



# Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 12:36 am BST

PDB ID : 5BTI  
Title : Crystal structure of a topoisomerase II complex  
Authors : Blower, T.R.; Williamson, B.H.; Kerns, R.J.; Berger, J.M.  
Deposited on : 2015-06-03  
Resolution : 2.50 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](mailto: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.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.11  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11

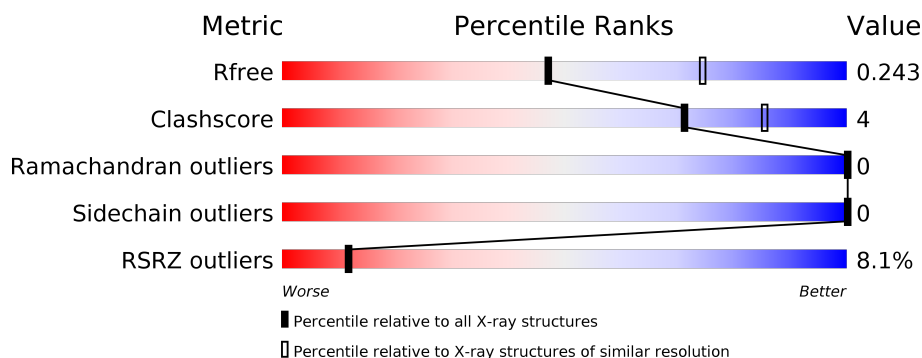
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 Å.

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





Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	503	<div> <div>6%</div> <div>88%</div> <div>9%</div> <div>•</div> </div>
1	C	503	<div> <div>10%</div> <div>91%</div> <div>6%</div> <div>•</div> </div>
2	B	253	<div> <div>9%</div> <div>91%</div> <div>6%</div> <div>•</div> </div>
2	D	253	<div> <div>5%</div> <div>92%</div> <div>5%</div> <div>•</div> </div>
3	E	24	<div> <div>17%</div> <div>75%</div> <div>13%</div> <div>13%</div> </div>
3	H	24	<div> <div>13%</div> <div>75%</div> <div>13%</div> <div>13%</div> </div>

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Mol	Chain	Length	Quality of chain
4	F	24	
4	G	24	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
1	PTR	C	129	-	-	X	-

## 2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 26069 atoms, of which 12523 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 gyrase subunit A.

Mol	Chain	Residues	Atoms							ZeroOcc	AltConf	Trace
1	A	487	Total	C	H	N	O	P	S	0	1	0
			7690	2388	3851	704	733	1	13			
1	C	487	Total	C	H	N	O	P	S	0	1	0
			7690	2388	3851	704	733	1	13			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	90	SER	ALA	engineered mutation	UNP P9WG47
A	501	ILE	-	expression tag	UNP P9WG47
A	502	GLY	-	expression tag	UNP P9WG47
A	503	SER	-	expression tag	UNP P9WG47
A	504	GLY	-	expression tag	UNP P9WG47
C	90	SER	ALA	engineered mutation	UNP P9WG47
C	501	ILE	-	expression tag	UNP P9WG47
C	502	GLY	-	expression tag	UNP P9WG47
C	503	SER	-	expression tag	UNP P9WG47
C	504	GLY	-	expression tag	UNP P9WG47

- Molecule 2 is a protein called DNA gyrase subunit B.

Mol	Chain	Residues	Atoms							ZeroOcc	AltConf	Trace
2	B	245	Total	C	H	N	O	S		0	0	0
			3906	1217	1974	348	360	7				
2	D	247	Total	C	H	N	O	S		0	0	0
			3930	1224	1984	351	364	7				

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	423	SER	-	expression tag	UNP P9WG45
B	424	ASN	-	expression tag	UNP P9WG45

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Chain	Residue	Modelled	Actual	Comment	Reference
B	425	ALA	-	expression tag	UNP P9WG45
D	423	SER	-	expression tag	UNP P9WG45
D	424	ASN	-	expression tag	UNP P9WG45
D	425	ALA	-	expression tag	UNP P9WG45

- Molecule 3 is a DNA chain called DNA substrate 24-mer GGTCATGAATGACTATGCAC GTAA.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	E	21	Total	C	H	N	O	P	0	21	0
			618	196	208	74	120	20			
3	H	21	Total	C	H	N	O	P	0	21	0
			614	196	204	74	120	20			

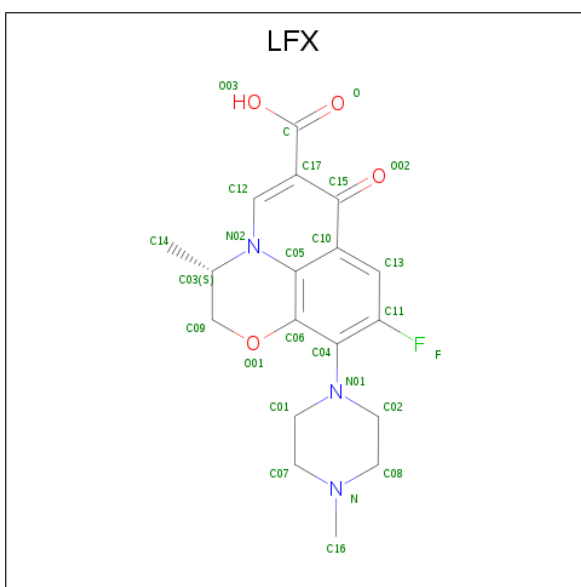
- Molecule 4 is a DNA chain called DNA substrate 24-mer TTACGTGCATAGTCATTTCAT GACC.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
4	F	21	Total	C	H	N	O	P	0	21	0
			619	196	209	74	120	20			
4	G	21	Total	C	H	N	O	P	0	21	0
			614	196	204	74	120	20			

