



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 03:42 AM UTC

PDB ID : 1QTM / pdb_00001qtm
Title : DDTTP-TRAPPED CLOSED TERNARY COMPLEX OF THE LARGE
FRAGMENT OF DNA POLYMERASE I FROM THERMUS AQUATICUS
Authors : Li, Y.; Mitaxov, V.; Waksman, G.
Deposited on : 1999-06-28
Resolution : 2.30 Å(reported)

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

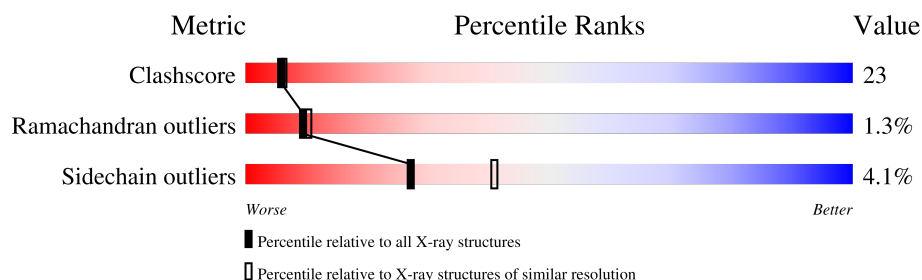
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	B	12	
2	C	14	
3	A	539	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 4908 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 DNA chain called 5'-D(*GP*AP*CP*CP*AP*CP*GP*GP*CP*GP*CP*(2DT))-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	12	Total	C	N	O	P	0	0	0
			241	115	47	68	11			

- Molecule 2 is a DNA chain called 5'-D(*AP*AP*AP*GP*CP*GP*CP*CP*GP*TP*GP*GP*TP*C)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	14	Total	C	N	O	P	0	0	0
			286	136	56	81	13			

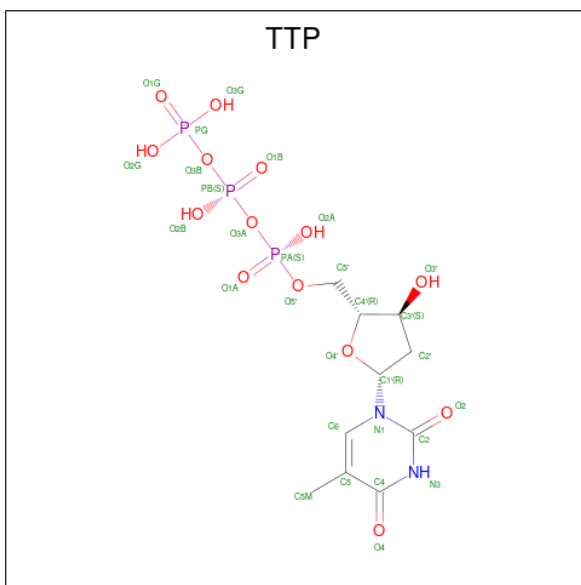
- Molecule 3 is a protein called DNA POLYMERASE I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	A	539	Total	C	N	O	S	0	0	0
			4186	2672	750	751	13			

- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Mg	0	0
			2	2		

- Molecule 5 is THYMIDINE-5'-TRIPHOSPHATE (CCD ID: TTP) (formula: C₁₀H₁₇N₂O₁₄P₃).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	P	0	0
			28	10	2	13	3		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	13	Total O 13 13	0	0
6	C	17	Total O 17 17	0	0
6	A	135	Total O 135 135	0	0

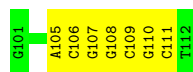
3 Residue-property plots

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. 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. 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.

Note EDS was not executed.

