



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 05:11 PM EDT

PDB ID : 3GGS / pdb_00003ggs
Title : Human purine nucleoside phosphorylase double mutant E201Q,N243D complexed with 2-fluoro-2'-deoxyadenosine
Authors : Sawaya, M.R.; Afshar, S.
Deposited on : 2009-03-02
Resolution : 2.52 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

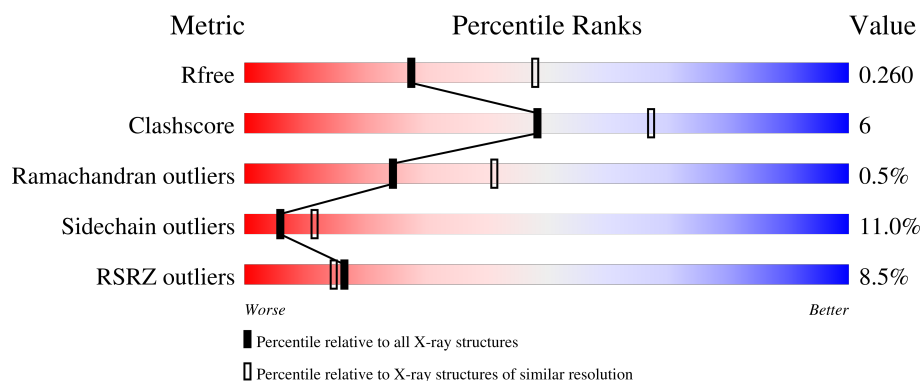
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.52 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	7383 (2.54-2.50)
Clashscore	190562	8079 (2.54-2.50)
Ramachandran outliers	187476	7944 (2.54-2.50)
Sidechain outliers	187428	7946 (2.54-2.50)
RSRZ outliers	180081	7387 (2.54-2.50)

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	311	6% 71% 18% • 9%
1	B	311	7% 77% 12% • 8%
1	C	311	9% 71% 15% • 10%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6904 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 Purine nucleoside phosphorylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	284	Total	C	N	O	S	0	0	0
			2211	1407	386	403	15			
1	B	285	Total	C	N	O	S	0	0	0
			2220	1413	387	404	16			
1	C	279	Total	C	N	O	S	0	0	0
			2183	1389	382	397	15			

There are 72 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-21	LYS	-	expression tag	UNP P00491
A	-20	GLU	-	expression tag	UNP P00491
A	-19	THR	-	expression tag	UNP P00491
A	-18	ALA	-	expression tag	UNP P00491
A	-17	ALA	-	expression tag	UNP P00491
A	-16	ALA	-	expression tag	UNP P00491
A	-15	LYS	-	expression tag	UNP P00491
A	-14	PHE	-	expression tag	UNP P00491
A	-13	GLU	-	expression tag	UNP P00491
A	-12	ARG	-	expression tag	UNP P00491
A	-11	GLN	-	expression tag	UNP P00491
A	-10	HIS	-	expression tag	UNP P00491
A	-9	MET	-	expression tag	UNP P00491
A	-8	ASP	-	expression tag	UNP P00491
A	-7	SER	-	expression tag	UNP P00491
A	-6	GLY	-	expression tag	UNP P00491
A	-5	GLY	-	expression tag	UNP P00491
A	-4	GLY	-	expression tag	UNP P00491
A	-3	GLY	-	expression tag	UNP P00491
A	-2	SER	-	expression tag	UNP P00491
A	-1	GLY	-	expression tag	UNP P00491
A	0	HIS	-	expression tag	UNP P00491
A	201	GLN	GLU	engineered mutation	UNP P00491

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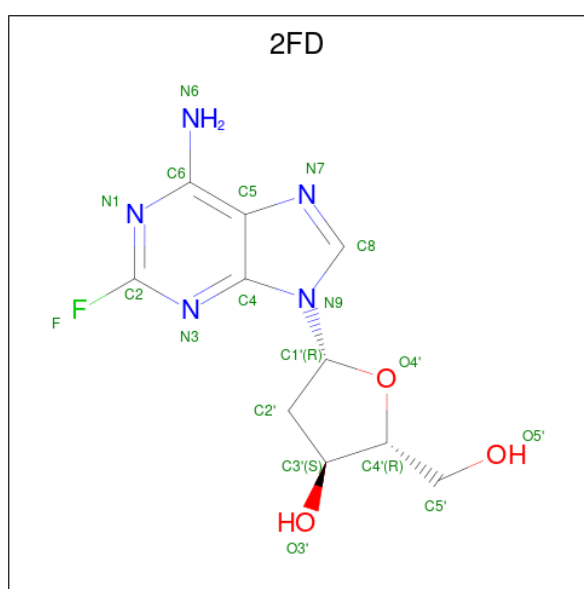
Chain	Residue	Modelled	Actual	Comment	Reference
A	243	ASP	ASN	engineered mutation	UNP P00491
B	-21	LYS	-	expression tag	UNP P00491
B	-20	GLU	-	expression tag	UNP P00491
B	-19	THR	-	expression tag	UNP P00491
B	-18	ALA	-	expression tag	UNP P00491
B	-17	ALA	-	expression tag	UNP P00491
B	-16	ALA	-	expression tag	UNP P00491
B	-15	LYS	-	expression tag	UNP P00491
B	-14	PHE	-	expression tag	UNP P00491
B	-13	GLU	-	expression tag	UNP P00491
B	-12	ARG	-	expression tag	UNP P00491
B	-11	GLN	-	expression tag	UNP P00491
B	-10	HIS	-	expression tag	UNP P00491
B	-9	MET	-	expression tag	UNP P00491
B	-8	ASP	-	expression tag	UNP P00491
B	-7	SER	-	expression tag	UNP P00491
B	-6	GLY	-	expression tag	UNP P00491
B	-5	GLY	-	expression tag	UNP P00491
B	-4	GLY	-	expression tag	UNP P00491
B	-3	GLY	-	expression tag	UNP P00491
B	-2	SER	-	expression tag	UNP P00491
B	-1	GLY	-	expression tag	UNP P00491
B	0	HIS	-	expression tag	UNP P00491
B	201	GLN	GLU	engineered mutation	UNP P00491
B	243	ASP	ASN	engineered mutation	UNP P00491
C	-21	LYS	-	expression tag	UNP P00491
C	-20	GLU	-	expression tag	UNP P00491
C	-19	THR	-	expression tag	UNP P00491
C	-18	ALA	-	expression tag	UNP P00491
C	-17	ALA	-	expression tag	UNP P00491
C	-16	ALA	-	expression tag	UNP P00491
C	-15	LYS	-	expression tag	UNP P00491
C	-14	PHE	-	expression tag	UNP P00491
C	-13	GLU	-	expression tag	UNP P00491
C	-12	ARG	-	expression tag	UNP P00491
C	-11	GLN	-	expression tag	UNP P00491
C	-10	HIS	-	expression tag	UNP P00491
C	-9	MET	-	expression tag	UNP P00491
C	-8	ASP	-	expression tag	UNP P00491
C	-7	SER	-	expression tag	UNP P00491
C	-6	GLY	-	expression tag	UNP P00491
C	-5	GLY	-	expression tag	UNP P00491

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-4	GLY	-	expression tag	UNP P00491
C	-3	GLY	-	expression tag	UNP P00491
C	-2	SER	-	expression tag	UNP P00491
C	-1	GLY	-	expression tag	UNP P00491
C	0	HIS	-	expression tag	UNP P00491
C	201	GLN	GLU	engineered mutation	UNP P00491
C	243	ASP	ASN	engineered mutation	UNP P00491

