:H2"	2:P:11:DOC:H5'	1.73	0.71
1:A:802:ASP:HB3	1:A:804:HIS:CE1	2.27	0.69
1:A:1103:THR:HG23	1:A:1104:GLU:H	1.58	0.67
3:T:15:DT:H2"	3:T:16:DA:C8	2.29	0.66
1:A:1011:THR:HG23	1:A:1014:GLY:H	1.62	0.65
1:A:1167:VAL:HG12	1:A:1168:SER:O	1.96	0.65
1:A:1121:SER:O	1:A:1125:ARG:HG3	1.96	0.64
1:A:1103:THR:CG2	1:A:1104:GLU:H	2.11	0.63
1:A:1028:ASP:CG	1:A:1173:ARG:HH22	2.02	0.63
1:A:1104:GLU:O	1:A:1105:ARG:HB2	1.97	0.63
1:A:1102:VAL:HG11	3:T:13:DG:H5'	1.81	0.63
1:A:708:THR:HB	1:A:720:VAL:HG13	1.81	0.62
1:A:1103:THR:CG2	1:A:1104:GLU:N	2.64	0.61
1:A:439:VAL:CG2	6:A:1304:ACT:H2	2.31	0.61
1:A:1035:LEU:HD12	1:A:1042:LEU:HD23	1.83	0.61
1:A:1030:LEU:HD21	1:A:1147:ARG:HA	1.83	0.61
1:A:1094:SER:O	1:A:1105:ARG:HD2	2.01	0.61
1:A:439:VAL:HG21	6:A:1304:ACT:H2	1.83	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1046:ILE:HG23	1:A:1146:TYR:CE2	2.37	0.60
1:A:836:ARG:HH22	3:T:4:DT:H72	1.68	0.59
1:A:1102:VAL:CG1	3:T:13:DG:H5'	2.32	0.59
1:A:701:LYS:O	1:A:705:GLN:HG3	2.02	0.59
2:P:1:DT:H2"	2:P:2:DA:C8	2.37	0.59
1:A:1035:LEU:HD13	1:A:1037:LEU:HG	1.85	0.58
1:A:1155:GLN:HA	1:A:1159:THR:HB	1.84	0.58
1:A:645:TYR:CD2	4:A:1301:DTP:H2'1	2.39	0.58
1:A:152:VAL:HG23	1:A:189:ILE:HD11	1.86	0.57
1:A:124:GLU:OE2	1:A:278:LYS:HE2	2.04	0.57
1:A:794:ASN:O	1:A:798:ILE:HG12	2.07	0.55
1:A:645:TYR:CG	4:A:1301:DTP:H2'1	2.41	0.55
1:A:152:VAL:HG23	1:A:189:ILE:CD1	2.37	0.55
1:A:858:ILE:HG13	1:A:874:LEU:HD11	1.89	0.55
1:A:444:GLN:NE2	1:A:450:ASN:OD1	2.40	0.55
1:A:242:ILE:HG13	1:A:245:TYR:CD2	2.43	0.54
1:A:1137:ILE:H	1:A:1137:ILE:HD12	1.72	0.54
1:A:329:SER:OG	1:A:464:PHE:HA	2.08	0.53
1:A:287:MET:O	1:A:374:ILE:HA	2.08	0.53
1:A:1020:ALA:CB	1:A:1171:VAL:HG22	2.38	0.53
1:A:741:GLU:HA	1:A:744:ARG:HD3	1.90	0.52
1:A:1035:LEU:HD13	1:A:1037:LEU:CD1	2.39	0.52
1:A:153:GLU:OE1	1:A:169:ILE:HD11	2.10	0.52
1:A:89:GLN:O	1:A:90:GLU:C	2.48	0.52
1:A:143:CYS:SG	1:A:152:VAL:HG21	2.49	0.52
1:A:287:MET:HG3	1:A:315:ILE:HG12	1.93	0.51
1:A:321:LEU:HB3	1:A:349:ILE:HD12	1.92	0.51