- Molecule 1: 5'-D(*GP*AP*CP*CP*AP*CP*GP*GP*CP*GP*CP*(2DT))-3'

Chain B: 



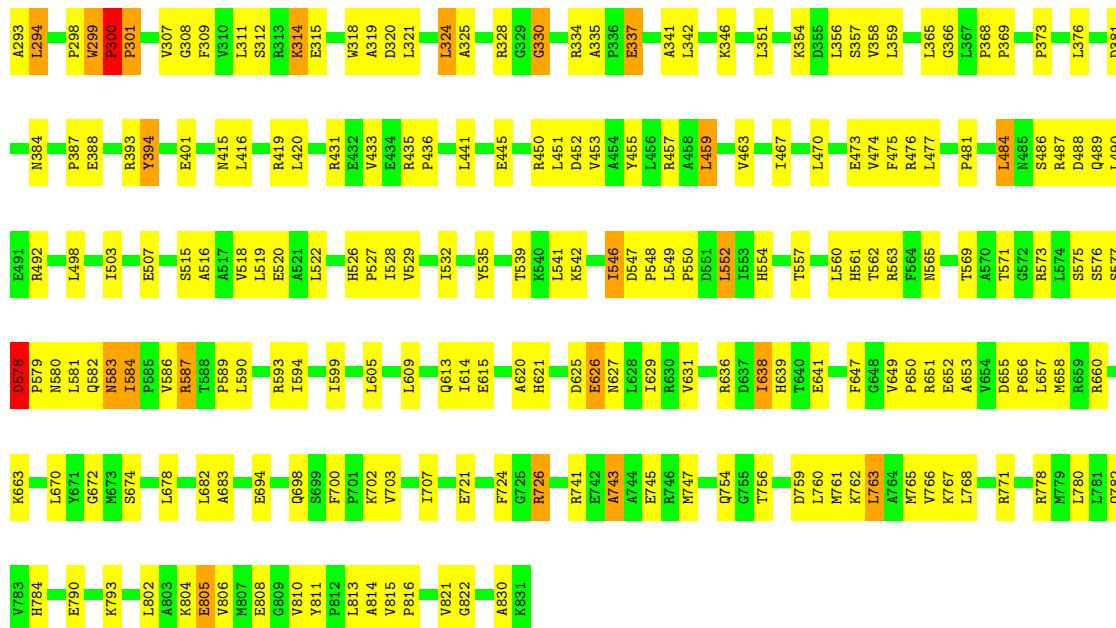
- Molecule 2: 5'-D(*AP*AP*AP*GP*CP*GP*CP*CP*GP*TP*GP*GP*TP*C)-3'

Chain C: 



- Molecule 3: DNA POLYMERASE I

Chain A: 



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	107.99Å 107.99Å 90.20Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 2.30	Depositor
% Data completeness (in resolution range)	93.6 (30.00-2.30)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.227 , 0.280	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4908	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 2DT, TTP, MG

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	B	0.29	0/249	0.71	0/382
2	C	0.33	0/321	0.77	0/494
3	A	0.44	0/4276	1.02	21/5807 (0.4%)
All	All	0.43	0/4846	0.99	21/6683 (0.3%)

There are no bond length outliers.

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	578	ASP	CA-C-N	-11.18	105.86	119.84
3	A	578	ASP	C-N-CA	-11.18	105.86	119.84
3	A	507	GLU	N-CA-C	9.50	121.23	111.07
3	A	453	VAL	N-CA-C	7.28	118.00	110.36
3	A	672	GLY	N-CA-C	6.98	124.80	114.95
3	A	578	ASP	N-CA-C	-6.47	95.50	109.81
3	A	700	PHE	CA-C-N	6.38	126.59	119.32
3	A	700	PHE	C-N-CA	6.38	126.59	119.32
3	A	726	ARG	N-CA-C	-5.81	101.03	110.20
3	A	546	ILE	N-CA-C	5.80	116.45	110.36
3	A	587	ARG	N-CA-C	5.80	117.47	111.03
3	A	743	ALA	N-CA-C	-5.79	105.05	111.36
3	A	584	ILE	CA-C-N	5.49	125.49	119.89
3	A	584	ILE	C-N-CA	5.49	125.49	119.89
3	A	337	GLU	CA-C-N	5.47	126.67	119.84
3	A	337	GLU	C-N-CA	5.47	126.67	119.84
3	A	498	LEU	N-CA-C	-5.45	103.19	110.55
3	A	346	LYS	N-CA-C	-5.45	107.28	114.31
3	A	394	TYR	N-CA-C	5.44	119.89	112.88
3	A	768	LEU	N-CA-C	5.41	117.26	111.36
3	A	529	VAL	N-CA-C	5.02	115.74	110.62

