



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:01 AM UTC

PDB ID : 2V1X / pdb_00002v1x
Title : Crystal structure of human RECQ-like DNA helicase
Authors : Pike, A.C.W.; Shrestha, B.; Burgess-Brown, N.; King, O.; Ugochukwu, E.; Watt, S.; Edwards, A.; Arrowsmith, C.H.; Weigelt, J.; Sundstrom, M.; Gileadi, O.
Deposited on : 2007-05-30
Resolution : 2.00 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

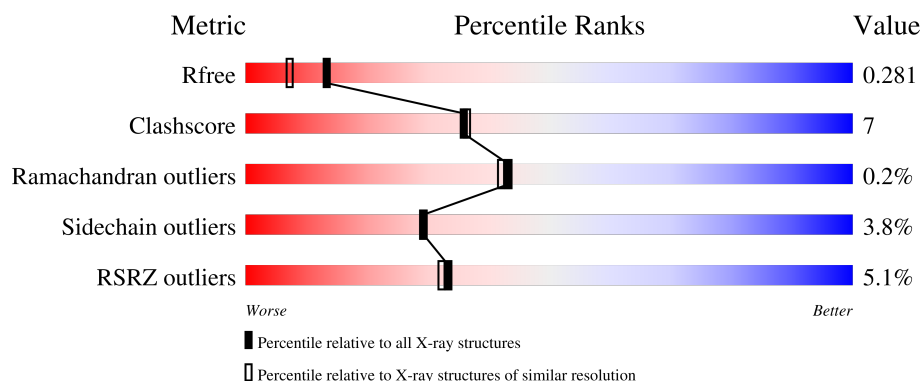
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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	591	4% 72% 16% • 11%
1	B	591	5% 73% 15% • 11%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 8630 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 ATP-DEPENDENT DNA HELICASE Q1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	527	Total	C	N	O	S	0	9	0
			4101	2626	686	755	34			
1	B	527	Total	C	N	O	S	0	13	0
			4139	2648	694	762	35			

There are 46 discrepancies between the modelled and reference sequences:

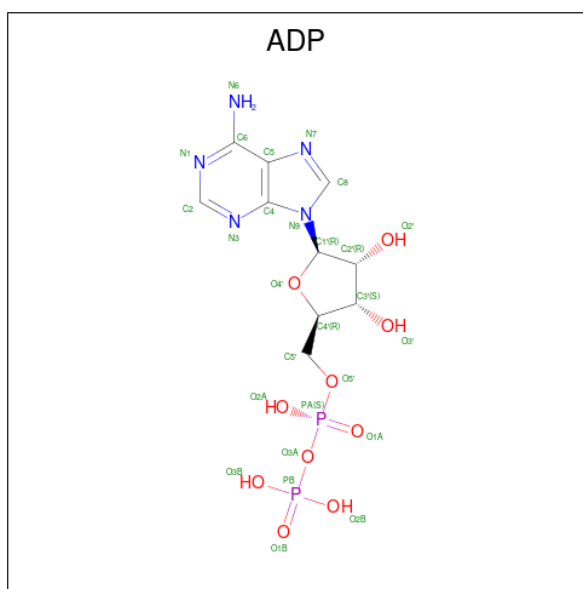
Chain	Residue	Modelled	Actual	Comment	Reference
A	48	MET	-	expression tag	UNP P46063
A	617	ALA	-	expression tag	UNP P46063
A	618	GLU	-	expression tag	UNP P46063
A	619	ASN	-	expression tag	UNP P46063
A	620	LEU	-	expression tag	UNP P46063
A	621	TYR	-	expression tag	UNP P46063
A	622	PHE	-	expression tag	UNP P46063
A	623	GLN	-	expression tag	UNP P46063
A	624	SER	-	expression tag	UNP P46063
A	625	HIS	-	expression tag	UNP P46063
A	626	HIS	-	expression tag	UNP P46063
A	627	HIS	-	expression tag	UNP P46063
A	628	HIS	-	expression tag	UNP P46063
A	629	HIS	-	expression tag	UNP P46063
A	630	HIS	-	expression tag	UNP P46063
A	631	ASP	-	expression tag	UNP P46063
A	632	TYR	-	expression tag	UNP P46063
A	633	LYS	-	expression tag	UNP P46063
A	634	ASP	-	expression tag	UNP P46063
A	635	ASP	-	expression tag	UNP P46063
A	636	ASP	-	expression tag	UNP P46063
A	637	ASP	-	expression tag	UNP P46063
A	638	LYS	-	expression tag	UNP P46063
B	48	MET	-	expression tag	UNP P46063
B	617	ALA	-	expression tag	UNP P46063

