



Full wwPDB X-ray Structure Validation Report ⓘ

May 30, 2024 – 03:15 PM EDT

PDB ID : 8UDK
Title : Human Mitochondrial DNA Polymerase gamma R853A Ternary Complex
Authors : Park, J.; Herrmann, G.K.; Yin, Y.W.
Deposited on : 2023-09-28
Resolution : 3.43 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 : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36.2
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) : 2.36.2

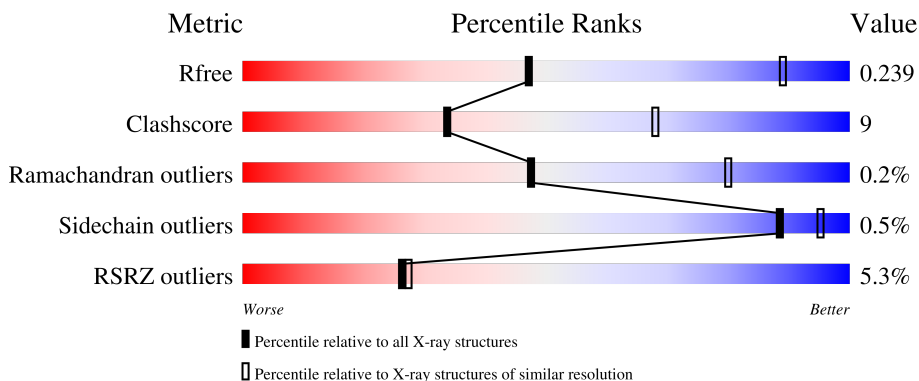
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.43 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.



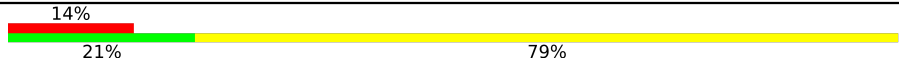

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1278 (3.50-3.38)
Clashscore	141614	1361 (3.50-3.38)
Ramachandran outliers	138981	1327 (3.50-3.38)
Sidechain outliers	138945	1328 (3.50-3.38)
RSRZ outliers	127900	1192 (3.50-3.38)

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	1239	 6% 64% 17% 18%
2	B	485	 % 59% 17% 24%
2	C	485	 2% 65% 11% 24%
3	P	24	 4% 46% 42% 8%
4	T	28	 7% 50% 39% 11%

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Mol	Chain	Length	Quality of chain
5	D	14	
6	E	14	

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
7	DCP	A	4000	-	-	-	X

2 Entry composition i

There are 7 unique types of molecules in this entry. The entry contains 15401 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 subunit gamma-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1012	7930	5047	1367	1466	50	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	198	ALA	ASP	engineered mutation	UNP P54098
A	200	ALA	GLU	engineered mutation	UNP P54098
A	853	ALA	ARG	engineered mutation	UNP P54098

- Molecule 2 is a protein called DNA polymerase subunit gamma-2, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	369	2983	1912	524	531	16	0	0	0
2	C	367	2920	1875	500	529	16	0	0	0

- Molecule 3 is a DNA chain called DNA (24-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	P	22	450	213	90	125	22	0	0	0

- Molecule 4 is a DNA chain called DNA (28-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	T	25	516	245	91	155	25	0	0	0

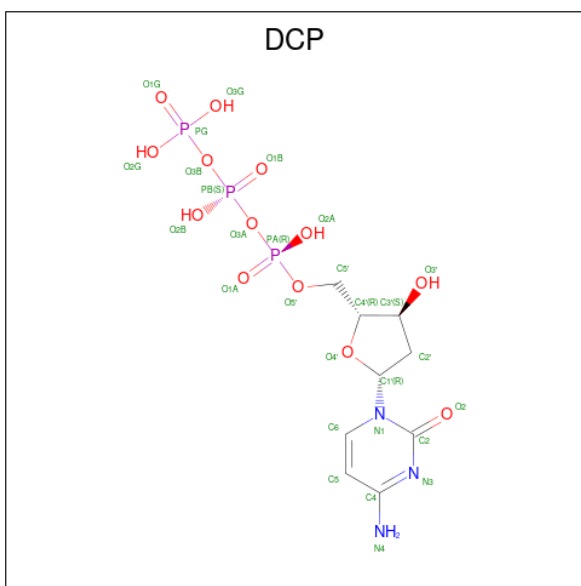
- Molecule 5 is a DNA chain called DNA (5'-D(P*AP*AP*GP*GP*GP*CP*CP*TP*AP*TP*AP*AP*AP*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
5	D	14	291	138	60	79	14	0	0	0

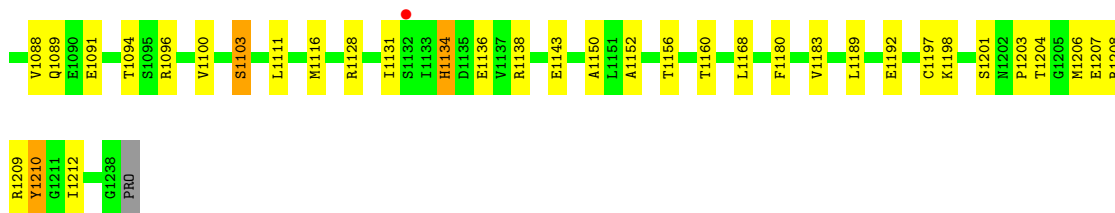
- Molecule 6 is a DNA chain called DNA (5'-D(P*TP*TP*TP*TP*AP*TP*AP*GP*GP*CP*CP*CP*TP*T)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
6	E	14	283	137	43	89	14	0	0	0