- Molecule 2 is 5-(6-AMINO-2-FLUORO-PURIN-9-YL)-2-HYDROXYMETHYL-TETRAHYDRO-FURAN-3-OL (CCD ID: 2FD) (formula: $C_{10}H_{12}FN_5O_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	F	N	O	0	0
			19	10	1	5	3		
2	B	1	Total	C	F	N	O	0	0
			19	10	1	5	3		
2	C	1	Total	C	F	N	O	0	0
			19	10	1	5	3		
2	C	1	Total	C	F	N	O	0	0
			19	10	1	5	3		

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0
3	C	1	Total O S 5 4 1	0	0

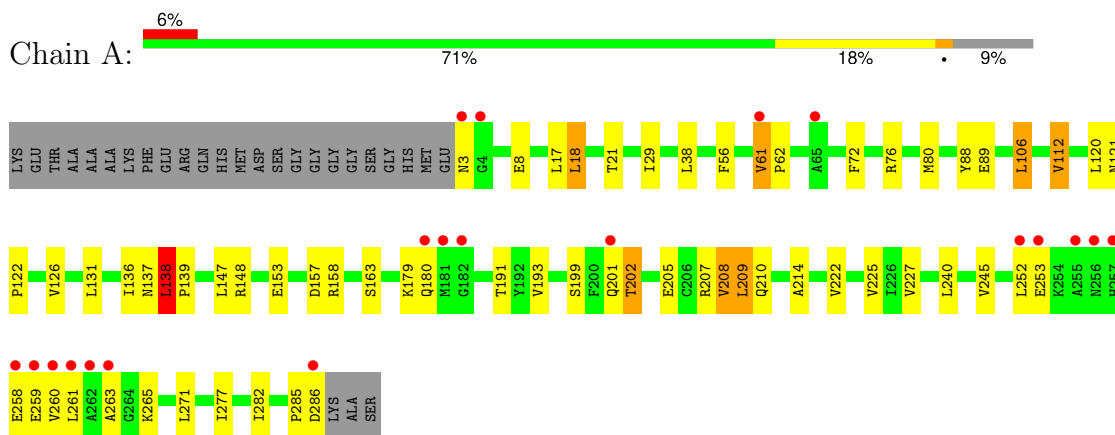
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	25	Total O 25 25	0	0
4	B	19	Total O 19 19	0	0
4	C	20	Total O 20 20	0	0

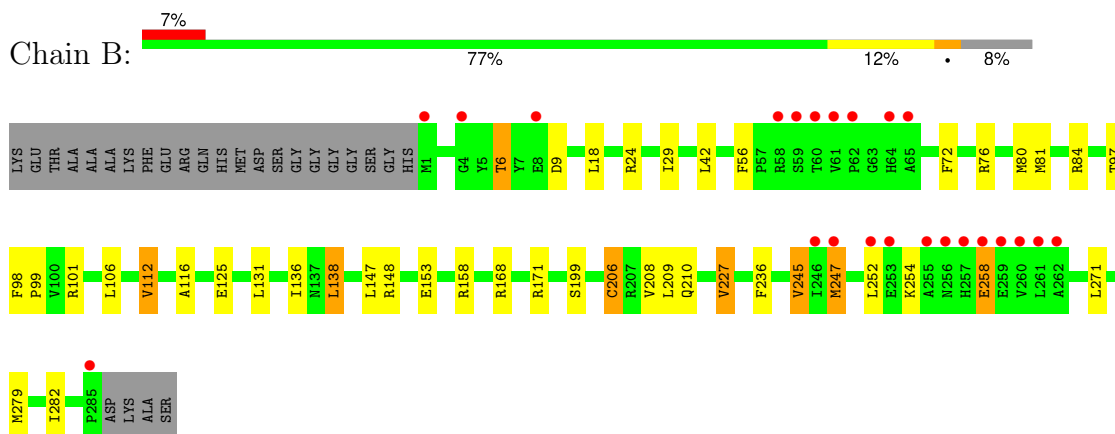
3 Residue-property plots [i](#)

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

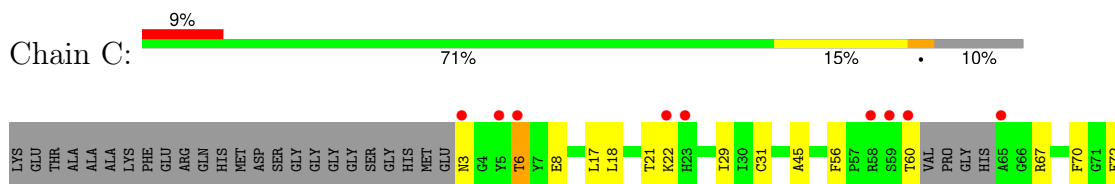
• Molecule 1: Purine nucleoside phosphorylase

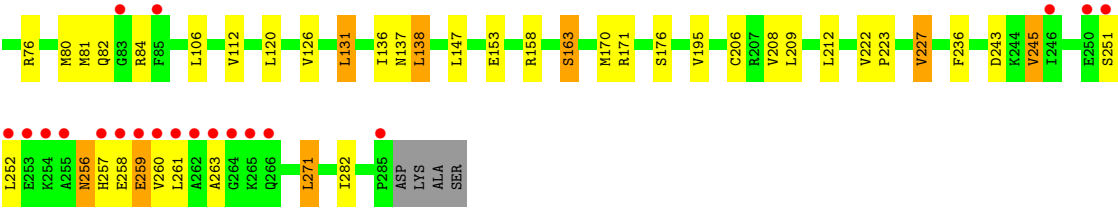


• Molecule 1: Purine nucleoside phosphorylase



• Molecule 1: Purine nucleoside phosphorylase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	71.24Å 130.65Å 149.43Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.52 50.00 – 2.52	Depositor EDS
% Data completeness (in resolution range)	98.6 (50.00-2.52) 99.0 (50.00-2.52)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.16 (at 2.51Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.212 , 0.251 0.220 , 0.260	Depositor DCC
R_{free} test set	2395 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	45.6	Xtriage
Anisotropy	0.034	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 41.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6904	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.28% 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: SO4, 2FD

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	0.66	0/2262	0.83	4/3062 (0.1%)
1	B	0.56	0/2271	0.80	1/3073 (0.0%)
1	C	0.59	0/2232	0.80	2/3018 (0.1%)
All	All	0.61	0/6765	0.81	7/9153 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	258	GLU	N-CA-C	10.74	124.01	108.86
1	A	138	LEU	CA-C-N	-5.94	112.58	119.47
1	A	138	LEU	C-N-CA	-5.94	112.58	119.47
1	A	258	GLU	N-CA-C	5.60	118.52	109.40
1	C	256	ASN	N-CA-C	5.54	116.67	108.86
1	C	263	ALA	N-CA-C	-5.11	106.56	112.89
1	A	225	VAL	CB-CA-C	-5.03	105.54	111.97

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	2211	0	2183	31	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2220	0	2197	23	0
1	C	2183	0	2161	21	0
2	A	19	0	12	0	0
2	B	19	0	12	1	0
2	C	38	0	24	2	0
3	A	50	0	0	1	0
3	B	50	0	0	0	0
3	C	50	0	0	0	0
4	A	25	0	0	1	0
4	B	19	0	0	1	0
4	C	20	0	0	0	0
All	All	6904	0	6589	74	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 6.

