



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 10, 2023 – 02:26 AM EDT

PDB ID : 7MCI  
Title : MoFe protein from *Azotobacter vinelandii* with a sulfur-replenished cofactor  
Authors : Kang, W.; Lee, C.; Hu, Y.; Ribbe, M.W.  
Deposited on : 2021-04-02  
Resolution : 1.65 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

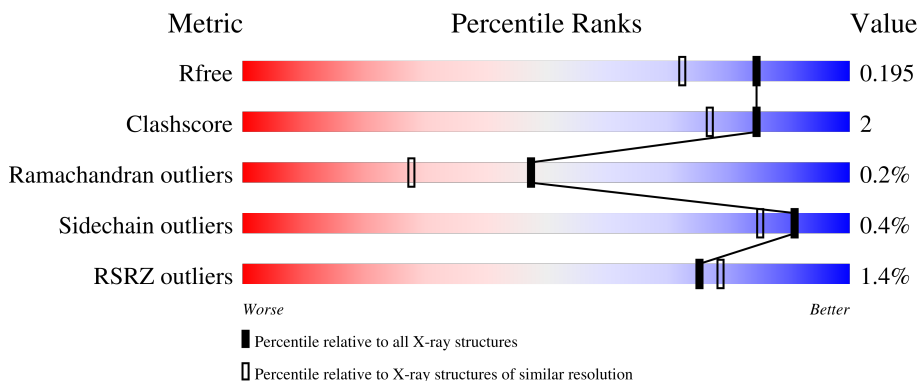
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

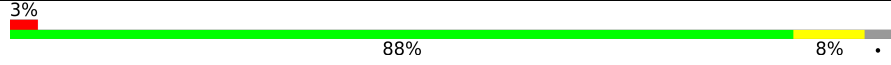
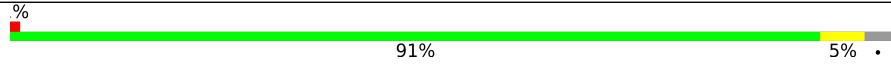
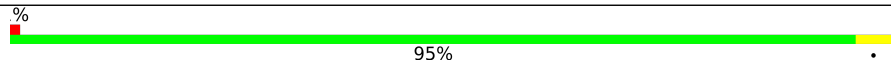
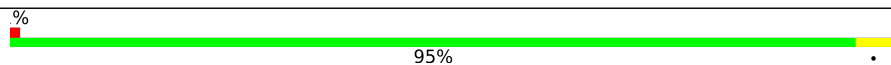
The reported resolution of this entry is 1.65 Å.

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	1827 (1.66-1.66)
Clashscore	141614	1931 (1.66-1.66)
Ramachandran outliers	138981	1891 (1.66-1.66)
Sidechain outliers	138945	1891 (1.66-1.66)
RSRZ outliers	127900	1791 (1.66-1.66)

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	492	 3% 88% 8%
1	C	492	 % 91% 5%
2	B	523	 % 95%
2	D	523	 % 95%

## 2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 17333 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.

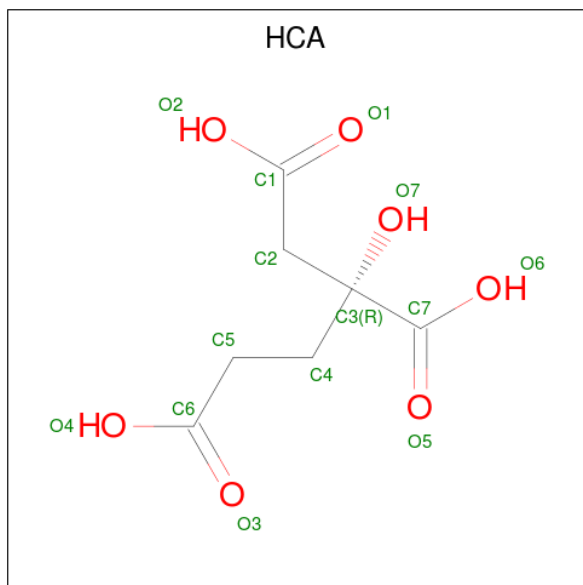
- Molecule 1 is a protein called Nitrogenase molybdenum-iron protein alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	477	Total 3761	C 2392	N 642	O 701	S 26	0	1	0
1	C	477	Total 3754	C 2385	N 639	O 705	S 25	0	0	0

- Molecule 2 is a protein called Nitrogenase molybdenum-iron protein beta chain.

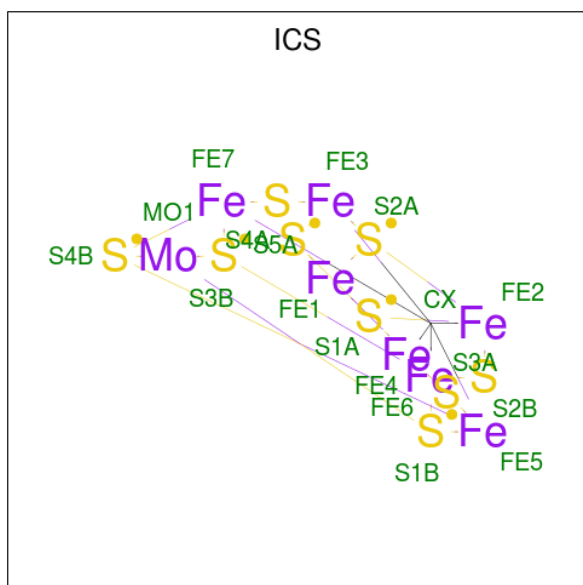
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	522	Total 4140	C 2642	N 696	O 774	S 28	0	1	0
2	D	522	Total 4118	C 2629	N 695	O 766	S 28	0	0	0

- Molecule 3 is 3-HYDROXY-3-CARBOXY-ADIPIC ACID (three-letter code: HCA) (formula: C<sub>7</sub>H<sub>10</sub>O<sub>7</sub>) (labeled as "Ligand of Interest" by depositor).



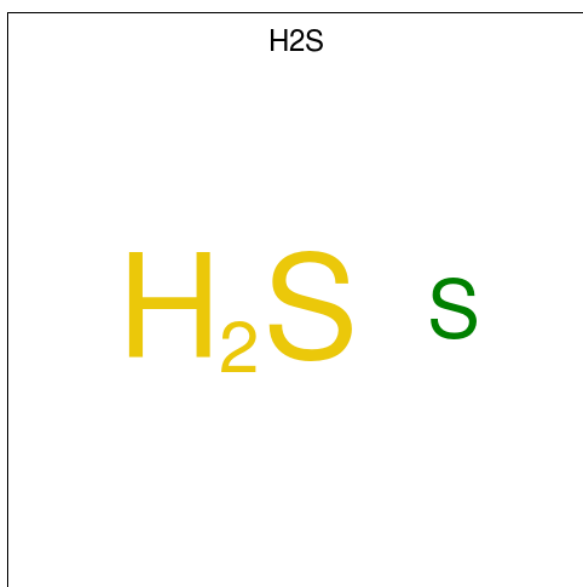
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			14	7	7		
3	C	1	Total	C	O	0	0
			14	7	7		

- Molecule 4 is iron-sulfur-molybdenum cluster with interstitial carbon (three-letter code: ICS) (formula:  $\text{CFe}_7\text{MoS}_9$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
4	A	1	Total	C	Fe	Mo	S	0	0
			18	1	7	1	9		
4	C	1	Total	C	Fe	Mo	S	0	0
			18	1	7	1	9		

- Molecule 5 is HYDROSULFURIC ACID (three-letter code: H2S) (formula:  $\text{H}_2\text{S}$ ).

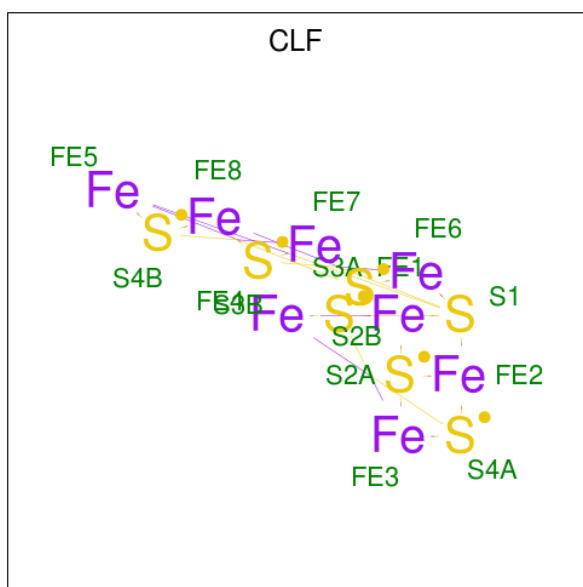


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total S 1 1	0	0
5	C	1	Total S 1 1	0	0

- Molecule 6 is MOLYBDENUM ATOM (three-letter code: MO) (formula: Mo).