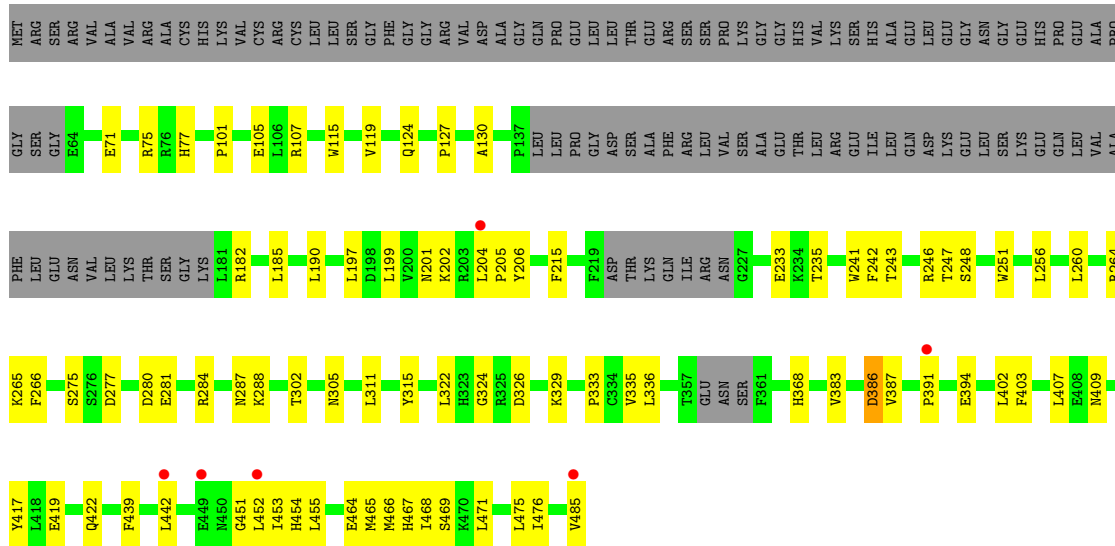
- Molecule 7 is 2'-DEOXYCYTIDINE-5'-TRIPHOSPHATE (three-letter code: DCP) (formula: C₉H₁₆N₃O₁₃P₃) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
7	A	1	28	9	3	13	3	0	0



• Molecule 2: DNA polymerase subunit gamma-2, mitochondrial



• Molecule 2: DNA polymerase subunit gamma-2, mitochondrial



• Molecule 3: DNA (24-MER)





- Molecule 4: DNA (28-MER)



- Molecule 5: DNA (5'-D(P*AP*AP*GP*GP*GP*CP*CP*TP*AP*TP*AP*AP*AP*A)-3')



- Molecule 6: DNA (5'-D(P*TP*TP*TP*TP*AP*TP*AP*GP*GP*CP*CP*CP*TP*T)-3')



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	215.41Å 215.41Å 169.97Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.87 – 3.43 48.87 – 3.43	Depositor EDS
% Data completeness (in resolution range)	98.2 (48.87-3.43) 98.2 (48.87-3.43)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.80 (at 3.40Å)	Xtrriage
Refinement program	PHENIX 1.21.1_5286+SVN	Depositor
R, R_{free}	0.198 , 0.234 0.202 , 0.239	Depositor DCC
R_{free} test set	2000 reflections (3.79%)	wwPDB-VP
Wilson B-factor (Å ²)	119.6	Xtrriage
Anisotropy	0.150	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 80.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	15401	wwPDB-VP
Average B, all atoms (Å ²)	138.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.19% 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: DCP, DOC

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	0.25	0/8140	0.48	0/11071
2	B	0.25	0/3058	0.48	0/4134
2	C	0.25	0/2993	0.47	0/4055
3	P	0.49	0/486	0.80	0/747
4	T	0.50	0/577	0.93	0/890
5	D	0.50	0/328	0.81	0/504
6	E	0.65	0/314	1.95	6/482 (1.2%)
All	All	0.29	0/15896	0.60	6/21883 (0.0%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
6	E	98	DT	O5'-P-OP2	-20.20	86.46	110.70
6	E	98	DT	OP1-P-OP2	17.18	145.38	119.60
6	E	97	DT	OP2-P-O3'	-15.87	70.28	105.20
6	E	97	DT	OP1-P-O3'	-13.02	76.56	105.20
6	E	98	DT	O5'-P-OP1	-10.06	96.65	105.70
6	E	97	DT	O4'-C1'-N1	5.46	111.82	108.00

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	7930	0	7647	142	0
2	B	2983	0	2967	55	0
2	C	2920	0	2851	35	0
3	P	450	0	245	8	0
4	T	516	0	284	9	0
5	D	291	0	157	9	0
6	E	283	0	162	10	0
7	A	28	0	12	2	0
All	All	15401	0	14325	252	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 9.

