



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 07:54 PM UTC

PDB ID : 3THV / pdb_00003thv
Title : Crystal Structure of Bacillus DNA Polymerase I Large Fragment Bound to DNA and ddATP-dT in Closed Conformation
Authors : Wang, W.; Beese, L.S.
Deposited on : 2011-08-19
Resolution : 1.61 Å(reported)

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

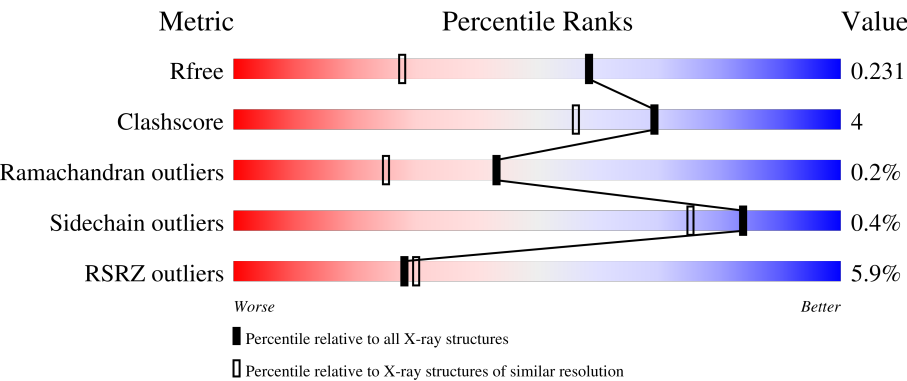
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

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 1.61 Å.

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




Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R _{free}	180053	6728 (1.64-1.60)
Clashscore	190562	7023 (1.64-1.60)
Ramachandran outliers	187476	6898 (1.64-1.60)
Sidechain outliers	187428	6896 (1.64-1.60)
RSRZ outliers	180081	6727 (1.64-1.60)

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	592	<div><div>11%</div><div><div></div><div>88%</div><div>9%</div><div>.</div></div></div>
1	D	592	<div><div>%</div><div><div></div><div>91%</div><div>7%</div><div>.</div></div></div>
2	B	9	<div><div></div><div><div>89%</div><div>11%</div></div></div>
2	E	9	<div><div></div><div><div>89%</div><div>11%</div></div></div>
3	C	13	<div><div></div><div><div>77%</div><div>15%</div><div>8%</div></div></div>

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Mol	Chain	Length	Quality of chain
3	F	13	 A horizontal bar chart showing the quality of chain F. The bar is divided into three segments: a green segment representing 69%, a yellow segment representing 23%, and a grey segment representing 8%. The percentages are labeled below the corresponding segments.

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 21942 atoms, of which 9980 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 I.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	579	Total	C	H	N	O	S	0	2	0
			9378	2959	4724	809	869	17			
1	D	579	Total	C	H	N	O	S	0	12	0
			9447	2978	4756	814	882	17			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	456	GLU	ALA	SEE REMARK 999	UNP C9RTX7
A	505	LYS	GLU	SEE REMARK 999	UNP C9RTX7
A	598	ALA	ASP	engineered mutation	UNP C9RTX7
A	710	TYR	PHE	engineered mutation	UNP C9RTX7
A	823	HIS	ARG	SEE REMARK 999	UNP C9RTX7
D	456	GLU	ALA	SEE REMARK 999	UNP C9RTX7
D	505	LYS	GLU	SEE REMARK 999	UNP C9RTX7
D	598	ALA	ASP	engineered mutation	UNP C9RTX7
D	710	TYR	PHE	engineered mutation	UNP C9RTX7
D	823	HIS	ARG	SEE REMARK 999	UNP C9RTX7

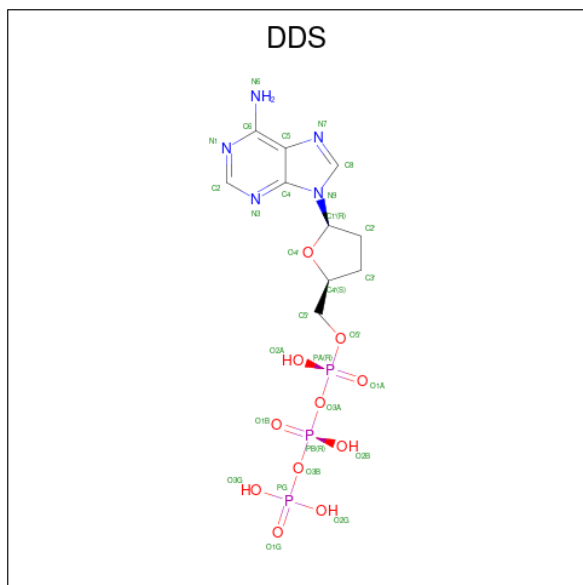
- Molecule 2 is a DNA chain called 5'-D(*CP*CP*TP*GP*AP*CP*TP*CP*(2DA))-3'.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	9	Total	C	H	N	O	P	0	0	0
			277	86	101	31	51	8			
2	E	9	Total	C	H	N	O	P	0	0	0
			277	86	101	31	51	8			

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

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	C	12	Total	C	H	N	O	P	0	0	0
			384	119	137	46	71	11			
3	F	12	Total	C	H	N	O	P	0	0	0
			384	119	137	46	71	11			

- Molecule 4 is 2',3'-dideoxyadenosine triphosphate (CCD ID: DDS) (formula: $C_{10}H_{16}N_5O_{11}P_3$).





Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	O	S	0	0
			5	4	1		
6	D	1	Total	O	S	0	0
			5	4	1		
6	D	1	Total	O	S	0	0
			5	4	1		

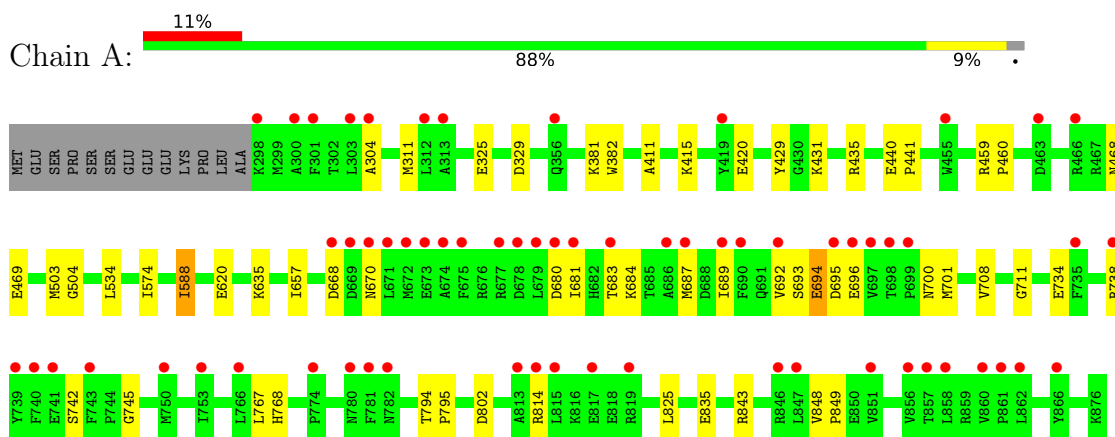
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	582	Total	O	0	0
			582	582		
7	D	859	Total	O	0	0
			859	859		
7	B	40	Total	O	0	0
			40	40		
7	C	80	Total	O	0	0
			80	80		
7	E	46	Total	O	0	0
			46	46		
7	F	89	Total	O	0	0
			89	89		

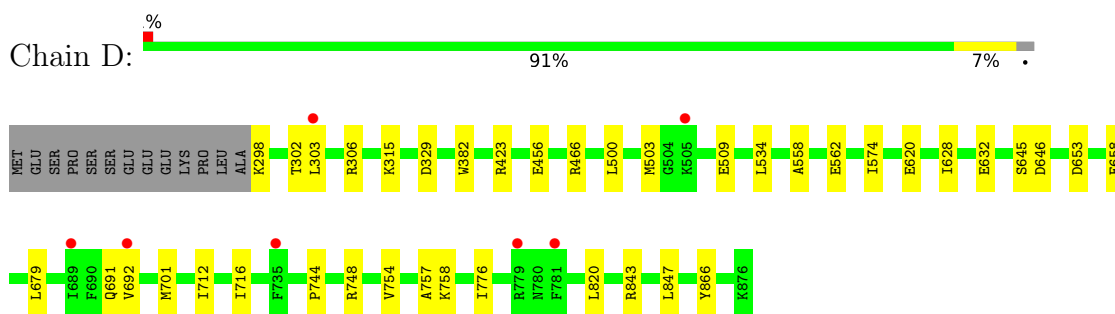
3 Residue-property plots [i](#)

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.

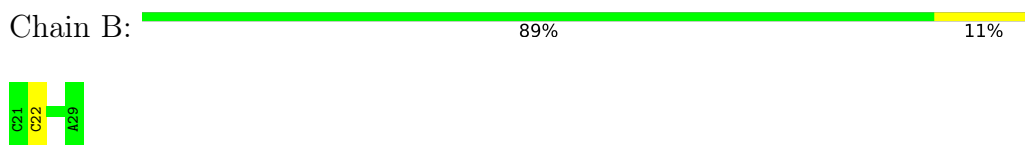
• Molecule 1: DNA polymerase I



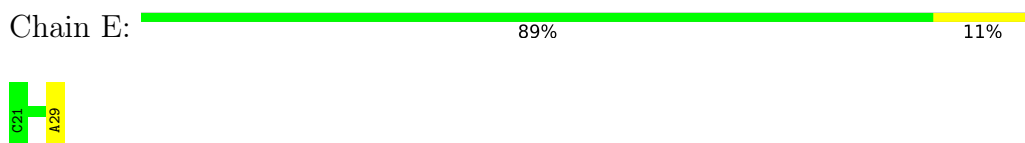
• Molecule 1: DNA polymerase I




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

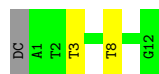


• Molecule 2: 5'-D(*CP*CP*TP*GP*AP*CP*TP*CP*(2DA))-3'



