



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 29, 2024 – 08:28 PM EDT

PDB ID : 4EON  
Title : Thr 160 phosphorylated CDK2 H84S, Q85M, Q131E - human cyclin A3 complex with the inhibitor RO3306  
Authors : Echalier, A.; Cot, E.; Camasses, A.; Hodimont, E.; Hoh, F.; Sheinerman, F.; Krasinska, L.; Fisher, D.  
Deposited on : 2012-04-14  
Resolution : 2.40 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 : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 1.20.1  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

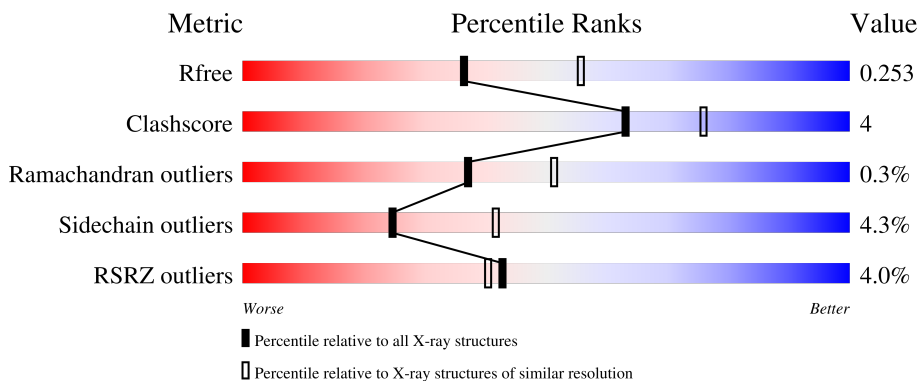
# 1 Overall quality at a glance

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	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	164625	4642 (2.40-2.40)
Clashscore	180529	5218 (2.40-2.40)
Ramachandran outliers	177936	5158 (2.40-2.40)
Sidechain outliers	177891	5159 (2.40-2.40)
RSRZ outliers	164620	4642 (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  $\geq 3$ , 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	300	 4% 90% 10%
1	C	300	 5% 84% 14% •
2	B	258	 4% 89% 9% •
2	D	258	 2% 93% 5% •

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

<b>Mol</b>	<b>Type</b>	<b>Chain</b>	<b>Res</b>	<b>Chirality</b>	<b>Geometry</b>	<b>Clashes</b>	<b>Electron density</b>
3	1RO	A	301	-	-	X	-

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 9199 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 Cyclin-dependent kinase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	N	O	P				S
1	A	300	Total	C	N	O	P	S	0	1	0
			2415	1566	407	432	1	9			
1	C	299	Total	C	N	O	P	S	0	3	0
			2426	1570	411	435	1	9			

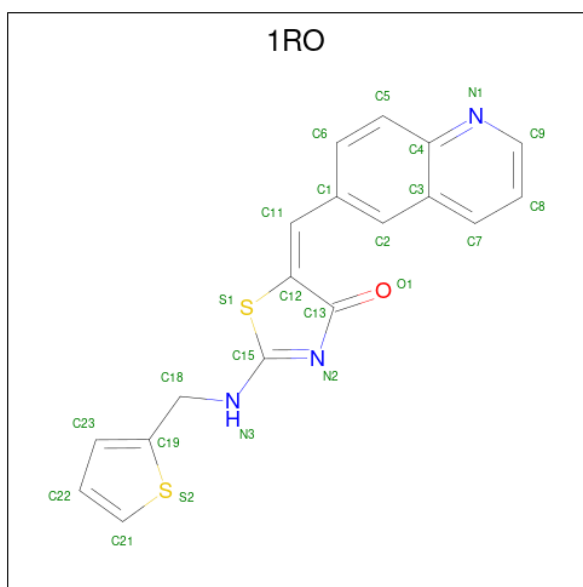
There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP P24941
A	0	SER	-	expression tag	UNP P24941
A	84	SER	HIS	engineered mutation	UNP P24941
A	85	MET	GLN	engineered mutation	UNP P24941
A	131	GLU	GLN	engineered mutation	UNP P24941
C	-1	GLY	-	expression tag	UNP P24941
C	0	SER	-	expression tag	UNP P24941
C	84	SER	HIS	engineered mutation	UNP P24941
C	85	MET	GLN	engineered mutation	UNP P24941
C	131	GLU	GLN	engineered mutation	UNP P24941

- Molecule 2 is a protein called Cyclin-A2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	257	Total	C	N	O	S	0	1	0
			2084	1349	339	385	11			
2	D	257	Total	C	N	O	S	0	2	0
			2094	1355	342	386	11			

- Molecule 3 is (5E)-5-(quinolin-6-ylmethylidene)-2-[(thiophen-2-ylmethyl)amino]-1,3-thiazol-4(5H)-one (three-letter code: 1RO) (formula: C<sub>18</sub>H<sub>13</sub>N<sub>3</sub>OS<sub>2</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
3	A	1	24	18	3	1	2	0	0
3	C	1	24	18	3	1	2	0	0