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Chain	Residue	Modelled	Actual	Comment	Reference
B	618	GLU	-	expression tag	UNP P46063
B	619	ASN	-	expression tag	UNP P46063
B	620	LEU	-	expression tag	UNP P46063
B	621	TYR	-	expression tag	UNP P46063
B	622	PHE	-	expression tag	UNP P46063
B	623	GLN	-	expression tag	UNP P46063
B	624	SER	-	expression tag	UNP P46063
B	625	HIS	-	expression tag	UNP P46063
B	626	HIS	-	expression tag	UNP P46063
B	627	HIS	-	expression tag	UNP P46063
B	628	HIS	-	expression tag	UNP P46063
B	629	HIS	-	expression tag	UNP P46063
B	630	HIS	-	expression tag	UNP P46063
B	631	ASP	-	expression tag	UNP P46063
B	632	TYR	-	expression tag	UNP P46063
B	633	LYS	-	expression tag	UNP P46063
B	634	ASP	-	expression tag	UNP P46063
B	635	ASP	-	expression tag	UNP P46063
B	636	ASP	-	expression tag	UNP P46063
B	637	ASP	-	expression tag	UNP P46063
B	638	LYS	-	expression tag	UNP P46063

- Molecule 2 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mg	0	0
			1	1		
3	B	1	Total	Mg	0	0
			1	1		

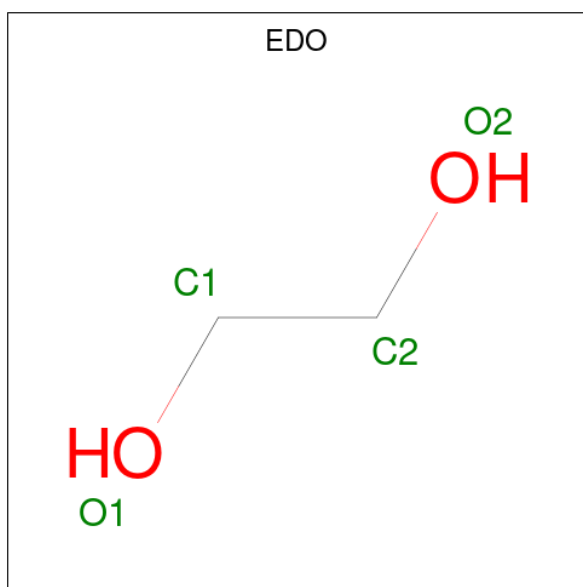
- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Zn	0	0
			1	1		
4	B	1	Total	Zn	0	0
			1	1		

- Molecule 5 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	4	Total	Cl	0	0
			4	4		
5	B	5	Total	Cl	0	0
			5	5		

- Molecule 6 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



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

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	146	Total	O	0	0
			146	146		
7	B	169	Total	O	0	0
			169	169		

- Molecule 1: ATP-DEPENDENT DNA HELICASE Q1



GLU
ALA
GLU
ASN
LEU
TYR
PHE
GLN
SER
HIS
HIS
HIS
HIS
HIS
ASP
TYR
LYS
ASP
ASP
ASP
ASP
LYS

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	83.23Å 97.65Å 85.85Å 90.00° 104.50° 90.00°	Depositor
Resolution (Å)	45.00 – 2.00 45.00 – 2.00	Depositor EDS
% Data completeness (in resolution range)	100.0 (45.00-2.00) 100.0 (45.00-2.00)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.81 (at 2.00Å)	Xtriage
Refinement program	REFMAC 5.3.0037	Depositor
R, R_{free}	0.232 , 0.278 (Not available) , 0.281	Depositor DCC
R_{free} test set	4497 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	34.3	Xtriage
Anisotropy	0.078	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 48.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.52$, $\langle L^2 \rangle = 0.36$	Xtriage
Estimated twinning fraction	0.000 for l,-k,h	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8630	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 47.42 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.9456e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: MG, ZN, EDO, ADP, CL

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	0.80	1/4218 (0.0%)	0.94	1/5713 (0.0%)
1	B	0.80	0/4276	0.96	3/5788 (0.1%)
All	All	0.80	1/8494 (0.0%)	0.95	4/11501 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	569	TYR	C-O	-5.01	1.17	1.23

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	76	SER	N-CA-C	6.25	118.09	111.28
1	B	113	MET	CA-C-N	5.90	125.91	119.89
1	B	113	MET	C-N-CA	5.90	125.91	119.89
1	A	569	TYR	N-CA-C	-5.45	101.08	109.52