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

Chain C:  77% 15% 8%



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

Chain F:  69% 23% 8%



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	93.81Å 109.27Å 150.43Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	88.41 – 1.61 88.41 – 1.61	Depositor EDS
% Data completeness (in resolution range)	93.0 (88.41-1.61) 93.0 (88.41-1.61)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.63 (at 1.61Å)	Xtriage
Refinement program	PHENIX 1.7.1_743	Depositor
R, R_{free}	0.193 , 0.224 (Not available) , 0.231	Depositor DCC
R_{free} test set	8429 reflections (4.55%)	wwPDB-VP
Wilson B-factor (Å ²)	17.0	Xtriage
Anisotropy	0.070	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 48.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	21942	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.72% 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: DDS, 2DA, MG, SO4

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	0.51	1/4747 (0.0%)	0.74	1/6416 (0.0%)
1	D	0.68	1/4822 (0.0%)	0.80	0/6515
2	B	0.45	0/173	1.24	1/264 (0.4%)
2	E	0.48	0/173	1.19	0/264
3	C	0.44	0/277	0.99	1/427 (0.2%)
3	F	0.50	0/277	1.07	0/427
All	All	0.59	2/10469 (0.0%)	0.81	3/14313 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	620	GLU	C-O	5.41	1.26	1.23
1	A	620	GLU	C-O	5.02	1.26	1.23

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	22	DC	C4'-C3'-O3'	-5.60	101.60	110.00
3	C	8	DT	O4'-C1'-N1	-5.42	100.28	108.40
1	A	657	ILE	N-CA-C	5.26	115.47	110.42

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	4654	4724	4703	39	0
1	D	4691	4756	4690	29	0
2	B	176	101	103	0	0
2	E	176	101	103	0	0
3	C	247	137	138	1	0
3	F	247	137	138	3	0
4	A	29	12	12	0	0
4	D	29	12	12	1	0
5	A	1	0	0	0	0
5	D	1	0	0	0	0
6	A	5	0	0	0	0
6	D	10	0	0	0	0
7	A	582	0	0	8	1
7	B	40	0	0	0	0
7	C	80	0	0	0	0
7	D	859	0	0	12	1
7	E	46	0	0	0	0
7	F	89	0	0	2	0
All	All	11962	9980	9899	71	1

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 4.

All (71) 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:D:679:LEU:HD23	7:D:1137:HOH:O	1.84	0.76
1:D:653:ASP:HB2	7:D:1696:HOH:O	1.95	0.67
1:D:754:VAL:HG12	1:D:758:LYS:HE2	1.77	0.66
1:D:466:ARG:NH2	7:D:1078:HOH:O	2.27	0.63
1:A:848:VAL:HB	1:A:849:PRO:HD3	1.79	0.63
1:D:754:VAL:CG1	1:D:758:LYS:HE2	2.29	0.62
1:A:694:GLU:O	1:A:694:GLU:HG2	2.00	0.61
1:A:431:LYS:NZ	7:A:1179:HOH:O	2.36	0.59
1:D:456:GLU:HG2	7:D:1245:HOH:O	2.05	0.57
1:D:509:GLU:HG3	7:D:984:HOH:O	2.04	0.56
1:A:459:ARG:HB3	1:A:460:PRO:HD3	1.88	0.56
1:A:843:ARG:NH1	7:A:1364:HOH:O	2.40	0.55
1:D:315:LYS:HG3	7:D:978:HOH:O	2.09	0.53
1:D:500:LEU:HA	1:D:503:MET:HE3	1.90	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:9:DC:H2'	7:F:1621:HOH:O	2.08	0.53
1:A:692:VAL:HB	1:A:696:GLU:HB2	1.90	0.53
1:D:653:ASP:OD2	7:D:1695:HOH:O	2.19	0.53
1:A:325:GLU:H	1:A:325:GLU:CD	2.16	0.53
1:D:748:ARG:HD3	7:D:1097:HOH:O	2.10	0.51
1:A:504:GLY:HA2	1:A:588:ILE:HD12	1.91	0.51
1:D:658:GLU:CD	4:D:202:DDS:H2'A	2.35	0.50
3:F:9:DC:H2''	3:F:10:DA:C8	2.47	0.50
1:A:693:SER:C	1:A:695:ASP:H	2.20	0.49
1:D:744:PRO:O	1:D:748:ARG:HG3	2.12	0.49
1:D:558:ALA:O	1:D:562:GLU:HG3	2.12	0.49
1:D:847:LEU:C	1:D:847:LEU:HD23	2.38	0.49
1:A:304:ALA:CB	1:A:311:MET:HE1	2.43	0.49
1:A:325:GLU:OE1	1:A:435:ARG:NH1	2.30	0.48
1:A:440:GLU:HB3	1:A:441:PRO:HD3	1.95	0.48
1:A:411:ALA:O	1:A:415:LYS:HG2	2.14	0.47
1:A:687:MET:HE2	1:A:694:GLU:HG3	1.96	0.47
1:A:825:LEU:HD11	1:A:835:GLU:HB3	1.96	0.47
1:A:670:ASN:ND2	1:A:742:SER:O	2.48	0.47
1:D:820:LEU:HD21	1:D:843:ARG:CZ	2.45	0.47
1:A:683:THR:O	1:A:687:MET:HG3	2.15	0.46
1:D:866:TYR:HE1	7:D:1057:HOH:O	1.99	0.46
1:A:415:LYS:NZ	1:A:420:GLU:OE2	2.49	0.46
1:A:381:LYS:NZ	7:A:1633:HOH:O	2.48	0.46
1:D:692:VAL:HG21	1:D:701:MET:HE1	1.97	0.45
1:A:767:LEU:HG	1:A:802:ASP:HB3	1.98	0.45
1:D:329:ASP:H	1:D:382:TRP:CD1	2.34	0.45
1:A:680:ASP:HB3	1:A:683:THR:OG1	2.17	0.45
1:A:668:ASP:OD1	1:A:745:GLY:N	2.50	0.45
1:A:814:ARG:HG2	7:A:1350:HOH:O	2.15	0.45
1:A:700:ASN:ND2	7:A:1437:HOH:O	2.51	0.44
1:A:692:VAL:HG21	1:A:701:MET:HE1	1.99	0.43
1:A:767:LEU:O	1:A:768:HIS:HB2	2.18	0.43
1:D:645:SER:O	1:D:646:ASP:HB2	2.18	0.43
1:D:757:ALA:HB3	1:D:776:ILE:HD13	2.01	0.43
1:A:711:GLY:HA2	3:C:3:DT:C2	2.53	0.43
1:D:423:ARG:HG2	1:D:423:ARG:HH11	1.84	0.42
1:D:534:LEU:HD11	1:D:574:ILE:HD13	2.00	0.42
1:A:503:MET:HE1	1:A:635:LYS:O	2.19	0.42
1:A:689:ILE:HD11	1:A:708:VAL:HG11	2.01	0.42
1:A:843:ARG:HD3	7:A:1053:HOH:O	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:687:MET:SD	1:A:694:GLU:HB2	2.60	0.42
1:A:329:ASP:H	1:A:382:TRP:CD1	2.37	0.42
1:D:298:LYS:CD	7:D:1066:HOH:O	2.68	0.42
1:D:691:GLN:OE1	1:D:691:GLN:HA	2.19	0.42
1:A:429:TYR:O	1:A:435:ARG:HA	2.19	0.42
1:A:468:ASN:O	1:A:469:GLU:HB2	2.20	0.41
1:A:534:LEU:HD11	1:A:574:ILE:HD13	2.01	0.41
3:F:11:DG:OP1	7:F:566:HOH:O	2.21	0.41
1:D:306:ARG:NH2	7:D:1495:HOH:O	2.47	0.41
1:A:734:GLU:HG2	7:A:949:HOH:O	2.20	0.41
1:A:794:THR:N	1:A:795:PRO:CD	2.83	0.41
1:A:684:LYS:HA	1:A:687:MET:HE3	2.03	0.41
1:D:302:THR:HG21	7:D:1488:HOH:O	2.20	0.41
1:D:500:LEU:HD12	1:D:503:MET:HE3	2.03	0.41
1:D:712:ILE:HA	1:D:716:ILE:HG22	2.02	0.41
1:A:738:ARG:NE	7:A:1502:HOH:O	2.54	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
7:A:1190:HOH:O	7:D:947:HOH:O[4_445]	2.12	0.08