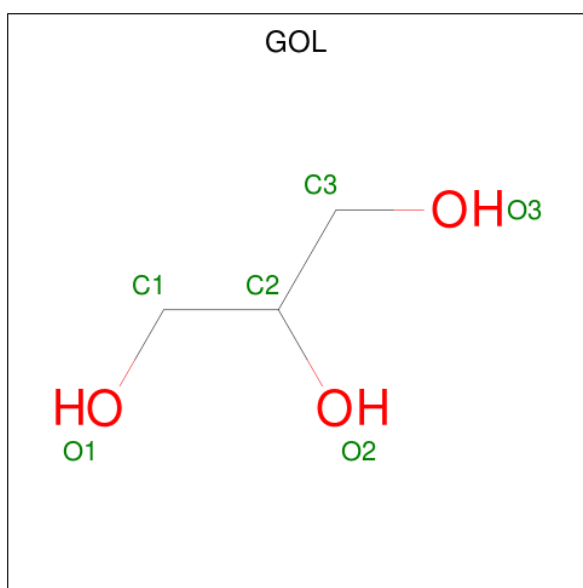
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	3	Total Mo 3 3	0	0
6	C	3	Total Mo 3 3	0	0

- Molecule 7 is FE(8)-S(7) CLUSTER (three-letter code: CLF) (formula: Fe<sub>8</sub>S<sub>7</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total Fe S 15 8 7	0	0
7	C	1	Total Fe S 15 8 7	0	0

- Molecule 8 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



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

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

- Molecule 9 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	B	1	Total Ca 1 1	0	0
9	D	1	Total Ca 1 1	0	0

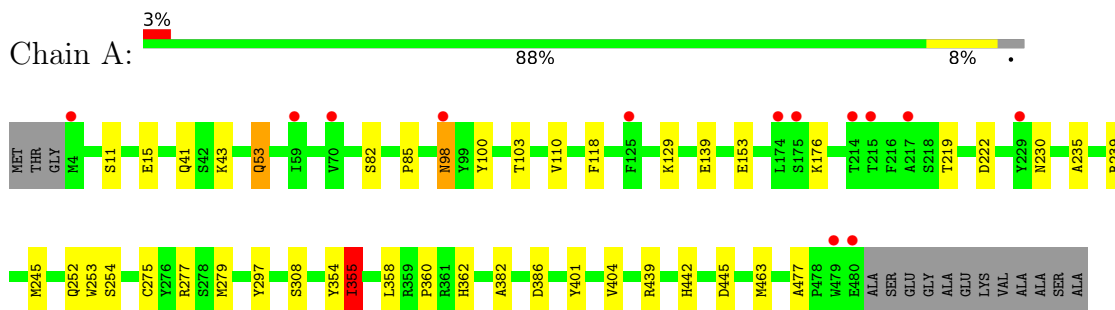
- Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	268	Total O 268 268	0	0
10	B	406	Total O 406 406	0	0
10	C	330	Total O 330 330	0	0
10	D	386	Total O 386 386	0	0

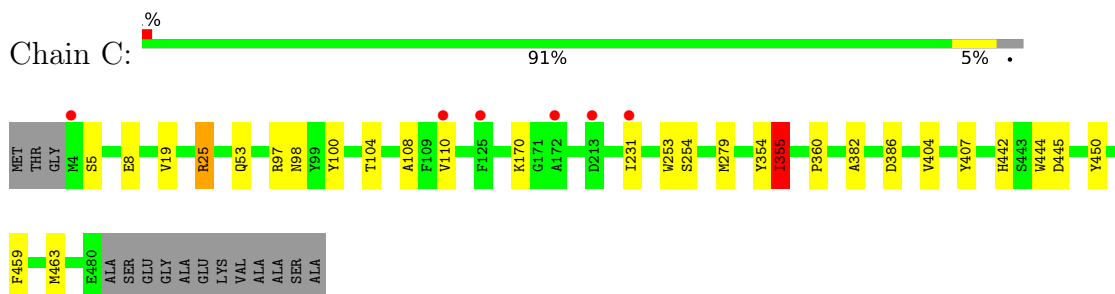
### 3 Residue-property plots [i](#)

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.

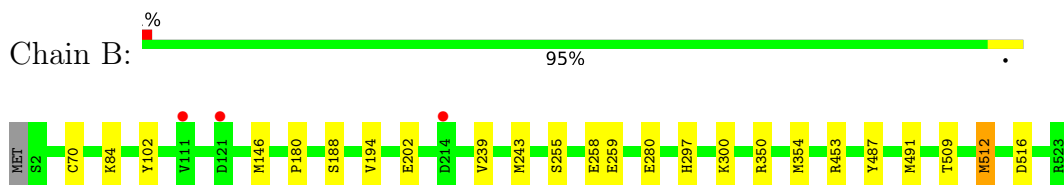
- Molecule 1: Nitrogenase molybdenum-iron protein alpha chain



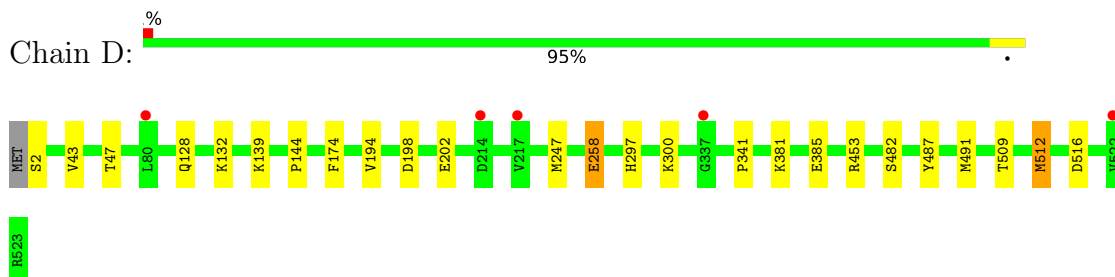
- Molecule 1: Nitrogenase molybdenum-iron protein alpha chain



- Molecule 2: Nitrogenase molybdenum-iron protein beta chain



- Molecule 2: Nitrogenase molybdenum-iron protein beta chain





## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	166.83Å 74.00Å 208.77Å 90.00° 103.05° 90.00°	Depositor
Resolution (Å)	38.22 – 1.65 38.22 – 1.65	Depositor EDS
% Data completeness (in resolution range)	98.1 (38.22-1.65) 98.1 (38.22-1.65)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.15 (at 1.65Å)	Xtrriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, $R_{free}$	0.172 , 0.195 0.172 , 0.195	Depositor DCC
$R_{free}$ test set	14399 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	19.8	Xtrriage
Anisotropy	0.711	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 43.0	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	0.97	EDS
Total number of atoms	17333	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.41% 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: MO, CA, H2S, ICS, CLF, GOL, HCA

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	0.54	2/3852 (0.1%)	0.71	5/5201 (0.1%)
1	C	0.50	1/3842 (0.0%)	0.65	2/5191 (0.0%)
2	B	0.43	1/4249 (0.0%)	0.60	2/5756 (0.0%)
2	D	0.43	0/4224	0.62	4/5725 (0.1%)
All	All	0.47	4/16167 (0.0%)	0.64	13/21873 (0.1%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
2	D	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	477	ALA	C-N	8.08	1.49	1.34
1	C	53	GLN	C-N	7.79	1.49	1.34
1	A	53	GLN	C-N	7.38	1.48	1.34
2	B	280	GLU	CD-OE1	-5.09	1.20	1.25

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	129	LYS	CD-CE-NZ	-14.97	77.26	111.70
1	A	245	MET	CG-SD-CE	12.49	120.18	100.20
2	B	512	MET	CG-SD-CE	-8.98	85.84	100.20
2	D	258	GLU	N-CA-CB	8.29	125.52	110.60
2	D	258	GLU	OE1-CD-OE2	-7.57	114.22	123.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	355	ILE	CG1-CB-CG2	-7.28	95.38	111.40
2	D	512	MET	CG-SD-CE	-6.72	89.45	100.20
2	D	258	GLU	CB-CA-C	-6.71	96.99	110.40
1	A	118	PHE	CB-CG-CD2	-5.51	116.94	120.80
1	A	277	ARG	NE-CZ-NH1	-5.38	117.61	120.30
1	C	355	ILE	CG1-CB-CG2	-5.26	99.83	111.40
1	C	25	ARG	CG-CD-NE	-5.11	101.07	111.80
2	B	102	TYR	CB-CG-CD1	-5.04	117.98	121.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	D	258	GLU	Sidechain

## 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	3761	0	3674	28	0
1	C	3754	0	3644	15	0
2	B	4140	0	3996	12	0
2	D	4118	0	3967	17	0
3	A	14	0	6	2	0
3	C	14	0	6	3	0
4	A	18	0	0	0	0
4	C	18	0	0	0	0
5	A	1	0	0	0	0
5	C	1	0	0	0	0
6	A	3	0	0	0	0
6	C	3	0	0	0	0
7	B	15	0	0	1	0
7	C	15	0	0	0	0
8	B	30	0	40	0	0
8	D	36	0	48	1	0
9	B	1	0	0	0	0
9	D	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
10	A	268	0	0	1	0
10	B	406	0	0	0	0
10	C	330	0	0	0	0
10	D	386	0	0	1	0
All	All	17333	0	15381	71	0

