



## Full wwPDB X-ray Structure Validation Report ⓘ

Aug 14, 2023 – 10:19 am BST

PDB ID : 8PRX  
Title : Crystal structure of human cathepsin L after reaction with the bound ketoamide inhibitor 13b  
Authors : Falke, S.; Lieske, J.; Guenther, S.; Reinke, P.Y.A.; Ewert, W.; Loboda, J.; Karnicar, K.; Usenik, A.; Lindic, N.; Sekirnik, A.; Chapman, H.N.; Hinrichs, W.; Turk, D.; Meents, A.  
Deposited on : 2023-07-12  
Resolution : 1.80 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](#) ①) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.35  
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

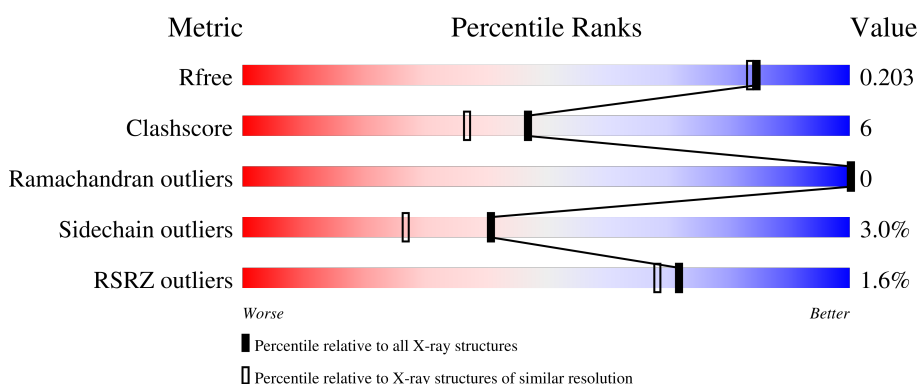
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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	220	
1	B	220	
1	C	220	
1	D	220	

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:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
6	EDO	A	310	-	-	X	-

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 7766 atoms, of which 52 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.

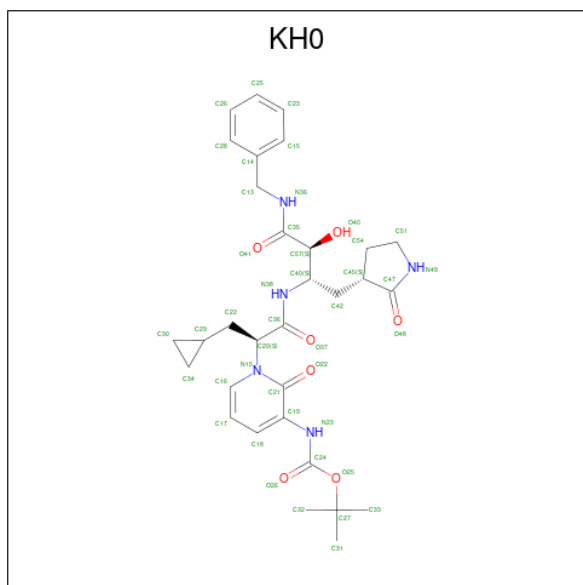
- Molecule 1 is a protein called Cathepsin L.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	220	1695	1060	281	341	13	0	0	0
1	B	220	1703	1065	282	342	14	0	1	0
1	C	216	1673	1049	278	332	14	0	1	0
1	D	220	1722	1075	285	348	14	0	4	0

There are 4 discrepancies between the modelled and reference sequences:

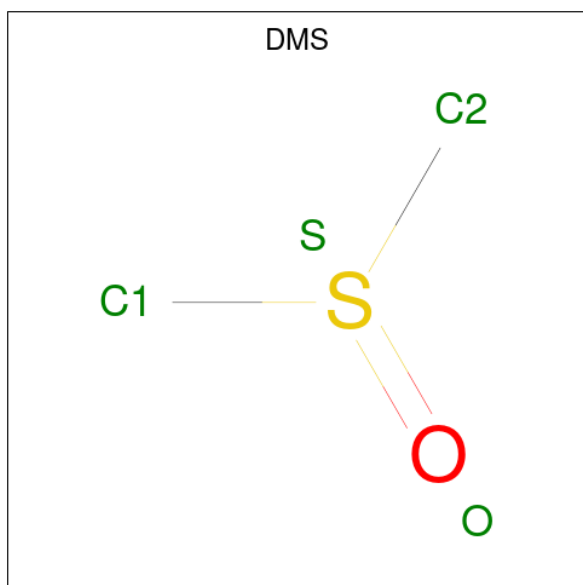
Chain	Residue	Modelled	Actual	Comment	Reference
A	110	ALA	THR	engineered mutation	UNP P07711
B	110	ALA	THR	engineered mutation	UNP P07711
C	110	ALA	THR	engineered mutation	UNP P07711
D	110	ALA	THR	engineered mutation	UNP P07711

- Molecule 2 is {tert}-butyl {N}-[1-[(2 {S})-3-cyclopropyl-1-oxidanylidene-1-[(2 {S},3 {S})-3-oxidanyl-4-oxidanylidene-1-[(3 {S})-2-oxidanylidene-pyrrolidin-3-yl]-4-[(phenylmethyl)amino]butan-2-yl]amino]propan-2-yl]-2-oxidanylidene-pyridin-3-yl]carbamate (three-letter code: KH0) (formula: C<sub>31</sub>H<sub>41</sub>N<sub>5</sub>O<sub>7</sub>) (labeled as "Ligand of Interest" by depositor).



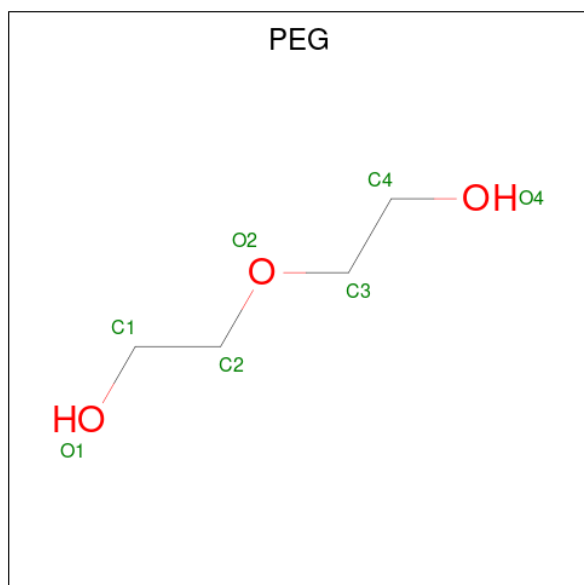
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	
			Total	C	N			O
2	A	1	43	31	5	7	0	0
2	B	1	43	31	5	7	0	0
2	C	1	43	31	5	7	0	0
2	D	1	43	31	5	7	0	0

- Molecule 3 is DIMETHYL SULFOXIDE (three-letter code: DMS) (formula:  $C_2H_6OS$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O S 4 2 1 1	0	0
3	A	1	Total C O S 4 2 1 1	0	0
3	A	1	Total C H O S 10 2 6 1 1	0	0
3	B	1	Total C O S 4 2 1 1	0	0
3	B	1	Total C O S 4 2 1 1	0	0
3	B	1	Total C O S 4 2 1 1	0	0
3	B	1	Total C O S 4 2 1 1	0	0
3	B	1	Total C O S 4 2 1 1	0	0
3	C	1	Total C O S 4 2 1 1	0	0
3	C	1	Total C O S 4 2 1 1	0	0
3	D	1	Total C O S 4 2 1 1	0	0
3	D	1	Total C O S 4 2 1 1	0	0

- Molecule 4 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C<sub>4</sub>H<sub>10</sub>O<sub>3</sub>).