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	579/592 (98%)	563 (97%)	15 (3%)	1 (0%)	43	25
1	D	589/592 (100%)	577 (98%)	11 (2%)	1 (0%)	43	25
All	All	1168/1184 (99%)	1140 (98%)	26 (2%)	2 (0%)	43	25

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	694	GLU
1	D	628	ILE

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	497/507 (98%)	495 (100%)	2 (0%)	84	75
1	D	507/507 (100%)	505 (100%)	2 (0%)	84	75
All	All	1004/1014 (99%)	1000 (100%)	4 (0%)	84	75

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	588	ILE
1	A	681	ILE
1	D	303	LEU
1	D	632	GLU

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	516	GLN
1	A	579	GLN
1	D	418	GLN
1	D	704	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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	$\# Z > 2$
2	2DA	E	29	2,3	19,22,23	0.35	0	25,31,34	0.84	1 (4%)
2	2DA	B	29	2,3	19,22,23	0.31	0	25,31,34	0.79	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	2DA	E	29	2,3	-	0/7/18/19	0/3/3/3
2	2DA	B	29	2,3	-	0/7/18/19	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($^{\circ}$)	Ideal($^{\circ}$)
2	E	29	2DA	C3'-C2'-C1'	-2.64	99.83	102.87

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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 7 ligands modelled in this entry, 2 are monoatomic - leaving 5 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
6	SO4	A	2	-	4,4,4	0.30	0	6,6,6	0.22	0
6	SO4	D	1	-	4,4,4	0.24	0	6,6,6	0.41	0
4	DDS	D	202	5	30,31,31	1.22	3 (10%)	42,48,48	1.92	9 (21%)
4	DDS	A	201	5	30,31,31	1.50	6 (20%)	42,48,48	2.46	16 (38%)
6	SO4	D	3	-	4,4,4	0.23	0	6,6,6	0.10	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	DDS	A	201	5	-	5/22/31/31	0/3/3/3
4	DDS	D	202	5	-	6/22/31/31	0/3/3/3

