



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 17, 2023 – 11:42 PM EDT

PDB ID : 4XDZ  
Title : Holo structure of ketol-acid reductoisomerase from Ignisphaera aggregans  
Authors : Cahn, J.K.B.; Brinkmann-Chen, S.; Arnold, F.H.  
Deposited on : 2014-12-20  
Resolution : 1.15 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 : 2.35.1  
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) : 2.35.1

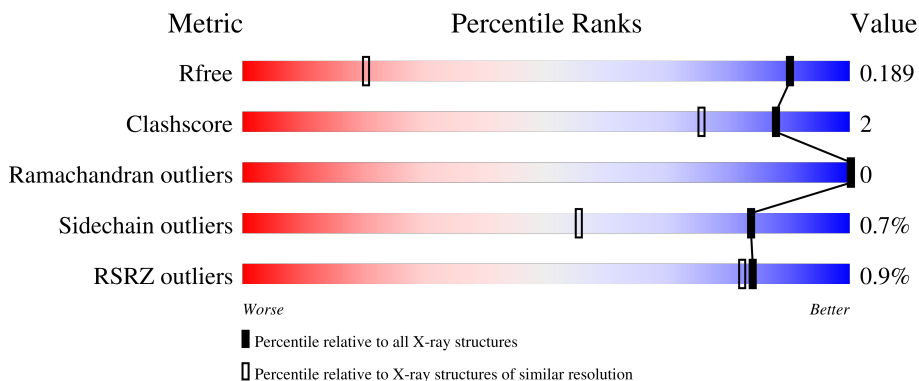
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.15 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	1492 (1.18-1.10)
Clashscore	141614	1537 (1.18-1.10)
Ramachandran outliers	138981	1483 (1.18-1.10)
Sidechain outliers	138945	1480 (1.18-1.10)
RSRZ outliers	127900	1464 (1.18-1.10)

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	343	
1	B	343	

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 6039 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 Ketol-acid reductoisomerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	328	2634	1701	433	485	15	0	11	0
1	B	329	2631	1693	436	487	15	0	9	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	336	LEU	-	expression tag	UNP E0SRA9
A	337	GLU	-	expression tag	UNP E0SRA9
A	338	HIS	-	expression tag	UNP E0SRA9
A	339	HIS	-	expression tag	UNP E0SRA9
A	340	HIS	-	expression tag	UNP E0SRA9
A	341	HIS	-	expression tag	UNP E0SRA9
A	342	HIS	-	expression tag	UNP E0SRA9
A	343	HIS	-	expression tag	UNP E0SRA9
B	336	LEU	-	expression tag	UNP E0SRA9
B	337	GLU	-	expression tag	UNP E0SRA9
B	338	HIS	-	expression tag	UNP E0SRA9
B	339	HIS	-	expression tag	UNP E0SRA9
B	340	HIS	-	expression tag	UNP E0SRA9
B	341	HIS	-	expression tag	UNP E0SRA9
B	342	HIS	-	expression tag	UNP E0SRA9
B	343	HIS	-	expression tag	UNP E0SRA9

- Molecule 2 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NDP) (formula: C<sub>21</sub>H<sub>30</sub>N<sub>7</sub>O<sub>17</sub>P<sub>3</sub>).

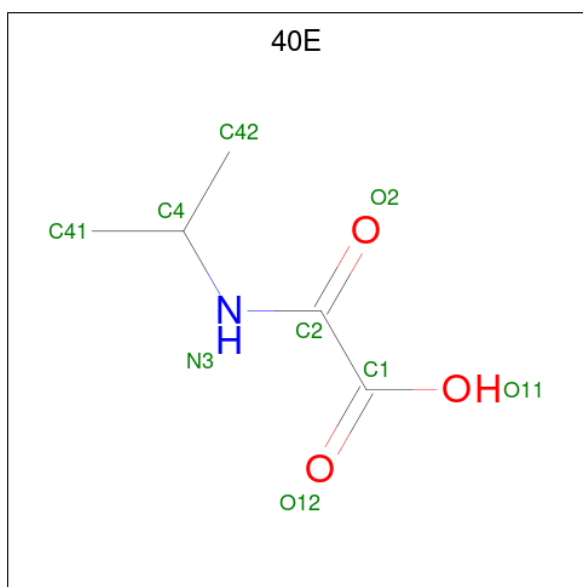


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
2	A	1	48	21	7	17	3	0	0
2	B	1	48	21	7	17	3	0	0

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

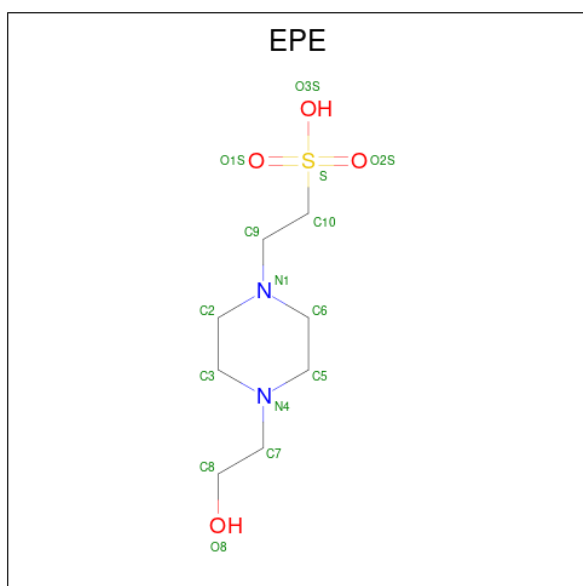
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
3	A	2	2	2	0	0
3	B	2	2	2	0	0