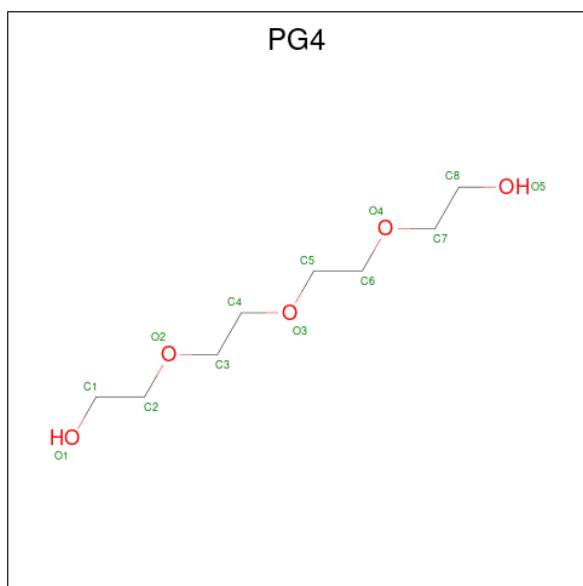
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 7 4 3	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 7 4 3	0	0
4	A	1	Total C O 7 4 3	0	0
4	B	1	Total C O 7 4 3	0	0
4	B	1	Total C O 7 4 3	0	0
4	B	1	Total C H O 17 4 10 3	0	0
4	D	1	Total C O 7 4 3	0	0
4	D	1	Total C O 7 4 3	0	0

- Molecule 5 is TETRAETHYLENE GLYCOL (three-letter code: PG4) (formula: C<sub>8</sub>H<sub>18</sub>O<sub>5</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 13 8 5	0	0

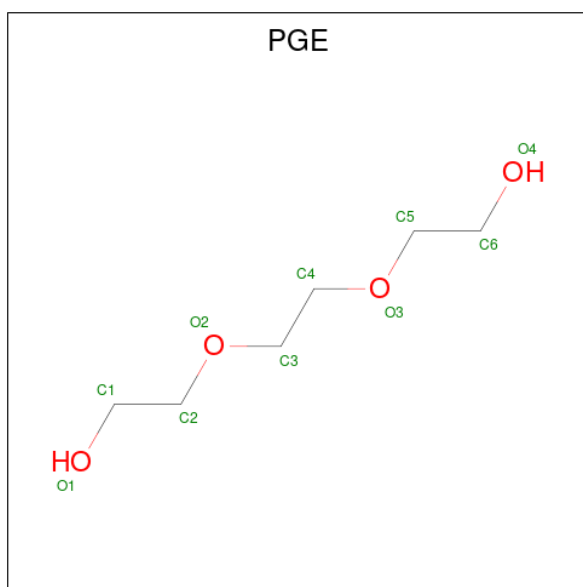
- Molecule 6 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).





Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C O 4 2 2	0	0
6	A	1	Total C H O 10 2 6 2	0	0
6	A	1	Total C H O 10 2 6 2	0	0
6	B	1	Total C O 4 2 2	0	0
6	B	1	Total C O 4 2 2	0	0
6	B	1	Total C H O 10 2 6 2	0	0
6	B	1	Total C H O 10 2 6 2	0	0
6	C	1	Total C O 4 2 2	0	0
6	D	1	Total C H O 10 2 6 2	0	0
6	D	1	Total C H O 10 2 6 2	0	0

- Molecule 7 is TRIETHYLENE GLYCOL (three-letter code: PGE) (formula: C<sub>6</sub>H<sub>14</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total C O 10 6 4	0	0
7	C	1	Total C O 10 6 4	0	0
7	D	1	Total C O 10 6 4	0	0

- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	132	Total O 132 132	0	0
8	B	150	Total O 150 150	0	0
8	C	98	Total O 98 98	0	0
8	D	186	Total O 186 186	0	0

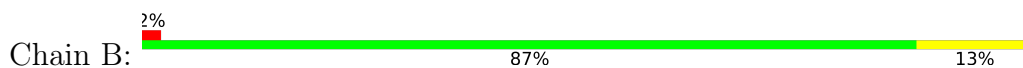
### 3 Residue-property plots [i](#)

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.

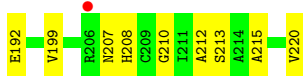
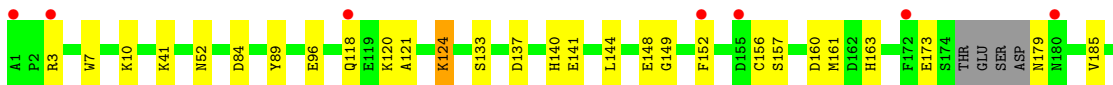
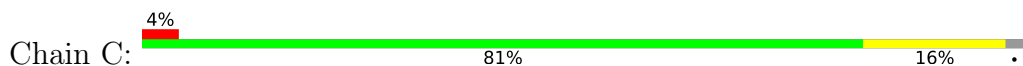
- Molecule 1: Cathepsin L



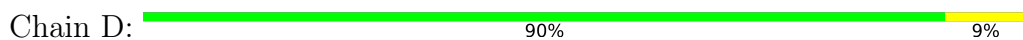
- Molecule 1: Cathepsin L



- Molecule 1: Cathepsin L



- Molecule 1: Cathepsin L



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	57.09Å 62.67Å 67.51Å 105.45° 93.67° 115.53°	Depositor
Resolution (Å)	49.70 – 1.80 49.70 – 1.80	Depositor EDS
% Data completeness (in resolution range)	91.6 (49.70-1.80) 91.6 (49.70-1.80)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	5.44 (at 1.79Å)	Xtrriage
Refinement program	PHENIX 1.18_3861	Depositor
R, $R_{free}$	0.157 , 0.203 0.157 , 0.203	Depositor DCC
$R_{free}$ test set	1476 reflections (2.18%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	13.5	Xtrriage
Anisotropy	0.130	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 47.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7766	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	17.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.05% 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: EDO, DMS, PG4, PGE, KH0, PEG

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	0.59	0/1737	0.67	0/2348
1	B	0.67	0/1745	0.68	0/2358
1	C	0.54	0/1714	0.64	0/2314
1	D	0.65	0/1764	0.70	0/2384
All	All	0.62	0/6960	0.67	0/9404

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 [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	1695	0	1568	13	0
1	B	1703	0	1576	25	0
1	C	1673	0	1553	31	0
1	D	1722	0	1590	18	0
2	A	43	0	0	1	0
2	B	43	0	0	2	0
2	C	43	0	0	1	0
2	D	43	0	0	0	0
3	A	12	6	18	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	16	0	24	1	0
3	C	8	0	12	1	0
3	D	8	0	12	0	0
4	A	21	0	30	3	0
4	B	21	10	30	1	0
4	D	14	0	20	1	0
5	A	13	0	18	1	0
6	A	12	12	18	5	0
6	B	16	12	24	0	0
6	C	4	0	6	0	0
6	D	8	12	12	0	0
7	B	10	0	14	4	0
7	C	10	0	14	0	0
7	D	10	0	14	0	0
8	A	132	0	0	0	0
8	B	150	0	0	1	0
8	C	98	0	0	0	0
8	D	186	0	0	0	0
All	All	7714	52	6553	85	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 6.

