



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 19, 2024 – 12:42 PM EST

PDB ID : 4JLK  
Title : Human dCK C4S-S74E mutant in complex with UDP and the F2.2.1 inhibitor  
(2-[(2-[3-(2-FLUOROETHOXY)-4-METHOXYPHENYL]-5-METHYL-1,3-THIAZOL-4-YL)METHYL]SULFANYL]PYRIMIDINE-4,6-DIAMINE)  
Authors : Nomme, J.; Lavie, A.  
Deposited on : 2013-03-12  
Resolution : 1.89 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

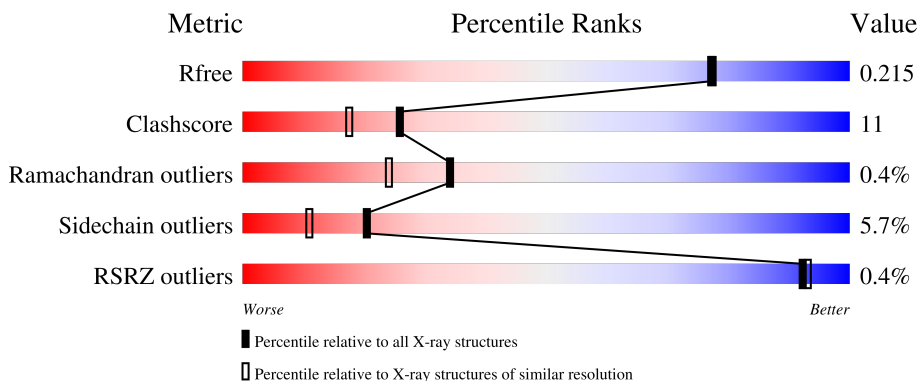
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.89 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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	280	
1	B	280	

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 4263 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 Deoxycytidine kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	229	Total 1926	C 1233	N 318	O 367	S 8	0	5	0
1	B	233	Total 1967	C 1261	N 323	O 375	S 8	0	8	0

There are 50 discrepancies between the modelled and reference sequences:

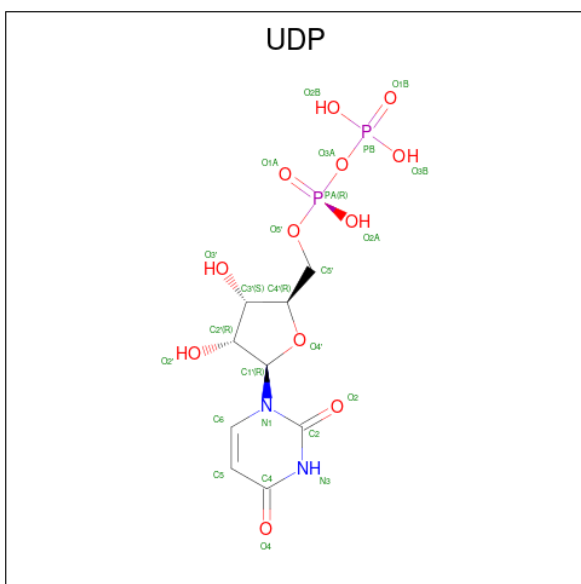
Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP P27707
A	-18	GLY	-	expression tag	UNP P27707
A	-17	SER	-	expression tag	UNP P27707
A	-16	SER	-	expression tag	UNP P27707
A	-15	HIS	-	expression tag	UNP P27707
A	-14	HIS	-	expression tag	UNP P27707
A	-13	HIS	-	expression tag	UNP P27707
A	-12	HIS	-	expression tag	UNP P27707
A	-11	HIS	-	expression tag	UNP P27707
A	-10	HIS	-	expression tag	UNP P27707
A	-9	SER	-	expression tag	UNP P27707
A	-8	SER	-	expression tag	UNP P27707
A	-7	GLY	-	expression tag	UNP P27707
A	-6	LEU	-	expression tag	UNP P27707
A	-5	VAL	-	expression tag	UNP P27707
A	-4	PRO	-	expression tag	UNP P27707
A	-3	ARG	-	expression tag	UNP P27707
A	-2	GLY	-	expression tag	UNP P27707
A	-1	SER	-	expression tag	UNP P27707
A	0	HIS	-	expression tag	UNP P27707
A	9	SER	CYS	engineered mutation	UNP P27707
A	45	SER	CYS	engineered mutation	UNP P27707
A	59	SER	CYS	engineered mutation	UNP P27707
A	74	GLU	SER	engineered mutation	UNP P27707
A	146	SER	CYS	engineered mutation	UNP P27707

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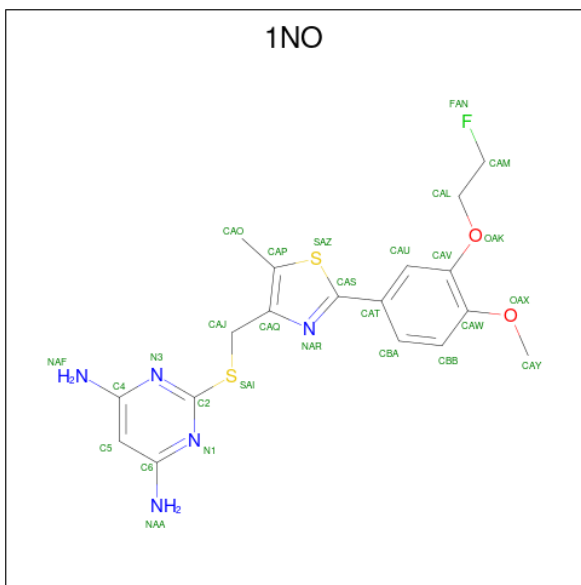
Chain	Residue	Modelled	Actual	Comment	Reference
B	-19	MET	-	initiating methionine	UNP P27707
B	-18	GLY	-	expression tag	UNP P27707
B	-17	SER	-	expression tag	UNP P27707
B	-16	SER	-	expression tag	UNP P27707
B	-15	HIS	-	expression tag	UNP P27707
B	-14	HIS	-	expression tag	UNP P27707
B	-13	HIS	-	expression tag	UNP P27707
B	-12	HIS	-	expression tag	UNP P27707
B	-11	HIS	-	expression tag	UNP P27707
B	-10	HIS	-	expression tag	UNP P27707
B	-9	SER	-	expression tag	UNP P27707
B	-8	SER	-	expression tag	UNP P27707
B	-7	GLY	-	expression tag	UNP P27707
B	-6	LEU	-	expression tag	UNP P27707
B	-5	VAL	-	expression tag	UNP P27707
B	-4	PRO	-	expression tag	UNP P27707
B	-3	ARG	-	expression tag	UNP P27707
B	-2	GLY	-	expression tag	UNP P27707
B	-1	SER	-	expression tag	UNP P27707
B	0	HIS	-	expression tag	UNP P27707
B	9	SER	CYS	engineered mutation	UNP P27707
B	45	SER	CYS	engineered mutation	UNP P27707
B	59	SER	CYS	engineered mutation	UNP P27707
B	74	GLU	SER	engineered mutation	UNP P27707
B	146	SER	CYS	engineered mutation	UNP P27707

- Molecule 2 is URIDINE-5'-DIPHOSPHATE (three-letter code: UDP) (formula:  $C_9H_{14}N_2O_{12}P_2$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
2	B	1	Total	C	N	O	P	0	0
			25	9	2	12	2		

- Molecule 3 is 2-[(2-[3-(2-fluoroethoxy)-4-methoxyphenyl]-5-methyl-1,3-thiazol-4-yl)methylsulfanyl]pyrimidine-4,6-diamine (three-letter code: 1NO) (formula: C<sub>18</sub>H<sub>20</sub>FN<sub>5</sub>O<sub>2</sub>S<sub>2</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
3	A	1	Total	C	F	N	O	S	0	0
			28	18	1	5	2	2		
3	A	1	Total	C	F	N	O	S	0	0
			28	18	1	5	2	2		
3	B	1	Total	C	F	N	O	S	0	0
			28	18	1	5	2	2		
3	B	1	Total	C	F	N	O	S	0	0
			28	18	1	5	2	2		

- Molecule 4 is water.