- Molecule 4 is oxo(propan-2-ylamino)acetic acid (three-letter code: 40E) (formula: C<sub>5</sub>H<sub>9</sub>NO<sub>3</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			9	5	1	3		
4	B	1	Total	C	N	O	0	0
			9	5	1	3		

- Molecule 5 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: C<sub>8</sub>H<sub>18</sub>N<sub>2</sub>O<sub>4</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
5	B	1	15	8	2	4	1	0	0

- Molecule 6 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
6	A	1	6	3	3	0	0
6	A	1	6	3	3	0	0
6	A	1	6	3	3	0	0
6	B	1	6	3	3	0	0
6	B	1	6	3	3	0	0

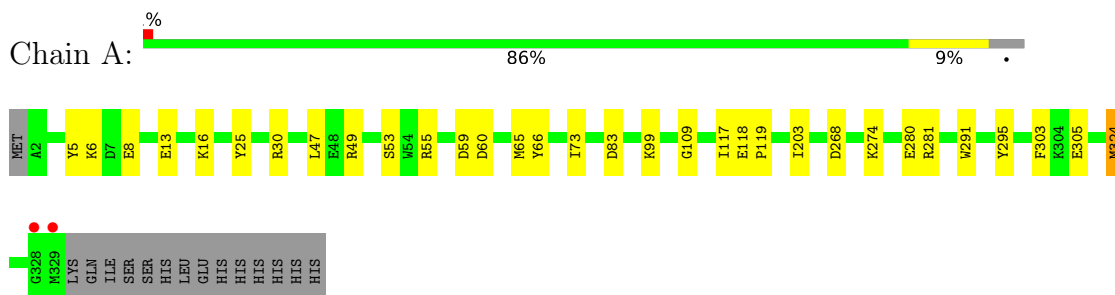
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
7	A	291	291	291	0	0
7	B	304	305	305	0	1

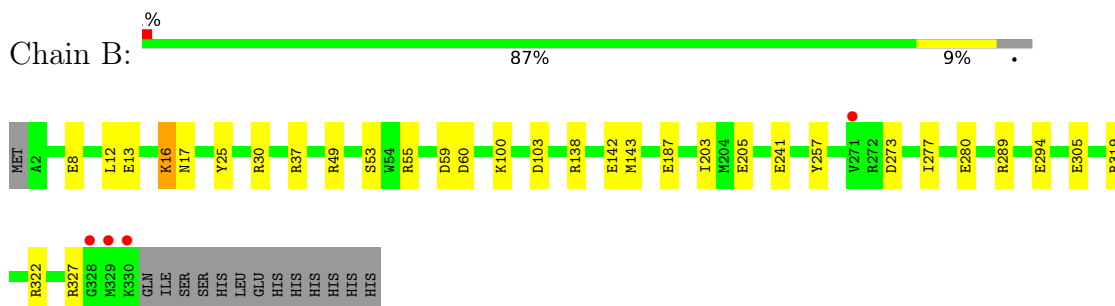
### 3 Residue-property plots [i](#)

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: Ketol-acid reductoisomerase



- Molecule 1: Ketol-acid reductoisomerase



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	54.58Å 90.75Å 69.53Å 90.00° 100.25° 90.00°	Depositor
Resolution (Å)	68.42 – 1.15 39.01 – 1.15	Depositor EDS
% Data completeness (in resolution range)	94.9 (68.42-1.15) 94.9 (39.01-1.15)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.42 (at 1.15Å)	Xtrriage
Refinement program	REFMAC 5.8.0069	Depositor
R, $R_{free}$	0.157 , 0.190 0.156 , 0.189	Depositor DCC
$R_{free}$ test set	11215 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	9.3	Xtrriage
Anisotropy	0.107	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 50.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.98	EDS
Total number of atoms	6039	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	13.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 44.48 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.5164e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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: MG, 40E, GOL, EPE, NDP

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	1.27	9/2706 (0.3%)	1.31	21/3639 (0.6%)
1	B	1.26	13/2700 (0.5%)	1.31	22/3633 (0.6%)
All	All	1.27	22/5406 (0.4%)	1.31	43/7272 (0.6%)

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	37	ARG	CZ-NH1	12.33	1.49	1.33
1	A	8	GLU	CD-OE2	11.99	1.38	1.25
1	B	53	SER	CB-OG	-11.75	1.26	1.42
1	A	53	SER	CB-OG	-11.54	1.27	1.42
1	B	8	GLU	CD-OE1	9.71	1.36	1.25
1	A	280	GLU	CG-CD	8.38	1.64	1.51
1	B	8	GLU	CD-OE2	8.32	1.34	1.25
1	A	281	ARG	CZ-NH2	7.27	1.42	1.33
1	B	205	GLU	CD-OE1	7.00	1.33	1.25
1	B	280	GLU	CD-OE1	6.70	1.33	1.25
1	B	187	GLU	CD-OE1	-6.41	1.18	1.25
1	A	280	GLU	CD-OE1	6.33	1.32	1.25
1	B	294	GLU	CD-OE2	-6.00	1.19	1.25
1	A	305	GLU	CD-OE1	5.62	1.31	1.25
1	B	305	GLU	CD-OE1	5.50	1.31	1.25
1	A	291	TRP	CG-CD1	-5.29	1.29	1.36
1	B	280	GLU	CG-CD	5.27	1.59	1.51
1	B	142	GLU	CD-OE2	-5.20	1.20	1.25
1	A	109	GLY	CA-C	5.13	1.60	1.51
1	B	37	ARG	NE-CZ	5.12	1.39	1.33
1	B	25	TYR	CE2-CZ	-5.11	1.31	1.38
1	A	8	GLU	CG-CD	5.04	1.59	1.51