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	4101	0	3969	58	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	4139	0	4026	61	0
2	A	27	0	12	0	0
2	B	27	0	12	1	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	4	0	0	1	0
5	B	5	0	0	0	0
6	B	8	0	12	0	0
7	A	146	0	0	4	0
7	B	169	0	0	2	0
All	All	8630	0	8031	120	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 (120) 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:B:144:MET:HE1	1:B:190:THR:HG23	1.45	0.98
1:B:386:VAL:HG23	1:B:405:ALA:HB2	1.64	0.79
1:A:426:ILE:HG21	1:A:440:LEU:HD13	1.67	0.77
1:A:130:SER:O	1:A:185:LYS:NZ	2.18	0.75
1:A:193:LYS:NZ	7:A:2027:HOH:O	2.24	0.71
1:B:144:MET:HE1	1:B:190:THR:CG2	2.20	0.70
1:B:443:MET:HA	1:B:443:MET:HE3	1.75	0.69
1:A:227:TRP:HB2	1:A:261:VAL:HG22	1.76	0.68
1:A:141:ILE:HA	1:A:144:MET:HE2	1.76	0.67
1:A:204:LEU:HD22	1:A:213:PHE:CE2	2.30	0.67
5:A:1599:CL:CL	7:A:2037:HOH:O	2.49	0.66
1:B:500:LEU:HD23	1:B:510:LEU:HD12	1.76	0.66
1:B:426:ILE:HG21	1:B:440:LEU:HD13	1.78	0.65
1:A:103:THR:HG22	1:A:215:ARG:HD3	1.77	0.65
1:B:254:THR:HG21	1:B:257:ALA:HB2	1.78	0.65
1:A:426:ILE:CG2	1:A:440:LEU:HD13	2.28	0.64
1:B:360:TRP:O	1:B:380[A]:LYS:NZ	2.29	0.64
1:B:82:ILE:HD12	1:B:129:CYS:SG	2.41	0.60
1:B:137:ILE:HD12	1:B:137:ILE:N	2.16	0.60
1:B:428:SER:OG	1:B:568[A]:SER:OG	2.19	0.60
1:A:443:MET:HA	1:A:443:MET:HE3	1.84	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:441:TYR:OH	1:B:557:GLU:OE1	2.18	0.58
1:B:141:ILE:HA	1:B:144:MET:HE3	1.86	0.57
1:A:114:PRO:HG3	1:A:281[A]:PHE:CD1	2.40	0.56
1:B:360:TRP:CD1	1:B:368:VAL:HG23	2.41	0.56
1:A:103:THR:O	1:A:215:ARG:NH1	2.40	0.54
1:A:137:ILE:HG21	1:A:238:LEU:HD11	1.90	0.54
1:A:372:VAL:HG12	1:A:401:GLU:OE2	2.08	0.54
1:A:326:ASP:O	1:A:330:VAL:HG23	2.08	0.53
1:B:254:THR:CG2	1:B:257:ALA:HB2	2.38	0.53
1:B:426:ILE:CG2	1:B:440:LEU:HD13	2.38	0.53
1:A:567:ILE:HD11	1:A:569:TYR:OH	2.09	0.53
1:B:257:ALA:HB1	1:B:262:LEU:HD21	1.91	0.53
1:B:130:SER:O	1:B:185:LYS:NZ	2.42	0.52
1:B:125:LEU:HB3	1:B:126:PRO:HD3	1.91	0.52
1:B:496:LEU:HA	1:B:499:ILE:HD12	1.93	0.51
1:A:315:GLN:OE1	7:A:2054:HOH:O	2.19	0.51
1:B:137:ILE:N	1:B:137:ILE:CD1	2.74	0.51
1:A:360:TRP:CD1	1:A:368:VAL:HG23	2.45	0.51
1:B:70:LYS:HG2	1:B:72:ASP:HB2	1.92	0.51
1:B:79:VAL:HG13	1:B:125:LEU:HD21	1.91	0.51
1:B:380[A]:LYS:NZ	7:B:2080:HOH:O	2.44	0.51
1:A:103:THR:CG2	1:A:215:ARG:HD3	2.39	0.50
1:B:519:TRP:CH2	1:B:542:LEU:HD22	2.46	0.50
1:B:257:ALA:HB1	1:B:262:LEU:CD2	2.42	0.49
1:A:70:LYS:HG2	1:A:72:ASP:HB2	1.95	0.49
1:A:96:GLN:O	1:A:100:ILE:HD12	2.11	0.49
1:A:500:LEU:HD23	1:A:510:LEU:HD12	1.94	0.48
1:A:114:PRO:HG3	1:A:281[A]:PHE:CG	2.49	0.48
1:A:497:ILE:HG23	1:A:572:ILE:HG12	1.96	0.48
1:B:191:PRO:HG3	1:B:235:TYR:CE2	2.48	0.48
1:A:380:LYS:NZ	1:A:382:ASP:OD1	2.42	0.47
1:B:114:PRO:HG3	1:B:281[A]:PHE:CD1	2.49	0.47
1:B:114:PRO:HG3	1:B:281[A]:PHE:CG	2.49	0.47
1:A:502:GLN:OE1	7:A:2101:HOH:O	2.20	0.47