- Molecule 5 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	1	Total	Mg	0	0
			1	1		
5	D	1	Total	Mg	0	0
			1	1		
5	C	1	Total	Mg	0	0
			1	1		
5	E	1	Total	Mg	0	0
			1	1		

- Molecule 6 is (3S)-9-fluoro-3-methyl-10-(4-methylpiperazin-1-yl)-7-oxo-2,3-dihydro-7H-[1,4]oxazino[2,3,4-ij]quinoline-6-carboxylic acid (three-letter code: LFX) (formula: C<sub>18</sub>H<sub>20</sub>FN<sub>3</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
6	E	1	Total	C	F	H	N	O	0	0
			45	18	1	19	3	4		
6	F	1	Total	C	F	H	N	O	0	0
			45	18	1	19	3	4		

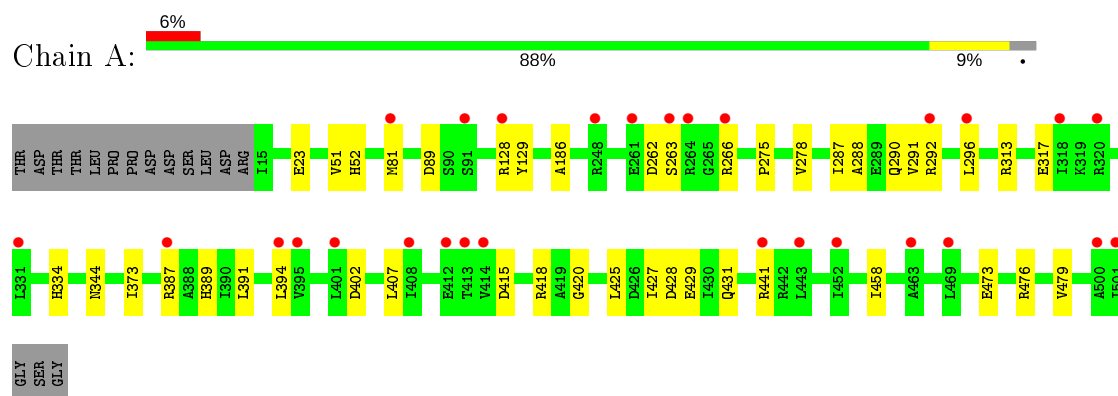
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	100	Total	O	0	0
			100	100		
7	B	37	Total	O	0	0
			37	37		
7	C	89	Total	O	0	0
			89	89		
7	D	37	Total	O	0	0
			37	37		
7	E	11	Total	O	0	0
			11	11		
7	F	12	Total	O	0	0
			12	12		
7	G	3	Total	O	0	0
			3	3		
7	H	5	Total	O	0	0
			5	5		

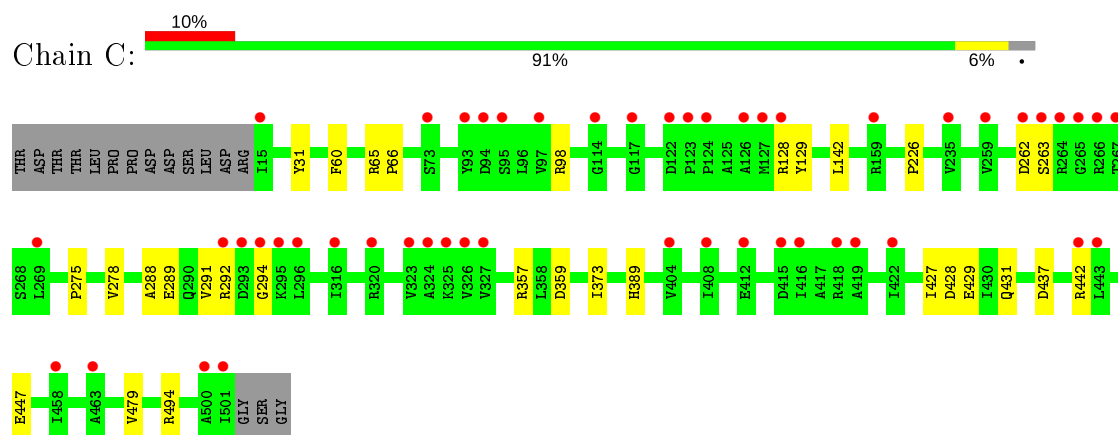
### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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.