All (43) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	281	ARG	NE-CZ-NH1	-16.25	112.17	120.30
1	B	37	ARG	NE-CZ-NH2	-14.56	113.02	120.30
1	A	324[A]	MET	CG-SD-CE	12.90	120.84	100.20
1	A	324[B]	MET	CG-SD-CE	12.90	120.84	100.20
1	B	37	ARG	NE-CZ-NH1	10.43	125.52	120.30
1	A	30	ARG	NE-CZ-NH2	7.73	124.16	120.30
1	B	138	ARG	NE-CZ-NH2	7.64	124.12	120.30
1	B	100	LYS	CD-CE-NZ	-7.39	94.70	111.70
1	B	55	ARG	NE-CZ-NH2	-7.31	116.64	120.30
1	A	83	ASP	CB-CG-OD1	-7.27	111.76	118.30
1	B	30	ARG	NE-CZ-NH2	7.09	123.85	120.30
1	B	59	ASP	CB-CG-OD2	-6.96	112.04	118.30
1	A	281	ARG	NH1-CZ-NH2	6.91	127.00	119.40
1	B	289[A]	ARG	NE-CZ-NH2	-6.83	116.89	120.30
1	B	289[B]	ARG	NE-CZ-NH2	-6.83	116.89	120.30
1	A	60	ASP	CB-CG-OD1	6.76	124.38	118.30
1	B	273	ASP	CB-CG-OD2	-6.61	112.35	118.30
1	A	280	GLU	OE1-CD-OE2	-6.51	115.48	123.30
1	B	60	ASP	CB-CG-OD1	6.51	124.16	118.30
1	B	327	ARG	NE-CZ-NH2	-6.44	117.08	120.30
1	B	53	SER	CB-CA-C	6.43	122.31	110.10
1	A	268	ASP	CB-CG-OD1	6.37	124.03	118.30
1	A	303	PHE	CB-CG-CD1	-6.32	116.37	120.80
1	B	30	ARG	NE-CZ-NH1	-6.28	117.16	120.30
1	A	55	ARG	NE-CZ-NH2	-6.26	117.17	120.30
1	A	280	GLU	CA-CB-CG	6.06	126.73	113.40
1	B	319	ARG	NE-CZ-NH1	-6.04	117.28	120.30
1	B	289[A]	ARG	NE-CZ-NH1	6.02	123.31	120.30
1	B	289[B]	ARG	NE-CZ-NH1	6.02	123.31	120.30
1	A	25	TYR	CB-CG-CD1	-5.92	117.45	121.00
1	A	53	SER	CB-CA-C	5.86	121.23	110.10
1	A	5	TYR	CB-CG-CD2	5.81	124.48	121.00
1	A	274	LYS	CD-CE-NZ	5.67	124.74	111.70
1	B	143	MET	CG-SD-CE	5.56	109.09	100.20
1	A	59	ASP	CB-CG-OD2	-5.53	113.33	118.30
1	A	8	GLU	CG-CD-OE1	-5.28	107.75	118.30
1	B	322	ARG	NE-CZ-NH1	5.25	122.92	120.30
1	B	257	TYR	CD1-CE1-CZ	-5.23	115.09	119.80
1	A	99	LYS	CB-CA-C	-5.22	99.96	110.40
1	B	241	GLU	OE1-CD-OE2	5.21	129.54	123.30
1	A	280	GLU	CG-CD-OE1	5.18	128.66	118.30
1	B	103	ASP	CB-CG-OD1	5.14	122.93	118.30
1	A	295	TYR	CB-CG-CD2	-5.05	117.97	121.00

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	2634	0	2730	17	0
1	B	2631	0	2714	7	0
2	A	48	0	26	0	0
2	B	48	0	26	0	0
3	A	2	0	0	0	0
3	B	2	0	0	0	0
4	A	9	0	7	0	0
4	B	9	0	7	0	0
5	A	15	0	18	0	0
5	B	15	0	18	0	0
6	A	18	0	24	0	0
6	B	12	0	16	0	0
7	A	291	0	0	8	1
7	B	305	0	0	3	1
All	All	6039	0	5586	22	1

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 2.

