



# Full wwPDB X-ray Structure Validation Report ⓘ

Dec 20, 2023 – 12:05 PM EST

PDB ID : 8STD  
Title : S127A variant of LarB, a carboxylase/hydrolase involved in synthesis of the cofactor for lactate racemase, in complex with authentic substrate NaAD and soaked with CS2  
Authors : Chatterjee, S.; Rankin, J.A.; Hu, J.; Hausinger, R.P.  
Deposited on : 2023-05-10  
Resolution : 2.65 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.

The types of validation reports are described at

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

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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)  
Xtrriage (Phenix) : 1.13  
EDS : 2.36  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

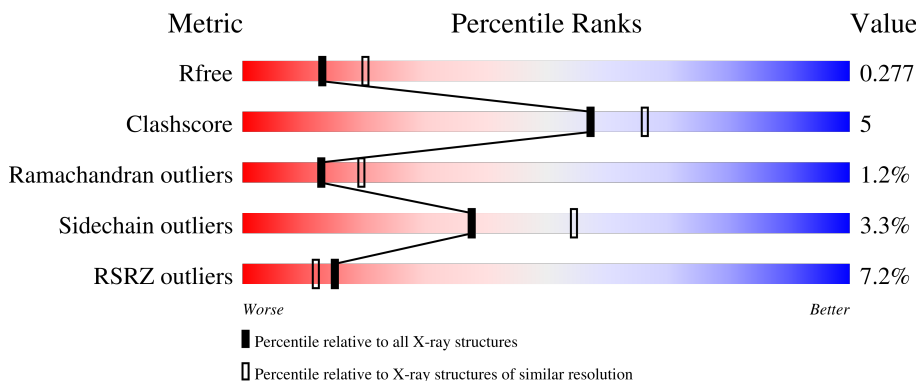
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.65 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.



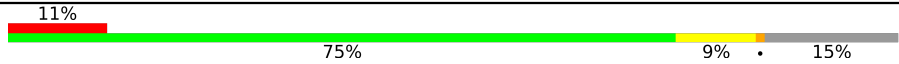

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1332 (2.68-2.64)
Clashscore	141614	1374 (2.68-2.64)
Ramachandran outliers	138981	1349 (2.68-2.64)
Sidechain outliers	138945	1349 (2.68-2.64)
RSRZ outliers	127900	1318 (2.68-2.64)

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  $\geq 3$ , 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	256	3% 67% 11% 21%
1	B	256	% 70% 9% 21%
1	C	256	3% 70% 8% 21%
1	D	256	6% 68% 12% 20%

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Mol	Chain	Length	Quality of chain
1	E	256	
1	F	256	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 8620 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 Pyridinium-3,5-biscarboxylic acid mononucleotide synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	203	1435	906	246	274	9	0	6	0
1	B	202	1406	891	242	265	8	0	1	0
1	C	202	1405	895	238	265	7	0	0	0
1	D	204	1387	877	241	261	8	0	0	0
1	E	217	1448	916	250	276	6	0	0	0
1	F	198	1320	836	225	251	8	0	0	0

There are 66 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	127	ALA	SER	conflict	UNP F9UST0
A	247	ALA	-	expression tag	UNP F9UST0
A	248	SER	-	expression tag	UNP F9UST0
A	249	TRP	-	expression tag	UNP F9UST0
A	250	SER	-	expression tag	UNP F9UST0
A	251	HIS	-	expression tag	UNP F9UST0
A	252	PRO	-	expression tag	UNP F9UST0
A	253	GLN	-	expression tag	UNP F9UST0
A	254	PHE	-	expression tag	UNP F9UST0
A	255	GLU	-	expression tag	UNP F9UST0
A	256	LYS	-	expression tag	UNP F9UST0
B	127	ALA	SER	conflict	UNP F9UST0
B	247	ALA	-	expression tag	UNP F9UST0
B	248	SER	-	expression tag	UNP F9UST0
B	249	TRP	-	expression tag	UNP F9UST0
B	250	SER	-	expression tag	UNP F9UST0
B	251	HIS	-	expression tag	UNP F9UST0

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Chain	Residue	Modelled	Actual	Comment	Reference
B	252	PRO	-	expression tag	UNP F9UST0
B	253	GLN	-	expression tag	UNP F9UST0
B	254	PHE	-	expression tag	UNP F9UST0
B	255	GLU	-	expression tag	UNP F9UST0
B	256	LYS	-	expression tag	UNP F9UST0
C	127	ALA	SER	conflict	UNP F9UST0
C	247	ALA	-	expression tag	UNP F9UST0
C	248	SER	-	expression tag	UNP F9UST0
C	249	TRP	-	expression tag	UNP F9UST0
C	250	SER	-	expression tag	UNP F9UST0
C	251	HIS	-	expression tag	UNP F9UST0
C	252	PRO	-	expression tag	UNP F9UST0
C	253	GLN	-	expression tag	UNP F9UST0
C	254	PHE	-	expression tag	UNP F9UST0
C	255	GLU	-	expression tag	UNP F9UST0
C	256	LYS	-	expression tag	UNP F9UST0
D	127	ALA	SER	conflict	UNP F9UST0
D	247	ALA	-	expression tag	UNP F9UST0
D	248	SER	-	expression tag	UNP F9UST0
D	249	TRP	-	expression tag	UNP F9UST0
D	250	SER	-	expression tag	UNP F9UST0
D	251	HIS	-	expression tag	UNP F9UST0
D	252	PRO	-	expression tag	UNP F9UST0
D	253	GLN	-	expression tag	UNP F9UST0
D	254	PHE	-	expression tag	UNP F9UST0
D	255	GLU	-	expression tag	UNP F9UST0
D	256	LYS	-	expression tag	UNP F9UST0
E	127	ALA	SER	conflict	UNP F9UST0
E	247	ALA	-	expression tag	UNP F9UST0
E	248	SER	-	expression tag	UNP F9UST0
E	249	TRP	-	expression tag	UNP F9UST0
E	250	SER	-	expression tag	UNP F9UST0
E	251	HIS	-	expression tag	UNP F9UST0
E	252	PRO	-	expression tag	UNP F9UST0
E	253	GLN	-	expression tag	UNP F9UST0
E	254	PHE	-	expression tag	UNP F9UST0
E	255	GLU	-	expression tag	UNP F9UST0
E	256	LYS	-	expression tag	UNP F9UST0
F	127	ALA	SER	conflict	UNP F9UST0
F	247	ALA	-	expression tag	UNP F9UST0
F	248	SER	-	expression tag	UNP F9UST0
F	249	TRP	-	expression tag	UNP F9UST0

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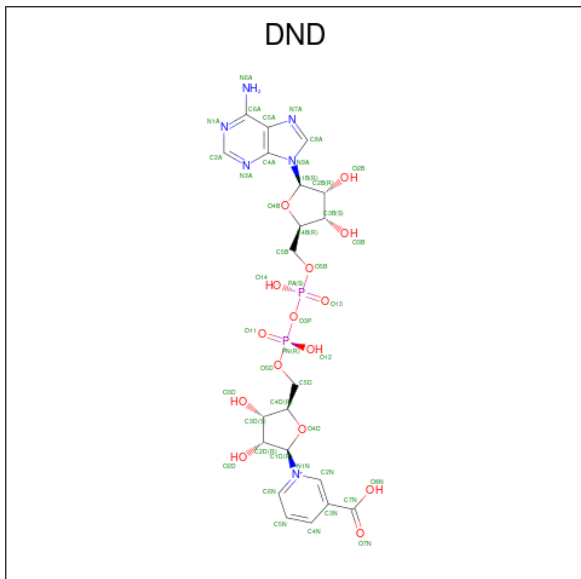
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Chain	Residue	Modelled	Actual	Comment	Reference
F	250	SER	-	expression tag	UNP F9UST0
F	251	HIS	-	expression tag	UNP F9UST0
F	252	PRO	-	expression tag	UNP F9UST0
F	253	GLN	-	expression tag	UNP F9UST0
F	254	PHE	-	expression tag	UNP F9UST0
F	255	GLU	-	expression tag	UNP F9UST0
F	256	LYS	-	expression tag	UNP F9UST0

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total Mg 2 2	0	0
2	B	2	Total Mg 2 2	0	0
2	C	2	Total Mg 2 2	0	0
2	D	1	Total Mg 1 1	0	0
2	E	1	Total Mg 1 1	0	0
2	F	1	Total Mg 1 1	0	0

- Molecule 3 is NICOTINIC ACID ADENINE DINUCLEOTIDE (three-letter code: DND) (formula: C<sub>21</sub>H<sub>27</sub>N<sub>6</sub>O<sub>15</sub>P<sub>2</sub>) (labeled as "Ligand of Interest" by depositor).

