



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 29, 2024 – 08:43 AM EST

PDB ID : 5U23  
Title : X-ray structure of the WlaRG aminotransferase from *Campylobacter jejuni* in complex with TDP-Qui3N  
Authors : Holden, H.M.; Thoden, J.B.; Dow, G.T.; Gilbert, M.  
Deposited on : 2016-11-29  
Resolution : 1.45 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)  
Xtriage (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

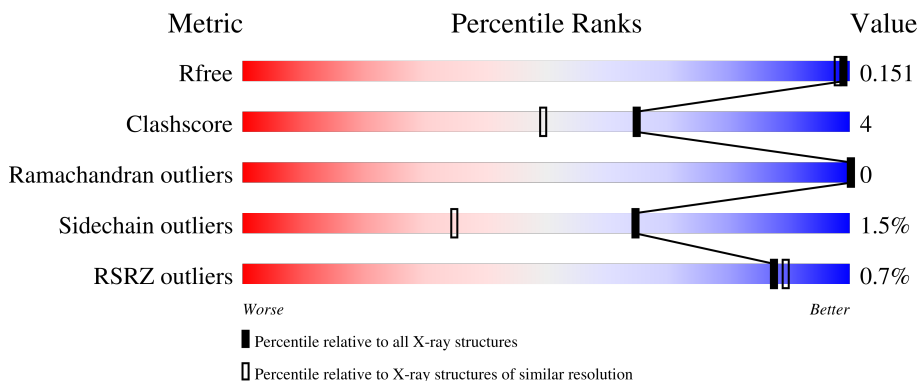
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.45 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	1156 (1.46-1.46)
Clashscore	141614	1202 (1.46-1.46)
Ramachandran outliers	138981	1178 (1.46-1.46)
Sidechain outliers	138945	1178 (1.46-1.46)
RSRZ outliers	127900	1139 (1.46-1.46)

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	382	 87% 7% 5%
1	B	382	 87% 7% 5%
1	C	382	 85% 9% 5%
1	D	382	 88% 8%

## 2 Entry composition i

There are 7 unique types of molecules in this entry. The entry contains 13733 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 Putative aminotransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	C	361	2952	1901	496	540	15	0	5	0
1	D	366	2984	1925	503	542	14	0	3	0
1	A	361	2974	1914	503	542	15	0	7	0
1	B	363	2986	1925	503	543	15	0	5	0

There are 88 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-21	MET	-	initiating methionine	UNP Q9ALS9
C	-20	GLY	-	expression tag	UNP Q9ALS9
C	-19	SER	-	expression tag	UNP Q9ALS9
C	-18	SER	-	expression tag	UNP Q9ALS9
C	-17	HIS	-	expression tag	UNP Q9ALS9
C	-16	HIS	-	expression tag	UNP Q9ALS9
C	-15	HIS	-	expression tag	UNP Q9ALS9
C	-14	HIS	-	expression tag	UNP Q9ALS9
C	-13	HIS	-	expression tag	UNP Q9ALS9
C	-12	HIS	-	expression tag	UNP Q9ALS9
C	-11	SER	-	expression tag	UNP Q9ALS9
C	-10	SER	-	expression tag	UNP Q9ALS9
C	-9	ARG	-	expression tag	UNP Q9ALS9
C	-8	ASN	-	expression tag	UNP Q9ALS9
C	-7	LEU	-	expression tag	UNP Q9ALS9
C	-6	TYR	-	expression tag	UNP Q9ALS9
C	-5	PHE	-	expression tag	UNP Q9ALS9
C	-4	GLN	-	expression tag	UNP Q9ALS9
C	-3	GLY	-	expression tag	UNP Q9ALS9
C	-2	GLY	-	expression tag	UNP Q9ALS9
C	-1	GLY	-	expression tag	UNP Q9ALS9

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Chain	Residue	Modelled	Actual	Comment	Reference
C	0	HIS	-	expression tag	UNP Q9ALS9
D	-21	MET	-	initiating methionine	UNP Q9ALS9
D	-20	GLY	-	expression tag	UNP Q9ALS9
D	-19	SER	-	expression tag	UNP Q9ALS9
D	-18	SER	-	expression tag	UNP Q9ALS9
D	-17	HIS	-	expression tag	UNP Q9ALS9
D	-16	HIS	-	expression tag	UNP Q9ALS9
D	-15	HIS	-	expression tag	UNP Q9ALS9
D	-14	HIS	-	expression tag	UNP Q9ALS9
D	-13	HIS	-	expression tag	UNP Q9ALS9
D	-12	HIS	-	expression tag	UNP Q9ALS9
D	-11	SER	-	expression tag	UNP Q9ALS9
D	-10	SER	-	expression tag	UNP Q9ALS9
D	-9	ARG	-	expression tag	UNP Q9ALS9
D	-8	ASN	-	expression tag	UNP Q9ALS9
D	-7	LEU	-	expression tag	UNP Q9ALS9
D	-6	TYR	-	expression tag	UNP Q9ALS9
D	-5	PHE	-	expression tag	UNP Q9ALS9
D	-4	GLN	-	expression tag	UNP Q9ALS9
D	-3	GLY	-	expression tag	UNP Q9ALS9
D	-2	GLY	-	expression tag	UNP Q9ALS9
D	-1	GLY	-	expression tag	UNP Q9ALS9
D	0	HIS	-	expression tag	UNP Q9ALS9
A	-21	MET	-	initiating methionine	UNP Q9ALS9
A	-20	GLY	-	expression tag	UNP Q9ALS9
A	-19	SER	-	expression tag	UNP Q9ALS9
A	-18	SER	-	expression tag	UNP Q9ALS9
A	-17	HIS	-	expression tag	UNP Q9ALS9
A	-16	HIS	-	expression tag	UNP Q9ALS9
A	-15	HIS	-	expression tag	UNP Q9ALS9
A	-14	HIS	-	expression tag	UNP Q9ALS9
A	-13	HIS	-	expression tag	UNP Q9ALS9
A	-12	HIS	-	expression tag	UNP Q9ALS9
A	-11	SER	-	expression tag	UNP Q9ALS9
A	-10	SER	-	expression tag	UNP Q9ALS9
A	-9	ARG	-	expression tag	UNP Q9ALS9
A	-8	ASN	-	expression tag	UNP Q9ALS9
A	-7	LEU	-	expression tag	UNP Q9ALS9
A	-6	TYR	-	expression tag	UNP Q9ALS9
A	-5	PHE	-	expression tag	UNP Q9ALS9
A	-4	GLN	-	expression tag	UNP Q9ALS9
A	-3	GLY	-	expression tag	UNP Q9ALS9

