Full wwPDB X-ray Structure Validation Report (i)

Mar 24, 2022 – 03:31 pm GMT

PDB ID	:	6S0S
Title	:	The crystal structure of kanamycin B dioxygenase (KanJ) from Streptomyces kanamyceticus in complex with nickel, ribostamycin B and 2-oxoglutarate
Authors	:	Mrugala, B.; Porebski, P.J.; Niedzialkowska, E.; Minor, W.; Borowski, T.
Deposited on	:	2019-06-18
Resolution	:	2.40 Å(reported)

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

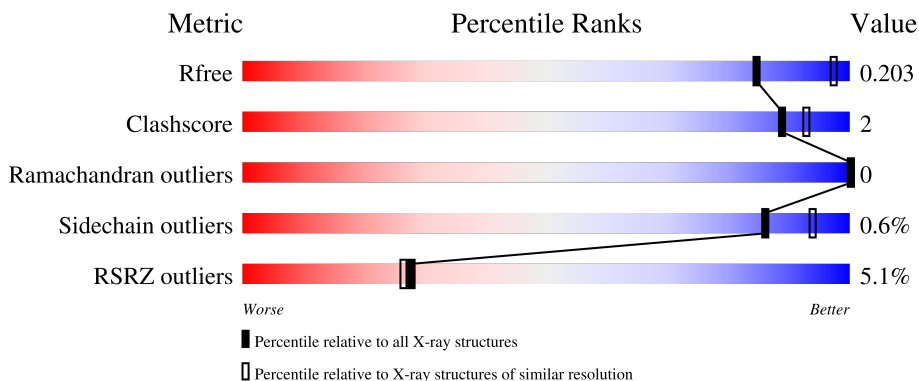|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.27
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.27

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 2.40 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.
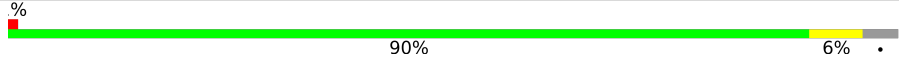
Metric	Percentile Ranks	Value
Rfree		0.203
Clashscore		2
Ramachandran outliers		0
Sidechain outliers		0.6%
RSRZ outliers		5.1%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=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	288	2% / 92% / 6% ·
1	B	288	% / 94% / 5% ·
1	C	288	% / 92% / 5% ·
1	D	288	89% / 8% ·
1	E	288	24% / 91% / · 5%

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Mol	Chain	Length	Quality of chain
1	F	288	

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 13802 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 Kanamycin B dioxygenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	282	Total	C	N	O	S	0	2	0
			2209	1405	387	408	9			
1	B	283	Total	C	N	O	S	0	2	0
			2216	1411	389	407	9			
1	C	277	Total	C	N	O	S	0	0	0
			2158	1372	379	397	10			
1	D	279	Total	C	N	O	S	0	2	0
			2184	1387	383	404	10			
1	E	274	Total	C	N	O	S	0	0	0
			2140	1361	376	394	9			
1	F	277	Total	C	N	O	S	0	3	0
			2175	1383	380	402	10			

There are 18 discrepancies between the modelled and reference sequences:

| Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	expression tag	UNP Q6L732
A	-1	ASN	-	expression tag	UNP Q6L732
A	0	ALA	-	expression tag	UNP Q6L732
B	-2	SER	-	expression tag	UNP Q6L732
B	-1	ASN	-	expression tag	UNP Q6L732
B	0	ALA	-	expression tag	UNP Q6L732
C	-2	SER	-	expression tag	UNP Q6L732
C	-1	ASN	-	expression tag	UNP Q6L732
C	0	ALA	-	expression tag	UNP Q6L732
D	-2	SER	-	expression tag	UNP Q6L732
D	-1	ASN	-	expression tag	UNP Q6L732
D	0	ALA	-	expression tag	UNP Q6L732
E	-2	SER	-	expression tag	UNP Q6L732
E	-1	ASN	-	expression tag	UNP Q6L732
E	0	ALA	-	expression tag	UNP Q6L732
F	-2	SER	-	expression tag	UNP Q6L732
F	-1	ASN	-	expression tag	UNP Q6L732

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Chain	Residue	Modelled	Actual	Comment	Reference
F	0	ALA	-	expression tag	UNP Q6L732

- Molecule 2 is NICKEL (II) ION (three-letter code: NI) (formula: Ni).

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

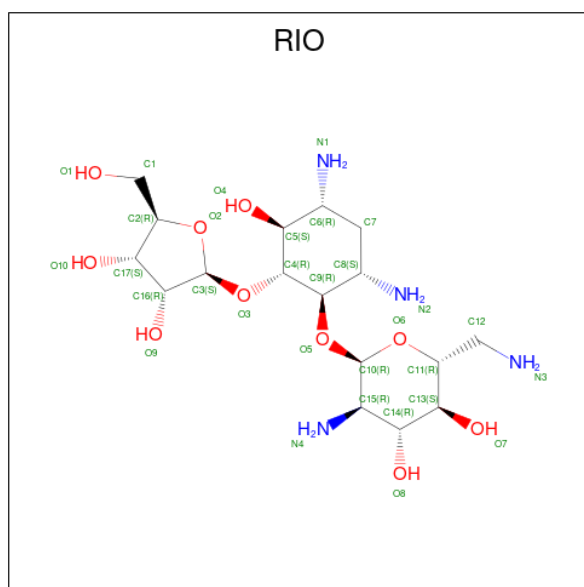- Molecule 3 is 2-OXOGLUTARIC ACID (three-letter code: AKG) (formula: $C_5H_6O_5$).
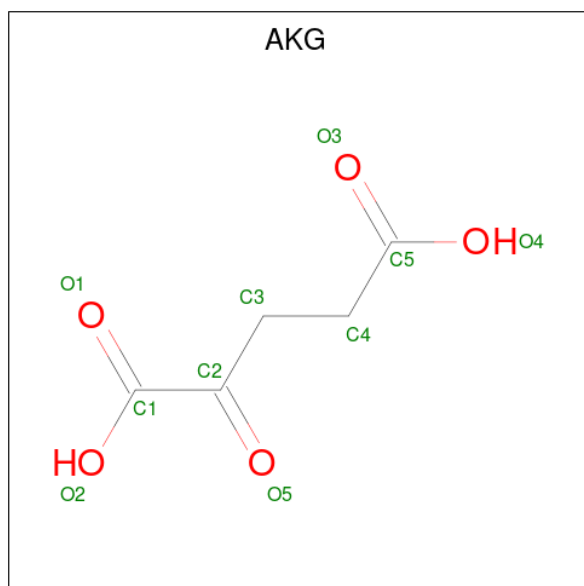
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 10	C 5	O 5	0	0
3	B	1	Total 10	C 5	O 5	0	0
3	C	1	Total 10	C 5	O 5	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	D	1	Total 10	C 5	O 5	0	0
3	E	1	Total 10	C 5	O 5	0	0
3	F	1	Total 10	C 5	O 5	0	0

- Molecule 4 is RIBOSTAMYCIN (three-letter code: RIO) (formula: $C_{17}H_{34}N_4O_{10}$).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total 31	C 17	N 4	O 10	0	0
4	B	1	Total 31	C 17	N 4	O 10	0	0
4	C	1	Total 31	C 17	N 4	O 10	0	0
4	D	1	Total 31	C 17	N 4	O 10	0	0
4	E	1	Total 31	C 17	N 4	O 10	0	0
4	F	1	Total 31	C 17	N 4	O 10	0	0

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

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

- Molecule 6 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	54	Total 55	O 55	0	1
6	B	128	Total 129	O 129	0	1
6	C	65	Total 65	O 65	0	0
6	D	116	Total 116	O 116	0	1
6	E	11	Total 11	O 11	0	0
6	F	88	Total 89	O 89	0	1