All (85) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:141:GLU:HA	1:C:144:LEU:HD13	1.30	1.08
6:A:310:EDO:H21	1:D:148:GLU:HB2	1.48	0.95
1:B:5:VAL:HG13	7:B:308:PGE:H1	1.54	0.89
1:C:207:ASN:HD21	1:C:212:ALA:H	1.24	0.84
1:A:147:LYS:HD2	1:D:148:GLU:HG3	1.60	0.83
1:A:147:LYS:HD2	1:D:148:GLU:CG	2.16	0.76
1:C:161:MET:CE	1:C:213:SER:HB2	2.18	0.74
1:B:37:GLN:HE22	1:B:40:ARG:HH11	1.34	0.73
1:C:148:GLU:HG2	1:C:149:GLY:N	2.03	0.72
1:B:206:ARG:HH21	1:B:206:ARG:HG3	1.56	0.70
1:D:97:SER:O	1:D:99:LYS:HD2	1.93	0.69
1:B:62:ASN:HD21	1:B:69:LEU:H	1.42	0.68
1:C:161:MET:HE2	1:C:213:SER:HB2	1.75	0.67
1:B:3:ARG:HH11	1:B:3:ARG:HG3	1.58	0.67
1:C:161:MET:HE3	1:C:210:GLY:HA3	1.77	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:141:GLU:HA	1:C:144:LEU:CD1	2.16	0.65
1:C:41:LYS:HD2	1:C:220:VAL:CG1	2.29	0.63
1:C:124:LYS:N	1:C:124:LYS:HD2	2.15	0.62
1:B:62:ASN:ND2	1:B:69:LEU:H	1.98	0.61
6:A:310:EDO:C2	1:D:148:GLU:HB2	2.27	0.60
1:A:7:TRP:CE2	1:A:130:GLY:HA2	2.37	0.59
1:C:161:MET:HE1	1:C:213:SER:HB2	1.85	0.58
1:B:206:ARG:HG3	1:B:206:ARG:NH2	2.16	0.58
1:B:6:ASP:N	7:B:308:PGE:H4	2.18	0.57
1:C:52:ASN:ND2	1:C:84:ASP:H	2.02	0.56
1:B:41:LYS:HD2	1:B:220:VAL:HG12	1.89	0.54
1:C:161:MET:HE1	1:C:213:SER:CB	2.37	0.54
1:D:159:GLU:OE1	1:D:159:GLU:N	2.41	0.54
1:B:3:ARG:HG3	1:B:3:ARG:NH1	2.19	0.53
1:C:161:MET:CE	1:C:210:GLY:HA3	2.38	0.53
1:C:124:LYS:HD2	1:C:124:LYS:H	1.74	0.53
1:A:20:GLY:HA3	4:A:305:PEG:H21	1.94	0.50
1:A:148:GLU:HG3	6:A:309:EDO:H22	1.93	0.50
1:B:137:ASP:OD1	1:B:140:HIS:HE1	1.94	0.50
1:C:52:ASN:HD22	1:C:84:ASP:H	1.59	0.49
1:B:150:ILE:HD12	1:B:180:ASN:HB3	1.96	0.48
1:C:118:GLN:HG3	1:C:121:ALA:H	1.79	0.48
1:A:153:GLU:H	1:A:208:HIS:CE1	2.32	0.48
1:A:88:SER:O	5:A:307:PG4:H42	2.13	0.47
1:A:192:GLU:N	1:A:192:GLU:OE2	2.47	0.47
1:C:144:LEU:HD12	1:C:144:LEU:H	1.80	0.47
6:A:310:EDO:H21	1:D:148:GLU:CB	2.32	0.47
1:B:9:GLU:O	1:B:10:LYS:HE2	2.15	0.46
1:D:148:GLU:OE2	1:D:195:MET:HE2	2.15	0.46
1:C:152:PHE:HA	1:C:208:HIS:NE2	2.31	0.46
1:B:41:LYS:HD2	1:B:220:VAL:CG1	2.46	0.45
1:C:140:HIS:O	1:C:144:LEU:HD12	2.16	0.45
1:C:137:ASP:OD2	1:C:140:HIS:HE1	2.00	0.45
1:B:128:THR:HB	3:B:313:DMS:H13	1.97	0.45
1:D:141:GLU:OE2	1:D:145:PHE:HE2	2.00	0.45
1:D:195:MET:HE2	1:D:195:MET:HB2	1.59	0.45
1:C:7:TRP:CZ3	1:C:10:LYS:HD3	2.52	0.45
1:B:6:ASP:H	7:B:308:PGE:H4	1.82	0.44
1:A:20:GLY:CA	4:A:305:PEG:H21	2.47	0.44
1:C:207:ASN:HD21	1:C:212:ALA:N	2.04	0.44
1:D:193:TRP:CH2	1:D:199:VAL:HB	2.52	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:148:GLU:HG2	1:C:149:GLY:H	1.82	0.44
1:A:2:PRO:HA	1:B:159:GLU:O	2.18	0.44
4:D:603:PEG:H12	4:D:603:PEG:H32	1.34	0.44
1:C:133:SER:O	1:C:215:ALA:HA	2.19	0.43
1:B:178:ASP:OD1	1:C:96:GLU:HB3	2.19	0.43
1:C:173:GLU:HB3	1:C:179:ASN:O	2.19	0.43
1:A:153:GLU:O	1:A:208:HIS:HE1	2.02	0.43
1:D:147:LYS:O	1:D:148:GLU:HG2	2.18	0.43
1:B:19:GLN:HG2	1:B:188:SER:O	2.19	0.42
1:C:163:HIS:HA	2:C:301:KH0:O40	2.20	0.42
1:D:147:LYS:C	1:D:148:GLU:HG2	2.40	0.42
1:D:175:THR:HG22	1:D:177:SER:H	1.84	0.42
1:A:148:GLU:OE2	1:C:192:GLU:OE2	2.37	0.42
1:C:41:LYS:HD2	1:C:220:VAL:HG12	2.02	0.42
3:C:305:DMS:C2	1:D:21:GLN:OE1	2.67	0.42
1:D:31:THR:O	1:D:35:GLU:HG3	2.20	0.42
1:B:7:TRP:CZ3	7:B:308:PGE:H12	2.54	0.41
1:B:63:GLU:CD	4:B:310:PEG:H41	2.40	0.41
2:B:301:KH0:O26	2:B:301:KH0:C31	2.67	0.41
1:A:3:ARG:HH22	2:B:301:KH0:C30	2.34	0.41
2:A:301:KH0:C17	4:A:304:PEG:H21	2.51	0.41
1:B:120:LYS:HA	1:B:120:LYS:HD3	1.76	0.41
1:B:201[B]:MET:HB3	8:B:470:HOH:O	2.20	0.41
1:D:69:LEU:HD12	1:D:72:TYR:CZ	2.56	0.41
6:A:310:EDO:H22	1:D:148:GLU:HG3	2.03	0.40
1:B:9:GLU:C	1:B:10:LYS:HE2	2.41	0.40
1:B:150:ILE:CD1	1:B:180:ASN:HB3	2.50	0.40
1:C:120:LYS:O	1:C:124:LYS:HD2	2.21	0.40
1:C:185:VAL:HB	1:C:199:VAL:HG13	2.03	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	218/220 (99%)	213 (98%)	5 (2%)	0	100	100
1	B	219/220 (100%)	212 (97%)	7 (3%)	0	100	100
1	C	213/220 (97%)	207 (97%)	6 (3%)	0	100	100
1	D	222/220 (101%)	215 (97%)	7 (3%)	0	100	100
All	All	872/880 (99%)	847 (97%)	25 (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	178/178 (100%)	173 (97%)	5 (3%)	43	30
1	B	179/178 (101%)	176 (98%)	3 (2%)	60	51
1	C	175/178 (98%)	169 (97%)	6 (3%)	37	22
1	D	182/178 (102%)	175 (96%)	7 (4%)	33	18
All	All	714/712 (100%)	693 (97%)	21 (3%)	41	29

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	52	ASN
1	A	89	TYR
1	A	155	ASP
1	A	156	CYS
1	A	158	SER
1	B	52	ASN
1	B	89	TYR
1	B	156	CYS
1	C	3	ARG
1	C	89	TYR
1	C	124	LYS
1	C	156	CYS
1	C	157	SER

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Mol	Chain	Res	Type
1	C	160	ASP
1	D	52	ASN
1	D	89	TYR
1	D	99	LYS
1	D	118	GLN
1	D	156	CYS
1	D	174	SER
1	D	195	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	179	ASN
1	B	37	GLN
1	B	62	ASN
1	B	140	HIS
1	C	52	ASN
1	C	207	ASN
1	D	66	ASN