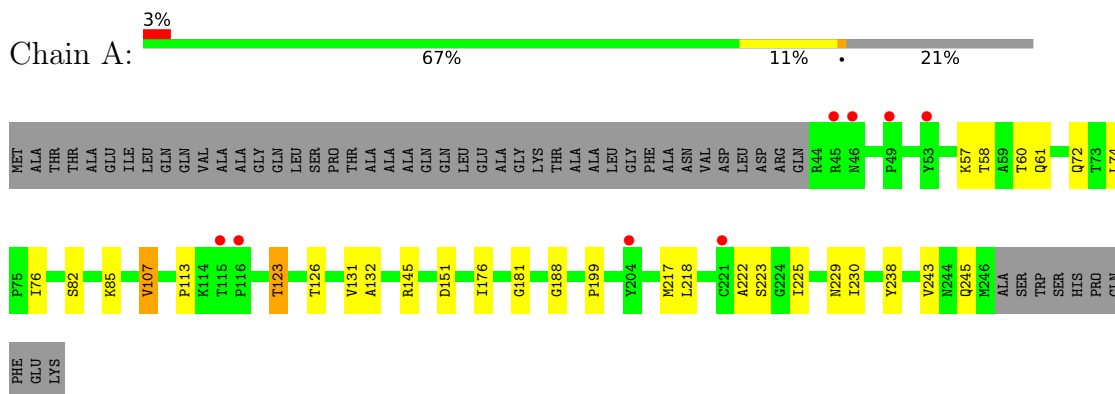


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			44	21	6	15	2		
3	B	1	Total	C	N	O	P	0	0
			26	11	1	12	2		
3	C	1	Total	C	N	O	P	0	0
			44	21	6	15	2		
3	D	1	Total	C	N	O	P	0	0
			26	11	1	12	2		
3	E	1	Total	C	N	O	P	0	0
			44	21	6	15	2		
3	F	1	Total	C	N	O	P	0	0
			26	11	1	12	2		

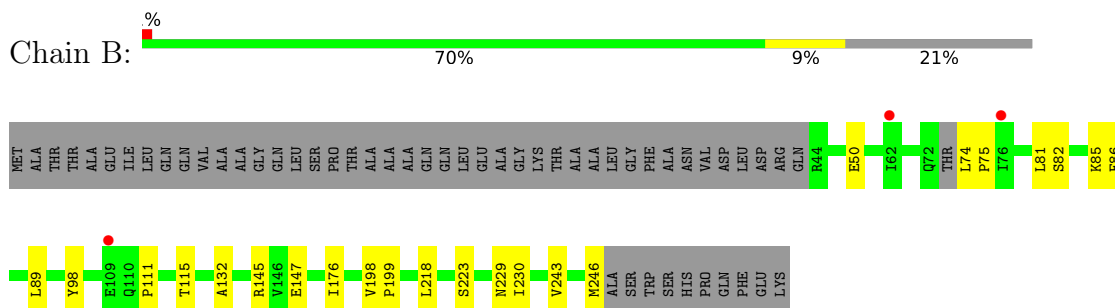
### 3 Residue-property plots [i](#)

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.

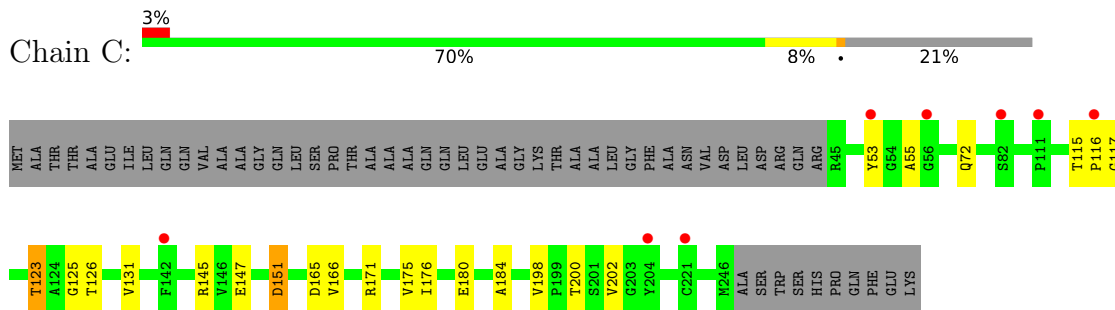
- Molecule 1: Pyridinium-3,5-biscarboxylic acid mononucleotide synthase



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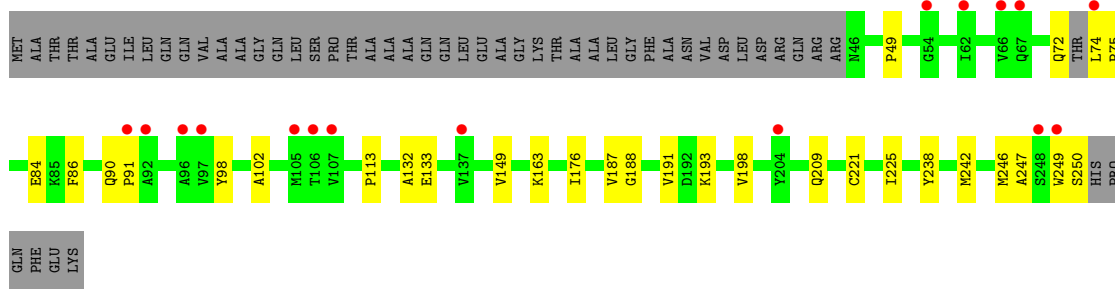
- Molecule 1: Pyridinium-3,5-biscarboxylic acid mononucleotide synthase



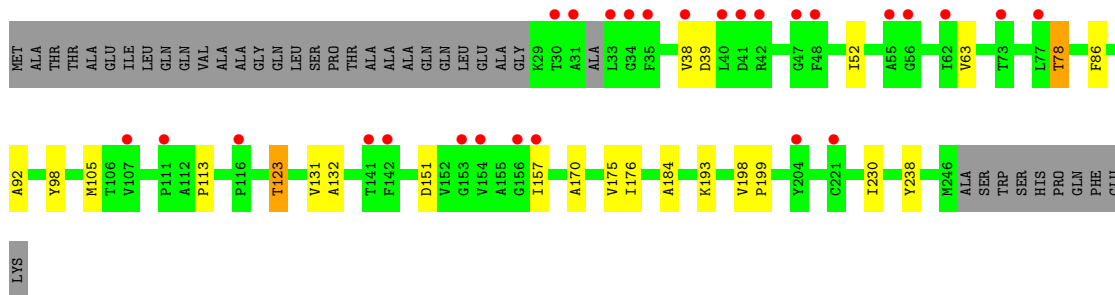
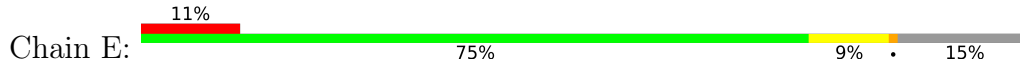
- Molecule 1: Pyridinium-3,5-biscarboxylic acid mononucleotide synthase



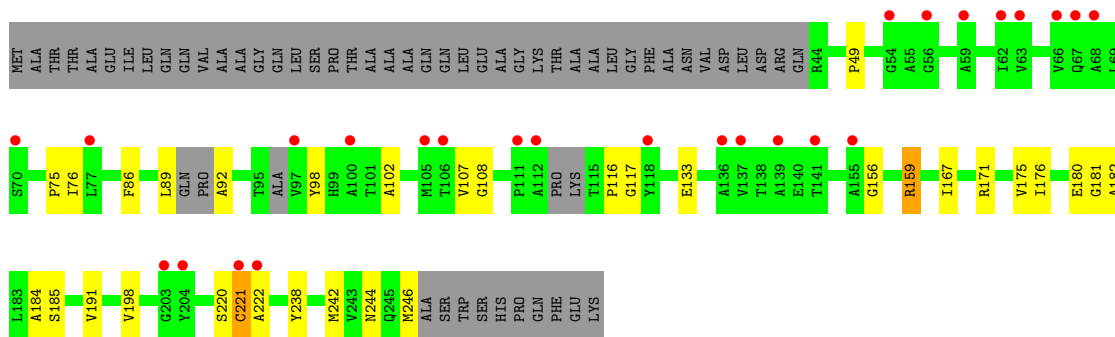




● Molecule 1: Pyridinium-3,5-bis(carboxylic acid) mononucleotide synthase



● Molecule 1: Pyridinium-3,5-bis(carboxylic acid) mononucleotide synthase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 4 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	118.84Å 118.84Å 211.29Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	78.96 – 2.65 84.03 – 2.65	Depositor EDS
% Data completeness (in resolution range)	99.4 (78.96-2.65) 99.5 (84.03-2.65)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.40 (at 2.65Å)	Xtrriage
Refinement program	PHENIX (1.19_4092: ???)	Depositor
R, $R_{free}$	0.242 , 0.273 0.243 , 0.277	Depositor DCC
$R_{free}$ test set	2245 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	57.8	Xtrriage
Anisotropy	0.085	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 51.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.91	EDS
Total number of atoms	8620	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	80.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.49% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG, DND

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	0.28	0/1460	0.53	0/1999
1	B	0.29	0/1425	0.54	0/1946
1	C	0.31	0/1427	0.55	0/1955
1	D	0.28	0/1409	0.51	0/1931
1	E	0.27	0/1470	0.48	0/2019
1	F	0.28	0/1335	0.49	0/1826
All	All	0.28	0/8526	0.52	0/11676

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

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	1435	0	1401	18	0
1	B	1406	0	1408	14	0
1	C	1405	0	1400	16	0
1	D	1387	0	1325	15	0
1	E	1448	0	1353	11	0
1	F	1320	0	1259	16	0
2	A	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
3	A	44	0	24	1	0
3	B	26	0	12	0	0
3	C	44	0	25	2	0
3	D	26	0	12	0	0
3	E	44	0	24	0	0
3	F	26	0	12	0	0
All	All	8620	0	8255	83	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 5.