1:A:539:ILE:HG22	1:A:732:VAL:HG21	1.92	0.51
1:A:69:ILE:HG23	1:A:70:ASP:OD1	2.11	0.51
1:A:1064:SER:OG	1:A:1067:ILE:HD12	2.11	0.51
1:A:462:TYR:CZ	1:A:466:LYS:HE2	2.45	0.50
1:A:1093:ILE:HA	1:A:1105:ARG:O	2.11	0.50
1:A:1093:ILE:HD11	1:A:1146:TYR:CE1	2.46	0.50
1:A:1181:LYS:HA	1:A:1184:ILE:CD1	2.42	0.50
1:A:64:PHE:HA	1:A:270:GLN:HE22	1.77	0.50
3:T:11:DC:H2"	3:T:12:DG:C8	2.47	0.49
1:A:1169:ASN:HB2	1:A:1176:HIS:NE2	2.26	0.49
1:A:677:CYS:O	1:A:763:CYS:HA	2.13	0.49
1:A:1094:SER:HB3	1:A:1105:ARG:HG2	1.95	0.49
1:A:613:ILE:HD12	1:A:891:TYR:HB3	1.95	0.49
1:A:369:VAL:HG23	1:A:371:PRO:HD3	1.96	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1093:ILE:HD11	1:A:1146:TYR:CZ	2.48	0.48
1:A:722:THR:HG23	1:A:725:GLU:OE2	2.13	0.48
2:P:5:DC:H2"	2:P:6:DG:C8	2.48	0.48
1:A:345:GLY:O	1:A:347:PHE:CE1	2.67	0.48
1:A:635:LEU:HD13	1:A:889:GLU:CD	2.33	0.47
1:A:1093:ILE:HD12	1:A:1093:ILE:O	2.14	0.47
1:A:568:SER:HB2	1:A:951:LYS:HA	1.95	0.47
1:A:742:TYR:CZ	1:A:746:VAL:HG21	2.49	0.47
1:A:1005:VAL:CG2	1:A:1019:VAL:HA	2.44	0.47
1:A:340:LYS:HG2	1:A:342:GLU:HG2	1.96	0.47
1:A:635:LEU:HD13	1:A:889:GLU:OE2	2.15	0.47
1:A:517:GLU:OE1	1:A:833:TYR:OH	2.27	0.47
1:A:1011:THR:HG23	1:A:1014:GLY:N	2.28	0.47
1:A:799:ASP:O	1:A:800:PRO:C	2.54	0.46
1:A:636:ILE:HD12	1:A:950:TYR:O	2.15	0.46
1:A:279:ILE:HG13	1:A:280:ALA:H	1.80	0.46
1:A:1049:ASN:O	1:A:1050:ARG:HG3	2.16	0.46
1:A:201:GLU:O	1:A:205:LEU:HD23	2.15	0.46
1:A:801:SER:O	1:A:802:ASP:C	2.54	0.45
1:A:347:PHE:CE1	1:A:475:VAL:HG13	2.52	0.45
1:A:1035:LEU:HD13	1:A:1037:LEU:CG	2.46	0.45
1:A:905:TYR:N	1:A:906:PRO:HD2	2.32	0.45
3:T:3:DC:H2"	3:T:4:DT:O5'	2.16	0.45
1:A:64:PHE:HA	1:A:270:GLN:NE2	2.32	0.44
1:A:575:LYS:HB3	1:A:575:LYS:HE3	1.86	0.44
1:A:680:LYS:HG2	1:A:761:ILE:HD13	1.99	0.44
1:A:1100:ALA:O	1:A:1105:ARG:NH2	2.44	0.44
1:A:1179:TRP:HA	1:A:1182:ARG:CZ	2.47	0.44
1:A:606:LYS:O	1:A:895:LEU:HA	2.18	0.44
1:A:1011:THR:OG1	1:A:1012:LEU:N	2.50	0.44
1:A:373:VAL:HG11	1:A:485:TYR:CZ	2.52	0.44
1:A:446:LYS:HB3	1:A:488:TYR:CE2	2.53	0.44