### 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](#)

37 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
4	PEG	D	603	-	6,6,6	0.15	0	5,5,5	0.10	0
4	PEG	A	305	-	6,6,6	0.21	0	5,5,5	0.20	0
6	EDO	A	310	-	3,3,3	0.52	0	2,2,2	0.18	0
2	KH0	D	602	1	46,46,46	0.32	0	57,65,65	0.62	0
7	PGE	B	308	-	9,9,9	0.36	0	8,8,8	0.37	0
2	KH0	A	301	1	46,46,46	0.27	0	57,65,65	0.53	1 (1%)
3	DMS	D	605	-	3,3,3	0.72	0	3,3,3	0.89	0
5	PG4	A	307	-	12,12,12	0.20	0	11,11,11	0.15	0
4	PEG	D	606	-	6,6,6	0.10	0	5,5,5	0.18	0
6	EDO	C	304	-	3,3,3	0.51	0	2,2,2	0.27	0
6	EDO	D	608	-	3,3,3	0.47	0	2,2,2	0.50	0
4	PEG	B	303	-	6,6,6	0.19	0	5,5,5	0.12	0
2	KH0	B	301	1	46,46,46	0.25	0	57,65,65	0.70	2 (3%)
4	PEG	A	303	-	6,6,6	0.22	0	5,5,5	0.13	0
6	EDO	A	308	-	3,3,3	0.54	0	2,2,2	0.13	0
4	PEG	B	302	-	6,6,6	0.12	0	5,5,5	0.17	0
3	DMS	C	302	-	3,3,3	0.75	0	3,3,3	0.37	0
6	EDO	B	311	-	3,3,3	0.45	0	2,2,2	0.30	0
3	DMS	A	302	-	3,3,3	0.70	0	3,3,3	0.67	0
3	DMS	B	313	-	3,3,3	0.54	0	3,3,3	0.40	0
3	DMS	B	307	-	3,3,3	0.71	0	3,3,3	0.45	0
6	EDO	B	305	-	3,3,3	0.66	0	2,2,2	0.32	0
3	DMS	A	306	-	3,3,3	0.69	0	3,3,3	0.72	0
6	EDO	A	309	-	3,3,3	0.66	0	2,2,2	0.15	0
4	PEG	B	310	-	6,6,6	0.26	0	5,5,5	0.73	0
7	PGE	C	303	-	9,9,9	0.36	0	8,8,8	0.29	0
3	DMS	B	309	-	3,3,3	0.74	0	3,3,3	0.70	0
7	PGE	D	601	-	9,9,9	0.47	0	8,8,8	0.70	0
6	EDO	B	304	-	3,3,3	0.52	0	2,2,2	0.30	0
6	EDO	D	607	-	3,3,3	0.48	0	2,2,2	0.44	0
4	PEG	A	304	-	6,6,6	0.14	0	5,5,5	0.16	0
3	DMS	C	305	-	3,3,3	0.63	0	3,3,3	0.23	0
3	DMS	D	604	-	3,3,3	0.62	0	3,3,3	1.21	0
6	EDO	B	312	-	3,3,3	0.51	0	2,2,2	0.44	0
3	DMS	A	311	-	3,3,3	0.69	0	3,3,3	0.94	0
2	KH0	C	301	1	46,46,46	0.34	0	57,65,65	0.51	0
3	DMS	B	306	-	3,3,3	0.77	0	3,3,3	0.69	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	PEG	D	603	-	-	3/4/4/4	-
4	PEG	A	305	-	-	0/4/4/4	-
6	EDO	A	310	-	-	1/1/1/1	-
7	PGE	B	308	-	-	4/7/7/7	-
2	KH0	A	301	1	-	4/42/54/54	0/4/4/4
5	PG4	A	307	-	-	8/10/10/10	-
4	PEG	D	606	-	-	2/4/4/4	-
6	EDO	C	304	-	-	0/1/1/1	-
6	EDO	D	608	-	-	1/1/1/1	-
4	PEG	B	303	-	-	2/4/4/4	-
2	KH0	B	301	1	-	7/42/54/54	0/4/4/4
4	PEG	A	303	-	-	2/4/4/4	-
6	EDO	A	308	-	-	0/1/1/1	-
4	PEG	B	302	-	-	1/4/4/4	-
6	EDO	B	311	-	-	0/1/1/1	-
6	EDO	B	305	-	-	1/1/1/1	-
6	EDO	A	309	-	-	1/1/1/1	-
4	PEG	B	310	-	-	2/4/4/4	-
7	PGE	D	601	-	-	3/7/7/7	-
6	EDO	B	304	-	-	0/1/1/1	-
6	EDO	D	607	-	-	0/1/1/1	-
4	PEG	A	304	-	-	1/4/4/4	-
6	EDO	B	312	-	-	1/1/1/1	-
7	PGE	C	303	-	-	3/7/7/7	-
2	KH0	D	602	1	-	1/42/54/54	0/4/4/4
2	KH0	C	301	1	-	6/42/54/54	0/4/4/4

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	301	KH0	C54-C51-N49	-2.37	99.95	103.43
2	B	301	KH0	C19-N23-C24	2.09	130.47	124.14
2	A	301	KH0	C54-C51-N49	-2.09	100.36	103.43

There are no chirality outliers.

All (54) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	D	603	PEG	C1-C2-O2-C3
2	B	301	KH0	C31-C27-O25-C24
2	B	301	KH0	C32-C27-O25-C24
5	A	307	PG4	O2-C3-C4-O3
2	B	301	KH0	C33-C27-O25-C24
7	B	308	PGE	O2-C3-C4-O3
2	C	301	KH0	C32-C27-O25-C24
2	C	301	KH0	C31-C27-O25-C24
2	C	301	KH0	C33-C27-O25-C24
4	D	606	PEG	C4-C3-O2-C2
7	C	303	PGE	O2-C3-C4-O3
4	D	603	PEG	O1-C1-C2-O2
4	B	310	PEG	O1-C1-C2-O2
4	D	606	PEG	O2-C3-C4-O4
7	D	601	PGE	O1-C1-C2-O2
6	A	309	EDO	O1-C1-C2-O2
7	C	303	PGE	O1-C1-C2-O2
2	B	301	KH0	C22-C20-N15-C21
2	C	301	KH0	C22-C20-N15-C21
7	B	308	PGE	O3-C5-C6-O4
4	B	302	PEG	C1-C2-O2-C3
7	B	308	PGE	C3-C4-O3-C5
4	B	303	PEG	C4-C3-O2-C2
7	B	308	PGE	C4-C3-O2-C2
7	C	303	PGE	C6-C5-O3-C4
2	B	301	KH0	C22-C20-N15-C16
2	C	301	KH0	C22-C20-N15-C16
6	B	305	EDO	O1-C1-C2-O2
5	A	307	PG4	C6-C5-O3-C4
4	B	310	PEG	O2-C3-C4-O4
2	C	301	KH0	C36-C20-N15-C21
5	A	307	PG4	C5-C6-O4-C7
4	A	303	PEG	O1-C1-C2-O2
5	A	307	PG4	C8-C7-O4-C6
6	A	310	EDO	O1-C1-C2-O2
2	A	301	KH0	C22-C20-N15-C21
4	B	303	PEG	O1-C1-C2-O2
4	A	304	PEG	C1-C2-O2-C3
5	A	307	PG4	C4-C3-O2-C2
6	D	608	EDO	O1-C1-C2-O2
4	D	603	PEG	O2-C3-C4-O4
7	D	601	PGE	O2-C3-C4-O3

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Mol	Chain	Res	Type	Atoms
2	A	301	KH0	C32-C27-O25-C24
2	A	301	KH0	C42-C40-C57-C35
2	B	301	KH0	C42-C40-C57-C35
5	A	307	PG4	O3-C5-C6-O4
5	A	307	PG4	O1-C1-C2-O2
6	B	312	EDO	O1-C1-C2-O2
2	D	602	KH0	C22-C20-N15-C21
4	A	303	PEG	C4-C3-O2-C2
7	D	601	PGE	C1-C2-O2-C3
2	A	301	KH0	C36-C20-N15-C21
2	B	301	KH0	C36-C20-N15-C21
5	A	307	PG4	O4-C7-C8-O5