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

All (71) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:98:ASN:O	1:A:98:ASN:ND2	2.16	0.78
2:B:487:TYR:O	2:B:491:MET:HG3	1.96	0.65
1:A:139:GLU:CD	1:A:176:LYS:HE2	2.20	0.62
2:D:202:GLU:HG3	2:D:300:LYS:HG2	1.83	0.59
2:D:132:LYS:HD2	2:D:174:PHE:CE1	2.38	0.58
1:C:100:TYR:CE1	1:C:110:VAL:HB	2.39	0.57
1:C:354:TYR:CZ	1:C:404:VAL:HG12	2.41	0.55
1:A:354:TYR:CZ	1:A:404:VAL:HG12	2.43	0.54
1:A:53:GLN:NE2	10:A:603:HOH:O	2.40	0.53
2:D:487:TYR:O	2:D:491:MET:HG3	2.09	0.53
2:B:512:MET:HG2	2:D:453:ARG:HD2	1.91	0.51
1:A:253:TRP:HB3	1:A:279:MET:HE1	1.93	0.51
1:A:253:TRP:HB3	1:A:279:MET:CE	2.41	0.51
1:A:382:ALA:HB1	1:A:386:ASP:HB2	1.92	0.51
2:D:482:SER:HB3	8:D:605:GOL:H32	1.93	0.51
1:A:100:TYR:CE1	1:A:110:VAL:HB	2.46	0.50
2:B:258:GLU:HG3	2:B:259:GLU:N	2.26	0.50
1:A:139:GLU:OE2	1:A:176:LYS:CE	2.60	0.50
2:B:239:VAL:O	2:B:243:MET:HG3	2.12	0.50
1:A:41:GLN:C	1:A:41:GLN:HE21	2.15	0.49
2:D:194:VAL:HB	2:D:297:HIS:CG	2.48	0.49
1:C:459:PHE:O	1:C:463:MET:HG2	2.13	0.48
1:A:355:ILE:HB	1:A:360:PRO:HG3	1.96	0.48
1:C:382:ALA:HB1	1:C:386:ASP:HB2	1.95	0.48
1:A:11:SER:O	1:A:15:GLU:HG3	2.14	0.47
1:A:139:GLU:OE2	1:A:176:LYS:HE2	2.14	0.47
1:A:219:THR:OG1	1:A:222:ASP:OD1	2.29	0.47
3:C:501:HCA:O2	3:C:501:HCA:O7	2.32	0.47
2:B:194:VAL:HB	2:B:297:HIS:CG	2.50	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:442:HIS:HB3	3:A:501:HCA:O5	2.16	0.46
1:A:41:GLN:NE2	1:A:41:GLN:CA	2.79	0.46
1:A:41:GLN:NE2	1:A:41:GLN:HA	2.30	0.45
2:D:381:LYS:O	2:D:385:GLU:HG3	2.17	0.45
2:D:128:GLN:HG2	2:D:132:LYS:HE2	1.99	0.45
1:C:442:HIS:HB3	3:C:501:HCA:O6	2.17	0.44
2:D:139:LYS:HA	2:D:144:PRO:HD2	1.99	0.44
1:A:82:SER:HB3	1:A:153:GLU:OE2	2.18	0.43
1:A:239:ARG:HD2	1:A:252:GLN:OE1	2.18	0.43
2:B:350:ARG:O	2:B:354:MET:HG3	2.19	0.43
1:C:442:HIS:CG	3:C:501:HCA:H52	2.54	0.43
1:A:297:TYR:HB2	1:A:308:SER:HB3	2.01	0.43
2:B:202:GLU:HG3	2:B:300:LYS:HG2	2.00	0.43
1:C:19:VAL:HG11	1:C:407:TYR:CE2	2.53	0.43
3:A:501:HCA:O1	3:A:501:HCA:O7	2.36	0.43
2:B:453:ARG:HD2	2:D:512:MET:HG2	2.01	0.43
1:A:85:PRO:HB2	7:B:601:CLF:S2B	2.59	0.42
2:B:509:THR:O	2:B:516:ASP:HA	2.20	0.42
2:D:2:SER:N	10:D:715:HOH:O	2.53	0.42
2:D:509:THR:O	2:D:516:ASP:HA	2.20	0.42
2:B:70:CYS:HB2	2:B:188:SER:HB2	2.02	0.42
1:C:253:TRP:HA	1:C:254:SER:HA	1.80	0.42
1:A:275:CYS:HA	1:A:358:LEU:HD22	2.02	0.42
1:A:355:ILE:HB	1:A:360:PRO:HD3	2.02	0.42
1:C:97:ARG:O	1:C:231:ILE:HA	2.20	0.41
1:C:170:LYS:HA	1:C:170:LYS:HD2	1.89	0.41
1:A:103:THR:HG23	2:D:512:MET:HE2	2.02	0.41
1:A:439:ARG:HG3	1:A:463:MET:CE	2.51	0.41
2:B:146:MET:HG3	2:B:180:PRO:HB2	2.01	0.41
1:C:444:TRP:CE3	1:C:450:TYR:CD2	3.08	0.41
2:D:198:ASP:HB2	2:D:297:HIS:O	2.20	0.41
1:A:41:GLN:HE21	1:A:43:LYS:H	1.69	0.41
2:B:84:LYS:HB3	2:B:84:LYS:HE3	1.72	0.41
1:C:104:THR:HA	1:C:108:ALA:O	2.20	0.41
1:C:355:ILE:HB	1:C:360:PRO:HD3	2.02	0.41
2:D:43:VAL:O	2:D:47:THR:HG23	2.20	0.41
1:A:253:TRP:HA	1:A:254:SER:HA	1.70	0.41
2:D:512:MET:HE2	2:D:512:MET:HB3	1.82	0.41
1:A:230:ASN:HA	1:A:235:ALA:H	1.86	0.40
2:D:247:MET:HG2	2:D:341:PRO:HD3	2.03	0.40
1:C:5:SER:OG	1:C:8:GLU:HG3	2.22	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:25:ARG:HE	1:C:25:ARG:HB3	1.59	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	476/492 (97%)	454 (95%)	21 (4%)	1 (0%)	47 28
1	C	475/492 (96%)	454 (96%)	20 (4%)	1 (0%)	47 28
2	B	521/523 (100%)	509 (98%)	11 (2%)	1 (0%)	47 28
2	D	520/523 (99%)	510 (98%)	10 (2%)	0	100 100
All	All	1992/2030 (98%)	1927 (97%)	62 (3%)	3 (0%)	47 28

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	255	SER
1	A	355	ILE
1	C	355	ILE

### 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	400/415 (96%)	396 (99%)	4 (1%)	76	62
1	C	398/415 (96%)	395 (99%)	3 (1%)	81	70
2	B	445/455 (98%)	445 (100%)	0	100	100
2	D	440/455 (97%)	440 (100%)	0	100	100
All	All	1683/1740 (97%)	1676 (100%)	7 (0%)	91	85

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	98	ASN
1	A	362	HIS
1	A	401	TYR
1	A	445	ASP
1	C	98	ASN
1	C	279	MET
1	C	445	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	41	GLN
1	A	53	GLN
1	C	53	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](#)

Of 27 ligands modelled in this entry, 2 are modelled with single atom and 8 are monoatomic - leaving 17 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$
8	GOL	D	607	-	5,5,5	0.20	0	5,5,5	0.49	0
3	HCA	C	501	-	13,13,13	1.00	0	14,18,18	1.93	2 (14%)
8	GOL	B	604	-	5,5,5	0.24	0	5,5,5	0.60	0
8	GOL	B	605	-	5,5,5	0.21	0	5,5,5	0.79	0
7	CLF	C	503	2,1	0,24,24	-	-	-		
8	GOL	D	603	-	5,5,5	0.19	0	5,5,5	0.67	0
3	HCA	A	501	-	13,13,13	1.03	0	14,18,18	1.63	3 (21%)
4	ICS	C	502	1	18,30,30	3.48	13 (72%)	-		
8	GOL	B	606	-	5,5,5	0.09	0	5,5,5	0.40	0
8	GOL	D	604	-	5,5,5	0.19	0	5,5,5	0.50	0
8	GOL	D	605	-	5,5,5	0.18	0	5,5,5	0.58	0
8	GOL	D	606	-	5,5,5	0.08	0	5,5,5	0.61	0
8	GOL	D	602	-	5,5,5	0.17	0	5,5,5	0.37	0
4	ICS	A	502	1	18,30,30	3.09	11 (61%)	-		
8	GOL	B	602	-	5,5,5	0.20	0	5,5,5	0.52	0
7	CLF	B	601	2,1	0,24,24	-	-	-		
8	GOL	B	603	-	5,5,5	0.19	0	5,5,5	0.52	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
8	GOL	D	607	-	-	0/4/4/4	-
3	HCA	C	501	-	-	5/17/17/17	-
8	GOL	B	604	-	-	0/4/4/4	-
8	GOL	B	605	-	-	2/4/4/4	-
7	CLF	C	503	2,1	-	-	0/12/10/10

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
8	GOL	D	603	-	-	2/4/4/4	-
3	HCA	A	501	-	-	3/17/17/17	-
8	GOL	D	605	-	-	2/4/4/4	-
8	GOL	B	606	-	-	4/4/4/4	-
8	GOL	D	604	-	-	2/4/4/4	-
8	GOL	D	606	-	-	4/4/4/4	-
8	GOL	D	602	-	-	0/4/4/4	-
8	GOL	B	602	-	-	2/4/4/4	-
7	CLF	B	601	2,1	-	-	0/12/10/10
8	GOL	B	603	-	-	0/4/4/4	-