All (252) 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:422:VAL:HG11	1:A:1111:LEU:HD12	1.63	0.81
2:C:204:LEU:HD11	2:C:333:PRO:HB3	1.65	0.79
2:C:204:LEU:HD13	2:C:324:GLY:HA3	1.66	0.77
1:A:618:HIS:HB3	1:A:751:LYS:HD2	1.66	0.75
2:B:199:LEU:HD11	2:C:101:PRO:HG3	1.72	0.72
1:A:1010:LEU:HB3	1:A:1012:VAL:HG23	1.73	0.70
1:A:953:ARG:HA	1:A:957:ALA:HB3	1.75	0.69
1:A:950:ASN:OD1	1:A:953:ARG:NH2	2.27	0.68
1:A:1111:LEU:HB3	1:A:1160:THR:HG22	1.76	0.67
1:A:1204:THR:HB	1:A:1209:ARG:HG2	1.76	0.67
2:B:204:LEU:HD11	2:B:333:PRO:HB3	1.75	0.67
1:A:852:ARG:NH1	1:A:1103:SER:OG	2.29	0.66
2:C:280:ASP:OD1	2:C:281:GLU:N	2.28	0.66
2:B:204:LEU:HD13	2:B:324:GLY:HA3	1.78	0.65
2:C:260:LEU:HG	2:C:264:ARG:HE	1.61	0.65
1:A:825:VAL:HG13	1:A:882:PRO:HG2	1.78	0.65
1:A:163:PRO:HD3	1:A:218:SER:HA	1.79	0.64
1:A:304:LEU:HB2	1:A:308:GLN:HB3	1.80	0.63
2:B:260:LEU:HD21	2:B:264:ARG:HH21	1.62	0.63
1:A:755:LYS:O	1:A:964:ARG:NH1	2.31	0.63
1:A:914:THR:HG23	1:A:917:GLY:H	1.63	0.63
1:A:723:GLY:HA2	1:A:730:PRO:HG3	1.82	0.62
1:A:496:LYS:HB2	1:A:560:PRO:HG3	1.82	0.62
1:A:579:ARG:NH1	1:A:581:ASP:OD2	2.31	0.62
2:C:430:SER:O	2:C:432:TYR:N	2.33	0.62
1:A:559:LEU:HB3	1:A:560:PRO:HD2	1.81	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:107:ARG:HD2	2:B:235:THR:HG21	1.81	0.61
1:A:890:ASP:HB3	1:A:1136:GLU:HG2	1.82	0.60
2:B:442:LEU:HB3	2:B:454:HIS:HB2	1.84	0.60
2:B:280:ASP:HB3	2:B:284:ARG:H	1.67	0.60
2:B:248:SER:HB3	2:B:305:ASN:HD21	1.66	0.59
1:A:998:SER:HG	1:A:1046:GLU:N	2.00	0.59
2:B:130:ALA:O	2:B:182:ARG:NH2	2.36	0.59
5:D:24:DG:N2	6:E:105:DC:O2	2.35	0.59
6:E:96:DT:H1'	6:E:97:DT:H5'	1.83	0.59
1:A:1089:GLN:OE1	1:A:1089:GLN:N	2.34	0.59
1:A:1091:GLU:O	4:T:3:DA:N6	2.36	0.58
1:A:1150:ALA:HB1	1:A:1183:VAL:HG21	1.85	0.58
2:C:257:ARG:O	2:C:261:GLN:NE2	2.37	0.58
1:A:552:LEU:HG	2:B:468:ILE:HD12	1.86	0.58
1:A:899:ALA:HB1	1:A:1057:MET:HE3	1.86	0.57
5:D:20:DA:H2'	5:D:21:DA:C8	2.38	0.57
2:B:260:LEU:HG	2:B:264:ARG:HE	1.67	0.57
1:A:569:HIS:ND1	2:B:464:GLU:OE2	2.29	0.57
1:A:283:LEU:O	1:A:1128:ARG:NH1	2.38	0.57
6:E:100:DT:H2''	6:E:101:DA:C8	2.39	0.57
1:A:287:SER:O	1:A:290:ARG:NH1	2.33	0.56
1:A:1131:ILE:HG21	1:A:1189:LEU:HD21	1.86	0.56
1:A:309:ARG:HD3	1:A:353:VAL:HG23	1.87	0.56
1:A:618:HIS:CE1	1:A:738:PRO:HG2	2.40	0.56
2:B:452:LEU:HB3	2:B:465:MET:HG3	1.86	0.56
1:A:900:ALA:HB1	1:A:917:GLY:HA2	1.86	0.55
1:A:417:ARG:HG2	1:A:1078:CYS:HB2	1.88	0.55
1:A:201:VAL:HG12	1:A:209:PRO:HA	1.88	0.55
1:A:153:ALA:HB1	1:A:194:ALA:HB2	1.87	0.55
2:B:205:PRO:HA	2:B:242:PHE:O	2.07	0.55
2:C:311:LEU:HG	2:C:322:LEU:HD23	1.89	0.55
1:A:372:GLU:OE1	1:A:375:GLU:N	2.41	0.54
1:A:1203:PRO:HD2	1:A:1209:ARG:HH21	1.72	0.54
1:A:1204:THR:HG22	1:A:1208:ARG:HB2	1.90	0.54
1:A:115:GLN:HG2	1:A:929:THR:HG21	1.90	0.54
1:A:549:LEU:HD11	2:B:468:ILE:HG21	1.89	0.54
2:B:383:VAL:HG21	2:B:475:LEU:HD13	1.89	0.54
1:A:275:ARG:HH21	1:A:432:VAL:HG23	1.74	0.53
2:B:451:GLY:HA3	2:B:467:HIS:CE1	2.44	0.53
6:E:107:DT:H2''	6:E:108:DT:H5''	1.90	0.53
1:A:991:GLY:H	1:A:1055:SER:HG	1.55	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1010:LEU:N	1:A:1011:PRO:HA	2.23	0.53
6:E:102:DG:H5''	6:E:102:DG:H8	1.74	0.53
2:C:107:ARG:NH1	2:C:343:ASP:OD1	2.42	0.53
1:A:297:MET:O	1:A:301:ILE:HG12	2.09	0.52
1:A:941:ILE:HD13	1:A:945:HIS:HB2	1.91	0.52
1:A:162:LEU:HD23	1:A:162:LEU:H	1.74	0.52
6:E:97:DT:H1'	6:E:98:DT:OP2	2.09	0.52
1:A:1197:CYS:HB2	1:A:1206:MET:HG2	1.92	0.51
2:B:105:GLU:HG2	2:C:127:PRO:HG3	1.92	0.51
1:A:376:LEU:HD12	1:A:392:LEU:HD11	1.91	0.51
4:T:4:DG:H2'	4:T:5:DG:H8	1.75	0.51
2:C:93:SER:HB3	2:C:218:VAL:HG21	1.92	0.51
2:C:354:PHE:CZ	2:C:370:LYS:HD2	2.46	0.51
1:A:931:LEU:H	1:A:931:LEU:HD23	1.76	0.51
1:A:610:PHE:HB3	1:A:622:TYR:HB2	1.92	0.50
1:A:901:VAL:HG22	1:A:1168:LEU:HD12	1.93	0.50
1:A:999:ASP:HB2	1:A:1004:LEU:HD21	1.92	0.50