1:A:1065:THR:HG21	1:A:1091:TYR:OH	2.17	0.44
1:A:152:VAL:CG1	1:A:238:LEU:HB2	2.48	0.43
1:A:1102:VAL:O	1:A:1104:GLU:O	2.36	0.43
1:A:337:TYR:O	1:A:345:GLY:HA3	2.18	0.43
1:A:969:TYR:CZ	1:A:982:LYS:HG3	2.53	0.43
1:A:158:LYS:O	1:A:161:GLU:HG3	2.18	0.43
1:A:189:ILE:HG22	1:A:191:LEU:HD12	1.99	0.43
1:A:1097:PRO:HG3	1:A:1128:LEU:HD12	2.01	0.43
1:A:552:THR:OG1	1:A:553:TYR:N	2.48	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:572:ASN:OD1	1:A:634:PRO:HG3	2.19	0.43
1:A:895:LEU:HD11	1:A:901:LEU:HG	2.01	0.43
1:A:656:PRO:HG2	1:A:841:TRP:HB3	2.01	0.43
1:A:558:VAL:HG13	3:T:9:DC:OP1	2.19	0.43
1:A:1136:ASP:O	1:A:1139:THR:HG22	2.19	0.42
1:A:36:GLN:HB3	1:A:86:LEU:CD1	2.49	0.42
1:A:1095:SER:N	1:A:1140:ILE:O	2.52	0.42
1:A:51:GLY:O	1:A:128:SER:OG	2.35	0.42
1:A:708:THR:HB	1:A:720:VAL:CG1	2.48	0.42
1:A:1096:LYS:HA	1:A:1097:PRO:C	2.40	0.42
1:A:460:THR:HB	1:A:461:PRO:HD3	2.02	0.42
1:A:1101:PRO:HB2	1:A:1103:THR:CG2	2.44	0.42
1:A:384:TRP:HB3	1:A:412:TYR:CG	2.55	0.42
1:A:604:VAL:O	1:A:607:VAL:HG12	2.19	0.42
1:A:153:GLU:HG3	1:A:167:LEU:HD21	2.01	0.42
1:A:553:TYR:HE1	1:A:851:CYS:HG	1.67	0.41
1:A:553:TYR:CZ	1:A:847:ALA:HB1	2.55	0.41
1:A:568:SER:O	1:A:633:LEU:HD21	2.20	0.41
1:A:496:LEU:HD23	1:A:496:LEU:HA	1.93	0.41
1:A:347:PHE:CZ	1:A:475:VAL:HG13	2.56	0.41
1:A:1160:ILE:N	1:A:1161:PRO:CD	2.84	0.41
1:A:55:TYR:CZ	1:A:75:ARG:HB2	2.55	0.41
1:A:654:LEU:HD23	1:A:762:VAL:HG11	2.01	0.41
1:A:588:LEU:HB3	1:A:589:PRO:HD3	2.03	0.41
1:A:986:LEU:HA	1:A:996:LYS:HG2	2.03	0.41
1:A:439:VAL:HG23	6:A:1304:ACT:H2	2.01	0.41
1:A:1181:LYS:O	1:A:1184:ILE:HG12	2.21	0.41
1:A:649:MET:HA	1:A:654:LEU:HB2	2.03	0.40
1:A:928:ASP:HB3	1:A:933:ILE:HB	2.03	0.40
1:A:272:PHE:N	1:A:272:PHE:CD1	2.88	0.40
1:A:1111:ILE:HD12	1:A:1111:ILE:HA	1.91	0.40
1:A:186:LYS:HD3	1:A:188:LEU:HD21	2.03	0.40
1:A:199:LEU:HD23	1:A:199:LEU:C	2.41	0.40
1:A:264:TRP:CD1	1:A:278:LYS:HB3	2.56	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	1114/1185 (94%)	1065 (96%)	49 (4%)	0	100 100