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	502	ICS	S4B-FE7	-6.20	2.17	2.32
4	C	502	ICS	S1B-FE6	-6.04	2.17	2.32
4	C	502	ICS	S3B-FE6	-4.93	2.20	2.32
4	A	502	ICS	S3B-FE6	-4.71	2.20	2.32
4	C	502	ICS	S4B-FE7	-4.68	2.20	2.32
4	C	502	ICS	S3B-FE7	-4.51	2.21	2.32
4	C	502	ICS	S1B-FE5	-4.47	2.21	2.32
4	A	502	ICS	S3B-FE7	-4.39	2.21	2.32
4	A	502	ICS	S1B-FE6	-3.95	2.22	2.32
4	C	502	ICS	S4B-FE5	-3.64	2.23	2.32
4	C	502	ICS	S2A-FE2	-3.59	2.23	2.32
4	A	502	ICS	S1B-FE5	-3.56	2.23	2.32
4	C	502	ICS	S2B-FE2	-3.50	2.16	2.24
4	A	502	ICS	S2A-FE2	-3.35	2.24	2.32
4	A	502	ICS	S4B-FE5	-3.34	2.24	2.32
4	C	502	ICS	S5A-FE7	-3.32	2.17	2.24
4	C	502	ICS	S2A-FE3	-3.17	2.24	2.32
4	C	502	ICS	S4A-FE4	-3.06	2.24	2.32
4	A	502	ICS	S4A-FE3	-2.92	2.25	2.32
4	C	502	ICS	S4A-FE3	-2.90	2.25	2.32
4	A	502	ICS	S2B-FE2	-2.86	2.18	2.24
4	C	502	ICS	S2B-FE6	-2.76	2.18	2.24
4	A	502	ICS	S2B-FE6	-2.23	2.19	2.24
4	A	502	ICS	S5A-FE7	-2.07	2.20	2.24

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	501	HCA	O6-C7-C3	4.86	121.48	113.05
3	A	501	HCA	O6-C7-C3	3.24	118.68	113.05
3	C	501	HCA	O4-C6-C5	2.74	122.82	114.03
3	A	501	HCA	O4-C6-O3	-2.10	118.06	123.30
3	A	501	HCA	O4-C6-C5	2.03	120.55	114.03

There are no chirality outliers.

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	501	HCA	C2-C3-C4-C5
3	C	501	HCA	C2-C3-C4-C5
8	B	602	GOL	C1-C2-C3-O3
8	D	604	GOL	C1-C2-C3-O3
8	D	605	GOL	O1-C1-C2-C3
8	D	606	GOL	O1-C1-C2-O2
8	D	606	GOL	O1-C1-C2-C3
8	D	606	GOL	C1-C2-C3-O3
8	B	605	GOL	O1-C1-C2-C3
8	B	606	GOL	O1-C1-C2-C3
8	D	603	GOL	O1-C1-C2-C3
8	B	605	GOL	O1-C1-C2-O2
8	B	606	GOL	O1-C1-C2-O2
8	D	603	GOL	O1-C1-C2-O2
8	D	605	GOL	O1-C1-C2-O2
8	D	606	GOL	O2-C2-C3-O3
8	B	606	GOL	O2-C2-C3-O3
3	A	501	HCA	C7-C3-C4-C5
8	D	604	GOL	O2-C2-C3-O3
3	A	501	HCA	O7-C3-C4-C5
3	C	501	HCA	O7-C3-C4-C5
8	B	602	GOL	O1-C1-C2-C3
8	B	606	GOL	C1-C2-C3-O3
3	C	501	HCA	O1-C1-C2-C3
3	C	501	HCA	C7-C3-C4-C5
3	C	501	HCA	O2-C1-C2-C3

There are no ring outliers.

4 monomers are involved in 7 short contacts:

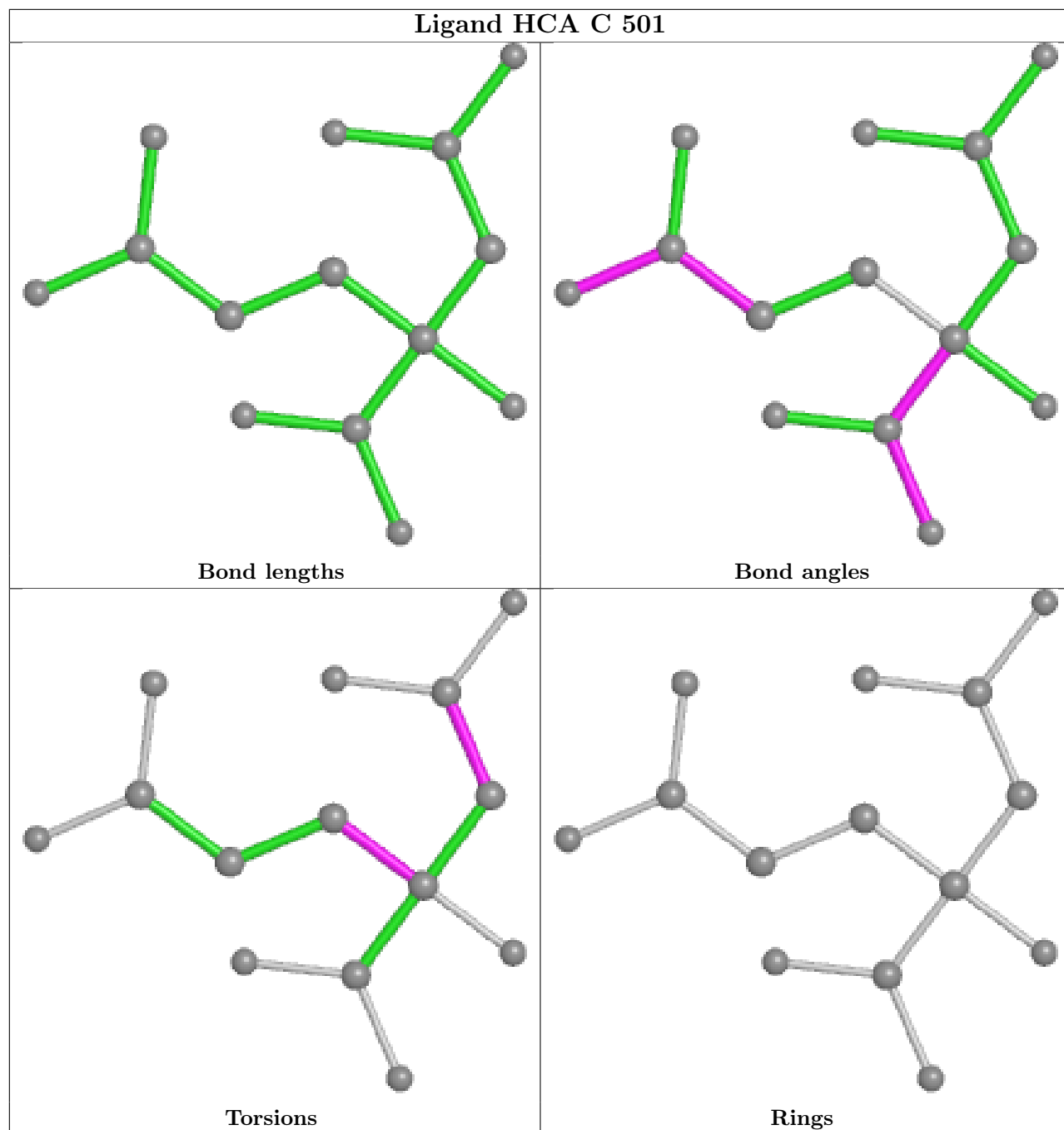
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	501	HCA	3	0