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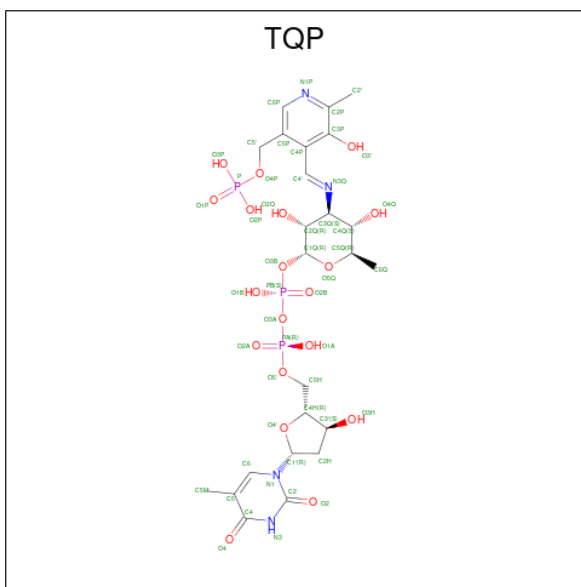
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Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP Q9ALS9
A	-1	GLY	-	expression tag	UNP Q9ALS9
A	0	HIS	-	expression tag	UNP Q9ALS9
B	-21	MET	-	initiating methionine	UNP Q9ALS9
B	-20	GLY	-	expression tag	UNP Q9ALS9
B	-19	SER	-	expression tag	UNP Q9ALS9
B	-18	SER	-	expression tag	UNP Q9ALS9
B	-17	HIS	-	expression tag	UNP Q9ALS9
B	-16	HIS	-	expression tag	UNP Q9ALS9
B	-15	HIS	-	expression tag	UNP Q9ALS9
B	-14	HIS	-	expression tag	UNP Q9ALS9
B	-13	HIS	-	expression tag	UNP Q9ALS9
B	-12	HIS	-	expression tag	UNP Q9ALS9
B	-11	SER	-	expression tag	UNP Q9ALS9
B	-10	SER	-	expression tag	UNP Q9ALS9
B	-9	ARG	-	expression tag	UNP Q9ALS9
B	-8	ASN	-	expression tag	UNP Q9ALS9
B	-7	LEU	-	expression tag	UNP Q9ALS9
B	-6	TYR	-	expression tag	UNP Q9ALS9
B	-5	PHE	-	expression tag	UNP Q9ALS9
B	-4	GLN	-	expression tag	UNP Q9ALS9
B	-3	GLY	-	expression tag	UNP Q9ALS9
B	-2	GLY	-	expression tag	UNP Q9ALS9
B	-1	GLY	-	expression tag	UNP Q9ALS9
B	0	HIS	-	expression tag	UNP Q9ALS9

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

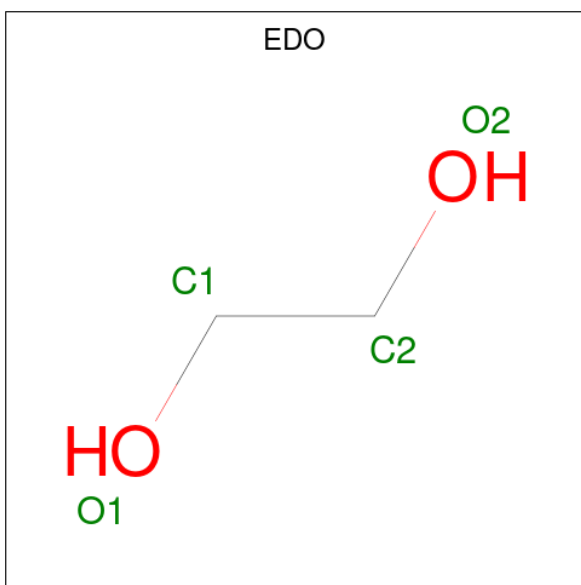
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	C	1	Total Na 1 1	0	0
2	B	1	Total Na 1 1	0	0

- Molecule 3 is (2R,3R,4S,5S,6R)-3,5-dihydroxy-4-(((1E)-{3-hydroxy-2-methyl-5-[(phosphonoxy)methyl]pyridin-4-yl)methylidene]amino)-6-methyltetrahydro-2H-pyran-2-yl [(2R,3S,5R)-3-hydroxy-5-(5-methyl-2,4-dioxo-3,4-dihydropyrimidin-1(2H)-yl)tetrahydrofuran-2-yl]methyl dihydrogen diphosphate (three-letter code: TQP) (formula: C<sub>24</sub>H<sub>35</sub>N<sub>4</sub>O<sub>19</sub>P<sub>3</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	N	O	P			
3	C	1	Total	50	24	4	19	3	0	0
3	D	1	Total	50	24	4	19	3	0	0
3	A	1	Total	50	24	4	19	3	0	0
3	B	1	Total	50	24	4	19	3	0	0

- Molecule 4 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).

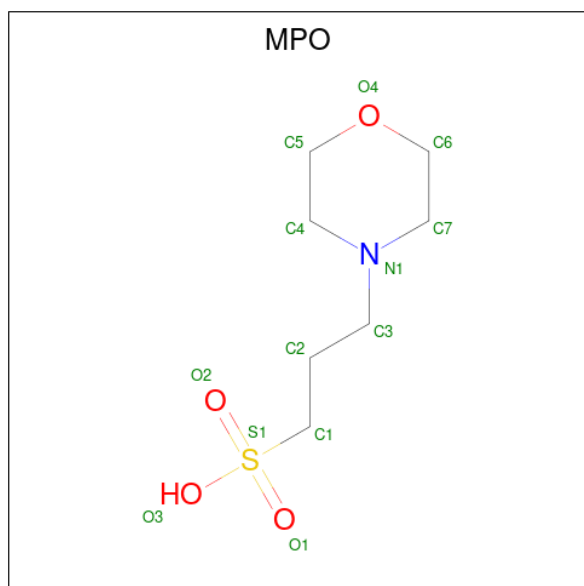


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	C	1	Total	C	O	0	0
			4	2	2		
4	C	1	Total	C	O	0	0
			4	2	2		
4	C	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	A	1	Total	C	O	0	0
			4	2	2		
4	B	1	Total	C	O	0	0
			4	2	2		
4	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 5 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	1	Total	Cl	0	0
			1	1		

- Molecule 6 is 3[N-MORPHOLINO]PROPANE SULFONIC ACID (three-letter code: MPO) (formula: C<sub>7</sub>H<sub>15</sub>NO<sub>4</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	C	1	Total	C	N	O	S	0	0
			13	7	1	4	1		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	C	439	Total O 439 439	0	0
7	D	399	Total O 399 399	0	0
7	A	391	Total O 391 391	0	0
7	B	364	Total O 364 364	0	0







## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	107.82Å 56.64Å 124.55Å 90.00° 90.01° 90.00°	Depositor
Resolution (Å)	29.92 – 1.45 29.92 – 1.45	Depositor EDS
% Data completeness (in resolution range)	98.2 (29.92-1.45) 99.6 (29.92-1.45)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.36 (at 1.45Å)	Xtriage
Refinement program	REFMAC 5.8.0124	Depositor
R, $R_{free}$	0.127 , 0.153 0.133 , 0.151	Depositor DCC
$R_{free}$ test set	13156 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	9.8	Xtriage
Anisotropy	0.053	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 43.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.018 for h,-k,-l	Xtriage
Reported twinning fraction	0.383 for H, K, L 0.617 for -h,-k,l	Depositor
Outliers	4 of 265441 reflections (0.002%)	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	13733	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	13.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.13% 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: CL, TQP, EDO, MPO, NA

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	0.52	0/3049	0.83	0/4115
1	B	0.52	0/3052	0.82	1/4118 (0.0%)
1	C	0.57	0/3029	0.85	2/4089 (0.0%)
1	D	0.56	0/3057	0.86	1/4125 (0.0%)
All	All	0.54	0/12187	0.84	4/16447 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	132	TYR	CB-CG-CD1	7.32	125.39	121.00
1	C	191	ASP	CB-CG-OD2	6.91	124.51	118.30
1	D	17	PHE	CB-CG-CD2	-5.30	117.09	120.80
1	B	104	ASP	CB-CG-OD1	5.15	122.94	118.30