There are no Ramachandran outliers to report.

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	986/1063 (93%)	943 (96%)	43 (4%)	28 37

All (43) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	30	TYR
1	A	70	ASP
1	A	151	ASP
1	A	166	SER
1	A	225	VAL
1	A	278	LYS
1	A	279	ILE
1	A	342	GLU
1	A	383	ASP
1	A	558	VAL
1	A	569	ASP
1	A	575	LYS
1	A	628	ASN

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Mol	Chain	Res	Type
1	A	640	ASP
1	A	650	THR
1	A	677	CYS
1	A	689	PHE
1	A	717	LYS
1	A	719	LYS
1	A	721	LEU
1	A	722	THR
1	A	799	ASP
1	A	801	SER
1	A	818	SER
1	A	820	GLN
1	A	925	GLU
1	A	935	GLU
1	A	980	GLU
1	A	986	LEU
1	A	1005	VAL
1	A	1015	CYS
1	A	1016	TYR
1	A	1051	SER
1	A	1063	LYS
1	A	1072	ARG
1	A	1076	PHE
1	A	1079	GLU
1	A	1083	LYS
1	A	1107	ILE
1	A	1120	ARG
1	A	1159	THR
1	A	1181	LYS
1	A	1183	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	24	ASN
1	A	150	ASN
1	A	211	GLN
1	A	444	GLN
1	A	450	ASN
1	A	698	ASN
1	A	915	HIS
1	A	973	ASN

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Mol	Chain	Res	Type
1	A	1155	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

1 non-standard protein/DNA/RNA residue is 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	DOC	P	11	2,3	16,19,20	0.38	0	20,26,29	0.29	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
2	DOC	P	11	2,3	-	2/7/18/19	0/2/2/2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	P	11	DOC	C3'-C4'-C5'-O5'
2	P	11	DOC	O4'-C4'-C5'-O5'

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	P	11	DOC	1	0

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	$\#\|Z\| > 2$
4	DTP	A	1301	5	26,32,32	0.70	0	30,50,50	0.77	1 (3%)
6	ACT	A	1304	5	3,3,3	0.92	0	3,3,3	0.66	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	DTP	A	1301	5	-	4/18/34/34	0/3/3/3

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	1301	DTP	C5-C6-N6	2.31	123.87	120.35

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1301	DTP	PB-O3B-PG-O2G
4	A	1301	DTP	PB-O3B-PG-O3G
4	A	1301	DTP	PB-O3B-PG-O1G
4	A	1301	DTP	PA-O3A-PB-O2B

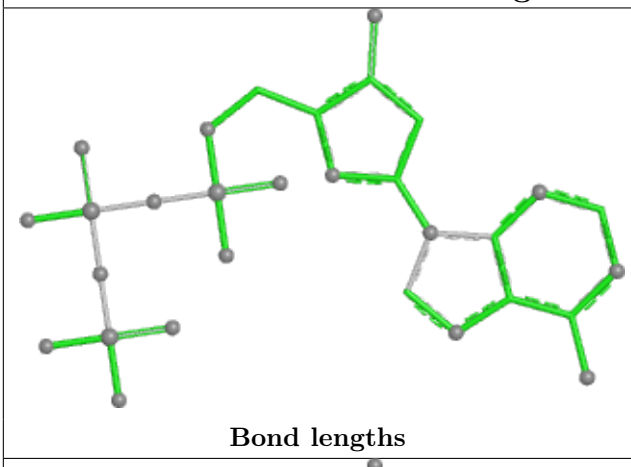
There are no ring outliers.

2 monomers are involved in 5 short contacts:

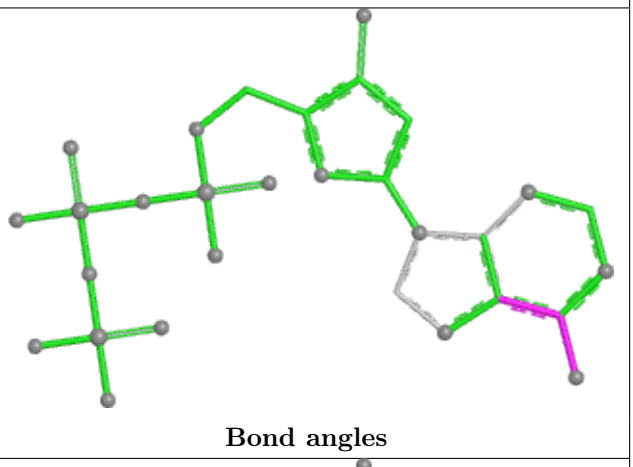
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1301	DTP	2	0
6	A	1304	ACT	3	0

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 then 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.