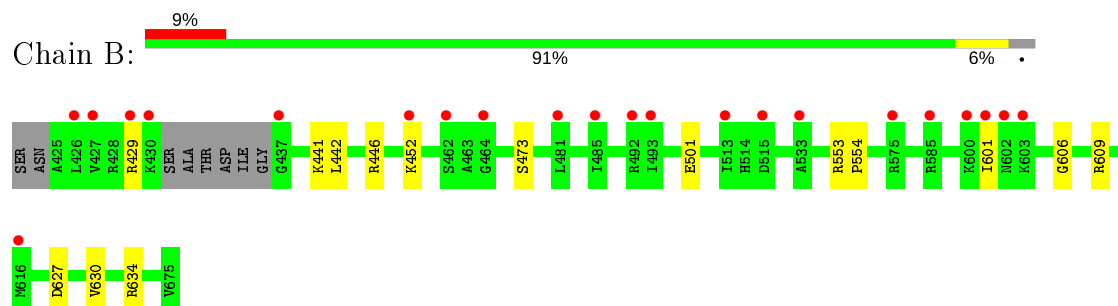
#### • Molecule 1: DNA gyrase subunit A



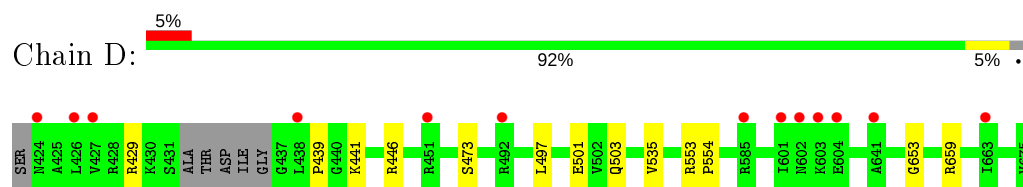
#### • Molecule 1: DNA gyrase subunit A



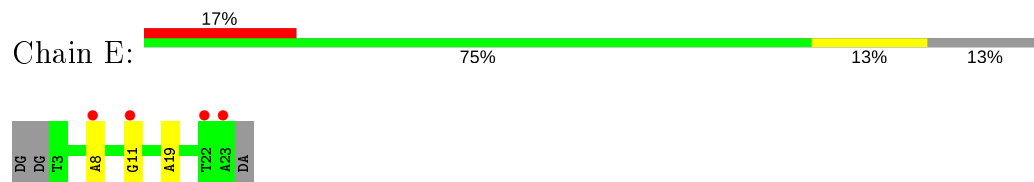
#### • Molecule 2: DNA gyrase subunit B



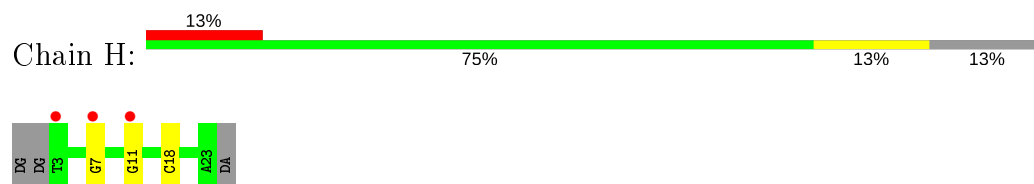
- Molecule 2: DNA gyrase subunit B



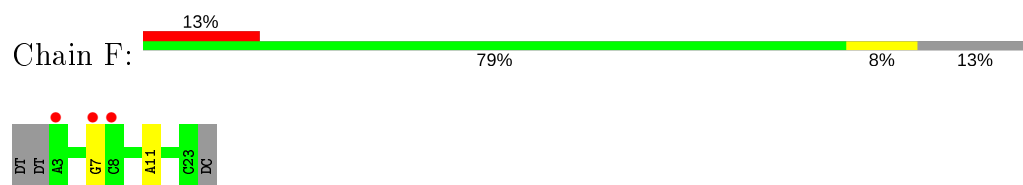
- Molecule 3: DNA substrate 24-mer GGTCATGAATGACTATGCACGTAA



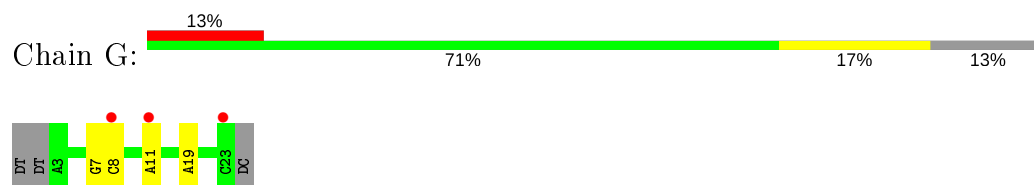
- Molecule 3: DNA substrate 24-mer GGTCATGAATGACTATGCACGTAA



- Molecule 4: DNA substrate 24-mer TTACGTGCATAGTCATTCATGACC



- Molecule 4: DNA substrate 24-mer TTACGTGCATAGTCATTCATGACC





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	108.39Å 83.28Å 129.70Å 90.00° 108.73° 90.00°	Depositor
Resolution (Å)	49.43 – 2.50 49.43 – 2.50	Depositor EDS
% Data completeness (in resolution range)	95.2 (49.43-2.50) 95.6 (49.43-2.50)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.34 (at 2.51Å)	Xtriage
Refinement program	PHENIX	Depositor
R, $R_{free}$	0.214 , 0.240 0.220 , 0.243	Depositor DCC
$R_{free}$ test set	3660 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.7	Xtriage
Anisotropy	0.319	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 48.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	26069	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	72.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.21% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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, PTR, LFX

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	0.22	0/3882	0.41	0/5254
1	C	0.22	0/3882	0.41	0/5254
2	B	0.21	0/1960	0.39	0/2634
2	D	0.22	0/1974	0.39	0/2653
3	E	0.53	0/458	0.94	0/704
3	H	0.55	0/458	0.98	0/704
4	F	0.53	0/458	0.95	0/704
4	G	0.53	0/458	0.94	0/704
All	All	0.28	0/13530	0.52	0/18611

There are no bond length outliers.