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	2974	0	3010	20	0
1	B	2986	0	3016	28	0
1	C	2952	0	2988	29	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	2984	0	3014	23	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
3	A	50	0	30	0	0
3	B	50	0	30	0	0
3	C	50	0	30	0	0
3	D	50	0	30	0	0
4	A	4	0	6	0	0
4	B	8	0	12	0	0
4	C	12	0	18	0	0
4	D	4	0	6	0	0
5	C	1	0	0	0	0
6	C	13	0	14	2	0
7	A	391	0	0	2	0
7	B	364	0	0	6	1
7	C	439	0	0	9	1
7	D	399	0	0	8	0
All	All	13733	0	12204	100	1

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

All (100) 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:63:ARG:HD2	1:C:93:ASP:OD2	1.41	1.16
1:A:63:ARG:HD2	1:A:93:ASP:OD2	1.45	1.15
1:B:63:ARG:HD2	1:B:93:ASP:OD2	1.53	1.09
1:C:141:ILE:HG13	7:C:501:HOH:O	1.52	1.08
1:B:-5:PHE:CE1	1:B:293:HIS:CE1	2.54	0.95
1:A:63:ARG:CD	1:A:93:ASP:OD2	2.19	0.90
1:B:-5:PHE:HE1	1:B:293:HIS:CE1	1.90	0.86
1:C:121:LYS:HD3	6:C:407:MPO:O2	1.81	0.79
1:C:163:ILE:HG23	7:C:763:HOH:O	1.84	0.77
1:A:128:VAL:CG2	1:A:136[B]:CYS:SG	2.73	0.77
1:A:128:VAL:HG22	1:A:136[B]:CYS:SG	2.25	0.76
1:B:272:ASN:ND2	7:B:501:HOH:O	2.20	0.71
1:B:63:ARG:CD	1:B:93:ASP:OD2	2.37	0.70
1:D:9:ILE:CD1	1:D:342:THR:OG1	2.39	0.70
1:B:289:ASP:HB3	7:B:627:HOH:O	1.93	0.69
1:B:85:ILE:HD11	1:B:316:TYR:HE2	1.56	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:137:ASP:O	7:C:501:HOH:O	2.13	0.66
1:D:16:GLU:HG3	7:D:516:HOH:O	1.94	0.66
1:B:156:CYS:SG	1:B:169:VAL:HG13	2.35	0.66
1:C:246:GLU:HG3	7:C:554:HOH:O	1.96	0.66
1:B:85:ILE:HD11	1:B:316:TYR:CE2	2.30	0.66
1:B:215:HIS:HD2	7:B:685:HOH:O	1.79	0.65
1:B:272:ASN:OD1	7:B:501:HOH:O	2.16	0.62
1:B:20:LYS:HG3	1:B:239:ILE:HD11	1.80	0.61
1:B:85:ILE:HD12	1:B:310:PRO:HB3	1.82	0.61
1:C:318:ASP:HB2	7:C:800:HOH:O	2.01	0.60
1:B:-5:PHE:CZ	1:B:293:HIS:CE1	2.90	0.59
1:C:63:ARG:CD	1:C:93:ASP:OD2	2.35	0.59
1:C:163:ILE:CG2	7:C:763:HOH:O	2.46	0.59
1:D:232[A]:ILE:HG22	1:D:236:PHE:CE2	2.38	0.59
1:C:232:ILE:HG22	1:C:236:PHE:CE2	2.38	0.59
1:C:232:ILE:CG2	1:C:236:PHE:CE2	2.86	0.58
1:C:67:LYS:HE2	7:C:876:HOH:O	2.03	0.57
1:C:63:ARG:HD2	1:C:93:ASP:CG	2.21	0.56
1:B:345:GLU:HA	1:B:348:PHE:CE2	2.41	0.55
1:B:49:VAL:HG21	1:B:196:CYS:HB3	1.89	0.55
1:D:232[A]:ILE:CG2	1:D:236:PHE:CE2	2.90	0.55
1:B:-5:PHE:CD1	1:B:-5:PHE:N	2.75	0.54
1:B:232:ILE:CG2	1:B:236:PHE:CE2	2.91	0.54
1:D:67:LYS:HE2	1:D:209:LEU:HD22	1.90	0.54
1:B:232:ILE:HG22	1:B:236:PHE:CE2	2.43	0.53
1:D:135:VAL:HG23	1:D:169:VAL:HG12	1.92	0.52
1:B:345:GLU:HA	1:B:348:PHE:CZ	2.45	0.52
1:C:93:ASP:OD1	7:C:503:HOH:O	2.19	0.52
1:D:9:ILE:HD13	1:D:342:THR:OG1	2.09	0.51
1:A:129:VAL:O	1:A:136[B]:CYS:SG	2.69	0.50
1:B:-5:PHE:HZ	1:B:293:HIS:CG	2.29	0.50
1:A:20:LYS:HG3	1:A:239:ILE:HD11	1.93	0.50
1:B:272:ASN:CG	7:B:501:HOH:O	2.46	0.50
1:A:110:ILE:O	1:A:112:PRO:HD3	2.11	0.50
1:D:9:ILE:HD12	1:D:342:THR:OG1	2.12	0.50
1:A:135[A]:VAL:HG13	1:A:162:ALA:HB1	1.94	0.50
1:A:8:GLN:HG2	1:A:342:THR:OG1	2.13	0.49
1:C:163:ILE:CD1	1:C:168:ARG:HD3	2.42	0.49
1:D:7:LYS:HE2	7:D:547:HOH:O	2.13	0.49
1:B:232:ILE:HG23	1:B:236:PHE:CZ	2.47	0.49
1:B:-6:TYR:HA	7:B:555:HOH:O	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:135[B]:VAL:HG11	1:A:164:TYR:HB2	1.93	0.48
1:D:242:LYS:HD2	7:D:828:HOH:O	2.12	0.48
1:A:305:HIS:HA	1:A:306:TYR:CD1	2.49	0.48
1:D:232[A]:ILE:HG23	1:D:236:PHE:CZ	2.48	0.48
1:D:121:LYS:HG2	7:D:826:HOH:O	2.13	0.48
1:C:49:VAL:HG21	1:C:196:CYS:HB3	1.96	0.48
1:C:232:ILE:HG23	1:C:236:PHE:CZ	2.48	0.47
1:A:350:LYS:HG2	1:A:354:ILE:HD12	1.95	0.47
1:D:292:GLN:HG3	1:D:302:THR:OG1	2.14	0.47
1:C:232:ILE:CG2	1:C:236:PHE:CZ	2.98	0.47
1:D:232[A]:ILE:CG2	1:D:236:PHE:CZ	2.98	0.46
1:C:137:ASP:HB2	7:C:787:HOH:O	2.15	0.46
1:C:305:HIS:HA	1:C:306:TYR:CD1	2.50	0.45
1:C:163:ILE:HD11	1:C:168:ARG:CD	2.47	0.45
1:B:189:LEU:HD22	1:B:236:PHE:CD2	2.52	0.45
1:A:135[A]:VAL:CG1	1:A:162:ALA:HB1	2.47	0.45
1:C:50:LYS:HE2	1:C:198:ASN:O	2.17	0.45
1:C:311:HIS:O	1:C:320:ASN:HA	2.18	0.44
1:B:79:VAL:CG2	1:B:80:PRO:HD2	2.47	0.43
1:C:129:VAL:O	1:C:136[B]:CYS:SG	2.77	0.43
1:C:242:LYS:HB3	1:C:242:LYS:HE2	1.52	0.43
1:A:345:GLU:HA	1:A:348:PHE:CZ	2.54	0.42
1:D:134:GLN:HB2	1:D:276:HIS:CD2	2.55	0.42
1:C:163:ILE:HD11	1:C:168:ARG:HD3	2.02	0.42
1:A:67:LYS:HE3	7:A:829:HOH:O	2.19	0.42
1:A:79:VAL:CG2	1:A:80:PRO:HD2	2.50	0.42
1:A:128:VAL:HG23	1:A:136[B]:CYS:SG	2.58	0.42
1:C:79:VAL:CG2	1:C:80:PRO:HD2	2.49	0.42
1:B:217:LYS:O	1:B:218:TYR:HB2	2.19	0.42
1:D:294:TYR:CE2	1:D:358:TRP:HB2	2.54	0.41
1:C:120:THR:O	6:C:407:MPO:H12	2.19	0.41
1:D:9:ILE:HD13	1:D:9:ILE:N	2.35	0.41
1:A:79:VAL:HG23	1:A:80:PRO:HD2	2.03	0.41
1:D:97:LYS:HG2	7:D:535:HOH:O	2.20	0.41
1:D:20:LYS:HD2	7:D:521:HOH:O	2.20	0.41
1:D:311:HIS:O	1:D:320:ASN:HA	2.21	0.41
1:B:85:ILE:CD1	1:B:310:PRO:HB3	2.50	0.41
1:C:73:GLU:HG3	1:C:95:LYS:HB3	2.02	0.41
1:A:204[A]:SER:OG	1:A:215:HIS:CE1	2.74	0.40
1:D:67:LYS:HD3	7:D:842:HOH:O	2.22	0.40
1:D:97:LYS:HE2	7:D:535:HOH:O	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:67:LYS:CE	7:A:829:HOH:O	2.68	0.40
1:D:81:ALA:HB2	1:D:100:LEU:HB3	2.04	0.40