All (83) 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:E:123:THR:HG22	1:E:151:ASP:H	1.39	0.88
1:C:123:THR:HG22	1:C:151:ASP:H	1.36	0.86
1:A:123:THR:HG22	1:A:151:ASP:H	1.39	0.84
1:F:156:GLY:O	1:F:159:ARG:HG3	1.83	0.78
1:A:76:ILE:HB	1:A:107:VAL:HG13	1.65	0.77
1:F:221:CYS:SG	1:F:222:ALA:N	2.60	0.75
1:C:171:ARG:NH1	1:D:247:ALA:O	2.22	0.73
1:A:58:THR:HG22	1:A:61:GLN:HG3	1.72	0.71
1:C:116:PRO:HA	1:C:145:ARG:HH21	1.58	0.67
1:C:125:GLY:HA3	3:C:303:DND:H3	1.80	0.63
1:A:199:PRO:HD3	1:A:217:MET:HE1	1.81	0.63
1:C:126:THR:HG23	1:C:151:ASP:OD2	2.00	0.62
1:F:76:ILE:H	1:F:107:VAL:HG22	1.66	0.61
1:A:199:PRO:HG2	1:A:230:ILE:HA	1.83	0.60
1:C:126:THR:CG2	1:C:151:ASP:OD2	2.49	0.60
1:A:58:THR:HG23	1:A:60:THR:H	1.67	0.58
1:E:170:ALA:O	1:E:193:LYS:HD3	2.05	0.56
1:F:49:PRO:HB3	1:F:75:PRO:HD2	1.87	0.56
1:E:63:VAL:HG21	1:E:92:ALA:HB3	1.89	0.54
1:D:187:VAL:O	1:D:191:VAL:HG13	2.09	0.53
1:B:111:PRO:HG2	1:D:250:SER:HA	1.89	0.53
1:B:86:PHE:CZ	1:B:98:TYR:HB2	2.43	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:229[A]:ASN:OD1	1:A:230:ILE:N	2.42	0.52
1:B:81:LEU:HA	1:B:85[B]:LYS:HE2	1.91	0.52
1:B:82:SER:OG	1:B:85[B]:LYS:HG2	2.09	0.52
1:D:132:ALA:HA	1:D:176:ILE:HD13	1.92	0.52
1:A:132:ALA:HA	1:A:176:ILE:HD13	1.92	0.51
1:E:52:ILE:HB	1:E:78:THR:HB	1.92	0.51
1:F:176:ILE:HG12	1:F:198:VAL:HB	1.93	0.50
1:F:86:PHE:CE1	1:F:98:TYR:HB2	2.47	0.49
1:B:145:ARG:HH12	1:C:165:ASP:HB3	1.77	0.49
1:D:191:VAL:HG23	1:D:193:LYS:H	1.76	0.49
1:A:57:LYS:O	1:A:85:LYS:NZ	2.33	0.49
1:F:89:LEU:HA	1:F:92:ALA:HB3	1.96	0.48
1:A:113:PRO:HB3	1:A:145:ARG:HG3	1.96	0.48
1:F:180:GLU:O	1:F:182:ALA:N	2.47	0.48
1:B:132:ALA:HA	1:B:176:ILE:HD13	1.94	0.48
1:A:229[A]:ASN:HB2	1:B:218:LEU:O	2.14	0.47
1:D:188:GLY:HA3	1:D:225:ILE:HD11	1.96	0.47
1:A:222[B]:ALA:O	1:A:223[B]:SER:OG	2.26	0.47
1:C:176:ILE:HG12	1:C:198:VAL:HB	1.96	0.47
1:F:175:VAL:HG11	1:F:184:ALA:HA	1.96	0.47
1:B:176:ILE:HG12	1:B:198:VAL:HB	1.96	0.47
1:E:175:VAL:HG11	1:E:184:ALA:HA	1.97	0.47
1:F:167:ILE:HG22	1:F:191:VAL:HG11	1.96	0.46
1:D:149:VAL:HG13	1:D:163:LYS:HD2	1.97	0.46
1:D:72:GLN:O	1:D:74:LEU:N	2.49	0.46
1:B:199:PRO:HG2	1:B:230:ILE:HA	1.99	0.45
1:D:102:ALA:HB2	1:D:133:GLU:HB3	1.98	0.45
1:C:147:GLU:HG2	1:C:166:VAL:HG11	1.99	0.44
1:B:145:ARG:NH2	1:C:166:VAL:HG22	2.32	0.44
1:A:126:THR:N	3:A:303:DND:O11	2.50	0.44
1:E:176:ILE:HG12	1:E:198:VAL:HB	1.98	0.44
1:C:147:GLU:HG2	1:C:166:VAL:CG1	2.48	0.44
1:F:102:ALA:HB2	1:F:133:GLU:HB3	2.00	0.44
1:F:171:ARG:NH1	1:F:244:ASN:O	2.51	0.44
1:E:86:PHE:CZ	1:E:98:TYR:HB2	2.53	0.44
1:F:242:MET:O	1:F:246:MET:HG3	2.18	0.44
1:E:199:PRO:HG2	1:E:230:ILE:HA	2.00	0.43
1:F:185:SER:HB3	1:F:221:CYS:SG	2.58	0.43
1:C:126:THR:HG22	1:C:151:ASP:OD2	2.18	0.43
1:A:199:PRO:CD	1:A:217:MET:HE1	2.47	0.43
1:A:243:VAL:HG13	1:B:243:VAL:HG13	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:157:ILE:H	1:E:157:ILE:HG13	1.58	0.43
1:D:49:PRO:HB3	1:D:75:PRO:O	2.18	0.43
1:D:176:ILE:HG12	1:D:198:VAL:HB	2.01	0.43
1:D:90:GLN:N	1:D:91:PRO:HD2	2.34	0.42
1:C:175:VAL:HG11	1:C:184:ALA:HA	2.00	0.42
1:D:221:CYS:HA	1:D:225:ILE:HB	2.00	0.42
1:B:145:ARG:NH1	1:C:165:ASP:HB3	2.34	0.42
1:A:218:LEU:O	1:B:229:ASN:HB2	2.19	0.42
1:C:200:THR:OG1	1:C:202:VAL:HG22	2.20	0.42
1:F:117:GLY:HA3	1:F:171:ARG:CD	2.50	0.41
1:C:53:TYR:CZ	1:C:55:ALA:HB3	2.55	0.41
1:E:78:THR:HG23	1:E:105:MET:HB3	2.03	0.41
1:B:74:LEU:HB3	1:B:75:PRO:CD	2.51	0.41
1:D:86:PHE:CZ	1:D:98:TYR:HB2	2.56	0.40
1:A:188:GLY:HA3	1:A:225:ILE:HD11	2.03	0.40
1:D:242:MET:O	1:D:246:MET:HG3	2.22	0.40
1:F:159:ARG:HG3	1:F:159:ARG:H	1.58	0.40
3:C:303:DND:H25	3:C:303:DND:H21	1.90	0.40
1:E:132:ALA:HA	1:E:176:ILE:HD13	2.02	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	207/256 (81%)	196 (95%)	8 (4%)	3 (1%)	11 16
1	B	199/256 (78%)	188 (94%)	10 (5%)	1 (0%)	29 43
1	C	200/256 (78%)	186 (93%)	12 (6%)	2 (1%)	15 23
1	D	200/256 (78%)	190 (95%)	8 (4%)	2 (1%)	15 23
1	E	213/256 (83%)	193 (91%)	17 (8%)	3 (1%)	11 16

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	F	190/256 (74%)	174 (92%)	12 (6%)	4 (2%)	7	10
All	All	1209/1536 (79%)	1127 (93%)	67 (6%)	15 (1%)	13	19