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	B	241	0	135	14	0
2	C	286	0	158	17	0
3	A	4186	0	4192	193	0
4	A	2	0	0	0	0
5	A	28	0	11	2	0
6	A	135	0	0	3	0
6	B	13	0	0	1	0
6	C	17	0	0	0	0
All	All	4908	0	4496	212	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 23.

All (212) 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)
2:C:215:DT:H2''	2:C:216:DC:H5'	1.34	1.05
3:A:314:LYS:NZ	3:A:314:LYS:H	1.58	1.00
3:A:621:HIS:HD2	3:A:814:ALA:H	1.13	0.97
3:A:314:LYS:H	3:A:314:LYS:HZ3	1.09	0.94
3:A:552:LEU:HD23	3:A:579:PRO:HG3	1.53	0.91
2:C:203:DA:H2'	3:A:674:SER:HB3	1.53	0.89
2:C:215:DT:H2''	2:C:216:DC:C5'	2.04	0.88
3:A:314:LYS:HZ3	3:A:314:LYS:N	1.77	0.82
1:B:107:DG:H4'	3:A:487:ARG:CD	2.09	0.82
3:A:631:VAL:HG11	3:A:638:ILE:HD11	1.63	0.80
3:A:557:THR:OG1	3:A:561:HIS:HE1	1.69	0.76
3:A:314:LYS:HD2	6:A:3053:HOH:O	1.84	0.76
3:A:780:LEU:HD11	3:A:790:GLU:HB2	1.67	0.75
3:A:615:GLU:CD	5:A:113:TTP:H2'1	2.12	0.75
3:A:761:MET:HE3	3:A:761:MET:HA	1.68	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:203:DA:C2'	3:A:674:SER:HB3	2.18	0.74
3:A:541:LEU:HD12	3:A:590:LEU:HD23	1.70	0.73
3:A:503:ILE:HD13	3:A:522:LEU:HD11	1.70	0.73
1:B:105:DA:H2''	1:B:106:DC:H5'	1.70	0.73
2:C:213:DG:H1'	2:C:214:DG:H5'	1.68	0.73
1:B:107:DG:H4'	3:A:487:ARG:HD2	1.72	0.71
3:A:660:ARG:HG3	3:A:660:ARG:HH11	1.56	0.69
3:A:473:GLU:O	3:A:477:LEU:HD23	1.92	0.69
3:A:625:ASP:HB2	3:A:702:LYS:HB2	1.75	0.67
2:C:215:DT:C2'	2:C:216:DC:H5'	2.18	0.67
3:A:609:LEU:HD23	3:A:821:VAL:HG22	1.77	0.66
3:A:299:TRP:HB3	3:A:300:PRO:HD3	1.77	0.66
3:A:314:LYS:H	3:A:314:LYS:CE	2.08	0.66
3:A:605:LEU:HG	3:A:793:LYS:HG2	1.76	0.66
3:A:822:GLY:HA3	3:A:830:ALA:O	1.96	0.66
3:A:366:GLY:O	3:A:368:PRO:HD3	1.94	0.66
1:B:107:DG:H1'	1:B:108:DG:H5''	1.78	0.65
3:A:778:ARG:HD2	3:A:790:GLU:OE1	1.96	0.65
3:A:569:THR:HG22	3:A:571:THR:H	1.60	0.65
3:A:516:ALA:O	3:A:520:GLU:HG2	1.97	0.64
3:A:614:ILE:HG22	5:A:113:TTP:O2B	1.97	0.64