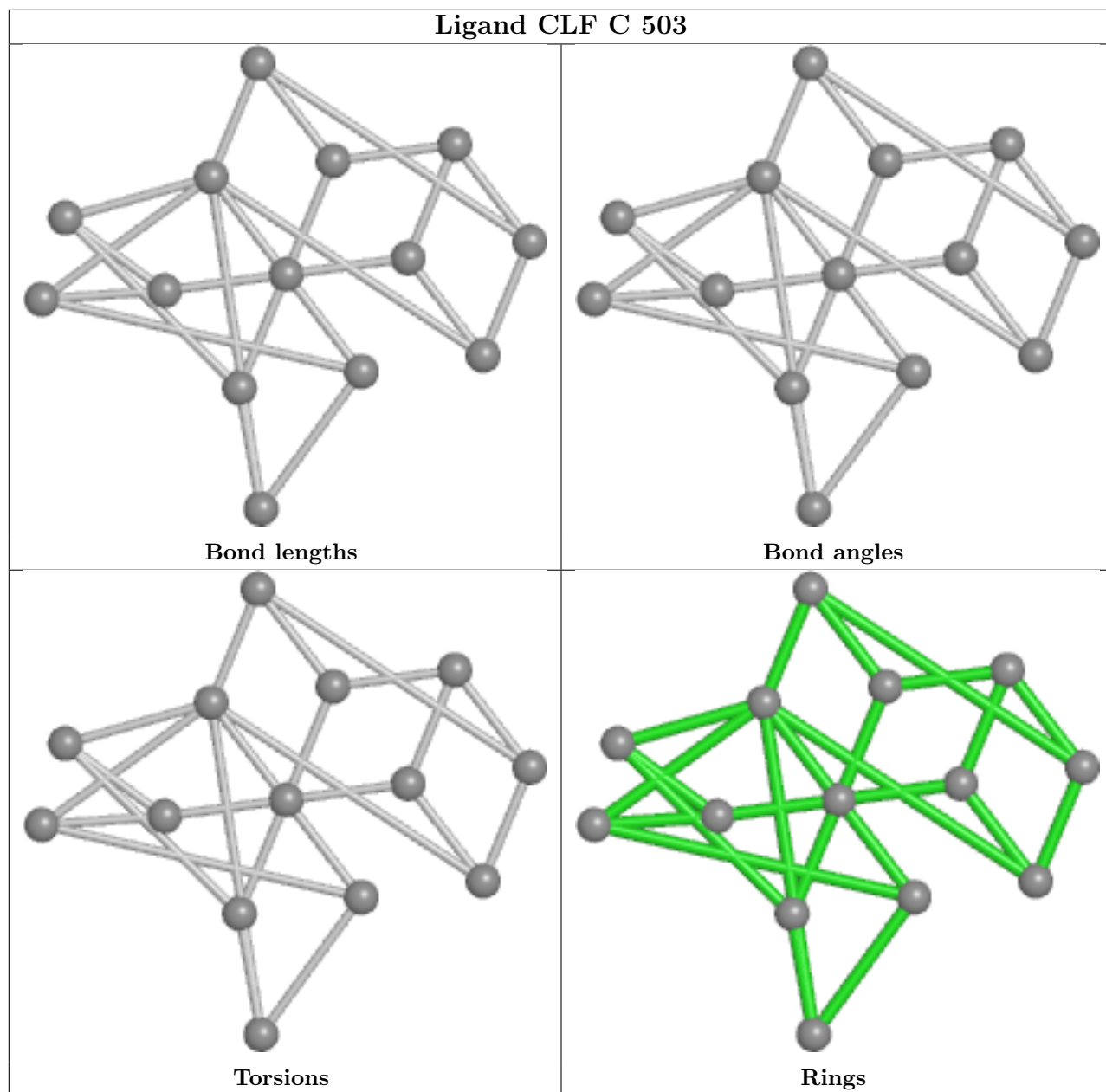
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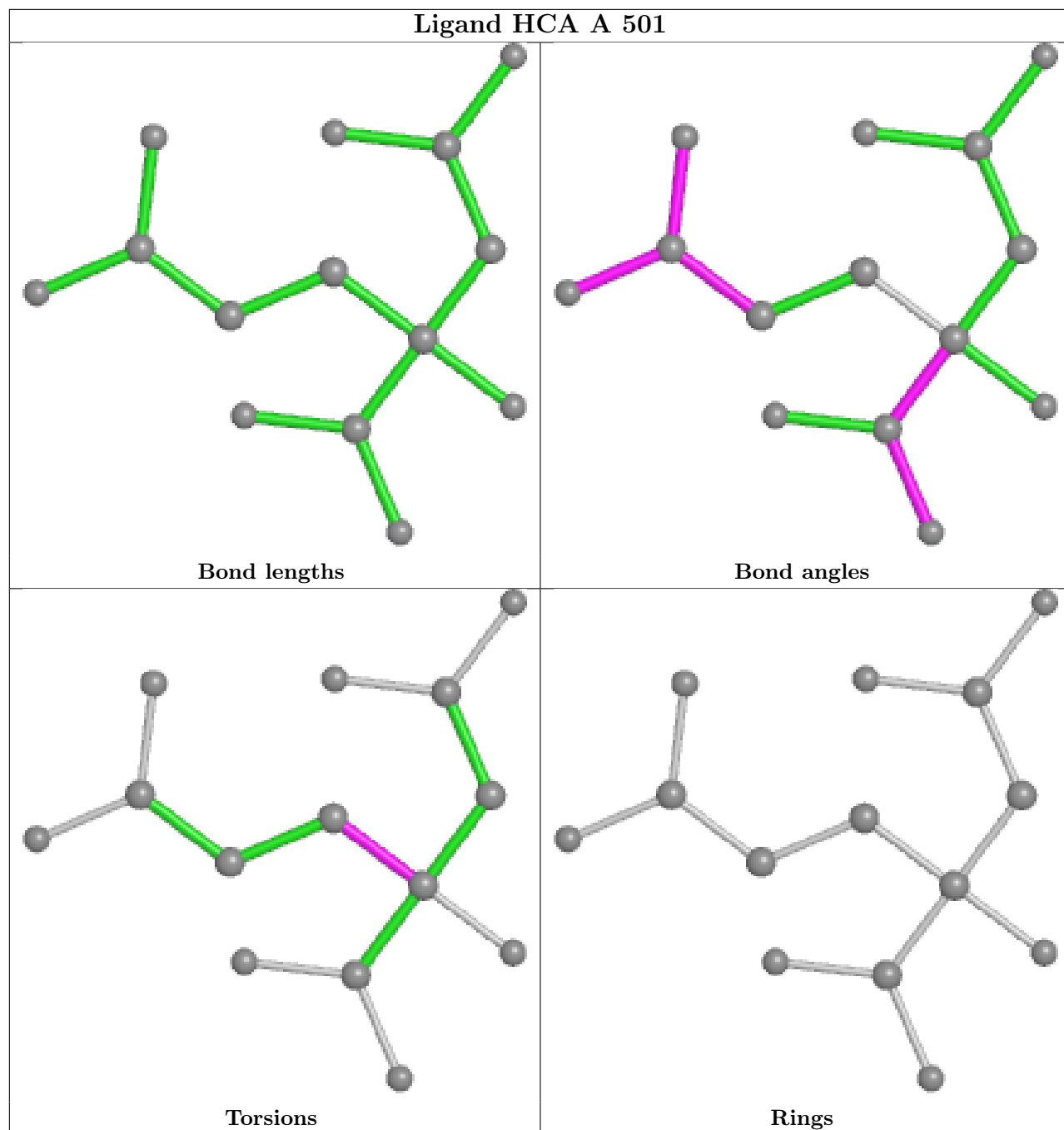
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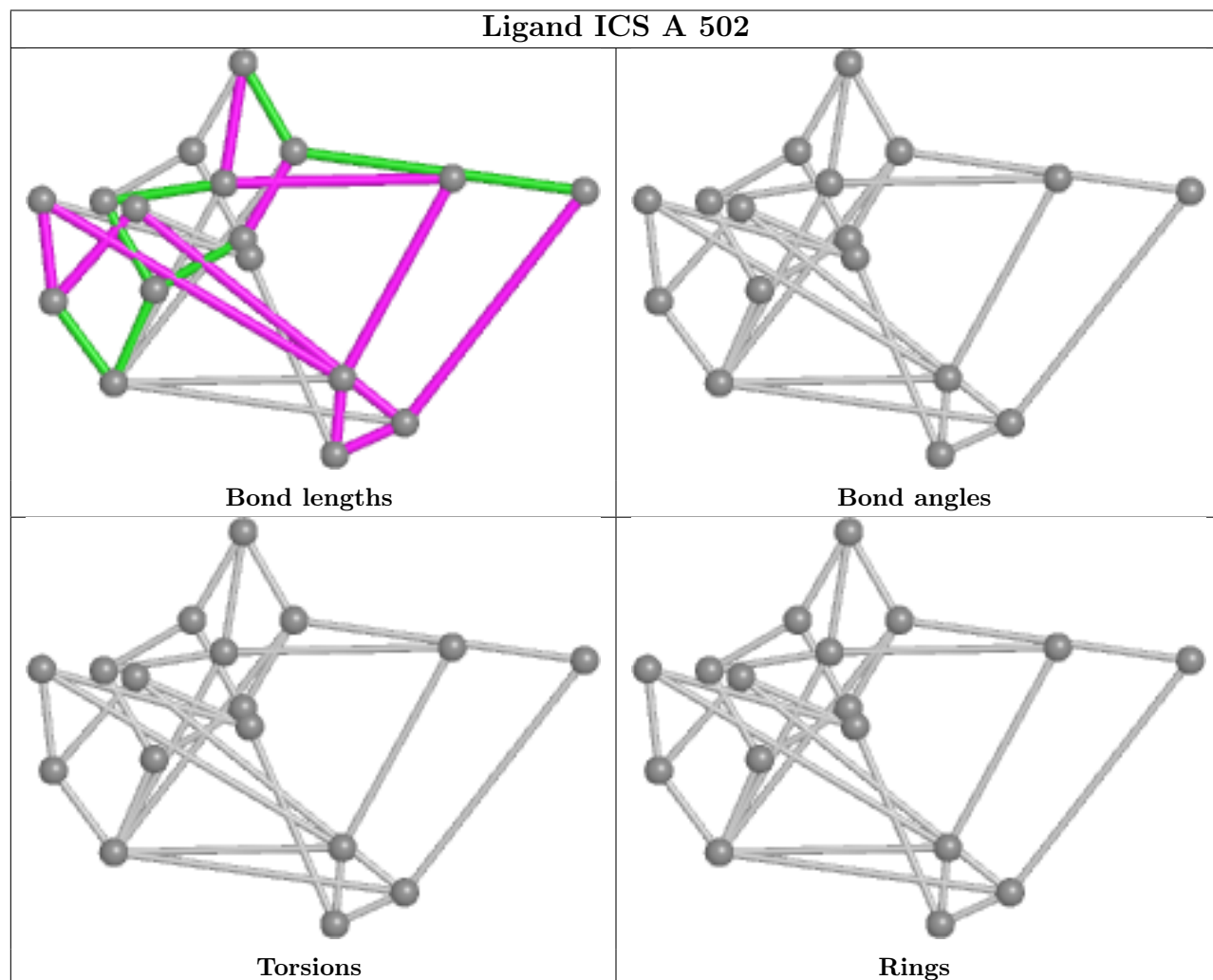
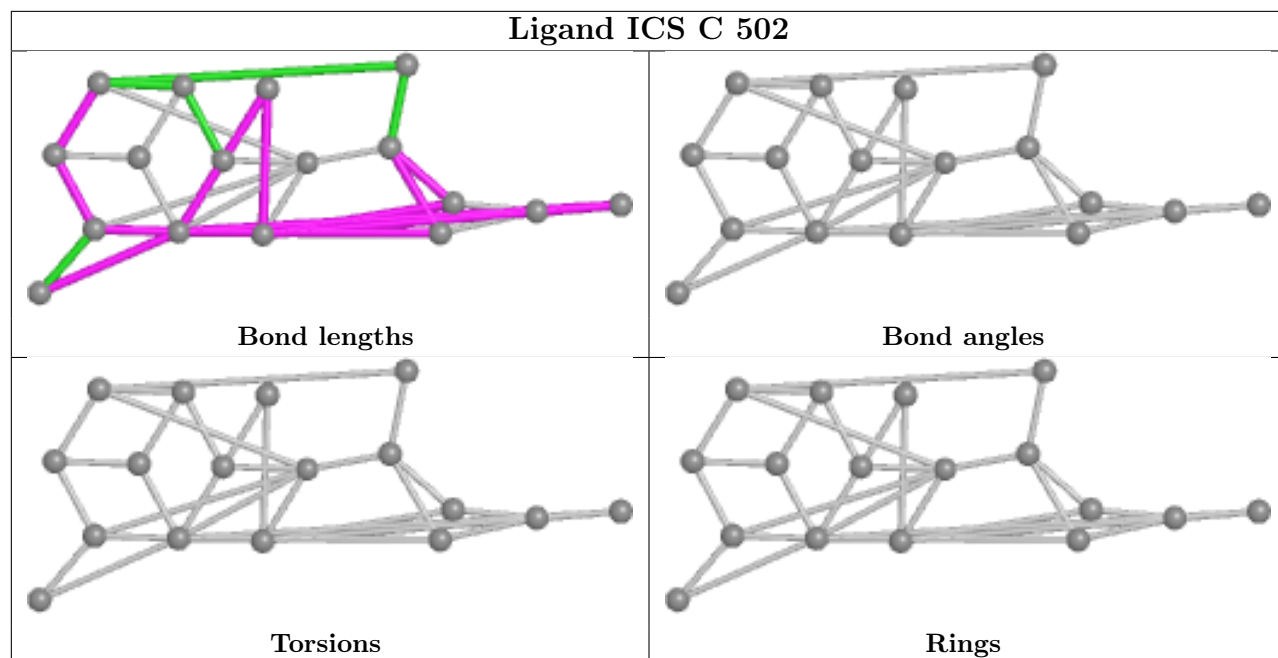
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	501	HCA	2	0
8	D	605	GOL	1	0
7	B	601	CLF	1	0