3 Residue-property plots ⓘ

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.
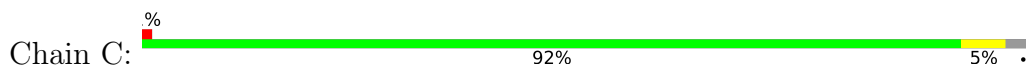
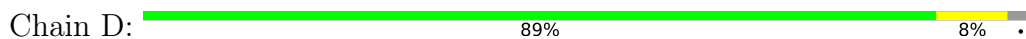- Molecule 1: Kanamycin B dioxygenase
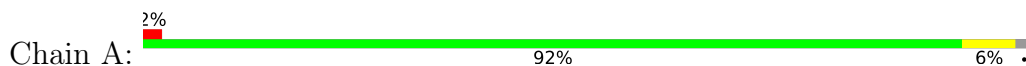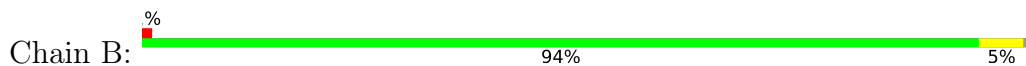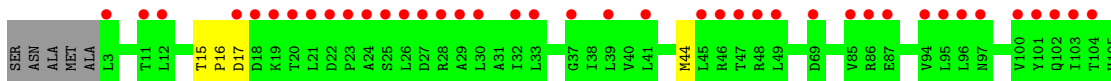
Chain A:

- Molecule 1: Kanamycin B dioxygenase

Chain B:

- Molecule 1: Kanamycin B dioxygenase

Chain C:

- Molecule 1: Kanamycin B dioxygenase

Chain D:

- Molecule 1: Kanamycin B dioxygenase

Chain E:

A106 V107 L108 D111 L133 H137 W168 S171 H172 V173 L174 N175 P176 C179 A198 R216 L217 W218 P250 D251 K254 S255 W256 V257 D258 G259 R262 H263 T264 H265 F268 V269 A270 G271 D272 V273 D274 H275 L276 THR GLY ASP HIS PRO PHE ALA VAL ARG

• Molecule 1: Kanamycin B dioxygenase

Chain F:

90%   6%

SER ASN A0 L14 L21 M44 L61 P62 L65 R66 P71 T72 N73 Q80 V85 S118 M121 L133 H137 R216 D272 V273 D274 H275 L276 THR GLY ASP HIS PRO PHE ALA VAL ARG
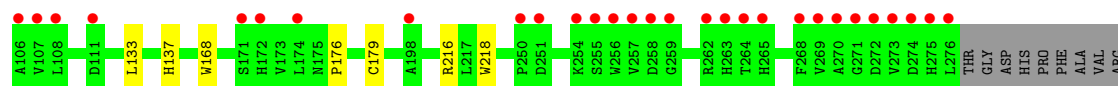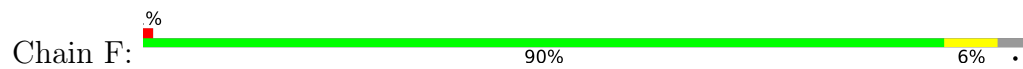
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	50.08Å 184.58Å 110.33Å 90.00° 94.97° 90.00°	Depositor
Resolution (Å)	47.27 – 2.40 47.22 – 2.40	Depositor EDS
% Data completeness (in resolution range)	91.1 (47.27-2.40) 90.9 (47.22-2.40)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.36 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, R_{free}	0.173 , 0.204 0.177 , 0.203	Depositor DCC
R_{free} test set	3579 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	36.1	Xtriage
Anisotropy	0.062	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	13802	wwPDB-VP
Average B, all atoms (Å^2)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.77% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: NI, AKG, RIO, CL

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$|Z|$>5	RMSZ	#$|Z|$>5
1	A	0.65	0/2284	0.79	0/3142
1	B	0.67	0/2291	0.83	0/3151
1	C	0.67	0/2224	0.82	0/3059
1	D	0.65	0/2256	0.84	1/3103 (0.0%)
1	E	0.66	0/2206	0.80	0/3035
1	F	0.65	0/2250	0.82	0/3094
All	All	0.66	0/13511	0.82	1/18584 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	202	ARG	NE-CZ-NH2	-6.24	117.18	120.30

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	2209	0	2153	8	0
1	B	2216	0	2169	7	0
1	C	2158	0	2114	8	0
1	D	2184	0	2139	14	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	E	2140	0	2092	5	0
1	F	2175	0	2132	12	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	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	10	0	4	0	0
3	B	10	0	4	0	0
3	C	10	0	4	0	0
3	D	10	0	4	0	0
3	E	10	0	4	0	0
3	F	10	0	4	0	0
4	A	31	0	34	0	0
4	B	31	0	34	0	0
4	C	31	0	34	0	0
4	D	31	0	34	0	0
4	E	31	0	34	0	0
4	F	31	0	34	0	0
5	B	1	0	0	0	0
5	C	1	0	0	0	0
5	E	1	0	0	0	0
6	A	55	0	0	0	0
6	B	129	0	0	0	0
6	C	65	0	0	0	0
6	D	116	0	0	1	0
6	E	11	0	0	0	0
6	F	89	0	0	1	0
All	All	13802	0	13027	51	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 2.

All (51) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:48:ARG:HG2	1:C:51:ASP:OD2	1.85	0.77
1:E:15:THR:OG1	1:E:16:PRO:HD2	1.98	0.63
1:D:14:LEU:HD21	1:D:21:LEU:CD2	2.30	0.62
1:D:3:LEU:CD1	1:D:7:PRO:HG3	2.29	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:80:GLN:NE2	1:D:118:SER:OG	2.34	0.61
1:A:80[B]:GLN:NE2	1:A:118:SER:OG	2.34	0.60
1:D:14:LEU:HD11	1:D:21:LEU:HD21	1.84	0.59
1:F:0:ALA:N	6:F:404:HOH:O	2.36	0.59
1:F:80[A]:GLN:NE2	1:F:118:SER:OG	2.36	0.58
1:D:86:ARG:NH1	6:D:404:HOH:O	2.38	0.56
1:A:14:LEU:HD11	1:A:21:LEU:HD21	1.88	0.56
1:F:62:PRO:O	1:F:66:ARG:HG3	2.06	0.54
1:C:14:LEU:HD11	1:C:21:LEU:HD21	1.90	0.53
1:D:3:LEU:HD13	1:D:7:PRO:HG3	1.92	0.50
1:F:85:VAL:CG2	1:F:273:VAL:HB	2.43	0.49
1:D:61:LEU:HD13	1:D:121:MET:HG2	1.93	0.49
1:D:166:GLU:HA	1:D:202:ARG:HG2	1.95	0.48
1:F:85:VAL:HG23	1:F:273:VAL:HB	1.97	0.47
1:C:147:TYR:CE2	1:C:242:PHE:CE2	3.04	0.46
1:D:-1:ASN:OD1	1:D:0:ALA:N	2.47	0.46
1:F:14:LEU:HD11	1:F:21:LEU:HD21	1.98	0.46
1:D:2:ALA:HB1	1:D:160:LEU:CD1	2.47	0.45
1:B:168:TRP:HB2	1:B:218:TRP:HB2	1.97	0.45
1:F:71:PRO:HB2	1:F:80[B]:GLN:OE1	2.16	0.45
1:B:80[B]:GLN:NE2	1:B:118:SER:OG	2.45	0.45
1:B:190:GLU:OE2	1:B:193:ARG:NH1	2.47	0.44
1:D:174:LEU:HD11	1:D:194:ARG:HD3	1.98	0.44
1:B:48:ARG:HD3	1:C:48:ARG:HA	1.99	0.44
1:B:137:HIS:CE1	1:B:216:ARG:HD2	2.53	0.44
1:C:192:GLU:HB3	1:F:65:LEU:HD13	2.00	0.44
1:C:1:MET:O	1:C:1:MET:HG2	2.18	0.43
1:D:137:HIS:CE1	1:D:216:ARG:HD2	2.54	0.43
1:F:44:MET:HE2	1:F:44:MET:HB3	1.96	0.43
1:F:137:HIS:CE1	1:F:216:ARG:HD2	2.53	0.43
1:E:17:ASP:O	1:E:17:ASP:OD1	2.36	0.43
1:A:137:HIS:CE1	1:A:216:ARG:HD2	2.54	0.43
1:C:168:TRP:HB2	1:C:218:TRP:HB2	2.01	0.43
1:F:73:ASN:HD21	1:F:80[B]:GLN:HG2	1.84	0.42
1:D:64:VAL:HG21	1:D:81:GLN:HG3	2.01	0.42
1:E:176:PRO:HG2	1:E:179:CYS:HB2	2.02	0.42
1:A:174:LEU:HD11	1:A:194:ARG:HD3	2.00	0.42
1:B:248:GLN:NE2	1:B:280:HIS:NE2	2.62	0.42
1:F:61:LEU:HD13	1:F:121:MET:HG2	2.01	0.42
1:A:61:LEU:HD13	1:A:121:MET:HG2	2.01	0.42
1:D:176:PRO:HG2	1:D:179:CYS:HB2	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:137:HIS:CE1	1:E:216:ARG:HD2	2.55	0.41
1:C:137:HIS:CE1	1:C:216:ARG:HD2	2.56	0.41
1:A:280:HIS:HB2	1:A:281:PRO:HD2	2.03	0.41
1:E:168:TRP:HB2	1:E:218:TRP:HB2	2.01	0.41
1:A:176:PRO:HG2	1:A:179:CYS:HB2	2.02	0.40
1:A:168:TRP:HB2	1:A:218:TRP:HB2	2.03	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	282/288 (98%)	279 (99%)	3 (1%)	0	100	100
1	B	283/288 (98%)	281 (99%)	2 (1%)	0	100	100
1	C	275/288 (96%)	271 (98%)	4 (2%)	0	100	100
1	D	279/288 (97%)	276 (99%)	3 (1%)	0	100	100
1	E	272/288 (94%)	269 (99%)	3 (1%)	0	100	100
1	F	278/288 (96%)	274 (99%)	4 (1%)	0	100	100
All	All	1669/1728 (97%)	1650 (99%)	19 (1%)	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	245/248 (99%)	244 (100%)	1 (0%)	91	96
1	B	246/248 (99%)	244 (99%)	2 (1%)	81	91
1	C	239/248 (96%)	238 (100%)	1 (0%)	91	96
1	D	243/248 (98%)	242 (100%)	1 (0%)	91	96
1	E	238/248 (96%)	236 (99%)	2 (1%)	81	91
1	F	242/248 (98%)	240 (99%)	2 (1%)	81	91
All	All	1453/1488 (98%)	1444 (99%)	9 (1%)	86	94