1:A:126:PRO:O	1:A:127:ALA:C	2.58	0.46
1:A:300:PHE:CE2	1:A:389:HIS:CD2	3.04	0.46
1:A:112:VAL:CG1	1:A:257:ALA:HB3	2.45	0.46
1:B:395:MET:SD	1:B:443:MET:HE3	2.55	0.46
1:B:112:VAL:HA	1:B:254:THR:O	2.16	0.46
1:A:258:THR:HB	1:A:261:VAL:HG23	1.98	0.45
1:A:407:ARG:HD3	1:A:407:ARG:HA	1.81	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:567:ILE:HD11	1:B:569:TYR:OH	2.16	0.45
1:A:408:ASP:O	1:A:409:ASP:HB2	2.16	0.45
1:A:535:PRO:HB2	1:A:537:LEU:HG	1.98	0.45
1:B:89:LEU:HD22	2:B:1593:ADP:C2	2.51	0.45
1:B:301:ILE:O	1:B:305:VAL:HG23	2.17	0.45
1:A:317:GLY:HA2	1:A:383:VAL:HG13	1.99	0.45
1:B:191:PRO:HB2	1:B:234:ASP:HB3	1.99	0.45
1:A:78:LYS:HG2	1:A:82:ILE:HD12	1.99	0.44
1:B:443:MET:HA	1:B:443:MET:CE	2.47	0.44
1:A:395:MET:SD	1:A:443:MET:HE3	2.57	0.44
1:B:179:ASN:OD1	1:B:179:ASN:C	2.61	0.44
1:A:225:SER:HB3	1:A:261:VAL:HG13	1.98	0.44
1:B:544:LYS:NZ	7:B:2146:HOH:O	2.47	0.44
1:B:120:SER:OG	1:B:147:GLN:NE2	2.28	0.44
1:A:137:ILE:HD12	1:A:137:ILE:N	2.32	0.44
1:A:360:TRP:CG	1:A:368:VAL:CG2	3.01	0.44
1:B:132:GLY:HA2	1:B:212[B]:ARG:NH2	2.33	0.44
1:A:148:LEU:HD11	1:A:160:MET:HB3	1.99	0.44
1:B:397:ASN:O	1:B:401:GLU:HG3	2.18	0.44
1:A:367:VAL:HG22	1:A:385:PHE:HZ	1.83	0.43
1:A:250:LEU:HD22	1:A:271:ILE:HD11	1.99	0.43
1:A:84:GLN:HA	1:A:89:LEU:O	2.17	0.43
1:B:360:TRP:CG	1:B:368:VAL:HG23	2.53	0.43
1:B:562:THR:O	1:B:563:ALA:C	2.61	0.43
1:A:227:TRP:CD1	1:A:227:TRP:N	2.87	0.43
1:B:502:GLN:NE2	1:B:526:LYS:O	2.52	0.43
1:B:149:MET:HE3	1:B:149:MET:HA	2.00	0.43
1:B:217:ALA:HA	1:B:251:ILE:HG23	2.01	0.43
1:B:224:CYS:HA	1:B:235:TYR:HB3	2.01	0.43
1:B:516:ILE:HG21	1:B:539:ARG:NH2	2.33	0.42
1:A:112:VAL:HG11	1:A:257:ALA:HB3	2.01	0.42
1:B:496:LEU:HD22	1:B:515:LEU:HG	2.01	0.42
1:B:343:ALA:HA	1:B:369:VAL:O	2.19	0.42
1:B:501:LYS:O	1:B:504:GLU:HG2	2.20	0.42
1:A:216:ILE:HD13	1:A:241:LEU:HB3	2.01	0.42
1:A:113:MET:HE3	1:A:113:MET:HB2	1.92	0.41
1:A:562:THR:O	1:A:563:ALA:C	2.63	0.41
1:B:407:ARG:HD3	1:B:407:ARG:HA	1.91	0.41
1:A:64:SER:HB2	1:A:65:PRO:HD2	2.02	0.41
1:B:120:SER:O	1:B:121:LEU:C	2.62	0.41
1:A:166:SER:O	1:A:170:VAL:HG23	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:64:SER:HB2	1:B:65:PRO:CD	2.51	0.41
1:B:487:LYS:HZ1	1:B:537:LEU:HD11	1.86	0.41
1:A:257:ALA:HB1	1:A:262:LEU:HD11	2.03	0.41
1:B:95:LEU:HD12	1:B:279:ALA:HB2	2.02	0.41
1:B:257:ALA:HB1	1:B:262:LEU:HG	2.02	0.41
1:B:290:VAL:HG22	1:B:416:LEU:HB3	2.03	0.41
1:A:113:MET:O	1:A:119:LYS:NZ	2.48	0.40
1:A:228:GLY:O	1:A:230:ASP:N	2.54	0.40
1:A:254:THR:HG23	1:A:257:ALA:HB2	2.04	0.40
1:A:441:TYR:OH	1:A:557:GLU:OE1	2.28	0.40
1:A:519:TRP:O	1:A:534:ALA:HB2	2.21	0.40
1:B:113:MET:HA	1:B:114:PRO:HD3	1.94	0.40
1:B:257:ALA:CB	1:B:262:LEU:HD21	2.51	0.40
1:A:311:ARG:HD2	1:A:312:TYR:CZ	2.56	0.40
1:A:384:ARG:HH21	1:A:384:ARG:HG2	1.85	0.40
1:A:102:VAL:HG11	1:A:109:VAL:HB	2.02	0.40
1:B:446:TYR:CZ	1:B:454:ARG:HD2	2.56	0.40