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	201	DDS	C6-N6	4.24	1.45	1.34
4	D	202	DDS	C6-N6	3.35	1.42	1.34
4	A	201	DDS	PA-O3A	-2.68	1.56	1.59
4	A	201	DDS	C3'-C2'	-2.31	1.47	1.54
4	D	202	DDS	C8-N7	2.29	1.36	1.31
4	D	202	DDS	C3'-C2'	-2.25	1.47	1.54
4	A	201	DDS	O4'-C4'	-2.12	1.40	1.44
4	A	201	DDS	C4-N9	-2.07	1.33	1.37
4	A	201	DDS	O4'-C1'	2.05	1.46	1.42

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	201	DDS	N3-C2-N1	-6.03	119.46	128.58
4	A	201	DDS	O4'-C1'-N9	5.83	118.44	107.96
4	A	201	DDS	C5-C4-N3	-4.86	120.03	126.72
4	D	202	DDS	C5-C4-N3	-4.81	120.09	126.72
4	D	202	DDS	N3-C2-N1	-4.79	121.33	128.58
4	A	201	DDS	N9-C8-N7	-4.30	107.83	113.94
4	A	201	DDS	C2-N3-C4	3.96	121.50	111.83
4	A	201	DDS	O2B-PB-O3B	3.93	117.91	107.27
4	D	202	DDS	N9-C8-N7	-3.71	108.67	113.94
4	A	201	DDS	C2'-C1'-N9	-3.66	105.60	112.48
4	D	202	DDS	C2-N3-C4	3.49	120.35	111.83
4	A	201	DDS	C4-C5-N7	-3.46	106.62	110.58
4	D	202	DDS	N3-C4-N9	3.44	133.01	127.17
4	A	201	DDS	C5-N7-C8	3.38	108.77	103.45
4	D	202	DDS	C4-N9-C8	3.35	109.25	105.74
4	D	202	DDS	O4'-C1'-N9	3.27	113.83	107.96
4	A	201	DDS	C4-N9-C8	3.22	109.12	105.74
4	A	201	DDS	N3-C4-N9	3.03	132.32	127.17
4	A	201	DDS	O2G-PG-O3B	2.83	114.12	104.64
4	A	201	DDS	O3A-PB-O1B	-2.79	102.31	110.70
4	D	202	DDS	O2B-PB-O3B	2.53	114.11	107.27
4	A	201	DDS	C2-N1-C6	2.31	122.53	118.73
4	A	201	DDS	O2B-PB-O3A	2.19	113.20	107.27
4	A	201	DDS	C6-C5-N7	2.14	136.22	132.09
4	D	202	DDS	C5-N7-C8	2.02	106.62	103.45

There are no chirality outliers.

All (11) torsion outliers are listed below:

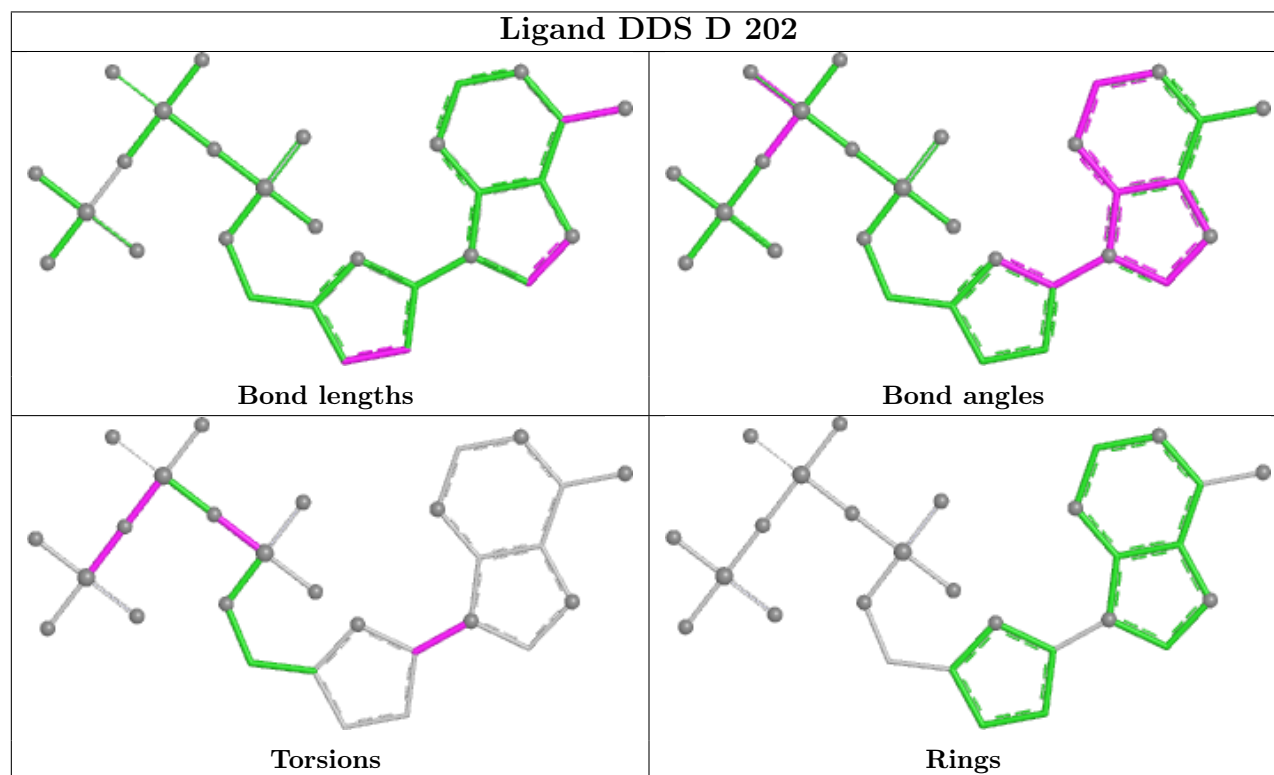
Mol	Chain	Res	Type	Atoms
4	A	201	DDS	PB-O3B-PG-O1G
4	A	201	DDS	PB-O3B-PG-O2G
4	A	201	DDS	PB-O3A-PA-O2A
4	D	202	DDS	PG-O3B-PB-O2B
4	D	202	DDS	PB-O3B-PG-O1G
4	A	201	DDS	PG-O3B-PB-O1B
4	D	202	DDS	PB-O3A-PA-O2A
4	D	202	DDS	O4'-C1'-N9-C8
4	A	201	DDS	PG-O3B-PB-O2B
4	D	202	DDS	PG-O3B-PB-O1B
4	D	202	DDS	C2'-C1'-N9-C8