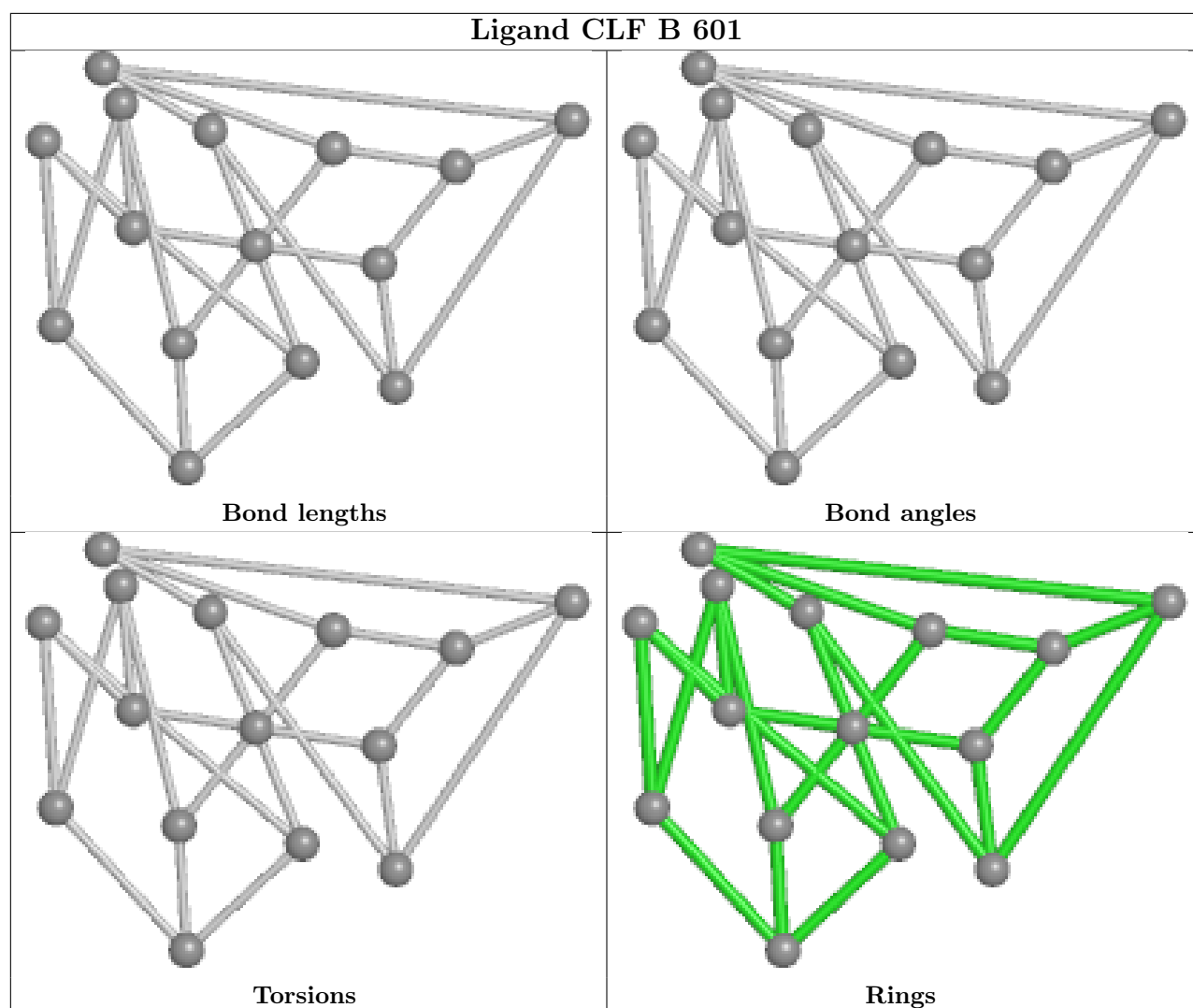
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	477/492 (96%)	-0.14	13 (2%) 54 55	20, 28, 41, 61	0
1	C	477/492 (96%)	-0.21	6 (1%) 77 80	18, 25, 38, 52	0
2	B	522/523 (99%)	-0.30	3 (0%) 89 90	18, 26, 36, 52	0
2	D	522/523 (99%)	-0.26	5 (0%) 82 85	19, 27, 39, 55	0
All	All	1998/2030 (98%)	-0.23	27 (1%) 75 79	18, 26, 39, 61	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	4	MET	4.7
1	C	125	PHE	4.2
2	D	217	VAL	3.9
2	D	214	ASP	3.0
2	D	337	GLY	3.0
2	D	80	LEU	2.9
1	A	214	THR	2.9
1	A	479	TRP	2.8
1	A	480	GLU	2.6
1	A	174	LEU	2.6
1	C	172	ALA	2.5
1	C	110	VAL	2.5
1	A	229	TYR	2.5
1	C	4	MET	2.4
1	A	175	SER	2.4
1	A	70	VAL	2.3
2	B	214	ASP	2.3
1	A	125	PHE	2.3
1	A	215	THR	2.3
2	B	121	ASP	2.2
2	D	522	VAL	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	59	ILE	2.2
1	C	231	ILE	2.2
2	B	111	VAL	2.1
1	C	213	ASP	2.0
1	A	217	ALA	2.0
1	A	98	ASN	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.