All (15) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	113	PRO
1	E	38	VAL
1	F	181	GLY
1	A	181	GLY
1	C	72	GLN
1	F	220	SER
1	A	74	LEU
1	F	116	PRO
1	B	223	SER
1	A	72	GLN
1	D	249	TRP
1	E	39	ASP
1	E	113	PRO
1	C	117	GLY
1	F	108	GLY

### 5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	138/190 (73%)	132 (96%)	6 (4%)	29	44
1	B	137/190 (72%)	132 (96%)	5 (4%)	35	51
1	C	136/190 (72%)	131 (96%)	5 (4%)	34	50
1	D	126/190 (66%)	123 (98%)	3 (2%)	49	67
1	E	126/190 (66%)	122 (97%)	4 (3%)	39	56
1	F	119/190 (63%)	116 (98%)	3 (2%)	47	66
All	All	782/1140 (69%)	756 (97%)	26 (3%)	38	54

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	82	SER
1	A	107	VAL
1	A	123	THR
1	A	131	VAL
1	A	238	TYR
1	A	245	GLN
1	B	50	GLU
1	B	89	LEU
1	B	115	THR
1	B	147	GLU
1	B	246	MET
1	C	115	THR
1	C	123	THR
1	C	131	VAL
1	C	151	ASP
1	C	180	GLU
1	D	84	GLU
1	D	209	GLN
1	D	238	TYR
1	E	78	THR
1	E	123	THR
1	E	131	VAL
1	E	238	TYR
1	F	159	ARG
1	F	221	CYS
1	F	238	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	D	245	GLN
1	E	90	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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



## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 15 ligands modelled in this entry, 9 are monoatomic - leaving 6 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
3	DND	F	302	2	24,27,48	2.70	9 (37%)	34,41,73	1.77	8 (23%)
3	DND	E	302	2	42,48,48	2.52	13 (30%)	50,73,73	1.87	9 (18%)
3	DND	C	303	2	42,48,48	2.60	14 (33%)	50,73,73	1.79	10 (20%)
3	DND	D	302	-	24,27,48	2.73	9 (37%)	34,41,73	1.79	9 (26%)
3	DND	A	303	2	42,48,48	2.55	13 (30%)	50,73,73	1.84	12 (24%)
3	DND	B	303	2	24,27,48	2.70	9 (37%)	34,41,73	1.74	8 (23%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	DND	F	302	2	-	7/20/36/62	0/2/2/5
3	DND	E	302	2	-	7/26/62/62	0/5/5/5
3	DND	C	303	2	-	4/26/62/62	0/5/5/5
3	DND	D	302	-	-	0/20/36/62	0/2/2/5
3	DND	A	303	2	-	6/26/62/62	0/5/5/5
3	DND	B	303	2	-	7/20/36/62	0/2/2/5

All (67) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	303	DND	O4D-C1D	7.94	1.52	1.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	303	DND	O4B-C1B	7.72	1.51	1.41
3	C	303	DND	O4B-C1B	7.65	1.51	1.41
3	D	302	DND	O4D-C1D	7.57	1.51	1.41
3	A	303	DND	O4D-C1D	7.56	1.51	1.41
3	B	303	DND	O4D-C1D	7.49	1.51	1.41
3	E	302	DND	O4B-C1B	7.46	1.51	1.41
3	F	302	DND	O4D-C1D	7.45	1.51	1.41
3	E	302	DND	O4D-C1D	7.29	1.51	1.41
3	B	303	DND	PA-O13	5.09	1.66	1.50
3	D	302	DND	PA-O13	5.07	1.66	1.50
3	F	302	DND	PA-O13	5.00	1.66	1.50
3	D	302	DND	PN-O11	4.64	1.67	1.50
3	C	303	DND	PA-O13	4.64	1.67	1.50
3	F	302	DND	PN-O11	4.60	1.67	1.50
3	B	303	DND	PN-O11	4.60	1.67	1.50
3	A	303	DND	PA-O13	4.58	1.67	1.50
3	E	302	DND	PA-O13	4.58	1.67	1.50
3	A	303	DND	C2D-C1D	-3.81	1.48	1.53
3	D	302	DND	C2D-C1D	-3.77	1.48	1.53
3	E	302	DND	C2B-C1B	-3.74	1.48	1.53
3	F	302	DND	C2D-C1D	-3.65	1.48	1.53
3	C	303	DND	C2D-C1D	-3.63	1.48	1.53
3	E	302	DND	C2D-C1D	-3.58	1.48	1.53
3	B	303	DND	C2D-C1D	-3.52	1.48	1.53
3	A	303	DND	C2B-C1B	-3.47	1.48	1.53
3	C	303	DND	C2B-C1B	-3.46	1.48	1.53
3	C	303	DND	C6A-N6A	3.44	1.46	1.34
3	A	303	DND	C6A-N6A	3.44	1.46	1.34
3	E	302	DND	C6A-N6A	3.41	1.46	1.34
3	B	303	DND	PA-O14	3.25	1.67	1.54
3	D	302	DND	PA-O14	3.23	1.67	1.54
3	F	302	DND	PA-O14	3.20	1.67	1.54
3	C	303	DND	O4D-C4D	3.08	1.51	1.45
3	C	303	DND	O4B-C4B	3.05	1.51	1.45
3	C	303	DND	C2D-C3D	-2.95	1.45	1.53
3	E	302	DND	O4B-C4B	2.95	1.51	1.45
3	A	303	DND	O4B-C4B	2.93	1.51	1.45
3	A	303	DND	O4D-C4D	2.88	1.51	1.45
3	D	302	DND	C2D-C3D	-2.84	1.45	1.53
3	E	302	DND	C2B-C3B	-2.84	1.45	1.53
3	B	303	DND	O4D-C4D	2.80	1.51	1.45
3	F	302	DND	C2D-C3D	-2.80	1.45	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	303	DND	C2D-C3D	-2.80	1.45	1.53
3	C	303	DND	C2B-C3B	-2.80	1.45	1.53
3	F	302	DND	O4D-C4D	2.77	1.51	1.45
3	A	303	DND	C2D-C3D	-2.73	1.45	1.53
3	E	302	DND	O4D-C4D	2.71	1.51	1.45
3	E	302	DND	C2D-C3D	-2.70	1.46	1.53
3	D	302	DND	O4D-C4D	2.69	1.51	1.45
3	A	303	DND	C2A-N3A	2.62	1.36	1.32
3	C	303	DND	C2A-N3A	2.59	1.36	1.32
3	C	303	DND	PN-O12	2.56	1.67	1.55
3	A	303	DND	PN-O12	2.54	1.67	1.55
3	E	302	DND	PN-O12	2.52	1.67	1.55
3	A	303	DND	C2B-C3B	-2.50	1.46	1.53
3	E	302	DND	C2A-N3A	2.48	1.36	1.32
3	B	303	DND	C3N-C7N	2.40	1.54	1.49
3	A	303	DND	C3N-C7N	2.36	1.54	1.49
3	C	303	DND	C3N-C7N	2.30	1.54	1.49
3	F	302	DND	C3N-C7N	2.24	1.54	1.49
3	B	303	DND	PA-O5B	-2.21	1.46	1.54
3	E	302	DND	C3N-C7N	2.20	1.54	1.49
3	F	302	DND	PA-O5B	-2.18	1.46	1.54
3	D	302	DND	PA-O5B	-2.16	1.46	1.54
3	D	302	DND	C3N-C7N	2.16	1.54	1.49
3	C	303	DND	C3D-C4D	-2.01	1.47	1.53

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	302	DND	O8N-C7N-O7N	5.94	136.53	123.35
3	D	302	DND	O8N-C7N-O7N	5.91	136.45	123.35
3	F	302	DND	O8N-C7N-O7N	5.85	136.33	123.35
3	A	303	DND	O8N-C7N-O7N	5.81	136.24	123.35
3	C	303	DND	O8N-C7N-O7N	5.78	136.16	123.35
3	E	302	DND	N3A-C2A-N1A	-5.77	119.67	128.68
3	A	303	DND	N3A-C2A-N1A	-5.59	119.94	128.68
3	C	303	DND	N3A-C2A-N1A	-5.56	119.99	128.68
3	B	303	DND	O8N-C7N-O7N	5.55	135.66	123.35
3	E	302	DND	C3D-C2D-C1D	4.26	107.40	100.98
3	F	302	DND	C3D-C2D-C1D	3.89	106.84	100.98
3	A	303	DND	PA-O3P-PN	-3.88	119.51	132.83
3	E	302	DND	O7N-C7N-C3N	-3.74	111.49	121.45
3	B	303	DND	C3D-C2D-C1D	3.73	106.59	100.98