1:A:1013:ASP:OD1	1:A:1014:ARG:N	2.44	0.50
2:C:205:PRO:HA	2:C:242:PHE:O	2.12	0.50
1:A:594:LEU:HA	1:A:599:THR:HG21	1.94	0.50
2:C:182:ARG:NH2	2:C:213:VAL:O	2.28	0.50
1:A:208:CYS:HB2	1:A:239:LEU:HD11	1.93	0.50
1:A:1053:THR:HG23	1:A:1054:GLU:HG3	1.93	0.50
1:A:990:LYS:HD3	1:A:1058:PHE:CG	2.47	0.50
2:B:311:LEU:HG	2:B:322:LEU:HD23	1.94	0.50
4:T:7:DA:H3'	4:T:8:DT:H71	1.94	0.50
1:A:873:GLU:OE2	1:A:1201:SER:OG	2.26	0.49
1:A:83:LEU:HD21	1:A:125:LEU:HD23	1.93	0.49
1:A:741:ASP:N	1:A:741:ASP:OD1	2.46	0.49
6:E:101:DA:H2''	6:E:102:DG:C8	2.48	0.49
4:T:5:DG:H2'	4:T:6:DT:C6	2.48	0.49
1:A:1019:TRP:CE2	1:A:1021:SER:HB3	2.48	0.49
1:A:353:VAL:HG12	1:A:358:GLU:OE1	2.13	0.48
1:A:949:PHE:HE1	1:A:962:ALA:HA	1.78	0.48
1:A:1019:TRP:NE1	1:A:1021:SER:HB3	2.28	0.48
2:B:419:GLU:OE2	2:B:422:GLN:NE2	2.46	0.48
1:A:888:GLY:HA3	1:A:1138:ARG:HH11	1.76	0.48
1:A:215:ILE:HD11	1:A:220:TRP:CH2	2.48	0.48
1:A:534:SER:HB2	1:A:537:GLU:HB2	1.95	0.48
2:B:215:PHE:HD1	2:B:233:GLU:HG2	1.78	0.48
2:C:360:SER:OG	2:C:361:PHE:N	2.45	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1204:THR:HG22	1:A:1208:ARG:CB	2.43	0.48
1:A:223:TRP:CZ2	1:A:245:ILE:HG22	2.49	0.48
1:A:935:THR:O	1:A:939:VAL:HG12	2.13	0.48
2:B:124:GLN:HB2	2:B:206:TYR:HA	1.95	0.48
1:A:272:SER:HB3	1:A:843:GLN:HA	1.96	0.48
1:A:737:GLY:HA3	1:A:751:LYS:HB2	1.95	0.48
2:B:246:ARG:HG3	2:B:247:THR:HG23	1.96	0.47
2:B:277:ASP:OD1	2:B:287:ASN:ND2	2.47	0.47
5:D:29:DT:H2''	5:D:30:DA:C8	2.49	0.47
1:A:604:ALA:HB3	1:A:782:GLY:HA3	1.96	0.47
6:E:104:DC:H2''	6:E:105:DC:C5	2.49	0.47
2:B:71:GLU:HG3	2:B:75:ARG:HH12	1.80	0.47
1:A:727:ASP:HA	1:A:745:PRO:HA	1.96	0.47
1:A:865:ALA:HA	1:A:872:SER:HB2	1.95	0.47
1:A:216:SER:OG	1:A:219:ALA:HB3	2.15	0.47
1:A:610:PHE:CE2	1:A:748:TRP:HD1	2.33	0.47
2:B:403:PHE:CZ	2:B:407:LEU:HD11	2.50	0.47
5:D:30:DA:H2''	5:D:31:DA:N7	2.30	0.46
1:A:556:THR:HG1	2:B:467:HIS:CG	2.33	0.46
1:A:999:ASP:HB2	1:A:1004:LEU:HD11	1.96	0.46
1:A:771:LEU:O	1:A:775:GLU:HG2	2.16	0.46
3:P:11:DG:H2''	3:P:12:DG:C8	2.50	0.46
1:A:223:TRP:CH2	1:A:245:ILE:HG22	2.51	0.46
2:B:439:PHE:HB3	2:B:455:LEU:HD11	1.97	0.46
2:C:190:LEU:HD22	2:C:311:LEU:HD13	1.98	0.46
1:A:444:TYR:CG	1:A:877:MET:HG3	2.50	0.46
1:A:904:ASP:OD1	1:A:914:THR:HG22	2.16	0.46
4:T:11:DC:H2''	4:T:12:DA:C8	2.51	0.46
1:A:77:GLN:HG2	1:A:120:LEU:HB2	1.97	0.46
1:A:345:TRP:HE3	1:A:348:LEU:HD11	1.80	0.46
1:A:728:THR:OG1	1:A:740:ASN:OD1	2.24	0.46
4:T:11:DC:H2''	4:T:12:DA:H8	1.80	0.46
1:A:282:TYR:HD2	1:A:839:ALA:HB3	1.81	0.45
1:A:1210:TYR:HB2	1:A:1212:ILE:HD13	1.97	0.45
2:C:389:ARG:HH11	2:C:389:ARG:HA	1.81	0.45
6:E:102:DG:H5''	6:E:102:DG:C8	2.50	0.45
2:B:315:TYR:HB2	2:B:322:LEU:HD11	1.98	0.45
2:C:383:VAL:HG11	2:C:406:LEU:HD13	1.98	0.45
1:A:441:TRP:O	1:A:444:TYR:HB3	2.16	0.45
1:A:540:GLN:HA	1:A:543:VAL:HG12	1.98	0.45
1:A:990:LYS:HD2	1:A:1049:TRP:CZ2	2.50	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:D:26:DC:H2''	5:D:27:DT:O5'	2.16	0.45
2:B:387:VAL:HG13	2:B:417:TYR:HB2	1.99	0.45
1:A:910:MET:HB2	1:A:913:CYS:HB3	1.99	0.45
1:A:1116:MET:HG2	1:A:1156:THR:HG21	1.98	0.45
1:A:396:CYS:O	1:A:400:VAL:HG23	2.17	0.45
1:A:573:TYR:OH	1:A:589:PRO:HD3	2.16	0.45
1:A:1096:ARG:O	1:A:1100:VAL:HG23	2.17	0.45
2:B:243:THR:HG1	2:B:251:TRP:HD1	1.61	0.45
1:A:312:TRP:NE1	1:A:351:SER:O	2.50	0.45
1:A:1134:HIS:HB2	3:P:24:DOC:H4'	1.99	0.45
2:B:115:TRP:CZ2	2:B:119:VAL:HG11	2.52	0.45
1:A:477:GLU:HB3	1:A:480:LYS:HE2	1.99	0.44
2:C:193:TYR:OH	2:C:333:PRO:HG3	2.17	0.44
2:B:280:ASP:OD1	2:B:281:GLU:N	2.50	0.44
1:A:796:LYS:HE2	1:A:796:LYS:HB3	1.80	0.44
2:C:354:PHE:HZ	2:C:370:LYS:HD2	1.82	0.44
3:P:14:DC:H2''	3:P:15:DA:C8	2.52	0.44
1:A:885:THR:HG23	1:A:1143:GLU:HG2	2.00	0.44
1:A:351:SER:HB3	1:A:1082:ALA:HB2	2.00	0.44
4:T:10:DG:H2''	4:T:11:DC:C6	2.53	0.44
1:A:723:GLY:HA2	1:A:730:PRO:CG	2.46	0.44
2:B:265:LYS:HE3	2:B:266:PHE:CZ	2.53	0.44