There are no bond angle outliers.

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	3839	3851	3853	36	0
1	C	3839	3851	3853	27	0
2	B	1932	1974	1973	9	0
2	D	1946	1984	1984	9	0
3	E	410	208	208	5	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	H	410	204	204	4	0
4	F	410	209	209	4	0
4	G	410	204	204	7	0
5	B	1	0	0	0	0
5	C	1	0	0	0	0
5	D	1	0	0	0	0
5	E	1	0	0	0	0
6	E	26	19	19	0	0
6	F	26	19	19	0	0
7	A	100	0	0	3	0
7	B	37	0	0	2	0
7	C	89	0	0	1	0
7	D	37	0	0	0	0
7	E	11	0	0	0	0
7	F	12	0	0	0	0
7	G	3	0	0	0	0
7	H	5	0	0	0	0
All	All	13546	12523	12526	78	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 4.

All (78) 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:129:PTR:O2P	4:G:11[B]:DA:C5'	1.68	1.41
1:C:129:PTR:O2P	3:E:11[A]:DG:C5'	1.98	1.12
1:A:266:ARG:HD3	1:A:317:GLU:OE2	1.59	1.03
1:C:129:PTR:O2P	3:E:11[A]:DG:H4'	1.61	1.01
1:C:129:PTR:O2P	3:E:11[A]:DG:C4'	2.12	0.96
1:A:129:PTR:O3P	3:H:11[B]:DG:C5'	2.13	0.96
2:D:653:GLY:O	2:D:659:ARG:NH2	2.11	0.84
1:A:290:GLN:HE22	1:A:334:HIS:HB3	1.44	0.83
1:A:262:ASP:OD1	1:A:263:SER:N	2.14	0.81
1:A:129:PTR:O3P	4:F:11[A]:DA:C5'	2.30	0.79
1:C:98:ARG:NH1	4:F:7[A]:DG:OP1	2.19	0.74
1:A:266:ARG:CD	1:A:317:GLU:OE2	2.34	0.74
1:C:288:ALA:O	1:C:292:ARG:HG3	1.87	0.73
1:C:289:GLU:HA	1:C:292:ARG:HD3	1.75	0.68
1:C:357:ARG:NH1	1:C:359:ASP:OD1	2.28	0.66
1:C:129:PTR:P	4:G:11[B]:DA:C5'	2.84	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:128[B]:ARG:NH1	7:C:701:HOH:O	2.21	0.63
2:D:497:LEU:O	2:D:503:GLN:NE2	2.32	0.62
2:B:429:ARG:NH1	2:B:442:LEU:O	2.31	0.62
2:D:429:ARG:NH1	2:D:439:PRO:O	2.33	0.61
1:A:129:PTR:O3P	4:F:11[A]:DA:H4'	2.01	0.61
1:C:129:PTR:O2P	4:G:11[B]:DA:C4'	2.24	0.61
1:A:287:ILE:O	1:A:291:VAL:HG23	2.02	0.60
1:A:391:LEU:HD12	1:A:458:ILE:HD12	1.83	0.60
2:B:452:LYS:NZ	7:B:801:HOH:O	2.34	0.59
1:A:290:GLN:OE1	1:A:296:LEU:HD11	2.03	0.58
1:A:128[B]:ARG:NH1	7:A:603:HOH:O	2.35	0.57
1:C:129:PTR:O2P	4:G:11[B]:DA:H4'	2.00	0.56
1:C:291:VAL:O	1:C:294:GLY:HA2	2.06	0.56
1:A:129:PTR:O3P	4:F:11[A]:DA:C4'	2.54	0.56
1:A:441:ARG:NE	1:C:437:ASP:OD1	2.37	0.55
2:D:446:ARG:NH2	2:D:473:SER:OG	2.40	0.54
4:G:7[B]:DG:N2	3:H:18[B]:DC:O2	2.37	0.53
1:C:98:ARG:NH1	3:H:7[B]:DG:OP1	2.42	0.52
1:C:262:ASP:OD1	1:C:263:SER:N	2.38	0.51
1:A:288:ALA:O	1:A:292:ARG:HG3	2.10	0.51
2:D:441:LYS:NZ	2:D:501:GLU:OE1	2.43	0.51
2:B:446:ARG:NH1	2:B:473:SER:OG	2.43	0.51
2:D:659:ARG:NH1	3:E:19[A]:DA:OP1	2.44	0.50
1:A:387:ARG:HD2	1:A:458:ILE:HD11	1.92	0.50
1:A:427:ILE:CG2	1:A:431:GLN:HB2	2.42	0.50
1:A:51:VAL:HG11	3:E:8[A]:DA:H5'	1.94	0.49
1:C:428:ASP:OD1	1:C:429:GLU:N	2.41	0.49
2:D:659:ARG:NH1	4:G:19[B]:DA:OP1	2.46	0.48
1:A:428:ASP:OD1	1:A:429:GLU:N	2.44	0.48
1:A:290:GLN:NE2	1:A:334:HIS:HB3	2.21	0.48
2:B:609:ARG:NH2	7:B:805:HOH:O	2.46	0.48
1:A:23:GLU:OE1	2:B:634:ARG:NH1	2.47	0.47
1:C:442:ARG:HA	1:C:447:GLU:HB3	1.96	0.47
1:C:389:HIS:O	1:C:431:GLN:NE2	2.47	0.46
1:A:81:MET:HE1	1:A:89:ASP:HB3	1.97	0.46
1:A:415:ASP:OD1	1:A:418:ARG:NH2	2.49	0.46
1:A:402:ASP:N	7:A:601:HOH:O	2.49	0.46
1:C:60:PHE:HB2	1:C:142:LEU:HD13	1.98	0.46
1:A:186:ALA:O	1:A:344:ASN:ND2	2.49	0.46
1:C:373:ILE:HD12	1:C:479:VAL:HG22	1.98	0.45
1:A:389:HIS:NE2	1:A:431:GLN:OE1	2.51	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:373:ILE:HD12	1:A:479:VAL:HG22	2.00	0.44
1:A:391:LEU:HD23	1:A:394:LEU:HD12	1.99	0.43
1:A:407:LEU:HD21	1:A:420:GLY:HA3	2.00	0.43
2:B:553:ARG:N	2:B:554:PRO:CD	2.82	0.43
1:A:425:LEU:HB2	1:A:427:ILE:CD1	2.49	0.43
1:A:128[B]:ARG:HH21	3:H:11[B]:DG:C5'	2.32	0.42
1:C:275:PRO:HG2	1:C:278:VAL:HG21	2.01	0.42
1:A:52:HIS:NE2	4:G:8[B]:DC:OP1	2.48	0.42
1:C:226:PRO:O	1:C:494:ARG:NH2	2.52	0.42
1:A:275:PRO:HG2	1:A:278:VAL:HG21	2.01	0.42
1:C:65:ARG:HB3	1:C:66:PRO:HD2	2.00	0.42
2:B:441:LYS:NZ	2:B:501:GLU:OE1	2.52	0.42
2:B:627:ASP:HB3	2:B:630:VAL:HG22	2.02	0.42
1:A:441:ARG:NH2	1:C:437:ASP:OD1	2.52	0.42
1:A:313:ARG:NH1	7:A:609:HOH:O	2.47	0.42
1:A:387:ARG:CD	1:A:458:ILE:HD11	2.50	0.41
2:D:553:ARG:N	2:D:554:PRO:CD	2.83	0.41
1:A:473:GLU:OE1	1:A:476:ARG:NH2	2.53	0.41
1:C:31:TYR:HA	2:D:535:VAL:HG13	2.03	0.41
2:B:601:ILE:HG22	2:B:606:GLY:HA2	2.03	0.41
1:C:427:ILE:CG2	1:C:431:GLN:HB2	2.51	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	485/503 (96%)	466 (96%)	19 (4%)	0	100	100
1	C	485/503 (96%)	468 (96%)	17 (4%)	0	100	100
2	B	241/253 (95%)	233 (97%)	8 (3%)	0	100	100
2	D	243/253 (96%)	235 (97%)	8 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	1454/1512 (96%)	1402 (96%)	52 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 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	408/421 (97%)	408 (100%)	0	100	100
1	C	408/421 (97%)	408 (100%)	0	100	100
2	B	205/211 (97%)	205 (100%)	0	100	100
2	D	207/211 (98%)	207 (100%)	0	100	100
All	All	1228/1264 (97%)	1228 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA ⓘ