3:A:638:ILE:HD12	3:A:638:ILE:N	2.12	0.64
3:A:638:ILE:HD12	3:A:638:ILE:H	1.63	0.63
3:A:526:HIS:ND1	3:A:527:PRO:HD2	2.14	0.63
3:A:613:GLN:HE22	3:A:638:ILE:H	1.47	0.62
3:A:694:GLU:O	3:A:698:GLN:HG3	1.99	0.62
2:C:214:DG:H2''	2:C:215:DT:O5'	2.00	0.61
3:A:351:LEU:HD13	3:A:373:PRO:HG2	1.80	0.61
1:B:105:DA:H2''	1:B:106:DC:C5'	2.30	0.61
3:A:503:ILE:CD1	3:A:522:LEU:HD11	2.30	0.61
2:C:212:DT:H2''	2:C:213:DG:H5'	1.82	0.61
3:A:299:TRP:O	3:A:301:PRO:HD3	2.01	0.61
3:A:487:ARG:HG3	3:A:488:ASP:N	2.16	0.60
3:A:614:ILE:HG23	3:A:615:GLU:N	2.16	0.60
3:A:651:ARG:HG2	6:A:3122:HOH:O	2.01	0.60
3:A:565:ASN:ND2	3:A:577:SER:OG	2.33	0.60
3:A:625:ASP:CB	3:A:702:LYS:HB2	2.31	0.60
3:A:315:GLU:HG3	3:A:578:ASP:OD1	2.02	0.60
3:A:578:ASP:O	3:A:580:ASN:N	2.34	0.59
3:A:342:LEU:HD21	3:A:356:LEU:HD11	1.83	0.59
3:A:463:VAL:HG21	3:A:542:LYS:HD3	1.83	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:621:HIS:CD2	3:A:814:ALA:H	2.05	0.59
3:A:583:ASN:HD22	3:A:583:ASN:H	1.51	0.58
3:A:649:VAL:HG21	3:A:658:MET:HE1	1.86	0.58
3:A:573:ARG:HD3	3:A:754:GLN:HG2	1.86	0.58
3:A:575:SER:HA	3:A:582:GLN:HE22	1.68	0.58
3:A:324:LEU:HD23	3:A:325:ALA:N	2.19	0.57
3:A:576:SER:HB2	3:A:580:ASN:OD1	2.05	0.57
3:A:463:VAL:CG2	3:A:542:LYS:HD3	2.35	0.57
3:A:625:ASP:O	3:A:629:ILE:HG23	2.03	0.57
1:B:107:DG:H2''	1:B:108:DG:H5'	1.87	0.57
3:A:756:THR:O	3:A:760:LEU:HD13	2.05	0.57
3:A:307:VAL:HG12	3:A:308:GLY:N	2.20	0.56
1:B:105:DA:H1'	1:B:106:DC:H5''	1.87	0.56
3:A:621:HIS:HD2	3:A:814:ALA:N	1.93	0.56
3:A:810:VAL:HG13	3:A:811:TYR:N	2.20	0.56
3:A:445:GLU:O	3:A:561:HIS:HD2	1.88	0.56
1:B:107:DG:H2''	1:B:108:DG:C5'	2.35	0.56
3:A:647:PHE:CG	3:A:658:MET:HE3	2.41	0.56
3:A:489:GLN:HG2	3:A:492:ARG:HH21	1.70	0.55
3:A:474:VAL:HG13	3:A:528:ILE:HD11	1.88	0.55
3:A:542:LYS:HA	3:A:546:ILE:HB	1.87	0.55
2:C:212:DT:H4'	3:A:486:SER:HA	1.89	0.54
3:A:741:ARG:O	3:A:745:GLU:HG3	2.06	0.54
3:A:802:LEU:O	3:A:806:VAL:HG23	2.08	0.54