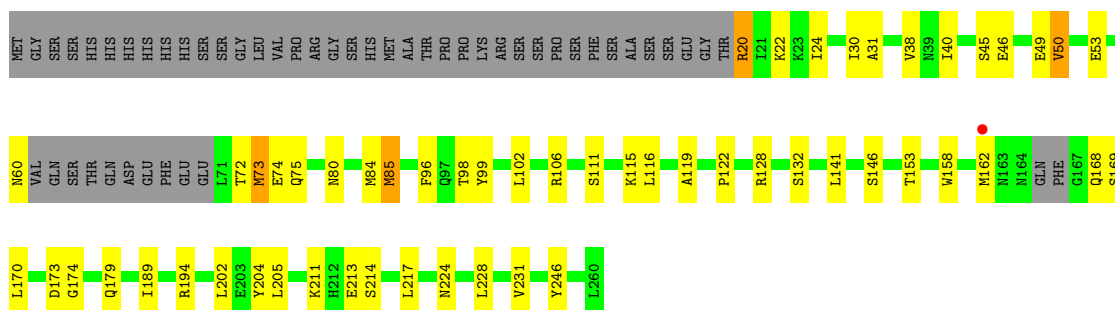
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	100	Total	O	0	0
			100	100		
4	B	108	Total	O	0	0
			108	108		

### 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.

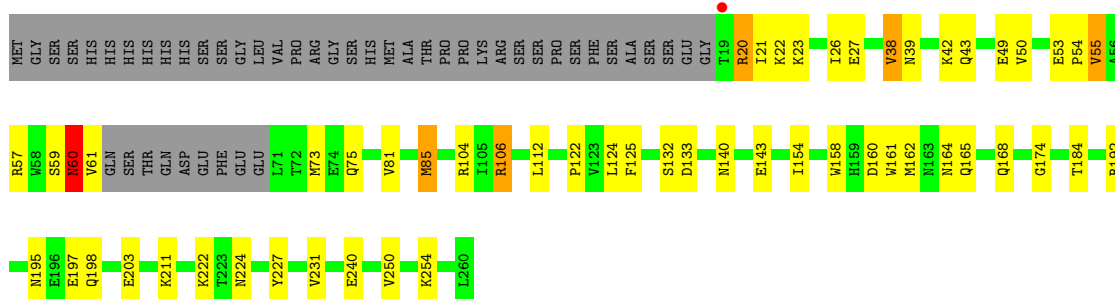
- Molecule 1: Deoxycytidine kinase

Chain A: 



- Molecule 1: Deoxycytidine kinase

Chain B: 



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 41	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.60Å 68.60Å 120.71Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.73 – 1.89 29.73 – 1.89	Depositor EDS
% Data completeness (in resolution range)	98.5 (29.73-1.89) 98.5 (29.73-1.89)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.21 (at 1.89Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, $R_{free}$	0.167 , 0.215 0.168 , 0.215	Depositor DCC
$R_{free}$ test set	4400 reflections (9.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	32.7	Xtriage
Anisotropy	0.032	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 28.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.486 for h,-k,-l	Xtriage
Reported twinning fraction	0.503 for H, K, L 0.497 for -H, K, -L	Depositor
Outliers	0 of 44055 reflections	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	4263	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.66% of the height of the origin peak. No significant pseudotranslation is detected.*

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

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: UDP, 1NO

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	0.62	0/1984	0.73	0/2679
1	B	0.58	0/2036	0.72	0/2752
All	All	0.60	0/4020	0.72	0/5431

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1926	0	1885	42	0
1	B	1967	0	1926	51	0
2	A	25	0	11	0	0
2	B	25	0	11	1	0
3	A	56	0	40	6	0
3	B	56	0	40	3	0
4	A	100	0	0	3	0
4	B	108	0	0	5	0
All	All	4263	0	3913	84	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 11.