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

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
7:C:505:HOH:O	7:B:501:HOH:O[1_556]	2.12	0.08

### 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	366/382 (96%)	356 (97%)	10 (3%)	0	100	100
1	B	364/382 (95%)	351 (96%)	13 (4%)	0	100	100
1	C	364/382 (95%)	351 (96%)	13 (4%)	0	100	100
1	D	365/382 (96%)	355 (97%)	10 (3%)	0	100	100
All	All	1459/1528 (96%)	1413 (97%)	46 (3%)	0	100	100

There are no Ramachandran outliers to report.

#### 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	329/339 (97%)	325 (99%)	4 (1%)	71	43
1	B	328/339 (97%)	323 (98%)	5 (2%)	65	35
1	C	326/339 (96%)	320 (98%)	6 (2%)	59	26
1	D	327/339 (96%)	323 (99%)	4 (1%)	71	43
All	All	1310/1356 (97%)	1291 (98%)	19 (2%)	65	35

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	20	LYS
1	C	38	LYS
1	C	97	LYS
1	C	242	LYS
1	C	340	SER
1	C	359	LYS
1	D	139	GLU
1	D	225	LEU
1	D	263	LYS
1	D	340	SER
1	A	215	HIS
1	A	225	LEU
1	A	318	ASP
1	A	340	SER
1	B	-6	TYR
1	B	-5	PHE
1	B	189	LEU
1	B	296	ASN
1	B	340	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	8	GLN
1	D	74	ASN
1	D	201	ASN
1	D	253	ASN
1	D	298	HIS
1	A	8	GLN
1	A	201	ASN
1	A	215	HIS

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Mol	Chain	Res	Type
1	A	253	ASN
1	A	256	ASN
1	A	260	GLN
1	A	293	HIS
1	A	297	ASN
1	B	215	HIS
1	B	253	ASN
1	B	296	ASN
1	B	321	HIS

### 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, 3 are monoatomic - leaving 12 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$
4	EDO	B	403	-	3,3,3	0.52	0	2,2,2	0.31	0
6	MPO	C	407	-	13,13,13	2.43	2 (15%)	17,17,17	2.06	5 (29%)
4	EDO	D	402	-	3,3,3	0.53	0	2,2,2	0.22	0
3	TQP	B	402	-	50,53,53	1.65	7 (14%)	71,81,81	1.77	12 (16%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	EDO	C	405	-	3,3,3	0.43	0	2,2,2	0.64	0
4	EDO	C	403	-	3,3,3	0.50	0	2,2,2	0.19	0
4	EDO	B	404	-	3,3,3	0.48	0	2,2,2	0.25	0
3	TQP	D	401	-	50,53,53	1.36	8 (16%)	71,81,81	1.85	16 (22%)
4	EDO	A	402	-	3,3,3	0.65	0	2,2,2	0.57	0
3	TQP	A	401	-	50,53,53	1.52	6 (12%)	71,81,81	1.86	12 (16%)
3	TQP	C	402	-	50,53,53	1.77	7 (14%)	71,81,81	1.99	18 (25%)
4	EDO	C	404	-	3,3,3	0.56	0	2,2,2	0.19	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	EDO	B	403	-	-	0/1/1/1	-
6	MPO	C	407	-	-	3/7/15/15	0/1/1/1
4	EDO	D	402	-	-	0/1/1/1	-
3	TQP	B	402	-	-	3/32/64/64	0/4/4/4
4	EDO	C	405	-	-	0/1/1/1	-
4	EDO	C	403	-	-	0/1/1/1	-
4	EDO	B	404	-	-	0/1/1/1	-
3	TQP	D	401	-	-	3/32/64/64	0/4/4/4
4	EDO	A	402	-	-	1/1/1/1	-
3	TQP	A	401	-	-	4/32/64/64	0/4/4/4
3	TQP	C	402	-	-	4/32/64/64	0/4/4/4
4	EDO	C	404	-	-	0/1/1/1	-

All (30) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	402	TQP	C3P-C2P	7.43	1.48	1.40
3	B	402	TQP	C3P-C2P	7.34	1.48	1.40
6	C	407	MPO	O1-S1	6.32	1.63	1.45
3	A	401	TQP	C3P-C2P	5.93	1.46	1.40
6	C	407	MPO	C1-S1	-5.70	1.69	1.77
3	A	401	TQP	C4P-C5P	5.25	1.48	1.42
3	C	402	TQP	C4P-C3P	4.93	1.48	1.40
3	C	402	TQP	C4P-C5P	4.64	1.47	1.42
3	D	401	TQP	C3P-C2P	4.62	1.45	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	402	TQP	C4P-C5P	4.42	1.47	1.42
3	D	401	TQP	C4P-C5P	4.23	1.47	1.42
3	A	401	TQP	C4P-C3P	3.70	1.46	1.40
3	B	402	TQP	C4P-C3P	3.62	1.46	1.40
3	C	402	TQP	C6-C5	3.24	1.39	1.34
3	B	402	TQP	C6-C5	3.00	1.39	1.34
3	D	401	TQP	C4-N3	-3.00	1.33	1.38
3	D	401	TQP	C4P-C3P	2.95	1.45	1.40
3	B	402	TQP	C4-N3	-2.88	1.33	1.38
3	A	401	TQP	C6-C5	2.76	1.39	1.34
3	A	401	TQP	C4-N3	-2.71	1.33	1.38
3	C	402	TQP	C2-N3	-2.65	1.33	1.38
3	B	402	TQP	C6-N1	-2.61	1.33	1.38
3	D	401	TQP	C2-N3	-2.55	1.33	1.38
3	B	402	TQP	C2-N3	-2.49	1.33	1.38
3	C	402	TQP	C4-N3	-2.45	1.34	1.38
3	C	402	TQP	C6-N1	-2.29	1.34	1.38
3	D	401	TQP	C6-C5	2.27	1.38	1.34
3	A	401	TQP	C4-C5	2.23	1.48	1.44
3	D	401	TQP	C4-C5	2.08	1.48	1.44
3	D	401	TQP	C6-N1	-2.07	1.34	1.38