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	302	DND	O7N-C7N-C3N	-3.73	111.53	121.45
3	A	303	DND	O7N-C7N-C3N	-3.68	111.66	121.45
3	D	302	DND	C3D-C2D-C1D	3.65	106.48	100.98
3	B	303	DND	O7N-C7N-C3N	-3.58	111.92	121.45
3	A	303	DND	C3B-C2B-C1B	3.54	106.31	100.98
3	C	303	DND	O7N-C7N-C3N	-3.53	112.04	121.45
3	F	302	DND	O7N-C7N-C3N	-3.53	112.04	121.45
3	E	302	DND	C1B-N9A-C4A	-3.29	120.86	126.64
3	C	303	DND	PA-O3P-PN	-3.10	122.20	132.83
3	C	303	DND	C4A-C5A-N7A	-3.08	106.19	109.40
3	E	302	DND	PA-O3P-PN	-3.02	122.45	132.83
3	E	302	DND	C4A-C5A-N7A	-2.86	106.42	109.40
3	C	303	DND	C3B-C2B-C1B	2.81	105.20	100.98
3	A	303	DND	C3D-C2D-C1D	2.80	105.19	100.98
3	E	302	DND	C2D-C3D-C4D	2.78	108.05	102.64
3	A	303	DND	C2B-C3B-C4B	2.71	107.90	102.64
3	F	302	DND	C2D-C3D-C4D	2.69	107.88	102.64
3	A	303	DND	C4A-C5A-N7A	-2.63	106.66	109.40
3	B	303	DND	PN-O3P-PA	-2.60	123.90	132.83
3	B	303	DND	O14-PA-O3P	2.59	113.32	104.64
3	C	303	DND	C6N-N1N-C2N	-2.58	119.62	121.97
3	C	303	DND	C1B-N9A-C4A	-2.51	122.23	126.64
3	D	302	DND	PN-O3P-PA	-2.51	124.21	132.83
3	F	302	DND	PN-O3P-PA	-2.45	124.42	132.83
3	D	302	DND	C2D-C3D-C4D	2.42	107.34	102.64
3	A	303	DND	C2D-C3D-C4D	2.38	107.27	102.64
3	D	302	DND	C6N-N1N-C2N	-2.36	119.83	121.97
3	B	303	DND	C2D-C3D-C4D	2.30	107.11	102.64
3	C	303	DND	O14-PA-O13	-2.19	101.39	112.24
3	A	303	DND	C6N-N1N-C2N	-2.17	119.99	121.97
3	F	302	DND	O14-PA-O3P	2.16	111.88	104.64
3	C	303	DND	O12-PN-O11	-2.16	101.56	112.24
3	B	303	DND	C6N-N1N-C2N	-2.15	120.01	121.97
3	E	302	DND	O14-PA-O13	-2.15	101.63	112.24
3	D	302	DND	O5B-PA-O3P	2.11	111.72	104.64
3	D	302	DND	O12-PN-O11	-2.11	101.83	112.24
3	A	303	DND	O14-PA-O13	-2.06	102.06	112.24
3	F	302	DND	O12-PN-O11	-2.06	102.06	112.24
3	F	302	DND	C6N-N1N-C2N	-2.04	120.11	121.97
3	A	303	DND	O12-PN-O11	-2.03	102.21	112.24
3	D	302	DND	O14-PA-O3P	2.01	111.38	104.64
3	B	303	DND	C5D-C4D-C3D	-2.00	107.67	115.18

There are no chirality outliers.

All (31) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	303	DND	C5D-O5D-PN-O12
3	B	303	DND	C5D-O5D-PN-O3P
3	B	303	DND	PN-O3P-PA-O14
3	C	303	DND	O4D-C1D-N1N-C2N
3	C	303	DND	C3B-C4B-C5B-O5B
3	F	302	DND	C5D-O5D-PN-O12
3	F	302	DND	C5D-O5D-PN-O3P
3	A	303	DND	C4N-C3N-C7N-O8N
3	A	303	DND	C4N-C3N-C7N-O7N
3	A	303	DND	C2N-C3N-C7N-O7N
3	A	303	DND	C2N-C3N-C7N-O8N
3	C	303	DND	O4B-C4B-C5B-O5B
3	E	302	DND	C4N-C3N-C7N-O8N
3	E	302	DND	C4N-C3N-C7N-O7N
3	E	302	DND	C2N-C3N-C7N-O7N
3	E	302	DND	C2N-C3N-C7N-O8N
3	F	302	DND	C4N-C3N-C7N-O8N
3	A	303	DND	PA-O3P-PN-O11
3	E	302	DND	PA-O3P-PN-O11
3	F	302	DND	C4N-C3N-C7N-O7N
3	F	302	DND	C2N-C3N-C7N-O8N
3	F	302	DND	C2N-C3N-C7N-O7N
3	C	303	DND	C4B-C5B-O5B-PA
3	B	303	DND	O4D-C4D-C5D-O5D
3	B	303	DND	C3D-C4D-C5D-O5D
3	B	303	DND	PN-O3P-PA-O5B
3	E	302	DND	PN-O3P-PA-O14
3	A	303	DND	C5B-O5B-PA-O14
3	B	303	DND	C5D-O5D-PN-O11
3	E	302	DND	C5B-O5B-PA-O14
3	F	302	DND	C5D-O5D-PN-O11

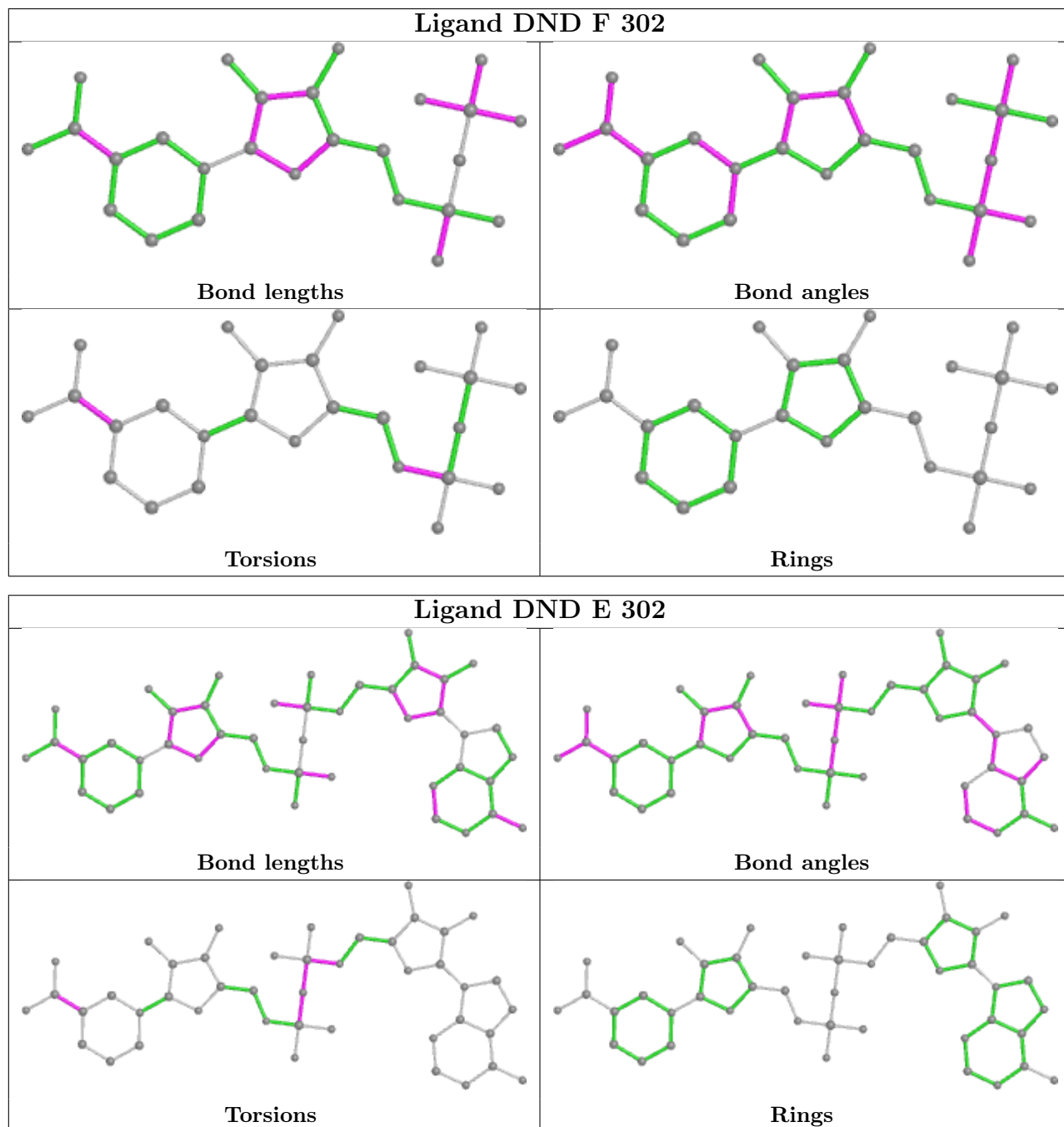
There are no ring outliers.