All (22) 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:277:ILE:HD12	7:B:578:HOH:O	1.37	1.19
1:A:16[B]:LYS:O	7:A:501:HOH:O	1.72	1.06
1:B:16[A]:LYS:O	7:B:804:HOH:O	1.83	0.96
1:A:6[B]:LYS:NZ	7:A:683:HOH:O	2.08	0.87
1:B:277:ILE:CD1	7:B:578:HOH:O	2.10	0.81
1:A:118[B]:GLU:CA	1:A:119:PRO:N	2.45	0.78
1:A:16[B]:LYS:CE	7:A:529:HOH:O	2.41	0.69
1:A:16[A]:LYS:O	7:A:756:HOH:O	2.18	0.56
1:A:203:ILE:CD1	1:B:203:ILE:HD13	2.38	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:324[A]:MET:CE	7:A:777:HOH:O	2.57	0.52
1:A:117:ILE:C	1:A:118[B]:GLU:CA	2.79	0.51
1:B:12:LEU:HB2	1:B:16[B]:LYS:HE3	1.94	0.49
1:B:13:GLU:HA	1:B:16[B]:LYS:HD2	1.95	0.48
1:A:16[B]:LYS:HE2	7:A:529:HOH:O	2.10	0.48
1:A:16[B]:LYS:HE3	7:A:529:HOH:O	2.12	0.47
1:A:13:GLU:CD	1:A:16[B]:LYS:HD2	2.35	0.47
1:A:118[B]:GLU:CA	1:A:119:PRO:CD	2.95	0.45
1:A:324[A]:MET:HE2	7:A:777:HOH:O	2.18	0.44
1:A:47:LEU:O	1:A:66:TYR:HA	2.18	0.43
1:A:203:ILE:HD13	1:B:203:ILE:CD1	2.49	0.43
1:A:13:GLU:OE2	1:A:16[B]:LYS:HD2	2.19	0.42
1:A:65[A]:MET:HE1	1:A:73:ILE:HD11	2.01	0.41

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

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
7:A:575:HOH:O	7:B:551:HOH:O[1_655]	2.14	0.06

## 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	338/343 (98%)	326 (96%)	12 (4%)	0	100	100
1	B	337/343 (98%)	330 (98%)	7 (2%)	0	100	100
All	All	675/686 (98%)	656 (97%)	19 (3%)	0	100	100

There are no Ramachandran outliers to report.

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

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	283/288 (98%)	282 (100%)	1 (0%)	91	74
1	B	283/288 (98%)	278 (98%)	5 (2%)	59	20
All	All	566/576 (98%)	560 (99%)	6 (1%)	84	38

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	49	ARG
1	B	16[A]	LYS
1	B	16[B]	LYS
1	B	17[A]	ASN
1	B	17[B]	ASN
1	B	49	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 15 ligands modelled in this entry, 4 are monoatomic - leaving 11 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
6	GOL	A	407	-	5,5,5	0.88	0	5,5,5	1.31	1 (20%)
4	40E	B	404	3	8,8,8	1.75	2 (25%)	9,10,10	3.01	2 (22%)
5	EPE	B	405	-	15,15,15	2.23	3 (20%)	18,20,20	3.36	8 (44%)
6	GOL	A	406	-	5,5,5	0.30	0	5,5,5	0.81	0
6	GOL	B	407	-	5,5,5	0.60	0	5,5,5	1.13	1 (20%)
2	NDP	A	401	-	45,52,52	1.39	4 (8%)	53,80,80	1.18	6 (11%)
6	GOL	B	406	-	5,5,5	0.67	0	5,5,5	0.95	0
6	GOL	A	408	-	5,5,5	1.42	1 (20%)	5,5,5	1.03	0
2	NDP	B	401	-	45,52,52	1.49	6 (13%)	53,80,80	1.32	6 (11%)
5	EPE	A	405	-	15,15,15	2.16	3 (20%)	18,20,20	2.82	6 (33%)
4	40E	A	404	3	8,8,8	1.89	3 (37%)	9,10,10	3.52	3 (33%)

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
6	GOL	A	407	-	-	0/4/4/4	-
4	40E	B	404	3	-	2/7/8/8	-
5	EPE	B	405	-	-	2/9/19/19	0/1/1/1
6	GOL	A	406	-	-	0/4/4/4	-
6	GOL	B	407	-	-	0/4/4/4	-
2	NDP	A	401	-	-	6/30/77/77	0/5/5/5
6	GOL	B	406	-	-	2/4/4/4	-
6	GOL	A	408	-	-	0/4/4/4	-
2	NDP	B	401	-	-	6/30/77/77	0/5/5/5
5	EPE	A	405	-	-	2/9/19/19	0/1/1/1
4	40E	A	404	3	-	2/7/8/8	-

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	405	EPE	C10-S	-5.40	1.69	1.77
5	A	405	EPE	O2S-S	4.90	1.59	1.45
5	B	405	EPE	C10-S	-4.88	1.70	1.77
5	B	405	EPE	O1S-S	4.85	1.59	1.45
2	B	401	NDP	C2A-N3A	4.51	1.39	1.32
5	B	405	EPE	C7-N4	4.46	1.57	1.47
2	A	401	NDP	C2A-N3A	3.92	1.38	1.32
2	A	401	NDP	C4A-N3A	-3.60	1.30	1.35
2	B	401	NDP	C4N-C5N	-3.16	1.40	1.48
4	B	404	40E	C2-N3	-2.95	1.28	1.34
5	A	405	EPE	C6-N1	-2.93	1.38	1.46
4	A	404	40E	C2-N3	-2.87	1.28	1.34
2	B	401	NDP	C4A-N3A	-2.81	1.31	1.35
2	B	401	NDP	C5A-N7A	-2.70	1.29	1.39
6	A	408	GOL	O1-C1	2.67	1.53	1.42
4	A	404	40E	O12-C1	2.41	1.29	1.22
2	B	401	NDP	C5A-C4A	2.39	1.47	1.40
2	A	401	NDP	C4N-C5N	-2.31	1.42	1.48
2	B	401	NDP	P2B-O2B	2.20	1.63	1.59
2	A	401	NDP	C7N-C3N	-2.20	1.44	1.48
4	B	404	40E	O12-C1	2.19	1.28	1.22
4	A	404	40E	C2-C1	-2.08	1.51	1.54