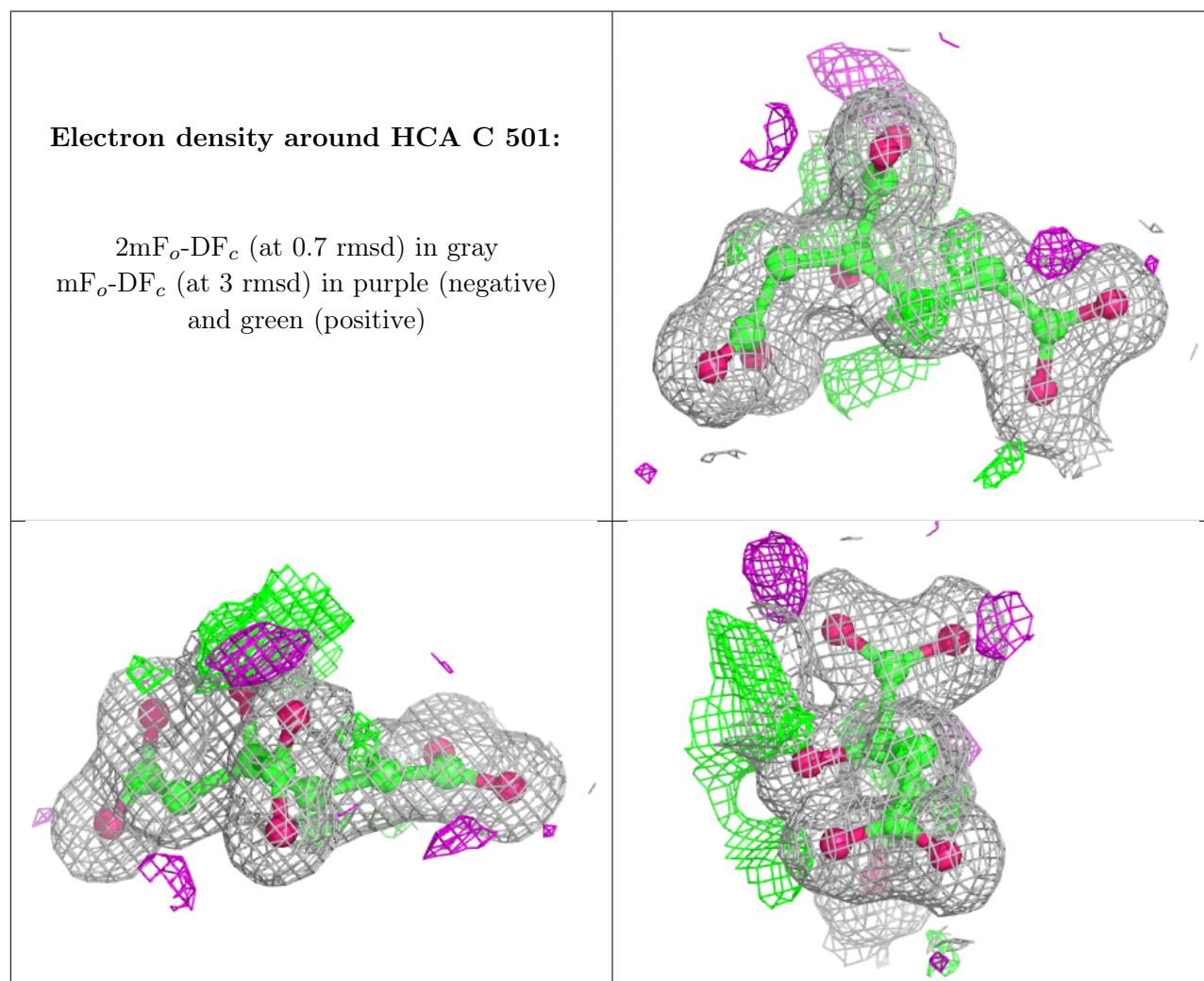
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
8	GOL	D	604	6/6	0.84	0.14	31,35,37,37	0
8	GOL	D	607	6/6	0.85	0.17	33,37,41,41	0
6	MO	A	506	1/1	0.86	0.08	49,49,49,49	1
8	GOL	B	604	6/6	0.86	0.12	29,32,33,35	0
8	GOL	D	605	6/6	0.88	0.14	28,31,33,38	0
8	GOL	D	606	6/6	0.88	0.24	35,36,38,40	0
8	GOL	D	602	6/6	0.88	0.10	26,27,30,32	0
8	GOL	B	606	6/6	0.89	0.21	37,39,40,43	0
8	GOL	B	603	6/6	0.90	0.13	26,27,28,30	0
8	GOL	B	602	6/6	0.91	0.20	30,34,38,40	0
8	GOL	D	603	6/6	0.91	0.11	29,30,34,35	0
8	GOL	B	605	6/6	0.92	0.10	27,29,31,33	0
6	MO	C	507	1/1	0.94	0.08	42,42,42,42	1
3	HCA	C	501	14/14	0.95	0.11	16,19,22,24	0
3	HCA	A	501	14/14	0.95	0.13	19,20,24,25	0
9	CA	D	601	1/1	0.95	0.10	25,25,25,25	1
6	MO	C	505	1/1	0.96	0.07	26,26,26,26	1

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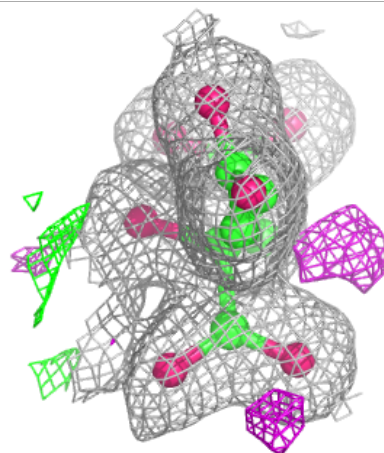
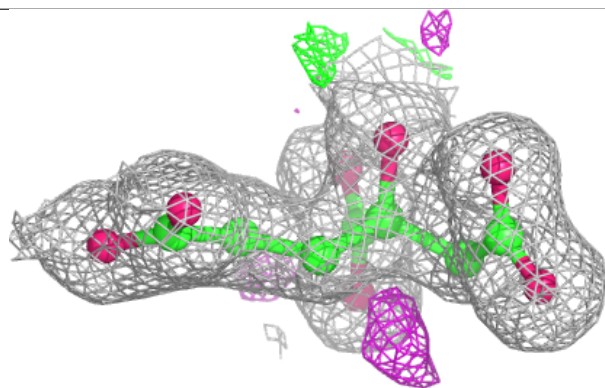
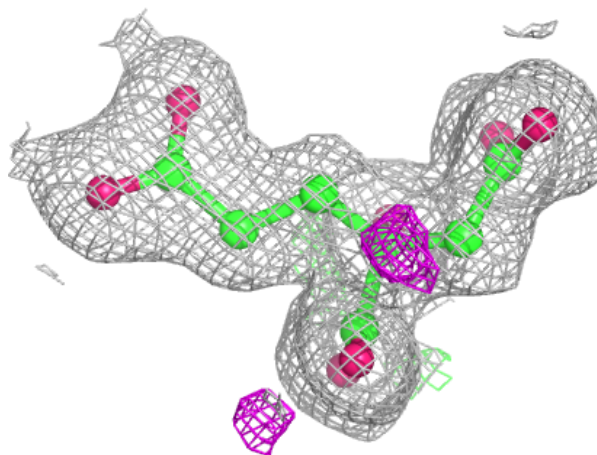
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
6	MO	C	506	1/1	0.96	0.07	26,26,26,26	1
6	MO	A	505	1/1	0.96	0.03	48,48,48,48	1
9	CA	B	607	1/1	0.98	0.10	24,24,24,24	1
6	MO	A	504	1/1	0.98	0.03	29,29,29,29	1
4	ICS	C	502	18/18	0.99	0.06	16,17,19,20	0
7	CLF	B	601	15/15	0.99	0.04	19,21,23,24	0
7	CLF	C	503	15/15	0.99	0.05	20,22,22,25	0
4	ICS	A	502	18/18	0.99	0.06	19,20,21,22	0
5	H2S	C	504	1/1	1.00	0.03	22,22,22,22	0
5	H2S	A	503	1/1	1.00	0.06	22,22,22,22	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