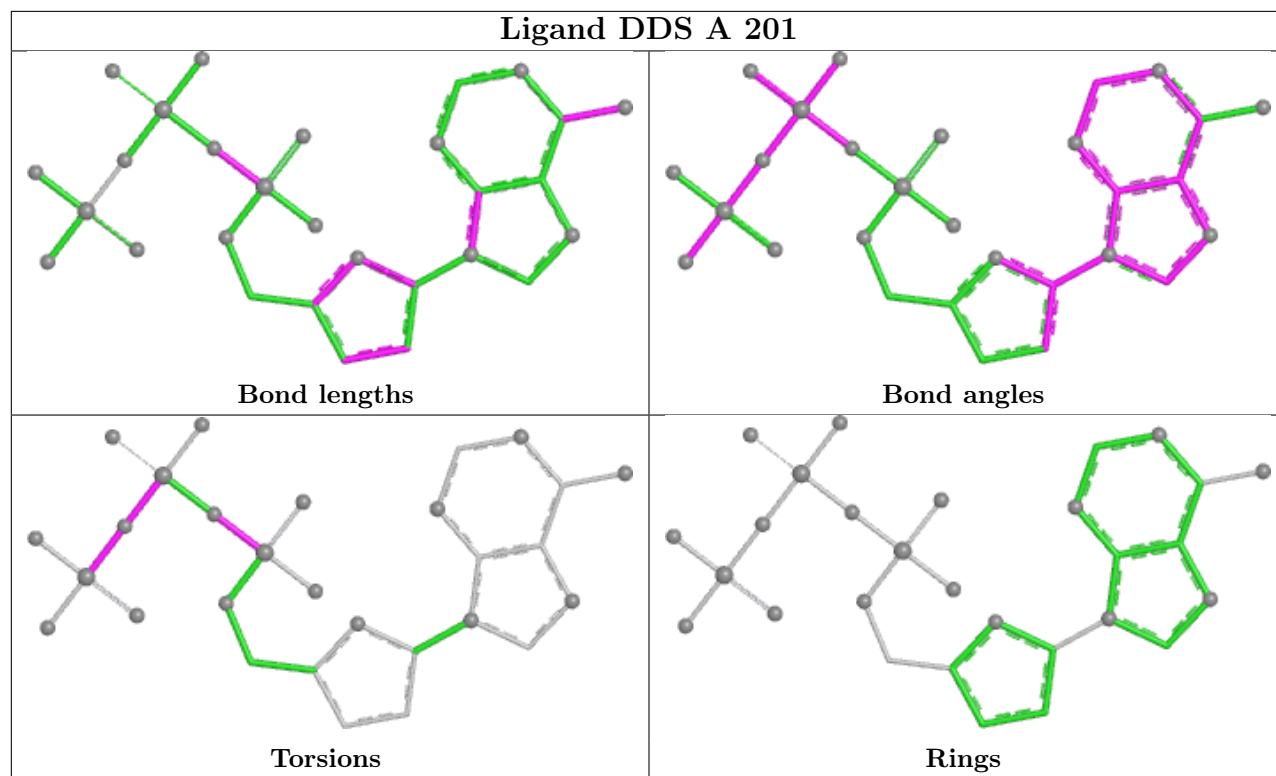
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	D	202	DDS	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 ⓘ

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	579/592 (97%)	0.70	64 (11%) 10 10	9, 32, 54, 62	1 (0%)
1	D	579/592 (97%)	-0.16	7 (1%) 76 81	5, 18, 36, 49	6 (1%)
2	B	8/9 (88%)	-0.41	0 100 100	17, 18, 31, 37	0
2	E	8/9 (88%)	-0.58	0 100 100	10, 17, 31, 38	0
3	C	12/13 (92%)	-0.30	0 100 100	15, 20, 40, 59	0
3	F	12/13 (92%)	-0.36	0 100 100	10, 15, 34, 54	0
All	All	1198/1228 (97%)	0.25	71 (5%) 28 30	5, 24, 50, 62	7 (0%)