All (74) 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:C:29:ILE:HD12	1:C:80:MET:HE2	1.51	0.93
1:A:29:ILE:HD12	1:A:80:MET:HE2	1.63	0.80
1:A:120:LEU:HD23	1:A:245:VAL:HG21	1.67	0.77
1:A:163:SER:O	1:B:252:LEU:HD21	1.86	0.74
1:C:17:LEU:O	1:C:21:THR:HG22	1.89	0.72
1:C:76:ARG:NH2	1:C:282:ILE:O	2.23	0.72
1:C:120:LEU:HD23	1:C:245:VAL:HG21	1.77	0.65
1:A:202:THR:HG23	1:A:205:GLU:OE1	1.97	0.65
1:B:6:THR:HG23	1:B:9:ASP:H	1.65	0.61
1:B:116:ALA:HB3	2:B:300:2FD:O3'	2.01	0.61
1:A:61:VAL:HG21	1:A:89:GLU:OE1	2.02	0.59
1:A:29:ILE:HG23	1:A:112:VAL:HG22	1.84	0.58
1:B:76:ARG:HG3	1:B:279:MET:HB3	1.86	0.58
1:B:29:ILE:HD12	1:B:80:MET:HE2	1.86	0.58
1:C:81:MET:HE2	1:C:84:ARG:HA	1.86	0.57
1:B:29:ILE:HG12	1:B:112:VAL:HG13	1.86	0.57
1:C:258:GLU:O	1:C:259:GLU:HB2	2.03	0.57
1:C:126:VAL:HG22	1:C:243:ASP:HA	1.88	0.54
1:A:285:PRO:O	1:A:286:ASP:C	2.51	0.53
1:A:76:ARG:NH2	1:A:282:ILE:O	2.41	0.53
1:A:18:LEU:HD13	1:A:106:LEU:HD12	1.90	0.53
1:A:193:VAL:HB	1:A:214:ALA:CB	2.40	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:300:2FD:H2'1	2:C:300:2FD:N3	2.25	0.52
1:C:29:ILE:HD12	1:C:80:MET:CE	2.32	0.52
1:A:240:LEU:CD2	1:A:263:ALA:HB1	2.41	0.51
1:B:136:ILE:HG22	1:B:138:LEU:HD13	1.92	0.50
1:B:206:CYS:SG	1:B:245:VAL:HG23	2.51	0.50
1:B:81:MET:HE2	1:B:84:ARG:HA	1.94	0.50
1:A:138:LEU:O	1:A:139:PRO:C	2.52	0.49
1:A:136:ILE:HG13	1:A:191:THR:HG21	1.94	0.48
1:A:240:LEU:HD23	1:A:263:ALA:CB	2.43	0.48
1:B:112:VAL:HA	1:B:236:PHE:O	2.13	0.48
1:C:72:PHE:CE1	2:C:301:2FD:H2'1	2.49	0.48
1:A:207:ARG:HA	1:A:210:GLN:HE21	1.79	0.48
1:C:6:THR:HG23	1:C:8:GLU:H	1.79	0.47
1:A:157:ASP:HB3	4:A:329:HOH:O	2.14	0.47
1:B:210:GLN:HE22	1:B:247:MET:CB	2.27	0.47
1:B:6:THR:HG23	1:B:9:ASP:N	2.30	0.47
1:B:101:ARG:NE	4:B:308:HOH:O	2.47	0.47
1:A:61:VAL:HG13	1:A:62:PRO:HD2	1.97	0.47
1:B:72:PHE:HA	1:B:76:ARG:O	2.15	0.47
1:A:121:ASN:O	1:A:122:PRO:C	2.56	0.46
1:A:72:PHE:HA	1:A:76:ARG:O	2.14	0.46
1:B:210:GLN:HE22	1:B:247:MET:HB3	1.79	0.46
1:A:193:VAL:HB	1:A:214:ALA:HB2	1.98	0.46
1:C:170:MET:HE2	1:C:236:PHE:CZ	2.50	0.46
1:C:223:PRO:O	1:C:227:VAL:HG13	2.15	0.45
1:C:258:GLU:OE1	1:C:260:VAL:HG13	2.16	0.45
1:A:29:ILE:HD12	1:A:80:MET:CE	2.39	0.45
1:A:240:LEU:HD23	1:A:263:ALA:HB2	1.99	0.45
1:A:137:ASN:HB2	1:A:222:VAL:HG11	1.99	0.44
1:B:6:THR:HG22	1:B:9:ASP:OD2	2.17	0.44
1:A:252:LEU:HD11	1:C:163:SER:HB2	1.99	0.44
1:C:45:ALA:HA	1:C:70:PHE:O	2.17	0.43
1:C:137:ASN:HB2	1:C:222:VAL:HG11	2.00	0.43
1:A:240:LEU:HD21	1:A:263:ALA:HB1	2.01	0.43
1:C:206:CYS:SG	1:C:245:VAL:HG23	2.59	0.43
1:C:136:ILE:HG22	1:C:138:LEU:HD13	1.99	0.43
1:A:29:ILE:HG23	1:A:112:VAL:CG2	2.46	0.43
1:A:17:LEU:O	1:A:21:THR:HG22	2.19	0.42
1:B:97:THR:HB	1:B:227:VAL:HG11	2.00	0.42
1:A:120:LEU:HD23	1:A:245:VAL:CG2	2.45	0.42
1:B:206:CYS:SG	1:B:245:VAL:CG2	3.08	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:42:LEU:HD21	1:B:80:MET:CE	2.50	0.41
1:C:271:LEU:HD22	1:C:271:LEU:O	2.20	0.41
1:A:265:LYS:N	3:A:298:SO4:O4	2.53	0.41
1:B:98:PHE:HB3	1:B:99:PRO:HD3	2.03	0.41
1:A:88:TYR:CE2	1:A:89:GLU:HG3	2.56	0.41
1:C:131:LEU:HD11	1:C:171:ARG:HA	2.04	0.40
1:B:29:ILE:HG23	1:B:112:VAL:HG22	2.03	0.40
1:B:168:ARG:HA	1:B:171:ARG:NH1	2.36	0.40
1:A:208:VAL:O	1:A:209:LEU:C	2.64	0.40
1:C:67:ARG:HE	1:C:82:GLN:NE2	2.19	0.40
1:B:76:ARG:NH2	1:B:282:ILE:O	2.54	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	282/311 (91%)	270 (96%)	11 (4%)	1 (0%)	30	47
1	B	283/311 (91%)	271 (96%)	12 (4%)	0	100	100
1	C	275/311 (88%)	266 (97%)	6 (2%)	3 (1%)	11	21
All	All	840/933 (90%)	807 (96%)	29 (4%)	4 (0%)	24	41

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	259	GLU
1	C	257	HIS
1	A	260	VAL
1	C	261	LEU

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	233/253 (92%)	205 (88%)	28 (12%)	5	9
1	B	234/253 (92%)	211 (90%)	23 (10%)	7	15
1	C	231/253 (91%)	205 (89%)	26 (11%)	5	11
All	All	698/759 (92%)	621 (89%)	77 (11%)	6	11

All (77) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	ASN
1	A	8	GLU
1	A	18	LEU
1	A	38	LEU
1	A	56	PHE
1	A	61	VAL
1	A	106	LEU
1	A	112	VAL
1	A	126	VAL
1	A	131	LEU
1	A	138	LEU
1	A	147	LEU
1	A	148	ARG
1	A	153	GLU
1	A	158	ARG
1	A	179	LYS
1	A	180	GLN
1	A	199	SER
1	A	201	GLN
1	A	202	THR
1	A	208	VAL
1	A	209	LEU
1	A	227	VAL
1	A	253	GLU
1	A	259	GLU
1	A	261	LEU

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Mol	Chain	Res	Type
1	A	271	LEU
1	A	277	ILE
1	B	6	THR
1	B	18	LEU
1	B	24	ARG
1	B	56	PHE
1	B	106	LEU
1	B	112	VAL
1	B	125	GLU
1	B	131	LEU
1	B	138	LEU
1	B	147	LEU
1	B	148	ARG
1	B	153	GLU
1	B	158	ARG
1	B	199	SER
1	B	206	CYS
1	B	208	VAL
1	B	209	LEU
1	B	227	VAL
1	B	245	VAL
1	B	247	MET
1	B	254	LYS
1	B	258	GLU
1	B	271	LEU
1	C	3	ASN
1	C	6	THR
1	C	18	LEU
1	C	22	LYS
1	C	31	CYS
1	C	56	PHE
1	C	60	THR
1	C	106	LEU
1	C	112	VAL
1	C	131	LEU
1	C	138	LEU
1	C	147	LEU
1	C	153	GLU
1	C	158	ARG
1	C	163	SER
1	C	176	SER
1	C	195	VAL