All (84) 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:106:ARG:HH11	1:B:106:ARG:HG2	1.19	1.01
1:A:45:SER:O	4:A:512:HOH:O	1.91	0.87
1:B:168:GLN:HG2	4:B:586:HOH:O	1.79	0.82
1:B:106:ARG:HH11	1:B:106:ARG:CG	1.93	0.81
1:B:26:ILE:HD13	1:B:38:VAL:HG23	1.63	0.79
1:B:49:GLU:HB3	1:B:124:LEU:CD1	2.15	0.76
1:B:161:TRP:CZ2	1:B:165:GLN:HG3	2.23	0.73
1:B:53[B]:GLU:OE2	1:B:55:VAL:HG13	1.90	0.71
1:A:162:MET:SD	1:B:162:MET:SD	2.91	0.68
1:A:38:VAL:HG13	1:A:50:VAL:HG22	1.75	0.68
1:A:153:THR:CG2	1:B:73:MET:SD	2.82	0.67
1:A:111:SER:O	1:A:115:LYS:HB2	1.95	0.67
1:B:195:ASN:HA	1:B:198:GLN:HG2	1.76	0.66
1:B:42:LYS:O	4:B:522:HOH:O	2.14	0.65
1:A:228:LEU:HA	1:A:231:VAL:HG23	1.77	0.65
1:B:49:GLU:HB3	1:B:124:LEU:HD12	1.78	0.65
1:A:98[B]:THR:HG23	1:A:158:TRP:CZ2	2.32	0.64
1:B:38:VAL:HG13	1:B:50:VAL:HG11	1.78	0.64
1:A:53:GLU:OE2	4:A:589:HOH:O	2.15	0.64
1:A:153:THR:HG21	1:B:73:MET:SD	2.37	0.63
1:B:53[B]:GLU:HG2	1:B:104:ARG:HH12	1.64	0.63
1:A:85:MET:HG3	1:A:96:PHE:HB2	1.81	0.62
1:A:204:TYR:CD1	3:A:403:1NO:H9	2.35	0.62
1:B:26:ILE:CD1	1:B:38:VAL:HG23	2.29	0.62
1:B:161:TRP:CE2	1:B:165:GLN:HG3	2.35	0.61
1:B:192:ARG:O	1:B:192:ARG:HG2	2.01	0.59
1:A:213:GLU:OE1	1:A:217:LEU:HD23	2.02	0.59
1:A:194:ARG:HD3	3:A:403:1NO:H20	1.68	0.59
1:A:98[B]:THR:HG23	1:A:158:TRP:CE2	2.40	0.56
1:A:38:VAL:HG13	1:A:50:VAL:CG2	2.36	0.55
1:B:174:GLY:HA2	1:B:231:VAL:HG13	1.88	0.54
1:A:72:THR:OG1	1:A:75:GLN:HG2	2.08	0.53
1:B:27:GLU:OE2	1:B:132:SER:OG	2.23	0.53
1:A:179:GLN:NE2	1:A:213:GLU:OE2	2.43	0.52
1:A:40:ILE:HD13	1:A:246:TYR:CD2	2.44	0.52
1:B:59:SER:HB3	3:B:403:1NO:NAA	2.25	0.52
1:B:50:VAL:HG22	1:B:125:PHE:HB2	1.92	0.52
1:B:23:LYS:HD3	1:B:112:LEU:HD21	1.92	0.52
1:B:106:ARG:HG2	1:B:106:ARG:NH1	2.01	0.51
1:A:168:GLN:C	1:A:170:LEU:H	2.14	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:20:ARG:CB	1:B:20:ARG:HH11	2.23	0.51
1:B:53[B]:GLU:HG2	1:B:104:ARG:NH1	2.26	0.51
1:B:106:ARG:CG	1:B:106:ARG:NH1	2.65	0.51
1:B:38:VAL:CG1	1:B:50:VAL:HG11	2.40	0.49
1:A:202:LEU:HA	1:A:205:LEU:HD12	1.94	0.49
1:A:30:ILE:O	1:A:31:ALA:HB3	2.13	0.49
1:B:81:VAL:O	1:B:85:MET:HB2	2.13	0.49
1:B:160:ASP:O	1:B:164:ASN:ND2	2.46	0.49
1:B:250:VAL:HG12	1:B:254:LYS:HE3	1.95	0.49
1:A:99:TYR:CD1	1:B:154:ILE:HG23	2.49	0.48
1:A:24:ILE:HA	1:A:174:GLY:O	2.14	0.47
1:A:204:TYR:CE2	3:A:403:1NO:H10	2.49	0.47
1:B:197:GLU:HG2	3:B:403:1NO:H14	1.97	0.46
1:A:20:ARG:NH2	1:A:119:ALA:O	2.49	0.46
1:B:39:ASN:O	1:B:43:GLN:HG3	2.16	0.46
1:A:22:LYS:HA	1:A:173:ASP:OD2	2.16	0.45
1:A:46[B]:GLU:HA	1:A:46[B]:GLU:OE1	2.16	0.45
1:A:162:MET:CE	1:B:161:TRP:CZ3	3.00	0.45
1:A:194:ARG:HD3	3:A:403:1NO:NAA	2.32	0.44
1:B:20:ARG:HH11	1:B:20:ARG:HB3	1.83	0.44
1:B:20:ARG:HB2	1:B:20:ARG:NH1	2.33	0.43
1:A:162:MET:CE	1:B:161:TRP:HZ3	2.31	0.43
1:A:102:LEU:HD12	1:B:158:TRP:HD1	1.83	0.43
1:A:189:ILE:O	4:A:560:HOH:O	2.21	0.43
1:B:140:ASN:OD1	4:B:524:HOH:O	2.22	0.43
1:B:54:PRO:O	1:B:57:ARG:HB2	2.19	0.43
1:A:158:TRP:O	1:A:162:MET:HB2	2.18	0.43
1:A:73:MET:HG3	1:A:74:GLU:N	2.33	0.42
1:A:102:LEU:CD1	1:B:158:TRP:HD1	2.32	0.42
1:A:116:LEU:HB3	1:A:122:PRO:HB3	2.01	0.42
1:B:133:ASP:HB3	4:B:501:HOH:O	2.18	0.42
1:A:80:ASN:O	1:A:84[A]:MET:HG3	2.20	0.42
1:B:21:ILE:HA	1:B:122:PRO:HG2	2.02	0.41
1:B:192:ARG:HB2	2:B:401:UDP:H4'	2.01	0.41
1:A:162:MET:HE1	1:B:161:TRP:CZ3	2.55	0.41
1:B:59:SER:O	3:B:403:1NO:H18	2.20	0.41
1:B:75:GLN:HG3	4:B:580:HOH:O	2.21	0.41
1:B:20:ARG:CB	1:B:20:ARG:NH1	2.84	0.41
1:B:60:ASN:HB2	1:B:61:VAL:H	1.56	0.41
1:A:49:GLU:HG2	1:A:115:LYS:HD3	2.01	0.41
1:A:141:LEU:CD2	3:A:402:1NO:H3	2.51	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:143:GLU:OE1	1:B:211:LYS:NZ	2.54	0.41
1:A:204:TYR:CD2	3:A:403:1NO:H10	2.55	0.40
1:A:53:GLU:OE2	1:A:128:ARG:NH1	2.55	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	228/280 (81%)	214 (94%)	13 (6%)	1 (0%)	34 24
1	B	237/280 (85%)	226 (95%)	10 (4%)	1 (0%)	34 24
All	All	465/560 (83%)	440 (95%)	23 (5%)	2 (0%)	34 24

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	60	ASN
1	A	169	SER

### 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	214/256 (84%)	203 (95%)	11 (5%)	24 14

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	219/256 (86%)	206 (94%)	13 (6%)	19	10
All	All	433/512 (85%)	409 (94%)	24 (6%)	20	12

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	20	ARG
1	A	50	VAL
1	A	60	ASN
1	A	73	MET
1	A	85	MET
1	A	106	ARG
1	A	132	SER
1	A	146	SER
1	A	211	LYS
1	A	214	SER
1	A	224	ASN
1	B	20	ARG
1	B	22	LYS
1	B	38	VAL
1	B	55	VAL
1	B	60	ASN
1	B	85	MET
1	B	106	ARG
1	B	184	THR
1	B	203	GLU
1	B	222	LYS
1	B	224	ASN
1	B	227	TYR
1	B	240	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	156	GLN
1	A	195	ASN
1	A	224	ASN
1	B	229	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

6 ligands 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
2	UDP	A	401	-	24,26,26	1.16	3 (12%)	37,40,40	1.68	5 (13%)
3	1NO	B	403	-	26,30,30	1.40	4 (15%)	28,41,41	2.03	7 (25%)
3	1NO	A	403	-	26,30,30	1.34	4 (15%)	28,41,41	1.71	5 (17%)
2	UDP	B	401	-	24,26,26	1.16	3 (12%)	37,40,40	1.63	5 (13%)
3	1NO	B	402	-	26,30,30	1.24	3 (11%)	28,41,41	2.13	9 (32%)
3	1NO	A	402	-	26,30,30	1.41	3 (11%)	28,41,41	1.78	5 (17%)

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
2	UDP	A	401	-	-	1/16/32/32	0/2/2/2
3	1NO	B	403	-	-	5/13/15/15	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	1NO	A	403	-	-	4/13/15/15	0/3/3/3
2	UDP	B	401	-	-	5/16/32/32	0/2/2/2
3	1NO	B	402	-	-	1/13/15/15	0/3/3/3
3	1NO	A	402	-	-	3/13/15/15	0/3/3/3