All (63) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	401	TQP	O4-C4-C5	-6.41	117.47	124.90
3	C	402	TQP	O3A-PB-O3B	-6.28	89.82	102.48
6	C	407	MPO	O1-S1-C1	5.77	113.87	106.92
3	C	402	TQP	N3-C2-N1	5.16	121.74	114.89
3	C	402	TQP	O4-C4-C5	-4.96	119.15	124.90
3	B	402	TQP	C3P-C4P-C5P	-4.89	114.51	118.26
3	D	401	TQP	C3Q-N3Q-C4'	4.83	126.56	117.99
3	A	401	TQP	C4-N3-C2	-4.82	121.12	127.35
3	D	401	TQP	O4-C4-C5	-4.80	119.34	124.90
3	D	401	TQP	O3A-PB-O3B	-4.78	92.85	102.48
3	C	402	TQP	C3P-C4P-C5P	-4.74	114.63	118.26
3	B	402	TQP	O3A-PB-O3B	-4.73	92.94	102.48
3	A	401	TQP	N3-C2-N1	4.62	121.02	114.89
3	A	401	TQP	O2-C2-N1	-4.57	116.71	122.79
3	B	402	TQP	N3-C2-N1	4.55	120.93	114.89
3	D	401	TQP	C5-C6-N1	-4.50	118.70	123.34
3	B	402	TQP	C4-N3-C2	-4.50	121.52	127.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	401	TQP	C5-C4-N3	4.45	119.11	115.31
3	C	402	TQP	C3Q-N3Q-C4'	4.40	125.79	117.99
3	B	402	TQP	C3Q-N3Q-C4'	4.35	125.71	117.99
3	D	401	TQP	C4-N3-C2	-4.35	121.72	127.35
3	C	402	TQP	C4-N3-C2	-4.30	121.78	127.35
3	D	401	TQP	N3-C2-N1	4.28	120.57	114.89
3	A	401	TQP	O3A-PB-O3B	-4.21	94.00	102.48
3	A	401	TQP	C3Q-N3Q-C4'	4.19	125.42	117.99
3	D	401	TQP	C3P-C4P-C5P	-4.16	115.07	118.26
3	B	402	TQP	C5-C6-N1	-3.95	119.28	123.34
3	B	402	TQP	C5-C4-N3	3.85	118.60	115.31
3	C	402	TQP	C5-C6-N1	-3.70	119.53	123.34
3	D	401	TQP	C5-C4-N3	3.62	118.40	115.31
3	B	402	TQP	C4P-C3P-C2P	-3.51	118.02	120.19
3	A	401	TQP	C5-C6-N1	-3.47	119.77	123.34
3	D	401	TQP	O5Q-C1Q-O3B	3.33	115.72	111.36
3	A	401	TQP	C4P-C3P-C2P	-3.31	118.14	120.19
3	B	402	TQP	O4-C4-C5	-3.15	121.25	124.90
3	C	402	TQP	O2-C2-N1	-3.03	118.75	122.79
6	C	407	MPO	C6-C7-N1	-2.94	105.65	110.10
6	C	407	MPO	O2-S1-C1	2.91	110.42	106.92
3	C	402	TQP	C2'-C2P-N1P	2.86	123.26	117.67
3	C	402	TQP	C5-C4-N3	2.83	117.72	115.31
3	D	401	TQP	C2'-C2P-C3P	-2.67	117.59	120.89
3	D	401	TQP	C1Q-O5Q-C5Q	-2.63	109.14	113.67
6	C	407	MPO	O2-S1-O1	-2.55	105.14	113.95
3	D	401	TQP	O5Q-C1Q-C2Q	-2.46	105.15	110.35
3	A	401	TQP	C3P-C4P-C5P	-2.41	116.41	118.26
6	C	407	MPO	C3-N1-C7	2.37	117.29	111.23
3	B	402	TQP	O3'-C3P-C2P	2.35	122.62	117.49
3	C	402	TQP	C6Q-C5Q-C4Q	-2.35	108.72	113.07
3	D	401	TQP	C2H-C1'-N1	-2.35	108.36	113.77
3	C	402	TQP	C1Q-O5Q-C5Q	2.31	117.64	113.67
3	C	402	TQP	C2'-C2P-C3P	-2.29	118.06	120.89
3	C	402	TQP	O5Q-C1Q-O3B	-2.29	108.38	111.36
3	C	402	TQP	C4P-C4'-N3Q	-2.27	117.97	123.01
3	B	402	TQP	C6Q-C5Q-C4Q	-2.25	108.91	113.07
3	D	401	TQP	O2-C2-N1	-2.25	119.80	122.79
3	A	401	TQP	O1B-PB-O2B	2.25	123.35	112.24
3	B	402	TQP	O1B-PB-O2B	2.20	123.14	112.24
3	D	401	TQP	O2P-P-O4P	-2.19	100.90	106.73
3	C	402	TQP	O5'-PA-O2A	-2.19	100.51	109.07

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	401	TQP	C2'-C2P-N1P	2.11	121.78	117.67
3	A	401	TQP	C2'-C2P-C3P	-2.05	118.36	120.89
3	C	402	TQP	C5M-C5-C4	2.03	121.00	118.77
3	C	402	TQP	C6P-N1P-C2P	2.00	122.87	119.17

There are no chirality outliers.

All (18) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	402	TQP	C1Q-O3B-PB-O1B
3	C	402	TQP	C4Q-C3Q-N3Q-C4'
3	D	401	TQP	C1Q-O3B-PB-O1B
3	D	401	TQP	C4Q-C3Q-N3Q-C4'
3	A	401	TQP	C1Q-O3B-PB-O1B
3	A	401	TQP	C4Q-C3Q-N3Q-C4'
3	B	402	TQP	C1Q-O3B-PB-O1B
3	B	402	TQP	C4Q-C3Q-N3Q-C4'
6	C	407	MPO	C2-C3-N1-C7
6	C	407	MPO	S1-C1-C2-C3
3	D	401	TQP	C1Q-O3B-PB-O3A
3	A	401	TQP	C1Q-O3B-PB-O3A
3	C	402	TQP	C1Q-O3B-PB-O3A
3	C	402	TQP	C1Q-O3B-PB-O2B
3	A	401	TQP	C1Q-O3B-PB-O2B
3	B	402	TQP	C1Q-O3B-PB-O3A
4	A	402	EDO	O1-C1-C2-O2
6	C	407	MPO	C2-C3-N1-C4