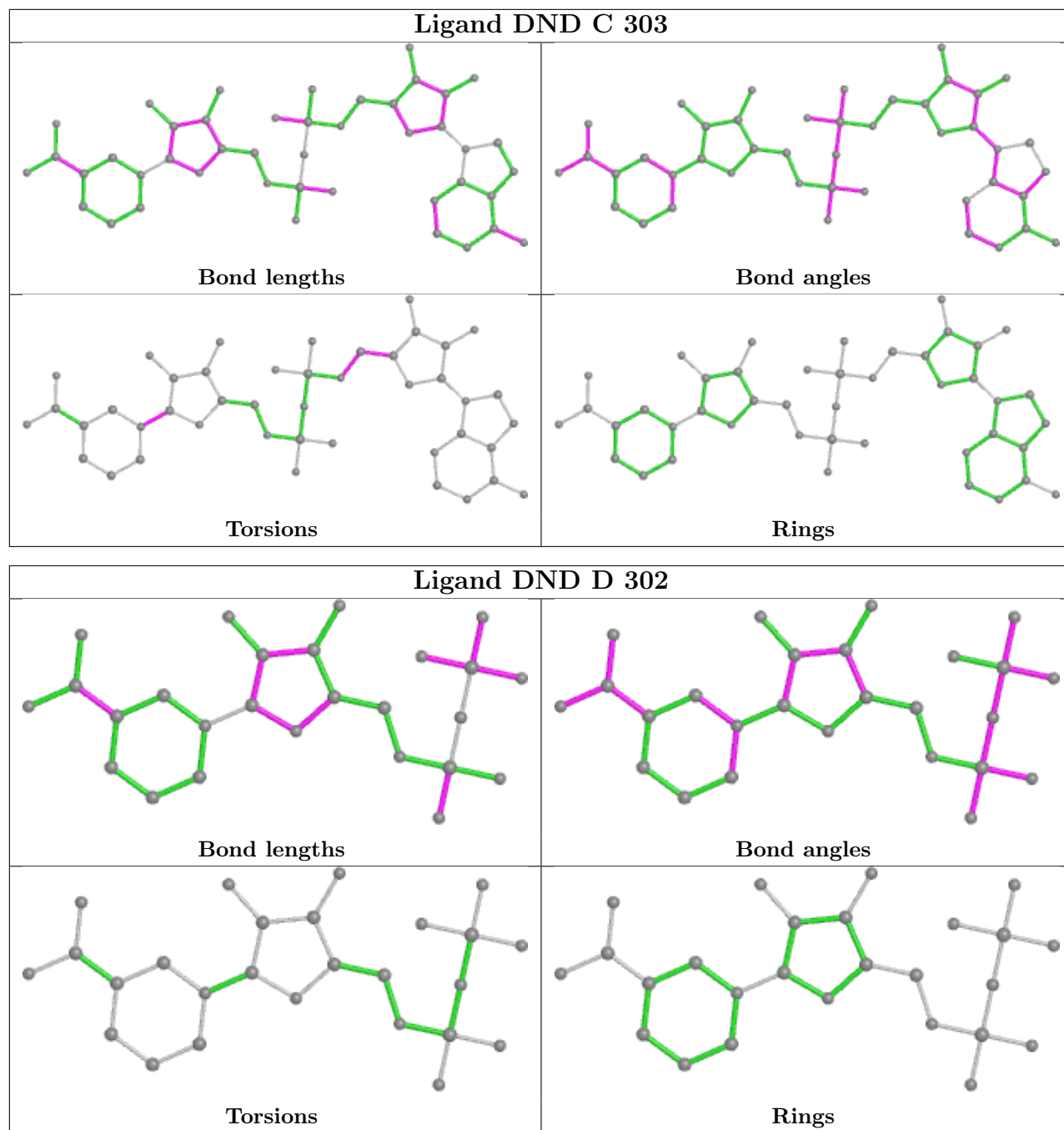
2 monomers are involved in 3 short contacts:

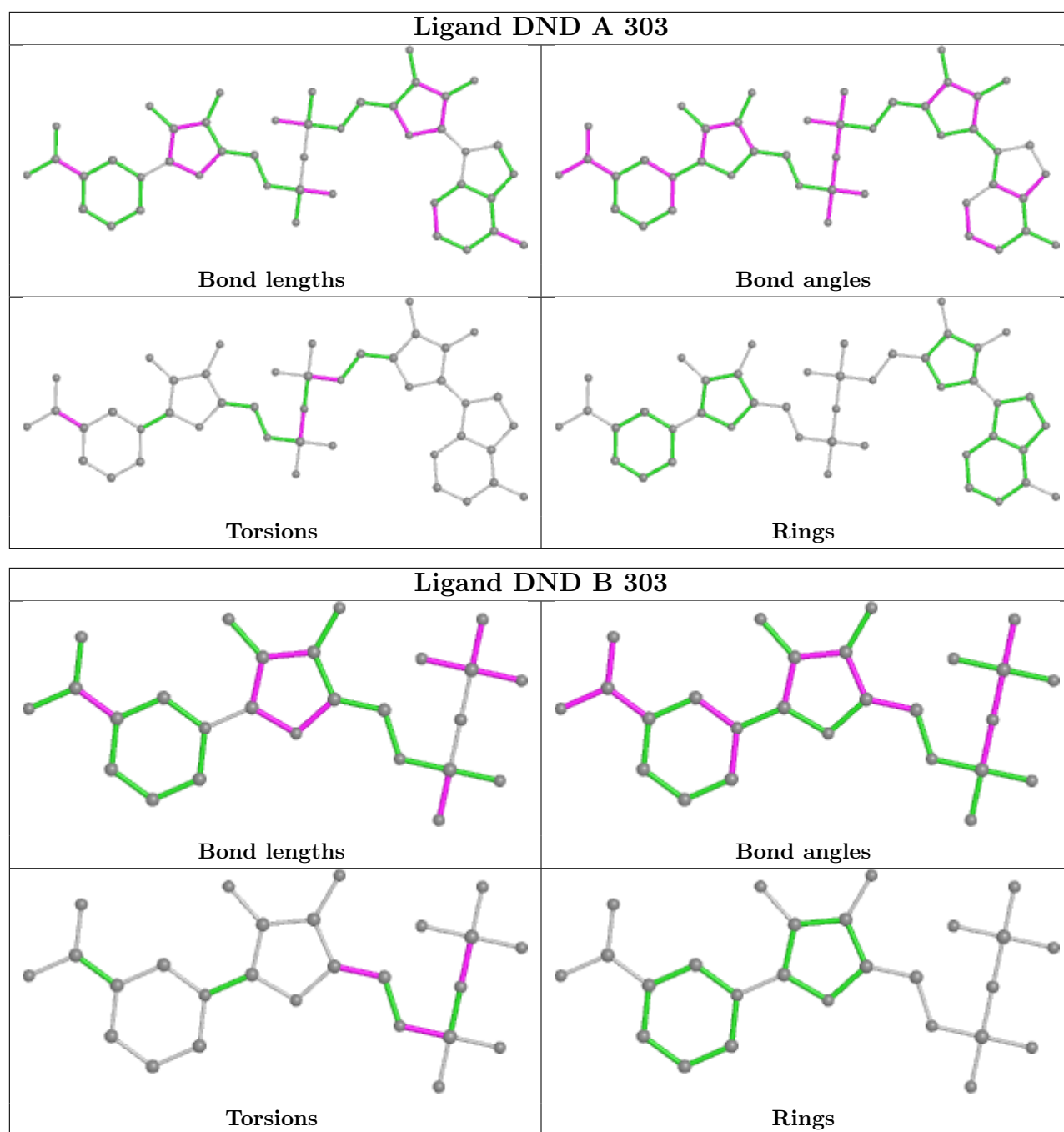
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	303	DND	2	0
3	A	303	DND	1	0

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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	203/256 (79%)	0.42	8 (3%) 39 35	35, 65, 137, 187	0
1	B	202/256 (78%)	0.32	3 (1%) 73 71	32, 58, 110, 152	0
1	C	202/256 (78%)	0.37	8 (3%) 38 34	30, 58, 129, 168	0
1	D	204/256 (79%)	0.56	16 (7%) 13 10	35, 72, 152, 191	0
1	E	217/256 (84%)	0.81	27 (12%) 4 2	47, 88, 152, 181	0
1	F	198/256 (77%)	0.76	26 (13%) 3 2	58, 94, 150, 190	0
All	All	1226/1536 (79%)	0.54	88 (7%) 15 12	30, 76, 143, 191	0