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
4	B	1	1	1	0	0
4	D	1	1	1	0	0

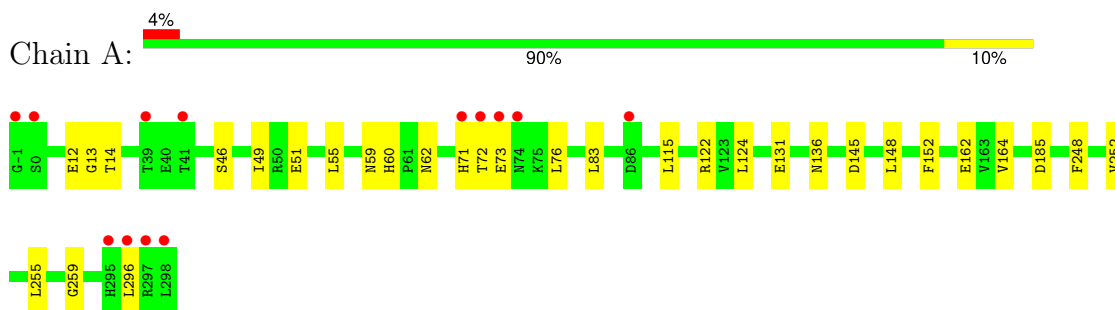
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	25	25	25	0	0
5	B	23	23	23	0	0
5	C	61	61	61	0	0
5	D	21	21	21	0	0

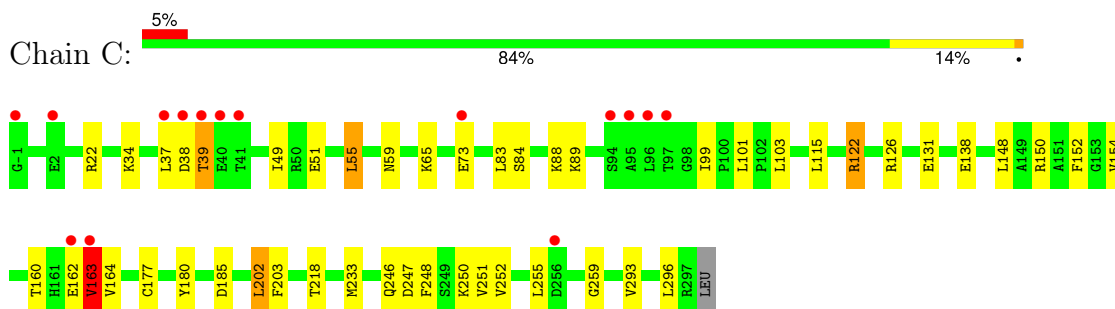
### 3 Residue-property plots [i](#)

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

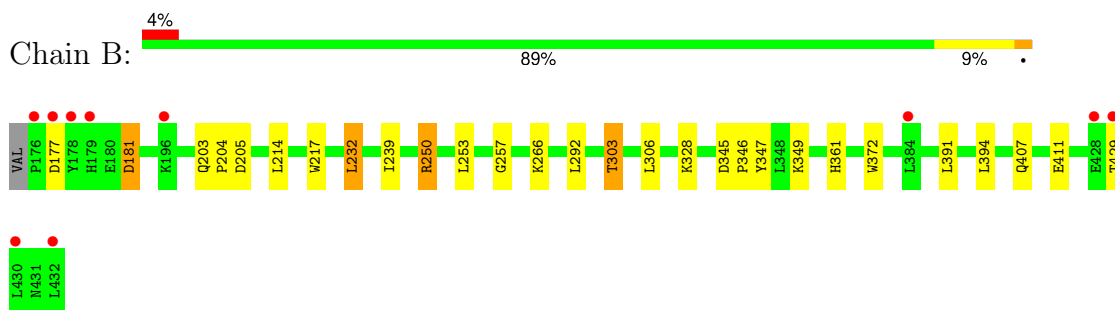
- Molecule 1: Cyclin-dependent kinase 2



- Molecule 1: Cyclin-dependent kinase 2



- Molecule 2: Cyclin-A2



- Molecule 2: Cyclin-A2





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	73.63Å 132.98Å 176.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.86 – 2.40 29.86 – 2.40	Depositor EDS
% Data completeness (in resolution range)	98.8 (29.86-2.40) 98.8 (29.86-2.40)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.89 (at 2.39Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, $R_{free}$	0.219 , 0.254 0.217 , 0.253	Depositor DCC
$R_{free}$ test set	3472 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	43.0	Xtrriage
Anisotropy	0.080	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 31.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	9199	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	46.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.24% 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: TPO, 1RO, MG