1:A:763:GLY:HA3	3:P:19:DC:H4'	2.00	0.44
1:A:600:PRO:HB3	1:A:605:LEU:HD12	2.00	0.44
2:C:257:ARG:HG2	2:C:261:GLN:NE2	2.33	0.44
1:A:210:THR:HG22	1:A:228:LEU:HD22	2.00	0.43
1:A:863:SER:HA	3:P:23:DA:H5'	2.00	0.43
2:B:288:LYS:HG2	2:B:302:THR:HG22	1.99	0.43
2:B:368:HIS:O	2:B:368:HIS:ND1	2.49	0.43
2:C:319:VAL:HA	2:C:322:LEU:HD13	2.00	0.43
2:C:358:GLU:HA	2:C:371:VAL:HG12	2.01	0.43
2:C:373:LYS:HE3	2:C:459:ASP:HA	2.00	0.43
2:B:197:LEU:HG	2:B:202:LYS:HG2	2.01	0.43
3:P:7:DC:H2''	3:P:8:DG:C8	2.53	0.43
1:A:1152:ALA:O	1:A:1156:THR:HG23	2.18	0.43
2:B:326:ASP:N	2:B:329:LYS:O	2.44	0.43
1:A:610:PHE:CD2	1:A:622:TYR:HD2	2.36	0.43
1:A:1094:THR:HG21	4:T:3:DA:H2'	2.01	0.43
3:P:22:DT:H2'	3:P:23:DA:C8	2.54	0.43
5:D:21:DA:H2'	5:D:22:DG:C8	2.53	0.43
1:A:69:LEU:HD21	1:A:71:HIS:CE1	2.54	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:241:TRP:HB3	2:B:336:LEU:HB3	2.01	0.43
2:B:386:ASP:HA	2:B:417:TYR:HB3	2.01	0.43
2:B:453:ILE:HG12	2:B:466:MET:O	2.18	0.43
2:C:136:GLY:HA2	2:C:137:PRO:HD3	1.88	0.43
1:A:939:VAL:HG13	1:A:941:ILE:HG13	2.01	0.43
2:B:201:ASN:ND2	2:C:419:GLU:HG2	2.34	0.43
2:C:181:LEU:HD23	2:C:181:LEU:HA	1.86	0.43
2:C:403:PHE:CZ	2:C:407:LEU:HD11	2.54	0.43
1:A:586:THR:HB	2:B:485:VAL:HG22	2.00	0.43
1:A:556:THR:OG1	2:B:467:HIS:ND1	2.50	0.43
5:D:30:DA:H2''	5:D:31:DA:C8	2.54	0.43
1:A:174:GLY:O	1:A:223:TRP:HA	2.18	0.42
1:A:197:PHE:HZ	1:A:245:ILE:HD11	1.84	0.42
1:A:474:LEU:HD12	1:A:490:TRP:HB3	2.01	0.42
2:B:402:LEU:HD11	2:B:471:LEU:HD23	2.00	0.42
1:A:729:GLN:OE1	1:A:746:GLY:HA2	2.20	0.42
1:A:1008:LEU:O	1:A:1011:PRO:HA	2.19	0.42
1:A:556:THR:HG21	2:B:469:SER:OG	2.20	0.42
2:B:190:LEU:HD21	2:B:335:VAL:HG11	2.01	0.42
2:C:204:LEU:HD23	2:C:244:PRO:HG3	2.02	0.42
1:A:454:GLU:HG2	1:A:457:ARG:HH22	1.84	0.42
2:B:115:TRP:CZ2	2:B:127:PRO:HB3	2.55	0.42
2:B:256:LEU:HD21	2:B:275:SER:OG	2.20	0.42
2:B:391:PRO:HB2	2:B:394:GLU:OE1	2.20	0.42
2:C:472:LYS:HB3	2:C:472:LYS:HE3	1.90	0.42
5:D:32:DA:H2''	5:D:33:DA:N7	2.35	0.42
1:A:729:GLN:H	1:A:747:CYS:HB3	1.84	0.42
2:B:182:ARG:HD3	2:B:185:LEU:HD23	2.01	0.42
6:E:104:DC:H2''	6:E:105:DC:C6	2.55	0.42
1:A:303:GLY:N	1:A:1080:SER:OG	2.51	0.42
2:C:358:GLU:HG2	2:C:359:ASN:O	2.20	0.42
1:A:892:ASP:HA	7:A:4000:DCP:H2'2	2.02	0.41
2:C:77:HIS:HB3	2:C:101:PRO:HD2	2.02	0.41
1:A:347:TRP:CD1	1:A:1088:VAL:HG12	2.55	0.41
2:B:215:PHE:CD1	2:B:233:GLU:HG2	2.55	0.41
1:A:992:LEU:HD12	1:A:992:LEU:H	1.85	0.41
1:A:997:LEU:HA	1:A:1004:LEU:HD22	2.02	0.41
1:A:1192:GLU:OE2	7:A:4000:DCP:H5	2.21	0.41
3:P:8:DG:H2''	3:P:9:DA:H8	1.86	0.41
2:B:77:HIS:HB3	2:B:101:PRO:HD2	2.02	0.41
2:C:441:VAL:HG13	2:C:453:ILE:HD12	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:143:ALA:HB3	1:A:421:PRO:HB2	2.02	0.41
1:A:886:LEU:HD13	1:A:1189:LEU:HD12	2.03	0.41
1:A:989:THR:HA	1:A:1053:THR:HG22	2.03	0.41
1:A:990:LYS:HD2	1:A:1049:TRP:CE2	2.55	0.41
4:T:21:DC:H2''	4:T:22:DG:C8	2.56	0.41
1:A:275:ARG:O	1:A:278:ILE:HG12	2.20	0.41
2:C:72:ILE:HD12	2:C:354:PHE:CE2	2.56	0.41
1:A:305:SER:O	1:A:309:ARG:N	2.52	0.41
1:A:722:ARG:O	1:A:730:PRO:HB3	2.21	0.41
1:A:867:PRO:HA	1:A:1198:LYS:O	2.21	0.41
1:A:1207:GLU:HG2	1:A:1212:ILE:O	2.21	0.41
5:D:20:DA:H8	5:D:20:DA:P	2.44	0.41
1:A:617:ARG:HB3	1:A:618:HIS:CD2	2.56	0.41
1:A:197:PHE:CZ	1:A:245:ILE:HD11	2.56	0.40
1:A:1019:TRP:O	1:A:1020:ILE:HG12	2.22	0.40
2:C:72:ILE:HG12	2:C:75:ARG:NH2	2.36	0.40
1:A:1010:LEU:H	1:A:1011:PRO:HA	1.86	0.40
2:B:204:LEU:HD12	2:B:204:LEU:HA	1.81	0.40
1:A:209:PRO:HD3	1:A:277:HIS:HD2	1.85	0.40
1:A:873:GLU:O	1:A:877:MET:HG2	2.22	0.40
2:B:409:ASN:HB3	2:B:476:ILE:HD11	2.02	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	996/1239 (80%)	952 (96%)	42 (4%)	2 (0%)	47 80
2	B	361/485 (74%)	356 (99%)	5 (1%)	0	100 100
2	C	357/485 (74%)	351 (98%)	5 (1%)	1 (0%)	41 75
All	All	1714/2209 (78%)	1659 (97%)	52 (3%)	3 (0%)	47 80