There are no symmetry-related clashes.

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	532/591 (90%)	509 (96%)	22 (4%)	1 (0%)	43	42
1	B	536/591 (91%)	523 (98%)	12 (2%)	1 (0%)	43	42
All	All	1068/1182 (90%)	1032 (97%)	34 (3%)	2 (0%)	43	42

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	375	GLY

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Mol	Chain	Res	Type
1	A	375	GLY

5.3.2 Protein sidechains ⓘ

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	425/520 (82%)	408 (96%)	17 (4%)	28	27
1	B	436/520 (84%)	417 (96%)	19 (4%)	25	24
All	All	861/1040 (83%)	825 (96%)	36 (4%)	29	25

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	100	ILE
1	A	130	SER
1	A	165	SER
1	A	212[A]	ARG
1	A	212[B]	ARG
1	A	227	TRP
1	A	253	LEU
1	A	361	SER
1	A	390	SER
1	A	427	SER
1	A	429[A]	MET
1	A	429[B]	MET
1	A	439	LYS
1	A	443	MET
1	A	458	MET
1	A	461	HIS
1	A	513	LEU
1	B	90	GLU
1	B	113	MET
1	B	137	ILE
1	B	162	ASN
1	B	178	VAL

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Mol	Chain	Res	Type
1	B	212[A]	ARG
1	B	212[B]	ARG
1	B	214[A]	THR
1	B	214[B]	THR
1	B	253	LEU
1	B	268	ILE
1	B	367	VAL
1	B	427	SER
1	B	429	MET
1	B	434	ASN
1	B	443	MET
1	B	490	THR
1	B	516	ILE
1	B	577	ASN

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	347	ASN
1	A	366	GLN
1	A	502	GLN
1	B	147	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 17 ligands modelled in this entry, 13 are monoatomic - leaving 4 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	EDO	B	1602	-	3,3,3	0.48	0	2,2,2	0.28	0
6	EDO	B	1601	-	3,3,3	0.55	0	2,2,2	0.08	0
2	ADP	A	1593	3	28,29,29	1.45	5 (17%)	43,45,45	1.90	10 (23%)
2	ADP	B	1593	3	28,29,29	1.43	4 (14%)	43,45,45	1.98	9 (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
6	EDO	B	1602	-	-	0/1/1/1	-
6	EDO	B	1601	-	-	1/1/1/1	-
2	ADP	A	1593	3	-	2/16/32/32	0/3/3/3
2	ADP	B	1593	3	-	2/16/32/32	0/3/3/3

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1593	ADP	C5-C4	4.52	1.47	1.39
2	B	1593	ADP	C5-C4	4.45	1.47	1.39
2	B	1593	ADP	C5-C6	3.13	1.49	1.41
2	B	1593	ADP	C5-N7	-2.72	1.34	1.39
2	A	1593	ADP	C5-N7	-2.63	1.34	1.39
2	A	1593	ADP	C5-C6	2.47	1.47	1.41
2	A	1593	ADP	C8-N7	2.23	1.36	1.31
2	A	1593	ADP	C4-N9	-2.19	1.33	1.37
2	B	1593	ADP	C8-N7	2.14	1.35	1.31