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	0.46	0/2464	0.55	0/3341
1	C	0.48	0/2475	0.60	1/3355 (0.0%)
2	B	0.44	2/2134 (0.1%)	0.53	1/2897 (0.0%)
2	D	0.44	0/2145	0.53	0/2913
All	All	0.45	2/9218 (0.0%)	0.55	2/12506 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	C	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	372	TRP	CD2-CE2	5.04	1.47	1.41
2	B	217	TRP	CD2-CE2	5.02	1.47	1.41

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	C	163	VAL	N-CA-C	8.44	133.78	111.00
2	B	232	LEU	CA-CB-CG	5.12	127.09	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	162	GLU	Peptide

## 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	2415	0	2459	16	0
1	C	2426	0	2463	25	0
2	B	2084	0	2102	15	0
2	D	2094	0	2108	10	0
3	A	24	0	13	9	0
3	C	24	0	13	5	0
4	B	1	0	0	0	0
4	D	1	0	0	0	0
5	A	25	0	0	0	0
5	B	23	0	0	0	0
5	C	61	0	0	0	0
5	D	21	0	0	0	0
All	All	9199	0	9158	71	0

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

All (71) 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)
3:A:301:1RO:C19	3:A:301:1RO:N2	2.30	0.94
1:C:37:LEU:HA	1:C:38:ASP:HB2	1.48	0.93
3:C:301:1RO:O1	3:C:301:1RO:H13	1.76	0.84
3:A:301:1RO:O1	3:A:301:1RO:C2	2.29	0.81
3:C:301:1RO:O1	3:C:301:1RO:C2	2.29	0.81
3:A:301:1RO:O1	3:A:301:1RO:H13	1.83	0.78
1:C:88:LYS:HD3	1:C:131[A]:GLU:HG3	1.68	0.74
3:C:301:1RO:N2	3:C:301:1RO:C19	2.36	0.74
1:C:163:VAL:HG13	1:C:163:VAL:O	1.90	0.72
1:C:83:LEU:O	3:C:301:1RO:H10	1.91	0.70
3:A:301:1RO:N2	3:A:301:1RO:C23	2.56	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:163:VAL:O	1:C:164:VAL:CG2	2.43	0.66
1:C:163:VAL:HG21	1:C:180:TYR:OH	1.97	0.65
2:D:175:VAL:N	2:D:176:PRO:CD	2.60	0.64
1:C:163:VAL:O	1:C:164:VAL:HG23	1.98	0.64
2:B:181:ASP:OD1	2:B:181:ASP:N	2.34	0.61
1:A:71:HIS:HD2	1:A:76:LEU:HD13	1.67	0.59
1:C:177:CYS:HB2	1:C:233:MET:CE	2.34	0.58
1:A:115:LEU:HD21	1:A:185:ASP:HB3	1.86	0.58
1:C:154:VAL:HG11	2:D:179[A]:HIS:HB2	1.87	0.57
2:D:175:VAL:N	2:D:176:PRO:HD3	2.19	0.56
1:A:49:ILE:HG23	2:B:306:LEU:HD12	1.88	0.56
1:C:163:VAL:O	1:C:163:VAL:CG1	2.56	0.54
1:C:51:GLU:O	1:C:55:LEU:HB2	2.08	0.53
1:A:60:HIS:CD2	1:A:62:ASN:H	2.27	0.53
3:A:301:1RO:H13	3:A:301:1RO:C13	2.39	0.52
2:B:177[B]:ASP:O	2:B:177[B]:ASP:OD2	2.28	0.51
1:C:131[A]:GLU:OE2	1:C:131[A]:GLU:N	2.29	0.50
1:C:202:LEU:HD13	1:C:203:PHE:CE2	2.46	0.50
1:A:131[A]:GLU:O	3:A:301:1RO:H4	2.11	0.50
1:C:99:ILE:HG23	1:C:103:LEU:HD23	1.93	0.50
1:A:13:GLY:HA2	3:A:301:1RO:H2	1.94	0.50
3:A:301:1RO:C2	3:A:301:1RO:C13	2.91	0.49
2:B:407:GLN:O	2:B:411:GLU:HG2	2.12	0.49
1:C:131[A]:GLU:H	1:C:131[A]:GLU:CD	2.15	0.49
1:A:131[B]:GLU:O	3:A:301:1RO:H4	2.13	0.48
1:A:60:HIS:HD2	1:A:62:ASN:H	1.61	0.48
1:A:252:VAL:HG11	1:A:255:LEU:HD22	1.95	0.48
2:B:214:LEU:HD22	2:B:253:LEU:HG	1.96	0.48
2:D:179[A]:HIS:CD2	2:D:179[A]:HIS:C	2.88	0.47
1:A:46:SER:HB2	2:B:266:LYS:O	2.14	0.47
1:A:14:THR:HG23	1:A:145:ASP:OD2	2.15	0.47
1:C:255:LEU:HG	1:C:259:GLY:HA3	1.98	0.46
1:C:122:ARG:HA	1:C:152:PHE:CE1	2.50	0.46
2:D:344:ALA:O	2:D:348:LEU:HB2	2.15	0.46
1:A:51:GLU:O	1:A:55:LEU:HB2	2.16	0.46
2:B:361:HIS:CD2	2:B:391:LEU:HD21	2.51	0.46
1:A:124:LEU:HG	1:A:152:PHE:CD1	2.50	0.45
1:C:115:LEU:HD21	1:C:185:ASP:HB3	1.99	0.45
3:C:301:1RO:H13	3:C:301:1RO:C13	2.46	0.45
2:D:334:MET:O	2:D:338:GLU:HB2	2.16	0.45
1:C:49:ILE:HG23	2:D:306:LEU:HD12	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:251:VAL:HG12	1:C:252:VAL:HG23	1.98	0.45
1:C:177:CYS:HB2	1:C:233:MET:HE1	1.98	0.44
2:B:205:ASP:OD2	2:B:250:ARG:HD2	2.18	0.44
1:C:126:ARG:HD2	1:C:163:VAL:HG22	1.99	0.44
1:C:39:THR:O	2:D:292:LEU:HD23	2.19	0.43
1:C:247:ASP:HB3	1:C:250:LYS:HG2	2.01	0.43
1:A:83:LEU:HD23	1:A:136:ASN:HB3	2.01	0.43
1:A:255:LEU:HG	1:A:259:GLY:HA3	2.00	0.43
2:B:203:GLN:HA	2:B:204:PRO:HD3	1.82	0.42
1:A:72:THR:HG22	1:A:73:GLU:H	1.84	0.42
2:B:239:ILE:HD11	2:B:257:GLY:HA2	2.00	0.42
2:B:346:PRO:HB2	2:B:349:LYS:HE2	2.01	0.42
2:D:344:ALA:HB1	2:D:348:LEU:HD22	2.01	0.42
2:B:345:ASP:HA	2:B:346:PRO:HA	1.86	0.41
1:C:163:VAL:HG21	1:C:180:TYR:HH	1.84	0.41
2:B:303:THR:O	2:B:303:THR:HG23	2.20	0.41
2:B:347:TYR:OH	2:B:394:LEU:HA	2.20	0.41
2:B:361:HIS:HD2	2:B:391:LEU:HD21	1.84	0.41
2:D:347:TYR:OH	2:D:394:LEU:HA	2.21	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	298/300 (99%)	284 (95%)	13 (4%)	1 (0%)	37 51
1	C	299/300 (100%)	284 (95%)	13 (4%)	2 (1%)	19 29
2	B	256/258 (99%)	250 (98%)	6 (2%)	0	100 100
2	D	257/258 (100%)	251 (98%)	6 (2%)	0	100 100
All	All	1110/1116 (100%)	1069 (96%)	38 (3%)	3 (0%)	37 51