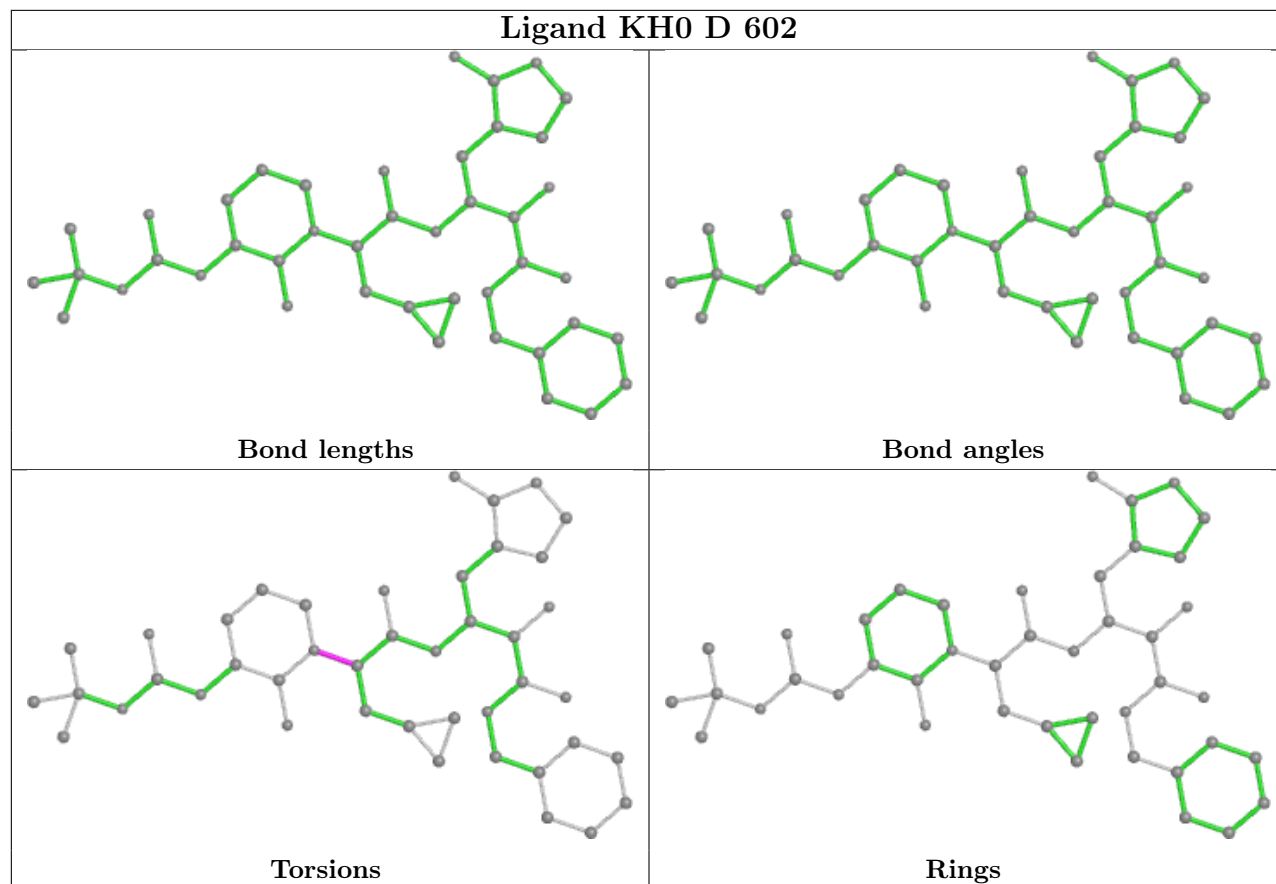
There are no ring outliers.