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1593	ADP	C5-C4-N3	-6.63	117.59	126.72

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1593	ADP	C5-C4-N3	-5.71	118.86	126.72
2	B	1593	ADP	N3-C4-N9	5.44	136.42	127.17
2	A	1593	ADP	N3-C4-N9	4.98	135.63	127.17
2	B	1593	ADP	C2-N3-C4	4.34	122.43	111.83
2	A	1593	ADP	N3-C2-N1	-3.89	122.69	128.58
2	A	1593	ADP	C2-N3-C4	3.84	121.22	111.83
2	B	1593	ADP	N3-C2-N1	-3.61	123.11	128.58
2	A	1593	ADP	C4-N9-C8	3.22	109.12	105.74
2	B	1593	ADP	C4-C5-N7	-3.06	107.08	110.58
2	A	1593	ADP	C4-C5-N7	-2.65	107.55	110.58
2	B	1593	ADP	C5-N7-C8	2.49	107.36	103.45
2	B	1593	ADP	C4-N9-C8	2.48	108.34	105.74
2	A	1593	ADP	O3B-PB-O2B	2.47	117.06	107.80
2	B	1593	ADP	O2A-PA-O1A	2.34	123.33	112.44
2	A	1593	ADP	C5-N7-C8	2.23	106.95	103.45
2	A	1593	ADP	N9-C8-N7	-2.16	110.88	113.94
2	B	1593	ADP	C6-C5-N7	2.12	136.17	132.09
2	A	1593	ADP	O3A-PB-O1B	-2.02	100.39	111.04

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1593	ADP	PA-O3A-PB-O2B
2	B	1593	ADP	PA-O3A-PB-O2B
6	B	1601	EDO	O1-C1-C2-O2
2	A	1593	ADP	PA-O3A-PB-O3B
2	B	1593	ADP	PA-O3A-PB-O3B

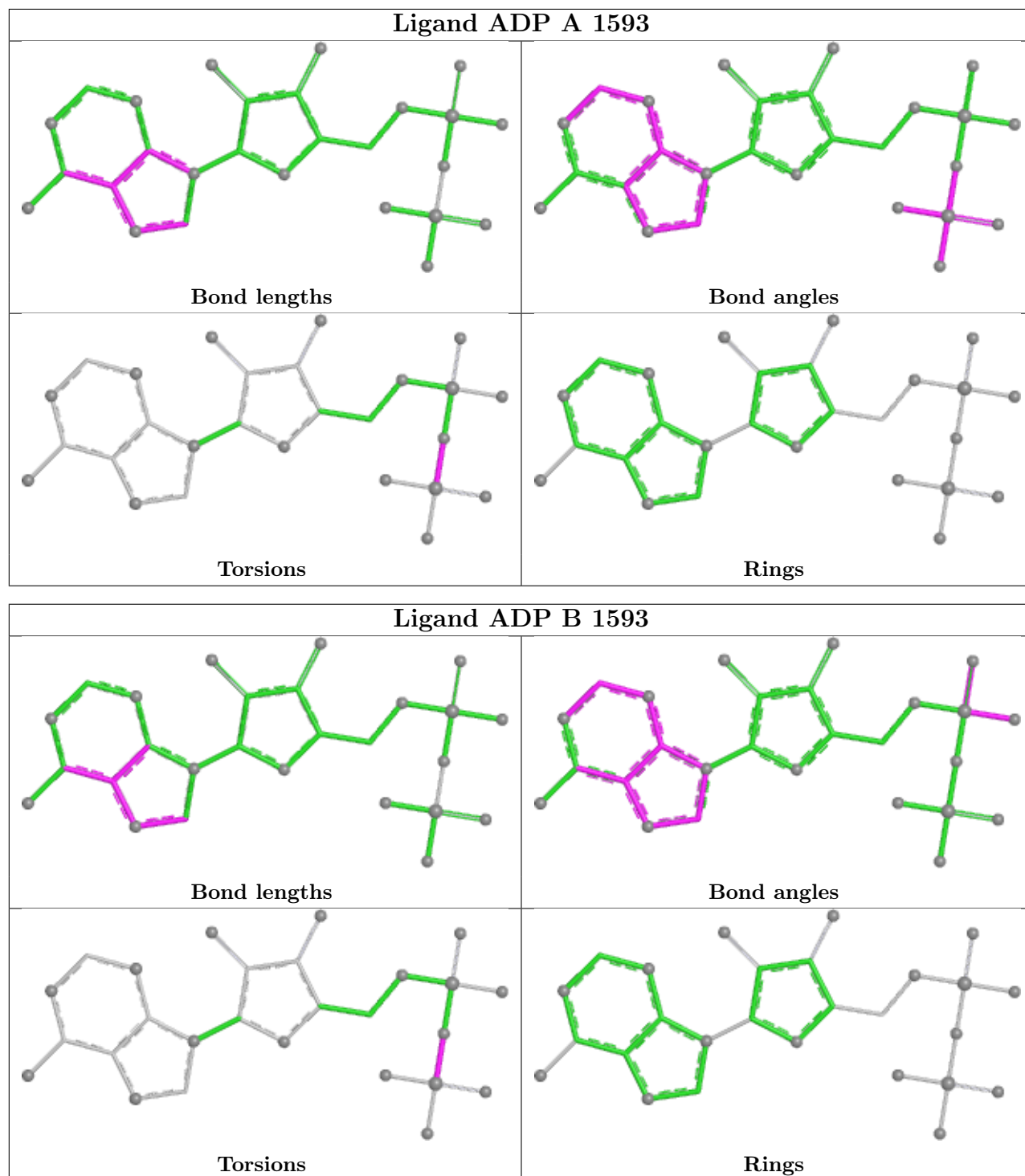
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1593	ADP	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	527/591 (89%)	0.47	26 (4%) 35 34	17, 41, 70, 94	9 (1%)
1	B	527/591 (89%)	0.47	28 (5%) 32 31	17, 39, 67, 86	13 (2%)
All	All	1054/1182 (89%)	0.47	54 (5%) 33 32	17, 40, 69, 94	22 (2%)