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	163	VAL
1	A	164	VAL
1	C	73	GLU

### 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	264/263 (100%)	257 (97%)	7 (3%)	40	60
1	C	265/263 (101%)	245 (92%)	20 (8%)	11	18
2	B	232/232 (100%)	225 (97%)	7 (3%)	36	57
2	D	233/232 (100%)	224 (96%)	9 (4%)	27	46
All	All	994/990 (100%)	951 (96%)	43 (4%)	25	42

All (43) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	12	GLU
1	A	59	ASN
1	A	122	ARG
1	A	148	LEU
1	A	162	GLU
1	A	248	PHE
1	A	296	LEU
2	B	181	ASP
2	B	232	LEU
2	B	250	ARG
2	B	292	LEU
2	B	303	THR
2	B	328	LYS
2	B	429	THR
1	C	22	ARG
1	C	34	LYS
1	C	39	THR

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Mol	Chain	Res	Type
1	C	55	LEU
1	C	59	ASN
1	C	65	LYS
1	C	84	SER
1	C	89	LYS
1	C	101	LEU
1	C	122	ARG
1	C	138	GLU
1	C	148	LEU
1	C	150	ARG
1	C	163	VAL
1	C	202	LEU
1	C	218	THR
1	C	246	GLN
1	C	248	PHE
1	C	293	VAL
1	C	296	LEU
2	D	175	VAL
2	D	179[A]	HIS
2	D	179[B]	HIS
2	D	232	LEU
2	D	281	ILE
2	D	283	ASP
2	D	292	LEU
2	D	328	LYS
2	D	384	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	59	ASN
1	A	60	HIS
1	A	62	ASN
1	A	113	GLN
1	A	268	HIS
2	B	179	HIS
2	B	183	HIS
2	B	254	GLN
1	C	59	ASN
1	C	74	ASN
1	C	246	GLN
2	D	254	GLN