All (71) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	671	LEU	3.7
1	A	313	ALA	3.7
1	A	697	VAL	3.6
1	A	689	ILE	3.6
1	A	679	LEU	3.6
1	A	677	ARG	3.5
1	A	672	MET	3.4
1	A	300	ALA	3.4
1	A	692	VAL	3.4
1	A	303	LEU	3.2
1	A	858	LEU	3.2
1	A	739	TYR	3.2
1	A	847	LEU	3.1
1	A	860	VAL	3.1
1	A	675	PHE	3.1
1	A	735	PHE	3.1
1	A	699	PRO	3.0
1	A	690	PHE	2.9
1	A	743	PHE	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	856	VAL	2.7
1	A	866	TYR	2.7
1	D	735	PHE	2.7
1	A	741	GLU	2.7
1	A	668	ASP	2.7
1	A	740	PHE	2.6
1	A	862	LEU	2.6
1	A	857	THR	2.6
1	A	861	PRO	2.6
1	D	505	LYS	2.6
1	D	303	LEU	2.6
1	A	738	ARG	2.6
1	A	819	ARG	2.6
1	A	683	THR	2.5
1	A	674	ALA	2.5
1	A	301	PHE	2.5
1	A	781	PHE	2.5
1	A	681	ILE	2.5
1	A	846	ARG	2.5
1	A	766	LEU	2.5
1	A	782	ASN	2.4
1	A	678	ASP	2.4
1	D	781	PHE	2.4
1	A	817	GLU	2.4
1	A	466	ARG	2.4
1	A	687	MET	2.4
1	A	750	MET	2.3
1	A	680	ASP	2.3
1	A	814	ARG	2.3
1	A	851	VAL	2.3
1	D	779	ARG	2.3
1	A	780	ASN	2.3
1	A	698	THR	2.2
1	A	312	LEU	2.2
1	A	815	LEU	2.2
1	A	695	ASP	2.2
1	D	689	ILE	2.2
1	A	463	ASP	2.2
1	A	669	ASP	2.2
1	A	673	GLU	2.2
1	A	753	ILE	2.2
1	A	774	PRO	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	356	GLN	2.2
1	A	670	ASN	2.2
1	A	813	ALA	2.1
1	A	419	TYR	2.1
1	A	304	ALA	2.1
1	A	696	GLU	2.1
1	A	686	ALA	2.1
1	D	692	VAL	2.1
1	A	455	TRP	2.1
1	A	298	LYS	2.1

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, 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(\AA^2)	Q<0.9
2	2DA	B	29	20/21	0.97	0.06	13,19,24,28	0
2	2DA	E	29	20/21	0.99	0.04	7,9,12,13	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

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

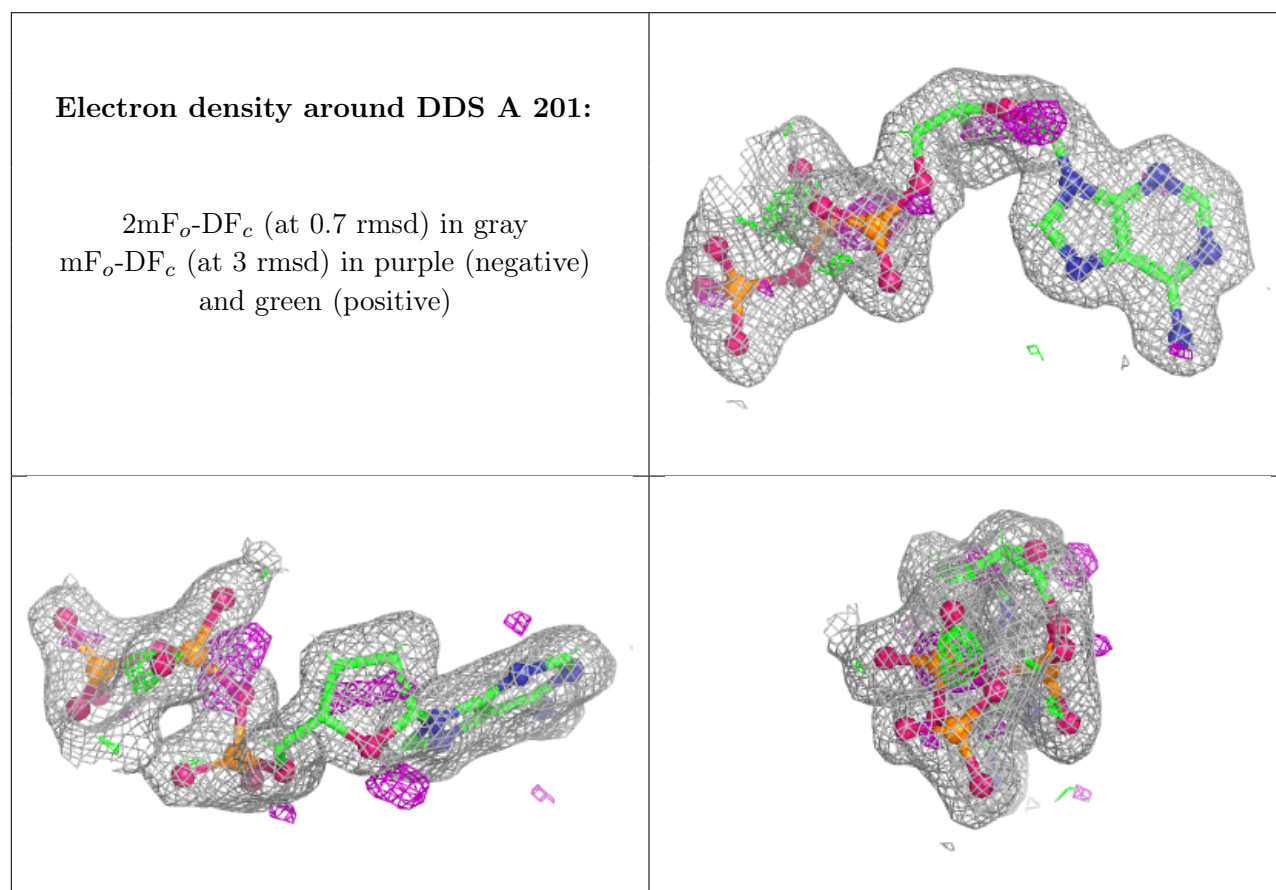
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
6	SO4	D	3	5/5	0.80	0.17	77,80,83,89	0
6	SO4	A	2	5/5	0.90	0.10	35,51,51,55	0
6	SO4	D	1	5/5	0.93	0.12	26,33,42,51	0
5	MG	A	1	1/1	0.93	0.07	26,26,26,26	0
4	DDS	A	201	29/29	0.94	0.08	17,21,27,32	0
4	DDS	D	202	29/29	0.98	0.04	8,11,14,17	0