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
1	PTR	C	129	1	15,16,17	0.80	0	19,22,24	0.97	1 (5%)
1	PTR	A	129	1	15,16,17	0.74	0	19,22,24	1.25	1 (5%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	PTR	C	129	1	-	0/10/11/13	0/1/1/1
1	PTR	A	129	1	-	0/10/11/13	0/1/1/1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	129	PTR	CB-CA-C	-3.57	104.77	111.47
1	C	129	PTR	CB-CA-C	-2.49	106.79	111.47

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	C	129	PTR	7	0
1	A	129	PTR	4	0

## 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 4 are monoatomic - leaving 2 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	LFX	E	101	5	21,29,29	3.11	8 (38%)	25,44,44	2.05	7 (28%)
6	LFX	F	101	5	21,29,29	3.06	8 (38%)	25,44,44	1.81	8 (32%)

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	LFX	E	101	5	-	0/4/27/27	0/3/4/4
6	LFX	F	101	5	-	0/4/27/27	0/3/4/4

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	E	101	LFX	O01-C06	9.67	1.50	1.36
6	F	101	LFX	O01-C06	9.52	1.50	1.36
6	E	101	LFX	C12-C17	5.36	1.48	1.39
6	F	101	LFX	C12-C17	5.34	1.48	1.39
6	F	101	LFX	C13-C11	4.64	1.42	1.35
6	E	101	LFX	C13-C11	4.60	1.42	1.35
6	E	101	LFX	C17-C	4.11	1.51	1.47
6	F	101	LFX	C17-C	3.85	1.51	1.47
6	E	101	LFX	C02-N01	-3.43	1.41	1.46
6	F	101	LFX	C02-N01	-3.35	1.41	1.46
6	F	101	LFX	C04-N01	3.09	1.49	1.40
6	E	101	LFX	C04-N01	3.08	1.49	1.40
6	E	101	LFX	C07-N	-2.29	1.41	1.46
6	F	101	LFX	C07-N	-2.26	1.41	1.46
6	E	101	LFX	C04-C06	2.21	1.44	1.40
6	F	101	LFX	C01-N01	-2.01	1.43	1.46