All (88) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	66	VAL	4.7
1	E	107	VAL	4.6
1	F	54	GLY	4.4
1	D	91	PRO	4.4
1	D	74	LEU	4.3
1	F	106	THR	4.2
1	C	221	CYS	4.1
1	A	116	PRO	4.1
1	D	66	VAL	4.1
1	D	96	ALA	3.9
1	E	221	CYS	3.8
1	F	97	VAL	3.8
1	E	154	VAL	3.8
1	D	67	GLN	3.4
1	F	111	PRO	3.4
1	A	53	TYR	3.3
1	F	63	VAL	3.2
1	E	41	ASP	3.2
1	E	33	LEU	3.2

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	A	45	ARG	3.1
1	D	106	THR	3.1
1	F	105	MET	3.1
1	E	34	GLY	3.1
1	E	142	PHE	3.1
1	E	111	PRO	3.0
1	F	139	ALA	3.0
1	F	67	GLN	3.0
1	F	221	CYS	3.0
1	A	46	ASN	3.0
1	F	137	VAL	3.0
1	F	68	ALA	3.0
1	D	249	TRP	3.0
1	E	48	PHE	2.9
1	E	42	ARG	2.9
1	D	107	VAL	2.9
1	A	204	TYR	2.9
1	F	70	SER	2.8
1	D	97	VAL	2.8
1	B	109	GLU	2.7
1	E	153	GLY	2.7
1	C	56	GLY	2.7
1	F	112	ALA	2.7
1	E	141	THR	2.7
1	C	111	PRO	2.6
1	F	77	LEU	2.6
1	E	73	THR	2.6
1	E	47	GLY	2.6
1	A	49	PRO	2.6
1	A	115	THR	2.6
1	D	92	ALA	2.6
1	F	56	GLY	2.6
1	E	62	ILE	2.5
1	E	30	THR	2.5
1	D	105	MET	2.5
1	C	82	SER	2.5
1	F	136	ALA	2.5
1	F	203	GLY	2.5
1	D	62	ILE	2.5
1	E	38	VAL	2.5
1	B	76	ILE	2.4
1	D	54	GLY	2.4

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Mol	Chain	Res	Type	RSRZ
1	C	204	TYR	2.4
1	B	62	ILE	2.4
1	F	204	TYR	2.3
1	D	248	SER	2.3
1	E	77	LEU	2.3
1	E	116	PRO	2.3
1	F	222	ALA	2.3
1	E	156	GLY	2.3
1	F	155	ALA	2.3
1	F	62	ILE	2.3
1	A	221[A]	CYS	2.2
1	C	53	TYR	2.2
1	E	56	GLY	2.1
1	F	59	ALA	2.1
1	E	40	LEU	2.1
1	E	35	PHE	2.1
1	E	204	TYR	2.1
1	C	116	PRO	2.1
1	E	157	ILE	2.1
1	D	204	TYR	2.1
1	F	118	TYR	2.1
1	D	137	VAL	2.0
1	F	141	THR	2.0
1	E	31	ALA	2.0
1	E	55	ALA	2.0
1	F	100	ALA	2.0
1	C	142	PHE	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 monosaccharides in this entry.

## 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

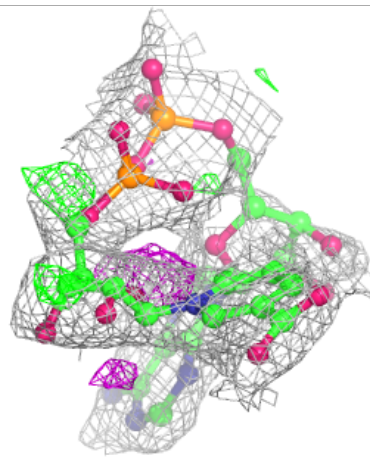
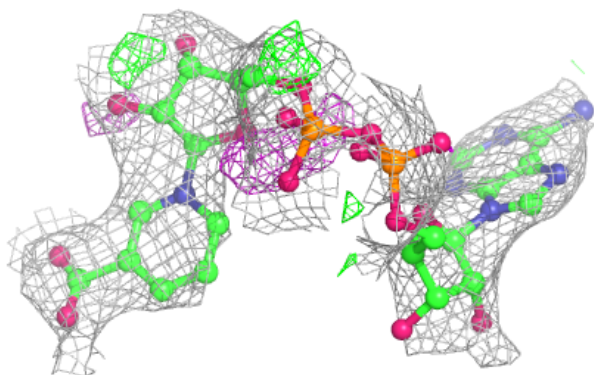
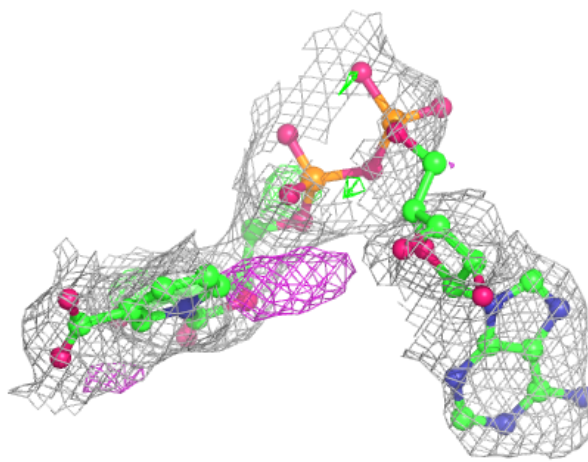
median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	MG	D	301	1/1	0.79	0.29	87,87,87,87	0
2	MG	C	302	1/1	0.81	0.09	93,93,93,93	0
2	MG	F	301	1/1	0.82	0.10	120,120,120,120	0
2	MG	B	301	1/1	0.83	0.17	61,61,61,61	0
3	DND	C	303	44/44	0.83	0.28	103,110,130,134	0
3	DND	F	302	26/44	0.84	0.21	110,115,133,136	0
2	MG	C	301	1/1	0.86	0.18	70,70,70,70	0
2	MG	A	301	1/1	0.87	0.22	68,68,68,68	0
3	DND	A	303	44/44	0.88	0.24	85,100,119,123	0
2	MG	E	301	1/1	0.90	0.08	98,98,98,98	0
3	DND	D	302	26/44	0.91	0.20	74,83,93,96	0
3	DND	E	302	44/44	0.92	0.25	84,95,107,116	0
3	DND	B	303	26/44	0.92	0.19	71,72,85,95	0
2	MG	B	302	1/1	0.93	0.15	91,91,91,91	0
2	MG	A	302	1/1	0.93	0.14	32,32,32,32	1

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.

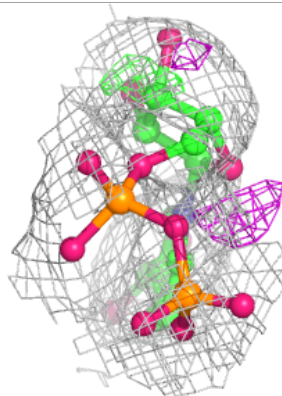
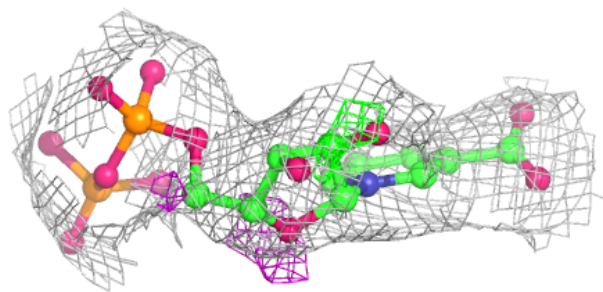
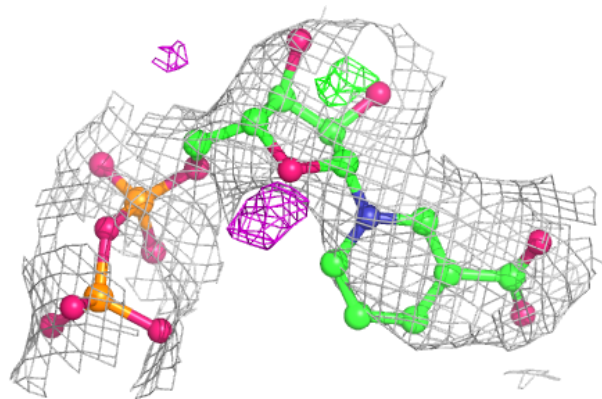
**Electron density around DND C 303:**