3:A:312:SER:HB3	3:A:320:ASP:HB3	1.89	0.54
3:A:678:LEU:O	3:A:678:LEU:HD23	2.08	0.54
3:A:621:HIS:CD2	3:A:813:LEU:HB3	2.43	0.54
3:A:804:LYS:O	3:A:808:GLU:HG3	2.07	0.53
3:A:433:VAL:O	3:A:436:PRO:HG2	2.09	0.53
3:A:639:HIS:CG	3:A:663:LYS:HG2	2.43	0.53
3:A:682:LEU:O	3:A:683:ALA:HB3	2.08	0.53
3:A:587:ARG:HG3	3:A:660:ARG:HE	1.73	0.53
3:A:613:GLN:NE2	3:A:638:ILE:H	2.06	0.53
3:A:314:LYS:NZ	3:A:314:LYS:N	2.40	0.53
3:A:337:GLU:HB3	6:A:3074:HOH:O	2.08	0.53
3:A:376:LEU:HD22	3:A:420:LEU:CD1	2.39	0.53
3:A:293:ALA:O	3:A:294:LEU:HB2	2.10	0.52
3:A:578:ASP:CB	3:A:579:PRO:CD	2.87	0.52
2:C:211:DG:H2'	2:C:212:DT:H72	1.91	0.52
1:B:109:DC:H1'	1:B:110:DG:C8	2.45	0.52
2:C:208:DG:H4'	3:A:576:SER:O	2.09	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:294:LEU:O	3:A:294:LEU:HD23	2.10	0.52
3:A:810:VAL:HG13	3:A:811:TYR:H	1.75	0.51
3:A:431:ARG:HG2	3:A:435:ARG:NH2	2.25	0.51
3:A:765:MET:SD	3:A:782:GLN:HG3	2.50	0.51
3:A:381:ASP:HB3	3:A:384:ASN:ND2	2.26	0.51
3:A:441:LEU:O	3:A:445:GLU:HG3	2.11	0.51
3:A:294:LEU:HA	3:A:330:GLY:O	2.11	0.50
3:A:578:ASP:HB2	3:A:579:PRO:CD	2.41	0.50
1:B:107:DG:H4'	3:A:487:ARG:HD3	1.91	0.50
3:A:627:ASN:O	3:A:631:VAL:HG23	2.11	0.50
3:A:562:THR:CG2	3:A:563:ARG:N	2.74	0.50
2:C:209:DC:OP1	3:A:578:ASP:N	2.44	0.50
3:A:638:ILE:H	3:A:638:ILE:CD1	2.25	0.50
3:A:636:ARG:HD2	3:A:641:GLU:OE2	2.12	0.50
3:A:450:ARG:HD3	3:A:599:ILE:HG13	1.93	0.50
3:A:311:LEU:HB3	3:A:319:ALA:HB1	1.93	0.49
3:A:581:LEU:HD23	3:A:584:ILE:HD11	1.93	0.49
1:B:111:DC:OP2	3:A:587:ARG:HD3	2.11	0.49
3:A:614:ILE:HG23	3:A:615:GLU:H	1.77	0.49
3:A:526:HIS:ND1	3:A:527:PRO:CD	2.76	0.49
3:A:578:ASP:O	3:A:579:PRO:C	2.49	0.49
3:A:581:LEU:CD2	3:A:584:ILE:HD11	2.43	0.49
3:A:724:PHE:CD1	3:A:759:ASP:HB3	2.46	0.49
1:B:106:DC:H2''	1:B:107:DG:C8	2.48	0.49
3:A:578:ASP:CB	3:A:579:PRO:HD3	2.42	0.49
3:A:721:GLU:HA	3:A:726:ARG:O	2.13	0.49
3:A:771:ARG:HB3	3:A:802:LEU:HD21	1.95	0.49
3:A:587:ARG:HG3	3:A:660:ARG:HH21	1.77	0.49