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Mol	Chain	Res	Type
1	C	208	VAL
1	C	209	LEU
1	C	212	LEU
1	C	227	VAL
1	C	245	VAL
1	C	251	SER
1	C	252	LEU
1	C	256	ASN
1	C	271	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3	ASN
1	A	180	GLN
1	A	188	GLN
1	A	210	GLN
1	A	269	GLN
1	B	55	ASN
1	B	104	HIS
1	B	172	GLN
1	B	180	GLN
1	B	210	GLN
1	C	55	ASN
1	C	82	GLN
1	C	188	GLN
1	C	256	ASN
1	C	266	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

34 ligands 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$
3	SO4	C	291	-	4,4,4	0.21	0	6,6,6	0.15	0
3	SO4	A	293	-	4,4,4	0.30	0	6,6,6	0.30	0
3	SO4	B	293	-	4,4,4	0.28	0	6,6,6	0.27	0
3	SO4	A	296	-	4,4,4	0.27	0	6,6,6	0.23	0
3	SO4	A	299	-	4,4,4	0.25	0	6,6,6	0.25	0
3	SO4	A	295	-	4,4,4	0.29	0	6,6,6	0.35	0
3	SO4	B	299	-	4,4,4	0.25	0	6,6,6	0.09	0
3	SO4	A	294	-	4,4,4	0.22	0	6,6,6	0.20	0
2	2FD	B	300	-	21,21,21	1.72	3 (14%)	30,31,31	2.82	13 (43%)
3	SO4	B	295	-	4,4,4	0.26	0	6,6,6	0.19	0
3	SO4	B	296	-	4,4,4	0.27	0	6,6,6	0.26	0
3	SO4	A	297	-	4,4,4	0.24	0	6,6,6	0.13	0
3	SO4	C	296	-	4,4,4	0.23	0	6,6,6	0.12	0
3	SO4	C	290	-	4,4,4	0.32	0	6,6,6	0.41	0
3	SO4	C	294	-	4,4,4	0.28	0	6,6,6	0.20	0
3	SO4	C	299	-	4,4,4	0.23	0	6,6,6	0.14	0
2	2FD	C	300	-	21,21,21	1.59	5 (23%)	30,31,31	2.85	10 (33%)
3	SO4	C	293	-	4,4,4	0.26	0	6,6,6	0.37	0
3	SO4	A	298	-	4,4,4	0.24	0	6,6,6	0.17	0
3	SO4	B	291	-	4,4,4	0.23	0	6,6,6	0.23	0
3	SO4	B	298	-	4,4,4	0.22	0	6,6,6	0.23	0
3	SO4	C	292	-	4,4,4	0.26	0	6,6,6	0.12	0
3	SO4	A	291	-	4,4,4	0.25	0	6,6,6	0.16	0
3	SO4	A	290	-	4,4,4	0.31	0	6,6,6	0.44	0
3	SO4	C	297	-	4,4,4	0.25	0	6,6,6	0.22	0
3	SO4	B	294	-	4,4,4	0.23	0	6,6,6	0.14	0
3	SO4	B	290	-	4,4,4	0.16	0	6,6,6	0.30	0
3	SO4	B	292	-	4,4,4	0.20	0	6,6,6	0.36	0
3	SO4	C	295	-	4,4,4	0.25	0	6,6,6	0.09	0
2	2FD	A	300	-	21,21,21	1.80	3 (14%)	30,31,31	2.93	13 (43%)
3	SO4	B	297	-	4,4,4	0.23	0	6,6,6	0.11	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	SO4	A	292	-	4,4,4	0.19	0	6,6,6	0.24	0
3	SO4	C	298	-	4,4,4	0.23	0	6,6,6	0.07	0
2	2FD	C	301	-	21,21,21	1.93	5 (23%)	30,31,31	2.85	12 (40%)

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	2FD	C	300	-	-	6/6/18/18	0/3/3/3
2	2FD	C	301	-	-	1/6/18/18	0/3/3/3
2	2FD	A	300	-	-	0/6/18/18	0/3/3/3
2	2FD	B	300	-	-	3/6/18/18	0/3/3/3

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	301	2FD	C2-N1	5.43	1.36	1.31
2	C	301	2FD	C2-N3	4.80	1.36	1.31
2	A	300	2FD	C2-N3	4.79	1.36	1.31
2	B	300	2FD	C2-N1	4.75	1.36	1.31
2	A	300	2FD	C2-N1	4.68	1.36	1.31
2	C	300	2FD	C2-N1	4.61	1.36	1.31
2	B	300	2FD	C2-N3	4.11	1.35	1.31
2	C	300	2FD	C2-N3	2.75	1.34	1.31
2	C	301	2FD	C1'-N9	2.61	1.51	1.46
2	B	300	2FD	C5-N7	-2.48	1.34	1.39
2	C	300	2FD	C8-N7	2.41	1.36	1.31
2	C	301	2FD	C8-N7	2.31	1.36	1.31
2	A	300	2FD	C5-N7	-2.25	1.35	1.39
2	C	300	2FD	C1'-N9	2.24	1.50	1.46
2	C	300	2FD	C5-N7	-2.12	1.35	1.39
2	C	301	2FD	C5-N7	-2.03	1.35	1.39

All (48) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	300	2FD	F-C2-N1	7.93	122.31	114.69
2	C	301	2FD	C5-C4-N3	-7.89	118.87	127.18
2	A	300	2FD	C5-C4-N3	-7.78	118.99	127.18

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	300	2FD	C5-C4-N3	-7.60	119.17	127.18
2	C	300	2FD	C5-C4-N3	-7.56	119.22	127.18
2	A	300	2FD	N1-C2-N3	-6.53	121.16	130.60
2	C	301	2FD	N1-C2-N3	-6.45	121.28	130.60
2	C	300	2FD	N1-C2-N3	-6.38	121.38	130.60
2	B	300	2FD	N1-C2-N3	-6.34	121.43	130.60
2	A	300	2FD	F-C2-N1	5.97	120.43	114.69
2	C	301	2FD	F-C2-N1	5.73	120.19	114.69
2	B	300	2FD	F-C2-N1	5.69	120.15	114.69
2	A	300	2FD	N3-C4-N9	5.47	133.93	126.99
2	B	300	2FD	N3-C4-N9	5.11	133.47	126.99
2	C	301	2FD	N3-C4-N9	4.30	132.44	126.99
2	A	300	2FD	N6-C6-N1	4.16	122.64	117.03
2	C	301	2FD	F-C2-N3	4.00	118.53	114.69
2	B	300	2FD	F-C2-N3	3.88	118.42	114.69
2	A	300	2FD	F-C2-N3	3.87	118.41	114.69
2	C	300	2FD	N3-C4-N9	3.80	131.82	126.99
2	C	301	2FD	O4'-C1'-N9	3.63	114.48	107.96
2	C	300	2FD	C4-C5-N7	-3.42	106.67	110.58
2	C	301	2FD	C4-C5-N7	-3.41	106.69	110.58
2	B	300	2FD	N6-C6-N1	3.38	121.59	117.03
2	A	300	2FD	N9-C8-N7	-3.31	109.23	113.94
2	B	300	2FD	N9-C8-N7	-3.23	109.36	113.94
2	C	300	2FD	N9-C8-N7	-3.07	109.58	113.94
2	C	300	2FD	C5-C4-N9	2.89	108.96	105.81
2	C	300	2FD	C5-N7-C8	2.70	107.70	103.45
2	B	300	2FD	O4'-C1'-N9	2.68	112.77	107.96
2	C	301	2FD	C5-N7-C8	2.67	107.65	103.45
2	B	300	2FD	C5-N7-C8	2.66	107.63	103.45
2	C	301	2FD	C5-C4-N9	2.64	108.69	105.81
2	C	300	2FD	N6-C6-N1	2.58	120.51	117.03
2	A	300	2FD	C5-N7-C8	2.58	107.50	103.45
2	B	300	2FD	C4-C5-N7	-2.56	107.66	110.58
2	C	301	2FD	N9-C8-N7	-2.52	110.36	113.94
2	A	300	2FD	C4-N9-C8	2.50	108.36	105.74
2	B	300	2FD	C2-N1-C6	2.47	120.47	112.44
2	C	301	2FD	C2-N1-C6	2.45	120.42	112.44
2	A	300	2FD	C4-C5-N7	-2.41	107.82	110.58
2	A	300	2FD	C5-C6-N6	-2.28	117.65	123.29
2	A	300	2FD	C2-N1-C6	2.27	119.84	112.44
2	B	300	2FD	C6-C5-C4	2.27	120.27	117.18
2	C	300	2FD	C2-N1-C6	2.21	119.65	112.44