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Mol	Chain	Res	Type
2	D	395	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](#)

2 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
1	TPO	A	160	1	8,10,11	0.84	0	10,14,16	1.09	0
1	TPO	C	160	1	8,10,11	0.79	0	10,14,16	1.18	1 (10%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	TPO	A	160	1	-	1/9/11/13	-
1	TPO	C	160	1	-	0/9/11/13	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	C	160	TPO	O3P-P-O2P	2.29	116.38	107.80

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	160	TPO	O-C-CA-CB

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	1RO	C	301	-	27,27,27	3.05	9 (33%)	32,37,37	5.74	13 (40%)
3	1RO	A	301	-	27,27,27	2.90	9 (33%)	32,37,37	5.11	13 (40%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	1RO	C	301	-	-	3/7/21/21	0/4/4/4
3	1RO	A	301	-	-	5/7/21/21	0/4/4/4

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	301	1RO	C11-C12	12.05	1.47	1.34
3	A	301	1RO	C11-C12	11.92	1.47	1.34
3	C	301	1RO	C13-N2	-4.50	1.28	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	301	1RO	C13-N2	-4.43	1.28	1.38
3	C	301	1RO	C13-C12	-4.32	1.42	1.50
3	C	301	1RO	C5-C4	-3.81	1.35	1.41
3	A	301	1RO	C13-C12	-3.42	1.44	1.50
3	A	301	1RO	C5-C4	-3.28	1.36	1.41
3	C	301	1RO	C2-C3	-2.89	1.35	1.42
3	A	301	1RO	C4-N1	-2.87	1.32	1.37
3	C	301	1RO	C4-N1	-2.74	1.32	1.37
3	A	301	1RO	C3-C4	2.61	1.46	1.42
3	C	301	1RO	C3-C4	2.42	1.45	1.42
3	C	301	1RO	C7-C3	-2.38	1.36	1.42
3	A	301	1RO	C7-C3	-2.25	1.37	1.42
3	A	301	1RO	C2-C3	-2.24	1.37	1.42
3	C	301	1RO	C15-N3	-2.06	1.30	1.34
3	A	301	1RO	C19-S2	-2.06	1.69	1.73

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	301	1RO	N3-C15-N2	-17.95	109.88	123.99
3	C	301	1RO	C12-C13-N2	15.44	122.84	113.43
3	A	301	1RO	N3-C15-N2	-13.47	113.41	123.99
3	A	301	1RO	C12-C13-N2	12.97	121.33	113.43
3	A	301	1RO	C22-C21-S2	-11.03	104.03	112.98
3	C	301	1RO	S1-C15-N3	10.94	132.75	121.32
3	C	301	1RO	C13-C12-S1	-10.40	103.02	109.15
3	A	301	1RO	C1-C11-C12	-10.31	117.05	130.92
3	A	301	1RO	C13-C12-S1	-8.54	104.11	109.15
3	C	301	1RO	C1-C11-C12	-8.08	120.06	130.92
3	A	301	1RO	S1-C15-N3	7.89	129.56	121.32
3	C	301	1RO	C22-C21-S2	-7.80	106.65	112.98
3	C	301	1RO	C18-N3-C15	-7.32	112.30	122.27
3	A	301	1RO	C11-C12-C13	7.24	129.12	122.24
3	C	301	1RO	C11-C12-C13	5.11	127.09	122.24
3	A	301	1RO	O1-C13-N2	-4.61	114.77	124.27
3	C	301	1RO	O1-C13-N2	-4.45	115.09	124.27
3	C	301	1RO	C15-N2-C13	-2.64	106.29	110.75
3	A	301	1RO	C18-N3-C15	-2.56	118.78	122.27
3	C	301	1RO	C8-C7-C3	-2.24	117.37	120.48
3	A	301	1RO	C15-N2-C13	-2.16	107.10	110.75
3	A	301	1RO	C9-N1-C4	2.13	120.15	116.93
3	C	301	1RO	C2-C1-C11	2.13	123.95	118.55

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	301	1RO	C5-C4-N1	2.11	121.94	118.55
3	C	301	1RO	C7-C8-C9	2.04	121.46	118.92
3	A	301	1RO	C19-C18-N3	2.00	117.04	112.64

There are no chirality outliers.