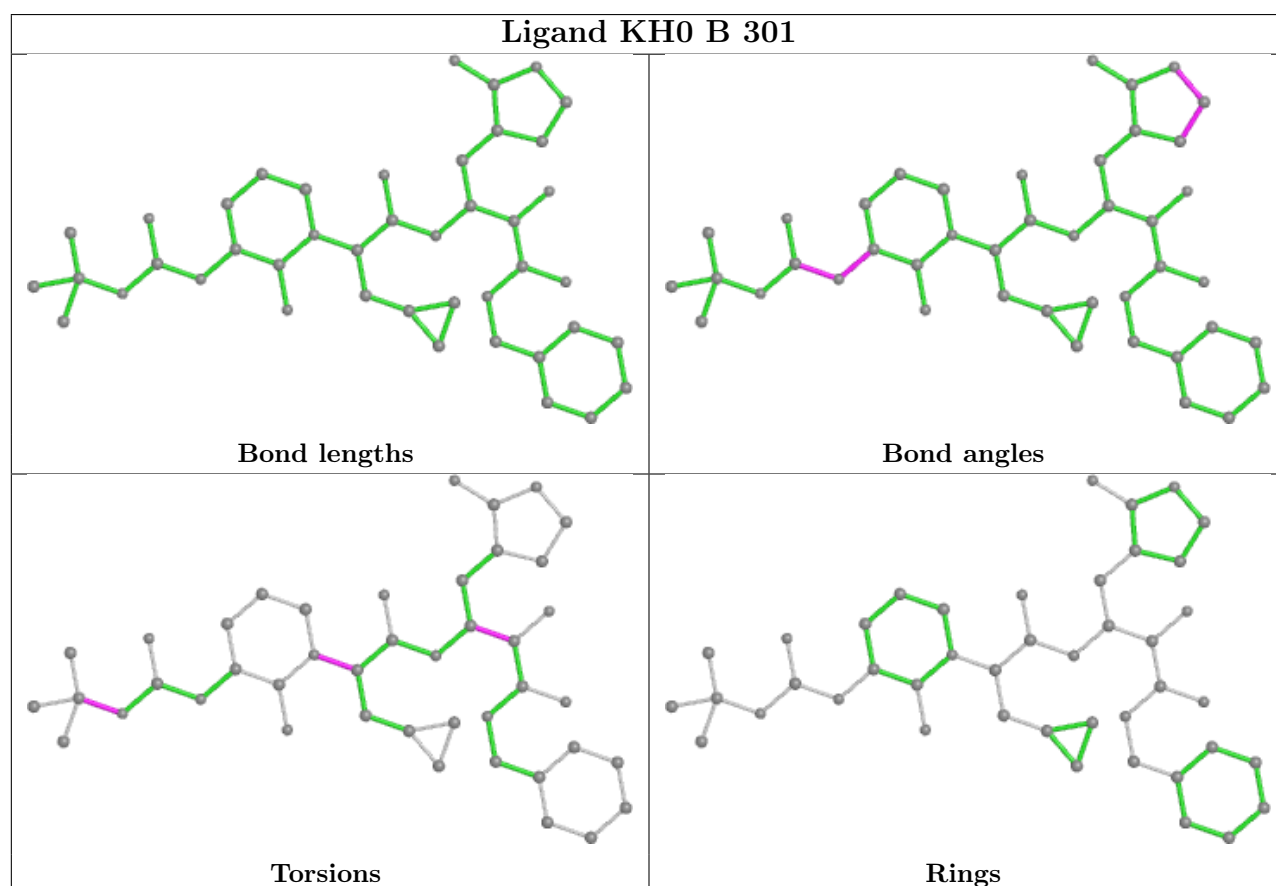
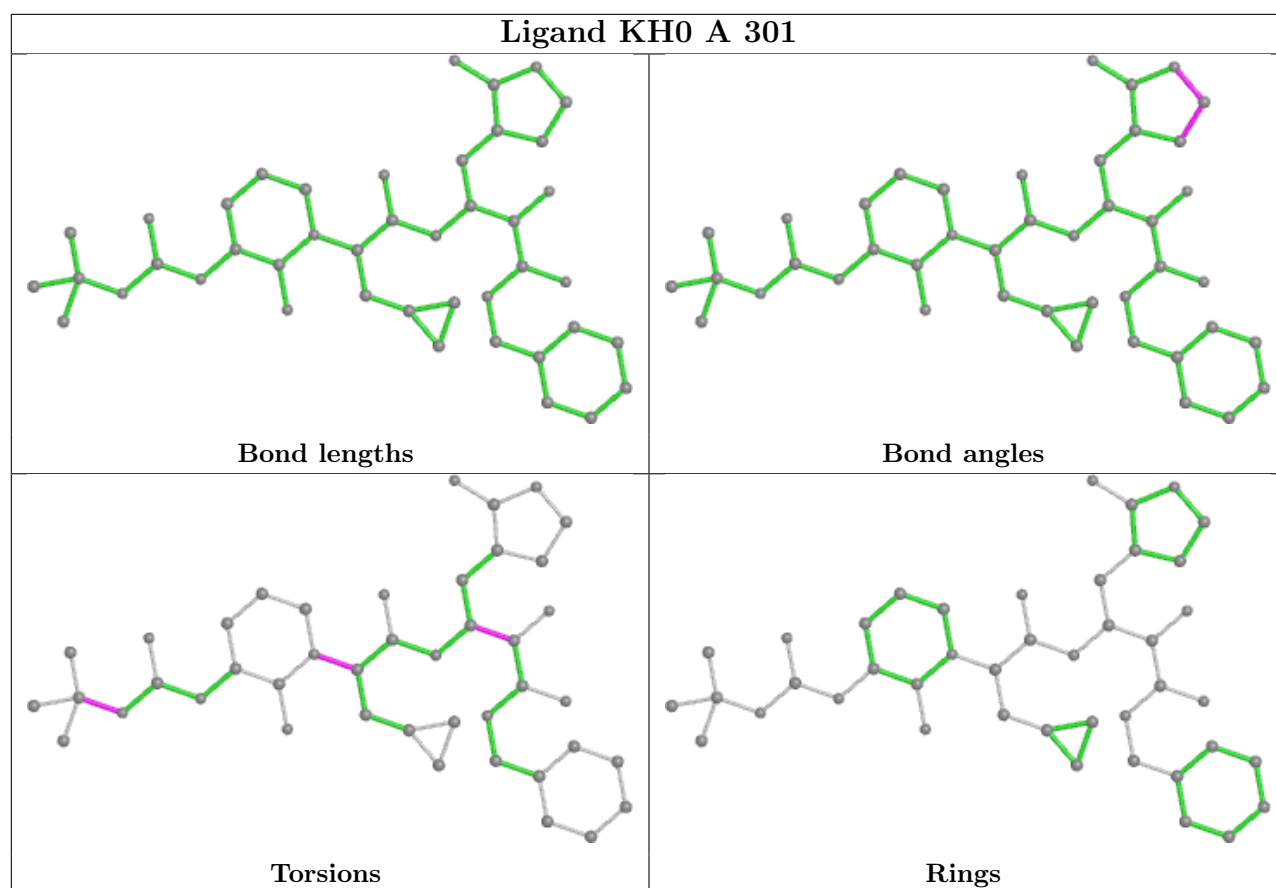
13 monomers are involved in 20 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	D	603	PEG	1	0
4	A	305	PEG	2	0
6	A	310	EDO	4	0
7	B	308	PGE	4	0
2	A	301	KH0	1	0
5	A	307	PG4	1	0
2	B	301	KH0	2	0
3	B	313	DMS	1	0
6	A	309	EDO	1	0
4	B	310	PEG	1	0
4	A	304	PEG	1	0
3	C	305	DMS	1	0
2	C	301	KH0	1	0

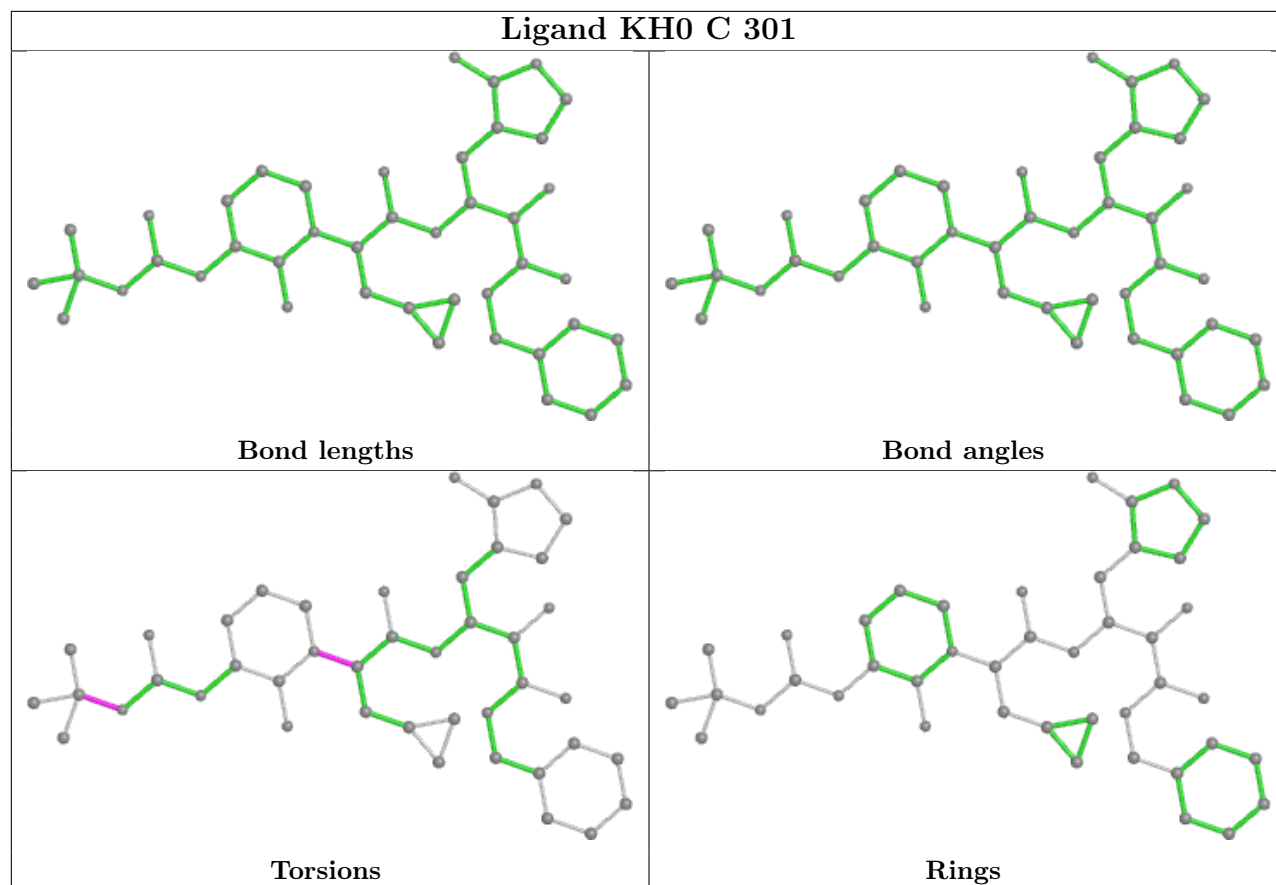
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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 [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	220/220 (100%)	-0.20	2 (0%) 84 82	7, 15, 31, 64	0
1	B	220/220 (100%)	-0.12	4 (1%) 68 64	5, 12, 32, 61	0
1	C	216/220 (98%)	-0.02	8 (3%) 41 36	8, 17, 45, 56	0
1	D	220/220 (100%)	-0.38	0 100 100	4, 10, 24, 31	0
All	All	876/880 (99%)	-0.18	14 (1%) 72 68	4, 14, 34, 64	0

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	1	ALA	4.9
1	B	176	GLU	3.4
1	B	175	THR	3.3
1	C	206	ARG	3.1
1	B	178	ASP	2.9
1	C	152	PHE	2.6
1	C	172	PHE	2.6
1	C	3	ARG	2.5
1	C	180	ASN	2.4
1	C	118	GLN	2.4
1	B	177	SER	2.3
1	A	159	GLU	2.3
1	A	158	SER	2.1
1	C	155	ASP	2.0

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

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

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 6.4 Ligands [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.