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	403	1NO	CAS-SAZ	-4.60	1.67	1.73
3	A	402	1NO	CAS-SAZ	-4.20	1.67	1.73
3	A	403	1NO	CAM-CAL	3.62	1.54	1.49
3	A	403	1NO	CAS-SAZ	-3.55	1.68	1.73
3	A	402	1NO	CAJ-CAQ	3.54	1.54	1.50
3	B	403	1NO	CAM-CAL	3.51	1.54	1.49
3	B	402	1NO	CAM-CAL	3.15	1.53	1.49
2	A	401	UDP	C2-N1	3.07	1.43	1.38
3	B	402	1NO	CAJ-CAQ	2.90	1.53	1.50
3	A	402	1NO	CAM-CAL	2.74	1.53	1.49
3	A	403	1NO	CAJ-CAQ	2.61	1.53	1.50
2	B	401	UDP	C4-N3	-2.52	1.34	1.38
2	A	401	UDP	C4-N3	-2.38	1.34	1.38
3	B	403	1NO	CAJ-CAQ	2.35	1.53	1.50
2	B	401	UDP	C6-C5	2.32	1.40	1.35
2	B	401	UDP	C2-N1	2.30	1.42	1.38
3	B	402	1NO	CAS-SAZ	-2.26	1.70	1.73
3	B	403	1NO	CAS-NAR	2.25	1.34	1.31
2	A	401	UDP	C2-N3	-2.11	1.34	1.38
3	A	403	1NO	CAS-NAR	2.03	1.34	1.31

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	403	1NO	C2-N3-C4	5.68	121.84	115.51
3	B	402	1NO	C2-N3-C4	5.52	121.66	115.51
2	B	401	UDP	N3-C2-N1	5.16	121.74	114.89
2	A	401	UDP	C4-N3-C2	-5.05	119.92	126.58
3	A	403	1NO	C2-N3-C4	4.72	120.77	115.51
3	A	402	1NO	C2-N3-C4	4.71	120.75	115.51
2	B	401	UDP	C4-N3-C2	-4.55	120.58	126.58
3	B	403	1NO	C2-N1-C6	4.52	120.54	115.51
3	B	402	1NO	C2-N1-C6	4.43	120.45	115.51

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	403	1NO	C2-N1-C6	4.43	120.45	115.51
2	A	401	UDP	N3-C2-N1	4.38	120.70	114.89
3	A	402	1NO	C2-N1-C6	4.21	120.20	115.51
2	A	401	UDP	C5-C4-N3	4.19	121.10	114.84
3	B	403	1NO	CAJ-SAI-C2	3.69	106.48	102.42
3	B	402	1NO	OAK-CAL-CAM	-3.54	103.43	107.92
3	B	402	1NO	N3-C2-N1	-3.50	120.54	126.95
3	A	402	1NO	N3-C2-N1	-3.50	120.55	126.95
3	B	403	1NO	N3-C2-N1	-3.36	120.79	126.95
3	A	403	1NO	N3-C2-N1	-3.00	121.45	126.95
3	B	402	1NO	CAJ-SAI-C2	2.91	105.62	102.42
2	B	401	UDP	C5-C4-N3	2.88	119.16	114.84
3	B	402	1NO	NAA-C6-N1	2.73	120.80	116.49
3	A	402	1NO	NAA-C6-N1	2.71	120.77	116.49
3	A	403	1NO	OAX-CAW-CAV	2.56	118.98	115.41
2	A	401	UDP	O4-C4-C5	-2.54	120.69	125.16
3	B	402	1NO	CAL-OAK-CAV	-2.51	111.55	117.69
2	B	401	UDP	O2-C2-N1	-2.40	119.59	122.79
2	A	401	UDP	PA-O3A-PB	-2.34	124.78	132.83
3	B	403	1NO	OAX-CAW-CAV	2.32	118.64	115.41
3	B	402	1NO	NAF-C4-N3	2.26	120.06	116.49
3	A	403	1NO	OAK-CAL-CAM	-2.22	105.11	107.92
3	B	403	1NO	OAK-CAV-CAW	2.18	120.23	115.73
3	B	402	1NO	CAY-OAX-CAW	-2.11	114.34	117.53
2	B	401	UDP	C3'-C2'-C1'	2.08	105.38	101.43
3	A	402	1NO	CBA-CAT-CAU	2.06	121.08	118.16
3	B	403	1NO	OAX-CAW-CBB	-2.02	120.90	124.37

There are no chirality outliers.

All (19) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	UDP	PA-O3A-PB-O3B
2	B	401	UDP	PA-O3A-PB-O3B
3	A	403	1NO	OAK-CAL-CAM-FAN
3	B	403	1NO	N3-C2-SAI-CAJ
3	B	403	1NO	N1-C2-SAI-CAJ
3	A	403	1NO	N3-C2-SAI-CAJ
3	A	403	1NO	N1-C2-SAI-CAJ
3	B	403	1NO	CAW-CAV-OAK-CAL
3	A	402	1NO	OAK-CAL-CAM-FAN
3	B	403	1NO	CAM-CAL-OAK-CAV

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Mol	Chain	Res	Type	Atoms
2	B	401	UDP	O4'-C1'-N1-C6
2	B	401	UDP	C2'-C1'-N1-C6
2	B	401	UDP	O4'-C1'-N1-C2
2	B	401	UDP	PA-O3A-PB-O1B
3	A	402	1NO	CAW-CAV-OAK-CAL
3	B	403	1NO	CAU-CAV-OAK-CAL
3	A	402	1NO	CAQ-CAJ-SAI-C2
3	A	403	1NO	CAQ-CAJ-SAI-C2
3	B	402	1NO	CAQ-CAJ-SAI-C2