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	133	LEU
1	B	44	MET
1	B	133	LEU
1	C	133	LEU
1	D	133	LEU
1	E	44	MET
1	E	133	LEU
1	F	44	MET
1	F	133	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	248	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 21 ligands modelled in this entry, 9 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	RIO	B	303	-	33,33,33	0.44	0	47,49,49	0.79	0
3	AKG	D	302	2	3,9,9	0.32	0	4,11,11	1.34	0
3	AKG	A	302	2	3,9,9	0.47	0	4,11,11	1.27	0
3	AKG	E	302	2	3,9,9	0.39	0	4,11,11	1.07	0
4	RIO	E	303	-	33,33,33	0.36	0	47,49,49	0.80	0
4	RIO	A	303	-	33,33,33	0.33	0	47,49,49	0.71	0
3	AKG	B	302	2	3,9,9	0.49	0	4,11,11	1.74	1 (25%)
3	AKG	F	302	2	3,9,9	0.22	0	4,11,11	1.39	0
4	RIO	D	303	-	33,33,33	0.42	0	47,49,49	0.74	0
4	RIO	F	303	-	33,33,33	0.32	0	47,49,49	0.70	0
3	AKG	C	302	2	3,9,9	0.60	0	4,11,11	1.81	1 (25%)
4	RIO	C	303	-	33,33,33	0.42	0	47,49,49	0.74	1 (2%)

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	RIO	B	303	-	-	4/12/68/68	0/3/3/3
3	AKG	D	302	2	-	0/3/9/9	-
3	AKG	A	302	2	-	0/3/9/9	-
3	AKG	E	302	2	-	0/3/9/9	-
4	RIO	E	303	-	-	4/12/68/68	0/3/3/3
4	RIO	A	303	-	-	3/12/68/68	0/3/3/3
3	AKG	B	302	2	-	0/3/9/9	-
3	AKG	F	302	2	-	0/3/9/9	-
4	RIO	D	303	-	-	4/12/68/68	0/3/3/3
4	RIO	F	303	-	-	4/12/68/68	0/3/3/3
3	AKG	C	302	2	-	0/3/9/9	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	RIO	C	303	-	-	3/12/68/68	0/3/3/3

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	302	AKG	C3-C4-C5	2.81	117.38	112.67
3	B	302	AKG	O5-C2-C3	-2.51	116.09	120.38
4	C	303	RIO	O3-C3-O2	2.06	113.66	111.43

There are no chirality outliers.

All (22) torsion outliers are listed below:

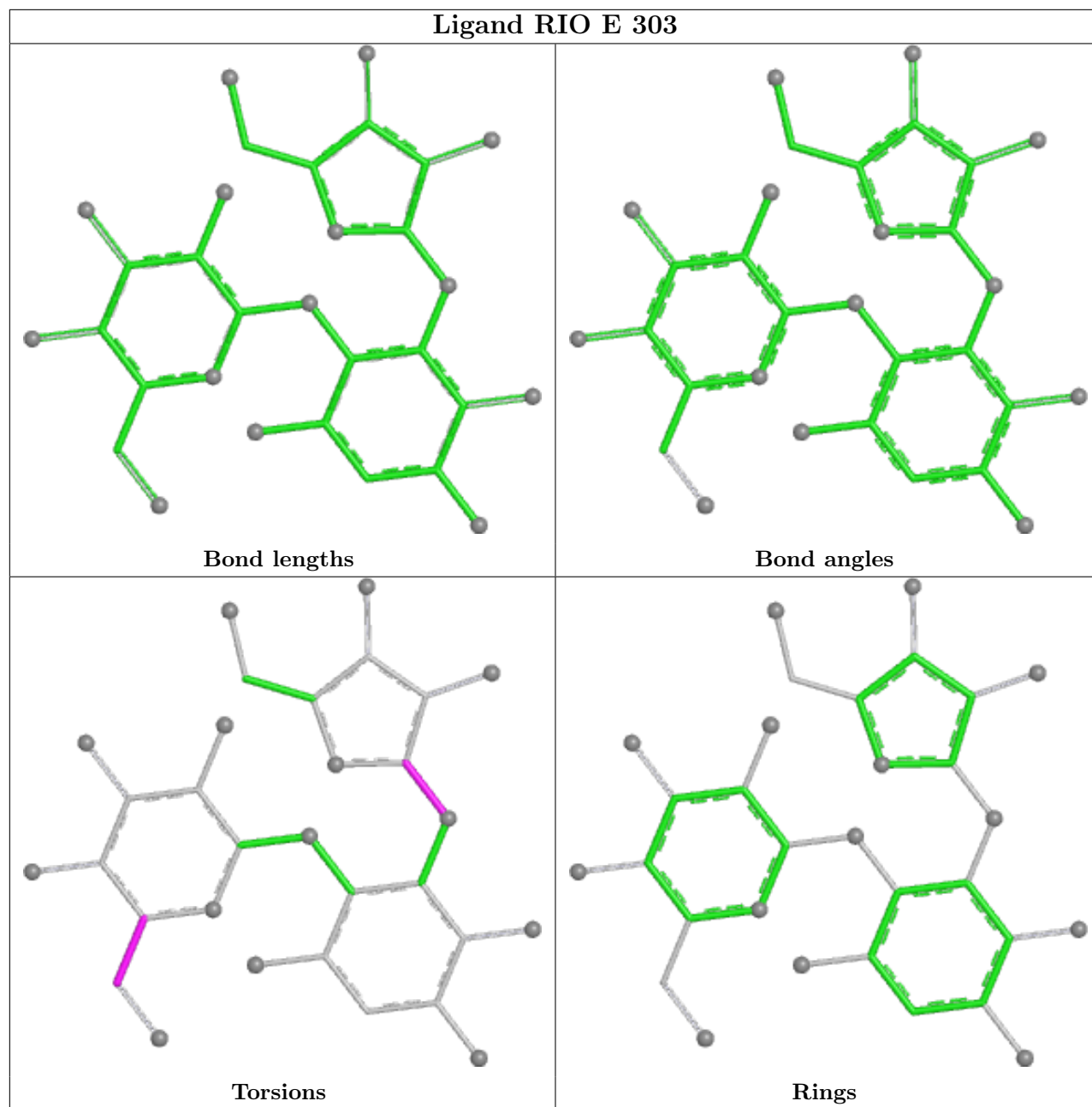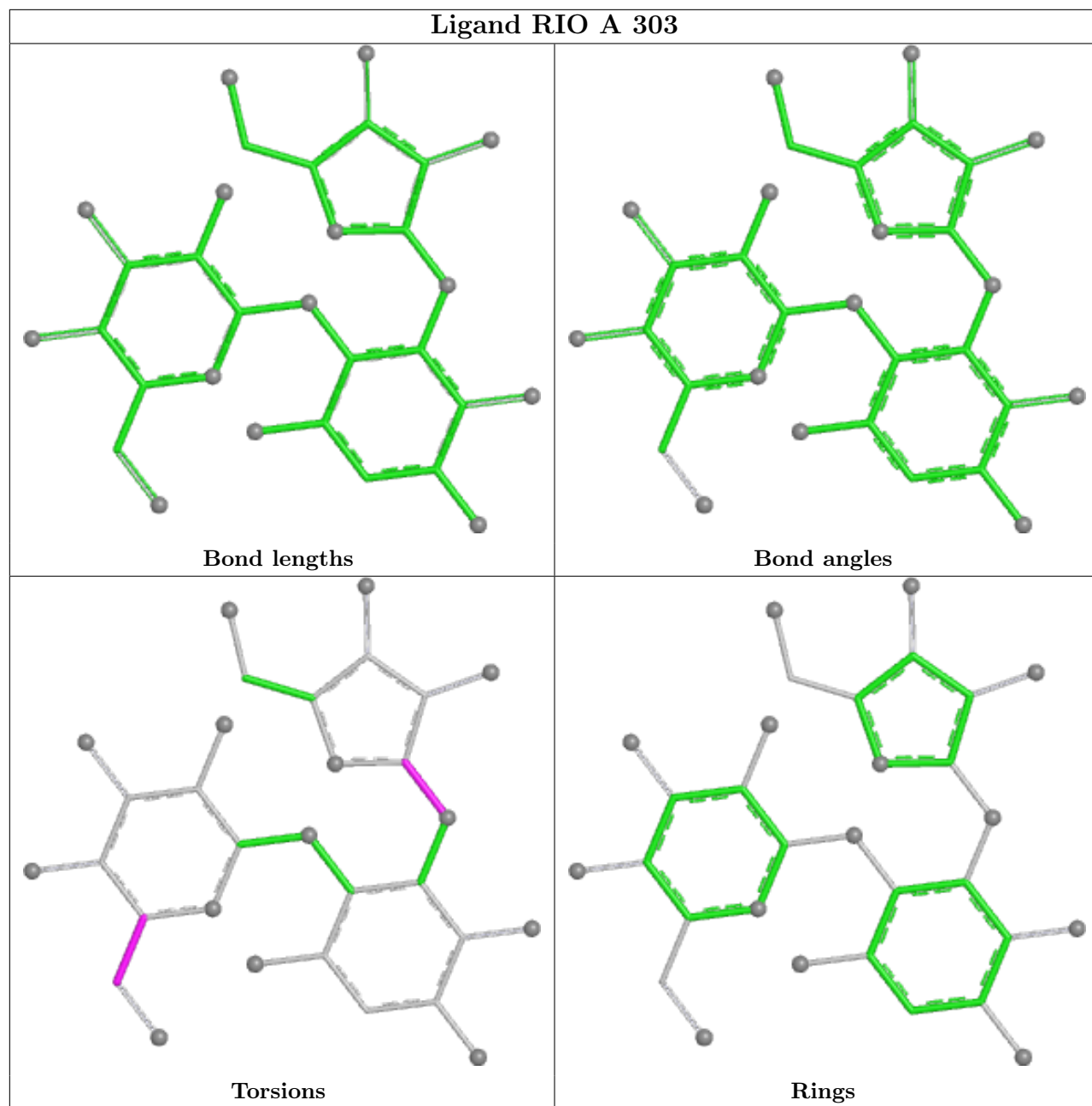| Mol	Chain	Res	Type	Atoms
4	A	303	RIO	C16-C3-O3-C4
4	B	303	RIO	C16-C3-O3-C4
4	B	303	RIO	C13-C11-C12-N3
4	C	303	RIO	O2-C3-O3-C4
4	C	303	RIO	C16-C3-O3-C4
4	C	303	RIO	O6-C11-C12-N3
4	D	303	RIO	C16-C3-O3-C4
4	D	303	RIO	C13-C11-C12-N3
4	E	303	RIO	O2-C3-O3-C4
4	E	303	RIO	C16-C3-O3-C4
4	F	303	RIO	C16-C3-O3-C4
4	A	303	RIO	O2-C3-O3-C4
4	B	303	RIO	O2-C3-O3-C4
4	D	303	RIO	O2-C3-O3-C4
4	F	303	RIO	O2-C3-O3-C4
4	E	303	RIO	C13-C11-C12-N3
4	F	303	RIO	C13-C11-C12-N3
4	B	303	RIO	O6-C11-C12-N3
4	D	303	RIO	O6-C11-C12-N3
4	E	303	RIO	O6-C11-C12-N3
4	F	303	RIO	O6-C11-C12-N3
4	A	303	RIO	C13-C11-C12-N3

There are no ring outliers.