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	E	101	LFX	C08-N-C07	5.68	117.47	109.52
6	F	101	LFX	C08-N-C07	4.08	115.23	109.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	E	101	LFX	C02-C08-N	3.97	115.29	110.80
6	E	101	LFX	C13-C10-C05	3.73	119.98	118.48
6	F	101	LFX	C13-C10-C05	3.24	119.78	118.48
6	E	101	LFX	C06-C04-C11	2.97	118.83	115.99
6	F	101	LFX	C02-C08-N	2.95	114.13	110.80
6	F	101	LFX	C06-C04-C11	2.92	118.78	115.99
6	E	101	LFX	O01-C06-C04	2.71	120.79	117.85
6	E	101	LFX	C01-C07-N	2.59	113.73	110.80
6	F	101	LFX	C06-C04-N01	-2.58	116.48	122.83
6	F	101	LFX	F-C11-C04	2.40	121.84	118.36
6	E	101	LFX	C02-N01-C04	-2.33	112.14	119.44
6	F	101	LFX	C01-C07-N	2.32	113.43	110.80
6	F	101	LFX	C13-C11-C04	-2.32	119.88	123.25

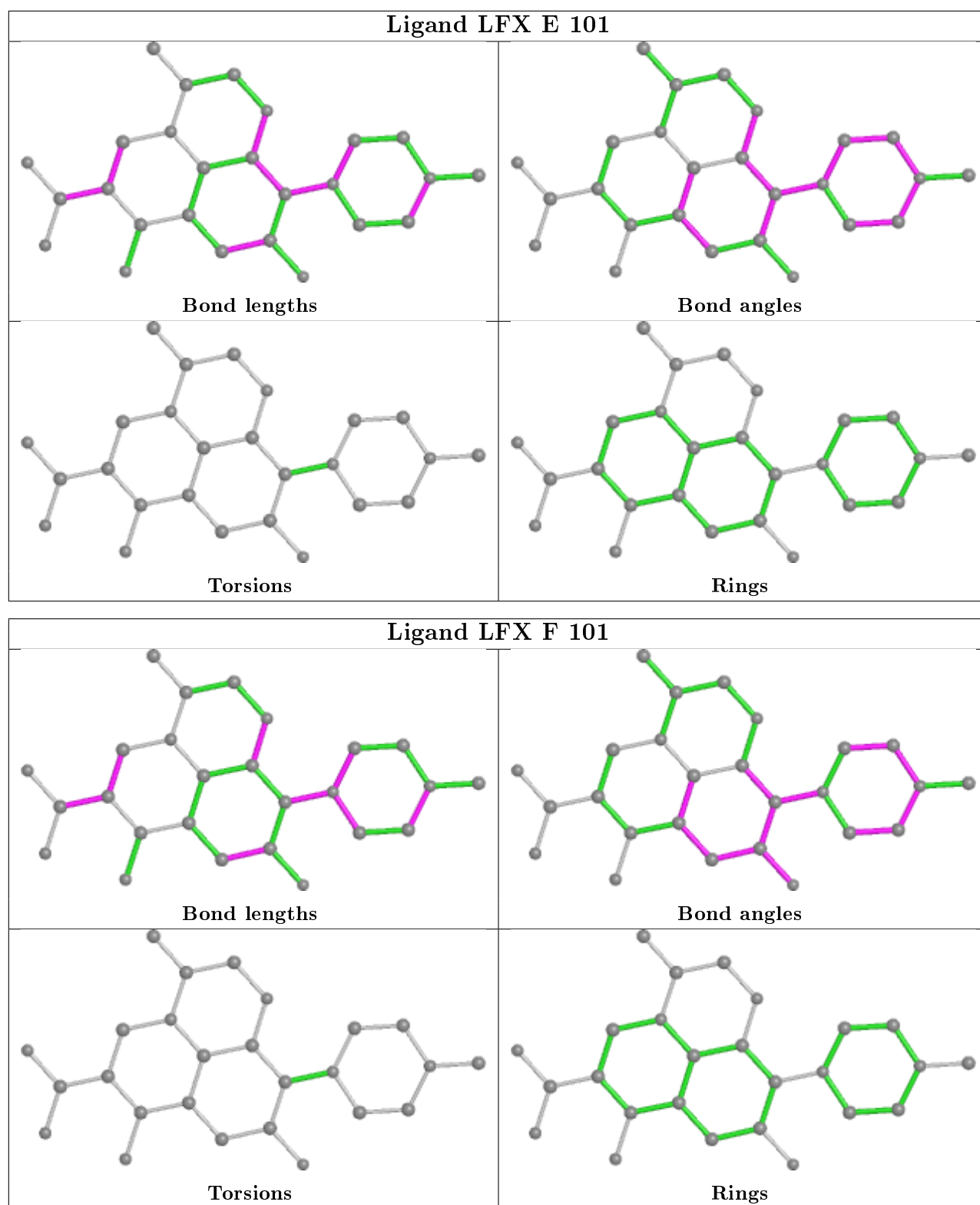
There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	486/503 (96%)	0.68	28 (5%) 23 24	31, 55, 104, 163	0
1	C	486/503 (96%)	0.81	50 (10%) 6 6	28, 58, 108, 159	0
2	B	245/253 (96%)	0.76	22 (8%) 9 9	42, 64, 99, 127	0
2	D	247/253 (97%)	0.58	13 (5%) 26 28	40, 59, 100, 143	0
3	E	21/24 (87%)	1.28	4 (19%) 1 1	54, 92, 174, 194	21 (100%)
3	H	21/24 (87%)	0.98	3 (14%) 2 2	22, 44, 101, 169	21 (100%)
4	F	21/24 (87%)	1.00	3 (14%) 2 2	66, 83, 193, 206	21 (100%)
4	G	21/24 (87%)	1.09	3 (14%) 2 2	21, 44, 132, 148	21 (100%)
All	All	1548/1608 (96%)	0.74	126 (8%) 12 12	21, 59, 111, 206	84 (5%)