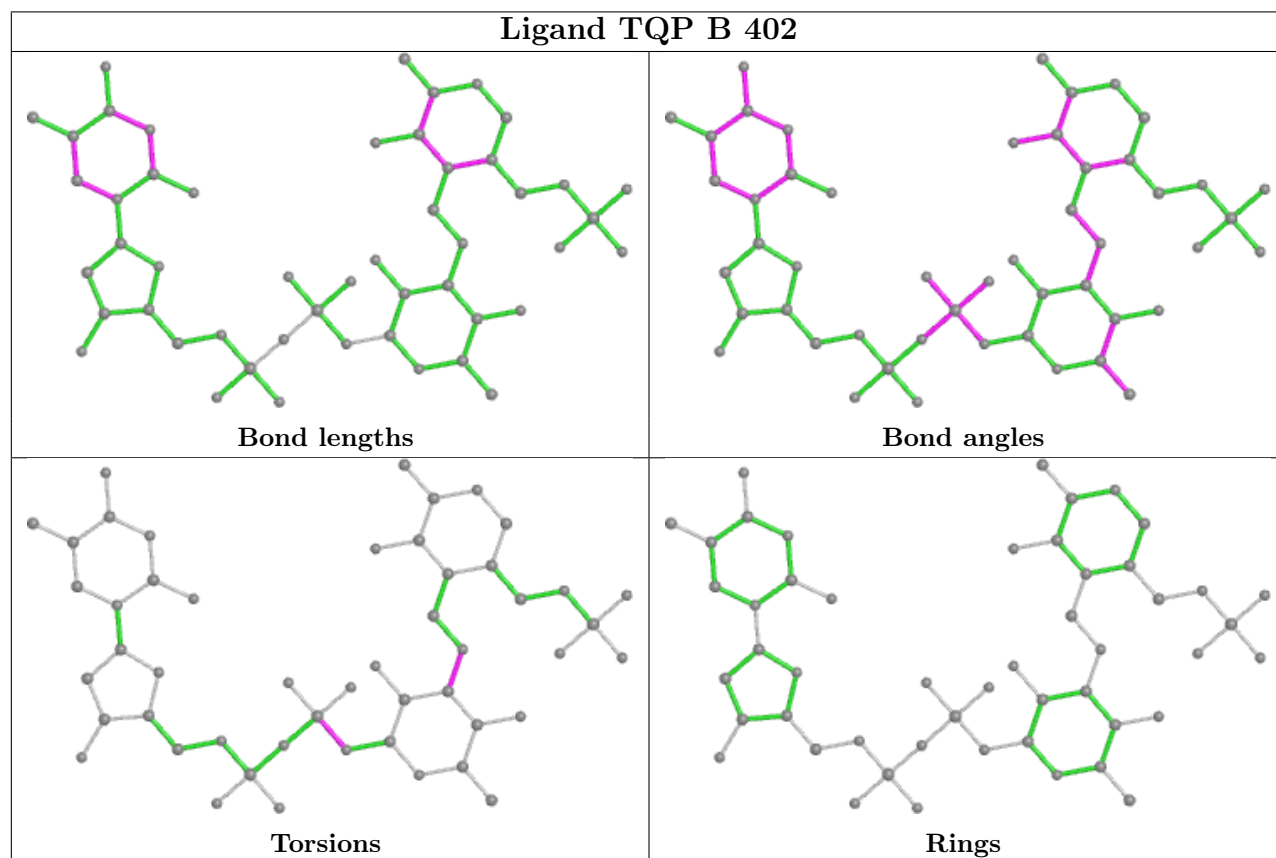
There are no ring outliers.

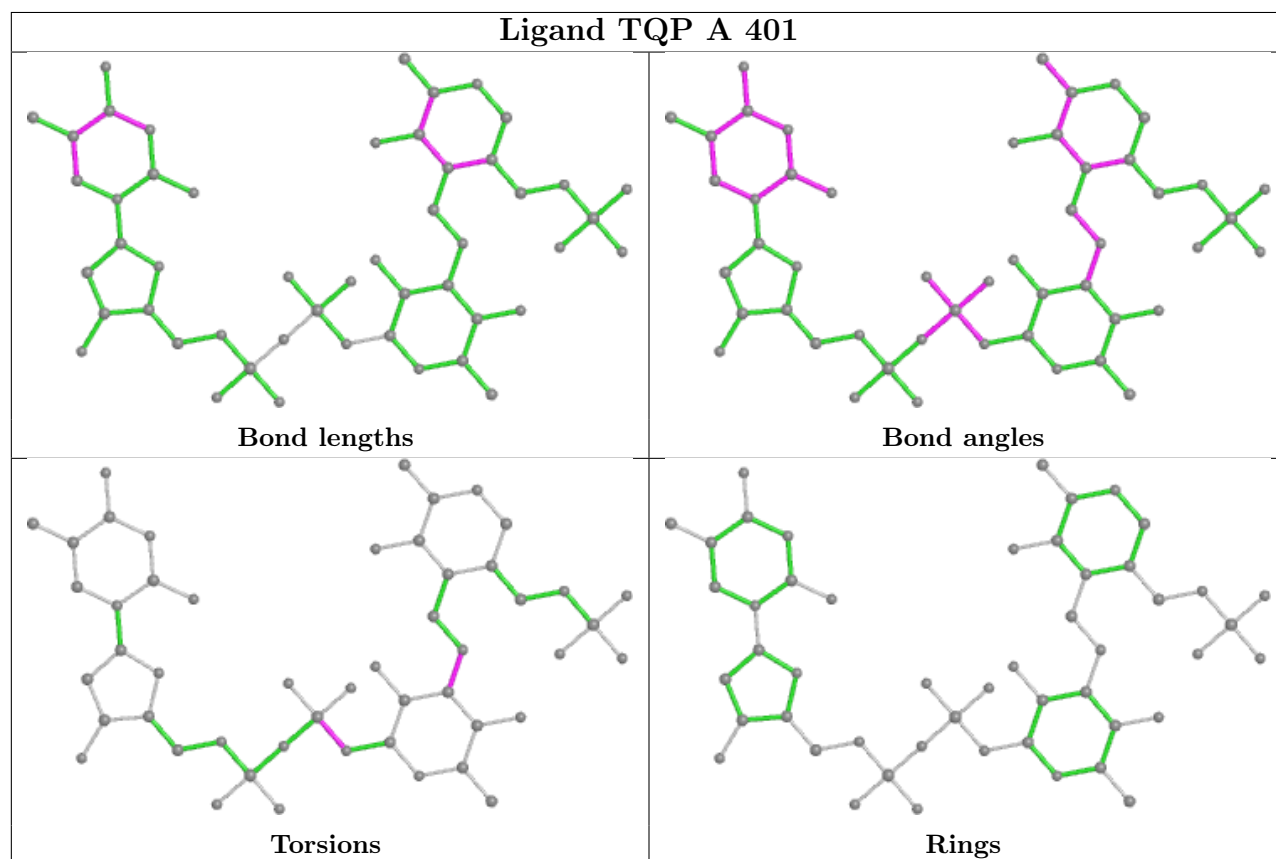
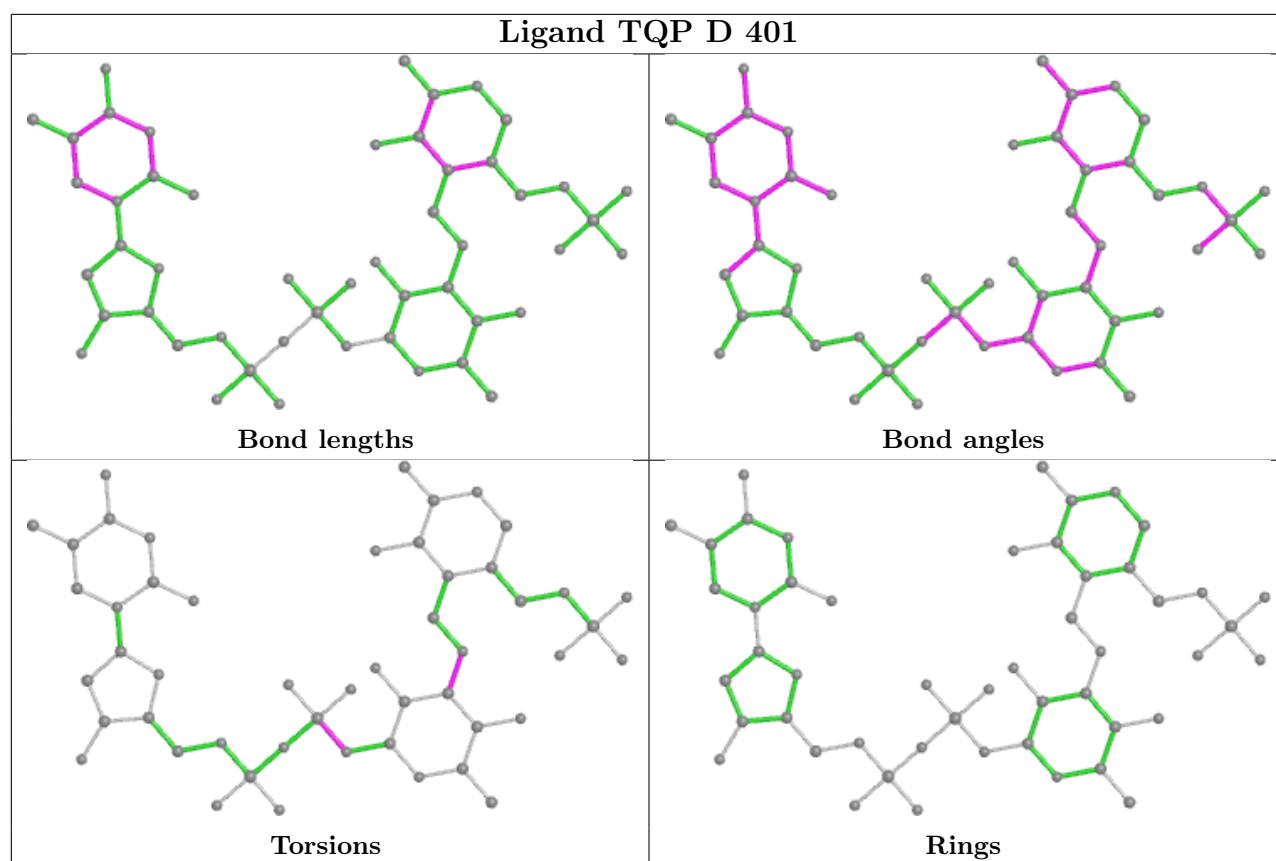
1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	C	407	MPO	2	0