All (8) torsion outliers are listed below:

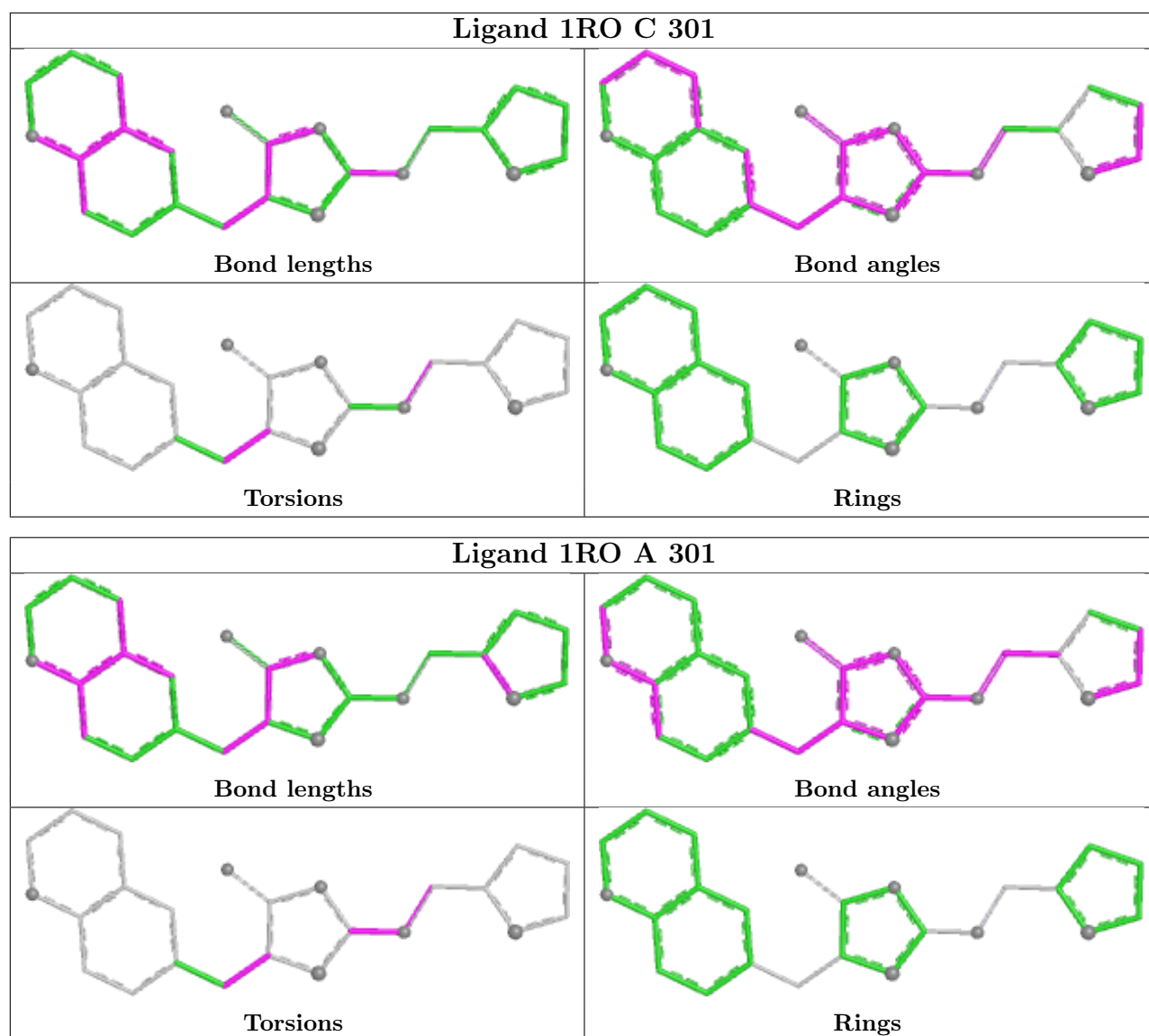
Mol	Chain	Res	Type	Atoms
3	A	301	1RO	S1-C15-N3-C18
3	A	301	1RO	C19-C18-N3-C15
3	A	301	1RO	C1-C11-C12-C13
3	C	301	1RO	C1-C11-C12-C13
3	A	301	1RO	C1-C11-C12-S1
3	C	301	1RO	C1-C11-C12-S1
3	C	301	1RO	C19-C18-N3-C15
3	A	301	1RO	N2-C15-N3-C18

There are no ring outliers.

2 monomers are involved in 14 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	301	1RO	5	0
3	A	301	1RO	9	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	299/300 (99%)	0.15	13 (4%) 40 38	18, 47, 76, 106	3 (1%)
1	C	298/300 (99%)	-0.12	15 (5%) 35 32	14, 34, 63, 103	8 (2%)
2	B	257/258 (99%)	0.19	10 (3%) 44 41	30, 49, 77, 109	4 (1%)
2	D	257/258 (99%)	-0.03	6 (2%) 61 58	16, 44, 65, 84	2 (0%)
All	All	1111/1116 (99%)	0.05	44 (3%) 43 40	14, 43, 75, 109	17 (1%)