All (33) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	404	40E	C4-N3-C2	8.55	132.66	122.74
4	B	404	40E	C4-N3-C2	8.20	132.25	122.74
5	A	405	EPE	O2S-S-C10	-7.37	98.05	106.92
5	B	405	EPE	O1S-S-C10	-6.40	99.21	106.92
5	B	405	EPE	C6-N1-C2	5.66	121.57	108.83
5	A	405	EPE	C7-N4-C5	5.31	124.81	111.23
5	B	405	EPE	C5-N4-C3	5.19	120.52	108.83
5	B	405	EPE	C9-N1-C2	4.87	123.69	111.23
5	B	405	EPE	C7-N4-C3	4.78	123.45	111.23
4	A	404	40E	O12-C1-C2	-4.25	112.71	122.18
5	A	405	EPE	C5-N4-C3	4.12	118.11	108.83
5	B	405	EPE	C6-C5-N4	3.70	118.24	110.64
5	B	405	EPE	C2-C3-N4	3.68	118.19	110.64
4	A	404	40E	O11-C1-C2	3.63	123.84	113.15
5	B	405	EPE	C5-C6-N1	3.57	117.96	110.64
2	B	401	NDP	N3A-C2A-N1A	-3.47	123.25	128.68
5	A	405	EPE	C3-C2-N1	3.46	117.74	110.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	NDP	C3N-C7N-N7N	3.06	123.10	117.67
5	A	405	EPE	C6-N1-C2	3.06	115.72	108.83
2	A	401	NDP	N3A-C2A-N1A	-2.99	124.01	128.68
2	B	401	NDP	C2A-N1A-C6A	2.82	123.58	118.75
2	A	401	NDP	O3X-P2B-O2X	2.78	118.28	107.64
5	A	405	EPE	C6-C5-N4	2.66	116.10	110.64
4	B	404	40E	O2-C2-N3	-2.57	118.57	123.08
2	A	401	NDP	O2B-P2B-O1X	-2.40	100.13	109.39
6	A	407	GOL	C3-C2-C1	-2.38	102.45	111.70
2	B	401	NDP	O2A-PA-O1A	2.28	123.52	112.24
2	A	401	NDP	C3N-C7N-N7N	2.12	121.44	117.67
2	B	401	NDP	O7N-C7N-N7N	-2.07	118.04	122.88
2	B	401	NDP	C1D-N1N-C6N	-2.06	116.39	120.83
6	B	407	GOL	C3-C2-C1	-2.04	103.78	111.70
2	A	401	NDP	O5D-C5D-C4D	2.03	115.99	108.99
2	A	401	NDP	O3D-C3D-C4D	-2.01	105.25	111.05

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	NDP	C2B-O2B-P2B-O1X
4	A	404	40E	C1-C2-N3-C4
4	A	404	40E	O2-C2-N3-C4
4	B	404	40E	C1-C2-N3-C4
4	B	404	40E	O2-C2-N3-C4
5	A	405	EPE	C8-C7-N4-C5
5	B	405	EPE	C10-C9-N1-C2
5	A	405	EPE	N4-C7-C8-O8
6	B	406	GOL	O2-C2-C3-O3
6	B	406	GOL	C1-C2-C3-O3
2	A	401	NDP	C2D-C1D-N1N-C6N
2	B	401	NDP	C2D-C1D-N1N-C6N
2	B	401	NDP	C2B-O2B-P2B-O2X
2	B	401	NDP	C2B-O2B-P2B-O3X
2	A	401	NDP	C5B-O5B-PA-O2A
2	B	401	NDP	C5B-O5B-PA-O2A
2	A	401	NDP	O4D-C1D-N1N-C6N
2	B	401	NDP	O4D-C1D-N1N-C6N
5	B	405	EPE	C8-C7-N4-C3
2	A	401	NDP	C5B-O5B-PA-O3
2	A	401	NDP	C2B-O2B-P2B-O2X