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	300	2FD	C4-N9-C8	2.15	107.99	105.74
2	A	300	2FD	C6-C5-C4	2.06	119.99	117.18
2	C	301	2FD	C3'-C2'-C1'	2.04	107.60	102.60

There are no chirality outliers.

All (10) torsion outliers are listed below:

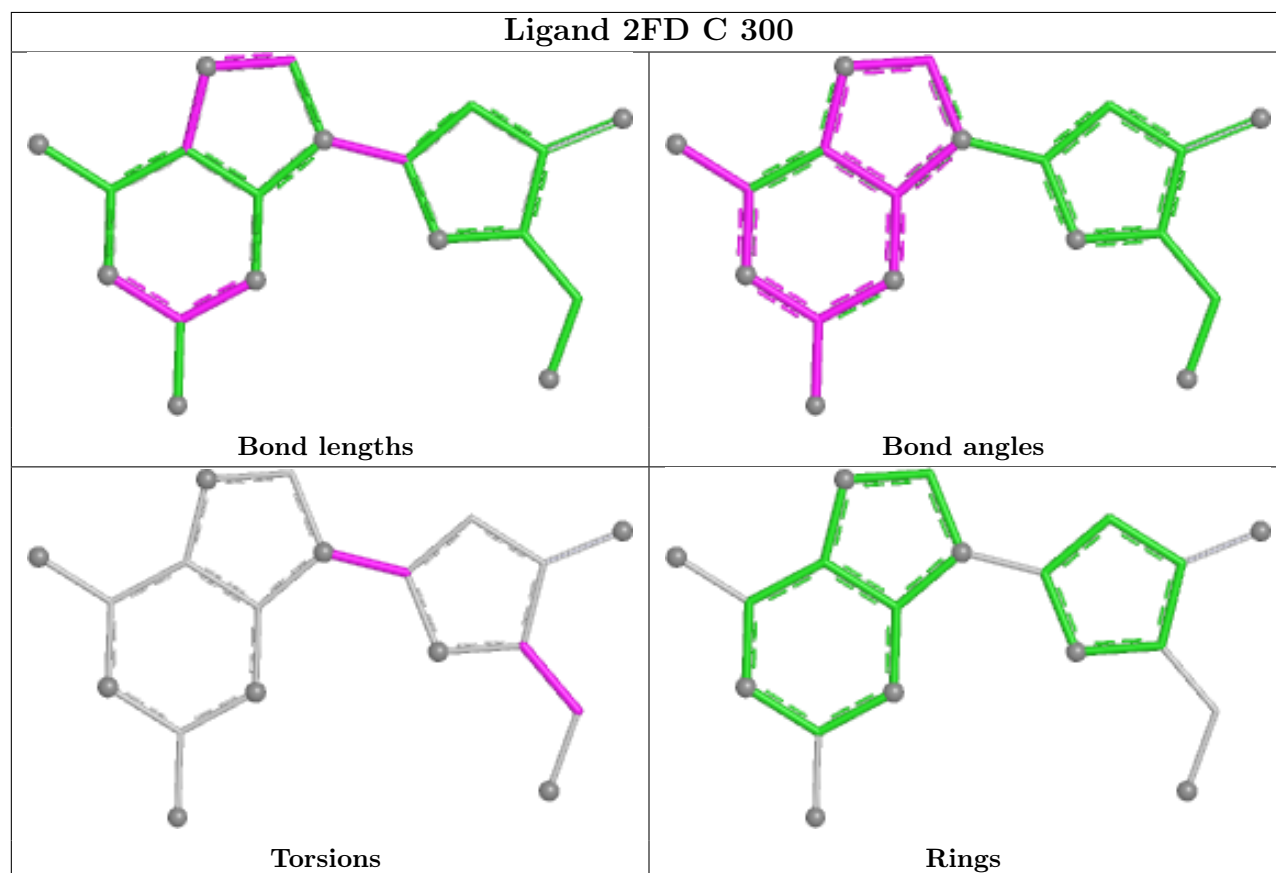
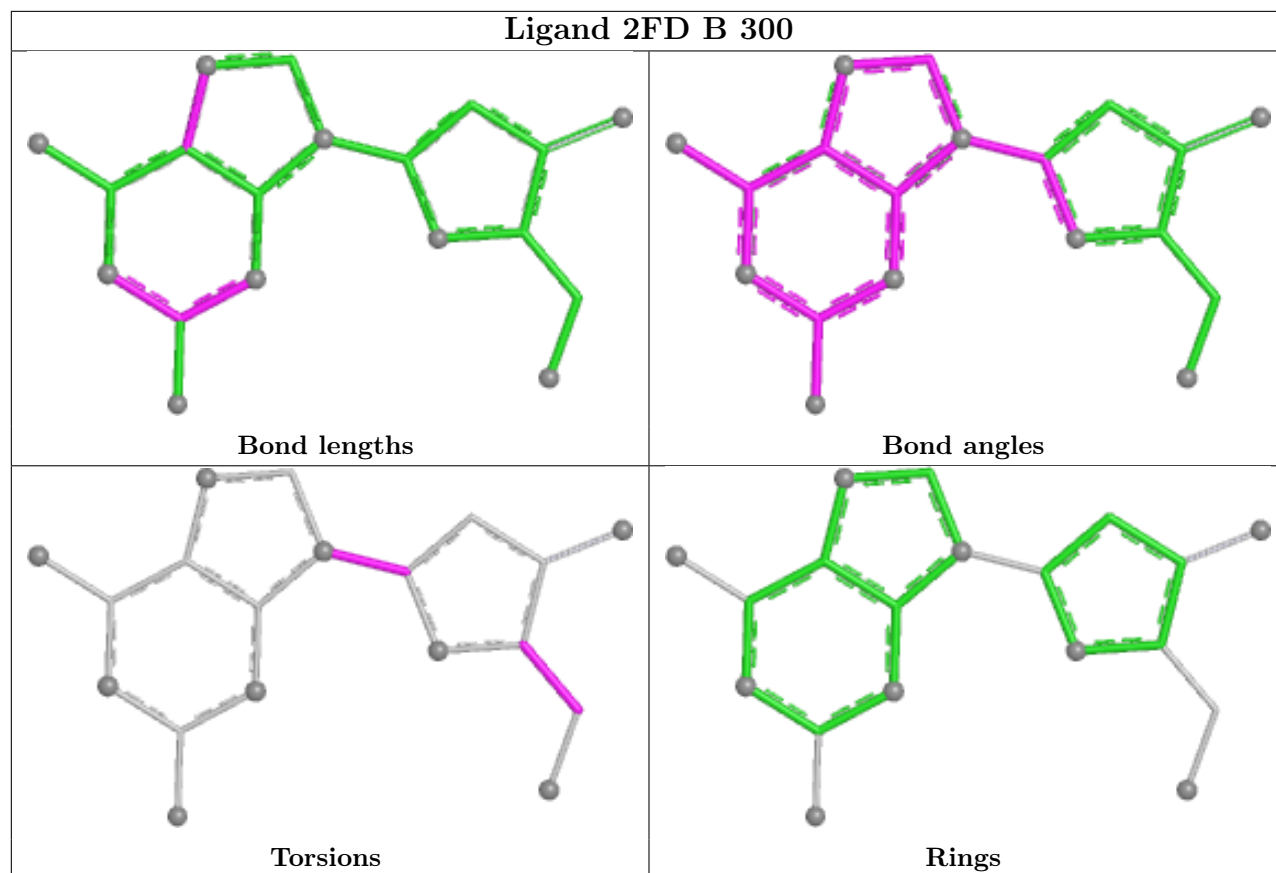
Mol	Chain	Res	Type	Atoms
2	C	300	2FD	C2'-C1'-N9-C4
2	C	300	2FD	C2'-C1'-N9-C8
2	C	300	2FD	C3'-C4'-C5'-O5'
2	B	300	2FD	C3'-C4'-C5'-O5'
2	C	300	2FD	O4'-C4'-C5'-O5'
2	B	300	2FD	O4'-C4'-C5'-O5'
2	B	300	2FD	C2'-C1'-N9-C4
2	C	301	2FD	C2'-C1'-N9-C4
2	C	300	2FD	O4'-C1'-N9-C4
2	C	300	2FD	O4'-C1'-N9-C8