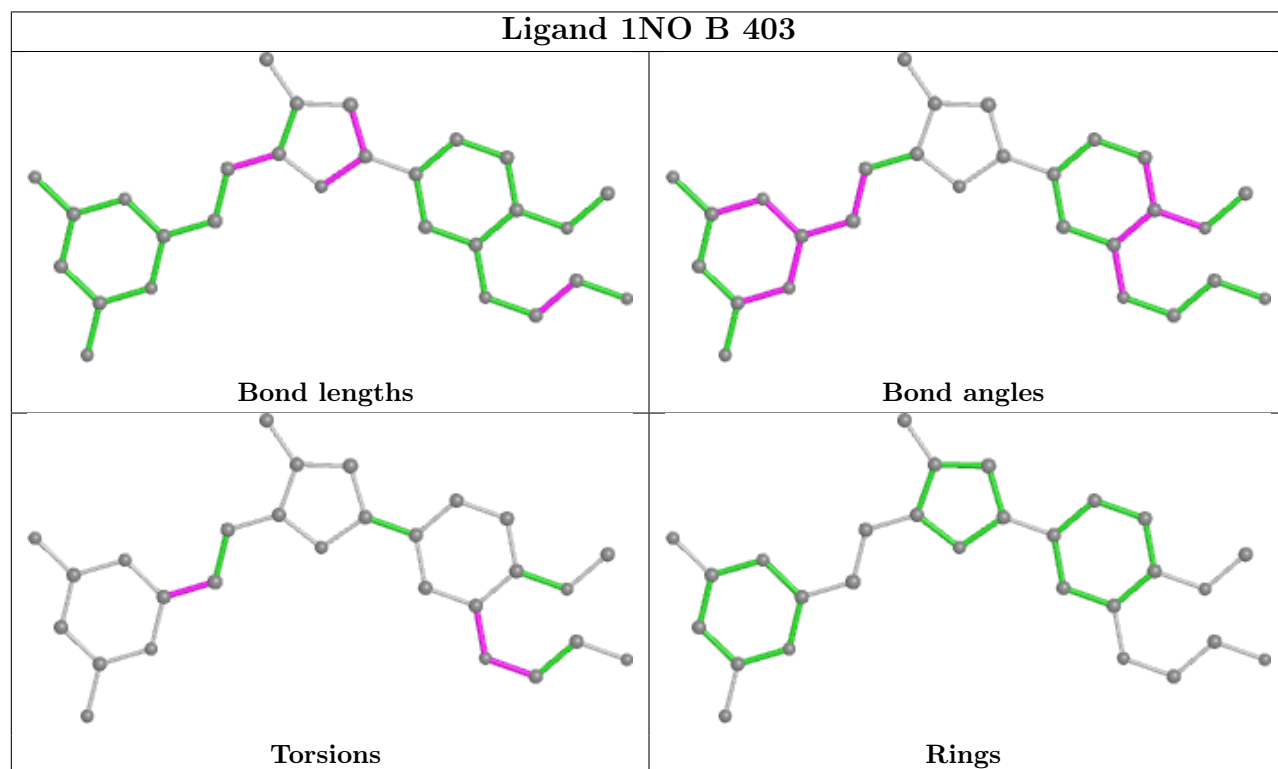
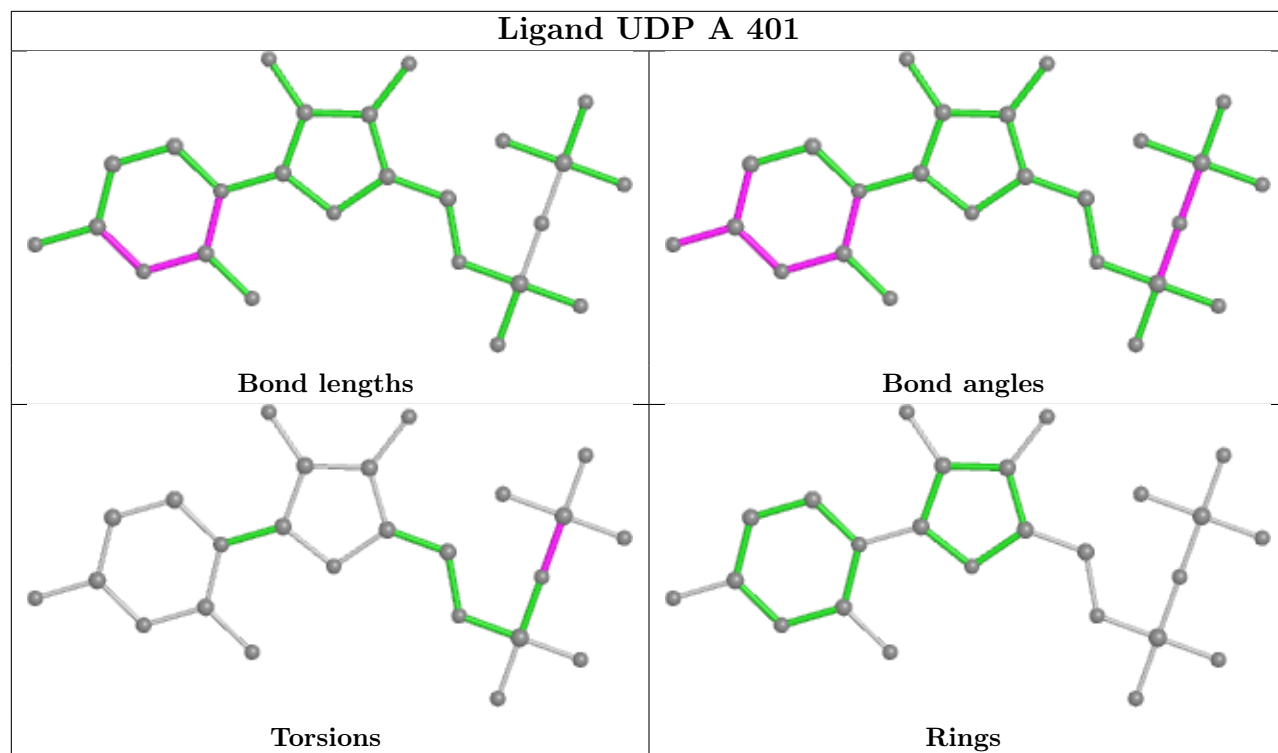
There are no ring outliers.

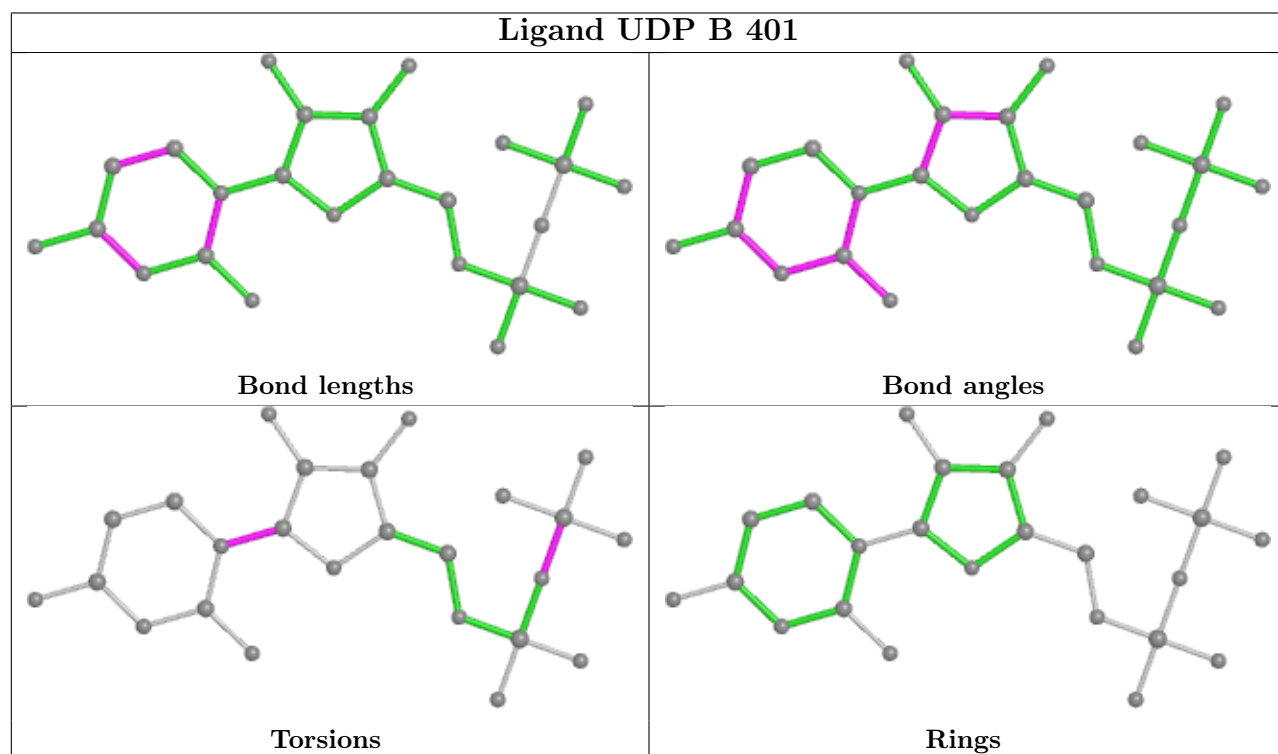
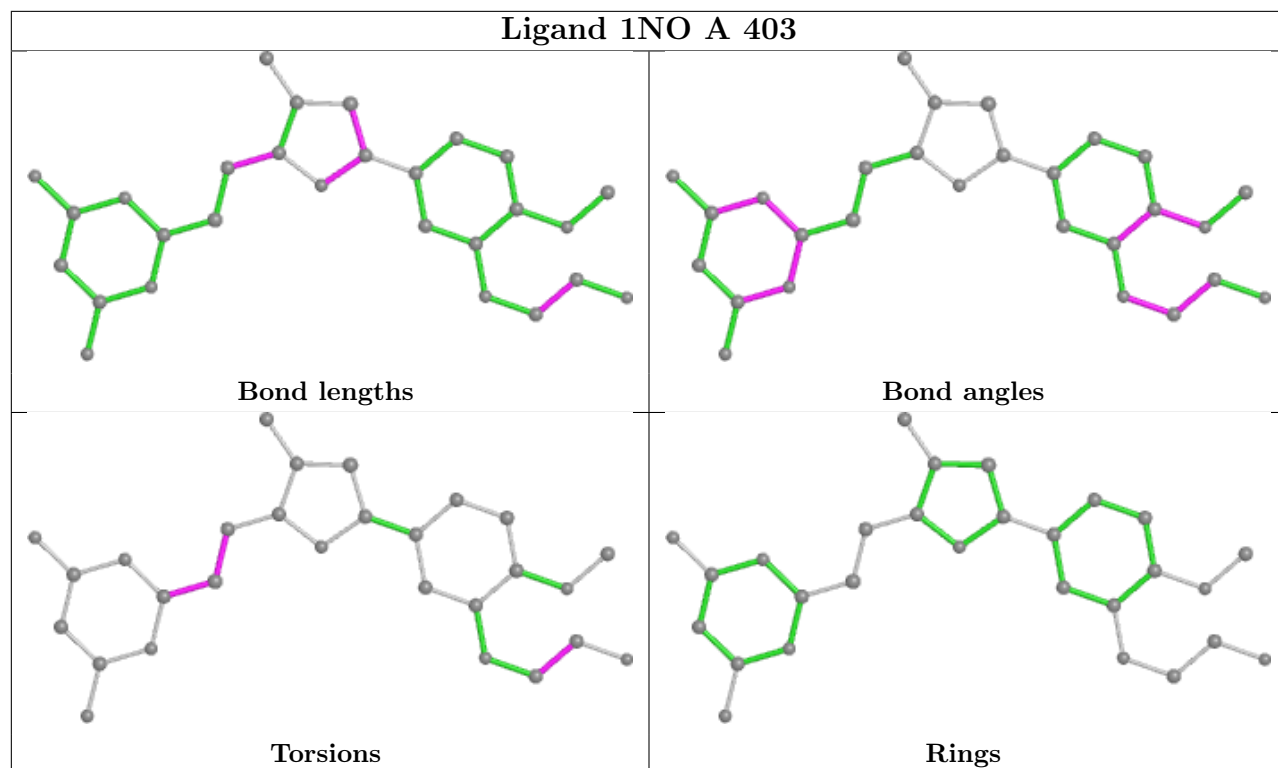
4 monomers are involved in 10 short contacts:

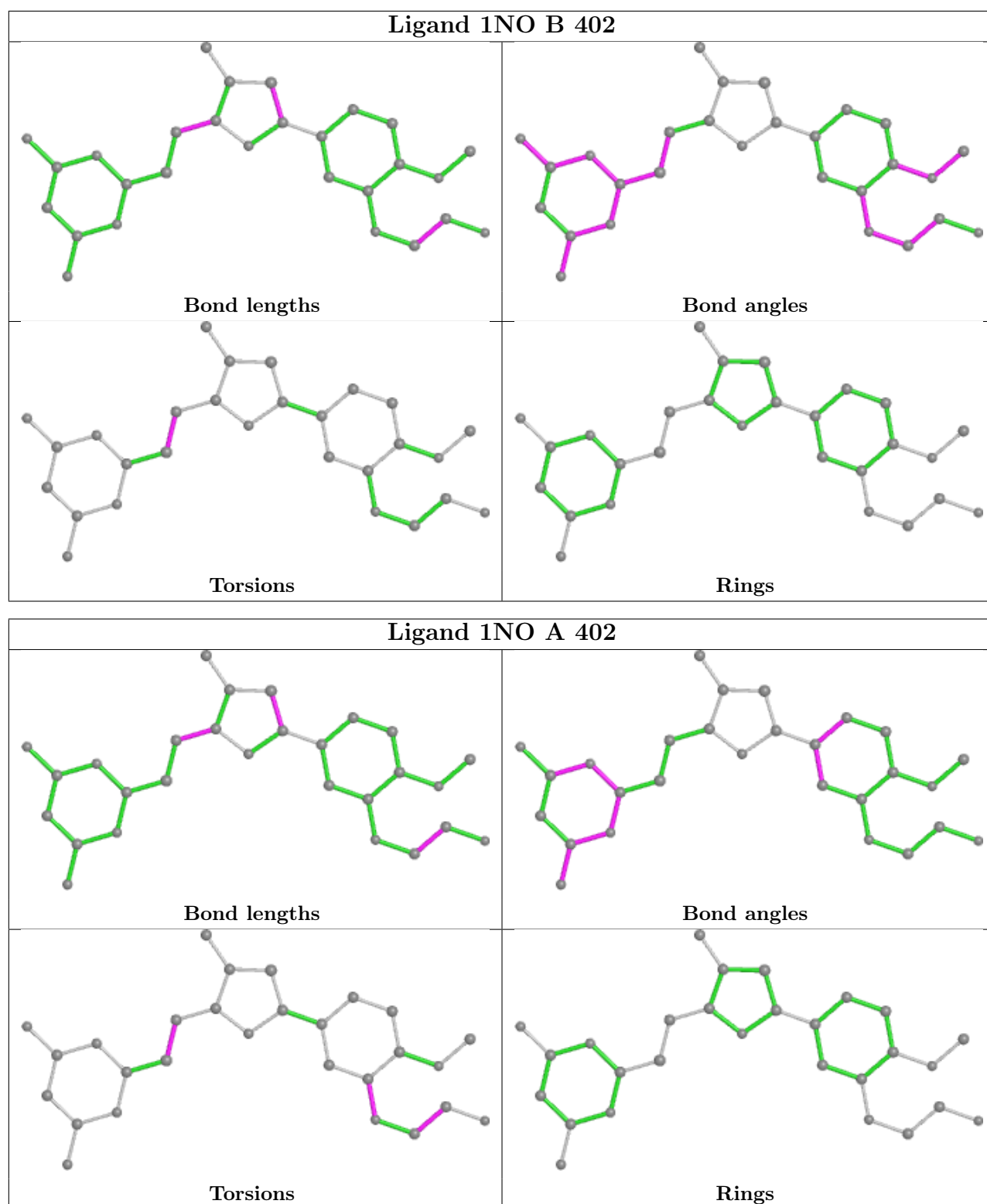
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	403	1NO	3	0
3	A	403	1NO	5	0
2	B	401	UDP	1	0
3	A	402	1NO	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

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	229/280 (81%)	-0.15	1 (0%) 92 93	21, 33, 47, 55	0
1	B	233/280 (83%)	-0.11	1 (0%) 92 93	23, 33, 49, 61	0
All	All	462/560 (82%)	-0.13	2 (0%) 92 93	21, 33, 47, 61	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	19	THR	2.6
1	A	162	MET	2.2

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

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

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 6.4 Ligands [i](#)