All (126) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	501	ILE	10.7
1	A	501	ILE	8.1
1	A	412	GLU	5.9
1	C	264	ARG	5.6
2	B	426	LEU	5.6
3	E	23[A]	DA	5.3
1	C	292	ARG	4.8
2	D	424	ASN	4.7
4	G	23[B]	DC	4.6
2	B	430	LYS	4.4
2	D	426	LEU	4.3
1	A	408	ILE	4.2
2	B	603	LYS	4.2
1	C	419	ALA	4.1
1	C	293	ASP	4.1
1	C	412	GLU	4.0

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Mol	Chain	Res	Type	RSRZ
1	A	128[A]	ARG	3.9
1	A	413	THR	3.7
1	C	416	ILE	3.6
1	C	266	ARG	3.5
1	A	414	VAL	3.5
2	D	601	ILE	3.5
2	B	601	ILE	3.5
1	A	292	ARG	3.5
1	A	387	ARG	3.5
1	C	128[A]	ARG	3.4
2	D	602	ASN	3.4
1	A	441	ARG	3.2
2	B	437	GLY	3.2
2	B	585	ARG	3.2
1	C	404	VAL	3.2
1	C	422	ILE	3.1
1	A	264	ARG	3.0
1	A	261	GLU	3.0
1	C	267	THR	3.0
1	A	320	ARG	3.0
1	A	463	ALA	3.0
1	C	415	ASP	3.0
2	D	603	LYS	2.9
3	E	11[A]	DG	2.9
3	H	3[B]	DT	2.9
4	F	3[A]	DA	2.9
1	A	248	ARG	2.9
4	G	8[B]	DC	2.9
1	C	265	GLY	2.9
1	C	15	ILE	2.8
1	C	408	ILE	2.8
1	C	500	ALA	2.8
1	A	500	ALA	2.8
1	A	266	ARG	2.8
1	A	296	LEU	2.8
2	D	585	ARG	2.7
1	C	323	VAL	2.7
1	C	259	VAL	2.7
2	B	493	ILE	2.7
1	C	126	ALA	2.6
2	D	438	LEU	2.6
1	A	443	LEU	2.6

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Mol	Chain	Res	Type	RSRZ
2	D	604	GLU	2.6
1	C	463	ALA	2.6
4	F	7[A]	DG	2.5
3	E	8[A]	DA	2.5
1	A	401	LEU	2.5
2	B	575	ARG	2.5
1	C	327	VAL	2.5
2	B	427	VAL	2.5
2	B	513	ILE	2.4
1	C	262	ASP	2.4
3	E	22[A]	DT	2.4
1	C	159	ARG	2.4
1	C	295	LYS	2.4
1	C	296	LEU	2.4
2	B	481	LEU	2.4
1	C	458	ILE	2.4
2	B	600	LYS	2.4
1	C	294	GLY	2.3
1	C	443	LEU	2.3
3	H	11[B]	DG	2.3
4	G	11[B]	DA	2.3
2	B	492	ARG	2.3
2	D	451	ARG	2.3
1	C	124	PRO	2.3
3	H	7[B]	DG	2.3
1	C	418	ARG	2.3
1	A	394	LEU	2.3
1	C	269	LEU	2.3
2	B	452	LYS	2.3
2	B	429	ARG	2.3
1	C	114	GLY	2.3
2	B	515	ASP	2.3
1	C	123	PRO	2.2
1	C	320	ARG	2.2
1	A	81	MET	2.2
1	C	127	MET	2.2
2	B	464	GLY	2.2
1	C	97	VAL	2.2
1	C	122	ASP	2.2
1	A	91	SER	2.2
1	A	263	SER	2.2
2	B	616	MET	2.2

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Mol	Chain	Res	Type	RSRZ
2	D	427	VAL	2.2
1	C	94	ASP	2.2
1	C	117	GLY	2.2
1	C	442	ARG	2.2
2	B	485	ILE	2.2
1	C	325	LYS	2.2
1	C	324	ALA	2.2
1	A	331	LEU	2.2
1	A	395	VAL	2.2
1	A	452	ILE	2.2
2	B	602	ASN	2.2
2	B	462	SER	2.1
1	C	93	TYR	2.1
1	C	95	SER	2.1
2	D	663	ILE	2.1
1	A	318	ILE	2.1
1	A	469	LEU	2.1
4	F	8[A]	DC	2.1
2	B	533	ALA	2.0
2	D	492	ARG	2.0
2	D	641	ALA	2.0
1	C	73	SER	2.0
1	C	235	VAL	2.0
1	C	263	SER	2.0
1	C	326	VAL	2.0
1	C	316	ILE	2.0