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1134	HIS
2	C	228	VAL
1	A	1012	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	831/1041 (80%)	825 (99%)	6 (1%)	84	93
2	B	329/426 (77%)	328 (100%)	1 (0%)	92	98
2	C	318/426 (75%)	317 (100%)	1 (0%)	92	98
All	All	1478/1893 (78%)	1470 (100%)	8 (0%)	88	95

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	731	SER
1	A	951	TYR
1	A	1027	LYS
1	A	1103	SER
1	A	1180	PHE
1	A	1210	TYR
2	B	386	ASP
2	C	361	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	137	GLN
1	A	1098	ASN
1	A	1102	GLN
2	C	261	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](#)

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
3	DOC	P	24	3,4	16,19,20	1.49	3 (18%)	20,26,29	1.50	4 (20%)

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	DOC	P	24	3,4	-	0/7/18/19	0/2/2/2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	P	24	DOC	O5'-C5'	-3.50	1.36	1.44
3	P	24	DOC	C4-N4	2.44	1.39	1.33
3	P	24	DOC	C2-N1	2.26	1.44	1.40

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	P	24	DOC	O4'-C1'-C2'	3.06	109.99	106.67
3	P	24	DOC	N4-C4-N3	-2.64	113.33	117.97
3	P	24	DOC	C5-C4-N3	2.36	125.35	121.33
3	P	24	DOC	C4-N3-C2	-2.18	116.73	120.25

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	P	24	DOC	1	0

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand 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	$\# Z > 2$
7	DCP	A	4000	-	25,29,29	1.72	5 (20%)	37,45,45	1.56	9 (24%)

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
7	DCP	A	4000	-	-	5/22/34/34	0/2/2/2

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	4000	DCP	PA-O5'	5.70	1.82	1.59
7	A	4000	DCP	O5'-C5'	-2.91	1.33	1.44
7	A	4000	DCP	C2-N3	2.77	1.42	1.36
7	A	4000	DCP	C4-N4	2.35	1.39	1.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	4000	DCP	C2-N1	2.25	1.44	1.40