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

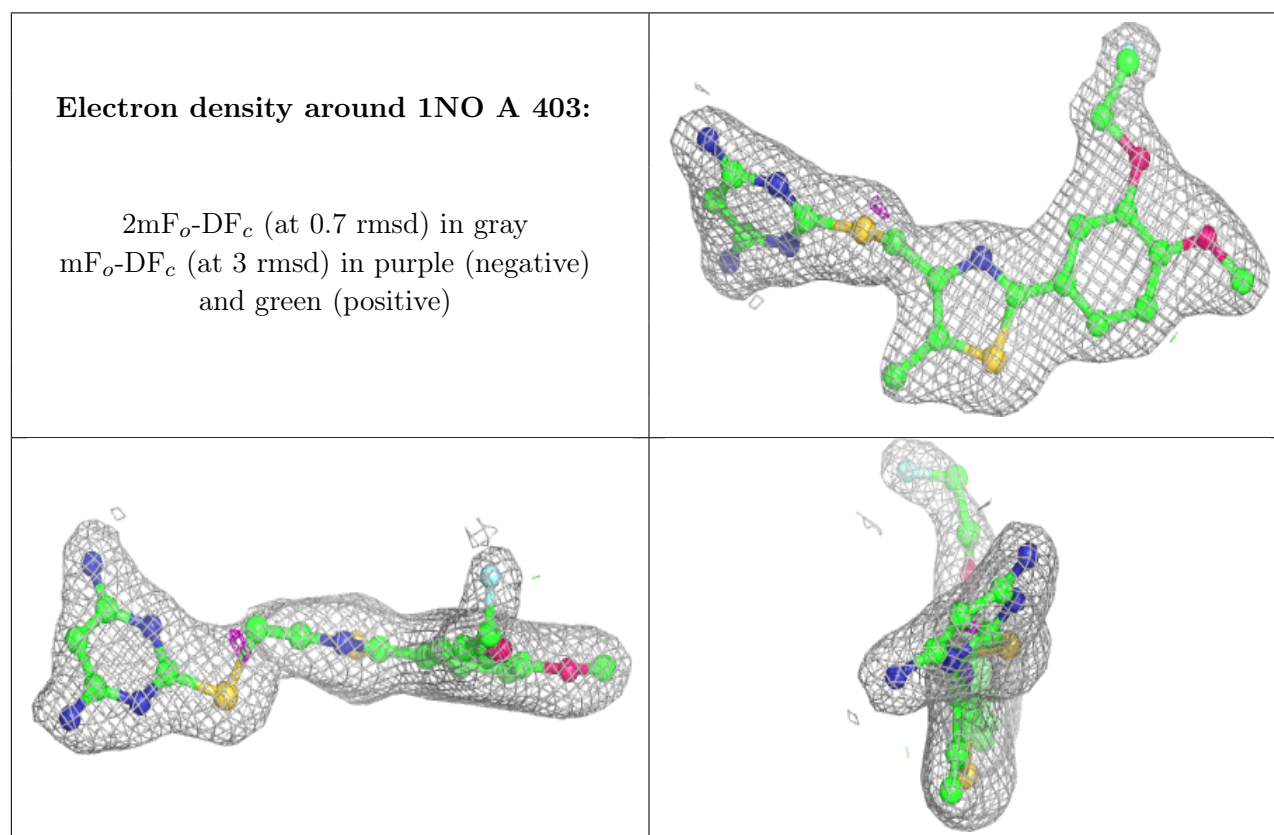
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	1NO	A	403	28/28	0.95	0.11	39,44,51,55	0
3	1NO	B	403	28/28	0.96	0.10	38,43,47,50	0
2	UDP	A	401	25/25	0.97	0.09	27,38,44,49	0

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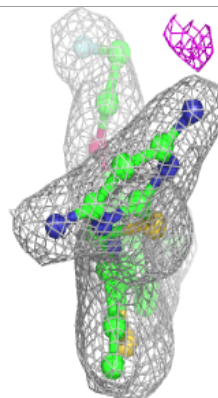
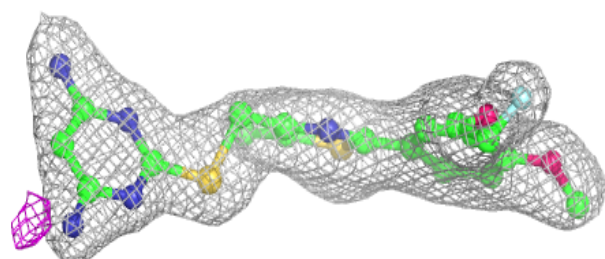
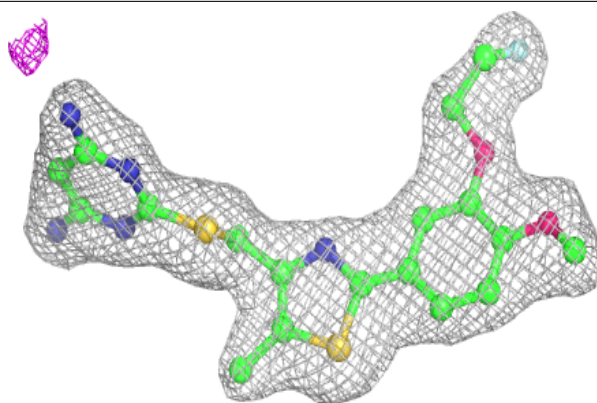
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	1NO	B	402	28/28	0.97	0.10	28,36,41,41	0
2	UDP	B	401	25/25	0.97	0.10	34,47,49,51	0
3	1NO	A	402	28/28	0.98	0.10	25,40,49,54	0

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.

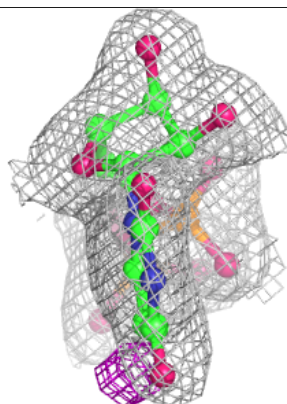
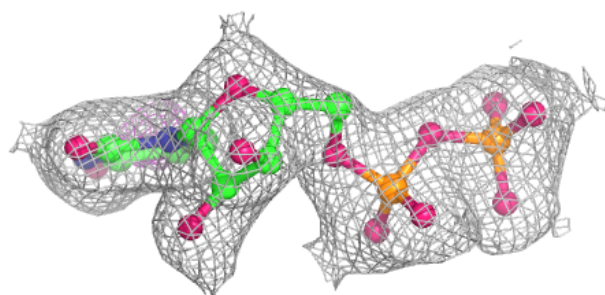
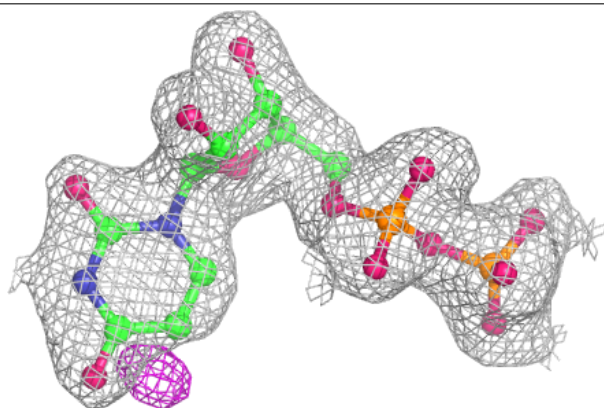