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	PTR	A	129	16/17	0.95	0.27	41,50,57,60	0
1	PTR	C	129	16/17	0.96	0.29	38,42,60,65	0

## 6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 6.4 Ligands ⓘ

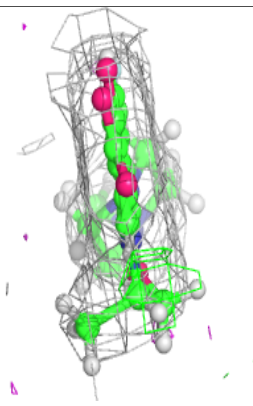
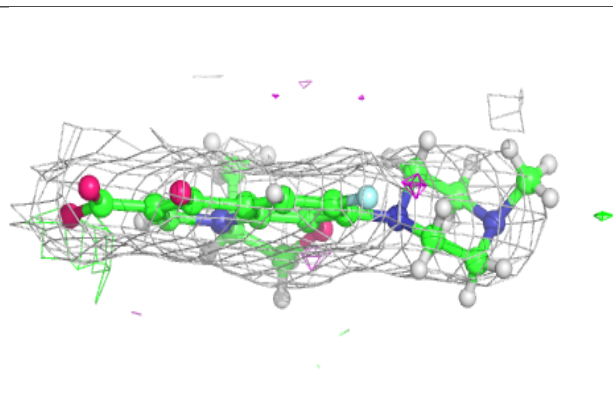
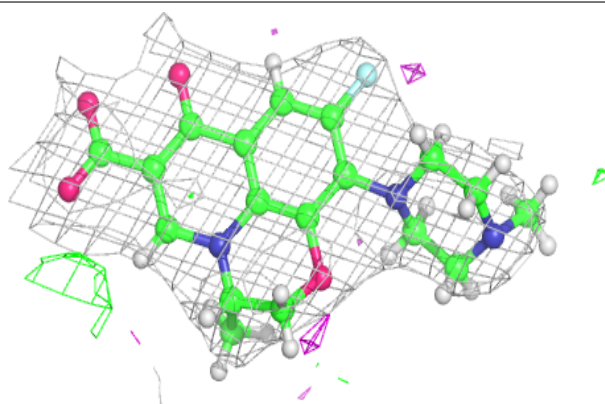
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
6	LFX	F	101	26/26	0.92	0.26	34,48,65,67	0
5	MG	B	701	1/1	0.93	0.29	49,49,49,49	0
5	MG	D	701	1/1	0.93	0.18	31,31,31,31	0
6	LFX	E	101	26/26	0.94	0.24	35,43,58,61	0
5	MG	C	601	1/1	0.96	0.20	38,38,38,38	0
5	MG	E	102	1/1	0.97	0.15	35,35,35,35	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 LFX F 101:

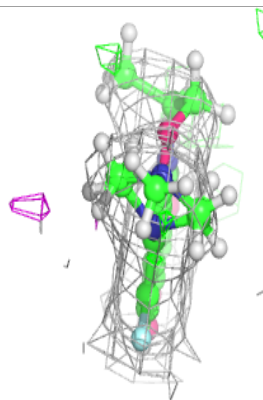
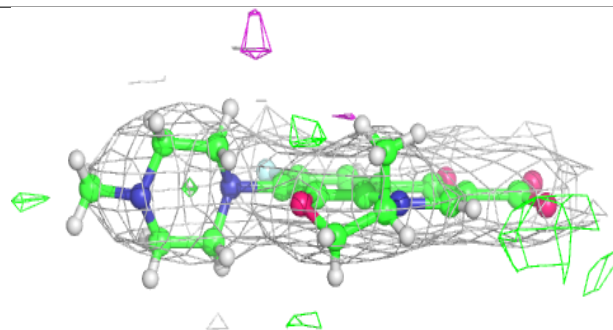
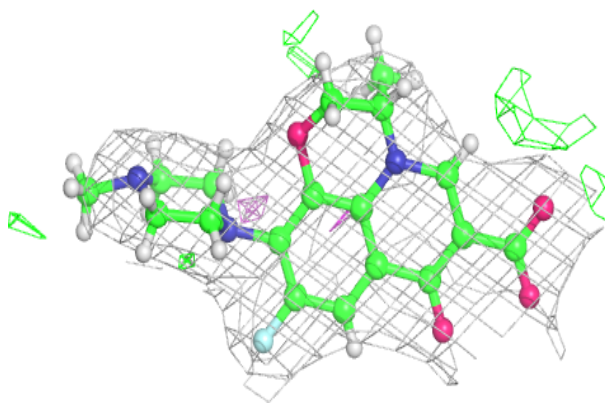
2mF<sub>o</sub>-DF<sub>c</sub> (at 0.7 rmsd) in gray  
mF<sub>o</sub>-DF<sub>c</sub> (at 3 rmsd) in purple (negative)  
and green (positive)





**Electron density around LFX E 101:**

$2mF_o-DF_c$  (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.