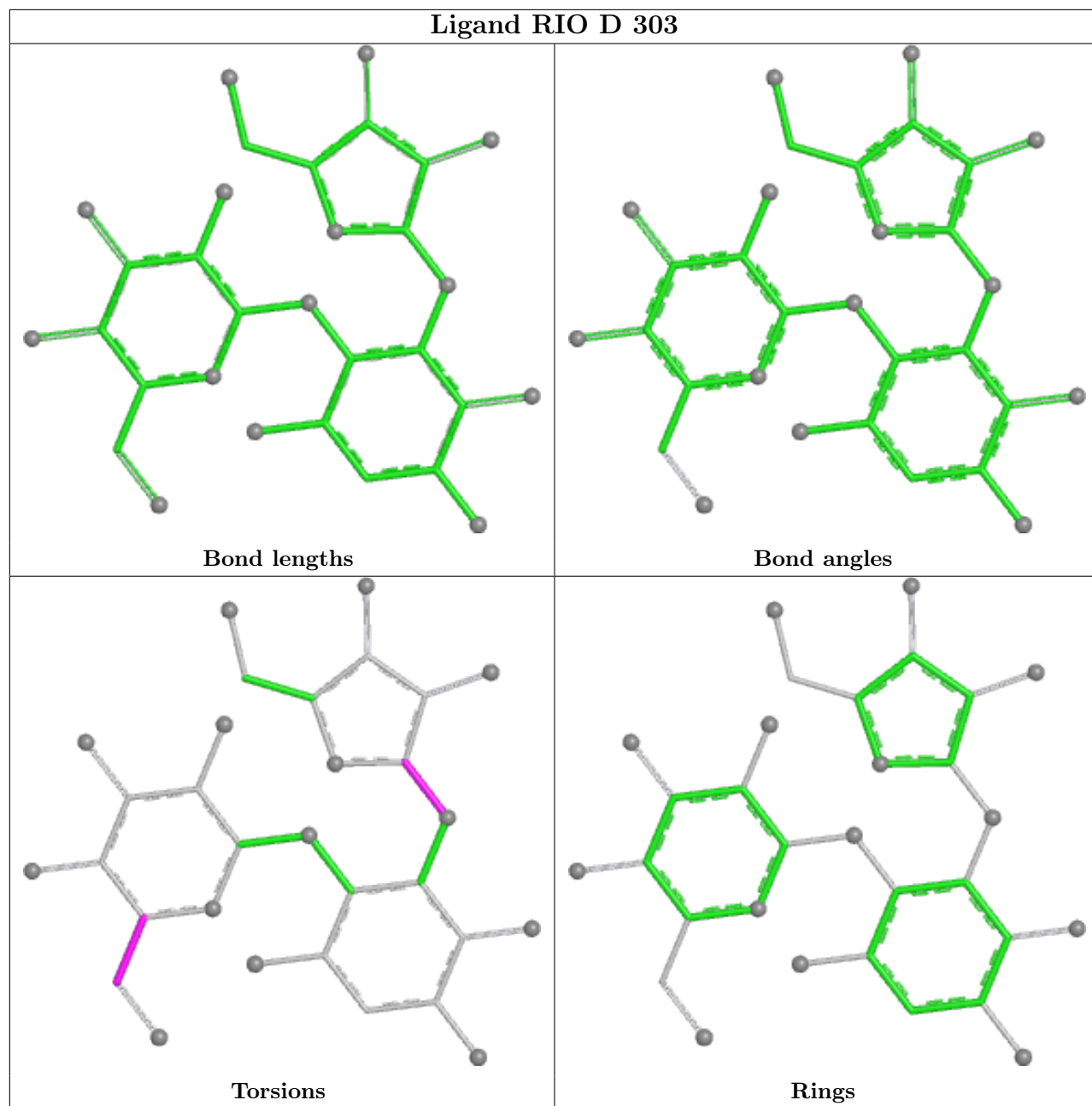No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,
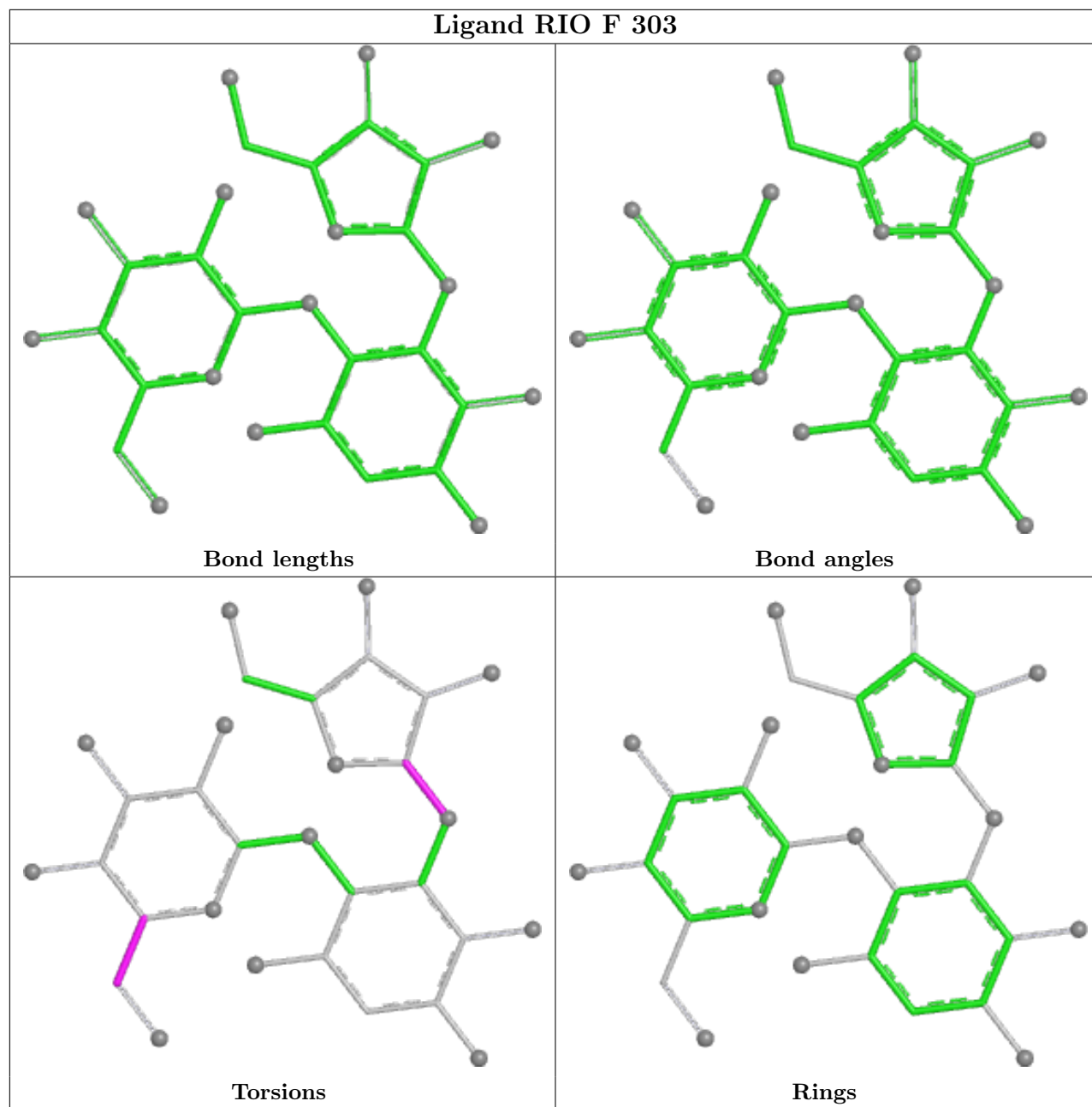
bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 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.