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	298	LEU	6.9
1	C	39	THR	6.7
1	C	95	ALA	6.3
2	B	432	LEU	4.8
2	B	176	PRO	4.7
1	A	71	HIS	4.6
1	C	40	GLU	4.5
1	C	96	LEU	4.2
1	A	72	THR	4.1
1	A	296	LEU	4.1
2	D	175	VAL	4.0
1	C	37	LEU	3.7
1	A	-1	GLY	3.5
1	C	41	THR	3.1
2	B	179	HIS	3.0
1	C	163	VAL	3.0
1	C	162	GLU	2.9
1	C	97	THR	2.9
2	B	429	THR	2.8
2	D	431	ASN	2.8
1	C	38	ASP	2.8

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Mol	Chain	Res	Type	RSRZ
2	D	177	ASP	2.8
1	A	86	ASP	2.8
2	B	178	TYR	2.8
2	D	285	THR	2.7
1	A	39	THR	2.7
1	A	295	HIS	2.6
2	B	177[A]	ASP	2.6
1	C	-1	GLY	2.6
2	B	384	LEU	2.5
1	A	297	ARG	2.4
1	C	94	SER	2.4
1	A	0	SER	2.4
1	C	256[A]	ASP	2.3
2	D	323	GLN	2.3
1	C	73	GLU	2.2
2	B	428	GLU	2.2
1	A	74	ASN	2.2
1	A	73	GLU	2.2
1	C	2	GLU	2.2
2	D	374	GLU	2.2
2	B	430	LEU	2.1
1	A	41	THR	2.1
2	B	196	LYS	2.0

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

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
1	TPO	A	160	11/12	0.98	0.06	34,37,43,43	0
1	TPO	C	160	11/12	0.99	0.06	28,30,34,35	0

## 6.3 Carbohydrates [i](#)

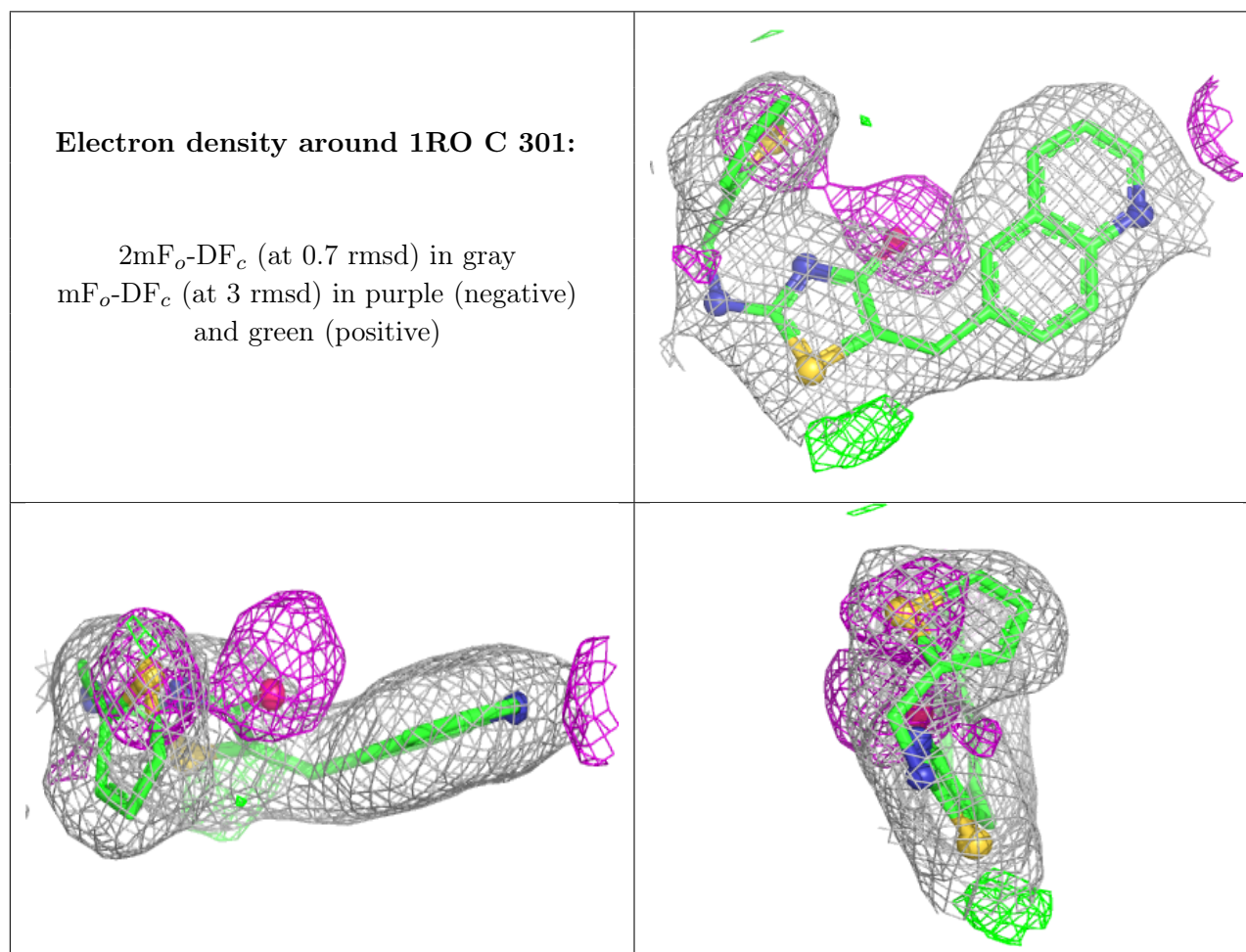
There are no monosaccharides in this entry.