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	A	4000	DCP	C1'-N1-C2	4.10	124.94	117.74
7	A	4000	DCP	C1'-N1-C6	-3.60	114.45	121.55
7	A	4000	DCP	C4'-O4'-C1'	-2.96	102.30	109.45
7	A	4000	DCP	C2'-C1'-N1	2.34	119.17	113.77
7	A	4000	DCP	O5'-PA-O1A	-2.30	100.08	109.07
7	A	4000	DCP	C5-C4-N3	2.29	125.22	121.33
7	A	4000	DCP	O3G-PG-O2G	2.18	115.97	107.64
7	A	4000	DCP	O4'-C4'-C3'	-2.07	100.83	105.67
7	A	4000	DCP	O2-C2-N3	-2.03	119.03	122.33

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	A	4000	DCP	C5'-O5'-PA-O1A
7	A	4000	DCP	C5'-O5'-PA-O2A
7	A	4000	DCP	C5'-O5'-PA-O3A
7	A	4000	DCP	C3'-C4'-C5'-O5'
7	A	4000	DCP	O4'-C4'-C5'-O5'

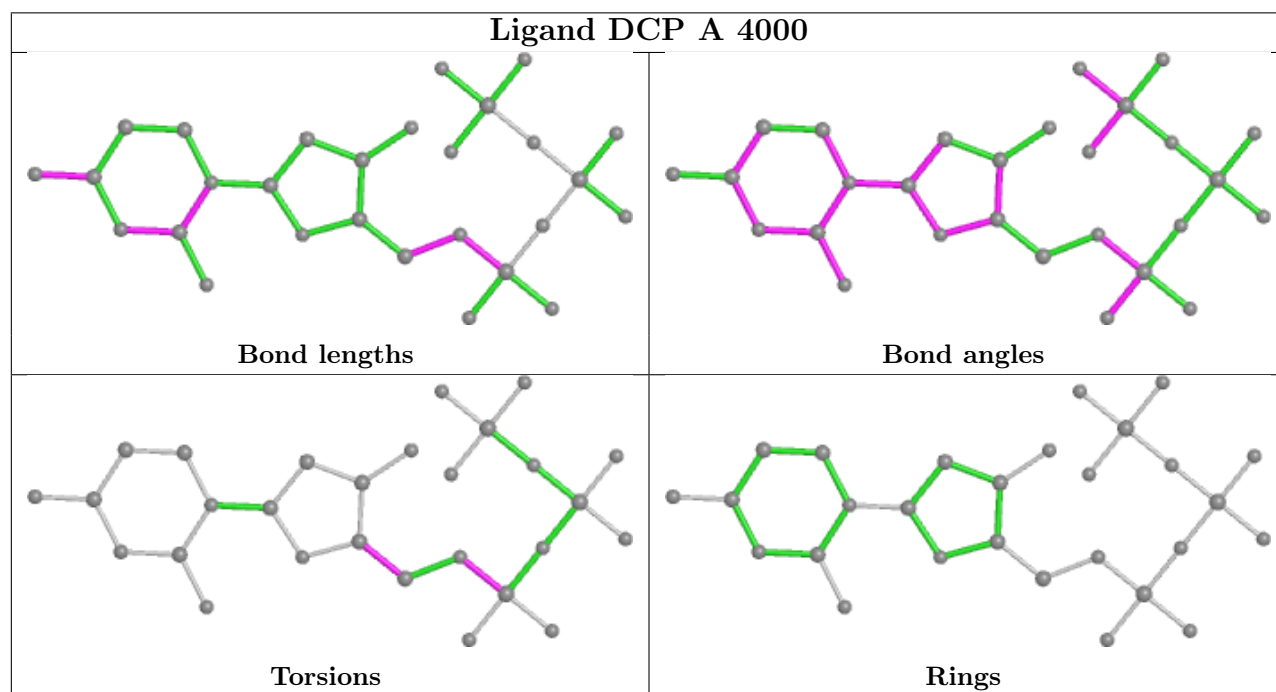
There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	A	4000	DCP	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

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	1012/1239 (81%)	0.25	72 (7%) 16 18	75, 125, 220, 302	0
2	B	369/485 (76%)	0.04	6 (1%) 72 70	76, 108, 192, 268	0
2	C	367/485 (75%)	0.07	10 (2%) 54 52	84, 119, 187, 252	0
3	P	21/24 (87%)	0.14	1 (4%) 30 31	146, 181, 252, 269	0
4	T	25/28 (89%)	0.32	2 (8%) 12 15	134, 202, 270, 306	0
5	D	14/14 (100%)	0.83	2 (14%) 2 4	231, 258, 307, 364	0
6	E	14/14 (100%)	0.76	3 (21%) 0 1	192, 231, 304, 305	0
All	All	1822/2289 (79%)	0.18	96 (5%) 26 27	75, 122, 222, 364	0

All (96) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	976	GLN	8.9
2	C	356	LEU	7.9
1	A	967	MET	7.7
1	A	945	HIS	7.4
1	A	971	HIS	6.7
1	A	977	GLU	6.7
1	A	966	LEU	6.6
1	A	975	GLN	6.2
5	D	33	DA	6.0
1	A	937	THR	5.8
1	A	939	VAL	5.5
1	A	946	ALA	5.1
1	A	926	SER	5.0
1	A	623	LEU	4.9
1	A	941	ILE	4.9
1	A	963	GLU	4.7
1	A	974	THR	4.7