**Electron density around 1NO B 403:**

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

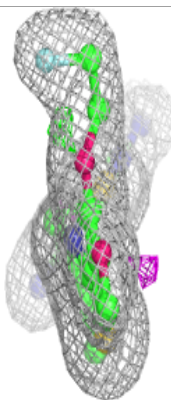
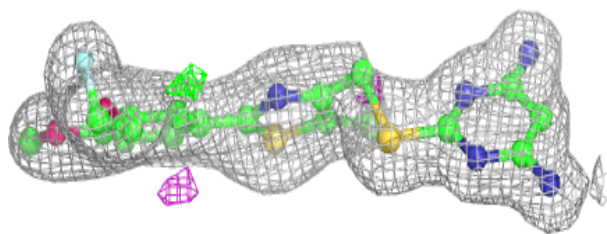
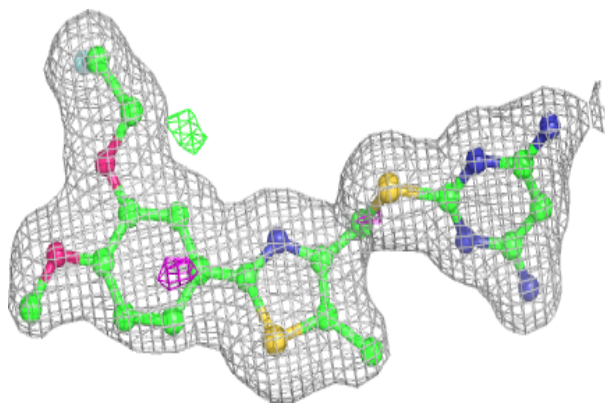
**Electron density around UDP A 401:**

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



**Electron density around 1NO B 402:**

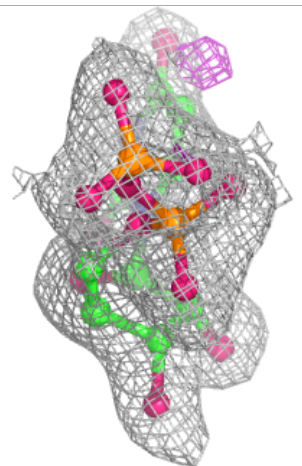
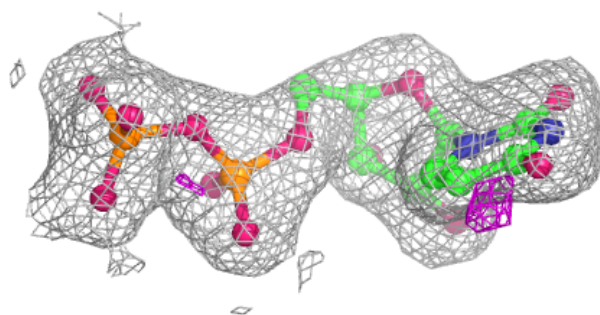
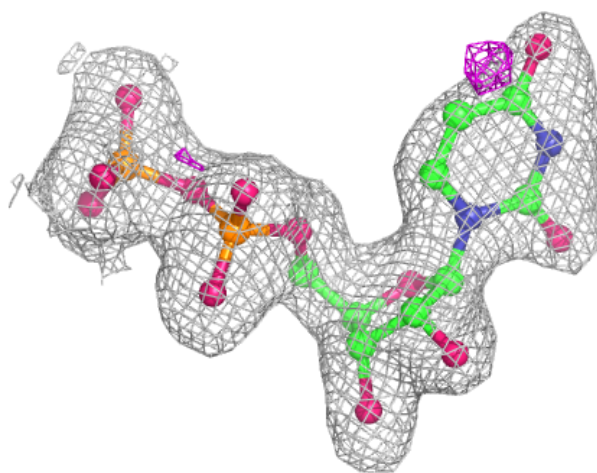
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

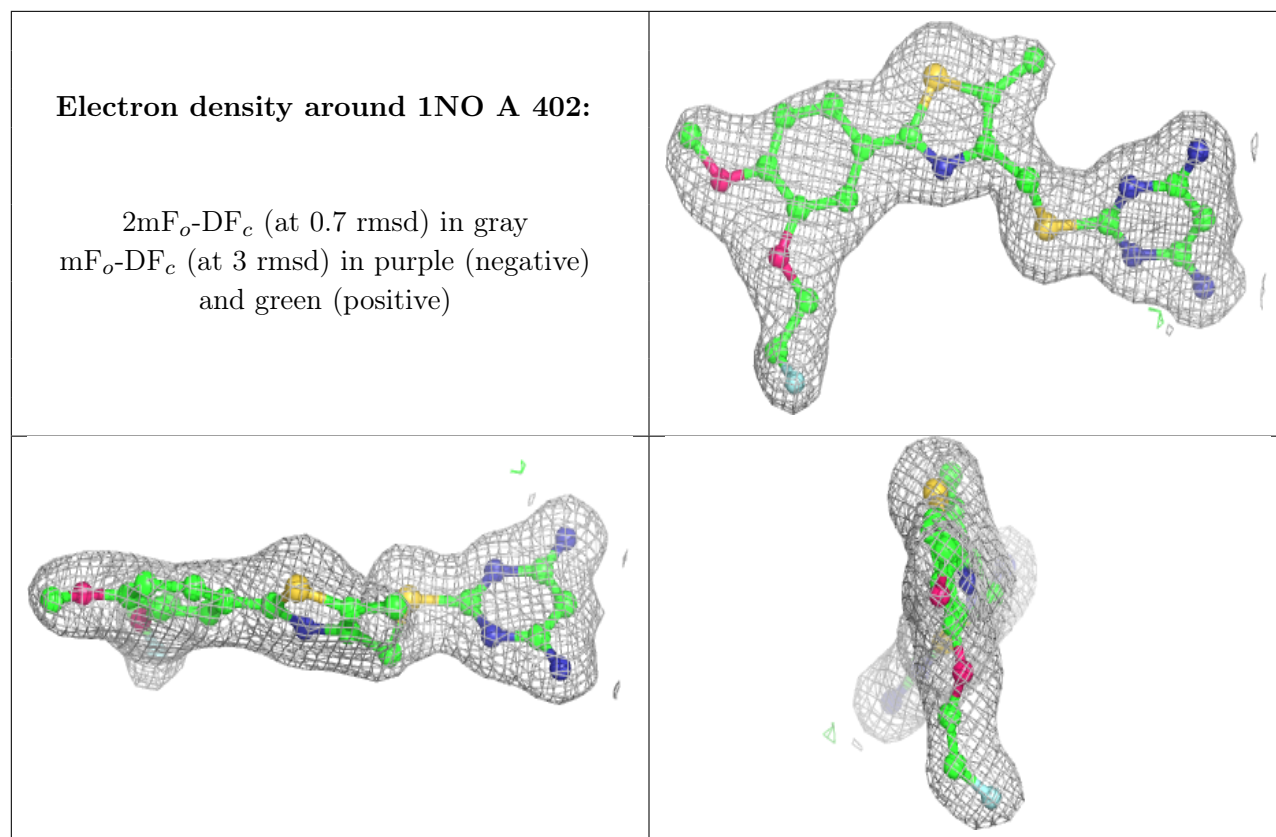




**Electron density around UDP B 401:**

$2mF_o-DF_c$  (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.