3:A:299:TRP:O	3:A:301:PRO:CD	2.61	0.49
3:A:578:ASP:HB3	3:A:579:PRO:HD3	1.95	0.48
1:B:107:DG:C4'	3:A:487:ARG:HD2	2.40	0.48
3:A:626:GLU:CD	3:A:626:GLU:H	2.21	0.48
3:A:334:ARG:HG3	3:A:334:ARG:HH11	1.78	0.48
3:A:450:ARG:HB3	3:A:599:ILE:O	2.14	0.48
3:A:651:ARG:O	3:A:653:ALA:N	2.46	0.48
3:A:587:ARG:CG	3:A:660:ARG:HE	2.27	0.47
3:A:626:GLU:O	3:A:629:ILE:HG12	2.14	0.47
3:A:354:LYS:O	3:A:358:VAL:HG23	2.13	0.47
3:A:365:LEU:N	3:A:365:LEU:HD12	2.29	0.47
3:A:415:ASN:HD21	3:A:419:ARG:HE	1.63	0.47
3:A:484:LEU:HD13	3:A:535:TYR:CD2	2.49	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:815:VAL:HG13	3:A:816:PRO:HD2	1.95	0.47
2:C:203:DA:C2'	2:C:203:DA:N3	2.78	0.47
3:A:703:VAL:O	3:A:707:ILE:HG13	2.15	0.47
3:A:655:ASP:OD1	3:A:658:MET:HG3	2.15	0.46
3:A:451:LEU:HD22	3:A:560:LEU:HD11	1.96	0.46
3:A:651:ARG:C	3:A:653:ALA:H	2.24	0.46
3:A:470:LEU:O	3:A:474:VAL:HG23	2.15	0.46
3:A:459:LEU:HD22	3:A:463:VAL:HG13	1.98	0.46
3:A:780:LEU:CD1	3:A:790:GLU:HB2	2.43	0.46
3:A:583:ASN:HD22	3:A:583:ASN:N	2.12	0.46
3:A:650:PRO:O	3:A:651:ARG:C	2.57	0.46
3:A:335:ALA:HB1	3:A:341:ALA:HB2	1.99	0.45
3:A:387:PRO:HG2	3:A:388:GLU:H	1.81	0.45
3:A:415:ASN:ND2	3:A:419:ARG:HE	2.15	0.45
3:A:475:PHE:CD1	3:A:481:PRO:HA	2.52	0.45
3:A:743:ALA:O	3:A:747:MET:HG3	2.17	0.45
3:A:515:SER:O	3:A:519:LEU:HG	2.16	0.45
3:A:589:PRO:O	3:A:593:ARG:HG3	2.17	0.45
3:A:476:ARG:HH11	3:A:476:ARG:HG2	1.83	0.44
3:A:394:TYR:CG	3:A:416:LEU:HD21	2.53	0.44
3:A:318:TRP:CH2	3:A:554:HIS:HA	2.53	0.44
3:A:393:ARG:O	3:A:393:ARG:HG3	2.17	0.44
3:A:365:LEU:N	3:A:365:LEU:CD1	2.80	0.44
3:A:526:HIS:CE1	3:A:527:PRO:HD2	2.52	0.44
3:A:590:LEU:O	3:A:594:ILE:HG13	2.17	0.44
3:A:562:THR:OG1	3:A:581:LEU:HG	2.18	0.44
3:A:563:ARG:O	3:A:576:SER:HA	2.18	0.44
3:A:678:LEU:HD23	3:A:678:LEU:C	2.43	0.44
3:A:518:VAL:O	3:A:522:LEU:HD13	2.18	0.44
3:A:549:LEU:HB2	3:A:550:PRO:HD3	2.00	0.44
2:C:203:DA:C2	3:A:674:SER:HA	2.53	0.43
3:A:299:TRP:O	3:A:301:PRO:N	2.51	0.43