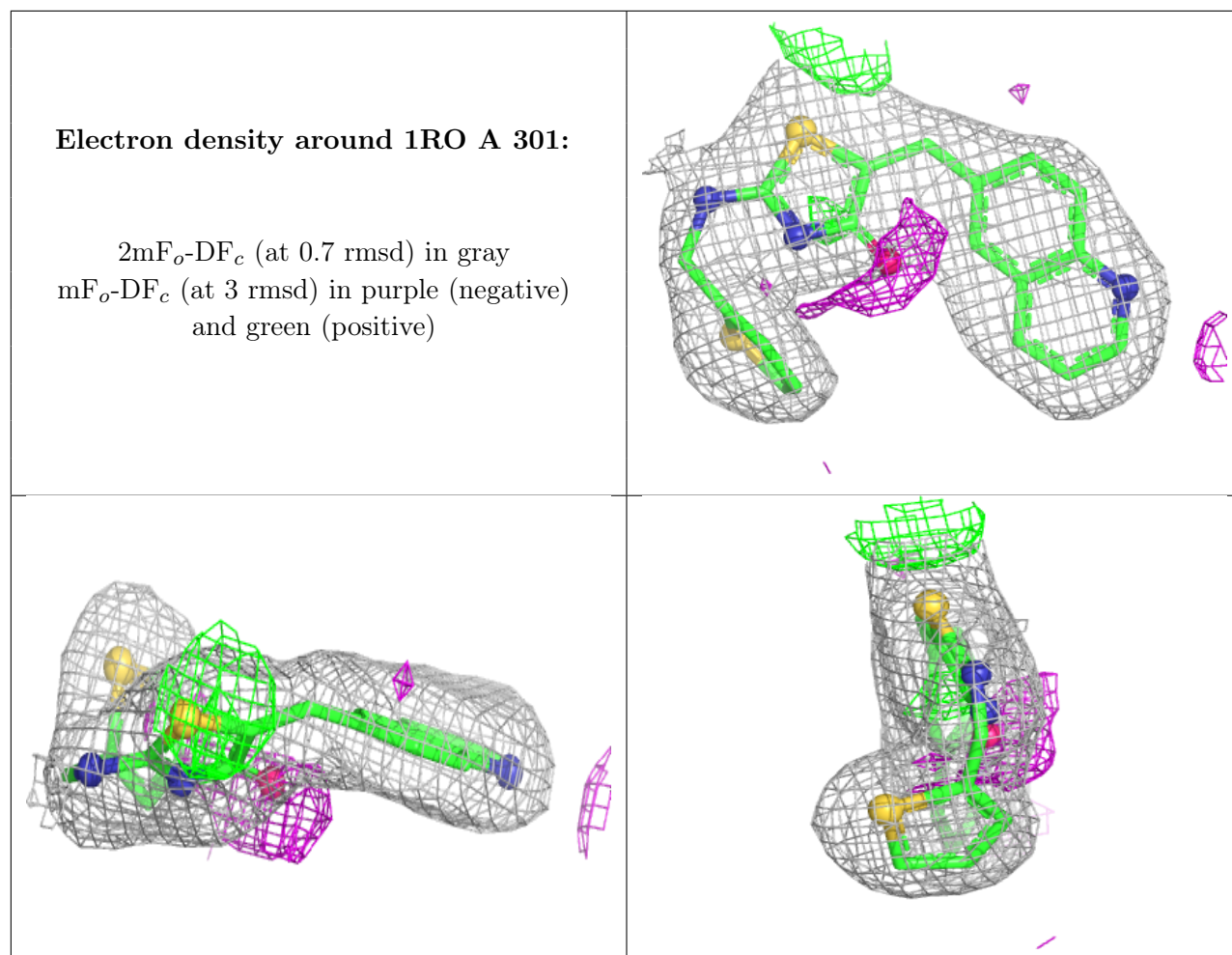
## 6.4 Ligands [i](#)

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
3	1RO	C	301	24/24	0.88	0.11	30,37,43,43	0
3	1RO	A	301	24/24	0.92	0.10	47,52,54,56	0
4	MG	B	501	1/1	0.96	0.09	38,38,38,38	0
4	MG	D	501	1/1	0.98	0.10	41,41,41,41	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.





## 6.5 Other polymers [\(i\)](#)

There are no such residues in this entry.