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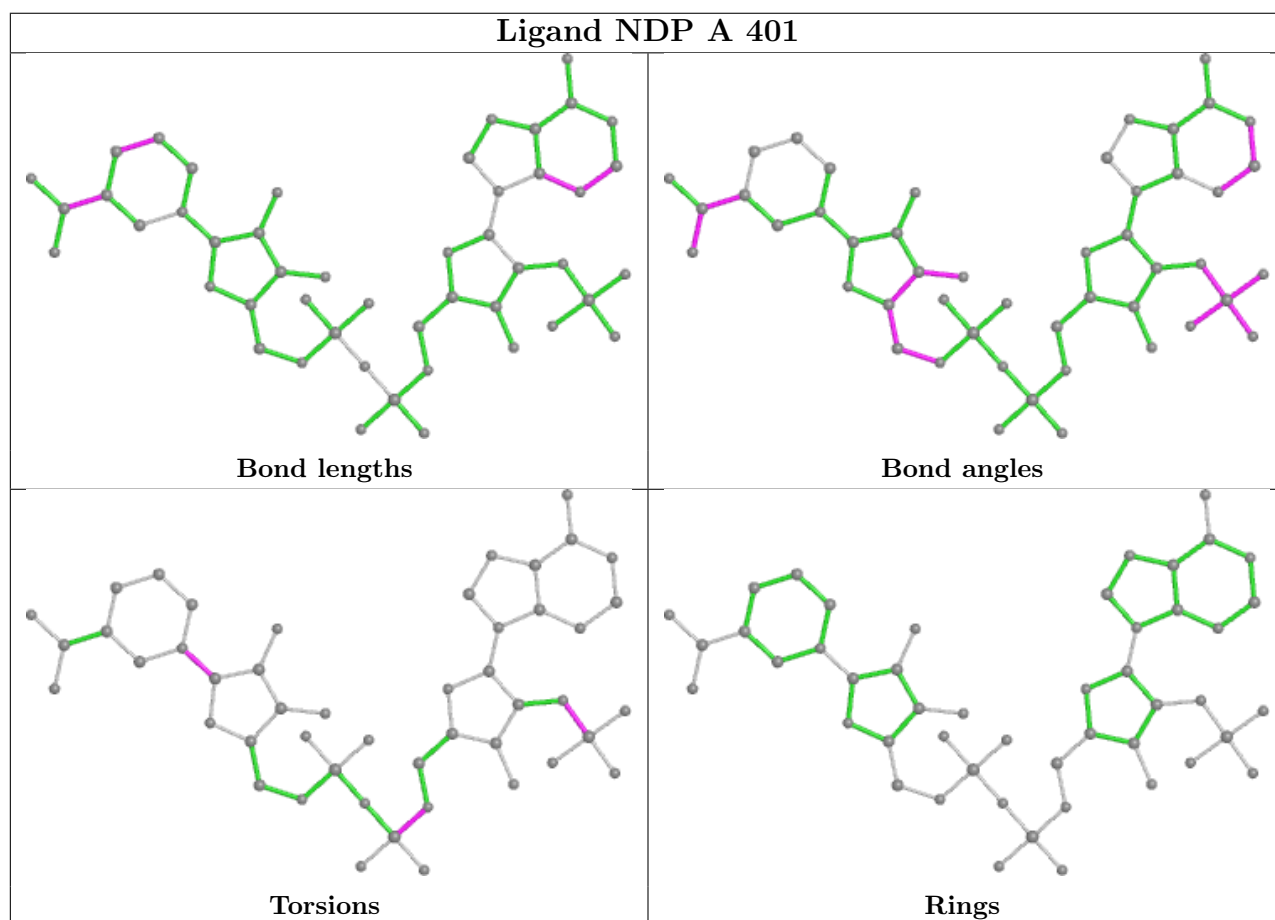
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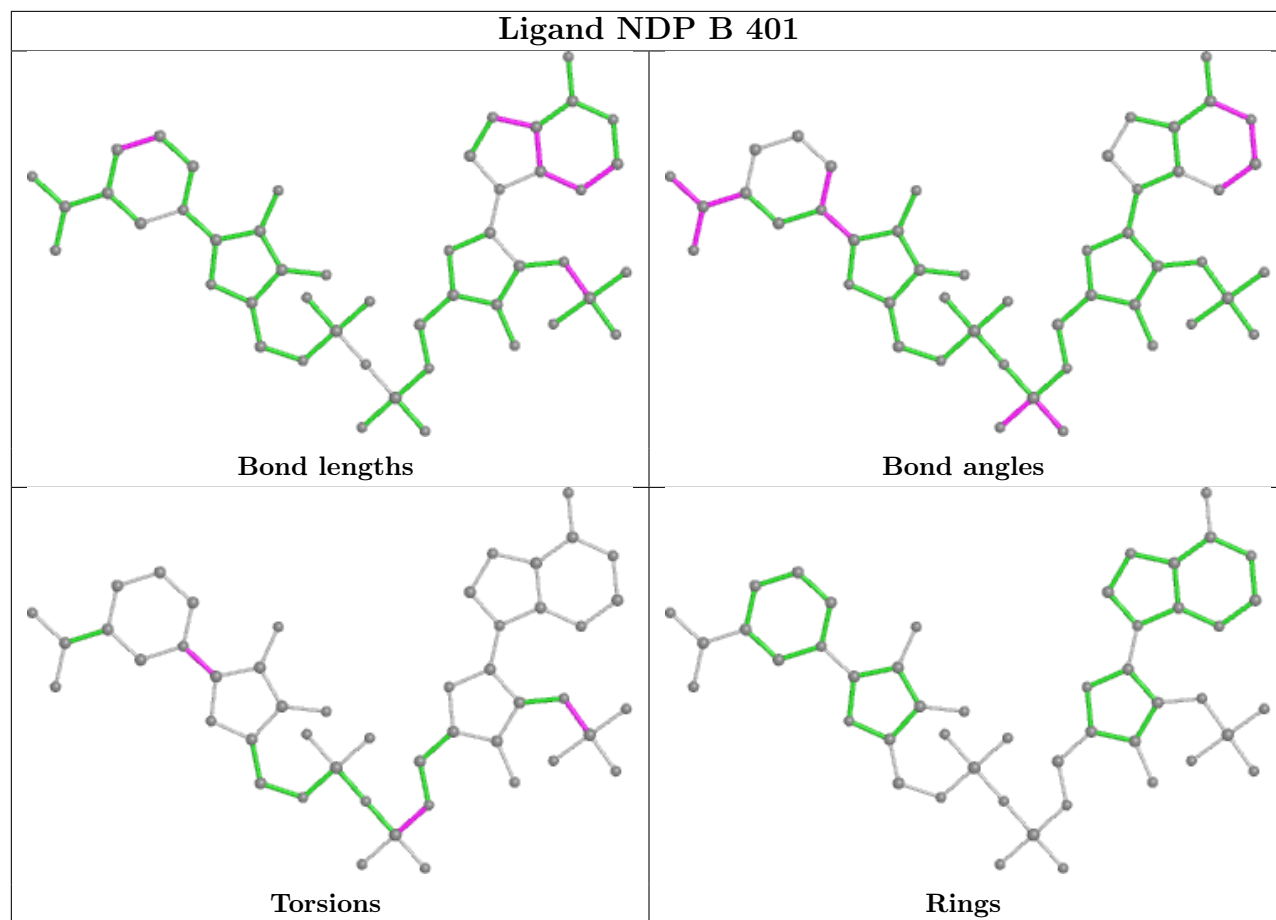
Mol	Chain	Res	Type	Atoms
2	B	401	NDP	C5B-O5B-PA-O3