3:A:299:TRP:O	3:A:299:TRP:CE3	2.72	0.43
3:A:299:TRP:O	3:A:300:PRO:C	2.61	0.43
3:A:562:THR:HG22	3:A:563:ARG:N	2.32	0.43
3:A:660:ARG:HH11	3:A:660:ARG:CG	2.27	0.43
3:A:805:GLU:OE1	3:A:805:GLU:HA	2.18	0.43
3:A:651:ARG:H	3:A:651:ARG:HD2	1.83	0.43
3:A:813:LEU:C	3:A:815:VAL:H	2.25	0.43
3:A:359:LEU:C	3:A:359:LEU:HD23	2.44	0.42
3:A:655:ASP:OD2	3:A:657:LEU:HB2	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:203:DA:H2	3:A:674:SER:HA	1.85	0.42
3:A:762:LYS:O	3:A:766:VAL:HG23	2.19	0.42
2:C:213:DG:H2''	2:C:214:DG:O5'	2.19	0.42
3:A:299:TRP:CZ2	3:A:341:ALA:HB1	2.55	0.42
3:A:804:LYS:HB2	3:A:821:VAL:HG21	2.01	0.42
3:A:467:ILE:HD13	3:A:539:THR:HG22	2.02	0.42
3:A:490:LEU:HD11	3:A:532:ILE:HD13	2.01	0.42
3:A:547:ASP:N	3:A:548:PRO:HD2	2.35	0.42
3:A:387:PRO:HG2	3:A:388:GLU:OE2	2.20	0.41
3:A:587:ARG:CG	3:A:660:ARG:NE	2.83	0.41
2:C:203:DA:H2'	2:C:203:DA:N3	2.34	0.41
3:A:359:LEU:HD23	3:A:359:LEU:O	2.20	0.41
3:A:557:THR:OG1	3:A:561:HIS:CE1	2.60	0.41
1:B:107:DG:C2'	1:B:108:DG:H5''	2.50	0.41
3:A:647:PHE:CD1	3:A:658:MET:HE3	2.55	0.41
6:B:3020:HOH:O	3:A:784:HIS:HE1	2.03	0.41
3:A:309:PHE:N	3:A:309:PHE:CD1	2.88	0.41
3:A:763:LEU:HD23	3:A:763:LEU:HA	1.84	0.41
3:A:298:PRO:O	3:A:299:TRP:C	2.64	0.41
3:A:639:HIS:CE1	3:A:663:LYS:HG2	2.56	0.41
3:A:299:TRP:CE3	3:A:301:PRO:HD3	2.55	0.41
3:A:459:LEU:CD2	3:A:463:VAL:HG13	2.51	0.41
3:A:484:LEU:HD13	3:A:535:TYR:CG	2.55	0.41
3:A:639:HIS:CD2	3:A:663:LYS:HG2	2.56	0.41
3:A:763:LEU:O	3:A:767:LYS:HG3	2.21	0.41
3:A:314:LYS:HE2	3:A:315:GLU:OE1	2.21	0.40
3:A:334:ARG:HG3	3:A:334:ARG:NH1	2.35	0.40
3:A:528:ILE:O	3:A:532:ILE:HG13	2.21	0.40
3:A:626:GLU:HA	3:A:629:ILE:HG12	2.01	0.40
3:A:357:SER:OG	3:A:369:PRO:HD3	2.22	0.40
3:A:452:ASP:O	3:A:455:TYR:HB3	2.22	0.40
3:A:620:ALA:HB1	3:A:629:ILE:HG22	2.03	0.40
3:A:655:ASP:HB2	3:A:656:PRO:CD	2.52	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
3	A	537/539 (100%)	504 (94%)	26 (5%)	7 (1%)	9 10