Ligand RIO B 303

Bond lengths

Bond angles

Torsions

Rings

Ligand RIO E 303

Bond lengths

Bond angles

Torsions

Rings

Ligand RIO A 303

Bond lengths

Bond angles

Torsions

Rings

Ligand RIO D 303

Bond lengths

Bond angles

Torsions

Rings

Ligand RIO F 303

Bond lengths

Bond angles

Torsions

Rings

Ligand RIO C 303

Bond lengths

Bond angles

Torsions

Rings
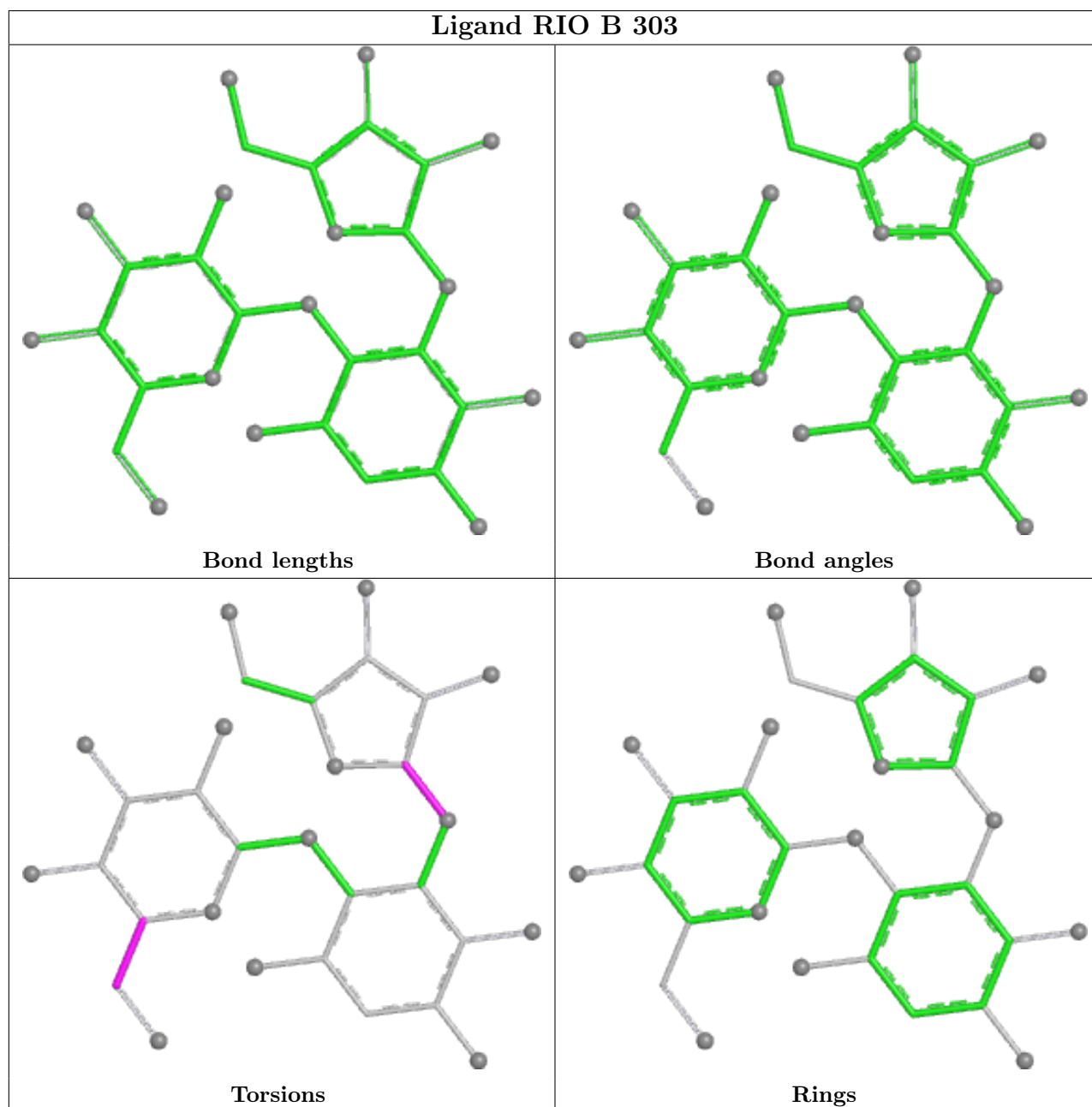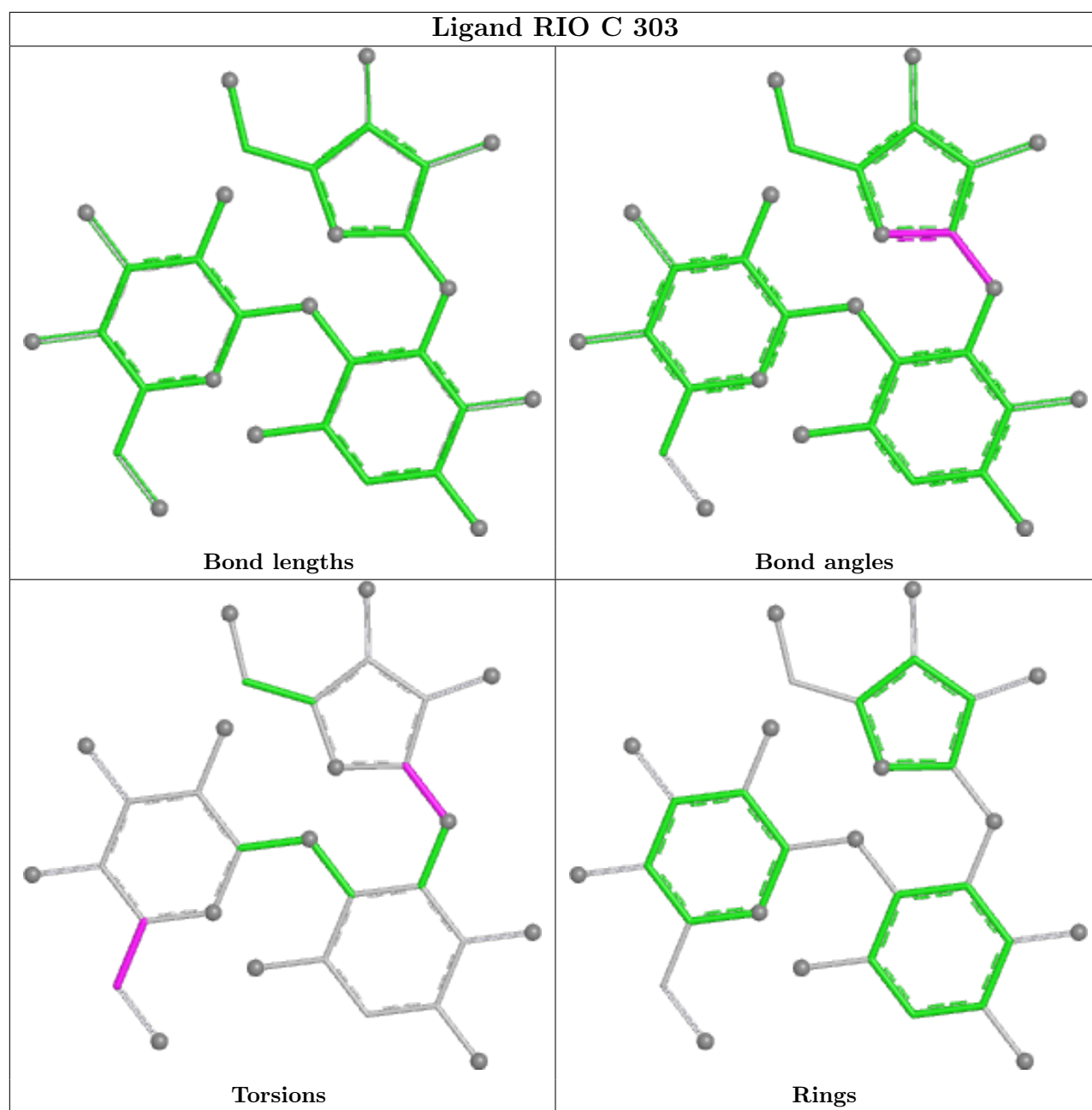
5.7 Other polymers ⓘ

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, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	282/288 (97%)	-0.07	6 (2%)	63	61	30, 47, 81, 100	0
1	B	283/288 (98%)	-0.30	2 (0%)	87	86	17, 30, 72, 111	0
1	C	277/288 (96%)	-0.14	4 (1%)	75	73	22, 51, 95, 119	0
1	D	279/288 (96%)	-0.32	1 (0%)	92	91	22, 33, 65, 98	0
1	E	274/288 (95%)	1.10	69 (25%)	0	0	40, 85, 139, 160	0
1	F	277/288 (96%)	-0.35	3 (1%)	80	79	21, 38, 76, 125	0
All	All	1672/1728 (96%)	-0.02	85 (5%)	28	26	17, 44, 107, 160	0

All (85) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	26	LEU	7.5
1	F	272	ASP	5.7
1	E	274	ASP	5.6
1	E	18	ASP	5.4
1	E	21	LEU	5.4
1	E	103	ILE	4.9
1	E	19	LYS	4.7
1	E	96	LEU	4.7
1	E	12	LEU	4.7
1	C	272	ASP	4.6
1	E	111	ASP	4.6
1	E	100	VAL	4.5
1	A	2	ALA	4.5
1	E	29	ALA	4.3
1	E	22	ASP	4.2
1	A	279	ASP	4.1
1	E	272	ASP	4.1
1	E	257	VAL	4.1
1	B	284	VAL	4.0

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Mol	Chain	Res	Type	RSRZ
1	E	27	ASP	3.9
1	E	273	VAL	3.9
1	E	256	TRP	3.9
1	E	28	ARG	3.8
1	E	23	PRO	3.8
1	E	17	ASP	3.8
1	E	95	LEU	3.7
1	E	250	PRO	3.6
1	E	20	THR	3.6
1	E	24	ALA	3.5
1	F	0	ALA	3.4
1	E	108	LEU	3.3
1	E	47	THR	3.3
1	E	271	GLY	3.3
1	E	101	TYR	3.3
1	E	102	GLN	3.2
1	E	269	VAL	3.2
1	A	282	PHE	3.1
1	E	85	VAL	3.1
1	C	178	GLU	3.0
1	C	250	PRO	3.0
1	E	107	VAL	3.0
1	E	48	ARG	3.0
1	A	283	ALA	3.0
1	E	94	VAL	3.0
1	E	275	HIS	3.0
1	E	251	ASP	2.9
1	E	49	LEU	2.9
1	E	86	ARG	2.9
1	E	174	LEU	2.9
1	E	37	GLY	2.9
1	E	254	LYS	2.9
1	E	30	LEU	2.8
1	E	259	GLY	2.8
1	A	12	LEU	2.8
1	A	17	ASP	2.8
1	E	265	HIS	2.7
1	E	264	THR	2.7
1	E	41	LEU	2.7
1	E	258	ASP	2.6
1	E	198	ALA	2.6
1	E	25	SER	2.6