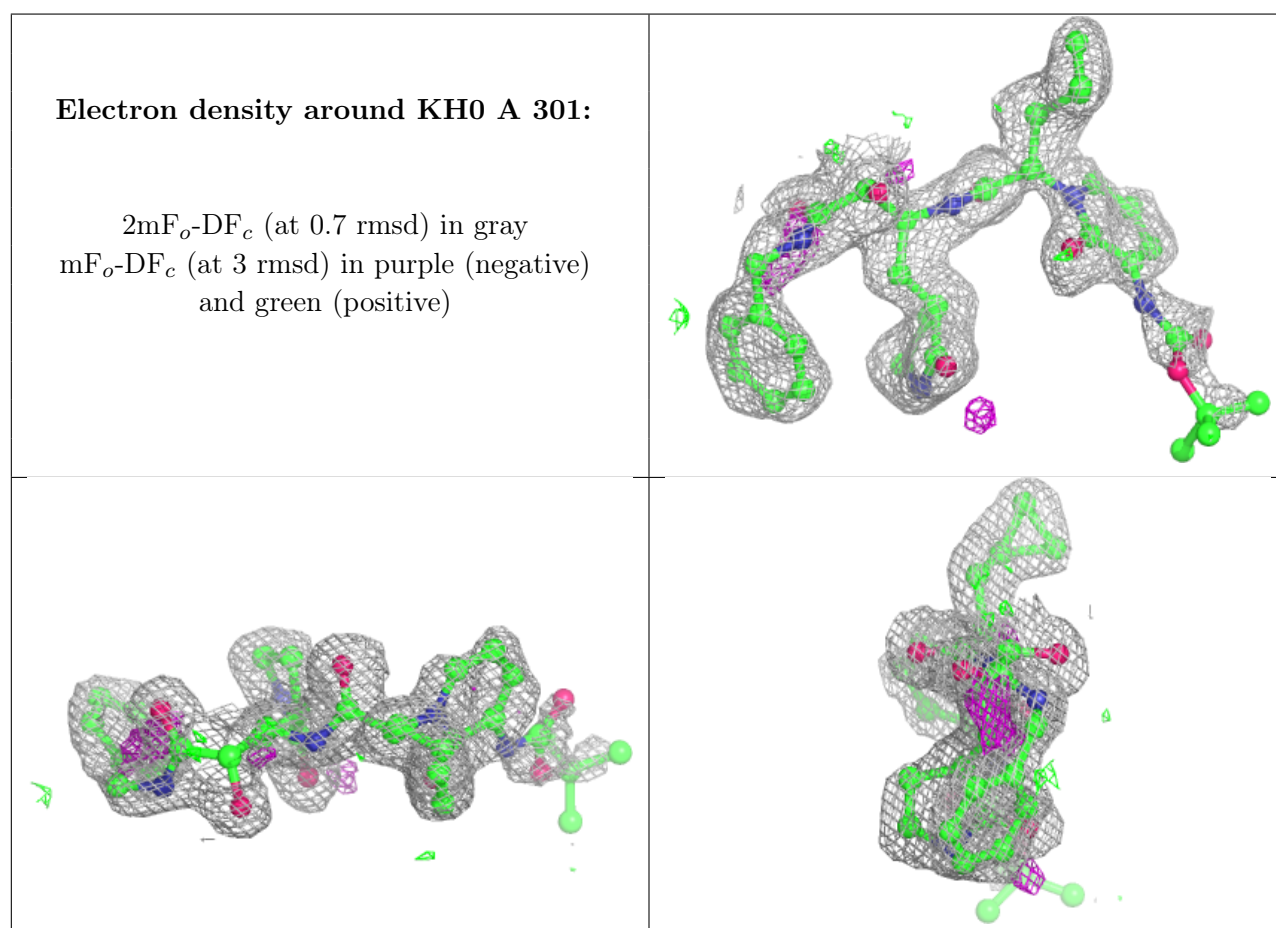
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
6	EDO	A	309	4/4	0.73	0.19	29,36,41,48	0
3	DMS	B	309	4/4	0.77	0.16	39,42,46,66	0
4	PEG	B	303	7/7	0.78	0.20	38,45,48,50	0
7	PGE	D	601	10/10	0.78	0.18	23,30,36,37	0
6	EDO	B	311	4/4	0.82	0.23	31,37,42,50	0
4	PEG	A	303	7/7	0.84	0.14	22,29,34,36	0
4	PEG	A	305	7/7	0.86	0.35	30,36,40,44	0
4	PEG	B	310	7/7	0.86	0.28	26,37,44,52	0
5	PG4	A	307	13/13	0.86	0.24	26,36,45,48	0
2	KH0	A	301	43/43	0.88	0.23	21,30,64,74	0
6	EDO	B	312	4/4	0.88	0.19	23,29,35,43	0
6	EDO	D	607	4/4	0.88	0.10	31,38,46,49	0
4	PEG	D	606	7/7	0.88	0.14	27,32,38,44	0
3	DMS	C	305	4/4	0.89	0.16	28,36,48,57	0
2	KH0	C	301	43/43	0.89	0.19	17,27,58,61	0
4	PEG	A	304	7/7	0.90	0.22	31,33,36,40	0
6	EDO	B	305	4/4	0.90	0.11	19,20,29,32	0
6	EDO	D	608	4/4	0.90	0.19	31,37,44,45	0
4	PEG	B	302	7/7	0.90	0.13	30,32,36,40	0
3	DMS	A	306	4/4	0.91	0.17	31,38,40,47	0
6	EDO	B	304	4/4	0.91	0.13	23,26,30,30	0
3	DMS	D	605	4/4	0.91	0.20	19,33,39,46	0
6	EDO	A	308	4/4	0.91	0.30	27,30,31,38	0
6	EDO	A	310	4/4	0.92	0.13	20,24,30,31	0
6	EDO	C	304	4/4	0.92	0.10	28,31,34,35	0
2	KH0	D	602	43/43	0.92	0.17	11,18,38,40	0
4	PEG	D	603	7/7	0.92	0.15	25,27,36,40	0
7	PGE	C	303	10/10	0.92	0.18	21,35,42,48	0
2	KH0	B	301	43/43	0.92	0.20	13,21,53,62	0
3	DMS	B	306	4/4	0.94	0.17	20,21,38,43	0
7	PGE	B	308	10/10	0.94	0.22	21,33,40,41	0
3	DMS	A	311	4/4	0.95	0.18	30,36,43,45	0