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	A	294	LEU
3	A	578	ASP
3	A	300	PRO
3	A	586	VAL
3	A	652	GLU
3	A	299	TRP
3	A	330	GLY

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
3	A	418/440 (95%)	401 (96%)	17 (4%)	27 41

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	A	300	PRO
3	A	301	PRO
3	A	314	LYS
3	A	321	LEU

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Mol	Chain	Res	Type
3	A	324	LEU
3	A	328	ARG
3	A	401	GLU
3	A	457	ARG
3	A	459	LEU
3	A	484	LEU
3	A	552	LEU
3	A	583	ASN
3	A	626	GLU
3	A	638	ILE
3	A	670	LEU
3	A	763	LEU
3	A	805	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
3	A	415	ASN
3	A	534	GLN
3	A	561	HIS
3	A	565	ASN
3	A	566	GLN
3	A	582	GLN
3	A	583	ASN
3	A	613	GLN
3	A	621	HIS
3	A	633	GLN
3	A	680	GLN
3	A	690	GLN
3	A	784	HIS

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
1	2DT	B	112	2,1	17,20,21	0.42	0	22,28,31	0.45	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
1	2DT	B	112	2,1	-	0/7/18/19	0/2/2/2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 2 are monoatomic - leaving 1 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	TTP	A	113	4	28,29,30	1.90	9 (32%)	39,45,47	1.03	3 (7%)

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
5	TTP	A	113	4	-	2/22/31/34	0/2/2/2

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	113	TTP	PA-O3A	-5.56	1.53	1.59
5	A	113	TTP	PB-O3B	3.91	1.63	1.59
5	A	113	TTP	PG-O1G	-2.85	1.41	1.50
5	A	113	TTP	O4-C4	-2.61	1.18	1.23
5	A	113	TTP	PB-O1B	-2.37	1.42	1.50
5	A	113	TTP	PA-O2A	-2.35	1.44	1.55
5	A	113	TTP	PB-O2B	-2.35	1.44	1.55
5	A	113	TTP	C2-N3	-2.23	1.34	1.38
5	A	113	TTP	C6-C5	-2.00	1.31	1.34

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	113	TTP	O2B-PB-O3A	2.13	113.04	107.27
5	A	113	TTP	O2G-PG-O1G	2.11	119.04	110.83
5	A	113	TTP	O3A-PB-O1B	-2.08	104.46	110.70

There are no chirality outliers.

All (2) torsion outliers are listed below:

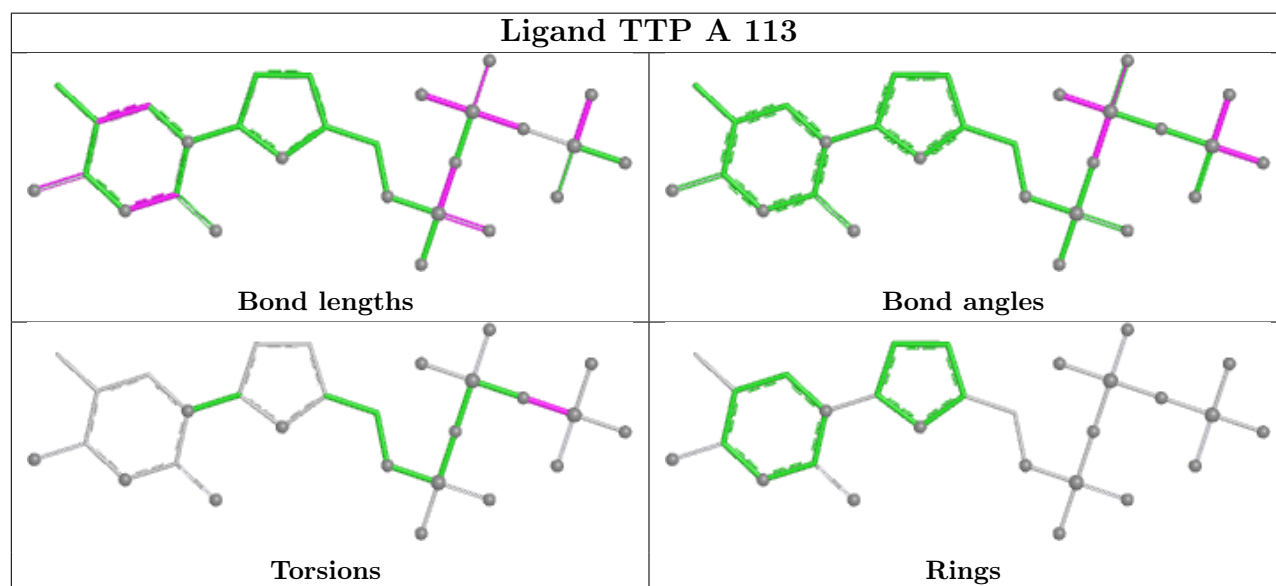
Mol	Chain	Res	Type	Atoms
5	A	113	TTP	PB-O3B-PG-O2G
5	A	113	TTP	PB-O3B-PG-O1G

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	113	TTP	2	0

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



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.