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 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	328/343 (95%)	-0.36	2 (0%) 89   88	6, 10, 21, 68	0
1	B	329/343 (95%)	-0.32	4 (1%) 79   77	6, 11, 21, 45	0
All	All	657/686 (95%)	-0.34	6 (0%) 84   82	6, 10, 21, 68	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	328	GLY	8.2
1	B	328	GLY	4.9
1	B	330	LYS	3.2
1	A	329	MET	3.0
1	B	329	MET	2.9
1	B	271	VAL	2.5

### 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](#)

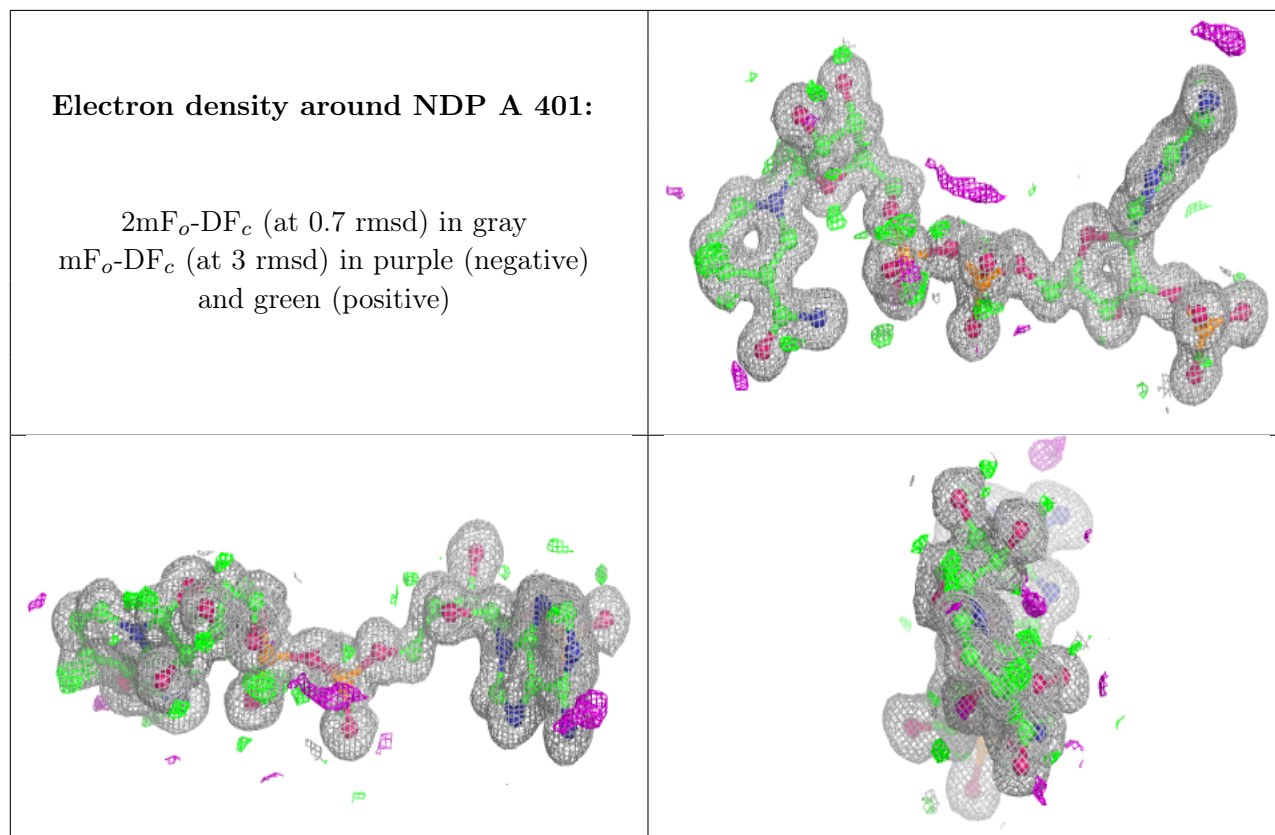
There are no monosaccharides in this entry.