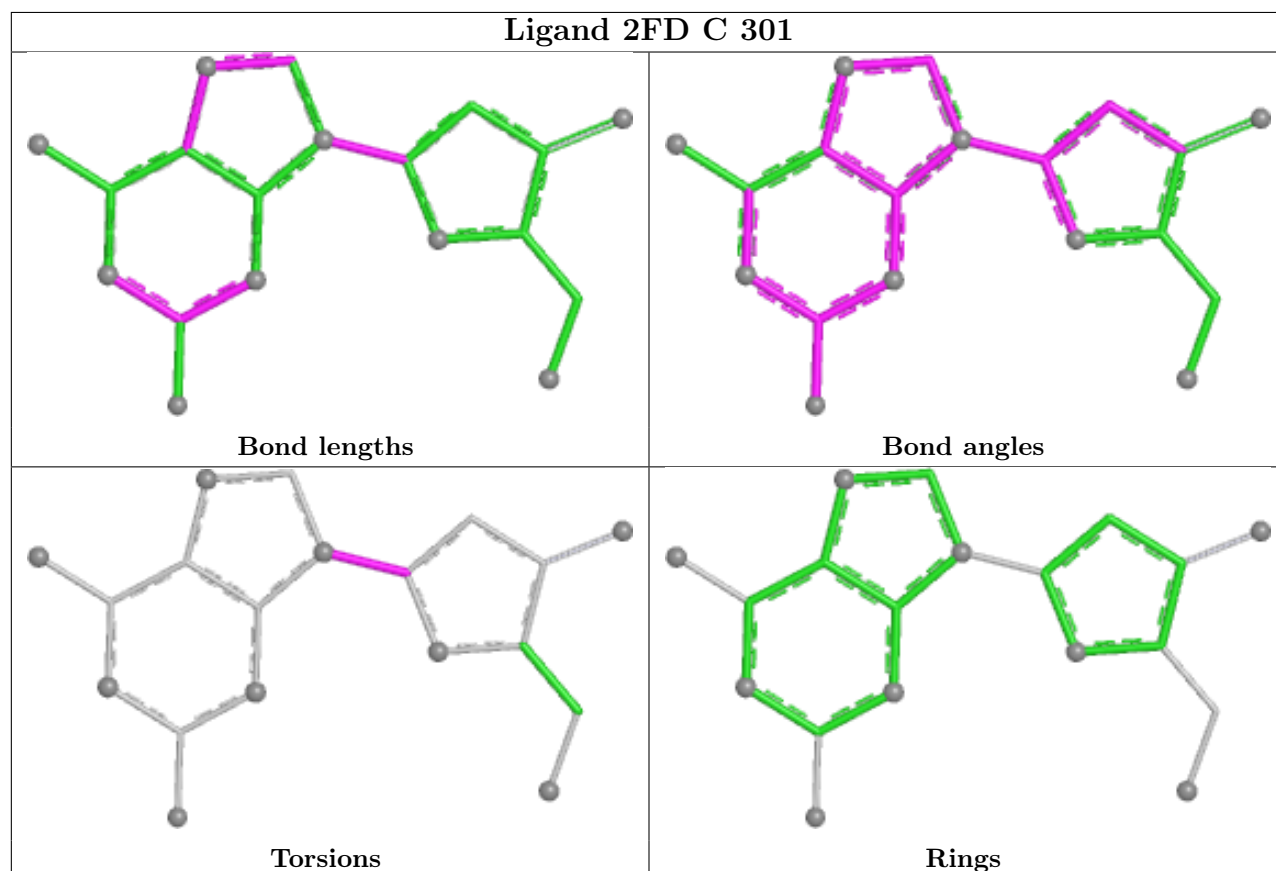
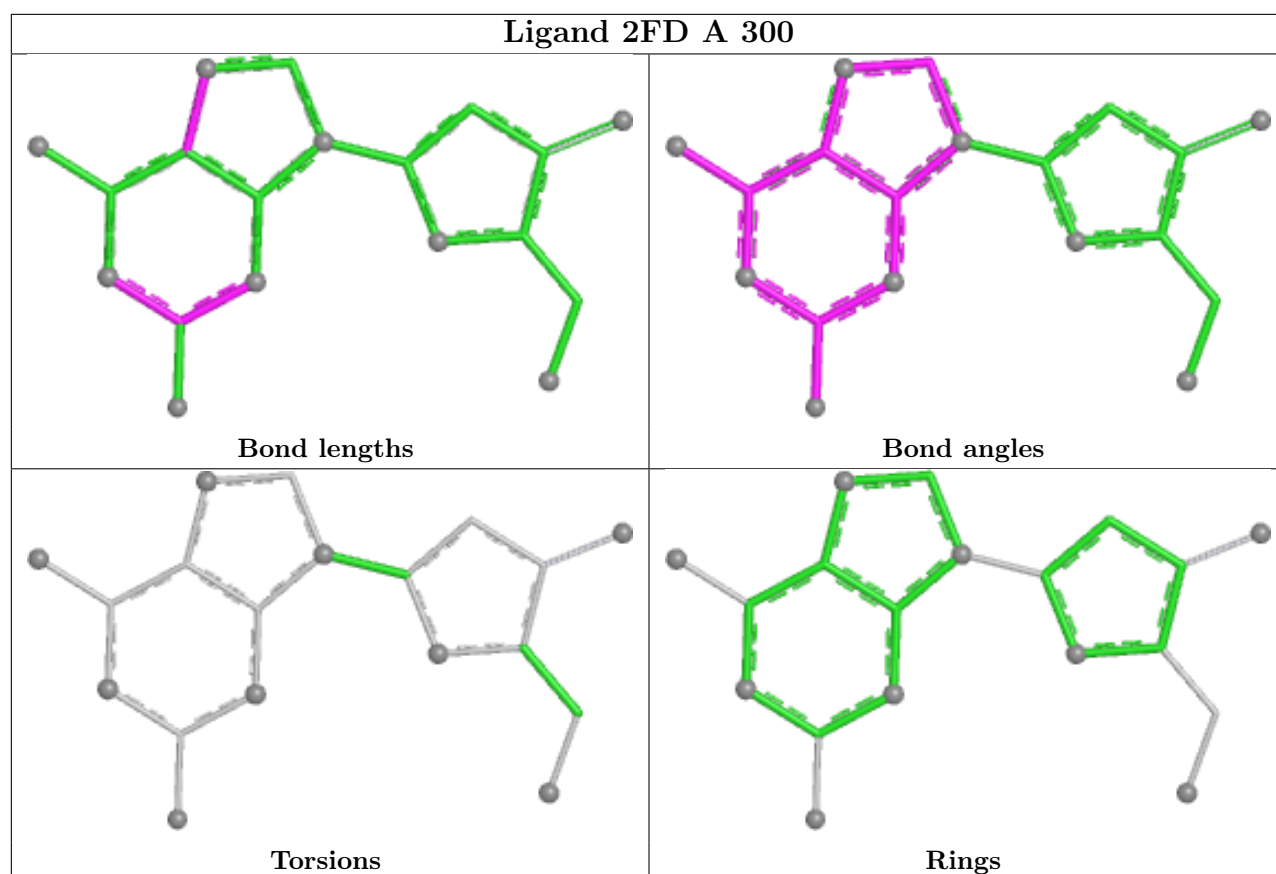
There are no ring outliers.