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

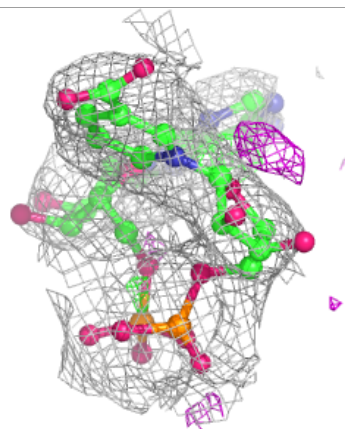
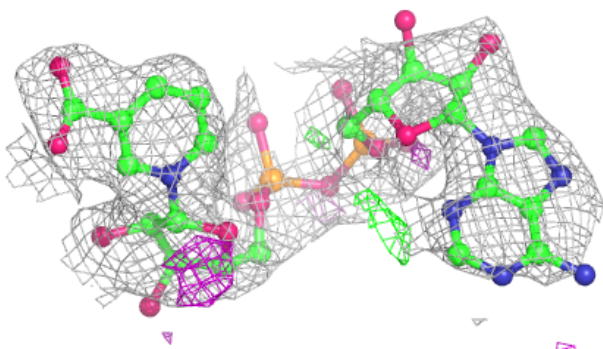
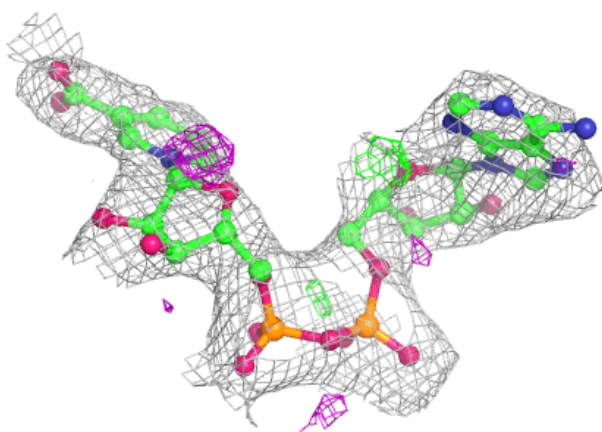


**Electron density around DND F 302:**

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

**Electron density around DND A 303:**

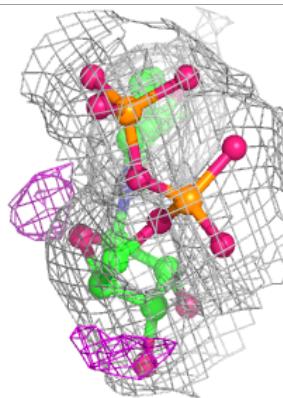
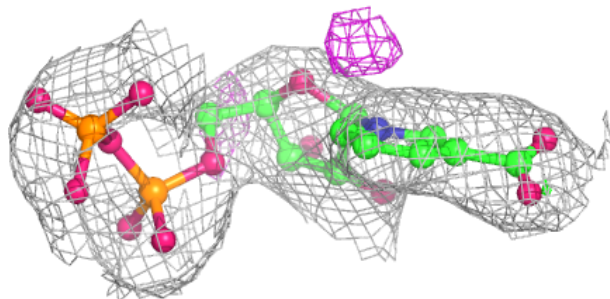
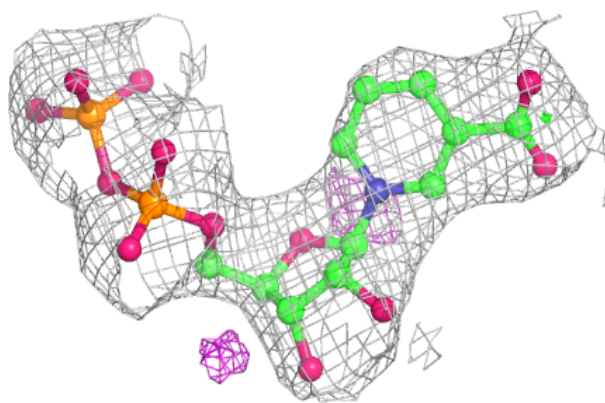
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



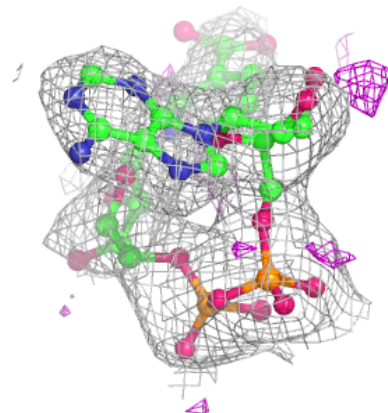
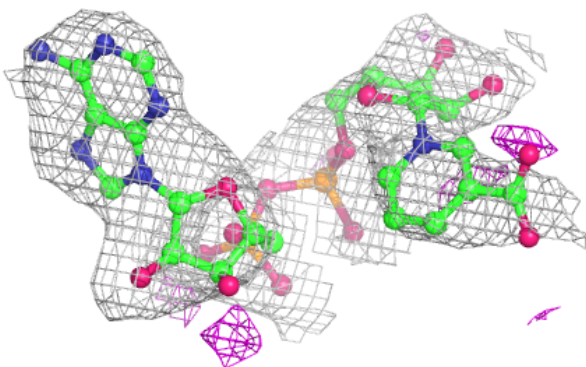
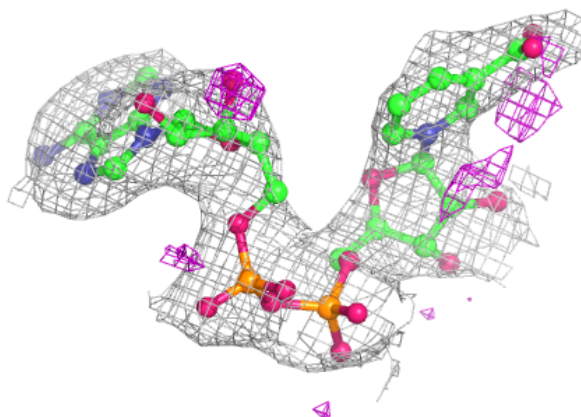


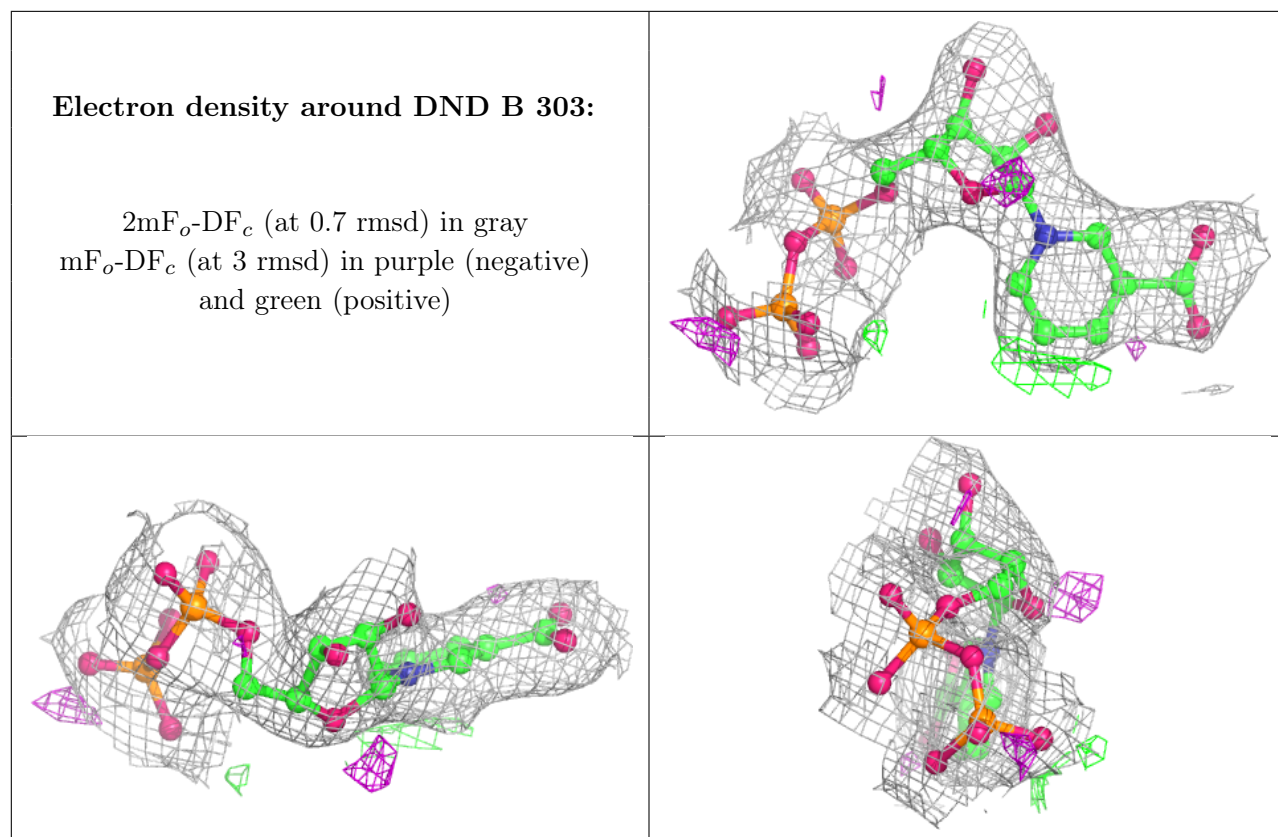
**Electron density around DND D 302:**

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

**Electron density around DND E 302:**

$2mF_o-DF_c$  (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.