All (54) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	227	TRP	5.3
1	A	281[A]	PHE	5.3
1	A	227	TRP	5.0
1	B	226	GLN	4.6
1	A	229	HIS	4.5
1	B	281[A]	PHE	4.2
1	A	466	TRP	4.1
1	A	231	PHE	3.8
1	A	228	GLY	3.6
1	B	178	VAL	3.6
1	B	231	PHE	3.6
1	A	465	VAL	3.5
1	A	260	HIS	3.5
1	B	260	HIS	3.3
1	B	229	HIS	3.2
1	B	583	ALA	3.2
1	B	297	THR	3.2
1	A	226	GLN	3.2
1	B	465	VAL	3.1
1	B	534	ALA	3.1
1	B	466	TRP	3.1
1	A	230	ASP	3.1
1	B	181	ASN	3.0
1	B	232[A]	ARG	3.0

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Mol	Chain	Res	Type	RSRZ
1	B	228	GLY	2.9
1	A	258	THR	2.9
1	B	224	CYS	2.8
1	B	462	PHE	2.8
1	A	225	SER	2.7
1	A	261	VAL	2.7
1	B	261	VAL	2.7
1	B	470	ALA	2.6
1	A	564	TYR	2.6
1	A	232	ARG	2.5
1	B	162	ASN	2.4
1	A	364	GLU	2.4
1	B	472	ASN	2.3
1	B	305	VAL	2.3
1	A	272	GLU	2.3
1	B	63	SER	2.3
1	B	225	SER	2.2
1	B	163	ALA	2.2
1	A	233	PRO	2.2
1	A	224	CYS	2.2
1	A	417	TYR	2.2
1	B	564	TYR	2.2
1	A	434	ASN	2.2
1	A	338	GLY	2.2
1	B	257	ALA	2.2
1	A	168	GLU	2.1
1	A	153	GLN	2.1
1	A	63	SER	2.1
1	B	461	HIS	2.1
1	A	470	ALA	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