4 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	300	2FD	1	0
2	C	300	2FD	1	0
3	A	298	SO4	1	0
2	C	301	2FD	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	284/311 (91%)	0.64	20 (7%)	22 20	26, 47, 76, 88	0
1	B	285/311 (91%)	0.60	23 (8%)	18 16	28, 47, 84, 108	0
1	C	279/311 (89%)	0.71	29 (10%)	11 10	29, 47, 76, 95	0
All	All	848/933 (90%)	0.65	72 (8%)	16 15	26, 47, 79, 108	0

All (72) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	260	VAL	12.0
1	C	261	LEU	10.9
1	B	61	VAL	7.3
1	B	261	LEU	6.6
1	A	261	LEU	6.4
1	C	264	GLY	6.4
1	C	60	THR	6.0
1	B	65	ALA	5.8
1	B	64	HIS	5.4
1	C	257	HIS	5.3
1	A	262	ALA	5.1
1	A	260	VAL	5.1
1	B	60	THR	5.0
1	C	263	ALA	5.0
1	C	262	ALA	4.8
1	B	62	PRO	4.7
1	A	257	HIS	4.4
1	B	257	HIS	4.4
1	B	1	MET	4.4
1	B	260	VAL	4.4
1	C	258	GLU	4.3
1	A	286	ASP	4.2
1	A	181	MET	4.2

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Mol	Chain	Res	Type	RSRZ
1	C	65	ALA	4.2
1	C	255	ALA	4.2
1	A	256	ASN	4.2
1	B	256	ASN	4.1
1	C	251	SER	4.0
1	A	182	GLY	4.0
1	A	255	ALA	3.9
1	C	252	LEU	3.8
1	C	59	SER	3.7
1	B	252	LEU	3.7
1	B	259	GLU	3.6
1	A	259	GLU	3.5
1	C	259	GLU	3.5
1	A	252	LEU	3.4
1	C	85	PHE	3.2
1	C	22	LYS	3.2
1	A	258	GLU	3.2
1	B	255	ALA	3.2
1	A	65	ALA	3.1
1	C	265	LYS	3.1
1	A	3	ASN	3.1
1	C	3	ASN	3.0
1	A	253	GLU	3.0
1	B	253	GLU	3.0
1	B	59	SER	3.0
1	B	258	GLU	2.9
1	B	58	ARG	2.8
1	C	23	HIS	2.8
1	B	4	GLY	2.7
1	B	247	MET	2.7
1	C	254	LYS	2.7
1	C	246	ILE	2.7
1	C	83	GLY	2.6
1	A	61	VAL	2.6
1	C	250	GLU	2.6
1	B	285	PRO	2.6
1	C	253	GLU	2.6
1	C	6	THR	2.5
1	A	263	ALA	2.5
1	C	5	TYR	2.5
1	B	246	ILE	2.5
1	C	266	GLN	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	4	GLY	2.3
1	B	262	ALA	2.3
1	C	285	PRO	2.3
1	C	58	ARG	2.3
1	A	180	GLN	2.2
1	A	201	GLN	2.1
1	B	8	GLU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

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(Å ²)	Q<0.9
3	SO4	B	298	5/5	0.48	0.15	116,116,117,117	0
3	SO4	C	298	5/5	0.57	0.13	118,118,118,119	0
3	SO4	C	297	5/5	0.59	0.14	108,108,109,109	0
3	SO4	B	295	5/5	0.61	0.16	111,111,112,112	0
3	SO4	A	298	5/5	0.61	0.15	103,104,104,104	0
3	SO4	C	299	5/5	0.64	0.13	102,102,102,103	0
3	SO4	A	297	5/5	0.66	0.13	89,89,90,91	0
2	2FD	C	301	19/19	0.66	0.23	82,85,90,91	0
3	SO4	B	299	5/5	0.66	0.12	100,101,101,101	0
3	SO4	C	296	5/5	0.67	0.13	131,131,132,132	0
3	SO4	B	294	5/5	0.71	0.14	96,97,97,98	0
3	SO4	A	299	5/5	0.73	0.12	98,99,99,100	0
3	SO4	B	296	5/5	0.75	0.14	92,92,93,93	0
3	SO4	C	294	5/5	0.77	0.23	83,84,85,85	0
3	SO4	C	295	5/5	0.80	0.10	94,94,95,95	0
3	SO4	B	297	5/5	0.83	0.11	99,99,99,100	0

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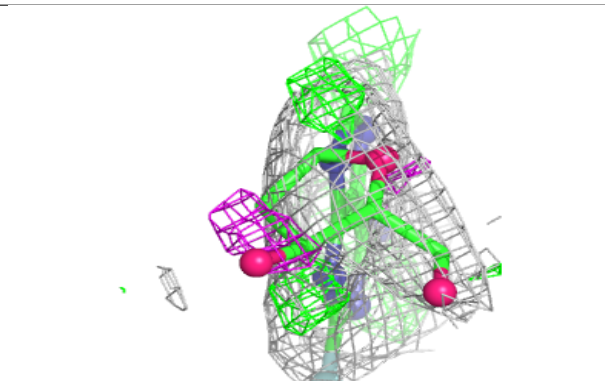
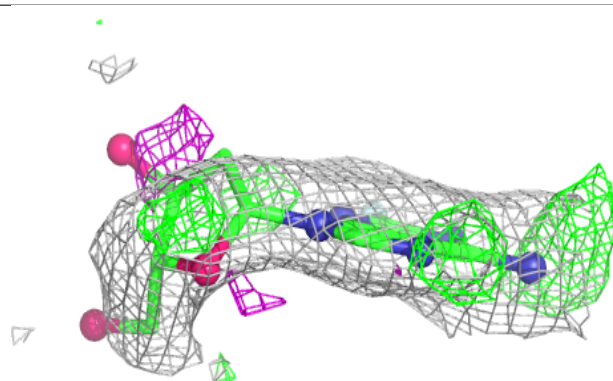
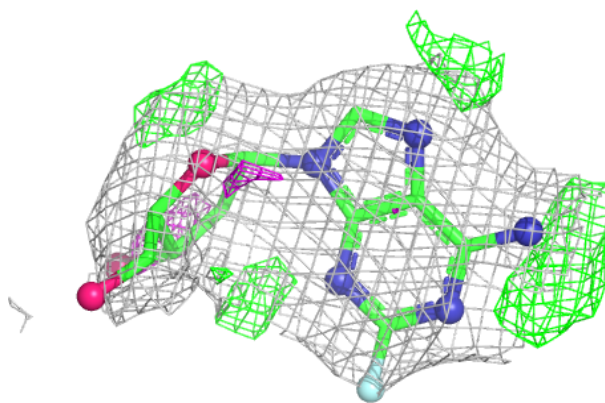
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	SO4	B	293	5/5	0.83	0.20	88,89,89,89	0
3	SO4	B	291	5/5	0.83	0.22	76,76,77,77	0
3	SO4	C	293	5/5	0.84	0.18	81,81,81,82	0
3	SO4	A	293	5/5	0.85	0.16	66,67,69,69	0
3	SO4	A	295	5/5	0.85	0.17	76,77,77,78	0
2	2FD	B	300	19/19	0.85	0.16	62,65,69,70	0
2	2FD	C	300	19/19	0.85	0.17	72,75,82,83	0
2	2FD	A	300	19/19	0.85	0.16	58,63,70,71	0
3	SO4	A	296	5/5	0.86	0.17	88,88,89,89	0
3	SO4	A	294	5/5	0.89	0.21	85,85,86,86	0
3	SO4	B	292	5/5	0.91	0.14	63,63,66,67	0
3	SO4	C	290	5/5	0.96	0.10	45,46,48,50	0
3	SO4	C	292	5/5	0.96	0.13	70,70,70,72	0
3	SO4	A	291	5/5	0.96	0.11	49,50,51,51	0
3	SO4	A	290	5/5	0.97	0.10	44,44,46,46	0
3	SO4	B	290	5/5	0.97	0.11	38,42,42,43	0
3	SO4	A	292	5/5	0.97	0.11	46,47,49,50	0
3	SO4	C	291	5/5	0.97	0.14	54,55,57,58	0