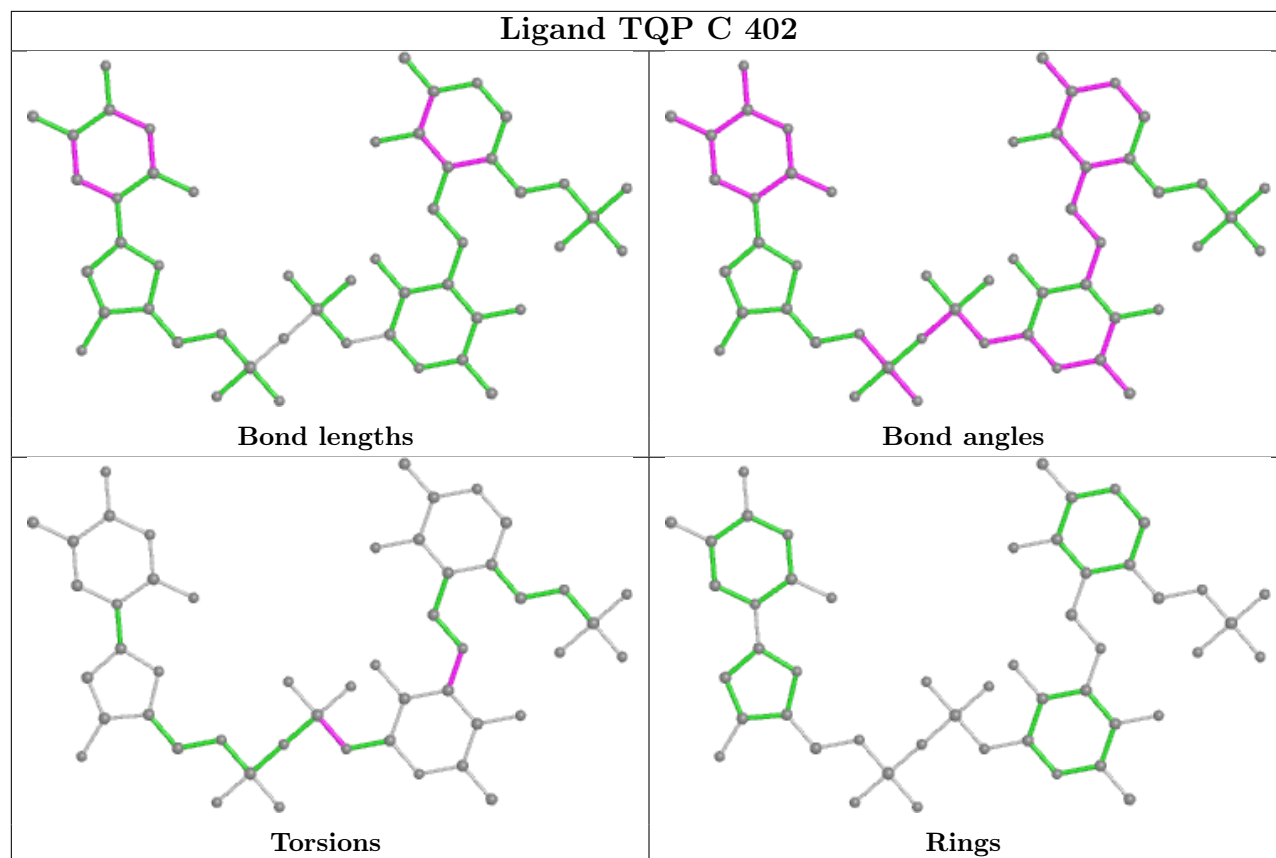
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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	361/382 (94%)	-0.46	3 (0%) 86 87	5, 11, 24, 42	0
1	B	363/382 (95%)	-0.39	5 (1%) 75 76	5, 11, 27, 34	0
1	C	361/382 (94%)	-0.52	0 100 100	4, 9, 20, 33	0
1	D	366/382 (95%)	-0.49	2 (0%) 91 93	4, 10, 23, 59	0
All	All	1451/1528 (94%)	-0.46	10 (0%) 87 89	4, 10, 23, 59	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	-5	PHE	4.5
1	D	360	VAL	3.8
1	A	360	VAL	3.2
1	D	-8	ASN	3.0
1	B	-6	TYR	2.8
1	B	215	HIS	2.8
1	B	360	VAL	2.5
1	A	29	TRP	2.1
1	B	29	TRP	2.1
1	A	2	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