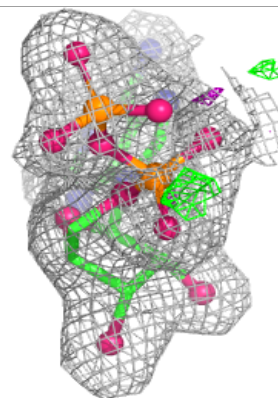
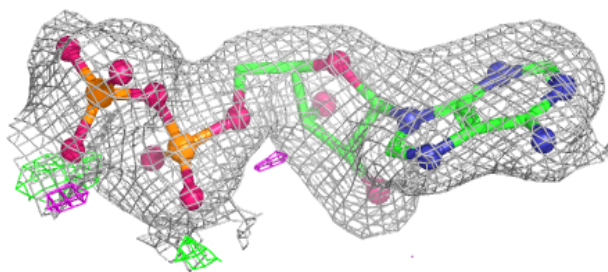
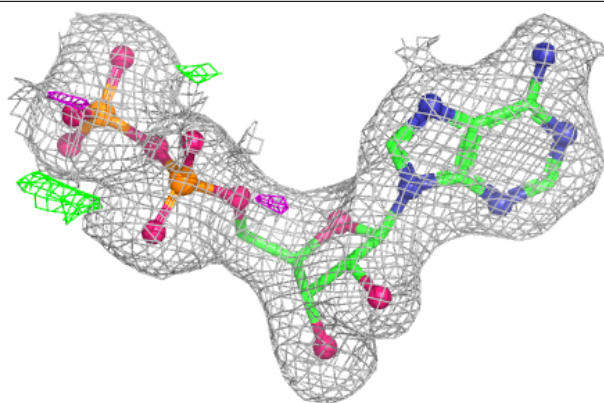
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	EDO	B	1601	4/4	0.87	0.16	32,36,39,45	0
6	EDO	B	1602	4/4	0.91	0.12	22,36,37,44	0
3	MG	A	1594	1/1	0.92	0.07	42,42,42,42	0
5	CL	A	1597	1/1	0.94	0.07	54,54,54,54	0
5	CL	B	1600	1/1	0.94	0.13	50,50,50,50	0
5	CL	A	1596	1/1	0.95	0.09	54,54,54,54	0
5	CL	A	1599	1/1	0.95	0.17	45,45,45,45	0
5	CL	B	1597	1/1	0.95	0.09	51,51,51,51	0
2	ADP	A	1593	27/27	0.96	0.07	16,39,45,48	0
3	MG	B	1594	1/1	0.97	0.05	38,38,38,38	0
2	ADP	B	1593	27/27	0.97	0.06	10,32,40,43	0
5	CL	A	1598	1/1	0.98	0.05	41,41,41,41	0
5	CL	B	1598	1/1	0.98	0.06	38,38,38,38	0
5	CL	B	1599	1/1	0.98	0.04	34,34,34,34	0
4	ZN	A	1595	1/1	0.99	0.03	43,43,43,43	0
4	ZN	B	1595	1/1	0.99	0.03	43,43,43,43	0
5	CL	B	1596	1/1	1.00	0.05	37,37,37,37	0

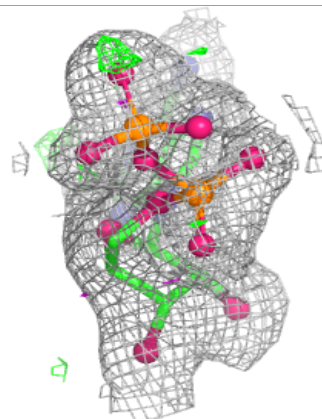
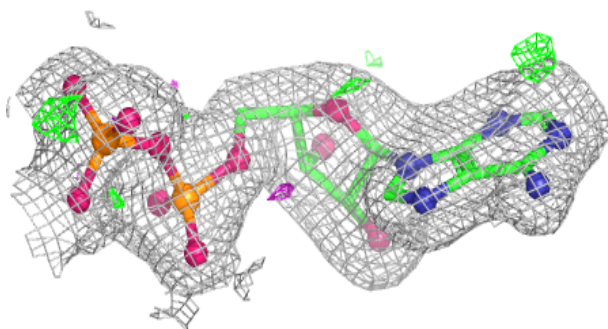
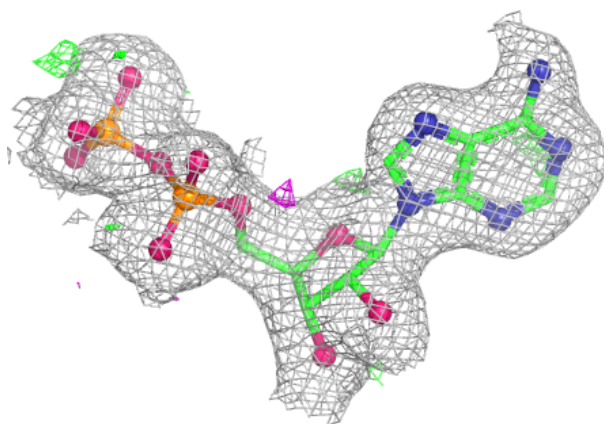
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around ADP A 1593:

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

**Electron density around ADP B 1593:**

$2mF_o-DF_c$ (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.