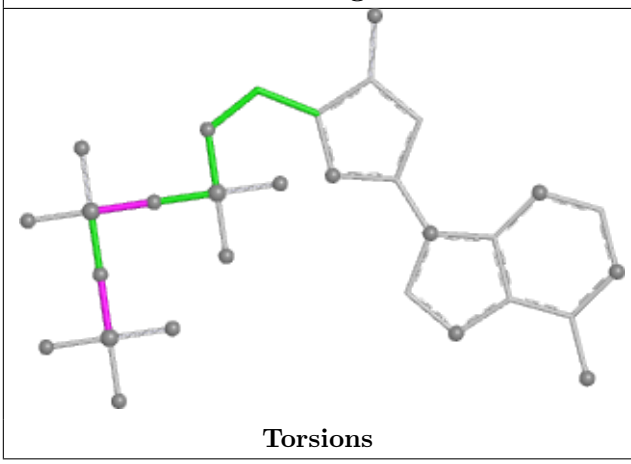
Ligand DTP A 1301



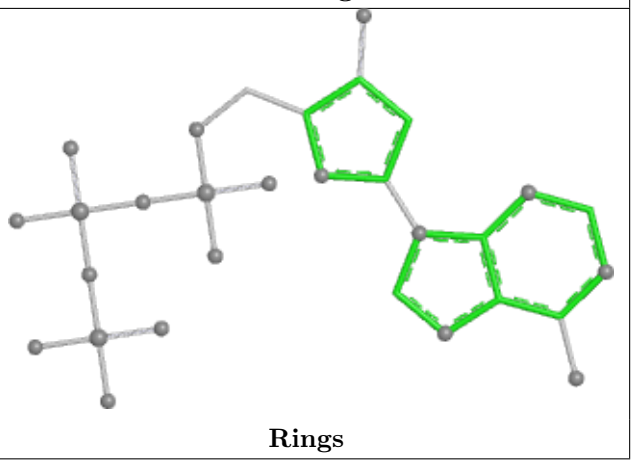
Bond lengths



Bond angles



Torsions



Rings

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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, 95^{th} 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	1122/1185 (94%)	0.36	62 (5%) 25 22	39, 76, 127, 157	0
2	P	10/11 (90%)	0.15	0 100 100	58, 71, 109, 125	0
3	T	15/16 (93%)	0.01	0 100 100	43, 67, 117, 125	0
All	All	1147/1212 (94%)	0.35	62 (5%) 25 23	39, 76, 127, 157	0

All (62) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	893	PHE	4.9
1	A	801	SER	4.8
1	A	746	VAL	4.8
1	A	1016	TYR	4.1
1	A	799	ASP	4.0
1	A	216	ASN	4.0
1	A	1135	LEU	3.9
1	A	798	ILE	3.7
1	A	1120	ARG	3.7
1	A	743	SER	3.6
1	A	1118	ILE	3.6
1	A	1174	VAL	3.3
1	A	26	LEU	3.1
1	A	1103	THR	3.0
1	A	894	THR	2.9
1	A	158	LYS	2.9
1	A	152	VAL	2.8
1	A	1164	LEU	2.8
1	A	1145	TYR	2.8
1	A	217	ASN	2.8
1	A	1179	TRP	2.8
1	A	802	ASP	2.8
1	A	219	GLN	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	573	GLU	2.6
1	A	215	ASN	2.6
1	A	232	LYS	2.6
1	A	1147	ARG	2.6
1	A	1028	ASP	2.6
1	A	961	GLU	2.6
1	A	1171	VAL	2.5
1	A	1115	ASP	2.5
1	A	1015	CYS	2.5
1	A	1019	VAL	2.5
1	A	1172	PRO	2.5
1	A	218	VAL	2.4
1	A	1168	SER	2.4
1	A	1146	TYR	2.4
1	A	896	GLU	2.3
1	A	1010	ASP	2.3
1	A	744	ARG	2.3
1	A	607	VAL	2.2
1	A	233	VAL	2.2
1	A	381	PHE	2.2
1	A	1012	LEU	2.2
1	A	1024	ASN	2.2
1	A	24	ASN	2.2
1	A	1122	PHE	2.2
1	A	1178	ASP	2.2
1	A	346	PHE	2.2
1	A	225	VAL	2.1
1	A	1102	VAL	2.1
1	A	892	PHE	2.1
1	A	1030	LEU	2.1
1	A	1132	LEU	2.1
1	A	1110	ALA	2.1
1	A	1159	THR	2.1
1	A	741	GLU	2.1
1	A	1136	ASP	2.0
1	A	986	LEU	2.0
1	A	426	VAL	2.0
1	A	1173	ARG	2.0
1	A	1180	LEU	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^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	DOC	P	11	18/19	0.95	0.23	57,68,72,73	0