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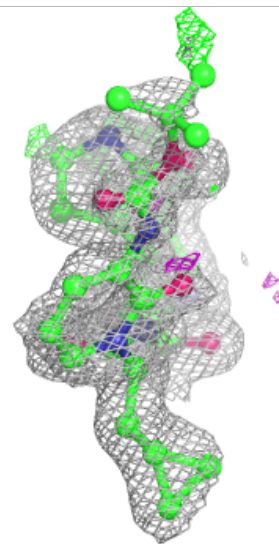
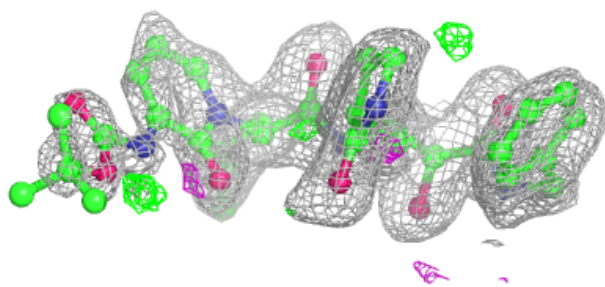
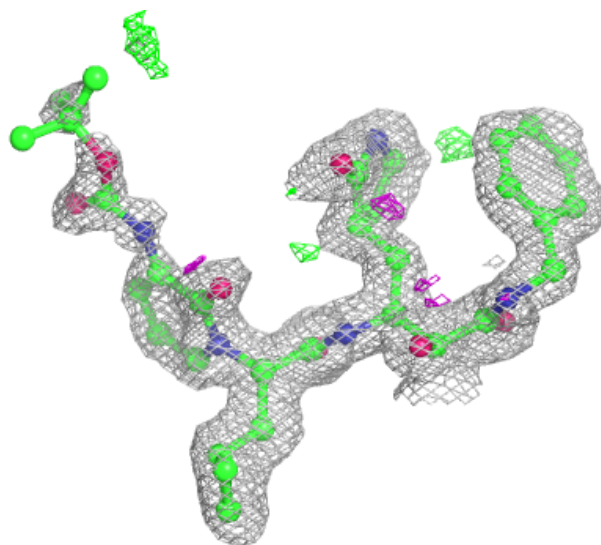
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	DMS	B	313	4/4	0.97	0.10	17,24,25,31	0
3	DMS	C	302	4/4	0.97	0.23	30,31,33,34	0
3	DMS	B	307	4/4	0.98	0.15	23,26,26,34	0
3	DMS	A	302	4/4	0.98	0.26	27,29,30,40	0
3	DMS	D	604	4/4	0.99	0.08	14,18,20,21	0

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.



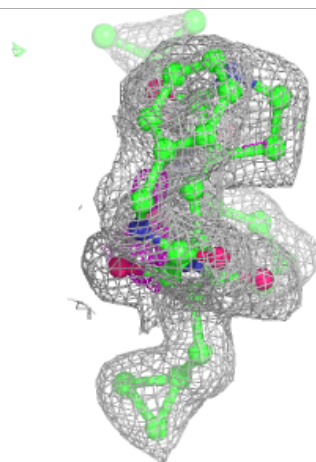
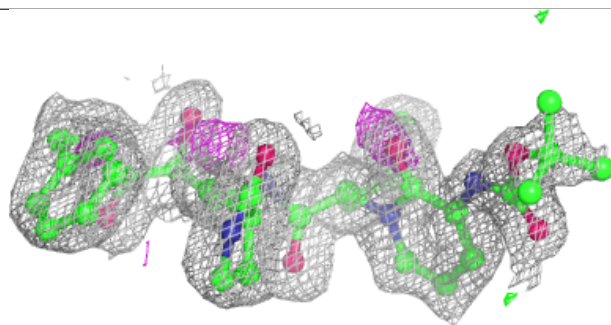
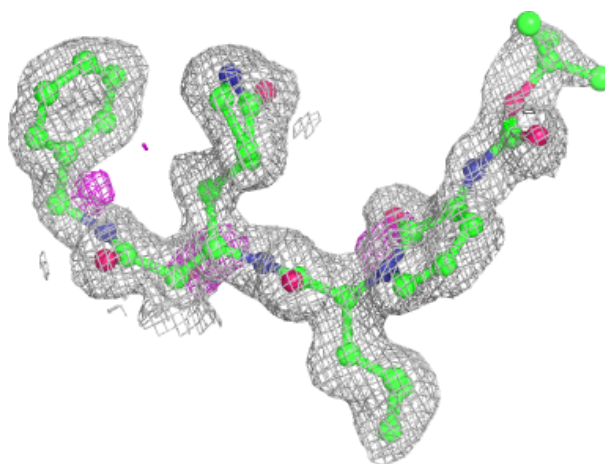
**Electron density around KH0 C 301:**

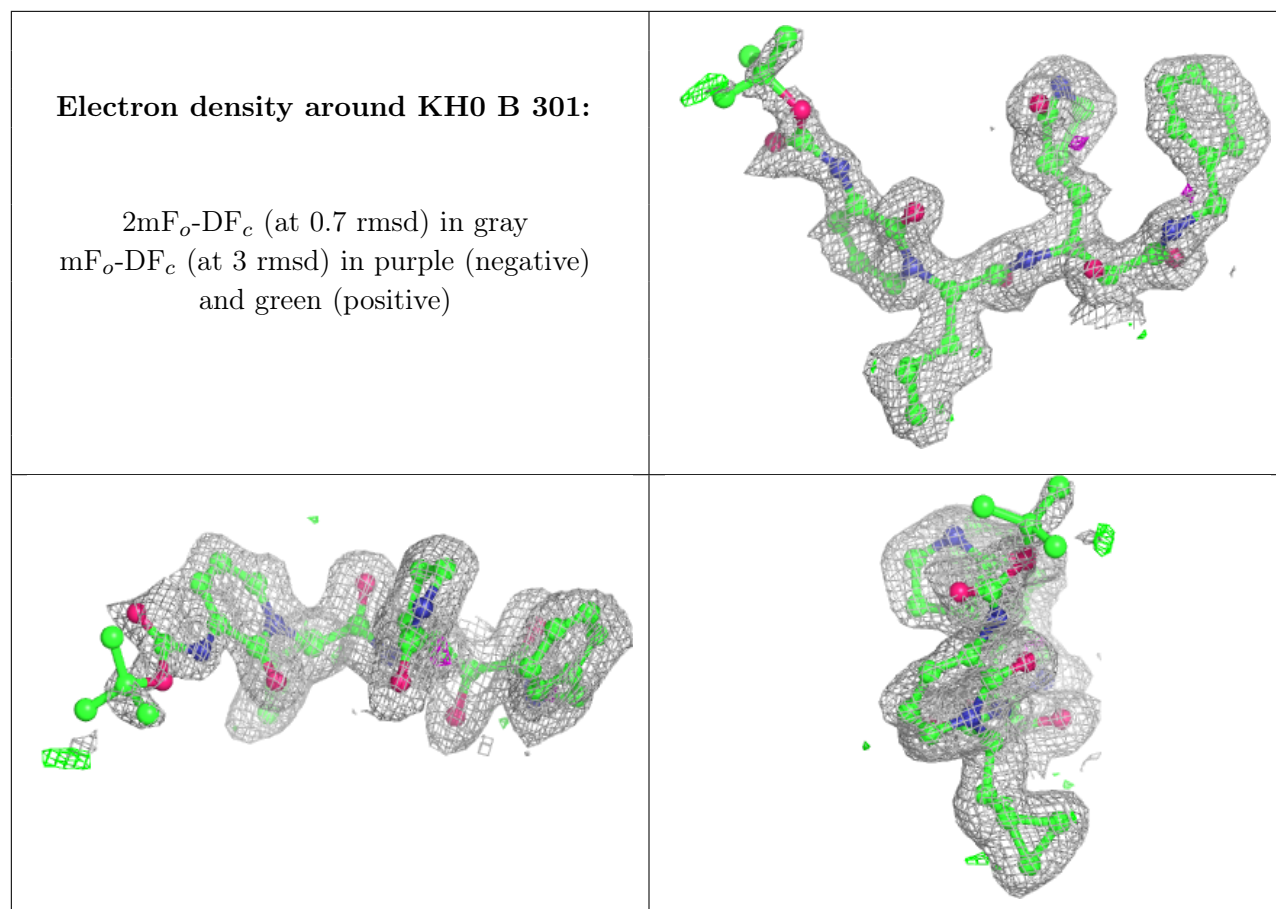
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around KH0 D 602:**

$2mF_o-DF_c$  (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.