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Mol	Chain	Res	Type	RSRZ
1	E	46	ARG	2.6
1	E	104	THR	2.5
1	B	276	LEU	2.4
1	E	263	HIS	2.4
1	F	275	HIS	2.4
1	E	3	LEU	2.4
1	E	270	ALA	2.3
1	E	11	THR	2.3
1	E	171	SER	2.2
1	E	87	GLU	2.2
1	E	255	SER	2.2
1	E	268	PHE	2.2
1	E	262	ARG	2.2
1	E	32	ILE	2.1
1	E	172	HIS	2.1
1	E	106	ALA	2.1
1	E	69	ASP	2.1
1	C	274	ASP	2.1
1	E	39	LEU	2.1
1	E	45	LEU	2.1
1	E	33	LEU	2.1
1	E	276	LEU	2.1
1	D	17	ASP	2.0
1	E	97	ASN	2.0

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

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

6.3 Carbohydrates ⓘ

There are no 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, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
4	RIO	C	303	31/31	0.94	0.14	30,45,58,65	0
4	RIO	E	303	31/31	0.94	0.10	36,51,56,59	0
3	AKG	E	302	10/10	0.95	0.14	50,59,67,69	0
4	RIO	A	303	31/31	0.95	0.12	33,42,50,52	0
5	CL	B	304	1/1	0.96	0.10	58,58,58,58	0
4	RIO	D	303	31/31	0.97	0.12	27,38,52,54	0
4	RIO	B	303	31/31	0.97	0.12	31,37,47,50	0
4	RIO	F	303	31/31	0.97	0.12	26,32,42,44	0
3	AKG	A	302	10/10	0.97	0.11	30,47,55,63	0
3	AKG	C	302	10/10	0.98	0.09	18,27,31,34	0
2	NI	E	301	1/1	0.98	0.09	45,45,45,45	0
3	AKG	B	302	10/10	0.98	0.11	20,24,29,29	0
5	CL	C	304	1/1	0.98	0.15	63,63,63,63	0
3	AKG	F	302	10/10	0.99	0.11	23,28,31,31	0
3	AKG	D	302	10/10	0.99	0.12	21,28,29,30	0
2	NI	A	301	1/1	0.99	0.13	36,36,36,36	0
5	CL	E	304	1/1	0.99	0.06	41,41,41,41	0
2	NI	F	301	1/1	1.00	0.12	23,23,23,23	0
2	NI	C	301	1/1	1.00	0.12	26,26,26,26	0
2	NI	D	301	1/1	1.00	0.12	23,23,23,23	0
2	NI	B	301	1/1	1.00	0.14	22,22,22,22	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.
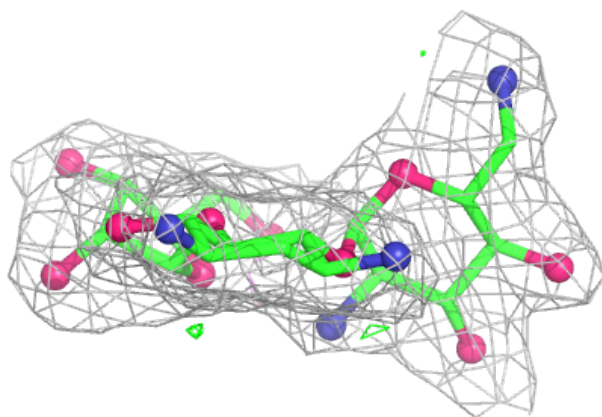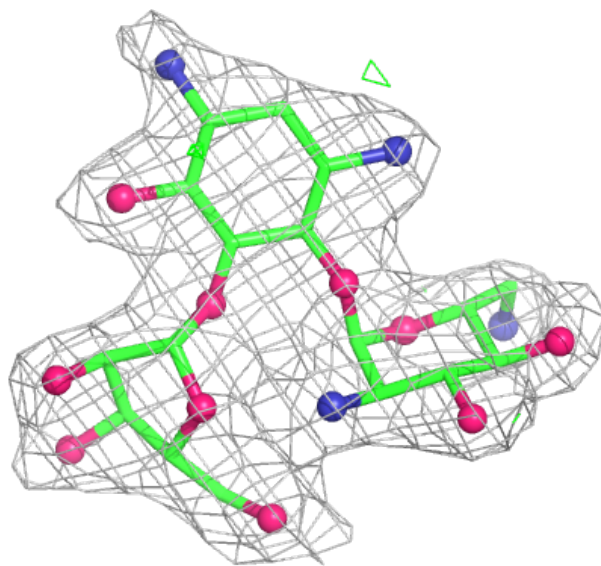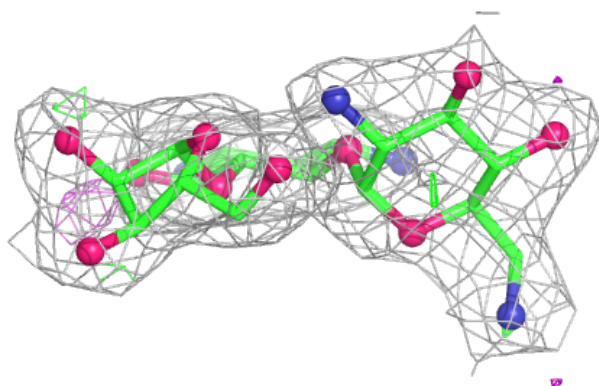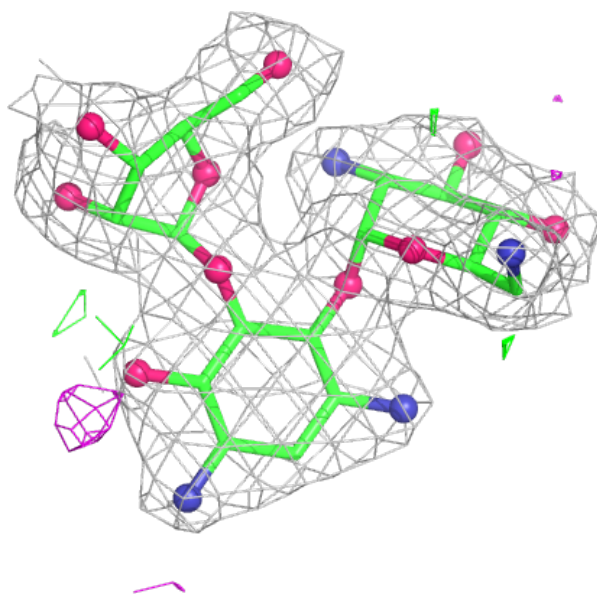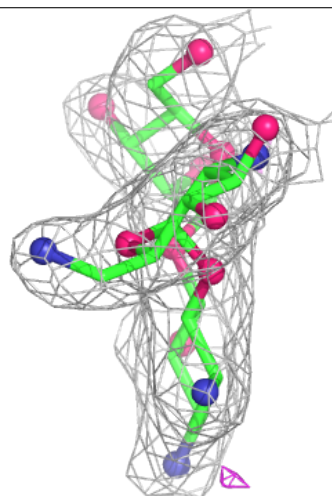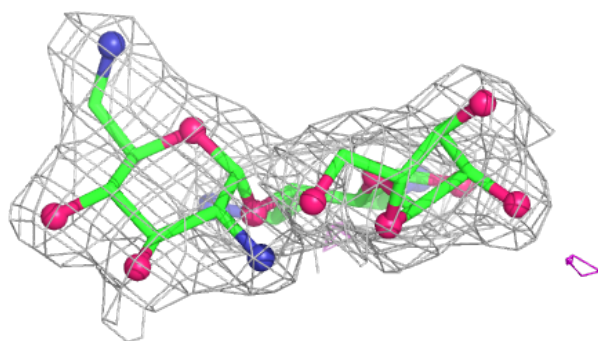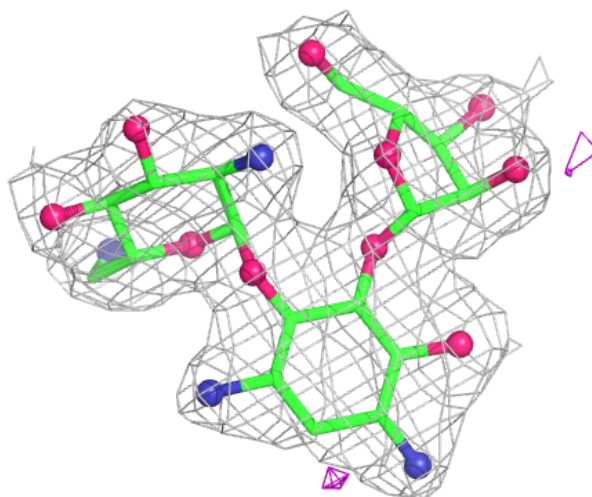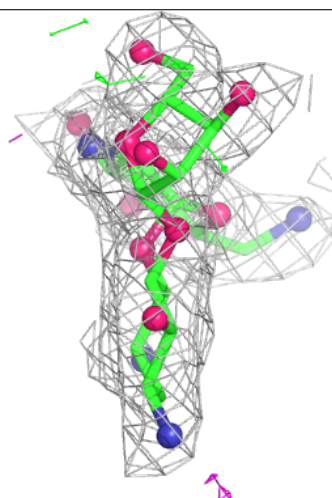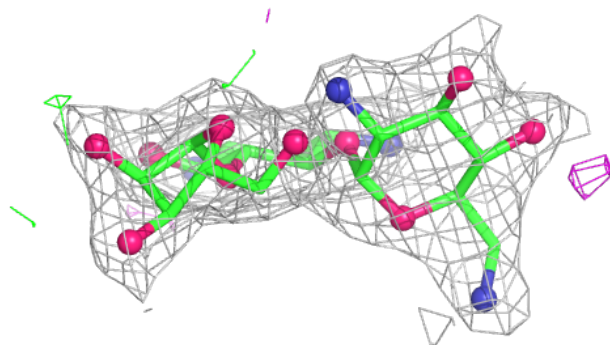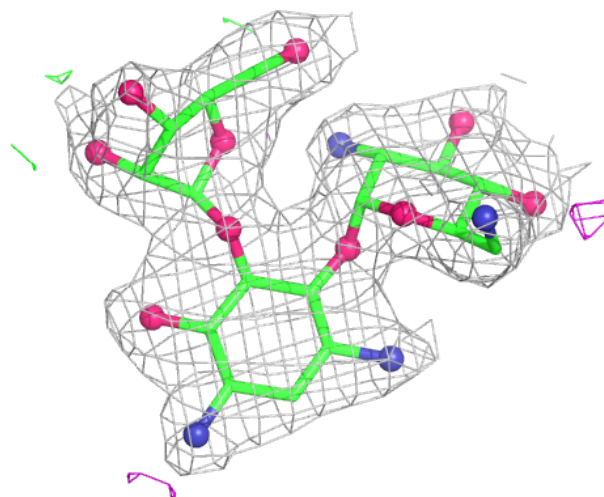
Electron density around RIO C 303:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
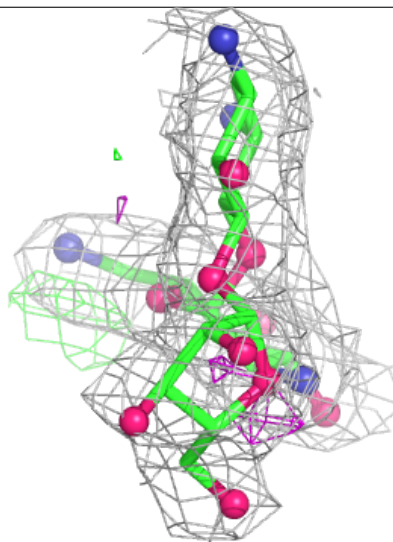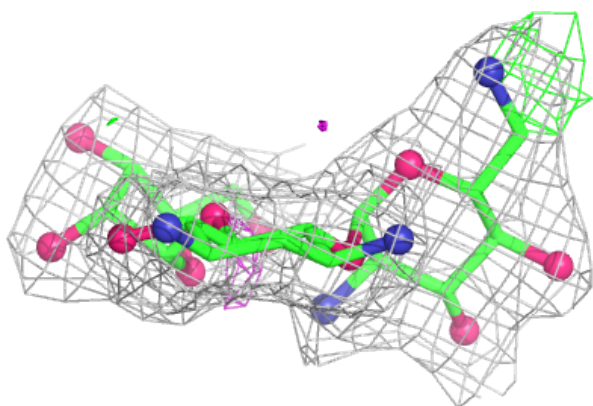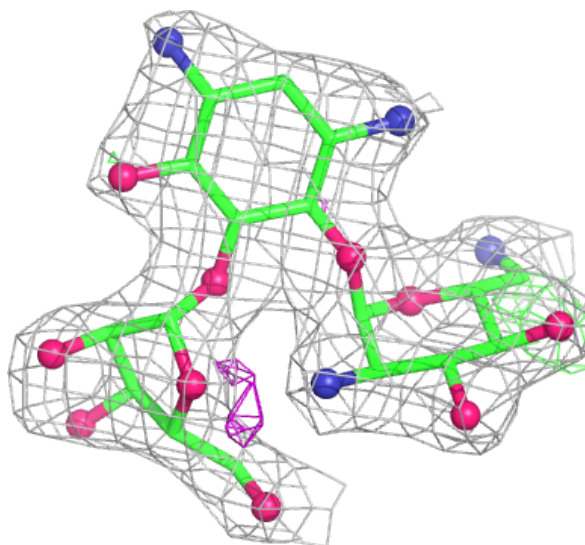
Electron density around RIO E 303:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
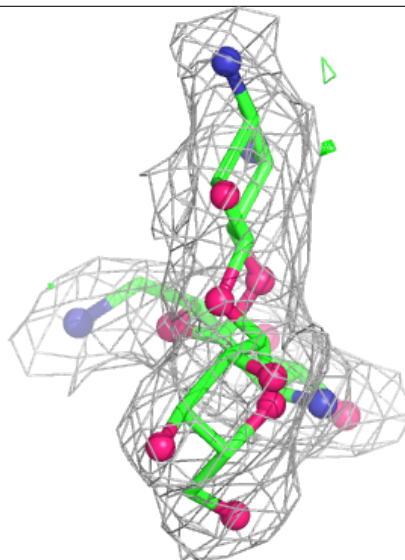
Electron density around RIO A 303:

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

Electron density around RIO D 303:

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

Electron density around RIO B 303:

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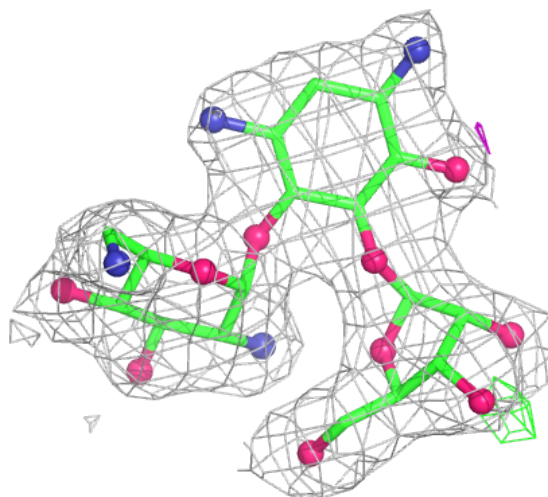$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around RIO F 303:

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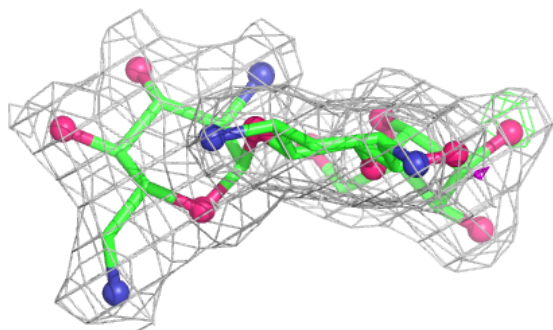
6.5 Other polymers (i)

There are no such residues in this entry.