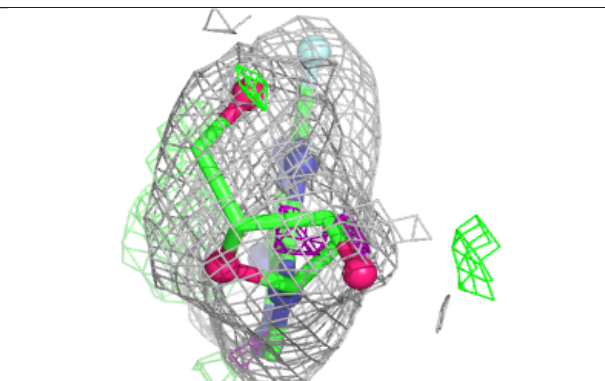
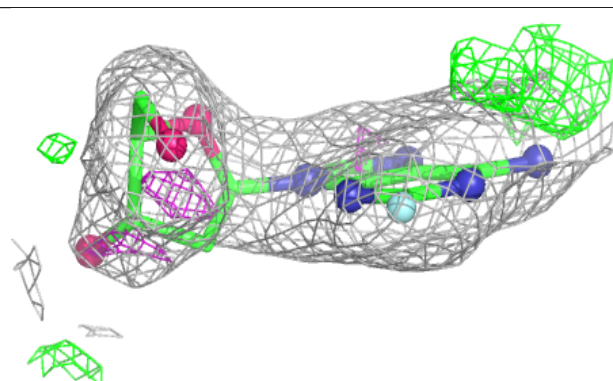
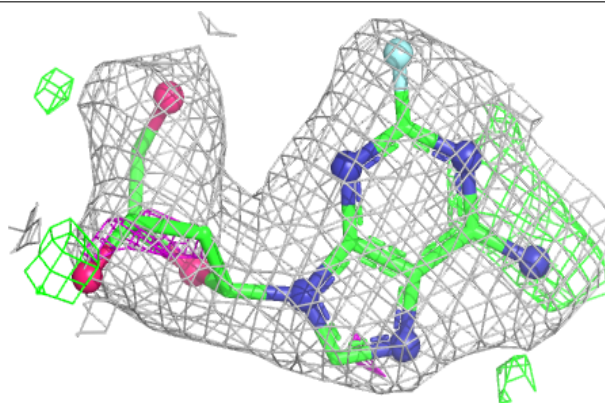
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around 2FD C 301:

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

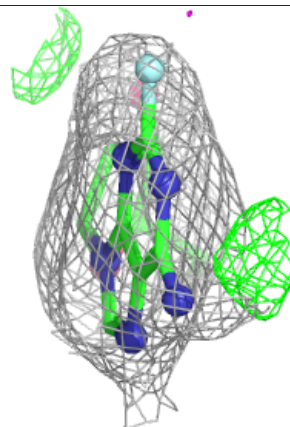
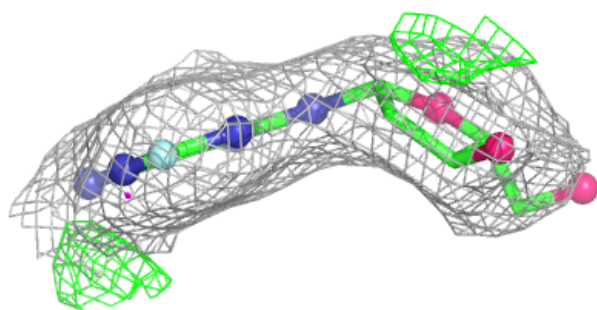
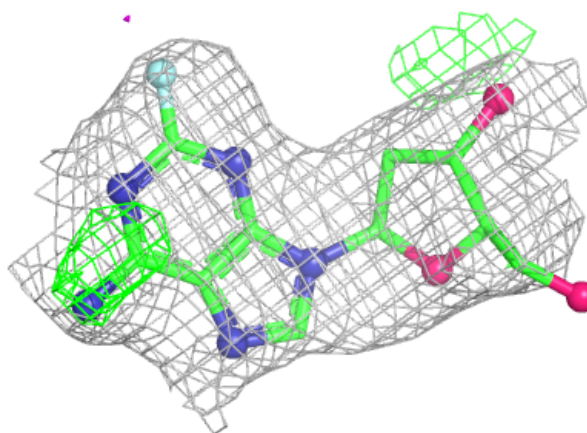
**Electron density around 2FD B 300:**

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

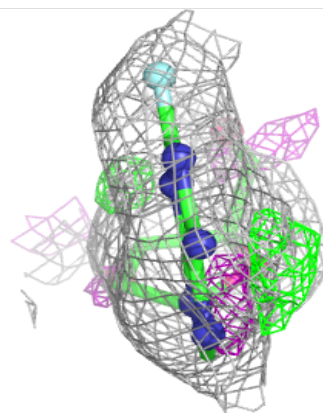
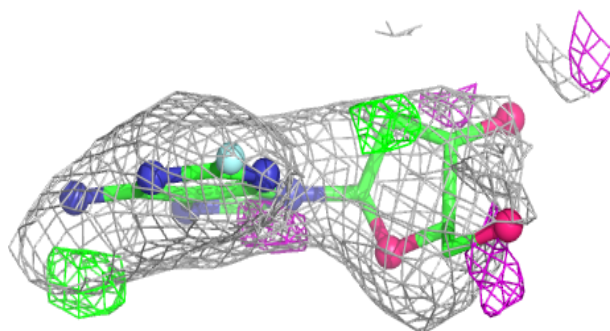
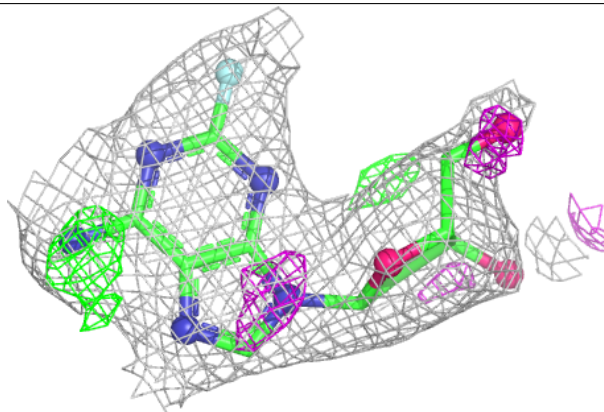


Electron density around 2FD C 300:

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

**Electron density around 2FD A 300:**

$2mF_o-DF_c$ (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.