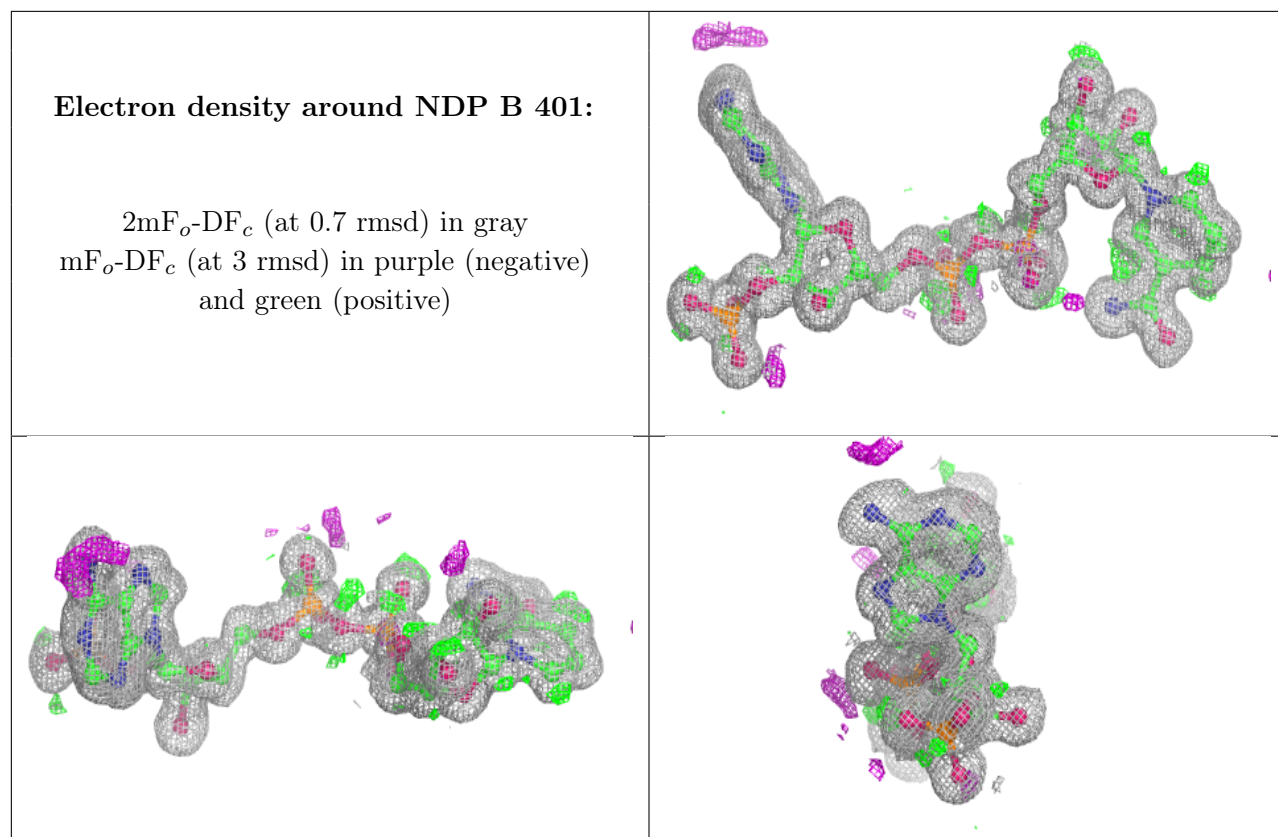
### 6.4 Ligands [i](#)

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( $\text{\AA}^2$ )	Q<0.9
6	GOL	A	408	6/6	0.90	0.11	19,22,25,42	0
6	GOL	A	407	6/6	0.94	0.11	18,22,23,23	0
6	GOL	B	407	6/6	0.95	0.12	21,23,28,35	0
5	EPE	B	405	15/15	0.97	0.14	18,21,44,65	0
6	GOL	B	406	6/6	0.97	0.07	13,18,21,33	0
5	EPE	A	405	15/15	0.97	0.13	14,19,40,62	0
6	GOL	A	406	6/6	0.98	0.08	14,19,22,34	0
4	40E	B	404	9/9	0.99	0.06	7,7,10,10	0
2	NDP	A	401	48/48	0.99	0.06	5,8,13,15	0
2	NDP	B	401	48/48	0.99	0.06	5,8,15,17	0
4	40E	A	404	9/9	0.99	0.06	7,8,11,12	0
3	MG	A	403	1/1	1.00	0.02	8,8,8,8	0
3	MG	B	402	1/1	1.00	0.02	8,8,8,8	0
3	MG	B	403	1/1	1.00	0.03	6,6,6,6	0
3	MG	A	402	1/1	1.00	0.04	6,6,6,6	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.