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Mol	Chain	Res	Type	RSRZ
1	A	962	ALA	4.5
1	A	959	GLN	4.2
1	A	731	SER	4.2
1	A	968	GLN	4.2
1	A	940	GLY	4.1
1	A	1047	ARG	4.1
1	A	342	ILE	3.8
1	A	742	VAL	3.8
1	A	938	THR	3.7
1	A	622	TYR	3.7
1	A	949	PHE	3.7
1	A	969	PHE	3.7
1	A	728	THR	3.5
1	A	846	THR	3.5
1	A	1011	PRO	3.5
1	A	738	PRO	3.5
1	A	935	THR	3.4
1	A	929	THR	3.4
2	B	452	LEU	3.4
1	A	747	CYS	3.3
1	A	743	ASP	3.3
1	A	749	PHE	3.2
6	E	108	DT	3.2
1	A	343	SER	3.2
1	A	723	GLY	3.1
1	A	344	SER	3.1
5	D	32	DA	3.1
1	A	930	ASP	3.0
2	C	204	LEU	3.0
1	A	744	ILE	3.0
1	A	995	TYR	3.0
1	A	960	PRO	3.0
1	A	1008	LEU	2.9
1	A	1012	VAL	2.9
2	B	449	GLU	2.8
2	C	360	SER	2.8
1	A	557	GLU	2.8
2	C	361	PHE	2.8
1	A	942	SER	2.8
2	C	326	ASP	2.7
6	E	101	DA	2.6
1	A	910	MET	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	552	LEU	2.6
1	A	981	LYS	2.6
1	A	652	ILE	2.5
1	A	980	GLU	2.5
2	B	204	LEU	2.4
2	C	355	GLN	2.4
1	A	934	LYS	2.4
1	A	958	GLY	2.4
3	P	3	DA	2.4
1	A	1046	GLU	2.3
1	A	979	ALA	2.3
2	B	391	PRO	2.3
1	A	943	ARG	2.3
1	A	1024	ASP	2.3
1	A	970	ASN	2.3
1	A	345	TRP	2.3
2	B	442	LEU	2.3
1	A	978	ALA	2.2
2	C	387	VAL	2.2
1	A	724	GLY	2.2
1	A	1048	ALA	2.2
1	A	1132	SER	2.2
2	B	485	VAL	2.2
1	A	733	HIS	2.2
2	C	133	HIS	2.2
4	T	2	DG	2.1
1	A	972	ARG	2.1
2	C	420	THR	2.1
1	A	316	LYS	2.1
4	T	17	DC	2.1
1	A	933	SER	2.1
6	E	97	DT	2.1
1	A	928	GLY	2.1
1	A	483	PRO	2.1
1	A	1026	ARG	2.1
2	C	324	GLY	2.0
1	A	725	PRO	2.0

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

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
3	DOC	P	24	18/19	0.82	0.39	136,142,167,325	0

6.3 Carbohydrates [i](#)

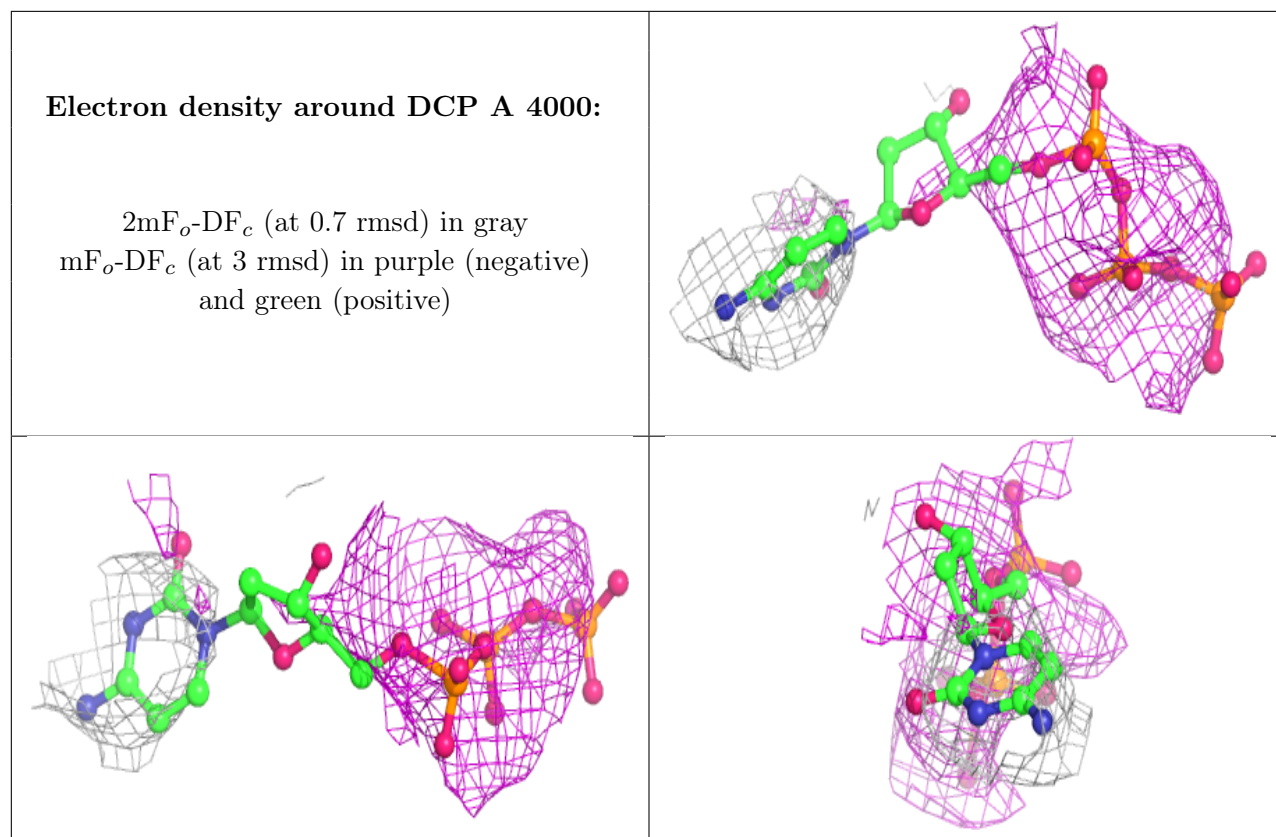
There are no monosaccharides in this entry.

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, 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
7	DCP	A	4000	28/28	0.60	0.58	145,245,356,376	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.



6.5 Other polymers [i](#)

There are no such residues in this entry.