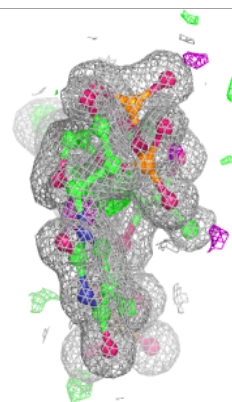
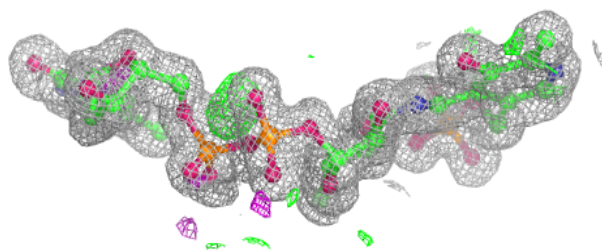
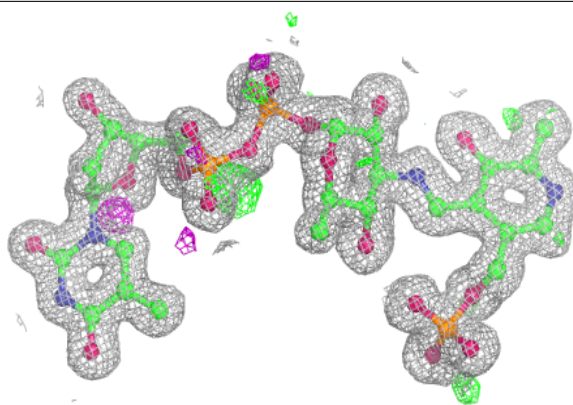
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 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
4	EDO	C	405	4/4	0.93	0.10	18,18,23,26	0
4	EDO	D	402	4/4	0.93	0.07	23,24,25,27	0
6	MPO	C	407	13/13	0.95	0.20	23,26,31,35	0
4	EDO	A	402	4/4	0.96	0.07	12,16,17,20	0
4	EDO	C	403	4/4	0.96	0.08	12,15,15,20	0
3	TQP	B	402	50/50	0.97	0.07	6,11,19,24	0
3	TQP	D	401	50/50	0.97	0.07	5,11,19,27	0
3	TQP	A	401	50/50	0.98	0.07	6,10,15,22	0
4	EDO	C	404	4/4	0.98	0.06	8,9,10,11	0
4	EDO	B	403	4/4	0.98	0.07	12,12,12,20	0
3	TQP	C	402	50/50	0.98	0.07	6,9,13,18	0
4	EDO	B	404	4/4	0.99	0.04	10,10,11,13	0
2	NA	C	401	1/1	0.99	0.07	5,5,5,5	0
5	CL	C	406	1/1	1.00	0.04	11,11,11,11	0
2	NA	B	401	1/1	1.00	0.07	5,5,5,5	0

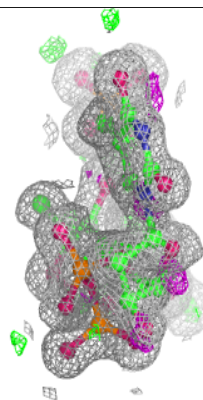
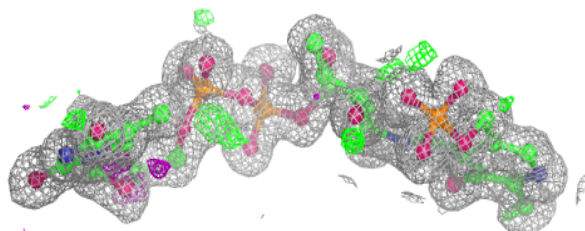
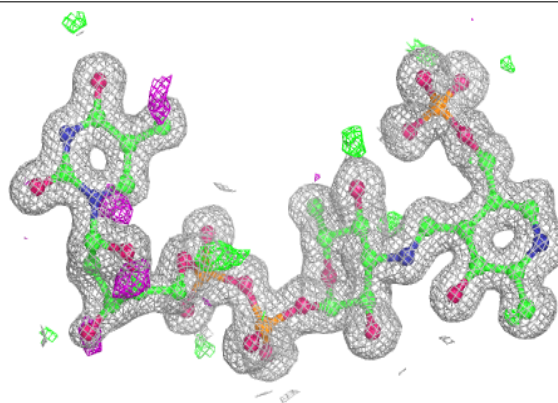
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

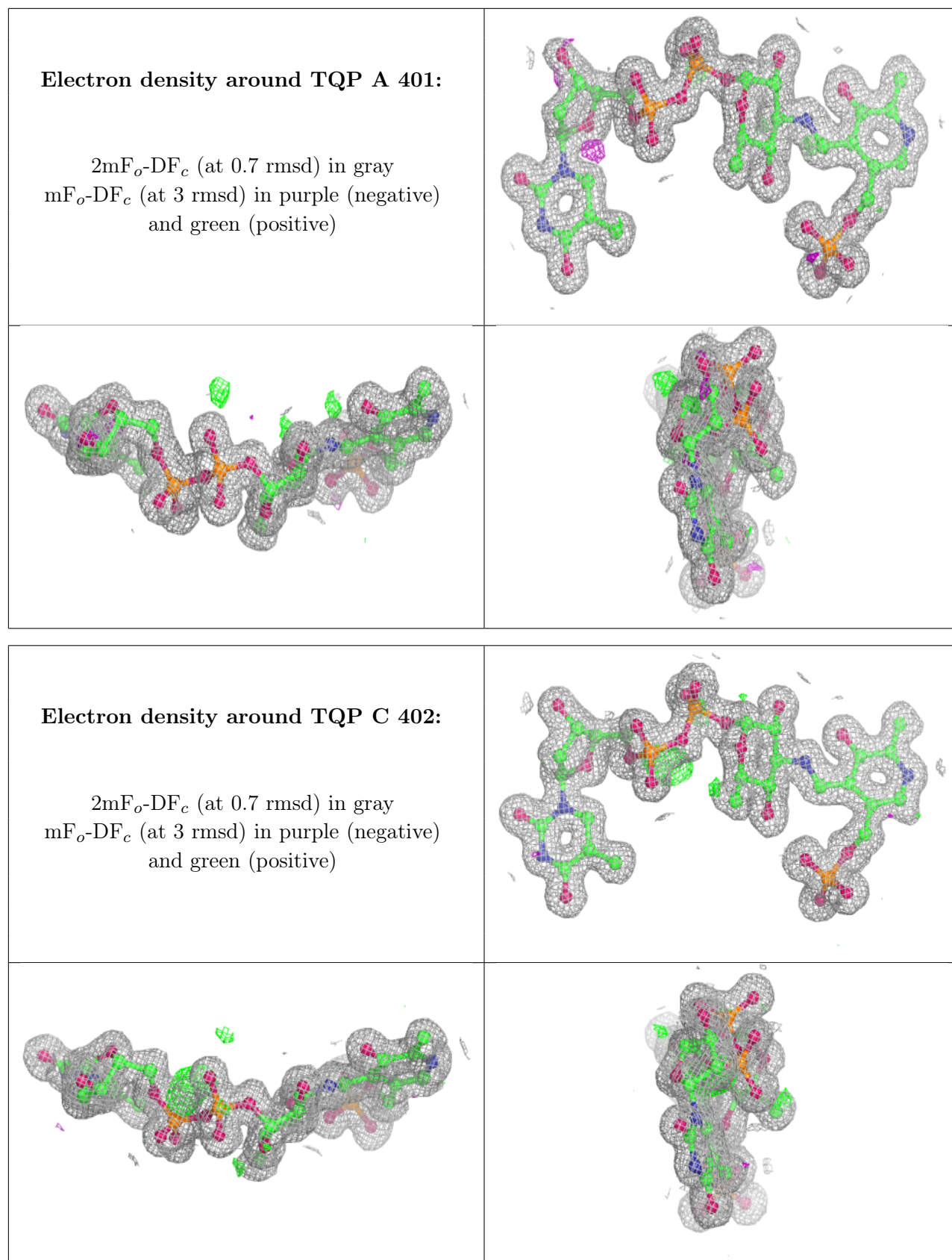
**Electron density around TQP B 402:**

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

**Electron density around TQP D 401:**

$2mF_o-DF_c$  (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.