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

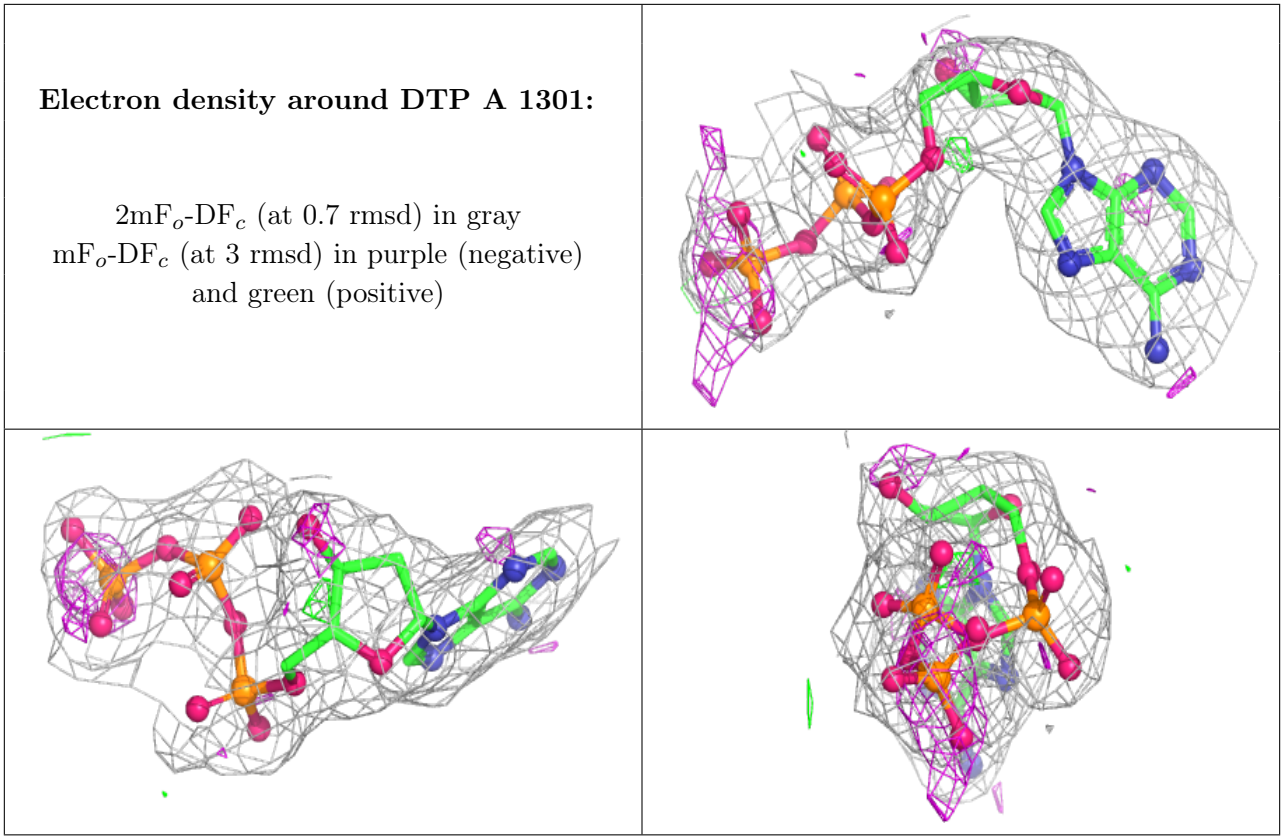
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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	CA	A	1303	1/1	0.89	0.09	65,65,65,65	0
6	ACT	A	1304	4/4	0.92	0.17	66,67,67,70	0
4	DTP	A	1301	30/30	0.95	0.17	41,46,75,82	0
5	CA	A	1302	1/1	0.95	0.11	61,61,61,61	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 DTP A 1301:

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



6.5 Other polymers (i)

There are no such residues in this entry.