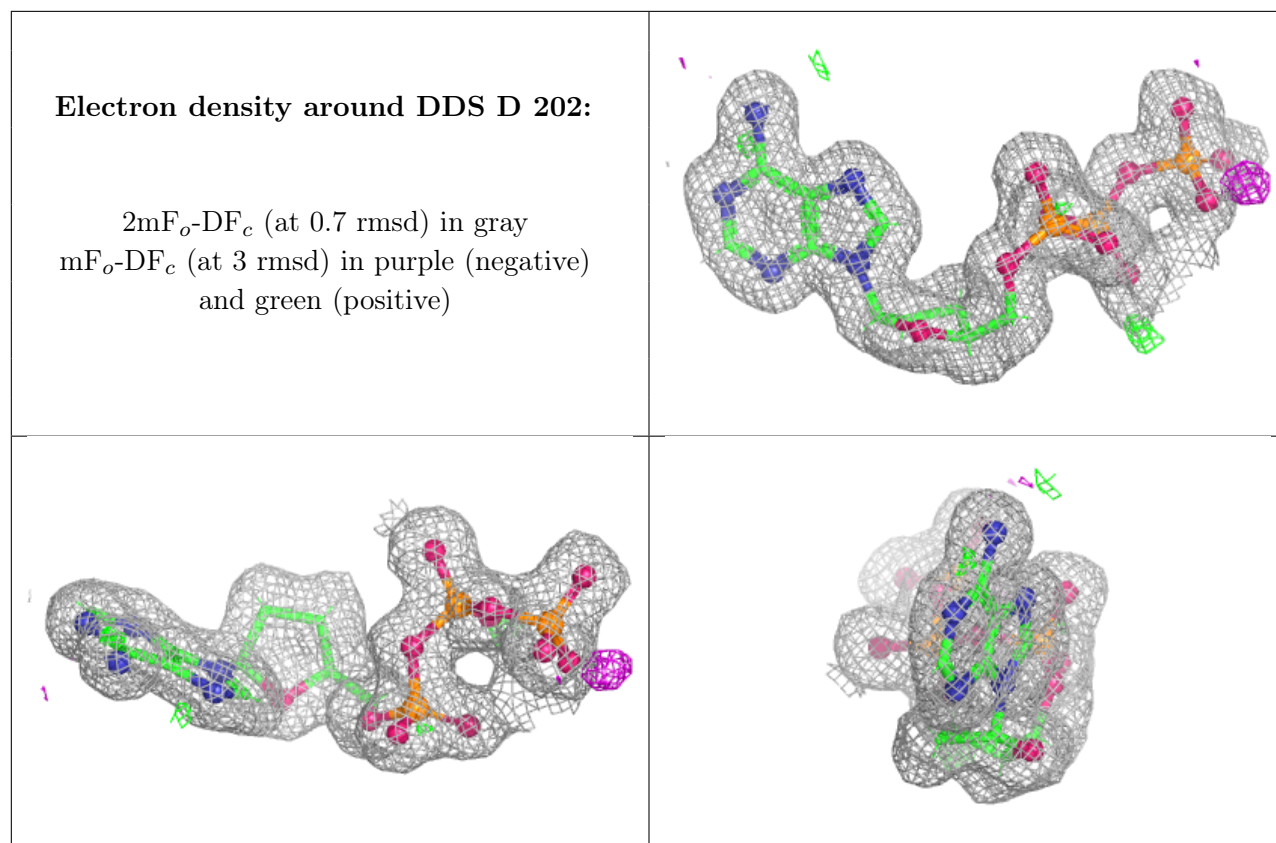
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
5	MG	D	2	1/1	0.99	0.05	13,13,13,13	0

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 ⓘ

There are no such residues in this entry.