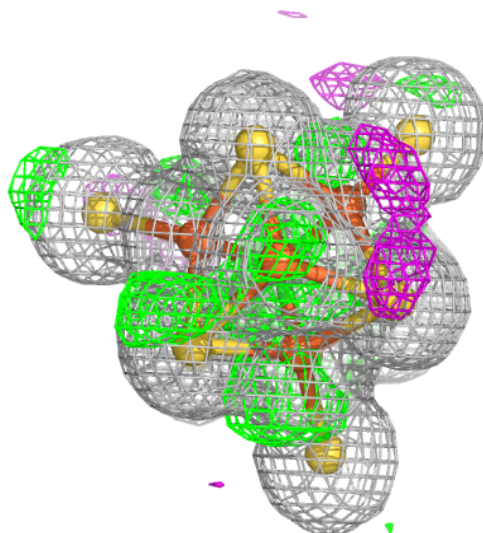
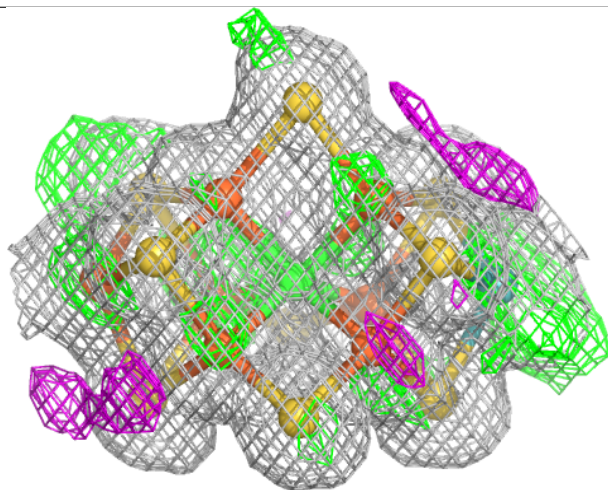
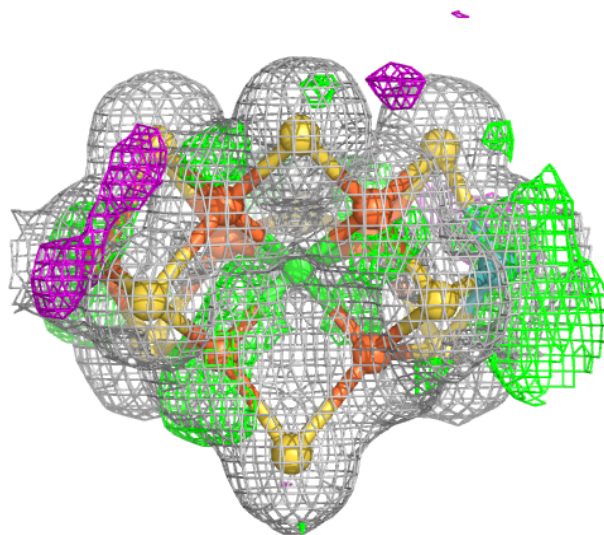
**Electron density around HCA A 501:**

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



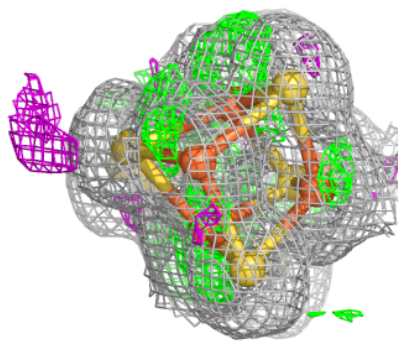
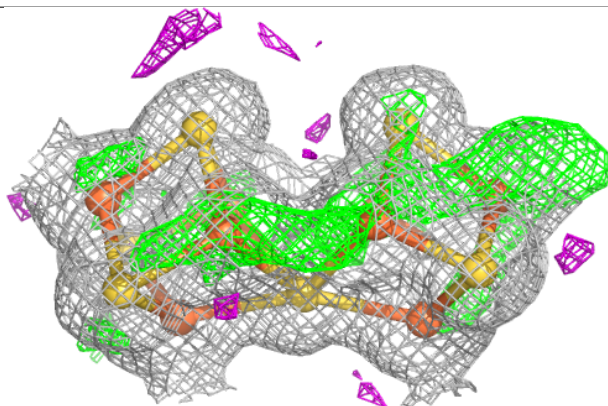
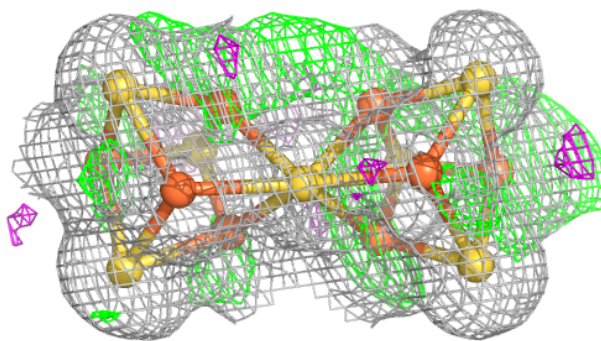
**Electron density around ICS C 502:**

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

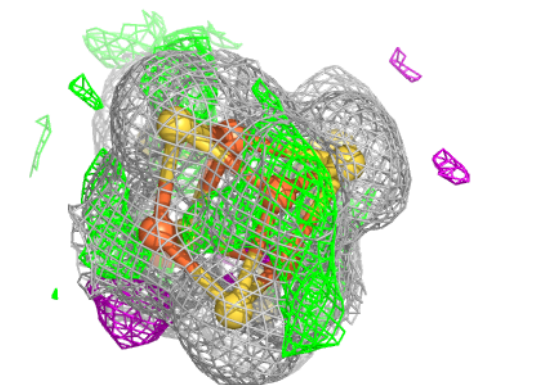
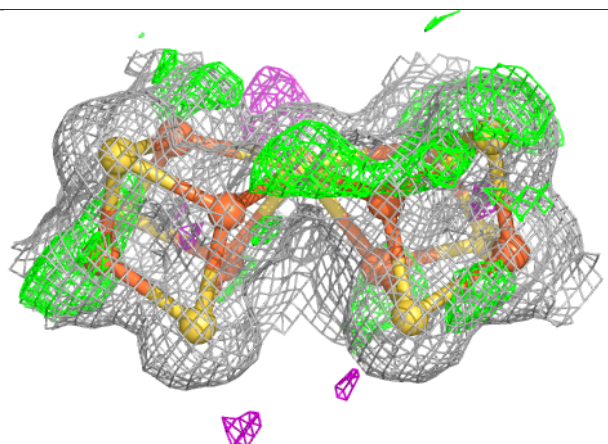
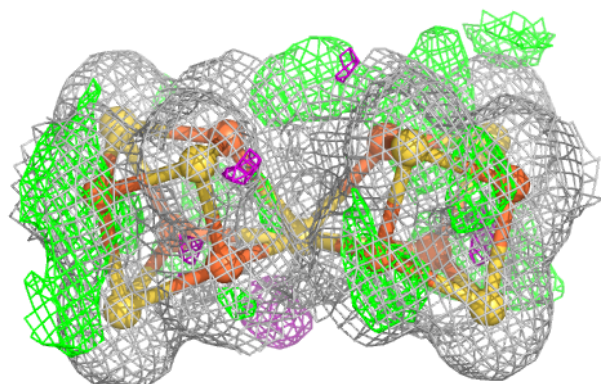


**Electron density around CLF B 601:**

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

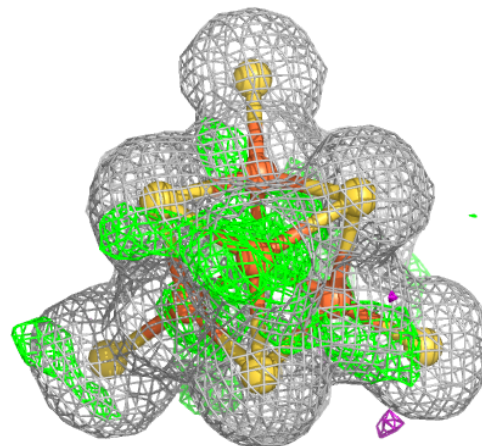
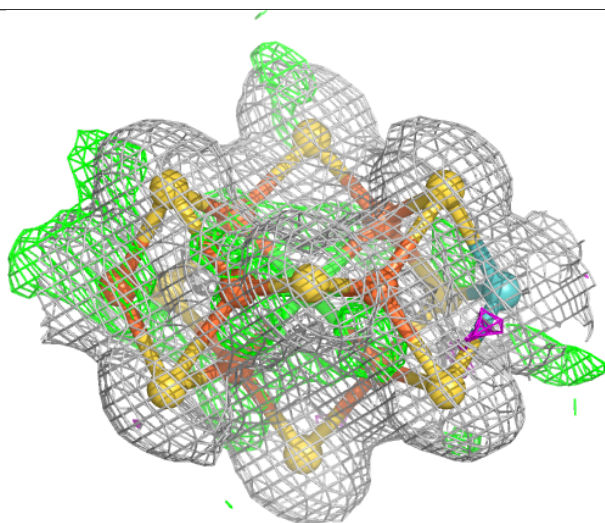
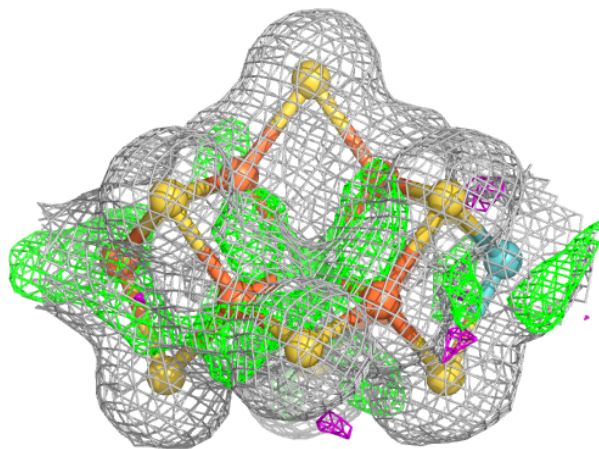
**Electron density around CLF C 503:**

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



**Electron density around ICS A 502:**

$2mF_o-DF_c$  (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.